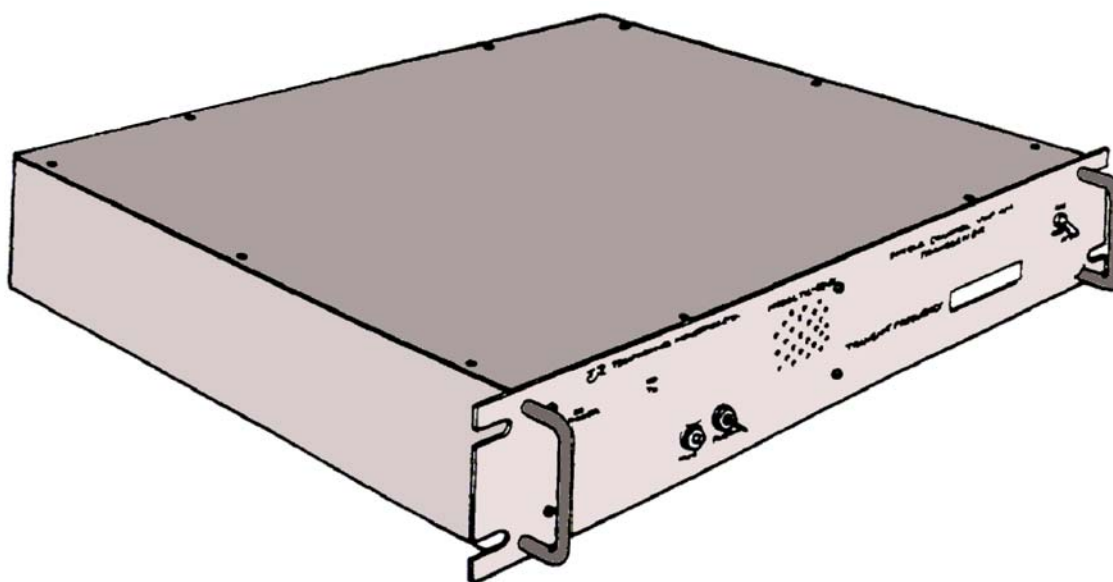


Model 1791 VHF Radio



User's Manual



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INTRODUCTION

This publication provides general information on the Model 1791 VHF Radio. The Model 1791 VHF Radio is a single channel, fixed frequency transmitter operating over the frequency range of 117.975 MHz to 138.000 MHz. These units are intended for base station operation in an air traffic environment. The Model 1791 operates from AC power.

DESCRIPTION

Each Model 1791 VHF Radio consists of a Transmitter Module, Power Supply Module, and Mother Board. Each transmitter comes standard with an RF Isolator, which provides unidirectional coupling to the antenna in multiple transmitter configurations.

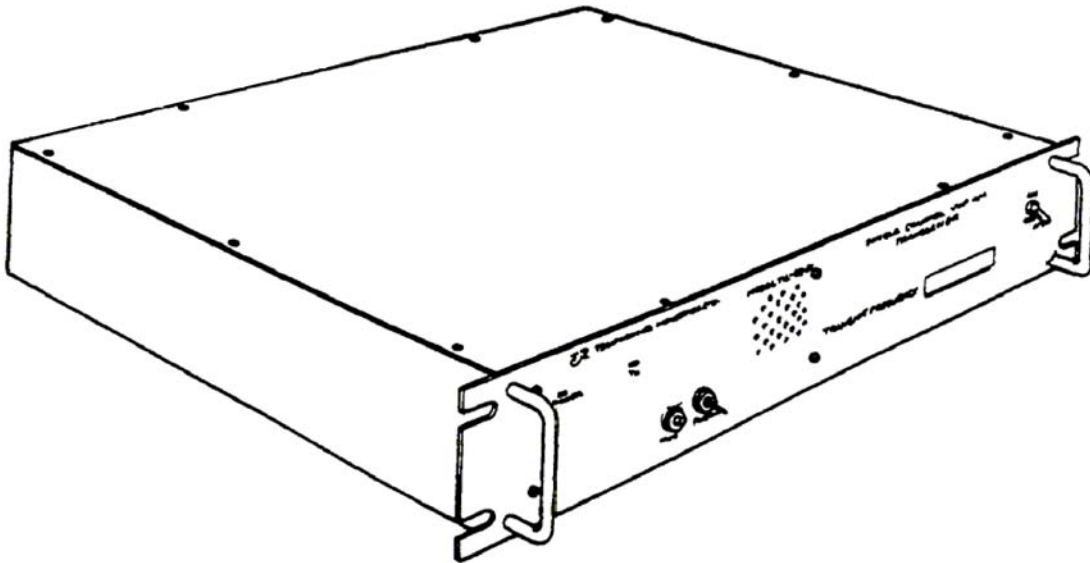


Figure 1. VHF/AM Single Channel Transmitter

Transmitter Module

The Transmitter Module is a low power VHF/AM transmitter which can transmit on a single pre-programmable synthesized frequency, with 25kHz channel spacing in the frequency range 117.975 MHz to 138.000 MHz. The single channel memory set board is mounted external to the transmitter module to facilitate ease of frequency programming.

Power Supply Module

The Power Supply Module provides the DC supply voltage to the transmitter and linear amplifier.

Mother Board

The Mother Board provides all interconnection between the two external remote control connectors, Power Supply Module, and Transmitter Module. The RF Isolator and all internal fuses are mounted on the Mother Board.

RF Isolator

The RF Isolator is a broadband (118 MHz - 138 MHz) RF directional coupler. The RF Isolator provides 20 dB of isolation between the antenna and RF Amplifier while providing 0.7 dB (Max.) insertion loss.

SPECIFICATIONS**POWER REQUIREMENTS:**

AC Input Voltage/Current 100 to 240 VAC @ 1.0 Amp

Power Output 1-10 Watts

REMOTE CONTROL:

Remote Audio Input 2 wire, balanced 600 Ω lines

Tone Keying Impedance 600 Ω floating with respect to ground

Ground Keying Closure to Ground

TX RF Output Signal RF ON=Ground, RF OFF=Open Circuit

Operating Temperature Range -25C(-13F) to +55C(+131F)

Storage Temperature Range -55C(-67F) to +65C(+149F)

Relative Humidity 100%

Dimensions & Weight:

Width 483 mm (19.0 in) MAX

Height 89 mm (3.5 in) MAX

Depth 432 mm (17.0 in) MAX

Weight 6.3 Kg (14 lbs) MAX

TECHNICAL:

Audio Input 0.05 Vrms to 2.0 Vrms

Speech Processor Dynamic Range 35 dB

Modulation 95% MAX

Audio Distortion

 @ 90% mod (Low Power) 10% MAX

 @ 90% mod (with Linear Amplifier at High Power) 15% MAX

Audio Frequency Response 300 Hz to 2,500 Hz, +1 -3 dB

Spurious Emissions 60 dB below carrier

Hum and Noise 45 dB below modulated carrier

INSTALLATION & CHECKOUT

Before using the VHF Radio, it is necessary to set the operating frequency. To access the frequency set jumpers, you must first remove the top dust cover.

REMOVING THE TOP DUST COVER

- 1 Remove and retain the twelve screws securing the top dust cover to the radio chassis.
- 2 Note the location of the four longer screws that travel through the heat sink shims riveted to the inside of the top cover.
- 3 Lift the cover clear of the chassis to expose the internal view of the transmitter as shown in Figure 3.

SETTING THE TRANSMITTER FREQUENCY

The operating frequency may be programmed over the frequency range 117.975 MHz to 138.000 MHz with 25kHz channel spacing.

- 1 Determine the operating frequency to be programmed. Jumpers on the Single Channel Memory Set Board (Figure 2) are used to set the frequency by separating it into its MHz and kHz components.

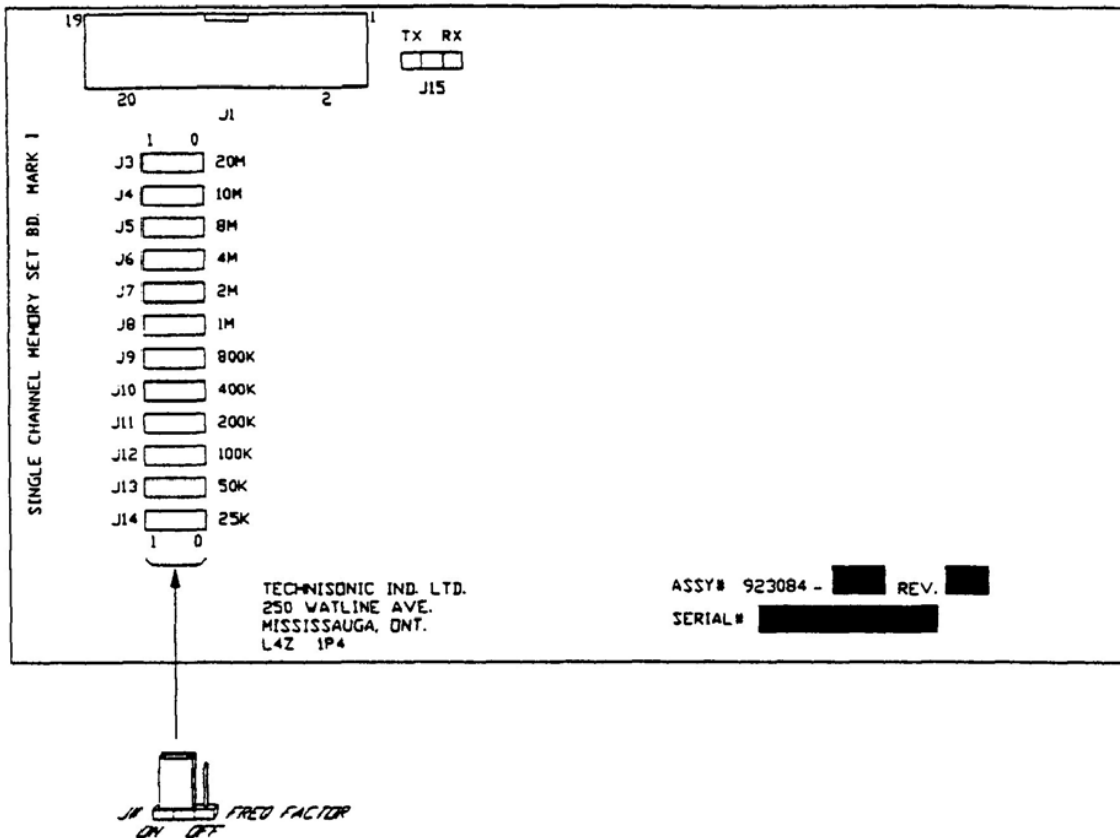


Figure 2. Frequency Set Jumpers

- 2 Refer to Table 1, Frequency Selection MHz. Using the OPERATING FREQUENCY (MHz) column, find the desired frequency in MHz. Cross-refer to the JUMPER LOCATION column, and install the jumper as required.
- 3 Refer to Table 2, Frequency Selection kHz. Using the OPERATING FREQUENCY kHz column, find the portion of the desired frequency in kHz. Cross-refer to the JUMPER LOCATION column, and install the jumpers in the locations as required.
- 4 Replace the top dust cover.

REPLACING THE TOP DUST COVER

- 1 Position the top cover on the chassis.
- 2 Position one screw in each corner of the top cover mounting holes.
- 3 Place the four longer screws into their correct holes located over the internal transmitter module.
- 4 Secure the cover to the chassis with the remaining screws.

CONNECTIONS

The 1791 VHF Radio installs indoors. It is available in a 110VAC or 220VAC version. In AWOS systems, the radio is installed at the Central Data Platform (CDP), and the signal cable connects to the 20909 AWOS Peripheral Interface at terminal block J2. The signal cable is fitted with a DB25 connector at one end for connection to the radio, and is unterminated at the other end for connection to the Peripheral Interface.

The antenna connector is a 50 ohm "N" Type connector. A BNC adapter is provided for connection to the standard RG-58 antenna cable. For runs longer than 50 feet, RG-8 cable should be used, connected directly to the "N" type connector. An AC line cord is supplied for connection to AC power.

- 1 Ensure that the radio's POWER ON/OFF switch is set to OFF.
- 2 Connect the antenna cable to the rear panel's BNC connector (for RG-58) or "N" Type connector (for RG-8).
- 3 Connect the signal cable's DB25 connector to the 25-pin D connector on the radio's back panel.
- 4 Connect the unterminated end of the signal cable to terminal block J2 on the Peripheral Interface board as follows:
 - a) Signal cable WHITE wire to pin 1.
 - b) Signal cable GREEN wire to pin 2.
 - c) Signal cable RED wire to pin 3.
 - d) Signal cable BLACK wire to pin 4.
- 5 Connect the AC line cord to the AC connector on the radio's rear panel.
- 6 Power on the radio by switching the radio's POWER ON/OFF switch to ON.

OPERATIONAL CHECK

Ensure that the transmitter operates as described in the Operating Instructions on page 8.

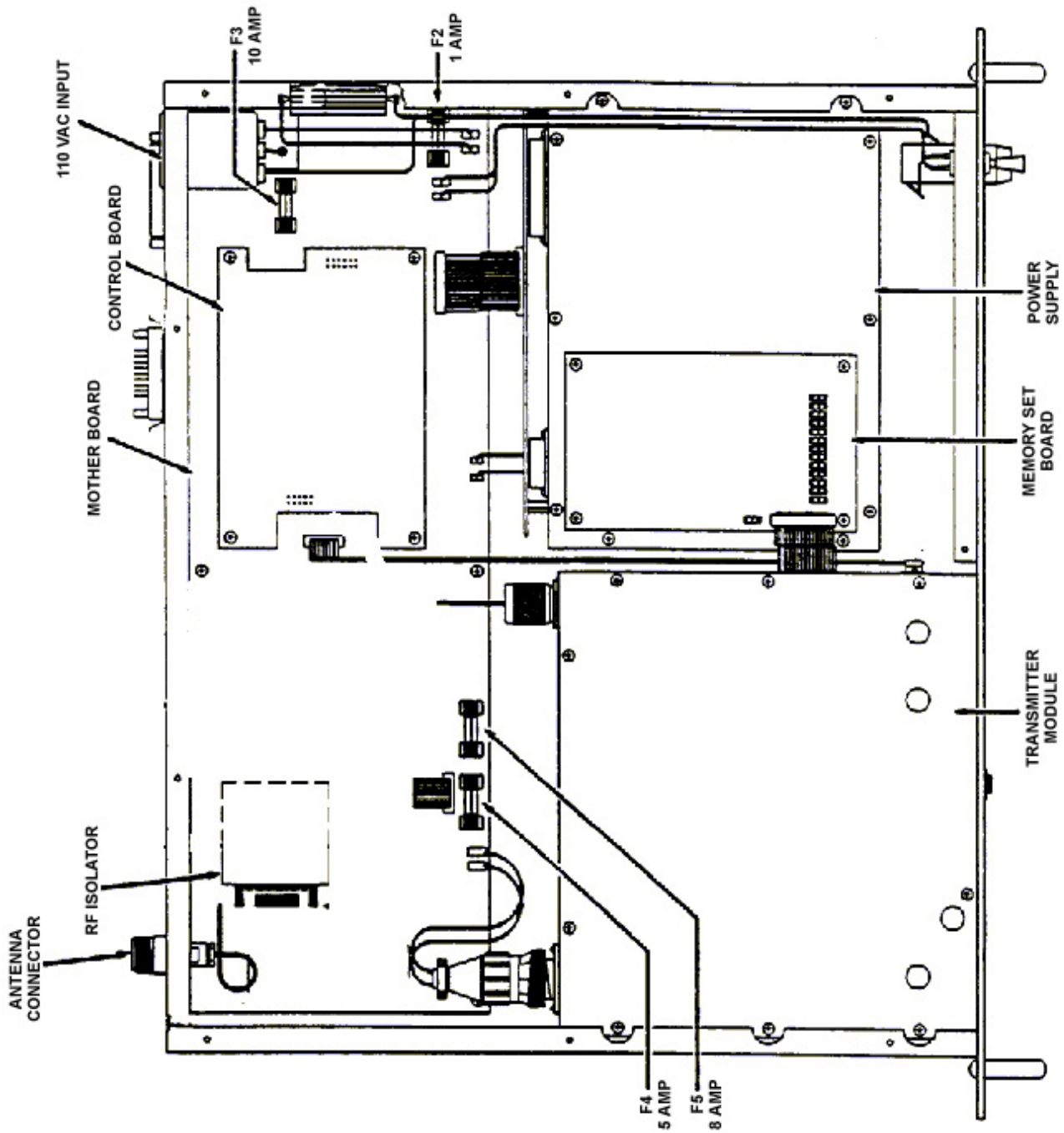


Figure 3. Model 1791 Internal View

TABLE 1 FREQUENCY SELECTION MHz						
OPERATING FREQUENCY (MHz)	JUMPER LOCATION					
	20 MHz	10 MHz	8 MHz	4 MHz	2 MHz	1 MHz
117	0	1	0	1	1	1
118	0	1	1	0	0	0
119	0	1	1	0	0	1
120	1	0	0	0	0	0
121	1	0	0	0	0	1
122	1	0	0	0	1	0
123	1	0	0	0	1	1
124	1	0	0	1	0	0
125	1	0	0	1	0	1
126	1	0	0	1	1	0
127	1	0	0	1	1	1
128	1	0	1	0	0	0
129	1	0	1	0	0	1
130	1	1	0	0	0	0
131	1	1	0	0	0	1
132	1	1	0	0	1	0
133	1	1	0	0	1	1
134	1	1	0	1	0	0
135	1	1	0	1	0	1
136	1	1	0	1	1	0
137	1	1	0	1	1	1
138	1	1	1	0	0	0

TABLE 2 FREQUENCY SELECTION KHz						
OPERATING FREQUENCY (KHz)	JUMPER LOCATION					
	800 KHz	400 KHz	200 KHz	100 KHz	50 KHz	25 KHz
000	0	0	0	0	0	0
025	0	0	0	0	0	1
050	0	0	0	0	1	0
075	0	0	0	0	1	1
100	0	0	0	1	0	0
125	0	0	0	1	0	1
150	0	0	0	1	1	0
175	0	0	0	1	1	1
200	0	0	1	0	0	0
225	0	0	1	0	0	1
250	0	0	1	0	1	0
275	0	0	1	0	1	1
300	0	0	1	1	0	0
325	0	0	1	1	0	1
350	0	0	1	1	1	0
375	0	0	1	1	1	1
400	0	1	0	0	0	0
425	0	1	0	0	0	1
450	0	1	0	0	1	0
475	0	1	0	0	1	1
500	0	1	0	1	0	0
525	0	1	0	1	0	1
550	0	1	0	1	1	0
575	0	1	0	1	1	1
600	0	1	1	0	0	0
625	0	1	1	0	0	1
650	0	1	1	0	1	0
675	0	1	1	0	1	1
700	0	1	1	1	0	0
725	0	1	1	1	0	1
750	0	1	1	1	1	0
775	0	1	1	1	1	1
800	1	0	0	0	0	0
825	1	0	0	0	0	1
850	1	0	0	0	1	0
875	1	0	0	0	1	1
900	1	0	0	1	0	0
925	1	0	0	1	0	1
950	1	0	0	1	1	0
975	1	0	0	1	1	1

OPERATION

A view of the front and rear panel is given in Figure 4. A functional description of each of the operator's switches, controls and indicators, Operator's Switches, Controls and Indicators is provided in Table 3.

OPERATING INSTRUCTIONS

- 1** Ensure that the signal and antenna cables are connected.
- 2** Set the Tx AUDIO switch to the desired High, Low, or OFF position.
- 3** Set the POWER ON/OFF switch to "ON".
- 4** Verify that the POWER ON green LED is ON.
- 5** Verify that the AWOS station voice message is being transmitted.
- 6** Ensure that the Tx ON amber LED cycles ON during voice message output.
- 7** Verify that the Tx ON amber LED cycles OFF between voice message broadcasts.

Switching OFF

To switch off the transmitter:

- 1** Set the POWER ON/OFF on transmitter to switch to OFF.
- 2** Verify that all indicator LED's on the front panel are OFF.

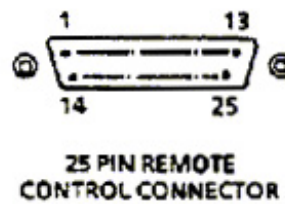
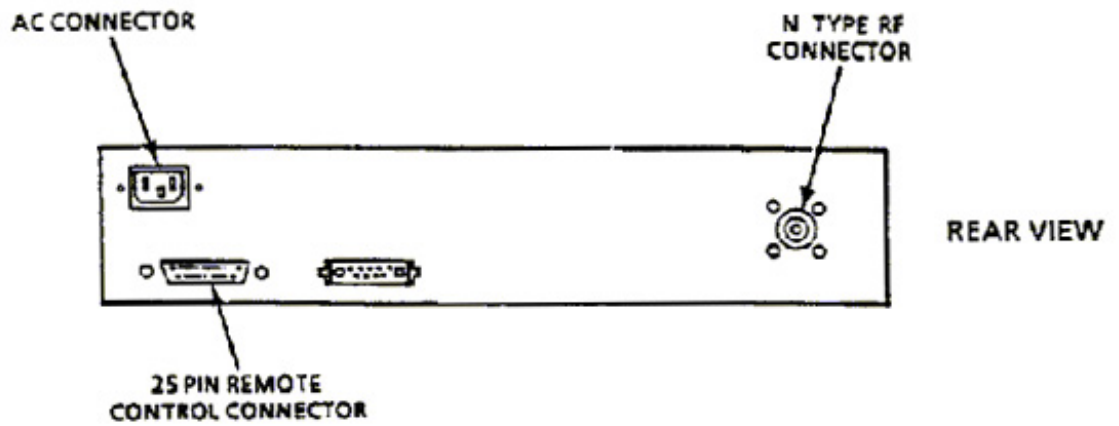
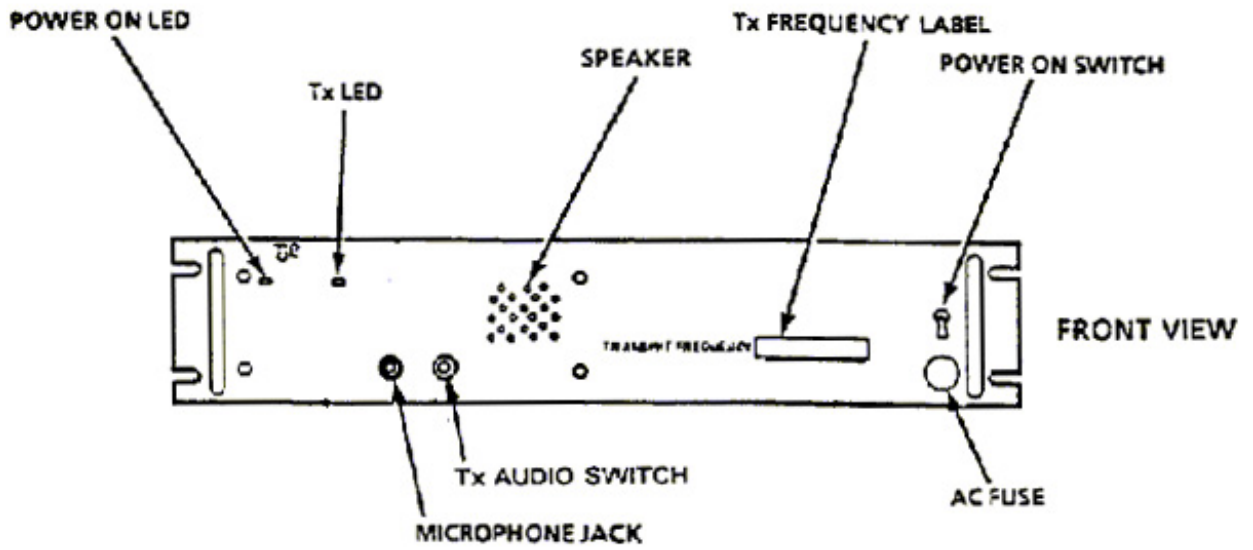


Figure 4. Single Channel Transmitter Controls and Indicators

TABLE 3 OPERATOR'S SWITCHES, CONTROLS AND INDICATORS		
Item No.	SWITCHES CONTROLS & INDICATORS	FUNCTIONAL DESCRIPTION
1	POWER ON/OFF SWITCH	A toggle switch applies the AC power to the power supply and the DC 27.5 or 13.7 VDC nominal power to the transmitter. The transmitter is switched to ON in the toggle UP position the transmitter is switched OFF in the toggle DOWN position.
2	POWER ON LED INDICATOR	A GREEN LED Indicates when the POWER ON/OFF switch is set to ON and voltage is applied to the transmitter.
3	Tx AMBER LED INDICATOR	An AMBER LED indicates when the transmitter is keyed by the microphone PRESS-TO-TALK (PTT) switch or remote land line, and the transmitter is in the Tx mode. The Tx ON AMBER LED switches OFF, when the transmitter is in the stand-by mode.
4	Tx AUDIO SWITCH	A three position high-off-low switch is provided to control the speaker's output level.
5	MICROPHONE JACK	Not Used
6	Tx FREQUENCY LABEL	Indicates the frequency programmed for transmit.
7	SPEAKER	An 8-ohm internal speaker reproduces the Tx audio input, for maintenance.
8	AC FUSE	A 2.5 Amp fuse protects the power supply from power supply internal short circuit or transceiver short circuit.
9	* "N" TYPE RF CONNECTOR	A 50 ohm coaxial connector provides connection to external antenna. A BNC adapter is included for connection to RG-58 cable.
10	*AC POWER CONNECTOR	3 Prong AC Connector for use with AC Power Cord P/N 927002-1.
11	*9 PIN REMOTE CONTROL CONNECTOR	Not Used
12	*25 PIN REMOTE CONTROL CONNECTOR	25 Pin "D" type connector provides signal cable connection.

* Denotes items located on rear panel.

MAINTENANCE

The Model 1791 VHF Radio requires no maintenance, other than the recommended periodic checks outlined below. If transmission problems should arise, perform the alignment procedures described in the *Calibration* section below. If the problem persists, contact All Weather Inc. Customer Service.

TRANSMITTER ADJUSTMENTS AND SETTINGS

The locations at which certain transmitter settings and adjustments can be performed are shown in Figure 5. The top dust cover of the transmitter must be removed as described on page 3 to access the Modulation setting. The plastic plug must be removed prior to adjustment of the power output potentiometer, which is accessed from the bottom of the transmitter chassis. Perform an operational check of the transmitter after all adjustments. If alignment procedures for these settings are required, please consult All Weather Inc.

PERIODIC MAINTENANCE

Periodic maintenance of the Model 1791 is divided into three categories within the maintenance cycle: monthly, quarterly, and annual maintenance procedures.

Equipment Required

Equipment required for periodic maintenance of the Model 1791 consists of:

- Bird 43 Power Meter w/elements
- 0-500 MHz Frequency Meter
- CT Systems 4101 Modulation Meter
- 50Ω, 10W min. dummy load

Monthly Maintenance

Check the cabling for integrity. Verify the voice output. Verify the Transmit LED illuminates when voice output is activated.

Quarterly Maintenance

Quarterly maintenance of the Model 1791 is identical to that specified in the monthly maintenance procedure above.

Annual Maintenance

Before performing the annual maintenance tasks described below, perform the procedures outlined above for monthly and quarterly maintenance.

When performing the following procedures, you will be instructed in several places to record measurements on the appropriate data sheet. With AWOS installations, use the data sheet provided in the AWOS System Maintenance Manual. Otherwise use the data sheet at the back of this manual.

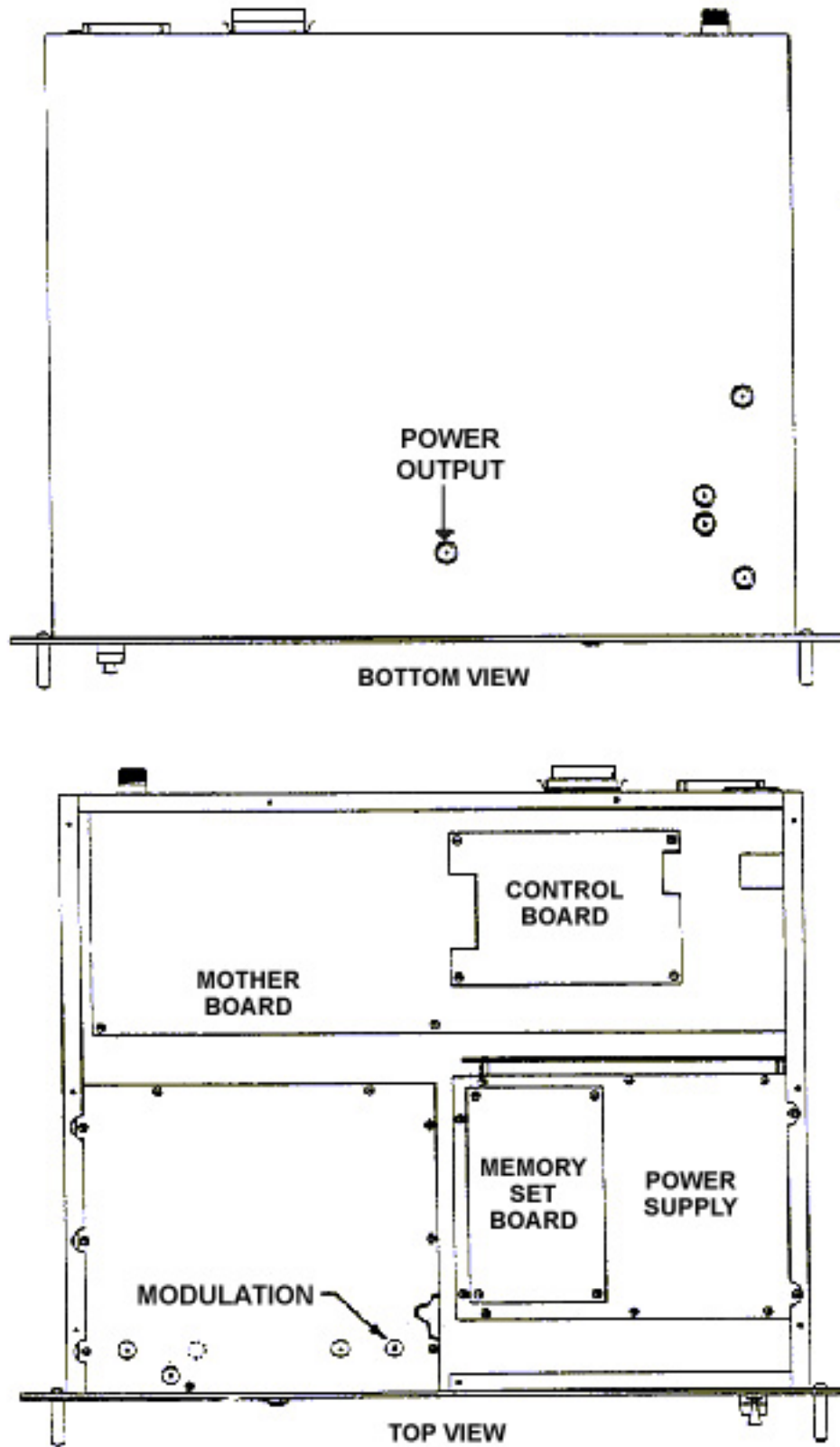


Figure 5. Power and Modulation Adjustment Controls

Power Level

Remove AC power from the radio. Connect the power meter with the provided cable between the connector on the enclosure and the cable to the antenna. Place the 10 watt 100-250 MHz frequency element in the power meter. Adjust to 5W, ± 1 W. Indicate on the data sheet the VHF radio output power level.

VSWR (At Transmitter)

Replace the power element with a 1 watt 110-160 MHz frequency element with the arrow in the direction of the radio. (**NOTE: Damage will occur to the element if the arrow is in the direction of the antenna.**) Measure the reflected power. Enter the value on the data sheet. Calculate the VSWR from Figure 6 and enter the value on the data sheet.

Frequency

Replace the power element with the RF sampler element. Connect an RG-58 coaxial cable (or RG-8 for runs longer than 50 feet) from the sampler to the frequency meter. Set the frequency meter to "500" MHz range, "fast" gate, and "batt" power. Measure and log the frequency on the data sheet. Log the assigned frequency on the data sheet. **NOTE:** The radio transmits for approximately 30 seconds followed with an off time of five seconds.

Modulation

Replace the frequency meter with the modulation meter. Connect the coaxial cable to the RF input on the modulation meter. Set the modulation meter switches to:

Function	AM +
Range	100%
Filter	25-15 KHz
De-emphasis	Off
Power	On

Enter the meter reading on the data form.

$$VSWR = \frac{1 + \sqrt{\frac{\text{reflected power}}{\text{forward power}}}}{1 - \sqrt{\frac{\text{reflected power}}{\text{forward power}}}}$$

Sample Calculation:

Reflected power = .02

Forward power = 5W

$$\begin{aligned} \frac{1 + \sqrt{\frac{\text{reflected power}}{\text{forward power}}}}{1 - \sqrt{\frac{\text{reflected power}}{\text{forward power}}}} &= \frac{1 + \sqrt{\frac{.02}{5}}}{1 - \sqrt{\frac{.02}{5}}} = \frac{1 + \sqrt{.004}}{1 - \sqrt{.004}} = \\ &= \frac{1 + .063}{1 - .063} = \frac{1.063}{.937} = 1.134 \text{ VSWR} \\ \frac{1 + \sqrt{\frac{\text{reflected power}}{\text{forward power}}}}{1 - \sqrt{\frac{\text{reflected power}}{\text{forward power}}}} &= \frac{1 + \sqrt{\frac{.02}{5}}}{1 - \sqrt{\frac{.02}{5}}} = \frac{1 + \sqrt{.004}}{1 - \sqrt{.004}} = \\ &= \frac{1 + .063}{1 - .063} = \frac{1.063}{.937} = 1.134 \text{ VSWR} \end{aligned}$$

Figure 6. VSWR Calculation

Transmission Line Loss

Remove power from the VHF radio. Disconnect the coaxial cable from the antenna input connector. Connect the power meter (with a 10 W, 100-250 MHz frequency element installed) pointing away from the transmitter. Connect a 50 Ohm, 5 W dummy load to the output of the meter. Energize the transmitter, read and record the forward power of the antenna. Repeat this procedure at the transmitter end of the coaxial cable with the dummy load still connected at the antenna end. Compute the line loss as follows and record on the data form:

$$dB(\text{Loss}) = 10 \log \frac{P(\text{transmitter end})}{P(\text{antenna end})}$$

FUSE REPLACEMENT

A 2.5 Amp AC supply fuse is located on the front panel of the Model 1791. Check this fuse first if the radio should fail, and replace as necessary with an appropriately rated replacement.

CALIBRATION

The following procedures are performed at the factory prior to shipment, and should not need to be performed by the user prior to installation. Calibration may be required after the unit has been in use. When calibrating the 1791, output power and modulation level should be set and checked carefully. The following equipment is needed for these adjustments:

- Digital voltmeter
- Watt meter
- 50 ohm RF load
- Frequency counter
- Modulation meter
- Various coaxial cables, RF adapters, etc.

POWER OUTPUT AND MODULATION LEVEL ADJUSTMENT

- 1** Connect the watt meter to the radio's RF output and the modulation meter to the output of the 50 ohm RF load.
- 2** Turn the Power Level potentiometer (see Figure 5) until the output power reads 5 watts. If audible static is present, reduce the signal level at the Peripheral Interface as explained below.
- 3** Turn the Modulation Level potentiometer (see Figure 5) until the modulation meter displays the desired value.

VOICE OUTPUT STATIC REDUCTION

The Model 1791 VHF Radio is pre-adjusted for use with the 900 series AWOS to minimize audible static on the voice transmission. Should additional adjustment be required, proceed as follows:

- 1** Reduce the VHF voice output signal at the Peripheral Interface by adjusting trim potentiometer R29 until the desired reduction in static is achieved.
- 2** Reducing the output signal will also decrease the modulation level. Increase the modulation level by adjusting the radio's Modulation Level potentiometer (see Figure 5).

WARRANTY

Unless specified otherwise, All Weather Inc. (the Company) warrants its products to be free from defects in material and workmanship under normal use and service for one year from date of shipment, subject to the following conditions:

- (a) The obligation of the Company under this warranty is limited to repairing or replacing items or parts which have been returned to the Company and which upon examination are disclosed, to the Company's satisfaction, to have been defective in material or workmanship at time of manufacture.
- (b) The claimant shall pay the cost of shipping any part or instrument to the Company. If the Company determines the part to be defective in material or workmanship, the Company shall prepay the cost of shipping the repaired instrument to the claimant. Under no circumstances will the Company reimburse claimant for cost incurred in removing and/or reinstalling replacement parts.
- (c) This warranty shall not apply to any Company products which have been subjected to misuse, negligence or accident.
- (d) This warranty and the Company's obligation thereunder is in lieu of all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, consequential damages and all other obligations or liabilities.

No other person or organization is authorized to give any other warranty or to assume any additional obligation on the Company's behalf, unless made in writing and signed by an authorized officer of the Company.

ANNUAL MAINTENANCE DATA SHEET

Parameter	Measured Value (A)	Standard Value (B)	Acceptable Tolerance (A-B)
Radio Power (At Xmtr)		2.5 W	±1.0 W
Reflected Power			
VSWR		1.0:1	3.0:1
Frequency			±1.0 kHz
Modulation		80%	65-95%
Transmission Line Loss		2.2 dB/50 ft. max.	3.2 dB/50 ft. max.



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