INSTRUCTION BOOK

for

Model 8562

RADIO FREQUENCY LOAD

Model 8562 TERMALINE

SUMMARY OF CHARACTERISTICS

Electrical Specifications

Power Rating	50 kilowatts
RF Input Impedance	50 ohms
Input Connector	3-1/8" EIA Swivel Flange
Frequency	DC to 1 KHz and 300 MHz to 1500 MHz
VSWR	1.2 max. 300 to 450 MHz 1.1 max. 450 to 1300 MHz 1.25 max. 1300 to 1500 MHz
Modes	CW, AM, TV, and Pulsed Signals
Ambient Temperature Range	+5°C to +60°C
AC Power Required	115V, 50/60 Hz Single Phase

Mechanical Specifications

Water Flow Rate	8 GPM (5°C) -10 GPM (60°C)
Water Connections	1/2" Pipe Thread or 3/4" Hose
Weight	13-1/2 lb.
Dimensions	18" Long, 3-1/4" Dia.
Finish	Bright Nickel Plate

CAUTION: COOLING WATER R.F. LOADS

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

The thermal performance of the Loads is affected with impurities, particularly those impurities that accumulate in the form of scale on the inside surface of the ceramic tube. This results in the increase of thermal resistance of the load and in turn causes the load to overheat and fail.

The following types of water are considered safe for the cooling of the Loads.

1. Distilled Water
2. Filtered Water
3. City Water
4. Soft Water (demineralized)

In general any potable water is good for cooling the RF Loads.

MODEL 8562 TERMALINE COAXIAL LOAD RESISTOR

Section 1 - General Description

The Model 8562 TERMALINE Coaxial Load Resistor is designed as a compact low reflection and non-radiating termination for RF transmission lines. It is capable of continuous power dissipation up to 50 kilowatts from dc to 1 kHz, 300 to 450 MHz, 450 to 1300 MHz, and 1300 to 1500 MHz, with VSWR of 1.2, 1.1, and 1.25 respectively from 300 to 1500 MHz when used in 50-ohm 3-1/8" flanged lines. The Model 8562 is intended for use on CW, AM, and TV modulation envelopes, and within certain limits on radar or pulse modes. Application information for use involving pulse-type signals should be obtained directly from Bird Electronic Corporation.

The Model 8562 consists of two units, the Load Assembly and the Control Assembly. The Load Assembly contains the resistor element and the water cooling system; the Control Assembly consists of the electrical circuitry required to prevent damage to the transmitter or other signal generator in case of malfunction of the load, and also to protect the RF load should the water stop flowing.

When used in conjunction with a Bird Model 4617 THRULINE Wattmeter, the Model 8562 may be used for power measurement up to 50 kilowatts.

Section 2 - Theory of Operation

1. General

This TERMALINE Coaxial Load Resistor is unique in that it employs water cooling of the resistor element while still maintaining an air dielectric. By using this technique, the need for an intermediate fluid to transfer the heat generated in the resistor element has been eliminated, reducing the physical size of the load to an absolute minimum. The resistor element is made of a special ceramic material to provide high structural strength, optimum thermal conductivity, and electrical isolation from the cooling water.

2. Heat Transfer

The 50-ohm resistor consists of beryllia ceramic and a vacuum deposited resistive film, covered by a thin coating of non-conductive material. The heat generated by absorption of power is conducted to the inner surface of the resistor where it is dissipated by the cooling water, Figure 2. The water inlet tube, which is also a high dielectric material, is supported rigidly and concentrically inside the resistor tube.

The cooling water flows through the inlet tube toward the RF input end of the resistor. As it nears the end of the inlet tube, the water is released through peripheral holes in its wall and makes contact with the inner surface of the resistor. The cooling water flows back along the inner surface of the resistor to the water outlet absorbing the dissipated energy.

Because virtually all of the power input to the load is transformed into heat which is carried away by the cooling water, the amount of power dissipated by the load may be calculated from the following formula:

$$P = 0.263(T_1 - T_2)GPM$$ Where.....

P =Power in kilowatts
T_1 =Outlet water temperature in ^{o}C
T_2 =Inlet " " " "
GPM =Water flow in gallons per minute

3. Flow Interlock Control Circuit

The interlock control circuit provides instantaneous fail-safe protection of the transmitter and load in the event of even momentary interruption of the cooling water supply. This protection is necessary because dissipation of the heat generated by the RF power absorption is critically dependent upon a required minimum water flow regardless of inlet water temperature.

The Water Flow Switch, normally open (contacts closed), is factory calibrated to close (contacts open) whenever water flow drops below 8 gallons per minute. When the Water Flow Switch is closed, the Time Delay Switch is deactivated, which in turn, opens the Interlock Switch causing immediate shutdown of the transmitter or other signal source. The Time Delay Switch also keeps the Interlock Switch "open" for a pre-determined interval after the minimum flow of 8 gallons per minute has been re-established. This safeguard feature is to assure proper operation of the cooling system before RF power can be applied to the load, preventing damage or burnout of the resistor element.

Section 3 - Installation

1. General

The Model 8562 may be installed in any operating position desired, with operating requirements of adequate cooling water and 115 vac, single phase supply. Do not install unit in a location which will subject it to severe vibration or physical shock. Its small size permits installation in a space less than 24 x 8 x 8 inches. The unit is ready for connection as received from the factory; there are no pre-installation operations required.

2. Transmission Line Attachment

a. Clean all conductor and insulator surfaces on transmission line flange and RF input connector.

b. Place the anchor bullet (Bird #4600-021) in center conductor of RF input connector and push in firmly to seat evenly.

c. Place O-ring (Bird #4600-022) in groove of transmission line flange and place load in desired mounting position on transmission line flange.

d. Fasten transmission line flange and swivel flange of RF input connector together using mounting hardware set (Bird #4600-023) NOTE: If Coupling Kit (Bird #4600-020) was not ordered, use 3/8-16 x 1-1/2" bolts, nuts, washers, and lockwashers. Finger tighten all bolts.

e. Rotate load until warning label is easily seen and the water outlet connection is readily accessible.

f. Tighten all flange bolts evenly and securely.

CAUTION

DO NOT DISTURB socket head cap screws joining connector section to main housing.

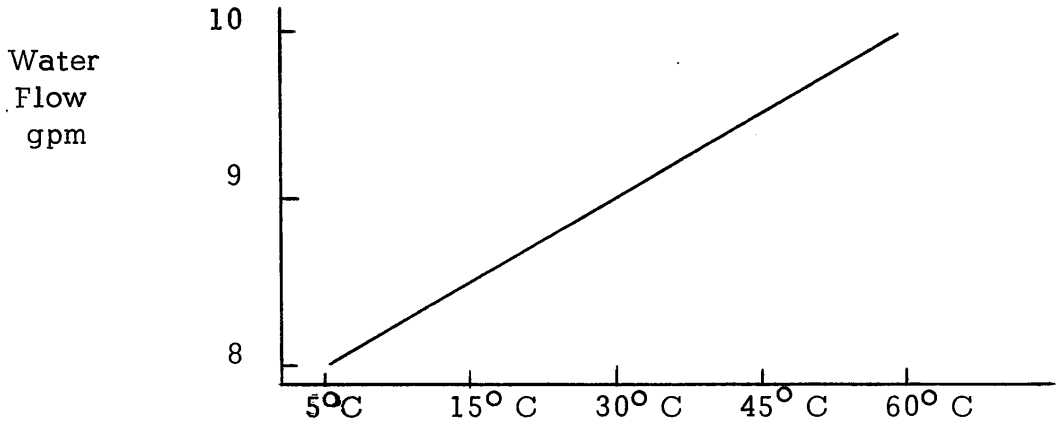
3. Water Line Attachment

The RF Load is factory supplied with fittings which connect to standard 3/4" water hose. The WATER INLET connection (at the end opposite and in line with the RF Input Connector) and the WATER OUTLET connection (90° to WATER INLET) mate with 3/4" water hose connectors. If rigid piping is to be used, replace the WATER INLET hose nipple with a 1/2" male pipe fitting. A 1/2" female pipe fitting should be used in place of the WATER OUTLET hose nipple.

CAUTION

Make sure hose connections are properly made:
INPUT TO INPUT, OUTPUT TO OUTPUT.
Failure to do this will cause immediate destruction of the load resistor.

The cooling water supply required must not be less than the following minimums:



4. Water Flow Switch Installation

a. Connect the Water Flow Switch water outlet port to the WATER INLET hose of the Load. (Outlet port located on side of switch body.) Use a minimum hose length of 10 feet.

CAUTION

It is recommended that not more than 40 feet of hose or piping should be used between the Water Flow Switch and the Load Resistor.

b. With hose or piping, attach the water inlet port of the Flow Switch to the supply of running water. Note that inlet port has 3/4" Female NPT threads.

c. Turn water supply on and check proper hook-up and operation of cooling system.

CAUTION

Be sure Water Flow Switch is properly attached - SWITCH OUTLET PORT TO LOAD WATER INLET. Restricted water flow will cause the Load to burn out.

d. DO NOT connect Water Flow Switch leads at this time.

5. Flow Interlock Installation

All elements of the interlock control circuit are contained in the Control Assembly enclosure. The enclosure is supplied with three "BX" type cable connectors for the 115V ac, Water Flow Switch, and Interlock Switch connections. No other electrical fittings are required.

a. Select a desirable location and mount enclosure by means of the four 1/4" holes on its back. Mounting holes are on a 5" x 5" base plane.

b. Connect Water Flow Switch leads to terminals 2 and 3.

c. Connect Interlock Switch leads to terminals 4 and 5.

d. Connect 115V ac to terminals 1 and 2.

6. Pre-Operational Checkout

BEFORE ATTEMPTING TO OPERATE THE RF LOAD either under test or actual operating conditions, TEST THE COMPLETE WATER COOLING SYSTEM AND INTERLOCK CONTROL CIRCUIT AS FOLLOWS:

a. Make sure 115V ac and transmitter interlock power are OFF.

b. Connect an ohmmeter across terminals 4 and 5; Interlock Switch.

c. Turn 115V ac power on.

d. Turn water supply on and note when Water Flow Switch operates. (Audible click)

e. The ohmmeter across terminals 4 and 5 should indicate operation of Time Delay Switch and Interlock Switch in not less than 14 ±2 seconds.

f. Water flow from WATER OUTLET connection of Load must not be less than 8 gallons per minute. See paragraph 3, page 5.

NOTE

As a precautionary measure, the Pre-Operation Checkout should be performed each time the Load is to be put into service.

Section 4 - Operation

1. General

The TERMALINE RF Load is not equipped with any operating controls, therefore, requires no presence of an operator while in use. Proper operation of the equipment is assured if the instructions contained in Section 3, Installation are followed exactly.

CAUTION

DO NOT apply more than the rated RF power to the Load. The water flow rate and inlet water temperature must be as specified in paragraph 3 of Section 3.

2. Operating as a Load Resistor

a. Turn on 115V ac.

b. Turn water supply on.

c. Turn interlock supply on.

d. Apply RF power to Load.

3. Operating as an RF Wattmeter

The RF Load can be combined with a Bird Model 4617 THRULINE to form an absorption-type wattmeter by attaching the THRULINE to the coaxial transmission line ahead of the RF Load. Installation and operation of the THRULINE is covered in the THRULINE Instruction Manual.

a. Turn on 115V ac power.

b. Turn water supply on.

c. Turn on interlock supply.

d. Apply RF power to the Load.

e. Rotate Element in THRULINE to monitor incident or reflected power. Measurement is taken in direction indicated by arrow on Element.

4. Shut-Down Procedure

a. Turn RF power to Load off.

b. Wait 1 minute.

c. Turn interlock and 115V ac off.

d. Turn off water supply.

CAUTION

DO NOT disconnect Water Flow Switch leads from Control Assembly. Any operation of Load without proper functioning of cooling system will cause immediate destruction of the resistor element.

Section 5 - Maintenance

1. General

The TERMALINE Coaxial Load Resistor is rugged and simple, requiring only nominal and routine attention. The Load is designed to operate for long periods of time if care is taken not to exceed its power handling capabilities.

The outside surface of the unit should be wiped free of dust and dirt at regular intervals. Disconnect the instrument from the transmission line and clean the RF input connector (both metallic and insulator surfaces) with Inhibisol or trichlorethylene on a cotton swab stick.

NOTE

Always handle the Load with care to prevent subjection to unnecessary shock or impact.

2. 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 with an accuracy of one percent or better at 50 ohms (such as the Leeds & Northrop Model 5305 Test Set) should be used. Use low resistance leads, preferably a short piece of 50-ohm cable. The measured resistance should not deviate more than 2 ohms from the value stamped on the blue tag attached to the load.

NOTE

It is recommended that this resistance check be performed each time the load is to be used.

The sealed construction and the precision assembly of the internal components of the Load MAKE IT UNSUITABLE FOR FIELD REPAIR. Consult with Bird Electronic Corporation for information regarding return of the unit for repair.

3. Water Flow Switch

The Water Flow Switch should be inspected and/or cleaned from accumulated scale to permit free movement of the sliding valve. This should be done after 25 hours of operation, and if the water is clean, every 50 to 100 hours. This component is non-repairable and must be replaced. For replacement, proceed as follows:

a. Make certain the RF power, 115V ac, and transmitter interlock supply are turned off.

b. Disconnect leads at the Water Flow Switch.

c. Remove defective Switch and replace with new unit.

d. Connect Flow Switch leads.

e. Perform Pre-operational Checkout, page 6.

4. Flow Interlock Control

This component cannot be repaired. Replace according to the steps outlined below:

a. Be sure RF power, 115V ac, and transmitter interlock supply are off.

b. Unsolder leads 1, 3, 4, and 5 from the Interlock Control side of the terminal board.

c. Remove the four #10-32 nuts and lockwashers from the corners of the mounting plate inside the control box.

d. Remove the two #8-32 x 5/16" screws and nuts holding the delay timer to the mounting plate.

e. Replace the defective flow interlock control by reversing the above procedure.

SECTION 6

Replacement Parts List

Description	Part No.	Quantity
Water Flow Switch	5-393-2	1
Control Assembly	8750-035	1
Hose Nipple (Inlet)	5-065-2	1
Hose Nipple (Outlet)	5-274-2	1
Delay Timer	5-545	1
	Optional	
Coupling Kit	4600-020	1
Consisting of:		
Anchor Bullet	4600-021	1
O-Ring	4600-022	1
Mounting Hardware	4600-023	1 set