INSTRUCTION BOOK

LINE AMPLIFIER

TYPE 236 MODEL 1

NORTHERN RADIO COMPANY
Incorporated
143-145 WEST 22nd ST., NEW YORK 11, N.Y.

pace-setters

in quality

communication

equipment

In Canada: Northern Radio Mfg. Co., Ltd., 1950 Bank St., Billings Bridge, Ottawa, Ontario.

GUARANTEE

All items of equipment and material used in this unit are guaranteed against material defects, workmanship or manufacture, for a period of one year from date of the installation, except that the items of equipment and material are not guaranteed for a term longer than two years from the date of shipment.

Under the terms of this guarantee, all items which fall within the periods defined will be replaced F.O.B. point of installation without cost to the purchaser. The company will pay transportation charges of any defective part which it desires to have returned to its plant. If, upon examination of the defective item the company can show that failure was not due to any defective workmanship, material or manufacture, the company will bill the purchaser for the cost of replacement, including transportation charges.

NORTHERN RADIO COMPANY, Incorporated
NEW YORK, NEW YORK

Instruction Book
Line Amplifi r (Transistorized) Type 236 Model 1

TABLE OF CONTENTS

7/28/59 ns

Instruction Book
Line Amplifier (Transistorized) Type 236 Model 1

1. GENERAL

Purpose:

The Northern Radio Line Amplifier (Transistorized), Type 236 Model 1, is a transistorized low distortion speech input amplifier. Its gain and frequency are more than adequate for use in communication systems. It is ideally suited for studio or program amplification to boost the output of microphones, preamplifiers, or teletype tone signals to a level suitable for telephone lines or radio transmitter input. It is also suited for use as a low level monitoring amplifier.

This amplifier is designed to slide into the Northern Radio Company Type 222 Shelf. The shelf is equipped to accommodate nine units of this amplifier or combinations of amplifiers and Type 212 Converters or other similar size units.

Description:

The Type 236 Model 1, Line Amplifier, is a two-stage push-pull amplifier. The frequencies are limited to the range of 300 to 10,000 cps for use in teletype tones and speech intelligence. Within its range, it has excellent amplitude response and very low distortion due to the use of push-pull Class A amplification, and adequate negative feedback. Satisfactory input attenuation is provided as are balanced input and output terminals for 600 or 150 ohms. Impedance change is effected by straps easily accessible on the amplifier printed circuit board. Pin jacks are included for monitoring purposes.

Technical Data:

Input Impedance:	150 ohm single ended and 600 ohm balanced
Output Impedance:	150 ohm single ended and 600 ohm balanced
Transmission Gain:	40 VU
Input Level:	For rated output of +8 VU, -32 VU to +8 VU
Output Level:	Maximum +14 VU at 8% distortion Rated +8 VU at 1% distortion
Frequency Response:	± 1 VU 300 to 10,000 cps
Noise Level:	80 VU below output level of +8 VU
Controls:	Input Level Control

Technical Data: (cont'd)

Power Requirement:	14 V DC, 50 milliamperes
Dimensions:	1-7/8" wide x 5-1/4" high x 11-3/4" deep For rack mounting a number of these or similar units, a shelf assembly is available accommodating nine (9) units in a panel height of 5-1/4"
Weight:	2-1/2 lbs.

2. DESCRIPTION OF OPERATION

(Refer to Schematic Diagram, NRC Dwg No. C-236-1-01)

The Northern Radio Line Amplifier, Type 236 Model 1, is a two-stage, push-pull transistorized amplifier employing current feedback in the emitter circuit of each transistor (Emitter Resistors R6, R7, R9 and R10) and voltage feedback between the push-pull stages (Resistors R12 and R13). Temperatur stabilization is provided through use of Diodes CR1 and CR2 in the base biasing circuits.

Input attenuation control is accomplished by varying the coupling between the secondary of Transformer T1 and the bases of Transistors Q1 and Q2, by means of adjustment of Twin Potentiometer, R2.

3. INSTALLATION

Mechanical:

The Type 236 Model 1, Line Amplifier, will normally be install d in a Northern Radio Type 222 Shelf, which is wired to accept the amplifier.

Prior to installation, each new amplifier should be thoroughly inspected for mechanical damage due to rough handling during shipment. If there is no sign of mechanical defect, the amplifier should be installed by inserting into the proper space in the shelf until the plug on the back of the Converter engag s with the socket of the shelf. The unit is secured in the shelf by turning th knurled thumbscrew finger-tight.

Electrical:

Since the Type 236 Model 1 Amplifier is a plug-in unit, its electrical connections are completed to the shelf when it is placed in operating position. It is only necessary to be assured that the internal amplifier impedance connections are compatible with the external requirement (600 or 150 ohm terminations as required), and that the appropriate circuit connections are made to the shelf and also that Power Supplies are installed on the back of the shelf.

Type 236 Model 1, Line Amplifiers, are normally shipped with internal straps arranged for 600 ohms input and output terminations. When 150 ohm terminations are required, straps may be easily changed as indicated on NRC Dwg. No. C-236-1-01.

4. OPERATING INSTRUCTIONS

In setting up circuits employing the Type 236 Model 1, Line Amplifier, it is necessary to determine the required output level for the intended usage and to adjust the "Gain" control accordingly. A suitable AC voltmeter or VU meter (with "bridging" terminations) may be connected to the output of the amplifier through Pin Jacks J3 and J4, to monitor the output level.

For "Diversity" reception in the Type 235 System, normal output levels should average approximately +6 dbm for each voice frequency channel.

5. MAINTENANCE

Since the Line Amplifier, Type 236 Model 1, employs long-life, reliable semi-conductor elements and since very little heat is generated in the operating device, it is anticipated that maintenance requirements will be minimized. In the event of malfunction, the amplifier should be removed to the test bench for checking. Use of Schematic Diagram, Dwg. No. C-236-1-01, Component Layout, Dwg. No. B-236-1-02, and the Table of Voltage Measurements will serve to quickly localize any troubles.

In the infrequent instances when it is necessary to remove and replace components on the printed board, it is highly desirable that an appropriate small soldering iron with limited heat storage be employed.

6. TABLE OF VOLTAGE MEASUREMENTS

SYMBOL	FUNCTION	VOLTAGES		
		EMITTER	BASE	COLLECTOR
Q1	1st Stage Amplifier	-1.0	-1.2	-8.4
Q2	1st Stage Amplifier	-1.0	-1.2	-8.4
Q3	Output Amplifier	-1.1	-1.2	-8.5
Q4	Output Amplifier	-1.1	-1.2	-8.5

NOTE: All voltage readings taken with respect to positive terminal of Power Supply (or positive lead of Capacitor C1).

7. ELECTRICAL PARTS LIST

Symbol	Function	Description	Mfr.	Part No.
C1	Power supply filter capacitor	200 mfd 15 V DC miniature electrolytic capacitor	SPR	TE-1164
CR1	1st bias diode	High conductance silicon diode	PSC TXI	PS592 Conf A or G130
CR2	2nd bias diode	High conductance silicon diode	PSC TXI	PS592 C nf A or G130
J1	Input monitor	Pin jack - Green	ANY	MS16108-5A
J2	Input monitor	Pin jack - White	ANY	MS16108-1A
J3	Output monitor	Pin jack - Blue	ANY	MS16108-7A
J4	Output monitor	Pin jack - White	ANY	MS16108-1A
P1	Main connector plug	14 pin male connector	AMP	57-10140
Q1	1st stage amplifier	General purpose germanium transistor high gain 250 milliamperes 200 milliwatt PNP	MOT	2N652A
Q2	1st stage amplifier	General purpose germanium transistor high gain 250 milliamperes 200 milliwatt PNP	MOT	2N652A
Q3	Output amplifier	High voltage high gain power transistor. Germanium PNP type	MOT	2N618
Q4	Output amplifier	High voltage high gain power transistor. Germanium PNP type	MOT	2N618
R1	T1 terminating resistor	680 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF681K
R2	Q1, Q2 gain control	Dual 100K ohms potentiometer, ± 20% counter clockwise logarithmic taper	ALB	JD1N048S104TA
R3	Q1 bas stabilizing resistor	2.2K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF222K

Symbol	Function	Description	Mfr.	Part No.
R4	Q2 base stabilizing	2.2K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF222K
R5	Q1, Q2, Q3, Q4 base bias resistor	4.7K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF472K
R6	Q1 emitter resistor	10 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF100K
R7	Q2 emitter resistor	10 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF100K
R8	Q1, Q2 emitter resistor	220 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF221K
R9	Q3 emitter resistor	10 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF100K
R10	Q4 emitter resistor	10 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF100K
R11	Q3, Q4 emitter resistor	15 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF150K
R12	Q3, Q1 feedback resistor	6.8K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF682K
R13	Q4, Q2 feedback resistor	6.8K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF682K
R14	Power supply filter	47 ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF470K
R15	J1 isolating resistor	4.7K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF472K
R16	J3 isolating resistor	4.7K ohms ± 10% 1/2 watt composition resistor	ANY	RC20GF472K
T1	Input matching transformer	Transformer 600 - 600 ohms	NRC	234

Symbol	Function	Description	Mfr.	Part No.
T2	Interstage coupling transformer	1500 ohm center tapped/10K ohm center tapped 100 milliwatt miniature transformer	NRC	1211
T3	Output matching transformer	Transformer 600-600 ohms	NRC	234
XQ3	Q3 socket	Power transistor socket	CIN	14T24324
XQ4	Q4 socket	Power transistor socket	CIN	14T24324

MANUFACTURERS' DESIGNATIONS

MFR. CODE NO.	FEDERAL CODE NO.	NAME
ALB	01121	Allen-Bradley Company
AMP	02660	Amphenol-Borg Electronics Corporation
CIN	71785	Cinch Manufacturing Corporation
MOT	04713	Motorola Semiconductor Products Division
NRC	88183	Northern Radio Company, Incorporated
PSC	01281	Pacific Semi-Conductor, Incorporated
SPR	56289	Sprague Electric Company
TXI	01295	Texas Instruments, Incorporated

FRONT PANEL

J1 IN J2

J3 J4 OUT

R2 100K GAIN

PRINTED CIRCUIT BOARD

(B)

(A)

R3 2.2K

R4 2.2K

R5 4.7K

Q1

Q2

CR1

CR2

R6 10Ω

R7 10Ω

R8 220Ω

T2

BLU

R

BRN

GRN

BLK

Y

Q3 XQ3

Q4 XQ4

R12 6.8K

R13 6.8K

R9 10Ω

R10 10Ω

+

4

3

2

1

R15 4.7K

T1

1 3 2 4 8 6 7 5

R1 680Ω

NOTE:

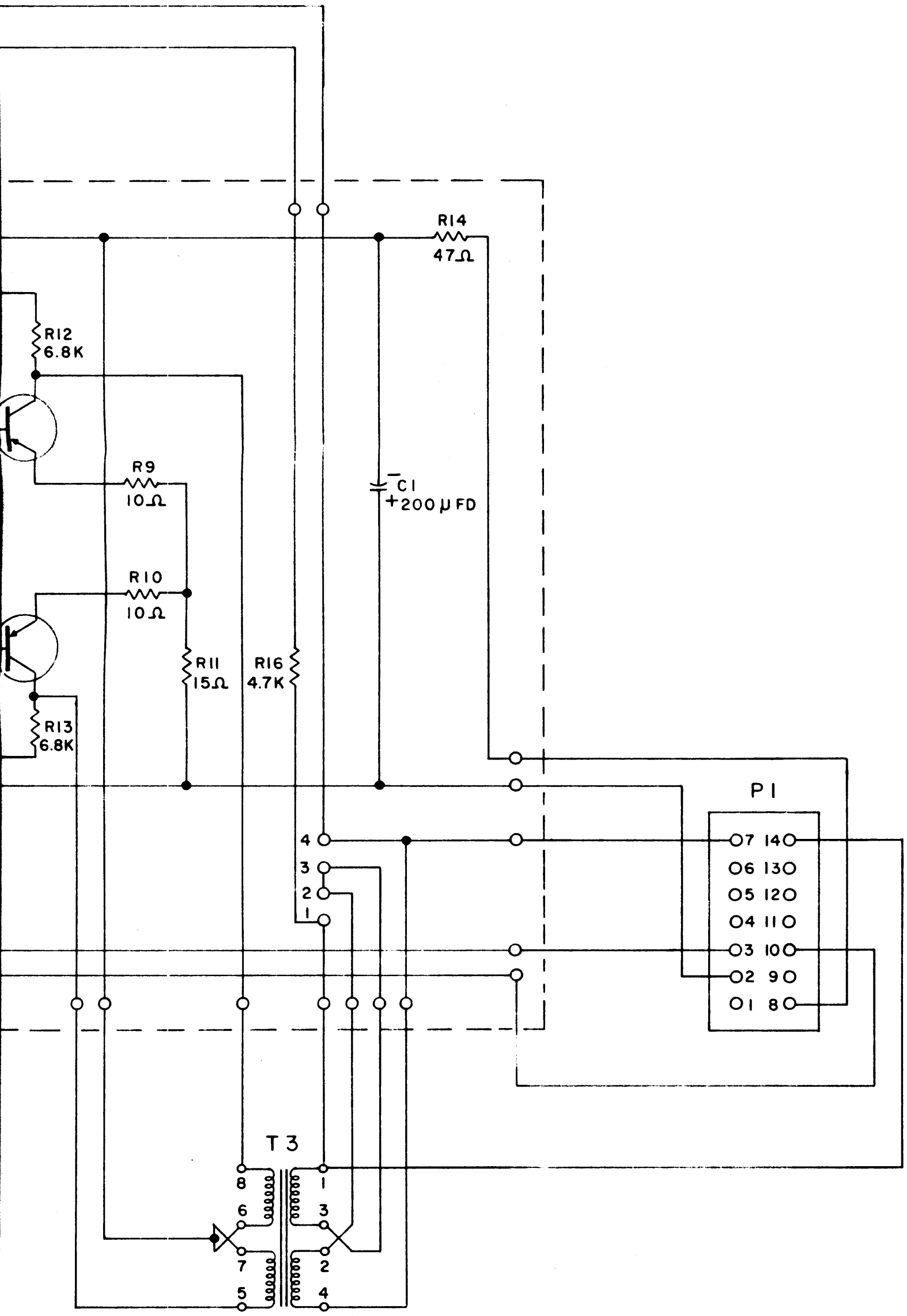
1. INPUT TO T1 & OUTPUT OF T3 SHOWN STRAPPED FOR 600~ OPERATION.
2. INPUT TO T1 & OUTPUT OF T3 SHOWN BELOW FOR 150~ OPERATION.

T1 1 3

T3 1 3

UNLESS OTHER
DIMENSIONS
TOLERANCES O
FRACTIONS DECI
± 1/64 ± .0
MATERIAL:

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL



REV.

DWG. No.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	DRAFTSMAN R.L.F.	DATE 3-25-59	NAME: SCHEMATIC, LINE AMPLIFIER
MATERIAL:	CHECKER Y.Q	7-28-59	
	ENGINEER		

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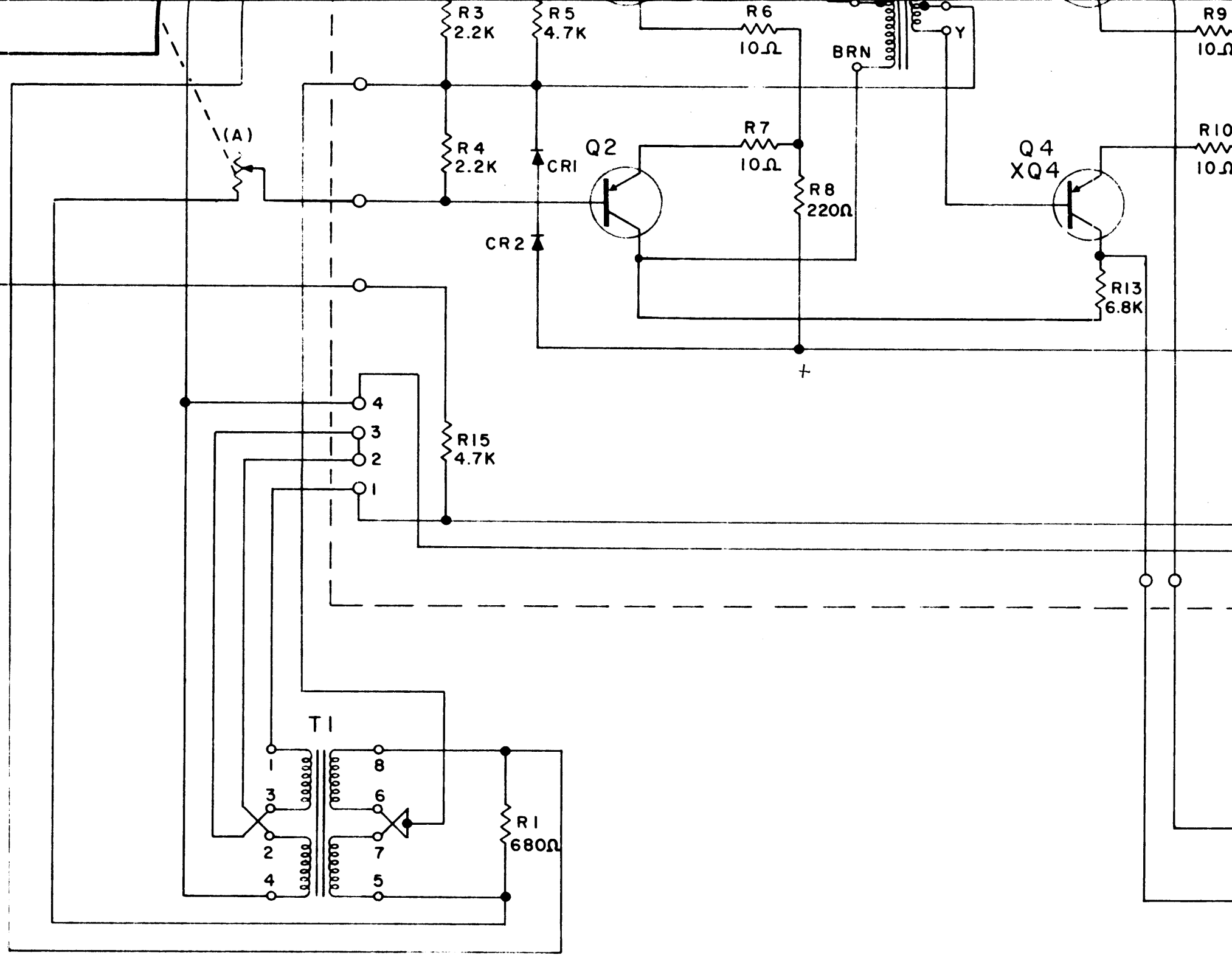
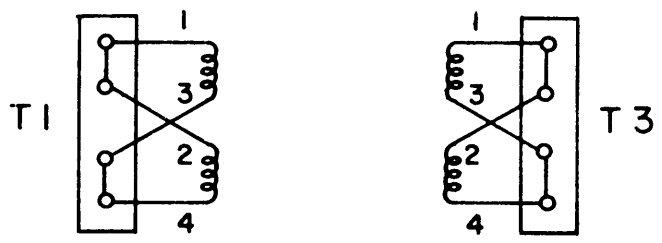
INCORPORATED
143-147 WEST 22ND ST. N.Y. 11
NEW YORK



NOTE:

1. INPUT TO T1 & OUTPUT OF T3 SHOWN STRAPPED FOR 600~ OPERATION.
2. INPUT TO T1 & OUTPUT OF T3 SHOWN BELOW FOR 150~ OPERATION.



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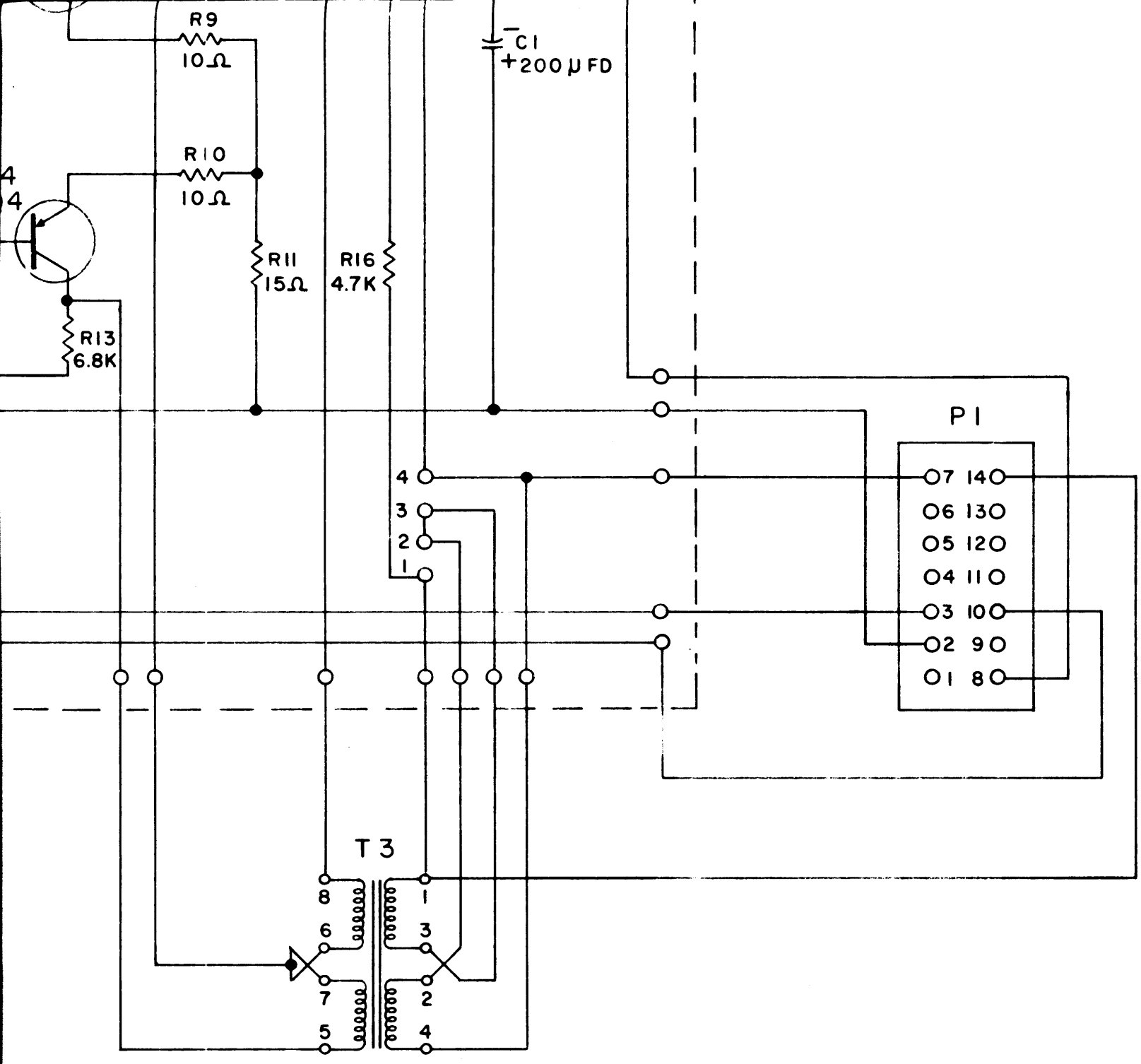


REV.

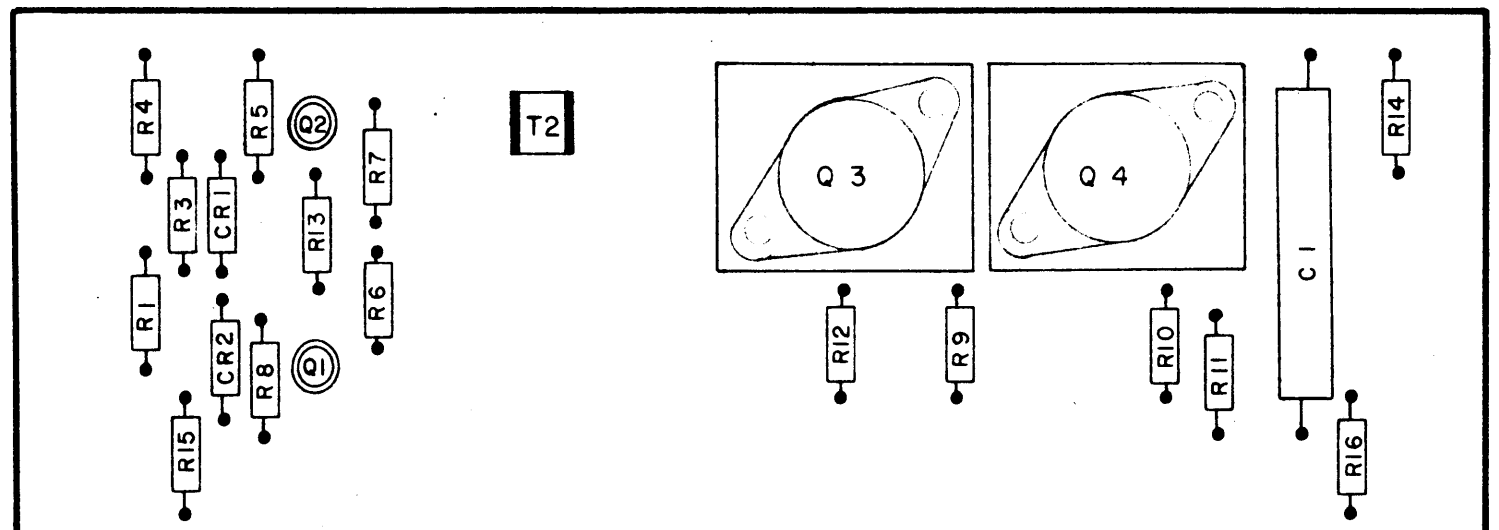
DWG. No.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	DRAFTSMAN R.L.F.	DATE 3-25-59	NAME: SCHEMATIC, LINE AMPLIFIER	NORTHERN RADIO COMPANY INCORPORATED 143-147 WEST 22ND ST. N.Y. 11 NEW YORK
MATERIAL:	CHECKER [illegible]	7-28-59		
FINISH:	ENGINEER [illegible]	7/28/59	TYPE 236 MODEL 1	DWG. No. 236-1-01
	APPROVAL [illegible]	7/28/59	SCALE: NONE SHEET 1 OF 1	DWG. SIZE C

REVISIONS			
SYM.	DESCRIPTION	DATE	

DWG. No. 236-1-02 REV.

CIRCUIT BOARD SUB – ASSEMBLY
NRC – 794



UNLESS OTHERWISE SPECIFIED	DRAFTSMAN	DATE	NAME:
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	J. G.	7-28-59	LAYOUT, COMPONENT
MATERIAL:	CHECKER JA	7-28-59	LINE AMPLIFIER
FINISH:	ENGINEER GPH	7/28/59	TYPE 236 MOD.1
	APPROVAL GPH	7/28/59	SCALE: NONE SH. 1 OF 1

NORTHERN RADIO
INCORPORA
143-147 WEST 22ND
NEW YORK

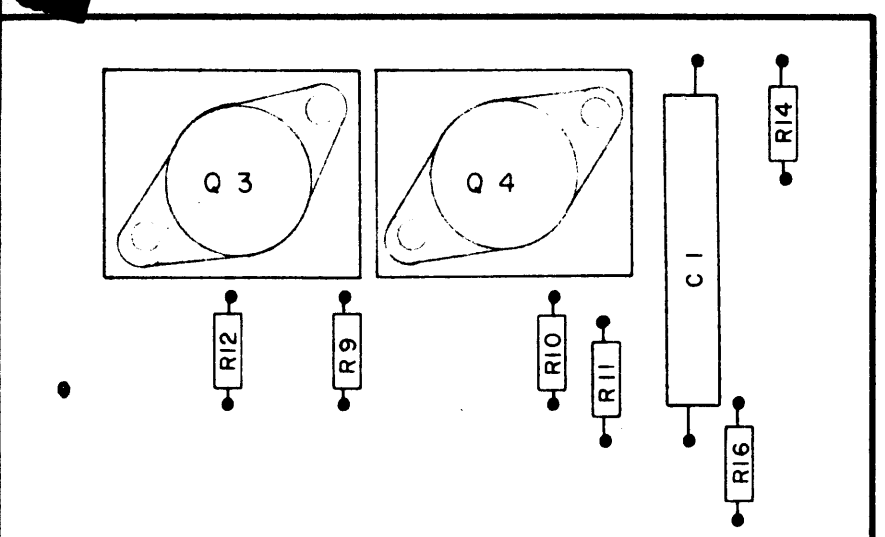
DWG. N. 236-1-
DWG. SIZE B

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL

DWG. N. 236-1-02

REV.

RCUIT BOARD SUB – ASSEMBLY
NRC – 794



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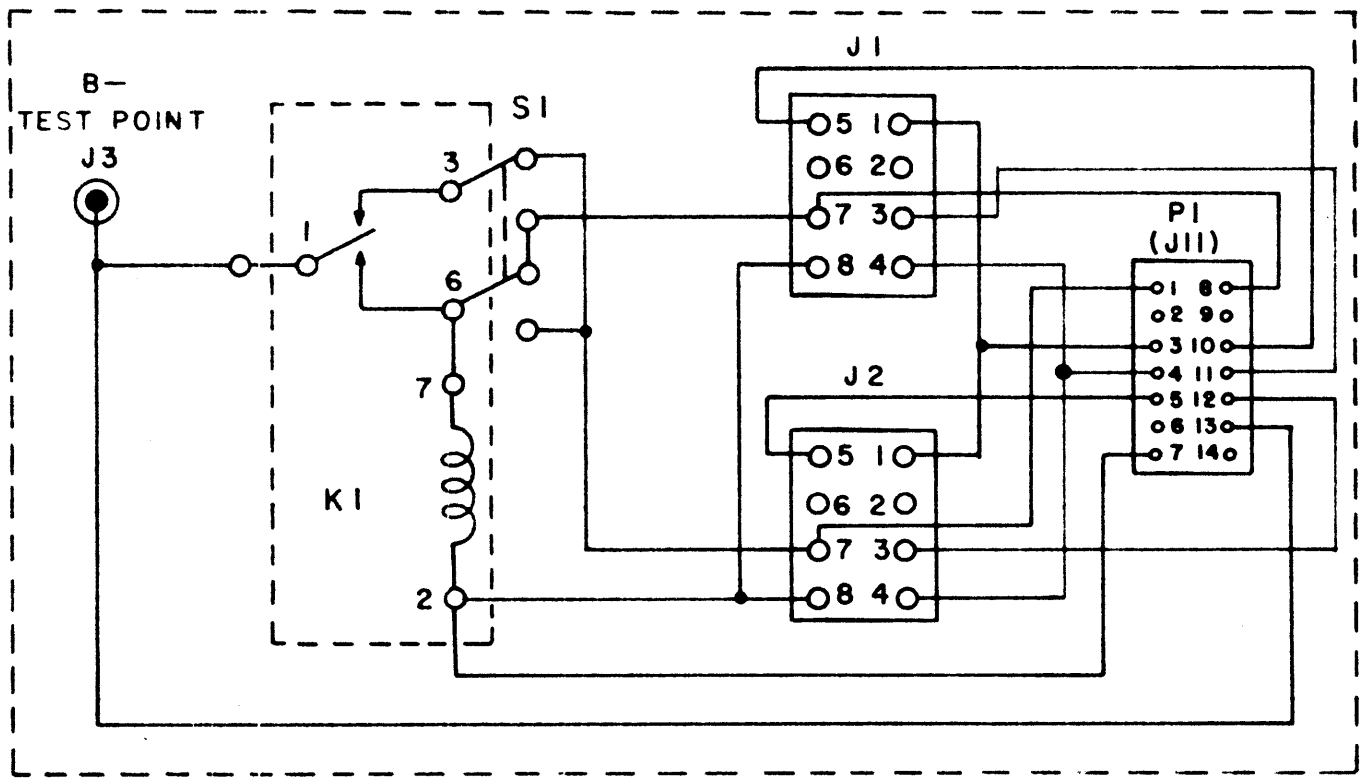
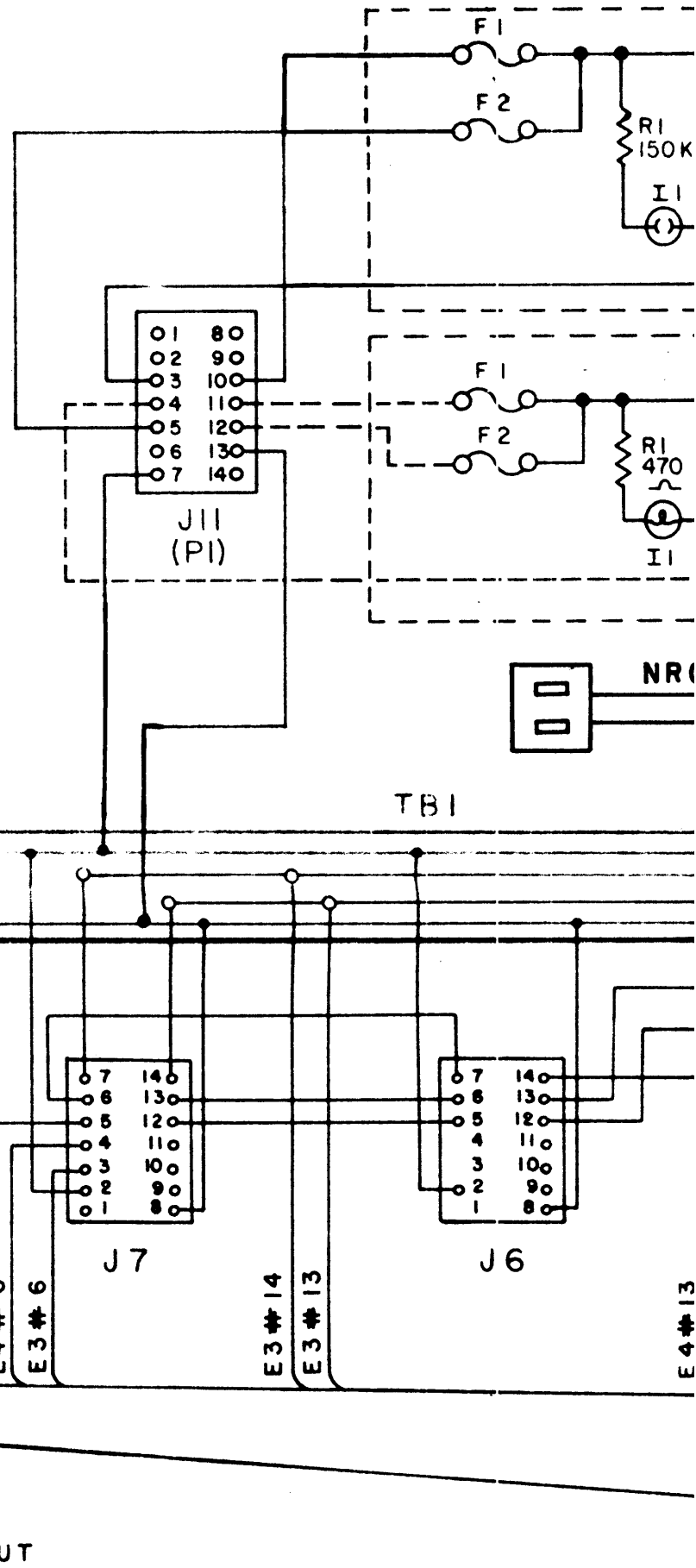
NS ARE IN INCHES S ON ECIMALS ANGLES ± .005	J. G.	7-28-59	LAYOUT, COMPONENT LINE AMPLIFIER TYPE 236 MOD.I
	CHECKER JA	7-28-59	
	ENGINEER GPH	7/28/59	
	APPROVAL GPH	7/28/59	
	SCALE: NONE	SH. 1 OF 1	DWG. SIZE B

NORTHERN RADIO COMPANY
INCORPORATED
143-147 WEST 22ND ST. N.Y. 11
NEW YORK

DWG. N. 236-1-02

AUTOMATIC P.S. CONTROL UNIT
ZI NRC 690





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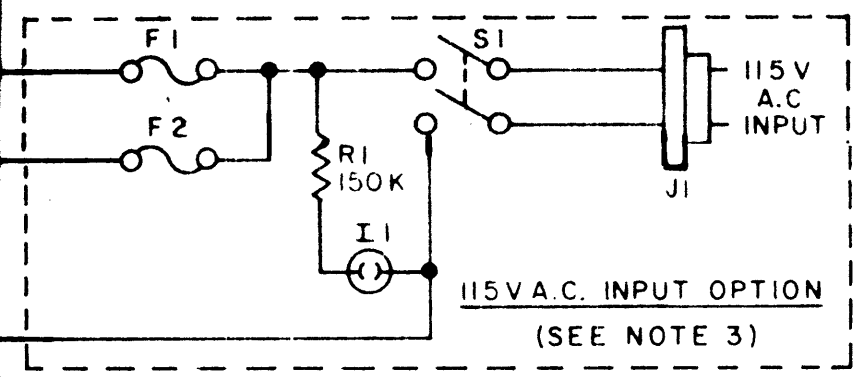
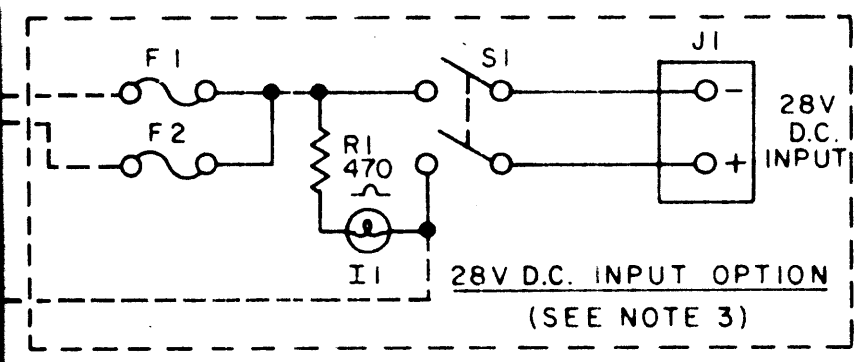
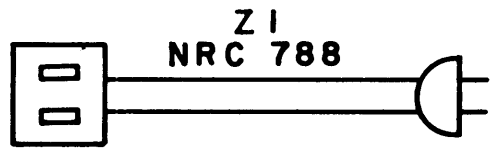
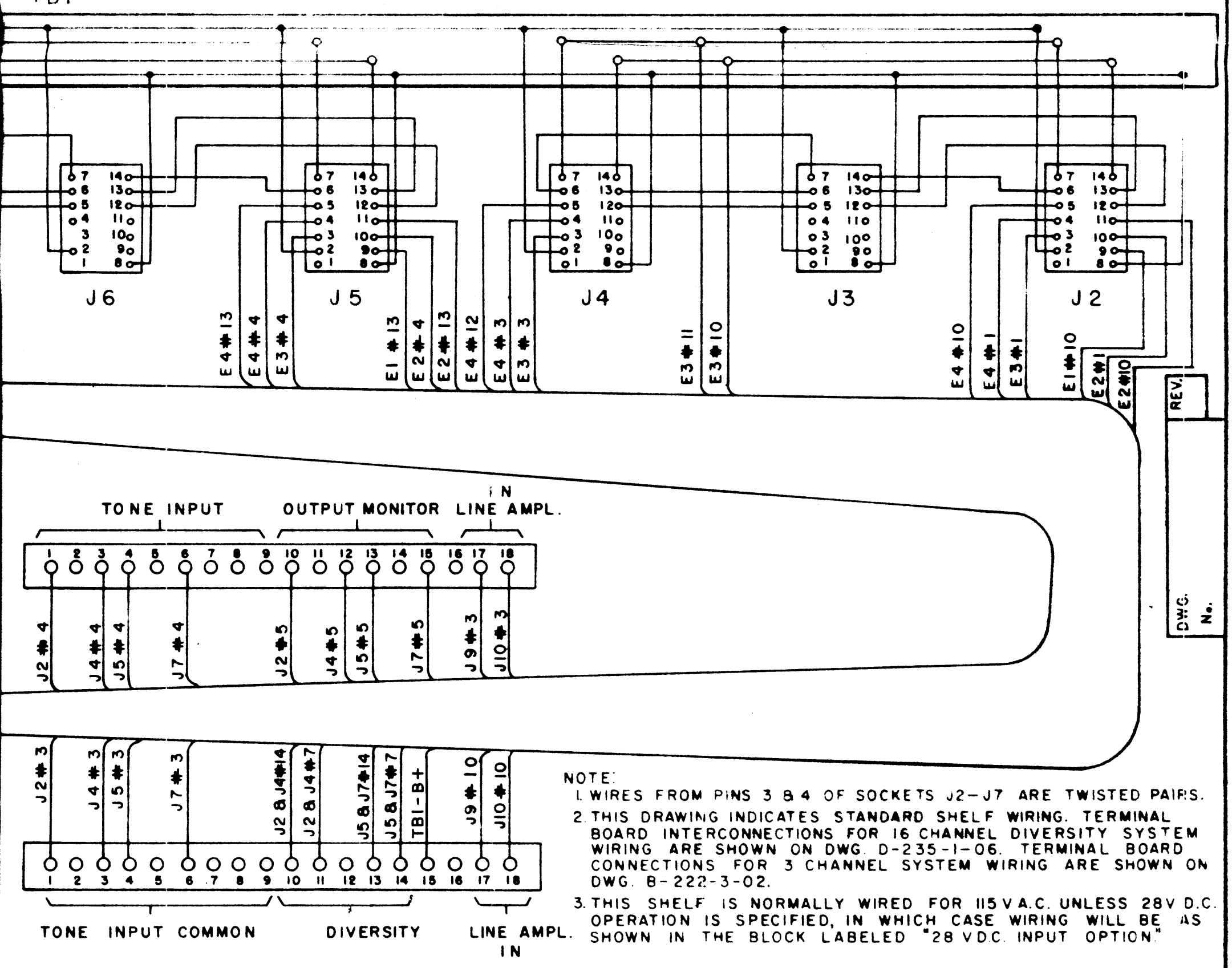
DIMENSIONS AR	
TOLERANCES ON	
FRACTIONS ± 1/64	DECIMA ± .00
MATERIAL:	

REVISIONS			
SYM.	DESCRIPTION	DATE	APPRCVAL
A	ADDED: 28 V. D.C. INPUT; PINS 3 & 4 ON J1 & J2; PIN 4 ON P1. R1, 150K WAS R7.	8-6-59	
B	NOTES REWORDED; A.C.-D.C. OPTIONS REDRAWN; NRC 693 TERMINATIONS CHNGD; E2 #7 RMVD, J10, PINS 7 & 14 REVERSED.	8-25-59	
C	E3 #15 CONNECTED TO B+	9-21-62	
D	REMOVED CONNECTION FROM E1 #15. Z1 WAS Z2.	6-11-63	









NOTE:
1. WIRES FROM PINS 3 & 4 OF SOCKETS J2–J7 ARE TWISTED PAIRS.
2. THIS DRAWING INDICATES STANDARD SHELF WIRING. TERMINAL BOARD INTERCONNECTIONS FOR 16 CHANNEL DIVERSITY SYSTEM WIRING ARE SHOWN ON DWG. D-235-1-06. TERMINAL BOARD CONNECTIONS FOR 3 CHANNEL SYSTEM WIRING ARE SHOWN ON DWG. B-222-3-02.
3. THIS SHELF IS NORMALLY WIRED FOR 115 V A.C. UNLESS 28V D.C. OPERATION IS SPECIFIED, IN WHICH CASE WIRING WILL BE AS SHOWN IN THE BLOCK LABELED "28 V D.C. INPUT OPTION."

TCH PANEL
240 FOR
M WIRING
NOTE 2)

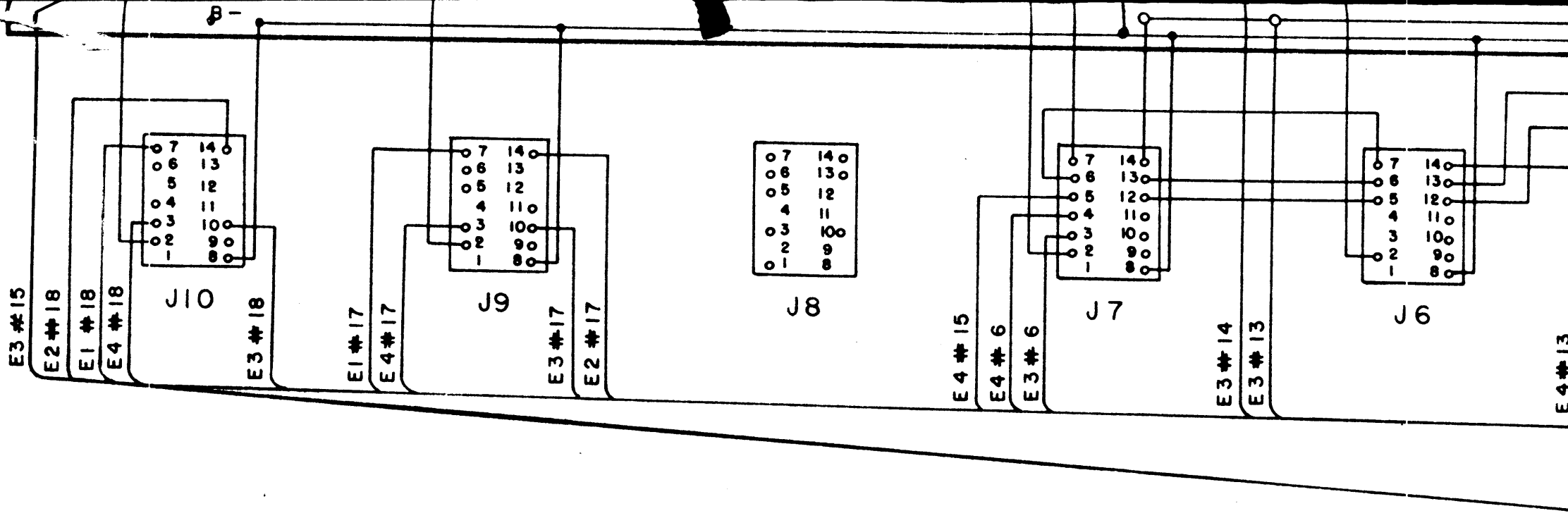
UNLESS OTHERWISE SPECIFIED	DRAFTSMAN	DATE
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	J. G.	3-18-59
MATERIAL:	CHECKER	
	ENGINEER	

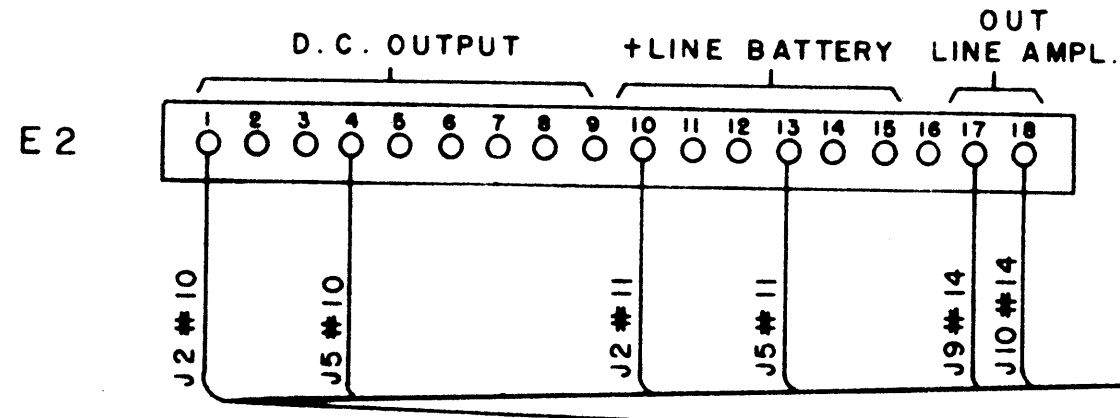
NAME: SCHEMATIC

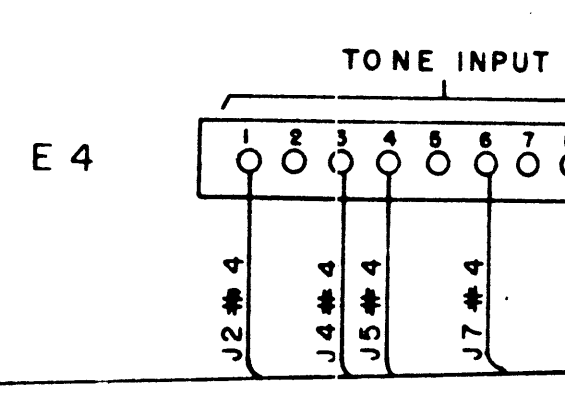
F. S. TONE CONVERTER SHELF

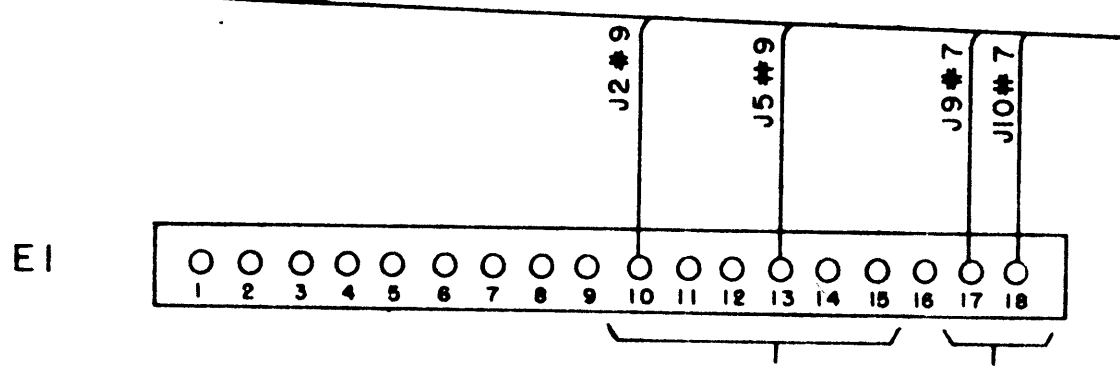
TYPE 222 MOD. 3

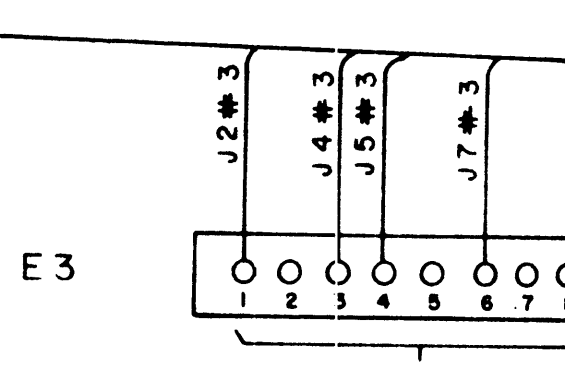
NORTHERN RADIO COMPANY
INCORPORATED
143-147 WEST 22ND ST. N.Y. 11
NEW YORK

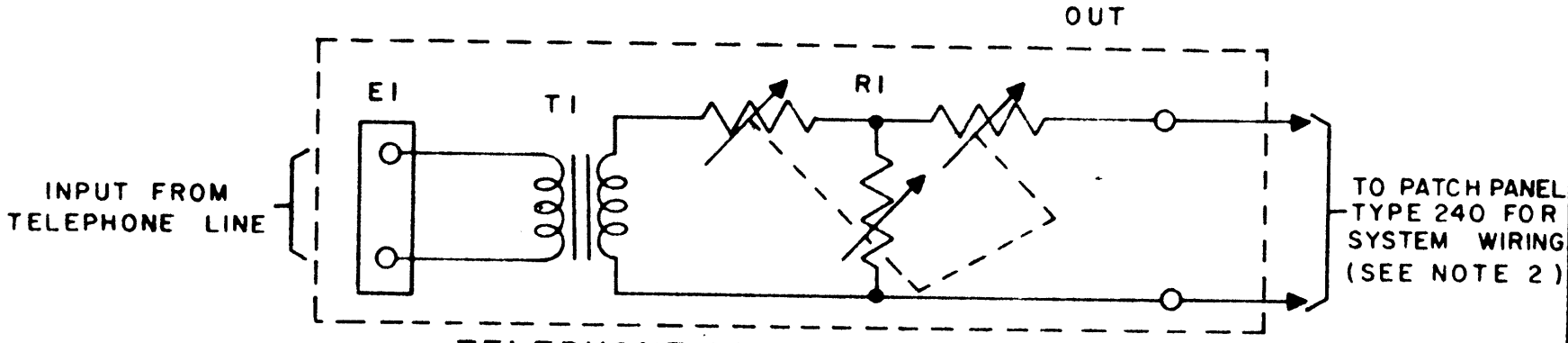






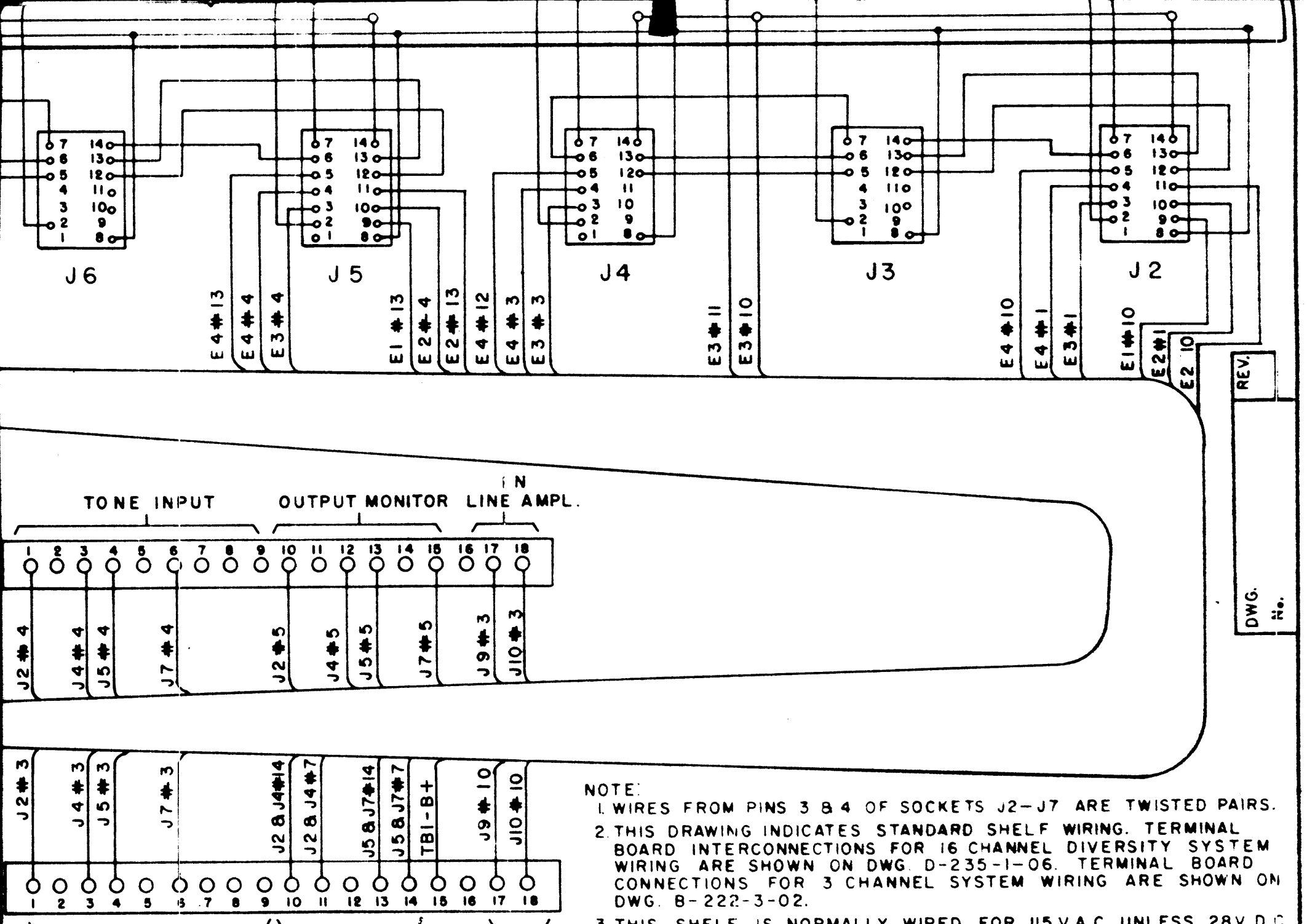






TELEPHONE LINE ISOLATION UNIT
Z2 NRC 693

UNLESS OTHERWIS	
DIMENSIONS ARE	
TOLERANCES ON	
FRACTIONS	DECIMAL
± 1/64	± .005
MATERIAL:	
FINISH:	



NOTE:

1. WIRES FROM PINS 3 & 4 OF SOCKETS J2–J7 ARE TWISTED PAIRS.
2. THIS DRAWING INDICATES STANDARD SHELF WIRING. TERMINAL BOARD INTERCONNECTIONS FOR 16 CHANNEL DIVERSITY SYSTEM WIRING ARE SHOWN ON DWG. D-235-1-06. TERMINAL BOARD CONNECTIONS FOR 3 CHANNEL SYSTEM WIRING ARE SHOWN ON DWG. B-222-3-02.
3. THIS SHELF IS NORMALLY WIRED FOR 115 V A.C. UNLESS 28V D.C. OPERATION IS SPECIFIED, IN WHICH CASE WIRING WILL BE AS SHOWN IN THE BLOCK LABELED "28 V D.C. INPUT OPTION."

H PANEL
O FOR
WIRING
TE 2)

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	DRAFTSMAN J. G.	DATE 3-18-59	NAME: SCHEMATIC F. S. TONE CONVERTER SHELF TYPE 222 MOD. 3 (ACCOMODATES 2 CHANNEL DIV. OPER. & 2 LINE AMPL.)
MATERIAL:	CHECKER		
FINISH:	ENGINEER		
	APPROVAL 9/17	3/18/59	SCALE: NONE SH. 1 OF 1 DWG. SIZE C

NORTHERN RADIO COMPANY
INCORPORATED
143-147 WEST 22ND ST. N.Y. 11
NEW YORK

DWG. No. 222-3-01

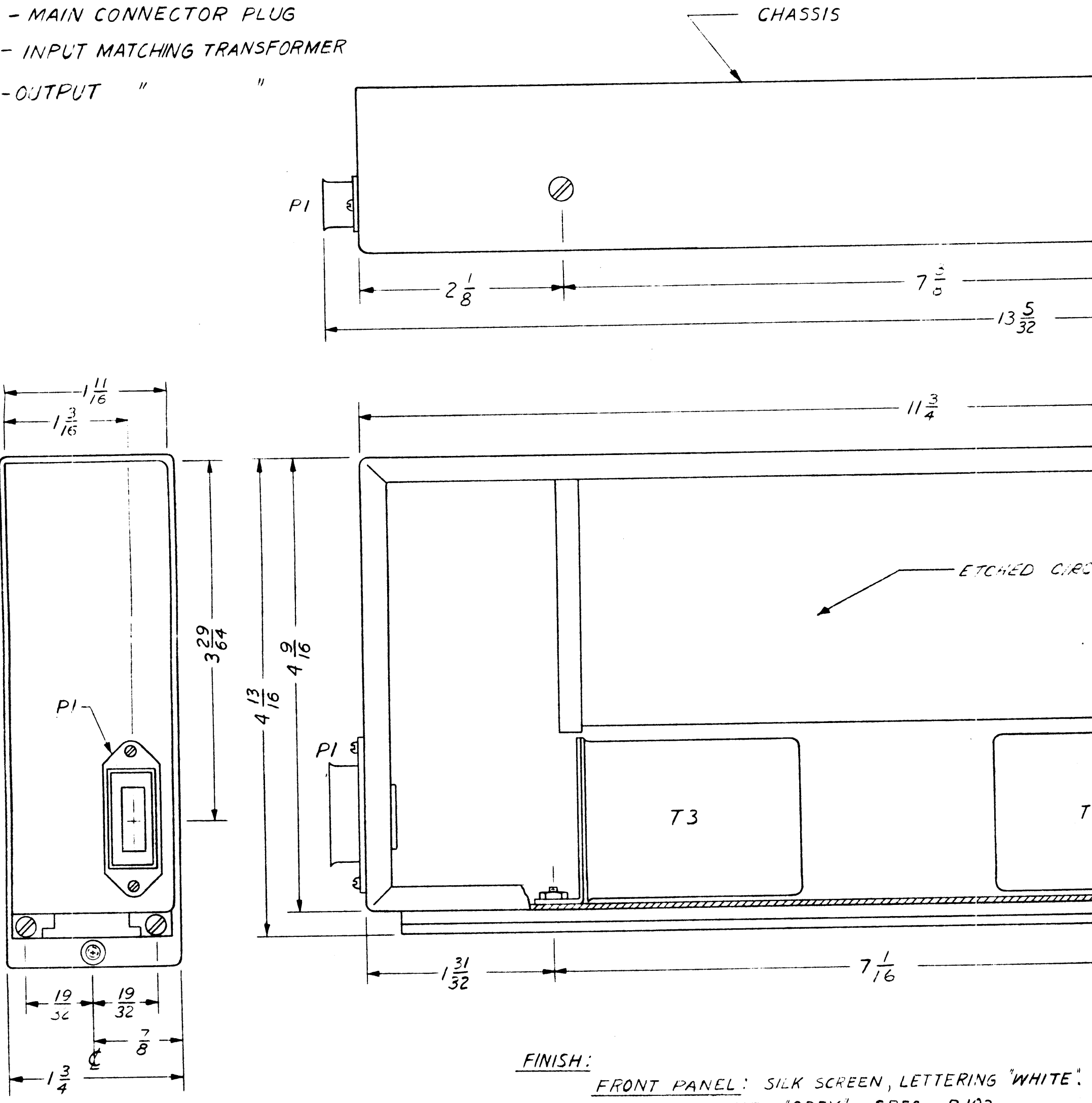
J1 - INPUT MONITOR
J2 - " "
J3 - OUTPUT MONITOR
J4 - " "

R2 - Q1, Q2 GAIN CONTROL

P1 - MAIN CONNECTOR PLUG

T1 - INPUT MATCHING TRANSFORMER

T3 - OUTPUT " "



FINISH:

FRONT PANEL: SILK SCREEN, LETTERING "WHITE". BACKGROUND NRC "GREY", SPEC. P102.

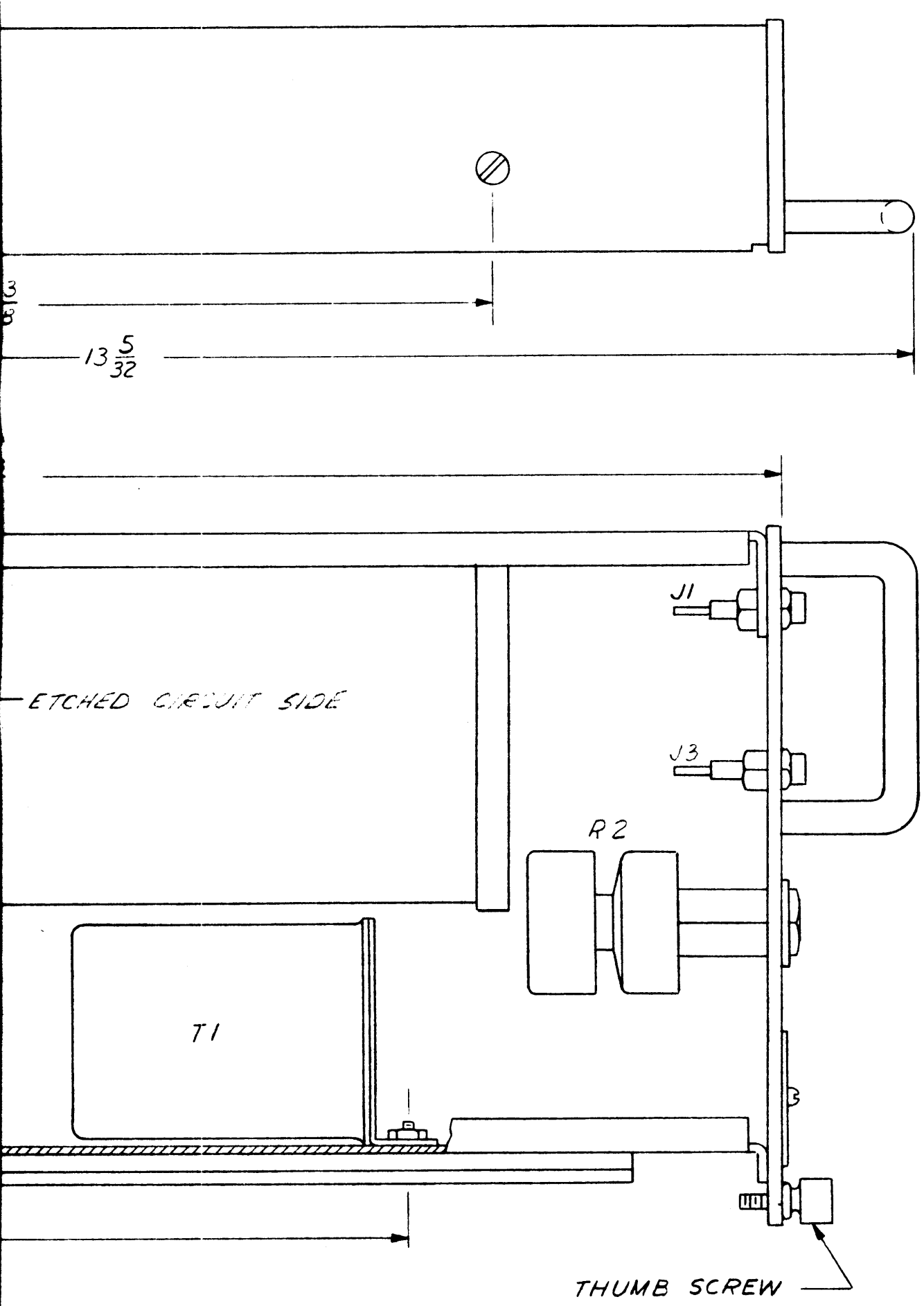
CHASSIS: HEAVY ALKALI ETCH
CLEAR LACQUER SPRAY.

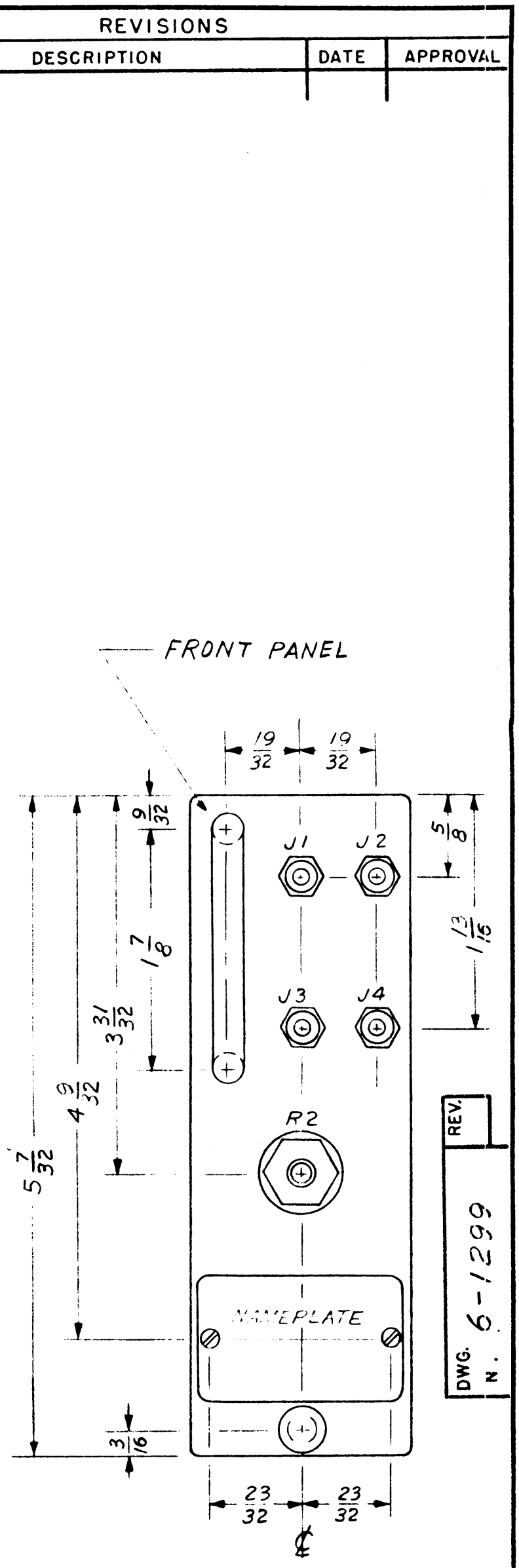
FOR MORE INFORMATION REGARDING COMPONENTS DESIGNATED ON THIS DWG. SEE THE FOLLOWING:

DWG. NO. C-236-1-01 - SCHEMATIC
ARTICLE NO. 12-55 - ELECTRICAL PARTS LIST

UNLESS OT
DIMENSIO
TOLERANCE
FRACTIONS ± 1/64
MATERIAL: FRONT PA
CHASSIS -

REVISIONS			
SYM.	DESCRIPTION	DATE	APPROVAL





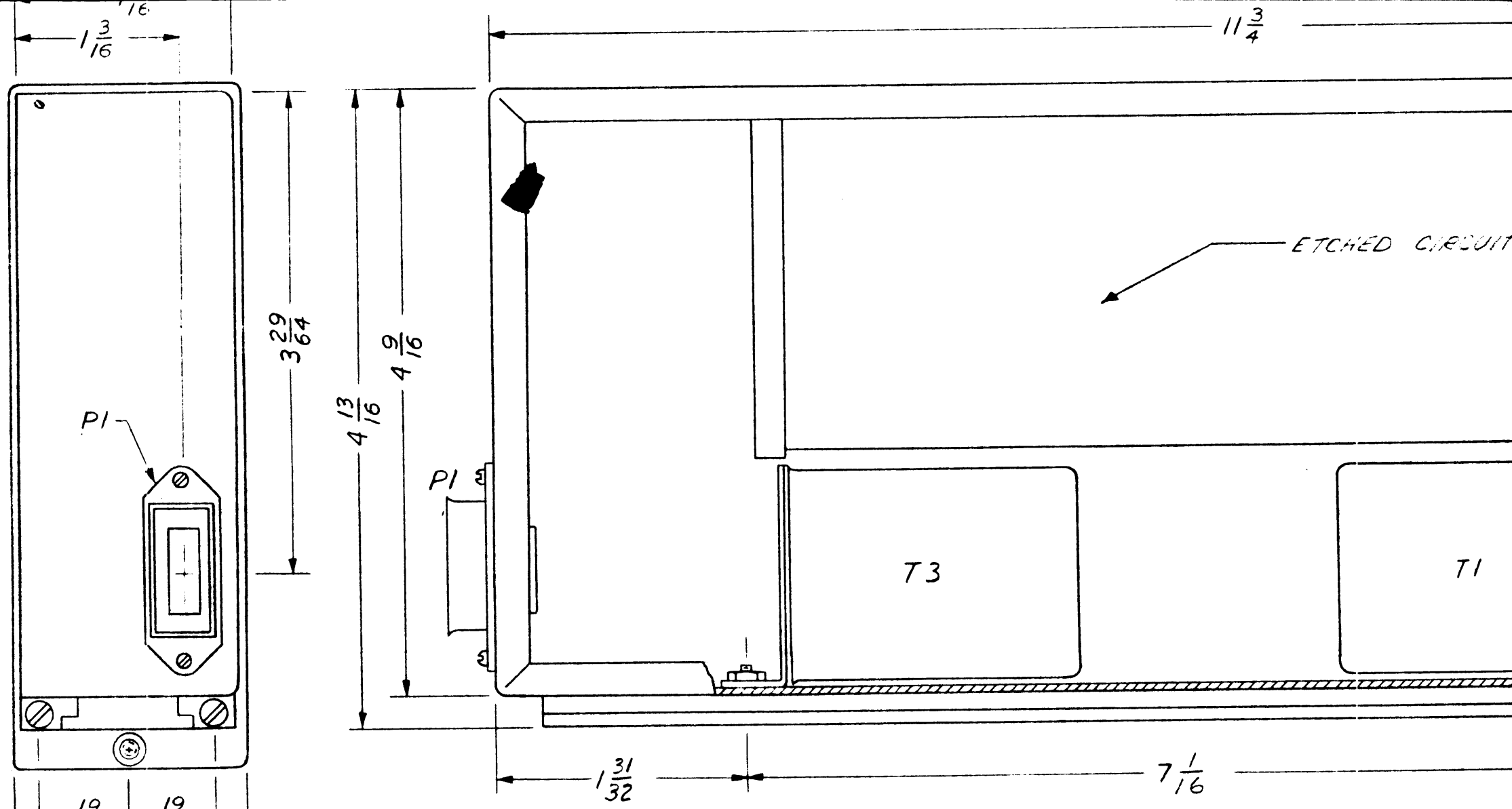
REV.

DWG. N. 6-1299

ERING "WHITE".
P 102.

UNLESS OTHERWISE SPECIFIED	DRAFTSMAN	DATE	NAME:
DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	S. S.	9-15-64	ENVELOPE DWG LINE AMPLIFIER TYPE 336 MOD 1
MATERIAL: FRONT PANEL – 1/8 IN. AL. CHASSIS – 1/16 IN. AL.	CHECKER	9-15-64	
	ENGINEER		

NORTHERN RADIO COMPANY
INCORPORATED
143-147 WEST 22ND ST. N.Y. 11
NEW YORK



FINISH:

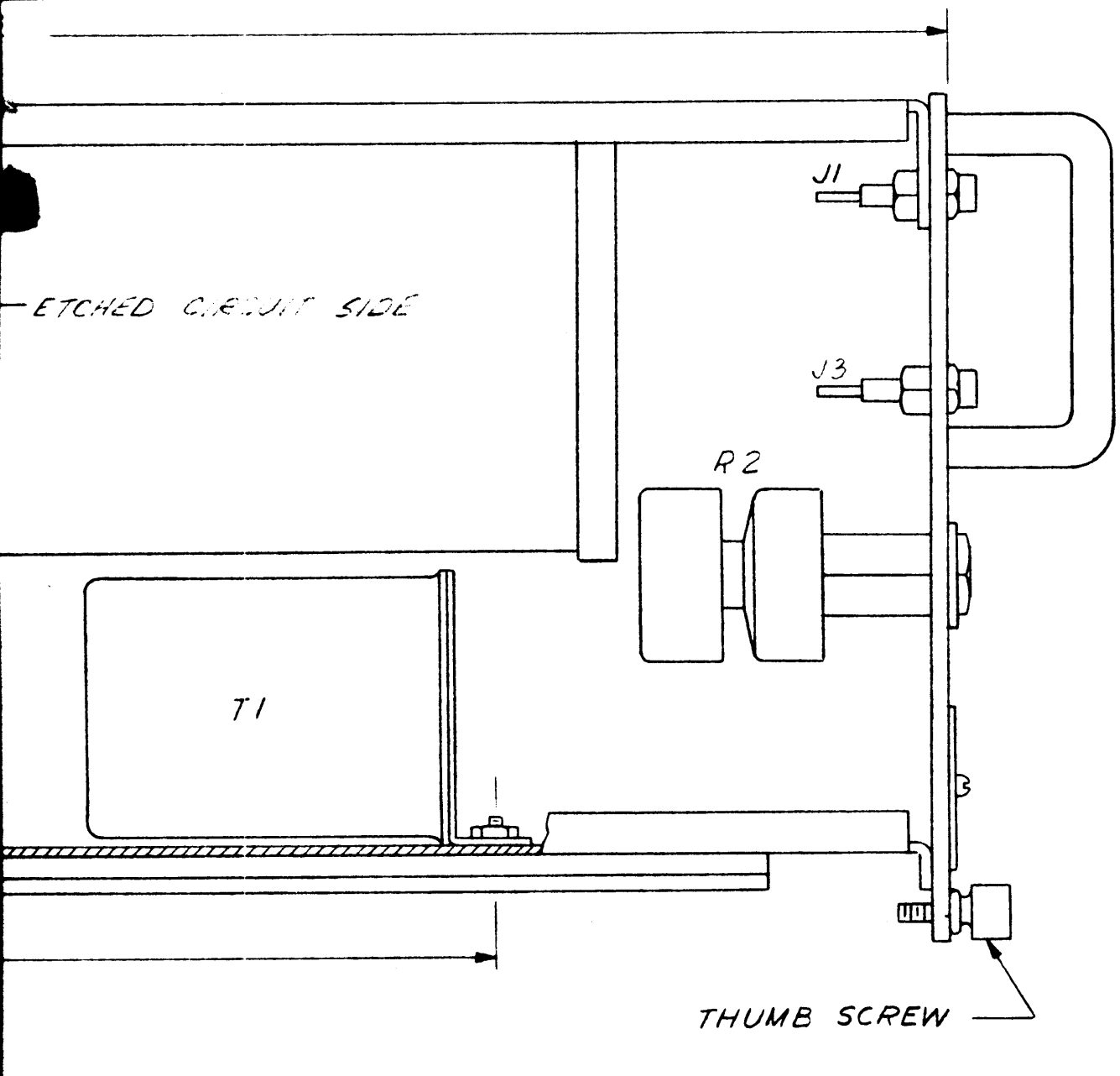
FRONT PANEL: SILK SCREEN, LETTERING "WHITE".
BACKGROUND NRC "GREY", SPEC. P102.

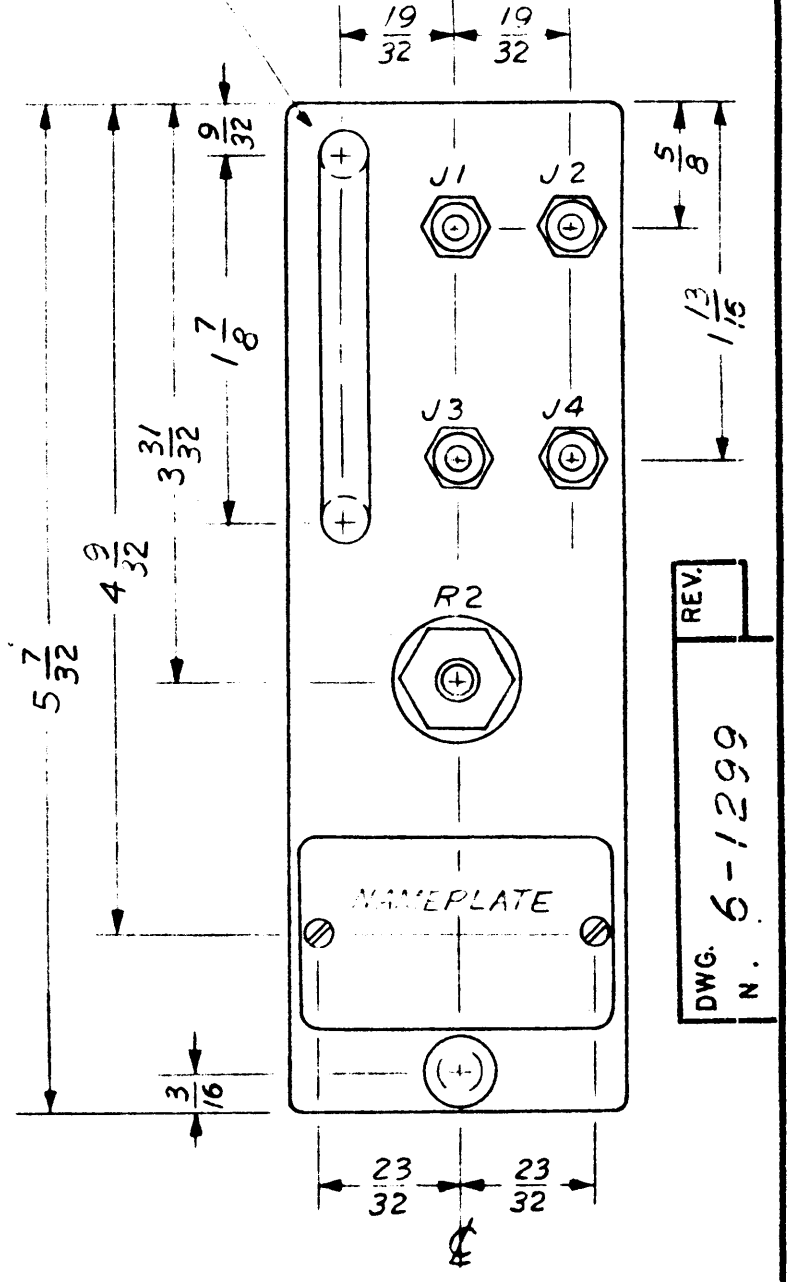
CHASSIS: HEAVY ALKALI ETCH
CLEAR LACQUER SPRAY.

FOR MORE INFORMATION REGARDING COMPONENTS
DESIGNATED ON THIS DWG. SEE THE FOLLOWING:

DWG. NO. C-236-1-01 - SCHEMATIC
ARTICLE NO. 12-55 - ELECTRICAL PARTS LIST

UNLESS OTHERWI
DIMENSIONS AR
TOLERANCES ON
FRACTIONS ± 1/64 DECIM ± .00
MATERIAL: FRONT PANEL CHASSIS - 1/16
FINISH: SEE ABO





REV.

DWG. N. 6-1299

ERING "WHITE".
P102.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES	DRAFTSMAN S. S.	DATE 9-15-64	NAME: ENVELOPE DWG. LINE AMPLIFIER TYPE 236 MOD. 1	NORTHERN RADIO COMPANY INCORPORATED 143-147 WEST 22ND ST N.Y. 11 NEW YORK
MATERIAL: FRONT PANEL – 1/8 IN. AL. CHASSIS – 1/16 IN. AL.	CHECKER	9-15-64		
FINISH: SEE ABOVE	ENGINEER			DWG. No. 6-1299
	APPROVAL	9-15-64	SCALE: NONE SHEET 1 OF 1	DWG. SIZE C