OPERATING AND SERVICE MANUAL

MODEL DY-5842
VLF RECEIVER

Serials Prefixed

HEWLETT PACKARD

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SECTION 1
GENERAL DESCRIPTION

1.1 ELECTRICAL DESCRIPTION

The Model DY-5842 VLF Receiver is a transistorized, crystal controlled, superheterodyne type for the frequency range 14 to 60 kc. It is designed for high sensitivity, narrow bandwidth reception of VLF Standard Frequency broadcasts, such as those from WWVL. The received broadcast signal is restored at up to 130 db of voltage gain. This restored broadcast signal may be applied to a calibration system for a local standard frequency. For Station WWVL only, an optional modification (M1) to the standard DY-5842 Receiver provides a simple phase comparison system for calibration of a 100 kc local standard frequency.

The DY-5842 includes a signal level meter, permitting it to be used for VLF field strength measurements. Such measurements are facilitated through the ability of the DY-5842 Receiver to operate from a battery power supply. In addition, a front panel jack provides for recordings of the meter indications by an ungrounded, external, galvanometer type recorder.

Each of up to five crystal controlled reception channels, or a sixth channel controlled by an external local oscillator, may be used. The following table lists the frequencies and transmitting stations covered by Dymec supplied crystals:

FREQUENCY	TRANSMITTING STATION	
14.7 kc	NAA	Maine, U.S.A.
16. kc	GBR	Great Britain
18. kc	NBA	Panama
18.6 kc	NPG/NLK	Washington State, U.S.A.
19.8 kc	NPM	Hawaii, U.S.A.
20. kc	WWVL	Colorado, U.S.A.
60. kc	WWVB	Colorado, U.S.A.
60. kc	MSF	Great Britain

Crystals for other signals in the Receiver's range may be obtained, by special order, from Dymec.

As a result of the high sensitivity of the DY-5842 Receiver, a loop antenna may be used in noisy urban locations. A 4-foot diameter, shielded loop is available as an optional accessory.

1.2 PHYSICAL DESCRIPTION

The DY-5842 VLF Receiver is available housed in a cabinet designed for bench top use, or enclosed in dust covers for rack mounting. Standard front panel finish is non-reflecting light-grey baked enamel with black-filled engraved control titles. Cabinets for the Receiver are equipped with carrying handles and are painted in wrinkle-finish grey-baked enamel.

1.3 SPECIFICATIONS

FREQUENCY RANGE
14 to 60 kc.

SENSITIVITY
Seven ranges for full scale outputs, 3, 10, 30, 100, 300, 1000, and 3000 μv. (Receiver useful to less than 1 μv.)

SELECTIVITY
± 3-1/2 cycle bandwidth -- at least 3 db down.
±70-0/0 cycle bandwidth -- at least 80 db down.

INPUT CIRCUIT
Balanced input for shielded 2-wire input cable through a UG-103/U connector. 2-position front panel switch provides selection of tuned or untuned input. Tuned input operation includes tuning controls for the accessory loop antenna, and adjustable trimmers to compensate for length of antenna-to-Receiver cable used. Impedance of untuned input 20K (kilohms) minimum.

RESTORED BROADCAST SIGNAL OUTPUT
10v rms maximum for full scale meter deflection regardless of meter range. Front panel GAIN control provided to establish desired output level. Output impedance 600Ω.

RESTORED BROADCAST SIGNAL PHASE SHIFT
Phase shift between restored and received signals varies less than 5 μs over the temperature 0 to 50°C.

EXTERNAL FILTER
An external Bridged-T filter can be plugged directly into front panel binding posts to provide at least 35 db of adjacent signal rejection.

EXTERNAL LOCAL OSCILLATOR
An external local oscillator, which provides sine wave signals 100 kc above the broadcast signals to be received, may be applied through a front panel BNC connector. Input impedance 600Ω, input level 10 to 50 mv rms, sine wave.

RECORDER OUTPUT
1 ma dc into 1500Ω or less, for an ungrounded galvanometer type recorder.

POWER REQUIRED
115/230 vac ±10%, 50 to 1000 cps, approximately 3w. Circuitry provided for operation from an external battery supply, 18 to 28v dc.

DIMENSIONS (Overall)

Cabinet Mount: 20-3/4 inches wide, 12-1/2 inches high, 16 inches deep.

Rack Mount: 19 inches wide, 10-5/32 inches high, 16 inches deep.

WEIGHT

Cabinet Mount: Net 40 lb, shipping 60 lb.

Rack Mount: Net 35 lb, shipping 55 lb.

ACCESSORIES AVAILABLE

1. Internal Local Oscillator Crystals: Frequency range 14.7, 16., 18., 18.6, 19.8, 20., and 60. kc. Crystals for other frequencies within the range 14. to 60. kc available on special order.

2. Loop Antenna: Shielded, 4-foot diameter. Permissible wind load, 80 mph. Furnished with 50 feet of input cable. Longer input cables furnished on special order, recommended maximum 250 feet. Stock No. 9060-0020. (Net weight 19 lb, Shipping weight, with 50 feet of input cable, 70 lb, approximately.)

3. Bridged-T Filter: Fixed tuned for specified frequency. Provides at least 35 db adjacent signal rejection.

OPTIONAL MODIFICATIONS

M1. Electronic Phase Comparator: Permits direct and continuous phase comparison against WWVL. Specifications on page 1-4.

OPTIONAL MODIFICATION M1 SPECIFICATIONS ADDED TO STANDARD DY-5842 VLF RECEIVER

1. 100 kc Standard Reference Input: Input impedance 6000Ω approximately. Accepts sine wave voltages from 1 to 10v rms; positive pulses 1v peak minimum; square wave voltages 1.5v p-p minimum.

2. Potentiometer Recorder Output: Adjustable from 0 to at least 100 mv for full scale (50 μs or 360°) deflection.*

3. Galvanometer Recorder Output: Adjustable from 0 to at least 1 ma for full scale (50 μs or 360°) deflection.*

4. Integration Time Constant: 5 seconds on both recorder outputs. May be modified by user as desired.

*Both recorder outputs may be used simultaneously.

SECTION 2
INSTALLATION AND OPERATION

2.1 INSTALLATION

Due to low power consumption and heat dissipation, the DY-5842 VLF Receiver may be operated in any location with normal temperature and humidity conditions, and does not require any special ventilation.

Normally, the DY-5842 Receiver's ac power input circuits are wired for a 115v ac power source. These circuits may be converted to operate from a 230v power source by rewiring the primary of the power transformer T10 as follows:

1) Leads for the primary winding are wired to a 5-lug tie-point strip mounted near the transformer.
2) Remove the jumper wire between the black and green-with-black tracer leads.
3) Remove the jumper wire between the black-with-yellow and red-with-black tracer leads.
4) Install an insulated jumper between the green-with-black and black-with-yellow tracer leads.
5) Replace the .125a fuse F1 used for 115v ac operation with a 1/16a fast-action fuse.

2.2 CONTROLS, CONNECTORS, AND INDICATORS

Front Panel	Description
RANGE (μv)	Switch used to set the gain of the IF amplifier and, thereby, the full scale reading of the Receiver's level meter.
RMS VOLTS	Meter to indicate the level of the received broadcast signal, when the GAIN control is in the CAL (switched) position.
CHANNEL	Switch used to select the predetermined local oscillator frequency (one of five internal, or an external) for a desired broadcast signal. In the Receiver's LOOP INPUT operating mode, this control also selects a capacity to initially tune the accessory loop antenna.

Front Panel	Description
LOOP TUNE -- COARSE and FINE	Two switches used to select the internal capacities to compensate for the length of antenna-to-Receiver cable used.
METER CAL	Screwdriver control used in the Receiver's maintenance procedure only, to establish the gain of the meter amplifier. Refer to Section 4.5.5.
FREQUENCY TRIM	Screwdriver controls used with the corresponding positions of the CHANNEL switch, to optimize the internal local oscillator frequencies.
UNTUNED -- LOOP INPUT	The LOOP INPUT position of this switch applies tuning capacitors in the Receiver to the antenna system.
GAIN -- CAL	Potentiometer-with-switch control used to adjust the Receiver's input differential amplifier for a desired output level. In the CAL position, the RMS VOLTS meter indicates the input signal level.
CHANNEL -- FREQ	Chart identifies the broadcast signal frequency for which each reception channel has been preset. Refer to Section 1.1.
INPUT	Connector to accept a shielded 2-wire input cable from the Receiver's antenna system.
EXT FILTER	Binding posts provided with a shorting bar between the two red posts. The circuit between the Receiver's differential preamplifier and input amplifier is completed through these posts. The Bridged-T filter accessory may be substituted for the shorting bar at any time.
RECORDER	Phone jack receptacle to provide connection for an ungrounded galvanometer type recorder in series with the RMS VOLTS meter.
OUTPUT	Connector (BNC) furnishes the Receiver's restored broadcast signal output to external circuits.
EXT L.O.	Connector (BNC) receives signals from an external local oscillator to provide a sixth reception channel.

Front Panel	Description
POWER ON	Toggle switch in the ON position applies ac line power to the primary of the power transformer T10, and connects the positive terminal of the dc power source to the Receiver's chassis.
POWER	Indicator lamp lights when the ac line is turned on, does not light when the dc power source is on.
0.125A	Fuseholder to contain the 0.125a cartridge fuse. It is wired in series with the ac power input circuits. This fuse must be replaced by a 1/16a fuse if the instrument is wired for 230v ac operation.

Rear Panel	Description
AC	Power line cable is a 3-conductor cable equipped with a NEMA approved 3-contact plug. The round, off set contact connects the instrument chassis to earth ground. An adapter may be used to connect the Receiver to a 2-contact receptacle.
POWER INPUT DC	Binding posts to receive power from an external dc power source. Voltage from the dc power source must be within the limits indicated, and connected according to the polarity indicated. CAUTION The positive (red) terminal is connected to the instrument chassis, when the front panel POWER switch is ON. The external dc power source should be a floating supply, otherwise a short circuit may be established. Fuses on both sides of the dc power source, rated at a maximum of 1a, are recommended.
SELECTOR -- DC and AC	Slide switch used to connect the appropriate supply to the Receiver's power supply regulator circuits.

The following items are blank positions filled by plug buttons in a standard Receiver. When Optional Modification M1 is included with the Receiver, these items exist as listed.

Blank Positions	Optional Modification M1 Description
100 KC IN	Connector (BNC) used to receive a user's 100 kc input for comparison with WWVL.
POT RCDR	Binding posts wired to connect the phase comparator output to a potentiometer type recorder.
CALIBRATE (HALF SCALE)	Two screwdriver controls used when the RCDR OUT MODE switch is in the CAL position. Each control is used to set its corresponding recorder's deflection at half of the full scale deflection.
GALV RCDR	Binding posts used to connect the phase comparator output to a galvanometer type recorder.
RCDR OUT MODE	A 3-position switch used to set the phase comparator output as follows: <u>ZERO-Position:</u> Disables the phase comparator's input and output circuits. <u>CAL-Position:</u> Connects both phase comparator inputs to the same signal to obtain an output for 25 μs (180°) phase difference. <u>OPERATE-Position:</u> Connects each of the comparator inputs to their normal signal sources. The output then is proportional to phase differences between WWVL and the user's local 100 kc standard frequency.
LEVEL RCDR INPUT MODE INPUT	Blank positions used when the RECORDER connector, UNTUNED INPUT--LOOP INPUT switch, and INPUT connector are to be relocated to the rear panel, as might be desired for a rack installation.

2.3 OPERATION

To ready the Receiver for operation for the first time, the meter should be mechanically zero set before power is applied. This adjustment is needed only at the initial installation of the instrument in a given location. The meter pointer should be adjusted by the procedures given below, under three Receiver conditions -- at normal operating temperature -- in normal operating position -- power has been turned off for at least 10 minutes.

Mechanically zero set the meter by the following steps:

1) Rotate the adjustment screw on the meter panel clockwise (cw) until the meter pointer is to the left of zero and further cw rotation will move the pointer up scale toward zero.

2) Turn the adjustment screw cw until the meter pointer is exactly over the zero mark. If the screw is turned too far, do not correct it by counter-clockwise (ccw) rotation, but repeat steps 1 and 2 of this Section.

3) Now turn the adjustment screw ccw about 15°, but not far enough to move the meter pointer down scale. If the pointer moves in either direction, repeat the entire procedure. This procedure zero sets the meter for best accuracy and mechanical stability.

Before the POWER switch is turned on, the SELECTOR switch on the rear panel must be set for AC or DC operation, as required.

2.3.1 Instrument Turn On

Before the instrument is turned on, the preliminary adjustments given in the preceding paragraphs should be checked. No special turn on procedure or warm up period is needed. The following operating procedures may be started directly after the POWER switch is turned on.

2.3.2 VLF Broadcast Reception

The basic function of the Receiver is to amplify the level of the transmissions received, from a Standard Frequency broadcast station, to a voltage level which may be used in a comparison system. This section describes the procedures which optimize the reception of a given broadcast signal.

2.3.2.1 Preliminary Tuning of FREQUENCY TRIM

1) Disconnect the shorting bar between the two red binding posts. Connect a 1 kc sine wave signal, from a crystal controlled local standard frequency, between the black and right hand red binding posts of the EXT FILTER connector. The Receiver may then be pre-tuned to harmonics of this signal (such as the 16th harmonic for GBR, 18th for NBA, 20th for WWVL, etc.) by the following steps.

2) Set the GAIN control to the CAL (switched, at fully cw) position.

3) Set the CHANNEL selector to the position indicated by the CHANNEL-FREQ chart, or the EXT L.O. position. If an external local oscillator signal is to be used, it is connected to the EXT L.O. connector (BNC) on the front panel. The frequency used must be 100 kc above the frequency of the signal to be received at an amplitude between 10 and 50 mv.

4) Set the RANGE selector as needed to keep the RMS VOLTS meter deflection on scale.

NOTE: When the 3 (μv) position of the RANGE control is used the Receiver is extremely sensitive. In most locations this sensitivity will allow the ambient noise to cause a restored frequency output, even when there is no connection to the INPUT receptacle. This undesired output may be stopped by shorting the INPUT connectors or increasing the RANGE control setting.

The 3 (μv) RANGE position may also allow the Receiver to oscillate due to feedback from the circuits using the restored frequency output. Suitable shielding of the output circuits will prevent this.

5) When a LOOP INPUT is to be used (see step 2, Section 2.3.2.2) adjust the COARSE and FINE TUNE controls for maximum meter deflection, while re-setting the RANGE control as needed to keep the meter pointer on scale.

6) Adjust the appropriate FREQUENCY TRIM control for maximum meter deflection, again re-setting the RANGE control as needed to keep the mter pointer on scale.

2.3.2.2 Final Tuning to a Station

1) Connect the antenna to the Receiver's INPUT receptacle.

2) Set the UNTUNED-LOOP INPUT switch to the position defined by the following factors:

   a) A loop antenna with a nominal inductance of 1.43 mh and no provisions of its own for tuning requires the LOOP INPUT position.

b) A "long wire" antenna or a loop antenna with its own tuning capacities requires the UNTUNED INPUT position.

3) Connect either the shorting bar or the accessory Bridged-T filter to the EXT FILTER binding posts.

4) Perform steps 2 through 6 of Section 2.3.2.1.

The Receiver is now indicating the level of the received signal in the RMS VOLTS meter according to the range indicated by the RANGE switch setting. At the OUTPUT connector the received signal re-appears at an increased voltage level. The output level is proportional to the meter deflection, up to a maximum of 10v for a full scale deflection, regardless of meter range. The output level may be controlled by either or both the RANGE switch and the GAIN control.

2.3.3 Applications

The restored signal of the DY-5842 VLF Receiver provides a convenient comparison reference for calibration of local frequency standards. Figure 2.1, page 2-8, illustrates a typical comparison system.

Descriptions given in the hp Application Note 52, Section 1 -- page 1-3, Section 2 -- page 2-6, cover most aspects of frequency comparisons by this and other systems. A brief summary of those descriptions follows:

For CW (continuous wave) broadcasts, such as those transmitted by WWVL and WWVB, the 1 kc output of the hp 113BR Divider and Clock is used to start a time interval measurement, and the restored broadcast signal output of the DY-5842 Receiver is used to stop the measurement. Controls of the hp time interval measurement instruments allow selection of repeatable points on both the start and stop signals. Thus, the time interval measurement indicates the time lapse between the selected start trigger point on the local standard signal and the selected stop trigger point on the broadcast standard signal. Variations in this count identify a frequency difference between the local standard and the broadcast standard. A steadily decreasing count shows that the frequency of the local standard is low, an increasing count shows a high frequency, and a steady count indicates a correct local standard.

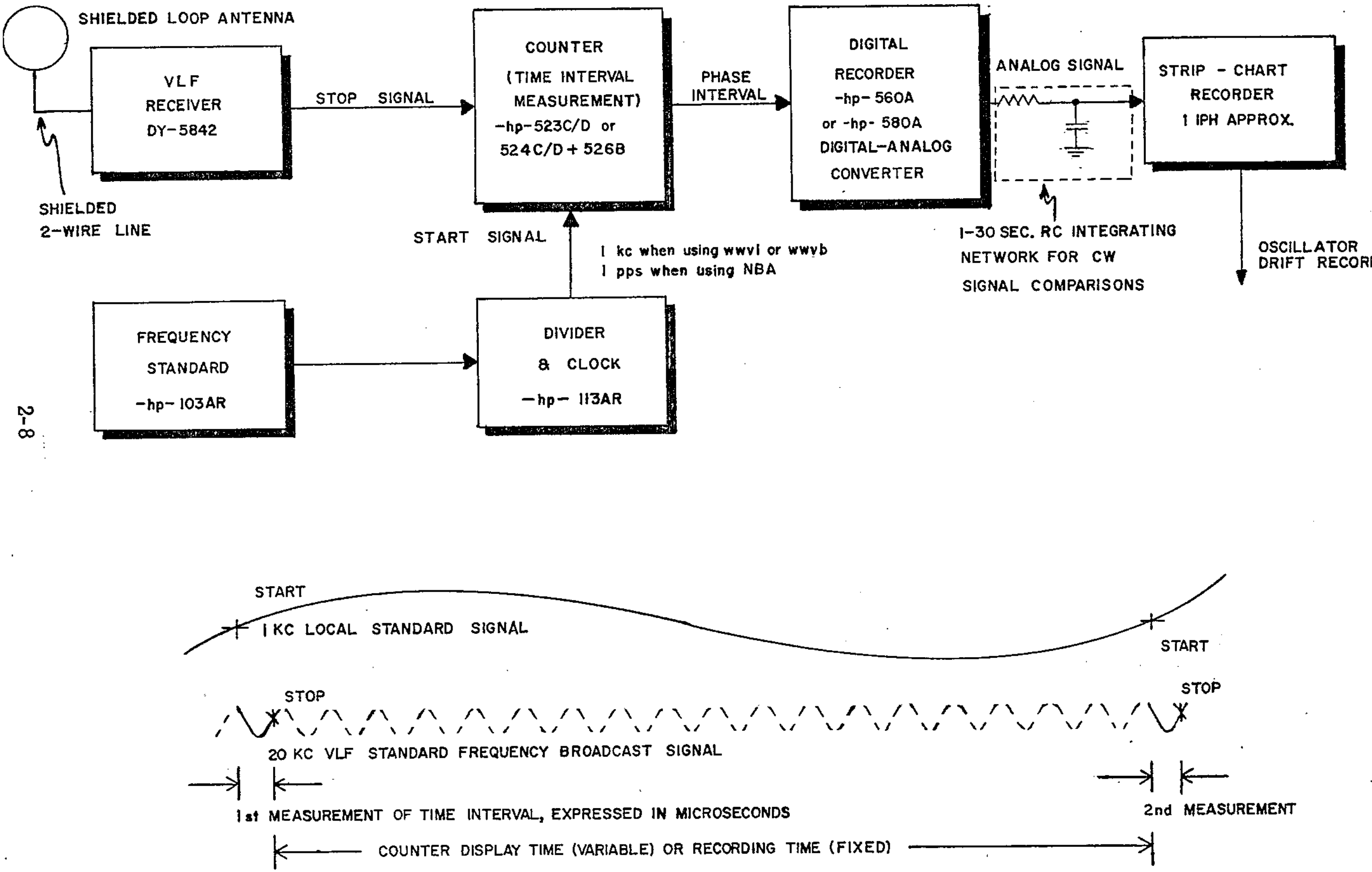


Figure 2.1

GENERAL FREQUENCY COMPARISON TECHNIQUE USING THE DY-5842 VLF RECEIVER

Printed tape records from the digital recorder, or analog records from the strip-chart recorder may be used to integrate the individual measurements over large periods of time. Integration provides greater comparison accuracies and a means of computing the local standard frequency error. Comparison accuracies of 1 part in 10^9 in less than 1 hour are possible in this system.

2.4 OPTIONAL MODIFICATION M1

Optional Modification M1 of the DY-5842 VLF Receiver provides for a simple analog comparison system using the 20 kc Standard Frequency broadcast by WWVL from Sunset, Colorado. A linear phase comparator circuit and a 5:1 divider circuit are added to the Receiver's circuits.

A 100 kc local standard frequency is applied to the divider input, where it is reduced to 20 kc. The phase comparator then produces dc voltage and current outputs proportional to phase differences between the two 20 kc signals. Maximum outputs correspond to 50 μs, the period of a single 20 kc cycle.

The dc voltage output may be applied to a potentiometer-type recorder, or the dc current output to a galvanometer-type recorder. Each of these circuits operates independently of the other, thus they may be used simultaneously -- if desired.

Full applications of this comparison system are also given in the ⓗⓟ Application Note 52.

2.4.1 OPTIONAL MODIFICATION M1 OPERATION

Operating procedures for the Modification M1 system follow these general steps:

1) Optimize the reception of WWVL by the procedures given in Section 2.3.2 of this handbook.

2) Connect a 100 kc signal, derived from the local standard frequency to be checked to the 100 KC IN connector (BNC) on the rear panel. This signal must meet the specifications listed in Section 1.3 of this handbook, under Optional Modifications.

3) Connect a potentiometer-type recorder to the POT RCDR binding posts on the rear panel, or a galvanometer-type recorder to the GALV RCDR binding posts.

4) Set the RCDR OUT MODE switch to ZERO, and adjust the recorder controls for zero deflection.

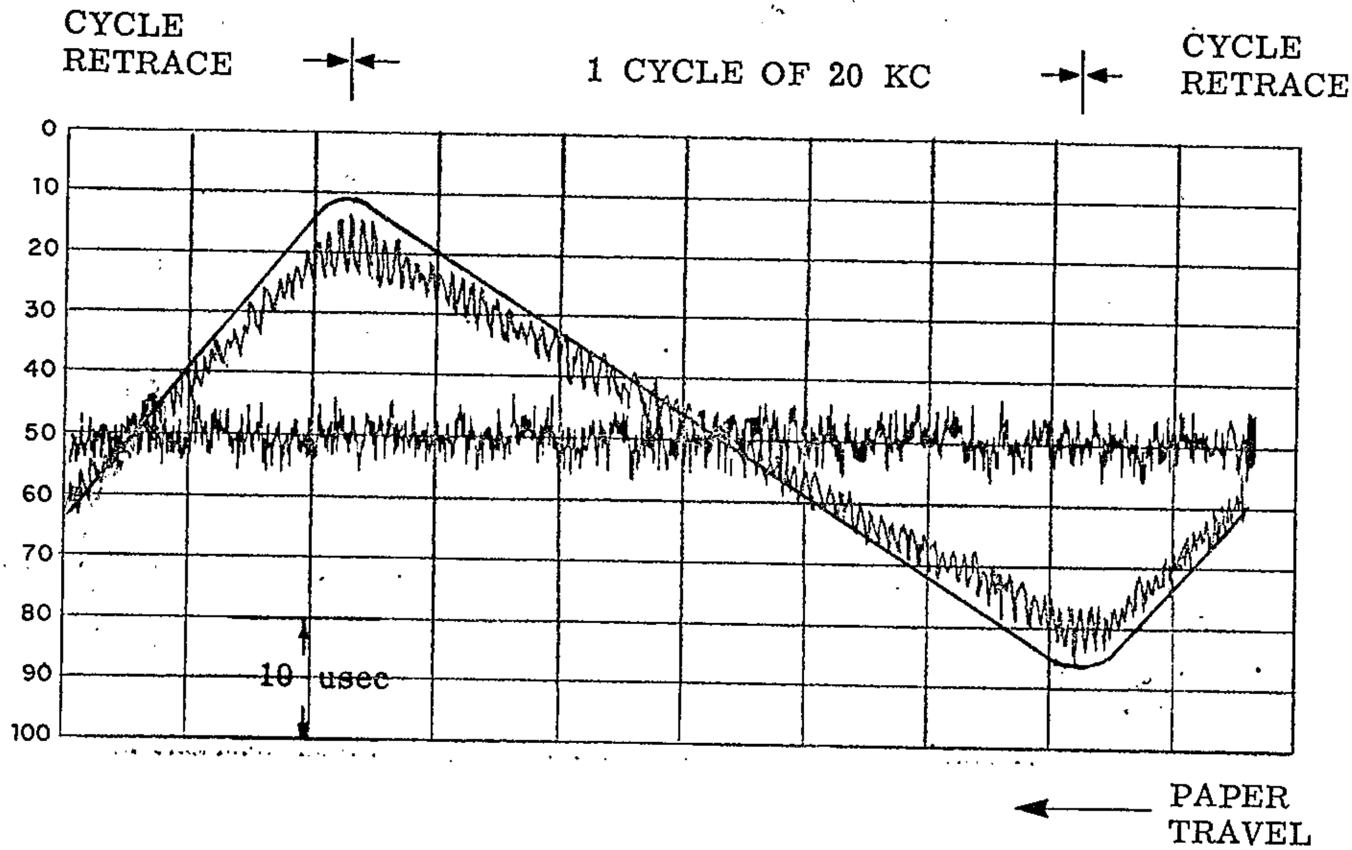
5) Set the RCDR OUT MODE switch to CAL, and adjust the CALIBRATE (HALF-SCALE) control -- and the recorder's range controls where necessary -- for half-scale deflection.

6) Set the RCDR OUT MODE switch to OPER.

Curves plotted by the recorder will drift up scale if the local standard frequency is too high, down scale if the frequency is too low. The angle of the plotted curve will depend on the paper speed and the amount of frequency drift.

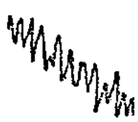
Reception in some areas may have low signal-to-noise ratios. Each of the M1 phase comparator outputs has resitance-capacitance type integrating networks to minimize the effects of noisy receptions. As shipped from the factory, both integrating time constants are approximately 5 seconds.

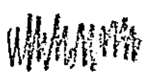
Phase comparisons accurate to within ±1 μs are possible with the DY-5842-M1. The integrating networds inherently deteriorate the noisy reception linearity as the instantaneous phase differences approach the minimum and maximum limits. Idealized and typical potentiometer recorder plots are shown in Figure 2.2.



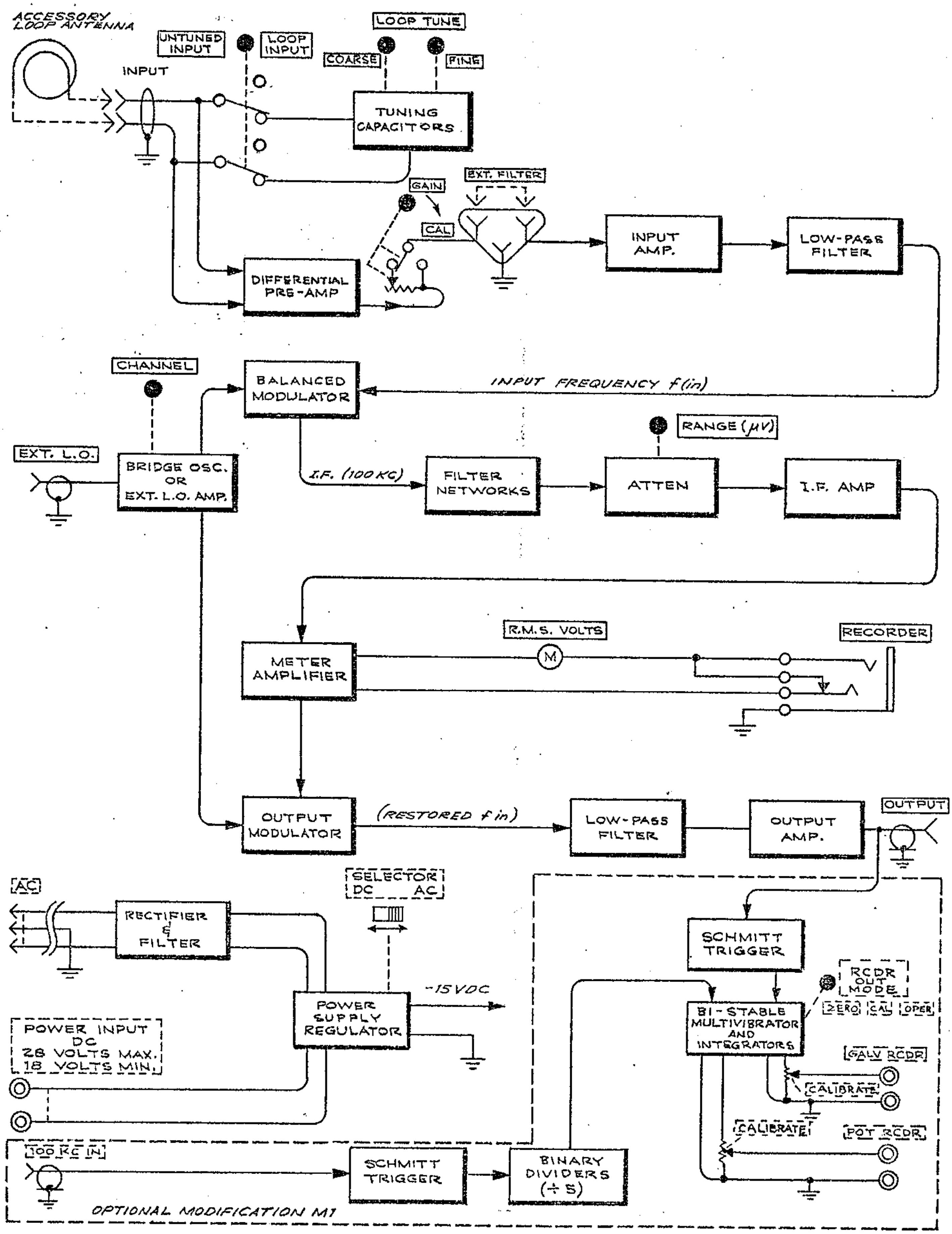
DY-5842-M1 Idealized and Typical Recorder Plots
Figure 2.2


Plot of a large phase drift in a noise free reception, the result of a high local standard frequency.


The same plot as seen in a typically noisy reception.


Plot of a steady phase difference, the result of a correct local standard frequency.

<u>NOTE:</u> The "cycle retrace" occurs when the maximum instantaneous phase differences are reached. Under ideal noise reception conditions and without any integrating networks, the "cycle retrace" would be practically a vertical line from full scale deflection back to zero and the corners would be sharp.



DY-5842 VLF RECEIVER
FUNCTIONAL BLOCK DIAGRAM
FIG. 3.1

DY-5842, 6/64

SECTION 3
THEORY OF OPERATION

3.1 GENERAL DESCRIPTION

Figure 3.1 on the previous page shows the arrangement of circuits in the DY-5842 VLF Receiver. The broadcast signal is applied to differential amplifier and filter circuits, then to a balanced modulator to be heterodyned with a local oscillator signal. Filter networks in series with the balanced modulator output allow only the 100 kc difference frequency to reach the input attenuator for the IF amplifier. A meter amplifier then detects the average level of the IF signal, indicates the level in a front panel meter, and passes the IF signal along to an output modulator. Here the amplified IF is heterodyned with the same local oscillator signal frequency. A low pass filter in series with the output modulator output allows only the restored broadcast signal difference frequency to reach the output amplifier.

A conventional full wave, r-c (resistance capacitance) filtered, rectifier circuit converts ac line power to a 28v dc input for the 15v dc power supply regulator. The regulator input may be switched to an external dc supply for instrument operation at a remote location.

Optional Modification M1 circuits use a separate, adjustable Schmitt Trigger for each of two input signals. Reception of Station WWVL applies 20 kc to one Schmitt Trigger, while 100 kc derived from a user's local standard frequency is the input for the other. Output from the 20 kc trigger is applied directly to one input of a bistable multivibrator.

The 100 kc trigger output is divided by 5 to apply a second 20 kc input to the bistable multivibrator. The multivibrator thus remains in one of its two states for a period determined by the instantaneous phase differences between the two original signals. Both of the multivibrator output voltages are integrated in RC networks. One output voltage is used to control a current output to an external galvanometer recorder, the other is used as a voltage output to a external potentiometer recorder.

3.2 DIFFERENTIAL AMPLIFIER

Referring to sheet 1 of the schematic diagram D5842-1001, the differential preamplifier circuit of transistors Q23 and Q24 permit the use of a balanced antenna input. Each side of the antenna has the same impedance to ground through the base circuits.

Transistor Q23 operates as an emitter follower, the output of which is coupled to the emitter of Q24. Thus, as the Q24 base potential changes in one direction, the emitter potential changes in the opposite direction, effectively doubling the total input signal.

Diodes CR31, CR32 and CR33, CR34 form limiter circuits for the base signals of Q23 and Q24. Diodes CR1 and CR2 are also limiters for the following input amplifier, but are needed only when a signal is inserted through the EXT FILTER connector.

3.3 BALANCED MODULATOR

Incoming broadcast signals are converted to a 100 kc IF signal by using a local oscillator signal to alternate the polarity of an induced secondary voltage. The balanced modulator circuit using diodes CR8 through CR11 and the transformers T3 and T4 has a wide dynamic range, provided that the local oscillator voltage is considerably larger than the incoming broadcast signal.

In the balanced modulator, the diodes are connected to form a bridge. The junctions of R44, R47 and R46, R48 of the bridge are fed by the local oscillator. The signal from the input amplifier is applied to the center tap of the transformer T4 primary feeding the opposite "corners" of the bridge.

The large, local oscillator signal drives two adjacent arms of the bridge alternately into conduction, providing a ground return path each time for the amplified broadcast (modulating) signal. Thus, a voltage proportional to the broadcast signal with its polarity changed at the rate of the local oscillator frequency, is induced in the transformer T4 secondary winding. This is an amplitude modulated signal with suppressed carrier, since the modulator bridge is balanced for the local oscillator (carrier) signal. From the two modulation sidebands, the lower frequency component becomes the 100 kc IF signal.

Resistor R45 and capacitor C36 are adjusted (see Section 4.5.3) to balance the modulator bridge. Resistors R44, R46, R47, and R48 in series with the diodes compensate for bridge unbalance caused by different forward resistances of the diodes.

3.4 BRIDGE OSCILLATOR OR EXT. L.O. AMPLIFIER

Transistors Q6 through Q8 and the associated circuits form a local oscillator or an amplifier, both with an AGC (automatic gain control) system. Signals in the frequency range 114 to 160 kc are generated or amplified for use in the balanced modulator and the output modulator.

3.4.1 Oscillator Circuit

Switch S8 sets Q6 through Q8 circuitry in any of the channel A through E positions, to operate as an oscillator. In each of these switch positions, a resonant crystal circuit is connected to the Q6 base circuit. The crystal circuits, the AGC system, and the blue-green-white winding of transformer T2 form a bridge. At oscillation, the bridge is slightly unbalanced. Transformer T2 provides positive feedback to the bridge from the collector of Q6.

3.4.2 Amplifier Circuit

When switch S8 is in the EXT. L.O. position, the bridge circuit of the oscillator mode is opened by S8A and C, and an external signal is injected between the Q6 base and the AGC diodes CR6 and CR7 through S8B.

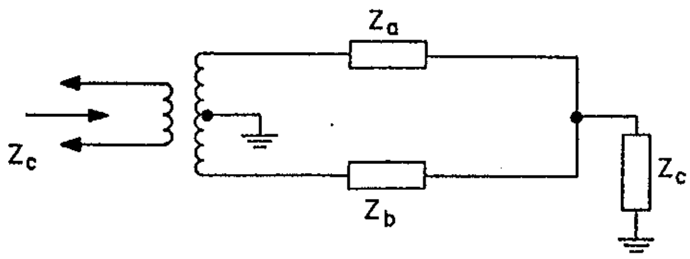
3.4.3 AGC Circuit

The common emitter current of Q7 and Q8 is proportional to the amplitude of the local oscillator signal. A portion of this current is passed through diodes CR6 and CR7, affecting the forward bias and thereby their ac impedance. An increase of oscillator voltage will decrease the ac impedance, thus reducing the ac input to Q6 -- or a decrease of the oscillator voltage will have the opposite effect. The value of R51 determines the oscillator voltage since it shunts a portion of the AGC current.

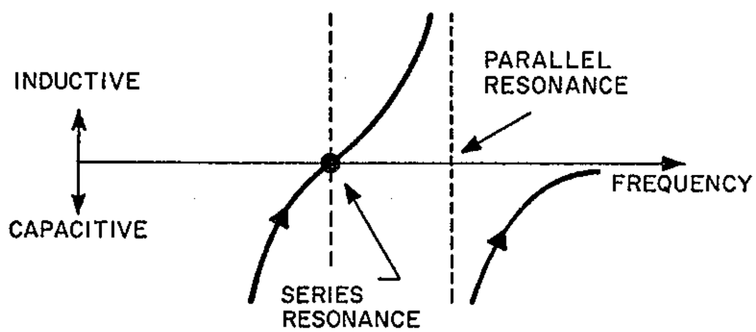
3.5 100 KC CRYSTAL FILTER

The narrow bandpass filter characteristics are obtained by cascading two crystal tuned filter sections, which are complementary for the desired frequency response. Both filter sections are of the symmetrical lattice type, whose simplified circuit is shown in Figure 3.2.

The typical frequency response of the crystal used in both filter sections is shown in Figure 3.3. Note that the crystal response



Symmetrical Lattice Type Filter
Figure 3.2

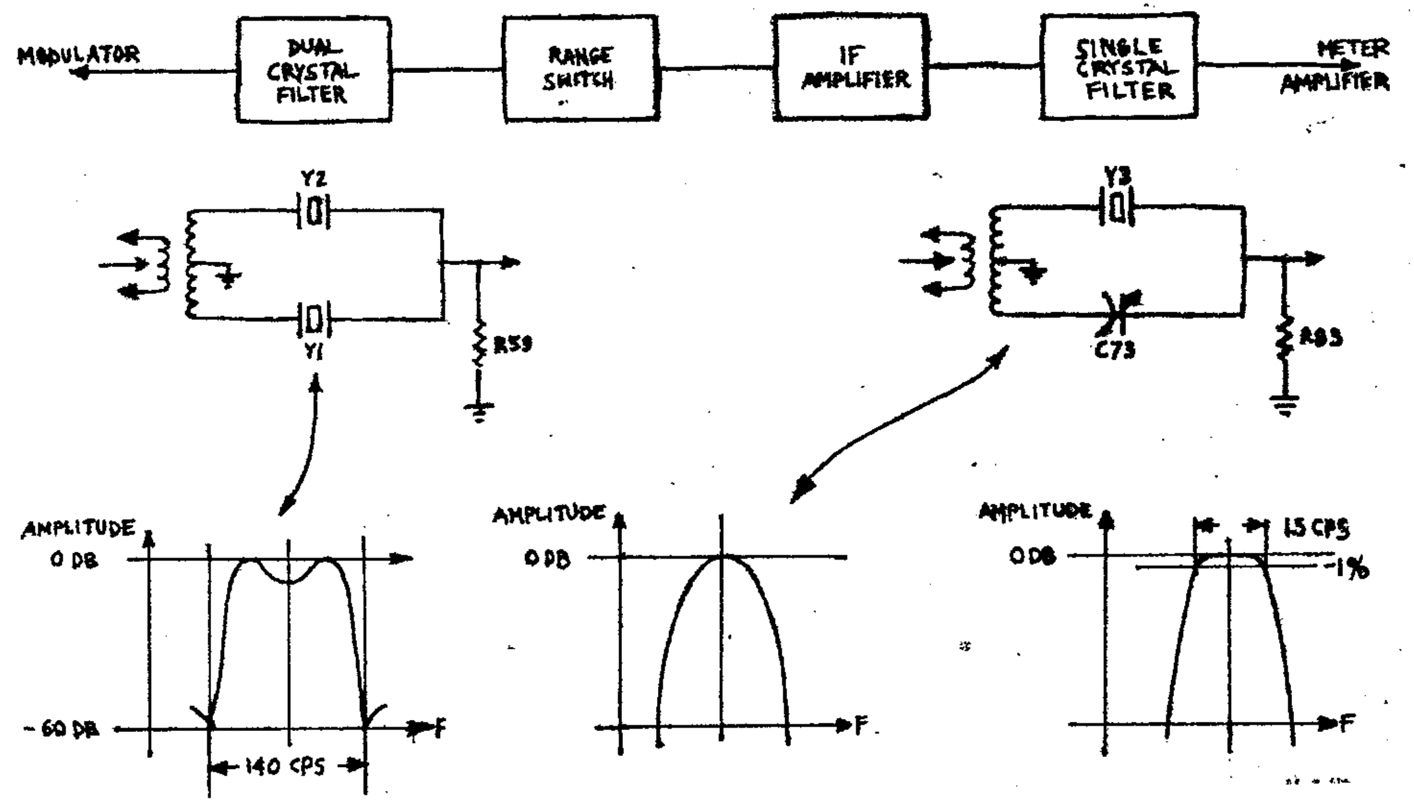


Frequency Response of Crystal
Figure 3.3

is capacitive for low frequencies, then passes through series resonance and the closely adjacent parallel resonance. For higher frequencies the crystal acts again like a capacitance. The series resonance frequency can be slightly shifted by an external capacitor.

Consider now the complete filter as shown in Figure 3.4. The IF signal from the modular output passes the double crystal filter, which has a double peak response. Since any strong adjacent signal component is rejected, the signal level can now be raised without overloading the IF amplifier. From the IF amplifier output, the IF signal passes the second filter section, containing one tuned crystal only, which complements the frequency response of the first filter section.

The correct frequency response of any bandpass filter depends on its proper resistive termination. This fact is important since the two crystal filter sections are terminated on both input and output by impedance networks. Refer to the schematic diagram of D5842-1001, sheet 2. These filter termination networks are tuned to 100 kc to become resistive and terminate the filter properly.



Complete 100 kc Crystal Filter
Figure 3.4

The second crystal filter operates into the meter amplifier input, thus its input impedance may affect the termination and hence the response of the filter.

The two tuned tank circuits following the first crystal filter reject spurious response frequencies at 228 kc and 381 kc respectively. Resistive termination of the filter is obtained by tuning the two tank circuits with C58 to series resonance at 100 kc.

3.6 METER AMPLIFIER, RECTIFIER

The schematic of the 4-stage meter amplifier and the rectifier circuit is shown in D5842-1001, sheet 2. All four transistor stages are of the grounded emitter type. Negative feedback is applied through C76 from the output of Q12 to the emitter of Q11 to stabilize the first two stages. A portion of the ac return signal of the rectifier bridge is fed to the emitter of Q13 as negative feedback, stabilizing stages Q13 and Q14 and the rectifier circuit. R92 (Meter Cal.) adjusts the gain of the meter amplifier when calibrating the instrument. Refer to Section 4.5.5.

3.6.1 Rectifier Circuit

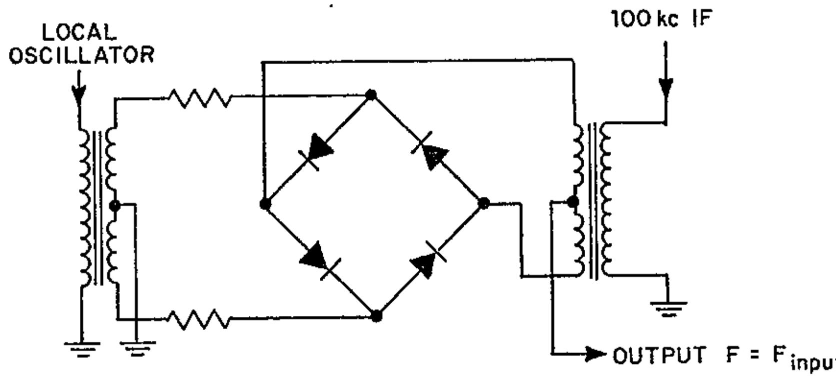
The amplified IF signal is fed from the collector of Q14 to a single ended, full wave rectifier bridge. In series with the meter is the phone jack recorder output, decoupled by bifilar-wound chokes (L13AB) from the rectifier circuit. The ac signal from the bridge is returned to ground through R109 and R110.

At low IF signal levels, diodes CR12 and CR13 of the meter bridge have a non-linear resistance causing the indicated meter current to be non-proportional with respect to the input signal. To eliminate the effect of the diode non-linearity, the diodes are driven from a current source Q14. The emitter of Q14 is returned to ground through resistors R100 and R101, having the effect of negative current feedback.

3.7 OUTPUT MODULATOR AND AMPLIFIER

3.7.1 Output Modulator

The output modulator and the associated amplifiers provide an output signal of a frequency and amplitude dependent on the broadcase signal. Refer to Figure 3.5 showing the simplified circuit.



Output Modulator Section
Figure 3.5

The 100 kc IF signal is heterodyned with the local oscillator signal to produce an output signal having the original frequency of the input signal.

The local oscillator signal passes through emitter follower stage Q16 before driving the output modulator. The operating principle of this type of modulator is described in Section 3.3. From the output of the modulator the output signal passes a 50 kc low pass filter and is amplified in a 3-stage output amplifier Q17 through Q19.

3.7.2 Output Amplifier

The output amplifier is a 3-stage dc coupled amplifier as shown in D5842-1001, sheet 3. To maintain the level and polarity of the dc biases, stage Q18 is an NPN type.

DC feedback is applied across all three stages from the emitter of Q19 to the emitter of Q17 through R144.

3.8 REGULATED POWER SUPPLY

The regulated power supply is of the conventional type using grounded emitter stage Q21 to drive series regulator Q20. Drawing D5842-1001, sheet 2, shows the complete circuit diagram of the regulated power supply and the supply circuits. Breakdown diode CR27 provides the voltage reference level.

The power input circuits are conventional. The indicator light operates only on ac. Selector switch S5 has to be set manually when changing from ac to dc operation. Diode CR26 protects the instrument against reversal of battery polarity.

SECTION 4
MAINTENANCE

4.1 GENERAL MAINTENANCE INFORMATION

The DY-5842 VLF Receiver is a fully transistorized instrument and under normal operating conditions requires little or no maintenance. Before making any repairs or adjustment, the information given in the following paragraphs must be considered.

4.1.1 Front Panel Performance Check

Before any repairs are attempted, performance of the Receiver should be checked from the front panel by the procedures in Section 4.4. These procedures serve as a routine check to confirm a malfunction of the Receiver itself.

4.1.2 Tuned Crystal Filters

CAUTION

The VLF Receiver uses sharply-tuned crystal filters that have very critical adjustments. These adjustments must not be touched. Even a slight change of any one of the filter adjustment capacitors affects the selectivity characteristics of the instrument. If trouble in the crystal filter circuit is suspected, the selectivity check in Section 4.8 should be performed.

The three quartz crystals Y1, Y2, Y3 are matched for optimum performance as a group and should not be interchanged or exchanged individually. Since the tuning of the crystal filter requires special test equipment, in the event of trouble the instrument should be returned to the factory for complete retuning.

4.1.3 Transistor Circuits

Perform the checks in Section 4.5.4 before removing any transistors. Turn off the instrument power when replacing a transistor (or any other components). Unlike vacuum tubes, transistors are sensitive to overloads and may be permanently damaged if the power is not turned off. If a transistor is replaced, refer to Section 4.5, Adjustment After Component Replacement, procedures.

4.1.4 Test Equipment

All the test equipment necessary for normal maintenance of the DY-5842 Receiver is listed in Section 4.3.

4.2 CABINET REMOVAL

Remove the cabinet by the following procedures:

4.2.1 Cabinet Mount

1) Remove the five "Phillips" screws (one round-head and four sheet-metal) holding the rear cover, and take the cover off the back of the cabinet.
2) Provide clearance for the rear panel binding posts, and set the instrument up on its open cabinet back with the bottom toward you.
3) Remove the two screws located on the instrument bottom near the front panel.
4) Lift the cabinet off the instrument.

4.2.2 Rack Mount

1) Two simple "dust covers" (one on top and one on bottom) enclose the instrument.
2) Remove these covers by removing the screws located around their edges.

4.3 TEST EQUIPMENT

The following instruments or equivalents are recommended for the DY-5842 maintenance procedures:

1) <u>DC Vacuum Tube Voltmeter with Ohmmeter</u>
   (hp)410B equivalent. Minimum specifications: 100M input impedance; ±3% accuracy; ohmmeter center scale reading [illegible]Ω to 10M.
2) <u>Battery Operated AC Voltmeter</u>
   (hp)403A equivalent. Minimum specifications: 1 cps to 1 mc frequency; 2M shunted by a maximum of 40 pf input impedance; range 0.1 mv to 300v.

3) Oscillator
(hp)200CD equivalent. Minimum specifications: 5 cps to 600 kc frequency; 0 to 10v into a 600Ω load output.

4) Oscilloscope
(hp)120A equivalent. Minimum specifications: dc to 200 kc frequency; 0.01v/cm sensitivity; 5 μs/cm sweep speed.

5) Electronic Counter
(hp)524C equivalent. Capability of measuring frequencies up to 100 kc to an accuracy of ±0.1 cps.

6) Line Matching Transformer for Connecting an Attenuator's Output to the Receiver's Balanced Input
(hp)AC-60A equivalent. Minimum specifications: 5 to 600 kc frequency; 600Ω balanced line output.

7) Attenuators (Two)
(hp)350B equivalent. Minimum specifications: 0 to 110 db frequency in 1 db steps; matching a 600 Ω impedance for 0 to 100 kc frequency.

8) Source for High Stability, High Purity, Accurate Signals
14 to 100 kc frequency at 20 mv rms minimum.

9) Crystal Controlled Oscillator to furnish an EXT L.O. Signal
This signal must be in the range of 114 to 160 kc frequency, ±3.5 cps at 10 to 50 mv.

4.4 FRONT PANEL PERFORMANCE CHECK

A malfunction in a VLF reception system may be due to other components of the system, rather than the DY-5842 Receiver. The following steps will show the operating condition of the Receiver itself.

1) Connect test equipment as shown in Figure 4.1.

2) Remove the shorting connection from between the Receiver's EXT FILTER red binding posts (or remove the external filter).

3) Set the input signal frequency to the value provided for by one of the Receiver's reception channels.

4) Set the Receiver's RANGE switch to "3000" and the CHANNEL switch to the appropriate position.

5) Adjust the appropriate FREQUENCY TRIM control for maximum deflection of the Receiver's meter.

6) Set the attenuator to a position that will leave at least seven 10 db steps of attenuation available, and allow the input signal amplitude control to set the Receiver's meter deflection at "2" on the lower scale. Set this deflection.

7) Increase the attenuation by 10 db, then set the Receiver's RANGE switch to the next ccw position. The RMS VOLTS meter should now read approximately the same as before.

8) Repeat step 7 until the "3" position of the RANGE switch is reached. Normal Receiver operation is indicated if the meter has never exceeded full scale.

9) Repeat steps 3 through 5 for each of the Receiver's pre-established reception channels. Do not remove the signal applied to the EXT FILTER connector.

10) Connect the crystal controlled oscillator to the Receiver's EXT L.O. input through a second attenuator via shielded cabling. Set the EXT L.O. input signal level between 10 and 50 mv and its frequency 100 kc above the frequency of the input signal.

11) Set the Receiver's CHANNEL switch to EXT L.O., and repeat steps 4 through 5.

12) Return the CHANNEL switch to the last position used for step 9, and disconnect the EXT L.O. input signal.

13) Monitor the Receiver OUTPUT with the ac voltmeter and the oscilloscope in parallel.

14) Adjust the input signal to obtain an RMS VOLTS meter deflection of "1" on the upper scale.

15) The OUTPUT level should be 10v rms and the waveform should be sinusoidal.

4.5 ADJUSTEMENT AFTER COMPONENT REPLACEMENT

Generally, the DY-5842 Receiver will operate properly after a component is replaced. The procedures given in Section 4.4 may be used to check the performance. The following paragraphs are a guide to checks that may be used when a given transistor is replaced.

4.5.1 Q1, Q2, Q3 Checks

1) Perform steps 1 through 5 and 13 through 15 in Section 4.4.

4.5.2 Q6 Checks

1) Perform steps 1 through 5 in Section 4.4, and repeat these steps for each of the Receiver's pre-established reception channels.

4.5.3 Q7, Q8 Checks

1) Perform steps 1 through 3 in Section 2.3.
2) Connect test equipment as shown in Figure 4.2.
3) Set the Receiver's RANGE switch to 3, the CHANNEL switch to EXT L.O.
4) Set the EXT L.O. input signal level between 10 and 50 mv.
5) Set the EXT L.O. input signal to 100 kc ±2 cps, as measured by the counter.
6) Connect both of the Receiver's EXT FILTER terminals to ground.
7) Adjust the CARRIER BAL CAP and CARRIER BAL RES controls (C36 and R45) for minimum deflection of the RMS VOLTS meter. These controls are interacting and must be adjusted repetitively. Be sure to use an insulated screwdriver when adjusting C36. Two holes at the upper rear panel provide access to these controls.

4.5.4 Q9, Q10 Checks

1) Do not attempt replacement of these components. Perform steps 1 through 5 and 13 through 15 in Section 4.4. In the event of failure, contact the factory or the nearest representative.

4.5.5 Q11, Q12, Q13, Q14 Checks

1) Perform steps 1 through 3 in Section 2.3.
2) Connect test equipment as shown in Figure 4.3.
3) Set the input signal frequency to the value provided for by one of the Receiver's reception channels.
4) Use the attenuator and/or the input signal amplitude control to set the Receiver's input signal at 3.0 mv.

5) Set the Receiver's RANGE switch to 3000 and the CHANNEL switch to the appropriate position.

6) Set the Receiver's GAIN control fully cw to the CAL (switched) position.

7) Adjust the appropriate FREQUENCY TRIM control for maximum RMS VOLTS meter deflection.

8) Adjust the METER CAL until the RMS VOLTS meter deflection corresponds to that on the ac voltmeter. It may be necessary to select a new value for R99.

4.5.6 Q16, Q17, Q18, Q19 Checks

1) Perform steps 1 through 5 and 13 through 15 in Section 4.4.

2) Loosen the locknut, and adjust R111 to obtain the 10v rms sine wave output. This control is reached from the bottom of the instrument. Retighten the locknut.

4.5.7 Q20, Q21, Q22 Checks

1) Set the DC-AC SELECTOR switch to AC.

2) Measure the ac and dc components of the -15v dc power supply regulator output, while the Receiver is operated from an ac power source. Connect the ac and dc voltmeters to this supply at the taper pin M. This taper pin is located under the small cover on the right side gusset. The ac voltage should not exceed 280 μv.

3) Set the dc voltage to exactly -15v by loosening the locknut and adjusting R160. This control is reached from the bottom of the instrument. Retighten the locknut.

4.5.8 Q23, Q24 Checks

1) Perform steps 1 through 7 in Section 4.5.5.

2) Vary the GAIN control between its two extreme positions. There should be at least 10 db variation reflected in the RMS VOLTS meter deflections.

4.6 TROUBLESHOOTING

Faulty circuits in the DY-5842 Receiver may be located by the systematic procedures listed in this section. These procedures trace the signal from the Receiver's input. Each sub-section presumes that the previous steps have been performed.

4.6.1 Power Supply

1) Perform steps 1 through 3 in Section 4.5.7. If the -15v dc cannot be obtained, check the voltage at the collectors of Q20 and Q21. Voltage between -18 and -28v dc indicates trouble in the circuits of Q20, Q21, Q22 or CR27.

4.6.2 Differential Preamplifier

1) Perform steps 2 through 4 and 6 in Section 4.5.5.
2) Remove the (hp)403A Voltmeter from the input circuit of the EXT FILTER connector. Connect it between the left red and black binding posts. Remove the shorting connection between the two red binding posts.
3) Set the Receiver's GAIN control fully ccw. The (hp)403A meter reading should decrease by at least 10 db.

4.6.3 Input Amplifier

1) Perform steps 1 through 3 in Section 4.4.
2) Set the signal level at the EXT FILTER input to 30 mv.
3) Measure the ac voltage at the emitter of Q3. The amplifier gain is correct if the voltage is approximately 197 mv. The emitter of Q3 is located from the bottom of the instrument, on resistor board A9TB2.

4.6.4 Balanced Modulator and Bridge Oscillator

1) Perform steps 1 through 6 in Section 4.5.3.
2) Monitor the ac voltage at the base of Q9 located under the inner cover at the top of the instrument. The four screws holding this cover are accessible through holes in the side gussets.
3) Adjust the CARRIER BAL CAP and CARRIER BAL RES controls for minimum ac voltage at the base of Q9. These controls are interacting and must be adjusted repetitively.
4) Remove the test equipment of step 1 of this section, and perform steps 1 through 5 in Section 4.4.

5) Set the signal input to the EXT FILTER connector at 1v ac rms. The Q9 base ac voltage should now be approximately 1 mv rms.

4.6.5 IF Amplifier

1) Perform steps 1 through 3 in Section 4.4.

2) Set the RANGE switch to 30.

3) Set the signal level at the EXT FILTER input to 3 mv.

4) The ac voltage at Q10 collector should measure approximately 200 mv.

4.6.6 Meter Amplifier

1) Perform steps 1 through 7 in Section 4.5.5.

2) Set the Receiver's METER CAL control to each of its two extremes. The difference between the meter readings at each extreme should be at least 5 db.

3) Adjust the METER CAL control until the Receiver's meter deflection corresponds to that of the ac voltmeter.

4.6.7 Output Modulator and Output Amplifier

1) Perform steps 1 through 2 in Section 4.5.6.

4.7 OPTIONAL MODIFICATION M1

The Schmitt Trigger circuits of Optional Modification M1 are factory adjusted for optimum performance. These adjustments are critical and should not be disturbed. If any of the circuits of transistors Q301, Q302, Q303, Q304 or Q307, Q308 or Q317 fail, refer the instrument to the factory or your nearest Dymec representative. Refer to Figure 4.5 for Section 4.7.

4.7.1 CR302 Checks

1) The dc voltage at Q316 collector should measure between -9 and -12v.

4.7.2 Q301, Q302, Q303, Q304 Checks

1) Connect both the Receiver's EXT FILTER red binding posts to ground.

2) Set the CHANNEL switch to EXT L.O., and do not connect any signal to the EXT L.O. input.

3) Set the RCDR OUT MODE switch (on the rear panel) to ZERO.

4) Connect test equipment as shown in Figure 4.4.

5) Set the signal to 20 kc at 1.0v ac.

6) Observe the waveform at the cathode of CR301. Positive pulses of at least 2.0v peak with a rise time of 0.5 μs or less should be seen.

4.7.3 Q307, Q308, Q317 Checks

1) Connect both of the EXT FILTER red binding posts to ground.

2) Set the CHANNEL switch to EXT L.O., and do not connect any signal to the EXT L.O. input.

3) Set the RCDR OUT MODE switch to CALIB.

4) Connect test equipment similar to that shown in Figure 4.4, but to the Receiver's 100 KC IN connector on the rear panel, rather than the OUTPUT connector.

5) Set the signal to 100 kc at 1.0v ac.

6) Observe the waveform at the cathode of CR303. Positive pulses of at least 2.5v peak should be seen.

4.7.4 Q309, Q310, Q311, Q312, Q313, Q314, Q315 Checks

1) Perform steps 1 through 5 in Section 4.7.3.

2) Observe the waveform at the cathode of CR307. Positive pulses of at least 2.0v peak with a rise time of 5 μs or less should be seen. Check that the repetition rate is 20 kc.

4.7.5 Q305, Q306 Checks

1) Perform steps 1 through 5 in Section 4.7.3.

2) Observe the waveform at the cathode of CR308. The amplitude of these positive pulses should be no less than 6.8v peak.

4.7.6 Q316 Checks

1) Perform steps 1 through 5 in Section 4.7.3.

2) The dc voltage at the emitter of Q316 should measure between -4.0 and -5.5v.

4.8 CRYSTAL FILTER SELECTIVITY CHECK

The procedures in this section should be performed only if the procedures of Sections 4.5 and 4.6 do not locate the faulty circuit.

1) Perform steps 1 through 7 in Section 4.5.3.

2) Perform steps 1 through 6 in Section 4.4.

3) Slowly decrease the input signal frequency until the Receiver's meter reading drops to "1.4". Record the frequency as read on the counter.

4) Slowly increase the frequency until the meter again drops to the same point used in step 3 of this section. Record the frequency as read on the counter.

5) Now set the frequency to give a counter reading exactly halfway between the two previous readings. Set the signal amplitude for a full scale (upper scale) deflection of the Receiver's meter.

6) Carefully increase the frequency until the meter reading drops by one-half of one division (1%). Record the counter reading.

7) Carefully decrease the frequency until the meter reading again drops to the same point used in step 6 of this section. Record the counter reading.

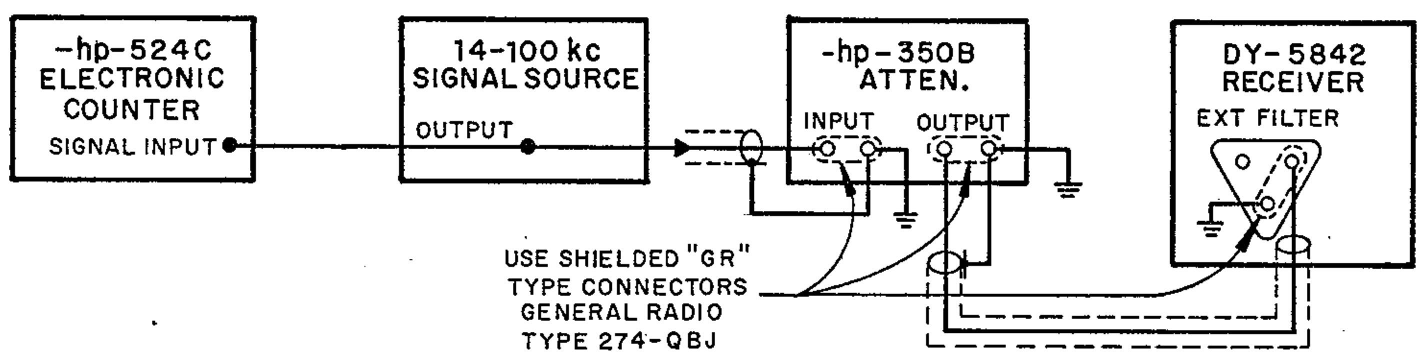
SPECIFICATION: THE DIFFERENCE BETWEEN THE COUNTER READINGS OF STEPS 6 AND 7 MUST BE AT LEAST 1.5 CPS.

8) Repeat step 5 of this section.

9) Decrease the frequency by exactly 35 cps. Record the largest on scale meter deflection available and the RANGE switch position at which the deflection occurred.

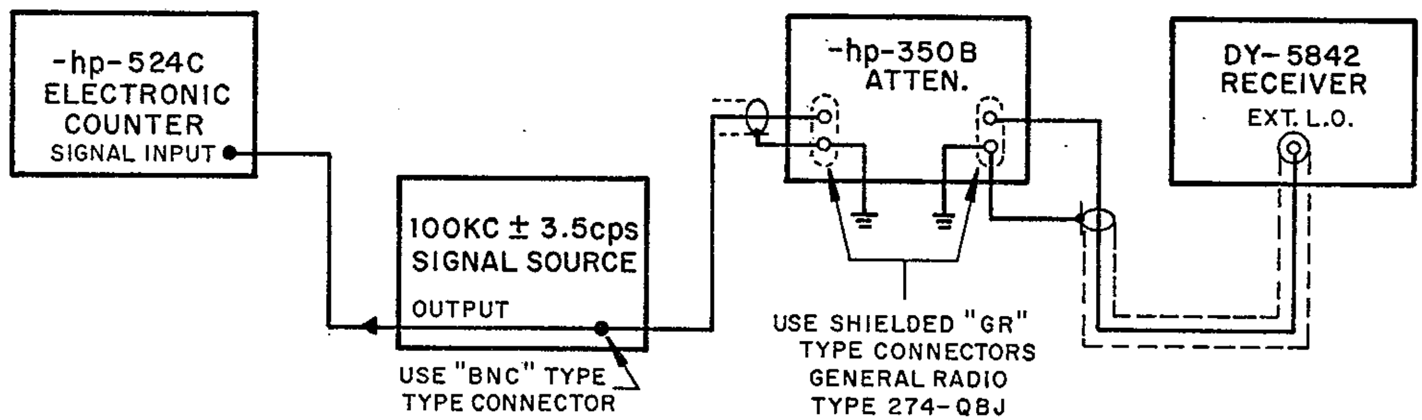
10) Increase the frequency by exactly 70 cps. Record the largest meter deflection and RANGE switch position as above in step 9.

SPECIFICATION: MAXIMUM METER DEFLECTION ".1" ON THE UPPER SCALE AT THE "3" RANGE POSITION.



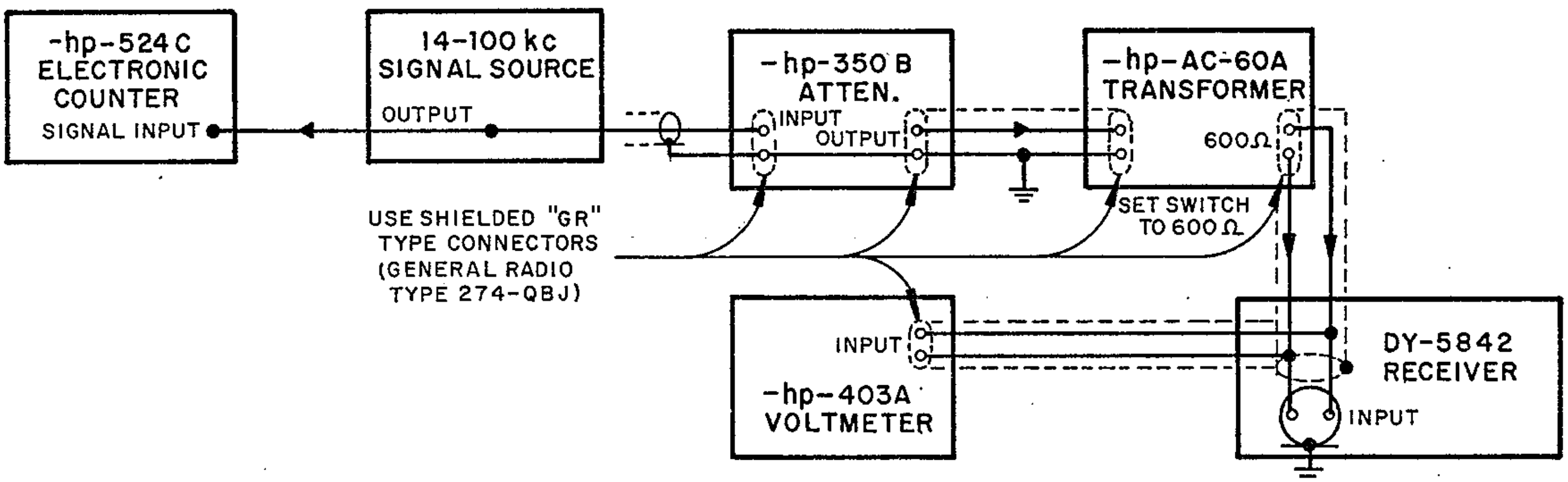
Test System A
Figure 4.1

Reference: Section 4.4



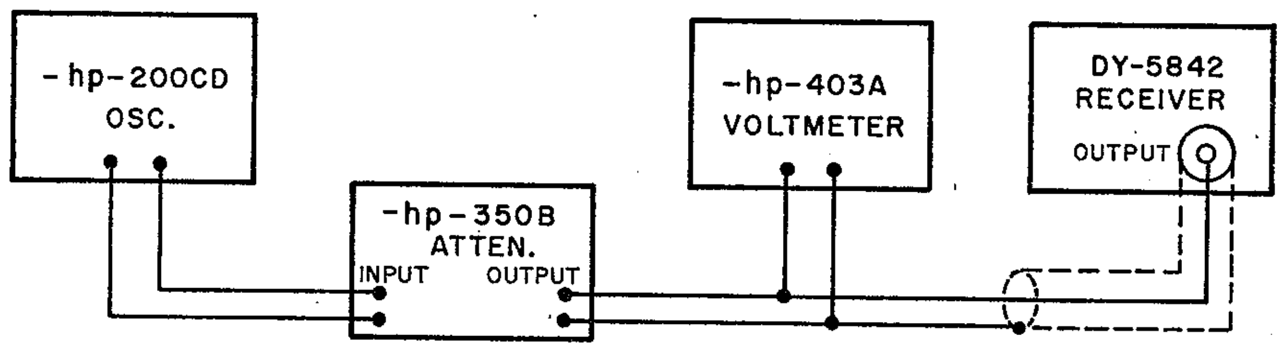
Test System B
Figure 4.2

Reference: Section 4.5.3



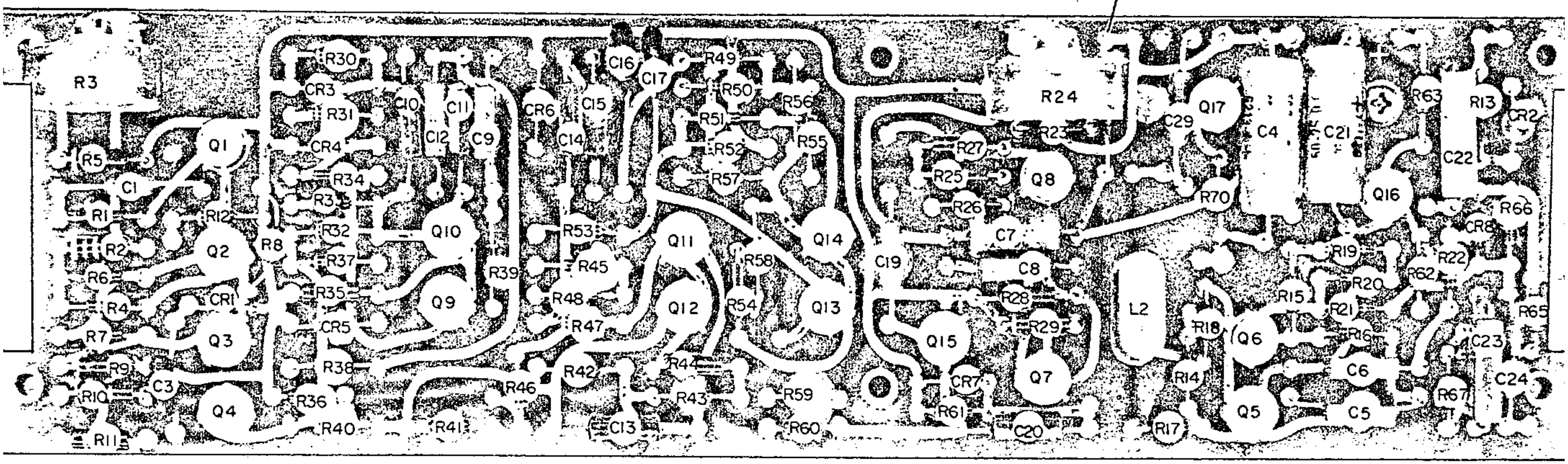
Test System C
Figure 4.3

Reference: Section 4.5.5



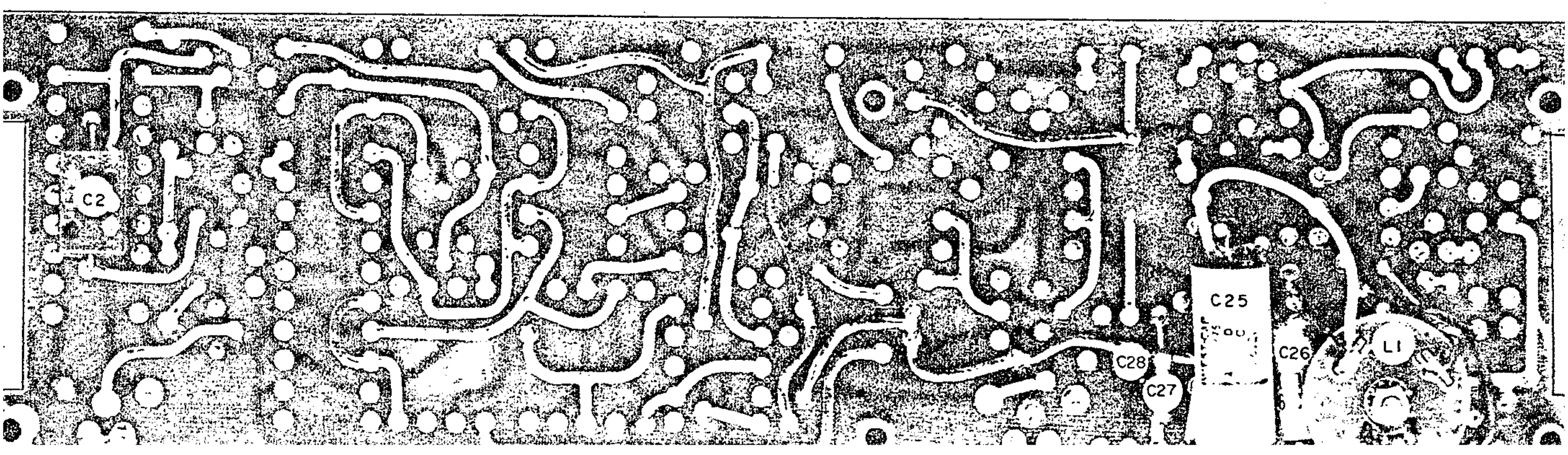
Test System D
Figure 4.4

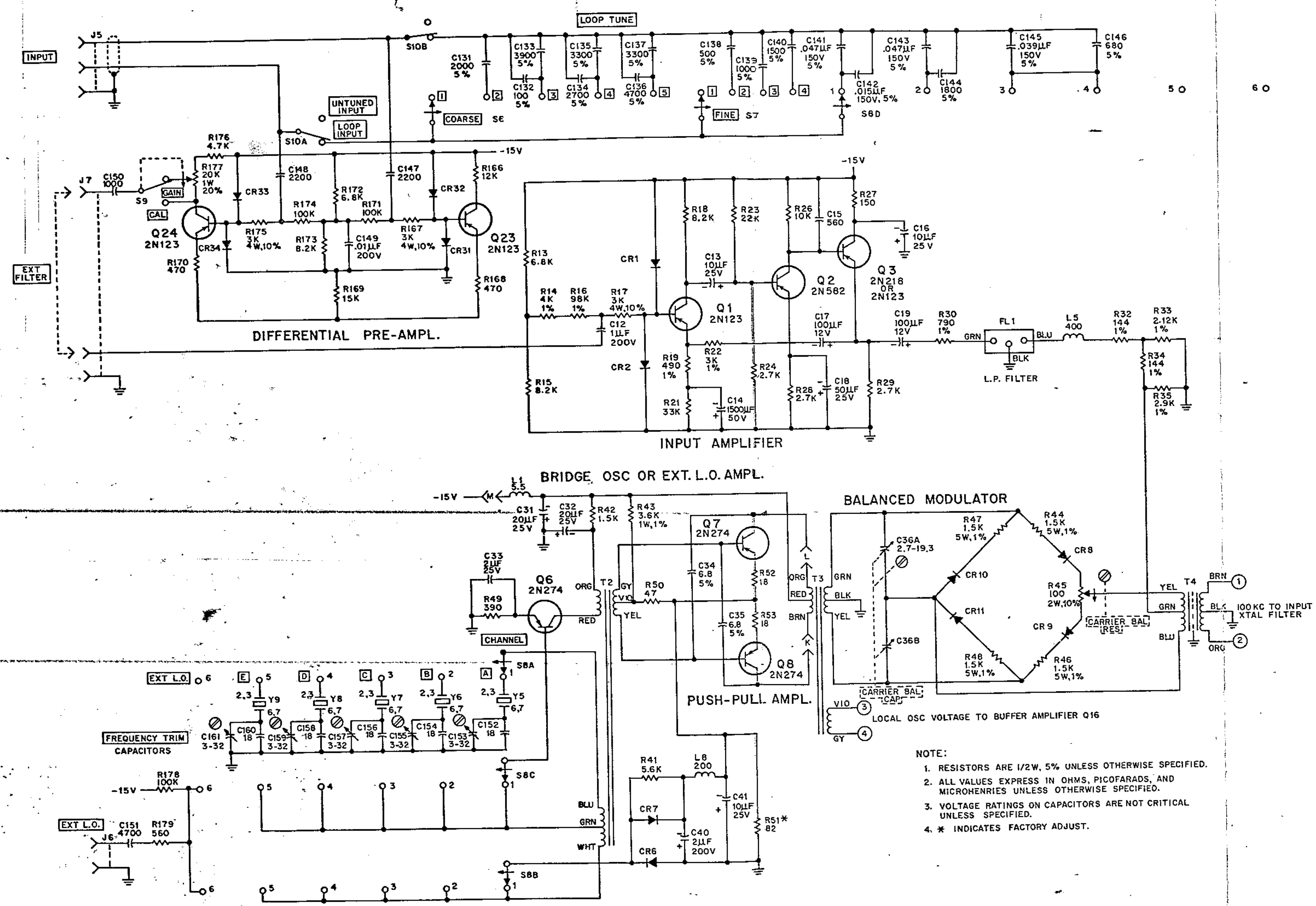
Reference: Section 4.7.2



Optional
Modification M1
Component Layout
Figure 4.5

Note:
1. All reference designator's are 300 series numbers.
2. C28 is a factory selected component.





NOTE:

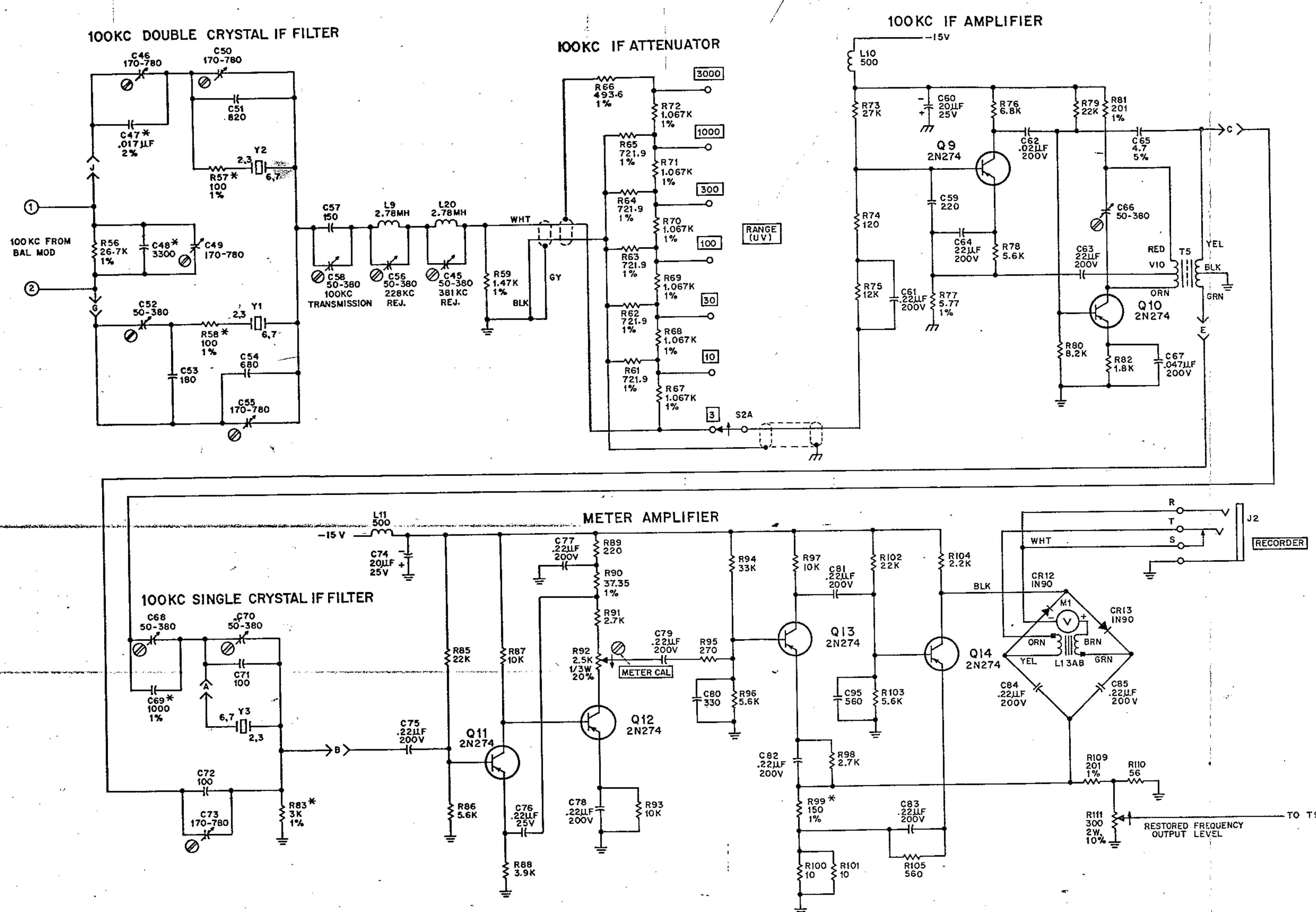
1. RESISTORS ARE 1/2W, 5% UNLESS OTHERWISE SPECIFIED.
2. ALL VALUES EXPRESS IN OHMS, PICOFARADS, AND MICROHENRIES UNLESS OTHERWISE SPECIFIED.
3. VOLTAGE RATINGS ON CAPACITORS ARE NOT CRITICAL UNLESS SPECIFIED.
4. * INDICATES FACTORY ADJUST.

DY-5842 VLF RECEIVER

INPUT AND BALANCED MODULATOR

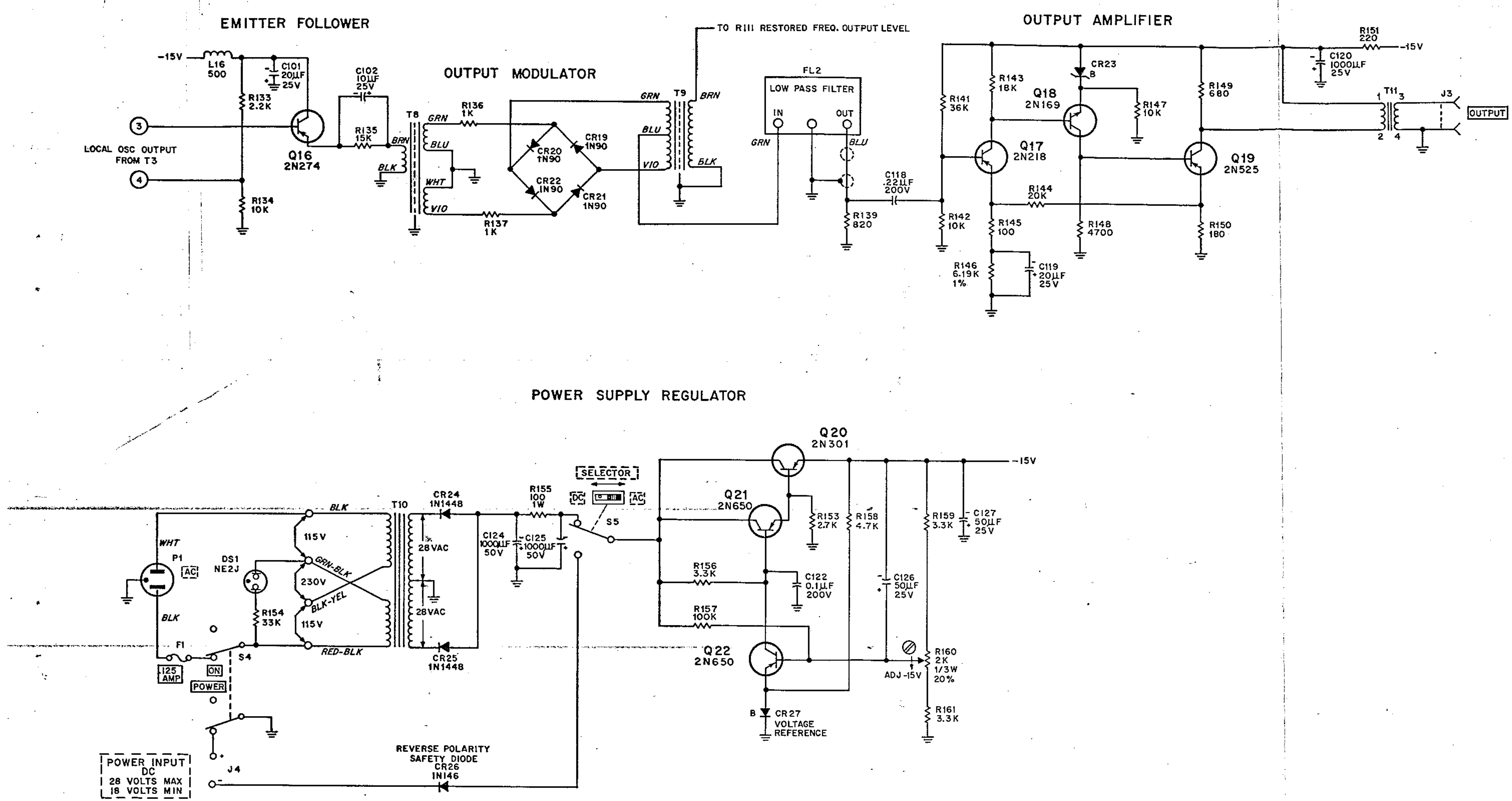
SERIALS PREFIXED 127-

DRAWN BY R STRING	DATE 7-23-62	DY-5842 VLF RECEIVER		DYMEC A DIVISION OF HEWLETT-PACKARD CO. PALO ALTO, CALIFORNIA
CHECKED BY				
ENG APPD		INPUT AND BALANCED MODULATOR		D5842-1001
PROJ APPD				
MFG APPD		SCALE		CODE 04404 / SHEET 1 of 3



DY-5842 VLF RECEIVER
I.F./METER AMPLIFIERS
SERIALS PREFIXED 127

DRAWN BY R. STRING	DATE 7-30-62	DY-5842 VLF RECEIVER I.F./METER AMPLIFIERS	DYMEC A DIVISION OF HEWLETT-PACKARD CO. PALO ALTO, CALIFORNIA
CHECKED BY			D5842-1001
ENG APPD			
PROJ APPD			
MFG APPD		SCALE	CODE 04404 SHEET 2 OF 3

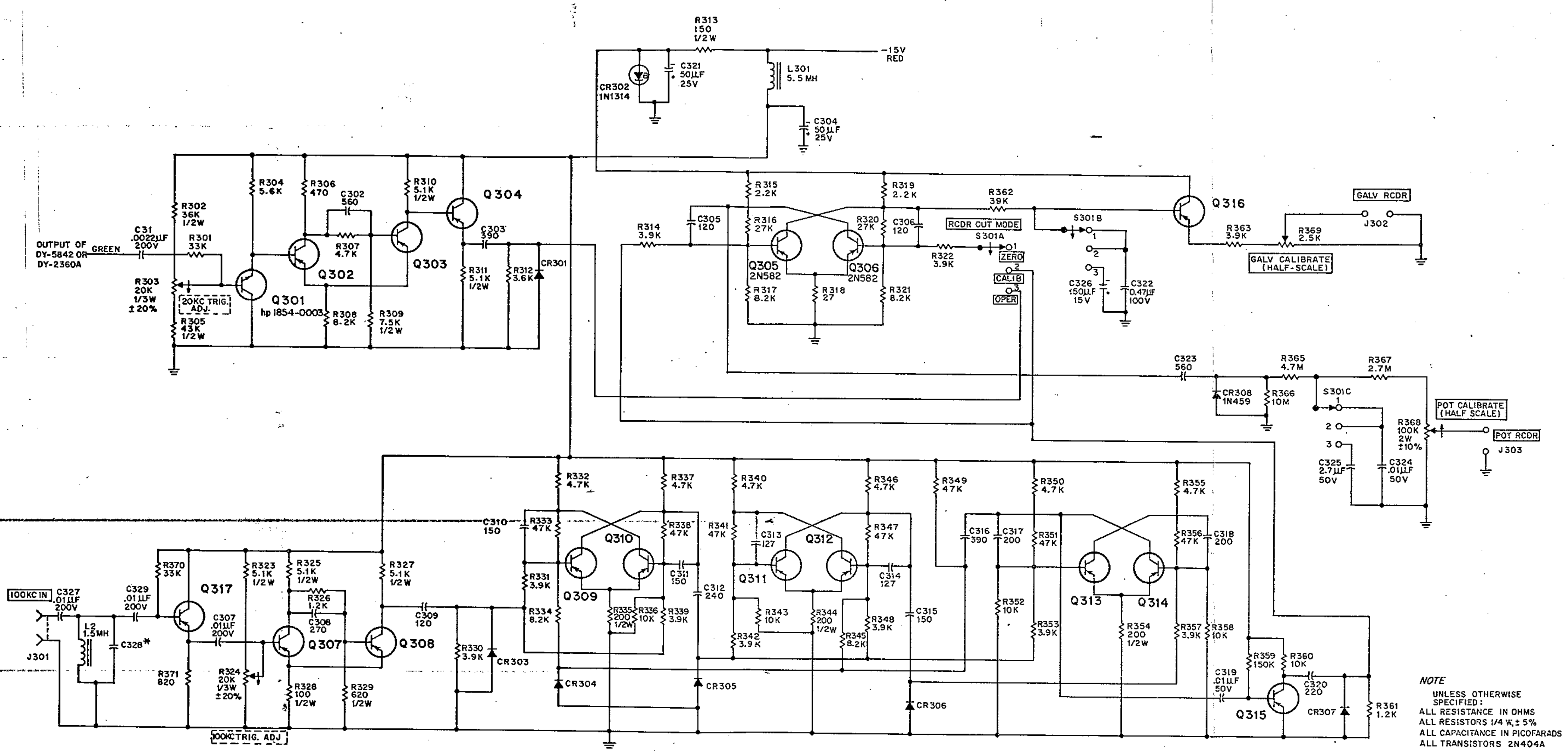


DY-5842 VLF RECEIVER

OUTPUT AND POWER SUPPLY

SERIALS PREFIXED 127-

DRAWN BY	DATE		
R STRING	8-3-62	DY-5842 VLF RECEIVER OUTPUT & POWER SUPPLY	DYMEC A DIVISION OF HEWLETT-PACKARD CO. PALO ALTO, CALIFORNIA
CHECKED BY			D5842-1001
ENG APPD		SCALE	CODE 04404
PROJ APPD			SHEET 3 OF 3
MFG APPD			



NOTE
UNLESS OTHERWISE SPECIFIED:
ALL RESISTANCE IN OHMS
ALL RESISTORS 1/4 W, ± 5%
ALL CAPACITANCE IN PICOFARADS
ALL TRANSISTORS 2N404A
ALL DIODES 1N270
ALL INDUCTANCE IN MICROHENRIES

DY-5842 VLF RECEIVER

OPTIONAL MODIFICATION M1

SERIALS PREFIXED 127-

DRAWN BY R STRING	DATE 8-7-62	DY-5842 VLF RECEIVER OPTIONAL MODIFICATION M1	DYMEC A DIVISION OF HEWLETT-PACKARD CO PALO ALTO, CALIFORNIA
CHECKED BY			D 5842-1006
ENG APPD			CODE 04404 SHEET 1 OF 1
PROJ APPD			
MFG APPD		SCALE	

SECTION 5
TABLE OF REPLACEABLE PARTS

5.1 INTRODUCTION

This section contains identification and ordering information for replacement parts. Any changes to the Table of Replaceable Parts will be listed on a Change Sheet at the front of this handbook. Note that Dymec uses ⓗⓟ stock numbers. A part described as ⓗⓟ only is a special part that can be obtained only from the Hewlett-Packard Co. If another manufacturer's stock (part) number is listed, the part may be obtained directly from that manufacturer. A list of manufacturers' code numbers will be found in the Appendix at the end of the Table. In general, parts available from manufacturers other than those listed may be used if the part has equivalent electrical and physical characteristics and quality.

As noted on schematic diagrams, the optimum electrical value of certain components may be selected at the factory to compensate for variations in other components, wiring capacitance, etc. In some instruments, a selected part may be omitted (e.g., a selected resistor might be a wire or an open circuit). The nominal (or average) value of the part is indicated on the schematic diagram. When replacing, use the original value of the part installed in your instrument.

The Table lists parts in alpha-numerical order of their reference designation and provides the following information on each part:

1. Description (see list of abbreviations used, paragraph 5.3).
2. ⓗⓟ stock number or Dymec drawing number.
3. Typical manufacturer of the part in a five-digit code (see list of manufacturers in Appendix).
4. Manufacturer's part, stock, or drawing number.
5. Total quantity used in instrument.
6. Recommended spare part quantity for complete maintenance during one year of isolated service.

Miscellaneous and mechanical parts not indexed by reference designation are listed at the end of the Table.

5.2 ORDERING INFORMATION

To order a replacement part, address your order or inquiry either to your local Hewlett-Packard/Dymec field office (listed on last page of this handbook) or to:

United States
CUSTOMER SERVICE
Hewlett-Packard Co.
395 Page Mill Road
Palo Alto, California

Western Europe
Hewlett-Packard S. A.
54 Route des Acacias
Geneva, Switzerland

Specify the following information on each part:

1. Dymec model number and complete serial number of instrument.
2. ⓗⓟ stock number.
3. Circuit reference designation.
4. Description.

To order a part not listed in the Table, give complete description and include function and location of the part in the instrument and/or system.

5.3 ABBREVIATIONS USED

Reference Designation Column

A	= assembly	MP	= mechanical part
B	= motor	P	= plug
C	= capacitor	Q	= transistor
CR	= diode	R	= resistor
DL	= delay line	RT	= thermistor
DS	= device signaling (lamp)	RV	= varistor
E	= misc electronic part	S	= switch
F	= fuse	T	= transformer
FL	= filter	V	= vacuum tube, neon bulb, photo-cell, etc.
J	= jack		
K	= relay	W	= cable
L	= inductor	X	= socket
M	= meter	Z	= network

Description Column

a	= amperes	pos	= position(s)
c	= carbon	poly	= polystyrene
cer	= ceramic	pot	= potentiometer
comp	= composition	rect	= rectifier
depc	= deposited carbon	rot	= rotary
elect	= electrolytic	s-b	= slow-blow
f	= farads	Se	= selenium
f-a	= fast acting	sect	= section(s)
fxd	= fixed	Si	= silicon
Ge	= germanium	SPL	= special
incd	= incandescent	Ta	= tantalum
metflm	= metal film	Ti	= titanium dioxide
MFR	= manufacturer	tog	= toggle
my	= mylar	tol	= tolerance
NC	= normally closed	v	= volts
Ne	= neon	var	= variable
NFR	= not field replaceable	w/	= with
NO	= normally open	w	= watts
NPO	= zero temp coeff	ww	= wirewound
NSN	= no stock number	w/o	= without
NSR	= not separately replaceable	*	= optimum value selected, nominal value shown (component may be omitted)
OBD	= order by description		
pc	= printed circuit board		
piv	= peak inverse voltage		

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	DY-5842 VLF RECEIVER					
C12	C: fxd, nylon, 1 μf, 5%, 200 vdcw	0160-0293	84411	HEW-4	1	1
C13, 16, 41, 102	C: fxd, elect, 10 μf, -10 +100%, 25v	0180-0059	56289	Type 30D 182A1	4	1
C14	C: fxd, elect, 1500 μf, 10v	0180-0054	56289	D-32495	1	1
C15	C: fxd, mica, 560 μμf, 5%, 500 vdcw	0140-0059	00853	KR-1356	1	1
C17, 19	C: fxd, elect, 100 μf, 10 vdcw	0180-0207	56289	TE-119.3	2	1
C18, 126, 127	C: fxd, elect, 50 μf, -10 +100%, 25v	0180-0058	56289	Type 30D 186A1	3	1
C31, 32, 60, 74, 101, 119	C: fxd, elect, 20 μf, 25v	0180-0045	56289	Type 30D	6	2
C33, 40	C: fxd, mtflm, 2 μf, 20%, 200v	0160-0030	82376	MQCS-22M	2	1
C34, 35	C: fxd, Ti, 6.8 μμf, 5%, 500v	0150-0043	78488	Type GA	2	1
C36	C: var, air, 2.7 to 19.6 μμf	0121-0028	74970	Type 19MA11 160-311	1	1
C45, 52, 56, 58, 66, 68, 70	C: var, trimmer, mica, 50 to 380 μμf, 175v	0131-0001	04062	Type 46	7	2
C46, 49, 50, 55, 73	C: var, trimmer, mica, 170 to 780 μμf, 175v	0131-0003	04062	Type 46	5	2
C47	C: fxd, paper, .017 μf, 2%, 300v	0140-0166	04062	DM30F173G	1	1
C48	C: fxd, mica, 3300 μμf, 5%, 500 vdcw, *	0160-0246	00853	CR-1233	1	1
C51	C: fxd, mica, 820 μμf, 5%, 500 vdcw	0140-0091	00853	KR-1382	1	1
C53	C: fxd, mica, 180 μμf, 5%, 500 vdcw	0160-0366	00853	RR-1318	1	1
C54	C: fxd, mica, 680 μμf, 10%, 500v	0140-0007	00853	CM20C681K	1	1
C57	C: fxd, mica, 150 μμf, 10%, 500 vdcw	0140-0055	76433	Type OXM	1	1
C59	C: fxd, mica, 220 μμf, 10%, 500 vdcw	0140-0083	76433	Type 0	1	1

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
C61, 63, 64, 75-79, 81-85, 118	C: fxd, my, .22 μf, 10%, 200v	0170-0038	56289	148P22492	14	4
C62	C: fxd, my, .02 μf, 5%, 200v	0170-0027	84411	20352	1	1
C65	C: fxd, Ti, 4.7 μμf, 5%, 500v	0150-0042	78488	Type GA	1	1
C67	C: fxd, my, .047 μf, 10%, 200v	0170-0040	56289	148P47392	1	1
C69	C: fxd, mica, 1000 μμf, 1%, 500 vdcw	0140-0099	00853	Type CR	1	1
C71, 72	C: fxd, mica, 100 μμf, 10%, 500 vdcw	0140-0054	00853	CM15C101K	2	1
C80	C: fxd, mica, 330 μμf, 10%, 500 vdcw	0140-0043	00853	K-1333	1	1
C95	C: fxd, mica, 560 μμf, 5%, 500 vdcw	0140-0059	00853	KR-1356	1	1
C120, 124, 125	C: fxd, elect, 1000 μf, 50v	0180-0056	56289	D32429	3	1
C122	C: fxd, my, .1 μf, 5%, 200 vdcw	0170-0019	84411	663UW10452	1	1
C131	C: fxd, mica, 2000 μμf, 5%, 500 vdcw	0140-0086	56289	CR1220 E5	1	1
C132	C: fxd, mica, 100 μμf, 5%, 500 vdcw	0140-0041	00853	RR-1310	1	1
C133	C: fxd, mica, 3900 μμf, 2%, 500 vdcw	0140-0115	76433	CM30E392G	1	1
C134	C: fxd, mica, 2700 μμf, 5%, 500 vdcw	0160-0245	00853	CR-1227	1	1
C135, 137	C: fxd, mica, 3300 μf, 5%, 500 vdcw	0160-0246	00853	CR-1233	2	1
C136	C: fxd, mica, 4700 μμf, 5%, 500v	0140-0084	00853	CR-1247	1	1
C138	C: fxd, mica, 507 pf, 2%, 500v	0140-0107	00853	Type CM15E	1	1
C139, 150	C: fxd, mica, 1000 μμf, 5%, 500 vdcw	0160-0353	00656	1464TT	2	1
C140	C: fxd, mica, 1500 μμf, 5%, 500v	0160-0243	00853	CR-1215	1	1
C141, 143	C: fxd, my, .047 μf, 5%, 200v	0160-0138	84411	Type 663UW	2	1
C142	C: fxd, my, .015 μf, 10%, 150 vdcw	0160-0194	72928	338Y153K	1	1

Reference Designation	Description	(hp) Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
C144	C: fxd, mica, 1800 μμf, 5%, 500 vdcw	0140-0063	00853	CR-12118	1	1
C145	C: fxd, my, .039 μf, 5%, 200v	0160-0316	84411	Type 663UW	1	1
C146	C: fxd, mica, 680 μμf, 5%, 500 vdcw	0160-0241	00853	KR-1368	1	1
C147, 148	C: fxd, mica, 2200 μμf, 10%, 600 vdcw	0160-0007	00853	160P22296	2	1
C149	C: fxd, cer, .01 μf, 20%, 1000 vdcw	0150-0012	56289	H-1038	1	1
C151	C: fxd, paper, 4700 μμf, 10%, 600 vdcw	0160-0010	56289	160P47296	1	1
C152, 154, 156, 158, 160	C: fxd, mica, 18 μμf, 5%, 500 vdcw	0160-0365	00853	RR-1418	5	2
C153, 155, 157, 159, 161	C: var, 3 to 32 μμf	0121-0049	74970	160-130	5	2
CR1, 2, 31-34	Diode: Si	1901-0073	28480	G-29A-45	6	6
CR6, 7	Diode: Si, matched pair	1901-0074	28480	G-172E	pr 1	pr 1
CR8-11	Diode: Ge, matched set of 4	1910-0026	28480	G-172F	set 1	set 1
CR12, 13, 19-22	Diode: Ge, 1N90	1282-0003	73293		6	6
CR23	Diode: Si, Zener	1902-0052	28480	G-29A-26	1	1
CR24, 25	Diode: Si, 1N3254	1901-0028	02735		2	2
CR26	Diode: Si, 1N146	1901-0026	81483		1	1
CR27	Diode: Si, Zener	1902-0108	28480	G-29A-74	1	1
DS1	Lamp: Ne, NE-2J	2140-0034	24455		1	1
XDS1	Lampholder for above:	1450-0032	72619	137-8536-9	1	
F1	Fuse: 1/8a	2110-0027	75915	312.125	1	10
	Fuseholder for above:	1400-0084				

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
FL1, 2	Filter: low pass	5080-1511	28480	302A-27A	2	1
J2	Jack: telephone, 3 conductor	1251-0070	82389	2J-1230	1	1
J3, 6	Connector: BNC	1250-0118	91737	UG-1094A/U	2	1
J5	Connector: UHF	1250-0177	02660	83-22R	1	1
L1	Coil: RF, 5.5 mh	9140-0002	98405	Cat. No. 11	1	1
L5	Coil: RF, 400 mh	9140-0020	99848	1400-15-401	1	1
L8	Coil: RF, 200 μh	9140-0019	99848	1200-15-201	1	1
L9, 20	Coil: toroid assembly	5080-1513	28480	302A-60H	1	1
L10, 11, 16	Coil: RF, 500 μh	9140-0022	99848	1500-15-501	3	1
L13A, B	Coil: recorder	5080-1512	99848	302A-60G	1	1
M1	Meter: milliameter	1120-0144	12073	320-00956	1	1
Q1, 3, 23, 24	Transistor: Ge, 2N123	1850-0010	03508		4	1
Q2	Transistor: Ge, 2N582	1850-0047	02735		1	1
Q6, 11-14, 16	Transistor: Ge, 2N274	1850-0037	02735		10	3
Q17	Transistor: Ge, 2N218	1850-0036	02735		1	1
Q18	Transistor: Ge, 2N169A	1851-0006	03508		1	1
Q19	Transistor: Ge, 2N525	1850-0017	03508		1	1
Q20	Transistor: Ge, 2N301	1850-0126	02735		1	1
Q21, 22	Transistor: Ge, 2N650	1850-0048	04713		2	1
R13	R: fxd, comp, 6.8K, 5%, 1/2w	0686-6825	01121	EB6825	1	1
R14	R: fxd, cflm, 4K, 1%, 1/2w	0727-0771	19701	DC-1/2A	1	1
R15, 18, 80, 173	R: fxd, comp, 8.2K, 5%, 1/2w	0686-8225	01121	EB8225	4	1

Reference Designation	Description	(hp) Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R16	R: fxd, cflm, 98K, 1%, 1/2w	0727-0877	19701	DC-1/2A	1	1
R17	R: fxd, ww, 3K, 7w	0777-0001	07115	LD1-7	1	1
R19	R: fxd, cflm, 490Ω, 1%, 1/2w	0727-0897	19701	DC-1/2A	1	1
R21, 94, 154	R: fxd, comp, 33K, 5%, 1/2w	0686-3335	01121	EB3335	3	1
R22	R: fxd, cflm, 3K, 1%, 1/2w	0727-0767	19701	DC-1/2A	1	1
R23, 79, 85, 102	R: fxd, comp, 22K, 5%, 1/2w	0686-2235	01121	EB2235	4	1
R24, 28, 29, 91, 98, 153	R: fxd, comp, 2.7K, 5%, 1/2w	0686-2725	01121	EB2725	6	2
R26, 87, 93, 97, 134, 142, 147	R: fxd, comp, 10K, 5%, 1/2w	0686-1035	01121	EB1035	7	2
R27	R: fxd, comp, 150Ω, 5%, 1/2w	0686-1515	01121	EB1515	1	1
R30	R: fxd, cflm, 790Ω, 1%, 1/2w	0727-0091	19701	DC-1/2C	1	1
R32, 34	R: fxd, cflm, 144Ω, 1%, 1/2w	0727-0899	19701	DC-1/2A	2	1
R33	R: fxd, cflm, 2.12K, 1%, 1/2w	0727-0875	19701	DC-1/2A	1	1
R35	R: fxd, cflm, 2.9K, 1%, 1/2w	0727-0123	19701	DC-1/2A	1	1
R41, 78, 86, 96, 103	R: fxd, comp, 5.6K, 5%, 1/2w	0686-5625	01121	EB5625	5	1
R42	R: fxd, comp, 1.5K, 5%, 1/2w	0686-1525	01121	EB1525	1	1
R43	R: fxd, cflm, 3.6K, 1%, 1/2w	0727-0878	19701	DC-1/2A	1	1
R44, 46-48	R: fxd, ww, 1.5K, 1%, 5w	0811-0005	91637	Type RS5	4	1
R45	R: var, ww, 100Ω, 10%, 2w	2100-0003	11237	Type 252	1	1
R49	R: fxd, comp, 390Ω, 5%, 1/2w	0686-3915	01121	EB3915	1	1
R50	R: fxd, comp, 47Ω, 5%, 1/2w	0686-4705	01121	EB4705	1	1

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R51	R: fxd, comp, 82Ω, 5%, 1/2w	0686-8205	01121	EB8205	1	1
R52, 53	R: fxd, comp, 18Ω, 5%, 1/2w	0686-1805	01121	EB1805	2	1
R56	R: fxd, comp, cflm, 26.7K, 1%, 1/2w	0727-0876	19701	DC-1/2A	1	1
R59	R: fxd, cflm, 1.47K, 1%, 1/2w	0727-0881	19701	DC-1/2A	1	1
R61-65	R: fxd, ww, 721.9Ω	5080-1509	28480	302A-26B	5	1
R66	R: fxd, ww, 493.6Ω	5080-1508	28480	302A-26A	1	1
R67-72	R: fxd, ww, 1.067K	5080-1510	28480	302A-26C	6	2
R73	R: fxd, comp, 27K, 5%, 1/2w	0686-2735	01121	EB2735	1	1
R74	R: fxd, comp, 120Ω, 5%, 1/2w	0686-1215	01121	EB1215	1	1
R75, 166	R: fxd, comp, 12K, 5%, 1/2w	0686-1235	01121	EB1235	2	1
R76, 172	R: fxd, comp, 6.8K, 5%, 1/2w	0686-6825	01121	EB6825	2	1
R77	R: fxd, cflm, 5.77K, 1%, 1/2w	0727-0005	19701	DC-1/2C	1	1
R81, 109	R: fxd, cflm, 200Ω, 1%, 1/2w	0727-0724	19701	DC-1/2A	2	1
R82	R: fxd, comp, 1.8K, 5%, 1/2w	0686-1825	01121	EB1825	1	1
R83	R: fxd, cflm, 3K, 1%, 1/2w, *	0727-0767	19701	DC-1/2A	1	1
R88	R: fxd, comp, 3.9K, 5%, 1/2w	0686-3925	01121	EB3925	1	1
R89, 151	R: fxd, comp, 220Ω, 5%, 1/2w	0686-2215	01121	EB2215	2	1
R90	R: fxd, cflm, 37.35K, 1%, 1/2w	0727-0017	19701	DC-1/2C	1	1
R92	R: var, comp, 2.5K, 20%, 1/3w	2100-0196	11237	Type 70	1	1
R95	R: fxd, comp, 270Ω, 5%, 1/2w	0686-2715	01121	EB2715	1	1
R99	R: fxd, cflm, 150Ω, 1%, 1/2w, *	0727-0874	19701	DC-1/2A	1	1

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R100, 101	R: fxd, comp, 10Ω, 5%, 1/2w	0686-1005	01121	EB1005	2	1
R104, 133	R: fxd, comp, 2.2K, 5%, 1/2w	0686-2225	01121	EB2225	2	1
R105, 179	R: fxd, comp, 560Ω, 5%, 1/2w	0686-5615	01121	EB5615	2	1
R110	R: fxd, comp, 56Ω, 5%, 1/2w	0686-5605	01121	EB5605	1	1
R111	R: var, ww, 300Ω, 10%, 2w	2100-0038	11237	Type 252	1	1
R135	R: fxd, comp, 1.5K, 5%, 1/2w	0686-1525	01121	EB1525	1	1
R136, 137	R: fxd, comp, 1K, 5%, 1/2w	0686-1025	01121	EB1025	2	1
R139	R: fxd, comp, 820Ω, 5%, 1/2w	0686-8215	01121	EB8215	1	1
R141	R: fxd, comp, 36K, 5%, 1/2w	0686-3635	01121	EB3635	1	1
R143	R: fxd, comp, 18K, 5%, 1/2w	0686-1835	01121	EB1835	1	1
R144	R: fxd, comp, 20K, 5%, 1/2w	0686-2035	01121	EB2035	1	1
R145	R: fxd, comp, 100Ω, 5%, 1/2w	0686-1015	01121	EB1015	1	1
R146	R: fxd, comp, 6.19K, 1%, 1/2w	0727-0777	19701	DC-1/2A	1	1
R148, 158, 176	R: fxd, comp, 4.7K, 5%, 1/2w	0686-4725	01121	EB4725	3	1
R149	R: fxd, comp, 680Ω, 5%, 1/2w	0686-6815	01121	EB6815	1	1
R150	R: fxd, comp, 180Ω, 5%, 1/2w	0686-1815	01121	EB1815	1	1
R155	R: fxd, comp, 100Ω, 5%, 1w	0689-1015	01121	GB1015	1	1
R156, 159, 161	R: fxd, comp, 3.3K, 5%, 1/2w	0686-3325	01121	EB3325	3	1
R157, 171, 174, 178	R: fxd, comp, 100K, 5%, 1/2w	0686-1045	01121	EB1045	4	1
R160	R: var, comp, 2K, 20%, 1/3w	2100-0153	11237	Type 45	1	1
R167, 175	R: fxd, ww, 3K, 10%, 4w	0777-0001			2	1

Reference Designation	Description	ⓗⓟ Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
R168, 170	R: fxd, comp, 470Ω, 5%, 1/2w	0686-4715	01121	EB4715	2	1
R169	R: fxd, comp, 15K, 5%, 1/2w	0686-1535	01121	EB1535	1	1
R177	R: var, 20K, 20%, 1w with SPDT switch S9	2100-0460			1	1
S2	Switch: rot, 7-pos, 3 sect	3100-0460			1	1
S4	Switch: tog, DPST, POWER	3101-0003	R. H. Fisher		1	1
S5	Switch: slide, DPDT, SELECTOR	3101-0011	42190	4603	1	1
S6	Switch: rot, SP5T, COARSE	3100-0468			1	1
S7	Switch: rot, SP4T, FINE	3100-0467			1	1
S8	Switch: rot, 6-pos, 3 sect, CHANNEL	3100-0461			1	1
S9	Part of R177, GAIN/CAL					
S10	Switch: rot, DPDT, UNTUNED INPUT/LOOP INPUT	3100-0459			1	1
T2	Transformer: audio	9120-0041	98734	2302	1	1
T3	Transformer: audio	9120-0040	98734	2300	1	1
T4	Transformer: IF input	9120-0078	98734	2445	1	1
T5	Transformer: audio	9120-0043	98734	2301	1	1
T8	Transformer: audio	9120-0038	98734	2305	1	1
T9	Transformer: audio	9120-0039	98734	2306	1	1
T10	Transformer: power	9100-0107	98734	8396	1	1
T11	Transformer: output	9120-0074	98734	2-2653	1	1
Y1-3	Crystal: quartz, matched set	5080-0204			1	1
Y5-9	Crystal: quartz (subject to customer spec)	0410-0029				

Reference Designation	Description	(hp) Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	DY-5842 OPTIONAL MODIFICATION M1					
C301	C: fxd, my, .0022 μf, 10%, 200v	0160-0154	56289	192P22292	1	1
C302, 323	C: fxd, mica, 560 pf, 5%, 500 vdcw	0140-0059	00853	KR-1356	2	1
C303, 316	C: fxd, mica, 390 pf, 5%, 300v	0140-0200	84171	DM15F391J	2	1
C304, 321	C: fxd, elect, 50 μf, -10 +100%, 25v	0180-0058	56289	30D186A1	2	1
C305, 306, 309	C: fxd, mica, 120 pf, 5%, 500 vdcw	0160-0239	00853	RR-1312	3	1
C307	C: fxd, my, .1 μf, 10%, 200v	0160-0168	56289	192P10492	1	1
C308	C: fxd, mica, 270 pf, 5%, 500 vdcw	0160-0240	00853	RR-1327	1	1
C310, 311	C: fxd, mica, 150 pf, 10%, 500 vdcw	0140-0055	76433	Type OXM	2	1
C312	C: fxd, mica, 240 pf, 5%, 500 vdcw	0140-0092	00853	Type RR	1	1
C313, 314	C: fxd, mica, 127 pf, 2%, 300v	0140-0110	76433	Type PQ	2	1
C315	C: fxd, mica, 150 μμf, 5%, 500 vdcw	0140-0067	00853	RR-1315	1	1
C317, 318	C: fxd, mica, 200 pf, 5%, 300v	0140-0198	84171	DM15F201J	2	1
C319, 324, 327, 329	C: fxd, my, .01 μf, 10%, 200 vdc	0160-0161	00853	192P10392	4	1
C320	C: fxd, mica, 220 pf, 5%, 500 vdcw	0140-0083	00853	RR-1322	1	1
C322	C: fxd, paper, 47 μf, 5%, 50v	0160-0290	West-cap	WS4J274	1	1
C325	C: fxd, my, 2.7 μf, 5%, 50v	0160-0289	West-cap	WS4J275	1	1
C326	C: fxd, Ta, 150 μf, 15v	0180-0194	21520	STA-819-1	1	1
C328	C: fxd, mica, 1045 μμf, 2%, 300v	0140-0106	76433	RCM20E	1	1

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	DY-5842 OPTIONAL MODIFICATION M1					
CR301, 303-307	Diode: Ge, 1N270	1910-0023	73293		6	6
CR302	Diode: Si, Zener, 1N1314	1902-0106	99942		1	1
CR308	Diode: Si, 1N459	1281-0018	73293		1	1
J301 J302 J303	Connector: BNC	1250-0118	91737	UG-1094A/U	1	1
L301	Coil: RF, 5.5 mh	9140-0002	98405	Cat. No. 11	1	1
L302	Coil: toroid, 1 mh	9140-0173	Bornell	TC-12/SC-33	1	1
Q301	Transistor: Si	1854-0003	Fair-child	S-3056	1	1
Q302-304, 307-317	Transistor: Ge, 2N404A	1850-0111	93332		14	4
Q305, 306	Transistor: Ge, 2N582	1850-0047	02735		2	1
R301, 370	R: fxd, comp, 33K, 5%, 1/4w	0683-3335	01121	CB3335	2	1
R302	R: fxd, comp, 36K, 5%, 1/2w	0686-3635	01121	EB3635	1	1
R303, 324	R: var, 20K, 20%, 1/3w	2100-0456	11237	YLE-45	2	1
R304	R: fxd, comp, 5.6K, 5%, 1/4w	0683-5625	01121	CB5625	1	1
R305	R: fxd, comp, 43K, 5%, 1/2w	0686-4335	01121	EB4335	1	1
R306	R: fxd, comp, 470Ω, 5%, 1/4w	0683-4715	01121	CB4715	1	1
R307, 332, 337, 340, 346, 350, 355	R: fxd, comp, 4.7K, 5%, 1/4w	0683-4725	01121	CB4725	7	2

Reference Designation	Description	hp Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	DY-5842 OPTIONAL MODIFICATION M1					
R308,317,321, 334,345	R: fxd, comp, 8.2K, 5%, 1/4w	0683-8225	01121	CB8225	5	2
R309	R: fxd, comp, 7.5K, 5%, 1/2w	0686-7525	01121	EB7525	1	1
R310,311,323, 325,327	R: fxd, comp, 5.1K, 5%, 1/2w	0686-5125	01121	EB5125	5	1
R312	R: fxd, comp, 3.6K, 5%, 1/4w	0683-3625	01121	CB3625	1	1
R313	R: fxd, comp, 150Ω, 5%, 1/2w	0686-1515	01121	EB1515	1	1
R314,322,330, 331,339,342, 348,353,357, 363	R: fxd, comp, 3.9K, 5%, 1/4w	0683-3925	01121	CB3925	10	3
R315,319	R: fxd, comp, 2.2K, 5%, 1/4w	0683-2225	01121	CB2225	2	1
R316,320	R: fxd, comp, 27K, 5%, 1/4w	0683-2735	01121	CB2735	2	1
R318	R: fxd, comp, 27Ω, 5%, 1/4w	0683-2705	01121	CB2705	1	1
R326,361	R: fxd, comp, 1.2K, 5%, 1/4w	0683-1225	01121	CB1225	2	1
R328	R: fxd, comp, 100Ω, 5%, 1/2w	0686-1015	01121	EB1015	1	1
R329	R: fxd, comp, 620Ω, 5%, 1/2w	0686-6215	01121	EB6215	1	1
R333,338,341, 347,349,351,356	R: fxd, comp, 47K, 5%, 1/4w	0683-4735	01121	CB4735	7	2
R335,344,354	R: fxd, comp, 200Ω, 5%, 1/2w	0686-2015	01121	EB2015	3	1
R336,343,352, 358,360	R: fxd, comp, 10K, 5%, 1/4w	0683-1035	01121	CB1035	5	2
R359	R: fxd, comp, 150K, 5%, 1/4w	0683-1545	01121	CB1545	1	1

Reference Designation	Description	(hp) Stock No.	Mfr. Code	Mfr. Part No.	Qty.	1-Yr. Spa.
	DY-5842 OPTIONAL MODIFICATION M1					
R362	R: fxd, comp, 39K					
R365	R: fxd, comp, 4.7M					
R366	R: fxd, comp, 10M, 5%, 1/4w	0683-1065	01121	CB1065	1	1
R367	R: fxd, comp, 2.7M, 5%, 1/4w	0683-2755	01121	CB2755	1	1
R368	R: var, comp, 100K, 20%, 2w	2100-0462	01121	Type J	1	1
R369	R: var, comp, 2.5K, 10%, 2w	2100-0463	01121	Type J	1	1
R371	R:					
S301	Switch: rot, 6 pole, 2 sect	3100-0456	76854	216475-F2	1	1

TABLE 6-3.
CODE LIST OF MANUFACTURERS

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U.S.A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00287	Cemco Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N.J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp. Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co., Pickens Div.	Pickens, S.C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N.J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01930	Amerock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Chicago, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N.J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
03508	G.E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div. Finderne Plant	Somerville, N.J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lambertville, N.J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P.M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Linde Div., Kemet Dept.	Cleveland, Ohio
05593	Illumitronic Engineering Co.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Semcor Div. Components Inc.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Birtcher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N.J.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Blinn, Delbert Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08792	CBS Electronics Semiconductor Operations, Div of C.B.S. Inc.	Lowell, Mass.
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Metex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13103	Thermolloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dubilier Electric Corp.	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cabletronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Amelco Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Detroit, Ill.
16352	Computer Diode Corp.	Lodi, N.J.
16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Tranex Company	Mountain View, Calif.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas

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TABLE 6-3.
CODE LIST OF MANUFACTURERS (Cont'd)

Code No.	Manufacturer	Address
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Grobet File Co. of America, Inc.	Carlstadt, N.J.
26992	Hamilton Watch Co.	Lancaster, Pa.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akron, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60741	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Inst. Inc. Weston-Newark	Newark, N.J.
66295	Wittek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Groov-Pin Corp.	Ridgefield, N.J.
74276	Signalite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Borg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc.	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental-Wirt Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp.	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Any brand Tube meeting EIA Standards-Washington, DC.	
80207	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80223	United Transformer Corp.	New York, N.Y.
80248	Oxford Electric Corp.	Chicago, Ill.
80294	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	New York, N.Y.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	. . . . . .
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.

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TABLE 6-3.
CODE LIST OF MANUFACTURERS (Cont'd)

Code No.	Manufacturer	Address
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Wesbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stevens Mfg. Co., Inc.	Mansfield, Ohio
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94682	Worcester Pressed Aluminum Corp.	Worcester, Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.,	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Siemon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Huggins Laboratories	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Troncis, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98821	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

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0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	A "N" D Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlington, Calif.
000YY	S. K. Smith Co.	Los Angeles, Calif.

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