
INSTRUCTION BOOK

OPERATING INSTRUCTIONS

**TERMALINE® LOAD RESISTOR
SERIES 8710**



Electronic Corporation

30303 Aurora Road, Cleveland, Ohio 44139-2794

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MODELS COVERED IN THIS INSTRUCTION BOOK

8710	8713
8711	8714
8712	8710-025

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.

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.

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.

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.

SHOCK HAZARD

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

CHEMICAL HAZARD

Dry cleaning solvents used to clean parts may be potentially dangerous to your health. Avoid inhalation of fumes and also prolonged contact with skin.

RESUSCITATION

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

SAFETY SYMBOLS

WARNING

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

CAUTION

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

The following safety warnings appear in the text where there is procedures, that if not carefully followed, could be detrimental to operating and maintenance personnel and are repeated here for emphasis.

WARNING

Provide adequate ventilation and observe normal precautions when using dry cleaning solvents. Many dry cleaning agents emit toxic fumes that may be harmful to your health if inhaled.

WARNING

This product contains a resistor substrate made of beryllium oxide. This is a potentially toxic ceramic and may be harmful to your health. Beryllium 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.

The following cautions appear in the text whenever a procedure, if not properly followed, could put the equipment in danger of damage and are repeated here for emphasis.

CAUTION

Take care while installing the load not to pinch cooling water tubes when making connections. Restricted water flow will cause resistor failure.

CAUTION

Never reverse the cooling water connections. It is very important for the safety of the load resistor to observe proper flow direction. Also, when the load is first installed or is reconnected, run the water for approximately a minute to fill the system and remove all bubbles before turning on the RF power.

CAUTION

Do not exceed the rated power of this instrument for any extended period of time as damage may result.

CAUTION

Be sure cooling liquid is flowing through the load before RF power is applied and make sure the cooling liquid supply is not interrupted while load is in operation. Even momentary interruption of coolant supply while load power is applied will cause almost immediate burnout.

CAUTION

Any more than 5 W of power applied to the load resistor without water cooling will quickly damage the equipment. The new sealed system effectively protects the resistive film from possible moisture damage by any condensate formation. Flow of cooling water through the system without applied power represents no danger.

CAUTION

Handle the load with care. Do not subject it to unnecessary shock or impact.

CAUTION

Do not submerge the device during the cleaning process. The fluid could enter the inside of the system and cause the failure of the device when power is applied.

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SECTION I. INTRODUCTION

1.1. GENERAL

The Bird TERMALINE® Series 8710 are termination type radio frequency loads handling up to 1000 Watts of RF power. The frequency range is from dc to 3.5 GHz (see page 1-2). The power input is through a 50 ohm Female or Male type N, C, SC or 7/8 inch EIA flanged connector, depending on model selected. The RF power is converted to heat in the load resistor and directly dissipated by means of the cooling water system.

The equipment consists essentially of a power-dissipating resistor section with a unique internal water cooling system. Water flow through the inside of the resistor directly absorbs the dissipated power of the resistive film. These subminiature units may be carried easily, installed anywhere, and used in whatever position desired.

1.2. UNIT SPECIFICATIONS

SERIES 8710 TERMALINE® LOAD RESISTOR

Impedance	50 ohms nominal
VSWR	
All Models except 8710-025	
dc-1000 MHz	1.1:1.0 maximum
1000-3000 MHz	1.3:1.0 maximum
3000-3500 MHz	1.35:1.0 maximum
Model 8710-025	
3100-3500 MHz	1.1:1.0 maximum
Connectors	
Models 8710/12 & 8710-025	N-Female or Male
Model 8711	C-Female or Male
Model 8713	7/8" EIA Flanged
Model 8714	SC-Female or Male
Power Rating, All Except Model 8714	
Model 8714 (only)	1000 W (water cooled) Varies with type of coolant used & flow rate
Frequency Range	
8710-025 (only)	DC-3500 MHz 3100 MHz-3500 MHz
Dimensions	
Model 8710/12 (Female) 8710-025	3-1/2"L x 11/16"DIA (89 x 17.5 mm)
Model 8710/11/12 (Male)	3-21/32"L x 11/16"DIA (92.9 x 17.5 mm)
Model 8711 (Female)	3-7/16"L x 11/16"DIA (87.3 x 17.5 mm)
Model 8713	4-27/32"L x 15/16"DIA (123 x 23.8 mm)
Model 8714 (Female)	3-15/16"L x 11/16"DIA (100 x 17.5 mm)
Model 8714 (Male)	4"L x 11/16"DIA (102 x 17.5 mm)
Flow Rate	
	1-3 quarts/minute (.95-2.83 liters/minute)
Weight (Approximately)	
Model 8710/11/12/15 & 8710-025	5 oz (141.7 grams)
Model 8713	14 oz (397 grams)
Model 8714	4 oz (113.4 grams)

UNIT SPECIFICATIONS [CONT.]

Modulation	CW, AM, FM, SSB, TV & Pulsed Signals
Water Connections	
Model 8710/11/12/13 & 8710-025	3/16" tube to 1/8" F.P.T. (Standard length 18", specify length when ordering)
Model 8714	3/16" tube (Specify length when ordering)
Water Input Temperature	8°C at 1 quart/minute (46.4°F) 80°C at 3 quarts/minute (176°F)
Finish	Silver plate & alodine
Coolant	
Models 8712 & 8714 Only*	Coolants other than water may be used provided flow rate, input temperature & power rating are adjusted accordingly
Model 8710-025 Only**	35% Ethylene glycol & 65% water by volume only

*The Models 8712 and 8714 TERMALINE® differs from the other models in that the internal flow tube is made of a high temperature material to allow exotic coolants to be used instead of water, although water may still be used.

When water is used, the power rating and frequency performance remains unchanged. The power rating and frequency performance will vary depending upon other types of coolant used and its input temperature. Consult with the factory before using an exotic coolant.

**The Model 8710-025 is basically identical to the Model 8710 except for internal differences which permit the use of an ethylene glycol-water mixture coolant. These differences also were designed to function with improved frequency characteristics between 3100 and 3500 MHz.

All other particulars of the Model 8712, 8714 and 8710-025 are identical to the other models described in this manual.

SECTION II. INSTALLATION

2.1. GENERAL

The Series 8710 TERMALINE® Load Resistor unit may be installed in any position or attitude needed. Their relatively small size permits location in very limited space. It is also comparatively easy to relocate the equipment as desired. The loads are nonmagnetic and can be located inside focusing coils. The water connection tubes are normally furnished 18 inches long unless specially ordered otherwise. They are fitted with standard 1/8 inch female pipe thread and captive slip-type connector nuts. These may therefore be directly attached to standard 1/8 inch MPT (male pipe or nipples), sealing the flared tubes.

2.2. CONNECTIONS

CAUTION

Take care while installing the load not to pinch cooling water tubes when making connections. Restricted water flow will cause resistor failure.

CAUTION

Never reverse the cooling water connections. It is very important for the safety of the load resistor to observe proper flow direction. Also, when the load is first installed or is reconnected, run the water for approximately a minute to fill the system and remove all bubbles before turning on the RF power.

The input and output water tubes are made of copper and can be directed as required. However, care should be exercised not to pinch the tubes while bending as this would restrict the coolant flow and cause the device to operate improperly. The center tube is the water input, which is sometimes longer in certain original equipment, and the outer is the water output tube.

Never reverse the cooling water connections. It is very important for the safety of the load resistor to observe proper flow direction. Also, when the load is first installed or is reconnected, run the water for approximately a minute to fill the system and remove all bubbles before turning on the RF power. Note the water flow rate is contingent on water input temperature adjusted accordingly (see page 1-1).

Attach the RF power with clean connectors, bottom firmly, and tighten connector nut securely.



SECTION III. THEORY OF OPERATION

3.1. GENERAL

The Series 8710 Load Resistor is an original type of Bird load resistor in which the RF energy, converted to heat in the load resistor, is transmitted directly to the cooling agent, ordinarily water, without the use of any intermediate transfer fluid. Although water is normally used as a coolant in all loads, the Models 8712, 8714 and 8710-025 are designed with special flow tubes enabling these loads to use liquid coolants other than or in conjunction with water. Flow rate, input temperature and power rating will be effected by different coolants. Consult with the factory for technical information.

3.2. HEAT TRANSFER

Cold water entering the unit is led by the center pipe down to the RF input end of the load resistor and released through peripheral holes in its wall. The pipes, supported at both ends, is constructed of dielectric material that will not affect the electrical properties of the device. The water is then directed backwards over the inside surface of the ceramic resistor tube. This tube has, on its outside surface, a uniformly thick resistive film, protected with a thin nonconductive coating. The special high-strength compound of the resistor tube is a good thermal conductivity material, so that the heat generated by the RF energy is readily conducted through its comparatively thin wall. This substrate compound also essentially isolates the water electrically from fields inherent to the coaxial line. The generated heat is carried off by the water passing over the inner surface, and the RF power absorbed by the load is translated into increased temperature of the water flowing out of the equipment.

The value of this power may be easily calculated, if the water flow rate is known, by using the following formula:

$$P = 0.263 (T_1 - T_2) \text{ GPM.}$$

Where: P = RF power in kilowatts.
T₁ = Outlet water temperature in °C
T₂ = Inlet water temperature in °C
GPM = Water flow in gallons per minute

In °F the formula is: $P = 0.146 (T_1 - T_2) \text{ GPM}$

SECTION IV. OPERATING INSTRUCTIONS

4.1. GENERAL

CAUTION

Do not exceed the rated power of this instrument for any extended period of time as damage may result.

CAUTION

Be sure cooling liquid is flowing through the load before RF power is applied and make sure the cooling liquid supply is not interrupted while load is in operation. Even momentary interruption of coolant supply while load power is applied will cause almost immediate burnout.

CAUTION

Any more than 5 W of power applied to the load resistor without water cooling will quickly damage the equipment. The new sealed system effectively protects the resistive film from possible moisture damage by any condensate formation. Flow of cooling water through the system without applied power represents no danger.

Operation of this equipment is rather simple. Always turn on the water supply first, before applying RF power. Any more than five watts power applied to the load resistor without water cooling would quickly damage the equipment.

Do not allow any interruption of the water flow during operation for the load. Even momentary suspension of water supply under power application will cause almost immediate burnout of the resistor and destruction of the load.

A unique "sealed-system" effectively protects the resistive film from any moisture damage by possible condensate formation. Flow of cooling water through the system without applies power

therefore presents no danger to the resistor.

4.2. SHUTDOWN

In the shut-off procedure, always remember to shut off the RF power first before turning off the water flow.

SECTION V. MAINTENANCE

5.1. GENERAL

WARNING

This product contains a resistor substrate made of beryllium oxide. This is a potentially toxic ceramic and may be harmful to your health. Beryllium 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.

CAUTION

Handle the load with care. Do not subject it to unnecessary shock or impact.

The simple, self-contained construction of the Series 8710 RF Load makes it virtually free of routine maintenance requirements. Handle with normal care; do not drop the load resistor or treat it with unnecessary roughness. Store in a clean and dust-free place if not in use, and cover the connector. Keep the unit dusted off from time to time when exposed.

5.2. CLEANING

WARNING

Provide adequate ventilation and observe normal precautions when using dry cleaning solvents. Many dry cleaning agents emit toxic fumes that may be harmful to your health if inhaled.

CAUTION

Do not submerge the device during the cleaning process. The fluid could enter the inside of the system and cause the failure of the device when power is applied.

Care and cleanliness are the main factors. If the input connector becomes dirty, it should be cleaned with a residue-free aerosol contact cleaner or any dry cleaning solvent on a cotton swab stick. Carefully clean the metallic contact areas and exposed faces of the Teflon insulator.

5.3. REPAIRS

The user should not attempt any repair operations on the RF load. The highly integral nature of the component makes it unsuited to field maintenance. We urge that any unit requiring repair be returned to a qualified service center. Bird Electronic Corporation maintains complete repair and calibration facilities at the following addresses:

Service Group
Bird Electronic Corporation
30303 Aurora Road
Cleveland (Solon) Ohio 44139-2794

Phone: (216) 248-1200
Fax: (216) 248-5426
Cable: BIRDELEC
Telex: 706898 Bird Elec UD

European Sales Office:

Bird Electronic Ltd.
Unit 1
Shannon Business Centre
Towne Centre
Shannon
County Clare Ireland

	(Country Code)	(City Code)	(Number)
Phone:	353	61	360583
or	353	61	360577
Fax:	353	61	360585

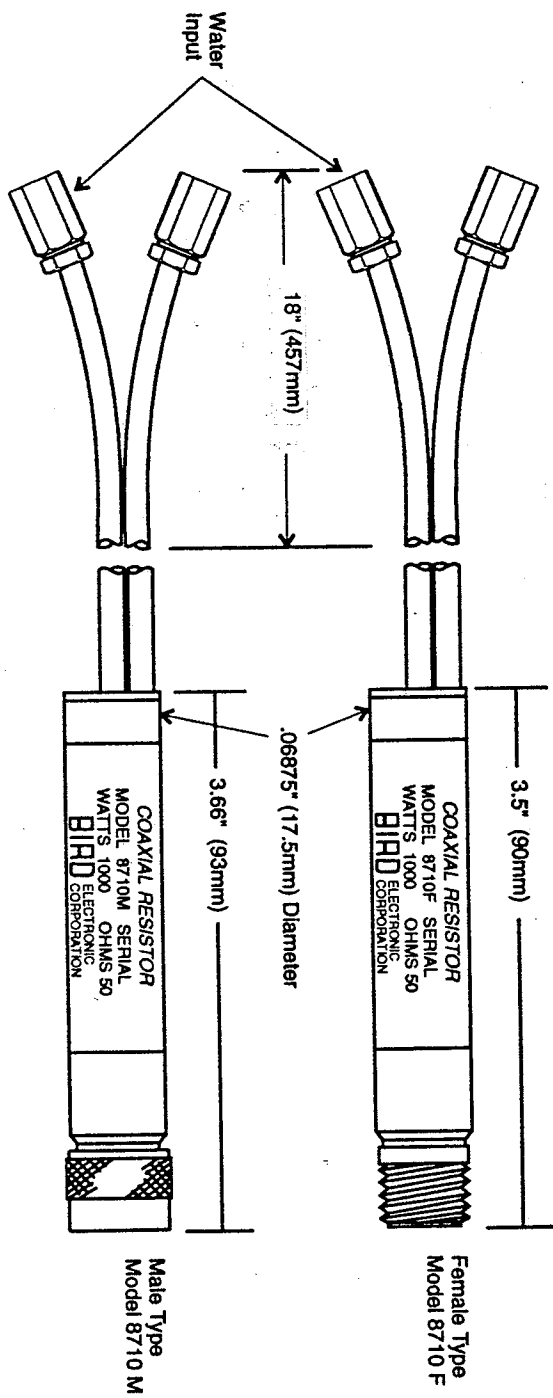


Figure 5-1. Outline Drawing Models 8710F and 8710M

DECLARATION OF CONFORMITY

Manufacturer: Bird Electronic Corporation
30303 Aurora Road
Cleveland, Ohio 44139-2794

Product: Termaline Load Resistor
Models: 8710F 8710M 8713
 8711F 8711M

The undersigned hereby declares, on behalf of Bird Electronic Corporation of Cleveland, Ohio, that the above-referenced product, to which this declaration relates, is in conformity with the provisions of the following standards:

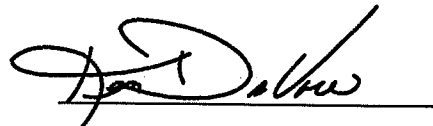
1. European Standard EN 61010-1:1993 - Safety, Group II.

This standard is in accordance with Council Directive 73/23/EEC and 93/68/EEC.

The technical documentation file required by this directive is maintained at the corporate headquarters of Bird Electronic Corporation, 30303 Aurora Road, Cleveland, Ohio.

If you are located in Europe and have any questions, please contact

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