Multi-Channel Power Meter

Model
3140A200

Operation Manual

Instruction Book Part Number 920-3140A200 Rev. P1

Safety Precautions

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.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Shock Hazard

Do not attempt to remove the RF transmission line while RF power is present.

WARNING

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.

WARNING

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.

WARNING

Resuscitation

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

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power on.

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.

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 disconnect the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

See page 7.

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 HACERIO.

WARTUNG

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

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

ENTRENTIEN

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.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARRE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating and maintenance instructions for the following models:

3140A200

Changes to this Manual

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

Chapter Layout

Introduction — Describes the Multi-Channel Power Meter and list compatible Power Sensors, the equipment supplied with the power meter is listed and the controls and indicators are described.

Installation — Provides unpacking instructions, describes the theory of operation and includes installation instructions.

Operating Instructions — Describes how to adjust the analog meter and provides instructions for calculating VSWR.

Maintenance — Lists routine maintenance tasks as well as troubleshooting for common problems. Specifications are also included.

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Chapter 1 Introduction

Purpose and Function

The Bird Multi-Channel Power Meter is capable of monitoring radio performance and antenna/feedline characteristics. The Multi-Channel Power Meter provides forward and reflected power for up to eight channels when used in conjunction with compatible power sensors.

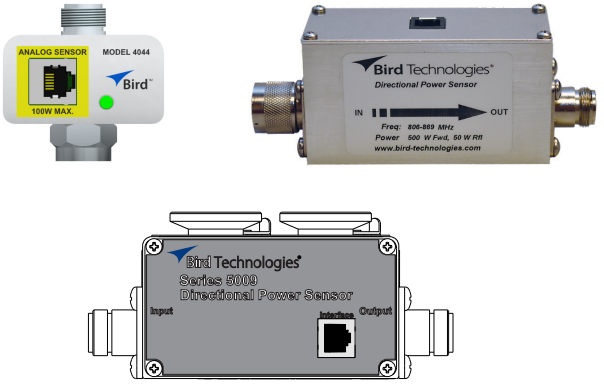
Figure 1 Multi-Channel Power Meter

Items Supplied

- Multi-Channel Power Meter
- 100-240 VAC 50/60 Hz Power Adapter
- Operation Manual

Compatible Power Sensors

Figure 2 Compatible Power Sensors



Non-Directional Power Sensors

Non-Directional power sensors provide power readings in one direction, forward power only.

4044 Power Sensor — The 4044 Series power sensors are typically used to measure forward average power on a 50 ohm RF transmission line with a maximum 100 watt power level in a frequency band with an overall range of 144 to 960 MHz. Refer to the 4044 Sensors operation manual (920-4044) for specific frequency ranges and model features. The manual is available at www.birdrf.com.

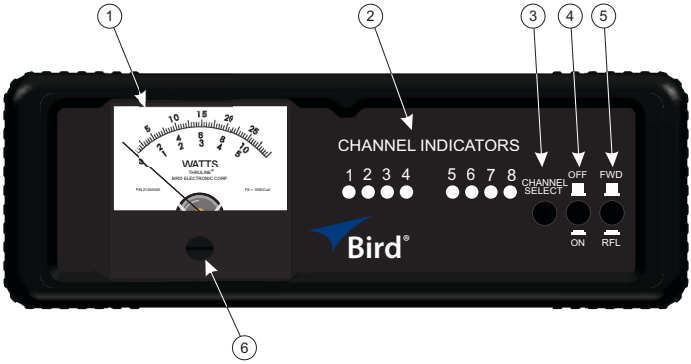
Directional Power Sensors

4045 Power Sensor — The 4045 Series power sensors are typically used to measure forward and reflected average power on a 50 ohm RF transmission line with a maximum 500 watt forward and maximum 50 watt reflected power levels in a frequency band with an overall range of 144 to 960 MHz. Refer to the 4045 Sensors operation manual (920-4045) for specific frequency ranges and model features. The manual is available at www.birdrf.com.

5009 Power Sensor — The DPS Power Sensors are intended for use in coaxial transmission lines of 50 ohm nominal impedance. The sensor utilizes elements to make power measurements. Each element has an arrow on it that represents the direction in which it measures power. The elements ignore power in the opposite direction with a directivity of at least 25 dB. The frequency and power rating will depend on the elements used.

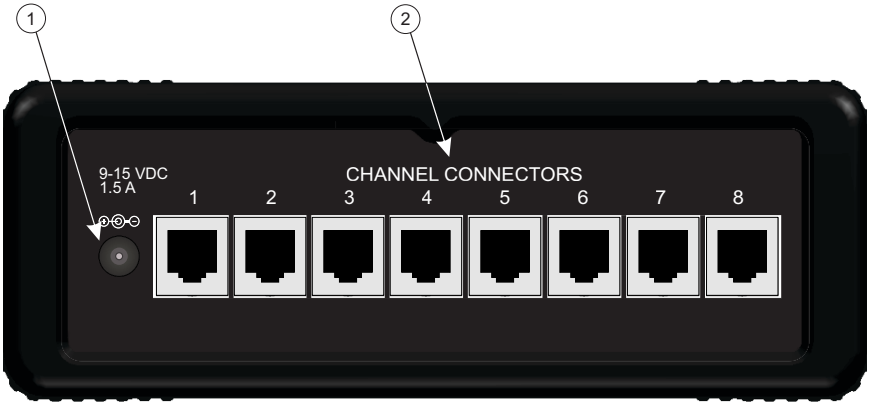
Controls and Indicators

Figure 3 Front Panel



1	**Analog Meter**	**Analog Meter Indicating power for the selected channel.**
2	**Channel Indicator LEDs**	**LED will illuminate when the associated channel is selected. Selected channel power readings will be indicated on the meter. Only one channel may be selected at a time.**
3	**Channel Select Pushbutton**	**When pressed, advances to the next channel, and illuminates the Channel Indicator for the newly selected channel.**
4	**Power Pushbutton**	**Applies or removes power to the power meter when pressed.**
5	**Forward/Reflected Power Selection Pushbutton**	**Alternate action pushbutton, when pressed selects the forward power or reflected power measurement from the selected power sensor.**
6	**Zero Adjust**	**When turned, adjusts the position of the needle on the meter.**

Figure 4 Rear Panel



1	**DC Power Input Connector**	**Input connector for DC power Supply.**
2	**Sensor Input Connectors**	**RJ-25 Input connectors for up to eight compatible power sensors.**

Chapter 2 Installation

Unpacking and Inspection

1. Carefully inspect shipping container for signs of damage.
   - If the shipping container is damaged, do not unpack the unit. Immediately notify the shipping carrier and Bird Technologies.
   - If the shipping container is not damaged, unpack the unit. Save shipping materials for repackaging.
2. Inspect unit for visual signs of damage.

   Note: *If there is damage, immediately notify the shipping carrier and Bird Technologies.*

Items Required

- Multi-Channel Power Meter, with power supply
- Sensor (s)

  Note: *Ordered separately*
- Data Cable - one for each sensor, length as required

Theory Of Operation

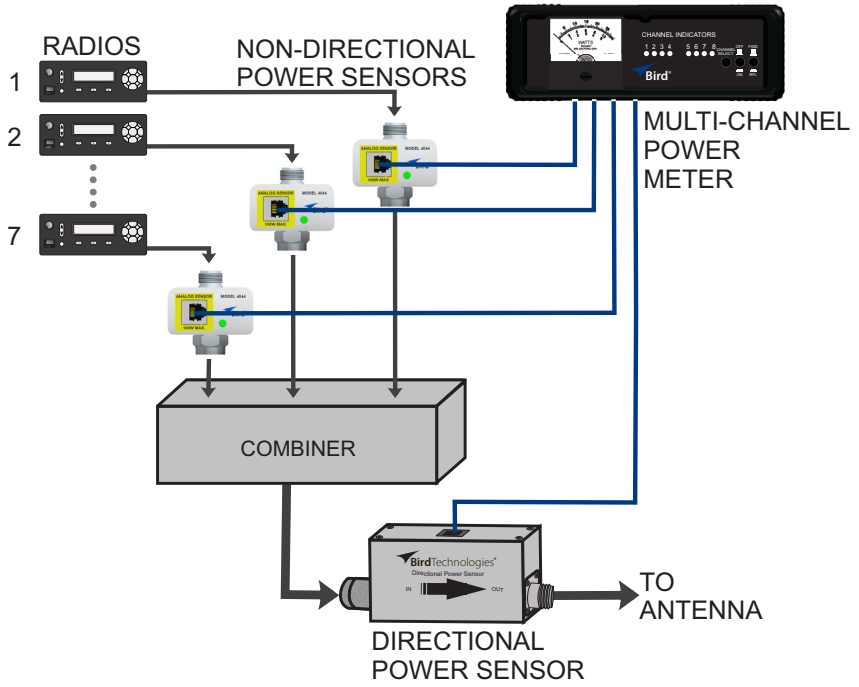
The Multi-Channel Power Meter is capable of monitoring up to eight Power Sensors. In Figure 5 on page 6 a typical Multi-Channel Power Meter installation is shown. In this example Directional and Non- Directional Power Sensors are used to monitor system performance.

The Non-Directional Power Sensors are used to monitor the power output of the individual radios. Each Non-Directional Power Sensor is connected to a channel input on the Multi-Channel Power Meter. The Non-Directional Power Sensors monitor forward power from the transmitters (radios), changes in any radios output power level will be indicated on the Analog meter.

The Directional Power Sensor is used to monitor the output of the combiner. The Directional Power Sensor is connected to a channel input on the Multi-Channel Power Meter. The Directional Power Sensor can monitor both forward power and reflected power, thus providing a measurement of total output power. The forward and reflected power values can be used to calculate Voltage Standing Wave Ratio (VSWR). See "Determining VSWR" on page 9.

Reflected power and VSWR measurements provide indications of the impedance match of the transmitters (radios) with the antenna. Antenna damage or other degradation can cause an increase in reflected power and a higher VSWR, changes in forward or reflected power levels as measured at the Multi-Channel Power Meter should be investigated.

Figure 5 Connection Diagram



RF and Data Connections

This procedure is an example of one possible cable configuration, based on the description in the Channel Power Monitor Theory Of Operation and shown in Multi-Channel Power Meter Connection Diagram (Figure 5 on page 6). Some configurations may require additional RF cables or adapters..

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

1. Disable RF power for transmission lines to be disconnected.

2. Disconnect RF input cable from Combiner. See Power Sensor Connection Figure.

3. Connect Non-Directional Power Sensor's RF output connector to the Combiner’s RF input.

4. Connect the RF input cable to the Non-Directional Power Sensor's RF input connector.

5. Repeat step 1 through 4 for all Non-Directional Power Sensors.

6. Disconnect RF output (antenna) cable from the Combiner RF output connector.

7. Connect Directional Power Sensor's RF input to the Combiner’s RF output connector.

8. Connect the RF output (antenna) cable to the Directional Power Sensor's RF Output connector.

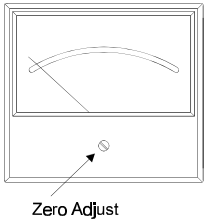
9. Connect a data/power cable from the Multi-Channel Power Meter to each power sensor.

Note: *Record each channel number and associated power sensor.*

Zero Adjust

The Analog meter should be checked for zero set under no power conditions. With no power applied the meter pointer should set exactly on zero. If adjustment is required, turn the adjustment screw until the pointer is set at zero.

Figure 6 Zero Adjust



Determining VSWR

The forward/reverse RF power ratio is readily calculated from the readings, and VSWRs may be determined from Figure 7 and Figure 8. Following the vertical and horizontal grid, determine intersection of forward and reverse power values. Slanted lines passing closest to this point indicate VSWR.

Figure 7 VSWR Conversion Nomograph

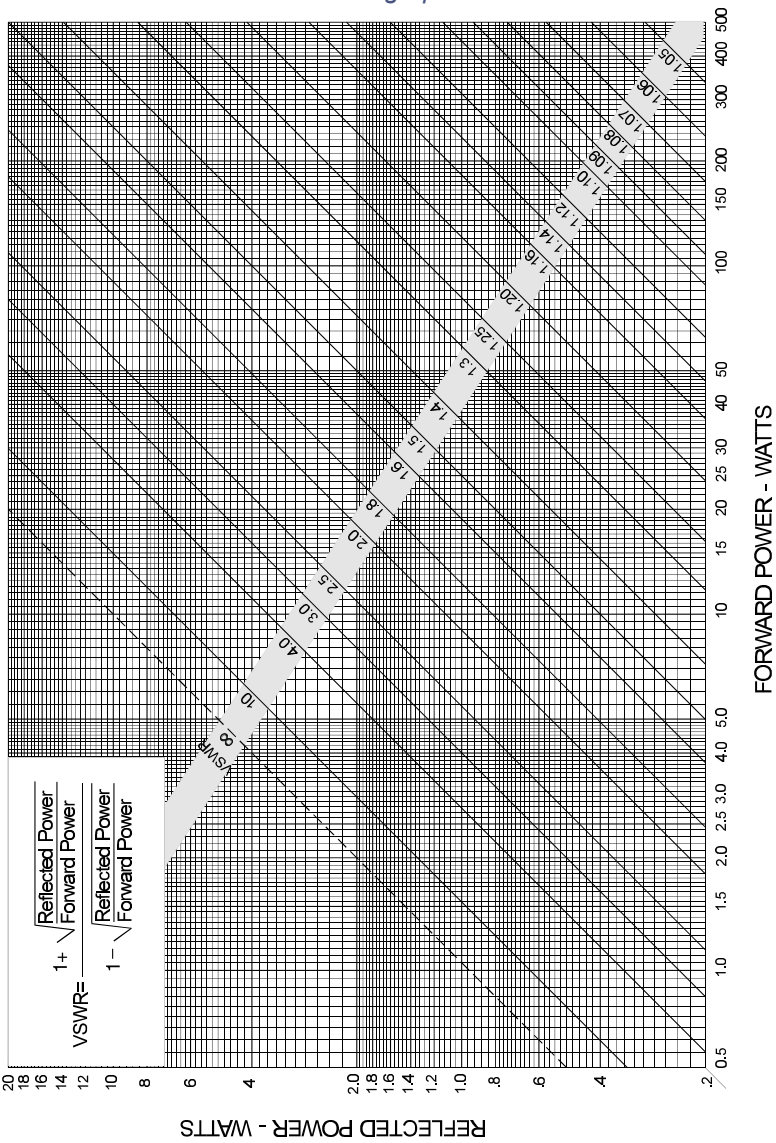
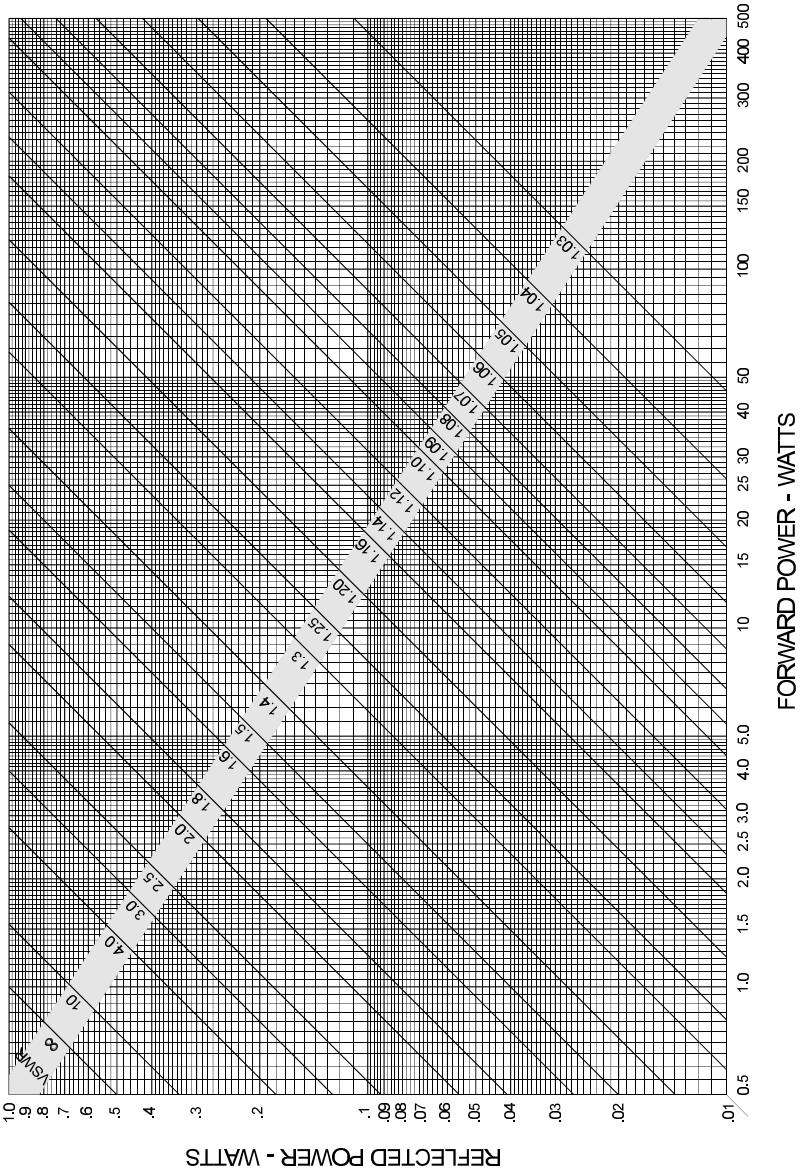


Figure 8 VSWR Conversion Nomograph



Chapter 4 Maintenance

Cleaning

The outside surface of the Multi-Channel Power Meter may be cleaned with a soft cloth dampened with a mild detergent solution. Do not wipe the meter glass with a dry cloth, a static charge could develop causing an erroneous indication on the meter.

Storage and Shipment

Storage

No special preparations for storage are necessary other than to cover the equipment to keep out dust and dirt.

Shipment

Package instrument using the original shipping container. If the original shipping container is not available, use a corrugated box. Place shock absorbing material around all sides of the instrument to prevent movement during handling or shipment. Equipment packaging shall be in accordance with best commercial practices.

Troubleshooting

The following table contains troubleshooting information for problems which can occur during normal operation. Locate the problem, review the possible cause, and perform the corrective action listed.

Only those functions within the scope of normal maintenance are listed. This manual cannot list all malfunctions that may occur, or all corrective actions. If a malfunction is not listed or not corrected by the listed corrective actions, notify a qualified service center.

Table 1 Troubleshooting

PROBLEM	CAUSE	AREAS TO CHECK / CORRECTION
No meter indication	No DC Power	Check power supply
	No RF power	Check RF source, sensors and cables.
	Open or short circuit in data cable	Replace defective data cable .
	Meter burned out or damaged	Return Multi-Channel Power Meter to the factory for meter replacement. See "Storage and Shipment" on page 11.
Intermittent or inconsistent meter readings	Faulty Sensor or transmission line	Inspect sensors and transmission line.
	Dirty DC contact on sensor elements.	Clean DC contacts. Refer to sensor's operation manual.
	Sticky or defective meter	Return Multi-Channel Power Meter to the factory for meter replacement See "Storage and Shipment" on page 11.
High VSWR or reflected power	Bad Antenna or poor connectors	Repair or replace Antenna or connectors.
	Shorted or open transmission line	Have line serviced.
	Foreign material in the sensor's line section or in RF connector bodies	Remove foreign material.

Customer Service

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

If the unit needs to be returned for any reason, request an Return Material Authorization (RMA) through the Bird Technologies website. All instruments returned must be shipped prepaid and to the attention of the RMA number.

Bird Service Center
30303 Aurora Road
Cleveland (Solon), Ohio 44139-2794
Fax: (440) 248-5426
E-mail: *bsc@birdrf.com*

For the location of the Sales Office nearest you, visit our Web site at:

http://www.birdrf.com

Specifications

Power Requirements (AC Power Supply)	Input Voltage 100-240 VAC, 50/60 Hz, 0.7 A
Power Input (Power Meter)	9-15 VDC, 1.5 A
Sensor Interface Connections	8 - RJ-25
Environmental Requirements	
Operating Temperature	0° C to +50° C (32° F to 122° F)
Storage Temperature	-20° C to +80° C (-4° F to 176° F)
Humidity	95 % ± 5 % max. (non condensing)
Altitude	up to 3,048 m (10,000 feet)
Physical Characteristics	
Dimensions	(D, W, H) 9.5 x 17.78 x 5.7 cm (3.75" x 7" x 2.25")
Weight	0.56 kg (1.25 lbs.)
Power Range	Sensor dependant
Frequency Range	Sensor dependant

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.