

Sine wave generator 067-0542-99
FACTORY CALIBRATION PROCEDURE

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067-0542-99
SINE WAVE
GENERATOR

INTRODUCTION:

This is the guide for calibrating brand-new instruments, it therefore, calls out many procedures and adjustments that are rarely required for subsequent recalibration. *This procedure is company confidential.* In this procedure, all front panel control labels or Tektronix equipment names are in capital letters (VOLTS/DIV, etc.) internal adjustment labels are capitalized only (Gain Adj, etc.).

Tek form number:

0-358

September 1966

For all serial numbers.

FACTORY TEST LIMITS:

We initially calibrate the instrument to Factory Test Limits. These limits are often more stringent than advertised performance requirements. This helps insure that the instrument will meet advertised requirements after shipment, allows for inaccuracies of test equipment used, and may allow for changes in environmental conditions.

QUALIFICATION:

Factory test limits are qualified by the conditions specified in the main body of the calibration procedure. The numbers and letters to the left of the limits correspond to the factory calibration procedure steps where the check or adjustment is made. Instruments may not meet factory test limits if calibration or check-out methods and test equipment differ substantially from those in this procedure.

ABBREVIATIONS:

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100.

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes that have been made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 47-261.

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

- a. TEKTRONIX Test Equipment
 - 1 TYPE 530 or 540 SERIES OSCILLOSCOPE
 - 1 TYPE CA PLUG-IN UNIT
 - 1 TYPE W PLUG-IN UNIT
 - 1 1X PROBE
 - 1 10X PROBE
 - 1 TYPE 184 TIME MARK GENERATOR

- b. Test Accessories
 - 2 50 Ω , 42 inch, BNC cables (012-0057-00)

- c. Miscellaneous Equipment
 - 1 Variable Line Voltage Source with meter
 - 1 Multimeter, 20,000 Ω /VDC

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

It is assumed that all equipment is provided with BNC connectors; if equipment used has other than BNC connectors, adapters, not listed, may be needed.

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QUALIFICATION

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8. AMPLITUDE REGULATION

- b. Amplitude change with frequency
±2%, max
- c. Amplitude change with line voltage
±1%, max

THE END

1. PRELIMINARY INSPECTION

2. RESISTANCE CHECKS

3. POWER SUPPLIES

c. Accuracy and ripple

<u>Supply</u>	<u>Tolerance</u>	<u>Max Ripple</u>
+150	adj	10mV
+ 75	±7.5V	10mV
-100	+16V, -6V	20mV
- 22	±2.2V	5mV

- d. Regulation 105 to 125 VAC

- 4. AMPLIFIER DC LEVEL +75V, ±5V

5. FEEDBACK

6. AMPLITUDE

- d. Attenuator accuracy ±2%, max

7. FREQUENCY

- d. Frequency accuracy ±3%, max
- d. VARIABLE range .1X MULTIPLIER, min

1. PRELIMINARY INSPECTION

Check for unsoldered joints, rosin joints, lead dress and long ends. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation, proper indexing and knob spacing from front panel. Check fuse for .6a Slo-Blo. Correct all defects found.

2. RESISTANCE CHECKS

Check power supply resistances to ground using the X1K meter scale and the positive polarity meter lead to ground.

<u>SUPPLY</u>	<u>APPROX RESISTANCE</u>
+150V	10KΩ
+ 75V	1,2KΩ
-100V	12KΩ
- 22V	8KΩ

Check resistance from emitter of output transistor (Q63) to ground for greater than 10KΩ.

* 3. POWER SUPPLIES

a. *Setup*

Connect Sine Wave Generator to variable line voltage source and set source for 115 VAC. Switch POWER to ON and set units and tenths controls to 0.

b. *Adjust +150 volts*

Connect meter to +150 volts and adjust R225 for 150 volts.

c. *Check accuracy and ripple*

<u>Supply</u>	<u>Tolerance</u>	<u>Max Ripple</u>
+150V	adj	10mV
+ 75V	±7.5V	10mV
-100V	+16V, -6V	20mV
- 22V	±2.2V	5mV

*yr/ ~~line~~ / unit: draagel. ELCO
zener h, no volts potm
hais van Croy (Elco)
C226 (500µF) hais*

d. *Check regulation 105 to 125 VAC*

Check +150V ripple for 10mV max from 105 to 125 VAC. Return to 115 VAC.

6. (cont'd)

d. Check attenuator accuracy $\pm 2\%$, max

Using the settings in the following table check the difference in level of the top and bottom of waveform when switching Vc RANGE from + to -.

AMPLITUDE	INPUT ATTEN	Vc	MILLI-VOLTS/CM	Max Shift	
100V	100	5.00	10	2cm	1V/DIV
10V	10	5.00	10	2cm	0.1V/DIV
1V	1	0.5.00	10	2cm	0.01V/DIV
50V	100	2.50	5	2cm	0.5V/DIV
5V	10	2.50	5	2cm	0.05
.5V	1	0.2.50	5	2cm	0.005
20V	100	1.00	2	2cm	.2V/DIV
2V	10	1.00	2	2cm	0.02V/DIV
.2V	1	1.00	2	2cm	0.002V/DIV
.1V	1	0.50	1	2cm	0.1mV/DIV
.05V	1	0.25	1	1cm	0.05mV/DIV
.02V	1	0.10	1	4mm	0.02mV/DIV

7. FREQUENCY

a. Setup

Replace the TYPE W test scope plug-in with a TYPE CA. Set the CA MODE to ALTERNATE and the test scope TIME/CM to 1 μ SEC. Connect the TYPE 184 MARKER OUTPUT to CHANNEL A and the Sine Wave Generator OUTPUT to CHANNEL B. Set the Sine Wave Generator units to 1.0, MULTIPLIER to 100 kHz and FREQUENCY VARIABLE to CAL. Set the TYPE 184 for 10 μ SEC markers. Adjust test scope triggering and positioning for a stable display with both waveforms centered on the graticule.

b. Adjust 100 kHz

Set TRIGGERING LEVEL so the rising portion of the first time mark and the first cycle of sinewave cross the center horizontal graticule line at the same point. Adjust C133 so the second cycle and time mark cross the center graticule line at the same point.

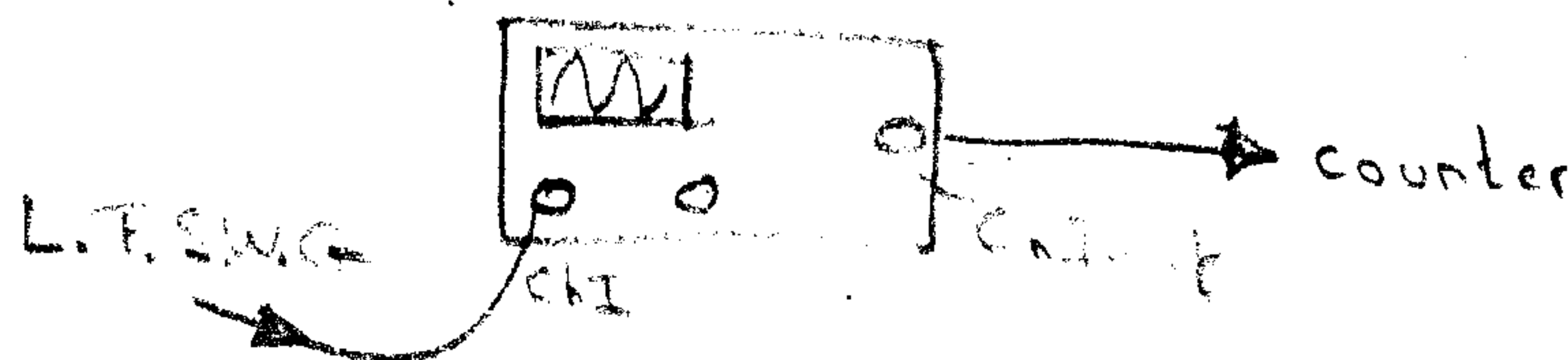
7a Check with count

10 Hz,
100 Hz
1 kHz

10 kHz

7b • 100 kHz → adj

7c • 1 MHz → adj



• cap side

Monitor waveform on test scope. Look for distortion

7. (cont'd)

c. *Adjust 1 MHz*

Set units to 10.0 and adjust C3 so the 11th cycle crosses the graticule center at the same point as the 2nd marker.

Switch test scope MAG to X10 and make final adjustments of C133 and C3, rechecking for interaction.

d. *Check frequency accuracy $\pm 3\%$, max*

Using the following settings check each position of the units switch at each MULTIPLIER setting for no more than 3% (3cm) difference between the 2nd time mark and the corresponding cycle of the sine-wave.

d. When checking frequencies below 100 Hz it may be easier to check each channel separately rather than using ALTERNATE.

<u>MULTIPLIER</u>	<u>TYPE 184</u>	<u>TIME/CM</u>	<u>MAG</u>
100 kHz	10 μ S	1 μ SEC	X10
10 kHz	.1mS	10 μ SEC	X10
1 kHz	1mS	.1mSEC	X10
100 Hz	10mS	1mSEC	X10
10 Hz	.1 S	10mSEC	X10

Switch units to 0 and check the tenths switch with TIME/CM at .1 SEC and TYPE 184 set for 1 S markers.

e. *Check VARIABLE range .1X MULTIPLIER, min*

Set MULTIPLIER to 1 kHz and units to 1. Check that FREQUENCY VARIABLE control has at least as much range as each step on the tenths switch.

8. AMPLITUDE REGULATIONa. *Setup*

Replace ~~TYPE CA~~ with ~~TYPE W~~ and ¹⁰¹³ set COMPARISON VOLTAGE to .5~~x~~00, MILLIVOLTS/~~CM~~^{Div.} to 10 and INPUT ATTEN to 1. Set Sine Wave Generator FREQUENCY to 1 kHz and AMPLITUDE to 1 VOLT.

8. (cont'd)

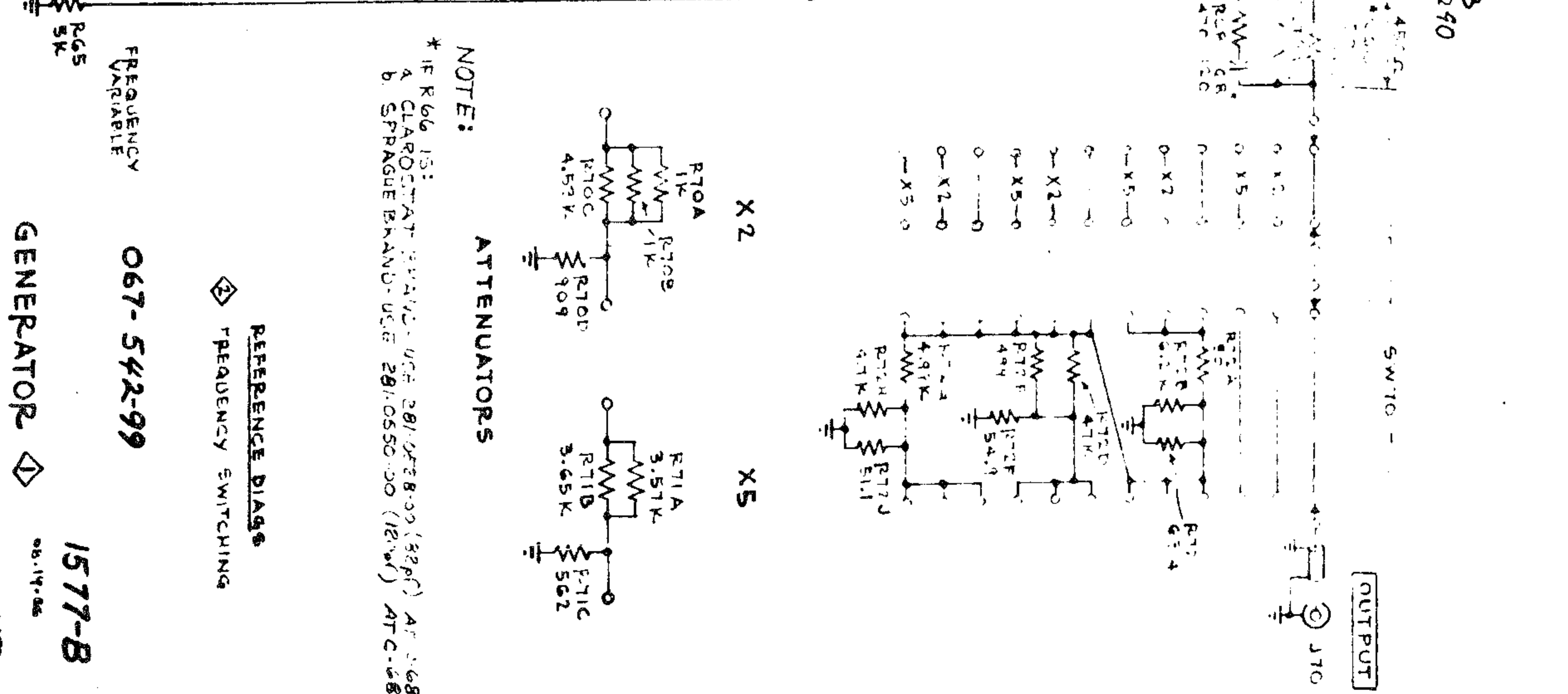
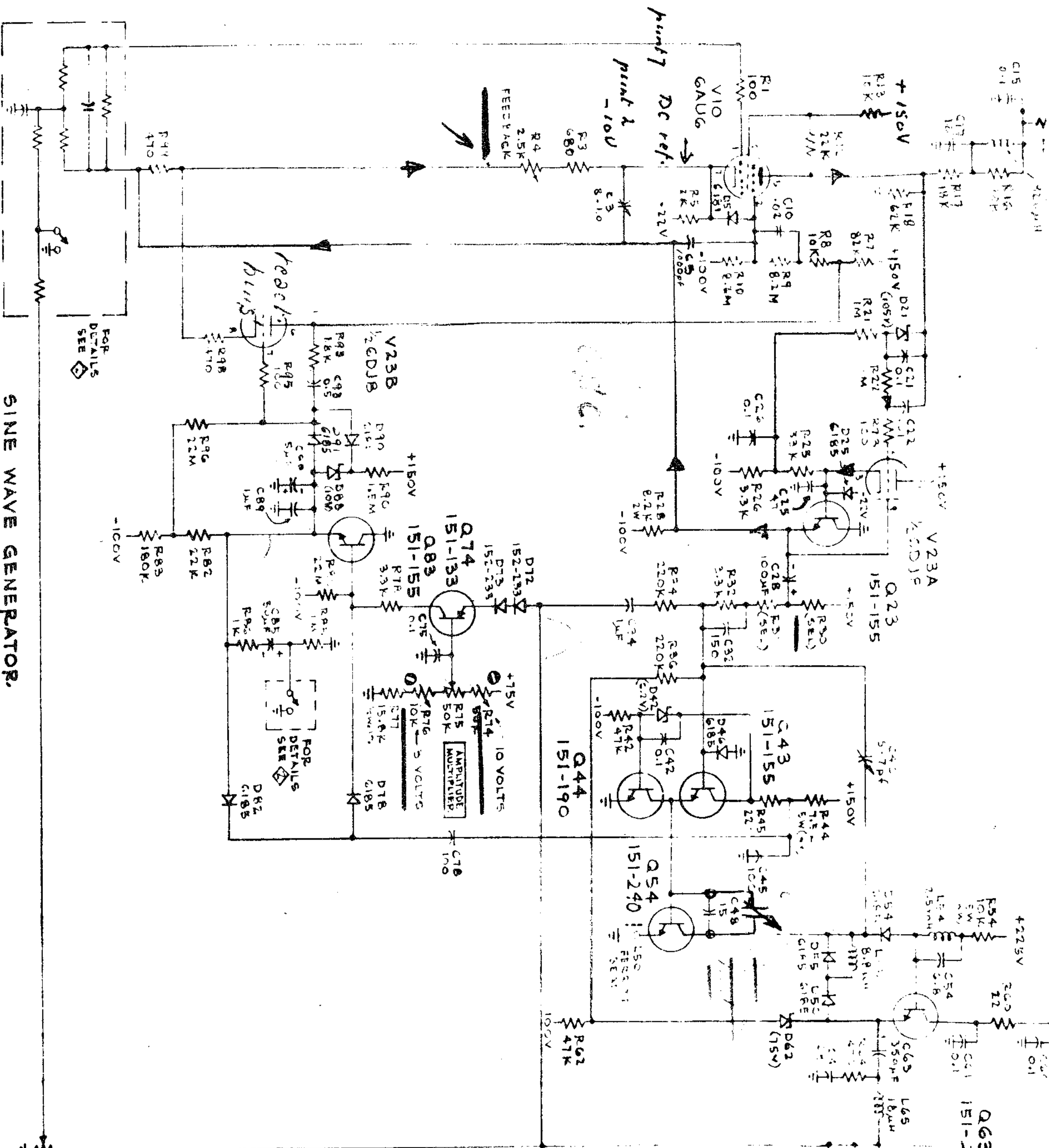
b. *Check amplitude change with frequency*
±2%, max

Connect Sine Wave Generator to TYPE W and check amplitude error at 1 kHz by switching VC RANGE to -1.1 and +1.1. Similarly check amplitude at 1 Hz and 1 MHz for no more than 2% (2cm) change.

c. *Check amplitude change with line voltage*
±1%, max

With FREQUENCY set for 1 MHz check amplitude change while varying line voltage from 105 to 125 VAC for no more than 1% (1cm).

THE END



NOTE:

- * IF R66 IS:
- A CLARODIAT 254V-052 281.078-32 (32P) AT 368
- B SPRAGUE BAND-052 281.055-30 (28P) AT C-68

ATTENUATORS

REFERENCE DIAGRAM

FREQUENCY SWITCHING

067-542-99

GENERATOR

1577-B

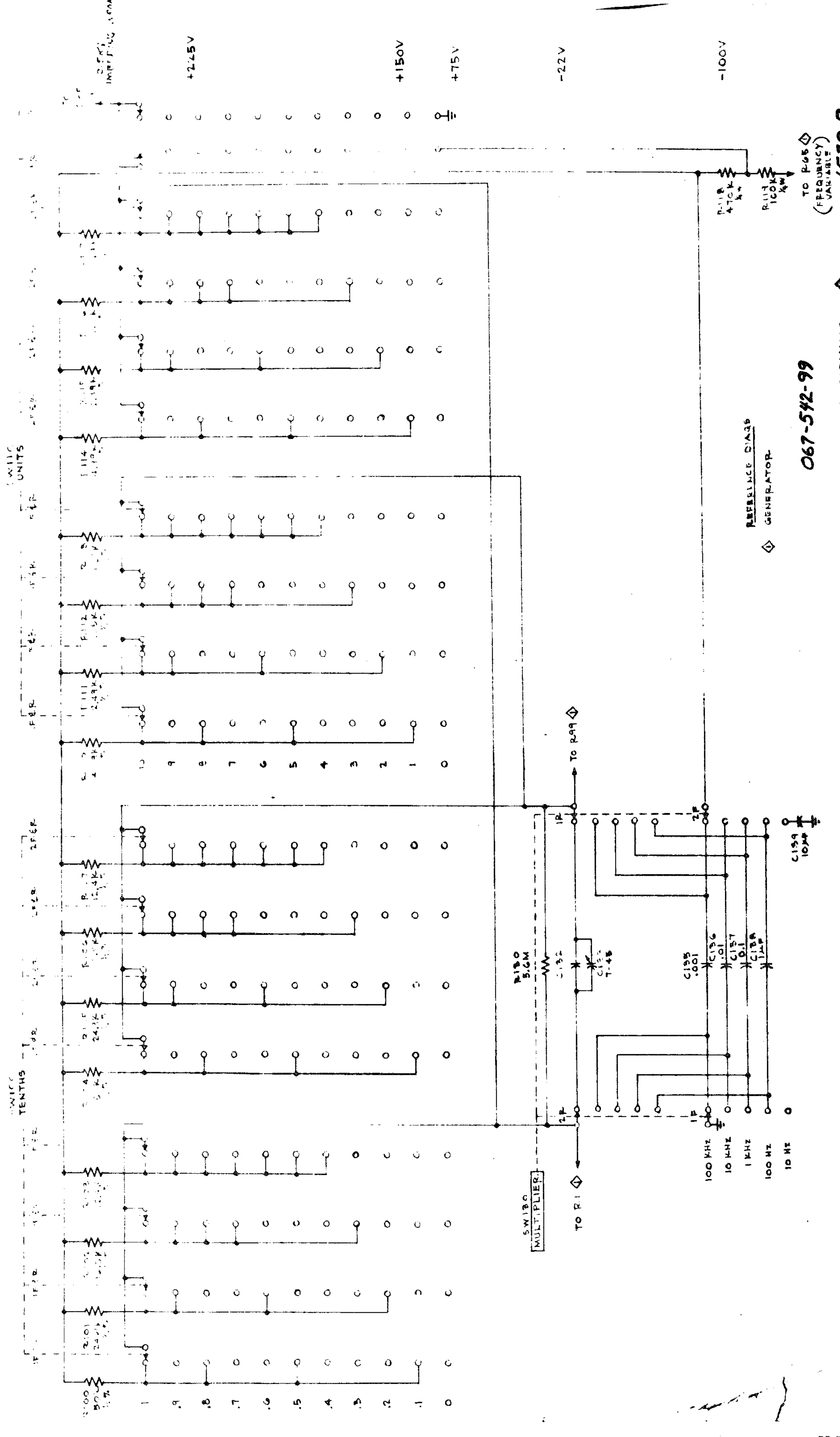
28.14.06

SINE WAVE GENERATOR.

FOR DETAILS SEE

FOR DETAILS SEE

OUTPUT

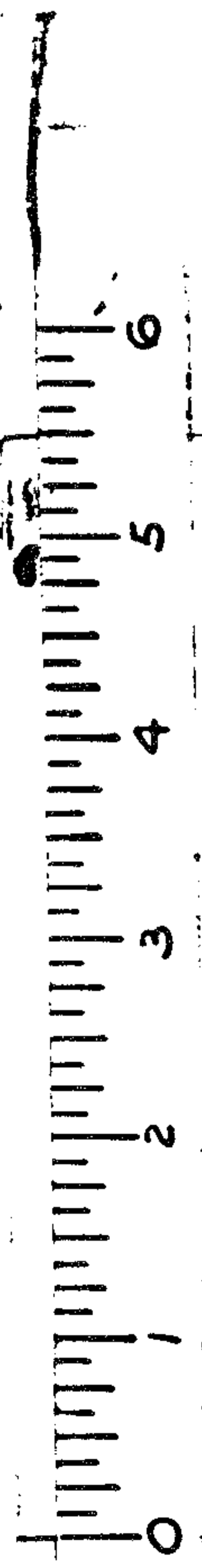


TO P65
(FREQUENCY VARIABLE)
1578-B

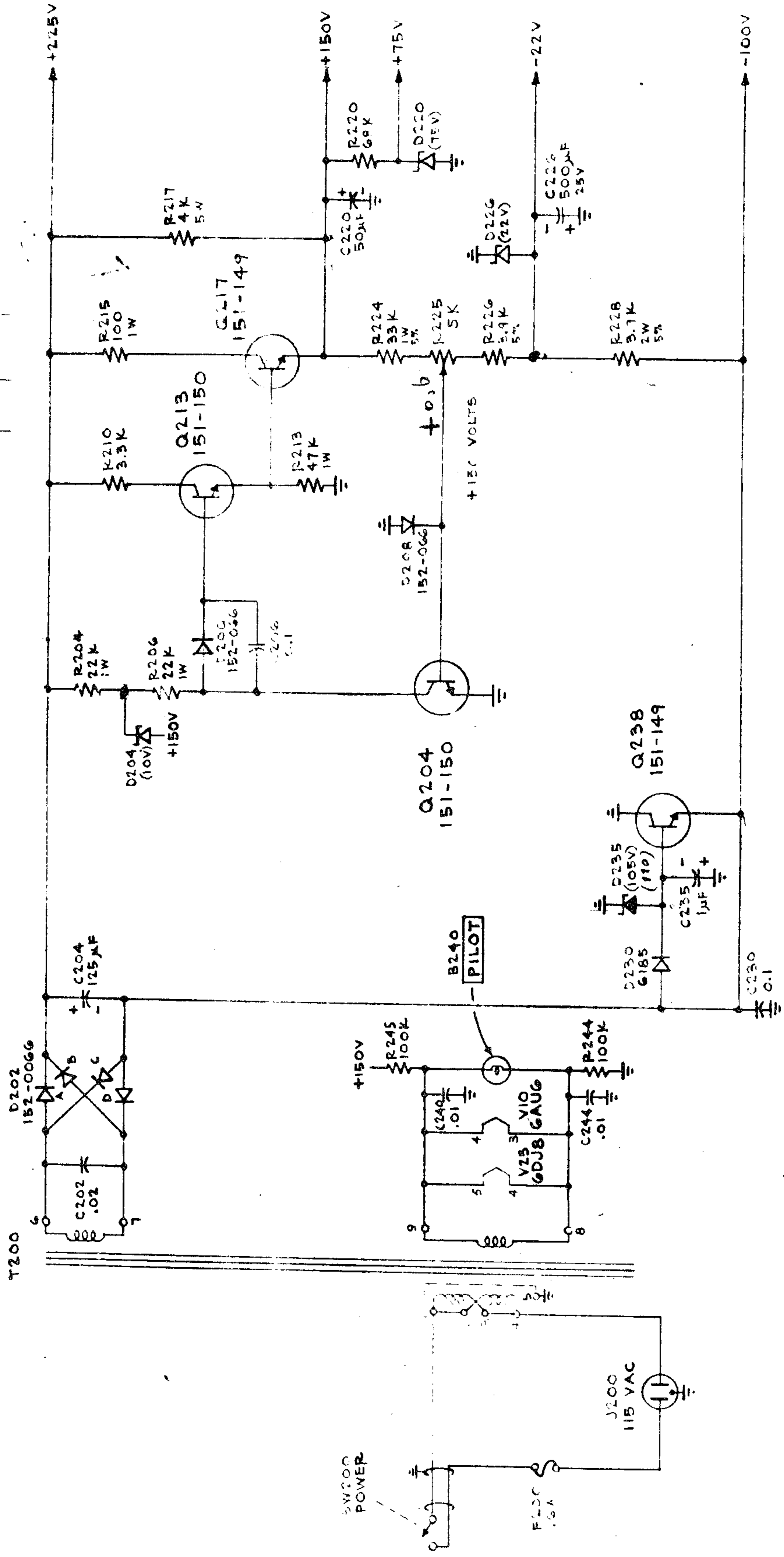
067-542-99

FREQUENCY SWITCHING

SINE WAVE GENERATOR



REF ID: A66757
 C202 WAS .022 (R225 WAS 2.5K)
 XFORMER FILED OF VIO V23 NUMBER 106 1960M



SINE WAVE GENERATOR

POWER SUPPLY

067-542-99

1579-B

REV. 11-66

067-0542-99

SINE WAVE GENERATOR

ELECTRICAL PARTS LIST

Ckt. No.	Tek P/N	Description		
		BULBS		
B240	150-0018-00	pilot light		
		CAPACITORS		
C3	281-0022-00	8-50 pf	Var	
C5	281-0536-00	1000pf	Cer	500V
C10	283-0006-00	.02	disc	500V
C15	283-0057-00	0.1	disc	200V
C17	281-0504-00	10	disc	200V
C21	283-0057-00	0.1	disc	200V
C22	283-0002-00	.01	disc	500V
C25	281-0518-00	47pf	Cer	500V
C26	283-0057-00	0.1	disc	500V
C28	290-0215-00	100µf	EMT	25V
C32	281-0524-00	150pf	Cer	500V
C34	290-0164-00	1µf	EMT	150V
C40	281-0034-00	1.5 - 7pf	Cer	NPO
C42	283-0023-00	0.1	disc	10V
C45	281-0523-00	100pf	Cer	350V
C48	281-0509-00	15pf	Cer	500V
C54	281-0572-00	6.8pf	Cer	500V
C60	283-0057-00	0.1	disc	200V
C61	283-0057-00	0.1	disc	200V
C63	290-0258-00	350µf	EMT	100V
C64	281-0549-00	68pf	Cer	500V
C68	selected capacitor			
C75	283-0052-00	0.1	disc	200V
C78	281-0523-00	100	Cer	350V
C85	290-0209-00	50µf	EMT	25V
C88	290-0026-00	5µf	EMT	25V
C89	283-0059-00	1µf	disc	25V
C93	285-0537-00	0.5	MPT	400V

Ckt. No.	Tek P/N	Description.		
C132	283-0534-00	82pf	mica	
C133	281-0012-00	7-45pf	Var	
C135	285-0665-00	.001	set	285-0107-00
C136	285-0664-00	.01	set	
C137	285-0663-00	0.1	set	
C138	285-0715-00	1μf	set	
C139	291-0041-01	10μf	set	
C202	283-0022-00	.02	disc	1400V
C204	290-0017-00	125μf		450V
C206	283-0057-00	0.1	disc	200V
C220	290-0260-00	50μf	EMT	200V
C226	290-0116-00	500μf	EMT	25V
C230	283-0057-00	0.1	disc	200V
C235	290-0164-00	1μf	EMT	150V
C240	283-0079-00	.01	disc	250V
C244	283-0079-00	.01	disc	250V

CONNECTORS

J70	131-0106-00	connector	BNC
J200	131-0102-02	connector	Motor Base

DIODES

D5	152-0185-01	Silicon	CD8204
D21	152-0287-00	Zenner	1N2986
D25	152-0185-01	Silicon	CD8204
D42	152-0166-00	Zenner	1N753A
D46	152-0185-01	Silicon	CD8204
D54	152-0185-01	Silicon	CD8204
D55	152-0185-01	Silicon	CD8204
D56	152-0185-01	Silicon	CD8204
D62	152-0101-00	Zenner	3041
D72	152-0233-00	Silicon	6233
D73	152-0233-00	Silicon	6233
D78	152-0185-01	Silicon	CD8204
D88	152-0149-00	Zenner	1N961
D90	152-0185-01	Silicon	CD8204
D91	152-0185-01	Silicon	CD8204
D202	152-0066-00	Silicon	1N3194
D204	152-0149-00	Zenner	1N961
D206	152-0066-00	Silicon	1N3194
D208	152-0066-00	Silicon	1N3194
D220	152-0101-00	Zenner	3041
D226	152-0281-00	Zenner	1N969
D235	152-0287-00	Zenner	1N986
D230	152-0185-01	Silicon	CD8204

ELECTRON TUBES

V23	154-0187-00	6DJ8
V10	154-0022-00	6AU6

FUSES

F200		.6A	slow
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Ckt No. Tek P/N Description

INDUCTORS

L16	108-0240-00	820uh
L50	276-0543-00	Ferrite bead
L54	108-0213-00	2.5mh
L55	108-0057-00	8.8uh
L65	108-0129-00	18uh

RESISTORS

R1	302-0101-00	100Ω	1/2W	10%
R3	302-0681-00	680Ω	1/2W	10%
R4	311-0172-00	2.5K	Var	
R5	301-0202-00	2K	1/2W	5%
R7	301-0823-00	82K	1/2W	5%
R8	301-0103-00	10K	1/2W	10%
R9	301-0825-00	8.2M	1/2W	5%
R10	301-0825-00	8.2M	1/2W	5%
R12	302-0223-00	22K	1/2W	10%
R13	302-0103-00	10K	1/2W	10%
R15	302-0220-00	22Ω	1/2W	10%
R16	301-0303-00	30K	1/2W	5%
R17	301-0183-00	18K	1/2W	5%
R19	301-0623-00	62K	1/2W	5%
R21	302-0105-00	1M	1/2W	10%
R22	302-0105-00	1M	1/2W	10%
R23	302-0101-00	100Ω	1/2W	5%
R25	302-0333-00	33K	1/2W	10%
R26	302-0332-00	3.3K	1/2W	10%
R28	305-0822-00	8.2K	2W	5%
R30	selected resistor			
R31	selected resistor			
R32	302-0332-00	3.3K	1/2W	10%
R34	301-0224-00	220K	1/2W	5%
R36	301-0224-00	220K	1/2W	5%
R42	302-0473-00	47K	1/2W	10%
R44	308-0267-00	7.5K	5W	WW
R45	302-0221-00	220Ω	1/2W	10%
R54	308-0023-00	10K	5W	WW
R60	302-0220-00	22Ω	1/2W	10%
R62	302-0473-00	47K	1/2W	10%
R64	315-0471-00	470Ω	1/4W	5%
R66	308-0183-00	500Ω	10W	WW
R67	selected resistor			
R68	302-0471-00	470Ω	1/2W	10%
R70A	324-0193-00	1K	1W	1%
R70B	324-0193-00	1K	1W	1%
R70C	323-0256-00	4.53K	1/2W	1%
R70D	323-0189-00	909Ω	1/2W	1%
R71A	323-0246-00	3.57K	1/2W	1%
R71B	323-0247-00	3.65K	1/2W	1%
R71C	323-0169-00	562Ω	1/2W	1%
R72A	323-0626-00	50Ω	1/2W	1%
R72B	315-0622-00	6.2K	1/4W	5%
R72C	323-0078-00	63.4Ω	1/2W	1%
R72D	315-0473-00	47K	1/4W	5%
R72E	323-0169-00	499Ω	1/2W	1%
R72F	323-0072-00	54.9Ω	1/2W	1%

Ckt. No.	Tek P/N	Description	
R72G	323-0260-00	4.99K	1/2W 1%
R72H	315-0472-00	4.7K	1/4W 5%
R72J	323-0069-00	51.1Ω	1/2W 1%
R74	311-0218-00	50K	Var
R75	311-0218-00	50K	Var
R76	311-0015-00	10K	Var
R77	323-0308-00	15.8K	1/2W 1%
R78	302-0332-00	3.3K	1/2W 10%
R80	302-0226-00	22M	1/2W 10%
R82	302-0223-00	22K	1/2W 10%
R83	301-0184-00	180K	1/2W 5%
R85	302-0105-00	1M	1/2W 10%
R86	302-0102-00	1K	1/2W 10%
R90	302-0155-00	1.5M	1/2W 10%
R93	302-0182-00	1.8K	1/2W 10%
R95	302-0101-00	100Ω	1/2W 10%
R96	302-0220-00	22M	1/2W 10%
R98	302-0471-00	470Ω	1/2W 10%
R99	302-0471-00	470Ω	1/2W 10%
R100	323-0636-01	50K	1/2W 1%
R101	323-0327-00	24.9K	1/2W 1%
R102	323-0310-00	16.5K	1/2W 1%
R103	323-0298-00	12.4K	1/2W 1%
R104	323-0262-01	50K	1/2W 1%
R105	323-0327-00	24.9K	1/2W 1%
R106	323-0310-00	16.5K	1/2W 1%
R107	323-0298-00	12.4K	1/2W 1%
R110	323-0260-00	4.99K	1/2W 1%
R111	323-0231-00	2.49K	1/2W 1%
R112	323-0214-00	1.65K	1/2W 1%
R113	323-0202-00	1.24K	1/2W 1%
R114	323-0260-00	4.99K	1/2W 1%
R115	323-0231-00	2.49K	1/2W 1%
R116	323-0214-00	1.65K	1/2W 1%
R117	323-0202-00	1.24K	1/2W 1%
R118	316-0474-00	470K	1/4W 10%
R119	316-0104-00	100K	1/4W 10%
R130	301-0565-00	5.6M	1/2W 5%
R204	304-0223-00	22K	1W 10%
R206	304-0223-00	22K	1W 10%
R210	302-0332-00	3.3K	1/2W 10%
R213	304-0473-00	47K	1W 10%
R215	304-0101-00	100K	1W 10%
R217	308-0229-00	4K	5W WW
R220	302-0683-00	68K	1/2W 10%
R224	303-0333-00	33K	1W 5%
R225	311-0011-00	5K	Var
R226	301-0392-00	3.9K	1/2W 5%
R228	305-0293-00	3.9K	2W 5%
R244	302-0104-00	100K	1/2W 10%
R245	302-0104-00	100K	1/2W 10%

Ckt No.

Tek P/N

Description

T200

120-

Transformer
#24-63

Q23
Q43
Q44
Q54
Q63
Q74
Q83
Q204
Q213
Q217
Q238

151-0155-00
151-0155-00
151-0190-00
151-0240-00
151-0240-00
151-0133-00
151-0155-00
151-0150-00
151-0150-00
151-0149-00
151-0149-00

Transistor
2N2925
2N2925
2N3904
40256
40256
MM999
2N2925
2N3440
2N3440
2N3441
2N3441

SW70
SW100
SW110
SW130
SW200

SP1004
SP1001
SP1003
SP1002
260-0134-00

SWITCHES

Amplitude
2nd Significant figure
1st Significant figure
Multiplier
Switch, toggle

Sine wave generator

067-0542-99.

MECHANICAL PARTS LIST

Qty	Tek P/N	Description
8	124-0094-00	Ceramic Strip, 7 notch
2	124-0095-00	Ceramic strip, 9 notch
2	124-0106-00	Ceramic strip, 11 notch
4	124-0120-00	Ceramic strip, 4 notch
7	131-0181-00	Socket, trans. 3 pin
1	136-0015-00	Socket, tube, 9 pin
1	136-0008-00	Socket, tube, 7 pin
1	136-0047-00	Socket, pilot light ass'y
1	179-	Cable harness
1	200-0260-00	Cover, cap
1	200-0582-00	Cap, fuse holder
1	214-0317-00	Heat sink, beryllium oxide
1	214-0668-00	Heat sink, black anodized
1	214-0368-00	Spring, trans. heat sink
1	214-0553-00	Latch, screw
1	337-0649-00	Shield, heat dissapating
1	351-0096-00	Rail, guide
1	343-0008-00	Clamp, cable 3/4"
1	343-0009-00	Clamp, cable 7/8
1	343-0014-00	Clamp, cable 1"
6	343-0097-00	lamp, trans. heat sink
1	348-0031-00	Grommet, 5/32"
1	348-0056-00	Grommet, 3/8"
1	352-0010-00	Holder, fuse
7	352-0062-00	Holder, trans. heat sink
1	354-0234-00	Ring, trans. socket mtg.
32	358-0255-00	Busing, latch (for lock screw)
6	361-0009-00	Spacer, ceramic strip
3	366-0173-00	Knob, char. 1/4 insert
1	384-0615-00	Rail
1	386-0143-00	Washer, mica trans.
1	386-0254-00	Flange, lg. fiber
1	386-1094-00	Washer, mica trans.
1	390-0006-00	Bottom, cabinet w/feet
1	390-0007-00	Top, cabinet
1	DWG # 1382-B	Shield, switch
1	DWG #1393-C	Panel, front film #4C96
1	DWG #1381-B	Plate, rear
1	DWG #1269-C	Panel, front sub
1	DWG #1286-A	Bracket, cap mtg
1	DWG #395-D	Chassis