



TERMALINE®  
LOAD RESISTOR

OPERATION MANUAL

MODEL 8141

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INSTRUCTION BOOK PART NUMBER 920-8141 REV. D

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## Safety Precautions

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

### **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 RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.

[See page 6.](#)

### WARNING

This product contains substrate made of beryllium oxide. This is a potentially toxic ceramic and may be harmful to health. Beryllia oxide must be disposed of in accordance with the legal statutes dealing with hazardous material.

Do not attempt to repair this unit, but return to BIRD ELECTRONIC CORPORATION.

[See page 11.](#)

## Caution Statements

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

### CAUTION

Do not operate this equipment over the rated 250 watts continuously. Damage to the resistive element will result.

[See page 5.](#)

## **Safety Statements**

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### **USAGE**

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

### **USO**

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

### **BENUTZUNG**

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

### **UTILISATION**

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

### **IMPIEGO**

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

## **SERVICE**

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

## **SERVICIO**

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

## **WARTUNG**

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

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

## **ENTRETIEN**

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

## **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

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

8141

8141-010

## Changes to this Manual

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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

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**Introduction** — Describes the features of the load resistor, lists equipment supplied and optional equipment, and provides power-up instructions.

**Theory of Operation** — Describes how the load resistor works.

**Installation** — Describes the power supply and load connection instructions.

**Operating Instructions** — Describes the base level operation instructions.

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

# TABLE OF CONTENTS

|  |          |
|--|----------|
| <b>Safety Precautions</b> .....                    | <b>i</b> |
| Safety Symbols .....                               | ii       |
| Warning Statements .....                           | ii       |
| Caution Statements .....                           | iii      |
| Safety Statements .....                            | iii      |
| <b>About This Manual</b> .....                     | <b>v</b> |
| Changes to this Manual .....                       | v        |
| Chapter Layout .....                               | v        |
| <b>Chapter 1 Introduction</b> .....                | <b>1</b> |
| General .....                                      | 1        |
| Purpose And Function .....                         | 1        |
| Performance Characteristics and Capabilities ..... | 1        |
| Dimensions and Weight .....                        | 1        |
| Power and Utility Requirements .....               | 2        |
| Environmental Requirements .....                   | 2        |
| Items Supplied .....                               | 2        |
| Items Required .....                               | 2        |
| Tools and Test Equipment .....                     | 2        |
| <b>Chapter 2 Theory of Operation</b> .....         | <b>3</b> |
| General .....                                      | 3        |
| <b>Chapter 3 Installation</b> .....                | <b>4</b> |
| General .....                                      | 4        |
| <b>Chapter 4 Operating Instructions</b> .....      | <b>5</b> |
| Start-up .....                                     | 5        |
| Normal Operation .....                             | 5        |
| Shutdown .....                                     | 5        |
| Emergency Shutdown .....                           | 6        |

|                                    |           |
|------------------------------------|-----------|
| <b>Chapter 5 Maintenance</b> ..... | <b>7</b>  |
| Troubleshooting .....              | 7         |
| Cleaning .....                     | 8         |
| Outside Surface .....              | 8         |
| Inspection .....                   | 8         |
| Preventive Maintenance .....       | 8         |
| RF Assembly Test .....             | 8         |
| DC Resistance .....                | 8         |
| Disassembly .....                  | 9         |
| RF Input Connector .....           | 9         |
| Coolant Oil & Diaphragm .....      | 9         |
| RF Load Resistor Assembly .....    | 10        |
| Reassembly .....                   | 10        |
| RF Input Connector .....           | 10        |
| Coolant Oil & Diaphragm .....      | 10        |
| RF Load Resistor Assembly .....    | 11        |
| Repairs .....                      | 11        |
| Storage .....                      | 11        |
| Customer Service .....             | 11        |
| Shipment .....                     | 12        |
| Replacement Parts List .....       | 12        |
| Available QC Type Connectors ..... | 12        |
| <b>Limited Warranty</b> .....      | <b>13</b> |



## General

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This instruction book is intended for use by operators of the Models 8141 and 8141-010 Termaline Load Resistor. This chapter contains introductory information including product specifications; items supplied; and accessory items.

## Purpose And Function

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The Models 8141 and 8141-010 Termaline Load Resistor are portable, general purpose 50 ohm coaxial transmission line terminations. They are self-contained units requiring no outside power source or additional equipment. They provide accurate, dependable, and practically non-reflective terminations for testing and adjusting transmitters under non-radiating conditions from DC to 2500 MHz.

The models are rectangular in shape with transverse cooling fins spaced evenly along its entire length. Their short length makes it particularly useful in locations. Also, the ten pounds total weight is a convenience in portable use. Mounting holes are provided, see Chapter 3, Installation.

The RF connector, on the front face of the unit, is a Female N similar to UG-58A/U, but is a "Quick-Change" design permitting rapid and easy interchange with other AN type connectors.

## Performance Characteristics and Capabilities

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The loads will absorb and dissipate as heat up to 250W of RF power in continuous duty. It can handle up to 20 percent overload for a maximum of ten minutes overload without damage, provided a half-hour interval is maintained for cooling between power applications. The design of the resistor and its impedance matching shell keeps the VSWR below 1.1 to 1.0 from DC to 1000 MHz, 1.2 to 1.0 from 1000 to 1800 MHz and 1.3 to 1.0 from 1800 to 2500 MHz. With its .QC. type of connector Model 8141 can be adapted to coaxial cables equipped with any of a variety of standard connectors.

## Dimensions and Weight

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Consult the Specification Sheet for the size and weight of each load.

## **Power and Utility Requirements**

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Other than the RF power input the Models 8141 and 8141-010 has no need for an external source of power or utility services.

## **Environmental Requirements**

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The loads should be operated in as clean and vibration free an environment as possible. The ambient temperature range should remain within -40°C to +45°C (-40°F to +113°F) for proper operation.

## **Items Supplied**

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The models are a self-contained unit, there are no additional parts other than this instruction book supplied. The load is prefilled at the factory with the proper amount of coolant.

## **Items Required**

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No additional items are required other than a coaxial cable for connecting the RF source to the load. The load is furnished with a Female N type connector. The cable should be equipped with a Male N type plug. If the cable has any other type of standard connector, then the load should be ordered with the appropriate type of mating connector.

## **Tools and Test Equipment**

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Only a screwdriver is needed for disassembling for service. An ohmmeter or resistance bridge with an accuracy of one percent or better at 50 ohms, is useful for checking resistor condition.

## General

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The Models 8141 and 8141-010 Terminal Load Resistor consists essentially of a cylindrical film type resistor immersed in a dielectric coolant. The resistor, individually selected for its accuracy, is enclosed in a special tapered housing which provides a linear reduction in surge impedance directly proportional to the distance along the resistor. This produces the uniform, practically reflectionless line termination over the stated frequencies of the load.

The dielectric coolant is chosen for its desirable electrical properties and thermal characteristics. Cooling of the load is accomplished by natural fluid and air convection. The 0.35 gallon (1.3 liter) of dielectric coolant carries the electrically generated heat from the resistor to the walls of the cylindrical cooling tank. The tank is encased in a set of heavy gauge aluminum radiator fins, which are firmly pressed on the cylinder. The heat from the dielectric oil is transferred to the surrounding air through the fins by natural convection.

A synthetic rubber diaphragm located in the rear dome of the load allows for the expansion of the coolant as the temperature rises.

## General

---

Position the Model 8141 and 8141-010 Termaline Load Resistor to provide at least six inches of unobstructed space around and above the unit. Place the load to permit the shortest possible cable length between the unit and the transmitting equipment.

Operate the load in a horizontal position only, with the handle on top. The load may be free-standing or fastened to any convenient flat surface. The front and rear fins are made extra thick and bent outward 90° to form mounting flanges. Fasten the Model 8141 by its mounting brackets with 1/4 machine screws and nuts or No. 12 wood screws if desired. The four 9/32 inch holes in the mounting brackets form a base rectangle of 7-15/32" x 5-1/8" (189.7 x 130.2 mm) for the Model 8141 and 7-13/32. x 5/1/8. (180 x 130.2 mm) for the Model 8141-010.

## Start-up

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Connect the Models 8141 and 8141-010 Termaline Load Resistor to the transmitting equipment under test with 50 ohm coaxial cable such as RG-213/U or equal, equipped with a Male N type plug (UG-21E/U or equal) which mates with the RF input connector of the load. After the transmitter has been connected to the load, proceed according to the transmitter manufacturer's instruction.

Due to the difference in VSWR between the dummy load and the transmitter's antenna, readjustment of the transmitter may be required when returning to the original antenna.

### CAUTION

Do not operate this equipment over the rated 250 watts continuously.  
Damage to the resistive element will result.

The unit will sustain an intermittent input of 300 W maximum for up to ten minutes with half-hour off intervals between power applications.

## Normal Operation

---

The loads will dissipate 250W of RF power safely and continuously without an operator in attendance.

As stated previously, the load can be overloaded to 300W of RF power for a maximum of ten minutes at a time with an interval of at least a half-hour in between to permit the load to cool off. Because of the additional heat that must be given off by the cooling fins under these conditions, touch the load with caution to avoid the possibility of painful burns.

## Shutdown

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The only way to turn off the equipment is to cut off power from the RF generator. Allow sufficient time for the load to cool down after removing RF power before handling it.

## **Emergency Shutdown**

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**WARNING**

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

Turn off the equipment by removing power from the RF generator.

**Troubleshooting**

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For corrections requiring repair or replacement of components, refer to the appropriate section for each specific model.

| PROBLEM  | POSSIBLE CAUSE                         | REMEDY  |
|--|--|---|
| Coolant oil leak around clamping band or radiator. | Clamping bands not tight.              | Tighten slightly with screwdriver.  |
|  | Faulty O-Ring (front).                 | Replace O-ring  |
|  | Faulty diaphragm (rear).               | Replace diaphragm   |
| Overheating of the radiator.                       | Transmitter power too high.            | Reduce transmitter power.   |
|  | Coolant oil level too low.             | Add more coolant oil to the radiator, see <a href="#">"Coolant Oil &amp; Diaphragm" on page 9</a> |
|  | Accumulation of dirt on cooling fins.  | Clean cooling fins.   |
|  | Faulty RF section assembly, check RDC. | Replace if needed.  |
| High and low DC resistance values.                 | Loose or faulty RF connector.          | Tighten or replace as needed.   |
|  | Faulty RF section assembly             | Replace if needed.  |

## Cleaning

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### Outside Surface

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The outside surface of the instrument, especially the cooling fins, should be wiped free of dust and dirt when necessary. Clean the RF input connector with a clean dry cloth. Use an aerosol type non residue forming contact cleaner on the inaccessible portions. Take special care to clean the metallic contact surfaces and exposed face of the teflon insulator.

## Inspection

---

With the rugged and simple construction of loads, periodic inspection will be necessary at only about six month intervals. Inspection should include the items listed below:

1. Cleanliness - Keep the housing and connector free of grime.
2. Oil Leakage - Check for coolant oil seepage from the radiator tank, and particularly at the front and rear near the under side of the clamping band. See "[Troubleshooting](#)" on page 7 if leakage is observed. Check tightness of the clamping screw.
3. Inspect the load for completeness and general condition of the equipment.

## Preventive Maintenance

---

The load requires only nominal routine care. It is designed to operate for long periods of time, if care is taken not to exceed its power handling capabilities.

The principal item of preventive maintenance is cleanliness. Keep the cooling fins clear of accumulated dust and grime. They interfere with the efficient and rapid transfer of heat from the fins to the surrounding air and therefore could cause the unit to overheat. Keep the coolant level up.

## RF Assembly Test

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### DC Resistance

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The electrical condition of the load resistor itself may be ascertained generally from its DC resistance at room temperature.

It must be remembered that VSWR and RF impedance are the prime requisites of a good dummy load, however, occasionally checking the DC resistance will offer an indication of a failing load.



Normally the DC resistance of the load will be a nominal 50 ohms. Stabilization of the resistive film or temperature can cause a change in the DC resistance. Always check the load, when its temperature is between 20 and 25 degrees Celsius.

Check and record the DC resistance value of the load before it is put into service. Use a resistance bridge or ohmmeter with an accuracy of one percent or better at 50 ohms for this purpose.

If the load is used frequently, daily to weekly, it would be wise to check the resistance on a monthly schedule. If however, the load is used more infrequently, set up a six month to yearly schedule accordingly. If there is no change or even a slight change in DC resistance there is no cause for alarm, however, if there is a drastic change greater than two ohms, this could be an indication of a failing load.

These tests are by no means a dire necessity to the operation of the load but merely guidelines for the users information and advisement.

## Disassembly

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There are no special techniques required for the repair or replacement of components. A screwdriver is the only tool needed. The following paragraphs outline component removal.

### RF Input Connector

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The input connector is a .Quick-Change. design which permits easy interchange with the use of only a screwdriver. This process does not interfere with the essential coaxial continuity of the load resistor.s RF input or the coolant oil seal. For replacement, proceed as follows:

1. Remove the four 8-32 x 5/16 inch pan head machine screws from the corners of the RF connector.
2. Pull the connector straight out of its socket.

### Coolant Oil & Diaphragm

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To examine the coolant oil and diaphragm, remove the diaphragm cover. Proceed as follows:

1. Stand the load vertically, with the back end up.
2. Loosen the clamp screw to release the clamping band.
3. Remove the diaphragm cover and lift the diaphragm from the back end of the radiator tank.

**Note:** *The diaphragm should be soft and pliable. If it is hard or shows signs of surface cracks, replace it. (Bird P/N 2430-015).*

**Note:** *The coolant level should be about one inch below top of the cylinder. If oil appears contaminated, replace. Use only the specified coolant, Bird P/N 5-1070.*

## RF Load Resistor Assembly

---

1. Stand the radiator vertically with RF input connector up.
2. Loosen the 10-32 clamping screw on the clamp band that holds the RF section in place with a screwdriver
3. Remove the clamping band.
4. Lift the RF section straight up and out of the radiator tank.

**Note:** *Hold for a short time over tank to allow oil to drain back in.*

5. Inspect the O-Ring seal just inside the sloped flange of the mounting ring.
6. Replace the seal, Bird P/N 5-230, if it shows any evidence of cuts or deterioration such as hardening or surface cracks.

## Reassembly

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### RF Input Connector

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To install a new connector, reverse the procedures in "[Disassembly](#)" on page 9.

**Note:** *Ensure that the projecting center contact pin on the connector is carefully engaged and properly seated with the mating socket of the load resistor input.*

### Coolant Oil & Diaphragm

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**Note:** *Inspect the diaphragm and coolant oil as indicated in disassembly.*

1. Put the diaphragm back in place on the radiator tank.
2. Press the cup-like swelling in the center of the diaphragm down into the tank to remove the trapped air bubble.
3. Pry the diaphragm away from the edge of the tank to allow the air to escape.

**Note:** *Through the same opening add more oil, if necessary, until the oil level is flush with the top of the tank.*

4. Replace the diaphragm cover and the clamping band.
5. Tighten the clamping screw.

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## RF Load Resistor Assembly

---

To install assembly, reverse the procedures in "[Disassembly](#)" on page 9.

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## Repairs

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### WARNING

This product contains substrate made of beryllium oxide. This is a potentially toxic ceramic and may be harmful to health. Beryllia oxide must be disposed of in accordance with the legal statutes dealing with hazardous material.

Do not attempt to repair this unit, but return to BIRD ELECTRONIC CORPORATION.

Repairs beyond what is covered in this instruction book will require return of the equipment to Bird Electronic Corporation for service. Please consult the factory.

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## Storage

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No special preparation for storage is required other than to cover the equipment to keep it free of dust and dirt accumulations. Storage in a dry, dust and vibration free environment is recommended. The storage temperature should preferably remain within the working temperature range of -40°C to +45°C (-40°F to +113°F).

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## Customer Service

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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](mailto:bsc@birdrf.com)

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

<http://www.birdrf.com>

## Shipment

Wrap and secure the RF connector with tape to keep out foreign material during shipment. Pack and brace the load in a shipping container, a corrugated paper container should suffice.

## Specifications

|                     |   |
|---------------------|---|
| Impedance           | 50 ohms nominal   |
| VSWR                | 1.1:1.0 maximum DC-1000 MHz<br>1.2:1.0 maximum 1000-1800 MHz<br>1.3:1.0 maximum 1800-2500 MHz |
| Connectors          | Female N "QC" type (normally supplied)  |
| Power Range         | 250 W continuous  |
| Frequency Range     | DC-2500 MHz   |
| Dimensions          | 9-9/16"L x 5-5/16"W x 8-1/2"H<br>(243 x 151 x 216 mm)   |
| Ambient Temperature | -40C to +45C (-40F to +113F)  |
| Cooling Method      | Dielectric liquid & air convection  |
| Weight, Nominal     | 10 lb (4.5 kg)  |
| Operating Position  | Horizontal only   |
| Finish              | Grey Powder Coat Paint  |

## Replacement Parts List

| Item | Qty | Description  | Part Number      |
|------|-----|--|------------------|
| 1    | 1   | Radiator assembly                                      | 2440-015         |
| 2    | 1   | RF section assembly                                    | 8141-002         |
| 3    | 1   | Coolant .35 gallons<br>(1.3 liter)(1 gallon container) | 5-1070-2         |
| 4    | 1   | "QC" connector   | See Table Below. |
| 5    | 2   | Clamp band assembly                                    | 2430-055         |
| 6    | 1   | O-Ring seal  | 5-230            |
| 7    | 1   | Diaphragm  | 2430-015         |
| 8    | 1   | Diaphragm cover  | 2430-148         |

**Available QC Type Connectors**

| <b>Description</b>  | <b>Part Number</b> |
|---------------------|--------------------|
| N-Female            | 4240-062           |
| N-Male              | 4240-063           |
| HN-Female           | 4240-268           |
| HN-Male             | 4240-278           |
| LC-Female           | 4240-031           |
| LC-Male             | 4240-025           |
| LT-Female           | 4240-018           |
| LT-Male             | 4240-012           |
| C-Female            | 4240-100           |
| C-Male              | 4240-110           |
| UHF-Female (SO-230) | 4240-050           |
| UHF-Male (PL-259)   | 4240-179           |
| 7/8" EIA Air Line   | 4240-002           |

# 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.