

I N S T R U C T I O N B O O K

F O R

M O D E L 8 2 3 0

L O A D R E S I S T O R

BIRD

Electronic Corporation

30303 Aurora Road, Cleveland, Ohio 44139-2794

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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.

Keep away from live circuits.

Operating personnel must at all times observe normal safety regulations. Do not attempt to replace parts or disconnect an RF transmission or any other high voltage line while power is applied. When working with high voltage always have someone present who is capable of rendering aid if necessary. Personnel working with or near high voltage should be familiar with modern methods of resuscitation.

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.

The following will appear in the text of this publication and are shown here for emphasis.

* CAUTION *
*
* Do not operate this equipment above the rated power *
* limits continuously. Load failure will result. *

* WARNING *
*
* When the unit is used in the upper range of its power *
* capacity, the radiator may become hot - care should *
* be used in touching the equipment. *

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

* WARNING *
*
* When using dry cleaning solvents, provide adequate *
* ventilation and observe normal safety precautions. *
* Many dry cleaning agents emit toxic fumes that may be *
* harmful to your health, if inhaled. *

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MODEL 8230 TERMALINE® RF LOAD RESISTOR

INTRODUCTION

GENERAL

The Model 8230 TERMALINE® Load Resistor is a general purpose load resistor for use with 50 ohm transmission lines. When water cooled, the load resistor has a continuous power rating of 2500 watts within its specified air ambient temperature range. The Model 8230 Load provides an accurate dependable, and practically non-reflective termination for testing and adjusting transmitters under nonradiating conditions from dc to 2500 MHz (see Specifications, page iv). The RF input connector on the front face of the unit is of a Bird Quick-Change "QC" design which allows rapid and easy interchange with other standard AN type connectors. A Female LC connector is normally supplied unless otherwise specified at the time of ordering by the customer.

The Model 8230 is rectangular in shape with transverse fins encasing a liquid-filled coolant cylinder which houses the RF assembly. A top mounted retractable handle is recessed in the radiator fins. The front and rear fins of the radiator are made of heavier gauge material and bent outward 90° to form bottom mounting flanges. These flanges are supports for free-standing use or brackets for fixed vertical mounting. Flange holes are provided for this purpose.

PURPOSE AND FUNCTION

The Model 8230 is useful for the following purposes:

- a. As a substitute antenna
 1. For tuning transmitters - under nonradiating conditions.
 2. For making routine tests and adjustments.
- b. As a substitute for any circuit loading element up to 2500 watts.
- c. To measure, with a suitable indicating device, the power level of coaxially transmitted power within its rating. Consult the Bird catalog or the company direct for applicable THRULINE® Wattmeters.

SPECIFICATIONS FOR MODEL 8230 TERMALINE® RF LOAD RESISTOR

Power Rating.....	2500 watts - water cooled - vertically mounted 500 watts w/o water - horizontal position 200 watts w/o water - vertically mounted
RF Input Impedance.....	50 ohms nominal
Input Connectors.....	Bird Quick Change "QC" (Female LC normally supplied)
Frequency Range.....	DC to 2.5 GHz
VSWR.....	1.1 to 1, max dc to 1000 MHz 1.25 to 1, max 1000 to 2500 MHz
Modes.....	CW, AM, FM, SSB, TV, and certain pulse systems
Ambient Temperature Range.....	-40°C to +45°C (-40F to 113F)
Operating Position.....	Vertical with water cooling, or horizontal (see instructions)
Weight.....	27 pounds (12 kg)
Overall Dimensions.....	17-23/32L x 5-15/16W x 8-1/2H (450 x 151 x 216 mm)
Finish.....	Light Navy Gray Baked Enamel

SECTION I - INSTALLATION

1-1. GENERAL

1-2. The Model 8230 Load Resistor is primarily intended for mounting in a vertical position. When mounted vertically with the connector end down and with cooling water supplied it is capable of dissipating up to 2500 watts of RF power. Without water cooling, it is restricted to 200 watts maximum.

1-3. The Model 8230 can also be operated without water cooling in a horizontal position. However, the power limit will be restricted to 500 watts. When used horizontally, the load may be used free-standing or fastened to any convenient flat surface.

1-4. MOUNTING

1-5. There are four 1/4 inch holes in the base flanges provided for permanent mounting. These holes are spaced in a 12-17/32 by 5-1/8 inch (318 x 130 mm) rectangle. Fasten the load with suitable 1/4 inch machine screw and nut sets or No. 12 wood or lag screws of sufficient length. Mount the load horizontally for power consumption up to 500 watts, or vertically with the connector pointing down, but never with the connector pointing upwards. Be sure that there is ample provision for free air circulation of at least 6 inches around and above the unit.

1-6. For power levels above 500 watts, the Model 8230 is mounted vertically with the input connector down. Fasten as above. In this position the water supply must be connected and flowing for maximum RF power dissipation. Very efficient coolant convection maintains a low temperature rise in the resistive element. Water flow should be at the rate of at least 1/2 gallon (2 liter) per minute. In preparation for operation of the unit above 500 watts, allow the water to flow approximately 15 seconds prior to the application of power. The water flow should also be allowed to continue for at least five minutes after the RF input power has stopped. Limit power to 200 watts with no water flow in the vertical position.

1-7. CONNECTIONS

1-8. Tap water is ordinarily used and the connections are made with light rubber hose (not supplied). Any convenient size tubing of approximately 3/8 inch ID, may be used. Use appropriate hose clamps if necessary. Water is a thermal medium only, and the water impurities have no important side effect on the equipment other than possible scale formation inside the water tubes after prolonged use.

1-9. Place the load to permit the shortest possible cable length between the unit and the transmitting equipment. Connect the Model 8230 TERMALINE® Load to the transmitting equipment under test with 50 ohm coaxial cable such as RG-17/U, RG-18/U, or equal. Be sure all connections are tightened securely. Avoid the use of adapters and unnecessary connectors when possible.

SECTION II - THEORY OF OPERATION

2-1. BASIC PRINCIPLE

2-2. The equipment consists basically of a carbon film-on-ceramic resistor immersed in a dielectric coolant. The resistor, particularly selected for its uniform film accuracy, is enclosed in a specially tapered housing. This provides a reduction in surge impedance directly proportional to the distance along the resistor. When surrounded by the dielectric coolant, the characteristic impedance is a nominal 50 ohms at the front (connector end), 25 ohms at the mid-point, to compensate for the resistance already passed over, and zero ohms at the rear (where the housing joins to the resistor form the return conductor).

2-3. DESCRIPTION

2-4. The dielectric coolant is chosen for its chemical inactivity, to prevent damage to the resistor, and for its thermal and desirable dielectric characteristics to which the diameters of the resistor housing are matched. A Teflon insulator supports the resistor, while introducing only a very slight variation to the coaxial line impedance. The insulator is sealed against coolant seepage by use of a radially compressed O-ring on its periphery.

2-5. Another synthetic rubber O-ring, placed over a projecting lip of the radiator cylinder, furnishes a seal for the radiator opening. A beveled flange on the resistor housing retains the O-ring. This flange, with the O-ring inside, is pressed against the radiator face by the drawing action of a radial V-clamp band around two matching beveled flanges.

2-6. COOLING

2-7. When input power is applied, the electrically generated heat in the resistor is given off to the surrounding coolant. By convection, the heated liquid flows through the openings in the coaxial shell to the cooling water coil and the walls of the fabricated metal tank. A series of radiating fins pressed onto the tank body transmit part of the heat of the dielectric coolant to the surrounding air. The Model 8230 has 27 feet of single length copper tubing in two nested coils wrapped around the resistor housing. At high power levels, water flowing through these coils carries away most of the heat from the dielectric coolant.

SECTION IV - MAINTENANCE

4-1. GENERAL MAINTENANCE

```
*****  
*                               W A R N I N G                               *  
*                               *                                           *  
* Never attempt to disconnect the equipment from the *  
* transmission line while RF power is being applied. *  
* Leaking RF energy is a potential health hazard. *  
*****
```

```
*****  
*                               W A R N I N G                               *  
*                               *                                           *  
* When using dry cleaning solvents, provide adequate *  
* ventilation and observe normal safety precautions. *  
* Many dry cleaning agents emit toxic fumes that may be *  
* harmful to your health, if inhaled. *  
*****
```

4-2. This equipment is rugged and simple, and it requires only nominal routine care. Keep the radiator fins and faces dusted off and the connector parts free of dirt and grime. If the connector contacts or insulator faces should become dirty, wipe them with a little dry cleaning solvent, such as alcohol, Freon or equivalent solvent, on a cotton swab stick. Exercise caution to avoid breathing the fumes if any toxic solvent is used.

4-3. If any portions of the radiator become corroded or rusted, clean the area with a fine flint sandpaper and then touch up with a light gray enamel.

4-4. PERIODIC INSPECTION

4-5. With the rugged and simple construction of the Model 8230 TERMALINE® Load Resistor, periodic inspection will be necessary at only about six-month intervals. Inspection should include the items listed below:

a. Coolant Leakage. Check for coolant seepage around the radiator tank, particularly at the front and back around the underside of the clamping band. If leakage is observed, check the tightness of the clamping band screw.

b. DC Resistance. Check the condition of the load resistor by accurate measurement of the dc resistance between the inner and outer conductors of the RF input connector. Use a resistance bridge or ohmmeter with an accuracy of one percent or better at 50 ohms. The measured resistance should be a nominal 50 ohms ± 2 ohms. It is helpful to keep a log of the resistance at room ambient prior to each use.

c. Inspect the Model 8230 TERMALINE® Load for completeness and general condition of the equipment.

4-6. COOLANT

4-7. The Model 8230 Load Resistor is factory filled to the proper liquid level with 0.8 gallons (3 liter) of dielectric coolant at room temperature. Expansion of the coolant with a rise in temperature is taken care of by means of a synthetic rubber diaphragm (not visible) under the rear dome of the unit. Watch for possible coolant leakage. Small amounts of loss will not impair the efficiency of the equipment, but more than a 10 percent loss may produce unfavorable effects on the VSWR. If it becomes necessary to add coolant, use only the proper coolant (obtainable from Bird Electronic Corporation). The particular dielectric and thermal characteristics of the coolant are essential to preserve the RF impedance matching and power rating.

4-8. REPAIRS

4-9. There are no special techniques required for the repair or replacement of components in the Model 8230 TERMALINE® Load. A screwdriver is the only tool needed. The paras below outline component removal.

a. RF Input Connector Replacement. The input connector is a patented Quick-Change "QC" 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 RF input or the coolant seal. For replacement, proceed as follows:

1. Remove the four 8-32 x 5/16 inch round head machine screws from the corners of the RF connector flange.
2. Pull the connector straight out of its socket.
3. Reverse the above stated procedure to install a new connector. Be sure that the projecting center contact pin on the connector is carefully engaged and properly seated in the mating socket of the load resistor input.

b. Diaphragm and Coolant. Remove the diaphragm to replace or examine the coolant liquid. Replacement of the diaphragm and coolant are listed in the steps below.

1. Stand the load vertically, with the back end up. Brace it in this position to keep it from tipping.
2. Loosen the clamp screw until the clamping band around the rear dome is released.
3. Remove the diaphragm cover and carefully lift off the diaphragm from the back end of the radiator tank. Visually inspect the diaphragm for any signs of hardening or cracking, and if found, replace the diaphragm.

4. The coolant liquid level should be about one inch below the top of the radiator cylinder. If the coolant appears to be contaminated, i.e., has other than a clear yellow tint, it should be replaced.

5. To reassemble, reverse the above procedure. When replacing the diaphragm, press in on the center cup and slowly insert the diaphragm to ensure that most of the air has been displaced.

c. RF Load Resistor Assembly. To replace the load resistor assembly, it is not necessary to drain the unit of the dielectric coolant. Proceed with the steps below.

1. Stand the load vertically with the front end up. Brace it in this position to keep it from tipping and spilling the coolant.

2. Loosen the clamp screw until the clamping band around the RF assembly is released.

3. Hold the load assembly by the RF input connector and pull the Assembly slowly out of the radiator, allowing the coolant time to drain back into the radiator.

4. After the RF load assembly has been removed, inspect the dielectric coolant for contamination. If the load resistor has burned out or the ceramic substrate has broken, it is more than likely that the coolant is contaminated. If there are particles in the coolant or if it is dark or murky in color, it should be replaced. Be sure to clean and dry the radiator tank thoroughly before adding fresh coolant.

5. Inspect the O-Ring seal which is located just inside the mounting flange of the resistor assembly. Do not re-use the O-Ring if it shows signs of deterioration or nicks.

6. To replace the RF assembly, reverse the above procedure. Tighten the clamping band securely to avoid coolant seepage.

4-10. LOAD RESISTOR

4-11. The resistor is held in its housing by mechanical means. When the three Tru-Arc rings are removed from the rear of the resistor housing, the resistor is freed at the back end and can be pulled free of the spring fingers of the resistor support inside the front of the assembly. However, it is not recommended that these resistors be changed in the field.

4-12. If a resistor replacement is necessary, it is advised that the entire RF load assembly be returned to Bird Electronic Corporation for service. Consult the company before returning.

SECTION V - REPLACEMENT PARTS LIST

5-1. MODEL 8230 TERMALINE® RF LOAD RESISTOR

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	1	Radiator assembly	2430-050
2	1	RF section assembly	8230-002-2
3	-	Dielectric coolant 0.8 gal. (3 liter)	5-030-3 (1 gal. container)
4	1	Connector: "QC" type (Female LC) normally supplied	See below
5	1	Diaphragm	2430-015
6	1	Diaphragm cover	2430-148
7	2	Clamp band assembly	2430-055
8	1	O-Ring seal	8110-039
9	1	Radiator handle	2430-028

*Available QC Type Connectors

N-Female	4240-062	LC-Male	4240-025
N-Male	4240-063	LT-Female	4240-018
HN-Female	4240-268	LT-Male	4240-012
HN-Male	4240-278	UHF-Female (SO-239)	4240-050
C-Female	4240-100	UHF-Male (SO-259A)	4240-179
C-Male	4240-110	7/8" EIA Air Line	4240-002
LC-Female	4240-031		

FIGURE 1. MODEL 8230 TERMALINE® LOAD RESISTOR OUTLINE DRAWING

