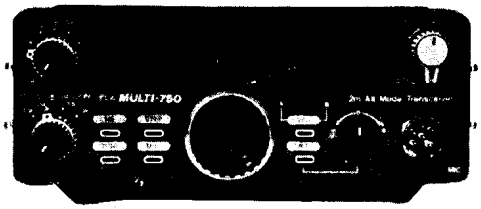
FDK



MULTI-750A/E

2m FM/SSB/CW ALL MODE 1/10W TRANSCEIVER

INSTRUCTION MANUAL

FUKUYAMA ELECTRONICS CO., LTD.

GENERAL INFORMATION

The FUKUYAMA ELECTRONICS CO., LTD. (FDK) Model MULTI-750A/E mobile and base station 2 meter all mode transceiver is reliable and "MULTI" functionable amateur radio unit. It is designed and assembled with selected components to give reliable performance and is all solid-state. In normal use, and with proper care, it will give long and trouble-free service.

Communication range depends upon the usual factors such as antenna in use, operating location, RF output power level and band conditions. Read the manual carefully before putting the equipment into use.

NOTE:

This transceiver has provisions for use with an EXPANDER-430 UHF cross-band transverter system. For further details of specification and method of operation, please refer to the later paragraphs in this manual under the heading "EXPANDER-430 UHF/VHF OPERATION".

TABLE CONTENTS

SPECIFCATIONS

GENERAL;

Frequency range:	144.000 – 145.999.9MHz for 750E, 144.000 – 147.999.9MHz for 750A.
Frequency selection:	100Hz or 5kHz steps using main dial rotary knob, or UP/DOWN Microphone switch on any mode.
Operation mode:	FM: Reactance Mod. (F3), USB/LSB: Balanced. (A3j), CW: Carrier Keying. (A1).
Antenna impedance:	50 – 52 ohms (unbalanced).
Power supply:	11 – 15 volts DC (Negative ground), 13.8 volts nominal.
Power consumption:	3 Amps at 10W Transmit, 2 Amps at 1W Transmit, .8 Amps at Audio Max. on Receive, .4 Amps at Audio Squelched. 1.5 mA at Back-up (typical) current.
Operation temperature:	–10° C to +60° C.
Frequency stability:	Less than 500Hz after 1–30 Min, Less than 200Hz after 1 Hour.
Dimensions:	163W x 73H x 260D in mm.
Weight:	Approx. 2.6Kg (without Acc's).

TRANSMITTER;

R.F output power:	10 Watts at High, 1W at Low (by rear switch).
Max. Deviation:	+/–5kHz (factory pre-set).
Unwanted spurious:	Better than 60dB.
Carrier suppression:	Better than 40dB below carrier.
Sideband suppression:	Better than 40dB below carrier.
Microphone impedance:	500 – 600 ohms dynamic microphone with Up/Down counter switch and PTT function switch.

RECEIVER;

Receiving system:	USB/LSB & CW: Single-Superheterodyne, FM: Double-superheterodyne.
Intermediate frequency:	1st: 10.7MHz, 2nd: 455kHz.
Sensitivity:	SSB/CW: –8dBu at 10dB S/N, FM: –4dBu at 20dB Noise Quieting.
	Better than 60dB below carrier.
	SSB/CW: More than 2.2kHz at –6 dB, Less than 6 kHz at –60dB.
	FM: More than 15kHz at –6dB, Less than 25kHz at –70dB.
Audio output power:	More than 1.2 watts at 10% T.H.D.
Audio impedance:	8 ohms.

NOTE: The specifications may change without notice due to technical improvements.

OUTSTANDING FEATURES

* Compact Size and Simple Operation with Many Features:

Although only the same size as an ordinary FM transceiver, the MULTI-750 has all the facilities and features of a MULTI-MODE base station. For SSB operation there is an SSB/CW Noise Blanker, R. F. gain control, RIT and 100Hz or 5kHz click stop tuning steps using endless rotary switch.
For FM operation, features include SQUELCH control, SIMPLEX/+ or – REPEATER offset/FREE split CROSS operation selector, MHz shift/Step, Tone-Burst/and two VFO function using built-in memory.

* Green Digital Frequency Display for Accurate and Safe Readout:

The large Green Fluorescent Displayer indicates frequency down to 100Hz and provides clear readout for safe day or night operation.

* A Dual VFO Selects Two Independent Frequencies Anywhere in the Band:

VFO A and B permit 2 independent frequencies to be programmed anywhre in the frequency range and on any mode. In addition, they may also be used for VHF or UHF band operation and CROSS-BAND VHF/UHF operation when used in conjunction with the optional EXPANDER-430 UHF transverter.

* Excellent Cross-modulation Characteristics, Sideband Suppression, and Output Protection Circuits:

Band pass Helical-Resonator section with dualgate MOSFET in receiver Front-end gives improved rejection of adjacent service and greater freedom from cross-modulation and blocking. In the event of accidental high VSWR or open/short circuit antenna connection, the power input to the transmitter section is automatically reduced.

* Selectable R.F. Output Power and Discrete P.A Stage:

The desired R.F output power of either 1 watt or 10 watts can be selected for both SSB/CW and FM operation. The linear amplifier comprises discrete components rather than a hy-brid package in order to ensure clean and spurious free output.

CONTROLS AND LAYOUT:

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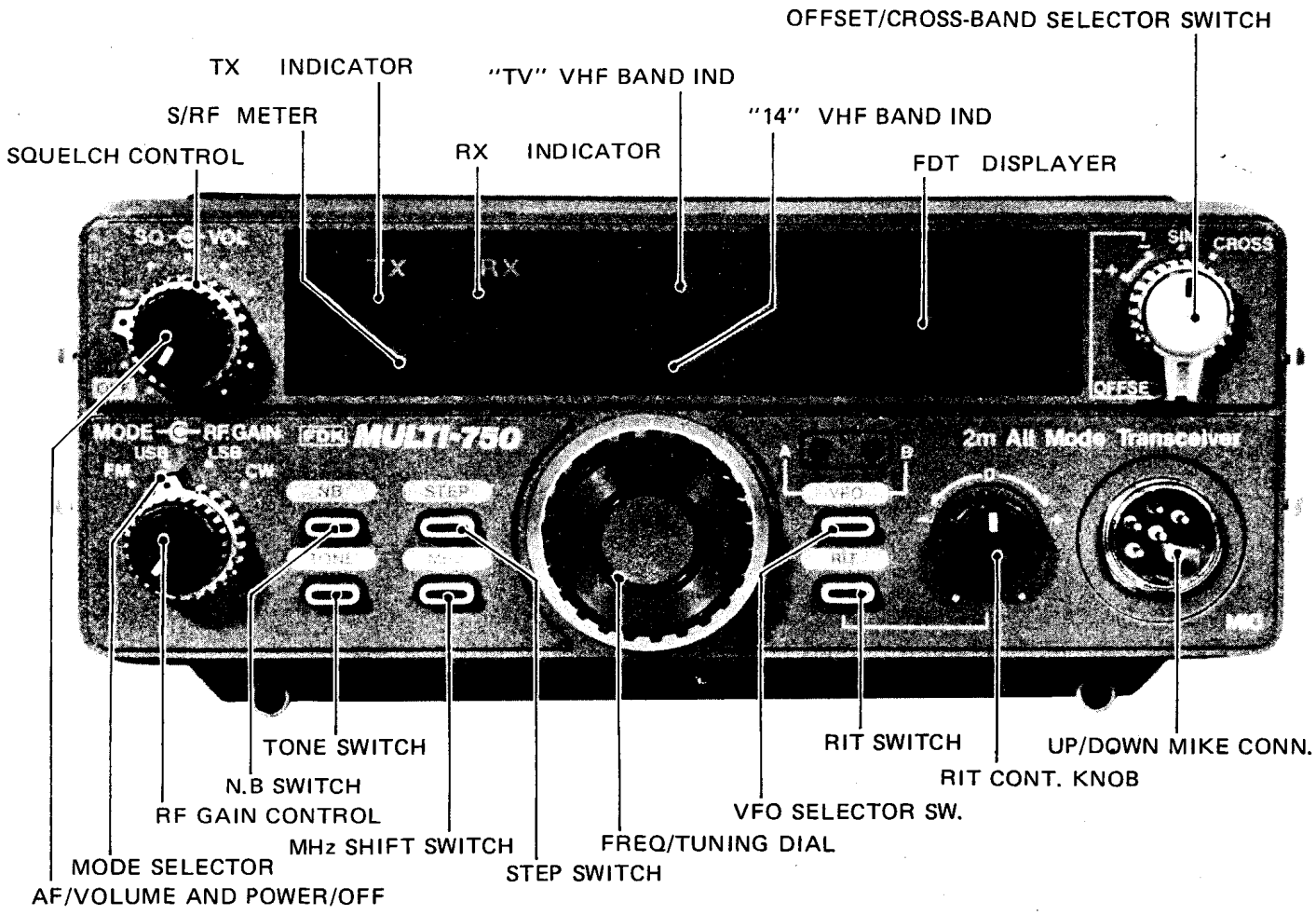

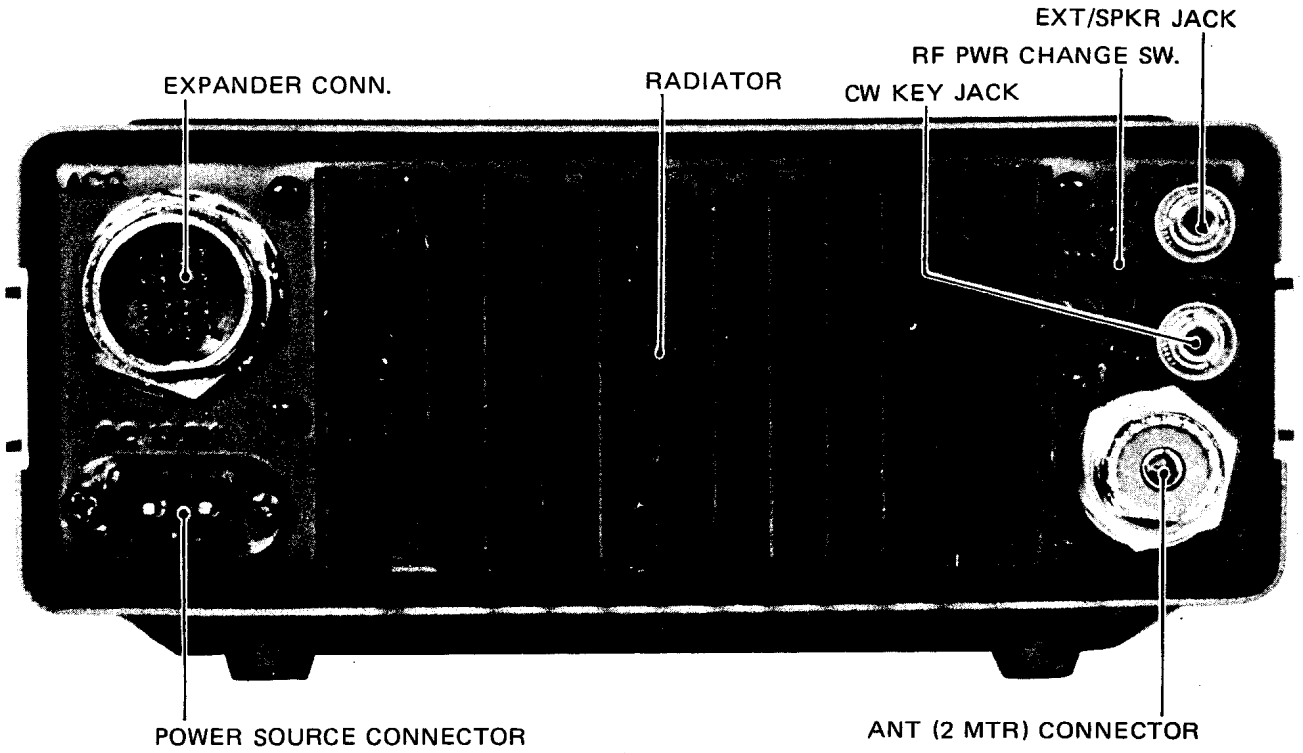

TOP VIEW WITH COVER REMOVED:

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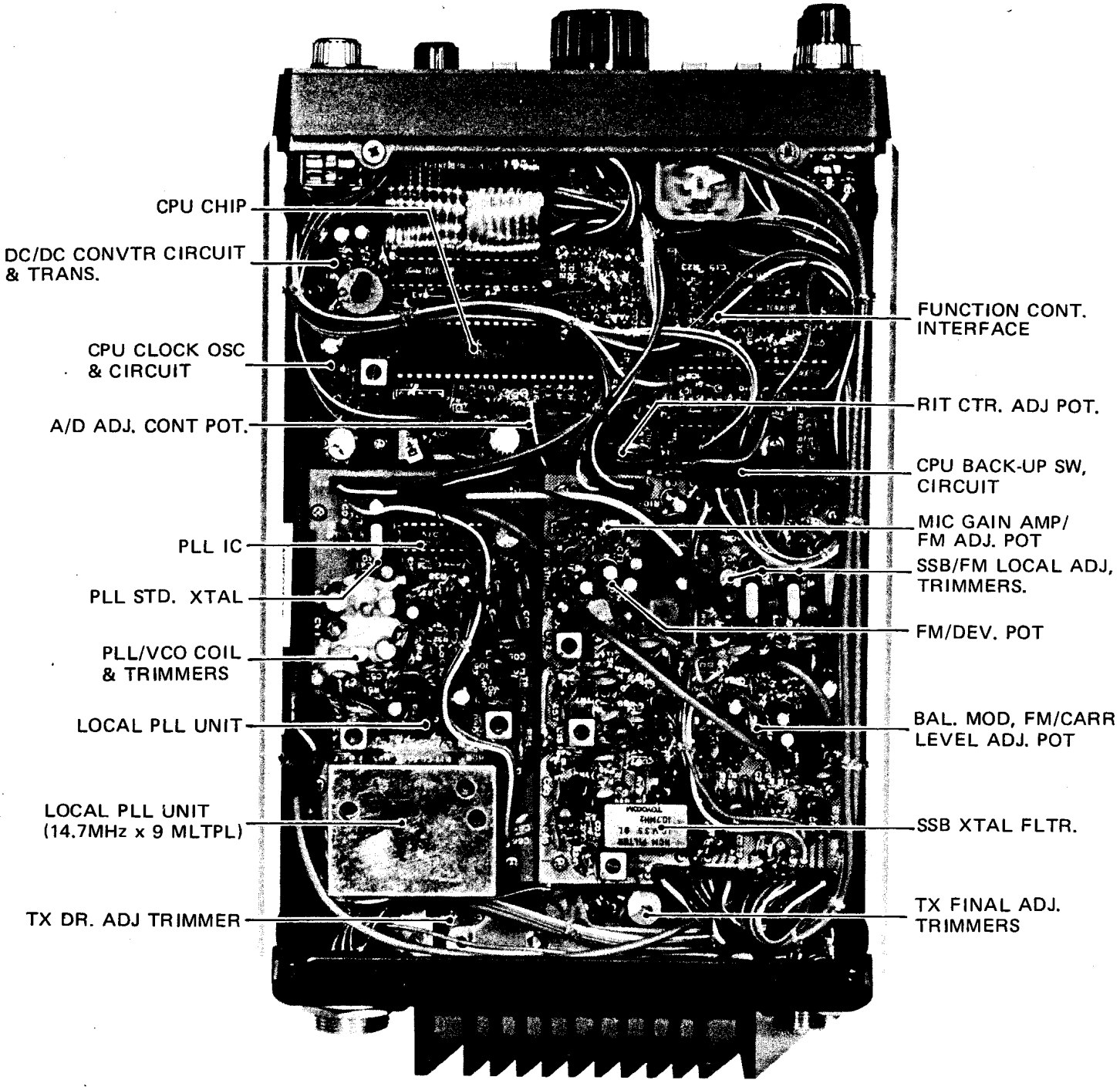
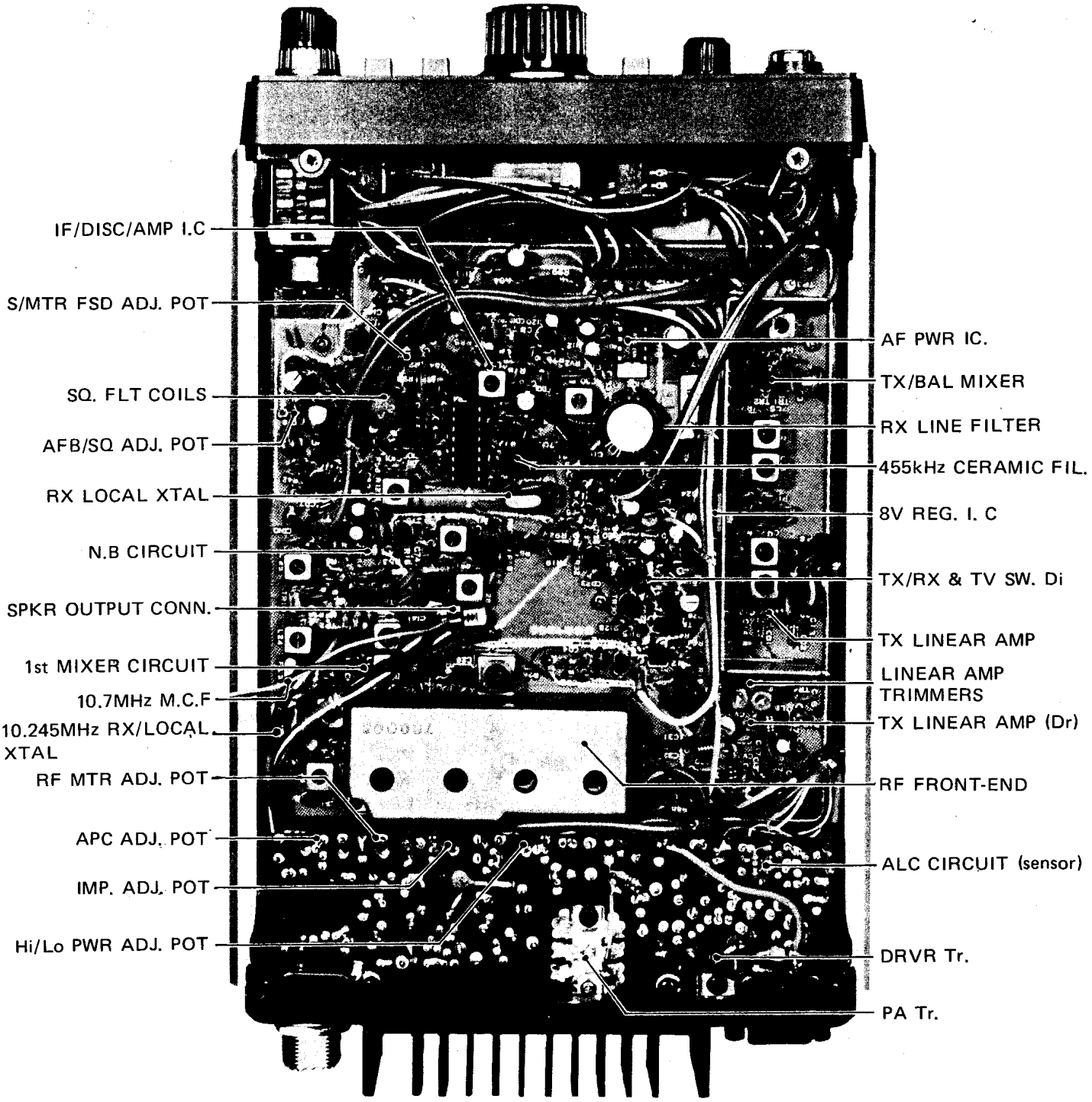


BOTTOM VIEW WITH COVER REMOVED



CONTROL FUNCTIONS

* OFF/VOLUME CONTROL

This is combined with an ON/OFF power switch and VOLUME control, which adjusts the received signals to a comfortable level.

* SQUELCH CONTROL

The outer knob SQUELCH control is used to mute the receiver in the absence of incoming signals, and removes the annoying rushing sound that would otherwise be present.
It is normally rotated clockwise until the background noise just disappears without an incoming signal. To advance the control beyond this point could mean missing a weak signal. This squelch control is not operational on the CW/SSB modes.

* RF GAIN CONTROL

Provides manual control of the receiver RF gain on both SSB/CW and FM modes. Although primarily intended for SSB/CW operation it may also be used on FM to prevent Front-end blocking in the presence of extremely strong signals.

* MODE SELECTOR SWITCH

This outer control selects the mode indicated immediately above the knob.

* S/RF METER

Indicates the strength of incoming signals on receive, and gives a relative power output indication on transmit.
The normal reading at full power output is approx. 80% of full scale but, can vary higher or lower if the antenna matching (VSWR) is higher than usual.

* NOISE-BLANKER SWITCH

In case of ignition pulse noise interference as caused by automobiles, etc., the Noise-Blanker switch is pushed on.
This only operates on SSB/CW and will enable even weak signals to be heard clearly.

* STEP SWITCH

With the switch in the OFF position each step on the tunign dial is 100Hz and when pushed ON the steps are 5kHz for any mode.

* TONE SWITCH

This TONE switch selects TONE-BURST function. The European model has 1,750Hz approx. 1 sec, Tone-Burst installed. This tone is activated in FM mode position with microphone PTT switch, and is used for repeater access operation.

* MHz STEP SWITCH

Selects the range 144 to 145MHz or 145 to 144MHz (750E) and 144-145-146-147MHz (750A) then returns to 144MHz.

NOTE:

This switch not only gives 1MHz steps between 144-145 MHz or 144-147MHz, but also 1MHz steps between 430-439MHz when connected with the EXPANDER-430 UHF transverter unit.
The frequency can automatically be read on the frequency display which shows the last MEGAHERTZ digit of frequency plus 4 digits to 100Hz.
For further details of EXPANDER-430 UHF operation and frequency display, please refer to operating procedure in instruction manual.

* MAIN TUNING DIAL

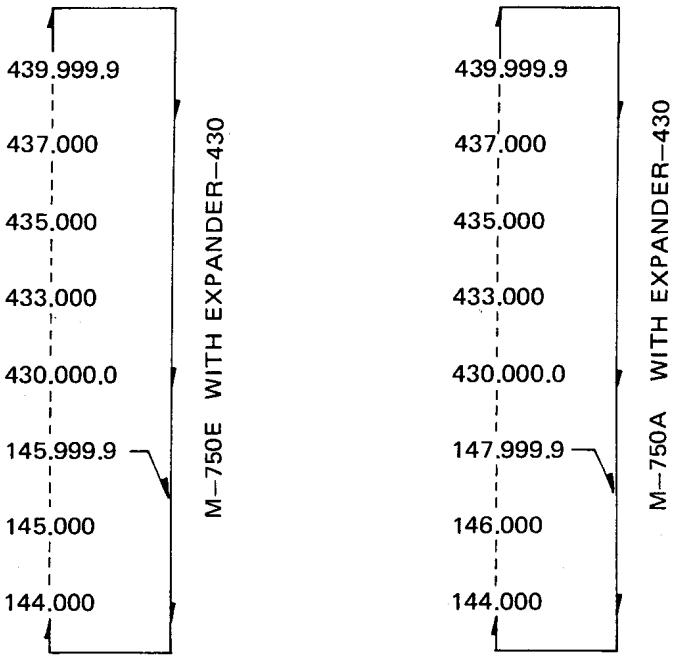
Selects the frequency in either 100Hz or 5kHz steps by STEP push switch. This rotary switch continuously covers the entire the frequency range of the transceiver, even in UHF band frequency, if used with EXPANDER-430 UHF band transverter operation.

* SELECTOR SWITCH

This changes the OFFSET + or — and also provides SIMPLEX or "CROSS" operation between A and B VFO frequencies.
This "CROSS" position operates with the optional EXPANDER-430 UHF band linear transverter providing VHF/UHF operation possibilities as follows;

For both, shift frequency is 100Hz or 5kHz steps continuously through 145.999.9MHz or 147.999.9MH— to 430.000MHz on up to 439.999.9MHz when connected with the EXPANDER-430 UHF transverter unit.

CONTROL FUNCTIONS



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For desired mono-band or cross-band VHF/UHF OFFSET using "CROSS" operation, simply set the required frequencies using both VFO A and VFO B. Selects the desired receive frequency on VFO A or B. The other VFO will then be "TRANSMIT" channel when using "CROSS" operation. For reverse operation just push VFO selector again.

* FREQUENCY DISPLAY

The Five digit Fluorescent Display Tube gives an accurate frequency display from internal frequency synthesizer and also last MEGAHERTZ digit of UHF transverter.
It also displays programmed OFFSET and VHF/UHF cross-band frequencies when used with EXPANDER-430. However, it does not display RIT frequency deviation on reception.

* VFO SELECTOR SWITCH

When programmed, the frequencies in A or B VFO can instantly be recalled backwards and forwards. This permits 2 channel operation and VFO A or B is indicated by LED indicators.
This VFO function can also be used for CROSS-BAND/ SHIFT operation when selector switch is set to "CROSS" position.

Once each VFO has been programmed with desired frequency, the selector can be set to "CROSS". This then permits transmit on "A" and receive on "B" or vise versa. The true frequency is indicated on digital display.

* RIT CONTROL KNOB & SWITCH

The RIT covers approx. +/—2.5kHz from the center of the "0" position. Receiver Incremental Tuning gives proper adjustment of incoming frequency at the receiver without tuning the main dial or transmitter frequency when RIT switch is pushed "ON".

* MIKE CONNECTOR

This unit is supplied with a Push-To-Talk Up/Down counter control microphone. If using replacement microphone, use dynamic type of 500—600 ohms impedance.
The Up/Down control switch is supplied with 5 volts DC common line. For further details and wiring, consult general assembly diagram.

* ACCESSORY SOCKET

This is for use with EXPANDER-430 UHF linear transverter control connection. Do not extend to use these pins or short any of the connector pins.

* EXT. SPEAKER JACK

Internal speaker disconnected when used for an external speaker.

CONTROL FUNCTIONS

* KEY JACK

This socket is used for CW Telegraph/Electronic Keyer. The Keyer used should have good contacts in order to avoid key-click appearing on transmission.

* ANTENNA CONNECTOR

This female (SO-239) UHF connector connects to a suitable resonated 2 meter antenna. If the antenna or cable is open or shorted, will automatically operate transmitter power protection circuit.

* DC 13.8V POWER SOURCE

Battery voltage should be checked on transmit load as if this falls much below 12 volts, output power, stability and quality will suffer. Must be correct connection to battery polarity with supply BLACK (Negative) and RED (Positive) twin cable.
When using a power supply unit, it must be of a regulated type and capable of more than 3 Amps at 13.8 volts for the full 10 watts output power to be obtained.

ACCESSORY

Microphone (Up/Down + PTT) with plug	1
Microphone hanger	1
Mibile Mounting bracket with screws	1
Red/Black twin power cord with plug	1
EXT/SPKR & CW KEY plugs	2
Desk top angle stand	1
Glass fuse (6 Amps)	1
Instruction manual	1

GENERAL OPERATION

Connect the DC power cable to a proper power source, plug in suitable antenna and connect up microphone. For CW operation and external speaker use appropriate plugs.

RECEIVER OPERATION:

The receiver becomes operative when the audio volume control is rotated clockwise. The power switch is a part of the volume control and power is ON, unless turned fully counterclockwise. Adjust the audio volume control to appropriate sound level.

After turning power on, allow 1 to 2 seconds for FDT frequency displayer to reach full brightness. It should read 4.000MHz. Select the appropriate frequency for the mode of operation desired, using main tuning dial and 1MHz step switch.

FM OPERATION:

Set the mode selector switch to the FM position with the selector switch in SIMPLEX position. The required frequency can now be set in 5kHz steps. For rapid tuning the 1MHz step button may also be used. The frequency may also be selected by the hand UP/DOWN Microphone control. Two desired frequencies can be quickly recalled by selecting frequencies on both VFO A and B.

In the FM mode all controls are operative with the exception of the Noise Blanker.

With the R.F gain control almost fully clockwise, the squelch control should be set either just below noise level, or at a setting that will open the receiver at a desired level of incoming signal.

SSB/CW OPERATION:

For operation on SSB, preset the controls on the front panel as below; The RF gain control fully clockwise, set the MODE switch to the desired sideband positon, Select the frequency as required, and select SIMPLEX or CROSS position.

If looking for stations on SSB or CW first set the step switch to 5kHz. Then rotate dial slowly or press UP/DOWN mic control. As soon as any signal is heard, return step switch to 100Hz for final tuning. When using 5kHz steps, rapid tuning of the band can be made to look for any active stations.

For CW operation set the mode switch to CW positon and tune as for sideband reception described above.

TRANSMITTER OPERATION:

It is good operating practice to use the minimum R.F output power to secure good communication, according to distance and band conditions. Output level is controlled by the rear panel "High/Low" switch.

The transmitter becomes operative on FM/SSB when the microphone is plugged in and the Push-To-Talk switch is depressed. On CW a telegraph or electronic key must be plugged into rear socket of transceiver and the PTT switch depressed. The "CROSS" position is used with the two VFO channels and also with the EXPANDER-430 UHF transverter for VHF/UHF cross-band operation or mono-band "FREESPLIT" operation.

CROSS OPERATION: (DUPLEX)

The CROSS function switch selects two independent VFO's, A & B, and provides transmit and receive on two different frequencies anywhere in the transceiver frequency range. These two VFO's act like memories and retain the selected frequencies at all times whilst the power source is connected. (If the power source or battery is disconnected, the memory will be lost).

When the power switch is first operated the transceiver should automatically select VFO "A" but the other desired frequency will still be retained in VFO "B". This is desirable when VFO "A" and "B" are used for a particular in-band frequency offset and with optional EXPANDER-430 UHF transverter for CROSS-BAND or VHF/UHF operation.

For reverse frequency shift operation, simply push the VFO selector switch once. This reverses the transmit and receive frequencies.

REMOVAL OF TOP/BOTTOM COVERS AND FRONT/CHASSIS PANEL:

TOP COVER REMOVAL:

1) For programming offset frequency diode-matrix diodes on the channel switching board.

   NOTE:
   Do not remove CPU from the socket as this CPU is easily damaged by static and careful handling is necessary. If it is necessary to remove this unit for servicing or inspection, it is essential that the work is carried out at your local distributor or service depot.

2) Meter, LED displayer output leads from behind front panel to printed boards.

3) Local/Main PLL unit.

4) Microphone amplifier/Transmitter local crystal oscillator, Deviation and 10.7MHz IF amplifier unit.

5) Final amplifier unit output power adjustment trimmers.

To remove the upper cover take out four black screws. Lift streight up to clear.

BOTTOM COVER REMOVAL:

1) Audio amplifier, Squelch circuit, all DC switching control circuit, R.F fronted resonator, Signal/Sensitivity meter adjustment pots, Speaker output connectors, Transverter input harness of the main receiver board.

2) Transmitter balanced mixer and low level amplifier, Transmitter pre-driver amplifier and final amplifier unit with Driver/Power transistors also protection/ALC/RF meter and power adjustment pots.

To remove the bottom side take out four black screws, and slightly lift. It may also be necessary to remove speaker connector leads from the receiver board. (Removal speaker leads, just lift the white plastic, when replace, put the leads into the hole and push down the white plastic connector cover.)

FRONT/CHASSIS PANEL:

It is necessary to remove both TOP/BOTTOM covers and both end hanger rails before removal of the FRONT panel and CHASSIS panel mount. Specially this front PANEL/ CHASSIS are not completely removal. Move only bottom side for replacing or changing the function switch and controls.

Move slowly with great care all above thin wires and ribbon displayer leads, and on no account use any force as this will damage wiring.

WARNING:

THE ABOVE PANELS AND COVERS SHOULD BE REMOVED IF THE OWNER HAS NECESSARY TECHNICAL ABILITY TO CARRY OUT THE REQUIRED ADJUSTMENT ONLY.
SUITABLE TEST EQUIPMENT AND TOOLS MUST BE AVAILABLE. OTHERWISE REFER TO DEALER OR DISTRIBUTOR FOR SERVICE OR MAINTENANCE.

UHF BAND OFFSET FREQUENCY PROGRAM:

This unit "OFFSET FREQUENCY" has been programmed with a +/—600kHz in VHF band and a UHF band +/—1.6 MHz, +/—5MHz or +/—7.6MHz frequencies before shipment from factory.

The UHF offset frequency is selected automatically when connected for use with EXPANDER-430 UHF band transverter. It should only be necessary to change the program if the shift does not suit your local repeater. This modification only changers the UHF frequency shift and does not later the +/—600kHz VHF shift.

The +/—600kHz VHF band offset frequency is independent logically programmed on the CHANNEL-SWITCHING board, if not connection with a EXPANDER-430 UHF transverter unit offset function will operates +/—600kHz only.

NOTE:
The MULTI-750A/E is normally programmed to suit local UHF repeater shifts. Before making any alternations be sure to check the exact frequency shift needed for your local repeater.

MODIFICATION:

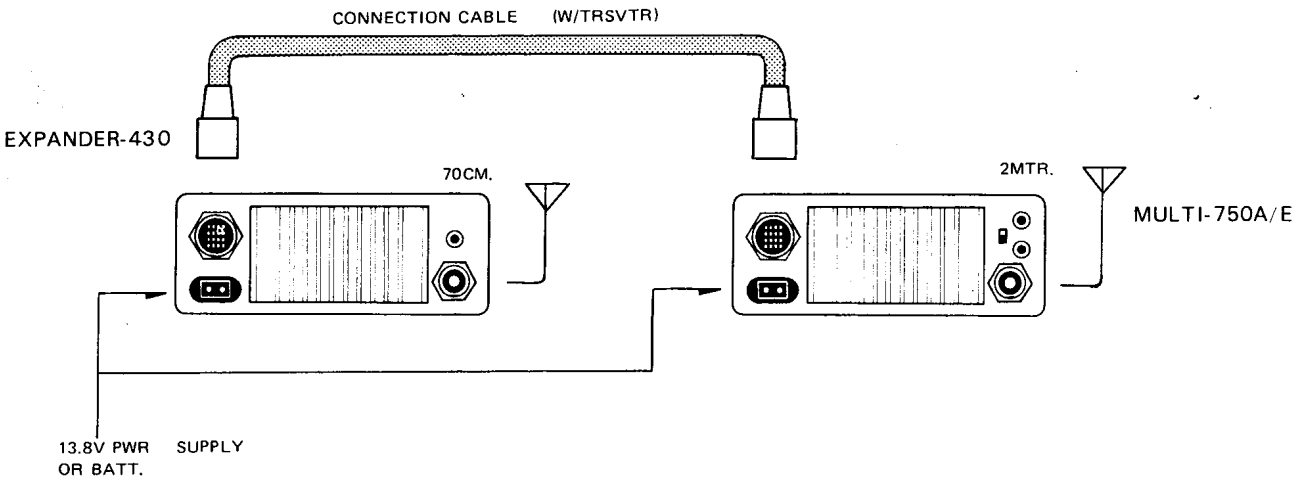
1) Remove the upper cover of the transceiver.
2) Locate the middle of the CHANNEL-SWITCHING board and view from front. It is not recommended that any attempt should be made to remove the whole of this board from the chassis mount. Soldering should take place on the top surface (component side) of the board. Therefore, make sure that there is sufficient space for your soldering iron. Only use a small low wattage iron.
3) If necessary, when confirming diode position with your rig, remove the "P-10" connector with leads from the CHANNEL-SWITCHING board and "P-8" connector with leads.
4) When removing or replacing a diode, be sure to use a clean soldering iron and avoid overheating the diode. Also make sure that no other components or the foil track are shorted out.
5) Check once again after completing work that the diode is properly soldered and that it has been connected to the right palce on the circuit board.

ALWAYS ENSURE THAT DIODE ARE CONNECTED THE RIGHT WAY AROUND AND THAT ARE NOT TOUCHING ONE ANOTHER. FAILURE TO OBSERVE THIS MAY RESULT IN PERMANENT DAMAGE.

NOTE:
Modification diodes are not provided with this transceiver. Use any kind of silicon type diode if required. (example; 1N-914, 1S-1588 etc.,).

EXPANDER-430 UHF/VHF BAND OPERATION:

CONNECTION PROCEDURE:



The special connecting cable should be plugged into the rear of the MULTI-750A/E and EXPANDER-430 transverter unit.

Separate 2 meter and 70cm antennas should be used. Both antennas should be resonant within the desired operating frequency range and have the correct impedance of 50 ohms.

It is recommended that both VHF and UHF antennas have a VSWR of less than 1.5:1 and that the longest possible diameter coax be used on 70cm.

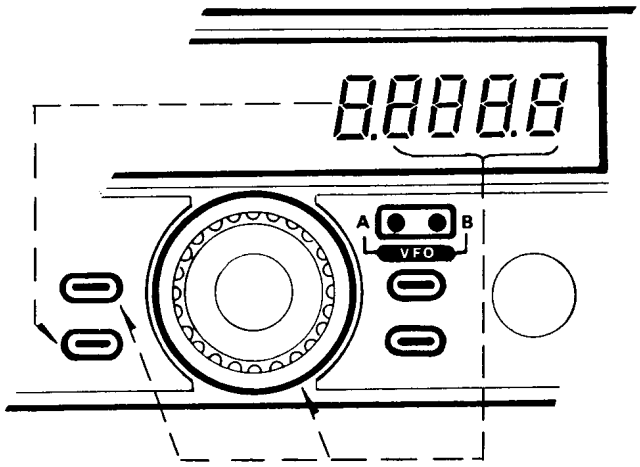
COMPREHENSIVE OPERATION:

In order to recognize the exact operating frequency of the MULTI-750A/E PLUS EXPANDER-430 combinations, observe the designation of the function selected by the "Selector Switch" and the frequency displayed by the "MHz" step switch. The "MHz" starts at 144 and goes up to 439 MHz in ONE MEGAHERTZ steps. However, the Kilohertz/Hertz frequency will only be controlled by main dial knob.

If operating only on the VHF band the "14" LED should be displayed at all times. If the "TV" light operates, this indicates that the EXPANDER-430 has been activated.

The offset and simplex operations should be selected as desired by the selector function switch which operates up to 439.999.9 MHz.

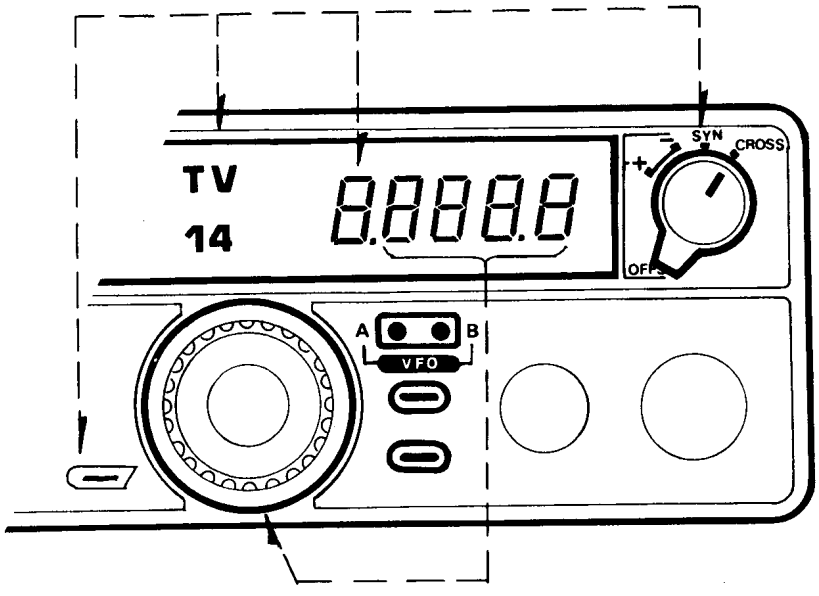
Normal +/–600kHz offset is automatically selected whilst operating in the VHF (144–146/144–148 MHz) range. When the frequency goes onto the "TV" position the frequency is in the UHF (430–440 MHz) band and repeater shift changes automatically to 1.6, 5 or 7.6 MHz depending on local programming requirements.



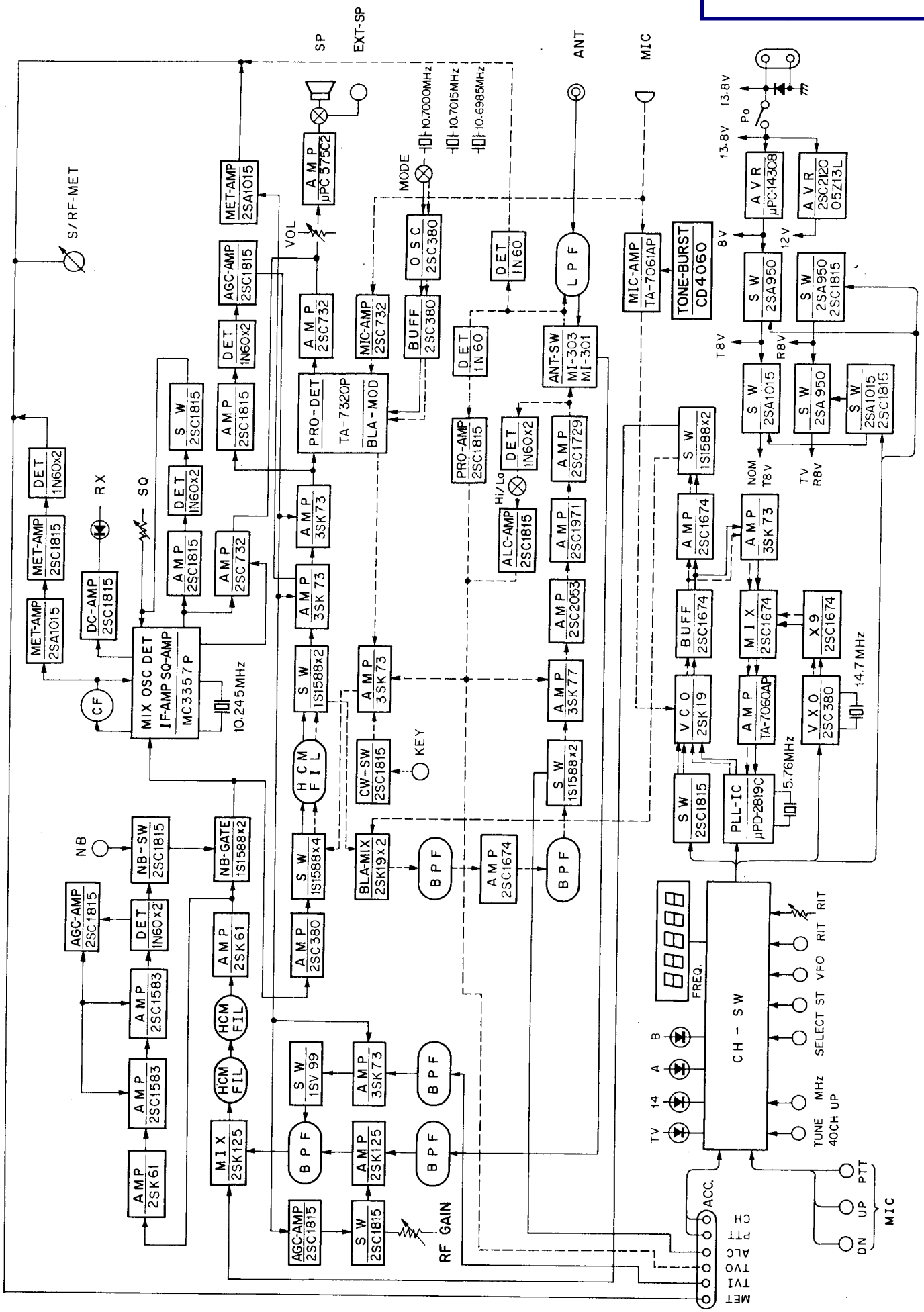
If it is desired to use any other UHF repeater offset or VHF offset or combined VHF/UHF offset, this can be programmed by user. Even shifts as small as 100 Hz can be used.

This free programmable offset uses the facilities of VFO "A" & "B" function switch with the selector switch in the "CROSS" position. VFO A can be used for receive and VFO B for transmit or vise versa. Three possibilities are then available;

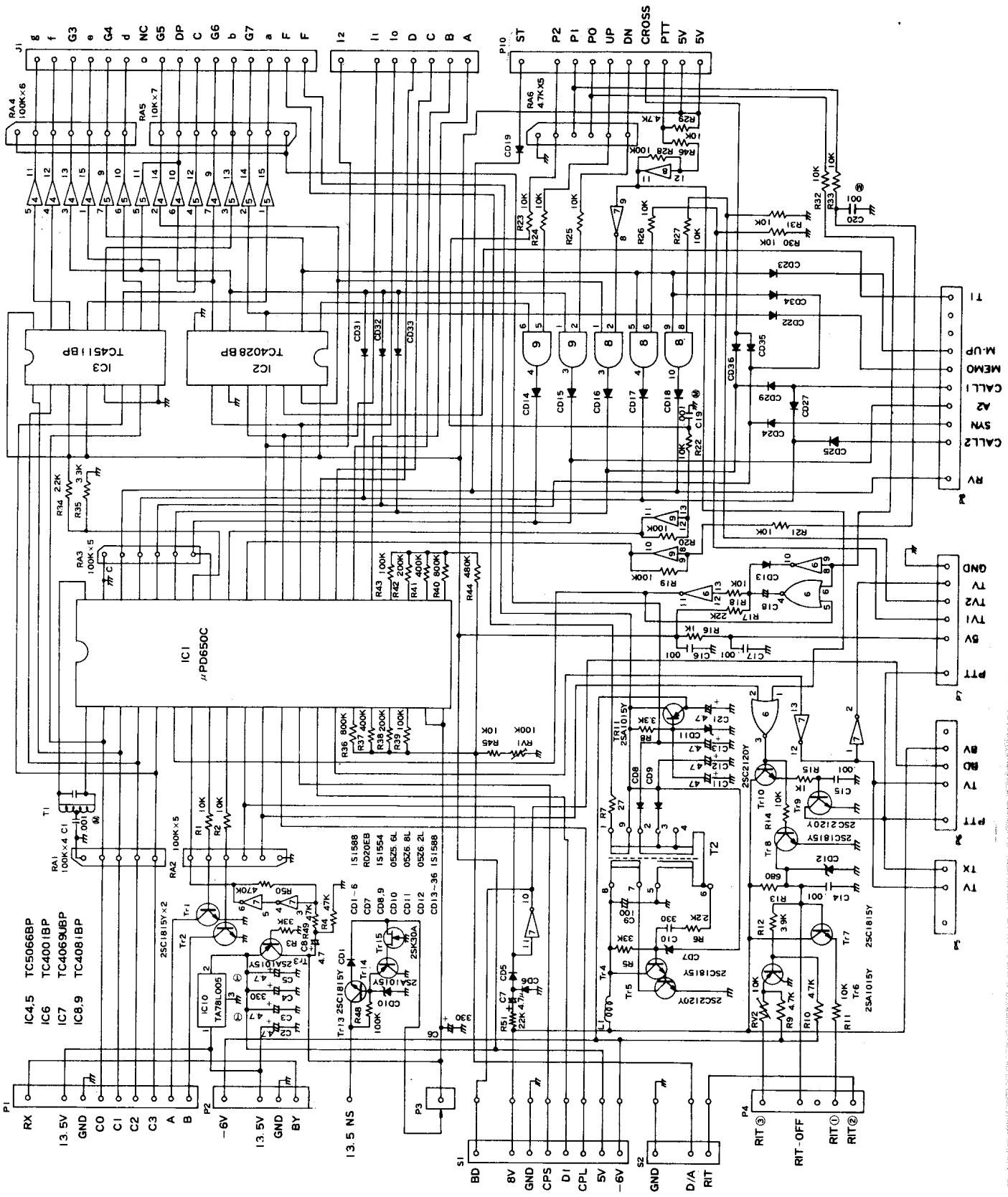
This latter combination provides scope for satellite telecommunications as offset can be used on all modes FM/CW/SSB.



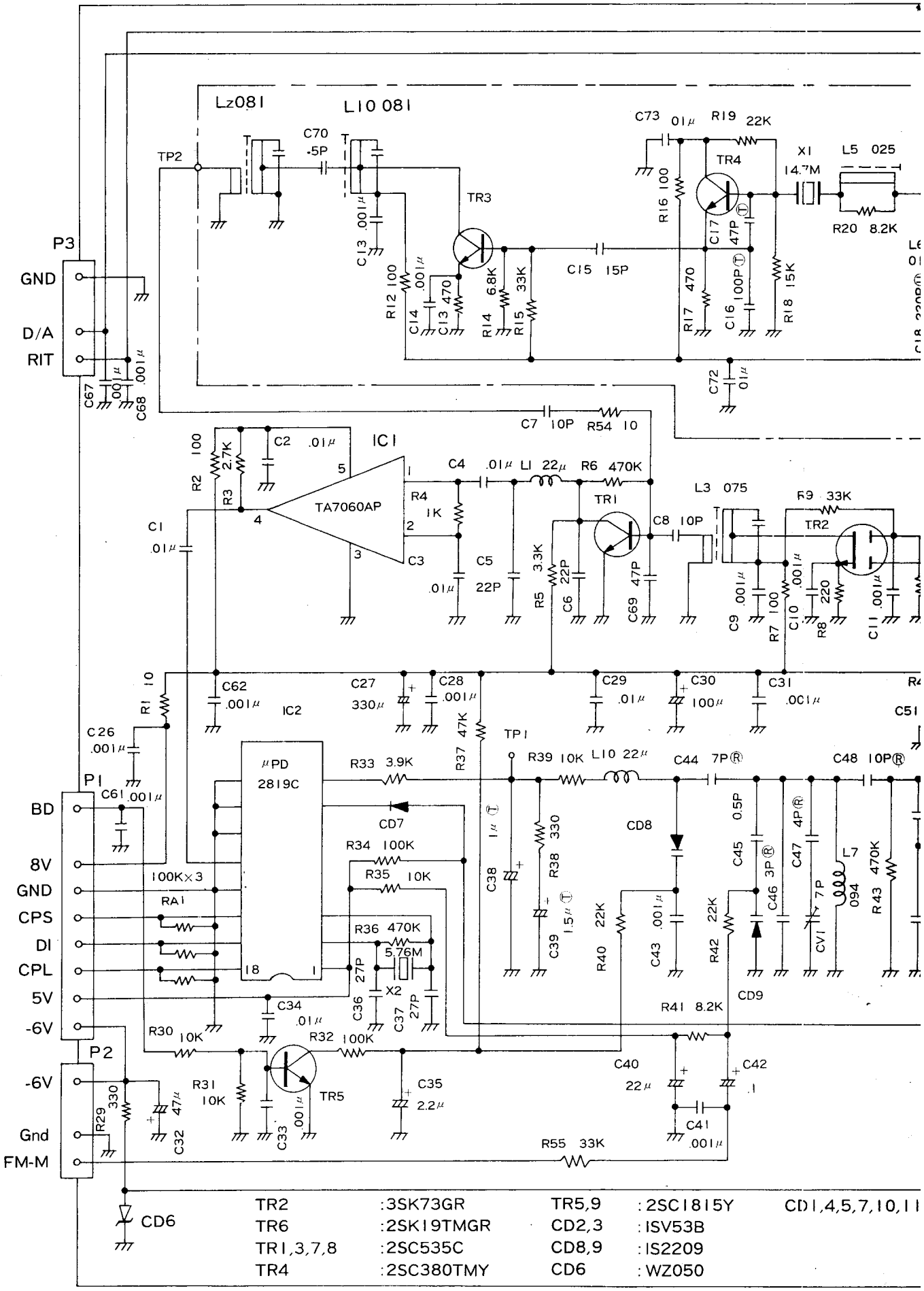
BLOCK DIAGRAM



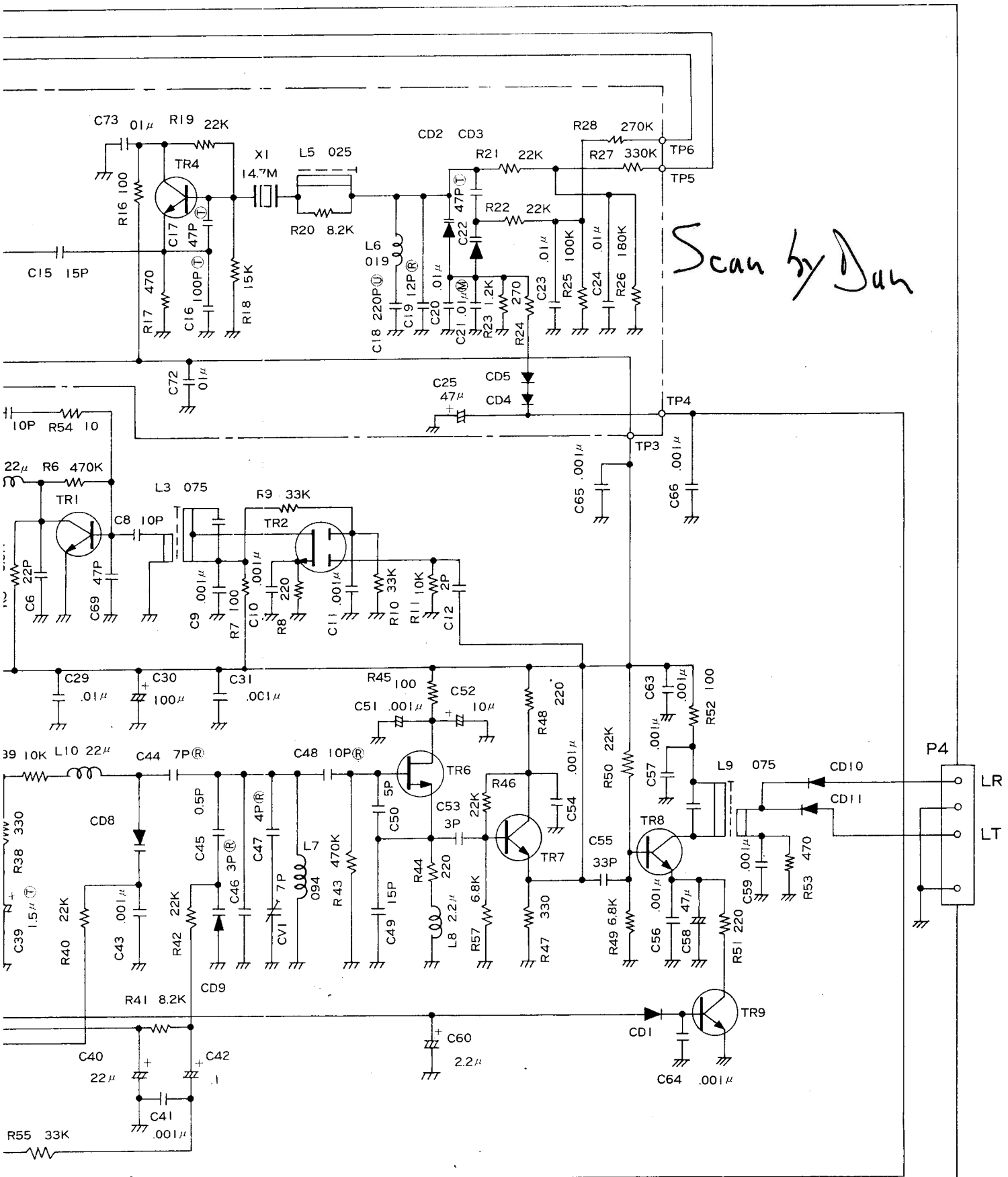
CHANNEL SWITCHING CIRCUIT DIAGRAM



MULTI-750A/E P.L·L CIRCUIT DIAGRAM



TR2	:3SK73GR	TR5,9	:2SC1815Y	CD1,4,5,7,10,11
TR6	:2SK19TMGR	CD2,3	:ISV53B	
TR1,3,7,8	:2SC535C	CD8,9	:IS2209	
TR4	:2SC380TMY	CD6	:WZ050	



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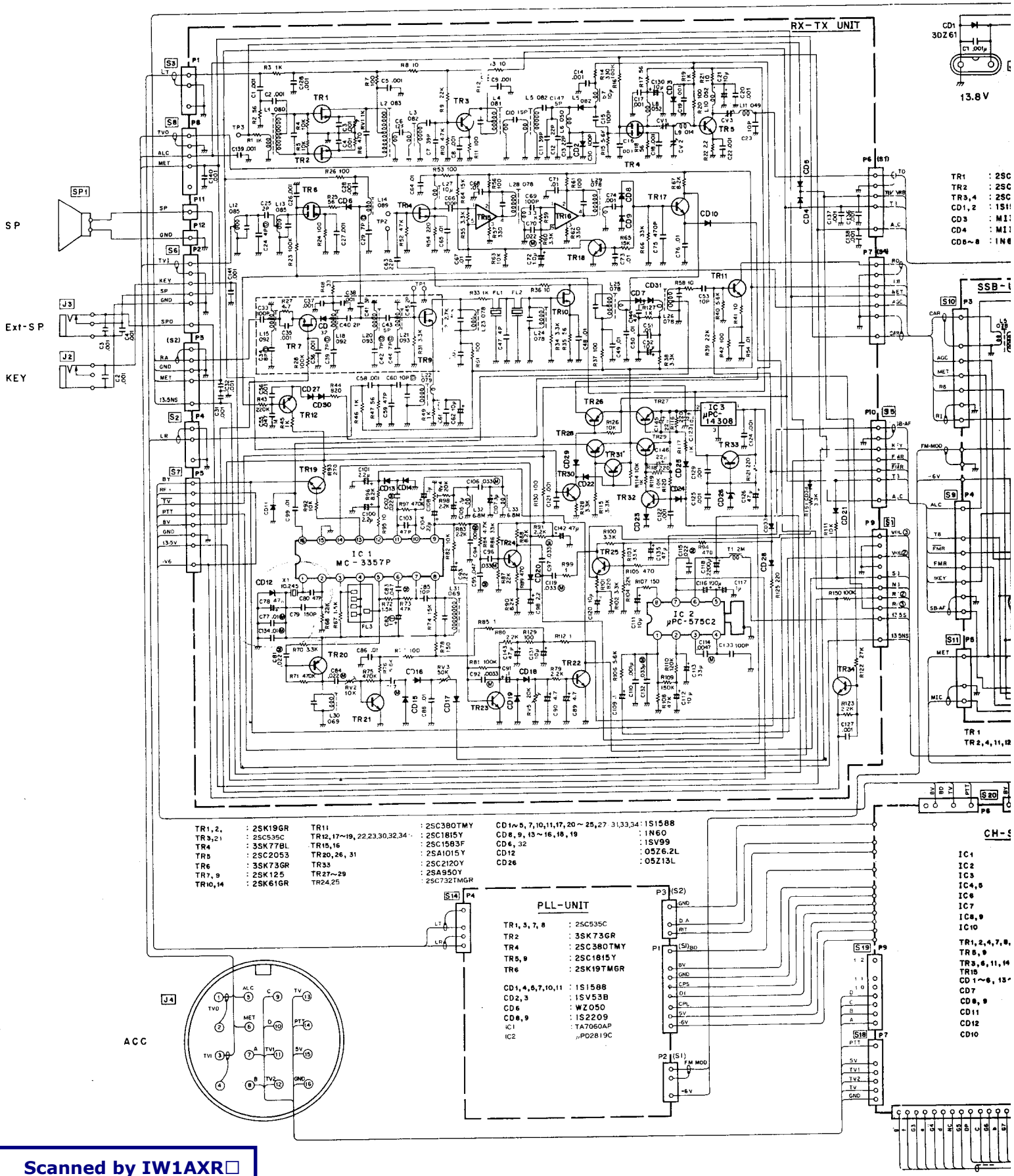
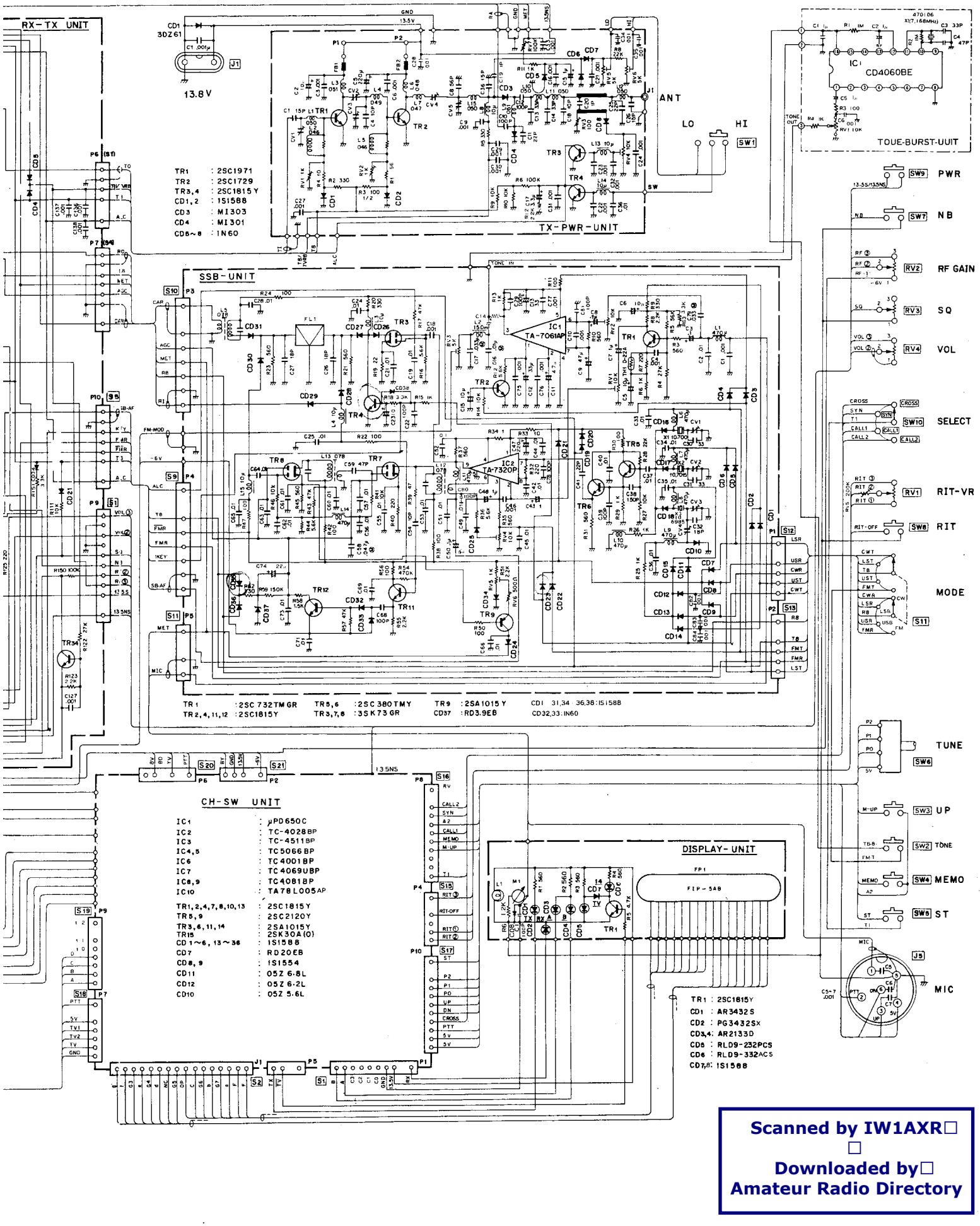
TR5,9	: 2SC1815Y	CD1,4,5,7,10,11	: IS1588
CD2,3	: ISV53B		
CD8,9	: IS2209		
CD6	: WZ050		

MULTI-750A/E SCHMATIC DIAGRAM / ASSEMBLY UNIT




RX-TX UNIT
TX-PWR-UNIT
SSB-UNIT
CH-SW UNIT
DISPLAY-UNIT
TOUE-BURST-UUIT
13.8V
ANT
LO
HI
PWR
NB
RF GAIN
SQ
VOL
SELECT
RIT-VR
RIT
MODE
TUNE
UP
TONE
MEMO
ST
MIC
CD4060BE
TA-7061AP
TA-7320P
FIP-5A8
TR1 : 2SC1971
TR2 : 2SC1729
TR3,4 : 2SC1815Y
CD1,2 : 1S1588
CD3 : MI303
CD4 : MI301
CD5~8 : IN60
IC1 : μPD650C
IC2 : TC-4028BP
IC3 : TC-4511BP
IC4,5 : TC5066BP
IC6 : TC4001BP
IC7 : TC4069UBP
IC8,9 : TC4081BP
IC10 : TA78L005AP
TR1,2,4,7,8,10,13 : 2SC1815Y
TR5,9 : 2SC2120Y
TR3,6,11,14 : 2SA1015Y
TR15 : 2SK30A(O)
CD1~6, 13~36 : 1S1588
CD7 : RD20EB
CD8,9 : 1S1554
CD11 : 05Z 6.8L
CD12 : 05Z 6.2L
CD10 : 05Z 5.6L
TR1 : 2SC1815Y
CD1 : AR3432S
CD2 : PG3432SX
CD3,4 : AR2133D
CD5 : RLD9-232PCS
CD6 : RLD9-332ACS
CD7,8 : 1S1588
TR1 :2SC732TM GR
TR2,4,11,12 :2SC1815Y
TR5,6 :2SC380TMY
TR3,7,8 :3SK73GR
TR9 :2SA1015Y
CD37 :RD3.9EB
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