UNCLASSIFIED

NAVSHIPS 93493

TECHNICAL MANUAL

FOR

RADIO SET

AN/SRC-17(XN-1)

MANSON LABORATORIES, INC
375 FAIRFIELD AVENUE
STAMFORD, CONNECTICUT

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS

UNCLASSIFIED

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From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Technical Manual for Radio Set AN/SRC-17(XN-1)
NAVSHIPS 93493

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Chief of Bureau

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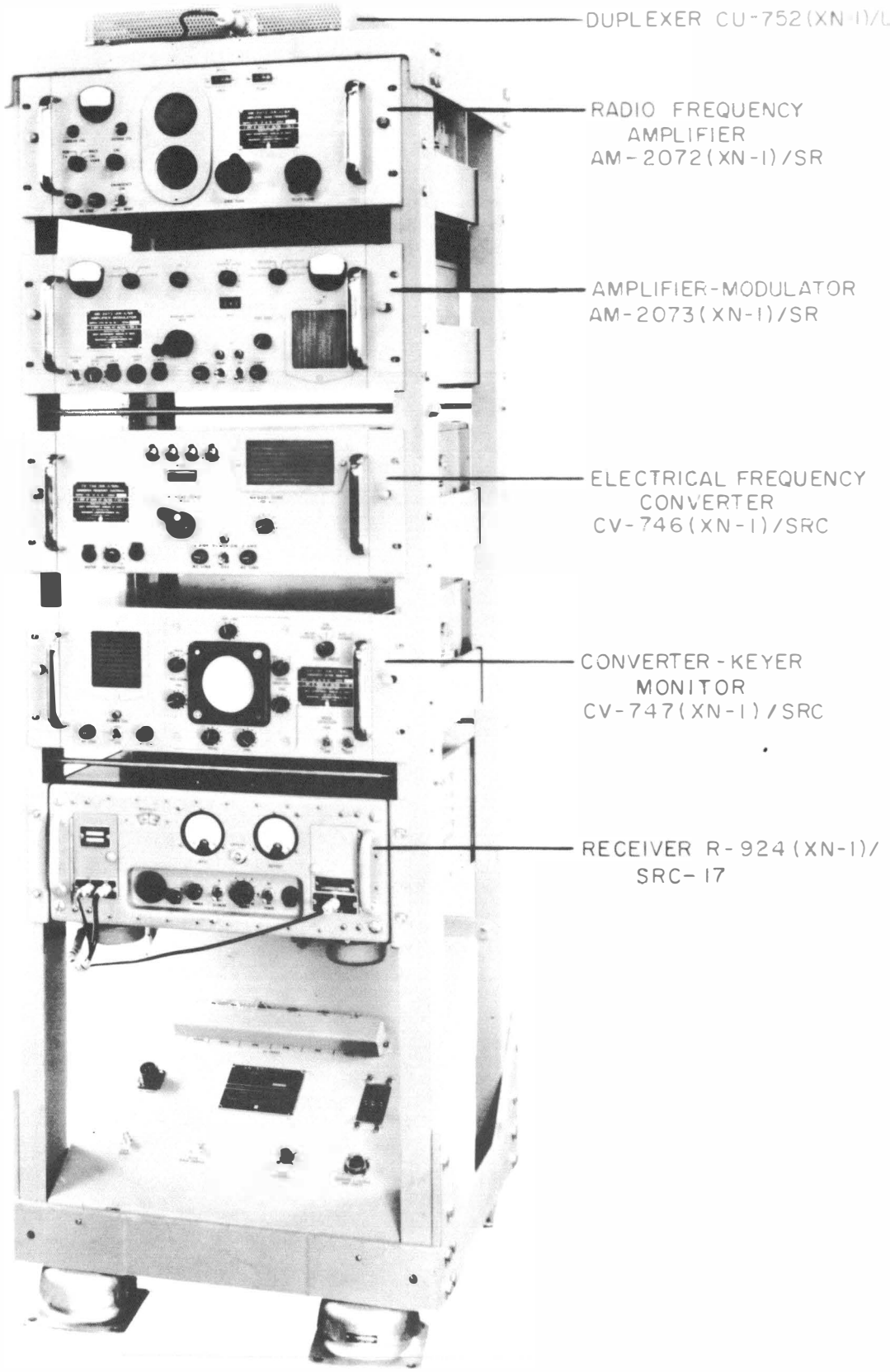

FIGURE 1-1. RADIO SET AN/SRC-17 (XN-1)

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION (see figure 1-1)

The Radio Set AN/SRC-17(XN-1) consists of the following sub-sections:

a. Electrical Frequency Converter CV-746(XN-1)/SRC, NAVSHIPS 93494

b. Converter-Keyer-Monitor CV-747(XN-1)/SRC, NAVSHIPS 93495

c. Receiver R-924(XN-1)/SRC-17, NAVSHIPS 93496

d. Amplifier-Modulator AM-2073(XN-1)/SR, NAVSHIPS 93497

e. Radio Frequency Amplifier AM-2072(XN-1)/SR, NAVSHIPS 93498

f. Duplexer CU-752(XN-1)/U, NAVSHIPS 93499

The Radio set is designed to transmit 100 watts of FM carrier or a 100% voice modulated AM carrier, and to receive either FM or AM.

1-2. REFERENCE DATA

a. RADIO SET AN/SRC-17(XN-1)

(1) Contract No. and Date: NObsr 72730, 18 June 1957.

(2) Cognizant Naval Inspection: INM, Bridgeport, Conn.

(3) Contractor: Manson Laboratories, Inc., Stamford, Conn.

(4) Application: Ship and shore.

(5) Frequency Range: 225 to 400 mc

(6) Power Requirements: 115 vac, 50/60 cycles, single phase, 1.5 kw

b. ELECTRICAL FREQUENCY CONVERTER CV-746(XN-1)/SRC

(1) Frequency Range: $\frac{225}{3}$ to $\frac{400}{3}$ mc for transmitter;
$\frac{243.6}{3}$ to $\frac{418.6}{3}$ mc for receiver in 33 kc steps.

(2) Type of Frequency Control: Crystal synthesizer

(3) Total crystals employed: 11 (supplied with equipment)

(4) Stability: 1 part 10^8 for 1 mc reference oscillator;
5 parts 10^6 for incremental oscillator

(5) Temperature range: 0° to 65°C

(6) Output impedance: 50 ohms to transmitter;
90 ohms to receiver

(7) Output power: 0.5 to 1.5w to transmitter;
100 mw to receiver

c. CONVERTER-KEYER-MONITOR CV-747(XN-1)/SRC

Converter

(1) Local oscillator frequency: 16.835 mc

(2) Limiting: 80 db change above 10 uv in antenna input results in 1 db change in output.

(3) Sensitivity: 30 db quieting for antenna input of 30 uv.

(4) Discriminator sensitivity: 0.3v/kc.

(5) Clipping level: 18 db.

Keyer

(1) Carrier frequency: AM, 6.2 mc; FSK, 6.2 mc ∠ 6.66 kc.

(2) Mark frequency: 6.2 mc ∠ 6.66 kc.

(3) Space frequency: 6.2 mc - 6.66 kc.

(4) Frequency stability: 5 parts in 10^7

(5) Temperature range: 0° to 60°C

(6) Maximum bit rate: 13,000 bits per second.

(7) Phase distortion (jitter): 7% at maximum bit rate.

(8) Data input level: ∠ 5v, ∠ 20% or 0 to -5v, ∠ 20%.

(9) Data input impedance: 2.5K minimum.

(10) Data output level: ∠ 5v ∠ 10%.

(11) Data output impedance: 2K.

Monitor Generator

(1) Frequency: 30 to 9000 cps.

(2) Signal level: 0 to -5v.

(3) Signal rise and fall time: Less than 1 microsecond.

Monitor Oscilloscope

(1) Vertical amplifier sensitivity: 1v/cm.

(2) Vertical amplifier bandwidth: 400 kc.

(3) Sweep frequency ranges(cps): 2 to 20; 12 to 140; 110 to 1150; 900 to 8500.

d. RECEIVER R924(XN-1)/SRC-17

(1) Tuning bands: Complete coverage of frequency with 19 turns of tuning control.

(2) Number of preset frequencies: Manual tuning: none; Crystal tuning: one.

(3) Type of frequency control: Crystal controlled oscillator.

(4) Type of receiver: Superheterodyne

(5) I-f frequency output: 18.6 mc ± 2 kc, 30 mv minimum into 90-ohm load.

(6) Oscillator injection: 100 mv minimum into 90-ohm load.

(7) TR gating voltage: -12v

(8) Full recovery time: 100 microseconds maximum.

(9) Audio channel maximum output: 60 mw into 600-ohm load or 600 mw into 60-ohm load.

(10) Maximum audio distortion: 7%

(11) Phone jack maximum output: 60 mw into 600 ohm load.

(12) Scanning channel output: 10 microvolts minimum; across 50-ohm load for input signal of 25 uv maximum.

(13) Type of reception: AM signals, voice; FM signals, FSK.

(14) Maximum antenna input when transmitting: 2_W

(15) Crystal type: JAN type CR-24/U

(16) Crystal frequencies: 20.3000 to 34.8833 mc

(17) Silencing range: Up to 15,000 uv minimum input

(18) Silencer audio output reduction: 40 db maximum

(19) Antenna input impedance: 51 ohms

(20) Audio channel output impedance: 600 ohms

e. AMPLIFIER-MODULATOR AM-2073(XN-1)/SR

(1) Frequency range: 225/3 to 400/3 mc input;
225 to 400 mc output

(2) Input power: 0.5 to 1.5 w

(3) Input impedance: 50 ohms

(4) Output power: 10 to 15 w

(5) Output impedance: 50 ohms

(6) Audio input: 0.15 to 3 v

(7) Audio input impedance: 600 ohms

(8) Modulation power output: 2.5 w maximum

(9) Modulation distortion: 10% maximum

(10) Percent modulation: 95% screen modulation

(11) Clipping: 16 to 20 db

(12) AGC: ±30 db change in input above input level
results in ±3 db change in output

(13) Microphone: Carbon or dynamic

f. RADIO FREQUENCY AMPLIFIER AM-2072(XN-1)/SR

(1) Frequency range: 225.0 to 400.0 mc

(2) Power output: 100 watts carrier, FM;
100% voice modulated carrier, AM

g. DUPLEXER CU-752(XN-1)/U

(1) Power level: 400w maximum peak power
200w average peak power

(2) Pulse rate: 500 cycles maximum

(3) Duty cycle: 50% maximum

(4) Power leakage: Less than 1w across the band at 100w level

(5) Recovery time: 100 microseconds

(6) Bandwidth: 225 to 400 mc

(7) VSWR: 1.6:1 maximum

(8) Insertion loss: 0.8 db maximum

(9) ATR: Gas cell, series element

(10) TR: Gas cell, shunt element

(11) Firing power: 20w minimum input

SECTION 2

INSTALLATION

2-1. INSTALLATION (see figures 2-1 and 2-2.)

The radio set is designed to be deck-mounted. Four shock mounts on the bottom of the rack are provided for securing the unit to the deck. In addition, two mounts at the upper rear of the rack are provided for securing the radio set to a bulkhead.

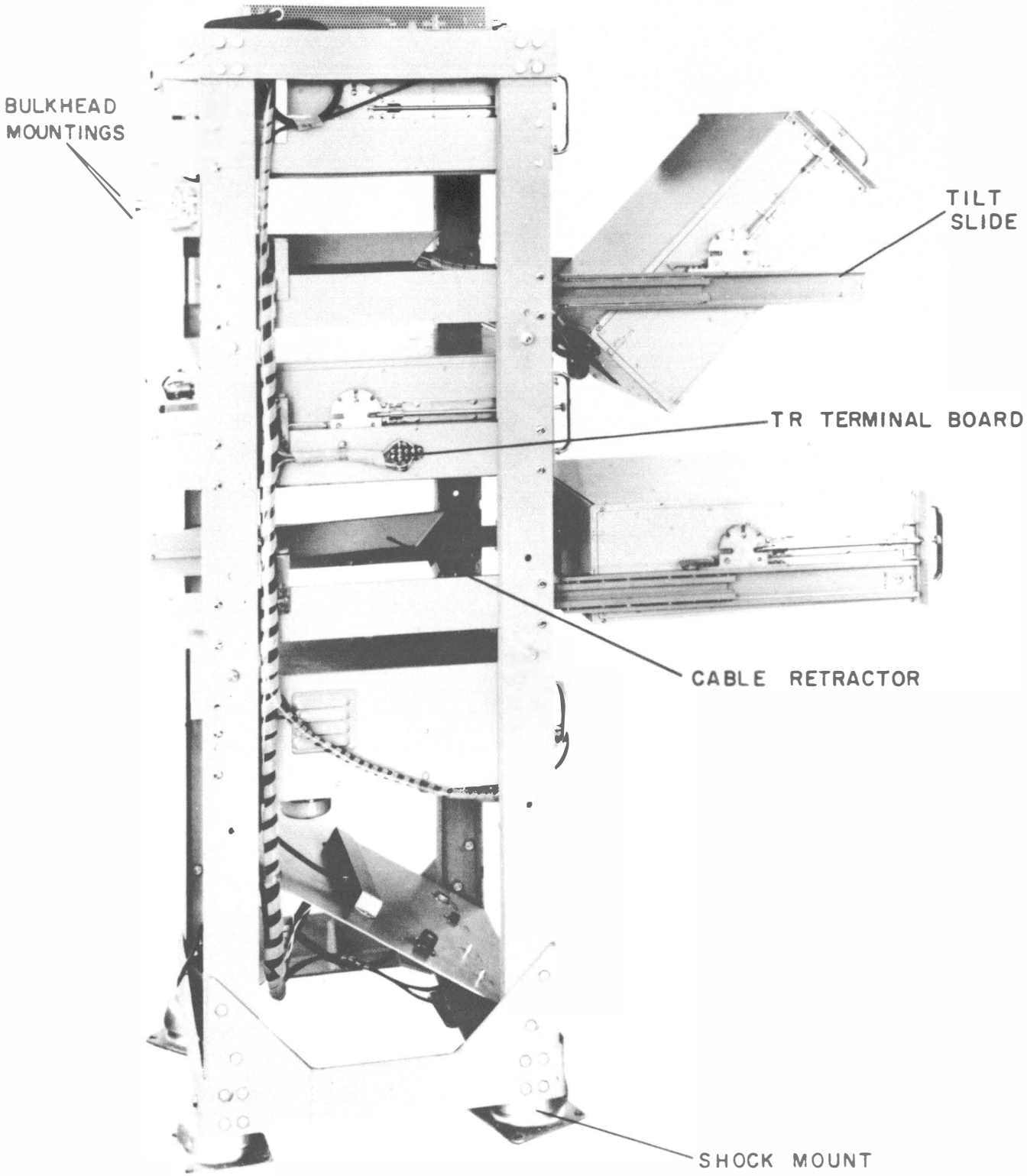

FIGURE 2-1 SIDE VIEW OF RADIO SET

SECTION 3

OPERATOR'S SECTION

3-1. CONTROLS AND INDICATORS

The table below lists the front-panel controls and indicators and their functions. Refer to the individual instruction manuals for detailed locations.

Table 3-1. CONTROLS AND INDICATORS

CONTROL OR INDICATOR	FUNCTION
Electrical Frequency Converter CV-746(XN-1)/SRC	
POWER ON-OFF switch	Turns the power on or off in the unit.
POWER on indicator lamp	Indicates that the power is on.
MANUAL TUNE MCS control	Manually tunes the unit to the desired frequency in megacycles. The frequency is read on the MCS counters and on the first three MCS indicator lamps.
MANUAL TUNE 100 kc switch	Tunes the unit in 100 kc steps which appear as the final digit on the fourth MCS indicator lamp.
MCS indicator lamps	Indicate the frequency to which the unit is tuned.
MCS indicator counters	Indicate the frequency to which the MANUAL TUNE MCS control is tuned.
TEST POINTS switch	Connects the seven test points to the METER jack.
METER jack	Makes available each of the seven test points (as selected by the TEST POINTS switch) for monitoring by an external meter.
Converter-Keyer-Monitor CV-747(XN-1)/SRC	
POWER ON-OFF switch	Turns the power on or off in the unit.
POWER ON indicator lamp	Indicates that the power is on.
MOD. SELECTOR switch	Switches the unit for the type of input signal.
DATA-TEST switch	Selects the desired keying input signal.

SCOPE INPUT switch	Selects the type of signal to be monitored on the scope.
RCVR OUTPUT	The converter output signal is displayed on the scope.
FSK INPUT	The remote data input signal is displayed on the scope, with the DATA-TEST switch in the DATA position.
TEST SIGNAL	The internal test signal is displayed on the scope, with the DATA-TEST switch in the TEST position.
SWEEP FREQ. COARSE switch	Turns the scope on or off and coarsely adjusts the sweep frequency.
SWEEP FREQ. FINE control	Finely adjusts the sweep frequency of the scope.
VERT. CENT. control	Centers the sweep on the scope in the vertical plane.
SYNC. control	Synchronizes the sweep on the scope.
FOCUS control	Focuses the scope presentation.
TEST SIGNAL switch	Selects the desired type of test signal.
OFF position	There is no test signal output. This corresponds to a mark signal.
SPACE position	A space test signal is generated.
ON position	A square wave consisting of space and mark signals is generated. This corresponds to the full test signal.

Receiver R-924(XN-1)/SRC-17

POWER ON-OFF switch	Turns the power on or off in the unit.
CRYSTAL indicates lamp	Indicates that the unit is under crystal control and the power is on.
DIMMER control	Adjusts the intensity of the panel lights.
LOCK control	Locks the tuning control.
MEGACYCLES indicator	Indicates the frequency to which the unit is tuned by the tuning control.
INPUT meter	Indicates the relative strength of the input signal when the AM FSK switch is in the AM position.

OUTPUT meter	Indicates the receiver output in db.
N.L. switch	Switches the noise limiting circuit in or out.
A.F. LEVEL control	Sets the audio output level.
SILENCER control	Sets the silencing circuit level.
ALIGN-REC. switch	Sets the receiver to the receive condition or align condition.
OSC switch	Selects the desired mode of operation.
CRYSTAL position	The receiver tuning is crystal controlled.
MANUAL position	The receiver tuning is manually controlled.
MOD. SELECTOR switch	Selects the type of signal to be received.
AM position	The received signal is AM.
FSK position	The received signal is FSK.

Amplifier-Modulator AM-2073(XN-1)/SR

POWER ON-EMER. OFF switch	Allows for emergency removal of power to the unit and connects the input power.
START-STOP switch	A momentary contact switch to start or stop the unit by applying or removing power.
START indicator lamp	Indicates that power is applied to the unit.
FSK-AM switch	Selects the desired type of transmission to be amplified. In AM position the FSK operation is in standby.
MANUAL TUNE MCS control	Coarse tunes the amplifier to the input frequency.
FINE TUNE control	Fine tunes the amplifier to the input frequency.
MCS indicator	Indicates the frequency set by the MANUAL TUNE MCS control.
EARPHONE JACK	Allows for connection of a headset to monitor the modulating signal.

EARPHONE LEVEL control	Sets the audio level in the headset.
HANDSET jack	Allows for operation of the amplifier by a remote handset.
MIKE jack	Allows for connection of a microphone for voice modulation.
R-f meter switch	Selects the type of r-f reading on the r-f meter.
FORWARD position	The forward power in the output line is read on the r-f meter.
BACK position	The back power in the output line is read on the r-f meter.
CAL. position	The meter is calibrated for VSWR reading.
V.S.W.R. position	The VSWR in the output line is read on the r-f meter.
R-f meter	Indicates the various readings as selected by the r-f meter switch.
CAL. control	Calibrates the r-f meter for VSWR readings with the r-f meter switch in the CAL position.
D-c meter switch	Selects the stage to be monitored on the d-c meter.
TRIP. GRID position	The tripler grid current is read on the d-c meter.
TRIP. PLATE position	The tripler plate current is read on the d-c meter.
PA GRID position	The final amplifier-grid current is read on the d-c meter.
PA PLATE position	The final amplifier plate current is read on the d-c meter.
MOD. LEVEL position	The audio modulation level is read on the d-c meter.
REMOTE position	All AM operations (microphone, earphones and handset) are remotely controlled.

Radio Frequency Amplifier AM-2072(XN-1)/SR

EMERGENCY ON-OFF-RESET switch	Resets the overload relay and allows for application or removal of power.

POWER ON indicator lamp	Indicates that the power is on in the amplifier.
GRID TUNE control	Tunes the amplifier grids to the input frequency.
MCS-GRID indicator	Indicates the frequency to which the grids are tuned.
PLATE TUNE control	Tunes the amplifier plates to the input frequency.
MCS-PLATE indicator	Indicates the frequency to which the plates are tuned.
CARRIER ON indicator lamp	Indicates that the carrier on control on the Amplifier-Modulator has been depressed.
Meter switch	Select the type of reading on the meter.
IB position	The plate current of the amplifier tubes is read on the meter.
FOR position	The forward output power is read on the meter.
BACK position	The backward output power is read on the meter.
CAL. position	The meter is calibrated for VSWR reading.
VSWR position	The VSWR in the output line is read on the meter.
Meter	Indicates the various readings as selected by the meter switch.
CAL control	Calibrates the meter (with the switch in the CAL position) for VSWR reading.

3-2. SEQUENCE OF OPERATION

To operate the radio set, each subunit must be individually energized and tuned. Follow the sequence below:

a. Check that the power cable is connected to the relay-rack panel and that all r-f cables are connected from the relay rack to the subunits, and between subunits. Refer to figures 4-1 and 5-1. Check that all subunits are properly fused.

b. Disconnect the TR input plug from the TR input jack on the relay-rack panel.

c. Set the main circuit breaker on the relay rack to the ON position.

d. Set the RF OUTPUT LEVEL control on Amplifier-Modulator AM-2073 (XN-1)/SR fully counterclockwise.

e. Set the POWER switch on Amplifier-Modulator AM-2073(XN-1)/SR to the ON position. Set the EMERGENCY ON-OFF-RESET switch on Radio Frequency Amplifier AM-2072(XN-1)/SR to the ON position.

f. Energize and tune Electrical Frequency Converter CV-746(XN-1)/SRC as follows:

(1) Set the power switch to the POWER ON position. The POWER ON indicator lamp should light. After a one-minute time delay the MCS numerical indicator lamps should light. If the third indicator lamp does not light, slightly rotate the MANUAL TUNE MCS control until it clicks into position. The lamp should now light.

(2) Set the electrical frequency converter to the desired frequency by rotating the MANUAL TUNE MCS control until the first three digits of the desired frequency appear in the counter window and on the first three indicator lamps.

NOTE

A detent switch on the MANUAL TUNE MCS control assures that the control is properly set on frequency. If the control is not properly engaged in its detent, the third numerical indicator lamp will not light. Correct realignment of the control by rotating it slightly in either direction until it clicks into position, will cause the indicator lamp to light.

(3) An external reference oscillator may be connected in place of the built-in oscillator. To connect the external reference, disconnect plug P500, and connect plug P501 to the regenerative divider jack.

NOTE

At least one-hour warm-up is necessary for maximum stability from the built-in frequency standard of the electrical frequency converter. The equipment should be continuously operated even under conditions where its output is not required for short periods of time.

g. Energize and tune Converter-Keyer-Monitor CV-747(XN-1)/SRC for the desired mode of operation. The converter-keyer-monitor may be operated either AM or FSK. Refer to the proper table below for the sequence of operation of the desired mode of operation:

TABLE 3-2. AM OPERATIONAL SEQUENCE

SWITCH	POSITION	NORMAL INDICATION
POWER	ON	POWER ON indicator lamp lights
MOD. SELECTOR	AM	
TEST SIGNAL	OFF	
DATA-TEST	TEST	
SCOPE INPUT	RCVR OUTPUT	Scope presentation (If necessary, adjust the scope controls for a presentation.)

TABLE 3-3. FSK OPERATIONAL SEQUENCE

SWITCH	POSITION	NORMAL INDICATION
POWER	ON	POWER ON lamp lights
MOD. SELECTOR	FSK	
TEST SIGNAL	OFF	
DATA-TEST	DATA	
SCOPE INPUT	FSK INPUT	Scope presentation (If necessary, adjust the scope controls for a presentation.)

h. Energize and tune Receiver R-925(XN-1)/SRC-17 for the desired mode of operation. The receiver may be operated in any one of three modes: crystal, using an internal crystal as the frequency standard; crystal, using the electrical frequency converter as the frequency standard; and manual, using no

frequency standard. Energize the receiver for the desired mode of operation as described in the following paragraphs:

(1) For crystal control, using an internal crystal as the frequency standard, insert a crystal of the desired frequency in the holder on the left panel of the receiver. Disconnect the plug from the OSC IN jack and set the controls, in order, to the position specified in the table below:

CAUTION

The plug removed from the OSC IN jack must be connected to a 100-ohm load.

TABLE 3-4. INTERNAL CRYSTAL-CONTROLLED OPERATION

CONTROL	POSITION	NORMAL INDICATION
CRYSTAL-MANUAL	CRYSTAL	
N.L.	OUT	
SILENCER	OUT	
A.F. LEVEL	Fully clockwise	
ALIGN-REC	REC.	
PHONES	8	
MOD. SEL.	FSK or AM, as selected on the converter-keyer-monitor	
POWER	ON	CRYSTAL lamp lights after a one-minute delay

(2) For crystal control, using the electrical frequency converter as the frequency standard, remove (if necessary) the crystal from its holder on the left panel of the receiver. Make sure that the electrical frequency converter is connected to the OSC IN jack at the left side of the receiver, and set the controls, in order, to the position specified in the table below:

TABLE 3-5. CONVERTER-CONTROLLED OPERATION

CONTROL	POSITION	NORMAL INDICATION
CRYSTAL-MANUAL	CRYSTAL	
N.L.	OUT	
SILENCER	OUT	
A.F. LEVEL	Fully clockwise	
ALIGN-REC	REC	
PHONES	8	
MOD. SEL.	FSK or AM, as selected on the converter-keyer-monitor	
POWER	ON	CRYSTAL lamp lights with a one-minute delay.

(3) For manual control, using no frequency standard, set the controls, in order, to the position specified in the table below:

TABLE 3-6. MANUAL-CONTROLLED TUNING

CONTROL	POSITION
CRYSTAL-MANUAL	MANUAL
N.L.	OUT
SILENCER	OUT
A.F. LEVEL	Fully clockwise
ALIGN-REC	REC
PHONES	8
MOD. SEL.	FSK or AM, as selected on the converter-keyer-monitor
POWER	ON

(4) For crystal control, using an internal crystal as the frequency standard, rotate the tuning control on the receiver until the crystal frequency appears on the MEGACYCLES indicator dial.

(5) For crystal control, using the electrical frequency converter as the frequency standard, rotate the tuning control on the receiver until the desired frequency (as set on the electrical frequency converter) appears on the MEGACYCLES indicator dial.

(6) For manual control, using no frequency standard, rotate the tuning control on the receiver to the desired frequency.

(7) Check the INPUT meter reading. If it is not zero, adjust the INP MTR. control for a zero reading on the INPUT meter.

NOTE

If the receiver is operated FSK, and the transmitter position of the radio set is not used, the TR IN jack on the receiver must be shorted.

(8) Refer to the receiver instruction book for operation of the SILENCER, N.L., PHONES and A.F. LEVEL controls.

i. Tune Amplifier-Modulator AM-2073(XN-1)/SR as follows:

(1) For FSK operation, set the FSK-AM switch to the FSK position. Make sure that the d-c meter switch is in the P.A. PLATE position.

(2) For AM operation, set the FSK-AM switch to the AM position, and proceed as follows:

(a). Plug the microphone into the MIC jack.

(b). Plug the earphones into the EARPHONE jack.

(c). Set the d-c meter switch to the MOD level position.

(d). Depress the press-to-talk switch on the microphone, and speak into the microphone. Observe the following normal indications: The AM carrier indicator lamp should light, the d-c meter reading should fluctuate and the voice should be heard in the earphones.

(e). Adjust the EARPHONE LEVEL control to a comfortable level of listening.

(3) With the FSK-AM switch in the FSK position, or the switch in the AM position and the press-to-talk switch on the microphone depressed, tune the amplifier as follows:

(a). Set the r-f meter switch to the FOR position.

(b). Adjust the RF OUTPUT LEVEL control until the r-f meter indicates one watt.

(c). Rotate the MANUAL TUNE MCS control to the frequency on the electrical frequency converter.

(d). Adjust the FINE TUNE control for maximum reading on the r-f meter.

(e). The counter reading should be in the immediate vicinity of the counter reading of the electrical frequency converter. Always tune for maximum output power, rather than a correct counter reading.

NOTE

In the REMOTE position of the d-c meter switch, all AM operations of the microphone, earphones and handset are remotely controlled by standard Navy remote control units 23496 and 23497.

NOTE

Under FSK operation, the Amplifier may be placed in the standby condition by setting the AM-FSK switch to the AM position.

j. Energize and tune Radio Frequency Amplifier AM-2072(XN-1)/SR as follows:

(1) Set the EMERGENCY POWER ON-OFF switch to the ON position.

(2) Set the meter switch to the IB position.

(3) After a one-minute delay, tune the GRID TUNING control for a plate current indication.

(4) Set the meter switch to the FOR position, and tune the PLATE TUNING control for maximum power output.

(5) Set the meter switch to the IB position, and retune the GRID TUNING control for a maximum plate current indication.

(6) Set the meter switch to the FOR position, and retune the PLATE TUNING control for maximum power output.

(7) The MCS GRID and MCS PLATE indicators should indicate the approximate frequency set on the electrical frequency converter.

(8) Increase output drive from the Amplifier-Modulator AM-2073 (XN-1)/SR until 100 watts is indicated on the AM-2072 Amplifier wattmeter.

3-3. The radio set may be monitored on the following subsections as follows:

a. To check the unit for proper FSK operation, set the following switches on Converter-Keyer-Monitor CV-747(XN-1)/SRC, in order, to the position specified in the table below:

TABLE 3-7. MONITORING OPERATIONAL SEQUENCE

SWITCH	POSITION	NORMAL INDICATION
MOD. SELECTOR	FSK	
DATA-TEST	TEST	
SCOPE INPUT	TEST SIGNAL	
TEST SIGNAL	ON	Square wave on scope
TEST SIGNAL	SPACE	Horizontal trace on scope
TEST SIGNAL	OFF	Horizontal trace on scope
SCOPE INPUT	FSK INPUT	
DATA-TEST	DATA	Square wave from remote unit on scope

b. To check the amplifier section for proper operation, set the switches on Amplifier-Modulator AM-2073(XN-1)/SR as indicated below.

(1) To monitor the r-f output, proceed as follows:

(a). Set the r-f meter switch to the FOR position. Adjust the R.F. OUTPUT LEVEL control for 100 watts output from Radio Frequency Amplifier AM-2072(XN-1)/SR. At this level, the r-f meter on Amplifier-Modulator AM-2073(XN-1)/SR should indicate approximately 10 watts. Under no circumstances should this meter read more than 15 watts.

(b). Set the r-f meter switch to the CAL position. Adjust the CAL control for a full-scale reading on the r-f meter.

(c). Set the r-f meter switch to the V.S.W.R. position. The r-f meter should indicate a maximum VSWR of 1.5.

(2) With the amplifier locally operated, the individual stages in the unit may be monitored. The normal readings on the d-c meter for the various positions of the d-c meter switch are listed in the table below:

TABLE 3-8. D-C METER READINGS

SWITCH POSITION	METER READING
MOD LEVEL	
PA PLATE	
PA GRID	
TRIP. PLATE	
TRIP. GRID	

c. To check the receiver for proper operation, the INPUT and OUTPUT meters are provided. The INPUT meter indicates the presence of a received signal and its relative strength. The OUTPUT meter, under AM operation, indicates the signal-to-noise ratio.

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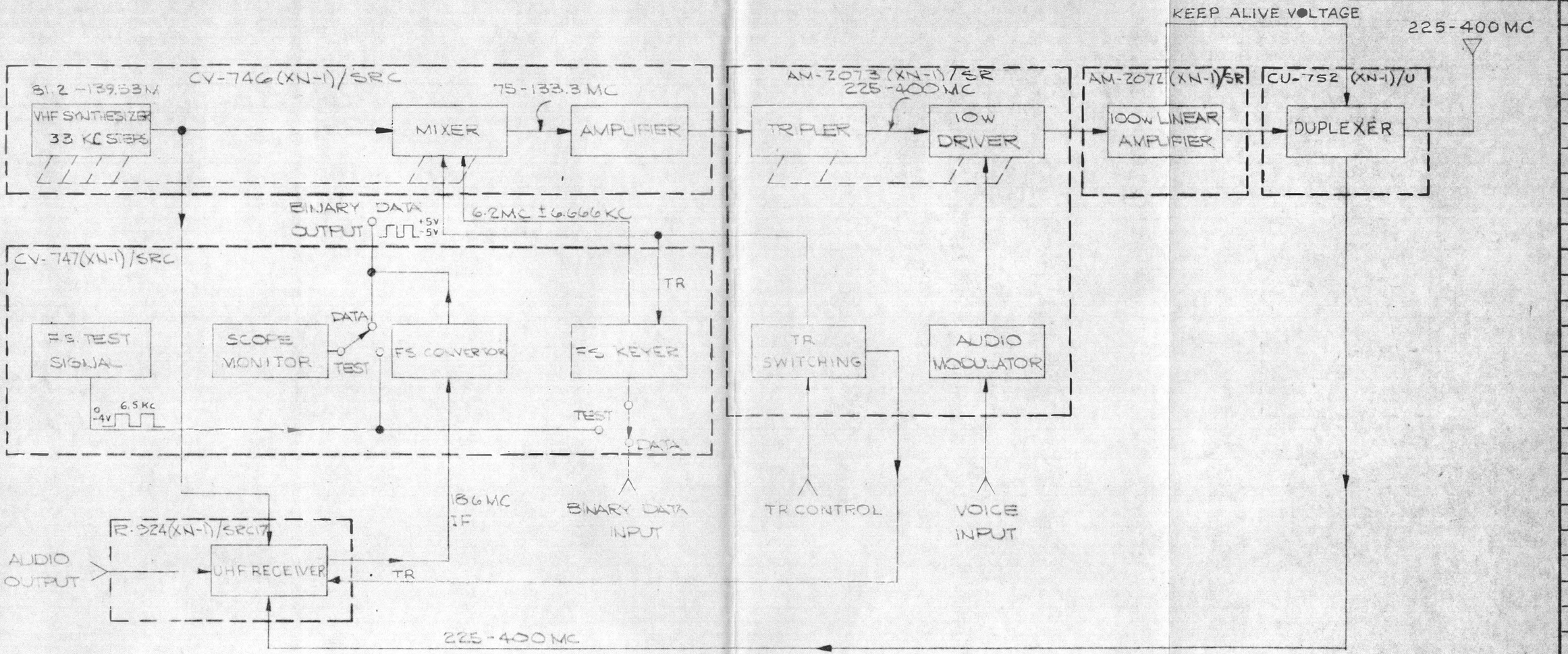


FIGURE 4-1

NOTE
ALL UNITS FITTED WITH INDEPENDENT POWER SUPPLIES AND CONTROL EQUIPMENT

REQ.	REQ.	PART NO.	ITEM	DESCRIPTION	MAT.	FIN.
GROUP 1	GROUP 2	USED ON / ASSEMBLY / REQ.				

BLOCK DIAGRAM OF RADIO SET AN/SRC-17(XN-1)

RV 9-4-56

DRAWN BY	CHECKED BY	ELEC. DES. APP.
	MJR	
MECH. DES. APP.	FINAL APP.	

MANSON LABORATORIES, INC.
STAMFORD, CONN.

ISSUE

TOLERANCES UNLESS NOTED: UP TO 6" FRACT. ± 1/64 DEC. ± .005 ANG. ±½° ; 6" TO 24" DIM. ± 1/32 DIM. ± .010 DIM.

MATERIAL: ~ FINISH: ~ SCALE: ~ ~

IF IT IS FOUND DESIRABLE TO CHANGE ANY TOLERANCE OR OTHER DETAIL SPECIFIED ON THIS DRAWING, NOTIFY THE PURCHASER PROMPTLY.

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND DEVIATIONS WILL BE CAUSE FOR REJECTION. REMOVE ALL BURRS AND SHARP EDGES.

PART NO. B-N283A-X6 | ISSUE

SECTION 4

PRINCIPLES OF OPERATION

4-1. This section describes the general principles of operation of the radio set. For detailed circuit analysis, refer to the individual instruction books.

4-2. OVERALL DESCRIPTION (See figure 4-1.). - The radio set consists of three basic sections: an oscillator and an amplifier (which constitute the transmitter portion) and a receiver. The oscillator section (Electrical Frequency Converter CV-746(XN-1)/SRC) consists of a VHF synthesizer which develops a highly stable output of 81.2 to 139.53 mc. This output acts both as the receiver local oscillator and the transmitter VFO. For the transmitter, the output is mixed with the 6.2 mc frequency developed by Converter-Keyer-Monitor CV-747(XN-1)/SRC. The resultant 75 to 133.3 mc output is amplified and fed to Amplifier-Modulator AM-2073(XN-1)/SR. Input to the amplifier-modulator is tripled to a 225 to 400 mc carrier and amplified to a 10-watt level. An audio modulator circuit provides for modulating the carrier. A TR switching circuit disables the output of the converter-keyer-monitor and the input of the electrical frequency converter in receive condition; in transmit condition it disables the receiver output.

The 10-watt output is fed to Radio Frequency Amplifier AM-2072 (XN-1)/SR where it is amplified to a 100-watt level. This amplified output is coupled to the antenna by the duplexer. A keep-alive voltage for the TR and ATR tubes in the duplexer is supplied by the radio frequency amplifier. Under receive conditions, the duplexer switches the antenna to the receiver.

The receiver local oscillator frequency is normally obtained from the electrical frequency converter. The receiver is capable of AM or FSK reception. In FSK operation, the received signal is amplified by the

receiver and fed to the converter-keyer-monitor. The converter-keyer-monitor, as its nomenclature indicates, has a threefold function. As a converter, it converts the receiver FSK signal to a lower if and discriminates the signal for data information. As a monitor, it develops a test signal to substitute for the data input, which can be monitored on an oscilloscope. As a keyer, it acts as a side-step oscillator to develop a 6.2 mc ∠ 6.66 kc signal for FSK transmission. In addition, it generates the 6.2 mc frequency required for AM operation. Both signals (6.2 mc or 6.2 mc ∠ 6.66 kc) are fed to the electrical frequency converter mixer stage.

4-3. GENERAL THEORY OF OPERATION (See figure 4-2.)

a. ELECTRICAL FREQUENCY CONVERTER

The output of the oscillator is fed into a regenerative divider which divides the input reference frequency of 1 mc to 333 kc. The 333 kc signal is amplified by a power amplifier, which is the driving source for a passive magnetic modulator in the spectrum generator. The output of the spectrum generator consists of very sharp pulses. These pulses are coupled to a ringing circuit which selects the desired harmonic frequency. The harmonic frequency is filtered through a high-pass and band-pass circuit and fed to the mixer. The spectrum signal is mixed with the output of the VFO buffer, and produces the first if of 16.66 mc. This signal feeds the second mixer and in conjunction with incremental oscillator frequency produces the second if of 1.66 mc. The second if is amplified, limited, and fed to a frequency-based discriminator. The discriminator reference is the 1.66 mc signal generated from the 5th harmonic of the 333 kc spectrum generator. When the two frequencies feeding the discriminator are in phase, there is no d-c output. If a phase difference occurs, the voltage developed is passed through a low-pass filter and d-c amplifier to a reactance modulator across the VFO. The discriminator is a combined phase and frequency

discriminator, in which the output of the discriminator produces d-c voltage when two phase-locked signals are applied. The d-c output is also obtained when two frequencies differing by more than one cycle are applied. The d-c voltage fed to the reactance modulator causes the VFO to change its frequency and thus reduce the frequency difference. At this point phase locking occurs in the discriminator and the VFO is phase-captured at the new frequency. The VFO output is mixed in the gated mixer with the output of the converter-keyer-monitor. A gate driver disables the mixer with the application of a TR pulse when the radio set is receiving. This eliminates any carrier output. The 75 to 133.3 mc carrier is amplified by the r-f amplifier and fed to the amplifier-modulator.

b. AMPLIFIER-MODULATOR

(1) Input to the tripler stage is from the electrical frequency converter. The tripled output is coupled to the power amplifier from which it is fed to the radio frequency amplifier via a low-pass filter and a directional coupler. A meter monitors the forward and back power, and the voltage standing wave ratio (VSWR) in the output line.

(2) The microphone input is amplified by two audio amplifiers. An AGC voltage, developed at the output of the second amplifier is fed back via the AGC switch to the inputs of the two amplifiers. The output of the second amplifier is fed to a high-pass filter and a clipper. A switch selects either the "sine" wave from the high-pass filter, or the "square wave" from the clipper. The selected audio signal is fed to an audio amplifier. The output of the amplifier is fed to a modulator which modulates the r-f signal in the power amplifier.

(3) A TR (transmit) switching circuit provides a sharp pulse for a rapid (20 microsecond duration) change-over from "receive" to "transmit" condition in the electrical frequency converter, converter-keyer-monitor and the receiver. When the output pulse of the switching circuit is at zero

volts, the receiver is "off" and the transmitter is "on."

c. RADIO FREQUENCY AMPLIFIER

The 10-2att input, from the amplifier-modulator, is fed to a push-pull Class B r-f amplifier. The resultant 100-watt signal is fed through a low-pass filter to eliminate frequencies above 400 mc. From the low-pass filter the signal is routed to the duplexer via a directional coupler. A meter monitors the forward and back power, and the VSWR in the output line. A power supply furnishes a ⁄350-volt keep alive voltage for the TR and ATR tubes in the duplexer.

d. DUPLEXER

The duplexer functions as a switch to connect the transmitter to the antenna in transmit condition, and the receiver to the antenna in receive condition. In transmit, the series ATR (anti-transmit-receive) tube fires and completes the circuit between the transmitter and the antenna, while the shunt TR (transmit-receive) tube fires and shorts the input to the receiver, so that no transmitted power is applied to the receiver. In the receive condition, neither tube fires, and the input is fed only to the receiver, since the transmitter input is now open. A tuning stub in the receiver arm of the duplexer matches the receiver input to the TR tube.

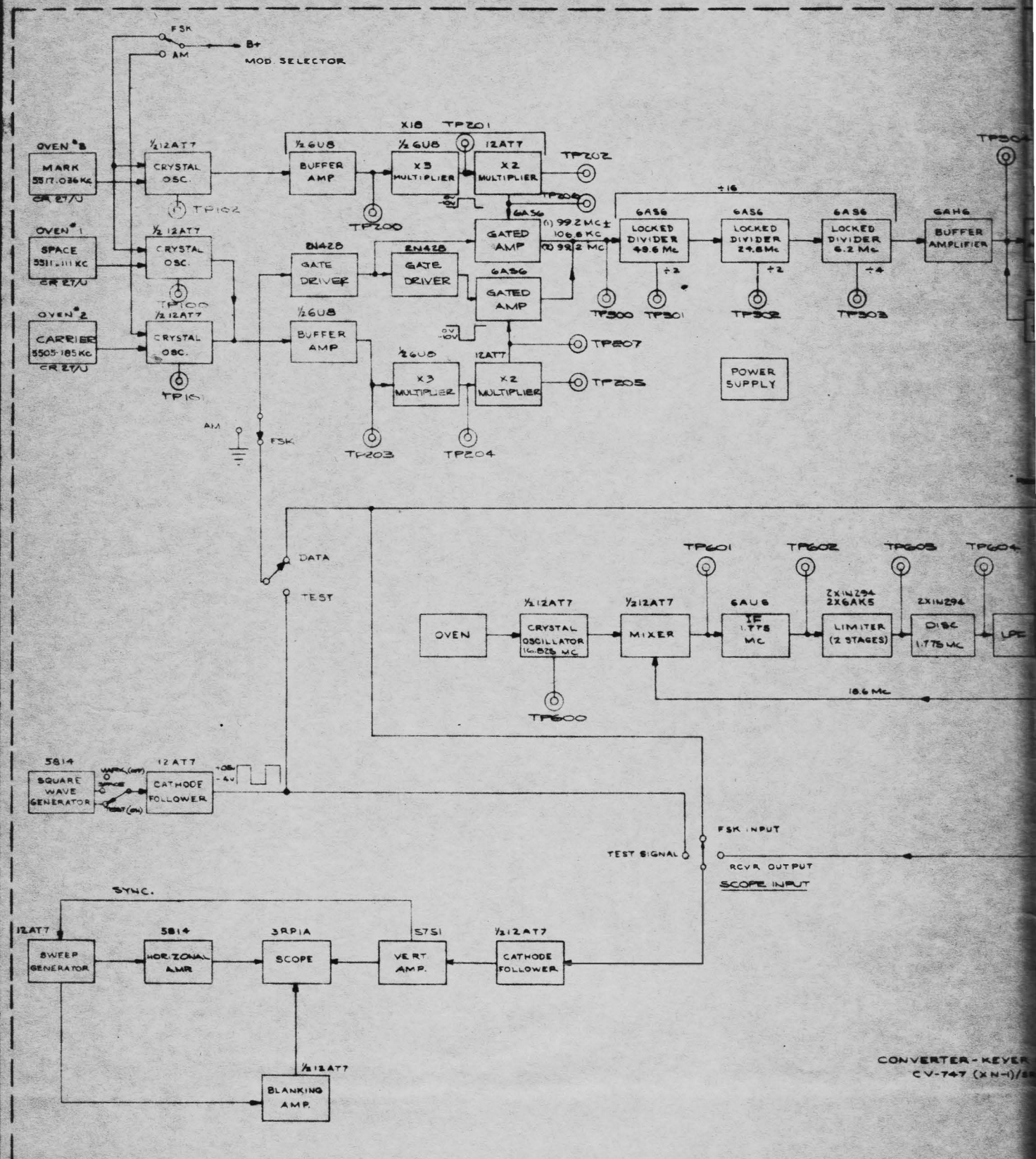
e. CONVERTER-KEYER-MONITOR

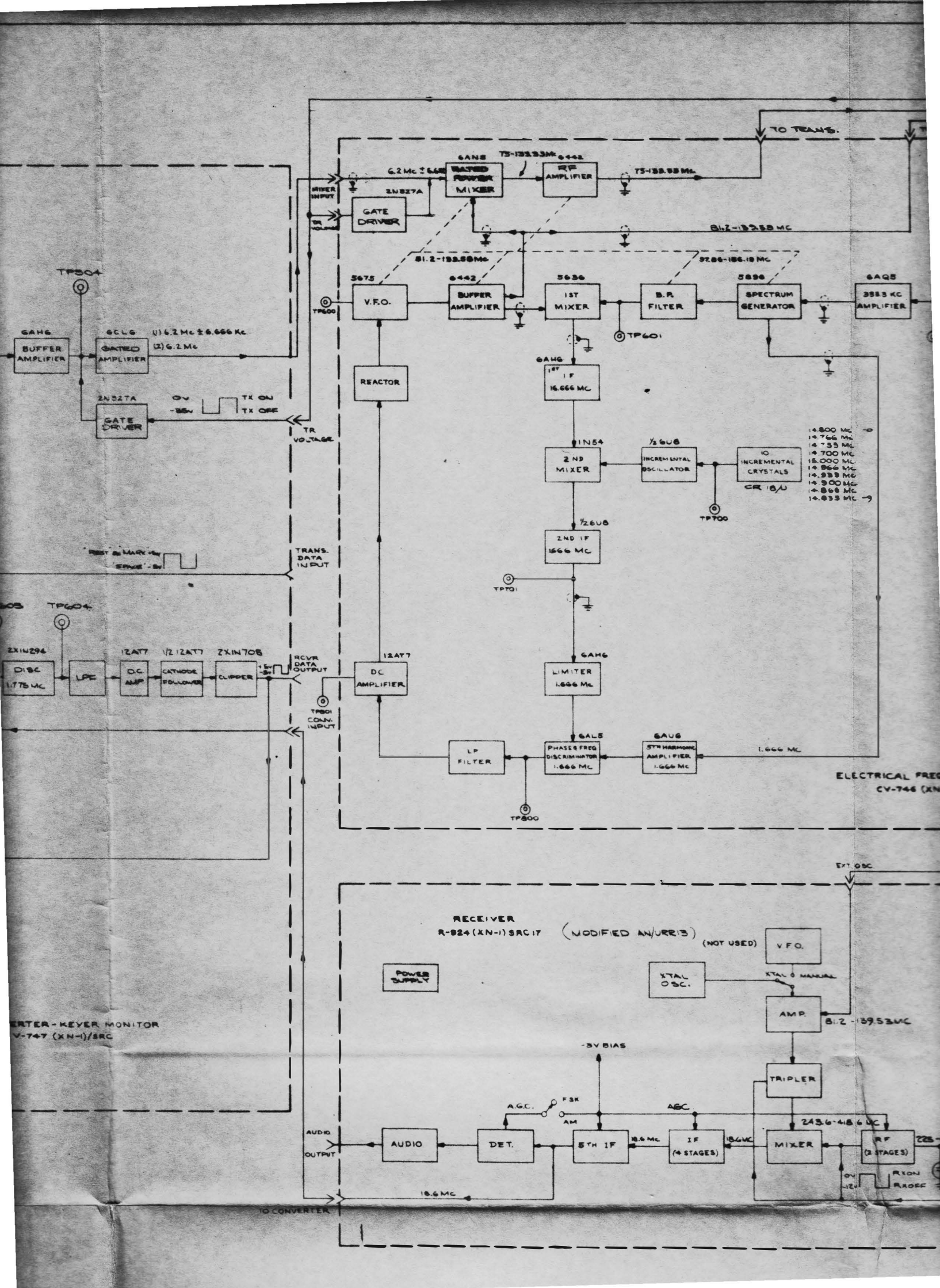
(1) Three crystal oscillators supply space, carrier, and mark frequencies, respectively. The selected oscillator output is fed to a multiplier circuit. In AM operation, the multiplier consists of the lower section. In FSK operation, both multiplier circuits are used. The miltiplied outputs are fed to their respective gated amplifiers. In FSK operation, each amplifier is alternately cut off by an external gate signal, or an internal test gate signal, fed through a driver. In AM operation there is no gating action, and the signal is only amplified. The outputs

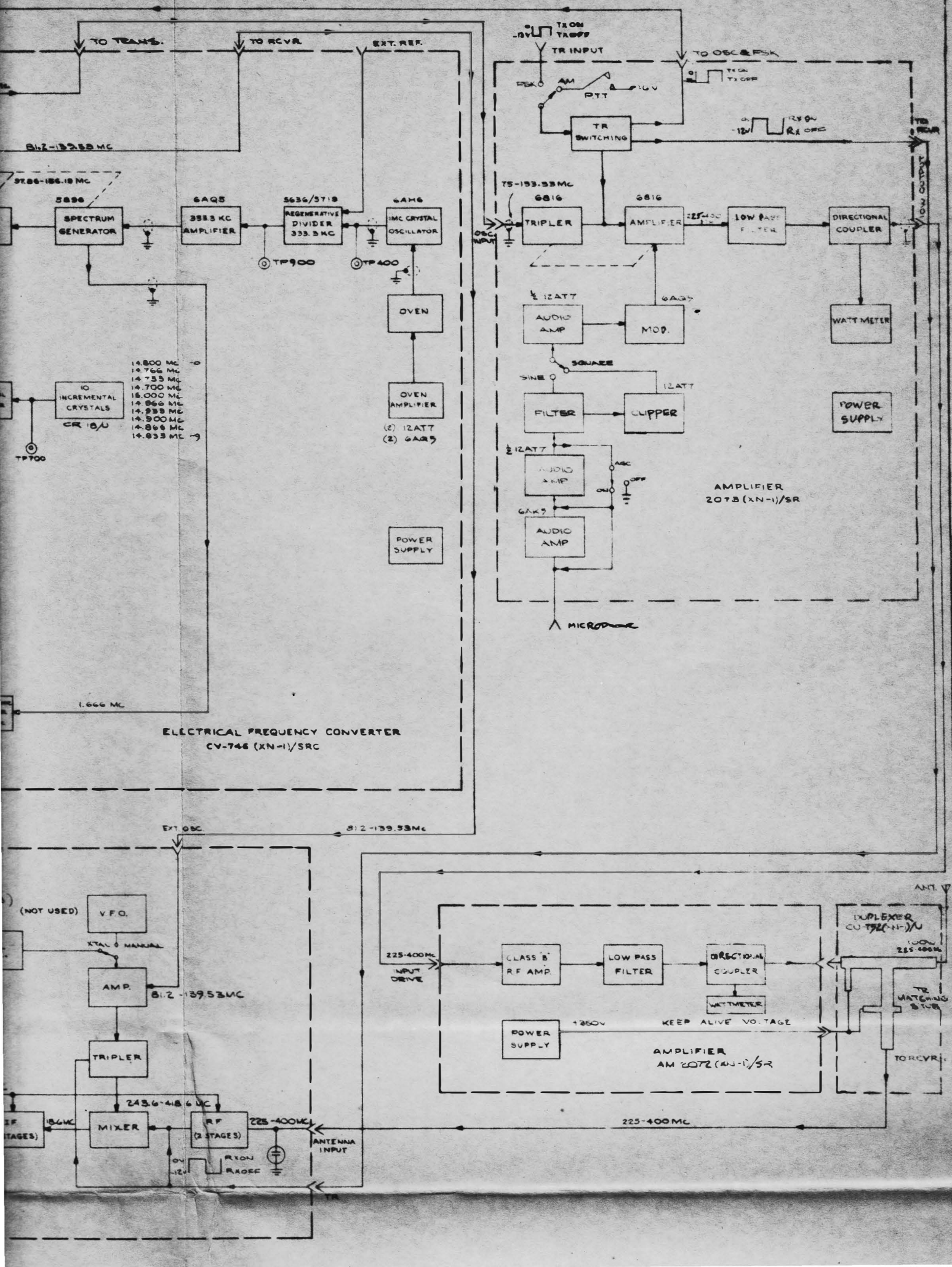
of the gated amplifiers are either a fixed frequency in AM operation, or a fixed-frequency shifted signal in FSK operation. The output signal is divided, amplified and fed to the electrical frequency converter. A TR pulse gates the final amplifier to cut it off under receive conditions.

(2) The converter circuit provides a second stage of conversion in FSK operation for the receiver. A crystal oscillator output beats with the incoming signal from the receiver in the mixer. The resultant if is amplified, fed to two limiter stages, and discriminated. The detected output is amplified and returned via the cathode follower to the receiver. A clipper shapes and clips the high-level output to a low-level square wave.

(3) The monitoring circuit consists of a square-wave generator with a cathode-follower output and an oscilloscope. The conventional circuits in the oscilloscope include a cathode-follower input, push-pull vertical and horizontal amplifiers, sweep generator, and a blanking amplifier.


FSK
AM
B+
MOD. SELECTOR
OVEN #0
MARK
5517.036 Kc
CR 27/U
OVEN #1
SPACE
5511.111 KC
CR 27/U
OVEN #2
CARRIER
5505.185 Kc
CR 27/U
½ 12AT7
CRYSTAL OSC.
TP102
TP100
TP101
½6U8
BUFFER AMP
X18
TP201
½6U8
X3 MULTIPLIER
12AT7
X2 MULTIPLIER
TP202
TP200
6AS6
GATED AMP
6) 99.2 MC ± 106.8 KC
99.2 MC
EN428
GATE DRIVER
÷16
6AS6
LOCKED DIVIDER 49.6 Mc
÷2
6AS6
LOCKED DIVIDER 24.8 Mc
÷2
6AS6
LOCKED DIVIDER 6.2 Mc
÷4
6AH6
BUFFER AMPLIFIER
TP300
TP301
TP302
TP303
TP304
TP207
TP205
TP203
TP204
POWER SUPPLY
AM
FSK
DATA
TEST
TP601
TP602
TP603
TP604
OVEN
½12AT7
CRYSTAL OSCILLATOR 16.825 MC
½12AT7
MIXER
6AU6
IF 1.775 MC
2X1N294 2X6AK5
LIMITER (2 STAGES)
2X1N294
DISC 1.775 MC
LPF
18.6 Mc
TP600
5814
SQUARE WAVE GENERATOR
MARK (OFF)
SPACE
TEST (ON)
12AT7
CATHODE FOLLOWER
+0V
-4V
FSK INPUT
TEST SIGNAL
RCVR OUTPUT
SCOPE INPUT
SYNC.
12AT7
SWEEP GENERATOR
5814
HORIZONAL AMP
3RP1A
SCOPE
S7S1
VERT. AMP.
½12AT7
CATHODE FOLLOWER
½12AT7
BLANKING AMP.
CONVERTER-KEYER
CV-747 (XN-1)/


TO TRANS.
6AN8
GATED POWER MIXER
6442
RF AMPLIFIER
TS-133.33Mc
TS-133.33 Mc
6.2 Mc ± 6.66 Kc
MIXER INPUT
2N327A
GATE DRIVER
TR VOLTAGE
81.2-139.53 MC
81.2-133.53Mc
97.86-186.19 Mc
TP504
5675
V.F.O.
6442
BUFFER AMPLIFIER
5636
1ST MIXER
B.P. FILTER
5836
SPECTRUM GENERATOR
6AQ5
3333 KC AMPLIFIER
TP600
TP601
6AH6
BUFFER AMPLIFIER
6CL6
GATED AMPLIFIER
(1) 6.2 Mc ± 6.666 Kc
(2) 6.2 Mc
REACTOR
6AH6
1ST I.F. 16.666 MC
2N327A
GATE DRIVER
0V
-35V
TX ON
TX OFF
TR VOLTAGE
1N54
2ND MIXER
½6U8
INCREMENTAL OSCILLATOR
10 INCREMENTAL CRYSTALS
CR 18/U
14.800 Mc
14.766 Mc
14.733 Mc
14.700 Mc
15.000 Mc
14.966 Mc
14.933 Mc
14.900 Mc
14.866 Mc
14.833 Mc
TP700
½6U8
2ND I.F. 1666 MC
TP701
TRANS. DATA INPUT
TP604
2XIN294
DISC 1.775 Mc
LPF
12AT7
D.C. AMP
½ 12AT7
CATHODE FOLLOWER
2XIN706
CLIPPER
RCVR DATA OUTPUT
12AT7
DC AMPLIFIER
6AH6
LIMITER 1.666 Mc
TP801
CONN. INPUT
6AL5
PHASE & FREQ. DISCRIMINATOR 1.666 Mc
6AU6
5TH HARMONIC AMPLIFIER 1.666 Mc
1.666 MC
LP FILTER
TP800
ELECTRICAL FREQ
CV-746 (XN
EXT OSC.
RECEIVER
R-824 (XN-1) SRC 17
(MODIFIED AN/URR13)
(NOT USED)
V.F.O.
POWER SUPPLY
XTAL OSC.
XTAL O MANUAL
AMP.
81.2 - 139.53MC
-3V BIAS
TRIPLER
A.G.C.
F3K
AM
AGC
243.6-418.6 MC
AUDIO OUTPUT
AUDIO
DET.
5TH IF
18.6 Mc
IF (4 STAGES)
18.6MC
MIXER
RF (2 STAGES)
RION
RADEF
18.6 Mc
TO CONVERTER
ERTER-KEYER MONITOR
V-747 (XN-1)/SRC


TO TRANS.
TO RCVR
EXT. REF.
81.2-139.53 MC
97.86-186.18 MC
5896
SPECTRUM GENERATOR
6AQ5
333.3 KC AMPLIFIER
5636/5718
REGENERATIVE DIVIDER 333.3 KC
6AH6
1MC CRYSTAL OSCILLATOR
TP900
TP400
OVEN
OVEN AMPLIFIER
(2) 12AT7
(2) 6AQ5
POWER SUPPLY
10 INCREMENTAL CRYSTALS
CR 18/U
14.800 MC
14.766 MC
14.733 MC
14.700 MC
15.000 MC
14.966 MC
14.933 MC
14.900 MC
14.866 MC
14.833 MC
TP700
1.666 MC
ELECTRICAL FREQUENCY CONVERTER
CV-746 (XN-1)/SRC
TX ON
TX OFF
TR INPUT
TO OSC & FSK
FSK
AM
P.T.T
+6V
TR SWITCHING
RX ON
RX OFF
-12V
TO ANT
75-133.33 MC
6816
TRIPLER
OSC INPUT
6816
AMPLIFIER
225 MC
LOW PASS FILTER
DIRECTIONAL COUPLER
LOW OUTPUT
WATT METER
½ 12AT7
AUDIO AMP
MOD.
6AQ5
SQUARE
SINE
12AT7
FILTER
CLIPPER
½ 12AT7
AUDIO AMP
AGC
ON
OFF
6AK5
AUDIO AMP
MICROPHONE
AMPLIFIER
207B (XN-1)/SR
EXT OSC.
81.2-139.53 MC
(NOT USED)
V.F.O.
XTAL & MANUAL
AMP.
81.2-139.53 MC
TRIPLER
243.6-418.6 MC
MIXER
186 MC
RF
(2 STAGES)
225-400 MC
ANTENNA INPUT
0V
-12V
RXON
RXOFF
TR
225-400 MC
INPUT DRIVE
CLASS B R.F AMP
LOW PASS FILTER
DIRECTIONAL COUPLER
WATTMETER
POWER SUPPLY
+350V
KEEP ALIVE VOLTAGE
AMPLIFIER
AM 6072 (XN-1)/SR
ANT.
DUPLEXER
CU-752 (XN-1)/U
100W
225-400 MC
TR MATCHING STUB
TO RCVR

SECTION 6

SERVICE & REPAIR

6-1. FAILURE REPORT

Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), and the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the tehcnical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember--there are two sides to the failure report—

"YOUR SIDE"

"Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

"BUREAU SIDE"

"The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest Forms and Publications Supply Point.

6-2. SERVICE

a. Check all fuses to make sure that the specified amperage rating is not exceeded.

b. Use the cable retractors and the tilt slides to remove the subsections from the rack.

c. Check all connectors on the rack and at the rear of each subsection to make sure they are well seated and securely attached.

d. The air filters should be cleaned weekly or after 100 hours of operation. Clean the filters with carbon tetrachloride or equivalent, and saturate the filters with a light oil, such as No. 10. Allow the excess oil to drip out. If necessary, remove the excess oil by manually whipping the filters or by forced-air blowing from an external high-pressure air supply.

6-3. REPAIR

Refer to the individual instruction books for test-point readings and voltage-measurement tables.

SECTION 7

PARTS LIST

7-1 INTRODUCTION

Reference designations (previously referred to as circuit symbols, reference symbols, etc.) have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, amplifier, electron tubes, etc. The number differentiates between parts of the same generic group. Parts of the same first major unit are numbered from 1 to 199; parts of the second 201 to 299, etc. Two consecutive series of numbers have been assigned to major units in which there are more than 100 parts of the same generic group. Sockets associated with a particular plug-in device, such as an electron tube or a fuse, are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for fuse F7 is designated XF7.

7-2 MAINTENANCE PARTS LIST

Table 7-1 lists all maintenance parts. The parts of each major unit are grouped together. Column 1 lists the reference series of each major unit, followed by the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and describes the various parts. Column 3 indicates how the part is used and gives its functional location in the equipment.

TABLE 7-1 PARTS LIST

NOTE

This parts list covers only the relay rack. Refer to the individual instruction books for complete parts lists of each subsection.

REF DES	DESCRIPTION	FUNCTION
CB1000	115 vac, 15A, 2 poles, Heinemann type 2263 circuit breaker	A-c line circuit breaker
J1000		A-c input to TB1000 distribution board
J1001	UG1055/U	Receiver data output
J1002	Same as J1001	Data input
J1003	Cannon MS3102A10SL3P(c)	100 watt control
J1004	Amphenol 165-27, 24 pins	Remote control
P100	Amphenol 165-30, 24 pins	Remote control to Amplifier-Modulator
P104	Cannon MS3106A10SL3(c)	A-c output to Amplifier-Modulator
P400	Same as P104	A-c output to Converter-Keyer-Monitor
P401	Same as P104	A-c output to Receiver
P502	UG1033/U	Receiver data input
P603	Same as P502	Data input
P800	Same as P104	A-c output to Electronic Frequency Converter
P1000	Cannon MS3106A16S-(c)	A-c input to distribution board TB1000
P1003	Cannon MS3106A10SL3S(c)	100 watt control plug
P1004	Same as P100	Remote control plug
TB1000	Terminal barrier strip, Cinch-Jones type 17-142	A-c distribution board