TECHNICAL MANUAL

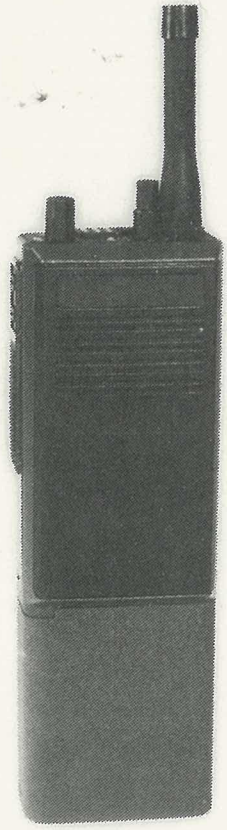
403 - 433 MHz
438 - 470 MHz

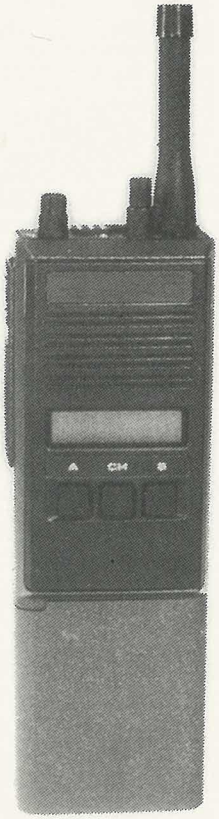
MOTOROLA

Storno

MOTOROLA HTX

STORNO CP1000





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HTX/CP1000
PORTABLE RADIOTELEPHONE
TECHNICAL MANUAL
403 - 470 MHz

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HTX/CP1000 - UHF

TECHNICAL MANUAL

ADDITIONAL MANUALS:
TECHNICAL MANUAL VHF : 68P02022U65
ACCESSORIES MANUAL : 68P02022U64

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MODEL NOMENCLATURE

MOTOROLA HTX/STORNO CP1000

The diagram below is a schematic description of the model configuration explaining the meaning of the different numbers and characters.
This schematic description should be used for decoding the models described on the following page.

LOCATION	TYPE OF UNIT	TX POWER	FREQ.	MODEL SERIES	FRONT ASSEMBLY	SQUELCH	CHANNEL SPACING	NO. OF CHAN'S	MODEL VARIA-TION
MS Cph.	H Hand held	3 2 W	3 VHF 146-174 MHz	UK Std.	E Display & 3 button keypad	5 Trunking capab.	1 20/25 kHz	0 10 or more	0 Univer-sal
		4 4/5 W	4 UHF 403-470 MHz	PX Secure	K Display & full keypad		5 12.5 kHz		

MODEL CONFIGURATION

MOTOROLA HTX/STORNO CP1000 - UHF

The list below covers models in the frequency sub-bands: 403 - 433 MHz and 438 - 470 MHz.

The individual frequencies of the radio do not appear from the model nomenclature. These frequencies are indicated on the test sheets delivered together with the radios.
If such test sheet is not present it should be noted that the frequencies are indicated on the board of the radio, too.

MODEL	MAX. POWER	CHANNEL SPACING	STD./SECURE
FRONT I: WITHOUT KEYPAD OR DISPLAY			
MSH34UKD5500	2 W	12.5 kHz	Standard
MSH34UKD5100	2 W	20/25 kHz	Standard
MSH44UKD5500	4 W	12.5 kHz	Standard
MSH44UKD5100	4 W	20/25 kHz	Standard
MSH34PXD5100	2 W	25 kHz	Secure
MSH44PXD5100	4 W	25 kHz	Secure
FRONT II: WITH DISPLAY AND 3 BUTTON KEYPAD			
MSH34UKE5500	2 W	12.5 kHz	Standard
MSH34UKE5100	2 W	20/25 kHz	Standard
MSH44UKE5500	4 W	12.5 kHz	Standard
MSH44UKE5100	4 W	20/25 kHz	Standard
MSH34PXE5100	2 W	25 kHz	Secure
MSH44PXE5100	4 W	25 kHz	Secure
FRONT III: WITH DISPLAY AND FULL KEYPAD			
MSH34UKK5500	2 W	12.5 kHz	Standard
MSH34UKK5100	2 W	20/25 kHz	Standard
MSH44UKK5500	4 W	12.5 kHz	Standard
MSH44UKK5100	4 W	20/25 kHz	Standard
MSH34PXK5100	2 W	25 kHz	Secure
MSK44PXK5100	4 W	25 kHz	Secure

MOTOROLA HTX/STORNO CP1000

GENERAL DESCRIPTION

The frequency-synthesized Motorola HTX/Storno CP1000 Radio is an advanced design, microprocessor-based transceiver that incorporates the latest technology available in two-way radio communications.
The functions provided by the radio are identified by the model and option numbers. Model and option numbers will be shown on the radio's customer information sheet, which is shipped with each new radio.

PHYSICAL DESCRIPTION

All operating controls, except the push-to-talk (PTT) switch, the monitor buttons, and the keypad, are located on top of the radio. The PTT switch and monitor buttons are located on the left side of the radio (viewed from the front), and the keypad (if so equipped) is an integral part of the front cover.
The radio is small in size and weight, and constructed of a highly durable impact resistant, molded polycarbonate housing. O-rings and seals are utilized throughout the radio. All controls, including the PTT switch, the monitor buttons, and the keypad, are weather resistant. The microphone and speaker are covered with a special diaphragm to provide extra resistance against dirt, dust, and water intrusion. This proven rugged construction offers excellent protection against adverse environmental conditions.
The height of the radio varies with the size of the battery. All other dimensions are standard, except for radios with a keypad option.

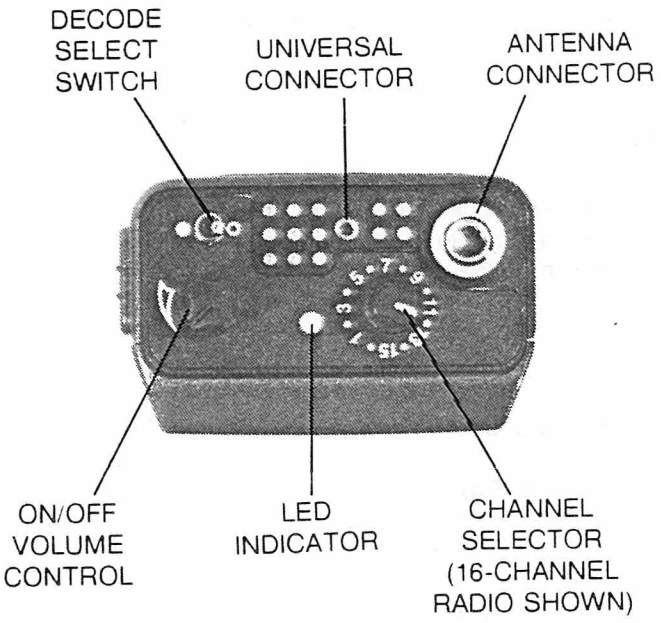

Figure 1. Top Panel Controls and Indicators

ELECTRICAL DESCRIPTION

Electrically, the radio can be divided into two basic sections: a transceiver board and a controller flexible circuit. The transceiver performs the transmit and receive functions, and the controller controls those functions.
The transceiver board includes an antenna switching circuit, a dual-conversion receiver, and a transmitter. The transmitter carrier and receiver first injection signals are generated by a common phase-locked loop (PLL) consisting of a voltage controlled oscillator (VCO) and a frequency synthesizer.
The controller flex assembly contains a microcomputer, an EEPROM which stores the channel frequencies and squelch codes, and an audio power amplifier IC that includes transmitter and receiver audio amplifiers. The controller flex also includes an audio filter IC which encodes and decodes (in conjunction with a microcomputer) PL and SELECT 5, adjusts and limits the audio level for correct transmitter deviation, and pre-emphasizes and de-emphasizes audio signals. Another circuit which is contained on the controller flex is a DC switch, which controls the radio's transmit and receive voltages.

PRINTED CIRCUIT BOARDS AND FLEXIBLE CIRCUITS

GENERAL

Functional circuits in the radio are contained on: (1) the Transceiver Board and (2) the Controller Flex.
Five flexible printed circuits eliminate all discrete wiring, except the switched B + wire to the transceiver board. Radios with keypad options have functional circuits contained on a board in the front cover.

TRANSCEIVER BOARD

The transceiver board is a two-layer printed circuit board containing the RF and IF portions of the radio. Almost all components are mounted on the top side of this board.

CONTROLLER FLEX

The controller flex is packaged inside a protective flex carrier. It is a three-layer flexible printed circuit with the components surface-mounted on one side. When packaged in the flex carrier, it is folded in half with all the components on the outside.

INTERCONNECT FLEXES

The interconnect flexes are two-layer flexible printed circuits. These include:

- PTT/B + Flex
- Volume Pot Flex
- Frequency Switch Flex
- IF Interconnect Flex
- Front Cover Flex
- DVP Flex

KEYPAD BOARD (OPTIONAL)

The keypad option board is a four-layer printed circuit board mounted in the radio's front cover. All components are surface mounted on one side of the board.

FEATURES

STANDARD FEATURES

The radio has an internal microphone and speaker, but can be operated with an optional external microphone and/or speaker. An external antenna connector and a top-mounted "universal connector" provide easy access for testing, and for attaching a wide variety of audio accessories. Radio models are available with up to 99 channels of carrier tone "Privat-Line" (PL), or SELECT 5 squelch operation or trunked operation.

Two power output levels are offered: Medium power (2 watt) or high power (5 watt).
The battery pack slides on to the bottom of the radio and is held in place by a spring loaded catch. Batteries are available in two different sizes which correspond to the battery capacity: medium and high. The medium and high capacity batteries are available in standard and rapid charge rates. The different size batteries effect the operating time between charges as well as the overall height and weight of the radio.
A bicolor LED on the top of the radio serves as user feedback.

SPECIAL STANDARD FEATURES

FIELD PROGRAMMING

The radio utilizes a reprogrammable EE FLASH-PROM codeplug, which permits operating characteristics to be changed without opening the radio. Programming is accomplished via a programming cable interface to a PC.

SELECT 5 CODED SQUELCH AND TONE PRIVATE-LINE CODED SQUELCH

Coded squelch allows only those calls with a radio's particular code to be heard, and can be enabled on a per channel basis. So a radio can have carrier squelch on some channels, SELECT 5 squelch on others, and Tone PL squelch on even others. You can choose from any of the standard European SELECT 5 Signalling formats and 42 Tone Private-Line codes.

TRUNKED OPERATION

Models are available on MPT1327 based trunking systems. These models utilize 1200 Baud FFSK binary signalling.

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SPECIFICATIONS

MOTOROLA HTX/STORNO CP1000 - UHF

GENERAL

NOTE:

All batteries must be charged prior to use.
Use of chemicals (Detergents, alcohol, aerosol spray, petroleum products) may be harmful and damage the radio housing. We recommend a mild dishwashing soap for cleaning the exterior of the product.
O-ring seals must be properly lubricated and assembled to insure conformance to IP54 specifications for water intrusion.

Frequency Range:
403 - 433 MHz or
438 - 470 MHz

Channel Spacing:
12.5/20/25 kHz

Mode of Operation:
One or two frequency simplex

Antenna Impedance
50 ohm

Power Supply:
Nickel-Cadmium Battery

Frequency Stability (-25°C to +55°C; +25°C ref.):
±.0002% (12.5 kHz Channel Spacing)
±.0002% (25/20 kHz Channel Spacing)

Typical Battery Drain, at 10 VDC:

	2 W	4 W
Standby:	*60 mA	*60 mA
Receive:	*179 mA	*179 mA
Transmit:	**745 mA	**1320 mA

*Add 8 mA with Remote Antenna
**Add 15 mA with Remote Antenna

Dimensions (H x W x D):
Radio only: 126.00 x 66.60 x 42.50 mm

Radio with battery:
With Medium-Capacity Battery: 185.00 x 66.60 x 42.50 mm
With High-Capacity Battery: 200.00 x 66.60 x 42.50 mm

Weight:
Radio only: 469 g

Radio with battery (Nickel-Cadmium):
With Medium-Capacity Battery: 708 g
With High-Capacity Battery: 776 g

Temperature Range:
-25 to +55°C

TRANSMITTER

RF Output, at 10 Vdc	**MSH34**	**MSH44**
Nickel-Cadmium battery:	2.0 W	4.0 W

Modulation (Type 16F3):
For 12.5 kHz channel spacing: ±2.5 kHz for 100% modulation at 1000 Hz (min. ±2.0 kHz.)
For 20 kHz channel spacing: ±4 kHz for 100% modulation at 1000 Hz (min. ±3.2 kHz.)
For 25 kHz channel spacing: ±5 kHz for 100% modulation at 1000 Hz (min. ±4.0 kHz.)
Including PL-modulation for PL-models.

PL Modulation:
12.5 kHz channel spacing: max. ±500 Hz min. ±250 Hz
20 kHz channel spacing: max. ±800 Hz min. ±400 Hz
25 kHz channel spacing: max. ±1 kHz min. ±500 Hz

Audio Distortion:
Less than 5% at 1 kHz

Maximum Permissible Channel Separation:
13 MHz

Spurious & Harmonic Frequencies:
<250 nW below 1 GHz
<1.0 uW between 1 GHz - 4 GHz

FM Noise:
At least 40 dB below ±3.0 kHz deviation at 1000 Hz

RECEIVER

Audio Output:
Rated output power: ≥500 mW (28 Ohm)

Second I-F Frequency:
450 kHz ± 1.5 kHz measured at M1

Sensitivity
Max. 1.0 uV EMF (20 dB SINAD Psophometrically weighted)
Max. 0.31 uV 1/2 EMF (12 dB SINAD Psophometrically weighted)

Noise Squelch Selectivity
Programmable

Maximum Permissible Channel Separation
8 MHz

Useable Bandwidth:
±2.5 kHz (12.5 kHz Channel Spacing)
±4 kHz (20 kHz Channel Spacing)
±5 kHz (25 kHz Channel Spacing)

Spurious Frequency Rejection:
More than 70 dB (CEPT 88 Method)

AF Output Power:
0.5 W

Image Rejection:
More than 70 dB (CEPT 88 Method)

Selectivity
More than 60 dB at ±12.5 kHz
More than 70 dB at ±20/25 kHz

Intermodulation:
More than 65 dB (CEPT 88 Method)

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SAFETY INFORMATION

DO NOT hold the radio with the antenna close to, or touching, exposed parts of the body, especially the face or eyes, while transmitting. The radio will perform best if the microphone is five to eight centimeters away from the lips and the radio is vertical.

DO NOT hold the transmit (PTT) switch on when not actually desiring to transmit.

DO NOT allow children to play with any radio equipment containing a transmitter.

DO NOT operate a transmitter near unshielded electrical blasting caps or in an explosive atmosphere unless it is a type especially qualified for such use.

CMOS PRECAUTIONS

This radio contains static-sensitive devices. Do not open the radio unless properly grounded. Take the following precautions when working on this unit.

The red and green printed circuit boards indicate static sensitive devices and contained on these boards, and should be handled with the following precautions.

1. Store and transport all CMOS devices in conductive material so that all exposed leads are shorted together. Do not insert CMOS devices into conventional plastic "snow" or plastic trays used for storage and transportation of other semiconductor devices.

2. Ground the working surface of the service bench to protect the CMOS device. We recommend using the P/N 95D5042-00 Static Protection Table Mat (0.6 x 1.2 m) which includes ground cord and connector, plus wrist wrap with coil cord 95D5045-00.
   See also TEST INSTRUMENTS AND SOFTWARE).

3. Do not wear nylon clothing while handling CMOS devices.

4. Neither insert nor remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices and be certain there are no voltage transients present.

5. When straightening CMOS pins, provide ground straps for apparatus used.

6. When soldering, use a grounded soldering unit.

7. If at all possible, handle CMOS devices by the package and not by the leads. Prior to touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

CAUTION

Do not depress the PTT or side switches while inserting the frame into the housing; damage to the switches could occur.
For reassembly, use only the tools that are recommended. Using unauthorised tools, or failing to adhere to torque specifications may cause irreparable damage.
Do not attempt to remove the antenna bushing from the control top; it is ultrasonically welded in place.
Do not desolder or resolder any connections between the volume potentiometer flex and the on/off-volume potentiometer with the switch in the off position. Make sure that the switch is in the on position before applying any heat; otherwise the internal parts of the switch will be damaged.

CLEANING

- Clean all external radio surfaces with a 0.5% solution of a mild dishwashing detergent in water (one teaspoon of detergent per 4 liters of water).
- Stronger cleaning agents may only be used to remove soldering flux from circuit boards after making repairs.
- Clean internal surfaces with water-activated optical wipes.

CAUTION

Never allow any alcohol- or solvent-based product to contact any plastic or rubber radio part.

MOTOROLA HTX/STORNO CP1000

MAINTENANCE

1. INTRODUCTION

This section of the manual describes the disassembly and reassembly procedures, recommended repair procedures, special precautions regarding maintenance, and recommended test equipment. Each of these topics provides information vital to the successful operation and maintenance of the radio.

2. PREVENTIVE MAINTENANCE

The radio does not require a scheduled preventive maintenance program; however, periodic visual inspection and cleaning is recommended.

a. Inspection

Check that the external surfaces of the radio are clean, and that all external controls and switches are functional. A detailed inspection of the interior electronic circuitry is not needed or desired.

b. Cleaning

The following procedures describe the recommended cleaning agents and the methods to be used when cleaning the external and internal surfaces of the radio. External surfaces include the front cover, housing assembly, and battery case. These surfaces should be cleaned whenever a periodic visual inspection reveals the presence of smudges, grease, and/or grime. Internal surfaces should be cleaned only when the radio is disassembled for servicing or repair.

The only recommended agent for cleaning the external radio surfaces is a 0.5% solution of a mild dishwashing detergent, in water. The only factory recommended liquid for cleaning the printed circuit boards and their components is ISOPROPYL alcohol (70% by volume).

CAUTION

The effects of certain chemicals and their vapors can have harmful results on certain plastics. Aerosal sprays, tuner cleaners and other chemicals should be avoided.

(1) Cleaning External Surfaces

(a) Polycarbonate Surfaces

The detergent-water solution should be applied sparingly with a stiff, non-metallic, short-bristled brush to work all loose dirt away from the radio. A soft, absorbent, lintless cloth or tissue should be used to remove the solution and dry the radio. Make sure that no water remains entrapped near the connectors, cracks, or crevices.

(b) Silverized Surfaces

A non-metallic, soft-bristled brush should be used to apply the detergent-water solution to silverized surfaces, and a second non-metallic soft-bristled brush (free of detergent or rinsed in clean water) should be used to remove the detergent-water solution.

Upon completion of the cleaning process, a soft, absorbent, lintless cloth or tissue should be used (with a blotting action) to dry the frame and covers. The blotting action will prevent damage to the silverized conductive coating.

(2) Cleaning Internal Circuit Boards and Components

Isopropyl alcohol may be applied with a stiff, non-metallic, short-bristled brush to dislodge embedded or caked materials located in hard-to-reach areas. The brush stroke should direct the dislodged material out and away from the inside of the radio.

Alcohol is a high-wetting liquid and can carry contamination into unwanted places if an excessive quantity is used. Make sure that controls or tunable components are not soaked with the liquid. Do not use high-pressure air to hasten the drying process, since this could cause the liquid to puddle and collect in unwanted places.

Upon completion of the cleaning process, use a soft, absorbent, lintless cloth to dry the area. Do not brush or apply any isopropyl alcohol to the frame, front cover, or back cover.

NOTE

Always use a fresh supply of alcohol and a clean container to prevent contamination by dissolved material (from previous usage).

3. DISASSEMBLY

Disassembly of the radio involves removal of the major components listed below, one at a time, in the sequence described in the following paragraphs.

NOTE

1. Several special tools are required to completely disassemble the radio. Refer to the "Tools, Test and Programming Equipment" section. Also refer to the "Torque and Tool Specifications Chart.
2. Before proceeding, make sure that the radio is turned off.

a. Battery Removal

To remove the battery from the radio, proceed as follows:

Step 1. Hold the radio with the front of the radio facing up.

Step 2. Disengage the battery latch from the battery by pushing and holding the latch towards the top of the radio.

Step 3. With the battery latch disengaged, slide the battery from left to right to remove it from the baseplate on the bottom of the radio housing.

b. Gaining Access to Internal Components

CAUTION

The radio contains complementary metal-oxide semiconductor (CMOS) devices, which are highly susceptible to damage in handling due to static discharge. The entire printed circuit board should be treated as static sensitive. Damage can be latent, resulting in failures occurring weeks or months later.

DO NOT attempt to disassemble the radio without first referring to the "Safe Handling of CMOS Devices" paragraph in this section

Step 1. Remove the battery as described in paragraph **a**.

Step 2. Remove the two screws from the back of the radio.

Step 3. Remove the two screws on the bottom of the radio (baseplate corners).

Step 4. Lift the front cover from the radio housing, being careful not to pull against the speaker/-microphone flex.

Step 5. Disconnect the speaker/microphone connector from the controller flex by grasping the speaker flex strain relief (near the plug) and pulling the plug straight out and away from the circuit board.

Step 6. Loosen the two captive screws on the bottom of the radio. Do not completely remove the captive screws from the baseplate.

Step 7. With a thumb and forefinger, grasp the antenna at its base and pull lightly to remove the frame assembly from the radio housing. Do not press the PTT switch during removal.

Step 8. Remove the antenna by unscrewing it counterclockwise.

Step 9. Remove the screw that secures the front shield to the controller carrier.

Step 10. Remove the front shield by pulling it straight out and away from the radio.

Step 11. Remove the four screws that secure the main back shield to the frame.

Step 12. Remove the main back shield by pulling it straight out and away from the radio.

c. Removing the Controller Assembly

Step 1. Perform steps 1 through 10 of paragraph **b**.

NOTE

Be careful to pull each connector straight out and away from the mating socket so as not to bend or break the connector pins.

Step 2. Disconnect the two connectors at the top of the controller.

Step 3. Disconnect the two bottom flex connectors by carefully sliding them away from the synthesizer.

Step 4. Lift the controller circuit (nearest the bottom of the radio) away from the radio just enough to gain access to the connector under the controller.

Step 5. Disconnect the connector under the controller.

Step 6. Lift the controller assembly totally away from the radio.

d. Gaining Access to the Controller Flexible Circuit

Step 1. Perform steps 1 through 7 of paragraph **c.**

Step 2. Along the top edge of the controller assembly (edge nearest speaker clearance indentation), gently pry the bottom shield away from the top flex carrier.

Step 3. Pull the bottom shield completely away from the top flex carrier and remove the controller flexible circuit.

e. Removing the Transceiver Board from the Frame

Step 1. Perform steps 1 through 7 of paragraph **c.**

Step 2. Remove the four screws that secure the main back shield, and remove the shield.

Step 3. Unsolder four contacts (two pins and one frame ground connection) located next to the screw (back, top-center of transceiver board), and the antenna ferrule located on the back, top-left corner of the transceiver board.

Step 4. Remove one screw (back, top-center of transceiver board) that secures the transceiver board to the frame.

Step 5. Unsolder and remove the red B+ wire (controller side of radio) from the On-Off / volume switch pot.

CAUTION

Always place the On-Off / Volume switch pot in the 'On' position before soldering to this switch, and return to the 'Off' position when finished soldering.

Step 6. Gently pull the transceiver circuit board straight out and away from the frame.

f. Removing the Control-Top Panel Components

Step 1. Perform steps 1 through 5 of paragraph **e.**

NOTE

All control-top panel components, except the antenna jack, are connected on two flexible circuits, which are connected together and should be removed as one unit.

Step 2. Remove the control knob(s) by pulling straight out and away from the control-top panel.

Step 3. The escutcheon is stuck to the top surface of the control-top panel with adhesive. Gently pry one corner of the escutcheon away from the control-top panel and then peel the escutcheon completely away. Notice that washer(s) are stuck on the back side of the escutcheon.

Step 4. Remove the hex nut and washer from the volume potentiometer.

Step 5 Remove the hex nut and washer from the frequency switch.

Step 6. Remove the spanner nut and washer from the PL switch.

Step 7. Pry the header (part of volume pot flex assembly) away from the universal connector pins.

Step 8. Unsolder the three legs of the LED and pull the flex away from the legs.

Step 9. Unsolder and remove the black wire (ground wire from header to frame) where it contacts the frame.

Step 10. The frequency switch flex connects to the PTT / B+ flex with five solder tabs located along the side of the frame near the monitor popple switches. Unsolder the five contact tabs, and with "solder- wick", remove the solder and separate the two flexes.

NOTE

A capacitor is placed across the last two tabs.

Step 11. Push the switch shaft(s) until clear of the mounting holes, and remove the flex circuits and control-top panel components away from the frame.

g. Removing the Control-Top Panel and LED

Step 1. Perform steps 1 through 8 of paragraph **f.**

Step 2. Unsolder the ground pin of the universal connector contacting the frame (near the antenna bushing).

Step 2a. Remove the screw and washer located near the antenna receptacle.

Step 2b. Gently pull the control-top panel away from the frame.

Step 2c. Push the LED and rubber boot out of the control-top panel, and pull the LED out of the rubber boot.

h. Removing the Battery Latch

Step 1. Perform steps 1 through 7 of paragraph **b**.

Step 2. Remove the ground contact screw that holds the negative battery contact. Be careful not to lose the lockwasher, contact, and rubber pad (under the contact).

Step 3. While holding the latch slide, carefully pull the baseplate assembly away from the housing.

Step 4. Carefully slide the latch out of the housing.

Step 5. Remove the exposed latch springs.

i. Removing the PTT / B+ Flex

Step 1. Perform steps 1 through 7 of paragraph **b**.

Step 2. Two corners of the PTT / B+ flex are soldered to the frame. Remove the solder, using "solder-wick".

Step 3. The PTT / B+ flex connects to the frequency switch flex with five solder tabs located along the top side of the frame near the PL switch. Unsolder the five contact tabs, and with "solder-wick", remove the solder and separate the two flexes.

NOTE

A capacitor is placed across the last two tabs.

Step 4. The PTT / B+ flex is stuck to the frame with adhesive. Carefully peel the PTT / B+ flex away from the frame.

4. REASSEMBLY

1. DO NOT attempt to reassemble the radio without first referring to the "Safe Handling of CMOS Devices" paragraph in this section of the manual.

2. DO NOT attempt to reassemble the radio without first referring to the approriate VHF or UHF service manual "TORQUE AND TOOL SPECIFICATIONS CHART".

3. Inspect all O-rings and replace if obvious damage exists.

a. Reinstalling the Battery Latch and Base Plate

Step 1. Insert the two springs into their proper holes, and replace the slide latch.

Step 2. Position the base plate and hold it firmly to compress the springs.

Step 3. Holding the base plate in place, install the negative battery contact, being sure that the rubber pad is in place in the cup of the contact.

Step 4. Reinstall the screw and lockwasher in the negative battery contact. Tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

b. Reinstalling the PTT / B+ Flex

Step 1. Position the PTT / B+ flex to the frame such that the five contact tabs line up with the corresponding tabs on the frequency switch flex. Note that a little oval hole in the corner of the flex (near the solder tabs) mates with a round dot on the frame.

Step 2. Press the flex to the frame. Note that two more places, holes in the flex correspond with dots on the frame.

Step 3. Resolder the five solder tabs connecting the PTT / B+ flex to the frequency switch flex.

NOTE

A capacitor is placed across the last two tabs.

Step 4. Resolder the two corners of the flex to the frame.

c. Reinstalling the LED and Control-Top Panel

Step 1. Insert the LED into the rubber boot such that the flat edge of the LED's base mates with the flat edge inside the boot.

Step 2. Insert the LED and boot into the control-top panel.

Step 3. Place the control-top panel on the frame.

Step 4. Reinstall the screw and washer located near the antenna receptacle, and tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 5. Resolder the ground pin of the universal connector to the frame.

d. Reinstalling the Control-Top Panel Components

Step 1. Insert the switch shafts into the proper holes.

Step 2. Resolder the three LED legs to the frequency switch flex.

Step 3. Press the volume pot header on to the corresponding pins of the universal connector.

Step 4. Resolder the black ground wire to the frame.

Step 5. Resolder the five solder tabs of the frequency switch flex to the corresponding tabs of the PTT / B+ flex.

Step 6. Reinstall the PL switch washer and spanner nut, and tighten per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 7. Reinstall the frequency switch and volume pot washers and hex nuts, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 8. Reinstall the escutcheon.

Step 9. Reinstall the teflon washers on the frequency switch and volume pot shafts.

Step 10. Reinstall the switch knobs.

e. Reinstalling the Transceiver Board

Step 1. With the frame's backside laying down, and viewing the transceiver board from the solder side with the assembly upright, slightly spread the sides of the frame and slide the transceiver into the frame.

Step 2. Turn the unit over and resolder the loose end of the red B+ wire to the On-Off/Volume switch pot.

CAUTION

Always place the On-Off / Volume switch pot in the 'On' position before soldering to this switch, and return to the 'Off' position when finished soldering.

Step 3. Reinstall one screw (back, top-center of transceiver board) that secures the transceiver board to the frame, and tighten securely.

Step 4. Resolder four contacts (two pins and one frame ground connection) located next to the screw (back, top-center of transceiver board), and the antenna ferrule contact (back top-left corner of board).

Step 5. Press the main back shield (edges over the frame) flush to the transceiver board.

Step 6. Reinstall the four screws that secure the main back shield to the frame, and tighten each screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

f. Reassembling the Controller Assembly

CAUTION

Make sure that the flex insulator is installed around the controller flex before placing the controller flex into the carrier.

Step 1. With the outside surface of the carrier laying down, and the controller flex folded over align the holes in the flex with corresponding holes in the carrier, and place the flex into the carrier. Make sure that the P1 and P2 jack's grooves slide into the tabs of the carrier. Also, make sure that the J5 and J7 jack is seated properly in the carrier.

Step 2. Align the controller bottom shield to the controller flex and carrier. In the J5 and J7 jack area, slide the tab of the shield under the slot in the carrier, and press the bottom shield into place (sides of the bottom shield fit inside the sides of the carrier).

g. Reinstalling the Controller Assembly

NOTE

Be careful to push each connector straight into the mating socket so as not to bend or break the connector pins.

Step 1. Reconnect the connector under the controller, firmly seating the plug / jack connection.

Step 2. Reconnect the two bottom flex connectors, firmly seating both plug / jack connections.

Step 3. Reconnect the two top flex connectors, firmly seating both plug / jack connections.

Step 4. Press the controller into place (inside of frame sides).

Step 5. Reinstall front shield (shield edges fit inside the frame).

Step 7. Reinstall the screw that secures the front shield to the controller carrier, and tighten the screw per the "TORQUE AND TOOL SPECIFICATIONS CHART".

h. Final Reassembly

Step 1. Insert the internal radio unit into its housing, and tighten the two screws on the baseplate per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 2. Reconnect the speaker / microphone connector, being careful to push the connector straight into the mating socket so as not to bend or break the connector pins.

Step 3. Reinstall the front cover.

Step 4. Reinstall the two screws on the bottom of the radio (baseplate corners), and tighten the screws per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 5. Reinstall the two screws that secure the front cover to the housing, and tighten each screws per the "TORQUE AND TOOL SPECIFICATIONS CHART".

Step 6. Reinstall the antenna.

Step 7. Reinstall the battery.

5. SAFE HANDLING OF CMOS DEVICES

Complementary metal-oxide semiconductor (CMOS) devices are used in the radio. While the attributes of CMOS are many, their characteristics make them susceptible to damage by electrostatic or high voltage charges. Damage can be latent, resulting in failures occurring weeks or months later. Therefore, special precautions must be taken to prevent device damage during disassembly, troubleshooting, and repair. The following handling precautions are mandatory for CMOS circuits, and are especially important in low humidity conditions.

a. All CMOS devices must be stored or transported in conductive material so that all exposed leads are shorted together. CMOS devices must not be inserted into conventional plastic "snow" or plastic trays of the type that are used for storage or transportation of other semiconductor devices.

b. All CMOS devices must be placed on a grounded bench surface and the technicians must ground themselves prior to handling the devices. This is done most effectively by having the technician wear a conductive wrist strap in series with a 1M ohm resistor to ground.

c. Do not wear nylon clothing while handling CMOS circuits.

d. Do not insert or remove CMOS devices with power applied. Check all power supplies to be used for testing CMOS devices, and be certain that there are no voltage transients present.

e. When straightening CMOS device leads, provide ground straps for the apparatus used.

f. When standing, use a grounded soldering iron.

g. All power must be turned off in a system before printed circuit boards containing CMOS devices are inserted, removed, or soldered.

6. REPAIR PROCEDURES AND TECHNIQUES

a. Parts Replacement and Substitution

Special care should be taken to be as certain as possible that a suspected component is actually the one at fault. This special care will eliminate unnecessary unsoldering and removal of parts, which could damage or weaken other components or the printed circuit board itself.

When damaged parts are replaced, identical parts should be used. If the identical replacement component is not locally available, check the parts list for the proper part number and order the component from your service center.

b. Rigid Circuit Boards

The radio uses bonded multi-layer printed circuit boards. Since the inner layers are not accessible, some special considerations are required when soldering and unsoldering components. The printed through holes may interconnect multiple layers

of the printed circuit. Therefore, care should be exercised to avoid pulling the plated circuit out of the hole.

When soldering near the module socket pins, use care to avoid accidentally getting solder in the socket. Also, be careful not to form solder bridges between the module socket pins. Closely examine your work for shorts due to solder bridges. When removing modules with metal enclosures, be sure to desolder the enclosure ground tabs as well as the module pins.

c. Flexible Circuits

The flexible circuits are made from a different material than the rigid boards, and different techniques must be used when soldering. Excessive prolonged heat on the flexible circuit can damage the material. Avoid excessive heat and excessive bending.

To replace a component on a flexible circuit, grasp the edge of the flexible circuit with seizers near the part to be removed, and pull gently. Apply the tip of the soldering iron to the component connections while pulling with the seizers. Do not attempt to puddle out components. Prolonged application of heat may damage the flexible circuit.

7. TEST EQUIPMENT AND SERVICE AIDS

The following paragraphs describe the test equipment and service aids required for maintaining the radio.

Refer to Figure 1 for an illustration of trouble-shooting, test equipment, and programming set-up.

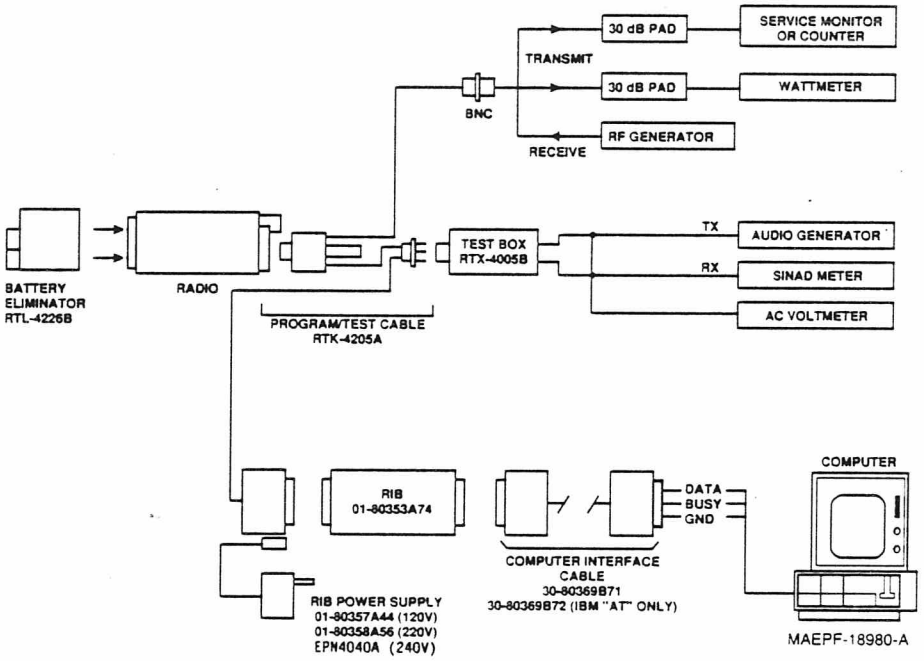

Figure 1. Troubleshooting, Test Equipment, and Programming Set-Up Detail

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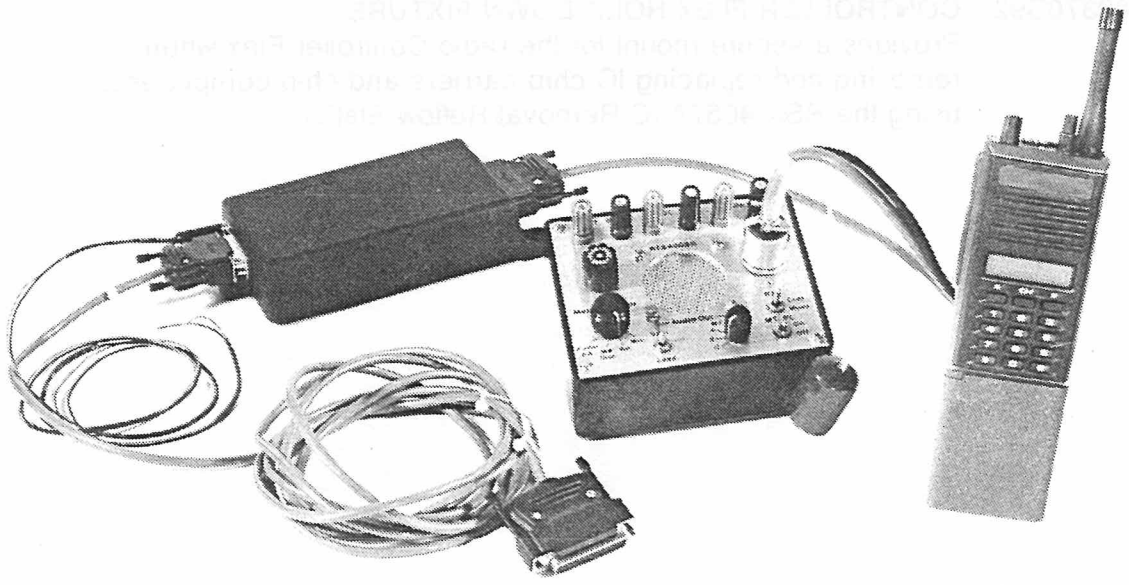
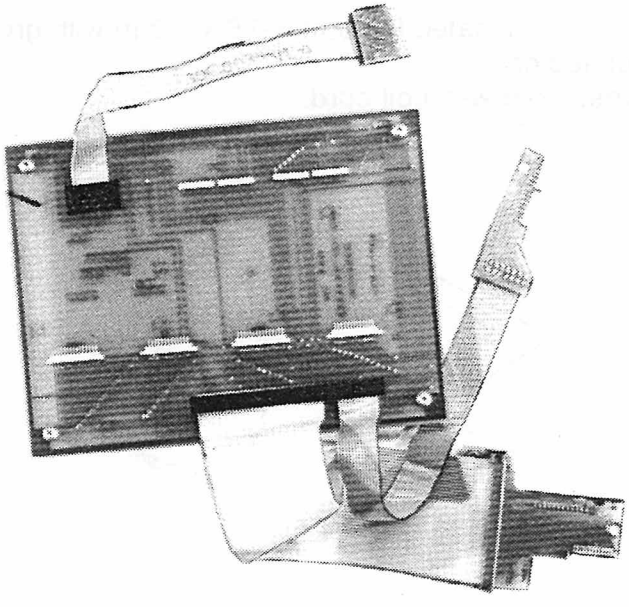


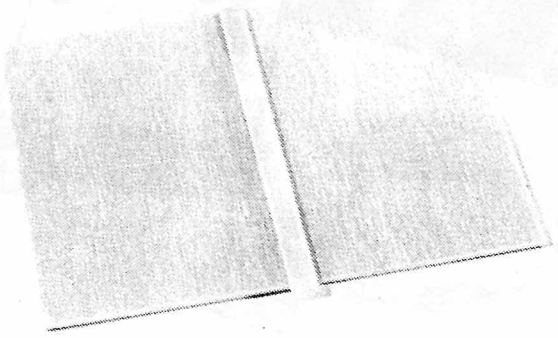
TOOLS

SDEN4004A **CONTROLLER FLEX EXTENDER FIXTURE**

Allows access to all electrical points on the radio Controller Flex and the interior of the RF board for troubleshooting purposes. The Controller Flex is removed from the flex carrier assembly and then externally mounted on the fixture's P.C. board. Electrical interconnect between the fixture and the radio RF board is provided through two ribbon cables.



01-80370B92 **CONTROLLER FLEX HOLD DOWN FIXTURE**
Provides a secure mount for the radio Controller Flex when removing and replacing IC chip carriers and chip components using the RSX-4057A IC Removal/Reflow Station.

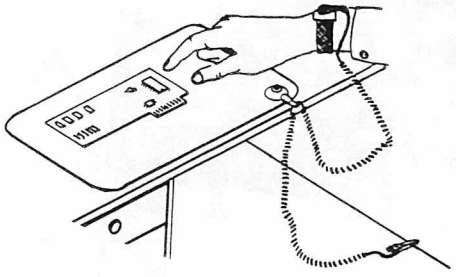


RTR-1500B **INFRA RED REWORK STATION**
Used for removal of surface mounted devices.

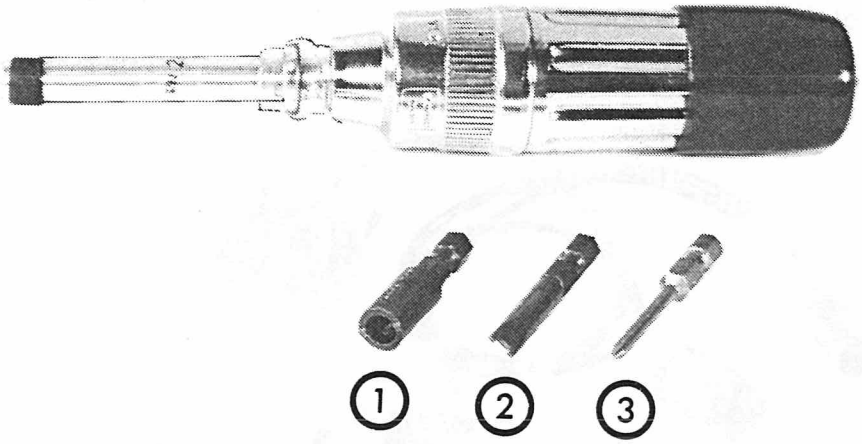
ANTI-STATIC PROTECTION MATERIAL
Used during all radio assembly and disassembly procedures.

95D5042-00 3-layer laminated table mat 0.6 x 1.2 m with grounding wire and connector.

95D5045-00 Wrist strap with coil cord.



RSX-4043A **TORQUE SCREWDRIVER**
Handle for bits:



- bits described below:

55-05717E01 **HEXSOCKET BIT** (1)
Removes nuts on volume and rotary switch.

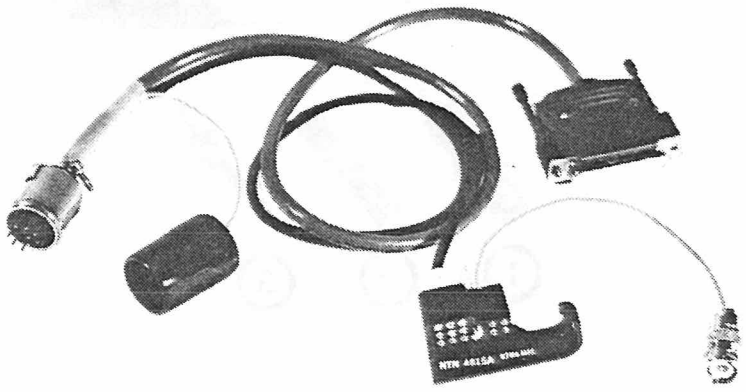
66-80370B95 **SPANNER BIT** (2)
For use on toggle switch spanner nut.

66-80321B86 **PHILIPS BIT** (3)
For removal of radio screws.

66-05106N01 **TUNING TOOL**
For use on tunable coils and potentiometers.

TEST EQUIPMENT

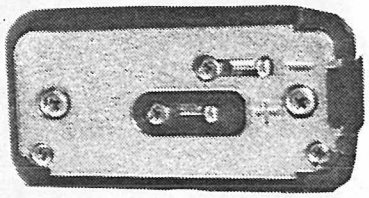
RTK-4205A **PROGRAMME TEST CABLE**
Connects radio to RTX-4005B Test Box and RIB for programming and testing of the radios.



RTL-4226B **BATTERY ELIMINATOR**
Replaces the battery pack during radio servicing of all radio models. The power supply input is overvoltage protected to 12 V DC maximum supply voltage. Reverse supply polarity protection and input fuse protection are also provided.

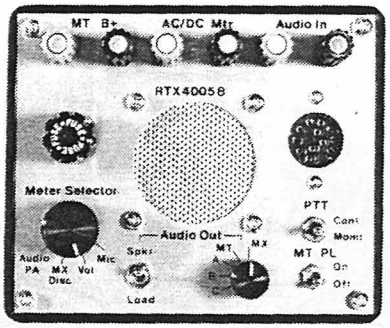
15-80384B40 BATTERY ADAPTER

Replaces the radio housing during servicing of all radio models. The Battery Adaptor is screw mounted to the base of the radio frame providing an easy slide on mount for a battery or the Battery Eliminator. With the Battery Adaptor in place, electrical test points located on the back of the radio RF board are accessible.



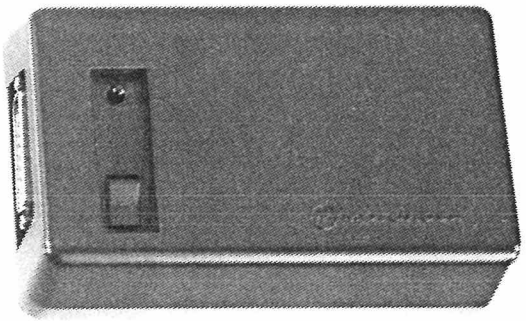
RTX-4005B PORTABLE TEST SET

Provides the capability for testing many transmitter and receiver functions. Transmitter modulation and keying can be simulated and receiver parameters can be tested without opening the radio. The Test Set is used in conjunction with the RTK-4205B Program/Test Cable.

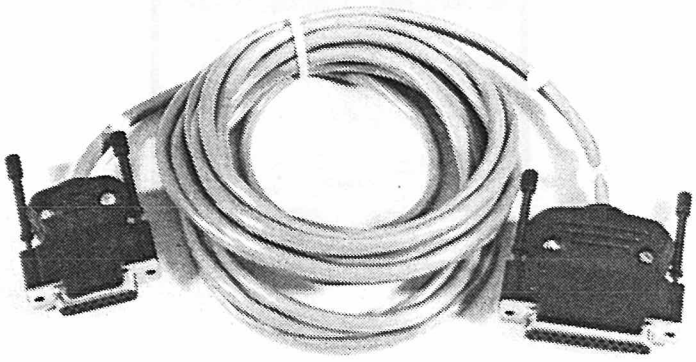


PROGRAMMING EQUIPMENT

RLN4008B **RADIO INTERFACE BOX (RIB)**
Voltage level shifter to enable communications between the radio and the computer's RS232 Serial Communications Adaptor.



30-80369B71/ COMPUTER INTERFACE CABLES
30-80369B72 Used to Connect the computer's Asynchronous Serial Communications adapter to the RIB (RLN4008B). Use B72 for the IBM PC AT. All other IBM models use B71.

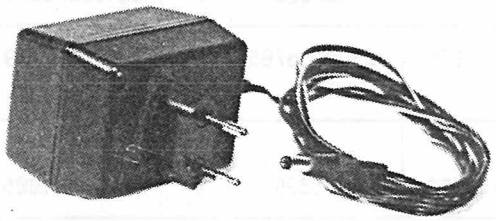


0180358A56 **POWER SUPPLY FOR RIB RLN4008B**
220 V European Plug.

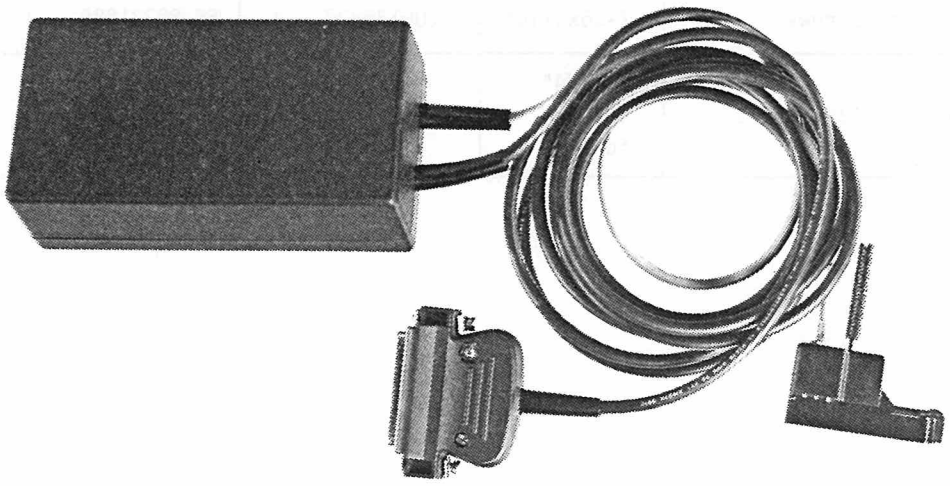
EPN-4040A **POWER SUPPLY FOR RIB RLN4008B**
240 V UK Plug.

SDPN4006A **POWER SUPPLY FOR RIB SDLN4010A**
220 V European Plug.

SDPN4005A **POWER SUPPLY FOR RIB SDLN4010A**
240 V UK Plug.



SDLN4010A **RADIO INTERFACE BOX (RIB)**
For programmimng purposes only. Fixed interface cables.
Voltage level shifter to enable communications between the radio and the computer's RS232 Serial Communications Adaptor.



TORQUE AND TOOL SPECIFICATIONS CHART

MOTOROLA HTX/STORNO CP1000

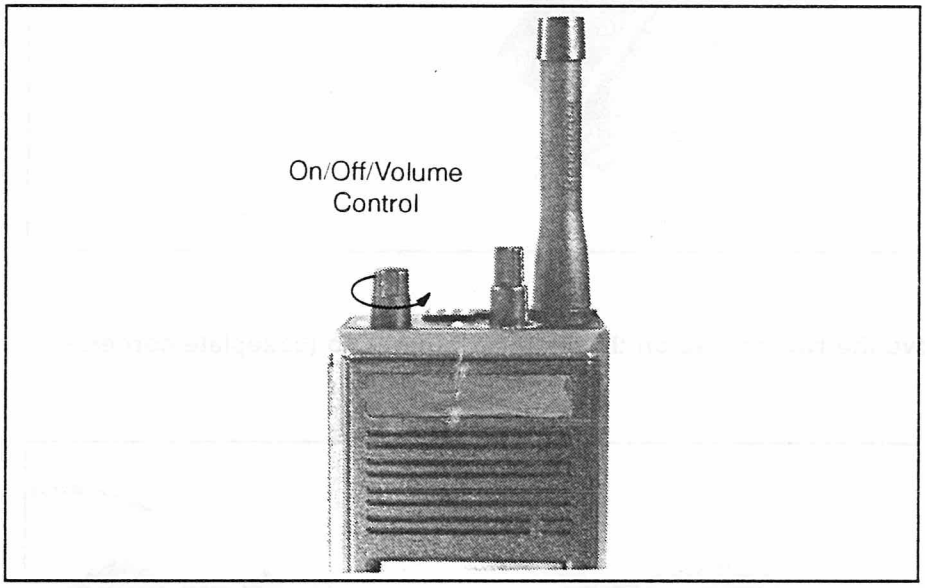
DESCRIPTION	SIZE	PART NUMBER	QTY.	RETIGHTEN WITH RSX-4043A TORQUE SCREWDRIVER AND BIT NO.	TORQUE IN N/METER INT'L.	CHAPT.6, DIA.NO.: M405.719 EXP.VIEW NUMBER
Control Top Antenna Bushing Spanner		025571R02	1	66-80370B90	1.45	68
Volume Pot Nut	0.75x8x1.6	0205629L01	1	66-80371B03	0.56	58
Freq. Switch Nut 16 channel only	0.75x8x1.6	0205629L01	1	66-80371B03	0.56	58
Toggle Switch Spanner		020516Q01	1	66-80370B95	0.56	56
Control Top Screw 16 channel radios	4-40x3/16"	0300136785	1	66-80321B79	0.56	71
Housing Battery Contact Screws	2-56x5/32"	0300139982	2	66-80321B86	0.35	19
Bottom Front Cover Screws	2-56x1/4"	0300140041	2	66-80321B86	0.35	20
Baseplate to Frame Screws	4-40 (captive)	0305941K01	2	66-80321B79	0.56	23
Front Cover Post Screws	4-40x1/2"	0305137Q01	2	66-80321B79	0.56	33
Controller Front Shield Screw	2-56x5/16"	0300136772	2	66-80321B86	0.35	48
RF Board Back Shield Screws	2-56x5/16"	0300136772	4	66-80321B86	0.35	48
Front Cover Speaker/Mic Tab Screws	#2x1/4" thread forming	03050731P	1	66-80321B86	0.35	94

DISASSEMBLY PROCEDURE

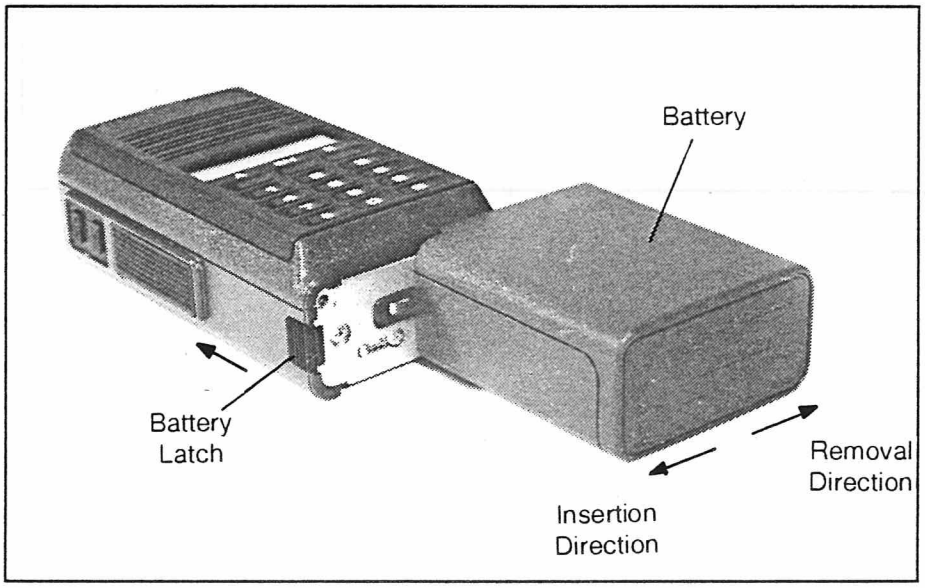
MOTOROLA HTX/STORNO CP1000

1. **Turn off the radio**

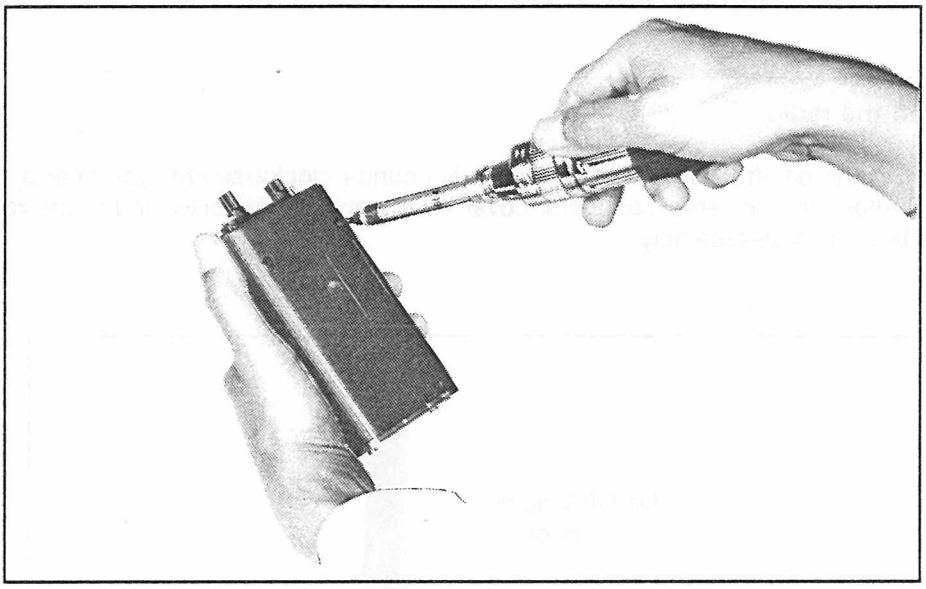
by rotating the on/off-volume control knob fully counter clockwise until you hear a click. Remove the universal connector cover or any accessory connected to the radio before beginning disassembly.



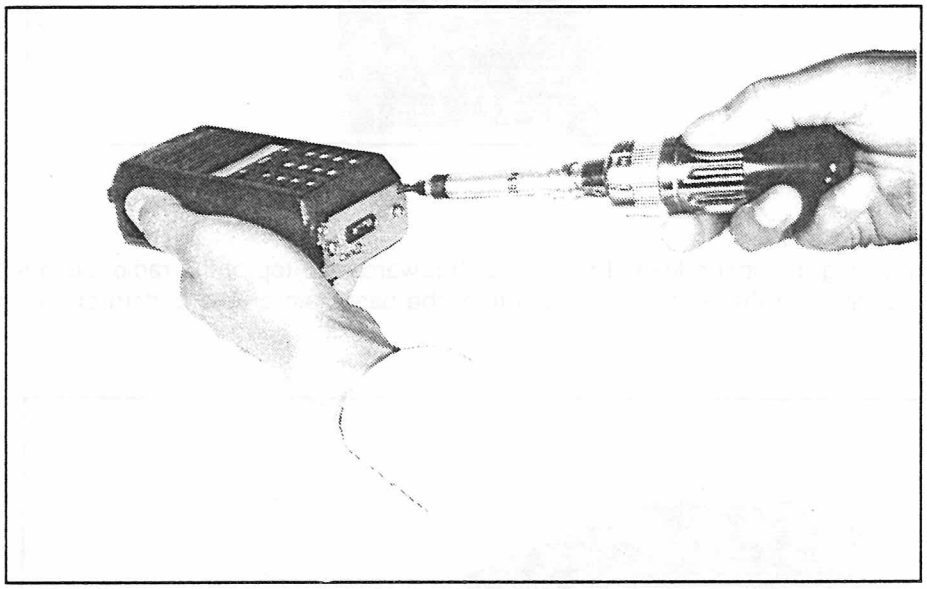
2. **Remove the battery:**
While pushing the spring-loaded battery latch towards the top of the radio, slide the battery away from the latch, removing it from the baseplate on the bottom of the radio.



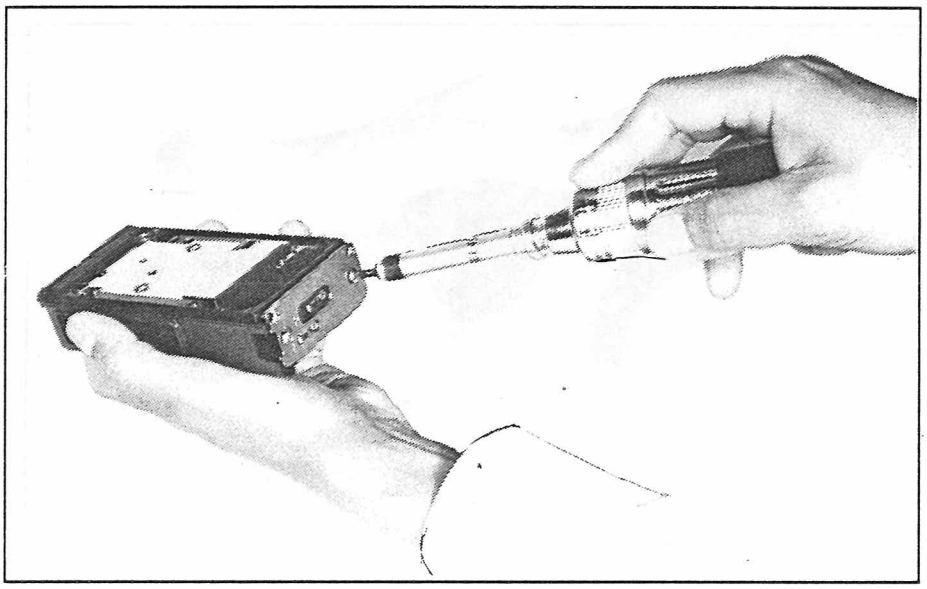
3. Remove the two screws from the back of the radio.



4. Remove the two screws on the bottom of the radio (baseplate corners).

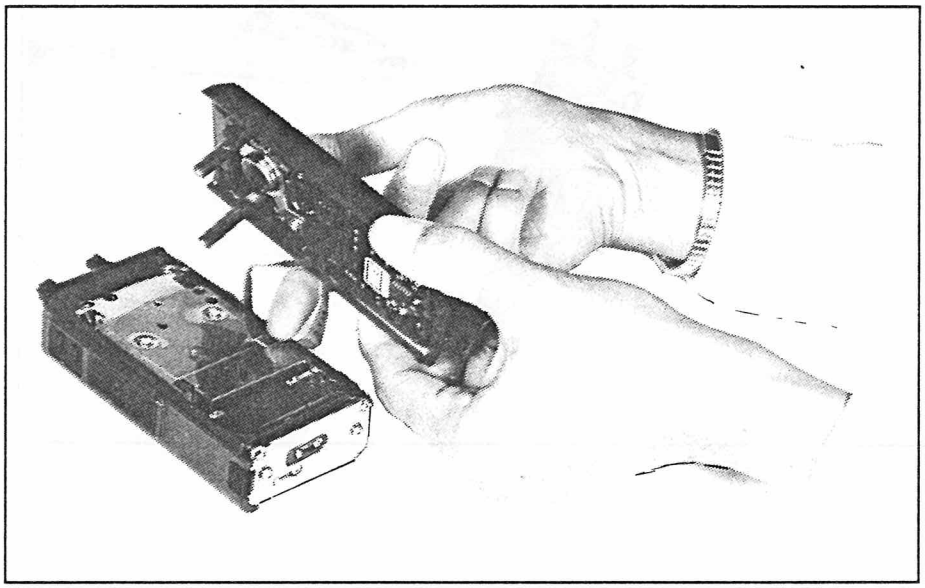


5. **Loosen the two captive screws on the bottom of the radio,**
(middle of each end of baseplate).
Do not completely remove the captive screws from the baseplate.

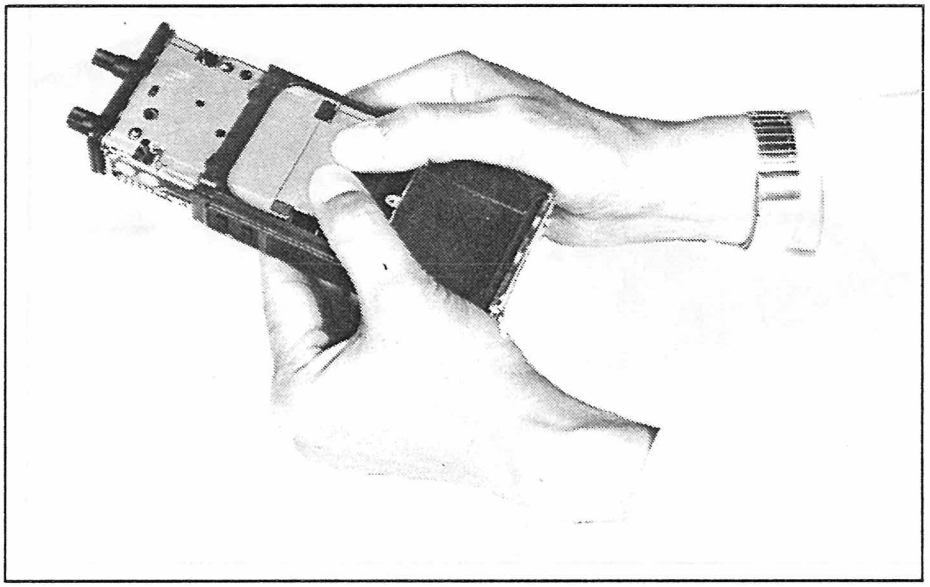


6. **Lift the front cover from the radio housing**
being careful not to pull against the speaker/microphone wires.

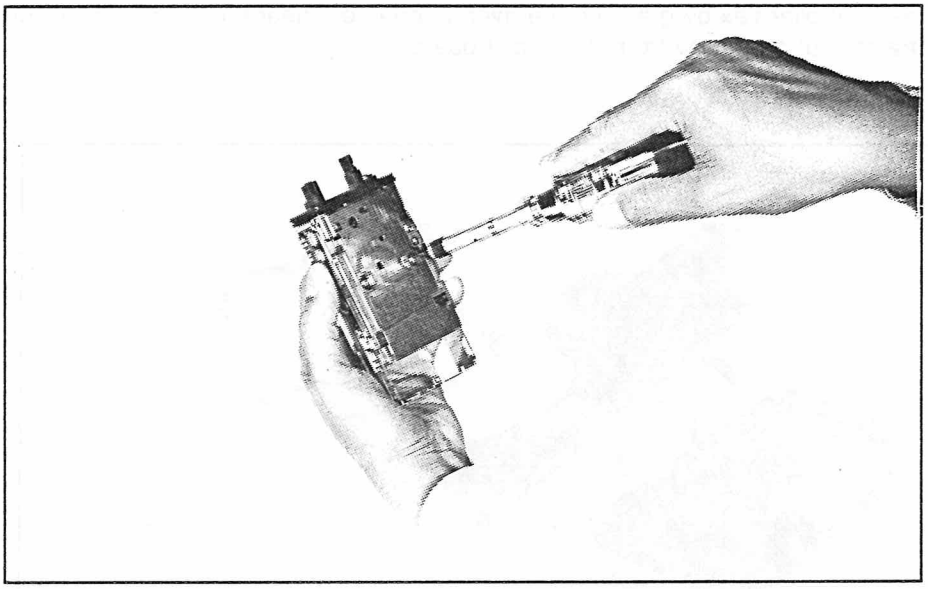
7. **Disconnect the speaker/microphone connector**
from the controller flex by grasping the microphone flex (near the plug) and pulling the plug straight out and away from the circuit board.



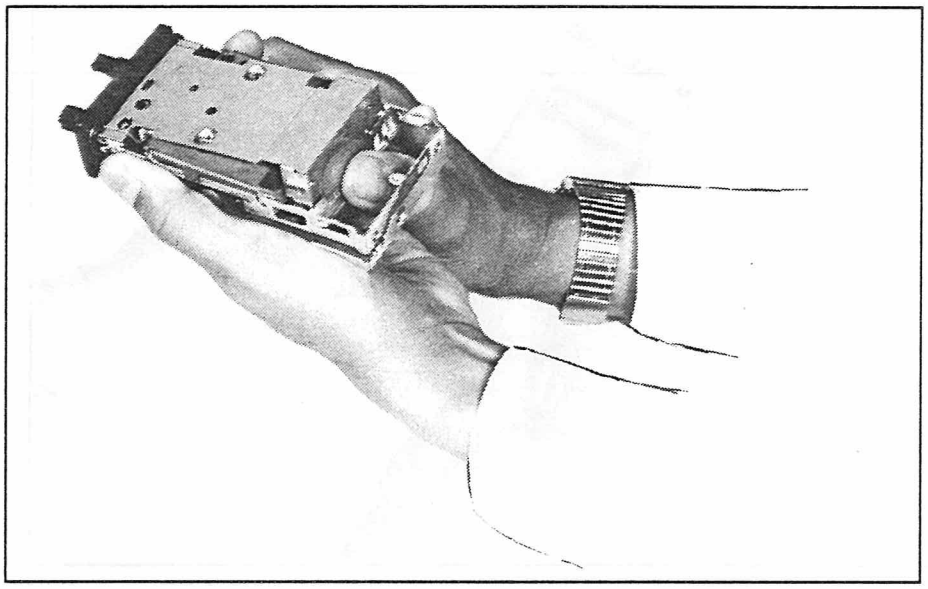
8. **Remove the frame assembly**
with a thumb and forefinger, grasp the antenna at its base and pull lightly to remove the frame assembly from the radio housing. Do not press the PTT switch during removal.



9. **Remove the screws that secures the front shield.**



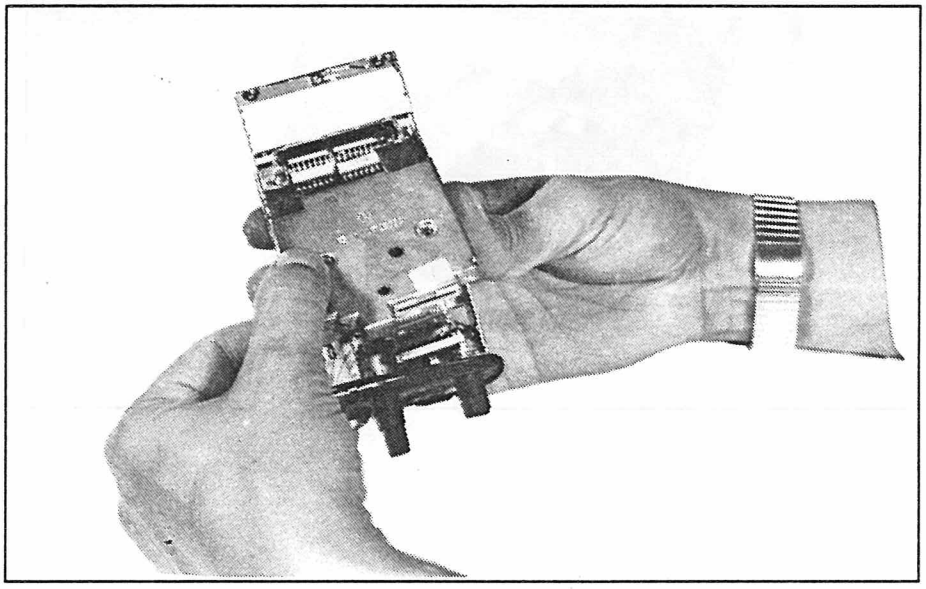
10. **Remove the front shield**
by pulling it straight out and away from the radio.



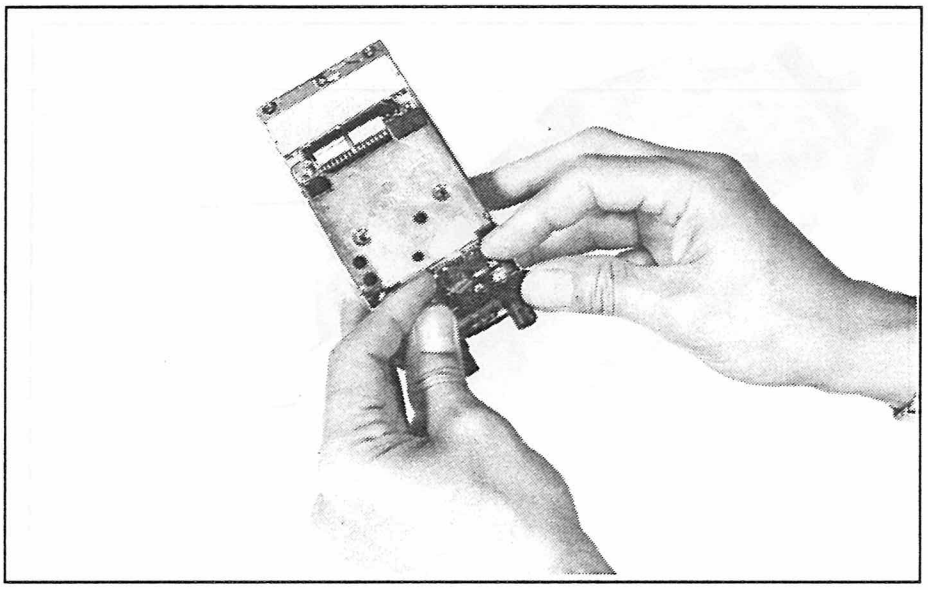
11. **Remove the controller circuit as follows:**
Remove the controller from the frame.

NOTE

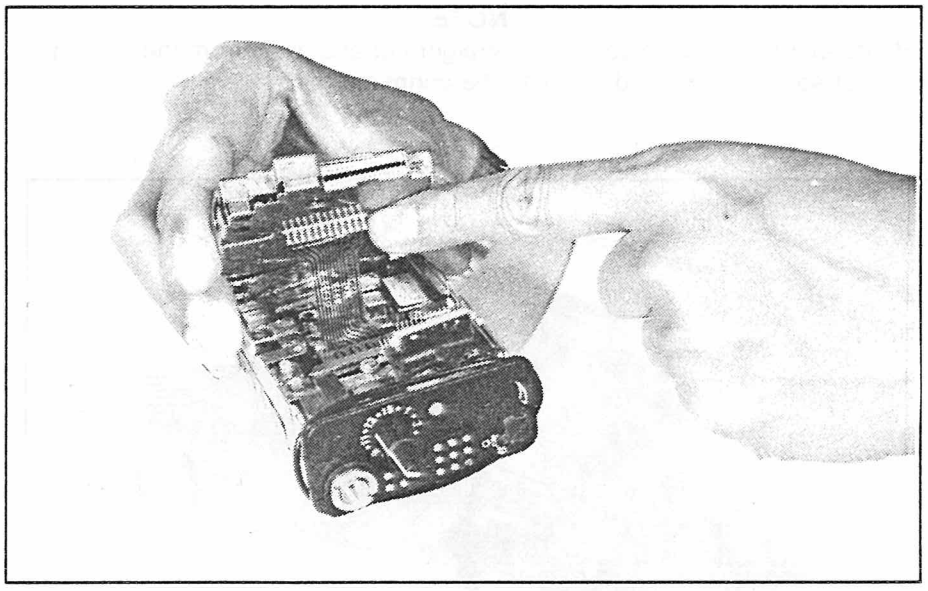
Be careful to pull each connector straight out and away from the mating socket so as not to bend or break the connector pins.



- Disconnect the 2 bottom flex connectors by carefully sliding them away from the bottom of the radio.



- Lift the controller circuit (nearest the bottom of the radio) away from the radio just enough to gain access to the connector under the controller.



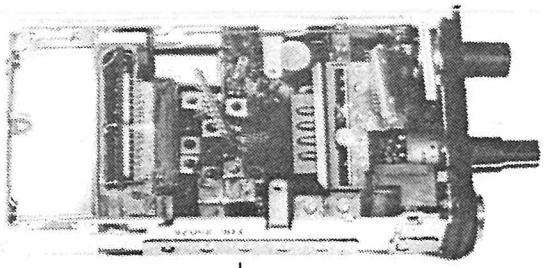
- Disconnect the connector under the controller.

- Disconnect the 2 connectors at the top of the controller.

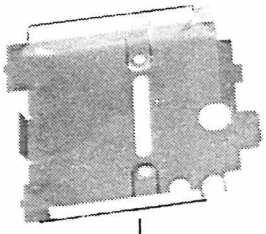
CAUTION

REFER TO "CMOS" PRECAUTIONS, PART OF SAFETY INFORMATION SECTION

- Lift the controller totally away from the radio.

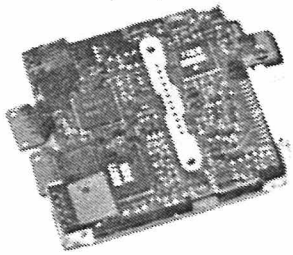


Transceiver
Component side

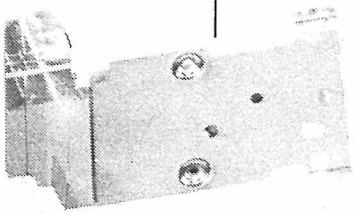


Controller shield

Controller flex



Front housing shield



NOTE

Refer to the Exploded View Diagram if further disassembly is necessary.

12. Assemble the radio in the reverse order of disassembly, making certain:

- to avoid damage to the flex circuits, connectors, and connector pins when reinserting the controller.
- not to depress the PTT switch when sliding the circuit board back into the housing.

CAUTION
Inspect the frame O-ring and control head O-ring. Replace if obvious damage exists.

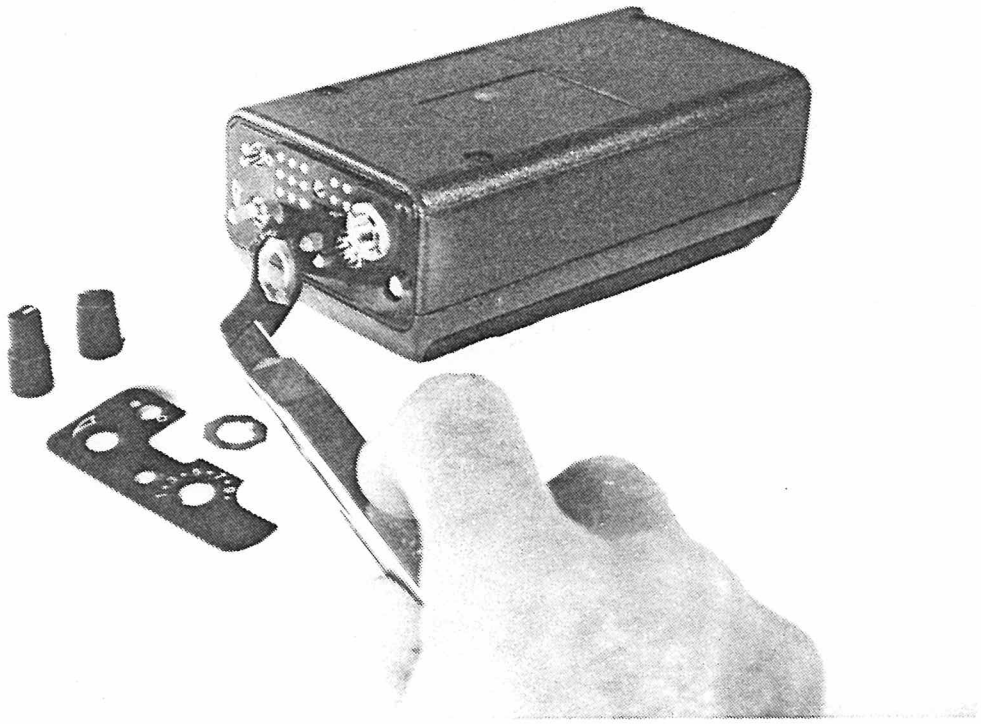
ESCUTCHEON REPLACEMENT

The escutcheon mounted on the radio top can contain either 10 or 16 positions for the rotary selector.

10-position escutcheon: P/N 1305676R19
10-position programmable washer: P/N 0405218Q03
16-position escutcheon: P/N 1305676R20

To replace a 16-position rotary selector with a 10-channel selector follow the procedure below:

1. Remove the volume knob, the rotary selector knob, and the two washers.
2. Remove the old escutcheon, e.g with the edge of a scalpel/knife.
3. When mounting a 10-position rotary selector a programmable washer must be mounted under the rotary knob so that the turn-knob is blocked at the position 10.
4. Mount the new escutcheon with glue.
5. Remount the washers and the two knobs.



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RADIO FUNCTIONAL TESTS (@ 10 Vdc)

MOTOROLA HTX/STORNO CP1000

TRANSMITTER PERFORMANCE

TEST	SERVICE MONITOR	RADIO	TEST BOX	COMMENTS
REFERENCE FREQUENCY	Set to POWER MONITOR, FREQ.ERROR;frequency to radio transmit frequency; input to RF IN/OUT	Set to channel corresponding to frequency of test	PTT Continuous (during performance check)	Frequency error= ≤450 Hz (VHF) ≤750 Hz (UHF)
RF POWER OUT	Same as above, except set monitor to measure POWER	Set to channel corresponding to frequency and power level under test.	PTT Continuous (during performance check)	RF power output ≥ published specs for channel under test.*
VOICE MODULATION	Same as above, except set monitor to measure DEVIATION	Set to channel corresponding to frequency and power level under test.		Press radio's PTT switch and say "four" loudly into mic. Deviation should be ≥4.0 kHz and ≤5.0 kHz

RECEIVER PERFORMANCE

TEST	SERVICE MONITOR	RADIO	TEST BOX	COMMENTS
RATED AUDIO	Set to GENERATOR; frequency to radio receive frequency;1 mV RF output; 1 kHz modulation; 3 kHz deviation	Set to open squelch	Speaker selector on position "A";switch to load.	Verify that audio is present; adjust radio volume control to read 3.7 to 3.9 Vac on DVM.
20 dB SINAD Psophometric	Same as above,except set monitor to measure SINAD	Set to open squelch	Set to speaker load	Reduce RF level to achieve 20 dB SINAD; RF level ≤published specs.

Note: Tests should be performed with Test Box RTX-4005 and associated Test Cable RTK4203.

* RF power levels can be different for each individual channel.

ALIGNMENT

MOTOROLA HTX/STORNO CP1000 - UHF

THIS RADIO HAS BEEN FACTORY ALIGNED AND DOES NOT REQUIRE ANY ADJUSTMENTS.

Realignment may be required if components are replaced or have aged, or if any transmitter/receiver frequencies are changed. If it is necessary to realign the radio, perform the following procedures:

1. When using the RTX-4005 test box, place the MT PL switch in the OFF position.

2. Remove the battery and front cover as described in the "DISASSEMBLY PROCEDURE".

3. Refer to the Test Set-Up Detail and connect the test equipment and Programmer/Tuner to the radio as illustrated.

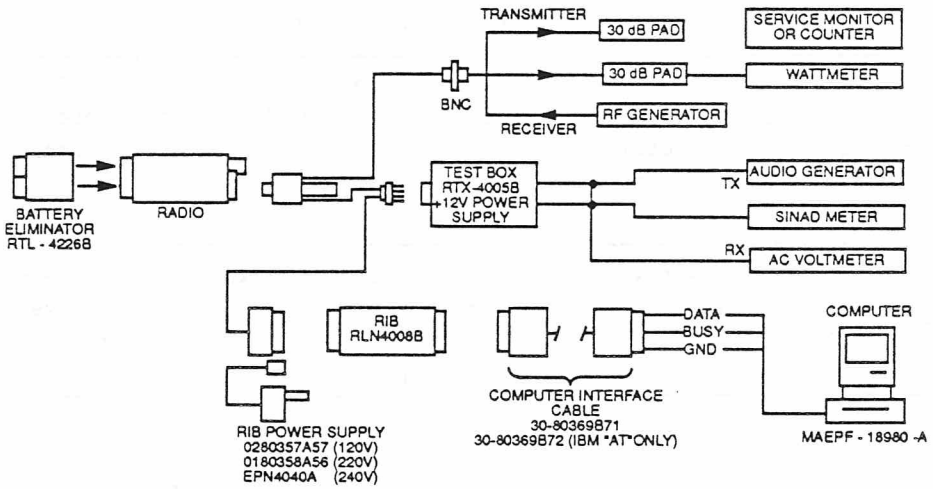
4. Connect a DC power supply to the battery eliminator and attach the battery eliminator to the radio.

5. Adjust the power supply for 10.0 VDC. Set current limit to 2.0 A.

6. Turn the radio off then on to reinitialise the radio.

7. Frequency Adjust (Synthesizer). Terminate the program/test cable (RTK-4205), RF lines (pins 10 and 12), through a 30 dB pad to a frequency counter or service monitor. Set the radio's frequency switch to any channel. Key the radio using the external PTT switch. Compare the frequency reading on the counter (or service monitor) to the customer frequency assigned to that channel. The frequency difference should be less than ±750 Hz. Adjust R120 if the frequency difference is more than ±750 Hz.

8. Perform either the "RECEIVER ALIGNMENT" procedure or "TRANSMITTER ALIGNMENT" procedure or both procedures as required.



TRANSMITTER ALIGNMENT

PRELIMINARY ADJUSTMENTS:

1. Terminate the program/test cable (RTK-4205), RF lines (pins 10 and 12), to a power meter through a 30 dB pad.

2. Make all measurements at the Program Test Cable (pins 10 and 12), with radio keyed through the external PTT switch.

3. Program new customer frequencies (if necessary)

POWER OUTPUT ADJUSTMENTS:

STEP	ADJUST	FOR	USING	NOTE
1	Check power output on all channels. NOTE: You must dekey before changing channels for the synthesizer to change frequencies. Set the frequency switch to the channel with the lowest output power			
2	P.A.Trimmer capacitor (on U102) See fig. p.6	Maximum power output with least current drain	RF Wattmeter and Ammeter	Reading should be greater than rated RF power output, with current drain less than 840 mA (2-W-Models), or less than 1575 mA (4-W-Models.) **Note:** Two possible peaks, choose peak with least current drain. Adjust from component side.
3	Check remaining channels	Same power and current readings obtained in STEP 2	RF Wattmeter and Ammeter	

4 Repeat steps 1 through 3 if necessary.

DEVIATION ADJUSTMENT

1. Terminate the program/test cable (RTK-4205) through a 30 dB pad to a service monitor (or deviation meter).

2. Place the METER SELECTOR switch on the RTX-4005 test box to the MIC position. Insert a 1 kHz tone at the AUDIO IN port of the test box. Use an AC voltmeter to monitor the voltage at the AC/DC METER port of the test box. Using the PTT switch on the RTX-4005 box to key the radio, adjust the level of the 1 kHz tone until 45 mV is present at the AC/METER port. Dekey the radio.

3. Connect the program/test cable to the Radio Interface Box (RIB). Use the Programmer/Tuner to read the radio.

4. If the radio requires a change in frequency or options, make the appropriate changes to the personality file and program the radio.

5. Enter the SERVICE menu from the main menu. Select the TUNE CHANNEL option.

NOTE

For radios with encryption module: Set toggle switch to "Clear Mode".

6. Select the channel by SET CHANNEL and ±.

7. Proceed to the TRANSMIT DEV PARAMETER position of the TUNE CHANNEL screen

8. Press and hold down the PTT switch on the RTX-4005 to continuously key the radio.

9. Press the ± keys to tune for a peak deviation as shown in the table below for the radio's appropriate channel spacing.

10. Release the PTT switch on the RTX-4005 to dekey the radio

11. Proceed to the REF DEV PARAMETER position of the TUNE CHANNEL screen.

12. Disconnect the 1 kHz tone from the AUDIO IN port on the RTX-4005

13. Press and hold down the PTT switch on the RTX-4005 to continuously key the radio.

14. Press the ± keys to tune for a peak deviation as shown in the table below for the radio's appropriate channel spacing.

15. Release the PTT switch on the RTX-4005 to dekey the radio.

16. Reconnect the 1 kHz tone to the AUDIO IN port of the RTX-4005.

17. Repeat steps 6-16 for all channels to be tuned.

18. Exit from the TUNE CHANNEL menu and program the radio.

19. With the 1 kHz tone applied, check the total transmit deviation to the range shown in the table below. Repeat the above procedure to retune any of the channels if necessary.

20. The programmer disables normal transmit (5-tone or PL encode) while on the REF DEV PARAMETER operation, and forces the radio to encode 30 Hz PL regardless of radio settings.

21. If any changes to the deviation levels were necessary, the radio must be reprogrammed.

CH SPACING	VCO MODULATION		REF MODULATION
	STEP 9	STEP 19	STEP 14
12.5 kHz	2.15-2.35 kHz	2.1-2.4 kHz	420-480 Hz
20 kHz	3.45-3.75 kHz	3.2-3.9 kHz	840-960 Hz
25 kHz	4.35-4.65 kHz	4.2-4.8 kHz	840-960 Hz

NOTE

While in the TUNE CHANNEL Screen, changes to the deviation settings are made in the radio's RAM. If the radio is dekeyed during the deviation adjustment, the radio's original information will be returned to RAM.
To place the programmer settings back into RAM, press either the ENTER, +, or - key.

RECEIVER ALIGNMENT

PRELIMINARY ADJUSTMENTS:

1. Coils L2 and L13 are tuned at the factory for a 30 MHz bandwidth and should never need retuning. Coils L1 and L2 adjust an 8 MHz window anywhere across the 30 MHz bandwidth. Perform the "Receiver Check" to determine if "RECEIVER ALIGNMENT" (tuning any portion of the receiver) is necessary.

2. Connect the program/test cable (RTK-4205) to the Radio Interface Box (RIB). Use the Programmer/Tuner to read the radio.

3. When using the RTX-4005 test box, place the AUDIO OUT switch in the B position to set for proper speaker loading. Place the meter selector in the AUDIO PA position for receiver tests.

4. Connect the RF cable of the test cable to an RF generator or service monitor.

RECEIVER CHECK:

1. Use the Programmer/Tuner to program for new customer frequencies, if necessary. Make sure the 12 Vdc programming voltage is connected to RTX4005B, port B +.

2. Set the RF generator (or service monitor) for the appropriate frequency at a 1 mV level with a 1 kHz tone modulated at:
   3 kHz deviation (25 kHz channel spacing)
   2.4 kHz deviation (20 kHz channel spacing)
   1.5 kHz deviation (12.5 kHz channel spacing)

3. Connect the AC/DC METER port of the RTX-4005 to an AC voltmeter. Adjust the volume potentiometer (R140) for an AC voltmeter reading of 4.47 Vrms.

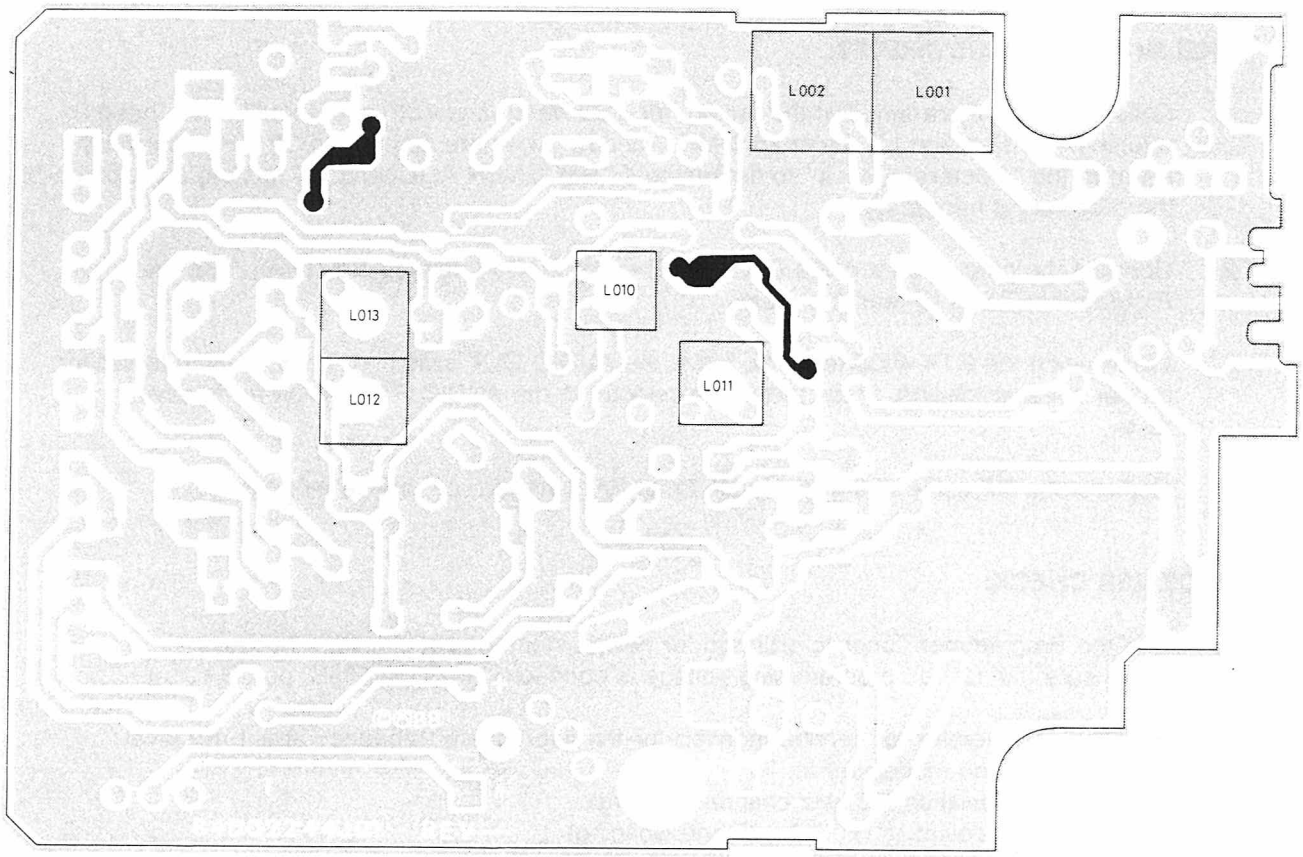
4. Connect a SINAD meter with psophometric filter to the AC/DC METER port of the RTX-4005.

5. Reduce the RF level until 20 dB of SINAD is obtained; record the RF level reading. Depress the monitor button while taking this measurement to ensure that the radio is not squelched. Also temporarily disconnect the test cable from the RIB to ensure that computer noise does not affect the measurement.

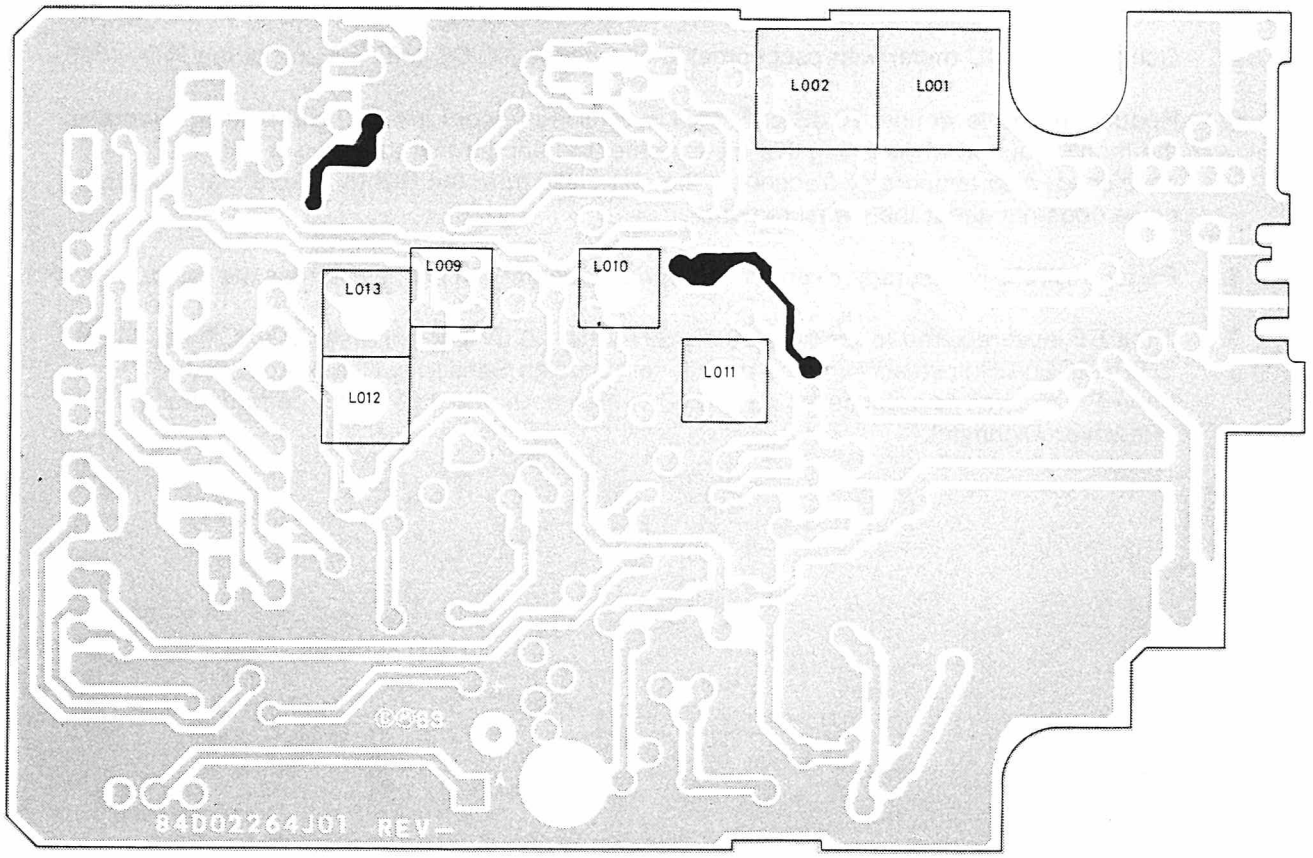
6. Perform SINAD measurement on an appropriate number of channels across the band.

7. If the RF level required to produce 20 dB SINAD is 1.0 uV EMF or less, DO NOT REALIGN THE RECEIVER; instead, proceed directly to "Squelch Sensitivity/Check Adjustment." If the RF required to produce 20 dB SINAD is greater than 1.0 uV EMF, perform the "Receiver Alignment."

2 WATT RADIOS



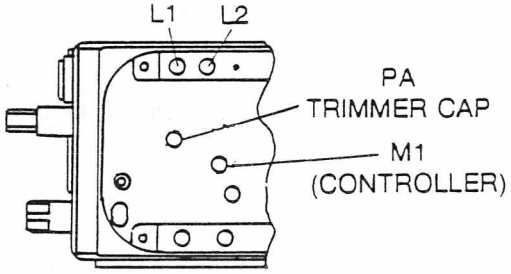
4 WATT RADIOS



RECEIVER FRONT END:

> **NOTE**
>
> The receiver front end tuning procedure can be accomplished with the radio in its housing. Coils L1 and L2 are tuned through the flex carrier while M1 is monitored on the controller flex.

M1 METERING POINT LOCATION (CONTROLLER)



RECEIVER ALIGNMENT FRONT END

1. Select the customer frequency which is closest to the center of the specified customer frequencies. For two-frequency radio select the channel with the lowest frequency. Set the channel switch for the appropriate frequency.

2. Tune coils L1 and L2 to the top of the coil form. This will be the position where the slugs are nearest to the flex carrier.

3. With an AC voltmeter, monitor M1 on the controller flex. Set the service monitor to the appropriate frequency and adjust the RF level so that the AC voltage can be read at M1. During the following procedure, adjust the RF level to keep the AC voltage at M1 within the range of the voltmeter.

4. Peak coil L1 for maximum AC voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.

5. Peak coil L2 for maximum AC voltage at M1. Select the peak where the coil's slug is closest to the flex carrier assembly.

6. Perform steps 2 through 7 of the "Receiver Check" procedure, then repeat the "Receiver Alignment Front End" procedure, if necessary.

RECEIVER ALIGNMENT (BACK END/INJECTION FILTER):

> **NOTE**
>
> The receiver back end coils L6, L7, and L8, and the injection filter coils L9 and L10 are factory tuned for 30 MHz and should not need retuning. Should the mixer, crystal filter, IF modules, or accompanying back end parts need replacing, it will be necessary to perform the back end procedure.

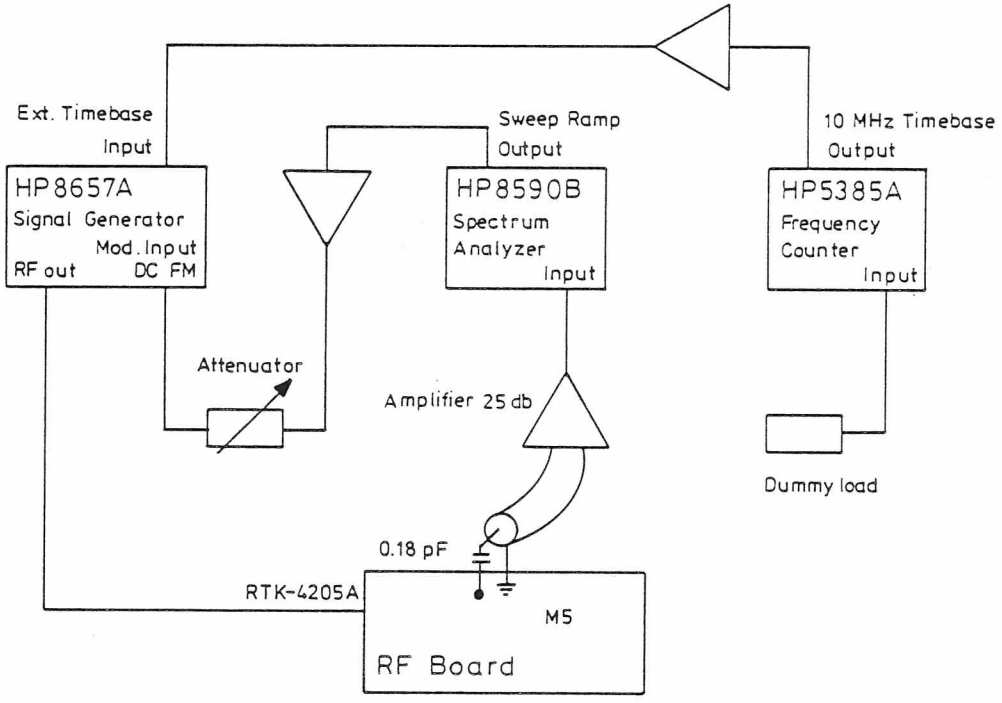
IF TUNING 20 kHz AND 25 kHz CHANNEL SPACING RADIOS

> **NOTE**
>
> This adjustment is done in order to achieve low group delay distortion of the first IF crystal filters. This makes the radio able to receive DVP, Digital Voice Privacy, and other 12 kBaud digital signals.

7. Remove the radio from its housing as described in the "DISASSEMBLY PROCEDURE", then remove the backplane shield (exploded view item #74).

8. Attach the battery adapter to the radio frame, then attach the battery eliminator to the battery adapter, and apply voltage.

9. Attach the Programme Test Cable, RTK-4205A, to the radio.
Use the following set up.



Set analyzer to:
Resolution BW = 100 kHz
Video BW = 300 Hz
Sweeptime = 167 ms
Attenuation = 0 dB
Frequency Span = 25 kHz

Set the Signal Generator to:
Amplitude = -65 dBm
External DC FM 25 kHz/V

10. Between the Programme Test Cable and the frequency counter connect a dummy load and key up the radio. Then adjust R129 for the expected carrier frequency within ± 0.1 ppm.

11. Apply the signal generator output to the frequency counter.

12. Bring analyzer in external trig mode (this brings sweep ramp at 0 V.) Set signal generator to external DC FM 25 kHz/V. Fine adjust the frequency of the signal generator to fo + 12.5 kHz, use the frequency counter. Where fo is a frequency in the current bandsplit.

13. Bring analyzer in single sweep mode, sweep once (this brings sweep ramp at the top of the ramp). Adjust attenuator so that frequency of the signal generator is fo -12.5 kHz.

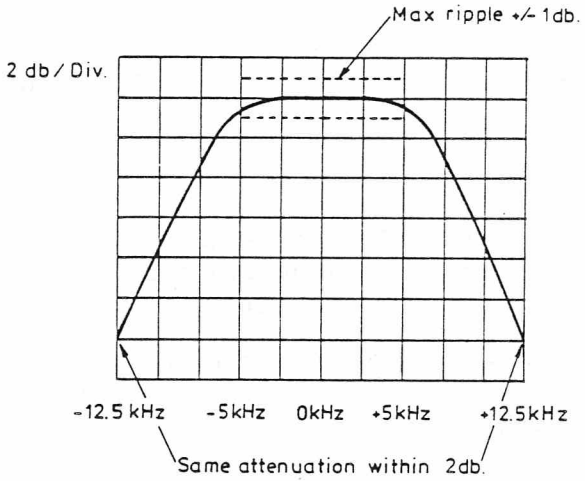
14. Apply 53.55 MHz, no modulation and power level of -65 dBm to the spectrum analyzer. Adjust spectrum analyzer centre frequency until the 53.55 MHz signal is in centre of the screen.

15. Tune L6, L7 and L8 slugs to flush with solder side of the RF board. Connect 0.18 pF probe to test point M5. Assure that analyzer is tracking.

16. Connect the Programme Test Cable to the signal generator and tune this to fo. Adjust L6, L7 and L8 (in that order) to maximum gain at centre frequency.

17. Fine tune L6, L7 and L8 for best flat top and symmetrical filter response. The adjustment for flatness and symmetry should not cause loss of gain more than 3 dB relative to result achieved in step 16.
Maximum ripple: ± 1 dB within ± 5 kHz of centre frequency.
Symmetry: Same attenuation within 2 dB at ± 12.5 kHz of centre frequency.
Hints for tuning:
    - Fine tune L7 to same attenuation ± 2 dB at ± 12.5 kHz of centre frequency.
    - Adjust L6 to minimum ripple at top of response.
    - Repeat above until wanted response is achieved.

    After tuning a typical response should look like shown below.



18. Perform "RECEIVER CHECK" procedure, then repeat steps 10 to 17 if necessary.

IF TUNING 12.5 kHz CHANNEL SPACING

Perform steps 7 to 9 in "IF TUNING FOR 20 kHz AND 25 kHz CHANNEL SPACING RADIOS."

19. Connect the Programme Test Cable to a signal generator tuned to the receiving frequency of the current channel.

20. Preset L6, L7 and L8 so that they flush to solder side of the board.

21. Monitor M1 with an AC voltmeter and peak L6, L7 and L8 for maximum reading on the voltmeter. Always tune slugs inward towards the controller flex. There are more than one peak, select the peak closest to the soldering side of the board.

22. Perform "RECEIVER CHECK" procedure, then repeat step 21 if necessary.

SQUELCH CHECK/ADJUSTMENT

1. Set radio to channel determined to have the poorest sensitivity.

2. Connect an AC voltmeter to the AC/DC METER port of the RTX-4005 test box.

3. Set the RF generator for the appropriate frequency and no modulation. Reduce the RF level to a minimum, then turn off the RF.

4. Start the PC programmer/tuner and enter the squelch tuning menu. Select the appropriate frequency.

5 Note the squelch attenuator level. Adjust the attenuator down to 0. (Use the + /- keys to adjust).

6. Note the AC_{RMS} voltage at the AC/DC METER port of the RTX-4005B test box. This is now 0 dB quieting reference level.

7. Increase the squelch attenuator to the value noted in step 5. The radio should now be squelched.

8. Increase the RF level until the radio unsquelches.

9. Measure the AC_{RMS} voltage at the AC/DC METER port of the RTX-4005B test box. If the level is between 8 and 14 dB below the level noted in stap 6, the squelch does not need retung. In this case go to step 13, otherwise proceed wirh step 10.

10. Set the RF level to a minimum, then turn RF off. Set the squelch attenuator to 0. The radio should be unsquelched. Note the AC_{RMS} voltage at the AC/DC METER port. This is now 0 dB quieting reference level.

11. Increase the RF level until 8 dB of quieting is measured at the AC/DC METER port.

12. Increase the squelch attenuator until the radio squelches. This is the new squelch attenuator setting.

13. If the squelch setting required modification, program the radio and exit. Otherwise exit without programming.

RX AUDIO FULL SCALE VOLUME LEVEL CHECK/ADJUSTMENT

1. Set the radio to any user channel.

2. Connect an oscilloscope to AC/DC METER port of RTX-4005B test box.

3. Set the RF generator for the appropriate frequency at a 1 mV level with a 1 kHz tone. Deviation is set according to the following:

   0.75 kHz deviation (12.5 kHz channel spacing)
   1.30 kHz deviation (20 kHz channel spacing)
   1.60 kHz deviation (25 kHz channel spacing)

4. Turn the volume knob to maximum volume position.

5. Check that the audio seen on the oscilloscope is a 1 kHz sine with sligtly clipped peaks. If this is the case, tuning of maximum volume is not necessary, and the rest of this procedure can be omitted. Otherwise proceed with step 6.

6. Set the RF generator for the appropriate frequency at a 1 mV level with a 1 kHz tone. Deviation is set according to the following:

   0.75 kHz deviation (12.5 kHz channel spacing)
   1.20 kHz deviation (20 kHz channel spacing)
   1.50 kHz deviation (25 kHz channel spacing)

7. Start the PC programmer/tuner and go to the RX audio full scale volume level tuning menu. Select same frequency as in step 6.

8. Adjust the volume attenuator until the audio signal at oscilloscope is slightly clipped. (Use the +/- keys to adjust). This is the new maximum volume attenuator setting.

9. Program the radio and exit.

TEST & PROGRAMMING SET-UP

EXAMPLE

EQUIPMENT REQUIREMENTS LIST FOR TEST AND PROGRAMMING

- IBM Personal Computer
  The HTX/CP1000 Radio Software is designed to operate on the IBM PC. IBM DOS Version 3.0 or higher, an asynchronous communication adaptor, and 512K of RAM are required.

- Radio Interface Box (RIB) P/N 01-80353A74
  Interface communication between the radio and the computer's asynchronous communication adaptor.

- Wall Mounted Power Supply
  A 220 V AC/DC converter to supply 9 V DC to the RIB.

- Computer Interface Cable
  P/N: 30-80369B71 for 25 pin "D" connector (XT)
  P/N: 30-80369B72 for 9 pin "D" connector (AT)
  Connects the computer's asynchronous communication adaptor to the RIB.

- Program/Test Cable P/N RTK-4205
  Provides electrical interconnect to the RIB, Portable Product Test Set, and the HTX/CP1000 radio.

- HTX/CP1000 Radio Service Software

- Portable Product Test Set P/N RTX-4005B

- Programming supply voltage (12 V DC)

EQUIPMENT SET-UP

1. Plug the 15 pin connector on the computer interface cable to the RIB. Connect the other end of the computer interface cable to the asynchronous adapter on the computer. The program uses COM1 as the default communication port.

2. Plug the 25 pin connector on the program/test cable to the RIB. Connect the round 12 pin plug on the program/test cable to the Portable Product Test set (RTX-4005B). Connect the 13 pin plastic connector on the program/test cable to the radio.

3. Turn on the radio.

4. Plug the wall mount power supply into the RIB and the other end into the wall outlet.

5. Make sure the PL and PTT switches on the Portable Product Test Set are in the OFF position.

6. Connect 12 V, to program the radio, on the B + connector.

7. Type HTX/CP1000 and press "ENTER" on the IBM PC.

EQUIPMENT REQUIREMENT LIST FOR PROGRAMMING ONLY

- IBM Personal Computer
  The HTX/CP1000 Radio Software is designed to operate on the IBM PC. IBM DOS Version 3.0 or higher, an asynchronous communication adaptor, and 512K of RAM are required.

- HTX/CP1000 Radio Service Software

- Wall Mounted Power Supply
  A 220 V AC/DC Converter to supply 17 V DC to the RIB.

- Radio Interface Box (RIB) P/N SDLN4010A

TEST DESCRIPTION

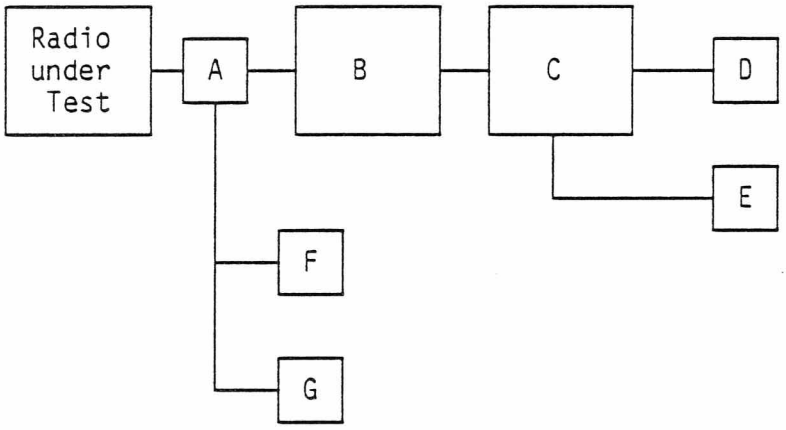
EQUIPMENT AND MATERIAL REQUIRED

Test Equipment and Fixtures
- Test Cable RTK-4205B
- Radio Test Box RTX-4005B
- Testbox
- Keyloader
- Bit-error-analyzer
- RF signal generator
- Deviation meter

Material
Radio to be tested

TEST SET-UP

Set-Up block diagram



Key-Load
Load the key using the KEYLOADER to the actual encryption module.

TEST PROCEDURE

Bit ERROR Rate
Load the encryption teat box using the KEYLOADER to the actual encryption module.
Connect the radio to the Encryption Test Box.
Modulate the RF signal generator, with the TX output from the test box. Adjust the deviation to 4.2 kHz.
Locate J2 pin 2 (Disc) on the Encryption Flexboard in the radio and connect this point to the test box LINE input connector.
Adjust the output from the RF signal generator according to table 5.3.3.1.

Table 5.3.3.1.
RF generator level relative to sensitivity level. (It is presumed that 20 dB Psopho-Sinad sensitivity is already measured).

Radio Split	Fc	Fc +2 kHz	Fc -2 kHz
146-162 MHz	+5 dB	+7 dB	+7 dB
157-174 MHz	+5 dB	+7 dB	+7 dB
403-433 MHz	+5 dB	+7 dB	+7 dB
438-470 MHz	+5 dB	+7 dB	+7 dB

Measure the BIT error rate.
Requirement: BIT error rate < 1%.
Rise the RF generator output to 0 dBm and measure the BIT error rate.
Requirement: NO BIT errors.

Talk Test
Adjust the RF generator output to -47 dBm.
Set the test box to external microphone. Talk to the microphone and switch between "analog" and encrypted mode. Check that output is present in both modes.

TX Modulation Adjustment
Set the radio in encryption mode and key the PTT.
Adjust R505 on the encryption flex until a peak deviation of 4.2 kHz.

CHAPTER
CHAPITRE
KAPITEL

6

MOTOROLA HTX/STORNO CP1000

THEORY OF OPERATION - UHF

RECEIVER

Turnable preselectors L1, L2 form a 2 pole turnable Butterworth filter. It has a BW > 8 MHz and can be positioned anywhere within each band split. C1, C2 and L2 match the presels to Q1. C4 improves presel performance. The RF amplifier is configured in the common emitter topology. The amplified RF signal at its collector is matched to the 3 pole (L5-7) fixed tuned filter by L4, C6-7. C35-7 improve presel performance. In some bandsplits C7, C35-37 and C41 may be replaced by zero ohms resistors. This filter has a BW > 30 MHz. All presels are 50 Ohms based. C8, L16 and L8 match the 3 pole presel to the mixer Q2. Q2, the first mixer down convert the carrier signal from RF to 53.55 MHz first I.F. The mixing product from the mixer is routed through the 53.55 MHz crystal filter for filtering out the 53.55 MHz IF signal. L9-11, L14, C14-16, C18, C29 and C43 provide impedance matching at the mixer o/p and the IF module input pin 7. VCO module U101 provides low side injection signal for the mixer Q2. This low level signal is amplified and buffered by buffer module U108. U108 contains 3 buffers: the Rx injection buffer enabled by R5, the Tx injection buffer enabled via T5. The prescaler buffer feeds the VCO signal back to the synthesizer module U107 to phase lock the VCO. The prescaler buffer is always on. R5 and T5 control voltages are used in the VCO module to synthesize Rx and Tx injection frequencies. The o/p af the Rx buffer is routed to a band pass filter formed C21-23, L12-13, C31. C30 is a D.C. blocking capacitor so 5 V gate bias can be developed across gate 2 of Q2. This filter has a BW of 30 MHz. The injection signal of either 53.1 MHz of 54.0 MHz for the second mixer is generated by the 2nd VCO in the synthesizer module. The injection signal is injected into input of the 2nd mixer pin 9 of U1. Module U1 contains the 2nd mixer, IF amplifier, limiter, PLL demodulator for the 2nd IF, noise amplifier, carrier detect circuit and 5 V regulator. The 2nd IF frequency is 450 KHz and selectivity is provided by ceramic filter FL3 and FL4. The 2nd IF signal can be monitored at pin 4 of U1 (M1 test point). The demodulated signal is available at U1 pin 1 (top) and is routed to U405 on the controller flex for signal processing. A noise output is routed out on U1 pin 5 (Top) to the controller flex audio filter IC U404 for adjusting the noise level to be feed back to U1 pin 7 (Top), to the carrier detect circuit. The carrier detect signal is available at U1 pin 9. In the receive mode the uP pulls the R/T (J6 pin 4) line to 1 allowing U1 to operate. In Tx mode the uP pulls this line to low shutting down the only the IF circuits in U1.

When a carrier is detected J6 pin 9 goes high. This level is detected by the uP an the audio PA is enabled.
The demodulated signal is filtered in the audio filter IC U404 on the controller flex. The U404 function is under control of the uP U401. The processed audio from U404 goes to the audio PA module U406. The volume is set in the attenuator in U404. In application mode the uP uses its A/D converter to read the position of the volume knob an set the attenuator accordingly. The PA o/p has the separate amplifiers which are wired to give bridge output for both internal and external speakers.

TRANSMITTER

The o/p of the Tx injection buffer module U108 is matched to predriver stage Q102 via C105, L101, C102, L116. R113 is a damping resistor across L101. Q102 is the predriver operating in class AB mode. In the 4 W radio, this stage is powered from the T line. In the 2 W radio, the stage is powered from a 7 V regulator; the regulator being turned on by supplying bias from the T line to a zener diode. The regulator is made up of Q106, R135 and VR102.

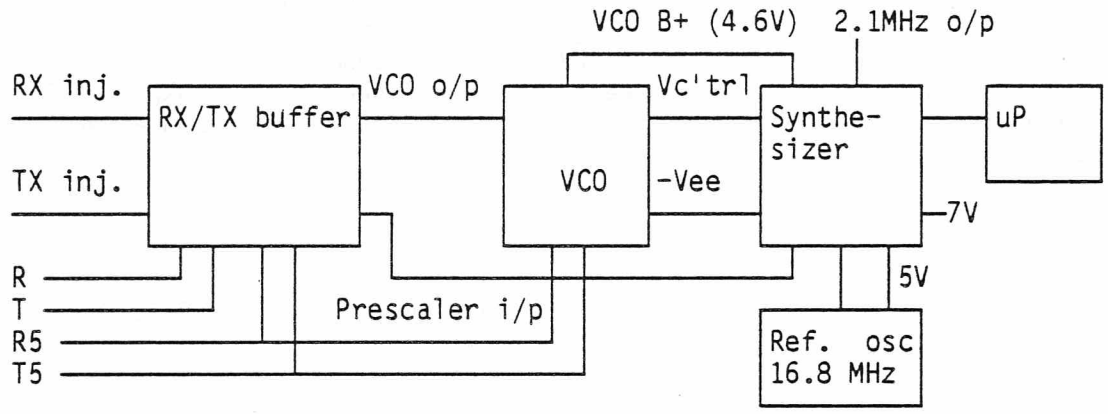
Both the buffer and the predriver stage operate with 30 MHz bandwidth. The interstage matching networks for predriver Q102, (L105, C108, C110, L106), drives Q103 (C130, L118, C167, C111, L109, C112) and IPA Q104 (C116, L112, C117) are broad band networks of 30 MHz. R121-C152 and R127- C155 are RF stability networks for predriver and buffer. L112, C117 and C116 match the o/p of the IPA to the 4 W PA module. In the 2 W radio, the same components match the 2 W driver Q103 to the 2 W PA module. The PA module is a broad band module. The capacitance trimmer at the top of the module is for Tx power adjustment. This trimmer needs to be adjusted for best transmitter performance over customer/band edge frequencies.
Applying 10 V via the T line to L114 willl turn the antenna switch U105 to transmit mode, R129 sets the antenna switch current drawn via L114. The RF power is routed to either one of 2 ports in the antenna switch.
One port is the remote antenna port which is turned on by grounding pin 13 in the universal connector sockets. If this pin (also connected to pin 7 of U105) is not grounded, the RF power is routed to standard antenna port. There is an antenna matching network (L115, C143, C154) between the standard port and the antenna. C151 and C157 match the remote port to the RF pin on the universal connector. When the remote mode is selected, current flows via R128 and L119 to turn on the remote port. In the remote mode during transmit, additional current is provided to the antenna switch via diode CR103 and R123. This is in addition to the current via L114.

SYNTHESIZER AND VCO

The synthesizer consists of two chips U201 and U202. The PLL master clock is provided by a 16.8 MHz crystal oscillator U106. R120 fine tunes the frequency of the reference oscillator. The second VCO in U201 provides a 53.1 MHz or 54.0 MHz 2nd injection signal to the IF module (U1). The synthesizer is programmed by the uP U401. The synthesizer also provides regulated 5 V to U106 and filtered 6.6 V to the VCO. The synthesizer provides a negative voltage (-Vee line) to the VCO, the voltage being a function of uP programming.

VCO module U101 provides the injection signal for the 1st mixer in the receive mode and a modulated transmit signal during transmit mode. A 5 V on pin 3 will put the VCO in Tx mode and a 5 V on pin 8 puts the VCO in receive mode. In the transmit mode the weak microphone signal is amplified by the preamp in U406. This amplified signal is feed to U404 for signal processing. The resultant signal the drives the VCO pin 1 so as to modulate the carrier for the transmitter. The amplitude of the signal from U404 is controlled by the uP U401. The signal is also sent to the synthesizer module for low modulation with the phase modulator. This allows modulation of low audio frequencies.

SYNTHESIZER BLOCK DIAGRAM:



SYNTHESIZER OPERATION

For the VCO to lock onto a stable frequency there must be:

1. Proper VCO B + voltage of 6.6 and 7 V to synthesizer.
2. The -VEE voltage from the synthesizer must be correct according to table 7.1.4. Valid -VEE voltages are approx. -2 V, -4 V, -6 V and -8 V.
3. Supply voltage R5 and R must be present in receive mode. Supply voltage T5 and T must be present in transmit mode.
4. There must be RF signal present from the buffer module to the prescaler input of the synthesizer.
5. The 16.8 MHz reference oscillator signal must be present at synthesizer.
6. The uP read the personality of the radio and program the synthesizer accordingly. When the VCO and synthesizer locks at the right frequency the Vctrl voltage is usually somewhere between 0.5 and 4.5 V.

CONTROLLER FLEX

For a extensive and detailed description of the controller see "THEORY OF OPERATION FOR CONTROLLER FLEX".
The controller flex consists of the following main functions:

Microprocessor (U401)
Runs the software programs which load and read radio ICs with the Serial Peripheral Interface (SPI) Bus:

- Prescaler (BIP SEL)
- Synthesizer (CMOS SEL)
- ODIE output expand (OCSO)
- Display (CE DISP)
- Audio Filter (AFIC SEL)
- Signalling Filter (SFIC SEL)
- Read keyboard (CE KEY)
- Read ODIE input expand (OCSI)

The uP also set up supply voltages for RF board, reads channel selector, PTT, Opt Sel pin, volume potentiometer, Carrier Detect, Low battery and other inputs and acts accordingly. uP also takes care of Sunshine Bus communication (BUSY and DATA J2.6 and J2.7).

EEFlash Prom (U402)
64 K x 8 bits non volatile memory used as storage for software programs. The Flash Prom can be programmed and erased by applying 12 V to pin 1 and using the service mode program. The 12 V is applied through the Universal Connector, J2.14 and the switch U419. U419 is controlled by an output from ODIE.

RAM (U403)
Used as temporary storage for Data during execution of software.

SNIF Gate Array (U413)
Used as 8-bit latch for address/data demultiplexing, Port expand, Sequential tone decoder, Private line (PL) decoder (CTCSS), Memory banking, address decoding with current save for the EEFlash Prom.

Odie Gate Array (U412)
Used as 1200 baud FFSK demodulation, Frame detection, 8 bit pack unit, Input / output expand, DVP support logic.

AUDIO FILTER IC (U404) AND AUDIO PA IC (U406), SIGNALLING FILTER IC (U405)

The audio circuitry is provided by the Audio Filter IC U404 and the Audio PA IC U406. U404 takes care of the audio shaping for both Rx and Tx and PL encoding. U406 contains the Audio PA and the microphone preamplifiers.

In receive mode, audio from the discriminator is AC coupled to pin 7 & pin 8/U404. In U404 the audio signal is deemphasised and passed through a programmable 8 bit volume attenuator, that is set accordingly with the A/D converter readings of the volume potentiometer. The processed audio signal at pin 23/U404 is AC coupled to the Audio PA at pin 10/U406. If the Audio PA is enabled (pin 23/U406 = 5 V) the amplified audio will appear at either the Internal Speaker output across pin 27, 28 and pin 31-32/U406 or at the External Speaker output across pin 4, 5 and pin 31, 32/U406. The External Speaker is selected by setting pin 24/U406 low, which is done by the software when OPT SEL J2.3 is shorted to ground indicating External Speaker. The audio signal from the discriminator is DC coupled to the DVP connector J7.13.

In transmit mode, the microphone amplifiers are enabled by setting pin18/U406 high. Either the Internal mic or the External mic will be selected. The External mic preamplifier is selected by short circuit EXT PTT J2.2 to ground, which will set pin 20/U406 low. The amplified audio at pin 19/U406 passes through a 3rd order high pass filter with a corner frequency of 300 Hz to avoid that audio is blocking PL. From pin 11/U406 the audio goes to pin 10/U404 to be emphasised and filtered before it appears on pin 21/U404 (J7.10). The DVP dummy reenters the signal at J7.18 to the controller pin 14, 15/U404, where it is attenuated in the 5 bit and 4 bit attenuators in U404, for finally to appearing at pin 20/U404 and pin 19/U404 respectively.

VOLTAGE SUPPLY GENERATION (U410, U411, U417, Q406)

The controller flex operates on 10 V (B+) coming in on J2.12 from the radios on/off switch. On the controller flex the B+ is used to generate the following supply voltages:

- Analog 5 V (Vcc1) is used to supply all the analog circuitry i.e. Audio Filter U404, Signalling Filter U405, MIC amplifier inside Audio PA U406, microphone bias Q404 and DC-switching for R5 and T5. The Vcc1 is generated by emitter follower Q406, R448, R449 and C401.

- Digital 5 V (Vcc2) is used to supply all the digital circuitry i.e. Microprocessor U401, EEFlash Prom U402 and the two gate arrays SNIF U413 and ODIE U412. The regulator for Vcc2 is U417 which also contains a comparator to reset the controller, if B+ drops below 4.6 V.

- 7 V (S+ U202) is used to supply the synthesizer and the DVP module. The 7 V is generated with a regulator (U411) with a internal reference of 1.23 V and two resistors R432 and R433. The regulator contains a comparator to indicate low battery when B+ drops below approx. 7 V.

- 10 V to supply accessories (Vcc J2.14) is generated through U418 and D405. The voltage on J2.14 is actually only 9.3 V, caused by the diode voltage drop. U418 forms with R428 and D410 a short-circuit protection. J2.14 can be shortened to ground when the Keyloader for the DVP is connected. D405 is needed in order to be able to bring in 12 V from the Universal Connector for programming the EEFlash Prom.

In addition to B+ another 10 V supply is applied to the controller flex directly from the battery. This 10 V is applied to the controller as long as the battery is on the radio (also when radio is turned off) to maintain the content of the RAM U403. The RAM is supplied by UN SW BATT (J2.15) via the 5 V regulator U410 that is stepped up by R434 and R435 to compensate for the voltage drop across D403. During battery replacement the RAM is supplied by C446 (Vcont) and D403 is preventing C446 from discharging into U410. Vcont is also supplying the NAND gate U414 that assures that the RAM is disabled as long as B+ is below 4.6 V (RESET).

DC SWITCHING CIRCUIT (U407, U408, U416, U409, U418)

In order to control the supplies for the RF with the microprocessor, 4 dc-switches are implemented:

R5: R5 is controlled by an output expand on ODIE (RX5) that, when low, turns on a transistor inside U408 which sets up Vcc1 on J6.3. When RX5 is high the transistor inside U408 is turned off and a transistor inside U416 is turned on to remove the charge on the RF decoupling capacitors in order to bring down R5 fast.

R10: R10 is controlled by an output expand on ODIE (RX10) that, when high, turns on the switch U408 to set up B + on J4.7. D411 and R404 are together with U408 providing short circuit protection of R10.

T5: T5 is controlled by an output expand on the Audio Filter (GCB3) that, when low, turns on a transistor inside U408 which sets up Vcc1 on J4.6. When GCB3 is high the transistor inside U408 is turned off and a transistor inside U416 is turned on to remove the charge on the RF decoupling capacitors in order to bring down T5 fast. GCB3 also, when low, turns on Q404 to bias the microphones.

T10: T10 is controlled by an output expand on ODIE (TX10) that, when high, turns on the transistor in U407 which turns on Q405 to set up B + on J6.2. D412 and R403 are together with U407 providing short circuit protection of T10.

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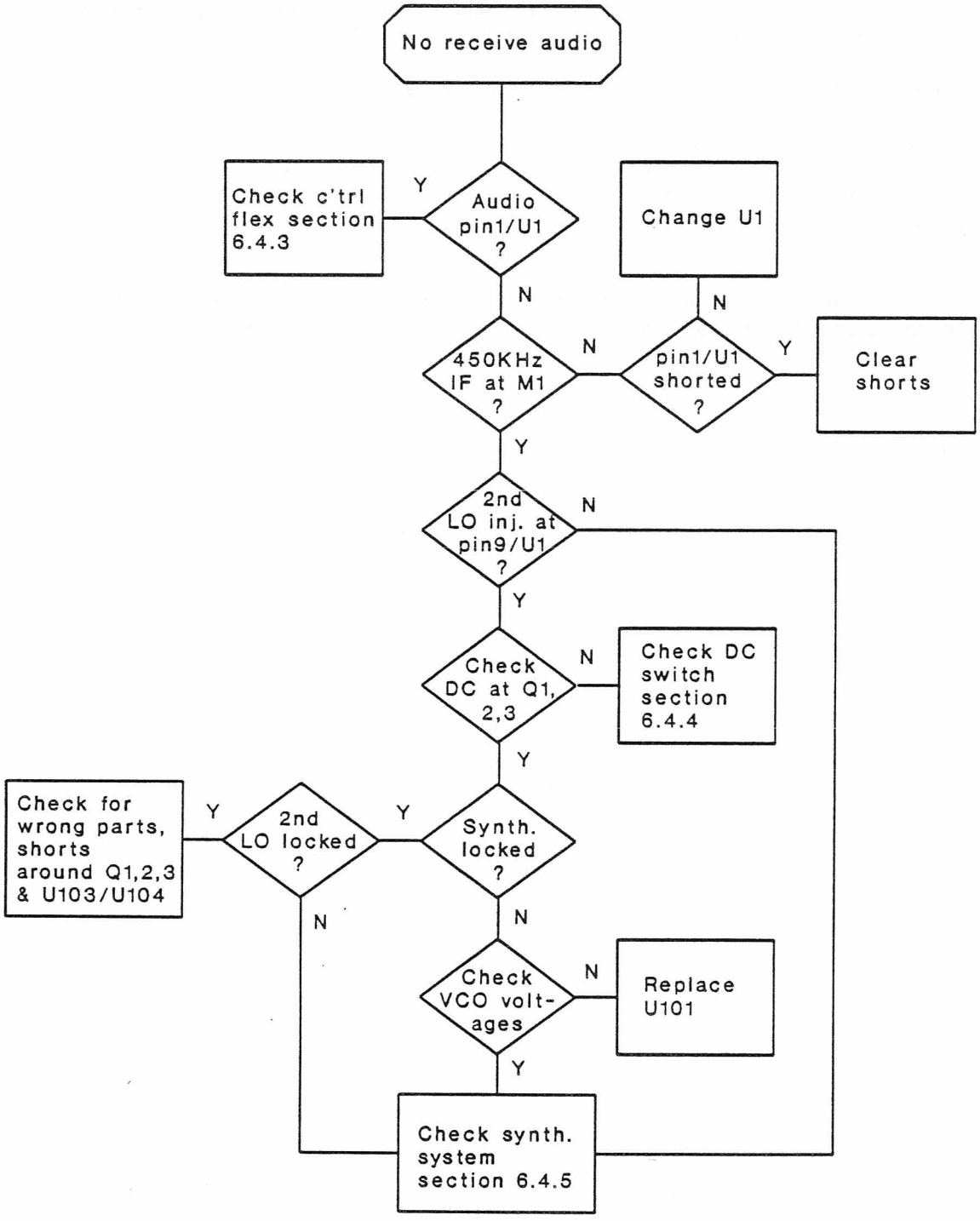
TROUBLE SHOOTING

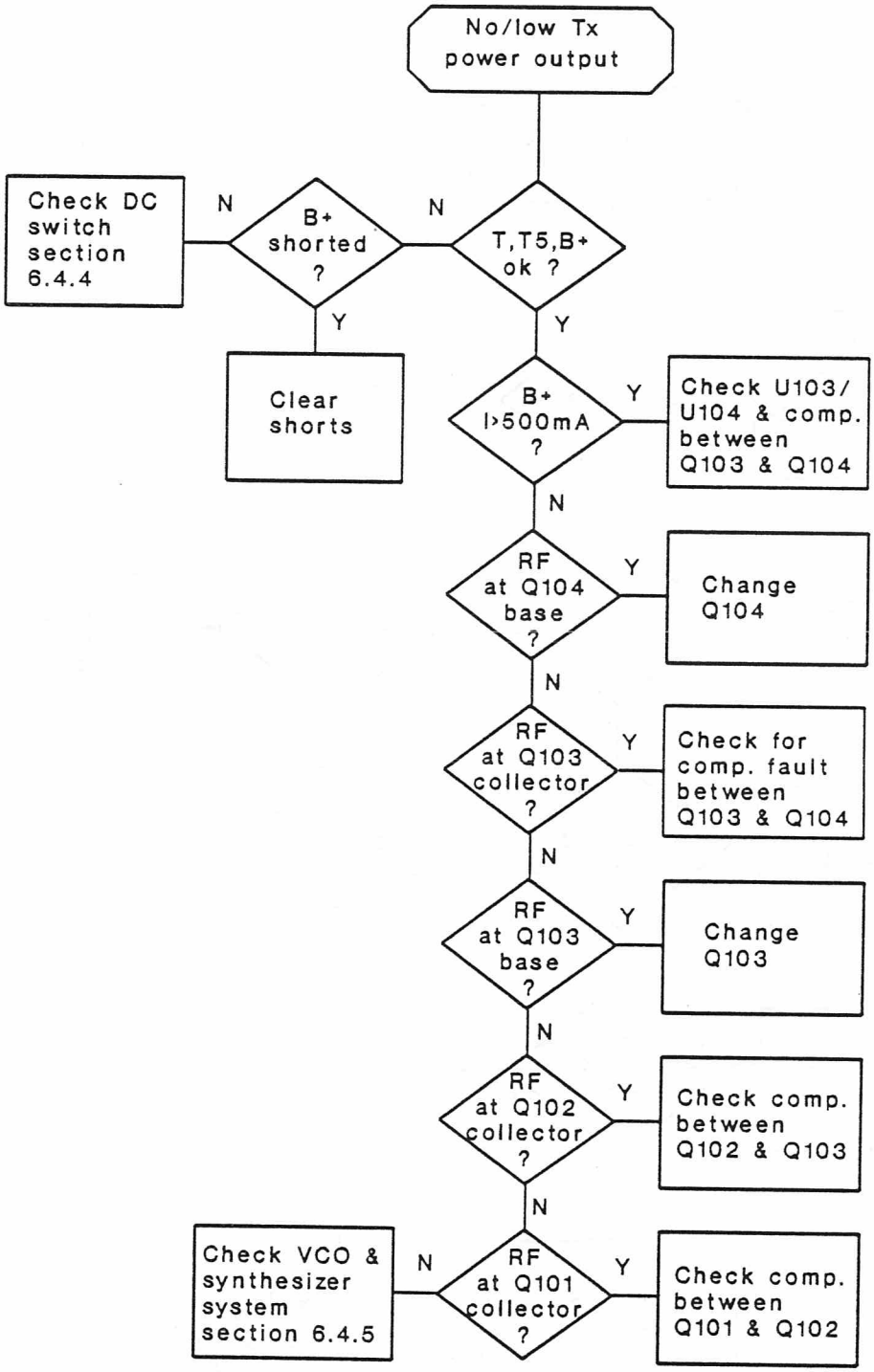
On power up the uP does a self check. If the self check is alright a power up alert tone should be heard. However, this does not exclude errors on controller or RF mother board.

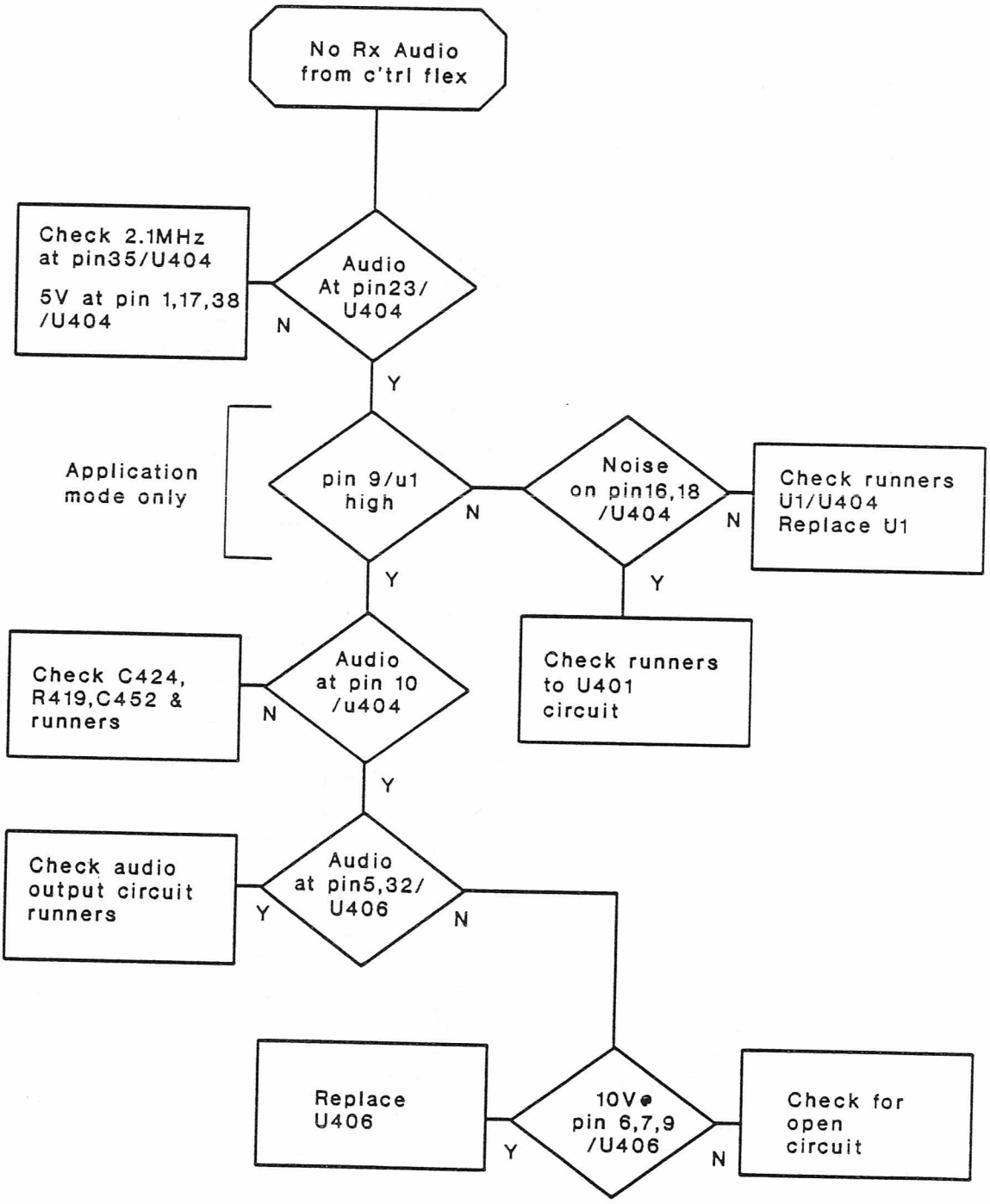
Some of the possible faults that can happen to the radio are:

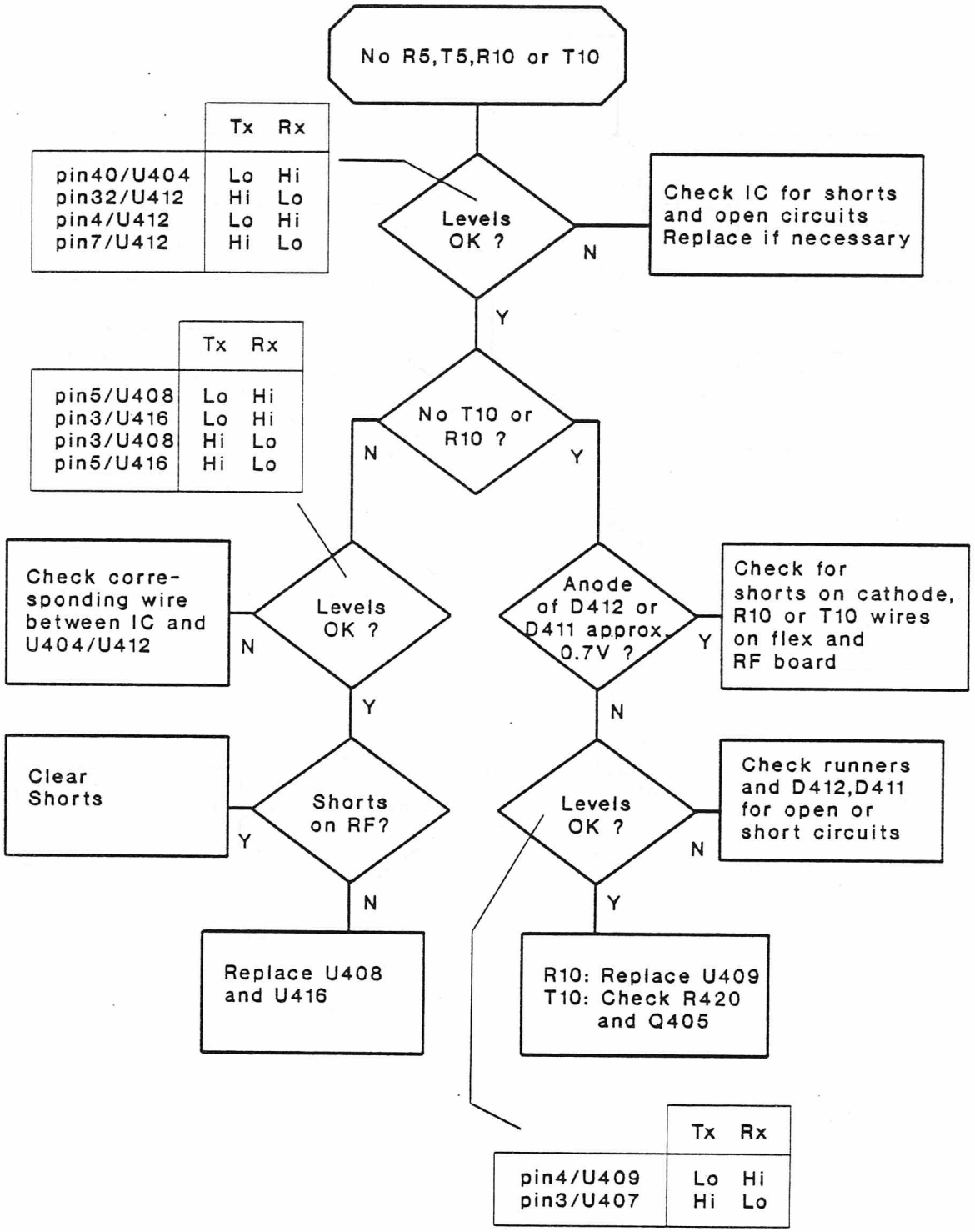
- No receive audio output
- No transmitter power output
- No receive audio from controller flex
- No DC switch voltages
- No Tx deviation, RF power is OK.

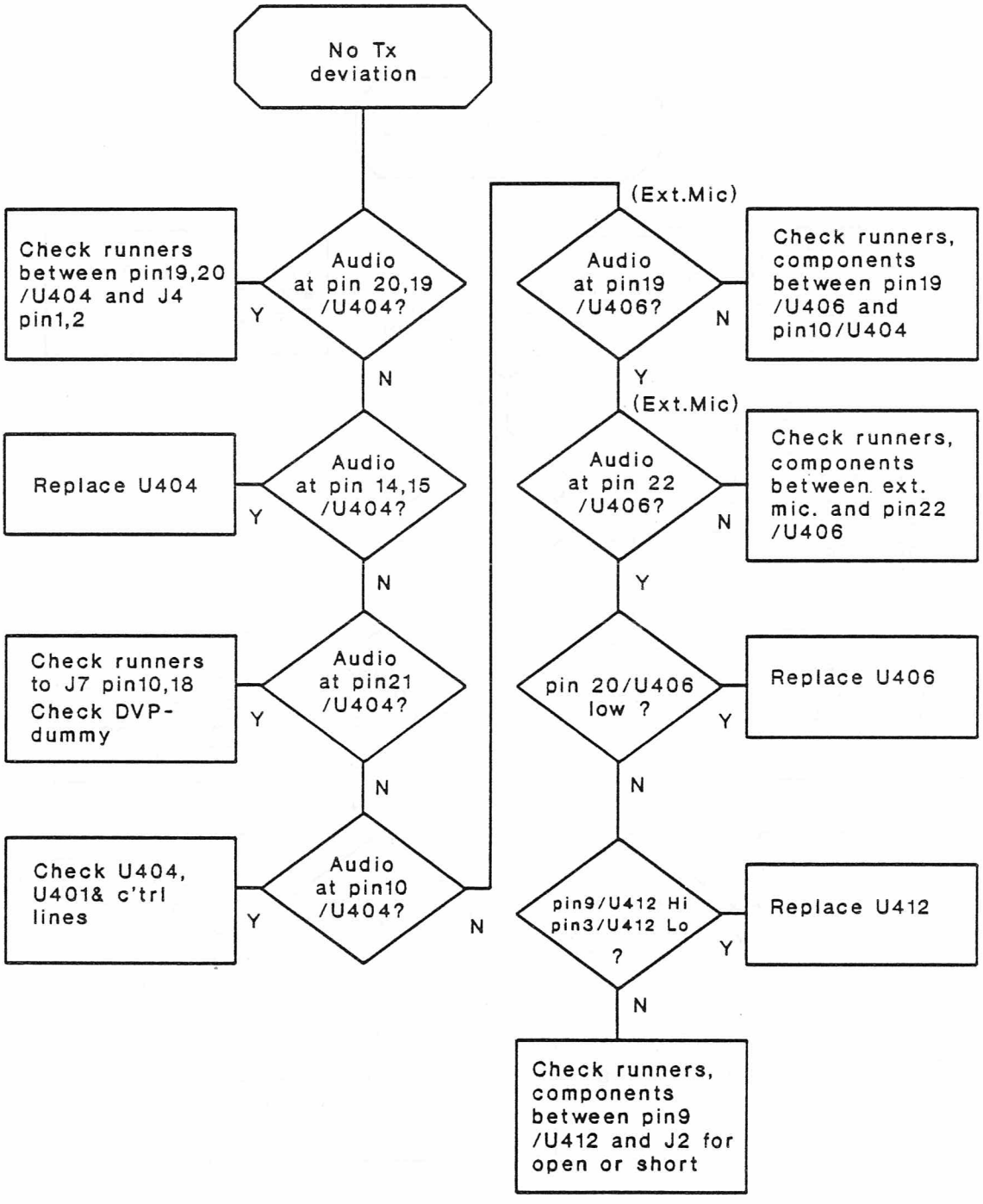
The following pages show trouble shooting charts related to these five types of faults. They are not intended to be exhaustive but only to provide a possible path of investigation.


No receive audio
Audio pin1/U1 ?
Y
Check c'trl flex section 6.4.3
N
Change U1
N
450KHz IF at M1 ?
N
pin1/U1 shorted ?
Y
Clear shorts
Y
2nd LO inj. at pin9/U1 ?
N
Y
Check DC at Q1, 2,3
N
Check DC switch section 6.4.4
Y
Check for wrong parts, shorts around Q1,2,3 & U103/U104
Y
2nd LO locked ?
Y
Synth. locked ?
N
N
Check VCO volt-ages
N
Replace U101
Y
Check synth. system section 6.4.5


No/low Tx power output
T,T5,B+ ok ?
N
B+ shorted ?
N
Check DC switch section 6.4.4
Y
Clear shorts
Y
B+ I>500mA ?
Y
Check U103/ U104 & comp. between Q103 & Q104
N
RF at Q104 base ?
Y
Change Q104
N
RF at Q103 collector ?
Y
Check for comp. fault between Q103 & Q104
N
RF at Q103 base ?
Y
Change Q103
N
RF at Q102 collector ?
Y
Check comp. between Q102 & Q103
N
RF at Q101 collector ?
Y
Check comp. between Q101 & Q102
N
Check VCO & synthesizer system section 6.4.5


No Rx Audio from c'trl flex
Check 2.1MHz at pin35/U404
5V at pin 1,17,38 /U404
Audio At pin23/ U404
N
Y
Application mode only
pin 9/u1 high
N
Noise on pin16,18 /U404
N
Check runners U1/U404 Replace U1
Y
Y
Check C424, R419,C452 & runners
Audio at pin 10 /u404
N
Check runners to U401 circuit
Y
Check audio output circuit runners
Audio at pin5,32/ U406
Y
N
Replace U406
10V@ pin 6,7,9 /U406
Y
N
Check for open circuit


No R5,T5,R10 or T10
Tx Rx
pin40/U404 Lo Hi
pin32/U412 Hi Lo
pin4/U412 Lo Hi
pin7/U412 Hi Lo
Levels OK ?
N
Check IC for shorts and open circuits Replace if necessary
Y
Tx Rx
pin5/U408 Lo Hi
pin3/U416 Lo Hi
pin3/U408 Hi Lo
pin5/U416 Hi Lo
No T10 or R10 ?
N
Y
Check corresponding wire between IC and U404/U412
Levels OK ?
N
Anode of D412 or D411 approx. 0.7V ?
Y
Check for shorts on cathode, R10 or T10 wires on flex and RF board
Y
N
Clear Shorts
Shorts on RF?
Y
Levels OK ?
N
Check runners and D412,D411 for open or short circuits
N
Y
Replace U408 and U416
R10: Replace U409
T10: Check R420 and Q405
Tx Rx
pin4/U409 Lo Hi
pin3/U407 Hi Lo


No Tx deviation
Audio at pin 20,19 /U404?
Y
Check runners between pin19,20 /U404 and J4 pin1,2
N
Audio at pin 14,15 /U404?
Y
Replace U404
N
Audio at pin21 /U404?
Y
Check runners to J7 pin10,18 Check DVP-dummy
N
Audio at pin10 /U404?
Y
Check U404, U401& c'trl lines
N
(Ext.Mic)
Audio at pin19 /U406?
N
Check runners, components between pin19 /U406 and pin10/U404
Y
(Ext.Mic)
Audio at pin 22 /U406?
N
Check runners, components between ext. mic. and pin22 /U406
Y
pin 20/U406 low ?
Y
Replace U406
N
pin9/U412 Hi pin3/U412 Lo ?
Y
Replace U412
N
Check runners, components between pin9 /U412 and J2 for open or short

CHAPTER
CHAPITRE
KAPITEL

7

MOTOROLA HTX/STORNO CP1000

THEORY OF OPERATION FOR CONTROLLER FLEX

SUPPLY VOLTAGES

The controller flex operates on 10 V (B+) coming in on J2.12 from the on/off switch of the radios. On the controller flex the B+ is used to generate the following supplies:

Analog 5 V (Vcc1) used to supply all the analog circuitry i.e. Audio Filter U404, Signalling Filter U405, MIC amplifier inside Audio PA U406, microphone bias Q404 and DC-switching for R5 and T5. The B+ is regulated by Q406, R448, R449, and C401.

Digital 5 V (Vcc2) used to supply all the digital circuitry i.e. Microprocessor U401, EEFlash Prom U402 and the two gate arrays SNIF U413 and ODIE U412. The regulator is made up by U417 that also contains a comparator to reset the controller, if B+ drops below 4.6 V.

7 V (S+ U202) used to supply the synthesizer and the DVP module. The 7 V is generated with a 5 V-regulator (U411) that is stepped up with R432 and R433.

10 V to supply accessories (Vcc J2.14) is B+ through 418 and D405, so the voltage on J2.14 is actually only 9.3V. U418 forms with R428 and D410 a short-circuit protection, so that J2.14 can be shortened to ground when the Keyloader for the DVP is on. D405 is needed in order to be able to bring in 12 V from the Universal Connector for programming the EEFlash Prom.

In addition to B+ another 10 V supply is applied to the controller flex directly from the battery. This 10 V is applied to the controller as long as the battery is on the radio (also when radio is turned off) to maintain the content of the RAM U403. The RAM is supplied by UN SW BATT (J2.15) via the 5 V regulator U410 that is stepped up by R434 and R435 to compensate for the voltage drop across D403. During battery replacement the RAM is supplied by C446 (Vcont) and D403 is preventing C446 from discharging into U410. Vcont is also supplying the NAND gate U414 that assures that the RAM is disabled as long as B+ is below 4.6 V.

SUNSHINE BUS

The Sunshine Bus is a software routine the radio is using to communicate with the outside world or the DVP module. The main communication is:

- Programming of Service Mode Software
- Controlling radio with Service Mode s/w (test)
- Programming of application program
- Programming of customer specific information i.e. frequency, TPL tones etc.
- Control radio from CVC, SMARTMIC etc.
- Communicate with DVP module

The Sunshine Bus is using the Serial Communications Interface (SCI) in the microprocessor at 9600 baud.
The SCI is using two wires called BUSY and DATA, that go into the controller from the Universal Connector via J2.6 and J2.7.

MICROPROCESSOR

The microprocessor contains 8Kb mask memory with the following software routines:

- Sunshine Bus
- Watchdog that will enable the watchdog in the Audio Filter via the SPI to obtain a reset period of app. 50mS.
- A part of the Service Mode Software to be able to program the EEFlash Prom.
- The Operating System

The rest of the software needed for the controller and radio to be tested (Service Mode S/W) and the customer specific program (Application S/W) is programmed via the Sunshine Bus after controller encapsulation.
During program execution the microprocessor is using the code in the 8Kb mask ROM, as well as the code and data in the external memory: EEFlash Prom and RAM. This memory is accessed with the data/address bus (Port C) and the most significant address byte Port B. The data/address bus is de-multiplexed inside the SNIF gate array, with the use of the AS signal. In order to have only one memory device active on the common data/address bus at a time, a complete address decoding is performed by the SNIF gate array and the external memories are turned on accordingly, depending on R/W and the E-clock.
When in application mode the following microprocessor inputs are monitored periodically:

- PA2 LOCK low when synthesizer locked
- PE0 EVENT low when a input on the ODIE gate array has changed state
- PE1 RSSI (Radio Signal Strength Indicator) analog input monitored by the A/D converter in the microprocessor.
- PE2 VOL dc voltage from the volume pot. monitored by the A/D converter to determine the volume level the microprocessor is to set in the Audio Filter
- PE3 OPT SEL monitored by the A/D converter to tell the uP what kind of accessory there is on the Universal Connector. To be compatible to Genesis accessory, External Speaker is defined as 0 V.
- PE4 CARRIER DETECT digital input from IF
- PE5 CHANNEL ACTIVITY digital input from IF
- PE6 KEY ACTIVE low when key on front cover is pressed
- PE7 LOW BATTERY low when B + is below 7.6 V

The microprocessor outputs are described in "5-TONE AND BINARY DECODING".
The microprocessor operates with a 7.3728 MHz crystal Y401. The uP clock frequency can be shifted to avoid self quieting problems at certain radio frequencies. By turning Q401 off and thereby putting a coil L401 in series with the crystal, the uP clock frequency is shifted app. 330 ppm. Q401 is controlled with a output expand from the ODIE gate array. The 7.3728 MHz clock is also supplied to the ODIE gate array where it is divided down to 230.4 KHz to be used for the SNIF gate array. By setting the LEDR and LEDG bit in ODIE to "1" the 230.4 KHz can be measured on J1.5 for test purpose.

SERIAL PERIPHERAL INTERFACE (SPI)

The SPI is a synchronous bus which allows several devices to be loaded or read by the same CLOCK and DATA lines by using a separate chip-select line for each device. The chip selects are done with a port expand in the SNIF gate array (write to address B800H) and the clock and data come from the uP.
The following devices can be read with the SPI:

- ODIE input expand (OCSI)
- Key board (CE KEY)

The following devices can be loaded with the SPI:

- Prescaler (BIP SEL)
- Synthesizer (CMOS SEL)
- ODIE output expand (OCSO)
- Display (CE DISP)
- Audio Filter (AFIC SEL)
- Signalling Filter (SFIC SEL)

EEFLASH PROM

The EEFlash Prom is a 512K bit memory organised as 64K x 8 bits. It is also available as a 1024K bit memory organised as 128K x 8 bits. This controller will cater for both versions (in the 512K bit EEFlash Prom A16 is not connected).
The Flash Prom can be programmed and erased by applying 12 V to pin 1 and using the program in the microprocessor mask. The 12 V is applied through the Universal Connector, J2.14 and the switch U419. U419 is controlled by an output from ODIE.

SNIF GATE ARRAY

SNIF is implemented in a Motorola gate array with 2500 gates. Here following a brief description of the main features:

- 8-bit latch for address/data demultiplexing
- Port expand
- Sequential tone decoder.
- Private line (PL) decoder (CTCSS)
- Memory banking
- Address decoding with current save for the EEFlash Prom

Memory Banking

In order to address 128K byte with a microprocessor that is only capable of addressing 64K byte and to utilize the program memory that physically is placed where the uP mask ROM and the external RAM addresses are located a memory banking circuit is implemented in the gate array. The memory map is divided into one big part (48kb) and 6 minor parts of 16kb each. Which one of the 6 minor parts to use is determined by writing the bank no. into the expand port via the data/address bus. The default value after reset is bank 0. The minor banks are entered when ever the address is between 0000H and 3FFFH.
The 3 most significant bits for the EEFlash Prom A14EE, A15EE and A16 are generated by switching between A14, A15 from the uP and the expand port.
So, when using the 48Kb part, by addressing within 4000H to FFFFH, A14EE and A15EE are equal to A14 and A15 from the uP and A16 is 0. When using one of the 16Kb banks A14EE, A15EE and A16 are equal to the value on the expand port. The expand port (add. B803H) selects the memory banks as follows:

EXPAND PORT	Bank	A16	A15EE	A14EE
xxxxx000	0	0	0	0
xxxxx011	1	0	1	1
xxxxx100	2	1	0	0
xxxxx101	3	1	0	1
xxxxx110	4	1	1	0
xxxxx111	5	1	1	1

Current Save

Using an eeflash prom in a portable radio, where low power consumption is a must, requires that the flash prom is only turned on when needed and for as short a period as possible. In SNIF this is done by gating the E-clock from the uP HC11 with a signal from the address decoding logic saying whether the address is a flash prom address or not, in order to generate a signal to control the chip select of the flash prom. If the chip select where tied to ground (active low) and the flash prom where controlled by out enable and write enable only, witch is the normal way to do it, the stand-by current consumption would have been app. 20 mA.
With this concept the stand-by current consumption, when the program is executed in the microprocessor mask ROM, for the flash prom is reduced to less than 100 uA.
During program execution in the flash prom with chip select tied to ground and a uP clock frequency of 7.3728 MHz the current consumption would have been app. 21 mA. With this concept it is reduced by app. 6 mA, due to the fact that the EEFflash prom is only turned on in the last half of the E-clock cycle.

Tone Decoding

In the SNIF gate array there are two tone detectors.
Both can be used for 5-tone decode or one can be used for 5-tone decode, the other for PL decode.
The tone detectors comprise a bandpass filter and a detector. 4 data registers are provided to set up the centre frequency and the Q for the bandpass filter. In the detector two thresholds can be programmed. Reading address B802H gives the output of the two detectors.

ODIE GATE ARRAY

ODIE is implemented in a Motorola gate array with 2500 gates. Here following a brief description of the main features:

- 1200 baud FFSK demodulation.
- Frame detection.
- 8 bit pack unit.
- Input / output expand.
- DVP support logic.

The binary modem running at the speed of 7.372800 MHz, is performing a complete demodulation. The Frame Detect Unit is capable of decoding 3 different standardised frames with out involving the microprocessor. The bit pack unit makes it possible to save CPU time by fetching 8 bit on an interrupt instead of fetching single bits.
The input/output expand unit performs resp. the parallel to serial and the serial to parallel conversion. The DVP support logic will provide the DVP unit with the necessary signals from the Keyloader via the Universal Connector.
The input expansion circuit is a parallel in serial out register. To get access to this register pull CSI low and use the synchronous bus.
On the falling edge of CSI all the inputs are sampled into a double buffer. If one of the inputs (excl. D0 - D7, and KYLD) changes state the EVENT pin will go low, to indicate that new information is available on the input pins.
The output expand register is a serial in parallel out register. To get access to this register pull CSO low and use the synchronous bus. It is necessary always to load 16 bit. All the signals become active (= change) on the rising edge of the CSO signal.

DC SWITCHING

In order to control the supplies for the RF with the microprocessor, 4 dc-switches are implemented:

R5:

R5 is controlled by an output expand on ODIE (RX5) that, when low, turns on a transistor inside U408 which set up Vcc1 on J6.3. When RX5 is high the transistor inside U408 is turned off and a transistor inside U416 is turned on to remove the charge on the RF decoupling capacitors in order to bring down R5 fast.

R10:
R10 is controlled by an output expand on ODIE (RX10) that, when high, turns on the switch U408 to set up B + on J4.7. D411 and R404 are together with U408 providing short circuit protection of R10.

T5:
T5 is controlled by R5 that, when low, turns on a transistor inside U408 which sets up Vcc1 on J4.6. When R5 is high the transistor inside U408 is turned off and a transistor inside U416 is turned on to remove the charge on the RF decoupling capacitors in order to bring down T5 fast. GCB3, when low, turns on Q404 to bias the microphones.

T10:
T10 is controlled by an output expand on ODIE (TX10) that, when high, turns on the transistor in U407 which turns on Q405 to set up B + on J6.2. D412 and R403 are together with U407 providing short circuit protection of T10.

AUDIO CIRCUITS

The audio circuitry is provided by the Audio Filter IC U404 and the Audio PA IC U406. U404 takes care of the audio shaping for both RX and TX and PL encoding. U406 contains the Audio PA and the microphone preamplifiers.
In receive mode, audio from the discriminator is AC coupled to 7 & 8/U404. In U404 the audio signal is deemphasised and passed through a programmable 8 bit volume attenuator, that is set accordingly with the A/D converter readings of the volume potmeter. To read the volume potm., set uP port PD5 low. If the radio is placed in a CVC, the A/D converter will read a specified voltage on the OPT SEL pin (J2.3) and the application program will program the volume attenuator in the Audio Filter to a fixed level, so that the radio volume control will not affect the CVC audio output level. The processed audio signal at 23/U404 is AC coupled to the Audio PA at 10/U406. If the Audio PA is enabled (23/U406 = 5 V) the amplified audio will appear at either the Internal Speaker output across 27, 28 and 31, 32/U406 or at the External Speaker output across 4, 5 and 31, 32/U406. The External Speaker is selected by setting 24/U406 low, which is done by the software when OPT SEL J2.3 is pulled to ground indicating External Speaker or when the radio is in a CVC. The audio signal from the discriminator is DC coupled to the DVP connector J7.13. With a DVP module in the radio and a coded signal is detected, the DVP module will decode the audio signal and route it to the Audio Filter on AUX RX (6/U404) for processing.
In transmit mode, the microphone amplifiers will be enabled by setting 18/U406 high. Either the Internal mic or the External mic will be selected. The External mic preamp is selected by pulling EXT PTT J2.2 low, which will set 20/U406 low. The amplified audio at 19/U406 is passed through a 3. order high pass filter with a corner frequency of 300 Hz to avoid PL blocking. From 11/U406 the audio goes to 10/U404 to be emphasised and filtered before it appears on 21/U404 (J7.10). If there is a DVP module in the radio, the audio signal passes through the DVP or is getting coded (depending on the operating mode), before it reenters (J7.18) the controller to go through the 5 bit and 4 bit attenuator in U404 and finally appearing at 20/U404 and 19/U404 respectively.
If the radio is not equipped with a DVP module, J7.10 and J7.18 is shorted with a female connector and a small PCB.

TPL AND DPL SIGNALLING

Decoding is done with U404 and U413. The sub-audio signal from the discriminator is fed to 8/U404 where it is filtered and hard limited.
For TPL the squarewawe is fed to 37/U413 to be decoded by the bandpass filter in U413.
For DPL the squarewawe goes to the microprocessor 64/U401 to be software decoded.
Encoding is done by applying clock pulses to the Audio Filter 32/U404. The TPL or DPL is generated inside the Audio Filter and appears on 20/U404 and 19/U404.

5-TONE AND BINARY DECODING

5-Tone decoding is done with U405 and U413. The 5-tone signal from the discriminator is fed to 31/U405 where it is filtered and hard-limited. The squarewave on 25/U405 is fed to 43/U413 to be decoded by the bandpass filter.
The binary decoding signal path is the same as above, except that the squarewawe goes to 30/U412 for decoding. The decoded data is available on 27/U412 the moment the interrupt for the microprocessor goes low. If U412 is set up for bit-packaging, 8 data bits can be loaded into the microprocessor via the SPI, when an interrupt occurs on 29/U412.

5-TONE, BINARY AND DTMF ENCODE

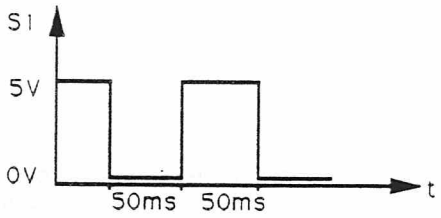
5-Tone and binary encode is done by clocking 9/U405. The encoded signal appears on 14/U405 and from there the signal is AC coupled to 13/U404 (AUX TX), where it enters the TX signal path.
DTMF encode is done the same way as above, with the second tone generated by clocking 7/U405. Side tone is brought out on 17/U405 and AC coupled to 6/U404, where is enters the RX signal path.

MOTOROLA HTX/STORNO CP1000

TROUBLE SHOOTING FOR CONTROLLER FLEX

The trouble shooting flow charts in this chapter are provided to help the debugger to locate the area on the flex which is most likely to be a fault. The trouble shooting charts are not intended to be exhaustive, but only to provide a possible path of investigation.

PROGRAMMING STAGE



IF NO REPLY ON SUNSHINE BUS

RESET 5/U417 = 5V

YES → CHECK J 2.7, J 7.16, R 427, D 408, J 2.6, J 7.15, R 426, D 407, U 401

NO

RESET 5/U417= 0V

YES → CHECK: 10V AT 8/U417, 5V AT 1/U417, 5V AT 3/U415, CHECK FOR SHORTS ON RESET: J7.17, J5.12, R446,43/U401, 3/U413, 2/U414, 31/U412, 34/U404, 5/U417

NO → RESET=S1

1.84MHZ AT 25/U401

NO → CHECK: 31/U401, 33/U401, L401, Y401, R407, C413, C412, 26/U413, U401

YES

4/U404= 5V

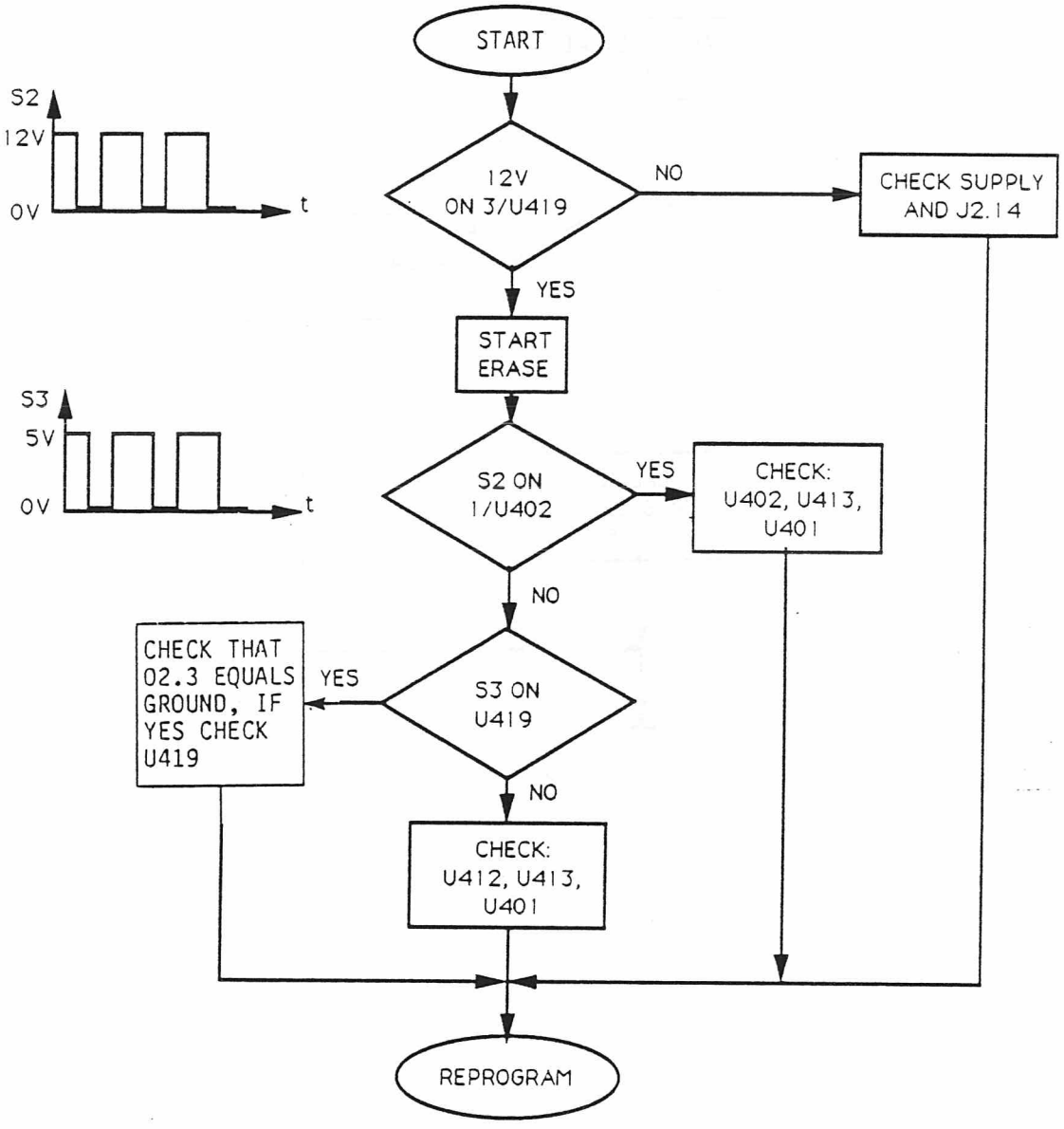
YES → CHECK: 2.1MHz AT 35/U404, C423, U404

NO → CHECK SPI: DATA: J3.1 J5.2, 11/U405, 30/U404, 35/U412, 51+52/U401. CLK: J3.6, J5.7, 10/U405, 31/U404, 36/U412, 53/U401, U405, U404, U412, U401, R406, R429

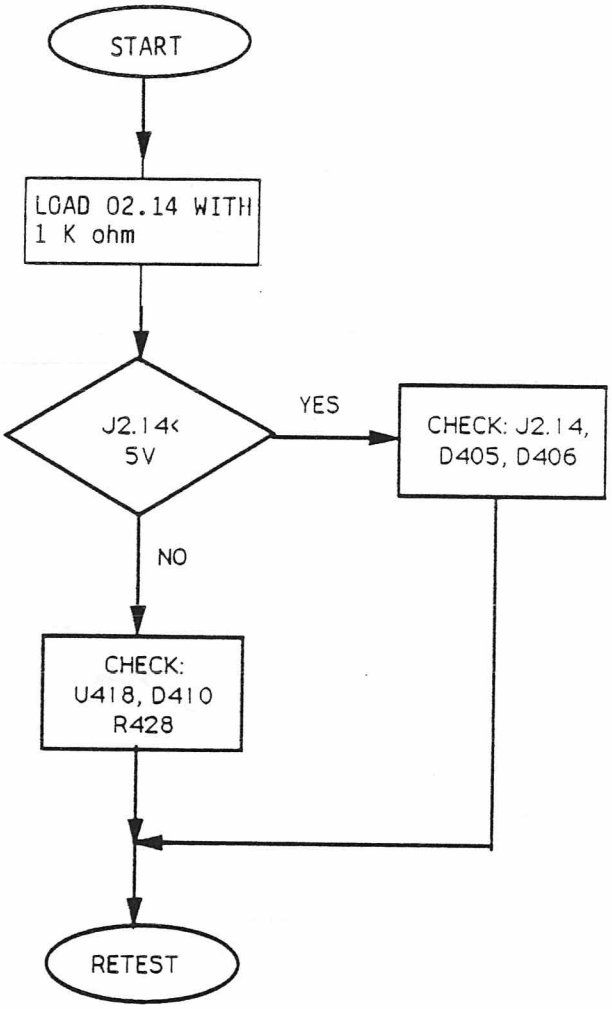
CHECK: U403, U414, U413, U401

RETEST

SUNSHINE BUS OK, NO ERASE NOR PROGRAMMING OF EE FLASH PROM

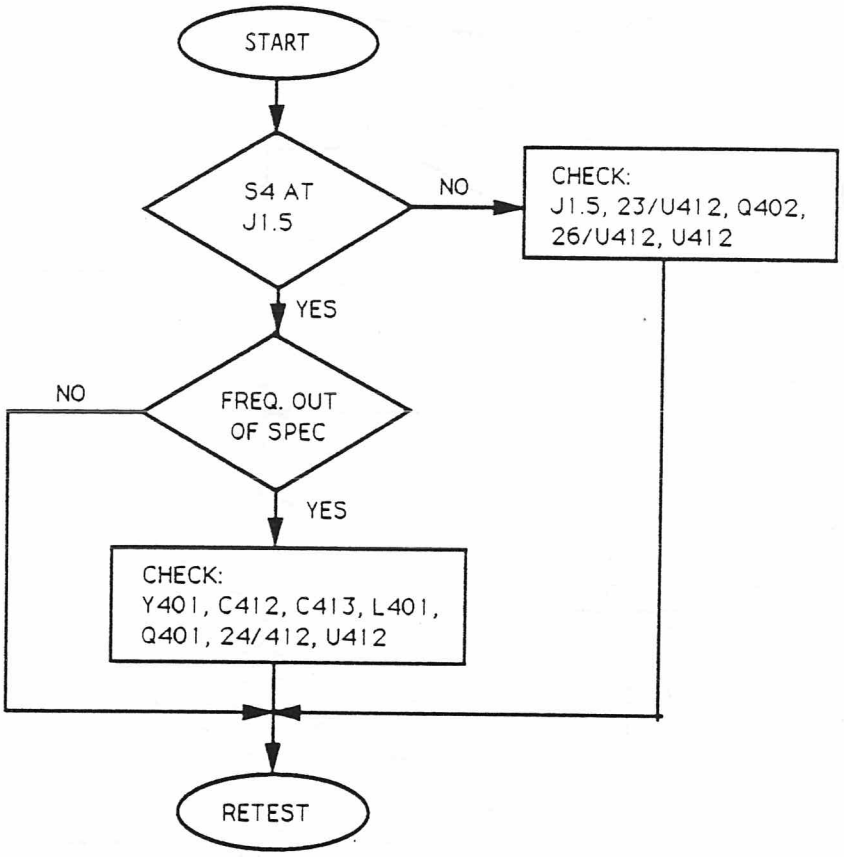


NO SUPPLY AT Vcc/Vpp/KEYLOAD



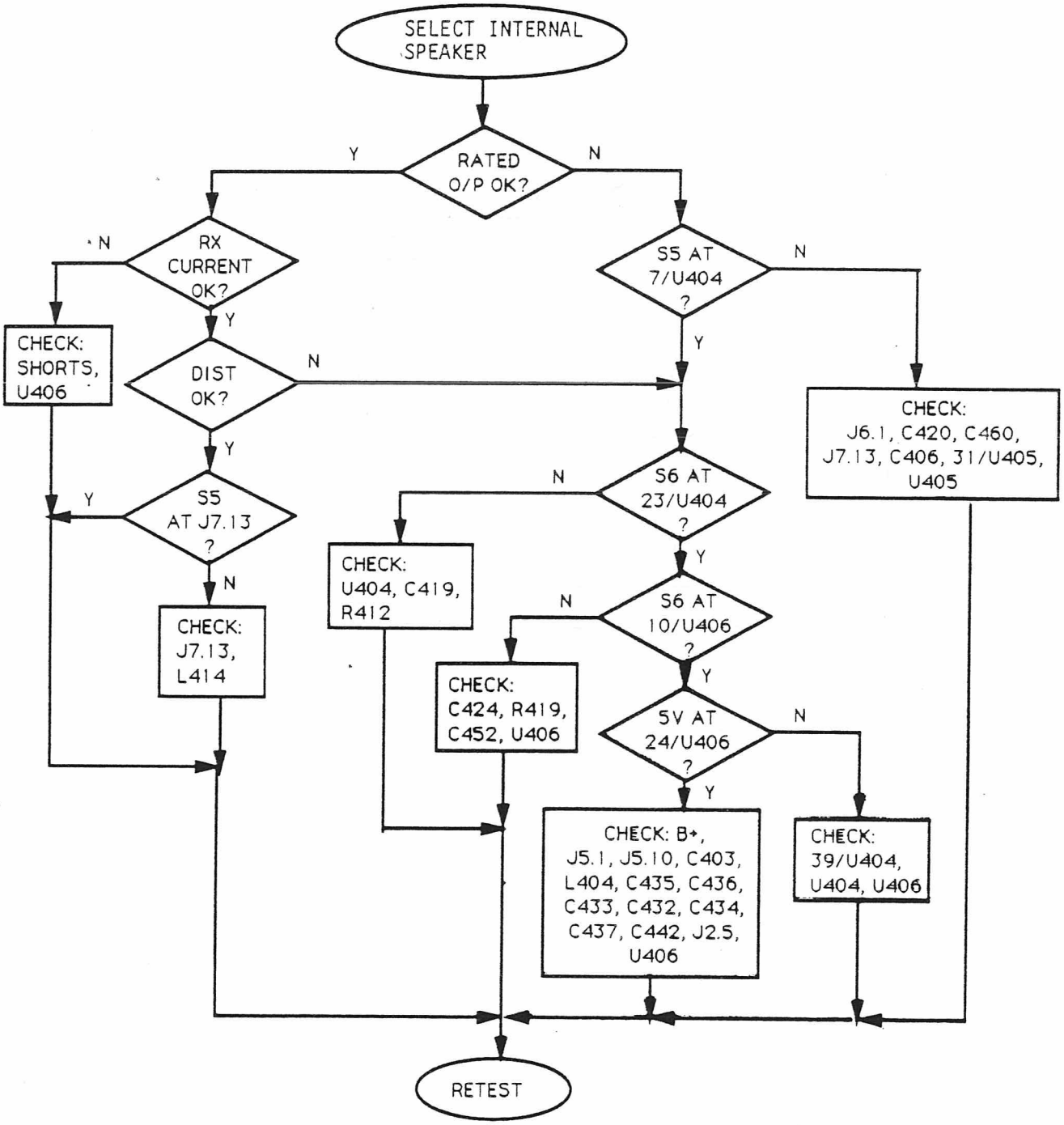
SYSTEM-CLOCK TEST

S4: SQUARE WAVE 5Vpp, APP. 230.4KHz

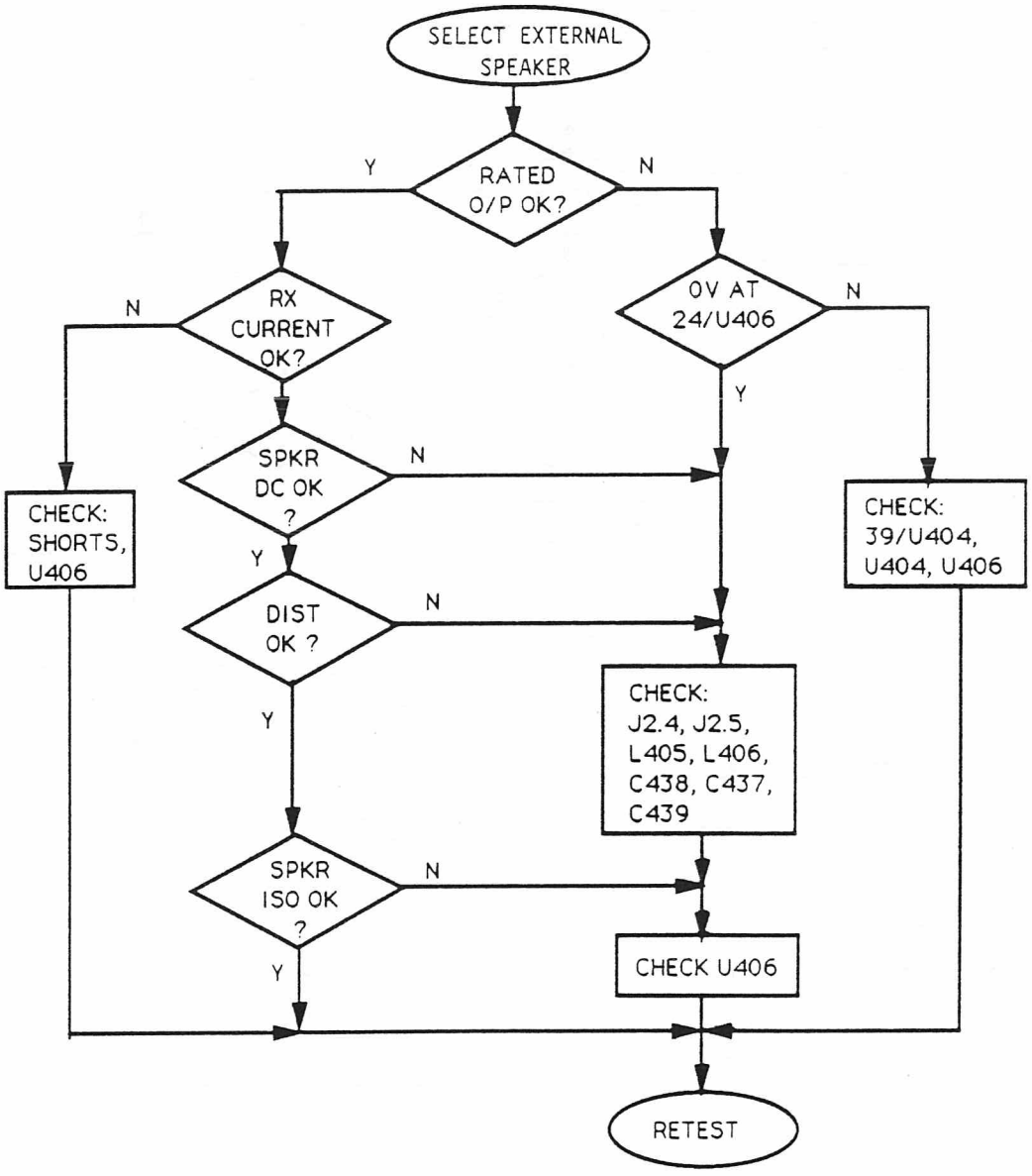


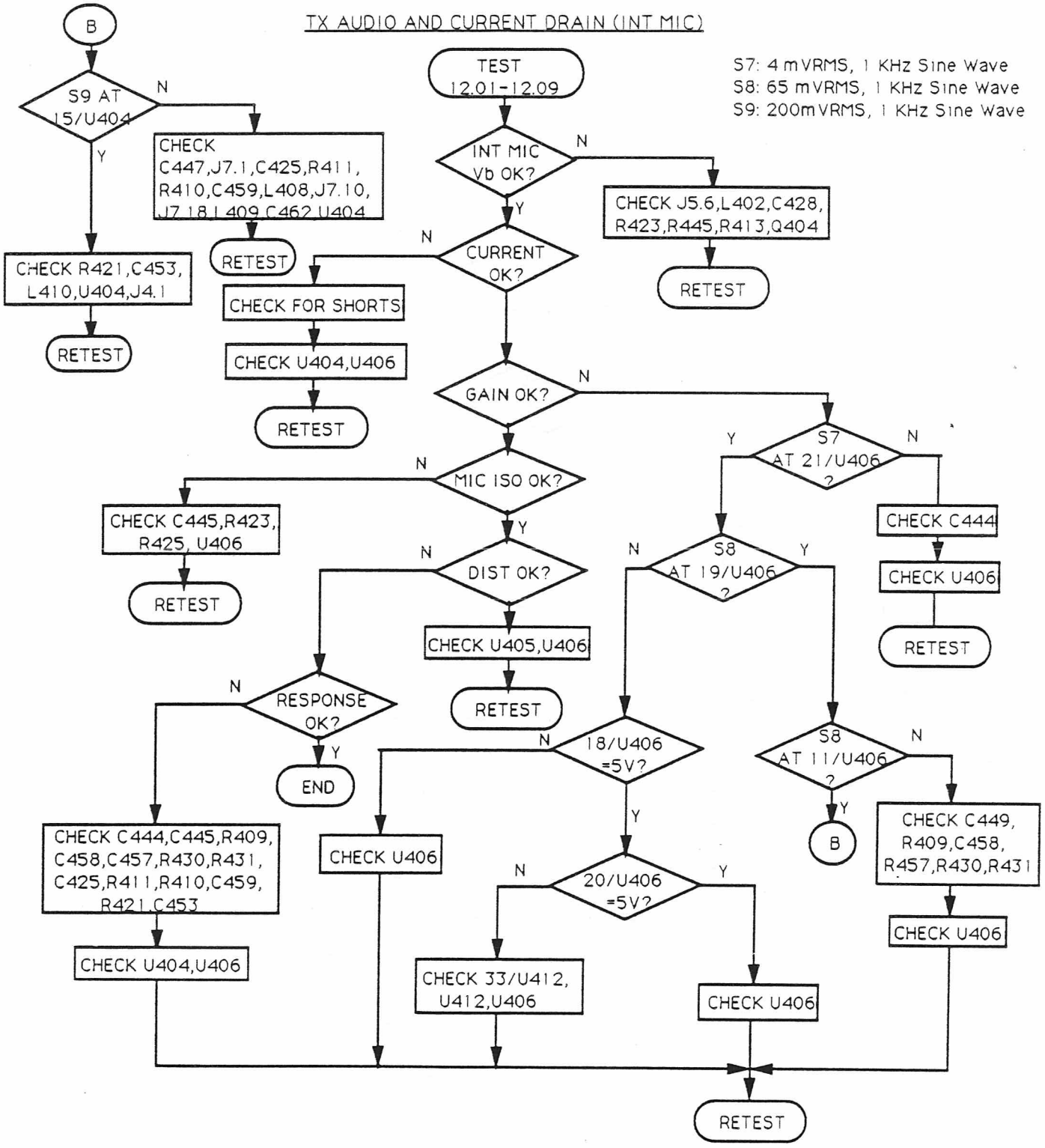
CURRENT DRAIN AND RX OUTPUT LEVEL INTERNAL SPEAKER

S5: 255mVrms, 1KHz SINE WAVE
S6: 770mVrms, 1KHz SINEWAVE WITH NO ATTENUATION IN AUDIO FILTER



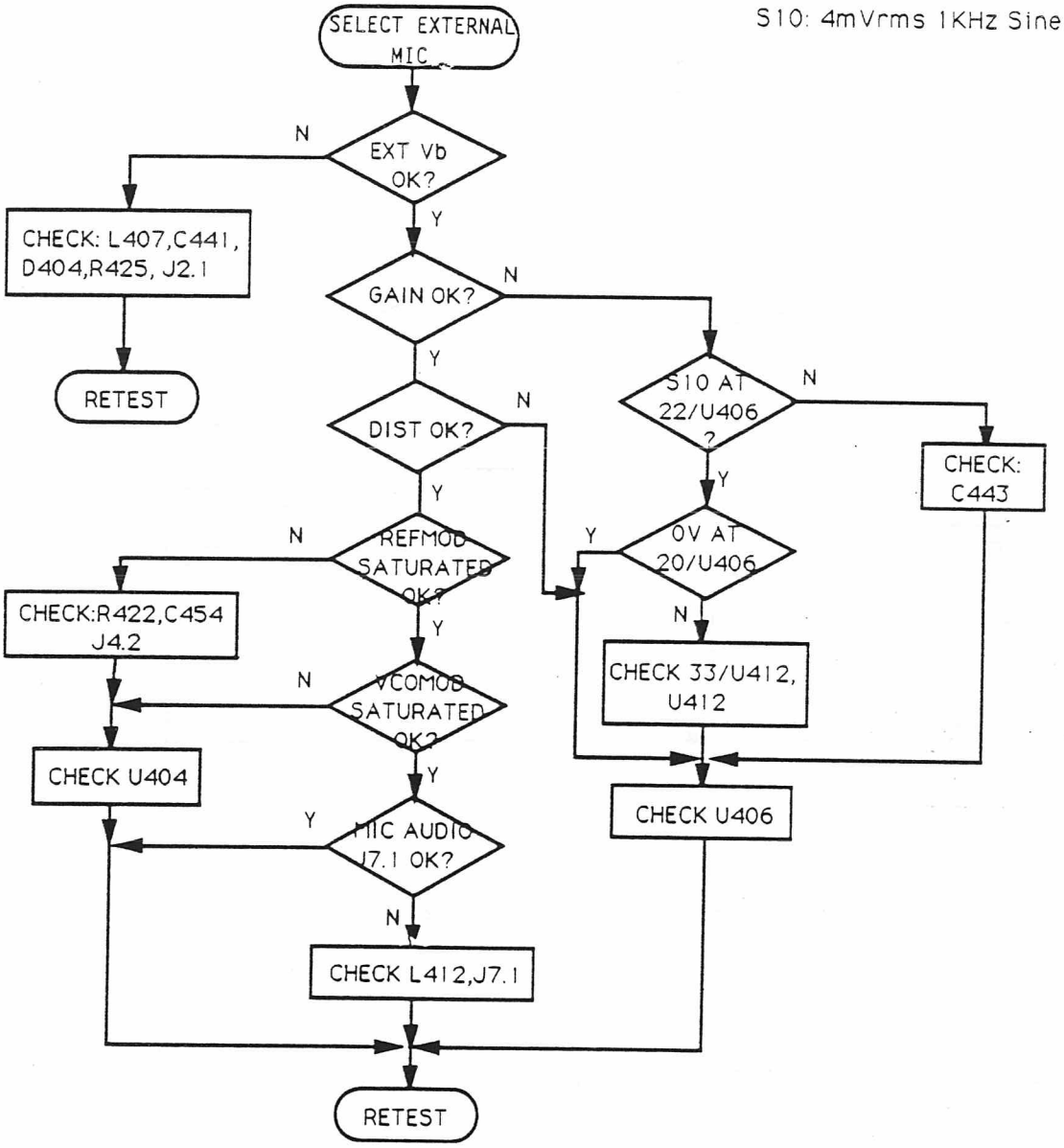
CURRENT DRAIN AND RX OUTPUT LEVEL EXTERNAL SPEAKER



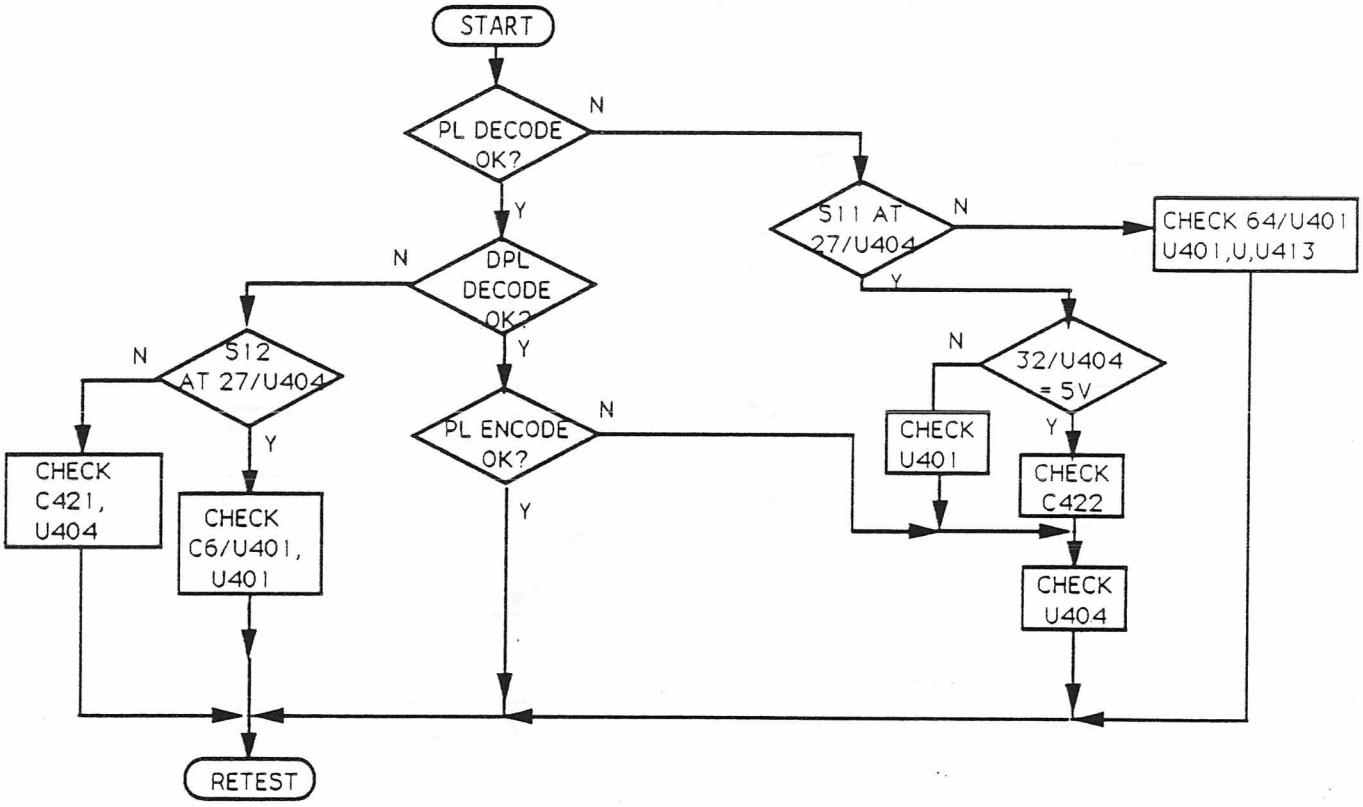

TX AUDIO AND CURRENT DRAIN (INT MIC)
S7: 4 mVRMS, 1 KHz Sine Wave
S8: 65 mVRMS, 1 KHz Sine Wave
S9: 200mVRMS, 1 KHz Sine Wave
B
S9 AT 15/U404
N
Y
CHECK C447,J7.1,C425,R411, R410,C459,L408,J7.10, J7.18,L409,C462,U404
RETEST
CHECK R421,C453, L410,U404,J4.1
RETEST
TEST 12.01-12.09
INT MIC Vb OK?
N
Y
CHECK J5.6,L402,C428, R423,R445,R413,Q404
RETEST
CURRENT OK?
N
CHECK FOR SHORTS
CHECK U404,U406
RETEST
GAIN OK?
N
S7 AT 21/U406 ?
Y
N
CHECK C444
CHECK U406
RETEST
MIC ISO OK?
N
Y
CHECK C445,R423, R425, U406
RETEST
DIST OK?
N
Y
CHECK U405,U406
RETEST
S8 AT 19/U406 ?
N
Y
RESPONSE OK?
N
Y
END
CHECK C444,C445,R409, C458,C457,R430,R431, C425,R411,R410,C459, R421,C453
CHECK U404,U406
18/U406 =5V?
N
Y
CHECK U406
20/U406 =5V?
N
Y
CHECK 33/U412, U412,U406
CHECK U406
S8 AT 11/U406 ?
N
Y
B
CHECK C449, R409,C458, R457,R430,R431
CHECK U406
RETEST

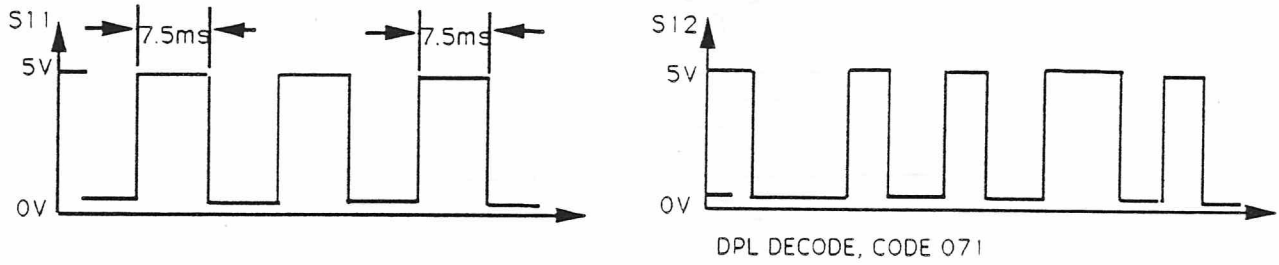
TX AUDIO WITH EXTERNAL MIC.

S10: 4mVrms 1KHz Sine wave



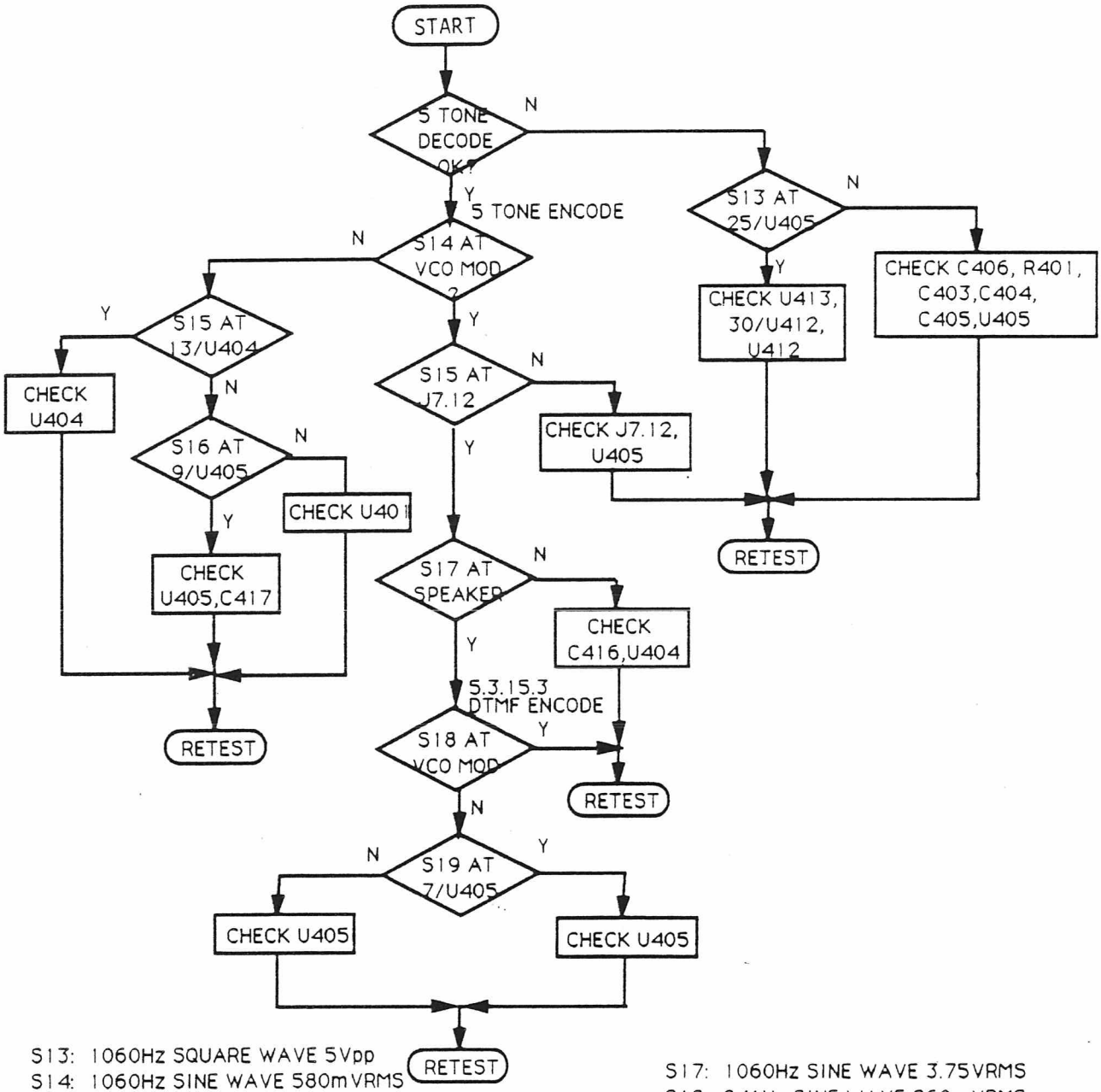
TPL/DPL SIGNALLING DECODE AND ENCODE





DPL DECODE, CODE 071

5-TONE SIGNALLING DECODER AND ENCODER



S13: 1060Hz SQUARE WAVE 5Vpp
S14: 1060Hz SINE WAVE 580mVRMS
S15: 1060Hz SINE WAVE 320mVRMS
S16:

S17: 1060Hz SINE WAVE 3.75VRMS
S18: 941Hz SINE WAVE 260mVRMS
S19:

CHAPTER
CHAPITRE
KAPITEL

8

DIAGRAMS AND PARTS LISTS OVERVIEW

MOTOROLA HTX/STORNO CP1000 - UHF

SCHEMATIC AND CIRCUIT BOARD NOTES

MOTOROLA HTX/STORNO CP1000

GENERAL DIAGRAM NOTES

- Unless otherwise stated, resistances are in ohm (k = 1000), capacitances less than 1 are in microfarad, and capacitances 1 or greater are in picofarad.
- DC Voltages are measured from point indicated to chassis ground using DC Multimeter or equivalent. Transmitter measurements should be made with a 0.29 uH RF Choke in series with voltage probe to prevent circuit loading.
- Interconnect tie point legend:

(B) CONTROLLER FLEX B +

(M1) METERING POINTS M1, M2, M3, M4, M5

(R) RECEIVE 10 V

(R5) RECEIVE 5 V

[S] TO SYNTHESIZER BOARD

(T) TRANSMIT 10 V

(T5) TRANSMIT 5 V

(G1) TO UNIVERSAL CONNECTOR

[M] MOTHER BOARD

VOLTAGE OVERLAY AND WAVEFORM NOTES

Note 1. -30 dBm Signal Generator Level:
Place a 47 ohm resistor across L10 to reduce first LO injection feed-through.

Note 2. These readings obtained by S/C Base of Q102 to ground.

Note 3. Inject (at selected antenna) an on-channel signal at 1 mV, 1 kHz modulation at 3 kHz deviation.

Note 4. Verify using programmer.

Note 5. All DC Voltages made via a 0.29 uH RFC.

Note 6. All AC Voltage readings in dBm are made via a 1 pF capacitor into the 50 ohm adapter of an RF mV meter. RX readings are made with -20 dBm carrier signal into remote port. TX readings made with remote port into 50 ohm.

Note 7. All AC Voltage readings in mV are made via a high impedance RF mV meter.

MOTOROLA HTX/STORNO CP1000

KITS

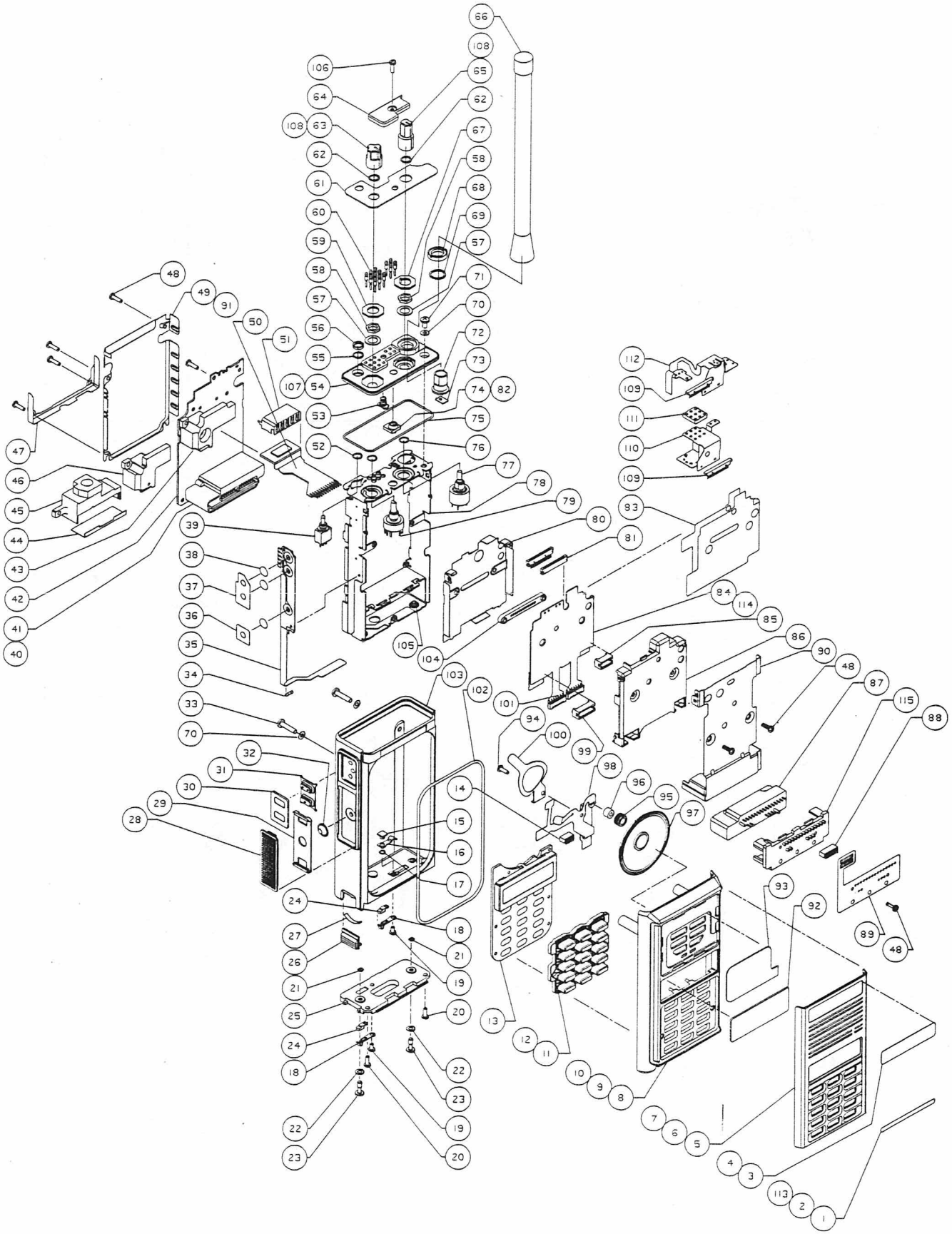
Kit Numbers	Position Numbers (Refer to MPL405.719 and M405.719)
ETN2301A (3K Front Cover, Ver. 2)	6, 9, 12, 13, 14, 92, 93, 94, 95, 96, 97, 98, 100, 102
ETN2302A (Plain Front Cover, Ver. 1)	7, 10, 14, 93, 94, 95, 96, 97, 98, 100, 102
ETN2303A (15K Front Cover, Ver. 3)	5, 8, 11, 13, 14, 92, 93, 94, 95, 96, 97, 98, 100, 102
ETN2304A (Housing Kit)	15-33, 70
ETN2305A (Control Logic)	80, 81, 83, 84, 85, 86, 99, 101, 104, 114
ETN2306A (Frame Kit)	34-39, 52-58, 60, 68-74, 76-79, 82, 109-112, 105, 107
ETN2310A (VHF Shield Assembly)	48, 75, 90
ETN2311A (UHF Shield Assembly)	48, 75, 90
ETN2315A (Connector Kit for Secure Modules)	48, 88, 89, 115
RF Tanapa (see Model Configuration)	40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 91, ETN2306A

MECHANICAL PARTS LIST FOR HTX/CP1000

Pos	Code No.	Description	Qt
01	3305787T04	LABEL, GRAPHIC (15 KEY)	1
01	5402011U59	LABEL, GRAPHIC (15 KEY)	1
01	5402011U60	LABEL, GRAPHIC (15 KEY)	1
		REGIONET FULL K.	
02	3305787T02	LABEL, GRAPHIC (15 KEY BLANK)	1
03	3305787T01	LABEL, LOGO (MOTOROLA)	1
04	3305787T03	LABEL, LOGO (STORNO)	1
05	1305708T01	GRILLE, 15 KEY	1
06	1305708T02	GRILLE, 3 KEY	1
07	1305708T03	GRILLE, PLAIN	1
08	1505707T01	COVER, FRONT 15 KEY	1
09	1505707T02	COVER, FRONT 3 KEY	1
10	1505707T03	COVER, FRONT PLAIN	1
11	7505705T01	KEYPAD, 15 KEY	1
12	7505705T02	KEYPAD, 3 KEY	1
13	5105898J34	DISPLAY MODULE	1
14	0905887T01	CONN, SPKR FLEX 2 X 6F	1
15	4605945K05	CONTACT STUD, BATTERY	1
16	3905127Q01	CONTACT, B+	1
17	3205082E24	GASKET, O-RING	1
18	3905453Q01	CONTACT, BATTERY POWER	2
19	0300139982	SCREW, PH.PN.HD.#2-56 X 5/32"	2
20	0300140041	SCREW, PH.PN.HD.#2-56 X 1/4"	2
21	3205082E03	GASKET, O-RING	2
22	0400009761	LOCKWASHER, SPLIT #4	2
23	0305941K01	SCREW,PH.PN.HD. #4-40 CAPTIVE	2
24	0705932T01	SUPPORT, CONTACT	2
25	6405709T01	BASE PLATE	1
26	5505536P01	LATCH	1
27	4105775Q01	SPRINT, BATTERY LATCH	1
28	4505535P01	LEVER, PTT	1
29	4205534P01	RETAINER, PTT	1
30	6405186Q01	PLATE MONITOR	1
31	3805187Q01	BUTTON, MONITOR	1
32	3805236Q01	ACTUATOR, PTT	1
33	0305137Q01	SCREW, PH.PN.HD. #4-40 X 1/2"	2
34	6505663R03	FUSE, 5 AMP	1
35	8405711T01	PCB, PTT FLEX	1
36	3205231Q01	SEAL, DOME (PTT)	1
37	3205196Q01	SEAL, DOME (MONITOR)	1
38	3905834K04	CONTACT, SNAP DOME	1
39	4005101Q02	SWITCH, PL TOGGLE	1
40	-----	PLUG, (VCO)	1
41	1505533P01	HOUSING, VCO	1
42	-----	TYPICAL CIRCUIT BOARD (R.F.)	1
43	2605532P01	HEAT SINK PA H. POWER (VHF)	1
44	2605161Q01	SHIELD, UHF HEATSINK	1
45	2605570P01	HEAT SINK (UHF)	1
46	2605578P01	HEAT SINK PA L. POWER (VHF)	1
47	2605123S01	SHIELD, BACK	1
48	0300136772	SCREW, PH.BND.HD.#2-56 X 5/16"	8
49	2605775R01	SHIELD, MAIN BACK	1
50	8405126U01	PCB, IF MODULE FLEX	1
51	2605494R01	SHIELD, IF MODULE	1
52	3205141Q03	GASKET, O-RING	1
53	4605159Q01	STUD, INSERT	1
54	0105951N41	ASM.TOP CONTROLPANEL 16-CHANNEL	1
		INCLUDES ITEMS 107,53,60 & 72	1
55	0405162Q01	WASHER, FLAT, TOGGLE	1
56	0205163Q01	NUT, SPANNER, TOGGLE	1
57	0405162Q02	WASHER, FLAT;VOL.POT.,FREQ.SW.	1
58	0205629L01	NUT, HEX;VOL.POT.,FREQ.SW.	1
59	0405534R01	WASHER, FLAT OCTAGONAL	1
60	3902243J01	PIN, CONTACT	1
61	1305676R18	ESCUTCHEON (10-FREQ.RADIOS)	1
	1305676R19	ESCUTCHEON (16-FREQ.RADIOS)	1
62	0405676R18	WASHER, FLAT	2
63	3605120Q01	KNOB, VOL	1
64	1505102S01	COVER, DUST	1
65	3605677R01	KNOB, FREQ	1
66	-----	ANTENNA	1
67	0405218Q02	WASHER, PROGRAMMABLE	1
68	0205571R02	NUT, SPANNER	1
69	0405216L04	WASHER, FLAT	1
70	0484345A06	WASHER, SEAL	1
71	0300136785	SCREW, PH.PH.HD. #4-40 X 3/16"	1
72	4305577S01	BUSHING, ANTENNA	1
73	-----	LUG, ANTENNA	1
74	3205157Q01	SEAL, LED	1
75	3205157Q02	GASKET, O-RING (PANEL)	1
76	3205082E01	GASKET, O-RING (FREQ., VOL.)	1
77	4005265Q02	SWITCH, FREQUENCY	1
78	0705710T01	FRAME	1
79	1805100Q03	SWITCH/POT, ON-OFF/VOLUME	1
80	2605716T01	SHIELD, CONTOLLER	1
81	0905467R01	JACK, 15 PIN	2
82	4805729G24	LED, BICOLOR	1
83	1405889T01	INSULATOR, CONTROLLER	1
84	8402206J01	CONTROLLER FLEX	1
85	2805888T01	CONN, CONTROLLER 2 X 6M	1
86	1505718T01	HOUSING, CONTROLLER CASTING	1
88	0905887T02	CONN.2 X 9F (IN SECURE VERSION	1
		REPLACED BY 87,89 & 115)	
90	2605715T01	SHIELD, FRONT HOUSING	1
91	1405511R01	INSULATOR, BACK SHIELD	1
92	6105451Q02	WINDOW LCD (LENS)	1
93	3505714T01	FLET, SPEAKER	1
94	0305073P	SCREW, #2 THREAD FORMING	1
95	1405874T01	MIC. BOOT (STORNO)	1
96	5005227J01	MICROPHONE, ELECTRET	1
97	5005269T04	SPEAKER, 28 OHMS	1
98	8405712T01	PCB, SPEAKER MIC. FLEX	1
99	2805888T02	CONN, 2 X 9M	1
100	4205713T01	RETAINER, SPEAKER	1
101	0905577P01	JACK 7 PIN	2
102	3205082E76	O-RING, FRONT COVER	1
103	1505706T01	HOUSING	1
104	0105959M27	HEADER, CONTROLLER	1
105	4305170Q01	INSERT, FRAME	1
106	0305103S01	SCREW, #2 CAPTIVE	1
107	6405158Q02	PANEL, CTRL TOP	1
108	4205123Q02	CLIP, KNOB	1
109	0905467R01	JACK 15 PIN MALE	2
110	8405122S01	PCB, VOL.POT.FLEX	1
111	1405147Q01	HEADER, UNIVERSAL CONNECTOR	1
112	8405741R01	PCB. VOL.POT. FLEX	1
113	3305787T05	LABEL, GRAPHIC (3 KEY)	1
113	5402011U56	LABEL, GRAPHIC (3 KEY)	1

Pos	Code No.	Description	Qt
113	5402011U57	LABEL, GRAPHIC (3 KEY)	1
113	5402011U70	LABEL, GRAPHIC (3 KEY) REGIONET 3K	1
114	2605---	SHIELD, CONTROLLER FLEX	1
----	----------	----------	---
87	-----	SECURE MODULE	1
89	8002003U96	PCB,SECURE INTERCONNECT FLEX (ETN2315A)	1
115	6402430J01	PANEL, SECURE	1

Pos	Code No.	Description	Qt

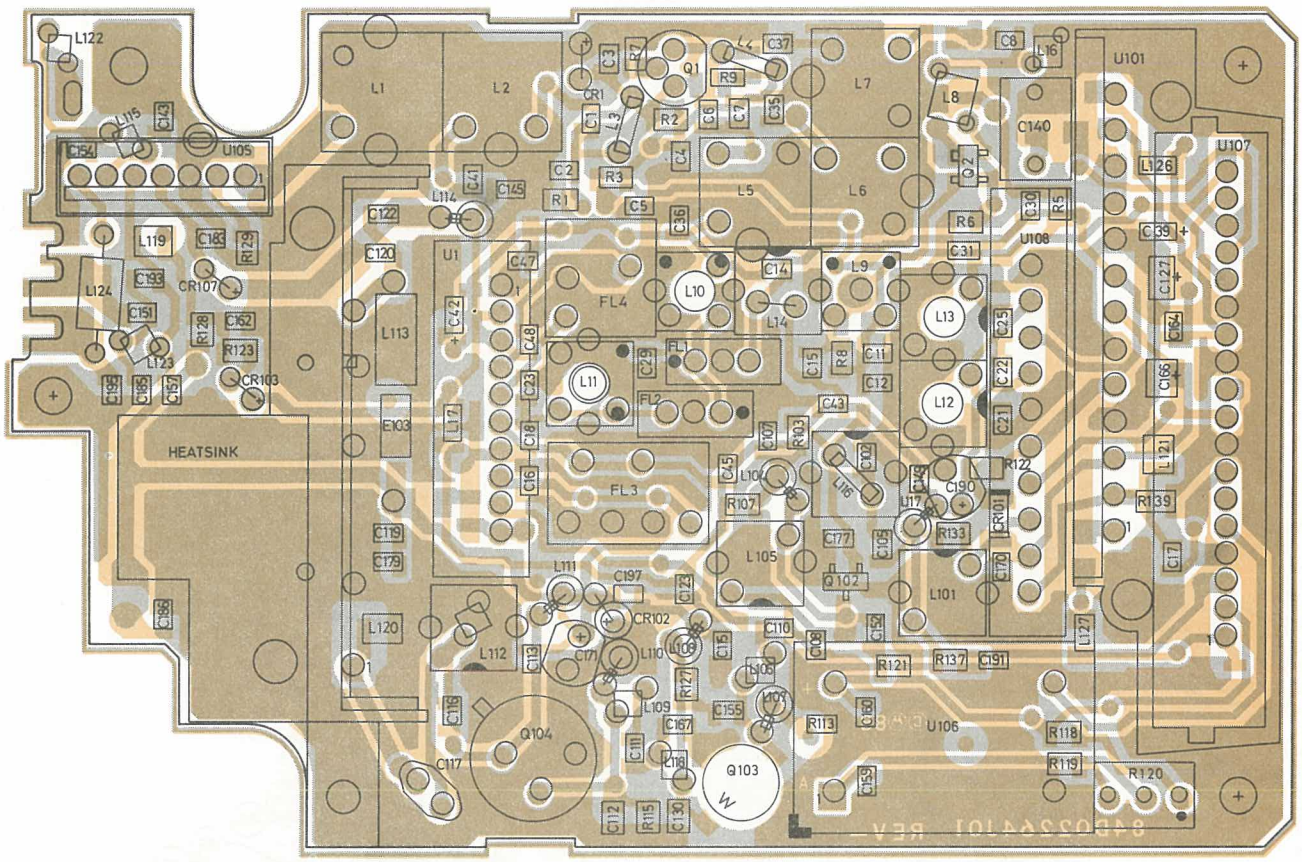


HTX/CP1000
EXPLODED VIEW & PART NUMBERS

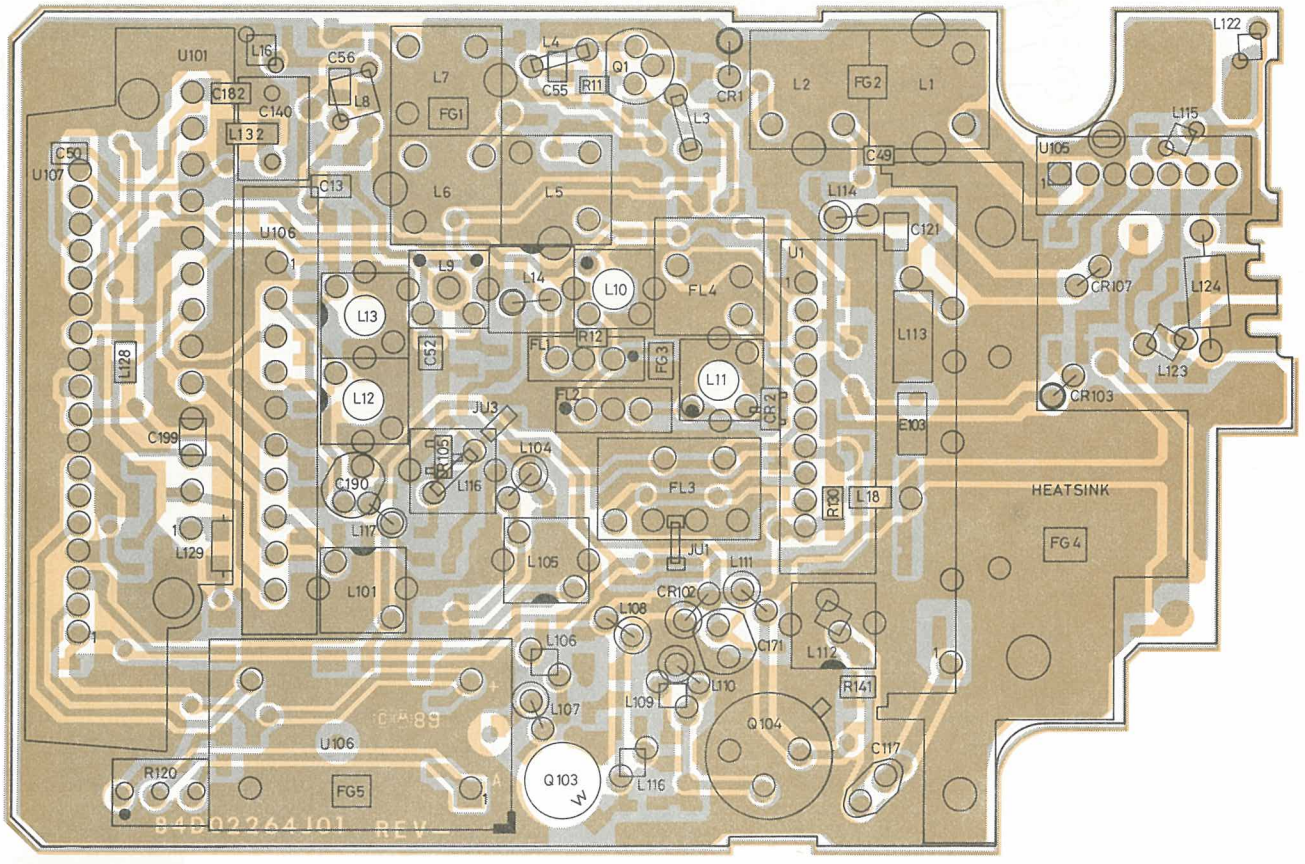
DOC.ISSUE 10.04.89

M405.719

COMPONENT SIDE



SOLDER SIDE

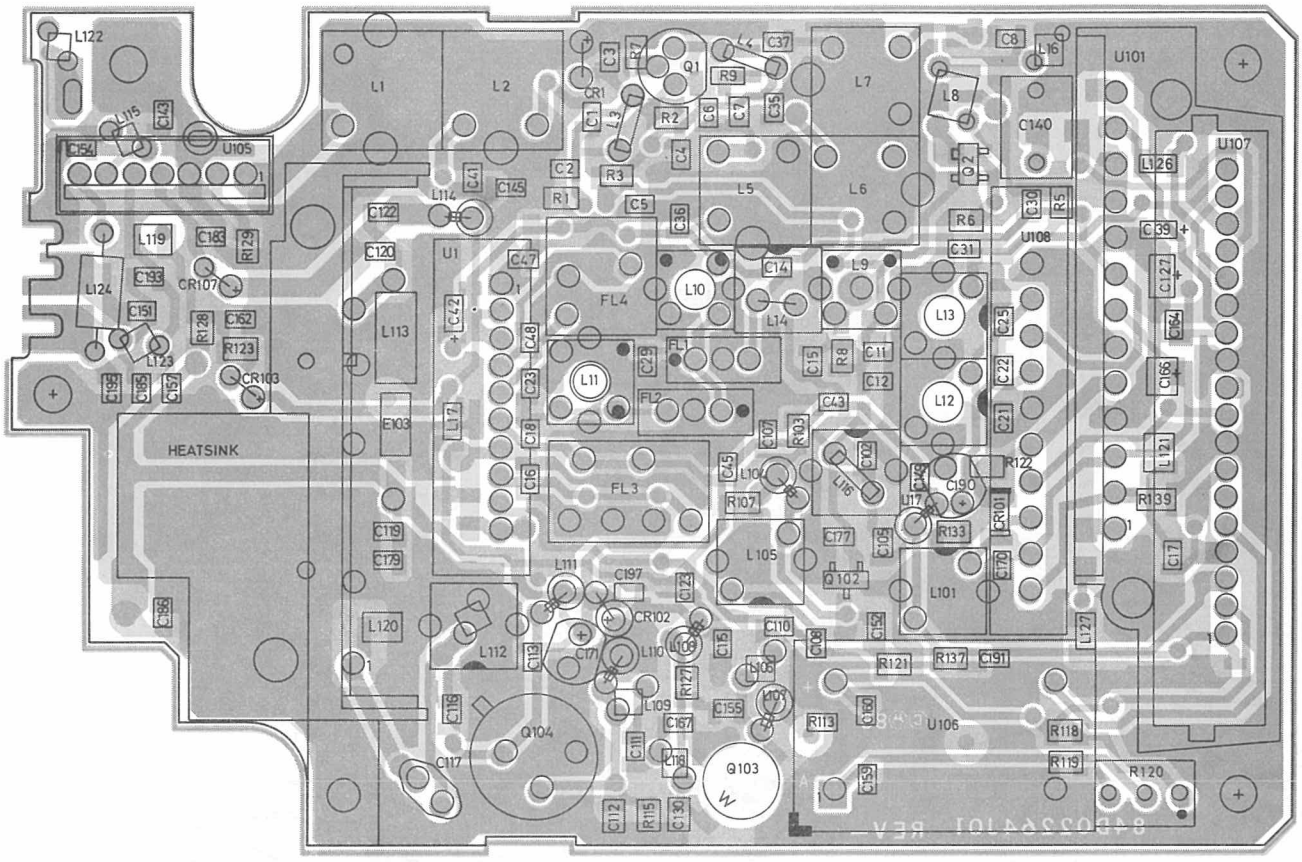


HTX/CP1000
UHF TRANSCEIVER BOARD 4 WATT
COMPONENT LAYOUT

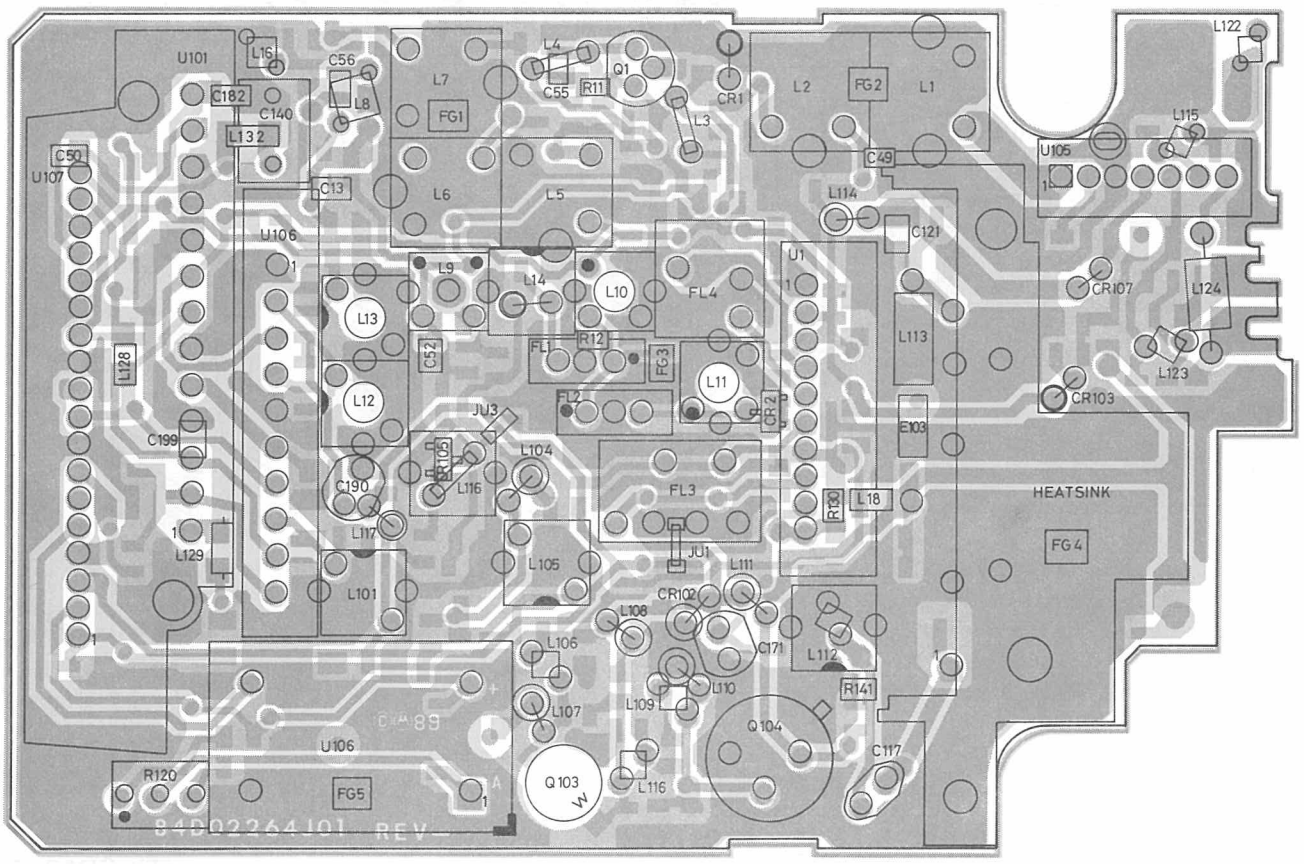
D405.500

DOC. ISSUE 09.28.89

COMPONENT SIDE



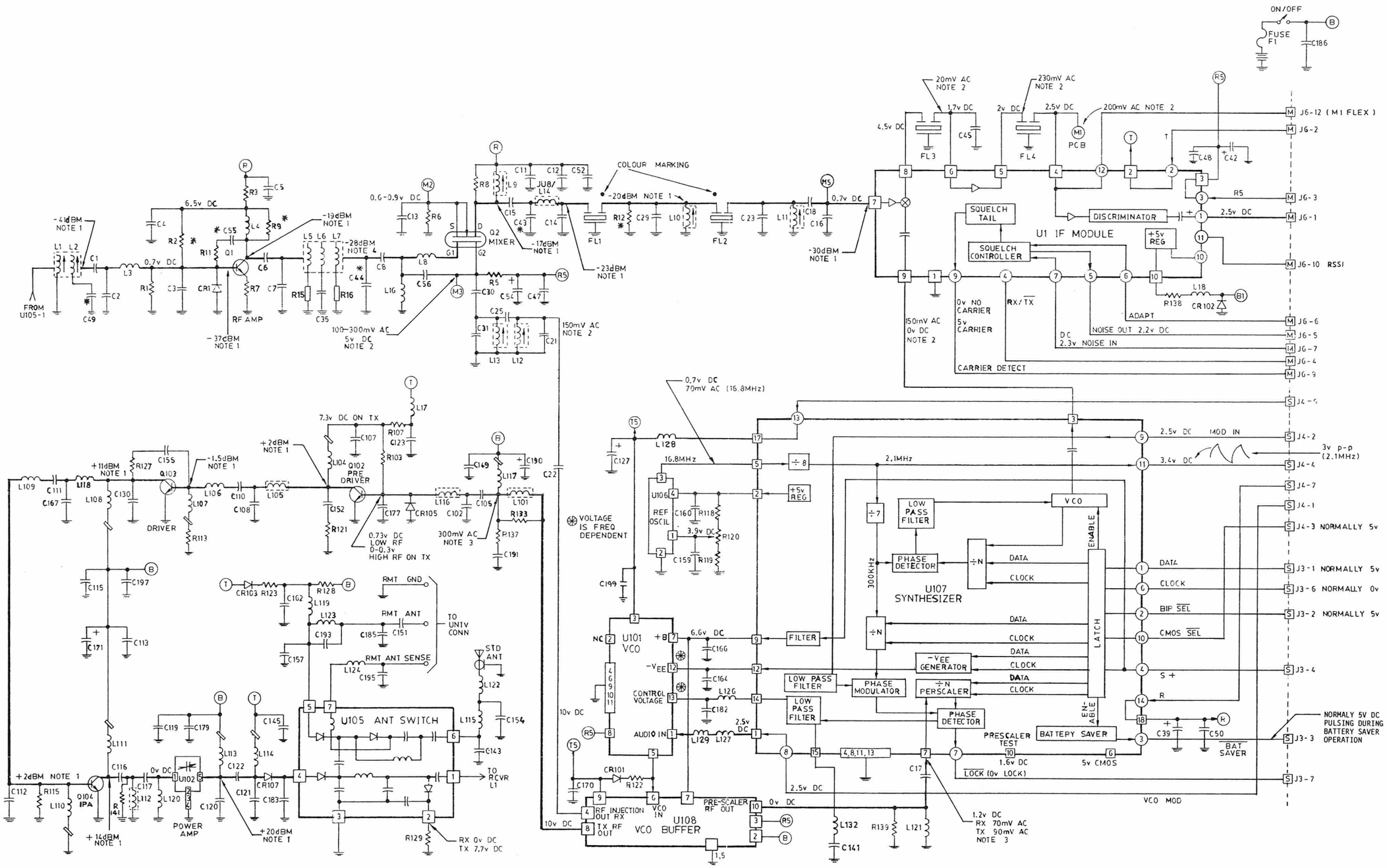
SOLDER SIDE



HTX/CP1000
UHF TRANSCEIVER BOARD 4 WATT
COMPONENT LAYOUT

D405.500

DOC. ISSUE 09.28.89



U105 PIN 5
TX 1.5V REMOTE
RX 1.4V REMOTE

U108 PIN 6
RX 1.4V DC 100-160mV AC
TX 3.4V DC 95-150mV AC NOTE 3

ITEM NO.	FREQUENCY	CHANNEL SPACING	OUTPUT POWER
EUE3103A	403 - 433MHz	12.5kHz	4 WATT
EUE3104A	403 - 433MHz	20/25kHz	4 WATT
EUE3107A	438 - 470MHz	12.5kHz	4 WATT
EUE3108A	438 - 470MHz	20/25kHz	4 WATT

CRYSTAL FILTER MARKING		
CHANNEL SPACING	FL1	FL2
12.5kHz	RED	YELLOW
20/25kHz	BLACK	BLUE

* USAGE DEPEND ON BANDSPIT OR MODEL

◯ SOCKET AT CONTROLLER FLEX

□ PINS AT MAIN CIRCUIT BOARD

L12 AND CORRESPONDING CAN IS ONLY USED IN 12.5kHz CHANNEL SPACING RADIOS. IN 20/25kHz RADIOS A JUMPER IS USED. (JU08)

HTX/CP1000
UHF TRANSCEIVER BOARD 4 WATT SCHEMATIC DIAGRAM

D405.501/2

DOC. ISSUE 03.09.90

PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 4 WATT

Pos	Code No.	Description		Qt
	EUE3103A	403 - 433 MHZ, 12.5 KHZ (A)		
	EUE3104A	403 - 433 MHZ, 20/25 KHZ (B)		
	EUE3107A	438 - 470 MHZ, 12.5 KHZ (C)		
	EUE3108A	438 - 470 MHZ, 20/25 KHZ (D)		
C1	2113740A23	CAP CHIP 6.2PF ±0.25PF	C,D	1
C1	2113740A29	CAP CHIP 10PF/C1	A	1
C1	2113740A33	CAP CHIP 15PF ±5%	B	1
C2	2113740A13	CAP CHIP 2.7PF ±2.5PF	C,D	1
C2	2113740A15	CAP CHIP 3.3PF ±2.5PF	B	1
C2	2113740A21	CAP CHIP 5.6PF ±2.5PF	A	1
C3	2113740A21	CAP CHIP 5.6PF ±2.5PF	B	1
C3	2113740A28	CAP CHIP 9.1PF ±2.5PF	C,D	1
C3	2113740A33	CAP CHIP 15PF ±5%	A	1
C4	2113740A53	CAP CHIP 82PF ±5%		1
C5	2113741A21	CAP CHIP 1000PF ±5%		1
C6	2113740A30	CAP CHIP 11PF ±5%	B	1
C6	2113740A16	CAP CHIP 3.6PF ±0.25PF	A	1
C6	2113740A17	CAP CHIP 3.9PF ±0.25PF	C,D	1
C7	2113740A17	CAP CHIP 3.9PF ±0.25PF	A	1
C7	2113740A23	CAP CHIP 6.2PF ±0.25PF	C,D	1
C7	2113740A27	CAP CHIP 8.2PF ±0.25PF	B	1
C8	2113740A53	CAP CHIP 82PF ±5%		1
C11	2113741A33	CAP CHIP 3300PF ±5%		1
C12	2113740A53	CAP CHIP 82PF ±5%		1
C13	2113741A45	CAP CHIP 10000PF ±5%		1
C14	2113740A17	CAP CHIP 3.9PF ±0.25PF	B,D	1
C14	2113740A29	CAP CHIP 10PF/C1	C	1
C14	2113740A29	CAP CHIP 10PF/C1	A	1
C15	2113740A32	CAP CHIP 13PF ±5%	A	1
C15	2113740A35	CAP CHIP 18PF ±5%	C	1
C15	2113741A21	CAP CHIP 1000PF ±5%	B,D	1
C16	2113740A31	CAP CHIP 12PF ±5%	B,D	1
C16	2113740A38	CAP CHIP 24PF ±5%	A,C	1
C17	2113740A40	CAP CHIP 30PF ±5%	C,D	1
C17	2113740A43	CAP CHIP 39PF ±5%	A,B	1
C18	2113740A35	CAP CHIP 18PF ±5%	B,D	1
C18	2113740A40	CAP CHIP 30PF ±5%	A,C	1
C21	2113740A28	CAP CHIP 9.1PF ±2.5PF	B	1
C21	2113740A31	CAP CHIP 12PF ±5%	C,D	1
C22	2113740A03	CAP CHIP 1PF ±0.25PF	C,D	1
C22	2113740A10	CAP CHIP 2PF ±0.25PF	A,B	1
C23	2113740A17	CAP CHIP 3.9PF ±0.25PF	A	1
C25	2113740A09	CAP CHIP 1.8PF ±0.25PF	C,D	1
C25	2113740A14	CAP CHIP 3.0PF ±2.5PF	A,B	1
C29	2113740A17	CAP CHIP 3.9PF ±0.25PF	B,D	1
C29	2113740A24	CAP CHIP 6.8PF ±0.25PF	A,C	1
C30	2113741A21	CAP CHIP 1000PF ±5%		1
C31	2113740A19	CAP CHIP 4.7PF ±0.25PF	A,B	1
C31	2113740A28	CAP CHIP 9.1PF ±2.5PF	C,D	1
C35	2113740A25	CAP CHIP 7.5PF ±0.25PF	A,B	1
C35	2113740A40	CAP CHIP 30PF ±5%	C,D	1
C36	0660076M01	RES CHIP 0 OHM 2012		1
C37	0660076M01	RES CHIP 0 OHM 2012		1
C39	2360562A13	CAP TANT 1.0UF 16V		1
C41	0660076M01	RES CHIP 0 OHM 2012		1
C42	2360562A16	CAP TANT 1.5UF 10V		1
C43	2113740A43	CAP CHIP 39PF ±5%	A,C	1
C47	2113741A33	CAP CHIP 3300PF ±5%		1
C48	2113740A53	CAP CHIP 82PF ±5%		1
C49	2113740A38	CAP CHIP 24PF ±5%		1
C50	2113741A21	CAP CHIP 1000PF ±5%		1
C52	2160521G37	CAP CHIP 100NF +80% -20%		1
C56	2113740A05	CAP CHIP 1.2PF ±2.5PF	C	1
C56	2113740A07	CAP CHIP 1.5PF ±0.25PF	A	1
C56	2113740A11	CAP CHIP 2.2PF ±0.25PF	B	1
C102	2113740A33	CAP CHIP 15PF ±5%	C,D	1
C102	2113740A36	CAP CHIP 20PF ±5%	A,B	1
C105	2113740A41	CAP CHIP 33PF ±5%	C,D	1
C107	2113740A53	CAP CHIP 82PF ±5%		1
C108	2113740A30	CAP CHIP 11PF ±5%	A,B	1
C108	2113740A31	CAP CHIP 12PF ±5%	C,D	1
C110	2113740A42	CAP CHIP 36PF ±5%	C,D	1
C110	2113740A53	CAP CHIP 82PF ±5%	A,B	1
C111	2113740A31	CAP CHIP 12PF ±5%	C,D	1
C111	2113740A53	CAP CHIP 82PF ±5%	A,B	1
C112	2113740A38	CAP CHIP 24PF ±5%	C,D	1
C112	2113740A39	CAP CHIP 27PF ±5%	A,B	1
C113	2113740A53	CAP CHIP 82PF ±5%		1
C115	2113740A53	CAP CHIP 82PF ±5%		1
C116	2113740A34	CAP CHIP 16PF ±5%	C,D	1
C116	2113740A36	CAP CHIP 20PF ±5%	A,B	1
C117	2105454G18	CAP CER 22PF ±5% N150 50V	C,D	1
C117	2105454G28	CAP CER 24PF 5% N150 63V	A	1
C117	2105454G38	CAP CER 33PF 5% N150 63V	B	1
C119	2113740A53	CAP CHIP 82PF ±5%		1
C120	2113740A10	CAP CHIP 2PF ±0.25PF	C,D	1
C121	2113740A10	CAP CHIP 2PF ±0.25PF	A,B	1
C122	2113740A53	CAP CHIP 82PF ±5%		1
C123	2160521G37	CAP CHIP 100NF +80% -20%		1
C127	2360562A24	CAP TANT 3.3UF 16V		1
C130	2113740A03	CAP CHIP 1PF ±0.25PF	C,D	1
C140	0860101B37	CAP 0.47UF METALL POLY		1
C143	2113740A15	CAP CHIP 3.3PF ±2.5PF	C,D	1
C143	2113740A17	CAP CHIP 3.9PF ±0.25PF	A,B	1
C145	2113740A53	CAP CHIP 82PF ±5%		1
C149	2113740A53	CAP CHIP 82PF ±5%		1
C151	2113740A53	CAP CHIP 82PF ±5%		1
C152	2160521G37	CAP CHIP 100NF +80% -20%		1
C154	2113740A03	CAP CHIP 1PF ±0.25PF	C,D	1
C154	2113740A24	CAP CHIP 6.8PF ±0.25PF	A,B	1
C155	2160521G37	CAP CHIP 100NF +80% -20%		1
C157	2113740A10	CAP CHIP 2PF ±0.25PF	C,D	1
C157	2113740A23	CAP CHIP 6.2PF ±0.25PF	A,B	1
C162	2113740A53	CAP CHIP 82PF ±5%		1
C164	2113740A53	CAP CHIP 82PF ±5%		1
C166	2360562A24	CAP TANT 3.3UF 16V		1
C167	2113740A03	CAP CHIP 1PF ±0.25PF	C,D	1
C167	2113740A18	CAP CHIP 4.3PF ±0.25PF	A,B	1
C170	2113740A53	CAP CHIP 82PF ±5%		1
C171	2305499G20	CAP SOL TANT 10UF 20% 20V		1
C177	2113740A19	CAP CHIP 4.7PF ±0.25PF	C,D	1
C177	2113740A27	CAP CHIP 8.2PF ±0.25PF	A,B	1
C179	2160521G37	CAP CHIP 100NF +80% -20%		1
C182	2113741A37	CAP CHIP 4700PF ±5%		1
C183	2113740A13	CAP CHIP 2.7PF ±2.5PF	A,B	1
C183	2113740A15	CAP CHIP 3.3PF ±2.5PF	C,D	1
C185	2113740A15	CAP CHIP 3.3PF ±2.5PF	C,D	1

PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 4 WATT

Pos	Code No.	Description		Qt
C185	2113740A19	CAP CHIP 4.7PF ±0.25PF	A,B	1
C186	2113740A53	CAP CHIP 82PF ±5%		1
C190	2305458G12	CAP TANT 33UF 16V	C	1
C190	2305499G13	CAP SOL TANT 1UF 20% 25V	A,B,D	1
C191	2113740A53	CAP CHIP 82PF ±5%		1
C193	2113740A20	CAP CHIP 5.1PF ±2.5PF	A,B	1
C195	2113740A53	CAP CHIP 82PF ±5%		1
C197	2113741A21	CAP CHIP 1000PF ±5%		1
C199	2113740A53	CAP CHIP 82PF ±5%	C,D	1
CR				
1	4883654H08	DIODE SLCN		1
103	4883654H08	DIODE SLCN		1
102	4805490G02	DIODE RECT SIL		1
101	4805494Q04	DIODE CHIP SILICON		1
107	4880010E05	DIODE PIN RF		1
105	4805119G14	DIODES		1
FG1	3905509R02	CONTACT		1
FG2	3905509R02	CONTACT		1
FG3	3905509R02	CONTACT		1
FG4	3905509R02	CONTACT		1
FG5	3905509R02	CONTACT		1
FL1	4805245J19	X'TAL FILTER	A,C	1
FL1	4805245J20	XTAL FILTER 53.55-13.5B	B,D	1
FL2	4805245J19	X'TAL FILTER	A,C	1
FL2	4805245J20	XTAL FILTER 53.55-13.5B	B,D	1
FL3	9105725Q03	CER FILTER CFW450F	A,C	1
FL3	9105685Q12	CER FILTER SFG450EN	B,D	1
FL4	9105726Q03	CER FILTER CFW450F	A,C	1
FL4	9105685Q11	CER FILTER SFG450DN	B,D	1
JU1	4205495C04	STRAP CROSSOVER	C	1
JU1	4205495C07	STRAP CROSSOVER	A,B,D	1
JU3	4205495C07	STRAP CROSSOVER	A,B	1
JU6	3005889C01	WIRE FLAT	A,B,C	1
JU7	3005889C01	WIRE FLAT		1
JU8	1000000519	JUMPER WIRE	B	1
L1	0105951P30	2P PRESEL	A,B	1
L1	0105957M23	2P PRESEL ASSY	C,D	1
L2	0105951P30	2P PRESEL	A,B	1
L2	0105957M23	2P PRESEL ASSY	C,D	1
L3	2484238H02	COIL FIN 1 1/2T FIXED	C,D	1
L3	2405559P03	COIL 1 1/2T AIR WOUND	A	1
L3	2405559P09	COIL 1 1/2T AIR WOUND	B	1
L4	2484238H02	COIL FIN 1 1/2T FIXED	C,D	1
L4	2405559P03	COIL 1 1/2T AIR WOUND	A,B	1
L5	2405732J21	COIL 10.75 TURN PRESEL	C,D	1
L5	2405732J22	COIL 11.75T 3P PRESEL	A,B	1
L6	2405732J01	COIL 11 TURNS PRESEL	C,D	1
L6	2405732J10	COIL 12 TURNS 3P PRESEL	A,B	1
L7	2405732J01	COIL 11 TURNS PRESEL	C,D	1
L7	2405732J22	COIL 11.75T 3P PRESEL	A,B	1
L8	2405559P13	COIL 5.5T AIR WOUND	B,C,D	1
L8	2405559P22	COIL 4.5T AIR WOUND	A	1
L9	2405063H24	COIL MINIATURE	A,C	1
L9	2405063H35	COIL 0.6±16 TUNABLE TOKO	B,D	1
L10	2405063H13	COIL 1.2UH ±16% TUNABLE		1
L11	2405063H05	COIL 0.4±16 TUNABLE TOKO	A,B,C	1
L11	2405063H09	COIL 0.6UH ±16 TUNABLE	D	1
L12	2405523P35	COIL 5MM	C,D	1
L12	2405523P36	COIL 2 1/2T SPACE 5MM AL	A,B	1

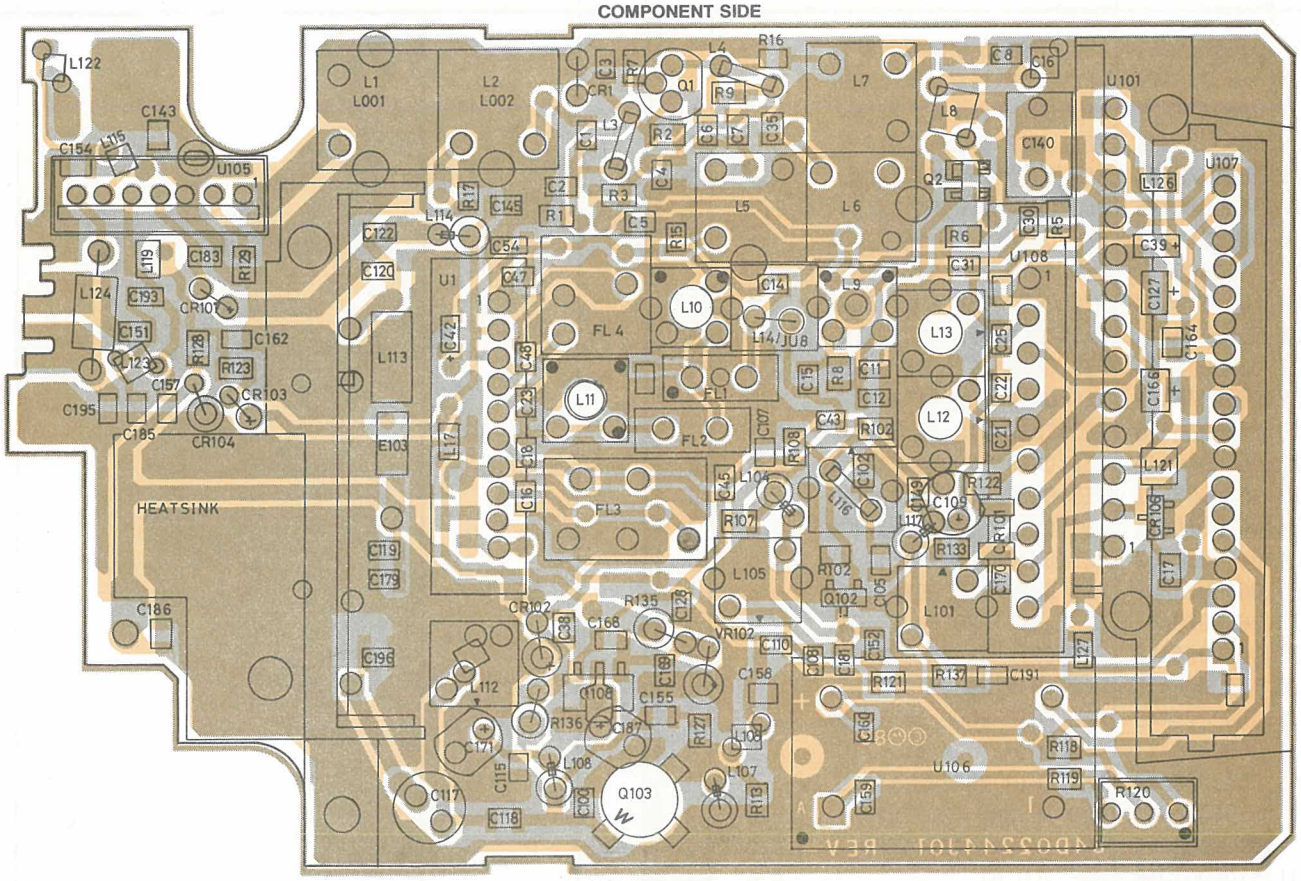
Pos	Code No.	Description		Qt
L13	2405523P35	COIL 5MM	C,D	1
L13	2405523P36	COIL 2 1/2T SPACE 5MM AL	A,B	1
L14	2505129Q02	CHOKE 1.2 UH. PRECISION	A,C	1
L16	2405027E19	COIL RF FIN		1
L17	2462575A01	CHOKE 0.39UH		1
L18	2462575A01	CHOKE 0.39UH		1
L101	2405523P07	COIL 2 1/2T SPACE, 5MM	C,D	1
L101	2405523P08	COIL 3 1/2T SPACE - 5MM	A,B	1
L104	0105951N35	CHOKE & BEAD AS(0.085UH)		1
L105	2405523P08	COIL 3 1/2T SPACE - 5MM		1
L106	2405027E38	COIL FIN 3 1/2T FIXED		1
L107	0105950L78	1.2UH RF CHOKE & BEAD AS		1
L108	0105951N35	CHOKE & BEAD AS(0.085UH)		1
L109	2405027E38	COIL FIN 3 1/2T FIXED		1
L110	0105951N34	RF CHK & BD ASSY (0.29UH)		1
L111	0105951N35	CHOKE & BEAD AS(0.085UH)		1
L112	2405027E38	COIL FIN 3 1/2T FIXED		1
L113	0105952N08	0.15UH RF CHK & BD ASSY		1
L114	0105951N34	RF CHK & BD ASSY (0.29UH)		1
L115	2405559P19	COIL 4 1/2T AIR WOUND		1
L116	2484238H02	COIL FIN 1 1/2T FIXED		1
L117	0105951N34	RF CHK & BD ASSY (0.29UH)		1
L118	2405027E38	COIL FIN 3 1/2T FIXED		1
L119	2405452C08	COIL ELEC CHIP 275NH		1
L120	2405452C08	COIL ELEC CHIP 275NH	A,B	1
L121	2405452C06	COIL 21NH		1
L122	2405027E21	COIL 2 1/2T AIRWOUND	C,D	1
L122	2405559P18	COIL 3 1/2T AIR WOUND	A,B	1
L123	2405027E38	COIL FIN 3 1/2T FIXED	A,B	1
L123	2405559P18	COIL 3 1/2T AIR WOUND	C,D	1
L124	2482723H28	COIL RF .29 UH YEL		1
L126	2462575A01	CHOKE 0.39UH		1
L127	2462575A01	CHOKE 0.39UH		1
L128	2462575A01	CHOKE 0.39UH		1
L129	0105957P25	0.29UH/HEAT SHRINK		1
L132	2462575A01	CHOKE 0.39UH		1
Q1	4880182D39	TSTR M8239 SMALL SIG		1
Q2	4805452G13	TSTR BF990 MOSFET		1
Q102	4805128M84	TSTR MMBR 920		1
Q103	4805474G38	TSTR MRF559		1
Q104	4800869887	TSTR M9887		1
R1	0660076A69	RES CHIP 6800 5% 1/10W	C,D	1
R1	0660076A71	RES CHIP 8200 ±5% 1/10W	A,B	1
R2	0660076A89	RES CHIP 47K 5% 1/10W		1
R3	0660076A57	RES CHIP 2200 5% 1/8W	C,D	1
R3	0660076A59	RES CHIP 2700 5% 1/10W	A,B	1
R5	0660076A32	RES CHIP 200 5% 1/10W	B	1
R5	0660076A45	RES CHIP 680 5% 1/10W	A,C,D	1
R6	0660076A35	RES CHIP 270 5% 1/10W	A	1
R6	0660076A37	RES CHIP 330 5% 1/10W	B,D	1
R6	0660076A39	RES CHIP 3900HM ±5% 0.1W	C	1
R7	0660076A03	RES CHIP 12 5% 1/10W	B	1
R7	0660076M01	RES CHIP 0 OHM 2012	A,C,D	1
R8	0660076A54	RES CHIP 1600 5% 1/8W	A,C	1
R8	0660076A61	RES CHIP 3.3K ±5% 0.1W	B,D	1
R9	0660076A56	RES CHIP 2000 5% 1/10W	A,B	1
R9	0660076A57	RES CHIP 2200 5% 1/8W	C	1
R12	0660076A85	RES CHIP 33K 5% 1/10W	A,C	1
R15	0660076M01	RES CHIP 0 OHM 2012		1

PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 4 WATT

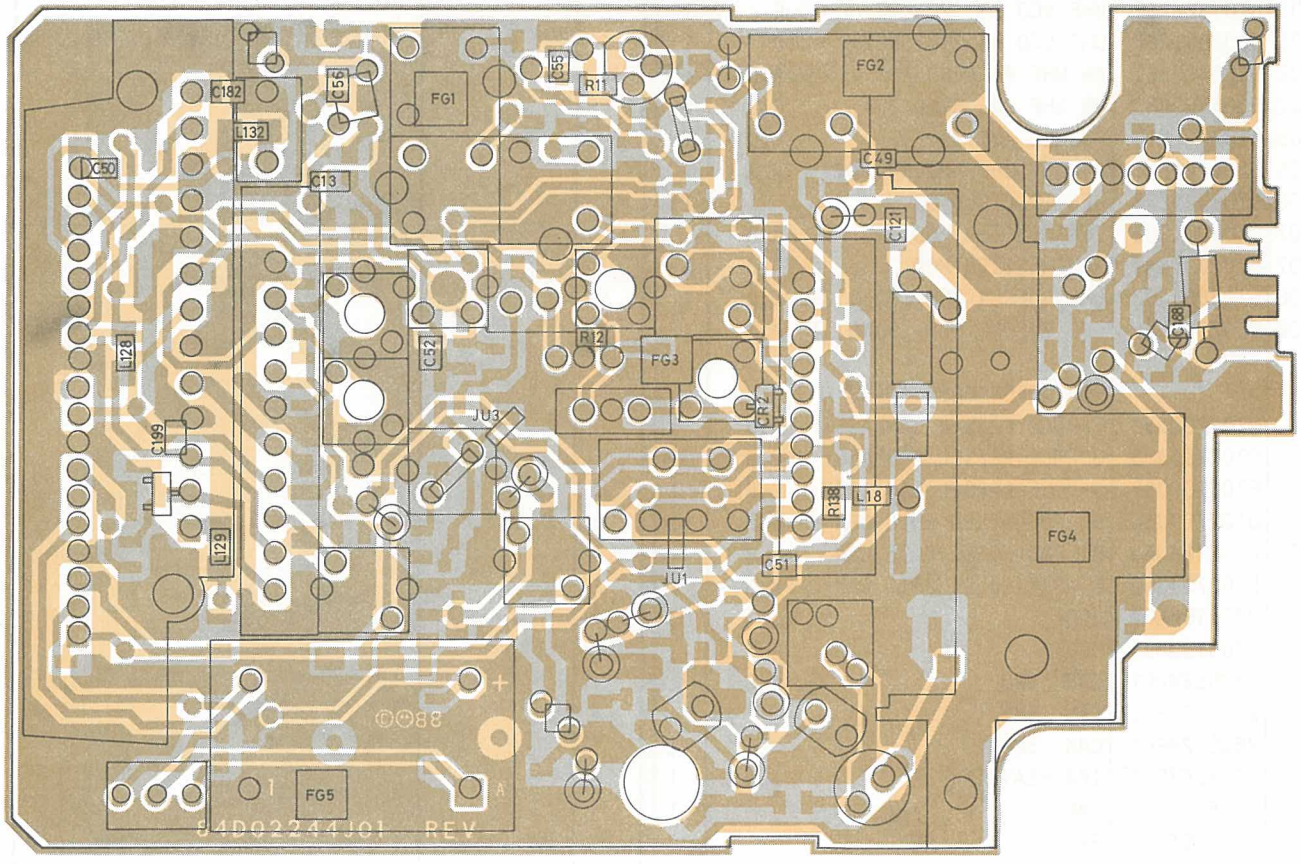
Pos	Code No.	Description		Qt
R16	0660076M01	RES CHIP 0 OHM 2012		1
R103	0660076A77	RES CHIP 15K ±5% 1/8W		1
R107	0660076A29	RES CHIP 150 5% 1/10W		1
R113	0660076M01	RES CHIP 0 OHM 2012		1
R115	0660076A22	RES CHIP 75 5% 1/10W	A,B	1
R115	0660076A25	RES CHIP 100 5% 1/10W	C,D	1
R118	0660076A72	RES CHIP 9.1K 5% 1/10W		1
R119	0660076A87	RES CHIP 39K 5% 1/10W		1
R120	1805559S02	RES POT 50K MULTITURNS		1
R121	0660076A41	RES CHIP 470 5% 1/10W		1
R122	0660076A63	RES CHIP 3900 5% 1/10W	C,D	1
R122	0660076A79	RES CHIP 18K 5% 1/10W	A,B	1
R123	0660076A48	RES CHIP 910 5% 1/10W	A,B	1
R123	0660076A49	RES CHIP 1000 5% 1/10W	C,D	1
R127	0660076A41	RES CHIP 470 5% 1/10W		1
R128	0660076A51	RES CHIP 1.2K 5% 1/10W	C,D	1
R128	0660076A52	RES CHIP 1.3K 5% 1/10W	A,B	1
R129	0660076A42	RES CHIP 510 ±5% 1/10W		1
R133	0660076A45	RES CHIP 680 5% 1/10W		1
R137	0660076A18	RES CHIP 51 5% 1/10W		1
R138	0660076A15	RES CHIP 39 5% 1/10W		1
R139	0660076A49	RES CHIP 1000 5% 1/10W	C,D	1
R139	0660076A51	RES CHIP 1.2K 5% 1/10W	A,B	1
R141	0660076A39	RES CHIP 3900HM ±5% 0.1W	C,D	1
U1	5102001J41	MOD IF UHF (20/25KHZ)	B,D	1
U1	5102001J55	MOD IF UHF (12.5KHZ)	A,C	1
U101	5102001J59	UHF VCO B1	A,B	1
U101	5105822P56	UHF VCO B3 12.5KHZ	C	1
U101	5102001J62	UHF VCO B3 20/25KHZ	D	1
U102	5105729E81	4W UHF PA BAND 1	A,B	1
U102	5105729E82	4W UHF PA, BAND 3	C,D	1
U105	5102001J19	MODULE ANT SW.	C,D	1
U105	5105729E75	4-PORT UHF ANTENNA SW	A,B	1
U106	5105729E72	REF. OSCILLATOR		1
U107	5102001J39	SYNTHESIZER MOD	A,B	1
U107	5102001J40	SYNTHESIZER MOD	C,D	1
U108	5102001J02	UHF BUFFER MOD (BAND 3)	C,D	1
U108	5102001J05	UHF BUFFER MOD (BAND 1)	A,B	1
		NON REFERENCED ITEMS:		
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102704J66	B1 PRE-SELEC COIL CAN	A,B	1
	0102704J66	B1 PRE-SELEC COIL CAN	A,B	1
	0102704J66	B1 PRE-SELEC COIL CAN	A,B	1
	0705196A04	BOOT		1
	0705196A04	BOOT		1
	2605524P01	CAN 5MM	A,C	1
	2605524P01	CAN 5MM		1
	2605524P01	CAN 5MM		1
	2605567S01	IPA HEATSINK	A,B,D	1
	7505295B07	PAD		1
	7505295B07	PAD		1
	7505695R01	PAD OSCILLATOR		1

Pos	Code No.	Description	Qt

COMPONENT SIDE



SOLDER SIDE

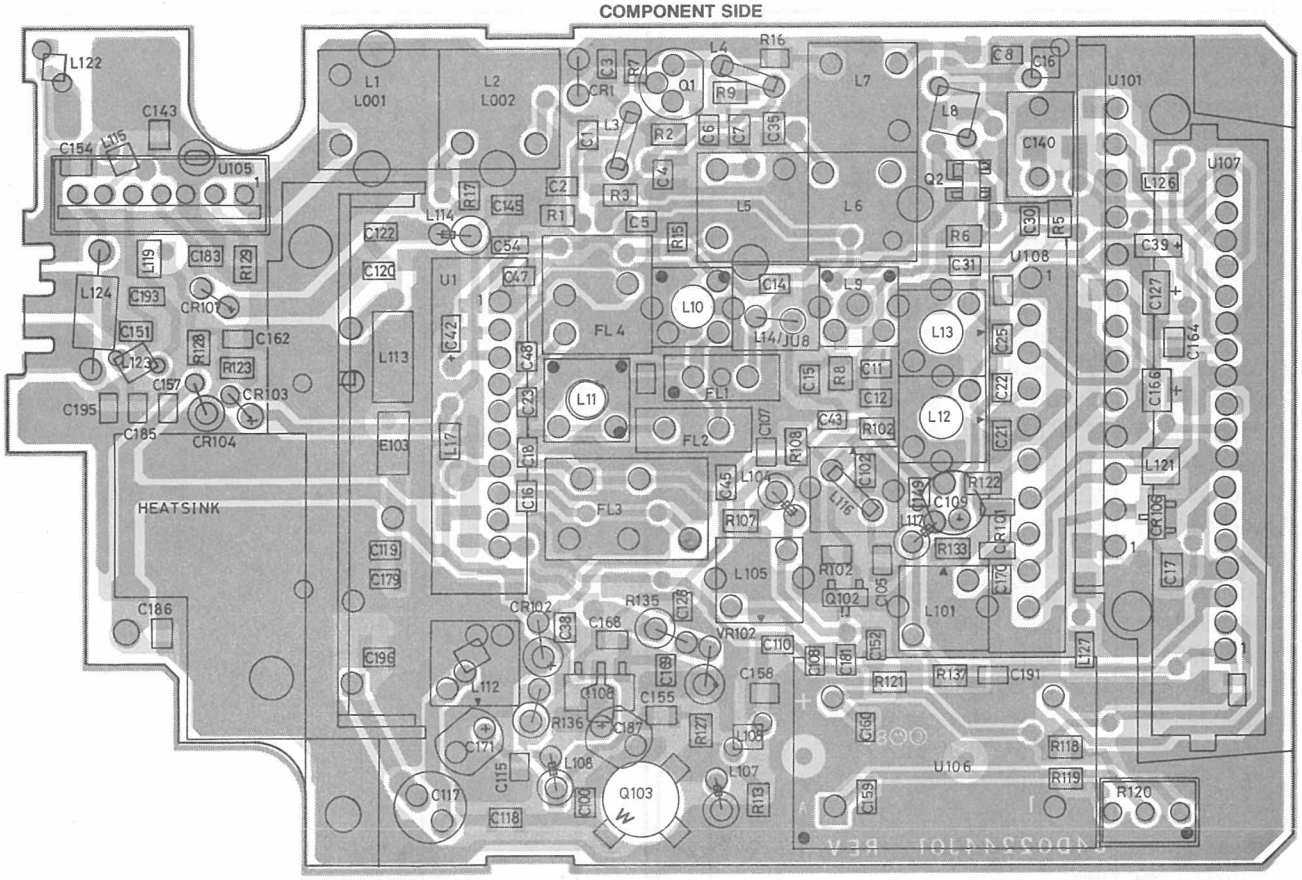


HTX/CP1000
UHF TRANSCEIVER BOARD 2 WATT
COMPONENT LAYOUT

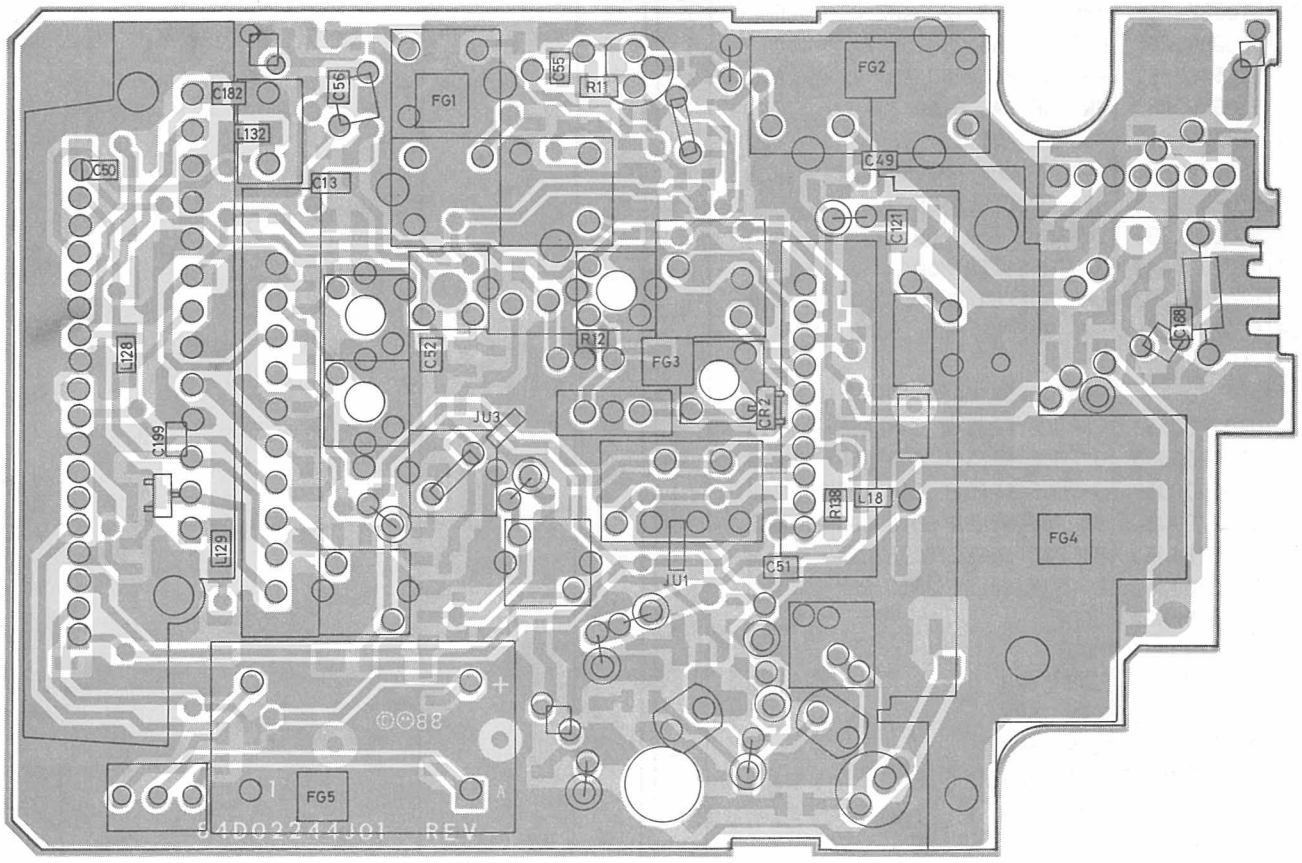
D405.497

DOC. ISSUE 09.28.89

COMPONENT SIDE



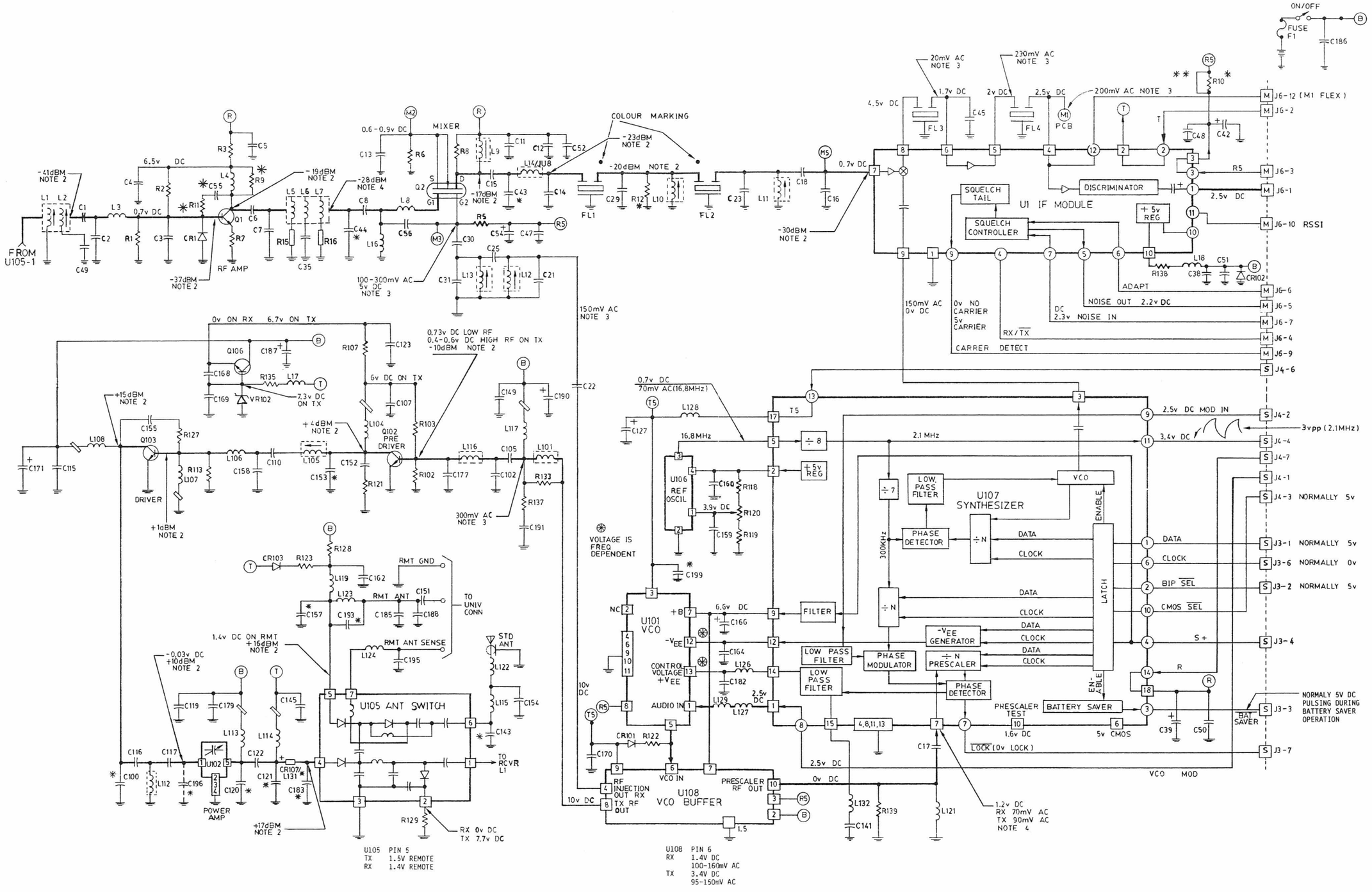
SOLDER SIDE



HTX/CP1000
UHF TRANSCEIVER BOARD 2 WATT
COMPONENT LAYOUT

D405.497

DOC. ISSUE 09.28.89



ITEM NO.	FREQUENCY	CHANNEL SPACING	OUTPUT POWER
EUE3101A	403 - 433MHz	12.5kHz	2 WATT
EUE3102A	403 - 433MHz	20/25kHz	2 WATT
EUE3105A	438 - 470MHz	12.5kHz	2 WATT
EUE3106A	438 - 470MHz	20/25kHz	2 WATT

CRYSTAL FILTER MARKING		
CHANNEL SPACING	FL1	FL2
12.5kHz	RED	YELLOW
20/25kHz	BLACK	BLUE

* USAGE DEPEND ON BANDSPIT OR MODEL

◯ SOCKET AT CONTROLLER FLEX

□ PINS AT MAIN CIRCUIT BOARD

L12 AND CORRESPONDING CAN IS ONLY USED IN 12.5kHz CHANNEL SPACING RADIOS. IN 20/25kHz RADIOS A JUMPER IS USED. (JU08)

HTX/CP1000
UHF TRANSCEIVER BOARD 2 WATT SCHEMATIC DIAGRAM

D405.498/2

DOC. ISSUE 03.09.90

PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 2 WATT

Pos	Code No.	Description		Qt
	EUE3101A	403 - 433 MHZ, 12.5KHZ (A)		
	EUE3102A	403 - 433 MHZ, 20/25KHZ (B)		
	EUE3105A	438 - 470 MHZ, 12.5KHZ (C)		
	EUE3106A	438 - 470 MHZ, 20/25KHZ (D)		
C1	2113740A23	CAP CHIP 6.2PF ±0.25PF	C,D	1
C1	2113740A29	CAP CHIP 10PF/C1	A	1
C1	2113740A33	CAP CHIP 15PF	B	1
C2	2113740A13	CAP CHIP 2.7PF ±0.25PF	C,D	1
C2	2113740A15	CAP CHIP 3.3PF ±2.5PF	B	1
C2	2113740A21	CAP CHIP 5.6PF ±2.5PF	A	1
C3	2113740A21	CAP CHIP 5.6PF ±2.5PF	B	1
C3	2113740A28	CAP CHIP 9.1PF ±2.5PF	C,D	1
C3	2113740A33	CAP CHIP 15PF	A	1
C4	2113740A53	CAP CHIP 82PF ±5%		1
C5	2113741A21	CAP CHIP 1000PF ±5%		1
C6	2113740A16	CAP CHIP 3.6PF ±0.25PF	A	1
C6	2113740A17	CAP CHIP 3.9PF ±0.25PF	C,D	1
C6	2113740A30	CAP CHIP 11PF ±5%	B	1
C7	2113740A17	CAP CHIP 3.9PF ±0.25PF	A	1
C7	2113740A23	CAP CHIP 6.2PF ±0.25PF	C,D	1
C7	2113740A27	CAP CHIP 8.2PF ±0.25PF	B	1
C8	2113740A53	CAP CHIP 82PF ±5%		1
C11	2113741A33	CAP CHIP 3300PF ±5%		1
C12	2113740A53	CAP CHIP 82PF ±5%		1
C13	2113741A45	CAP CHIP 10000PF ±5%		1
C14	2113740A17	CAP CHIP 3.9PF ±0.25PF	B,D	1
C14	2113740A29	CAP CHIP 10PF/C1	A,C	1
C15	2113740A32	CAP CHIP 13 PF ±5%	A	1
C15	2113741A21	CAP CHIP 1000PF ±5%	B,D	1
C16	2113740A31	CAP CHIP 12PF ±5%	A,B,D	1
C16	2113740A38	CAP CHIP 24PF ±5%	A,C	1
C17	2113740A40	CAP CHIP 30PF ±5%	C,D	1
C17	2113740A43	CAP CHIP 39PF ±5%	A,B	1
C18	2113740A35	CAP CHIP 18PF ±5%	B,D	1
C18	2113740A40	CAP CHIP 30PF ±5%	C	1
C21	2113740A28	CAP CHIP 9.1PF ±2.5PF	B	1
C21	2113740A32	CAP CHIP 13 PF ±5%	A	1
C22	2113740A03	CAP CHIP 1.0PF ±0.25PF	C,D	1
C22	2113740A10	CAP CHIP 2.0PF ±0.25PF	A,B	1
C23	2113740A17	CAP CHIP 3.9PF ±0.25PF	A	1
C25	2113740A09	CAP CHIP 1.8PF ±0.25PF	C,D	1
C25	2113740A14	CAP CHIP 3.0PF ±2.5PF	A,B	1
C29	2113740A17	CAP CHIP 3.9PF ±0.25PF	B,D	1
C29	2113740A24	CAP CHIP 6.8PF ±0.25PF	A,C	1
C30	2113741A21	CAP CHIP 1000PF ±5%		1
C31	2113740A19	CAP CHIP 4.7PF ±0.25PF	A,B	1
C31	2113740A28	CAP CHIP 9.1PF ±2.5PF	C,D	1
C35	2113740A25	CAP CHIP 7.5PF ±0.25PF	A,B	1
C35	2113740A40	CAP CHIP 30PF ±5%	C,D	1
C38	2113741A21	CAP CHIP 1000PF ±5%		1
C39	2360562A13	CAP TANT 1.0UF 16V		1
C42	2360562A16	CAP TANT 1.5UF 10V		1
C43	2113740A43	CAP CHIP 39PF ±5%	A	1
C47	2113741A33	CAP CHIP 3300PF ±5%		1
C48	2113740A53	CAP CHIP 82PF ±5%		1
C49	2113740A38	CAP CHIP 24PF ±5%	C,D	1
C50	2113741A21	CAP CHIP 1000PF ±5%		1
C51	2113741A21	CAP CHIP 1000PF ±5%		1

Pos	Code No.	Description		Qt
C52	2160521G37	CAP CHIP 100NF+80% -20%		1
C55	2113740A53	CAP CHIP 82PF ±5%	D	1
C56	2113740A03	CAP CHIP 1.0PF ±0.25PF	A	1
C56	2113740A11	CAP CHIP 2.2PF ±0.25PF	B	1
C100	2113740A09	CAP CHIP 1.8PF ±0.25PF	C,D	1
C102	2113740A33	CAP CHIP 15PF	A,B	1
C102	2113740A35	CAP CHIP 18PF ±5%	C,D	1
C105	2113740A53	CAP CHIP 82PF ±5%		1
C107	2113740A53	CAP CHIP 82PF ±5%		1
C110	2113740A18	CAP CHIP 4.3PF ±2.5PF	A,B	1
C110	2113740A42	CAP CHIP 36PF ±5%	C,D	1
C115	2113740A53	CAP CHIP 82PF ±5%		1
C116	2113740A29	CAP CHIP 10PF/C1	A,B	1
C116	2113740A42	CAP CHIP 36PF ±5%	C,D	1
C117	2105454G18	CAP CER 22PF±5% N150 63V	C,D	1
C117	2105454G38	CAP CER 33P 5% N150 63V	A,B	1
C119	2113740A53	CAP CHIP 82PF ±5%		1
C121	2113740A10	CAP CHIP 2.0PF ±0.25PF	A,B	1
C121	2113740A11	CAP CHIP 2.2PF ±0.25PF	C,D	1
C122	2113740A53	CAP CHIP 82PF ±5%		1
C123	2113740A53	CAP CHIP 82PF ±5%		1
C127	2360562A24	CAP TANT 3.3UF 16V		1
C140	0860101B37	CAP 0.47UF METALL. POLYES		1
C143	2113740A17	CAP CHIP 3.9PF ±0.25PF	A,B	1
C143	2113740A20	CAP CHIP 5.1PF ±2.5PF	D	1
C143	2113740A24	CAP CHIP 6.8PF ±0.25PF	C	1
C145	2113740A53	CAP CHIP 82PF ±5%		1
C149	2160521G37	CAP CHIP 100NF+80% -20%		1
C151	2113740A53	CAP CHIP 82PF ±5%	A,B,D	1
C152	2160521G37	CAP CHIP 100NF+80% -20%		1
C154	2113740A03	CAP CHIP 1.0PF ±0.25PF	C,D	1
C154	2113740A24	CAP CHIP 6.8PF ±0.25PF	A,B	1
C155	2160521G37	CAP CHIP 100NF+80% -20%		1
C157	2113740A20	CAP CHIP 5.1PF ±2.5PF	A,B	1
C157	2113740A21	CAP CHIP 5.6PF ±2.5PF	C,D	1
C158	2113740A17	CAP CHIP 3.9PF ±0.25PF		1
C158	2113740A29	CAP CHIP 10PF/C1	C,D	1
C162	2113740A53	CAP CHIP 82PF ±5%		1
C164	2113740A53	CAP CHIP 82PF ±5%		1
C166	2360562A24	CAP TANT 3.3UF 16V		1
C168	2113740A53	CAP CHIP 82PF ±5%	A,B,D	1
C169	2113740A53	CAP CHIP 82PF ±5%	C	1
C169	2160521G37	CAP CHIP 100NF+80% -20%	A,B,D	1
C170	2113740A53	CAP CHIP 82PF ±5%		1
C171	2305499G13	CAP SOL TANT 1UF 20 25V		1
C177	2113740A20	CAP CHIP 5.1PF ±2.5PF	A,B	1
C177	2113740A23	CAP CHIP 6.2PF ±0.25PF	C,D	1
C179	2160521G37	CAP CHIP 100NF+80% -20%		1
C182	2113741A37	CAP CHIP 4700PF ±5%		1
C183	0102700J45	CAP 6.8PF ASSY	A,B	1
C183	2113740A05	CAP CHIP 1.2PF ±2.5PF	C,D	1
C185	2113740A12	CAP CHIP 2.4PF ±0.25PF	C,D	1
C185	2113740A20	CAP CHIP 5.1PF ±2.5PF	A,B	1
C186	2113740A53	CAP CHIP 82PF ±5%		1
C187	2305499G19	CAP SOL TANT .1UF ±20%		1
C190	2305458G12	CAP TANT 33UF 16V	A	1
C190	2305499G13	CAP SOL TANT 1UF 20 25V	B,C,D	1
C191	2113740A53	CAP CHIP 82PF ±5%		1
C195	2113740A53	CAP CHIP 82PF ±5%		1

PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 2 WATT

Pos	Code No.	Description		Qt
C199	2113740A44	CAP CHIP 43PF ±5%	A,B	1
C199	2113740A50	CAP CHIP 62PF ±5%	C,D	1
CR				
1	4883654H08	DIODE SLCN		1
101	4805494Q04	DIODE CHIP SILICON		1
102	4805490G02	DIODE RECT SIL		1
103	4883654H01	DIODE SILICONE		1
107	4880010E05	DIODE PIN RF	C,D	1
FG1	3905509R02	CONTACT		1
FG2	3905509R02	CONTACT		1
FG3	3905509R02	CONTACT		1
FG4	3905509R02	CONTACT		1
FG5	3905509R02	CONTACT		1
FL1	4805245J19	X'TAL FILTER	A,C	1
FL1	4805245J20	XTAL FILTER 53.55-13.5B	B,D	1
FL2	4805245J19	X'TAL FILTER	A,C	1
FL2	4805245J20	XTAL FILTER 53.55-13.5B	B,D	1
FL3	9105725Q03	CER FILTER CFW450F	A,C	1
FL3	9105685Q12	CERAMIC FILTER SFG450EN	B,D	1
FL4	9105726Q03	CER FILTER CFW450F	A,C	1
FL4	9105685Q11	CERAMIC FILTER SFG450DN	B,D	1
JU1	4205495C04	STRAP CROSSOVER	C	1
JU1	4205495C07	STRAP CROSSOVER	A,B,D	1
JU3	4205495C07	STRAP CROSSOVER	A,B	1
JU6	3005889C01	WIRE FLAT		1
JU7	3005889C01	WIRE FLAT		1
L1	0105957M23	COIL 2P PRESEL ASSY	C,D	1
L2	0105951P30	COIL 2P PRESEL	A,B	1
L2	0105957M23	COIL 2P PRESEL ASSY	C,D	1
L3	2405559P03	COIL 1 1/2T AIR WOUND	A	1
L3	2405559P09	COIL 1 1/2T AIR WOUND	B	1
L3	2484238H02	COIL FIN 1 1/2T FIXED	C,D	1
L4	2405559P03	COIL 1 1/2T AIR WOUND	A,B	1
L4	2484238H02	COIL FIN 1 1/2T FIXED	C,D	1
L5	2405732J21	COIL PRESEL TURN 10.75	C,D	1
L5	2405732J22	COIL 11.75T 3P PRESEL	A,B	1
L6	2405732J10	COIL 3P PRESEL 12 TURNS	A,B	1
L6	2405732J01	COIL PRESEL. 11 TURN	C,D	1
L7	2405732J22	COIL 11.75T 3P PRESEL	A,B	1
L7	2405732J01	COIL PRESEL. 11 TURN	C,D	1
L8	2405559P22	COIL 4.5T AIR WOUND	A	1
L8	2405027E19	COIL RF FIN	C	1
L8	2405559P13	COIL AIR WOUND 5.5T	B,D	1
L9	2405063H24	COIL MINIATURE	A,C	1
L9	2405063H35	COIL 0.6 ±16 TUNABLE	B,D	1
L10	2405063H13	COIL 1.2UH ±16% TUNABL		1
L11	2405063H05	COIL 0.4 ±16% TUNABLE	A,C	1
L11	2405063H09	COIL 0.6UH ±16 TUNABLE	B,D	1
L12	2405523P35	COIL 5MM	A,B	1
L12	2405523P36	COIL 2 1/2T SPACE 5MM	C,D	1
L13	2405523P35	COIL 5MM	A,B	1
L13	2405523P36	COIL 2 1/2T SPACE 5MM	C,D	1
L14	1000000519	JUMPER WIRE	B,D	1
L14	2505129Q02	CHOKE 1.2 UH PRECISION	A,C	1
L16	2405027E19	COIL RF FIN	B,C,D	1
L16	2405559P18	COIL 3 1/2T AIR WOUND	A	1
L17	2462575A01	CHOKE 0.39UH		1
L18	2462575A01	CHOKE 0.39UH		1
L101	2405523P07	COIL 2 1/2T SPACE, 5MM	C,D	1

Pos	Code No.	Description		Qt
L101	2405559P07	COIL 2 1/2T AIR WOUND	A,B	1
L104	0105951N35	CHOKE & BEAD (0.085UH)		1
L105	2405523P08	COIL 3 1/2T SPACE - 5MM		1
L106	2405027E38	COIL FIN 3 1/2T FIXED	C,D	1
L106	2405559P19	COIL 4 1/2T AIR WOUND	A,B	1
L107	0105950L78	1.2UH RF CHOKE & BEAD	A,B	1
L107	0105951N35	CHOKE & BEAD (0.085UH)	C	1
L108	0105951N34	RF CHK & BD (0.29UH)	C	1
L108	0105951N35	CHOKE & BEAD (0.085UH)	A,B,D	1
L112	2405027E38	COIL FIN 3 1/2T FIXED	C,D	1
L112	2405523P08	COIL 3 1/2T SPACE - 5MM	A,B	1
L113	0105955N19	0.2UH RF CHK & BD ASSY		1
L114	0105951N34	RF CHK & BD AS (0.29UH)		1
L115	2405559P19	COIL 4 1/2T AIR WOUND		1
L116	2484238H02	COIL FIN 1 1/2T FIXED		1
L117	0105951N34	RF CHK & BD AS (0.29UH)		1
L119	2405452C08	COIL ELEC CHIP 275		1
L121	2405452C06	COIL 21NH		1
L122	2405559P18	COIL 3 1/2T AIR WOUND		1
L123	2405027E38	COIL FIN 3 1/2T FIXED		1
L124	2482723H28	COIL RF .29 UH YEL		1
L126	2462575A01	CHOKE 0.39UH		1
L127	2462575A01	CHOKE 0.39UH		1
L128	2462575A01	CHOKE 0.39UH		1
L129	0105957P25	0.29UH/HEAT SHRINK		1
L131	2405559P18	COIL 3 1/2T AIR WOUND	A,B	1
L132	2462575A01	CHOKE 0.39UH		1
Q1	4880182D39	TSTR M8239 SMALL SIG		1
Q2	4805452G13	TSTR BF990 MOSFET		1
Q102	4805128M84	TSTR MMBR 920		1
Q103	4805474G48	TSTR MRF837		1
Q106	4805128M09	TSTR BCX 54-16 (RH)		1
R1	0660076A69	RES CHIP 6800 5% 1/10W	C,D	1
R1	0660076A71	RES CHIP 8200 ±5% 1/10W	A,B	1
R2	0660076A89	RES CHIP 47K 5% 1/10W		1
R3	0660076A57	RES CHIP 2200 5% 1/8W	C,D	1
R3	0660076A59	RES CHIP 2700 5% 1/10W	A,B	1
R5	0660076A32	RES CHIP 200 5% 1/10W	B	1
R5	0660076A45	RES CHIP 680 5% 1/10W	A,C,D	1
R6	0660076A35	RES CHIP 270 5% 1/10W	A	1
R6	0660076A37	RES CHIP 330 5% 1/10W	B,D	1
R6	0660076A39	RES CHIP 390 ±5% 0.1W	C	1
R7	0660076A03	RES CHIP 12 5% 1/8W	A,B	1
R7	0660076M01	RES CHIP 0 OHM 2012	A,C,D	1
R8	0660076A54	RES CHIP 1600 5% 1/8W	A,C	1
R8	0660076A61	RES CHIP 3.3K ±5% 0.1W	B,D	1
R9	0660076A56	RES CHIP 2000 5% 1/10W	A,B	1
R9	0660076A57	RES CHIP 2200 5% 1/8W	C,D	1
R11	0660076A49	RES CHIP 1000 5% 1/10W	D	1
R12	0660076A85	RES CHIP 33K 5% 1/10W	A,C	1
R15	0660076M01	RES CHIP 0 OHM 2012		1
R16	0660076M01	RES CHIP 0 OHM 2012		1
R17	0660076M01	RES CHIP 0 OHM 2012		1
R102	0660076A46	RES CHIP 750 5% 1/10W		1
R103	0660076A64	RES CHIP 4300 5% 1/10W	C,D	1
R103	0660076A65	RES CHIP 4700 ±5% 1/10W	A,B	1
R107	0660076A17	RES CHIP 47 5% 1/10W		1
R113	0660076A22	RES CHIP 75 5% 1/10W	A,B	1
R113	0660076A25	RES CHIP 100 5% 1/10W	C,D	1

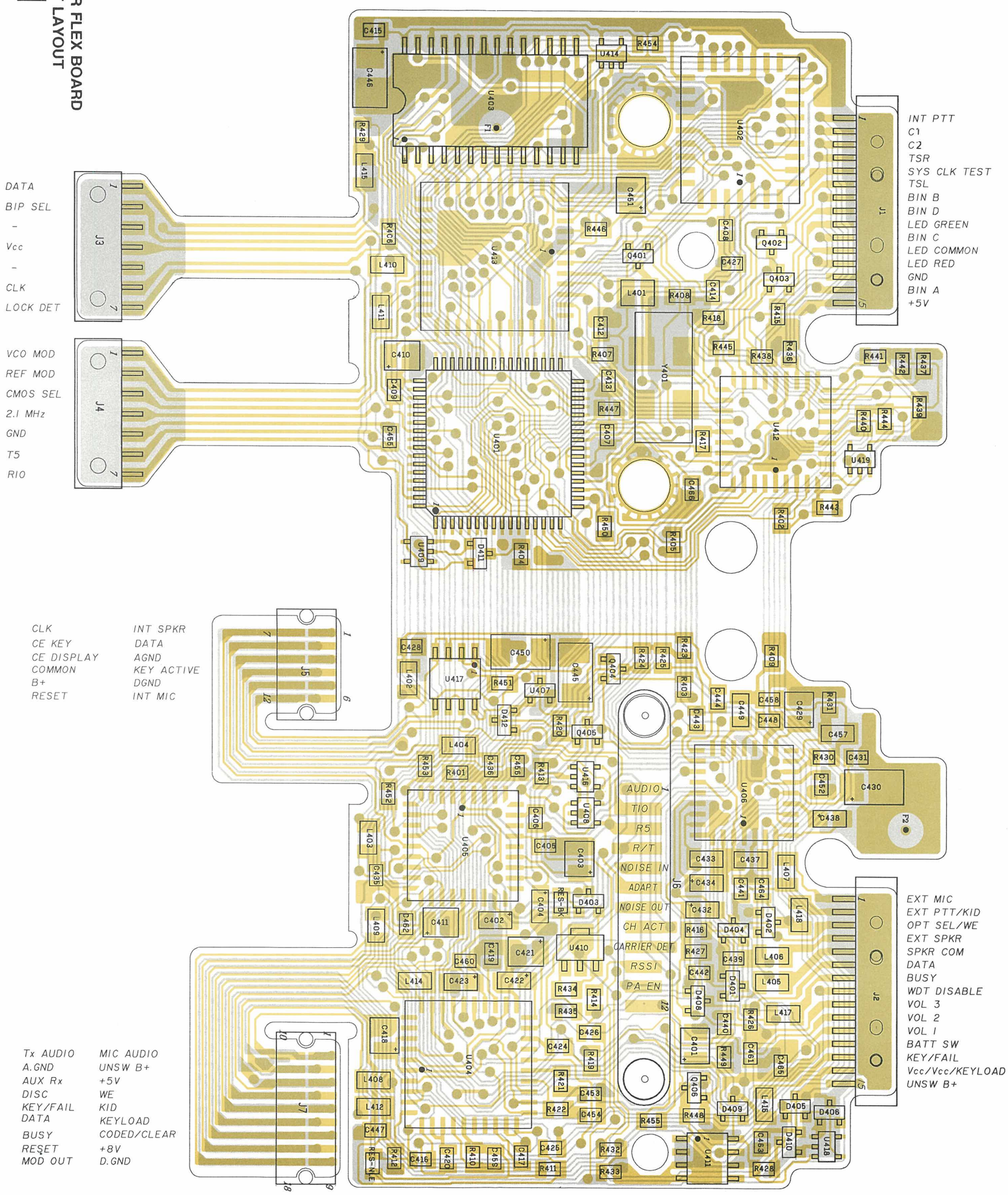
PARTS LIST FOR HTX/CP1000, UHF TRANSCEIVER BOARD, 2 WATT

Pos	Code No.	Description		Qt
R113	0660079A25	RES CHIP 100 5% 1/10W	C	1
R118	0660076A72	RES CHIP 9.1K 5% 1/10W		1
R119	0660076A87	RES CHIP 39K 5% 1/10W		1
R120	1805559S02	RES POT 50K MULTITURNS		1
R121	0660076A42	RES CHIP 510 ±5% 1/10W	C,D	1
R121	0660076A49	RES CHIP 1000 5% 1/10W	A,B	1
R122	0660076A67	RES CHIP 5600 5% 1/10W	C,D	1
R122	0660076A79	RES CHIP 18K 5% 1/10W	A,B	1
R123	0660076A48	RES CHIP 910 5% 1/10W	A,B	1
R123	0660076A49	RES CHIP 1000 5% 1/10W	C,D	1
R127	0660076A41	RES CHIP 470 5% 1/10W		1
R128	0660076A51	RES CHIP 1.2K 5% 1/10W	C,D	1
R128	0660076A52	RES CHIP 1.3K 5% 1/10W	A,B	1
R129	0660076A42	RES CHIP 510 ±5% 1/10W		1
R133	0660076A45	RES CHIP 680 5% 1/10W		1
R135	0660075C45	RES CAR.FILM 680 5% 1/8W		1
R137	0660076A18	RES CHIP 51 5% 1/10W		1
R138	0660076A15	RES CHIP 39 5% 1/10W		1
R139	0660076A49	RES CHIP 1000 5% 1/10W	C,D	1
R139	0660076A51	RES CHIP 1.2K 5% 1/10W	A,B	1
R142	0660076A18	RES CHIP 51 5% 1/10W	A	1
U1	5102001J41	MOD IF UHF 20/25KHZ	B,D	1
U1	5102001J55	MOD IF UHF 12.5 KHZ	A,C	1
U101	5102001J59	UHF VCO B1	A,B	1
U101	5102001J60	UHF VCO B3 12.5KHZ	C	1
U101	5102001J62	UHF VCO B3 20/25KHZ	D	1
U102	5105729E79	2W UHF PA (BAND 1)	A,B	1
U102	5105729E80	2W UHF PA (BAND 3)	C,D	1
U105	5105822P63	4-PORT UHF ANT. SWITCH	C,D	1
U105	5105822P85	4-PORT UHF ANT. SWITCH	A,B	1
U106	5105729E72	REF. OSCILLATOR		1
U107	5102001J39	SYNTHESIZER MOD		1
U108	5102001J02	UHF BUFFER MOD (BAND 3)	C,D	1
U108	5102001J05	UHF BUFFER MOD (BAND 1)	A,B	1
VR 102	4805189E05	DIODE ZENER 7.5V ±2% 50		1
		NON REFERENCED ITEMS:		
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102704J66	B1 PRE-SELECTOR COIL CAN	A,B	1
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102704J66	B1 PRE-SELECTOR COIL CAN	A,B	1
	0102700J33	3 POLE PRESEL CAN ASSY	C,D	1
	0102704J66	B1 PRE-SELECTOR COIL CAN	A,B	1
	7505295B07	PAD		2
	7505295B07	PAD		2
	0705196A04	BOOT		1
	0705196A04	BOOT		1
	7505695R01	PAD OSCILLATOR		1
	8402244J01	PCB UHF LO PWR		1
	0300136771	SCREW 2-56 X 3/16		4
	0300136771	SCREW 2-56 X 3/16		4
	2605524P01	CAN 5MM	A,B	1
	2605524P01	CAN 5MM	C,D	1
	2605524P01	CAN 5MM	A	2
	2605524P01	CAN 5MM	A,C	1

Pos	Code No.	Description	Qt

HTX/CP1000
CONTROLLER FLEX BOARD
COMPONENT LAYOUT

D405.503/3



DOC.ISSUE.08.24.90

HX/CP1000
CONTROLLER FLEX BOARD
D405.504/3

ETN2305A
DOC. ISSUE 08.25.90

PARTS LIST FOR CONTROLLER FLEX BOARD ETN2305A

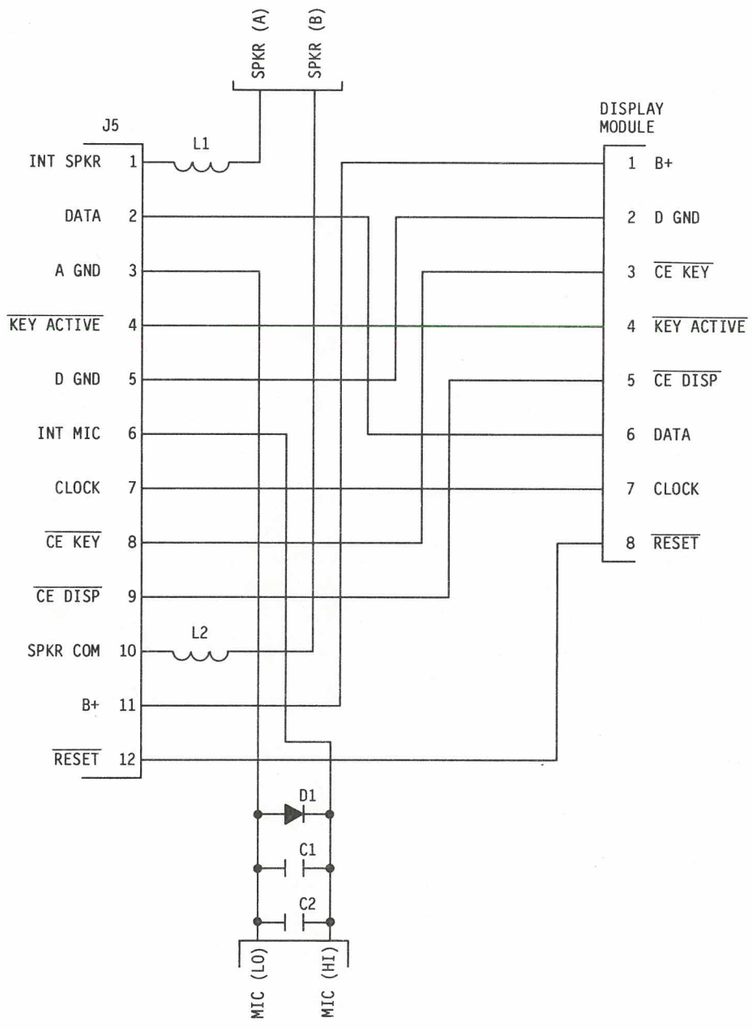
Pos	Code No.	Description	Qt
C401	2311049J12	TANT CAP 4.7U 16V	1
C402	2311049A37	TANT CAP 1.0UF 16V	1
C403	2311049J07	CAP 3.3UF	1
C404	2311049A35	0.47 UF 25V TANT CAP	1
C405	2160521G37	CHIP CAP 100NF +80% -20%	1
C406	2160521G37	CHIP CAP 100NF +80% -20%	1
C407	2160521G37	CHIP CAP 100NF +80% -20%	1
C408	2160521G37	CHIP CAP 100NF +80% -20%	1
C409	2160521G37	CHIP CAP 100NF +80% -20%	1
C410	2311049J12	TANT CAP 4.7U 16V	1
C411	2311049J12	TANT CAP 4.7U 16V	1
C412	2113740A29	CHIP CAP 10PF ±5% NP0	1
C413	2113740A31	CHIP CAP 12PF ±5% NP0	1
C414	2113741A45	CHIP CAP 10N	1
C415	2160521G37	CHIP CAP 100NF +80% -20%	1
C416	2160521G37	CHIP CAP 100NF +80% -20%	1
C417	2160521G37	CHIP CAP 100NF +80% -20%	1
C418	2311049J12	TANT CAP 4.7U 16V	1
C419	2160521G37	CHIP CAP 100NF +80% -20%	1
C420	2160521G37	CHIP CAP 100NF +80% -20%	1
C421	2311049J04	TANT CAP 2.2U 20V	1
C422	2311049A35	0.47 UF 25V TANT CAP	1
C423	2311049A37	TANT CAP 1.0UF 16V	1
C424	2160521G37	CHIP CAP 100NF +80% -20%	1
C425	2113741A33	CHIP CAP 3.3N ±10%	1
C426	2113741A53	CHIP CAP 22N	1
C427	2160521G37	CHIP CAP 100NF +80% -20%	1
C428	2113740A59	CHIP CAPACITORS 150PF ±5%	1
C429	2311049J12	TANT CAP 4.7U 16V	1
C430	2311049J26	TANT CAP 10UF 16V	1
C431	2113741A45	CHIP CAP 10N	1
C432	2360562A13	TANT CAP 1.0UF 25V	1
C433	2160521H43	CHIP CAP 330NF +80%-20%	1
C434	2311049A37	TANT CAP 1.0UF 25V	1
C435	2113740A59	CHIP CAP 150PF	1
C436	2113740A59	CHIP CAP 150PF	1
C437	2160521H43	CHIP CAP 330NF +80%-20%	1
C438	2311049A37	TANT CAP 1.0UF 25V	1
C439	2113740A59	CHIP CAP 150PF	1
C440	2113741A45	CHIP CAP 10N	1
C441	2113740A59	CHIP CAP 150PF	1
C442	2113740A59	CHIP CAP 150PF	1
C443	2160521G37	CHIP CAP 100NF +80% -20%	1
C444	2160521G37	CHIP CAP 100NF +80% -20%	1
C445	2311049J26	TANT CAP 10UF 16V	1
C446	2311049J38	TANT CAP 33UF 7V	1
C447	2113740A59	CHIP CAP 150PF	1
C448	2113741A37	CHIP CAP 4.7N	1
C449	2113741B61	CHIP CAP 47NF	1
C450	2311049J26	TANT CAP 10U 16V	1
C451	2311049J12	TANT CAP 4.7U 16V	1
C452	2113741A45	CHIP CAP 10N	1
C453	2113741A39	CHIP CAP 5.6N	1
C454	2113741A31	CHIP CAPS 2.7N	1
C455	2113741A21	CHIP CAP 1N	1
C456	2113741A21	CHIP CAP 1N	1
C457	2113741B61	CHIP CAP 47N ±5	1
C458	2113741A53	CHIP CAP 22N ±5	1
C459	2113741A05	CHIP CAP 220PF ±5%	1

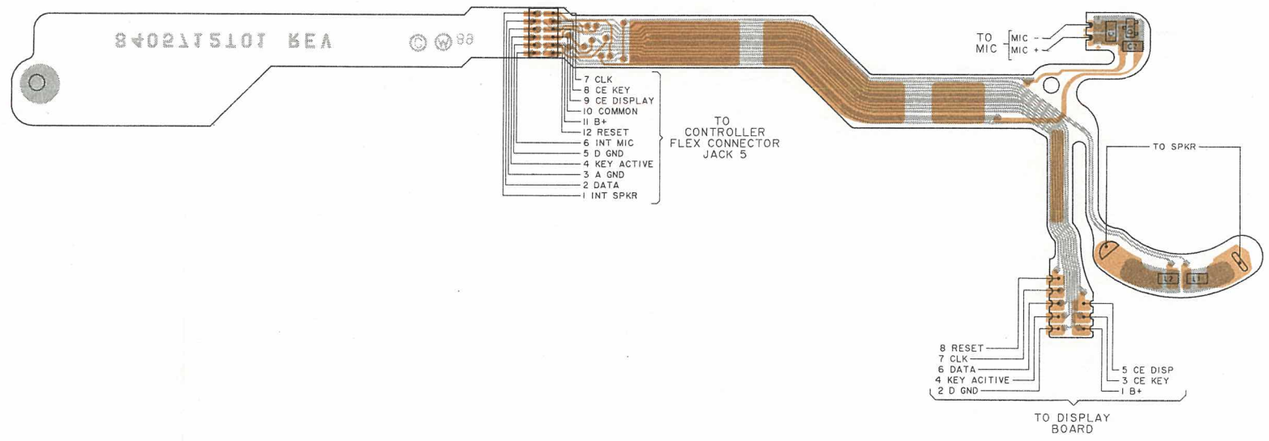
Pos	Code No.	Description	Qt
C460	2113740A59	CHIP CAP 150P	1
C461	2113740A59	CHIP CAP 150P	1
C462	2113740A59	CHIP CAP 150P	1
C463	2113740A59	CHIP CAP 150P	1
C464	2113740A59	CHIP CAP 150P	1
C465	2160521G37	CHIP CAP 0.1U +80%, -20%	1
C466	2160521C25	CHIP CAP 10N	1
D401	4880140L09	ZENER DIODE 6.2V	1
D402	4880140L09	ZENER DIODE 6.2V	1
D403	4805129M12	DIODE MMBD6100	1
D404	4880140L09	ZENER DIODE 6.2V	1
D405	4805129M12	DIODE MMBD6100	1
D406	4805140L20	ZENER DIODE 15V	1
D408	4880140L09	ZENER DIODE 6.2V	1
D409	4880140L09	ZENER DIODE 6.2V	1
D410	4880236E08	DIODE SMBD1014LT1	1
D411	4880236E08	DIODE SMBD1014LT1	1
D412	4880236E08	DIODE SMBD1014LT1	1
J1	0905467R01	CONNECTOR 15 - PIN	1
J2	0905467R01	CONNECTOR 15 - PIN	1
J3	0905577P01	CONNECTOR 7 - PIN	1
J4	0905577P01	CONNECTOR 7 - PIN	1
J5	2805878S03	CONNECTOR 12 - PIN	1
J6	0105959M27	CONNECTOR 12 - PIN	1
J7	2805878S04	CONNECTOR 18 - PIN	1
L401	2462585A40	CHOKE 33UH	1
L402	2462575A01	CHOKE 0.39UH	1
L403	2462575A01	CHOKE 0.39UH	1
L404	2462575A01	CHOKE 0.39UH	1
L405	2462575A01	CHOKE 0.39UH	1
L406	2462575A01	CHOKE 0.39UH	1
L407	2462575A01	CHOKE 0.39UH	1
L408	2462575A01	CHOKE 0.39UH	1
L409	2462575A01	CHOKE 0.39UH	1
L410	2462575A01	CHOKE 0.39UH	1
L411	2462575A01	CHOKE 0.39UH	1
L412	2462575A01	CHOKE 0.39UH	1
L413	2462575A01	CHOKE 0.39UH	1
L414	2462575A01	CHOKE 0.39UH	1
L415	2462575A01	CHOKE 0.39UH	1
L416	2462575A01	CHOKE 0.39UH	1
L417	2462575A01	CHOKE 0.39UH	1
L418	2462575A01	CHOKE 0.39UH	1
Q401	4805218N03	TSTR MMBR901	1
Q402	4805128M12	TSTR BCW60B	1
Q403	4805128M12	TSTR BCW60B	1
Q404	4805128M94	TSTR BCW61B	1
Q405	4805128M94	TSTR BCW61B	1
Q406	4805128M12	TSTR BCW60B	1
R401	0660078J80	RES CHIP 49.9K 1%	1
R402	0660076A73	RES CHIP 10K	1
R403	0660076A43	RES CHIP 560	1
R404	0660076A35	RES CHIP 279	1
R405	0660078J80	RES CHIP 49.9K 1%	1
R406	0660076A65	RES CHIP 4.7K	1
R407	0660076B25	RES CHIP 1M	1
R408	0660076A65	RES CHIP 4.7K	1
R409	0660076E77	RES CHIP 15K 1%	1
R410	0660076E89	RES CHIP 47K	1

PARTS LIST FOR CONTROLLER FLEX BOARD ETN2305A

Pos	Code No.	Description	Qt
R411	0660076A61	CHIP RES 3.3K	1
R412	0660078J80	RES CHIP 49.9K 1%	1
R413	0660076A95	RES CHIP 82K	1
R414	0660076B01	RES CHIP 100K	1
R415	0660076A27	RES CHIP 120	1
R416	0660076E80	RES CHIP 20K 1%	1
R417	0660076A73	RES CHIP 10K	1
R418	0660076A59	RES CHIP 2.7K	1
R419	0660076A49	RES CHIP 1K	1
R420	0660076A65	RES CHIP 4.7K	1
R421	0660076A49	RES CHIP 1K	1
R422	0660076A49	RES CHIP 1K	1
R423	0660076A56	RES CHIP 2K	1
R424	0660076A25	RES CHIP 100	1
R425	0660076A56	RES CHIP 2K	1
R426	0660076A73	RES CHIP 10K	1
R427	0660076A73	RES CHIP 10K	1
R428	0660076A49	RES CHIP 1K	1
R429	0660076A65	RES CHIP 4.7K	1
R430	0660076E65	RES CHIP 4.7K 1%	1
R431	0660076E94	RES CHIP 75K 1%	1
R432	0660076E91	RES CHIP 56K 1%	1
R433	0660076E75	RES CHIP 12K 1%	1
R434	0660076E95	RES CHIP 82K 1%	1
R435	0660076E71	RES CHIP 8.2K 1%	1
R436	0660076B01	RES CHIP 100K	1
R437	0660076B01	RES CHIP 100K	1
R438	0660076B01	RES CHIP 100K	1
R439	0660076B01	RES CHIP 100K	1
R440	0660076B01	RES CHIP 100K	1
R441	0660076B01	RES CHIP 100K	1
R442	0660076B01	RES CHIP 100K	1
R443	0660076B01	RES CHIP 100K	1
R444	0660076B01	RES CHIP 100K	1
R445	0660076B01	RES CHIP 100K	1
R446	0660076A73	RES CHIP 10K	1
R447	0660076B01	RES CHIP 100K	1
R448	0660076E57	RES CHIP 2.2K 1%	1
R449	0660076E75	RES CHIP 12K 1%	1
R450	0660076B01	RES CHIP 100K	1
R451	0660076A15	RES CHIP 39	1
R452	0660076A49	RES CHIP 1K	1
R453	0660076A49	RES CHIP 1K	1
R454	0660076A15	RES CHIP 39	1
R455	0660076E95	RES CHIP 82K 1%	1
U401	5105431L48	UP 68HC11A8	1
U402	5105462G48	EEFLASH PROM 64B	1
U403	5105469E92	RAM 8Kb	1
U404	5105165R77	AUDIO FILTER	1
U405	5105226P68	SIGNALLING FILTER	1
U406	5105165R65	AUDIO PA	1
U407	4805218N48	DTC114	1
U408	4802233J05	FMA2	1
U409	4805921T02	FMC2	1
U410	5160880B01	5V REG	1
U411	5105469E65	IC REG	1
U412	5105414S42	ODIE GATE ARRAY	1
U413	5105414S43	SNIF GATE ARRAY	1
U414	5105461G61	TC7SOOF	1

Pos	Code No.	Description	Qt
U416	4805921T03	FMG2	1
U417	5105469E65	IC REG	1
U418	4805921T02	FMC2	1
U419	4805921T04	FMC1	1
Y401	4802297J03	SMD OSC 7.3728MHZ	1
		NON REFERENCED ITEMS:	
	2602421J01	CENTRE SHIELD	1
	6402206J01	CONTROLLER FLEX	1
	1405889T01	INSULATOR, CONTROLLER	1
	1505718T01	HOUSING, CONTROLLER	1
	2605716T01	SHIELD, CONTROLLER	1

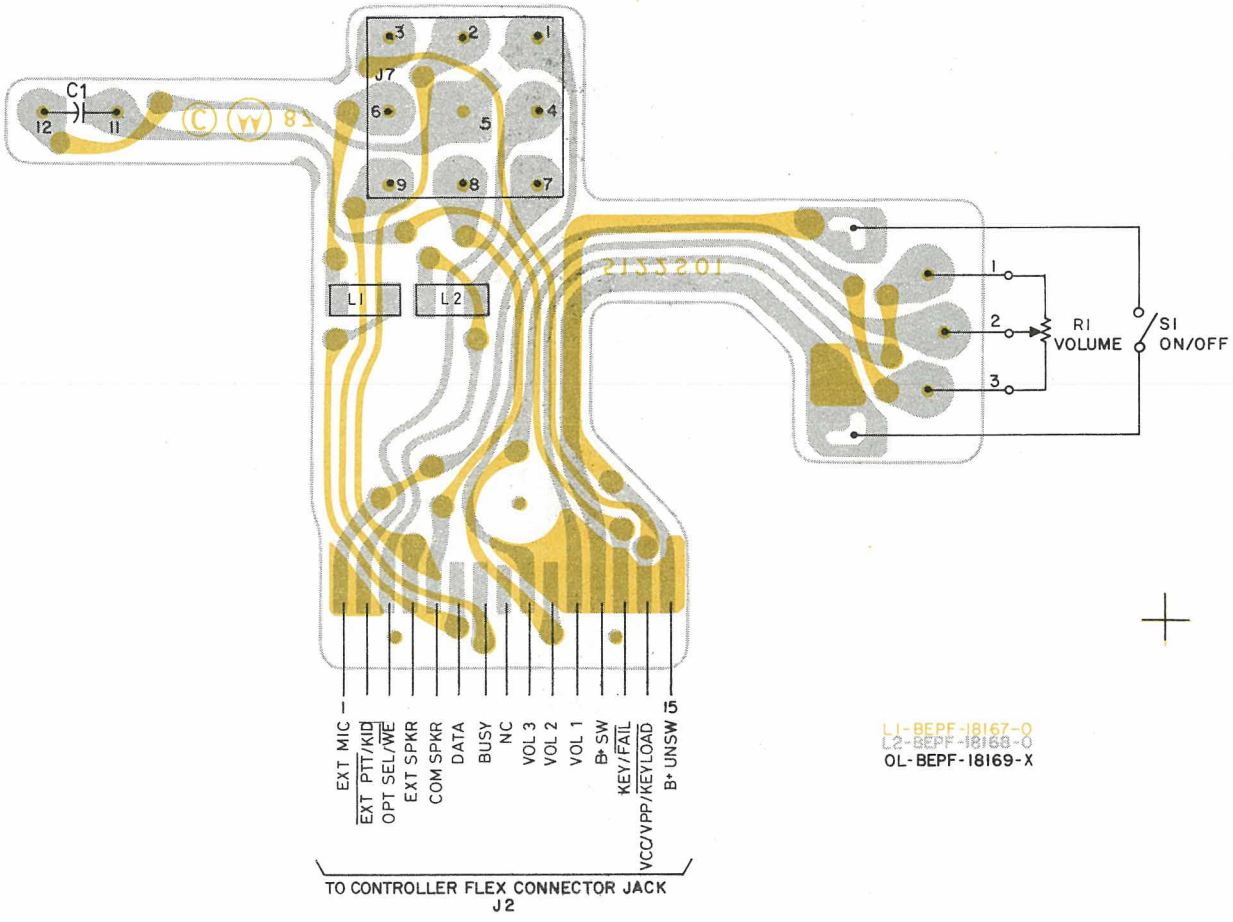


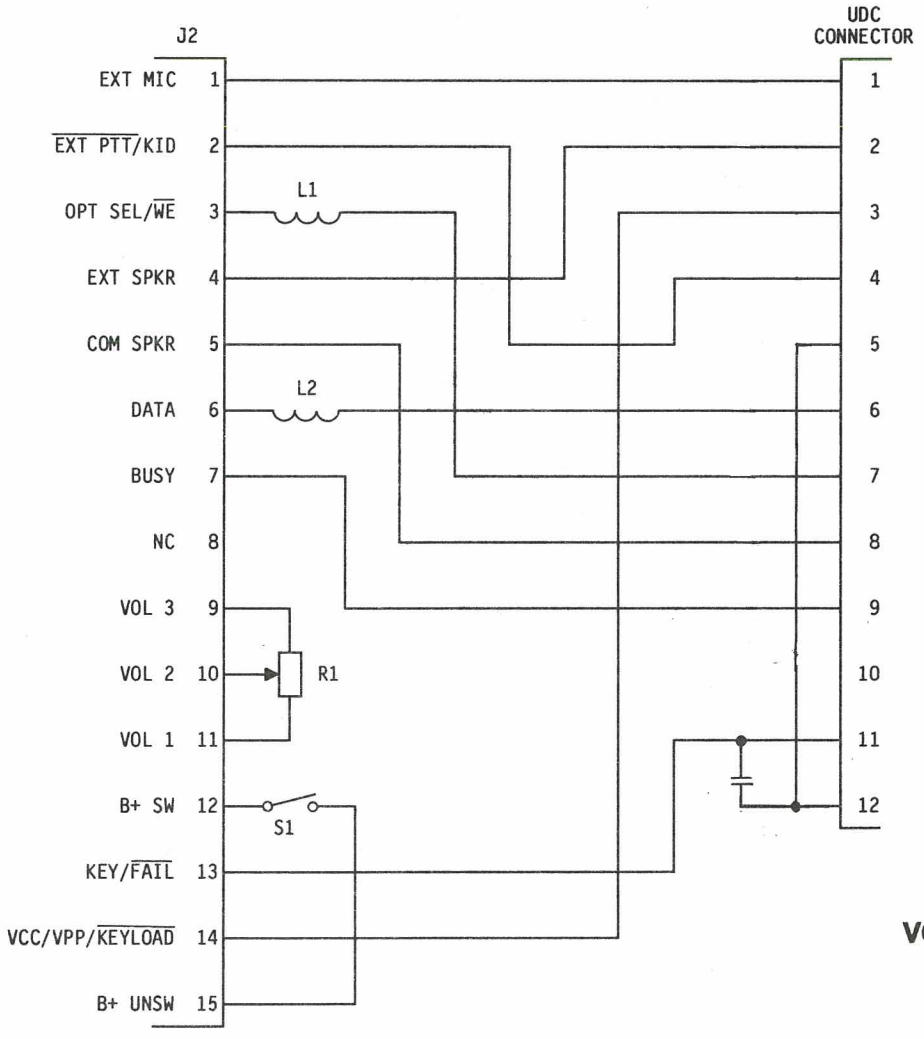


DOC. ISSUE 10.05.89

SPEAKER MIC. FLEX

D405.508





VOL. POT FLEX

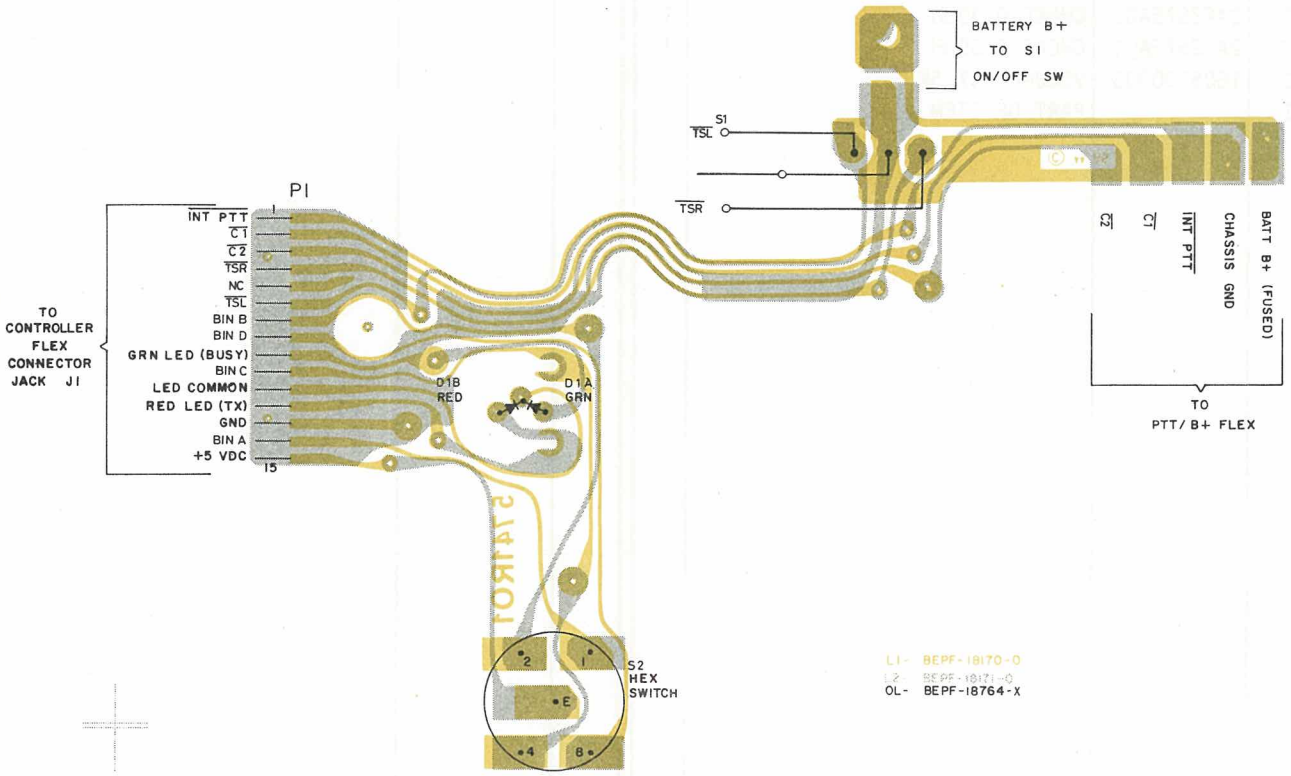
D405.506/2

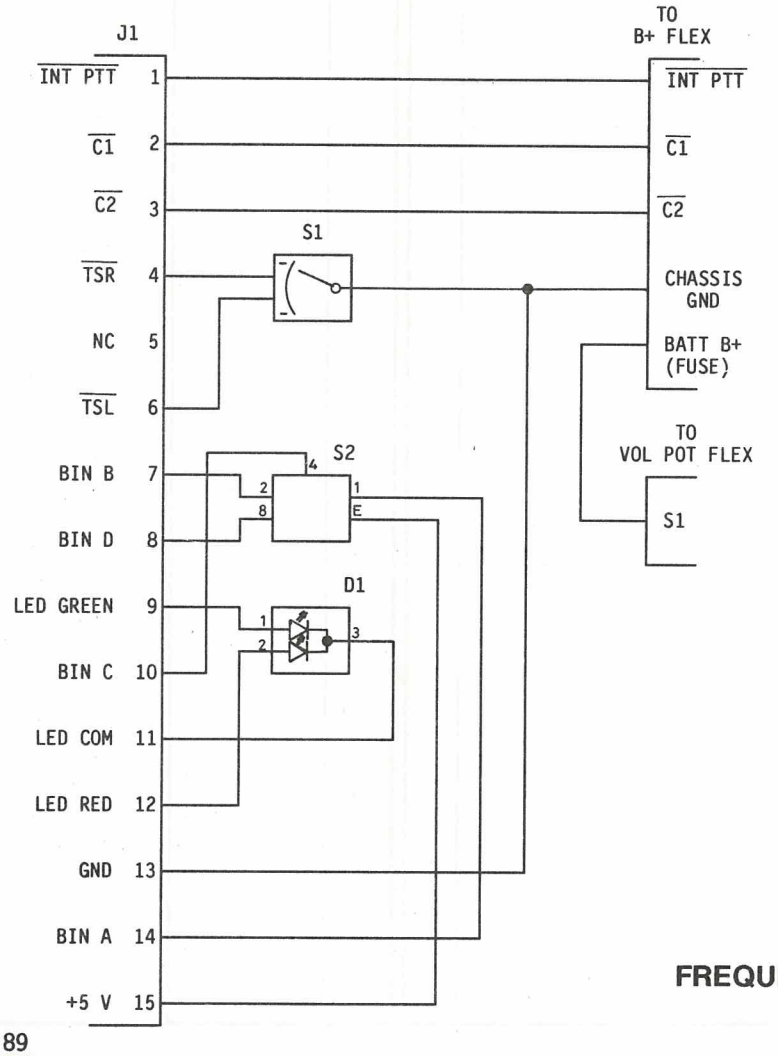
DOC. ISSUE 03.15.90

PARTS LIST FOR HTX/CP1000, VOLUME POT FLEX

Pos	Code No.	Description	Qt
C1	2105454G38	CAP CER 33P 5% N150 63V	1
L1	2462575A01	CHOKE 0.39UH	1
L2	2462575A01	CHOKE 0.39UH	1
R1	1805100Q03	VOLUME POT 5K	1
S1		PART OF ITEM R1	

Pos	Code No.	Description	Qt

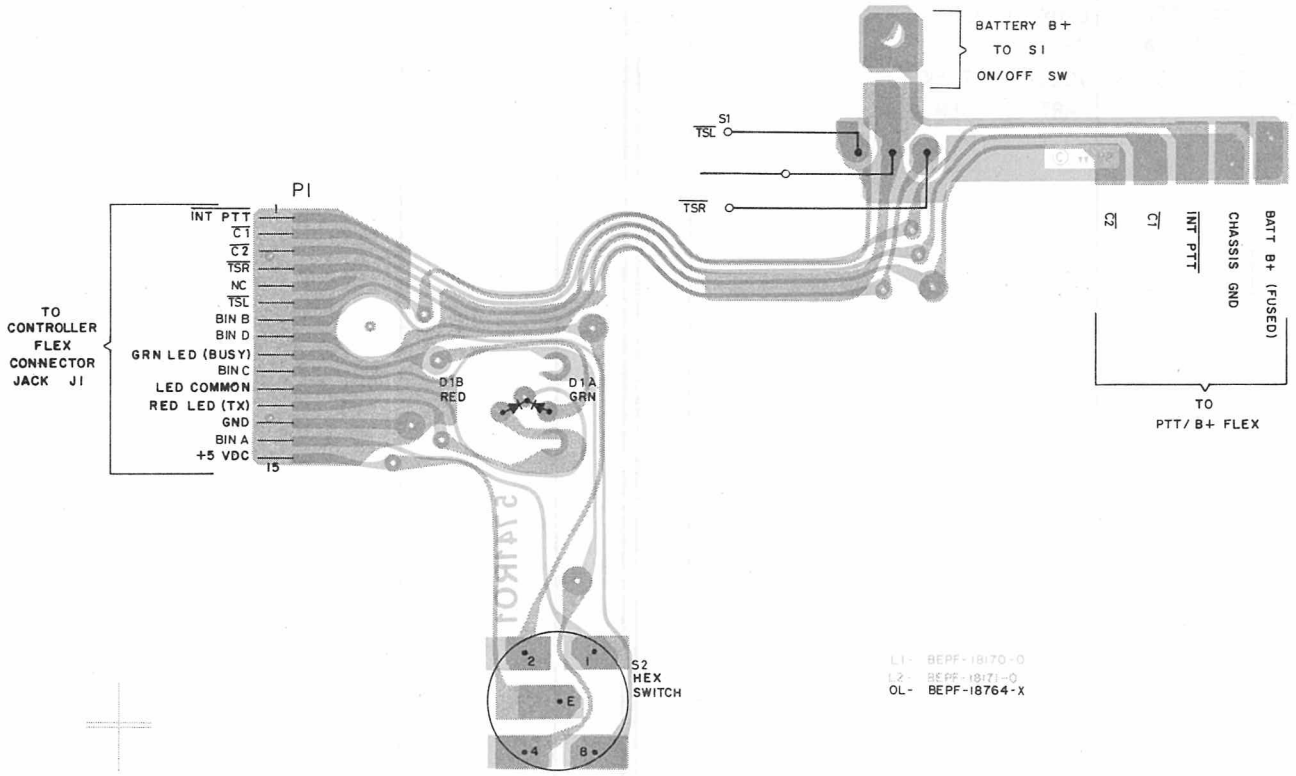


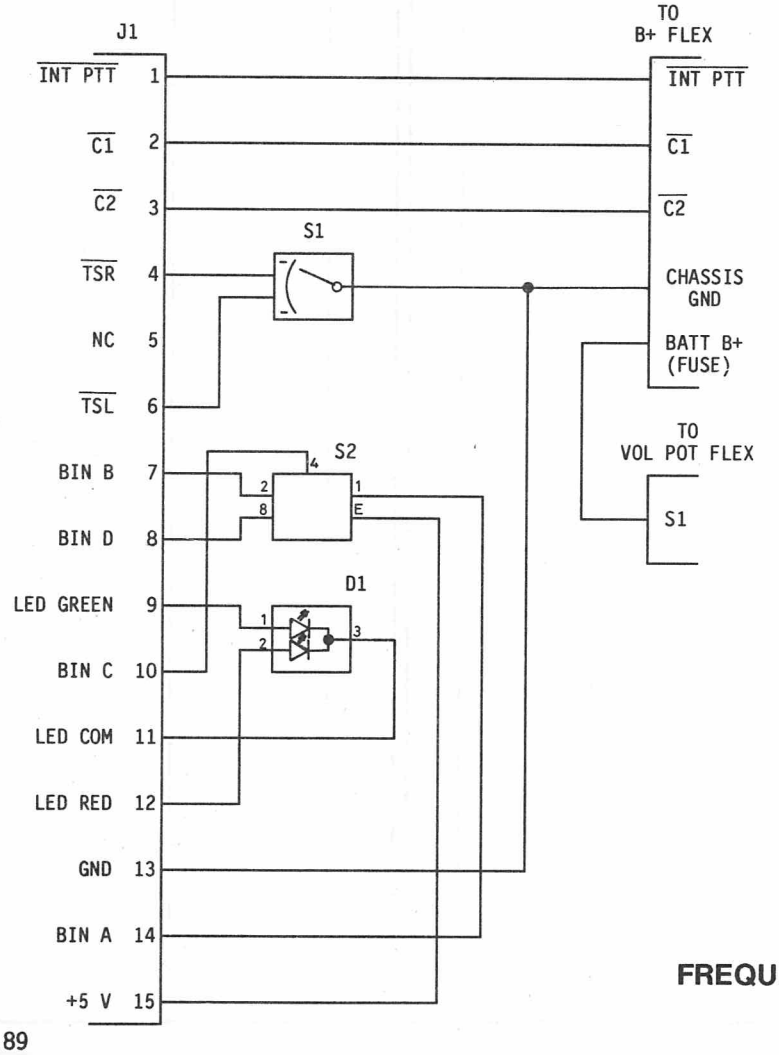


FREQUENCY SWITCH FLEX

D405.507/2

DOC. ISSUE 10.05.89





FREQUENCY SWITCH FLEX

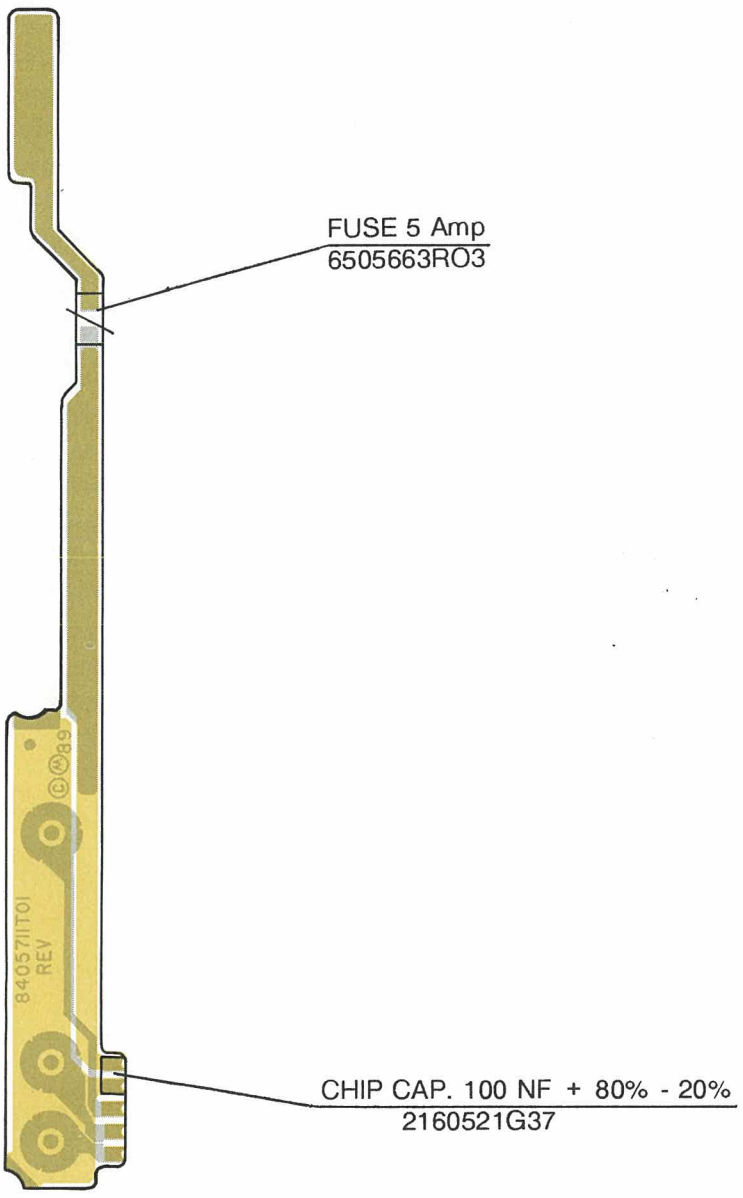
D405.507/2

DOC. ISSUE 10.05.89

PARTS LIST FOR HTX/CP1000, FREQUENCY SWITCH FLEX

Pos	Code No.	Description	Qt
D1	4805729G24	LED BICOLOR	1
S1	4005101Q01	TOGGLE SWITCH	1
S2	4005265Q02	16 POS HEXIDECIMAL SWITCH	1

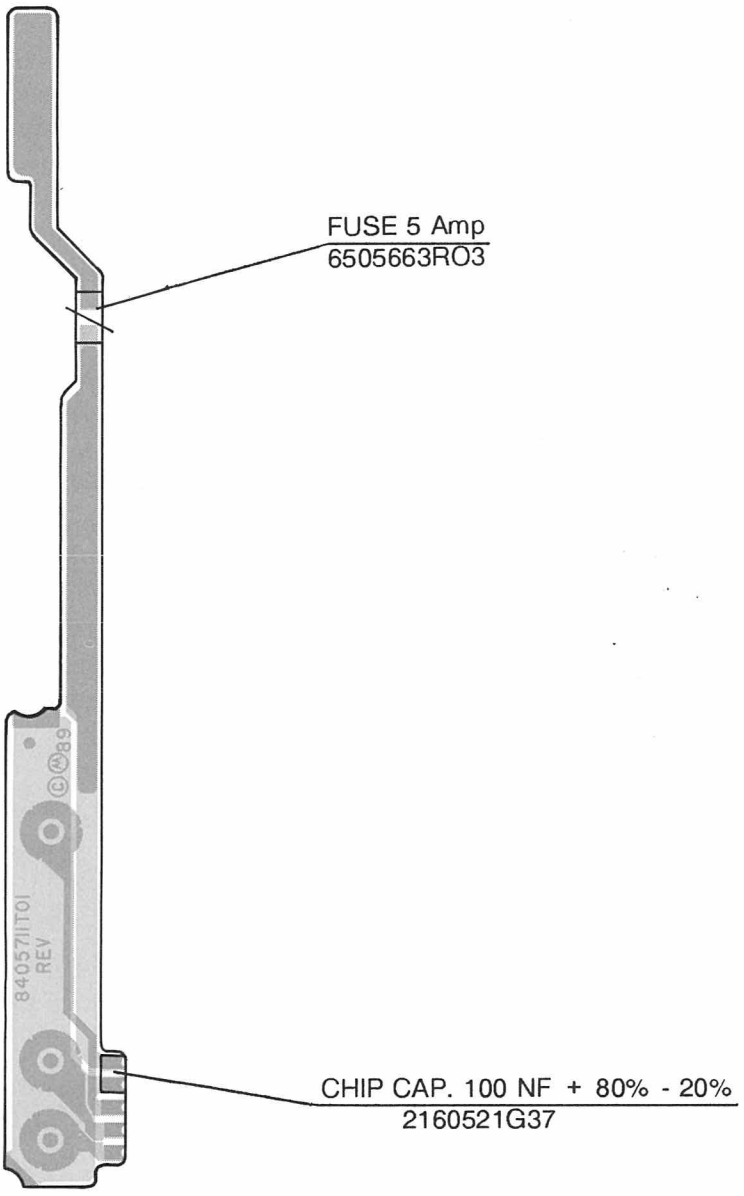
Pos	Code No.	Description	Qt



PTT FLEX
COMPONENT LAYOUT

D405.625

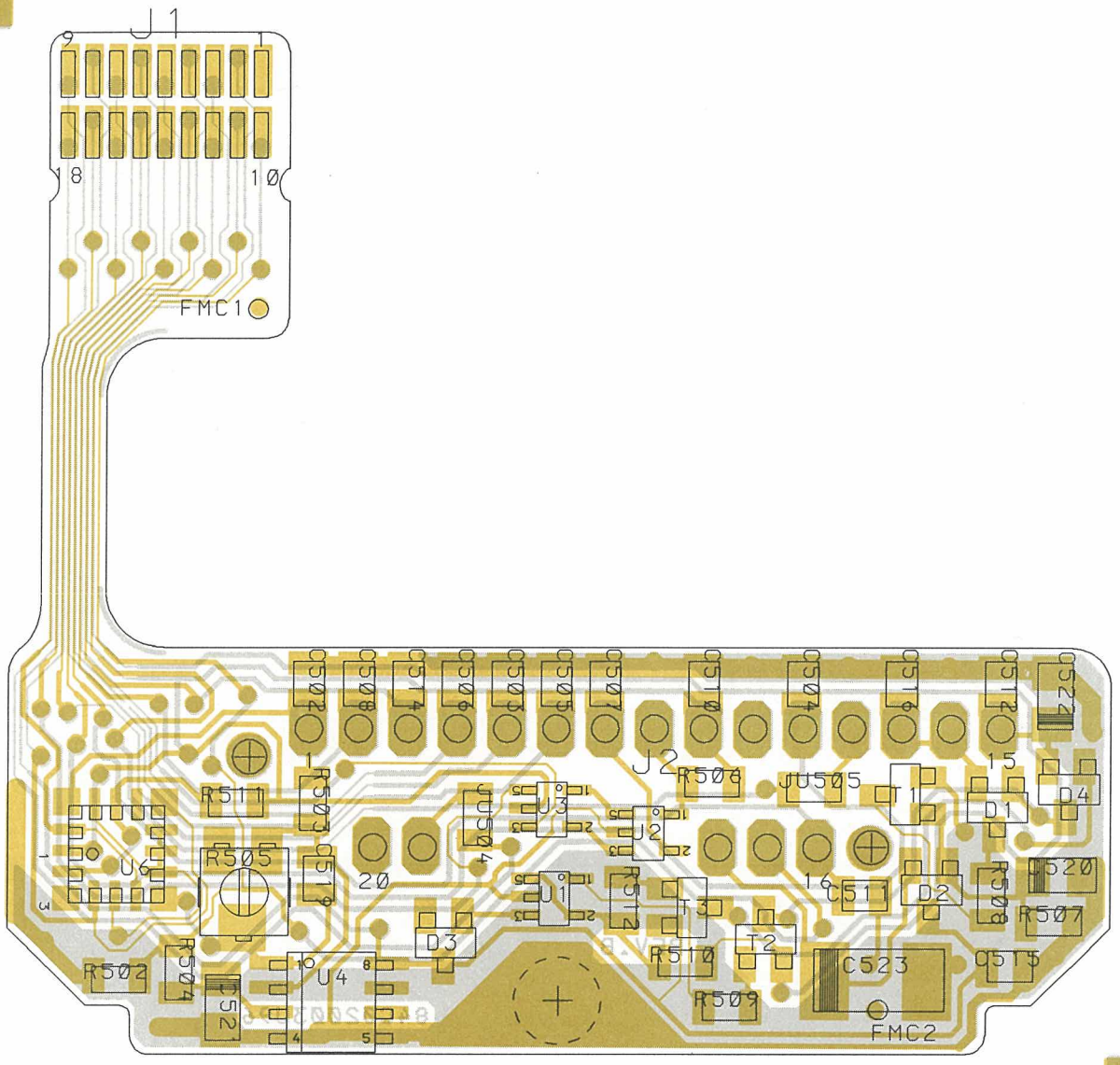
DOC. ISSUE 08.20.90



PTT FLEX
COMPONENT LAYOUT

D405.625

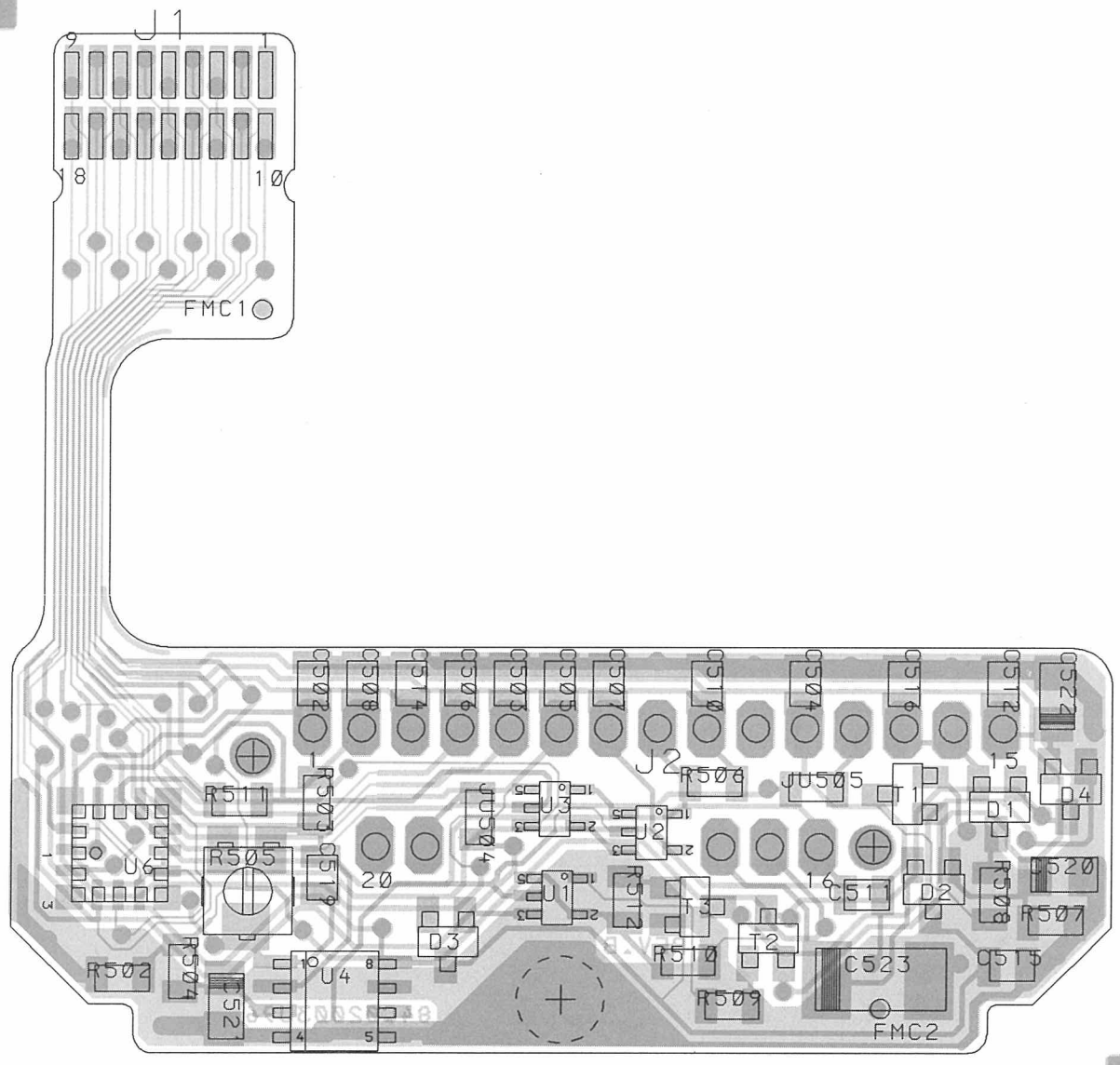
DOC. ISSUE 08.20.90



SECURE INTERCONNECT FLEX ETN2315A
COMPONENT LAYOUT

D405.626

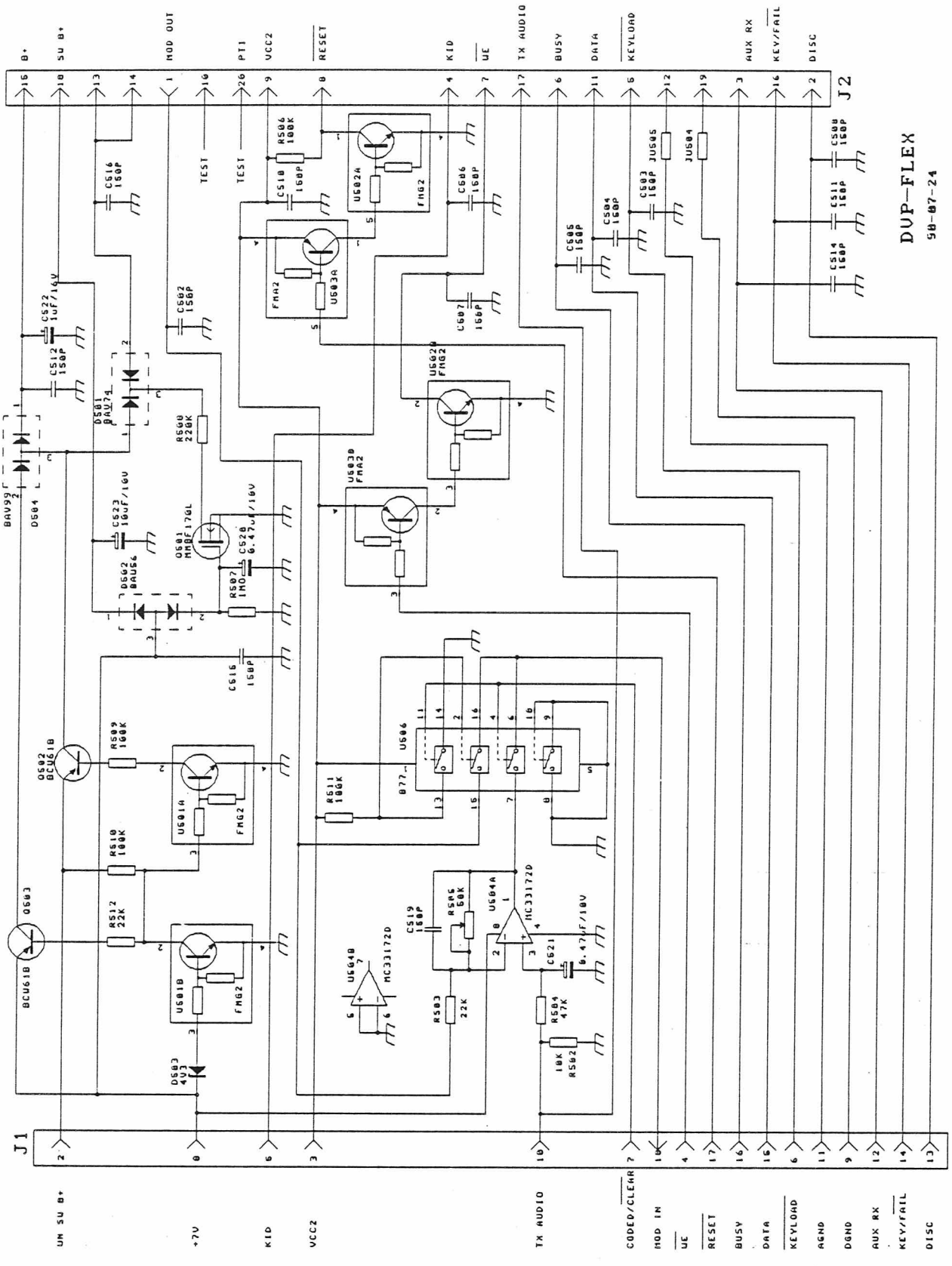
DOC. ISSUE 08.20.90



SECURE INTERCONNECT FLEX ETN2315A
COMPONENT LAYOUT

D405.626

DOC. ISSUE 08.20.90



SECURE INTERCONNECT FLEX ETN2315A

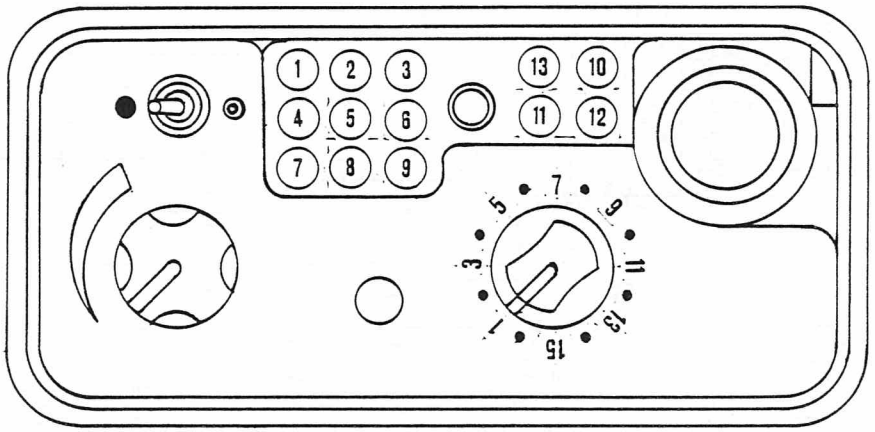
DOC. ISSUE 08.24.90

D405.624

PARTS LIST FOR SECURE INTERCONNECT FLEX ETN2315A

Pos	Code No.	Description	Qt
C502	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C503	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C504	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C505	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C506	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C507	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C508	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C510	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C511	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C512	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C514	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C515	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C516	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C519	2113740A59	CAP CHIP REEL CL1 +/-30 150P	1
C520	2311049A35	CAP TANT CHIP 0.47µF 10V	1
C521	2311049A35	CAP TANT CHIP 0.47µF 10V	1
C522	2311049A07	CAP TANT CHIP 1µF 16V	1
C523	2311049A18	CAP TANT CHIP 10µF 16V	1
D501	4805129M12	DIODE BAV 74	1
D502	4802049U01	DIODE BAV 56	1
D503	4880140L04	DIODE 4V3	1
D504	J707389P1	DIODE SI SIG BAV 99	1
Q501	4805218N11	XISTOR SOT RH BST82	1
Q502	4805128M94	TSTR RH BCW61BB	1
Q503	4805128M94	TSTR RH BCW61BB	1
R502	0611079A98	RES FIXED CHIP 10K	1
R503	0611079B07	RES FIXED CHIP 22K	1
R504	0611079B23	RES FIXED CHIP 100K	1
R505	J710708P9	RES,VAR,CERM 50K 20%	1
R506	0611079B23	RES FIXED CHIP 100K	1
R507	0611079B47	RES FIXED CHIP 1MO	1
R508	0611079B31	RES FIXED CHIP 220K	1
R509	0611079B23	RES FIXED CHIP 100K	1
R510	0611079B23	RES FIXED CHIP 100K	1
R511	0611079B23	RES FIXED CHIP 100K	1
R512	0611079B07	RES FIXED CHIP 22K	1
U501	4805921T03	XISTOR FMG2 RH	1
U502	4805921T03	XISTOR FMG2 RH	1
U503	4802233J05	TSTR DUAL W/BIAS RES SOT25-R	1
U504	5184785R03	IC OP AMP	1
U506	0105954P13	HYBRID SOLDER XFER 37B77	1
	8402003U96	FLEX BD PW ODIN SECURE	1

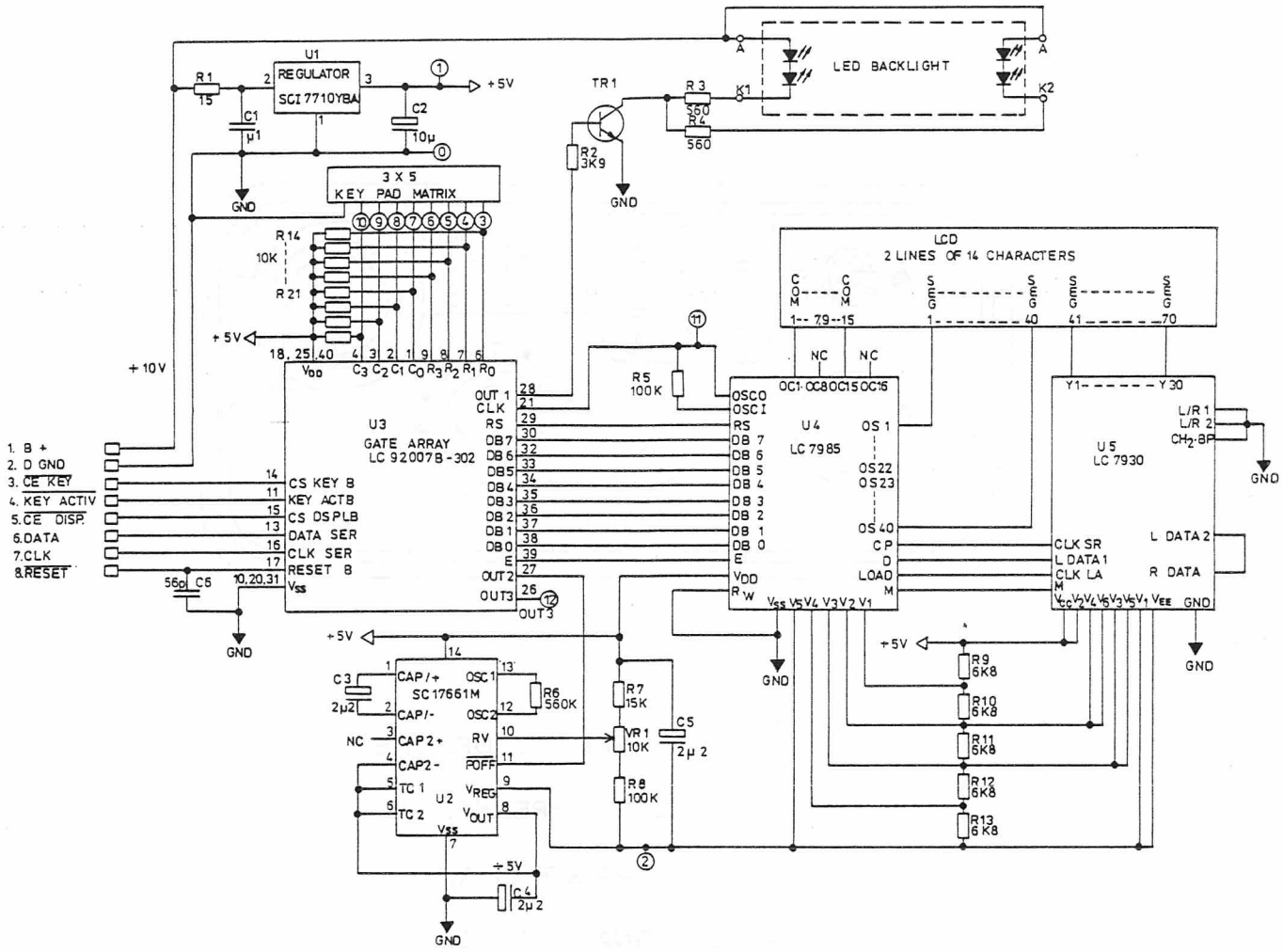
Pos	Code No.	Description	Qt

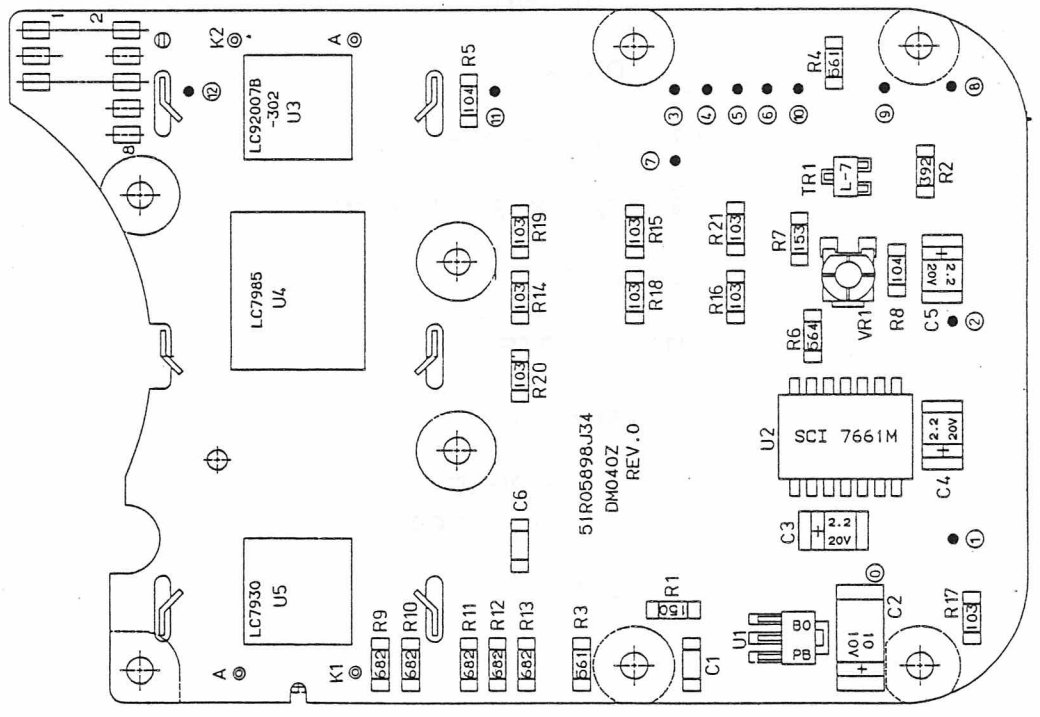


1. EXTERNAL MICROPHONE
2. EXTERNAL SPEAKER
3. VVC/VPP/KEYLOAD
4. EXTERNAL PTT/KID
5. GROUND
6. DATA
7. OPT SEL/WE
8. SPEAKER COMMON
9. BUSY
10. REMOTE ANTENNA
11. KEY/FAIL
12. RF GROUND
    (to mother board)
13. SENSE

RADIO TOP VIEW

M405.742/2





NOTE: THE INDIVIDUAL COMPONENTS ARE NOT REPLACEABLE

DOC.ISSUE 10.04.89

DISPLAY MODULE FOR HTX/CP1000
SCHEMATIC DIAGRAM & COMPONENT LAYOUT
D405.514

GRAPHICAL SYMBOLS USED IN CIRCUIT DIAGRAMS

Resistors(R)

- Resistor
- Resistor with fixed tap
- Variable resistor
- Resistor with movable tap (Potentiometer).
- VDR — Varistor (voltage-dependent resistor)
- NTC — Temperature-dependent resistor with negative temperature coefficient
- Light-emitting diode (photosensitive resistor)
- PTC — Temperature dependent resistor with positive temperature-coefficient.
- Resistor with preset adjustment

Capacitors(C)

- Capacitor
- Variable capacitor
- Trimmer capacitor
- Feedthrough capacitor
- Electrolytic capacitor polarized
- Polarized capacitor general
- Electrolytic capacitor non-polarized

Coils(L)

- RF coil, air core
- Coupled RF coils, air core
- RF coil with adjustable core
- Coil with tap.
- Helical-coil.

Transformers(T)

- Transformer with iron core
- Transformer with adjustable RF cores

Diodes(D)

- Diode
- Bridge rectifier
- Series-connected stabilizer diodes within one case
- Light-emitting diode
- Zener diode (unidirectional)
- Zener diode (bidirectional)
- Tunnel diode
- Backward diode
- Varactor diode
- Controlled rectifier, PNPN (N-thyristor)
- Controlled rectifier, NPNP (P-thyristor)
- Zener diode-programable.

Transistors(Q)

- Transistor, PNP
- Transistor, NPN
- Light-sensitive transistor PNP
- Unipolar transistor with N-type base

Junction Field Effect Transistors (JFET)

- DRAIN / GATE / SOURCE — N-channel JFET
- P-channel JFET
- DRAIN / GATE / GATE2 (SUBSTR.) / SOURCE — N-channel dual gate JFET
- P-channel dual gate JFET

Insulated Gate Field Effect Transistors (IGFET or MOS)

- DRAIN / GATE / SUBSTR. / SOURCE — N-channel IGFET (MOS)
- P-channel IGFET (MOS)
- DRAIN / GATE1 / GATE2 / SOURCE — N-channel dual gate IGFET (MOS)
- P-channel dual gate IGFET (MOS)

Integrated Circuits(U)

Several integrated circuits contained within one case are designated by one common number followed by an identifying letter (a, b, c, etc.). Thus, circuits U1A, U1B and U1C are contained within one case.

Gates

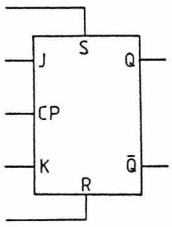
- AND gate.
- OR gate.
- NAND gate.
- NOR gate.
- Exclusive OR gate.
- VCC / OUTPUT — Wired OR (combined OR outputs) (presentation at top is used in detailed diagrams; presentation below is used in functional diagrams)
- OUTP.

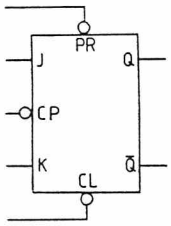
GRAPHICAL SYMBOLS USED IN CIRCUIT DIAGRAMS

Flip-flops

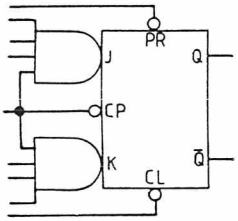
Abbreviations used:

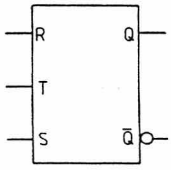
S =Set
R =Reset
CP=Clock pulse
PR=Preset
CL=Clear
T =Toggle

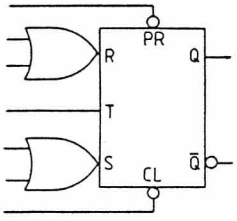




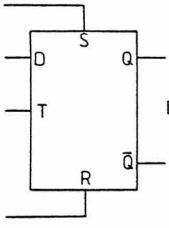
J-K Flip-Flops





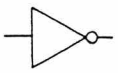


R-S Flip-Flops

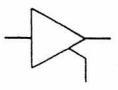


D Flip-Flop

Inverters

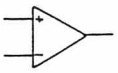


Inverter

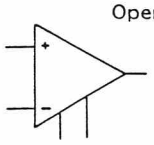


Three-state driver

Operational Amplifiers



Operational amplifiers.



Relays(K)

Single-coil relay

Dual-coil relay

P Polarized relay

SO Slow-acting relay

SR Slow-release relay

Relay with change-over contacts

Contacts

Open contact (make)

Closed contact (break)

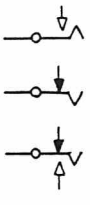
Change-over contact

Change-over contact centre off

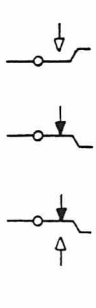
Make-before-break

Switches and Keys(S)

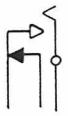
On/Off switch



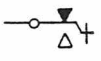
Locking keys or switches: push on, push off



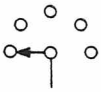
Non-Locking self-releasing keys or switches



Make-before-break



Locking mutually releasing keys or switches (In row of push-buttons etc.)



Rotary switch.

ON/OFF switch electrically controlled. (Not a relay)

Lamps(V)

Indicator Lamp.

Neon Lamp

Fuses and Cut-outs(F)

Fuse

Circuit breaker

Batteries(B)

Battery one cell

Battery multi cell

Feedthrough Filters(Z)

Feedthrough filter

Ferrite Beads(FB)

Ferrite bead

Crystals(Y)

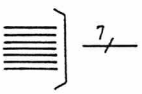
Crystal

Cables and Wires(W)

Usual conductor.

Three conductors

Eight conductors.



Shift from multiple-line to single-line presentation.

Screened cable.

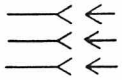
Coaxial cable.

GRAPHICAL SYMBOLS USED IN CIRCUIT DIAGRAMS

Connectors(J and P)


Female (socket) connector.


Male (plug) connector

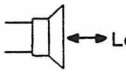

Multi-wire connector.


Coaxial plug.


Coaxial socket.

Loudspeakers(LS)


Loudspeaker.


Loudspeaker-Microphone.

Telephones(TEL)


Telephone.


Single headphone.
(Earphone).


Double headphone.

Microphones(M)


Microphone.

Meters etc.


Indicating instrument.


Balancing instrument.
(Galvanometer).


Basic letters
see DESIGN STANDARD
10.02.3.1 section 12.

Test Points

DC test point.

AC test point.

Replaceable Connections(W)

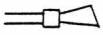

Cross-field connection.
(jumper).

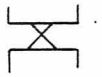

Strap.

Miscellaneous

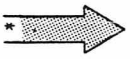

Antenna


Buzzer.


Horn.


Directional Coupler.


Circulator.



Multiconductor bus
(used in logic diagrams)
* = Identifying bus label
e.g. DATA, ADDRESS....


Chassis or frame
connection


Grouping of leads.


Crossing of wires.


Junction of connected wires

COLOUR CODE/
CODE DES COULEURS/
FARBKODE

0	BK/BLK	BLACK	NOIR	SCHWARZ
1	BN/BRN	BROWN	MARRON	BRAUN
2	RD/RED	RED	ROUGE	ROT
3	OR/ORG	ORANGE	ORANGE	ORANGE
4	YW/YEL	YELLOW	JAUNE	GELB
5	GN/GRN	GREEN	VERT	GRÜN
6	BL/BLU	BLUE	BLEU	BLAU
7	VT/VIO	VIOLET	VIOLET	VIOLET
8	GY/GRY	GREY	GRIS	GRAU
9	WH/WHT	WHITE	BLANC	WEIβ