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**INSTRUCTION BOOK**

**OPERATING INSTRUCTIONS**

**TERMALINE<sup>®</sup> WATTMETER  
SERIES 8890-400**

**BIRD**  
**Electronic Corporation**  
Cleveland (Solon) Ohio USA

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Instruction Book Part Number 920-8890-400S Revision A.

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## 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 phrases of operation and maintenance.

### Keep Away From Live Circuits

Operating personnel must at all times observe normal safety regulations. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

### Do Not Service Or Adjust Alone

Under no circumstances should any personnel reach into an enclosure for the purpose of service or adjustments 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 the RF transmission line while RF power is present. Radiated RF power is a potential health hazard.

### Resuscitation

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

### Safety Symbols


<p style="text-align: center;"><b>WARNING</b> Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.</p>
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**CAUTION**

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



This symbol appears on the equipment indicating there is important information in the instruction manual regarding that particular area.

 Note: Calls attention to supplemental information

**Warning Statements**

The following safety warnings appear in the text where there is danger to operating and maintenance personnel and are repeated here for emphasis.

**WARNING**

Before placing the unit into operation, remove the shipping plug at the top of radiator, near front, substitute with the specially shielded breather plug. Use a 3/4 inch flat wrench for this purpose - do not lose the O-Ring Seal.

This vent hole must remain open 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. The use of the vent plug also protects the filler opening against intrusion of foreign material while allowing unobstructed venting of the tank. The shipping plug (with O-Ring seal) should be put back in place whenever the unit is to be transported. Be sure to check this plug.

**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.

**Caution Statement**

The following equipment caution appears in the text whenever the equipment is in danger of damage and is repeated here for emphasis.

**CAUTION**

This unit is factory filled with approximately 2.9 gallons (11 liter) of a specially selected dielectric fluid, P/N 5-1070-3. No other coolant should be used.

## Safety Statements



### USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

### USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

### BENUTZUNG

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

### UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

### IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROIZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.



### SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE -TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

### SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

## WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL. ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIE\_LICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

## ENTRETIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

## ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.



CONNECT INTERLOCK TO TRANSMITTER BEFORE OPERATING.

BRANCHER LE VERROUILLAGE À L'ÉMETTEUR AVANT EMPLOI.

CONECTE EL INTERBLOQUEO AL TRANSMISOR ANTES DE LA OPERACION.

VOR INBETRIEBNAHME VERRIEGELUNG AM SENDER ANSCHLIESSEN.

PRIMA DI METTERE IN FUNZIONE L'APPARECCHIO, COLLEGARE IL DISPOSITIVO DI BLOCCO AL TRASMETTITORE.

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## About This Manual

This instruction book covers the models:

8890-400A	8897-400A
8891-415B	8897-415B
8891-420B	8897-420B

This instruction book is arranged so that essential information on safety is contained in the front of the book. Reading the Safety Precautions Section before operating the equipment is strongly advised.

The remainder of the instruction book is divided into Sections and Chapters. At the beginning of each chapter a general overview will be given, describing the contents of that chapter.

### Operation

First time operators should read Chapter 1 - Introduction, Chapter 2 - Theory of Operation, and Chapter 3 - Installation, to get an overview of equipment capabilities and how to install it. An experienced operator can refer to Chapter 4 - Operating Instructions. All instructions necessary to operate the equipment are contained in this section.

### Maintenance

All personnel should be familiar with preventive maintenance found in Chapter 5 - Maintenance. If failure should occur, the troubleshooting section will aid in isolating and repairing the failure.

### Changes To The Manual

We have made every effort to ensure this manual is accurate. If you should discover any errors, or if you have suggestions for improving this manual, please send your comments to our factory. This manual may be periodically updated. When inquiring about updates to this manual, refer to the part number and revision level on the title page.

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## Chapter 1

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### Introduction

This instruction book is intended for use by operators of the Model 8890-400 Termaline Wattmeter.

This chapter contains introductory information including product specifications; items supplied; and accessory items available.

**Purpose and Function** The Series 8890-400 Termaline Wattmeters are low reflection and nonradiating terminations for coaxial transmission lines. They aid in the tuning and troubleshooting of transmission equipment whose characteristics fall within the performance range of the elements used. These performance specifications are described in the next paragraph and summarized in the Specifications.

#### Items Supplied

- ♦ Coolant — Pre-filled unit
- ♦ Shipping Plug
- ♦ Vent Relief Valve
- ♦ Coupler — Pre-Mounted
- ♦ Instruction Manual

**Description** The Series 8890-400 Wattmeters will safely and continuously dissipate up to 5000 watts of RF power when blower equipped. It is possible to subject these loads to moderately higher power for limited periods of time. In this case it is recommended that an 8890-400 be equipped with an over-temperature thermoswitch, Bird P/N 8890-008, which should be interlocked with the source of RF energy. In this way, the load will be automatically protected from the consequences of over heating. The intended frequency range is 2 to 1000 MHz within which the loads will reflect very little power back to the source. The actual VSWR, "Voltage Standing Wave Ratio", will not exceed 1.15 to 1.00 from dc to 1 Ghz.

**Accessory** Thermoswitch P/N 8890-008 — An optional item for Models  
**Items** 8891-400A and 8897-400A.

Blower Assembly P/N BA-310 — An optional item for Models 8891-400A and 8897-400A. All other wattmeters are shipped with the blowers already mounted.

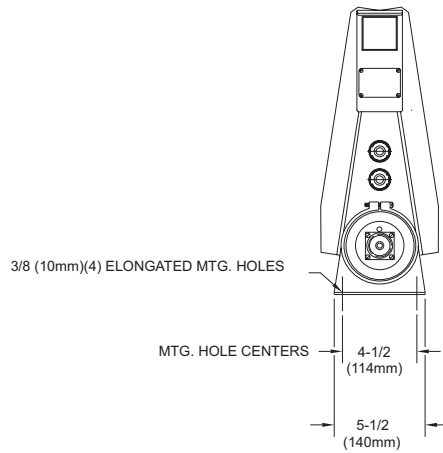
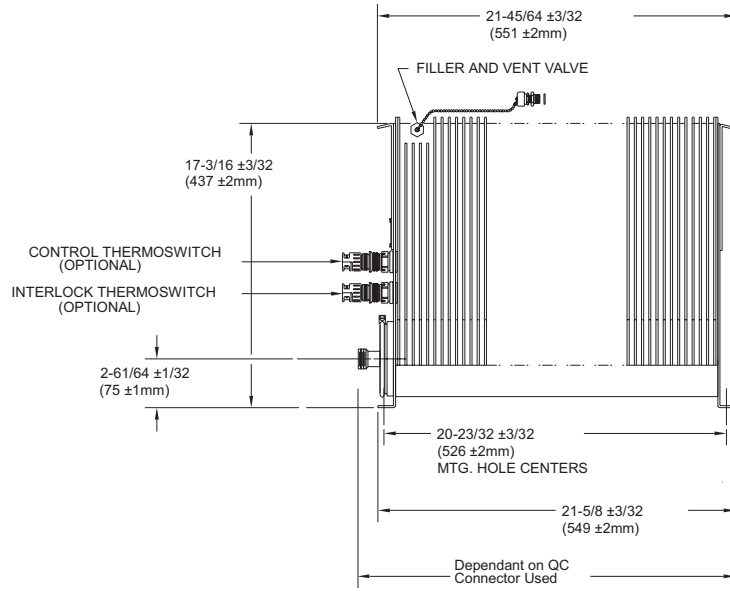
**Items** Mating Connector — Necessary on the transmission line to  
**Required** which the load is to be connected.

AC Socket — If the Model BA-310 Blower Assembly Kit is ordered, provide an ac socket convenient to the equipment.

## Specifications

<b>Impedance</b>	50 ohms
<b>VSWR</b>	1.15 - 1.00 dc to 1000 MHz
<b>Connectors</b> Model 8891-400A, 8891-420B Model 8897-400A	3-1/8" EIA flanged 3-1/8" unflanged (Flush Center Conductor)
<b>Power Rating*†</b> Models 8891-400A, 8897-400A All other models	2500 W continuous duty 5000 W continuous duty
<b>Frequency Range*</b>	2 to 1000 MHz
<b>Accuracy</b>	± 8% of full scale
<b>Ambient Temperature</b> Storage  Operating	+10°C to +40°C (+50°F to 104°F)  +25°C ± 5°C (77°F ± 9°F)
<b>Cooling Method</b>	Liquid dielectric and convection currents**
<b>Overall Dimensions</b>	17-3/16" H x 7-1/8" W (437 x 181 mm)
<b>Length</b> Flanged Units Unflanged Units	25-1/8" (638 mm) 24-5/32" (613.6 mm)
<b>Meter Dimensions</b>	4-11/64"L x 5-9/16"W x 6-1/2"H (106 x 141 x 165 mm)
<b>Meter Weight</b>	5 lb (2.27 kg)
<b>Finish</b> Load and Meter Housing RF Section	Grey Powder Coat Bright Silver Plate
<p>*Actual frequency and power ratings are determined by the element used.  †Power Rating with blower assembly installed:  Blower running - 5000 W  Blower not running - 1250 W</p> <p>**Assisted by forced draft when blowing assembly is installed and running.</p>	

Figure 1  
Outline Drawing

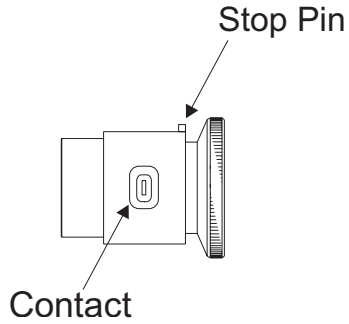


The Series 8890-400 equipment consists essentially of a film-on ceramic resistor immersed in a dielectric coolant. The resistor, which is individually selected for its accuracy is enclosed in an exponentially tapered housing, providing a reduction in surge impedance directly proportional to the distance along the resistor. When the resistor unit is immersed in the dielectric liquid, the characteristic impedance will be 50 ohms at the connector end and graduate down from there to zero ohms at the rear, where the resistor joins the housing to form the return conductor of the coaxial circuit. This produces a uniform, practically reflectionless line termination over the stated frequencies of the load resistor.

**Element Socket** An accurately positioned socket for inserting a radio frequency coupling device, called a Thru-line Plug-In Element, is mounted on the outer conductor. 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.

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. Refer to figure 2. 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.

Figure 2  
Element  
Contact &  
Stop-Pin

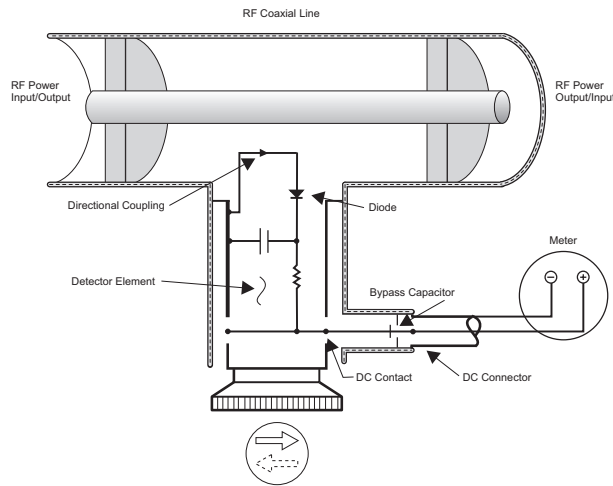


**Coupling Circuit**

The coupling circuit which samples the travelling waves is in the plug-in element. Energy will be produced in the coupling circuit of the element by both mutual inductance and capacitance from the travelling RF waves of the line section. The inductive currents will flow according to the direction of the travelling waves producing them. Refer to figure 3 for the schematic diagram of an element.

The capacitive position of these currents are naturally independent of the direction of the travelling waves. Therefore, it is apparent that the inductive portion of the current produced from the waves of one direction will add in phase to the capacitive portion of the current, and those of the opposite direction will subtract in phase. The additive direction is the forward or arrow direction of the element.

Figure 3  
Schematic  
Diagram



**Dielectric Coolant and Seal** The dielectric coolant, a low volatility, high flash point synthetic oil, is used for its desirable thermal characteristics and dielectric properties. 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.

**Cooling** 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.



## Chapter 3

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### Installation

**Power and Utility Requirements** The Series 8890-400 Wattmeters are fully self-contained. No additional equipment or outside power source is needed, unless the load is equipped with an optional BA-310 blower assembly. If it is, either 115 V, 50/60 Hz or 230 V, 50/60 Hz ac power is required.

**Environmental Requirements** Although Series 8890-400 Wattmeters are ruggedly built and have no moving parts, a dust and vibration free dry environment is preferred. For the Wattmeter to function according to its specifications it is important that:

1. The ambient temperature remains within the range of +10°C to +40°C (50°F to +104°F)
2. Access to air is not impeded. It is recommended that a clear space of at least 12 inches (30 cm) be allowed around the load.

Because the wattmeter absorbs and dissipates, as heat, all of the RF power it receives, no harmful RF radiation is released into the environment.

**Tools Required**

- ♦ Screwdriver
- ♦ Box wrenches — needed for changing connectors, changing the coolant, etc.
- ♦ Ohmmeter — For checking the resistor. An ohmmeter with an accuracy of one percent or better at 50 ohms is suggested. A simple volt-ohm meter will suffice for checking the blower assembly and thermoswitch.

**Mounting** The Series 8890-400 Termaline Wattmeters are equipped for either fixed installations or portable use. There are mounting brackets on the front and rear faces of the unit. The load may stand free or be attached to a bench, etc., by means of four fasteners. Four 3/8 inch (9.53 mm) mounting slots, to be used with appropriate screw sets up to 3/8 inch diameter, are arranged in a 4-1/2 inch x 20-23/32 inch rectangle (114.3 x 526.3 mm).

**Coupling Kits** Models 8891-400A, 8891-415B, and 8891-420B: The RF connector section has bolted flanges that are swivel type. It is inserted into the existing transmission line using a coupling kit, P/N 4600-020.

Models 8897-400A, 8897-415B, and 8897-420B: The RF section is unflanged. It is inserted into the transmission line using an unpressurized straight coupling kit, P/N 5-726

**RF Connection** Follow the instructions below for flanged and unflanged connections. While following these instructions, refer to figure 5.

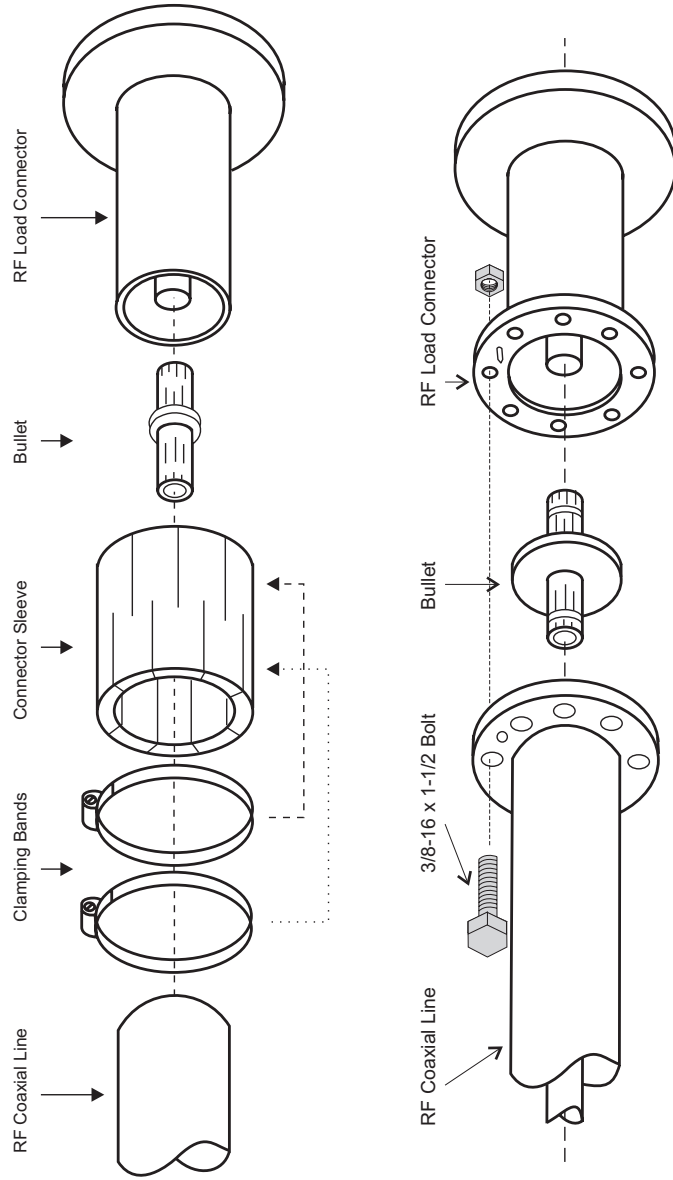
For the models with flanged RF connectors, the center conductor anchor bullet, P/N 4600-021 mates with the center conductor of the 3-/18 inch EIA bolt-type flange. The mating flange of the stationary line may be rigid because the connector section has a swivel type flange.

1. Position the center conductor anchor bullet with the insulators seated in the counterbores.
2. Fit the bolts to the coupling flange. Use six screw and nut assemblies for attachment, 3/8-16 x 1-1/2 nut and screw assemblies are recommended.
3. Tighten evenly all around to get a firm and uniform contact on the periphery of the outer conductor of both flanges.

For models with unflanged connectors, the connector bullet mates with the center conductor of the 3-1/8 inch 50 ohm coaxial transmission line.

1. Insert the bullet firmly in the center conductor of the wattmeter's connector.
2. Push the the bullet firmly until it bottoms in the conductor.
3. Slide the outer conductor sleeves over the transmission line.
4. Insert the connector into the transmission line. Both ends of the bullet should be firmly seated in the center conductor with the connector of the wattmeter butted snugly against the transmission line.
5. Tighten the clamping bands.

Figure 4  
RF Connection



**Thermoswitch** As an optional item, the dummy load may be provided with an interlock thermoswitch assembly, P/N 8890-008. When installed in the radiator, it will prevent possible damage occurring from accidental transmitted power overload or equipment malfunction. Being normally closed, the thermoswitch opens at a maximum safe temperature of +236°C (+457°F). Connected in series with the transmitted interlock, it cuts off transmitter power if the coolant temperature exceed this value. The assembly consists of a thermoswitch body, P/N 8890-005 with a coupling jack, P/N 2450-018 attached.

**WARNING**

Before placing the unit into operation, remove the shipping plug at the top of radiator, near front, substitute with the specially shielded breather plug. Use a 3/4 inch flat wrench for this purpose - do not lose the O-Ring Seal.

This vent hole must remain open 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. The use of the vent plug also protects the filler opening against intrusion of foreign material while allowing unobstructed venting of the tank. The shipping plug (with O-Ring seal) should be put back in place whenever the unit is to be transported. Be sure to check this plug.

To field install the thermoswitch, follow these instructions:

1. *Replace the vent plug with the shipping plug first, refer to figures 5 and 6 for identification of plugs.*

Figure 5  
Shipping Plug

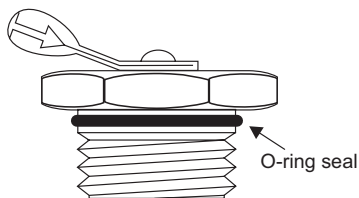
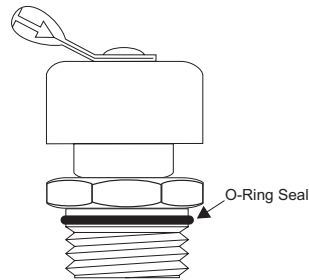




Figure 6  
Vent Plug



- Stand the unit on its back end with the connector end up.

 Note: In this position there is no danger of the coolant pouring out through the socket plug hole.

- Remove the socket plug located just above the connector assembly. Use a 9/16 inch hex wrench.
- Replace the plug with the thermostat. Use an acceptable pipe sealing compound sparingly on the external threads *only* of the thermostat.

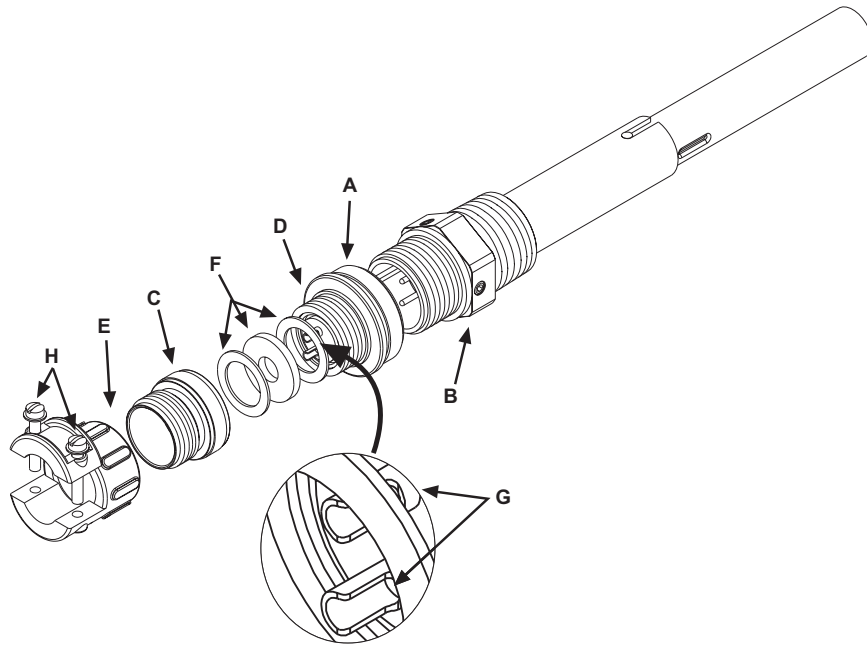
 Note: Do not contaminate the coolant with pipe sealing compound.

- Check the unit for coolant leaks.


While following the instructions below for connecting the thermostat, refer to figure 7.

- Unscrew the larger knurled ring-nut (A) at the lower end of the coupling jack assembly. Pull it off from the thermostat jack (B). Unscrew the small knurled cover fitting (C) from the base plug (D) of the connector to release the base.
- Thread the interlock wires through the clamp (E) with the washers (F) inside and with its threaded fitting in place. Service the interlock wire with short tips, use spaghetti sleeves over the wire ends if needed. Then securely solder

Figure 7  
Thermoswitch Diagram



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.

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

**Meter Placement** A standard ten foot (3 meter) cable is supplied with each wattmeter. It is equipped with a dc connector plug on one end and lugs on the other. Alternate lengths are available on request.

1. Connect the the dc cable plug to the jack on the element socket.
2. Make certain that the connection is tight and clean to ensure accurate readings.
3. Place the meter in a convenient location, away from dust and temperature extremes.

**Blower Assembly** The optional BA-310 blower assembly adds forced air cooling capability to the load. When the blower is installed, the rated capacity of the load is doubled. Mounting instructions are located in part number 920-BA-300/310 Instruction Book.



## Chapter 4

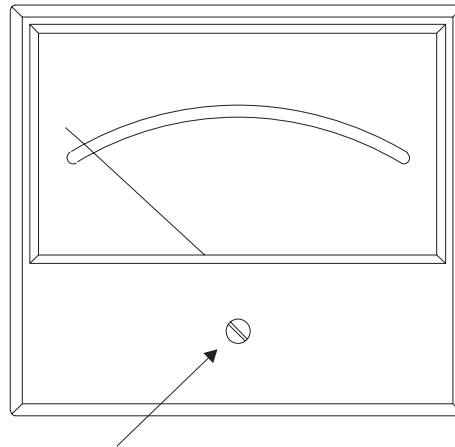
### Operating Instructions

**Use and Function of Controls** There are no operating controls for the Series 8890-400 Wattmeters. The Model BA-310 Blower Assembly, supplied with some models, has a manual/automatic switch.

**Initial Adjustments** Before connection of the load, perform the following steps:

1. Wipe all conductors and insulator surfaces on the transmission line face with a clean soft cloth and check the RF input connector. Use a self-drying, non-residue forming, contact cleaner on the inaccessible portions of the connector.
2. Check the 50 ohm input resistance of the load. Refer to Section 1, Maintenance.
3. Zero adjust the meter. The meter should be checked for zero set under no power conditions. With no power applied, the meter pointer should set exactly on zero. If adjustment is required, turn the adjustment screw until the pointer is set at zero. Refer to figure 8.

Figure 8  
Zero Adjust



Zero Adjust

**Start-Up** Proceed according to the instructions pertaining to the specific transmitting equipment. Due to the difference in VSWR between the dummy load and the transmitter's antenna, readjustment of the transmitter may be required when returning to the original antenna.

<p style="text-align: center;"><b>WARNING</b> Never attempt to disconnect RF equipment from the transmission line while RF power is being applied. Leaking RF energy is a potential health hazard.</p>
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**Normal Operation** Since there are no operating controls or adjustments, these wattmeters do not require hands-on attention. They should function faultlessly converting RF energy into heat for indefinite periods providing their power capacity is not exceeded.

To make measurements:

1. Insert the appropriate element in the socket of the line section. Rotate the element so that the arrow on the nameplate is pointed away from the RF source for forward power and towards the source for reflected power.
2. Turn on the RF source and read the power level from the appropriate meter scale.

**Operation Under Abnormal Conditions** Series 8890-400 Wattmeters are not intended or recommended for outdoor use where they may be unprotected and exposed to the elements. They may be subjected to moderate overloads for limited periods without overheating. However, this should be done cautiously and it is strongly recommended that if such a use is contemplated, the load be equipped with a thermoswitch, P/N 8890-008. When interlocked with the power line of the RF source, the thermoswitch becomes a fail safe device to guard the load against the danger of overheating.

**Shutdown** Because these wattmeters are passive devices and require no external source of power, they can not be shut off. The RF source must be turned off instead. On blower equipped models, the blower fans will turn off automatically as the wattmeter cools.

**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.

**Emergency Shutdown**

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. After rotating the element, turn off the power to the source of RF energy.



## **Chapter 5**

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### **Maintenance**

This chapter contains operator maintenance instructions, troubleshooting, and parts information.

All instruments returned for service must be shipped prepaid and to the attention of the Customer Service Group.

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

#### **Customer Service**

#### **Sales / Repair Facilities    U.S.A. Sales and Manufacturing**

Service Group  
Bird Electronic Corporation  
30303 Aurora Road  
Cleveland (Solon), Ohio 44139-2794  
Phone: (440) 248-1200  
Fax: (440) 248-5426

If the unit needs to be returned, call for a return authorization before shipping the unit.

**Sales Facilities** For the location of the Sales office nearest you, give us a call or visit our Web site at:

<http://www.bird-electronic.com>

### **Cleaning**

The most important cleaning task is to remove accumulations of dust, lint, and grime that could interfere with proper air circulation and therefore efficient heat transfer. The cooling fins should be checked periodically for possible collection of dust and lint. When cleaning is necessary, follow these instructions.

Preparation:

- ♦ Material: Lint-free cleaning cloth
- ♦ Mild detergent

#### **Outside Surfaces**

The outside surface of the instrument should be wiped free of dust and dirt when necessary. Excessive collection of dust and lint on the cooling fins will interfere with the efficient dissipation of heat. Clean the RF input connector with a self-drying, non-residue forming contact cleaner. Take special care to clean the metallic contact surface and the exposed faces of the teflon insulator.

It is particularly important to keep the following areas clean:

- ♦ Mating surfaces of the socket and plug-in element including; the bore of the socket, and the circumference of the element body.
- ♦ Bottom rim of the element body and the seat of the socket in the line section.
- ♦ The ends of the insulated dc contacts on the element. The ends should be clean and smooth.

### **Inspection**

Periodically perform the following checks:

- ♦ Make sure all connections are clean and tight.
- ♦ Disconnect the RF power and check the zero setting without power, adjust if necessary.
- ♦ Inspect around the clamping band of the connector and also around the thermoswitch, for signs of possible coolant leakage.
- ♦ Check the connector assembly for tightness.

- ♦ Inspect the cooling fins for accumulation of dust and lint. Also, check the painted metal parts for signs of corrosion.

### **Preventive Maintenance**

The main factor in maintenance is care and cleanliness. The element socket should be kept plugged as much as possible to prevent dust intrusion. 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.

If there are signs of coolant leakage around the clamping band, try tightening it. If the leakage persists, it is likely that the O-Ring seal is damaged or deteriorated. Replace it, refer to the Disassembly paragraph. Wipe the cooling fins clean of accumulated dust and lint.

### **Contact Adjustment**

When cleaning the socket bore, be careful not to disturb the spring finger of the dc contact. It is important that the operating position of the part be maintained. If the spring finger of the dc contact requires adjustment. It may be done manually. 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. To adjust follow the instructions below.

1. Remove the two screws which fasten the dc jack, with attached spring finger, to the side of the RF line section.
2. Lift off the jack assembly carefully to avoid losing the small teflon insulating bead. The bead straddles the base of the phosphor bronze spring and nests in the counterbore on the side of the RF body.
3. Gently push the spring finger in the direction necessary.
4. Replace the assembly. When replacing the assembly, be sure that the bead is again properly positioned.

### **Repairs**

As indicated in Disassembly, the element is not subject to field repair and must be replaced if it is found to be defective. Similarly if the RF connector in the Series 8890-400 is damaged it must be replaced.

### **RF Load Resistor Test**

Preparation:

- ♦ Tools: Common hand tools
- ♦ Ohmmeter with an accuracy of  $\pm 1\%$  at 50 ohms.
- ♦ Temperature of the load between 20°C to 25°C (38°F to 77°F)

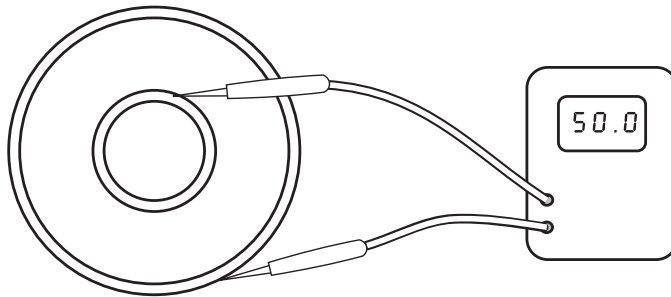
Accurate measurement of the dc resistance between the inner and outer conductors of the RF input connector will provide a good check of the condition of the load resistor. Checking the dc resistance is simply used to measure a change in the condition of the resistor over time. The tracking of the dc resistance must start *before* the resistor is first put into service. When the resistor is checked the measured resistance should be within a range of 49 to 52.5 ohms. Generally, if the value exceeds this allowance, the load resistor may need replacement. Perform the following steps and record the value for future comparison. Check and record the resistance of the load periodically according to use.

#### **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.

1. Turn off RF power and interlock circuitry before any electrical disconnection's are made.
2. Disconnect the RF coaxial line.
3. Connect the multimeter test leads across the center and outer conductor of the load resistor. Refer to figure 9.


Figure 9  
Meter Lead  
Placement



### Disassembly

To change the load resistor assembly:

1. Place the unit on its back end, connector up, and loosen the 10-32 x 1-1/2 inch screw on the clamping band.

 Note: When lifting the radiator front, be careful to keep its top side always face up. The vent hole at the radiator top is so placed that, when the equipment is up-ended in this manner, the coolant level will be just below the vent hole and will not spill out.

2. Remove the clamping band, and lift the load resistor assembly out of the tank, allow coolant to drip back into the tank.

This unit is not subject to further disassembly by field maintenance, and a defective unit should be replaced in its entirety. Before replacing a load resistor, be sure that the O-Ring seal is in good condition. It should be free of surface cracks and of twists and be positioned evenly all around the beveled flange of the resistor housing. If it is not, replace it.

### Assembly

To assemble the load after replacing the resistor or the coolant reverse the above procedure.

### **Coolant**

The level of the dielectric coolant should remain constant in the unit even after prolonged usage under normal operating conditions. Inspect occasionally around the lower portion of the clamping band, for possible coolant leakage. Tighten the clamping screw if required. Under very unusual conditions it might become necessary to replace the resistor housing seal O-Ring.

**CAUTION**

This unit is factory filled with approximately 2.9 gallons (11 liter) of a specially selected dielectric fluid, P/N 5-1070-3. No other coolant should be used.

Check the coolant level by placing the load on end with the input connector up. As above, remove the load resistor assembly. When the unit is at ambient room temperature, the coolant level should be 4-3/4 inch (120 mm) below the top surface of the load resistor assembly mounting ring.

When the coolant oil is heated, thermal expansion will cause an increase in the internal pressure. The vent plug installed on the topside of the radiator tank is provided to relieve this pressure while protecting the opening from possible entry of dirt or other contamination.

### **RF Input Connector**

The input connector on the 8890-400, is of a special "QC" design which permits easy interchange of connectors using only a screwdriver. 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 supplied with the Series 8890-400. However, other "QC" connectors may be used.

It must be clearly understood that at the full power and frequency capability of this model, refer to the specification, only type LC or LT (Female or Male) or 7/8 inch EIA air line connectors will be adequate. Even though connectors are easily changed, as described below, for any of the other connector types listed herein, input power values must be limited to the specified parameters of the selected type.

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

1. Remove the four 8-32 x 5/16 inch round head machine screws from the corners of the RF connector.
2. Pull the connector straight out.
3. Reverse the preceding procedure to install the 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 other AN standard type connectors specially manufactured by Bird Electronic Corporation.

### **Shipment**

If the occasion arises for the Series 8890-400 Wattmeter to be shipped, the following steps should be taken:

1. Remove the vent plug and replace it with the special shipping plug. The vent plug is attached to the load by a short length of bead chain. Wrap the vent plug with padding and tape it to the side of the load for protection. With the shipping plug installed, it is not necessary to empty out the coolant.
2. After disconnecting the load from the transmission line wrap the connector with padding for its protection.
3. The elements may be left in the sockets of the line section with their arrows 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.
4. Pad and wrap the dc connector plugs and then coil the cables tightly. For convenience tape them on the back of the meter.

5. Cover the meter face with padding to protect the glass window. Wrap the housing and place it in the same container as the wattmeter.
6. Because of the size and weight of the wattmeter it is recommended that the wattmeter then be packed and braced in a sturdy wooden crate for shipment.

### **Storage**

If it should become necessary to store the wattmeter for any length of time, no special preparation is necessary. The vent plug is designed to normally remain closed and therefore no coolant should evaporate during even lengthy storage. The connector should be wrapped and sealed to prevent dirt from entering. It is also suggested that the load housing be covered to prevent the accumulation of dust on the cooling fins. The storage environment should be clean, dry and as dust-free as possible and the ambient temperature should be kept preferably within the +10°C to +40°C (+50°F to +104°F) working range of the instrument.

### Troubleshooting

Table 1 contains troubleshooting information for problems which can occur during normal operation. Locate the problem, review the possible cause, and perform the corrective action.

Only those functions within the scope of normal maintenance are listed. This manual cannot list all malfunctions that may occur, or corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify a qualified service center.

Table 1  
Troubleshooting

Problem	Possible Cause	Corrective Action
No meter indication.	No RF power.	Check RF source.
	Arrow on plug-in element pointed in the wrong direction.	Re-position element.
	No pick-up from dc contact finger.	Adjust, refer to Contact Adjustment paragraph.
	Open or short circuit in dc meter cable.	Replace defective cable.
	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.	Check load.
	Dirty dc contact on elements	Clean contacts, refer to the cleaning paragraph.
	Sticky or defective meter.	Return meter and elements to the factory for meter replacement and recalibration.
Excessive reflected power (as indicated by wattmeter).	Resistor element damaged.	Test resistor for resistance value.
	Insufficient dielectric fluid.	Check coolant level and add coolant if necessary.
Leaking dielectric fluid.	Worn or defective O-Ring seal.	Replace O-Ring.
	Loose clamping band.	Tighten clamping band.

**Replacement Parts List**

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	RF section assembly Series 8891-400A Series 8897-400A	8891-402 8897-402
2	1	O-Ring, Resistor Housing Seal (Supplied with item 1)	5-230
3	1	Clamping band assembly (2430-043 & screw)	2430-055
4	1	Breather seal/Shipping plug, O-Ring	5-504
5	1	Vent plug assembly	2450-094
6	1	Shipping plug	2450-049
7	1	Thermoswitch assembly, over-temp (includes item 8 & 9)*	8890-008
8	1	Thermoswitch body (goes with item 9)	8890-005
9	1	Thermoswitch jack (goes with item 8)	2450-018
10	1	Dielectric liquid, 1.0 gallons (3.79 liters)	5-1070-3
11	1	Radiator assembly Models: 8891-400A and 8897-400A Models 8891-420B/415B and 8897-420B/415B	2450-301 2450-313
12	1	Thermoswitch assembly, control (Includes item 9 & 13)	2450-085
13	1	Thermoswitch body (use with item 9)*	2450-086
14	1	Blower assembly (BA-310)* 115 V model 230 V model	BA-310-115 BA-310-230
15	2	Access plug 3/4-14 hex socket	5020-103
16	1	Meter assembly  Models 8891-415B/420B and 8897-415B/420B	2150-230 2150-271
17	1	Meter Housing assembly  Models 8891-415B/420B and 8897-420B/415B	6810-241 6810-421
18	1	DC connector assembly	4230-010
19	1	DC connector plug	7500-076
20	1	Radiator, assembly  Models 8891-400A and 8897-400A Models 8891-420A/415B/420B and Models 8897-420A/415B/420B	2450-301 2450-313

<b>*Available QC Type Connectors</b>			
N-Female	4240-062	LT-Female	4240-012
N-Male	4240-063	C-Female	4240-100
HN-Female	4240-268	C-Male	4240-110
HN-Male	4240-278	UHF-Female(SO-230	4240-050
LC-Female**	4240-031	UHF-Male (PL-259)	4240-179
LC-Male	4240-025	7/8" EIA Air Line	4240-002
LT-Female	4240-018		
*Optional Items **Normally Supplied			

## Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.

# DECLARATION OF CONFORMITY

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

Product: Termaline Wattmeter  
Models: 8890-400A            8897-400A  
          8891-415B            8897-415B  
          8891-420B            8897-420B

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 55011:1991-Emissions:Class B.
2. European Standard EN 50082-2:1992-Immunity; Residential, Commercial, and Light Industrial.

These standards are in accordance with Council Directive 89/336/EEC , on Electromagnetic Compatibility, as amended by Council Directive 92/31/EEC.

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

3. 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.



Ken DeVore  
Manager QA/Metrology  
Bird Electronic Corporation