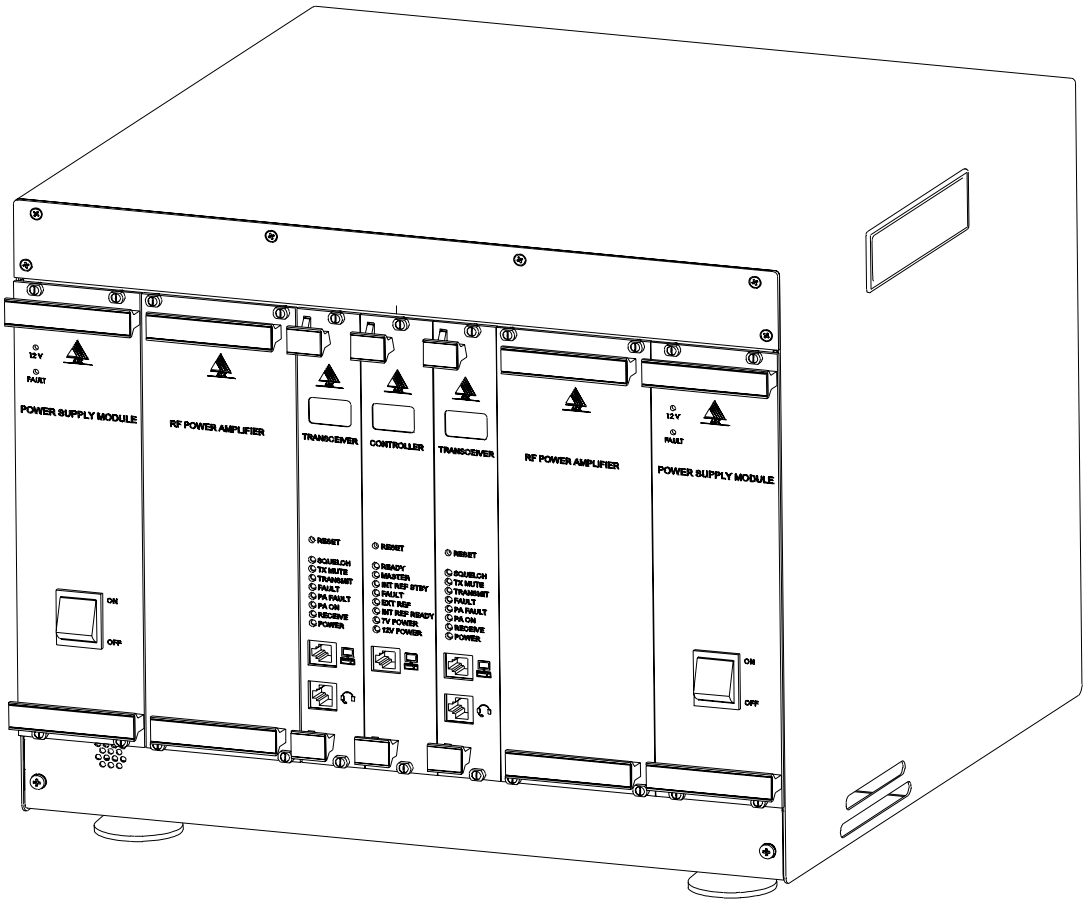
5600 Series

SERVICE MANUAL

DIGITAL REPEATER/BASESTATION

5601/11 - VHF
5604/14 - UHF
APCO 25 DIGITAL REPEATER/BASESTATION



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5600 SERIES REPEATER
SERVICE MANUAL

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PRECAUTIONARY NOTATIONS

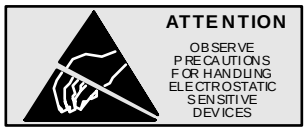
Where it is necessary to highlight a potentially hazardous situation, a critical procedure or requirement, or an important fact, the appropriate precautionary notation is used:

WARNING

A WARNING PRECEDES A PRACTICE OR PROCEDURE WHICH, IF NOT CORRECTLY FOLLOWED, COULD RESULT IN PERSONAL INJURY OR LOSS OF LIFE.

CAUTION

A caution precedes a practice or procedure which, if not strictly observed, could result in damage to or destruction of the equipment, or corruption of data.



A caution for static devices precedes a practice or procedure which, if not strictly observed, could result in damage to or destruction of the equipment, or corruption of data.

NOTE

A note either precedes or follows a practice, procedure or condition which requires highlighting.

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SECTION 1 INTRODUCTION

1.1 OVERVIEW

This document describes the 5600 Repeater Dual Radio Base Station system installation procedures, configuration and operational details.

The 5600 Repeater, shown in Figure 1-1 and Figure 1-2, is a compact, multi-mode transceiver package which provides users with one or two analog or APCO Project 25 digital radio channels. The small size and high level of flexibility of the 5600 Repeater make it an ideal solution for any organization starting out on the digital migration path.

The 5600 Repeater provides one or two independent radios in a single package. Each radio can be used as a base station or a repeater, and may be configured to support both APCO Project 25 compliant digital subscribers as well as providing backwards compatibility to analog users. This means that existing mobile radio equipment need not be immediately retired.

Each radio may be configured to provide an analog interface (2 -Wire with Loop or Ground Start or 4-Wire plus E & M signaling) to the public switched telephone network (PSTN), to a private branch exchange (PBX), or to existing Tone Remote Control Units.

The 5600 Repeater provides the key elements of an APCO Project 25 RF Sub-System including the Air Interface (Um), Telephone Interfaces and PBX Interconnect (Et) and Host Data Systems (Ed). Support for Ethernet based Network Management, Digital Consoles and the APCO Project 25 Fixed Station Interface (Ef) will be available as software upgrades.

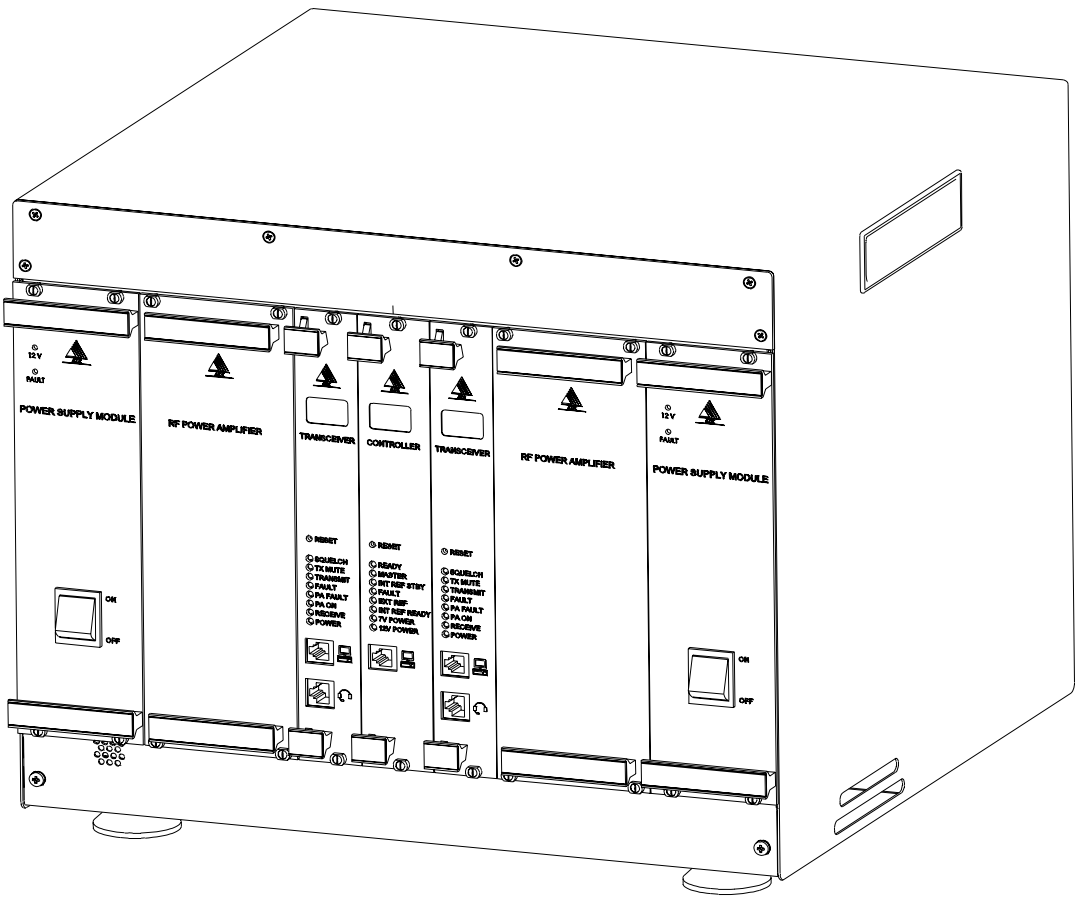


Figure 1-1 FRONT VIEW - 5600 REPEATER

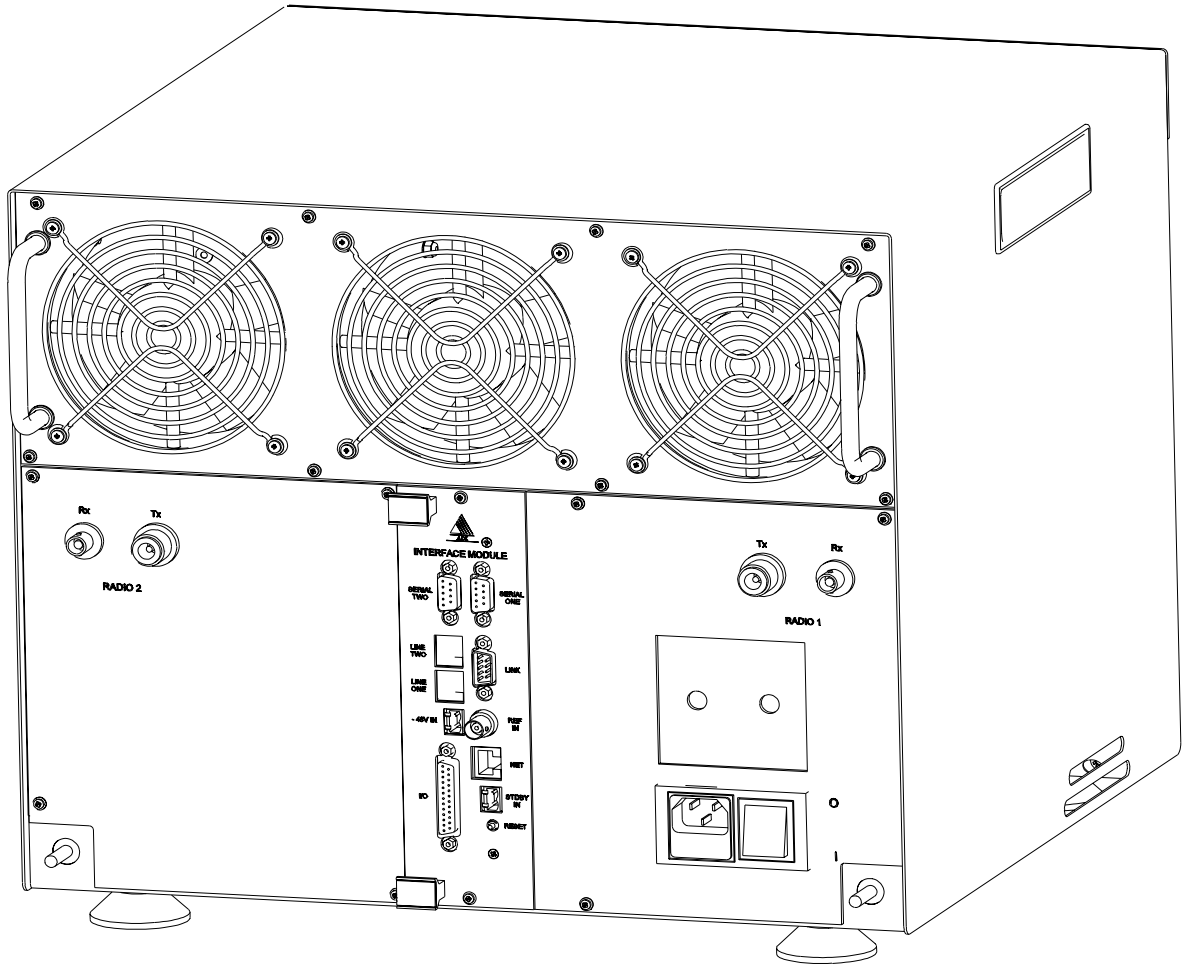
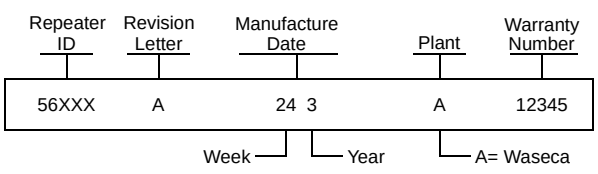


Figure 1-2 REAR VIEW - 5600 REPEATER

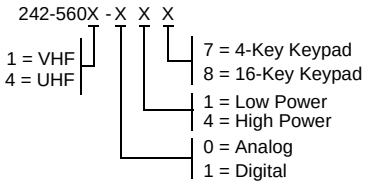
1.2 REPEATER IDENTIFICATION

The repeater identification number is printed on a label affixed to the inside of the repeater cabinet. The following information is contained in that number:



1.3 MODEL NUMBER BREAKDOWN

The following breakdown shows the part number scheme used for the 5600 repeater.



1.3.1 FEATURES

The 5600 Repeater provides the following features:

- Automatically and concurrently supports the digital mobile and FM analog radios (TIA/EIA 603 including CTCSS selective calling).
- VHF (136-174 MHz) or UHF (400-470 MHz) frequency bands.
- 60W or 125W RF output.
- Configurable as single or dual channel with any mix of frequency bands and output power levels.
- 512 programmable channels per radio, with each channel programmable as APCO Project 25 digital or TIA/EIA 603 analog.
- Programmable channel scan of up to eight channels.
- Optional RS-232, RS-485, Ethernet and general purpose I/O interfaces.
- Optional 2-Wire or 4-Wire + E&M wire line interfaces for Remote Control or Telephone Interconnect.
- Compatible with industry standard Tone Remote Control Consoles.
- Compatible with Microwave Links using 4-Wire and E & M signaling.
- User friendly Windows configuration and diagnostic software for local or remote configuration.
- Self test diagnostic routines.
- 240/110V AC or 12, 24 or 48V DC versions.
- Available as a standard 19” rack mount sub-rack, as a desktop unit or housed in a secure floor mount cabinet.

1.3.2 ADDITIONAL FEATURES

In addition, the 5600 Repeater:

- Enables a gradual migration from analog to digital terminals, or from one frequency band to another, communicating across-mode and across-bands while the migration is taking place.
- Provides link radio functions to other base stations or repeaters for geographically remote areas.
- Enables upgrade from a single-channel to dual-channel at low cost.
- Provides a low cost upgrade path from the dual-channel to a multi-channel base station.

1.4 PHYSICAL ARRANGEMENT

1.4.1 GENERAL

The 5600 Repeater is a completely self-contained cabinet unit housing all the components necessary to support one (single-channel) or two (dual-channel) radio configurations. The basic housing is provided with feet for desktop use and may optionally be supplied with mounting brackets for rack-mounting. Alternatively the entire unit may be installed in a secure cabinet.

Integral to the housing are the system power supplies, fans and air-flow control for cooling of modules and a common backplane into which the Transceiver, Controller and Interface Modules are plugged. A single-channel 5600 Repeater requires one Controller Module and the following plug-in modules:

- One Transceiver Module.
- One Power Amplifier Module.
- One Power Supply Module.
- One Interface Module (Optional - depending on external interfaces).

A dual-channel 5600 Repeater requires one Controller Module and the following plug-in modules:

- Two Transceiver Modules.
- Two Power Amplifier Modules.
- Two Power Supply Modules.
- One Interface Module (Optional - depending on external interfaces).

A single-channel 5600 Repeater can be easily and inexpensively converted to a dual-channel 5600 Repeater by the installation of the additional modules.

The 5600 Repeater may be configured for AC or DC power sources, or as AC power with DC revert in the case of AC power failure.

A block diagram of a 5600 Repeater is shown in Figure 1-3.

A description of the equipment is given in Section 2.

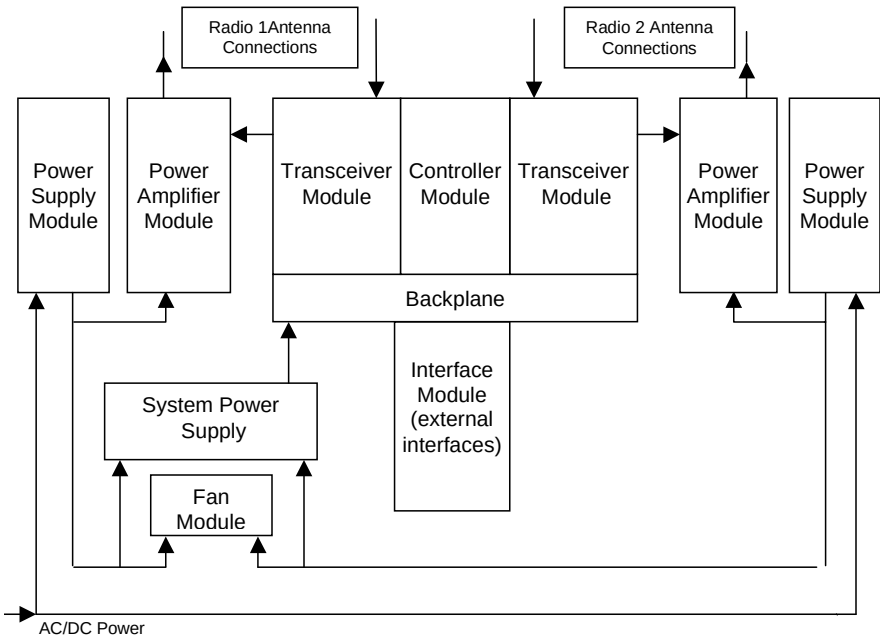


Figure 1-3 BLOCK DIAGRAM - 5600 REPEATER

1.4.2 CONFIGURATION OPTIONS

The 5600 Repeater may be configured as a Conventional (i.e. non-trunked) single or dual-channel radio base station. The configuration options are summarized in Table 1-1 to Table 1-3.

Table 1-1 PROGRAMMING AND DIAGNOSTIC CONFIGURATION OPTIONS

Setup and Console Interconnection	DESCRIPTION
Programming using Transceiver Module Programmer (TMP)	A PC running TMP is connected to the front panel serial port of either transceiver module to upload programming information into the 5600 repeater. TMP may also be used remotely using a dial-up modem (future option).
Diagnostics using the DMR Diagnostic Monitor (ZDM)	A PC running ZDM is connected to the front panel serial port of the Controller Module which enables both transceivers to be monitored and diagnostic checks to be run. The serial ports may also be used to connect the 5600 repeater to a digital console (future option). ZDM may also be used remotely using a dial-up modem (future option).

Table 1-2 OPERATIONAL CONFIGURATIONS

MODE OF USE	DESCRIPTION
Single-Channel Repeater	The 5600 repeater is configured with a single Transceiver, PA and Power Supply. If a mobile radio makes a call on the Transceiver's assigned frequency, the signal is repeated using the same format (analog or digital) used by the mobile.
Dual-Channel Repeater	The 5600 repeater is fitted with two Transceivers, PAs and Power Supply Modules. If a signal is received on the assigned frequencies of either of the Transceivers the signal is repeated in the same format in which it was received. Both Transceivers operate independently and two signals may be repeated simultaneously although not on the same frequency.
Scanning Repeater	The 5600 repeater is configured as either a single or dual channel unit. Each transceiver is programmed with up to 8 channels which can be any mix of frequency and operating mode (analog/digital). The transceiver scans through the list of programmed channels until a valid signal is detected from a mobile when the signal is repeated using the same format (analog or digital) used by the mobile.
Crossbanding Repeater	The 5600 repeater is fitted with two Transceivers and PA Modules which have operating frequencies in different bands. When a Transceiver receives a mobile call on its assigned frequency it repeats it using the same format, and passes the audio to the other Transceiver. The second Transceiver transmits the call on its assigned frequency in the user-programmed mode (analog FM or APCO Project 25).
Crossmoding Repeater	The 5600 repeater is fitted with two Transceivers which have operating frequencies in the same bands. When a Transceiver receives a signal on its frequency it repeats it using the same format, and passes the audio to the other Transceiver. The second Transceiver transmits the call on its frequency in either the user-programmed mode (analog FM or APCO Project 25).
Crossbanding and Crossmoding Repeater	The 5600 repeater is fitted with two Transceivers which have operating frequencies in different bands. When a Transceiver receives a signal on its assigned frequency it repeats it using the same format, and passes the audio to the other Transceiver. The second Transceiver operating in a different band to the first transmits the call on its assigned frequency in the user-programmed mode (analog FM or APCO Project 25).

Table 1-3 VOICE INTERCONNECT CONFIGURATION OPTIONS

MODE OF VOICE INTERCONNECTION	DESCRIPTION
None	The 5600 repeater operates as a stand-alone repeater (Single or dual channel) and does not have any external wired voice connections.
Handset/DTMF Microphone	A single channel 5600 repeater may be configured with a loudspeaker/handset panel in place of the transceiver module and its associated power amplifier and power supply module. A DTMF microphone may be used to control the transceiver.
Tone Remote	Either one or two 2-Wire or 4-Wire + E&M connections are used to link the Transceiver Modules to industry standard Tone Remote Units. Received audio is fed down the line and industry standard tone frequencies are used to control 5600 repeater functions such as PTT and Channel Select. Existing Analog Tone Remotes may be used with the 5600 repeater operating in both Analog and APCO Project 25 Digital modes.
PSTN	Either one or two 2-Wire or 4-Wire + E&M connections are used to link the Transceiver Modules to the PSTN. Each connection can seize a line or grant a line in response to a PSTN request. Once a connection is established, monitor audio is fed down the line and tones from the remote end are used to control the 5600 repeater functions such as PTT and Channel Select.
Microwave	Either one or two 2-Wire or 4-Wire + E&M connections are used to link the Transceiver Modules to the outside world. The interface can be connected to a multiplexer of the microwave link.

SPECIFICATIONS

GENERAL SPECIFICATIONS

Power supply	110 / 240V AC, 12 / 24V DC
Analog performance	Conforms to TIA / EIA603
Digital performance	Conforms to TIA / IS102.CAAB
Frequency bands:	VHF: 136 to 174 MHz
	UHF (low): 400 to 470 MHz (future option)
Operating frequencies	Selectable across full band
Dimensions:	Width: 19 inches (483 mm)
	Height: 14 inches (355 mm or 8 Rack Units)
	Depth: 17.5 inches (445 mm)
Weight:	Single radio: 58 lb (26 kg)
	Dual radio: 81lb (37 kg)

POWER CONSUMPTION

	AC Receive	AC Transmit	DC Receive	DC Transmit
Single channel, 60 W	55W	245W	45W	205W
Single channel, 125 W	55W	380W	45W	340W
Additional channel, 60 W	26W	210W	20W	180W
Additional channel, 125 W	26W	340W	20W	310W

ENVIRONMENTAL SPECIFICATIONS

The 5600 Repeater equipment is intended to be located in an indoor environment and meets these environmental requirements.

Operating Temperature	-30°C to +60°C (-22°F to +140°F)
Storage Temperature	-40°C to +60°C (-40°F to +150°F)
Operating Altitude	0 to 5,000 m (0 to 16,400 feet ≈3 miles)
Relative humidity (non-condensing)	5% to 95% RH, as defined in MIL-STD-810E Method 507.3 (humidity)
EMI/EMC	Equivalent to FCC part 15, subpart A, C, and J

STANDARDS COMPLIANCE

The design and construction of the 5600 Repeater meets or exceeds the requirements of recommendations and standards.

Digital mode performance	TIA IS102.CAAB
Analog mode performance	TIA 603
EMI/EMC	NTIA Manual Chapter 5 FCC part 90
PSTN line isolation	TS001 (Australia), AS3260 (Australia), FCC part 68 (USA)

SECTION 2 EQUIPMENT DESCRIPTION

2.1 INTRODUCTION

5600 Repeater equipment consists of modular hardware that is easily installed as a desktop cabinet, floor-mount cabinet or into standard 19 inch racks.

The 5600 Repeater chassis and its component modules are described in the following sub-sections.

2.2 POWER SOURCE OPTIONS

2.2.1 AC POWER SUPPLY

The 5600 Repeater may be powered from the 240 or 110V AC power supply via one or two Power Supply Modules. Figure 2-1 shows the power distribution of an AC powered 5600 Repeater.

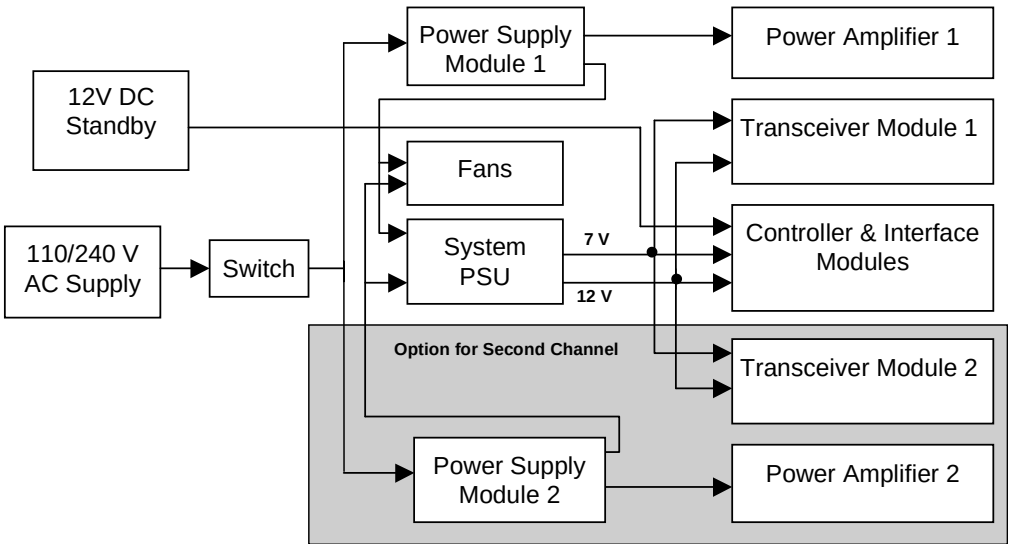


Figure 2-1 POWER DISTRIBUTION OF AN AC POWERED 5600 REPEATER

2.2.2 DC POWER SUPPLY

The 5600 Repeater may be powered from 12, 24 or 48V DC power supplies via one or two DC/DC Power Supply Modules. Alternatively, the 5600 Repeater may be powered directly from DC power sources as follows:

- 12V DC to 13.8V DC (for 60W PA Modules).
- 24V DC to 28V DC (for 125W PA Modules).

NOTE:The RF output power of the 5600 Repeater is derated by 3 dB if the DC voltage is at the low end of the range (i.e. at 12 or 24V DC). When operating from a direct DC power source the Power Supply Modules are replaced with blank panels.

Figure 2-2 shows the power distribution of a DC powered 5600 Repeater.

2.2.3 AC POWERED WITH DC REVERT

The 5600 Repeater may be powered from the 240 or 110V AC power supply via one or two Power Supply Modules with provision for 12 or 24V DC revert in the event that the AC power fails. The DC revert options are:

- 12V DC to 13.8V DC (for 60W PA Modules).
- 24V DC to 28V DC (for 125W PA Modules).

When using DC revert the RF output power of the 5600 Repeater is derated by 3 dB if the DC voltage is at the low end of the range (i.e. at 12 or 24V DC). When operating from a direct DC power source the Power Supply Modules are replaced with blank panels.

AC powered with 48V DC revert is also available using external power supplies, however, where a 48V DC battery backed supply is available it is generally preferable to use this as the main power source for the 5600 Repeater.

2.2.4 REFERENCE OSCILLATOR BACKUP POWER

The 5600 Repeater has provision for a user to connect a 12V DC backup supply to keep the system reference oscillator oven at its operating temperature in the event of a brief primary power failure. An interface module connector acts as the connection point for the keep-alive power.

If the backup supply is not used, any interruption to the primary supply requires a start-up cycle of up to ten minutes in which the reference oscillator heats up.

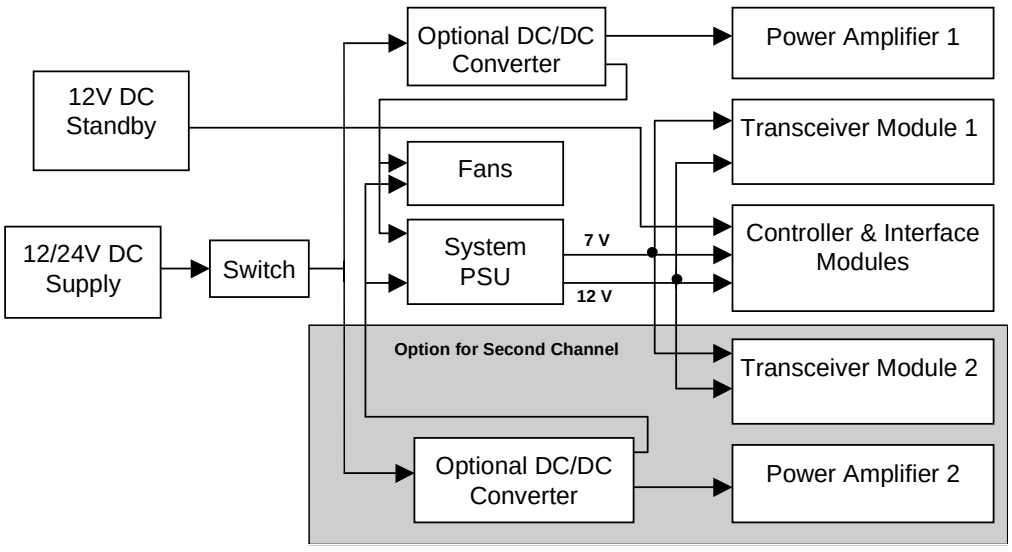


Figure 2-2 POWER DISTRIBUTION OF A DC POWERED 5600 REPEATER

2.3 PLUG-IN MODULES

The 5600 Repeater has the following types of plug-in Modules:

- Transceiver Module
- Controller Module
- Power Amplifier Module
- Interface Module
- Power Supply Module

2.3.1 TRANSCEIVER MODULE

The Transceiver Module (TM) provides full duplex radio operation for analog and digital modulation schemes. Each module consists of an RF card for receive and transmit and a daughter board for digital signal processing. Modules are standard half-Eurocard layout measuring 10.5 inches (6 Rack Units) high by 10 inches (250 mm) deep. The Transceiver Modules plug into a common backplane with the Controller Module, providing seamless transfer and switching of traffic and control data.

Transceiver Modules are specific to frequency bands and are available for frequency bands; VHF (136 to 174 MHz), and UHF (low) (400 to 470 MHz). Each Transceiver module may be programmed with up to 512 channels.

Transceiver Modules of different bands are interchangeable provided the associated Power Amplifier is also changed. The Transceiver Module is powered by 12V and 7V supplies from the System Power Supply within the case of the 5600 Repeater.

Two RJ style connectors are provided on the module front panel. The upper connector (RJ-11) provides a standard RS-232 serial interface which allows maintenance staff to program and configure the module using the Transceiver Module Programmer application software from an external PC. The lower (RJ-45) connector provides an audio interface for the connection of a speaker, microphone or handset.

Internally to the 5600 Repeater the Transceiver Module provides two connections to its associated power amplifier; the RF output and a serial data link for control and communication between the two modules. Figure 2-3 shows the front panel controls, indicators and connectors and Table 2-1 lists the control and indicator functions.

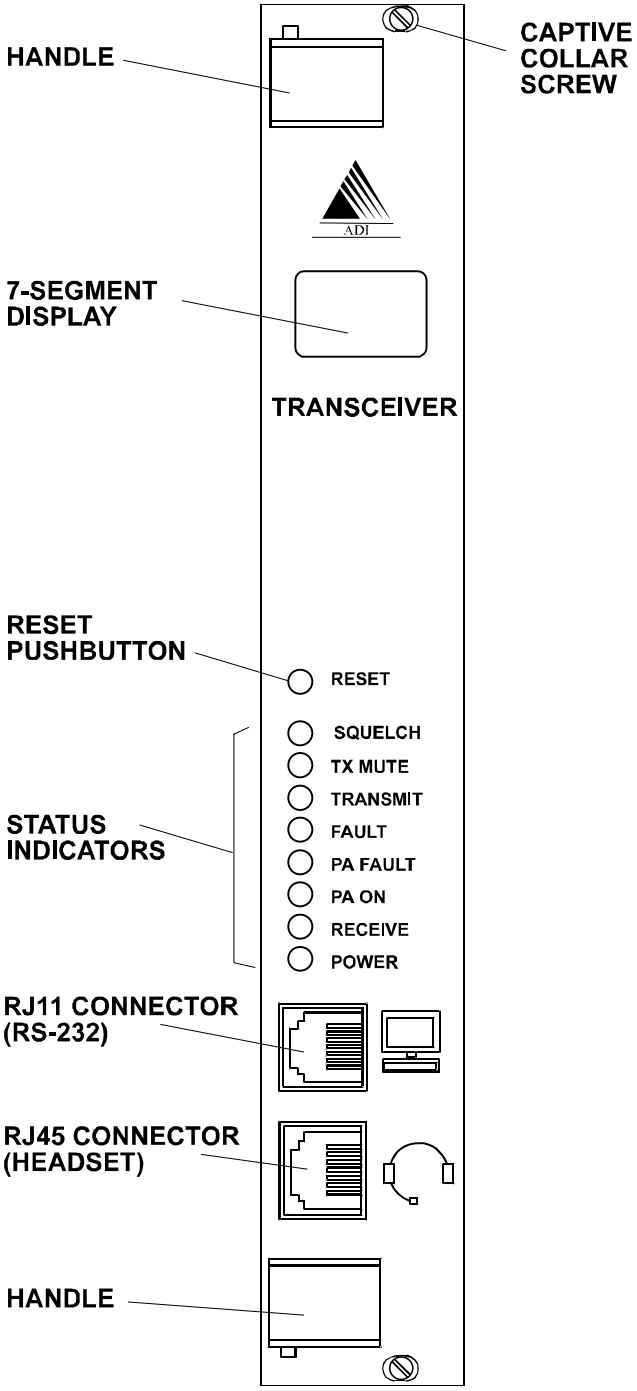


Figure 2-3 TRANSCEIVER MODULE FRONT PANEL

The Transceiver Module also provides interfaces to the internal backplane for audio, data and control. The Transceiver Module also provides an audio output interface for connection to a front panel speaker when configured as a single channel system with optional front panel speaker module.

Table 2-1 TRANSCEIVER MODULE CONTROLS AND INDICATORS

ITEM	DESCRIPTION
7-Segment Display	In normal operation the display indicates the current channel being used by the Transceiver Module (in the range 0 to 511). If an error condition is detected in either the Transceiver or PA Module then the display indicates the relevant error code. A flashing “E” is displayed with a number in the range “1” to “99” displayed to indicate the error condition.
RESET	Recessed push-button switch. Press to reset the Transceiver Module.
SQUELCH (Green LED)	ON indicates that a signal has been received and the NAC or CxCSS has been validated.
TX MUTE (Green LED)	ON indicates that the selected channel is in “receive only” mode (i.e. it receives signals and the operator can monitor the received signals, but nothing can be transmitted).
TRANSMIT (Green LED)	ON indicates that the Transceiver Module is transmitting.
FAULT (Red LED)	ON indicates that the Self-Test and Diagnostic routines have detected a fault condition in the Transceiver Module circuitry. The 7-segment display indicates the nature of the fault.
PA FAULT (Red LED)	ON indicates that the Self-Test and Diagnostic routines have detected a fault condition in the circuitry of the Power Amplifier Module used with this Transceiver Module. The 7-segment display indicates the nature of the fault.
PA ON (Green LED)	ON indicates that the Power Amplifier Module has received a transmit command from the Transceiver Module and is transmitting.
RECEIVE (Green LED)	ON indicates that a carrier has been detected on the receive frequency. If this indicator is ON, but the SQUELCH indicator is OFF, an invalid signal has been received.
POWER (Green LED)	ON indicates that the Transceiver Module is receiving power from the power supply.

2.3.2 CONTROLLER MODULE

The Controller Module (CM) provides central control functions for the 5600 Repeater and high-stability timing for all radio elements. One Controller Module is required for each 5600 Repeater system. The module is a standard half-Eurocard plugged into a common backplane with the Transceiver Modules, providing seamless transfer and switching of traffic and control data.

The Controller Module contains a 10 MHz oven-controlled reference oscillator from which all system timing is derived. The Transceiver Modules are inhibited from transmitting if the reference clock fails. Since the oven takes up to 10 minutes to reach its operating temperature and achieve the required stability provision is made for the connection of an external oven supply (12V DC) which can keep the oven at the required temperature during power outages. It is also possible to supply an external 10 MHz reference directly to the Controller Module which is then used instead of the internal reference oscillator.

The 5600 Repeater has six general-purpose inputs and outputs (provided on the Interface Module). These can be programmed to be alarm inputs for functions such as site alarms, AC power failure alarms etc. The Controller Module monitors all internal alarms generated by Transceiver Modules, Power Amplifier Modules and Power Supply Modules. The Controller Module also monitors the general-purpose inputs and can be programmed to activate a single general-purpose output or remotely interrogated to determine the cause of the alarm.

Figure 2-4 shows the front panel controls, indicators and connectors and Table 2-2 lists the control and indicator functions.

There is a RESET switch, nine indicators and one RJ-11 connector on the front panel of the Controller Module. The RJ-11 connector provides a standard RS-232 serial interface which allows maintenance technicians to program and configure the module using the programmer and to monitor radio functions with a computer.

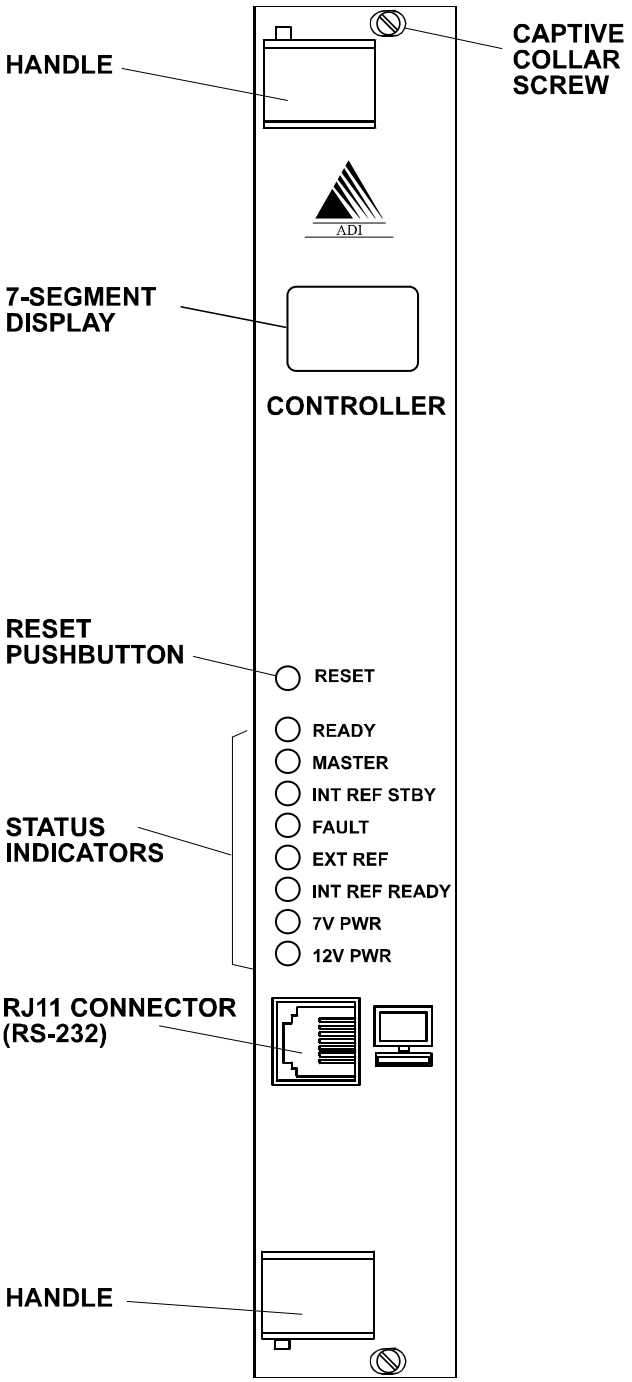


Figure 2-4 CONTROLLER MODULE FRONT PANEL

Table 2-2 CONTROLLER MODULE CONTROLS AND INDICATORS

ITEM	DESCRIPTION
7-Segment Display	An oscillating pattern indicates normal operation of the module. If an error condition is detected in the Controller Module then the display indicates the relevant error code. A flashing "E" is displayed with a number in the range of "1" to "99" is displayed to indicate the error condition.
RESET	Recessed push-button switch. Press to reset the Controller Module.
READY (Green LED)	ON indicates that the Controller Module is operating and ready for operation.
MASTER (Green LED)	ON indicates that the Controller Module is the Master and is generating the 10 MHz reference clock for the unit. This indicator is always ON, unless a redundant controller is used in multi-channel configurations.
INT REF STBY (Green LED)	ON indicates that the internal 10 MHz clock reference oscillator is operating from the 12V DC STBY PWR on the Interface Module.
FAULT (Red LED)	ON indicates that the self test and diagnostic routines have detected a fault condition in the Controller Module circuitry. The 7-segment display indicates the nature of the fault.
EXT REF (Green LED)	ON indicates that an external 10 MHz clock source is connected to the BNC connector on the Interface Module.
INT REF READY (Green LED)	ON indicates that the internal 10 MHz clock reference oscillator has reached operating temperature.
7V PWR (Green LED)	ON indicates that the 7V supply is present in the Controller Module.
12V PWR (Green LED)	ON indicates that the nominal 12V supply is present in the Controller Module.

2.3.3 POWER AMPLIFIER MODULE

The Power Amplifier Module (PAM) is a six Rack Units high plug-in module. One Power Amplifier Module is required for each Transceiver Module. Power Amplifier Modules are specific to frequency bands and are available for the same frequency bands as the Transceiver Modules.

Power Amplifier Modules are available in 60W (VHF) and 125W (VHF and UHF) versions. The 60W VHF version is for systems using analog FM and digital C4FM modulation schemes, and outputs up to 60W between 136 MHz and 160 MHz and up to 50W between 160 MHz and 174 MHz. 125W Power Amplifier Modules support analog FM and digital C4FM.

Each Power Amplifier Module has an on-board Microcontroller that supervises its operation and reports alarms via a control link to the associated radios. Power output is adjustable over a 10 dB range in increments of less than 1 dB. UHF Power Amplifier Modules can be fitted with optional circulators.

Each Power Amplifier Module is powered by its associated Power Supply Module. The 60W model operates from a 12V Power Supply Module while 125W models operate from 24V. All Power Amplifier Modules for a given band are interchangeable provided that the Power Supply Module is changed if a 60W Power Amplifier Module is replaced by a 125W Power Amplifier Module. Figure 2-5 shows the front panel layout.

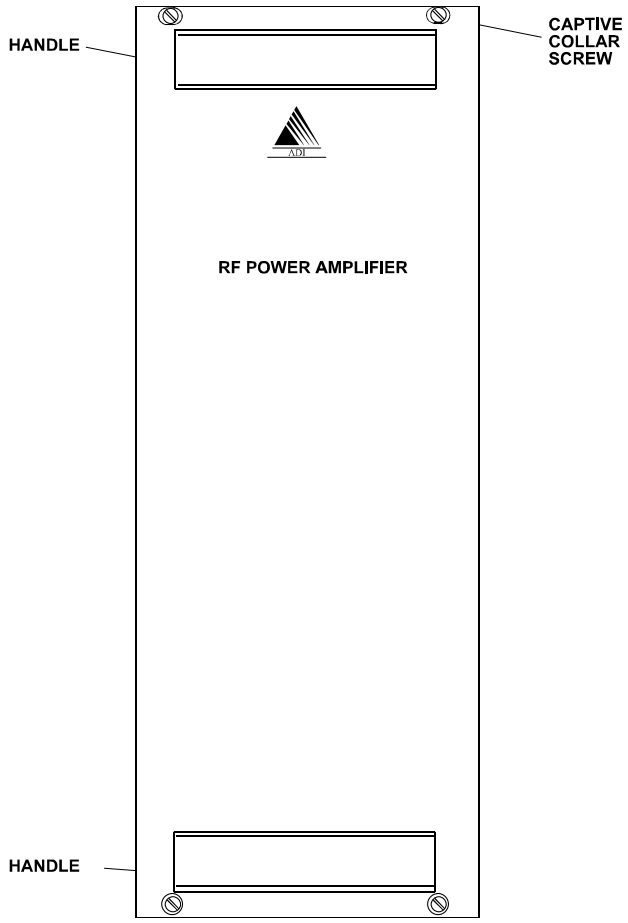


Figure 2-5 POWER AMPLIFIER MODULE FRONT PANEL

The Power Amplifier Module has two connectors. The N-type connector is the Power Amplifier output connector, and the D connector contains RF input, DC power, and serial communications lines.

2.3.4 POWER SUPPLY MODULE

The Power Supply Module provides the system power supply and one Power Amplifier Module with DC power derived from the 240 or 110V AC power and is available in two versions depending on the Power Amplifier Module being used:

- 240/110V AC to 12V DC for 60W PA Modules.
- 240/110V AC to 24V DC for 125W PA Modules.

The inputs of both 240/110V power supplies are fuse-protected and the outputs are over-current protected. They have dry contact (relay contacts) alarm outputs which close when the unit is operating correctly and open in the event of a malfunction. Figure 2-6 shows the Power Supply Module front panel indicators and Table 2-3 lists the indicator functions.

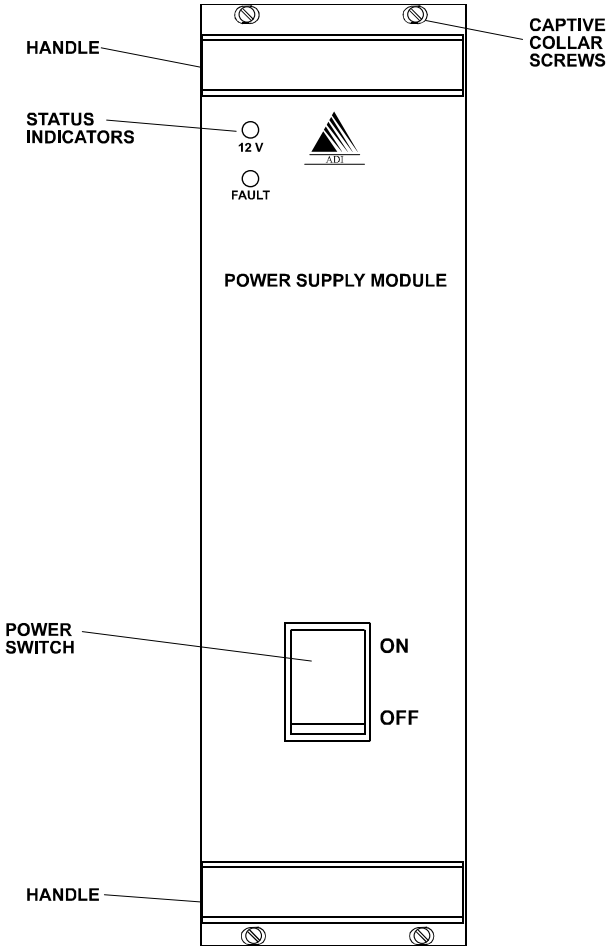


Figure 2-6 POWER SUPPLY MODULE FRONT PANEL

Table 2-3 POWER SUPPLY MODULE CONTROLS AND INDICATORS

ITEM	DESCRIPTION
ON/OFF Switch	Controls application of AC supply to the Power Supply Module.
Red neon indicator (part of switch)	ON indicates that supply is present.
12V (or 24V) (Green LED)	ON indicates that the DC supply is available as output.
FAULT (Red LED)	ON indicates that there is a fault within the Power Supply Module

2.3.5 INTERFACE MODULE

The Interface Module (IM) provides connections for the 5600 Repeater external interfaces. The Front Panel of the Interface Module is shown in Figure 2-7 and the connector functions listed in Table 2-3. Connector pin-outs are listed in Section 3.6.5.

The 2-wire or 4-wire configuration of the Line 1 and Line 2 interfaces for telephone/microwave/tone remote control connection is provided by an additional line interface daughterboard on the Interface Module. Daughterboards are available to provide this connection as 4-Wire plus E & M; or 2-Wire Loop Start and 2-Wire Ground Start. If no connection is required the daughterboard is not needed.

The general-purpose digital I/O provides six configurable inputs and outputs. Two of the output lines may be configured by jumper selection in the Interface Card to provide to drive 12V antenna relays for each of the transceivers. All other outputs, and these two when not configured as antenna drivers, provide optically-isolated contact closures which can be used to control other equipment.

The six inputs are also optically isolated. With an input of 5V to 10V they are sensed as active (on), when open circuited, they are sensed as inactive (off). The first two inputs are used to disable the transmitter during test.

The general purpose input and output lines, apart from the antenna relay outputs and transmit disable inputs, are unused in the present software release. In future releases user-configurability will be available.

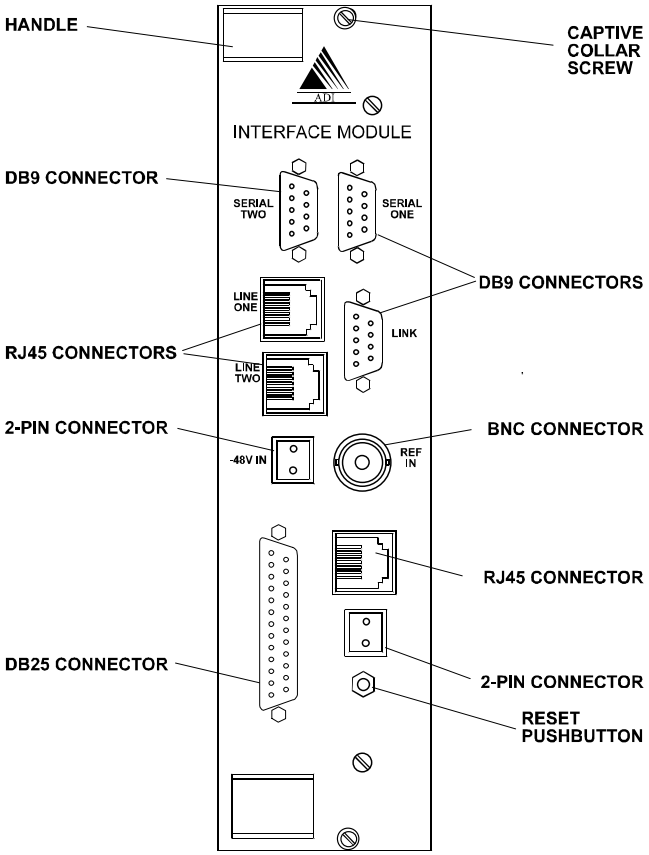


Figure 2-7 INTERFACE MODULE FRONT PANEL

Table 2-4 INTERFACE MODULE EXTERNAL INTERFACES

DESIGNATION	CONNECTOR	DESCRIPTION
LINE 1	RJ-45	Radio 1 connections for: 2-Wire PSTN or PABX 4-Wire + E&M microwave interconnect 2 or 4-Wire Tone Remote unit
LINE 2	RJ-45	Radio 2 connections for: 2-Wire PSTN or PABX 4-Wire + E&M microwave interconnect 2 or 4-Wire Tone Remote unit
SERIAL 1	DB-9 Socket	Radio 1 data connection (RS-232)
SERIAL 2	DB-9 Socket	Radio 2 data connection (RS-232)
LINK	DB-9 Plug	RS-485 serial data connection for APCO Project 25 Fixed Station Interface (Ef), Digital Console Interface or Multi-Site Voting (future options)
NET	RJ-45	Ethernet connection for Network Management Interface (future option)
I/O	DB-25 Socket	General purpose input and output lines (6-inputs and 6-outputs) including dedicated outputs from Antenna Relay Control and dedicated inputs for Transmit Disable.
REF IN	BNC	External 10 MHz reference oscillator input
STBY PWR	2-pin plug	Standby power for reference oscillator oven.
-48 V IN	2-pin plug	DC input for E&M signaling

SECTION 3 INSTALLATION INSTRUCTIONS

3.1 GENERAL

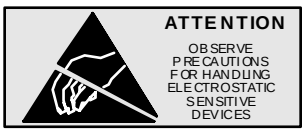
This chapter provides a detailed description of the installation procedure for the 5600 Repeater Dual Channel Radio System and should be read **before** starting the installation. Use the Installation Instructions in conjunction with the configuration checklist for the specific system being installed.

3.2 SAFETY PRECAUTIONS

Observe standard safety procedures for the handling of electronic equipment:

WARNING

FOLLOW CORRECT LIFTING PROCEDURES FOR HEAVY ELECTRONIC EQUIPMENT.



When removing or handling cards, use an anti-static wrist strap connected to ground and always place the card on an anti-static mat.

Handle modules by their edges and do not touch components or connectors.

CAUTION

- Avoid placing the 5600 Repeater near any source of excessive heat
- Avoid placing the 5600 Repeater near a naked flame
- Avoid placing the 5600 Repeater in a wet or damp location
- Do not subject the 5600 Repeater to severe mechanical shock

3.3 SITE REQUIREMENTS

Before installing the 5600 Repeater at the operating site, the following details regarding desk or floor space, rack clearance and lightning protection should be considered.

3.3.1 DESK/FLOOR SPACE OR RACK MOUNTING CONSIDERATIONS

The 5600 Repeater is standard 19 inch rack mountable:

Width	19 inches (483 mm)
Height	14 inches (355 mm)
Depth	17.4 inches (440 mm)
Weight	58 lb (26 kg) single radio configuration
	81 lb (37 kg) dual radio configuration.

When mounting the 5600 Repeater Cabinet:

- Ensure that the 5600 Repeater is securely mounted.
- Ensure that the 5600 Repeater air vents are clear of obstructions.
- Provide sufficient space on all sides to of the 5600 Repeater to allow adequate access to the equipment and cables.
- Ensure that there is adequate space for entry of external cables (antenna and AC power cables) at the rear of the unit without the need for small radius bends.

3.3.2 LIGHTNING PROTECTION

To minimize damage to equipment, or injury to maintainers, a complete system of lightning protection and grounding connections should be installed. The following points should be considered:

- All down conductors, bonding interconnections, ground rings and radial tapes should be un-insulated solid copper tape at least 25 x 3 mm in cross section. All connection clamps and supports should be protected by non-reactive paste or tape.

- The use of gas lightning arresters or metal oxide varistors is recommended on line interfaces, including antenna cables.

- Protected test points should be included where appropriate and sacrificial grounding lugs should be clearly marked and accessible for periodic inspection and replacement if necessary.

- Use a large copper strap to take outer cable casings to a central ground bonding point.

- Antenna support structures, whether on the ground or on a building, should be connected to an o ring arrangement (or equivalent) via sacrificial ground lugs.

- A ground ring consists of copper tape with driver ground electrodes or radial tapes around the base of the structure (as close to it as possible), buried approximately 24 inches (0.6 m), where soil conditions allow.

- The main building and any other metalwork structures within 3m (≈ 10 ft.) should be connected to a ground ring.

3.4 DELIVERY AND UNPACKING

The 5600 Repeater cabinet and supporting modules are packed and transported in customized packages which conform to best commercial practices for transportation and protection of electronic assemblies.

The 5600 Repeater cabinet is delivered complete, requiring only the fitting of the plug in modules.

In addition to the 5600 Repeater cabinet, the Modules which may be supplied in separate packages are:

- One or two Power Supply Modules.
- One or two Power Amplifier Modules.
- One or two Transceiver Modules.
- Controller Module.
- Interface Module.

In addition a programming kit may be provided, including a programming disk and interface cable.

Before unpacking, examine the packages for evidence of external damage, water ingress or vermin activity which may have occurred during transportation.

Examine the delivery docket or installation check list to confirm that the correct items for the intended 5600 Repeater configuration has been delivered.

Notify the supplier or its agent immediately if any discrepancy is noted.

Unpack the 5600 Repeater as follows:

- Carefully remove the 5600 Repeater cabinet from its packaging and relocate to a convenient level work surface.

- Remove all protective wrapping and inspect the cabinet for signs of damage or loose parts. Notify the supplier or its agent immediately if any is noted.

- Remove each of the modules in turn from their packages, unwrap and inspect as for the cabinet. Notify the supplier or its agent immediately if any damage or loose parts are noted.

3.5 INSTALLATION

CAUTION

Take care to align each module correctly into its guide rails. Ensure that the module is correctly mated into the backplane of the 5600 Repeater and the connectors are firmly seated. Failure to do so may result in damage to the module or 5600 Repeater system.

3.5.1 TOOLS REQUIRED

The following tools should be on hand during installation:

- Flat-bladed screwdrivers (small, medium and large).
- Cross-recessed (Phillips) screwdriver (large and medium).
- Cable ties and cutters.
- 9/32 inch (7 mm) hexagonal nut driver.
- Multimeter with pointed probes for continuity and DC voltage measurements.

3.5.2 INSTALLING THE 5600 REPEATER CABINET

If the 5600 Repeater is to be desk mounted then screw the supplied feet to the four threaded inserts on the underside of the case and position the case as required.

If the cabinet is to be rack-mounted then assemble the rack mounting brackets and case as shown in Figure 3-1: 5600 Repeater Rack Mounting Arrangement:

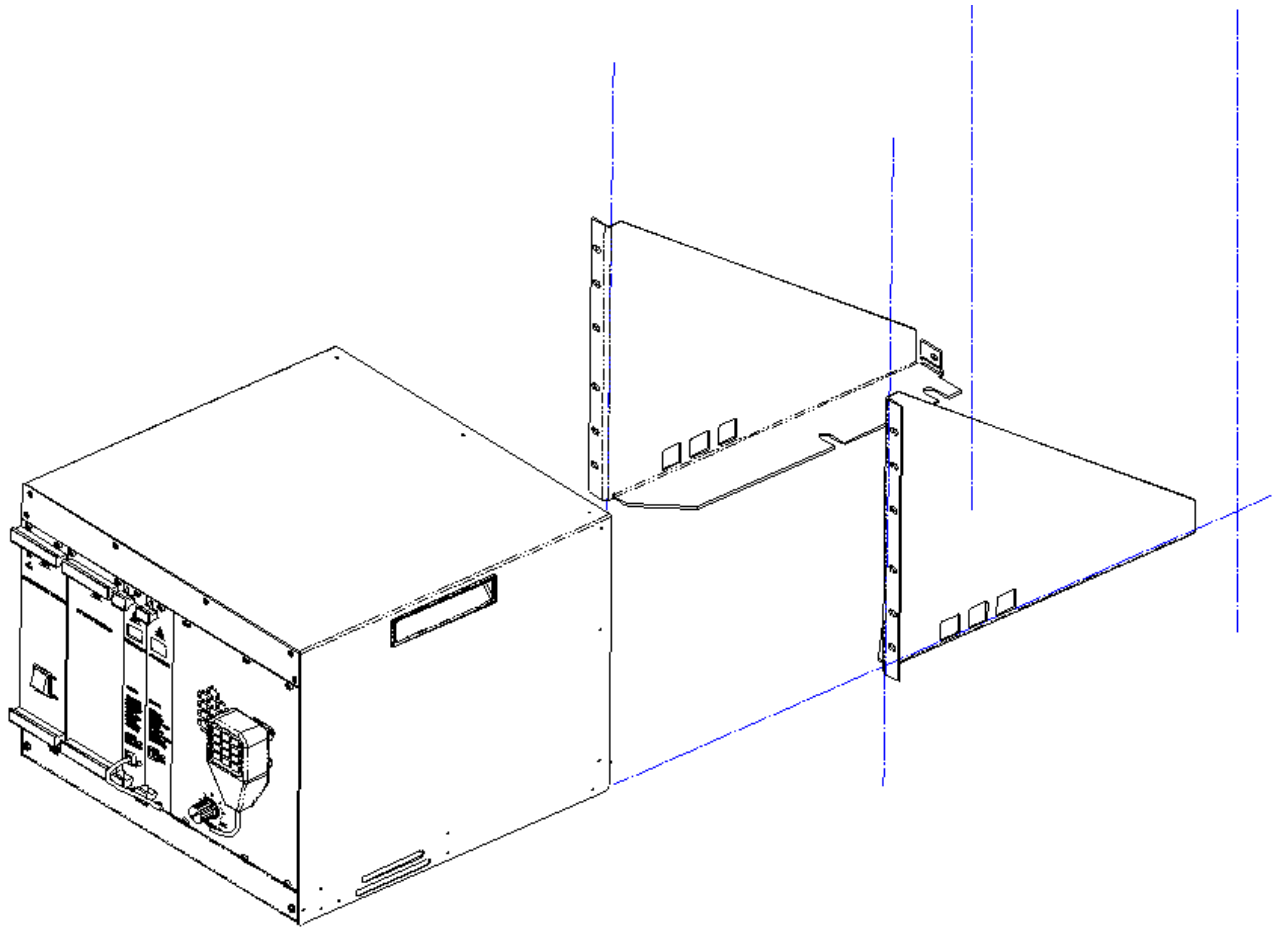


Figure 3-1 5600 REPEATER RACK MOUNTING ARRANGEMENT

1. Fit the brackets to the rack using the caged nuts and bolt supplied.

2. Slide the 5600 Repeater case into the brackets.

3. Fix the 5600 Repeater in place by locating the two studs at the rear of the case through the hole in each bracket, and secure using the nuts supplied.

4. Configuring 5600 Repeater Identity (Box ID)

3.5.3 CONFIGURING 5600 REPEATER IDENTITY (BOX ID)

An 8-way DIP switch on the backplane adjacent to Transceiver 2 enables a Box ID to be set for each 5600 Repeater. The switch is accessed from the front of the unit with the modules removed. A total of 256 identities are available.

The Box ID is used by each Transceiver to determine its default settings on power-up. Transceiver modules can be programmed with up to 512 operating channels, and the default operating channel for each Transceiver is determined by the 5600 Repeater Box ID as detailed in Appendix A Table A-1.

5600 Repeater Box ID settings may be defined in a plan that covers all 5600 Repeater units in the network. The Box ID is also used by the Controller Module for network management purposes to enable it to identify itself within a network.

The default factory setting is a box identity of zero.

To set the DIP switches:

1. Locate the DIP switch on the upper right of the backplane, through the front of the 5600 Repeater case without the plug in modules fitted.

2. Using a screwdriver or pen, set the eight sections of the DIP switch to the desired Box ID, according to the intended 5600 Repeater Box numbering plan.

3. The Switch 1 (LSB) is the top switch; Switch 8 (MSB) is the lower switch. OFF is to the left, ON is to the right.

3.5.4 INSTALLING THE MODULES

Refer to Figure 3-2, Figure 3-3 and Figure 3-4 to identify the correct position for each module within the 5600 Repeater cabinet. Install the supplied modules as detailed in the following paragraphs.

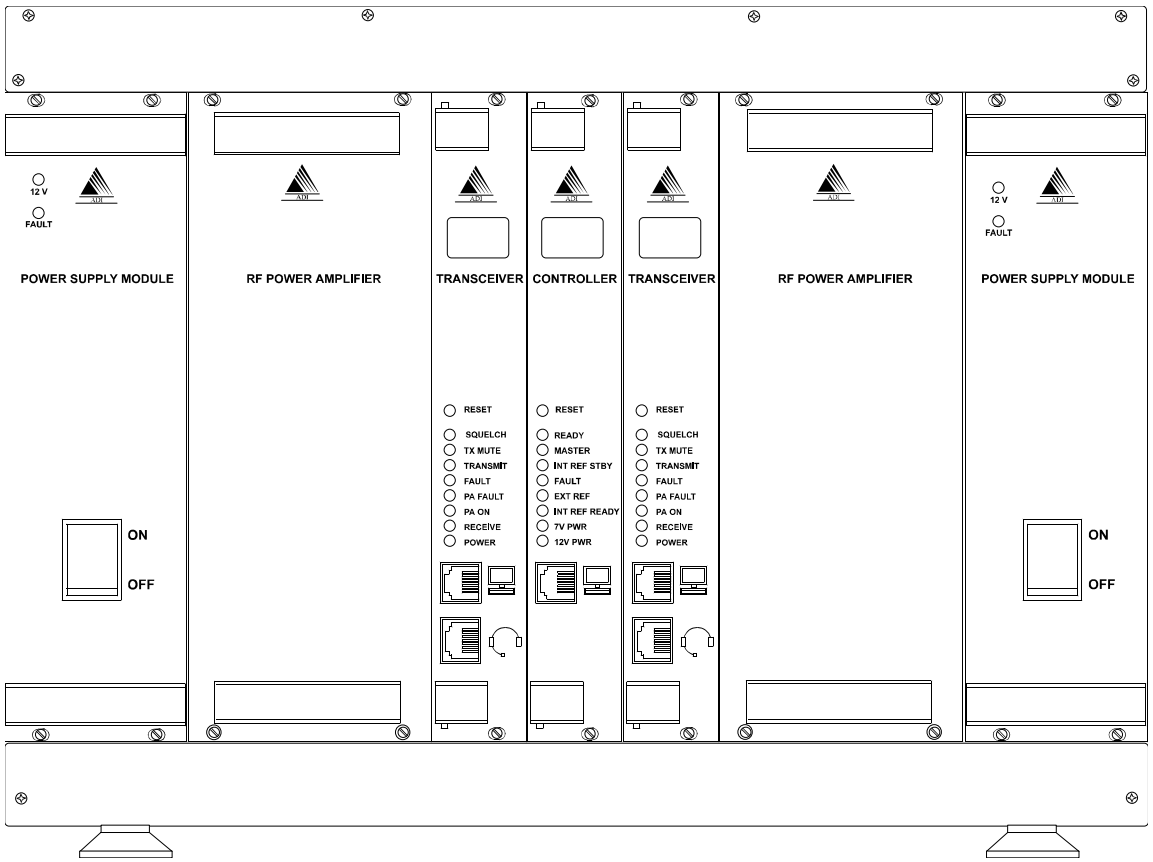


Figure 3-2 5600 REPEATER FRONT MODULE POSITIONS

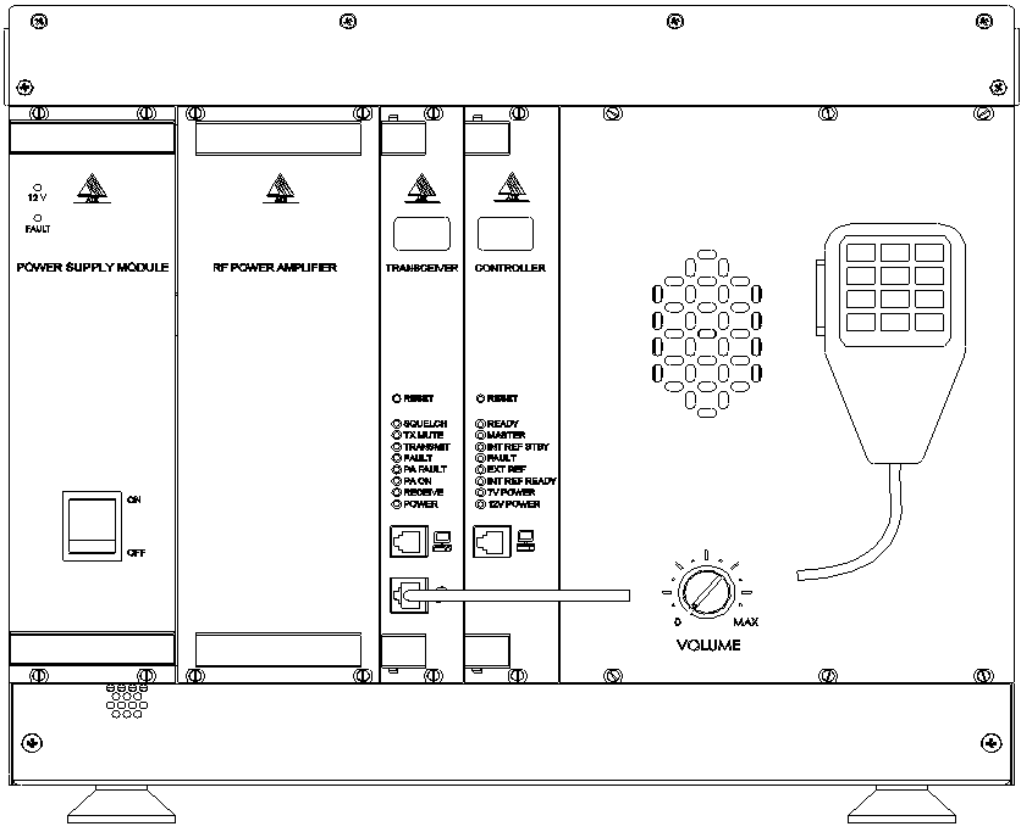


Figure 3-3 5600 REPEATER WITH LOUDSPEAKER AND MICROPHONE FITTED

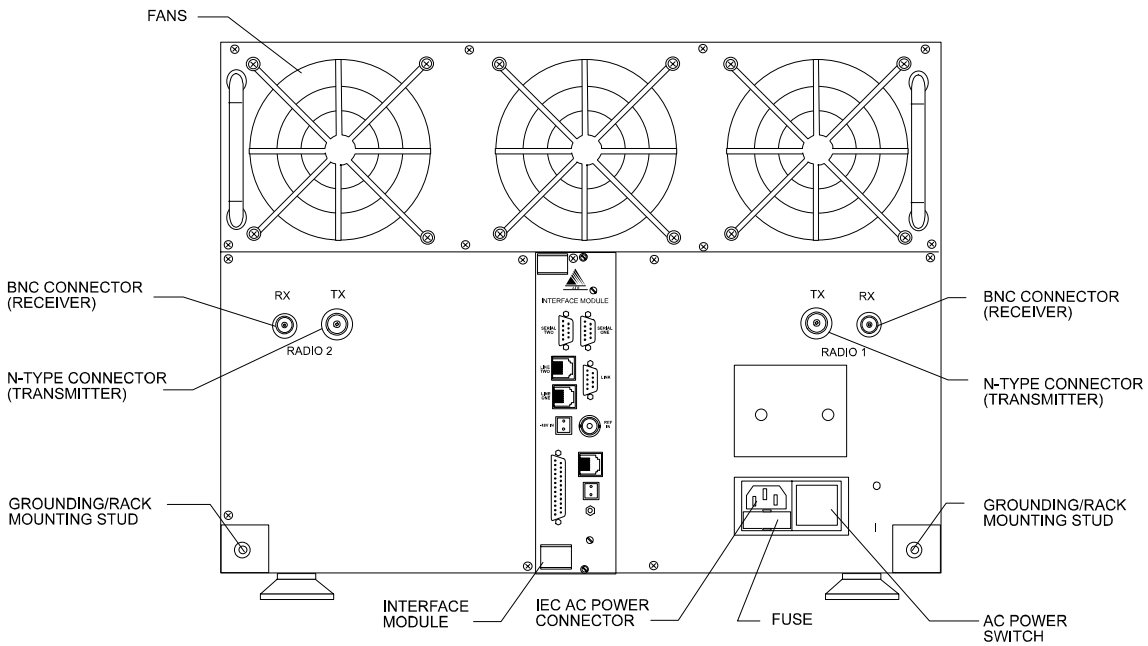


Figure 3-4 5600 REPEATER REAR MODULE POSITIONS

Power Supply Module

To install the Power Supply Module:

1. Carefully insert the Power Supply Module into its position from the front of the cabinet by aligning the guide rails and pushing home until the backplane connector is correctly mated and the panel is flush with the adjacent panels.

2. Using a medium sized flat-bladed screwdriver, secure the Module with the four captive collar screws. Do not over-tighten.

3. If two Power Supply Modules are supplied, repeat for the other module.

Power Amplifier Module

To install the Power Amplifier Module:

1. Locate the coax lead with a right-angled N-type connector. Stretch the lead out of the box and partially insert the Power Amplifier into its card slot. Attach the N-type connector to the mating connector on the Power Amplifier, then carefully insert the Power Amplifier Module fully into position from the front of the cabinet. Push the module home so that the backplane connector is correctly mated and the panel is flush with the adjacent panels.

2. Using a medium sized flat-bladed screwdriver, secure the Module using the four captive collar screws. Do not over-tighten.

3. If two Power Amplifier Modules are supplied, repeat for the other module.

Transceiver Module

To install the Transceiver Module:

1. Carefully insert the Transceiver Module into its position from the front of the cabinet by aligning the guide rails and pushing home until the backplane connector is correctly mated and the panel is flush with the adjacent panels.

2. Using a medium sized flat-bladed screwdriver, secure the Module using the two captive collar screws. Do not over-tighten.

3. If two Transceiver Modules are supplied repeat for the other module.

Controller Module

To install the Controller Module:

1. Carefully insert the Controller Module into its position from the front of the cabinet by aligning the guide rails and pushing home until the backplane connector is correctly mated and the panel is flush with the adjacent panels.

2. Using a medium sized flat-bladed screwdriver, secure the Module using the two captive collar screws. Do not over-tighten.

Interface Module

To install the Interface Module:

1. Carefully insert the Interface Module into its position from the rear of the cabinet by aligning the guide rails and pushing home until the backplane connector is correctly mated and the panel is flush with the adjacent panels.

2. Using a medium sized Phillips screwdriver, secure the Module using the two captive screws. Do not over-tighten.

Loudspeaker Panel and Microphone

A 5600 Repeater configured with only one transceiver may have a Loudspeaker Panel, (or a Loudspeaker Panel and microphone) installed in place of Transceiver 2 and its associated PA and power supply.

To install the Loudspeaker Panel and microphone:

1. The panel is installed on the right hand side of a single channel 5600 Repeater in place of Transceiver 2. An internal cable is connected from the rear of the loudspeaker panel to the connector marked “TR1 Audio” on the 5600 Repeater backplane adjacent to Transceiver 2.

2. Carefully align the panel and using a medium sized flat-bladed screwdriver secure the panel using the six captive collar screws.

3. If the panel is supplied with a microphone, the cable is connected to the Transceiver 1 front panel audio connector (RJ-45).

3.6 CONNECTIONS

3.6.1 GROUNDING STRAP

Before connecting the 5600 Repeater, it is recommended that a secure ground strap be connected from the grounding stud at the rear left hand side of the 5600 Repeater case to a substantial ground system:

1. Locate the primary grounding stud at the rear of the chassis on the lower left hand side.

2. Connect a grounding strap from an external grounding point or ground ring to the chassis primary grounding stud.

3. Ensure good electrical contact and security of all connections.

3.6.2 AC POWER

An IEC standard AC power cable is provided with the AC and DC revert configurations. Connect the AC power cable as follows:

1. Set the power switch on the rear of the 5600 Repeater to OFF.

2. Plug-in the IEC connector of the cable to the recessed IEC plug on the rear of the 5600 Repeater.

3. Connect the other end of the AC power cable to a properly protected and grounded AC power outlet.

3.6.3 DC POWER

External DC power connection for DC and DC revert configurations is via a 2-way terminal block mounted on the rear of the 5600 Repeater above the mains input receptacle. Connect DC power cable as follows:

1. Ensure that DC power is not applied to the cables being connected to the 5600 Repeater.

2. Strip back 3/8” of cable insulation on both positive and negative cables.

3. Insert positive supply into the topmost terminal (Red) and negative supply into the lower terminal (Black).

4. Secure both terminal screws and apply DC power to cable.

5. DC configurations include an internal fuse within the 5600 Repeater, however to allow isolation of the unit it is recommended that a circuit breaker or DC switch is placed in the DC circuit to the 5600 Repeater.

3.6.4 ANTENNA CABLING

The length and type of antenna cabling required depends on the system configuration and will be supplied separately. Connect the Transmit (N-type) and Receive (BNC type) cables to the Transmit and Receive connectors on the rear of the cabinet to the Antenna system.

3.6.5 EXTERNAL INTERFACES

The 5600 Repeater supports the following external interfaces:

- Transceiver Module audio connector.
- Transceiver Module programming connector.
- Radio serial data.
- Analog line connections for PSTN, PBX, Microwave or tone remote control unit.
- RS-485 serial data (for future use as APCO Project 25 Fixed Station Interface (Ef) and digital console interface.
- Ethernet connection for future use as a network management interface.
- General purpose input/output lines.
- External 10 MHz reference source input.
- Standby power to maintain temperature of reference oscillator oven during power outages.
- -48 V DC input for operation of E & M signalling interface.

Transceiver Module Audio Connector

Function:	Connects external microphone or speaker or both to Transceiver Module
Located:	Transceiver Module front panel (lower connector)
Connector:	RJ-45
Pin allocation:	(Pin 1 is the top pin looking from the front of the module)

Pin	Function
1	Microphone audio
2	Ground
3	Line/speaker output (link selectable on the Tx module)
4	Microphone supply (+12 V)
5	PTT (Active Low)
6	Monitor (Active Low)
7	SW1 (Active Low)
8	SW2 (Active Low)

Transceiver Module Programming Connector

Function: Connects programming PC to Transceiver Module
Located: Transceiver Module front panel (upper connector)
Electrical: RS-232
Connector: RJ-11
Pin allocation: (Pin 1 is the top pin looking from the front of the module)

Pin	Function
1	N/C
2	Reserved
3	Transmit data (output)
4	Receive data (input)
5	Ground
6	N/C

Controller Module Serial Data Connector

Function: Connects Diagnostic PC to 5600 Repeater
Located: Controller Module front panel
Electrical: RS-232
Connector: RJ-11
Pin allocation: (Pin 1 is the top pin looking from the front of the module)

Pin	Function
1	RTS (outpuyt)
2	CD (input)
3	Transmit data (output)
4	Receive data (input)
5	Ground
6	CTS (input)

Radio Serial Data

Function: APCO Project 25 Data Host Interface (Ed) for circuit switched data
Status: Future enhancement, software upgrade
Located: Interface Module
Label: Serial One, Serial Two (one per transceiver module)
Electrical: RS-232
Connector: DB-9 (female)
Pin allocation:

Pin	Function
1	Reserved
2	Receive data (input)
3	Transmit data (output)
4	Reserved
5	Ground
6	Reserved
7	Reserved
8	Reserved
9	Reserved

Analog Line Connection

Function: Provides line connections for PSTN, PBX, Microwave or Tone Remote Control unit. (4-Wire functional, 2-Wire future enhancement).
Located: Interface Module
Label: Line One and Line Two (one per transceiver module)
Electrical: See Pin Allocation below
Connector: RJ-45
Pin allocation: (Pin 1 is the lower pin on the connector)

Pin	2-Wire	4-Wire
1	Reserved	SB
2	Reserved	M-Lead
3	Reserved	Rx Audio (+) (balanced signal, 600R, 0 dBm nominal)
4	Ring	Tx Audio (+) (balanced signal, 600R, 0 dBm nominal)
5	Tip	TX Audio (-) (balanced signal, 600R, 0 dBm nominal)
6	Reserved	RX Audio (-) (balanced signal, 600R, 0 dBm nominal)
7	Reserved	SG
8	Reserved	E

4-Wire Console/Exchange Pin Allocation: The default configuration of the 4-Wire interface is as a console interface with pin allocation as shown above, suitable for connection to a Tone Remote Console.

The interface may be reconfigured by jumper placement to an exchange interface suitable for connection to a PSTN or PABX network. The exchange configuration has pin 3 connected to 5600 Repeater Transmit Audio (-), pin 4 connected to 5600 Repeater Receive Audio (+), and is otherwise the same as the console configuration pin allocation.

To configure the pin allocation as either a console or exchange interface place the jumpers on connectors XL5, XL6 (line 1) and XL3, XL4 (line 2) as follows:

	Line 1	**Line 2**
Connectors	L5 & XL6	XL3 & XL4

Console configuration jumper position (default)

Line 1	**Line 2**
pin 1- pin 2	pin 1- pin 2

Exchange configuration jumper position

Line 1	**Line 2**
pin 2- pin 3	pin 2- pin 3

RS-485 Serial Data

Function: Provides vocoded voice for APCO Project 25 Fixed Station Interface (Ef) or for a digital console interface. Future enhancement, software upgrade.
Located: Interface Module front panel
Label: LINK
Electrical: RS-485
Connector: DB-9 (male)

Pin allocation:

Pin	**Function**
1	Reserved
2	Transmit data + (out of IAC)
3	Transmit data - (out of IAC)
4	Reserved
5	Ground
6	Reserved
7	Receive data + (into IAC)
8	Receive data - (into IAC)
9	Reserved

Ethernet

Function: Network management interface and APCO Project 25 Data Host Interface (Ed) for packet data.
Status: Future enhancement, software upgrade.
Located: Interface Module
Label: NET
Electrical: 10Base-T
Connector: RJ-45
Pin allocation: Pin 1 is the lower pin).

Pin	**Function**
1	Transmit data + (out of IDC)
2	Transmit data - (out of IDC)
3	Receive data + (into IAC)
4-5	Reserved
6	Receive data - (into IAC)
7-8	Reserved

General Purpose Input/Output Lines

Function: Provides 6 general purpose inputs and outputs for control of transmit/receive antenna change-over relays, external site alarms and functions.
Located: Interface Module
Label: I/O
Connector: DB-25 (female)
Pin allocation:

Pin	**Function**
1	Antenna relay output radio 1: +
14	Antenna relay output radio 1: -
2	Antenna relay output radio 2: +
15	Antenna relay output radio 2: -
3	General purpose output 3: +
16	General purpose output 3: -
4	General purpose output 4: +
17	General purpose output 4: -
5	General purpose output 5: +
18	General purpose output 5: -
6	General purpose output 6: +
19	General purpose output 6: -
7	Transmit disable input radio 1: +
20	Transmit disable input radio 1: -
8	Transmit disable input radio 2: +
21	Transmit disable input radio 2: -
9	General purpose input 3: +
22	General purpose input 3: -
10	General purpose input 4: +
23	General purpose input 4: -

Pin	Function
11	General purpose input 5: +
24	General purpose input 5: -
12	General purpose input 6: +
25	General purpose input 6: -
13	Ground

Transmit disable inputs: When the + input is connected to +12V and the - input to ground the relevant transmitter is disabled.

Antenna relay outputs: Ensure that 4 links are present on Interface Module XM3. When the radio PTT is active, the + output is connected to +12V, the - output is connected to ground.

External 10 MHz reference source

Function: Provides 10 MHz input. When present automatically used in preference to internal 10 MHz reference
Located: Interface Module
Label: REF IN
Electrical: Level between 450 mV P-P and 4V P-P, impedance 50 Ohm
Connector: BNC
Pin allocation:

Pin	Function
Inner	External reference input
Outer	Ground

Standby power

Function: Maintain internal reference oscillator during power outages.
Located: Interface Module
Label: STDBY IN
Electrical: 12V DC (+/- 5%) input, max. current 1A
Connector: 2-pin (male). Mating plug: Phoenix Contact MSTB 2.5/2-ST-5.08
Pin allocation:

Pin	Function
Upper	+12 V DC ground (0 V)
Lower	+12 V DC input

48 V DC input

Function: Provides –48V DC input for E/M signaling
Located: Interface Module
Label: -48V DC
Connector: 2-pin (male) Mating plug: Phoenix Contact MSTB 2.5/2-ST-5.08

Pin allocation:

Pin	Function
Upper	-48V DC ground (0V)
Lower	-48V DC input

SECTION 4 OPERATING INSTRUCTIONS

4.1 INTRODUCTION

After installation (as described in Section 3), normal operation of the 5600 Repeater is achieved by applying power to the 5600 Repeater and switching on the rear panel power switch and the Power Supply Modules.

The 5600 Repeater Modules will perform self-test diagnostics after power is applied. Visual indicators on the module front panels convey the status of the 5600 Repeater to the Operator. If any of these visual indicators show an error or fault code, simple faultfinding procedures may identify the problem and suggest an immediate solution.

If operational checks reveal a fault in 5600 Repeater equipment, it may be necessary to replace it. Removal of equipment is the reverse of the installation procedure described in Section 3. Any faulty items should be carefully packaged and sent to an authorized repair center.

If faults are not corrected by substituting equipment at an operational level, contact the supplier or its representative.

Additional connectors on the front and back panels of selected equipment allow maintenance personnel to access functions for system configuration, operational statistics and faultfinding.

4.2 SWITCHES

There are two types of switches on the front panels of the 5600 Repeater: Power and Reset switches.

If an AC supply is used with the 5600 Repeater, there is a master power supply switch on the rear of the unit which should be turned on first. The power switches on the front panel of the Power Supply Modules are switched on next.

Recessed reset switches on the Transceiver, Controller and Interface Modules (optional) allow the equipment to be reset. Table 4-1 describes each reset switch and its function.

Table 4-1 RESET SWITCHES

EQUIPMENT	RESET FUNCTION
Interface Module	Resets all cards.[1]
Controller Module	Resets the clocks for all modules.[2]
Transceiver Module	Resets the Transceiver Module.[2]
[1] accessed from rear [2] accessed from front	

4.3 APPLYING POWER

Perform the following final checks before applying power:

1. Check that the ground wires are connected to the 5600 Repeater primary ground from an external ground point.

2. Check that all equipment and connections are secure.

3. Ensure the power cable to the 5600 Repeater is plugged in securely and switch power on.

4. Switch on each Power Supply Module

NOTE: DC direct configurations have no power supplies or switches.

4.3.1 INITIAL POWER-ON CHECKLIST

Refer to Table 4-2 to verify that power indications are correct. Should displays or indicators suggest a fault condition, refer to Section 4.3.2 before proceeding.

Table 4-2 POWER ON INDICATORS

Module	Indicator	Normal Power On Indication
Power Supply	ON	Red Lamp lit (in switch)
Controller	12V Power	Green LED lit
Controller	7V Power	Green LED lit
Transceiver	Power	Green LED lit

Table 4-3 FAULTFINDING CHART FOR POWER ON PROBLEMS

FAULT	PROBABLE CAUSE	RECOMMEDED ACTION
Red lamp in power switch of Power Supply Module not lit.	Poor supply connection.	Check all connections to the relevant equipment.
	Supply faulty.	Check supply for correct output of 115V/240V AC or 12V/24V DC as appropriate.
	Power fuse blown.	Replace fuse as detailed in Section 4.3.3.
Output lamp on Power Supply Module not lit.	Power Supply Module failure.	Substitute known good Power Supply Module and re-test.
7V PWR or 12V PWR lamps on Controller or Transceiver Module fail to light.	System Power Supply failure.	Check outputs of System Power Supply on the backplane as detailed in Section 4.3.4.
	Controller Module failure.	If voltages are present, switch power off, substitute known good Controller Module and re-test.
	Transceiver Module failure.	If voltages are present, switch power off, substitute known good Transceiver Module and re-test.
Controller or Transceiver Module display error code in the range E1 to E99	User serviceable failure or Module failure.	See Table B-1 in Appendix B for likely cause and recommended action.

The 5600 Repeater performs a self test and warm-up routine at power-on. During this, the Controller display flashes while the Transceiver display remains blank. When the warm-up is complete, the Controller READY indicator illuminates and the display changes to an oscillating pattern. The Transceiver then tunes to its default channel and displays the channel number, and the unit is ready to operate.

At normal temperatures the Controller takes approximately one minute to warm up, however at -30°C warm-up will take up to 10 minutes.

4.3.2 POWER-ON FAULTFINDING

If the power-on indicators do not display normally, refer to Table 4-3 for simple faultfinding procedures. Check each indication in sequence, proceeding to the next fault only when the previous one has been eliminated.

4.3.3 FUSE REPLACEMENT

AC 5600 Repeater units are protected by a single fuse located on the IEC connector/switch module. To check and if required, replace the 5600 Repeater AC power fuse, proceed as follows:

1. Switch off all power to the 5600 Repeater and disconnect the Mains lead.
2. Unclip and withdraw the fuse slide immediately below the AC power connector on the IEC connector/switch module on the rear of the cabinet.
3. Remove the fuse from the slide and check the continuity using a multimeter. If the fuse is ruptured, replace with a new 205 size (20 x 5) 10 Amp cartridge fuse.
4. Fit the fuse to the slide and push the fuse slide firmly home.
5. 5600 Repeater units fitted with DC input are protected by fuses located adjacent to the DC power input connector. Each Power Amplifier Module is protected by a separate fuse.

To check and, if required, replace the 5600 Repeater DC power fuse, proceed as follows:

6. Switch off DC power to the 5600 Repeater.
7. Unclip and withdraw the relevant fuse slide immediately below the DC power input connector on the rear of the cabinet.
8. Remove the fuse from the slide and check the continuity using a multimeter. If the fuse is ruptured, replace with a new ¼" x 1 ¼" 20 Amp cartridge fuse.
9. Fit the fuse to the slide and push the fuse slide firmly home.

4.3.4 CHECKING SYSTEM POWER SUPPLY OUTPUTS

To check the presence of 7V and 12V DC outputs from the System Power Supply, proceed as follows:

1. Disconnect and remove the Controller and Transceiver Modules from the front of the 5600 Repeater cabinet.

2. Observe the position of the backplane and identify the 12V DC and 7V DC test points between the connectors for Transceiver 1 and the Controller.

3. Connect the negative probe of a Multimeter to the 0V test point or the 5600 Repeater system cabinet grounding stud.

4. Using the positive lead, probe the +12V and +7V test points on the backplane card for the presence of the indicated voltages ± 5%.

4.3.5 REPLACING SYSTEM POWER SUPPLY

If the above test indicates the lack of one or both voltage rails, replace the System Power Supply as follows:

WARNING

ENSURE ALL POWER IS SWITCHED OFF BEFORE ATTEMPTING TO WORK ON THE 5600 REPEATER.

1. Switch off all power to the 5600 Repeater and disconnect the Mains lead.

2. Disconnect and remove the Interface Module from the rear of the 5600 Repeater cabinet.

3. Disconnect and remove the antenna system RF cables from the rear of the 5600 Repeater.

4. Remove the four Philips head screws securing the left-hand rear panel of the 5600 Repeater.

5. Ease the panel out from the Cabinet, disconnect the two RF cables from the inside of the bulkhead connectors on the panel, and carefully lay the panel aside.

6. Remove the four Philips head screws from the right-hand rear panel of the 5600 Repeater.

7. Ease the panel out from the 5600 Repeater Cabinet, disconnect the two RF cables from the inside of the bulkhead connectors on the panel, and carefully lay the panel aside.

8. Locate the 4-pin DC power connector on the backplane and disconnect.

9. Locate System Power Supply DC input power leads, trace these leads to the DC power distribution terminal block located in the area behind the right hand rear panel of the cabinet and disconnect. *Note the connection points for reference during refitting.*

10. Using a 9/32 inch (7 mm) hexagonal nut driver, remove the four Nyloc nuts securing the Power Supply Module to the studs on the rear of the left-hand panel and remove the Power Supply Module.

11. Refitting is a reversal of the removal procedure.

4.4 OPERATIONAL FAULTFINDING

If, during operation, the 5600 Repeater should fail to operate as expected, observe the status indicators and displays of the modules as described in Section 2. Press the RESET button of the Controller Module and the Transceiver Module and re-evaluate the condition. If this fails to clear the problem, proceed with the faultfinding detailed in Table 4-4.

4.5 CONFIGURATION

If all the external indications are that the 5600 Repeater is operational, proceed with the configuration process using the Transceiver Module Programmer application as described in Section 5. Once configuration has been completed, the 5600 Repeater can be tested in its intended system environment.

Channels may be configured as fixed channels or scan channels as described in Section 5.

Table 4-4 FAULTFINDING CHART FOR OPERATIONAL PROBLEMS

INDICATION	PROBABLE CAUSE	RECOMMEDED ACTION
Fault lamp on Controller Module lit and error code displayed.	Controller Module failure.	Note displayed error code on Controller Module: see Appendix B for recommended action.
Fault lamp on Transceiver Module lit and error code displayed.	Transceiver Module failure.	Note displayed error code on Transceiver: see Appendix B for recommended action.
PA fault lamp on Transceiver Module lit and error code displayed.	Power Amplifier Module failure.	Note displayed error code on Transceiver: see Appendix B for recommended action.
Repeater fails to transmit SWR Error E08.	Antenna System failure.	Check antenna system for damage and ensure correct connections.
	Power Amplifier Module failure.	Switch power off, substitute known good Power Amplifier Module and re-test.
Repeater fails to receive.	Antenna System failure.	Check antenna system for damage and ensure correct connections.
	Transceiver Module failure.	Switch power off, substitute known good Transceiver Module and re-test.
Failure of external interfaces.	Interface Module failure.	Switch power off, substitute known good Interface Module and re-test.

4.5.1 FIXED CHANNEL OPERATION

Fixed channels will operate according to all the parameters entered in the channel settings dialog box (see Section 5).

4.5.2 SCAN CHANNEL OPERATION

Scan channels may be set up to scan between up to eight channels. The first channel selected in the scan sequence will define the operating mode (local or remote basestation or repeater), station ID, timers, encryption, power output and source priority during all scanning. The 5600 Repeater will scan between the channel mode, spacing, talk group ID, receive configuration and transmit configuration of each selected channel.

The 5600 Repeater will scan sequentially through the selected channels, with a maximum scan rate of 2 channels per second (500ms on each channel), unless a valid signal is detected on a channel. If a valid signal is detected then the 5600 Repeater will remain on that channel until the call is completed, then continue scanning. The scan channel can also be programmed with additional dwell times, such that the 5600 Repeater will remain on the channel for the specified dwell time after the completion of a call, to allow for a return call.

4.6 LOCAL OPERATION

The 5600 Repeater may be operated locally by using a DTMF microphone and speaker connected to the front panel handset socket of the transceiver module. Each transceiver must have a separate speaker and microphone.

4.6.1 MONITORING AUDIO

In single channel configurations a loudspeaker panel may be fitted to the unit to provide a speaker and volume control (refer to Section 3.5.4). Audio may be also monitored from the Transceiver Module via an external speaker connected to the front panel RJ-45 audio connector.

The speaker will monitor audio on the selected channel of the transceiver, with receive parameters as defined by the channel table entry in the Transceiver Module Programmer. In normal operation all traffic with a valid NAC (digital mode) or CTCSS/CDCSS (analog mode) will be routed to the speaker. When operating as a basestation the unit may be put into 'monitor' mode by keying the sequence ***5*** on a DTMF microphone connected to the transceiver module audio connector. In monitor mode all traffic on the receive frequency will be routed to the speaker irrespective of NAC or CTCSS/CDCSS. The DTMF key sequence ***5*** will revert the basestation to normal squelch mode.

NOTE: The DTMF key # will erase any preceding (incomplete) DTMF key sequence.

4.6.2 MAKING CALLS

Calls may be sent from the 5600 Repeater using a microphone connected to the transceiver module front panel RJ-45 audio connector. Calls will be broadcast with the transmit NAC and Talkgroup ID (digital mode) or transmit CTCSS/CDCSS (analog mode) of the transceiver's current channel, as defined by the channel table entry in the Transceiver Module Programmer.

4.6.3 CHANGING AUDIO VOLUME

If a loudspeaker panel is fitted, audio volume is controlled by the volume knob on the panel. If an external speaker is connected, audio volume may be controlled using a DTMF microphone connected to the transceiver module front panel RJ-45 audio connector. The DTMF key sequence ***2***nn* will set audio volume to level 'n' between 00 (off) and 09 (full volume).

NOTE: the DTMF key # will erase any preceding (incomplete) DTMF key sequence.

4.6.4 CHANGING SELECTED CHANNEL:

The transceiver's current channel may be changed using a DTMF microphone connected to the transceiver module front panel RJ-45 audio connector. The DTMF key sequence ***1***nnn* will change the transceiver to channel 'nnn'. The selected channel will be displayed on the front panel of the transceiver module.

NOTE: the DTMF key # will erase any preceding (incomplete) DTMF key sequence.

4.6.5 SQUELCH ADJUSTMENT

The receiver squelch level may be set in analog mode using a DTMF microphone connected to the transceiver module front panel RJ-45 audio connector. The DTMF key sequence ***3***nn* will change the squelch level as follows:

- ***3***00* sets carrier squelch.
- ***3***nn* sets squelch level to 'nn' dB SINAD where 'nn' is between 06 and 20.
- Squelch hysteresis is 2dB.

4.7 REMOTE OPERATION

The 5600 Repeater may be controlled remotely using any industry standard tone remote control console over 2- or 4-Wire telephone lines using leased lines or dial up, provided the 5600 Repeater is fitted with the corresponding two or four wire line interface option. One line is used for each transceiver. To configure the 5600 Repeater for remote operation:

1. Connect the 2- or 4-Wire line(s) to the RJ-45 line socket on the interface module at the rear of the 5600 Repeater.

2. Configure the allocation of function tones (F1 up to F12) if required (this functionality is part of the Transceiver Module Programmer software described in Section 5).

Connect the tone remote console to the line and operate according to the console manufacturer's instructions.

SECTION 5 CONFIGURATION

5.1 OVERVIEW

Configuration of the 5600 Repeater is performed using the Windows™-based Transceiver Module Program software application running on an IBM™ compatible PC connected to the RS-232 port (RJ-11) on the Transceiver Module of the 5600 Repeater.

5.2 GETTING STARTED

5.2.1 SYSTEM REQUIREMENTS

The minimum system requirements for operation of the Transceiver Module Program software application are given in Table 5-1.

5.2.2 MAKING A BACKUP COPY OF THE TRANSCEIVER MODULE PROGRAMMER DISK

To prevent accidental erasing or overwriting of files, it is recommended that a write-protected backup copy of the Transceiver Module programmer disk be made prior to installation.

5.2.3 INSTALLING THE TRANSCEIVER MODULE PROGRAMMER SOFTWARE

The following steps assume that the Transceiver Module programmer software is being installed from a CD ROM or a diskette drive A:\ on to hard drive D:\. If other drives are being used, make the appropriate substitutions in the following procedure.

To install the Transceiver Module Programmer Software application:

1. Start Windows

2. Place the Transceiver Module Programmer distribution diskette #1 in a floppy disk drive on the PC or if the software is supplied on CDROM, insert the CD in the CDROM drive.

3. Run File Manager (for Windows 3.1) or Explorer (for Windows 95 or NT), and with it display the contents of the CD drive or floppy drive in which the installation media is located.

4. Double-click on the file “setup.exe” to commence the installation. If there are multiple disk images on the CD, it will be located in the directory labelled “Disk1”. On a floppy it will be a top-level file.

5. Follow the instructions given by the **Setup** dialog boxes. If an old version of the Programmer is already installed on the PC then either:

   a. Replace the old version Programmer by specifying the same destination folder location and program folder as used for the old programmer.
   b. Retain the old version Programmer by specifying a different destination folder location and program folder.

If installation problems occur, contact the supplier.

5.2.4 STARTING TRANSCEIVER MODULE PROGRAMMER FOR THE FIRST TIME

To start the Transceiver Module programmer, select the TMP icon from the **Start | Programs** menu.

The Transceiver Module Field Programmer main window will appear as shown in Figure 5-1.

Table 5-1 SYSTEM REQUIREMENTS

COMPONENT	MINIMUM	RECOMMENDED
Computer	80386	Intel Pentium at 100 MHz
Operating System	Windows 3.1	Windows 95 or Windows NT
RAM	4 Mb	16 Mb
Hard disc free space.	1.5 Mb	10 Mb
Display type	Super VGA	Super VGA
Display resolution	640 x 480 pixels	1024 x 768 pixels

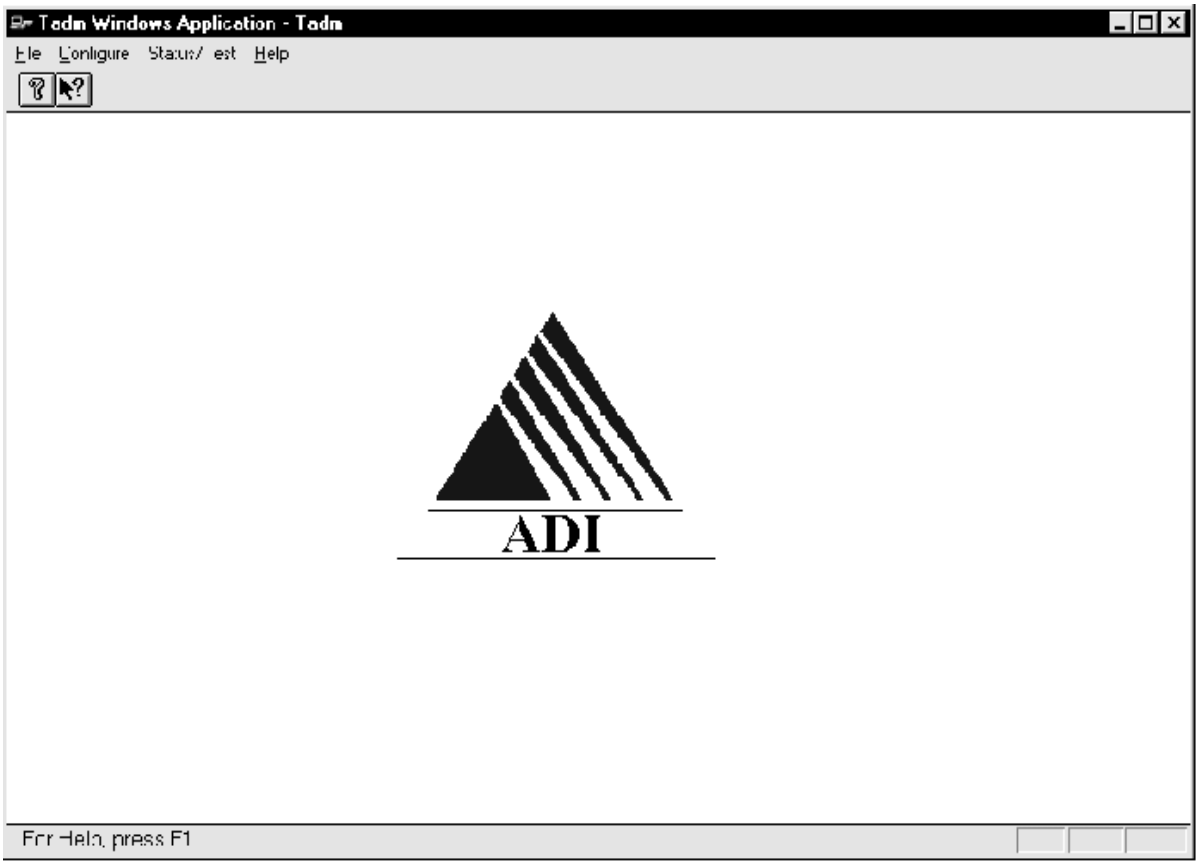


Figure 5-1 TRANSCEIVER MODULE PROGRAMMER MAIN WINDOW

5.2.5 CONNECTING THE PROGRAMMER TO THE TRANSCEIVER MODULE

To connect a Transceiver Module:

1. A programming cable (ADI Part number CB-02272) is required. Connect the PC communications port to be used to the required 5600 Repeater Transceiver Module RJ-11 serial port connector using the programming cable.

2. Using the procedure given in Section 5.4 “Configuring Communications”, set the PC communications port used to connect to the 5600 Repeater, and the PC communication parameters required for the Transceiver Module. The Transceiver Module default communications settings are 9600 baud, 8 data bits, 1 stop bit and no parity (8N1).

3. On the Transceiver Module programmer, activate the **Configure** pull-down menu and select **Connect**.

4. The **Password Entry** dialog box will appear as shown in Figure 5-2.

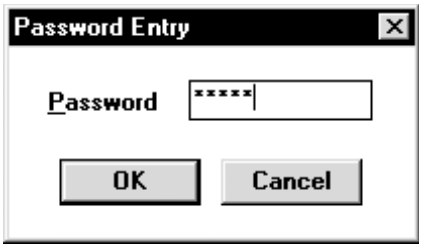


Figure 5-2 PASSWORD ENTRY DIALOG BOX

Enter the Password corresponding to the Login for the module and click OK. Password entry is case-sensitive. Passwords are from 1 to 8 characters. The initial password is “1234”. For security, the password should be changed as soon as practical to a secret password known only to the user. Procedures for password change are in Section 5.2.6.

When the password has been successfully entered, the Transceiver Module programmer is now ready to read or write data to or from the 5600 Repeater module.

5.2.6 CHANGING THE PASSWORD

To change the password, from the main menu activate the **Program** pull-down menu and select **Change Passwords**. The **Change Password** dialog box will appear as shown in Figure 5-3.

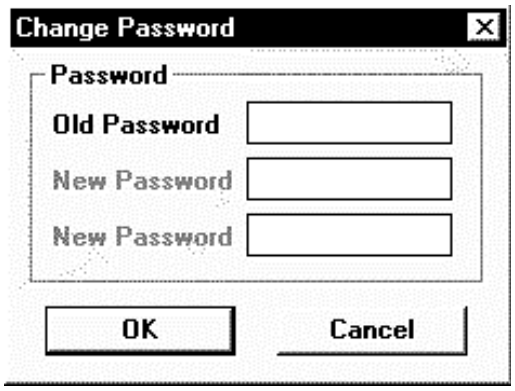


Figure 5-3 CHANGE PASSWORD DIALOG BOX

Enter the old password, followed by the desired new one. Enter the new password again in the bottom field for verification and click **OK**. The Tab key may be used to move between the text boxes.

5.2.7 GETTING HELP

To get help on the Transceiver Module programmer, from the main menu activate the **Help** pull-down menu and select **Contents, Search** or **Index** as required.

5.3 RUNNING THE TRANSCEIVER MODULE PROGRAMMER

There are several configuration options available to the user, some of which depend on the hardware options installed. Other parameters are operational such as the desired receive and transmit operating frequency and channel number.

Once the Transceiver Module programmer is installed the Main Screen provides access to the following dialog boxes.

- **File:** Generate a **New** file
  Open an existing file
  and **Save**.
  Other options allow:
  Importing
  Exporting
  and **Printing** data.
- **Configure**: **Configure** communications
  and **Connect** to Transceiver Module.
- **Program**: **General** settings,
  Channel settings,
  Tone Remote parameters,
  Change Password.
- **Help** dialog box.

Initial configuration data can be obtained in the following ways.

- **File | Open:** Opens a previously saved file (Will prompt user to save before overwriting open file).
- **File | Get:** Gets the current file from a 5600 Repeater Transceiver Module (Will prompt user to save before overwriting open file).
- **File | New:** Creates a new file via user input dialog boxes.

It is possible to send parameters obtained from a previously saved data file to the transceiver module by using the **File | Send** option.

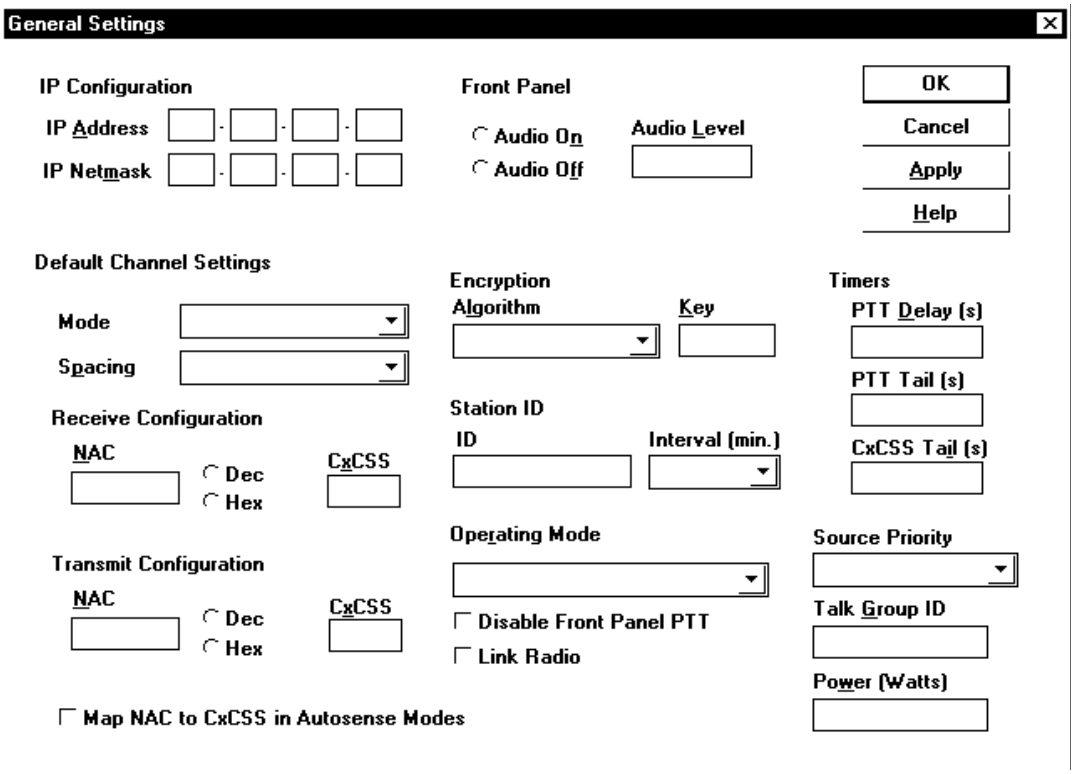


Figure 5-4 GENERAL SETTINGS DIALOG BOX

5.3.1 GENERAL SETTINGS

The user will be prompted for the General Settings dialog box whenever **File | New** is selected. It may also be accessed via **Program | General Settings**. This dialog box contains general 5600 Repeater parameters and default channel setting parameters.

- IP address and netmask parameters for the ethernet interface (future option).
- Front panel audio status and volume.
- Default Channel settings.

To configure general settings, from the main menu activate the **Program** pull-down menu and Select **General Settings**. The **General Settings** dialog box will appear as shown in Figure 5-4.

The general settings of the currently open file will be displayed. If there is no file open, the **General Settings** menu item will be greyed out and cannot be selected.

To enter IP Configuration parameters:

1. The IP configuration is required whenever the 5600 Repeater is connected to a LAN using the ethernet facility on the Interface Module.

2. Point the cursor to a cell where the change is required, click and enter the new parameter. The cursor in the cell will flash when selected. The cells can be highlighted in sequence using the <Tab> key.

To enter Front Panel Audio parameters:

1. Audio On or Off. Point and click as required to enable or disable audio output to the transceiver module audio connector and the loudspeaker panel (if fitted).

2. Audio Level. Click the up or down buttons to select an audio volume level from 0 to 10.

To enter Default Channel settings:

The default channel settings are used to define the configuration of channels when first edited under the **Program | Channel Settings** dialog box. Refer to Section 5.3.2 for details of each parameter.

- **OK**

If the General Settings dialog was entered as a result **of File | New** on exiting from the General Settings by clicking on OK the user will be prompted for a filename for the newly generated configuration file.

If the General Settings dialog was entered as a result of **Program | General Settings** on exiting by clicking OK the updated settings will be saved in the configuration file.

- **Apply**

This is only available when the dialog was entered as a result of **Program | General Settings**. The updated information is used for editing new channels, however, it is not stored to file.

- **Cancel**

Closes the **General Settings** dialog box. Does not update the current configuration.

- **Help**

Provides access to On-line help for the **General Settings** dialog box.

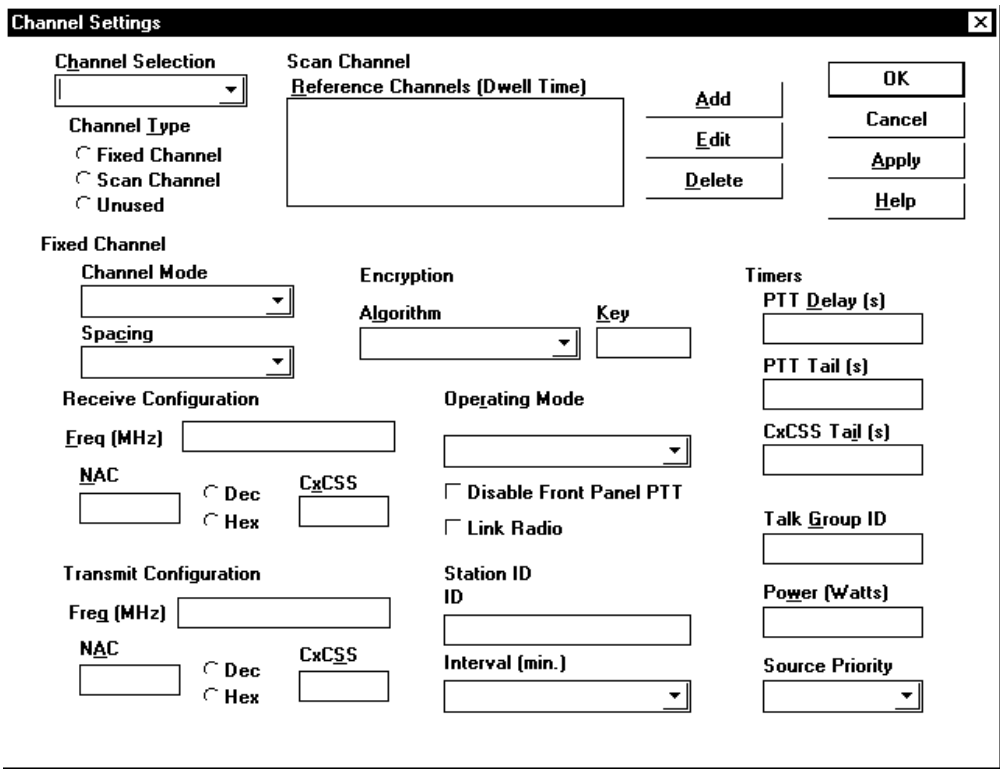


Figure 5-5 CHANNEL SETTINGS DIALOG BOX

5.3.2 CHANNEL SETTINGS

To configure channel settings from the main menu activate the **Program** pull-down menu and select **Channel Settings**. The **Channel Settings** dialog box will appear as shown in Figure 5-5.

The channel settings for the currently open file will be displayed in this dialog box. Where there is no file open, the default settings will be displayed.

To Enter Parameters:

- Channel Selection: Select the channel (0 to 511) to be configured.
- Channel Type: Click as required to select the type of channel.

Fixed Channel :

For fixed channels, enter or select as follows:

- Channel Mode: Select the channel mode from the list of digital, analog and autosense modes.
- Spacing: Select the required channel spacing from the list, to set wideband or narrowband analog operation.

Receive/Transmit Configuration:

Table 5-2 ISOLATION LEVELS

Receive/Transmit Spacing	Minimum Isolation	Recommended Isolation
<600 kHz	-	Requires case by case consideration
600 kHz to 1 MHz	85 dB	>100 dB
1 MHz to 2.5 MHz	70 dB	>80 dB
>2.5 MHz	60 dB	80 dB

- **Freq (MHz)**: Enter the receive or transmit frequency for the channel or click on the up/down arrows to raise or lower the displayed frequency in 1 Hz increments.

  When the 5600 Repeater is operated in full duplex (simultaneous reception and transmission) isolation is required between the receive and transmit signals to ensure that the receiver is not de-sensed by the transmitter. The isolation is generally provided by a separate antenna. The Table 5-2 shows the minimum and recommended isolation levels:

  Due to harmonics of internal clocks and oscillators degradation of receiver sensitivity may be experienced on the following specific frequencies, and these frequencies should therefore be avoided:
  140.000000 MHz
  150.000000 MHz
  157.287500 MHz
  160.000000 MHz and
  170.000000 MHz

  NAC (Network Access Code). For digital operation select the NAC as required, using decimal (Dec) or hexadecimal (Hex) notation as selected. Receive and transmit NAC may be set independently, or the transmit NAC may be set the same as the received NAC ('Same as Rx'). If analog channel mode is selected then this box will be greyed out.

  CxCSS: For analog operation select CDCSS or CTCSS as required. Receive and transmit CxCSS may be set independently, or the transmit CxCSS may be set to be the same as the received CxCSS ('Same as Rx'). If APCO 25 channel mode is selected then this box will be greyed out.

Operating Mode:

Click as required to select the operating mode for the channel, as a combination of basestation/repeater and local/remote control.

Local control is via a DTMF microphone connected to the Transceiver Module audio connector. Tone control is via a tone remote control unit connected to the Interface Module line connector.

In basestation mode an antenna relay may be controlled using output lines 1 (radio 1) and 2 (radio 2) of the general purpose input/output connector on the interface module.

Disable Front Panel PTT:

This provides the ability to disable the transceiver module audio connector PTT, in order to prevent unauthorized on-air access from the 5600 Repeater.

Link Radio:

Link Radio enables two transceiver modules to be linked allowing cross-band and cross-mode operation (future option).

Algorithm and key:

Select as required from a list of the available algorithms (future option).

Talk Group ID:

Select or enter the Talk Group ID for transmissions from the 5600 Repeater in basestation mode.

Power (Watts):

Enter the transmit output power for the channel or click on the up/down arrows to raise or lower the output power in 1W increments. An output power of 0W will set the transceiver in Transmit Mute mode.

Source Priority:

This field is provided for future use and does not presently influence the operation of the radio.

Station ID and Interval (future option)**:**

Enter the station's call sign and select the broadcast interval as 15 or 30 minutes.

PTT Timers:

- PTT Delay (sec): Enter the amount of time the Tx/Rx changeover is allowed to stabilize before RF power is applied, or click on the up/down arrows to raise or lower the Delay time in 0.1 second increments.
- PTT Tail (sec): (applicable to Analog channels only) Enter the amount of time the 5600 Repeater continues to transmit after the Press To Talk is released, or click on the up/down arrows to raise or lower the Tail time in 0.1 second increments.
- CxCSS Tail (sec): (applicable to Analog channels only) Enter the amount of time the 5600 Repeater continues to apply CTCSS or CDCSS to a transmission after the Press To Talk is released, or click on the up/down arrows to raise or lower the Tail time in 0.1 second increments.
- PTT Timeout (sec): Enter the maximum duration of continuous transmission in seconds, or click on the up/down arrows to raise or lower the Timeout in 1 second increments.

Scan Channels:

A scan channel consists of two or more fixed channels. The transceiver module will step through the list of reference channels until it finds one with a valid receive signal.

- REFERENCE CHANNELS (Dwell Time): A list of the reference scan channels and their dwell times. Use the **Add**, **Edit** and **Delete** buttons to manage this list.
- ADD: Adds a reference channel or channels to the selected scan channel. Using the **Configure Scan Channel Reference** Dialog Box. The **Configure Scan Channel Reference** dialog box is shown in Figure 5-6.

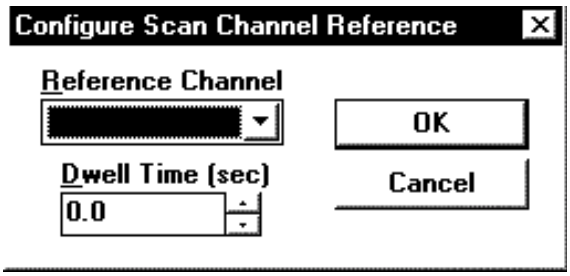


Figure 5-6 CONFIGURE SCAN CHANNEL REFERENCE DIALOG BOX

- EDIT: Enter the preconfigured fixed channel in the **Reference Channel** field and nominate a **Dwell Time** in seconds that the scan channel will monitor that reference channel. This reference channel is then added to the scan channel when the **OK** button is clicked or discarded if the **Cancel** button is clicked.
- DELETE: Deletes channels from the current configuration.

Channel Settings Dialog Box Controls:

- APPLY: Updates the **Channel Settings** dialog box and updates the current configuration with any newly entered General Settings data. Does not save the data to a file. The data is saved to file via the **File | Save** menu item.

- OK: Closes the **Channel Settings** dialog box and updates the current configuration with any newly entered General Settings data. Does not save the data to a file. The data is saved to file via the **File | Save** menu item.

- CANCEL: Closes the Channel Settings dialog box. Does not update the current configuration.

- HELP: Provides access to on-line help on the **Channel Settings** dialog box.

Table 5-2 lists the applicable setting ranges and brief descriptions of the channel parameters.

Table 5-3 CHANNEL PARAMETERS

Parameter	Range/Description
Channel Selection	Channel 0 to Channel 511
Channel Type	Fixed, Scan, Unused
Channel Mode	APCO 25, Analog FM (CTCSS), Analog FM (CDCSS), Autosense (P25-CTCSS), Autosense (P25-CDCSS)
Spacing	12.5 kHz, 15 kHz, 25 kHz, 30 kHz.
Network Access Code (NAC)	Receive: 3-digit hexadecimal (0x293 accepts any NAC) Transmit: 3-digit hexadecimal, or “same as receive”
CxCSS	Receive: Tones and Codes according to TIA-603, or “any” Transmit: Tones and Codes according to TIA-603, “non” or “same as receive”
Talg Group ID	3-digit hexadecimal
Encryption Algorithm	Future Option.
Encryption Key	Future Option.
Operating Mode	Repeater (Local Control), Repeater (Tone Control), Basestation (Local Control), Basestation (Tone Control)
Disable Front Panel PTT	On/Off
Link Radio	Future Option.
Station ID	Up to 16 ASCII characters
Station ID Interval	0 = Off, 15 minutes, 30 minutes
PTT Time-out	0 to 255 seconds
PTT Tail	0 to 9.9 seconds
CxCSS Tail	0 to 9.9 seconds
PTT Delay	0 to 9.9 seconds
Power	60W PA: 5 to 60W (134-160 MHz), 5 to 50W (160-174 MHz) 125W PA: 12 to 125W OW sets transmit mute
Source Priority	Local/Remote, Radio, None
Number of channels	1 to 8. Number of fixed reference channels within a scan channel.
Dwell	The time allocated to each reference channel within a scan channel. This can be deferentially allocated to each reference channel.
Reference Channel	Any fixed channel.
Dwell Time	0 to 9.9 seconds

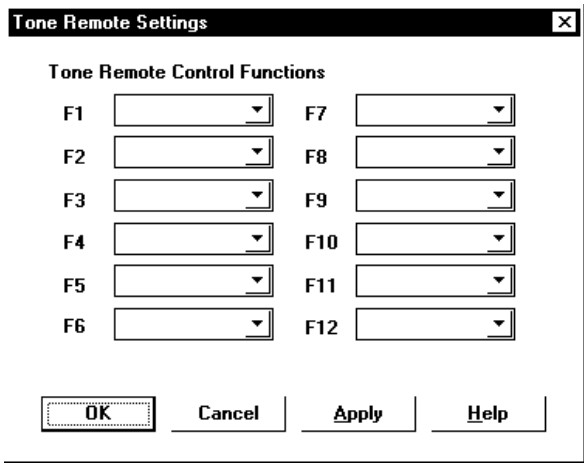


Figure 5-7 TONE REMOTE SETTINGS

Table 5-4 FUNCTION TONE FREQUENCIES

Function	Frequency (Hz)	Level (dBm)
F1	1950	0
F2	1850	0
F3	1750	0
F4	1650	0
F5	1550	0
F6	1450	0
F7	1350	0
F8	1250	0
F9	1150	0
F10	1050	0
F11	950	0
F12	850	0
Monitor	2050	0
Guard	2175	+10
PTT	2175	-20

5.3.3 TONE REMOTE SETTINGS

Using the Tone Remote Settings the following functions may be allocated to tones used by industry standard tone remote units:

- Increase audio level
- Decrease audio level
- Change channel

The **Tone Remote Settings** dialog box will appear as shown in Figure 5-7.

F1 may be allocated to Increase Audio and Change Channel. F2 may be allocated to Decrease Audio and Change Channel. F3 – F14 may only be allocated to Change Channel. The 5600 Repeater Tone Remote functions are pre-programmed to detect the industry standard tones in Table 5-4.

5.4 CONFIGURING COMMUNICATIONS

The following communications parameters may be set:

- Flow control (Xon or Xoff).
- Communications Port.
- Data Bits.
- Baud rate.
- Stop Bits.
- Parity.

To configure communications parameters, from the main menu activate the **Program** pull-down menu and select **Configure Comms**. The **Configure Comms** dialog box will appear as shown in Figure 5-8.

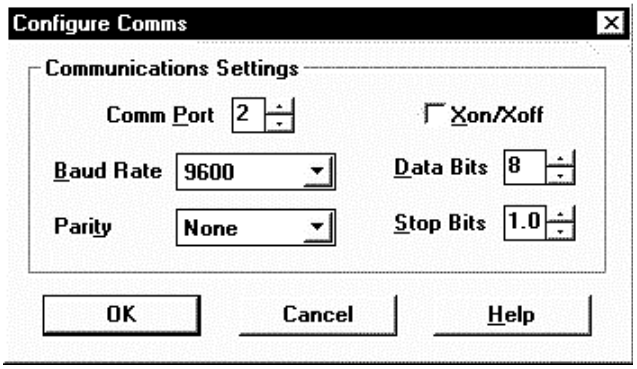


Figure 5-8 CONFIGURE COMMS DIALOG BOX

The communications settings of the currently open file will be displayed. Where there is no file open, the default settings will be displayed. Figure 5-8 lists the default communications settings.

To enter parameters:

Note: The Transceiver Module presently only supports comms at 9600, no parity, 8 bits, 1 stop bit.

1. Place the cursor on a cell where a change is required. The cursor flashes in the cell if placed there by use of the mouse. The cell is highlighted if the Tab key is used.

2. Delete the existing value in the cell and enter the new parameter.

3. Click **OK** to update the current configuration.

OK

OK closes the **Configure Comms** dialog box without changes.

Cancel

This closes the **Configure Comms** dialog box without changing data.

Help

Help provides access to on-line help on the **Configure Comms** dialog box.

Table 5-5 lists the applicable ranges and defaults for the communications parameters.

Table 5-5 COMMUNICATIONS PARAMETERS

Parameter	Range/Description	Default
Flow Control	Xon or Xoff	X off
Baud Rate	1200, 2400, 4800, 9600, 14400, 19200 and 28800	9600
Com Port	1,2,3 etc.	1
Data Bits	7 to 10	8
Parity	Odd, Even, None.	None
Stop bits	1, 1.5, 2	1

SECTION 6 5600 REPEATER DIAGNOSTICS MONITOR

6.1 OVERVIEW

5600 Repeater Diagnostics Monitor is a Windows™ based software application running on an IBM™ compatible PC connected to the front panel RS-232 port (RJ-11) on the Controller Module of the 5600 Repeater. ZDM allows an operator to monitor the activity and status of both transceiver modules together with the alarm status of all 5600 Repeater modules.

6.2 GETTING STARTED

6.2.1 SYSTEM REQUIREMENTS

The minimum system requirements for operation of the 5600 Repeater Diagnostics Monitor software application are given in Table 6-1.

6.2.2 MAKING A BACKUP COPY OF THE 5600 REPEATER DIAGNOSTIC MONITOR DISK

To prevent accidental erasing or overwriting of files, it is recommended that a write-protected backup copy of the 5600 Repeater Diagnostics Monitor program disk be made prior to installation.

6.2.3 INSTALLING THE 5600 REPEATER DIAGNOSTIC MONITOR SOFTWARE

The following steps assume that the 5600 Repeater Diagnostic Monitor software is being installed from diskette drive A:\ or CD ROM on to hard drive D:\. If other drives are being used, make the appropriate substitutions in the following procedure.

To install the 5600 Repeater Diagnostic Monitor software application:

1. Start Windows.

2. Place the 5600 Repeater Diagnostic Monitor distribution diskette in a floppy disk drive on the PC or if the software was distributed on CDROM, place the CD in the CDROM drive.

3. Run File Manager (Windows 3.1) or Explorer (Windows98 and NT), and display the files on the distribution medium.

4. Double-click on the file “setup.exe”. For floppy disk distributions this will be a top-level file, for CDROMS it may be located in a subdirectory named “disk1”.

5. Follow the instructions given by the **Setup** dialog boxes.

If installation problems occur then contact the supplier.

Table 6-1 SYSTEM REQUIREMENTS

Component	Minimum	Recommended
Computer	80386	Intel Pentium at 100 MHz
Operating system	Windows 3.1	Windows 95 or Windows NT
RAM	4 Mb	16 Mb
Hard disc free space	1.5 Mb	10 Mb
Display type	Super VGA	Super VGA
Display resolution	640 x 480 pixels	1024 x 768 pixels

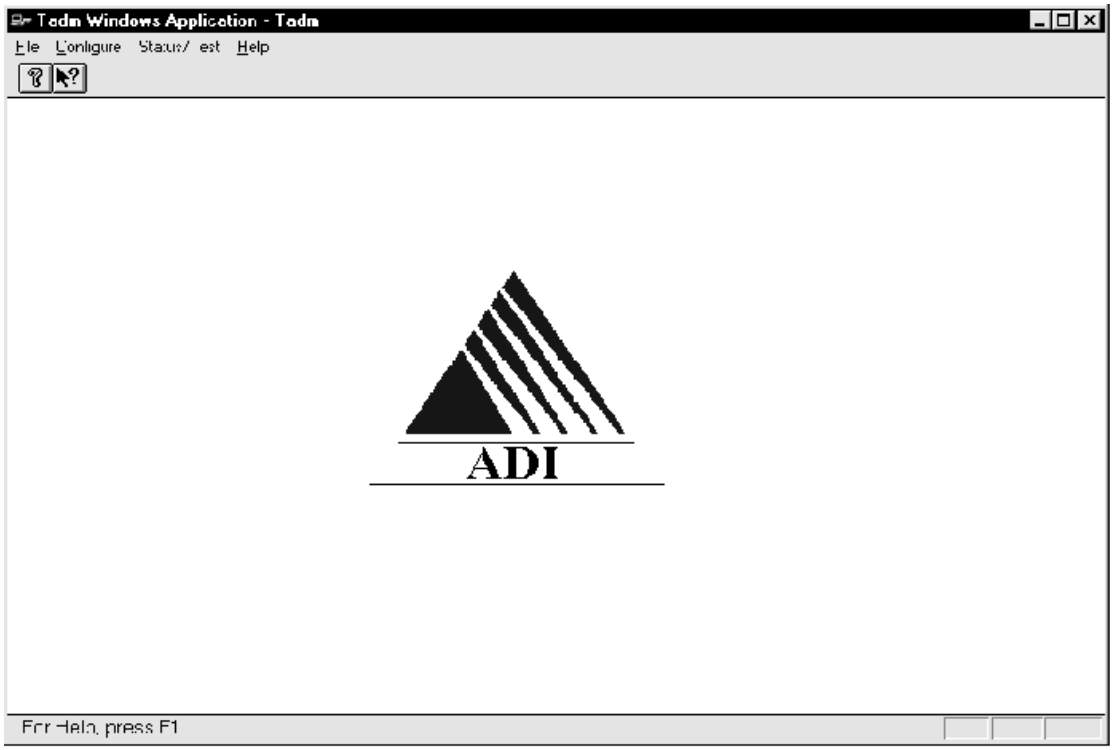


Figure 6-1 5600 REPEATER DIAGNOSTIC MONITOR MAIN WINDOW

6.2.4 STARTING 5600 REPEATER DIAGNOSTIC MONITOR FOR THE FIRST TIME

To start the 5600 Repeater Diagnostic Monitor, select the ZDM icon from the **Start | Programs** menu.

The 5600 Repeater Diagnostic Monitor main window will appear as shown in Figure 6-1.

6.2.5 CONNECTING THE 5600 REPEATER DIAGNOSTIC MONITOR TO THE CONTROLLER MODULE

To connect to a Controller Module:

1. A 5600 Repeater Programming Cable (ADI Part number AMX-CB-02272) is required. Connect the PC communications port to be used to the 5600 Repeater Controller Module RJ-11 serial port connector using the cable.
2. The 5600 Repeater Diagnostic Monitor will attempt to automatically establish communications with the Controller Module. If this is successful the status dialog boxes will open automatically. If not the Configure Comms dialog box will be opened.
3. Using the procedure given in Section “Configuring Communications”, set the PC communications port used to connect to the 5600 Repeater, and the PC communication parameters required for the Controller Module. The Controller Module default communications settings are 9600 baud, 8 data bits, 1 stop bit and no parity (8N1).

6.2.6 GETTING HELP

To get help on the Transceiver Module programmer from the main menu, activate the **Help** pull-down menu and select **Contents, Search** or **Index** as required.

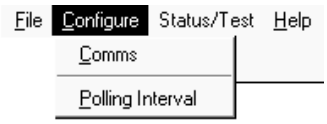
6.3 RUNNING THE 5600 REPEATER DIAGNOSTIC MONITOR

Once 5600 Repeater Diagnostic Monitor is installed it will attempt establish communications with the Controller Module and if successful the status dialog boxes will open automatically. The Main Screen provides access to the following dialog boxes.

- **File menu:** The only option available is **Exit**.
- **Configure**: Dialog boxes for Configure **Communications** and **Polling** Interval.
- **Status/Test**: Status dialog boxes for **Radio 1 Status, Radio 2 Status** and **Alarms**; Test dialog boxes for **Radio 1 Test, Radio 2 Test** and **Change Test Password**
- **Help** Dialog box

6.3.1 CONFIGURATION

From the main screen the Configure Menu gives access to configuring communication parameters and the polling interval.



6.3.2 CONFIGURE COMMUNICATIONS

The user will be prompted for Configure Communications dialog box if the 5600 Repeater Diagnostic Monitor is unable to establish communications with the Controller Module or whenever Configure | Comms is selected. The following communications parameters may be set:

- Flow control (Xon or Xoff).
- Communications Port.
- Data Bits.
- Baud rate.
- Stop Bits.
- Parity.

To configure communications parameters from the main menu, activate the **Program** pull-down menu and select **Configure Comms**. The **Configure Comms** dialog box will appear as shown in Figure 6-2.

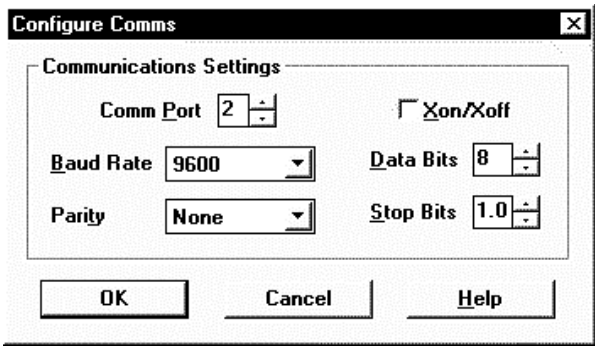


Figure 6-2 CONFIGURE COMMS DIALOG BOX

The communications settings of the currently open file will be displayed. Where there is no file open, the default settings will be displayed. Table 6-2 lists the default communications settings.

To enter parameters:

1. Place the cursor on a cell where a change is required. The cursor will flash in the cell if placed there by use of the mouse. The cell will be highlighted if the Tab key is used.
2. Delete the existing value in the cell and enter the new parameter.
3. Click **OK** to update the current configuration.

OK

OK closes the **Configure Comms** dialog box and writes any newly-entered communications data to the BP application's .INI file.

Cancel

This closes the **Configure Comms** dialog box without writing data to the .INI file.

Help

Help provides access to on-line help on the **Configure Comms** dialog box.

Table 6-2 lists the applicable ranges and defaults for the communications parameters.

Table 6-2 COMMUNICATIONS PARAMETERS

Parameter	Range/Description	Default
Flow Control	Xon or Xoff	X off
Baud Rate	1200, 2400, 4800, 9600, 14400, 19200 and 28800	9600
Com Port	1,2,3 etc.	1
Data Bits	7 to 10	8
Parity	Odd, Even, None.	O
Stop bits	1, 1.5, 2	1

6.3.3 CONFIGURE POLLING INTERVAL

The Configure | Polling Interval dialog box enables the user to set the interval at which the 5600 Repeater Diagnostic Monitor polls the Controller card for status information. The default polling interval is 1000ms. The **Polling Interval Dialog** box will appear as shown in Figure 6-3.

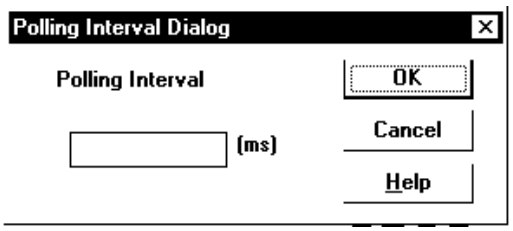


Figure 6-3 POLLING INTERVAL DIALOG BOX

To enter/change parameters:

1. Place the cursor in the cell

2. Delete the existing value in the cell and enter the new parameter.

3. Click **OK** to update the current configuration.

OK

OK closes the **Polling Interval** dialog box and writes any newly-entered communications data to the ZDM application's .INI file.

Cancel

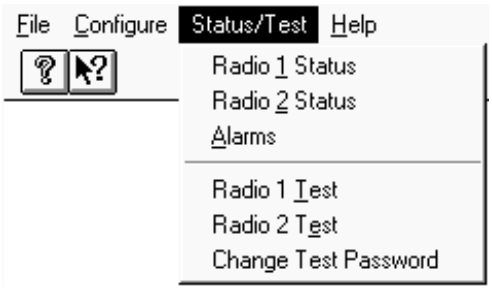
This closes the **Polling Interval** dialog box without writing data to the .INI file.

Help

Help provides access to on-line help on the **Polling Interval** dialog box.

6.3.4 STATUS/TEST

From the Main Menu the Status/Test gives access to the status dialog boxes for Radio 1, Radio 2 and Alarms and the test dialog boxes for Radio 1, Radio 2. It also includes provision to change the password used to access the test functions.



Radio Status

The status boxes for Radio 1 and Radio 2 provide identical parameters for the two 5600 Repeater transceiver modules:

- Channel — The current channel in use
- Mode — The current mode
- Frequency — The current receive and transmit frequencies
- Signal Strength — The current receive signal level
- BER — The current BER (%) for digital signals
- Squelch — Open/closed
- NAC — The current transmit and receive NAC for digital signals
- CxCSS — The current CTCSS or CDCSS for analog signals
- Talk Group ID — The current receive and transmit TGID for digital signals
- Station ID — The station ID/FCC call sign
- Last subscriber ID — The identity of the last subscriber unit heard for digital signals.

The **Radio Status** dialog box will appear as shown in Figure 6-4.

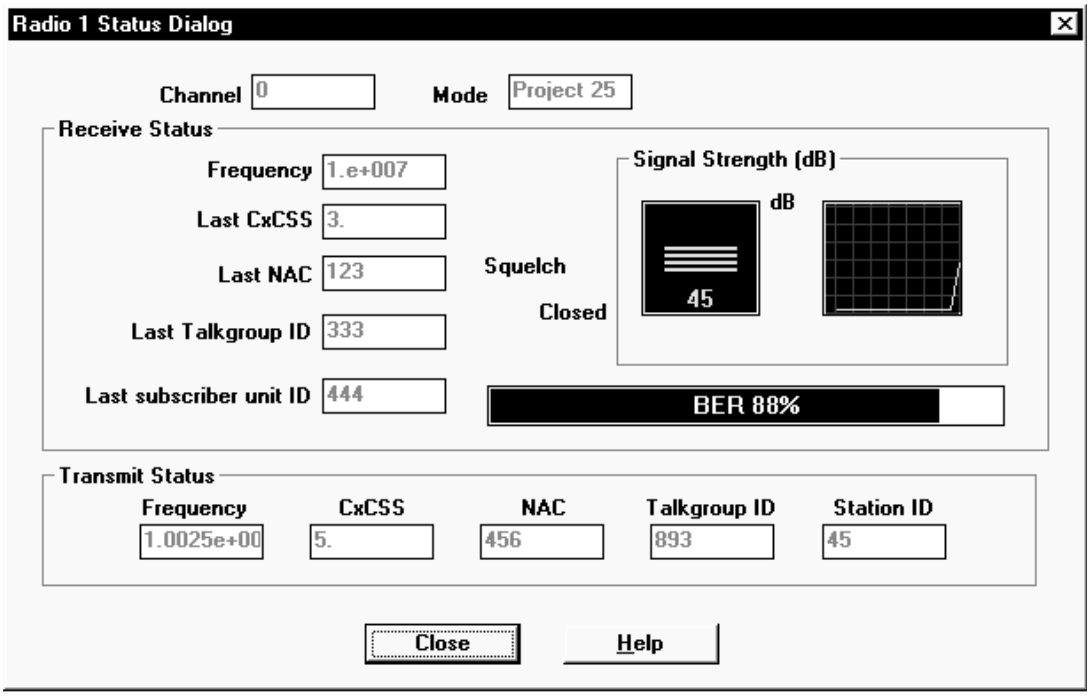


Figure 6-4 RADIO 1 AND RADIO 2 STATUS DIALOG BOX

The status parameters are updated at the rate specified in the Configure | Polling Interval dialog box.

Close

This closes the **Radio Status** dialog box.

Help

This provides access to On-line help for the **Radio Status** dialog box.

6.3.5 ALARMS

The **Alarms** dialog box shows the status of the following 5600 Repeater parameters and alarms:

- VSWR Hi/Lo/Normal
- Temperature Critical/Abnormal/Normal
- Radio Fault Status On/Off
- PA Fault On/Off
- Controller Fault Set/Clear
- DC Standby On/Off

The **Alarms** dialog box will appear as shown in Figure 6-5.

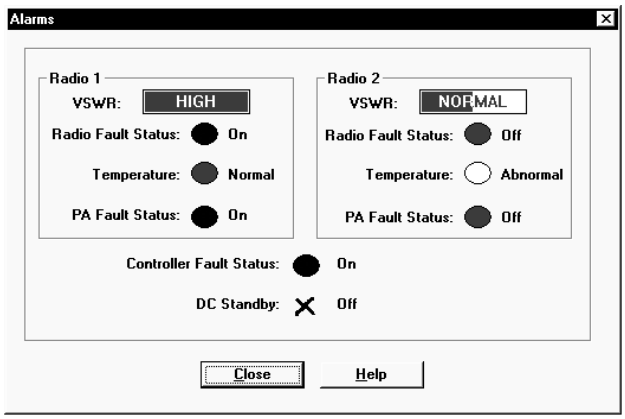


Figure 6-5 ALARMS DIALOG BOX

Close

This closes the **Alarms** dialog box.

Help

Help provides access to on-line help on the **Alarms** dialog box.

6.3.6 TEST

The Test dialog boxes (**Test Radio 1** and **Test Radio 2**) enable the operator to select various APCO Project 25 digital and Analog FM test signals and conduct limited testing of the transmitter to verify the performance.

On entering the test dialog boxes the user will be prompted for a password. The **Password** dialog box will appear as shown in Figure 6-6.

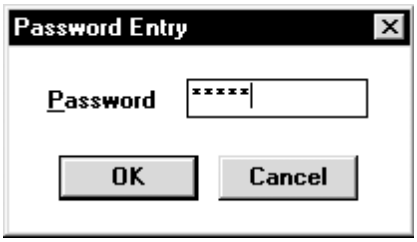


Figure 6-6 PASSWORD DIALOG BOX

Enter the Password corresponding to the Login for the module and click OK. Password entry is case-sensitive. Passwords are from 1 to 8 characters. The initial password is “ZDM”. For security, the password should be changed as soon as practical to a secret password known only to the user. Procedures for password change are in Section 5.2.6.

When the password has been successfully entered, the Transceiver Module programmer is now ready to read or write data to or from the 5600 Repeater module.

The following APCO Project 25 digital test signals are available:

- Standard 1011 Hz Test Tone;
- Standard Silence Test Pattern;
- Hi Deviation Pattern;
- Lo Deviation Pattern, and
- PRBS sequence.

The following Analog modulation test signals are available:

- 1000 Hz test tone, deviation = 1.5 kHz (25 kHz wideband FM)
- 1000 Hz test tone, deviation = 3.0 kHz (12.5 kHz narrowband FM)
- The Test Dialog boxes allows the following radio controls to be exercised:
- **Enable Local PTT** (on/off) check box allows the user to transmit from a front panel microphone while the TDM is connected even if the channel in use has front panel PTT turned off.
- **Enable Intercom** check box shall allow the user to use a front panel microphone or handset to talk to a tone remote or console operator via 4 W/2 W interface while the TDM is connected.
- Select **Channel**.

The **Test Radio** dialog box will appear as shown in Figure 6-7.

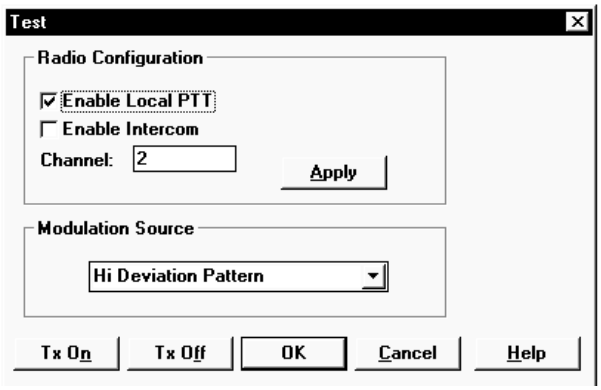


Figure 6-7 TEST RADIO DIALOG BOX

Apply

The **Apply** button sets the Enable Local PTT, Enable Intercom and Channel. This is, however, not stored on the Transceiver Module.

Tx On

The TDM Test dialog box **Tx On** button selection causes the TDM to write the factory test parameter to the selected Transceiver Module. The transmitter is turned on using the selected test tone as the modulation source. Note that if TDM is closed with TX On still selected then TDM will turn the transmitter off before closing and the transceiver will revert to its normal operating mode for its current channel.

Tx Off

This turns the transmitter off.

OK

OK closes the **Test** dialog box and returns the user to the **Main** dialog box. The transmitter is returned to the off state and the Enable Local PTT and Enable Intercom revert to their previous settings.

If a channel has been changed during a test session a box will appear after the user closes the test dialog box: 'The current channel of Radio x has been changed during this session. Do you wish to change the radio back to its original channel?' Yes/No. If yes is clicked, then the channel will be changed back to the channel in use when the TDM session was started.

Cancel

This closes the **Test** dialog box without writing data to the .INI file.

Help

Help provides access to on-line help on the **Polling Interval** dialog box.

6.3.7 CHANGING THE PASSWORD

To change the password from the main menu, activate the S**tatus/Test** pull-down menu and select **Change Passwords**. The **Change Password** dialog box will appear as shown in Figure 6-8.

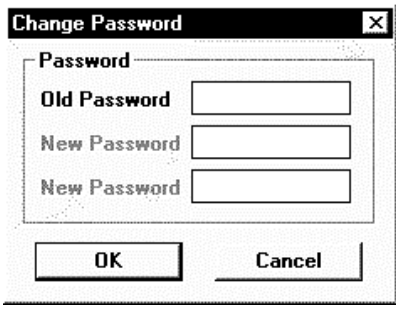


Figure 6-8 CHANGE PASSWORD DIALOG BOX

Enter the old password, followed by the desired new one. Enter the new password again in the bottom field for verification and click **OK**. The Tab key may be used to move between the text boxes.

APPENDIX A BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
0	0	1	Off	Off	Off	Off	Off	Off	Off	Off
1	2	3	On	Off	Off	Off	Off	Off	Off	Off
2	4	5	Off	On	Off	Off	Off	Off	Off	Off
3	6	7	On	On	Off	Off	Off	Off	Off	Off
4	8	9	Off	Off	On	Off	Off	Off	Off	Off
5	10	11	On	Off	On	Off	Off	Off	Off	Off
6	12	13	Off	On	On	Off	Off	Off	Off	Off
7	14	15	On	On	On	Off	Off	Off	Off	Off
8	16	17	Off	Off	Off	On	Off	Off	Off	Off
9	18	19	On	Off	Off	On	Off	Off	Off	Off
10	20	21	Off	On	Off	On	Off	Off	Off	Off
11	22	23	On	On	Off	On	Off	Off	Off	Off
12	24	25	Off	Off	On	On	Off	Off	Off	Off
13	26	27	On	Off	On	On	Off	Off	Off	Off
14	28	29	Off	On	On	On	Off	Off	Off	Off
15	30	31	On	On	On	On	Off	Off	Off	Off
16	32	33	Off	Off	Off	Off	On	Off	Off	Off
17	34	35	On	Off	Off	Off	On	Off	Off	Off
18	36	37	Off	On	Off	Off	On	On	Off	Off
19	38	39	On	On	Off	Off	On	On	Off	Off
20	40	41	Off	Off	On	Off	On	On	Off	Off
21	42	43	On	Off	On	Off	On	On	Off	Off
22	44	45	Off	On	On	Off	On	On	Off	Off
23	46	47	On	On	On	Off	On	On	Off	Off
24	48	49	Off	Off	Off	On	On	On	Off	Off
25	50	51	On	Off	Off	On	On	On	Off	Off
26	52	53	Off	On	Off	On	On	On	Off	Off
27	54	55	On	On	Off	On	On	On	Off	Off
28	56	57	Off	Off	On	On	On	On	Off	Off
29	58	59	On	Off	On	On	On	On	Off	Off
30	60	61	off	On	On	On	On	On	Off	Off
31	62	63	On	On	On	On	On	On	Off	Off
32	64	65	Off	Off	Off	Off	Off	On	Off	Off
33	66	67	On	Off	Off	Off	Off	On	Off	Off
34	68	69	Off	On	Off	Off	Off	On	Off	Off
35	70	71	On	On	Off	Off	Off	On	Off	Off
36	72	73	Off	Off	On	Off	Off	On	Off	Off
37	74	75	On	Off	On	Off	Off	On	Off	Off
38	76	77	Off	On	On	Off	Off	On	Off	Off
39	78	79	On	On	On	Off	Off	On	Off	Off

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
40	80	81	Off	Off	Off	On	Off	On	Off	Off
41	82	83	On	Off	Off	On	Off	On	Off	Off
42	84	85	Off	On	Off	On	Off	On	Off	Off
43	86	87	On	On	Off	On	Off	On	Off	Off
44	88	89	Off	Off	On	On	Off	On	Off	Off
45	90	91	On	Off	On	On	Off	On	Off	Off
46	92	93	Off	On	On	On	Off	On	Off	Off
47	94	95	On	On	On	On	Off	On	Off	Off
48	96	97	Off	Off	Off	Off	On	On	Off	Off
49	98	99	On	Off	Off	Off	On	On	Off	Off
50	100	101	Off	On	Off	Off	On	On	Off	Off
51	102	103	On	On	Off	Off	On	On	Off	Off
52	104	105	Off	Off	On	Off	On	On	Off	Off
53	106	107	On	Off	On	Off	On	On	Off	Off
54	108	109	Off	On	On	Off	On	On	Off	Off
55	110	111	On	On	On	Off	On	On	Off	Off
56	112	113	Off	Off	Off	On	On	On	Off	Off
57	114	115	On	Off	Off	On	On	On	Off	Off
58	116	117	Off	On	Off	On	On	On	Off	Off
59	118	119	On	On	Off	On	On	On	Off	Off
60	120	121	Off	Off	On	On	On	On	Off	Off
61	122	123	On	Off	On	On	On	On	Off	Off
62	124	125	Off	On	On	On	On	On	Off	Off
63	126	127	On	On	On	On	On	On	Off	Off
64	128	129	Off	Off	Off	Off	Off	Off	On	Off
65	130	131	On	Off	Off	Off	Off	Off	On	Off
66	132	133	Off	On	Off	Off	Off	Off	On	Off
67	134	135	On	On	Off	Off	Off	Off	On	Off
68	136	137	Off	Off	On	Off	Off	Off	On	Off
69	138	139	On	Off	On	Off	Off	Off	On	Off
70	140	141	Off	On	On	Off	Off	Off	On	Off
71	142	143	On	On	On	Off	Off	Off	On	Off
72	144	145	Off	Off	Off	On	Off	Off	On	Off
73	146	147	On	Off	Off	On	Off	Off	On	Off
74	148	149	Off	On	Off	On	Off	Off	On	Off
75	150	151	On	On	Off	On	Off	Off	On	Off
76	152	153	Off	Off	On	On	Off	Off	On	Off
77	154	155	On	Off	On	On	Off	Off	On	Off
78	156	157	Off	On	On	On	Off	Off	On	Off
79	158	159	On	On	On	On	Off	Off	On	Off
80	160	161	Off	Off	Off	Off	Off	Off	On	Off
81	162	163	On	Off	Off	Off	On	Off	On	Off

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
82	164	165	Off	On	Off	Off	On	Off	On	Off
83	166	167	On	On	Off	Off	On	Off	On	Off
84	168	169	Off	Off	On	Off	On	Off	On	Off
85	170	171	On	Off	On	Off	On	Off	On	Off
86	172	173	Off	On	On	Off	On	Off	On	Off
87	174	175	On	On	On	Off	On	On	On	Off
88	176	177	Off	Off	Off	On	On	On	On	Off
89	178	179	On	Off	Off	On	On	On	On	Off
90	180	181	Off	On	Off	On	On	On	On	Off
91	182	183	On	On	Off	On	On	On	On	Off
92	184	185	Off	Off	On	On	On	On	On	Off
93	186	187	On	Off	On	On	On	On	On	Off
94	188	189	off	On	On	On	On	On	On	Off
95	190	191	On	On	On	On	On	On	On	Off
96	192	193	Off	Off	Off	Off	Off	On	On	Off
97	194	195	On	Off	Off	Off	Off	On	On	Off
98	196	197	Off	On	Off	Off	Off	On	On	Off
99	198	199	On	On	Off	Off	Off	On	On	Off
100	200	201	Off	Off	On	Off	Off	On	On	Off
101	202	203	On	Off	On	Off	Off	On	On	Off
102	204	205	Off	On	On	Off	Off	On	On	Off
103	206	207	On	On	On	Off	Off	On	On	Off
104	208	209	Off	Off	Off	On	Off	On	On	Off
105	210	211	On	Off	Off	On	Off	On	On	Off
106	212	213	Off	On	Off	On	Off	On	On	Off
107	214	215	On	On	Off	On	Off	On	On	Off
108	216	217	Off	Off	On	On	Off	On	On	Off
109	218	219	On	Off	On	On	Off	On	On	Off
110	220	221	Off	On	On	On	Off	On	On	Off
111	222	223	On	On	On	On	Off	On	On	Off
112	224	225	Off	Off	Off	Off	On	On	On	Off
113	226	227	On	Off	Off	Off	On	On	On	Off
114	228	229	Off	On	Off	Off	On	On	On	On
115	230	231	On	On	Off	Off	On	On	On	On
116	232	233	Off	Off	On	Off	On	On	On	On
117	234	235	On	Off	On	Off	On	On	On	On
118	236	237	Off	On	On	Off	On	On	On	On
119	238	239	On	On	On	Off	On	On	On	On
120	240	241	Off	Off	Off	On	On	On	On	On
121	242	243	On	Off	Off	On	On	On	On	On
122	244	245	Off	On	Off	On	On	On	On	On
123	246	247	On	On	Off	On	On	On	On	On

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
124	248	249	Off	Off	On	On	On	On	On	On
125	250	251	On	Off	On	On	On	On	On	On
126	252	253	Off	On	On	On	On	On	On	On
127	254	255	On	On	On	On	On	On	On	On
128	256	257	Off	Off	Off	Off	Off	Off	Off	On
129	258	259	On	Off	Off	Off	Off	Off	Off	On
130	260	261	Off	On	Off	Off	Off	Off	Off	On
131	262	263	On	On	Off	Off	Off	Off	Off	On
132	264	265	Off	Off	On	Off	Off	Off	Off	On
133	266	267	On	Off	On	Off	Off	Off	Off	On
134	268	269	Off	On	On	Off	Off	Off	Off	On
135	270	271	On	On	On	Off	Off	Off	Off	On
136	272	273	Off	Off	Off	On	Off	Off	Off	On
137	274	275	On	Off	Off	On	Off	Off	Off	On
138	276	277	Off	On	Off	On	Off	Off	Off	On
139	278	279	On	On	Off	On	Off	Off	Off	On
140	280	281	Off	Off	On	On	Off	Off	Off	On
141	282	283	On	Off	On	On	Off	Off	Off	On
142	284	285	Off	On	On	On	Off	Off	Off	On
143	286	287	On	On	On	On	Off	Off	Off	On
144	288	289	Off	Off	Off	Off	On	Off	Off	On
145	290	291	On	Off	Off	Off	On	Off	Off	On
146	292	293	Off	On	Off	Off	On	On	Off	On
147	294	295	On	On	Off	Off	On	On	Off	On
148	296	297	Off	Off	On	Off	On	On	Off	On
149	298	299	On	Off	On	Off	On	On	Off	On
150	300	301	Off	On	On	Off	On	On	Off	On
151	302	303	On	On	On	Off	On	On	Off	On
152	304	305	Off	Off	Off	On	On	On	Off	On
153	306	307	On	Off	Off	On	On	On	Off	On
154	308	309	Off	On	Off	On	On	On	Off	On
155	310	311	On	On	Off	On	On	On	Off	On
156	312	313	Off	Off	On	On	On	On	Off	On
157	314	315	On	Off	On	On	On	On	Off	On
158	316	317	off	On	On	On	On	On	Off	On
159	318	319	On	On	On	On	On	On	Off	On
160	320	321	Off	Off	Off	Off	Off	On	Off	On
161	322	323	On	Off	Off	Off	Off	On	Off	On
162	324	325	Off	On	Off	Off	Off	On	Off	On
163	326	327	On	On	Off	Off	Off	On	Off	On
164	328	329	Off	Off	On	Off	Off	On	Off	On
165	330	331	On	Off	On	Off	Off	On	Off	On

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
166	332	333	Off	On	On	Off	Off	On	Off	On
167	334	335	On	On	On	Off	Off	On	Off	On
168	336	337	Off	Off	Off	On	Off	On	Off	On
169	338	339	On	Off	Off	On	Off	On	Off	On
170	340	341	Off	On	Off	On	Off	On	Off	On
171	342	343	On	On	Off	On	Off	On	Off	On
172	344	345	Off	Off	On	On	Off	On	Off	On
173	346	347	On	Off	On	On	Off	On	Off	On
174	348	349	Off	On	On	On	Off	On	Off	On
175	350	351	On	On	On	On	Off	On	Off	On
176	352	353	Off	Off	Off	Off	On	On	Off	On
177	354	355	On	Off	Off	Off	On	On	Off	On
178	356	357	Off	On	Off	Off	On	On	Off	On
179	358	359	On	On	Off	Off	On	On	Off	On
180	360	361	Off	Off	On	Off	On	On	Off	On
181	362	363	On	Off	On	Off	On	On	Off	On
182	364	365	Off	On	On	Off	On	On	Off	On
183	366	367	On	On	On	Off	On	On	Off	On
184	368	369	Off	Off	Off	On	On	On	Off	On
185	370	371	On	Off	Off	On	On	On	Off	On
186	372	373	Off	On	Off	On	On	On	Off	On
187	374	375	On	On	Off	On	On	On	Off	On
188	376	377	Off	Off	On	On	On	On	Off	On
189	378	379	On	Off	On	On	On	On	Off	On
190	380	381	Off	On	On	On	On	On	Off	On
191	382	383	On	On	On	On	On	On	Off	On
192	384	385	Off	Off	Off	Off	Off	Off	On	On
193	386	387	On	Off	Off	Off	Off	Off	On	On
194	388	389	Off	On	Off	Off	Off	Off	On	On
195	390	391	On	On	Off	Off	Off	Off	On	On
196	392	393	Off	Off	On	Off	Off	Off	On	On
197	394	395	On	Off	On	Off	Off	Off	On	On
198	396	397	Off	On	On	Off	Off	Off	On	On
199	398	399	On	On	On	Off	Off	Off	On	On
200	400	401	Off	Off	Off	On	Off	Off	On	On
201	402	403	On	Off	Off	On	Off	Off	On	On
202	404	405	Off	On	Off	On	Off	Off	On	On
203	406	407	On	On	Off	On	Off	Off	On	On
204	408	409	Off	Off	On	On	Off	Off	On	On
205	410	411	On	Off	On	On	Off	Off	On	On
206	412	413	Off	On	On	On	Off	Off	On	On
207	414	415	On	On	On	On	Off	Off	On	On

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
208	416	417	Off	Off	Off	Off	On	Off	On	On
209	418	419	On	Off	Off	Off	On	Off	On	On
210	420	421	Off	On	Off	Off	On	On	On	On
211	422	423	On	On	Off	Off	On	On	On	On
212	424	425	Off	Off	On	Off	On	On	On	On
213	426	427	On	Off	On	Off	On	On	On	On
214	428	429	Off	On	On	Off	On	On	On	On
215	430	431	On	On	On	Off	On	On	On	On
216	432	433	Off	Off	Off	On	On	On	On	On
217	434	435	On	Off	Off	On	On	On	On	On
218	436	437	Off	On	Off	On	On	On	On	On
219	438	439	On	On	Off	On	On	On	On	On
220	440	441	Off	Off	On	On	On	On	On	On
221	442	443	On	Off	On	On	On	On	On	On
222	444	445	Off	On	On	On	On	On	On	On
223	446	447	On	On	On	On	On	On	On	On
224	448	449	Off	Off	Off	Off	Off	On	On	On
225	450	451	On	Off	Off	Off	Off	On	On	On
226	452	453	Off	On	Off	Off	Off	On	On	On
227	454	455	On	On	Off	Off	Off	On	On	On
228	456	457	Off	Off	On	Off	Off	On	On	On
229	458	459	On	Off	On	Off	Off	On	On	On
230	460	461	Off	On	On	Off	Off	On	On	On
231	462	463	On	On	On	Off	Off	On	On	On
232	464	465	Off	Off	Off	On	Off	On	On	On
233	466	467	On	Off	Off	On	Off	On	On	On
234	468	469	Off	On	Off	On	Off	On	On	On
235	470	471	On	On	Off	On	Off	On	On	On
236	472	473	Off	Off	On	On	Off	On	On	On
237	474	475	On	Off	On	On	Off	On	On	On
238	476	477	Off	On	On	On	Off	On	On	On
239	478	479	On	On	On	On	Off	On	On	On
240	480	481	Off	Off	Off	Off	On	On	On	On
241	482	483	On	Off	Off	Off	On	On	On	On
242	484	485	Off	On	Off	Off	On	On	On	On
243	486	487	On	On	Off	Off	On	On	On	On
244	488	489	Off	Off	On	Off	On	On	On	On
245	490	491	On	Off	On	Off	On	On	On	On
246	492	493	Off	On	On	Off	On	On	On	On
247	494	495	On	On	On	Off	On	On	On	On
248	496	497	Off	Off	Off	On	On	On	On	On
249	498	499	On	Off	Off	On	On	On	On	On

Table A-1 BOX ID AND TRANSCEIVER DEFAULT CHANNEL SETTINGS

Box ID	Default Channel		Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6	Switch 7	Switch 8
	Tx/Rx 1	Tx/Rx 2	(LSB)							(MSB)
250	500	501	Off	On	Off	On	On	On	On	On
251	502	503	On	On	Off	On	On	On	On	On
252	504	505	Off	Off	On	On	On	On	On	On
253	506	507	On	Off	On	On	On	On	On	On
254	508	509	Off	On	On	On	On	On	On	On
255	510	511	On	On	On	On	On	On	On	On

APPENDIX B MODULE ERROR CODES AND RECOMMENDED ACTIONS

Table B-1 ERROR CODES E00 – E99 : USER SERVICEABLE FAILURES/ADVISORIES

	Transceiver Module	Controller Module	Recommended Action
E00	Reserved	Reserved	
E01	-	Internal 10MHz failure	Either replace Controller Module or use external 10 MHz oscillator
E02 – E03	Reserved	Reserved	
E04	-	DC Revert Active	Check AC Power Supply
E05	Channel Programming Error or Empty Channel Table	-	Check channel programming using Transceiver Module Programmer
E06	PA Comms Failure	-	Check PA inserted correctly and power applied from PSU. If PSU fault light is on, or PSU power light is off, then replace PSU module. Otherwise replace PA module.
E07	PA Over Temperature Alarm	-	Check fans operating correctly.
E08	PA High VSWR Alarm	-	Check antenna connections.
E09	Remote Diagnostics Active in Test Mode	-	An advisory, not an error condition
E10 – E22	Reserved	Reserved	
E23	-	GPIO Xilinx boot failure	Replace Controller Module
E24	DSP boot failure	DSP boot failure	Replace Module
E25	Reserved	Reserved	
E26–E99	Not Used		