



Fixed Station Terminal – FST 5000 Series

ASTRO 25 Digital APCO Project 25 Compliant

Installation & Service Handbook

Item 3 of List of Deliverables
Document Number G/05164G
Version 1.1 – May 2012

Design Two Thousand Pty Ltd

9-11 Rose Street
Upper Ferntree Gully
Melbourne, Victoria, 3156
Australia

Australian Business Number: 45 005 014 639

Telephone: +613 9758 5933
Facsimile: +613 9758 5560
Email: gen@design2000.com.au
Web Site: www.design2000.com.au

© 2012 - Design 2000 Pty Ltd

design2000

Est. 1968



DOCUMENT CONTROL

Document Number	G/05164G		
Document Name	FST-5000 Series Installation & Service Handbook		
Security	Commercial In Confidence		
Circulation	Motorola, Design 2000, Licensed Installers		
Prepared By	Peter Zeug		
Reviewed By	Ross Kells, James O’Ryan, Kevin Byrne		
Approved By			
Version Control	Edition	Date	Notes
	Draft 1	22/06/2006	Initial version
	Draft 2	26/06/2006	J.O.’s amendments included
	V 1.0	27/06/2006	K.B.’s notes & corrections made
	V1.1	25/05/2012	New desktop mic



FIXED STATION TERMINAL

FST-5020-2A, FST-5050

SECTION	CONTENTS	PAGE
1	Functional Description	6
1.1	General Features	6
1.1.1	Operating Conditions	7
1.1.2	Microphone Cradles	7
2	Housing Concept	8
2.1	FST-5020	8
2.2	FST-5020-2A	8
2.3	FST-5050	9
3	Electrical & EMC	10
3.1	Protection	10
3.2	Safety	10
3.3	EMC	10
4	Front Panel Electronics	11
	Power ON/OFF	11
	DC Supply Indicator	11
5	Rear Panel Electronics	12
5.1	10dB Attenuated RF Output	12
5.2	RF Output	12
5.3	External 12Vdc	13
5.4	Rx Line Output (balanced)	13
5.5	External Speaker Outputs	14
5.6	E&M Interface	14
5.6.1	E Interface	14
5.6.2	M Interface	14
5.7	Foot Pedal PTT	15
5.8	Desk Microphone	15
5.9	Headset	17
5.10	Remote Head / 936 MPI Power	17
6	Accessories	18
6.1	Controller Microphone	18
6.2	Fixed Antenna	18
6.3	5W Dummy Load	18
6.4	Notes	19
6.4.1	Microphone Bias	19
6.4.2	Audio PA Output	19
6.4.3	Main Power	19
7	Circuit Description	20
7.1	Radio Interface	20
7.1.1	Ground	20
7.1.2	Channel Activity	20
7.1.3	PTT	21
7.1.4	Rx Filtered Audio	21
7.1.5	Monitor	21
7.1.6	Auxiliary Microphone	21
7.1.7	Ignition Sense	21
7.2	12V Charger	21
7.3	External Speaker Outputs	21
7.4	External Microphone	22
7.5	External PTT	23
7.6	Headset	24
7.7	E&M Interface	25



7.8	Remote Head / 936 MPI Power	25
8	Circuit Description for Fault Finding	26
8.1	Radio Interface	26
8.2	Power Supply	27
8.3	12 Volt Charger	27
8.4	Power Supply Test	28
8.5	Radio & Internal Speaker Test	29
8.6	External Speaker Outputs	29
8.7	Power Amplifier Test	30
8.8	Headset	31
8.9	External Microphone	31
8.10	External PTT	32
8.11	E&M Interface	32
8.12	E&M Test	33
8.13	Rx Line Output Test	34
9	Board Level Tests	35
10	Battery Maintenance	37
10.1	Battery Check	37
10.2	Battery Replacement	38
11	Installation	39
11.1	Aesthetics	39
Appendix A	Feature Sets	40
Appendix B	Circuit – Hierarchy schematic	41
Appendix C	Circuit – Audio, E&M schematic	42
Appendix D	Circuit – Amplifier schematic	43
Appendix E	Circuit – Sub-board schematic	44
Appendix F	Circuit – Power Supply schematic	45



Assumptions

This document assumes that qualified installers and maintenance technicians perform the installation and maintenance procedures and are therefore aware of basic wiring and installation 'Industry Best Practices'.

The Occupational Health & Safety of all personnel working on or near this equipment is the responsibility of the installer or technician performing the tests, or operations.

Warning

This equipment may contain lethal voltages, and must be isolated from supply before any cover is removed.

Warranty

The Fixed Station Terminal Units have a Two Year Warranty against defects in Materials and Workmanship.

If problems are experienced with the installation or operation of the Fixed Station Terminal Unit please call the Help Desk Number listed below before returning units to the factory for repair.

In many cases, problems can be diagnosed and rectified over the phone, avoiding unnecessary transportation and service costs.

HELP DESK 03 9758 5933 (All Hours)





Figure 2: FST5020-2A Rear

1.1 GENERAL FEATURES

The Fixed Station Terminal operates from either 230 Vac mains power, or an internal/external 12 Vdc battery. The FST-5020-2A Terminal has the capability to:

- ☐ *Charge the inbuilt 12 Vdc rechargeable battery whilst powered from the mains*
- ☐ *Power four external 5W nom., 4-8 Ohm speakers*
- ☐ *Provide a 600 Ohm balanced Rx audio output*
- ☐ *Provide an E&M interface for an external microphone/speaker (Tx/Rx) arrangement*
- ☐ *Interface an external desk microphone*
- ☐ *Interface an external lightweight headset/microphone*
- ☐ *Interface an external foot pedal PTT.*
- ☐ *Power a remote radio head and speaker.*

These interfaces meet telecommunications network connection safety and level requirements (AS/NZS 60950, ACA TS 006 Clause 5.2.2 (a)). The Fixed Station Terminal Interface (audio break-outs) circuit board is buffered to allow operation of all facilities simultaneously. Preset controls are accessible via recessed, screwdriver adjustable, controls located on the rear panel.

1.1.1 Operating Conditions

The Fixed Station Terminal enclosure and its installed power supply operate under the following physical conditions:

Power source: 85~240 Vac 50 Hz mains (230 Vac 50 Hz nominal).
Nominal output current rating: Continuous 5.0 Amps @ 13.8 V
20 Minutes @ 20% duty cycle 10 Amps @ 13.8 V
Temperature: Ambient temperature range 0°C to 40°C with a relative humidity of 0 to 90% non-condensing while mounted in the enclosure.

1.1.2 Microphone Cradles

The FST-5020-2A & 5050 has microphone cradles on each side to accommodate left & right handed applications.

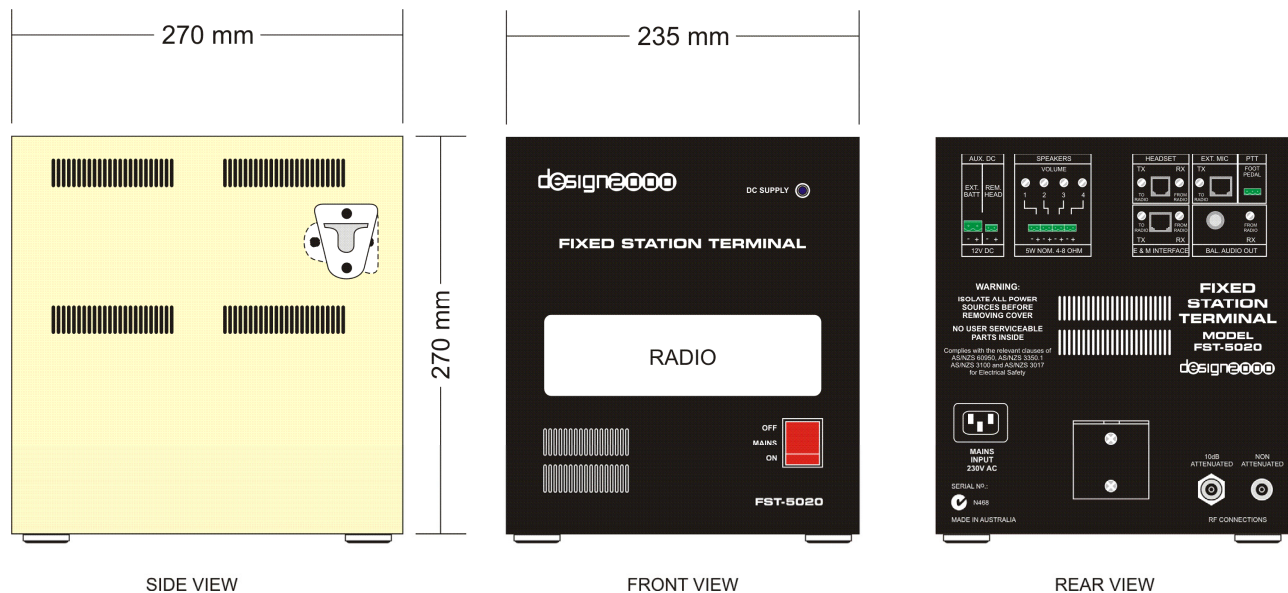


2 HOUSING CONCEPT

There are four variants (at this time) of the enclosure that houses the basic elements. The physical layout consists of a metal housing that holds the XTL 5000 Mobile radio, audio and control interface board, bi-directional coupler, antenna and power supply.

2.1 Fixed Station Terminal FST-5020

This housing is a freestanding case with a minimal footprint. The physical layout consists of a metal housing that holds the XTL 5000 Mobile radio, audio and control interface board, bi-directional coupler, antenna and power supply. The radio is a dash mount or remote mount (optional) Motorola XTL 5000 Mobile Terminal. The standard mobile trunnion bracket is used inside the enclosure and the radio is held in place with two trunnion screws.



Enclosure dimensions including feet: 280mm x 235mm x 270mm (H x W x D)

2.2 Fixed Station Terminal FST-5020-2A

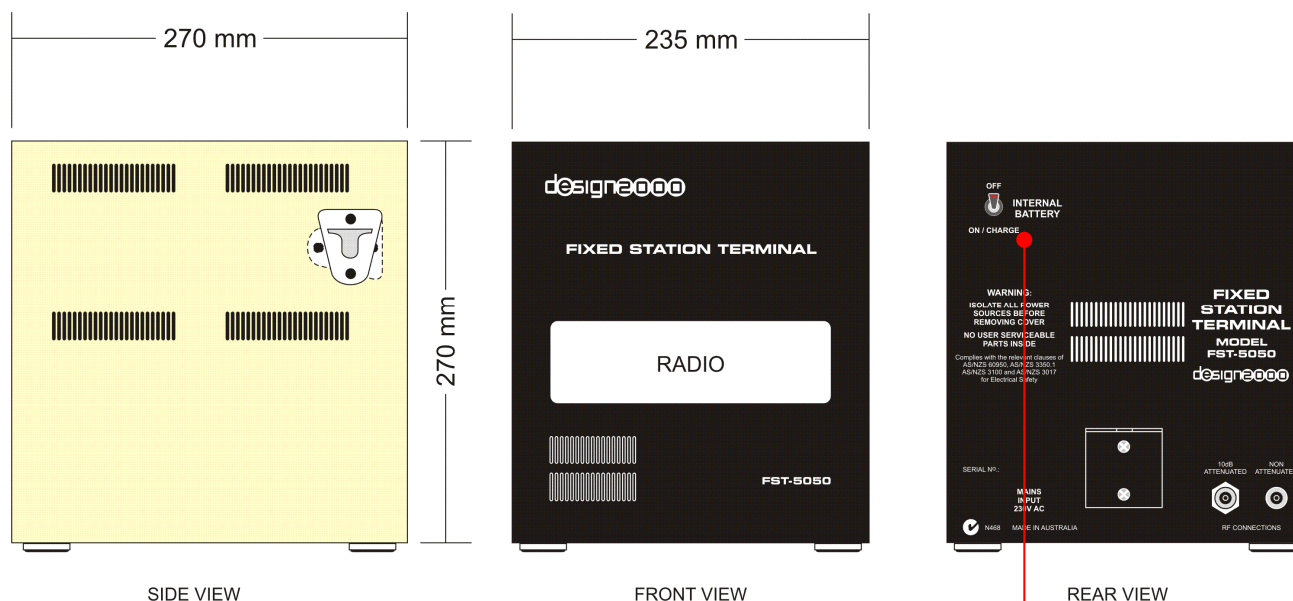
This model also includes a 7.2Ah internal lead acid battery mounted on the internal mounting tray, and a battery isolation switch on the front panel. The battery isolation switch should be turned to the downward 'ON' position whenever the FST is connected to mains power or when you require the FST to run on battery power. Whenever the FST is to be stored, turn the switch to the upward 'OFF' position.

Enclosure dimensions including feet: 280mm x 235mm x 270mm (H x W x D)



2.3 Fixed Station Terminal FST-5050

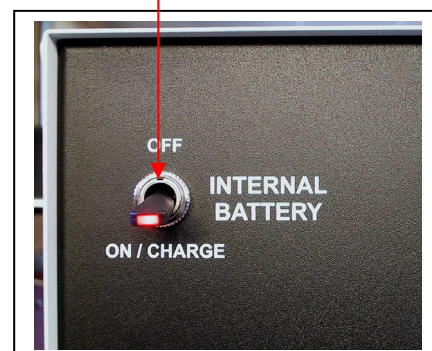
This model is a 'no-frills' version with similar RF & electrical characteristics as the FST-5020-2A but with no external audio inputs and outputs. The mains power cable is hard-wired. This model also includes a 10.5Ah internal lead acid battery mounted on the internal mounting bracket, and a battery isolation switch on the rear panel. The battery isolation switch should be turned to the 'ON / CHARGE' position whenever the FST is connected to mains power or when you require the FST to run on battery power. Whenever the FST is to be stored, turn the switch to the 'OFF' position.



Enclosure dimensions including feet: 280mm x 235mm x 270mm (H x W x D)

Please Note:

The battery isolation switch should be turned to the 'ON / CHARGE' position whenever the FST is connected to mains power or when you require the FST to run on battery power. Whenever the FST is to be decommissioned & stored, turn the switch to the 'OFF' position.



3 ELECTRICAL & EMC

3.1 Protection

The Fixed Station Terminal has the following safety protection characteristics:

In-Rush current: The maximum in-rush current is 40 A at 230 Vac cold start.

Power supply: The Power supply is fully protected against overload and short circuit by an OVP circuit with shutdown. Recycle AC supply to reset after 30 seconds.

The Fixed Station Terminal has a front panel Mains on/off switch, 'AC on' indicator and 'DC Supply' present indicator.

Output regulation: $\pm 3\%$ over 0 to 10 A and full mains variation from a nominal 13.8 Vdc

Output ripple and noise: 300mV Peak-to-Peak maximum at 0 to 100% load and over the full mains voltage range.

Power cord: IEC, 230Vac, 10A. It is two metres in length.



Shown here is the FST-5020-2A IEC power cord & input

3.2 Safety

The Power Supply is designed and tested to AS/NZS 61558.2.6-2001 and AS/NZS 61558.1-2000, UL1950, EN60950, EN50178 as applicable

3.3 EMC compatibility

The Motorola XTL 5000 Mobile Terminal meets the requirements of AS/ANZ 3548-1995 and EN55022 Level B.



4 FRONT PANEL ELECTRONICS

There are a number of front panel indicators and control features on the Fixed Station Terminal:

Main Power ON/OFF Switch: Located on the bottom right corner. When the main power switch is switched to the ON position the switch will illuminate and the XTL 5000 radio will power up.



Model FST-5020-2A.
Model FST-5050 has no Mains on/off switch. Only the radio power button is used.

DC Supply LED: Located on the top right hand corner. When the dc power switch is placed in the ON position (down) and the internal battery is charging, the LED will illuminate (red).



The FST-5020-2A has a battery on/off switch with an integrated red LED.
The FST-5050 has the same switch on the rear panel.



5 REAR PANEL INTERFACE ELECTRONICS

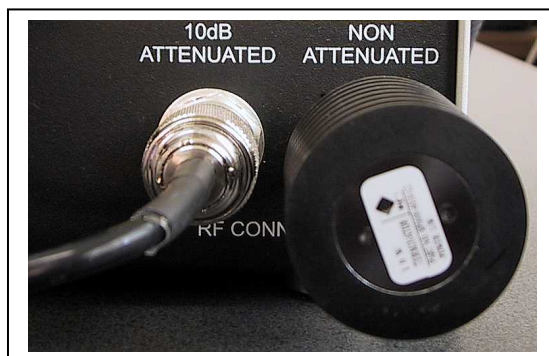
There are a number of additional audio and control features located on the rear panel of the Fixed Station Terminal:

5.1 10 dB Attenuated RF Output

Located on the rear panel is a 10 dB attenuated RF output for the fixed antenna or a suitable external antenna (unity gain, 450 – 520 MHz). This is to be used during normal trunking operation. The following indicates the nominal output of the terminal in low and high power modes (with the dummy load connected to the non-attenuated RF Output):

Low power – 1 Watt
High power – 2.5 Watt

Caution: If the Fixed Station Terminal is set to high power and the fixed antenna is connected to the Attenuated RF Output, the Terminal will transmit at a nominal 2.5 Watts. ACMA regulations stipulate that all Fixed Stations in a normal office environment must not transmit more than 1 Watt of RF output power. Verify that the 5 Watt dummy load is connected to the **RF Output** when operating the Fixed Terminal with the fixed antenna.



5.2 Non-Attenuated RF Output

Located on the rear panel is a non-attenuated RF output for an external antenna located on a mast. An external antenna is to be used only if the integrated fixed antenna does not provide adequate reception. The following indicates the nominal output of the terminal in low and high power modes (with the dummy load connected to the Attenuated RF Output):

Low power – 10 Watt
High power – 25 Watt

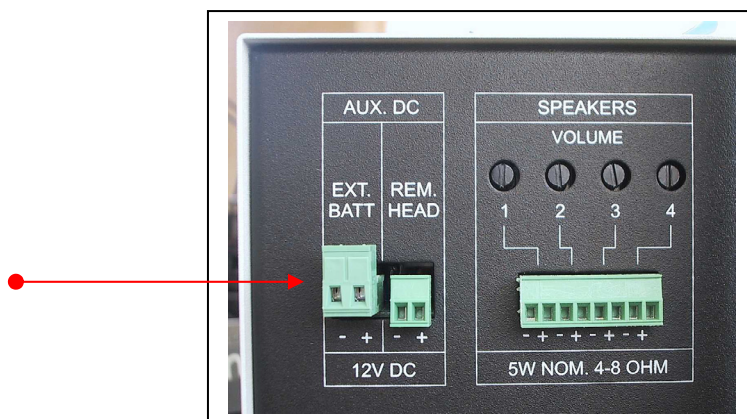
Warning: Do not connect the fixed antenna to this output. Operating the Fixed Station Terminal with the fixed antenna connected to the non-attenuated RF Output can result in a radiation hazard to the operator and bystanders. Only use a proper external antenna located on a mast. Verify that the supplied 5 Watt dummy load is connected to the **Attenuated RF Output** when operating the Fixed Terminal with an external antenna.



5.3 External Battery

This interface accepts an input of 12 Vdc (up to 18 Vdc with reverse polarity fuse protection) or charges an external 12V 10 Ah sealed lead-acid battery for standby power. This standby battery may operate the radio and auxiliary equipment in the case of mains power failure. The battery connection charges the battery at a minimum of the 10 Amp-hour rate when the AC supply is available, while continuing to run the radio.

It is possible to connect a 12 Vdc standby power source other than a battery to provide standby power.



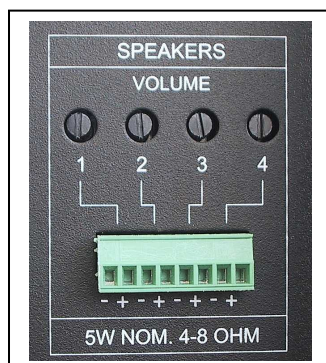
5.4 500/600Ω Receive Line Output with preset level

This audio output is designed to connect to high impedance balanced input PA amplifier systems. The line output has a standard ¼" stereo phono jack connector located on the rear panel. The level is adjusted by a recessed, screwdriver adjustable, volume control located next to the jack.



5.5 External 4-8Ω Speaker Outputs with preset level

These outputs are designed to drive four independent 5W nom. 4-8Ω speakers. The minimum audio output level for each output is internally fixed. The maximum audio output level for each speaker is adjusted by a recessed, screwdriver adjustable, volume control above each of the speaker outputs. The outputs are on a pluggable eight-way connector block with screw terminals.



5.6 4-wire E&M Interface

This is a radio-independent 4-Wire 600Ω balanced Tx pair and Rx pair plus 12-48V E&M connections. Both the E & M interfaces are optically isolated providing galvanic isolation. These interfaces meet telecommunications network connection safety and level requirements (AS/NZS 60950, ACA TS 006 Clause 5.2.2 (a)) and are available on an RJ-45 connector located on the rear panel.

5.6.1 Receiver E (Ear/Equipment) interface

The Receive signal condition is indicated by a 'contact closure' on the 'E' lead of the Fixed Station Terminal. -12 to -48V is supplied by the external equipment. The Receive audio level is adjustable from -20dBm to -5dBm for 60% system deviation using the recessed, screwdriver adjustable, volume control to the right of the jack.

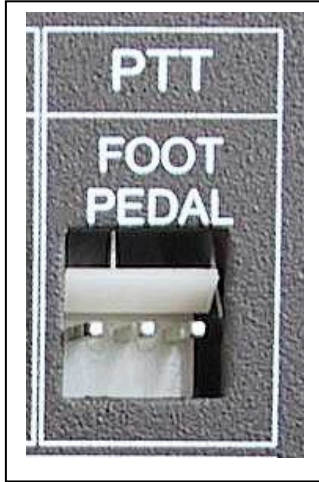
5.6.2 Transmitter M (Mouth/Modulator) interface

The transmitter is keyed by -12 to -48V applied from the external equipment to the 'M' lead of the Fixed Station Terminal. The Transmit audio level is adjustable from -20 dBm to -5 dBm for 60% system deviation using the recessed, screwdriver adjustable, volume control to the left of the jack.



5.7 Foot Pedal PTT

The external Push to Talk input uses a 3 pin 0.156 inch header interface. Pulling this line to ground will enable the PTT function, activating the AUX_MIC input.



5.8 Desk Microphone

Located on the rear panel, this RJ-45 provides an interface for PTT and microphone audio. The microphone signal is independent of the microphone signal on the front microphone connector. The nominal input level is 80mV RMS for 60% deviation, but can also support 300 mV RMS. The DC impedance is 600 Ohms and the AC impedance is 560 Ohms. The transmit level can be adjusted using the recessed, screwdriver adjustable, volume control next to the Mic jack.



A new desktop microphone was released circa 2011. It is model number RMN5068. The RJ-45 connector is pin for pin compatible however the internal dips switches require adjustment. The dipswitches are accessed by removing the base plate.



RMN5068 Desktop Microphone

Recommended RMN5068 Dip Switch settings for operation with FST-5020-2A

SW1	Lever DOWN
SW2	Lever DOWN
SW3	Lever UP
SW4	Lever DOWN
SW5	Lever DOWN
SW6	Lever DOWN
SW7	Lever DOWN
SW8	Lever UP



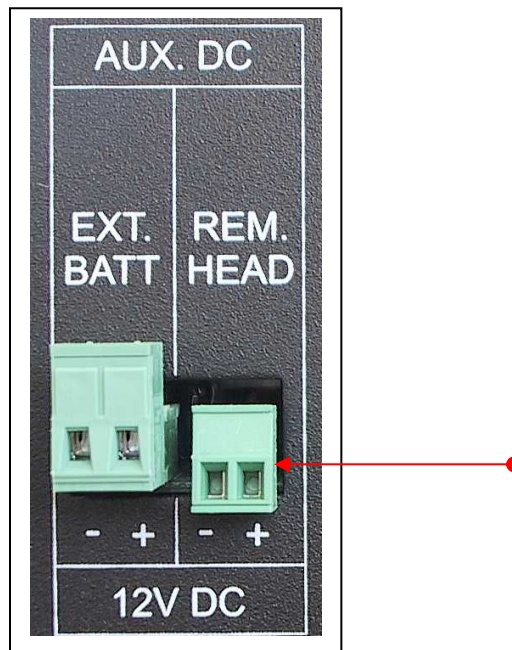
5.9 Light Weight Headset and Microphone

Located on the rear panel, this RJ-22 interface (4P4C) provides a Tx mic pair and an Rx ear piece pair. The headset and microphone level adjustments are recessed, screwdriver adjustable, volume controls on either side of the jack. These interfaces meet telecommunications network connection safety and level requirements (AS/NZS 60950, ACA TS 006 Clause 5.2.2 (a)).



5.10 XTL 5000 Remote Control Head Power

A 12 Vdc external power connection can be used to power the XTL 5000 Remote Control Head and external speaker connected to it. For this application it is used to power the Omnitronics 936 Multi-purpose Interface for remote handsets.

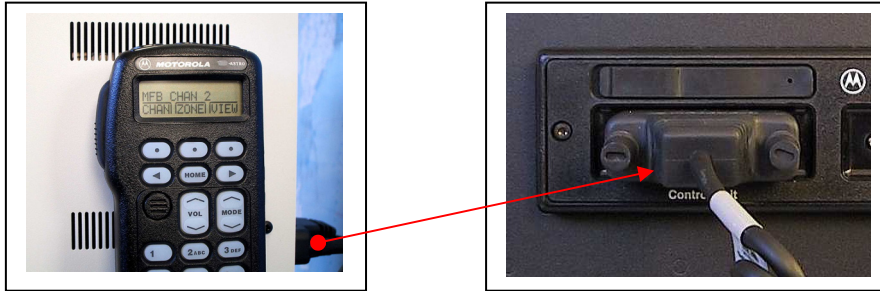


6 ACCESSORIES

There are a number of accessories included with the Fixed Station Terminal (model dependant):

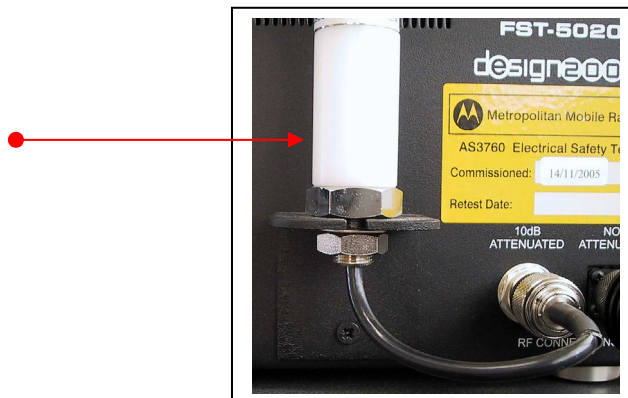
6.1 Controller Microphone

The Controller keypad with PTT and programmable buttons connects to the DB25 interface located on the front of the XTL5000 mobile radio.



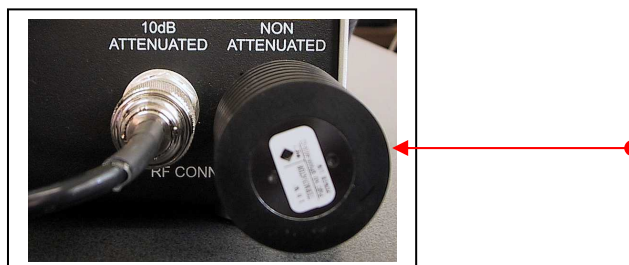
6.2 Fixed Antenna

A 450 – 520 MHz ground independent dipole antenna with unity gain (Polar model 315U) is fixed to the rear of the cabinet and connects to the 10 dB Attenuated RF connector.



6.3 5 Watt Dummy Load

A 5 Watt dummy load, to absorb excess transmit power while in Low Power mode, normally connects to the RF connector. It is alternatively connected to the Attenuated RF connector when operating the Fixed Terminal in the high power state with an external antenna connected to the RF connector.



6.4 Notes

The following technical notes assist accessory selection:

6.4.1 Microphone Bias (Transmitter)

Most microphones are powered by a 'phantom' Power supply, where the bias to the electronics within the microphone is supplied as direct-coupled down the MIC_IN line.

During Push-To-Talk or transmit (PTT), the microphone electronics are connected to this line and loads it down from 9 V to a bias voltage between 3 to 6 volts. The AC load (or load line) is less than 560 Ohms at the radio due to AC decoupling on both sides of this resistor. AC Audio from the microphone passes up the same MIC_IN line and AC coupled eventually to a high impedance amplifier circuit. It is imperative that this input has a bias voltage between 1.5 and 9.5 volts. Connecting to anything other than a microphone could short out or clamp the input signal resulting in distortion.

Warning: The output of other types of electronics is typically referenced to zero volts DC and would require a 10 μ F capacitor to be placed in series with MIC_IN. If the capacitor is polarized, the positive lead goes to the radio MIC_IN. Some audio generators have the option of applying the 1.5 Volts DC offset, which may be used in place of a capacitor.

6.4.2 Audio PA Output Bias (Receiver)

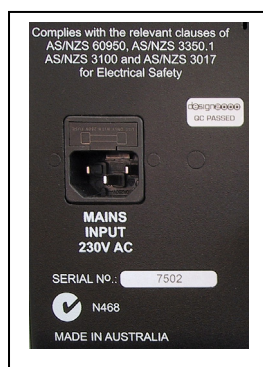
The audio PA is a Bridge-To-Load (BTL) amplifier. When the radio is in receive mode, the output of both speaker leads are biased up to half of the supply voltage. Both leads are at the same potential so the average DC voltage across the load is zero.

At maximum volume, the signal voltage to the load is double that of one amplifier peak-to-peak because the amplifiers work together 180 degrees out of phase.

Caution: Do not short either lead to ground, which might cause component damage. Even though audio may still be heard from the speaker, the shorted side will go into current limiting and eventually into thermal shutdown, shutting off the amplifier. These protection devices are not intended to be tested.

6.4.3 Main power

The radio itself requires a nominal 13.75Vdc supply with negative ground. This is provided by an internal power supply with 85~240 Vac 50 Hz mains (230 Vac 50 Hz nominal) input and 14.2Vdc output. This output travels via Schottky steering protection diodes to produce about 13.75V at the radio power input. This supply to the radio transceiver meets low output hum and noise requirements, as well as low RF radiation levels to prevent interference with the radio receiver. The power supply may operate with a 12 Vdc sealed lead-acid standby battery.

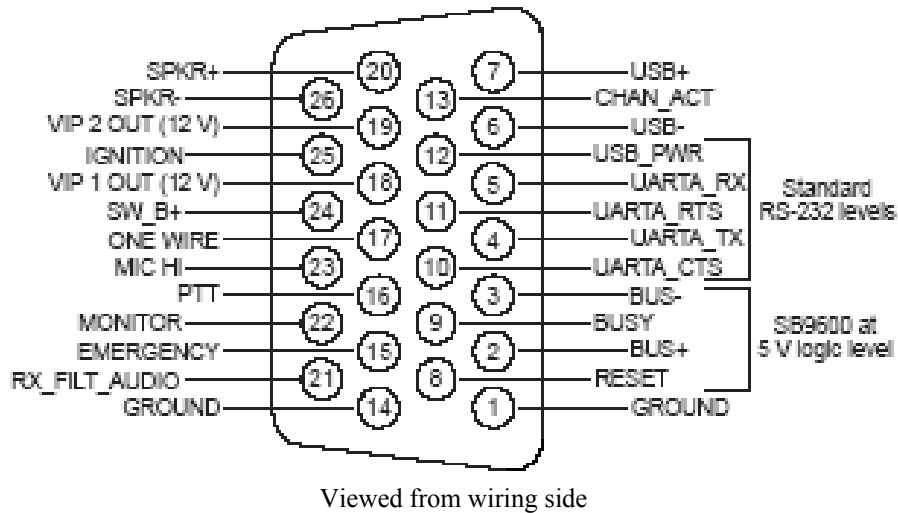


7 CIRCUIT DESCRIPTIONS

These are mid-level descriptions of the interfaces.

7.1 Radio Interface

(FST-5020-2A)



The feature connector (J2) on the XTL5000 provides a number of signals required by the FST for interfacing to various functions. These are listed in the table below:

Signal Description	J2 Pin Number Feature connector 26 pin 4 row DB style	PC-5021 Pin Number DB9 (PL13) PC-5041 Pin Number DB9 (PL18)	PC-5041 Pin Number RJ-45 (PL13)
Ground	1	1	2
Channel Activity	13	2	1
PTT	16	3	8
Rx Filtered Audio	21	6	7
Monitor	22	5	4
Aux. Microphone	23	7	5
Ignition Sense	25	9	3

7.1.1 Ground

The Ground terminal is a common ground and return for all signals, to and from the FST.

7.1.2 Channel Activity

The Channel Activity output from the radio indicates Carrier Operated Squelch (COS) to the FST E&M and squelch circuits.

Please note that the Channel Activity signal is dependent on the radio's code plug. The Channel Activity output is required for proper operation of the Omnitronics 936 MP Interface and the FST's squelch facility.



7.1.3 PTT

The PTT input to the radio accepts PTT signals from the FST E&M circuit, Foot pedal PTT and Desk microphone PTT switch.

7.1.4 Rx Filtered Audio

This is the audio received by the radio and subsequently used to drive the following circuits: Speaker amplifiers, E&M audio from Radio, Balanced Audio out, and Headset output for earphones.

7.1.5 Monitor

Not used on the FST at this time.

7.1.6 Aux Microphone

The Aux Microphone input to the radio receives audio from the Desk Mic and the FST E&M Tx Audio for transmission to air.

7.1.7 Ignition Sense

The FST supplies 12V to the Ignition Sense pin of dash mount and remote mount radios for automatic turn on.

Please Note: The Radios currently in use will only operate correctly if this signal is at 12V. On PC-5041 (FST-5020-2A) boards, link LK5 will break this supply should it be needed in the future.

7.2 12 Volt / Charger

(FST-5020-2A)

12Vdc (nominal) 10A is fed into the FST boards on PL9 through to D1, a steering diode, then to the output to the lead acid battery for charging. From D1 the power is tracked through D2, to feed the circuits on the FST board, and power the radio.

7.3 External Speaker Outputs

(FST-5020-2A)

The signal originating at J2 pin 21 (Rx Filtered Audio) is amplified via 4 independent circuits designed to drive 4-8 Ohm loads rated at a nominal 5W with a set level audio output. Each has an independent potentiometer to adjust the output. All 4 outputs are presented at the rear panel on a combined 8 way terminal block. The minimum audio output level for each output is internally preset. The maximum audio output level is adjusted by a recessed, screwdriver adjustable, volume control above each of the four outputs. These outputs are separate connectors interchangeable with two pin pluggable screw connectors.

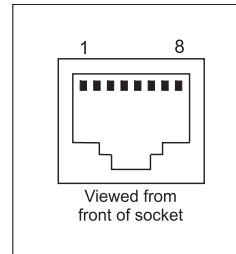
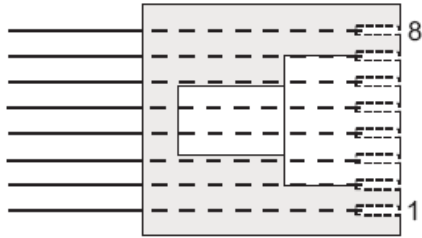
Caution: Do not short either lead to ground, which might cause component damage. Even though audio may still be heard from the speaker, the shorted side will go into current limiting and eventually into thermal shutdown, shutting off the amplifier. These protection devices are not intended to be tested.



7.4 External Microphone

(FST-5020-2A)

The microphone connector is an RJ-45 (SK3). This provides an interface for PTT and microphone audio with pin outs as per the table below:



RJ-45 (8P8C) Plug
Viewed with tab on top

Pin Number	Description	Level / Sensitivity
1 & 2	Not Connected	
3	PTT	Pull down to activate
4	Microphone	Bias voltage 12V
5	Ground	0V
6	Hook	Via LK4 to MON (Not implemented
7 & 8	Not connected	

These pin outs match Motorola Desk Microphone HMN3000B-4273 and RMN5068A RJ-45 interface. The microphone signal is independent of the microphone signal on the front microphone connector. The nominal input level is 80mV RMS for 60% deviation, but can also support 300 mV RMS. The DC impedance is 660 Ohms and the AC impedance is 560 Ohms. The level adjustment is a recessed, screwdriver adjustable, volume control located on the rear panel. Please note that the RMN5068A has an eight way dip switch in the base of the unit. Dipswitch 6 must be in the DOWN position.



HMN3000B-4273



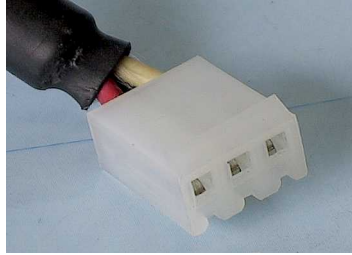
RMN5068A



7.5 External PTT

(FST-5020-2A)

A 3 pin header (PL17) provides the connectivity for a foot operated PTT. Pins 1 & 3 are the PTT connection (pull low to activate) and the centre pin is 0V or Ground. This interface is for a Motorola 40C82663C06 foot pedal assy. It uses a 0.156" (3.96mm) pitch connector.



3.96mm (0.156") CONNECTOR

PIN	DESCRIPTION
1	PTT
2	GND
3	PTT



7.6 Headset

(FST-5020-2A)

A Headset can be connected to the RJ-22 interface socket (SK2). The pin-outs are as per the table below:



RJ-22 (4P4C) Plug
Viewed with tab on top

Pin Number	Description	Level / Sensitivity
1	Microphone +	5.6V bias
2	Speaker +	Speaker drive
3	Speaker -	Speaker return
4	Microphone -	Microphone return

These pin outs match the North American Reverse polarity standard (please note that electret microphones are polarity sensitive. If there is no Tx audio, the RJ-22 plug on the headset lead will need to be reversed). The microphone bias provides drive to suit all tested headsets. It is buffered and then fed to the Auxiliary Microphone input on pin 23 of the J2 feature connector. The earpiece and microphone level can be adjusted by the recessed, screwdriver adjustable, volume controls located on the rear panel.

An amplified headset may also be used. The Plantronics Vista M12 has been approved for use with the FST-5020 and FST-5020-2A



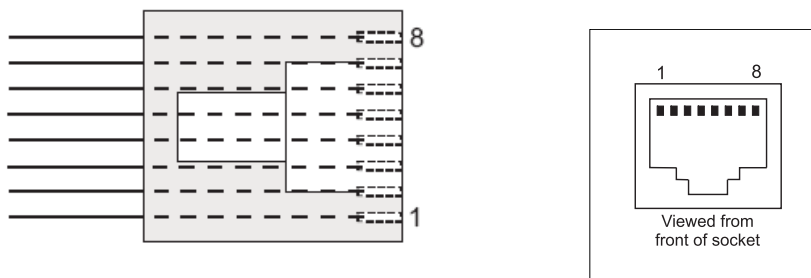
- Default settings on the Plantronics Vista M12 (Switch setting 5, adjustable pots set half way) and on the FST-5020 (Headset Tx & Rx adjustable pots set half way) are an excellent starting point.
- It is possible to wind up all Rx pots with no reproducible risk of acoustic shock.
- It is suggested that all Tx pots are not adjusted higher than to the $\frac{3}{4}$ way mark. There are no serious ramifications other than distorted audio (not excessively loud but overdriven) at the distant radio.



7.7 E&M Interface

(FST-5020-2A)

This is a radio-independent, 4-Wire 600Ω balanced, (Tx pair and Rx pair) plus 48 V passive E&M connection. This interface was set to match the Omnitronics 936 MPI interface. This interface meet telecommunications network connection safety and level requirements (AS/NZS 60950, ACA TS 006 Clause 5.2.2 (a)) and is available on an RJ-45 (PL5) connector with pin outs as per the table below:



RJ-45 (8P8C) Plug
Viewed with tab on top

Pin Number	Description	Level / Sensitivity
1	Rx Carrier E +ve	Open collector=off, collector switched to return when carrier present (channel activity goes low)
2	Rx return E -ve	Rx (E) return
3	Tx Audio	Audio to Omnitronics 936 MPI from radio
4	Rx audio	Audio from Omnitronics 936 MPI to radio
5	Rx audio	Audio from Omnitronics 936 MPI to radio return
6	Tx Audio	Audio to Omnitronics 936 MPI from radio return
7	PTT (M +ve)	Apply voltage (12-48V) between this pin and M return to PTT
8	PTT (M -ve)	M return

The Receive signal condition is indicated by a contact closure on the 'E' lead of the Fixed Station Terminal. -12 to -48V is supplied by the external equipment. The Receive audio level is adjustable from -20dBm to -5dBm for 60% system deviation using the recessed, screwdriver adjustable, volume control located on the rear panel.

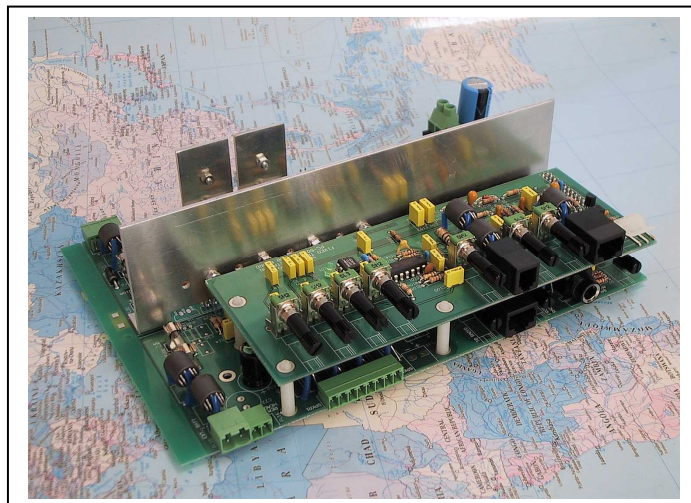
The transmitter is keyed by -12 to -48V applied from the external equipment to the 'M' lead of the Fixed Station Terminal. The Transmit audio level is adjustable from -20 dBm to -5 dBm for 60% system deviation using the recessed, screwdriver adjustable, volume control located on the rear panel.

7.8 XTL 5000 Remote Control Head /936 Power

(FST-5020-2A)

A 12Vdc external power connection to the XTL 5000 Remote Control Head, also used to power the Omnitronics 936 Multi-purpose Interface for remote handsets.



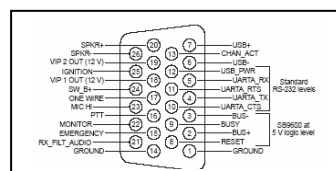


The Occupational Health & Safety of all personnel working on or near this equipment is the responsibility of the installer or technician performing the tests, or operations.

This equipment may contain lethal voltages, and must be isolated from supply before any cover is removed.

8.1 Radio Interface

(FST-5020-2A)



The feature connector (J2) on the XTL5000 provides a number of signals required by the FST for various interfacing functions. These are listed in the table below:

Signal Description	J2 Pin Number Feature connector 26 pin 4 row DB style	PC-5021 Pin Number DB9 (PL13) PC-5041 Pin Number DB9 (PL18)	PC-5041 Pin Number RJ-45 (PL13)
Ground	1	1	2
Channel Activity	13	2	1
PTT	16	3	8
Rx Filtered Audio	21	6	7
Monitor	22	5	4
Aux. Microphone	23	7	5
Ignition Sense	25	9	3

These signals are described in the previous introduction, and further referred to in text below.

8.2 Power Supply (Model dependant)

FST-5020-2A

The 5020 incorporates a 15V 150W switch mode supply with internal over voltage and over current protection. It is supplied from an IEC / Filter / Fuse combination via a two pole mains neon indicator rocker switch located on the front panel. The fuse in the IEC socket is a 6A 20 x 5 glass type fuse. An Earth connection is made on a stud beside the IEC socket, the body of the socket and the frame of the power supply. The radio body is connected to earth via its RF connectors.

FST-5050

The 5050 incorporates a 15V 150W switch mode supply with internal over voltage, and over current protection. It is supplied from a hardwired mains lead. An Earth connection is made on a stud beside the cord grip grommet and at the frame of the power supply. The radio body is connected to earth via its RF connectors.

8.3 12 Volt / Charger

(FST-5020-2A)

14.2Vdc (nominal) 10A is fed to the FST board from the power supply on PL9 (a 2 pin connector on PC-5021 or 3 pin connector on PC-5041). The three pin model tracks the current through T17 (filter) and the +ve via switch connections TP2 & TP3 and fed to D1. This is a heat sunk Schottky steering diode. From the cathode of D1 the +ve tracks via a 10A (20 x 5) fuse F6 to the output for charging the lead acid battery. The external battery is supplied via T11 (filter) to PL10 on the rear panel. Internal batteries are supplied via PL20. The power supply should be adjusted to provide 13.75 Volts at the Battery Connector. The Battery charge circuit is limited to a Maximum of 18V and is reverse polarity protected by a 5W zener diode Z7.

From D1 the power is tracked through D2, to feed the circuits on the FST board, the auxiliary out put for the remote head, and power to the radio. The auxiliary output for remote head PL16 is protected by a 6A (20 x 5) fuse F7 and D5 protects it from reverse connections. A LED (normally blue) is provided to indicate DC present during operation (LED2), and either mounted on the PCB or in a bezel on the front panel. The FST-5020-2A has a battery isolation switch with an integrated red LED in place of the blue DC supply indicator found on the FST-5020.

Sheet 4E of the circuit diagram shows the power connections and decoupling / supply caps to the various components on the main PCB. U4C is a buffered divider that provides 0VA and 0VB for the op amps on both boards.

FST-5050

The FST-5050 charges the internal battery directly from the internal power supply when mains power is connected & the battery isolation switch is in the 'ON / CHARGE' position.



8.4 Power Supply Test

Equipment required: True RMS Multimeter.

Test Prerequisites / setup: Fully assembled FST plugged into a switchable 230Vac Mains socket outlet via portable in-line RCD. FST Mains switch OFF.

Procedure:

#	Action	Expected result	Check if incorrect
1	Turn on socket outlet switch and reset RCD		
2	Turn on FST Mains switch	ac Neon to illuminate	No Neon, check fuse in IEC socket
		dc Power LED to illuminate	No DC LED, Check for voltage to PL9 If no Voltage cycle power
3	Connect Multi-Meter to EXT. BATT terminal and measure for dc volts	10 – 15Vdc	
4	Adjust battery charging potentiometer so that Multi-Meter reads 13.75Vdc	13.75Vdc	
5	Disconnect Multi-Meter		
6	Turn off FST Mains switch	ac Neon to go out and dc Power LED to go out	



8.5 Radio & Internal Speaker Test

Equipment required: True RMS multimeter, Portable Radio - Model XTS5000, 820Hz Oscillator.

Test Prerequisites / setup: Fully assembled FST plugged into a switchable 230Vac Mains socket outlet via a portable in-line RCD. Power applied to FST, radio turned on and talk group selected. Portable radio turned on and talk group selected.

Procedure

#	Action	Expected result	Check if incorrect
1	Key Portable	FST to go into RX carrier receive mode	
2	Acoustically couple 820Hz Oscillator to Portable	FST speaker to sound	Check speaker connector
3	Adjust FST XTL5000 Radio volume control slowly from min to max	No distortion up to 90%	
4	Adjust volume back to ½ way		
5	Turn off FST and portable	All indicators to go out.	

8.6 External Speaker Outputs

(FST-5020-2A)

Signal from J2 pin 21 (Rx Filtered Audio) tracks from pin 6 on the DB9 (or pin 7 RJ-45) PL13 to PL15 PL14 header / socket combination to the sub board on pin 25. On the sub board it passes through C68 & R85 to U15D. This op amp buffers the signal and passes the signal to the Level pots RV4, 5, 6, & 7 via capacitors. The op amp gain can be reduced to zero if there is current flowing through the LED in the LCA110 K2 as would be indicated by LED1 illuminating. This function is to squelch the signal and is active when J2 pin 13 (Channel Activity) is low or not active. K2 is in series with K1 across U3B on the main PCB. From the pots the signals pass through caps to A1,2,3&4 back to the main PCB on pins 3,5,7 & 9 PL15 PL14 header / socket combination to the amplifier section as shown on sheet 4C. The signal to each amplifier is buffered then passed through a tantalum capacitor to pin 1 of the amplifier (TDA2003) mounted on the heat sink dissecting the main PCB. It should be noted that the amplifier can be configured in a bridge arrangement but this is not fitted to conserve power (these components are designated "BRIDGE" on the circuit diagram). The amplified signal from pin 4 on the TDA2003 passes through a 1000uF 16V electrolytic capacitor via a choke to the output terminals.



8.7 Power Amplifiers Test

(FST-5020-2A)

Equipment required: True RMS multimeter, Oscilloscope (CRO) - Tektronix TDS 220, 820 Hz Oscillator, Portable Radio, 8 Ohm load.

Test Prerequisites / setup: Fully assembled FST plugged into a switchable 230Vac Mains socket outlet via a portable in-line RCD. Power applied to FST, radio turned on and talk group selected. Portable radio turned on and talk group selected.

#	Action	Expected result	Check if incorrect
1	Connect 8 Ohm load and CRO to Speaker 1 output		
2	Key Portable	FST to go into RX carrier receive mode	
3	Acoustically couple 820Hz oscillator to Portable	FST speaker to sound	Check signal to Main PCB
		CRO displays signal	Check volume control Trace signal through path described above.
4	Adjust Speaker 1 volume control slowly from min to max	No clipping from min to 90%	
5	Repeat 1 – 4 for Speaker terminals 2, 3, and 4	No clipping from min to 90%	
6	Turn all four speaker potentiometers anti-clockwise to ½ way mark		
7	Disconnect 8 Ohm load and CRO		
8	Turn off FST and portable	All indicators to go out.	

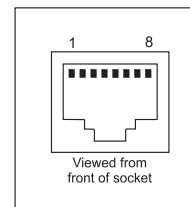


8.8 Headset

(FST-5020-2A)

Connections for the headset are provided by an RJ-22 interface socket (SK2). Connections are as per the table below:

Pin Number	Description	Level / Sensitivity
1	Microphone +	5.6V bias
2	Speaker +	Speaker drive
3	Speaker -	Speaker return
4	Microphone -	Microphone return



The pin outs match the North American Reverse Polarity standard, see sheet 4D sub board for circuit detail. The microphone bias is provided by R103, clamped at 5.6 volts by zener Z8, and stabilised by C98. This voltage is applied via R104 to MIC+ pin 1 SK2. The signal from the mic decoupled by C99 and the level set by pot RV9 (Tx [to radio]). The signal is buffered / filtered by the op amp U15D before being mixed by the buffer microphone op amp U4D on the main board (common to E&M, and External Mic) and input to Auxiliary Microphone input at pin 23 on J2 (feature connector) on the main board. The headset and microphone level adjustment are recessed, screwdriver adjustable, volume controls located on the rear panel.

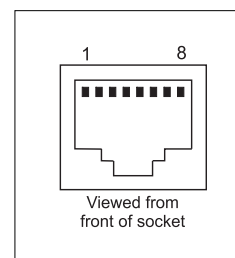
The speaker audio (From Radio) is derived from J2 pin 21 Rx Filtered Audio via the buffer U3B (squelched) and the output from this is common to the Balanced Audio & E&M. The signal is tracked through C106 to pot RV10 (Rx [from radio]) then C105 / R109 to the buffer / driver U15C. The audio is then tracked via decoupling cap C103 to limit resistor R113. The output is clamped by back to back zener diodes Z9 & Z10 to limit the amplitude of the signal. The return is via R114 to ground.

8.9 External Microphone

(FST-5020-2A)

The microphone connector is an RJ-45 (SK3) that provides an interface for PTT and microphone audio with pin outs as per the table below:

Pin Number	Description	Level / Sensitivity
1 & 2	Not Connected	
3	PTT	Pull down to activate
4	Microphone	Bias voltage 12V
5	Ground	0V
6	Hook	Via LK4 to MON (Not implemented)
7 & 8	Not connected	



These pin outs match Motorola Desk Microphone HMN3000B-4273 RJ-45 interface. The microphone signal is independent of the microphone signal on the front microphone connector. The nominal input level is 80mV RMS for 60% deviation, but can also support 300 mV RMS. The DC impedance is 660 Ohms and the AC impedance is 560 Ohms. The level adjustment is a recessed screwdriver adjustable volume control located on the rear panel. The microphone bias is provided by R97, the signal from the mic decoupled by C94 and the level set by pot RV8. There is a clamp and filter network provided by D3 & 4 plus capacitors and resistors (see sheet 4D sub board for detail) before being buffered by the microphone op amp U4D on the main board (common to E&M, and Head set) and input to Auxiliary Microphone input at pin 23 on J2 (feature connector). Pin 6 on the RJ-45 SK3 is tracked to LK4 (not fitted) and then to J2 pin 22 Monitor. This circuit has not been implemented. The PTT circuitry is common with the External PTT described below.



8.10 External PTT

(FST-5020-2A)

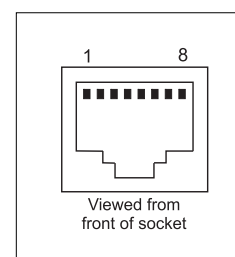
A 3 pin header (PL17) provides the connectivity for a foot operated PTT. Pins 1 & 3 are the PTT connection (pull low to activate) and the centre pin is 0V or Ground. This interface is for a Motorola 40C82663C06 foot pedal assy. It uses a 0.156" (3.96mm) pitch connector. The Ext PTT is applied to a bias / divider network of R93, 94, & 95 and applied to the base of Q2. Q2 conducts in the idle state holding Q3 off. When PTT is switched to ground Q2 is turned off, turning Q3 on and J2 pin 16 PTT is switched to ground causing the radio to transmit. See circuit diagram sheet 4D (Sub board) for details

8.11 E&M Interface

(FST-5020-2A)

This is a radio-independent, 4-Wire 600Ω balanced, (Tx pair and Rx pair) plus 48 V passive E&M connection. This interface meets telecommunications network connection safety and level requirements AS/NZS 60950, ACA TS 006 Clause 5.2.2 (a) and is available on an RJ-45 (PL5) connector with pin outs as per the table below:

Pin Number	Description	Level / Sensitivity
1	Rx Carrier E +ve	Open collector=off, collector switched to return when carrier present (channel activity goes low)
2	Rx return E -ve	Rx (E) return
3	Tx Audio	Audio to Omnitronics 936 MPI from radio
4	Rx audio	Audio from Omnitronics 936 MPI to radio
5	Rx audio	Audio from Omnitronics 936 MPI to radio (return)
6	Tx Audio	Audio to Omnitronics 936 MPI from radio (return)
7	PTT (M +ve)	Apply voltage (12-48v) between this pin and M return to PTT
8	PTT (M -ve)	M return



E&M signalling provides the means to remotely signal and control the FST. The RJ-45 connector PL5 located on the rear panel has the associated circuitry (see circuit diagram sheet 4B) to achieve this control.

The received (E) signalling, Pins 1 & 2 are connected to an open collector of U2 PS-2532-1 opto via a diode bridge, protection fuse and limiting resistor as shown on sheet 4B. This arrangement provides a polarity independent open collector that switches when J2 pin 13 Channel Activity (COS) goes high. In the table above polarities are indicated to reduce confusion. This signal indicates that there is audio being received by the radio, which is delivered to pins 3 & 6 of the RJ-45 PL5. Voltages between 12 and 48 Volts can be safely switched. LK3 is provided to shunt the limiting resistor out should there be insufficient current flowing for signalling, fit this link with great care.

The received audio (From Radio) is derived from J2 pin 21 (Rx Filtered Audio) via the buffer U3B (squashed) and the out put from this is common to the Balanced Audio & Headset speakers. The signal passes through C5 and pot RV2 (Rx [from radio]) to drivers U4 A&B which are arranged in a push pull configuration to drive the primary on the 600 Ohm isolation Transformer T4. The secondary of T4 is connected to pins 3&6 via limiting resistors, fuse F4 and choke T2. There are also back to back zener diodes to limit the amplitude of the signal.

The transmit (M) signalling on pins 7 & 8 of PL5 are connected to the bi-directional LED of U1 PS2505-1 via a limiting resistor and fuse. A capacitor is connected in parallel with the LED to provide some persistence & resistance to noise. The open collector of U1 is connected between J2 pin 16 PTT and Ground. In the table above polarities are indicated to reduce confusion. When this signal is applied audio to be transmitted by the radio, which is delivered to pins 4 & 5 of the RJ-45 PL5 will be transmitted by the radio. Voltages between 12 and 48 Volts can be safely used for



signalling. LK2 is provided to shunt the limiting resistor out should there be insufficient current flowing for signalling, fit this link with great care.

The Transmit Audio (To Radio) applied to pins 4 & 5 of the RJ-45 PL5. It passes through a choke T1, limit resistor R4 and Fuse F2 to the primary of the 600 Ohm isolation transformer T3. There are also back to back zener diodes to limit the amplitude of the signal. The secondary of the transformer has an impedance matching resistor R5 in parallel and then the signal passes to the pot RV1 (Tx [to radio]). From the wiper of the pot the audio then tracks to a buffer amplifier U4D (which is common to the external microphone and headset mic) and this drives a bi-polar decoupling / isolating capacitor C3 to J2 pin 23 Auxiliary Mic.

8.12 E&M Test

(FST-5020-2A)

Test Equipment: Oscilloscope (CRO) - Tektronix TDS 220, 820 Hz Oscillator, Portable Radio, ODX driver – Model LI-4302.

Test Prerequisites/Setup: Power applied to FST, radio turned on and talk group selected.
Portable radio turned on and talk group selected.

Procedure:

#	Action	Expected result	Check if incorrect
1	Connect ODX driver output to E pair on RJ-45.	FST to Tx and Portable to Rx.	
2	Connect CRO to Tx pair on RJ-45		
3	Connect 820Hz Oscillator to Rx pair on RJ-45	Sine wave on CRO	
4	Adjust Tx potentiometer (audio to radio) for 1 V p-p.	1V p-p (observe no clipping).	
5	Connect ODX Driver to M pair on RJ-45		
6	Connect CRO to Rx pair on RJ-45		
7	Acoustically couple 820Hz Oscillator to Portable and key up	FST to Rx	
8	Observe ODX driver looped condition	Looped	
9	Adjust Rx potentiometer (audio from radio) for 1 V p-p.	1V p-p (observe no clipping).	
10	Disconnect CRO		
11	Turn off FST and portable	All indicators to go out.	

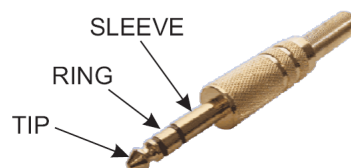


8.13 Balanced Audio Out Test

(FST-5020-2A)

The received audio (From Radio) is derived from J2 pin 21 (Rx Filtered Audio) via the buffer U3B (squelched) and the output from this is common to the E&M & Headset speakers. The signal passes through C8 and pot RV3 (Rx [from radio]) to drivers U3 C&D which are arranged in a push pull configuration to drive the primary on the 600 Ohm isolation Transformer T6. The secondary of T6 is connected to a 6.35mm “stereo” socket SK1 across the tip and ring. This is via limiting resistors R17 & 18, fuse F5 and choke T5. There are also back to back zener diodes Z5 & Z6 to limit the amplitude of the signal. A link LK1 is provided in case an earth is required for the shield (sleeve) of SK1.

BALANCED AUDIO



6.35mm (1/4") Stereo Plug

TIP	AUDIO FROM RADIO
RING	AUDIO FROM RADIO
SLEEVE	SHIELD

Test Equipment: Oscilloscope (CRO) - Tektronix TDS 220, 820 Hz Oscillator, Portable Radio

Test Prerequisites/Setup: Power applied to FST, radio turned on and talk group selected.
Portable radio turned on and talk group selected.

#	Action	Expected result	Check if incorrect
1	Connect CRO to 'BAL. AUDIO OUT' 1/4" phono socket		
6	Acoustically couple 820Hz Oscillator to Portable and key up	FST to Rx	
6	Adjust Rx potentiometer (audio from radio) for 1 V p-p.	1V p-p (observe no clipping).	
7	Disconnect CRO		
8	Turn off FST and portable	All indicators to go out.	



9 BOARD LEVEL TESTS

(FST-5020-2A)

Equipment required:

True RMS multimeter, Oscilloscope (CRO) - Tektronix TDS 220, Sine wave Oscillator set to 1kHz 430mV P-P, 13.5 Vdc power supply, 8 Ohm load, Assorted leads / adapters, eg DB9 male or RJ-45 with flying leads, 6.35mm Stereo plug with flying leads, Desk Mic, Foot Pedal PTT, Headset, Switch with fly leads, test LED set to illuminate at 12V with leads, 4k7, 560R, 47k axial 0W25 resistors, 4 x 3.9R 5W resistors.

Test Prerequisites / setup:

All pots (10) set to Minimum, Connect Headset, Desk Mic and PTT pedal, Connect Scope earth to convenient ground (-ve power supply), Power applied to FST at PL9.

#	Action	Expected result	Check if incorrect
1	Observe LED 2 Illuminates	Illuminated	Trace Voltage from PL9 through D1 & 2 to VS
	Voltage at Pin 1 PL12 (5020)	Voltage present	Trace Voltage from PL9 through D1 & 2 to VS
2	Check voltages at PL10 External Batt Connector or PL20 Internal Batt Connector	330 – 350mV lower than supply	Check D1
3	Check Voltage at PL11 or 19	330 – 350mV lower than Batt Connectors	Check D2
4	Connect switch between 12V and DB9 pin 2 (or RJ-45 PL13 pin 1) Channel activity input.		
5	Observe LED1 (green) on sub board	Illuminated when switch off	Check squelch circuit (K1, K2 & LED1)
6	Connect test LED between 12V and pin 1 of RJ-45 PL5, Pin 2 connect to ground.	Test LED illuminates when switch is on.	Check E circuit of E&M.
7	Disconnect Switch from Channel activity input & test LED from PL5.		
8	Connect test LED between 12V and DB9 pin 3 (or RJ-45 PL13 pin 8) PTT input		
9	Press PTT switch on Desk Mic	Test LED Illuminates	Check PTT circuit
10	Operate Foot Pedal PTT	Test LED Illuminates	Check PTT circuit
11	Disconnect Test LED		
12	Connect oscillator with a 4k9 resistor in series to RJ-45 PL5 pin 5 and connect RJ-45 PL5 pin 4 to ground	Verify input signal using Channel 1 of O'scope at 435mV 1kHz	Adjust oscillator
13	Connect channel 2 to DB9 pin 7 (or RJ-45 PL13 pin 5) Aux Mic input with a 560 Ohm resistor from pin 7 to ground.	Verify 45mV +/- 5mV output.	See below
14	Set E&M Tx RV1 to Max	Verify 575mV +/- 25mV output.	If Ok See test 15 No output check the following points: See 14A & B Refer to Circuit diagram Sht 4B
14 A	Check the voltages at end of R5 nearest Amplifiers (using scope set to DC) located near T3.	should read ~6.65V Flat (0VA).	
14 B	Check the voltages at end of R5 furthest from Amplifiers (using scope set to DC) located near T3.	approx 200mV p-p on top of ~6.65V DC level.	If not check Fuse F2 and T3. If ok perform next test 14C
14 C	Check the voltages at U4(d) pin 14 Microphone Buffer (using scope set to DC) located near T3.	approx 1V p-p on top of ~6.65V DC level.	If not check pot RV1, R6 and for any short to PL14 / 15 header to sub board pin 21, and circuits to MIC BUF see circuit diagram sht 4D If ok check C3 10uF 50V Bi-polar cap.
15	Remove Oscillator, Check Channels 1 & 2 are connected as per 12 & 13 above		
16	Set headset Tx RV9 to Maximum. Speak into head set mic	Observe approx 200mV on channel 2	Check Headset Tx Circuit on sheet 4D of diagram
17	Set Ext. Mic Tx to Maximum	Observe approx 200mV on channel	Check Desk Mic Tx Circuit on sheet 4D of diagram



	Press PTT on Desk mic and speak into Desk Mic	2	
18	Connect oscillator to DB9 pin 6 (or RJ-45 PL13 pin 7) Rx Filtered Audio.		
19	Connect Scope channel 1 with a 20k resistor in series to the oscillator point as above	Verify approx. 300mV	
20	Connect Scope channel 2 to RJ-45 PL5 pin 6 with a 560R resistor in parallel to ground and connect RJ-45 PL5 pin 3 to ground	Verify approx. 65mV +/- 5mV	
21	Set pot E&M Rx RV2 to Maximum	Observe Ch2 approx. 450mV +/- 50mV	Check E&M Rx (from radio) Circuit on sheet 4B of diagram
22	Connect Channel 2 to the Tip of a 6.35mm stereo plug with a 47k resistor across Tip & Ring. Connect the Ring to ground.	Observe 85mV +/- 15mV on channel 2	
23	Set pot Balanced audio Out Rx RV3 to Maximum	Observe 550mV +/- 25mV on channel 2	Check Balanced Audio Out Rx (from radio) Circuit on sheet 4B of diagram
24	Listen to Headset Earpiece	Observe no signal	
25	Set pot Headset Rx RV10 to halfway	Observe comfortable signal level	
26	Set pot Headset Rx RV10 to max.	Observe loud signal level	Check Headset Rx (from radio) Circuit on sheet 4D of diagram
27	Connect 4 x 3R9 5 Watt resistors to speaker socket across pins 1&2, 3&4, 5&6, 7&8 (+ to -) CAUTION: RESISTORS GET HOT		
28	Connect Scope Channel 2 to +ve end of resistor on speaker 1		
29	While advancing Volume 1 RV4	observe trace increasing until clipping occurs approx 3.7V then back off to approx 3.3V	Check Amplifier1 Circuit on sheet 4C of diagram
30	Repeat for other resistors / amplifiers		
31	Check resistor / amplifier 1 again	Observe still at 3.3V	If not check for power supply sag.
32	Test complete See below		

Switch off power supply, set all pots to centre (halfway), remove all connected equipment, reconnect internal power supply and all other connections. Test complete.



10 BATTERY MAINTENANCE

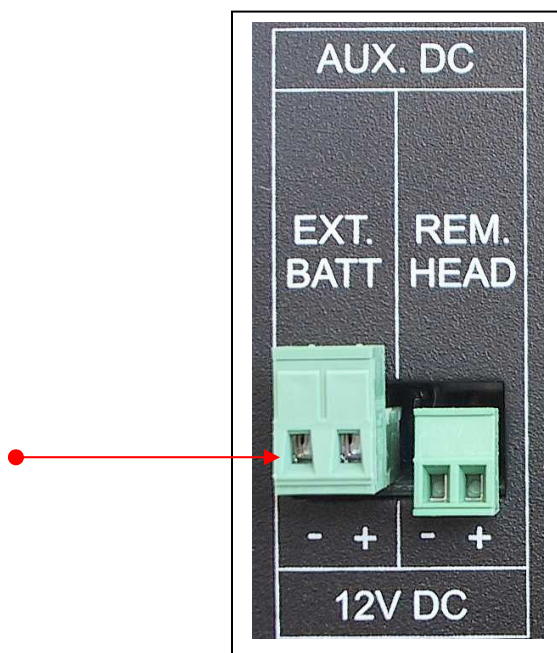
(FST-5020-2A & 5050)

This FST-5020-2A includes a 12V, 7.2Ah internal lead acid battery mounted on the internal mounting bracket, and a battery isolation switch on the front panel. The battery isolation switch should be turned to the downward 'ON' position whenever the FST is connected to mains power or when you require the FST to run on battery power. Whenever the FST is to be stored, turn the switch to the upward 'OFF' position.

The FST-5050 includes a 12V, 10.5Ah internal lead acid battery mounted on the internal mounting bracket, and a battery isolation switch on the rear panel. The battery isolation switch should be turned to the 'ON / CHARGE' position whenever the FST is connected to mains power or when you require the FST to run on battery power. Whenever the FST is to be stored, turn the switch to the 'OFF' position.

10.1 Battery Check

Whenever mains power is connected and the battery switch is ON, the internal battery is automatically float-charged. The charge voltage on the FST-5020-2A can be checked with a multi-meter at the 'EXT. BATT' connector on the rear panel. It should read about 13.8Vdc. The battery supply voltage can also be checked at the same point by turning off the 'MAINS' power switch. It should be steady at $\geq 12\text{Vdc}$ with the radio turned on.



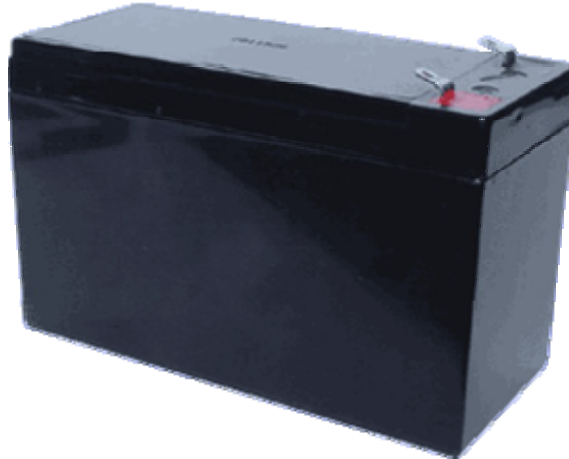
The FST-5050 can be checked in the same way but at the internal battery terminals, which involves removing the FST cover to access the battery terminals. This should only be performed by an authorised service technician. Exercise extreme care not to go near the mains power underneath the internal shelf.



10.2 Battery Replacement

If the battery fails to operate the FST, isolate mains power, turn off the battery isolation switch, remove the FST cover, remove the battery clamp, battery leads and battery, and replace with the same type. Check for correct polarity (red = +ve, black = -ve) and reassemble the FST. Batteries should be systematically replaced at least every five years.

The FST-5020-2A uses an Altronics Model S5090B battery.



The FST-5050 uses a Power Sonic Model PSH-12100 F2 battery.



Spares are available from Design 2000 Pty Ltd.

11 INSTALLATION: GENERAL

The relevant subsections & Installation check sheet for FST installation are covered in other Motorola documentation. Please consult your Fixed Station Terminal Manager as required.

11.1 Aesthetics

Check that the equipment has no marks or damage that detracts from the equipment and appearance of the installation. More substantial marks and damage may affect equipment performance. An example of which may be a cracked case or damaged controller microphone inhibiting the function of the push buttons.



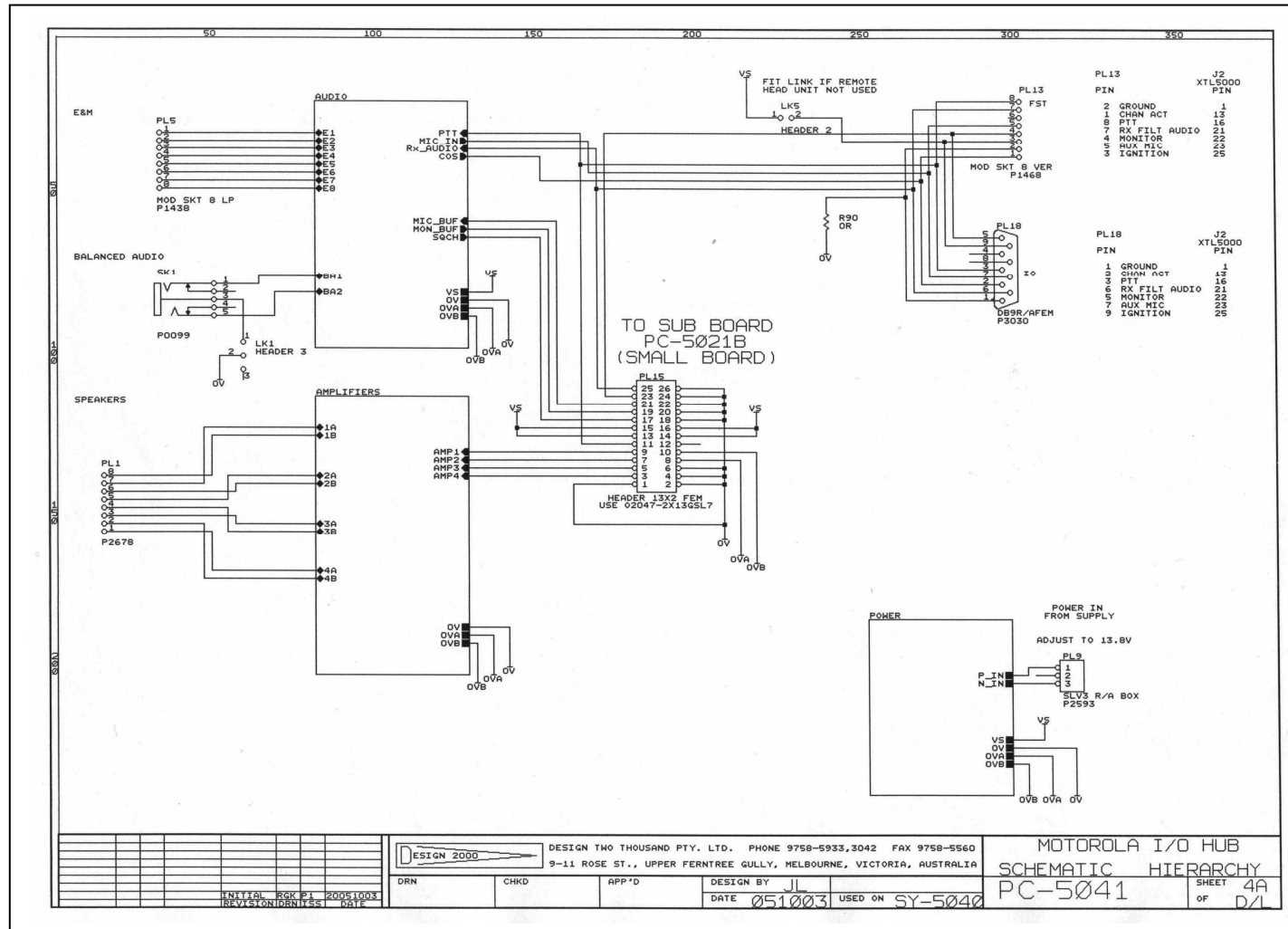
Appendix A - Feature Sets

Please Note: Model FST-5040 is not currently used in Australia.

FEATURE	FST-5020	FST-5020-2A	FST-5040	FST-5050
Single Enclosure Design (no external boxes)	✓	✓	✗	✓
Mains Rocker Switch	✓	✓	-	✗
Mains Indicator	✓	✓	-	✗
DC Indicator	✓	✓	✓	✗
Internal 14.2Vdc, 10A Supply	✓	✓	✗	✓
Internal Battery Charger	✓	✓	✓	✓
Internal 12V, 10Ah SLA Battery	✗	✗	-	✓
Internal 12V, 7Ah SLA Battery	✗	✓	-	-
Battery On Indicator	✗	✓	✗	✓
Battery Isolation Switch	✗	✓	✗	✓
Internal Battery bracket (removable)	✗	✓	-	✓
Terminal for External Battery	✓	✓	✓	✗
IEC Mains Filter & Fuse	✓	✓	-	✗
Attenuated & Non Attenuated N-Type RF Sockets	✓	✓	✓	✓
Internal Bi-Directional Coupler	✓	✓	✓	✓
Antenna Bracket	✓	✓	-	✓
4 x Speaker Amplifiers, 5W nom., 4-8 Ohm	✓	✓	✓	✗
E & M Interface	✓	✓	✓	✗
Balanced Line Level Audio Output	✓	✓	✓	✗
Inbuilt Speaker	✓	✓	-	✓
Foot Pedal PTT Input	✓	✓	✓	✗
Headset Socket	✓	✓	✓	✗
Remote Head Unit Power Terminal	✓	✓	✓	✗
Desk Microphone Input	✓	✓	✓	✗
Squelch circuitry	✓	✓	✓	✗
Service Manual	✓	✓	✓	✓



Appendix B - Circuit Diagram PC-5041 sheet 4A - Hierarchy Schematic





Circuit Diagram PC-5041 sheet 4E – Power Supply Schematic

