INSTRUCTION MANUAL

FT-620

YAESU MUSEN CO., LTD.

TOKYO JAPAN

SPECIFICATIONS

GENERAL

Frequency Range	50.0 ~ 50.5, 50.5 ~ 51.0, 51.0 ~ 51.5, 51.5 ~ 52.0 52.0 ~ 52.5, 52.5 ~ 53.0, 53.0 ~ 53.5, 53.5 ~ 54.0 (52.0 ~ 54.0 crystals are option.)
Mode	SSB (A3J) LSB or USB selectable AM (A3) CW (A1)
Power Requirements	12.5 ~ 14 volts DC negative ground (13.5 volts DC nominal), or 100/110/117/200/220/234 volts AC 50/60 Hz
Power Consumption	DC — 0.3A receive, 2A transmit AC — 16VA receive, 60VA transmit
Speaker	Internal dynamic speaker 10 cm diameter with provision for connecting external 4 ohms dynamic speaker
Microphone	Dynamic push-to-talk microphone with retractable coiled cord 10K ohms impedance
Dimensions	(W)280, (H)125, (D)295 m/m
Weight	Approx. 8 kg

TRANSMITTER

Final Input	SSB, CW 20 watts DC AM 8 watts DC
Carrier Suppression	40 db or better
Unwanted Sideband Suppression	40 db or better
Spurious Radiation	60 db below carrier
Frequency Response	300 ~ 2700 Hz within ±3 db
Antenna Impedance	50 ohms unbalanced

RECEIVER

Sensitivity	SSB — less than 0.5 μV input for 10 db STN/N AM — less than 1 μV input for 10 db STN/N
Selectivity	SSB — 2.5 KHz at -6 db 4.1 KHz at -60 db AM — 6 KHz at -6 db 10 KHz at -60 db (with optional AM filter)
Image Rejection	60 db or better
Audio Output	2.0 watts at 10% distortion 4 ohms unbalanced

SEMICONDUCTORS COMPLEMENT

Transistor	2SC1216	1
	2SC1306	1
	2SC1307	1
	2SC372Y	17
	2SC710D	3
	2SC735Y	2
	2SC784R	5
	2SC828Q	2
	2SD67E	1
	2SD313	2
FET	2SK19GR	5
	3SK39Q	2
Integrated Circuit	AN214R	1
	TA7045M	1
SCR	CW01B	1

Diode	1S145	1
	1S188FM	10
	1S1007	7
	1S1209	2
	1S1555	2
	1N4744	1
	DS130ND	1
	GP2-354	1
	TLR104	2
	V06B	12
	WZ061	1
	WZ110	1

FT-620 VHF SSB TRANSCEIVER

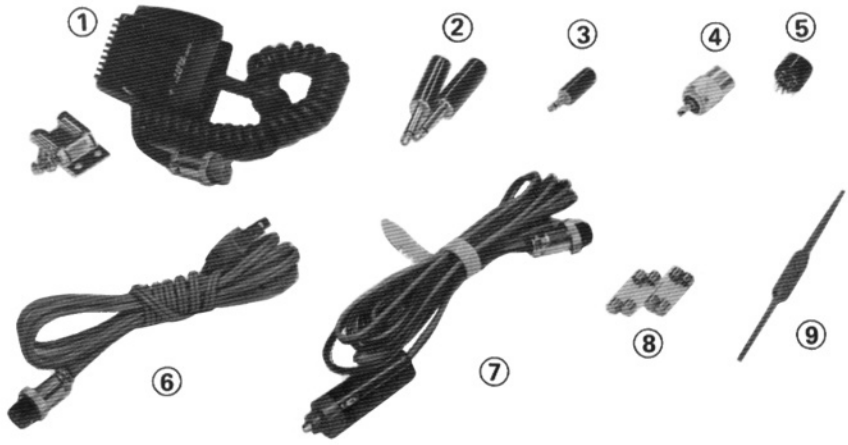
DESCRIPTION

The model FT-620 VHF SSB Transceiver is specifically designed to provide a high performance, compact transceiver for amateur VHF SSB service, base or mobile.

The FT-620 is completely solid state with provision for VFO operation covering entire 6 meter amateur bands in eight segments. In addition to the VFO operation, 4 crystal controlled channels are provided. Advance design features include noise blanker, squelch circuit and AFP (automatic final protection) circuit to prevent damage to the transistors in case of high antenna VSWR.

The FT-620 is self-contained, requiring only an antenna and power source for home or mobile operation. The FT-620 may be operated from 100/110/117/200/220/234 volts AC (normally supplied wired for 117 volts), or 13.5 volts DC. Two power cables are supplied with the transceiver. Selection of AC or DC power source is automatic when the proper power cable is connected to the transceiver.

The FT-620 VHF SSB Transceiver is supplied complete with cables, connectors, microphone and accessories, as shown below.



1. Dynamic push-to-talk microphone YM-86 with retractable coiled cord.
2. Phone plug for headphone or key.
3. Miniature phone plug for external speaker.
4. PL-259 UHF coaxial cable connector.
5. 7 pin male connector for accessory receptacle.
6. AC power cable.
7. DC power cable.
8. Spare fuses 2A for AC, 3A for DC operation.
9. Alignment tool.

INSTALLATION

GENERAL

The transceiver is designed to provide a complete single unit installation for fixed, portable, or mobile operation. Two prewired plugs are supplied with the unit for AC or DC power source. This system provides the flexibility required for various installations and allows rapid change from base to mobile operation.

BASE STATION INSTALLATION

The transceiver is designed for use in many countries in the world using supply voltage that may differ from the operators local supply voltage. Therefore, prior to connecting the AC cable to the power outlet, be sure the voltage marked on the rear of the transceiver agrees with the local AC supply voltage.

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSCEIVER.

The transceiver should be connected to a good ground. The ground lead should be as short as possible and connected to the terminal marked GND on the rear panel.

MOBILE INSTALLATION

The transceiver will operate satisfactorily from any 12 volts negative ground battery source by connecting the DC power cable to the rear panel receptacle.

For under-dash mounting, a mounting bracket is available from your local dealer. A location should be selected clear of heater ducts. No special mounting precautions need be observed if adequate ventilation space is available. Never stack other units above or below the cabinet since the accumulated heat from both units could cause permanent damage.

The transceiver requires an average of 2 amps on transmit. The fuse in the DC power cable should be rated at 3 amps. The power cable may be plugged directly into the vehicle's cigar lighter receptacle for casual operation if desired. For a permanent installation, the lighter plug may be removed and the leads routed directly to the battery (red positive, black negative or ground), or to the nearest termination of the battery, i.e. fuse block, etc. If it is necessary to extend the power cable, use #16 AWG insulated copper wire and do not make the leads any longer than required, otherwise excessive voltage drop may occur.

CAUTION

BEFORE CONNECTING THE POWER CABLE TO THE TRANSCEIVER, CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING AND THE BATTERY CHARGING. IF THE VOLTAGE EXCEEDS 14.5 VOLTS DC, THE REGULATOR SHOULD BE READJUSTED SO THE HIGHEST CHARGING VOLTAGE DOES NOT EXCEED 14.5 VOLTS. ALSO BE SURE TO OBSERVE PROPER POLARITY WHEN MAKING BATTERY CONNECTIONS. REVERSED CONNECTION COULD PERMANENTLY DAMAGE THE TRANSCEIVER.

ANTENNA

CAUTION

NEVER TRANSMIT WITHOUT HAVING PROPER ANTENNA OR DUMMY LOAD CONNECTED TO THE TRANSCEIVER.

The transceiver is designed for use with resonant antenna having an impedance 50 ohms resistive load. The antenna is usually the most critical part of a station installation. Results both in receiving and transmitting will depend on how well the antenna is installed and adjusted. Any of common antenna systems, such as dipole, cubical quad, Yagi beam, designed for use on the 6 meter amateur bands may be used with the transceiver, provided the input impedance of the antenna system is 50 ohms. The antenna should always be as high and in the clear as possible. Also, in mobile installation, it is advisable to locate the antenna as far from the engine as practical to minimize ignition noise pick up. In all installations, ensure that the antenna VSWR is less than 1.5:1.

For mobile installation, the most popular antenna is vertical type, either a quarter wave length whip with unity gain, or a 5/8 wave length whip affording approximately 3.5 db gain.

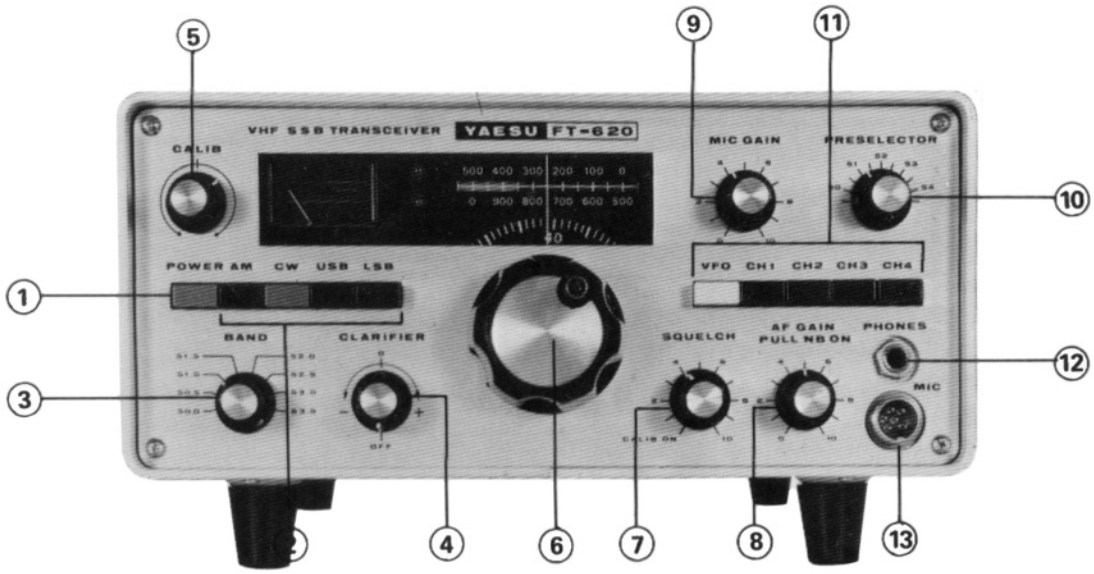
To minimize loss in the antenna system, use shortest possible length of coaxial cable, avoiding any sharp angles or kinks. Use type RG-8U cable if the transmission line length exceeds 25 feet. RG-58U cable is suitable for shorter length. Install type PL-259 coaxial connector supplied to the antenna cable.

OPERATION

The transceiver is specifically designed for ease of operation and versatility. All controls have been preset at the factory. The front panel controls and their functions are described in the following section. Be sure you throughly understand the function of each control before operating equipment.

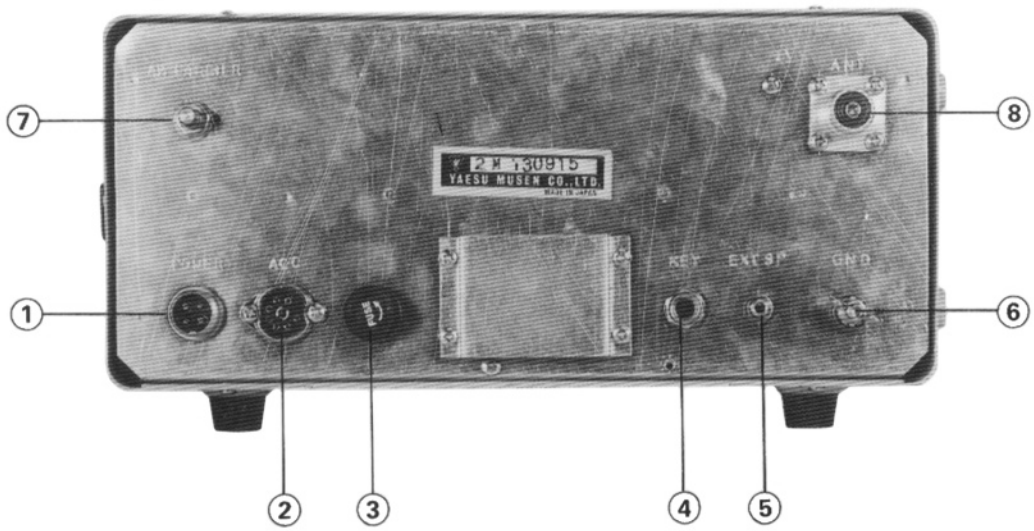
CONTROLS AND FUNCTIONS

Front Panel;



1. POWER: Main switch. When pressed first, turns transceiver ON for both AC and DC, and when pressed second, turns the transceiver OFF.
2. MODE SELECTOR: Selects the mode of operation; AM, CW, USB or LSB.
3. BAND: Selects the desired band in 50 ~ 54 MHz split into eight 500 KHz segments.
4. CLARIFIER: Provides a mean for turning the receiver frequency few KHz to either side of the transmitting frequency. Thus it is possible to set the pitch of the voice you are receiving to the most readable point without affecting your transmitting frequency. The receiver frequency may be locked to transmitting frequency at OFF position.
5. CALIB: Is used to calibrate the dial readout with 100 KHz marker signal.
6. TUNING KNOB: The tuning knob (VFO) directly below the main dial window in conbination with the band switch. Determines actual operating frequency.
7. SQUELCH: Adjusts the receiver squelch threshold sensitivity.
8. AF GAIN: Adjusts the audio output level at the speaker and phone jack. Clockwise rotation increases the audio output. When pulled, the noise blanker works.
9. MIC GAIN: Adjusts the audio level from the microphone amplifier stages. Clockwise rotation increases the microphone gain.
10. PRESELECTOR: Tunes the signal circuit for both transmit and receive.
11. VFO SELECT: Selects VFO or four fixed crystal oscillator positions. Normal operation by VFO requires that VFO push button is depressed.
12. PHONES: Headphone may be inserted in this jack. The internal speaker is disconnected when the plug is installed.
13. MIC: Microphone jack.

Rear Panel;



1. POWER: Power receptacle. Both AC and DC cables are supplied.
2. ACC: Accessory socket. Provides access to transceiver operating voltages and relay contacts.
3. FUSE: Fuse holder requires 1 amp for AC operation.
4. KEY: Key jack for code operation
5. EXT SP: Audio output is provided at this jack for an external speaker. Output impedance is 4 ohms.
6. GND: Ground connection
7. AM CARRIER: Adjusts carrier level for AM transmitting.
8. ANT: Coaxial connector for antenna

INITIAL CHECK

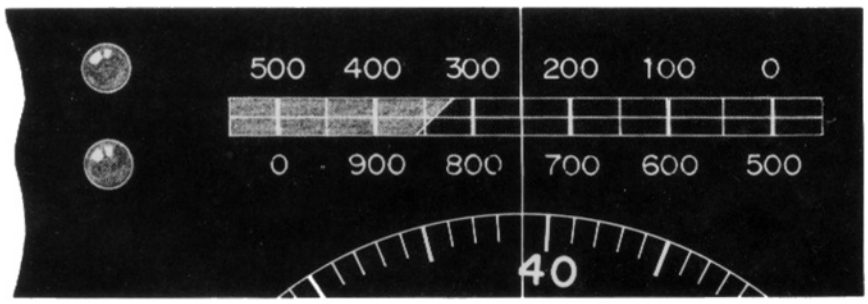
Before connecting the transceiver to a power source, carefully examine the unit for any visible damage. Ensure that voltage specification marked on rear panel matches the supply voltage.

FREQUENCY SELECTION

The main tuning dial has two scales for proper frequency readout with the setting of the band switch. The operator reads upper scale for the band switch setting of 50.0, 51.0, 52.0 and 53.0 MHz and lower scale for 50.5, 51.5, 52.5 and 53.5 MHz. The lamps on the left side of the main dial lights to show the dial scale corresponding to the band switch setting. Read the upper scale when upper lamp is lit and read the lower scale when lower lamp is lit. The main tuning dial is marked in 50 KHz increment between each 100 KHz segment. This provides a course frequency setting within the band. Upper point of green arrow shows approximate frequency.

The sub-dial surrounding the tuning knob is marked in 1 KHz increment and provides for fine setting of the transceiver operating frequency.

Following the example shown, familiarize yourself with the relationship of the main and dial scale frequency readout.



BAND	LAMP	FREQUENCY
50.0	Upper	50.339
50.5	Lower	50.839
51.0	Upper	51.339
51.5	Lower	51.839
52.0	Upper	52.339
52.5	Lower	52.839
53.0	Upper	53.339
53.5	Lower	53.839

RECEIVER CALIBRATION

(1) Preset the controls and switches as follows:

POWER:	OFF
MODE:	Desired mode
BAND:	Desired band
CLARIFIER:	OFF
SQUELCH:	Position 1
AF GAIN:	Position 5
SELECT SW:	VFO
PRESELECTOR:	Operating frequency position
MAIN TUNING KNOB:	100 KHz point

(2) Press power switch. Meter and dial lamps will light and noise or signal may be heard from the speaker.

(3) To calibrate, set the TUNING control to the 100 KHz point on the dial nearest the desired frequency. Rotate SQUELCH potentiometer fully counterclockwise. Adjust CALIB control to zero beat. Set SQUELCH control to position 1.

Note: Marker unit is an option and not supplied with transceiver.

RECEIVE

Connect antenna to the ANT connector on rear panel. Tune the transceiver to desired signal. Tune the PRESELECTOR for maximum S-meter reading. Adjust the AF GAIN for audible level. When the AUDIO GAIN control is pulled, the noise blanker is placed in the circuit for elimination of noise pulses caused by auto ignition. The CLARIFIER may be used to set the pitch of the voice you are receiving to the most readable point without affecting your transmitting frequency. Its use is particularly valuable in "net" operation when several participants may be transmitting slightly off frequency. The CLARIFIER control may be switched off and the receiver frequency locked to the transmitting frequency by setting the CLARIFIER control to the OFF position. Normally, you will want to keep the CLARIFIER in the OFF position until the initial contact is made. The CLARIFIER control may then be used to zero-in and correct any drift on the received signal.

TRANSMIT

CAUTION

NEVER TRANSMIT WITHOUT HAVING PROPER ANTENNA OR DUMMY LOAD CONNECTED TO THE TRANSCEIVER.

SSB

(1) Connect microphone to the MIC jack on front panel.

(2) Press desired sideband switch, LSB or USB.

(3) Set the MIC GAIN control to 12 o'clock position.

(4) Press the push-to-talk switch on the microphone and speak normally into the microphone.

(5) The meter shows the modulated output power and meter deflection corresponds to the strength of the audio speech.

(6) When the push-to-talk switch is released, the transceiver reverts to receive mode.

CAUTION

EXCESSIVE MIC GAIN WILL CAUSE DISTORTION ON TRANSMITTED SIGNAL.

AM

(1) Press AM mode switch.
(2) Set the MIC GAIN control to zero position.
(3) Press the push-to-talk switch on the microphone.
(4) Adjust AM CARRIER control on the rear panel until meter indicates 1/5 of maximum meter deflection available for CW transmission.
(5) Advance the MIC GAIN control until the meter indicates very slight movement with voice peaks while speaking normally into microphone.

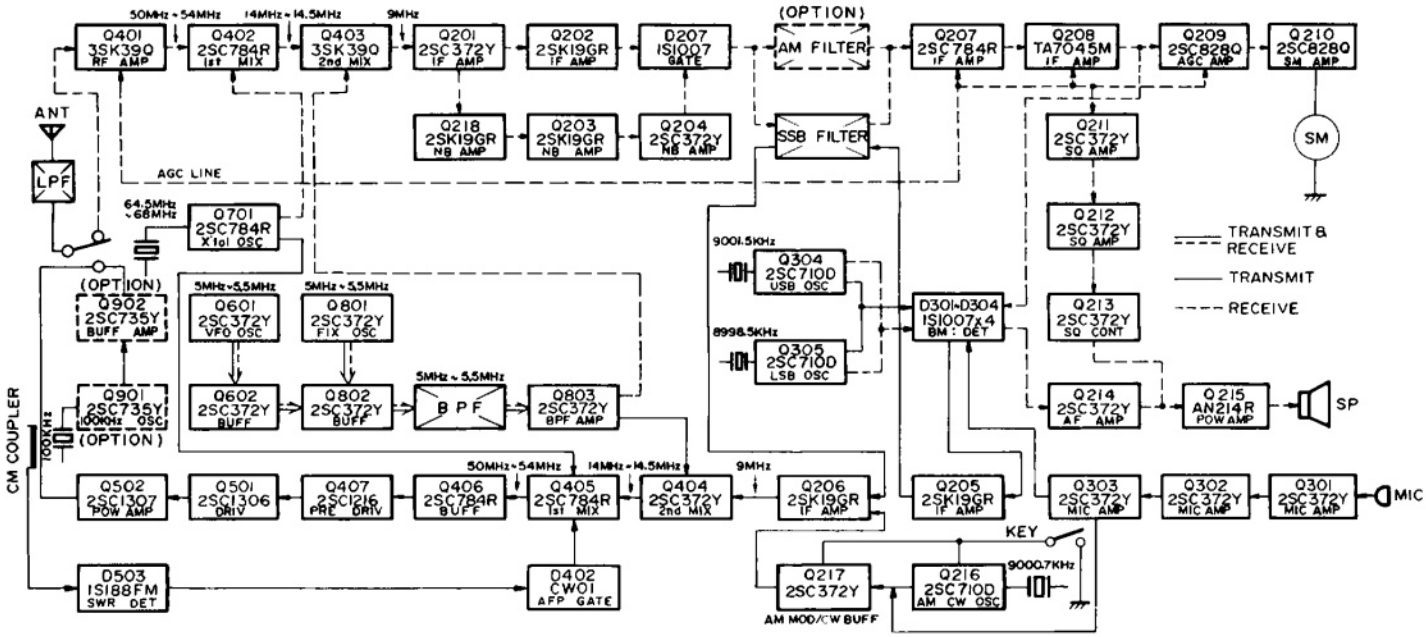
CW

(1) Connect key to the KEY jack on the rear panel.
(2) Press CW mode switch. The transceiver is now ready for code transmission. With key down, the meter will indicate 8.
(3) For receive, press the USB mode switch.

CIRCUIT DESCRIPTION

The block diagram and the circuit description will provide you with a better understanding of this transceiver.

FT-620 BLOCK DIAGRAM



Block Diagram

RECEIVER SIGNAL PASS

The signal from the antenna is fed to the first gate of Q401, 3SK39Q, field effect transistor through antenna relay and IF trap. The AGC (automatic gain control) voltage is applied to the second gate of Q401. Amplified signal output from the Q401 is then coupled to the base of Q402, 2SC784R, first mixer when the incoming signal is mixed with a signal from the first local oscillator. The signal is connected to 14 ~ 14.5 MHz first IF signal. The first IF signal is applied to the first gate of Q403, 3SK39Q, the second mixer. The VFO signal is applied to the second gate of Q403 where the first IF signal is connected to 9 MHz second IF signal.

The second IF signal is amplified by Q201, 2SC372Y, and Q202, 2SK19GR and fed to the crystal filter XF-90A through noise blanker gate diode D204, 1S-1007. The 6 KHz AM filter XF-90B is an optional feature available at additional cost. Diode switch is used to select the filter. Without optional AM filter, all signals are passed through SSB filter.

The signal passing the crystal filter is then amplified by Q207, 2SC784R and Q206, TA7045M. For SSB and CW, the amplified signal is coupled to the demodulator which is used as modulator in transmit. For AM, the signal is applied to D211, 1S188FM, detector diode. The carrier oscillator oscillates either 8998.5 KHz for LSB or 9001.5 KHz for USB depending upon whether Q305, 2SC710D or Q304, 2SC710D is selected by the mode switch. The mode switch disconnects the emitter circuit of either transistor when not in use. The output from the oscillator is fed to balanced demodulator. These crystal frequencies are matched to the bandpass characteristics of the crystal filter. The 9001.5 KHz output is also used as BFO voltage for CW reception.

Demodulated signal is fed to the base Q214, 2SC372Y, audio voltage amplifier through the mode switch and audio gain control potentiometer.

The amplified signal is then fed to Q215, AN214R, audio power amplifier. Q215 delivers 3.5 watts output to the speaker.

TRANSMITTER SIGNAL PASS

Speech from the microphone is fed to the first Mic amplifier Q301, 2SC372Y. Input impedance of the microphone amplifier is 50K ohms. The signal controlled in amplitude by the MIC GAIN control is amplified by the second Mic amplifier Q302, 2SC372Y, and applied to the emitter flower Q303, 2SC372Y to be delivered to the modulator. For AM operation, the signal is fed directly to modulator Q217, 2SC372Y. For SSB operation, the signal is fed to the balanced modulator through diode switch. For CW operation, the output of the microphone amplifier is grounded. The carrier oscillator oscillates either 8998.5 KHz for LSB or 9001.5 KHz for USB, depending upon whether Q306, 2SC710D or Q304, 2SC710D is selected by the mode switch. The output from the oscillator is fed to the balanced modulator. These crystal frequencies are matched to the characteristics of the crystal filter to place the carrier frequency approximately 25 db down on the skirt of the filter response. The modulated double side band signal is amplified by a first IF amplifier Q205, 2SK19GR and then fed to the crystal filter XF-202 where unwanted sideband is filtered. The single side band signal is then amplified by second IF amplifier Q206, 2SK19GR.

For CW and AM, a separate oscillator Q216, 2SC710D oscillates 9000.7 KHz carrier signal. This signal is fed to the AM modulator Q217, 2SC372Y which works as a buffer amplifier for CW operation.

The output signal (9 MHz) from Q206 or Q217 is fed to the base of the transmitter first mixer Q404, 2SC372Y where the signal is converted into 14 ~ 14.5 MHz IF signal.

14 ~ 14.5 MHz IF signal is then fed to the transmitter second mixer Q405, 2SC784R and converted into the transmitting signal. This transmitting signal is applied to the four stage amplifier chain Q406, 2SC784R, Q407, 2SC319, Q501, 2SC1306 and Q502, 2SC1307. The amplified signal is fed to the antenna connector through antenna change over relay and a low pass filter.

COMMON CIRCUIT

As described in previous pages, the carrier oscillator, modulator and filter are used in common for transmitting and receiving. The following circuit is also used in common for transmitter and receiver.

Heterodyne Crystal Oscillator Circuit;

Crystal controlled oscillator Q701, 2SC784R, oscillates the heterodyne local signal for receiver first mixer and transmitter second mixer. One of eight crystals is selected by the BAND switch to cover 500 KHz segment. The output from the oscillator is fed to the emitter of Q402 and Q405 through an output coil L701.

VFO and FIX Oscillator Circuit;

The VFO signal is generated by Q601, 2SC372Y and fed to the buffers Q602, 2SC372Y, and Q802, 2SC372Y, which provide isolation and amplification of VFO signal. The VFO oscillation frequency is 5000 ~ 5500 KHz and covers tunable IF range of 500 KHz. Varactor diode D601, 1S145, is connected into the circuit by the clarifier switch, and this diode is used to shift VFO frequency when operating mode is changed.

In addition to normal VFO operation, four crystals may be selected for crystal controlled operation by CH1-CH4 push button switch. For oscillator, Q801, 2SC372Y, is used and its output is fed to a buffer amplifier Q802, 2SC372Y, through L801. The crystal frequency may be corrected by series connected trimmer capacitor TC801-TC804.

The output from VFO or crystal oscillator is amplified by buffer amplifier Q802, 2SC372Y, and fed to second buffer amplifier Q803, 2SC372Y, through band pass filter. This signal is fed to the second gate of Q403 and emitter of Q404.

POWER SUPPLY

The power supply is designed to operate either 100/110/117/200/220/234 volts AC or 12 volts DC (negative ground). Inserting appropriate power plug into the rear panel receptacle makes necessary connections to operate the supply in either AC or DC.

When AC cord is inserted, AC voltage is applied to pin 1 and 2, and fed to the power transformer through fuse and power switch.

Secondary output of the power transformer is rectified by the bridge connected silicon rectifier, D101-D108, V06B, and fed to voltage regulator Q1, 2SD67E, to obtain regulated 13.5 volts DC supply.

A part of 13.5 volts supply is fed to other voltage regulator consists of Q101, 2SD313, and Q102, 2SC372Y, to obtain extremely stable 9 volts DC supply.

For DC operation, DC voltage is applied to pin 3 and 4 of the receptacle. This voltage is supplied to the transceiver through power switch. The regulator circuit by Q101 and Q102 is used for regulated 9 volts supply.

AUXILIARY CIRCUIT

In addition to the basic circuit described above, a number of auxiliary circuits are adopted to optimize the performance of this transceiver.

Noise Blanker;

Output from receiver first IF Q201 is amplified by noise amplifier Q218, 2SK19GR. The signal amplified by Q218 is rectified by D201, 1S1555, and biases D202, 1S1555. D202 conducts with the noise pulse and the negative output voltage from the diode is applied to the gate of Q203, 2SK19GR, in order to turn off Q203. Then the noise blanker driver Q204, 2SC372Y, conducts to switch a noise blanker diode D204, 1S1555, which disconnects the input circuit of the filter. The switching level is adjusted by the noise blanker threshold control VR201. At the most effective blanking position, there may be slight distortion on the received signal due to mixing at the switching diode. This effect can be reduced by adjusting the threshold control slightly.

AGC (Automatic Gain Control) Circuit;

A part of output from receiver IF amplifier Q208 is rectified by voltage doubler D212 and D213, 1S-1007. This DC voltage is amplified by AGC amplifier, Q209, 2SC828Q, and applied to RF amplifier Q401, IF amplifier Q207 and Q208 to reduce the gain automatically when strong signal is received. This AGC voltage is amplified by S-meter amplifier Q210, 2SC828Q, for S-meter indication.

Squelch Circuit;

The voltage variation at the collector of S-meter amplifier Q210, 2SC828Q is fed to the schumit circuit Q211, Q212, 2SC372Y, through squelch threshold control. When incoming signal disappears, the collector voltage of Q210 and Q212 rises in order to conduct squelch control transistor Q213, 2SC372Y. Q213 is so connected in parallel to the output of audio amplifier Q214 that conduction of Q213 shorts the audio signal pass between Q214 and Q215 to the ground. When signal received, Q213 stops conduct and the audio signal is fed to Q215 from Q214.

Clarifier Circuit;

A varactor diode D601, 1S145 is connected to the VFO tank circuit in order to tune the receiver frequency few KHz either side of the transmitting frequency. In receive mode, the bias voltage for D601 is fed through clarifier control, VR5, and in transmit mode this voltage is fed from voltage divider R3 and R4.

Output Indicator;

A part of RF output power is fed to the RF rectifier D1, 1S188, through capacitor C1, and the rectified DC voltage is used to read relative power output on the meter.

ALC (Automatic Level Control) Circuit;

The ALC rectifier diode D504, 1S188, is so biased that it conducts for only higher signal than predetermined level. The audio signal detected by D504 is rectified by voltage doubler D505 and D506, V06B, and then fed to the transmitter IF stage Q205 and Q206 to control the IF gain in order to prevent distortion due to over drive.

AFP (Automatic Final Protection) Circuit;

This circuit is provided to protect the final transistor against over load conditions, which may occur if the transmitter is keyed without an antenna or with a high VSWR antenna system.

When the reflected power increases, the diode D503, 1S188, detects the voltage and supplies a control voltage to the gate of controller D402, CW01B, which conducts through AFP threshold control VR502. Thus supply voltage to the transmitter second mixer drops and the mixer gain decreases to protect the following stages.

CRYSTAL CALCULATION FOR CRYSTAL CONTROLLED OPERATION

The crystal holders accept standard HC-25U type crystals. All crystal frequencies must fall between 5000 KHz and 5500 KHz. A trimmer capacitor is connected in series with each crystal to permit proper frequency adjustment within approximately 1 KHz.

The correct crystal frequency of any desired operating frequency may be determined by the following formula.

$$f_x = f_1 - f_o$$

When f_x is the crystal frequency, f_o is the operating frequency and the constant f_1 is taken from the following table.

BAND (MHz)	LSB	USB	AM/CW
50.0 ~ 50.5	55501.5	55498.5	55499.3
50.5 ~ 51.0	56001.5	55998.5	55999.3
51.0 ~ 51.5	56501.5	56498.5	56499.3
51.5 ~ 52.0	57001.5	56998.5	56999.3
52.0 ~ 52.5	57501.5	57498.5	57499.3
52.5 ~ 53.0	58001.5	57998.5	57999.3
53.0 ~ 53.5	58501.5	58498.5	58499.3
53.5 ~ 54.0	59001.5	58998.5	58999.3

For example;

Find the proper crystal for operation at 51.9 MHz USB.

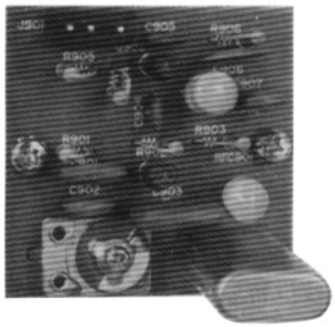
From the table, the constant f_1 is 56998.5 KHz.

Therefore, f_x = 56998.5 KHz - 51900 KHz

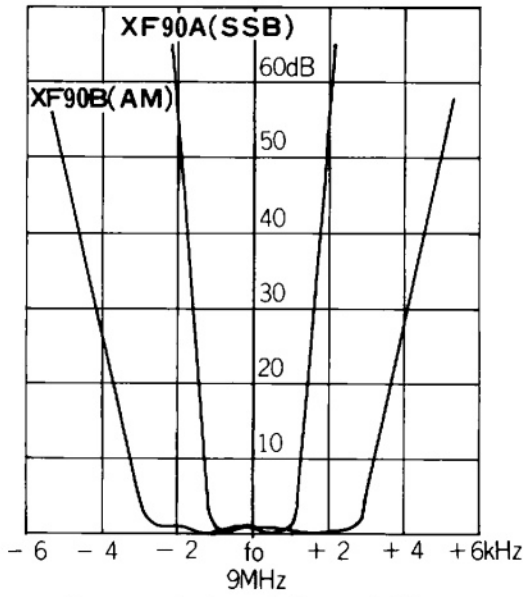
= 5098.5 KHz

OPTIONAL UNIT

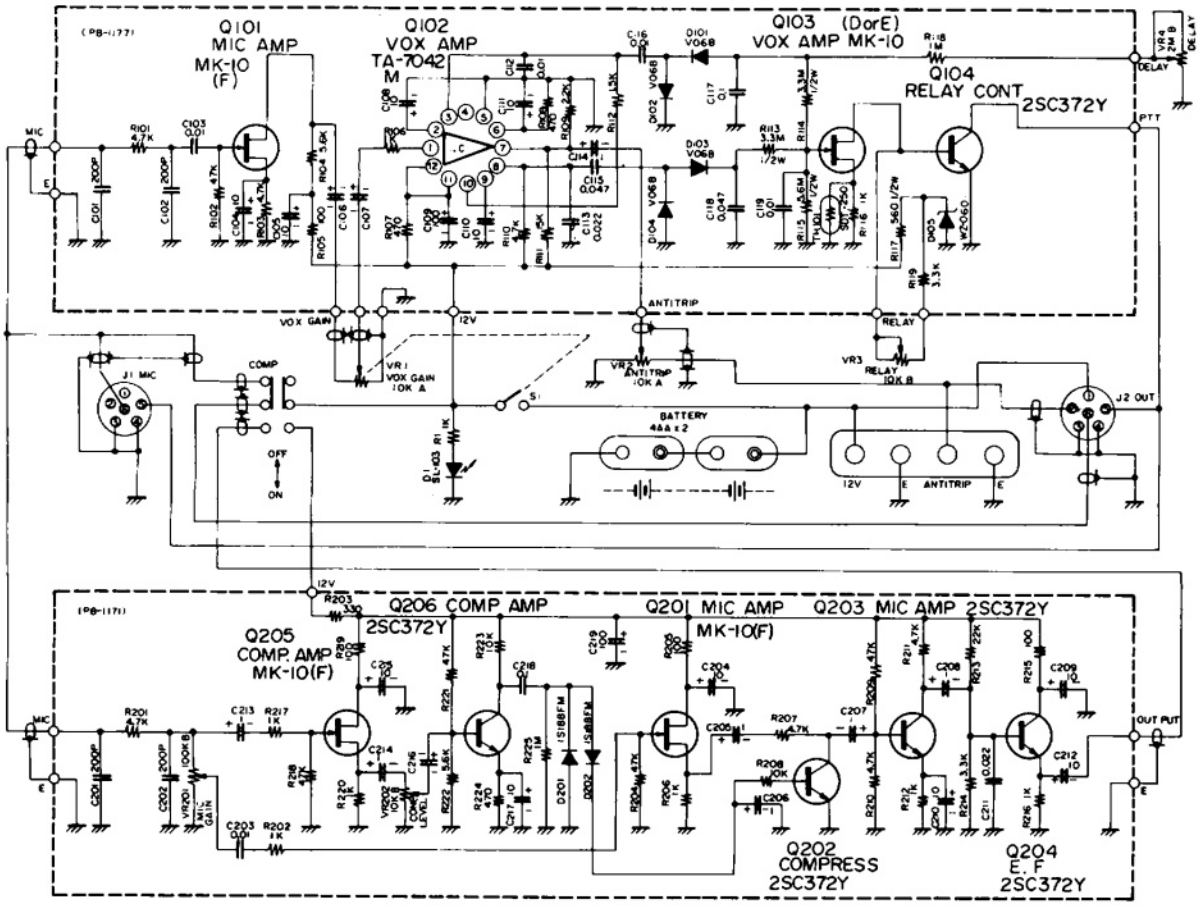
* 100 KHz Marker Oscillator
* 6 KHz Crystal Filter for AM (XF90B)
* VC-75 Mic Compressor and VOX Unit



Marker Unit



Characteristics of Crystal Filters



ALIGNMENT

CAUTION

NEVER OPERATE TRANSCEIVER IN TRANSMIT MODE WITHOUT A MATCHED ANTENNA OR ADEQUATE DUMMY LOAD.

GENERAL

The transceiver has been carefully aligned and tested at the factory and, with normal usage, should not require other than usual attention given to electronic equipment. Service or replacement of a major component may require subsequent realignment, but under no circumstance should realignment be attempted unless the operation of the transceiver is fully understood and the malfunction has been analized and definitely traced to misalignment. Service work should only be performed by experienced personnel, using the proper test equipment.

EQUIPMENT REQUIRED

(1) RF Signal Generator with one volt output at an impedance of 50 ohms and a frequency coverage 5 MHz to 60 MHz.
(2) Vacuum Tube Voltmeter (VTVM) Hewlett-Packard model 401B, or equivalent with a RF-probe good to 60 MHz.
(3) Dummy Load, 50 ohms non-reactive load rated at 20 watts.
(4) Frequency Counter, YC-355D or equivalent.

Note: Cores in coil form are fixed by wax. Melt the wax with hot soldering iron to adjust cores.

RECEIVER ALIGNMENT

Front End;

Connect signal generator to the antenna terminal and set signal generator frequency to 52 MHz. Set the preselector to 52 MHz. Peak L401-L403 for maximum S-meter reading.

First IF;

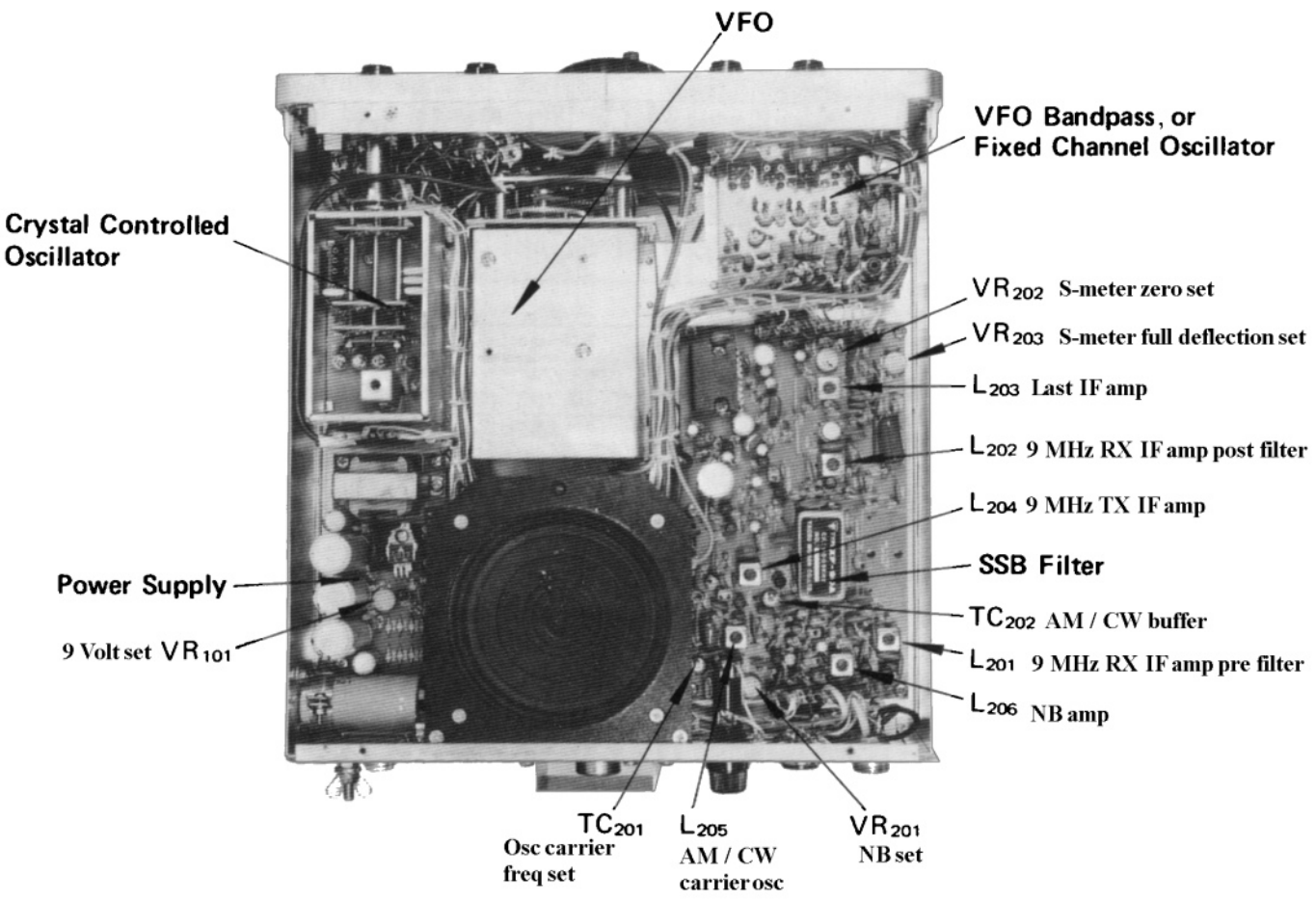
Set the transceiver to 50.250 MHz in LSB or USB mode, Connect signal generator output to the base of Q402, 2SC784R. Set the frequency to 14.250 MHz. Peak TC401, TC402 and L406 for maximum S-meter reading.

Second IF;

Connect signal generator to pin 7 of P201. Set the frequency to 9 MHz and peak L201-L203 for maximum S-meter reading.

Trap;

Set the transceiver to 50.250 MHz in USB or LSB mode. Apply 14.250 MHz signal generator output to the antenna terminal. Adjust L1001 for minimum S-meter reading. Apply 9 MHz output. Adjust L1002 for minimum S-meter reading.



S-METER ADJUSTMENT

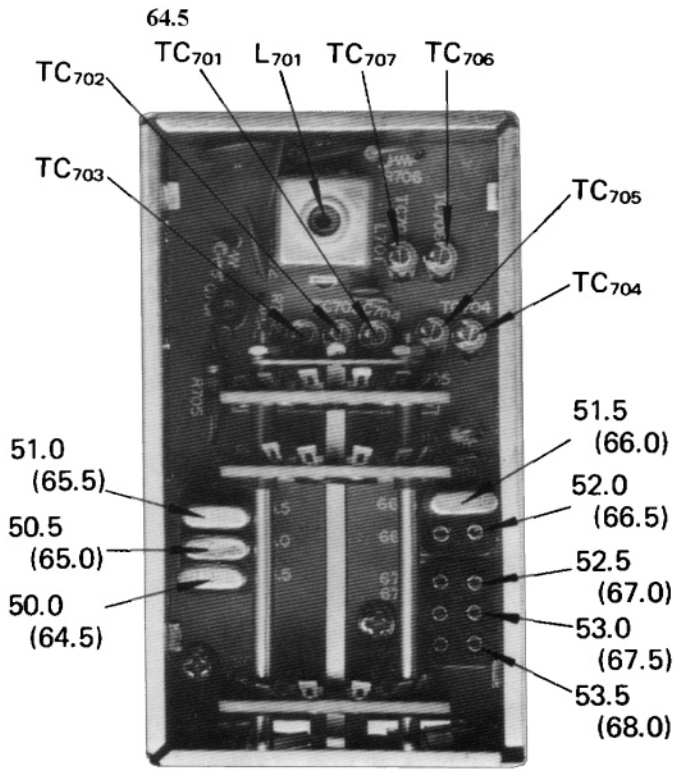
Connect the signal generator to antenna terminal and set frequency to 52.250 MHz and output level to 100 db. Tune the transceiver to this signal. Peak the preselector. Adjust VR203 for S-meter full deflection. Disconnect signal generator and adjust VR202 for S-meter zero reading. Repeat this procedure several times.

NOISE BLANKER

Set the VTVM to 3 volts max range and connect plus lead to the junction point of D201 and R283, and minus lead to ground. Tune the transceiver to signal generator at 52.000 MHz. Peak L206 for maximum VTVM reading.

NOISE BLANKER THRESHOLD LEVEL

The operating level of the noise blanker is determined by threshold control VR201. With the noise blanker OFF position, tune in a signal on any band that registers S9. Note the S-meter changes when the noise blanker is placed in the circuit. When the noise blanker level is adjusted properly by VR201, the meter should indicate a decrease of one or half S-unit.



The figures in brackets show the crystal oscillating frequencies (MHz).
The figures outside brackets show the LSB band frequencies (MHz).

CRYSTAL CONTROLLED OSCILLATOR

CLARIFIER

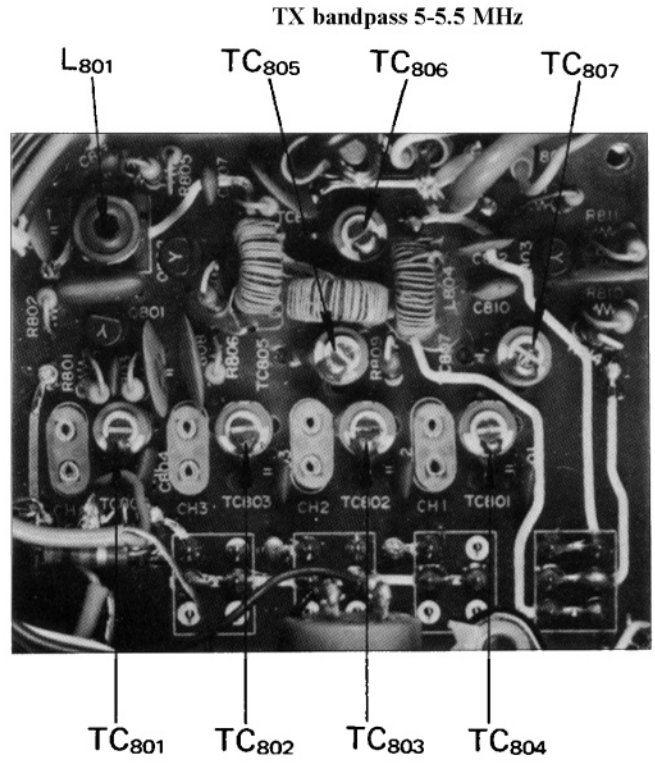
Set the clarifier control to OFF position. Tune in a signal and zero beat. Set clarifier control to zero, 12 o'clock position. Adjust VR7 for zero beat.

HETERODYNE OSCILLATOR

Connect VTVM RF-probe to pin 7 of P702. Set the BAND switch to 52.5 MHz band. Adjust L701 for 0.15 ~ 0.2 volt VTVM reading. Set the BAND switch to 53.0 and adjust TC707 for same VTVM reading (0.15 ~ 0.2 volt).
Set the BAND switch to 52.5 and adjust TC706
Set the BAND switch to 52.0 and adjust TC705
Set the BAND switch to 51.5 and adjust TC704
Set the BAND switch to 51.0 and adjust TC703
Set the BAND switch to 50.5 and adjust TC702
Set the BAND switch to 50.0 and adjust TC701

VFO

Connect RF-probe of VTVM to pin 2 of P801. Set the VFO dial to 500 KHz in upper scale. Adjust TC806 for maximum VTVM reading. Then set the VFO dial to 0 KHz in upper scale. Adjust TC807 and TC806 for maximum VTVM reading. Repeat this procedure until unity output is available at any setting of the VFO dial. The output voltage is approximately 0.06 ~ 0.07 volt.



VFO BANDPASS

TRANSMITTER

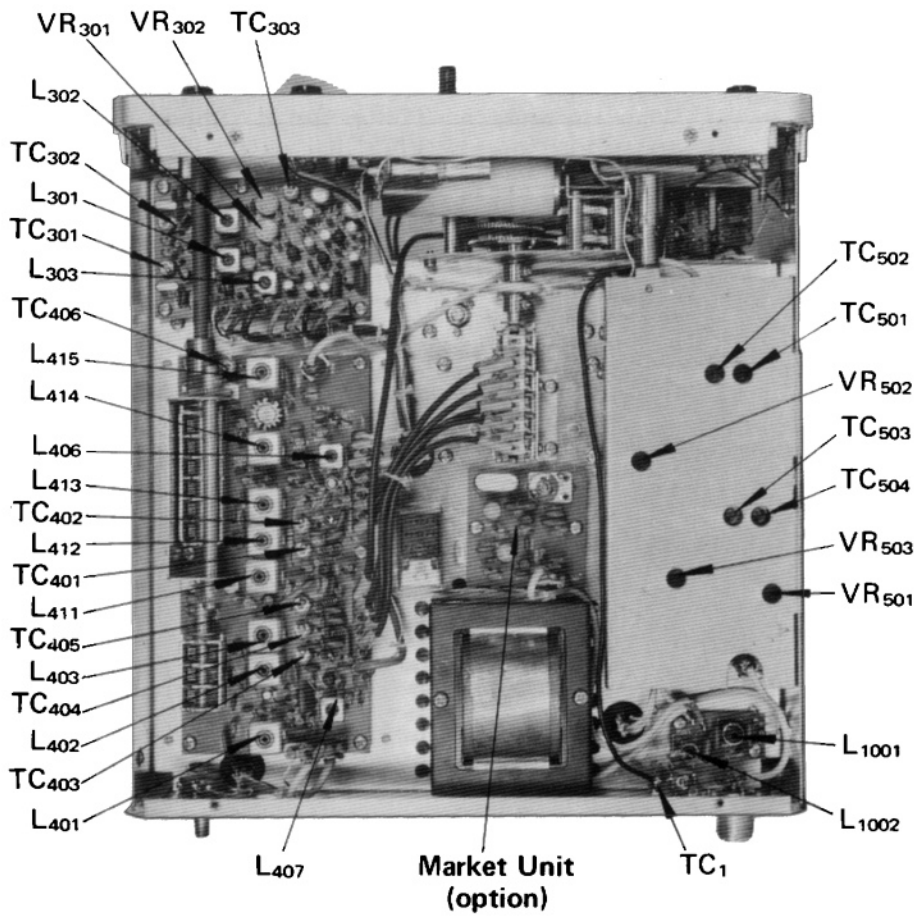
CAUTION

CONTINUOUS FULL OUTPUT FOR MORE THAN 10 SECONDS MAY RESULT IN DESTRUCTION OF FINAL POWER TRANSISTOR.

Connect a 50 ohms dummy load to antenna terminal. Set the BAND switch to 52 MHz in CW mode. Set PRESELECTOR to 52 MHz. Adjust L411-L415, TC406 and TC501-TC504 for maximum output.

AFP (Automatic Final Protection) Circuit;

Tune up the transceiver for full output in CW mode. Set VTVM to DC volt range and connect it between pin 3 of P501 and ground. Adjust VR501 for minimum VTVM reading when transmitting. Rotate VR502 to the direction that VTVM reading becomes zero. Disconnect dummy load. Adjust VR502 until the VTVM reading becomes zero suddenly. Push USB switch and resume to receive mode. Then transmit again and check the transmitter works normally.



BOTTOM VIEW

RESISTANCE CHART

NO.	EorS	BorG	CorD	NO.	EorS	BorG	CorD
Q_{1}	10	540	540	Q_{302}	1K	1.7K	3.5K
				Q_{303}	470	900	100
Q_{101}	1K	1.1K	540	Q_{304}	1K	1.8K	1.1K
Q_{102}	1.6K	1.4K	1.1K	Q_{305}	∞	2.8K	1.1K
Q_{201}	1K	900	100	Q_{401}	160	(1)120K (2)40K	100
Q_{202}	200	900	100	Q_{402}	1K	900	100
Q_{203}	650	1.7K	650	Q_{403}	300	(1)70K (2)7K	100
Q_{204}	∞	1.5K	3K	Q_{404}	1K	1K	220
Q_{205}	250	1K	200	Q_{405}	220	1K	330
Q_{206}	250	1K	200	Q_{406}	56	800	220
Q_{207}	1K	1.1K	100	Q_{407}	10	650	120
Q_{209}	1.2K	4K	2.2K	Q_{501}	0	46	120
Q_{210}	200	1.2K	3K	Q_{502}	0	46	120
Q_{211}	22	850	2K	Q_{601}	2.2K	3K	4K
Q_{212}	22	850	2K	Q_{602}	150	1K	1.1K
Q_{213}	0	800	2.2K	Q_{701}	1K	1.5K	1.1K
Q_{214}	1.3K	1.6K	7K	Q_{801}	470	1.3K	26K
Q_{216}	∞	2.6K	1.1K	Q_{802}	1K	1.3K	1.1K
Q_{217}	∞	2K	1K	Q_{803}	470	1.2K	1.1K
Q_{218}	200	900	100	Q_{901}	100	950	56K
Q_{301}	1K	1.6K	5K	Q_{902}	100	950	56K

NO.	1	2	3	4	5	6	7	8	9
Q_{208}	∞	1.2K	0	550	700	100	2.2K	∞	
Q_{215}	900	0	900	2.7K	950	0	1.7K	70K	10

Notes: 1. Values are in OHMS and are measured by VTVM.
2. Values are measured at POWER SW. OFF, MODE USB, SELECT SW. VFO, SQUELCH control fully counter-clockwise and AF GAIN control fully counter-clockwise.

VOLTAGE CHART

	EorS		BorG		CorD			EorS		BorG		CorD	
NO.	R	T	R	T	R	T	NO.	R	T	R	T	R	T
Q_{1}	13.5	13.5	14.0	14.0	17.0	17.0	Q_{302}	0.9	0.9	1.5	1.5	9.0	9.0
							Q_{303}	5.5	5.5	6.0	6.0	12.5	12.5
Q_{101}	9.0	9.0	9.5	9.5	17.0	17.0	Q_{304}	2.7	2.7	0.2	0.2	8.8	8.8
Q_{102}	6.0	6.0	6.8	6.8	9.5	9.5	Q_{305}	1.9	1.9	2.3	2.3	9.0	9.0
Q_{201}	0.55	0	1.2	0	13.4	0	Q_{401}	2.7	0	(1)2.3 (2)3.5	(1)0 (2) 3.2	13.0	0
Q_{202}	1.15	0	0	0	13.4	0	Q_{402}	0.55	0	1.25	0	13.4	0
Q_{203}	1.5	0	0	0	11.5	0	Q_{403}	4.3	0	4.3	0	13.4	0
Q_{204}	6.0	0	6.5	0	11.5	0	Q_{404}	0	0.85	0	1.45	0	13.4
Q_{205}	0	13.5	0	0	0	13.4	Q_{405}	0	0.45	0	1.2	0	13.0
Q_{206}	0	1.3	0	0	0	13.4	Q_{406}	0	0.35	0	1.15	0	13.0
Q_{207}	0.15	0.05	1.65	0.7	13.4	0	Q_{407}	0	0.02	0	0.75	0	13.5
Q_{209}	0.55	0.55	0.75	0.75	9.0	8.5	Q_{501}	0	0	0	0.7	0	13.5
Q_{210}	0	0	0.55	0.55	9.0	8.0	Q_{502}	0	0	0	0.7	0	13.5
Q_{211}	0.25	0.25	0.9	0.9	4.2	6.0	Q_{601}	2.6	2.6	3.0	3.0	4.8	4.8
Q_{212}	0.25	0.25	0.95	0.95	0.3	0.3	Q_{602}	0.4	0.4	1.1	1.1	8.8	8.8
Q_{213}	0	0	0.3	0.65	0	0	Q_{701}	1.5	1.5	6.2	6.2	8.8	8.8
Q_{214}	0.25	0.25	0.8	0.8	8.0	8.0	Q_{801}	0	0	0	0	0	0
Q_{216}	0	0	2.3	2.3	9.0	9.0	Q_{802}	0.7	0.7	1.2	1.2	9.0	9.0
Q_{217}	1.9	1.9	2.3	2.3	9.0	9.0	Q_{803}	2.6	2.6	3.3	3.3	8.5	8.5
Q_{218}	1.15	0	0	0	13.4	0	Q_{901}	0.1		-0.7		9.0	
Q_{301}	0.37	0.37	1.0	1.0	9.5	9.5	Q_{902}	0.45		0.75		9.0	

		1	2	3	4	3	6	7	8	9
Q_{208}	R	0.6	3.5	0	2.4	8.9	13.4	9.0	0.6	
	T	0	1.0	0	0.2	0	0	8.5	0	
Q_{215}	R	6.0	0	7.5	11.0	6.0	0	6.0	12.5	13.5
	T	6.0	0	7.5	11.0	6.0	0	6.0	12.5	13.5

Notes: 1. Values are in VOLTS and measured by VTVM.
2. Values are measured at MODE USB, SELECT SW. VFO, SQUELCH control fully counter-clockwise and AF GAIN control fully counter-

PARTS LIST

C-CAPACITOR

DIPPED MICA

419, 432, 433, 444, 445	50WV	1PF	±0.5PF
1, 206	50WV	3PF	±0.5PF
523, 701	50WV	5PF	±0.5PF
610	50WV	6PF	± 1PF
704	50WV	10PF	±10%
314, 319, 614, 257	50WV	15PF	±10%
261, 403	50WV	20PF	±10%
402, 407, 410, 411, 446~448, 455, 462, 463, 518, 521, 603, 801~804, 815	50WV	30PF	±10%
258, 315, 320, 418, 421, 437~439, 508	50WV	40PF	±10%
220, 275, 276, 422, 904 905	50WV	50PF	±10%
417, 420, 434, 519, 520, 606	50WV	60PF	±10%
514, 515	50WV	80PF	±10%
238, 239, 263, 902, 907	50WV	100PF	±10%
205, 209, 806	50WV	200PF	±10%
301, 302, 604, 1003	50WV	250PF	±10%
428, 901	50WV	300PF	±10%
233, 607	50WV	470PF	±10%
15	50WV	650PF	±10%
1001, 1002	50WV	680PF	±10%
903	50WV	2000PF	±10%
522	50WV	2PF	±0.5PF
268	50WV	120PF	±10%
2	50WV	180PF	±10%
262	50WV	600PF	±10%

CERAMIC DISC

242, 267, 281, 318, 323, 412, 440, 456~459, 503, 504, 506, 507, 510~513, 807, 810, 813	50WV	0.001μF	$^{+80}_{-20}$%
201, 207, 211, 213, 218, 221, 225, 240, 241, 277, 278, 324, 329~332, 416, 423, 431, 442, 468, 501, 516, 525, 528, 605, 608, 611, 612, 812	50WV	0.01μF	$^{+80}_{-20}$%
3 ~ 5, 10, 11, 13, 14, 105, 202, 204, 208, 210, 215~217, 222~224, 226, 228~230, 232, 234, 235, 237, 260, 265, 266, 272, 273, 279, 317, 322, 325, 404~406, 408, 413, 415, 424, 426, 429, 441, 450~453, 460, 464, 517, 524, 530, 609, 702, 703, 705, 706, 805, 808, 809, 8M, 814, 906	50WV	0.047μF	$^{+80}_{-20}$%
7, 8	150WV A.C.	0.0047μF	$^{+100}_{-0}$%

CERAMIC TC

409	50WV SL	0.5PF	
613	50WV UJ	5PF	±0.5PF
601	50WV UJ	10PF	±10%
602	50WV CH	20PF	±10%

PLASTIC FILM

307	50WV	0.0033μF	±20%
214, 271, 526	50WV	0.01μF	±20%
247, 280	50WV	0.022μF	±20%
6, 249, 250, 527	50WV	0.1μF	±20%
264, 255	50WV	0.22μF	±20%

TANTALUM

243	16WV	4.7μF	±20%

ELECTROLYTIC

246, 303, 305, 306, 311, 312	16WV	1μF
467	16WV	4.7μF
212, 244, 245, 254, 269, 304, 309, 313	16WV	10μF
502, 505, 529	16WV	22μF
248, 253, 308, 310	16WV	47μF
251, 509	16WV	100μF
104, 256	16WV	220μF
12, 252	16WV	470μF
101~103	25WV	1000μF
9	25WV	3300μF

TC-TRIMMER CAPACITOR

201, 301, 302	ECV1ZW20P32	20PF
202, 801~804	ECV1ZW40P32	40PF
1, 303, 401~406, 501, 502, 805~807	ECV1ZW50P32	50PF
705~707	ECV1ZW10P50	10PF
701~704	ECV1ZW20P50	20PF
901	CV01D500	50PF
503, 504	CV08S600	60PF

VC-VARIABLE CAPACITOR

1	C521C
2, 402	C365A
401	C332A
601	KC30PM

R-RESISTOR

CARBON FILM

437	¼W	10Ω	±10%
250	¼W	22Ω	±10%
281, 427, 429, 438	¼W	56Ω	±10%
261	¼W	82Ω	±10%
204, 207, 215, 225, 228 234, 237, 241, 265, 276, 282, 311, 317, 321, 408, 412, 416, 420, 439, 609, 611, 704, 812, 903, 906	¼W	100Ω	±10%
610	¼W	150Ω	±10%
322~325, 422, 424, 269	¼W	220Ω	±10%
279	¼W	270Ω	±10%
214, 407	¼W	330Ω	±10%
310, 313, 803, 811, 813	¼W	470Ω	±10%
103, 217, 218, 220, 221, 428	¼W	560Ω	±10%
101, 102, 104, 203, 210, 224, 227, 233, 236, 239, 243, 257, 264, 266, 272, 273, 303, 305, 309, 316, 320, 419, 426, 703, 806	¼W	1KΩ	±10%
206, 209, 216, 406, 411 423, 1001	¼W	1.5KΩ	±10%
235, 244, 246, 249, 255, 409, 415, 602, 606	¼W	2.2KΩ	±10%

105, 202, 212, 213, 219, 222, 229, 230, 242, 252, 256, 268, 274, 275, 285, 306, 326, 418, 603, 608, 701, 801, 805, 810	¼W	3.3KΩ	±10%
302	¼W	3.9KΩ	±10%
286, 304, 308, 264	¼W	4.7KΩ	±10%
808, 809, 814	¼W	5.6KΩ	±10%
232, 253	¼W	6.8KΩ	±10%
238, 247, 248, 267, 270, 277, 278, 425, 436, 601, 702, 901, 905	¼W	10KΩ	±10%
410, 421	¼W	15KΩ	±10%
259, 604	¼W	18KΩ	±10%
258, 280, 307, 404, 435, 607, 802, 804	¼W	22KΩ	±10%
211, 231, 417	¼W	27KΩ	±10%
201, 251, 262, 301, 314 318, 605	¼W	33KΩ	±10%
260, 267	¼W	39KΩ	±10%
245	¼W	47KΩ	±10%
403	¼W	68KΩ	±10%
205, 208, 223, 226, 240, 263, 284, 312, 315, 319, 401, 402, 405, 413, 902, 904	¼W	100KΩ	±10%
414	¼W	220KΩ	±10%
283	¼W	1MΩ	±10%
CARBON COMPOSITION			
432	½W	2.2Ω	±10%
434	½W	5.6Ω	±10%
6, 431	½W	10Ω	±10%
490	½W	22Ω	±10%
502, 507	½W	56Ω	±10%
7, 106	½W	100Ω	±10%
504, 508, 503	½W	470Ω	±10%
705	½W	1KΩ	±10%
5	½W	22KΩ	±10%
3	½W	33KΩ	±10%
4	½W	47KΩ	±10%
512	½W	100KΩ	±10%
513	½W	1MΩ	±10%

VR-VARIABLE RESISTOR

4, 7	EVLSOAA00B54	50KΩB
301, 302	SR19R	220ΩB
501	SR19R	470ΩB
101, 202, 203	SR19R	1KΩB
201, 502, 503	SR19R	10KΩB
3, 5	VM11A5M1112	50KΩB
2	VM13A5M3121	5KΩA
1, 8	VM20A	5KΩB
6	VM20A	50KΩB

D-DIODE

GERMANIUM	
1, 205~211, 503, 504	1S188
212~214, 301~304	1S1007
SILICON	
501, 502	1S1209
201, 202, 204	1S1555
2	DS130ND
101~108, 215, 401, 505, 506	V06B
ZENER	
111	WZ061
110, 203	WZ110
109	1N4744
VARI-CAP	
601	1S145
S. C. R.	
402	CW01B

Q-TRANSISTOR, FET & I. C.

TRANSISTOR	
102, 201, 204, 211~214, 217, 301~303, 404, 601, 602, 801~803	2SC372Y
216, 304, 305	2SC710D
901, 902	2SC735Y
207, 402, 405, 406, 701	2SC784R
209, 210	2SC828Q
407	2SC1216
501	2SC1306
502	2SC1307
1	2SD67E
101, 2	2SD313
F. E. T.	
202, 203, 205, 206, 218	2SK19GR
401, 403	3SK39Q
INTEGRATED CIRCUIT	
215	AN214R
208	TA7045M

RFC-R. F. CHOKE COIL

207	EL0610	10μH
1	EL0610	22μH
201~206, 209, 301, 506 507	EL0610	250μH
302	LT-K1M	1mH
901, 902	LT-K4M	4mH
401, 501, 502, 504	NO. 55002850	
503, 505	NO. 55002840	

L-INDUCTOR & TRANSFORMER

1	5MHz TRAP COIL	
201, 206, 406, 407	IFT31K10E1	R124171
202~205, 301~303	IFT31K10E1	R124170
401	NO. 55002671	
402	NO. 55002680	
403	NO. 55002691	
404, 408	NO. 55002700	
405, 409	NO. 55002710	
410	NO. 55002740	
411	NO. 55002750	
412	NO. 55002760	
413	NO. 55002770	
414	NO. 55002780	
415	NO. 55002791	
501	NO. 55002810	
502	NO. 55002820	
503~505	NO. 55002830	
601	VFO OSC.	8.7μH
701	NO. 55002800	
801	FIX OUT	NO. 54000060
802	BPF-A	NO. 55000380
803	BPF-B	NO. 55000390
1001	14MHz TRAP	NO. 55002860
1002	9MHz TRAP	NO. 55002870

PB-PRINTED CIRCUIT BOARD	
PB1212 (A ~ Z)	HET. OSC. UNIT
PB1213 (A ~ Z)	R. F. UNIT
PB1215 (A ~ Z)	V. F. O.
PB1216 (A ~ Z)	MIC AMP. & BAL. MOD.
PB1217 (A ~ Z)	BOOSTER UNIT
PB1218 (A ~ Z)	I. F. UNIT
PB1219 (A ~ Z)	FIX OSC. & B. P. F.
PB1226 (A ~ Z)	POWER SUPPLY
PB1227 (A ~ Z)	CALIBRATOR
PB1242 (A ~ Z)	TRAP ASS'Y

J-RECEPTACLE & SOCKET	
1 (ANTENNA)	COAX. JSO-239
2 (KEY)	SG7615 (2P)
3 (ACCESSORY)	SB5203 (7P)
4 (POWER)	FM144S (4P)
5 (MIC.)	FM146S (6P)
6 (PHONES)	SG7814 (3P)
7 (EXT. SP)	P2240 (2P)
503, 901	128- 3-10-181S (3P)
401	128- 6-10-181S (6P)
702, 801	128- 7-10-181S (7P)
201	128- 8-10-181S (8P)
402, 403, 501	128-11-10-181S (11P)
101, 202, 203, 301	128-15-10-181S (15P)
404, 502	SQ3056 1 (2P)
701A	CRYSTAL SOCKET S14-2P
701B, 701C	CRYSTAL SOCKET S14-3P
801~804	CRYSTAL SOCKET S2-101P00

P-PLUG	
503, 901	128- 3-10-181J (3P)
401	128- 6-10-181J (6P)
702, 801	128- 7-10-181J (7P)
201	128- 8-10-181J (8P)
402, 403, 501	128-11-10-181J (11P)
101, 202, 203, 301	128-15-10-181J (15P)
404, 502	SQ4052 (2P)

PT-POWER TRANSFORMER	
1	SA3-10542

CH-A. F. CHOKE COIL	
1	SA2-10386 2.4mH 2.5A

M-METER	
1	V-54 NO. 54674

XF-CRYSTAL FILTER	
202	XF-90A (SSB)
201	XF-90B (AM) (OPTION)

X-CRYSTAL OSCILLATOR UNIT	
201	HC-18/U 9000.7KHz
301	HC-18/U 9001.5KHz
302	HC-18/U 8998.5KHz
701	HC-25/U 64.5MNz
702	HC-25/U 65.0MHz
703	HC-25/U 65.5MHz
704	HC-25/U 66.0MHz
705 (OPTION)	HC-25/U 66.5MHz
706 (OPTION)	HC-25/U 67.0MHz
707 (OPTION)	HC-25/U 67.5MHz
708 (OPTION)	HC-25/U 68.0MHz
901 (OPTION)	HC-13/U 100KHz

RL-RELAY	
1	AE3171
501	AE1323

PL-PILOT LAMP	
1, 2	08-1596 16V 0.15A
3, 4	TLR104 RED

SP-SPEAKER	
1	SA101 4Ω 4W

S-SWITCH	
1	5PFS12U533B
701	S-21P
801	5FS10U623DA

OPERATING INSTRUCTIONS FOR FT620

1. To calibrate band in use.
   -Peak preselector for max. RECEIVER noise.
   -Switch calibrator on. (SQUELCH KNOB OFF)
   -Tune to a 100KHZ point on the dial and set the main tuning knob rotary dial to "0".
   -Adjust to zero beat with CALIB. knob.

2. For AM operation, push AM button in. Press microphone PTT button and peak preselector for max. indication on the P.O meter. Adjust AM CARRIER LEVEL (rear panel) to give P.O meter reading of 5.

   Set MIC. GAIN to "8" for normal operation on A.M.

3. For SSB operation, follow the tune up procedure as for A.M. Press USB or LSB button as required. Set MIC. GAIN at approx. "2" or as required to produce a reading of 4 or 5 on the P.O meter on voice peaks.

4. On C.W. the P.O meter should indicate 9 or 10. PUSH CW BUTTON FOR "TRANSMIT," SSB BUTTON FOR "RECEIVE".

English language inst. book will be provided when available. All sets are checked before despatch and covered by our 90 day warranty except valves and semi-conductors.
Failure to observe precautions and operate the equipment in a proper manner renders warranty void. No sets to be returned for service without agents authority and unless all freight charges are pre-paid by owner.

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Bail Electronic Services.
60 Shannon St;
Box Hill Nth. 3129
Melbourne. Vic.
Tel. 89-2213.