

JAMES MILLEN MFG. CO., INC.

Instructions for No. 92201

TRANSMATCH JUNIOR

1. GENERAL

The Millen No. 92201 TRANSMATCH JUNIOR is a 300 watt peak band-switching adjustable r.f. transformer with a reflectometer as the indicator. It is a single-ended or unbalanced device intended to match single-ended transmitters to coaxial transmission lines. The purpose of the No. 92201 TRANSMATCH JUNIOR is to convert the impedance of any coaxial fed antenna system to 50 ohms so that at all frequencies the transmitter may work into the impedance for which it was designed.

TRANSMATCH is a generic name coined by the editors of QST to define a device or matching network inserted between a transmitter and a transmission line. The No. 92201 TRANSMATCH JUNIOR is a 300 watt peak commercial version of the 50 ohm network described by Lewis McCoy, W1ICP, in the July, 1961 QST.

Nearly all transmitters are built with the pi-network tank circuits which are designed to work into a 50 ohm load. If the actual load on the transmitter is other than 50 ohms, the transmitter cannot be loaded properly and the overall operation is not optimum.

Multi-band beam antennas or trapped dipoles are fed with 50 ohm coaxial cable. Unfortunately, no antenna designed to cover a band of frequencies will look like a pure resistance of 50 ohms across the entire band. There will necessarily be a mis-match as frequency is changed within the band. The height of the antenna above ground, its proximity to nearby objects, and its actual impedance at resonance all effect the match between the antenna and the transmission line. The match or mismatch between the antenna and the transmission line determines the impedance that the transmission line presents to the transmitter. When the antenna is not matched in to the 50 ohm transmission line, the transmitter load will not be 50 ohms even though 50 ohm coaxial cable is used. This means that the transmitter will not be working into 50 ohms and thus will not do the job for which it was designed. The Millen No. 92201 TRANSMATCH JUNIOR will match the load to the transmitter. The No. 92201 TRANSMATCH JUNIOR also has provision for coupling a Modulation Monitor, such as the Millen No. 90932, to r.f. output of the transmitter.

2. POWER INPUT

The power handling capability of the TRANSMATCH JUNIOR is limited by the voltage rating of the band switch or the air gap of the SERIES capacitor. Under most conditions of input and output impedances and load reactances, the voltage ratings will not be reached until the power input is 300 watts peak envelope. However it is possible to have a set of operating conditions that will result in internal arcing at power levels below

300 watts. Under no circumstances should the TRANSMATCH JUNIOR be operated with a peak envelope power input of more than 300 watts. If possible, the matching procedure should be accomplished at reduced power. If arcing is suspected, do not continue to operate, as a sustained arc in the band switch will burn the switch contacts.

3. INPEDANCE RANGE

At all amateur frequencies between 3.5 mc. and 29.7 mc., the TRANSMATCH JUNIOR will match impedances of 5 ohms up to a relatively high impedance to the 50 to 75 ohm output impedance of the transmitter. The upper impedance which can be matched depends on the frequency in use. The high impedance limits are:

3.5	mc.	4000 ohms
7	mc.	2000 ohms
14	mc.	650 ohms
21	mc.	500 ohms
28	mc.	140 ohms
29.7	mc.	475 ohms

4. DESCRIPTION

The No. 92201 TRANSMATCH JUNIOR is in a desk top or mobile cabinet measuring 4 $\frac{3}{4}$ inches high x 7 inches wide x 8 $\frac{1}{4}$ inches deep. Electrically the TRANSMATCH JUNIOR is

a band-switched "L" network with a 50 ohm reflectometer and meter to simplify adjustment. The "L" network consists of a band-switched inductor in parallel with a split stator variable

capacitor and a variable capacitor in series with the output connector. The R.F. input from the transmitter is fed through a 50 ohm reflectometer (popularly called a monimatch) to the rotor of the split stator parallel capacitor.

The reflectometer rectifies a sample of the r.f. power going out toward the antenna and a sample of the r.f. power reflected back. A switch on the front panel allows the operator to read either relative forward power or relative reflected power on the meter on the front panel.

Proper adjustment of the "SERIES" and "PARALLEL" controls on the TRANSMATCH JUNIOR should result in zero reflected power.

A link coil is loosely coupled to the parallel coil and connected to the "MONITOR" jack on the rear to facilitate connection to a modulation monitor oscilloscope requiring low impedance input.

The two large dials on the front panel are labeled "SERIES" and "PARALLEL" to indicate their use in the circuit. This has no connection with series and parallel tuning of impedance feed lines since the TRANSMATCH JUNIOR is designed exclusively for use with coaxial fed antenna systems.

5. INSTALLATION

Installation of the TRANSMATCH JUNIOR is very simple. The desk top TRANSMATCH JUNIOR cabinet should be placed on the operating table so the controls may be reset when changing bands. The low impedance r.f. output of the transmitter should be connected to the "TRANSMITTER" jack on the TRANSMATCH JUNIOR by means of 50 ohm coaxial cable. The length of the cable is not critical. The coaxial antenna feed line should be connected to the "ANTENNA

The large dials are marked 0 to 100. This is approximately the per cent of maximum capacity. When the dial is at 0, the capacitor is at minimum capacity; when the dial is at 100, the capacitor is at maximum capacity.

The large switch in the center of the panel selects the amateur frequency band. This switch taps the coil.

The switch at the lower left of the panel is marked "FORWARD" and "REVERSE". This switch selects the sampled forward and reverse power to be indicated by the meter.

The control at the lower right of the panel is marked "SET". This control is used to set the forward indication at full scale on the meter. It is turned counterclockwise toward "HIGH" when the transmitter power is high and clockwise toward "LOW" when the transmitter is low power.

There are three coaxial connectors on the rear of the TRANSMATCH JUNIOR. The output connector is marked "ANTENNA TRANSMISSION LINE" and the input connector is marked "TRANSMITTER". The center connector is marked "LOW IMPEDANCE PICK-UP FOR MILLEN 90932 MODULATION MONITOR".

TRANSMISSION LINE" jack on the rear of the TRANSMATCH JUNIOR. The r.f. input jack on the station modulation monitor should be coupled to the center connector on the TRANSMATCH JUNIOR by means of coaxial cable. The installation is now complete.

Mobile installation in the trunk or under the dashboard is also easy, only requiring two No. 10 bolts through the two holes provided in the bottom of the TRANSMATCH JUNIOR chassis.

6. ADJUSTMENT

Initial adjustment is best accomplished on a particular band by disconnecting the antenna and transmitter cables from the TRANSMATCH JUNIOR and connecting them together.

1. Tune and load the transmitter in the normal manner with the TRANSMATCH JUNIOR out of the circuit.

2. Connect the antenna and transmitter cables to the TRANSMATCH JUNIOR.

3. Adjust the "SET" control to "HIGH". This is necessary to avoid damaging the sensitive meter in the TRANSMATCH JUNIOR.

4. Set the "FREQUENCY" switch to the desired operating band.

5. Set the meter selector switch to "FORWARD".

6. Set the "PARALLEL" knob to 32 on the dial, as a starting point.

7. Set the "SERIES" knob to 39 on the dial, as a starting point.

8. Turn on the transmitter. If possible, use reduced power.

9. Adjust the "SET" control for approximately full scale forward power.

10. Set the meter selector switch to "REFLECTED".

11. Adjust both the "PARALLEL" and "SERIES" knobs SLOWLY and simultaneously or in small steps for minimum reflected power. Minimum reflected power may be as high as 50 microamps as is the case when the TRANSMATCH JUNIOR is used at 3.5 mc. with rated power. However, this indicated reflected power is only fictitious and is actually stray forward power. It is only important that the minimum null be obtained. On all bands except 3.5 mc. the minimum null will be close to zero. Even though the reflectometer is carefully shielded, the extremely compact design of the TRANSMATCH JUNIOR causes the internal r-f field to be so strong at 3.5 to 4 mc. that there is some residual meter reading even though matching is proper.

12. Switch to "FORWARD".

13. Adjust transmitter for maximum forward power, being careful not to exceed transmitter current ratings.

14. Adjust "SET" for exactly full scale forward power.

15. Switch to "REFLECTED".

16. Adjust very carefully both the "PARALLEL" and "SERIES" knob for minimum reflected power.

17. Make a note of the exact dial readings

so that subsequent adjustment on this band will be greatly simplified.

THE TRANSMATCH JUNIOR is now adjusted properly and the antenna is now coupled to the transmitter so that the transmitter is working into the impedance for which it was designed and the transmission line standing wave ratio is 1.0. The actual adjustment of the TRANSMATCH JUNIOR takes considerably less time and effort than reading how to do it.

7. CALIBRATION CURVES

Included in this instruction book are five sets of curves showing typical curves of TRANSMATCH JUNIOR dial readings versus load (line) impedance, assuming 50 ohms transmitter impedance. Each set of curves includes a curve

for each end of the amateur frequency band. These curves are useful in estimating the actual load impedance but, more important, give convenience dial readings as "starting points".

8. MARS FREQUENCIES

The TRANSMATCH JUNIOR may be used at the MARS frequencies. Although the range of impedance which can be match to 50 ohms is reduced, those impedances which one is likely to encounter can be matched.

Table I shows the range of Line impedances which can be matched to 50 ohms versus frequency. This data covers 3.0 to 5.5 mc. with the FREQUENCY switch at 3.5 mc.

Frequency Megacycles	Low Impedance Ohms	High Impedance Ohms
3.00	29	132
3.20	13	309
3.25	8	397
3.30	5	547
3.40	5	1217
3.50	5	4970
4.00	5	8640
4.1	5	9790
4.2	5	10K
4.4	5	10K
4.5	8	10K
4.75	21	10K
5.00	29	10K
5.1	38	772
5.3	47	399
5.5	70	270

Table I

9. TECHNICAL SPECIFICATIONS

Input Impedance (Transmitter)—50 to 75 ohms single-ended.

Output Impedance (Transmission Line)—5 to 300 ohms coaxial. 5 to 500 ohms at most frequencies.

Frequency Range—3.5, 7, 14, 21, 28 mc. amateur bands band-switched.

Power Handling Capability—300 Watts Peak.

Indicator—50 ohm Reflectometer with meter.

Physical Data

Construction—Desk top or mobile cabinet

Height—4 $\frac{3}{4}$ inches

Width—7 inches

Depth—8 $\frac{1}{4}$ inches

Weight—6 $\frac{1}{8}$ pounds

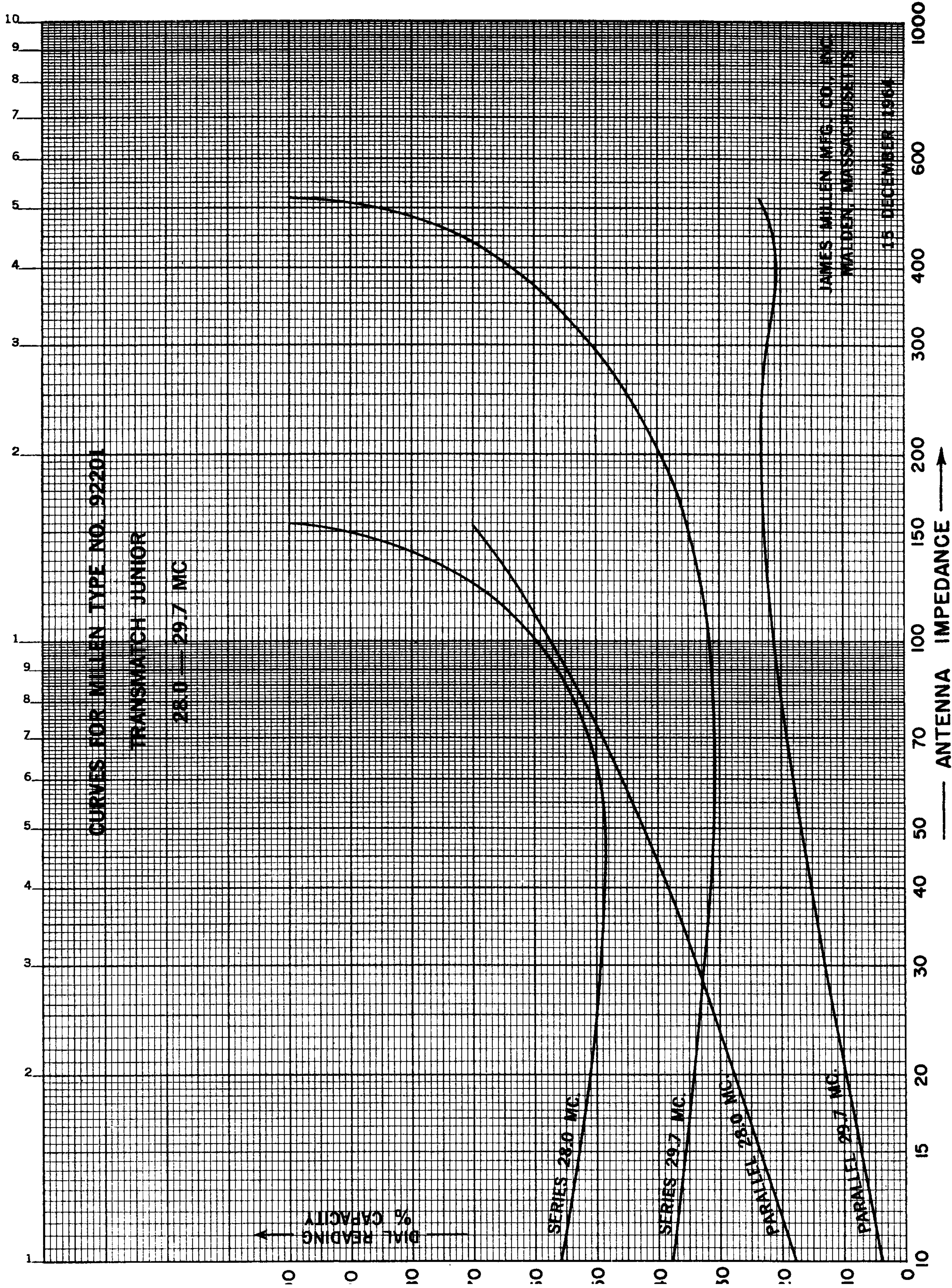
Connectors—SO-239

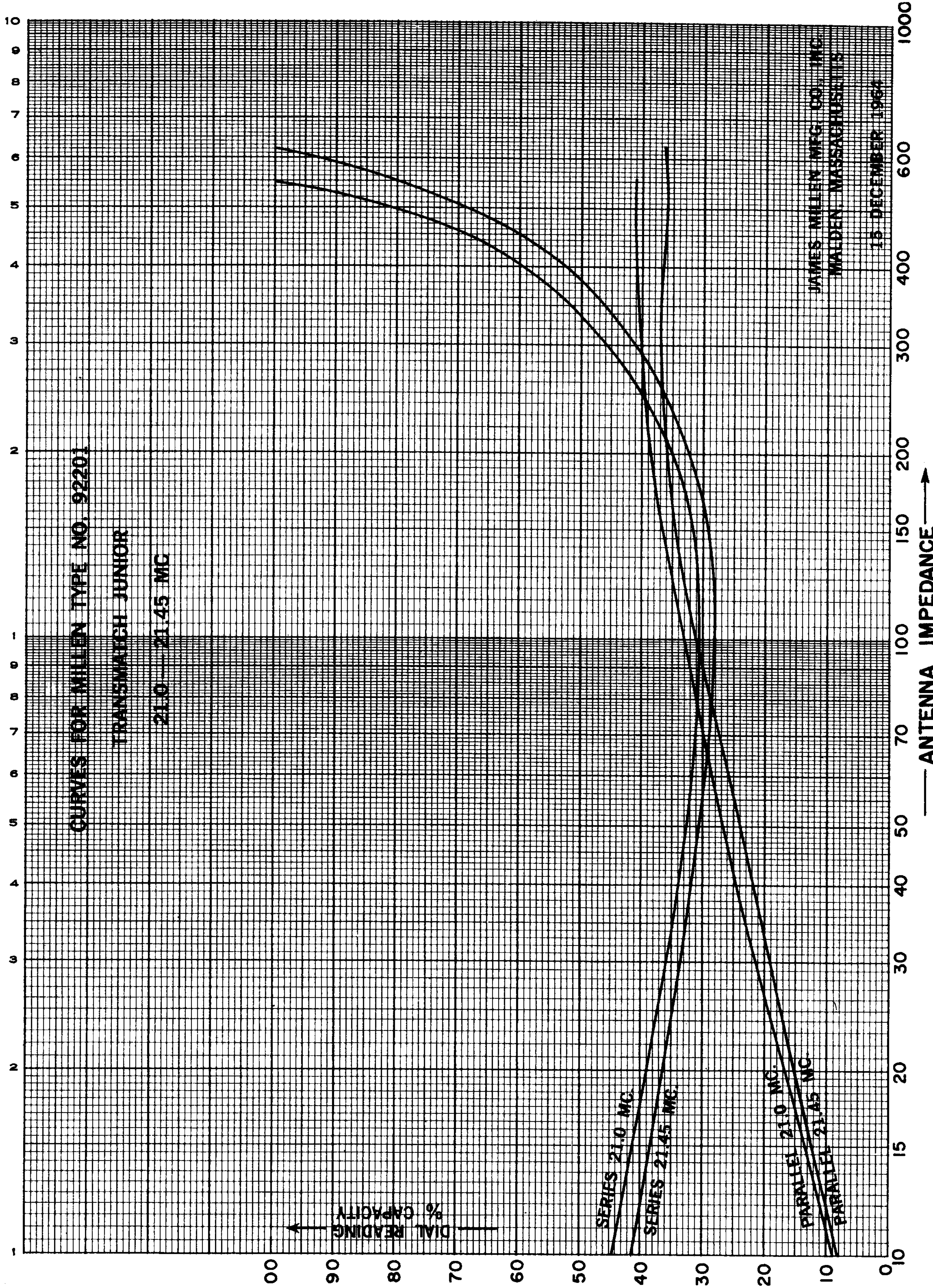
TRANSMATCH JUNIOR

Millen No. 92201

PARTS LIST

R 1	470 ohm \pm 10% $\frac{1}{2}$ Watt Composition Resistor—Allen Bradley Type EB		Switch—2500 V. Shorting Contacts—30° Detent—Oak Type DHC
R 2	Same as R 1	L 1	Millen 300 Watt TRANSMATCH JUNIOR Coil
R 3	25 K ohm \pm 10% $\frac{1}{2}$ Watt Linear Taper Potentiometer $\frac{3}{8}$ " dia. Bushing $\frac{3}{8}$ " Long— $\frac{1}{4}$ " dia. Plain Shaft $\frac{3}{8}$ " Long from Bushing; IRC-CTS Type PQ	L 2	Pick-up Loop to feed Millen No. 90932 Monitor Oscilloscope.
C 1	0.001 mfd \pm 10% 500 V. Ceramic Disc Capacitor	M 1	0-500 microampere Edgewise Meter
C 2	Same as C 1	J 1	Coaxial R.F. Connector—Amphenol Type 83-1R
C 3	Millen No. 28975KMY 2250 V. Single Section Condenser	J 2	Same as J 1
C 4	Millen No. 28975MY 2250 V. Dual Section Condenser	J 3	Same as J 1
CR 1	1N34A Germanium Diode—P.I.V.: 75 V. I.: 50 Ma.—Erie	2	Millen No. 10018-E $1\frac{3}{4}$ " dia. Black Phenolic Knob with white line
CR 2	Same as CR1	1	Millen No. 10002-D $1\frac{1}{8}$ " Black Phenolic Bar Knob
S 1	DPDT Phenolic Rotary Switch— $\frac{3}{8}$ " dia. Bushing $\frac{3}{8}$ " Long— $\frac{1}{4}$ " dia. Shaft $\frac{3}{8}$ " Long from Bushing	2	Millen No. 10001-D $\frac{3}{4}$ " Dia. Black Phenolic Bar Knob
S 2	1 Section 1 Pole 5 Position Ceramic Rotary	2	Millen No. 31030 Steatite Standoffs
		2	Millen No. 39033 Insulated Shaft Coupling
		1	Millen No. 92201-9 Meter Shield
		1	Millen No. 92201-5 Panel
		6	Millen No. 92201-8 Coil Mounting Bracket
		1	Millen No. 92201-11 Cabinet





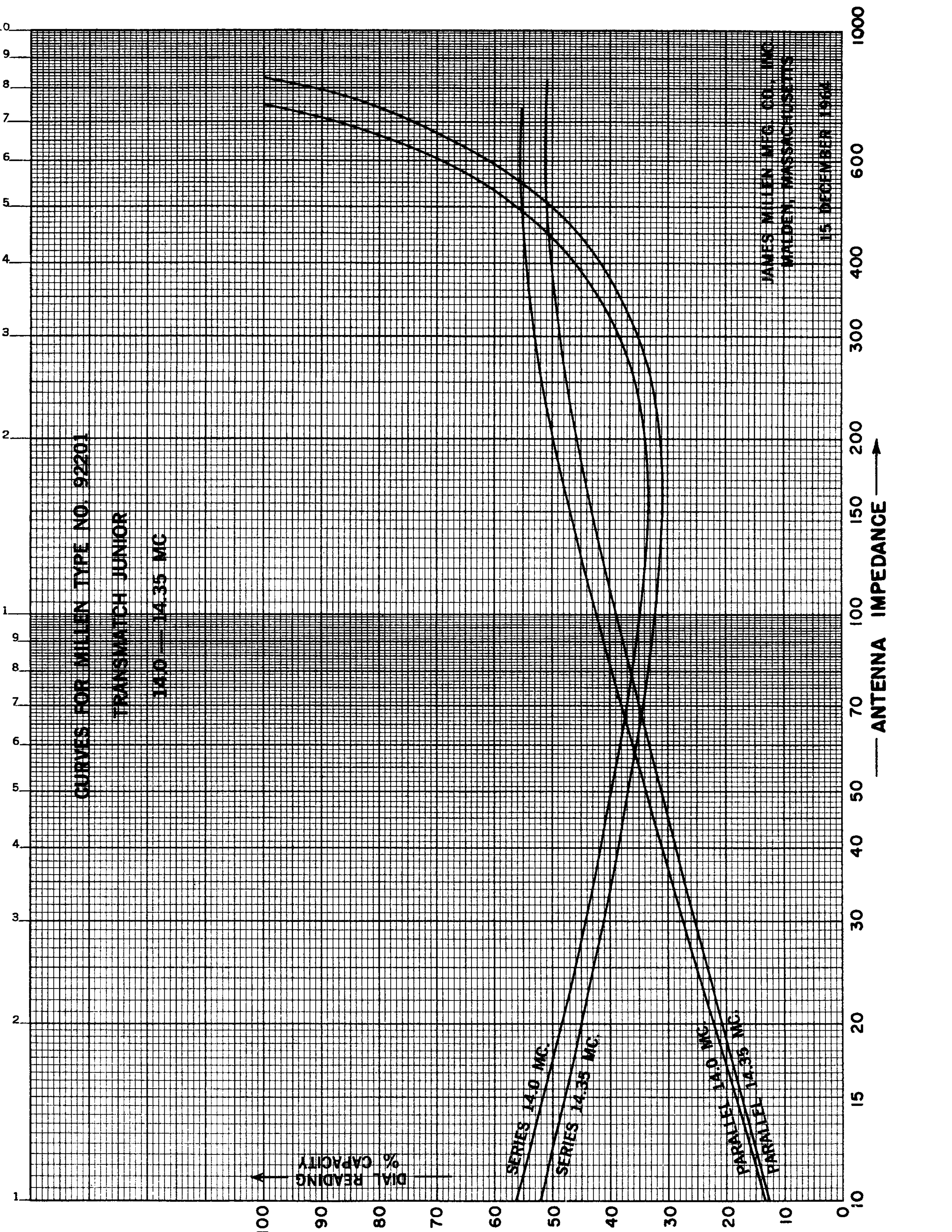
JAMES MILLEN MFG. CO., INC.
 MALDEN, MASSACHUSETTS

15 DECEMBER 1964

CURVES FOR MILLER TYPE NO. 92201

TRANSMATCH JUNIOR

14.0 — 14.35 MC



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MALDEN, MASSACHUSETTS

15 DECEMBER 1964

— ANTENNA IMPEDANCE —>

DIAL READING
% CAPACITY

CURVES FOR MILLEN TYPE NO. 92201

TRANSMATCH JUNIOR

14.0 — 14.35 MC

**DIAL READING
% CAPACITY**

ANTENNA IMPEDANCE

SERIES 14.0 MC.

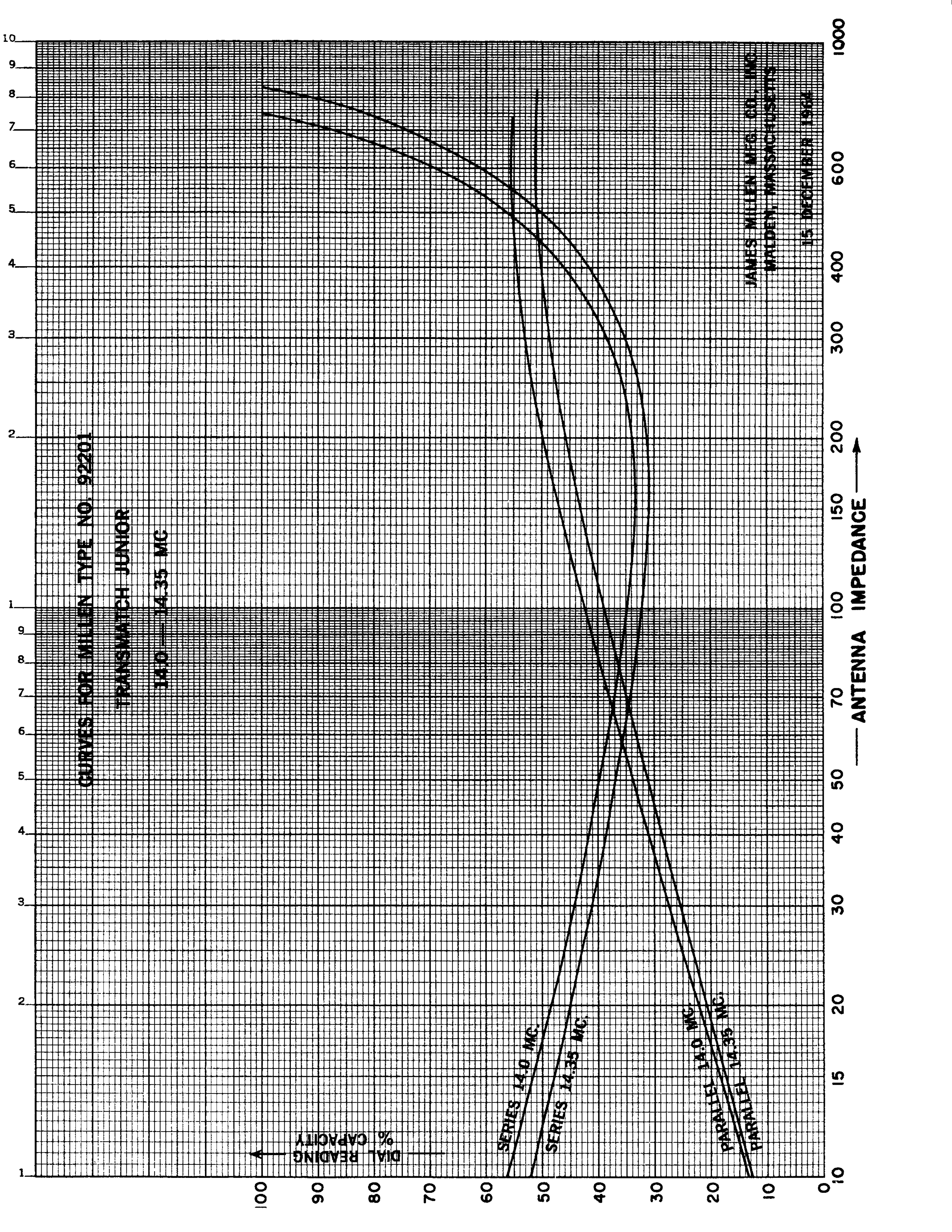
SERIES 14.35 MC.

PARALLEL 14.0 MC.

PARALLEL 14.35 MC.

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MALDEN, MASSACHUSETTS**

15 DECEMBER 1964



CURVES FOR MILLEN TYPE NO. 92201

TRANSMATCH JUNIOR

7.0 — 7.3 MC

**DIAL READING
% CAPACITY** ←

SERIES 7.0 MC

SERIES 7.3 MC

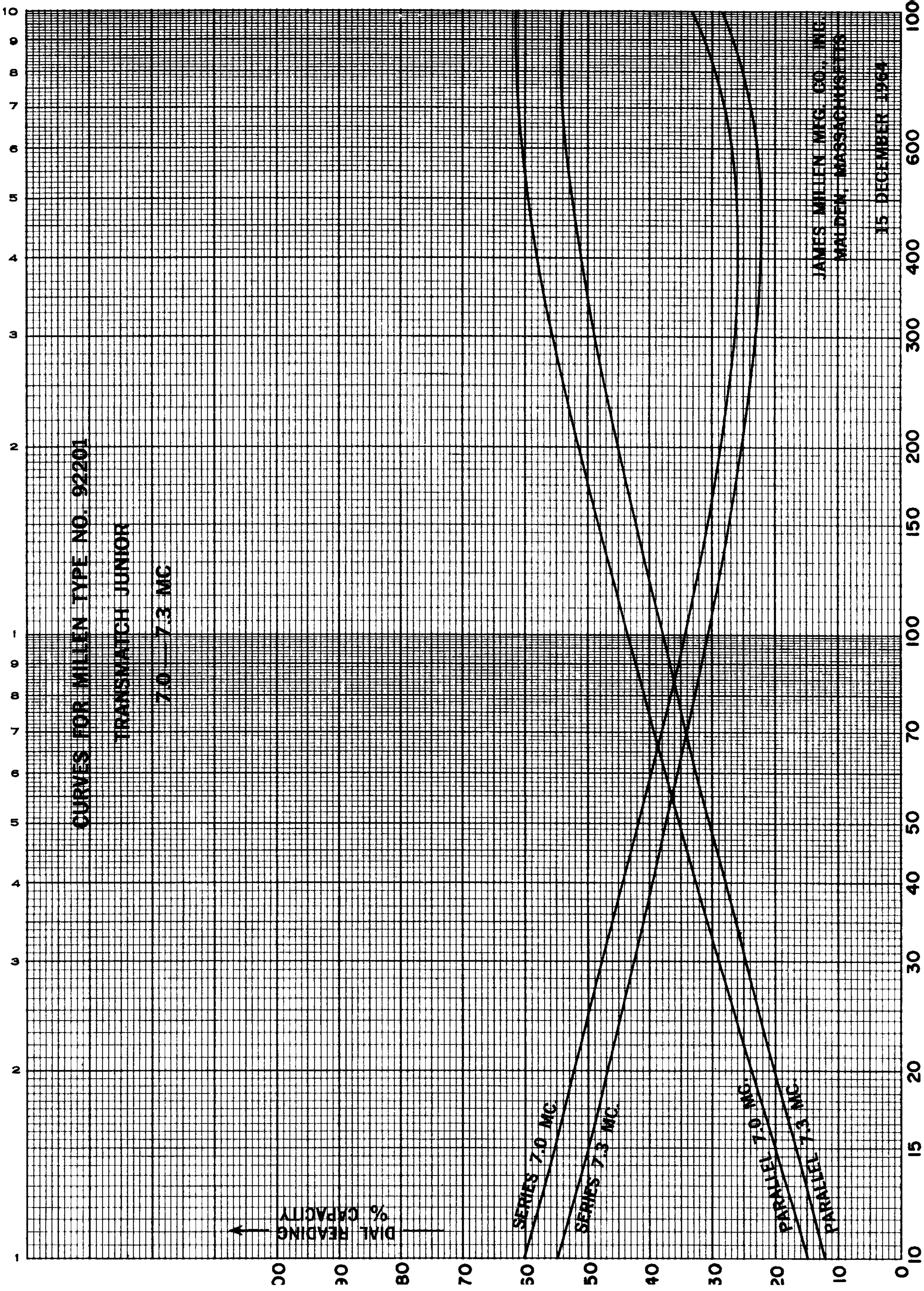
PARALLEL 7.0 MC

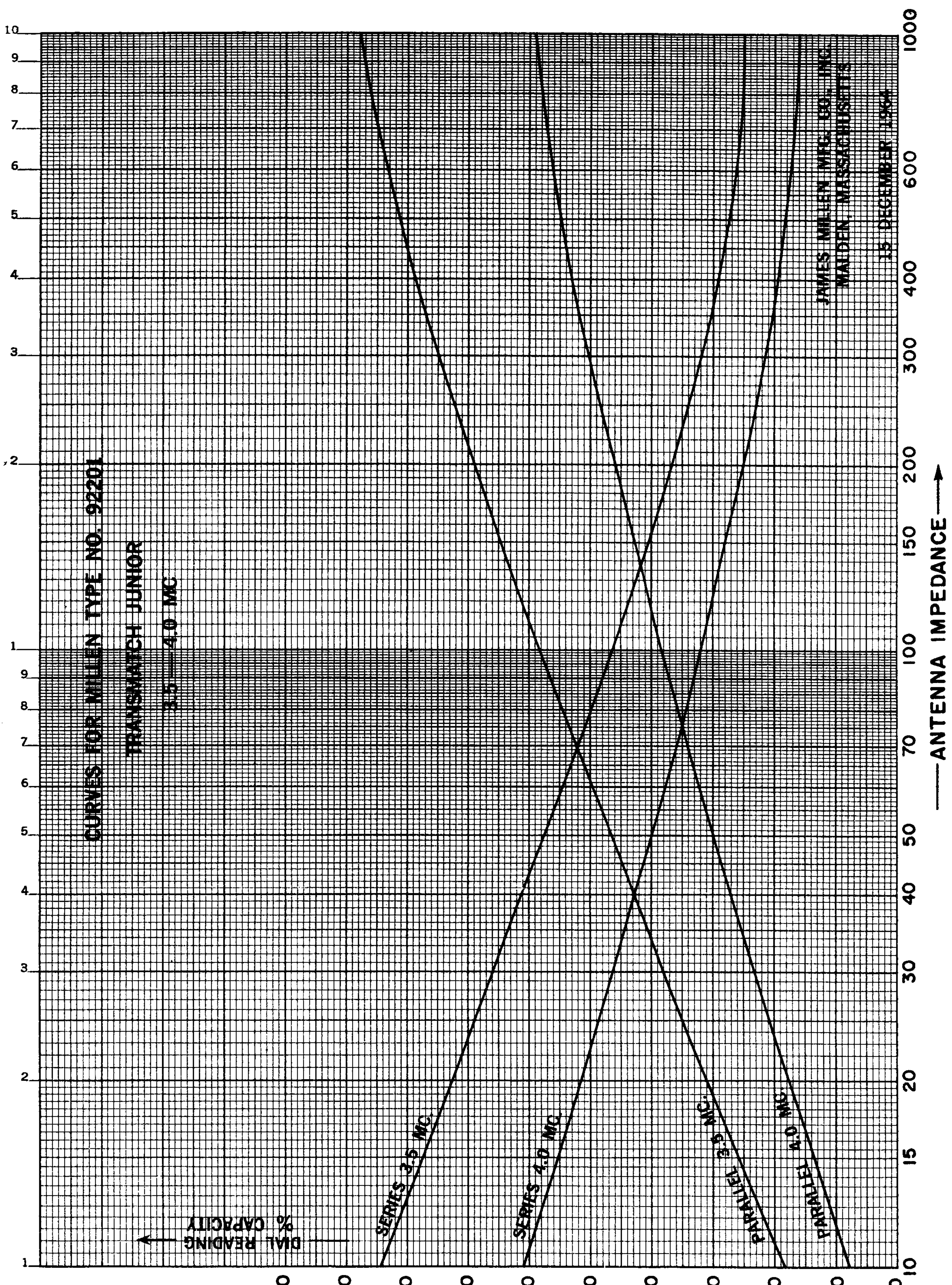
PARALLEL 7.3 MC

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15 DECEMBER 1964

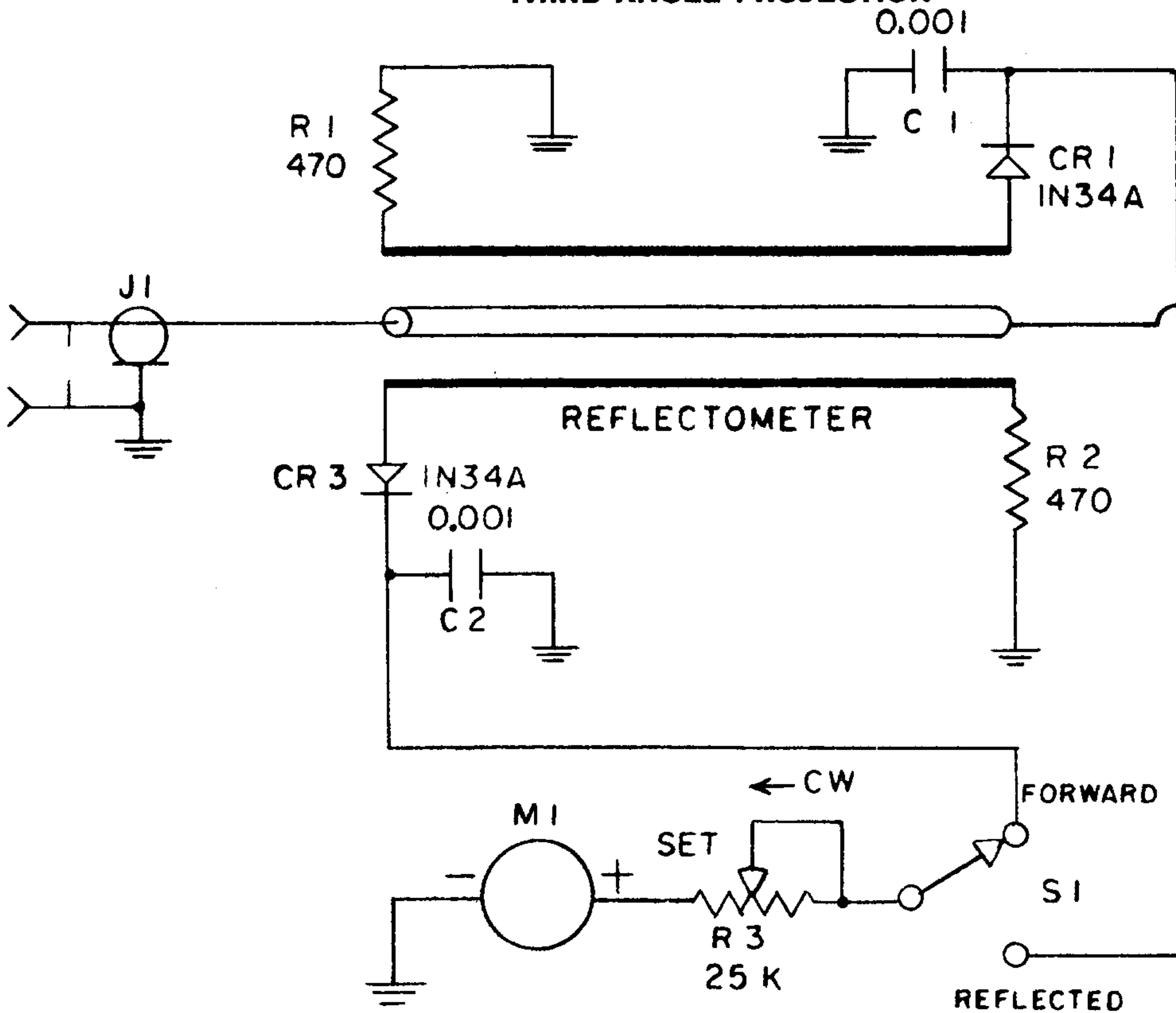
— ANTENNA IMPEDANCE →



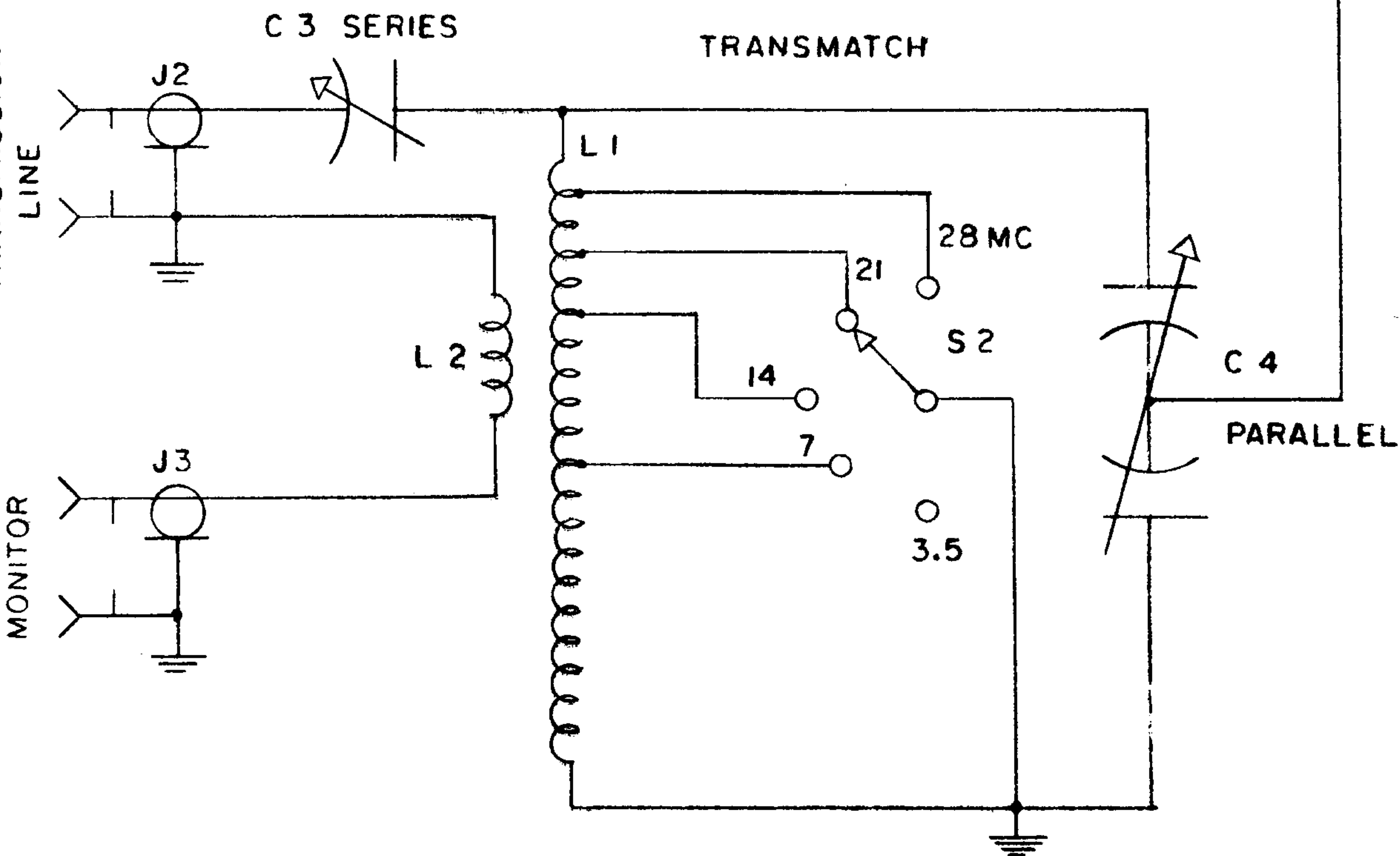


THIRD ANGLE PROJECTION

TRANSMITTER



ANTENNA TRANSMISSION LINE



ALL DIMENSIONS UNLESS OTHERWISE NOTED MUST BE HELD TO A TOLERANCE OF

TRANSMATCH JUNIOR
FIRST MADE FOR SCHEMATIC

DESIGNED BY CGE
DRAWN BY R.J. Thomas

CHECKED BY CGE
APPROVED R.W.C.

JAMES MILLEN MFG. CO., INC.
MALDEN, MASS., U.S.A.

K92201-13

DATE
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