INSTRUCTION MANUAL

MODEL 1500C RECEIVER

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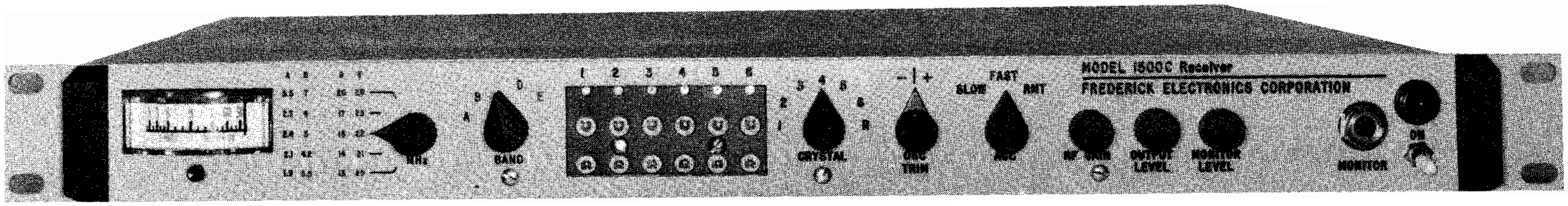


Figure 1-1. Model 1500C Receiver

SECTION I

INTRODUCTION

1.1 PURPOSE OF EQUIPMENT

The Frederick Electronics Corporation (FEC) Model 1500C Receiver provides optimum reception of FSK (F1) signals in the range of 10 kHz to 29 MHz. The Receiver is crystal-controlled and designed for use with an external FSK Demodulator such as the FEC Model 1200. When used with the Model 1200, the Receiver accepts AGC information from the Demodulator and maintains an ideal environment for the Demodulator's Detectors and patented Decision Threshold Computer.

The Receiver preselects the desired signal at its antenna input circuit, converts this signal to a 9 MHz IF and then to an audio frequency signal. Separate amplifier stages change the audio signal into a form suitable for driving both an external demodulator and a monitoring device. The output to the demodulator is rated at a nominal level of 0 dbm; the monitoring output is rated at approximately 1/4 watt into a 16-ohm load.

The Receiver utilizes highly selective filter circuits, a low-noise beam deflection mixer, and a product detector to reduce the effects of cross modulation to a level substantially below that of conventional communications receivers.

Frequency tuning of the Receiver is accomplished by selecting different crystals which are plugged into sockets on the front panel. As many as six crystals can be plugged in at any one time. An optional frequency synthesizer further simplifies tuning by providing crystal control on any frequency within the Receiver's range. In this case, frequency selection is effected by dialing the desired frequency.

A built-in noise generator allows the operator to peak the Receiver for optimum sensitivity at the tuned frequency.

1.2 PHYSICAL DESCRIPTION

The Model 1500C Receiver contains plug-in IF, Audio/AGC, and Power supply printed circuit boards and fixed Preselector, Mixer, and Local Oscillator printed circuit boards. Front Panel items include an S-meter, six crystal sockets and associated trim capacitors, a headphone jack, and various controls and switches. The Receiver is conveniently packaged for mounting in a standard 19-inch equipment rack. The unit requires a rack space of 1-3/4 inches and weighs approximately 10 pounds.

1.3 SPECIFICATIONS

Specifications for the Receiver are shown in Table 1-1.

Table 1-1. Specifications, Model 1500C

ANTENNA INPUT	Nominal 50 ohms, unbalanced.
NOISE GENERATOR	Approximately 1 microvolt in the standard 2.1 kHz bandwidth over range of Receiver (injected at antenna terminal).
SENSITIVITY	The Receiver requires the following carrier levels for a 10 db $\frac{S+N}{N}$:

Frequency	Level
1.7-3.5 MHz	0.3 uV
3.5-7 MHz	0.3 uV
7-13 MHz	0.4 uV
13-20 MHz	0.5 uV
20-29 MHz	0.6 uV
10-550 kHz	0.6 uV

*FREQUENCY RANGE	10 kHz to 550 kHz and 1.7 MHz to 29 MHz in 6 bands.
**FSK SELECTIVITY (F1)	1.0 kHz minimum 6 db bandwidth.
IMAGE RESPONSE	Minimum of 50 db down.
ADJACENT CHANNEL INTERFERENCE THRESHOLD	60 db at 10 kHz from center frequency. 100 db at 50 kHz from center frequency.
INTERMEDIATE FREQUENCY	9 MHz.
AUTOMATIC GAIN CONTROL	Internal: Fast or slow release. External: Slow release.
RECEIVER OUTPUT	600 ohms, variable for a nominal 0 dbm.
MONITOR OUTPUTS	Speaker or headphones: 16 ohms, 1/4 watt.
POWER REQUIREMENTS	115/230 vac, 47 to 63 Hz, 20 watts nominal. (Internal switch change needed for 230 volt operation.)

Table 1-1. (cont.)

TEMPERATURE RANGE	0^{o} to 50^{o} C.
DIMENSIONS.	Depth: 17 inches Width: 19 inches Height: 1-3/4 inches

*Since the Receiver IF is within the operating range (9 MHz), signals may not be received within this IF channel. Reception in the 13.5 and 18.0 MHz channels is possible only with special crystals at 22.5 and 27 MHz, respectively. Reduced sensitivity occurs at several frequencies due to internal spurious outputs generated by the Local Oscillator and BFO. These frequencies are listed in Table 3-3 of this manual.

**Selectivity is determined by crystal filter/audio filter. Center frequency for FSK reception (F1) of passband is determined by BFO crystal frequency. The Receiver is available in a range of selectivities and center frequencies as requested by the customer. It is not recommended that field modifications be attempted for the purpose of varying the specifications.

SECTION II

INSTALLATION

2.1 UNPACKING AND INSPECTION

Carefully unpack and remove the Model 1500C from its shipping container. Inspect the unit for damage. If any damage is found, file a written claim with the shipping agency. Send a copy of this claim to Frederick Electronics Corporation.

2.2 POWER REQUIREMENTS

The Receiver is shipped ready to operate directly on 105-130 volt, 47-63 Hz ac current. Power is applied to the Receiver by plugging its power cord into an ac outlet. Provision is made for operation from a 230-volt source by repositioning switch S1 located on power supply board N0724 in the Model 1500C.

CAUTION

Switch must be in correct position before the Receiver can operate on 230 volts. Serious damage will result if the Receiver is connected to 230 volts without this change.

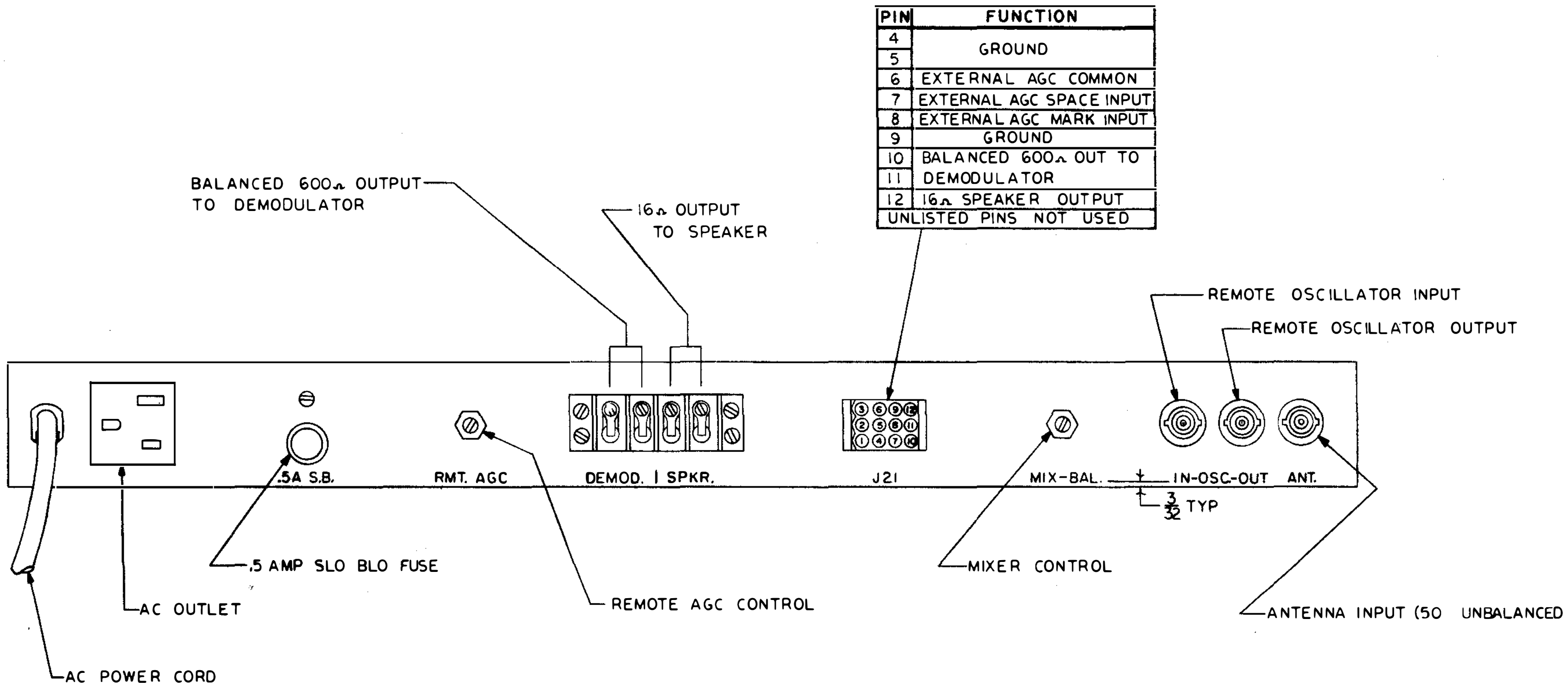
2.3 MOUNTING

The Receiver is designed to mount in a standard 19-inch equipment rack. A vertical rack space of 1-3/4 inches is required.

2.4 REAR PANEL CONNECTIONS (Refer to Figure 2-1.)

2.4.1 ANTENNA

The RF signal input circuit to the Receiver is designed to operate from any antenna having a transmission line impedance of 50 ohms, unbalanced. Antenna connections are made to a BNC connector located at the rear of the Receiver. Detailed information on the subject of antennas and transmission lines is found in the Radio Amateur's Handbook and the A.R.R.L. Antenna Book, both published by the American Radio Relay League, Newington, Connecticut, U.S.A.



PIN	FUNCTION
4	GROUND
5	
6	EXTERNAL AGC COMMON
7	EXTERNAL AGC SPACE INPUT
8	EXTERNAL AGC MARK INPUT
9	GROUND
10	BALANCED 600Ω OUT TO DEMODULATOR
11	
12	16Ω SPEAKER OUTPUT
UNLISTED PINS NOT USED	

NOTES

1. STENCIL APPROXIMATELY AS SHOWN ⅛ HIGH.

Figure 2-1. Rear Panel Connections

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2.4.2 SPEAKER

Two outputs for driving external permanent magnet speakers are provided at the rear of the Receiver. One output is at terminals 1 and 2 (ground) of TB1. The other output is at pins 9 (ground) and 12 of J1. This latter output is convenient when a single plug is used to interconnect the Receiver and Demodulator. Speaker voice coil impedances can be almost any standard value, although maximum efficiency will be obtained with 16-ohm impedances.

2.4.3 HEADPHONES

A headphone jack labeled MONITOR is located on the Receiver front panel. This jack is wired so that the speaker or speakers are disconnected when headphones are plugged in. Headphone impedance is not critical, and any commercial headphone should function satisfactorily.

2.4.4 DEMODULATOR

Two outputs are also provided for driving an associated Demodulator. Both provide a 0 dbm, 600 ohm balanced output. One output is at terminals 3 and 4 of TB1; the other output is at pins 10 and 11 of J21.

2.4.5 REMOTE AGC

Remote AGC signals are accepted at pins 6, 7, and 8 of J21. The remote circuitry is specifically designed to operate with an FEC Model 1200 FSK Demodulator.

2.4.6 REMOTE LOCAL OSCILLATOR

The remote local oscillator input and output connections are provided through a pair of BNC connectors. The remote input is specifically designed for use with an FEC Model 1550 Synthesizer unit but will operate from a 50 ohm signal source which provides a 1 vpp input.

SECTION III

OPERATION

3.1 GENERAL

This section contains complete operating instructions for the Receiver. It includes a tabular list of each control and indicator (Table 3-1), information on the use of the controls and indicators, procedures for tuning the Receiver, and special instructions for operating the Receiver with an FEC Model 1200 FSK Demodulator.

Table 3-1. Controls and Indicators

Power ON switch	Controls ac power to Receiver.
Power ON lamp	Lights to indicate that power is applied to equipment.
MONITOR jack.	Provides headphone reception of received signal.
MONITOR LEVEL control	Adjusts audio level at speaker terminals and MONITOR jack.
OUTPUT LEVEL control.	Adjusts audio level to external Demodulator.
RF GAIN control	Varies gain of mixer and IF stages by setting the AGC threshold.
AGC SLOW FAST RMT switch. . . .	<u>SLOW position</u>: Selects internal AGC with slow release time constant for FSK operation. <u>FAST position</u>: Selects internal AGC with fast release time constant for FSK operation. <u>RMT position</u>: Selects external AGC input and slow release time constant for FSK operation.
OSC TRIM -/+ control.	Permits crystal frequency to be "pulled" slightly to either side of channel for fine tuning adjustments.

CRYSTAL switch	Positions 1 thru 6: Select any one of six front panel crystal sockets. R position: Selects a remote oscillator input to determine Receiver operating frequency. NOTE This input is normally used with an FEC Model 1550 Synthesizer.
CRYSTAL sockets	Six standard HC6/U crystal sockets that accept any parallel-resonant crystal in range of Receiver.
BAND switch	Selects frequency range of Receiver tuning. A (black) position: 1.7 to 3.5 MHz B (green) position: 3.5 to 7 MHz C (yellow) position: 7 to 13 MHz D (red) position: 13 to 20 MHz E (blue) position: 20 to 29 MHz L (white) position: 10 kHz to 550 kHz
MHz (Preselector) control	Used in conjunction with BAND switch to peak preselector tuning. Has approximate frequency settings within each selected band. Frequency settings are color-coded to agree with BAND switch positions. (This control is not used on low frequency band L.)
S-UNITS meter	Indicates accuracy of tuning and relative strength of received signals. Meter is calibrated in S-units from 1 to 9, and in decibels above S9 (0 to +90 db).
Noise pushbutton switch (below S-UNIT meter)	Activates noise generator and allows Receiver to be peaked for optimum reception.
RMT. A.G.C. control (rear panel)	Adjusts remote AGC gain.
MIX-BAL. control (rear panel)	Adjusts mixer balance. This is a maintenance adjustment and must not be attempted by the operator.

3.2 USE OF CONTROLS

3.2.1 BAND SELECTOR SWITCH

The BAND selector switch permits the operator to cover the six different frequency ranges of the Receiver. This switch is used in conjunction with the MHz preselector control to tune the Receiver to a specific frequency. (There is no preselector control setting for the L band.) Each band of the selector switch is identified by a different-colored letter of the alphabet (A thru E and L). Settings of the MHz control are color-coded to agree with the band selected. In this manner, the operator immediately knows the band he has selected and the approximate frequency setting within that band.

If the desired frequency coincides with the dividing point between bands, always choose the band which produces the higher S-meter reading.

3.2.2 MHz CONTROL

The MHz control is a variable tuning control that peaks the preselector tuning. After a particular band is selected by the BAND switch, the MHz control is adjusted to the approximate frequency being used. This control is inoperative on the L band. Frequency settings indicated on the control are not intended to pinpoint the exact operating frequency, but they will narrow down the tuning until the operator can zero-in on the desired frequency. The S-meter is a valuable aid in peaking the MHz control.

3.2.3 S-METER

The S-meter provides a visual means of determining when the MHz preselector control is properly tuned, as well as an indication of relative signal strength. To the experienced operator, the S-meter can provide valuable information about receiving conditions.

The S-meter is calibrated in S-units from 1 to 9, and in decibels above S9 to +90 db. Readings on the S-meter will be correct only when the RF GAIN control is at maximum sensitivity (fully clockwise).

3.2.4 NOISE SWITCH

The noise pushbutton switch (located below the S-meter) activates a noise generator which permits the Receiver to be peaked at the preselector for optimum reception. No signal other than the noise signal is necessary for this adjustment. After the MHz preselector is set to the approximate frequency desired, the noise pushbutton should be depressed and held while the MHz control is adjusted for maximum reading on the S-meter.

NOTE

> If care is not taken, the preselector may be peaked at an image frequency. To avoid this condition, make sure that the MHz preselector control is set to the desired frequency.

The noise generator signal may be used for emergency alignment of the Receiver when no other signal source is available. In addition, the noise generator provides a test for Receiver operation, since failures (including local oscillator failure) will result in no noise output when the pushbutton is depressed.

3.2.5 RF GAIN CONTROL

The RF GAIN control varies the gain of the mixer and IF amplifier stages by setting a fixed threshold in the AGC circuits. Maximum gain is obtained with the control rotated fully clockwise.

3.2.6 CRYSTAL SELECTOR SWITCH

The CRYSTAL selector switch is a seven-position switch that permits the operator to choose the exact frequency of operation. Associated with the numbered positions of this switch are correspondingly numbered crystal sockets and trim capacitors. To change frequency, the operator first inserts the proper crystal into any empty socket. Second, the operator must tune in the signal and adjust the crystal trim capacitor (located directly above the crystal socket) for a maximum reading on the S-meter. (See paragraph 3.3.) The R position of this switch enables the Receiver to accept the input from an external synthesizer.

3.2.7 CRYSTAL FREQUENCY

The local oscillator crystal frequency is determined by the band selected. Table 3-2 shows the relationship of the received signal to the local oscillator frequency. The crystal frequency is 9 MHz above the carrier frequency on bands A, B, C, and L and 9 MHz below the carrier on bands D and E.

Table 3-2. Signal Frequency vs. Crystal Frequency

BAND	FREQUENCY RANGE	CRYSTAL RANGE MHz
A	1.7 MHz - 3.5 MHz	10.7 - 12.5
B	3.5 MHz - 7 MHz	12.5 - 16
C	7 MHz - 13 MHz (excluding 9 MHz IF Channel)	16 - 22
D	13 MHz - 20 MHz	4 - 11
E	20 MHz - 29 MHz	11 - 20
L	10 kHz - 550 kHz	9.010 - 9.550

Table 3-3 lists certain frequencies that cannot be received by the Model 1500C because of spurious interference. Crystals used should meet the following specifications:

Crystal Specifications

Mode of oscillation: 4,000-22,000 kHz, AT cut
Shunt capacitance: 7 Pf (maximum)
Resistance: 75 to 25 ohms
Maximum drive: 10 milliwatts (4,000-9,999 kHz)
4 milliwatts (10,000-22,000 kHz)
Load capacity: 32 Pf
Temperature Tolerance: -10° to +60° C within 0.0005%
Holder: HC6/U

3.2.8 OSC TRIM CONTROL

The OSC TRIM control permits the frequency of the crystal local oscillator to be varied slightly around its center frequency for optimum tuning of the received signal. (Recall that each crystal is trimmed individually when it is initially installed and the OSC TRIM control is centered for this adjustment.) In general, the amount of variation possible is proportional to the frequency of the crystal selected. Normally, the Receiver is tuned with the OSC TRIM control set to its center position (indicated by a vertical line). The OSC TRIM control is then used to optimize the input signal by rubbering the IF frequency slightly.

Extreme accuracy in the FSK mode can only be obtained with the aid of the tuning indicator associated with the external De-

Table 3-3. INTERNAL SPURIOUS FREQUENCIES

OPERATING FREQUENCY KHz	BAND	*LOCAL OSCILLATOR FREQUENCY KHz	BFO FREQUENCY KHz	LOWEST ORDER SPURIOUS PRODUCT EQUAL TO IF	CARRIER LEVEL (uV) FOR 10db $\frac{S+N}{N}$ ADJACENT FREQUENCIES MAXIMUM	TYPICAL	SPURIOUS FREQUENCY TYPICAL
3,002.5	A	12,002.5	9,002.5	3LO-3BFO	0.3	0.2	2.0
3,603.0	B	12,603.0	9,002.5	5LO-6BFO	0.3	0.2	2.0
5,403.5	B	14,403.5	9,002.5	5LO-7BFO	0.3	0.2	6.0
6,003.3	B	15,003.3	9,002.5	3LO-4BFO	0.3	0.2	30.0
9,002.5	C	18,002.5	9,002.5	LO-BFO	0.4	0.2	Receiver Blocked
11,255.0	C	20,255.0	9,002.5	4LO-8BFO	0.4	0.2	8.0
12,005.0	C	21,005.0	9,002.5	3LO-6BFO	0.4	0.2	300 for 3db $\frac{S+N}{N}$
13,500.0	D	4,500.0	8,997.5	2LO	0.5	0.3	Receiver Blocked
14,999.16	D	5,999.16	8,997.5	3LO-BFO	0.5	0.3	8.0
18,000.0	D	9,000.0	8,997.5	LO	0.5	0.3	Receiver Blocked
20,997.5	E	11,997.5	8,997.5	3LO-3BFO	0.6	0.4	0.5
21,597.0	E	12,597.0	8,997.5	5LO-6BFO	0.6	0.4	2.0
23,396.5	E	14,396.5	8,997.5	5LO-7BFO	0.6	0.4	8.0
23,996.67	E	14,996.67	8,997.5	3LO-4BFO	0.6	0.4	2.0
25,196.0	E	16,196.0	8,997.5	5LO-8BFO	0.6	0.4	4.0
26,997.5	E	17,997.5	8,997.5	LO-BFO	0.6	0.4	30.0
29,245.0	E	20,245.0	8,997.5	4LO-8BFO	0.6	0.4	6.0

*NOTE: If the local oscillator internal crystal frequency is a subharmonic of an indicated lowest order frequency, particularly if a 4-7 MHz crystal third harmonic is coincident with a spurious generating lowest order frequency slight degradation in the $\frac{S+N}{N}$ can occur as some spurious output may be generated and appear as a small increase in the noise level.

modulator. For example, if a Model 1200 FSK Demodulator is being used, the OSC TRIM control is rotated + and - from the vertical line until the Demodulator's tuning meter reads maximum. The Model 1200 instruction manual explains this tuning procedure in more detail.

3.2.9 AGC SWITCH

The AGC switch is used to select either an internally generated automatic gain control signal or externally generated signal from which AGC signals are derived. In either case, the gain of the Receiver is automatically regulated in inverse proportion to the strength of the received audio signal. The overall result is that the output level of the Receiver tends to remain constant regardless of variations in input signal strength.

The SLOW position of the AGC switch provides a fast attack and a slow release time constant for the reception of FSK signals. Slow AGC is desirable for normal receiving conditions, since it inserts just enough delay to suppress noise buildup during momentary absences of either the mark or space tone.

The FAST position of the AGC switch provides a fast attack and fast release time constant. Fast AGC is more beneficial when receiving conditions include rapid signal fades. One objectionable feature of fast AGC is that noise buildup can occasionally become excessive. This is because the Receiver recovers rapidly and allows noise to appear in the output.

The RMT position of the AGC switch selects mark and space input signals from an external Demodulator such as the FEC Model 1200. An AGC control voltage is then derived from these external signals.

3.2.10 OUTPUT LEVEL CONTROL

The OUTPUT LEVEL control adjusts the level of the audio output. Maximum output is obtained with the control rotated fully clockwise.

3.2.11 MONITOR LEVEL

The MONITOR LEVEL control adjusts the level of the audio amplifier feeding the headphone jack and external speaker terminals. Maximum output is obtained with the control rotated fully clockwise.

3.3 OPERATING THE RECEIVER

Before operating the Receiver, make sure that it is properly installed as described in Section II of this manual. The Receiver can now be tuned to any frequency within its range by means of the following step-by-step procedures:

1. Insert crystal of proper frequency into any unused socket on front panel. (Refer to paragraph 3.2.7.)
2. Set CRYSTAL switch to match socket number selected above.
3. Set power switch to ON. Pilot lamp will light indicating that Receiver is operative.
4. Rotate RF GAIN control fully clockwise. S-meter needle will drop to zero.
5. Rotate MONITOR LEVEL control clockwise until a low volume hiss is heard from speaker or headphones.
6. Set AGC switch to SLOW.
7. Rotate OSC TRIM control to center line.
8. Set BAND switch to band containing desired frequency.
9. Rotate MHz preselector control to number approximating desired frequency. Tune to signal by rotating MHz control for maximum reading on S-meter. With a small screwdriver adjust crystal trim capacitor for a maximum reading on S-meter. After crystal trimmer is adjusted once for a given frequency the Receiver can be returned to the correct frequency by centering the OSC TRIM control, selecting the crystal, and rotating the MHz control for a maximum reading on the S-meter.

NOTE

Avoid peaking Receiver at an image frequency by making sure that the MHz control is set to the scale reading corresponding to the desired frequency. Although it will be necessary to rock the MHz control back and forth around the indicated frequency, the final scale setting will always be fairly close to the desired frequency.

10. With a strong signal present on the frequency just tuned, rotate OUTPUT LEVEL control clockwise until Receiver provides a zero dbm signal into 600-ohm line of external Demodulator. The Demodulator should have some type of level meter to indicate zero dbm. When this point is reached, the Demodulator's level control can be used to control its gain.

11. Adjust OSC TRIM control for a maximum reading on Demodulator tuning meter. (See paragraph 3.2.8.) After this adjustment is made the Receiver is properly tuned.

SECTION IV

THEORY OF OPERATION

4.1 FUNCTIONAL DESCRIPTION

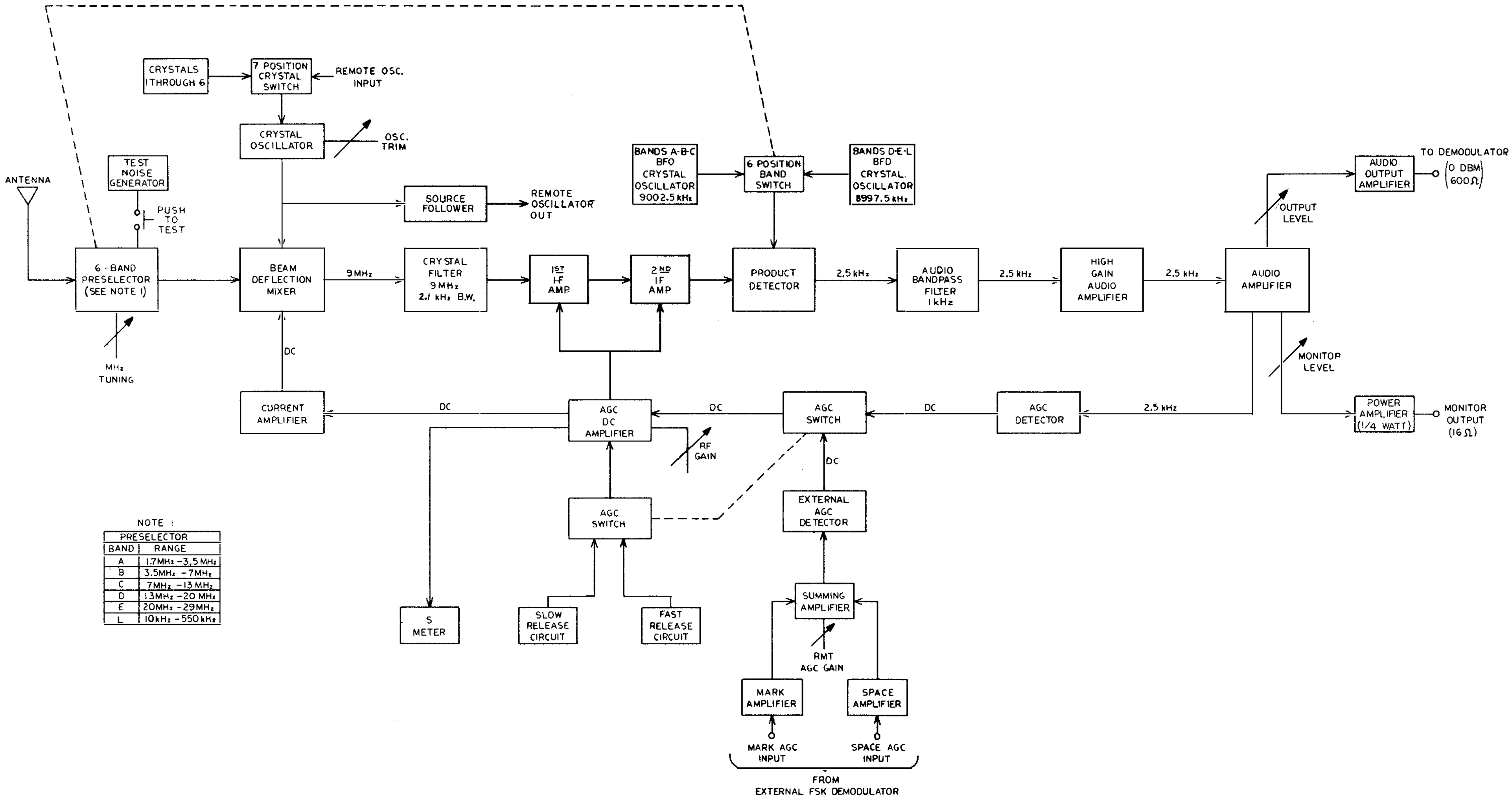
A functional block diagram of the Model 1500C Receiver is shown in Figure 4-1. Frequency shift keying (FSK) in the range of 10 kHz to 550 kHz and 1.7 MHz to 29 MHz is routed from the antenna to the appropriate section of a 6-band preselector. The preselector is fixed-tuned on the 10 kHz to 550 kHz band, and tunable on all other bands. A built-in noise generator allows the operator to peak the preselector in the absence of a signal. Output signals from the preselector are connected to a beam deflection mixer circuit.

The beam deflection mixer circuit combines the preselected signal with a local crystal oscillator signal or an external synthesizer signal to produce a 9 MHz IF signal. Inherent characteristics of the mixer circuit provide a signal output which is low in noise content and virtually free of cross modulation.

Local oscillator crystals are selected so that the difference between the desired input signal and the crystal frequency is nominally 9 MHz. A front panel OSC TRIM control provides fine adjustment of the oscillator frequency. To facilitate Receiver tuning, provision is made at the front panel to accept up to six plug-in crystals for any specified frequency within the 10 kHz to 29 MHz range. Crystals are selected by a front panel rotary switch; an additional switch position permits the output of a remote frequency synthesizer to be selected. FEC produces a Model 1550 Synthesizer Unit that is specifically designed for use with the Receiver. The Synthesizer provides crystal-controlled dialing of any desired frequency within the Receiver's range.

The 9 MHz IF output from the beam deflection mixer circuit is passed through a 6-pole crystal-lattice filter. This filter has a center frequency of 9 MHz, and provides sharp skirt selectivity to produce a 2.1 kHz band-pass. The filter output is amplified by two tuned IF stages and connected to a product detector.

In the FSK mode, the product detector converts the 9 MHz IF signal to a 2.5 kHz audio signal. The BFO injection signal is supplied by one of two crystal oscillators, as determined by the frequency band selected. The resultant 2.5 kHz output from the product detector is routed to a 1 kHz 3-pole band-pass filter.



PRESELECTOR	
BAND	RANGE
A	1.7MHz -3.5 MHz
B	3.5MHz -7MHz
C	7MHz -13 MHz
D	13MHz -20 MHz
E	20MHz - 29MHz
L	10kHz -550 kHz

Figure 4-1. Functional Block Diagram
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The 1 kHz band-pass filter has a center frequency of 2.5 kHz, and provides sharp skirt selectivity to produce an ideal band-pass for FSK signals. A low level audio amplifier provides the signal from the filter to an audio distribution amplifier. This latter amplifier distributes the audio signal to an output amplifier, a monitor amplifier, and an AGC detector.

The audio output amplifier is a push-pull circuit with 600 ohm terminals for matching the input of an external Demodulator. The OUTPUT LEVEL control permits the audio signal to be varied up to a nominal 0 dbm.

The Monitor output amplifier is also a push-pull circuit with 16-ohm terminals for driving an external speaker or headphones. The MONITOR LEVEL control permits the audio signal to be adjusted to a suitable listening level.

The AGC circuits include a detector, fast and slow release circuits, several dc amplifiers, and an external input circuit. The AGC attempts to hold the Receiver output level constant despite changes in input signal strength. The AGC switch permits selection of either an internally generated control voltage with slow or fast release times, or an externally generated signal voltage (with slow release time) from an associated Demodulator. The internal AGC voltage is derived from the 2.5 kHz audio signal; the signal is successively detected, filtered, and amplified to produce an average dc level that reflects the audio amplitude. The resultant average dc level provides negative feedback to the cathode circuits of the beam deflection mixer stages and to both IF amplifier stages. If the signal received at the antenna begins to fade, the generated AGC voltage tends to increase the mixer and IF stage gain and, thus, a constant output from the Receiver is maintained. Similarly, increases in signal strength reduce the gain of both stages to produce the same effect.

The external circuits used to derive the AGC control voltage are designed for operation with an FSK Demodulator such as the Frederick Electronics Model 1200. Mating of the Receiver and the Model 1200 produces an ideal environment for the Detectors and patented Decision Threshold Computer (DTC) in the FSK Demodulator. Mark and space tones from the Demodulator are separately amplified, and the resultant outputs are combined in a summing amplifier. An AGC detector then extracts the dc signal strength variations in the same manner as described for the internal AGC detector. The remaining operation is identical to that of the internal AGC circuit.

The AGC switch on the Receiver has positions designated SLOW, FAST, and RMT. The first two positions are used with the internal AGC circuit and function as follows: SLOW AGC provides a fast attack and a slow release. This mode provides ideal conditions for FSK operation by providing sufficient delay in release to suppress noise during momentary absences of the mark or space signal. FAST AGC provides both fast attack and fast recovery times. This mode of operation is advantageous only during the reception of rapidly fading signals.

The RMT (remote) position of the AGC switch selects the external Demodulator signal previously described. This mode of operation uses only the slow internal AGC time constant.

The S-METER provides visual indication of both Receiver tuning and relative signal strength. The S-METER is connected in the AGC dc amplifier circuit.

4.2 CIRCUIT DESCRIPTION

4.2.1 PRESELECTOR (Refer to Figure 6-1.)

The preselector comprises six switch-selectable RF filters, a wave trap, and a noise generator. Five of these circuits, covering the 1.7 to 29 MHz range, consist of a 4-pole high-Q toroidal filter and a tunable RF network. The remaining circuit, covering the 10 kHz to 550 kHz range, consists of a 4-pole high-Q toroidal filter without the tunable RF network. In operation, the preselector circuits accept RF signals thru the ANT connector from any unbalanced antenna having a transmission line impedance of 50 ohms. The signals are directed to the proper preselector circuit by means of BAND switch S1. For example, signals in the range of 1.7 to 3.5 MHz are directed to the band A preselector.

The tunable portion (1.7 to 29 MHz) of the preselector consists of the front panel MHz control (C1) and inductors L1 through L5. Each inductor is associated with a different preselector section. When a specific frequency range is selected by the BAND switch, the proper inductor is connected to C1. Manual adjustment of C1 will then peak the preselector to the desired frequency. C1 is switched out of the fixed-tuned portion (10 kHz to 550 kHz) of the preselector circuit.

The wave trap consists of a 9 MHz series-resonant crystal (Y1) located at the output of the preselector circuits. The wave trap provides a low impedance path to ground for signals at or near the 9 MHz IF of the Receiver.

The noise generator consists of the base-emitter junction of Q1, and pushbutton switch S1. When S1 is depressed, the switch completes the dc path to ground through L3. The base-emitter junction is back-biased and breaks down in the reverse direction, generating large junction noises. The overall result is a wide, even spectrum of white noise throughout the RF range. The reverse junction current is sufficiently limited by R4 to prevent permanent damage to the transistor.

4.2.2 MIXER STAGE (Refer to Figure 6-2.)

The mixer stage consists of dual beam deflection tube circuits V1 and V2 and a 9 MHz crystal filter. V1 and V2 mix the received signal with a local oscillator signal to generate a difference IF signal of 9 MHz. The beam deflection tube is unique in that its elements are so arranged that the cathode and control grid form an electron gun, and the deflecting electrodes form an electron lens. Together the gun and lens direct a beam of electrons towards the plates in a manner similar to that of the cathode-ray tube. Thus, the total tube current is varied by the input signal at the control grid and the division of tube current between the plates is varied by the local oscillator signal at the deflecting electrodes.

The input signal from the preselector is connected to control grid (pin 3) of V1.

The input signal from the local oscillator is connected to deflecting electrode pins 8 and 9 of V1 and V2, respectively. The local oscillator is also connected to pins 9 and 8 of V1 and V2, respectively, by unbalanced-to-balanced transformer T2. Thus, the mixer is balanced both with respect to the input signal and the local oscillator signal. The signal voltage variations on the control grid vary the total tube current, and the local oscillator signal variations at the deflecting electrodes control the division of this current between the plates. The resultant mixing action produces sum and difference frequencies at the output of mixing transformer T1.

Both the input signal frequency and the local oscillator frequency (and its noise component) are attenuated in the mixer output. Since the input signal current is divided between the plates of V1 in a push-pull configuration approximately 35 db suppression is provided at the output of balanced plate load T1. Maximum suppression is provided by proper adjustment of R2. (Refer to Section V for adjustment procedure.) The local oscillator input is also connected in a push-pull configuration controlling current deflection of each pair of deflecting electrodes. Thus, the local oscillator and noise components are suppressed approximately 30 db at the output of T1. Optimum balance is provided by proper adjustment of R1. (Refer to Section V for adjustment procedure.)

Of the remaining frequencies in the mixer output, only the 9 MHz difference frequency is coupled to the IF stage. The other frequencies are eliminated by the highly selective crystal filter circuit.

The crystal filter is a modularized 6-pole crystal-lattice filter with a center frequency of 9 MHz and a bandwidth of 2.1 kHz. The filter is driven from the secondary of T1. In operation, the 9 MHz mixer output is passed through the filter and connected to the input of the first IF amplifier. Unwanted signals in the mixer output are rejected by the sharp skirt selectivity of the crystal-lattice filter.

4.2.3 LOCAL OSCILLATOR (Refer to Figure 6-2.)

The local oscillator uses a single transistor (Q3) as a wide band crystal oscillator circuit that provides a nominal 32 pf load for any one of six switch-selectable parallel resonant crystals. Individual crystal frequencies are chosen so that the difference between the received signal frequency and the crystal frequency is always 9000.0 kHz. On bands A, B, C, and L the crystal frequency must be above the received signal; on bands D and E crystal frequency must be below the received signal.

Individual crystal frequencies can be varied slightly to compensate for small frequency discrepancies by means of an individual crystal trim capacitor (located above and adjacent to the crystal sockets). Operational adjustment of the local oscillator frequency is provided by front panel OSC TRIM control C8 in any crystal position. Adjustment of either trim control alters the value of the tuned circuit capacitance to a small degree, thereby varying the resonant frequency. The amount of frequency variation possible is proportional to the frequency of the crystal.

The crystal oscillator has a direct sample output from its emitter to rear panel connector J26, pin 1. The oscillator input to the mixer is routed by S1 to buffer amplifier Q2 before connection to balance transformer T2.

The CRYSTAL selector switch has an extra position (R) which selects a signal from an external oscillator or frequency synthesizer via a rear panel connector. A companion synthesizer unit, the Model 1550, is available from FEC and is designed to operate with the Model 1500C. The Synthesizer eliminates crystal changing and permits convenient dial selection of any desired frequency in the range of the Receiver.

The Synthesizer or external oscillator input is applied to wide band amplifier Q1 to raise the input to the required operating level. The amplifier has a 13 db gain and requires a nominal 1 vpp input for proper operation of the Receiver.

4.2.4 IF AMPLIFIERS (Refer to Figure 6-3.)

The IF amplifiers consist of two inductively coupled, tuned input cascode amplifiers (Z1 and Z2). The 9 MHz IF signal from the crystal filter is coupled by T1 to the input of Z1. The secondary of T1 is tuned by adjusting C4. The output of Z1 is coupled to an identical second IF amplifier. The output of Z2 is, in turn, coupled by T3 to the product detector. Both IF amplifiers are controlled by an AGC voltage at pin N. The AGC inputs to each amplifier are electrically isolated from each other by RFC choke L5 to prevent RF signal feedover. RF is also isolated from the AGC bus by L3.

Alignment procedures for tuning the IF amplifiers are listed in Section V of this manual.

4.2.5 PRODUCT DETECTOR (Refer to Figure 6-3.)

The product detector consists of operational amplifier Z3, and beat frequency oscillators (BFO) Q1 and Q2. The detector circuit heterodynes the input IF signal with the BFO output to generate a 2.5 kHz audio FSK signal. Both oscillators are Pierce and are functionally identical.

Two BFO's are used to insure that an increase in the received signal frequency always results in an increase in the detected signal frequency when operating in the HF region. This is in accordance with current communications standards. The Q1 circuit operates 2.5 kHz above the 9 MHz IF signal and is enabled on bands A, B, and C to match the input signal inversion (i.e., local oscillator signal is 9 MHz above the input RF signal). The opposite oscillator (Q2) is enabled on bands D, E, and L and operates 2.5 kHz below the 9 MHz IF.

Z3 is essentially a differential pair with a third transistor used as a constant current source. The current source is modulated by the 9 MHz IF signal, while the division of this current in the differential pair is controlled by the selected Pierce oscillator input signal. This mixing action is analogous to that described in paragraph 4.2.2 for the beam deflection mixer. The resultant difference frequency is an audio tone of 2.5 kHz ± the shift frequency. It is routed to the input of the band-pass filter via audio transformer T4, and a low-pass filter.

The 1 kHz audio band-pass filter consists of R21 and R22, C39 thru C47 and L11 thru L13. The audio band-pass filter is a 3-pole Butterworth filter with a center frequency of 2.5 kHz. The sharp skirt selectivity of the filter yields an optimum band-pass for FSK signals. The filter output is amplified by low-level audio amplifier Q3 and coupled to audio distribution amplifier Q1.

4.2.6 AUDIO AMPLIFIERS (Refer to Figure 6-4.)

The audio amplifiers consist of a distribution amplifier, a monitor amplifier, and an output amplifier. Amplifier Q1 distributes the audio signal to the monitor and output amplifiers, and to the AGC circuit.

The audio monitor amplifier consists of driver stage Q11 and push-pull power amplifier stage Q12-Q13. This circuit provides an audio power output of approximately 1/4-watt into an external 16-ohm speaker. The audio monitor circuit also includes a MONITOR jack which accepts any standard impedance headphones. Insertion of the headphone plug into the MONITOR jack disconnects the speaker. The monitor output level is adjustable by means of MONITOR LEVEL control R6.

The audio output amplifier consists of driver stage Q8 and push-pull amplifier Q9-Q10. This circuit provides an audio output into 600 ohm terminals for matching the input of the external Demodulator. OUTPUT LEVEL control R5 permits the audio signal level to be varied up to a maximum of +10 dbm.

4.2.7 AGC CIRCUITS (Refer to Figure 6-4.)

The AGC circuits comprise internal detector Q2-Q3, dc amplifiers Q4-Q5, current drivers Q6-Q7, remote mark-space amplifiers Q17-Q18, summing amplifier Q14, and remote detector Q15-Q16. These circuits function to maintain a constant output from the Receiver despite variations in the input signal. In operation, the AGC control voltages are developed from either the internal audio or from a remote input signal. The remote input signal consists of the mark and space audio from an external demodulator.

The 2.5 kHz audio signal at the collector of Q1 is coupled thru T1 to the bases of active detector Q2-Q3. The resultant rectified negative-going detector pulses are routed thru AGC switch S3 to the base of Q4. If RF GAIN control R4 is set at minimum gain (maximum negative), negative voltage is coupled through CR1 to increase current flow in Q4. This action tends to reduce the current in Q5, causing a corresponding increase in the Q6 current and a decrease in the Q7 current. The overall effect of the operation is to reduce Receiver gain by feeding back a positive voltage to the cathode of mixer stage V1 and to IF amplifiers Z1 and Z2.

During normal signal reception the RF GAIN control is rotated to some higher gain position (slider moves towards ground). As a result, less negative voltage is coupled thru CR1 and the detected audio signal assumes control of the circuit. Current in Q4 thru Q7 will thus vary in accordance with the detected signal, causing more or less Receiver gain. Strong signals increase the negative feedback; thereby, reducing Receiver gain. Weak signals decrease the feedback to produce the opposite effect.

The slow and fast positions of the AGC switch permit the operator to choose the most favorable operating conditions for a given receiving condition. Slow AGC is normally desirable for receiving FSK signals, since a slow release time introduces the proper amount of delay to suppress noise during momentary signal fadeouts. The slow release circuit in the Receiver consists of capacitor C8 and resistors R14-R15. Release time is approximately 7.5 seconds.

Fast AGC is desirable for receiving FSK signals during rapid fades, since Receiver sensitivity recovers quickly enough to follow the changing signal. The fast release circuit consists of capacitor C7 and resistors R14-R15. Release time is approximately 1.1 seconds.

The external signal input to the AGC circuit consists of mark and space tones from an external FSK Demodulator such as the FEC Model 1200. The mark tone is connected across pins 8 and 6 of rear panel Molex connector J21; the space tone is connected across pins 7 and 6 of the same connector. These tones are coupled through their respective transformers (T2 and T3) and connected to separate amplifiers: Q17 for the mark and Q18 for the space. The tone outputs are summed by amplifier Q14 and the resultant collector signal is coupled through T4 to active detector Q15-Q16. The detected output is then routed through the remote position of the AGC switch and applied to the base of Q4. From this point on, circuit operation is identical to that of the internal AGC.

External AGC is controlled by potentiometer R3. Adjustment of R3 varies the amount of degenerative feedback applied to Q14. Maximum gain is obtained with the slider of R3 at ground; minimum gain is obtained with the slider at the other extreme.

4.2.8 POWER SUPPLY (Refer to Figure 6-5.)

The power supply consists of a +12 vdc full-wave rectifier, a -12 vdc full-wave rectifier, a +150 vdc full-wave bridge rectifier, and a 6.3 volt filament transformer. The rectifier circuits furnish all dc operating voltages for the transistors and the vacuum tube in the Receiver. The 6.3 volt filament transformer provides ac filament voltage for the vacuum tubes.

SECTION V

ALIGNMENT

5.1 GENERAL

The Model 1500C Receiver has been carefully aligned at FEC by trained personnel using precision test equipment. Alignment will be necessary only if the Receiver has been tampered with or component parts have been replaced in the mixer and/or IF section (s). Before attempting any alignment of the malfunctioning Receiver, always investigate and eliminate all other possible causes of the malfunction.

The alignment is divided into three separate precedures:

(1) BFO And 2nd Mixer Oscillator adjustment

(2) IF Alignment

(3) Mixer Balance Adjustment

Each procedure can be performed independently when a component which affects only one circuit is replaced. For example, if either mixer tube is replaced only the mixer balance adjustment must be performed. When a complete alignment is required it is essential that the procedures be performed in the order presented. Allow at least 1/2 hour warmup time before starting alignment.

CAUTION

Only qualified personnel should work on the Receiver.

5.2 REQUIRED TEST EQUIPMENT

The following test equipment (or equivalent) is required to align the unit:

(a) Electronic Counter, Transistor Specialties, Inc. Model 373.

(b) AC Voltmeter, Hewlett-Packard Model 403B.

(c) RF Signal Generator, Clemens Mfg. Co. Model SG-83B.

5.3 INITIAL CONTROL SETTINGS

Initial settings of all front panel controls are listed below. Unless otherwise stated, these settings should be maintained throughout the alignment procedures.

POWER switch	ON
OUTPUT LEVEL control	Maximum clockwise
RF GAIN control	Maximum clockwise
AGC switch	RMT
OSC TRIM control	Center
CRYSTAL switch	R
BAND switch	C
MHz control	Approximately 9 MHz

5.4 BFO OSCILLATOR ADJUSTMENT (Refer to Figure 7-5.)

The BFO oscillator outputs should be checked whenever it is necessary to replace faulty components in one of the oscillator circuits. Only the circuit actually affected by the replacement must be checked; but, it is recommended that the complete procedure be performed since the test equipment is already connected.

1. Connect Counter lead to TP2 on board N0901; connect common lead to chassis.
2. Adjust C40 for a 9002.500 kHz ±1 Hz reading on Counter.
3. Set BAND switch to D and connect Counter to TP3. Adjust C42 for a 8997.500 kHz ±1 Hz reading on Counter.
4. Disconnect Counter and restore controls to initial settings.

NOTE

The Model 1500C is often used with demodulators utilizing a 2550 Hz audio center frequency. Since the standard audio output is 2500 Hz, the BFO oscillators should be offset 50 Hz to produce the desired output. The BFO associated with bands A, B, and C should be adjusted for a frequency of 9002.550 kHz and the BFO used with bands D, E, and L should be adjusted for a frequency of 8997.450 kHz.

9002.2

5.5 IF ALIGNMENT (Refer to Figures 7-3 and 7-5.)

The IF alignment should be performed whenever components in the tuned 1st mixer output (on N0971 or the tuned first and second IF amplifiers (on N0901) are replaced. In addition, when components in the 1st mixer circuit are replaced the mixer balance must be adjusted.

1. Connect Signal Generator lead to center pin of rear panel ANT connector. Connect common lead to chassis. Set Generator and Receiver for any convenient operating frequency (approximately 1 microvolt input). Insert proper frequency crystal in socket 1 and set CRYSTAL switch to position 1.
2. Connect Voltmeter leads across DEMOD terminal of rear panel terminal strip. Set BAND switch to proper position and tune Receiver for maximum audio output.
3. Adjust C8 on board N0971 for a maximum reading on Voltmeter.
4. Adjust C4, C13, and C21 on board N0901 for a maximum reading on Voltmeter.
5. Disconnect test equipment and restore controls to initial settings.

5.6 MIXER BALANCE ADJUSTMENT (Refer to Figure 7-3.)

The mixer balance must be adjusted whenever components in the balanced 1st mixer circuit or in the associated tuned IF output circuit are replaced.

NOTE

When replacing the 7360 tube in V1 or V2 on the mixer printed circuit board (N0971/N0973) it is recommended that the new tube be seasoned for approximately 3 or 4 hours before attempting to balance the mixer. Seasoning may be accomplished with the tube in its normal operating position and all voltages applied.

1. Connect Generator lead to center pin of rear panel ANT connector. Connect common lead to chassis. Monitor Generator frequency with Counter.
2. Remove 9.000 MHz crystal from board N0730. Adjust Generator frequency to 9000.000 kHz and set output level to approximately 100 microvolts.

3. Connect Voltmeter and Oscilloscope across DEMOD terminals on rear panel terminal strip. Adjust rear panel MIX-BAL potentiometer for minimum output level on Voltmeter.

4. Disconnect Generator lead from ANT connector and connect to OSC-IN connector.

WARNING

> HIGH VOLTAGE is carried on exposed track adjacent to R1. Use extreme caution while adjusting R1; high voltage can result in death on contact.

Adjust oscillator balance potentiometer R1 on board NO971 for minimum output level on Voltmeter.

5. Repeat steps 3 and 4 until minimum output is obtained after both adjustments.

NOTE

> If either control is at its end limit, proper balance has not been obtained and it may be necessary to switch one of the mixer tubes (V1 or V2 on NO971).

6. Disconnect test equipment and replace 9.000 MHz crystal on board NO730. Return controls to initial settings.

5.7 OSC TRIM CONTROL ADJUSTMENT (Refer to Figure 7-4.)

The OSC TRIM adjustment is normally required only during the initial Receiver calibration at the factory or after a major component change in the local oscillator circuit. This procedure should be performed before the initial local oscillator adjustment described in Paragraph 5.8.

The following symbols are used in the adjustment procedure:

f_c = nominal (marked) crystal frequency

$+\Delta f$ = number of Hz above f_c

$-\Delta f$ = number of Hz below f_c

Proceed as follows:

1. Insert any crystal in the range of 4000 kHz to 6000 in crystal socket 1. Set CRYSTAL switch to position 1.
2. Connect Counter to rear panel OSC OUT connector.
3. Rotate OSC TRIM control full counterclockwise and note Counter reading (-Δf).
4. Rotate OSC TRIM control full clockwise and note Counter reading (+Δf).
5. Adjust crystal trim capacitor located above crystal socket 1 until (-Δf) = (+Δf).
6. Rotate OSC TRIM control to setting where local oscillator reading equals f_c. Loosen locking screw of OSC TRIM knob and rotate knob pointer to zero center position. Tighten locking screw.

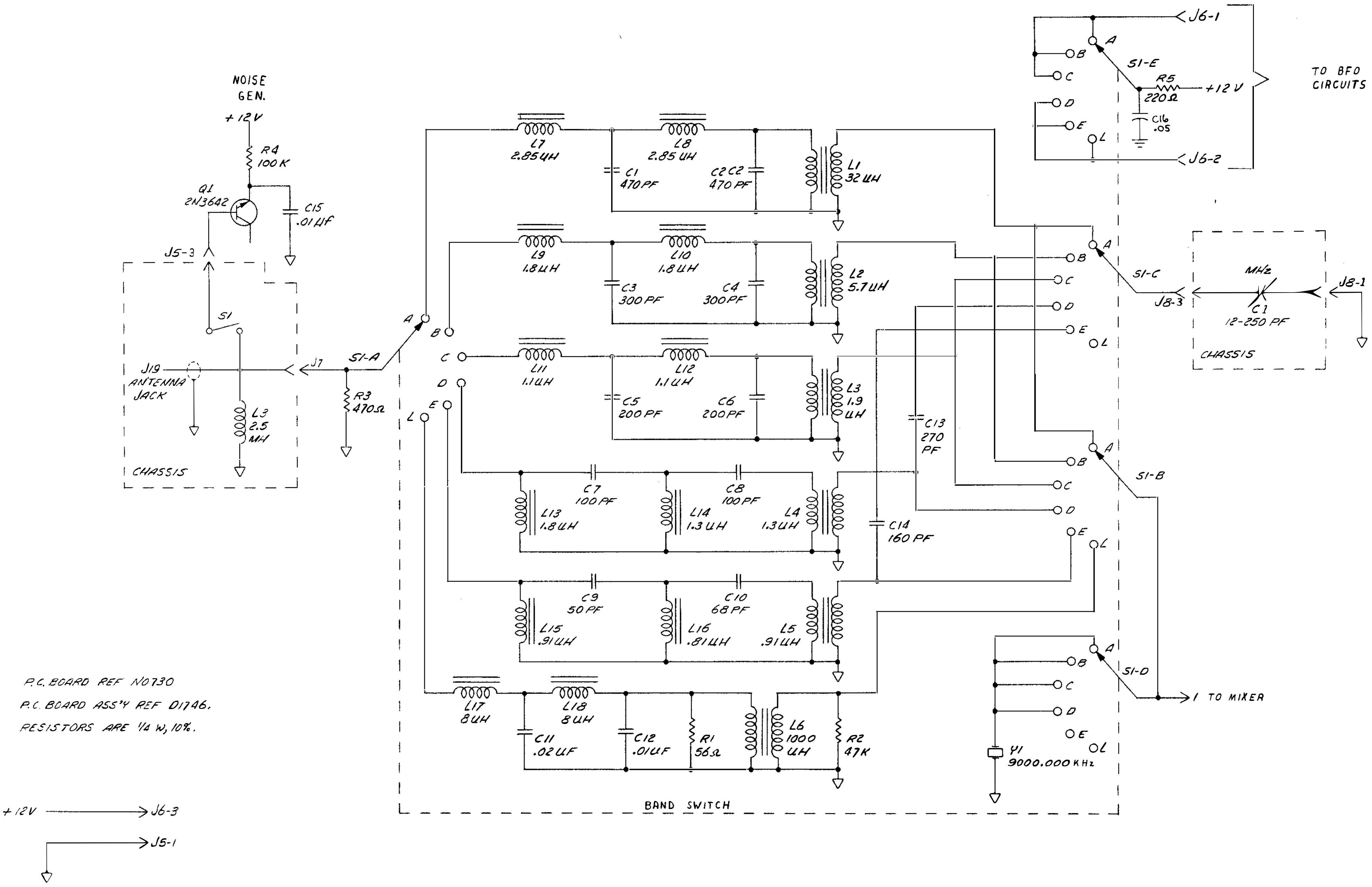
5.8 LOCAL OSCILLATOR ADJUSTMENT (Refer to Figure 7-4.)

The local oscillator crystal adjustment is not necessary for proper alignment of the Receiver. The oscillator can be set up with this procedure when the exact local oscillator frequency is desired or it can be set up to match the actual input signal as described in Paragraph 3.2.7 of this manual.

1. Insert operating crystals in desired crystal position. Connect Counter to rear panel OSC OUT connector. Connect oscilloscope to J2 on N0973 with a high impedance (1 meg/ 7 Pf) probe.
2. Set CRYSTAL switch to each position and check that the oscillator output is at least 3 VPP. Remove oscilloscope probe.
3. Set CRYSTAL switch to each position and adjust trimmer capacitors (located directly above crystal) for proper operating frequency on counter.
4. Rotate OSC TRIM control from - to + ends of scale and check that frequency range is at least ±50 Hz per MHz of the crystal frequency.

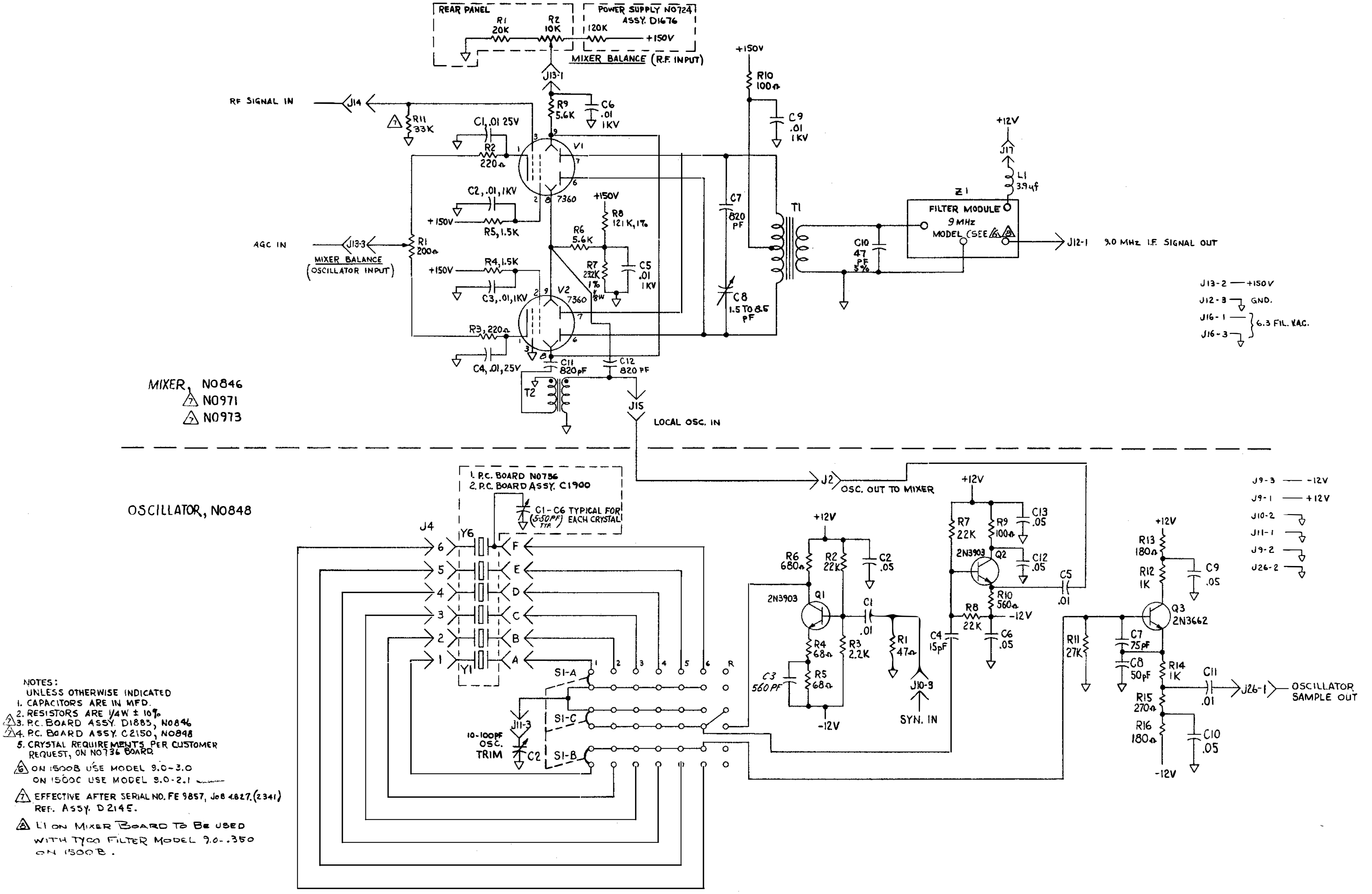
SECTION VI

SCHEMATIC DIAGRAMS



P.C. BOARD REF N0730
P.C. BOARD ASS'Y REF D1746.
RESISTORS ARE 1/4 W, 10%.

Figure 6-1. Preselector, Schematic Diagram
N0730-J5 thru J8-D1745B



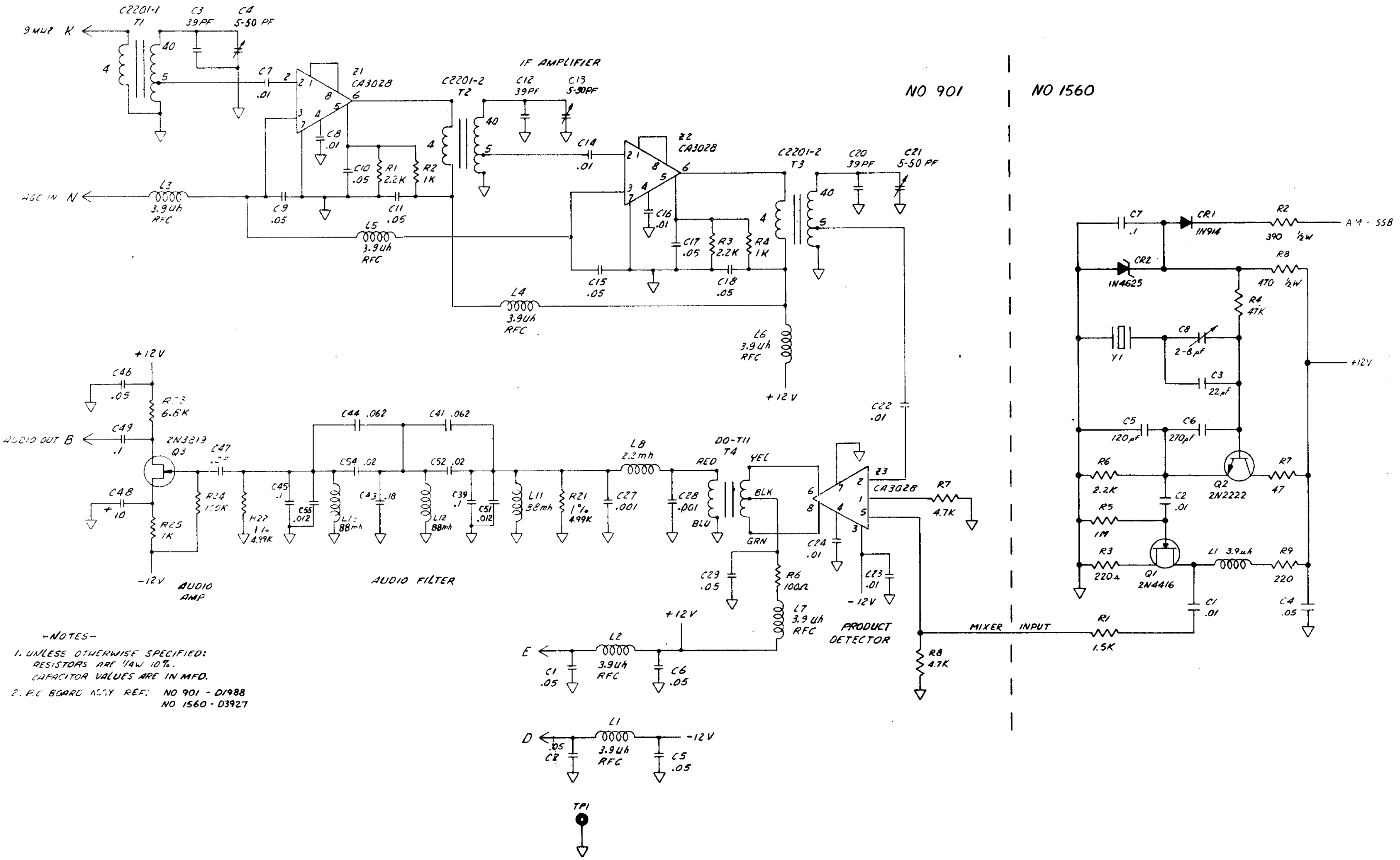
NOTES:
UNLESS OTHERWISE INDICATED
1. CAPACITORS ARE IN MFD.
2. RESISTORS ARE 1/4W ± 10%
⚠7 3. P.C. BOARD ASSY. D1883, N0846
⚠7 4. P.C. BOARD ASSY. C2150, N0848
5. CRYSTAL REQUIREMENTS PER CUSTOMER REQUEST, ON N0736 BOARD

⚠6 ON 1500B USE MODEL 9.0-3.0
ON 1500C USE MODEL 9.0-2.1

⚠7 EFFECTIVE AFTER SERIAL NO. FE 9857, JOB 4827.(2341)
REF. ASSY. D2145.

⚠8 L1 ON MIXER BOARD TO BE USED
WITH TYCO FILTER MODEL 9.0-.350
ON 1500B.

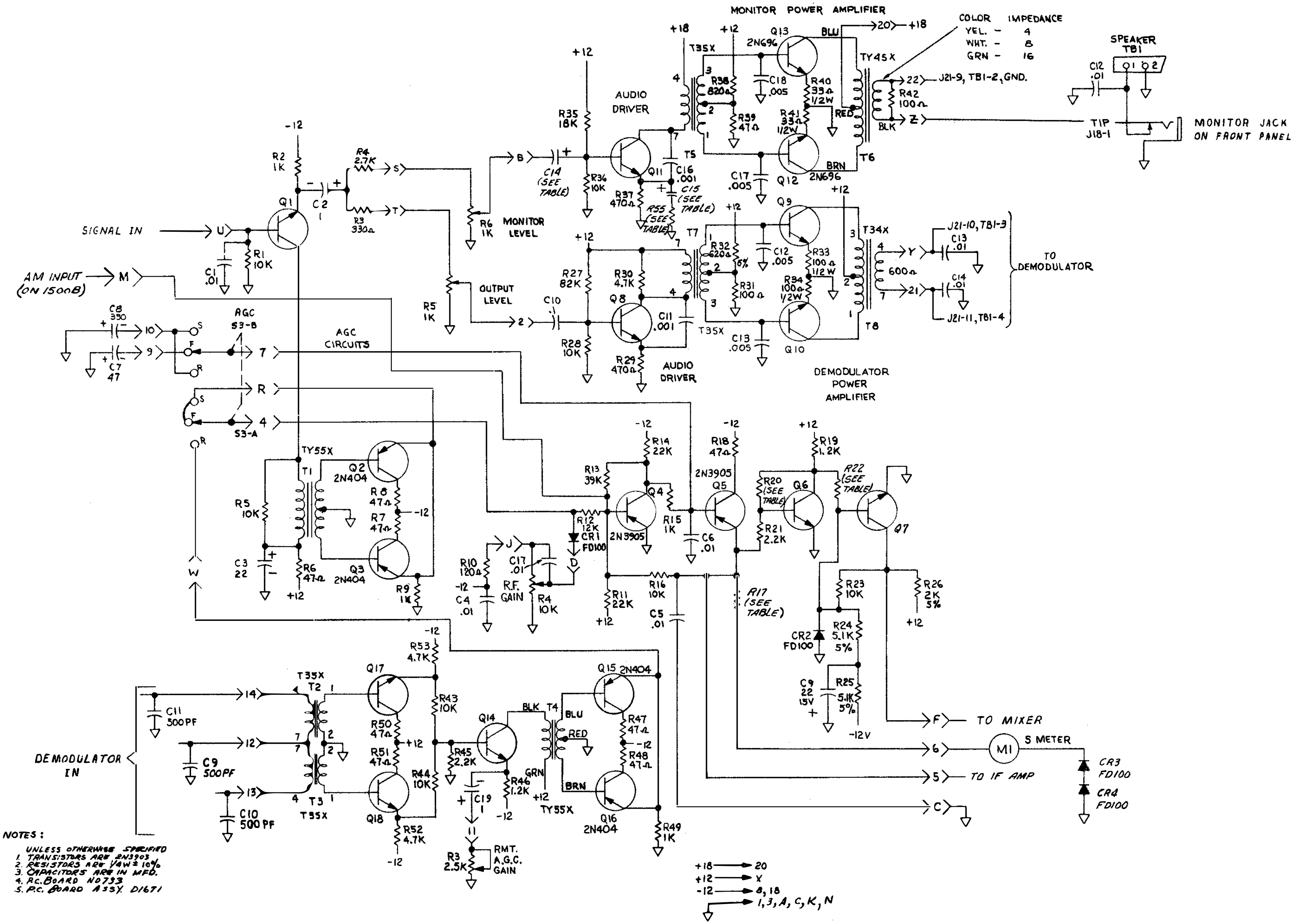
Figure 6-2. Mixer And Oscillator, Schematic Diagram
N0971-J9 thru J16 & J26-D1882G



-NOTES-

1. UNLESS OTHERWISE SPECIFIED:
   RESISTORS ARE ¼W 10%.
   CAPACITOR VALUES ARE IN MFD.
2. P.C BOARD ASSY REF: NO 901 - D1988
   NO 1560 - D3927

Figure 6-3. IF, BFO, And Detector, Schematic Diagram
N0901-J2-D1987K

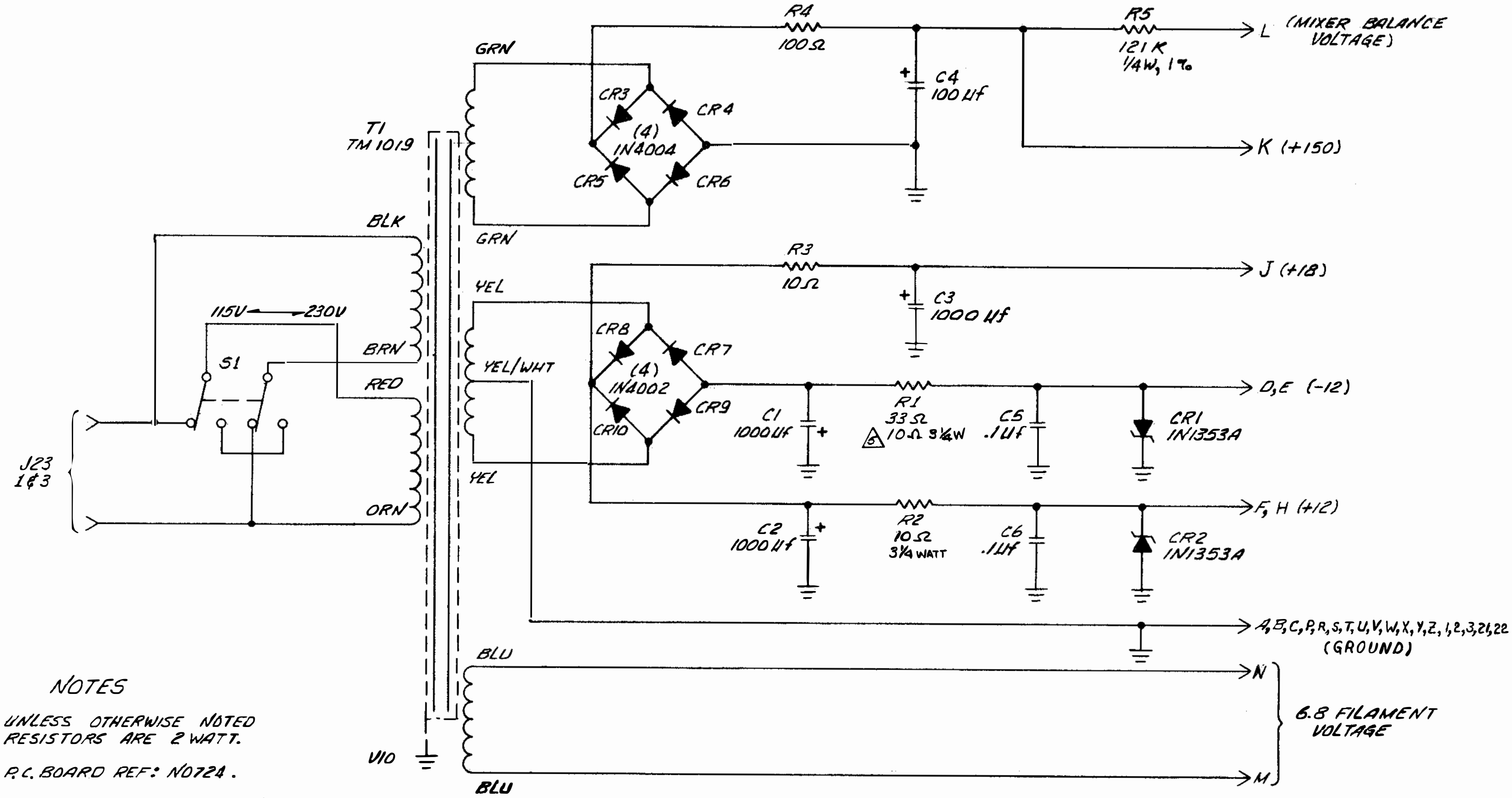


NOTES:

UNLESS OTHERWISE SPECIFIED
1. TRANSISTORS ARE 2N3903
2. RESISTORS ARE 1/4W ± 10%
3. CAPACITORS ARE IN MFD.
4. P.C. BOARD N0733
5. P.C. BOARD ASSY. D1671

1500C	15Ω	1K	1.5K	NOT USED	.1UF	2.7UF	FD100	FD100
1500B	15Ω	1K	1.5K	27Ω	22 UF	22UF	FD100	FD100
1500A	200Ω 5%	1.2K	2.2K	NOT USED	.1UF	2.7UF	NOT USED	NOT USED
MODEL Nº	R17	R20	R22	R55	C14	C15	CR3	CR4

Figure 6-4. Audio And AGC, Schematic Diagram
N0733-J3-D1670E



NOTES

1. UNLESS OTHERWISE NOTED RESISTORS ARE 2 WATT.
2. P.C. BOARD REF: N0724.
3. P.C. BOARD ASS'Y REF: D1676.
4. FOR 115V OPERATION, CONNECT RED & BRN LEADS IN PARALLEL. FOR 230V OPERATION, CONNECT RED & BRN LEADS IN SERIES.

△5 USE FOR 1500B ONLY

Figure 6-5. Power Supply, Schematic Diagram
N0724-J1-C1899D

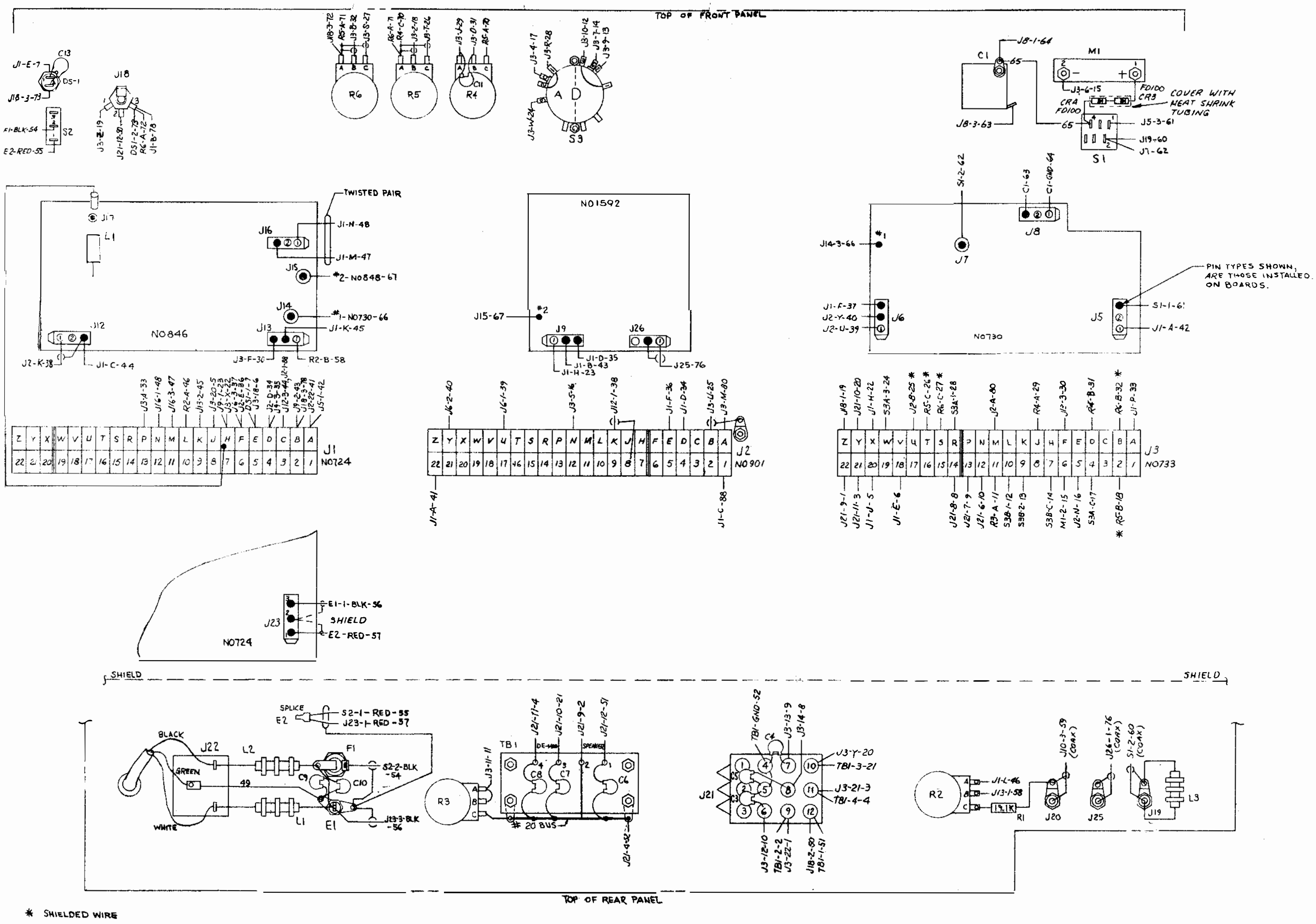
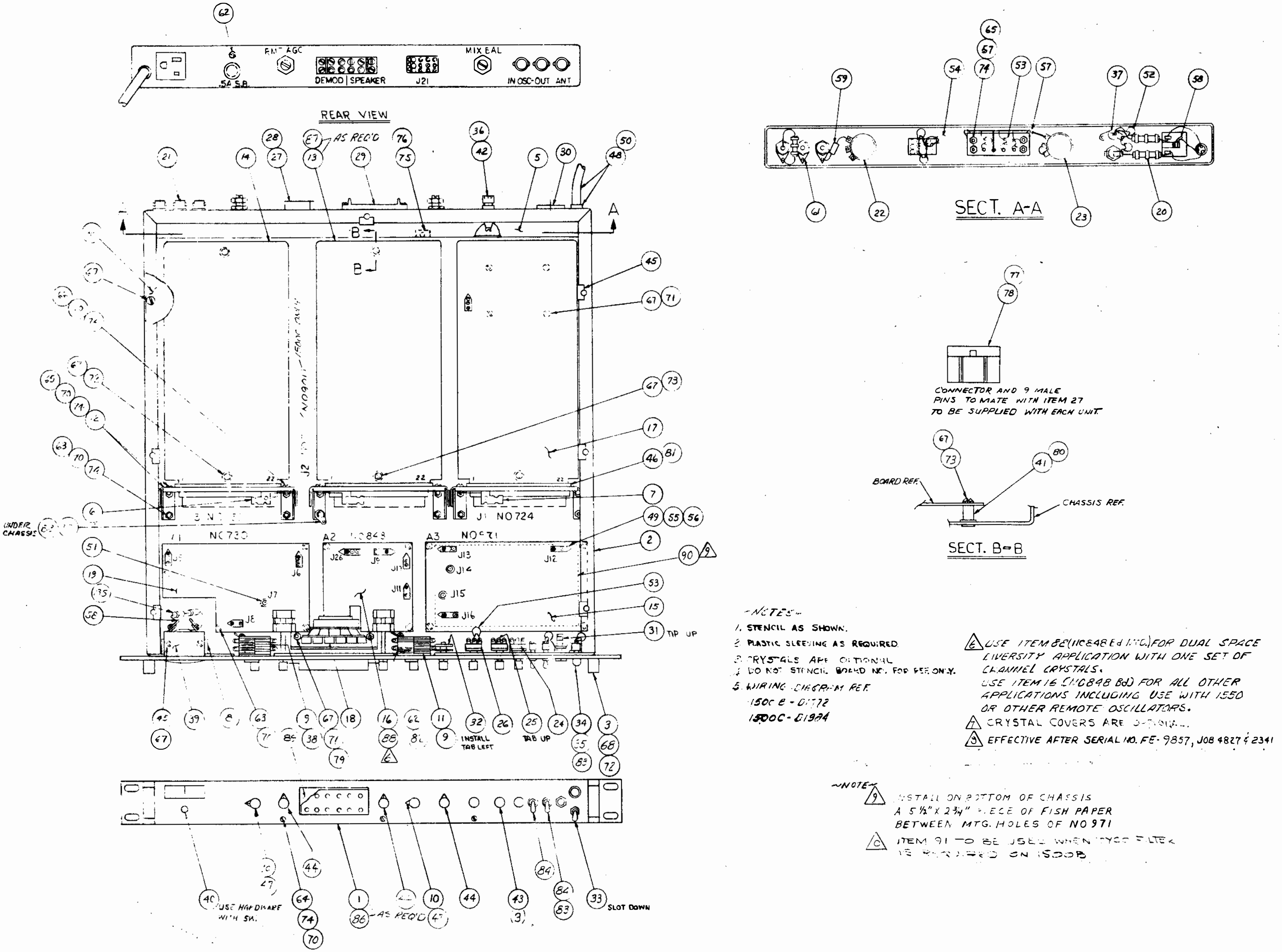


Figure 6-6. Wiring Diagram
D1984A, Sheet 2

SECTION VII

ASSEMBLY DRAWINGS



CONNECTOR AND 9 MALE PINS TO MATE WITH ITEM 27 TO BE SUPPLIED WITH EACH UNIT.

-NOTES-

1. STENCIL AS SHOWN.
2. PLASTIC SLEEVING AS REQUIRED.
3. CRYSTALS ARE OPTIONAL
4. DO NOT STENCIL BOARD NO. FOR FEE ONLY.
5. WIRING DIAGRAM REF.
   150C E - D1772
   1500C - D1984

△6 USE ITEM 88(NC848 Ed MTG.)FOR DUAL SPACE DIVERSITY APPLICATION WITH ONE SET OF CHANNEL CRYSTALS.
USE ITEM 16 (NC848 Bd) FOR ALL OTHER APPLICATIONS INCLUDING USE WITH 1550 OR OTHER REMOTE OSCILLATORS.

△7 CRYSTAL COVERS ARE OPTIONAL.

△9 EFFECTIVE AFTER SERIAL NO. FE-9857, JOB 4827 & 2341

~NOTE~

△9 INSTALL ON BOTTOM OF CHASSIS A 5½" X 2¾" PIECE OF FISH PAPER BETWEEN MTG. HOLES OF NO 971

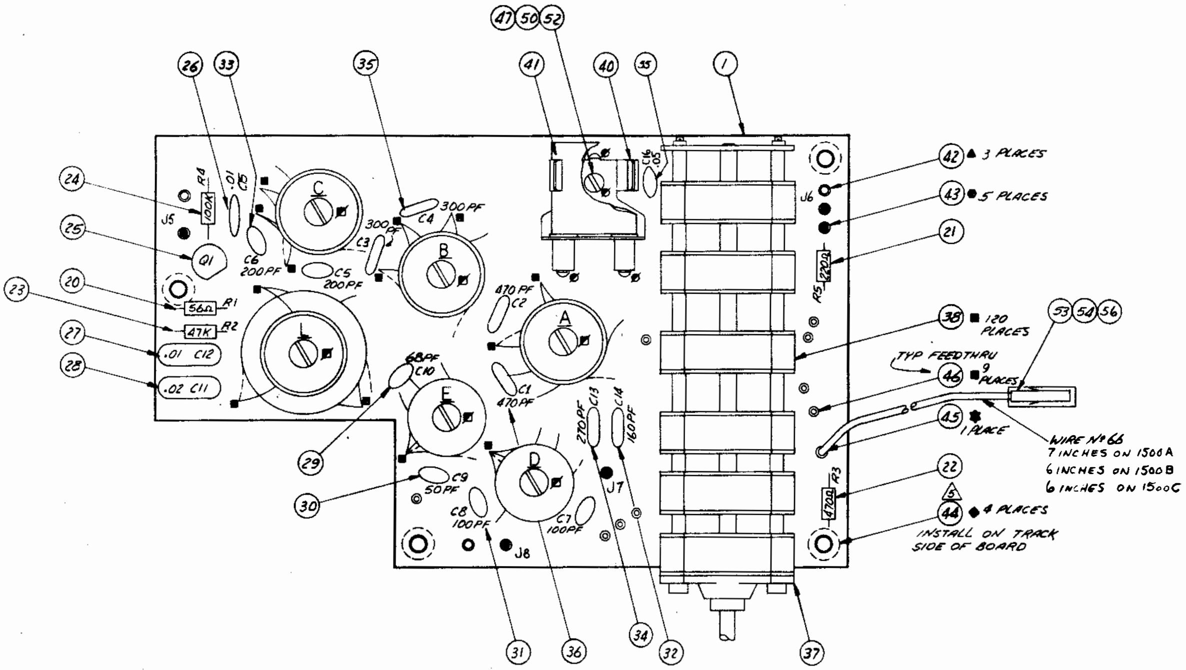
△C ITEM 91 TO BE USED WHEN TYCO FILTER IS REQUIRED ON 1500B

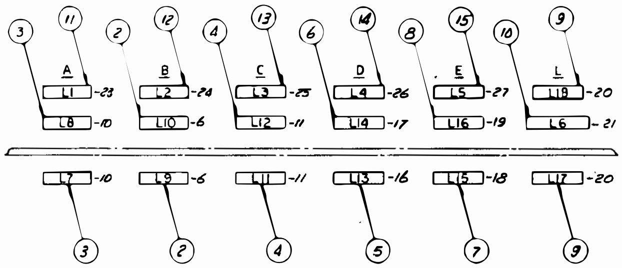
Figure 7-1. Model 1500C, Assembly
D1765M

	1500C	ITEM	1500B	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT. PART NO.	SLOT FINISH	FINISH SPEC	CKT SYM
	AR	60	A/E	55T1	TIE OFF	PANDUIT				
	1	59	1	RN55D1912-F	RESISTOR, 19.1K 1/8 WATT 1%	A-B	625484			
	3	58	3	1416-6	SOLDER LUG	SMITH	242756			
	5	57	5	1416-4	SOLDER LUG	SMITH	242754			
	18	56	18	1561-TLB	PIN. FEMALE	MOLEX	744410			
	9	55	9	1560-TLB	PIN. MALE	MOLEX	744400			
	3	54	3	DD-501	CAPACITOR, 500 PF 1KV	CRL	021210			
	4	53	4	5835-150-1032	CAPACITOR, .01 μf 25V	ERIE	021540			
	2	52	2	SHK-510	CAPACITOR, .01 μf 1000V	SPRAGUE	021570			
	3	51	3	1625-1R	CONNECTOR, SINGLE PIN	MOLEX	246225			
	1	50	1	SR-1	STRAIN RELIEF	HEYCO	688025			
	11	49	11	1625-3R1	CONNECTOR, 3 PIN	MOLEX	248275			
	1	48	1	17237	LINE CORD	BELDEN	366050			
	2	47	2	50-1-1G	KNOB, ROUND	RAYTHEON	460075			
	3	46	3	67031-7	CONNECTOR	AMP	241475			
	10	45	10	C5020-632-67	SPEED NUT #6	TINNERMAN	403180			
	3	44	3	50-5-1G	KNOB, POINTER	RAYTHEON	460175			
	3	43	3	50-2-1G	KNOB, POINT	RAYTHEON	460025			
	1	42	1	3AG 1/2 A	FUSE 1/2 AMP SLO-BLOW	LITTELFUSE	368200			
	5	41	5	1246-20	STAND OFF	CTC	683280			
	1	40	1	976	SWITCH. DPDT	SWITCHCRAFT	721075			
	1	39	1	MODEL 15	METER 0-5 Ma.	EMICO	088-000-492 HALLICRAFTERS	524075		
	1	38	1	60-4635-9	VARIABLE CAP. 12-250PF	STAR PROD.	029450			
	1	37	1	750	STANDOFF	WINCHESTER	683014			
	1	36	1	342004	FUSE SOCKET	LITTELFUSE	368425			
	1	35	1	327	LAMP	G.E.	481050			
	1	34	1	162-8430-931	PILOT LIGHT ASSY	DIALCO	481200			
	1	33	1	MST-115D	SWITCH. SPDT	ALCO	727125			
	1	32	1	X72031N	ROTARY SWITCH	JBT	723666			
	1	31	1	12 A	PHONE JACK	SWITCHCRAFT	244100			
	1	30	1	M1536-GS	A.C.RECEPTACLE	CIRCLE F	247025			
	1	29	1	4-140-Y	BARRIER STRIP	C-J	100225			
	9	28	9	1381TL	PIN, FEMALE	MOLEX	744325			
	1	27	1	1360R	CONNECTOR	MOLEX	246050			
	1	26	1	RS 9850	POT. 10K	CTS	627480			
	1	25	1	PB 3205A	POT. 1K	CTS	627180			
	1	24	1	RS 9849	POT. 1K	CTS	627192			
	1	23	1	CLU-2521	POT. 2.5K	OHMITE	627240			
	1	22	1	CLU-1031	POT. 10K	OHMITE	627492			
	3	21	3	95-712-667-6	CONNECTOR, BNC	DAGE	241050			
	3	20	3	6302	CHOKE 2.5 mh	MILLER	760020			
	1	19	1	D1746	ASSY. PRESELECTOR	FEC	NO730A			
	1	18	1	C1900	ASSY. CRYSTAL & TRIM CAP.		NO736			
	1	17	1	D1676A	ASSY. POWER-SUPPLY		NO724	12620		
△6	1	16	1	C2150	ASSY. OSCILLATOR		NC548			
	1	15	1	D2145	ASSY. MIXER		NC271	[illegible]		
	1	14	1	D16[illegible]1	ASSY. AUDIO & AGC.		[illegible]	[illegible]		
1500B ONLY →		13	1	[illegible]	ASSY. BFO, IF AMP. AUDIO FILTER		NO767	[illegible]		
	3	12	3	C1303-4 A	PLUG HOLDER ASSY.	FEC				
	1	11	1	5632	OSCILLATOR TRIM CAPACITOR	STAR PROD.	029500			
	2	10	2	B1074	POINTER. CAPACITOR	FEC				
	2	9	2	B1086	SHIM, CAPACITOR					
	1	8	1	B1454	BRACKET, METER MTG.					
	2	7	2	B1129-2	CABLE CLAMP					
	1	6	1	B1124-1	CABLE CLAMP					
	1	5	1	C1645	SHIELD, POWER					
	1	4	1	C0706D	COVER					
	2	3	2	B1132	BAR, FRONT PANEL					
	1	2	1	C1896A	CHASSIS					
1500B ONLY →	1	1	1	C1961	FRONT PANEL ENGRAVED	FEC				
	-2		-1	LIST OF MATERIAL						

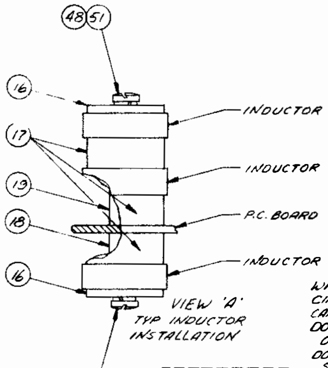
		91		1625-1R	CONNECTOR, SINGLE PIN	MOLEX	246225
	1	90	1	5½" x 2¾"	FISH PAPER	REED	
△7	1	89	1	C2404	ASSY, CRYSTAL COVER	FEC	
△6	1	88	1	N0848 MOD.	ASS'Y, OSCILLATOR	FEC	ECN889
1500C ONLY	1	87		D1988	ASS'Y, BFO, IF AMP, AUDIO FILTER	FEC	NO981 SLOT 6&7
	1	86		C1961-1	FRONT PANEL ENGRAVED	FEC	
	2	85	2	FD100	DIODE	FAIRCHILD	040238
1500B ONLY →		84	2	MST215N	SWITCH, DPDT	ALCO	727150
	1	83	2	5855Y5U503Z	CAPACITOR, .05 μf 25V	ERIE	021660
	5	82	5		WASHER, #4 EXTERNAL TOOTH	404879	PHOS. BRZ.
	3	81	3	67611-6	KEY, CONNECTOR	AMP.	241560
	5	80	5		WASHER, #10 INT. TOOTH	404915	PHOS. BRZ.
	2	79	2		NUT, HEX 6-32 x 1/4 AF	403035	SST
	9	78	9	1380TL	TERMINAL, MALE	MOLEX	744300
	1	77	1	1360P	CONNECTOR, MALE	MOLEX	246025
	3	76	3		SCREW, #4 SHEET METAL		SST
	3	75	3	C15263-42-24	SPEED NUT #4	TINNERMAN	403170
	25	74	25		NUT, HEX. 4-40 x 1/4 AF	403030	SST
	3	73	3		WASHER, #6 EXT. TOOTH	404894	PHOS. BRZ.
	6	72	6		WASHER, #6 SPLIT LOCK	404895	
	6	71	6		WASHER, #6 INT. TOOTH	404893	
	38	70	38		WASHER, #4 INT. TOOTH	404878	PHOS. BRZ.
	7	69	7		SCREW, 6-32 x 5/16 FLAT HD.	UNDER-CUT	SST
	4	68	4		6-32 x 3/8 FIL. H.D.	404375	
	9	67	9		6-32 x 1/4 BD. HD.	404361	
	3	66	3		4-40 x 5/8 BD. HD	404227	
	7	65	7		4-40 x 1/2 BD. HD.	404220	
	3	64	3		4-40 x 3/8 OVAL HD.	404213	
	23	63	23		SCREW, 4-40 x 5/16 BD. HD.	404203	
	5	62	5		SCREW, 4-40 x 1/4 BD. HD.	404194	SST
	3	61	3	1497	SOLDER LUG	SMITH	242800

Figure 7-1. Parts List

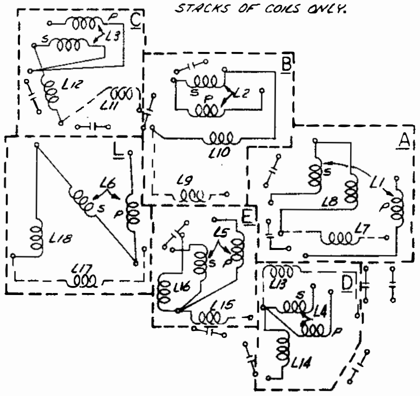




INDUCTORS ARE TO BE STACKED AS SHOWN ABOVE.
SEE VIEW 'A' FOR ASSOCIATED PARTS AND INSTALLATION.



WIRE INDUCTORS TO BOARD AS SHOWN.
CIRCLES INDICATE HOLES IN BOARD.
CAPACITORS ARE SHOWN FOR LOCATING REF.
DOTTED COILS ARE ON TRACK SIDE OF BOARD.
DOTTED BLOCKS ARE USED TO SHOW STACKS OF COILS ONLY.



NOTES:

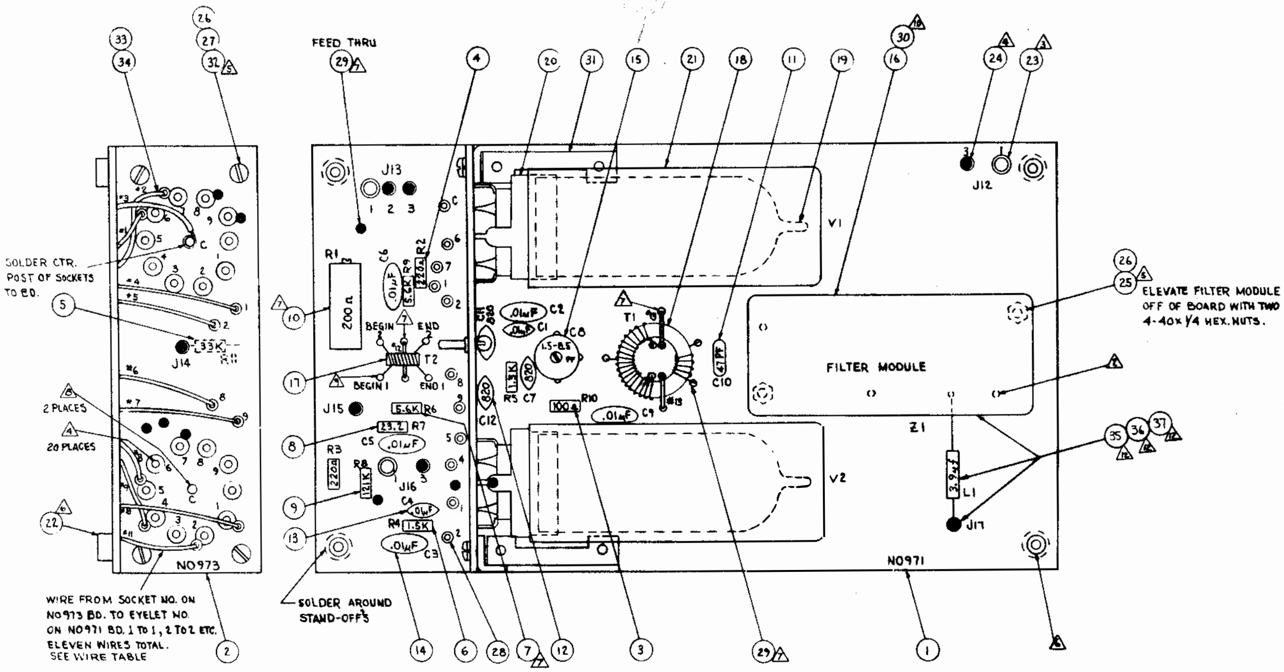
1. SCHEMATIC REF: D1745
2. SHEAR PER BOARDMASTER B1449.
3. DRILL ALL COMPONENT MTG. HOLES № 60(.040) DR. UNLESS OTHERWISE SPECIFIED:
   - ■ № 55 (.052) DR - 142 PLACES
   - ● № 52 (.067) DR - 5 PLACES
   - ✱ № 49 (.073) DR - 1 PLACE
   - ▲ № 43 (.089) DR - 3 PLACES
   - ∅ № 38 (.101) DR - 4 PLACES
   - ☒ .125 DIA DR - 6 PLACES
   - ◆ № 28 (.140) DR - 4 PLACES
4. DO NOT PUT BOARD IN HEAT.
5. SOLDER STANDOFFS.

Figure 7-2. Preselector, Board Assembly
NO730-J5 thru J8-D1746F

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT PART NO	FINISH	FINISH SPEC	CKT SYM
56	1	1625-1R	CONNECTOR	MOLEX	246225			
55	1	5855Y5U503Z	CAPACITOR, .05 MFD. 25V	ERIE	021660			
54	1	156ITL8	TERMINAL, FEMALE	MOLEX	744410			
53	6"		WIRE Nº20 GA STRANDED	ALPHA	WHITE			
52	1		NUT, Nº 2-56 x 3/16 AF	SST	403010			
51	12		WASHER, Nº 4 SPLIT LOCK		404880			
50	1		WASHER, Nº 2 SPLIT LOCK		404861			
49	6		SCREW, Nº 4-40 x 3/4 Bd Hd		404233			
48	6		SCREW, Nº A-40 x 1/4 Bd Hd		404194			
47	1		SCREW, Nº 2-56 x 3/16 Bd Hd	SST	404010			
46	9	S-6065	EYELET	U.S.				
45	1	2059	EYELET	STIMPSON				
44	4	1300-13	STANDOFF	CTC	683504			
43	5	R62-3-ET	STAKE PIN - MALE	BEAD CHAIN	744550			
42	3	M93-102-ET	STAKE PIN - FEMALE	BEAD CHAIN	744555			
41	1	MIL TYPE CR19U	CRYSTAL 9 MHz SERIES RES	ERIE	304950			
40	1	8000-A-G3	CRYSTAL SOCKET	AUGAT	305520			
39								
38								
37	1	JSA-325-30-5/06NX-EAAG	SWITCH ASSY	ITT	723956			
36	2	DM15-471J	CAPACITOR 470PF, 500V, 5%	ARCO	026690			
35	2	DM15-301J	300PF		026645			
34	1	DM15-271J	270 PF		026615			
33	2	DM15-201J	200PF		026570			
32	1	DM15-161J	160PF		026495			
31	2	DM15-101J	100PF		026435			
30	1	DM15-500J	50 PF		026330			
29	1	DM15-680J	68PF, 500V, 5%		026375			
28	1	IMD-1-203J	.02 UF, 100V, 5%		024572			
27	1	IMD-1-103J	.01 UF, 100V, 5%	ARCO	024396			
26	1	5835-Y5U-103Z	CAPACITOR .01UF, 25V	ERIE	021540			
25	1	2N3642	TRANSISTOR	FAIRCHILD	080616			
24	1		RESISTOR 100K, 1/4W, 10%	AB	602684			
23	1		47K		602636			
22	1		470Ω		602324			
21	1		220Ω		602276			
20	1		RESISTOR 56Ω, 1/4W, 10%	AB	602192			
19	6	81090-2	NYLON ROD, THREADED	F.E.C.				
18	6	81452-1	NYLON ROD					
17	18	81098	SPACER					
16	12	81453	WASHER					
15	1	C1146-27	TOROID INDUCTOR					
14	1	-26						
13	1	-25						
12	1	-24						
11	1	-23						
10	1	-21						
9	2	-20						
8	1	-19						
7	1	-18						
6	1	-17						
5	1	-16						
4	2	-11						
3	2	-10						
2	2	C1146-6	TOROID INDUCTOR					
1	1	N0730B	P.C. BOARD	F.E.C.				

LIST OF MATERIAL

Figure 7-2. Parts List



NOTES:

1. DRILL ALL HOLES #60(.040) DIA., UNLESS OTHERWISE INDICATED.
△2 DRILL #49(.073) DIA.
△3 DRILL #43(.089) DIA.
△4 DRILL #52(.063) DIA.
△5 DRILL # 1/8(.125) DIA.
△6 DRILL # 9/64(.140) DIA.
△7 DRILL #55 (.052) DIA.
△8 DRILL #29(.136) DIA.
△9 DRILL #70(.028) DIA.
△10 ON 1500B USE MODEL 9.0-3.0 (ITEM 16)
ON 1500C USE MODEL 9.0-2.1 (ITEM 30)
11. REF. SCHEMATIC D1882.
△12 ITEMS 35,36 AND 37 TO BE USED WITH TYCO FILTER MODEL 9.0-.360 ON 1500B.
ITEM 37 FOR SPECIAL APPLICATIONS ONLY.

WIRE TABLE

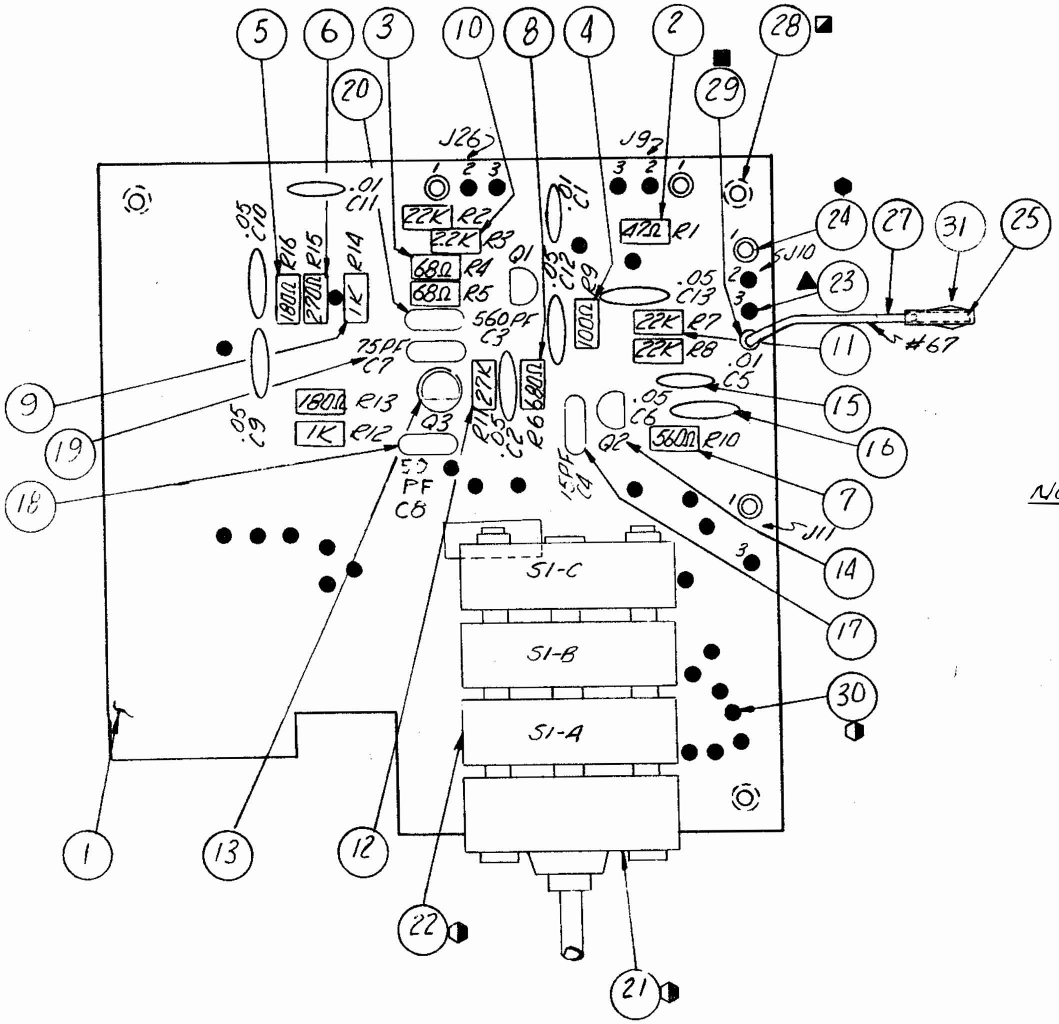
WIRE NO.	WIRE LENGTH	
1	5/16	
2	7/8	
3	9/16	
4	1	
5	3/4	
6	3/4	
7	1	
8	5/16	
9	3/4	
10	15/16	
11	5/8	
12	5/16	
13	5/16	

Figure 7-3. Mixer Board Assembly N0971-J2 thru J16-D2145C

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT PART NO	FINISH	FINISH SPEC	CKT SYM
△12 37	1	001-22080	CRYSTAL FILTER	TYCO	365480		MOD. 9.0-.350	
△12 36	1	DD 3.9	CHOKE	NYTRONIC	760005			
△12 35	1	R62-3-ET	STAKE PIN, MALE	BEAD CHAIN	744550			
34	A/R		TUBING, INSULATION, 24 GA.	ALPHA				
33	A/R		WIRE, SOLID #24 GA.	ALPHA				
32	8	34N-FL-.062	PRESSNUT	PMP	403525			
31	2	B1715	BRACKET	FEC				
△10 30	1	MODEL 90-2.1G	CRYSTAL FILTER	C.F. NETWORK	365050			
29	A/R	46410	GRIPLET	BERG				
28	21	S6064	EYELET	U.S.				
27	8		SCREW, 4-40 × 1/4 LG. BD.HD.	ST. STL.	404194			
26	10		WASHER, SPLITLOCK #4	PH. BRZ.	404880			
25	4		NUT, HEX 4-40 × 1/4 AF	ST. STL.	403030			
24	6	R62-3-ET	STAKE PIN, MALE	BEAD CHAIN	744550			
23	3	M93-102-ET	STAKE PIN, FEMALE	BEAD CHAIN	744555			
22	4	1300-9	STAND-OFF	CTC	683488			
21	2	TRT6-6025B	TUBE SHIELD	ELCO	780175			
20	2	9PCM-2	TUBE SOCKET	CINCH	248325			
19	2	7360	TUBE	RCA	780150			
18	1	C1322-2	COIL ASSY.	FEC				
17	1	C2151	COIL ASSY.	FEC				
△10 16	1	MODEL 9.0-3.0G	CRYSTAL FILTER	CF NETWORK	365075			
15	1	HT10KA/29	TRIM CAPACITOR	AMPEREX	029700			
14	5	SHK-910	CAPACITOR, .01 MFD 1 KV	SPRAGUE	021570			
13	2	5835Y5U103Z	↕ .01 MFD 25V	ERIE	021540			
12	3	JF820Z5F	↕ 820 PF	RMC	021270			
11	1	DM15-470 J	CAPACITOR, 47 PF ± 5%	ELMENCO	026300			
10	1	3067P-1-201	POTENTIOMETER, 200 Ω	BOURNS	627048			
9	1	RN60D1213 F	RESISTOR, 121 K, 1/4W ± 1%	A-B	625818			
8	1	RN55D2322F	↕ 23.2K, 1/8W ± 1%	↕	625568			
7	2		↕ 5.6K, 1/4W ± 10%	↕	602504			
6	2		↕ 1.5K ↕ ↕	↕	602396			
5	1		↕ 33K ↕ ↕	↕	602612			
4	2		↕ 220Ω ↕ ↕	↕	602276			
3	1		RESISTOR, 100Ω, 1/4, ± 10%	A-B	602228			
2	1	N0973	P.C. BOARD	FEC				
1	1	N0971A	P.C. BOARD	FEC				

LIST OF MATERIAL

Figure 7-3. Parts List



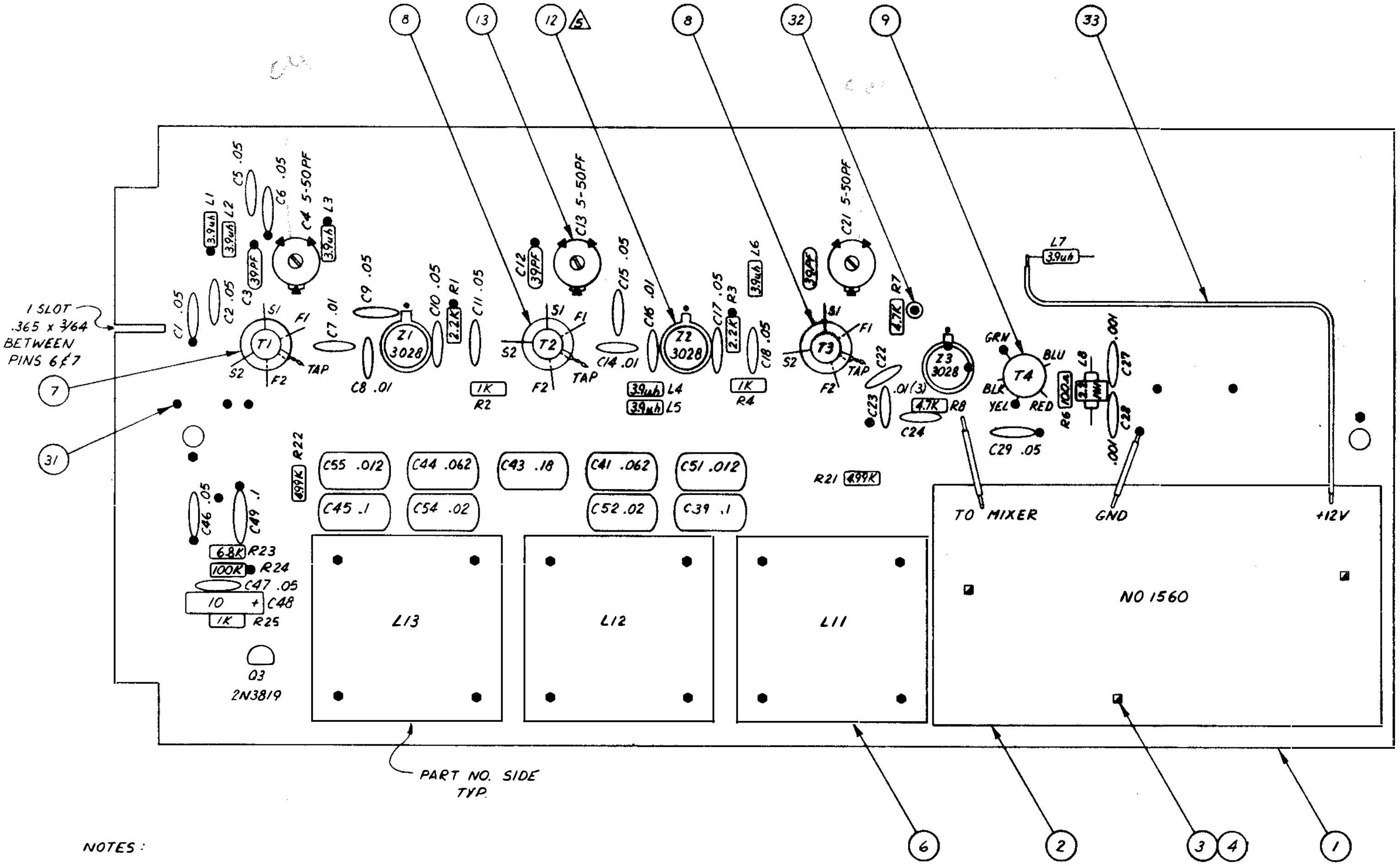
NOTES
1. UNLESS OTHERWISE SPECIFIED DRILL COMPONENT MTG. HOLES Nº 60(.040) OR
■ Nº 49 (.073) OR
⬢ Nº 43 (.089) OR
▲ Nº 52(.063) OR
◪ 9/64(.140) OR
◐ Nº 55(.052) OR
2. SOLDER AROUND STANDOFF & MALE PINS.
3. DO NOT PUT BOARD IN HEAT.

5. SCHEMATIC REF D1882

Figure 7-4. Local Oscillator, Board Assembly
NO848-J9 thru J11 & J26-C2150D

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT. PART NO.	FINISH	FINISH SPEC	CKT SYM
31	1	1625-1R	CONNECTOR	Molex.	246225			
30	19	46410	EYELET	BERG				
29	1	2059	EYELET	STIMPSON				
28	3	1300-13	STANDOFF	CTC	683504			
27	1		WIRE 20GA(WHT) 3"LG	ALPHA				
26								
25	1	1561TL8	FEMALE PIN	MoLEX	744410			
24	4	M93-102-ET	FEMALE STAKE PIN	MoLEX	744555			
23	7	R62-3-ET	MALE STAKE PIN	MoLEX	744550			
22	3							
21	1	JSR-325-30-3107	WX-EAAH SWITC ASSY.	ITT	723937			
20	1	DM-15-561J	CAPACITOR 560PF, 500V	ELMENCO	026715			
19	1	DM-15-750J	↑ 75PF, 500V	ELMENCO	026450			
18	1	DM-15-500J	│ 50PF, 500V	ELMENCO	026330			
17	1	DM-15-150J	│ 15PF, 500V	ELMENCO	026180			
16	6	5855Y5U503Z	↓ .05MF, 25V	ERIE	021660			
15	3	5835Y5U103Z	CAPACITOR .01MF, 25V	ERIE	021540			
14	2	2N3903	TRANSISTOR	MOT	080682			
13	1	2N3662	TRANSISTOR	G.E	080638			
12	1		RESISTOR 27K, 1/4W ± 10%	AB	602600			
11	3		↑ 22K ↑	↑	602588			
10	1		│ 2.2K │	│	602420			
9	2		│ 1K │	│	602372			
8	1		│ 680Ω │	│	602348			
7	1		│ 560Ω │	│	602336			
6	1		│ 270Ω │	│	602288			
5	2		│ 180Ω │	│	602264			
4	1		│ 100Ω │	│	602228			
3	2		↓ 68Ω ↓	↓	602204			
2	1		RESISTOR 47Ω, 1/4W ± 10%	AB	602180			
1	1	N°848	PC BOARD	FEC				

Figure 7-4. Parts List



NOTES:

1 SCHEMATIC REF D1987 SHT 2

2 UNLESS OTHERWISE SPECIFIED
DRILL ALL HOLES Nº 60 (.040) DR.
I.C.S' REQUIRE Nº 68 (.031) DR.
● – Nº 55 (.052) DR. – 24 PLACES – INSTALL 46410 GRIPLET
▲ – Nº 55 (.052) DR. – 9 PLACES
◉ – Nº 52 (.063) DR. – 1 PLACE – INSTALL R62-3-ET STAKE PIN
● – Nº 52 (.063) DR. – 12 PLACES
◘ – Nº 38 (.101) DR. – 3 PLACES
✱ – Nº 11 (.156) DR. – 2 PLACES

3 CLEAN BOARDS BEFORE INSTALLATION OF ITEM 13

△4 INSTALLATION OF NAT TYPE TRANSISTOR
WHEN USED FOR Q3 ◯ FLAT SIDE

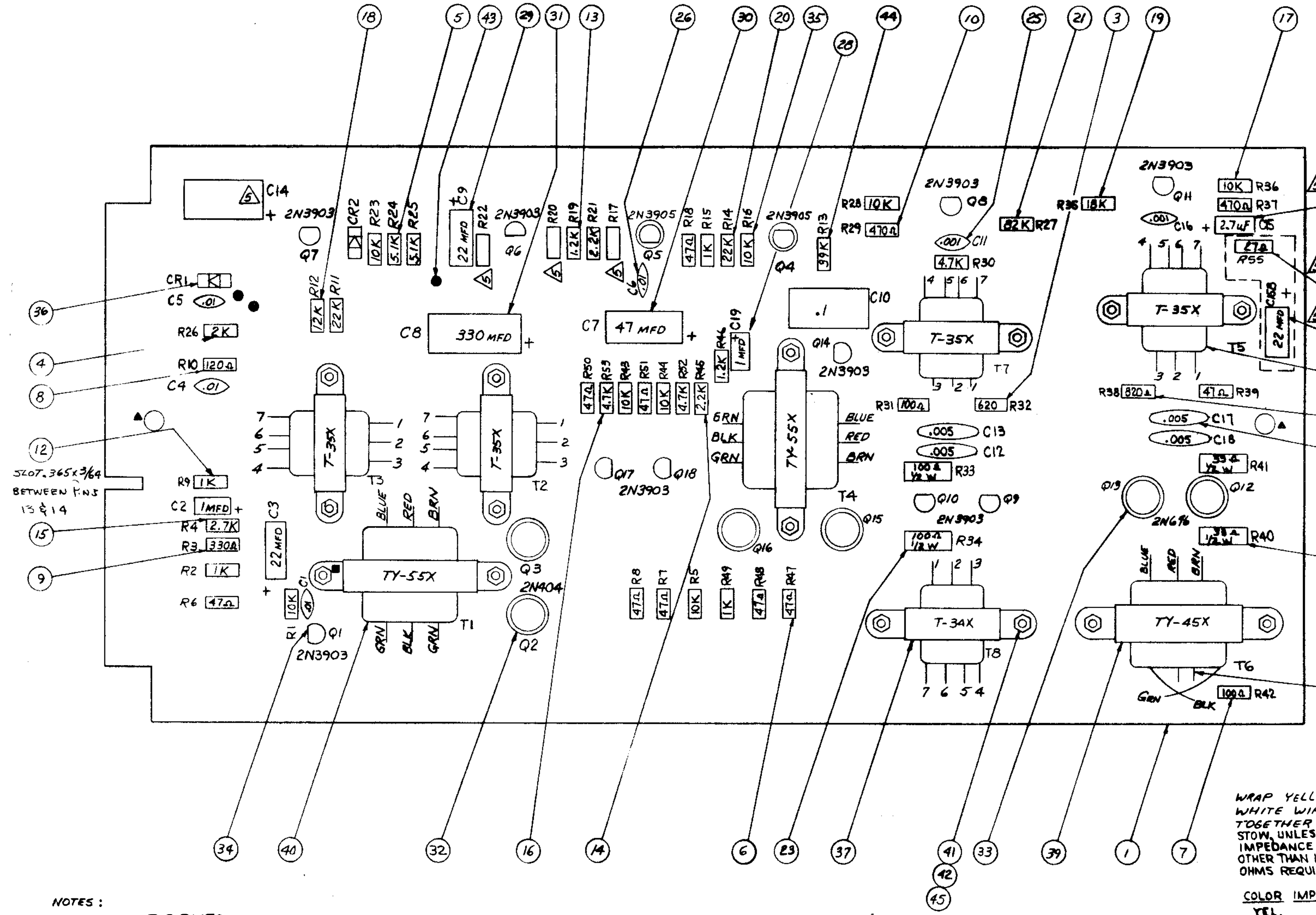
△5 WHEN INSTALLING ITEM 12 (Z1, Z2, Z3),
A SPACE OF 1/16"-1/8" MUST BE LEFT
BETWEEN I.C. AND BOARD. EFFECTIVE
AFTER JOB 61526

Figure 7-5. IF, BFO, And Detector, Board Assembly
NO901-J2-D1988M

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT PART NO	FINISH	FINISH SPEC	CKT SYM
36	2	1MD-2-623J	CAPACITOR .062uf 100V 5%	ELMENCO	025066			
35	1	J0.625X.250T22	INSULATED JUMPER	SQUIRE	366519			
34	1	J0.900X.250T22	INSULATED JUMPER	SQUIRE	366525			
33	1	J3.750X.250T22	INSULATED JUMPER	SQUIRE	366585			
32	1	R62-3-ET	STAKE PIN (MALE)	B.C.	744550			
31	A/R	46410	EYELET	BERG				
30	1	2N3819	TRANSISTOR	TI	080670			
29	2	RN55D4991F	RESISTOR 4.99K 1/4W 1%	CORNING	624891			
28	1	RC07GF104K	RESISTOR 100K 1/4W 10%	A-B	602684			
27	1	RC07GF682K	↓ 6.8K ↓	↓	602516			
26	2	RC07GF472K	4.7K		602492			
25	2	RC07GF222K	2.2K		602420			
24	3	RC07GF102K	↓ 1K ↓	↓	602372			
23	1	RC07GF101K	RESISTOR 100Ω 1/4W 10%	A-B	602228			
22	1	150D106X9020B2	CAPACITOR 10MF 20V	SPRAGUE	028506			
21	1	5815Y5U104Z	↓ .1MF 25V	ERIE	021840			
20	2	1MD-1-203J	.02MF 100V 5%	ELMENCO	024572			
19	2	1MD-2-104J	.1MF 100V 5%	ELMENCO	025154			
18	13	5855Y5U503Z	.05MF 25V	ERIE	021660			
17	1	1MD-3-184J	.18MF 100V 5%	ELMENCO	025315			
16	7	5835Y5U103Z	.01MF 25V	ERIE	021540			
15	2	801X5F102K	.001MF 1KV	ERIE	021300			
14	3	DM-15-390J	↓ 39PF 500V	ELMENCO	026270			
13	3	HT10MA/550	CAPACITOR 5-50PF	AMPEREX	029650			
12	3	CA3028A	INTEGRATED CIRCUIT	RCA	060190			
11	7	DD-3.9	CHOKE 3.9MH	NYTRONICS	760005			
10	1	70F223A1	CHOKE 2.2MH	MILLER	760025			
9	1	DO-T11	TRANSFORMER	UTC	765005			
8	2	C2201-2	COIL ASSY.	FEC				
7	1	C2201-1	COIL ASSY.	FEC				
6	3	B0974	INDUCTOR	FEC				
5	2	1MD-1-123J	CAPACITOR .012MF 100V 5%	ELMENCO	024484			
4	3		WASHER NO. 2 SPLIT LOCK	SST	404861			
3	3		SCREW NO. 2-56x5/16 BD HD	SST	404020			
2	1	D3927	P.C. BOARD ASSY. N01560	FEC				
1	1	N0901A	P.C. BOARD	FEC				

LIST OF MATERIAL 6/526

Figure 7-5. Parts List



WRAP YELLOW & WHITE WIRES TOGETHER & STOW, UNLESS IMPEDANCE OTHER THAN 16 OHMS REQUIRED.

COLOR	IMPEDANCE
YEL.	4
WHT.	8
GRN.	16

NOTES:

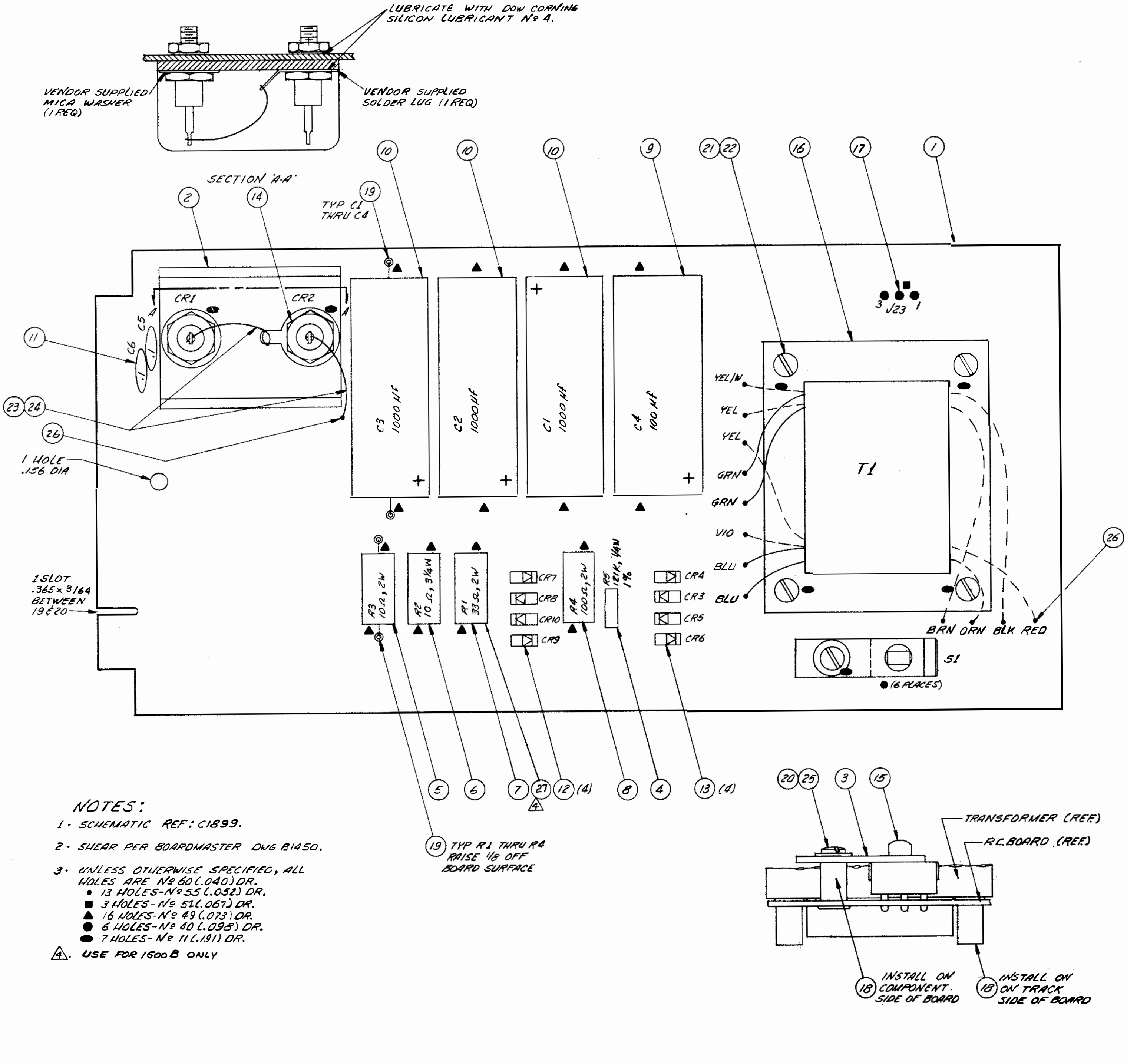
1. SCHEMATIC REF. D1670
2. UNLESS OTHERWISE SPECIFIED DRILL ALL MTG. HOLES #60(.040)
3. ▲ NO. 5/32 DR. (.156) 2 PLACES
4. ■ No. 38 DR. (.101) 16 PLACES
5. SEE TABLE BELOW FOR COMPONENT VALUE AND ITEM Nº
6. GRIPLET ALL HOLES ON P.C.B. EXCEPT TRANSISTOR MOUNTING HOLES.

1500C	15Ω ITEM 49	1K ITEM 12	1.5K ITEM 50	NOT USED	.1UF ITEM 27	2.7UF ITEM 46	NOT USED
1500B	15Ω ITEM 49	1K ITEM 12	1.5K ITEM 50	27Ω ITEM 47	22UF ITEM 29	NOT USED	22UF ITEM 29
1500A	200Ω ITEM 2	1.2K ITEM 13	2.2K ITEM 14	NOT USED	.1uf ITEM 27	2.7uf ITEM 46	NOT USED
MODEL Nº	R17	R20	R22	R55	C14	C15	C15B

Figure 7-6. Audio And AGC, Board Assembly
N0733-J3-D1671F

	1500C	1500B	ITEM	1500A	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT PART NO	FINISH	FINISH SPEC	CKT SYM
△5	1	1	50	N/R		RESISTOR 1.5K 1/4W 10%	A.B.	602396			
△5	1	1	49	N/R		RESISTOR 15Ω 1/4W 10%	A.B.	602108			
	A/R	A/R	48	A/R	46410	GRIPLET	BERG				
△5	N/R	1	47	N/R		RESISTOR, 27Ω 1/4W ± 10%	A-B	602144			
△5	1	N/R	46	1	V500275X3015A2	CAPACITOR 2.7UF 15V	SPRAGUE	028373			
	16	16	45	16		NUT, HEX 2-56 3/16 AF	BRASS	403010	NI-P		
	1	1	44	1		RESISTOR, 39K 1/4W ± 10%	A-B	602624			
	A/R	A/R	43	A/R		WIRE 22GA SOLID	ALPHA				
	16	16	42	16		WASHER, NO.2 SPLIT LOCK	PHOS. BRZ.	404861	NI-P		
	16	16	41	16		SCREW, 2-56 x 1/4 LG BD.HD.	BRASS	404016	NI-P		
	2	2	40	2	TY-55X	TRANSFORMER	TRIAD	765260			
	1	1	39	1	TY-45X			765025			
	4	4	38	4	T-35X			765020			
	1	1	37	1	T-34X	TRANSFORMER	TRIAD	765015			
	2	2	36	2	FD100	DIODE	FAIRCHILD	040238			
	2	2	35	2	2N3905	TRANSISTOR	G.E.	080704			
	10	10	34	10	2N3903		MOT.	080682			
	2	2	33	2	2N696		TI	080286			
	4	4	32	4	2N404	TRANSISTOR	G.E.	080132			
	1	1	31	1	V500-337X9006S2	CAPACITOR, 330 MFD, 6V	SPRAGUE	028880			
	1	1	30	1	V500-476X9006B2	47 6V		028704			
△5	2	4	29	2	V500-226X9015B2	22 15V		028594			
	2	2	28	2	500-105X9035A2	1 35V		028220			
△5	2	1	27	2	192P-10492	.1 200V	SPRAGUE	025176			
	4	4	26	4	5835-Y5U-103Z	.01 25V	ERIE	021540			
	2	2	25	2	801-X5F-102K	.001 1KV	ERIE	021300			
	4	4	24	4	835X5V0502Z	CAPACITOR, .005 MFD, 100V	ERIE	021480			
	2	2	23	2		RESISTOR, 100Ω 1/2 W 10%	A-B	604250			
	2	2	22	2		33Ω 1/2 W 10%		604150			
	1	1	21	1		82K 1/4W. 10%		602672			
	2	2	20	2		22K		602588			
	1	1	19	1		18K		602576			
	1	1	18	1		12K		602552			
	8	8	17	8		10K		602540			
	3	3	16	3		4.7K		602492			
	1	1	15	1		2.7K		602432			
△5	2	2	14	3		2.2K		602420			
△5	2	2	13	3		1.2K		602384			
△5	5	5	12	4		1K		602372			
	1	1	11	1		820Ω		602360			
	2	2	10	2		470Ω		602324			
	1	1	9	1		330Ω		602300			
	1	1	8	1		120Ω		602240			
	2	2	7	2		100Ω		602228			
	9	9	6	9		47Ω 1/4W. 10%		602180			
	2	2	5	2		5.1K 1/4W. 5%		601432			
	1	1	4	1		2K		601304			
	1	1	3	1		620Ω		601208			
△5	N/R	N/R	2	1		RESISTOR, 200Ω. 1/4W ± 5%	A-B	601160			
	1	1	1	1	N0733A	P. C. BOARD	FEC				
	-2	-1	LIST OF MATERIAL								

Figure 7-6. Parts List



NOTES:

1. SCHEMATIC REF: C1899.

2. SHEAR PER BOARDMASTER DWG B1450.

3. UNLESS OTHERWISE SPECIFIED, ALL HOLES ARE Nº 60 (.040) DR.
   - • 13 HOLES - Nº 55 (.052) DR.
   - ■ 3 HOLES - Nº 52 (.067) DR.
   - ▲ 16 HOLES - Nº 49 (.073) DR.
   - ● 6 HOLES - Nº 40 (.098) DR.
   - ⬬ 7 HOLES - Nº 11 (.191) DR.

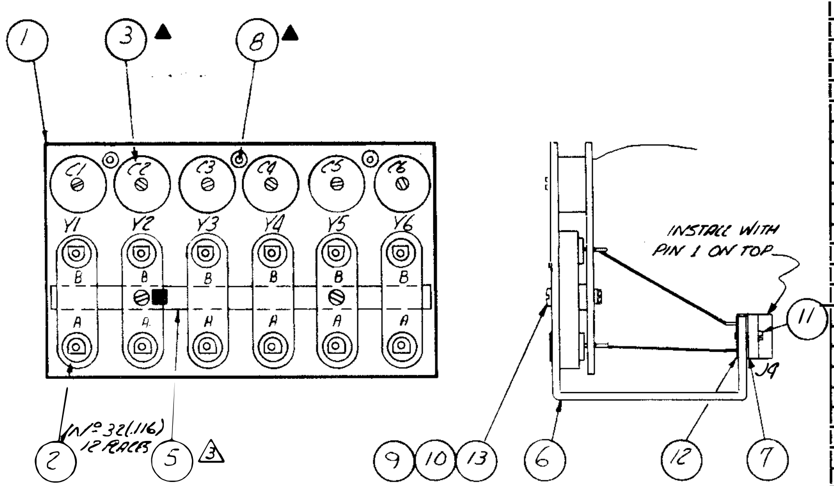
△4. USE FOR 1600B ONLY

Figure 7-7. Power Supply, Board Assembly
N0724-J1-D1676E

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT. PART NO.	FINISH	FINISH SPEC	CKT SYM
27	1	4361	RESISTOR, 10Ω, 3¼W, 5%	OHMITE				
26	13	S6064	EYELET	U.S.				
25	1		WASHER, № 6 FLAT	SST				
24	A/R		TUBING, № 20 GA NATURAL	ALPHA				
23	A/R		WIRE, № 20 GA SOLID	ALPHA				
22	4		WASHER, № 6 INT. TOOTH	SST				
21	4		SCREW, № 6-32×⅜ Bd. Hd.	SST				
20	1		SCREW, № 6-32× 5/16 Bd Hd	SST				
19	16	2059	EYELET	STIMPSON				
18	5	1246-12	STANDOFF	CTC				
17	3	R62-3-ET	STAKE PIN, MALE	BEAD CHAIN				
16	1	TM1019	TRANSFORMER	TRANS. INC.				
15	1	G126	SWITCH, DPDT	C. WIRT				
14	2	1N1353A	DIODE, ZENER	MOT				
13	4	1N4004	DIODE	MOT				
12	4	1N4002	DIODE	ITT				
11	2	845X5V0104Z	CAPACITOR .1UF 100 V	ERIE				
10	3	390108G025GL4	CAPACITOR 1000 UF 25V	SPRAGUE				
9	1	390107F250HL4	CAPACITOR 100 UF 250 V	SPRAGUE				
8	1		RESISTOR 100Ω 2W 10%	AB				
7	1		33Ω 2W 10%	AB				
6	1	4361	10Ω 3¼W 5%	OHMITE				
5	1		10Ω 2W 10%	AB				
4	1	RN60D1213F	RESISTOR 121K ¼W 1%	AB				
3	1	B1173	SWITCH PLATE	FEC				
2	1	B1144-1	HEAT SINK	FEC				
1	1	N0724	P.C. BOARD	FEC				

Figure 7-7. Parts List

NOTE:
ALIGN BOARD ASSEMBLY IN JIG WHILE SOLDERING.



WIRING CHART

Y1-B	TO	J1-1
Y1-A	"	J1-A
Y2-B	"	J1-2
Y2-A	"	J1-B
Y3-B	"	J1-3
Y3-A	"	J1-C
Y4-B	"	J1-4
Y4-A	"	J1-D
Y5-B	"	J1-5
Y5-A	"	J1-E
Y6-B	"	J1-6
Y6-A	"	J1-F

USE 24 GA. BUS WIRE

NOTES

1. ▲ Nº 55(.052) DR. - 21 PLACES
   ■ 1/8(.125) DR. - 2 PLACES
2. CRYSTAL FREQ. DEPENDS ON CUSTOMERS REQUIREMENTS.
△3 ALIGN HOLES ON SPACER (ITEM 5) WITH HOLES ON PC BOARD BEFORE SOLDERING CRYSTAL SOCKETS TO BOARD.
4. WIRE J1(ITEM 7) PER WIRING CHART
5. SCHEMATIC REF D1674
6. DO NOT CLEAN THIS BOARD!
   BECAUSE IT REMOVES LUBRICANT ON ITEM 3.
7. DO NOT PUT BOARD IN HEAT.
8. REF SCHEMATIC D1882

ITEM	REQ'D	PART NO	DESCRIPTION	MAT'L OR MFR	MAT'L SPEC OR CAT PART NO.	FINISH	FINISH SPEC	CKT SYM
13	2		NUT Nº 4-40 x 1/4 AF		SST	403030		
12	2	C15263-42-24	NUT Nº 4	TINNERMAN	403170			
11	2		SCREW, SELF TAP Nº 4 x 1/2, B		SST	404780	[illegible]	
10	2		WASHER, Nº 4 INT. TOOTH		SST	404878		
9	2		SCREW, Nº 4-40 x 5/8 BH		SST	404227		
8	3	56064	EYELET	US				
7	1	251-06-30-160	CONNECTOR	C-J	241625			
6	1	B1451	CRYSTAL MTG BRACKET	FEC				
5	1	B1455	SPACER	FEC				
4			20GA. STR	ALPHA				
3	6	HT10MA1550	CAPACITOR, TRIM	AMPEREX	029650			
2	6	05-0210-01	CRYSTAL SOCKET	ELCO	305500			
1	1	Nº 736	PC BOARD	FEC				

LIST OF MATERIAL

Figure 7-8. Crystal Holder Assembly
N0736-J4-C1900F

APPENDICES

APPENDIX A

SPECIAL APPLICATION DATA

A.1 GENERAL

This Appendix contains useful application data for operating the 1500C Receiver in communication systems utilizing various transmission modes.

A.2 DEFINITIONS

Definitions of the terms used in the following examples are listed below:

f_c = Carrier frequency of transmitter or exciter (herein called exciter) as indicated by the frequency settings, whether or not the carrier is suppressed.

f(1500C) = Operating frequency of 1500C used to calculate the crystal frequencies or to set the frequency switches on an associated 1550 Synthesizer.

f_x = Calculated 1500C crystal frequency.

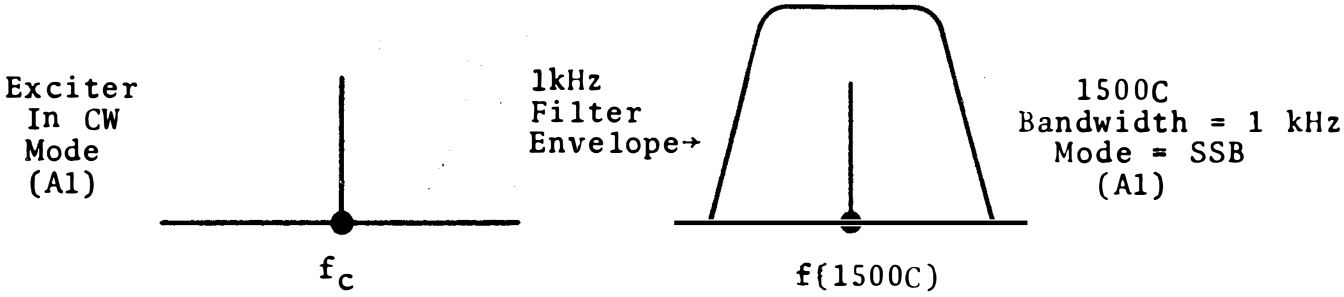
A1 = Modulation designator for on-off keying of a continuous-wave (CW) carrier by the modulating signal, without the use of any other modulation.

F1 = Modulation designator for Frequency-Shift-Keying (FSK) where the frequency of a continuous-wave carrier is shifted between two predetermined frequencies by the modulating signal.

A7J = Designator for keying (any type of keying: on-off, amplitude, frequency-shift, etc.) by a modulating signal of independent sub-carriers in frequency division multiplex systems, which in turn amplitude-modulate a continuous wave-carrier.

Example: Single sideband, suppressed carrier, single sub-carrier (single sideband emissions with suppressed carrier modulated only by a single sub-carrier are classified as if the sub-carrier were the main carrier.)

A.3 CW OPERATION



$$f_c = f(1500C)$$

FREQUENCY OF CRYSTAL (f_x)

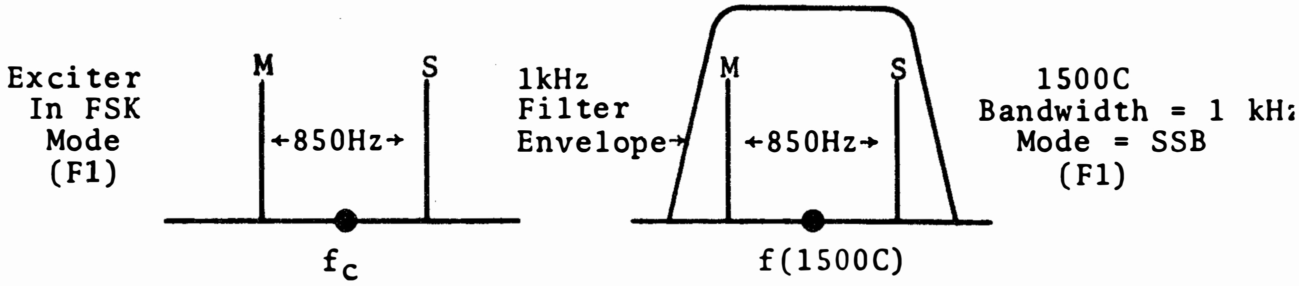
Bands A thru C and L: $f_x = f(1500C)+9.0$ MHz
$= f_c+9.0$ MHz

Bands D and E: $f_x = f(1500C)-9.0$ MHz
$= f_c-9.0$ MHz

A.4 FSK OPERATION

The frequency shift (850 Hz), audio center frequency (2550 Hz), and the mark-space tone relationship in the following examples are typical figures which can vary with individual customer requirements.

A.4.1 METHOD 1



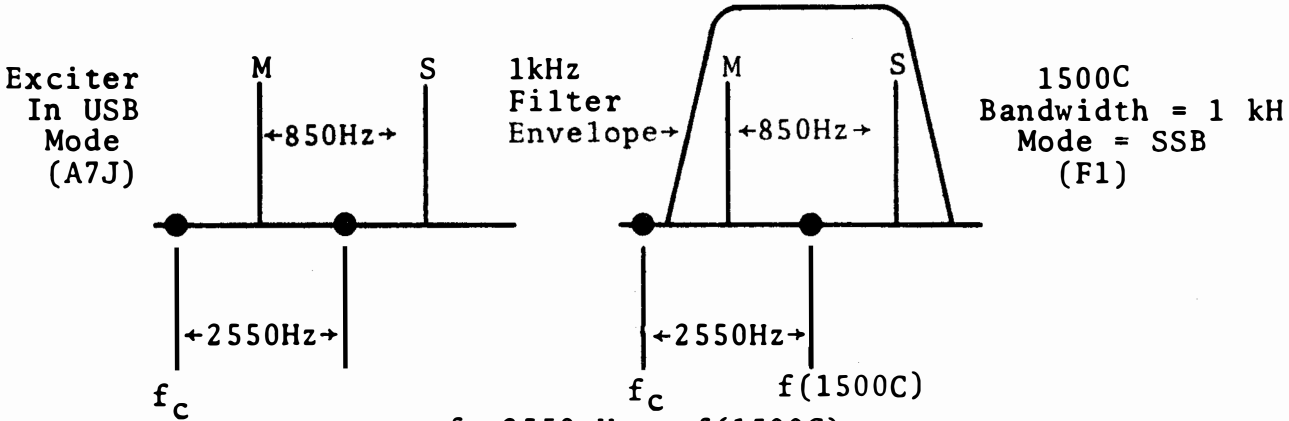
$$f_c = f(1500C)$$

FREQUENCY OF CRYSTAL (f_x)

Bands A thru C and L: $f_x = f(1500C)+9.0$ MHz
$= f_c+9.0$ MHz

Bands D and E: $f_x = f(1500C)-9.0$ MHz
$= f_c-9.0$ MHz

A.4.2 METHOD 2



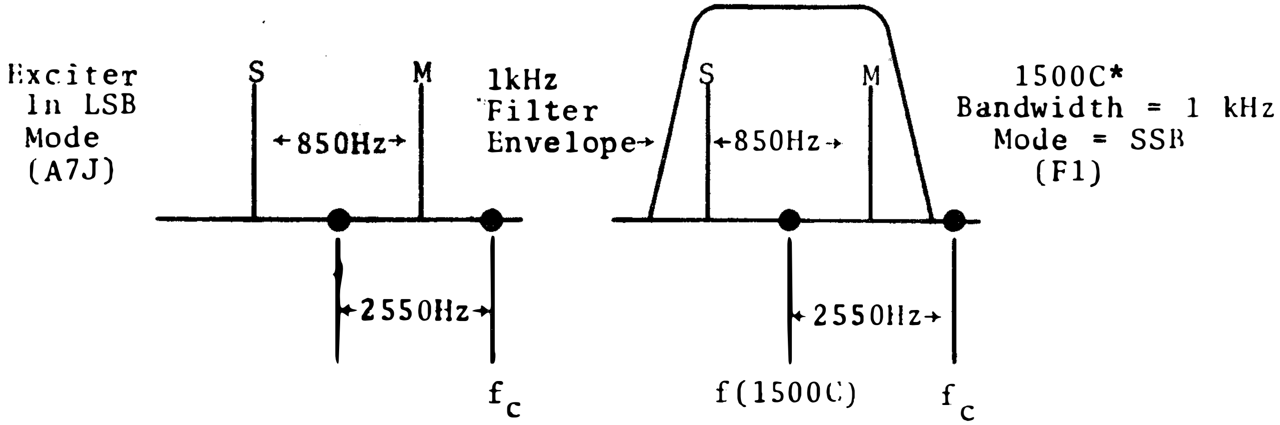
$$f_c+2550 \text{ Hz} = f(1500C)$$

FREQUENCY OF CRYSTAL (f_x)

Bands A thru C and L: $f_x = f(1500C)+9.0$ MHz
$= f_c+2550$ Hz$+9.0$ MHz

Bands D and E: $f_x = f(1500C)-9.0$ MHz
$= f_c+2550$ Hz-9.0 MHz

A.4.3 METHOD 3



$$f_c - 2550\text{ Hz} = f(1500C)$$

* 1200 and 1203 Converters - Place NORMAL/REVERSE switch in REVERSE

FREQUENCY OF CRYSTAL (f_x)

Bands A thru C and L: $f_x = f(1500C) + 9.0$ MHz
$= f_c - 2550$ Hz$+9.0$ MHz

Bands D and E: $f_x = f(1500C) - 9.0$ MHz
$= f_c - 2550$ Hz-9.0 MHz