



SEMICONDUCTOR
CAL CART

SCC7 MODELS

OPERATION MANUAL

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.

	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.
	This symbol indicates that the unit radiates heat and should not be touched while hot.

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
Potential Fire Hazard
Do not regularly exchange the power sensor installed in this Cal-Cart. Frequent interchange of power sensors can lead to cable / connector interface stresses that may impact the integrity of the cable outer conductor, resulting in points of high current density in the cable outer conductor. When this condition occurs, failure of the interconnecting RF cable is likely due to heating.

On pages 2, 6, and 15.

WARNING
Refer to the supplied load manual for load-specific warnings and cautions.

On pages 3 and 6.

WARNING
All vent plugs must be installed on the load at all times when the unit is operating or cooling. Failure to do so could result in an explosion or severe burns.

On pages 5.

WARNING
Do not attempt to lift the cart by the handle.

On pages 5.

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.

On pages 5, 11, and 15.

WARNING
The Bird 4421A contains no user-serviceable parts.
Do not remove its cover.

On pages 11.

WARNING
To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement.

On pages 11, 12, and 15.

WARNING

Care should be used when handling the RF cable and connector. DO NOT pull, pry, or tug on the RF cable or connector. Otherwise, damage may occur to the cable housing and may cause a fire.

On pages 16 and 17.

WARNING

Heavy load. Do not attempt to lift unaided.

On pages 17.

Caution Statements

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

CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

On pages 2, 5, 15, 21, and 28.

CAUTION

Check the electrical code for proper AC hookup prior to operation of the unit. Make sure the neutral or return hookup is only used for that purpose.

On page 5.

CAUTION

Maximum power dissipation is severely reduced when the blower is not running. If the indicator light should turn off, immediately reduce RF power by 75%.

On pages 6.

CAUTION

Due to the complexity of the Bird Power Sensor, field repairs beyond general maintenance should not be attempted. Removal or disturbance of the power sensor cover can result in cancellation of lifetime warranty.

On pages 11 and 15.

CAUTION

Failure to install the properly rated fuses may result in equipment damage.

On pages 12.

CAUTION

The Bird 4421A must be powered off when connecting or disconnecting the power sensor from the power meter.

On pages 15.

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 PROIZIONE 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.

ASSISTENZA TECNICA

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

About This Manual

This manual covers the operating & maintenance instructions for models with the following part number breakdown:

Cal-Cart Part Numbers

SCC7	X	XX	XX	XX	X
	Meter	Sensor	Load	Connector	Voltage
2) 4421A802-3	Meter, Serial	01) 4027A10M 10-15 MHz 02) 4027A250K 250-400 kHz 03) 4027A400K 400-550 kHz 04) 4027A800K 800-950kHz 05) 4027A2M 1.5 - 2.5 MHz 06) 4027A4M 3 - 5 MHz 07) 4027A12M 10-15MHz 08) 4027A25M 25-30MHz 09) 4027A35M 35-45 MHz 10) 4027A60M 45-35MHz 11) 4021 1.8-32 MHz 12) 4022 25-1000 MHz 13) 4024 1.5-32 MHz 14) 4025 0.1-2.5 MHz 15) 4027A100M 95-105MHz 16) 4027A150M 150-170 MHz 17) 4027F10M 13.56MHz 18) 4027F2M 1.8-2.2MHz 19) 4027AF60M 57-63MHz	01) 8251 1 kW Load 02) 8890-300 2.5 kW Load 03) 8921 5 kW Load 04) 8931-115 10 kW Load, 115V 05) 8931-230 10 kW Load, 230V 06) 8865SC13 1 kW Semicon Load 07) 8890-300SC13 2.5 kW Semicon Load 08) 8921SC13 5 kW Semicon Load 09) 8931-115SC13 10 kW Semicon Load, 115V 10) 8931-230SC13 10 kW Semicon Load, 230V	01) 4240-062 N, Female 02) 4240-344 IEC 7/16 03) 4240-031 LC, Female 04) 4240-268 HN, Female 05) 4240-371 SQS, Female 06) 4240-372 SQS, Male 07) 4240-063 N, Male 08) 4240-376 QRM, Female 09) 4240-050 UHF, Female 10) 4240-373 QDS-UL, Female 11) 4240-100 C, Female 12) 4240-278 HN, Male	1) 115V N. America 2) 230V N. America 3) 115V INTL 4) 230V INTL

Note: Not all combinations are possible, this table is meant to provide definition of existing model numbers. Contact a Bird Sales Associate for help with specific requirements.

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 features of the Bird Semiconductor Cal Cart, lists equipment supplied and optional equipment, and provides power-up instructions.

Set Up — Provides an overview of equipment capabilities and how to set it up.

Operating Instructions — All instructions necessary to operate the Bird Semiconductor Cal Cart.

4421A Operating Instructions — All instructions necessary to operate the 4421A Power Meter in conjunction with the Bird Semiconductor Cal Cart.

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

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This instruction book is intended for use by operators of the Bird Cal Cart System. This chapter contains introductory information including component descriptions and items supplied.

The Bird Cal Cart is designed for immediate, effortless use. It has three primary components. The Bird 4421A RF Power Meter displays radio frequency (RF) power. Bird 4020, 4027A, and 4027F Series Power Sensors are highly accurate sensors that measure RF power without requiring calibration or external couplers or attenuators. Bird Loads are low reflection 50 Ω terminations that can dissipate 1 kW to 10 kW max., depending on the model. These components are installed on a cart for easy transportation, and connected so that the only setup required is connecting AC and RF power. The cart is suitable for use in a cleanroom environment, and is equipped with four swivel casters for maximum maneuverability.

Items Supplied

Stainless Steel Cart with the following items installed:

- Bird 4421A RF Power Meter
- One Bird 4020, 4027A, or 4027F Series Sensors
- Bird Load with Shipping and Vent Plugs
- Cabling
- Instruction Manual

RF Power Meter

The Bird 4421A RF Power Meter measures forward and reflected RF power when used in conjunction with a Bird power sensor. Measurements can be made in units of either Watts or dBm. Because of the precision of the attached load, reflected power will be negligible and can usually be ignored.

Power Sensor

Sensors are available with a variety of connectors. Since the accuracy is critically dependent on the connectors used at calibration, do not remove or change the connectors. Sensors are controlled by the Bird 4421A Power Meter.

WARNING**Potential Fire Hazard**

Do not regularly exchange the power sensor installed in this Cal-Cart. Frequent interchange of power sensors can lead to cable / connector interface stresses that may impact the integrity of the cable outer conductor, resulting in points of high current density in the cable outer conductor. When this condition occurs, failure of the interconnecting RF cable is likely due to heating.

**CAUTION**

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

4020 Series

Bird 4020 Series Power Sensors are designed for lab or field use and are accurate to within $\pm 3\%$ of reading.

4027A Series

Bird 4027A Series Power Sensors are designed for use in semiconductor processing and calibration applications. Stringent calibration provides long-term unit-to-unit repeatability, allowing consistent amounts of RF energy to be applied to the etch process over many etch cycles. 4027A Sensors are accurate to $\pm 1\%$ at specified calibration frequencies and power levels.

4027F Series

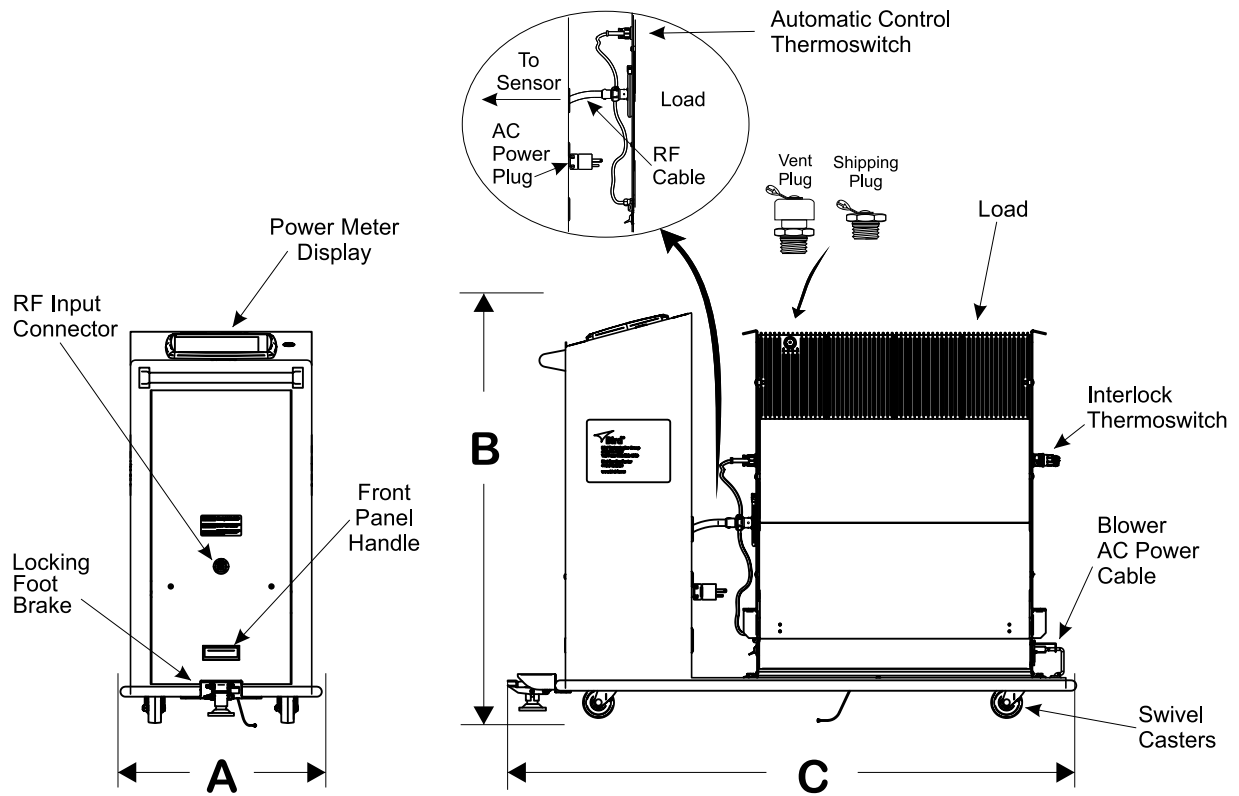
Bird 4027F Series Power Sensors are similar to the 4027A series. However, additional filtering allows the 4027F to ignore harmonics of the signal being measured. The 4027F is also less sensitive to AM components of the signal. 4027F Sensors are accurate to $\pm 1\%$ at specified calibration frequencies and power levels.

Load

Bird loads are available in power ranges from 1 – 10 kW. The loads have a coolant chamber surrounded by radiator fins. The front and rear fins form mounting flanges which are used as brackets for mounting the load on the Cal Cart. Vent plug(s) at the top of the load relieve internal pressure from coolant expansion. For further information, refer to the load manual included.

WARNING
Refer to the supplied load manual for load-specific warnings and cautions.

Figure 1 Cal Cart Outline Drawing



	DIM. A	DIM. B	DIM. C
Short Cal Cart	20" (508 mm)	39" (991 mm)	45" (1143 mm)
Long Cal Cart	20" (508 mm)	39" (991 mm)	55" (1397 mm)

Unpacking and Inspection

- 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.
- Inspect unit for visual signs of damage.

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

Setup



Setup consists of three basic steps: moving the Cal Cart into position, installing the vent plugs, and connecting AC power and the RF line. These steps are explained in more detail below.

WARNING

Do not attempt to lift the cart by the handle.

WARNING

All vent plugs must be installed on the load at all times when the unit is operating or cooling. Failure to do so could result in an explosion or severe burns.

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.

CAUTION

Check the electrical code for proper AC hookup prior to operation of the unit. Make sure the neutral or return hookup is only used for that purpose.

CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

CAUTION

Use the Bird Cal Cart in a dry, dust and vibration free environment. Do not use outdoors or in areas of condensing humidity. Allow at least 12" (30 cm) of clearance around the load.

- Remove the shipping plugs from the load.
- Install the vent plugs, shown in [Figure 1](#).

Note: *The AC power supply required is 115/230 V @ 50/60 Hz, 1φ. The unit is equipped with an IEC 320 "cold" (65°C) AC inlet.*

WARNING

RF Safety Cover provides protection against RF power. Do not defeat this safety device.

Note: *To connect the Cal Cart to the RF source, use 50 ohm coaxial cable suitable for the frequency and power level of operation. Use a connector which will mate with the cart's exposed RF connector.*

CHAPTER 3

OPERATING INSTRUCTIONS

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

Refer to the supplied load manual for load-specific warnings and cautions.

Normal Operation**WARNING****Potential Fire Hazard**

Do not regularly exchange the power sensor installed in this Cal-Cart. Frequent interchange of power sensors can lead to cable / connector interface stresses that may impact the integrity of the cable outer conductor, resulting in points of high current density in the cable outer conductor. When this condition occurs, failure of the interconnecting RF cable is likely due to heating..

Note: After setting up the Bird Cal Cart:

1. Connect the unit to the AC line.
2. Press the ON/OFF button next to the Power Meter display.

Operating Loads with Attached Blowers

Note: For the 8931 and other loads with attached blowers ONLY.

CAUTION

Maximum power dissipation is severely reduced when the blower is not running. If the indicator light should turn off, immediately reduce RF power by 75%.

1. Check that the indicator light is on.
2. Check that the switch is set to MANUAL.
3. Apply RF power.
4. Make measurements.

Note: See "[4421A User Interface](#)" on page 7 for specific instructions on controlling the meter.

Shutdown

1. Turn off RF power at the source.
2. Press the ON/OFF button next to the Power Meter display.

Note: For blower-equipped loads, wait approximately 15 minutes or for the fans to stop running. This will allow the load to cool without causing heat stress.

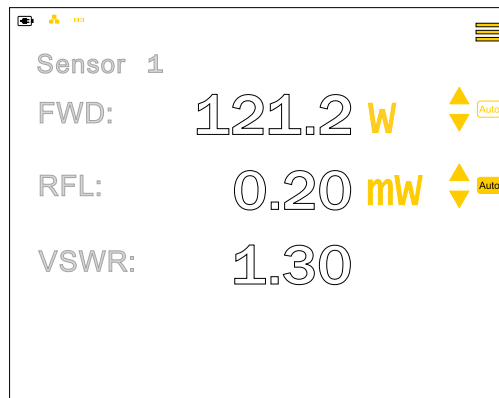
3. Disconnect the AC line.

The 4421A displays the measurement information from the Cal Cart's sensor. See [Figure 2](#).

The display may be configured to display the following measurements from a sensor:

- Forward Power
- Reflected Power
- VSWR
- Return Loss
- Reflection Coefficient

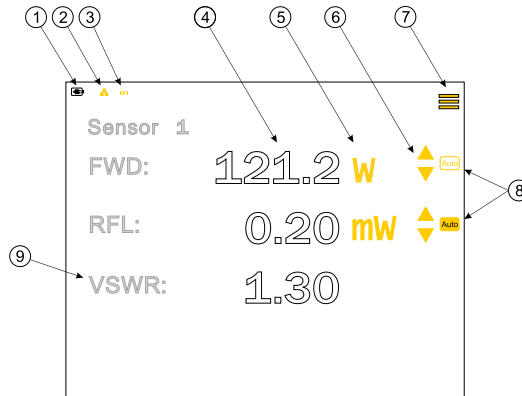
Figure 2 *Sensor Measurements Display*



Display Controls and Indicators

The display is used for presenting information and controlling the behavior of the 4421A. The controls are those items displayed on the screen, that, when tapped cause a change in the 4421A's behavior. Controls can be identified by their color, on screen controls are yellow. The table in [Figure 3](#) describes the on screen controls and indicators.

Figure 3 Display Controls

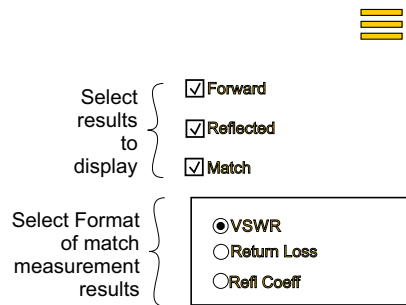


Item	Indicator	Description
1	AC Power indicator	When AC power is applied, a facsimile of an AC Power Plug is displayed.
2	IP Address Icon	When tapped, displays the 4421A's IP address, if connected to an Ethernet Network.
3	Serial Settings Icon	When tapped, displays the serial settings dialog box. See "Serial Port Settings Menu" on page 10.
4	Forward and Reflected Power	The sensor readings for Forward and Reflected power may be displayed in milliwatts, Watts, or Kilowatts.
5	Measurement Unit	The 4421A will display the signal measurements in Watts or dBm.
6	Manual Range Controls	Up and Down arrows are used to change the scale of the displayed power readings. <div style="text-align: center;"> </div> <p>Note: Stops automatic scaling. Auto indicator (9) turns off.</p>
7	Settings Menu	The settings menu is used to configure what measurement information is displayed. See "Settings Menu" on page 9.
8	Auto Range	Auto - When button is on, indicates range scale is set to auto. Auto - When button is off, indicates range scale is in manual control, see item 7.
9	VSWR / Return Loss/ Reflection Coefficient	This line on the display can be set to display one of three measurements: VSWR, Return Loss, or Reflection Coefficient The Settings Menu is used to select which measurement is displayed.

Settings Menu

The setting menu is used to select what information will appear on the 4421A's display. [Figure 4](#) describes the options available via the setting menu.

Figure 4 Settings Menu



Serial Port Settings Menu

Menu is used to define serial connection settings. Refer to the 4421A Operation Manual for a description of the 4421A's Serial Interface (www.birdrf.com).

Figure 5 Serial Settings Menu

The screenshot shows a dialog box for serial settings. On the left, four numbered circles (1-4) have arrows pointing to specific controls:

- 1 points to the 'Speed (baud)' dropdown menu, which is currently set to '9600'.
- 2 points to the 'Data bits' section, which has two radio buttons labeled '7' and '8'. The '8' button is selected.
- 3 points to the 'Stop bits' section, which has two radio buttons labeled '1' and '2'. The '1' button is selected.
- 4 points to the 'Parity' dropdown menu, which is currently set to 'NONE'.

 At the bottom of the dialog box are two buttons: 'OK' and 'Cancel'.

Item	Indicator	Description
1	Baud Rate	The Baud rate may be set to one of the following options: 300 600 1200 2400 4800 9600
2	Data Bits (word length)	Select either 7 or 8 bit data.
3	Stop Bits	Select 1 or 2 stop bits sent at the end of every character,
4	Parity	Options are: NONE - no parity bit is sent EVEN - parity bit is set so the number of "logical ones" is even. ODD - parity bit is set so the number of "logical ones" is odd.

This chapter describes routine maintenance, along with troubleshooting instructions for the power meter and power sensor. Disassembly instructions for the Bird Cal Cart are also provided. For service beyond this level, return the unit to a qualified service center.

WARNING

To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement.

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

The Bird 4421A contains no user-serviceable parts. Do not remove its cover.

The Bird Cal Cart and 4421A Power Meter requires only simple, routine maintenance.

- Wipe off dust and dirt regularly.
- Check the connectors and cables for damage.
- Clean the connector contacts with alcohol or dry cleaning solvent.

Troubleshooting

Since the power meter and power sensor can only work together, the first step is to determine which is malfunctioning. Verify the power sensor to power meter cable connection. If the power meter is malfunctioning, refer to the troubleshooting table below. If the power sensor is malfunctioning, return it for service.

CAUTION

Due to the complexity of the Bird Power Sensor, field repairs beyond general maintenance should not be attempted. Removal or disturbance of the power sensor cover can result in cancellation of lifetime warranty.

This manual cannot list all malfunctions that may occur, or corrective actions. If a malfunction is not listed or is not corrected by the listed corrective actions, contact a qualified service center.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Power meter has no power	The power meter's AC power cord is disconnected from the terminal strip.	Connect the power cord
	The Cal Cart's AC power cord is not connected to the AC line.	Connect AC power
	The ON/OFF switch is set to OFF.	Set the switch to ON
	The power meter fuse is blown. Note: <i>Unplug the Cal Cart to check the fuse.</i>	Replace fuse. See " Replace the Power Meter Fuses " on page 12.
Display blank or not updating	The meter is defective.	Return meter for service.

Repairing the Cal Cart

WARNING

To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement.

Remove Cal Cart Front Panel

1. Remove the two screws securing the front panel. See ["Front Panel" on page 12](#)

Figure 6 Front Panel



2. Pull on the handle set into the base of the front panel.
3. Remove the front panel.

Replace the Power Meter Fuses

WARNING

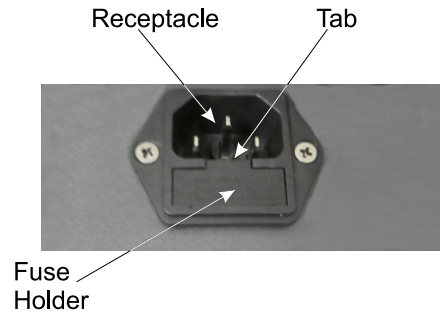
To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement.

CAUTION

Failure to install the properly rated fuses may result in equipment damage.

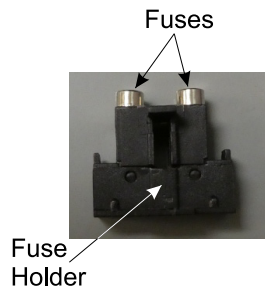
1. Remove the Cal Cart's front panel. See ["Remove Cal Cart Front Panel" on page 12](#).
2. Disconnect the AC power Cable from the receptacle on the left side of the 4421A Power Meter. See [Figure 7](#).
3. Gently pry on the fuse holder tab and pull the fuse holder out of the AC receptacle.

Figure 7 4421A AC Power Receptacle



4. Pull the two fuses out of the fuse holder. See [Figure 8](#).
5. Insert two new fuses into the fuse holder.

Figure 8 AC Line Fuses



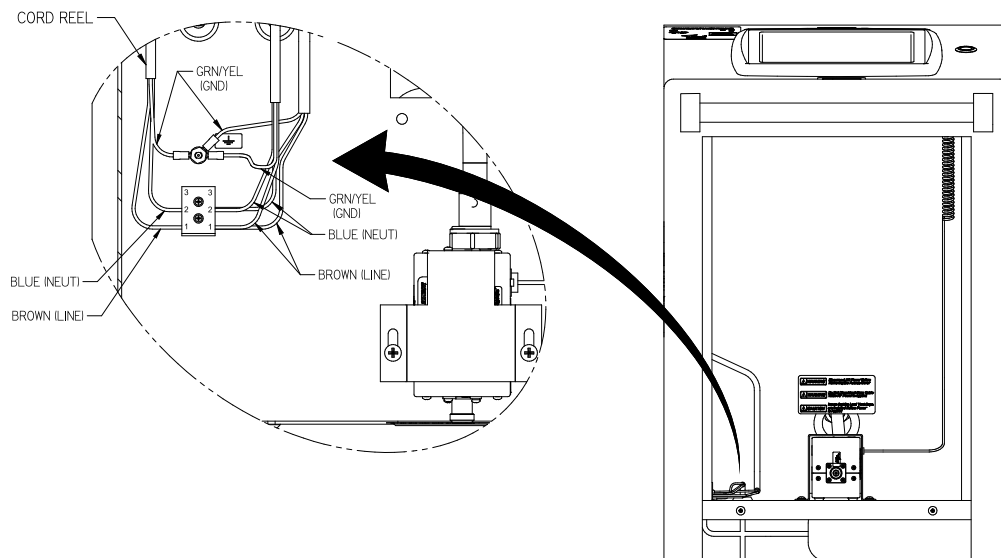
Fuse Rating
FUSE, SLO-BLO, 5x20mm, 1 AMP TYPE T

6. With fuse holder tab facing up ([Figure 7](#)), press fuse holder into the 4421A AC receptacle until fully seated.
7. Connect the AC power Cable to the receptacle on the left side of the 4421A Power Meter.
8. Install the Cal Cart's front panel.

Replacing the Cord Reel

1. Disconnect the cord reel from the terminal strip.
2. Unscrew the AC connector.
3. Unscrew and remove the cord reel.
4. Screw the replacement cord reel into place.
5. Thread the AC connector through the grommet.
6. Crimp a ring terminal to the green/yellow wire.
7. Connect the wires on the other end to the terminal strip.

Figure 9 Cal Cart Wiring Schematic



Replacing the Power Sensor

Replacement of the power sensor is only recommended when replacing failed or malfunctioning units. Power Sensors should not be changed as a regular operational activity.

WARNING

To avoid personal injury, disconnect the power cord from the AC line before performing any maintenance, including fuse replacement.

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

Potential Fire Hazard

Do not regularly exchange the power sensor installed in this Cal-Cart. Frequent interchange of power sensors can lead to cable / connector interface stresses that may impact the integrity of the cable outer conductor, resulting in points of high current density in the cable outer conductor. When this condition occurs, failure of the interconnecting RF cable is likely due to heating.

CAUTION

The Bird 4421A must be powered off when connecting or disconnecting the power sensor from the power meter.



CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

CAUTION

Due to the complexity of the Bird Power Sensor, field repairs beyond general maintenance should not be attempted.
Removal or disturbance of the power sensor cover can result in cancellation of lifetime warranty.

Removing the Power Sensor

1. Disconnect the RF line from the Cal Cart.
2. Disconnect AC power line.
3. Remove the Cal Cart front panel. See ["Remove Cal Cart Front Panel" on page 12.](#)
4. Disconnect Sensor Cable, see [Figure 10 on page 16.](#)
5. Remove the tamper seal from the 7/16 DIN connector nut.
6. Disconnect the sensor cable from the power sensor.
7. Loosen the 7/16 DIN connector nut that secures the RF cable to the sensor output on the Cal Cart by turning it clockwise.

Note: *DO NOT remove either the 7/16 DIN connector nut or RF cable yet.*

WARNING

Care should be used when handling the RF cable and connector. DO NOT pull, pry, or tug on the RF cable or connector. Otherwise, damage may occur to the cable housing and may cause a fire.

8. Remove the screws on the sensor mounting bracket.
9. Remove the sensor from the mounting bracket.
10. Ensure the gasket remains attached to the mounting bracket.
11. Remove the 7/16 DIN connector nut and RF cable from the sensor output port.

Installing the Power Sensor

1. Install the new sensor into the sensor mounting bracket.
2. Ensure the arrow on the side of the sensor points towards the load, and that the end labeled "SOURCE" points towards the front of the Cal Cart.
3. Connect the RF cable to the sensor end labeled "LOAD".

Note: DO NOT tighten either the 7/16 DIN connector nut or RF cable yet.

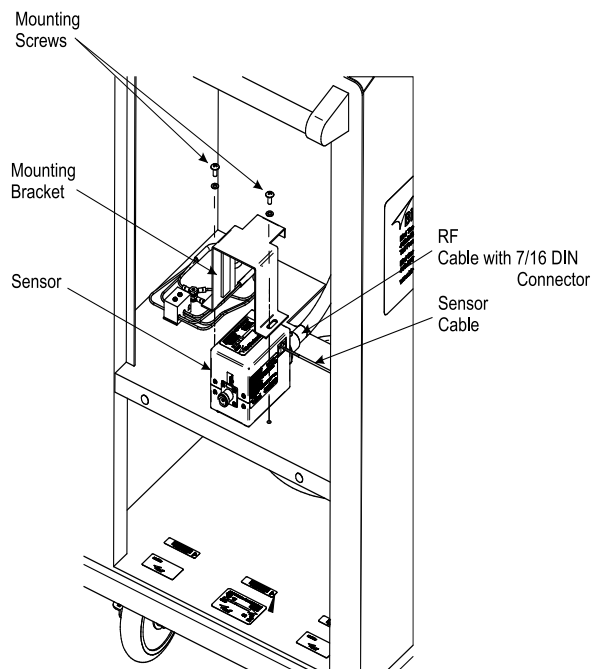
4. Secure the sensor mounting bracket with the mounting screws.
5. Tighten the cable by turning it counterclockwise.

WARNING

Care should be used when handling the RF cable and connector. DO NOT pull, pry, or tug on the RF cable or connector. Otherwise, damage may occur to the cable housing and may cause a fire.

6. Connect the sensor cable.
7. Replace the Cal Cart front panel. See ["Remove Cal Cart Front Panel" on page 12](#).

Figure 10 Replacing the Sensor



Removing the Load

WARNING

Heavy load. Do not attempt to lift unaided.

WARNING

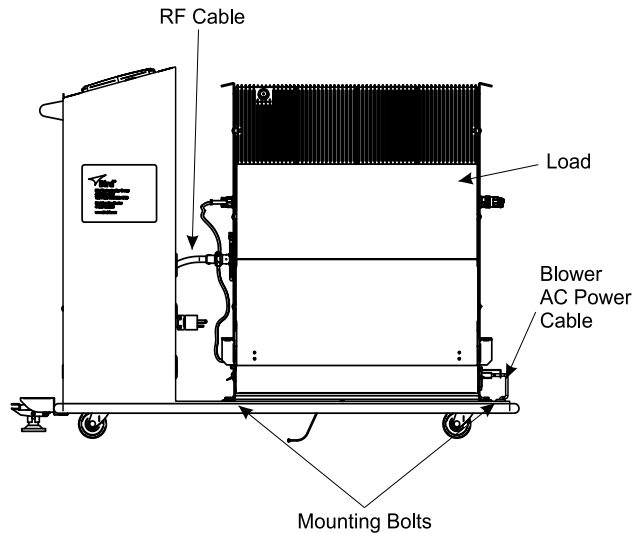
Care should be used when handling the RF cable and connector. DO NOT pull, pry, or tug on the RF cable or connector. Otherwise, damage may occur to the cable housing and may cause a fire.

1. Loosen the RF cables from the RF connectors on the load.
2. Unplug the blower assembly.
Note: *Step 2 is for blower equipped loads only.*
3. Remove the Cal Cart front panel. See ["Remove Cal Cart Front Panel" on page 12.](#)
4. Remove the screws on the sensor mounting bracket. See [Figure 10 on page 16.](#)
5. Pull the sensor assembly back until the RF cable disconnects from the load.
6. Replace the vent plugs with the shipping plugs.
7. Remove the mounting bolts connecting the load to the Cal Cart.
8. Remove the load.

Note: *The RF cable should disconnect when the load is moved.*

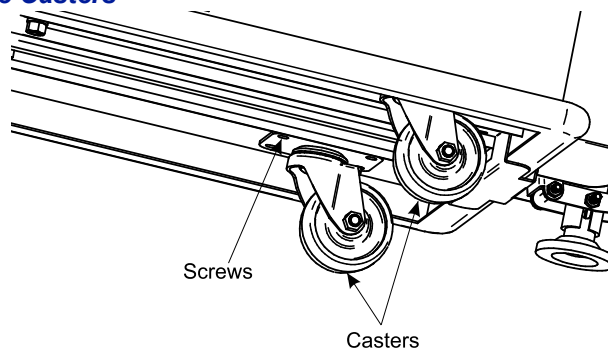
Note: *To install a new load, reverse this procedure.*

Figure 11 Removing the Load



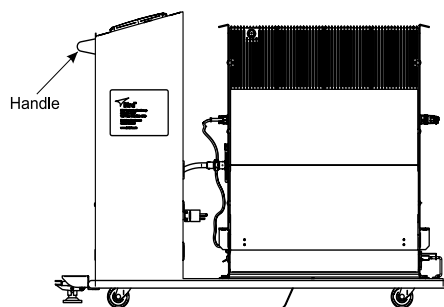
Replacing the Casters

1. Remove the load. See ["Removing the Load" on page 17.](#)
2. Flip the cart over.
3. Unscrew the defective caster.
4. Screw the new caster into place.
5. Replace the load. See ["Removing the Load" on page 17.](#)

Figure 12 Removing the Casters

Replacing the Handle

1. Unscrew and remove the old handle.
2. Screw the new handle into place.

Figure 13 Replacing the Handle

Storage and Shipment

Storing the Cal Cart

- Cover the unit before storing to keep out dust and dirt.
Note: *It is not necessary to install the shipping plug.*
- Store in a dry, dust-free environment where the ambient temperature will remain between -20 and $+70$ °C (-4 to $+158$ °F).

Shipping the Cal Cart

Note: *Before shipping the Bird Cal Cart, take the following precautions:*

1. Remove the vent plugs.
2. Replace the vent plugs with the shipping plugs.
3. Wrap the vent plugs with padding and tape them to the side of the load for protection.

Note: *With the shipping plugs installed, it is not necessary to empty out the coolant.*

4. Repack in the original carton or contact Bird for a transit case.

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

Note: Certain sensors or connectors may be incompatible with some models. For a list of available components, contact Bird Applications Engineering.

Max. Power

Under normal operating conditions, the Cal Cart's maximum power is the MINIMUM of the max. power of the sensor and the max. power of the load. The following modifiers apply:

- Above 65 MHz, derate the load's max. power. See "High Frequency Derating" on page 26.
- Due to the wide variety of available connectors, frequency range and maximum power may be reduced. Insertion loss is specified with female N connectors. Choose connectors appropriate for the frequency and power of operation.
- Derate RF power by 2.5% for every 305m (1,000 ft.) above 1,520m (5,000 ft.)

Bird Cal Cart

See "[Cal-Cart Part Numbers](#)" on page vii for Cal Cart components.

Frequency Range	Sensor dependent
Power Range	Dependent on sensor, sensor connectors, and load
Connectors	Customer specified (See " Available Connectors " on page 28)
AC Power	100 - 240 VAC @ 50/60 Hz, 490 W max.
Main Supply Voltage Fluctuations	± 10 %
Over-voltage Category	Category II
Pollution Degree	2
Dimensions Short Cart Long Cart	45"L x 20"W x 39"H (1143 x 508 x 991 mm) 55"L x 20"W x 39"H (1397 x 508 x 991 mm)
Weight, Nominal Short Cart Long Cart	175 lbs. (80 kg) 250 lbs. (113 kg)
Temperature Range Operating Storage	0 to +35 °C (32 to +95 °F) -20 to +70 °C (-4 °F to +158 °F)
Altitude	1520 m (5000 ft.)
Humidity	85% noncondensing max
Calibration Cycle, Nominal	1 year
CE	CE Compliant. Refer to Declaration of Conformity for specific standards.

Bird 4421A RF Power Meter

Frequency Range	Sensor dependent
Power Range	Sensor dependent
VSWR Display	1.0 – 199.9 max
Return Loss Display	0 to 40 dB max
Display	9.7 in TFT full color LCD with touch screen
Interfaces	RS-232, LAN
Fuse Rating	1A, IEC (5 x 20 mm), time-delay
CE	CE Compliant. Refer to Declaration of Conformity for specific standards.
Humidity	95% max. (noncondensing)
Altitude	Up to 15,000 feet (4572 m)
Operating Temperature	0° to 40° C (32° to 104° F)
Storage Temperature	–20 to +70 °C (–4 °F to +158 °F)
Dimensions	10.6 in x 9.7 in x 3.6 in (269 mm x 246 mm x 91 mm)
Weight, Nominal	Less than 5 lb, 2.3 kg



CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

Specifications Common to all Sensors

Impedance, Nominal	50 ohms
Max. Allowable Terminating VSWR	2.00:1
Calibration Technique	Frequency-specific calibration factors stored in nonvolatile memory in each sensor. Sensor output corrected for frequency and temperature within specified ranges.
Calibration Cycle, Nominal	1 year
Accuracy, Reflected	Calculated from FWD accuracy and FWD power $\text{RFL Accuracy} = \text{FWD Accuracy} + \frac{\text{FWD Power}}{10^{\text{Directivity}/10}}$
Accuracy, VSWR	Calculated from FWD and RFL power $\text{VSWR} = \left(1 + \sqrt{\frac{P_R}{P_F}} \right) / \left(1 - \sqrt{\frac{P_R}{P_F}} \right)$

Sampling Rate, Nominal	2 readings/second
Operating Power	Supplied by power meter via sensor cable
Connectors 4028B10M 4028A Series All other models	1-5/8" EIA Flanged 7-16 DIN, LC, HN, or 7/8" Customer specified from QC list, appropriate for frequency and power.
CE	CE Compliant. Refer to Declaration of Conformity for specific standards.
Humidity, Max.	95% (noncondensing)
Altitude, Max.	10,000 feet (3,000 m)
Temperature Range Operating Storage	0 to 50 °C (32 to 122 °F) -20 to +70 °C (-4 to +158 °F)
Dimensions 4028B10M 4028A Series All other models	6.75"L x 3.5"W x 4.75"H (175 x 89 x 121 mm) 4.7"L x 3.2"W x 3.8"H (120 x 82 x 97mm) 5.2"L x 2.5"W x 3.25"H (137 x 64 x 83 mm)
Weight, Nominal 4028B10M 4028A2M, 3M, 4M, 10M, and 25M All other models	5 lb. 2 oz. (2.33 kg) 3 lb. 5 oz. (1.5 kg) 1 lb. 13 oz. (0.8 kg)

Bird 4020 Series RF Power Sensors

RF Power Range 4021, 4022 4024, 4025	300 mW – 1 kW 3 W – 10 kW
Frequency Range 4021 4022 4024 4025	1.8 – 32 MHz 25 MHz – 1 GHz 1.5 – 32 MHz 100 kHz – 2.5 MHz
Accuracy, Fwd, Best Case¹	± 3% (1 σ)
VSWR, Max. 4021, 4024, 4025 4022	1.05:1 1.05:1, 25 – 512 MHz / 1.10:1, 512 MHz – 1 GHz
Insertion Loss, Max. 4021, 4024, 4025 4022	0.05 dB 0.05 dB, 25 – 512 MHz / 0.13 dB, 512 MHz – 1 GHz
Directivity, Min 4021 4022 4024 4025	30 dB 26 dB (28 dB typ), 400 – 1000 MHz 30 dB, 25 – 400 MHz 28 dB, 1.5 – 2.5 and 25 – 32 MHz / 30 dB, 2.5 – 25 MHz 28 dB, 100 – 125 kHz / 30 dB, 125 – 2500 kHz

- 1 For rated accuracy, no more than 1% AM; Harmonics –50 dBc or less
Derate accuracy by 3.0% (1 σ) below 15 °C and above 35 °C



CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

Bird 4027A Series RF Power Sensors

Frequency Range	
4027A250K	250 – 400 kHz
4027A400K	400 – 550 kHz
4027A800K	800 – 950 kHz
4027A2M	1.5 – 2.5 MHz
4027A4M	3 – 5 MHz
4027A10M	10 – 15 MHz
4027A12M	10 – 15 MHz
4027A25M	25 – 30 MHz
4027A35M	35 – 45 MHz
4027A60M	45 – 65 MHz
4027A100M	95 – 105 MHz
4027A150M	150 – 170 MHz
RF Power Range	
4027A12M	300 mW – 1 kW
4027A25M	3 W – 9 kW
4027A35M	3 W – 7.5 kW
4027A60M	3 W – 6 kW
4027A100M	3 W – 5 kW
4027A150M	3 W – 4 kW
All other models	3 W – 10 kW
Accuracy, Fwd, Best Case¹	± 1.0% (1 σ)
Calibration Frequencies, Typical (MHz)²	
4027A250K	0.25, 0.40
4027A400K	0.40
4027A800K	0.90
4027A2M	1.8, 2.0, 2.17
4027A4M	4.0, 5.0
4027A10M	10.0, 13.56, 15.0
4027A12M	10.0, 13.56, 15.0
4027A25M	25.76, 27.12, 28.48
4027A35M	40.68
4027A60M	55.0, 60.0
4027A100M	95.0, 100.0
4027A150M	162.0
Calibration Power, Typical	
4027A12M	700 W
All other models	1.7 kW
VSWR, Max.	1.05:1
Insertion Loss, Max.	0.05 dB (with female “N” connectors)
Directivity, Min.	
4027A12M	30 dB
All other models	28 dB

- 1 For rated accuracy, no more than 1% AM; Harmonics –50 dBc or less
 Derate accuracy by 1% (1 σ) outside cal. power or cal. frequency
 Derate accuracy by 1% (1 σ) below 15 °C and above 35 °C

- 2 Other calibration frequencies available upon request

Bird 4027F Series RF Power Sensors

Frequency Range 4027F2M 4027F10M 4027F60M	1.8 – 2.2 MHz 12 – 15 MHz 57 – 63 MHz
RF Power Range 4027F2M, 4027F10M 4027F60M	0.1 – 10 kW 0.1 – 3 kW
Accuracy, Fwd, Best Case	± 1.0% (2σ)
Calibration Frequencies, Typical¹ 4027F2M 4027F10M 4027F60M	1.8, 2.0, 2.17 MHz 12.0, 12.5, 13.56, 14.0, 15.0 MHz 57.0, 58.5, 60.0, 61.5, 63.0 MHz
Calibration Power, Typical	1.7 kW
Harmonic Rejection, Min. 4027F2M 4027F10M 4027F60M	26 dB @ 3.6 – 3.8 MHz, 30 dB @ > 3.8 MHz 30 dB @ > 25 MHz 30 dB @ > 114 MHz
Low Frequency Rejection, Min. 4027F2M 4027F60M	30 dB @ < 1 MHz 30 dB @ < 15 MHz
Max Error Induced by 10% AM 4027F2M, 4027F10M 4027F60M	0.2% @ < 5 kW, 1.0% @ 5 – 10 kW 0.2% @ < 1.5 kW, 1.0% @ 1.5 – 3 kW
VSWR, Max.	1.05:1
Insertion Loss, Max.	0.05 dB (with female “N” connectors)
Directivity, Min.	28 dB

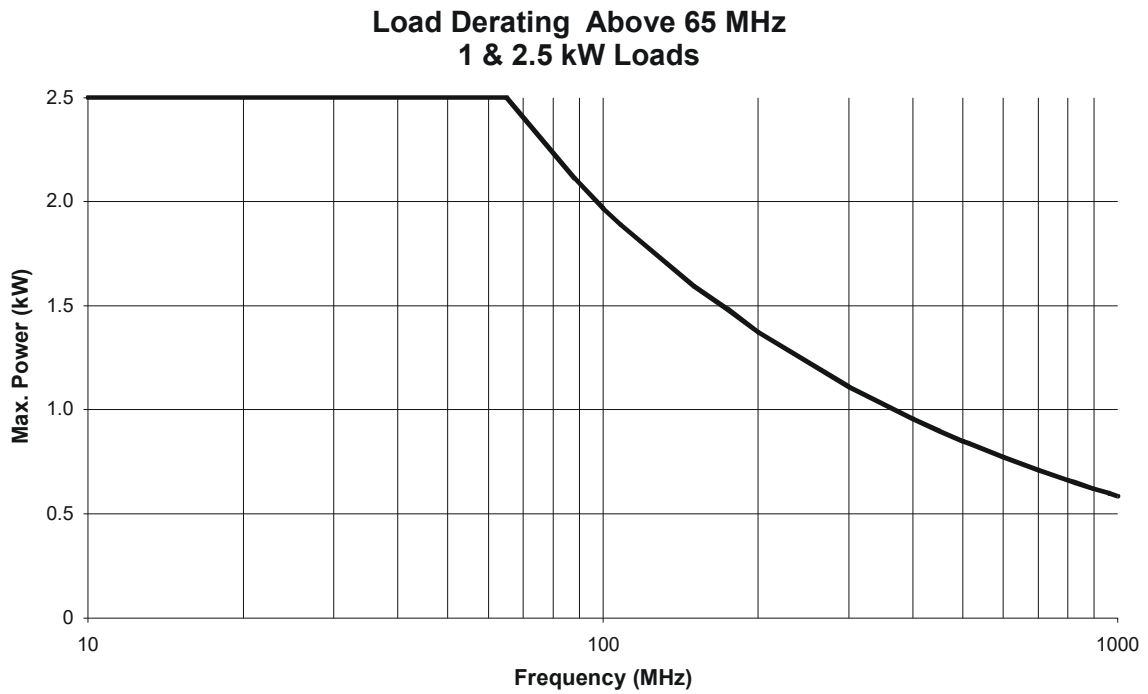
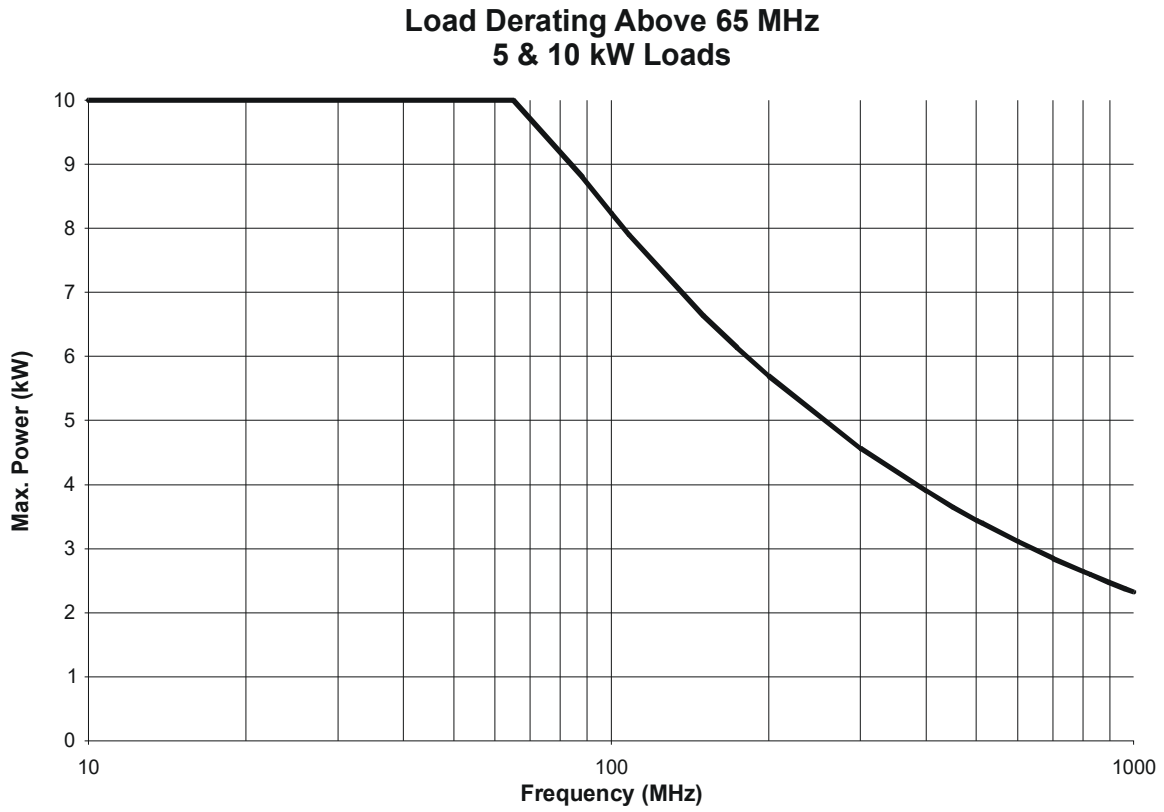
1 Other calibration frequencies available upon request

Bird 4028A and 4028B Series RF Power Sensors

Frequency Range	
4028A250K	250 – 400 kHz
4028A400K	400 – 550 kHz
4028A2M	1.5 – 2.5 MHz
4028A3M	2.5 – 3.5 MHz
4028A4M	3.5 – 4.5 MHz
4028A10M, 4028B10M	10 – 15 MHz
4028A25M	25 – 30 MHz
RF Power Range	
4028A250K, 4028A400K	1 kW – 20 kW
All other models	1 kW – 25 kW
Accuracy, Fwd, Best Case¹	± 2.0% (2 σ)
Calibration Frequencies, Typical (MHz)²	
4028A250K	0.25, 0.40
4028A400K	0.40
4028A2M	1.8, 2.0, 2.17
4028A3M	2.5, 3.2, 3.5
4028A4M	3.5, 4.0
4028A10M, 4028B10M	10.0, 13.56, 15.0
4028A25M	25.76, 27.12, 28.48
Calibration Power, Typical	3.5 kW
VSWR, Max.	1.05:1
Insertion Loss, Max.	0.05 dB (with female 7-16 DIN connectors)
Directivity, Min.	28 dB

- 1 For rated accuracy, no more than 1% AM; Harmonics –50 dBc or less
Derate accuracy by 2% (2 σ) outside cal. power or cal. frequency
Derate accuracy by 2% (2 σ) below 15 °C and above 35 °C
- 2 Other calibration frequencies available upon request

Figure 14 High Frequency Derating



Replacement Parts

Description	Qty	Part Number
Fuse, Slo-Blo,5x20mm, 1 Amp Type T	2	5A2257-16
Cord, AC Power, Harmonized	1	5A2416
Plug, 115 VAC	1	5A2626
Cable, Sensor	1	4421-038
Grommet	1	4421A372
Cordreel	1	4421B383
Casters	4	4421B384
Handle	1	4421A385
Locking Foot Brake	1	4421B385

Available Connectors



CAUTION

Changing the sensor's connectors will invalidate calibration data, and may reduce the maximum power rating of the unit.

Connector	Part Number	Connector	Part Number
LC (F)	4240-031	7/16 Jack, IEC Type 169-4	4240-344
UHF (F)	4240-050	TRU 6934 (F)	4240-371
N (F)	4240-062	TRU 7958 (F)	4240-372
N (M)	4240-063	QDS-UL (F)	4240-373
HN (F)	4240-268	QRM (F)	4240-376
HN (M)	4240-278	C (F)	4240-100

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 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.

Special Lifetime Warranty - Series 4020, Series 4027A, Series 4027F, and Series 4028 Power Sensor Head

In addition to its standard warranty, the Bird Electronic Corporation warrants its Series 4020, Series 4027A, Series 4027F, and Series 4028 Thruline Power Sensor Heads for lifetime to original purchaser. This extended warranty is against burnout. For the warranty to apply, the Sensor Head must be used with the correct Bird Electronic Corporation Display Unit, the maximum power rating of the Sensor must not be exceeded, the Sensor RF circuit must be properly terminated and the Sensor not subjected to physical abuse.

Bird Electronic Corporation, at its option, will repair or replace the defective Sensor at its world Headquarters at 30303 Aurora Road, Solon, Ohio 44139.

The customer is responsible to pay transportation charges to return the defective sensor to Bird.