SECTION 3
INSTALLATION-COMMISSIONING-MAINTENANCE

INSTALLATION

Unpacking & Checking

Equipments are despatched and transported in tailored cardboard packages as detailed in Fig. 3.1.

Note: *It is strongly recommended that the packaging is retained for future transportation of modules.*

The overall packaging caters for a single equipment complete with all acessories and ancillary items (e.g.: Handset, Duplexer etc.) in a single package.

The 'heavier' units of the base station (power supply unit and transmitter power amplifier) are removed from the shelf housing and individually packed in tailored cartons, with an additional carton provided for the 'accessories'. The shelf with other units fitted is packed in a separate carton. These inner packages are then fitted into a single outer carton fitted with suitable packing material.

On unpacking, each item should be checked against the contents list and thoroughly inspected for any signs of physical damage.

Note: *The Company, or their authorised agents, must be advised by letter, within ten days of equipment receipt, of any damage or shortages found.*

Shelf Installation

The base station shelf is supplied for installation into either a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All external interconnections are made via the backplane and sufficient space all around the unit should be allowed for access when in the withdrawn position. A depth of approximately 300mm in front of the equipment should be allowed for the withdrawal of the base station.

CAUTION

Do not transport the base station as a complete installation in the shelf housing. Failure to comply with this recommendation may lead to damage to the shelf housing.

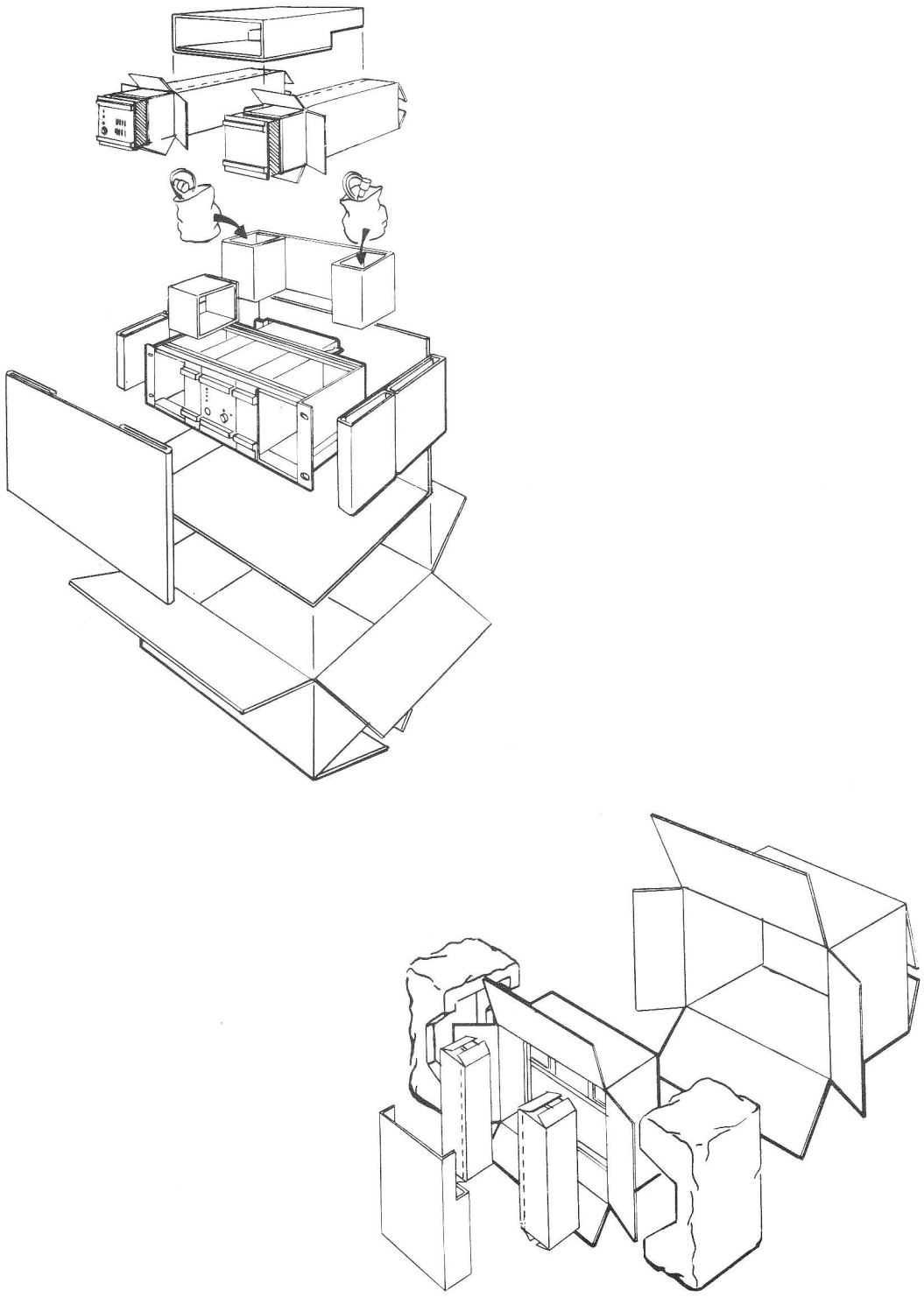

Fig. 3.1. Packaging Arrangements

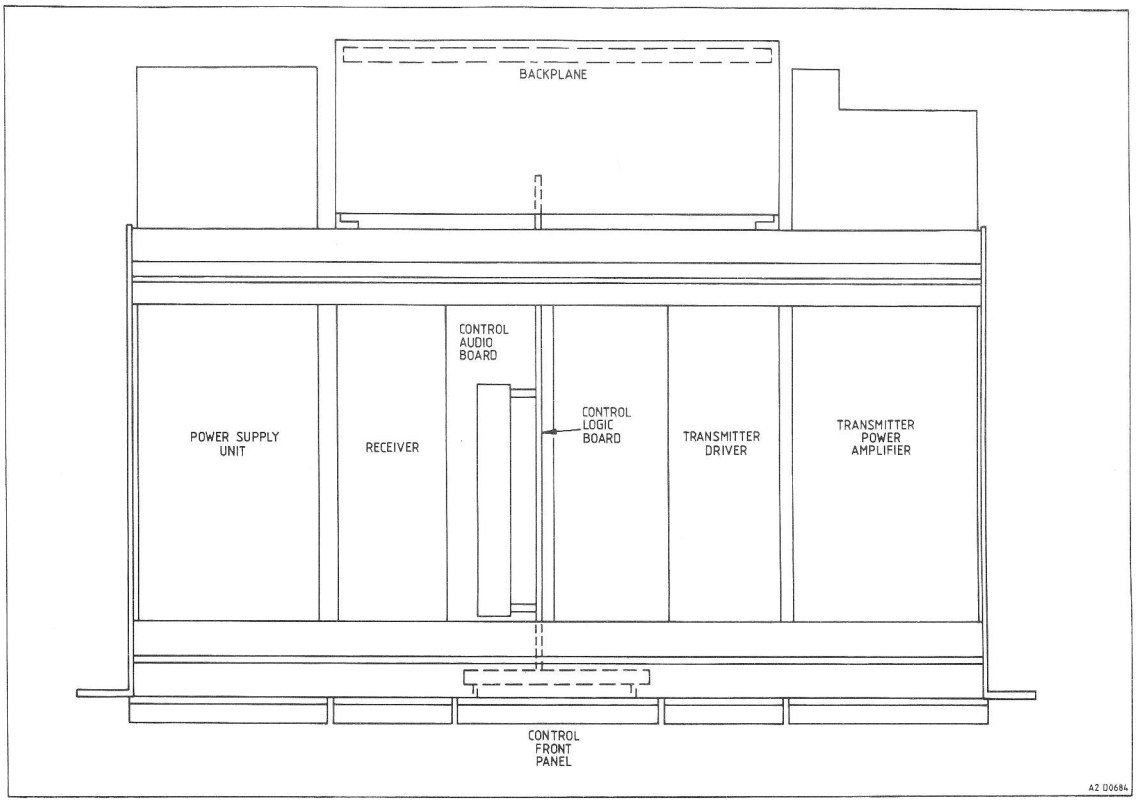

Fig. 3.2 Shelf Layout Diagram

Installation of Units

The power supply and transmitter power amplifier modules are packed separately and require to be installed into the main unit.

1. Power Supply Module

(a) Check that the power supply module is the correct version for the local supply.

(b) AC operated versions

(i) Check that the unit fuse rating is correct.

Supply Voltage	Module Version	Fuse Rating
240V AC	/01,07	2,5A
115V AC	/02,08	5A

(ii) If the DC standby supply is not connected ensure that the selector plug is fitted into the DC input connector. This connects the PSU -Ve line to chassis earth.

(iii) If a DC standby supply is connected refer to para.(d).

(c) 24V DC operated versions

(i) Connect the 24V supply to the DC input connector using the socket and lead assembly supplied with the PSU.

(ii) Fit an 'in-line' fuse (supplied with the equipment bagged items) to each (+Ve and -Ve) DC supply line.

(d) DC standby supply

WARNING

Most types of battery contain corrosive liquids and emit explosive gases. Therefore, when installing or charging such types of battery it is essential to follow the battery manufacturers safety recommendations.

(i) This equipment is capable of being supplied from a 24V DC standby source in the event of a mains failure; it is essential that only a professionally designed standby source is used to provide the standby supply to the equipment. Any DC supply requirement should be met by using the 24V DC only versions of the equipment.

(ii) At regular intervals it is advisable to check that the standby supply is functioning correctly by switching off the AC supply and operating the equipment solely from the standby supply.

(e) Locate and secure the power supply module in position at the left-hand end of the shelf.

(f) Make the appropriate supply connections and check the operation of the power switch and indicators.

(g) With power removed make the connection to the equipment backplane.

2. Transmitter Power Amplifier Module

(a) Locate and secure the module in position at the right-hand end of the shelf.

(b) Make the connections to the transmitter driver, antenna socket and backplane.

Interconnections

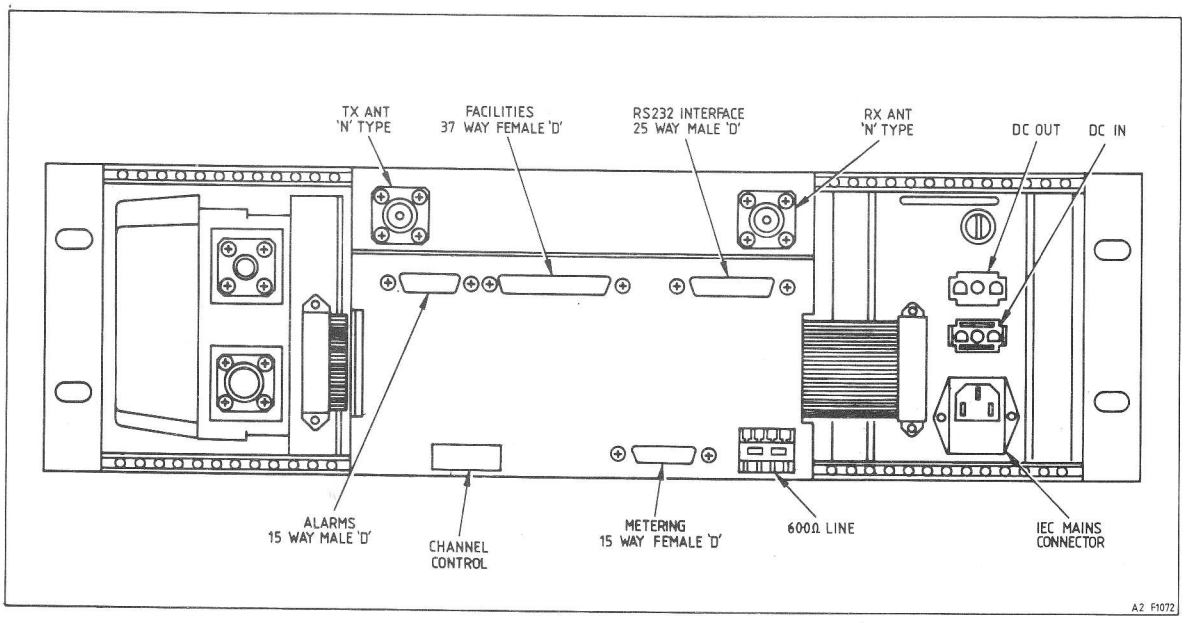

Fig. 3.3 Rear Panel Connections

All external connections to the equipment (including power supply, 600Ω lines, facilities and metering) are made at the rear of the equipment. Separate transmitter and receiver antenna connections are made on the rear of the shelf frame. The rear panel connector layout is shown in Fig. 3.3. Fig.4.2 details the interconnections on the backplane assembly.

Linking Checks

Equipment functions are defined by pre-set links located on the backplane and within the transmitter driver and control modules. Although these are set during manufacture it is advisable, before proceeding with the functional tests, to check that the correct links have been selected against the system requirements. Refer to Linking information starting on page 2.14.

Rack or Cabinet Mounted Installation

The base station may be installed in a 19in rack or in a cabinet. Modules can be withdrawn clear of the rack or cabinet for "in situ" servicing, or removed completely for bench testing or major repairs.

COMMISSIONING

Preliminaries

1. Equipments should be thoroughly checked for signs of physical damage during transit as part of the installation procedure.

2. The power supply unit and transmitter module should be installed and correctly connected.

3. An electrical check of the power supply unit, under 'no-load' conditions should be carried out (refer to 'Installation of Units').

4. Ensure that all equipment links are correctly set against operational requirements.

Test Equipment

Note: Items quoted relate to 'Table 3.1 - List of Recommended Types'

2	AF generator	13	Modulation meter
10	RF signal generator	15	Thruline wattmeter
12	Frequency counter	19	SINAD meter

Functional Checks

Note: (i) To ensure that equipment has reached a stable operating temperature, it must be switched on for at least one hour prior to commencing checks.

(ii) The 600Ω line level used by this equipment is a nominal -14dBm and this is the level used throughout these checks. If the system under test uses a different audio level this may be used as an alternative to the -14dBm.

(iii) msd = maximum system deviation, = 2,5kHz for 12,5kHz channel spacing equipment, 4kHz for 20kHz spacing and 5kHz for 25kHz channel spacing.

(iv) All adjustments (RV16,RV1,RV2,RV9,RV3 and RV5 are located within the control module).

1. Receiver Checks

(a) Select Receiver centre frequency

(b) Connect the RF signal generator to the Rx antenna socket,and adjust to receive frequency. Modulate the RF input 1kHz at 60% msd, output 1mV.

(c) Check for audio level of -14dBm across the Rx 600Ω line. Adjust RV16 (LINE LEVEL) as necessary.

(d) Reduce the RF input level to 0,3µV PD and check SINAD is better than 12dB.

(e) Reduce the RF input level to give 10dB SINAD.

(f) Set RV1 (CARRIER LEVEL SQUELCH) fully clockwise and adjust RV2 (NOISE SQUELCH) such that the squelch is just open.

(g) Reduce the RF input level by 6dB and check the squelch is closed.

(h) Increase the RF input level to 1mV. Switch off the modulation; check that the fall in the audio level is greater than 50dB.

(i) The above checks may be repeated on the customer extreme frequencies, if required.

(j) Disconnect and remove all test equipment.

Note: If a squelch level less sensitive than 0,3µV is required adjust RV1 (CARRIER LEVEL SQUELCH) to the desired level.

2.Transmitter Checks

Note: In order to modulate the carrier signal the manual function switch must be set to Tx ON and the PTT switch, on the engineers handset, operated.

(a) Connect the wattmeter and modulation meter to the TX antenna socket and loosely couple the frequency counter.

(b) Connect the AF generator set to 1kHz at -14dBm to the TX 600Ω line.

(c) Connect the engineer's handset to the control module front panel and set the manual function switch to Tx ON. Select Customer centre frequency on the transmitter.

(d) Check that the power output is greater than the minimum specified for the unit, and the carrier is within 2ppm of the allocated frequency.

(e) Operate the PTT switch (to modulate the carrier) and check for an output deviation of 60% msd. Adjust RV9 (LINE SENSITIVITY) as necessary.

(f) Increase the AF input by 20dB and sweep the frequency between 300Hz and 8kHz. Check that the deviation (+ve and -ve) does not exceed the msd. Adjust RV3 (DEVIATION) as necessary.
If RV3 requires adjustment repeat step (e).

(g) The above test may be repeated at the customer extreme frequencies, if required.

(h) Disconnect and remove all test equipment.

3. **Talkthrough Level**

(a) Connect the RF signal generator to the Rx antenna socket and the thruline wattmeter and modulation meter to the Tx antenna socket.

(b) Modulate the RF input signal 1kHz at 60% msd, output 1mV.

(c) Connect the engineer's handset to the control module front panel and set the manual function switch to T/T.

(d) Check for an RF output of greater than the minimum specified for the unit with deviation of 60% msd. If necessary, set deviation using RV5 on control audio board AT29024/-.

(e) Disconnect and remove all test equipment.

4. **Notch Filter - optional (M80 series signalling)**

Note: The notch filters and detector tuned filter are aligned in the factory and should not normally require adjustment. If, however, excessive keying tone is present on the transmitter modulation or the transmitter cannot be keyed from the control unit the following alignment may be carried out:

Notch 1 and 2

(a) The Rx Call generator is used to provide the 2970Hz tone for this test. Enable the generator by removing link LK13 A-B and connecting LK13A to the -ve line (P25). Remove link LK21 and connect the generator output (P16) to the TX audio line LK21B. Set link LK18 B-C.

(b) Connect the AC voltmeter to TP6 and check for the presence of a 2970Hz tone. Note this reading.

(c) Set link LK18 A-B.

(d) Link LK16-IN, LK17-OUT. Check TP6 for a level 50dB down on that noted in step(b). Link LK16-OUT, LK17-IN and repeat. Adjust RV7(NOTCH 1) /RV8 (NOTCH 2) as necessary.

2970Hz Detector

(e) Connect the AC voltmeter to TP9 and tune RV11 (2970 DET) for maximum output.

Notch 3

(f) Disconnect the receiver module from the control module. Connect the generator output (P16) to the RX audio line (TP11). Set link LK27 A-B .

(g) Connect the AC voltmeter to TP15 and check for the presence of a 2970Hz tone. Note this reading.

(h) Set link LK27 B-C.

(i) Check TP15 for a level 50dB down on that noted in step (g). Adjust RV17 (NOTCH 3) as necessary.

Conclusion

(j) Disconnect all test equipment and remove the connection between P16/TP11 and P25/LK13. Re-connect the receiver module.

(k) Refit links LK13,LK16-18,LK27 according to operational requirements.

5. **Hybrid Balance - optional (2-wire systems)**

Note: The hybrid circuit requires balancing for the particular 600Ω line to be used, therefore, this procedure should be carried out with the base station and control equipment fully installed.

(a) Disconnect the receiver module and remove link LK21.

(b) Apply a 1kHz tone at -14dBm (nominal) across the RX 600Ω line. Note the AC voltmeter reading at LK21C.

(c) Remove the AF generator, re-connect the receiver module and the control equipment. Connect the RF signal generator to the RX antenna socket.

(d) Modulate the RF input signal 1kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV13 (BALANCE R) as necessary.

(e) Modulate the RF input signal 3kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV12 (BALANCE X) as necessary.

(e) Modulate the RF input signal with 1kHz, 2kHz, 3kHz in turn. Check LK21C for the 'best achievable rejection' across the audio frequency range - better than 20dB down on the level noted in step (b).

(f) Disconnect and remove all test equipment and refit link LK21 according to operational requirements.

MAINTENANCE

Routine Checks

The Performance Checks detailed in the preceding pages should be carried out at regular intervals, as operational requirements permit, to ensure that optimum performance is obtained from the equipment.

A detailed log book should be kept of all data derived from these tests, as this will show any deterioration in performance.

Fault Location

The in-built 'local' supervisory system, contained within the control module, incorporates a number of alarm indicators (LED's), visible when the module is withdrawn fron the equipment. The alarm inputs to these indicators are combined on the logic board to provide a common alarm indication on the front panel of the module. This enables the existence and location of a fault to be quickly identified. See section 'Local Diagnostics' on pages 3.12 to 3.14.

'On-site' Repair & Replacement

Modular construction has been adopted throughout the equipment to simplify maintenance as far as possible. Any suspect module can be easily and quickly removed and replaced with a serviceable spare. The equipment can thus be returned to service with a minimum of delay and a thorough check and repair of the faulty unit or sub-assembly carried out under workshop conditions.

Facilities are available which enable units and sub-assemblies to be tested under operational conditions. Interconnection between modules is via flexible ribbon cables and coaxial cables enabling all but the power supply unit to be withdrawn with the equipment operational.

Note: Care must be taken to avoid damage to interconnecting cables or connectors when withdrawing or replacing modules.

Workshop Repair and Alignment

A comprehensive list of test equipment tools is given in this section; 'break-out' connectors which enable test equipment to be connected to the ribbon cable outputs.

It is advised that under no circumstances should field repairs at component level be attempted with this equipment. Servicing and repairs to this level should only be carried out by a workshop which has been fully certified by the equipment manufacturers (refer to page 1.3). Failure to observe this stipulation will result in invalidation of the product warranty.

Control Module

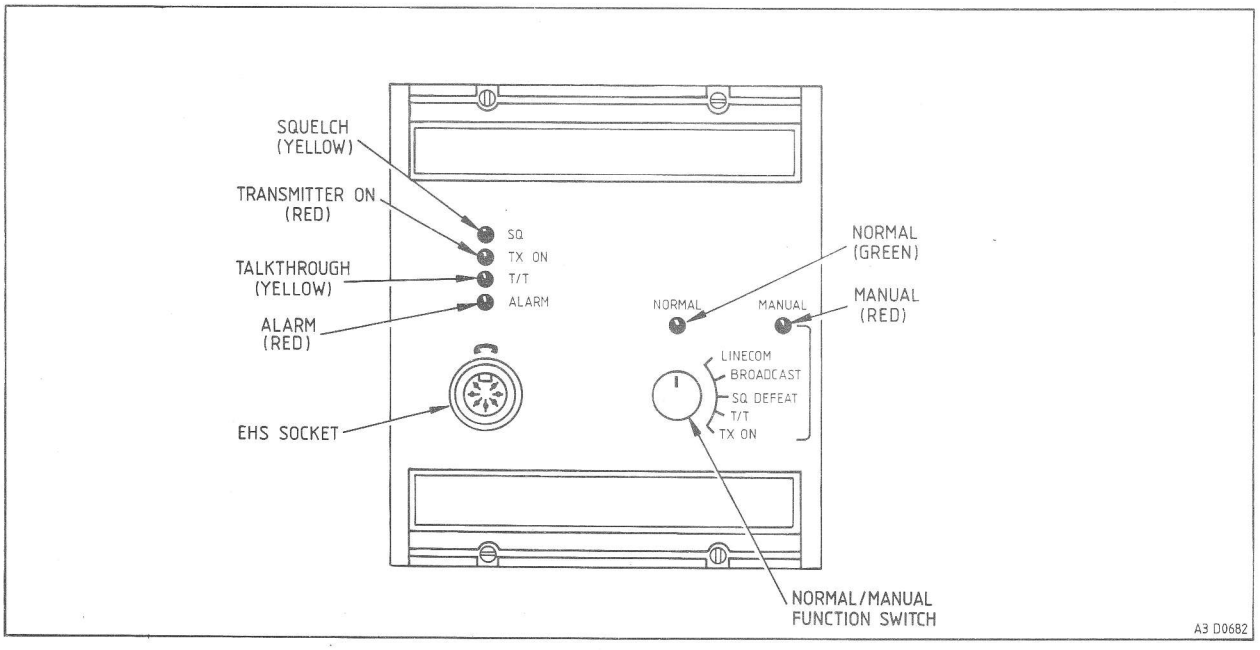

Fig. 3.4 Control Module Front Panel

A six position switch is provided on the front panel of the control module which, in conjunction with an engineers handset (EHS), overrides the local on-site control and provides basic control for alignment, testing and communicating 'over-the-air' or via the 600Ω audio interface. When the EHS is connected (via a 7-pin DIN socket on the front panel) the switch provides the following functions:

POSITION	FUNCTION	OPERATION
1	NORMAL	Normal operating position when EHS not in use. EHS pressel is inoperative. See note (iii).
2	LINECOM	Allows communication between EHS and control equipment connected to 600Ω line. Operate pressel to talk 'down-line'. The 600Ω line input is monitored on the loudspeaker and EHS when enabled by the TX KEY signal from the control equipment.
3	BROADCAST	Allows communication over the air between EHS and mobiles/other end of link. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
4	SQUELCH DEFEAT	Opens squelch to check/align receiver. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
5	TALKTHROUGH	Selects talkthrough mode for setting of talkthrough level. Operate pressel to override talkthrough and talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.

6	TX ON	Keys transmitter to give continuous unmodulated carrier for transmitter alignment. Operate pressel to modulate transmitter from 600Ω line input and adjust line sensitivity and CTCSS level. EHS microphone is not enabled.

Note: (i) With the handset connected and the switch in positions 2 to 6 the control module is in 'MANUAL' mode and control from any other source is inhibited. The receiver 600Ω output is also inhibited so as to effectively isolate the base station from the control equipment during engineering functions (i.e. servicing/ alignment).

(ii) When the handset is disconnected, the module defaults to 'NORMAL' mode irrespective of the switch position.

(iii) An engineer may use the EHS to communicate 'over-the-air' overriding any outgoing traffic, by connecting the EHS ENABLE pin on the control logic PCB to -ve. Control equipment inputs are not inhibited.

Also provided on the control module front panel are seven LED indicators:

FUNCTION (Colour)	OPERATION
TX ON (Red)	Indicates that RF power is being generated by the PA module. See note.
T/T (Yellow)	Talkthrough mode has been selected.
ALARM (Red)	Flashes to indicate that an alarm condition exists. (See ALARMS section).
NORMAL (Green)	The module is in NORMAL mode.
MANUAL (Red)	Flashes to show that the module is in MANUAL mode.

Note: A link on the backplane enables modification of the TX ON indicator to show TX KEY. This is normally only fitted on low power option equipment (i.e.: when a PA is not fitted, otherwise fault monitoring on the RF PA output is lost).

Alarms

A system of alarms is provided for station monitoring and to assist in fault diagnosis. Various parameters are monitored within the receiver, transmitter driver and PA module with alarm information being fed to the control module. This information is displayed on a row of LEDs inside the control module. The alarm lines are combined to generate a single alarm line to drive the front panel ALARM indicator and also a STATION FAIL output at the facilities socket. Linking is provided to enable additional TX and RX alarm outputs to be accessed, if required.

Local Diagnostics

The front panel alarm indicator will flash when any of the following alarm signals are generated:

	TX forward power alarm
*	TX supply alarm
	TX driver alarm
*	PA supply alarm
	PA temperature alarm
	VSWR alarm
	TX alarm latch
*	RX supply alarm
	RX alarm
	External alarm

With the exception of those marked thus * the above alarms are indicated on the row of LEDs within the control module. The source of the alarm condition can therefore be traced by withdrawing the control module and observing which, if any, of the seven internal LEDs are lit. If none are lit then the alarm must be a supply fail on one of the other modules. This can be confirmed by bridging the supply alarm disable link for that module (LK30 on the control module).

Note: (i) A disconnected module will cause a supply fail alarm to be generated, providing this alarm has been enabled by selection of LK30.

(ii) At switch on, the ALARM indicator will flash for approximately three minutes while the crystal ovens warm up.

Facility Socket Alarm Outputs

The following alarm outputs are available on the facility socket:

(i) STATION ALARM - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch
RX supply alarm
RX alarm
External alarm

(ii) DC STANDBY ALARM - Indicates that the DC supply input is being used to power the base station.

(iii) MANUAL ALARM - Indicates that manual mode has been selected.

Additionally, the following subsets of STATION ALARM can be brought out by linking within the control module:

(iv) TX ALARM OUTPUT - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch

(v) RX ALARM OUTPUT - a summation of:

RX supply alarm
RX alarm

Alarm Descriptions

PA Supply Alarm — Indicates that the PA regulator voltage is low or that the module has been disconnected.

PA Output Alarm — Indicates that the power control loop in the PA can no longer maintain the correct RF output power. Also indicates the presence of an RF output when the transmitter is not keyed.

Note: For the two stages of temperature shutdown in the PA, complete shutdown will generate a PA O/P alarm, whereas partial shutdown (3dB) will not.

TX Supply Alarm — Indicates that the Tx driver regulator voltage is low or that the module has been disconnected.

TX Driver Alarm — Indicates an alarm generated by TX driver, caused by:

cold oven
RF fail
Synthesizer out of lock
loss of external hi-stab drive (when used).

PA Temperature Alarm — Indicates high temperature in the PA module resulting in either 3dB or total shutdown. (PA O/P ALARM will show which).

VSWR Alarm — Indicates that the VSWR at the PA output exceeds approximately 3:1 and proportional shutdown is operative.

TX Alarm Latch — When enabled, indicates that one of the following alarms is, or has been, active;

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm

Can be reset by temporarily disabling. Used only in simple main/standby configurations.

RX Supply Alarm	Indicates that the Rx regulator voltage is low or that the module has been disconnected.
RX Alarm	Indicates alarm (other than supply alarm) generated by RX module, caused by: injection fail synthesizer out of lock
External Alarm	Indicates alarm signal present on external alarm input.
DC Standby Alarm	Indicates that the DC supply input is being used to power the base station.
Manual Alarm	Indicates that MANUAL mode has been selected from the front panel and therefore the local control inputs have been disabled.

Power Supply Unit

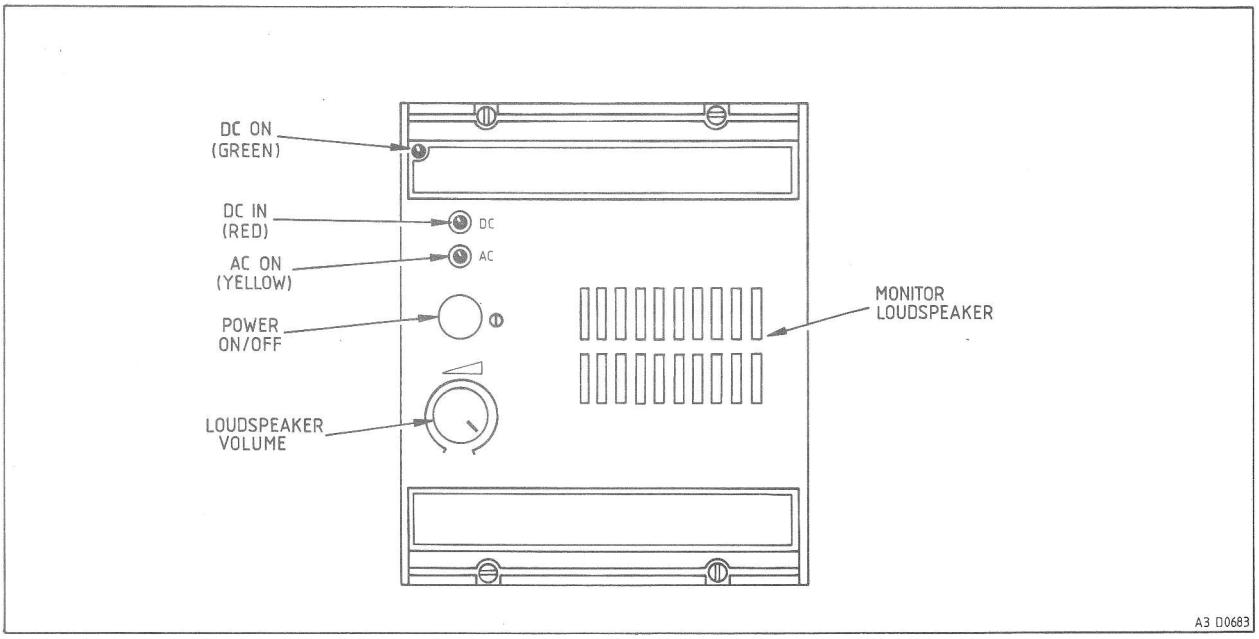

Fig. 3.5 Power Supply Unit Front Panel

The power supply unit houses the power on/off switch and three LEDs which indicate the availability of power supplies. The monitor loudspeaker (optional) and associated volume control are also located within this module.

FUNCTION (Colour)	OPERATION
AC ON (Yellow)	AC supply is present on the module
DC IN (Red)	DC supply is present on the module
DC OUT (Green)	An unregulated 24V DC output is available from the module

TEST EQUIPMENT

Note: The module descriptions given in Part II of this service manual refer only to Item No. and Description of test equipment, therefore, cross reference must be made to this list for full details of suitable types.

The following is a list of test equipment suitable for the maintenance of the FX5000 series of equipments. Equivalent types may be used where those listed are not available, provided that corrections are made for any differences in characteristics.

Table 3.1 - List of Suitable Types of Test Equipment

Item	Description	Outline Parameters	Suitable Type
1	DC power supply	0-40V, 1A	
2	AF generator (with output millivoltmeter)		Marconi TF1101
3	Variable DC load	6A at 26V; 1,5A at 18V	Zenith TS (open)
4	Digital Voltmeter	-	Philips 2517X
5	Oscilloscope	General purpose	Hameg 203.5
6	Multimeter	-	AVO 8X
7	Metrohm		Edgecombe Peebles
8	AF power meter	2W at 8Ω	Marconi TF893B
9	Distortion meter		Lyons Instruments D10
10	RF signal generator	0-520MHz	H-P 8640B
11	Marker oscillator	21,4MHz	Part No. SH10042
12	Frequency counter	10Hz-520MHz	Racal 9916
13	Modulation meter	0-520MHz	Marconi TF2300B
14	AC voltmeter		H-P 400FL
15	Thruline wattmeter	100-520MHz	Bird 4314
16	Spectrum analyser	0-520MHz	Advantest TR4131
17*	Return loss bridge	0-520MHz	Wiltron 60NF50
18	50Ω load(includes sniffer)	3W	Stabilock 4040
19	SINAD Meter		H-P 333A
20	'D' type 'Break-out' connector	9,15, 25 & 37 way	Part No SH10087

21*	Input test lead	-	(local manufacture)
22	Dummy Load	50Ω, 5-150W	Bird Termaline 6154

* required only for optional antenna filter alignment.

H-P Hewlett Packard