VIKING

6N2 CONVERTER

Instant Bandswitching 6 Meters, 2 Meters
Or Normal Receiver Operation



E. F. Johnson Company
WASECA, MINNESOTA

Model	Used with Receiver Tuning Range of
250-43-4	30.5-34.5 mc Kit
250-43-1	26-30 mc Kit
250-43-2	28-30 mc Kit
250-43-3	14-18 mc Kit
250-43-12	26-30 mc Assembled and Tested
250-43-22	28-30 mc Assembled and Tested
250-43-32	14-18 mc Assembled and Tested
250-43-42	30.5-34.5 mc Assembled and Tested

The successful operation of any radio equipment is largely dependent upon the operator's understanding of the equipment. This manual is made up of several parts, each with the purpose of making the operator more familiar with the converter. It is strongly recommended that this manual be carefully read prior to attempting operation of the equipment.

WARNING

The voltages encountered in this piece of equipment are high enough to cause fatal injury. Practice safety rules until they are second nature. Always use proper fuses. Always remove the power cord plug from the power source when working inside the converter.

A. INTRODUCTION

The Johnson Viking 6N2 converter is a completely self-contained bandswitching VHF (Very High Frequency) converter which has been designed to provide maximum station performance and flexibility. In addition to the 6 meter and 2 meter positions of the bandswitch, an OFF position connects the antenna directly to the receiver used in conjunction with the converter. This allows rapid changeover from VHF to HF operation. Merely a flip of the switch, no cables or plugs to disconnect.

The converter is 8 3/4 inches wide, 5 inches high, 12 inches deep and weighs 4 pounds. A one piece cabinet results in excellent shielding together with sturdiness and attractive appearance. The entire chassis and shields are heavily silver plated steel for maximum electrical and mechanical performance.

Auxiliary equipment required is:

1. A receiver to be used as a tunable IF at either 14-18, 26-30, 28-30 or 30.5-34.5 megacycles. The converter model number used is determined by the receiver tuning range.

2. 6 meter and 2 meter antennas. See ARRL Handbook.

3. 50 ohm coaxial cable to connect the converter to the receiver.

4. 50 ohm coaxial cable between the antenna and the converter. If the distance between the converter and the antenna is long, it is recommended that a coaxial balun be made and open wire line or twin lead be run to the antennae. See ARRL Handbook.

The Johnson Viking 6N2 converter has a built in power supply and is designed to operate from 105 to 125 volts 50-60 cycles single phase AC line. Power consumption is 28 watts at 117 volts AC.

B. DESCRIPTION

The radio frequency (RF) amplifier stage uses a type 6BS8 semi-remote cutoff dual triode in the famed CASCODE circuit. Each section of this remarkable frame-grid tube has the very high transconductance of 12,500 micro-mhos. This is more than double that of the usual cascode tube (i.e. 6BQ7). The much higher gain and lower noise resistance of this tube allows the design of a converter with excellent Noise Figure and high gain with fewer stages. The use of the 6BS8 (which is designed for minimum cross-modulation) and fewer stages materially aid in the reduction of cross-modulation and overloading.

A GAIN control in the cathode of the 6BS8 allows control of the converter gain. This is particularly useful when a strong local ham or TV station comes on the air. Merely decreasing the gain will decrease the overloading considerably. The input circuits have been designed to work with 50 ohm coaxial cable. On 2 meters the input circuit is a tapped single tuned coil for maximum gain and lowest Noise Figure. On 6 meters the input circuit is a double tuned undercoupled circuit which greatly improves overloading and cross-modulation characteristics. Those who live near a channel 2 TV transmitter or other strong local transmitter will be benefited materially.

The interstage circuits on both bands are double tuned overcoupled circuits. This produces a flat topped response with steep skirt selectivity and provides excellent spurious and image rejection.

The Mixer uses the pentode section of a 6U8. Grid leak biasing provides a self regulating action which prevents overloading. The use of a pentode provides good gain and quiet operation.

The crystal oscillator is an impedance inverting type. The use of an impedance inverting network allows series mode operation of the high frequency overtone crystals and results in greater frequency stability than the usual overtone circuit. The use of high frequency overtone crystals results in a minimum of oscillator beats. On 6 meters the crystal frequency is injected directly into the mixer grid thru a small capacitor. On 2 meters the crystal frequency is tripled in the pentode section of the 6U8 and then injected into the mixer grid.

The IF (intermediate frequency) amplifier uses a grounded cathode stage with a low value of plate load to match the output coaxial cable. This circuit is more stable and has greater gain than a cathode follower.

The Power Supply is a transformer supply which uses a type 6X4 rectifier and a capacitor-resistor filter. This supply delivers 175 volts at 50 milliamperes DC and 6.3 volts AC. The primary of the transformer is fused for protection. Careful attention to shielding, bypassing, the use of special feedthru type capacitors and silver plating results in excellent image and spurious rejection.

C. INSTALLATION

After removing the converter from the shipping container, inspect it thoroughly for any possible damage from shipping. Claims of damage should be made against the carrier delivering the equipment and must be made with the carrier agent at the point of delivery. DO NOT SHIP DAMAGED EQUIPMENT BACK TO THE MANUFACTURER UNTIL AUTHORIZED TO DO SO BY THE MANUFACTURER. NOTIFY THE SERVICE DIVISION THAT A CLAIM IS BEING MADE AGAINST THE CARRIER.

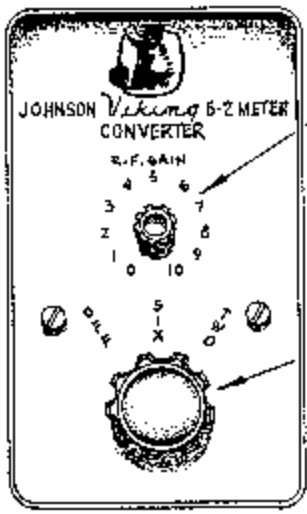
Remove all packing material from inside the converter. Note: In order to remove the cabinet it is necessary to remove the 4 rubber mounting feet and 18 screws. Install knobs as follows (the knobs may already be installed in some cases):

BAND
Turn the BAND switch fully counterclockwise and install the knob (with the green pointer) with pointer pointing to the OFF position.

GAIN
Turn the GAIN shaft fully clockwise and install the small knob with the pointer on 10. Tighten using a screwdriver.

D. OPERATION

1. Controls



RF GAIN

Maximum gain (10) should be used only when necessary.

AM: Normally near full gain (9). Decrease gain on strong signals to prevent overloading.

CW-SSB: Reduce RF GAIN to prevent overloading or cross-modulation.

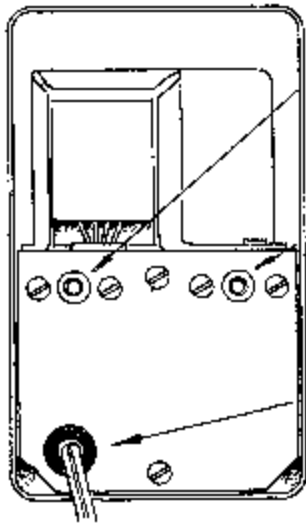
BAND SWITCH

OFF - Turns off the power supply and connects the antenna to the receiver.

6M - Turns ON the converter for 6 meter reception.

2M - Turns ON the converter for 2 meter reception.

2. Rear Connections



OUTPUT

Connects output of converter to receiver in 6M and 2M position of BAND switch. In the OFF position the receiver is connected directly to the antenna.

INPUT

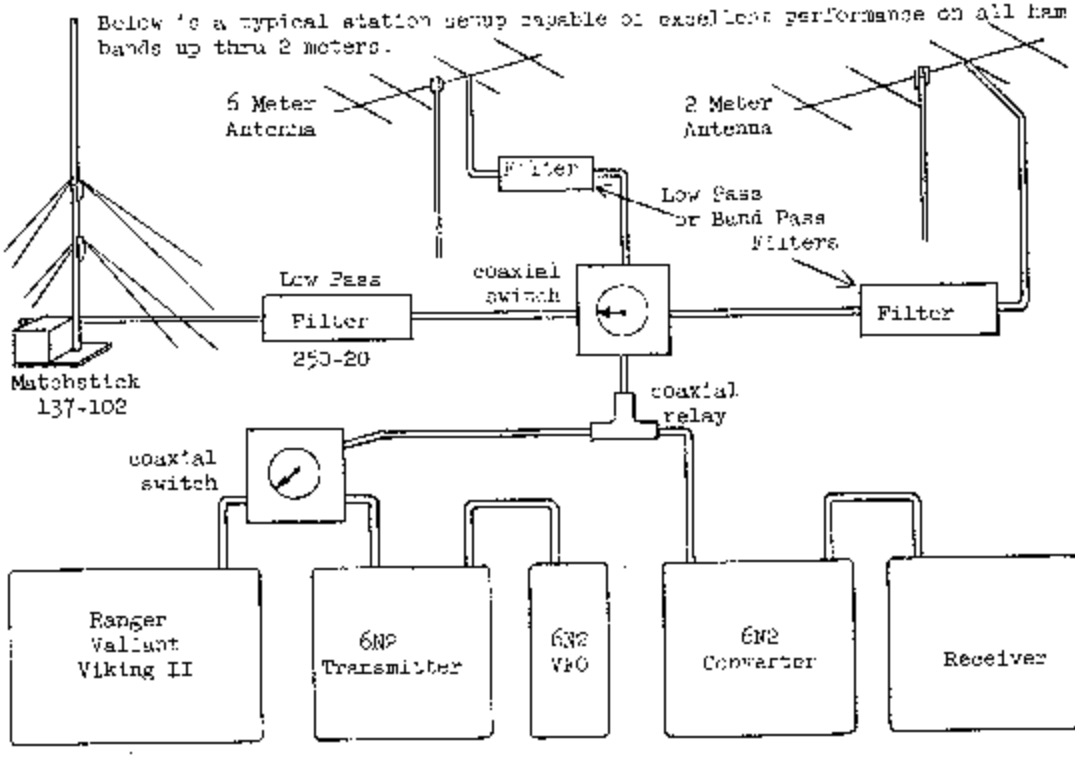
Connects antenna cable to input of the converter on 6M and 2M. Connects the antenna directly to the receiver in the OFF position.

POWER CORD

To be plugged into 105-125 volts AC 50-60 cycle power line.

3. Connections

Below is a typical station setup capable of excellent performance on all ham bands up thru 2 meters.



4. Operating Notes

a. Operation of the receiver (not the converter) is normal except that the RF GAIN control will generally have to be turned down. Too much gain can spoil the signal-to-noise ratio of the system.

The proper method of setting the receiver RF GAIN control is as follows:

1. Set converter GAIN to "10".
2. Set BAND to OFF.
3. Adjust receiver for normal lower frequency use. Adjust Audio for comfortable level of noise output.
4. Turn BAND to SIX or TWO (as desired).
5. Reduce receiver RF GAIN to approximately equal noise output.

b. Overloading or cross-modulation due to strong signals can be reduced or eliminated by reducing the converter RF GAIN. Use only as much gain as necessary.

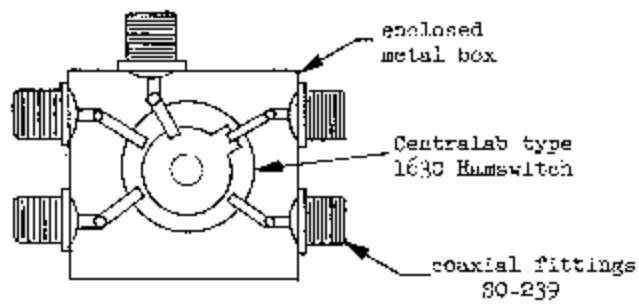
c. If coverage of the upper two megacycles of the 2 meter band is desired in the 28 to 30 megacycle converter model, it is necessary to substitute a 39.333 mc crystal in J3 and retune L15 and C69 as described in part B of the Alignment Procedure (available from Customer Service Department).

E. MISCELLANEOUS DATA

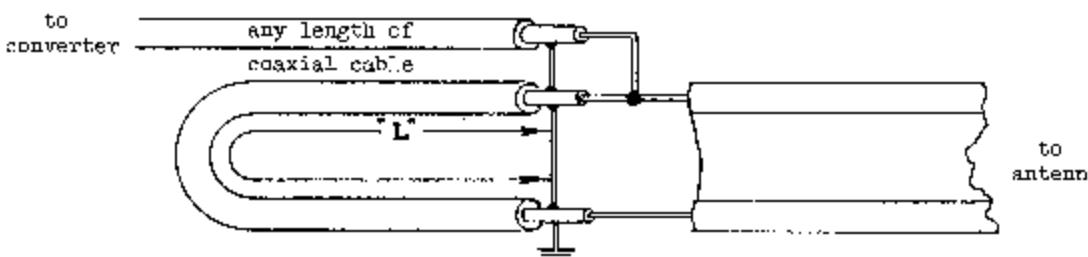
1. Typical Voltage and Resistance
DC voltage measured with a 20,000 ohm-per-volt meter between chassis and indicated test points. Line voltage 117 volts. GAIN control at maximum and BAND switch on 2 meter position. Resistance reading in ohms, taken with power removed.

TUBE		PIN 1	2	3	4	5	6	7	8	9
V1 6ES8	Voltage	178	102	104	6.3 AC	0	104	0	1.65	0
	Resistance	24K	200K	-	.2	0	-	56K	1500	0
V2 6U8	Voltage	177	- 3	72	0	6.3 AC	178	0	3.6	0
	Resistance	24K	100K	120K	0	.2	24K	0	1000	4700
V3 6U8	Voltage	128	-.2	117	6.3 AC	0	138	0	3.2	0
	Resistance	34K	68K	57K	.2		57K	0	510	10K
V4 6X4	Voltage	180 AC	0	0	6.3 AC	0	187	202	-	-
	Resistance	33K	-	0	.2	-	33K	24K	-	-

2. A coaxial switch may be purchased or home-made as shown in the sketch below and will add greatly to your station flexibility.



3. Coaxial baluns - to be used where long transmission lines employ open wire or parallel lines (balanced) to reduce losses.



BAND	L
6 meters	77 inches
2 meters	27 inches

$L = \frac{590\ V}{f} = \frac{390}{f}$ for polyethlyene coaxial cable

V = Velocity factor of cable = .66 for RG-8U, RG-59, RG-58

f = frequency in megacycles

See the ARRL Handbook for more complete details on transmission lines.

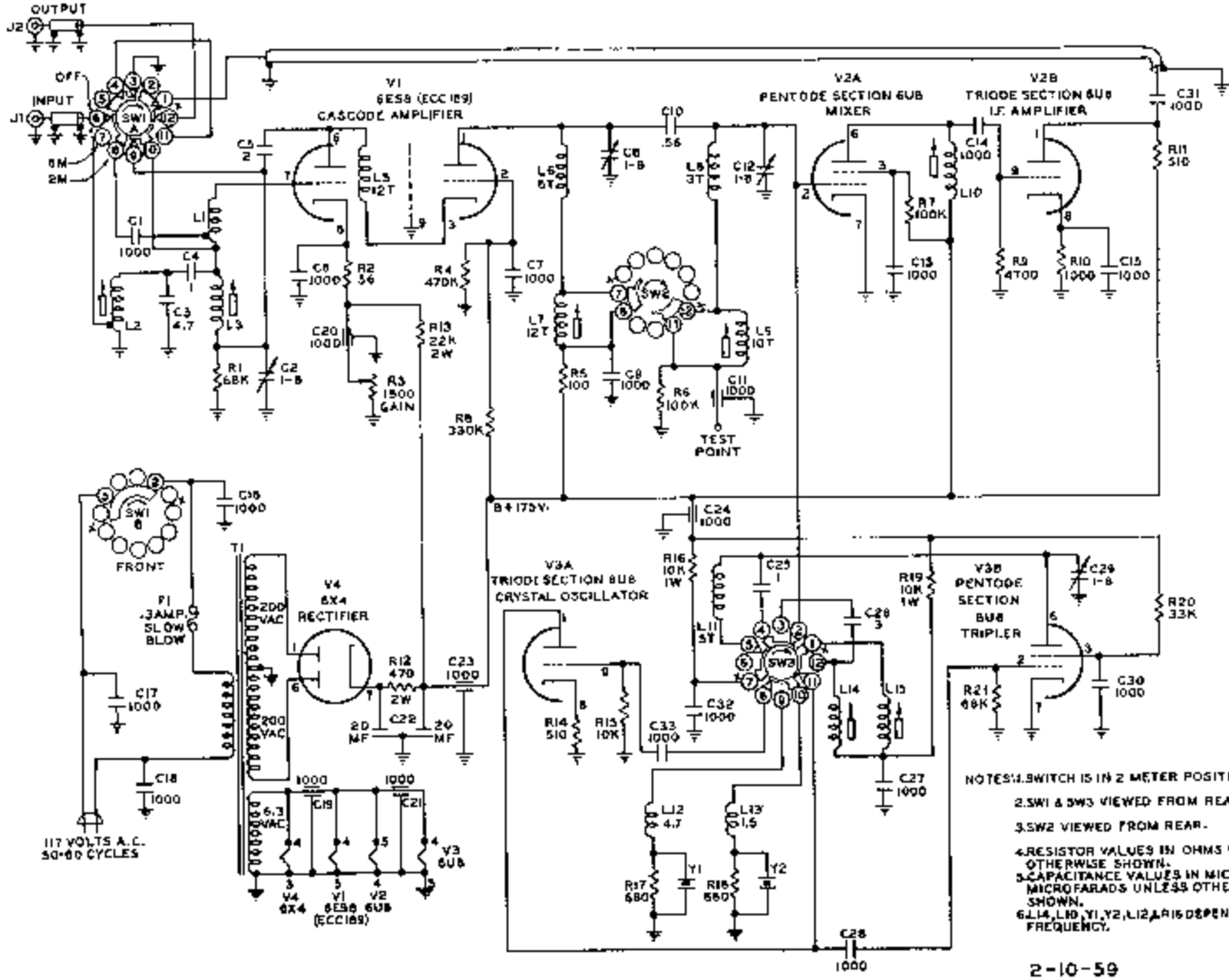
6N2 CONVERTER
250-43-1 (26-30 mc IF)

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
22.1184	C1,6,7,9 13,14,15 16,17,18 27,28,30 31,32,33	16	1000 mmf ± 20% 500 V disc capacitor
22.1514	C2,8,12 29	4	4-7.5 mmf ceramic trimmer capacitor
22.4437-10	C3	1	4.7 mmf ± 10% composition capacitor
22.4428-5	C5	1	2 mmfd ± 5% composition capacitor
22.4415-10	C10	1	.56 mmf ± 10% composition capacitor
22.1515	C11,19,20 21,23,24	6	1000 mmf feedthru capacitor
22.1420	C22	1	20-20 mfd 250 VW electrolytic capacitor
22.4421-10	C25,26	2	1 mmfd ± 10% composition capacitor
22.4432-10	C26	1	3 mmfd ± 10% composition capacitor
17.1070	CH1	1	Chassis
17.1071	CH2	1	Amplifier shield
17.1072	CH3	1	Oscillator shield
17.1073	CH4	1	Mixer shield
17.1079-2	CH5	1	Cabinet
17.1075-5	CH6	1	Front Panel
22.1171	D1,2,3,4 5,6,7	7	Coil and core holder - 3/8" diameter
23.1249	D8	1	Knob 1 1/8" dia. with green pointer
116-517-1	D11	1	Knob - collet type - light green
22.1210-5	E1,2,3,4	4	EE5001 iron slugs
22.1210-1	E5,6,7	3	EE5005 iron slugs
22.1522	E8	1	Standoff terminal
22.1525	F1	1	3/10 amp. slow blow fuse
22.113-1	G1,2,3	3	9/16" OD rubber grommet
	HW	1	Hardware envelope
22.1096	J1,2	2	Coaxial jack
16.1396-1	L1	1	2 meter input coil
23.1175-20	L2	1	6 meter antenna coil (red-black)
23.1175-5	L3	1	6 meter grid coil - green
16.1396-2	L5	1	Series coil
16.1396-3	L6	1	2 meter interstage plate coil
23.1175-19	L7	1	6 meter interstage plate coil (brown-white)
16.1396-4	L8	1	2 meter interstage grid coil
23.1175-18	L9	1	6 meter interstage grid coil (brown-gray)
23.1175-17	L10	1	Intermediate frequency coil - 20 to 30 mc IF (brown-violet)
16.1396-5	L11	1	2 meter multiplier coil
22.1517	L12	1	6 meter crystal inductor (4.7 uhy)
22.1516	L13	1	2 meter crystal inductor (1.5 uhy)
23.1175-5	L14	1	6 meter oscillator coil - 20 to 30 mc crystal (green)
23.1175-3	L15	1	2 meter oscillator coil (orange)
22.1095	P1,2	2	Coaxial plugs
22.5093-10	R1,2	2	68,000 ± 10% ohm 1/2 watt carbon resistor
22.926	G4	4	Rubber feet

Parts List

Part No. or Drawing No.	Item No.	Qty.	Description
22.5019-10	R2	1	56 ± 10% ohm 1/2 watt carbon resistor
22.1524	R3	1	1500 ohm ± 20% 1/4 watt potentiometer
22.5113-10	R4	1	470,000 ± 10% ohm 1/2 watt carbon resistor
22.5025-10	R5	1	100 ± 10% ohm 1/2 watt carbon resistor
22.5097-10	R6,7	2	100,000 ± 10% ohm 1/2 watt carbon resistor
22.5109-10	R8	1	330,000 ± 10% ohm 1/2 watt carbon resistor
22.5065-10	R9	1	4700 ± 10% ohm 1/2 watt carbon resistor
22.5049-10	R10	1	1000 ± 10% ohm 1/2 watt carbon resistor
22.5042-5	R11,14	2	510 ± 5% ohm 1/2 watt carbon resistor
22.7041-10	R12	1	470 ± 10% ohm 2 watt carbon resistor
22.7081-10	R13	1	22,000 ± 10% 2 watt carbon resistor
22.5073-10	R15	1	10,000 ± 10% ohm 1/2 watt carbon resistor
22.6073-10	R16,19	2	10,000 ± 10% ohm 1 watt carbon resistor
22.5045-10	R17,18	2	680 ± 10% ohm 1/2 watt carbon resistor
22.5085-10	R20	1	33,000 ± 10% ohm 1/2 watt carbon resistor
22.1218-1	SH1,2,3	3	9 pin tube shield
22.1496	SW1	1	Bandswitch
22.1419-1	T1	1	Power transformer
22.740-4	TS1	1	4 terminal strip
22.1519	V1	1	Type 6BS8/ECC189 vacuum tube
22.1323	V2,3	2	Type 6U8 vacuum tube
22.1356	V4	1	Type 6X4 vacuum tube
71.91-100	W1	32"	Black plastic covered wire
71.91-105	W2	16"	Green plastic covered wire
71.91-102	W3	12"	Red plastic covered wire
71.32-160	W4	21"	50 ohm Subminax cable
22.741	W5	1	Line cord
71.27-122	W6	20"	#20 tinned copper wire
22.1207	XV1,2,3	3	9 pin shielded miniature tube socket
22.975	XV4	1	7 pin miniature tube socket
126-105	J3,J4	2	Crystal socket
22.1520-2	Y1	1	24 MC crystal
22.1520-5	Y2	1	39.333 MC crystal
2-250-43		1	Operating Manual
3-250-43		1	Alignment Procedure
4-250-43		1	Assembly Details
250-43-2 (28 to 30 mc IF)			Same as 250-43-1 except: Use crystal 22.1520-1 in place of 22.1520-2. Use crystal 22.1520-4 in place of 22.1520-5.
250-43-3 (14 to 18 mc IF)			Same as 250-43-1 except: Use crystal 22.1520-3 in place of 22.1520-2. Use crystal 22.1520-6 in place of 22.1520-5. Use coil 23.1175-16 in place of 23.1175-17 (L10). Use coil 23.1175-3 in place of 23.1175-5 (L14). Use resistor 22.6085-10 in place of 22.6073-10 (R16). Use choke 22.1516 in place of 22.1517 (L12).
250-43-4 (30.5-34.5 mc IF)			Same as 250-43-1 except: Use crystals 22.1520-6 in place of 22.1520-2. Use crystals 22.1520-7 in place of 22.1520-5. Use coil (L10) 23.1175-5 in place of 23.1175-17. Use coil (L14) 23.1175-17 in place of 23.1175-5. Use capacitor (C26) 22.4439-10 in place of 22.4432-10.



NOTES:
1. SWITCH IS IN 2 METER POSITION.
2. SW1 & SW3 VIEWED FROM REAR.
3. SW2 VIEWED FROM REAR.
4. RESISTOR VALUES IN OHMS UNLESS OTHERWISE SHOWN.
5. CAPACITANCE VALUES IN MICRO-MICROFARADS UNLESS OTHERWISE SHOWN.
6. L14, L15, Y1, Y2, L12, & R15 DEPEND ON I.F. FREQUENCY.

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6N2 CONVERTER SCHEMATIC

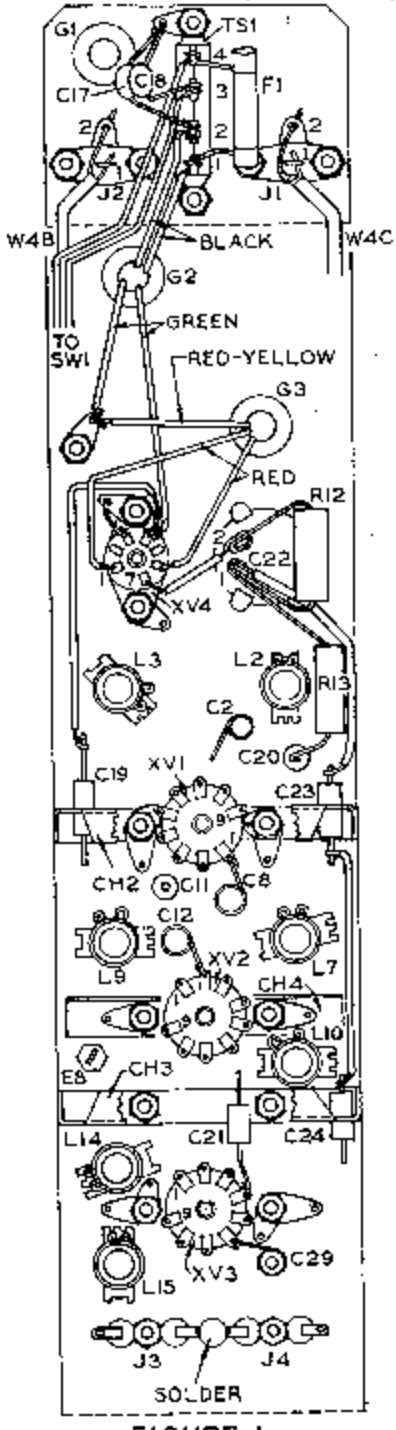


FIGURE 1.
CHASSIS - BOTTOM

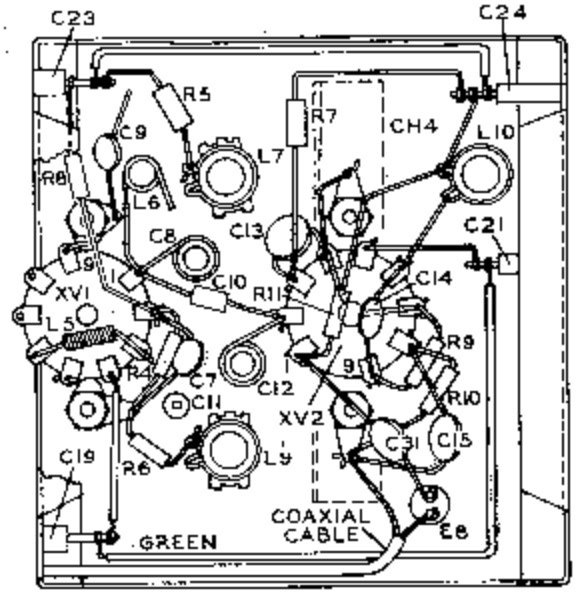


FIGURE 2.
MIXER AREA DETAIL

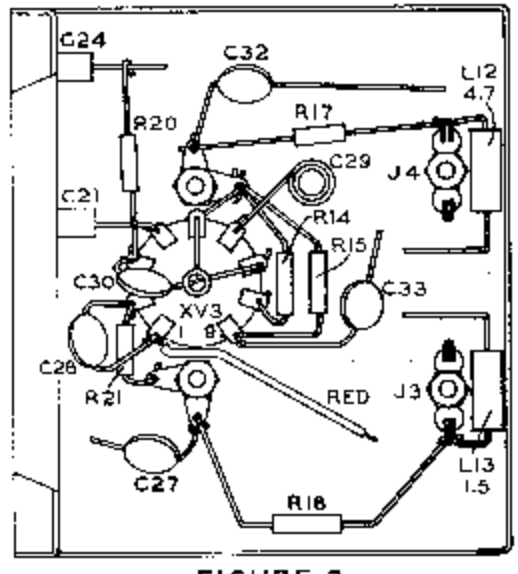
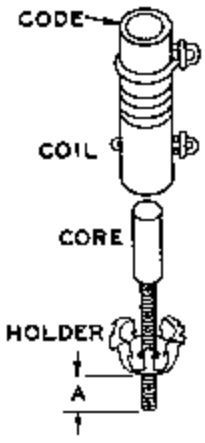


FIGURE 3.
OSCILLATOR DETAIL



STEP 1: TURN IRON CORES INTO COIL HOLDERS.
STEP 2: ADJUST DISTANCE "A" AS PER CHART.
STEP 3: PUSH COIL AND COIL HOLDER TOGETHER. OBSERVE CLIP ORIENTATION DETAIL.

COIL	TURNS	CODE	CORE *	"A" (INCHES)
L2	18	RED-BLACK	5001	15/32
L3	18	GREEN	5001	9/16
L7	12	BROWN-WHITE	5001	9/32
L9	10	BROWN-GRAY	5001	1/2
L15	11	ORANGE	5005	9/16


L2,3,14,15

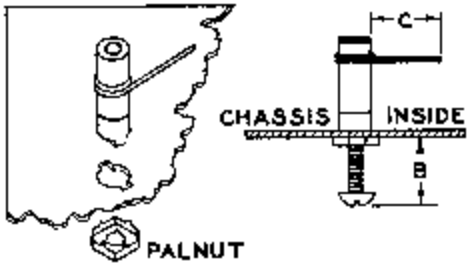
L10 AND L14 DEPEND ON CONVERTER MODEL

	L10	L14	
-1	BROWN-VIOLET	GREEN	26-30 MC
-2	BROWN-VIOLET	GREEN	28-30 MC
-3	BROWN-BLUE	ORANGE	14-18 MC
-4	GREEN	BROWN-VIOLET	30.5 - 34.5 MC
"A"	1/2	5/8	
CORE	5005	5005	


L7,9,10

* 5001 CORE IS SMALLER-BLACK CORE

FIGURE 4, COIL ASSEMBLY




7/8 X 6-32 SCREW

CAPACITOR	"B"	"C"
C2	11/16	1/2
C8	23/32	5/8
C12	5/8	5/8
C29	23/32	1/2

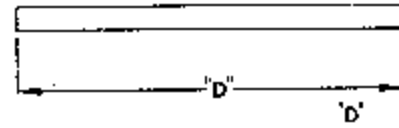
STEP 1: TURN NUT ONTO SCREW TO DISTANCE "B".

STEP 2: SCREW ASSEMBLY TOGETHER FINGER TIGHT.

STEP 3: USING A SMALL WRENCH TURN NUT 1/3 TURN ADDITIONAL.

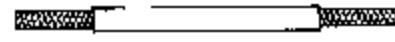
FIGURE 5
TRIMMER ASSEMBLY

STEP 1: CUT THREE LENGTHS OF COAXIAL CABLE.

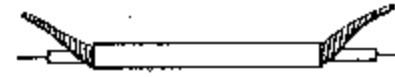


NO. 1 - W4A ——— 4 INCHES
NO. 2 - W4B ——— 6 1/2 INCHES
NO. 3 - W4C ——— 7 INCHES

STEP 2: STRIP 3/4" OUTER COVER OFF EACH END.



STEP 3: UNBRAID SHIELD AND TWIST TOGETHER.



STEP 4: REMOVE 1/4" INSULATION OFF EACH END.

FIGURE 6
COAXIAL CABLES

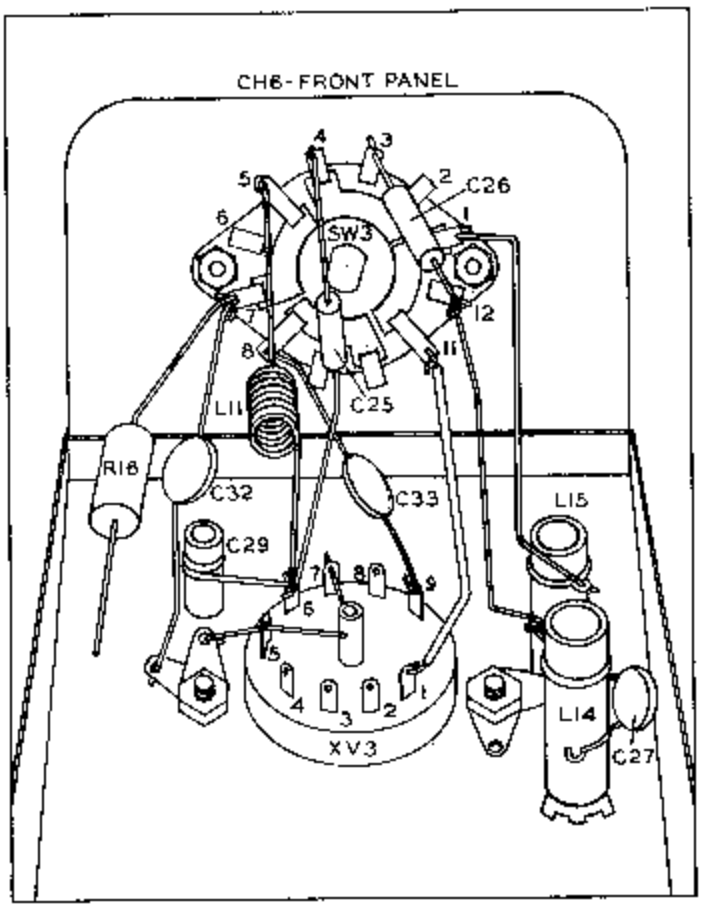


FIGURE 7.
OSCILLATOR AREA

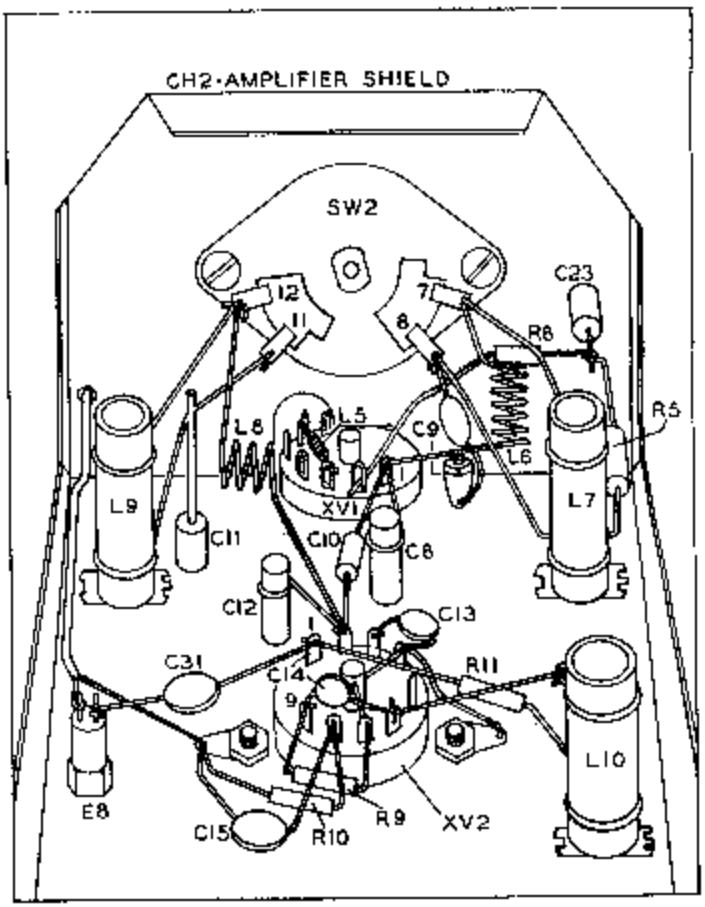


FIGURE 8.
MIXER AREA

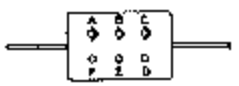
COLOR	SIGNIFICANT FIGURE	DECIMAL MULTIPLIER	TOLERANCE %	VOLTAGE RATING *
BLACK	0	1	—	—
BROWN	1	10	1	100
RED	2	100	2	200
ORANGE	3	1,000	3	300
YELLOW	4	10,000	4	400
GREEN	5	100,000	5	500
BLUE	6	1,000,000	6	600
VIOLET	7	10,000,000	7	700
GRAY	8	100 MEGS (UP)	8	800
WHITE	9	1000 MEG. (UP)	9	900
GOLD	—	0.1	5	1000
SILVER	—	0.01	10	2000
NO COLOR	—	—	20	500

* APPLIES TO CONDENSERS ONLY.

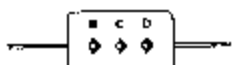


COLOR CODING OF FIXED RESISTORS

A - FIRST SIGNIFICANT FIGURE OF RESISTANCE IN OHMS.
B - SECOND SIGNIFICANT FIGURE.
C - DECIMAL MULTIPLIER.
D - RESISTANCE TOLERANCE IN PERCENT. IF NO COLOR SHOWN TOLERANCE IS ± 20 %.



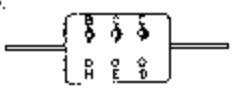
JAN FIXED CAPACITORS



RMA 3-DOT CODE 300 VOLT ± 20 %

COLOR CODING OF FIXED CONDENSERS

A - TYPE: MICA BLACK, PAPER SILVER.
B - FIRST SIGNIFICANT FIGURE OF CAPACITY.
C - SECOND SIGNIFICANT FIGURE
D - DECIMAL MULTIPLIER.
E - TOLERANCE.
F - CHARACTERISTIC.
G - THIRD SIGNIFICANT FIGURE.
H - VOLTAGE RATING.



RMA 8-DOT CODE



5-DOT RADIAL LEAD CERAMIC CAPACITOR

A - TEMP. COEFFICIENT.
B - FIRST SIGNIFICANT FIGURE.
C - SECOND SIGNIFICANT FIGURE.
D - DECIMAL MULTIPLIER.
E - TOLERANCE.



MOLDED PAPER TUBULAR CAPACITOR

A - FIRST SIGNIFICANT FIGURE.
B - SECOND SIGNIFICANT FIGURE.
C - DECIMAL MULTIPLIER.
D - TOLERANCE.
E - FIRST SIGNIFICANT VOLTAGE FIGURE.
F - SECOND SIGNIFICANT VOLTAGE FIGURE.



BUTTON SILVER MICA CAPACITOR

A - CLASS
B - TOLERANCE
C - MULTIPLIER
D - THIRD DIGIT
E - SECOND DIGIT
F - FIRST DIGIT



4-DOT DISC CERAMIC RMA CODE



DIPPED MICA CAPACITOR

THE TOLERANCE RATING OF CAPACITORS IS DETERMINED BY THE COLOR CODE. FOR EXAMPLE: RED = 2%, GREEN = 5%, ETC. THE VOLTAGE RATING OF CAPACITORS IS OBTAINED BY MULTIPLYING THE COLOR VALUE BY 100. FOR EXAMPLE: ORANGE = 3 X 100 OR 300 VOLTS. BLUE = 6 X 100 OR 600 VOLTS.

THE PHYSICAL SIZE OF CARBON RESISTORS IS DETERMINED BY THEIR WATTAGE RATING. CARBON RESISTORS MOST COMMONLY USED ARE 1/2 WATT. HIGHER WATTAGE RATED RESISTORS WHEN SPECIFIED ARE PROGRESSIVELY LARGER PHYSICALLY.

STANDARD COLOR CODE

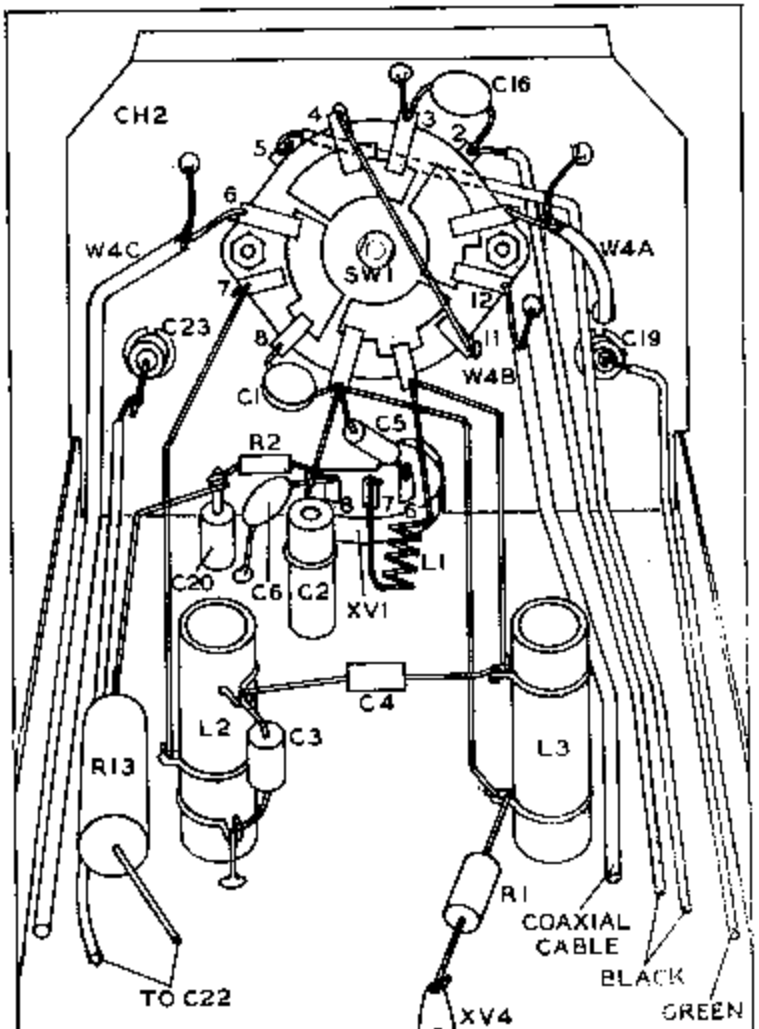


FIGURE 9.
R.F. GRID AREA

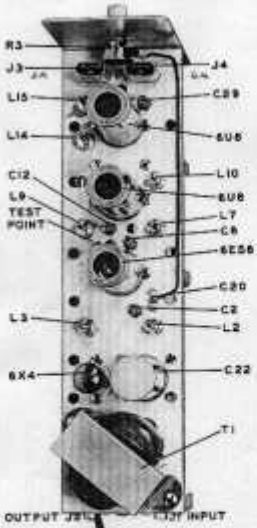


FIGURE 10
TOP VIEW

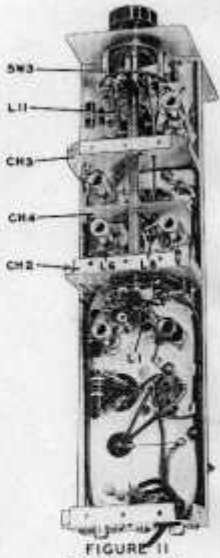


FIGURE 11
BOTTOM VIEW