INSTRUCTION BOOK

OPERATING INSTRUCTIONS
WITH
PARTS LIST

THRULINE® WATTMETER
HIGH-SPEED WATTCHER®
RF-MONITORING SYSTEM
SERIES 3170A

Electronic Corporation
Cleveland (Solon) Ohio USA

Instruction Book Part Number 920-3170AS Revision C

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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.

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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 phases of operation and maintenance.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the 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 person reach into an enclosure for the purpose of service or adjustment 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 RF transmission line while RF power is present.

CHEMICAL HAZARD

Dry cleaning solvents used to clean parts may be potentially dangerous. Avoid inhalation of fumes and also prolonged contact with skin.

RESUSCITATION

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

SAFETY SYMBOLS

WARNING
Warning 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.

SERIES 3170A 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

Do not use electrically conductive tools for calibration when the front panel is removed. Damage to the unit and or the possibility of electrical shock exists.

WARNING

Disconnect this unit from ac power source before any disassembly for repair or replacement procedures. The potential for electrical shock exists.

WARNING

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.

SERIES 3170A CAUTION STATEMENTS

The following equipment cautions appear in the text whenever the equipment is in danger of damage and are repeated here for emphasis.

CAUTION

Be sure the 115/230 voltage selector switch on the rear panel is set to the proper line voltage before ac power is applied.

This instruction book covers the series 3170A. Models covered are:

3170A	3171A020
3170A200	3172A
3170A300	3173A
3171A	

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 this Instruction Book is divided into Chapters and Sections. Figures and tables are numbered sequentially within each chapter. 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, and Chapter 3 - Preparation for Use, 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 a failure should occur, the troubleshooting section will aid in isolating and repairing the failure.

PARTS

For location of major assemblies or parts refer to the part lists and associated drawings in Chapter 5.

CHANGES

Changes to this publication will be made available in supplements. To keep your instruction book accurate and up to date, it is recommended that a periodic request of the latest supplement be made. It will be supplied at no cost. When requesting updates, reference your instruction book part number and its revision level listed on the title page.

REPORTING ERRORS

It is our goal to provide our users with the information needed to operate and maintain the series 3170A. If you should discover any errors in this publication, or if you have suggestions for improving this instruction book, please send your comments to our factory.

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Chapter 1

Introduction

General

This publication refers to the Model 3170A which is a member of the Bird Model 3170A Series of High Speed Wattcher RF Monitors. Models included in the series are listed in table 1-1. All models will generally be referred to as a Wattcher unit throughout this manual.

The information in this instruction book pertains to all models except noted differences referred to in the text and in the Difference Data Sheets (see Appendix A).

Table 1-1
Various Models

Model Number	**Power Range**	**Comments**
3170A	100 mW - 10 kW	Built in Line Section
3170A200	100 mW - 10 kW	
3170A300	100 mW - 10 kW	
3171A	250 W - 100 kW	Uses External Line Section
3171A020	300 W - 60 kW	
3172A	100 mW - 10 kW	
3173A	100 mW - 10 kW	

Purpose and Function

The Model 3170A Series High Speed Wattcher unit is a two channel power monitoring system for use in 50 ohm coaxial transmission lines. Adjustable set points allow user to preset maximum reflected and minimum forward power trip points.

Activated audible/visual alarms indicate an erroneous condition present on the transmission line. Corrective action can then be followed to either protect transmission equipment or restore transmission line to operational characteristics. This power monitoring capability is accomplished through the use of a dual port 50 ohm insertion type line section. Each port must contain a standard Bird Electronic Corporation plug-in element. Usually elements with a ten to one ratio is recommended for the forward and reverse power levels.

The Wattcher monitoring system also provides additional terminal connections for user specific applications. For details and wiring information, see Appendix B.

Specifications

Impedance	50 Ohms nominal
Power Range	
Models 3170A, 3170A200, 3170A300, 3172A, 3173A	100 mW to 10 kW full scale
Model 3171A	250 W to 100 kW full scale
Model 3171A020.	300 W to 60 kW full scale
Indicated Power Accuracy	5% of full scale
Alarm Accuracy	5% of full scale
Response Time	25 μsec maximum
Activate Forward Monitor (Adjustable Delay)	
Models 3170A, 3170A200, 3171A, 3171A020, 3172A, 3173A	71 μsec to 50 msec nominal
Model 3170A300	7.1 msec to 5 sec nominal
Activate Forward Monitor (Signal Levels)	Active state: 0 to 1 V Off state: held to 5 V internally
Models 3170A, 3170A300, 3171A, 3171A020, 3173A	Active state: 0 to 1 V Off state: 2.4 V to 50 V
Models 3170A200, 3172A	
Inputs and Outputs (All Units)	Will interface directly to TTL
Output Drive Capability	Will sink 180 mA
5 Volt Supply Output	Will source 360 mA, regulated
Insertion VSWR	1.05 maximum dc to 1 GHz
AC Power Requirements	115/230 Vac 50/60 Hz @ 56 mA maximum
DC Power Requirements	12.7 Vdc to 16.0 Vdc @ 400 mA maximum
Overall Dimensions	9-21/64"D x 19"W x 5-7/32"H (237 x 483 x 133 mm)
Weight	
Models 3170A, 3170A200, 3170A300	7 lb. (3.2 kg)
Models 3171A, 3171A020, 3172A, 3173A	5.5 lb. (2.5 kg)

Additional Options

Frequency and power range are governed by the line section and elements selected. A summary of the various models and their applications is provided in Appendix A, Different Data Sheets.

Elements An element table selection guide for the various line sections is provided in Chapter—5 Maintenance.

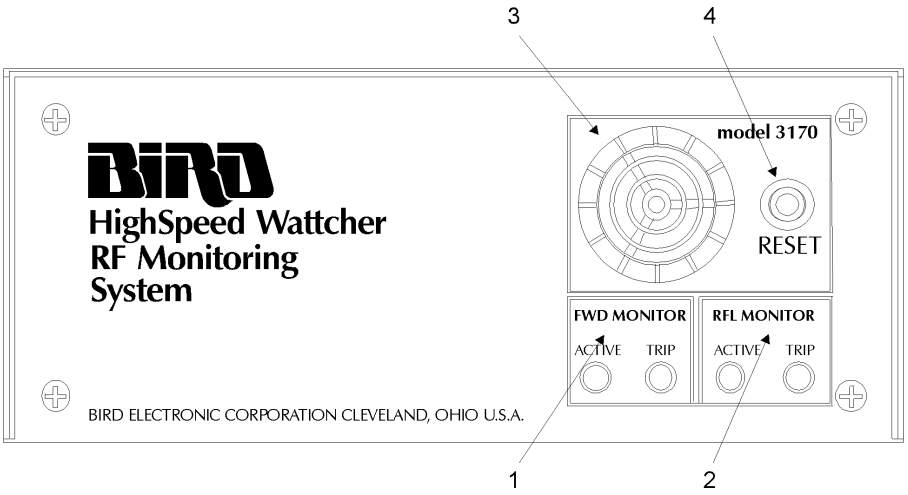
Cable Assemblies DC Cable Assemblies are available for remote rigid line installation. The assemblies are various length of RG-58/U cable with a dc plug, P/N 7500-076 on one end and a BNC(m) connector installed on the opposite end. Refer to the cable section of the parts list for cable lengths and part numbers.

Enclosures

The Wattcher Monitor's internal circuitry and analog meters are enclosed in separate aluminum housings. These housings are mounted to a standard 19 inch panel for rack mount applications.

Front Panel

Figure 1-1
Front Panel



1 Forward Monitor

Active LED—Indicates forward power is being monitored and an error condition will be indicated upon failure.
Trip LED—Indicates error condition has occurred.

2 Reflected Monitor

Active LED—Indicates reflected power is being monitored and an error condition will be indicated upon failure.
Trip LED—Indicates error condition has occurred.

3 Audible Alarm

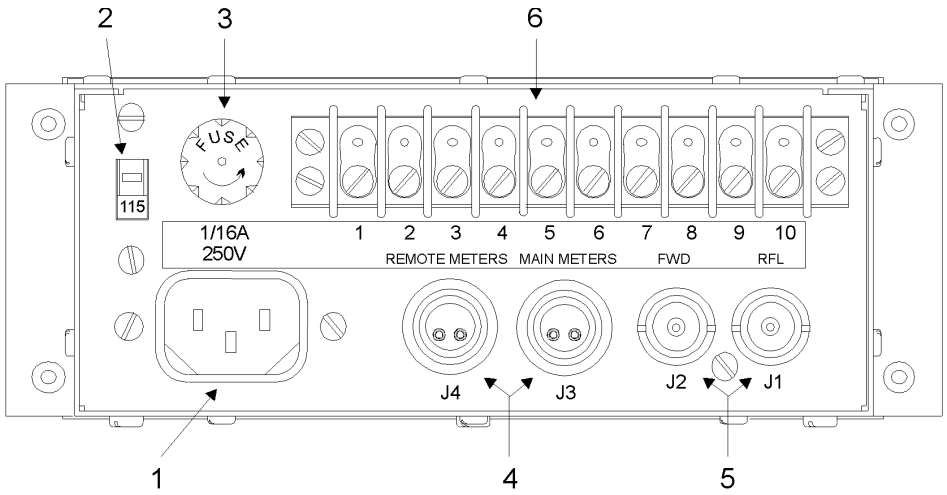
If forward or reflected power set points are exceeded an audible alarm is sounded. The alarm works in conjuction with error status indicator reflecting failure conditions.

4 Reset

This push button resets the monitoring system to normal operation after an error condition has been corrected.

Rear Panel

Figure 1-2
Rear Panel



1 AC Receptacle Provides a means of supplying ac line power to Wattcher control unit.

2 Line Voltage Selector Switch Determines line voltage operation.

3 AC Line Fuse 1/16A at 250V slow-blow fuse, provides circuit protection from excessive surge in line power or in the event of component failure.

4 Meter Connections J3—Connector for front panel main meters. Can also be used to connect remote meters. Levels: 30µA full scale into 1400 ohm (42mV).
J4—Extra meter connector for remote meters or chart recorder. For details on connecting remote meters see Appendix B. Levels: 1.038V full scale. Use 33.2k resistor in series with standard Bird 30µA meters.

5 RF Power Connections Female BNC connectors, provide means of connecting sampled RF power. J2 is for forward power, J1 is for reflected power. Levels: 30µA full scale into 1400Ω (42mV). May be over ranged to 100mV.

6 Terminal Strip A ten contact terminal strip provides connections for various user specific applications. Details of contact assignment and applications are in Appendix B.

Outline Drawings

Figure 1-3
Models 3171A, 3172A, & 3173A

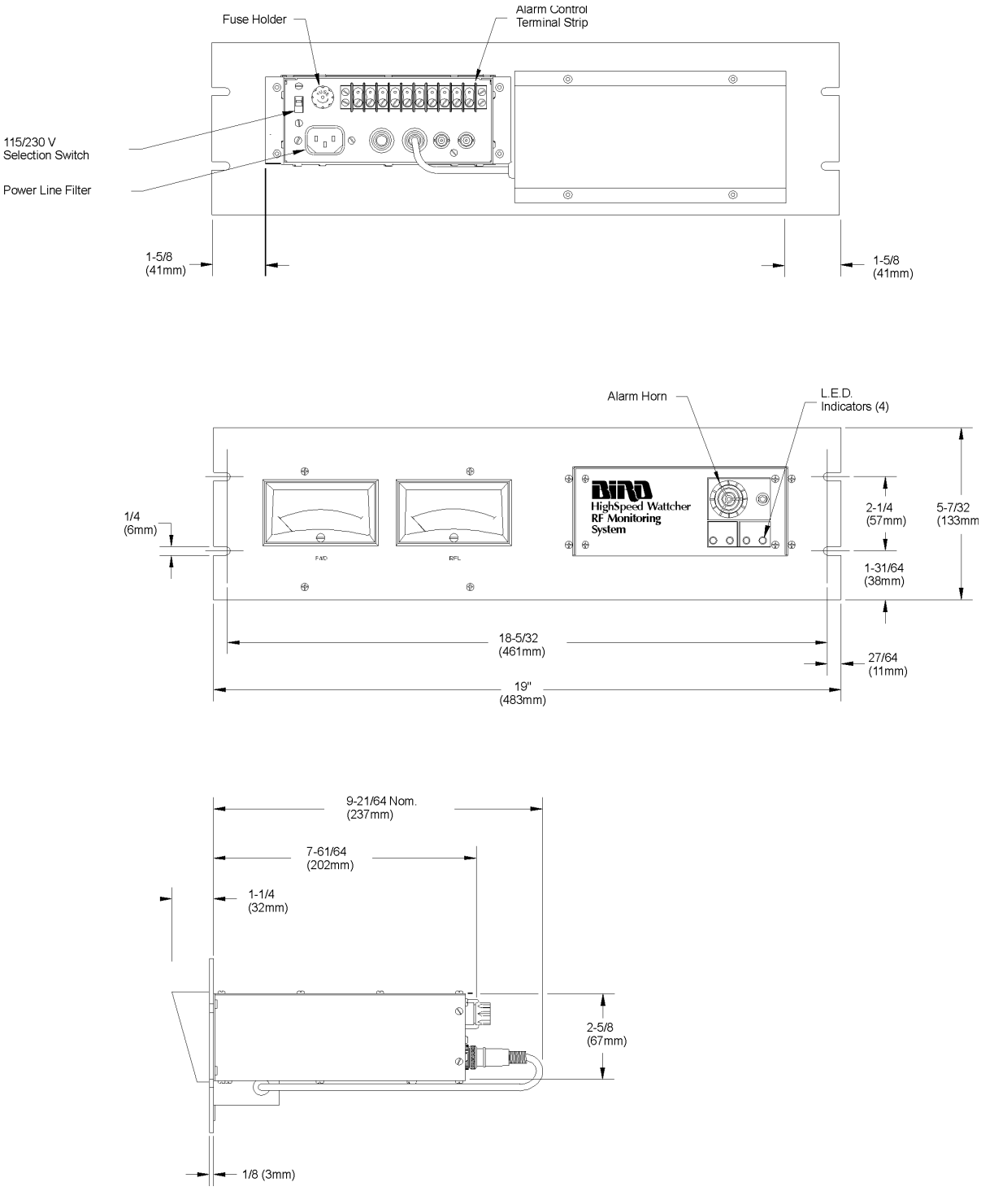
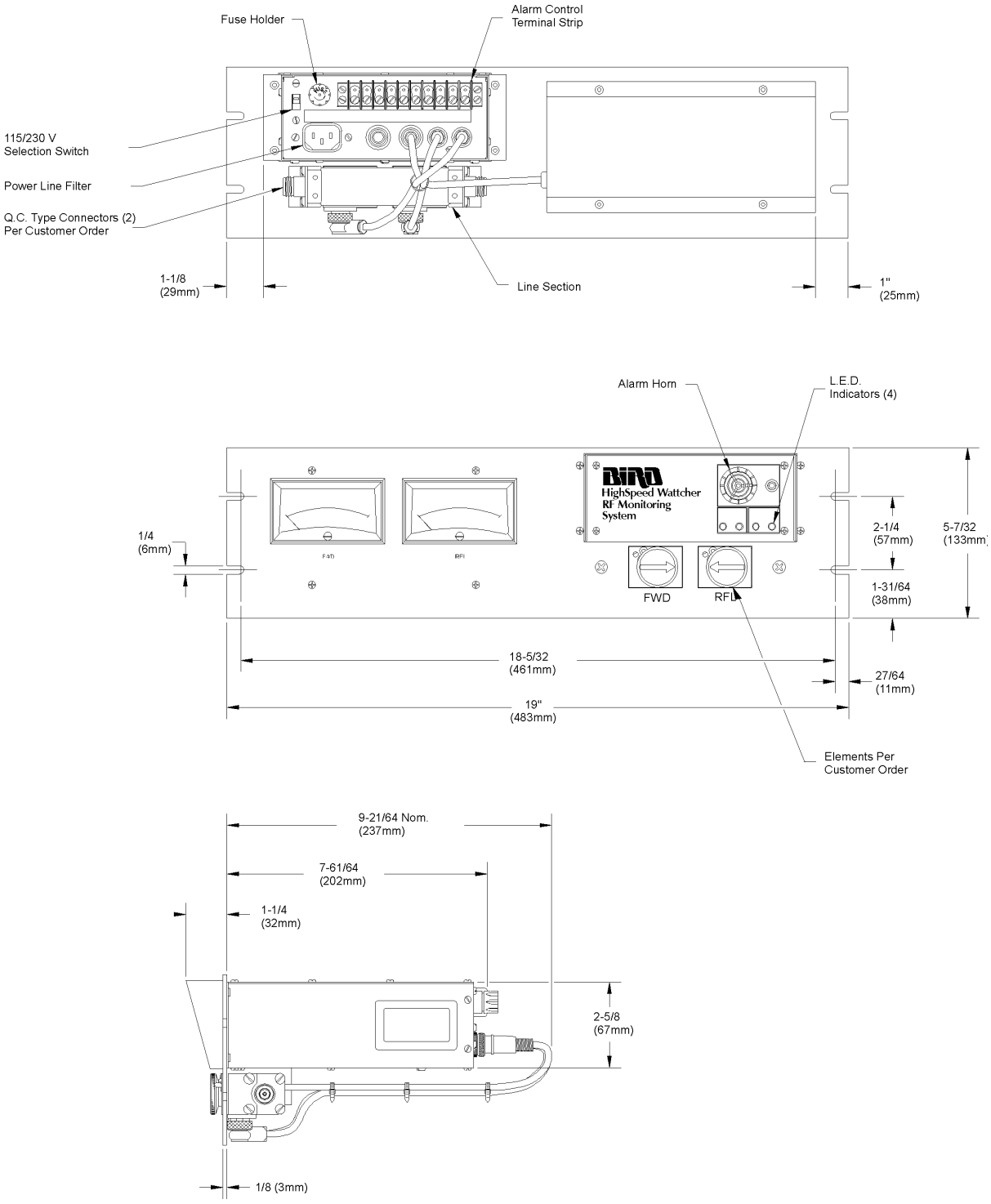


Figure 1-4
Models 3170A, 3170A200,
& 3170A300



Chapter 2

Theory of Operation

Input Signal

Direct current signals representing operating power levels are brought into the RF monitor from the sensing elements through the rear panel jacks J1 and J2. These currents are shunted to ground through 1400 ohm resistors. The voltage developed across these resistors is amplified by a pair of operational amplifiers to approximately one volt (meter full scale).

The drive current to the main indicating meters is taken from the amplifier outputs through series resistors of 33.2k ohm each. The drive voltage for remote meters also comes from the amplifier outputs and is buffered by a pair of op-amps configured for unity gain. This protects the 3170A/71A circuitry against accidental shorting of the remote meter line.

Adjustment

The calibrate/operate switch and the two reference potentiometer allow the user to substitute an adjustable current in place of the signals from the sensing elements to facilitate adjustment of the set-points.

The three set-point potentiometer (forward, reflected, and confirm) provide dc voltages which are compared to the amplifier outputs by three comparators.

The LED to the left of each potentiometer indicates whether the incoming signal is higher (LED ON) or lower (LED OFF) than the set-point of the potentiometer.

Operations

The output of the confirm comparator goes directly to the confirm output drive transistors. The output of the reflected comparator goes directly to the alarm circuitry and to the reflector monitor tripped LED latch. The output of the forward comparator is gated by the activate forward monitor signal AFM before going to the alarm circuitry and LED latch.

In other words, the signal is blocked if the activate forward monitor signal is not present. The AFM signal passes through a delay circuit before reaching the gate. The purpose of the delay is to allow for any delays in the user's equipment between the initial excitation of the carrier ON signal and the presence of power on the transmission line.

Reset

The reset signal clears the horn latch and the two trip LED latches. This signal can come from three sources: the pushbutton switch on the front panel, the rear panel input/output, or from the power-up reset capacitor when the device is first turned on or after a power interruption.

Chapter 3

Preparation for Use

General

The series 3170A High-Speed Wattcher RF Monitoring System was designed for indoor use. This section contains information on unpacking and inspection; and preparing the Wattcher Unit for use.

Unpacking and Inspection

1. Carefully inspect shipping container for signs of damage. If damage is noticed, do not unpack the unit. Immediatly notify the shipping carrier and Bird Electronic Corporation.
2. If container is not damaged, unpack the unit. Save shipping materials for repackaging.
3. Inspect unit for visual signs of damage. Immediatly notify the shipping carrier and Bird Electronic Corporation of equipment damage.

Installation

Mounting

The Model 3170A Series High Speed Wattcher System is intended for rack panel mounting. The panels are designed to fit ASA standard 19 inch size “C” racks.

The Models 3170A, 3170A200 and 3170A300 are fully self-contained units with the RF line section mounted on the panel. The Models 3171A, 3171A020, 3172A, and 3173A, however, utilize remotely mounted line sections.

CAUTION
Be sure the 115/230 voltage selector switch on the rear panel is set to the proper line voltage before ac power is applied.

For installation of Models 3170A, 3170A200, and 3170A300 refer to figure 1-4 Outline Drawing. For installation of Models 3171A, 3171A020, 3172A, and 3173A, refer to figure 1-3 Outline Drawing.

Models 3170A, 3170A200, and 3170A300

1. If the back of the unit is not accessible from the rear of the rack mount, any connections to the unit must be made before the panel is secured in place.
2. Connect the RF coaxial line to the line section.
3. Make sure the 115/230 line voltage switch is in the proper position for the voltage supplied.

4. Connect the ac power cord from the Wattcher unit to an appropriate source. Make dc power connections if needed.

5. Secure the panel to the rack with appropriate fasteners.

Models 3171A, 3171A020, 3172A, and 3173A.

1. Insert the line section in the coaxial RF transmission line. Connect the dc cable to the line section and run the dc cable to the rack console unit.

2. If the back of the unit is not accessible from the rear of the rack mount, all connections to the unit must be made before the panel is secured in place.

3. Make sure that the 115/230 line voltage switch is in the correct position for the voltage supplied.

4. Connect the ac power cord from the Wattcher unit to an appropriate source. Make dc power connections if needed.

5. Secure the panel to the rack mount using appropriate fasteners.

Initial Setup

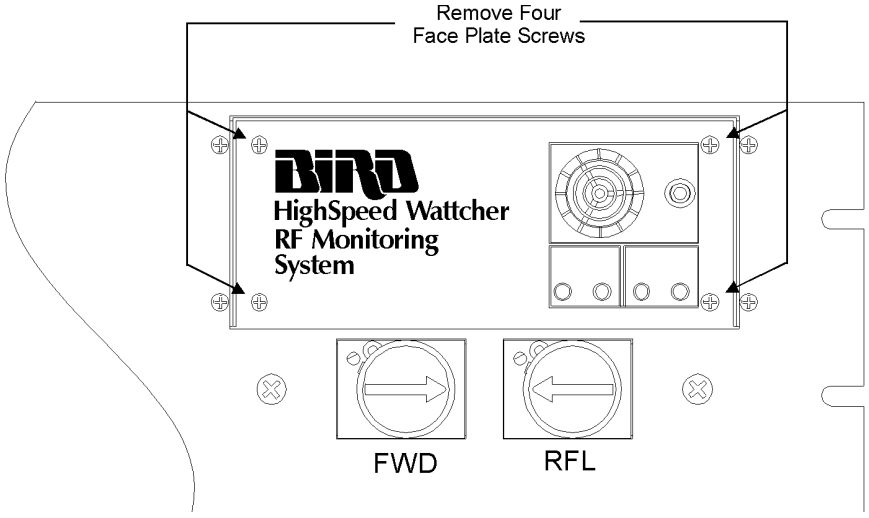
WARNING
Do not use electricically conductive tools for calibration when the front panel is removed. Damage to the unit and or the possibility of electrical shock exists.

When either ac or dc power is applied to the unit, the yellow reflected monitor active LED should light. If this light does not come on, disconnect the power cord and refer to Chapter 5, Maintenance. With the yellow reflected monitor active LED lit, signifying power is ON and the unit is operational, proceed with the initial set up below.

Preparation

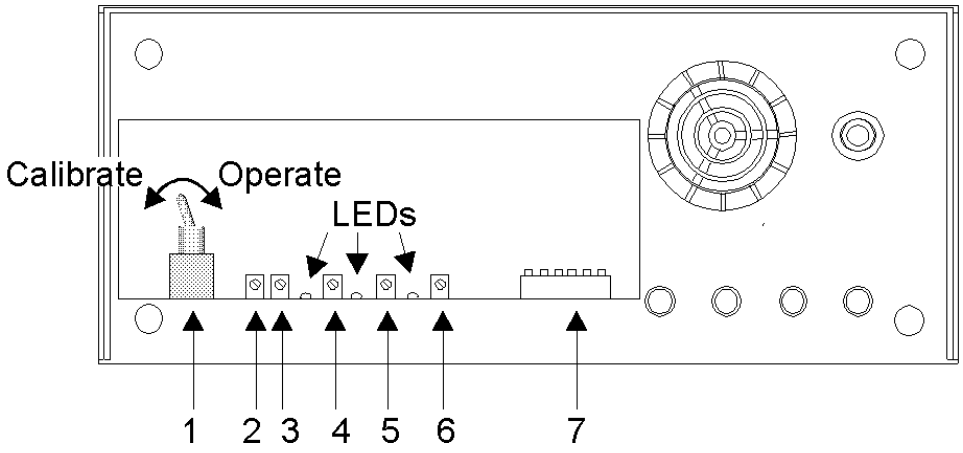
1. Remove the face plate by removing the four screws found in the corners of the face plate. This exposes the circuit board on which the calibration controls are located.

Figure 3-1
Face Plate Removal



2. Set the CALIBRATE/OPERATE switch to the calibrate position (to the left).

Figure 3-2
Controls and Indicators



1. Calibrate/Operate Switch
2. Forward Reference Adjustment Potentiometer
3. Reflected Reference Adjustment Potentiometer
4. Forward Set Point Potentiometer
5. Reflected Set Point Potentiometer
6. Confirm Set Point Potentiometer
7. Forward Monitor Active Delay Dip Switch

Adjust Set-points

1. Using the forward reference potentiometer adjust the forward meter to indicate the power level at which the forward alarm is to be tripped.

2. Adjust the forward set-point potentiometer until the miniature LED to the left of the potentiometer is just at the transition from off to on.

☞ NOTE: Turning the potentiometer clockwise will raise the set-point and turn the light off.

3. Using the reflected reference potentiometer and the reflected set-point potentiometer, set the reflected trip point in a similar manner. The alarm will trip during this operation unless the RESET button is held in.

4. The confirm set-point is adjusted using the forward reference potentiometer and the confirm set-point potentiometer. If the confirm output is not used, it is not necessary to adjust the confirm set-point potentiometer.

5. Once the set-points are adjusted, the CALIBRATE/OPERATE switch can be returned to the operate position (to the right). If using active forward monitor capability then proceed to paragraph 3-6. If not, then replace the face plate.

Active Forward Monitor Setup

Internal circuitry sets Active Forward Monitor (AFM) input to a high state. This inhibits monitoring of forward power on transmission line. To monitor forward power, follow the steps below.

1. Connect AFM input to ground by hardwiring terminal strip position 10 (AFM input) to position 7 (ground).

2. Select the appropriate delay (see table 3-1). This delay allows transmitting equipment to reach acceptable power output before being monitored by forward channel for low power condition.

There are two ways to determine the required delay:

a. If the delay in the user's equipment is known, the AFM should be set to the same delay plus a minimum of 25 percent safety factor.

b. The second alternative is to set the AFM to progressively shorter delays until switching on the carrier causes the FWD monitor to trip when the user's equipment is known to be working properly. Then add a 25 percent safety factor to the delay indicated by the switch setting and set the delay to that setting.

☞ NOTE: that the disabling of the forward monitor is virtually instantaneous when the AFM signal is removed and is unaffected by the switch settings.

Dip Switch Settings

Dip Switch bank S02 is used to select AFM delay time. Refer to figure 3-3 for correct on / off position. Be sure the switches or set fully on or off.

In table 3-1 the delay times are listed in the appropriate row & column for the switch settings.

☞ NOTE: The delay times are different for the model 3170A300.

Figure 3-3
S02 Dip Switch

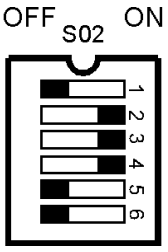


Table 3-1
Setting AFM Delay

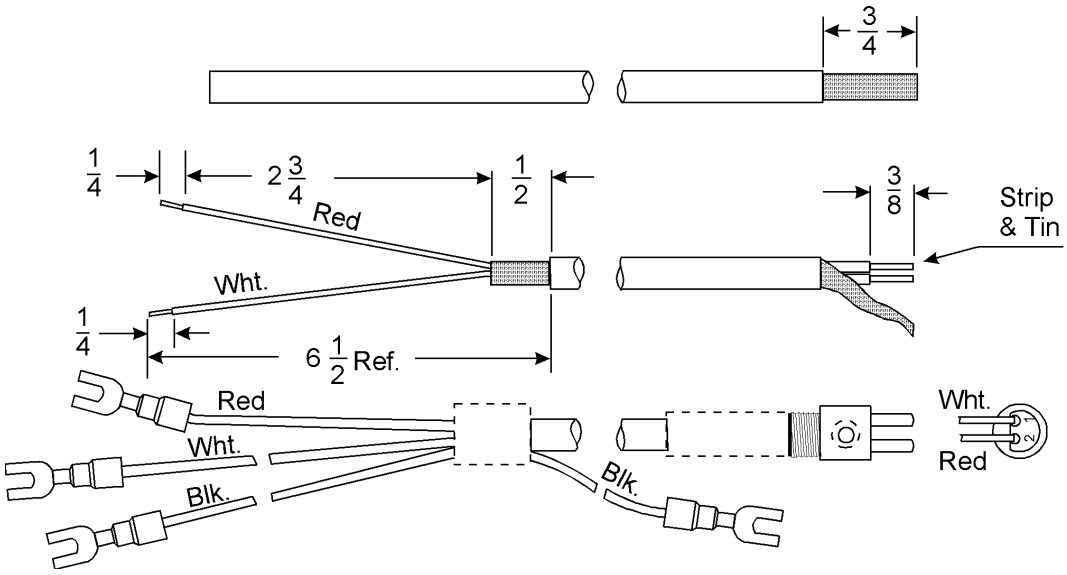
			SW6 ON SW5 OFF SW4 OFF		SW6 OFF SW5 ON SW4 OFF		SW6 OFF SW5 OFF SW4 ON	
SW1	SW2	SW3	3170A300	All Other Models	3170A300	All Other Models	3170A300	All Other Models
ON	ON	ON	7.1ms	71µs	71ms	710µs	710ms	7.1s
OFF	ON	ON	8.3ms	83µs	83ms	830µs	830ms	8.3s
ON	OFF	ON	10.0ms	100µs	100ms	1ms	1s	10.0s
OFF	OFF	ON	12.1ms	121µs	121ms	1.21ms	1.21s	12.1s

Remote Meter Cable Assembly

Remote meters can be connected to J4. The following instructions are provided for assembling cables for remote meter mounting.

Cable recommended is Belden number 8208, 18 AWG braided shield wire. Bird p/n is 5-704. Required connector plug is Bird p/n 5-665.

Figure 3-4
Remote Meter Cable



1. Cut cable to desired length.
2. Strip and tin wires to lengths as shown.
3. Disassemble connector and assemble the plug section on the cable. Insert wires into pins making sure the red wire is inserted in to pin number two and the white wire to pin one. Soft solder these connections securely.
4. Insert the shield braiding between the spring coils and clip short. Reassemble the connector's outer conductor and tighten the set screws securely.
5. Service the other end of the cable as shown. Connect two black leads to the braided ground wire as shown. The red wire is the forward power and the white is the reflected power.

Chapter 4

Operating Instructions

General

When the unit is installed and connected to a transmitter for remote monitoring, metering, or external alarms and functions as your installation requires, operator attention is not required. The equipment will completely monitor a transmitter's operation. The only time operating personnel will be necessary is to reset the unit if it has not been wired for automatic or remote reset. Refer to Appendix B for different applications in which the Wattcher monitor can be used.

RF Power Measurement

RF power measurements are made by the insertion of the detector elements into the line section. The elements are selected for the frequency range and power level used.

Forward and reflected power is indicated when the arrow on the element plate points in the direction of power flow. The forward power flows from the transmitter to the load or antenna and the reflected power flows from the load or antenna to the transmitter.

When the detecting element is placed in the line section, be sure it is fully seated and fully rotated to the stop for the appropriate indicating position. Also be sure the element catch on the element socket face of the line section is in place on the shoulder of the element. This will assure good contact between the element and line section body.

Elements are selected for the power and frequency range required. Since the reflected power is generally much less than the forward power, it may be beneficial to select an element of lower power value for the reflected side. This will allow better reading resolution. Generally elements of a ten to one ratio are used.

Chapter 5

Maintenance

With basic care, the series 3170A should provide many years of trouble free operation. This section contains operator maintenance instructions. Any maintenance or service procedure beyond the scope of those provided in this section should be referred to a qualified service center.

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 Cable: BIRDELEC
Fax: (440)248-5426 Telex: 706898 Bird Elec UD

Sales Facilities

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

http://www.bird-electronic.com

Safety Considerations

When servicing the series 3170A or related electrical equipment, observe the following safety precautions:

WARNING
Become thoroughly familiar with modern methods of resuscitation before working near high voltage sources.

WARNING
Shock hazard. Always turn off AC power before removing any equipment panels.

Preventive Maintenance

Preventive maintenance is limited to cleaning the unit and connectors.

> WARNING
> Disconnect this unit from ac power source before any disassembly for cleaning, repair or replacement procedures. The potential for electrical shock exists.

Cleaning

> WARNING
> 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.

Front Panel Clean the front panel face and meters with a soft cloth dampened with a mild detergent solution. Do not use an excessive amount of water that would enter the unit and damage electrical components.

Connectors Clean the line section connectors and elements with a dry cleaning solvent. Use a clean cloth to clean the mating surfaces of the larger line sections and a cotton swab stick for the smaller connectors, elements, and line section element socket. Clean all mating surfaces thoroughly, especially the bottom shoulder of the element socket and the spring contact finger. Do not bend this contact finger when cleaning. The position of this contact is somewhat critical. If it is out too far the element will not enter the socket and if it is in too far, it will not make contact with the button on the element.

Troubleshooting

Table 5-1 contains troubleshooting information for problems which can occur during normal operation. Locate the problem, review the possible cause, and perform the corrective action listed.

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 not corrected by the listed corrective actions, notify a qualified service center.

Table 5-1

Disassembly

Meter Replacement

If the meters should become defective and require replacement, proceed as outlined in the following steps:

1. Remove the housing that covers the back of the meters by unscrewing the four 4-40 oval head screws from the front panel. These screws are located above and below the meter faces. The cover will come right off.
2. Observe the connections of the meter leads, to maintain the correct polarity in reassembly. Then disconnect the leads.
3. Loosen the clamp screw on the sides of the meter until the clamp is released and can be taken off. The meter may now be withdrawn forward through the front panel.
4. The meters are replaced by merely reversing the above procedures.

Replace DC Fuse

> WARNING
> Disconnect this unit from ac power source before any disassembly for cleaning, repair or replacement procedures. The potential for electrical shock exists.

1. Remove top cover.
2. Using a fuse puller or a small flat blade screwdriver, carefully remove the fuse from fuse clips.

☞ NOTE: The fuse is located on the circuit board, toward the back right corner.

3. Replace with same type and rating fuse. 3 AG, ½Amp Bird P/N 5-721-2
4. Replace top cover.

Storage

If the unit is not to be used for an extended period of time, store in a cool dry place where it will be free from rough treatment, dust, and dampness.

Repackaging

Should you need to return the Wattcher unit, use the original shipping package if possible. If the original package is not available, use a heavy duty corrugated box with shock-absorbing material around all sides of the unit to provide firm cushion and to prevent movement in container. Container should be properly sealed.

Replacement Parts List

QTY.	DESCRIPTION	PART NUMBER
1	AC power fuse -3 AG, 1/16 A	5-721-15
1	DC power fuse -3 AG, 1/2 A	5-721-2
1	Power cord, 115/230 Vac	4421-055
2	Cable assembly	3170-058-1
1	Meter cable assembly	3170-057
2	Meter	
	Models 3170A, 3170A200, 3170A300, 3172A, & 3173A	2150-015
	Model 3171A	2150-086
	Model 3171A020	2150-093
1	Line section assembly (Model 3170A only)	4522- 002

DC Cable Assemblies

Length	Part Number	Length	Part Number
14"	3170-058-1	6’	3170-058-6
15’	3170-058-2	25’	3170-058-3
25’[1]	3171-010	40	3170-058-4
50’	3170-058-5	80’	3170-058-7
90’	3170-058-8	100’	3170-058-9

[1] Use if line section is 6⅛"

Element Tables

The following tables are used to determine the part numbers of elements required based on line section, power, and frequency ranges.

Table 5-2 should be used to determine which element table to use, based on the model.

Tables 5-3 through 5-15 are numbered consecutively for convenience. The table heading corresponds to the table heading in the Bird catalog which is the common reference for element tables.

Table 5-2

Model	Line Section Mount		Meter Scale			Line Section in Inches			
	Front Panel	External	Watts	kiloWatts		⅞	1⅝	3⅛	6⅛
			25/50/100	5/10/25	15/30/60	Table (5-)			
3170A	✔		✔			3 - 8			
3170A200	✔		✔			3 - 8			
3170A300	✔		✔			3 - 8			
3171A		✔		✔			9	11	14

⅞" Line Section The following tables are used to select elements for ⅞" line sections.

Table 5-3

Troubleshooting

Model	Line Section Mount		Meter Scale			Line Section in Inches			
	Front Panel	External	Watts	kiloWatts		⅞	1⅝	3⅛	6⅛
			25/50/100	5/10/25	15/30/60	Table (5-)			
3170A	✔		✔			3 - 8			
3170A200	✔		✔			3 - 8			
3170A300	✔		✔			3 - 8			
3171A		✔		✔			9	11	14
3171A020		✔			✔		10	13	15
3172A		✔	✔			3 - 8			
3173A		✔	✔			3 - 8			

Table 5-4

Selection Table

Power Range (Watts)	Frequency (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
5	—	5A	5B	5C	5D	5E
10	—	10A	10B	10C	10D	10E
25	—	25A	25B	25C	25D	25E
50	50H	50A	50B	50C	50D	50E
100	100H	100A	100B	100C	100D	100E
250	250H	250A	250B	250C	250D	250E
500	500H	500A	500B	500C	500D	500E
1000	1000H	1000A	1000B	1000C	1000D	1000E
2500	2500H					
5000	5000H					

Standard Elements

Table 5-5

High Frequency Milliwatt Elements
Entire Table ⌈8% FS

Power Range (Watts)	Frequency Band .45 to 2.5 MHz
1000	1000P
2500	2500P
5000	5000P
10000	10000P

Low Frequency Elements

Table 5-6

Low Power Elements

Power Range (milliwatts)	Frequency Bands (MHz)							
	905-1260	1250-1500	1500-1700	1700-2200	2200-2300	2300-2400	2400-2500	2500-2600
100	430-82	430-209	430-210	430-178	430-41	430-211	430-182	430-90

Table 5-7

Low Power Elements

Power Range (milliwatts)	Frequency Bands (MHz)							
	905-1260	1250-1500	1500-1700	1700-2200	2200-2300	2300-2400	2400-2500	2500-2600

Table 5-8

100 mW Frequency Band (MHz)	Cat. No	250 mW Frequency Band (MHz)	Cat. No.	500 mW Frequency Band	Cat. No.
45-50	430-266	45-50	430-267	45-54	430-242
50-60	430-191	50-60	430-212	54-60	430-243
60-66	430-192	60-66	430-213	60-66	430-244
66-72	430-193	66-72	430-214	66-72	430-245
72-76	430-2	72-76	430-22	72-76	430-33
76-82	430-194	76-82	430-215	76-88	430-246
82-88	430-195	82-88	430-216	88-108	430-247
88-97	430-170	88-108	430-217	105-120	430-26
97-108	430-171	105-120	430-20	120-136	430-248
108-136	430-57	116-126	430-48	136-150	430-249
135-175	430-86	125-136	430-218	150-170	430-53
170-190	430-62	130-150	430-13	170-190	430-250
190-210	430-63	150-180	430-15	190-216	430-251
210-216	430-176	170-190	430-64	216-240	430-252
216-230	430-196	190-210	430-65	240-290	430-27
230-240	430-197	210-220	430-184	290-340	430-253
240-250	430-198	216-230	430-219	340-360	430-157
250-260	430-199	230-240	430-220	350-400	430-254
260-270	430-200	240-250	430-221	400-450	430-255
270-280	430-201	250-260	430-222	450-500	430-256
280-290	430-202	260-270	430-223	500-600	430-257
290-300	430-203	270-280	430-224	600-800	430-258
300-320	430-204	280-290	430-225	800-1000	430-265
320-340	430-205	290-300	430-226		
340-360	430-164	300 -320	430-227		
360-380	430-206	320-340	430-228		
380-400	430-207	340-360	430-229		
400-420	430-7	360-380	430-230		
420-450	430-208	375-400	430-231		
450-470	430-8	400-450	430-232		
470-500	430-179	450-470	430-61		
500-600	430-168	470-500	430-233		
600-800	430-169	500-600	430-234		
800-1000	430-263	600-800	430-235		
		800-1000	430-264		

1⅝" Line Section The following tables are used to select elements for 1⅝" line sections.

Table 5-9

Low Frequency Elements

Power Range (Watts)	Frequency (MHz)							
	950-1260	1100-1800	1700-2200	2200-2300	2300-2400	2400-2500	2500-2600	2600-2700
1	1 J	1 K	1 L	1 M	431-17	431-20	431-23	431-120
2.5	2.5 J	2.5 K	2.5 L	2.5 M	431-110	431-107	431-108	431-117
5	5 J	5 K	5 L	5 M	432-15	432-28	432-2	432-12

Table 5-10

High Frequency Elements
Entire Table ⌠8% FS

Milliwatt Elements

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
100 W	—	100A12	100B12	100C12	100D12	100E12
250 W	—	250A12	250B12	250C12	250D12	250E12
500 W	500H12	500A12	500B12	500C12	500D12	500E12

3⅛" Line Section The following tables are used to select elements for 3⅛" line sections.

Table 5-11

1-⅝AA Standard Elements 30µA

Power Range (Watts)	Frequency Bands (MHz)			
	2-30	50-125	100-250	400-1000
300	300H12	300B12	300C12	300E12
600	600H12	600B12	600C12	600E12
1500	1500H12	1500B12	1500C12	1500E12
3000	3000H12	3000B12	3000C12	3000E12
6000	6000H12	6000B12	6000C12	6000E12
15k	15KH12	15KB12		

1-⅝BB Standard Elements 30µA

Table 5-12 *1-⅝BB Standard Elements 30µA*

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
100 W	—	100A32	100B32	100C32	100D32	100E32

Table 5-13

3⅛AA Standard Elements 30µA

Power Range 50kW	Frequency bands (MHz)		
	25-60	50-125	100-250
30µA	50KA42	50KB42	50KC42

3⅛AAA

6⅛" Line Section The following tables are used to select elements for 6⅛" line sections.

Table 5-14

3⅛AAA

Power Range	Frequency Bands (MHz)		
	50-125	100-250	400-1000
600 W	600B32	600C32	600E32
1500 W	1500B32	1500C32	1500E32
3000 W	3000B32	3000C32	3000E32
6000 W	6000B32	6000C32	6000E32
15 kW	15KB32	15KC32	15KE32

Table 5-15 *3⅛BB*

Power Range	Frequency Bands (MHz)					
	2-30	25-60	50-125	100-250	200-500	400-1000
250 W	—	250A62	250B62	250C62	250D62	250E62
500 W	—	500A62	500B62	500C62	500D62	500E62
1000 W	1000H62	1000A62	1000B62	1000C62	1000D62	1000E62
2500 W	2500H62	2500A62	2500B62	2500C62	2500D62	2500E62
5000 W	5000H62	5000A62	5000B62	5000C62	5000D62	5000E62
10 kW	10KH62	10KA62	10KB62	10KC62	10KD62	10KE62
25 kW	25KH62	25KA62	25KB62	25KC62	25KD62	25KE62
50 kW	50KH62	50KA62	50KB62	50KC62	50KD62	50KE62

Difference Data Sheet

Table A-1 is used to outline the differences between various models.

Table A-1 Differences Between Models

Model	Line Section Mount		Meter Scale			AFM Delay Adjustment Range		AFM: Off State Levels	
	Front Panel	External	Watts	kiloWatts		70ms to 50ms	7.1ms to 5s	Hold to +5V Internally	+2.4 to +5V
			25/50/100	5/10/25	15/30/60				
3170A	✔		✔			✔		✔	
3170A200	✔		✔			✔			✔
3170A300	✔		✔				✔	✔	
3171A		✔		✔		✔		✔	
3171A020		✔			✔	✔		✔	
3172A		✔	✔			✔			✔
3173A		✔	✔			✔		✔	

User Applications and Wiring

This section is a collection of user specific applications and the wiring information required to activate them.

Connector Assignment

Connection	Description	Function	Levels
BNC Jacks J1 & J2	DC Input Forward & Reflected	Detected RF signals from sensors	30μA full scale into 1400Ω (42mV). May be overranged to 100mV
J3	DC Main Meter Drive Output	Current to drive indicating meters	30μA full scale into 1400Ω (42mV)
J4	DC Remote Meter Drive Output	Voltage to drive remote indicating meters	1.038V full scale (use 33.2k resistor in series with standard Bird 30μA meters
TB1,2	External 12V Supply	Used to allow mobile operation	See page B-5 for connection information
TB3,4	Auxiliary Alarm Inputs	Signals to trip alarms from external sources	TTL levels, active low. Pulled up to 5V by 4.7k internally. Shunted to ground by 0.1μF capacitor.
TB5	5V Output	Regulated 5V output	Can supply 360mA max.
TB6	Alarm Output	Low when alarm is sounding, returned high by reset	TTL levels, active low. Open collector pulled up to 5V by 4.7k. Will sink 180mA.
TB7	Ground	Chassis ground	Reference for signals.
TB8	Reset Input / Output	Input to reset Wattcher from external source. May be used as an output to reset other equipment when Wattcher is reset by the front panel switch.	TTL levels, active low. Pulled up to 5V by 4.7k internally. Shunted to ground by 10μF capacitor.
TB9	Confirm Output	Low when forward power exceeds the users confirm set point	TTL levels, active low. Open collector pulled up to 5V by 4.7k. Will sink 180mA.

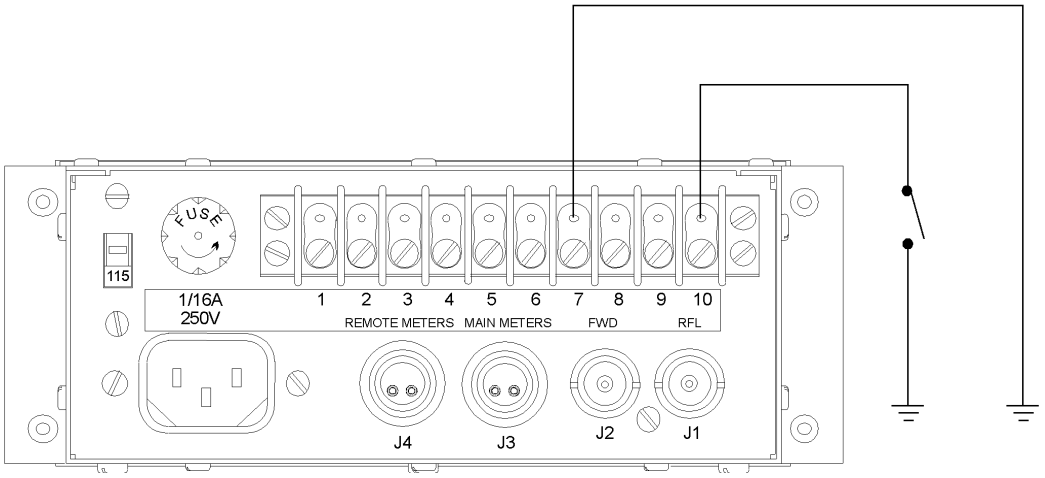
Active Forward Monitor (AFM) Input

Wiring concept examples for activating the AFM circuit are shown below. These can be used for remote on site or off site manual or automatic activation.

Dry Contact Closure

Closure will be from terminal 10 to case ground, terminal 7, in any convenient form, e.g. by an extra set of manual contacts on the transmitter keying relay or a separate remote switch.

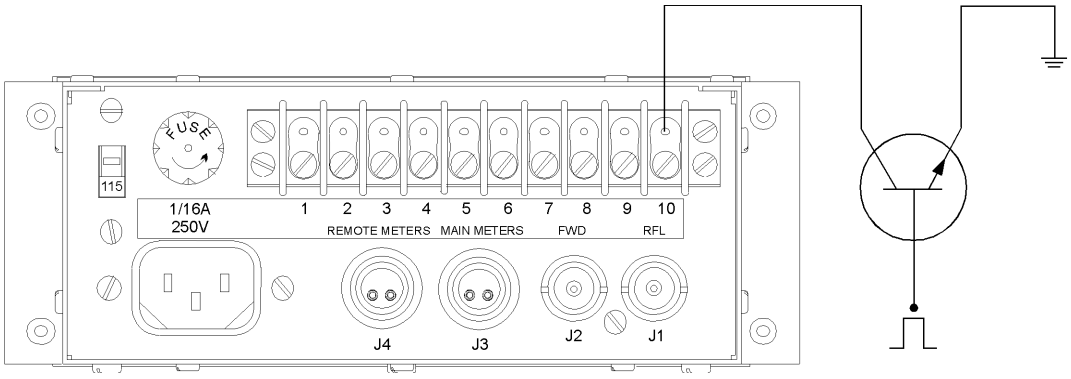
Figure B-1
Dry Contact Closure



Logic "1" Closure

Closure circuit shown is a simplified means of interfacing a logic "1" as required from TTL driving positive signal, indicating transmitter is on.

Figure B-2
Logic "1" Closure

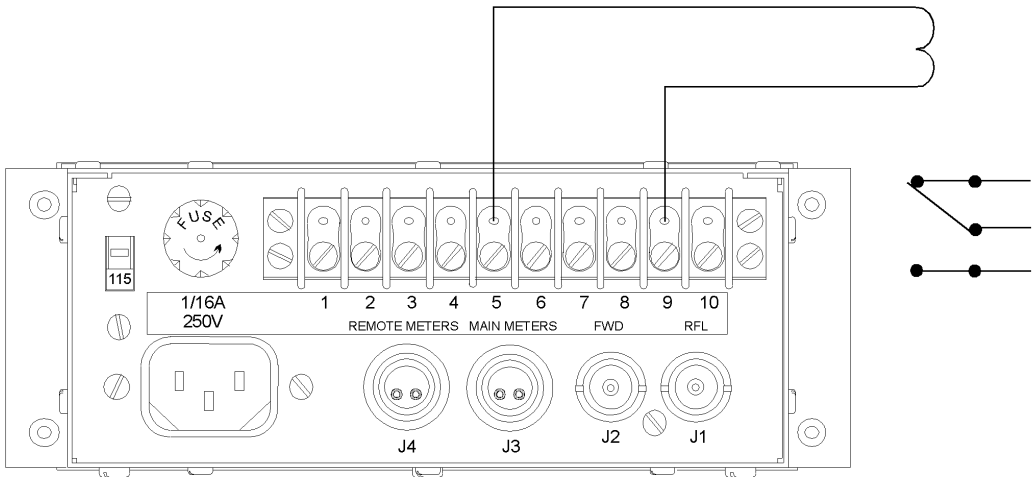


Confirm Output

For visual confirmation of transmitter “ON” see circuit below.

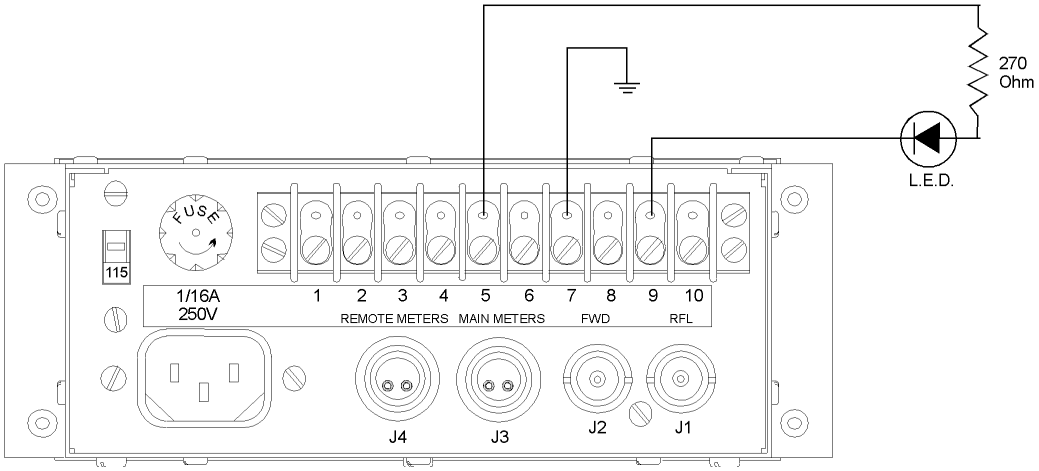
Relay Control Relay control for greater current requirements.

Figure B-3
Confirm Output
Relay Control



LED Indicator Simple local or remote light emitting diode indicator, that requires no more than 180mA.

Figure B-4
Confirm Output
LED Indicator



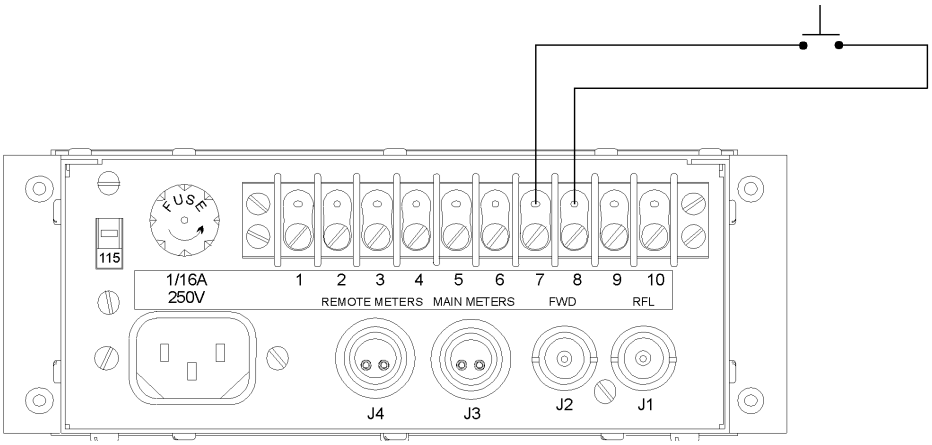
Reset Input

A remote reset could be used in case of false alarm or a brief disturbance has tripped the Wattcher Monitor but left the transmission intact.

Remote Contact Reset

This option allows reset on site, but remote from the Wattcher unit. Terminal 8, Reset, is active low and will cause a reset when the switch is closed, making a connection to terminal 7, ground. One or several momentary contact, normally open, switches can be connected in series for reset from various locations.

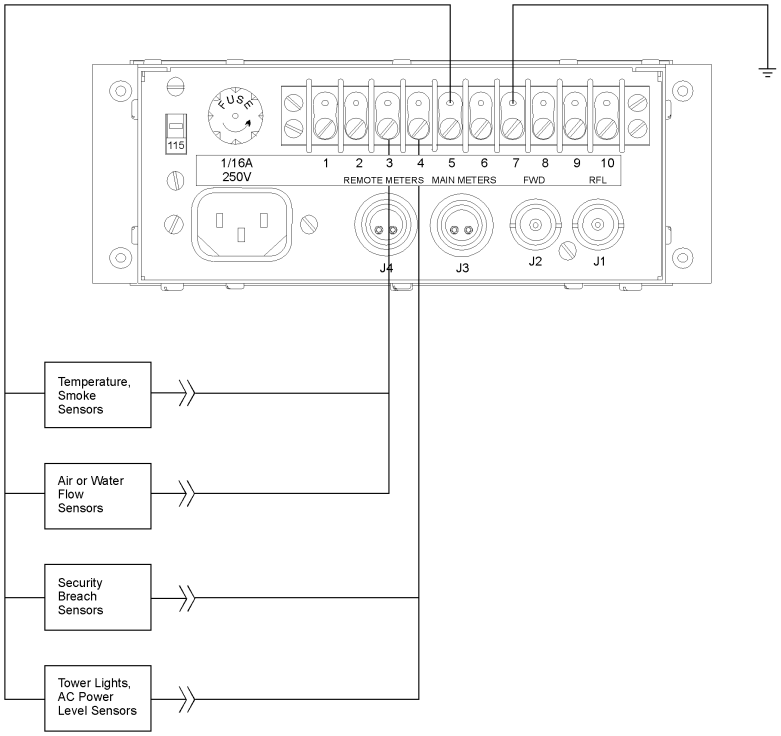
Figure B-5
Reset Input



External Alarms

Various sensors or systems may be connected to the external alarm, terminals 3 or 4. Terminals 3 and 4 are active low inputs. An alarm condition occurs when either terminal is pulled low. Under normal operating conditions, these inputs are held high by internal resistors.

Figure B-6
External Alarms

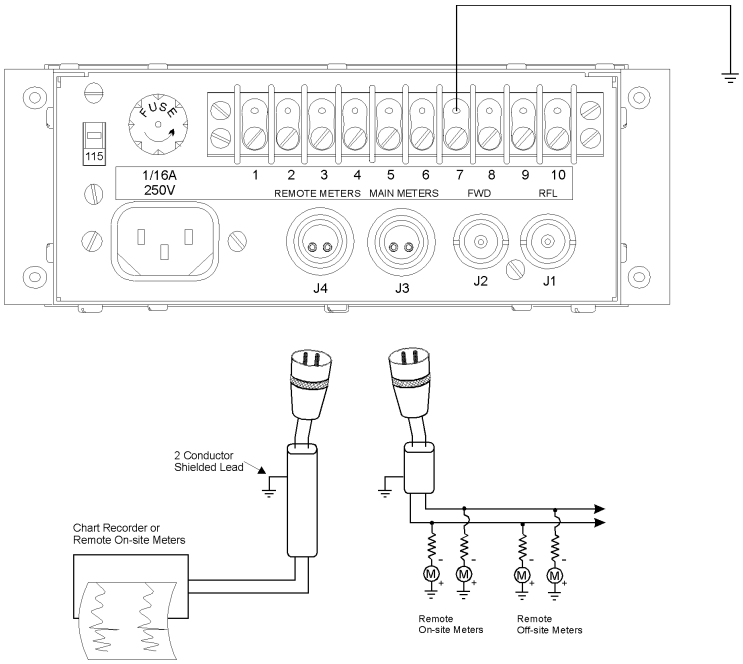


Remote Monitoring or Metering

Remote monitoring is accomplished by connecting a recorder to the remote meter jack, J4. An X-Y recorder can be used for time logging of forward and reflected power per FCC requirements for remote sites.

Any number of meter pairs can be driven by the meter amplifiers up to 1mA into a total load of 470 to 1400 ohms, without effecting scale shape. Long line losses are compensated by adjusting amplifier gain and full scale meter current after network is balanced and amplifier zero setting. Usually RFI prevention by shielding, using chokes and by-pass capacitors, is necessary only near the Wattcher unit.

Figure B-7
Remote Monitors and Meters



DC Power Supply Connections

A dc power supply can be connected to allow for mobile operation of the Wattcher unit.

The positive terminal of the dc power supply must be connected to Terminal 1. The negative terminal must be connected to terminal 2. The minimum dc voltage required for operation is +12.7Vdc. The maximum dc voltage allowable is +16Vdc. The maximum current draw for this range is 400mA.

Figure B-8
DC Power Supply