BCC 67

PANTHER V RADIO

Technical Manual

Module Level

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PANTHER V RADIO - BCC 67

TECHNICAL MANUAL

MODULE LEVEL

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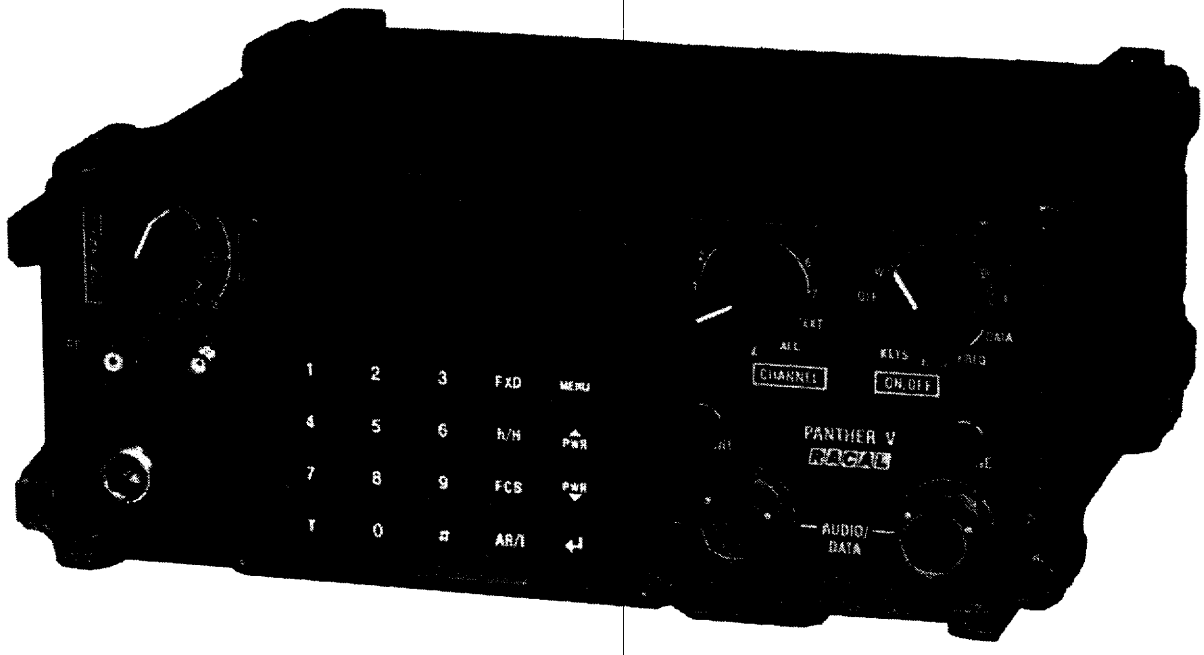
ILLUSTRATIONS



Panther V Radio BCC 67

WARNINGS

BERYLLIUM OXIDE - SAFETY PRECAUTIONS

Introduction

When handling components that contain beryllium oxide, observe the following safety precautions. Most Radio Frequency (RF) transistors contain beryllium oxide although the material is not visible.

Practical Precautions

Beryllium oxide is dangerous in dust form, when it can be inhaled or enter a cut or skin irritation area. Take care not to generate dust by abrasion of the material.

Power Transistors

There is normally no hazard with power transistors as the beryllium oxide is encapsulated within the devices. Power transistors are safe to handle for replacement purposes, but when removing them, ensure that they are not damaged in the process.

Do not carry them loosely in a pocket, bag or container with other components where they may rub together or break and disintegrate into dust.

Do not heat them excessively (normal soldering is quite safe).

Do not break them open for inspection or in any way scrape them.

Disposal

Do not dispose of defective or broken components that contain beryllium oxide in containers used for general refuse.

Wrap each defective item individually and identify clearly as "DEFECTIVE BERYLLIUM COMPONENTS" and return to the manufacturer for disposal.

Wrap each broken item individually and identify clearly as "BROKEN BERYLLIUM COMPONENTS" and return to the manufacturer for disposal.

Medical Precautions

If beryllium is believed to be on or to have entered the skin through cuts or abrasions, thoroughly wash the area and treat with normal first aid methods, then have a medical inspection.

Suspected inhalation of beryllium dust requires treatment as soon as possible by a doctor.

LITHIUM BATTERIES

Introduction

Lithium batteries can be dangerous if mishandled. Fire, explosion or severe burns may result from a battery being broken open, incinerated, recharged, heated above 100°C or its contents exposed to water. When operating with lithium batteries observe the following safety precautions.

Practical Precautions

The lithium content becomes hazardous if exposed to air and water - resulting in fire and possible explosion. The electrolyte when exposed to moist air is toxic and can cause severe burns.

The lithium battery is dangerous only if mistreated. Take care not to:

(1) Recharge the battery.

(2) Heat above 100°C.

(3) Break open the battery.

(4) Incinerate the battery.

If an internal leakage occurs a strong smell is given off - sulphur dioxide (like bad eggs) which is toxic if inhaled.

Disposal

Do not dispose of undamaged or damaged lithium batteries in containers used for general refuse. Proceed as follows:

(1) Remove any leads from the battery.

(2) Place in polythene bag.

(3) Sprinkle the bag with chalk powder (calcium carbonate). Typical amount 5 to 10 grams for small single battery. A guide for all batteries is that the chalk should be half the weight of the battery/batteries being disposed.

(4) Seal the bag.

(5) Return to manufacturer for disposal.

Medical Precautions

If the electrolyte is believed to be on or to have entered the skin through cuts or abrasions, thoroughly wash the area with water, then have a medical inspection.

Suspected inhalation of any toxic fumes should be treated by maximising of ventilation followed by a medical inspection.

RF VOLTAGES - WHIP ANTENNA

When the equipment is switched on and in transmit mode high RF voltages can be generated at the whip antenna. Therefore great care should be taken by operators not to touch the antenna until the equipment is switched off. The RF voltages present could cause an RF burn. If this occurs the equipment should be switched off and medical inspection and treatment urgently sought.

DC VOLTAGES

DC voltages in the order of 200 Volts exist inside the radio on motherboard connectors and inside the Vehicle Interface Unit on the amplifier board connectors. Care should be taken that power is switched off before removing external covers and prior to replacing any items.

CAUTIONS

CMOS DEVICE HANDLING PRECAUTIONS

The input impedance of a CMOS device is of the order of 10^{14} ohms. The breakdown voltage of the oxide within the device is about 100 volts. As static voltages of up to 4kV can be generated by silk, nylon or plastic clothing or containers, it is essential that precautions are taken to prevent high voltages occurring at the leads of CMOS devices, as follows:

(1) When working on boards containing these devices, earthed wrist straps must be worn and earthed anti-static mats must be employed.

(2) Earth the tips of soldering irons to the earth plane of the board being soldered.

(3) Do not store the devices in plastic bags or containers (unless the plastic has been specially treated with anti-static chemicals).

(4) Do not wear nylon or plastic gloves, or rubber soled shoes.

(5) Do not remove the input connection with the device connected to the supply rail.

Note that VMOS FETs are particularly sensitive to static.

SOLVENTS

Do not allow solvents used for cleaning purposes (e.g after a Printed Circuit Board (PCB) repair) to come into contact with the plastic switches.

TECHNICAL SPECIFICATION

Frequency Range	30 to 108 MHz fixed frequency 30 to 88 MHz frequency hopping 3120 frequencies at 25 kHz spacing
Preset Channels	8 programmable nets storing all operational information and synchronisation status (battery backed)
On Air Communication	Fixed Clear (FC) and Fixed Secure (FS) multimedia (voice, data, video, messaging, situation awareness) Frequency Hopping Secure (FHS) multimedia - optimised at 100 hops/second Mixed Free Channel Search (FCS), frequency hopping automatic net operation
On Air Interoperability	Fixed clear voice (STANAG 4204 interoperable - F3E simplex) Frequency hopping hailing (STANAG 4292) Jaguar V EPM modes Channel Scanning mode (8 channels - FC) Two Frequency Simplex (FS)
Frequency Hopping	All frequency hopping 4/16/256 user specified frequencies 256 channels orthogonal hopping (8 guaranteed orthogonal sets) 32 barred bands per programmed channel
Synchronisation	Fully automatic for both initial set up and late entry procedures Passive and active late net entry Independent of external time of day information All synchronisation takes place in frequency hopping mode using the chosen frequency hopset at the full hop rate Synchronisation can be achieved without a Master station in the radio net Radio silence - indefinite
Encryption	High level digital stream cypher encryption covering all media transmissions Number of keys greater than 10^{22}
Baseband Interfaces	Dual audio input / integral vehicle harness interface Dual RS232 data ports with flow control Connection to Combat Net Radio Interface / Radio Access Point Gateway capability to Allied Forces EPM CNR radios (option)
Data	Baseband data connections up to 115kbit/s Asynchronous / synchronous data throughput up to 16kbit/s Asynchronous / synchronous data throughput up to 9.6kbit/s with FEC Reed Solomon Forward Error Correction (FEC), binary block coding and interleaving Multiple Simultaneous Access (MSA) - up to 100 selective FHS data calls per net Carrier Sense Multiple Access (CSMA) with dynamic net management Automatic voice / data recognition

User Services

Selective call and radio banning
Multiple Simultaneous Access (MSA) - up to 100 selective FHS voice calls per net
Integral Over The Air Rekeying (Frequency, key and net information)
Authentication with operator and transceiver identification

Integrated Logistic Support

Comprehensive multi level Built In Test (BIT)
Integral Electronic Log Record includes: serial number, user defined record, automatic fault log, radio duty cycle
In field software upgrade capability

Remote Control

In built 2 wire remote control / retransmission (up to 4 km).
2 and 3 way rebroadcast capability
Intercom facility over D10 field wire
Extended control and programming from a PC based Windows application

Co-site

5W / 20W Manpack radio : 5 MHz frequency separation, 1.5 metres.
20W / 50W Vehicle radio : 5 MHz frequency separation, 1.5 metres.

Transmit

RF Output Power (nominal):
Manpack configuration
100 mW, 5 W, at 12 V DC
100 mW, 5 W, 20 W at 24 V DC;
Vehicle base station configuration
100 mW, 5 W, 20 W, 50 W (with amplifier) at 24 V DC

Harmonic Suppression: Better than -50 dB below carrier
Spurious Emissions: Better than 60 dB below carrier, for greater than 25kHz offset
AF Response: Voice 300 Hz to 3.0 kHz

Receive

Sensitivity: Better than -115 dBm at 10 dB SINAD.
Spurious Response: Better than 85 dB.
AF Response: Voice 300 Hz to 3.0 kHz.
AF Output Power: 20 mW nominal for each socket in to 300 ohms.
Squelch: Carrier, 150 Hz tone and 16kbit/s.

Power Supplies

Supply Voltage: 12 V or 24 V DC nominal
Primary or rechargeable batteries or vehicle supply.
Protection Against: Supply polarity reversal
Open/short circuit RF connection
RF input 65 V (EMF) applied
Spike/surge DEF Standard 61-05 (Q STAG 307)
24 V DC at remote line terminals.

Environmental

Temperature Range: -40°C to +70°C
Specification: MIL STD 810E & DEF Standard 07-55.
Nuclear Hardened: EMP protected.
EMI/EMC: MIL STD 461 & DEF Standard 59-36.

Physical Characteristics

	Height	Width	Depth	Weight
Transceiver	90 mm	230 mm	205 mm	4.4 kg
50W Amplifier (VIU)	70 mm	230 mm	230 mm	4.2 kg

ABBREVIATIONS

NOTE Signal Abbreviations are summarised in Chapter 6

ACM	Asynchronous Control Mode
A-D	Analogue to Digital
ADC	Analogue to Digital Converter
AM	Amplitude Modulation
AMU	Antenna Matching Unit
ASIC	Application Specific Integrated Circuit
ATE	Automatic Test Equipment
BDM	Background Debug Mode
BIT	Built In Test
BITE	Built In Test Equipment
BNC	Bayonet Neils Councilman (Coaxial Connector)
CCU	Central Control Unit
CDP	Correct Data Present
CKG	Crypto Keystream Generator
CMOS	Complementary Metal Oxide Semiconductor
CNR	Combat Net Radio
CSMA	Carrier Sense Multiple Access
CVSD	Continuous Variable Slope Detector
DB	Decibels
DBM	Decibels relative to 1 mW of power
DC	Direct Current
DEF STAN	Defence Standard
DSP	Digital Signal Processor
DVT	Digital Voice Terminal
ECCM	Electronic Counter Counter Measures
ECON	Economise
EMC	Electromagnetic Compatibility
EMF	Electromotive Force
EMI	Electromagnetic Interference
EMP	Electromagnetic Pulse
EPM	Electronic Protection Measures
EPROM	Erasable Programmable Read Only Memory
FC	Fixed frequency Clear
FCS	Free Channel Search
FEC	Forward Error Correction
FET	Field Effect Transistor
FHS	Frequency Hopping Secure
FIFO	First In First Out
FLA	Fixed Level Audio
FPGA	Field Programmable Gate Array
FM	Frequency Modulation
FRA	Forward error correction and Remote line interface Assembly
FS	Fixed frequency Secure
FSK	Frequency Shift Keying
FXD	Fixed (Frequency)
GPS	Global Positioning System
HI	Host Interface
HKG	Hopping Keystream Generator

IC	Integrated Circuit
IF	Intermediate Frquency
I/O	Input/Output
JFET	Junction Field Effect Transistor
KG	Keystream Generator
KBIT/S	Kilo Bits/Second
LED	Light Emitting Diode
LO	Local Oscillator
LOC	Local
LSI	Large Scale Integrated circuit
MCU	Microcontroller Unit
MIL STD	Military Standard
MMI	Man Machine Interface
MSA	Multiple Simultaneous Access
OTAR	Over The Air Rekey
ORT	Operational Readiness Test
PA	Power Amplifier
PC	Personal Computer
PCB	Printed Circuit Board
PD	Potential Difference
PIN	Diode with Positive, Insulating and Negative layers
PLL	Phase Locked Loop
PTT	Press To Transmit
PWM	Pulse Width Modulation
RAM	Random Access Memory
RCA	Radio Control Assembly
RCU	Remote Control Unit
REM	Remote
RF	Radio Frequency
ROM	Read Only Memory
RLI	Remote Line Interface
RS232	Data Signalling Standard
RTC	Real Time Clock
RX	Receive
SCI	Serial Communication Interface
SINAD	Signal / Noise And Distortion
SRAM	Static Random Access Memory
TCVR	Transceiver
TCXO	Temperature Controlled Crystal Oscillator
TDS789	Serial Control Specification
TX	Transmit
UART	Universal Asynchronous Receiver Transmitter
USART	Universal Synchronous Asynchronous Receiver Transmitter

V	Volts
VCO	Voltage Controlled Oscillator
VIU	Vehicle Interface Unit
VLA	Variable Level Audio
VMOS	V groove Metal Oxide Semiconductor
VRQ	Vehicle Radio Station
VT	Voltage Tuning
W	Watts
Z	Zeroise

CHAPTER 1

GENERAL DESCRIPTION

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CHAPTER 1

GENERAL DESCRIPTION

ROLE

1 The Panther V Manpack Radio BCC 67 is a medium power FM transceiver covering 30 to 107.975 MHz in 25 kHz steps (3120 channels). It provides Electronic Counter Counter Measures (ECCM) and Encryption for both analogue and digital communications. When connected to a BCC767 Vehicle Interface Unit (VIU) it forms the Panther V Vehicle Radio VRQ327.

2 The transceiver is compatible with existing Jaguar V radios in Fixed Frequency and Frequency Hopping (Wideband and Narrowband) modes. Channel Scanning of eight Fixed Frequency Channels and Free Channel Search (FCS) modes are provided. The Transceiver may be connected directly to a 24 V vehicle supply to provide a 20 W station (Vehicle Clip In Role). For High power (50 Watt) vehicle operation a VIU (BCC 767) is required.

3 Programming of the transceiver radio parameters may be accomplished via the RS232 compatible data socket by connection of a Fill Gun or Personal Computer (PC) based Programmer. A PC based Programmer can be used to load the data to the Fill Gun, prior to filling the radio. In addition reprogramming can be achieved via Over The Air Rekey (OTAR) facility.

4 A data position is provided on the Volume switch which may be used to enable internal RS232 interfaces for data transfer applications, alternatively the standard Panther V interface levels may be used. The radio allows selection of the in built Forward Error Correction (FEC) codes for benign, medium and hostile Radio Frequency (RF) environments. Rates up to 115 kbit/s are supported and asynchronous and synchronous interfaces. Over air rates of up to 9.6kbit/s are supported with FEC.

5 User services are provided to allow multiple simultaneous access on a single channel, authentication of transmissions, software upgrading from external connection and remote control from a PC based application. The interface supports E mail transfer from a PC and can utilise its Carrier Sense Multiple Access (CSMA) capability for packet data applications.

6 The transceiver incorporates Built In Test Equipment (BITE) to assist in isolating faults to module level. The BITE routine is entered automatically on switch on and can be initiated manually by keypad. An electronic log record provides recall of serial number, automatic fault log and radio duty cycle.

MODES

7 The Panther V transceiver provides communication in Fixed frequency Clear, Fixed frequency Secure and Hopping modes, including Fixed Clear Channel Scanning and Free Channel Search. Hopping mode operates on random frequencies with secure voice or data traffic, whilst Fixed Secure operates on a fixed frequency with secure voice or data traffic. The modes provided are as follows.

Fixed Clear

8 Fixed Clear mode operates on a fixed frequency with clear voice or data traffic. The mode outputs received noise when a fixed secure transmission is received.

Fixed Secure

9 Secure communications on a fixed frequency for voice and data traffic, includes the ability to send traffic signalling and selcall addresses. Provides the facility to receive fixed clear speech transmissions whilst in standby mode.

Hopping, Wideband, Orthogonal

10 Secure Hopping communication on from 64 to 256 (maximum) frequencies is available on up to eight sets within the 30 to 87.975 MHz bandwidth.

Hopping, Wideband, Non-orthogonal

11 All Frequency Secure Hopping communication on from 64 to 2320 frequencies is available within the 30 to 87.975 MHz bandwidth.

Hopping, Narrowband

12 Secure Hopping communication with a selection of up to nine 6.4 MHz narrowbands within the 30 to 87.975 MHz frequency bandwidth, each band will utilize from 64 to 256 frequencies.

Hopping 4/16/256 Fill

13 Secure Hopping communication on a number of programmed frequencies within the 30 to 87.975 MHz bandwidth. The 4/16/256 frequency fill is available on a per channel basis.

NOTE Interoperability with Jaguar V is provided in Fixed Clear, Fixed Secure and Hopping modes.

Free Channel Search

14 This mode achieves communication on a 'quiet' channel whereby the radio when in standby mode (no active receive or transmit) monitors a number of randomly chosen frequencies and records the average signal strength on each channel. When the pressel is operated the radio achieves synchronisation and sends the quietest frequency information to the receivers. Communication then takes place on that quiet frequency, which is displayed. Free Channel Search can utilize any of the hopping methods as detailed to achieve synchronization.

Channel Scanning

15 Channel Scanning will monitor all the programmed channels (up to eight) for a received signal. The received frequency is displayed temporarily during which time it may be locked by a short application of the pressel until the transmission is complete. It provides an ability to transmit on the received channel frequency for a short period of time after the net activity has ceased, and on a pre-programmed channel thereafter.

Two Frequency Simplex

16 This mode is used when pairs of radios operate together to act as repeater stations in order to extend the range of the net. The radio in this mode is programmed with different transmit and receive frequencies. Each participating repeater station must have the same frequencies programmed.

USER SERVICES

Selective Call

17 Selective Call (Selcall) operation allows the operator to selectively communicate within a radio net. Within the selcall application the operator can choose to select a radio for communication, ban a radio from communication, disable or re-enable the selcall system and view their own address. The operator is allowed to enter their own address if this has not been previously entered.

Over The Air Rekey

18 OTAR is a method of transferring stored programmed information from one radio to another by sending it over the air. OTAR operates on an individual channel basis and it can also be sent to a net or selected radios within it.

19 Access security is provided by the need of a sending operator to enter an Authentication Personal Identification Number code before access to OTAR is allowed. The OTAR information is secured over the air during transmission by the built in encryption system. OTAR is only possible in Fixed Secure, Hopping or Free Channel Search communication modes.

Authentication

20 The Authentication facility enables a radio operator to verify that another radio operator on the net is an approved user. The authentication takes the form of a four digit PIN which can be transmitted securely to an enquiring radio. Attached to the authentication code a five digit identification may be added. This facility is used in OTAR operation.

Multiple Simultaneous Access

21 The Multiple Simultaneous Access (MSA) facility enables an operator to call radios in a net, via the selcall address, without interruption to the main operating channel. MSA can only occur in Hopping mode.

Built In Test

22 The Built In Test (BIT) facility provides an automatic functional test on switch on, which can be entered manually. If a non-critical fault is found, operation in some modes may still be possible. A self test facility enables the operator to check various aspects of the radio performance at the instant the enquiry is made.

Software Upgrade

23 The complete radio software can be upgraded from a PC via the radio data connector over an RS232 link. No internal radio access is required.

PC Remote Control

24 The radio can be operated and filled remotely from an external PC source.

Operational Applications

25 The radio supports tactical multi-media information in the following areas; digital secure voice and rebroadcast, mixed voice and data messaging, slow scan video, E mail software application, operation with packet data and PC data terminals including Message Entry and Read Out Device (MEROD).

PARAMETERS

Main Parameters

26 The main parameters of the radio are:

Frequency Range	30 MHz to 107.975 MHz
Number of Channels	3120
Number of Pre-Set Channels	8
Channel Spacing	25 kHz
Traffic modes	Analogue voice 300 Hz - 3 kHz Analogue data Data from 30 baud to 115 kbit/s
Power Output:	
Manpack role	100 mW (Low), 5 W (Med)
Vehicle clip in role (24 V supply)	100 mW (Low), 5 W (Med), 20 W (High)
Vehicle role	100 mW (Low), 5 W (Med), 50 W/16 W (High)
Supply Voltage	10 V - 32 V d.c.
Battery Life (Primary at 20° C)	32 hours at 1:1:8 Tx/Rx/Standby Ratio
Battery Life (Rechargeable Nicad at 20° C)	12 hours at 1:1:8 Tx/Rx/Standby Ratio
Antenna	1.2 m or 2.4 m whip
Working Range (Nominal)	5 km (1.2 m whip) 10 km (2.4 m whip)
Working Temperature	-40° C to +70° C
Width	230 mm
Height	90 mm
Depth	205 mm
Depth with battery	292 mm
Weight	4.4 kg
Weight with battery	6.1 kg

27 In addition the following parameters apply to the ECCM (frequency hopping and free channel search) facility and each of the eight channels may be set to one of the following hopping modes.

Narrowband Hopping

Number of Hop Bands 9
Hop Band Range 6.4 MHz

Hop Bands

1	30.000 to 36.375 MHz
2	36.400 to 42.775 MHz
3	43.200 to 49.575 MHz
4	49.600 to 55.975 MHz
5	56.000 to 62.375 MHz
6	62.400 to 68.775 MHz
7	68.800 to 75.175 MHz
8	75.200 to 81.575 MHz
9	81.600 to 87.975 MHz

Wideband Hopping

Hop Band Range 30-87.975 MHz.

Alternative Hop Sets available:

(1) Choice of eight orthogonal sets, each having from 64 to 288 frequencies irregularly spaced.

(2) 256 specified frequencies entered using the Programmer/Fill Gun. For training, a Hop Set of only 4 or 16 frequencies is possible.

(3) All Frequency Hop Set.
This provides a hop set of from 64 to 2320 frequencies.

Barred Bands In each channel switch position up to 32 barred bands of frequencies can be entered from the keyboard or Programmer/Fill Gun.

Hailing Provided to enable fixed frequency radios to hail a hopping net.

SWITCHES (Fig 1.1)

Volume Switch

28 The 11 positions of the switch are:

OFF	Supply and radio off
W	Whisper and radio switched on. Enables a whispered transmission to be heard satisfactorily. Received signals and sidetone at a reduced level.
VOL	Increasing levels of audio from positions 3 to 6.
*	Noise on at audio output (receiver mute open).
DATA	Program Data parameters.
FREQ	Program frequency to channels 1-7.
HSET	Program hopset characteristics including Jaguar interoperability, barred band and fill frequencies, voice and interleaving
KEYS	Program Hop / Secure codes.

NOTE: Positions DATA, FREQ, HSET and KEYS are used only when programming changes are required. A restriction exists after the * (Noise On) position to prevent inadvertent operation. This is overcome by pressing the release button on the side panel adjacent to the Volume Switch.

Channel Switch

29 The 11 positions of the switch are:

M	Manual channel. Programmed frequency can be changed by selecting directly on keyboard. Hop/Secure codes, data parameters, frequencies and hopset characteristics can only be programmed as for channels 1 to 7.
1 to 7	Channels 1 to 7. Data parameters, Frequencies, Hopset characteristics and Hop/Secure codes can only be programmed by setting the Volume switch to DATA, FREQ, HSET or KEYS respectively.
EXT	Used to disable control of the radio from the front panel and to enable control from an externally connected PC based application or Control and Display Unit.
ALL	Used when all 8 channels need to be programmed with the same transceiver parameters.
Z	Zeroise. For emergency use to remove all codes from memory. Can selectively zeroise by setting the Volume switch to DATA, FREQ, HSET and KEYS position as appropriate.

NOTE: A restriction exists before the EXT, ALL and Z positions to prevent inadvertent operation. This is overcome by pressing the release button on the side panel adjacent to the Channel Switch. Positions ALL and Z are used only when programming changes are required.

Control Switch

30 This switch enables the radio to be controlled from either the local keyboard and switches or from a remote unit (using the remote line). The six positions of the switch are:

LOC — Local. Normal radio local operation.

LOC ECON — Local Economise. Normal radio local operation plus a battery saving facility.

DIS ECON — Disabled. Keyboard inactive to prevent accidental selection, also display off to avoid showing a light. Otherwise radio works normally. There is a battery saving facility in this position.

REM ECON — Remote Economise. For use when a radio is being remotely controlled. The radio acts normally except that the keyboard and display are inactive. There is a battery saving facility in this position.

REM — As for REM ECON but with no battery saving facility.

RCU — Remote Control Unit. To control another radio (set to REM) remotely.

Keyboard Switches

31 The 20 press button keys are:

0 to 9 — The 10 keys are used for entry of transceiver parameters e.g., frequencies. The 6 figure frequency is indicated on positions 3 to 8 of the 12 position display.

FXD — Fixed frequency Clear operation. Indicated in positions 10 and 11 of display as FC.

Press FXD twice for Fixed frequency Secure operation. Indicated in positions 10 and 11 as FS.

Press ↩ then FXD for previous selection of either Two Frequency Simplex or Channel Scanning operation. Two Frequency Simplex is indicated 2-FC in positions 4 to 7 and ⇄C in positions 10 and 11 of display. Channel Scanning is indicated 'scan' in positions 4 to 7 and \ C in positions 10 and 11 of display. A clockwise rotating pointer \ is indicated in position 10 of display whilst scanning is in progress.

NOTE The mode selected can only be changed via the 'Clr Mode' function of the MENU key.

h/H — Frequency Hopping operation, normally Secure. Press key once for previous selection of either hopping slave station or hopping master station. Indicated in positions 10 and 11 as hw (slave) or Hw (master). Position 11 will show w for wideband, n for narrowband or f for frequency fill.

Press h/H key twice to change from previous selection of either hopping slave station or hopping master station.

Press ↩ then h/H to select hopping master station.

FCS

Free Channel Search operation. Hopping synchronisation is used to acquire a new channel. Press key once for previous selection of either hopping slave station or hopping master station. Indicated in positions 10 and 11 as h\ or H\. A clockwise rotating pointer \ is indicated in position 11 of display whilst Free Channel Search is in progress.

Press FCS twice to change from previous selection of either hopping slave station or hopping master station.

Press ↩ then FCS to select hopping master station.

AR/I

Automatic Rebroadcast/Intercom or normal mode (ie automatic rebroadcast off) of operation. Press AR/I to step between automatic rebroadcast and normal mode. Indicated A in position 9 for automatic rebroadcast or (blank) for normal.

Press ↩ then AR/I to enter Intercom mode (zero transmit power). Once active, with key held down, Call selected; with key released Intercom mode selected. Indicated Ic in position 12 of display.

MENU

User applications menu, six options indicated between positions 3 and 10 with a ▲ and ▼ prompt indicated in position 12. Pressing ▼ to go down the list, the display is as follows:

MSA	Multiple Simultaneous Access mode
Selcall	Selective communication mode
Clr Modes	Clear Modes - Channel Scan, Two Frequency Simplex modes
OTAR	Over The Air Rekeying mode
FEC	Forward Error Correction (number between 1 and 4 added)
Tx Auth	Transmit Authentication mode

Pressing ▼ will go down the list again.
Press ▲ to go up list.
Press ↩ to enter mode.
Press MENU to exit

Press ↩ then MENU to access Engineering Menu. Display is as follows:

BIT	Built In Test
Service	Language - Language of display
	Version - Version of software in radio
	Calendar - Time of day

PWR▲

Up list of power settings / Up menu list
In normal operation goes up list of transmit power output options:

(1) Low power 100mW, indicated - in position 12 of display
(2) Medium power 5W, indicated = in position 12 of display
(3) High transmit power of 16 W or 50 W. (Used with high power vehicle station only.) A high power of 20 W is available in the manpack radio with 24 V vehicle supply. This is for the vehicle clip in role only. Indicated ≡ in position 12 of display.

PWR▼

Down list of power settings / Down menu list

↩

Enter key. Used when entering a selection.

T — Test key. Indicates current transceiver status on display. Opens radio squelch, giving noise in phones, for duration of key press. Display is as follows:

Position 1 - Transmit power or receive signal level, bar display
Position 2 - Transceiver state -, ↑ transmit, ↓ receive, * idle (squelch open)
Position 3 - Secure configuration - P Panther, J Jaguar
Position 4 - Synchronisation status, hopping mode only, bar display
Position 5 - Hopping bandwidth, hopping mode only, w - wideband, n - narrowband, f - frequency fill
Position 6 - Hopping set, hopping mode only, annotated a, or 1-9
Position 7 - Blank
Position 8 - Blank
Position 9 - Automatic Rebroadcast on/off state, A - selected, N - normal
Position 10 - Economise on/off state, cycling between 'O' then '◇' - Economise on, (blank) - Economise off
Position 11 - Blank
Position 12 - Battery voltage level display

\# — Future enhancement

DISPLAY

32 The display is red and consists of 12 characters which are used for various messages in many aspects of use of the radio. In normal operation the information at each position of the display is as follows:

1 — Channel annotation, '1' - '7' or 'm' manual

2 — Blank

3-8 — Frequency '30000' to '107975' in kHz or Channel Name
Press ↩ and T to change display

9 — Automatic Rebroadcast on/off state, 'A' - A-R on, (blank) A-R off

10,11 — Mode selected as follows:

FC	Fixed frequency Clear
FS	Fixed frequency Secure
Hw	'H' Hopping frequency master or control station, 'w' wideband
hw	'h' Hopping frequency slave station, 'w' wideband. In hopping position 11 could indicate 'n' narrowband, or 'f' frequency fill

12 — Power output selected as follows:

-	Low power, 100mW
=	Medium power 5W,
≡	High power 16W or 50W (vehicle station) or 20 W with 24V vehicle supply
Ic	Intercom (zero power out)

33 In normal operation, a typical display is as follows:

2 1 0 0 9 5 0 A h w =

2	Channel 2
100950	Frequency in kHz
A	Automatic Rebroadcast
h	Hopping slave station
w	Wideband
=	Medium power 5W

CONNECTORS

34

Hexagonal socket	1.2 m/2.4 m whip antenna.
Coaxial socket BNC(RF)	50 ohm aerial socket.
Two sockets 13 way (AUDIO/DATA)	Audio to headset/handset (7 outer pins) or Data to data terminal equipment (6 small pins). Also used for Fill purposes.
Two remote terminals	Two lines to remote radio or remote audio unit.
Plug 10 way (rear panel)	Vehicle Interface Unit via control link cable (Vehicle Radio role) or power input for vehicle clip in fit (manpack radio in vehicle installation).
Two supply terminals (rear panel)	Supply from battery MA 4025D.

BATTERY MA 4025D

35 The battery normally used with the Panther V manpack radio is the 12 V rechargeable battery MA 4025D. It has two supply terminals for the radio power input. Also there are two fuses mounted on the battery - one 6.3 A fuse and one spare.

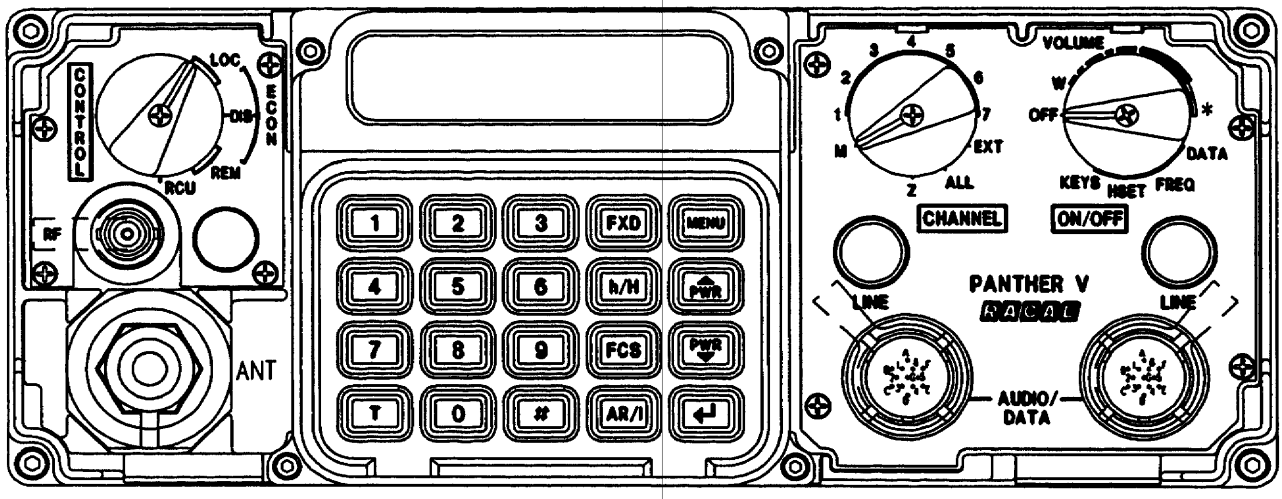


Fig 1.1
Panther V Radio : Front Panel

VEHICLE INTERFACE UNIT (Figs 1.2, 2.2)

36 The VIU BCC 767 enables the Panther V radio to operate in a vehicle station. With a 24 V supply the Panther V Vehicle radio will provide a high power output of 50 W (switchable to 16 W).

37 The connectors are as follows:

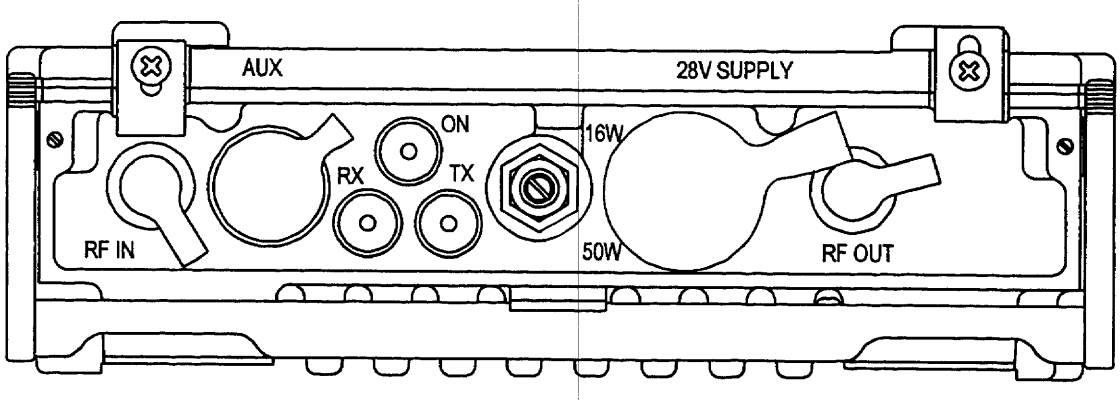
(1)	RF IN	BNC RF Input socket linked to the Transceiver BNC socket.
(2)	AUX	Seven way socket for auxiliary data equipment.
(3)	SUPPLY	Two way Supply plug for 24 V vehicle supply input.
(4)	RF OUT	BNC RF Output socket for connection to vehicle antenna.
(5)	Rear Panel	10 way socket for connection to transceiver.

38 The displays are as follows:

(1)	ON	Green LED, on when power switched on at radio.
(2)	Tx	Red LED, on when transmitting signal.
(3)	Rx	Amber LED, on when squelch is open, normally indicates signal being received.

NOTE: These displays will not operate if the CONTROL switch on the radio is set to DIS (display off).

39 The one control is a protected screw slot switch which enables setting of high power output level i.e. 16 W or 50 W.



VIU-FNT.WPG

Fig 1.2
Vehicle Interface Unit
BCC 767 Front Panel

CHAPTER 2

PREPARATION FOR USE

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CHAPTER 2

PREPARATION FOR USE

MANPACK RADIO

Station Items

1 The following items make up the Panther V Manpack Radio Station:

Panther V Radio BCC 67
Battery Rechargeable 12 V 4 Ah MA 4025D
Whip Antennas 1.2 m and 2.4 m
Carrying Harness
Handset/Headset.

Fitting The Battery (Fig 2.1)

2 The battery is connected to the rear panel of the radio. The battery can only be mounted to the radio one way since one of the two battery securing bolts is internally threaded. The battery securing bolts have a wing nut combined with a coin slot for ease of tightening. The terminals are spring loaded, so it is necessary to press the battery to the radio before attempting to screw in the bolts. Ensure that they are tightened evenly.

Fitting The Whip Antenna

3 Two folding whip antennas are provided, 1.2 m and 2.4 m. To erect the antennas the 1.2 m whip can be flicked straight, while the 2.4 m whip should be laid on a flat surface and the inner wire pulled at the top end. Check that the sections are slotted together correctly. The antenna is fitted to the hexagonal socket on the lower left of the front panel. Care must be taken to ensure that the hexagonal shaped rod fits into the socket before the securing flange is screwed to the front panel.

NOTE: The 50 ohm BNC aerial socket should not be used with a whip antenna connected. The BNC socket is used in vehicle installations.

Fitting The Handset

4 The handset is fitted to either of the audio sockets on the front panel. A headset of suitable type may be used in preference to a handset.

Fitting The Radio To The Carrying Harness

5 The four bolts on the carrying harnesss locate with the four threaded sockets on the side of the radio. Ensure that the wing nut headed bolts are tightened evenly to secure the radio to the harness.

The Assembled Radio

6 The assembled Panther V Manpack Radio, is now ready for use.

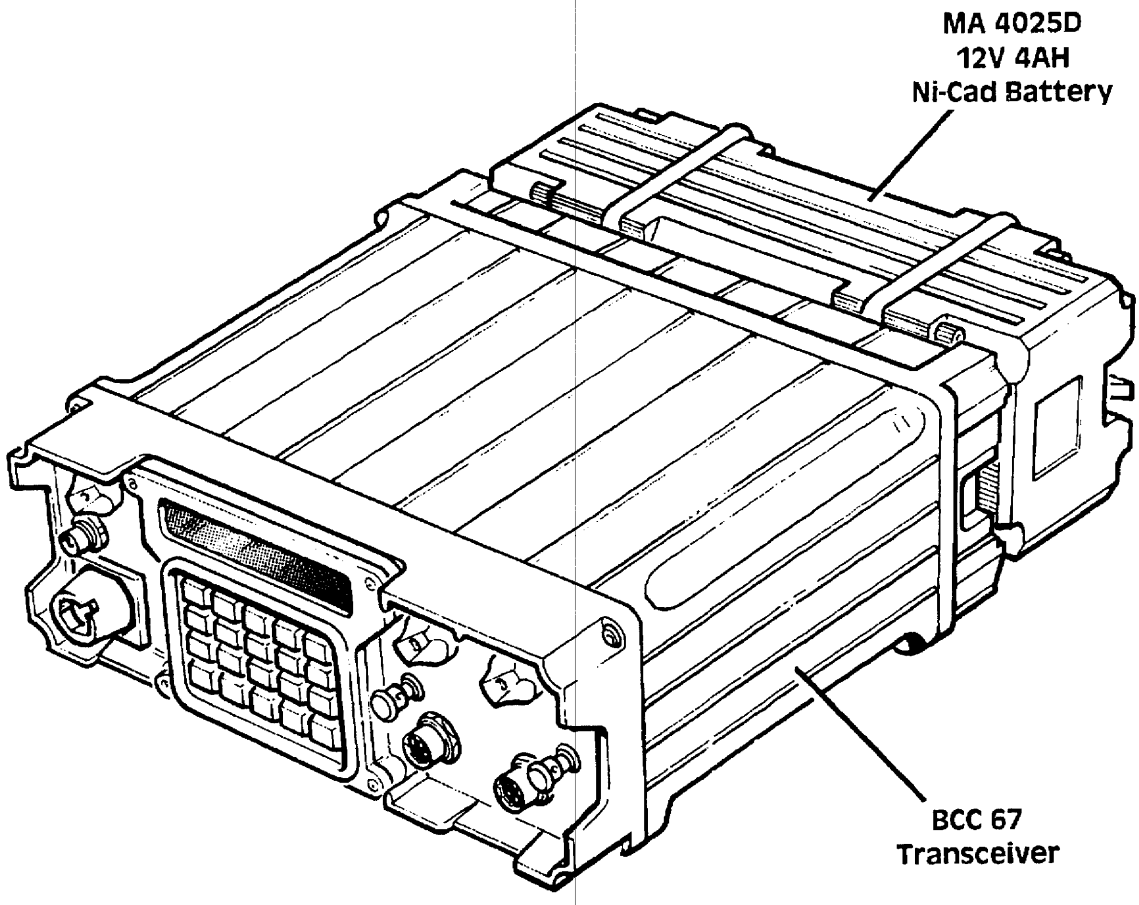


Fig 2.1
Manpack Radio

VEHICLE RADIO

Station Items

7 The following items make up the Panther V Vehicle Radio Station:

Panther V Radio BCC 67
Vehicle Interface Unit (VIU) BCC 767
Mounting Tray
Antenna Matching Unit (AMU) BCC 891B or 892B or suitable wideband antenna
Antenna 1.65 m whip to AMU
Handset/Headset

Leads (1) VIU RF In to BCC 67 (BNC sockets)

(2) VIU Rear Panel (10 way socket) to BCC 67 Rear Panel (10 way plug)

(3) VIU RF Out to AMU (BNC sockets)

(4) VIU Supply (two way plug) to Vehicle supply

(5) VIU earth braid to BCC 67.

Fitting The Radio To The Mounting Tray (Fig 2.2)

8 Mount the radio to the top of the VIU and secure the two flanges with the two screws. Fit the vehicle radio into the mounting runners and secure the two flanges with the two screws. These screws can also be tightened by using the captive tommy bar.

Fitting The Interconnecting Leads

9 Fit interconnecting leads as follows:

(1) Coaxial cable between BNC sockets on BCC 67 and VIU RF In.

(2) Coaxial cable between BNC sockets on AMU and VIU RF Out.

(3) 10 way cable between VIU Rear Panel 10 way socket and BCC 67 Rear Panel 10 way plug.

(4) Two way cable between VIU Supply two way plug to Vehicle supply.

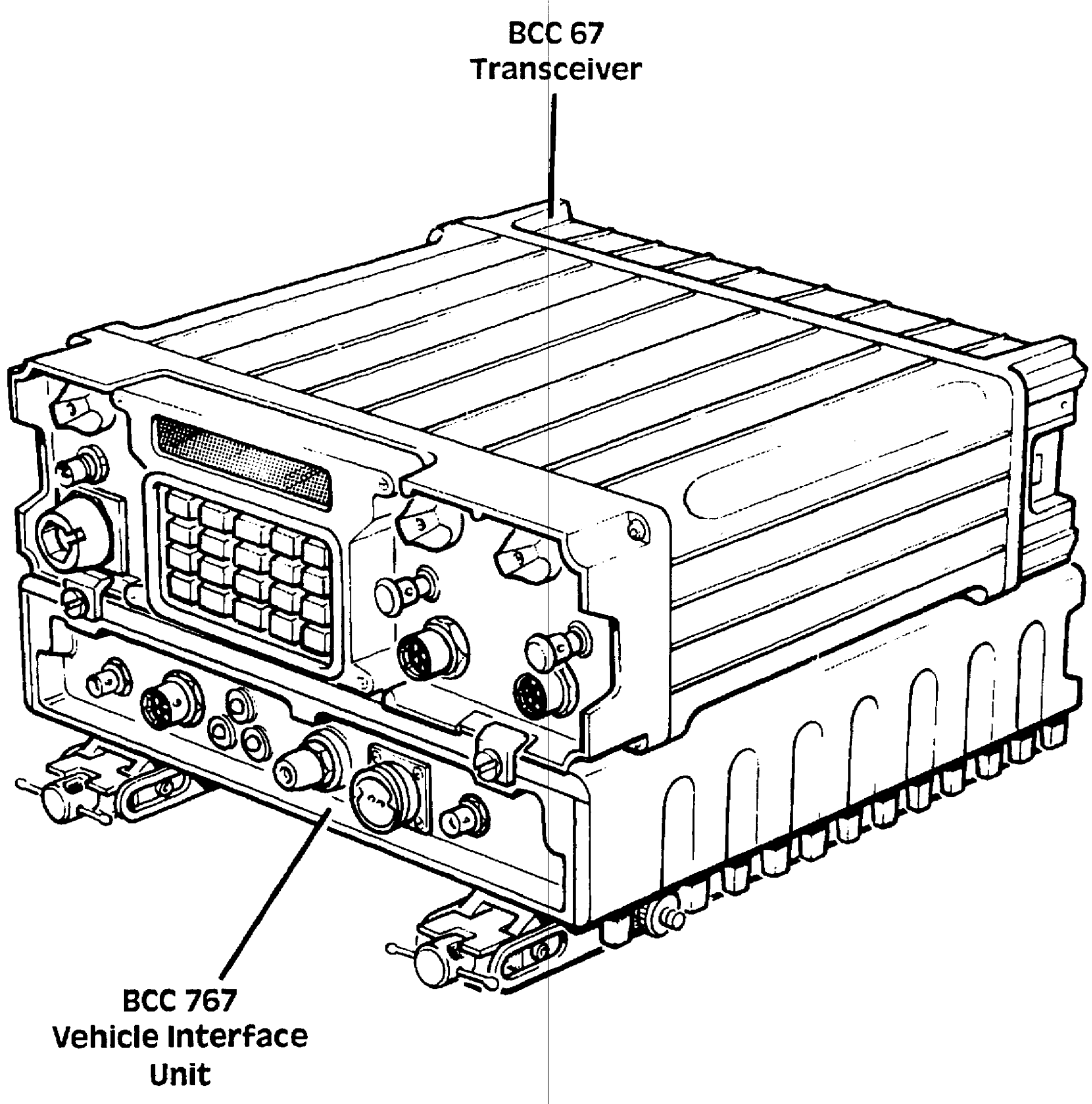
(5) An earth braid between VIU and BCC 67 at the back of both left side panels.

Fitting The Antenna

10 Fit the 1.65 m whip antenna to the AMU and secure by tightening the wing nut.

Fitting The Handset/Headset

11 Fit the handset or headset to either of the audio sockets on the front panel. Alternately a vehicle audio system could be connected to an audio socket.



E-321

Fig 2.2
Vehicle Radio

Connecting the Power Supply

12 Connect the power input to the supply plug on the VIU front panel. The vehicle supply required is 24 V nominal.

NOTE: Before switching on check that the High Power Output Selector on the front panel of the VIU is set to 16 W or 50 W as required.

VEHICLE CLIP IN RADIO

13 The Panther V radio used in a manpack role can be transferred to a vehicle station, where with a 24 V supply it can produce a high power of 20 W. A VIU is not required in this role.

Station Items

14 The following items make up the Panther V Vehicle Clip In Radio Station:

Panther V Radio

AMU BCC 891B or 892B or suitable wideband antenna

Antenna 1.65 m whip to AMU

Handset/Headset

Mounting Tray

Leads (1) AMU to BCC 67 BNC sockets

(2) BCC 67 Rear Panel (10 way plug) to VIU supply.

Fitting Instructions

15 These are similar to the Vehicle Radio Station except for the following:

(1) Fit the radio to the vehicle radio mounting tray.

(2) Connect the 24 V vehicle supply to the 10 way plug on the radio rear panel.

(3) Connect the coaxial cable between the BCC 67 BNC socket and the AMU BNC socket.

CHAPTER 3

OPERATING INSTRUCTIONS

CONTENTS

ILLUSTRATIONS

CHAPTER 3

OPERATING INSTRUCTIONS

NOTES: (1) The radio front panel layout is shown in Fig 1.1.

(2) For full operating information see the User Handbook Part No. BCC67/VRQ327/UHE-03.

PRELIMINARY

1 Connect the appropriate power supply and whip antenna as described in Chapter 2.

2 Connect the handset or headset to either of the audio sockets.

3 Set the Channel Selector Switch to the required operating channel.

4 Set the Keyboard Control to LOC (Local) - the fully anticlockwise position of the switch.

5 Switch the radio on by turning the Volume Control in a clockwise direction to a suitable volume position.

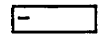
6 At switch on a radio test is automatically performed. If it is satisfactory the stored channel information will be displayed.

7 If a fault is detected an error message 'Critical', 'Severe' or 'Minor' is displayed and the error tone will be heard.

8 To clear the error tone press ↩.

9 If an error message exists the radio has failed its start up test and should be referred to a maintenance technician.

10 If 'Minor' is displayed the radio will operate in all modes, but with some loss of performance. See Built In Test (BIT) in Chapter 8 for more information on error messages.

11 In the manpack role the display will time out 10 seconds after any selection and  then  is displayed until the next selection. This will not occur in a vehicle station with 24 V supply.

HOW TO COMMUNICATE IN FIXED FREQUENCY CLEAR MODE

NOTE: These instructions assume that all channels to be used have been programmed with the required frequencies.

Using the Programmed Frequency

12 After switch on say, for example we have selected channel 1 and the display reads :

1 36850 FC=

1	indicates the channel number
36850	indicates the channel frequency in kHz.
FC	indicates Fixed frequency Clear mode of operation.
=	indicates a medium power output of 5 Watts.

NOTE: If the display reads channel title and not frequency, press ↩ and T to obtain channel frequency.

13 Assuming that this is the desired information the radio is now ready for normal use on this channel.

Changing the Programmed Frequency

14 If we now select Channel 2, and say the display reads:

2 75975 FC=

2	indicates the channel number
75975	Channel Frequency 75975 kHz.
FC	Fixed frequency Clear mode
=	Medium power output 5 Watts.

15 The information on the display is the same as for channel 1 except for the different frequency and channel. Now suppose that a new frequency is wanted - say 55975.

16 This frequency can be quickly introduced by turning the Channel Selector Switch to M, the Manual Channel and pressing in sequence the 5597 buttons on the keyboard. The display will now read 55975. (The fifth figure is entered automatically since there is a channel spacing of 25 kHz.)

17 Since we want Fixed frequency Clear mode and medium power operation we must check the display and press the following on the keyboard if necessary.

FXD for Fixed frequency Clear (FC) mode

PWR▲ for Medium Power.

The tenth, eleventh and twelth characters of the display are correct and the display reads:

m 55975 FC=

The radio is now ready for normal use on this the manual channel.

HOW TO COMMUNICATE IN FIXED FREQUENCY SECURE MODE

NOTE: These instructions assume that all channels to be used are programmed with Frequency and Hop/Secure codes.

18 Fixed frequency communication can also be made secure (encrypted). Secure operation may be selected by pressing the Fixed Frequency key FXD twice. The display will show:

m 55975 FS=

m indicates manual channel

55975 indicates Channel frequency in kHz

FS indicates Fixed frequency Secure mode

= indicates medium power output of 5 watts.

NOTE: If the display reads channel title and not frequency, press ↩ and T to obtain channel frequency.

The radio is now ready to communicate in the Fixed frequency Secure (FS) mode.

19 The operation is the same as for FC mode except that there will be a brief (less than 0.5 second) delay following pressel operation before the operator may speak. This is indicated by a short burst of rapid, high pitched, 'unready' pips.

20 Secure operation takes place when set to the FS and Hopping modes (including Free Channel Search). Secure transmissions can only be heard by another radio programmed with the same Hopping/Secure code; however a BCC 67 can hear a clear speech message when set to FS mode. This is the Fixed Clear Override condition which occurs automatically. Secure messages are identified by 'pip' audio tones which occur approximately every two seconds in the phones of the receiving station and in the sidetone of the transmitter.

HOW TO COMMUNICATE IN HOPPING MODE

NOTE: These instructions assume that all channels to be used are programmed with Frequency and Hop/Secure codes and Hop Set.

21 Check that the preliminary connections and settings given in Paras 1 to 3 are carried out, i.e. battery, whip antenna, handset or headset are connected and channel selected.

22 Set the Keyboard Control to LOC (Local), the fully anticlockwise position of the switch.

23 Switch the radio on by turning the Volume Control in a clockwise direction.

24 The display will show up to 12 characters of information stored in the selected channels memory.

25 Say, for example, we have selected Channel 5 and the display reads:

5 34625 hw=

5	indicates channel number
34625	indicates channel reference frequency in kHz
h	indicates hopping mode (slave station)
w	indicates wideband (bandwidth setting)
=	indicates medium power output of 5 Watts.

NOTES: 1 If the display reads channel title and not frequency press ↩ and T to obtain channel frequency.

2 The hopping bandwidth (position 11 of display) is normally set via the programmer. It can be set manually via the HSET position of the ON/OFF switch. The options are w - wideband, n - narrowband, f - frequency fill.

26 Check that the displayed information is correct. When last used the mode of operation (positions 10 and 11 of the display) could have been altered to FC. The channel memory will recall the last selection made. If necessary select hopping mode by pressing the hH key and check that the display shows hw in positions 10 and 11.

27 The radio is now ready to communicate on this channel as a hopping mode slave station. In a typical operation there are normally a number of slave stations, but only one radio, normally the Controller, is a hopping mode master station. The display on this radio would indicate H in position 10 of the display, this is selected by pressing the hH key twice rapidly.

28 In order to set up a hopping net, first ensure that the master and all slave stations are switched to the same channel and to the hop mode before making the initial synchronising transmission (otherwise synchronisation may take longer). The initial synchronising transmission should normally be made by the master station who will hear a rapid series of high pitched pips on operating the pressel for the first time. These continue for about five seconds while the other radios are becoming synchronised. When the pips have stopped the synchronising (Master) radio operator should start speaking and operate the net in the normal way.

29 Synchronisation will now be maintained even if the radio is switched off for up to 10 minutes or if there is a channel change. Initial synchronisation will occur if the radio has been switched off for greater than 10 minutes or is reprogrammed. Once synchronised there is no noticeable delay after operating the pressel unless the net has been silent for some time when the unready pips will indicate delays according to the net silence time. Hopping mode is normally Secure and to indicate that it is, slow pips (one in two seconds) will be heard in both sidetone and the received speech at low level.

NOTE: Initial synchronisation will also occur if the pressel is operated three times.

HOW TO OPERATE CHANNEL SCAN MODE

30 This mode enables an operator to monitor all programmed channels (up to 8) for a received fixed frequency clear signal.

31 To enter Channel Scan mode proceed as follows:

(1) Press MENU key, then go down list using ▼ for display of 'Clr Modes'. To select press ↩. Using ▲ and ▼ find display 'Scan', select using ↩.

(2) Check display is:

scan in positions 4 to 7

\ (clockwise rotating pointer) in position 10

C in position 11.

= in position 12 (power selected).

32 The radio will then scan the channels for a received signal. The frequency of a received signal will be displayed for up to three seconds. A short application of the pressel will enable that channel to be locked onto for the duration of the signal. Within five seconds of traffic ceasing on that channel, the operator can transmit on the displayed channel frequency. After that the radio will revert to scanning the other channels.

NOTE: If the channel was not locked onto or the operator transmits after five seconds of traffic ceasing, the channel will revert to operating on the programmed channel frequency.

33 To exit Channel Scan another communication mode should be selected.

HOW TO OPERATE TWO FREQUENCY SIMPLEX MODE

NOTE: These instructions assume that all channels to be used have been programmed with the required frequencies.

34 Two Frequency Simplex mode is used when pairs of radios need to be used as repeater stations in order to extend the working range of the net.

35 To enter Two Frequency Simplex mode proceed as follows:

(1) Press MENU key, then go down list using ▼ for display of 'Clr Modes'. To select press ↩. Using ▲ and ▼ find display '⇄FC', select using ↩.

(2) Check display is:

⇄-FC in positions 4-7

⇄ in position 10.

C in position 11.

= in position 12 (power selected).

(3) Press ↩ then 1 to display programmed transmit frequency.

(4) Press ↩ then 2 to display programmed receive frequency.

(5) Ensure that other repeater stations are programmed with the same pairs of frequencies.

HOW TO OPERATE FREE CHANNEL SEARCH MODE

36 Free Channel Search (FCS) is used when communication is difficult because of a large number of blocked channels resulting in poor quality reception. In FCS mode the radio will search for a quiet channel on which to communicate. FCS uses hopping synchronisation to acquire a new channel.

37 To enter FCS mode proceed as follows:

(1) Press FCS to enter free channel search mode.

(2) Check display is:

h in position 10 (assuming hopping slave previously selected)

\ (clockwise rotating pointer) in position 11

(3) When the radio is set to transmit it will now automatically find the best channel and display the best frequency.

(4) Similarly in receive the radio will automatically receive an FCS transmission and display the best frequency.

(5) If free channel search is set on the receiving radio then within 5 seconds of traffic ceasing on that channel the operator can transmit on the displayed quiet frequency. After that the radio will revert to choosing its own quiet frequency.

KEYBOARD CONTROL SWITCH

38 With the Keyboard Control Switch set to LOC (Local) the radio is controlled by its own keyboard. This position is used for normal local operation. With the switch set to LOC ECON (Local Economise) the operation is the same as for the LOC position except that a battery saving facility is provided.

39 With the switch set to DIS (Disabled) the keyboard is inactive to prevent the buttons being accidentally knocked and selected. The display on the radio and the LEDs on the VIU are also turned off in this position to avoid showing a light.

40 The REM ECON (Remote Economise), REM (Remote) and RCU (Remote Control Unit) positions are for use when the radio is controlled remotely.

CHANNEL SWITCH

41 The Channel Switch selects the radio operating channel. All 8 channels can be programmed with frequencies and where relevant with codes, data and hop set. The programmed frequency on the manual (M) channel can be overridden directly from the keyboard. Each channel can be programmed with its own code for the hopping and secure modes.

NOTE: Do not attempt to turn the Channel Switch past its restriction during normal operation. The restriction, situated after the channel 7 position, is fitted to prevent inadvertent selection of a program function.

VOLUME SWITCH

42 The Volume Switch has 7 positions and when set to any position from OFF switches the radio on. The W (Whisper) position enables a whispered transmission to be heard satisfactorily by a receiving station, also received signals and sidetone are at a reduced level. Positions 3 to 6 give increasing levels of audio. The last position, * is the Noise On facility, which gives a hiss in the phones to enable the receiver operation to be checked.

NOTE: Do not attempt to turn the Volume Switch past the restriction during normal operation. The restriction, situated after the * (Noise On) position, is fitted to prevent inadvertent selection of a program function.

CHANGING THE POWER OUTPUT SETTING

43 To change from medium power output to low power press the PWR▼ key on the keyboard -the display twelfth character will show -. To select medium power press the PWR▲ key - the display twelfth character will show = . To select high power press the PWR▲ key - the display twelfth character will show ≡ (see Note). The AR/I key selects Intercom, zero power, and the twelfth character will show Ic. To return to the operational mode reselect the required power level, using PWR▲ or PWR▼.

NOTE: In the manpack role if high power is selected medium power = will be displayed. High power can only be selected in the vehicle radio installation and in the vehicle clip in station with 24 V supply.

CHANGING THE MODE OF OPERATION

44 The operating modes Fixed Frequency Clear, Fixed Frequency Secure and Hopping (Master or Slave) are selected by the keys FXD, (once for Fixed Clear, twice for Fixed Secure) and hH. Position 10 and 11 on the display indicates whether the mode is FC, FS or Hopping Wideband (hw slave, Hw master, 'w' indicating that wideband has been programmed for the hopping mode).

45 The other operating modes are set as follows:

(1) Channel Scan. Press MENU then select 'Clr Modes' and 'Scan' for display of 'scan' (positions 4 to 7), \, (a clockwise rotating pointer - position 10) and C (position 11).

(2) Two Frequency Simplex. Press MENU then select 'Clr Modes' and ⇄FC for display of ⇄-FC (positions 4-7), ⇄ (position 10) and C (position 11).

(3) Free Channel Search. Press FCS for display of h or H (position 10) and \ , (a clockwise rotating pointer - position 11). Check for tone when transmitting and receiving.

46 To change from Normal to Automatic Rebroadcast:

Press AR/I for Automatic Rebroadcast - for display of A (position 9).

To revert to normal mode press AR/I again - A is removed from display.

47 To select Intercom, press ↩ then AR/I for display of Ic (position 12). To select Call press and hold the AR/I key for display of Ic (position 12).

USING FILL GUN AND PROGRAMMER

Introduction

48 The BCC 706C Fill Gun and the Panther PC Programmer SP 3635 provide data storage with the capability of loading Racal Programmable Transceivers with the necessary data. The Fill Gun is a pocket sized unit which is used to transfer electronic data only, having no means of manual data entry. The Programmer has a keyboard and display for the entry of data, checking the data entered and for operator prompts.

49 Use of the Programmer and Fill Gun allows for complete programming of the radio. It is not possible to partially programme a radio by over-writing only those parts which need to be changed.

Using Fill Gun BCC 706C

50 The Fill Gun is shown in Fig 3.1 and has the following main features:

(1) Rotary Switch consisting of 10 fill store positions and a Z (zeroise) facility. A lock prevents inadvertent Z selection.

(2) Two Status LEDs as follows:

(a) Red annotated NR is on when loading fill, off when fill complete.

(b) Yellow annotated ON is off when loading fill, on when fill complete.

(3) Connector to radio fill socket.

(4) Battery for memory back up and powering the unit when connected to a PC.

NOTE: The Fill Gun receives power from the radio it is filling.

(5) A White Board is provided for the operator to annotate the Fill Gun and details of the fill stores.

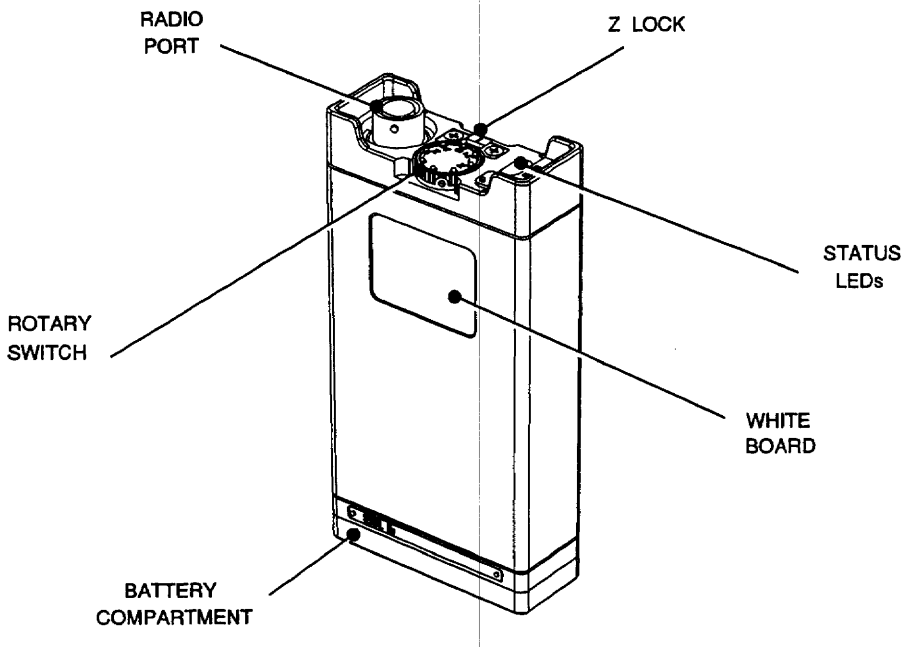


Fig. 3.1 Fill Gun BCC 706C

51 The following section assumes that the Fill Gun has already been filled with data from a Programmer. This data, held in the Fill Gun, may then be used to fill any number of radios with assurance that each radio has the same data entered into it.

52 To use the Fill Gun, set the rotary switch to the required Fill Store from 1 to 10, then switch on the BCC 67 radio in a normal operating mode with the channel switch set to EXT. Connect the Fill Gun to any vacant audio outlet socket using the connecting cable, part number 794958-0100. The audio socket selected must be programmed for Asynchronous Control Mode see Chapter 6 of the BCC 67 User Handbook Ref. BCC67/VRQ327/UHE - 03. The BCC 67 should not be set to a "program" mode when using the Fill Gun.

53 As soon as the Fill Gun is connected it starts to fill the radio. The red light on the Fill Gun lights and the display on the radio shows rapidly changing digits. When the radio is filled and all the data has been accepted the red light goes out and the yellow light comes on. The radio has now been filled and the Fill Gun should be disconnected. If the radio cannot accept the data, the lights on the Fill Gun will start to flash on and off.

54 A radio can be filled from a Fill Gun over the two wire remote lines if the radio is being controlled by another radio switched to the RCU mode. Connect the Fill Gun to the left hand socket of the radio in RCU mode and proceed as in Para 53. This will program the remote radio and will not program a local radio in RCU mode. Remember to set the remote radio back to "Normal" mode after programmming it.

55 The Fill Gun collects the electronic log record information which is then available to be read on an electronic log reader application.

56 For more information on the Fill Gun see:

Operators Card Ref. BCC706C/OCE-01
Technical Manual Ref. BCC706C/TMME-01

Panther Programmer SP3635

57 The Programmer may be used to program the radio direct or a Fill Gun which can then be used to program a radio with all the fill and operational parameters. The Programmer can be used to edit and store radio net information for a number of radios and the appropriate net information can be downloaded to the Fill Gun. The Fill Gun is used to down load the data to the respective radio. The BCC 67 requires data for VHF nets. A complete set of data for a Panther VHF net is outlined in Chapter 6 (Manual Programming) of the BCC 67 User Handbook Ref. BCC67/VRQ327/UHE - 03.

58 Information on the Panther Programmer SP3635 is given in the Operators Manual Ref. SW3635/OME.

CHAPTER 4

OPERATOR MAINTENANCE

CONTENTS

CHAPTER 4

OPERATOR MAINTENANCE

INTRODUCTION

1 Operator maintenance of the BCC 67 is restricted to the periodic performance of the cleaning, lubrication and inspection procedures set out in this chapter.

2 The frequency with which each of the user maintenance procedures is applied, and whether or not every operation of a particular procedure is required at every maintenance period, depends upon local circumstances. However, it is recommended that all the procedures are conducted in full before returning the radio to stores following its use in the field.

TOOLS AND MATERIALS REQUIRED

3
(1) Small, clean, dusting brush.
(2) Clean, soft, lint-free cloth.
(3) Clean water.
(4) Petroleum jelly.

CLEANING

WARNING

UNDER NO CIRCUMSTANCES ATTEMPT TO CLEAN THE RADIO USING SOLVENTS, DETERGENTS OR ABRASIVE SUBSTANCES. TO DO SO CAN RESULT IN DAMAGE TO THE DISPLAY WINDOW AND/OR THE UNIT SEALS, THUS IMPAIRING THE OPERATIONAL EFFICIENCY OF THE UNIT.

DO NOT ZEROISE (Z ON THE CHANNEL SWITCH) THE BCC 67 UNLESS THIS IS A REQUIREMENT AND IN ANY CASE DO NOT LEAVE IN THE ZEROISE POSITION FOR EXTENDED PERIODS.

4 Proceed as follows:

(1) Taking care not to scratch or otherwise damage the window protecting the display, remove all loose dirt, grit, etc. from the exterior of the radio. A dusting brush should be used to clean out corners and recesses, around the keypad pushbuttons, etc.

(2) Moisten a piece of clean, lint-free cloth in clean water (warm water may be used, if available).

(3) Using the moist cloth, thoroughly wipe over the exterior surfaces to remove any remaining dirt and stains. Caked dirt should be 'soaked' off.

(4) Using a dry, clean, lint-free cloth, dry the exterior of the radio. Ensure that all moisture is removed from within recesses, connector sockets, etc.

ANTI-CORROSION

5 Immediately following cleaning, the battery input terminals on the BCC 67 (i.e. the pair of stud contacts contained in the recess in the rear panel) must be coated with petroleum jelly to protect them against corrosion.

6 It is important that this protection is maintained while the radio is in use, especially if there is a possibility that it will be subjected to immersion in salt water or exposed to salt spray.

INSPECTION

7 Should a defect be found during any stage of the procedure which follows, the first-line repair authority must be notified. Under no circumstances should user personnel attempt any repair.

8 Proceed as follows:

(1) Examine the exterior of the radio for indications of mechanical damage, paying particular attention on the BCC 67 to the seals fitted between the front and rear panel assemblies and the centre sleeve section of the case.

(2) Confirm that all the screws fixing the panel assemblies are present and securely tightened.

(3) Inspect the display window for scratches and other marking. In particular, check that there is no blemish which could obscure or distort any part of the display or which could prevent light reaching the sensor that controls the display brightness.

(4) At the CONTROL switch:

(a) Check that the control knob is correctly orientated and securely fastened.

(b) Check for the correct mechanical operation of the switch over its complete range of movement.

(5) At the CHANNEL and the VOLUME-ON/OFF switch in turn:

(a) Check that the control knob is correctly orientated and securely fastened.

(b) Check that the mechanical lock operates and releases correctly.

(c) Check for the correct mechanical operation of the switch over its complete range of movement.

NOTE: Do not put the CHANNEL switch to Z (zeroise) unless this is required to be done.

(6) Depress and release each of the keypad pushbuttons in turn, checking that the pushbutton operates and releases correctly (a slight click should be heard).

(7) Check that each of the multi-way and coaxial connectors on the front and rear panels is undamaged and securely fitted. Also check that the connector interior and pins are clean and dry.

(8) Check that all plugs and sockets on the front panel are provided with a protective cap. Confirm that each of these caps is clean and undamaged and that the cap retaining strap is intact.

(9) At the rear panel, check that the battery terminals are clean and are protected against corrosion by a film of petroleum jelly.

(10) Check all headsets and handsets for external damage and cleanliness.

(11) Check the whip antenna for damage and correct function.

CHAPTER 5

FUNCTIONAL DESCRIPTION

CONTENTS

ILLUSTRATIONS

CHAPTER 5

FUNCTIONAL DESCRIPTION

RECEIVE RF PATH (Figs 5.1, 5.2)

1 The received RF signal enters the Antenna Matching Unit (AMU) by either the 50 Ω socket or the manpack whip socket. The received RF signal is then high-pass filtered and fed via coaxial cable to the RF Head.

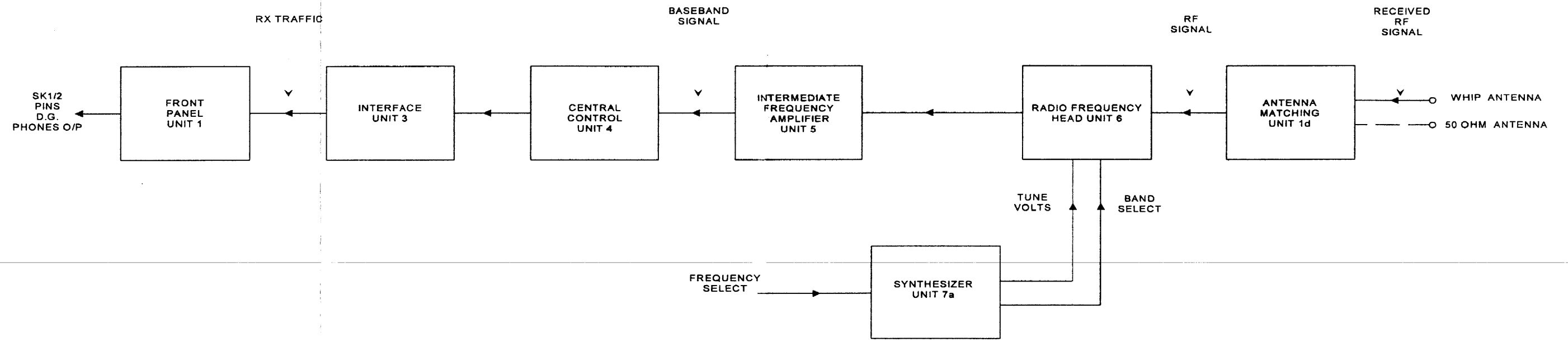
2 The RF Head contains selective hopping filters which are designed to reduce cosite interference off channel and to provide low noise amplification. The RF Head also contains the hopping local oscillator which is used to down convert the received RF signal to an Intermediate Frequency (IF) signal at 10.7 MHz for the IF Amplifier. The local oscillator (LO) is a three band oscillator which is phase-locked to the Temperature Controlled Crystal Oscillator (TCXO) in the synthesizer unit. The phase-locked loop consists of the TCXO, synthesizer loop filter and the LO, and is controlled by the frequency information from the Central Control Unit (CCU).

3 Once down-converted to 10.7 MHz the IF signal passes to the IF Amplifier which provides narrow crystal filtering for selectivity. The IF Amplifier then amplifies the IF signal and feeds it to a discriminator to extract the baseband received traffic from the carrier. The IF Amplifier also provides carrier and 150 Hz squelch detection for the radio. After the signal leaves the discriminator the IF Amplifier filters the baseband received traffic and amplifies it to an appropriate level for the CCU.

4 The receive traffic is processed by the CCU where de-interleaving, decryption and data de-compression may occur and is fed to the Interface where delta demodulation and audio processing is carried out. The Forward Error Correction (FEC) data output is produced after decryption using the serial keystream input from the keystream generator and FEC decoding.

5 The audio and digital outputs are processed by the Front Panel and fed via SK1/2 pins D and G to the phones.

RECEIVE PATH



TRANSMIT PATH

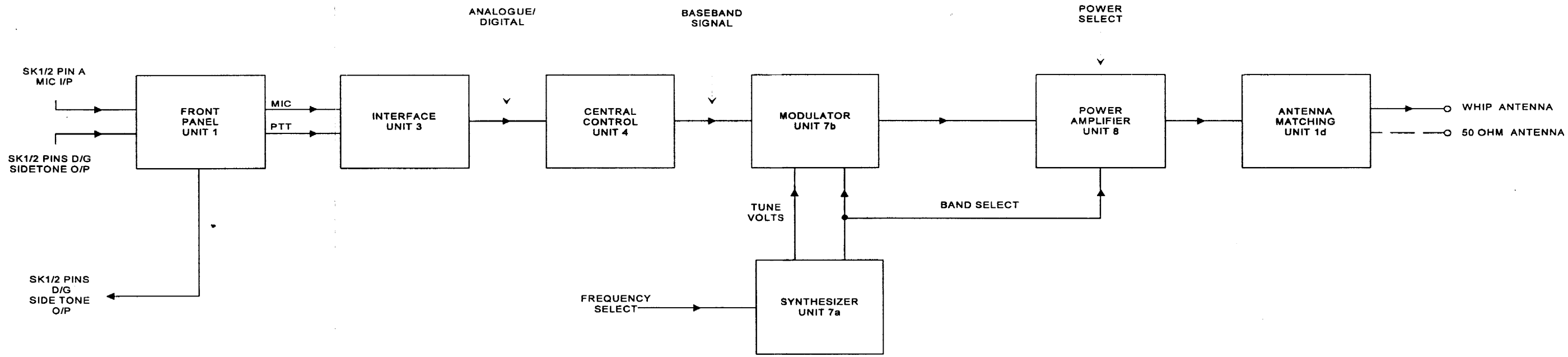


Fig 5.1
Functional Diagram
Panther V Radio

TRANSMIT RF PATH (Figs 5.1, 5.3)

6 The audio or digital input at SK1/2 pin A is fed via the Front Panel to the Interface. The PTT input at SK1/2 pin F is also fed to the Interface. The Interface provides audio processing and delta modulation when required. The analog/digital output is fed to the CCU and returned to the Front Panel as sidetone.

7 The transmit traffic (at baseband) to be transmitted is fed from the CCU, where encryption, interleaving and synchronization packages may have been added, to the Synthesizer/Modulator (except in Fixed Clear modes). The encryption for the data input is achieved after FEC encoding and a serial keystream input from the Keystream Generator.

8 The transmit traffic is then low-pass filtered to 11 kHz before being modulated up to the carrier frequency. The carrier frequency is provided by phase-locking the slave oscillator indirectly to a TCXO via a master oscillator.

9 The synthesizer IC provides the tuning voltage (VT) to the oscillator and the band switch information based on the frequency selection signals from the CCU. The slave oscillator is a 1 Watt, low noise oscillator which is modulated with the filtered traffic. The modulated RF signal is passed through a coaxial cable, to the Power Amplifier (PA) in the rear panel.

10 The PA has a ramp attenuator which smooths the rise and fall edges of the hops to reduce AM sidebands created as a result of the hopping mechanism. The RF modulated signal is then either fed into the PA or is by-passed in low power mode (0.1 W). The PA provides either 5 Watts or 20 Watts of output power depending on the power level selected on the front panel keypad, and whether a 24 Volt supply is provided. The RF modulated signal is then low pass filtered by one of three filters, to reduce harmonics from amplification. After the PA the RF modulated signal to be transmitted is fed via a coaxial cable to the AMU located at the front panel.

11 In the AMU the RF modulated signal passes through a transmit switch to a high pass filter then on to either the 50 Ω socket or through a matching circuit to the manpack whip socket. If there is no 50 Ω load detected on the 50 Ω port the AMU automatically routes the RF modulated signal to the manpack whip socket.

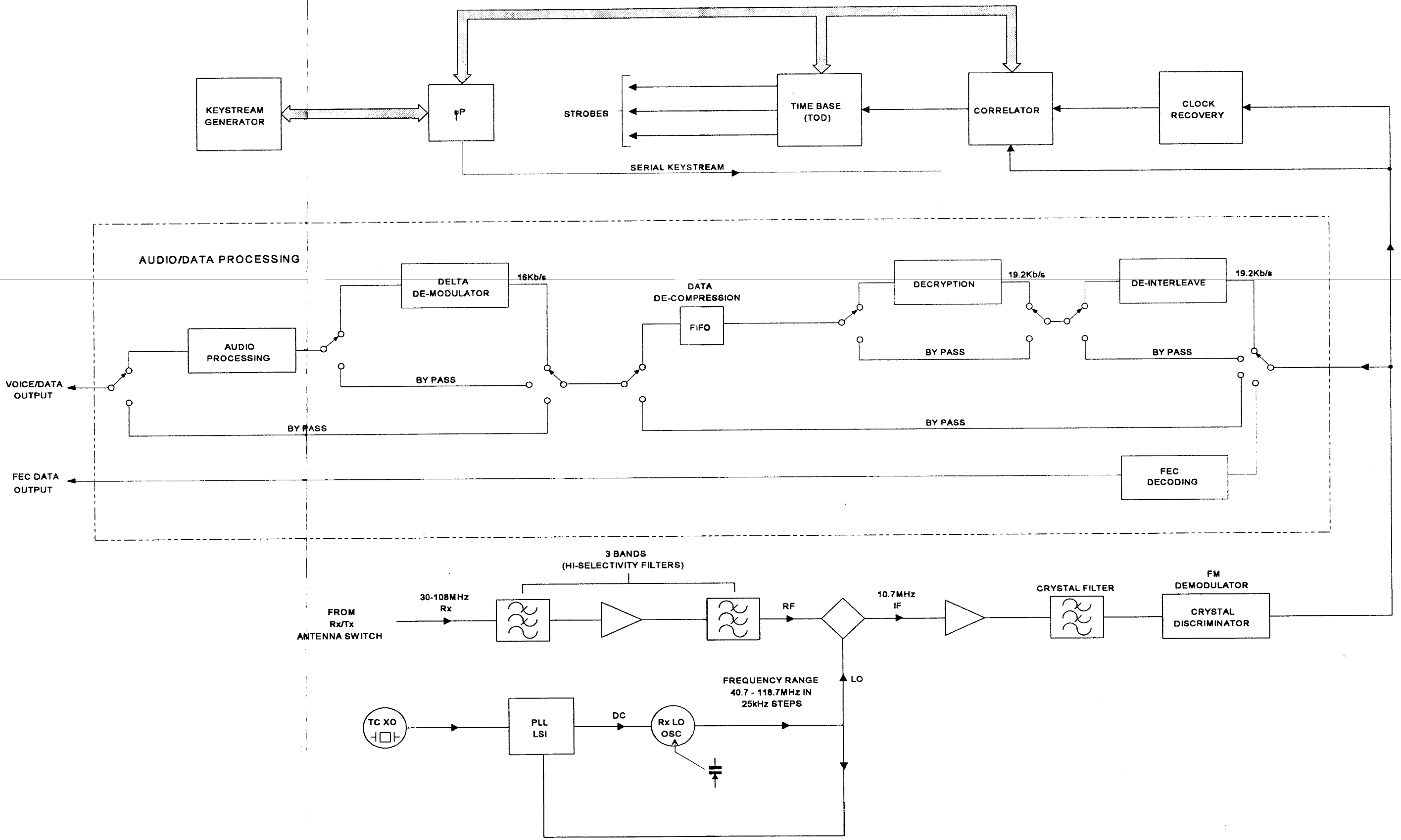


Fig 5.2
Functional Diagram
Receiver

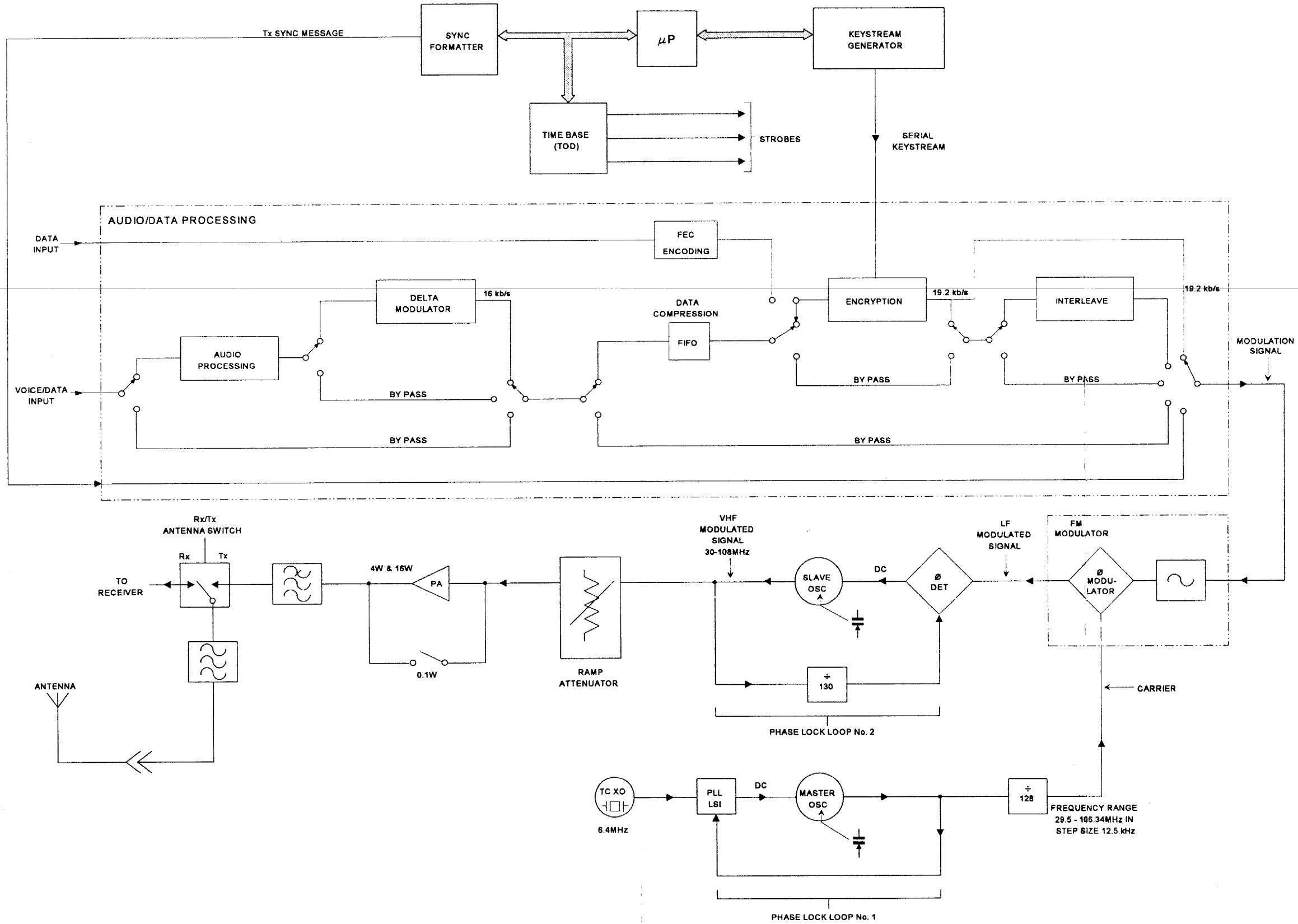


Fig 5.3
Functional Diagram
Transmitter

FRONT PANEL UNIT 1 (Fig 5.4)

NOTE: Description of controls and connectors relating to the Front Panel are described in Chapter 1.

Introduction

12 The front panel is designed to operate via a serial data line to the CCU. It is a microcontroller based system and acts as a machine interface to the radio, allowing the input of information by means of a keypad, switches and a display unit. Communication with the CCU is via a serial data bus. The front panel also provides facilities to fill, programme and zeroise the transceiver and provides a line interface for the remote lines and an RF interface via a 50 ohms socket or a whip antenna socket.

13 Audio and data signals are connected to the transceiver by two 13 way front panel connectors. These connectors also carry the pressel and auxiliary signals to and from the external equipment.

14 Fill information is entered into the transceiver at either audio socket and passes through to the CCU.

15 The Front Panel carries three Printed Circuit Board (PCB) assemblies. These are:

(a) The Front Panel PCB Unit 1b.
(b) The Display Unit 1c.
(c) The Antenna Matching Unit 1d.

NOTE: The Display Unit 1c is described within the Front Panel PCB Unit 1b.

Front Panel PCB Unit 1b

16 The electrical operation of the front panel is centred around an 8 bit microcontroller system which includes a controller software and port expander device and a microcontroller. The switches, keypad and display are connected to the input and output ports of the microcontroller system.

17 On receipt of a user input, keypress or switch selection, the microcontroller determines the source of the selection which is then sent to the CCU. If a key has been selected the CCU scans the columns and rows of the keypad switches to determine which key is selected.

18 If a valid switch state or keypress is determined an appropriate action is taken such as updating the display or the transmission of a serial message by the CCU.

19 The display is updated by messages returning from the CCU. The microcontroller sends the serial data to the display unit. The display senses the ambient light level and the microcontroller adjusts the display brightness accordingly.

20 The Control, Channel and Volume Switches provide inputs to the microcontroller system ports. Protection resistors are fitted to each port input line.

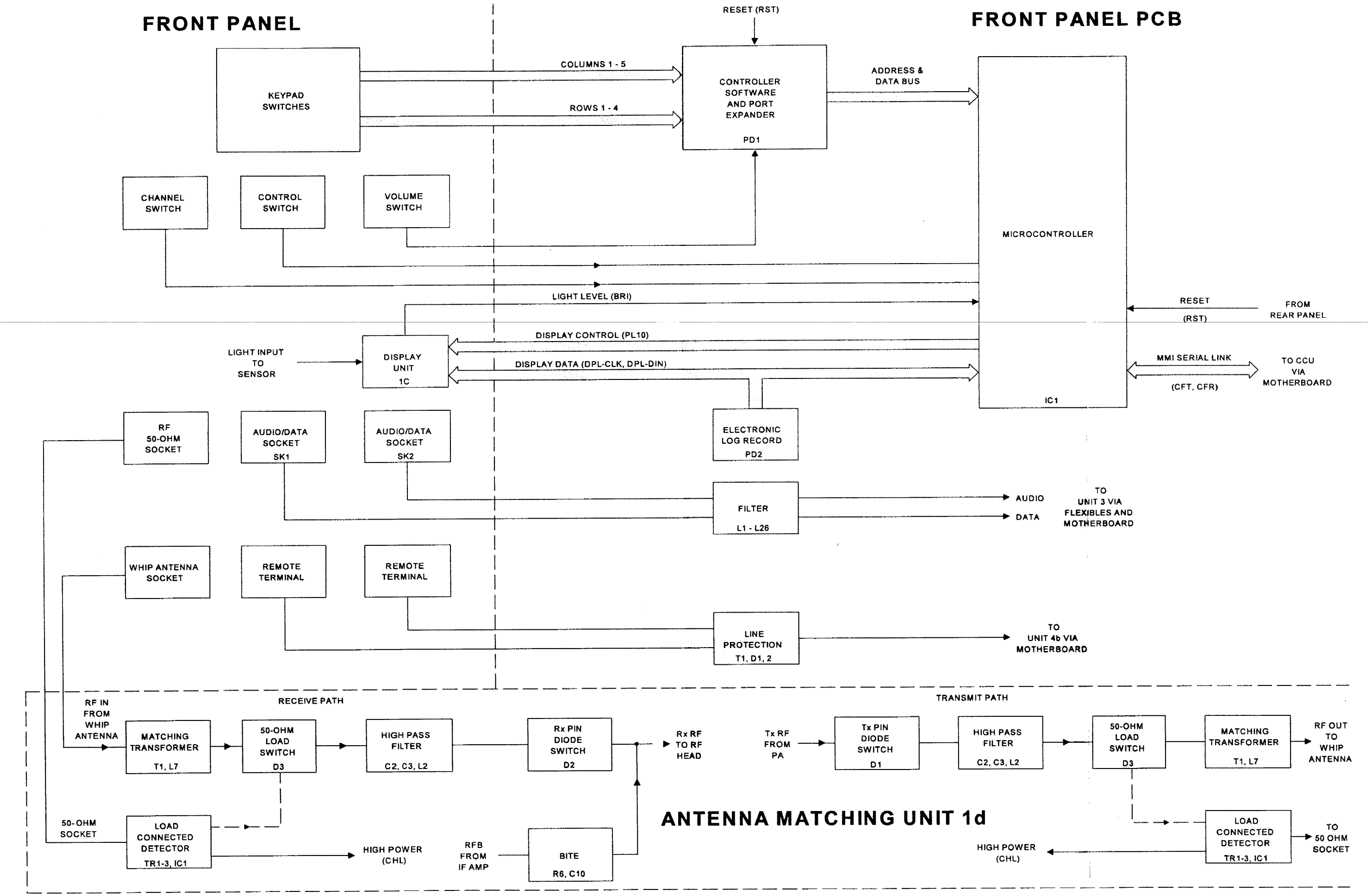


Fig 5.4
Functional Diagram :
Front Panel Unit 1

Antenna Matching Unit 1d

21 The AMU is attached to the Front Panel but plays no part in its operation. It connects between the antenna socket in use and the RF Head in receive mode and between the PA on the rear panel and the antenna socket in use in transmit mode.

22 The matching is suitable for a 1.2 m or 2.4 m whip antenna. It also provides a 50 ohm R.F. signal input/output line via the BNC socket on the front panel. The AMU operates over the frequency range 30 MHz to 108 MHz.

23 If the 50 ohm BNC socket is in use a Load Connected Detector causes a PIN diode to isolate the Whip Antenna Socket and allows high power to be selected.

24 In the transmit condition the R.F. from the PA is fed via a PIN diode switch to a band pass filter, and if a whip antenna is used, through a matching transformer to the antenna. The receive path to the RF Head is isolated by the Rx PIN diode being off.

25 In the receive condition the signal passes to the filter circuits. With a whip antenna fitted the signal is fed via the matching transformer to the band pass filter. The output is fed by the Rx PIN diode to the RF Head. The transmit path to the PA is isolated by the Tx PIN diode being off.

26 A built in test circuit enables the receive path to be tested. The signal RFB from the IF Amplifier is passed through to the RF Head.

INTERFACE UNIT 3 (Fig 5.5)

Introduction

27 The Interface PCB provides all the electrical connections between the circuits of the transceiver and the audio/data sockets. It produces microphone amplification and band pass filtering before being passed to an Automatic Gain Control (AGC) stage. A Continuous Variable Slope Detector (CVSD) modulation and demodulation circuit is provided for all secure modes.

28 The type of traffic can be either:

(a) Voice
(b) Analogue data
(c) Digital data.

29 The traffic format is either:

(a) Handset/headset Variable Level Audio (VLA)
(b) Fixed Level Audio (Rovis)
(c) FLA (Harness)
(d) Digital.

30 The following type/format combinations can be programmed on pins A and B of the audio/data connectors:

Type	Format
Voice	Handset/headset
	Rovis FLA
	Harness FLA
	Digital
	Analogue Data (FSK)
Digital Data	Digital

31 The traffic type/format information is fed to four Programming Decoders which act as comparators. This information is passed to the Field Programmable Gate Array (FPGA) and sent via an inter unit data bus to the CCU, which sets all affected circuits on the Interface Unit.

Transmit Path

32 Pin A is the entry point for the transmit path. The input can consist of four formats:

(a) VLA
(b) Rovis FLA
(c) Harness FLA
(d) Digital.

33 The VLA and Harness FLA inputs pass through the Microphone Pre Amplifier and into the Traffic Select Multiplexer. The Rovis FLA passes direct to the Multiplexer. The digital signal is fed via a Buffer stage to the Multiplexer.

34 The analogue signal passes through the AGC stage which adjusts the gain for a constant output level. This then feeds through to a Tx Band Pass Filter to a CVSD Modulator.

35 Traffic into the Tx Output Multiplexer is either analogue (TXA) from the Tx Band Pass Filter or digital (TXT) from either the CVSD Modulator or digital traffic from pin A. RS232 modes are provided by dedicated pins 1-6 on SK1 and SK2.

36 The output of the Multiplexer is the Baseband Tx Signal (TXA or TXT) to the CCU.

37 The transmit sidetone is taken from the Tx Band Pass Filter, fed into the Rx Traffic Select Multiplexer and then via the receive circuits to the phones.

38 PTT enters at SK1 or SK2 Pin F and passes through a Schmitt Buffer and Monostable circuit in order to remove switch bounce. Normally PTT is applied to the Logic Array where it is extracted and fed out as raw PTT.

Receive Path

39 The Baseband Rx signal (RXA) from the CCU is fed to a Mute Switch via a Rx Traffic Multiplexer. Digital signals from RXT are fed to the CVSD device via the FPGA.

40 The reconstructed analogue signal from the CVSD device is passed to the Rx Traffic Selector Multiplexer. The output of the Traffic Multiplexer is passed either through a RXA mute switch if it is analogue or directly to the Bandpass Filter. Output from the filter is passed through the Sidetone Select switch and passes out as either VLA or FLA. VLA passes through a Volume Control stage before entering the Output Multiplexer. FLA passes directly to the Output Multiplexer.

41 Depending on the programming mode the appropriate signal is fed out on Pin D or G via Output Amplifier stages. Appropriate clocks can be added at this stage from the FPGA.

42 Receive squelch is passed to the FPGA via the CCU control word or an inter unit data bus. The output dc level is fed via the Output Multiplexer and a buffer to Pin G. Squelch and Clock is not routed to pin G when programmed for handset/headset variable level analogue.

Alert Tones

43 Alert Tones are set from the CCU via an inter unit data bus. They are generated in the FPGA and are output to the phones via the receive circuits.

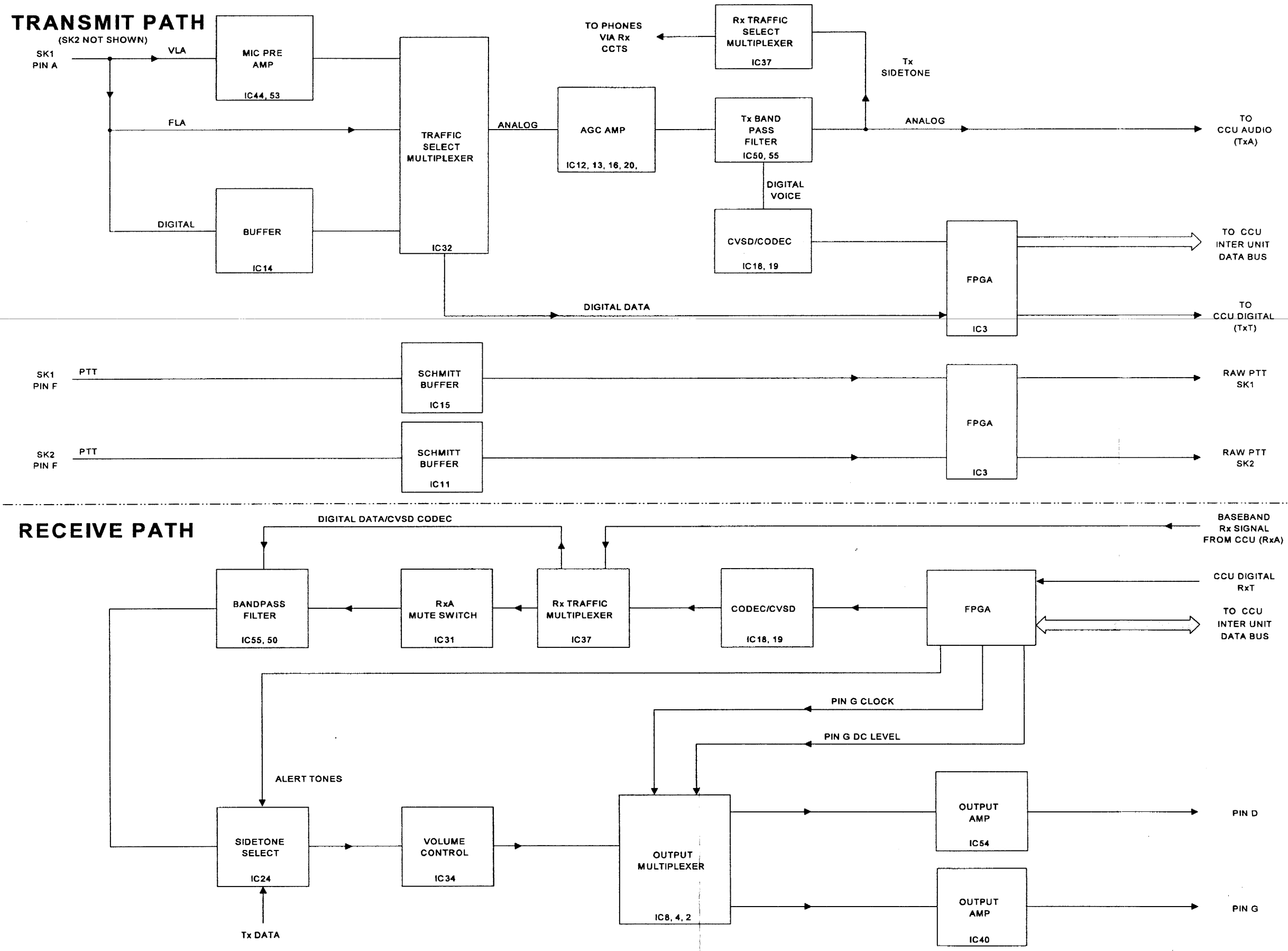


Fig 5.5
Functional Diagram
Interface Unit 3

CENTRAL CONTROL UNIT 4

Introduction

44 The CCU consists of two printed circuit boards:

Radio Control Assembly (RCA) - Unit 4a
Forward error correction and Remote line interface Assembly (FRA) - Unit 4b

45 The CCU provides the following functions:

(1) Control and monitoring of all the modules in the radio.

(2) Hardware and software systems to provide the transceiver Electronic Counter Counter Measures (ECCM) function.

(3) Front Panel interface to respond to commands and requests for transceiver operation.

(4) Input and storing of fill information.

(5) Remote and data interfaces for traffic and control messages via the FRA. The interface is used for Remote Control, Auto-Rebroadcast and Intercom functions.

(6) Control and monitoring of the Built In Test facility within the transceiver.

46 The RCA is a single board assembly which is mounted together with the FRA board within the CCU module. It is based on a MC68332 microcontroller, operating with 2 MByte (1024K x 16) of Flash EPROM program memory and 256 KByte (128K x 16) of RAM. The RCA board connects to the radio motherboard via a 120 way connector, and to the FRA daughter board via a surface-mounted 80 way 2 row connector.

47 The flash program memory of the board is in-system programmable. A system 'bootstrap' program is installed on the board via the Background Debug Mode (BDM) interface of the microcontroller. The BDM interface is connected to an Automatic Test Equipment based flash memory programming system via test pins on the board edge connector. The bootstrap program provides facilities for downloading the operational software of the transceiver via the asynchronous Serial Communication Interface (SCI) of the microcontroller, which also provides the Asynchronous Control Mode (ACM) serial port of the transceiver. This can be connected to a host PC running the Racal Software Upgrade utility in order to download and install new software in the transceiver.

48 The RCA operating software implements the Front Panel display and keyboard user interface (via the Front Panel microcontroller system) and controls and monitors functions provided by the other transceiver modules. Within the CCU it controls the ECCM and traffic encryption systems, the formatting and routing of traffic signals, and the FEC data system and Remote Line Interface on the FRA.

49 Communication with the Front Panel microcontroller is via a bidirectional Universal Asynchronous Receiver Transmitter (UART) link. The RCA also provides a TDS789 interface which, in conjunction with circuits on the Interface board, allows Fill programming by Jaguar ancillaries that connect to a 13-way Front Panel socket. Fill programming can also take place via the Asynchronous Control Mode (ACM) serial port.

50 Communication with the Digital Signal Processor (DSP) on the FRA board takes place via the memory-mapped Host Interface (HI). The DSP controls two Front Panel data interfaces (Ports 1 and 2) and an internal USART (Universal Synchronous Asynchronous Receiver Transmitter) based data interface that is part of the Remote Line Interface (RLI) system. The DSP software provides the link level functions, including error correction, required for enhanced data transmission modes.

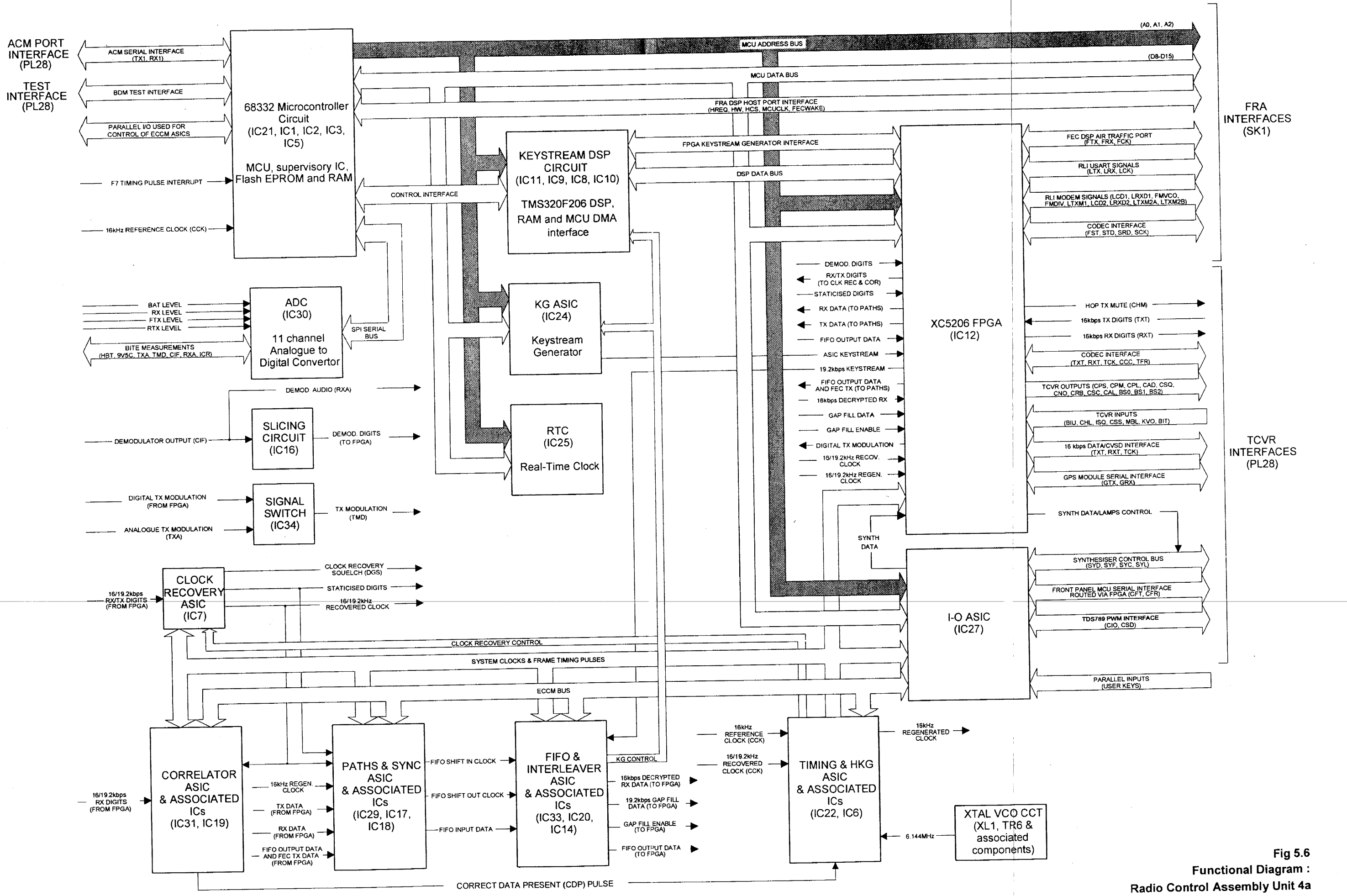


Fig 5.6
Functional Diagram :
Radio Control Assembly Unit 4a

51 The Over The Air Rekey (OTAR) signalling system is also operated via the Forward Error Correction (FEC) DSP and provided with error correction coding. The RCA microcontroller controls the RLI signalling circuits, which are located on the FRA board, via a Field Programmable Gate Array (FPGA) Input/Output (I/O) interface. It also controls the RLI supervisory channel UART and FSK/FM modulator circuits within the FPGA, and implements the High level Data Link Control (HDLC) protocol used by the RLI supervisory channel.

52 A set of seven Application Specific Integrated Circuits (ASIC) implement most of the ECCM system functions including timebase generation, ECCM bus and Synthesizer Control interfacing, Hopping and Crypto keystream generation, Sync formatting, clock recovery, signal routing, RX signal correlation and data interleaving. The MC68332 processor controls the ASICs via memory-mapped interfaces or the ECCM serial control/data bus.

53 The FPGA provides a number of radio interface functions including parallel and synchronous serial I/O interfaces, signal routing, interrupt control, hop timing functions, and the interfaces to both the Jaguar compatible Keystream Generator (KG) ASIC and an optional DSP-based keystream generator. The DSP system provides the facility for the keystream algorithm to be installed or updated by downloading a code module via a serial interface on the board. The KG ASIC provides compatibility for Jaguar secure and hopping communications.

Radio Control Assembly Unit 4a (Fig 5.6)

54 The CCU is driven by a Microcontroller circuit which operates with 2 MByte (1024K x 16) of EPROM programme memory and 256KByte (128K x 16) of RAM. The radio operating software is loaded from a PC or fill gun via a front panel audio socket. It enters the EPROM via the Asynchronous Control Mode (ACM) serial interface port. When the main power is removed all memory is backed up by a standby battery. The standby battery, which is housed on the Motherboard, is a 1.5 AH lithium and has a life in excess of 7 years.

55 A Real Time Clock maintains the calendar time via the standby battery. The microcontroller provides a 16 bit external data bus and an external address bus of up to 24 bits. It also provides a Host Port control bus for FEC data interface on the FRA, unit 4b, a control interface to the Keystream DSP and a serial bus to the Analogue to Digital Converter.

56 The 11 channel 8 bit Analogue to Digital Converter is used to measure the received signal level indication input (RSI), the forward transmit power level indication input (FTSI) and the battery pack voltage indication input (BAT) during normal transceiver operation. It is also used to perform BITE measurements of the standby battery input (HBT), 9.5V supply input (9V5C), TX audio signal (TXA), RX audio signal (RXA), demodulated receiver signal (CIF), and RLI received audio signal (ICR).

57 The Keystream Digital Signal Processor provides the DSP data bus and Keystream Generator Interface to the FPGA circuit. Control is provided by the control interfaces from the Microprocessor and the Crypto Keystream Generator (CKG) ASIC control from the First In First Out (FIFO) and Interleaver ASIC.

58 The Crypto Keystream Generator provides pseudo-random binary, either serially, in the form of a bit stream used for data encryption, or in parallel, in the form of byte values for use by the software for hop frequency selection. The CKG, which provides Jaguar compatibility, is controlled by the FPGA via the FIFO / Interleaver circuit.

59 The Xilinx FPGA is a SRAM-based part which is configured at power-up, via the Microcontroller data bus connections. A slave FPGA device is serially configured within the Interface module, using a daisy-chain connection to the serial data and clock pins of the RCA device. When the RCA FPGA is configured it provides the following peripheral functions and interfaces:

(1) Parallel TCVR input and output interfaces used to control other transceiver modules.
(2) Inter unit serial bus interface used for communication with the Interface module FPGA.

(1) Parallel TCVR input and output interfaces used to control other transceiver modules.
(2) Inter unit serial bus interface used for communication with the Interface module FPGA.
(3) CVSD digital voice interface between the RCA and Interface modules.
(4) FEC 'air traffic' interface used to route 19.2 kbit/s TX and RX data streams to the FRA board.
(5) Supervisory channel UART and FSK modulator circuits for Remote Line Interface (RLI) system.
(6) Control of the RLI signalling circuits on the FRA.
(7) Traffic signal routing functions required to augment Paths ASIC.
(8) Timing functions required to augment Timing ASIC.
(9) Hopping transmit mute timing and control.
(10) Control of microcontroller interrupt signals.
(11) Signal routing and clock generation for the codec interface between the FRA and Interface boards.
(12) Serial interface for the internal GPS module option.
(13) Serial keystream generator circuit and interface for the DSP-based Keystream Generator option.

60 The Input Output ASIC is a memory mapped periphal of the microcontroller which controls the following functions and interfaces:

(1) A four wire ECCM serial bus interface used to communicate with the Timing, Paths and Sync formatter and Correlator ASICs.
(2) Serial TCVR input and output interfaces can provide localised parallel TCVR I/O expansion via external shift register circuits.
(3) The synthesizer interface used to send new frequency data to the synthesizer (Unit 7) and to monitor the frequency lock status and timing.
(4) The PWM interface provides a TDS789 compatible interface for Jaguar ancillaries.
(5) A UART peripheral is used to provide the serial communications interface between the RCA and Front Panel microcontrollers. Messages are passed between the two modules at 9600 baud.
(6) The State Change Detector peripheral can be used to monitor up to eight external inputs and generate an interrupt when any one of them changes.

61 The ECCM interface is a four wire bus which provides both control and data transfer between the ECCM hardware. The hardware is used to perform part of the ECCM function together with the software. The ECCM hardware is as follows:

(1) The Correlator monitors incoming received data to detect valid sync messages, which results in the generation of the Correct Data Present (CDP) signal. This operates in parallel with the clock recovery process.

(2) The clock recovery circuit is used to recover a clock from the transmit or receive traffic, for traffic routing and clocking purposes.

(3) The Paths and Sync ASIC contains the circuitry for the routing of traffic and clock signals in both receive and transmit, and for the formatting of the sync data.

(4) The Timing ASIC performs a number of functions including Timebase control, Timing Frame Pulse and Clock generation, Hop Mute, CDP reset control and clock recovery control. The HKG is only used when Panther V is in Jaguar Interoperate mode. It is a similar device to the CKG, but is controlled solely through the ECCM bus and is not mapped into the MPUs address space.

(5) The FIFO and Interleaver contains a number of functions which in general perform processing on the traffic.

62 The FIFO and Interleaver provides the following functions:

(1) The FIFO function creates a space in the traffic which allows a Synchronisation packet to be sent once in 320 mS, without overwriting the traffic.
(2) The Interleaving process when enabled, interleaves the traffic at 19.2 kbit/s.
(3) The Encryption function controls the Keystream Generator (CKG) for slow access keystream generation which is then applied to the traffic to Encrypt/Decrypt.
(4) The gap fill pseudo random bitstream generator provides pseudo random data output during the dead time between hops in Fixed Secure mode.
(5) The Random Mask function when enabled places a 165 bit pseudo random binary data mask over the traffic.
(6) The Whitening function provides conditioning of received Voice traffic signals prior to their reconstitution in the Delta-Demodulation process.

63 The Clock Recovery ASIC is used to recover a data clock from both 16 kbit/s and 19.2 kbit/s data streams. Receive or transmit data is routed to the clock recovery via the FPGA and it is controlled by outputs of the Timing ASIC, which also provides a clock at 16 times the rate of the expected data input.

64 The recovered clock is used to internally generate and retime the input data, providing a staticised data output. In secure voice transmit modes, the data input will be the 16 kbit/s CVSD digitised voice signal from the interface module. In secure voice receive modes, it will be the 19.2 kbit/s digital output from the receiver.

65 A 'clock recovery squelch' indicates when clock recovery is taking place. In hopping or fixed secure receive modes, the recovery of a 19.2 kbit/s data clock is used as a squelch condition (in combination with sync data recovery). In fixed clear data modes, the recovery of a 16 kbit/s data clock is used.

66 The Receiver Output Slicer squares the demodulated input from the RF Head before the signal is routed to the Clock Recovery circuit via the FPGA.

67 The CCU includes a Built In Test (BIT) function which, at switch-on and on operator demand, requests BIT information from all radio units including the LSIs within the CCU. The results of these tests are collected by the CCU microcontroller and, if a failure is detected, a warning tone is generated. If the operator then enters the BIT menu, the CCU will send a BIT error message to the display. Within the CCU the microcontroller checks the ROM, RAM and the majority of the peripheral hardware.

Forward error correction and Remote line interface Assembly (FRA) Unit 4b (Fig 5.7)

68 The FRA is a single board assembly which is mounted together with the RCA board within the CCU module. The two boards are electrically connected by an 80 way connector, the FRA being the daughter board of the RCA. Direct connections between the FRA and other boards within the radio are provided via tracks on the RCA board and the Motherboard.

69 The FRA Digital Signal Processor (DSP) circuit is based on a digital signal processor and provides the radio with an enhanced data mode capability, implementing FEC coding for radio and remote line communications. The DSP controls two Front Panel data interfaces and a data interface that is used in remote line operating modes. It communicates with the microcontroller on the RCA via its memory mapped Host Port.

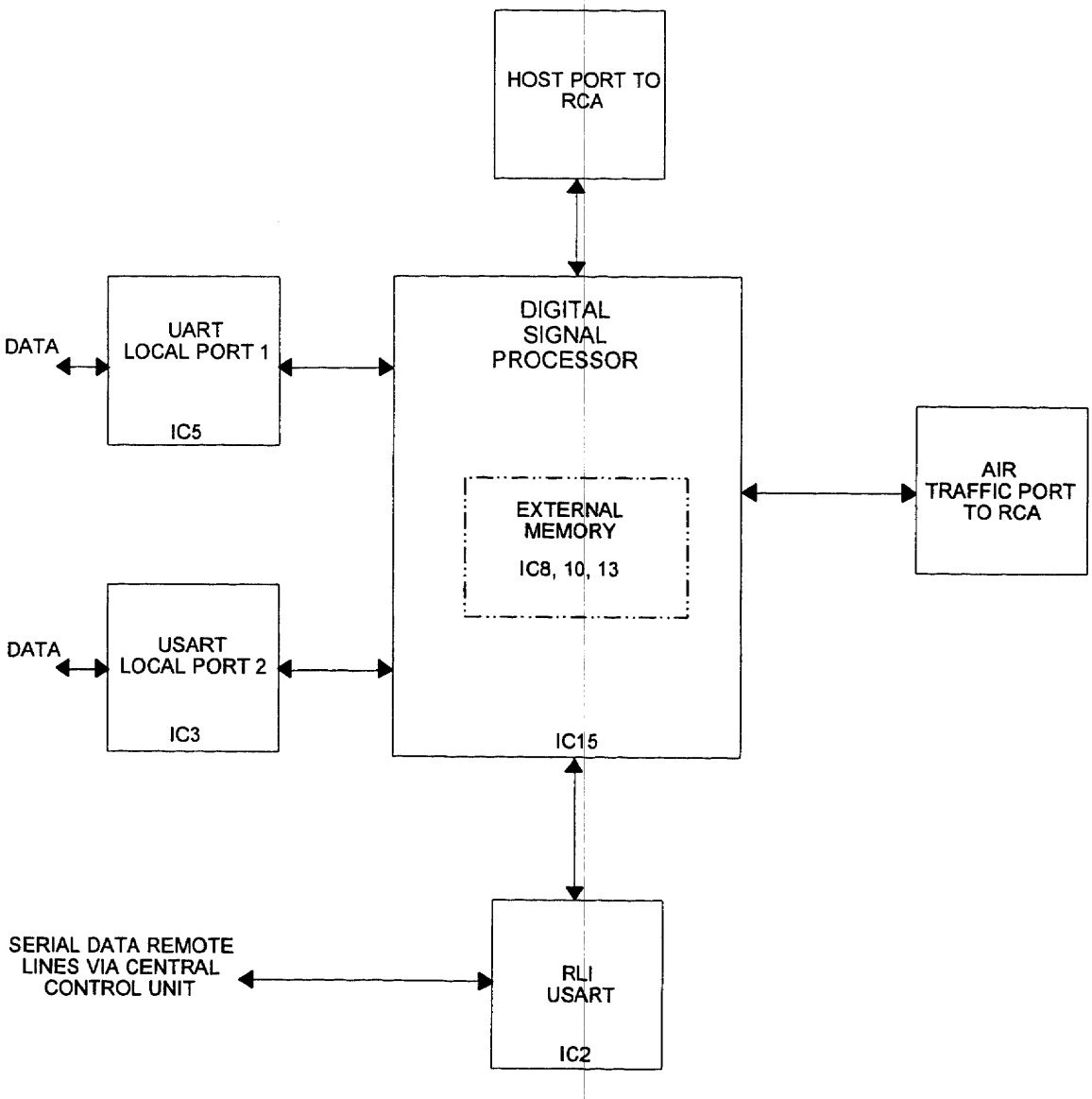


Fig 5.7
Functional Diagram :
FRA Unit 4b

70 Baseband data is transferred to and from the radio on the Local 1 and Local 2 Front Panel sockets using a UART and a USART respectively. The Local 1 port provides a high speed asynchronous data connection up to 115.2 kbit/s and the Local 2 port is compatible with lower speed asynchronous and synchronous connections. The DSP also controls the transfer of the data over the air via its internal Air Port and over the radio's RLI via a USART.

71 The data traffic is protected by using a set of FEC codes which can be set to low, medium, heavy and very heavy. Communication between the FRA DSP and the RCA is provided using the DSP Host Port (an 8 bit wide data bus).

72 The FRA RLI signalling circuits are controlled by a Field Programmable Gate Array I/O interface on the RCA. Connections to the Front Panel Line Transformer circuit are provided via tracks on the RCA board and the Motherboard. The RLI system provides facilities for wireline based communication between two radios for the remote operating modes RCU,REM, A-R and Intercom. Two independent frequency modulated channels are used. The system uses a traffic channel (Channel 1) in FM mode to convey analogue traffic and in FSK mode to convey digital traffic. It uses a control channel (Channel 2) and FSK signalling to convey control and supervisory messages.

73 Channel 1 has a centre frequency of approximately 147 kHz and uses 140/154 kHz FSK for the half duplex transmission of digital voice or data traffic at up to 16 kbit/s and 144 kHz narrow band linear FM for analogue voice traffic and the intercom mode. Channel 2 has a centre frequency of approximately 59 kHz and uses 55/64 kHz FSK to send half duplex control data at 9.6 kbit/s.

Receive Signal Path Routing and Control (Fig 5.8)

74 Fixed Clear Analogue Voice When a received signal is input to the CCU from the RF Head (CIF) it is routed via a buffer for outputting to the Interface (RXA).

75 Fixed Clear 16 kbit/s Digits The received input signal to the CCU is also directed to the slicer, where it is squared, and input to the clock recovery circuit. If 16 kbit/s is detected and either 16 kbit/s is programmed or Auto - Rebroadcast selected, then a digital path is selected via the FPGA and Paths ASIC to the Interface (RXT).

76 Frequency Hopping and Fixed Secure With the radio in Receive, signal CIF takes the form of bursts of 19.2 kbit/s message data interspersed with bursts of synchronising data at the same rate.

77 Included in the synchronising data is information indicating the source type (voice or data) of the associated message data. This source type, together with whichever of normal or Auto-Rebroadcast and clear or secure working is selected, determines the processing the Central Control performs on the message data.

78 Traffic is input to the clock recovery after being squared up by the slicer and is staticised at 19.2 kHz. The recovered clock is used to clock the traffic through the Correlator ASIC, in search of a synchronisation packet. The recovered clock is also used to clock the received traffic into the FIFO/Interleaver, where it is deleaved and decrypted if selected. Traffic is clocked out at 16 kHz, regenerated from the recovered clock. Two outputs are available from the FIFO/Interleaver and are routed to RXT. Data traffic is routed via the Paths ASIC, if this traffic type was flagged in the synchronisation packet. Voice traffic is output, having been suitably processed prior to delta demodulation and routed direct to RXT.

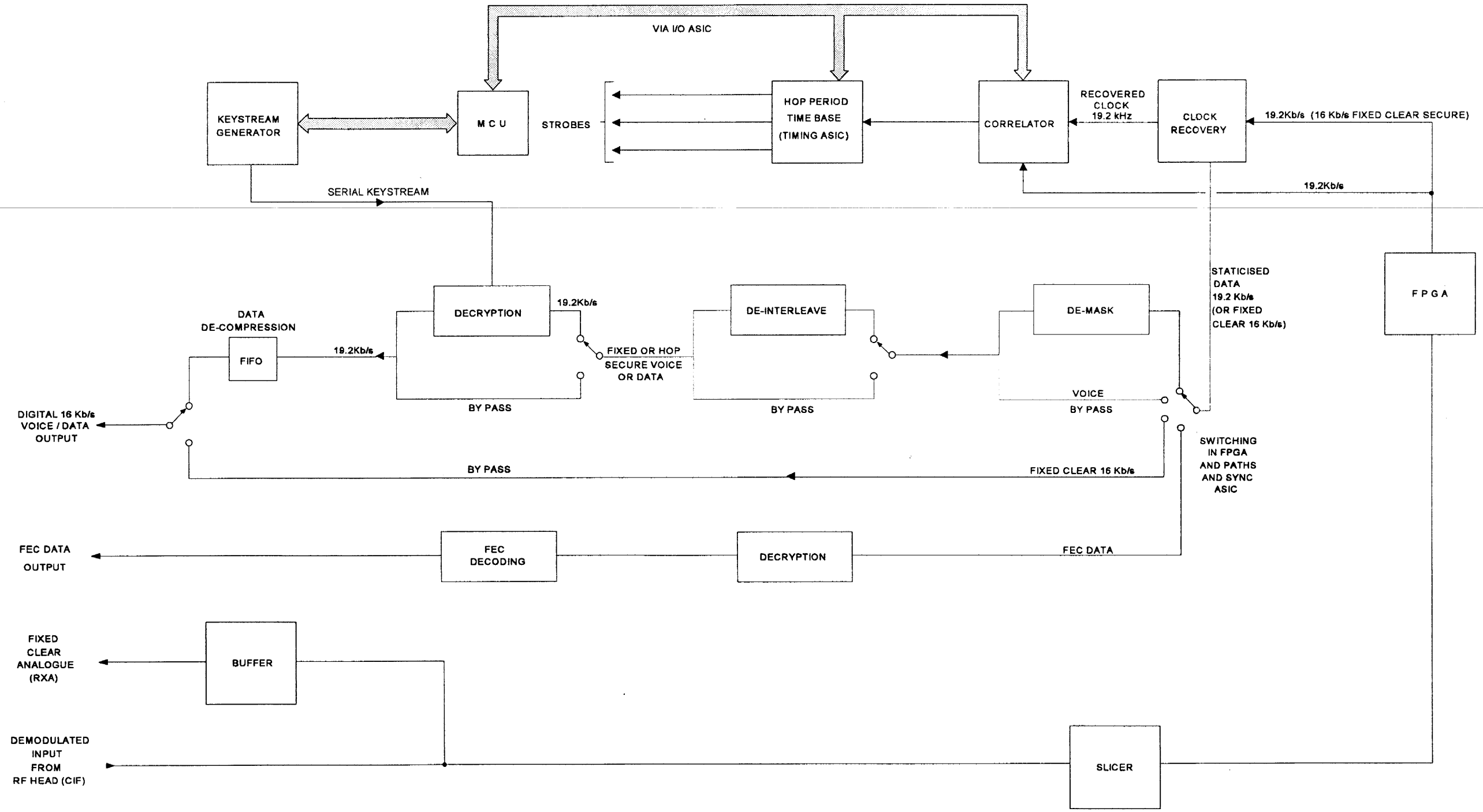


Fig 5.8
CCU Receive Traffic Path

79 In each case, the synchronising data is extracted by the correlator and passed to the timebase and the microcontroller in the form of timing information (CDP). The receiving circuits respond to the information by adjusting the timing within the Central Control, and the frequency data output to the Synthesizer, as required to bring the radio into synchronisation with the transmitting station.

NOTE: The synchronising data also contains the selected (or banned) address (used for selective communication). Data is also included to define whether or not the transmission is a selective communication. Interleaving selection is also sent in the sync packet to enable the receiver to adapt to the process selected by the transmitter i.e. non-interleaving or interleaving.

Transmit Signal Path Routing and Control (Fig 5.9)

80 Fixed Clear Analog Tx Analog Traffic is input to the CCU (TXT from Interface) and routed directly to TMD.

81 Fixed Clear Digits Tx Digital Traffic is input to CCU (TXT from Interface), as low rate or 16 kbit/s data. The traffic is input to the Paths and Sync ASIC. The digital traffic is retimed to 16 kHz via the Clock Recovery circuit, where low rate data is sampled at 16 kHz whilst 16 kbit/s traffic is retimed according to the clock recovered from it. Digital traffic is routed out of the Paths ASIC to TMD for transmission.

82 Frequency Hopping and Fixed Secure Traffic is input to the CCU and routed to the clock recovery circuit. Traffic is retimed to 16 kbit/s if data programming is selected, whilst voice programming selects pre-staticised traffic. The exception to this, is when Auto-Rebroadcast is enabled in which case all traffic is retimed to 16 kbit/s. The traffic is clocked into the FIFO/Interleaver at 16 kHz derived from the incoming data or the 16 kHz reference according to the data or voice programming.

83 Traffic is encrypted (if the external input is not 16 kbit/s) and interleaved if this is selected. Traffic is clocked out of the FIFO/Interleaver at 19.2 kHz, and routed to TMD. When a Synchronisation packet is to be sent, this is routed to TMD and the transmission of traffic is disabled, the Paths ASIC controls the insertion of the sync into the traffic stream at the appropriate time. Synchronisation data with source flags set to Data or Voice and Interleaving enabled/disabled as appropriate is inserted into the sync message.

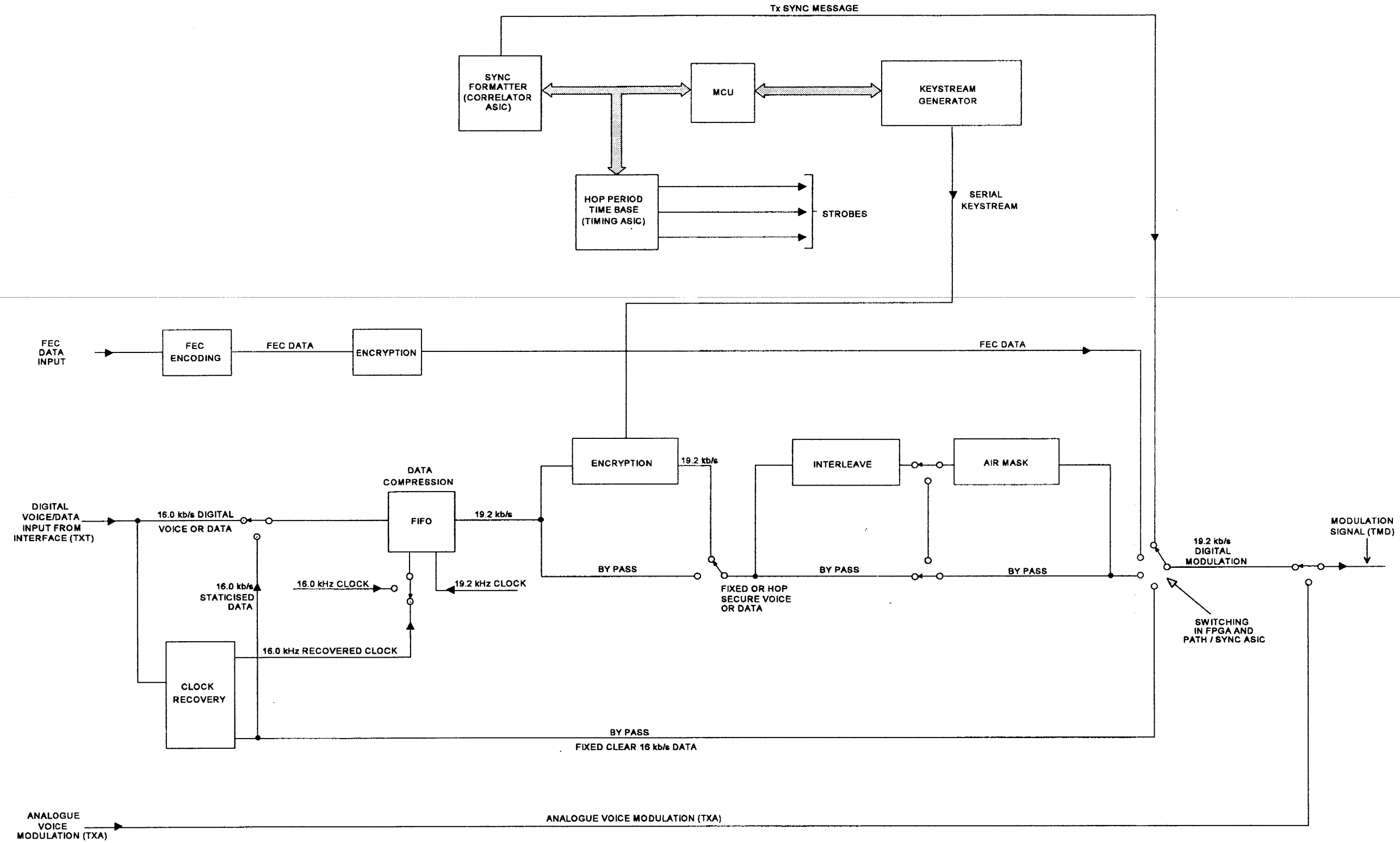


Fig 5.9
CCU Transmit Traffic Path

IF AMPLIFIER UNIT 5 (Fig 5.10)

Introduction

84 The IF Amplifier Unit consists of a single PCB in its own screened enclosure and is mounted vertically in the transceiver. It receives its signal from the mixer in the RF Head (Unit 6) and produces a demodulated output and a number of control signals. It contains the squelch circuits, a signal strength buffer and has its own BIT system.

85 The circuit divides into five stages:

(a) The input buffer amplifier and filter circuits
(b) The IF amplifier and discriminator chain
(c) The audio filtering stages
(d) The squelch logic and control system and
(e) The signal strength buffer and BIT.

The operation of the complete unit is described with reference to Fig 5.10.

Input Buffer

86 The 10.7 MHz IF input from the RF Head is tuned and matched and then fed to Buffer Amplifier and Filter stages.

IF Amplifier and Discriminator

87 The signal is then applied to IF Amplifier and Filter stages, the filter optimising the selectivity of the radio. The signal is fed to two Limiting Amplifier stages, a wideband noise filter and the Discriminator where the baseband signal is recovered.

Audio Filter

88 The baseband output from the discriminator is fed via a temperature compensating circuit, a Bessel Filter and amplifier to the CCU.

Squelch

89 The audio output from the temperature compensating circuit is also fed to noise squelch and 150 Hz tone squelch stages. These circuits produce control signals to the squelch logic. The squelch logic is controlled by the noise on, rebroadcast and synthesizer lock external signals. The resultant combined squelch signal and tone squelch is fed back to the CCU.

Signal Strength and Bit

90 An indication of signal strength is fed via a buffer to the central control. The BIT circuit provides an output to test the RF Head via the AMU on the front panel. Another output is provided to test the IF Amplifier operation.

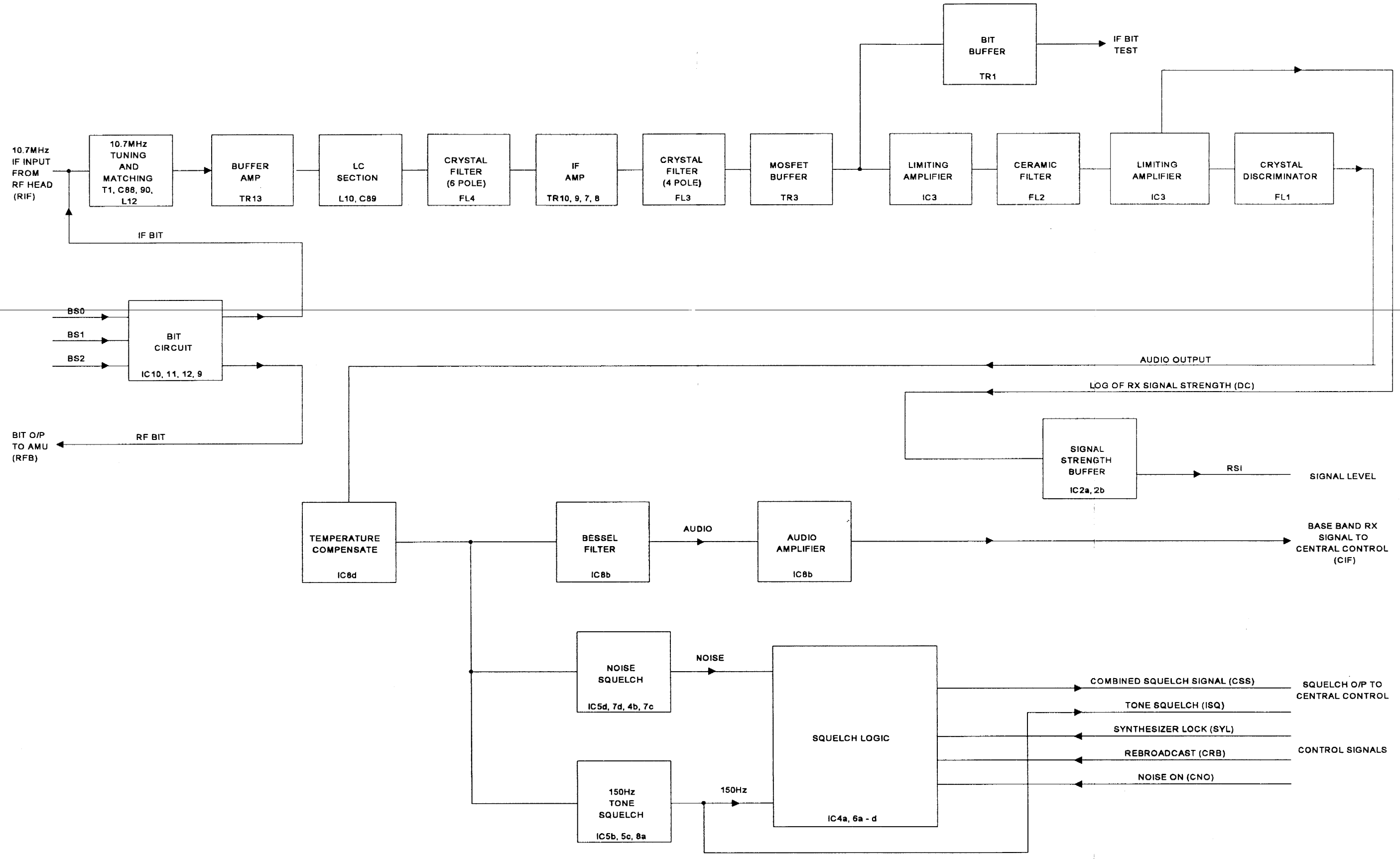


Fig 5.10
Functional Diagram : IF Amplifier Unit 5

RF HEAD UNIT 6 (Fig 5.11)

91 The RF Head is a single PCB assembled into a screening can and mounted vertically in the chassis. It receives its input from the Antenna Matching Unit (AMU), which is mounted on the front panel and sends its output to the IF Amplifier (Unit 5).It consists of three RF amplifier sections with a mixer and Rx local oscillator, which together cover the range from 30 to 108 MHz.

92 Each section has JFET amplifiers in a grounded gate configuration and uses two coupled pair tuned circuits. These are tuned by varactor diodes and use the same control voltage line (Vt) that controls the Rx local oscillator.

93 The Rx local oscillator works in a phase locked loop and comprises a maintaining amplifier and three resonant circuits, one for each band. Band selection for both the oscillator and RF amplifiers is controlled by two band select lines, which feed the decoding and drive circuits, as shown in the figure.

94 The RF and local oscillator signals pass to a double-balanced Shottky diode mixer to produce an IF output signal at 10.7 MHz. The local oscillator always works at a frequency above that of the received signal.

95 The RF input to the unit is protected from damage by excessive RF signals at the input. The protection circuit comprises an RF current transformer, a detector and a shunt PIN switch. A BIT circuit is also included.

96 The RF signals from the antenna, or from the 50 ohms input socket, pass through the AMU on the front panel before reaching the input to the RF Head.

97 The signal then passes through the current transformer of the input protection circuit and this circuit operates a diode switch which short-circuits excessive input signals to ground.

98 After passing through the current transformer, the input signal is directed to one of three amplifier sections by means of PIN diodes. These diodes select the appropriate section for the frequency band in use and are controlled by the band select decoding and drive circuits, in accordance with information from the synthesizer, Unit 7.

99 Each amplifier section comprises an amplifier and two coupled pair tuned circuits which are controlled by varactor diodes. The tuning voltage for the diodes is produced by the synthesizer and reaches the diodes through a low pass filter to remove any circuit noise.

100 The amplified RF signal then feeds through further PIN diodes to reach the mixer where it beats with the signal from the local oscillator to produce the IF output at 10.7 MHz.

101 The Rx local oscillator signal is generated by a grounded base bi-polar amplifier and three resonant circuits also switched by PIN diodes to select the required band. This signal passes through a buffer stage before it reaches the mixer, but it also feeds a buffer amplifier to produce the 40.7 to 118.7 MHz reference signals for the synthesizer circuits in Unit 7.

102 The AMU on the front panel applies a DC voltage to the RF input socket. This voltage passes through the first switching diode of the RF amplifier section in use, then through the transistors of the band-select drive circuits and finally through the second diode to meet the common line that feeds the mixer.

103 The BIT circuit detects the presence of the DC voltage on this line and thereby checks the operation of all the amplifier switching circuits and the coaxial flying lead from the AMU.

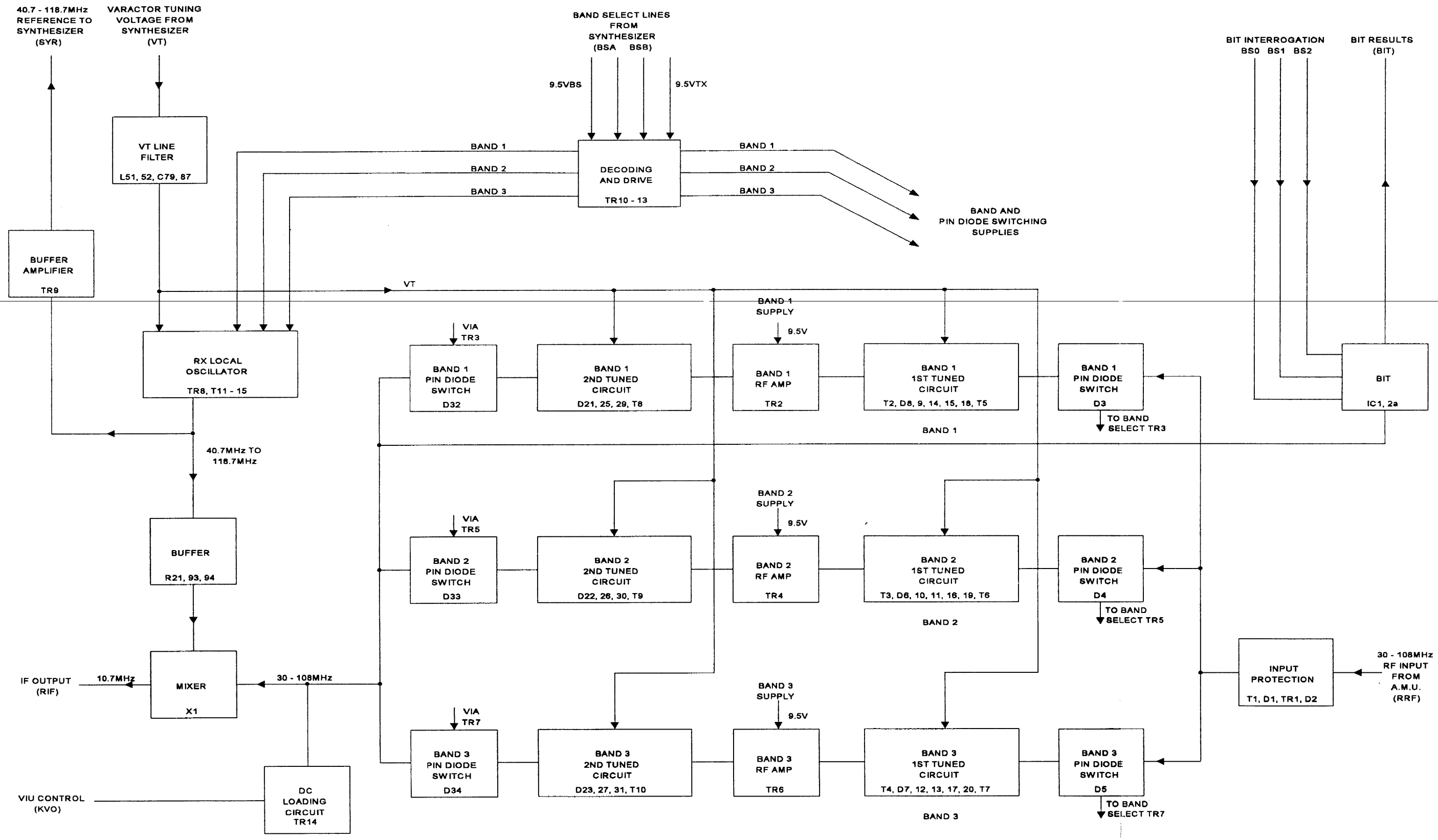


Fig 5.11
Functional Diagram
RF Head Unit 6

SYNTHESIZER/MODULATOR UNIT 7 (Fig 5.13)

Synthesizer Unit 7a

104 The main function of the synthesizer is to control the frequencies of the transmitter master oscillator and the receiver local oscillator with reference to a 6.4 MHz TCXO in a phase locked loop.

(1) Receiver Frequency Control (Figs 5.12, 5.13)

105 A sample of the local oscillator signal in the RF Head is fed into a high speed prescaler and programmable divider. These two circuits divide the incoming frequency of the RF Head to provide a 25 kHz signal which passes to a phase discriminator. The division of the incoming frequency is programmed from information from the CCU (Unit 4) which selects the operating frequency of the receiver.

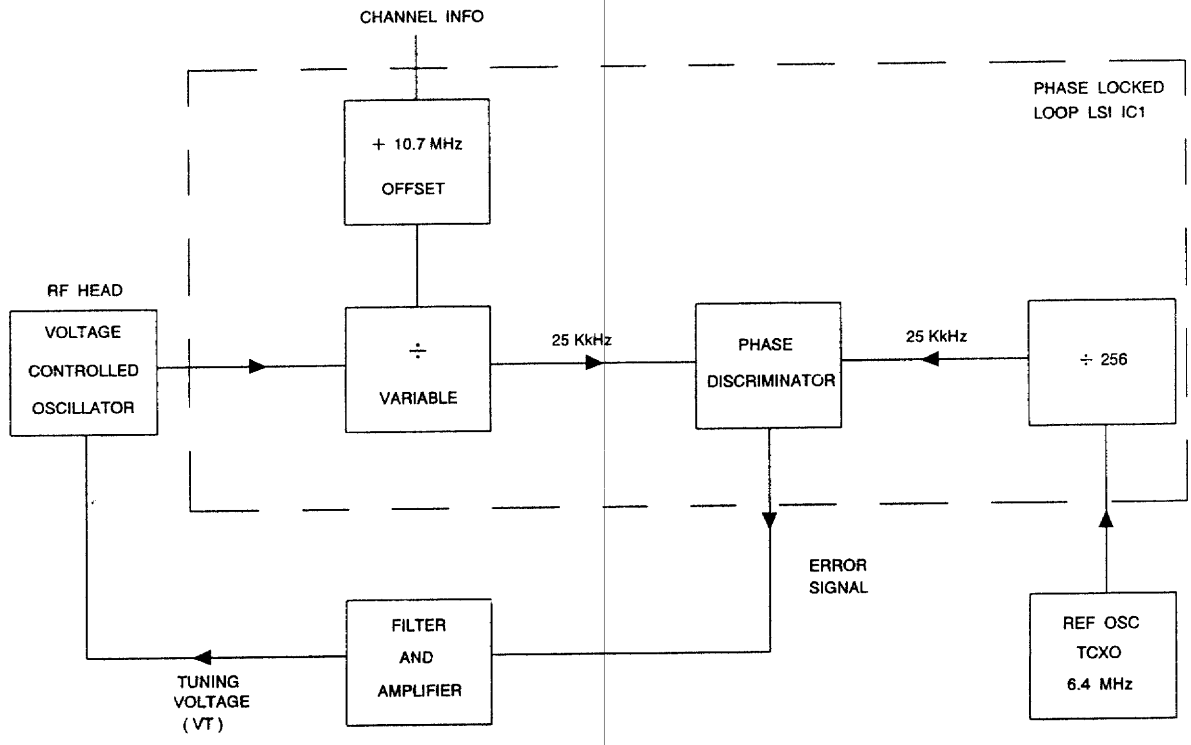


Fig 5.12 Synthesizer Receive Operation

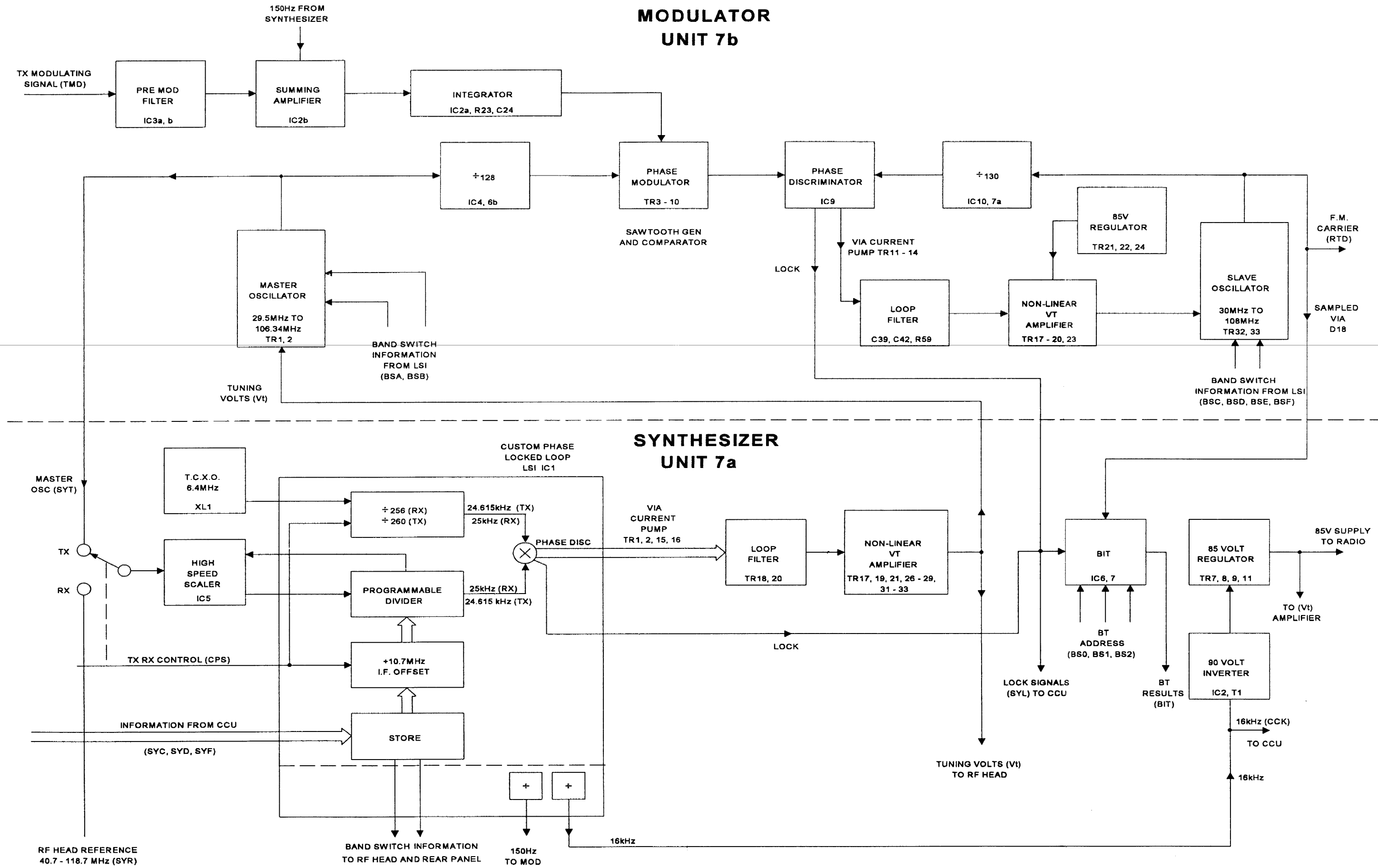


Fig 5.13
Functional Diagram : Synthesizer/Modulator Unit 7

106 The 25 kHz signal to the phase discriminator is compared to another 25 kHz signal which is produced by a 256 reference divider from the 6.4 MHz TCXO. The output from the discriminator passes to a non-linear DC amplifier, via a low pass filter, and generates the tuning voltage (Vt) that feeds the varactor diodes of the RF Head. This voltage closes the loop and locks the frequency of the local oscillator of the RF Head to that of the TCXO.

(2) **Transmitter Frequency Control (Figs 5.13, 5.14)**

107 A sample of the signal from the transmitter master oscillator is fed into the same high speed scaler and programmable divider that is used for the receiver. In this mode the frequency of the master oscillator operates at 64/65ths of that of the transmitter, so the 25 kHz signal to the phase discriminator drops by the same ratio, (i.e. to 24.615 kHz).

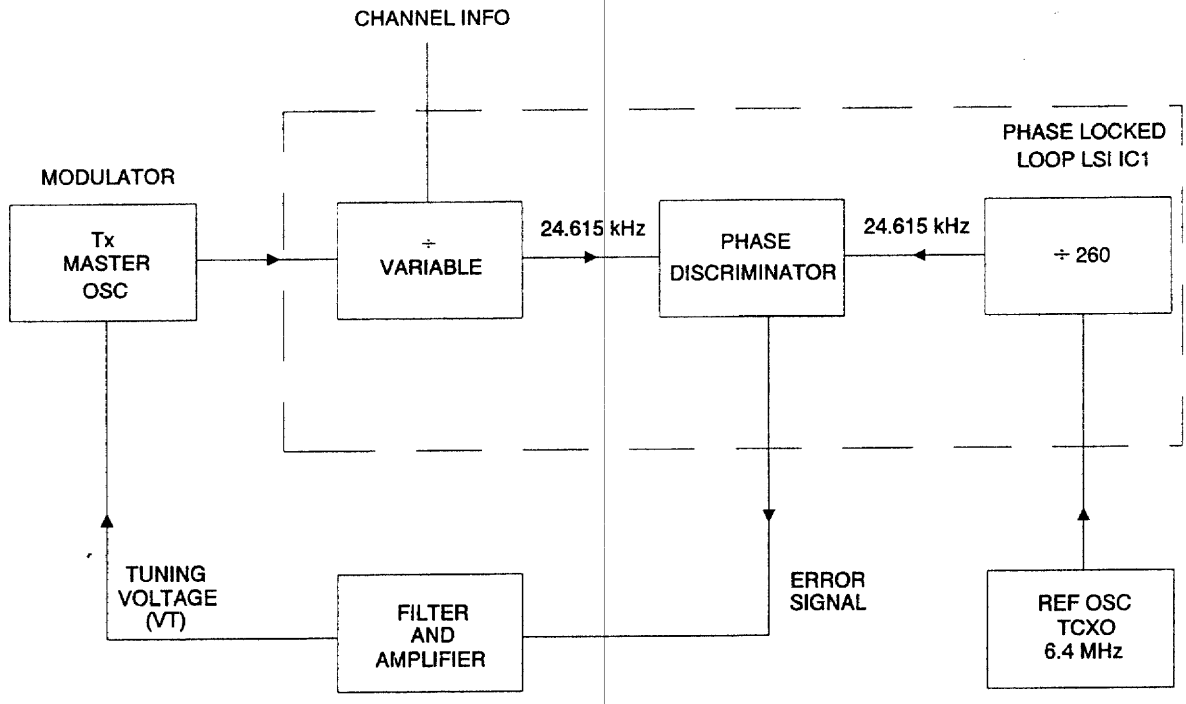


Fig 5.14 Synthesizer Transmit Operation

108 At the same time the reference signal from TCXO is divided by 260, (instead of the 256 used in Rx mode) so that the two phase discriminator signals are of the same but lower frequency. The varactor tuning voltage Vt that is fed to the RF Head also controls the transmitter master oscillator so that the latter is also locked to the frequency of the TCXO.

(3) **Other Functions**

109 The Synthesizer also provides the following:

(a) Lock signal to CCU.
(b) Band switch control lines to RF Head and Modulator.
(c) 16 kHz reference to CCU.
(d) 85 V supply to other units.
(e) Built In Test (BIT) circuitry.

Modulator Unit 7b

110 The signal from the master oscillator is divided by 128 and passes through a phase modulator to a phase discriminator. This discriminator also receives a sample of the slave oscillator signal that has been divided by 130.

111 The output from the discriminator passes through a low pass filter to a non-linear DC amplifier, whose output controls the tuning of the slave oscillator. By this means the frequencies of the slave and master oscillators are locked in the ratio 64 to 65 and avoid any harmonically related interaction between them.

112 The modulating signal for the transmitter passes through a low pass filter and, with the 150 Hz tone, is fed to the phase modulator. This modulator varies the phase of the signal from the master oscillator and, by way of the discriminator, phase modulates the slave oscillator and hence the transmitted signal.

113 An integrator circuit at the input of the phase modulator converts phase modulation to the frequency modulation that is required for transmission.

REAR PANEL UNIT 8 (Fig 5.15)

Introduction

114 The Rear Panel assembly accepts the 1 Watt FM Carrier from the Modulator section of Unit 7 and provides outputs of 100 mW, 5 or 20 Watts as required.

115 The Rear Panel is part of the main construction of the transceiver chassis and carries three major Printed Circuit Board (PCB) assemblies and two smaller assemblies. These are:

(a) The RF Power Amplifier Unit 8b
(b) The Power Supply and Control Logic Assembly Unit 8c
(c) The Converter Assembly Unit 8d
(d) The Battery Decoupling Assembly Unit 8aa
(e) The 10 way Decoupling Assembly Unit 8e.

116 The Power Amplifier PCB is attached to the bottom of the casting and uses it as a heatsink. It contains an input attenuator, a power amplifier and three output filters, one for each frequency band. It also carries a small amount of control logic for PIN diode switching and is a four layer board with components on both sides.

117 The Converter PCB is half buried in the casting and its power semiconductors use the casting as a heatsink. A screening can covers the complete assembly. The assembly carries a 12 V switched mode power supply, a bypass FET and a small amount of associated control circuits. It is a two layer board with components on one side only.

118 The Power Supply and Logic PCB contains most of the logic circuits needed to control the rear panel and has a special circuit to trap overvoltages and reversed DC power supplies. It also contains three linear power line regulators and one switched mode regulator. It is a four layer board with components mainly on one side.

119 The 10 way Decoupling PCB is a two layer board with components on both sides. It provides an interface between the transceiver and the VIU.

Power Amplifier Unit 8b

120 The RF in from the Modulator, a 1 Watt FM Carrier wave, is passed to a Ramp Attenuator which is controlled by the Tx Mute signal via a Compensating network which flattens the frequency response to give a 1 Watt level over the frequency range. This enables the carrier to be muted in hop frequency changes and also when the Synthesizer is out of lock. The hop mute signal is applied via a Bessel Filter to give smooth transition in the RF envelope and minimise AM sidebands.

121 With the radio set to medium or high power the signal passes to the Power Amplifier. This operates in conjunction with an Impedance Change circuit for 12 V or 24 V supply and medium or high power selections. The PA output is maintained by a feedback loop consisting of an Automatic Level Control and Bias Control circuit. This will ensure a constant current is drawn by the PA FET. If the Bias Control circuit is nearing its limit, ICTRL will attenuate the RF input - thus ensuring PA control is maintained. VCTRL attenuates the RF input if there is too much voltage showing on the PA Output.

122 When the radio is set to low power, a Low Power Select circuit causes the Bias Control Switch to turn off the PA FET and also causes the RF in 1 W input signal to pass to an attenuator (thus bypassing the PA) where it is reduced to 100 mW for the lower power level.

123 The amplified or bypassed signal is then fed to one of three band pass filters which are controlled by the band select signals from the Synthesizer. The filters are switched by PIN diode Input and Output Band Switches.

124 The RF out is fed to the AMU and a sample is fed via a detector and an Analogue to Digital Converter to indicate power level to the CCU.

Power Supply and Logic Unit 8c

125 The input supply of 12 V or 24 V ranging from 10 V to 33 V dc is applied via Unit 8aa and Unit 8e, where it is decoupled, to various protection circuits. Included in the protection circuits is an input filter, a surge protection and a reverse polarity protection circuit.

126 The input voltage is fed to the Topping Regulator which ensures that the input supply does not exceed 28 V. The On/Off Control circuit operates via the On/Off Switch. The output of the Topping Regulator is fed to the PA as PA Supply.

127 It is also sensed via a control circuit whether the original supply input is 12 V or 24 V nominal using 17 V as a change over voltage. If the supply is 24 V (over 17 V) the Switch Mode circuit in the Converter unit 8d operates producing a nominal 12 V. If the supply is 12 V (under 17 V) the Switch Mode circuit is shorted and switched off.

128 The 5 V Over Voltage Detector is connected to the Topping Regulator. When the 5 V Over Voltage triggers, the circuit latches and switches off the Topping Regulator, shutting down the radio. It is reset by switching the radio off and on again.

129 An indication of Battery Level is fed to the CCU. This is either from the Topping Regulator output or the KVO input voltage from the VIU. If a VIU is attached or there is a 24 V supply, a signal High power available is sent to the CCU.

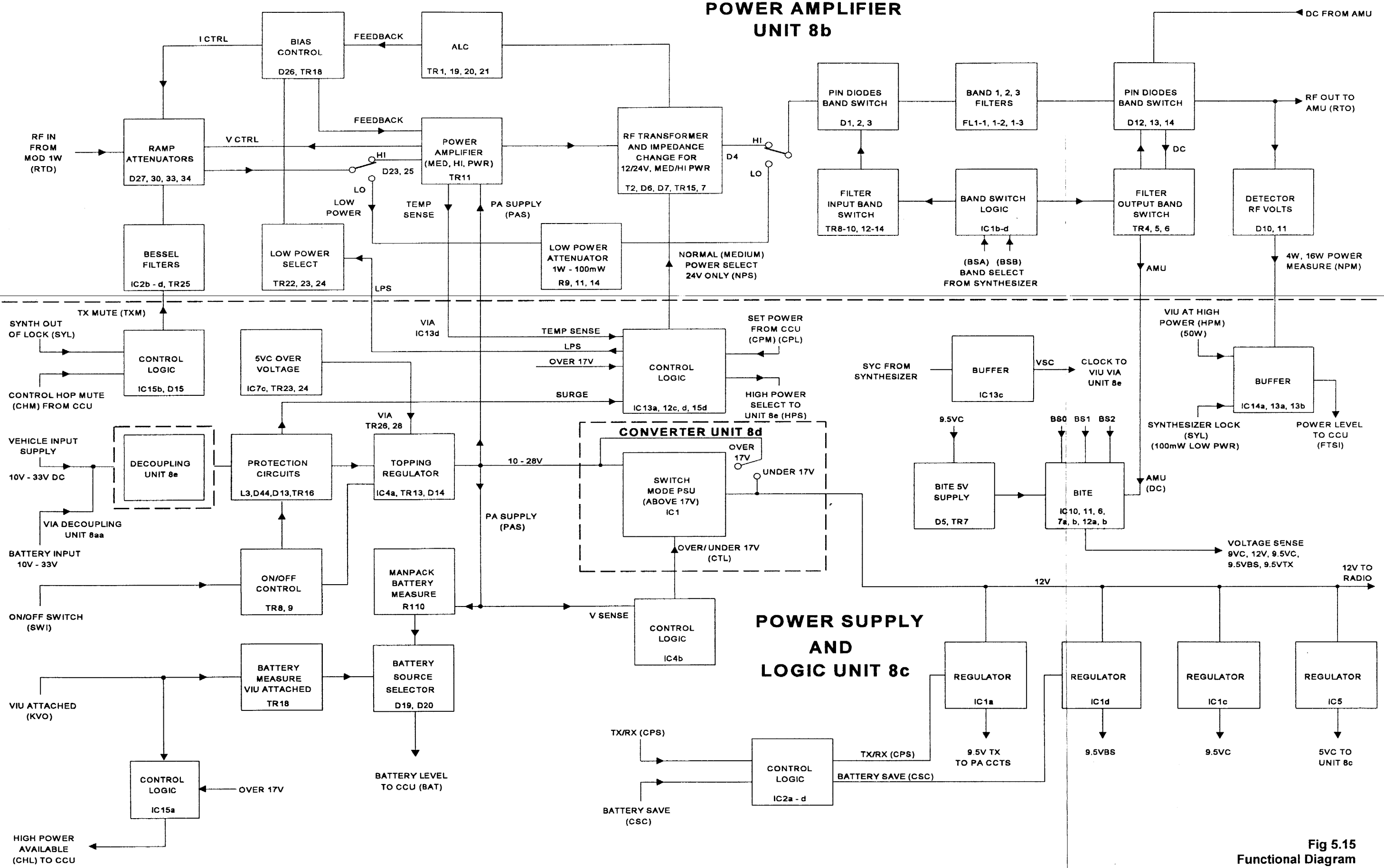


Fig 5.15
Functional Diagram
Rear Panel Unit 8

130 The output of the Converter unit, 12 V nominal, is fed to three 9.5 V regulators and a 5 V switch mode regulator. The first regulator, 9.5 V constant, is on all the time.

131 The other two 9.5 V regulators are as follows:

9.5 V BS	Battery Save (BS)
9.5 V Tx	Transmit

These are operated by a Control Logic circuit using Battery Save and Tx/Rx information from the CCU.

132 The 5 V switched mode power supply is on all the time to supply logic circuits in the radio and the display.

133 An indication of RF output power is fed to the CCU via a buffer. This is from either the power output from the PA unit 8b (5 W, 20 W) or the power output from the VIU (50 W).

134 Tx mute is generated for the PA board from a combination of the Synthesizer being unlocked or the Hop frequency changing (control hop mute). By default in 12 V operation the PA board switches to medium power and in 24 V operation it switches to high power. The CCU provides power information using CPL and CPM which is used to instruct the PA board to switch to Low Power operation.

135 In 24 V mode and when medium power is selected NPS signals this to the PA board. NPS also switches the PA board to medium power if:

(a) PA overheats.
(b) Voltage surge at input.

If high power is selected and a VIU is present, the HPS signal is sent to the VIU via unit 8e.

136 During BITE tests BS0, BS1, BS2 addresses the Rear Panel. While the radio is in Rx the circuit checks the levels of 9.5 VC, 9.5 V BS, 12 V and 5 VC to check for overvoltage. When in Tx the circuit checks the levels of 9.5 V Tx for overvoltage. When BS0, 1, 2 address the AMU in Tx the circuit checks the AMU voltage level. The BIT level when high indicates Test passes.

137 The Synthesizer Clock SYC is buffered to increase the drive capabilities before being fed via unit 8e to the VIU.

CHAPTER 6

INTERCONNECTIONS

CONTENTS

ILLUSTRATIONS

CHAPTER 6

INTERCONNECTIONS

INTRODUCTION

This chapter defines the interconnections between the various units within the radio. The Motherboard Track Index provides an index to the tracks and the track descriptions gives more detailed information on all signals within the radio.

MOTHERBOARD TRACK INDEX

Traffic and Control Signals

NOTES - 1. Signal sources are shown bold and underlined.

2. Connections shown in brackets are currently unused by the associated module.

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
BAT	Raw protected battery voltage.			A1				**28**
BIT	TCVR BIT Test Response Indication			A57	(B7)	**A1**	**B9**	**12**
BIU	BNC Socket In Use Indication	**PL20 /6**		B57		(B15)		
BSA	Band select 'A'					A7,B7	**B7**	13
BSB	Band select 'B'					A6,B6	**A7**	5
BS0	BIT device address bit 0			**A58**	A7	B1	A9	17
BS1	BIT device address bit 1			**A60**	A6	B2	B8	19
BS2	BIT device address bit 2			**A59**	B6	A2	A8	21
CAD	150Hz Tone Modulation Select			**A46**			A15	
CAL	TCXO Calibration Enable			**A43**			(B16)	
CCC	CODEC Conversion Clock		B16	**B34**				
CCK	16kHz system clock	(SK21 /7)	A3	A50			**A13**	
CDR	Discriminator Output DC Reference			A13	**A14**			

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
CFR	RCA MPU to FPA MPU Serial Link	SK21/ 4		**B55**				
CFT	FPA MPU to RCA MPU Serial Link	**SK21/ 3**		B58				
CHL	High Transmit Power Available Indication.			A38				**26**
CHM	PA (HOP) mute			**A37**				29
CHS	Hopping squelch			**A35**				
CIF	Discriminator Output			A9	**A16**			
CIO	Bi-directional TDS789 Serial Data Link		**B31**	**B19**				
CNO	Squelch Override			**A55**	A11			
CPL	Transmit Power Level Select LSB			**A40**				22
CPM	Transmit Power Level Select MSB			**A39**				25
CPS	Transmit Enable			**A45**			B15	24
CRB	Rebroadcast Selected			**A54**	B11			
CSC	Current Saving Supply Enable			**A41**				23
CSD	TDS789 Interface Reply Enable		B6	**B44**				
CSQ	Any Squelch Active Indication			**A42**				3
CSS	Noise/Radio Squelch			A52	**B12**			
CT1	CMOS Socket 1 UART Clear-to-Send		B17	**B33**				
CT2	CMOS Socket 2 USART Clear-to-Send		B18	**B32**				
CTE	CCU Test Enable			A34				
CTS1	RS232 Socket 1 UART Clear-to-Send	SK22/ 5	**A12**					

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
CTS2	RS232 Socket 2 USART Clear-to-Send	SK22/ 2	**A9**					
CZR	Zeroize	**SK21/ 15**	(A4)	B49				
DGS	Clock Recovery LSI Squelch			**A36**				
FTE	FPM Test Enable	SK21/ 17						
FTSI	Forward Transmit Signal Indication			A4				**32**
GRX	GPS Serial Receive Data	SK21/ 6		**B52**				
GTP	GPS Time Pulse	**SK21/ 9**		B60				
GTX	GPS Serial Transmit Data	**SK21/ 5**		B53				
HBT	Tamper Protected HUB Supply		(B40)	A3				18
HUB	Hold-up Battery Supply							16 From **BTY +VE via 150 ohm**
ICK	I2C Clock		B7	**B43**				
ICT	Intercom Transmit Analogue Traffic		**B49**	B3				
ICR	Intercom Receive Analogue Traffic		B50	**B2**				
IDT	I2C Bidirectional Data		**B9**	B41				
IRQ	I2C Interrupt		**B10**	B40				
ISQ	Tone/hailing Squelch			A53	**A12**			
ITE	Interface Module Test Enable		A6					
ITST1	Interface Production Test Signal No. 1		A15					

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
ITST2	Interface Production Test Signal No. 2		A16					
KBP	Key Board Press Indication	SK21/ 16		B51				
KVO	VIU Attached Indication			B59		B16		**8**
MBL	Build 3 RPA battery level word l.s. bit. For compatibility with Build 3 RPA on a build 4 radio.			A33				**27**
RC2	CMOS Socket 2 USART Receive Clock		B19	**B31**				
RD1	CMOS Socket 1 UART Receive Data		B21	**B29**				
RD2	CMOS Socket 2 USART Receive Data		B22	**B28**				
RDX1	RS232 Socket 1 RCA UART Receive Data	SK22/ 17	**A22**					
RFB	RF Comb (BIT)	PL20/ 4			**A1**			
RIF	IF Input from RFH (50 Ohm)				B4	**B4**		
RIO	Remote Input/Output	**SK25/ 2**		**B10**				
RME	Remote Signal Earth Return	SK25/ 3		**B12**				
RSI	Received Signal Strength Indication			A6	**B15**			
RST	Radio Global Reset	SK21/ 10	A1	**B50**				
RT1	CMOS Socket 1 UART Request-to-Send		**B23**	B27				
RT2	CMOS Socket 2 USART Request-to-Send		**B24**	B26				

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
RTS1	RS232 Socket 1 UART Request-to-Send	**SK22/ 10**	A14					
RTS2	RS232 Socket 2 USART Request-to-Send	**SK22/ 16**	A21					
RTSI	Reverse Transmit Signal Indication			A5				**31**
RX1	CMOS Socket 1 RCA UART Receive Data		B25	**B25**				
RXA	Receive Analogue Traffic		B48	**B4**				
RXC2	RS232 Socket 2 USART Receive Clock	SK22/ 6	**A13**					
RXD1	RS232 Socket 1 UART Receive Data	SK22/ 13	**A18**					
RXD2	RS232 Socket 2 USART Receive Data	SK22/ 14	**A19**					
RXT	Receive Digital Traffic		B11	**B39**				
SK1A	Microphone Audio/Data Input, Voltage Programming	**SK25/ 5**	A53					
SK1B	Microphone Earth, Voltage Programming	**SK25/ 4**	A52					
SK1C	Socket Supply	SK25/ 10	**A59, A60**					
SK1D	Received Voice/Data	SK25/ 9	**A57**					
SK1E	Socket Earth (See 0VDCE)							
SK1F	Pressel, TDS789 Serial Control	**SK25/ 6**	A54					
SK1G	Received Voice, Data Clock	SK25/ 7	**A55**					

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
SK2A	Microphone Audio/Data Input, Voltage Programming	**SK25/ 16**	B53					
SK2B	Microphone Earth, Voltage Programming	**SK25/ 15**	B54					
SK2C	Socket Supply	SK25/ 12	**B59, B60**					
SK2D	Received Voice/Data	SK25/ 13	**B58**					
SK2E	Socket Earth (See 0VDCE)							
SK2F	Pressel, TDS789 Serial Control	**SK25/ 17**	B52					
SK2G	Received Voice, Data Clock	SK25/ 14	**B56**					
SP1	Spare CCU to SYN/MOD Connection			(A44)			(A16)	
SYC	Synthesiser Clock			**A48**			A14	2
SYD	Synthesiser Data			**A47**			B14	1
SYF	Synthesiser Frame			**A49**			B13	10
SYL	Synthesiser in Lock			A56	A8, B8		**A10**	4
SYR	RFH RF Oscillator Output					**A13**	A3	
SWI	On/Off Switch Indication	**SK21/ 2**						15
TCK	Digital Traffic Clock		B12	**B38**				
TC2	CMOS Socket 2 USART Transmit Clock		B27	**B23**				
TD1	CMOS Socket 1 UART Transmit Data		**B28**	B22				
TD2	CMOS Socket 2 USART Transmit Data		**B29**	B21				

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
TDX1	RS232 Socket 1 RCA UART Transmit Data	**SK22/ 3**	A10					
TFR	Digital Traffic Frame		B13	**B37**				
TMD	Transmit Modulation			**A51**			B11	
TNK	Key Press Tone Enable		B33	B17				
TX1	CMOS Socket 1 RCA UART Transmit Data		**B30**	B20				
TXA	Transmit Analogue Traffic		**B47**	B5				
TXC2	RS232 Socket 2 USART Transmit Clock	SK22/ 4	**A11**					
TXD1	RS232 Socket 1 UART Transmit Data	**SK22/ 15**	A20					
TXD2	RS232 Socket 2 USART Transmit Data	**SK22/ 12**	A17					
TXT	Transmit Digital Traffic		**B15**	B35				
VT	Tuning Voltage					A15	**A1**	
XCK	Interface Module XILINX FPGA Configuration Clock		B1	**B48**				
XDP	Interface Module XILINX FPGA Configuration DONE/PROG Status/Control		**B3**	**B47**				
XDT	Interface Module XILINX FPGA Configuration Data		B4	**B46**				
XIT	Interface Module XILINX FPGA Configuration Initialisation Status		**B5**	B45				

Power Supply and Earth Connections

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
5VC	5V constant supply	SK21 /12	A5, B34	B16, B56				**9**
9V5C	9.5v constant supply		B44, B46	A15, A17	A9, B9		A11, B10	**11**
9V5BS	Battery saved 9.5V supply	PL20/ 1			B2	A9, B9	A5, B5	**14**
9V5TX	9.5V Tx supply				A3	A8, B8	A6, B6	**6**
85V	85V Rx supply	PL20/ 2				A10, B10	**B4**	7
12S	Switched 12V Supply (Max 17V)		A41, A43, A45, A47					**30**
0V-DCE	Chassis Ground path for audio and RF return currents.	PL20/ 3,5 SK22 / 1, 8, 11, 18 SK25 / 1, 8, 11, 18	A46, A48, A49, A50, A51, A56, A58, B45, B51, B55, B57	A2, A7, A8, A10, A11, B1, B6, B7	B1, A2, B3, A4, B5, A10, B10, A15, B16	A3, B3, A4(TP 1), A5, B5, A11, B11, A12, B12, A14, A16	B1, A2, B2, B3, A4, A12, B12 HUB BTY -VE NEAR RPA	
0VD	Ground path for Digital return currents.	SK21 / 1, 8, 11, 18	B2, B8, B14, B20, B26, B32	B18, B24, B30, B36, B42, B54				

Non Motherboard Connections

Signal Name	COMMENTS	UNITS CONNECTED						
		2	3 SK26	4 SK28	5 SK31	6 SK32	7 SK33	8 PL38
RRF	Coax AMU to RFH	PL2						
RTD	Coax Syn/mod to PA							A1
RTO	Coax PA to AMU	PL1						A2

TRACK DESCRIPTIONS

Traffic and Control Signals

BAT (Raw Protected Battery Voltage)

Description: Supply voltage minus 0.6V. Maximum 32.4V

Source: RP: Supply voltage via 1k (TBC) and series diode.
Destination: CCU: For Measurement purposes - Series 560K to ADC input with 100K and 10N in parallel to 0VDCE.

BIT (TCVR BIT Test Response Indication)

Description: Active high 5V logic level input to CCU to indicate BIT success as a result of a BIT selection from BS0, 1, 2.

Source: RP: CMOS logic output via 4K7 + series diode
IF: no connection
RF Head: open collector with 10k pull up via diode in series with 4k7
Syn/mod: CMOS logic output via 4K7 + series diode
Destination: CCU: 100K to 0VD to CMOS input via 10K.

BIU (BNC Socket in use Indication)

Description: Logic Level indication input to CCU to indicate that a 50 Ohm load is connected to the Front Panel BNC Socket. Used for determining whether it is safe to enable high power transmit.

0V: BNC socket in use
High Z: BNC socket unconnected

Source: AMU: Open Collector output.
RFH: Unconnected.
Destination: CCU: 100K to +5V to CMOS input via 10K.

BSA, BSB (Band select)

Description: 0 to 9.5V logic level generated by synthesiser to indicate the RF band currently selected:

Frequency in use	Band	BSA	BSB
30.0 to 45.975MHz	1	0	1
46.0 to 69.975MHz	2	1	1
70.0 to 107.975MHz	3	1	0

Source: Syn/mod: 4K7 pull-up to 9V5BS, FET pull to gnd.
Destination: RF Head: Cathode of diodes may source up to 2mA when line low (>9V=1, <1V=0)
RP: CMOS logic input via diode, 100K to 9V5TX

BS0, 1, 2 (BITE Device Address)

Description: Active high 5V logic level to select units for BIT:

Module	BS2	BS1	BS0
Unused	0	0	1
Syn/Mod	0	1	0
Rear Panel	0	1	1
IFA	1	0	0
RFH (via AMU)	1	0	1
AMU (via RFH(Rx), RP(Tx))	1	1	0
Unused	1	1	1

Source:	CCU:	CMOS output through 4K7
Destination:	Interface:	CMOS logic input via 47K
	IF:	CMOS logic input via 4K7, 1M to gnd
	RF Head:	CMOS logic input via 47K
	Syn/mod:	CMOS logic input via 100k
	RP:	100K to gnd + 100K in series with CMOS logic input

CAD (150Hz Tone Modulation Select)

Description: Active low logic level output from the CCU to instruct the synthesizer to apply 150Hz tone modulation to the transmission.

0 (gnd):	Fixed Clear Voice Tx, apply 150Hz tone
1 (5V):	Secure Tx, do not apply 150Hz tone

Source:	CCU:	CMOS output through 4K7
Destination:	Syn/mod:	CMOS input through 100K

CAL (TCXO Calibration Enable)

Description: Signal to inform the synthesizer that external calibration of the TCXO has been selected.

5V:	TCXO calibration enabled
0V:	TCXO calibration disabled

Source:	CCU:	CMOS output through 4K7
Destination:	Syn/mod:	Unconnected

CCC (CODEC Conversion Clock)

Description: 0V to 5V Conversion Clock for the Interface Module CODEC device at a frequency of 256kHz.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	Schmitt CMOS input via 1K (Note - Schmitt input unnecessary if receiving device can accept a 200ns rise/fall time without oscillation)

CCK (16kHz clock)

Description: 16kHz system clock from the synthesizer, phase locked to the TCXO. Voltage swing 0 to 5V. This clock is used by the central control and interface as a reference clock source.

Source:	Syn/mod:	Bipolar output from 5V supply via 4K7
Destination:	CCU:	Schmitt CMOS input through 10K
	Interface	CMOS input through 10K

CDR (DC reference to slicer)

Description: DC reference level from the IF nominally at the centre of the discriminator output. Used by the CCU to define the received signal slicing level.

Source:	IF:	Analogue level in the range 2.3 to 2.7V, impedance <1.2kOhms
Destination:	CCU:	Series 10K followed by 10nF to 0VDCE

CFR (CCU (RCA) MPU to Front Panel MPU Serial Link)

Description: Serial communication link from CCU (RCA) MPU to the Front Panel MPU. 0V to 5V CMOS logic levels at a bit rate of 9600 baud maximum.

Source:	CCU:	CMOS output through 1K
Destination:	FPM:	100K to 5VC followed by 10K to CMOS input

CFT (Front Panel MPU to CCU (RCA) Serial Link)

Description: Serial communication link from the Front Panel MPU to the CCU (RCA) MPU. 0V to 5V CMOS logic levels at a bit rate of 9600 baud maximum.

Source:	FPM:	CMOS output through 1K
Destination:	CCU:	100K to 5VC followed by 10K to CMOS input

CHL (High Transmit Power Available Indication)

Description: Flag generated by the PA to inform the CCU that high transmit power can be selected:

0:	0V:	High power not available
1:	5V:	High power (50/16W) available

Source:	RP:	CMOS output through 4K7
Destination:	CCU:	CMOS input through 10K

CHM (PA (Hop) Mute)

Description: Control signal generated by CCU to control the ramping of the PA:
0: 0V: Enable PA
1: 5V: Disable PA
↑: Start ramping down PA
↓: Start ramping up PA

Source: CCU: CMOS output through 4K7
Destination: RP: Diode then 100K to gnd & FET input

CHS (Hopping Squelch)

Description: Control signal generated by CCU to indicate Synchronisation state in Hopping and Fixed Secure modes:
0: 0V: Not in Sync
1: 5V: Synchronized

Source: CCU: CMOS output through 4K7
Destination: None, used for test only.

CIF (Discriminator output)

Description: Output from discriminator centred on a level nominally equal to CDR:
1.5V pk-pk for an input of ± 5kHz deviation
1.8V pk-pk for an input of ± 6kHz deviation
For data:
a +ve RF deviation results in CIF < CDR (data 0)
a -ve RF deviation results in CIF > CDR (data 1)

Source: IFA: Op-amp output with 3K9 to 0VDCE
Destination: CCU: Op-amp input through 100K

CIO (Bi-Directional TDS789 Serial Data Link)

Description: Bi-directional serial link, 4kb/s Pulse Width Modulation, 0v to 5v levels.

Source/Destination: CCU: 100K to +5V, 1nF to gnd, series 4K7
Interface: Series 4K7

CNO (Squelch Override)

Description: Control signal generated by CCU and used to force the IFA to override (open) the noise squelch.
0 (0V): Normal squelch operation
1 (5V): Noise-on

Source: CCU: CMOS output through 4K7
Destination: IF: CMOS input through 100K

CPL,CPM (Transmit Power Selection Word)

Description: Control signals generated by the CCU to instruct the PA to set the output power (0 = 0V; 1 = 5V):

Selected	CPL	CPM	Nominal Power Out
Low	0	0	100mW
Normal	1	0	5W
High	1	1	Max (5/20/50W)

Source: CCU: CMOS output through 4K7
Destination: RP: 100K to gnd and CMOS input through 100K

CPS (Transmit Enable)

Description: Control signal generated by CCU to instruct the Syn/mod and PA to go to Transmit.
1 (5V): Transmit
0 (0V): Receive

Source: CCU: CMOS output through 4K7
Destination: Syn/mod: CMOS input through 100K
RP: 100K + 1nF to gnd, and CMOS input through 100K. Also 47K to bipolar transistor base (for VIU).

CRB (Rebroadcast Selected)

Description: Control signal generated by CCU to instruct IFA that auto-rebroadcast mode has been selected.
1 (5V): Rebroadcast
0 (0V): Normal

Source: CCU: CMOS output through 4K7
Destination: IF: CMOS input through 100K

CSC (Current Saving Supply Enable)

Description: Control signal generated by CCU to instruct the Rear panel to remove the power from the battery saved supply 9V5BS.
1 (5V): Enable battery saved supply (9V5BS=9V5)
0 (0V): Disable battery saved supply (9V5BS=0V)

Source: CCU: CMOS output through 4K7
Destination: RP: 100K to gnd and CMOS input through 100K

CSD (TDS789 Interface Reply Enable)

Description: Control signal generated by CCU to instruct the Interface to enable the PWM Reply to be output on Pin F.
1 (5V): Enable PWM output
0 (0V): Disable PWM output

Source: CCU: CMOS output through 1K
Destination: Interface: CMOS input through 10K

CSQ (Any Squelch Active Indication)

Description: Control signal generated by CCU to inform the PA that any squelch has opened:
0 (0V): No squelch open
1 (5V): Any squelch: Hop sync/ 16kbs detected/ 150Hz tone/ noise squelch

Source: CCU: CMOS output through 4K7
Destination: RP: Transistor base through 47K for VIU.

CSS (Noise/Radio squelch)

Description: Control signal generated by the IF to inform the CCU that the 150Hz squelch or the noise squelch has opened AND the synthesizer is locked.
0 (0V): Squelch closed
1 (5V): Squelch open (150Hz tone/ Noise squelch/ CNO active) AND synthesizer locked

Source: IF: CMOS output through 4K7 with 1nF to gnd
Destination: CCU: CMOS input through 10K

CT1, CT2 (CMOS Socket 1/2 UART/USART Clear-to-Send)

Description: Clear-to-Send indications from the CCU for sockets 1 and 2 and sourced from the CCU DSP board UART and USART respectively. 0V to 5V CMOS logic levels with 5V indicating active Clear-to-Send.

Source: CCU: CMOS output through 1K and 100pF to 0VD
Destination: Interface: CMOS input through 10K

CTE (CCU Test Enable)

Description: Control input to the CCU which is reserved for enabling a test mode if required. Pull down to 0V to invoke test mode. High Z for normal operation

Source: Non-Radio Source: Hardwire connection/switch or open drain CMOS driver.
Destination: CCU: 100K pullup to 5VC to CMOS input through 10K.

CTS1, CTS2 (RS232 Socket 1/2 UART/USART Clear-to-Send)

Description: Clear-to-Send indications from the Interface Module for sockets 1 and 2. RS232 logic levels with < 0V indicating active Clear-to-Send.

Source: Interface: Slew rate limited RS232E transmitter through 470R.
Destination: FPM: Series SMD choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

CZR: (Zeroise)

Description: Hardware Zeroise, Erase = s/c to Ground, pulls backup battery supply to RAM low.

Source: FP: Switch to gnd
Destination: CCU: 1K to HUB supply + anode of series diode to RAM
Interface: Not used

DGS (CLK Recovery Squelch)

Description: Signal output from the CCU to indicate when the Clock Recovery LSI has detected 16kb/s traffic.
5V = 16kb/s detected.
0V = Not detected.

Source: CCU: CMOS output through 4K7.
Destination: None, used for test only.

FTE (FPM Test Enable)

Description: Control input to the FPM which is reserved for enabling a test mode if required. Pull down to 0V to invoke test mode. High Z for normal operation

Source: Non-Radio Source: Hardwire connection/switch or open drain CMOS driver.
Destination: FPM: 100K pullup to 5VC to CMOS input through 10K.

FTSI (Forward Transmit Signal Indication)

Description: Analogue representation of forward transmitted output power. 0V equates to TBA Watts and TBA V equates to TBA Watts, with a logarithmic scaling in between.

Source: RP: TBA.
Destination: CCU: TBA.

GRX (GPS Serial Link Receive Data)

Description: Serial link provision for FP integrated GPS module.

Source: CCU: Unconnected.
Destination: FP: CMOS input through 1K and 1nF to 0V

GTX (GPS Serial Link Transmit Data)

Description: Serial link provision for FP integrated GPS module.

Source:	FP:	CMOS output through 1K and 1nF to 0V
Destination:	CCU:	Unconnected.

GTP (GPS Time Pulse)

Description: One-pulse-per-second signal from GPS module.

Source:	FP:	CMOS output through 1K and 22pF to 0V
Destination:	CCU:	Unconnected.

HUB (Hold-up Battery Supply)

Description: 3.6V hold-up supply to the RP tamper link from the standby battery located on the motherboard.

Source:	M/board:	3.6V Lithium Battery +ve terminal via 150 Ohm protection resister.
Destination:	RPA:	Connected to HBT line via tamper link in 32 way PL38.

HBT (Tamper Protected HUB Supply)

Description: Sourced by the RP from its HUB input connection. If the RP is disconnected, then the HUB supply is cut off, thereby clearing secure memory.

Source:	RP:	Direct RP loom link from HUB line.
Destination:	CCU:	TBA
	Interface:	Not Used.

ICK (I2C Interface Clock)

Description: Clock signal for I2C interface between the CCU and Interface Module with 0V to 5V levels. Expected to run at 64kHz in a burst manner when transferring I2C data. Refer to an I2C specification for details of active clock edges.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	Schmitt CMOS input through 10K. (Note - Schmitt input unnecessary if receiving device can accept a 200ns rise/fall time without oscillation)

ICR (Intercom Receive Analogue Traffic)

Description: Received Intercom Analogue Traffic to Interface
Analogue 1V rms (for 6kHz deviation) centered on 2.5V

Source:	CCU:	output through 1K
Destination:	Interface:	input through 1K

ICT (Intercom Transmit Analogue Traffic)

Description: Transmit Intercom Analogue Traffic from Interface
Analogue 1V rms centered on 2.5V

Source: Interface: output via 1K
Destination: CCU: input through >100K

IDT (I2C Bidirectional Data)

Description: Bidirectional data signal for I2C interface between the CCU and Interface Module with 0V to 5V levels. 5V represents data '1'. Data sent in bursts of 64kBits/s. Refer to an I2C specification for details of orientation with the active ICK I2C clock active edges.

Source/Dest.: CCU: CMOS input via 10K, CMOS output through 100R followed by 10K pullup to 5VC and 100pF to 0VD.
Source/Dest.: Interface: CMOS input via 10K, CMOS output through 100R followed by 10K pullup to 5VC and 100pF to 0VD.

IRQ (I2C Interrupt Request)

Description: I2C Interrupt Request from Interface Module to CCU. 0V indicates interrupt request, while 5V indicates otherwise.

Source: Interface: Open-Drain output with 10K pullup to 5VC.
Destination: CCU: 10K pullup to 5VC, to CMOS input via 10K.

ISQ (Tone/Hailing Squelch)

Description: Indication from the IFA module to the CCU indicating the detection of 150Hz modulation on the current channel.
0 (0V): Tone squelch closed
1 (9.5V): 150Hz tone detected, squelch open

Source: IF: Op-amp output through 4K7 with 1nF to gnd
Destination: CCU: CMOS input through 10K

ITE (Interface Module Test Enable)

Description: Control input to the Interface Module which is reserved for enabling a test mode if required. Pull down to 0V to invoke test mode. High Z for normal operation.

Source: Non-Radio Source: Hardwire connection/switch or open drain CMOS driver.
Destination: Interface: 100K pullup to 5VC to CMOS input through 1K.

KBP (Key Board Press Indication)

Description: Key Board Press Indication from Front Panel Module to CCU.
5V Key currently pressed.
0V No keys Pressed.

Source: FPM: CMOS output through 1K.
Destination: Interface: CMOS input through 10K.

KVO (VIU Attached Indication)

Description: Control flag generated by the VIU via the Rear panel to inform the Front Panel and the IF that a Vehicle Interface unit is attached.
0 (0V): No VIU
1 (9 - 18V): VIU attached

Source: RP: Potential divider o/p impedance 5K
Destination: CCU: CMOS input through potential divider comprising series 100K with 100K to 0VD.
RFH: MOSFET input with 470K to 0VDCE & series 4K7

MBL (Build 3 RPA Battery Level LSB)

Description: Battery level least significant bit indication from a build 3 RPA only.

Battery Voltage	MBL
<10V	0
10V to 11.5V	1
11.5V to 13V	1
>13V	0

Source: Build 3 RP: Op-amp output through 4k7 with 1nF to gnd.
Destination: CCU: CMOS input through 10K.

RC2 (CMOS Socket 2 USART Receive Clock)

Description: Socket 2 USART receive clock at 0V to 5V levels.

Source: CCU: CMOS output through 1K with 100pF to 0VD.
Destination: Interface: Schmitt CMOS input through 10K.
(Note - Schmitt input unnecessary if receiving device can accept a 200ns rise/fall time without oscillation)

RD1 (CMOS Socket 1 UART Receive Data)

Description: Socket 1 UART receive data at 0V to 5V levels with 5V representing a data '1'.

Source: CCU: CMOS output through 1K with 100pF to 0VD.
Destination: Interface: CMOS input through 10K.

RD2 (CMOS Socket 2 USART Receive Data)

Description: Socket 2 USART receive data at 0V to 5V levels. Data is stable on the RC2 clock TBA edge, with 5V representing a data '1'.

Source: CCU: CMOS output through 1K with 100pF to 0VD.
Destination: Interface: CMOS input through 10K.

RDX1 (RS232 Socket 1 RCA UART Receive Data)

Description:	Socket 1 RCA UART receive data at RS232 levels. Data '1' represented as < 0V.	
Source:	Interface:	Slew rate limited RS232E transmitter output through 470R.
Destination:	FP:	SMD Choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

RFB (RF Comb (BIT) from IFA)

Description:	Comb of RF frequencies generated every 10MHz from 10MHz to 400MHz by IFA module as part of BIT.	
Source:	IFA:	-30dBm from 50 Ohm, DC blocked.
Destination:	AMU:	50 Ohm input, approximately 40dB loss to Rx path.

RIF (RF Input from RFH 50 Ohm)

Description:	Output of double balanced mixer at 10.7MHz in the range +1dB to -4dB with respect to RRF.	
Source:	RFH:	50 Ohm
Destination:	IFA:	50 Ohm

RIO (Remote In/Out)

Description:	Bi-directional Remote Control Line.	
Source:	CCU(RLI):	ac coupled I/O at 50-200kHz
Destination:	FP:	Transformer

RME (Remote Signal Earth)

Description:	Remote Control Line Signal Earth	
Source:	CCU(RLI):	Linked to 0VDCE
Destination:	FP:	Transformer

RSI (Received signal indication)

Description:	Analogue indication of received signal strength from IF in the range 0 to 5V. Used by CCU.	
Source:	IF:	Op-amp output through 10K
Destination:	CCU:	ADC input through 1K with 10nF to 0VDCE

RST (Radio Global Reset)

Description: Radio Global Reset.
0 (0V): Reset active
1 (5V): Reset inactive

Source: CCU: CMOS Open-Drain output with 100K pullup
Destination: FP: Input through reverse biased schottky diode, followed by 1K pullup to 5VC, and on to CMOS input.
Interface: Input through reverse biased schottky diode, followed by 1K pullup to 5VC, and on to CMOS input.

RT1 (CMOS Socket 1 UART Request-to-Send)

Description: Socket 1 UART Request-to-Send at 0V to 5V CMOS levels. Request to send is indicated by a 5V level.

Source: Interface: CMOS output through 1K and 100pF to 0VD.
Destination: CCU: CMOS input through 10K.

RT2 (CMOS Socket 2 USART Request-to-Send)

Description: Socket 2 USART Request-to-Send at 0V to 5V CMOS levels. Request to send is indicated by a 5V level.

Source: Interface: CMOS output through 1K and 100pF to 0VD.
Destination: CCU: CMOS input through 10K.

RTS1 (RS232 Socket 1 UART Request-to-Send)

Description: Socket 1 UART Request-to-Send at RS232 levels. Request to send is indicated by a < 0V level.

Source: FP: 100pF to 0VDCE within Front Panel 13 way socket pin followed by series SMD choke.
Destination: Interface: RS232E receiver input through 470R.

RTS2 (RS232 Socket 2 USART Request-to-Send)

Description: Socket 2 USART Request-to-Send at RS232 levels. Request to send is indicated by a < 0V level.

Source: FP: 100pF to 0VDCE within Front Panel 13 way socket pin followed by series SMD choke.
Destination: Interface: RS232E receiver input through 470R.

RTSI (Reverse Transmit Signal Indication)

Description: Analogue representation of reverse transmitted output power. 0V equates to TBA Watts and TBA V equates to TBA Watts, with a logarithmic scaling in between.

Source:	RP:	TBA.
Destination:	CCU:	TBA.

RX1 (CMOS Socket 1 RCA UART Receive Data)

Description: Socket 1 RCA UART receive data at 0V to 5V CMOS levels. Data '1' represented as 5V.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	CMOS input through 10K.

RXA (Receive Analogue Traffic)

Description: Analogue receive traffic from CCU to Interface Module. 1V rms (for 6kHz deviation) centred on 2.5V.

Source:	CCU:	Op-amp output through 1K.
Destination:	Interface:	Op-amp input through 1K.

RXC2 (RS232 Socket 2 USART Receive Clock)

Description: Socket 2 USART receive clock at RS232 levels.

Source:	Interface:	Slew rate limited RS232E transmitter through 470R.
Destination:	FPM:	Series SMD choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

RXD1 (RS232 Socket 1 UART Receive Data)

Description: Socket 1 UART receive data at RS232 levels with < 0V representing a data '1'.

Source:	Interface:	Slew rate limited RS232E transmitter through 470R.
Destination:	FPM:	Series SMD choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

RXD2 (RS232 Socket 2 USART Receive Data)

Description: Socket 2 USART receive data at RS232 levels. Data is stable on the RXC2 clock TBA edge, with < 0V representing a data '1'.

Source:	Interface:	Slew rate limited RS232E transmitter through 470R.
Destination:	FPM:	Series SMD choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

RXT (Received Digital Traffic)

Description: Received Digital Traffic to Interface at 0V to 5V levels. Data '1' represented as 5V. Data is output by the CCU on the positive edge of the TCK clock, and sampled by the Interface Module on the negative edge.

Source: CCU: CMOS output through a series 1K with 100pF to 0VD.
Destination: Interface: CMOS input through 10K.

SK1A	Mic/data input, voltage programming	)	
SK1B	Mic earth, voltage programming	)	
SK1C	Socket Supply	)	
SK1D	Received voice/data	)	see table 1
SK1E	Socket Earth	)	
SK1F	Pressel/TDS789 Serial Control	)	
SK1G	Received voice/data clock	)	
SK2A	Mic/data input, voltage programming	)	
SK2B	Mic earth, voltage programming	)	
SK2C	Socket Supply	)	
SK2D	Received voice/data	)	see table 1
SK2E	Socket Earth	)	
SK2F	Pressel/TDS789 Serial Control	)	
SK2G	Received voice/data clock	)	

SP1 (Spare Connection 1)

Description: Spare CCU to Syn/Mod Connection

Source/Dest.: CCU: Unconnected
Source/Dest.: Syn/Mod: Unconnected

SYC (Synthesizer clock)

Description: 16kHz Synthesizer data clock generated by the CCU at 0 to 5V. The rising edge is used by the Synthesizer to clock data (SYD) into its shift register when the frame (SYF) is high.

Source: CCU: CMOS output through 4K7 with 100pF to 0VD
Destination: Syn/mod: CMOS input through 100K
RP: Op-amp I/P through 47K

SYD (Synthesizer data)

Description: 16kb/s Synthesizer data generated by the CCU at 0 to 5V. The frequency data encoding is given in Fig.1 (positive logic). When the SYF signal is inactive or 0V, the state of the SYD signal conveys the required on/off state of a connected VIUs' front panel lamps.

Source: CCU: CMOS output through 4K7 with 100pF to 0VD
Destination: Syn/mod: CMOS input through 100K
RP: to VIU via 3K3 with 1nF to gnd

SYF (Synthesizer frame)

Description: Synthesizer data frame generated by the CCU at 0 to 5V. The falling edge of the frame is used to transfer data into the synthesizer.

Source:	CCU:	CMOS output through 4K7 with 100pF to gnd
Destination:	Syn/mod:	CMOS input through 100K
	VIU:	via rear panel through 3k3 with 1nF to gnd

SYL (Synthesizer in lock)

Description: Control flag from Syn/Mod to indicate that the synthesizer and modulator are locked to the selected frequency.

0 (0V):	Synthesizer or modulator out of lock (frequency incorrect)
1 (5V):	Synthesizer and modulator locked to chosen frequency

Source:	Syn/mod:	CMOS output through 4K7
Destination:	CCU:	CMOS input via 10K
	IF:	CMOS input through 100K
	RP:	CMOS input through 100K with 100K to gnd.

SYR (RF output to synth)

Description: Reference signal from Local Oscillator in the RF Head at a level of 0dbm ±3dB into 50Ohms.

Source:	RF Head:	100Ohms source impedance via 50Ohms Zo low-pass filter
Destination:	Syn/mod:	100Ohms

SWI (Main supply switch)

Description: Power-on switch connection.

1=Battery volts:	Radio OFF
0=0V:	Radio ON

Source:	FP:	volume switch contact s/c to 0VD in ON positions
Destination:	RP:	Transistor base through 10μH and 1K with reverse protection diode. Also to VIU via 23K with 1nF to gnd

TCK (Digital Traffic Clock)

Description: Clock signal for digital traffic flow between the CCU and Interface Module with 0V to 5V levels. Expected to run at mode dependent frequencies up to a maximum of 64kHz.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	Schmitt CMOS input through 10K. (Note - Schmitt input unnecessary if receiving device can accept a 200ns rise/fall time without oscillation)

TC2 (CMOS Socket 2 USART Transmit Clock)

Description: Socket 2 USART transmit clock at 0V to 5V CMOS levels.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	Schmitt CMOS input through 10K. (Note - Schmitt input unnecessary if receiving device can accept a 200ns rise/fall time without oscillation)

TD1 (CMOS Socket 1 UART Transmit Data)

Description: Socket 1 UART transmit data at 0V to 5V CMOS levels. 5V represents data '1'.

Source:	Interface:	CMOS output through 1K and 100pF to 0VD.
Destination:	CCU:	CMOS input through 10K.

TD2 (CMOS Socket 2 USART Transmit Data)

Description: Socket 2 USART transmit data at 0V to 5V CMOS levels. 5V represents data '1'.

Source:	Interface:	CMOS output through 1K and 100pF to 0VD.
Destination:	CCU:	CMOS input through 10K.

TDX1 (RS232 Socket 1 RCA UART Transmit Data)

Description: Socket 1 RCA UART transmit data at RS232 levels. Data '1' represented as < 0V.

Source:	FP:	100pF to 0VDCE within Front Panel 13 way socket pin followed by series SMD choke.
Destination:	Interface:	RS232E receiver input through 470R.

TFR (Digital Traffic Frame)

Description: Frame marker pulse train for use with CODEC traffic. Positive going pulse with a duration of one bit width. Expected to be at a rate of 8Kpulses/s, with the falling edge of the pulse defining the start of a new CODEC sample/word.

Source:	CCU:	CMOS output through 1K and 100pF to 0VD.
Destination:	Interface:	CMOS input through 10K.

TMD (Transmitter modulation)

Description: Signal for transmission, centred on 2.5V, passed from the CCU to the Modulator where it is processed by a low-pass Bessel filter. A 1V rms signal will result in ±6kHz deviation (nominally).
V > 2.5V: -ve Rf deviation
V < 2.5V: +ve Rf deviation

Source:	CCU:	Op-amp output through 1K
Destination:	Syn/Mod:	Op-amp input via 2x68K in series

TNK (Key Press Tone Enable)

Description: Key Pressed Tone Enable signal from CCU.
5V Enable key press tone.
0V Disable key press tone.

Source:	CCU:	CMOS output through 1K.
Destination:	FPM:	CMOS input through 10K.

TX1 (CMOS Socket 1 RCA UART Transmit Data)

Description: Socket 1 RCA UART transmit data at 0V to 5V CMOS levels. Data '1' represented as 5V.

Source:	Interface:	CMOS output through 1K and 100pF to 0VD.
Destination:	CCU:	CMOS input through 10K.

TXA (Transmit Analogue Traffic)

Description: Analogue transmit traffic from Interface Module to CCU. 1V rms (for 6kHz deviation) centred on 2.5V.

Source:	Interface:	Op-amp output through 1K.
Destination:	CCU:	Op-amp input through 1K.

TXC2 (RS232 Socket 2 USART Transmit Clock)

Description: Socket 2 USART Transmit clock at RS232 levels.

Source:	Interface:	Slew rate limited RS232E transmitter through 470R.
Destination:	FPM:	Series SMD choke followed by 100pF to 0VDCE within Front Panel 13 way socket pin.

TXD1 (RS232 Socket 1 UART Transmit Data)

Description: Socket 1 UART transmit data at RS232 levels. Data '1' represented as < 0V.

Source:	FP:	100pF to 0VDCE within Front Panel 13 way socket pin followed by series SMD choke.
Destination:	Interface:	RS232E receiver input through 470R.

TXD2 (RS232 Socket 2 USART Transmit Data)

Description:	Socket 2 USART transmit data at RS232 levels. Data '1' represented as < 0V.	
Source:	FP:	100pF to 0VDCE within Front Panel 13 way socket pin followed by series SMD choke.
Destination:	Interface:	RS232E receiver input through 470R.

TXT (Transmit Traffic)

Description:	Transmit Digital Traffic from Interface Module to CCU at 0V to 5V levels. Data '1' represented as 5V. Data is output by the Interface Module on the positive edge of the TCK clock, and sampled by the CCU on the negative edge.	
Source:	Interface:	CMOS output through 1K with 100pF to 0VD
Destination:	CCU:	CMOS input through 10K

VT (Voltage Tuning)

Description:	Local Oscillator tuning voltage. Generated by the synthesizer used by the RF Head (and by the modulator within the Syn/mod module).			
	Band 1	8 to 70V:	LO:	40.7 to 56.7MHz
	Band 2	8 to 70V:	LO:	56.7 to 80.7MHz
	Band 3	7 to 70V:	LO:	80.7 to 118.7MHz
Source:	Syn/mod:	Impedance 130Ohms, voltage range 7 to 70V, max load 100nF		
Destination:	RF Head:	Capacitance approx 75nF		

XCK (XILINX Configuration Clock)

Description:	Clock signal for use at radio start up by the CCU for transfer of configuration data to the Interface Module Xilinx FPGA. Refer to XILINX FPGA manuals for explanation of 'slave serial' configuration load of the Interface FPGA.	
Source:	CCU:	CMOS output through 1K.
Destination:	Interface:	CMOS input through 10K.

XDP (XILINX Configuration Status/Program Control)

Description:	DONE/PROG signal as defined in Xilinx FPGA literature. Open drain CMOS signal with 0V being used to initiate configuration and indicate configuration in progress, and the high-Z state indicating the completion of configuration.	
Source/Dest.:	CCU:	CMOS input/output through 100R to 10K pullup to 5VC.
Source/Dest.:	Interface:	CMOS input/output through 100R to 10K pullup to 5VC.

XDT (XILINX Configuration Data)

Description: For the serial loading of configuration data to the Interface Module XILINX FPGA at radio start up. Refer to XILINX literature for further details.

Source:	CCU:	CMOS output through 1K.
Destination:	Interface:	CMOS input through 10K.

XIT (XILINX Initialisation Status)

Description: INIT signal as defined in Xilinx FPGA literature. Input to CCU from the Interface Module FPGA indicating that the FPGA is in a initialising memory clearing phase when 0V, and that configuration may start when 5V.

Source:	Interface:	CMOS open drain output through 100R to 10K pullup to 5VC.
Source/Dest.:	CCU:	CMOS input through 10K.

Power Supply and Earth Connections

5VC (5V digital supply)

Voltage Range: 5.2V +/- 0.25V

9V5C (9.5v constant supply)

Voltage Range: 9.5V +/- 0.1V

9V5BS (Battery saved 9.5V supply)

Voltage Range: 9.5V +/- 0.2V

9V5TX (9.5V Tx supply)

Voltage Range: 9.5V +/- 0.2V

12S (Switched, regulated battery)

Description: Used by the Interface for the Socket Pin C supplies.
Voltage Range: 10V to 17V

85V 85V supply

Description: High voltage supply generated by Synthesizer, used by RF Head, PA and AMU

Source:	Syn/mod:	85 ± 5V, max load 1mA
Destination:	RF Head:	<350μA
	AMU:	<255μA
	RP:	≈75μA (Tx), <1μA (Rx)

0VD (0 Volts digital)

0V return for all signals powered from the 5VC supply.

0VDCE (Chassis Ground)

0V return for all signals powered from the 12S, 9V5C, 9V5BS, 9V5TX and 85V supplies.

Non Motherboard Connections

RRF Coax AMU to RFH

Description: 50Ohms coaxial signal connection from AMU to RF Head used to pass received signal and dc supply for PIN-diode band switches.

Source:	AMU:	50Ohms; 7.5V dc when battle antenna in use, 8.2V dc when battle antenna not in use
Destination:	RF Head:	dc current sink to 0V: <1uA, TX mode manpack mode (KVO = 0), enhanced protection off: 20mA vehicle mode (KVO = 1), enhanced protection on: 85mA

RTD Coax Syn/mod to PA

Description: 50Ohms coaxial signal connection from Syn/mod to Rear panel to pass transmit signal from the modulator to the PA.

Source:	Syn/mod:	50Ohms, power range 750mW to 1W
Destination:	RP:	50Ohms

RTO Coax PA to AMU

Description: 50 Ohms coaxial transmit signal connection from PA to AMU and dc reference (AMU to PA) for pin-diode band switches.

Source:	AMU:	50Ohms; 7.5V dc when battle antenna in use, 8.2V dc when battle antenna not in use
	RP:	Transmit power in the range 50mW to 22W
Destination:	AMU:	RF power handling capacity >50W to 50Ohms socket or battle antenna
	RP:	dc current sink to 0V approx 70mA in Tx

REAR PANEL 10 WAY PLUG INTERFACE

Pin A 16kHz clock a.c. coupled 5v pk-pk square - 2kohm source impedance.
Power on/off logic output (d.c. level 0V from 23 kohm when power on).

Pin B Positive d.c. supply input 12v or 24v from vehicle.

Pin C Squelch logic (open collector pulls to 0v via 1k5ohm when squelch active).

Pin D Pressel logic output (open collector pulls to 0v via 1k5ohm when in transmit).

Pin E DC earth (0v).

Pin F Synthesizer frame output 5v logic 4k7ohm source impedance.
Lamps on/off frame control logic 0 when lamps on/off data present on SYD.

Pin G VIU supply voltage monitor input more than 10kohm d.c. input impedance.

Pin H Synthesizer data output (SYD) 5v logic 4k7ohm source impedance.
Lamps on/off data modulated on to line. Logic 0 = on, Logic 1 = off.

Pin J High Power Select (HPS) 5v logic 11kohm source impedance.

Pin K VIU r.f. power monitor input more than 100kohm impedance.

AUDIO / DATA 13 WAY SOCKET INTERFACE

TRAFFIC TYPE	CONTROL PIN A	CONTROL PIN B	PIN B	PIN A	PIN D	PIN C	PIN E	PIN F	PIN G
Headset	0V	0V	Mic I/P return balanced with Pin A.	Mic I/P balanced with Pin B Differential Input with pin B. 1mV Impedance 300Ω	Phones output up to 1.7V (10mW) into 300 Ω	10.5 -17V DC Supply Short Circuit protected by resettable fuse. Current Limited by main regulator to 1 Amp	Earth Return (0V)	Pressel Rx = >22kΩ to 0V or >3V Tx = <2kΩ to 0V or <2V and Bi-directional PWM Serial Data: (TDS789) Input: High =>6V Low =<3V Output: High =>6V Low =<1.5V	Variable Level Phone Output up to 1.7V (10mW) into 300 Ω
Fixed Level Audio (ROVIS)	4V ±0.75V	0V or o/c	Digital Traffic Type Programming Input	Fixed Level ROVIS Input 262mV into 300Ω	Fixed Level ROVIS output 120mV into 150Ω				No 16KHz clock or Squelch, Tone or CTS indication
Fixed Level Audio (Harness)	8V ±0.75V			Fixed Level Harness input 20 mV into 300Ω	Fixed Level Harness output 1.7V (10mW) into 300Ω				No 16KHz clock. >7 Volts when no Squelch, Tone or CTS asserted, 0 volts with either Squelch, Tone or CTS.
Digital	Don't Care	>3.25V <8.75V		Digital Input 5V pk-pk centered on 4.5V Impedance =10kΩ	Digital output 6V pk-pk centered on 4V into 10kΩ load				16KHz clock 5V pk-pk via 4.7uF capacitor on 5Vdc to indicate: Squelch open, Tone active or CTS

Table 1 - Transceiver 13 Way Interface, Socket 1 and 2, Pins A-G

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6
Function	TXD	RXD	RTS	CTS	RXD	TXD
Description	Serial Input RS232 Data for Transmission	Serial Output RS232 Received Data	Ready to Send Input. Indicates a DTE is ready to transfer data to the Radio	Clear to Send Indicates the Radio is ready to receive data from the DTE	Serial RS232 Output Data	Serial RS232 Input Data
Specification	High = >3V Low = <-3V	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High = >3V Low = <-3V	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High = >3V Low = <-3V
Interface Mode	Pin Allocation				Dedicated to Asynchronous Control (ACM)	
ADM	TXD	RXD	RTS	CTS	RXD	TXD
ACM	TXD	RXD			RXD	TXD
GPSM	TXD	RXD			RXD	TXD

ADM - Asynchronous Data Mode
ACM - Asynchronous Control Mode
GPSM - Global Position Satellite Mode

Table 2 - Transceiver 13 Way Interface, Socket 1, Pins 1-6

	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6
Function	TXD	RXD	RTS	CTS	RXC	TXC
Description	Serial Input RS232 Data for Transmission	Serial Output RS232 Received Data	Ready to Send Input. Indicates a DTE is ready to transfer data to the Radio	Clear to Send Indicates the Radio is ready to receive data from the DTE	Receive Timing Element	Transmit Timing Element
Specification	High = >3V Low = <-3V	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High = >3V Low = <-3V	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ	High =>5V into 4.7kΩ Low =<-5V into 4.7kΩ
Interface Mode	Pin Allocation					
ADM	TXD	RXD	RTS	CTS		
SDM	TXD	RXD	RTS	CTS	RXC	TXC
ACM	TXD	RXD				
GPSM	TXD	RXD				

ADM - Asynchronous Data Mode
SDM - Synchronous Data Mode
ACM - Asynchronous Control Mode
GPSM - Global Position Satellite Mode

Table 3 - Transceiver 13 way Interface, Socket 2, Pins 1-6

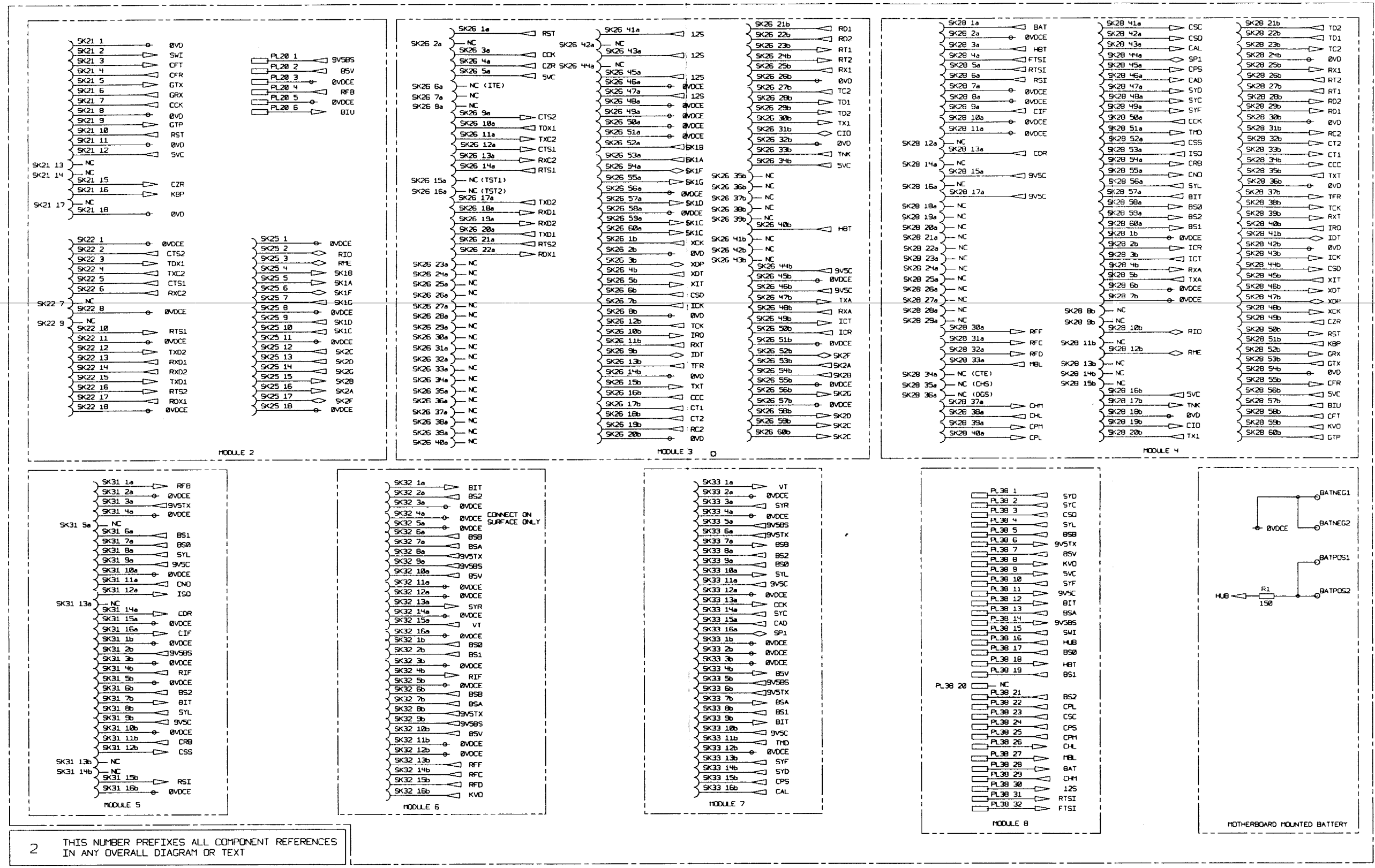


Fig 6.1
Circuit Diagram :
Motherboard Unit 2

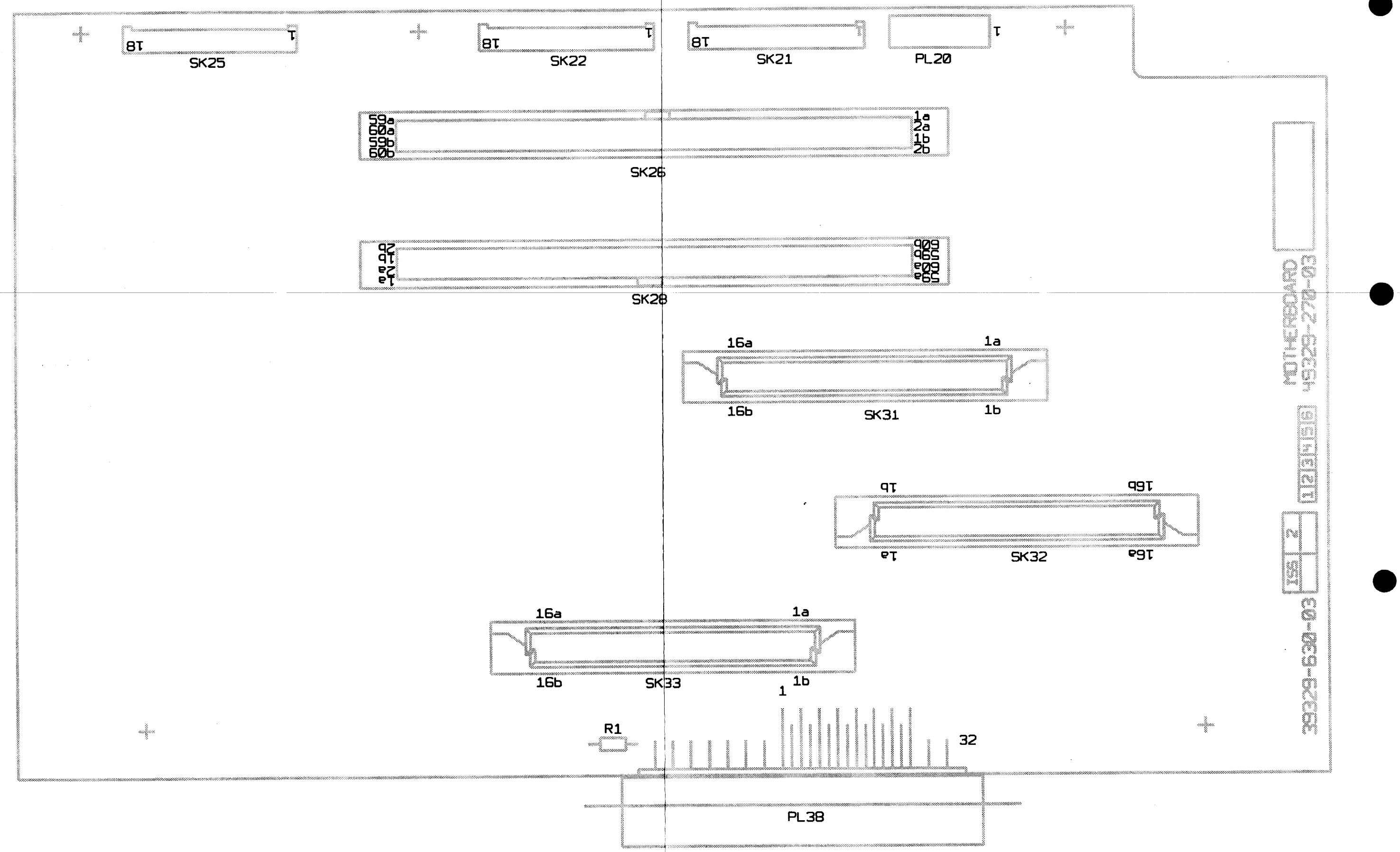


Fig 6.2 Layout :
Motherboard Unit 2 (Sheet 1)

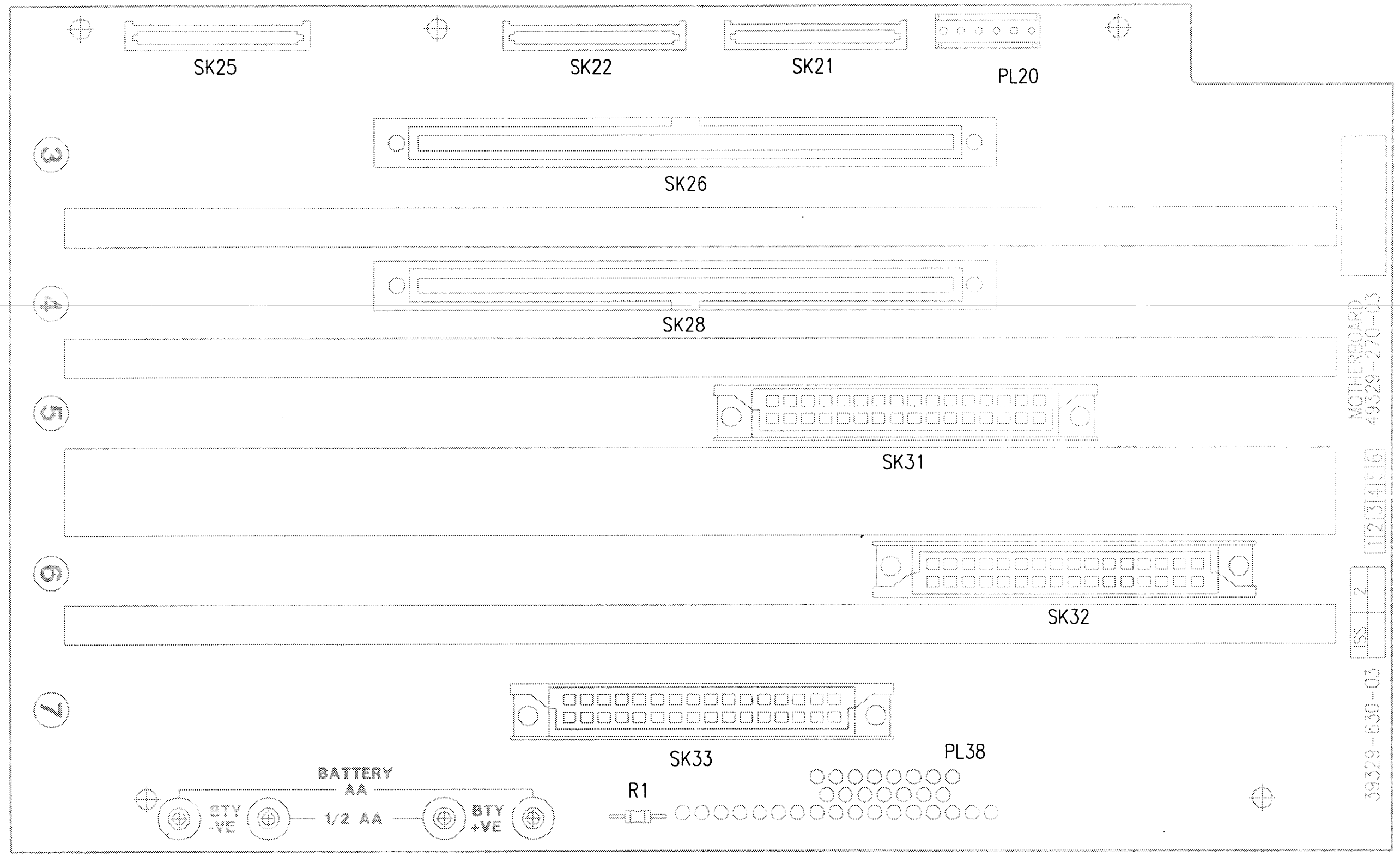


Fig 6.2 (Sheet 2 of 2)
Layout :
Motherboard Unit 2

CHAPTER 7

DISMANTLING AND REASSEMBLY

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CHAPTER 7

DISMANTLING AND REASSEMBLY

DISMANTLING (Figs 7.1, 7.2)

1 The following tools are required when dismantling the BCC 67:

(1) 3 mm Allen Key
(2) Module Extractor Tool
(3) Superdrive Screwdriver
(4) 5.5 mm Socket (Remote terminal nuts)
(5) 2.5 mm Allen Key (Keyboard).
(6) Castellated Tubular Spanner (Audio socket)
(7) 5mm Socket (Antenna Matching Unit)
(8) Soldering iron (Standby Battery)
(9) Heater gun (Standby Battery)
(10) Torque wrench up to 1.0 Nm

2 The following consumables may be required:

(1) Grease (980257) for Seals
(2) Desiccator sachet (98881-003-20).
(3) Adhesive (A03699/HZ) for Standby Battery

3 To gain access to the transceiver:

(1) Undo the four captive screws securing the Front Panel to the sleeve using a 3 mm allen key.

(2) Remove the Front Panel and Chassis / Motherboard Assembly from the Sleeve and the Rear Panel connectors.

Removing Modules Units 3, 4, 5, 6 and 7

4 After Para 3 actions, to remove modules from the Chassis / Motherboard Assembly - Units 3, 4, 5, 6 and 7, proceed as follows:

(1) If the Synthesizer / Modulator Unit 7 is to be removed, lift off the coaxial connector on the rear of the unit. This is best done after the module is lifted clear - see steps (3) and (4).

(2) If the RF Head Unit 6 is to be removed lift off the coaxial connector from the AMU, Unit 1d of the Front Panel and pull clear of the two cable clamps on the side of the chassis. The cable is attached to unit 6.

(3) For the module to be removed push up to the unlocked position the module securing clamps at either side of the chassis.

NOTE: Units 4 and 6 should be pressed firmly down towards the Motherboard when unlocking.

(4) Locate the slots on either side of the module housing. Fit the module extractor tool, locating in the two slots. Press down on the extractor tool handle and lever out the module. Lift out the module by hand.

Removing Rear Panel from Sleeve

5 To remove the Rear Panel from the Sleeve after Para 3 actions, undo the four captive screws securing the rear panel to the sleeve using the 3 mm allen key.

Removing Front Panel from Motherboard

6 To remove the Front Panel from the Chassis / Motherboard Assembly after Para 3 actions, proceed as follows:

(1) Remove units 3 (Interface) and 4 (Central Control) as described in Para 4 steps (3) and (4).

(2) Lift off the four flexible assemblies connected to the Motherboard from the Front Panel.

(3) Remove the coaxial connector to unit 1d AMU from the RF Head.

(4) Undo the four superdrive screws securing the Front Panel to the Chassis / Motherboard.

(5) Withdraw the chassis from the Front Panel and remove the coaxial cable from the Motherboard / Rear Panel to the AMU unit 1d.

Removing the Keyboard and Display

7 Remove the Front Panel by carrying out the actions of Paras 3 and 6 and proceed as follows:

(1) Undo the four captive screws securing the Keyboard cover to the Front Panel using the 2.5 mm Allen Key.

(2) Lift off the display window with seal and Keyboard boot.

(3) Lift off the display board from the connector.

(4) Lift off the Keyboard switch assembly from the connector.

Removing the Front Panel PCB Unit 1b

8 Remove the Front Panel by carrying out the actions of Paras 3 and 6 and proceed as follows:

(1) Remove the Keyboard and Display as described in Para 7.

(2) Lift off the three flexible connectors secured to the PCB.

(3) Undo the two audio socket locking rings using the castellated tubular spanner.

(4) Undo the two nuts securing the remote terminals to the PCB.

(5) Undo the six superdrive screws securing the PCB to the front panel casting.

(6) Move the control switch S1 so that the recess in the switch body is positioned next to the screw securing the switch. Undo the screw securing the switch to the front panel casting.

(7) Repeat (6) for the on / off switch S3.

(8) Lift off the circuit board.

Removing the Antenna Matching Unit 1d

9 Remove the Front Panel by carrying out the actions of Paras 3 and 6 and proceed as follows:

(1) Undo the two superdrive screws securing the screening can and lift off the can.

(2) Undo the two pillars using the 5 mm socket and one superdrive screw securing the circuit board to the front panel.

(3) Lift off the circuit board.

Removing the Standby Battery

10 Remove the Standby Battery by carrying out the actions of Para 3 and proceed as follows:

(1) Remove the RF Head and Synthesizer / Modulator units 6 and 7 as outlined in Para 4.

(2) Remove the adhesive securing the battery to the chassis.

(3) Remove the battery using the soldering iron.

REASSEMBLY

11 In general reassembly is the reverse of dismantling but the following points should be noted:

(1) Check the desiccator sachet for signs of ingress of moisture and replace if necessary. The crystals are normally blue and become pink with the effects of moisture. The desiccator sachet is fitted between the front panel and unit 3.

(2) Check the seals which are fitted into the recesses on the front and rear panels for any signs of pinching or damage and replace as necessary. Lightly smear the seals with silicon grease before refitting the front and rear panels.

(3) When refitting the AMU the two coaxial connectors in the aperture of the screening can should be connected as follows:

Nearest top of front panel - To RF Head
Nearest bottom of front panel - To Rear Panel

(4) When refitting the Front Panel PCB ensure that the three switch knobs are turned fully anticlockwise and the arrow on each switch is pointing to the top of the front panel.

(5) If the radio has been opened, the Calendar or Real Time Clock must be entered into the radio, see Chapter 8 Para 15.

(6) When refitting the standby battery ensure it is secured to the chassis using the heat gun and adhesive.

(7) The tightening torques for the captive screws for the front and rear panels and for the four screws securing the front panel to the Motherboard is 0.6 ± 0.1 Nm. All other screws should be tightened to a torque of 0.37 ± 0.02 Nm.

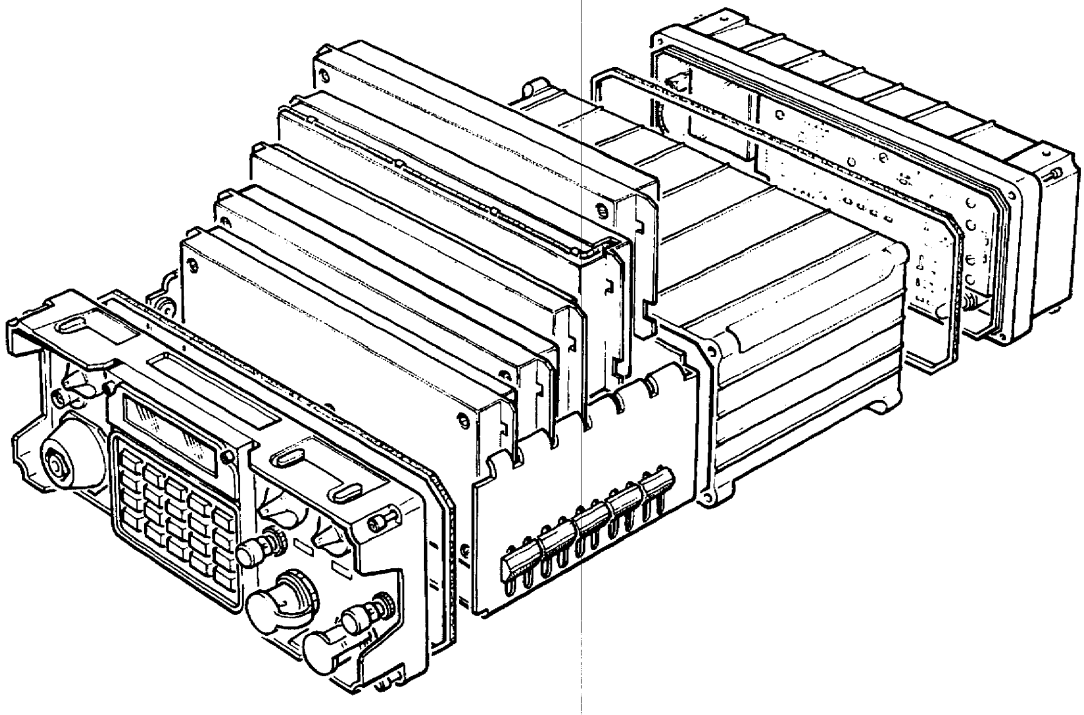
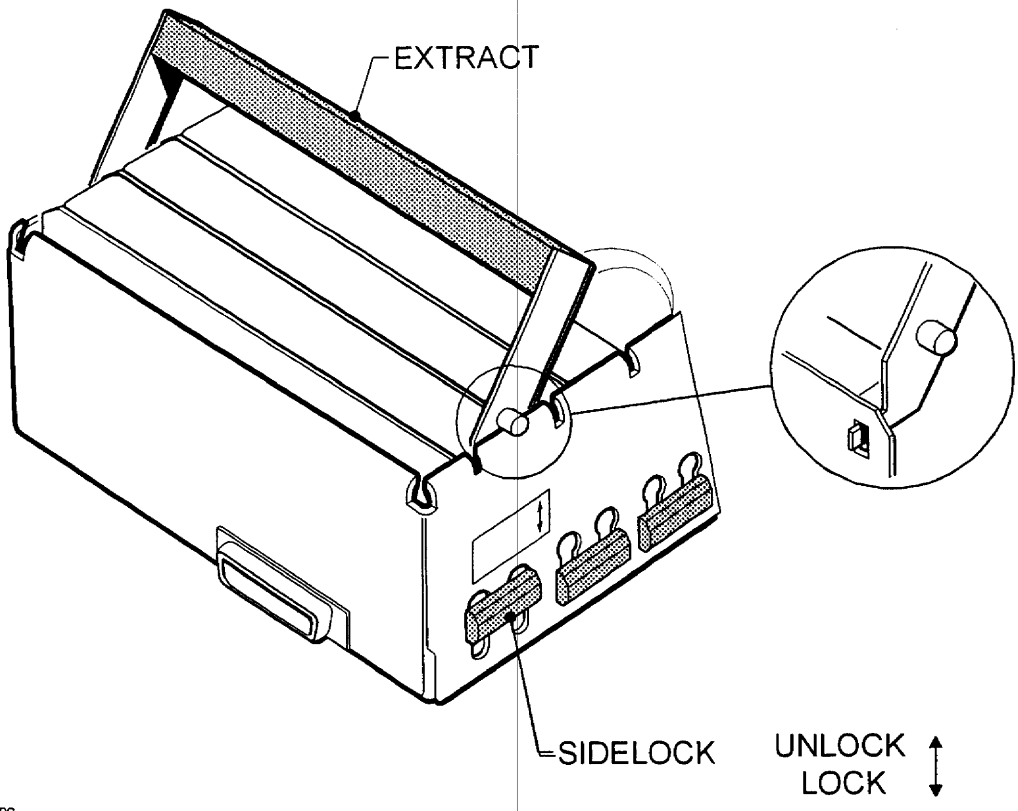
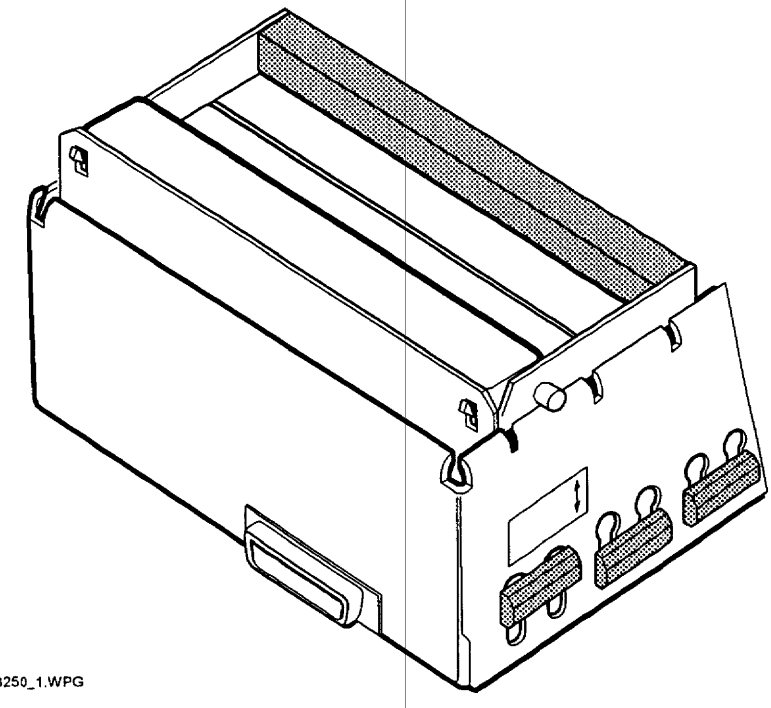


Fig 7.1
Construction Details



TG3250.WPG

EXTRACTOR FITTED TO UNIT



TG3250_1.WPG

EXTRACTOR FITTED TO UNIT

Fig 7.2
Removal of Modules

CHAPTER 8

FIELD MAINTENANCE

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FIELD MAINTENANCE

INTRODUCTION

1 This chapter contains information to enable the BCC 67 to be serviced in a field environment. The spares list consists of mechanical and electrical items which could easily be replaced to maintain operational capability. The fault location information enables the field technician to make a sequence of checks to indicate the suspect area. In general the electrical faults would be cleared by replacing circuit boards or other easily replaceable items.

FIRST LEVEL SPARED ITEMS

2 The Manpack radio requires the following spared items:

Cover Connector (Audio Socket) Qty 2	26212-882-30
Cap Protective BNC	703886-02
Cover Assy (Rear Panel Plug)	49329-590-00-01

SECOND LEVEL SPARED ITEMS

3 In addition to the First Level Spared Items, the radio requires the following second level spared items:

(1) These items are shown in Figs 10.1 and 10.5 as shown:

	Fig 10.1 49329-100-04-01	Fig 10.5 49329-100-03-01
Chassis and Motherboard Unit 2	49329-120-03-03	49329-120-03-02
Interface Unit 3	49329-130-03-01	49329-130-03-01
Central Control Unit 4	49329-140-04-01	49329-140-03-01
IF Amplifier Unit 5	49329-150-00-07	49329-150-00-07
RF Head Unit 6	49329-160-00-09	49329-160-00-09
Synthesizer and Modulator Unit 7	49329-170-00-10	49329-170-00-10
Rear Panel Unit 8	49329-180-04-01	49329-180-03-01
Desiccator	98881-003-20	98881-003-20
Battery 3.6 V, 1.9 Ah Lithium	A02501/HZ	A02501/HZ

(2) The following second level items are shown in the Front Panel Assembly with the LCD display 49329-110-04-01 - Fig 10.2:

Front Panel PCB Unit 1b	49329-113-04-01
Screw Captive Qty 4	39001-206-10-02
Seal Front Panel	29329-712-00-02
Screw M2.5 x 6 Qty 6	917693
Screw M2.5 x 12 Qty 2 (Switches)	932101
Washer M2.5 Crinkle Qty 8	917704
Flexible Assembly Qty 3	29329-365-03-01
LCD Module	29329-255-04-01
Screw Captive Qty 4	39010-025-10-02
Washer M2.5 Crinkle Qty 4	21541-009-27
Cover Keyboard Finished	49329-403-04-01
Switch Key Assembly	29226-266-04-01
Window LCD	39329-818-04-01
Plate Support	39329-622-04-01
Boot Keyboard	39226-623-04-01
Retainer LCD	39329-625-04-03
Seal Window Qty 2	39329-837-04-01
Seal Formed	39329-613-04-01
Antenna Matching Unit 1d	49329-118-00-08
Screening Can	39329-619-00-02
Screw M2.5 x 5 Qty 2	994064/EQ
Pillar Threaded Qty 2	39329-621-00-01
Washer M2.5 Crinkle Qty 2	917704
Insert Antenna	39226-600-10-03
Washer Antenna	39226-601-09-03
Nut Special Qty 2	39226-606-10-01
Base Antenna	39226-612-09-02
Seal O Ring 11.1 x 1.6	25311-010-03
Seal O Ring 23.52 x 1.78	25311-532-03
Line Terminal Qty 2	49329-409-00-02
Spacer	39329-725-03-03
Knob Control	39329-844-00-02
Knob Channel	39329-845-00-02
Knob Volume	39329-846-00-02
Screw M2 x 8 Qty 3	A05366
Switch Shaft Qty 3	39329-626-03-03
Washer Qty 3	39226-627-10-01
Slide Locking Qty 2	39329-605-00-01
Seal O Ring Qty 6	29226-633-10-02
Circlip Qty 6	A05980
Spring Qty 2	25511-051-20
Escutcheon	39329-606-04-01
Escutcheon	39329-607-04-01
Screw M 2 x 4 Qty 8	A04348
Washer M 2 Crinkle Qty 8	21541-007-27
Adaptor SMB to BNC	29329-260-00-01

(3) The following second level items are shown in the Front Panel Assembly with the LED display 49329-110-03-01 - Fig 10.6:

Front Panel PCB Unit 1b	49329-113-03-01
Screw Captive Qty 4	39001-206-10-02
Seal Front Panel	29329-712-00-02
Screw M2.5 x 6 Qty 6	917693
Screw M2.5 x 12 Qty 2 (Switches)	932101
Washer M2.5 Crinkle Qty 8	917704
Seal Formed	39800-613-00-01
Flexible Assembly Qty 3	29329-365-03-01
Display Unit 1c	49329-116-03-01
Screw Captive Qty 4	39010-025-10-02
Washer M2.5 Crinkle Qty 4	21541-009-27
Cover Keyboard Finished	49329-403-00-07
Switch Key Assembly	29226-266-10-03
Window	29329-818-00-01
Plate Support	39226-622-10-01
Boot Keyboard	39226-623-03-01
Seal Retainer	39226-625-07-01
Seal Window Qty 2	39226-626-07-01
Antenna Matching Unit 1d	49329-118-00-08
Screening Can	39329-619-00-02
Screw M2.5 x 5 Qty 2	994064/EQ
Pillar Threaded Qty 2	39329-621-00-01
Washer M2.5 Crinkle Qty 2	917704
Insert Antenna	39226-600-10-03
Washer Antenna	39226-601-09-03
Nut Special Qty 2	39226-606-10-01
Base Antenna	39226-612-09-02
Seal O Ring 11.1 x 1.6	25311-010-03
Seal O Ring 23.52 x 1.78	25311-532-03
Line Terminal Qty 2	49329-409-00-02
Spacer	39329-725-03-03
Washer M3 Crinkle Qty 4	917705
Knob Control	49329-844-00-01
Knob Channel	49329-845-00-01
Knob Volume	49329-846-00-01
Screw M2 x 8 Qty 3	A05366
Switch Shaft Qty 3	39329-626-03-02
Washer Qty 3	39226-627-10-01
Slide Locking Qty 2	39329-605-00-01
Seal O Ring Qty 6	29226-633-10-02
Circlip Qty 6	21561-207-19
Spring Qty 2	25511-051-20
Escutcheon	39329-606-03-02
Escutcheon	39329-607-03-01
Screw M 2 x 4 Qty 8	A04348
Washer M 2 Crinkle Qty 8	21541-007-27
Adaptor SMB to BNC	29329-260-00-01

(4) The following second level items are shown in the Chassis and Motherboard Figs 10.3 and 10.7:

Guide Qty 20	39329-636-00-02
Lock Slide Qty 10	39329-637-00-01
Spring Contact Qty 20	39329-638-00-03
Nut Special Qty 20	39226-649-10-01

(5) The following second level items are shown in the Rear Panel Figs 10.4 and 10.8:

Plug Pressure Test	22172-213-76
Seal O Ring	25311-007-21
Seal Rear Panel	29329-712-00-02

(6) The following item is in the Rear Panel Unit 8c:

Fuse 7 amp	26345-902-00

PREVENTIVE ROUTINE MAINTENANCE

4 Routine maintenance is carried out at first line and requires no tools or test equipment. At weekly intervals, carry out the checks detailed and ensure:

(1) The BCC 67 is complete, undamaged and clean.

(2) Each control switch has a smooth positive action.

(3) The Channel and Volume switch mechanical interlocks and release catches are serviceable.

(4) The audio and antenna sockets and remote terminals are serviceable and tightly fitted.

(5) The battery locking mechanism is serviceable.

FUNCTIONAL CHECKS

Introduction

5 The procedures enable a comprehensive functional check-out of a BCC 67 to be performed without the use of common or special-to-type test equipment, and without removing the radio from its case.

6 The frequency with which the functional check procedures are performed and whether or not every test is required at each performance, depends upon local circumstances. However, it is recommended that the procedures are conducted as follows:

(1) Before using the radio in the field, at least those functions appropriate to the proposed method of use should be checked.

(2) Before returning the radio to stores following its use, the procedures should be performed in full.

(3) At any time that it is suspected that the radio is faulty, those checks appropriate to the type of fault suspected should be performed.

Equipment Required

7 (1) BCC 67 - 2
(2) Whip Antenna 2.4m - 2
(3) Handset/Headset - 2
(4) Battery 12 V, MA4025D.

8 Ensure that the batteries are fully charged.

Preparation

9 Assemble the stations with fully charged batteries and assign an operator to each radio. Position the radios so that the operators are within easy calling distance (say 10m apart). Connect the antenna to the appropriate antenna socket. Connect a headset or handset to either audio socket.

Preliminary Check Out (both radios)

10 (1) Switch the radio on by setting the On/Off switch to a suitable Volume setting. Check for a normal display which will show the last selected channels operating mode, power output, channel number and frequency.

(2) Select Fixed Clear mode.

(3) Select Channel 1.

(4) Select 34975 (or the working frequency to be used on the test).

Confirm the display shows Channel 1 34.975.

(5) Operate the PTT and check from the sidetone and the presence of bars on the display that the transmitter is operating.

Functional Check

11 (1) Set both radios to the agreed working frequency, Low Power, Fixed Clear.

(2) Perform a talk through check between the two radios, transmitting in turn, and check the quality of the speech and the bar display on receive, at least 2 bars should be shown in the display.

(3) Repeat the talk through test using different channels and different frequencies.

(4) Repeat the talk through test using Fixed Secure.

(5) Repeat the talk through test using Frequency Hopping. Enter ECCM codes if required.

SECOND LEVEL CORRECTIVE MAINTENANCE

12 Second level corrective maintenance is restricted to the replacement of boards/modules. All required tools and consumables are detailed in Chapter 7.

13 Switch on the UUT and, with the aid of the second operator if required, confirm the radio fault. Fault Finding is carried out using the information on Built In Test given in Paras 18 to 35.

14 Rectification is primarily restricted to changing suspected faulty modules. For dismantling and reassembly information, see Chapter 7.

15 If the radio has been opened the radio Calendar time or Real Time Clock must be re-entered.

16 The Calendar time is entered or amended by entering the Engineering menu. To access Calendar time proceed as follows:

(1) Press ↩ and MENU to enter the Engineering menu.

(2) Press ▼ for display of 'Service'. Press ↩ to enter.

(3) Press ▼ for display of 'Calendar'. Press ↩ to enter.

(4) Check for either display of year previously entered - typically 'Year 1997' or if no year entered 'Year □□□□'. Press the four keys for required year.

(5) Press ▼ for display of month typically 'Month 11' or 'Month □□'. Press the two keys for required month.

(6) Press ▼ for display of day typically 'Day 23' or 'Day □□'. Press the two keys for required day.

(7) Press ▼ for display of time typically 'Time 1115' or 'Time □□□□'. Press the four keys for required time.

NOTE: Calendar time is not deleted in a zeroise operation.

17 When a radio has been repaired and reassembled, a Performance Test can be carried out (see Chapter 9). If required the radio can be returned to operational use after a functional check has been completed as detailed in Paras 5 to 11 to confirm that it is serviceable.

BUILT IN TEST

18 There are two levels of test provided by the Built In Test (BIT). These are:

(1) Operator Level

(2) Maintenance Level

Operator Level Tests

19 When the radio is switched on it automatically carries out an Operational Readiness Test (ORT) which acts as a confidence test for the operator. The tests consist of internal monitoring only and no transmissions occur. If the radio is serviceable a normal display is shown. If the test fails one of three possible failure messages is displayed.

Critical	A critical failure has been detected. Operation in any mode is not guaranteed.
Severe	A severe failure has been detected. The operation of one or more modes is not guaranteed. A list of the affected modes of operation is provided via the 'Fail Modes' section of the BIT menu.
Minor	A minor fault has been detected which is likely to result in some loss of performance, but without loss of function.

20 If any of the three failure conditions are detected the error tone will be triggered. To cancel the error tone press ↩. If the 'Critical' failure message has been displayed the radio is not serviceable and must be passed to a maintenance technician. If the 'Severe' failure message has been displayed the radio may operate in some modes - check the 'Fail Modes' section of the BIT menu.

21 In normal operation the ORT condition can be entered manually as follows:

(1) Press ↩ then MENU to enter the BIT menu.

(2) With 'BIT' displayed press the ↩ key.

(3) With 'ORT' displayed press the ↩ key.

22 The test is run and the result message is displayed. If the radio is serviceable 'Pass' is displayed. If the test fails one of the three failure messages is displayed.

23 To return back to the BIT menu press ↩. To return to normal operation press MENU.

24 In the BIT menu, after the ORT check, the operator can access a series of tests to verify the radios' performance. Press ↩ then MENU to enter the BIT menu. Press ▼ to go down list and press ↩ to enter test. The list is as follows:

(1) Transmit

(2) Display

(3) Keyswitch

(4) Headset

(5) Antenna

(6) Fail Modes

NOTE The Diagnosis test which follows the Fail Modes test is designed for the Maintenance Level operator.

25 The Keyswitch test involves pressing all the keys following display prompts. If any of the tests fail the radio should be passed to a maintenance technician.

26 The Fail Modes test provides a list of affected modes after a BIT or ORT failure. The affected modes information is in three areas as follows:

Broad mode of operation (display positions 1-3)
Sub mode of operation (display position 5)
Direction of operation (display position 7)

27 The list of broad modes of operation in display positions 1-3 is as follows:

TX	Transmit
RX	Receive
RLI	Remote Lines
FC	Fixed frequency Clear
SEC	Secure
FS	Fixed frequency Secure
HOP	Hopping
FCS	Free Channel Search

28 The list of sub modes of operation in display position 5 is as follows:

V	Voice
D	Data

29 The list of directions of operation in display position 7 is as follows:

Tx	Transmit
Rx	Receive

30 Also in normal operation the conditions pertaining to the radio at any time can be checked by pressing T - see the information on Self Test - Para 36.

Maintenance Level Tests

31 If the operator level tests have been performed and failures have been indicated the radio should be referred to a radio technician. The maintenance information is presented in the Diagnosis step of the BIT menu. Within the Diagnosis sub menu there are three tests as follows:

(1) Data socket
(2) Modules
(3) Codes

32 The data socket enables a loopback test to be carried out on the two audio/data sockets. This test involves using a mating connector which loops back transmit lines to receive lines.

33 The modules associated with the test failures will be displayed as follows:

FPM	Front Panel Module
IFM	Interface Module
RCM	Radio Control Module
IFA	Intermediate Frequency Amplifier
RFH	Radio Frequency Head
SMM	Synthesizer Modulator Module
RPM	Rear Panel Module

34 The codes section will display a three digit code and the associated module letters as shown.

35 Replace the module shown to be faulty.

SELF TEST FACILITY

36 The Self Test facility enables the operator to check various aspects of the radio performance by pressing the T (Test) key. The test key also introduces the noise on condition in the phones -this checks the receiver performance. The information displayed gives the current state of the radio. The displayed information will be updated until another selection is made. Providing that the radio is operating in the relevant mode information will be displayed as follows:

Display position	Mode
1	Receive Signal Level or Transmit Power Output Level
2	Receive or Transmit
3	Secure Operating Configuration - Panther/Jaguar
4	Hopping Synchronisation
5	Hopping Bandwidth
6	Hopping Set
7	Blank
8	Blank
9	Auto-Rebroadcast On/Off
10	Economise On/Off
11	Blank
12	Battery Voltage Level

Receive Signal or Transmit Power Output Level

37 The information in display position 1 is given by a dot or horizontal bars - from 1 to 7. Generalising, the more bars the better the condition. The minimum condition, 0 bars is indicated by a dot (.).

38 For receive signals information is available only when a signal is being recieved (↓ in display position 2). For receive signals the interpretations are as follows:

0,1,2 bars	Weak signal
3,4,5 bars	Normal signal
6,7 bars	Strong signal

39 For transmit signals information is available only when a signal is being transmitted (↑ in display position 2). This facility gives information on the output level relative to the power range selected. For transmit signals the interpretations are as follows:

0 bar (.)	Transmitter probably not working, no sidetone, rapid unready pips heard in phones.
1,2 bars	Low power level
3,4,5 bars	Normal power level
6,7 bars	High power level

40 In general a 1 to 7 bar display will mean that the radio will operate normally. There could be instances where a transmitter is working normally and a 0 bar (.) display is indicated. This could be caused by an antenna mismatch and rectified by re-positioning the antenna. Where a medium power level is set a 1 bar display could mean that the maximum range performance may be impaired. It could also mean that the battery level was low.

Receive or Transmit

41 The information in display position 2 is as follows:

↓	Receive condition
↑	Transmit condition
*	Idle

Panther/Jaguar Configuration

42 The information in display position 3 is as follows:

P	Panther
J	Jaguar

Hopping Synchronisation

43 This information is available only when a Hopping net is set up. The information in display position 4 is as follows:

0 bar (.)	Unacquired or Hopping not selected
1 bar	Synchronised (but not recently)
2 - 7 bars	Synchronised and Operating (On Receive or Transmit)

Hopping Bandwidth

44 This information is available only when a Hopping net is set up. If a Hopping net is not set up C (Clear) or S (Secure) will be displayed. The information in display position 5 is as follows:

w	Wideband
n	Narrowband
f	Frequency Fill

Hopping Set

45 This information is available only when a Hopping net is set up. If a Hopping net is not set up 0 bars (.) will be displayed. The information in display position 6, which should be read in conjunction with information in display position 5, is as follows:

a	Wideband All Frequency Hop
1-8	Wideband Orthogonal
1-9	Narrowband Set
a	All Frequency (Frequency Fill)
4	4 Frequency (Frequency Fill)
16	16 Frequency (Frequency Fill)

Auto-Rebroadcast On/Off

46 The information in display position 9 is as follows:

A	Auto-Rebroadcast
N	Normal

Economise On/Off

47 The information in display position 10 is as follows:

O	Economise
Blank	Off

NOTE The display cycles between O and ◇.

Battery Level

48 This information is available whenever a battery supply is fitted and the radio is switched on. The information in position 12 of the display is:

Dot (.)	Charge Battery (low battery warning).
	Battery Volts Reading

49 As the battery is discharged the dots within the box will reduce. If the battery level is indicated as a low level of dots within the box, the radio will still work normally. In normal operation and in receive mode the Low Battery Tone, medium pips, will be heard in the phones when the battery reaches the low condition. Also 'Low Battery' followed by a dot (.) in position 12 will be displayed. When the Low Battery Tone is heard it can be cancelled by operating the Test key, but the battery must be recharged.

WARNING TONES AND SIGNALS

50 The operator is warned automatically of the existence of certain operational conditions by means of distinctive tones and signals. A description of each of the warning tones and signals follows, phonetic approximations of how they are heard by the operator are given in Fig 8.1.

(1) Error Tone — A continuous tone alternating between 2 kHz and 1.6 kHz (512 ms high frequency, 512 ms low frequency). It is activated by an incorrect key entry and operation of a hopping net with two radios switched to 'master'.

(2) Call Tone — A continuous 2 kHz tone. It is generated in Intercom mode (press AR/I and ↩) with AR/I key held down.

(3) Hailing Tone — A series of 500 Hz tone bursts (256 ms on, 256 ms off). It is initiated during frequency hopping operation when hailed on the channel reference frequency for at least three seconds, and continues for five seconds.

(4) Unready Tone — A series of 2 kHz tone bursts (64 ms on, 192 ms off). It is generated:

When the transmit path is not clear to send (normally, while the radio is synchronising; lasts five seconds for initial synchronisation).

When the radio is unselected when receiving a selective call transmission.

(5) Low Battery Tone — A series of 2 kHz tone bursts (64 ms on, 512 ms off). It is initiated when the supply voltage at the battery terminals falls to approximately 10 V for the manpack role and 20 V for the vehicle and clip in role.

(6) Secure Tone — A series of 2 kHz tone bursts (20 ms on every two seconds). It is generated when actively transmitting or receiving in a secure mode.

(7) Free Channel Search Tone — A series of 2 kHz (20ms on, 80ms off) and 500 Hz (20 ms on, 1900ms off) tone bursts. It is generated when actively sending or receiving a free channel search transmission.

(8) Voice Overrun Tone — A series of 500 Hz tone bursts (20 ms on, 80 ms off, then 20ms on, 900ms off). A transmit timeout facility for voice and data functions. The time is set from a programmer, the tone is heard five seconds before the timeout occurs.

(9) Operation Notify Tone — Two 500 Hz tone bursts, (20ms on, 80ms off, then 20ms on). A recognition of action after key selection.

(10) Invalid Key Tone — A single 1.6 kHz tone burst for 20ms. Occurs after an irrelevant operation.

(11) Call Waiting Tone — A 2 kHz tone, on for two seconds, off for one second, repeated. Occurs after unanswered call.

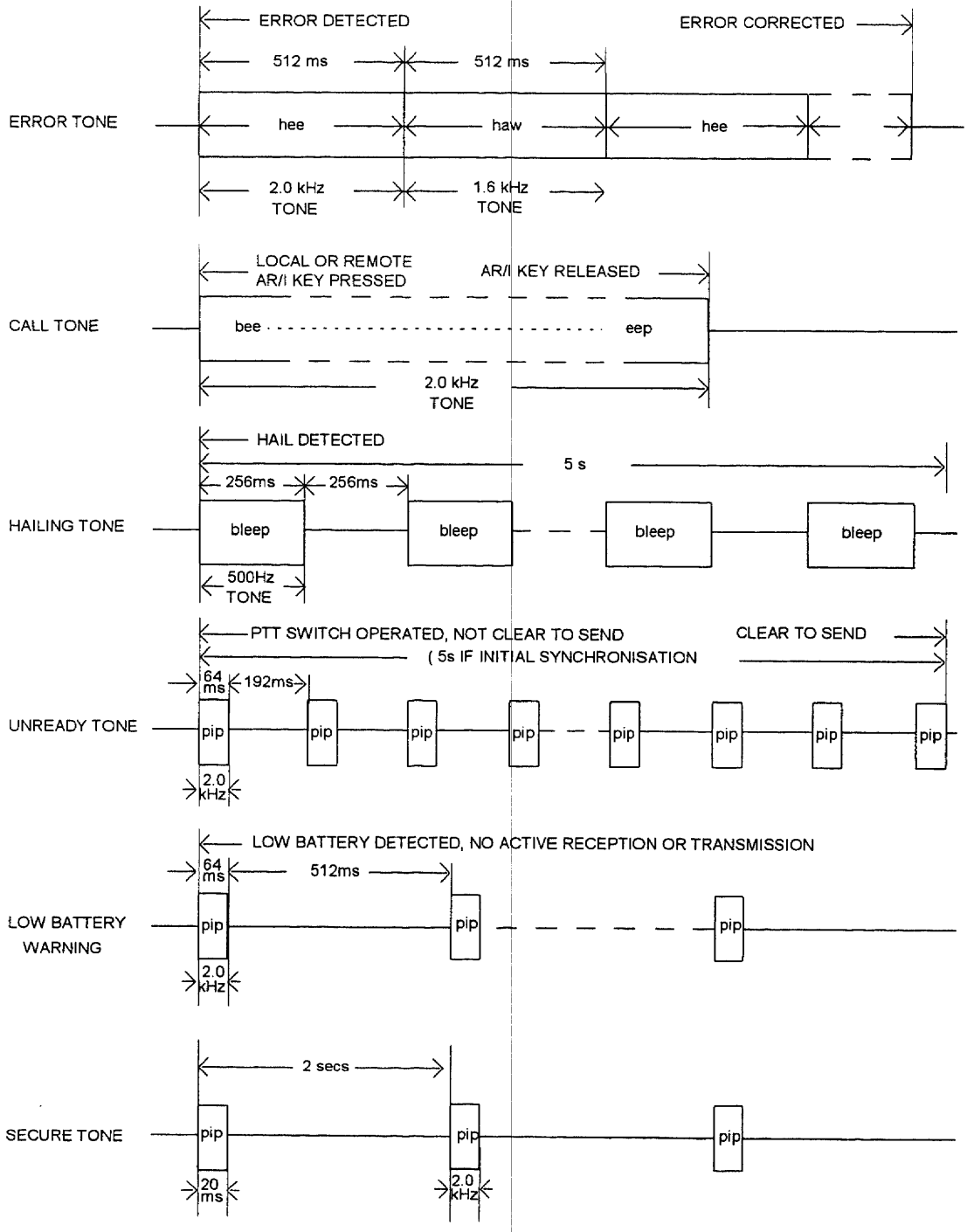


Fig 8.1 Warning Tones and Signals

CHAPTER 9

OVERALL PERFORMANCE TESTS

PERFORMANCE TESTS CARRIED OUT USING

AUTOMATIC TEST EQUIPMENT

MANUAL PERFORMANCE TESTS TO FOLLOW

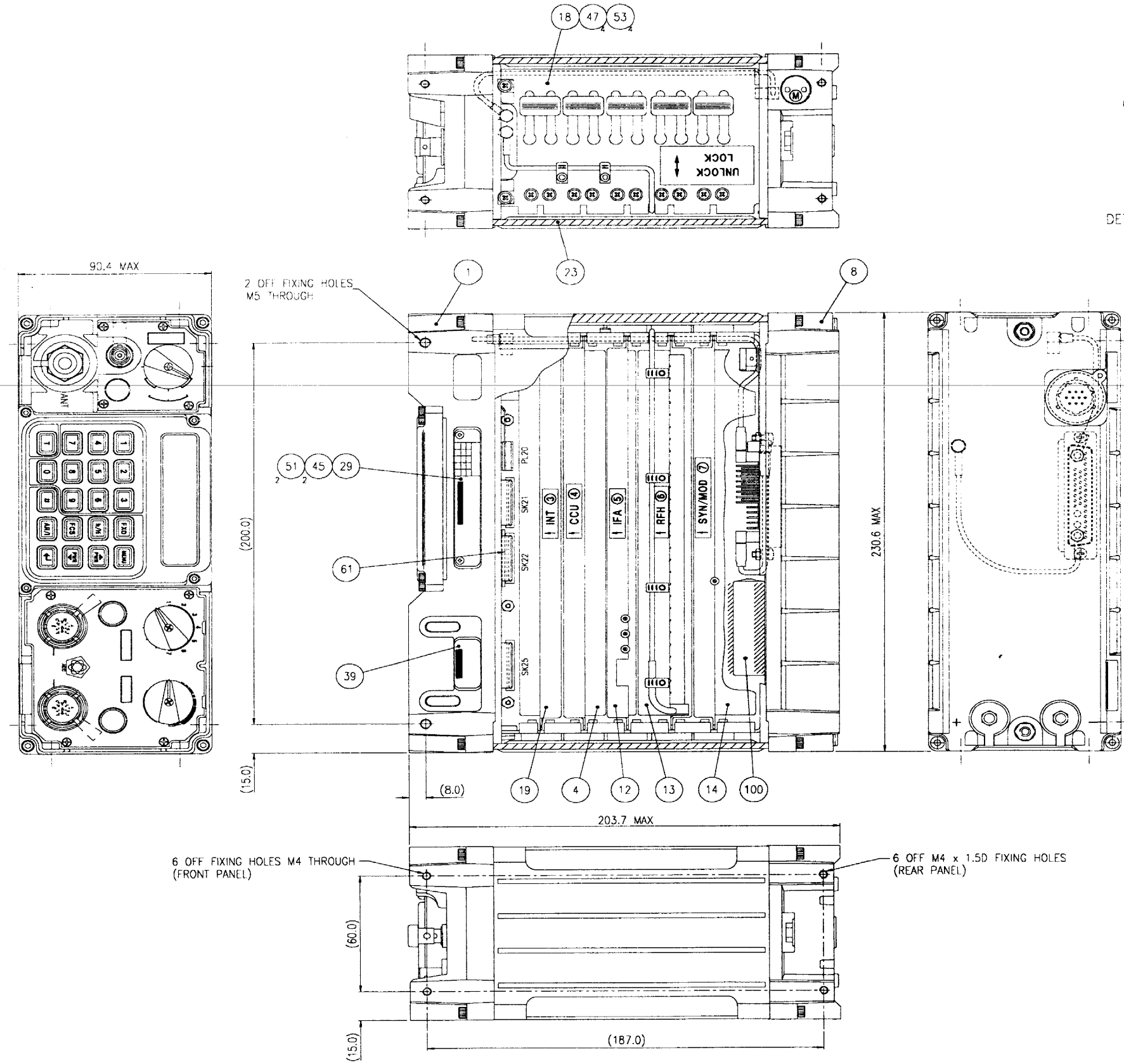
CHAPTER 10

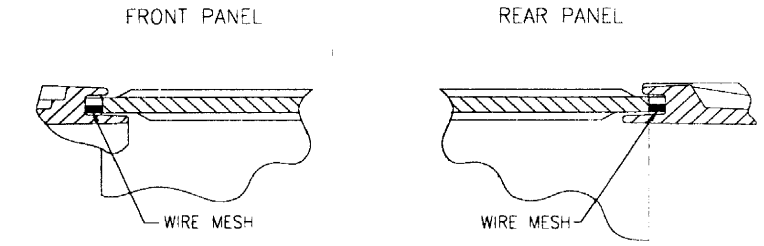
MECHANICAL PARTS LIST

CONTENTS

ILLUSTRATIONS

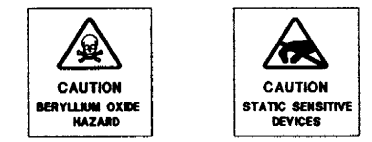
ITEM	PART No.	DESCRIPTION	QTY
1	49329-110-04-01	FRONT PANEL ASSY 1	1
4	49329-140-04-01	CENTRAL CONTROL MODULE 4	1
8	49329-180-04-01	REAR PANEL ASSY 8	1
12	49329-150-00-07	IFA MODULE 5	1
13	49329-160-00-09	RF HEAD MODULE 6	1
14	49329-170-00-10	SYNTHESIZER AND MODULATOR MODULE 7	1
18	49329-120-03-03	CHASSIS & MOTHERBOARD ASSY 2	1
19	49329-130-03-01	INTERFACE MODULE 3	1
23	49329-580-39-01	SLEEVE FINISHED,	1
29	39329-710-04-01	NAMEPLATE	1
38	39329-841-04-01	SEAL FORMED	1
39	39329-811-04-01	LABEL	1
45	A04348	SCREW M2 X 4 SS CB PAN REC,	2
47	917844	SCREW M3 X 6 PAN HD POSI SS SF	4
51	21541-007-27	WAS M 2 CRIN SS CB	2
53	917705	WASHER CRINKLE M3 SS SF	4
61	98881-003-20	DESICC SACHET 34W X 72 3GM SIL	1
64	A03777/HZ	SOLDER 0.5 DIA 63/37 FLUX 1.1%	0
75	A03699/HZ	ADHESIVE 3748 (5 KG=180 STICK)	0
100	A02501/HZ	BATTERY, 1.9 AH, 3.6 V, LITHIUM	1
150	29329-366-04-01	RADIO SOFTWARE	1





DETAIL SHOWING RFI SEALS (FITTED AT FRONT & REAR PANEL ASSY STAGES)

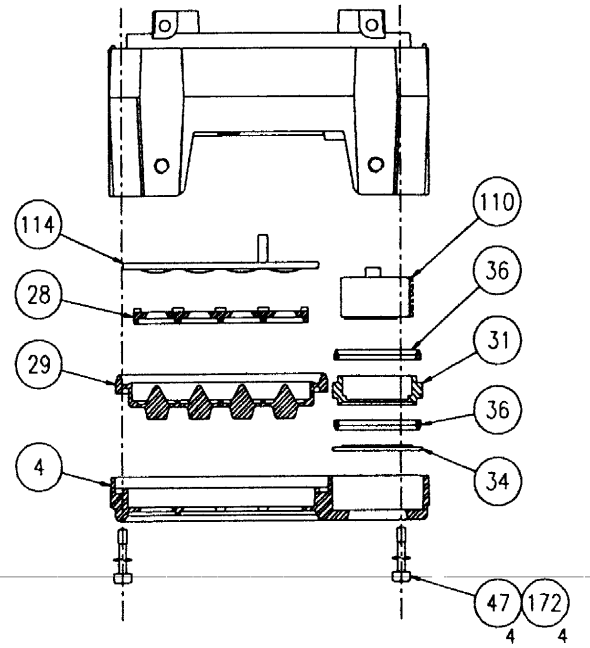
SCALE 2:1

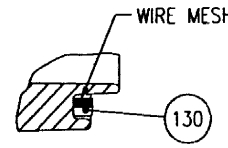


BERYLLIUM HAZARD

Fig 10.1
Panther VHF Transceiver BCC 67

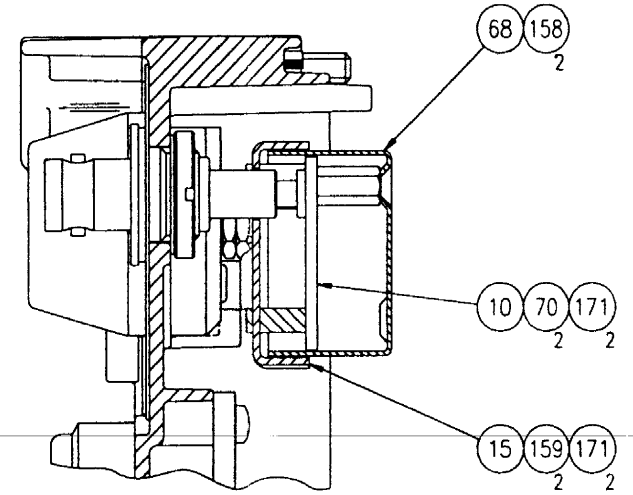
ITEM	PART No.	DESCRIPTION	QTY
1	49329-113-04-01	PCB ASSY FOR FRONT PANEL 1B	1
4	49329-403-04-01	COVER KEYBOARD FINISHED,	1
6	49329-430-04-02	FRONT PANEL FINISHED,	1
10	49329-118-00-08	PCB ASSY FOR ANTENNA MATCHING 1D	1
14	49329-409-00-02	LINE TERMINAL (MODIFIED),	2
15	49329-410-00-05	BASEPLATE ASSY,	1
21	39329-606-04-01	ESCUTCHEON	1
22	39329-607-04-01	ESCUTCHEON	1
25	39329-613-04-01	SEAL FORMED	1
28	39329-622-04-01	PLATE SUPPORT	1
29	39226-623-04-01	BOOT KEYBOARD	1
31	39329-625-04-03	RETAINER LCD	1
34	39329-818-04-01	WINDOW (LCD)	1
36	39329-837-04-01	SEAL WINDOW	2
38	39329-841-04-01	SEAL FORMED	1
44	39001-206-10-02	SCREW CAPTIVE	4
47	39010-025-10-02	SCREW CAPTIVE	4
50	39226-601-09-03	WASHER ANTENNA	1
52	39226-612-09-02	BASE ANTENNA	1
55	39226-600-10-03	INSERT ANTENNA	1
57	39226-606-10-01	NUT SPECIAL	2
59	39226-627-10-01	WASHER	3
65	39329-605-00-01	SLIDE LOCKING	2
68	39329-619-00-02	CAN SCREENING	1
70	39329-621-00-01	PILLAR THREADED	2
76	39329-770-00-01	LABEL HIGH VOLTAGE	1
81	39329-844-00-02	KNOB CONTROL	1
82	39329-845-00-02	KNOB CHANNEL	1
83	39329-846-00-02	KNOB VOLUME ON/OFF	1
89	39329-626-03-03	SHAFT	3
92	39329-725-03-03	SPACER	2
101	703886-02	CAP DUST BNC	1
104	93005/020-01	LABEL MODULE IDENT	1
110	29329-255-04-01	LCD MODULE	1
114	29226-266-04-01	SWITCH KEY ASSY	1
120	29226-633-10-02	SEAL O RING	6
126	29329-260-00-01	ADAPTOR SMB TO BNC	1
130	29329-712-00-02	SEAL (RFI)	1
134	29329-365-03-01	FLEXIBLE ASSY	3
136	29329-426-03-01	PLUG BLANKING SEAL	1
141	26212-882-30	CONNECTOR CIRC COVER SHELL 10	2
144	25311-010-03	SEAL O RING 11.1 X 1.6 ROR	1
147	25311-532-03	SEAL O RING 23.52 X 1.78 ROR	1
153	A04348	SCREW M2 X 4 SS CB PAN REC,	8
155	A05366	SCREW M2 X 8 SS CB PAN REC,	3
158	994064/EQ	SCR M 2.5 X 5 SS SF CSK REC,	2
159	917693	SCR M 2.5 X 6 SS SF PAN REC,	8
161	932101	SCR M 2.5 X 12 SS SF PAN REC,	2
168	21541-007-27	WAS M 2 CRIN SS CB	8
171	917704	WAS M 2.5 CRIN SS SF	12
172	21541-009-27	WAS M 2.5 CRIN SS CB	4
176	21541-010-27	WAS M 3 CRIN SS CB	4



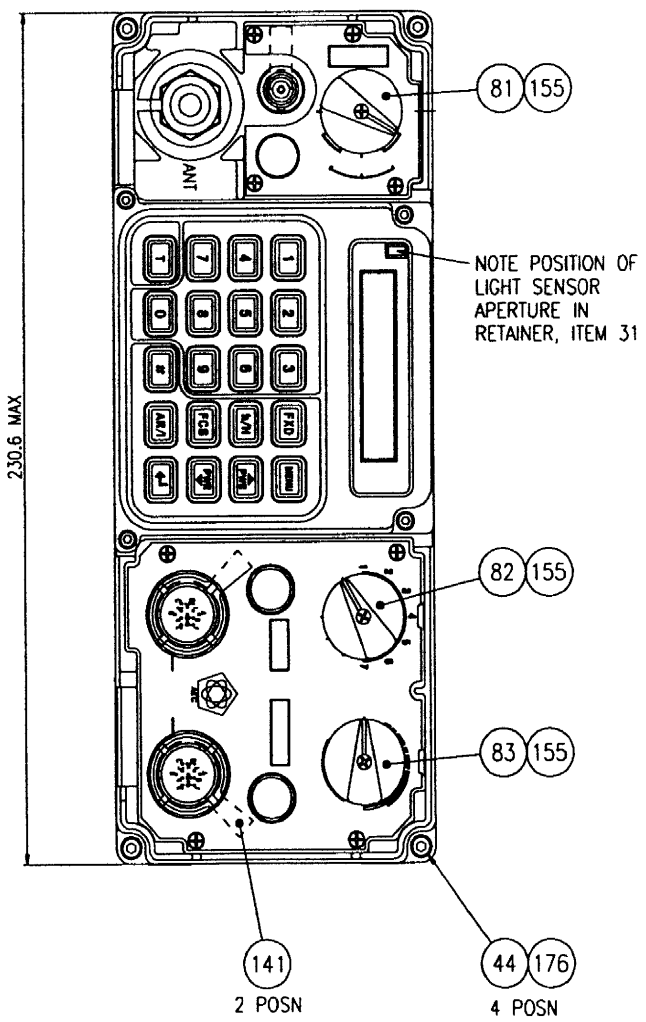


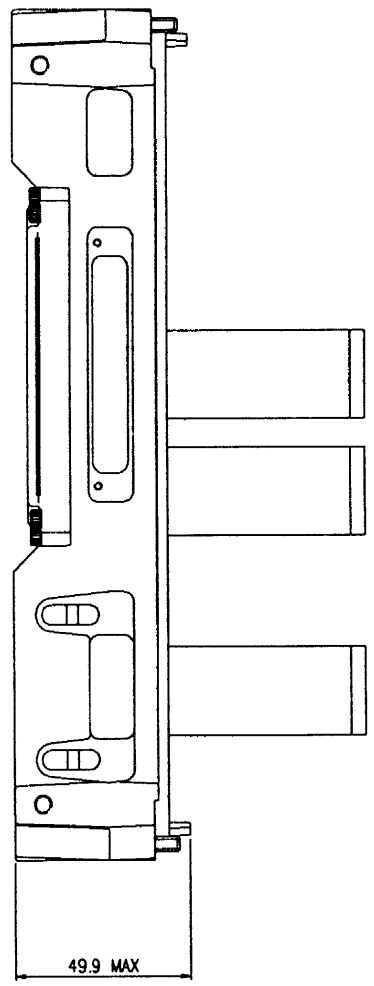
RFI SEAL, ITEM 130, DETAIL
SCALE 2:1

CARE MUST BE TAKEN TO AVOID DAMAGE TO SEAL DURING PRESSURE TESTING.



SCRAP SECTION W-W
SCALE 2:1





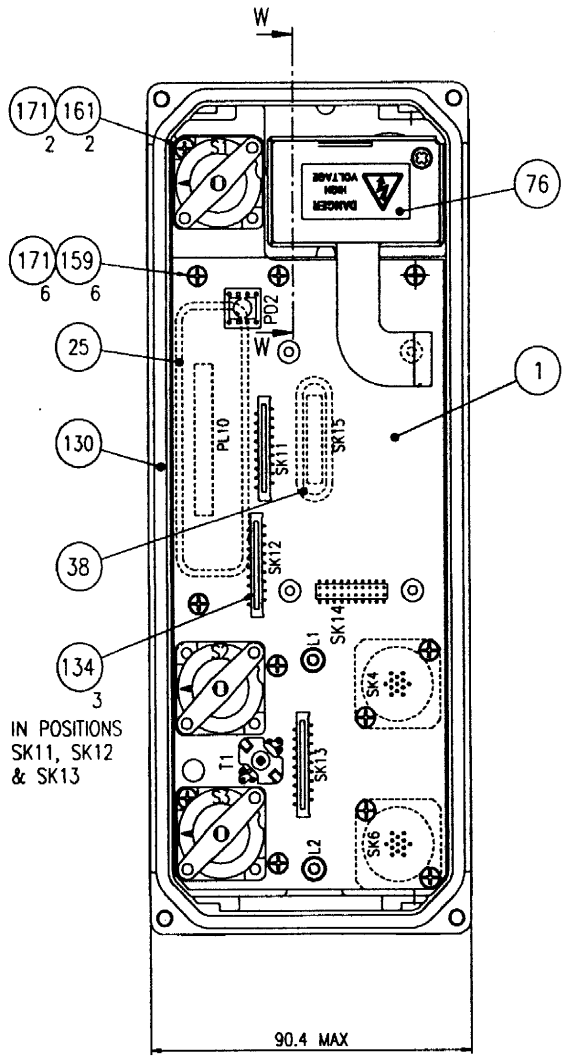
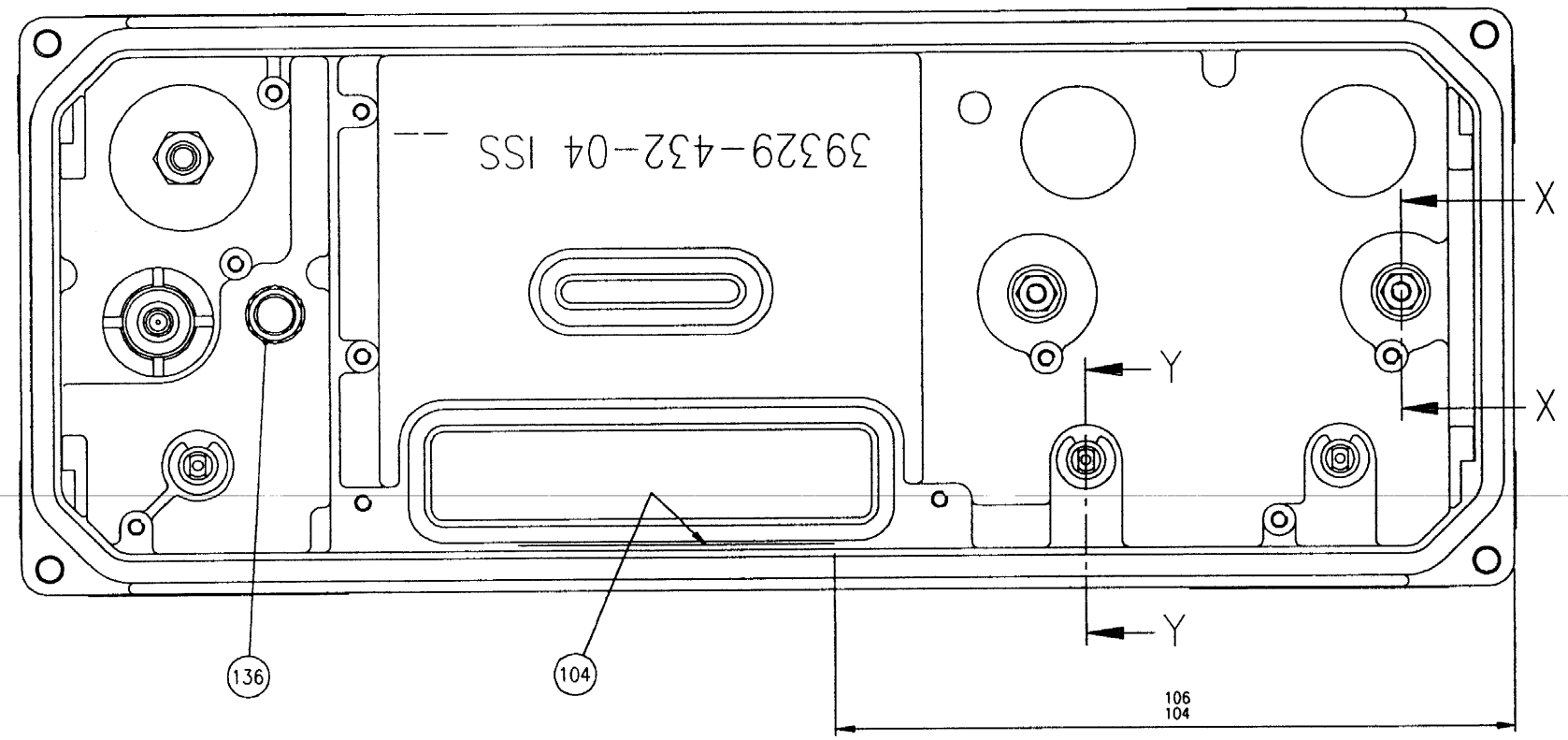
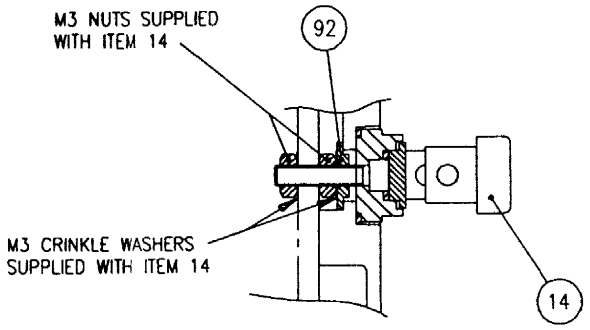
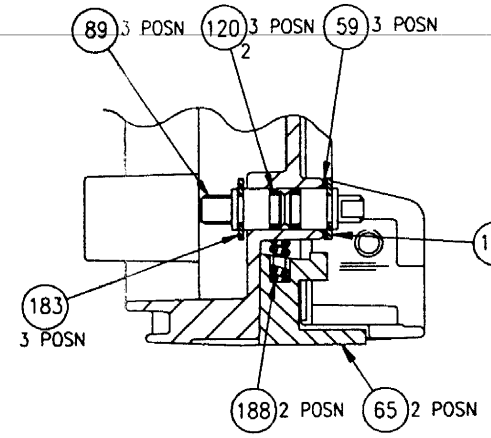


Fig 10.2
Front Panel Assy Unit 1 (Sheet 1)

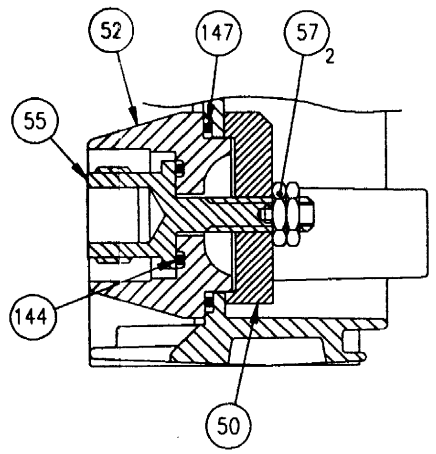




SCRAP SECTION X-X



SCRAP SECTION Y-Y



SCRAP SECTION Z-Z

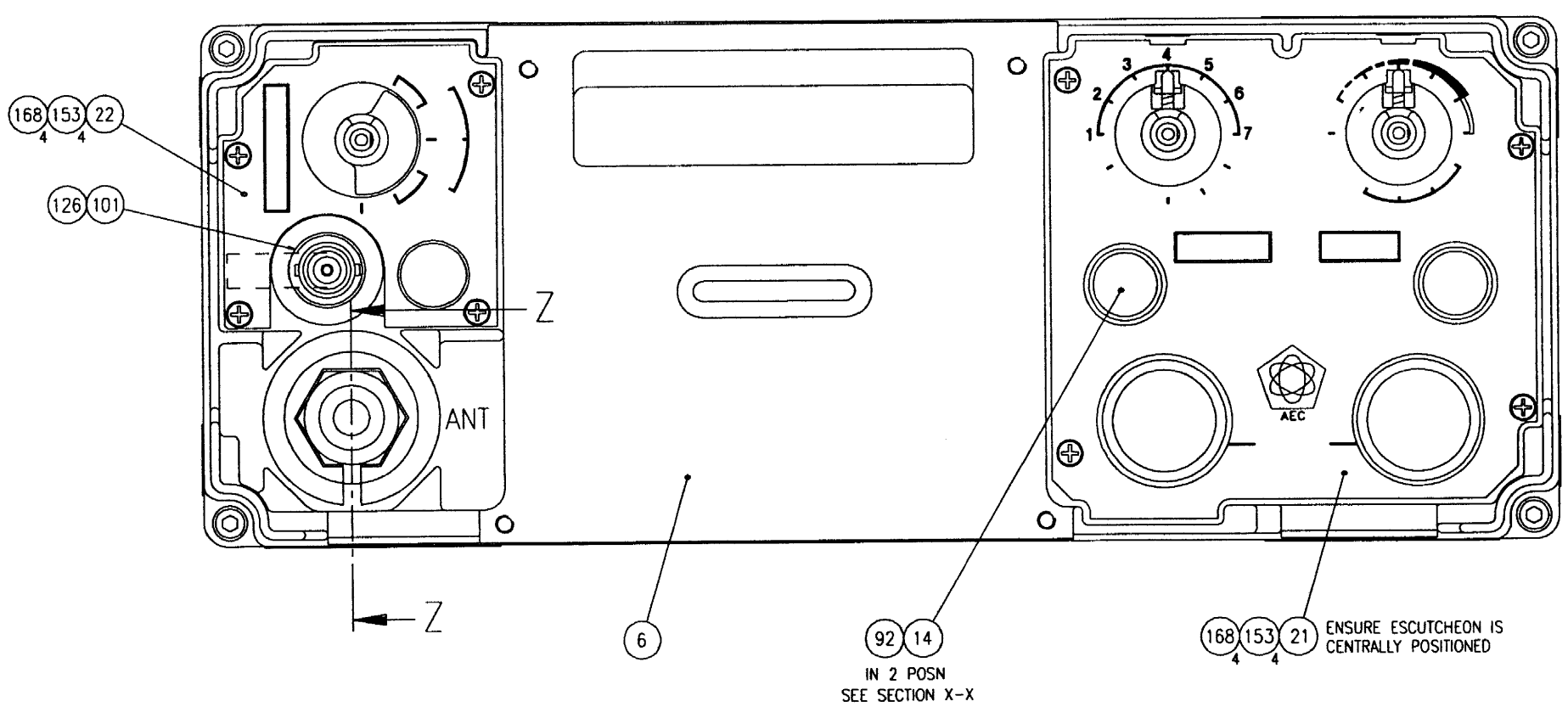


Fig 10.2
Front Panel Assy Unit 1 (Sheet 2)

ITEM	PART No.	DESCRIPTION	QTY
183	A05980	CIRCLIP EXT 4MM E CLIP SS SF	6
188	25511-051-20	SPRNG COMP 2.24OD 7.94FL SS	2
193	980129/HZ	ADHESIVE ANAEROBIC STUDLOCK (50 ML TUBE)	0
194	980469/HZ	ADHESIVE ANAEROBIC SCREWLOCK (50 ML TUBE)	0
199	16634-001-30	GREASE SILICONE HZ	0
200	A01131	GREASE LOW TEMPERATURE	0
CHASSIS AND MOTHERBOARD ASSY UNIT 2 (FIG 10.3)			**49329-120-03-03**
1	49329-270-03-02	PCB ASSY FOR MOTHERBOARD 2	1
3	49329-420-03-03	CHASSIS ASSY,	1
6	49329-272-00-03	CONNECTOR ASSY	1
7	49329-273-00-06	CONNECTOR ASSY	1
10	39329-639-03-02	INSULATOR	1
12	39226-649-10-01	NUT SPECIAL	20
14	39329-636-00-02	GUIDE	20
15	39329-637-00-01	LOCK SLIDE	10
16	39329-638-00-03	SPRING CONTACT	20
18	39329-770-00-01	LABEL HIGH VOLTAGE	1
20	39329-821-00-02	LABEL	1
22	39329-828-00-01	LABEL CAUTION	1
24	39329-830-00-01	NUT SPECIAL (M2.5)	11
26	754452-01	WASHER CRINKLE SPECIAL	25
27	93005/002-01	LABEL MODULE IDENT	1
29	917693	SCR M 2.5 X 6 SS SF PAN REC,	20
30	918569	SCR M 2.5 X 6 SS SF CSK REC,	5
31	918570	SCR M 2.5 X 8 SS SF CSK REC	6
33	917845	SCR M 3 X 8 SS SF PAN REC,	2
35	917825	NUT M3 HEX SS SF FULL	2
38	917705	WASHER CRINKLE M3 SS SF	2
40	945811	STRIP POLYOLEFIN SINGLE SIDE BK	1
42	980469/HZ	ADHESIVE ANAEROBIC SCREWLOCK (50 ML TUBE)	0
44	A03777/HZ	SOLDER 0.5 DIA 63/37 FLUX 1.1%	0
46	A05914	CONN RECT 36WAY MIX FX PSH R/AN,	1

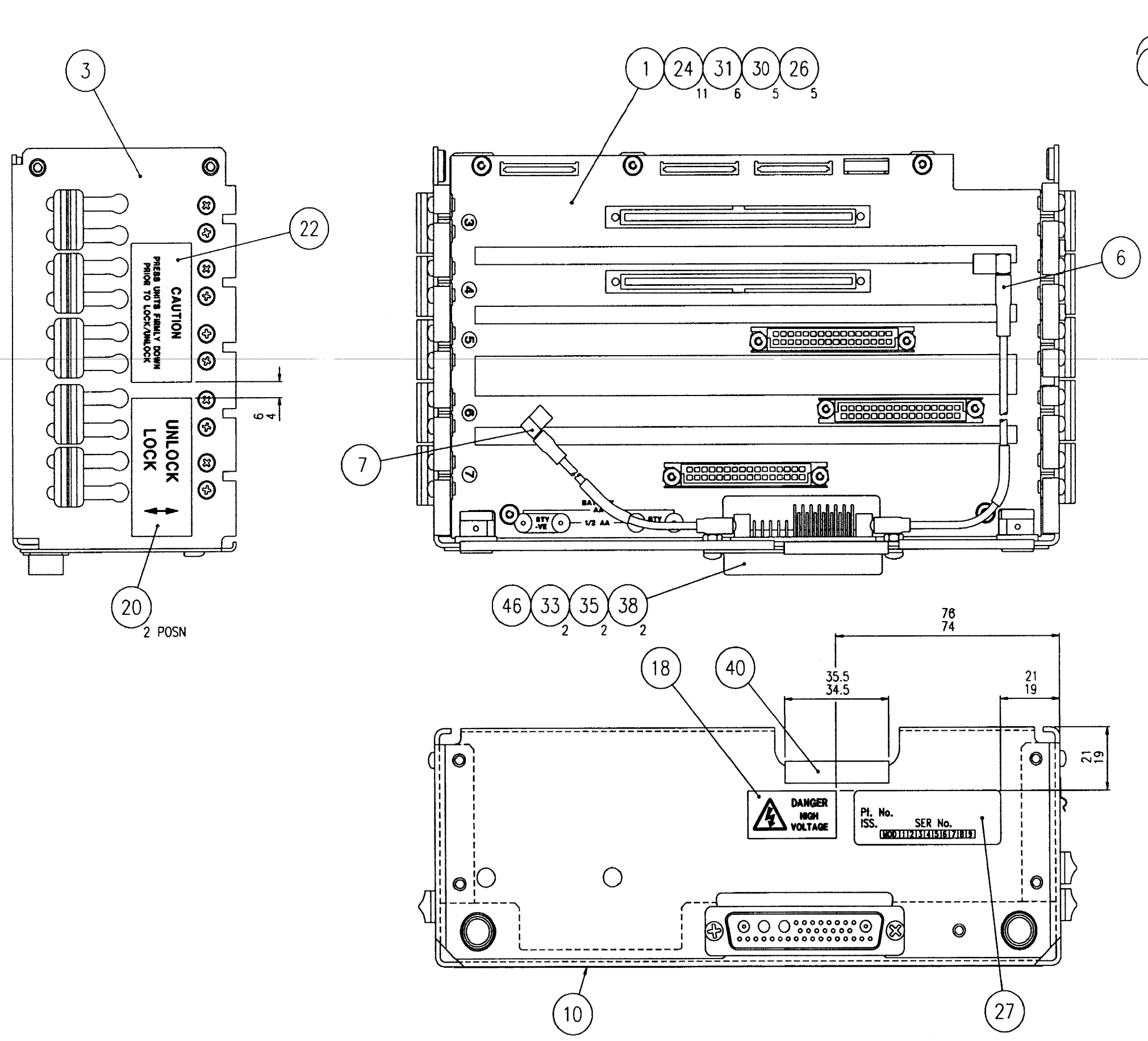
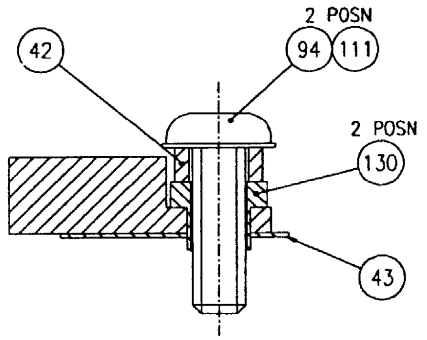
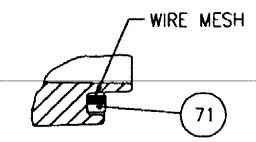


Fig 10.3
Chassis and Motherboard Assy Unit 2

ITEM	PART No.	DESCRIPTION	QTY
1	49329-184-00-13	PCB ASSY FOR POWER AMPLIFIER 8B	1
3	49329-188-00-07	PCB ASSY FOR CONVERTER 8D	1
5	49329-200-00-04	PCB ASSY FOR +VE BTY	1
8	49329-360-00-08	CABLEFORM	1
9	49329-361-00-04	CONNECTOR ASSY	1
10	49329-362-00-04	CONNECTOR ASSY	1
13	49329-590-00-01	COVER ASSY	1
16	49329-186-03-01	PCB ASSY FOR P. S. & LOGIC 8C	1
18	49329-440-39-04	REAR PANEL FINISHED	1
25	39001-206-10-02	SCREW CAPTIVE	4
27	39226-721-10-01	SCREW SPECIAL	1
28	39226-722-10-01	NUT SPECIAL	1
30	39226-724-10-02	INSULATOR	2
36	39329-695-00-03	CAN SCREENING	1
38	39329-700-00-01	SPACER	1
40	39329-705-00-01	STUD CONTACT	2
41	39329-706-00-01	INSULATOR	1
42	39329-707-00-01	CLAMP BAR	1
43	39329-708-00-02	INSULATOR	1
45	39329-770-00-01	LABEL HIGH VOLTAGE	1
47	39329-792-00-01	LABEL BERYLLIUM OXIDE	1
49	39329-797-00-01	LABEL STATIC DEVICE	1
51	39329-872-00-01	INSULATOR	1
53	39329-881-00-01	CLIP EARTHING	2
55	39329-885-00-03	PILLAR	3
57	39329-892-00-01	PIN DOWEL	2
62	754452-01	WASHER CRINKLE SPECIAL	19
64	93005/022-01	LABEL MODULE IDENT	1
68	29329-380-00-03	CONNECTOR FRONT MOUNT	1
71	29329-712-00-02	SEAL (RF1)	1
73	29329-898-00-01	'O' RING	1
77	25311-004-01	SEAL O RING 5.1 X 1.6 ROR	2
78	25311-007-21	SEAL O RING 8.1 X 1.6 N.R	1
82	917759	SCR M 2 X 8 SS SF PAN REC	2
84	928219	SCR M 2.5 X 5 SS SF PAN REC,	8
86	918357	SCR M 2.5 X 16 SS SF PAN REC,	4
88	990468/EQ	SCR M 2.5 X 25 SS SF PAN REC	4
92	917844	SCREW M3 X 6 PAN HD POSI SS SF	1
94	917818	SCREW M3 X 10 PAN HD POSI SS SF	2
95	917846	SCR M 3 X 12 SS SF PAN REC,	1
100	22181-010-54	NUT M3 HEX BR ET	4
105	21511-010-54	WAS M3 PLAN BR ET	2
110	917703	WASHER M2 CRIN SS SF	2
111	917705	WASHER CRINKLE M3 SS SF	6
114	21541-010-27	WAS M3 CRIN SS CB	4
120	22172-213-76	PLUG SCREWED M6X1 AA BU/BK	1
125	21561-754-20	CIRCLIP EXT 7.9	2
130	26611-706-90	BUSH INSULATING M3 FOR TO220,	2
135	A01131	GREASE LOW TEMPERATURE	0
136	980257	GREASE (125 GM TUBE)	0
140	16634-501-09	COMPOUND SILICON HEAT TRANSFER	0

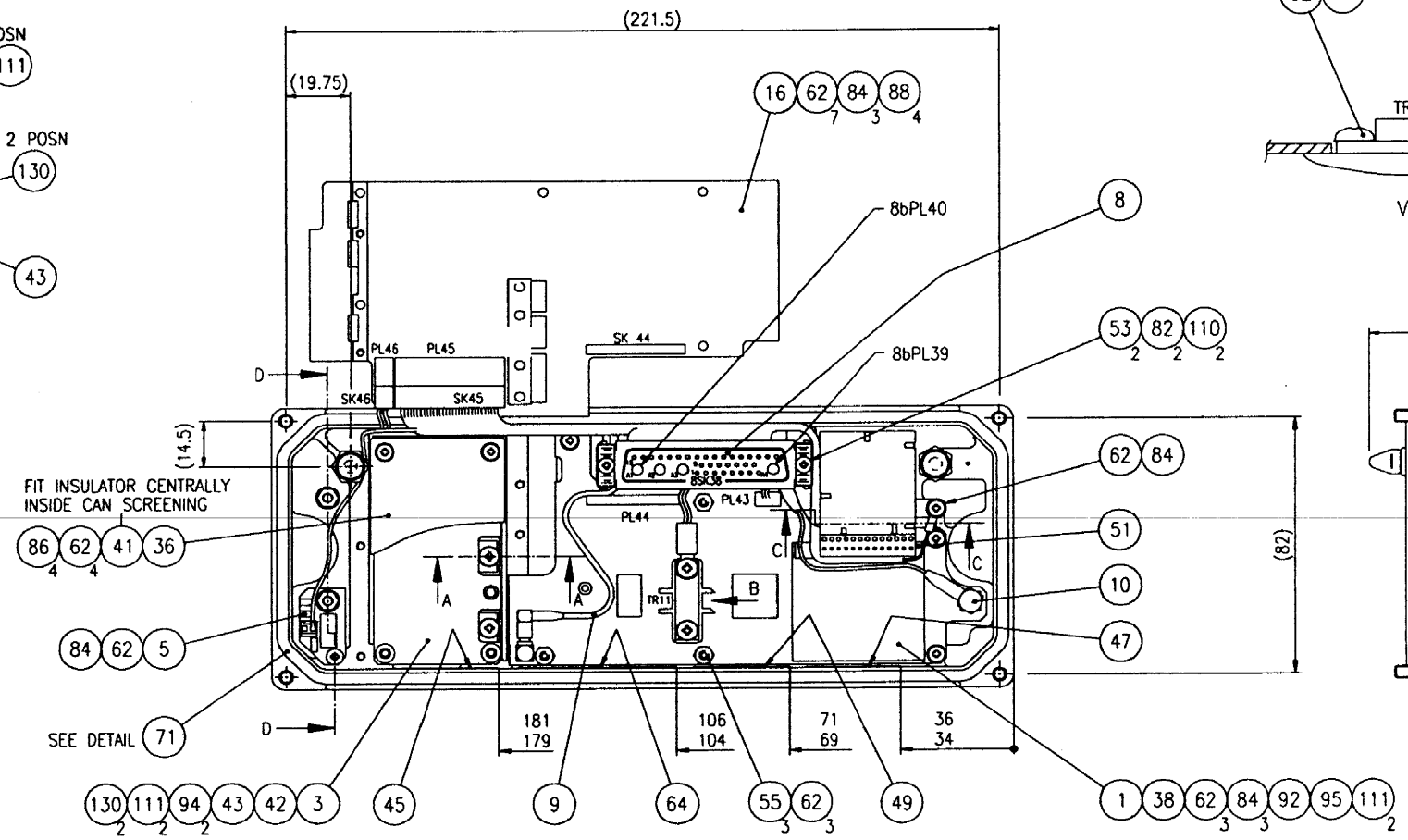


SCRAP SECTION A-A
SCALE 5:1

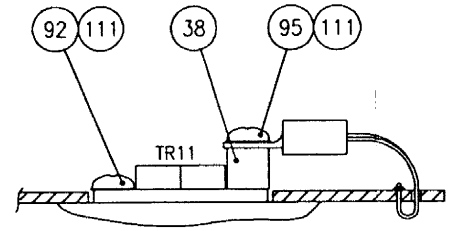


RFI SEAL, ITEM 71, DETAIL
SCALE 2:1

CARE MUST BE TAKEN TO AVOID DAMAGE TO SEAL DURING PRESSURE TESTING.

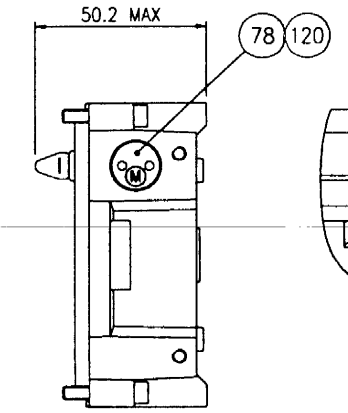


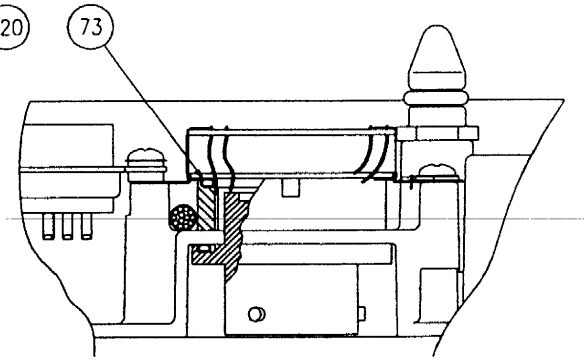
VIEW WITH ITEM 1 IN OPEN POSITION



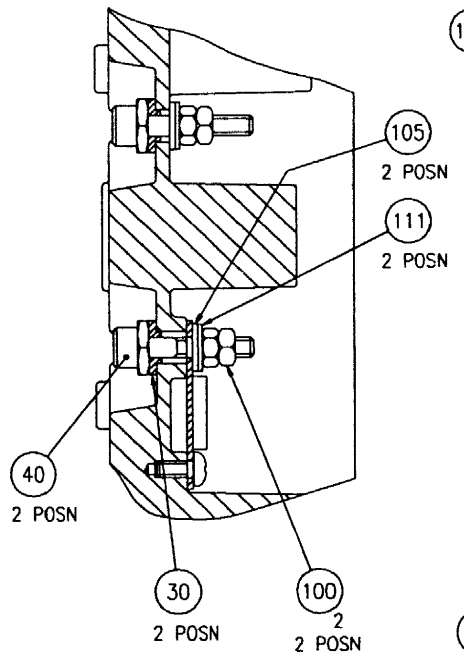
VIEW ON ARROW B
SCALE 2:1

BERYLLIUM HAZARD

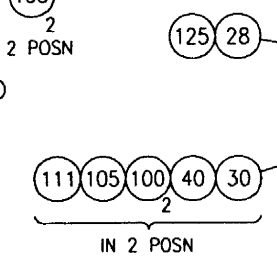


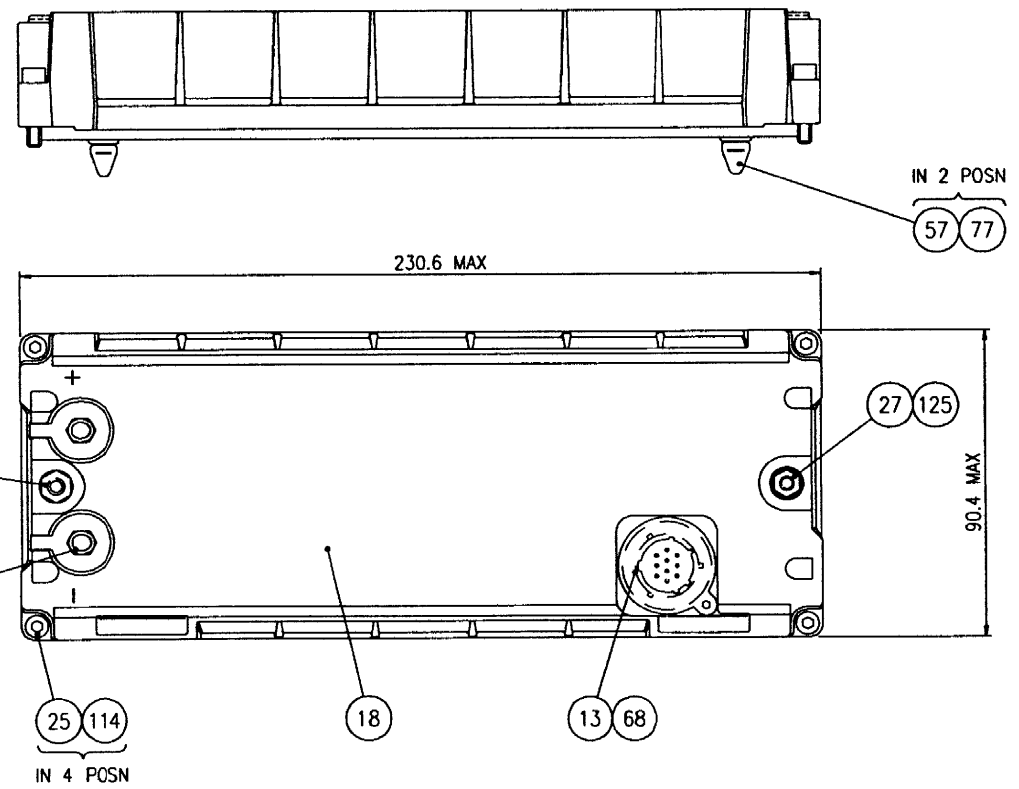


SCRAP SECTION C-C
SCALE:- 2:1

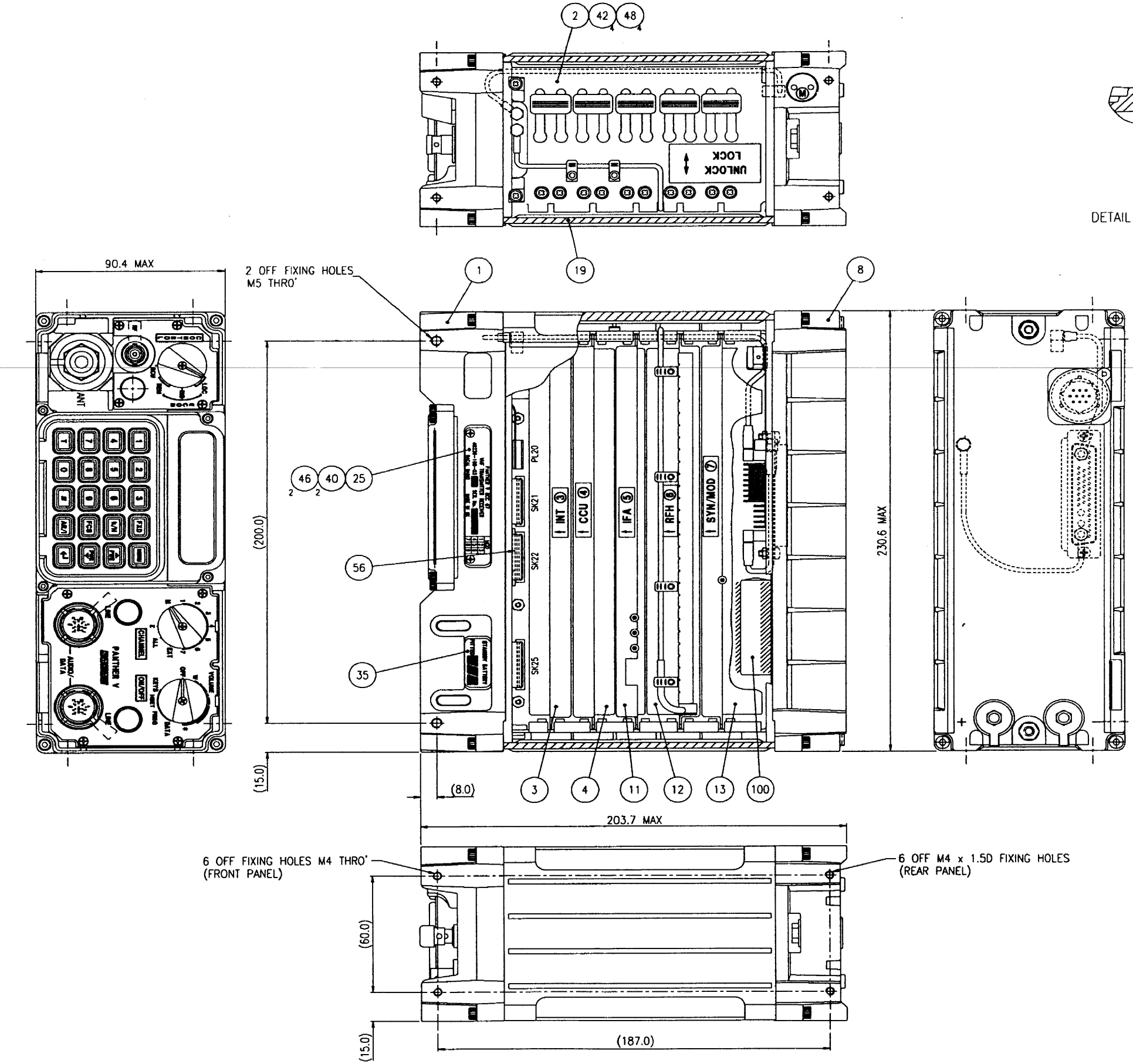


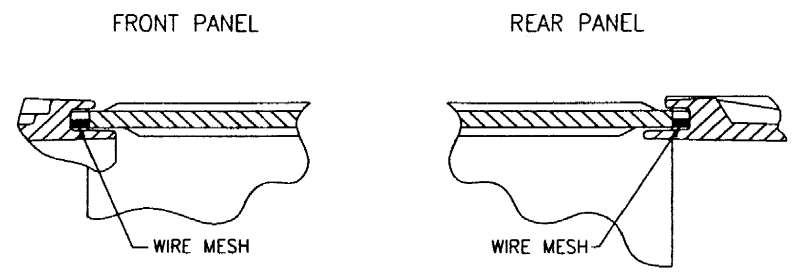
PART SECTION D-D
SCALE 2:1





ITEM	PART No.	DESCRIPTION	QTY
1	49329-110-03-01	FRONT PANEL ASSY 1	1
2	49329-120-03-02	CHASSIS & MOTHERBOARD ASSY 2	1
3	49329-130-03-01	INTERFACE MODULE 3	1
4	49329-140-03-01	CENTRAL CONTROL MODULE 4	1
8	49329-180-03-01	REAR PANEL ASSY 8	1
11	49329-150-00-07	IFA MODULE 5	1
12	49329-160-00-09	RF HEAD MODULE 6	1
13	49329-170-00-10	SYNTHESIZER AND MODULATOR MODULE 7	1
19	49329-580-00-02	SLEEVE FINISHED,	1
25	39329-710-03-02	NAMEPLATE	1
35	39329-811-00-02	LABEL	1
40	A04348	SCREW M2 X 4 SS CB PAN REC,	2
42	917844	SCREW M3 X 6 PAN HD POSI SS SF	4
46	21541-007-27	WAS M 2 CRIN SS CB	2
48	917705	WASHER CRINKLE M3 SS SF	4
56	98881-003-20	DESICC SACHET 34W X 72 3GM SIL	1
64	A03777/HZ	SOLDER 0.5 DIA 63/37 FLUX 1.1%	0
70	A03699/HZ	ADHESIVE 3748 (5 KG=180 STICK)	0
100	A02501/HZ	BATTERY, 1.9 AH, 3.6 V, LITHIUM	1



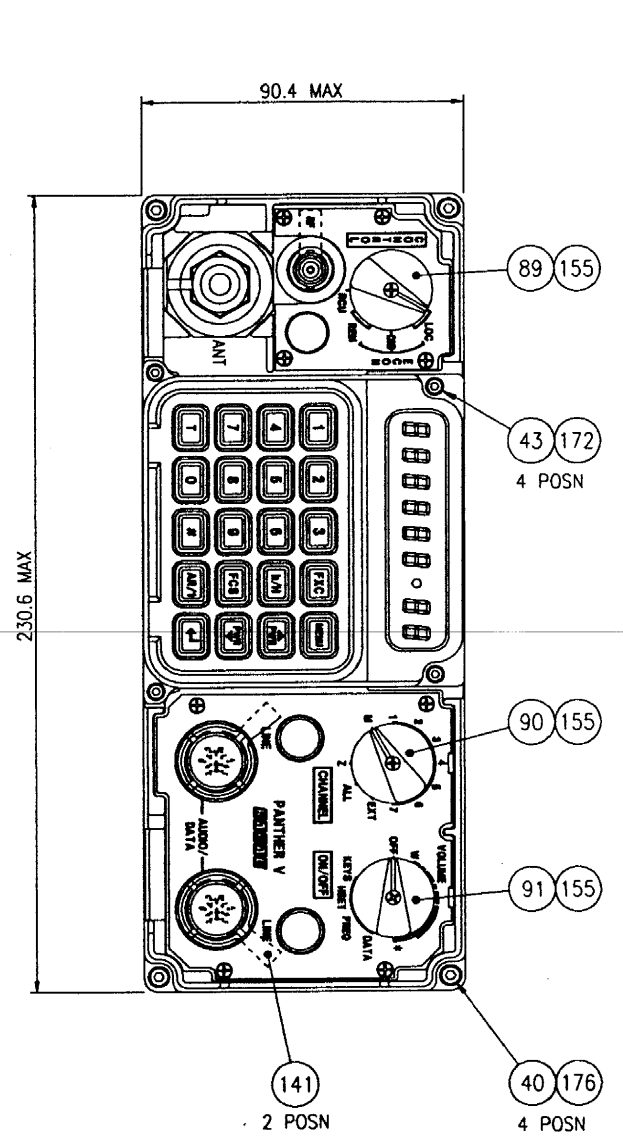


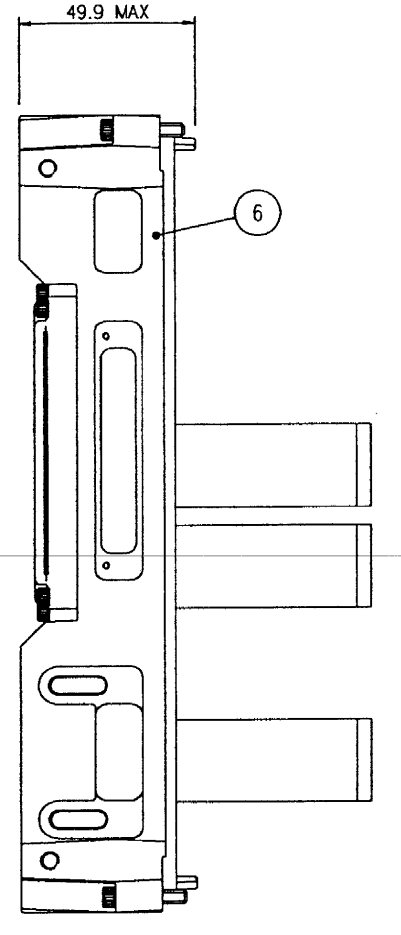
DETAIL SHOWING RFI SEALS (FITTED AT FRONT & REAR PANEL ASSY STAGES)

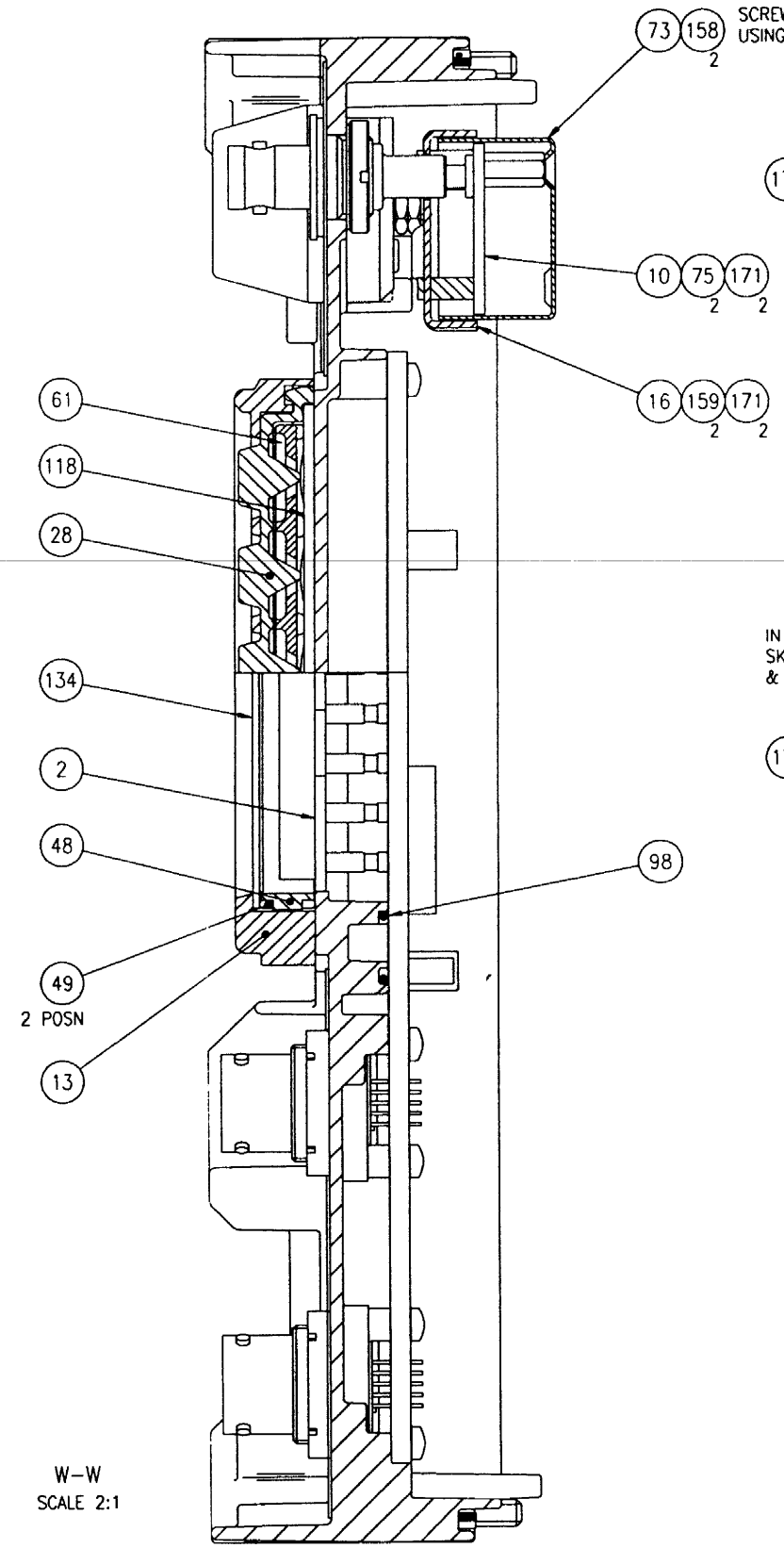
49329-100-03 / 1

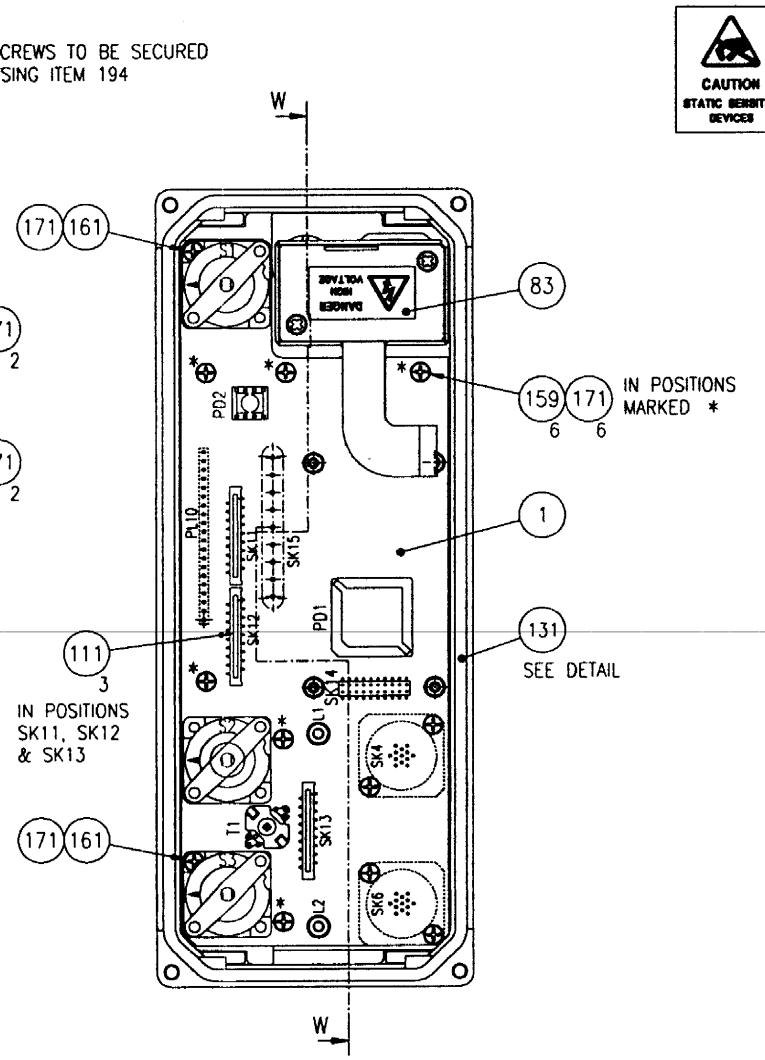
Fig 10.5
Panther VHF Transceiver BCC67

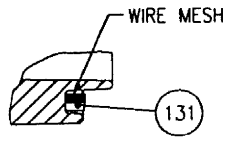
ITEM	PART No.	DESCRIPTION	QTY
1	49329-113-03-01	PCB ASSY FOR FRONT PANEL 1B	1
2	49329-116-03-01	PCB ASSY FOR DISPLAY 1C	1
6	49329-430-03-01	FRONT PANEL FINISHED,	1
10	49329-118-00-08	PCB ASSY FOR ANTENNA MATCHING 1D	1
13	49329-403-00-07	COVER KEYBOARD FINISHED,	1
15	49329-409-00-02	LINE TERMINAL (MODIFIED),	2
16	49329-410-00-05	BASEPLATE ASSY,	1
23	39329-606-03-02	ESCUTCHEON	1
24	39329-607-03-01	ESCUTCHEON	1
28	39226-623-03-01	BOOT KEYBOARD	1
30	39329-626-03-02	SHAFT	3
33	39329-725-03-03	SPACER	2
40	39001-206-10-02	SCREW CAPTIVE	4
43	39010-025-10-02	SCREW CAPTIVE	4
48	39226-625-07-01	SEAL RETAINER	1
49	39226-626-07-01	SEAL WINDOW	2
52	39226-601-09-03	WASHER ANTENNA	1
54	39226-612-09-02	BASE ANTENNA	1
57	39226-600-10-03	INSERT ANTENNA	1
59	39226-606-10-01	NUT SPECIAL	2
61	39226-622-10-01	PLATE SUPPORT	1
63	39226-627-10-01	WASHER	3
70	39329-605-00-01	SLIDE LOCKING	2
73	39329-619-00-02	CAN SCREENING	1
75	39329-621-00-01	PILLAR THREADED	2
83	39329-770-00-01	LABEL HIGH VOLTAGE	1
89	39329-844-00-01	KNOB CONTROL	1
90	39329-845-00-01	KNOB CHANNEL	1
91	39329-846-00-01	KNOB VOLUME ON/OFF	1
98	39800-613-00-01	SEAL FORMED	1
101	703886-02	CAP DUST BNC	1
104	93005/001-01	LABEL MODULE IDENT	1
111	29329-365-03-01	FLEXIBLE ASSY	3
113	29329-426-03-01	PLUG BLANKING SEAL	1
118	29226-266-10-03	SWITCH KEY ASSY	1
120	29226-633-10-02	SEAL O RING	6
127	29329-260-00-01	ADAPTOR SMB TO BNC	1
131	29329-712-00-02	SEAL (RFI)	1
134	29329-818-00-01	WINDOW	1
141	26212-882-30	CONNECTOR CIRC COVER SHELL 10	2
144	25311-010-03	SEAL O RING 11.1 X 1.6 ROR	1
147	25311-532-03	SEAL O RING 23.52 X 1.78 ROR	1
153	A04348	SCREW M2 X 4 SS CB PAN REC,	8
155	A05366	SCREW M2 X 8 SS CB PAN REC,	3
158	994064/EQ	SCR M 2.5 X 5 SS SF CSK REC,	2
159	917693	SCR M 2.5 X 6 SS SF PAN REC,	8
161	932101	SCR M 2.5 X 12 SS SF PAN REC,	2
168	21541-007-27	WAS M 2 CRIN SS CB	8
171	917704	WAS M 2.5 CRIN SS SF	12
172	21541-009-27	WAS M 2.5 CRIN SS CB	4
175	917705	WASHER CRINKLE M3 SS SF	4
176	21541-010-27	WAS M 3 CRIN SS CB	4
183	21561-207-19	CIRCLIP EXT 6.00 E CLIP CS PTFE	6









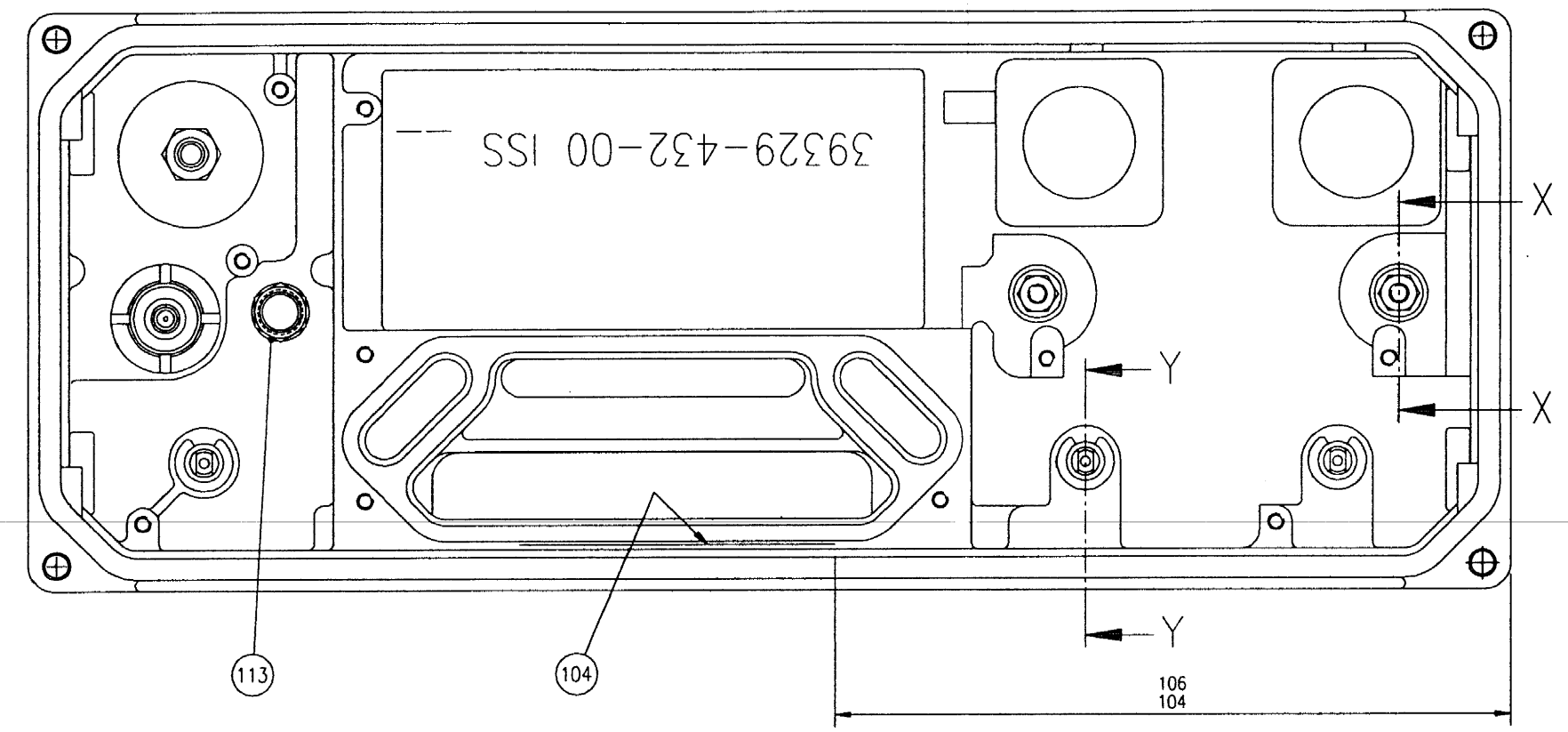


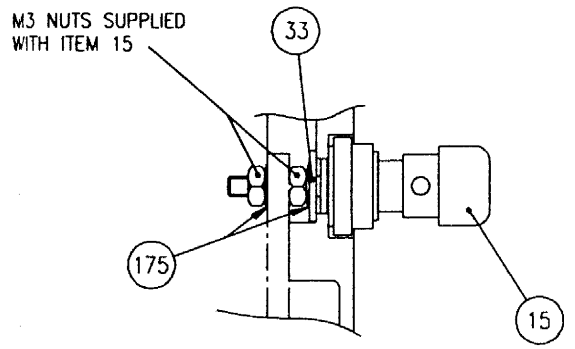
RFI SEAL, ITEM 131, DETAIL
SCALE 2:1

CARE MUST BE TAKEN TO AVOID DAMAGE TO SEAL DURING PRESSURE TESTING.

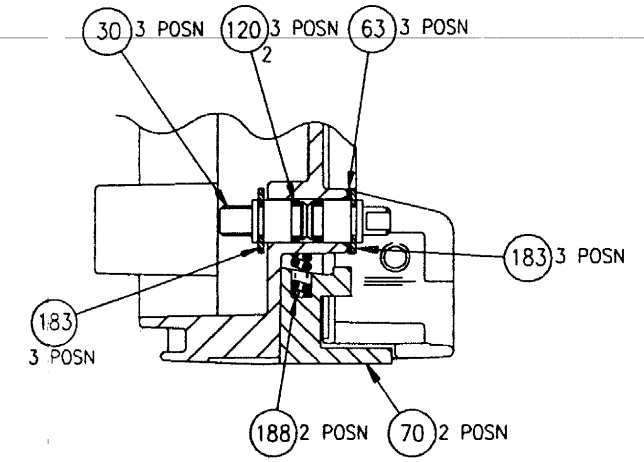
W–W
SCALE 2:1

Fig 10.6
Front Panel Assy Unit 1 (Sheet 1)

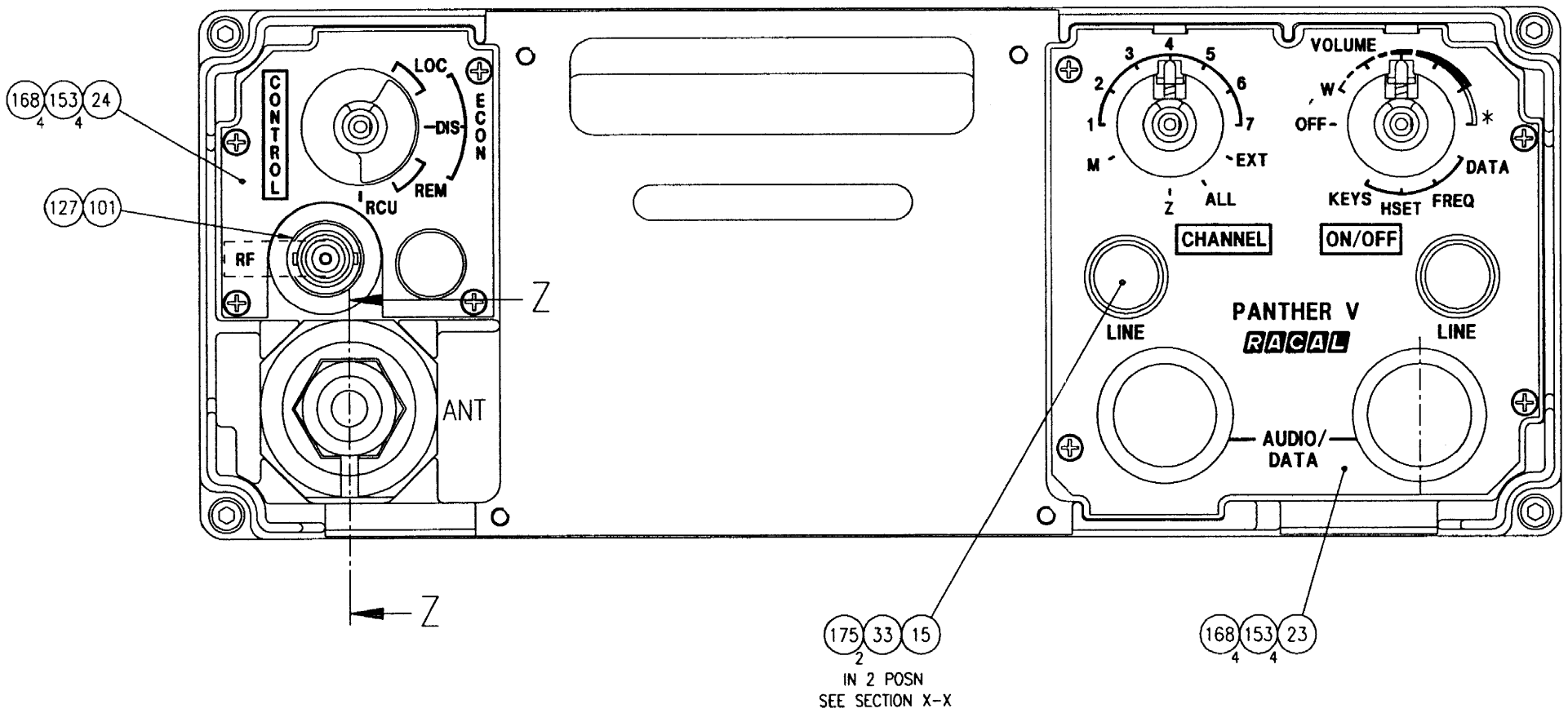


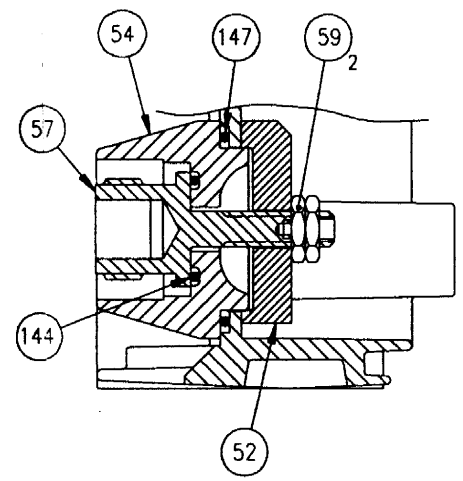


SCRAP SECTION X-X



SCRAP SECTION Y-Y





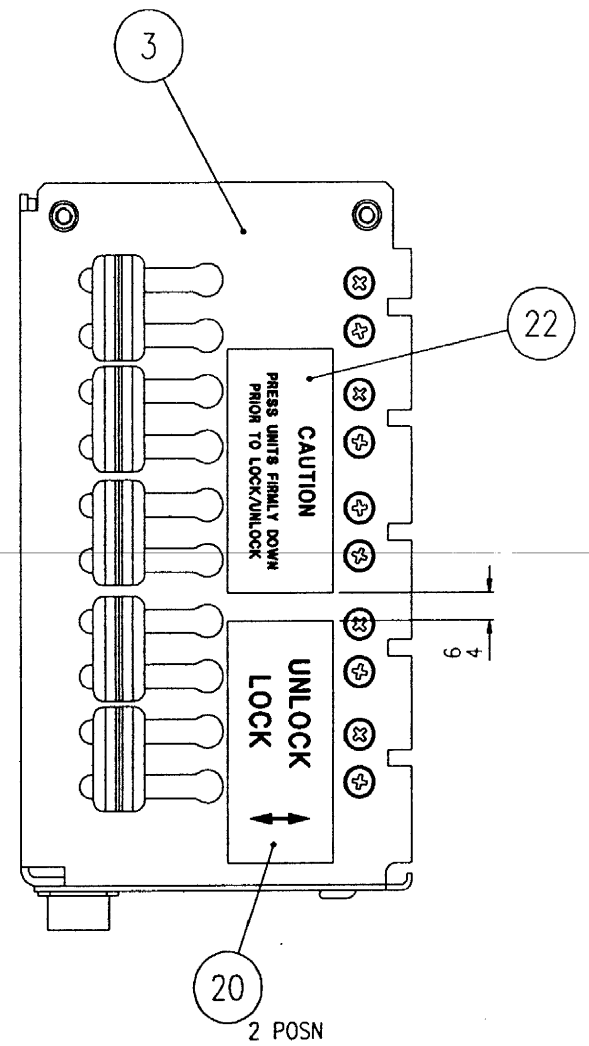
SCRAP SECTION Z-Z

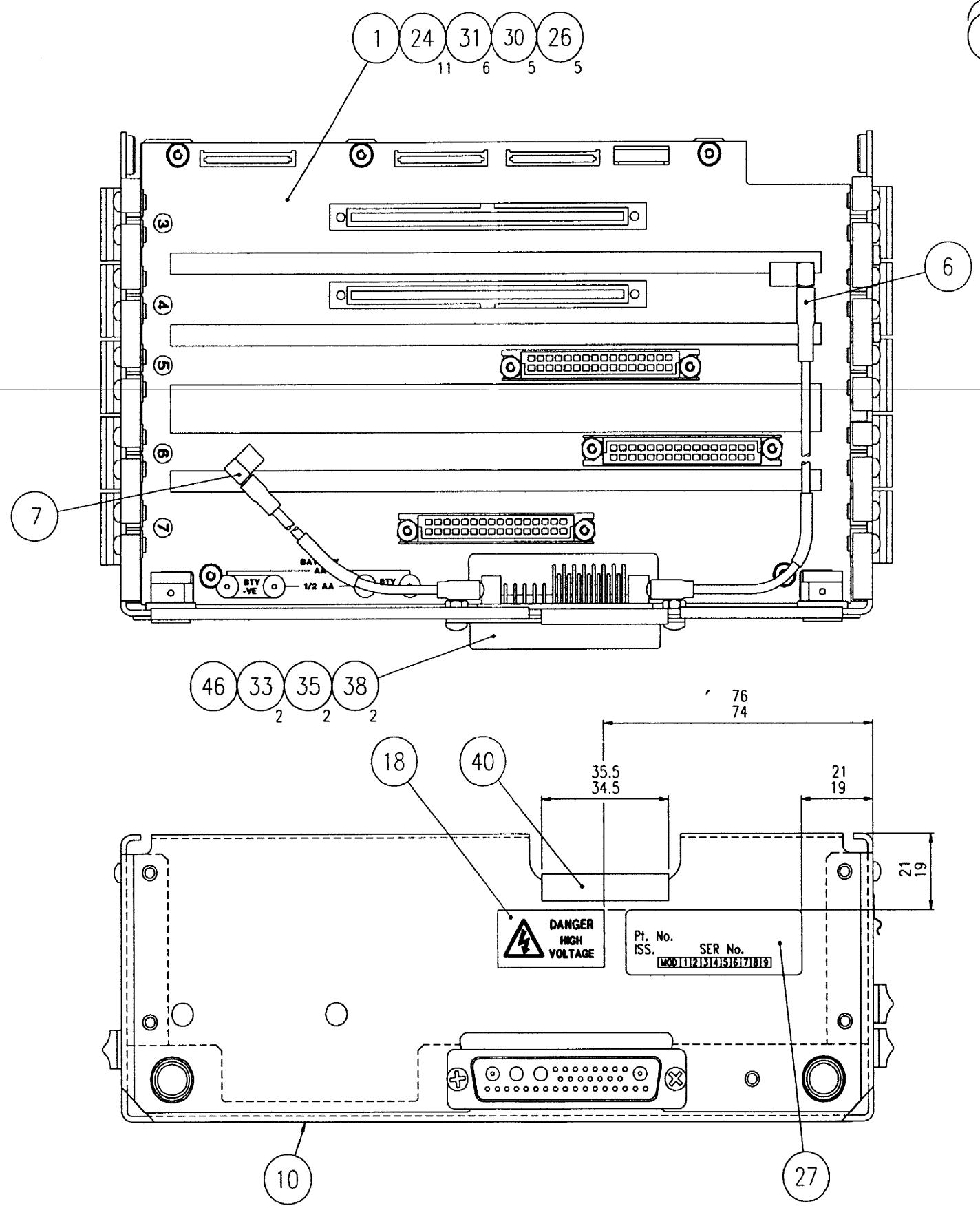
Fig 10.6
Front Panel Assy Unit 1 (Sheet 2)

ITEM	PART No.	DESCRIPTION	QTY
188	25511-051-20	SPRNG COMP 2.24OD 7.94FL SS	2
193	980129/HZ	ADHESIVE ANAEROBIC STUDLOCK (50 ML TUBE)	0
194	980469/HZ	ADHESIVE ANAEROBIC SCREWLOCK (50 ML TUBE)	0
199	16634-001-30	GREASE SILICONE HZ	0

CHASSIS AND MOTHERBOARD ASSY UNIT 2 (FIG 10.7) **49329-120-03-02**

1	49329-270-03-02	PCB ASSY FOR MOTHERBOARD 2	1
3	49329-420-03-02	CHASSIS ASSY,	1
6	49329-272-00-03	CONNECTOR ASSY	1
7	49329-273-00-06	CONNECTOR ASSY	1
10	39329-639-03-02	INSULATOR	1
12	39226-649-10-01	NUT SPECIAL	20
14	39329-636-00-02	GUIDE	20
15	39329-637-00-01	LOCK SLIDE	10
16	39329-638-00-03	SPRING CONTACT	20
18	39329-770-00-01	LABEL HIGH VOLTAGE	1
20	39329-821-00-02	LABEL	1
22	39329-828-00-01	LABEL CAUTION	1
24	39329-830-00-01	NUT SPECIAL (M2.5)	11
26	754452-01	WASHER CRINKLE SPECIAL	25
27	93005/002-01	LABEL MODULE IDENT	1
29	917693	SCR M 2.5 X 6 SS SF PAN REC,	20
30	918569	SCR M 2.5 X 6 SS SF CSK REC,	5
31	918570	SCR M 2.5 X 8 SS SF CSK REC	6
33	917845	SCR M 3 X 8 SS SF PAN REC,	2
35	917825	NUT M3 HEX SS SF FULL	2
38	917705	WASHER CRINKLE M3 SS SF	2
40	945811	STRIP POLYOLEFIN SINGLE SIDE BK	1
42	980469/HZ	ADHESIVE ANAEROBIC SCREWLOCK (50 ML TUBE)	0
44	A03777/HZ	SOLDER 0.5 DIA 63/37 FLUX 1.1%	0
46	A05914	CONN RECT 36WAY MIX FX PSH R/AN,	1





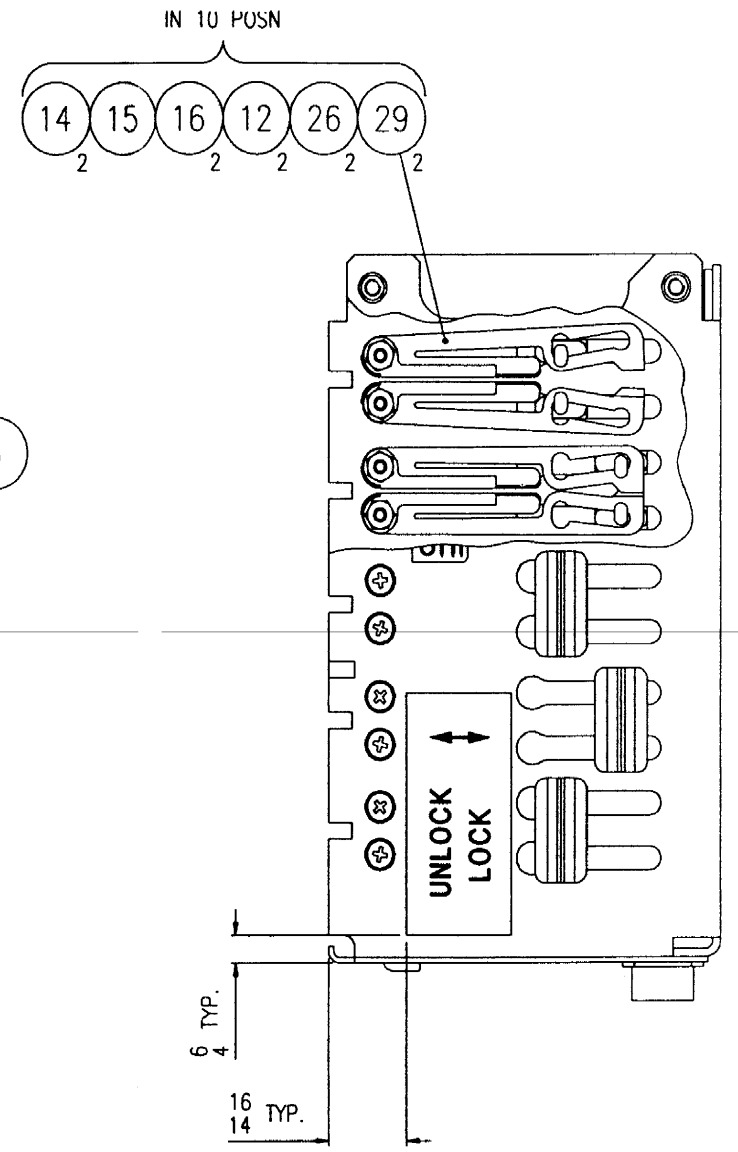
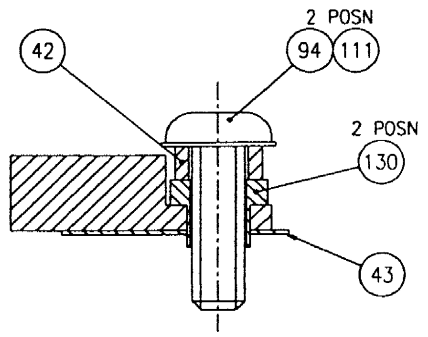
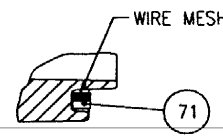


Fig 10.7
Chassis and Motherboard Assy Unit 2

ITEM	PART No.	DESCRIPTION	QTY
1	49329-186-03-01	PCB ASSY FOR P.S. & LOGIC 8C	1
4	49329-184-00-13	PCB ASSY FOR POWER AMPLIFIER 8B	1
6	49329-188-00-07	PCB ASSY FOR CONVERTER 8D	1
8	49329-200-00-04	PCB ASSY FOR +VE BTY	1
12	49329-360-00-08	CABLEFORM	1
13	49329-361-00-04	CONNECTOR ASSY	1
14	49329-362-00-04	CONNECTOR ASSY	1
16	49329-440-00-04	REAR PANEL FINISHED	1
18	49329-590-00-01	COVER ASSY	1
25	39001-206-10-02	SCREW CAPTIVE	4
27	39226-721-10-01	SCREW SPECIAL	1
28	39226-722-10-01	NUT SPECIAL	1
30	39226-724-10-02	INSULATOR	2
36	39329-695-00-03	CAN SCREENING	1
38	39329-700-00-01	SPACER	1
40	39329-705-00-01	STUD CONTACT	2
41	39329-706-00-01	INSULATOR	1
42	39329-707-00-01	CLAMP BAR	1
43	39329-708-00-02	INSULATOR	1
45	39329-770-00-01	LABEL HIGH VOLTAGE	1
47	39329-792-00-01	LABEL BERYLLIUM OXIDE	1
49	39329-797-00-01	LABEL STATIC DEVICE	1
51	39329-872-00-01	INSULATOR	1
53	39329-881-00-01	CLIP EARTHING	2
55	39329-885-00-03	PILLAR	3
57	39329-892-00-01	PIN DOWEL	2
62	754452-01	WASHER CRINKLE SPECIAL	19
64	93005/019-01	LABEL MODULE IDENT	1
68	29329-380-00-03	CONNECTOR FRONT MOUNT	1
71	29329-712-00-02	SEAL (RF1)	1
73	29329-898-00-01	'O' RING	1
77	25311-004-01	SEAL O RING 5.1 X 1.6 ROR	2
78	25311-007-21	SEAL O RING 8.1 X 1.6 N.R	1
82	917759	SCR M 2 X 8 SS SF PAN REC	2
84	928219	SCR M 2.5 X 5 SS SF PAN REC,	8
86	918357	SCR M 2.5 X 16 SS SF PAN REC,	4
88	990468/EQ	SCR M 2.5 X 25 SS SF PAN REC	4
92	917844	SCREW M3 X 6 PAN HD POSI SS SF	1
94	917818	SCREW M3 X 10 PAN HD POSI SS SF	2
95	917846	SCR M 3 X 12 SS SF PAN REC,	1
100	22181-010-54	NUT M3 HEX BR ET	4
105	21511-010-54	WAS M3 PLAN BR ET	2
110	917703	WASHER M2 CRIN SS SF	2
111	917705	WASHER CRINKLE M3 SS SF	6
114	21541-010-27	WAS M3 CRIN SS CB	4
120	22172-213-76	PLUG SCREWED M6X1 AA BU/BK	1
125	21561-754-20	CIRCLIP EXT 7.9	2
130	26611-706-90	BUSH INSULATING M3 FOR TO220,	2
135	A01131	GREASE LOW TEMPERATURE	0
136	980257	GREASE (125 GM TUBE)	0
140	16634-501-09	COMPOUND SILICON HEAT TRANSFER	0

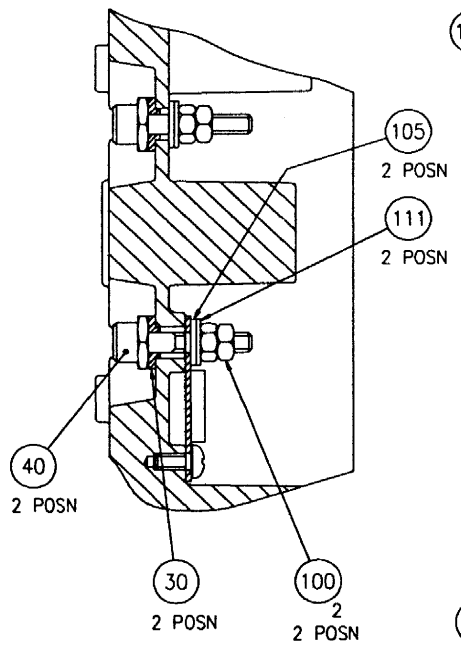


SCRAP SECTION A–A
SCALE 5:1

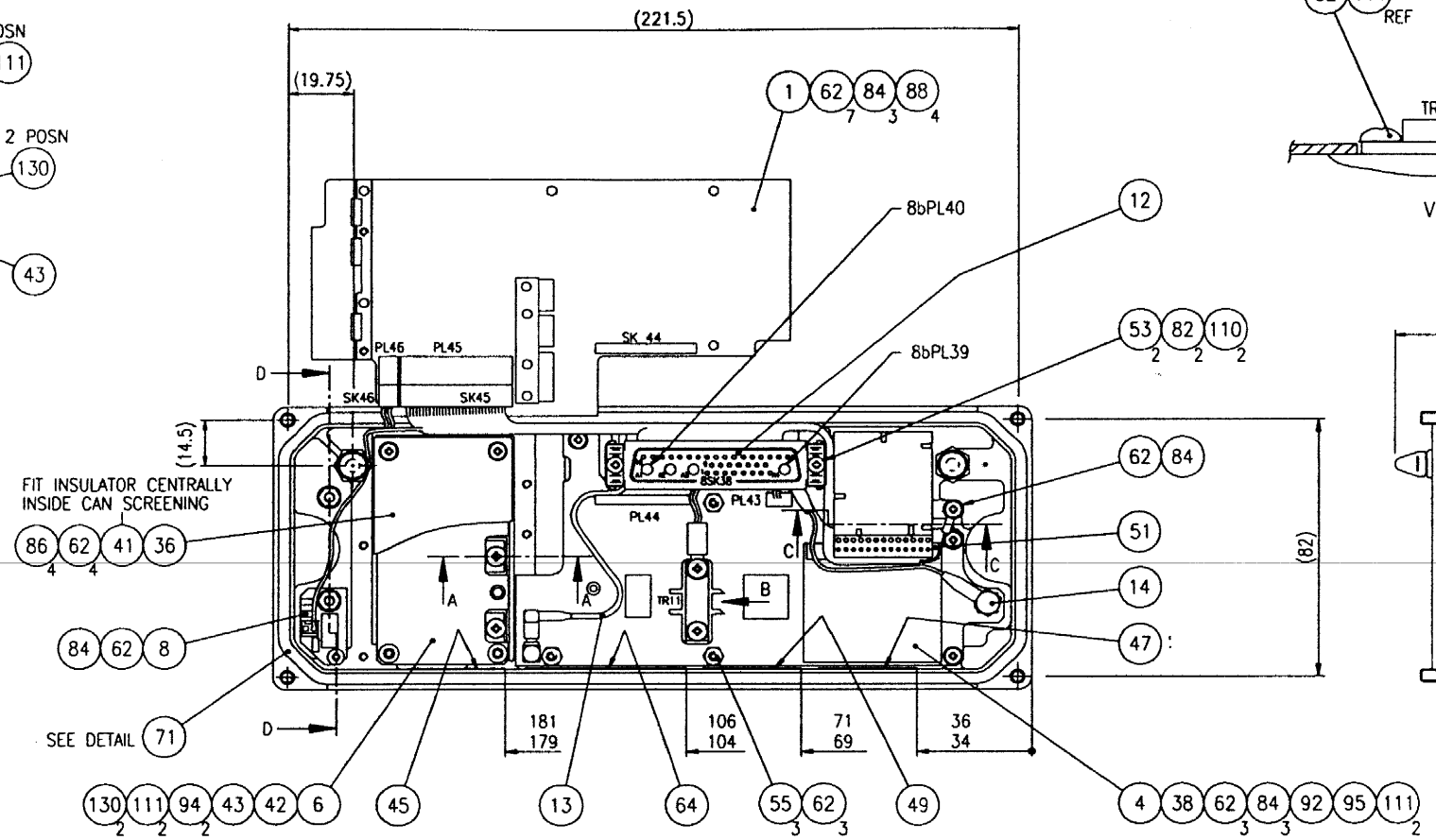


RFI SEAL, ITEM 71, DETAIL
SCALE 2:1

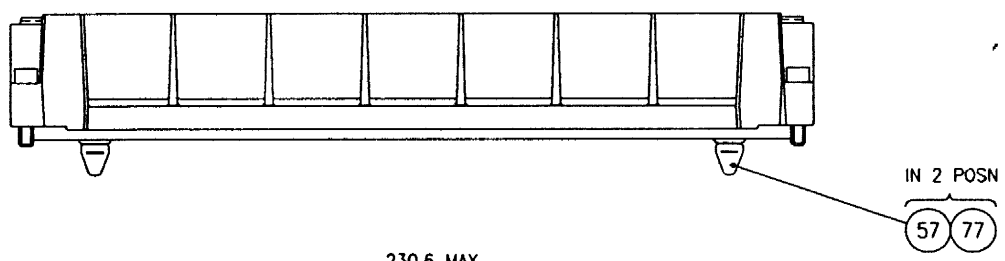
CARE MUST BE TAKEN TO AVOID DAMAGE TO SEAL DURING PRESSURE TESTING.

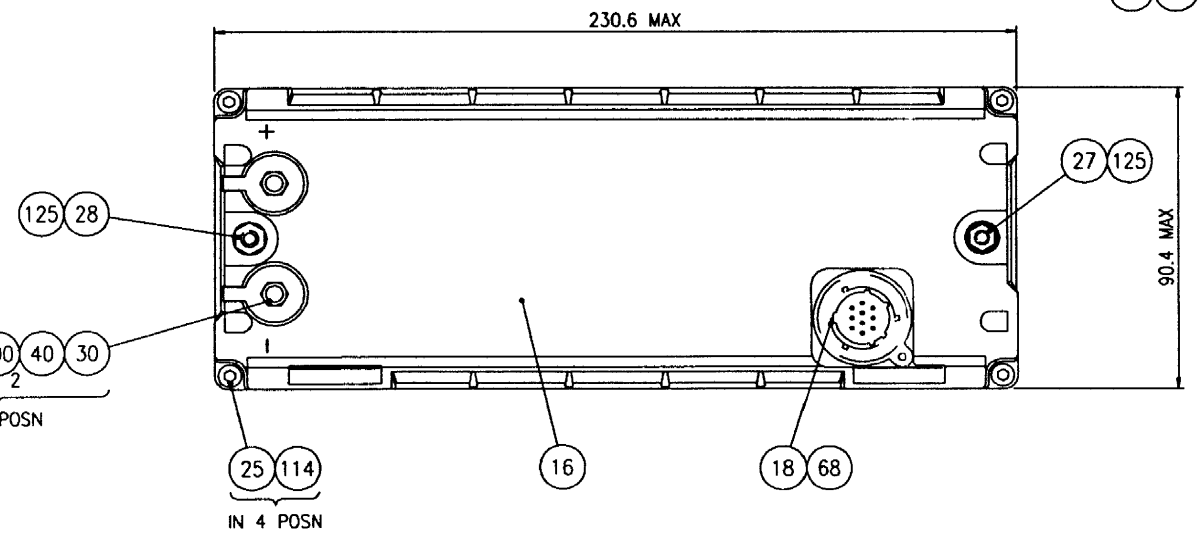


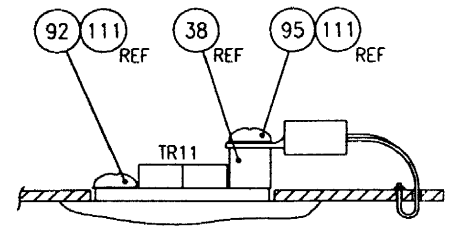
PART SECTION D–D
SCALE 2:1



VIEW WITH ITEM 1 IN OPEN POSITION

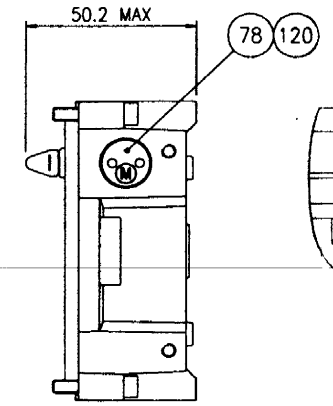


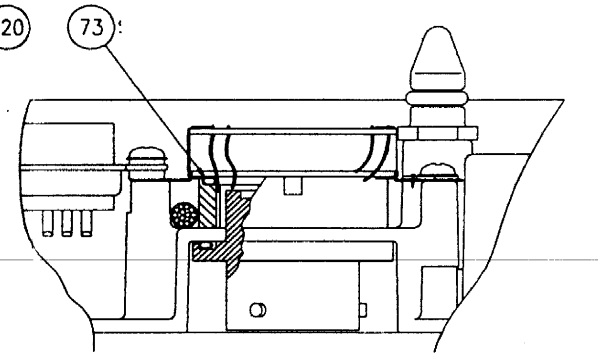




VIEW ON ARROW B
SCALE 2:1

BERYLLIUM HAZARD





SCRAP SECTION C–C
SCALE:– 2:1

49329-180-03 / 1

Fig 10.8
Rear Panel Assy Unit 8