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INSTRUCTION BOOK

**DIGITAL POWER METER  
MODEL 5000-EX**

**BIRD<sup>®</sup>**

**Electronic Corporation  
Cleveland (Solon) Ohio USA**

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Instruction Book P/N 920-5000-EX Rev. D

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## **Safety Precautions**

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The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

### ***Keep Away From Live Circuits***

Operating personnel must at all times observe normal safety regulations. Do not replace components or make adjustments inside the equipment with high voltage turned on. To avoid casualties, always remove power.

### ***Shock Hazard***

Do not attempt to remove the RF transmission line while RF power is present. Radiated RF power is a potential health hazard.

### ***Do Not Service or Adjust Alone***

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

### ***Chemical Hazard***

Dry cleaning solvents for cleaning parts may be potentially dangerous. Avoid inhalation of fumes or prolonged contact with skin.

## **Safety Earth Ground**

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

## **Resuscitation**

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

## **Safety Symbols**

### **WARNING**

Warning notes call attention to a procedure which, if not correctly performed, could result in personal injury.

### **CAUTION**

Caution notes call attention to a procedure which, if not correctly performed, could result in damage to the instrument.



This symbol indicates that a shock hazard exists if the precautions in the instruction manual are not followed.



The caution symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.

 **NOTE:** Calls attention to supplemental information

### **Warning Statements**

The following safety warnings appear in the text where there is danger to operating and maintenance personnel, and are repeated here for emphasis.

#### **WARNING**

Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied.  
Leaking RF energy is a potential health hazard.

#### **WARNING**

Disconnect from external power before any disassembly. The potential for electric shock exists.

#### **WARNING**

RF voltage may be present in RF element socket.  
Keep element in socket during operation.

### **Caution Statements**

The following equipment cautions appear in the text whenever the equipment is in danger of damage, and are repeated here for emphasis.

#### **CAUTION**

When connecting the TPS or the TPS-EF, only turn the connector nut. Damage may occur if torque is applied to the sensor body.

#### **CAUTION**

Discharge all static potentials before connecting the TPS(-EF). Electrostatic shock could damage the sensor.

**CAUTION**

Only use the ac adapter provided with the DPM.  
Do not use the adapter with the batteries removed.

**CAUTION**

Do not exceed 2 W average or 125 W peak power for  
5  $\mu$ s when using the TPS or the TPS-EF.  
Doing so will render the sensor inoperative.

**CAUTION**

Do not use harsh or abrasive detergents for cleaning.

**CAUTION**

Replace only with Ni-MH rechargeable A batteries.  
Nominal Voltage 1.2V; Capacity 2700mAh.  
Use Sanyo P/N HR-AUX or equivalent.

**Safety Statements**



**USAGE**

ANY USE OF THIS INSTRUMENT IN A  
MANNER NOT SPECIFIED BY THE  
MANUFACTURER MAY IMPAIR THE  
INSTRUMENT'S SAFETY PROTECTION.

**USO**

EL USO DE ESTE INSTRUMENTO DE MANERA  
NO ESPECIFICADA POR EL FABRICANTE, PUEDE  
ANULAR LA PROTECCIÓN DE SEGURIDAD DEL  
INSTRUMENTO.

**BENUTZUNG**

WIRD DAS GERÄT AUF ANDERE WEISE  
VERWENDET ALS VOM HERSTELLER  
BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT  
BEEINTRÄCHTIGT WERDEN.

## UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

## IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.



### SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

## SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

## WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE,  
ELEKTRISCHE SCHOCKS, SIND  
WARTUNGSARBEITEN AUSSCHLIEßLICH VON  
QUALIFIZIERTEM SERVICEPERSONAL  
DURCHZUFÜHREN.

#### ENTRETIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN  
DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ  
AUX OPÉRATIONS D'ENTRETIEN. POUR  
PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX,  
NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A  
PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.



RF VOLTAGE MAY BE PRESENT IN RF  
ELEMENT SOCKET - KEEP ELEMENT IN  
SOCKET DURING OPERATION.

DE LA TENSION H.F. PEAT ÊTRE PRÉSENTE  
DANS LA PRISE DE L'ÉLÉMENT H.F. -  
CONSERVER L'ÉLÉMENT DANS LA PRISE LORS  
DE L'EMPLOI.

HF-SPANNUNG KANN IN DER HF-ELEMENT-  
BUCHSE ANSTEHEN - ELEMENT WÄHREND DES  
BETRIEBS EINGESTÖPSELT LASSEN.

PUEDA HABER VOLTAJE RF EN EL ENCHUFE  
DEL ELEMENTO RF - MANTENGA EL ELEMENTO  
EN EL ENCHUFE DURANTE LA OPERACION.

IL PORTAELEMENTO RF PUÒ PRESENTARE  
VOLTAGGIO RF - TENERE L'ELEMENTO NELLA  
PRESA DURANTE IL FUNZIONAMENTO.

## About This Manual

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This instruction manual guides users through the operation and maintenance of the Bird 5000-EX Digital Power Meter (DPM), as well as the Bird 5010B Directional Power Sensor (DPS), Bird 5011 and 5011-EF Terminating Power Sensors (TPS), and Bird 5012 Wideband Power Sensor (WPS).

### ***Typography***

There are two types of keys on the DPM. A hard key has a specific function which is indicated on the key. The key names for hard keys are set in bold typeface, e.g. *Press the **ON** key.*

Speed keys, which appear under the display, have a different label depending upon the function selected. The names appear at the bottom of the display, directly above the corresponding key. The key names for speed keys are set in bold italic typeface, e.g. *Press the **SCALE** Key.* In this manual, speed keys will also be referred to by number, with speed key 1 being the key on the left. Figure 1 on page 3 shows these speed key numbers.

### ***Chapter Layout***

**Introduction** — Identifies the parts of the DPM, describes the functions of the various keys, and explains the meaning of the indicators which may be displayed. Also lists the items supplied and optional equipment available.

**Installation** — Gives directions for connecting the DPM, and discusses the various power sources.

**Operation** — Explains how to make measurements with the DPM, and the special functions used with specific sensors.

**Maintenance** — Lists routine maintenance tasks for the Digital Power Meter, and troubleshooting tips for common problems. Specifications and battery information are also included.

***Changes to this Manual***

We have made every effort to ensure this manual is accurate at the time of publication. If you should discover any errors or if you have suggestions for improving this manual, please send your comments to our factory. This manual may be periodically updated, when inquiring about updates to this manual refer to the part number and revision level on the title page.

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## Items Supplied

1. Bird Digital Power Meter (DPM)
2. AC Mains Adapter
3. Instruction Book
4. 9-pin Serial Cable

## Optional Equipment

### Directional Power Sensor (DPS)



Bird 5010B Thruline Sensor, requires two 43 or APM/DPM elements. The DPS measures both forward and reverse power, so VSWR and other match

measurements can be calculated and displayed.

☞ NOTE: The 5010B replaces the Bird 5010. The 5010 was only compatible with APM/DPM elements, and lacked peak-reading capability. The 5000-EX will still recognize the 5010.

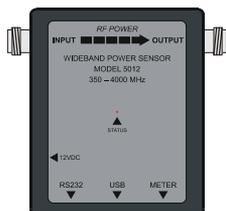
### Terminating Power Sensors (TPS)



Highly accurate terminating sensors; do not require elements.

The Bird 5011 frequency range is 40 MHz – 4 GHz.  
The 5011-EF frequency range is 40 MHz – 12 GHz.

## Wideband Power Sensor (WPS)



Bird 5012 ThruLine Sensor that does not require elements. Can measure average, peak, or burst power, VSWR, crest factor, and Complementary Cumulative Distribution Function (CCDF). A status LED on the front lights when the WPS is powered, and

blinks when the WPS is connected to the DPM.

### **Automobile Cigarette Lighter Adapter —**

(P/N 5A2238-1) Connects the DPM or WPS to a standard 12V automotive cigarette lighter jack.

**Virtual Power Meter — (VPM)** For the WPS only. PC software that can interface directly with the WPS without requiring a DPM or 'black box'. Can also log data for analysis, printing, or storage.

System requirements: IBM PC or equivalent; Windows 95 or later, 4 MB free hard disk space; available Serial or USB Port. Includes interface cable.

**Serial to USB Adapter — (P/N DC-DB9-U)** Converts the serial cable to USB. Connects the DPM to a PC's USB port if the serial port is unavailable.

**Attenuators & Accessories —** A variety of attenuators and connectors for measuring large powers with the TPS. For a complete list, see page 27.

**Soft Carry Case — (P/N 5000-030)** Convenient and protective. Cutouts allow operation while in the case.

**Hard Carry Case — (P/N 5000-035)** Protective case holds DPM, sensor, and accessories.

## Component Description

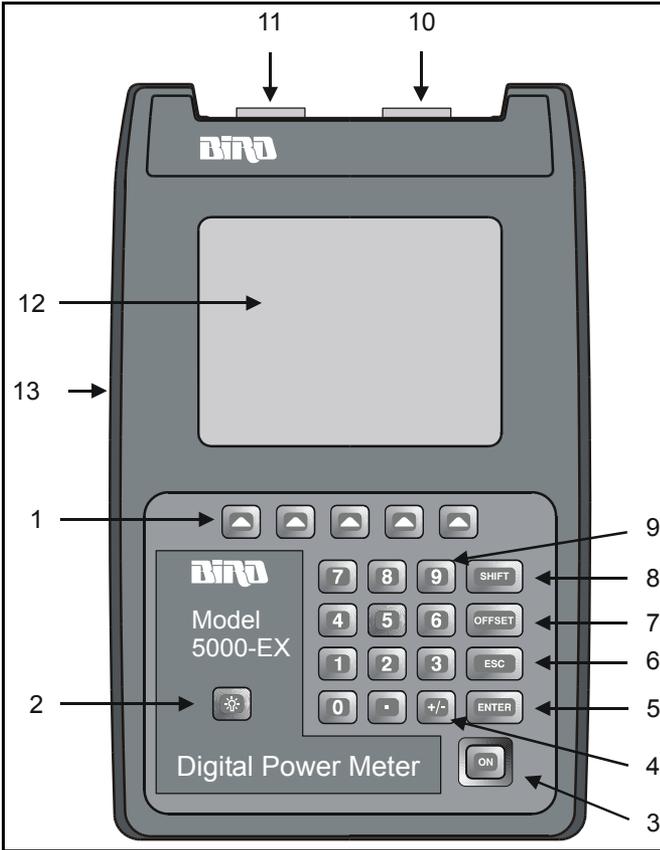


Figure 1 Component Description

*Bird Model 5000-EX Digital Power Meter*

<b>1. Speed Keys</b>	Activates the command displayed above it.
<b>2. Backlight Key</b>	Turns the backlight on momentarily.
<b>3. On Key</b>	Turns the DPM on or off.
<b>4. +/- Key</b>	Toggles between positive and negative numbers.
<b>5. Enter Key</b>	Completes data entry.
<b>6. Escape Key</b>	Aborts data entry without accepting changes. For WPS, in second set of softkeys, selects previous measurement mode.
<b>7. Offset Key</b>	Enter offset values in dB.
<b>8. Shift Key</b>	Toggles between different sets of speed key functions.
<b>9. Numeric Keys</b>	Input numeric values.
<b>10. Sensor Port</b>	Connection for power sensors.
<b>11. RS-232 Port</b>	Connection for an optional PC 9-pin RS-232 (DB9) connector, compatible with PC serial port. 9600 baud, 8 data bits, 1 stop bit, and no parity.
<b>12. LCD Display</b>	Backlit liquid crystal display.
<b>13. External DC Connector</b>	Connect either the ac adapter or the cigarette lighter adapter. External supplies power the unit and charge the internal battery.

## Display Description

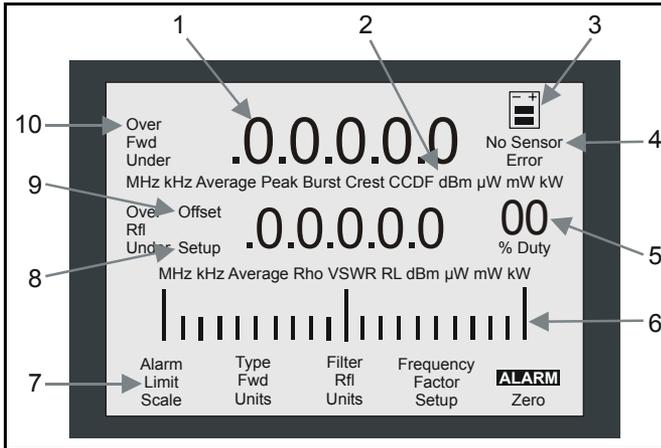


Figure 2 Display Description

**NOTE:** Numbers in parentheses (1) refer to the labeled parts of the display above.

**Display (1)** — The DPM-EX has two measurement displays. The top displays forward power, crest factor, and CCDF. The bottom displays reflected power and reflection measurement (VSWR).

**Display Units (2)** — Shows the measurement mode and units for the display directly above.

**Battery Level Indicator (3)** — When the external adapter is connected, the indicator blinks until the battery is fully charged. When using the internal batteries, the indicator is on continuously and the black bars show the battery charge remaining.

When the battery is low, the indicator will be empty and will blink. Recharge the batteries.

**No Sensor Indicator (4)** — Turns on when no sensor is connected to the sensor port.

**Duty Cycle Indicator (5)** — For burst power measurements, shows the signal's duty cycle.

**Analog Bar Graph (6)** — Proportional to the forward average power. Minimum at 0 W or -20 dBm. Max at full scale power.

**Speed Key Labels (7)** — Press the speed key below the label to activate the displayed function.

**Setup Indicator (8)** — Turns on when a stored setup is being used.

**Offset Indicator (9)** — Blinks when an offset is in use.

**Power Indicator (10)** — If the power exceeds 100% of full scale, "Over" will be displayed. If the power is less than zero, "Under" will be displayed. If the power exceeds 120% of full scale, the display will show a line of dashes and the bar scale will be filled.

## **Speed Keys**

**Scale** — For element-based sensors, sets the forward full scale power. This is listed on the forward element's nameplate. Reflected full scale power is automatically set to 10 dB below the forward full scale. This speed key is disabled for non-element-based sensors.

**Fwd Units** — Selects the units for the top display.

**Rfl Units** — Selects the units for the bottom display. If the bottom display is not in use, or does not have selectable units this key will be disabled.

**Setup** — For the DPS, enter a setup number to load a stored setup. 0 returns to the default setups.

For the WPS enter the threshold power, in Watts, for CCDF mode.

**Zero** — For the TPS and the WPS, does a zero-power calibration. This speed key is disabled for all other sensors.

**Type** — For the DPS, selects either average (APM/DPM) or peak-reading (43) elements.

For the WPS, selects the measurement mode. In the filter screen, selects the filter bandwidth.

**Filter** — For the WPS, opens the filter screen for selecting the filter bandwidth. This speed key is disabled for all other sensors.



### **Power Supply**

The DPM uses a rechargeable Nickel-Metal Hydride battery pack. Charge life is about 20 hours with the Bird WPS, 100 hours with other sensors.

The DPM can use an external power source. Using the DPM with the ac adapter or the 12V cigarette lighter adapter will also charge the battery. Charging time from full discharge is 8 hours using the ac adapter. When using the cigarette lighter adapter, charge time will depend on the car battery charge. When the external adapter is connected, the battery level indicator will blink until the battery is fully charged. When using the internal batteries, the indicator will be on continuously and the black bar will show the battery charge remaining.

 **NOTE:** For optimum battery life, only charge the batteries after the battery level indicator empties completely and begins to blink.

<p style="text-align: center;"><b>CAUTION</b></p>
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<p style="text-align: center;">Only use the ac adapter provided with the DPM. Do not use the adapter with the batteries removed.</p>
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- **AC Mains Adapter** — To use the ac adapter, insert the adapter's barrel connector into the DPM's external dc connector (See Figure 1 on page 3). Insert the adapter plug into a wall receptacle.
- **Automobile Cigarette Lighter Adapter** — Insert the adapter's barrel connector into the DPM's external dc connector. Insert the adapter plug into a cigarette lighter jack.

## Connections

**WARNING**  
Never attempt to connect or disconnect RF equipment from the transmission line while RF power is being applied.  
Leaking RF energy is a potential health hazard.

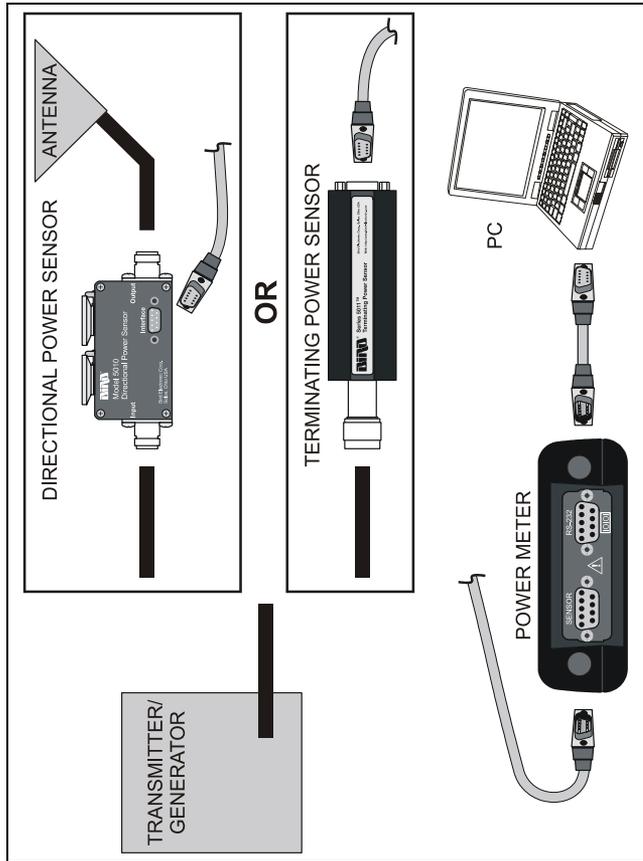


Figure 3 DPM Connections

## Directional Power Sensor (DPS)

### WARNING

RF voltage may be present in RF element socket.  
Keep element in socket during operation.

Connect the Bird DPS to the “Sensor” port on the DPM using the sensor cable provided.

Connect the DPS to the RF line so that the arrow on the sensor points towards the load. The arrow on the forward element should point towards the load. The arrow on the reflected element should point towards the transmitter. The forward element’s power rating must be 10x the reflected’s rating. Both elements must be either APM/DPM or 43 types, do not mix elements.

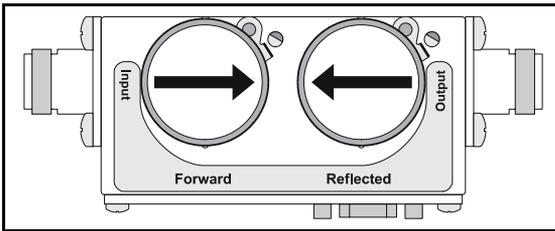


Figure 4 DPS Element Orientation

## Wideband Power Sensor (WPS)

Connect the DPM port on the Bird WPS to the “Sensor” port on the DPM using the sensor cable provided. Connect the WPS to the RF line so that the arrow on the sensor points towards the load.

👉 NOTE: The WPS is not compatible with the Bird PCTool. Use the VPM software instead. Refer to the VPM Quickstart for connection instructions.

### **Terminating Power Sensor (TPS)**

**CAUTION**

Discharge all static potentials before connecting the TPS(-EF). Electrostatic shock could damage the sensor.

**CAUTION**

When connecting the TPS or the TPS-EF, only turn the connector nut. Damage may occur if torque is applied to the sensor body.

**CAUTION**

Do not exceed 2 W average or 125 W peak power for 5  $\mu$ s when using the TPS or the TPS-EF. Doing so will render the sensor inoperative.

Connections are the same for the Bird TPS and TPS-EF. Connect the TPS to the “Sensor” port on the DPM using the sensor cable provided.

In most cases, an attenuator or directional coupler should be used with the TPS. For example, for an RF source with output between 0.1 and 50 W, use a 40 dB, 50 W attenuator. Put the attenuator between the TPS and the source. Only connect the TPS directly to a source if the RF power will be less than 10 mW.

The Bird Digital Power Meter is very easy to operate. Once a sensor is connected, turn the DPM on and take a reading. Additional commands are available, depending on the sensor used.

### ***Normal Operation***

- Connect the sensor.
  - Turn on the DPM.
  - Use the speed keys to set the measurement and measurement units. Refer to the sections following for instructions specific to each sensor.
  - If you know the system loss or are using an attenuator, add the losses (in dB) of all components in the system. For attenuators and other frequency-dependent components, use the loss at the measured frequency. Then, press **OFFSET** and enter the total loss in dB. This will allow you to read the actual line power. The DPM accepts offsets from -10 to 100 dB, depending on the sensor.
  - Turn on the RF source.
  - Take a reading.
-  **NOTE:** The analog bar graph will respond immediately to changes in the RF power. The major and minor displays will respond after a delay of 1 to 13 seconds, depending on the power level.

## **DPM Shutdown**

### **When Powered by Internal Batteries**

To shut down the DPM when it is powered from its internal batteries, press the On key one time.

### **When Powered by an External Source**

To shut down the DPM when it is powered from an external source connected to the External DC Connector jack at the side of the unit, make sure that the backlight is extinguished then press the ON key one time.

 **NOTE:** If you turn off the DPM while the backlight is lighted, you will need to disconnect the external power source for at least 30 seconds before turning the DPM on.

---

## **Directional Power Sensor (DPS)**

### **WARNING**

RF voltage may be present in RF element socket.  
Keep element in socket during operation.

### **Setting Scale**

The Bird DPS uses Bird Plug-In Elements. These are labeled with a max power and a frequency range. The transmitter frequency should be within the element range, and the forward element power should be 10x the reverse element power. Forward full scale power must be entered manually. Reflected full scale is automatically set to 1/10 of the forward full scale.

- Press **Scale**.
- Change the units with the **Fwd Units** key until the DPM units match the units on the forward element.
- Use the numeric keypad to enter the maximum power of the element in the forward element socket.

 **NOTE:** The element's max power is listed on the element nameplate.

- Press **ENTER**.

## Terminating Power Sensor (TPS)

### CAUTION

Do not exceed 2 W average or 125 W peak power for 5  $\mu$ s when using the TPS or the TPS-EF. Doing so will render the sensor inoperative.

### Zeroing Sensor

Over time, the sensor's "zero value" (reading with no applied RF power) can drift, making all readings inaccurate by this value. For example, if the zero value is  $-2 \mu$ W, measuring a 5 mW signal will give a reading of 4.998 mW, a 0.04% error. Measuring a 50  $\mu$ W signal will give a reading of 48  $\mu$ W, a 4% error. If the drift would be a significant error, rezero the sensor:

- Make sure the sensor has been connected to the DPM and the DPM turned on for at least 5 minutes.
- Make sure no RF power is applied to the sensor.
- Press **Zero**. "CAL 0" will be displayed and calibration will begin.
- Zeroing the sensor takes 60 seconds. The bar graph will display calibration progress. When complete, "0 CAL PASS" should be displayed. Press **ENTER** to return to normal operation. If "0 CAL FAIL" is displayed, make sure no RF power is applied to the sensor, press **ENTER** and zero the sensor again.

### TPS-EF

The Bird TPS-EF uses frequency correction factors to allow more accurate measurements. Look at the label on the side of the sensor and find the correction factor for the frequency being measured. Add the correction factor to the other attenuation or coupling factors and enter this as an offset.

## Wideband Power Sensor (WPS)

### Zeroing Sensor

Over time, the sensor's "zero value" (reading with no applied RF power) can drift, making all readings inaccurate by this value. For example, if the zero value is  $-0.02$  W, measuring a 50 W signal will give a reading of 49.98 W, a 0.04% error. Measuring a 1 W signal will give a reading of 0.98 W, a 2% error. If the drift would be a significant error, rezero the sensor:

- Make sure the sensor has reached a stable operating temperature.
- Make sure no RF power is applied to the sensor.
- Press **Zero**. Calibration will begin.
- Calibration will take about 30 seconds. *Do not interrupt the calibration!* A bar on the screen will display calibration progress.
- After a successful calibration, "Cal Pass" or "Calibration Complete" will be displayed. Press any key to return to normal operation.
- If calibration fails, "Cal Fail" will be displayed. Press a key to return to normal operation, then check that the WPS is properly connected, and that the RF is off. Rezero.

## Selecting Measurement

The Bird Wideband Power Sensor can measure Average, Peak, and Burst power as well as Crest Factor and CCDF. To select the measurement:

- Press **SHIFT** to display the second set of softkeys. **Type** should be key 2 and **Filter** should be key 3.
- Press **Type** to cycle through the possible modes.

## Video Filter

Except for average power and VSWR measurements, all measurements use a variable video filter to improve accuracy. This filter can be set to either 4.5 kHz, 400 kHz, or Full bandwidth. It should be as narrow as possible while still being larger than the demodulated signal bandwidth (video bandwidth). Narrowing the filter limits the noise contribution from interfering signals. Listed below are some common modulation schemes and the appropriate video filter.

Video Filter	Modulation Type
4.5 kHz	CW Burst (Burst width > 150 $\mu$ s), Voice Band AM, FM, Phase Modulation, Tetra
400 kHz	CW Burst (b.w. > 3 $\mu$ s), GSM, 50 kHz AM, DQPSK ( $\frac{1}{4}\pi$ , symbol rate < 24 k/s)
Full Bandwidth	CW Burst (b.w. > 200 ns), CDMA, WCDMA, DQPSK ( $\frac{1}{4}\pi$ , symbol rate < 200 k/s), DAB/DVB-T

## Average Mode

This mode displays the average forward and reflected power. In average mode, the VSWR or system match can be displayed instead of the reflected power.

- Press **SHIFT** to display the first set of softkeys.  
Press **Fwd Units** or **Rfl Units** to cycle through the possible units.

## Peak Mode

This mode displays the peak envelope power.

- Press **SHIFT** to display the first set of softkeys.  
Press **Fwd Units** to cycle through the possible units.

## Burst Mode

This mode displays the average power in a burst. The burst's duty cycle is measured by the DPM.

- Press **SHIFT** to display the first set of softkeys.  
Press **Fwd Units** to cycle through the possible units.

## Crest Factor Mode

The crest factor is the ratio of the forward peak power and the forward average power. It is measured in dB. There are no additional controls in this mode.

## CCDF Mode

The CCDF measures the percentage of time the power level is above a threshold. To set the power threshold:

- Press **Setup**. Enter the threshold power (in Watts) and press **ENTER**.



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## Chapter 4

## Maintenance

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### Cleaning

**CAUTION**

Do not use harsh or abrasive detergents for cleaning.

Clean the Bird Digital Power Meter and its display with a soft cloth dampened with mild detergent and water only. Clean sensors with a dry cleaning solvent that leaves no residue.

### Charging Batteries

Fully charged batteries provide about 20 hours of continuous operation with the Bird WPS, 100 hours with other sensors. Charging time is typically 8 hours using the ac adapter. The batteries charge whenever the DPM is connected to ac or dc power sources, using either the ac Mains adapter or the automobile cigarette lighter adapter. When the external adapter is connected, the battery level indicator will blink until the battery is fully charged. When using the internal batteries, the indicator will be on continuously and the black bar will show the battery charge remaining. The unit will charge with its power turned either on or off.

 **NOTE:** For optimum battery life, only charge the batteries after the battery level indicator empties completely and begins to blink.

## Troubleshooting

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REMEDY</b>
Nothing shown on display	Unit is off	Momentarily press the ON key.
	Batteries are drained	Use external power source. (page 9) Replace the batteries. (page 24)
Display shows dashes; bar scale is blank	No sensor connected	Connect a sensor.
	Sensor communication has failed	Use a different cable. Use a different sensor.
Display shows "Bat Error"; bar scale is blank	Batteries are drained	Use external power source. (page 9)
Display shows dashes and "Overrange"; bar scale is full	Unit is overrange	Use higher power elements (if applicable), or reduce RF power.
WPS Status LED is not on	WPS not powered	Check connection to DPM
		Connect WPS to a power supply using the ac adapter

<b>PROBLEM</b>	<b>POSSIBLE CAUSE</b>	<b>REMEDY</b>
Erratic power readings	Element contact out of alignment (DPS)	Align the contact. It must be far enough out to make good contact with the element, but must not restrict entry of the element body.
	Damaged element (DPS)	Replace element.
	Sensor has lost its zero (TPS)	Rezero sensor.
	Sensor is damaged	Replace sensor.
Unit will not turn ON	Unit is using ac power adapter and was turned OFF while the back light was illuminated.	Disconnect the ac adapter connector from the unit and wait for at least 30 seconds, then turn the unit ON.

## **Battery Replacement**

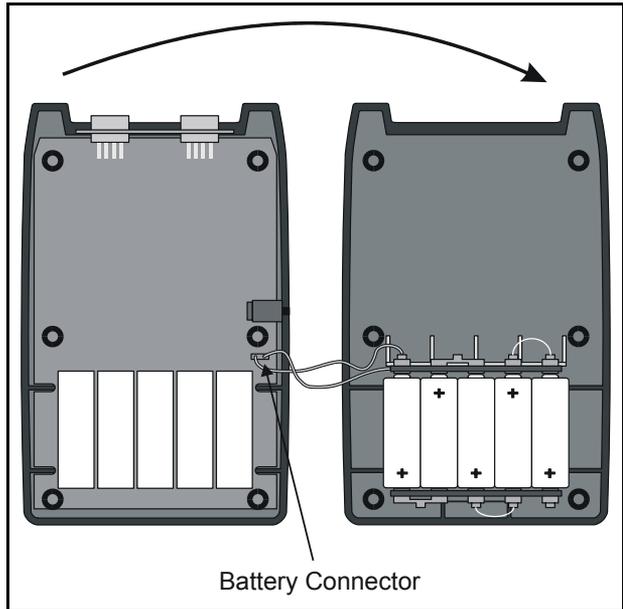
The Nickel-Metal Hydride (Ni-MH) batteries do not normally need to be replaced. If necessary, however, follow these instructions (see Figure 5).

### **WARNING**

Disconnect from external power before any disassembly. The potential for electric shock exists.

### **CAUTION**

Replace only with Ni-MH rechargeable A batteries.  
Nominal Voltage 1.2V; Capacity 2700mAh.  
Use Sanyo P/N HR-AUX or equivalent.



*Figure 5 Back Cover Removal*

- Lay the DPM, display side down, on a clean surface.
- Use a small screwdriver to remove all six screws from the back cover.
- Taking care to not disconnect the battery connector, lift the back cover off, flip it over, and lay it, battery side up, next to the front cover.
- Remove the old batteries.
- Install the new batteries checking the orientation of the positive and negative terminals.
- Make sure the battery connector is connected.
- Taking care to not pinch the connector wires, put the covers back together and screw into place.

## **Customer Service**

Any maintenance or service procedure beyond the scope of those in this chapter should be referred to a qualified service center.

If you need to return the unit for any reason, contact the Bird Service Center for a return authorization. All instruments returned must be shipped prepaid and to the attention of Bird Service Center.

### **Bird Service Center**

30303 Aurora Road

Cleveland (Solon), Ohio 44139-2794

Phone: (440) 519-2298

Fax: (440) 519-2326

E-mail: [bsc@bird-technologies.com](mailto:bsc@bird-technologies.com)

For the location of the Sales Office nearest you, give us a call or visit our Web site at:

*<http://www.bird-electronic.com>*

## **Parts List**

<b>Part Name</b>	<b>Part Number</b>
Digital Power Meter	5000-EX
AC adapter 120V ac	5A2229
230V ac	5A2226
Cigarette Lighter Adapter	5A2238-1
Directional Power Sensor	5010B
DPM Elements See P/N 871-DPM-019-901, the DPM Element Guide, for a complete list of elements	Various
Terminating Power Sensor 40 MHz – 4 GHz	5011
40 MHz – 12 GHz	5011-EF
Wideband Power Sensor	5012
Soft Carry Case	5000-030
Hard Carry Case	5000-035
PC Interface Virtual Power Meter (VPM)	VPM
Serial to USB Adapter	DC-DB9-U
Instruction manual	920-5000-EX

## Attenuators & Accessories

N(F) – N(M) Attenuators (RF power range with TPS)	
30 dB (10 mW – 10 W)	8353A030–10
40 dB (100 mW – 50 W)	8353A040–50
DC Block	5011A035–1
N(F) – N(M) Test Cable, 1.5 m	TC–MNFN–1.5–G
N(F) – N(M) Armored, Phase Stable Test Cable	
1.5 m	TC–MNFN–1.5
3.0 m	TC–MNFN–3.0
Calibration Data	5011–CALDATA
Recommended for attenuators, test cables, dc block, and right angle adapter	

### Adapters

N(F)–N(F)	4240-500-1	N(F)–N(M) Right Angle	4240-500-3
N(F)–SMA(F)	4240-500-4	N(F)–SMA(M)	4240-500-5
N(F)–7/16 DIN(F)	PA-FNFE	N(F)–7/16 DIN(M)	PA-FNME

## Specifications

### Bird 5000-EX Digital Power Meter

Display	Backlit LCD with major and minor digital displays, analog bar graph, and speed key labels
Analog Bar Graph	20 segment, horizontal. Tracks the major display
Measurement Modes	Determined by the sensor
Sensor Interface	9-pin RS-232 serial port. Sensor is powered from the DPM.
PC Interface	9-pin RS-232 serial port
Dimensions	8.0"H x 4.625"W x 2.0"D (203 x 118 x 51 mm)
Weight	2 lbs. (0.9 kg) nominal
Battery	Rechargeable Nickel-Metal Hydride (NiMH) battery. 8 hours for full charge
AC Power Input Output	Operates from ac mains using supplied adapter 120 ± 10% Vac @ 50/60 Hz 12 Vdc, < 400 mA
Operating Temp.	0 to +50 °C (32 to 122 ° F)
Storage Temp.	-20 to +50 °C (-4 to +122 ° F)
Humidity, Max.	95% (non-condensing)
Altitude	15,000 ft. (4500 m) operating
Mechanical Shock and Vibration	In accordance with MIL-T-28800D Class 3

**Bird 5010B Directional Power Sensor**

Sensor Type	Bird ThruLine directional two-element line section.	
Elements	APM/DPM or 43 series elements. Select two from the same series, with RFL power 1/10 of FWD power	
Frequency Range*	2 – 3600 MHz	
Average Power Measurement, APM/DPM Elements, Forward or Reflected Direction		
RF Power Range*	0.1 W to 1 kW	
Uncertainty†	± 5% of reading (95% c.l.)	
Peak/Average Ratio, Max	10 dB	
Average Power Measurement, 43 Elements, FWD or RFL		
RF Power Range*	0.1 W to 10 kW	
Uncertainty†	± 5% of full-scale power (95% c.l.)	
Peak Power Measurement, 43 Elements, FWD only		
Pulse Width, Min	2 – 25 MHz	15 µs
	25 – 100 MHz	1.5 µs
	> 100 MHz	800 ns
Rep. Rate, Min	15 pps	
Duty Cycle, Min	1 x 10 <sup>-4</sup>	
Uncertainty†	± 8% of full-scale peak envelope power (95% c.l.)	

*Bird Model 5000-EX Digital Power Meter*

Match Measurement	
Measurement Range	
Return Loss	0 to 20 dB
Rho ( $\rho$ )	0.1 to 1
VSWR	1.22 to 99.99
Uncertainty	Calculated from forward and reflected uncertainty. Twice the Avg Power Uncertainty
Settling Time, Max	2.5 seconds
Impedance, Nominal	50 ohms
Insertion Loss, Max	0.05 dB up to 1 GHz
Input VSWR, Max.	1.05:1 up to 1 GHz
Directivity, Typical*	30 dB
RF Connectors	QC Type, N(F) normally supplied
Power Supply	From host instrument via cable
Mechanical Shock and Vibration	In accordance with MIL-T-28800D Class 3
CE	CE compliant. Refer to DOC for specific standards.
Temp, Operating	-10 to +50 °C (+14 to +122 °F)
Temp, Storage	-40 to +75 °C (-40 to +167 °F)
Humidity, Max	95% (non-condensing)
Altitude, Max	3,000 m (10,000 ft.)
Dimensions, Nominal	2.5" x 5.0" x 2.0" (59 x 127 x 51 mm)
Weight, Nominal	1.25 lb. (0.6 kg)

\* Exact value depends on element selected

† Above 35 °C or below 15 °C add 2%

**Bird 5011 and 5011-EF Terminating Sensors**

Sensor Type	Diode based terminated true average power measurement
Frequency Range	
5011	40 MHz to 4 GHz
5011-EF	40 MHz to 12 GHz
RF Power Range	10 $\mu$ W to 10 mW (-20 dBm to +10 dBm)
Max Power (Damage Level)	2 W avg. 125 W peak for 5 $\mu$ s
Peak/Average Ratio	12 dB max
Uncertainty*	$\pm$ (5% of reading + 1 $\mu$ W) (95% c.l.) (excluding mismatch uncertainty) (with correction factors for -EF)
RF Connector	
5011	N Male
5011-EF	Precision N Male
Impedance, Nominal	50 ohms
Input VSWR:	
5011	
Typical	1.03 (36.6 dB return loss)
Maximum	1.20 (20.8 dB return loss)
5011-EF	
Typical	1.05 (32.0 dB return loss)
Maximum	1.25 (19.1 dB return loss)
Power Supply	From host instrument via cable

*Bird Model 5000-EX Digital Power Meter*

Temp, Operating	-10 to +50 °C (14 to 122 °F)
Temp, Storage	-40 to +80 °C (-40 to +176 °F)
Humidity, Max	95% (non-condensing)
Altitude, Max	4,500 m (15,000 ft.)
Dimensions, Nominal	6" long x 1.5" diameter
Weight, Max	0.75 lb. (0.35 kg)
Recommended Calibration Interval	12 Months

- \* 5011: Above 40 °C, when making measurements at frequencies between 40 and 100 MHz, add 1%.  
5011-EF: Above 40 °C or below 10 °C, add 1%.

## Bird 5012 Wideband Sensor

### Sensor Characteristics

Frequency Range	350 MHz to 4 GHz
RF Power Range	0.15 W – 150 W Average, 4.0 – 400 W Peak
Maximum Power	See Figure 7 on page 35
Impedance, Nominal	50 ohms
Insertion Loss, Max	
0.35 – 1 GHz	0.05 dB
1 – 4 GHz	0.1 dB
Input VSWR, Max	
0.35 – 2.5 GHz	1.05:1
2.5 – 4 GHz	1.10:1
Directivity, Min	
0.35 – 3 GHz	30 dB
3 – 4 GHz	28 dB
RF Connectors	N Female
Interface:	
DPM	Male DB-9, EIA-232, 9600 baud, no parity, 8 data bits, 1 stop bit
PC Serial Port	Fem. DB-9, EIA-232, 9600 baud, no parity, 8 data bits, 1 stop bit
PC USB Port	USB 1.1 interface
Power Supply:	
DPM	From host instrument via cable
USB Port	less than one low-power USB load
DC Connector	7 – 18 Vdc, < 100 mA

### Average Power

RF Power Range	0.15 – 150 W
Peak/Average Ratio, Max	12 dB
Measurement Uncert.	$\pm$ (4% of reading + 0.05 W) <sup>*</sup>

\* Above 35 °C or below 15 °C add 3%

### Match Measurement

Measurement Range	
Return Loss	0 to 23 dB
Rho ( $\rho$ )	0.07 to 1.0
VSWR	1.15 to 99.9
Forward Power, Min	0.5 W
Measurement Uncert.	See Figure 6 on page 35

### Peak Envelope Power

RF Power Range	4.0 – 400 W <sup>*</sup>
Measurement Uncert.	
burst width > 200 $\mu$ s	$\pm$ (7% of reading + 0.2 W) <sup>†</sup>
1 $\mu$ s < b.w. < 200 $\mu$ s	$\pm$ (10% of reading + 0.4 W) <sup>†</sup>
burst width < 1 $\mu$ s	$\pm$ (15% of reading + 0.4 W) <sup>†</sup>
burst width < 0.5 $\mu$ s	$\pm$ (20% of reading + 0.4 W) <sup>†</sup>

\* Max. power depends on frequency and system VSWR. See Figure 7 on page 35

† Above 35 °C or below 15 °C add 3%  
For D < 0.1 add 0.1 W  
For period > 0.1s add (1.5% + 0.15 W)

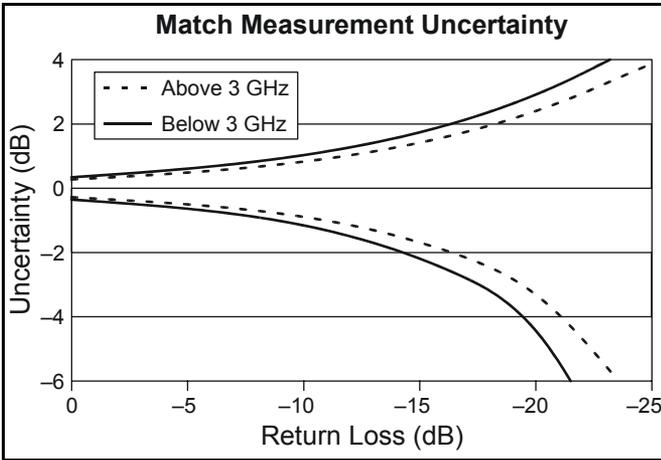


Figure 6 Match Measurement Uncertainty

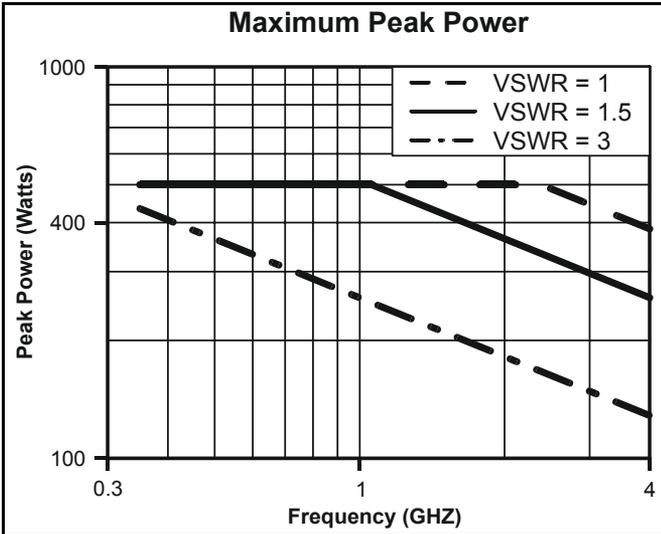


Figure 7 Max. Peak Power

### Burst Average Power

RF Power Range	2 – 150 W average
Burst Width	1 $\mu$ s – 50 ms
Repetition Rate, Min	15 Hz
Duty Cycle (D)	0.001 – 1 D = Burst Width / Period
Measurement Uncert.	$\pm$ (6% of reading + 0.05/D W)*

\* Above 35 °C or below 15 °C add 3%

### Crest Factor

RF Power Range	0.15 – 150 W
Measurement Uncert.	Linear sum of peak and average power uncertainty

### Complementary Cumulative Distribution Function (CCDF)

Measurement Range	0.1 – 100%
Measurement Uncert.	$\pm$ 0.2%
Threshold Level Range	2 – 400 W
Level Set Accuracy	As peak power uncert. + 2%

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### Physical and Environmental Specifications

Temp, Operating	-10 to +50 °C (+14 to +122 °F)
Temp, Storage	-40 to +80 °C (-40 to +176 °F)
Mechanical Shock and Vibration	MIL-PRF-28800F class 3
Humidity, Max	95% (non-condensing)
Altitude, Max	15,000 ft. (4,500 m)
Dimensions, Nominal	4.75" x 4.6" x 1.3" (121 x 117 x 33 mm)
Weight, Max	1.2 lb. (0.55 kg)

## Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

## DECLARATION OF CONFORMITY

Manufacturer: Bird Electronic Corporation  
30303 Aurora Road  
Cleveland, Ohio 44139-2794

Product: Digital Power Meter (DPM)  
Directional Power Sensor

Models: 5000-EX 5010B

The undersigned hereby declares, on behalf of Bird Electronic Corporation of Cleveland, Ohio, that the above referenced products, to which this declaration relates, are in conformance with the provisions of the following standards.

- European Standard EN 61326-1:1998 – Electronic Equipment for Measurement, Control and Laboratory Use – EMC Requirements
- European Standard EN 61010-1:2001 – Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

These standards are in accordance with EMC Directive (89/336/EEC) and Low Voltage Directive (73/23/EEC), 1973 Including Amendment (93/68/EEC), 1993

The technical documentation supporting compliance with these directives is maintained at Bird Electronic Corporation, 30303 Aurora Road, Cleveland, Ohio 44139.



Bob Gardiner  
Director of Quality  
Bird Electronic Corporation

## DECLARATION OF CONFORMITY

Manufacturer: Bird Electronic Corporation  
30303 Aurora Road  
Cleveland, Ohio 44139-2794

Product: Terminating Power Sensor  
Models: 5011 5011-EF

The undersigned hereby declares, on behalf of Bird Electronic Corporation of Cleveland, Ohio, that the above referenced product, to which this declaration relates, is in conformity with the provisions of the following standards.

- European Standard EN 61326-1:1997 - Electronic Equipment for Measurement, Control and Laboratory Use - EMC Requirements
- European Standard EN 55011:1998 - Radiated Emissions
- European Standard EN 61000-4-2:1995 - ESD Immunity
- European Standard EN 61000-4-3:1995 - Radiated RF / EMF Immunity
- European Standard EN 61000-4-4:1995 - Fast Transient / Burst Immunity
- European Standard EN 61000-4-6:1995 - Conducted Immunity

These standards are in accordance with EMC Directive (89/336/EEC).

- European Standard EN 61010-1:1993 - Part 1: General Requirements Including Amendment 2: 1995

This standard is in accordance with Low Voltage Directive (73/23/EEC), 1973

The technical documentation supporting compliance with these directives is maintained at Bird Electronic Corporation, 30303 Aurora Road, Cleveland, Ohio 44139.



Bob Gardiner  
Director of Quality  
Bird Electronic Corporation