DRAKE

INSTRUCTION MANUAL



MODEL MN-4

MATCHING NETWORK

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



LIMITED WARRANTY

R. L. DRAKE COMPANY warrants to the original purchaser that this product shall be free from defects in material (except tubes and RF output transistors) or workmanship for ninety (90) days from the date of original purchase.

During the warranty period the R. L. DRAKE COMPANY or an authorized Drake service facility will provide free of charge both parts (except tubes and RF output transistors) and labor necessary to correct defects in material or workmanship.

To obtain such warranty service, the original purchaser must:

(1) Complete and send in the Warranty Registration Card.

(2) Notify R. L. DRAKE COMPANY or its nearest authorized service facility, as soon as possible after discovery of a possible defect, of:

(a) The model number and serial number, if any;

(b) The identity of the seller and the approximate date of purchase;

(c) A detailed description of the problem, including details on the electrical connection to associated equipment and the list of such equipment.

(3) Deliver the product to the R. L. DRAKE COMPANY or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and shipping charges prepaid.

Correct maintenance, repair and use are important to obtain proper performance from this product. Therefore, carefully read the Instruction Manual. This warranty does not apply to any defect that R. L. DRAKE COMPANY determines is due to:

(1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and specifications of the original parts.

(2) Misuse, abuse, neglect or improper installation.

(3) Accidental or intentional damage.

All implied warranties, if any, terminate ninety (90) days from the date of the original purchase.

The foregoing constitutes R. L. DRAKE COMPANY'S entire obligation with respect to this product, and the original purchaser and any user or owner shall have no other remedy and no claim for incidental or consequential damages. Some states do not allow limitations on how long an implied warranty lasts or do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you.

This warranty gives specific legal rights and you may also have other rights which vary from state to state.

R. L. DRAKE COMPANY
540 Richard Street • Miamisburg, Ohio 45342



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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.

Section 4
Operation

4.1 CONTROLS

The controls of the MN-4 include the bandswitch (directly below the meter), resistive tuning, reactive tuning, push to set-release for VSWR, and forward watts-VSWR. The functions of these controls are described below.

4.2 BANDSWITCH

The primary function of the bandswitch is selection of the fixed capacitors and inductors needed for each band. Two 80 meter positions, marked 80B and 80A, are provided because of the large range of reactance values that must be accommodated on this band. The 80B position is the normal 80 meter position. If proper 80 meter tuning cannot be attained in the 80B position, the 80A position must be used.

Setting the bandswitch to the ALTERNATE position removes the MN-4 matching network from the circuit and connects the RF directly to the ALTERNATE socket. Setting the bandswitch to the DIRECT position removes the MN-4 matching network from the circuit and connect the RF directly to the ANTENNA socket. In both the ALTERNATE and the DIRECT positions forward power or VSWR can be read on the meter.

4.3 RESISTIVE TUNING

The RESISTIVE TUNING control varies the resistive component of the MN-4 to achieve a match with the resistive component of the antenna impedance.

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.

4.8 OPERATING PROCEDURE FOR 80 METERS

To use the MN-4 on 80 meters, set the bandswitch to 80B, and follow the procedure given in Paragraph 4.6. If it is not possible to reduce the VSWR to 1:1 in the 80B position of the bandswitch, change to the 80A bandswitch position. In the 80A position the low impedance range of the MN-4 is increased.

4.9 OFF-THE-AIR TUNING

If a 50 ohm dummy load that is capable of handling the full transmitter power output is available, it and the MN-4 can be used to tune-up with minimum interference. Connect the 50 ohm dummy load to the ALTERNATE connector on the MN-4, switch the MN-4 bandswitch to ALTERNATE, connect the transmitter RF output to the MN-4 TRANSMITTER connector and turn on the transmitter. The transmitter can now be tuned to match the 50 ohm dummy load. Then reduce the transmitter power output, without changing the transmitter loading. As little as 10 watts input to the MN-4 is enough for tuning. Set the bandswitch to the desired band, tune the MN-4 for MINIMUM VSWR, and then increase the transmitter power to its normal operating level.

4.10 REFLECTED POWER

It is possible to read reflected power with the MN-4, although the instrument was not primarily designed to do this. To read reflected power, first rotate the PUSH-RELEASE knob fully counterclockwise, and set the meter function switch to FORWARD WATTS. Increase transmitter power to the desired level (do not exceed 300 watts), then change the meter function

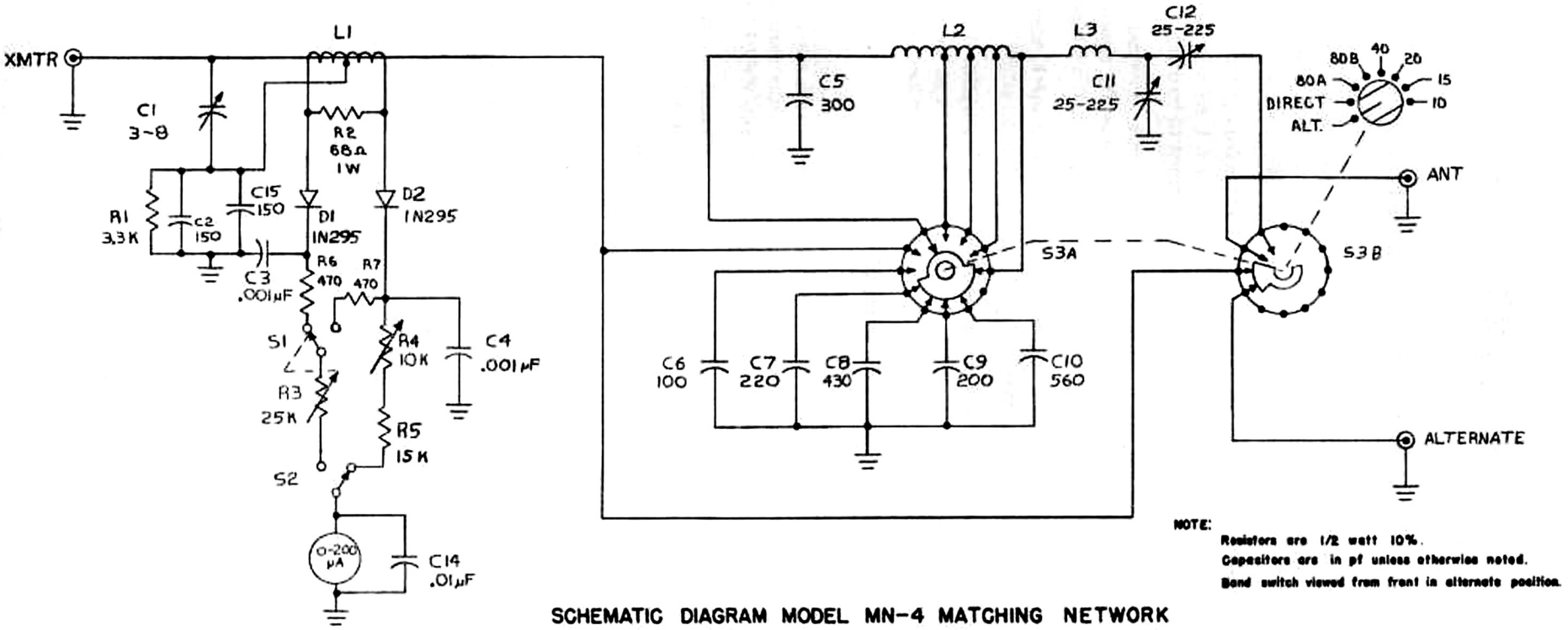
switch to the VSWR setting. Push in on the PUSH-RELEASE knob and turn it clockwise until the meter indicates the same as forward power. Release the PUSH-RELEASE knob. The meter now indicates reflected power on the power scale.

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

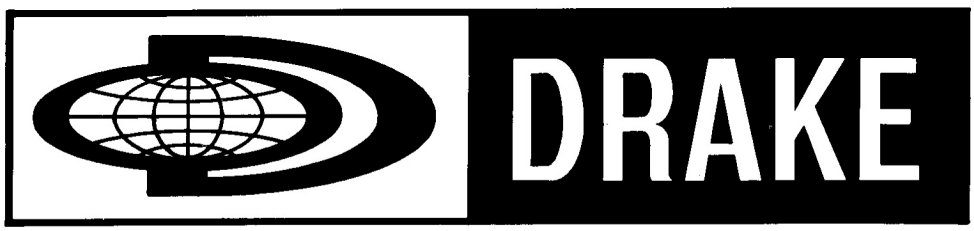


DRAKE AMATEUR PRODUCTS

R-4C	*Receiver, covers the 160 meter through 10 meter amateur bands and up to fifteen additional 500 kHz ranges. It has 8-pole crystal filter selectivity with passband tuning and transceives with the T-4XC with excellent sensitivity.*
T-4XC	*Transmitter, covers the 160 through 10 meter amateur bands and most other frequencies between 1.5 and 30 MHz. It has 8-pole crystal filters for sideband selection. It may be used to transceive with the R-4C.*
TR-4C	*Transceiver, 300 Watt high frequency single-sideband unit covers the 80 meter through 10 meter amateur bands. Includes AM and CW modes, a linear, permeability-tuned VFO and two 8-pole crystal lattice filters.*
L-4B	*Linear Amplifier, built for continuous duty at full capacity. 2000 Watts PEP on SSB. 1000 Watts on AM, CW and RTTY. Covers the 80 meter through 10 meter bands.*
C-4	*Station Console, matches Drake's T-4XC, R-4C and TR-4C.*
MN-4	*Antenna Matching Network, matches 50 Ohm transmitter output to coax antenna feedline with VSWR up to 5:1. An integral Wattmeter reads forward power in Watts and VSWR directly. 200 Watts continuous duty output.*
MN-2000	*Antenna Matching Network. Same as MN-4 except: 1000 Watts continuous duty output (2000 Watts PEP) and 3 antenna connectors switch-selectable from front panel.*
W-4	*Wattmeter, reads forward and reflected power directly in Watts (VSWR from nomograph). Range: 200 and 2000 Watts full scale, 1.8 to 54 MHz.*
WV-4	*Wattmeter, reads forward and reflected power directly in Watts (VSWR from nomograph). Range: 100 and 1000 Watts full scale, 20 to 200 MHz.*
TR-22C	*Transceiver, 2 meter VHF-FM, portable. Twelve channels, self-contained batteries and attached microphone.*
RCS-4	*Remote Coax Switch, provides remote selection of up to five antennas, using only one main feedline. Allows grounding of unused antennas. Motor driven switches controlled from station located console.*
SSR-1	*General Coverage Receiver, 0.5-30 MHz continuous. All solid state.*

For information on any of our products, please feel free to write our Sales Department, 540 Richard Street, Miamisburg, Ohio 45342 or call direct, 513-866-2421.

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