

Directional RF Thruline Wattmeter

Model 4480A

Operation Manual

©Copyright 2026 by Bird Technologies, Inc.
Instruction Book Part Number 920-4480 Rev. J

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

Outlets must match the supplied AC plug, never modify the plug in any way. Do not use any adapter plugs with grounded components. If the plug will not fit the outlet, have a proper outlet installed and grounded by a qualified electrician in accordance with all codes and ordinances. Standardized, grounded plugs and outlets reduce risk of electric shock, serious injury, or death.

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

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

CAUTION

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



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

NOTE

Notes call 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

Exposure to RF power radiation and the possibility of RF shock or burns exist under some operating conditions. Always turn off transmitter when connecting or disconnecting wattmeter. Be sure transmission line is terminated into a load or antenna.

On pages 7, 8, and 9.

WARNING

The RF terminals in mated position are not intended to be hand-held or touched during measurement operation.

On page 8.

Caution Statements

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION

Only install rechargeable NiMH AA batteries. Using non-rechargeable batteries may cause permanent damage when charger is connected.

On pages 6 and 11.

CAUTION

Batteries must be inserted in the correct polarity.

On pages 6 and 11.

CAUTION

Measurements will be inaccurate, if the measured frequency is outside the selected frequency band. Measurement accuracy relies on the input frequency being within the selected frequency band. The Model 4480A cannot determine if the signal is in the correct band or notify the user if an incorrect band is selected.

On page 8.

CAUTION

If other than Female N type connectors are used, limit power and frequency to the capabilities of the RF coaxial cable or connectors used. Damage to connectors or errors in reading could result.

On page 11.

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:

Model 4480A

Reproduction and distribution of this technical manual is authorized for government purposes.

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.

Bird Technologies Inc. 30303 Aurora Road, Solon, Ohio 44139-2794

Chapter Layout

Introduction — Provides a brief description of the features of the Bird Model 4480A Wattmeter, a theory of operation, and a description of the controls and indicators.

Installation — Describes how to make RF connections to the Model 4480A and battery installation.

Operation — Describes the steps required to make power measurements.

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

Table of Contents

Safety Precautions i

Safety Symbols ii

Warning Statements ii

Caution Statements iii

Safety Statements iv

About This Manual vi

Changes to this Manual vi

Chapter Layout vi

Chapter 1 Introduction 1

Description 1

Theory Of Operation 2

Line Section Assembly 2

Digital Circuit Board 2

Power Supply 2

Model 4480A Controls 4

Model 4480A Display 5

Chapter 2 Installation 6

Battery Installation 6

Charging 6

Transmission Line Connections 7

Connectors 7

Transportation and Storage 7

Chapter 3 Operation 8

RF Power Measurements 8

Power Range Coverage 8

Shutdown 9

Chapter 4 Maintenance 10

Calibration 10

Care and Cleaning 10

Housing 10

RF Connectors 10

Battery Care 10

Battery Replacement 11

RF Connectors Replacement 11

Firmware Updates - Keeping your Wattmeter at its Best 12

Troubleshooting 12

Customer Service 13

Shipment 13

Replacement Parts List 14

QC Type Connectors 14

Specifications 15

Limited Warranty 16

Chapter 1 Introduction

The Model 4480A Thruline Wattmeter is an insertion type RF wattmeter designed to measure power flow and load match in 50 ohm RF coaxial transmission lines. The Model 4480A measures true average power, even in the presence of complex modulation. When used in a 50 ohm application with N type connectors, the Model 4480A has an insertion VSWR of less than 1.05 for frequencies up to 1000 MHz. The meter has two RF ranges, a 2 to 30 MHz range and a 25 to 1000 MHz range. This provides a full range from 2 to 1000 MHz. Forward and reflected RF power and VSWR are displayed on the screen.

The Model 4480A may be used indoors and outdoors, the meter is certified for use in wet locations (IP 54). The Battery Charger is rated for indoor use only.

Figure 1 Model 4480A RF Wattmeter



Description

The Model 4480A Thruline Wattmeter is a portable unit housed in an thermoplastic polymer enclosure. The wattmeter has a 4.7 x 2.5 inch display and a pushbutton interface. The Model 4480A is powered by six AA NiMH rechargeable batteries. An AC to DC charger is supplied with the wattmeter. The unit is equipped with a carrying strap and four rubber feet on the base.

The wattmeter contains a line section inside the enclosure, circuit boards mounted to the line section sample the RF traveling waves and convert the samples to forward and reflected power measurements in two different RF bands. The frequency band selection switch on the Model 4480A's front panel is used to select the correct frequency range (high or low) of the measured RF. The measured forward and reflected RF power levels and VSWR are displayed on the Model 4480A's screen.

At the input and output of the line section are Bird Quick-Change type RF connectors, which may be quickly interchanged with any other Bird "QC" connectors.

Optional QC Connectors are available to allow the Model 4480A to interface with a wide range of RF connector types.

Theory Of Operation

On any uniform RF line section there are voltages, currents and standing waves present when RF power is applied. These are the results of two traveling waves, forward and reflected. The characteristic impedance of these lines is a pure resistance, usually 50 ohms for useful lines.

The Model 4480A samples the forward and reflected waves within the line section, measures their power, and displays the measurements on an LCD screen.

Line Section Assembly

The RF Line Section contains the center conductor and two RF coupling circuit boards. The main RF Coupling Circuit Board samples the Low-Band Forward and Reflected traveling waves as well as the High-Band Forward traveling waves. A smaller RF Coupling Circuit Board samples the High-Band Reflected traveling waves. The main RF Coupling Circuit Board converts the RF samples into voltages for use in the digital board. Figure 2 on page 3 shows a simplified diagram of these components.

Digital Circuit Board

The digital board is microprocessor controlled and is controlled by firmware. The digital board performs the following functions:

- Converts the voltage from the rechargeable batteries into the operating voltages for the digital board components, the coupling boards, and the LCD display.
- Digitizes the RF samples from the coupling boards.
- Outputs the RF measurements to the LCD display based on the band selected by the front panel's frequency band selection switch.

Power Supply

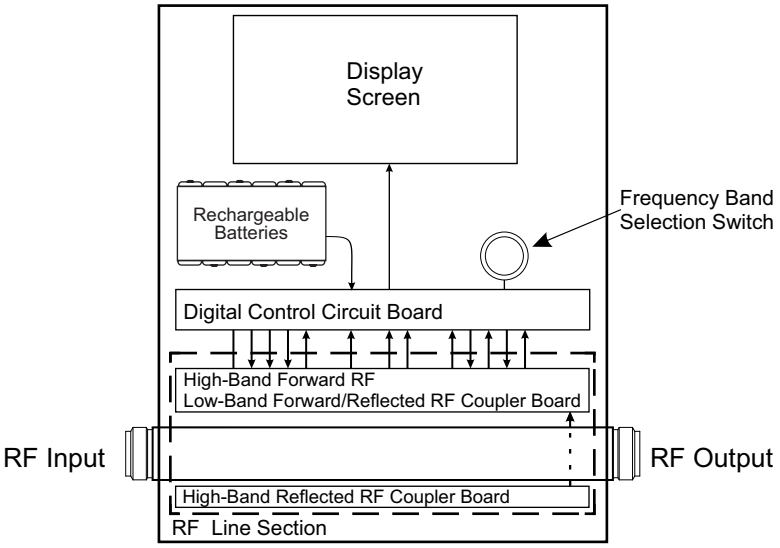
The Model 4480A is powered by six AA NiMH rechargeable batteries. Approximate battery life is 8-10 hours of continuous usage.

An AC to DC power supply is supplied to recharge the batteries. When AC power is applied, the wattmeter operates from the external power supply and recharges the batteries. When AC power is removed, the wattmeter operates from the batteries.

NOTE

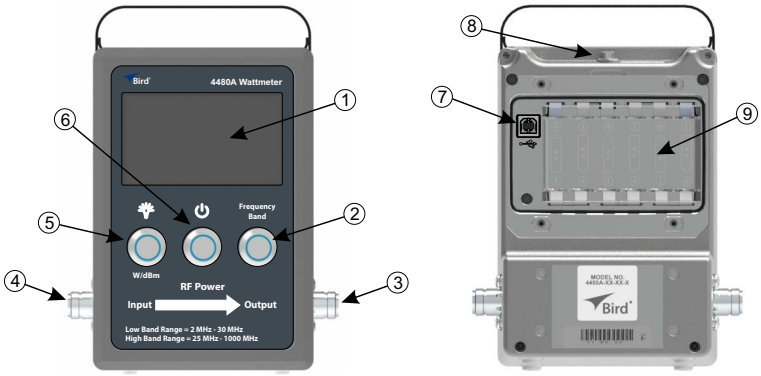
After one hour of inactivity, the 4480A will automatically power off to preserve battery life.

Figure 2 Model 4480A Simplified Diagram



Model 4480A Controls

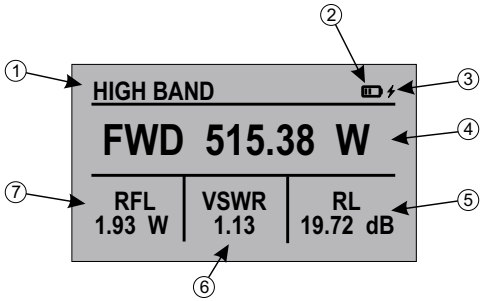
Figure 3 Model 4480A Controls



Item	Description
1	LCD Display, RF measurement data is displayed here along with remaining battery charge level. See "Model 4480A Display" on page 5.
2	Frequency Band Selection button, used to select the high or low frequency band. Low Band: 2 MHz to 30 MHz and 10 W to 10 kW continuous High Band: 25 MHz to 1000 MHz and 1 W to 1 kW continuous
3	Output RF connector, this connector must be connected to a load during RF measurement.
4	Input RF connector, this connector is used to connect an RF power source to the wattmeter. The RF input power is subject to the following limits: Low Band: 2 MHz to 30 MHz and 10 W to 10 kW continuous High Band: 25 MHz to 1000 MHz and 1 W to 1 kW continuous
5	Backlight/Toggle Units button, a short press of this button turns on and off the display's backlight. A long press of this button will toggle the forward and reflected power units between watts and dBm.
6	Power button, turns on and off the Model 4480A Power Meter.
7	USB Port. The USB port is for factory diagnostics and calibration. No user features or charging are available. Note: *The 4480A will not operate and will not charge from the USB port. Measurements are only possible with charged batteries or using the included DC charger.*
8	12 VDC input connector, this port is used for charging the batteries and/or operating power when batteries are discharged or removed. The meter may be operated while the charger is connected and charging the batteries.
9	Battery Compartment. The battery compartment requires 6 AA NiMH rechargeable batteries for normal operation.

Model 4480A Display

Figure 4 Model 4480A Display Description



Item	Name	Description
1	Selected Band	Indicates the frequency band the unit is setup to measure. The Frequency Band pushbutton is used to control which band is selected.
2	Battery Gauge	Indicates the current charge of the batteries.
3	Charge Indicator	The charge indicator is displayed when the unit is connected to the DC power supply.
4	Forward Power	Displays the forward power measured by the wattmeter in either watts or decibel milliwatts (dBm).
5	Return Loss	Displays the device's return loss in decibels.
6	VSWR	Displays the VSWR measured by the wattmeter.
7	Reflected Power	Displays the reflected power measured by the wattmeter in watts or decibel milliwatts (dBm).

Battery Installation

The Model 4480A is powered by six internal AA NiMH batteries. To install the batteries, remove four screws securing the battery cover on the rear panel with a 7/64 hex head wrench, see Figure 5. Install the six rechargeable NiMH AA batteries in the polarity indicated for each slot. Then reinstall the back cover, tightening the four screws.

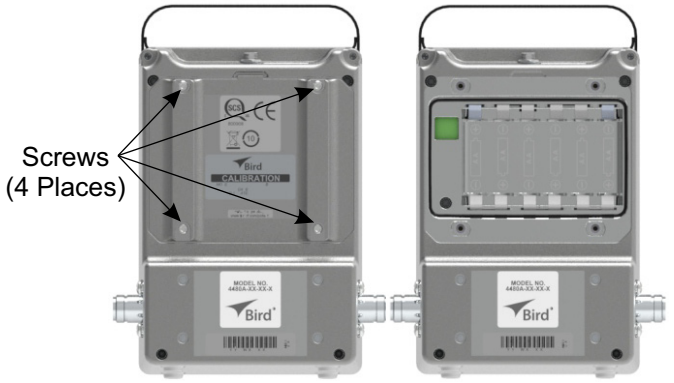
CAUTION

Only install rechargeable NiMH AA batteries. Using non-rechargeable batteries may cause permanent damage when charger is connected.

CAUTION

Batteries must be inserted in the correct polarity.

Figure 5 Battery Installation



Charging

The AC to DC power supply supplied with the Model 4480A is used to charge the batteries. After installing the batteries it is a good idea to fully charge the batteries to ensure they are at full capacity. Battery charging should be done within the temperature range specified by the battery manufacturer (0° to 45°C (32°F to 113°F)).

When fully charged the Model 4480A will operate for 8 hours before recharging is required.

The Model 4480A may be operated while the charger is connected and charging the batteries.

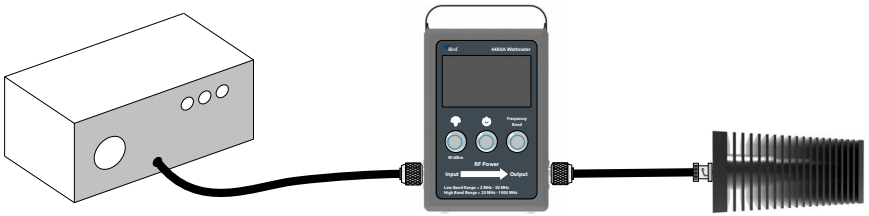
Transmission Line Connections

WARNING

Exposure to RF power radiation and the possibility of RF shock or burns exist under some operating conditions. Always turn off transmitter when connecting or disconnecting wattmeter. Be sure transmission line is terminated into a load or antenna.

Insert the Series Model 4480A Thruline Wattmeter in coaxial transmission lines of 50 ohms nominal impedance. Be sure to connect the power source to the input connector and the load to the output connector. Use a coaxial transmission line fitted with suitable matching RF connectors. If cables of other than 50 ohms impedance are used, a mismatch will occur which could cause serious inaccuracies in the readings.

Figure 6 RF Connections



Connectors

The Model 4480A Wattmeter is normally supplied with two Female N type connectors which are of the Bird Quick-Change “QC” design. Other “QC” connectors are available as listed in the "Replacement Parts List" on page 14.

NOTE

Although the Series Model 4480A Wattmeter is equipped with Quick-Change connector types, it must be remembered that the power rating and insertion loss may be affected if other connectors are used. Power limits must be governed by the type of connector or transmission line used.

Transportation and Storage

When transporting the wattmeter, be sure the power is off. If the unit is to be inactive for more than 2 weeks, remove the batteries to avoid damage from possible battery leakage.

RF Power Measurements

WARNING

Exposure to RF power radiation and the possibility of RF shock or burns exist under some operating conditions. Always turn off transmitter when connecting or disconnecting wattmeter. Be sure transmission line is terminated into a load or antenna.

1. Connect RF Power Source and Load to the Model 4480A wattmeter. See "Transmission Line Connections" on page 7.
2. Press Power button on Model 4480A.
3. Select Model 4480A frequency band. See "Power Range Coverage" on this page.

WARNING

The RF terminals in mated position are not intended to be hand-held or touched during measurement operation.

4. Turn on RF Power Source.

Power Range Coverage

CAUTION

Measurements will be inaccurate, if the measured frequency is outside the selected frequency band. Measurement accuracy relies on the input frequency being within the selected frequency band. The Model 4480A cannot determine if the signal is in the correct band or notify the user if an incorrect band is selected.

The frequency range switch on the Series Model 4480A Wattmeter determines the full scale power range to be used. The available switch settings are Low Band (2 to 30 MHz) and High Band (25 to 1000 MHz).

The transmitter frequency must be within the selected range.

Shutdown

WARNING

Exposure to RF power radiation and the possibility of RF shock or burns exist under some operating conditions. Always turn off transmitter when connecting or disconnecting wattmeter. Be sure transmission line is terminated into a load or antenna.

When all measurements are completed, be sure to turn off the power. Leaving the unit on will not harm the circuit in any way but it will drain the batteries.

Chapter 4 Maintenance

The Series Model 4480A Thruline Wattmeter is of very rugged construction and requires little care and maintenance.

Maintenance of the wattmeter is normally limited to cleaning and calibration. Protect the RF connectors on the line section against the entry of dust and dirt by keeping them connected to the transmission line or by covering them with dust covers when the unit is disconnected from the transmission line.

Calibration

Bird recommends a calibration interval of 12 months for the Model 4480A.

Care and Cleaning

All contacts must be kept clean to assure low resistance connections to, and from, the unit.

Housing

Clean the housing using a cloth dampened with a mild detergent solution. Do this only when necessary and take care not to allow water to enter any of the circuitry as damage may result.

RF Connectors

Clean RF connectors with a cotton swab stick dampened with alcohol, or any acceptable dry cleaning solvent.

Battery Care

To prolong the life of the battery, it is recommended that it be allowed to fully discharge periodically before recharging. If the batteries lose the ability to hold a charge, they can be replaced with a standard AA 1.2 volt, 2000 mAh, NiMH rechargeable batteries.

For an extended period of inactivity it is recommended that the batteries be removed from the unit and stored in the proper environment. To achieve the longest battery life, the most advantageous storage temperatures are between +10° and +35° C (50° to 95° F) at a relative humidity of 50%.

When charging for the first time after long-term storage, the batteries may have decreased battery capacity. To restore batteries to original performance repeat several cycles of charging and discharging.

When storing batteries for more than 1 year, recharge batteries at least every six months to prevent leakage and deterioration in performance due to self-discharging.

Battery Replacement

CAUTION

Only install rechargeable NiMH AA batteries. Using non-rechargeable batteries may cause permanent damage when charger is connected.

The battery compartment is located on the back of the unit. A cover protects the batteries. Refer to Figure 5 on page 6.

1. Remove four screws securing the battery compartment cover.
2. Remove the battery compartment cover.
3. Remove six batteries from the battery compartment.

CAUTION

Batteries must be inserted in the correct polarity.

4. Insert the replacement batteries into the battery compartment.
5. Replace the battery compartment cover.
6. Install four screws to secure the battery compartment cover.

RF Connectors Replacement

CAUTION

If other than Female N type connectors are used, limit power and frequency to the capabilities of the RF coaxial cable or connectors used. Damage to connectors or errors in reading could result.

1. Remove the four screws in the corners of the connector flange.
2. Pull the connector straight off carefully.
3. Insert replacement connector straight onto center conductor.
4. Install four screws in the corners of the connector flange.

NOTE

See "Replacement Parts List" on page 14 ***for available connectors.***

Firmware Updates - Keeping your Wattmeter at its Best

To ensure optimal performance, always keep your firmware up to date. Firmware updates may include critical improvements and new features that enhance functionality and measurement accuracy.

For the latest firmware and installation instructions, visit the product page at

https://birdrf.com/rf-measurement/wattmeters/digital-wattmeters/4480A

and refer to the **4480 Firmware Release Notes** section.

Troubleshooting

The Model 4480A Thruline Wattmeter is designed for independent, long term, trouble free operation.

In case of malfunction or for replacement of a major component —particularly if it is still under warranty—return the unit to the factory. Do not tamper with the calibration setting or do other unauthorized maintenance work during the first year, or you may void the warranty. For troubleshooting some of the most common problems, see Table 1.

The troubleshooting table contains a list of possible problems experienced in the field, as well as their possible cause and remedy.

Table 1 - Troubleshooting

Problem	Possible Cause	Remedy
Wattmeter not operating, no display indication	Power is off.	Depress power switch.
	Weak or dead batteries.	Connect power charger.
	Batteries will not hold a charge	Test the batteries and replace if faulty.
Intermittent or Inconsistent Readings	Input Frequency outside the Band selected on the Model 4480A.	Select the correct frequency band for the input frequency.
	Faulty transmission line or load.	Inspect line connections, antenna or load.
High percentage of reflected power	Foreign material in RF connector.	Check for foreign material and clean as required.
	Shorted or open transmission line.	Service or replace line.
	Bad load or poor connectors.	Replace load, antenna or connectors.

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

Shipment

Should you need to return the power meter, use the original shipping package if possible. If the original package is not available, use a heavy duty corrugated box with shock-absorbing material around all sides of the unit to provide firm cushion and to prevent movement in the container. The container should be properly sealed.

Replacement Parts List

Qty	Description	Part Number
1	Strap (Included in housing assembly)	4480A809
1	Battery Replacement Kit - AA NiMH, 6 count	RPK7000-2
1	AC to DC Power Supply (charger)	4480A152
1	Power Cord	5-1286
2	“QC” Connectors (Female “N” normally supplied)	See "QC Type Connectors" on this page.

QC Type Connectors

Connector Type	*Female PN*	*Male PN*
N	4240-062	4240-063
HN	4240-268	4240-278
LC	4240-031	4240-025
LT	4240-018	4240-012
BNC	4240-125	4240-132
C	4240-100	4240-110
UHF	4240-050 (SO-239)	4240-179 (PL-259)
7/16"	4240-344	4240-363
7/8" EIA Air Line	4240-002	

Specifications

Frequency Range Low Band High Band	 2 MHz-30 MHz 25 MHz-1000 MHz
Power Frequency range [2MHz - 30MHz] Frequency range [25 MHz -1000 MHz] Peak to Average Ratio Accuracy Directivity Impedance	 10 W to 10 kW continuous, 20% overrange 1 W to 1 kW, continuous, 20% overrange (10 dB) ±4% of reading 25 dB 50 Ohm nominal
Connectors* Input Output Insertion VSWR Impedance	 Type N(f); QC type, field changeable Type N(f); QC type, field changeable 0.1 dB max 1.2:1.0 max 50 Ohm nominal
Battery	Internal 6 - AA NiMH (8 hours minimum from full charge)
Charge Time	6-8 hours typical (Recharge on or off), the meter can be operated while charging.
DC input	12V/ 0.6AMax draw
Charger, Type-DC Jack	110/220V AC 50/60Hz single phase, DC 12V, 2A
Finish	Grey
Temperature Range Operating Charging Storage	 0° to 50°C (32°F to 122°F) 0° to 45°C (32°F to 113°F) -40° to 71°C (-40°F to 160°F)
Relative Humidity	5% to 90% non-condensing
Altitude	Up to 15,000 ft (4,572 m)
Dimensions (includes connectors)	7.4"H x 6.2"W x 3.1"D (188 x 158 x 79 mm)
Weight (Approx.)	4 lb. (1.8 kg) with N-Connectors
Certifications	CE, RoHS, UKCA
Calibration recommendation	12 Months interval
Pollution Degree	4
IEC 60529 Protection Degree	IP54

* Field-interchangeable "Quick Change" connectors are available.

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.