YAESU

Combined OPM/Service manual
(This is all that exists)

SAME AS SMC 2546L8

FM LAND MOBILE TRANSCEIVER

FTL-7007

25 WATTS OF POWER OUTPUT FOR SERIOUS BUSINESS COMMUNICATIONS ON THE UHF LAND MOBILE BAND.

FOR SERVICE MANUALS
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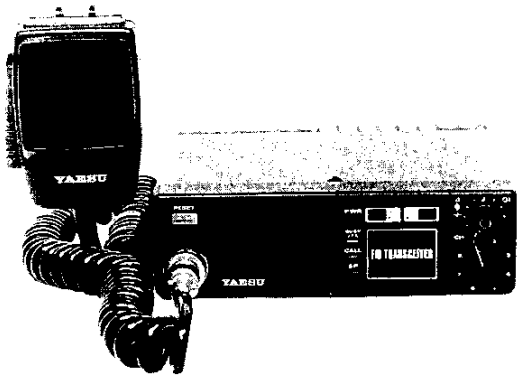

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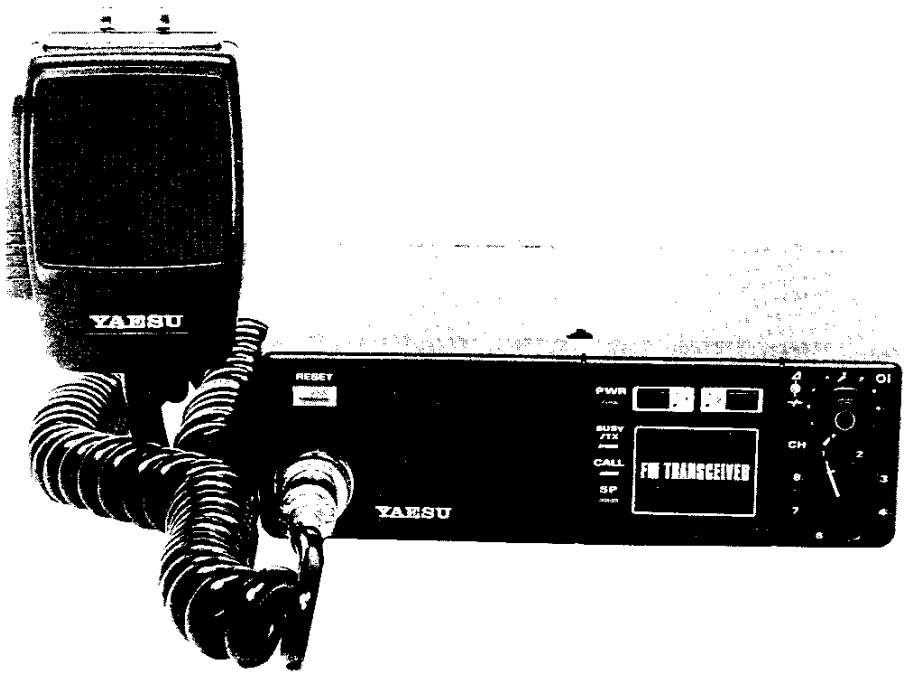


The 25-watt FTL-7007 is a synthesized two-way FM transceiver designed for serious business communications on the UHF land mobile band. Up to eight simplex or semi-duplex channels can be programmed in internal EEPROM.

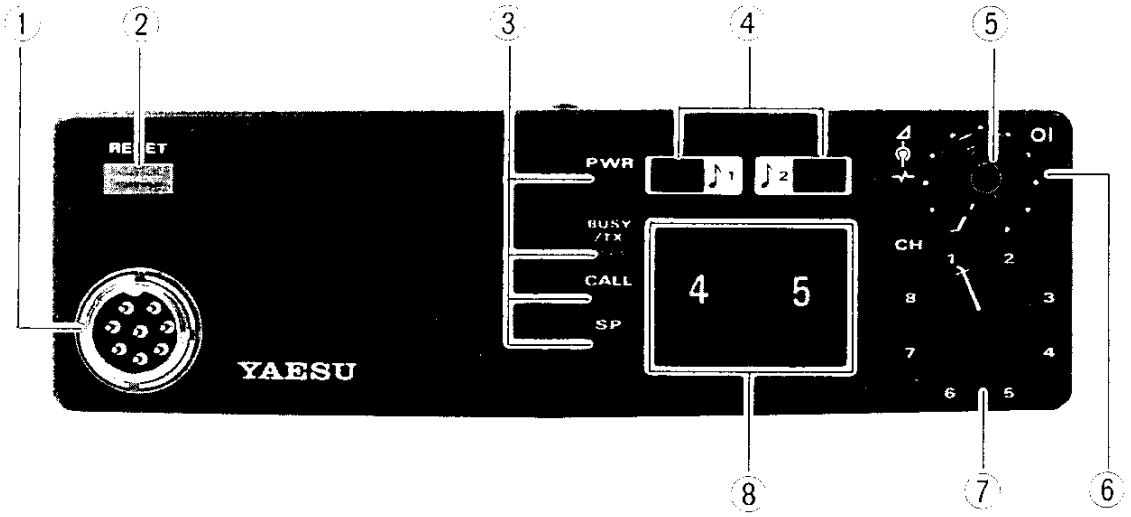
Options for the FTL-7007 allow precise tailoring to your business communications needs. ZVEI, CCIR and EEA five-tone selective calling systems can be installed, with two calling tones selectable from the front panel. Subaudible CTCSS Encoder/Decoder Options are also available, with and without PTT Lockout, providing silent monitoring of busy channels with different subaudible tones for transmit and receive on each channel, if required.

Channel and subaudible tone frequencies can be added or changed in minutes by your Yaesu dealer, using the FYG-4 EEPROM Programmer. The FYG-4 also allows cloning programmed data from one transceiver to another, meaning quick programming of your entire fleet.

Please take a few minutes to read this manual before operating the transceiver.

CONTROLS & CONNECTORS

FRONT PANEL



(1) MIC Jack

Connect the microphone plug to this jack. Tighten the knurled ring on the plug to secure it in place.

(2) RESET Button

If the optional tone squelch or 5-tone system is installed, press this button to defeat the squelch and hear all activity on the channel. If an optional selective calling system is installed, press this button after receiving a call to reset the system for another call.

(3) PWR, BUSY/TX, CALL and SP Lamps

PWR glows green whenever the transceiver is on.
BUSY/TX glows green when the squelch is open during reception, and red while transmitting.
CALL glows yellow after a selective call is received (until the RESET button is pressed).
SP glows red whenever the receiving audio is disabled (during transmission, or when disabled by an optional tone system).

(4) 1 and 2 Buttons

These buttons are used to activate and deactivate selective calling accessories.

(5) Squelch Control and Power Switch

Press this inner control to turn the transceiver on and off, and turn it to adjust the signal level at which the receiver is silenced. Set just to the point where noise is silenced on a clear channel.

(6) Volume Control

The outer knob adjust the receiver volume.

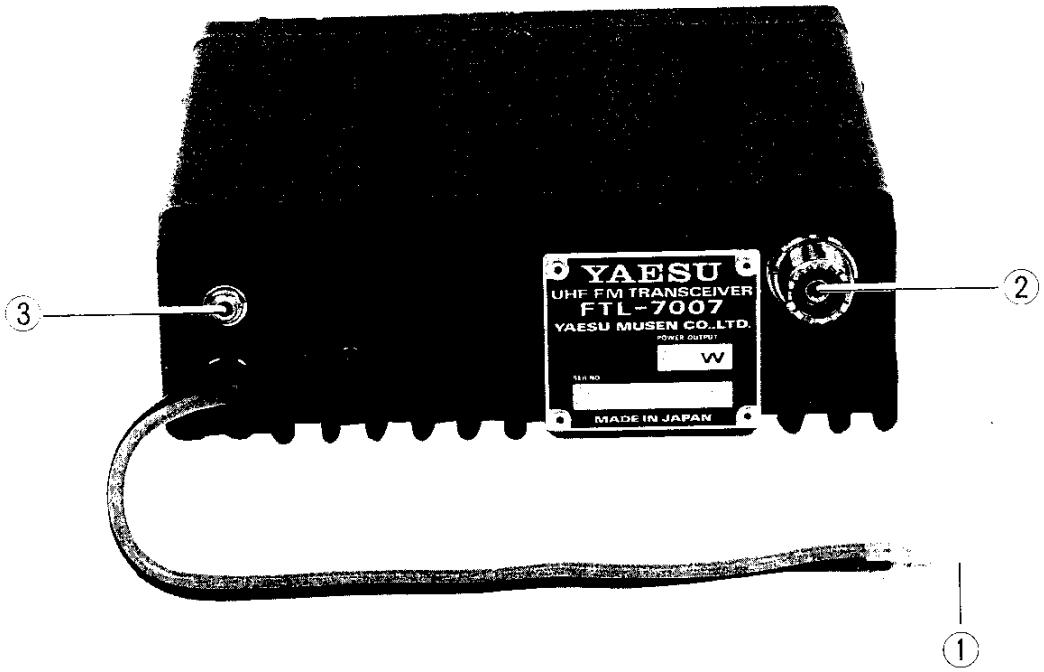
(7) CH (Channel) Selector

Turn this knob to select the operating channel (1 - 8). If fewer than 8 channels are installed, some positions will be inactive or redundant.

(8) Digit Selector Buttons

When the 5-tone option is installed, these four buttons select the id number of a station to be called using 5-tone selective calling. Press the upper ("-") button to step a digit down, and the lower ("+") button to step a digit up.

REAR (Heatsink)



(1) 13.2VDC Cable

Connect this pigtail via the supplied fused cable to the vehicle battery or other power source. The red lead must be connected to the positive supply, and black to negative (ground). Use only the supplied fused cable, extended if necessary, for any power connection.

(2) ANT (Antenna)

The 50-ohm coaxial feedline to the antenna must be connected here using a type-M (PL-259) plug.

(3) EXT SP (External Speaker)

The optional FSP-2/-3/-4 or SP-55 external loudspeakers may be connected to this 2-contact mini-phone jack.

HOW TO USE THE TRANSCEIVER

IMPORTANT! - Before turning on the radio the first time, confirm that the power connections have been made correctly to the power source, and that a proper antenna is connected to the antenna jack. If the transceiver is not installed, see the Installation section.

Press the squelch knob (with the red circle) to turn on the radio. The PWR lamp will glow green. If a continuous beep is heard, the transceiver has not yet been programmed with channel frequencies: switch off the power and contact your Yaesu dealer to have the channels programmed.

Setting the Squelch

If this is the first time to use the transceiver, set the (inner) squelch control counterclockwise, and the adjust the (outer) volume control for comfortable receiver volume on background noise or a signal (if the SP lamp is lit, press and hold the RESET button or remove the microphone from its hanger to hear the receiver while adjusting the volume control).

Rotate the CH selector, if necessary, to find a channel where only noise is heard. Turn the squelch control clockwise just to the point where the noise is silenced (and the green BUSY/TX indicator turns off).

Transmitting

To transmit, wait until the BUSY/TX indicator is off (the channel is not in use), and press the PTT (Push-To-Talk) switch on the side of the microphone (the BUSY/TX and SP lamps will both glow red). While holding the PTT switch, speak across the face of the microphone in a clear, normal voice, and then release the PTT switch to receive.

Note: if your transceiver has been programmed for busy channel lock-out, the transmitter will not be activated when the PTT switch is pressed unless the BUSY/TX and SP lamps are off. This prevents interference to other stations.

If the selected channel has been programmed for automatic time-out, you must limit the length of your transmissions. If you accidentally exceed the time-out period, a short beep will sound, the BUSY/TX indicator will no longer glow red and transmission will cease. Release the PTT switch, listen for a moment, and then press it again to resume transmitting if the channel is clear.

Tone Squelch Operation (FTS-14 Option)

The optional tone squelch unit allows silent monitoring of busy channels. See your Yaesu Dealer for purchasing and installation.

The mounting knob on the back of the microphone and its hanger form an integral part of the tone squelch system. For proper operation, the microphone hanger must be affixed to the metal body of the vehicle. To use the tone squelch system:

(1) Place the microphone into its hanger.

(2) The radio remains silent until a call is received from a station using an identical tone squelch system. When the matching tone signal is received, the caller will be heard in the speaker.

(3) When you transmit, a subaudible tone (too low to hear) will be sent automatically along with your voice. This will open the squelch of the other party's radio, in the same way that your receiver responded.

Note that when a signal is received which does not include a matching tone, your BUSY/TX lamp glows green, indicating that the channel is occupied. However, the SP lamp glows red, indicating that receiver audio is disabled (you cannot hear the signal). Always wait until the BUSY/-TX lamp is off before transmitting, to avoid interfering with the other stations on frequency.

When you remove the microphone from its hanger the tone squelch is defeated, so you will hear all stations on the channel.

Five-Tone Unit Operation (F5D-9 Option)

The F5D-9 sequential tone unit may be installed in your radio if you are part of a large group all using the same channel. Each radio is assigned a certain tone code to which only that receiver will respond. Digit selectors on the front panel allow each station to call any other simply by setting the selectors for another station's assigned code, and closing the PTT switch.

Receiving Calls

If you have not already adjusted the squelch control as described on page 1-5, you must do so now. If the yellow CALL lamp is lit, press the RESET button. Remember: the CALL lamp must be off for the 5-tone system to function.

When another station (with 5-tone unit) calls you, four things happen:

(1) your radio automatically transmits for a moment* to acknowledge your presence,
(2) a 1 kHz alerting tone sounds in your loudspeaker for three seconds,
(3) your receiver audio is activated, and
(4) the yellow CALL lamp lights.

Squeeze the PTT switch to respond to the call.

After finishing a contact with another station, remember to press the RESET button to turn off the CALL lamp and silence the receiver, so that you can receive other calls.

You may also receive group calls, at which time only items (2), (3) and (4) will occur (your radio will not transmit). Press RESET to turn off the CALL lamp when the call is finished.

If you leave your vehicle with the radio on and return to find the CALL indicator lit, you know that a call came for you while you were away. Just press the PTT switch and speak to return to the caller.

* may be disabled

Placing Calls

(1) If the CALL indicator is lit, press RESET.

(2) Select the code number of the station you want to call by pressing the buttons above (-) and below (+) the digits on the front panel.

(3) Press the PTT switch on the microphone briefly.

Your transmitter will automatically send the code number to activate the called party, your CALL indicator will light, and your loudspeaker will be activated. If the called station is within range** you will hear his tone acknowledgement. Now press (and hold) the PTT switch again and talk. Release it to listen.

When finished your call, remember to press RESET to silence your receiver, extinguish the CALL lamp and reactivate the 5-tone unit.

Note that when a signal is received which does not include a matching tone, your BUSY/TX lamp glows green, indicating that the channel is occupied. However, the SP lamp glows red, indicating that receiver audio is disabled (you cannot hear the signal). Always wait until the BUSY/-TX lamp is off before transmitting, to avoid interfering with the other stations on frequency.

** and his transpond function is not disabled

INSTALLATION

Normally, your Yaesu Dealer will provide complete installation of all stations in your system. However, basic installation information is provided here for your reference.

For mobile service, your transceiver should be installed so that the controls, indicators and microphone are easily accessible for operation and viewing, without interfering with road vision, and so that the loudspeaker may be easily heard. The radio may be installed in any position without loss of performance. Typical installation locations are beneath the dashboard or atop the transmission tunnel in small vehicles, or overhead in a truck cabin.

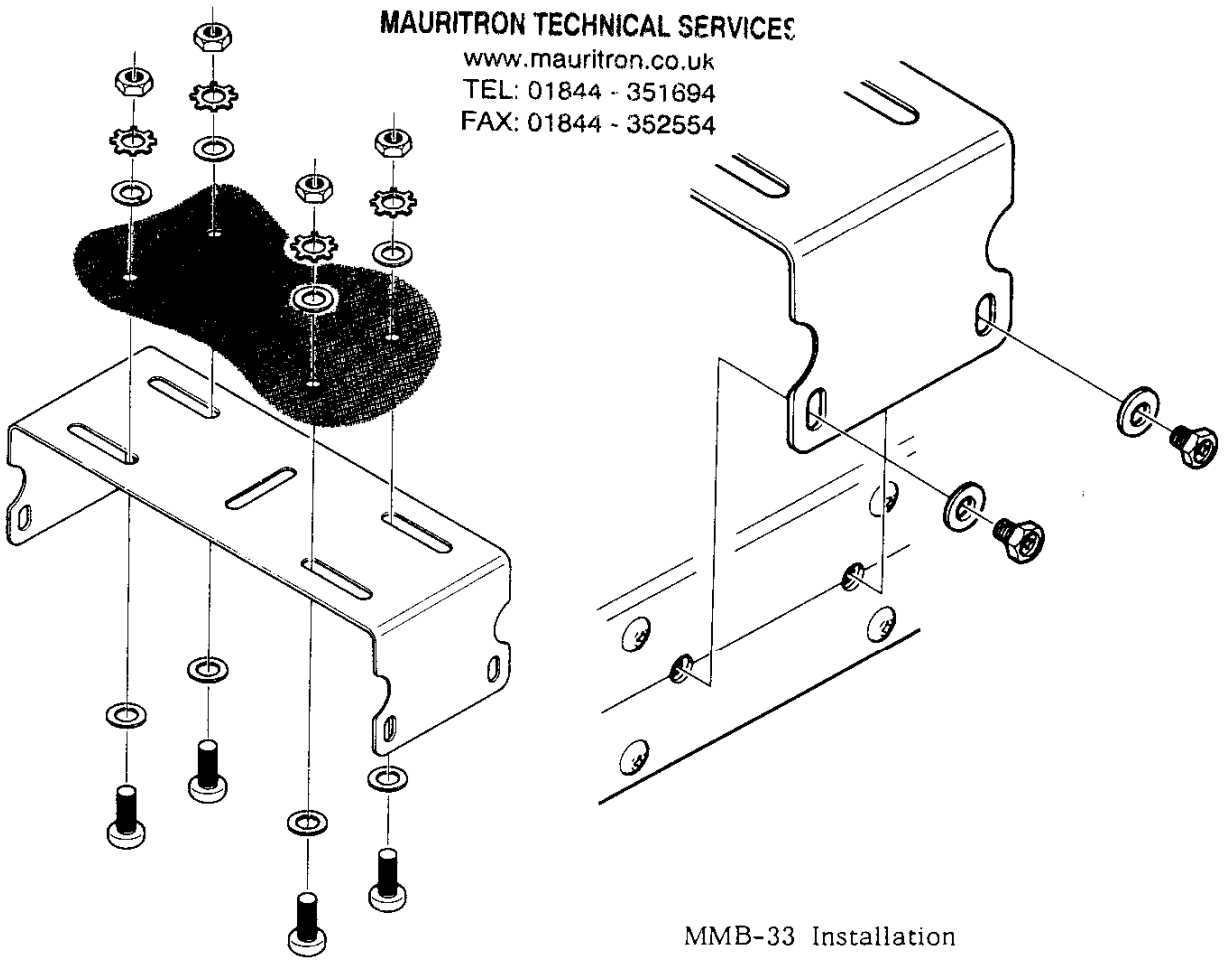
The MMB-33 universal mounting bracket and mounting hardware are supplied with the transceiver.

Mobile Mounting Procedure

(1) Using the mounting bracket as a template, mark the locations of the mounting holes in the desired position. Use a 3/16" (4.8mm) diameter bit to drill the holes after making certain that there will be enough space for the transceiver, connecting cables and controls. Secure the bracket with the screws, washers and nuts supplied, as shown in the drawing on the next page.

(2) Position the transceiver in the bracket so that the holes in the side panels are aligned with those in the sides of the bracket, and bolt the transceiver into place with the supplied short screws and flat washers.

(3) The microphone hanger must be installed so as to make electrical contact with the car body if tone squelch operation will be used. Otherwise the hanger may be installed wherever convenient.



MMB-33 Installation

Base Station Installation

The FP-700 AC Power Supply may be used to operate the FTL-7007 from a variety of AC mains voltages. Connect the fused DC Cable supplied with the transceiver to the colored terminals on the rear of the FP-700 (red-to-red and black-to-black).

NOTE: In all installations, means must be provided to ground the metal mounting loop on the microphone in order for the squelch and scanning/monitoring systems to function. In base installations, a grounding hook must be provided in which to rest the microphone when not transmitting.

For mobile installations, the power cable should be connected directly

to the automobile battery. This allows the radio to operate without turning on the ignition, and may also reduce noise in the receiver. Connection to the cigarette lighter or other existing circuits may result in overloading, or degradation of transceiver performance.

Always use the supplied DC power cable, which includes fuses to protect you, your vehicle and the equipment. If it is necessary to lengthen the power cable, use #12 AWG stranded, insulated copper wire. Use the shortest length possible, connected to the end of the DC cable that does not have connectors installed.

CAUTION

Permanent damage will result if the power supply polarity is reversed. Our warranty does not cover damage caused by reversed power supply connections.

Refer to the diagrams on page 1-13 for power cable connection details.

(1) Before connecting the supplied DC cable to the transceiver, connect the RED lead of the DC cable to the POSITIVE (+) battery (or power supply) terminal, and the BLACK lead to the NEGATIVE (-) terminal.

(2) Connect the DC power cable to the cable pigtail at the back of the transceiver: RED to RED and BLACK to BLACK.

(3) Connect the coaxial plug on the antenna cable (not supplied) to the coaxial antenna jack on the transceiver. Antenna impedance must be 50 ohms at the operating frequency.

(4) Connect the microphone plug to the jack on the transceiver.

(5) If the optional Yaesu SP-55, FSP-2/-3/-4 or similar external speaker is to be installed, insert the plug from the speaker into the EXT SP jack on the rear (disabling the internal speaker).

MAINTENANCE AND SERVICE

Keep the outside of the transceiver clean by wiping with a soft cloth as necessary. Avoid rain or immersion in water, and protect the radio from dust as much as possible. Do not open the case. If the radio fails to operate, check the cable connections, and inspect the fuses in the DC cable. See Fuse Replacement, below.

Regular Maintenance Plan

Your Yaesu dealer will advise you of the preventative maintenance plan that best suits your needs. We recommend that the transceiver be returned to your Yaesu dealer at least once every two years, for testing of receiving sensitivity and transmitter power output.

If the need for servicing does arise, phone your Yaesu dealer for a service appointment. Your dealer will be pleased to answer any service-related questions, and his qualified service technicians will make sure that your radio is back in service as quickly as possible.

Fuse Replacement

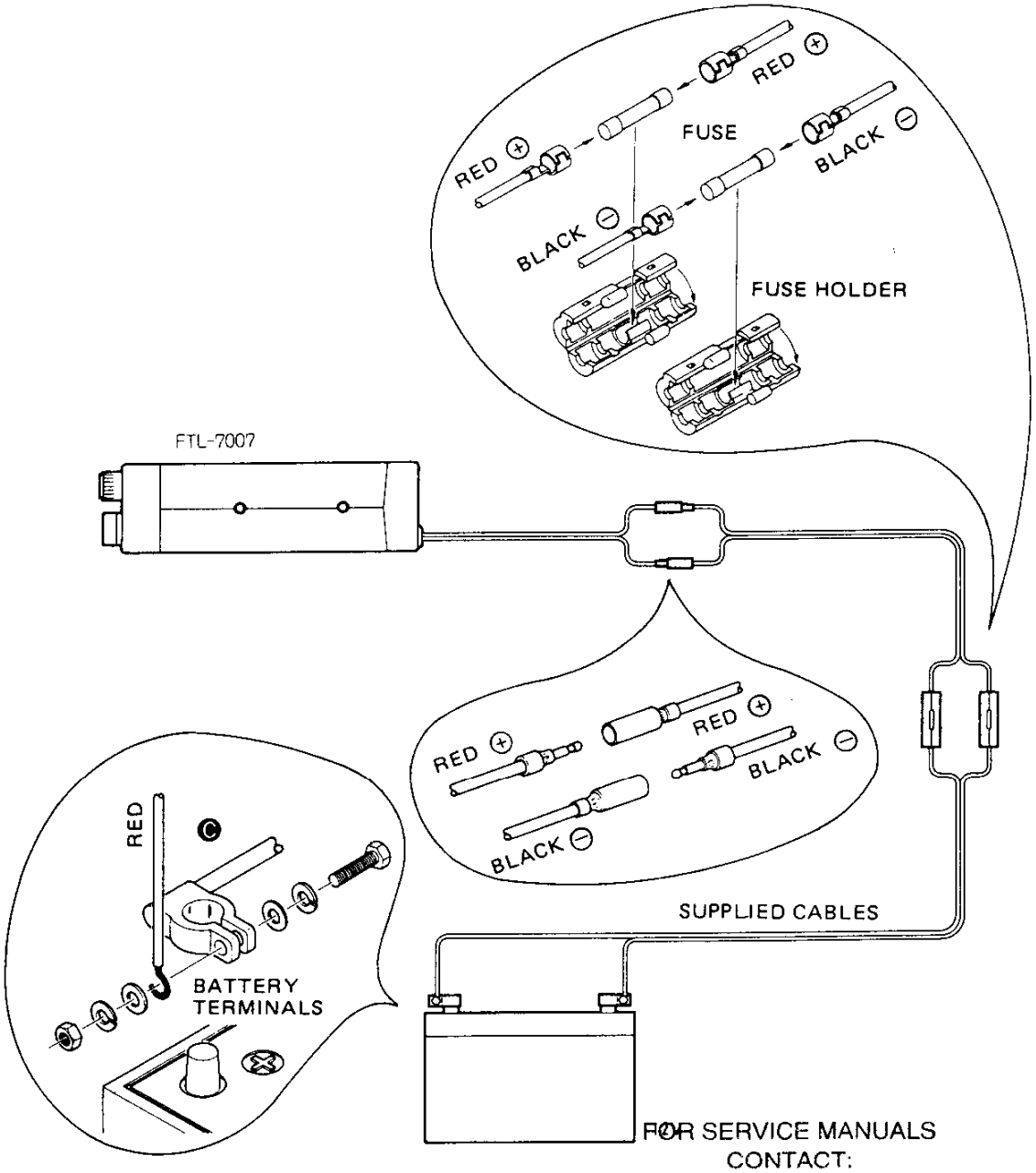
If a fuse is blown, before replacing it, see if you can determine if it was caused by something outside of the radio (perhaps a short circuit due to a worn cable or pigtail near the radio). Contact your Yaesu dealer at once if you do not find the cause of the problem. Replace fuses only with the same type installed.

CAUTION

When replacing fuses, make certain to use the correct type (fast-blow) and rating (10A) for the transceiver. The warranty policy does not cover damage that may result from use of an improper fuse.

SERVICE INFORMATION

If the transceiver fails to operate when switched on, check the fuses in the power cable. If either is found to have blown, attempt to locate and correct the cause of the problem before replacing the fuse(s). The FTL-7007 has no user-serviceable parts inside.



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SPECIFICATIONS

GENERAL

Frequency range:
450-470 MHz

Channels:
up to 8

Frequency stability:
better than ±1.5 kHz
(±1.0 kHz optional)

Emission type:
F3E

Antenna connection:
M-type (SO-239) socket

Supply voltage:
10.8 to 15.6V DC, negative ground

Current consumption (Approx.):
0.3A Standby, 0.45A Receive, 7A Transmit

Case size (WHD):
160 x 50 x 158mm

Weight (Approx.)
1.5 kg

RECEIVER

Circuit type:
Double conversion superheterodyne

Sensitivity (for 20 dB SINAD):
better than 1 uV

Adjacent channel selectivity:
better than 70 dB

IF frequencies:
54.5 MHz & 455 kHz

Image rejection:
better than 70 dB

Intermodulation distortion:
better than 70 dB

Audio output (for 5% THD):
more than 1.5 watts @ 8 ohms

TRANSMITTER

Power output:
up to 25 watts (maximum)

Modulation method:
Variable reactance modulation (F3E)

Maximum deviation:
±2.5 kHz (12.5 kHz/step vers.)
±4 kHz (20 kHz/step vers.)
±5 kHz (25 kHz/step vers.)

FM Noise:
better than -40 dB @ 1 kHz

Spurious emissions:
better than 80dB below carrier

Audio distortion:
less than 5% @ 1 kHz, with standard deviation

Microphone:
600-ohm dynamic

SUPPLIED ACCESSORIES

One Microphone:
MH-5F8 (Noise Cancelling), or MH-15B8 (DTMF Keypad)

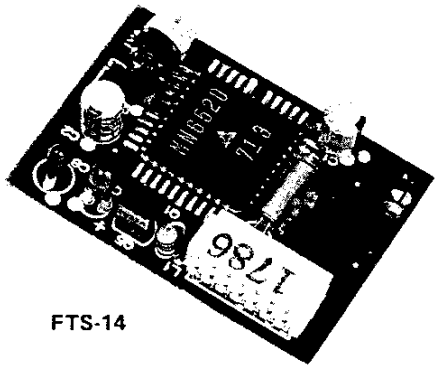
Fused DC Cable:
T9015615, with:
two 10A fuses for models with more than 10W, or
two 5A fuses for models w/10W or less

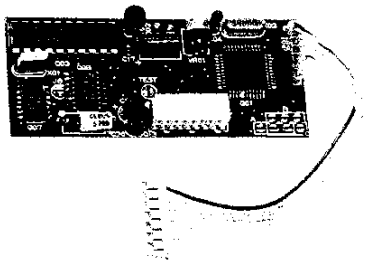
MMB-33 Mobile Mounting Bracket

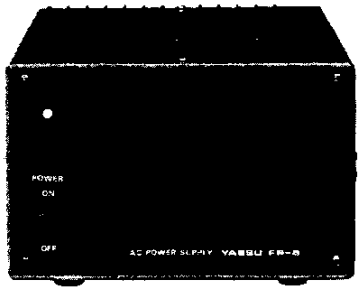
OPTIONAL ACCESSORIES

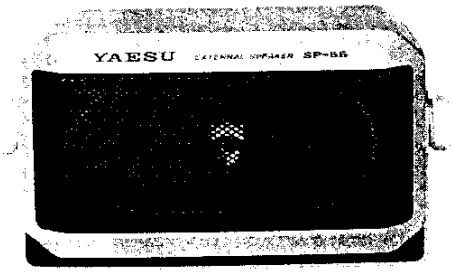
FYG-4	EEPROM Programmer
FTS-14	CTCSS (subaudible tone) Unit
F5D-9	Five-Tone Selective Calling Unit
FP-700	AC (Base Station) Power Supply
SP-55	External Loudspeaker

FYG-4


FTS-14


F5D-9


FP-8



SP-55

NOTES :

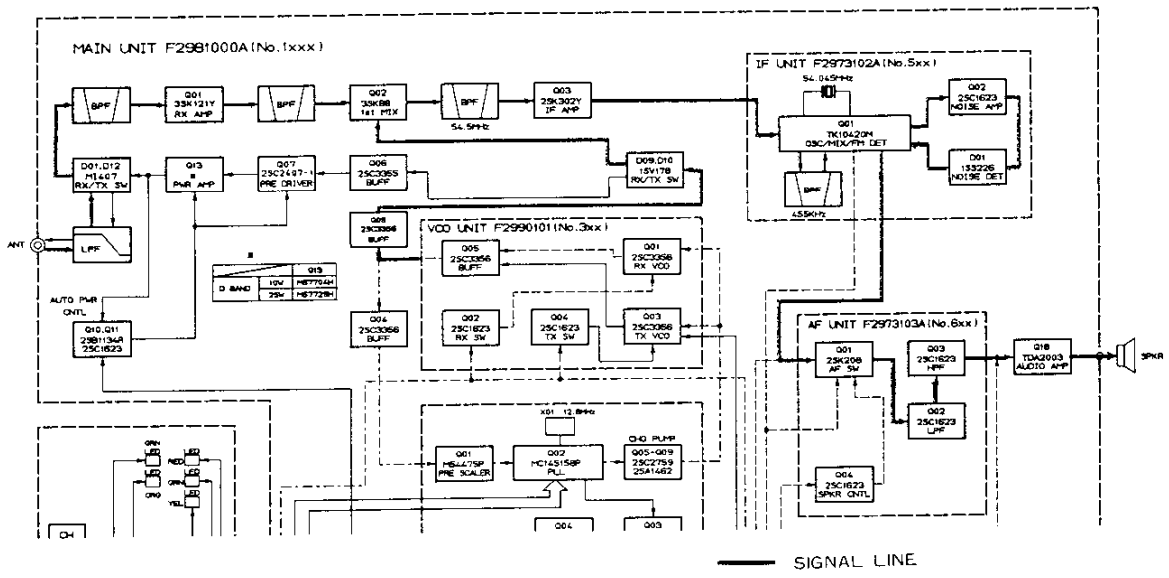
Receive Signal Path

Incoming RF from the antenna jack is delivered to the Main Unit and passed through a lowpass filter and a $\frac{1}{4}$-wave antenna switching network consisting of coils L1002 & L1003, capacitor C1004 and diodes D1001 & D1002. Signals within the frequency range of the transceiver are then passed through 2-stage helical resonator bandpass filter CV1001 before RF amplification by Q1001 (3SK121). The amplified RF is then bandpass filtered again by 2-stage helical resonator CV1002, to ensure pure in-band input to 1st mixer Q1002 (3SK88).

Buffered output from the VCO Unit is amplified by Q1005 (2SC3356) and passed through 1st local switching diode D1009 before filtering by 2-stage helical resonator CV1003, to provide a pure 1st local signal between 395.5 and 415.5 MHz to the 1st mixer. The resulting 54.5 MHz product of the 1st mixer is passed through dual monolithic crystal filter XF1001 on the Main Unit, to strip away all but the desired signal, which is then amplified by Q1003 (2SC2714).

The amplified 1st IF signal is delivered to the IF Unit and applied to FM IF subsystem IC Q501 (TK10420) on the IF Unit, which contains the 2nd mixer, 2nd local oscillator, limiter amplifier, noise amplifier and squelch gates. The 2nd local signal is generated from 54.045 MHz crystal X501, which produces the 455 kHz 2nd IF when mixed with the 1st IF within Q501. The 2nd IF is passed through ceramic filter CF1001 on the Main Unit, to strip away unwanted mixer products, and then applied to the limiter amp in Q501, which removes amplitude variations in the 455 kHz IF before detection of the speech signal by ceramic discriminator CD501.

Detected audio is de-emphasized by R1022 and C1032 and then delivered to the AF Unit. Here the audio is passed by audio muting gate Q601 (2SK208Y) through lowpass filter Q602 (2SC1623) and highpass filter Q603 (2SC1623) before delivery through the volume control to audio power amplifier Q1005 (TDA2003) on the Main Unit, providing up to 1.5 watts to the 8-ohm loudspeaker.



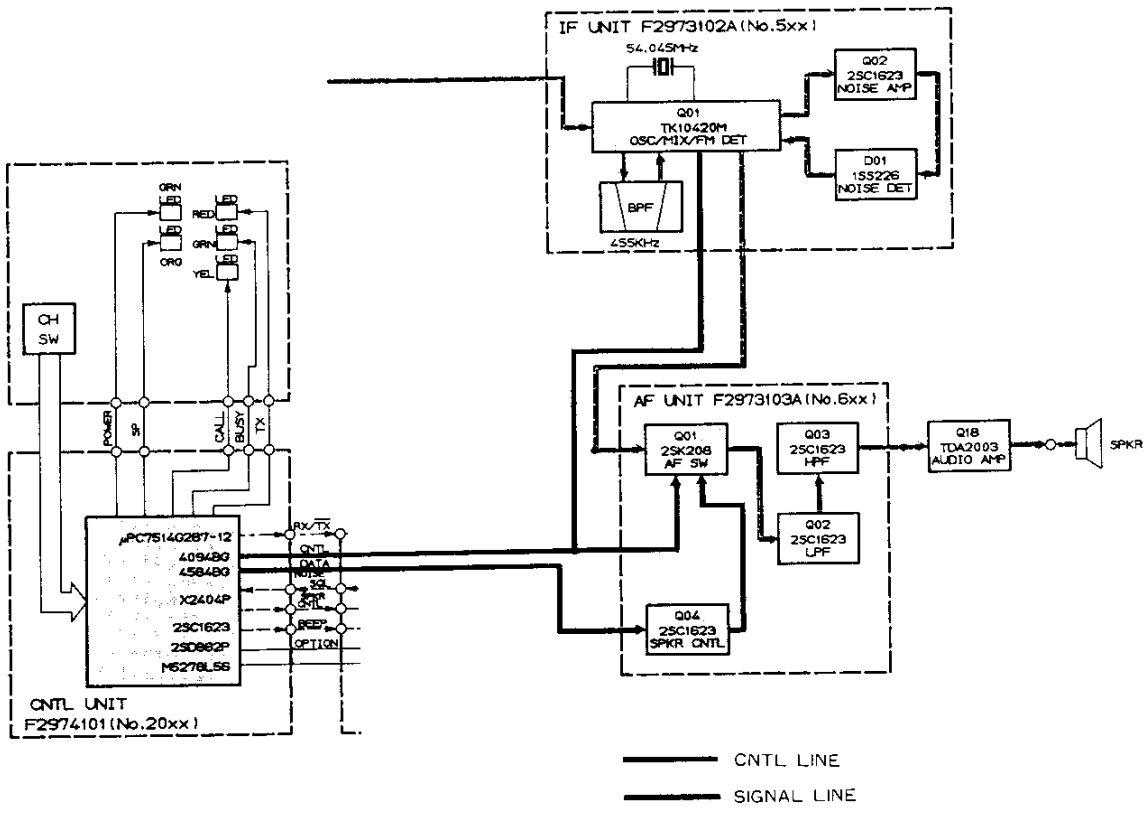
RECEIVER BLOCK DIAGRAM

Squelch Control

The squelch circuit consists of noise amplifier Q502 (2SC1623) on the IF Unit, a squelch trigger within Q501, and control circuitry within microprocessor Q2016 (uPD7514G) on the Control Unit.

When no carrier is received, noise at the output of the detector stage in Q501 on the IF Unit is highpass filtered and amplified in the noise amp section of Q501 and Q502 (2SC1623), and then rectified by D501 to provide a DC control voltage for the squelch switching section within Q501. With no carrier, pin 13 of Q501 is low. This pin connects via the Main Unit to Q2004 (2SC1623) on the Control Unit, which keeps the BUSY indicator off until a carrier is received. Q2004 also provides noise squelch status to the microprocessor for scanning control, and to mute the audio via Q604 on the AF Unit, which cuts off squelch gate Q601 and removes input to the final audio amplifier.

When a carrier appears at the discriminator, noise is removed from the output, causing pin 13 of Q501 to go high, which in turn causes Q2004 to turn on the BUSY indicator, and the microprocessor to activate Q604 so that Q601 passes audio to the amplifier and loudspeaker.

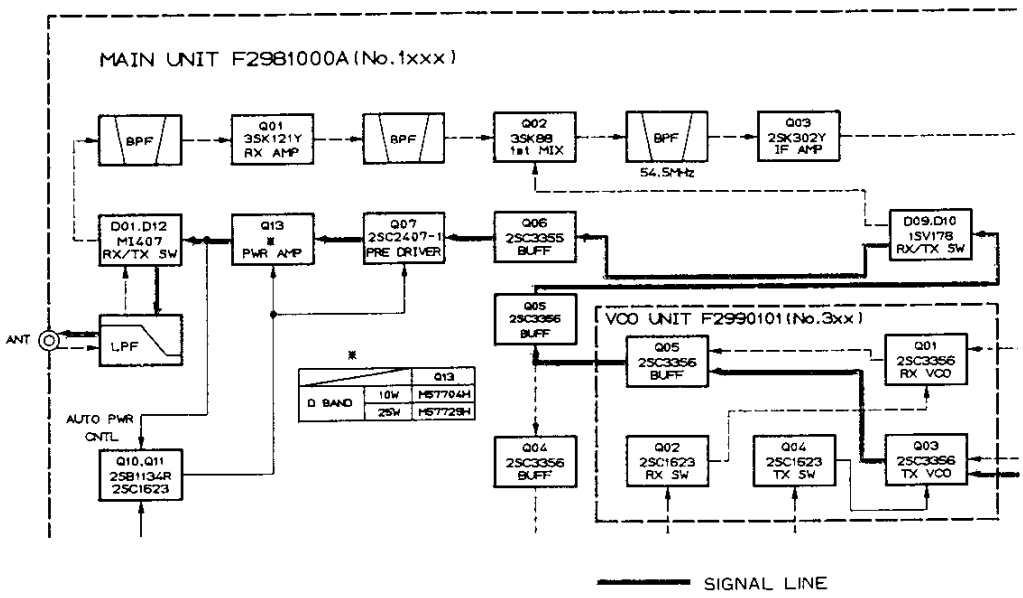


SQUELCH CONTROL BLOCK DIAGRAM

Transmit Signal Path

Speech input from the microphone is delivered to the Mic Amp Unit for amplification by one quarter (a) of quad opamp Q802, and pre-emphasis by R801 and C801. Q802b then provides IDC (Instantaneous Deviation Control), Q802c buffers the signal, and Q804d filters the speech signal to remove any high frequency components that might result in overdeviation.

The processed audio is delivered to diode D305 (1SS53) on the VCO Unit, frequency modulating the PLL carrier up to ±5 kHz (depending on transceiver version) from the unmodulated carrier at the transmitting frequency. The modulated signal from transmitter VCO Q303 (2SC3356) is buffered by Q305 (2SC3355) and delivered to the Main Unit for amplification by Q1005 and passage through transmit switching diode D1010 to amplifier Q1006 (2SC3355) and predriver Q1007 (2SC2407-1) before final amplification by RF Power Module Q1013 (M57729H) up to 25 watts. Harmonic spurious radiation in the final output is suppressed by a 3-pole lowpass filter, and the transmit signal then passes through $\frac{1}{4}$-wave antenna switch D1012 before delivery to the antenna.



TRANSMITTER BLOCK DIAGRAM

Automatic Transmit Power Control

RF power output from the final amplifier is sampled by C1096, and rectified by D1013 (1SS108). The resulting DC is amplified by Q1008 and Q1009 (2SA812 x 2), and Q1012 (2SC945AQ) to bias the predriver and RF power module through Q1010 (2SB1134), thus maintaining stable output power under varying antenna loading conditions.

Spurious Suppression

Generation of spurious products by the transmitter is minimized by the fundamental carrier frequency being equal to the final transmitting frequency, modulated directly in the transmit VCO. Additional harmonic suppression is provided by a 3-pole lowpass filter consisting of L1001, L1023, L1024 and C1002, C1003, C1093, C1095, C1097, C1098 and C1195, resulting in more than 80dB harmonic suppression prior to delivery to the antenna.

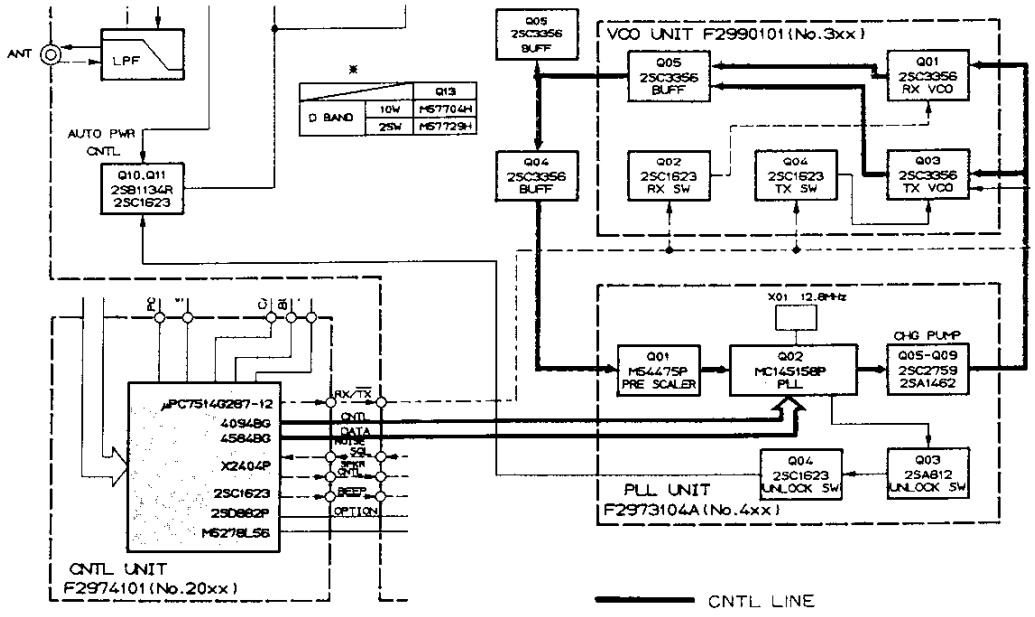
PLL Frequency Synthesizer

The PLL Unit contains swallow counter Q401 (M54475) and PLL subsystem IC Q402 (MC145158P), which consists of a reference oscillator/divider, serial-to-parallel data latch, programmable divider and a phase comparator. Stability is obtained by a regulated 5V supply to Q402 and a thermistor and temperature compensating capacitor associated with 12.8 MHz frequency reference crystal X401.

Receiver VCO Q301 (2SC3356) on the VCO Unit oscillates between 395.5 and 415.5 MHz according to the programmed receiving frequency. This local signal is buffered by Q305 (2SC3355), and delivered via buffer Q1004 (2SC3356) on the Main Unit to prescaler/-swallow counter Q401 on the PLL Unit. There the VCO signal is divided by 128 or 129, according to a control signal from the data latch section of Q402, before being applied to the programmable divider section of the PLL chip.

The data latch section of Q402 also receives serial dividing data from microprocessor Q2016 on the Control Unit, which causes the predivided VCO signal to be further divided by 31,640 to 33,240 (depending upon the desired receive frequency) in the programmable divider section, so as to produce a 12.5 kHz derivative of the original VCO frequency. Meanwhile, the reference divider section of Q402 divides the 12.8 MHz crystal reference by 1024 to produce the 12.5 kHz loop reference.

The 12.5 kHz signal from the programmable divider (derived from the VCO) and that derived from the crystal are applied to the phase detector section of Q402, which produces a dual 5V pulsed output with pulse duration depending on the phase difference between the input signals. This pulse train is converted to DC by charge pump Q405/Q406/-Q408 (2SA1462 x 3), and Q407/Q409 (2SC2759),



PLL & VCO BLOCK DIAGRAM

lowpass filtered on the Main Unit, and then applied to varactors D301 and D302 (1T32 x 2) on the VCO Unit to control the oscillating frequency of the VCO.

Changes in the level of the DC voltage applied to D301/D302 affect the reactance in the tank circuits of VCOs Q301 and Q303, changing the oscillating frequency according to the phase difference between the signal derived from the VCO and the crystal reference oscillator. The VCO is thus phase-locked to the crystal reference oscillator.

The output of receiver VCO Q301, after buffering by Q305 (2SC3355), is delivered to the Main Unit for amplification by Q1005 before application to the 1st mixer, as described previously.

Transmitter VCO Q303 (2SC3356) oscillates between 450 and 470 MHz according to the programmed transmit frequency. The remainder of the PLL circuitry is shared with the receiver. However, the dividing data from the microprocessor is such that the VCO frequency is at the actual transmit frequency (rather than offset for IFs, as in the receiving case). Also, the TX VCO is modulated by the filtered speech audio applied to modulating varactor D303, as described previously.

Transmit Inhibit

When the transmit PLL is unlocked pin 7 of PLL chip Q402 goes to a logic low, turning on Q403 (2SA1162) and Q404 (2SC1623). This unlock signal produces a low impedance at the base of Q1012 (2SC945AQ) on the Main Unit, which then turns off Automatic Power Controller Q1010 (2SB1134R) to disable the supply voltage to predriver Q1007, disabling the transmitter.

Push-To-Talk Transmit Activation

The PTT switch on the microphone is connected to pin 74 of microprocessor Q2016, so that when the switch is closed pin 65 (tx/rx) goes low. This signal is delivered to power bus controller Q1016 (MB3756) on the Main Unit, which then disables the receiver by disabling the 8V supply bus to the front end and IF Unit. At the same time, Q1016 activates the transmit 8V switching bias line to enable the transmitter.

NOTES :

The circuit boards in the FTL-7007 are located as shown in Figure 1. The following procedure describes how to access the various units.

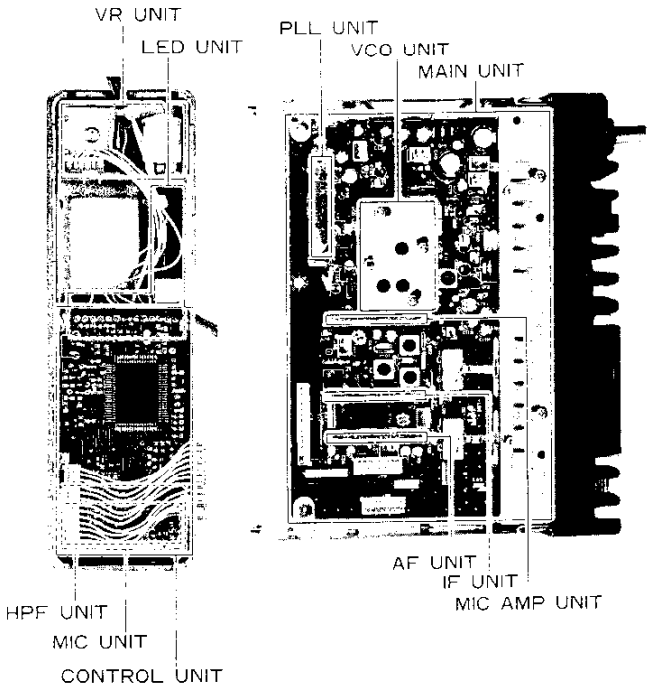


Figure 1

1) Remove the ten screws indicated in Figure 2, and remove the top and bottom covers, using care not to strain the speaker wires.

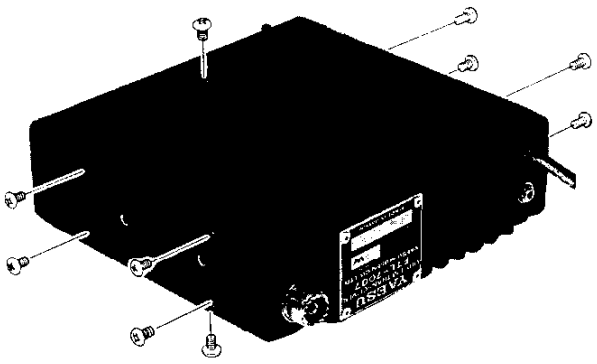


Figure 2

2) To access the Control, VR, HPF, MIC and Switch Units inside the front panel, remove the four screws indicated in Figure 3a, and unplug the seven connectors indicated in Figure 3b.

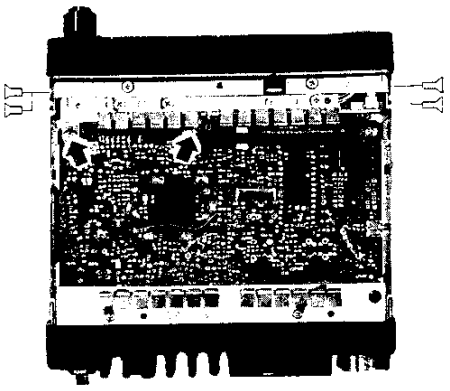


Figure 3a

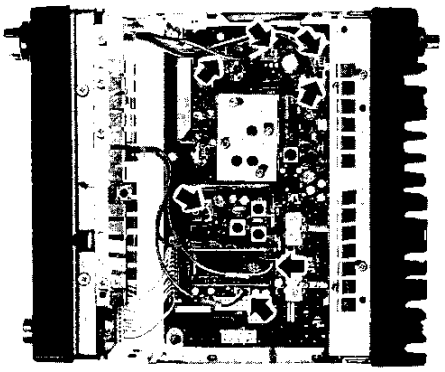


Figure 3b

To access the VR and Switch Units, remove the six screws (Figure 3c) affixing the shield plate to gain access to the VR and Switch Units.

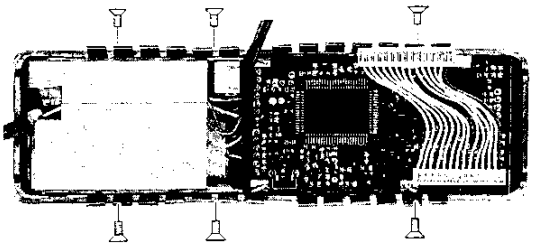


Figure 3c

To access the solder side of the Control Unit, or the VR, HPF and MIC Units, straighten the four mounting tabs shown in Figure 3d, and remove the three connectors between the Control Unit and other boards inside the front panel Ass'y.

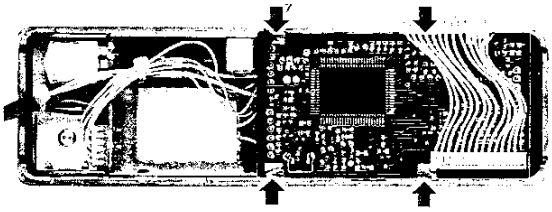


Figure 3d

3) To remove the PA Unit and the Main Unit from the chassis:

a) Remove the 4 screws on each of the shield covers on the top and bottom rear edges of the chassis (Figures 4a and 4b), and remove the covers.

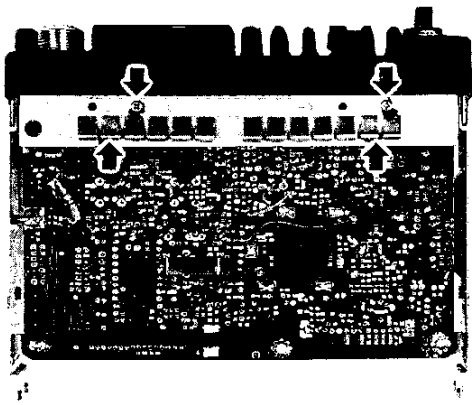


Figure 4a

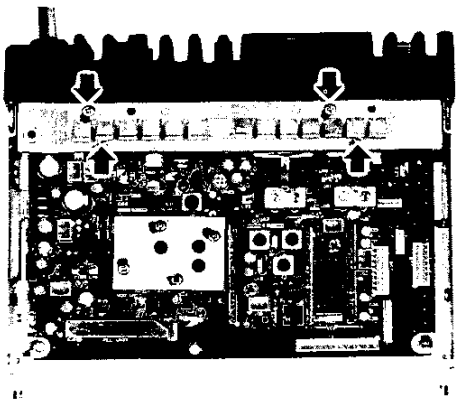


Figure 4b

b) Unsolder from the circuit board the resistor and capacitor shown in Figure 5a.

c) Unsolder the orange, red and black wires from the circuit board as shown in Figure 5b.

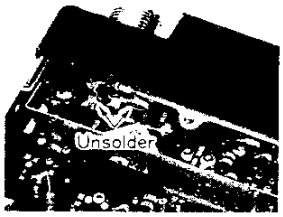


Figure 5a

Figure 5b

d) Referring to Figure 5c, remove the two black screws in the heatsink and the two screws on each side.

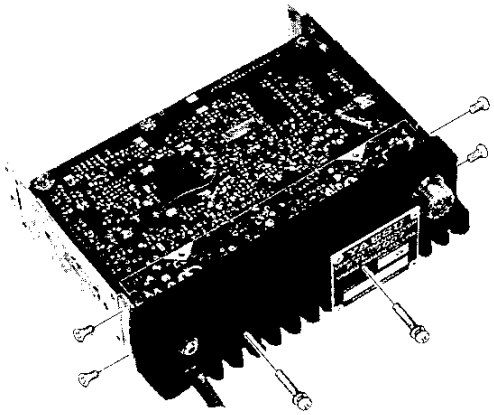


Figure 5c

e) Pull the heatsink back slightly from the chassis (Figure 5d), and unsolder the heavy red wire from the stand-off.

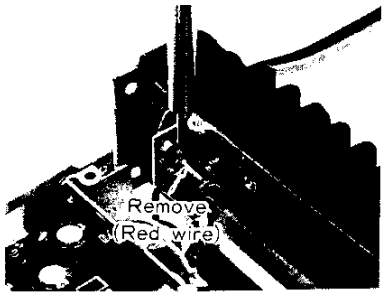


Figure 5d

The PA Unit can now be removed from the chassis.

Little maintenance should be required if the transceiver is not abused. As a Yaesu dealer, you are in the best position to determine how often your customers should bring the equipment in for maintenance. Operation in extremely harsh environments may warrant more frequent cleaning and checking of transceiver performance.

We recommend that your customers return their sets to you at least once every two years for routine checks of transmitter power output and receiver sensitivity. If these check okay (as described in the following alignment procedures), blow out any dust using moderate-force compressed air, and brush out any accumulated dirt inside the cabinet. Between maintenance checks, keep in contact with your customers in case they have particular service requirements.

Realignment should not be required unless new channel frequencies are installed above or below existing channels, or if damage requires replacement of certain parts. Realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing any faulty components.

The FTL-7007 is designed to allow simple, fast alignment. All adjustments except for the PLL VCV (Varactor Control Voltage) can be made without reprogramming channel frequencies. However, for the PLL VCV, the customer's channel frequencies must be replaced with the highest and lowest band limits for the model being aligned. This can be done with the FYG-4 Channel Frequency Programmer, or by cloning alignment frequencies from a preprogrammed set as described in the FYG-4 Manual. In this case you will want to reprogram the customer's original frequencies after alignment, so we recommend cloning them into another set (or FYG-4) for storage during alignment.

Of course, if the PLL is locking properly on all channels there should be no need to realign it, unless adding new channels above or below those already installed. Factory alignment is carried out at the limits of the frequency range.

ALIGNMENT

Three special alignment frequencies must be programmed in the FTL-7007 using the FYG-4 PROM writer. These are the high and low band edges, and the center of the band.

Alignment Equipment

Yaesu FYG-4 PROM Writer
DC voltmeter (at least 10 Megohms/volt)
AF millivoltmeter
500 MHz standard RF signal generator (SSG), with calibrated output and FM modulation levels (see note below).
AF signal generator
SINAD meter (Sinadder)
FM linear detector (deviation meter)
CM (directional RF) coupler
RF wattmeter (50W, ±5% @500 MHz)
50-ohm (500 MHz) dummy load
Frequency counter (100 Hz resolution at 500 MHz
Oscilloscope

Note: RF signal levels referred to in the alignment procedure assume 0dBu = 0.5uV.

Alignment Preparation and Precautions

Correct alignment requires the transceiver and test equipment temperature to be the same as the ambient air, and that this be held constant between 20 and 30°C (68 to 86°F). When the transceiver is brought into the repair shop it should be allowed at least two hours for thermal equalization and power on warm up before alignment.

Adjustments for specific readings or levels should not be made unless the oscillator shields and circuit boards are firmly mounted in place. Also, the frequency counter should be thoroughly warmed up before beginning.

Supply voltage during alignment must be held constant at 13.2V DC. Use a well-regulated, adjustable power supply capable of at least 10A continuous load.

Alignment Channel Frequencies

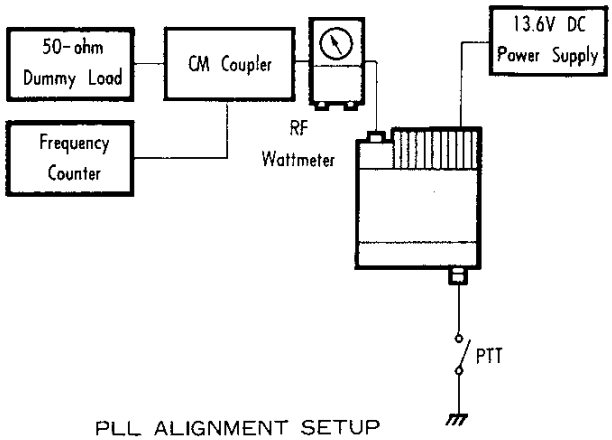
Channel 1:	450.000 MHz
Channel 2:	460.000 MHz
Channel 3:	470.000 MHz

A. PLL

Connect the dummy load to the antenna jack, and set the transceiver to Channel 3.

(1) PLL VCV (Varactor Control Voltage)

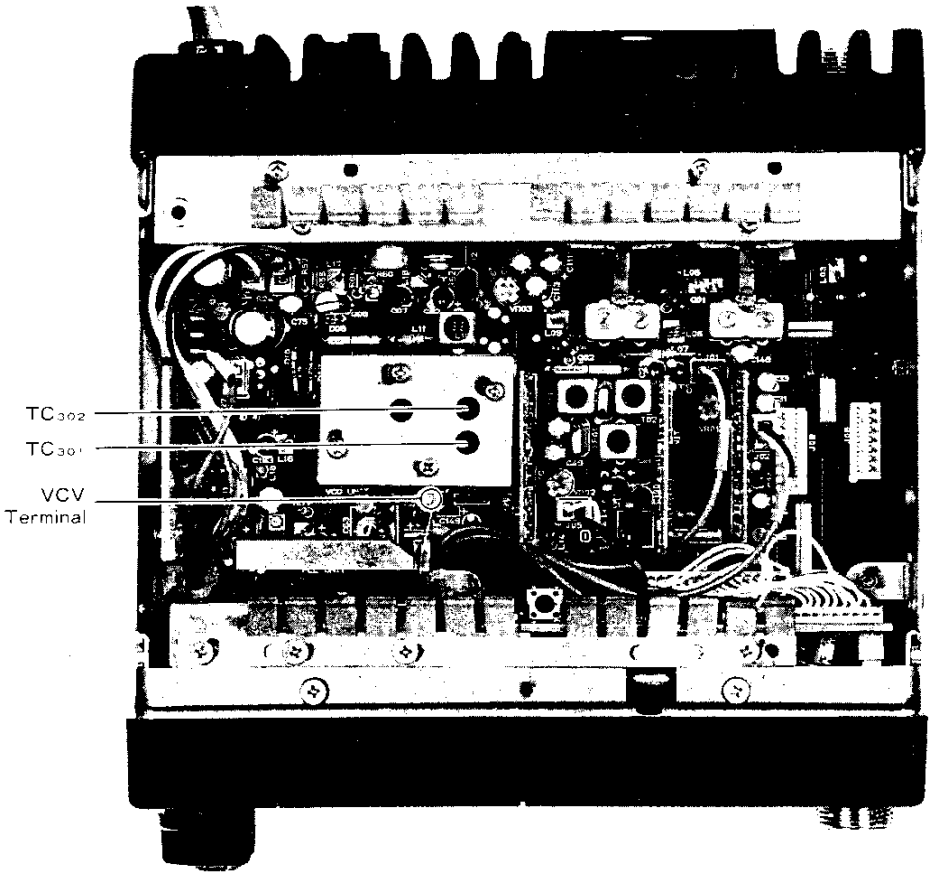
Connect the DC voltmeter (10V scale) from the VCV terminal on the VCO Unit to ground. Close the PTT and adjust TC302 (TX VCV) on the VCO Unit, if necessary, for 6V on the meter. Now release the PTT and adjust TC301 (RX VCV), if necessary, for 6V.



PLL ALIGNMENT SETUP

(2) PLL Lock (check only)

Select Channel 1 and check for 1.3 to 2.3V at the VCV terminal on the VCO Unit while receiving, and again while transmitting.



PLL ALIGNMENT POINTS

B. Transmitter

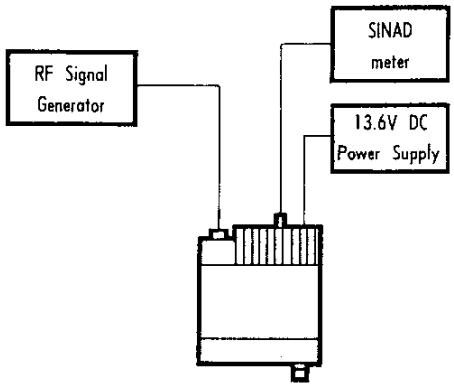
Set up the test equipment as shown in Figure 1. Close the PTT line when making adjustments. All adjustment points are on the Main Unit.

(1) Deviation

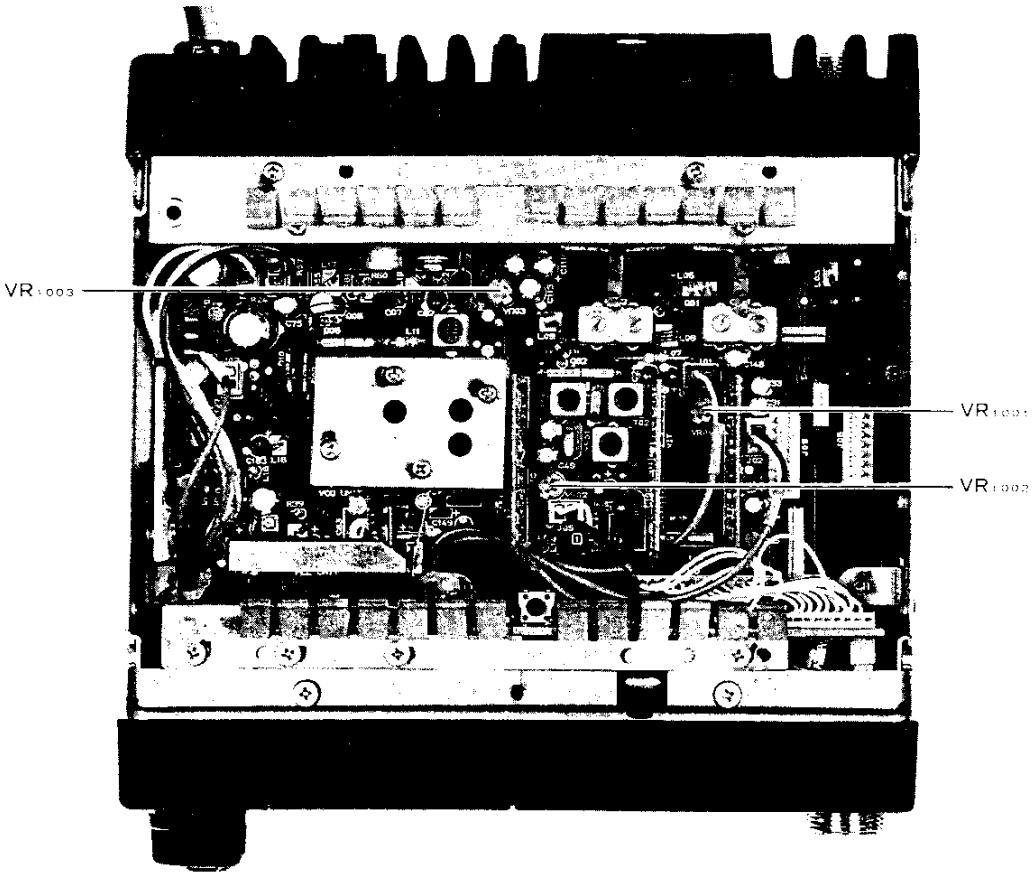
a) Set the AF generator for 25mV output at 1 kHz. Adjust VR1002 for 90% of system deviation.
b) Reduce the AF generator level to 2.0mV and adjust VR1001 for 60% of system deviation.

(2) Power Output

While tuned to the centermost transmit channel, adjust VR1003 for the required transmitter power output on the wattmeter (25W maximum).



TRANSMITTER ALIGNMENT SETUP



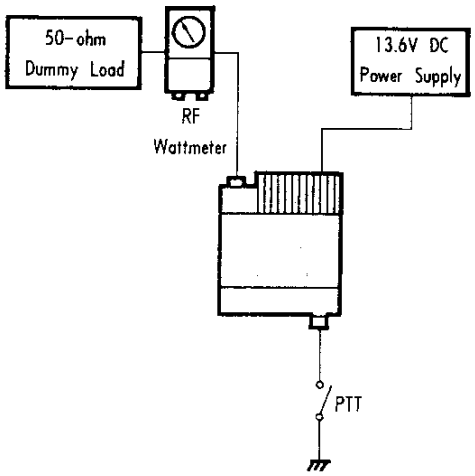
RECEIVER ALIGNMENT POINTS

C. Receiver Sensitivity

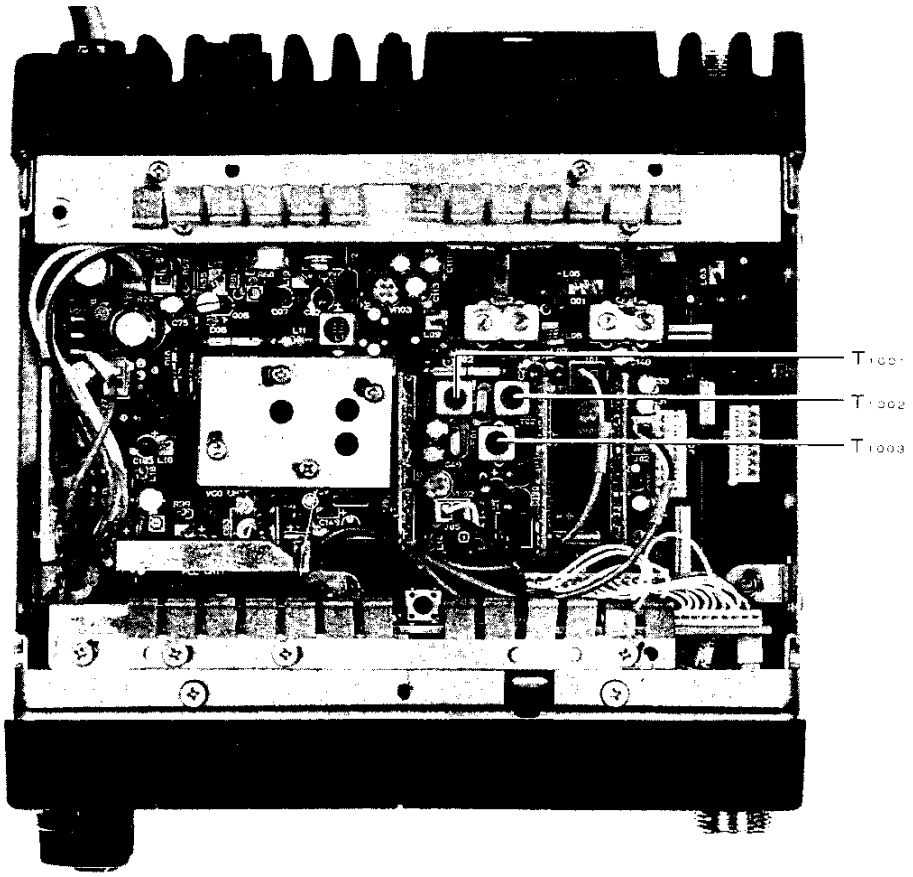
Connect the RF signal generator to the antenna jack, and the SINAD meter (with CCITT filter) across the speaker terminals (or to the EXT SP jack in parallel with an 8-ohm resistor).

Set the squelch control fully counterclockwise, and select Channel 2. Tune the signal generator to 460.0 MHz (Vers. D), and set for ±3 kHz deviation of a 1 kHz modulating tone.

Adjust T1001-T1003 for best SINAD sensitivity; adjust the output level of the signal generator, if necessary, to keep readings on scale.



RECEIVER ALIGNMENT SETUP



RECEIVER ALIGNMENT POINTS

D. Modulator

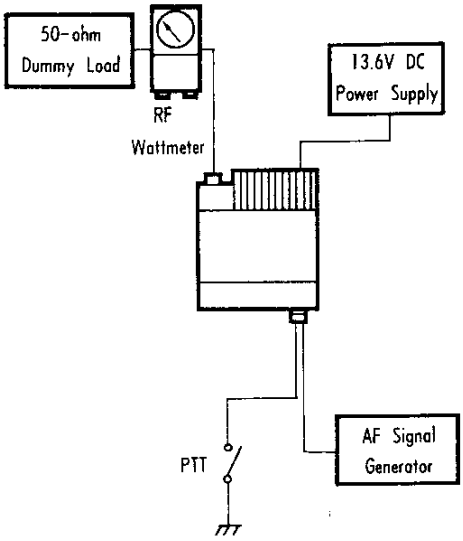
Select alignment Channel 2, connect the audio generator to the center pin of the microphone jack, and apply -30 dBm at 1 kHz. Close the PTT line to transmit during each of the following adjustments.

(1) Deviation

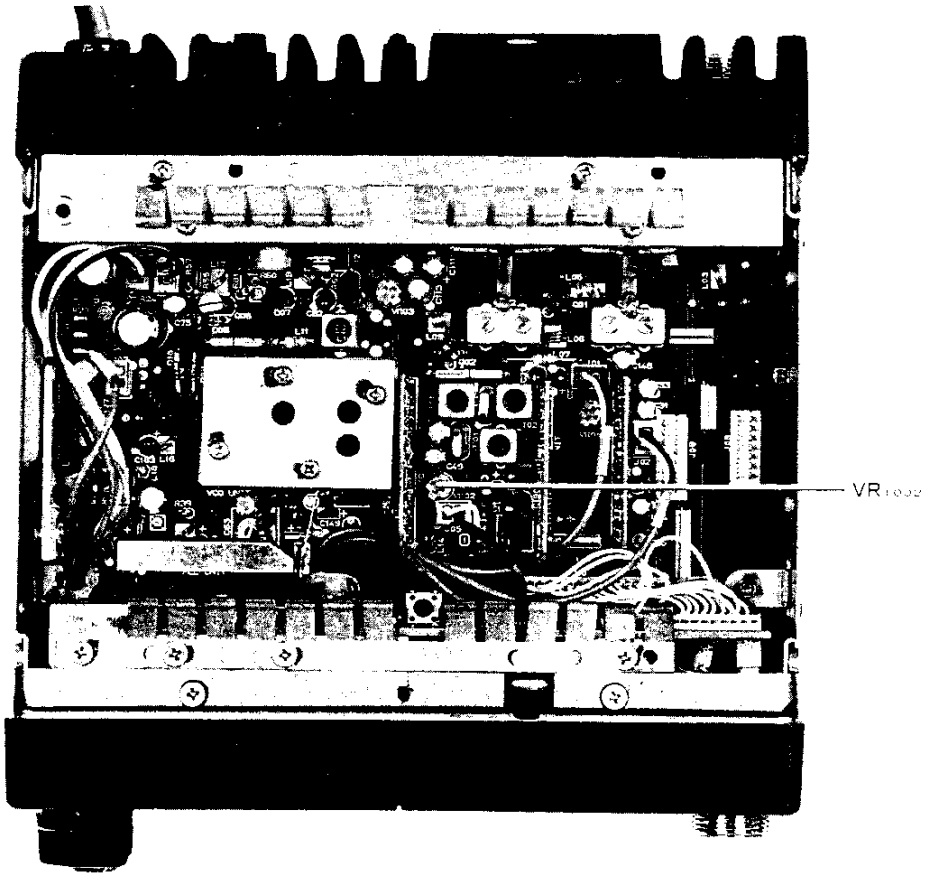
Adjust VR1002 for 90% of system deviation.

(2) Modulation Level Check

Check for 60% of system deviation with the audio generator set for -53 ±3dBm.



MODULATOR ALIGNMENT SETUP



MODULATOR ALIGNMENT POINTS

NOTES :

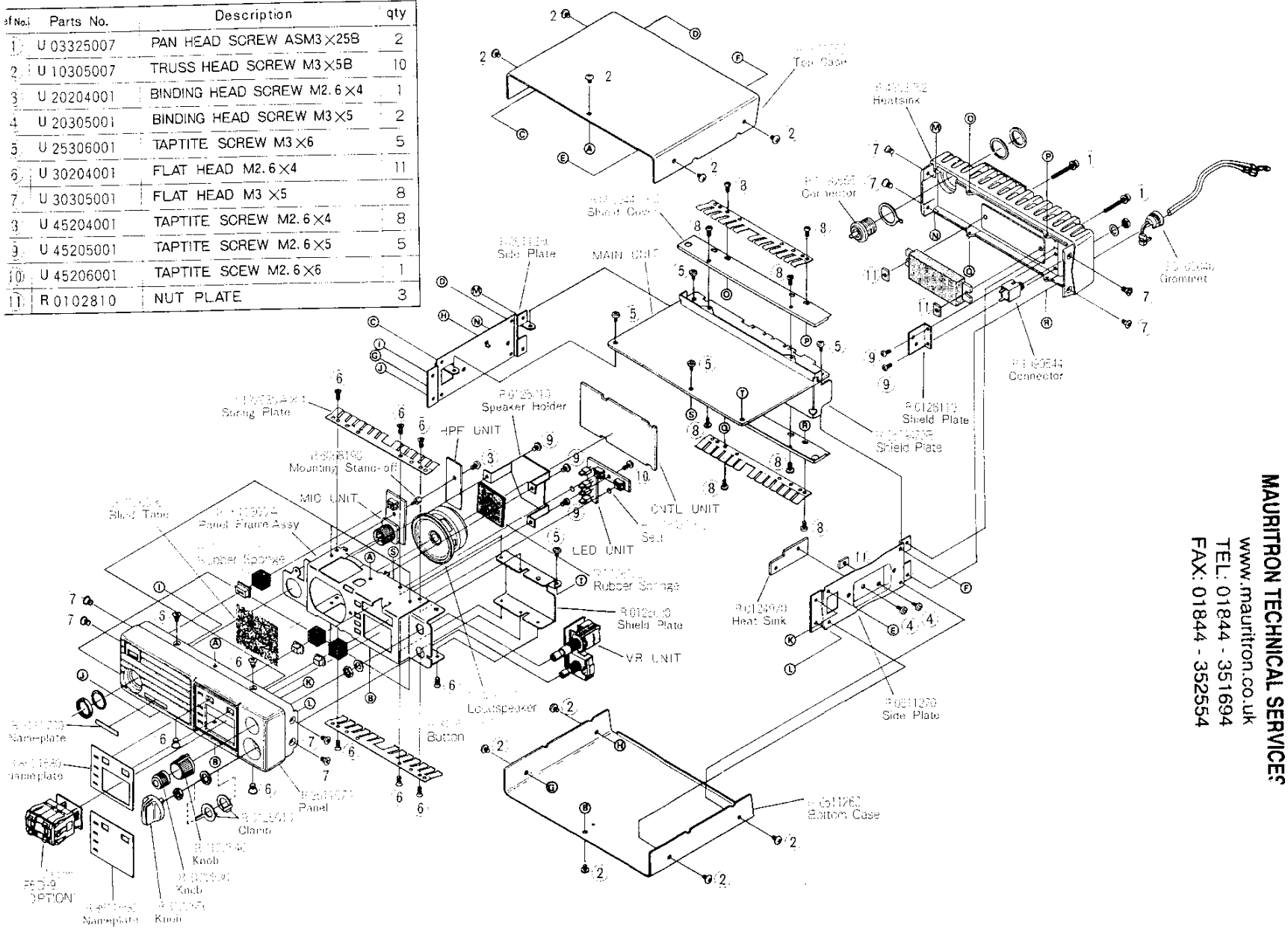
MAIN CHASSIS PARTS LIST

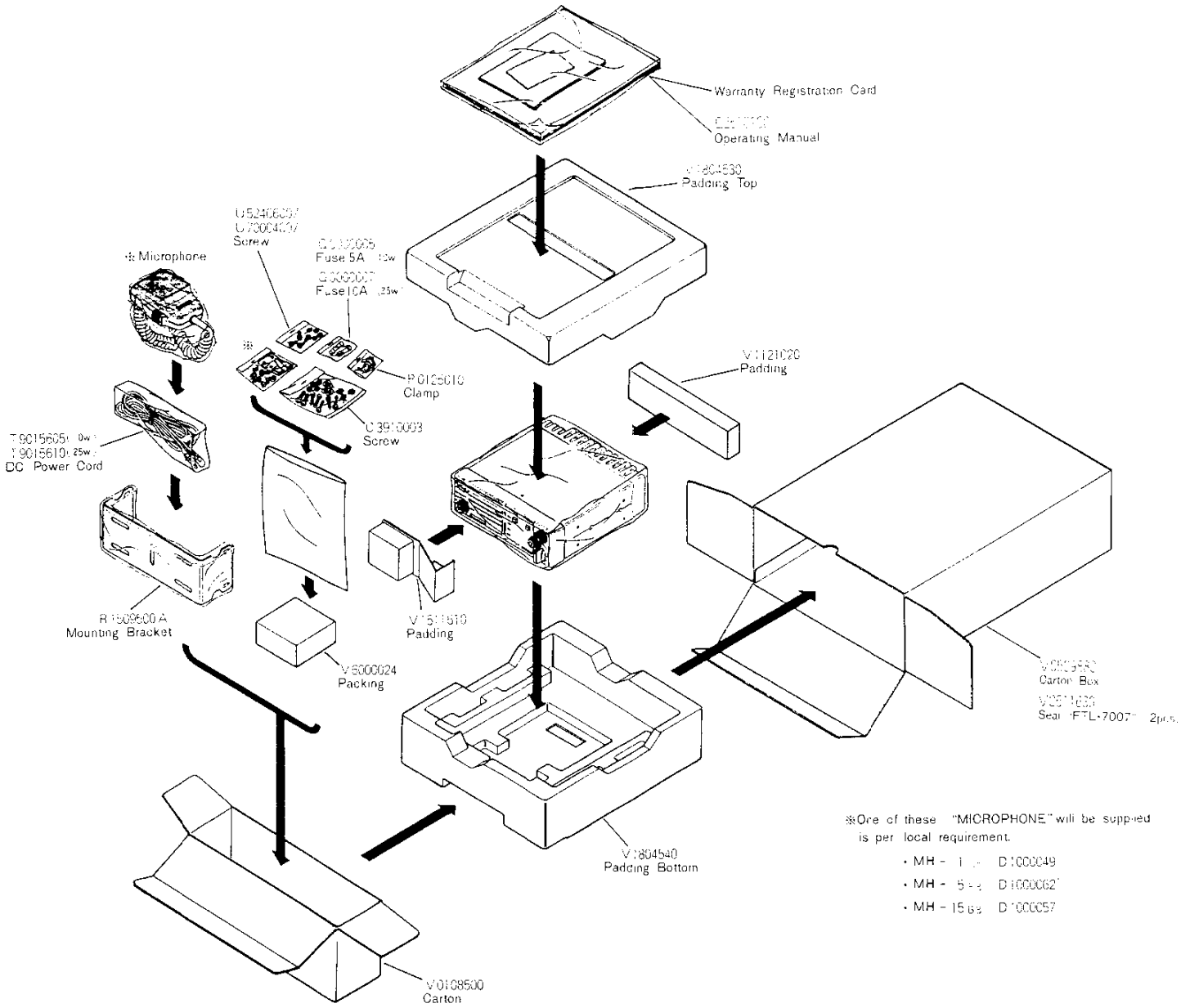
*** MAIN CHASSIS ***

R1	J01245223	Carbon Film Res.	22k Ohm	1/4W	
C1	K10176102	Ceramic Cap.	0.001uF	50V	B
C2	K21170002	Feed Thru Cap.	0.001uF	50V	B
C3	K21170002	Feed Thru Cap.	0.001uF	50V	B
J1	P1090556	Connector	FM-MR-M2(A)		
J2	P1090544	Connector	HSJ0341-01-130		
SP1	M4090071	Loudspeaker	SE-45F	2W	8-Ohm
P1	T9204868B	Wire Assy			
P4	T9205690A	Wire Assy			
	R3511570	Panel			
	R0511250	Top Case			
	R0511260	Bottom Case			
	R0511270	Side Plate (Right)			
	R0511280	Side Plate (Left)			
	R6068190	Mounting Stand-off			
	R3122530	Knob	SQL		
	R3122540	Knob	VOL		
	R3122550	Knob	CH		
	R3118880	Button	RESET		
	R3126070	Button	TONE		
	R7126080	Rubber Sponge 12x12x12			
	R0511300A	Panel Frame Assy			
	R0125010	Speaker Holder			
	R7126100	Rubber Sponge 30x30 Speaker Cushion			
	R0125000	Shield Plate			
	R0122030A	Spring Plate			
	R4803752	Heatsink			
	R0126110	Shield Plate			
	R0120020	Shield Plate			
	R0509440	Shield Cover			
	R7126130	Rubber Piece 8.5x8.5x4			
	S0000040	Grommet			
	R0102810	Nut Plate			
	R8511580	Nameplate (with Hole for Switches)			
	R8511590	Nameplate (FM TRANSCEIVER)			

SCREW LIST

Ref No.	Parts No.	Description	qty
1	U 03325007	PAN HEAD SCREW ASM3×25B	2
2	U 10305007	TRUSS HEAD SCREW M3×5B	10
3	U 20204001	BINDING HEAD SCREW M2.6×4	1
4	U 20305001	BINDING HEAD SCREW M3×5	2
5	U 25306001	TAPTITE SCREW M3×6	5
6	U 30204001	FLAT HEAD M2.6×4	11
7	U 30305001	FLAT HEAD M3 ×5	8
8	U 45204001	TAPTITE SCREW M2.6×4	8
9	U 45205001	TAPTITE SCREW M2.6×5	5
10	U 45206001	TAPTITE SCEW M2.6×6	1
11	R 0102810	NUT PLATE	3

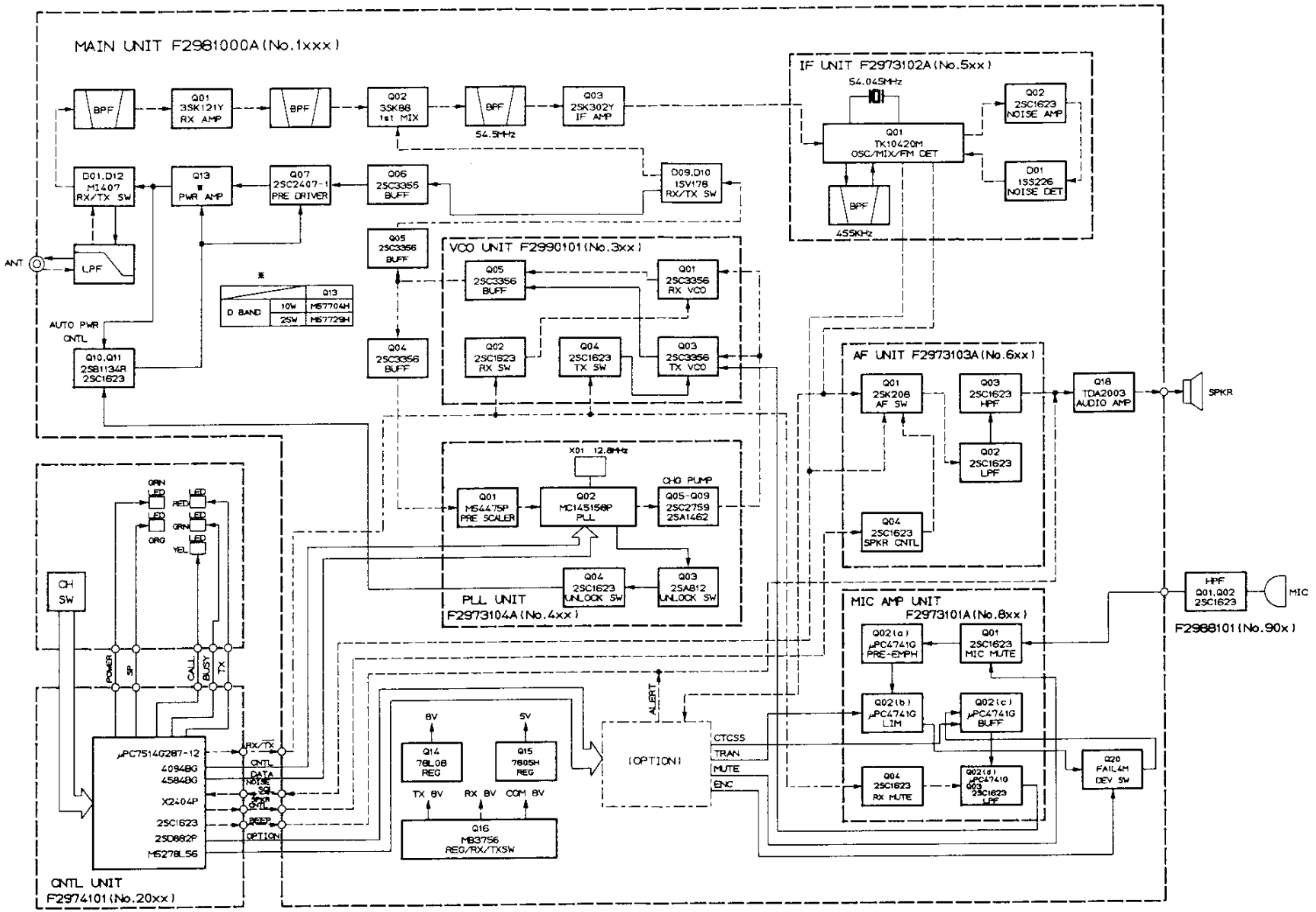


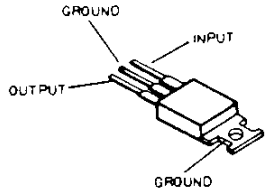


※One of these "MICROPHONE" will be supplied as per local requirement.

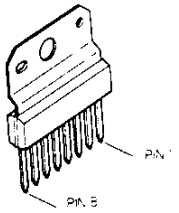
- MH - 1 : D1000049
- MH - 5 : D1000062
- MH - 15 : D1000057

BLOCK DIAGRAM

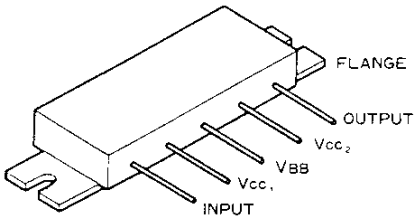




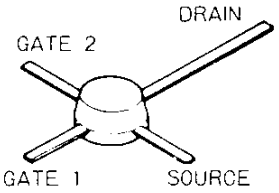
μPC7805H (Q1015)



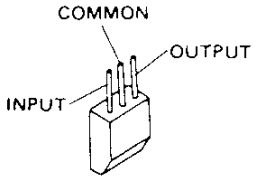
MB3756M (Q1016)



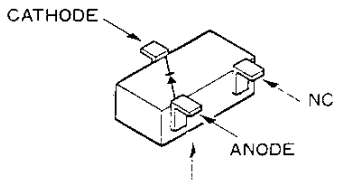
25W : M57729H (Q1013)
10W : M57704H (Q1013)



3SK121GR (Q1001)
3SK88 (Q1002)

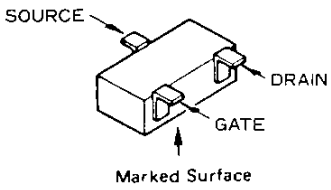


μPC78L08 (Q1014)

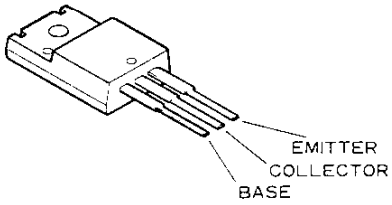


Marked surface

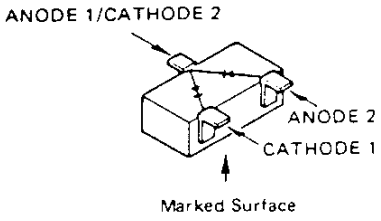
1SS196 (G3) (D1007)



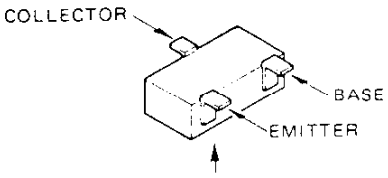
2SK302Y (TY) (Q1003)



2SB1134R (Q1010)

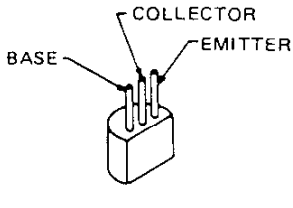


1SS226 (C3) (D1003,1005,1006)

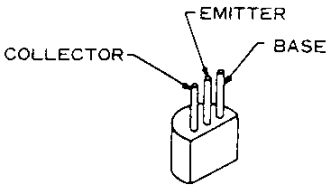


Marked surface

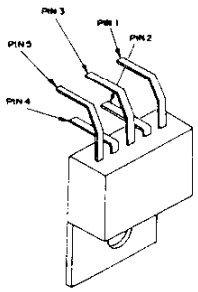
2SA812 (M6/M7) (Q1008,1009)
2SC1623 (L6/L7) (Q1011)
2SC3356 (R22) (Q1004,1005)
FA1L4M (L31) (Q1020)



2SC945AQ (Q1012)

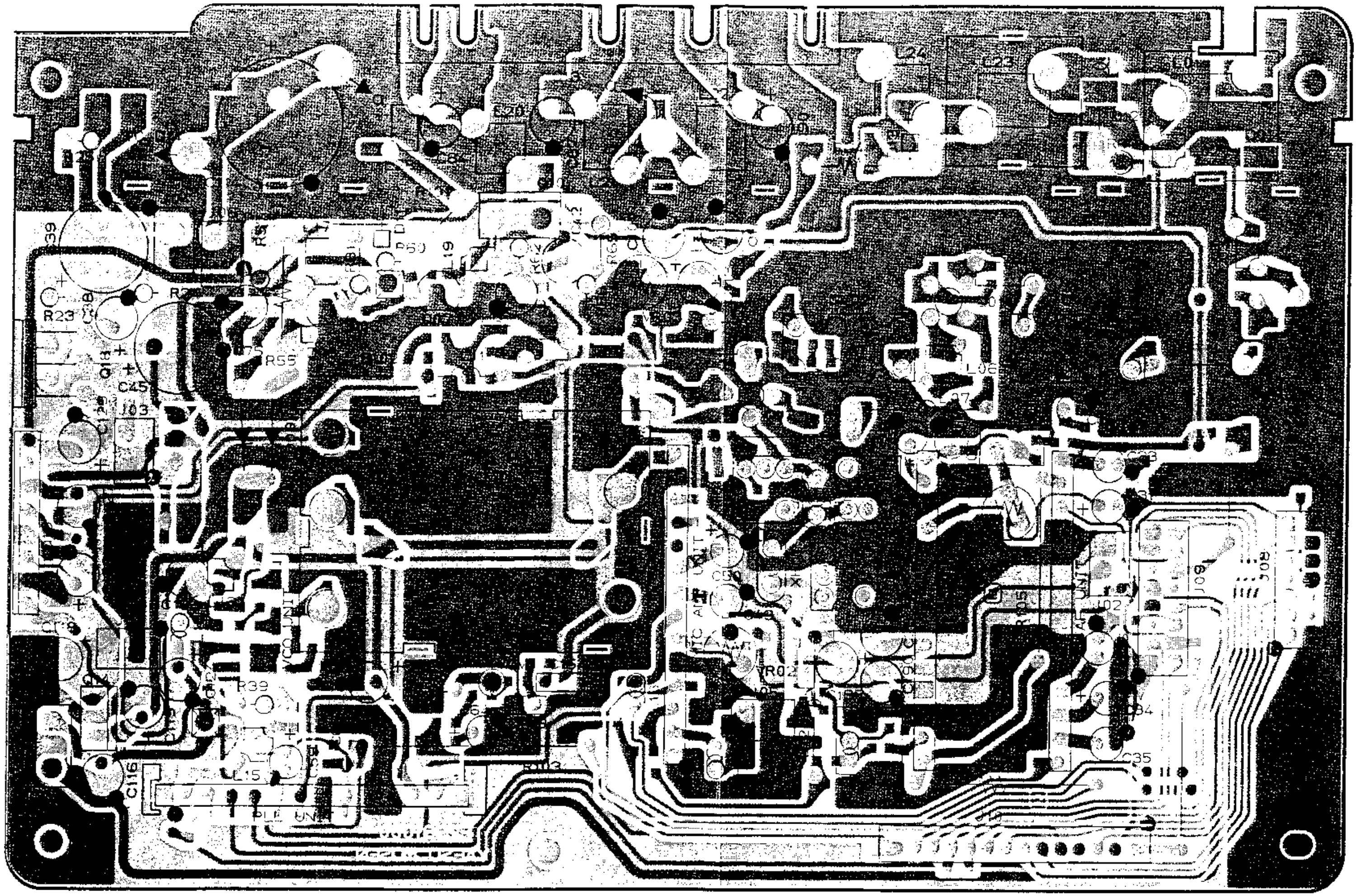


2SC3355 (Q1006)
2SC2407 (Q1007)

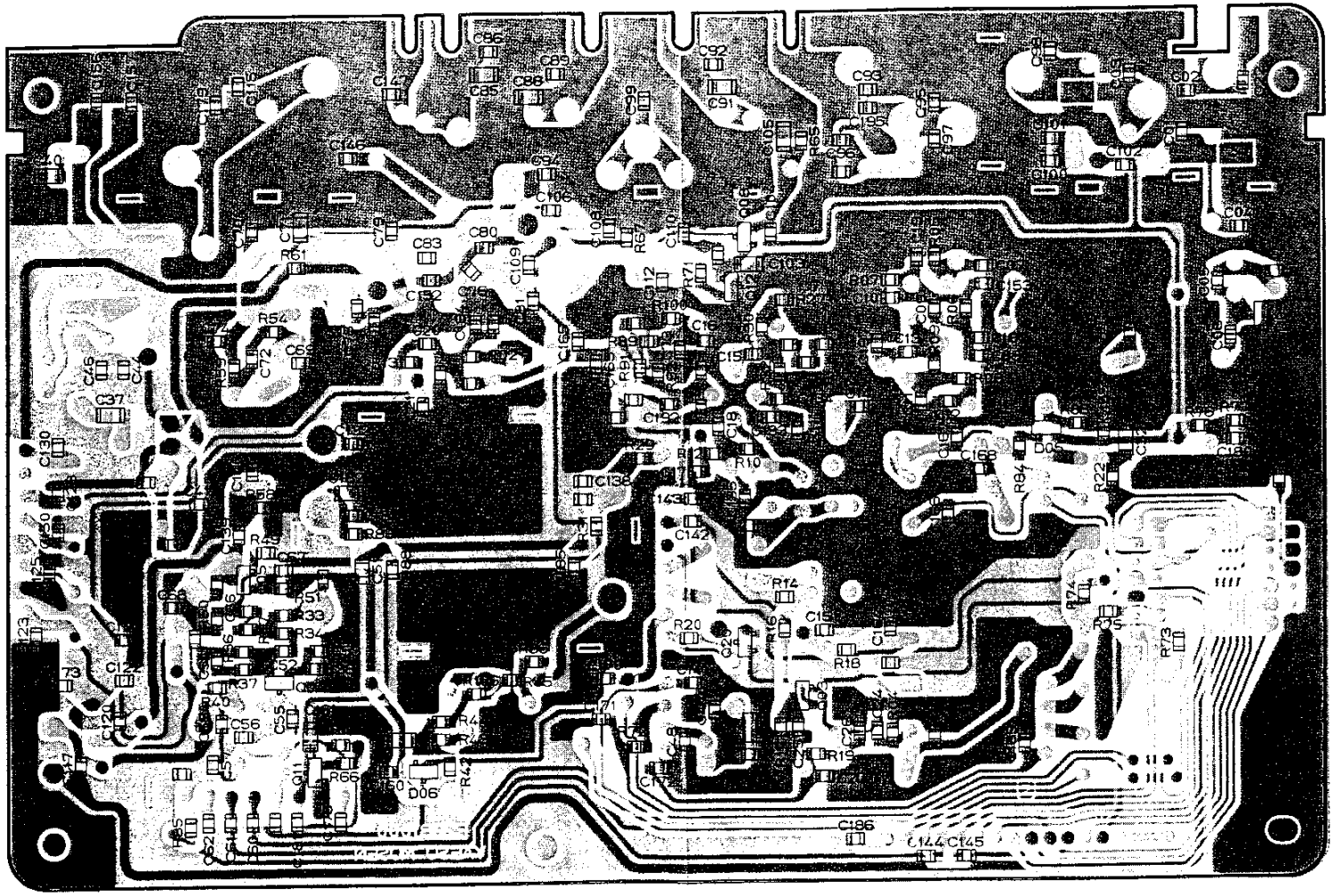


TDA2003 (Q1018)

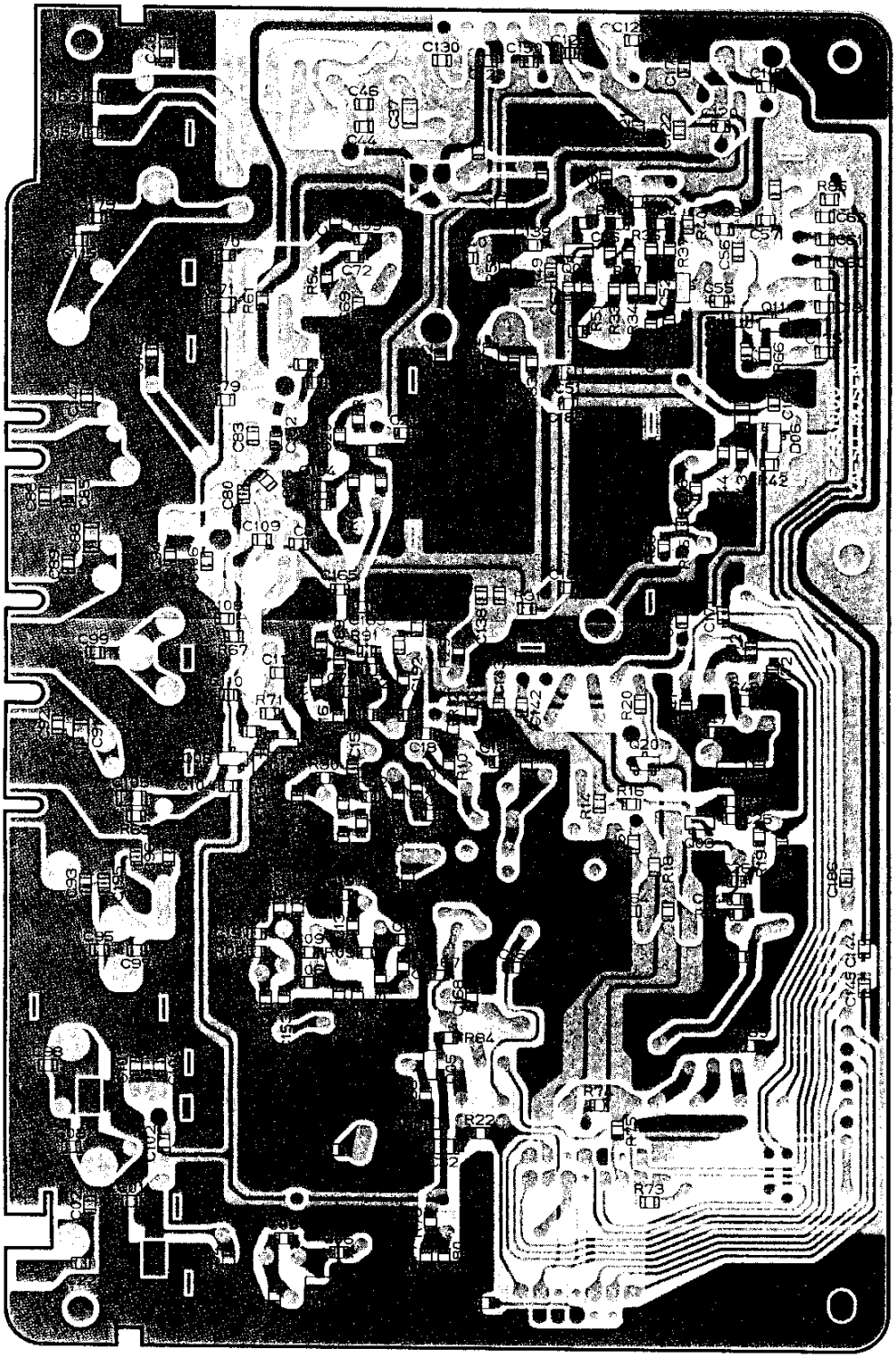
MAIN UNIT PARTS LAYOUT



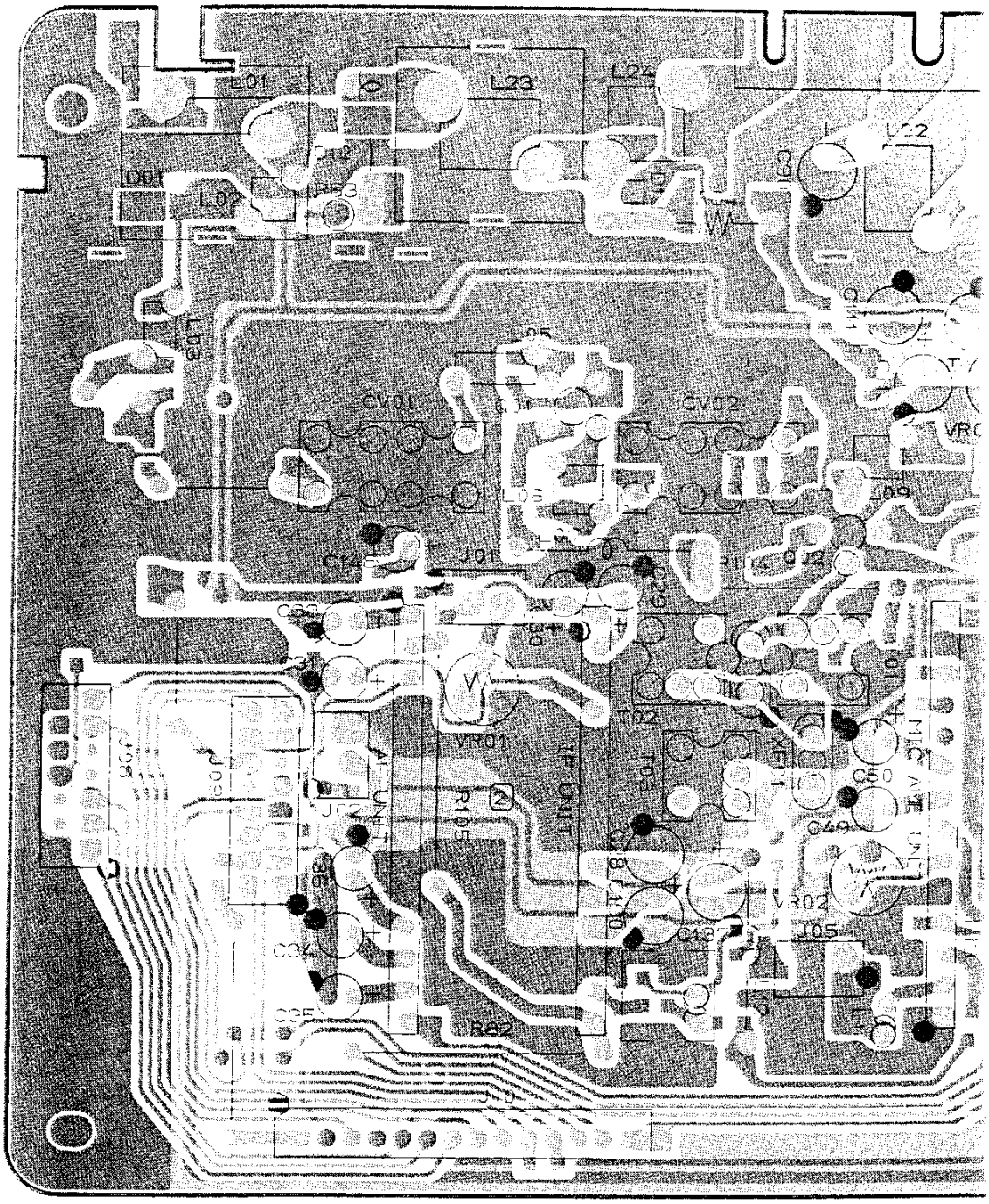
(obverse view of "component" side)



(reverse view of "chip-only" side)



(obverse view of "chip-only" side)



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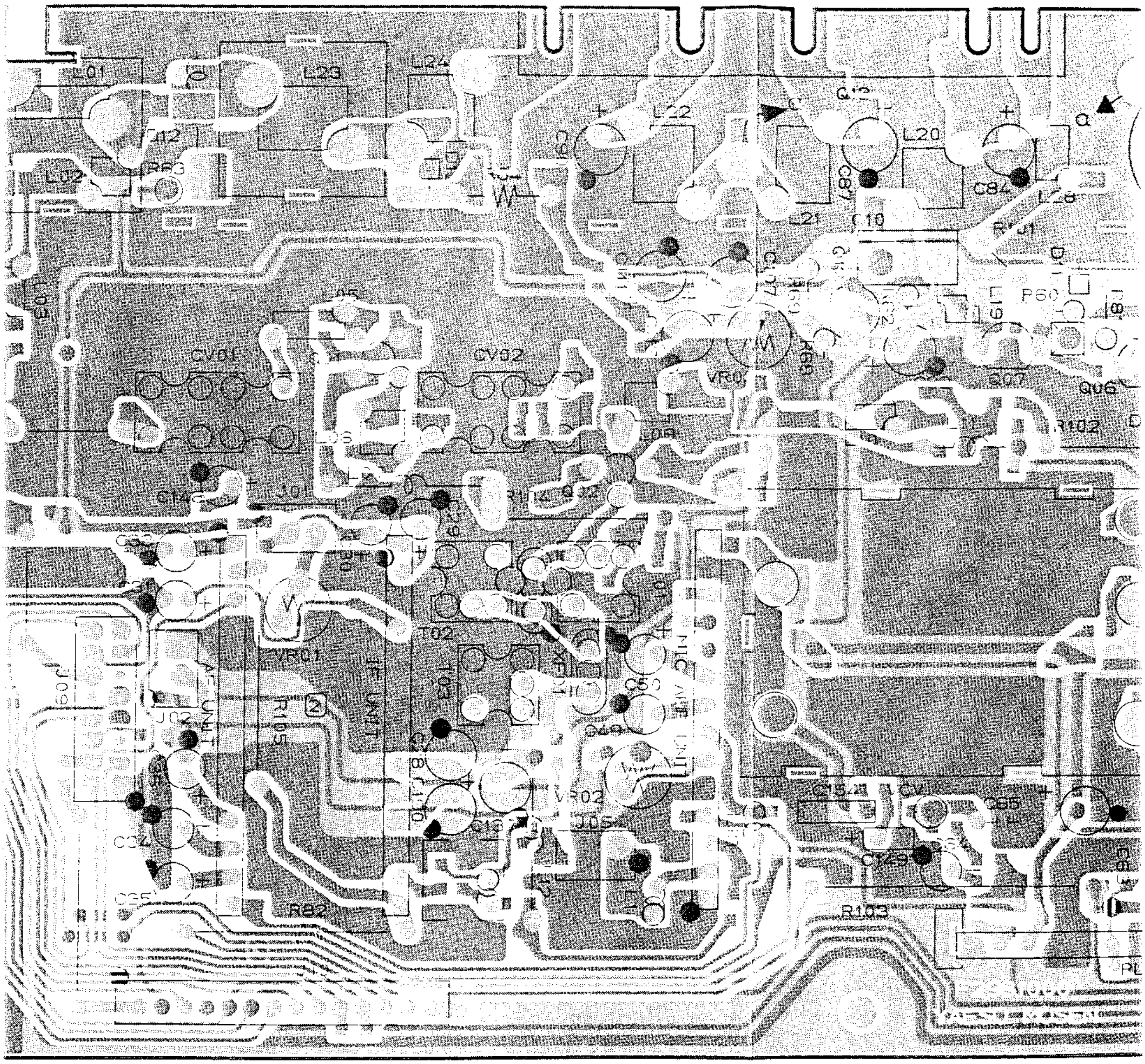
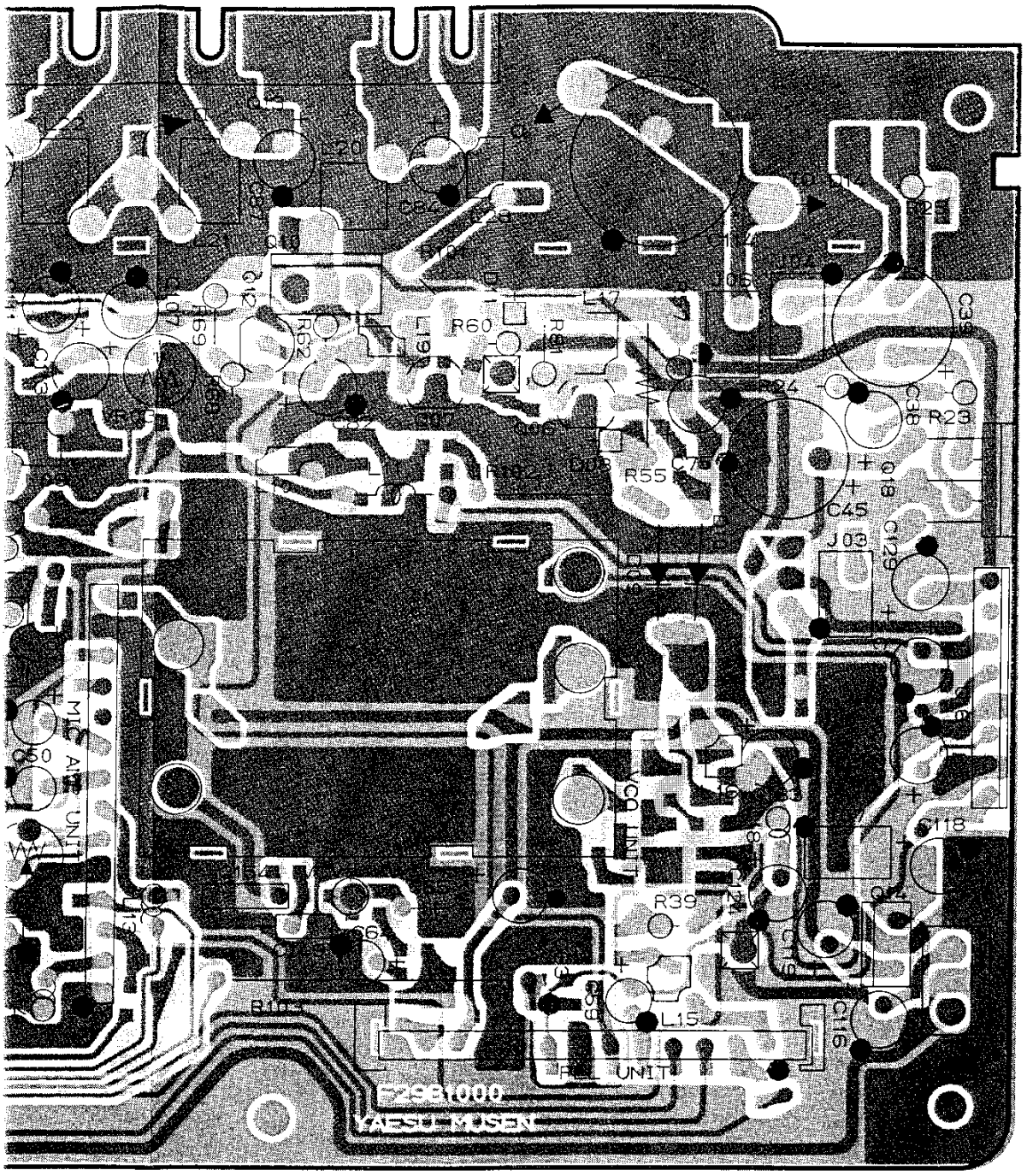
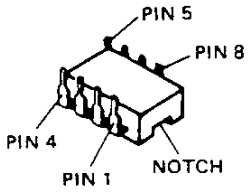

L01
L23
L24
L22
L20
L02
L21
C87
C84
C10
P60
CV01
CV02
L06
Q07
Q06
R102
C29
C30
T02
T03
VR01
VR02
IF UNIT
AF UNIT
MIC AMP UNIT
J02
J05
R105
R82
R103
C154
C149
C85
C34
C35
C50

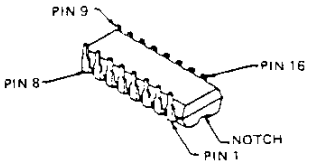
(reverse



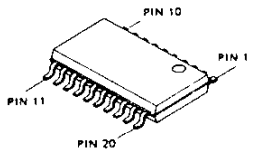
(reverse view of "component" side)



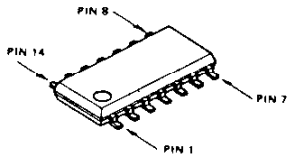
M54475P (Q401)



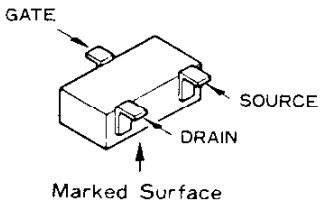
MC145158P (Q402)



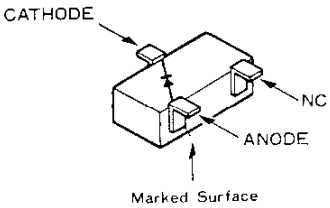
TK10420M (Q501)



μPC4741G (Q802)



2SK208Y (JY) (Q601)



1SS196 (G3) (D951)

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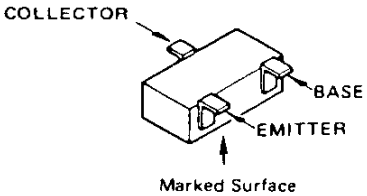
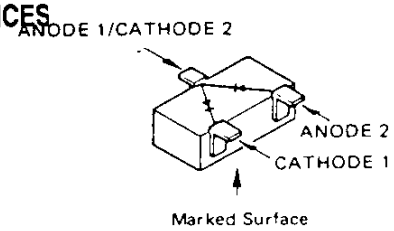
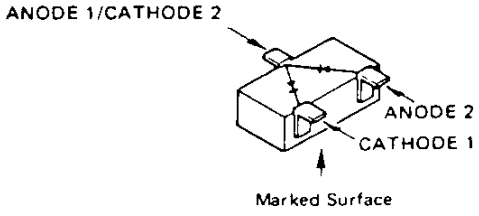


2SA812 (M4) (Q403)
2SA1462 (Y33)
(Q405,406,408)
2SC1623 (L6)
(Q302,304,305,404,502
602,603,604,801,803
804,901,902 ,951)
2SC2759 (U22)
(Q407,409)
2SC3356 (R25)
(Q301,303,305)

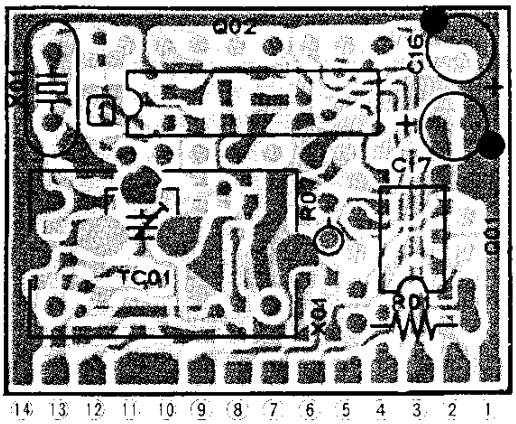


1SS184 (B3) (D401)

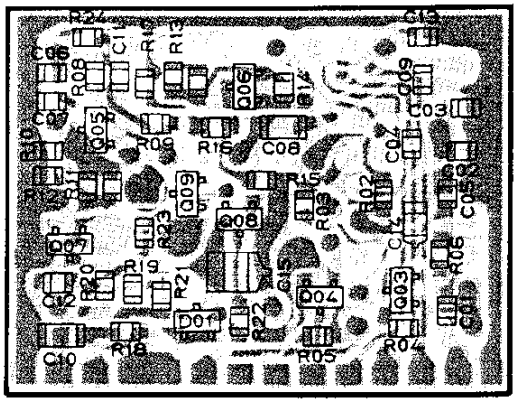


1SS226 (C3) (D501)

PLL UNIT (No. 4XX)

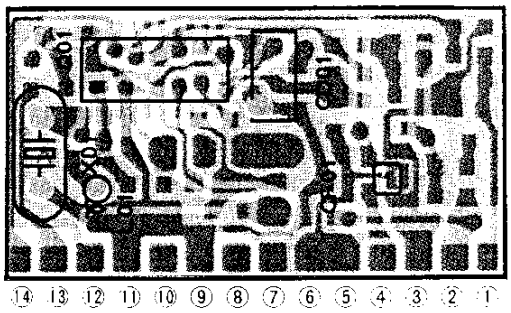


(obverse view of "component" side)

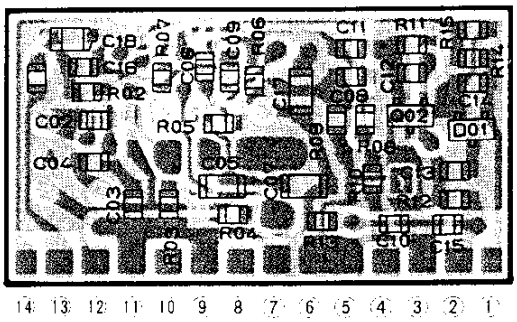


(reverse view of "chip-only" side)

IF UNIT (No. 5XX)

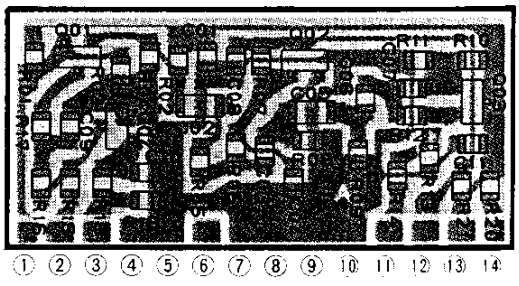


(obverse view of "component" side)

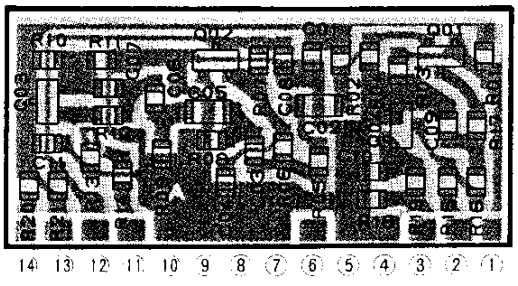


(reverse view of "chip-only" side)

AF UNIT (No. 6XX)



(obverse view of "chip-only" side)



(reverse view of "chip-only" side)

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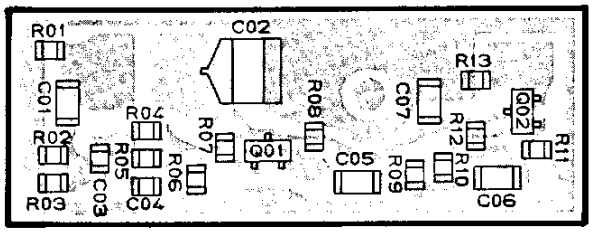
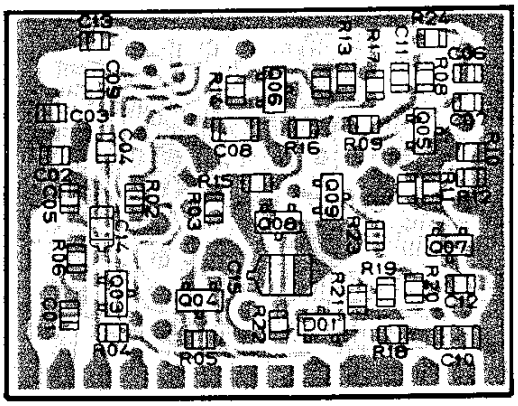
HIGH PASS FILTER UNIT (No. 9XX)

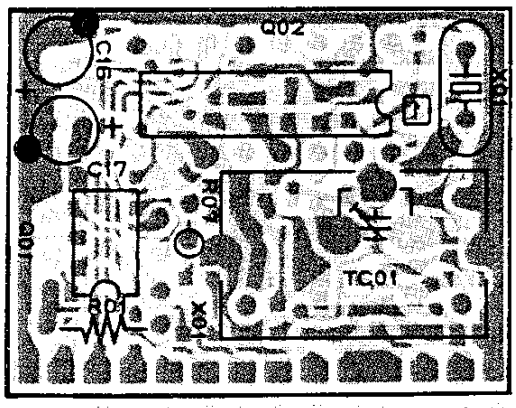


(obverse view of "chip-only" side)



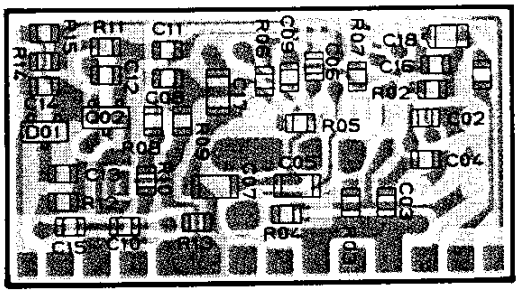
1 2 3 4 5 6 7 8 9 10 11 12 13 14

(obverse view of "chip-only" side)



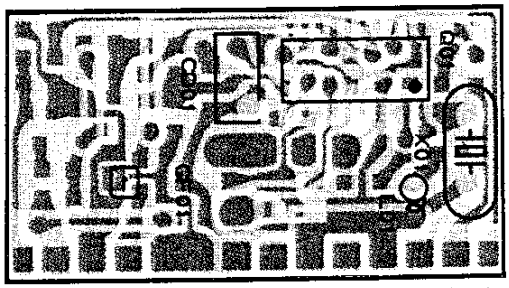
1 2 3 4 5 6 7 8 9 10 11 12 13 14

(reverse view of "component" side)



1 2 3 4 5 6 7 8 9 10 11 12 13 14

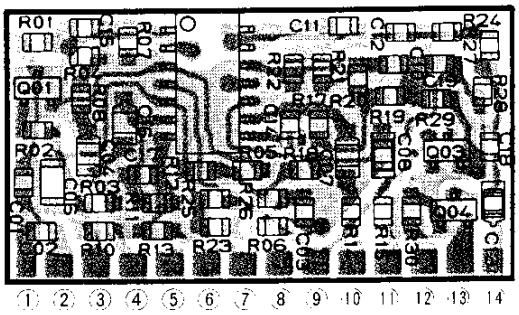
(obverse view of "chip-only" side)



1 2 3 4 5 6 7 8 9 10 11 12 13 14

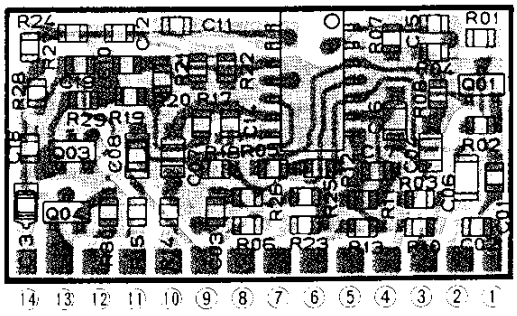
(reverse view of "component" side)

MIC AMP UNIT (No. 8XX)



1 2 3 4 5 6 7 8 9 10 11 12 13 14

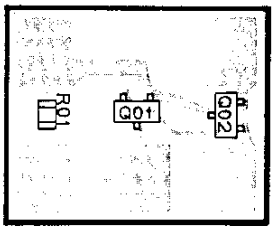
(obverse view of "chip-only" side)



14 13 12 11 10 9 8 7 6 5 4 3 2 1

(reverse view of "chip-only" side)

SW-A UNIT (No. 95X)



(obverse view of "chip-only" side)

※ Version 2.3 Only

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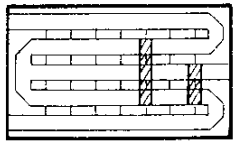
BAND MODIFICATION ADDENDUM

FOR THE FTL-7007

VCO UNIT

VERSION D

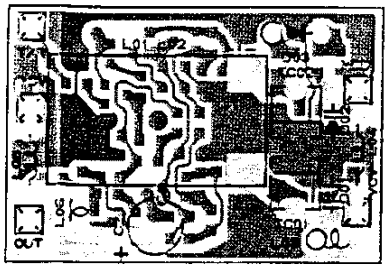
450 – 470MHz



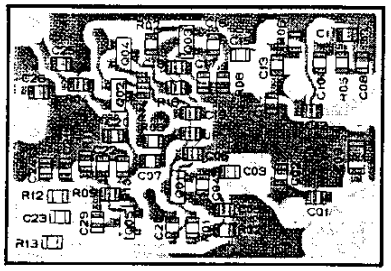
L01

L02

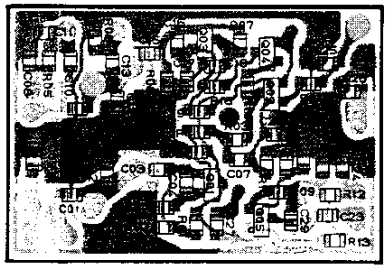
VCO UNIT (No. 3XX)



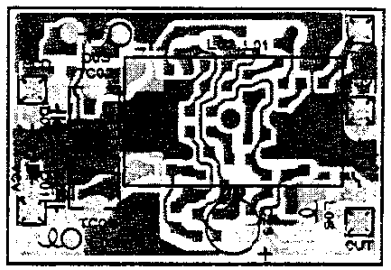
(obverse view of "component" side)



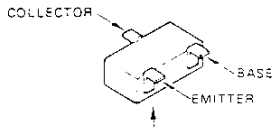
(reverse view of "chip-only" side)



(reverse view of "component" side)



(obverse view of "chip-only" side)

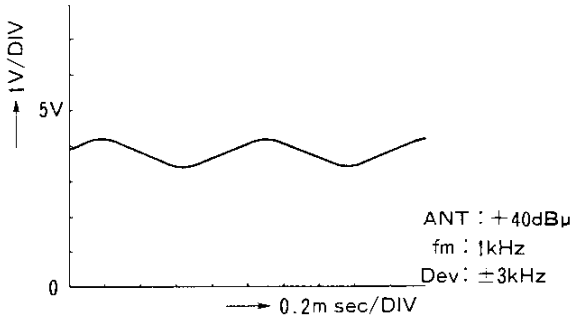


Marked surface

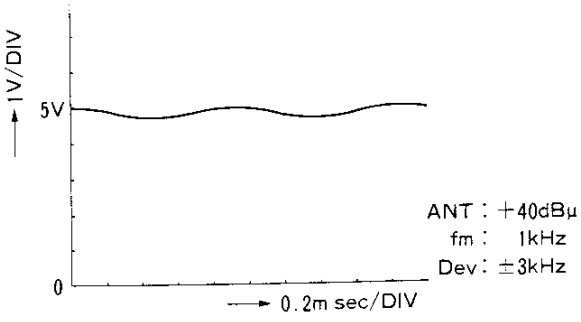
2SC1623 (L6) (Q302,304)

2SC3356 (R22) (Q301,303,305)

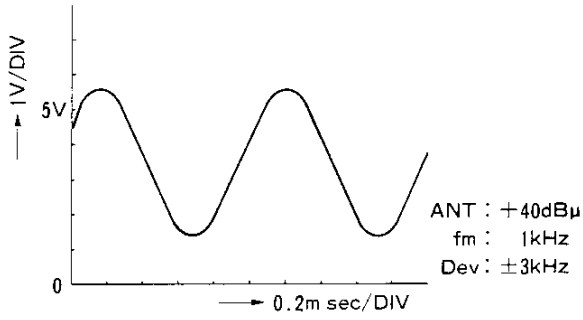
AF UNIT PIN ①



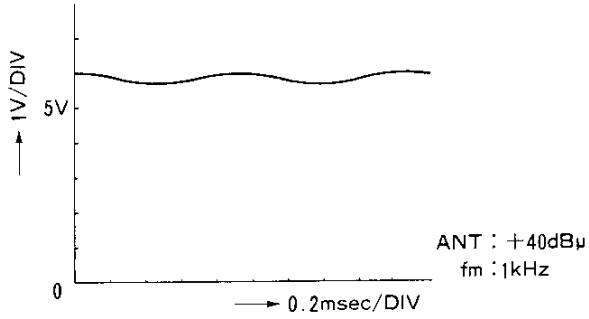
AF UNIT PIN ⑪



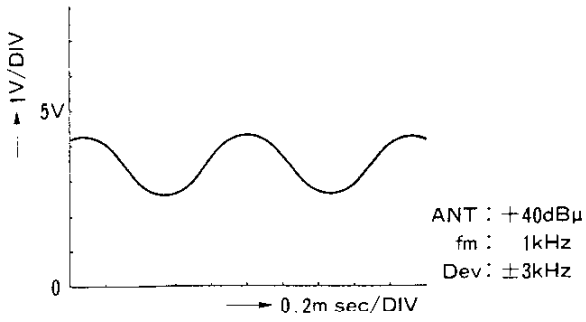
MIC AMP UNIT PIN ⑥



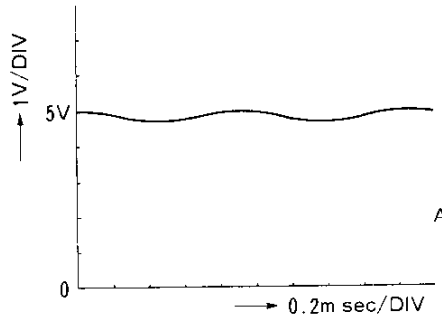
MIC AMP UNIT PIN ⑭



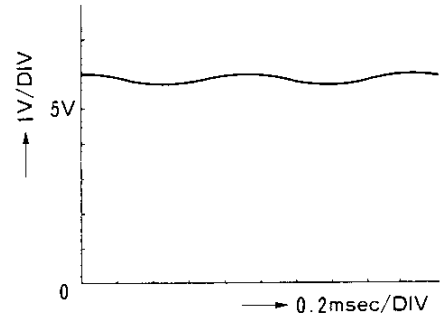
IF UNIT PIN ④



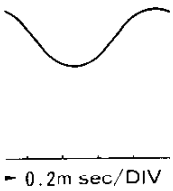
AF UNIT PIN ⑪

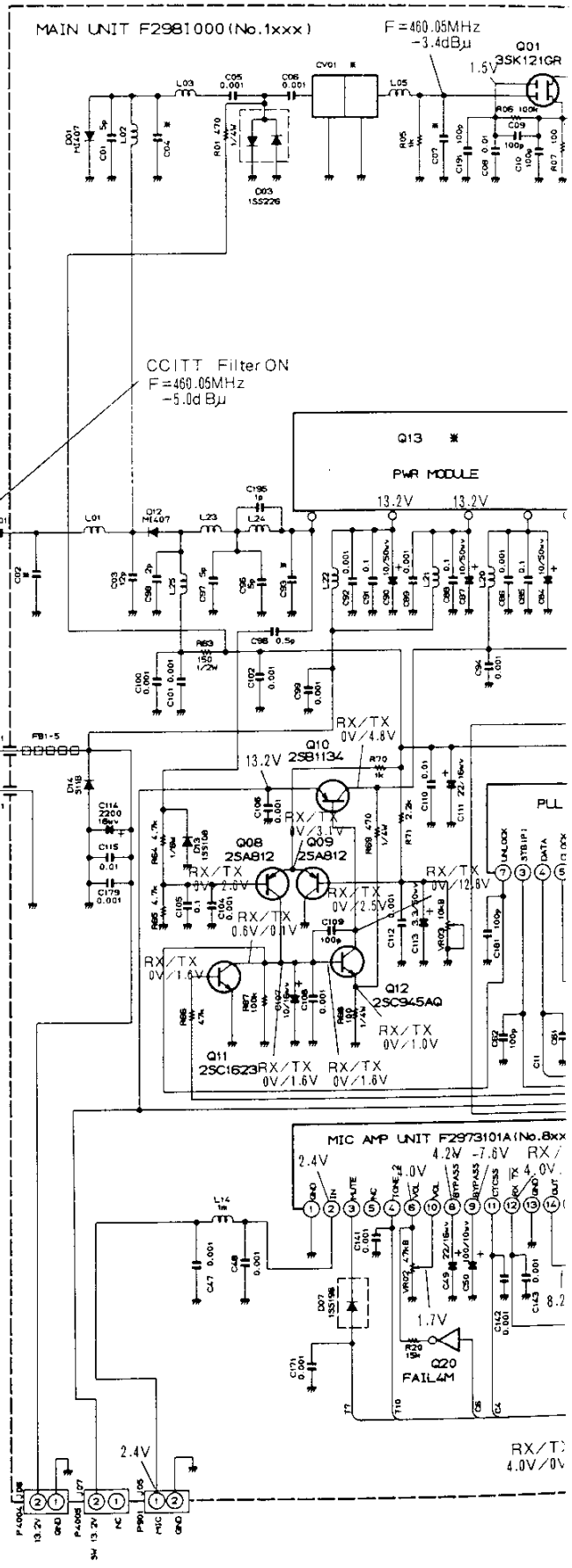


MIC AMP UNIT PIN ⑭

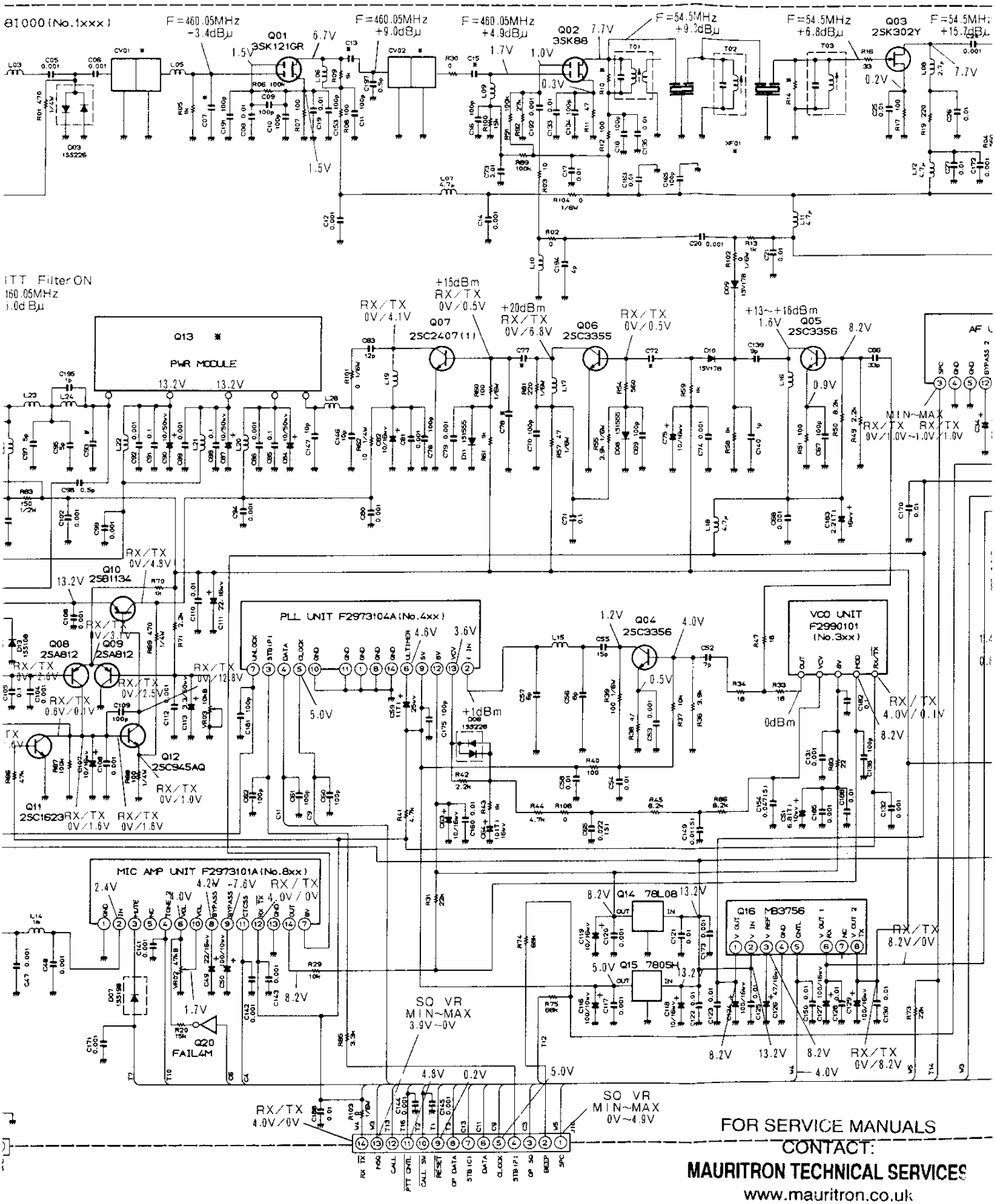


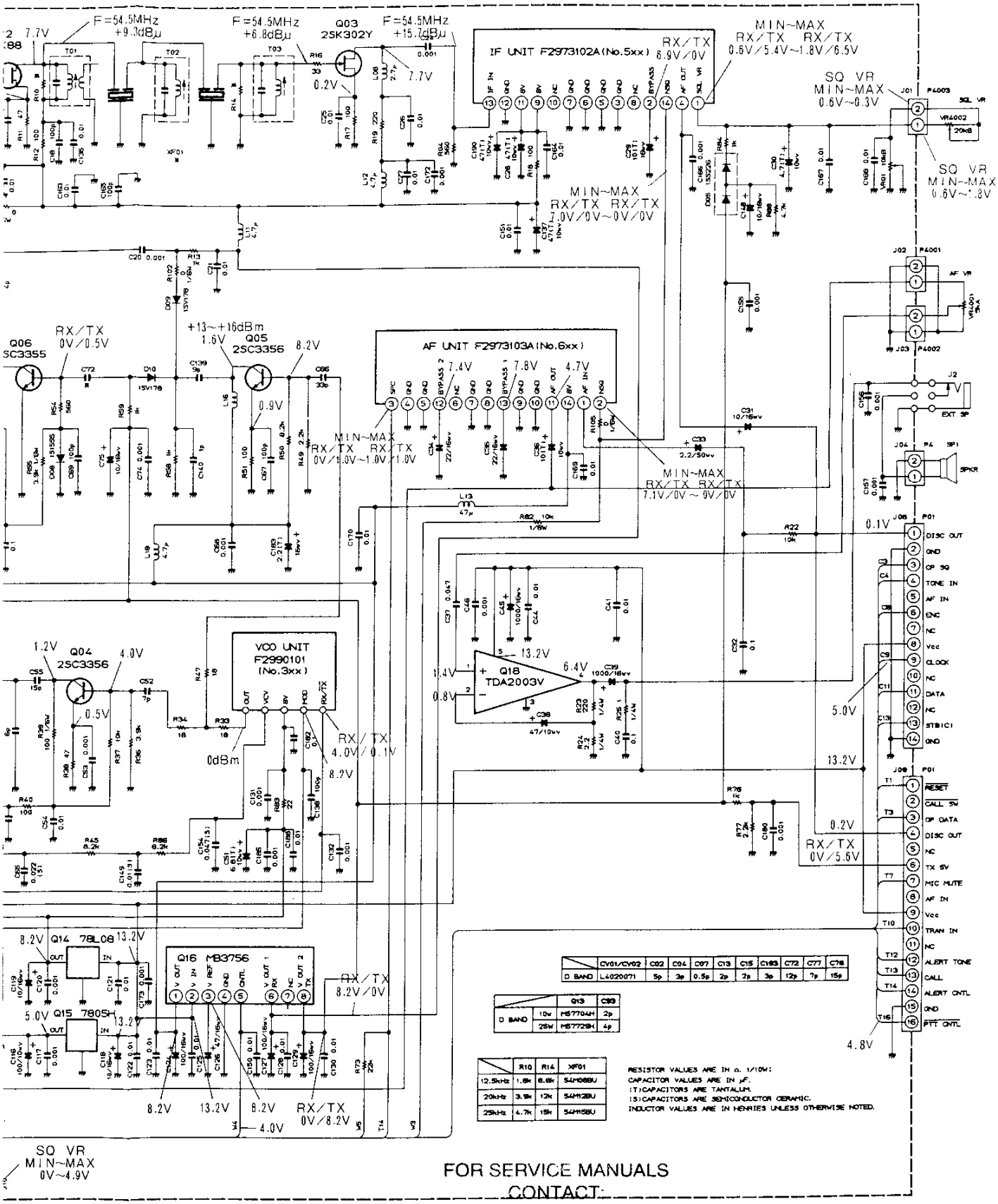
PIN ④





MAIN UNIT CIRCUIT DIAGRAM




IF UNIT F2973102A(No.5xx)
AF UNIT F2973103A(No.6xx)
VCO UNIT F2990101 (No.3xx)
Q18 TDA2003V
Q16 MB3756
Q14 78L08
Q15 7805H
Q01 2SK302Y
Q03 2SK302Y
Q04 2SC3356
Q05 2SC3356
Q06 SC3355
SQ VR MIN~MAX 0.6V~0.3V
SQ VR MIN~MAX 0V~4.9V
RX/TX 6.9V/0V
MIN~MAX RX/TX RX/TX 0.6V/5.4V~1.8V/6.5V
MIN~MAX RX/TX RX/TX 7.0V/0V~0V/0V
MIN~MAX RX/TX RX/TX 0V/1.0V~1.0V/1.0V
MIN~MAX RX/TX RX/TX 7.1V/0V ~ 9V/0V
RX/TX 0V/0.5V
RX/TX 4.0V/0.1V
RX/TX 8.2V/0V
RX/TX 0V/8.2V
RX/TX 0V/5.6V
+13~+16dBm
0dBm
F=54.5MHz +9.3dBμ
F=54.5MHz +6.8dBμ
F=54.5MHz +15.7dBμ
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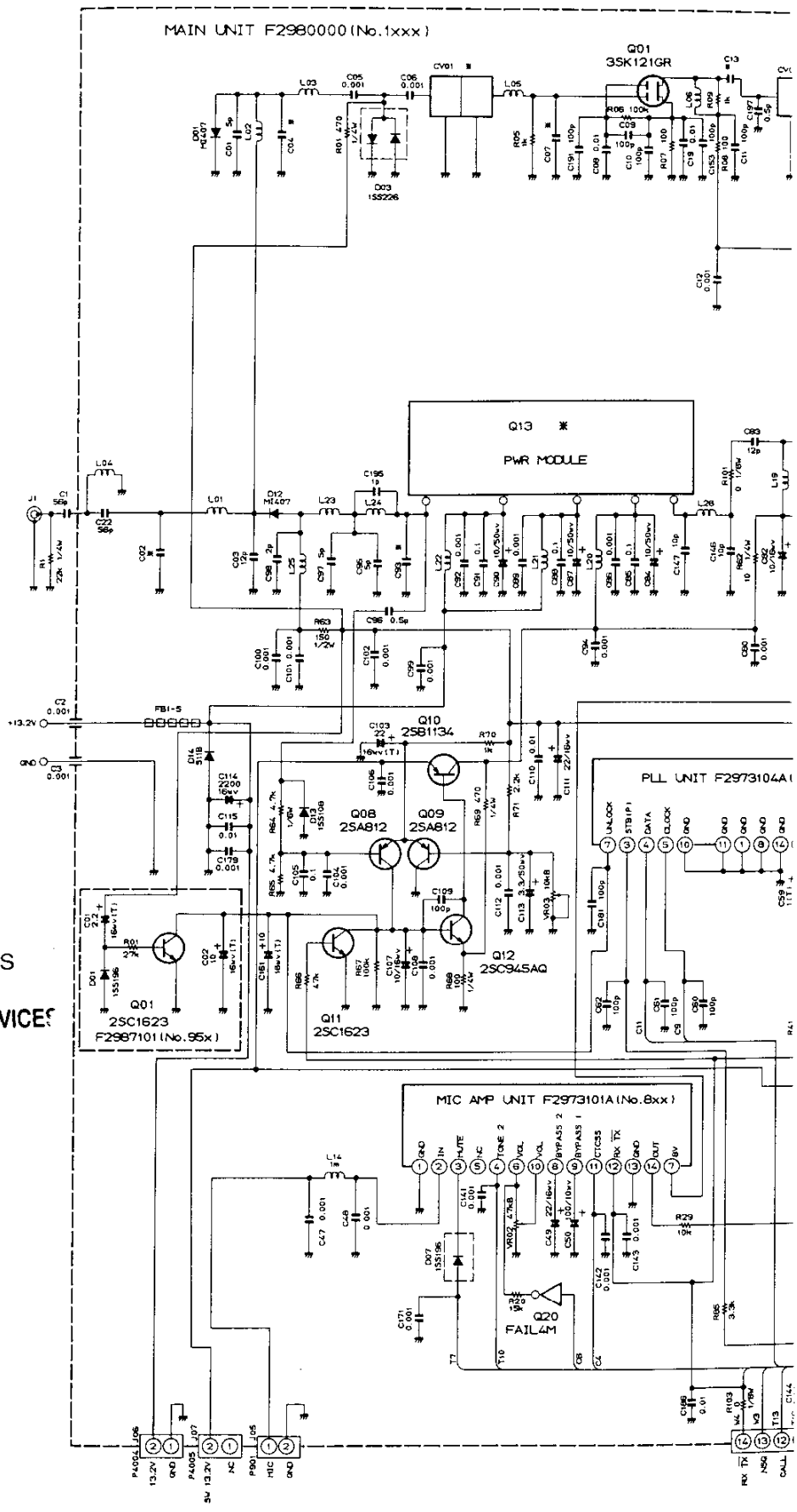
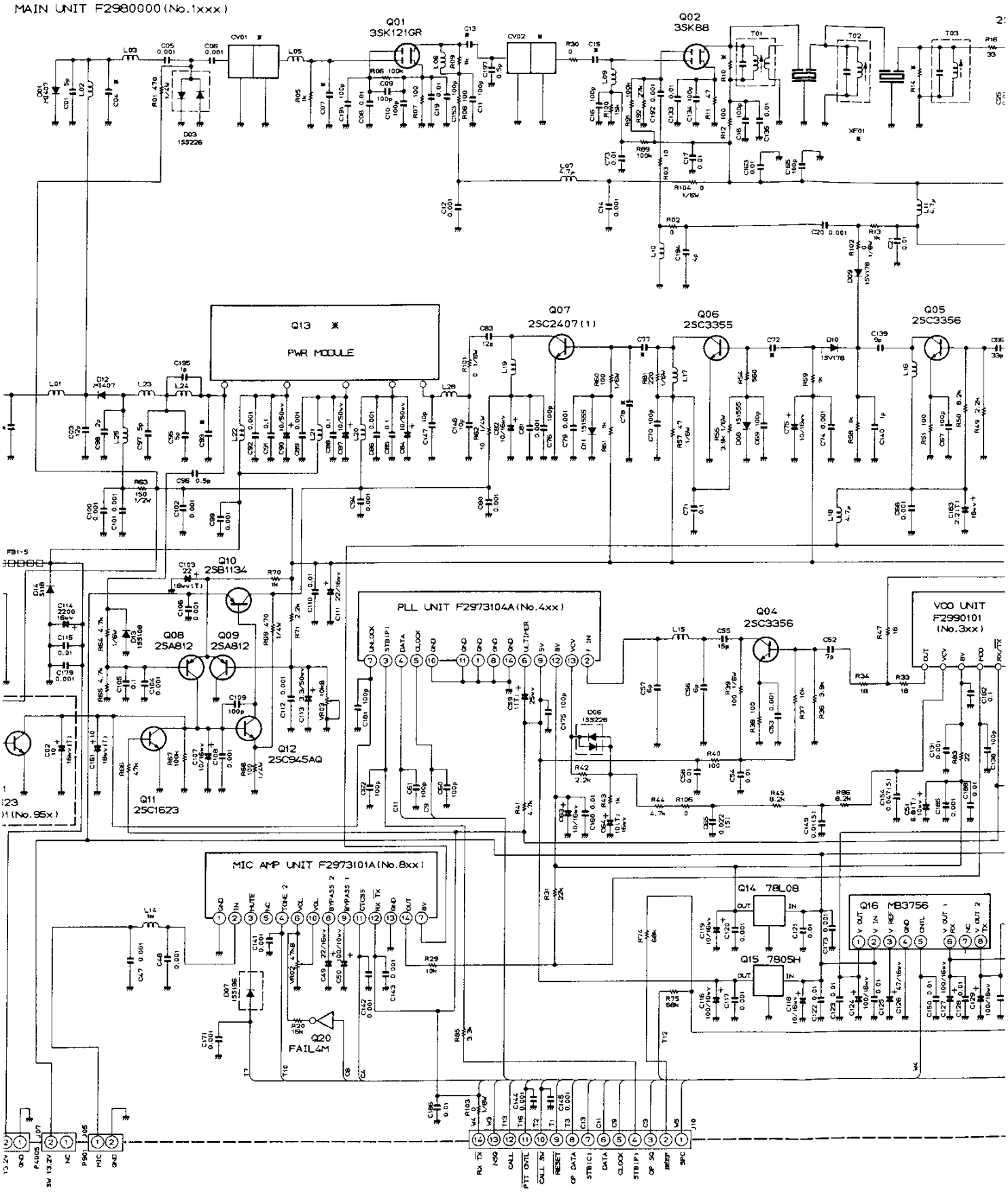
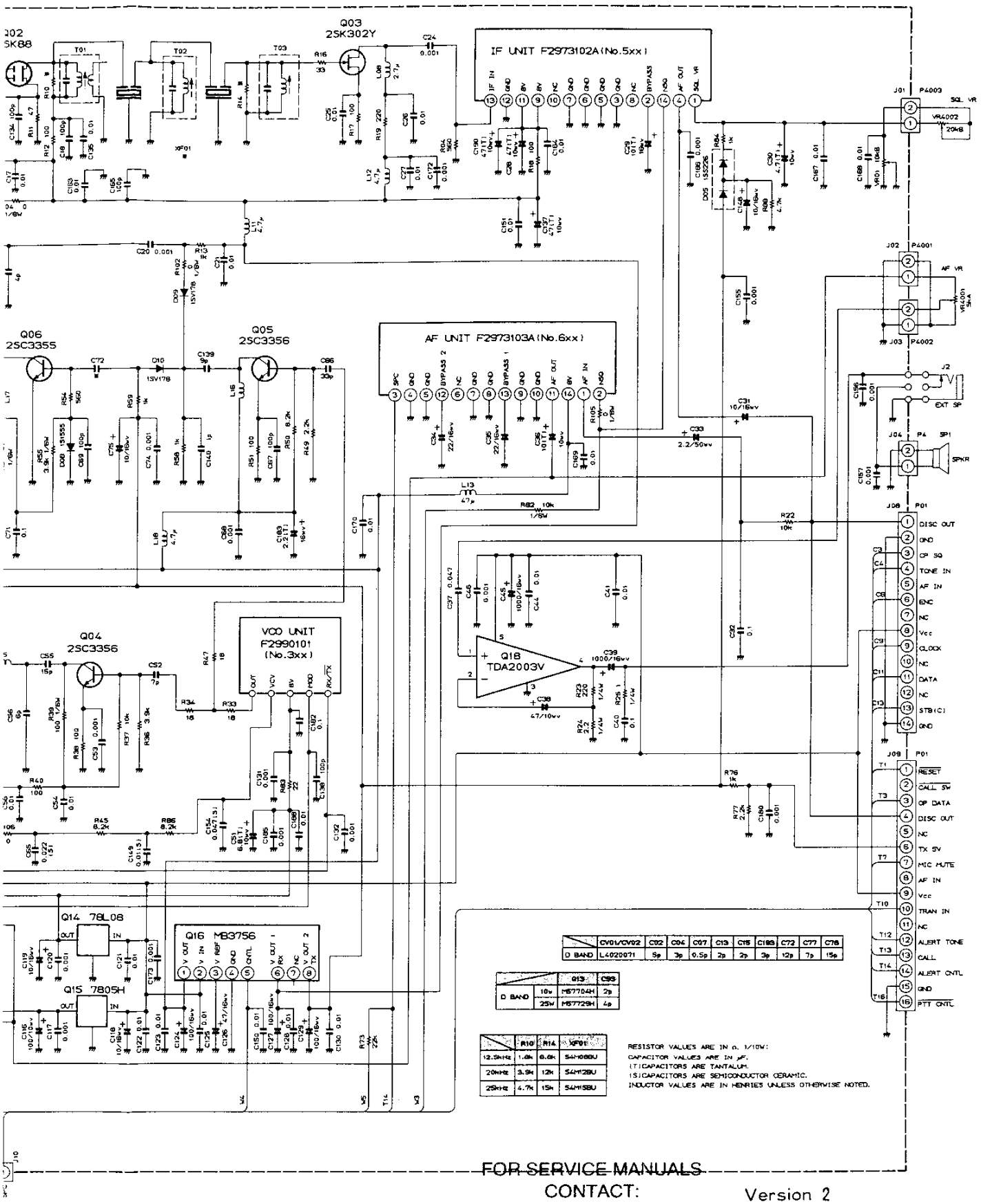
Version 1




MAIN UNIT F2980000(No.1xxx)
Q01
3SK121GR
Q02
3SK88
Q13 *
PWR MODULE
Q07
2SC2407(1)
Q06
2SC3355
Q05
2SC3356
Q10
2SB1134
Q08
2SA812
Q09
2SA812
Q12
2SC945AQ
Q11
2SC1623
PLL UNIT F2973104A(No.4xx)
Q04
2SC3356
VCO UNIT
F2990101
(No.3xx)
MIC AMP UNIT F2973101A(No.8xx)
Q14 78L08
Q15 7805H
Q16 MB3756
Q20
FAIL4M

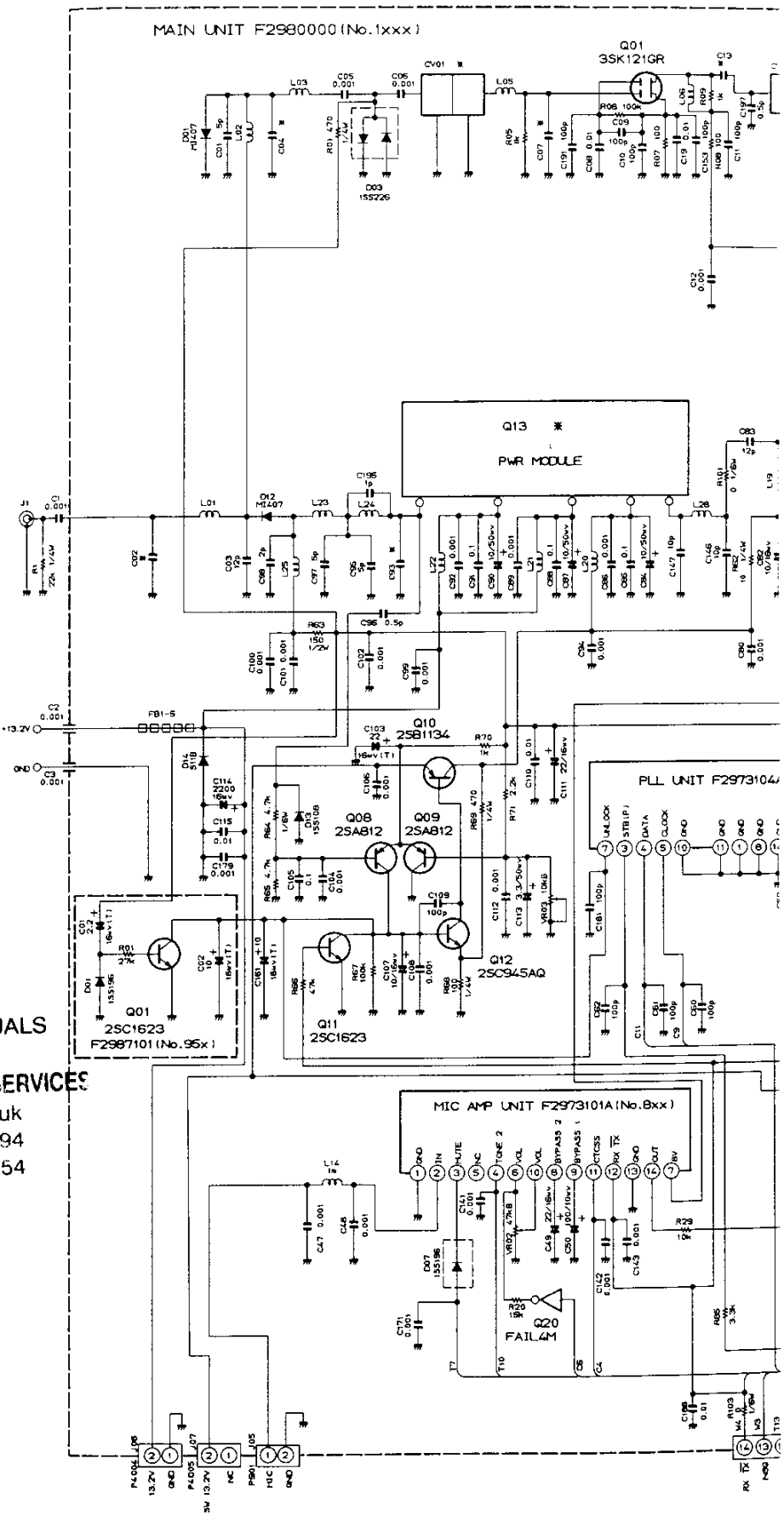


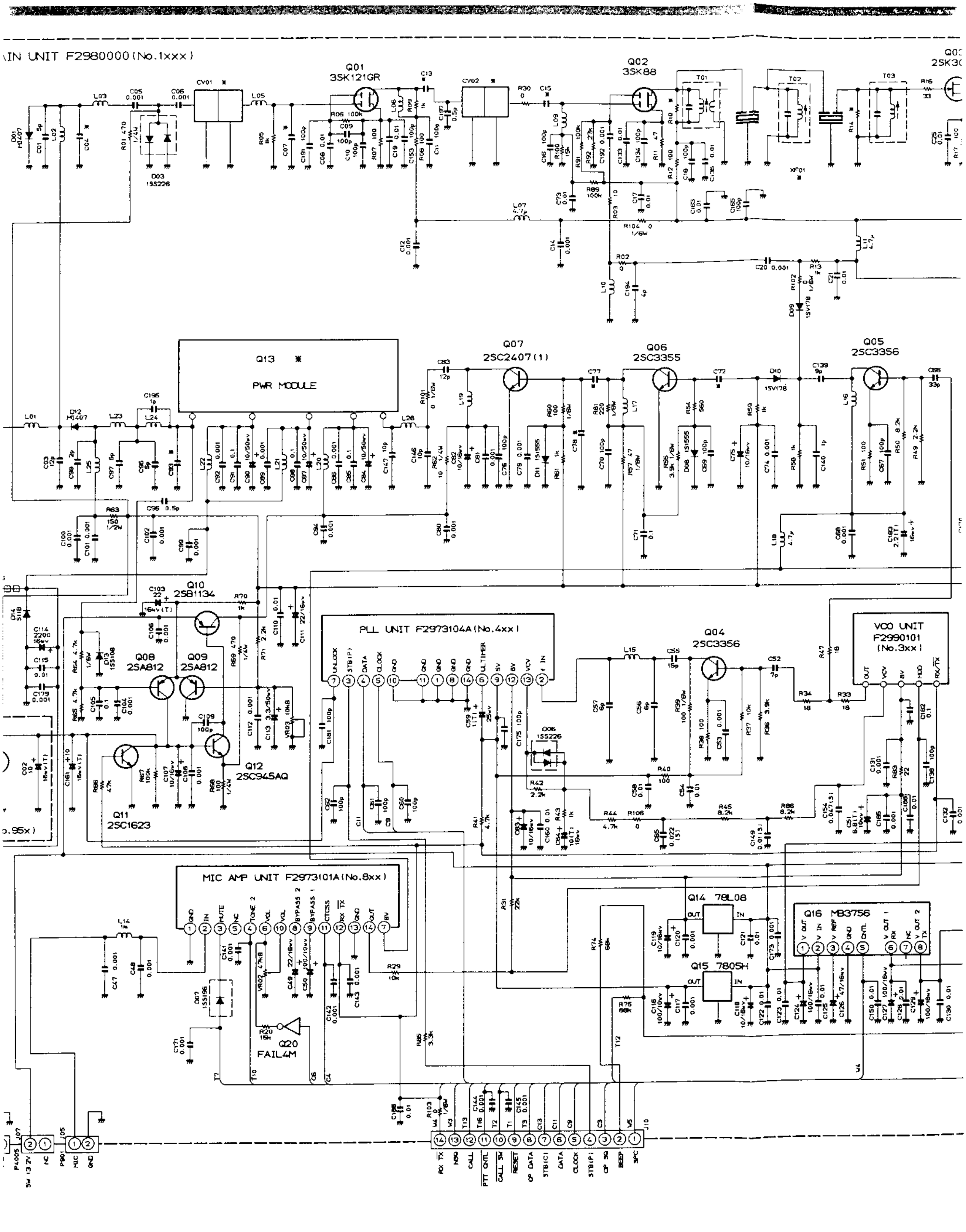
	CV01/CV02	C02	C04	C07	C13	C15	C18	C72	C77	C78
D BAND	L4020071	5p	3p	0.5p	2p	2p	3p	12p	7p	15p

		Q13	C93
D BAND	10v	MS7704H	2p
	25V	MS7729H	4p

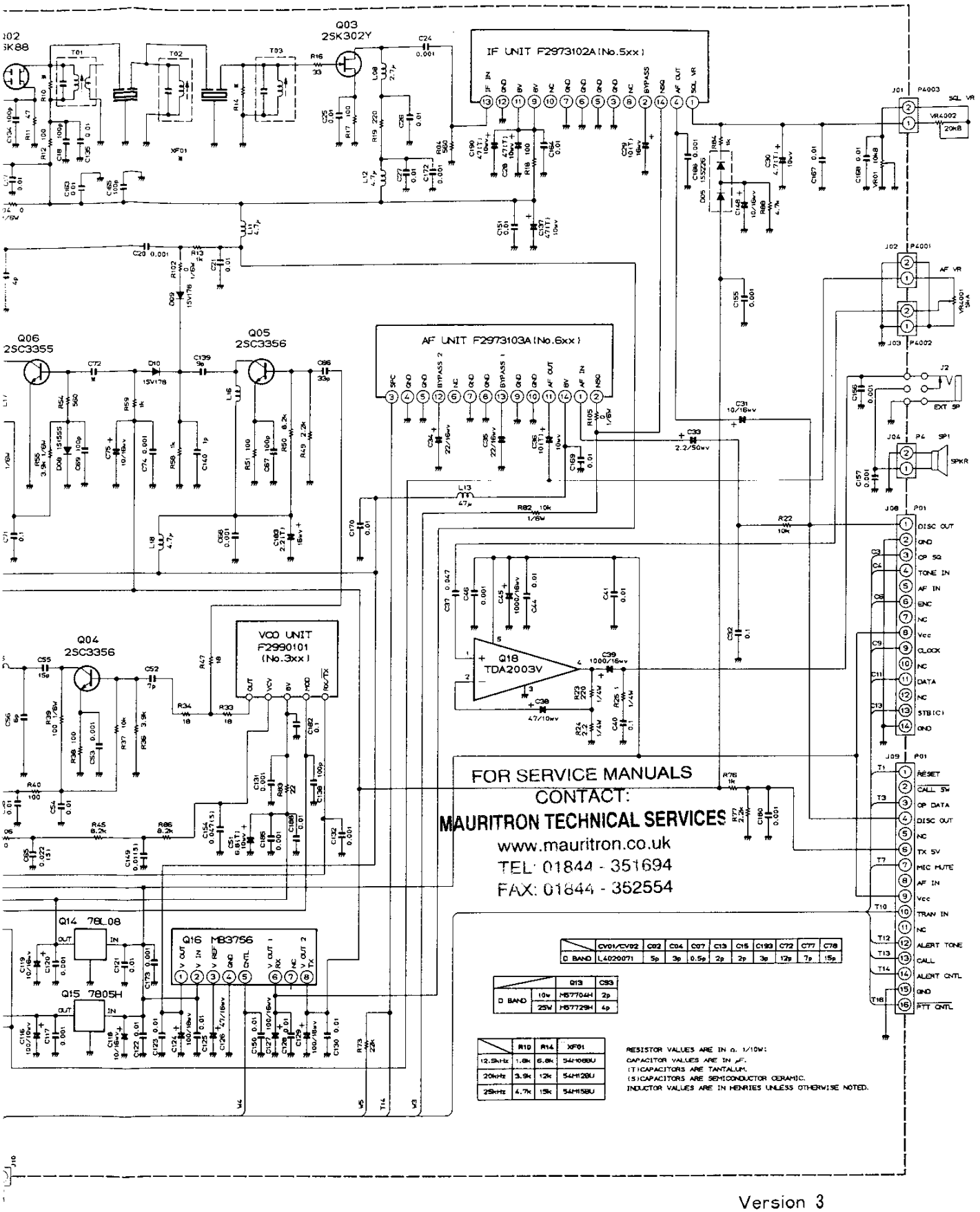
	R10	R14	XF01
12.5kHz	1.8k	6.8k	S4M10BU
20kHz	3.9k	12k	S4M12BU
25kHz	4.7k	15k	S4M15BU

RESISTOR VALUES ARE IN Ω, 1/10W.
CAPACITOR VALUES ARE IN μF.
(T)CAPACITORS ARE TANTALUM.
(S)CAPACITORS ARE SEMICONDUCTOR CERAMIC.
INDUCTOR VALUES ARE IN HENRIES UNLESS OTHERWISE NOTED.





AIN UNIT F2980000(No.1xxx)
Q01 3SK121GR
Q02 3SK88
Q13 PWR MODULE
Q07 2SC2407(1)
Q06 2SC3355
Q05 2SC3356
Q10 2SB1134
Q08 2SA812
Q09 2SA812
Q11 2SC1623
Q12 2SC945AQ
PLL UNIT F2973104A(No.4xx)
Q04 2SC3356
VCO UNIT F2990101 (No.3xx)
MIC AMP UNIT F2973101A(No.8xx)
Q14 78L08
Q15 7805H
Q16 MB3756
Q20 FAIL4M
RX TX
NSQ
CALL
PTT CNTL
CALL SW
RESET
OP DATA
STB(C)
DATA
CLOCK
STB(P)
OP SQ
BEEP
SPC
SW 13.2V
NC
MIC
GND

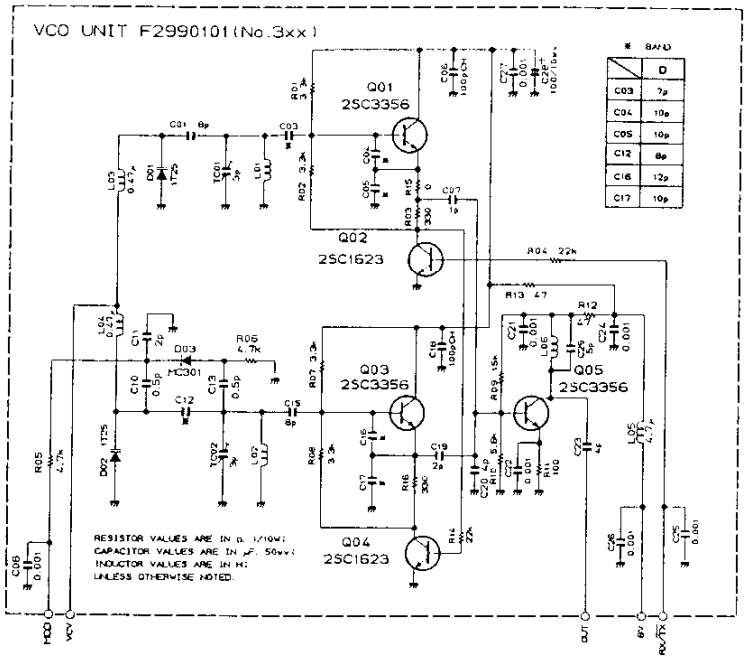


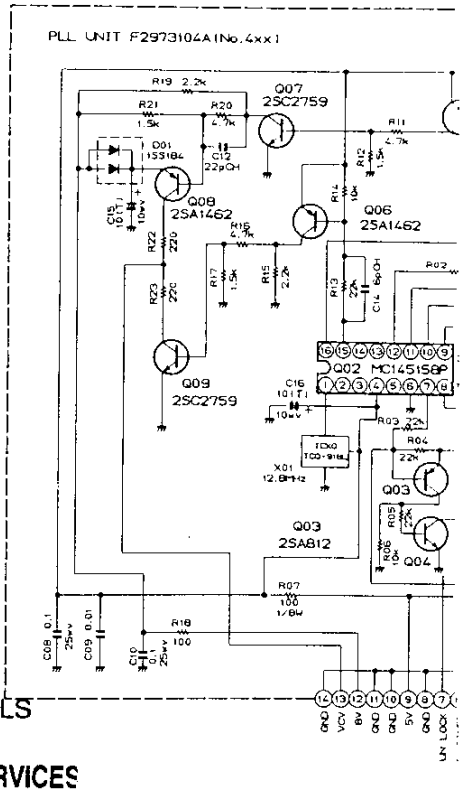
	CV01/CV02	C02	C04	C07	C13	C15	C193	C72	C77	C78
D BAND	L4020071	5p	3p	0.5p	2p	2p	3p	12p	7p	15p

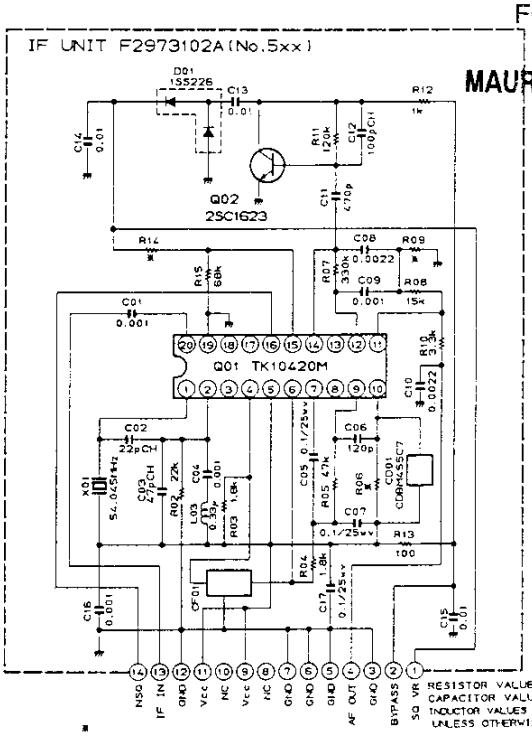
		Q13	C93
D BAND	10w	M57704H	2p
	25W	M57729H	4p

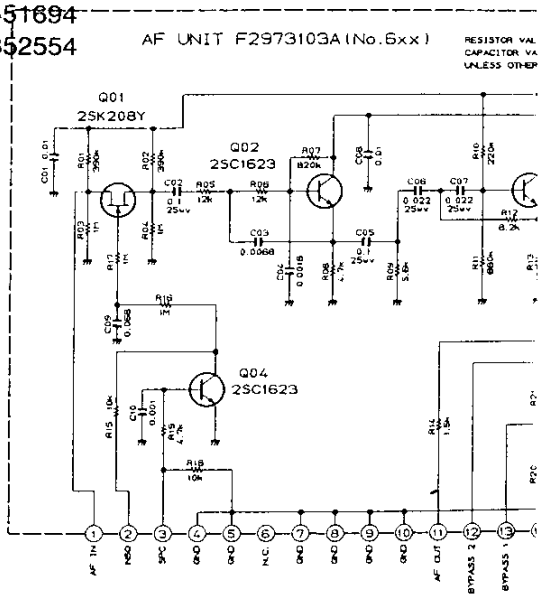
	R10	R14	XF01
12.5kHz	1.8k	6.8k	54H108U
20kHz	3.9k	12k	54H128U
25kHz	4.7k	15k	54H158U

Version 3

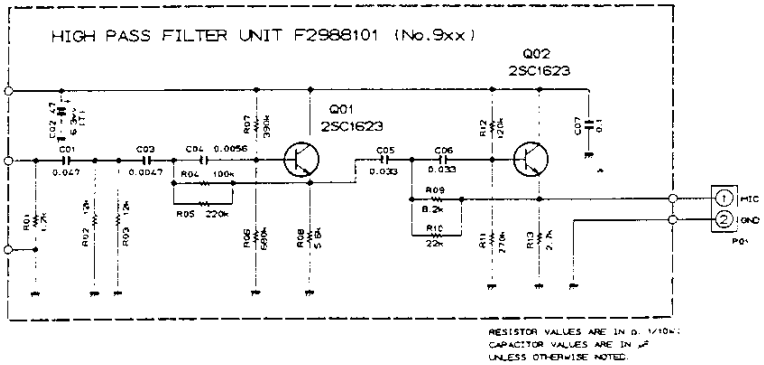


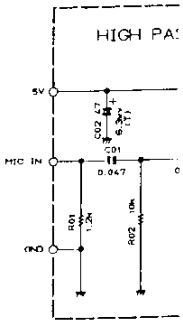


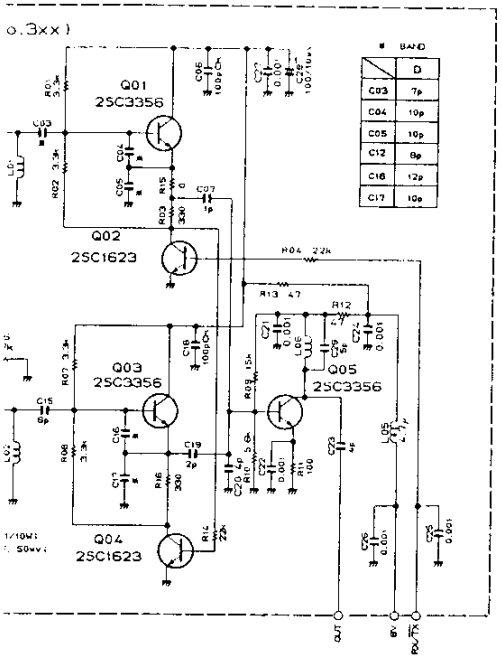


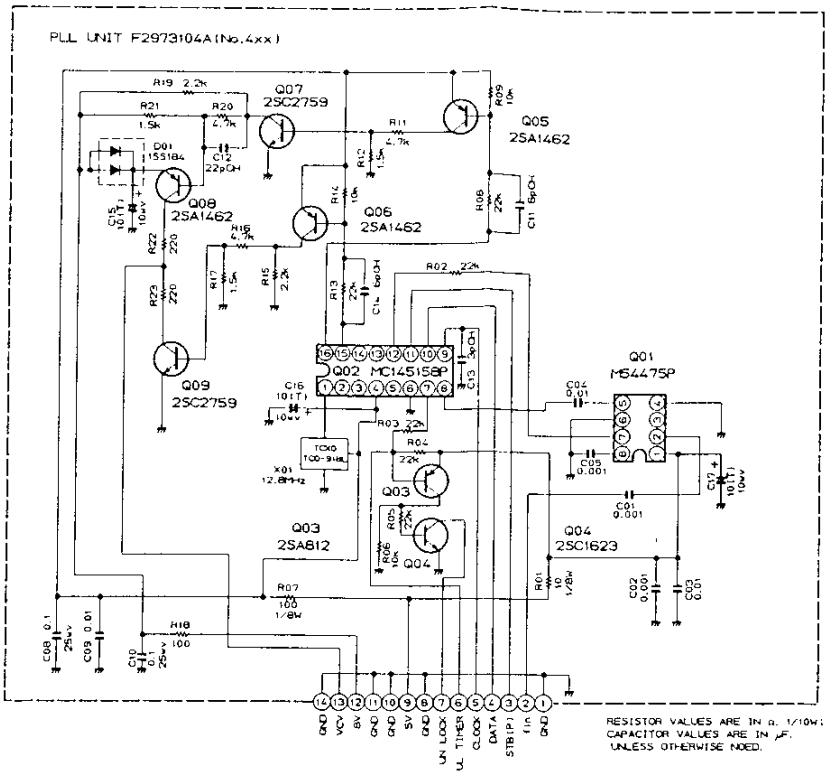


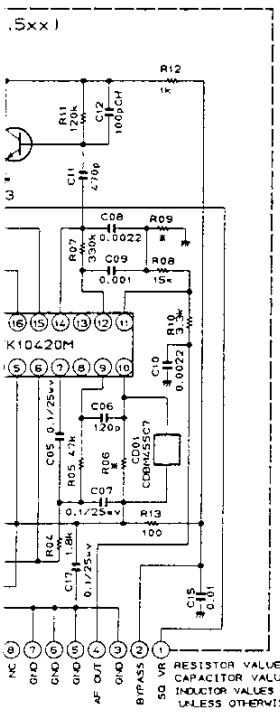
	12.5kHz	20kHz	25kHz
CF01	CFW 455D	CFW 455F	CFW 455E
R06	4.7k	1.5k	1.5k
R09	1.5k	820	1k
R14	4.7k	22k	27k



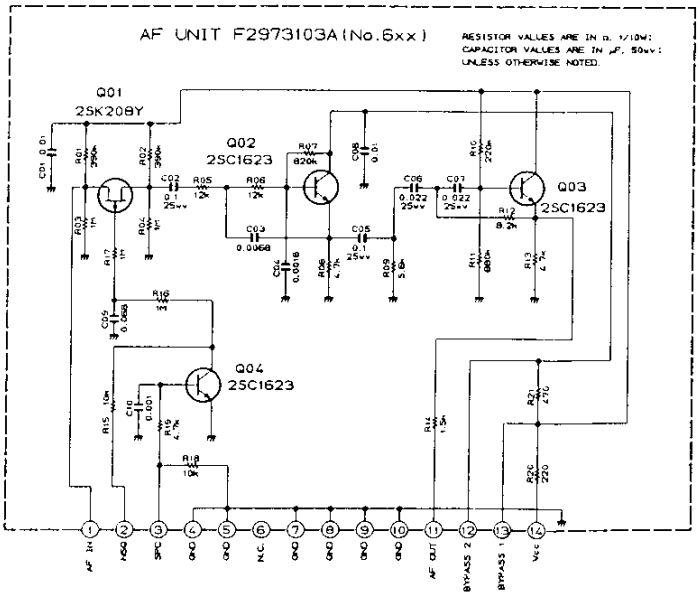


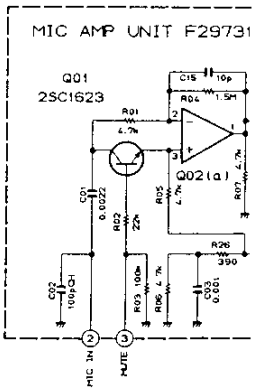




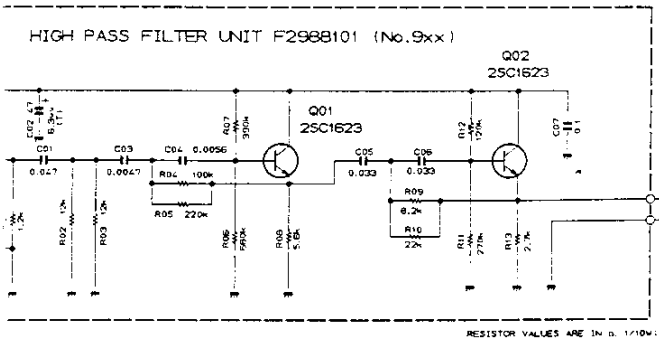


RESISTOR VALUES ARE IN Ω, 1/10W
CAPACITOR VALUES ARE IN μF:
INDUCTOR VALUES ARE IN H:
UNLESS OTHERWISE NOTED.

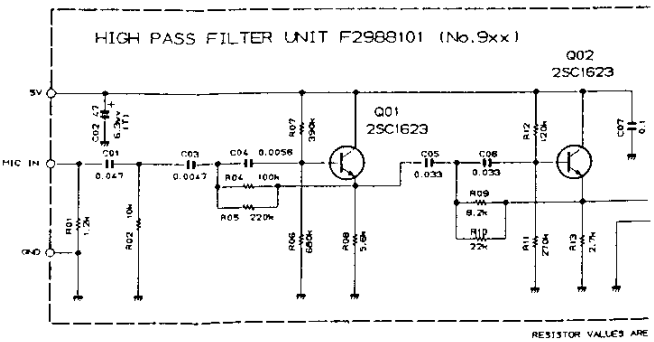




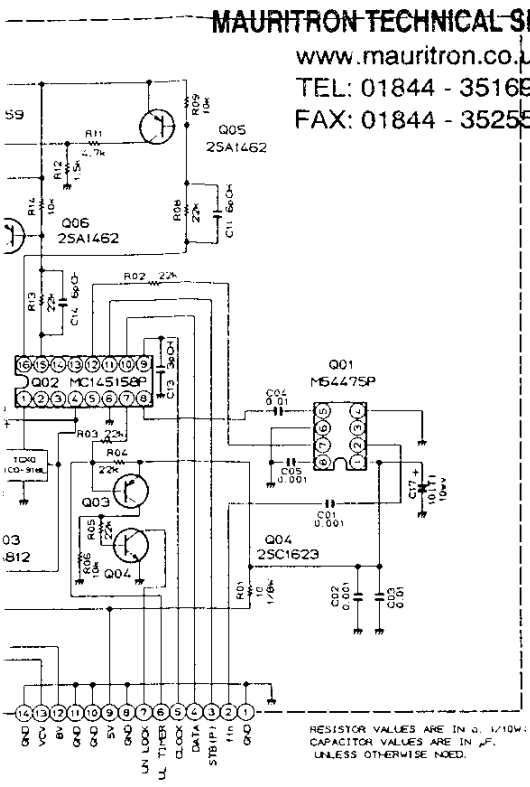
RESISTOR VALU
CAPACITOR VA
UNLESS OTHER
(T)CAPACITOR

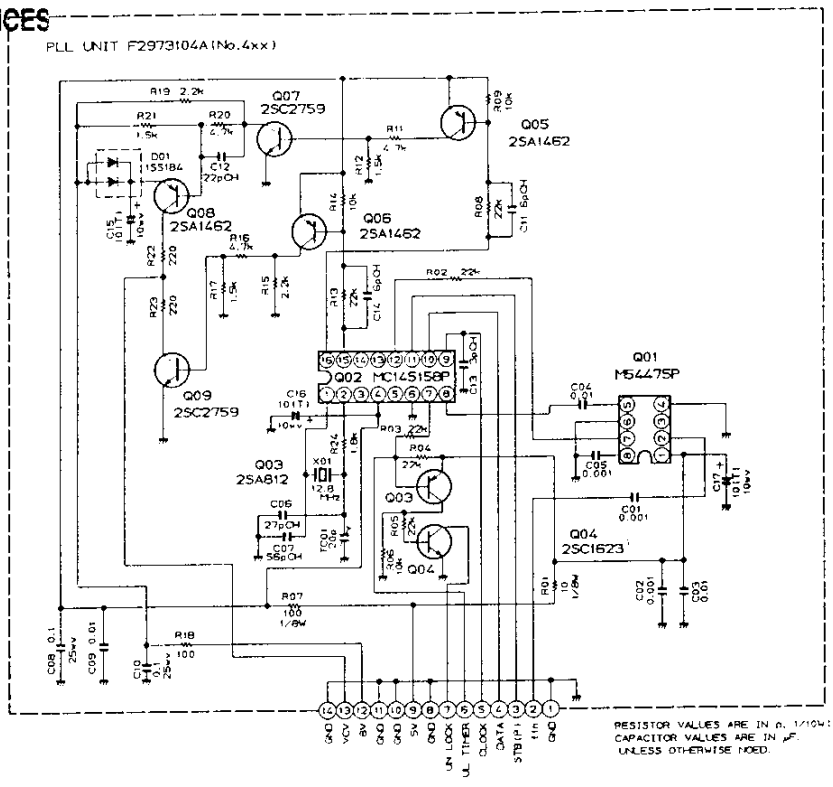


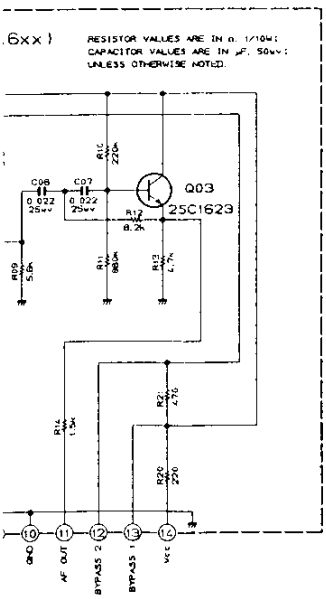
RESISTOR VALUES ARE IN Ω, 1/10W;
CAPACITOR VALUES ARE IN μF
UNLESS OTHERWISE NOTED

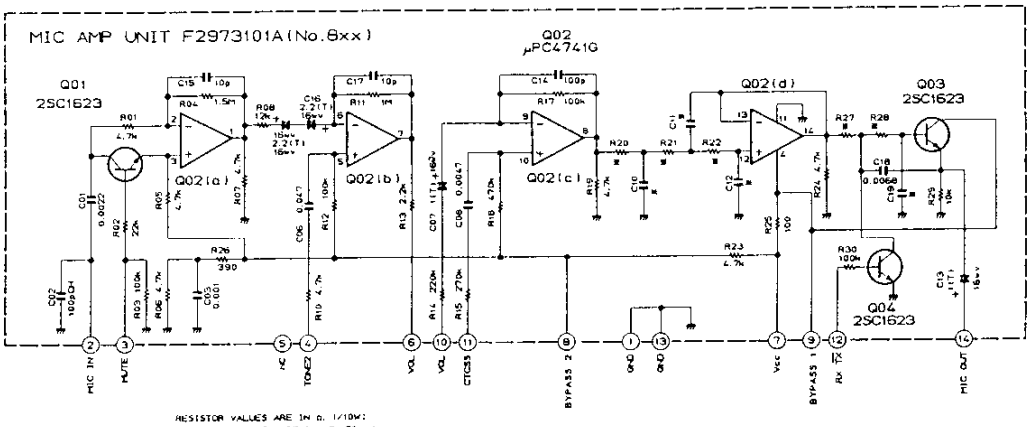


RESISTOR VALUES ARE
CAPACITOR VALUES AR
UNLESS OTHERWISE NO



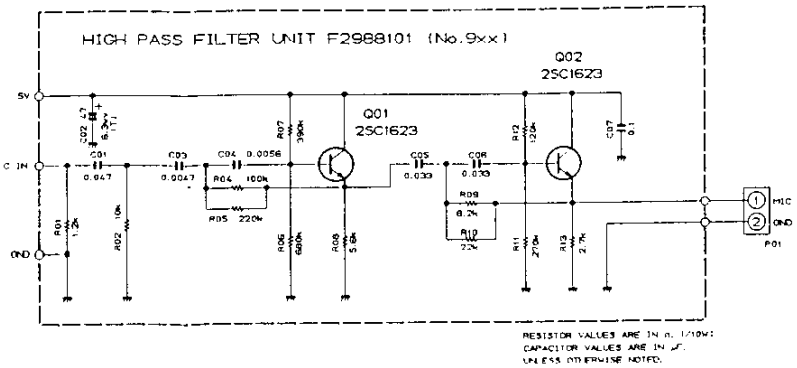


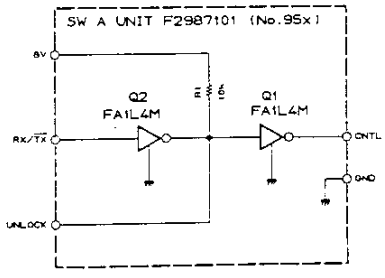




*

	R20	R21	R27	C12	C19	R22	R28	C18	C11
20.25kHz	10k	82k	6.8k	180p	0.0047	68k	8.8k	0.0047	0.0022
12.5kHz	1k	51k	22k	150p	0.0018	47k	18k	0.01	0.0068





*** MAIN UNIT ***

	F2981000A	Printed Circuit Board	
		PCB with Components	
	w/sub-unit		w/o sub-unit
	C029810AG	Band D 25kHz(25W)	C029810AA
	C029810AJ	Band D 20kHz(25W)	C029810AC
	C029810AL	Band D 12.5kHz(25W)	C029810AE
	C029810AH	Band D 25kHz(10W)	C029810AB
	C029810AK	Band D 20kHz(10W)	C029810AD
	C029810AM	Band D 12.5kHz(10W)	C029810AF
	C029810	Band A 25kHz(25W)	C029810
	C029810	Band A 20kHz(25W)	C029810
	C029810	Band A 12.5kHz(25W)	C029810
	C029810	Band A 25kHz(10W)	C029810
	C029810	Band A 20kHz(10W)	C029810
	C029810	Band A 12.5kHz(10W)	C029810
Q1001	G4801210G	FET	3SK121GR
Q1002	G4800880	FET	3SK88
Q1003	G3803027Y	FET	2SK302Y TE85R
Q1004	G3333567	Transistor	2SC3356-T2B R25
Q1005	G3333567	Transistor	2SC3356-T2B R25
Q1006	G3333550	Transistor	2SC3355
Q1007	G3090050	Transistor	2SC2407
Q1008	G3108127F	Transistor	2SA812-T2B M4B
Q1009	G3108127F	Transistor	2SA812-T2B M4B
Q1010	G3211340R	Transistor	2SB1134R
Q1011	G3316237F	Transistor	2SC1623-T2B L6
Q1012	G3309451Q	Transistor	2SC945AQ
Q1013		See Band Table	
Q1014	G1090080	IC	uPC78L08
Q1015	G1090299	IC	uPC7805H
Q1016	G9090222	IC	MB3756M-G
Q1018	G1090769	IC	TDA2003
Q1020	G3070013	Transistor	FA1L4M-T2B
D1001	G2090345	Diode	MI407
D1003	G2070003	Diode	1SS226 TE85R
D1005	G2070003	Diode	1SS226 TE85R
D1006	G2070003	Diode	1SS226 TE85R
D1007	G2070026	Diode	1SS196 TE85R
D1008	G2015550	Diode	1S1555
D1009	G2090344	Diode	1SV178
D1010	G2090344	Diode	1SV178
D1011	G2015550	Diode	1S1555
D1012	G2090345	Diode	MI407
D1013	G2090377	Diode	1SS108
D1014	G2090232	Diode	S11B
XF1001	H1102118	Crystal Filter(25kHz)	54M15BU
XF1001	H1102135	Crystal Filter(20kHz)	54M12BU
XF1001	H1102134	Crystal Filter(12.5kHz)	54M08BU
	R7066320	Filter Insulator	
R1001	J01245471	Carbon Film Res.	470 Ohm 1/4W
R1002	J24205000	Chip Res.	0 Ohm 1/10W
R1003	J01215100	Carbon Film Res.	10 Ohm 1/8W
R1004	J24205561	Chip Res.	560 Ohm 1/10W

R1005	J24205102	Chip Res.	1k Ohm	1/10W
R1006	J24205104	Chip Res.	100k Ohm	1/10W
R1007	J24205101	Chip Res.	100 Ohm	1/10W
R1008	J24205101	Chip Res.	100 Ohm	1/10W
R1009	J24205102	Chip Res.	1k Ohm	1/10W
R1010	J24205472	Chip Res.(25kHz)	4.7k Ohm	1/10W
R1010	J24205392	Chip Res.(20kHz)	3.9k Ohm	1/10W
R1010	J24205182	Chip Res.(12.5kHz)	1.8k Ohm	1/10W
R1011	J24205470	Chip Res.	47 Ohm	1/10W
R1012	J24205101	Chip Res.	100 Ohm	1/10W
R1013	J24205102	Chip Res.	1k Ohm	1/10W
R1014	J24205153	Chip Res.(25kHz)	15k Ohm	1/10W
R1014	J24205123	Chip Res.(20kHz)	12k Ohm	1/10W
R1014	J24205682	Chip Res.(12.5kHz)	6.8k Ohm	1/10W
R1016	J24205330	Chip Res.	33 Ohm	1/10W
R1017	J24205101	Chip Res.	100 Ohm	1/10W
R1018	J24205101	Chip Res.	100 Ohm	1/10W
R1019	J24205221	Chip Res.	220 Ohm	1/10W
R1020	J24205153	Chip Res.	15k Ohm	1/10W
R1022	J24205103	Chip Res.	10k Ohm	1/10W
R1023	J02245221	Carbon Film Res.	220 Ohm	1/4W
R1024	J02245229	Carbon Film Res.	2.2 Ohm	1/4W
R1025	J02245010	Carbon Film Res.	1 Ohm	1/4W
R1029	J24205103	Chip Res.	10k Ohm	1/10W
R1030	J24205000	Chip Res.	0 Ohm	1/10W
R1031	J24205223	Chip Res.	22k Ohm	1/10W
R1033	J24205180	Chip Res.	18 Ohm	1/10W
R1034	J24205180	Chip Res.	18 Ohm	1/10W
R1036	J24205392	Chip Res.	3.9k Ohm	1/10W
R1037	J24205103	Chip Res.	10k Ohm	1/10W
R1038	J24205101	Chip Res.	100 Ohm	1/10W
R1039	J02225101	Carbon Film Res.	100 Ohm	1/6W
R1040	J24205101	Chip Res.	100 Ohm	1/10W
R1041	J24205472	Chip Res.	4.7k Ohm	1/10W
R1042	J24205222	Chip Res.	2.2k Ohm	1/10W
R1043	J24205102	Chip Res.	1k Ohm	1/10W
R1044	J24205472	Chip Res.	4.7k Ohm	1/10W
R1045	J24205822	Chip Res.	8.2k Ohm	1/10W
R1047	J24205180	Chip Res.	18 Ohm	1/10W
R1049	J24205222	Chip Res.	2.2k Ohm	1/10W
R1050	J24205822	Chip Res.	8.2k Ohm	1/10W
R1051	J24205101	Chip Res.	100 Ohm	1/10W
R1054	J24205561	Chip Res.	560 Ohm	1/10W
R1055	J01225392	Carbon Film Res.	3.9k Ohm	1/6W
R1057	J02225470	Carbon Film Res.	47 Ohm	1/6W
R1058	J24205102	Chip Res.	1k Ohm	1/10W
R1059	J24205102	Chip Res.	1k Ohm	1/10W
R1060	J02225101	Carbon Film Res.	100 Ohm	1/6W
R1061	J24205102	Chip Res.	1k Ohm	1/10W
R1062	J02245100	Carbon Film Res.	10 Ohm	1/4W
R1063	J01275151	Carbon Film Res.	150 Ohm	1/2W
R1064	J01225472	Carbon Film Res.	4.7k Ohm	1/6W
R1065		See Band Table		
R1066	J24205473	Chip Res.	47k Ohm	1/10W
R1067	J24205104	Chip Res.	100k Ohm	1/10W
R1068	J02245101	Carbon Film Res.	100 Ohm	1/4W
R1069	J02245471	Carbon Film Res.	470 Ohm	1/4W
R1070	J24205102	Chip Res.	1k Ohm	1/10W

R513	J24205101	Chip Res.	100 Ohm	1/10W	
R514	J24205273	Chip Res.(25kHz)	27k Ohm	1/10W	
R514	J24205223	Chip Res.(20kHz)	22k Ohm	1/10W	
R514	J24205472	Chip Res.(12.5kHz)	4.7k Ohm	1/10W	
R1071	J24205822	Chip Res.	8.2k Ohm	1/10W	
R1073	J24205223	Chip Res.	22k Ohm	1/10W	
R1074	J24205683	Chip Res.	68k Ohm	1/10W	
R1075	J24205683	Chip Res.	68k Ohm	1/10W	
R1076	J24205102	Chip Res.	1k Ohm	1/10W	
R1077	J24205222	Chip Res.	2.2k Ohm	1/10W	
R1081	J02225221	Carbon Film Res.	220 Ohm	1/6W	
R1082	J01225103	Carbon Film Res.	10k Ohm	1/6W	
R1083	J24205220	Chip Res.	22 Ohm	1/10W	
R1084	J24205102	Chip Res.	1k Ohm	1/10W	
R1085	J24205332	Chip Res.	3.3k Ohm	1/10W	
R1086	J24205822	Chip Res.	8.2k Ohm	1/10W	
R1088	J24205472	Chip Res.	4.7k Ohm	1/10W	
R1089	J24205104	Chip Res.	100k Ohm	1/10W	
R1091	J24205104	Chip Res.	100k Ohm	1/10W	
R1092	J24205273	Chip Res.	27k Ohm	1/10W	
R1100	J24205153	Chip Res.	15k Ohm	1/10W	
R1101	J01225000	Jumper	0 Ohm	1/6W	
R1102	J01225000	Jumper	0 Ohm	1/6W	
R1103	J01225000	Jumper	0 Ohm	1/6W	
R1104	J01225000	Jumper	0 Ohm	1/6W	
R1105	J01225000	Jumper	0 Ohm	1/6W	
R1106	J24205000	Chip Res.	0 Ohm	1/10W	
VR1001	J51745103	Potentiometer	10k Ohm		
VR1002	J51745473	Potentiometer	47k Ohm		
VR1003	J51745103	Potentiometer	10k Ohm		
C1001	K22170206	Chip Cap.	5pF	50V	CH
C1002	K22170206	Chip Cap.	5pF	50V	CH
C1003	K22170213	Chip Cap.	12pF	50V	CH
C1004	K22170204	Chip Cap.	3pF	50V	CH
C1005	K22170805	Chip Cap.	0.001uF	50V	B
C1006	K22170805	Chip Cap.	0.001uF	50V	B
C1007	K22170201	Chip Cap.	0.5pF	50V	CH
C1008	K22170817	Chip Cap.	0.01uF	50V	B
C1009	K22170235	Chip Cap.	100pF	50V	CH
C1010	K22170235	Chip Cap.	100pF	50V	CH
C1011	K22170235	Chip Cap.	100pF	50V	CH
C1012	K22170805	Chip Cap.	0.001uF	50V	B
C1013	K22170203	Chip Cap.	2pF	50V	CH
C1014	K22170805	Chip Cap.	0.001uF	50V	B
C1015	K22170203	Chip Cap.	2pF	50V	CH
C1016	K22170235	Chip Cap.	100pF	50V	CH
C1017	K22170817	Chip Cap.	0.01uF	50V	B
C1018	K22170817	Chip Cap.	0.01uF	50V	B
C1019	K22170817	Chip Cap.	0.01uF	50V	B
C1020	K22170805	Chip Cap.	0.001uF	50V	B
C1021	K22170817	Chip Cap.	0.01uF	50V	B
C1024	K22170805	Chip Cap.	0.001uF	50V	B
C1025	K22170817	Chip Cap.	0.01uF	50V	B
C1026	K22170817	Chip Cap.	0.01uF	50V	B
C1027	K22170817	Chip Cap.	0.01uF	50V	B
C1028	K70107476	Tantalum Cap.	47uF	10V	
C1029	K70107106	Tantalum Cap.	10uF	10V	
C1030	K70107475	Tantalum Cap.	4.7uF	10V	
C1031	K40129012	Al Electro Cap.	10uF	16V	
C1032	K22141809	Chip Cap.	0.1uF	25V	B

C1033	K40179006	Al Electro Cap.	2.2uF	50V	
C1034	K40129016	Al Electro Cap.	22uF	16V	
C1035	K40129016	Al Electro Cap.	22uF	16V	
C1036	K70127106	Tantalum Cap.	10uF	16V	
C1037	K22141808	Chip Cap.	0.047uF	25V	B
C1038	K40109002	Al Electro Cap.	47uF	10V	
C1039	K40129046	Al Electro Cap.	1000uF	16V	
C1040	K22141809	Chip Cap.	0.1uF	25V	B
C1041	K22170817	Chip Cap.	0.01 uF	50V	B
C1044	K22170817	Chip Cap.	0.01uF	50V	B
C1045	K40129046	Al Electro Cap.	1000uF	16V	
C1046	K22170805	Chip Cap.	0.001uF	50V	B
C1047	K22170805	Chip Cap.	0.001uF	50V	B
C1048	K22170805	Chip Cap.	0.001uF	50V	B
C1049	K40129016	Al Electro Cap.	22uF	16V	
C1050	K40109024	Al Electro Cap.	100uF	10V	
C1051	K78100003	Tantalum Chip Cap.	6.8uF	10V	
C1052	K22170208	Chip Cap.	7pF	50V	CH
C1053	K22170805	Chip Cap.	0.001uF	50V	B
C1054	K22170817	Chip Cap.	0.01uF	50V	B
C1055	K22170215	Chip Cap.	15pF	50V	CH
C1056	K22170207	Chip Cap.	6pF	50V	CH
C1057	K22170207	Chip Cap.	6pF	50V	CH
C1058	K22170817	Chip Cap.	0.01uF	50V	B
C1059	K70167105	Tantalum Cap.	1uF	35V	
C1060	K22170235	Chip Cap.	100pF	50V	CH
C1061	K22170235	Chip Cap.	100pF	50V	CH
C1062	K22170235	Chip Cap.	100pF	50V	CH
C1063	K40129012	Al Electro Cap.	10uF	16V	
C1064	K70127106	Tantalum Cap.	10uF	16V	
C1065	K19149017	Ceramic Cap.	0.022uF	25V	
C1066	K22170223	Chip Cap.	33pF	50V	CH
C1067	K22170235	Chip Cap.	100pF	50V	CH
C1068	K22170805	Chip Cap.	0.001uF	50V	B
C1069	K22170235	Chip Cap.	100pF	50V	CH
C1070	K22170235	Chip Cap.	100pF	50V	CH
C1071	K22141809	Chip Cap.	0.1uF	25V	B
C1072	K22170213	Chip Cap.	12pF	50V	CH
C1073	K22170817	Chip Cap.	0.01uF	50V	B
C1074	K22170805	Chip Cap.	0.001uF	50V	B
C1075	K40129004	Al Electro Cap.	10uF	16V	
C1076	K22170235	Chip Cap.	100pF	50V	CH
C1077	K22170208	Chip Cap.	7pF	50V	CH
C1078	K22170215	Chip Cap.	15pF	50V	CH
C1079	K22170805	Chip Cap.	0.001uF	50V	B
C1080	K22170805	Chip Cap.	0.001uF	50V	B
C1081	K22170805	Chip Cap.	0.001uF	50V	B
C1082	K70127106	Tantalum Cap.	10uF	16V	
C1083	K22170213	Chip Cap.	12pF	50V	CH
C1084	K40179014	Al Electro Cap.	10uF	50V	
C1085	K22141809	Chip Cap.	0.1uF	25V	B
C1086	K22170805	Chip Cap.	0.001uF	50V	B
C1087	K40179014	Al Electro Cap.	10uF	50V	
C1088	K22141809	Chip Cap.	0.1uF	25V	B
C1089	K22170805	Chip Cap.	0.001uF	50V	B
C1090	K40179014	Al Electro Cap.	10uF	50V	
C1091	K22141809	Chip Cap.	0.1uF	25V	B
C1092	K22170805	Chip Cap.	0.001uF	50V	B

C1093		See Band Table			CH
C1094	K22170805	Chip Cap.	0.001uF	50V	B
C1095	K22170206	Chip Cap.	5pF	50V	CH
C1096	K22170201	Chip Cap.	0.5pF	50V	CH
C1097	K22170206	Chip Cap.	5pF	50V	CH
C1098	K22170203	Chip Cap.	2pF	50V	CH
C1099	K22170805	Chip Cap.	0.001uF	50V	B
C1100	K22170805	Chip Cap.	0.001uF	50V	B
C1101	K22170805	Chip Cap.	0.001uF	50V	B
C1102	K22170805	Chip Cap.	0.001uF	50V	B
C1104	K22170805	Chip Cap.	0.001uF	50V	B
C1105	K22141809	Chip Cap.	0.1uF	25V	B
C1106	K22170805	Chip Cap.	0.001uF	50V	B
C1107	K40129004	Al Electro Cap.	10uF	16V	
C1108	K22170805	Chip Cap.	0.001uF	50V	B
C1109	K22170235	Chip Cap.	100pF	50V	CH
C1110	K22170817	Chip Cap.	0.01uF	50V	B
C1111	K40129016	Al Electro Cap.	22uF	16V	
C1112	K22170805	Chip Cap.	0.001uF	50V	B
C1113	K40179011	Al Electro Cap.	3.3uF	50V	
C1114	K40129050	Al Electro Cap.	2200uF	16V	
C1115	K22170817	Chip Cap.	0.01uF	50V	B
C1116	K40109024	Al Electro Cap.	100uF	10V	
C1117	K22170805	Chip Cap.	0.001uF	50V	B
C1118	K40129004	Al Electro Cap.	10uF	16V	
C1119	K40129004	Al Electro Cap.	10uF	16V	
C1120	K22170805	Chip Cap.	0.001uF	50V	B
C1121	K22170817	Chip Cap.	0.01uF	50V	B
C1122	K22170817	Chip Cap.	0.01uF	50V	B
C1123	K22170817	Chip Cap.	0.01uF	50V	B
C1124	K40129060	Al Electro Cap.	100uF	16V	
C1125	K22170817	Chip Cap.	0.01uF	50V	B
C1126	K40129054	Al Electro Cap.	47uF	16V	
C1127	K40129042	Al Electro Cap.	100uF	16V	
C1128	K22170817	Chip Cap.	0.01uF	50V	B
C1129	K40129042	Al Electro Cap.	100uF	16V	
C1130	K22170817	Chip Cap.	0.01uF	50V	B
C1131	K22170805	Chip Cap.	0.001uF	50V	B
C1132	K22170805	Chip Cap.	0.001uF	50V	B
C1133	K22170817	Chip Cap.	0.01uF	50V	B
C1134	K22170235	Chip Cap.	100pF	50V	CH
C1135	K22170817	Chip Cap.	0.01uF	50V	B
C1137	K70107476	Tantalum Cap.	47uF	10V	
C1138	K22170235	Chip Cap.	100pF	50V	CH
C1139	K22170210	Chip Cap.	9pF	50V	CH
C1140	K22170202	Chip Cap.	1pF	50V	CH
C1141	K22170805	Chip Cap.	0.001uF	50V	B
C1142	K22170805	Chip Cap.	0.001uF	50V	B
C1143	K22170805	Chip Cap.	0.001uF	50V	B
C1144	K22170805	Chip Cap.	0.001uF	50V	B
C1145	K22170805	Chip Cap.	0.001uF	50V	B
C1146	K22170211	Chip Cap.	10pF	50V	CH
C1147	K22170211	Chip Cap.	10pF	50V	CH
C1148	K40129004	Al Electro Cap.	10uF	16V	
C1149	K19149013	Ceramic Cap.	0.01uF	25V	Sr
C1150	K22170817	Chip Cap.	0.01uF	50V	B
C1151	K22170817	Chip Cap.	0.01uF	50V	B
C1152		See Band Table			

C1153	K22170235	Chip Cap.	100pF	50V	CH
C1154	K19149021	Ceramic Cap.	0.047uF	25V	Sr
C1155	K22170805	Chip Cap.	0.001uF	50V	B
C1156	K22170805	Chip Cap.	0.001uF	50V	B
C1157	K22170805	Chip Cap.	0.001uF	50V	B
C1160	K22170817	Chip Cap.	0.01uF	50V	B
C1163	K22170817	Chip Cap.	0.01uF	50V	B
C1164	K22170817	Chip Cap.	0.01uF	50V	B
C1165	K22170235	Chip Cap.	100pF	50V	CH
C1166	K22170805	Chip Cap.	0.001uF	50V	B
C1167	K22170817	Chip Cap.	0.01uF	50V	B
C1168	K22170817	Chip Cap.	0.01uF	50V	B
C1169	K22170817	Chip Cap.	0.01uF	50V	B
C1170	K22170817	Chip Cap.	0.01uF	50V	B
C1171	K22170805	Chip Cap.	0.001uF	50V	B
C1172	K22170805	Chip Cap.	0.001uF	50V	B
C1173	K22170805	Chip Cap.	0.001uF	50V	B
C1175	K22170235	Chip Cap.	100pF	50V	B
C1179	K22170805	Chip Cap.	0.001uF	50V	B
C1180	K22170805	Chip Cap.	0.001uF	50V	B
C1181	K22170235	Chip Cap.	100pF	50V	CH
C1182	K22141809	Chip Cap.	0.1uF	25V	B
C1183	K70137225	Tantalum Cap.	2.2uF	20V	
C1185	K22170805	Chip Cap.	0.001uF	50V	B
C1186	K22170817	Chip Cap.	0.01uF	50V	B
C1188	K22170817	Chip Cap.	0.01uF	50V	B
C1190	K70107476	Tantalum Cap.	47uF	10V	
C1191	K22170235	Chip Cap.	100pF	50V	CH
C1192	K22170805	Chip Cap.	0.001uF	50V	B
C1194	K22170205	Chip Cap.	4pF	50V	CH
C1195	K22170202	Chip Cap.	1pF	50V	CH
C1197	K22170201	Chip Cap.	0.5pF	50V	CH

L1001	L0020912	Coil	
L1002	L0021711A	Coil	
L1003	L0021711A	Coil	
L1005	L0020677	Coil	
L1006	L0021356	Coil	
L1007	L1190203	RFC	4.7uH
L1008	L1190200	RFC	2.7uH
L1009	L0020676	Coil	
L1010	L0021818	Coil	
L1011	L1190203	RFC	4.7uH
L1012	L1190203	RFC	4.7uH
L1013	L1190203	RFC	4.7uH
L1014	L1190189	RFC	
L1015	L0021359	Coil	
L1016	L0020903	Coil	
L1017	L0021359	Coil	
L1018	L1190203	RFC	4.7uH
L1019	L0020903	Coil	
L1020	L0021705	Coil	
L1021	L0021705	Coil	
L1022	L0021705	Coil	
L1023	L0020912	Coil	
L1024	L0020912	Coil	
L1025	L0021520	Coil	
L1028	L0021359	Coil	

T1001	L0021760	Coil		54.5MHz
T1002	L0021760	Coil		54.5MHz
T1003	L0021760	Coil		54.5MHz
	L9190015	Coil Case	15mm	
	L9190036	Coil Case	7mm	
CV1001		See Band Table		
CV1002		See Band Table		
J1001	P0090621	Connector	SC25-02WS	
J1002	P0090621	Connector	SC25-02WS	
J1003	P0090621	Connector	SC25-02WS	
J1004	P0090621	Connector	SC25-02WS	
J1005	P0090621	Connector	SC25-02WS	
J1006	P0090621	Connector	SC25-02WS	
J1007	P0090621	Connector	SC25-02WS	
J1008	P0090604	Connector	5532-14A	
J1009	P0090605	Connector	5532-16A	
J1010	P0090656	Connector	SB20-14WS	
FB1001	L9190055	Ferrite Bead	3-20L-48B	
FB1002	L9190055	Ferrite Bead	3-20L-48B	
FB1003	L9190055	Ferrite Bead	3-20L-48B	
FB1004	L9190055	Ferrite Bead	3-20L-48B	
FB1005	L9190055	Ferrite Bead	3-20L-48B	
	R0509420B	Shield Plate		
	R0509430	Shield Plate		
	R0125030	Shield Plate		
	R0120820	Shield Plate		
	R0124970	Heatsink		

*** VCO UNIT ***

	F2990101	Printed Circuit Board			
	C029901AA	PCB with Components	(BAND D)		
		PCB with Components	(BAND A)		
Q301	G3333567E	Transistor	2SC3356-T2B R25		
Q302	G3316237F	Transistor	2SC1623-T2B L6		
Q303	G3333567E	Transistor	2SC3356-T2B R25		
Q304	G3316237F	Transistor	2SC1623-T2B L6		
Q305	G3333567E	Transistor	2SC3356-T2B R25		
D301	G2090107	Diode	1T25		
D302	G2090107	Diode	1T25		
D303	G2090044	Diode	MC301		
R301	J24205332	Chip Res.	3.3k Ohm	1/10W	
R302	J24205332	Chip Res.	3.3k Ohm	1/10W	
R303	J24205331	Chip Res.	330 Ohm	1/8W	
R304	J24205223	Chip Res.	22k Ohm	1/10W	
R305	J24205472	Chip Res.	4.7k Ohm	1/10W	
R306	J24205472	Chip Res.	4.7k Ohm	1/10W	
R307	J24205332	Chip Res.	3.3k Ohm	1/10W	
R308	J01215332	Carbon Film Res.	3.3k Ohm	1/8W	
R309	J24205153	Chip Res.	15k Ohm	1/10W	
R310	J24205562	Chip Res.	5.6k Ohm	1/10W	
R311	J24205101	Chip Res.	100 Ohm	1/10W	
R312	J24205470	Chip Res.	47 Ohm	1/10W	
R313	J24205470	Chip Res.	47 Ohm	1/10W	
R314	J24205223	Chip Res.	22k Ohm	1/10W	
R315	J24205000	Chip Res.	0 Ohm	1/10W	
R316	J24205331	Chip Res.	330 Ohm	1/10W	
C301		See Band Table			
C302		See Band Table			
C303		See Band Table			
C304		See Band Table			
C305		See Band Table			
C306	K22170235	Chip Cap.	100pF	50V	CH
C307	K22170202	Chip Cap.	1pF	50V	CH
C308	K22170805	Chip Cap.	0.001uF	50V	B
C310	K22170201	Chip Cap.	0.5pF	50V	CH
C311	K22170203	Chip Cap.	2pF	50V	CH
C312		See Band Table			
C313	K22170201	Chip Cap.	0.5pF	50V	CH
C314		See Band Table			
C315	K22170207	Chip Cap.	6pF	50V	CH
C316		See Band Table			
C317		See Band Table			
C318	K22170235	Chip Cap.	100pF	50V	CH
C319	K22170203	Chip Cap.	2pF	50V	CH
C320	K22170205	Chip Cap.	4pF	50V	CH
C321	K22170805	Chip Cap.	0.001uF	50V	B
C322	K22170805	Chip Cap.	0.001uF	50V	B
C323		See Band Table			
C324	K22170805	Chip Cap.	0.001uF	50V	B
C325	K22170805	Chip Cap.	0.001uF	50V	B
C326	K22170805	Chip Cap.	0.001uF	50V	B
C327	K22170805	Chip Cap.	0.001uF	50V	B
C328	K40109015	Al Electro Cap.	100uF	10V	
C329	K22170206	Chip Cap.	5pF	50V	CH

TC301	K91000159	Trimmer Cap.	3pF	
TC302	K91000159	Trimmer Cap.	3pF	
L301	F2880000	Ceramic Resonator	Strip Line w/L302	
L302	(F2880000)	Ceramic Resonator	Strip Line	
L303	L1190192	RFC	0.47uH	
L304	L1190192	RFC	0.47uH	
L305	L1190203	RFC	4.7uH	
L306	L0020676	Coil		
	Q5000036	Terminal Posts	TP-G	
	Q5000082	Terminal Posts	TP-N	
	R0119910	Shield Cover		
	R0119920	Shield Frame		
	R0120740A	Shield Rear Plate		

*** PLL UNIT ***

	F2973104A	Printed Circuit Board		
	C029734AB	PCB w/Components		
Q401	G1090770	IC	M54475P	
Q402	G1090648	IC	MC145158P	
Q403	G3108127F	Transistor	2SA812-T2B	
Q404	G3316237F	Transistor	2SC1623-T2B	
Q405	G3114627C	Transistor	2SA1462-T2B	
Q406	G3114627C	Transistor	2SA1462-T2B	
Q407	G3327597B	Transistor	2SC2759-T2B	
Q408	G3114627C	Transistor	2SA1462-T2B	
Q409	G3327597B	Transistor	2SC2759-T2B	
D401	G2070009	Diode	1SS184 TE85R	
X401	H0102799	Crystal	UM-2	12.800MHz
X401	H9500120	TCXO	TCO-918L	12.800MHz
R401	J01215100	Carbon Film Res.	10 Ohm	1/8W
R402	J24205223	Chip Res.	22k Ohm	1/10W
R403	J24205223	Chip Res.	22k Ohm	1/10W
R404	J24205223	Chip Res.	22k Ohm	1/10W
R405	J24205223	Chip Res.	22k Ohm	1/10W
R406	J24205103	Chip Res.	10k Ohm	1/10W
R407	J01215101	Carbon Film Res.	100 Ohm	1/8W
R408	J24205223	Chip Res.	22k Ohm	1/10W
R409	J24205103	Chip Res.	10k Ohm	1/10W
R410	J24205222	Chip Res.	2.2k Ohm	1/10W
R411	J24205472	Chip Res.	4.7k Ohm	1/10W
R412	J24205152	Chip Res.	1.5k Ohm	1/10W
R413	J24205223	Chip Res.	22k Ohm	1/10W
R414	J24205103	Chip Res.	10k Ohm	1/10W
R415	J24205222	Chip Res.	2.2k Ohm	1/10W
R416	J24205472	Chip Res.	4.7k Ohm	1/10W
R417	J24205152	Chip Res.	1.5k Ohm	1/10W
R418	J24205101	Chip Res.	100 Ohm	1/10W
R419	J24205222	Chip Res.	2.2k Ohm	1/10W
R420	J24205472	Chip Res.	4.7k Ohm	1/10W
R421	J24205152	Chip Res.	1.5k Ohm	1/10W
R422	J24205221	Chip Res.	220 Ohm	1/10W

R423	J24205221	Chip Res.	220 Ohm	1/10W	
R424	J24205182	Chip Res.	1.8k Ohm	1/10W	
C401	K22170805	Chip Cap.	0.001uF	50V	B
C402	K22170805	Chip Cap.	0.001uF	50V	B
C403	K22170817	Chip Cap.	0.01uF	50V	B
C404	K22170817	Chip Cap.	0.01uF	50V	B
C405	K22170805	Chip Cap.	0.001uF	50V	B
C406	K22170221	Chip Cap.	27pF	50V	CH
C407	K22170227	Chip Cap.	47pF	50V	CH
C408	K22141809	Chip Cap.	0.1uF	25V	B
C409	K22170817	Chip Cap.	0.01uF	50V	B
C410	K22141809	Chip Cap.	0.1uF	25V	B
C411	K22170207	Chip Cap.	6pF	50V	CH
C412	K22170219	Chip Cap.	22pF	50V	CH
C413	K22170204	Chip Cap.	3pF	50V	CH
C414	K22170207	Chip Cap.	6pF	50V	CH
C415	K78100004	Tantalum Chip Cap.	10uF	10V	
C416	K70107106	Tantalum Cap.	10uF	10V	
C417	K70107106	Tantalum Cap.	10uF	10V	
TC401	K91000115	Trimmer Cap.	20pF		
	R0120600	Shield Plate			

*** IF UNIT ***

	F2973102A	Printed Circuit Board		
	C029732AD	PCB w/Components	(25kHz)	
	C029732AE	PCB w/Components	(12.5kHz)	
	C029732AG	PCB w/Components	(20kHz)	
Q501	G1090698	IC	TK10420M	
Q502	G3316237F	Transistor	2SC1623-T2B	
D501	G2070003	Diode	1SS226 TE85R	
X501	H0102807	Crystal	HC-49/T	54.045MHz
CF501	H3900200	Ceramic Filter(25kHz)	CFW455E	
CF501	H3900202	Ceramic Filter(20kHz)	CFW455F	
CF501	H3900392	Ceramic Filter(12.5kHz)	CFW455G	
CD501	H7900480	Ceramic Discriminator	CDBM455C7	455kHz
R502	J24205223	Chip Res.	22k Ohm	1/10W
R503	J24205182	Chip Res.	1.8k Ohm	1/10W
R504	J24205182	Chip Res.	1.8k Ohm	1/10W
R505	J24205473	Chip Res.	47k Ohm	1/10W
R506	J24205152	Chip Res.(25kHz)	1.5k Ohm	1/10W
R506	J24205152	Chip Res.(20kHz)	1.5k Ohm	1/10W
R506	J24205472	Chip Res.(12.5kHz)	4.7k Ohm	1/10W
R507	J24205334	Chip Res.	330k Ohm	1/10W
R508	J24205153	Chip Res.	15k Ohm	1/10W
R509	J24205102	Chip Res.(25kHz)	1k Ohm	1/10W
R509	J24205821	Chip Res.(20kHz)	820 Ohm	1/10W
R509	J24205152	Chip Res.(12.5kHz)	1.5k Ohm	1/10W
R510	J24205332	Chip Res.	3.3k Ohm	1/10W
R511	J24205124	Chip Res.	120k Ohm	1/10W
R512	J24205102	Chip Res.	1k Ohm	1/10W

R515	J24205683	Chip Res.	68k Ohm	1/10W
C501	K22170805	Chip Cap.	0.001uF	50V B
C502	K22170219	Chip Cap.	22pF	50V CH
C503	K22170227	Chip Cap.	47pF	50V CH
C504	K22170805	Chip Cap.	0.001uF	50V B
C505	K22141809	Chip Cap.	0.1uF	25V B
C506	K22170237	Chip Cap.	120pF	50V CH
C507	K22141809	Chip Cap.	0.1uF	25V B
C508	K22170809	Chip Cap.	0.0022uF	50V B
C509	K22170805	Chip Cap.	0.001uF	50V B
C510	K22170809	Chip Cap.	0.01uF	50V B
C511	K22170801	Chip Cap.	470pF	50V B
C512	K22170235	Chip Cap.	100pF	50V CH
C513	K22170817	Chip Cap.	0.01uF	50V B
C514	K22170817	Chip Cap.	0.01uF	50V B
C515	K22170817	Chip Cap.	0.01uF	50V B
C516	K22170805	Chip Cap.	0.001uF	50V B
C517	K22141809	Chip Cap.	0.1uF	25V B
C518	K78120002	Tantalum Chip Cap.	2.2uF	16V
L501	L1190150	RFC	0.33uH	

*** AF UNIT ***

	F2973103A	Printed Circuit Board		
	C029733AB	PCB w/Components		
Q601	G3802087Y	FET	2SK208Y TE85R	
Q602	G3316237F	Transistor	2SC1623-T2B L6	
Q603	G3316237F	Transistor	2SC1623-T2B L6	
Q604	G3316237F	Transistor	2SC1623-T2B L6	
R601	J24205394	Chip Res.	390k Ohm	1/10W
R602	J24205394	Chip Res.	390k Ohm	1/10W
R603	J24205105	Chip Res.	1M Ohm	1/10W
R604	J24205105	Chip Res.	1M Ohm	1/10W
R605	J24205123	Chip Res.	12k Ohm	1/10W
R606	J24205123	Chip Res.	12k Ohm	1/10W
R607	J24205824	Chip Res.	820k Ohm	1/10W
R608	J24205472	Chip Res.	4.7k Ohm	1/10W
R609	J24205562	Chip Res.	5.6k Ohm	1/10W
R610	J24205224	Chip Res.	220k Ohm	1/10W
R611	J24205684	Chip Res.	680k Ohm	1/10W
R612	J24205822	Chip Res.	8.2k Ohm	1/10W
R613	J24205472	Chip Res.	4.7k Ohm	1/10W
R614	J24205152	Chip Res.	1.5k Ohm	1/10W
R615	J24205103	Chip Res.	10k Ohm	1/10W
R616	J24205105	Chip Res.	1M Ohm	1/10W
R617	J24205105	Chip Res.	1M Ohm	1/10W
R618	J24205103	Chip Res.	10k Ohm	1/10W
R619	J24205472	Chip Res.	4.7k Ohm	1/10W
R620	J24205221	Chip Res.	220 Ohm	1/10W
R621	J24205471	Chip Res.	470 Ohm	1/10W

C601	K22170817	Chip Cap.	0.01uF	50V	B
C602	K22141809	Chip Cap.	0.1uF	25V	B
C603	K22170815	Chip Cap.	0.0068uF	50V	B
C604	K22170808	Chip Cap.	0.0018uF	50V	B
C605	K22141809	Chip Cap.	0.1uF	25V	B
C606	K22140807	Chip Cap.	0.022uF	50V	B
C607	K22140807	Chip Cap.	0.022uF	50V	B
C608	K22170817	Chip Cap.	0.01uF	50V	B
C609	K22120805	Chip Cap.	0.068uF	16V	B
C610	K22170805	Chip Cap.	0.001uF	50V	B

*** MIC AMP UNIT ***

	F2973101A	Printed Circuit Board	
	C029731AC	PCB with Components	(25kHz)
	C029731AC	PCB with Components	(20kHz)
	C029731AD	PCB with Components	(12.5kHz)
Q801	G3316237F	Transistor	2SC1623 T2B L6
Q802	G1090913	IC	uPC4741G
Q803	G3316237F	Transistor	2SC1623 T2B L6
Q804	G3316237F	Transistor	2SC1623 T2B L6

R801	J24205472	Chip Res.	4.7k Ohm	1/10W
R802	J24205223	Chip Res.	22k Ohm	1/10W
R803	J24205104	Chip Res.	100k Ohm	1/10W
R804	J24205155	Chip Res.	1.5M Ohm	1/10W
R805	J24205472	Chip Res.	4.7k Ohm	1/10W
R806	J24205472	Chip Res.	4.7k Ohm	1/10W
R807	J24205472	Chip Res.	4.7k Ohm	1/10W
R808	J24205123	Chip Res.	12k Ohm	1/10W
R810	J24205472	Chip Res.	4.7k Ohm	1/10W
R811	J24205105	Chip Res.	1M Ohm	1/10W
R812	J24205104	Chip Res.	100k Ohm	1/10W
R813	J24205222	Chip Res.	2.2k Ohm	1/10W
R814	J24205224	Chip Res.	220k Ohm	1/10W
R815	J24205274	Chip Res.	270k Ohm	1/10W
R817	J24205104	Chip Res.	100k Ohm	1/10W
R818	J24205474	Chip Res.	470k Ohm	1/10W
R819	J24205472	Chip Res.	4.7k Ohm	1/10W
R820	J24205103	Chip Res.(25kHz)	10k Ohm	1/10W
R820	J24205103	Chip Res.(20kHz)	10k Ohm	1/10W
R820	J24205113	Chip Res.(12.5kHz)	11k Ohm	1/10W
R821	J24205823	Chip Res.(25kHz)	82k Ohm	1/10W
R821	J24205823	Chip Res.(20kHz)	82k Ohm	1/10W
R821	J24205513	Chip Res.(12.5kHz)	51k Ohm	1/10W
R822	J24205683	Chip Res.(25kHz)	68k Ohm	1/10W
R822	J24205683	Chip Res.(20kHz)	68k Ohm	1/10W
R822	J24205473	Chip Res.(12.5kHz)	47k Ohm	1/10W
R823	J24205472	Chip Res.	4.7k Ohm	1/10W
R824	J24205472	Chip Res.	4.7k Ohm	1/10W

R825	J24205101	Chip Res.	100 Ohm	1/10W	
R826	J24205391	Chip Res.	390 Ohm	1/10W	
R827	J24205682	Chip Res.(25kHz)	6.8k Ohm	1/10W	
R827	J24205682	Chip Res.(20kHz)	6.8k Ohm	1/10W	
R827	J24205223	Chip Res.(12.5kHz)	22k Ohm	1/10W	
R828	J24205682	Chip Res.(25kHz)	6.8k Ohm	1/10W	
R828	J24205682	Chip Res.(20kHz)	6.8k Ohm	1/10W	
R828	J24205183	Chip Res.(12.5kHz)	18k Ohm	1/10W	
R829	J24205103	Chip Res.	10k Ohm	1/10W	
R830	J24205104	Chip Res.	100k Ohm	1/10W	
C801	K22170809	Chip Cap.	0.0022uF	50V	B
C802	K22170235	Chip Cap.	100pF	50V	CH
C803	K22170805	Chip Cap.	0.001uF	50V	B
C804	K78120002	Chip Cap.	2.2uF	16V	
C806	K22141808	Chip Cap.	0.047uF	25V	B
C807	K78120013	Chip Cap.	1uF	16V	
C808	K22170813	Chip Cap.	0.0047uF	50V	B
C810	K22170813	Chip Cap.(25kHz)	0.0047uF	50V	B
C810	K22170813	Chip Cap.(20kHz)	0.0047uF	50V	B
C810	K22170817	Chip Cap.(12.5kHz)	0.01uF	50V	B
C811	K22170809	Chip Cap.(25kHz)	0.0022uF	50V	B
C811	K22170809	Chip Cap.(20kHz)	0.0022uF	50V	B
C811	K22170815	Chip Cap.(12.5kHz)	0.0068uF	50V	B
C812	K22170241	Chip Cap.(25kHz)	180pF	50V	CH
C812	K22170241	Chip Cap.(20kHz)	180pF	50V	CH
C812	K22170239	Chip Cap.(12.5kHz)	150pF	50V	CH
C813	K78120013	Chip Cap.	1uF	16V	
C814	K22170235	Chip Cap.	100pF	50V	CH
C815	K22170211	Chip Cap.	10pF	50V	CH
C816	K78120002	Chip Cap.	2.2uF	16V	
C817	K22170211	Chip Cap.	10pF	50V	CH
C818	K22170815	Chip Cap.	0.0068uF	50V	B
C819	K22170813	Chip Cap.(25kHz)	0.0047uF	50V	B
C819	K22170813	Chip Cap.(20kHz)	0.0047uF	50V	B
C819	K22170808	Chip Cap.(12.5kHz)	0.0018uF	50V	B

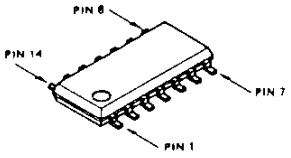
*** HPF UNIT ***

	F2988101	Printed Circuit Board		
	C029881AB	PCB w/Components		
Q901	G3316237F	Transistor	2SC1623-T2B	
Q902	G3316237F	Transistor	2SC1623-T2B	
R901	J24205122	Chip Res.	1.2k Ohm	1/10W
R902	J24205123	Chip Res.	12k Ohm	1/10W
R903	J24205333	Chip Res.	33k Ohm	1/10W
R904	J24205104	Chip Res.	100k Ohm	1/10W
R905	J24205224	Chip Res.	220k Ohm	1/10W
R906	J24205684	Chip Res.	680k Ohm	1/10W
R907	J24205394	Chip Res.	390k Ohm	1/10W
R908	J24205562	Chip Res.	5.6k Ohm	1/10W
R909	J24205822	Chip Res.	8.2k Ohm	1/10W
R910	J24205223	Chip Res.	22k Ohm	1/10W
R911	J24205274	Chip Res.	270k Ohm	1/10W
R912	J24205124	Chip Res.	120k Ohm	1/10W
R913	J24205272	Chip Res.	2.7k Ohm	1/10W

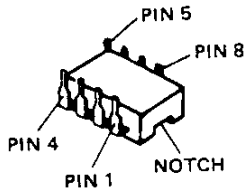
C901	K22141808	Chip Cap.	0.047uF	25V	B
C902	K78080013	Tantalum Chip Cap.	47uF	6.3V	
C903	K22170813	Chip Cap.	0.0047uF	50V	B
C904	K22170814	Chip Cap.	0.0056uF	50V	B
C905	K22141806	Chip Cap.	0.033uF	25V	B
C906	K22141806	Chip Cap.	0.033uF	25V	B
C907	K22141809	Chip Cap.	0.1uF	25V	B
P901	T9205691A	Wire Assy			
FB901	L9190055	Ferrite Bead	B-20-48B		

*** SW-A UNIT ***

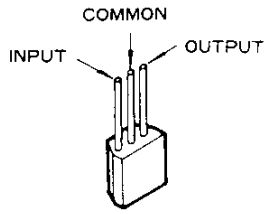
	F2987101	Printed Circuit Board		
	C029871AB	PCB with Components		
Q951	G3316237F	Transistor	2SC1623-T2B L6	
D951	G2070026	Diode	1SS196 TE85R	
R951	J24205223	Chip Res.	22k Ohm	1/10W
C951	K78120002	Tantalum Chip Cap.	2.2uF	16V
C952	K78100004	Tantalum Chip Cap.	10uF	10V



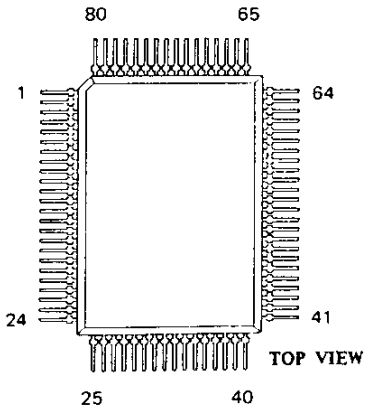
μPD4584BG(Q2001)



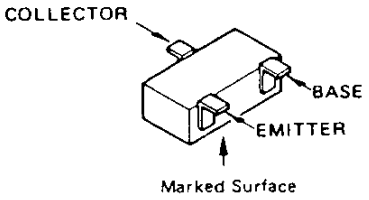
X2404P(Q2002)



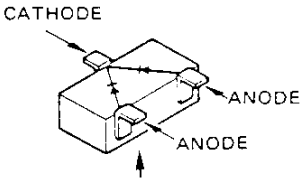
M5278L56 (Q2015)



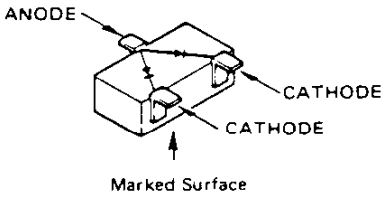
μPD7514G-287-12 (Q2016)



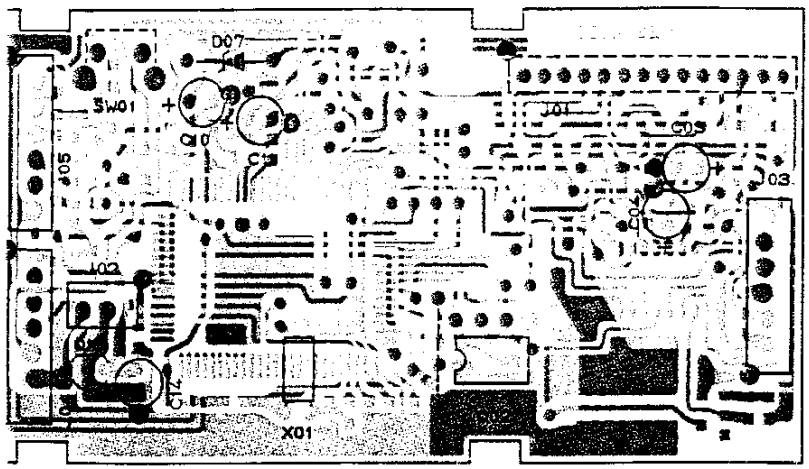
2SC1623 (L6/L7) (Q2003,2004,2008 2010,2013,2014)
2SA812 (M6/M7) (Q2005,2006,2007 2011,2012)
FA1L4L (M30) (Q2009)



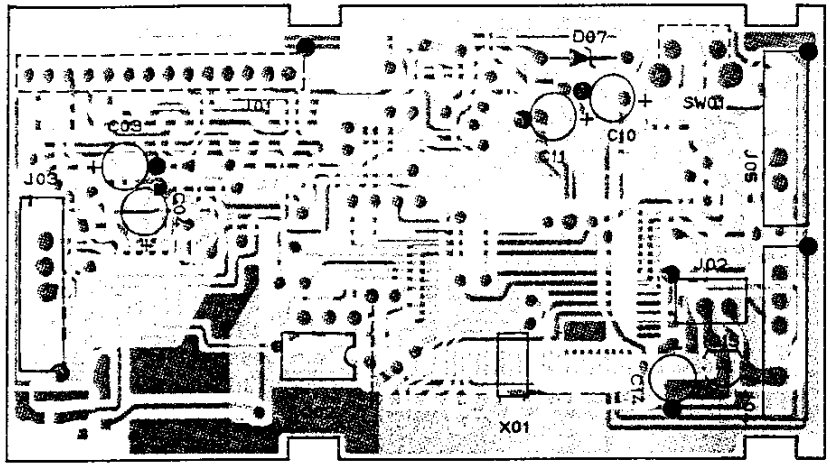
1SS184 (B3) (D2001,2002,2003)



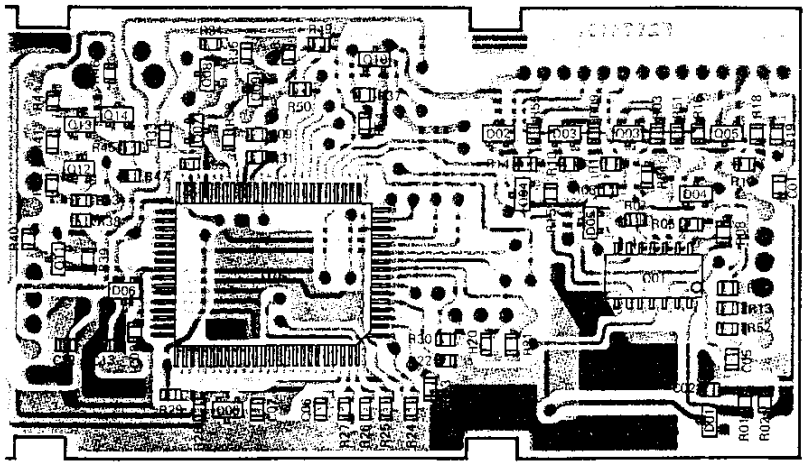
1SS181 (A3) (D2004,2006)



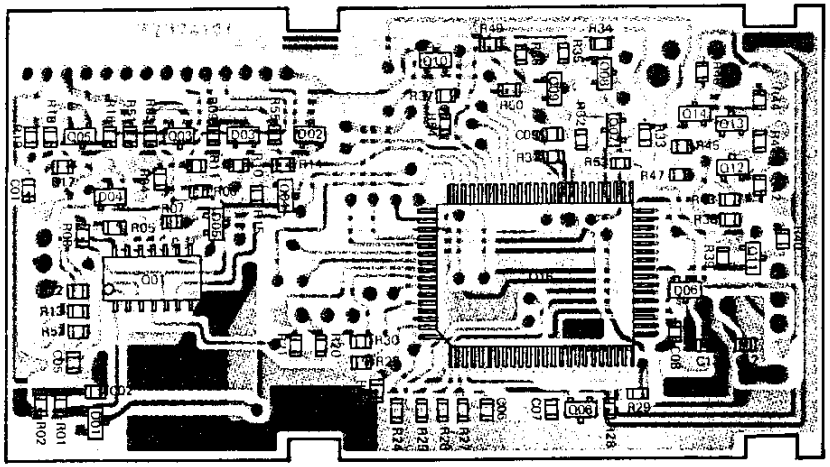
(obverse view of "component" side)



(reverse view of "component" side)



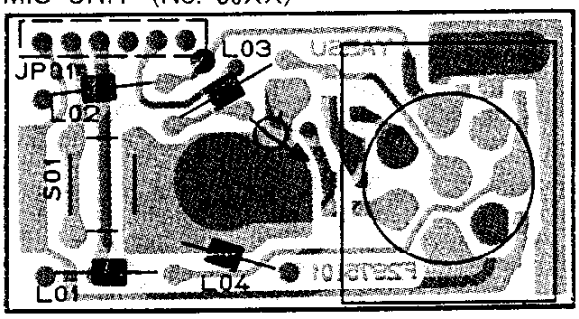
(reverse view of "chip-only" side)



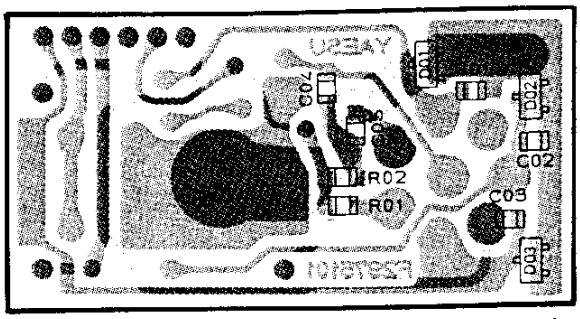
(obverse view of "chip-only" side)

MIC/VR/LED UNIT PARTS LAYOUT

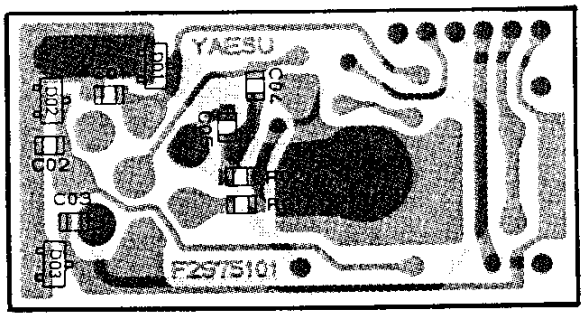
MIC UNIT (No. 30XX)



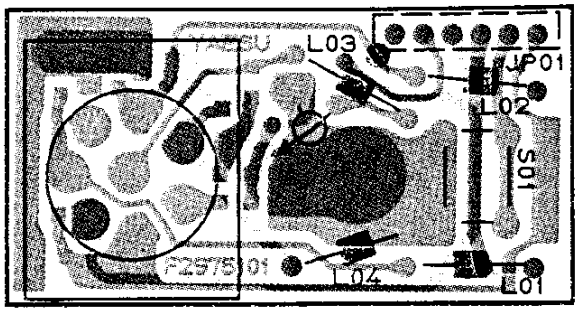
(obverse view of "CONNECTOR" side)



(reverse view of "chip-only" side)

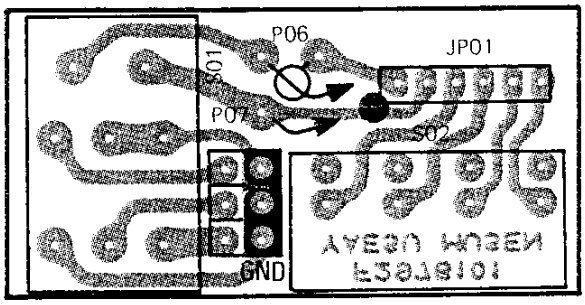


(obverse view of "chip-only" side)

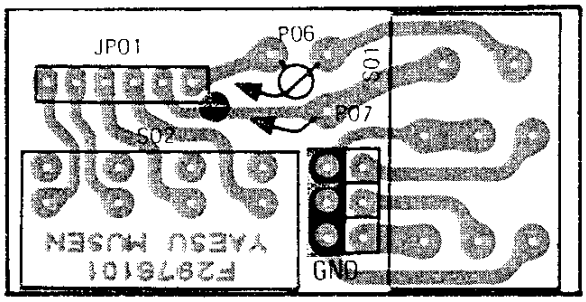


(reverse view of "CONNECTOR" side)

VR UNIT (No. 40XX)

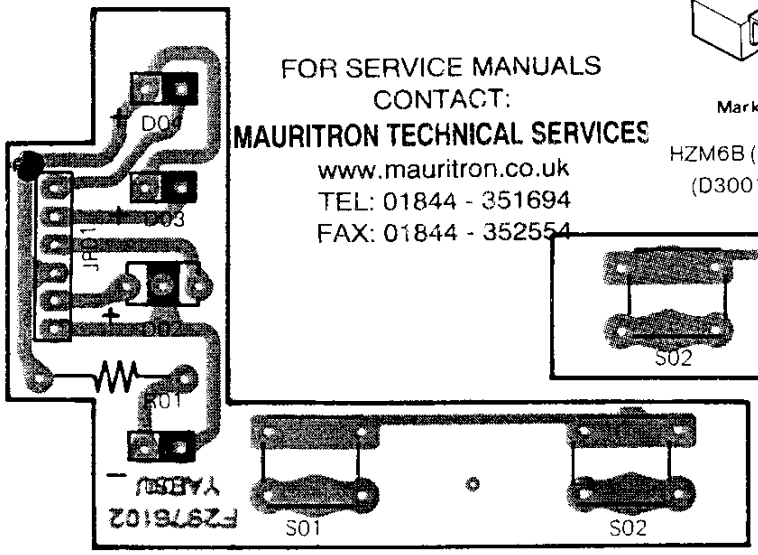


(obverse view of "VR" side)

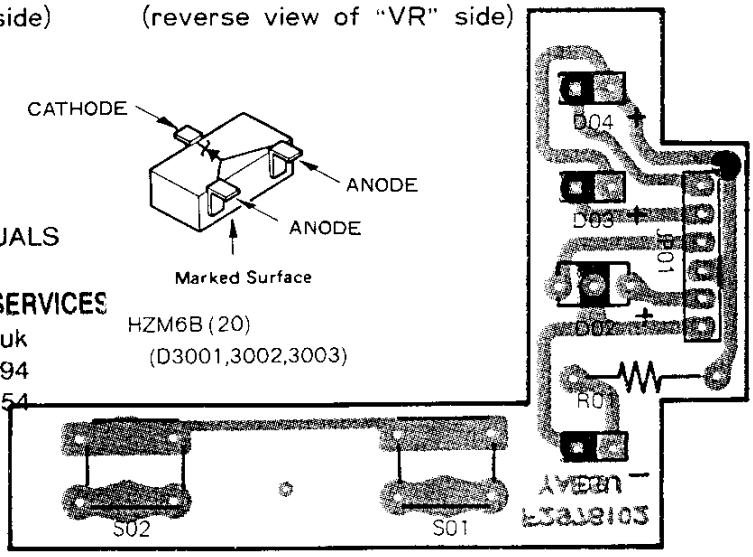


(reverse view of "VR" side)

LED UNIT (No. 50XX)



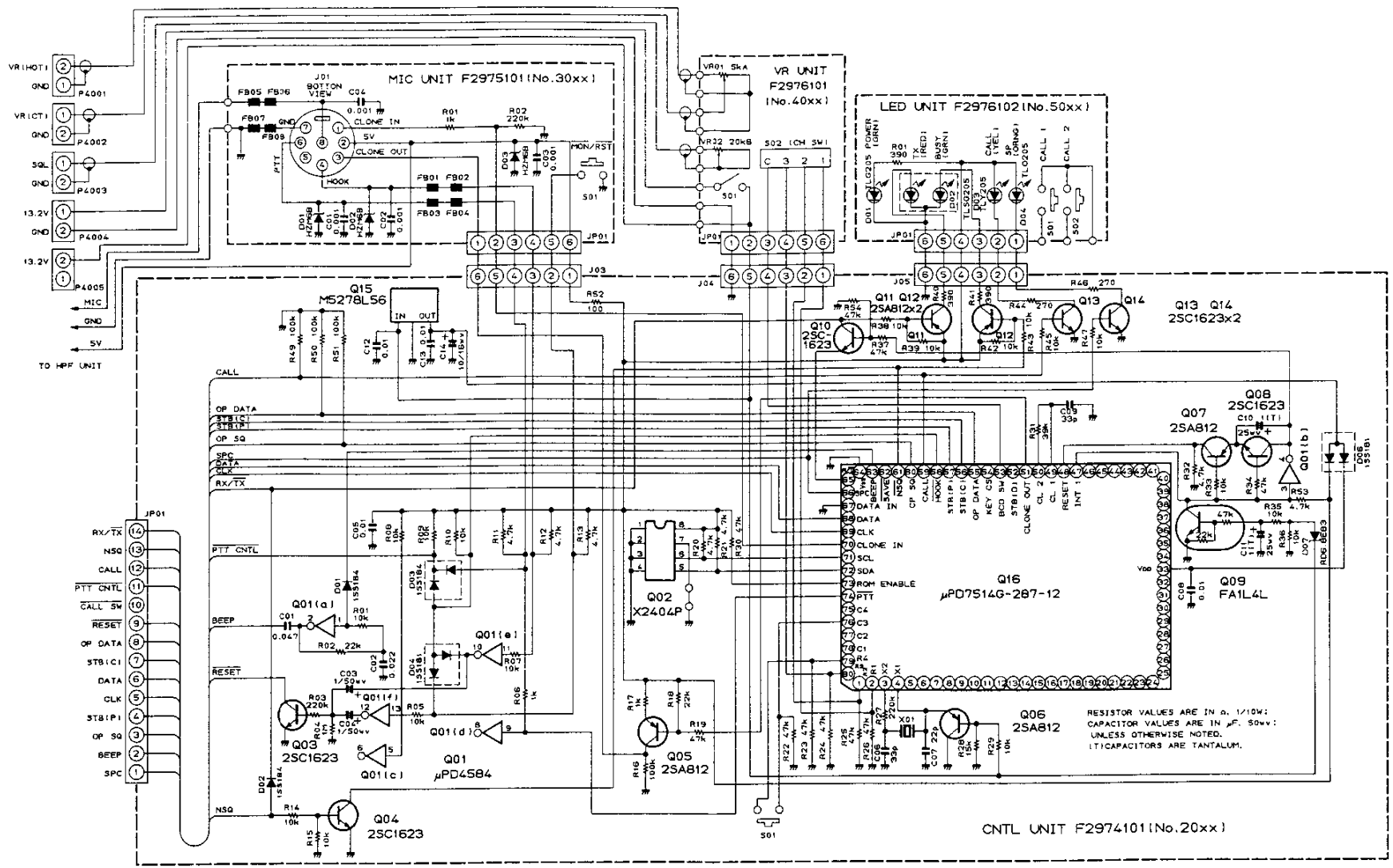
(reverse view of "LED" side)



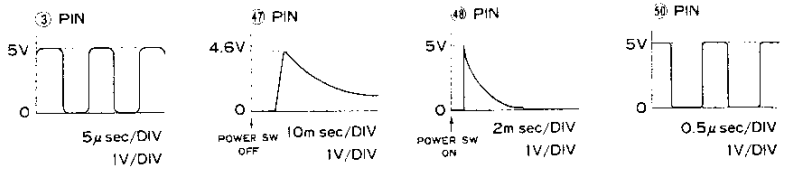
(obverse view of "LED" side)

HZM6B (20)
(D3001,3002,3003)

FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554



Q2016



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TEL: 01844 - 351694
FAX: 01844 - 352554

*** CONTROL UNIT ***

	F2974101	Printed Circuit Board		
	C029741AB	PCB w/Components		
Q2001	G1090689	IC	uPD4584BG	
Q2002	G1090782	IC	X2404P	
Q2003	G3316237F	Transistor	2SC1623-T2B	
Q2004	G3316237F	Transistor	2SC1623-T2B	
Q2005	G3108127F	Transistor	2SA812-T2B	
Q2006	G3108127F	Transistor	2SA812-T2B	
Q2007	G3108127F	Transistor	2SA812-T2B	
Q2008	G3316237F	Transistor	2SC1623-T2B	
Q2009	G3070014	Transistor	FA1L4L-T2B	
Q2010	G3316237F	Transistor	2SC1623-T2B	
Q2011	G3108127F	Transistor	2SA812-T2B	
Q2012	G3108127F	Transistor	2SA812-T2B	
Q2013	G3316237F	Transistor	2SC1623-T2B	
Q2014	G3316237F	Transistor	2SC1623-T2B	
Q2015	G1090694	IC	M5278L56	
Q2016	G1090783	IC	uPD7514G287-12	
D2001	G2070009	Diode	1SS184 TE85R	
D2002	G2070009	Diode	1SS184 TE85R	
D2003	G2070009	Diode	1SS184 TE85R	
D2004	G2070001	Diode	1SS181 TE85R	
D2006	G2070001	Diode	1SS181 TE85R	
D2007	G2090035	Diode	RD6.8EB3	
X2001	H0102806	Crystal	HT-38	48.0kHz
R2001	J24205103	Chip Res.	10k Ohm	1/10W
R2002	J24205223	Chip Res.	22k Ohm	1/10W
R2003	J24205224	Chip Res.	220k Ohm	1/10W
R2004	J24205105	Chip Res.	1M Ohm	1/10W
R2005	J24205103	Chip Res.	10k Ohm	1/10W
R2006	J24205102	Chip Res.	1k Ohm	1/10W
R2007	J24205103	Chip Res.	10k Ohm	1/10W
R2008	J24205103	Chip Res.	10k Ohm	1/10W
R2009	J24205103	Chip Res.	10k Ohm	1/10W
R2010	J24205103	Chip Res.	10k Ohm	1/10W
R2011	J24205472	Chip Res.	4.7k Ohm	1/10W
R2012	J24205472	Chip Res.	4.7k Ohm	1/10W
R2013	J24205472	Chip Res.	4.7k Ohm	1/10W
R2014	J24205103	Chip Res.	10k Ohm	1/10W
R2015	J24205103	Chip Res.	10k Ohm	1/10W
R2016	J24205104	Chip Res.	100k Ohm	1/10W
R2017	J24205102	Chip Res.	1k Ohm	1/10W
R2018	J24205223	Chip Res.	22k Ohm	1/10W
R2019	J24205473	Chip Res.	47k Ohm	1/10W
R2020	J24205472	Chip Res.	4.7k Ohm	1/10W
R2021	J24205472	Chip Res.	4.7k Ohm	1/10W
R2022	J24205473	Chip Res.	47k Ohm	1/10W
R2023	J24205473	Chip Res.	47k Ohm	1/10W
R2024	J24205473	Chip Res.	47k Ohm	1/10W
R2025	J24205473	Chip Res.	47k Ohm	1/10W
R2026	J24205473	Chip Res.	47k Ohm	1/10W
R2027	J24205224	Chip Res.	220k Ohm	1/10W
R2028	J24205153	Chip Res.	15k Ohm	1/10W
R2029	J24205103	Chip Res.	10k Ohm	1/10W
R2030	J24205473	Chip Res.	47k Ohm	1/10W
R2031	J24205393	Chip Res.	39k Ohm	1/10W

R2032	J24205472	Chip Res.	4.7k Ohm	1/10W	
R2033	J24205103	Chip Res.	10k Ohm	1/10W	
R2034	J24205473	Chip Res.	47k Ohm	1/10W	
R2035	J24205103	Chip Res.	10k Ohm	1/10W	
R2036	J24205103	Chip Res.	10k Ohm	1/10W	
R2037	J24205473	Chip Res.	47k Ohm	1/10W	
R2038	J24205103	Chip Res.	10k Ohm	1/10W	
R2039	J24205103	Chip Res.	10k Ohm	1/10W	
R2040	J24205391	Chip Res.	390 Ohm	1/10W	
R2041	J24205391	Chip Res.	390 Ohm	1/10W	
R2042	J24205103	Chip Res.	10k Ohm	1/10W	
R2043	J24205103	Chip Res.	10k Ohm	1/10W	
R2044	J24205271	Chip Res.	270 Ohm	1/10W	
R2045	J24205103	Chip Res.	10k Ohm	1/10W	
R2046	J24205271	Chip Res.	270 Ohm	1/10W	
R2047	J24205103	Chip Res.	10k Ohm	1/10W	
R2049	J24205104	Chip Res.	100k Ohm	1/10W	
R2050	J24205104	Chip Res.	100k Ohm	1/10W	
R2051	J24205104	Chip Res.	100k Ohm	1/10W	
R2052	J24205101	Chip Res.	100 Ohm	1/10W	
R2053	J24205472	Chip Res.	4.7k Ohm	1/10W	
R2054	J24205473	Chip Res.	47k Ohm	1/10W	
C2001	K22171008	Chip Cap.	0.047uF	50V	F
C2002	K22140807	Chip Cap.	0.022uF	25V	B
C2003	K40179001	Al Electro Cap.	1uF	50V	
C2004	K40179001	Al Electro Cap.	1uF	50V	
C2005	K22170817	Chip Cap.	0.01uF	50V	B
C2006	K22170223	Chip Cap.	33pF	50V	CH
C2007	K22170219	Chip Cap.	22pF	50V	CH
C2008	K22170817	Chip Cap.	0.01uF	50V	B
C2009	K22170223	Chip Cap.	33pF	50V	CH
C2010	K70167105	Tantalum Cap.	1uF	35V	
C2011	K70167105	Tantalum Cap.	1uF	35V	
C2012	K22170817	Chip Cap.	0.01uF	50V	B
C2013	K22170817	Chip Cap.	0.01uF	50V	B
C2014	K40129012	Al Electro Cap.	10uF	16V	
J2003	P0090625	Connector	SC-25-06WS		
J2004	P0090625	Connector	SC-25-06WS		
J2005	P0090625	Connector	SC-25-06WS		
JP2001	T9205693	Wire Assy			
S2001	N5090018	Switch	KHH15951		

*** MIC UNIT ***

	F2975101	Printed Circuit Board		
	C029751AB	PCB with Components		
D3001	G2070054	Diode	HZM6B-TR	
D3002	G2070054	Diode	HZM6B-TR	
D3003	G2070054	Diode	HZM6B-TR	
R3001	J24205102	Chip Res.	1k Ohm	1/10W
R3002	J24205224	Chip Res.	220k Ohm	1/10W
C3001	K22170805	Chip Cap.	0.001uF	50V B
C3002	K22170805	Chip Cap.	0.001uF	50V B
C3003	K22170805	Chip Cap.	0.001uF	50V B
C3004	K22170805	Chip Cap.	0.001uF	50V B
FB3001	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3002	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3003	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3004	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3005	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3006	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3007	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
FB3008	L9190001	Ferrite Bead	4A2 Ri 3x3-1	
S3001	N5090034	Switch	SKHHAR	
J3001	P0090158	Mic Jack	FM-214-8SS(A)	
JP3001	T9205683	Wire Assy		

*** VR UNIT ***

	F2976101	Printed Circuit Board		
	C029761AB	PCB w/Components		
VR4001	J62800099	Potentiometer	RK1242212	5KA/20KB
S4002	N0190145	Switch	SRRS18	
P4001	T9205688	Wire Assy		
P4002	T9205689	Wire Assy		
P4003	T9205687A	Wire Assy		
P4004	T9205686	Wire Assy		
P4005	T9205692	Wire Assy		
JP4001	T9205684	Wire Assy		

*** LED UNIT ***

	F2976102	Printed Circuit Board		
	C029762AB	PCB with Components		
D5001	G2090136	LED	TLG205	
D5002	G2090427	LED	TLSG205	
D5003	G2090134	LED	TLY205	
D5004	G2090428	LED	TLO205	
R5001	J01215391	Carbon Film Res.	390 Ohm	1/8W
S5001	N5090034	Switch	SKHHAR	
S5002	N5090034	Switch	SKHHAR	
JP5001	T9205685	Wire Assy		

FTL-7007 BAND TABLE		
	BAND A	BAND D
	- MHz	450-470MHz
CV1001		L4020071 HF-62H14 460MHz
CV1002		L4020071 HF-62H14 460MHz
C301		K22170209 CH 8pF
C302		Not Used
C303		K22170208 CH 7pF
C304		K22170211 CH 10pF
C305		K22170211 CH 10pF
C312		K22170209 CH 8pF
C314		Not Used
C316		K22170213 CH 12pF
C317		K22170211 CH 10pF
C323		K22170205 CH 4pF
Q1013 (25W)		G1090754 M57729H
R1065 (25W)		J24205472 4.7k Ohm
Q1013 (10W)		G1090228 M57704H
R1065 (10W)		J24205103 10k Ohm
C1093 (25W)		K22170205 CH 4pF
C1093 (10W)		K22170203 CH 2pF
C1152 (10W)		K22170205 CH 4pF

The FTL-2007 circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift." While this does not cause permanent damage to the board, much servicing trouble can result, because of the tendency for this lifted trace to break. A few simple precautions will keep your circuit boards in A-1 condition.

1. Use only a 12 to 30-watt chisel-tip soldering iron, with the tip grounded or isolated from AC and DC potential. Voltage at the tip can easily destroy CMOS components.

2. Use only the minimum amount of heat necessary to remove a component, or to cause the solder to "flow" when installing a new component.

3. USE ONLY 60/40 ROSIN CORE SOLDER.

4. Use solder removing braid and flux to absorb excess solder before installing a new component. A solder sucker can also be used, but most be handled with care to avoid lifting traces.

5. Do not attempt to remove DIP ICs without first cutting all of the pins on the component side of the board, unless you have the correct desoldering equipment (spring-loaded clamp and all-pin desoldering tip).

   If you do lift a trace, don't worry! Read on to find out how to repair traces like a pro.

NOTES ON USE OF CMOS COMPONENTS:

As CMOS devices are extremely sensitive to damage from static electricity, special precautions must be observed.

In storage, use only conductive sponge specially designed for CMOS components.

When installing a CMOS part in a socket, or on a circuit board, be certain that the power is off. In addition, the technician should rest his hand on the chassis as the component is inserted, so as to place his hand at the same potential as the chassis (better to discharge small amounts of static electricity through your fingers than through a $5 IC !).

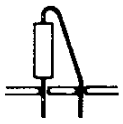
When soldering a CMOS part onto a circuit board, use a low-wattage iron, and be sure to ground the tip with a clip lead, if the tip is not grounded through a three-wire power cord.

INSERTION OF PARTS ON CIRCUIT BOARDS

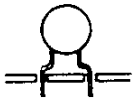
All of the below are acceptable ways of inserting components into circuit board mounting holes.

(a) Bend leads slightly

(b) Straight-in mounting



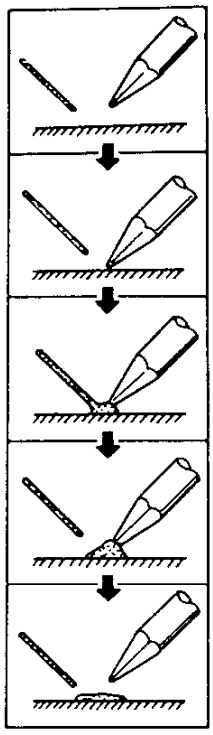
(c) Vertical mounting



(d) Preformed disc ceramic capacitor

(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE



(1) Prepare soldering iron and solder. The tip of the iron should be thoroughly tinned and wiped clean of excess solder.

(2) Apply soldering iron to surface to be soldered. Do not press the iron into the surface.

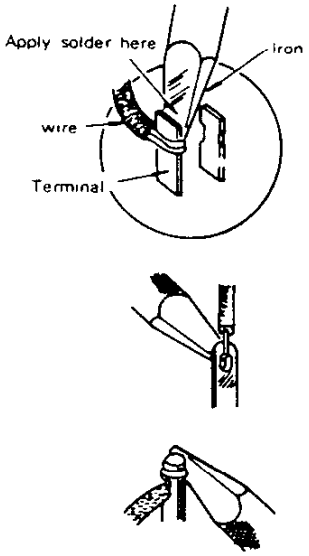
(3) Apply solder to junction of iron and heated surface.

(4) When enough solder is applied, remove solder. Continue to apply heat just until solder flows cleanly.

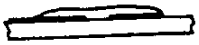
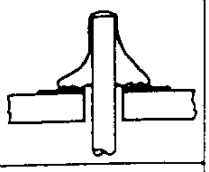
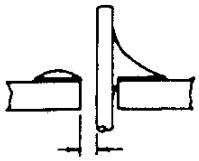
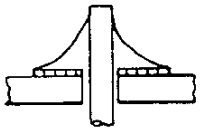
(5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

Soldering to terminal posts:

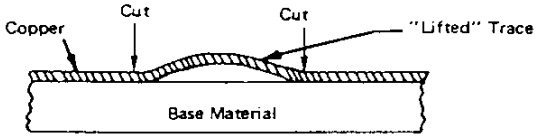
(Be certain to apply heat to both post and wire.)

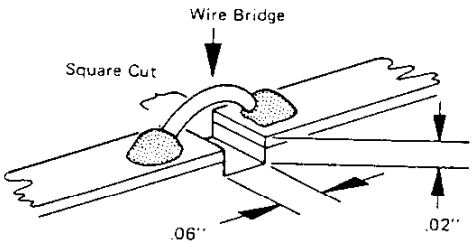


EXAMPLES OF POOR SOLDERING PRACTICE

Unwanted solder bridge connecting two tracks (caused by use of too much solder)	
"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)	
Unstable joint (caused by insufficient heat or solder)	
Proper soldering: A smooth fillet of solder surrounds the lead and just covers the foil pad.	

If you have previously lifted a trace, make an etch cut on each side of the lifted trace as shown in the drawing, and install a wire bridge.



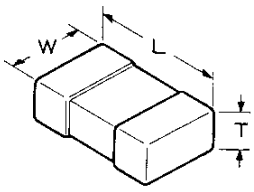


Coat Cut Area With Eastman 910
After Soldering Wire Bridge

Chip Components

The diagrams below indicate some of the distinguishing features of cmmon chip components.

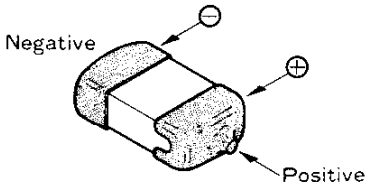
Capacitor



(Unit : mm)

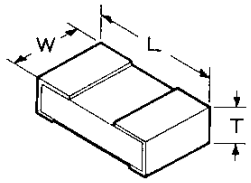
Type	L	W	T
3216	3.2	1.6	0.45~0.60
2125	2.0	1.25	0.35~0.50
1608	1.6	0.8	0.65~0.95

Tantalum Capacitor



Polarized, Unmarked
(determine value from layout and Parts List)

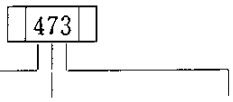
Resistors



Type	L	W	T
1/10	2.0	1.25	0.45
1/16	1.6	0.8	0.45

Type RMC 1/10W

Marking* 100,222,473·····



Ten unit	One unit	Multiplier code
0	0	10^0
1	1	10^1
2	2	10^2
3	3	10^3
4	4	10^4
5	5	10^5
6	6	10^6
7	7	10^7
8	8	10^8
9	9	10^9

Examples :

100 = 10Ω

222 = 2.2kΩ

473 = 47kΩ

Transistors

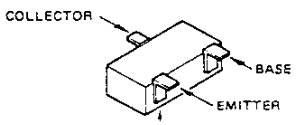
Location	Nomenclature	Mark
Q1011,1012,403, 2005,2006,2007, 2011,2012	2SA812	M4
Q405,406,408	2SA1462	Y33
Q1013,302,304, 305,404,502, 602,603,604, 801,803,804, 901,902,2003, 2004,2008,2010, 2013,2014	2SC1623	L6
Q407,409	2SC2759	U22
Q1006,1009,301, 303	2SC3356	R22
Q2009	FA1L4L	L30
Q1020,951,952	FA1L4M	L31

Example:

Nomen. Code

S G

h_{FE} Rank



Marked Surface

FETs

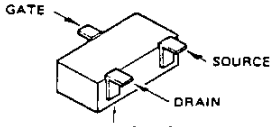
Location	Nomenclature	Mark
Q601	2SK208Y	JY
Q1003	2SK302Y	TY

Example:

Nomen. Code

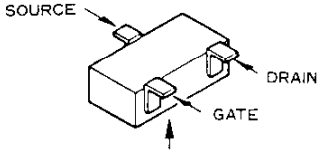
J O

I_{DSS} Rank



Marked Surface

2SK208Y (JY)

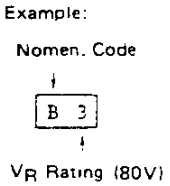


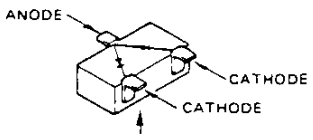
Marked Surface

2SK302Y (TY)

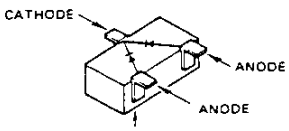
Diodes

Location	Nomenclature	Mark
D2004,2006	1SS181	A3
D401,2001,2002, 2003	1SS184	B3
D1003,1012,501	1SS226	C3
D1004,1006,1008, 1010	1SV188	Silver (Paint)
D3001,3002,3003	HZM6B	20

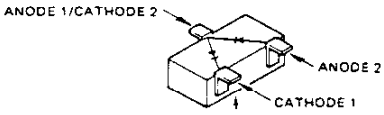




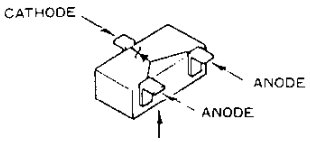
Marked Surface
1SS181 (A3)



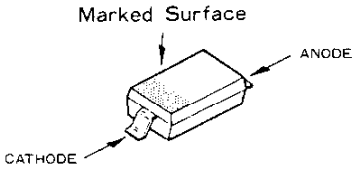
Marked Surface
1SS184 (B3)



Marked Surface
1SS226 (C3)



Marked Surface
HZM6B (20)



1SV188 (Silver)

Precautions for Chip Replacement

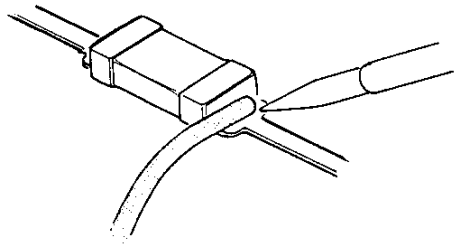
(1) Do not disconnect a chip forcefully, or the foil pattern may peel off the board.

(2) Never re-use a chip component. Dispose of all removed chip components immediately to avoid mixing with new parts.

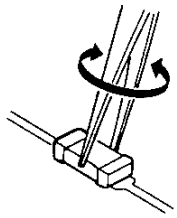
(3) Limit soldering time to 3 seconds or less to avoid damaging the component and board.

Removing Chip Components

(1) Remove the solder at each joint, one joint at a time, using solder wick wetted with non-acidic flux as shown below. Avoid applying pressure, and do not attempt to remove the tinning from the chip's electrode.



(2) Grasp the chip on both sides with tweezers, and gently twist the tweezers back and forth (to break the adhesive bond) while alternately heating each electrode. Be careful to avoid peeling the foil traces from the board. Dispose of the chip when removed.

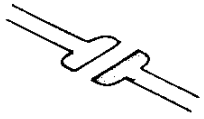


(3) After removing the chip, use the copper braid and soldering iron to wick away any excess solder and smooth the land for installation of the replacement part.

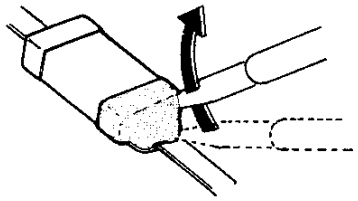
Installing a Replacement Chip

As the value of some chip components is not indicated on the body of the chip, be careful to get the right part for replacement.

(1) Apply a small amount of solder to the land on one side where the chip is to be installed. Avoid too much solder, which may cause bridging.



(2) Hold the chip with tweezers in the desired position, and apply the soldering iron with a motion indicated by the arrow in the diagram below. Do not apply heat for more than 3 seconds.



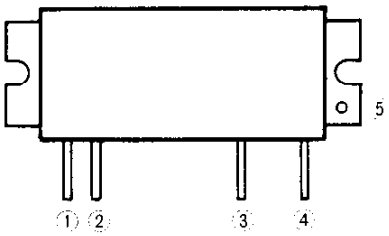
(3) Remove the tweezers and solder the electrode on the other side in the manner just described.

NOTES :

MAIN UNIT (Q1013)

VERSION B —— M57704H (10W)

M57729H (25W)

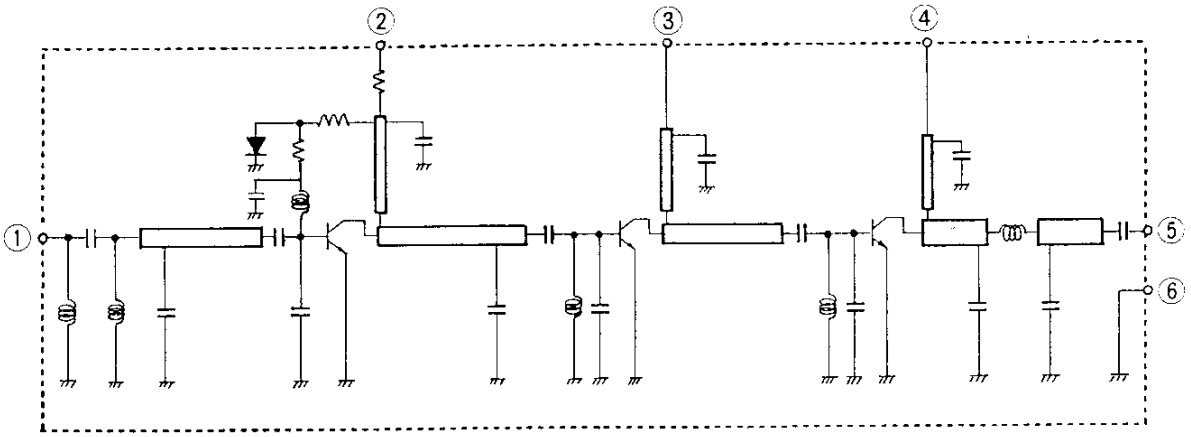


① INPUT ④ OUTPUT

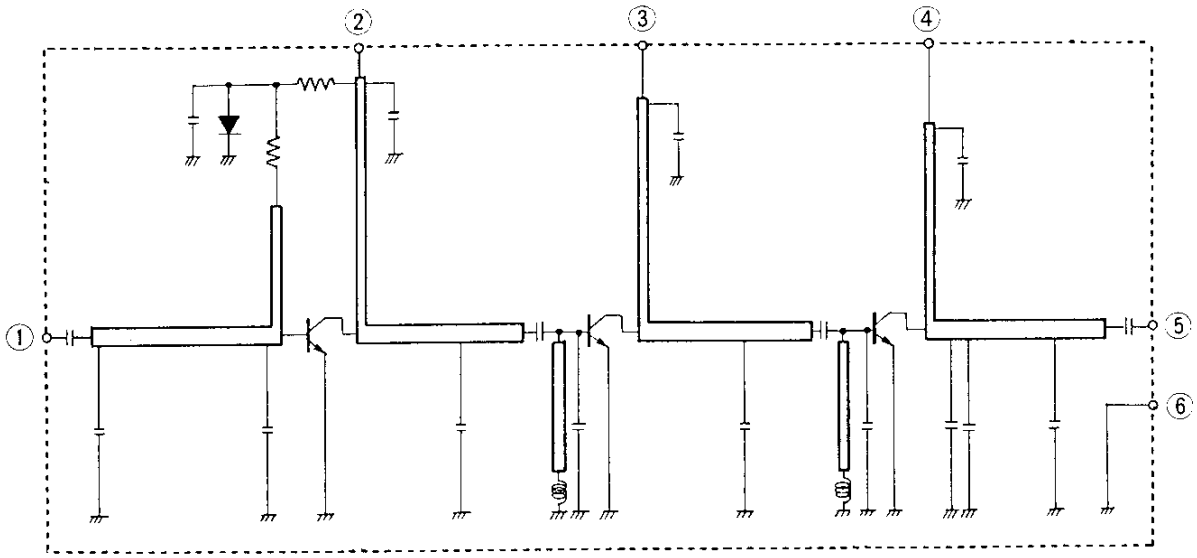
② Vcc_1 ⑤ FLANGE

③ Vcc_2

PIN ASSIGNMENT



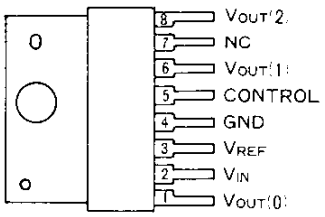
M57704H SCHEMATIC DIAGRAM



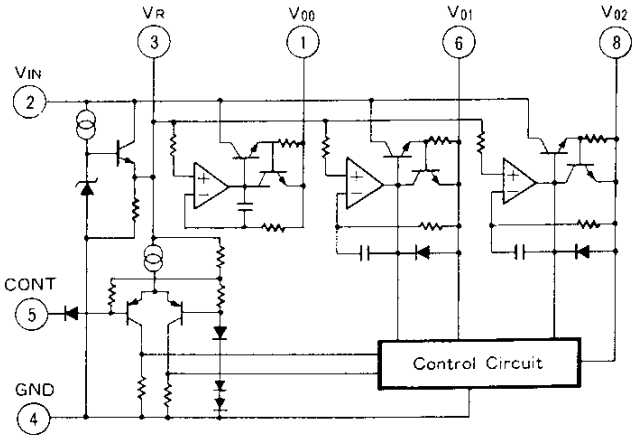
M57729H SCHEMATIC DIAGRAM

MAIN UNIT (Q1016) MB3756M

TOP VIEW

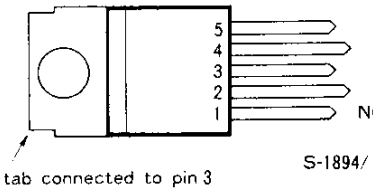


PIN ASSIGNMENT



BLOCK DIAGRAM

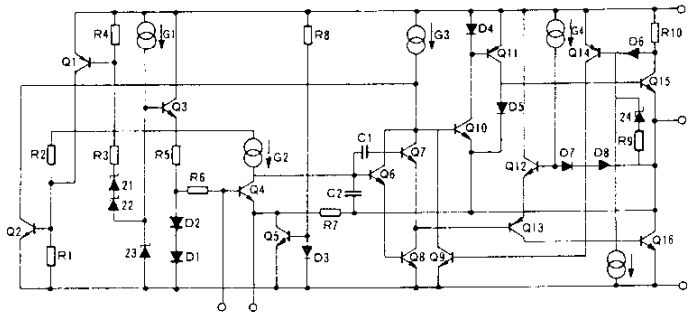
MAIN UNIT (Q1018) TDA2003



S-1894/1

SUPPLY VOLTAGE
OUTPUT
GROUND
INVERTING INPUT
NON INVERTING INPUT

PIN ASSIGNMENT

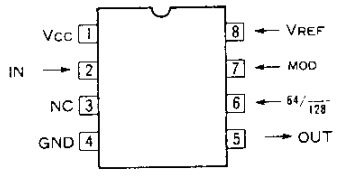


SCHEMATIC DIAGRAM

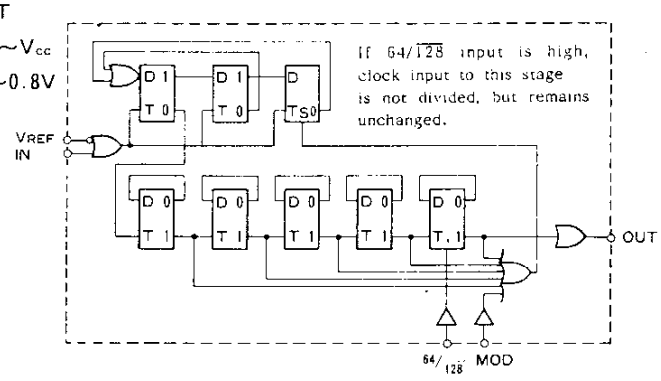
PLL UNIT (Q401) M54475P

64/$\overline{128}$	MOD	Div. Ratio
H	H	1:64
H	L	1:65
L	H	1:128
L	L	1:129

64/28 IN PUT
"H" : Vcc
"L" : OPEN
MOD INPUT
"H" : 2.0V~Vcc
"L" : 0V~0.8V

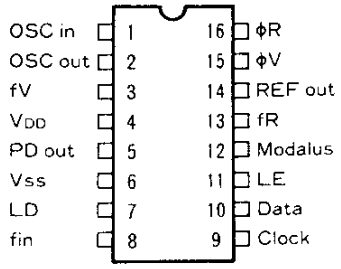


PIN ASSIGNMENT



BLOCK DIAGRAM

PLL UNIT (Q402) MC145158P



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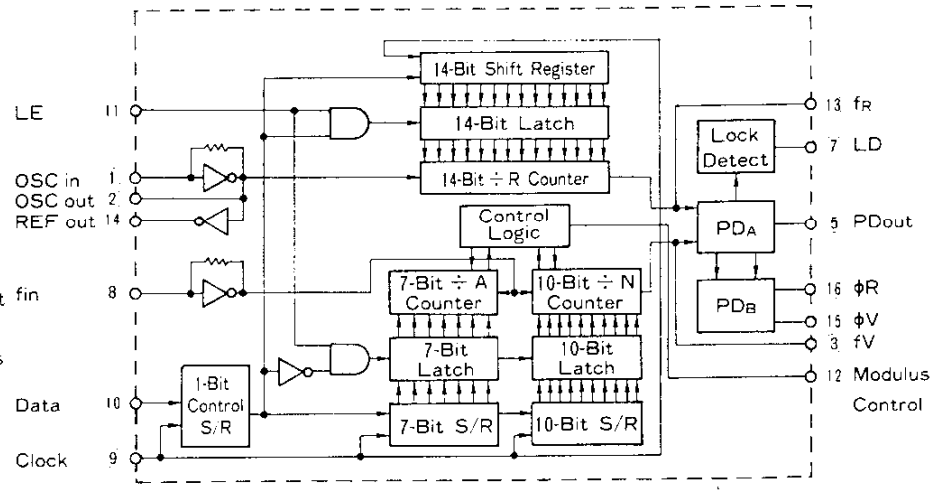
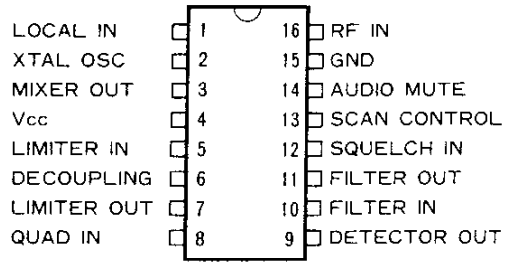
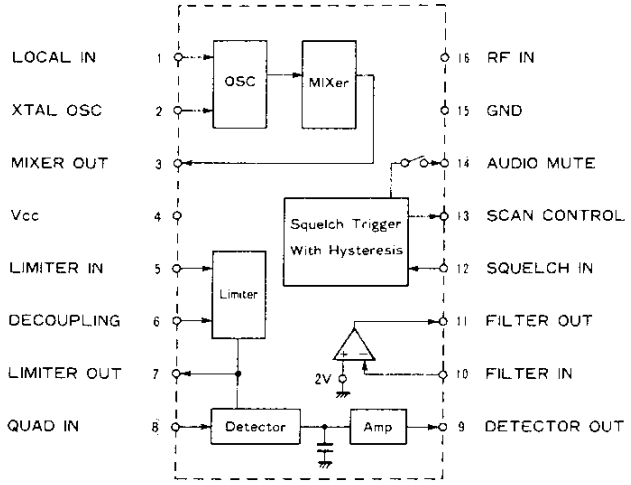


BLOCK DIAGRAM

IF UNIT (Q501) TK10420M

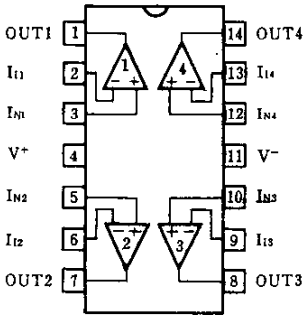


PIN ASSIGNMENT



BLOCK DIAGRAM

MIC AMP UNIT (Q802) μPC4741G



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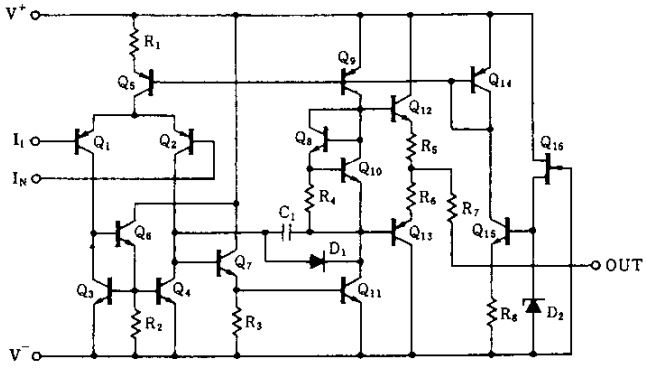
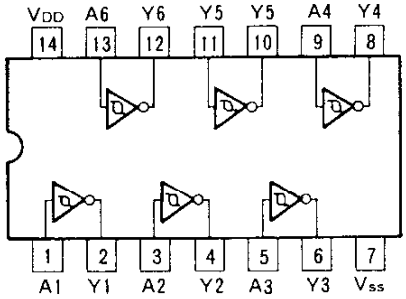
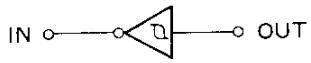


SCHEMATIC DIAGRAM

CONTROL UNIT (Q2001) μPD4584BG

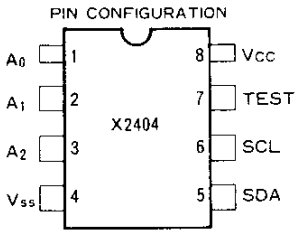


PIN ASSIGNMENT



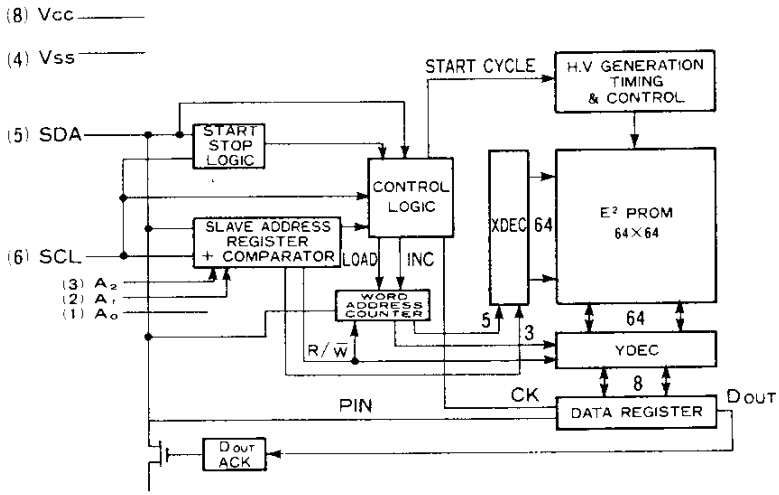
BLOCK DIAGRAM

CONTROL UNIT (Q2002) X2404P



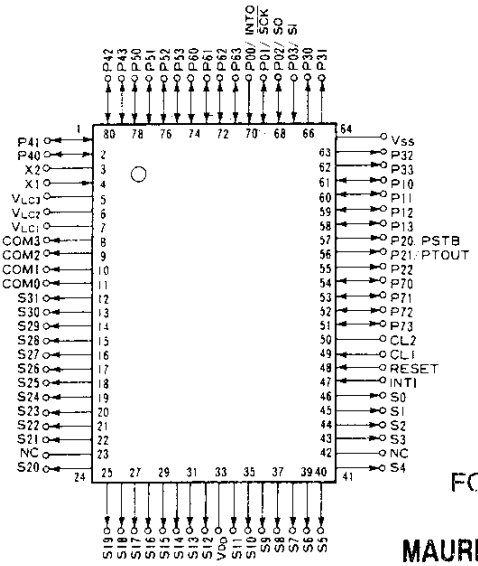
1 to 3	A_0 to A_2 Address Inputs
4	Vss
5	SDA Serial Data
6	SCL Serial Clock
7	Test Input→to Vss
8	Vcc

PIN ASSIGNMENT

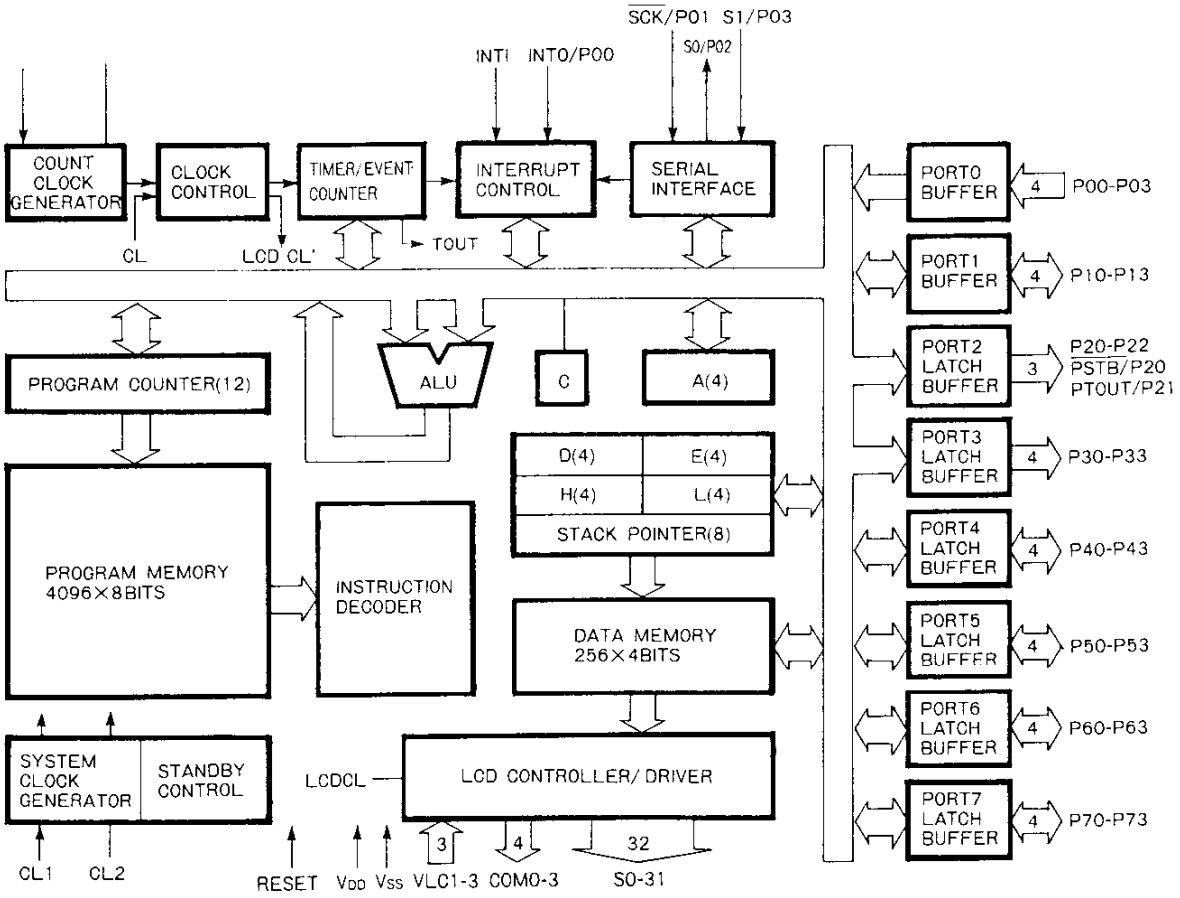


BLOCK DIAGRAM

CONTROL UNIT (Q2016) μPD7514G287-12



PIN ASSIGNMENT

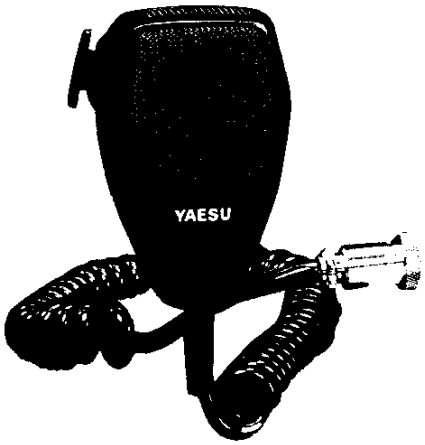


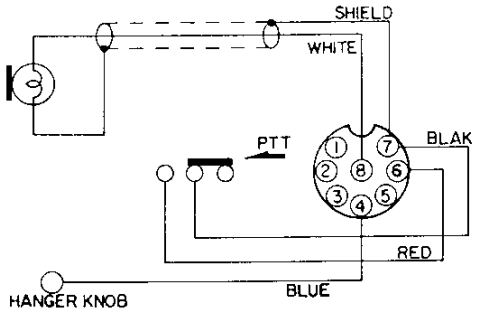
BLOCK DIAGRAM

NOTES :

MH-1C8 (Standard Hand Microphone)

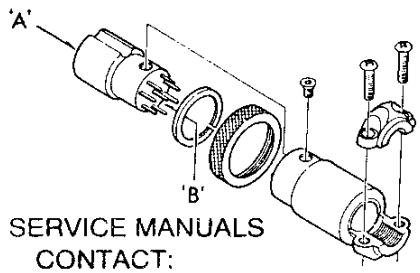
MH-5F8 (Noise Cancel Hand Microphone)





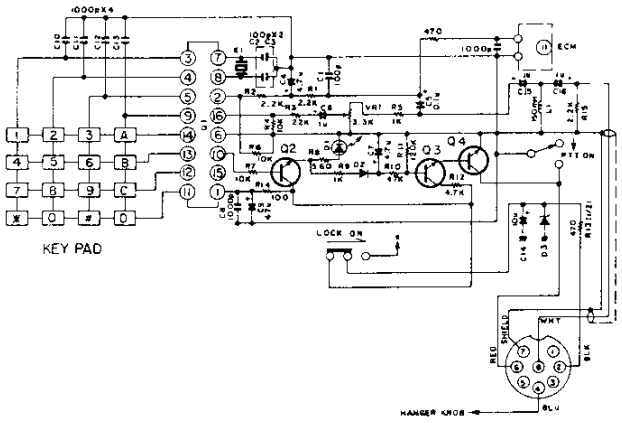
Viewed from "B" side

MH-1C8, MH-5F8
MICROPHONE CONNECTIONS



FOR SERVICE MANUALS
CONTACT:
MAURITRON TECHNICAL SERVICES
www.mauritron.co.uk
TEL: 01844 - 351694
FAX: 01844 - 352554

MH-15B8 (DTMF Hand Microphone)

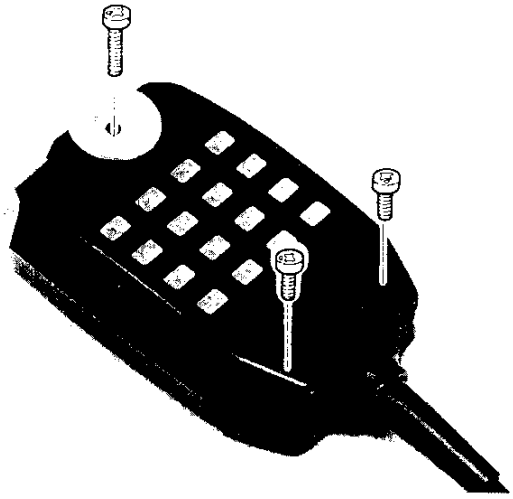


Viewed from "A" side

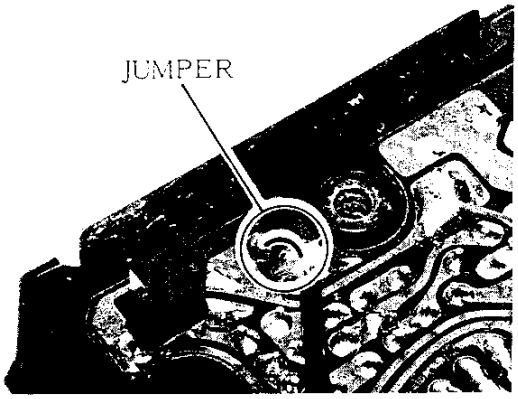
MH-15B8
CIRCUIT DIAGRAM

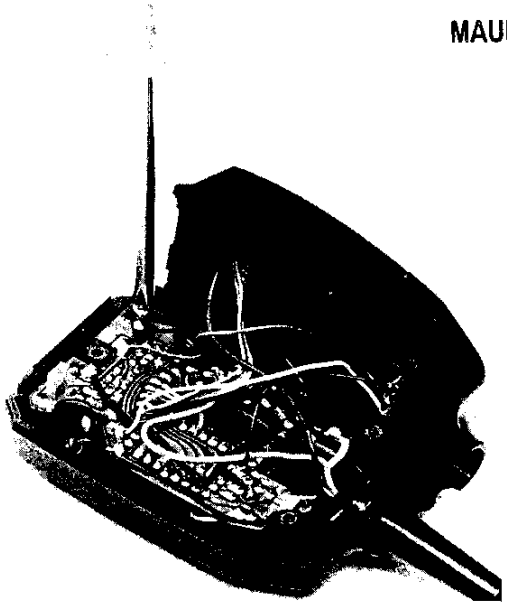
* One of these MICROPHONE will be supplied is per local requirement.

To use the MH-15B8 microphone with the FTL-2007, the microphone must be modified. Open the case of the microphone and cut or remove zener diode D3. Also, install a jumper across 470-ohm ½-watt resistor R13.

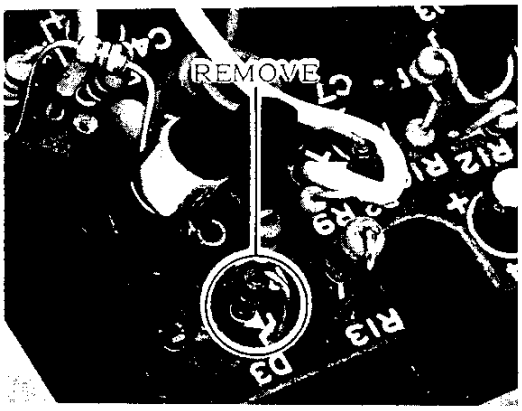


Remove three screws





Remove one screw



The FTS-14 is a sub-audible CTCSS (Continuous Tone Coded Squelch System) unit which generates and decodes any of 37 EIA standard RS-220-A tones, allowing silent monitoring of busy channels. Receivers set to decode a certain tone will only respond to signals from transmitters set to generate the same tone: all other signals are ignored.

Each transceiver is programmed for a specific encode and decode tone on each channel (generally according to the tone groups shown in the Charts on the next page), using the FYG-4 Programmer. The programmed encode tone will then be automatically superimposed on the transmitted signal, while the receiver squelch will be opened only when the programmed decode tone is received. Tones can be easily added, changed or deleted using the FYG-4, as described in the FYG-4 Operating Manual.

SPECIFICATIONS

Control System: Transceiver CPU selection of tone frequency by code no. (see Charts)
Operating voltage: 13.8V DC 10%
Dimensions (WHD): 43 x 10 x 30mm
Weight (approx.): 5 grams
Encode output level: 90mVrms (151.4 Hz @ 47 kilohms)

INSTALLATION

1) Disconnect the power cable from the transceiver, and remove the five screws affixing the bottom cover (see Figure 1). Remove the cover.

2) Referring to Figure 2, gently press the FTS-14 onto connector J1008 on the exposed circuit board.

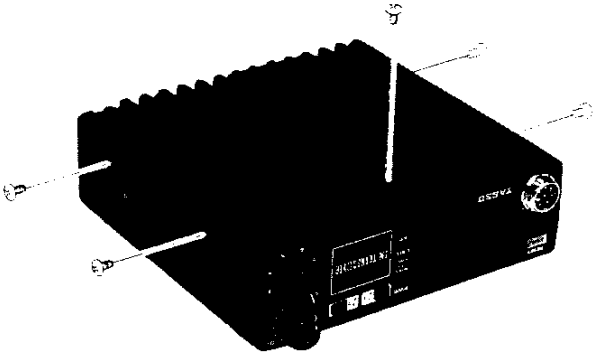


Figure 1

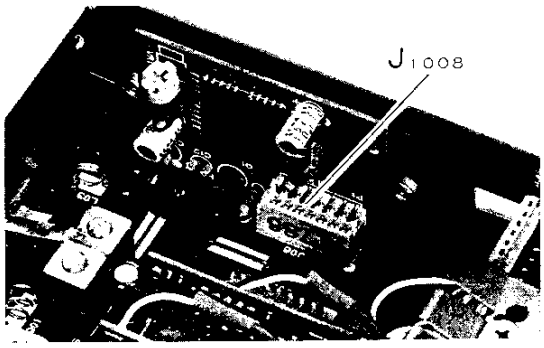


Figure 2

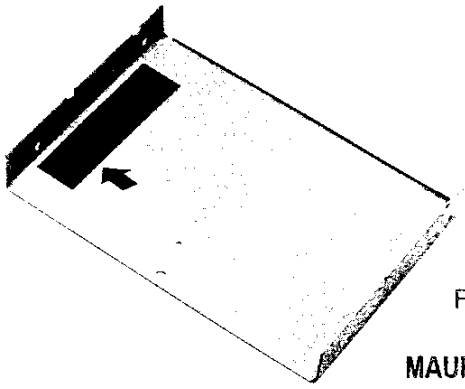


Figure 3

3) Referring to Figure 3, remove the protective backing from the supplied rubber adhesive pad, and place the pad on the cover that will be over the FTS-14, so that it will be cushioned when the cover is replaced.

4) The FTS-14 is aligned at the factory, so no further alignment should be necessary during installation. However, if the setting of VR1 (on the FTS-14) is disturbed during installation, it can be realigned by connecting the test equipment as shown in Figure 4 and adjusting VR1 for 0.5 kHz deviation.

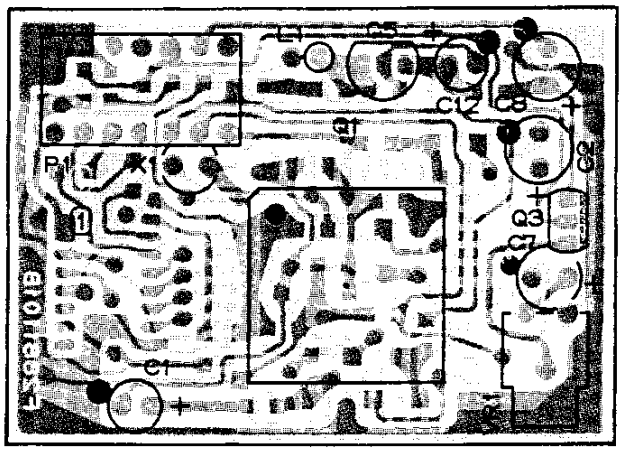
Figure 4

5) Replace the top and bottom covers and their mounting screws, and reconnect the power cable. Refer to the FYG-4 Operating Manual for programming, and the transceiver Operating Manual for operation.

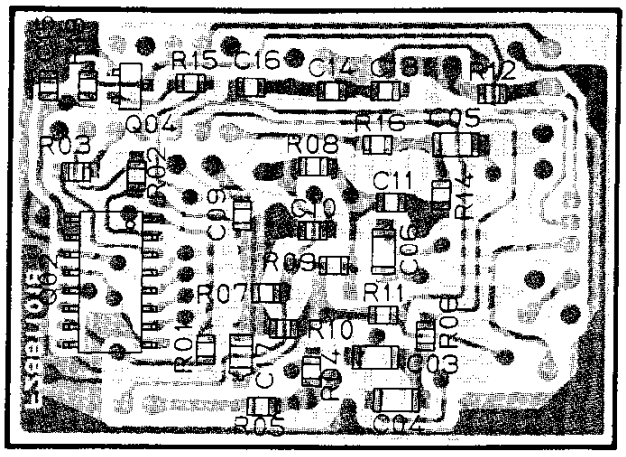
TONE GROUP CHARTS

EIA standard groups A, B and C are shown according to their tone frequencies (in Hz), and Codes required for programming with the FYG-4.

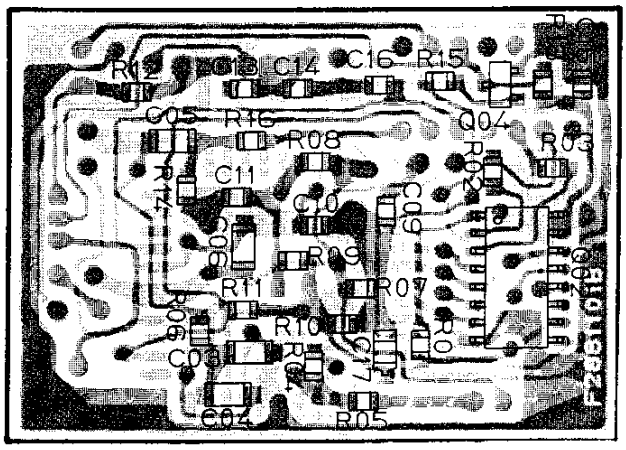
GROUP A				GROUP B				GROUP C	
Freq.	Code	Freq.	Code	Freq.	Code	Freq.	Code	Freq.	Code
67.0	062	141.3	046	71.9	061	146.2	045	74.4	027
77.0	060	151.4	044	82.5	059	156.7	043	79.7	025
88.5	058	162.2	042	94.8	057	167.9	041	85.4	023
100.0	056	173.8	040	103.5	055	179.9	039	91.5	021
107.2	054	186.2	038	110.9	053	192.8	037		
114.8	052	203.5	036	118.8	051	210.7	035		
123.0	050	218.1	034	127.3	049	225.7	033		
131.8	048	233.6	032	136.5	047	241.8	031		
		250.3	030						



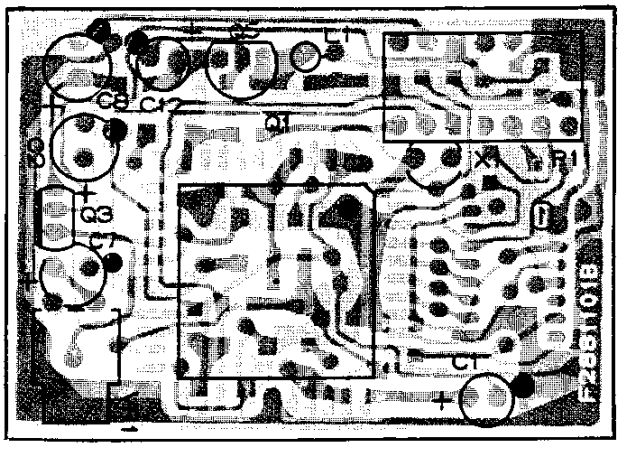
(obverse view of "component" side)



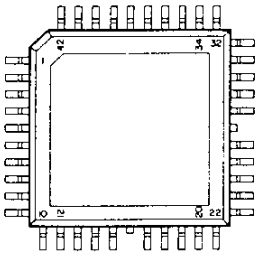
(reverse view of "chip-only" side)



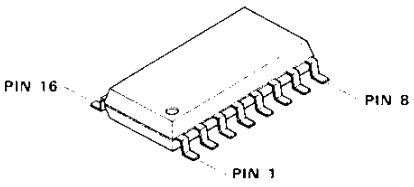
(obverse view of "chip-only" side)



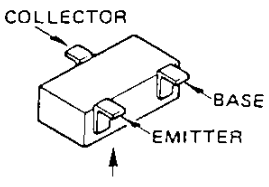
(reverse view of "component" side)



MN6520 (Q01)

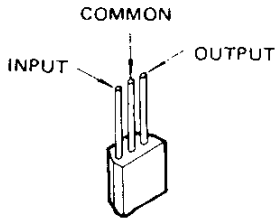


μPD4094BG(Q02)

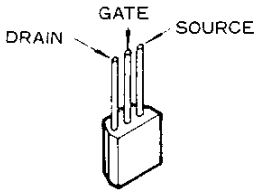


Marked Surface

2SC2712GR(LG) :(Q04)

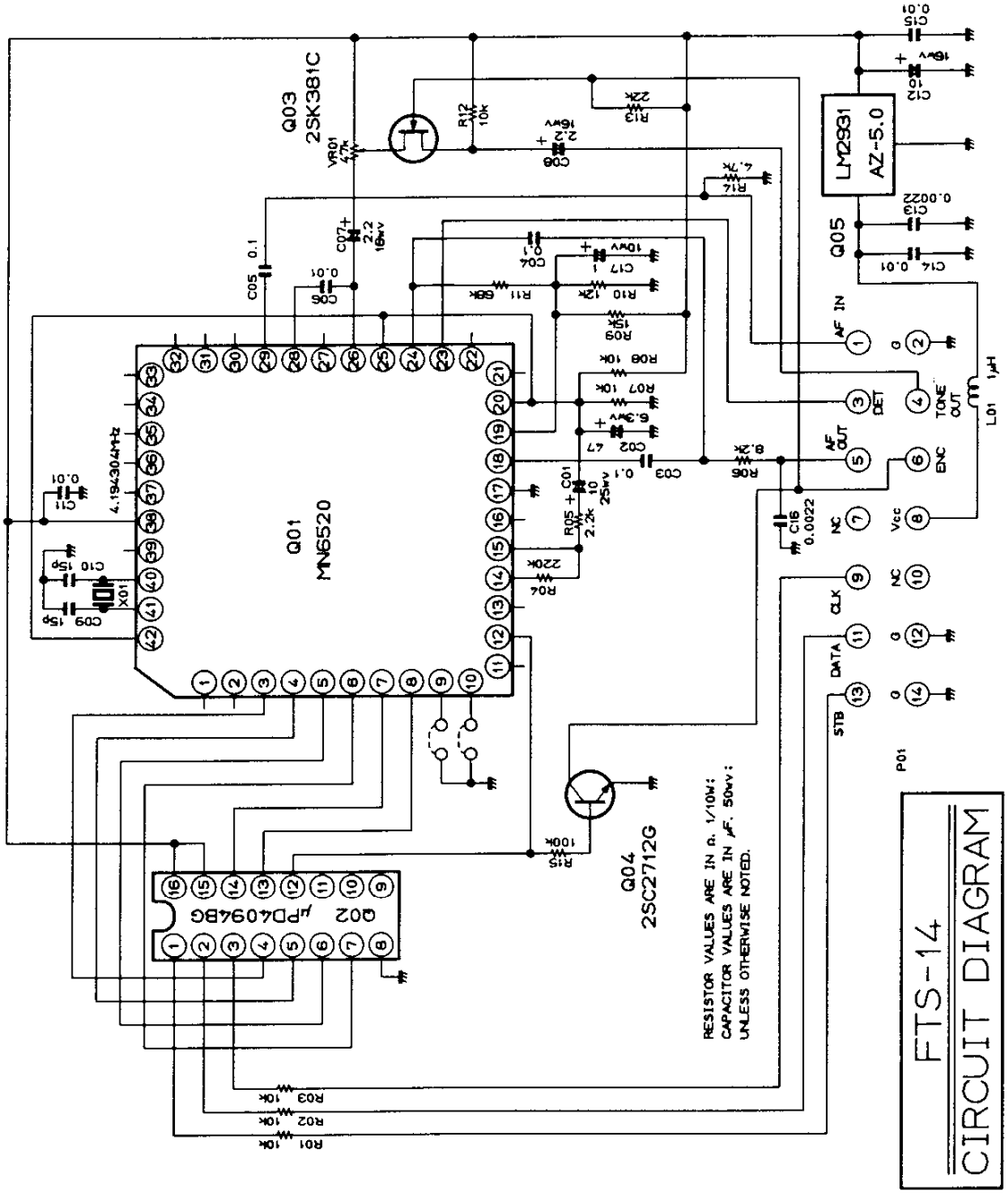


LM2931AZ (Q05)



2SK381C (Q03)

FTS-14 CIRCUIT DIAGRAM

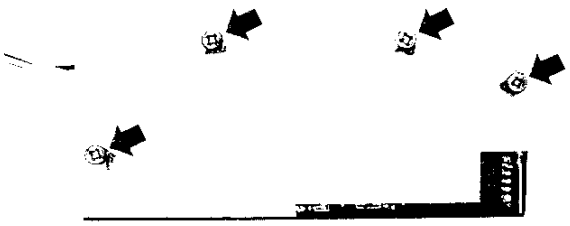


	F2881101B	Printed Circuit Board		
Q1	G1090577	IC	MN6520	
Q2	G1090696	IC	uPD4094BG	
Q3	G3803810C	FET	2SK381C	
Q4	G3327127G	Transistor	2SC2712GR TE85R	
Q5	G1090785	IC	LM2931AZ-5.0	
X1	H0102571	Crystal	MS41F	4.1943 MHz
R1	J24205103	Chip Res.	10k Ohm	1/10W
R2	J24205103	Chip Res.	10k Ohm	1/10W
R3	J24205103	Chip Res.	10k Ohm	1/10W
R4	J24205224	Chip Res.	220k Ohm	1/10W
R5	J24205222	Chip Res.	2.2k Ohm	1/10W
R6	J24205822	Chip Res.	8.2k Ohm	1/10W
R7	J24205103	Chip Res.	10k Ohm	1/10W
R8	J24205103	Chip Res.	10k Ohm	1/10W
R9	J24205153	Chip Res.	15k Ohm	1/10W
R10	J24205123	Chip Res.	12k Ohm	1/10W
R11	J24205683	Chip Res.	68k Ohm	1/10W
R12	J24205103	Chip Res.	10k Ohm	1/10W
R13	J24205222	Chip Res.	2.2k Ohm	1/10W
R14	J24205333	Chip Res.	33k Ohm	1/10W
R15	J24205104	Chip Res.	100k Ohm	1/10W
R16	J24205333	Chip Res.	33k Ohm	1/10W
VR1	J50770473	Potentiometer	47k Ohm	B
C1	K40149012	Al Electro. Cap	10uF	25V
C2	K40089003	Al Electro. Cap	47uF	6.3V
C3	K22141904	Chip Cap.	0.1uF	25V B
C4	K22141904	Chip Cap.	0.1uF	25V B
C5	K22141904	Chip Cap.	0.1uF	25V B
C6	K22141904	Chip Cap.	0.1uF	25V B
C7	K70127225	Tantalum Cap.	2.2uF	16V
C8	K70127225	Tantalum Cap.	2.2uF	16V
C9	K22170215	Chip Cap.	15pF	50V CH
C10	K22170215	Chip Cap.	15pF	50V CH
C11	K22170817	Chip Cap.	0.01uF	50V B
C12	K70127106	Tantalum Cap.	10uF	16V
C13	K22170809	Chip Cap.	0.0022uF	50V B
C14	K22170817	Chip Cap.	0.01uF	50V B
C15	K22170817	Chip Cap.	0.01uF	50V B
C16	K22170809	Chip Cap.	0.0022uF	50V B
C17	K78120013	Tantalum Chip Cap.	1uF	16V

NOTES :

Jumper Settings

The Main Unit circuit board of the F5D-9 has twelve solder bridge jumper points which allow presetting of 5-tone system options according to the various standards (ZVEI, CCIR and EEA), and local regulations and operating requirements. To access the circuit board, remove the four screws affixing the shield cover, and the cover. Jumper locations are indicated in the diagram below.



The F5D-9A is preset at the factory for the ZVEI standard with 70ms tones, while the F5D-9B is preset for the CCIR standards with 100ms tones. No other jumpers are installed, but additional system options can be preset by installing or removing solder jumpers from between the pairs of numbered solder pads on the F5D-9, as follows:

Jumper Location Number 1

Disables manual Alert beep turn-off by RESET Switch when shorted, so Alert tone will always sound for 10 seconds (if Jumper 6 is shorted). When open, the Alert beep will stop whenever the RESET button on the transceiver is pressed.

Jumper Location Numbers 2 & 3

Signal tone duration selection:

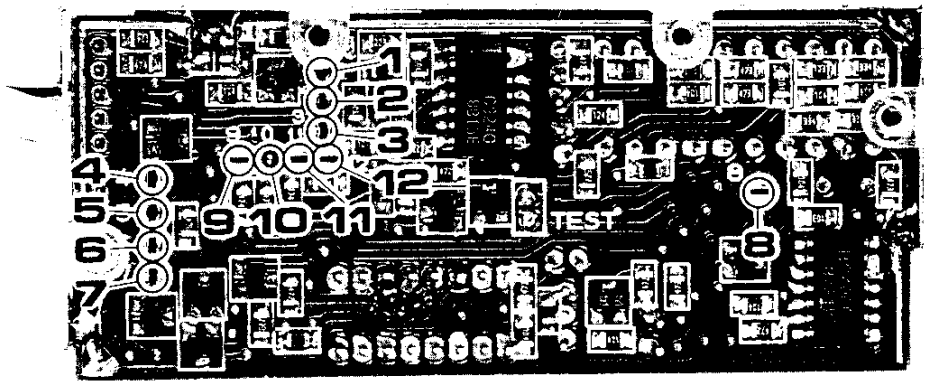
2	3	Duration (default)	
short	short	40ms	
open	short	70ms	(F5D-9A)
short	open	100ms	
open	open	100ms	(F5D-9B)

Jumper Location Number 4

Extends the first signalling tone to 700ms (regardless of settings of jumpers 2 and 3) when shorted. When open, the duration of the first tone is the same as the other four, and is equal to the tone duration set by jumpers 2 and 3.

Jumper Location Number 5

Activates 5-tone transmission (each time the PTT switch is pressed) when shorted. When open, 5-tone codes are never transmitted.



Jumper Location Number 6

Activates automatic reset, which causes the 5-tone decoder to reset itself automatically ten seconds after and incoming call is received (unless the operator responds to the call). When open, the decoder can be reset only by the operator pressing the RESET button.

Jumper Location Number 7

Causes a special Reset tone to be transmitted automatically when the RESET button on the transceiver is pressed. When open, pressing the RESET button still resets the decoder, but does not cause transmission of a tone.

Jumper Location Number 8

Causes all stations to be called when the PTT switch is pressed. When open, only the station whose code number is selected on the digital selectors will be called.

Jumper Location Numbers 9, 10 and 11

These three jumpers select the 5-tone system standard, as follows:

9	10	11	Std (default)
short	short	short	ZVEI(F5D-9A)
open	short	short	ZVEI-2
short	open	short	ZVEI-3
open	open	short	ZVEI-S
short	short	open	DZVEI
open	short	open	CCIR(F5D-9B)
short	open	open	EEA
open	open	open	EEA

Jumper Location Number 12

When shorted, the 5-tone signal is transmitted only when the CALL button is pressed. When open, the 5-tone signal is transmitted at the start of every transmission (whenever the PTT switch or CALL button is pressed).

Installation

Make certain the 12 jumper locations are set as required by the user before installing the F5D-9. Replace the shield cover and its four screws, if removed.

(1) Remove the five screws affixing the bottom cover of the transceiver, and remove the cover.

(2) Referring to Figure 1, remove the metal plate from the front panel of the transceiver, and install the supplied plate in its place. Then press the digital selector into the hole until the latches click into place.

(3) Connect 16-pin connector P01 from the F5D-9 to J1009 on the Main Unit of the transceiver, and install the 7-pin plug from the F5D-9 into the jack on the digital selector (Figure 2).

(4) Replace the bottom cover and five screws.

Programming

After selecting jumper options and installing the F5D-9, 5-tone function selections, ID codes and transpond code must be programmed into the "Miscellaneous Options" area of the EEPROM in the transceiver using the FYG-4 programmer (refer to the FYG-4 Operating Manual during the following procedure).

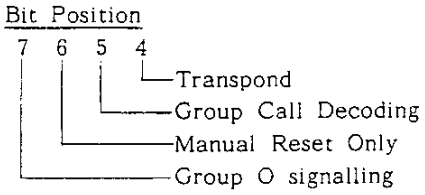
If the transceiver has already been programmed with other data, that data does not have to be reprogrammed: simply skip the those steps in the programming procedure. The data to be entered for the F5D-9 has been programmed with "FF" hexadecimal values if no F5D-9 was previously installed.

Referring to Table I on page 7-30 of the FYG-4 Operating Manual, the following information fills in the "Miscellaneous Options" section:

Address	Data	Group	Parameter
08	a	b	a = Function Select
09	c	d	b-h = Decoder ID Code
0A	e	f	
0B	g	h	
0C	i	j	i-o = Encoder ID Code
0D	k	l	
0E	m	n	
0F	o	p	p-v = Transpond Code
10	q	r	
11	s	t	
12	u	v	

A. Function Selection

Nybble "a" in the above table is a bitmap (each of the four bits is a switch), arranged from left to right) as follows:



Any of these four functions are either enabled by setting the corresponding bit to 1, or disabled by setting the corresponding bit to 0. When Manual Reset Only is disabled, reset of the alerting tone occurs automatically after three seconds. When Group O signalling is disabled, Group A signalling is used. The resulting hexadecimal value of the four bits is then stored in the EEPROM by pressing the corresponding key on the FYG-4.

For example, to enable Group O Signalling, Manual Reset Only and Group Call Decoding while disabling Transpond, the four corresponding bits of nybble "a" would be 1110 (binary), which converts to the value E in hexadecimal. Therefore when programming or altering the General Parameters as described on page 7-29 of the FYG-4 Manual, press the "E" key first when entering the code for address 08. This procedure is covered by a more detailed example later.

B. Decoder ID Code

Nybbles "b" through "h" at EEPROM addresses 08 (lower half) through 0B hold the 5-digit ID code which uniquely identifies each transceiver in a network. When programming, these digits are keyed in directly (with no conversion to hexadecimal). Notice that there are seven digit locations - the first two of which (nybbles b and c) are not used by the F5D-9 and must each be entered as "F" before the five numeric digits.

C. Encoder ID Code

Nybbles "i" through "o" at EEPROM addresses 0C through (one-half of) 0F hold the (2, 3 or 4) digits that are common to the 5-digit ID codes of all transceivers which are callable by this unit (the digit selectors on the front panel are used to select the remaining digits, allowing the operator to select whom he will call within the network). As in the case of the Decoder ID Code, there are seven digit locations, the first two of which (i and j) must first be entered as "F"s, followed by the fixed numeric digits common to all network stations,

followed by "b"s corresponding to the one, two or three digits which will be selected from the front panel selectors.

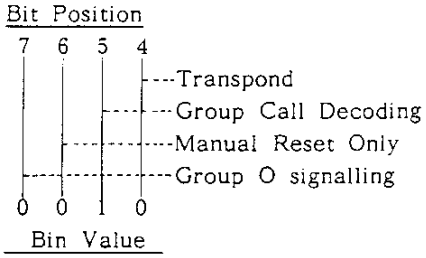
D. Transpond Code

Nybbles "p" through "v" at EEPROM addresses 0F (lower half) through 12 hold the first four digits of the 5-digit Transpond code, if this feature is activated (if not activated, these addresses should be filled with "F"s for each nybble). The last Transpond digit is selected by the leftmost selector on the front panel, if this feature is enabled. As in the above cases there are seven digit locations, the first two of which (p and q) must first be entered as "F"s, followed by the fixed numeric digits of the Transpond code common to all network stations, followed by a "b", corresponding to the Transpond digit which will be selected from the leftmost front panel selector.

EXAMPLE:

Program the F5D-9 for Transpond disabled, Group Call decoding enabled, automatic reset of the alert tone and Group A signalling, with a decoder ID for this station of 12345, and an encoder code (for this network) of 123.

(1) Calculate the value to enter for the high nybble of address 08:



The Bin Value is the binary representation of the digit to be entered, which in this case converts to "2".

(2) The decoder ID for this station is 12345, which must be preceded by two "F"s, so nybbles b through h will be entered as FF12345.

(3) The common encoder digits in this network are 123, and these must also be preceded by "FF", and succeeded by "bb" (for the digits that will be selected from the front panel), so nybbles i through o will be entered as "FF123bb".

(4) Since the Transpond feature is disabled, nybbles p through v are simply entered as "FFFFFFF" (if Transpond were enabled, these would be set like the common encoder digits described above, except that only the last digit would be entered as "b", since only one digit of the Transpond code is front panel selectable).

In Tabular form, the calculated data for this example looks like this:

Address	Nybbles	Keys
08	a b	2 F
09	c d	F 1
0A	e f	2 3
0B	g h	4 5
0C	i j	F F
0D	k l	1 2
0E	m n	3 b
0F	o p	b F
10	q r	F F
11	s t	F F
12	u v	F F

After uploading the existing channel data from the transceiver (page 7-27 of the FYG-4 manual), refer to page 7-29 under "Altering General Parameters". Step (1) is already completed, and steps (2) and (3) can be skipped (except for displaying the general parameter codes and pressing the SET(DE) key until address 08 is displayed). Then press "2" followed by "F", SET(DE), "F" and then "1", SET(DE), and etc.

When finished entering the data into the FYG-4, transfer it to the transceiver as described on page 7-27 of the FYG-4 manual.

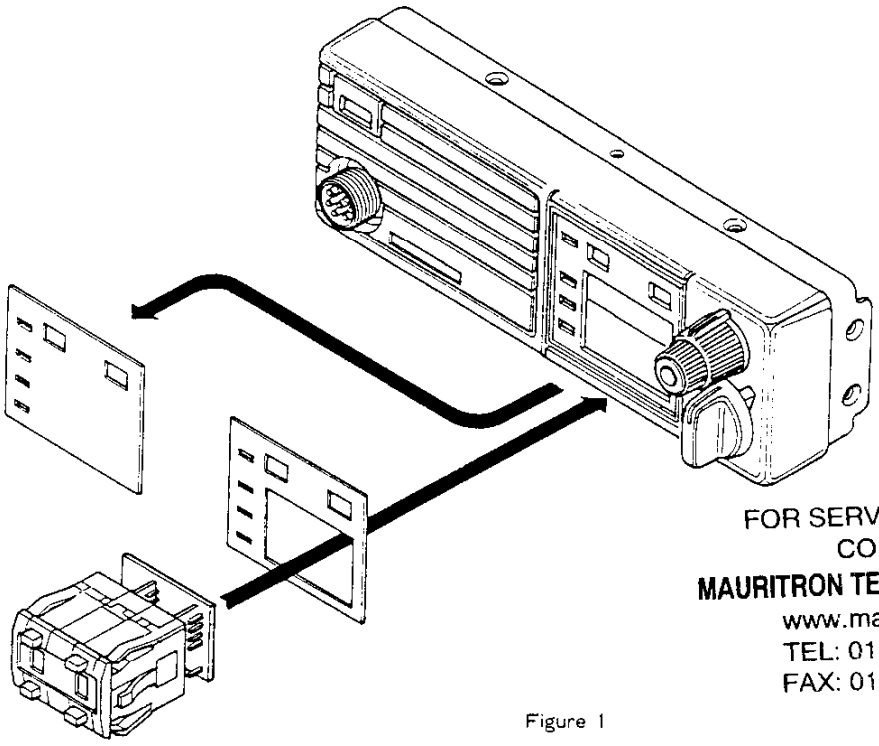


Figure 1

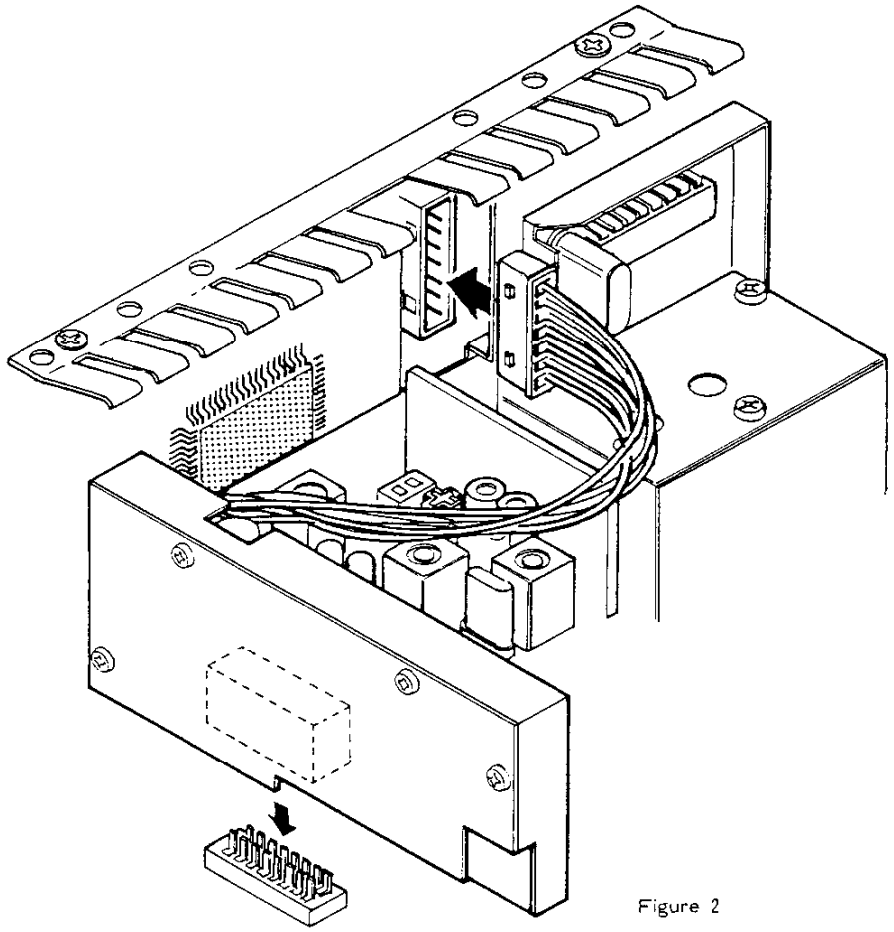
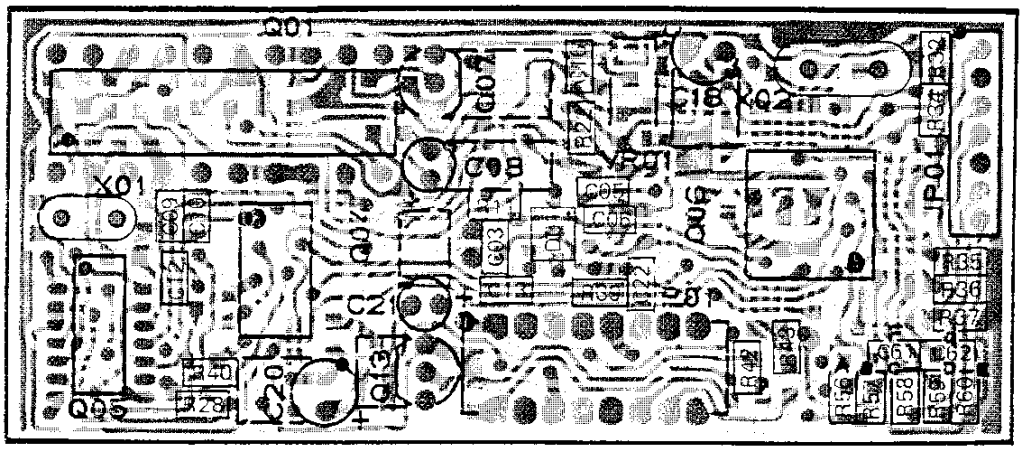
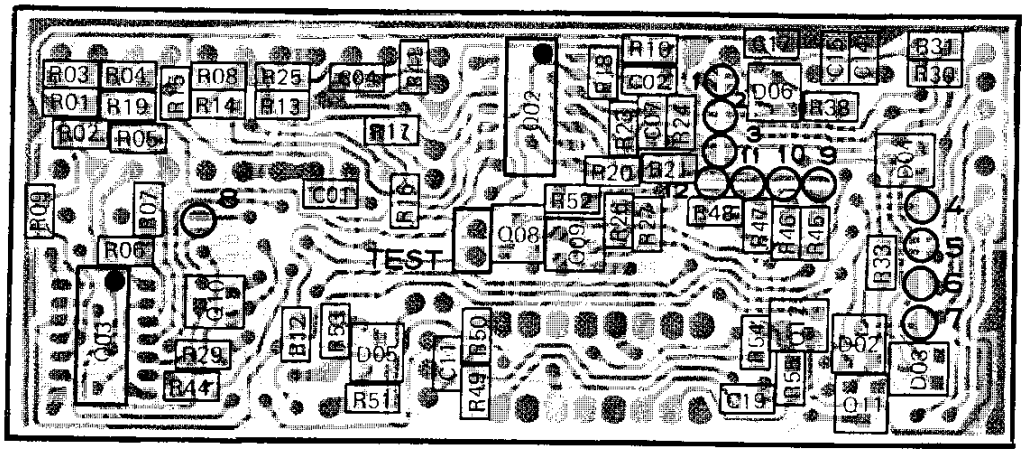


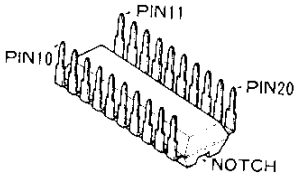
Figure 2



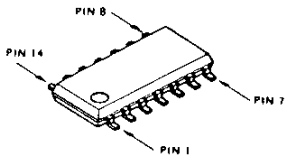
(obverse view of "component" side)



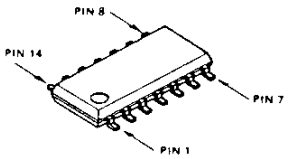
(reverse view of "chip-only" side)



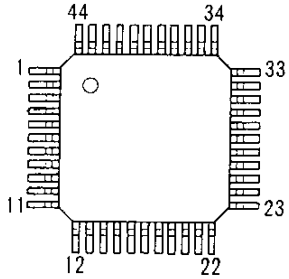
LTC1060ACN (Q101)



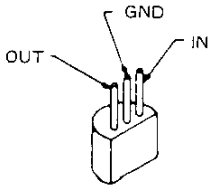
μPC324G (Q102)
μPD74HC4066G (Q103)
μPD74HC74G (Q105)



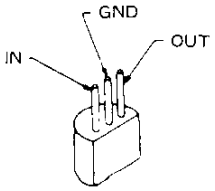
MB87006AFP-G-BND (Q104)



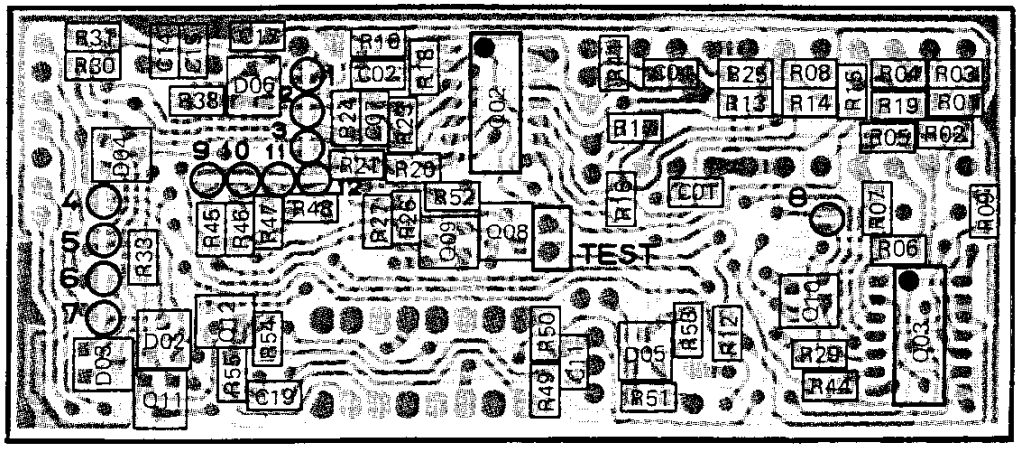
μPD7507HG-523-22 (Q106)



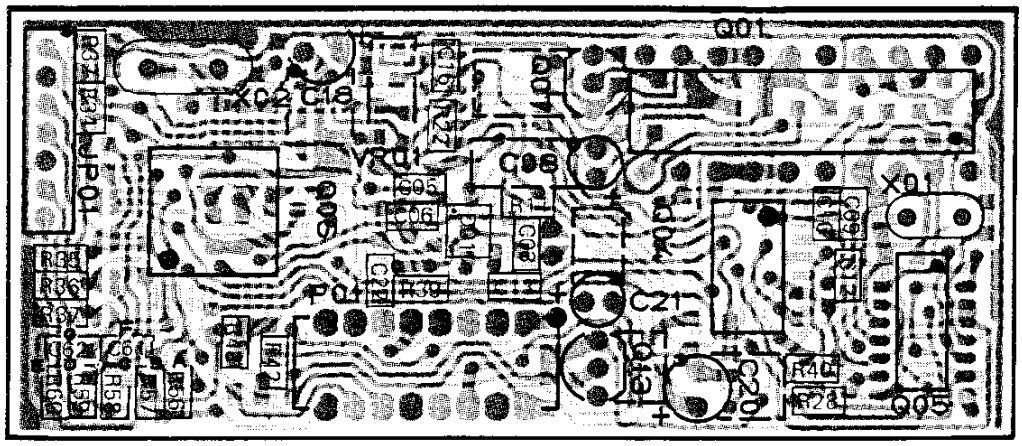
PST523E (Q107)



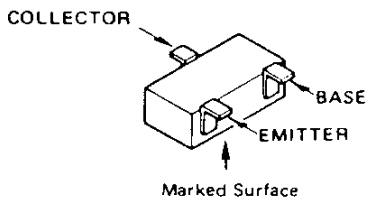
LM2931AZ-5.0 (Q113)



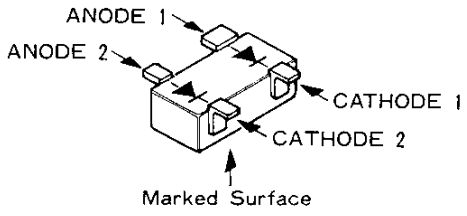
(obverse view of "chip-only" side)



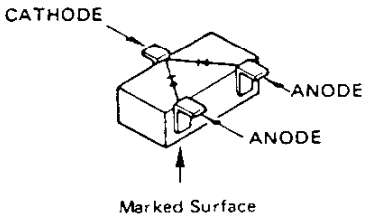
(reverse view of "component" side)



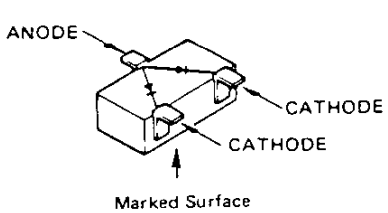
FA1L4M (L31)
(Q108,109,110,111,112)



1SS272 (A1) (D101)



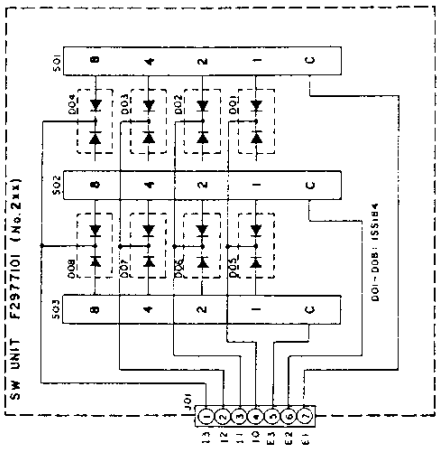
1SS184 (B3)
(D102,105,106,201
202,203,204,205
206,207,208)

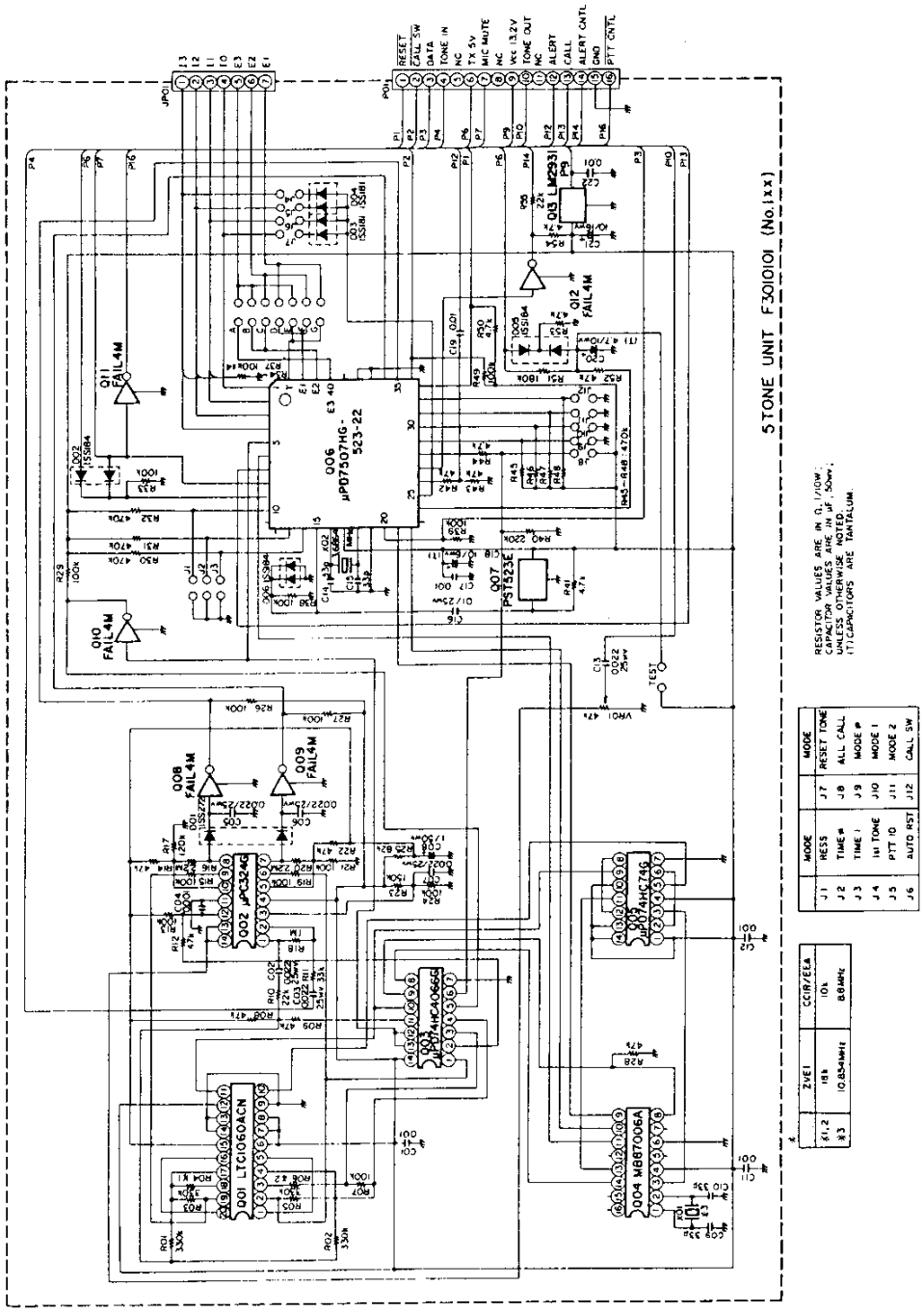


1SS181 (A3)
(D103,104)

F5D-9 CIRCUIT DIAGRAM

F5D-9
CIRCUIT DIAGRAM





	F3010101	Printed Cirtcuit Board		
Q101	G1090889	IC	LTC1060ACN	
Q102	G1090603	IC	uPC324G	
Q103	G1090871	IC	uPD74HC4066G	
Q104	G1090869	IC	MB87006AFP-G-BND	
Q105	G1090872	IC	uPD74HC74G	
Q106	G1090866	IC	uPD7507HG-523-22	
Q107	G1090917	IC	PST523E	
Q108	G3070013	Transistor	FA1L4M-T2B	
Q109	G3070013	Transistor	FA1L4M-T2B	
Q110	G3070013	Transistor	FA1L4M-T2B	
Q111	G3070013	Transistor	FA1L4M-T2B	
Q112	G3070013	Transistor	FA1L4M-T2B	
Q113	G1090785	IC	LM2931AZ-5.0	
D101	G2070048	Diode	1SS272 TE85R	
D102	G2070009	Diode	1SS184 TE85R	
D103	G2070001	Diode	1SS181 TE85R	
D104	G2070001	Diode	1SS181 TE85R	
D105	G2070009	Diode	1SS184 TE85R	
D106	G2070009	Diode	1SS184 TE85R	
X101	H0102880	Crystal(F5D-9A ZVEI)	10.854MHz	
X101	H0102881	Crystal(F5D-9B CCIR)	8.8MHz	
X102	H0102674	Crystal	HC-43/U/4	3.6864MHz
R101	J24205334	Chip Res.	330k Ohm	1/10W
R102	J24205334	Chip Res.	330k Ohm	1/10W
R103	J24205334	Chip Res.	330k Ohm	1/10W
R104	J24205183	Chip Res.(F5D-9A)	18k Ohm	1/10W
R104	J24205103	Chip Res.(F5D-9B)	10k Ohm	1/10W
R105	J24205334	Chip Res.	330k Ohm	1/10W
R106	J24205183	Chip Res.(F5D-9A)	18k Ohm	1/10W
R106	J24205103	Chip Res.(F5D-9B)	10k Ohm	1/10W
R107	J24205104	Chip Res.	100k Ohm	1/10W
R108	J24205473	Chip Res.	47k Ohm	1/10W
R109	J24205473	Chip Res.	47k Ohm	1/10W
R110	J24205223	Chip Res.	22k Ohm	1/10W
R111	J24205333	Chip Res.	33k Ohm	1/10W
R112	J24205473	Chip Res.	47k Ohm	1/10W
R113	J24205104	Chip Res.	100k Ohm	1/10W
R114	J24205473	Chip Res.	47k Ohm	1/10W
R115	J24205104	Chip Res.	100k Ohm	1/10W
R116	J24205225	Chip Res.	2.2M Ohm	1/10W
R117	J24205124	Chip Res.	120k Ohm	1/10W
R118	J24205105	Chip Res.	1M Ohm	1/10W
R119	J24205104	Chip Res.	100k Ohm	1/10W
R120	J24205225	Chip Res.	2.2M Ohm	1/10W
R121	J24205104	Chip Res.	100k Ohm	1/10W
R122	J24205473	Chip Res.	47k Ohm	1/10W
R123	J24205154	Chip Res.	150k OHm	1/10W
R124	J24205104	Chip Res.	100k Ohm	1/10W
R125	J24205823	Chip Res.	82k Ohm	1/10W

R126	J24205104	Chip Res.	100k Ohm	1/10W
R127	J24205104	Chip Res.	100k Ohm	1/10W
R128	J24205473	Chip Res.	47k Ohm	1/10W
R129	J24205104	Chip Res.	100k Ohm	1/10W
R130	J24205474	Chip Res.	470k Ohm	1/10W
R131	J24205474	Chip Res.	470k Ohm	1/10W
R132	J24205474	Chip Res.	470k Ohm	1/10W
R133	J24205104	Chip Res.	100k Ohm	1/10W
R134	J24205104	Chip Res.	100k Ohm	1/10W
R135	J24205104	Chip Res.	100k Ohm	1/10W
R136	J24205104	Chip Res.	100k Ohm	1/10W
R137	J24205104	Chip Res.	100k Ohm	1/10W
R138	J24205104	Chip Res.	100k Ohm	1/10W
R139	J24205104	Chip Res.	100k Ohm	1/10W
R140	J24205224	Chip Res.	220k Ohm	1/10W
R141	J24205472	Chip Res.	4.7k Ohm	1/10W
R142	J24205473	Chip Res.	47k Ohm	1/10W
R143	J24205473	Chip Res.	47k Ohm	1/10W
R144	J24205472	Chip Res.	4.7k Ohm	1/10W
R145	J24205474	Chip Res.	470k Ohm	1/10W
R146	J24205474	Chip Res.	470k Ohm	1/10W
R147	J24205474	Chip Res.	470k Ohm	1/10W
R148	J24205474	Chip Res.	470k Ohm	1/10W
R149	J24205104	Chip Res.	100k Ohm	1/10W
R150	J24205472	Chip Res.	4.7k Ohm	1/10W
R151	J24205184	Chip Res.	180k Ohm	1/10W
R152	J24205472	Chip Res.	4.7k Ohm	1/10W
R153	J24205472	Chip Res.	4.7k Ohm	1/10W
R154	J24205472	Chip Res.	4.7k Ohm	1/10W
R155	J24205223	Chip Res.	22k Ohm	1/10W
R157	J24205000	Chip Res.	0 Ohm	1/10W
R159	J24205000	Chip Res.	0 Ohm	1/10W

VR101	J50779473	Potentiometer	47k Ohm	RH04AVC

C101	K22170817	Chip Cap.	0.01uF	50V B
C102	K22140807	Chip Cap.	0.022uF	25V B
C103	K22140807	Chip Cap.	0.022uF	25V B
C104	K22170805	Chip Cap.	0.001uF	50V B
C105	K22140807	Chip Cap.	0.022uF	25V B
C106	K22140807	Chip Cap.	0.022uF	25V B
C107	K22140807	Chip Cap.	0.022uF	25V B
C108	K40179001	Al Electro Cap.	1uF	50V
C109	K22170223	Chip Cap.	33pF	50V CH
C110	K22170223	Chip Cap.	33pF	50V CH
C111	K22170817	Chip Cap.	0.01uF	50V B
C112	K22170817	Chip Cap.	0.01uF	50V B
C113	K22140807	Chip Cap.	0.022uF	25V B
C114	K22170223	Chip Cap.	33pF	50V CH
C115	K22170223	Chip Cap.	33pF	50V CH
C116	K22141809	Chip Cap.	0.1uF	25V B
C117	K22170817	Chip Cap.	0.01uF	50V B
C118	K70087106	Tantalum Cap.	10uF	6.3V

C119	K22170817	Chip Cap.	0.01uF	50V	B
C120	K70107475	Tantalum Cap.	4.7uF	10V	
C121	K40129012	Al Electro Cap.	10uF	16V	
C122	K22170817	Chip Cap.	0.01uF	50V	B
C123	K10176102	Ceramic Cap.	0.001uF	50V	B
P101	P1090561	Connector	5533-16APB		
JP101	T9205726	Wire Assy			

SW UNIT

	F2977101	Printed Circuit Board	
D201	G2070009	Diode	1SS184 TE85R
D202	G2070009	Diode	1SS184 TE85R
D203	G2070009	Diode	1SS184 TE85R
D204	G2070009	Diode	1SS184 TE85R
D205	G2070009	Diode	1SS184 TE85R
D206	G2070009	Diode	1SS184 TE85R
D207	G2070009	Diode	1SS184 TE85R
D208	G2070009	Diode	1SS184 TE85R
S201	N7090073	Thumbwheel Switch	A7BS-206-P2-1
S202	N7090073	Thumbwheel Switch	A7BS-206-P2-1 for 3-Digit
S203	N7090073	Thumbwheel Switch	A7BS-206-P2-1
	S6000141	Dummy Switch	A7B-PA-1 for 2-Digit
	S6000140	Switch Holder	A7B-M-1
J201	P0090626	Connector	SC25-07WS
	R0128810	Shield Case	
	R0128820	Shield Case Cover	

NOTES :

The FYG-4 is a microprocessor-controlled channel data programmer for the Yaesu FTL-2007 VHF and FTL-7007 UHF land mobile transceivers. Simplex and semi-duplex channel frequencies can be programmed, along with EIA standard RS-220-A subaudible CTCSS tones when the FTS-14 Tone Squelch Unit is installed in the transceiver.

The FYG-4 can be either manually programmed, or automatically programmed by transfer of data from a preprogrammed transceiver. In either case, data in the FYG-4 can be freely modified, and then transferred back to any number of transceivers to change or initially program them with new data. Once programmed, data is retained by an EEPROM in the FYG-4 indefinitely.

The FYG-4 can be operated portably by installing six UM-3 dry batteries, or from the AC mains by using the Yaesu NC-9 battery charger as a source of 9V DC. A shielded cable is provided for data transfer to and from transceivers.

CONTROLS AND CONNECTORS

(1) IN/OUT Jack

This 3-contact jack accepts data input from a transceiver to program the FYG-4, and provides output of FYG-4 data to a transceiver. The supplied programming cable connects between this jack and the microphone jack of the transceiver.

(2) DC IN Jack

This 2-contact jack accepts 9V DC for operation from the NC-9 Charger, when used as a power supply. When this jack is used the internal dry cell batteries are disconnected (the NC-9 does NOT function as a charger for the batteries in the FYG-4).

(3) POWER ON/OFF Switch

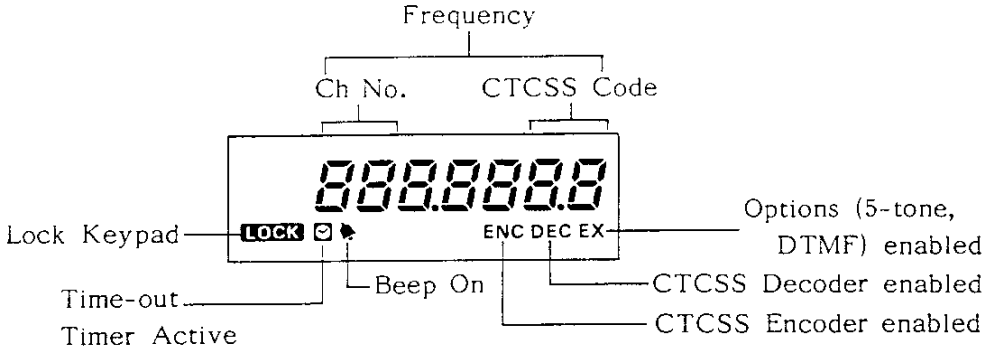
This switch turns the FYG-4 on and off. When operating from the internal batteries, make sure to switch the FYG-4 off when not in use.

(4) TX/RX Switch

On semi-duplex channels, this switch allows confirmation of the transmit frequency on the display.

(5) Display

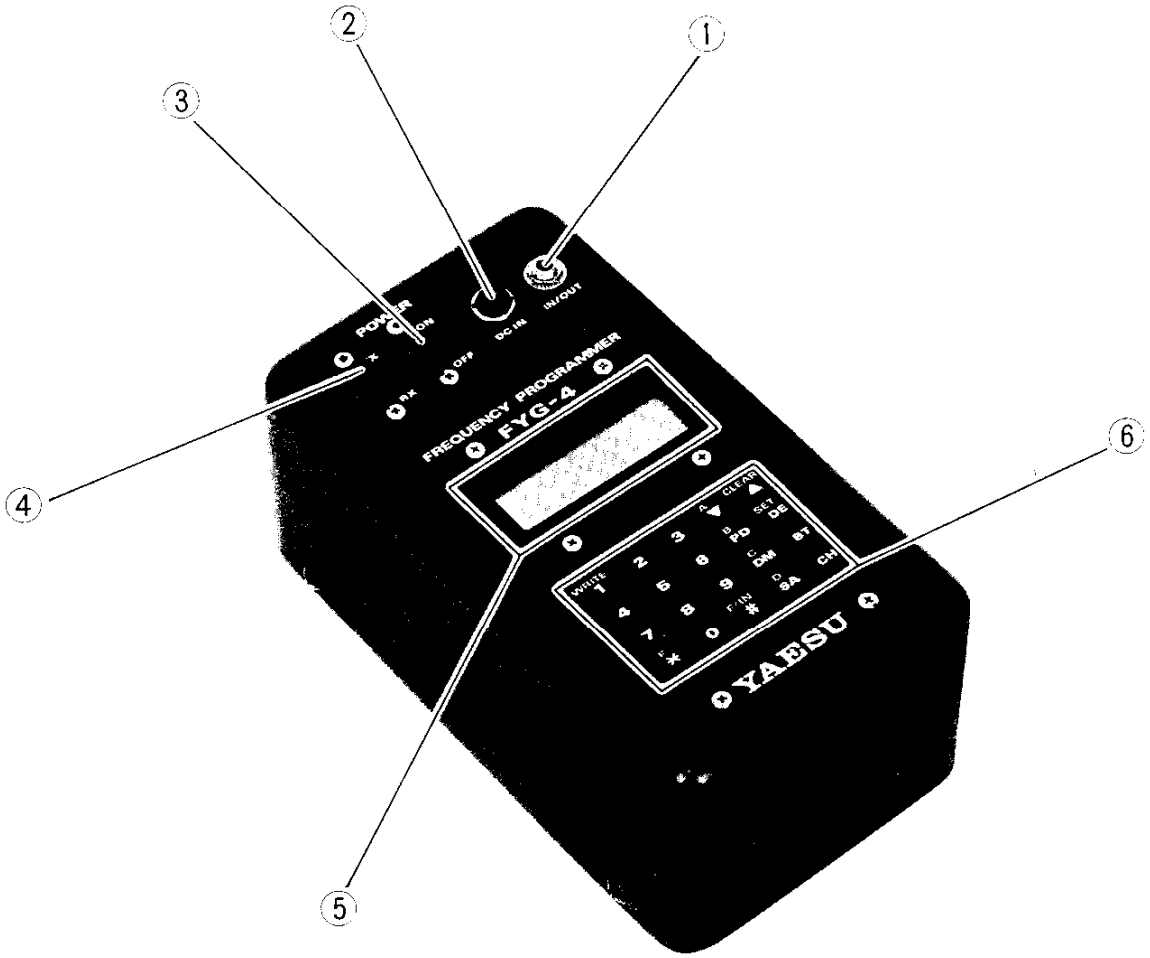
This 7-digit LCD shows frequency, channel number and CTCSS tone code:



(6) Keypad

These 20 keys are used to enter and check programming data in the FYG-4. Most keys have two functions, depending upon the mode of operation of the FYG-4 (Writing Data, or Simulating Operation). Normally, if the FYG-4 POWER switch is simply turned on, the keypad and display simulate transceiver operation. However, if the [WRITE 1] key is held down while the POWER switch is turned on, and "AAAA" is then keyed in, the keypad is activated for writing data.

KEY	Simulate mode	Write mode	Display
[WRITE 1]	Number 1	Number 1	1
[2] ~ [0]	Numbers 2,3,4,...0	Number 2,3,4,...0	2~0
[A ▼]	Step Channel Down	Hex Number A	A
[CLEAR ▲]	Step Channel Up	Erase or Skip Data	
[B PD]	(no function)	Hex Number B	b
[SET DE]	(no function)	Gen'l Parameter Prog.	
[C DM]	Change Channel Parameter	Hex Number C	C
[BT]	Keypad Beeper On/Off	(no function)	
[D SA]	(no function)	Hex Number D	d
[CH]	Select Ch (after entering Ch No.)	(no function)	
[E *]	Keypad Lock (hold >1 sec.)	Hex Number E	LOCK, E
[F/IN #]	Transfer Data	Hex Number F	F



Battery Installation, Power Connections

Before operating the FYG-4 for the first time, remove the four screws affixing the rear cover and install six UM-3 dry cell batteries according to the polarity marked in the battery holder. To operate the FYG-4 from the AC mains, connect the appropriate NC-9 battery charger to the DC IN jack (NC-9B for 110-120VAC, or NC-9C for 220-240VAC), and to the AC outlet.

PROGRAMMING PROCEDURES

OVERVIEW (see Flowchart 1)

Installing or changing the data in a transceiver will generally involve the following procedures:

I. Upload* data from one transceiver to the FYG-4.
II. Alter the data in the FYG-4 as required.
III. Download the altered data from the FYG-4 to transceiver(s).

Skipping Procedure I.: If the FYG-4 is already loaded

If the FYG-4 has been previously uploaded with data from a transceiver having some parameters (such as PLL parameters or lowest channel frequencies) the same as the target transceiver(s), uploading may be skipped, and only the parameters (such as channel frequencies) that are different need to be altered in Procedure II. Uploading allows much time to be saved in programming, since it will only be necessary to alter the data that is different between the source and target transceivers. New transceivers from the factory, if ordered without channel programming, still come with the General Parameters pre-programmed, so these will not normally need to be altered (unless timers need to be changed or certain options are added).

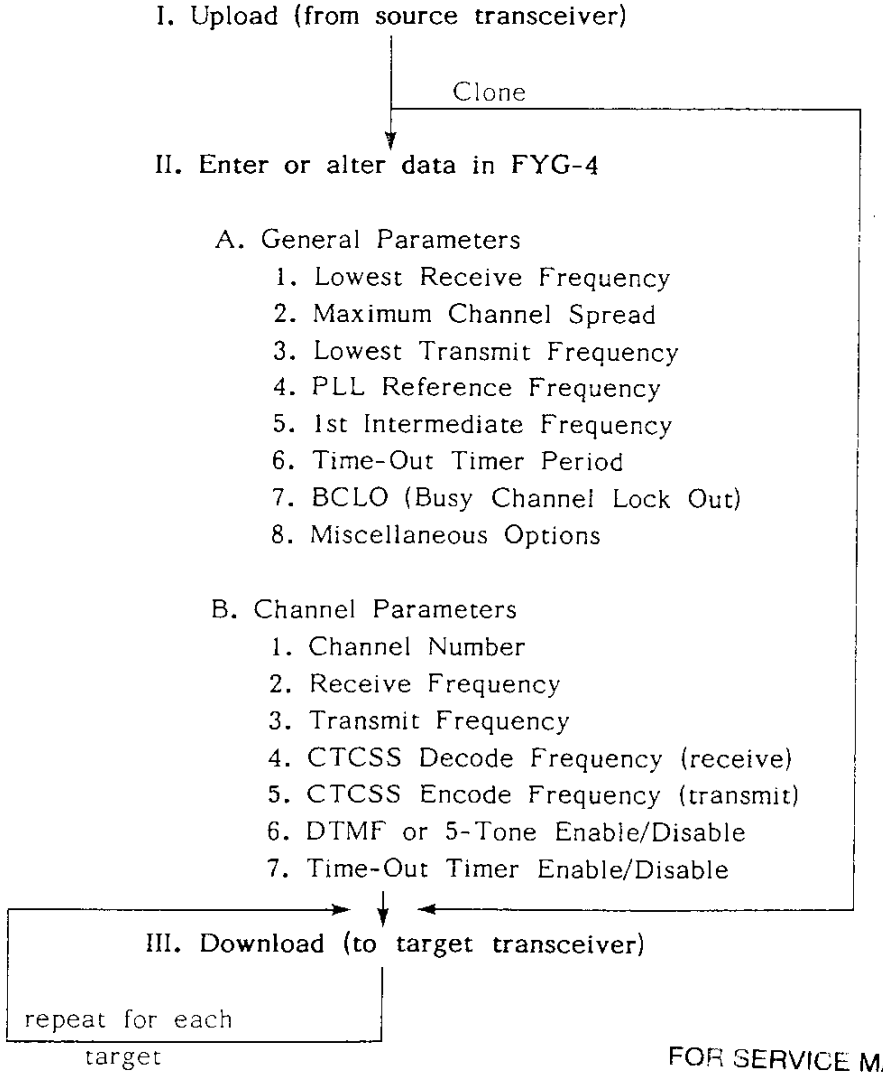
Skipping Procedure II.: Cloning

After the FYG-4 has been programmed once (either manually, or by uploading from a transceiver), it is generally only necessary to modify the data in the FYG-4 for different transceiver requirements before downloading. The EEPROM (memory) in the FYG-4 will hold its contents indefinitely. However, if adding transceivers to widely different networks, it may be more practical to upload from an existing (source)

* "Upload" = moving data from a source transceiver to the FYG-4. "Download" = moving data from the FYG-4 to a target transceiver.

transceiver in the network and then download it without alteration to the new (target) transceiver(s) in the same network (in other words, clone the data). Of course when adding more than one transceiver with the same programming data, uploading and data alteration may only need to be done once, with the downloading procedure repeated for each target transceiver.

Flowchart I. OVERVIEW OF PROGRAMMING PROCEDURES



UPLOADING AND DOWNLOADING THE FYG-4

When ready to upload or download, switch both the FYG-4 and transceiver off, and connect the IN/OUT jack on the FYG-4 to the MIC jack on the transceiver using the supplied programming cable.

To upload data from a source transceiver (either new, or previously programmed with some or all of the required data),

(1) Press and hold the F/IN [#] button on the FYG-4 while turning the FYG-4 POWER switch on.

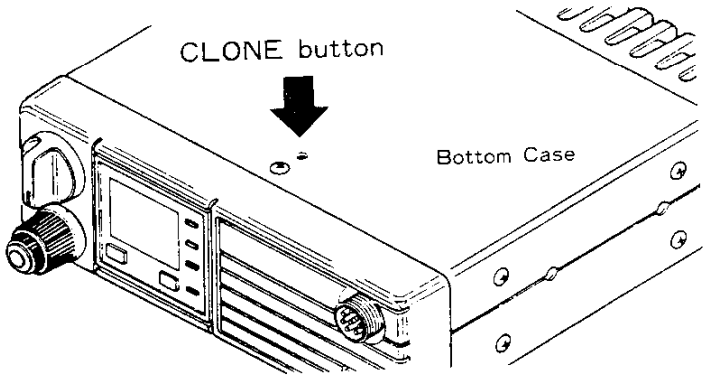
(2) Press the power switch on the transceiver (the FTL-2001/-7002 display should show two zeros).

(3) After 21 seconds the FYG-4 should display the lowest programmed channel number (if a continuous beep was heard, the data transfer failed).

(4) Switch off both the transceiver and FYG-4, and remove the programming cable.

To download data from the FYG-4 to a target transceiver,

(1) Press and hold the PRI button (on FTL-2001/7002) or the CLONE button (on FTL-2007/-7007) while turning the transceiver POWER switch on.



(2) Turn on the POWER switch on the FYG-4.

(3) After 21 seconds the FYG-4 will beep briefly, and display the lowest programmed channel number (if a continuous beep was heard, the data transfer failed).

(4) Switch off both the transceiver and FYG-4, and remove the programming cable.

DISPLAYING AND ALTERING DATA

Each transceiver requires two types of data: General Parameters and Channel Parameters. See Parts II.A and II.B in Flowchart I. This data will have been uploaded from a source transceiver into the FYG-4, where it can be displayed and modified before downloading to the target transceiver(s). Procedures for viewing and altering the General and Channel parameters are quite different, and so are described separately. Also, complete key-by-key examples of each procedure are provided starting on page 7-38. If any steps in the descriptions are unclear, please take the time to step through the example of that procedure.

The General Parameters are specific to the circuitry (and installed options) of the transceiver, and are common to all channels. These parameters are initially programmed in all transceivers after alignment at the factory, so normally you will only need to upload them from a source or target transceiver. The only cases where you may need to alter the General Parameters would be when you need to program a different frequency spread, time-out timer period or option. However, you will want to check the General Parameters that have been uploaded to the FYG-4, either to determine how a transceiver is set up, or to confirm the desired settings before downloading.

The Channel Data Parameters are different for each channel, and unless you are cloning the source transceiver channels to the target transceiver(s), these must be altered for each new or changed operating channel, as described starting on page 7-32.

Displaying General Parameter Codes

Press and hold [WRITE 1] while turning on the POWER switch (this brings up the Write Mode)

Press [A ▼] four times (to enter hexadecimal AAAA).

Press [SET 0E] to select General Parameter display.

A four-digit hexadecimal code is now displayed. The left-most two digits are the EEPROM address (02 to 12), and the right-most two digits are the 4-bit (nybble) codes at that address. Parameters are represented by one to three of these code digits, as described in Table I.

Press SET DE to step forward sequentially through each of the General Parameter addresses, for display or alteration.

Altering General Parameters

(1) To change a General Parameter, refer to Tables I - V to determine the code* that corresponds with the parameter you want to change. Then refer to Table I to determine the address(es) in which the code for that parameter is stored.

(2) Next, while displaying the general parameter codes, press SET DE until the address of the code is displayed, and make note of the two code digits currently stored at that address**.

(3) In the case of 3-digit channel range frequencies (which occupy one and a half addresses), key in only the hundreds and tens of MHz digits now, and press SET DE again to select the next address. Then go on to the next step.

* Channel range frequencies are keyed in directly as three decimal MHz digits, as indicated in Table I. All other parameters are hexadecimally coded.

** Any time you key in a new parameter code, the new digit will appear at the right end of the display. Therefore, to avoid disrupting the order of the parameters in the address space, you must always enter two code digits, even when you only wish to change one of them. This is the reason for taking note of both code digits: one may have to be re-entered.

(4) Key in the two code digits: entering the one that should finally appear at the right end of the display last (the first code entered will shift one place to the left when the second is entered). One of these digits will be the one you are altering, and the other will be one of the two you noted in step (2).

(5) When the display shows the parameter codes you desire, press SET/DE to set them into the memory.

(6) Switch the FYG-4 off before displaying or altering channel data, or downloading.

Table I. General Parameter Address Space Utilization

Circled numbers indicate data digit locations in the EEPROM address space - NOT actual values. Groupings of digits for each General Parameter are shown at the right. Actual parameter values associated with the codes are shown in Tables II - V.

Address	Data	Group	Parameter & Value (or Table Reference)
0 2	①	②	Lowest Receive Frequency (3 digits, MHz)
0 3	③	④	Channel Spread, in MHz (see Table II)
0 4	⑤	⑥	Lowest Transmit Freq. (3 digits, MHz)
0 5	⑦	⑧	PLL Prescale/Ref. Frequency (Table III)
0 6	⑨	⑩	1st IF (Table IV)
0 7	⑪	⑫	Time Out Timer Period (Table V)
0 8	⑬	⑭	BCLO (0 = ENABLED, F = DISABLED)
0 9	⑮	⑯	For Miscellaneous Options (see Option
0 A	⑰	⑱	Instructions for Data Codes)
0 B	⑲	⑳	
0 C	㉑	㉒	NOTE: All data in unused addresses
0 D	㉓	㉔	after address 07 should be set
0 E	㉕	㉖	to "FF".
0 F	㉗	㉘	
1 0	㉙	㉚	
1 1	㉛	㉜	
1 2	㉝	㉞	

TABLE II. Channel Spread Parameter Codes

This is the difference, in MHz, between the highest and lowest operating frequencies (transmit or receive) to be programmed in the transceiver.

Code Digit	1	2	3	4	5	6	7	8	9	0
Spread (MHz)	4	8	12	16	20	24	28	32	36	40

TABLE III. PLL Prescaler/Reference Frequency Parameter Codes

This code represents a combination of prescaler dividing ratio and (divided) reference frequency in the PLL circuit of the transceiver.

Code Digit	0	1	2	3	4	5	6	7
Prescaler Ratio	128	128	128	128	64	64	64	64
Reference (kHz)	5	6.25	10	12.5	5	6.25	10	12.5

TABLE IV. 1st Intermediate Frequency

This is the frequency of the 1st IF of the transceiver, in MHz. Positive values indicate additive mixing at the 1st mixer, negative values indicate subtractive mixing.

Code Digits	0F	1F	2F	3F	4F	5F	6F
1st IF	16.9	21.4	45.0	54.5	58.1	-16.9	-21.4

TABLE V. Time Out Timer Period

This is the maximum allowable length (in seconds) of continuous transmission, after which the transceiver will return to receive automatically. Note that the Time Out Timer is only active on channels where it is enabled (by setting another code in the Channel Programming Procedure).

Code	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Time	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480

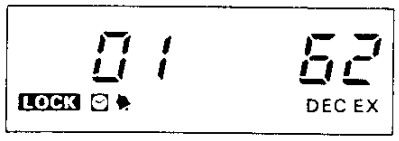
Displaying Channel Parameters

Please take a moment to refer back to the Channel Parameters in section II.B in Flowchart 1 on page 7-26. If the source transceiver from which you have uploaded the FYG-4 was already programmed with channel data, you may want to review the data before making additions or changes. Also, after programming new channel data you may want to confirm that it has been entered as you intended before downloading to a target transceiver. Otherwise, if you know that the source transceiver has not been previously programmed with channel data, skip right to Programming New Channel Data.

To view previously programmed channel data:

With the TX/RX switch set to RX, turn on the POWER switch (this brings up the Simulation Mode)

(Sample Display:)



The FYG-4 display shows a channel number at the left, and, if the CTCSS option is installed and activated for decode, a CTCSS code number (Table VI) with "DEC" underneath. A bell icon also appears beneath the channel number indicating the keypad beeper is active. If an optional 5-Tone Unit or DTMF decoder is installed and requires access to data in the General Parameters in memory for operation on the selected channel, "EX" is displayed at the lower right corner.

Slide the TX/RX switch to TX to check the CTCSS code (if installed) for transmission ("ENC" is displayed underneath, if active). Also, if the time-out timer is armed on this channel, a clock icon will appear next to the bell icon, and after the programmed time-out period, the display will revert to the receive state (so that you can check the time-out timer period). Make certain to return the TX/RX switch to the RX position before proceeding.

NOTE: When the TX/RX switch is set to TX the keypad is disabled, as the FYG-4 is simulating transmission. Set this switch back to RX to re-enable the keypad.

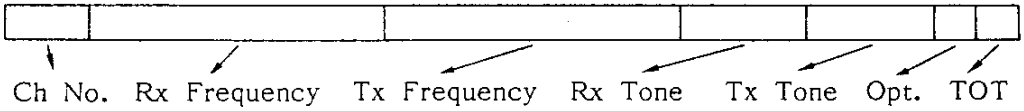
To display the receive frequency of this channel, press C DM . You can then check the transmit frequency by sliding the TX/RX switch to TX, then return the switch to RX.

Press the arrow keys to select other channels for checking*.

Programming New Channel Data

Data for each channel is stored in seven consecutive blocks, each consisting of one, two or three or seven digits, as follows;

Parameter	No. of Digits	Valid Range (Decimal)
Channel No.	two	00 to 79*
Receive Freq.	seven	**
Transmit Freq.	seven	**
Rx CTCSS Tone Code	three	021 to 062 and 100***
Tx CTCSS Tone Code	three	" " " "
Optional Unit	one	0 (Enable) or 1 (Disable)
Time-Out Timer	one	" " " " "



* Valid channel numbers are 00-79 for the FTL-2001/-7002, or 00, 10, 20, ..., 70 for the FTL-2007/-7007.

** All channel frequencies must conform to the General Parameters already programmed. That is, they must be above the low channel frequency limits, within the programmed band, and be on a multiple of the PLL reference frequency.

*** exc. 22, 24, 26, 28 & 29. Invalid entries are accepted by the FYG-4, but results are unpredictable in transceiver.

To program any parameter the required number of digits must be entered, followed by the SET DE key, which will cause the FYG-4 to accept the new value and access the next parameter (note, however, digits previously entered remain on the display until a new entry is started). If a parameter does not need to be changed, pressing only CLEAR ▲ will cause that parameter to be skipped, and the next one accessed.

The following procedure describes how to enter all new data for one channel. The KEYPAD ERROR RECOVERY box on page 7-36 describes what to do if you make a mistake. See also the New Channel Programming Example on page 7-39.

(1) Press and hold the WRITE 1 key while turning the FYG-4 POWER switch on (the display should remain blank).

(2) Press ▲ ▼ four times to activate the Write mode for data entry (the display should now show two zeros, indicating that the FYG-4 is ready to accept a channel number).

(3) Enter two digits for the Channel Number you wish to program*. Confirm that the display now shows this number in the right-most two digit locations. If you want to clear any previous data in this channel, press CLEAR ▲ .

(4) Press SET DE to step to the next parameter (Receive Frequency).

(5) Enter 7 digits** for the receive frequency, confirm the display, and then press SET DE again to step to transmit frequency.

* In the FTL-2007/-7007, or when fewer than nine channels are to be installed, number them 00, 10, 20, 30, ..., 70.

** A decimal appears at the center of the display whenever the FYG-4 is expecting a 7-digit frequency entry.

(6) If the transmit frequency is the same (ie., simplex channel), just press [SET DE] again to set it equal to the receive frequency and step to the CTCSS rx tone. Otherwise (for a semi-duplex channel) enter seven digits for the transmit frequency, and press [SET DE] to step to CTCSS rx tone.

(7) If CTCSS tones are required on the channel being programmed*, refer to Table VI to determine the 3-digit code that corresponds with the desired CTCSS rx (decode) tone frequency (if no rx tone is required, the code is "100"). Enter these digits and then press [SET DE] to step to the CTCSS tx tone.

(8) Repeat step (7) for the CTCSS tx tone, if different from the rx tone. Then press [SET DE] to step to the option switch.

(9) Enter "1" (disable) unless a 5-Tone or DTMF decoder option (or other special option using the EEPROM) is being used in the target transceiver. Otherwise, enter "0" (enable). Then press [SET DE] to step to the time-out timer switch.

(10) Enter "1" (disable) if the time-out timer is to be disarmed on this channel. Otherwise**, enter "0". Press [SET DE] once more.

The display will now return to two zeros, indicating the FYG-4 is ready to accept another channel number for programming. When finished programming all required channels, switch the FYG-4 OFF to exit the Write mode. You may then want to check the channel data (page 7-32) before downloading to the target transceiver(s) (page 7-27).

* The FTS-14 must be installed in target transceiver(s).

** Time-Out Period is the same for all channels on which the timer is enabled, and is set as a General Parameter.

Reprogramming (Altering) Channel Data

If the Channel Data in the FYG-4 already includes some channel data that you require, that data does not need to be reprogrammed. Just follow the procedure above for the channels that need some parameters changed, pressing only [SET DE] at each step where an existing parameter should be left unchanged. For example, if you only want to disable the time-out timer on an existing channel, after selecting the channel number and pressing [SET DE], press [SET DE] five times (to step over the other parameters), then enter 1 to disable the timer, and finally press the [SET DE] key to return to the double zeros.

KEYPAD ERROR RECOVERY

While keying in channel parameters, if you accidentally hit a wrong digit, keep entering digits until there are at least enough displayed to match the length of the parameter. Then, without pressing [SET DE], simply re-enter the parameter again.

For 7-digit frequency parameters, the invalid digits will be written over (from right to left). Otherwise, for shorter parameters, the invalid digits will be pushed to the left on the display, and the FYG-4 will ignore them when you press [SET DE] to store the parameter. That is, only the digits that are in the right-most locations will be accepted, although up to seven digits may be displayed. For example, if you want to select channel 20, but accidentally press 22, just go ahead and press 20. The display will show "2220", but since the channel number parameter is only two digits long, only the "20" at the right will be accepted when you press [SET DE] ("2220" will remain on the display until new digits are entered).

If you pressed [SET DE] before you noticed the entered data is wrong, abort this channel by pressing the [SET DE] key repeatedly until double zeros are displayed. Then re-enter the channel number and proceed from step (4) of the programming procedure.

TABLE VI. CTCSS Tone Codes (for FTS-14)

When the FTS-14 CTCSS Tone Squelch Unit is installed in the transceiver, EIA standard RS-220-A subaudible tones may be selected independently for receiving and transmitting, on each channel. Each tone frequency is stored in memory as a 3-digit code, with the first digit always zero if a tone is selected, or one if disabled. Available tone frequencies and their corresponding codes are as follows;

Code	Freq.	Group	Code	Freq.	Group	Code	Freq.	Group
021	91.5	C	040	173.8	A	050	123.0	A
023	85.4	C	041	167.9	B	051	118.8	B
025	79.7	C	042	162.2	A	052	114.8	A
027	74.4	C	043	156.7	B	053	110.9	B
030	250.3	A	044	151.4	A	054	107.2	A
031	241.8	B	045	146.2	B	055	103.5	B
032	233.6	A	046	141.3	A	056	100.0	A
033	225.7	B	047	136.5	B	057	94.8	B
034	218.1	A	048	131.8	A	058	88.5	A
035	210.7	B	049	127.3	B	059	82.5	B
036	203.5	A				060	77.0	A
037	192.8	B				061	71.9	B
038	186.2	A				062	67.0	A
039	179.9	B				100	no CTCSS	

PROGRAMMING EXAMPLES

General Parameter Programming Example

Sample parameter values for this Example are;

Lowest Receive Frequency	= 450 MHz
Maximum Channel Spread	= 40 MHz
Lowest Transmit Frequency	= 430 MHz
PLL Reference Frequency	= 12.5 kHz and 1/128 div.
1st Intermediate Frequency	= 54.5 MHz
Time-Out Timer Period	= 60 seconds
BCLO (Busy Channel Lock Out)	= disabled
Miscellaneous Options	= none

Press Key	Display	Comment
WRITE 1	WITH POWER SW ON	Power ON
A ▼		
A ▼		
A ▼		
A ▼	00	Enable Write Mode
SET DE	02××	
4	02×4	Lowest Receive Frequency
5	0245	
SET DE	03××	
0	03×0	

Press Key	Display	Comment
0	0300	Maximum Channel Spread
SET DE	04xx	
4	04x4	Lowest Transmit Freq.
3	0443	
SET DE	05xx	
0	05x0	
3	0503	PLL Reference Frequency
SET DE	06xx	
3	06x3	1st IF
F/IN #	063F	
SET DE	07xx	
WRITE 1	07x1	Time-Out Timer Period
F/IN #	071F	BCLO disable
SET DE	08FF	
SET DE	09FF	Miscellaneous Options
SET DE	0AFF	
SET DE	0bFF	
SET DE	0CFF	
SET DE	0dFF	
SET DE	0EFF	
SET DE	0FFF	
SET DE	10FF	
SET DE	11FF	
SET DE	12FF	
SET DE	0245	
		Power OFF

New Channel Programming Example

Sample parameter values for this Example are;

Channel No.	=	01
Receive Freq.	=	450.5000 MHz
Transmit Freq.	=	430.5000 MHz
Rx CTCSS Tone Code	=	058 (88.5 Hz)
Tx CTCSS Tone Code	=	059 (82.5 Hz)
Optional Unit		none
Time-Out Timer		disarmed

Channel No.	=	25
Receive Freq.	=	469.8625 MHz
Transmit Freq.	=	467.5125 MHz
Rx CTCSS Tone Code	=	210.7 Hz
Tx CTCSS Tone Code	=	210.7 Hz
Optional Unit		none
Time-Out Timer		disarmed

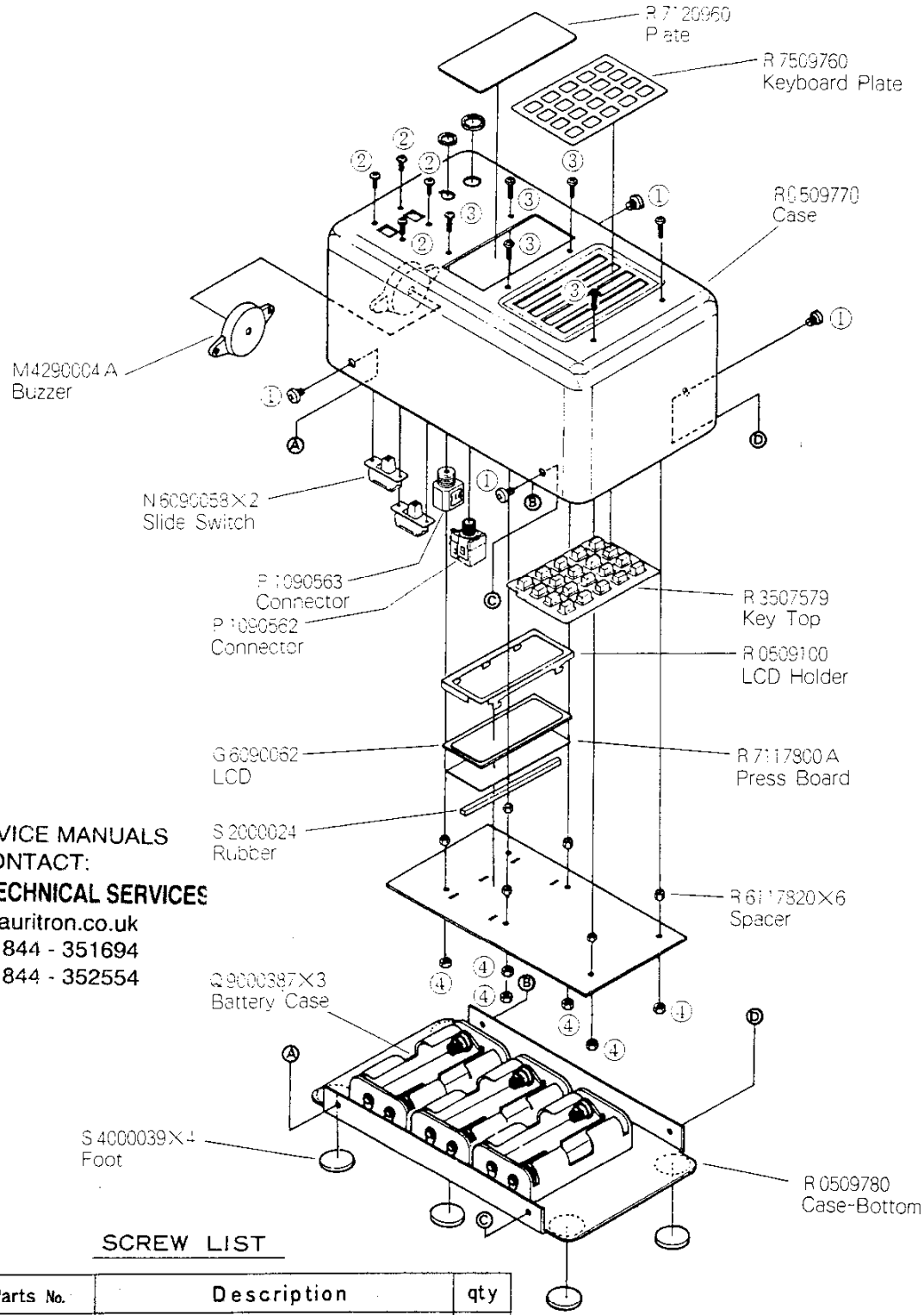
Note that the receive and transmit frequencies in this example correspond with the frequency limits, channel spread and PLL steps in the General Parameter Programming Example. The channel numbers correspond to what would be channels 1 and 2 in an FTL-2007/-7007, or in an FTL-2001/-7002 with 8 or fewer channels.

Press Key	Display	Comment
WRITE 1	WITH POWER SW ON	Power ON
▼		Enable Write Mode
▼		
▼		
▼	00	
0	0	Channel No.01
WRITE 1	01	
SET DE	01	

Press Key	Display	Comment
4	. 4	Receive Freq.
5	. 45	
0	. 450	
5	.4505	
0	4.5050	
0	45.0500	
0	450.5000	
SET DE	450.5000	
4	. 4	Transmit Freq.
3	. 43	
0	. 430	
5	.4305	
0	4.3050	
0	43.0500	
0	430.5000	
SET DE	430.5000	
0	0	RX CTCSS Tone Code
5	05	
8	058	
SET DE	058	
0	0	TX CTCSS Tone Code
5	05	
9	059	
SET DE	059	
WRITE 1	1	Optional Unit none
SET DE	1	
WRITE 1	1	TOT disarmed
SET DE	00	

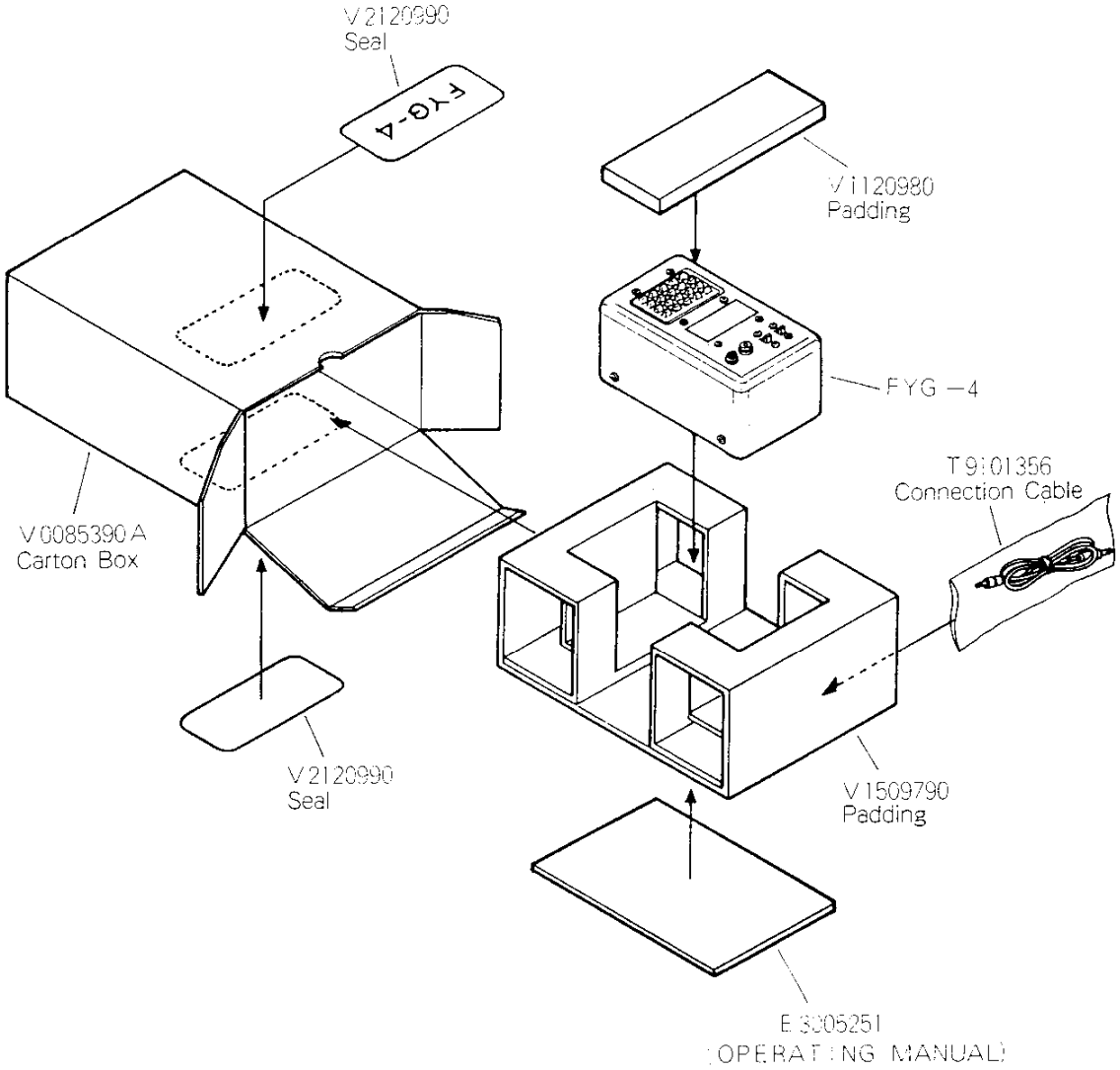
Press Key	Display	Comment
2	2	Channel No.25.
5	25	
SET DE	. 25	
4	. 4	Receive Freq.
6	. 46	
9	. 469	
8	.4698	
6	4.6986	
2	46.9862	
5	469.8625	
SET DE	4698625	
4	. 4	Transmit Freq.
6	. 46	
7	. 467	
5	.4675	
WRITE 1	4.6751	
2	46.7512	
5	467.5125	
SET DE	4675125	
0	0	RX CTCSS Tone Code
3	03	
5	035	
SET DE	035	
SET DE	035	TX CTCSS Tone Code (=RX CTCSS Tone Code)

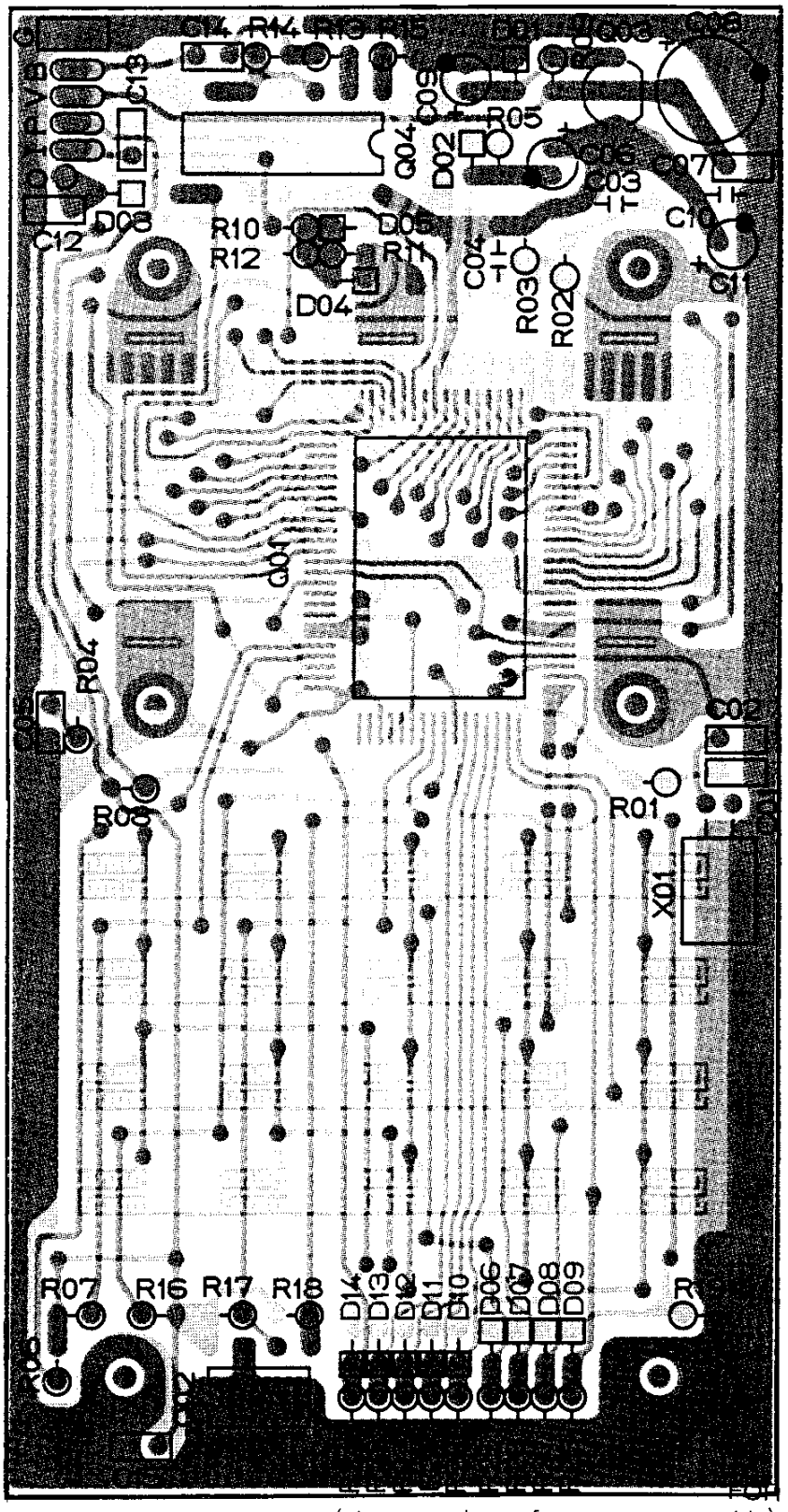
Press Key	Display	Comment
WRITE 1	1	Optional Unit none
SET DE	1	
SET DE	00	TOT disarmed
		Power OFF



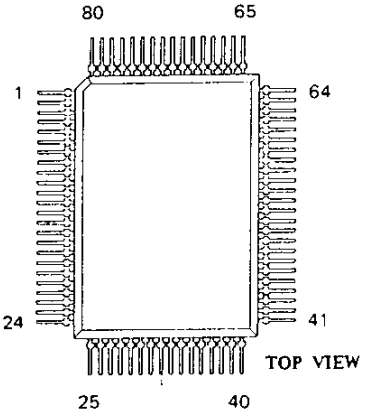
SCREW LIST

Ref No.	Parts No.	Description	qty
①	U20304007	BINDING HEAD SCREW M3×4B	4
②	U00103002	PAN HEAD SCREW M2×3NI	4
③	U20108002	BINDING HEAD SCREW M2×8NI	6
④	U60100301	HEX NUT N2	6

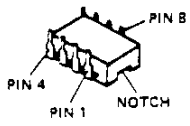




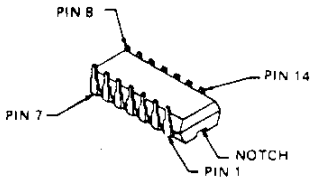
(obverse view of "component" side)



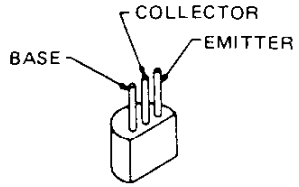
μPD7514G-287-12 (Q101)



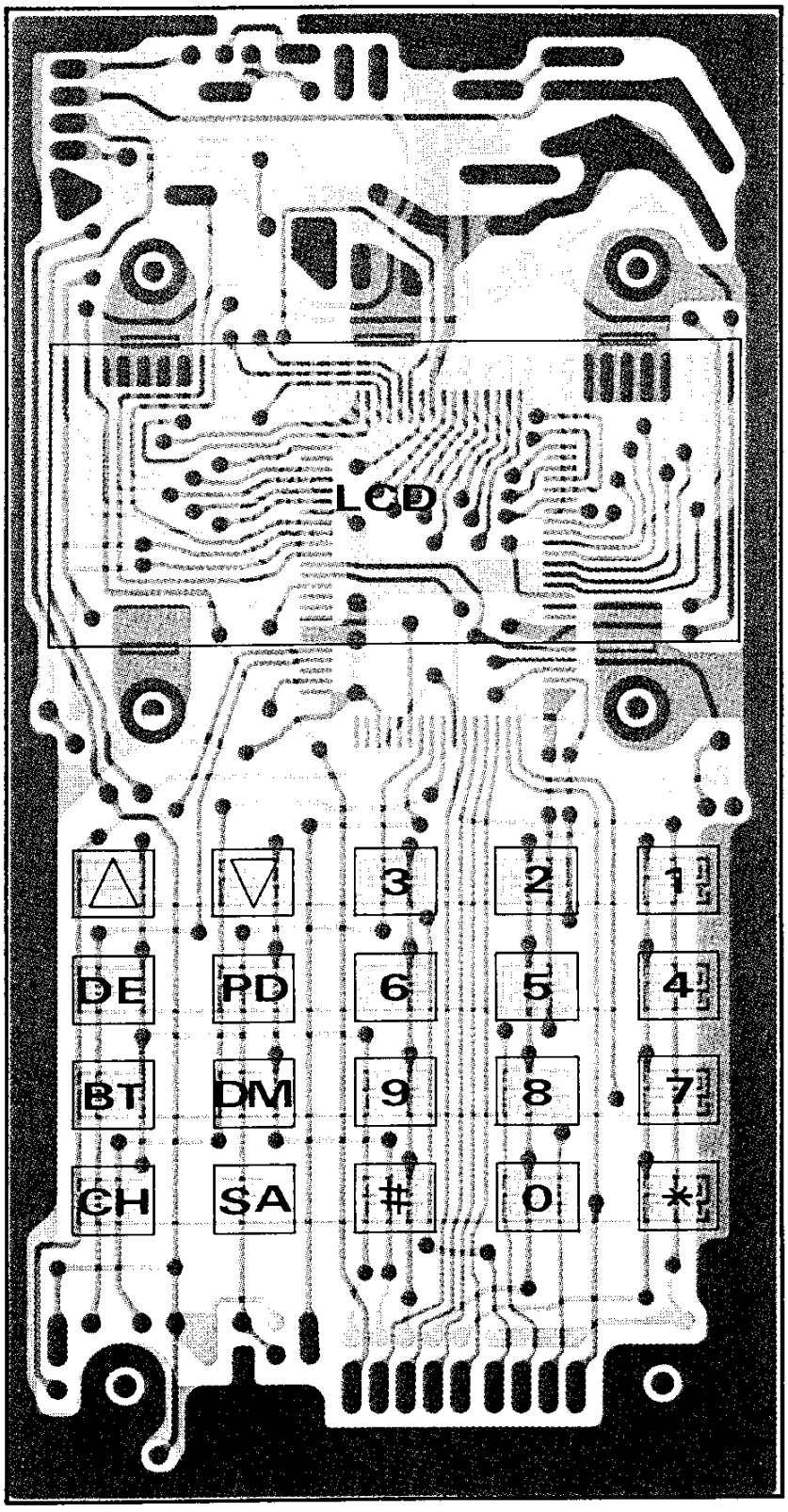
X2404P (Q102)



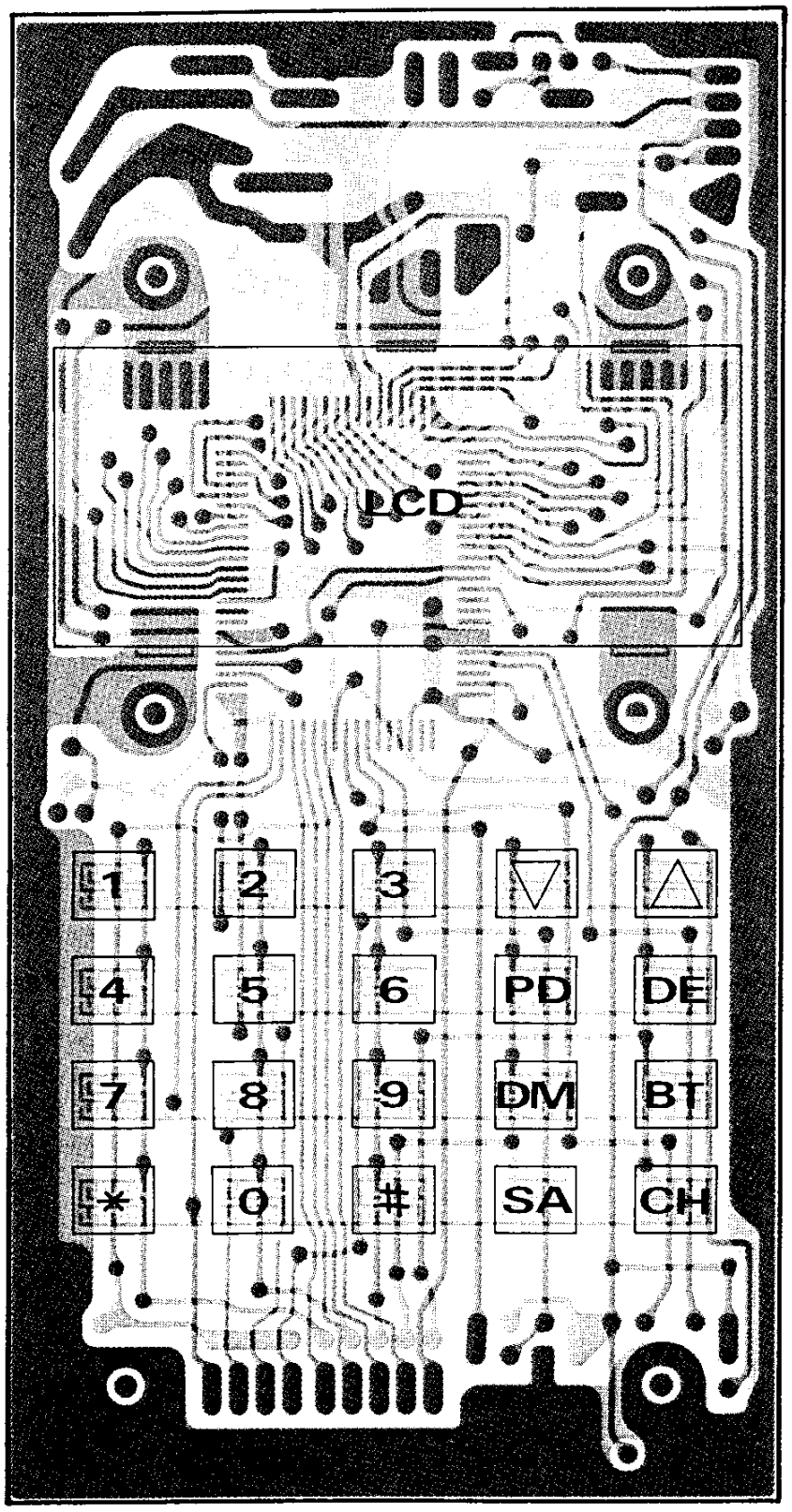
MC14011BCP (Q104)



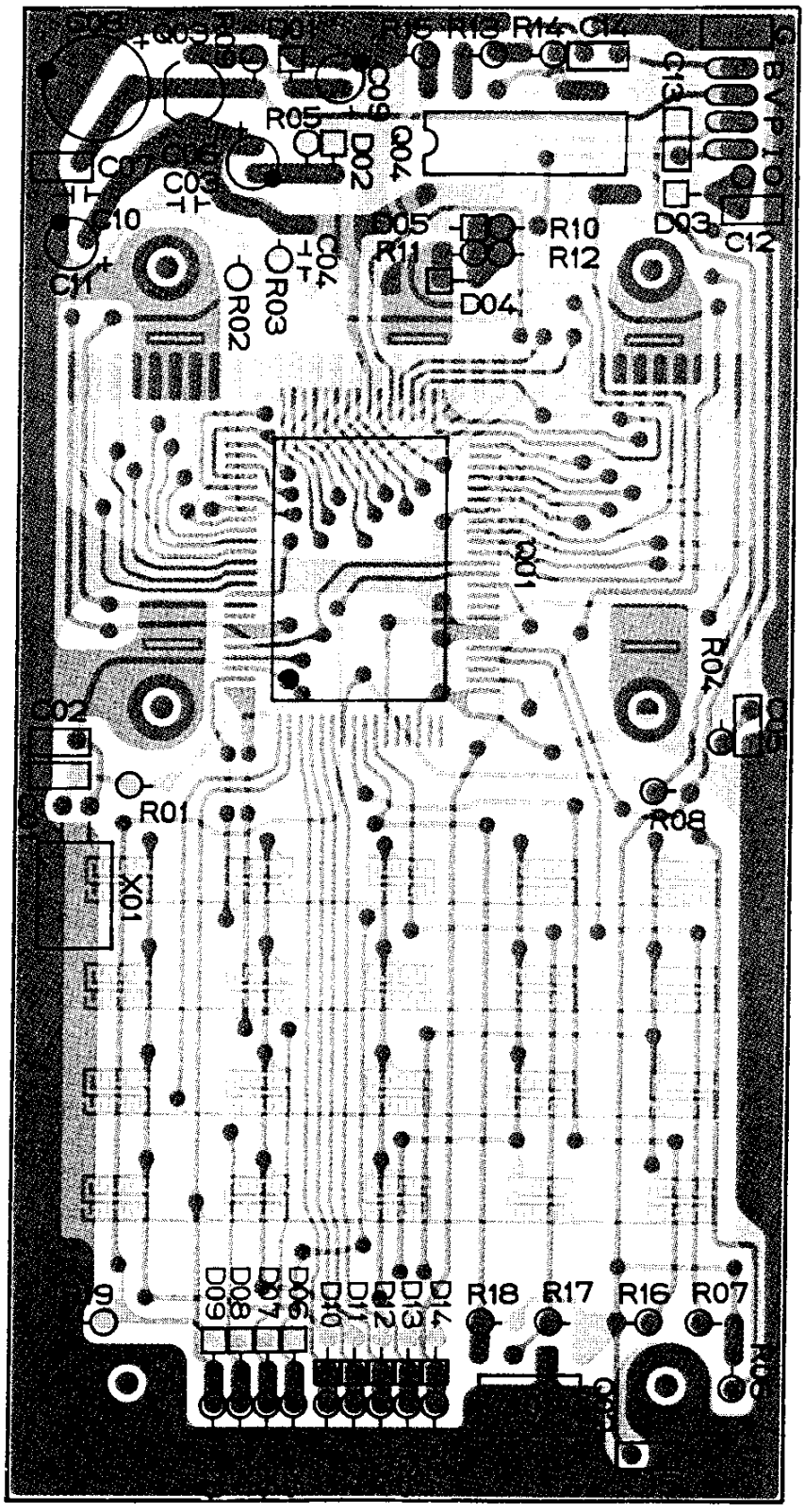
2SD601A (Q103)



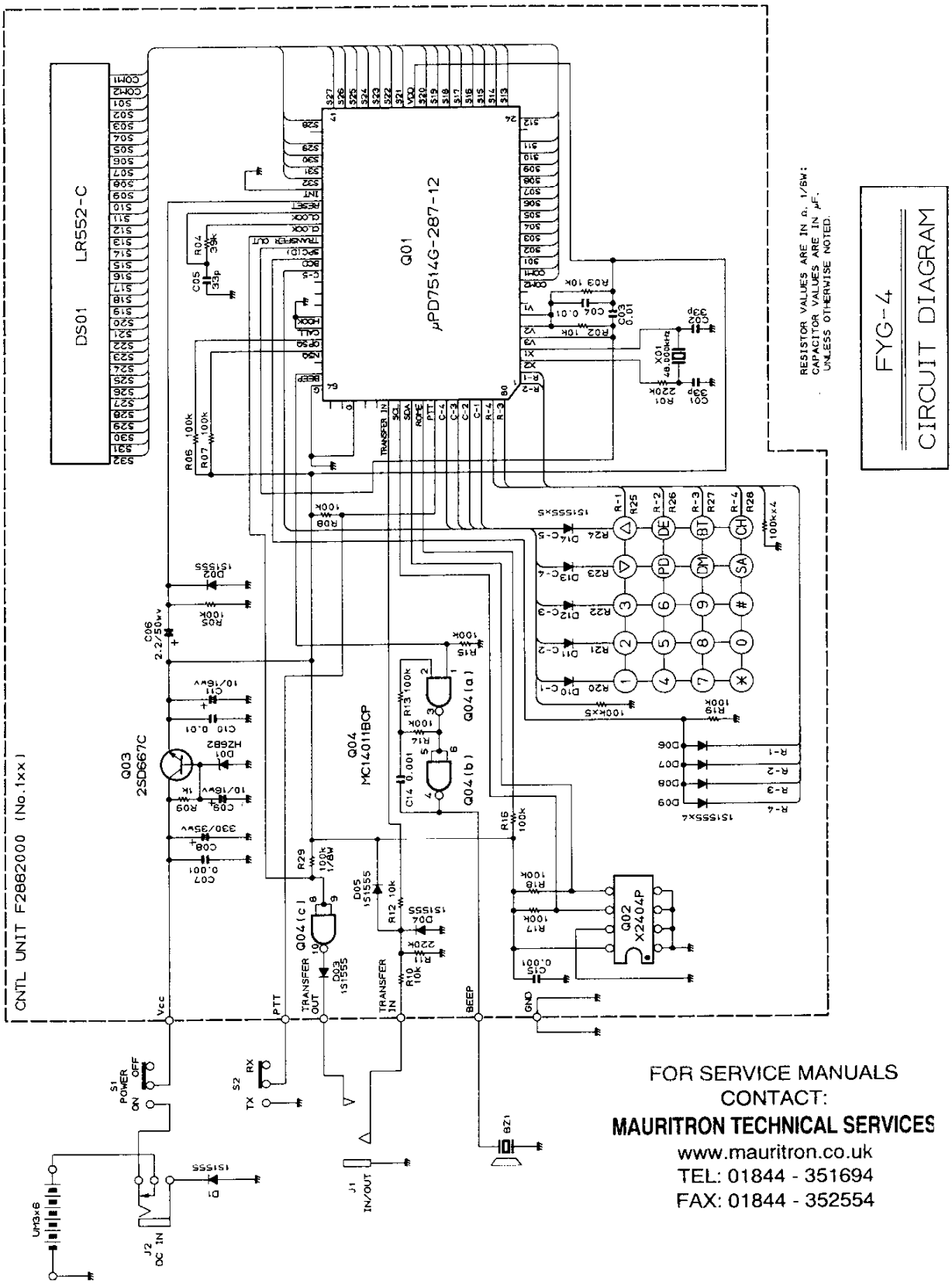
(reverse view of "LCD" side)



(obverse view of "LCD" side)



(reverse view of "component" side)



*** MAIN CHASSIS ***

D1	G2090306	Diode	10E1
S1	N6090058	Slide Switch	
S2	N6090058	Slide Switch	
J1	P1090562	Connector	
J2	P1090562	Connector	
	Q9000387	Battery Case	
	Q9000387	Battery Case	
	Q9000387	Battery Case	
BZ1	M4290004A	Buzzer	

*** CONTROL UNIT ***

	F2882000	Printed Circuit Board	
	C028820AA	PCB w/Components	
Q101	G1090783	IC	uPD7514G-287-12
Q102	G1090782	IC	X2404P
Q103	G3406670C	Transistor	2SD667C
Q104	G1090068	IC	MC14011BCP
D101	G2090113	Diode	HZ6B2
D102	G2015550	Diode	1S1555
D103	G2015550	Diode	1S1555
D104	G2015550	Diode	1S1555
D105	G2015550	Diode	1S1555
D106	G2015550	Diode	1S1555
D107	G2015550	Diode	1S1555
D108	G2015550	Diode	1S1555
D109	G2015550	Diode	1S1555
D110	G2015550	Diode	1S1555
D111	G2015550	Diode	1S1555
D112	G2015550	Diode	1S1555
D113	G2015550	Diode	1S1555
D114	G2015550	Diode	1S1555
DS101	G6090062	LCD	LR552-C
	R0509100	LCD Holder	
	S2000024	Rubber Conductor	
X101	H0102806	Crystal	48.000kHz
R101	J02225224	Carbon Film Res.	220k Ohm 1/6W
R102	J02225103	Carbon Film Res.	10k Ohm 1/6W
R103	J02225103	Carbon Film Res.	10k Ohm 1/6W
R104	J02225393	Carbon Film Res.	39k Ohm 1/6W
R105	J02225104	Carbon Film Res.	100k Ohm 1/6W
R106	J02225104	Carbon Film Res.	100k Ohm 1/6W
R107	J02225104	Carbon Film Res.	100k Ohm 1/6W
R108	J02225104	Carbon Film Res.	100k Ohm 1/6W

R109	J02225102	Carbon Film Res.	1k Ohm	1/6W	
R110	J02225103	Carbon Film Res.	10k Ohm	1/6W	
R111	J02225224	Carbon Film Res.	220k Ohm	1/6W	
R112	J02225103	Carbon Film Res.	10k Ohm	1/6W	
R113	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R114	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R115	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R116	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R117	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R118	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R119	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R120	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R121	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R122	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R123	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R124	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R125	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R126	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R127	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R128	J02225104	Carbon Film Res.	100k Ohm	1/6W	
R129	J02225104	Carbon Film Res.	100k Ohm	1/6W	
C101	K02175330	Ceramic Cap.	33pF	50V	CH
C102	K02175330	Ceramic Cap.	33pF	50V	CH
C103	K10179024	Ceramic Cap.	0.01uF	50V	B
C104	K10179024	Ceramic Cap.	0.01uF	50V	B
C105	K02175330	Ceramic Cap.	33pF	50V	CH
C106	K40179009	Al Electro Cap.	2.2uF	50V	
C107	K10176102	Ceramic Cap.	0.001uF	50V	B
C108	K40169020	Al Electro Cap.	330uF	35V	
C109	K40129004	Al Electro Cap.	10uF	16V	
C110	K10179024	Ceramic Cap.	0.01uF	50V	
C111	K40129004	Al Electro Cap.	10uF	16V	
C114	K10176102	Ceramic Cap.	0.001uF	50V	B
C115	K10176102	Ceramic Cap.	0.001uF	50V	B
J101	P3090060	IC Socket			

NOTES :