SECTION 2
GENERAL INFORMATION

INTRODUCTION

The FX5000 series of frequency modulated base station equipments is designed to meet a wide range of requirements for high quality, versatility and adaptability in the VHF and UHF frequency bands.

A modular approach to the construction of the FX5000 series has been adopted with sub-units sliding into proprietary shelf fittings. Interconnection between units is via flexible ribbons interfaced on a backplane PCB. Flexible coaxial cables allow external receiver and transmitter connections to be made to the fixed shelf bulkhead, and enable all but the power supply module to be withdrawn from the front of the shelf whilst the base station is operational.

Five modules are fitted into FX5000 series shelf:

- Power supply
- Receiver
- Control
- Transmitter driver
- Transmitter power amplifier

The use of individual modules provides for rapid on site repair by module replacement and enables faulty units to be repaired and aligned in a workshop environment.

All 'site' level adjustments are carried out on the control module; all other units are pre-aligned. Faulty units can, therefore, be replaced with the minimum of user disruption.

SUMMARY OF DATA

General

Bands	A9 146-174MHz BO 132-156MHz EO 66-88MHz TI 405-440MHz UO 440-470MHz WM 470-520MHz	
Temperature Range	-30 to +60°C	
Operational Temperature Range	-30 to +70°C (Performance to specification not guaranteed)	
Storage Temperature Range	-40 to +80°C	
Power Supply (AC)	115V or 220-240V ±10% 47-60Hz (Fitted with 24V DC standby)	
Power Supply (DC)	24V -10% +20% +ve or -ve chassis	
Channel Spacing	12,5kHz 20kHz 25kHz	
No. of Channels	Up to 128	
Frequency Stability	±2ppm	
Connectors	Engineers Handset	7 way DIN
	600Ω lines	5 way DIN
	AC Supply input	3 way IEC
	DC Supply input	3 way AMP
	RX RF input	N type
	TX RF output	N type
	Facilities	37 way D
	Metering	15 way D
Indicators	Power supply module:	DC supply on AC supply DC supply
	Control module:	Squelch Tx on Talkthrough Alarm Normal Manual

Note: Reference should be made to Part II of this manual for individual detailed module specifications.

CRYSTAL INFORMATION

The transmitter uses a 10MHz fundamental series mode crystal to specification YE00922.

The receiver uses an 8,4MHz fundamental paralled mode crystal to specification YE00923.

Both crystals are 80°C oven crystals giving a stability of ±2ppm over the range -30°C to +60°C.

MECHANICAL CONSTRUCTION

The mechanical design of the equipment is based on the use of a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All interconnections are made via the backplane so sufficient space should be allowed on installation for the withdrawal of equipment.

The base station comprises five sub-modules - power supply, receiver, control, transmitter driver and transmitter power amplifier. Each module is supported on a runner and is withdrawn from the front of the shelf.

Interconnection between modules is via flexible ribbon cables connected to the backplane. Flexible coaxial cables allow external connections to the receiver and transmitter to be made on the fixed shelf bulkhead. With the exception of the power supply module, checks and adjustments may be made on withdrawn modules whilst the equipment remains operational.

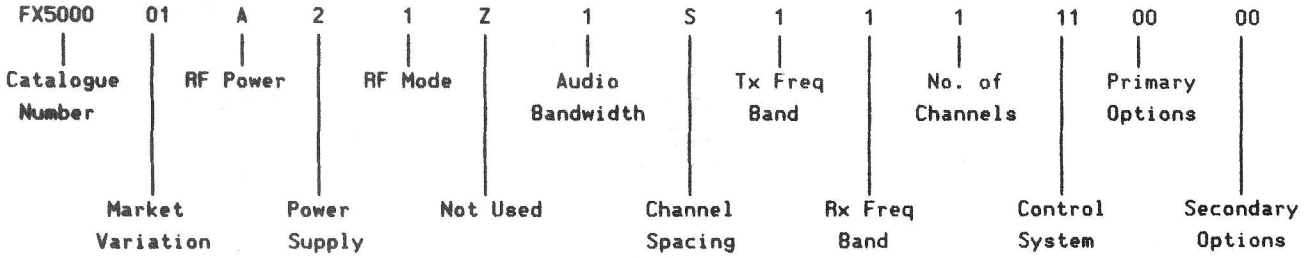
ANCILLARY EQUIPMENT

The following ancillary equipment is available for use with the FX5000 base station. These items are not listed as standard options, are not supplied with the standard equipment and do not form part of the equipment code structure.

Handset	Part No. FH00653
Metering Panel	Refer to page 2.12 for Part No.

EQUIPMENT CODING

The 17-digit code structure comprises a number of options and allows any version of this equipment to be specified. This code is shown on the equipment label, attached to the rear of the unit. A typical code number and its breakdown are given below.



Market Code

01	Standard production
T1	Trunking Applications only

RF Power

A	50 Watts	E0, A9 and B0 Bands only
1	30 Watts	E0, A9 and B0 Bands only
2	25 Watts	
3	15 Watts	
4	10 Watts	
5	6 Watts	
6	1 Watt	
N	Less Tx Modules, No Tx Driver, No Tx PA (Std. Var 2 Code N only)	

Power Supply

1	AC mains 220/240V with 24V DC standby +ve or -ve chassis
2	AC mains 110-115V with 24V DC standby +ve or -ve chassis
3	24V DC only +ve or -ve chassis
4	As code 1 less loudspeaker
5	As code 2 less loudspeaker
6	As code 3 less loudspeaker

RF Mode - ancillaries tray

The following options do not include an ancillaries tray:-

1	Single antenna working with changeover relay (simplex operation only)
2	Two antenna working

The following options include an ancillaries tray:-

3	Single antenna working with changeover relay and Tx isolator (bandwidth up to 0,25%) (simplex operation only)
4	Single antenna working with changeover relay and Tx isolator (bandwidth up to 4,5%) (simplex operation only)
5	Two antenna working with Tx isolator (bandwidth up to 0,25%)
6	Two antenna working with Tx isolator (bandwidth up to 4,5%)
7	Single antenna working with Duplexer (bandwidth - see note) includes Tx isolator

CRYSTAL INFORMATION

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MECHANICAL CONSTRUCTION

The mechanical design of the equipment is based on the use of a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All interconnections are made via the backplane so sufficient space should be allowed on installation for the withdrawal of equipment.

The base station comprises five sub-modules - power supply, receiver, control, transmitter driver and transmitter power amplifier. Each module is supported on a runner and is withdrawn from the front of the shelf.

Interconnection between modules is via flexible ribbon cables connected to the backplane. Flexible coaxial cables allow external connections to the receiver and transmitter to be made on the fixed shelf bulkhead. With the exception of the power supply module, checks and adjustments may be made on withdrawn modules whilst the equipment remains operational.

ANCILLARY EQUIPMENT

The following ancillary equipment is available for use with the FX5000 base station. These items are not listed as standard options, are not supplied with the standard equipment and do not form part of the equipment code structure.

Handset	Part No. FH00653
Metering Panel	Refer to page 2.12 for Part No.

8	As 1, with Fan
9	As 2, with Fan
A	As 3, with Fan
B	As 4, with Fan
C	As 5, with Fan
D	As 6, with Fan
E	As 7, with Fan

Note: (i) Bandwidth and Duplexer Tx-Rx frequency spacing must be within the following limits:-

E Band	*bandwidth up to 0,25%, within 5-10MHz spacing*
A,B and K Band	*bandwidth up to 0,25%, within 4,5-9MHz spacing*
T,U and W Band	*bandwidth up to 0,1%, within 4,5-20MHz spacing*

(ii) Fan assisted cooling is only necessary when greater than 4 x F5000(30W) or 2 x F5000(50W) equipments are stacked in one cabinet. The ancillary fan shelf must be centrally located within the FX5000 equipments. Spacing between equipments, in all cases, must be at least 1u and vented. The use of ancillary shelves is permissable if fronted with a 1u vented panel.

Not Used

Audio Bandwidth

1	300-3000Hz

Channel Spacing

S	12,5kHz
R	20kHz
V	25kHz

TX Frequency Band

2	146 to 174MHz	A9 Band
3	132 to 156MHz	BO Band
4	68 to 88MHz	EO Band
5	405 to 440MHz	T1 Band
6	440 to 470MHZ	UO Band
7	470 to 520MHz	WM Band
N	Less Tx modules. No Tx Driver, no Tx PA (with blank front panels)	

RX Frequency Band

2	146 to 174MHz	A9 Band
3	132 to 156MHz	BO Band
4	68 to 88MHz	EO Band
5	405 to 440MHz	T1 Band
6	440 to 470MHz	UO Band
7	470 to 520MHz	WM Band
N	Less Rx Module (with blank front panel)	

Number of Channels

T	Frequency not defined
1	1 RF Channel programmed
2	2 RF Channels programmed
3	3 RF Channels programmed
9	9 RF Channels programmed
X	10 RF Channels programmed
A	11 RF Channels programmed
B	12 RF Channels programmed
C	13 RF Channels programmed
D	14 RF Channels programmed
E	15 RF Channels programmed
F	16 RF Channels programmed
G	Greater than 16 RF Channels programmed (up to 128 channels)

Control System

00	Less control module

Series 10 - Extended Control

11	Standard systems base station or link for control by on-site interconnected equipment (600Ω audio + DC). Maximum distance 100 metres Simplex, duplex or T/T, 4-wire only.

Note: Less local 2970Hz keytone detection and generation.

12	As code 11 plus local 2970Hz keytone detection and generation plus 2-wire line controlled limited facility (Tx/Rx only).
13	As code 11 plus local 2970Hz keytone detection and generation plus 4-wire line controlled limited facility. (Tx/Rx only).

Series 20 Remote Control M80 Signalling 2-Wire

21	Transmit/Receive + Channel change control, 2-wire
22	Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 2-wire
23	Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 2-wire
24	Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 2-wire

Series 30 Remote Control M80 Signalling 4-Wire

31	Transmit/Receive + Channel change control, 4-wire
32	Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 4-wire
33	Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 4-wire
34	Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 4-wire

Primary Options (Installation)

00	Less installation items
01	Mounting for stack rack, less connectors
04	Mating connectors
05	01 + 04

Secondary Option 1 (High stability Tx oscillator)

0	Less high stability Tx oscillator.
1	Driver linked for use with 10MHz external oscillator (not provided)
2	With 5MHz high stability oscillator* (See Note)
3	Using external high stability source of arbitary frequency. (Not supplied, external phase-lock board required).

**Note: High stability oscillator module must be ordered under its 12NC code (3513 505 03161)*

Secondary Option 2 (Selective calling)

0	No selective calling
1	Voting Encoder/CTCSS Encoder/Decoder
2	Voting Encoder
3	CTCSS Encoder/Decoder
4	CTCSS Decoder only

Note: Secondary option 2 codes 1+2 not available with 2-wire systems. 2970Hz Rx call should not be used with voting.

OUTLINE TECHNICAL DESCRIPTION

Power Supply Unit

Three versions of this module provide for operation from an AC supply of either 115V or 240V, or from a nominal 24V DC supply. In each, an unregulated 24V DC output is provided for use on the transmitter power amplifier module whilst dual regulators provide two +18V outputs for use on the other modules.

Front panel LEDs indicate the availability of AC and DC inputs; a further LED indicates the presence of the DC outputs to the other modules within the equipment (as controlled by the On/Off switch). If both AC and DC supplies are present, the relay circuit will select the AC supply. Otherwise it will select the DC supply. However, in the event of an AC over-voltage, the relay circuit will select the DC supply. This module also houses the AF monitor amplifier and optional loudspeaker. Provision is made for connection of an external loudspeaker.

Receiver (All frequency bands, refer to the Receiver Block Diagram in Part II)

The received signal from the antenna is routed through the varicap-diode tuned input filters to the mixer. Inter-stage RF amplification is provided on UHF bands only. This signal is then mixed with the injection signal to an IF of 21,4MHz.

The reference frequency is provided by an 8,4MHz oven controlled crystal oscillator, which is fed directly into the frequency synthesizer.

A Voltage controlled oscillator operating at the final injection frequency is buffered and split to drive both the injection mixer and the prescaler, whose output is fed to the frequency synthesizer. Incoming channel selection information in 7-line parallel format is applied to the PROM which contains the customer frequency information. This PROM transfers the frequency information to the synthesizer, controlling the divide ratios as required for the channel frequency selected.

The synthesizer outputs an error voltage which controls the frequency of the VCO. The RF tuned filters are 'slaved' to this same voltage.

The 21,4MHz IF output from the mixer is filtered (FL1), mixed down the second IF frequency of 455MHz, filtered again (FL2) and applied to the discriminator (by which time it has been amplitude limited).

Audio from the discriminator is routed as follows:-

(i) Via a variable gain amplifier to the Rx AF processing circuit on the control module audio board.

(ii) Via the noise amplifier and filter to provide an input to the noise operated squelch gate on the logic board of the control module.

A carrier level DC output from the discriminator is applied to the metering amplifier, producing a DC output which controls the carrier level squelch gate on the logic board on the control module. Offset and slope controls are provided to adjust the RF signal level/DC output level characteristic to that required. This voltage is also used for external carrier level metering and assort voting tone selection.

Control Module

The local control module comprises an audio board, logic board and front panel assembly. The module houses all the AF processing and switching circuits for both the receiver and transmitter, the squelch control circuits, the logic for the switching circuits and status indicators. The audio inputs may be carried on either 2-wire or 4-wire lines.

Audio routeing for the receiver and transmitter is achieved using a series of gates which are controlled by outputs from the logic board.

Unprocessed audio from the receiver module is filtered, de-emphasised and passed to the squelch gate. This gate is controlled by the carrier and noise squelch circuits on the logic board which are derived from either the filtered noise output or carrier level monitor output on the receiver module. Audio from the squelch gate is applied to the line driver amplifiers and then fed via the line transformers to the 600Ω line. It is also fed to the engineer's handset and monitor amplifier.

Tx audio is derived from either the 600Ω line or the engineer's handset. The latter is applied directly to the pre-emphasis amplifier. The line audio is amplified and then fed, via the sensitivity control, to a high-pass filter and on to the line audio gate. The gated audio is pre-emphasised and passed to the limiting circuit. The output from the limiter is used to control a compressor which in turn adjusts the gain of the pre-emphasis amplifier. Further amplification, controlled by the deviation pot, is followed by a summing network which combines the audio with the CTCSS input.

A low pass filter removes the unwanted harmonics. The output is matched, via a buffer amplifier, to the transmitter driver.

The control module front panel houses the status indicators and provides for the connection of an engineer's handset (EHS). Used in conjunction with the manual/normal switch, the EHS is able to control the operation of the equipment and provide a number of engineering functions.

All front panel indicators are controlled from the logic board, whilst audio routeing for the EHS is carried out on the audio board.

The equipment functions, determined by pre-set links, and all 'site' level adjustments are made at the control module thus restricting any 'on site' adjustments to one module. This allows servicing and maintenance to be performed without disruption to the user.

Transmitter Driver (All frequency bands, refer to the Transmitter Driver Block Diagram in Part II)

The transmitter driver converts the audio signal processed by the control module into a phase modulated signal providing a 2W (UHF) or 1W (VHF) signal for connection either to the power amplifier or directly to the antenna for low power applications. Incoming audio is fed, via the deviation control, to the audio amplifier and modulation monitor circuit.

The transmitter frequency stability is derived from a 10MHz ovened crystal oscillator. Provision is made for phase-locking this oscillator to a high stability 5 or 10MHz externally-supplied frequency source, via an SMC connector. Alternatively, a sample of the 10MHz internal oscillator may be fed to this connector to drive an externally-located phase-lock circuit. The frequency control voltage from this circuit is fed back via the same socket to control the oscillator. In this way the driver stablity may be locked to an external source of arbitrary frequency. The selection of frequency stability option is made by way of on-board solder links.

The transmitter driver uses two voltage controlled oscillators which are phase-locked together at a constant offset frequency of 20MHz.

The first VCO, the 'offset' VCO is locked onto a frequency 20MHz away from the final required frequency, by the synthesizer. Incoming channel selection in 7-wire parallel format is fed to the PROM containing the customer frequencies. This PROM controls the divide ratios within the synthesizer. The synthesizer receives divided-down signals from both the crystal oscillator and the offset VCO, and generates an error signal which controls the offset VCO frequency, locking it to a frequency 20MHz away from the customer required frequency.

The second VCO, the 'modulation' VCO operates at the final RF frequency. It is locked to the offset VCO in the following manner;

Buffered samples from each oscillator are fed to the RF and LO ports of a balanced mixer. The IF port of this mixer contains the sum and difference frequencies of the two VCO's. This signal is applied to a 20MHz low-pass filter to remove the sum component. The filtered signal (20 MHz when in the locked condition) is then divided down to 625kHz, and fed to one input of a phase comparator. The other input is derived by dividing the 10MHz crystal reference to 625kHz *(see below). The filtered error signal from this comparator is then used to control the frequency of the modulation oscillator.

Modulation is applied to the modulation oscillator by pulse-width modulation of the divided-down 625kHz reference signal * (see above).

The modulated, final frequency output from the modulation oscillator is then amplified to give an output power of 2 watts for UHF frequency bands, or 1 watt at VHF frequencies.

Transmitter keying can be achieved either by keying on the amplifier stages of the driver, or by keying on the modulation VCO together with the amplifier stages. This latter case is normally preferred for single-frequency simplex working, when a continuously-running oscillator would interfere with the common-frequency receiver. Key-on time is extended due to the requirement for the modulation oscillator to achieve lock.

The output power from the wideband RF amplifier stages is monitored by a power detector. Output from this detector is used to adjust the gain of the stages, to maintain the output power preset by means of a potentiometer. An inability to maintain the required output produces an on-board LED power alarm. This alarm is combined with lock-alarms from the two phase-locked loops (and also from the crystal reference phase-locked loop when an external high-stability source is used) and the oven temperature alarm signal to produce a transmitter driver alarm signal. This signal is fed via the 15-way connector to the monitoring circuit within the control module.

Internal circuitry monitors the presence of the on-board regulated +12V and +5V supplied, lighting an LED when these are present. Supply failure from those detectors is also fed to the supply connector, for monitoring within the control module.

Transmitter Power Amplifier

The 50W power amplifier delivers a minimum of 50W into a 50Ω load; on 30 Watt versions the transmitter power amplifier output is greater than 30W into a 50Ω load and may be continuously adjusted down to 6W using the POWER SET control. In the case of the 30W module, the 24V unregulated DC supply applied to the module is used by the switching regulator to provide the voltage rail for the power amplifier circuit. This arrangement enables the RF output level to be controlled by adjusting the supply rail via the POWER SET feedback loop on the PA control board. An external control line enables the power to be remotely adjusted.

50 Watt modules are slightly different, in that the output stage is fed directly from the 24V unregulated supply, with power control being achieved via the driver transistor only.

A two-tier thermal protection circuit enables the module to register an initial over-temperature condition but continue operating at half power, or shutdown completely if the temperature increase is continued.

CHANNEL FREQUENCY INFORMATION

The channel frequency information for the receiver and transmitter driver units is held within a 512kb PROM (Programmable Read-Only Memory) located in the respective radio unit. These PROMs are normally identical for the transmitter and receiver within a basestation, and may be exchanged to assist fault-finding if they are labelled identically. A known good PROM may be copied using a suitable PROM programmer. The blank PROM to be used for this should be Part No. 3513 993 28002. A label, marked exactly as the original should be fixed onto the new PROM before use, a suitable label is Part No. 3513 903 71491.

PROM programming software is available as Part No. 3513 506 10360, which includes the instructions for operating the software.

Test frequencies are 'blown' into all PROMs to facilitate unit alignment, these are stored in a memory area of the PROM which is separate from that containing the customer frequencies. Details of how to access these frequencies are contained within the alignment procedure for the individual unit.

Note: Care must be taken to ensure that only the customer frequencies are accessed when the unit alignment is complete.

Each transmitter and receiver is capable of being switched to any one of up to 127 radio frequency channels. The two radio units are addressed simultaneously by 7 lines (C0-C6) entering the units via the 15-way 'D' connector.

These 7 lines (address lines) select the area of memory within the PROM from which the frequency is to be read. Since the transmitter and receiver units have independently-programmed PROMS, neither is 'slaved' to the other, despite the fact that both use the same address lines.

To access 128 channels, each of the address lines can be switched to a logic '1' (+5V) state or a logic '0' (0V) state. The designated 'channel number' corresponds to the decimal value of the binary coded number formed by lines C6 to C0 taking the values 0 or 2. Hence:-

Address line:	C6	C5	C4	C3	C2	C1	C0	Channel No
Logic state:	0	0	0	0	0	0	1	1
Similarly	0	0	0	0	0	1	0	2
	0	0	0	0	0	1	1	3
	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:
	1	1	1	1	1	1	1	127

Where C0 = 2^0, C1 = 2^1, C2 = 2^2 etc.

Channel 0 (consisting of logic 0 on all lines) is not used.

The radio frequency held in each used memory location within each Prom is determined at the time the PROM is programmed or 'blown'. This information normally forms part of the customer's order information. Should it be required to change this information, the PROM should be removed and replaced with a PROM containing the new required frequency information.

The only constraints on the usable frequencies are that they should all be on integral multiples of 5kHz or 6,25kHz and that they should all be within the 'switched bandwidth' of the equipment; for the FX5000 series of base stations this is 4,5% i.e.:-

$$\frac{2(fmax - fmin)}{(fmax + fmin)} \times 100 = 4,5$$

Channel Selection.

(a) Single Channel only operation.

If it is required to operate the equipment on one fixed channel only, this can be achieved as follows:-

(i) Transmitter Driver unit.

The seven plug-in links (Part No. FC99060) within the module (LK301 to LK307) in positions B-C connect the PROM address lines to the 'D' connector to enable control external to the unit. However, they may be used in position A-B to selectively pull down to 0V any of the lines C0 to C6. Since each line is pulled up to +5V, omitting a link puts a logic 1 on the associated line, whereas fitting a link pulls it down to 0V. By fitting only those links required to access the channel number containing the wanted frequency information and discarding the other links, the channel control is isolated from the C0-C6 control lines on the 'D' connector

(ii) Receiver Unit.

Removal of the ribbon cable between plugs PLD and PLC on the receiver board isolates the PROM address lines from the input connector. These lines, which are all pulled up to +5V by RN1, may then selectively be pulled down by fitting links (Part No. FC99060) as required between the pins of PLC. Channel lines are identified by the legend printed on the PCB.

(b) Multi-channel operation.

(i) Local control

The address lines are accessible on the channel switch plug PLX on the rear panel of the equipment. Control lines C0 to C6 are accessible on pins 1 to 7 respectively on modification state 0 equipment, and 0V is available on pin 12 for pull-down. C0 to C6 appear on pins 3,5,7,9,11,13 and 15 and the 0V appears on pins 19 and 20. Local channel control of the 127 channels can be obtained by extending these lines to 7 binary switches.

If control of only 7 channels is required a 7-way single pole switch may be used for channel selection. Since this enables only one line to be pulled down at any time, only the following channel numbers are accessible in this way:-

Ch No.	C6	C5	C4	C3	C2	C1	C0
63	0	1	1	1	1	1	1
95	1	0	1	1	1	1	1
111	1	1	0	1	1	1	1
119	1	1	1	0	1	1	1
123	1	1	1	1	0	1	1
125	1	1	1	1	1	0	1
126	1	1	1	1	1	1	0

This latter method of channel control is available using the FX5000 metering panel, (Part No. 9525 700 62005 for modification state 0 equipments; 9525 700 62006 for modification state 1 equipments). Although only the lower 6 of the above channels can be controlled from the 6-way front panel switch. For further information, refer to the metering panel information in the ancillaries section.

Alternatively, on modification state 0 equipment only, the channel control lines can be transferred from the channel switch connector to the facilities connector on the rear panel by fitting a linking socket (Part No. 3513 505 02951) into the channel switch plug PLX. Reference should be made to the backplane interconnection diagram to determine the facilities connector pin numbers.

For modification state 1 equipment, channel selection from the rear panel of the equipment is possible by using shorting links (Part No. FC99060) between row A (negative) and row B (C0-C6) selectively as required.

(ii) Extended Control.

Extended control over 600Ω lines of up to 6 channels is possible (the lower 6 channel numbers in the above table) if the remote control option (AT14920) is fitted to the control module.

For modification state 0 equipment, this requires the fitting a linking socket (Part No. 3513 505 02961) to transfer the control lines to the remote control module. For modification state 1 equipment, control is transferred by fitting seven shorting link connectors (Part No. FC99060) between the channel lines (Row B, pins 3,5 7,9,11,13 and 15) and the control module inputs (Row C, pins 4,6,8,10,12,14 and 16)

CAUTION

A shorting link should <u>not</u> be fitted between Row B pin 1 and Row C pin 2, since this will connect the negative supply to the chassis.

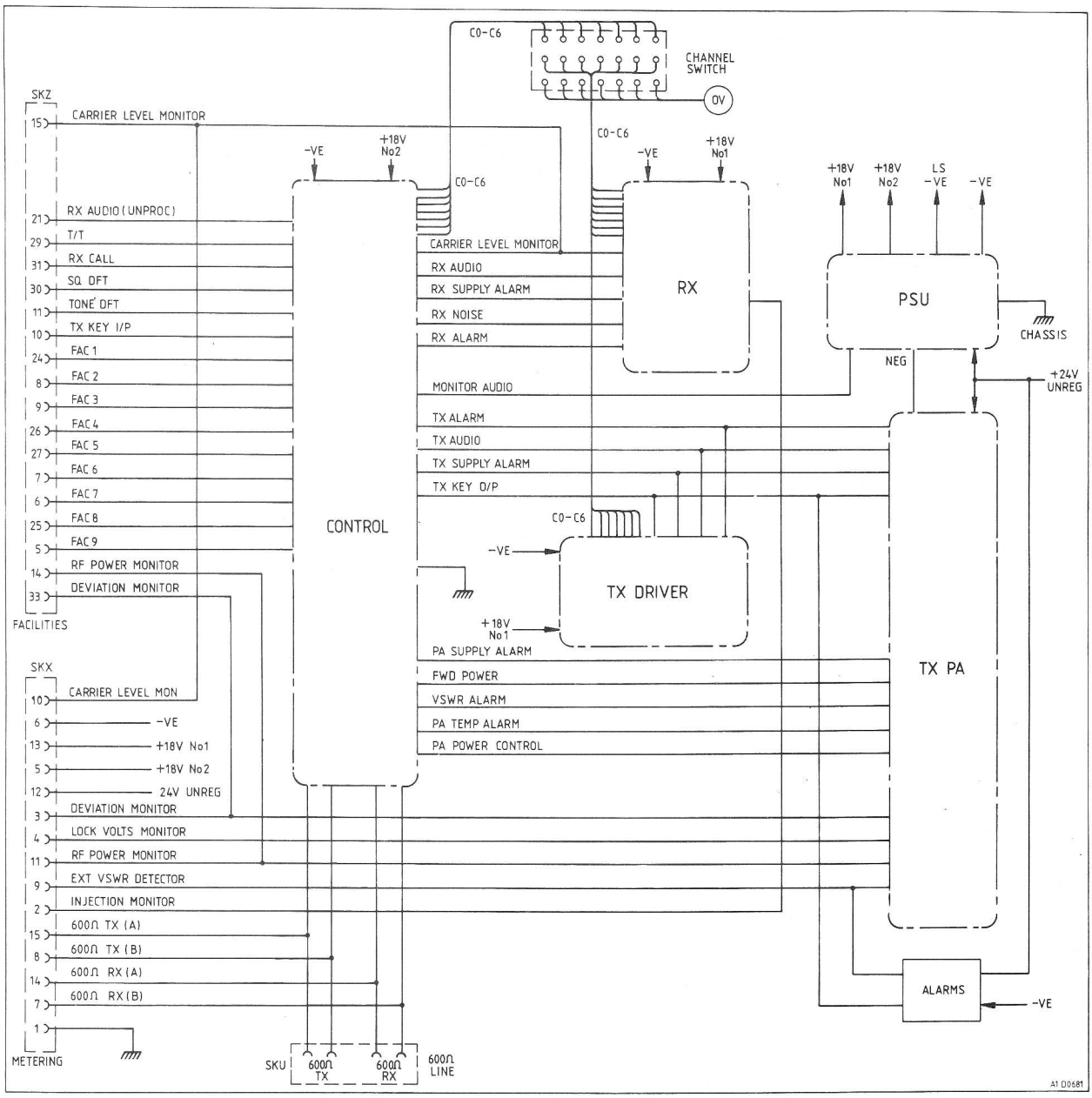

Fig.2.1 Outline Block Diagram - Local Control

LINKING INFORMATION

Links are provided on the backplane PCB assembly, the TX driver and control modules to enable the control functions and characteristics of the equipment to be altered. These are factory set according to the options specified when the equipment is ordered. Further customisation in the field may be carried out.

Backplane Links

LK1 INTERNAL LS

Internal loudspeaker operation.

A-B Internal loudspeaker enabled
B-C Internal loudspeaker disabled

LK2 PA SUPPLY ALARM

Operation of PA supply alarm.

A-B Alarm enabled
B-C Alarm disabled (for when the PA module is not fitted)

LK3 TX ON INDICATION

Connects TX ON indication (and TX power alarm circuit) to either FORWARD POWER (PA fitted) or TX KEY (PA not fitted).

A-B TX KEY (PA not fitted)
B-C FORWARD POWER (PA fitted)

PLV-T-W 600Ω LINKING

Provides 600Ω interface connection at either the Krone block (for direct connection to line) or at the 37-way facilities connector (for connection to local equipment).

PLV-PLT 600Ω in/out on Krone block
PLV-PLW 600Ω in/out on FACILITY socket (local control)

TX Driver Module Links

Two types of links are used within the Tx driver module; customising links and test/alignment links. Details of the latter type are to be found in the Tx alignment procedure in section 2 of this handbook.

CUSTOMISING LINKS

LK101,102,103,104,LK501: Frequency source selection.

The following three options of frequency source are available, dependent upon the required frequency stability:-

Option 1. Transmitter frequency locked to internal ovened crystal oscillator, giving ±2ppm over the temperature range -30°C to 60°C.

Option 2. Transmitter frequency locked to externally-supplied 10MHz frequency source (option 2A) or externally-supplied 5MHz frequency source (option 2B)

Note: Secondary option 1 Code 1 provides a transmitter driver linked to accept an external 10MHz source, but no such source is supplied with the equipment. Code 2 provides a high stability 5MHz source mounted on the rear of the equipment.

Option 3. An external source of arbitrary frequency may be used to lock the internal oscillator. This requires provision of external phase-lock circuitry, independent of the FX5000 Equipment.

The linking arrangements for these three options are shown below:

	LK101	LK102	LK103	LK104	LK501
Option 1	A-B	*	*	*	Open
Option 2A	B-C	A-C	A-B	A-B	Closed
Option 2B	B-C	A-C	A-B	A-C	Closed
Option 3	B-C	A-B	B-C	*	Open

*Note:- * Indicates 'Don't care'*

Unless Secondary option code 1-3 is requested, standard ex-factory linking is:- LK101 A-B; LK102 A-C; LK103 A-B; LK104 A-B; LK501 open.

LK502; Deviation Monitor.

Externally-available metering of deviation, or generation of a logic alarm output when the deviation drops below a preset level is available: link LK502 A-B for analogue monitoring, or LK502 A-C for logic alarm output.

LK403 Tx Key Mode

For use in single-frequency simplex systems, the key off command can be used to switch off the modulator oscillator, thereby preventing interference to the common-frequency receiver. Key-on time is, however, extended. LK403 not connected selects single-frequency simplex mode. For duplex systems the key-off command can be used to switch off the RF amplifier stages whilst leaving the oscillator running, thereby reducing the key-on time. For this option, connect link LK403.

Control Module Links

LK1 REM/LOC FAC SELECTION

Local Control versions do not require any links to be fitted.

Basic M80 remote system only requires two links to be fitted (Squelch Defeat + Talkthrough).

All 15 links factory fitted in remote position.

For each option:

A-B Remote
B-C Local

LK2 DISABLE REMOTE

Used only when an RCM is fitted. Temporarily restores local control for all functions, mainly used as a test facility. Control defaults to local if RCM is not fitted.

A-B	Remote enabled (standard)
B-C	Remote disabled

LK3 UNDEDICATED FAC LINKING

The facility connections on PLB can be reconfigured, if necessary, to provide alternative functions which are available on pins distributed around (mainly) the logic PCB. The primary functions are linked to these pins by 9 links which would normally all be fitted. Any number of these links may be removed in order to link in the alternative functions required using a Berg-Berg wire link.

LK3 pin 1A to pin 9A FAC1 to FAC9 on facility connector

Primary functions - Normally linked directly to LK3 pins 1A to 9A:

LK3 pin 1B Manual Alarm

Open collector output. Pulls low to indicate MANUAL mode selected from the front panel (ie: external control disabled).

LK3 pin 2B Disable TX

Control input. Prevents the transmitter from being keyed (including remote keying using 2970Hz tone) except for talkthrough operation and keying from the front panel as an engineering function.

LK3 pin 3B Station Alarm

Open collector output. Combined TX/RX alarm. Normally pulled down, releases to indicate an alarm condition in the transmitter driver module, PA module, receiver module or equipment connected to Ext. Alarm input.

LK3 pin 4B Disable ASSORT

Control input. Disable ASSORT encoder.

LK3 pin 5B Disable CTCSS Tone

Control input. Prevents CTCSS tone encoder (internal or external) from modulating transmitter.

LK3 pin 6B Disable Talkthrough

Control input. Prevents talkthrough from being selected (including CTCSS controlled talkthrough) except from the front panel as an engineering function.

LK3 pin 7B — Ext. Alarm Input

Control input. To signal alarm from ancillary equipment. Generates station alarm output.

LK3 pin 8B — Disable RX

Control input. Disables receiver audio and logic outputs. (Unprocessed RX audio and carrier level monitor remain active).

LK3 pin 9B — Tone Controlled Facility

Open collector output. Pulls low when signal with valid CTCSS tone is received.

Alternative functions - available on individual pins which may be linked to LK3 pins 1A to 9A using a wire link:

Note: With the exception of pins P16, P25 and P26, these pins are located on the control logic PCB.

P1 — -ve

P2 — On Line Data Enable

Control input. Interrupts RX audio to line and enables On Line Data input for sending to line.

P3 — Carrier Cont. Facility

Open collector output. Pulls low when signal received with or without valid CTCSS tone

P4 — Ext. CTCSS Tone

Audio input for CTCSS tone generated internally.

P5 — Carrier SQ DEF

Control input. Defeats carrier squelch but leaves noise squelch operational.

P6 — Carrier SQ Desens

Control input. Desensitises carrier squelch setting by 6db.

P7 — PA Power Control

Control input. Reduces the transmitter output power by 3dB (not 1W version).

P8 — PA Power Control

Control input. Reduces the transmitter output power by 6dB (not 1W version).

P9	ASSORT override
P10/11	TR1 (base/collector) For buffering logic outputs.
P12/13	TR16 (base/collector) For buffering logic outputs.
P14	EHS Enable Control input. Enables engineers handset to function (in broadcast mode) with switch in NORMAL position (ie: external control not interrupted).
P15	EHS MIC. Enabled Open collector output (when linked via TR1 or TR16 on the logic board). Pulls low to indicate that the engineers handset is in use and the microphone is enabled.
P16	Tone Gen O/P - (on Control Audio PCB) Audio output from 2970Hz tone RX CALL generator.
P17	TX Alarm Latch Control input. Enables internal latch in TX alarm circuit for simple main/standby applications.
P18	TX Alarm Output Open collector output (when linked via TR1 or TR16 on the logic board). Normally pulled down, releases to indicate an alarm condition in the TX driver module or PA module.
P19	RX Alarm Output Open collector output (when linked via TR1 or TR16 on the logic board). Normally pulled down, releases to indicate an alarm condition in the receiver module.
P20	EXT RX Alarm I/P Control input. Can be linked to RX squelch logic to generate RX alarm on carrier fail for link applications.
P21	Not TX Logic output. Can be linked to TX alarm latch to give alarm reset when TX unkeyed for simple main/standby applications.
P22 & P23	Spare (to options PCB)

P24 Carrier SQ

Open collector output (when linked via TR1 or TR16 on the logic board). Independent output from carrier squelch detector only. Pulls low to indicate carrier squelch threshold exceeded.

P25 -ve - (on Control Audio PCB)

P26 Ext CTCSS Tone - on control audio board.

TP10 2970Hz Detector

Open collector output (when linked via TR1 or TR16 on the logic board). Pulls down when a 2970Hz TX KEY tone has been detected.

LK29(pin A) On-line Data

Audio input. Sends data to line via line level control. Gated by On-line data enable.

LK4 TT HANG TIME

Provides an optional 2 second hang time before carrier drops out.

A-B No hangtime
B-C 2 seconds hangtime (standard)

LK5 SQ OPEN TIME

Selects squelch open and closing time option.

Note: The slow open/fast close setting, whilst reducing squelch tail, may reduce intelligibility on weak signals with flutter.

A-B Slow open/fast close
B-C Fast open/slow close (standard)

LK6 DISCONNECT CARRIER SQ

Disconnects the carrier squelch signal from the internal squelch logic. Used for systems where the carrier squelch detector is used to drive external logic only.

A-B Carrier squelch connected (standard)
B-C Carrier squelch disconnected.

LK7 DISCONNECT RX ALARM

Disconnects RX alarm signal from STATION ALARM output and from front panel alarm indication.

A-B RX alarm connected (standard)
B-C RX alarm disconnected

LK8 SIMPLEX

Mutes the receiver during transmissions for single frequency simplex operation. Also inhibits talkthrough.

Linked by factory for duplex except for single antenna working option or when TX frequency = RX frequency.

A-B Simplex operation
B-C Duplex operation

LK9 DISABLE RX ON RX ALARM

Mutes the receiver when an RX alarm is present (eg: while crystal oven is warming up).

A-B RX disabled on RX alarm
B-C RX not disabled on RX alarm (standard).

LK10 CTCSS CONTROL SELECT

Selects function to be controlled by the CTCSS decoder. Factory linked for squelch except on CTCSS controlled talkthrough option.

1A-1B Squelch
2A-2B Talkthrough
3A-3B RCM facility A
4A-4B RCM facility B

Note: *An open collector output is available for CTCSS control of external equipment regardless of link position.*

LK11 RX CALL TYPE

Allows SQ DEFEAT to generate an RX CALL signal to provide downward compatibility with 4000 series equipments.

A-B SQ DEF generates RX CALL
B-C SQ DEF does not generate RX CALL (standard)

LK12 PIPTONE ENABLE

Provides transmitter keying whenever squelch opens to enable the transmission of piptone generated on option PCB.

A-B Piptone enabled
B-C Piptone not enabled (standard)

LK13 RX CALL TONE ENABLE

Provides control of 2970Hz generator either from RX CALL (to give 2970Hz RX CALL tone superimposed on RX audio when squelch opens), or from alternative source. (ie: EHS pressel for use as ASSORT override). Output must also be linked for this alternative.

A-B RX CALL tone enabled
B-C RX CALL tone not enabled (standard)

See also LK31.

LK14 INT/EXT CTCSS TONE

Selects either internal or external CTCSS tone.

A-B Internal CTCSS tone (standard)
B-C External CTCSS tone

LK15 TX PRE-EMPHASIS

Allows TX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B Pre-emphasised TX audio (standard)
B-C Flat TX audio

LK16 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 2 to facilitate alignment of Notch 1.

LK17 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 1 to facilitate alignment of Notch 2.

LK18 TX NOTCH IN/OUT

Selects 2970Hz notch filter in TX audio path.

A-B Notch filter enabled (standard for remote)
B-C Notch filter disabled (standard for local)

LK19 TX CHAN SPACING

Controls transmitter deviation. Factory linked according to channel spacing.

1A-1B 12,5kHz spacing
2A-2B 20kHz spacing
3A-3B 25kHz spacing

LK20 TX 600Ω INPUT ATTENUATION

Provides 20dB gain reduction for high line input levels.

A-B Attenuation out
B-C Attenuation in (standard)

LK21 2-WIRE/4-WIRE OPERATION

Selects 2-wire or 4-wire operation

A-B 4-wire (standard)
B-C 2-wire

LK22 2970HZ DETECTOR NARROW/WIDE

Allows 2970Hz tone detector to detect 2300Hz and 2500Hz FSK tones (as per RCP80).

A-B Narrow (standard)
B-C Wide

LK23 2970HZ DETECTOR ENABLE

Enables 2970Hz TX tone detector. Factory linked to DISABLE for local control options, ENABLE for M80 remote options.

A-B Detector disabled
B-C Detector enabled

LK24 4-WIRE INTERCOM

Provides an intercom path between contollers on a 4-wire M80 system.

1A-1B Intercom path post notch
2A-2B Intercom path pre-notch
3A-3B No intercom path (standard)

LK25 RX AF PATH

RX audio routed either directly or via CTCSS options PCB. Factory linked for 'direct' except when CTCSS option PCB is fitted.

A-B Direct RX audio
B-C RX audio via options PCB

LK26 RX DE-EMPHASIS

Allows RX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B De-emphasised RX audio (standard)
B-C Flat RX audio

LK27 RX NOTCH IN/OUT

Selects 2970Hz notch filter in RX audio.

A-B Notch filter disabled (standard for local)
B-C Notch filter enabled (standard for remote)

LK28 RX 600Ω OUTPUT ATTENUATION

Provides 20dB or 40dB of attenuation of RX 600 Ω output for low output level applications.

1A-1B 40dB attenuation
2A-2B 20dB attenuation
3A-3B Attenuation out (standard)

LK29 INT/EXT LINE DATA

Allows data to line to be fed from external source (special applications only).

A-B Internal line data (standard)
B-C External line data

LK30 SUPPLY ALARM DEFEAT

Prevents continuous alarms from being generated when the equipment is to be operated with one or more modules missing.

Can also be used as a fault finding aid by short circuiting each pair in turn to determine which module is generating a supply alarm.

Factory set with no links fitted.

1A-1B Defeat PA supply alarm
2A-2B Defeat TX driver supply alarm
3A-3B Defeat RX supply alarm

See also backplane link LK2.

LK31 DISABLE RX CALL OSCILLATOR

Disables 2970Hz RX CALL generator master oscillator to avoid unnecessary spurious radiation when not in use.

A-B Oscillator disabled (standard)
B-C Oscillator enabled

See also LK13.

Table 2.1 - Control Module Standard Linking

LK1	Remote/local facility	-	
LK2	Disable remote	A-B	Enabled
LK3	Undedicated Facilities	-	
LK4	T/T hang time	B-C	Long
LK5	SQ open time	B-C	Fast open/slow close
LK6	Disconnect carrier SQ	A-B	Connected
LK7	Disconnect RX alarm	A-B	RX alarm connected
LK8	Simplex	A-B	Simplex
LK9	Disable RX on RX alarm	B-C	Not disabled
LK10	CTCSS control select	1A-1B	Squelch
LK11	RX call type	B-C	Normal
LK12	Piptone enable	B-C	Not enabled
LK13	RX call tone enable	B-C	Not enabled
LK14	Int/ext CTCSS tone	A-B	Internal
LK15	TX pre-emphasis	A-B	Pre-emphasised
LK16	TX notch align	IN	Non alignment mode
LK17	TX notch align	IN	Non alignment mode
LK18	TX notch in/out	B-C	Local control
LK19	TX channel spacing	1A-1B	12,5kHz
LK20	TX 600 Ω I/P attenuator	B-C	In
LK21	2-wire/4-wire operation	A-B	4-wire
LK22	2970Hz detector narrow/wide	A-B	Narrow
LK23	2970Hz detector enable	A-B	Disabled
LK24	4-wire intercom	3A-3B	No intercom
LK25	RX AF path	A-B	Direct
LK26	RX de-emphasis	A-B	De-emphasised
LK27	RX notch in/out	A-B	Local control
LK28	RX 600 Ω O/P attenuator	3A-3B	Attenuation out
LK29	Int/ext line data	A-B	Internal
LK30	Supply alarm defeat	OUT	No defeat
LK31	Disable RX call oscillator	A-B	Disabled

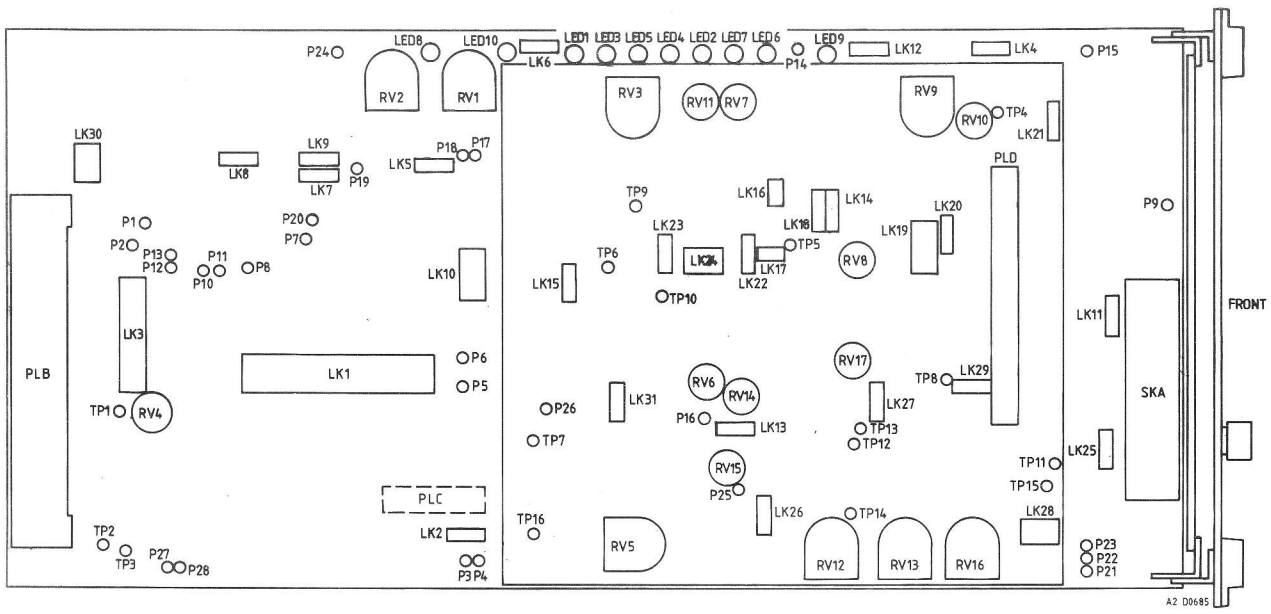

Fig. 2.2 Control Module Links