



INSTRUCTION MANUAL



MODEL ***MIN-2000***
MATCHING NETWORK

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

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CHAPTER I

INTRODUCTION

1-1. DESCRIPTION.

The MN-2000 is a wide range, impedance-matching network with a built-in calibrated directional wattmeter and an antenna switching arrangement. It is a versatile "tool" which allows the maximum transfer of power to an antenna system. The MN-2000 impedance-matching network has the following capabilities:

- a. Measures feedline VSWR, then reduces the VSWR to 1:1 at the transmitter output.
- b. Monitors transmitter power output in Watts directly and continuously.
- c. Attenuates 2nd harmonic output from transmitter by 25 to 35 dB; thus it may eliminate the need for a low-pass TVI filter.
- d. Matches an antenna to a transmitter having fixed loading.
- e. Provides optimum match with multiband antennas.
- f. Precisely matches the transmitter to an antenna across a complete amateur band.
- g. Permits "off the air" transmitter tuning and antenna matching at low power using a dummy load.
- h. Eliminates reloading the transmitter when switching from "barefoot" to linear amplifier operation as the antenna load can always be 50 Ohms.
- i. Matches the transmitter output to a linear amplifier which does not have 50 Ohm input impedance.
- j. Helps localize trouble by comparing the transmitter output into the antenna and into a dummy load.
- k. Provides switching for up to three separate antennas or two antennas and a dummy load.
- l. Can be switched in or out with front panel control. Front panel controls are provided for the adjustment of resistive and reactive tuning and VSWR calibration, bandswitching, selection of Watts or VSWR functions of the meter, and antenna or dummy load switching. The rear panel has a ground post and four type SO-239 connectors, one for input, two for outputs to antennas, and one for an alternate antenna or dummy load. The metering circuit employs two type 1N295 rectifiers. Frequencies outside the amateur bands can be matched, with some reduction in the impedance range. For highly resistive loads, VSWR well in excess of 5:1 can be matched.



Figure 1-1. Model MN-2000 Matching Network

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 29.7 MHz.
Input Impedance:	50 Ohms (relative).
Load Impedance:	50 Ohm coax with VSWR of 5:1 or less. 75 Ohm coax at a lower VSWR can be used.
Power Capability:	1000 Watts RF average continuous Duty, 2000 Watts PEP.
Wattmeter Accuracy:	$\pm 5\%$ of reading + 2 Watts on 200 Watt scale and $\pm 5\%$ of reading + 10 Watts on 2000 Watt scale.
Insertion Loss:	0.5 dB or less on each band after tuning.
Dimensions:	5-1/2 inches high, 10-3/4 inches wide, 14-3/8 inches deep (including connectors).

CHAPTER II

INSTALLATION

2-1. UNPACKING.

Carefully remove the unit from the shipping carton and examine it for evidence of damage. If any damage is discovered, immediately notify the transportation company that delivered the unit. Be sure to keep the shipping carton and packing material as the transportation company will want to examine them if there is a damage claim. Keep the carton and packing material even if no shipping damage occurs. Having the original carton available makes packing the unit much easier to store it or return it to the factory for service.

NOTE

Fill out the enclosed registration card and return it to the factory immediately to insure registration and validation of the warranty.

2-2. LOCATION.

The MN-2000 will work properly in almost any

location. Select a location on the operating table that will allow you to reach the control knobs easily. Figure 2-1 illustrates recommended viewing angle options using the hardware furnished with the unit.

2-3. CONNECTION.

Connect the RF output of a transmitter or linear amplifier to the XMTR connector at the rear of the MN-2000, using 50 Ohm coaxial cable such as RG8/U. Cable length is not critical. Connect the coaxial line feeding the antenna to the ANT-1 or ANT-2 connector of the MN-2000. In installations using a transceiver, or transmitter/receiver combinations, the MN-2000 should be the last item the outgoing RF signal passes through before entering the feedline to the antenna. The effects of this on receiver operation are discussed in the Operating Instructions, Chapter III of this manual. Bond the GROUND post of the MN-2000 to the station ground with a short piece of heavy braid. The connector labeled ALT may be used to connect a third antenna or a dummy load.

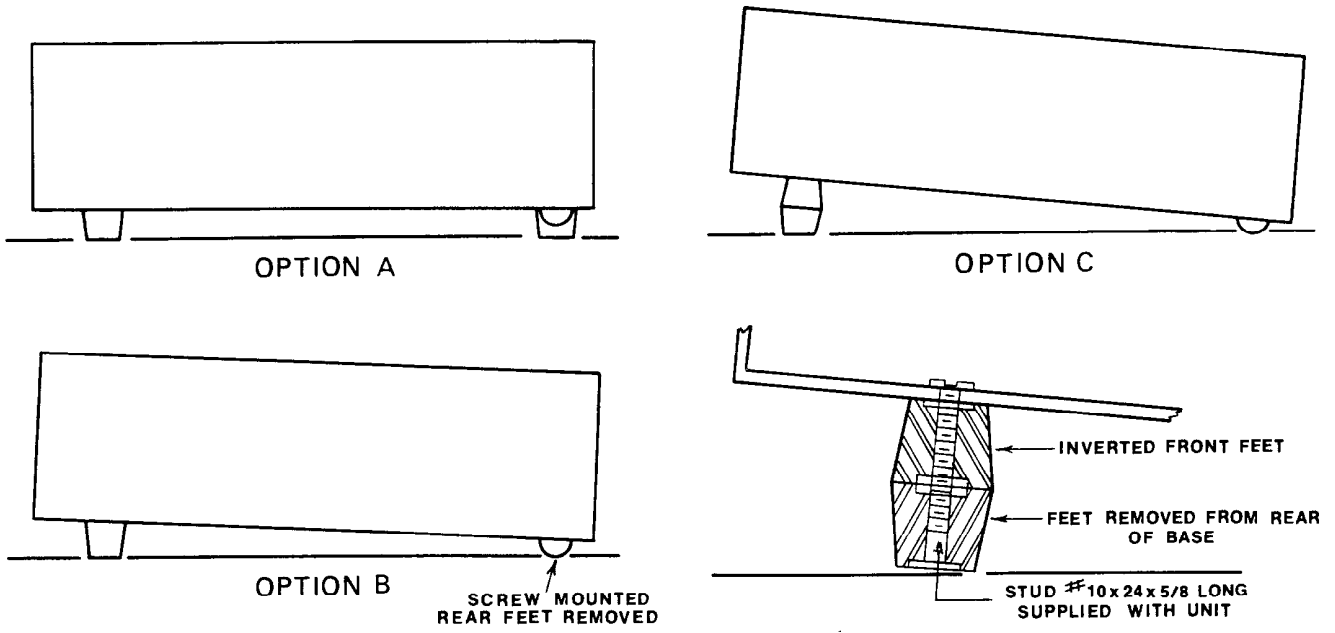


Figure 2-1. Viewing Angle Options

CHAPTER III OPERATION

3-1. TUNE UP PROCEDURE.

CAUTION

An antenna or dummy load **MUST** be connected to the MN-2000 before energizing the transmitter to avoid damage to both units. MN-2000 tuning should be done with low transmitter power whenever possible. **DO NOT EXCEED 125 WATTS DURING TUNE UP.**

Preset the operating controls as follows:

Bandswitch to desired band.

RESISTIVE TUNING to 5.

REACTIVE TUNING to 5.

PUSH TO SET fully counterclockwise.

Meter switch to VSWR.

Antenna Selector to either MATCH 1 or MATCH 2 for the antenna desired.

An ALTERNATE position is provided on the Antenna Selector to switch in a third antenna or dummy load. The tuning network is not connected in the ALTERNATE position.

All of the following operations may be done without the use of the linear amplifier in installations using transmitter/linear combinations.

Energize transmitter, apply low power to the MN-2000 and adjust the transmitter plate tuning to resonance. The VSWR meter should read upscale. Vary the RESISTIVE TUNING until the VSWR dips, then turn the REACTIVE TUNING control clockwise to bring the VSWR indication slightly upscale. Readjust the RESISTIVE TUNING for a dip. If this dip is lower than 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 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 adjustments until a minimum VSWR reading is reached.

If the dips observed 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, increase meter sensitivity and get readings that are farther upscale by turning the PUSH TO SET 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 reflected power level, probably less than 0.1 Watt.

When the MN-2000 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 Band switch setting. The next time you operate on this band, you can tune up quickly by returning the MN-2000 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 TO SET 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.

3-2. OFF-THE-AIR TUNING.

The MN-2000 can be tuned up with minimum interference if a 50 Ohm dummy load is used. The dummy load used must be capable of handling the full transmitter power output. Connect the 50 Ohm load to the ALT connector on the MN-2000, switch the MN-2000 Antenna Selector to ALTER-



NATE, connect the transmitter RF output to the MN-2000 XMTR connector and turn on the transmitter.

The exciter and linear amplifier can now be tuned to match the 50 Ohm dummy load. Turn off the linear amplifier and reduce the transmitter power output without changing the transmitter loading. As little as 20 Watts input to the MN-2000 is enough for tuning. Set the Band switch to the desired band, and switch the Antenna Selector switch to match the correct antenna. Tune the MN-2000 for minimum VSWR setting. Push in on the PUSH TO SET knob and turn it clockwise until the Meter indicates the same as forward power. Release the knob. The Meter now indicates reflected power on the power scale.

3-3. USE WITH TRANSCEIVERS AND T/R COMBINATIONS.

Adjustment of the MN-2000 with a transceiver is done exactly as described above. Since the received signal will be passed through the MN-2000, tune

up is necessary. If this is not done, the received signal will be attenuated by the MN-2000 whenever the Band switch setting is not the same as the band being tuned. DIRECT positions of the Antenna Selector switch may be used instead of tuning up the MN-2000.

3-4. DIRECT OPERATION.

In the DIRECT 1 and DIRECT 2 positions of the Antenna Selector switch, the matching network is switched out of the circuit and the transmitter is connected directly to the antenna. In the DIRECT position the VSWR of the antenna may be displayed on the Meter with some power supplied to the MN-2000 (as little as 20 Watts is sufficient). Switch the Meter switch to VSWR position. Depress the PUSH TO SET knob and rotate the sensitivity control until the Meter needle rests at the SET mark. Release the knob. The Meter will display VSWR directly on the VSWR scale. In all positions of the Antenna Selector switch the wattmeter is in the circuit and the output of the transmitter may be observed on the Meter.



Figure 2-1. Front Panel Controls

1. **REACTIVE TUNING** control: Turns out the reactive component of the antenna impedance.
2. **Antenna Selector** switch: Selects either of two antennas to be matched by the MN-2000 (i.e. the MATCH 1 or MATCH 2 position). In the DIRECT 1 and DIRECT 2 positions, the tuning network is removed and the VSWR of the antenna is displayed directly on the meter. ALTERNATE position may be used to switch in a dummy load or another antenna.
3. **Meter**: Displays forward power in Watts or VSWR as selected by Meter switching.
4. **Band** switch: Selects the fixed capacitors and inductors needed for each band.
5. **RESISTIVE TUNING** control: Varies the resistive component of the MN-2000 to achieve a match with the resistive component of the antenna impedance.
6. **Meter switch**: Connects the proper circuitry to allow the meter to display either forward power in Watts or VSWR, as desired. In the FORWARD position two ranges are provided, 200 and 2000 Watts full scale.
7. **PUSH TO SET** control: Varies the sensitivity of the meter circuit and calibrates the meter for VSWR measurements.

CHAPTER IV MAINTENANCE

4-1. SERVICE DATA.

The MN-2000 should be practically maintenance free, as it is a passive device. If either, or both, of the 1N295 diode rectifiers for the wattmeter are damaged, they must be replaced with diodes of the same type. Substitution of different diodes may seriously degrade the accuracy of the wattmeter. If any problems arise that cannot be corrected, either return the MN-2000 to your dealer or write to R. L. Drake Company, Service Department, describing your problem in full, including external connections, control settings, type of antenna, transmitter, etc. Do not return your MN-2000 to the factory without proper authorization.

We will check and align your unit at the factory for a nominal fee if it has not been tampered with. Transportation charges are extra. Any necessary

repairs will be made on a time and material basis. Please write or call the factory for authorization before returning your unit for alignment or service. Address your request for authorization to:

R. L. Drake Company
540 Richard Street
Miamisburg, Ohio 45342
ATTN: Customer Service Department
Telephone: (Area Code 513) 866-3211
Telex No. 288-017

4-2. PARTS ORDERING.

Replacement parts are available from the R. L. Drake Company at a nominal cost. When ordering replacement parts specify the serial number of the MN-2000, schematic reference designations, values, tolerances and voltage ratings as applicable.

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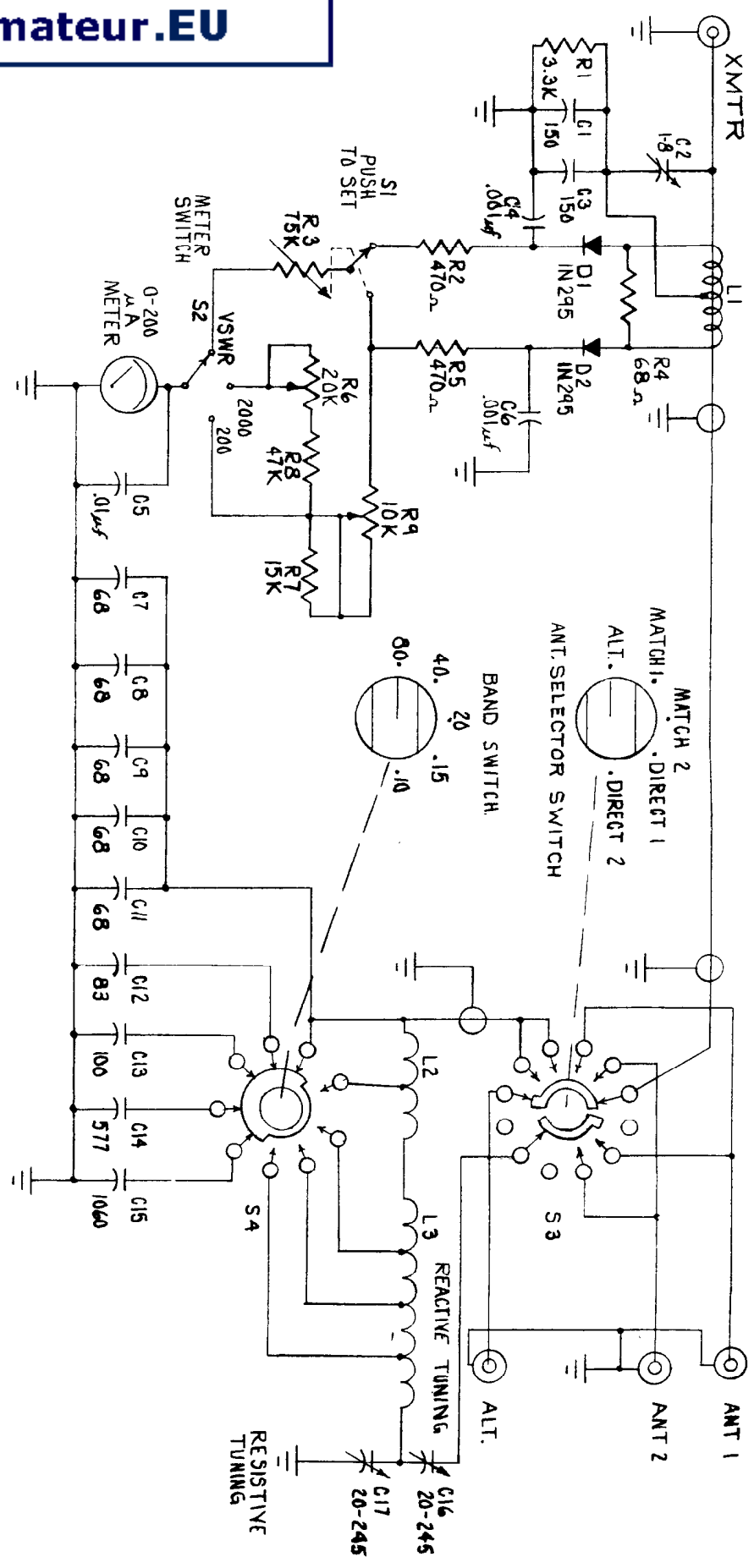


Figure 4-1. Model MN-2000 Matching Network Schematic Diagram

MN-2000 MATCHING NETWORK SPARE PARTS LIST

PRICES SUBJECT TO CHANGE
WITHOUT NOTICE 5-21-68

QTY	SYMBOL	ITEM	PRICE EACH
1	-	CABINET, with feet	15.00
1	C7 thru	CAPACITOR, Bank of 5-68 uuf in parallel	.70
1	C11	"	
1	C12	" Mica, 83 uuf	.85
1	C13	" " 100 uuf	.85
1	C14	" " 577 uuf	.85
1	C15	" " 1060 uuf	.85
2	C16,C17	" Variable	20.00
1	-	CARTON, Shipping	1.75
1	L2	COIL, Tank, on ceramic form.	7.00
1	L3	" " 1/4" plated tubing.	3.25
4	-	CONNECTOR, Co-ax SO-239	.66
1	S1-R3	CONTROL/SWITCH	2.00
1	R6	" 20K, PC Type	.35
1	R9	" 10K, PC Type	.75
2	D1,D2	DIODE, 1N295 (matched set of 2)	.75
4	-	INSULATORS, Ceramic standoff (NL-633)	.30
1	M1	METER	16.00
1	-	PANEL, MN-2000	6.00
1	S2	SWITCH, VSWR - POWER	1.50
1	S3	" FUNCTION	3.50
1	S4	" BAND	12.50
1	L1	Period COIL	2.50