INSTRUCTION BOOK
FOR

SERIES 8860-400A
TERMALINE® WATTMETERS

Bird Electronic Corporation

30303 Aurora Road, Cleveland, Ohio 44139-2794

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MODELS COVERED IN THIS INSTRUCTION BOOK

8863-400A
8864-400A

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.

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**************************************************************
*                      C A U T I O N                         *
*                                                            *
* This equipment is designed for operation in only a         *
* horizontal position, with mounting brackets down.          *
* Do not operate in any other manner.                        *
*                                                      pg 1 *
**************************************************************

**************************************************************
*                      W A R N I N G                         *
*                                                            *
* The vent plug must be used at all times when the unit      *
* is in operation or cooling.  Failure to do this could      *
* result in damage to the equipment and endanger the         *
* operator's safety.  Be sure to check this plug.            *
*                                                      pg 2 *
**************************************************************

**************************************************************
*                      W A R N I N G                         *
*                                                            *
* Using this wattmeter in the upper end of its power         *
* dissipation range will cause the housing to become hot!    *
* Care should be exercised in touching it.                   *
*                                                      pg 9 *
**************************************************************
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Continued

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**************************************************************
*                      W A R N I N G                         *
*                                                            *
* Never attempt to disconnect RF equipment from a            *
* transmission line while RF power is being applied.         *
* Leaking RF energy is a potential health hazard.            *
*                                                      pg 9  *
**************************************************************

**************************************************************
*                      W A R N I N G                         *
*                                                            *
* When operating this equipment in conjunction with RF       *
* power of 200 watts or higher, the potential of the         *
* center conductor of the RF line section will be 100        *
* volts or higher.  Do not contact the center conductor.     *
* If cleaning becomes necessary, shut off the RF power.      *
*                                                      pg 12 *
**************************************************************

**************************************************************
*                      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.                         *
*                                                      pg 12 *
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SERIES 8860 TERMALINE® LOAD RESISTOR

INTRODUCTION

PURPOSE AND FUNCTION

Series 8860-400A TERMALINE® Wattmeter are portable, general purpose 50 ohm coaxial RF transmission line terminating wattmeters. They are self-contained units requiring no outside power source or additional equipment. These wattmeters provide nonradiating, and practically nonreflective terminations for testing and adjusting RF transmitters and RF coaxial systems from dc to 900 MHz. Various power levels are indicated on a direct reading meter which has scales that correspond to detector element ranges selected by the user.

TERMALINE® Wattmeters are useful for the following purposes:

a. In place of the antenna.

   1. For tuning and checking transmitters output power under nonradiating conditions.

   2. For making routine tests and adjustments.

b. As a substitute for any circuit loading element.

c. To measure the power output of any coaxially transmitted signal within their rating.

PERFORMANCE CHARACTERISTICS AND CAPABILITIES

These wattmeters can absorb and measure RF power, up to 1500 watts continuously and dissipate it harmlessly as heat over a frequency range of dc to 890 MHz. They will allow a maximum VSWR of 1.10 to 1.00 from dc to 1000 MHz.

ENVIRONMENTAL REQUIREMENTS

These TERMALINE® Wattmeters should be operated in a dust and vibration free environment. The ambient temperature range should remain between -40°C and +45°C (-40F and +113F) for proper operation. Allow at least 12 inches of clearance around the units to permit an unimpeded access of convection air currents for adequate heat dissipation.

ITEMS FURNISHED

The Model 8863 has a 3-1/8 inch unflanged connector and Model 8864 a 3-1/8 inch EIA flanged connector. These are permanently mounted connectors. Just behind the connector is a socket in which the RF detector elements (not included) are inserted. A plug on the side of the socket connects with the cable of the meter. The vent plug and this instruction book are the only other items supplied.

TOOLS AND TEST EQUIPMENT

Only simple tools such as screwdrivers, and a wrench will be necessary for disassembly of this equipment. A resistance bridge or an ohmmeter with an accuracy of 1 percent or better at 50 ohms is useful for checking the resistance value of the RF section assembly.

OPTIONAL ITEMS

The detector elements, a connector coupling kit and an interlock over-temperature thermoswitch may be ordered as option items. However, the text of this Instruction Book reads including the interlock over-temperature thermoswitch.

Additional elements may be ordered from Table 19 in the Bird Electronic catalog.

SPECIFICATIONS FOR SERIES 8860-400A TERMALINE® WATTMETER

Impedance	50 ohms nominal
VSWR	1.10:1.00 maximum dc-1000 MHz
Connectors	
Model 8863-400A	3-1/8" Unflanged
Model 8864-400A	3-1/8" EIA Flanged
Power Rating	1500 Watts average (continuous duty)
Frequency Range	54-890 MHz
Note - actual frequency and power range is determined by the elements used. Select from Table 1-1.	
Accuracy	±8% of full scale
Dimensions	
Model 8863-400A	18-17/32"L x 7-3/8"W x 13-1/8"H (470.7 x 187.3 x 333.4 mm)
Model 8864-400A	19-1/2"L x 7-3/8"W x 13-1/8"H (495.3 x 187.3 x 333.4 mm)
Meter Housing	4-11/64"L x 5-17/32"W x 6-1/2"H (106 x 140 x 165 mm)
Ambient Temperature	-40°C to +45°C (-40F to +113F)
Cooling Method	Dielectric liquid and air convection currents.
Weight	27.75 lb (12.6 kg) approximately
Operating Position	Horizontal only
Finish	
Radiator and Meter Housing	Light navy gray baked enamel (MIL-E-15090)
Connector and RF Section	Bright silver plate

SECTION I - INSTALLATION

1-1. LOCATION

1-2. Allow at least 12 inches of clearance around these units to provide a sufficient amount of air for adequate cooling by natural air convection. Place the wattmeter to permit the shortest possible cable length between the unit and the transmitting equipment. The meter may be placed anywhere for convenient viewing, within the 10 foot cable reach. Operate these wattmeters in a horizontal position only, with the vent plug up.

1-3. MOUNTING

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**********************************************************
*                      C A U T I O N                     *
*                                                        *
* This equipment is designed for operation in only a     *
* horizontal position, with mounting brackets down.      *
* Do not operate in any other manner.                    *
**********************************************************
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1-4. These wattmeters may be used for portable operation or for fixed installation, that is they may stand free or may be secured to a bench or any convenient flat surface. The front and rear fins are made of heavier gauge material bent outward 90° to form mounting flanges. Four 3/8 inch (9.5 mm) elongated holes are provided in the flanges for mounting purposes. If it is desired to fasten the wattmeter by means of their base mounting flanges, secure the unit in place with 3/8 inch lag screws or nut and bolts sets. The holes are arranged in a 14-7/32 x 4-1/2 inch rectangle (361.2 x 114.3 mm). The front and rear face plates of the wattmeter are also bent over on the top to form convenient carrying handles.

1-5. LINE CONNECTION

1-6. The Model 8863-400A has a 3-1/8 inch unflanged connector. It is inserted in the transmission line using coupling kit P/N 5-726. The connector bullet mates with the center conductor of the 3-1/8 inch 50 ohm coaxial transmission line. Insert the bullet firmly in the center conductor of the wattmeter and push it in until it bottoms in the conductor. Slide the outer sleeve with clamping bands over the transmission line first and then insert the wattmeter into the transmission line. The bullet should be firmly seated in the center conductor with the ends of the connector butted snugly against the end of the transmission line. Then slide the outer sleeve over the junctures of the connector and the transmission line and tighten the clamping band screws to complete the installation.

1-7. The Model 8864-400A wattmeter has a swivel, bolted type connector. It is connected to the transmission line using the coupling kit, P/N 4600-020. The center conductor anchor bullet, P/N 4600-021, mate with the center conductor of the 3-1/8 inch 50 ohm coaxial transmission line. This line should be fitted with 3-1/8 inch EIA bolt-type flanges. It is permissible for the mating flange of the stationary line to be of the rigid type because of the swivel type flange on the wattmeter. Check that the

center conductor anchor bullets have been positioned with insulators properly seated in the counterbores. Use six suitable bolt assemblies for attachment, 3/8-16 x 1-1/2 inch nut and screw assemblies are recommended.

1-8. **VENT PLUG**

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**********************************************************
*                      W A R N I N G                     *
*                                                        *
* The vent plug must be used at all times when the unit  *
* is in operation or cooling. Failure to do this could   *
* result in damage to the equipment and endanger the     *
* operator's safety. Be sure to check this plug.         *
**********************************************************
```

1-9. Before placing the unit into service, the solid shipping plug, P/N 2450-049, must be removed and replaced by the spring loaded vent plug, P/N 2450-094. The vent hole for these plugs is located on the top left side near the front end. The two plugs are linked together by a piece of bead chain. The shipping plug should be placed back in the vent hole whenever the attenuator is to be shipped. Take care not to lose the O-Ring seal.

1-10. **THERMOSWITCH**

1-11. The Series 8860-400A wattmeters may be equipped with an optional interlock over-temperature thermoswitch assembly, P/N 8890-008. When installed on the back of the radiator, it will provide a safeguard against damage that might occur from accidental transmitter power overload or equipment malfunction. Being normally closed, the thermoswitch opens at a maximum safe coolant temperature. When connected in series with the transmitter interlock, it turns off the transmitter power if the wattmeter coolant temperature exceeds a safe level. The thermoswitch assembly consists of the thermoswitch body, P/N 8890-005, and a coupling jack, P/N 4250-018.

1-12. **THERMOSWITCH INSTALLATION**

1-13. If the thermoswitch is to be installed by the user, use the following procedure:

a. Replace the vent plug with the shipping plug.

b. Tip the load on its front end with the connector facing down. Brace it in that position to avoid tipping it over.

c. Use a 9/16 allen wrench to loosen and remove the plug that seals the thermoswitch socket on the back end of the load. Do this carefully to avoid damaging the threads in the plug hole.

d. Replace the socket plug with the thermoswitch. Use an acceptable pipe sealing compound, such as "Locktite with teflon" or its equivalent, sparingly on the external threads only. Do not use ordinary plumbers pipe dope because it will contaminate the

dielectric fluid. Screw the thermoswitch carefully but firmly into place.

e. Lower the load back onto its mounting flanges and check the thermoswitch for any signs of coolant leakage from the socket. If leakage is evident, then the thermoswitch will have to be removed and the threads recoated with sealant.

f. When there are no longer signs of leakage, replace the shipping plug with the vent plug.

1-14. **THERMOSWITCH CONNECTION**

1-15. Connect the thermoswitch, proceeding as follows:

a. Unscrew the larger knurled ring nut (A) at the lower end of the coupling jack assembly and pull it off of the thermoswitch jack (B). Unscrew the small knurled cover fitting (C) from the base plug (D) of the connector to release the base.

b. Thread the interlock wires through the clamp (E), with washers (F) inside, and with its threaded fitting (C) in place. Service the interlock wire with short tips, use spaghetti tubing over the wire ends if needed, then securely solder the interlock leads to the lugs (G) of the connector base. Note - Be sure that the larger captive clamping nut (A) is in place over the base plug (D) with the knurled end outward (towards face).

c. First screw on the cover ring (C), then fasten the cable clamp (E) in place, and tighten the two yoke screws (H) on the cable. Push the plug back on to the thermoswitch and tighten the captive knurled connecting ring. Do not attempt to operate the equipment without the interlock attached.

FIGURE 1-1. THERMOSWITCH ASSEMBLY (P/N 8890-008)

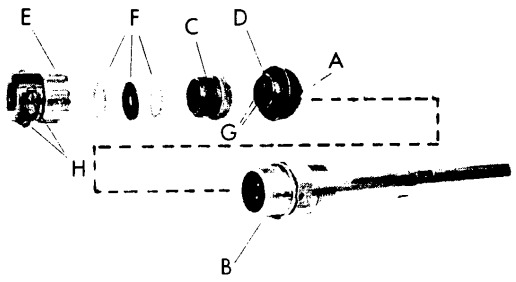
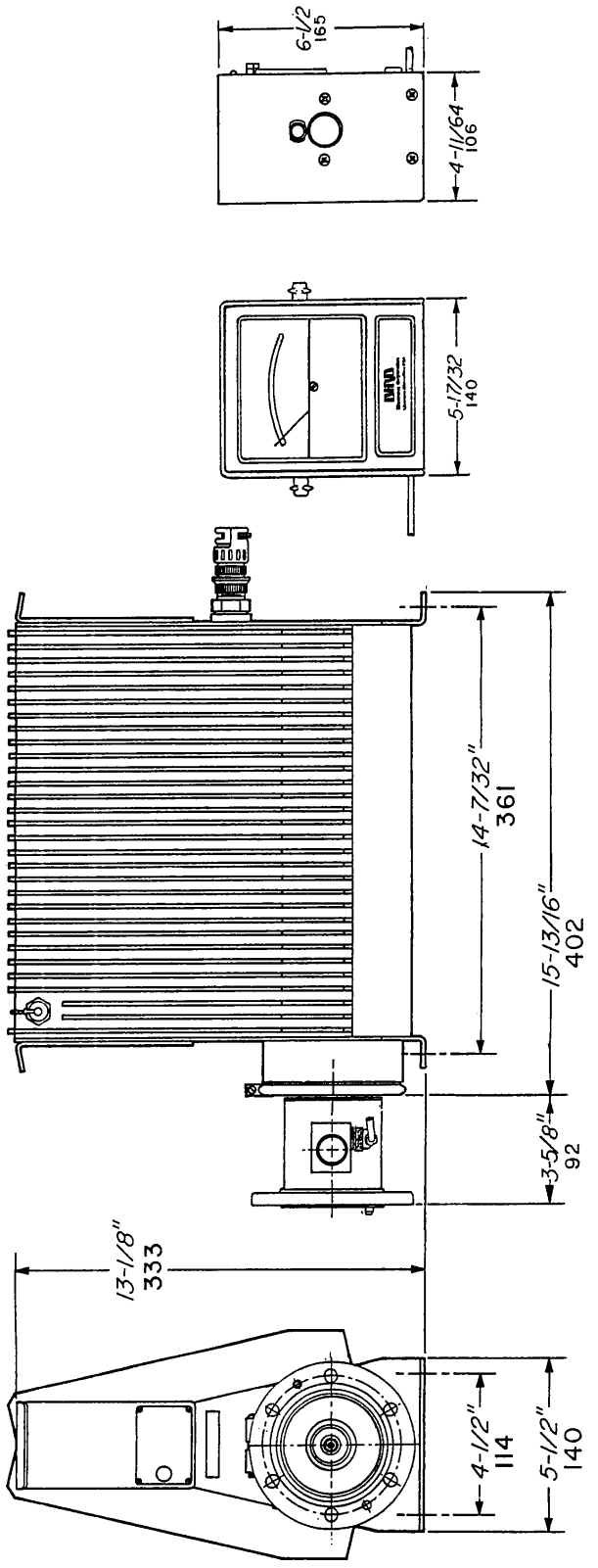


TABLE 1-1. ELEMENT SELECTION TABLE

These elements are temperature compensated for best accuracy. Elements are not included as part of wattmeter and must be selected from catalog Table 19.

POWER	54-88 MHz	88-108 MHz	174-216 MHz	470-890 MHz
1.5 kW	461-25	461-26	461-27	461-28
2.5 kW	461-23	461-22	461-21	461-20
5 kW	462-23	462-22	462-21	462-20
10 kW	463-110	463-111	463-112	463-113
3 kW	-	-	-	461-24

FIGURE 1-2. OUTLINE DRAWING MODEL 8864-400A



SECTION II - THEORY OF OPERATION

2-1. GENERAL

2-2. These absorption wattmeters consist essentially of carbon film resistors on a ceramic substrate immersed in a dielectric coolant. The resistor, individually selected for its accuracy, is enclosed in a special exponentially tapered housing. This provides a linear reduction in surge impedance directly proportional to the distance along the resistor. When surrounded by the dielectric coolant, the characteristic impedance is therefore; 50 ohms at the front (connector) end, 25 ohms at the midpoint to compensate for the resistance already passed over, and zero ohms at the rear where the resistor joins the housing, forming the return conductor of the coaxial circuit. This produces a uniform, practically reflectionless line termination over the stated frequencies of the wattmeter.

2-3. ELEMENT SOCKET

2-4. An accurately positioned socket for inserting a radio frequency coupling device, called a plug-in element, is mounted on the outer conductor of the RF input connector. The socket is precision bored to hold the rotatable element in its calibrated position, with a spring-loaded clasp to keep the element firmly seated. The machined step on the top face of the socket engages a stop-pin on the element. Rotary movement of the element is thereby restricted to 180° and is stopped on the axial center line.

2-5. The measuring socket has a hole bored through the wall through which an insulated phosphor bronze contact finger projects. The plug-in element has terminals on diametrically opposite sides of its body, so that pick-up can be made from either side. A small silvered button tip can contact the element only in the precise forward and reflected measuring position (against the end stops). A specially designed jack mounted on the side of the socket mates with the plug on the dc cable furnished with the read-out meter. The dc jack assembly has a built-in filter capacitor shunted across the meter circuit. This more fully protects meter readings against the adverse effects of any stray RF energy generated in the plug-in element. The scale on the read-out meter reads full scale for the power rating stamped on the cap of the plug-in element.

2-6. DIELECTRIC COOLANT AND SEAL

2-7. The dielectric coolant, a low volatility, high flash point synthetic oil, is chosen for its desirable thermal characteristics and dielectric properties, to which the diameters of the resistor housing are matched. A synthetic rubber O-Ring around the outside of the resistor housing mount furnishes a seal for the radiator opening. A beveled flange retains the O-Ring which is pressed against the radiator face by the action of drawing up on the radial V-band clamp around the flange.

2-8. COOLING

2-9. When input power is applied, the resistor generates heat which is absorbed by the surrounding dielectric coolant. By convection, the heated oil flows through holes in the coaxial shell to the walls of the radiator tank. The radiator is carefully designed of heat-sink sections on a unique vertical rhombic form and is fabricated into a single unit construction. This provides a very high efficiency in transferring heat from the dielectric coolant into the surrounding air.

SECTION III - OPERATING INSTRUCTIONS

3-1. USE AND FUNCTION OF CONTROLS

3-2. These loads, being passive devices, have no indicators or operating controls. Measurements are made by the insertion and operation of the plug-in elements previously mentioned. The elements will have a power range that corresponds with one of the scales on the meter face, and the major markings are the power values for that element. Elements are also marked for frequency range. The transmitter power and frequency must be within the limitations of the element used.

3-3. The arrow on the plug-in element indicates the sensitive direction; i.e., the direction of power flow which the meter will read. Forward and reflected are directional terms used in reference to the THRULINE® Element, and mean respectively the sensitive and null directions of the element. Rotate the element 180° to reverse the sensitive direction. Forward and reflected also are directional terms used in reference to the source-load circuit.

3-4. CONNECTION

3-5. Connect these loads to the transmitting equipment by means of a 50 ohm coaxial line. Attach the load resistor to the RF line as follows:

a. For the respective rigid line models use the connector kits as listed:

1. Model 8863-400A Wattmeter - 3-1/8 inch unflanged, 50 ohms, flush center conductor. Use Coupling Kit, P/N 5-726 (RCA MI-17791K-4A) which includes an outer sleeve with two clamping bands and the center conductor coupling bullet.

2. Model 8864-400A Wattmeter - 3-1/8 inch EIA flanged, 50 ohms. Use Coupling Kit, P/N 4600-020 which includes: six 3/8-16 x 1-1/2 nut and screw sets, O-Ring and center conductor anchor bullet.

b. Make sure all connections are properly tightened. Avoid the unnecessary use of adapters and elbows as much as possible.

c. After the transmitter has been connected to the load, proceed according to the transmitter manufacturer's instructions. When reconnecting the antenna it may be necessary to slightly readjust the transmitter due to the difference in VSWR between the load and the antenna system.

3-6. INITIAL ADJUSTMENTS AND CONTROL SETTINGS

3-7. Before taking readings be sure that the meter pointer has been properly zeroed under zero power conditions. Direct power readings are made from the wattmeter dial.

3-8. **NORMAL OPERATION**

3-9. Insert the appropriate element in the socket and rotate the element so that the arrow on its nameplate is pointed away from the RF source for forward power and towards the source for reflected power. Turn on the RF source and read the power level from the appropriate meter scale.

3-10. **OPERATION UNDER EMERGENCY, ADVERSE OR ABNORMAL CONDITIONS**

```
**********************************************************
*                      W A R N I N G                     *
*                                                        *
* Using this wattmeter in the upper end of its power     *
* dissipation range will cause the housing to become hot! *
* Care should be exercised in touching it.               *
**********************************************************
```

3-11. The elements for the THRULINE® Wattmeter can withstand at least a 20 percent of full scale, overload. The meter pointer will be deflected off scale, during overload conditions, but generally no damage to the meter movement will occur. This, however, is not a very propitious condition and should be avoided. This usage will, nevertheless, give an indication of the magnitude of power flow in the line section if necessary.

3-12. These units will sustain an input moderately greater than 1500 Watts for short periods of time. Such loading must be spaced at reasonable intervals to allow sufficient time for cooling to a safe temperature. These TERMALINE® Loads for instance, will sustain an input of 1750 Watts for a maximum of five minutes with intervals of at least 30 minutes between power applications. If such an overload is contemplated as a regular procedure, then using these loads with the overload thermoswitch connected is essential. This will save the load from damage and the operator from possible injury if the overload and/or its application time are inadvertently exceeded.

3-13. **SHUTDOWN**

3-14. Because these wattmeters are passive devices and require no external source of power, they can not be shut off. The RF source must be shut off instead.

3-15. **EMERGENCY SHUTDOWN**

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

3-16. In case of an overload, it is possible to rotate the element to the midpoint between the forward and reflected positions and thereby electrically decouple the element from the center conductor. For safety's sake do not attempt to remove the element while RF power is still flowing through the line section.

3-17. Turn off the RF power at its source.

SECTION IV - MAINTENANCE

4-1. TROUBLESHOOTING

4-2. As a brief guide to the operator in isolating occasional difficulties that may occur in the use of the TERMALINE® Wattmeter, the following summary is included. The remedies for some are referenced to the text in this section or are self-evident.

PROBLEM	POSSIBLE CAUSE	REMEDY
No meter indication	No RF power	Check RF source.
	Arrow on plug-in element pointed in wrong direction	Re-position element.
	No pick-up from dc contact finger	Adjust, see para 4-24.
	Open or short circuit in dc meter cable	Replace defective cable (RD-58/U).
	Meter burned out or damaged	Return wattmeter and elements to the factory for meter replacement and recalibration.
Intermittent or inconsistent meter readings	Faulty transmission line	Inspect line.
	Faulty load resistor	Check load resistor for high resistance replace RF section, if necessary return to factory for recalibration.
	Dirty dc contact on elements	Clean, see para 4-5, Cleaning.
	Sticky or defective meter	Return wattmeter and elements to the factory for meter replacement and recalibration.
High VSWR or reflected power	Bad load resistor	Replace load resistor and/or return unit to factory for repair and recalibration.
	Foreign material in RF connector body.	See para 4-3.

TROUBLESHOOTING [CONT.]

PROBLEM	POSSIBLE CAUSE	REMEDY
Leakage of coolant oil around clamping band or radiator housing	Clamping band not tight	Tighten slightly with a screwdriver.
	Faulty O-Ring (front)	Replace per para 4-15.
Excessive overheating of the radiator	Transmitter power too high	Reduce transmitter power.
	Faulty RF section assembly resistor	Check RF section. If faulty, return to factory for repair and recalibration.
	Coolant oil level too low	Add more coolant oil to the radiator per para 4-15.
High or low dc resistance values per para 4-12	Dirty RF input connector	Clean per para 4-4.
	Faulty RF section assembly resistor	Return to factory for repair and recalibration.

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

```
**********************************************************
*                    W A R N I N G                       *
*                                                        *
* When operating this equipment in conjunction with RF   *
* power of 200 watts or higher, the potential of the     *
* center conductor of the RF line section will be 100    *
* volts or higher.  Do not contact the center conductor. *
* If cleaning becomes necessary, shut off the RF power.  *
**********************************************************
```

4-3. **CLEANING**

4-4. The outside surface of these wattmeters should be wiped free of dust and dirt when necessary. The principle maintenance required by the operator will be to periodically wipe the accumulated dust and lint off of the radiator fins. Excessive collection of dust and lint on the cooling fins will interfere with the efficient dissipation of heat. If the teflon

insulator or metallic contact surfaces of the connector should become dirty or grimy, wipe them off with a soft cloth. Use a contact cleaner that is self-drying and nonresidue forming to clean the inaccessible internal parts.

4-5. It is particularly important to keep the mating surfaces of the socket and plug-in element clean. This applies not only to the bore of the socket and the circumference of the THRULINE® element body, but most particularly to the bottom rim of the element body and the seat at the base of the socket in the line section. Also check the ends of the insulated dc contacts on the element. They should be clean and smooth. These parts can be carefully cleaned with a soft cloth and contact cleaner as mentioned. There must be a good contact between the base of the plug-in element and its socket to assure stable operation.

4-6. If any portions of the radiator are corroded or rusted, clean the areas with a fine flint sandpaper, and then touch them up with gray enamel.

4-7. **INSPECTION**

4-8. With the rugged and simple construction of the TERMALINE® Wattmeter periodic inspection will be necessary only at about six month intervals. Inspection should include the items listed below:

a. Oil Leakage - Check for coolant oil seepage around the radiator tank, particularly at the front around the underside of the clamping band. If leakage is observed, see 4-1, Troubleshooting, and check the tightness of the clamping band. Also, check the tightness of the thermoswitch on the back, if the unit is so equipped.

b. Inspect the wattmeter for completeness and general condition of the equipment.

c. Inspect the THRULINE® from time to time for cleanliness and proper adjustments, see 4-3, Cleaning and 4-9, Preventive Maintenance. Make sure all connections are clean and tight. Disconnect the meter lead and check the zero setting without power, adjust if necessary.

d. A Troubleshooting Chart, see 4-1, lists the commonly encountered problems, their possible causes and remedies. Use this chart as a guide when analyzing symptoms.

4-9. **PREVENTIVE MAINTENANCE**

4-10. Due to the basic simplicity of construction, the major requirement for preventive maintenance is to keep the equipment clean, particularly the radiator fins. It is important to maintain the heat transfer efficiency of the cooling fins. Also, occasionally check the coolant level in the radiator tank. The element socket should be kept plugged as much as possible to prevent the intrusion of dust. If a plug-in element is to be used for this purpose, use the highest power element available. The element should be positioned so that the arrow is pointing midway between the forward and reflected measuring positions. This will not only protect the meter but will also avoid exposing the element diode to dangerous potentials

if the RF line section should be energized. Use reasonable care and do not drop the THRULINE® equipment or especially the plug-in elements.

4-11. EVALUATING RF ASSEMBLY

4-12. DC Resistance - Check the condition of these load resistors 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 1 percent or better at 50 ohms. The measured resistance should be a nominal 50 ohms. It should not deviate by more than ± 2 ohms from the nominal value of 50 ohms.

4-13. DISASSEMBLY

4-14. There are no special techniques required for the repair or replacement of components in these TERMALINE® Load Resistors. A screwdriver and a small wrench are the only tools needed. The paragraphs below outline component removal.

4-15. Seal and Coolant Oil - To check the seal and coolant level proceed as follows:

a. Lift the wattmeter up carefully by its front end, using the handle and foot bracket, until it is standing vertically on its back end. If the load is equipped with an overload thermoswitch, block it up so that the weight does not rest on the thermoswitch. Also block the load securely in the vertical position so that it cannot topple over.

b. Loosen the 10-32 x 1-1/2 screw on the clamping band around the connector until the band can be slipped off.

c. Grasp the RF connector and work the RF section assembly loose. Lift it slowly straight up and out of the radiator tank, allowing the excess coolant to drip back into the tank.

d. Inspect the coolant; it should be a clear water-white color. If it is not then it is probably contaminated and should be replaced with fresh coolant. The level of coolant should remain constant, even after prolonged usage under normal operating conditions. At room temperature, the coolant level should be about 3-5/8 inches (92 mm) below the top surface of the load resistor mounting ring. Add coolant if necessary, but do not overfill the radiator; the heated coolant will expand and may leak out through the vent plug. The unit is filled at the factory to this level with 1-1/2 gallons (5.68 liter) of a specially selected dielectric fluid, P/N 5-1070-2.

e. Check the O-Ring seal on the RF section assembly. It should still be soft and pliable and not show evidence of surface cracks. If there is any evidence of deterioration, replace the O-Ring, P/N 5-230.

4-16. RF Load Resistor Assembly - Remove the assembly by the same procedure given in para 4-14.

4-17. Thermoswitch - See 1-12, Thermoswitch Installation.

4-18. **REASSEMBLY**

4-19. Seal, Coolant Oil and RF load resistor assembly - To reassemble, reverse the procedures in para 4-14.

4-20. Thermoswitch - See para 1-13.

4-21. **REPAIRS**

4-22. Repairs beyond what is covered in this instruction book will require return of the equipment to Bird Electronic Corporation for service. Please consult the factory.

4-23. **CONTACT ADJUSTMENT**

4-24. In cleaning the socket bore, the operator should be careful not to disturb the spring finger of the dc contact. It is important that the operating position of this part be properly maintained. If the spring finger of the dc contact requires adjustment, it may be done manually if carried out with care. The tip must be positioned far enough out to maintain good contact with the element, but not so far as to interfere with easy entry of the element body. The dc jack, with attached spring finger, may be detached for service by removing the two 4-40 fillister head machine screws which fasten it to the side of the RF line section. Then lift off the jack assembly carefully to avoid losing the small teflon insulating bead that straddles the base of the phosphor bronze spring and nests in the counterbore on the side of the RF body. When replacing the assembly, be sure that the bead is again properly inserted.

SECTION V - PREPARATION FOR RESHIPMENT

5-1. RF LOAD ASSEMBLY

5-2. Pack and brace the load in a suitable shipping container, a corrugated paper box should suffice. It is not necessary to remove the dielectric coolant before shipping, but do not forget to replace the vent plug with the shipping plug.

5-3. ELEMENTS

5-4. An element may be left in the socket of the line section with its arrow turned midway between the measuring positions. Two additional elements can be placed in the storage sockets in the sides of the meter housing. Any additional elements should be well padded and wrapped before being placed in the shipping container.

5-5. CONNECTOR

5-6. Wrap the connector on the flanged models with padding and tape it securely in place. Cover the end of the line section and the socket to keep out dust and foreign material.

5-7. DC CABLES

5-8. Pad and wrap the dc connector plug and then coil the cable tightly. Secure with a rubber band or twist tie.

5-9. METER

5-10. Cover the meter face with padding to protect the glass window, then wrap the housing and place it in the same box as the load assembly.

SECTION VI - STORAGE

6-1. GENERAL

6-2. No special preparations for storage are necessary other than to cover the equipment to keep out dust and dirt. Store these units in a dry and dust-free environment where the ambient temperature will remain within the -40°C to +45°C (-40F to +113F) working range of the loads.

SECTION VII - REPLACEMENT PARTS LIST

7-1. SERIES 8860-400A

ITEM	QUANTITY	DESCRIPTION	PART NUMBER
1	1	RF section assembly Model 8863-400A unfl Model 8864-400A flg	 8897-402 8891-402
2	1	Radiator assembly	8860-002
3	1.5 Gallons (5.68 Liter)	Coolant - oil dielectric (1 gallon container)	5-1070-2
4	1	DC connector assembly	4230-010
5	1	O-Ring seal (RF section assembly)	5-230
6	1	Clamp band assembly (includes P/N 2430-043 and screw)	2430-055
7	2	O-Ring seal (vent and shipping plugs)	5-504
8	1	Vent plug	2450-094
9	1	Shipping plug	2450-049
10	1	Chain and anchor assembly	8180-094
11	1	Thermoswitch assembly (optional item)	8890-008
12	1	DC cable connector plug	7500-076
13	1	Cable assembly	6810-214-1
14	1	Meter housing assembly	6810-205
15	(1)	Meter and housing assembly	6810-247
16	1	Meter	2150-259
17	1	Back cover assembly	6810-204
18	1	Cable tie mount	5-1506
19	1	Plastic tie	5-382
20	1	DC connector shorting plug	7500-268