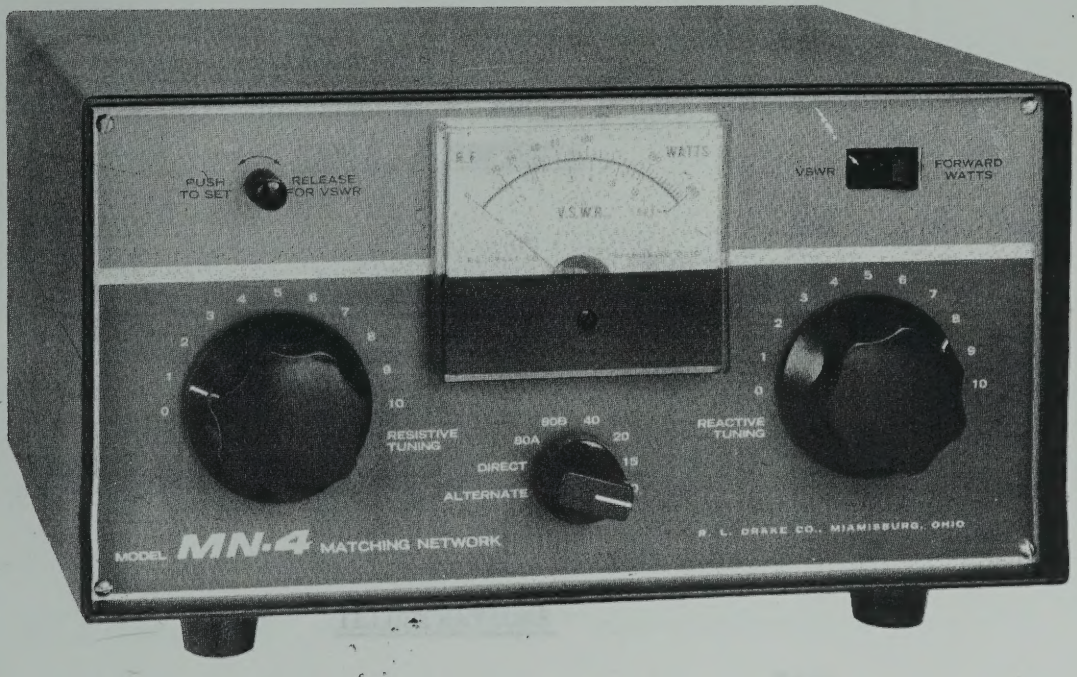
DRAKE

INSTRUCTION MANUAL



MODEL MN-4

MATCHING NETWORK

R. L. DRAKE COMPANY, MIAMISBURG, OHIO, U.S.A.

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Section 1
Specifications

MN-4 SPECIFICATIONS

FREQUENCY COVERAGE:

3.5 to 4.0 MHz
7.0 to 7.3 MHz
14.0 to 14.35 MHz
21.0 to 21.45 MHz
28.0 to 29.70 MHz

INPUT IMPEDANCE: 50 ohms (resistive)

LOAD IMPEDANCE: 50 ohm coax with VSWR of 5:1 or less
75 ohm coax at a lower VSWR can be used.

POWER CAPABILITY: 200 watts RF continuous

METER: Reads forward power in watts, or VSWR

WATTMETER ACCURACY: ±5% of reading +2 watts

INSERTION LOSS: 0.5 dB or less on each band after tuning

DIMENSIONS: 5 1/2" high, 10 3/4" wide, 8 1/2" deep (including connectors)

Front panel controls are provided for the adjustment of resistive and reactive tuning and VSWR calibration, bandswitching and selection of watts or VSWR functions of the meter. The rear panel has three type SO-239 connectors, one for input and two for outputs, and a ground post. The metering circuit employs two type IN295 rectifiers.

Frequencies outside the amateur bands can be matched, with some reduction in the impedance range that can be matched. For highly resistive loads, VSWR well in excess of 5:1 can be matched.

DESCRIPTION

The typical modern transmitter has a pi-network tank circuit and will work into resistive loads of 50 to 75 ohms with Voltage Standing Wave Ratios (VSWR) of 2:1 or less. This resistive load can only be achieved with a resonant antenna; thus for multi-band operation multiple antennas are required. Space and cost considerations render this solution impractical for most amateurs. The MN-4 impedance-matching network can:

1. Measure feedline VSWR, then reduce the VSWR at the transmitter output to 1:1.
2. Monitor transmitter power output in watts directly and continuously.
3. Attenuate 2nd harmonic output from transmitter by 25 to 35 dB; thus it may eliminate the need for a low-pass TVI filter.
4. Match an antenna to a transmitter having fixed loading.
5. Give optimum match with multi-band antennas.
6. Precisely match transmitter to an antenna across a complete amateur band.
7. Permit "off the air" transmitter tuning and antenna matching at low power using dummy load.
8. Stores antenna loading adjustment for transmitter when switching from "barefoot" to linear amplifier operation, as network is by-passed in DIRECT position of bandswitch.
9. Match transmitter output to linear amplifier which does not have 50 ohm input impedance.
10. Help localize trouble by comparing transmitter output into antenna and into dummy load.

Section 3
Installation

3.1 UNPACKING

Carefully remove the MN-4 from the shipping carton and examine it for evidence of damage. If any damage is found, immediately notify the transportation company that delivered the MN-4. Keep the shipping carton and packing material for the transportation company to examine. Keeping these items is recommended in any case, as having them available makes shipment of MN-4 much easier should it ever be necessary to return it to the factory for service.

Fill out the warranty registration card and mail it.

3.2 LOCATING

The MN-4 will work properly in almost any location. Select a location on the operating table that will allow you to reach the control knobs easily.

3.3 CONNECTING

Connect the RF output of your transmitter to the TRANSMITTER connector of the MN-4, using 50 ohm coaxial cable such as RG-8/U or RG-58/U. Cable length is not critical. Connect the coaxial line feeding the antenna to the ANTENNA connector of the MN-4. In installations using a transceiver, or transmitter-receiver combinations, the MN-4 should be the last item the out-going RF signal passes through before entering the feed line to the antenna. The effects of this on receiver operation will be discussed in the Operating Instructions, Section 4 of this manual.

Bond the GROUND post of the MN-4 to the station ground with a short piece of heavy braid.

4.4 REACTIVE TUNING

The REACTIVE TUNING control is used to tune out the reactive component of the antenna impedance.

4.5 PUSH TO SET-RESLEASE FOR VSWR

This control is used to vary the sensitivity of the meter circuit, and to calibrate the meter.

4.6 FORWARD WATTS-VSWR

This switch connects the proper circuitry to allow the meter to read either forward power in watts, or VSWR, as desired.

4.7 OPERATING PROCEDURE FOR 10, 15, 20, 40 METERS

CAUTION: An antenna or a dummy load MUST be connected to the MN-4 before energizing the transmitter to avoid damage to the MN-4 and the transmitter. MN-4 tuning should be done with low transmitter power whenever possible.

Preset the operating controls:

BANDSWITCH	To desired band
RESISTIVE TUNING	To 5
REACTIVE TUNING	To 5
PUSH-RELEASE	Fully counterclockwise
FORWARD WATTS-VSWR	To VSWR

Energize transmitter, apply low power to the MN-4, and adjust transmitter plate tuning to resonance. The VSWR meter should read upscale. Vary the RESISTIVE TUNING until the VSWR dips, then turn the REACTANCE TUNING control clockwise to bring the VSWR indication upscale. Re-adjust the RESISTIVE TUNING for a dip. If this dip is downscale from the first dip,

you are tuning in the right direction, and should continue to alternately move the REACTIVE tuning control clockwise and tune the RESISTIVE tuning for a dip until a minimum VSWR indication is obtained.

If the second dip found reads higher on the meter than the first dip, the REACTIVE tuning control must be turned counterclockwise a short distance, and the RESISTIVE tuning adjusted for a dip. Continue alternating these actions until a minimum VSWR reading is reached.

If the dips found during the tuning procedure are so far downscale that it becomes difficult to tell whether a particular dip is lower or higher than the preceding one, you can increase meter sensitivity and get readings that are farther upscale by turning the PUSH-RELEASE Knob clockwise. With this added sensitivity it may not be possible to dip to the meter zero, but any residual reading will represent a very small power level, probably less than 0.1 watt.

When the MN-4 has been adjusted to the lowest possible dip, it is properly tuned to present a 50 ohm resistive load to the transmitter. (Make a note of the settings of the RESISTIVE and REACTIVE tuning controls and the bandswitch. The next time you operate on this band, you can tune up quickly by returning the MN-4 controls to the same settings).

Adjust the transmitter plate tuning and loading controls as directed by the transmitter instruction book. Push in on the PUSH-RELEASE control, and rotate the knob clockwise until the meter pointer lines up with the SET mark (full scale) on the meter face. Release the knob. The meter is now calibrated for VSWR measurements.

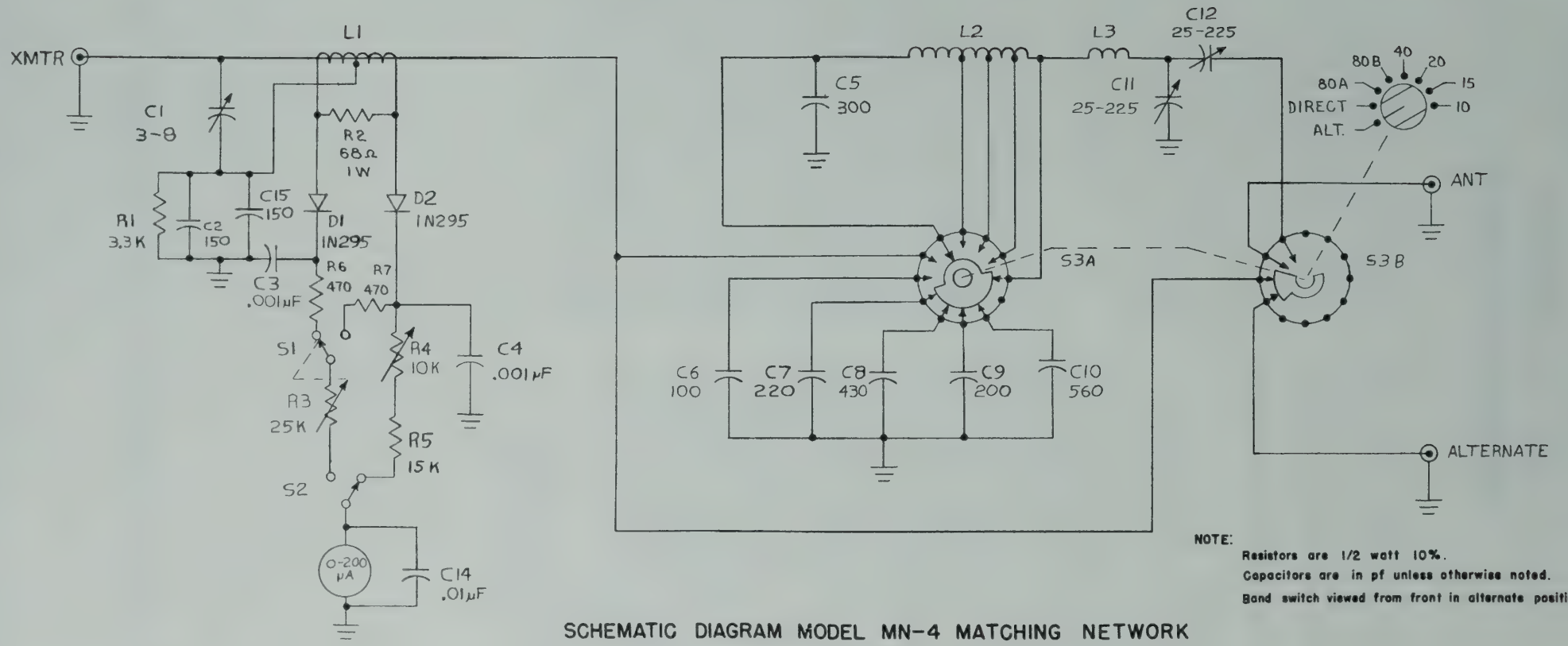
switch to the VSWR setting. Push in on the PUSH-RELEASE knob and turn it clockwise until the meter indicates the same as forward power. Release the PUSH-RELEASE knob. The meter now indicates reflected power on the power scale.

4.11 USE WITH TRANSCEIVERS AND T/R COMBINATIONS

Adjustment of the MN-4 with a transceiver is done exactly as described in Paragraphs 4.7 through 4.10. Since the received signal will be passed through the MN-4, it is necessary to change the bandswitch of the MN-4 to DIRECT, or to agree with the setting of the receiver bandswitch, when just tuning through the bands. If this is not done, the received signal will be attenuated by the MN-4 whenever the bandswitch setting is not the same as the band being tuned.

4.12 MAINTENANCE

The MN-4 should be practically maintenance free, as it is a passive device. If either, or both, of the IN295 diode rectifiers for the wattmeter are damaged, they must be replaced with the same type diodes. Substitution of other type diodes may seriously degrade the accuracy of the wattmeter. If any problems arise that cannot be corrected, either return the MN-4 to your dealer; or write to our Service Department, describing your problem in full, including external connections, control settings, type of antenna and transmitter, etc. Do not return your MN-4 to the factory without proper authorization.



NOTE:
Resistors are 1/2 watt 10%.
Capacitors are in pf unless otherwise noted.
Band switch viewed from front in alternate position.

SCHEMATIC DIAGRAM MODEL MN-4 MATCHING NETWORK

MODEL 4–NB
NOISE BLANKER

The Model 4—NB is a solid-state noise blanker for use with the R—4C Receiver. Unlike noise clippers or limiters commonly found in communications equipment, the 4—NB is an advanced noise blanker which actually mutes the receiver for the duration of the noise pulse. Between noise pulses, full receiver gain is restored. Receiver AGC is affected only by the desired signal and not by noise. The 4—NB is most effective on strong, periodic impulse noise such as ignition noise. It is least effective on random noise. Random noise is continuous in time and the information it masks cannot be recovered by either blanking or limiting techniques.

To install the 4—NB, remove the top row of three screws on each side of the R—4C Receiver. Disconnect the R—4C power cord. Remove the cabinet top. Remove the jumper plug from the noise blanker socket which is located near the 6BZ6 IF Amplifier. Retain the jumper plug so that it may be used if the 4—NB should ever require service. The 4—NB mounts on the four plastic printed circuit board stand-offs which are on the metal shields on either side of the Permeability Tuned Oscillator (PTO). Align the plastic stand-offs with the four holes in the 4—NB circuit board with the power cable of the 4—NB at the rear of the R—4C. Carefully push the circuit board onto the plastic stand-offs. Insert the 4—NB plug into the NB socket. Dress the cable against the top front of the mode switch bracket. Wrap the wire-wrap, which is on the mode switch bracket, around the cable. Make sure the cable is dressed away from the power transformer. Do not disturb any components on the 4—NB circuit board. Replace the cabinet top and the six screws.

The 4—NB is controlled with the R—4C Function switch. The switch may be left in the NB position except when receiving extremely strong signals which may cause some distortion in the 4—NB.

4—NB NOISE BLANKER ALIGNMENT.

WARNING
Always turn off the R—4C before plugging in or unplugging the 4—NB.

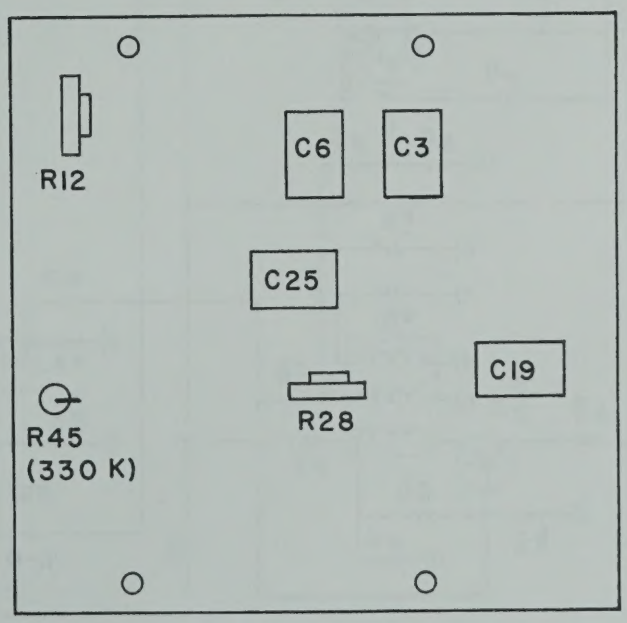
The 4—NB noise blanker requires no alignment at the time of installation. However, should alignment become necessary, the following procedure should be used: Connect a VTVM which will measure positive 15 Volts DC full scale, between the chassis and R45. Tune the R—4C to 28.5 MHz while using the crystal calibrator as a signal source. With the function switch in CAL position, adjust C3 and C6 for maximum S meter reading. With the function switch in the NB position and the RF gain control fully CCW, adjust R28 for maximum positive voltage on R45. Connect a jumper from pin 2 of the calibrator socket to ground. Pin 2 has a brown/white wire connected to it. Adjust the RF gain control to maintain 10 Volts on R45 while adjusting C19 and C25 for minimum positive voltage on R45. Remove the jumper from pin 2 of the calibrator socket and return the RF gain to full CW. With the calibrator turned on, adjust R12 so that the S meter has the same reading with the 4—NB installed as it does with the jumper plug installed.

WARNING
Always turn off the R—4C before plugging in or unplugging the 4—NB.

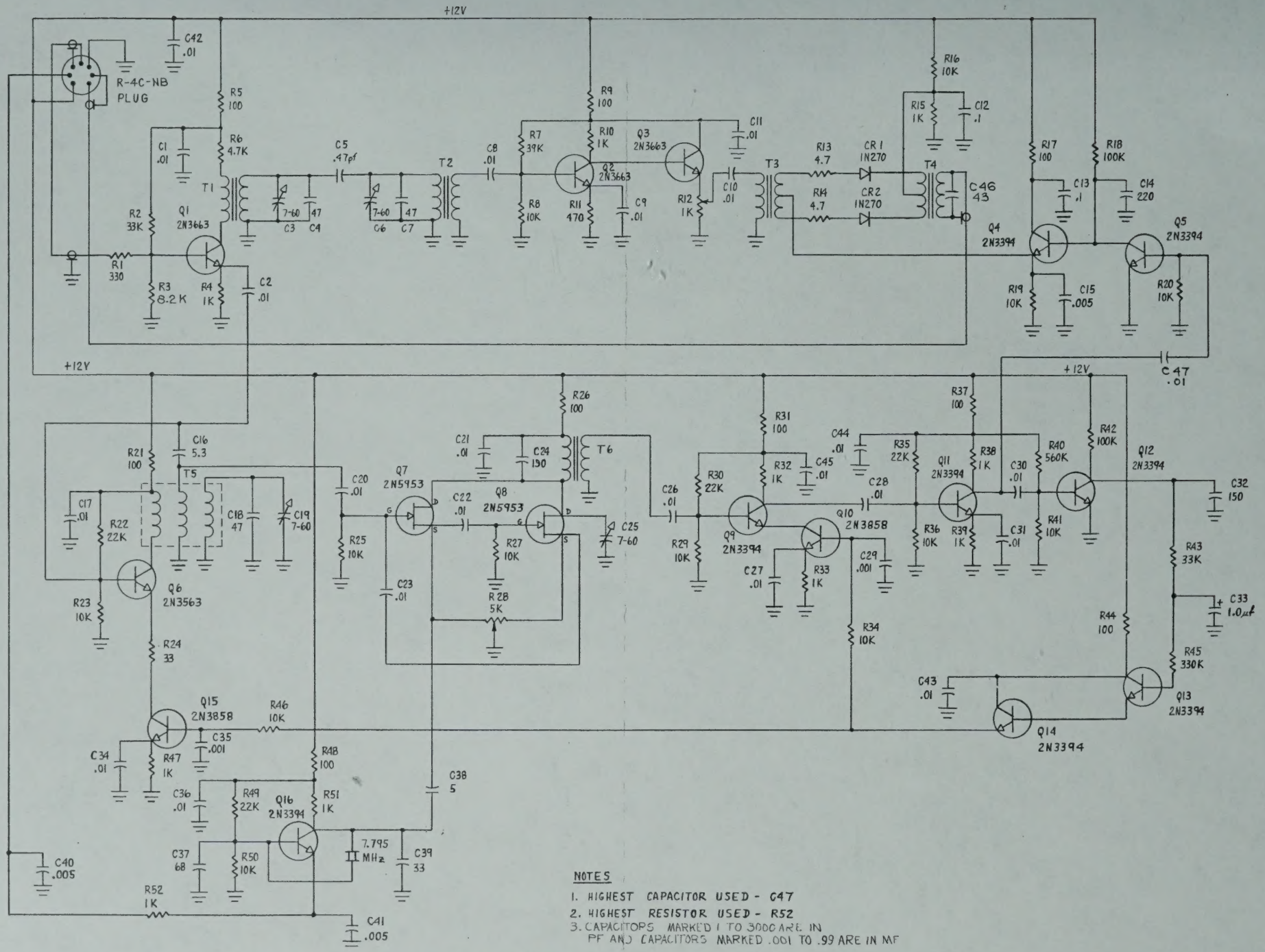
REF DES	EMITTER/SOURCE	BASE/GATE	COLLECTOR/DRAIN
Q1	1.6	2.4	6.3
Q2	1.5	2.3	9.1
Q3	8.3	9.1	12.6
Q4	7.3	7.9	13.2
Q5	0	0	7.9
Q6	3.3	4.0	13.5
Q7	1.6	0	13.7
Q8	1.4	0	13.7
Q9	3.4	4.0	10.5
Q10	3.4	4.0	3.4
Q11	3.6	4.2	9.9
Q12	0	0.22	6.7
Q13	6.3	6.7	13.8
Q14	5.8	6.3	13.8
Q15	3.8	3.2	3.2
Q16	4.2 (0)	3.5 (1.3 V)	9.2 (2.9 V)

MEASUREMENT CONDITIONS:
Conditions are the same as the R—4C voltage chart except the R—4C FUNCTION switch was in the NB position. Measurements were taken with an 11 Megohm VTVM and a Boonton 91C RF voltmeter.

Measurements in parenthesis are RF voltages.



Model 4–NB Noise Blanker Alignment Locations



NOTES

1. HIGHEST CAPACITOR USED - C47
2. HIGHEST RESISTOR USED - R52
3. CAPACITORS MARKED 1 TO 3000 ARE IN PF AND CAPACITORS MARKED .001 TO .99 ARE IN MF

Model 4—NB Noise Blanker Schematic Diagram