INSTRUCTION BOOK

OPERATING INSTRUCTIONS

TERMALINE® LOAD RESISTOR MODEL 8726

Electronic Corporation
30303 Aurora Road, Cleveland, Ohio 44139-2794

Instruction Book Part Number 920-8726

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MODELS COVERED IN THIS INSTRUCTION BOOK

8726

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.

SAFETY EARTH GROUND

An earth uninterruptible 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

Never attempt to disconnect RF 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 could be harmful to your health, if inhaled.

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

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 excessively overload these units above the rated 5 kilowatts of power. Overload for any length of time will cause resistor failure.

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

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.

CAUTION

Never attempt to dismantle the load itself.

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SECTION I. INTRODUCTION

1.1. PURPOSE AND FUNCTION

The Model 8726 Load Resistor is designed as a compact, low reflection and nonradiating termination of coaxial transmission lines. Cooled by internal water flow, it generates almost no ambient heat, making installation space minimal and convenient.

This sub-miniature unit may be carried easily and installed anywhere, for use in whatever position desired.

1.2. PERFORMANCE CHARACTERISTICS AND CAPABILITIES

A Model 8726 can absorb up to 5000 Watts continuously and dissipate it harmlessly as heat over a frequency range of dc to 2000 MHz. It will show a maximum VSWR of 1.1 to 1 from dc to 500 MHz and 1.25 to 1.0 from 500 to 2000 MHz.

The frequency range may be extended by the use of exotic liquid coolants. Consult with the company concerning particulars.

Power input is through a Bird 50 ohm Quick-Change "QC" Female LC connector. The RF power is converted to heat in the load resistor, and directly dissipated by means of the water cooling system. Water flow through the inside of the resistor directly absorbs the dissipated power of the resistive film.

1.3. DIMENSIONS

This load has a body length of 7-23/32 inch (196 mm). The LC Connector and water supply fitting adds another 2-5/8 inch (67 mm) to the overall length. The major body diameter is 1-11/16 inch (43 mm). The weight is only 2 lb, 8 oz (1.13 kg) and the shipping weight is 5 lb (2.27 kg).

1.4. UTILITY REQUIREMENTS

The Model 8726 is a passive device that is self-contained and does not need any external source of power or utilities to function. It does need a source of running water, however, to provide for its cooling. The water must flow from a rate of 1 gallon (3.8 liter) per minute at a water temperature of +5°C (+41°F) to a rate of 4 gallons (15.2 liter) per minute at +80°C (+176°F) in order to provide adequate heat dissipation.

1.5. ENVIRONMENTAL REQUIREMENTS

The load should be operated in a dust and vibration free environment. The ambient temperature range should remain between +5°C and +80°C (+41°F and +176°F) for proper operation. However, this is not critical for cooling.

1.6. ITEMS FURNISHED

The Model 8726 is equipped with a Female LC, Quick-Change connector and 3/4 inch hose fittings for the water supply lines. This instruction book is the only additional item furnished.

1.7. ITEMS REQUIRED

The only items required are hoses equipped with 3/4 inch female hose fittings on the ends of the water lines.

1.8. TOOLS AND TEST EQUIPMENT

An adjustable wrench is the only tool that would be useful for dismounting this load. A resistance bridge or an ohmmeter with an accuracy of one percent or better at 50 ohm is recommended for checking the resistance value of the load resistor.

1.3. UNIT SPECIFICATIONS

MODEL 8726 TERMALINE® LOAD RESISTOR

Power Rating	5 kW continuous
Impedance	50 ohms nominal
VSWR	1.1 to 1.0 max. dc to 500 MHz 1.25 to 1.0 max. 500 to 2000 MHz
Connector	Bird Quick-Change "QC" type Female LC normally supplied
Frequency Range	dc to 2000 MHz
Dimensions	7-23/32 inch* x 1-11/16 inch major body diameter (196 x 43 mm) *not including LC Connector or water supply fitting
Water Temperature	+5°C to +80°C (+41°F to +176°F)
Cooling Method	Forced liquid flow 1 to 4 gallons (3.8 to 15.2 liter) per minute
Weight	2 lb 8 oz (1.13 kg)
Operating Position	Any attitude
Finish	Bright nickel plate

SECTION II. INSTALLATION

2.1. GENERAL

The Model 8726 TERMALINE® Load Resistor unit may be installed in any position or attitude required. Its relatively small size permits mounting in a very limited space since cooling is by water flow rather than air convention. No clearance for airflow is needed. It is also comparatively easy to carry and to relocate as necessary.

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 conducting fittings are made of nickel plated brass. Care should be exercised not to pinch the hoses in bending as this would restrict the flow and cause the device to operate improperly. The fitting at the end of the water chamber is the water input and the water output fitting is at 90 degrees on the circumference. Water connections on the load are 3/4 inch hose fittings.

Attach the RF coaxial transmission line by means of a Male LC connector attached to it. Note - Always handle the load with care to prevent subjection to unnecessary shock or impact.

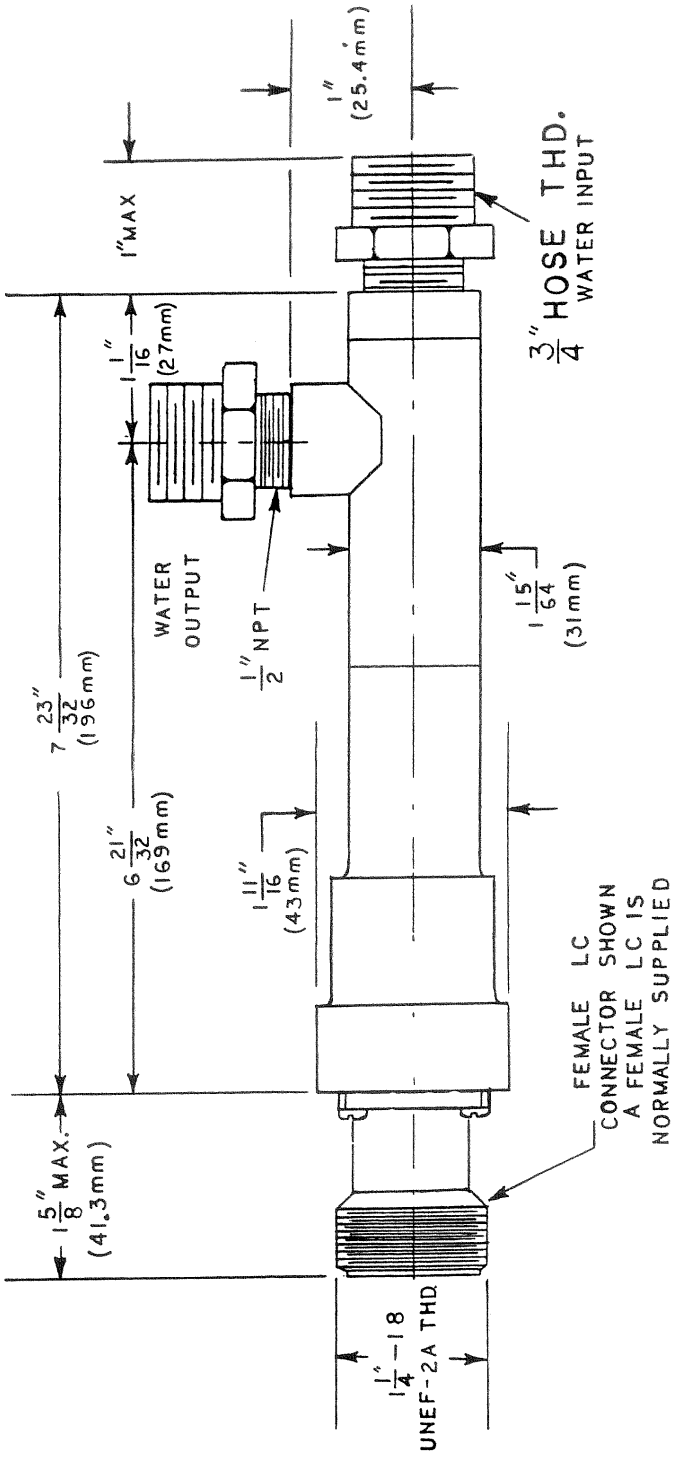

Figure 2-1. Model 8726 Outline Drawing

SECTION III. THEORY OF OPERATION

3.1. GENERAL

The Model 8726 RF Load Resistor is unique in that it uses primarily an external water supply for the cooling of the resistor element. By using this technique, the need for an intermediate dielectric fluid to transfer the heat generated in the resistive element has been eliminated, reducing the physical size of the load to a virtual minimum. This simplified system allows use of the load in more varied environments and attachment at any attitude (see Specifications, page 1-2).

For the direct reading of power measurements up to 5 kW, these loads may be used in conjunction with any Bird Series 4700 THRULINE® Wattmeter. To facilitate connection to the wattmeter, Quick-Change connectors P/N 4240-096 or 4240-208 must be used.

3.2. HEAT TRANSFER

Cold water enters the unit by the center pipe and is directed by a center flow tube to the RF input end of the load resistor where it passes through peripheral holes in the wall. This flow tube, supported at both ends, is constructed of dielectric material so that it 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 a resistive film of very uniform thickness deposited on its outside surface. The high strength of the resistor tube is manufactured from good thermal conductivity material. The heat generated by the RF energy absorbed is readily conducted through its comparatively thin wall. This ceramic also essentially isolates the water electrically from fields inherent to the coaxial line. The heat is carried off by the water passing over the inner surface, and the RF power absorbed by the load is translated into an increased temperature of the water flowing out of the load. The value of this power may be easily calculated, if the water flow is known, by using the following formula:

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

Where: P = Power in kilowatts
T_1 = Outlet water temperature in °C
T_2 = Inlet water temperature in °C
GPM = Water flow in gallons per minute

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

SECTION IV. OPERATION INSTRUCTIONS

4.1. USE AND FUNCTION OF CONTROLS

The load, being a passive device, has no indicators or operating controls.

4.2. INITIAL ADJUSTMENTS

No initial adjustments are required other than to connect the load to the RF source by means of a coaxial line with a suitable coupling.

4.3. START-UP

Turn on the water flow and wait a moment for all the air to be purged out of the lines before turning on the RF power.

4.4. COOLING WATER FOR THE MODEL 8726

The electrical performance of these RF loads is affected by impurities or other chemical additives in the cooling water. The presence of salts in the water definitely make the device unusable because they cause a rapid increase in VSWR. Therefore, sea water or silty water should not be used for cooling the loads.

The thermal performance of these loads is also affected by impurities, particularly those impurities that accumulate in the form of scale on the exposed surfaces of the fluid paths of the load assembly. These deposits may result in an increase in the thermal and/or fluid resistance(s) of the load and may in turn cause the load to overheat and fail.

The following types of water are considered safe for the cooling of the Model 8726 Load Resistor; filtered, city, or soft water. In general, any potable water is suitable for cooling the load.

4.5. NORMAL OPERATION

Operation of this equipment is rather simple. First, turn on the water supply, before applying any RF power. Set the flow between 1 gpm (3.8 liter) for +5°C (+41°F) water temperature and 4 gpm (15 liter) for 80°C (+176°F); i.e., add 1 gpm to the flow rate for each 25°C increase in water temperature above 5°C.

CAUTION

Do not excessively overload these units above the rated 5 kilowatts of power. Overload for any length of time will cause resistor failure.

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.

4.6. SHUTDOWN

Always turn off the RF power first, letting the water flow continue for a few minutes to cool down the load.

4.7. EMERGENCY SHUTDOWN

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.

Any cessation of water flow while the RF power is still being applied will almost certainly result in overheating causing damage to the load resistor and possible injury to the operator. Always turn off the RF power source immediately if water flow should fail.

SECTION V. MAINTENANCE

5.1. TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	REMEDY
Overheating or High exit water temperature	Excessive power	Reduce RF power.
	Water flow insufficient	Increase flow rate of water
	Obstruction in water flow system	Check water lines for source of blockage.
Resistor value changed see paragraph 5.6	Resistor damaged	Return load to factory for service.

5.2. CLEANING

WARNING

When using dry cleaning solvents, provide adequate ventilation and observe normal safety precautions. Many dry cleaning agents emit toxic fumes that could 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.

Wipe off dust and dirt from the housing with a dry cloth. Uncouple the RF connector and also wipe it off with a clean dry cloth. Use a self-drying nonresidue forming contact cleaner on the inaccessible portions, especially the metallic contact surfaces and the exposed faces of the TFE insulators.

5.3. INSPECTION

Check the water connections from time to time for leaks and the load itself for cleanliness. (see paragraph 5.2, Cleaning)

5.4. PREVENTIVE MAINTENANCE

The necessary preventive maintenance procedures are covered in paragraph 5.3, Inspection.

5.5. REPAIRS

Any maintenance or service procedure beyond scope of those provided in this section should be referred to a qualified service center. Bird Electronic Corporation maintains complete repair and calibration facilities at the following address:

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
Town Centre
Shannon
County Clare, Ireland

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

5.6. RF LOAD RESISTOR

Accurate measurement of the dc resistance between the inner and outer conductors of the RF input connector will provide a good check of the condition of the load resistor. For this measurement, a resistance bridge or an ohmmeter with an accuracy of one percent or better at 50 ohms should be used. Use low resistance leads, preferably a short piece of 50 ohm coaxial cable. The measured resistance should not deviate more than 2 ohms from the value stamped on the manila tag attached to the load. It is recommended that this resistance check be performed each time the load is to be used.

For greater accuracy the resistance of the load should be carefully checked prior to use at ambient room temperature. This resistance value should be recorded and used as a reference. Subsequent resistance measurements should not deviate more than two percent from this value.

5.7. DISASSEMBLY

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.

Other than disconnecting the Model 8726 from the coaxial transmission line and the water lines, no special disassembly procedures are necessary. (See Section II, Installation). Repairs must be performed by Bird Electronic Corporation. Please consult the factory.

5.8. RF INPUT CONNECTOR

The input connector on the Model 8726 is of a special Bird Quick-Change "QC" design which permits easy interchange of connectors with only simple tools. This process does not in any way disturb the coolant seal or interfere with the essential coaxial continuity of the load resistor input. Normally a female LC connector is supplies with Model 8726.

If replacement of the RF input connector becomes necessary, proceed as follows:

a. Remove the four 8-32 x 5/16 inch round head machine screws from the corners of the RF connector.

b. Pull connector straight out.

c. Reverse the preceding procedure to install new connector, making certain that the projecting center contact pin of the "QC" connector is carefully engaged and properly aligned with the mating socket of the load resistor.

The "QC" connector may be readily replaced, as above, with another AN Standard Type connectors if specially obtained from Bird Electronic Corporation. Available "QC" connector types are as follows:

TYPE	PART NO.
Female SC	4240-091
Female LC	4240-031
Male LC	4240-025
Female LT	4240-018
Male LT	4240-012
7/8" EIA	4240-002
1 5/8" EIA-Fixed	4240-096
1 5/8" EIA-Swivel	4240-208

SECTION VI. PREPARATION FOR RESHIPMENT

6.1. GENERAL

Disconnect the Model 8726 from both the RF coaxial line, with the RF power shut off, and the water lines. Drain the water out of the load. Wrap the RF connector with padding and tape securely in place. Pack and brace the load in a suitable shipping container, a corrugated paper box should suffice.

SECTION VII. STORAGE

7.1. GENERAL

No special preparations for storage are necessary other than to cover the equipment to keep out dust and dirt. Store this unit in a dry and dust free environment where the ambient temperature will remain within -5°C to +80°C (23°F to +176°F).

SECTION VIII. REPLACEMENT PARTS LIST

8.1. GENERAL

There are no field replaceable parts in the Model 8726 because it is a sealed and self-contained unit (see paragraph 5.7, Disassembly). Only the connector as mentioned in paragraph 5.8 is replaceable.

DECLARATION OF CONFORMITY

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

Product: TERMALINE RF COAXIAL LOAD RESISTOR
Models: 8726

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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