

INSTRUCTION BOOK

for

Model 8701

RADIO FREQUENCY LOAD

SPECIFICATIONS

FOR

MODEL 8701 TERMALINE RF LOAD RESISTOR

DIMENSIONS	5-3/8 max. overall length x 1-13/16 body dia.
WEIGHT	2-1/2 lbs.
FINISH	Bright nickel plate
POWER RATING	3K Watts continuous
VSWR	1.1 to 1.0 dc to 1GHz 1.25 to 1.0 1GHz to 1.5 GHz
INPUT CONNECTOR	7/8" EIA Flanged (2-1/4 dia. swivel)
IMPEDANCE	50 ohms
WATER SUPPLY	3/4 GPM at 4 ⁰ C 4 GPM at 80 ⁰ C
WATER CONNECTIONS	Compression Fittings for 5/16" O.D. Tube (see installation, Section III for orientation of fittings)
OPERATING POSITION	Any

INSTRUCTION MANUAL

for

Model 8701 - 3000 Watt RF Load

SECTION I - GENERAL DESCRIPTION

The Bird Electronic Model 8701 is a termination type Radio Frequency Load for up to 3000 watts of RF power. The frequency range is from DC to 15 GHz per second. The power input is through a 50-ohm 7/8" EIA flange. The RF power is converted to heat in the load resistor, and directly dissipated by means of the water cooling system.

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

SECTION II - THEORY

GENERAL

The Model 8701 is original in being the first Bird miniature TERMALINE Load Resistor in which the RF energy - converted to heat in the load resistor - is transmitted directly to the cooling agent, water, without the use of any intermediate transfer fluid.

HEAT TRANSFER

Cold water entering the unit is led by center pipe down to the RF input end of the load resistor and released through peripheral holes in its wall. This pipe, 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 on its outside surface a very uniform thickness resistive film, protected with a thin non-conductive coating. The high-strength beryllia ceramic 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 beryllia 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 increased temperature of the water flowing out of the equipment. The value of this power may be easily calculated (if the water flow is known) by using the following formula: -

$$P = 0.263(T_1 - T_2) G/M$$

Where; P = RF power in kilowatts

T₁ = Outlet water temp in °C

T₂ = Inlet water temp. °C

G/M = Water flow in gallons per minute

or $P = 0.146 (T_1 - T_2) G/M$ where T₁ and T₂ are expressed in °F.

SECTION III - INSTALLATION

The Model 8701 TERMA LINE Load Resistor unit may be installed in any required position or attitude, and its unusually small size and unique port design permit its location in very limited available space. It is also comparatively easy to relocate the load equipment as desired.

The inlet and outlet water connections are short, brass fittings fixed on the side of the Load Resistor Housing adjacent to the rear end. They are standard Compression Fittings for 5/16" O. D. tube. The inlet port is at the rear and the outlet is just ahead of it. By unscrewing the four #4-40 x 5/8 Pan Hd. Mch. Scrs. (in a square pattern on the rear face of the unit) the inlet port plate may be removed. It can be refitted to the housing at any of the four quadrant positions relative to the outlet fitting. This, along with the swivel flanging for the RF line connection, allows a very wide latitude in the orientation of the water connections. Be sure to check condition of O-ring on chamber face and retighten the four machine screws securely when replacing the inlet plate.

Connecting water tubing should be 5/16 O. D. with wall thickness of 21 to 16 gage. Brass or copper tubing is recommended. With the compression fittings, flaring is not needed. Face tube ends square and reasonably smooth. Shove tube to bottom of the fitting with nut loose, and tighten up nut snugly. Caution: In preparing

tubes for connections, care should be exercised not to pinch the tubes in bending as this would restrict the flow and cause the device to operate improperly. The center tube is the water INPUT and the outer is the water OUTPUT tube.

WARNING: 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 unit 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.

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

SECTION IV - OPERATION

Operation of this equipment is rather simple. Always turn on the water supply FIRST, before applying RF power. Warning - any more than five watts power applied to the Load Resistor without water cooling would 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 thru the system without applied power therefore presents no danger.

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

SECTION V - MAINTENANCE

The simple, self-contained construction of the Model 8701 RF Load makes it virtually free of routine maintenance requirements. Handle with normal care, do not drop the load resistor or treat with unnecessary roughness. Store in a clean and dust free place if not in use, and cover connector. Keep unit dusted off from time to time when exposed.

Care and cleanliness are main factors. If the input connector becomes dirty - it should be cleaned with a little dry solvent. Inhibisol¹ or its equivalent is recommended, or trichlorethylene, on a cotton swab stick. Carefully clean the matallic contact areas and exposed faces of the Teflon² insulator.

The user should not attempt any repair operations on the RF Load. The intregal nature of the component is not suited to field maintenance, and we urge that any unit requiring repair be returned to the factory - consult with the company.

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

¹Registered trade name of a carbon tet replacement, manufactured by the Penetone Co., Tenafly, New Jersey.

²Registered trade name for a fluorocarbon film, manufactured by the E. I. duPont De Nemours & Co., Inc.

Special Repair Instruction

Having first turned off the RF Power and then shut off the water supply, proceed as follows: -

- 1) With a 1/2-in. wrench, loosen the water tube coupling nuts, Item #2, by turning nuts counterclockwise to the fitting. When loose, pull the tubes straight out of the compression fittings. Take care to keep the nuts and sleeves on the fittings.
- 2) Uncouple from the 7/8-in. EIA connection and remove from RF line. The coupling is made with (3) 1/4-20 x 1-1/4 lg. bolt sets and supported center bullet.
- 3) Note the two #4-40 x 3/16 socket set screws on the body cylinder - one near middle and one near front. Remove the Glyptal coverings by careful chipping or softening with Glyptal thinner or suitable alcohol-based solvent.
- 4) Take out set screws with a 3/64-inch hex socket wrench.

Notice: For resistor replacements it is not necessary to disturb the four #4-40 pan head screws at the rear face of the unit - remove the water inlet and outlet chambers as a single body. (This is Item #3 and #4).

- 5) Twist off the water chamber assembly at the central seam of the Load.

a) When removed, check that the internal O-ring seal (Item 5) is in place just inside the interior flange in the water chamber.

b) The water flow (Item 6) tube (which nests inside the resistor) may stay with water chamber assembly when it is taken off. This is OK.

- 6) Carefully remove the three Tru-Arc retaining rings Item #11 surrounding the spring fingers at the rear end of the resistor

body. Without regular retaining ring tools, long-nosed type pliers are useful.

7) Turning counter-clockwise, unscrew the outer conductor piece from the front of the body. Because of the swivel flange, use a leather strap to grasp the outer conductor.

8) Carefully pull out the insulator and center conductor (Resistor Assy, Item #7) assembly. The resistor itself is epoxy cemented to both its fittings, so this assembly should emerge as a unit.

9) Unscrew the front center contact to release the Resistor Sub-Assy (Resistor with both fittings and coating) Item #10. This also releases the captive Insulator, Item #9.

10) The resistor unit cannot be further disassembled for field repair. Replace with a prepared assembly as ordered from the factory. (Item #10)

11) The RF Load is reassembled by reversing the above procedures. If the Insulator, Item #9 is removed, or particularly if replaced by a new part, a light application of Dow-Corning DC-4 compound on the fitting surfaces will assist positioning. When the Resistor and Center Contact Assy (Item #7) is properly seated, the resistor contact will extend beyond the rear spring fingers of the housing about 9/32-inch.

12) After the Resistor and Center Conductor Assy is restored in par. 11 above, be sure to replace the (3) Retaining Rings, Item #11, to their original lengthwise alignment. The ring openings should be at 90° to each other. Coat RTV #3145 seal over spring finger openings.

13) In replacing the Water Chambers Assy. be sure the inside flange O-Ring is in its internal groove (par. 5a) and also apply a light coat of DC-4 compound to ease assembly.

14) As noted in par. 4, removing the (4) screws at the rear of the Load will separate the Water Chambers. Their junction is sealed by another O-ring of the same size, Item #5.

Model 8701- 3 kW RF Load
Replaceable Parts List

<u>Item</u>	<u>Q/U</u>	<u>Description</u>	<u>Part/Dwg. No.</u>
1)	1	Housing	8701-019
2)	2	Coupling, Tube - Compression	5-607-5
3)	1	Cover, Inlet	8701-018
4)	1	Chamber, Outlet	8701-004
5)	2	Seal, O-ring	5-430
6)	1	Tube, Flow	8701-009
7)	-1-	Assy, Resistor & Cent. Cond. consisting of Items 8, 9 & 10.	8701-002
8)	1	Center Conductor	8701-014
9)	1	Insulator	8701-011
10)	1	Resistor/Fittings Assy, not field repairable; replace as a unit	8701-022
11)	3	Rings, Retaining - Std.	Tru-Arc #5100-56