

Draft

**6525 Multimode Digital Radio  
User Documentation**

## Draft

### Errata

Any errors found in this handbook are promulgated through the Park Air FTP network. Any user can access this information by logging on to:

*ftp.parkairsystems.com*

When logged on, select the public (Pub) folder, then the Handbook Errata Sheets folder, and then select the required equipment model.

[Adobe Acrobat™ must be loaded on your PC to use this facility]

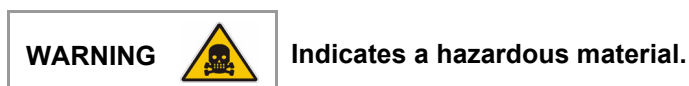
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## Health and Safety

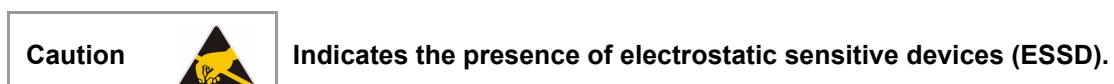
### Warnings

A warning is used to indicate possible danger to personnel. Throughout Park Air handbooks, warnings are indicated by the following symbols:



### Cautions

A caution is used to indicate possible danger to the equipment.



Health and Safety (Continued)

Specific Warnings Applicable to the MDR

**WARNING**



**Dangerous Voltage**

The instructions given in this documentation involve connecting dangerous voltage to the MDR. Installation must be carried out only by suitably qualified personnel.

**WARNING**



**Earth Connection**

This equipment must be earthed. The earth terminal of the ac connector must be used as the safety earth.

**WARNING**



**Antenna Radiation**

The antenna used with the MDR must be installed such that the resultant radiated field strength is below 10 W/m<sup>2</sup> in areas normally accessible to personnel.

The RF field strength from the antenna can be predicted from the equation  $S = 1.4PG/4\pi R^2$

[Where S = power density; P = power input to antenna; G = antenna gain; R = distance to centre of radiation and 1.4 = multiplication factor for average power based on a modulation index of 90%.]

Based on this formula a 2 dBi antenna, the predicted safe distance from the centre of radiation would be approximately 0.75 m for a field strength of 10 W/m<sup>2</sup> (1 mW/cm<sup>2</sup>).

This meets the requirements of Health Canada Safety Code 6 for RF and microwave exposed workers. For persons not classed as RF and microwave workers and including the general public the limit is 2 W/m<sup>2</sup> (0.2 mW/cm<sup>2</sup>) which increases the minimum safe distance to 1.7 m.

Further information on calculating the field strengths and power levels can be found in Health Canada Safety Code 6 'Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range 3 kHz to 300 GHz', and also in FCC document OET Bulletin 65.

**WARNING**



**Antenna Radiation**

Ensure an antenna, or dummy load, is connected before switching on the MDR. There is high RF voltage present at the antenna connector when the radio is keyed.

**WARNING**



**Beryllium Hazard**

Although no instructions in this documentation involve removing any equipment covers, users should be aware that the RFPA output transistors contain Beryllium.

**WARNING**



**Heavy Item**

During installation an MDR may have to be lifted, possibly to head height, to fit onto telescopic slides. At least two people should be used to lift the equipment. Failure to use sufficient people when lifting equipment can result in personal injury.

## Draft

### Disposal



This product is covered by the European Directive 2002/96/EC.

It must not be disposed of in domestic waste.

Disposal should be made using designated collection facilities appointed by the government or local authority in your area.

**List of Abbreviations**

A	amp
ac	alternating current
ACARS	aircraft communications, addressing and reporting system
AM	amplitude modulation
BIT	built-in test
C	celsius
dB	decibel
dBm	power ratio in decibel (dB) referenced to one milliwatt (mW)
dc	direct current
ESD	electrostatic sensitive devices
Fig	figure
Hz	hertz
kg	kilogramme
kHz	kilohertz
LCD	liquid crystal display
m	metre
mA	milliamp
MDR	multimode digital radio
MHz	megahertz
mm	millimetre
ms	milli-second
mW	milliwatt
PA	power amplifier
ppm	parts per million
PTT	press to transmit
RFPA	radio frequency power amplifier
s	second
V	volt
VDL	VHF data link
VHF	very high frequency
VSWR	voltage standing wave ratio
W	watt

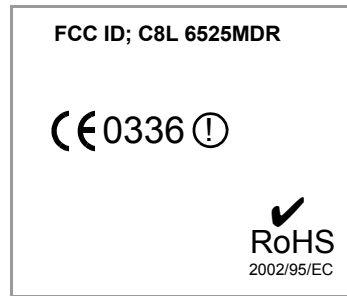
## Approvals and Standards 6525 Multimode Digital Radio

The equipment is designed to meet the following requirements:

- ❑ RoHS Directive 2002/95/EC
- ❑ WEEE Directive 2002/96/EC
- ❑ ICAO Annex 10 Vol III Part 1 Chapter 6
- ❑ EN 301 841-1 Electromagnetic compatibility and Radio spectrum Matters (ERM); VHF air-ground Digital Link (VDL) Mode 2; Technical characteristics and methods of measurement for ground-based equipment; Part 1: Physical layer and MAC sub-layer
- ❑ EN 300 676 Electromagnetic compatibility and Radio spectrum Matters (ERM); Ground-based VHF hand-held, mobile and fixed radio transmitters, receivers and transceivers for the VHF aeronautical mobile service using amplitude modulation; Technical characteristics and methods of measurement.

Approvals have been granted against the following:

- ❑ Safety approval to EN60950-1, CAN/CSA-C22.2 No. 60950 and UL 60950
- ❑ FCC Rules 47CFR Parts 15 and 87
- ❑ Technical Acceptance under Industry Canada, reference Radio Standard Specification RSS141
- ❑ CE approval under the R&TTE Directive 1999/5/EC.



### FCC / Industry Canada Statement

This device has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ❑ Reorient or relocate the receiving antenna.
- ❑ Increase the separation between the equipment and the receiver.
- ❑ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ❑ Consult the supplier or an experienced radio/TV technician for help.

**Operation on 8.33 kHz channel spacing is prohibited under the current regulations  
of Industry Canada and the FCC.**

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**Contents**

	Page
<b>Overview</b>	<b>11</b>
Introduction	12
Operating Modes	12
MDR Applications	13
Hardware Configuration	13
Software Configuration	13
<b>Specification</b>	<b>15</b>
MDR Operating Characteristics	16
Dimensions and Weight	16
Input Supply Requirement	16
Environmental	16
<b>Operation</b>	<b>17</b>
Controls and Indicators	18
Introduction	18
Controls and Indicators	18
Ready Indicator	18
Alarm Indicator	18
Receive Indicator	18
Transmit Indicator	18
Scroll/Select Switch and LCD	19
Connectors	19
Reference Connector	19
Headset/Microphone/Diagnostics Connector	19
Switching On and Setting the Operating Parameters	21
Using the Scroll/Select Switch	21
Screen Protocol	21
Switching On	22
Selecting an Operating Mode	23
Selecting the Operating Frequency	24
Storing and Recalling Frequency Channels	25
Setting Band Edges	27
Setting Parameters	29
Downloading Software Fills	35
<b>Installation</b>	<b>37</b>
Introduction	38
Fuses and Connectors	39
Initial Inspection of the MDR	39
Fitting an MDR into an Equipment Cabinet	40
Rear Panel Interfaces	41
Ethernet Connector	42
Facilities Connector	43
Auxiliary Connector	45
Connecting the Chassis Stud	46
Connecting an Antenna	46
Checking the ac Input Fuse	47
AC Supply Connection	47

**Contents (continued)**

	Page
<b>Maintenance</b>	<b>49</b>
Maintenance Policy	50
Unscheduled Maintenance	50
Scheduled Maintenance	50
Cleaning the Equipment	50
Security of External Connections	50
Checking the MDR's Internal Reference Frequency	51
Initiating an Interruptive BIT Test	52
Removing and Refitting the Cooling Fan	54

Draft

## Overview

## Introduction

This documentation describes the Park Air 6525 Multimode Digital Radio (MDR). The MDR is a VHF transceiver operating in the aeronautical frequency band between 118 and 136.975 MHz. The maximum transmit output power is 25 watts.

The MDR can be used as a conventional AM-Voice transceiver, or can operate as a subsystem of the Aircraft Communications, Addressing and Reporting System (ACARS) and the VHF Data Link (VDL) air-ground communication systems.

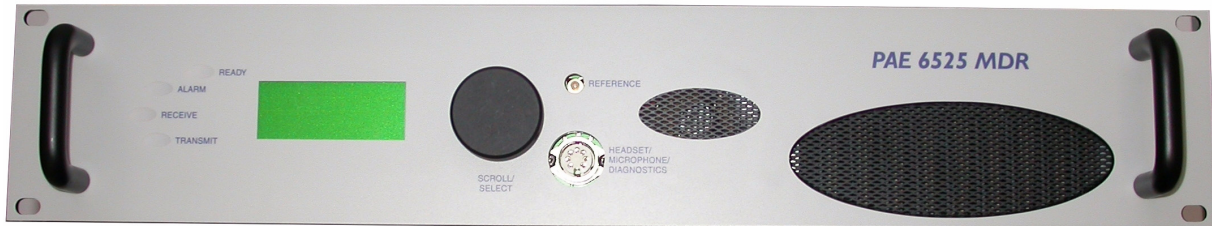


Fig 1 6525 Multimode Digital Radio (MDR)

## Operating Modes

Operating modes are software controlled. A 6525 MDR can be loaded with any two of the four available software fills shown in Fig 2. All four software fills are available to download through the user's network.

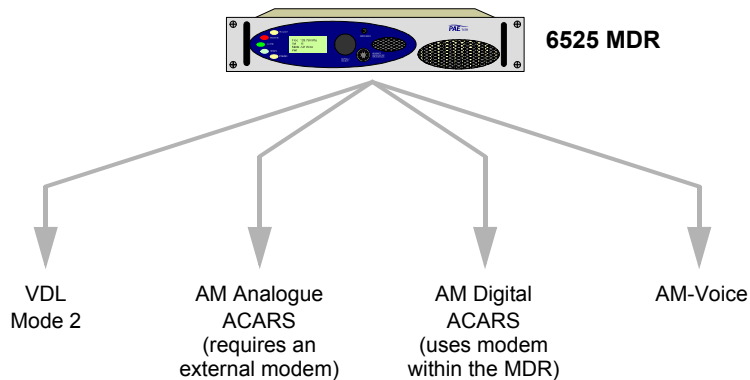


Fig 2 Operating Modes

## MDR Applications

In addition to operating in a conventional AM-Voice mode, the MDR can operate in two VHF air-ground data link services: ACARS and VDL mode 2.

ACARS is a low-speed data link in wide use throughout the world, operating at 2.4 kbits per second using MSK modulation.

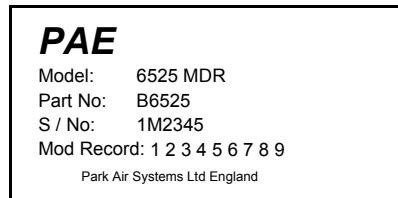
VDL mode 2 is a higher bandwidth, connection orientated service, operating at 31.5 kbits per second using D8PSK modulation.

## Hardware Configuration

The product model is: 6525 MDR.

The part number is: B6525.

A hardware configuration label is fixed to the MDR's rear panel. The label shows the model, part number, serial number and modification status. An example label is shown in Fig 3.



**Fig 3 Hardware Configuration Label**

## Software Configuration

The part order number is TBD (customer specific). This number encompasses the hardware part number detailed above, fitted with the software detailed below.

Any two of the four available software fills can be stored in the MDR at any one time. A software configuration label, as shown in Fig 4, is fixed to the MDR's top cover. This label details the part numbers for the four mode software fills, and the permanently installed Ethernet software.

### Software Configuration

Part Order No.	TBD (customer specific)	
Software	Mode	Part No.
Fill *	AM Voice	TBD (customer specific)
Fill *	AM Analogue ACARS	TBD (customer specific)
Fill *	AM Digital ACARS	TBD (customer specific)
Fill *	VDL Mode 2	TBD (customer specific)
Interface	Ethernet	TBD (customer specific)

\*Only 2 are stored in the radio at any one time

**Fig 4 Software Label**

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## **Specification**

## MDR Operating Characteristics

Frequency range	Between 118 and 136.975 MHz	
Number of channels	100	
Channel spacing	25 kHz (all modes) 8.33 kHz (Am-Voice mode only)	
Modulation modes	ACARS	13K0A2D
	VDL Mode 2	14K0G1D
	AM-Voice (25 kHz)	6K00A3E
	AM-Voice (8.33 kHz)	5K00A3E
Frequency stability	Better than 1 ppm within permissible environmental conditions	

## Dimensions and Weight

The dimensions and weight of the MDR are:

Width	483 mm (19 inches)
Depth	450 mm (17.8 inches)
Height	88.9 mm (3.5 inches).
Weight	12.5 kg (27.5 pounds)

## Input Supply Requirement

ac input supply	Between 90 and 264 Vac, 47 to 63 Hz
ac power consumption	Tx, less than 400 VA (250 VA typical)
	Rx, less than 70 VA

## Environmental

Temperature range	0 to +40°C operating -20 to +60°C non-operating
Ventilation	The MDR is cooled by a temperature controlled fan. When the MDR is switched on, the fan runs at full speed for a short period before coming under temperature control
Warm up time	Less than 30 seconds

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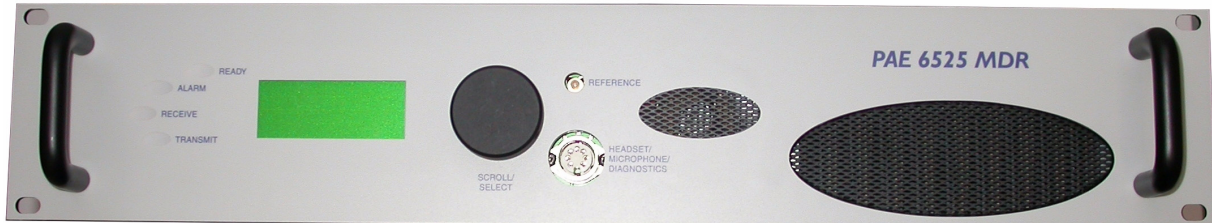
**Operation**

## Controls and Indicators

---

### Introduction

This topic describes the MDR's front panel (see Fig 5) controls, indicators and connectors.



**Fig 5 MDR Front Panel**

### Controls and Indicators

#### Ready Indicator

A green indicator that lights when the MDR is ready for use and no BIT faults have been detected.

#### Alarm Indicator

A red indicator that either flashes, or lights, when a BIT fault has been detected. BIT indications are classified as either Alerts or Alarms.

If an 'alert' condition is detected, the Alarm indicator flashes, the Ready indicator remains lit, and the MDR remains operational. A BIT 'alert' is indicated if:

- ❑ The MDR's RF output power has reduced from its setting by more than 1 dB but not more than 3 dB
- ❑ The supply volts falls below 21.6 V
- ❑ The RF PA temperature has exceeded 80°C.

Any other BIT condition results in an alarm. When detected, the Alarm indicator lights and the Ready indicator becomes unlit; the MDR cannot be used.

When the Alarm indicator flashes, or is lit, the front panel display indicates the nature of the Alert or Alarm

#### Receive Indicator

An amber indicator that lights as follows:

In AM-Voice mode	When a signal above the squelch threshold is received, or when the squelch is defeated.
In VDL 2 mode	Lights on Sync and remains lit until the end of message.
In AM Analogue ACARS mode	Lit when a signal is received.
In AM Digital ACARS mode	Lights on Sync and remains lit until the end of message.

#### Transmit Indicator

An amber indicator that lights when the transmit circuit is keyed and producing output power.

### Scroll/Select Switch and LCD

The Scroll/Select switch is used in conjunction with the LCD to select most of the MDR's operational settings. During normal operation, the LCD displays the Main screen. Detailed information regarding the Scroll/Select switch and LCD is given on [page 21](#).

## Connectors

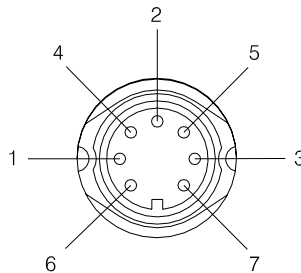
### Reference Connector

An SMB jack socket that allows a frequency counter to monitor the MDR's reference frequency. This connector is used only for maintenance purposes. The instructions for checking and adjusting the reference frequency are given in the Maintenance topic.

### Headset/Microphone/Diagnostics Connector

A dual purpose connector that allows either a headset/microphone, or a PC, to be connected to the MDR. The connector is a 7-pin self-locking DIN socket; the pin-out is shown in Fig 6 and detailed in Table 1 for the audio connections, and [Table 2](#) for the PC connections.

A microphone/headset is used to enable the MDR to be operated from the front panel in AM-Voice mode.



**Fig 6 Headset/Microphone/Diagnostics Connector Pin-Out**

**Table 1 Headset/Microphone/Diagnostics Connector - Audio Connections**

Pin Number	Signal	Input or Output	Description
1	Microphone ground	-	0 V.
3	Microphone PTT	Input	0 V to PTT.
5	Sidetone/headset drive	Output	0 to 3 V pk-pk.
6	Microphone input	Input	2 to 35 mV rms on Passive setting and 8 to 140 mV rms on Active setting to remain in VOGAD range.
7	Ground	-	0 V.

**Table 2 Headset/Microphone/Diagnostics Connector - PC Connections**

Pin Number	Signal	Input or Output	Description
2	Transmit data	Output	RS232, 115200 baud, 8 data bits, 1 stop bit, no parity, no handshaking.
4	Receive data	Input	RS232, 115200 baud, 8 data bits, 1 stop bit, no parity, no handshaking.
7	Ground	-	0 V.

**Note:**

PC connections are used for maintenance at Park Air. No instructions in this documentation require the use of this port.

## Switching On and Setting the Operating Parameters

---

### Using the Scroll/Select Switch

The Scroll/Select switch (referred to throughout this topic as the 'Switch') is used to leave the Main screen and display the Control screen. Further use of the Switch displays various selection menus and allows the required parameters to be set. The switch has three actions: it can be turned clockwise, anti-clockwise, or momentarily pushed in.

### Screen Protocol

The following protocol is applicable to all screens described in this document.

**Main Screen** During normal MDR operation, the Main screen, an example of which is shown below, is displayed.

F	r	e	q		1	1	8	.	0	0	0	M	H	z
M	o	d	e		V	D	L		M	O	D	E		2

**Switch** Refers to the front panel Scroll/Select switch. The switch is turned clockwise to scroll through fields from left to right, and from top to bottom. The switch is turned anticlockwise to scroll through fields from right to left, and from bottom to top. The switch is pressed to make a selection.

**Time out** If during any setting up procedure the Scroll/Select switch is not operated for 30 seconds, the display returns to the Main screen. If editing any parameter has not been completed, the MDR stays on the original setting.

**>>** Indicates more fields are available other than those currently displayed. To access those fields, turn the switch clockwise through the last displayed field.

**<<** Indicates more fields are available other than those currently displayed. To access those fields, turn the switch anti-clockwise through the first displayed field.

**Back** When Back is selected, you are returned to the previous menu.

**Exit** When Exit is selected, you are returned to the Main screen.

## Switching On

The MDR is switched on by setting the rear panel AC Supply switch to On. The LCD should light and show the following displays.

When switched on, the MDR initialises which takes approximately five seconds.

When the MDR is initialised a Main screen is displayed.

Four Main screens are available that reflect the MDR's four possible operating modes. The screen displayed after switch on reflects the last selected operating mode.

F	r	e	q		1	1	8	.	0	0	0	M	H	z
M	o	d	e		A	M		V	O	I	C	E		
V	o	I			I	I	I	I	I	I	I			

**Main Screen for AM-Voice Mode**

Channel (Ch) information is shown only when the MDR operates from a stored channel frequency.

A power (Pwr) level indication is shown only when the MDR is keyed.

A volume (Vol) level indication is shown only when the MDR is not keyed.

F	r	e	q		1	1	8	.	0	0	0	M	H	z
M	o	d	e		V	D	L		M	O	D	E	2	

**Main Screen for VDL Mode 2**

F	r	e	q		1	1	8	.	0	0	0	M	H	z
C	h				4	2								
M	o	d	e		A	M		A	/	A	C	A	R	S
V	o	I			I	I	I	I	I	I	I	I	I	I

**Main Screen for AM Analogue ACARS**

F	r	e	q		1	1	8	.	0	0	0	M	H	z
M	o	d	e		A	M		D	/	A	C	A	R	S
P	w	r			I	I	I	I	I	I	I	I	I	I

**Main Screen for AM Digital ACARS**

## Selecting an Operating Mode

To select the MDR's operating mode, use the following procedure:

With the Main screen displayed, press the Switch to display the Control screen.

F r e q	1 1 8 . 0 0 0	M H z
M o d e	V D L	M O D E 2

**Main Screen (example shown for VDL Mode 2)**

Turn the Switch until Settings is highlighted. Then press the Switch to display the Settings screen.

F r e q u e n c y	
C h a n n e l	
S e t t i n g s	
E x i t	> >

**Control Screen**

Turn the Switch until the current Mode is highlighted; then press the Switch. Turn the switch to alter the operating mode. When the required mode is displayed, press the Switch.

M o d e	A M	V O I C E
M o d e	S e t t i n g s	
P o l a r i t i e s		
E x i t		> >

**Settings Screen**



The MDR can contain the software fills for two operating modes. If the required operating mode cannot be selected during this procedure, the required fill must be downloaded. See [page 35](#).

## Selecting the Operating Frequency

The MDR's frequency can be changed in two ways: either from the frequency screen, or by recalling a preset channel. This procedure details using the Frequency screen. Storing and recalling channel frequencies is detailed on [page 25](#).

With the Main screen displayed, press the Switch to display the Control screen.

F r e q	1 1 8 . 0 0 0	M H z
M o d e	V D L	M O D E 2

**Main Screen (example shown for VDL Mode 2)**

Turn the Switch until Frequency is highlighted. Then press the Switch to display the Frequency screen.

F r e q u e n c y	
C h a n n e l	
S e t t i n g s	
E x i t	> >

**Control Screen**

Turn the Switch to highlight the digits to be changed, then press the Switch. Turn the Switch until the required digits are shown, then press the Switch. Repeat until the required frequency is shown, then highlight OK and press the switch.

F r e q	1 1 8 . 0 0 0	M H z
C a n c e l		O K

**Frequency Screen**



Only frequencies that fall between the band edge settings can be selected. Setting Band Edges is described on [page 27](#).

## Storing and Recalling Frequency Channels

As an alternative to setting an individual operating frequency, up to 100 preset frequency channels can be stored in the MDR; any stored channel can be recalled for immediate use.

To store a frequency channel:

With the Main screen displayed, press the Switch to display the Control screen.

F r e q	1	1	8	.	0	0	0	M	H	z
C h	2	3								
M o d e	A	M	A	/	A	C	A	R	S	
V o l										

**Main Screen (example shown for  
AM Analogue ACARS)**

Turn the Switch until Channel is highlighted. Then press the Switch to display the Channel screen.

F r e q u e n c y										
C h a n n e l										
S e t t i n g s										
E x i t									>	>

**Control Screen**

Turn the Switch to highlight the channel number and press the Switch. Turn the switch to select the required channel number and then press the switch again.

C h	2	4								
F r e q	1	1	8	.	0	0	0	M	H	z
S t o r e										
B a c k									E	x i t

**Channel Screen**

Turn the Switch to highlight the Frequency digits to be changed, then press the Switch. Turn the Switch until the required digits are shown, then press the Switch. Repeat until the required frequency is shown, then highlight Store and press the switch.

Repeat for other channels as required.

Select Back to return to the Control screen, or Exit to return to the Main screen.



Only channel frequencies that fall between the band edge settings can be selected. If an attempt is made to store a frequency outside the band edges, an error message is displayed.

Setting Band Edges is described on [page 27](#).

To recall a previously stored channel:

With the Main screen displayed, press the Switch to display the Control screen.

F	r	e	q		1	1	8	.	0	0	0	M	H	z
C	h			2	3									
M	o	d	e		A	M		A	/	A	C	A	R	S
V	o	l												

**Main Screen (example shown for  
AM Analogue ACARS)**

Turn the Switch until Channel is highlighted. Then press the Switch to display the Channel screen.

F	r	e	q	u	e	n	c	y						
C	h	a	n	n	e	l								
S	e	t	t	i	n	g	s							
E	x	i	t									>	>	

**Control Screen**

Turn the Switch to highlight the channel number and press the Switch. Turn the switch to select the required channel number/frequency and then press the switch.

C	h	2	4												
F	r	e	q		1	1	8	.	0	0	0	M	H	z	
R	e	c	a	l											
B	a	c	k									E	x	i	t

**Channel Screen**

Highlight Recall and press the Switch. The MDR now operates on the selected frequency channel.

Select Back to return to the Control screen, or Exit to return to the Main screen.

## Setting Band Edges

The frequency range of the MDR is 118 to 136.975 MHz. If required, operation can be limited to either one or two smaller parts of the frequency band by setting the band edges BE1 to BE4. Operation is possible between BE1 and BE2 frequencies, and frequencies between BE3 and BE4. Examples are shown in Table 3.

**Table 3 Band Edge Values**

	BE1	BE2	BE3	BE4
MDR set so that the full frequency range can be received.	118.000	136.975	118.000	136.975
<i>Example:</i> MDR set to transmit and receive only those frequencies in the range 120 to 130 MHz.	120.000	130.000	120.000	130.000
<i>Example:</i> MDR set to transmit and receive only those frequencies in the ranges 120 to 125 MHz and 130 to 135 MHz.	120.000	125.000	130.000	135.000

To set the band edges:

With the Main screen displayed, press the Switch to display the Control screen.

F r e q	1 1 8 . 0 0 0 M H z
M o d e	V D L M O D E 2

**Main Screen (example shown for VDL Mode 2)**

Turn the Switch until Settings is highlighted. Then press the Switch to display the Settings screen.

F r e q u e n c y
C h a n n e l
S e t t i n g s
E x i t > >

**Control Screen**

Turn the Switch clockwise until the Settings screen (second page) is displayed. Highlight Band Edges and press the Switch to display the Band Edge screen.

(continued ...)

M o d e	V D L	M O D E	2
M o d e	S e t t i n g s		
P o l a r i t i e s			
E X I T			> >

**Settings Screen (First Page)**

B a n d E d g e s
I P S e t t i n g s
R e f F r e q 6 7 . 0 %
E x i t < < > >

**Settings Screen (Second Page)**

Using the Switch, highlight the band edge values to be altered, pressing the switch after each alteration.

When all values are correct, select Exit to return to the Main page.

Note that band edge frequencies can be set only in increments of 25 kHz.

B E 1	1	2	0	.	0	0	0	M	H	z
B E 2	1	2	5	.	0	0	0	M	H	z
B E 3	1	3	0	.	0	0	0	M	H	z
E x i t									>	>

**Band Edge Screen (First Page)**

B E 4	1	3	5	.	0	0	0	M	H	z
B a c k										
E x i t										
									<	<

**Band Edge Screen (First Page)**

## Setting Parameters

The MDR's parameters listed in the following tables can be set by the user. Not all parameters can be set from the MDR's front panel.

The applicable tables are:

- ❑ Analogue ACARS mode, [Table 4](#)
- ❑ Digital ACARS mode, [Table 5](#)
- ❑ VDL mode 2, [Table 6](#)
- ❑ AM-Voice mode, [Table 7](#).

Mode specific parameters are set by selecting Mode Settings as follows:

With the Main screen displayed, press the Switch to display the Control screen.

F r e q	1 1 8 . 0 0 0	M H z
M o d e	V D L	M O D E 2

**Main Screen (example shown for VDL Mode 2)**

Turn the Switch until Settings is highlighted. Then press the Switch to display the Settings screen.

F r e q u e n c y
C h a n n e l
<b>S e t t i n g s</b>
E x i t > >

**Control Screen**

Turn the Switch until Mode Settings is highlighted; then press the Switch. Turn the switch to scroll through and set the applicable parameters.

M o d e	A M V O I C E
<b>M o d e S e t t i n g s</b>	
P o l a r i t i e s	
E x i t	> >

**Settings Screen**

**Table 4 Analogue ACARS Functions and Parameters**

Function	Adjustment Range	Factory Default	Step Size
Frequency	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE1 and BE3	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE2 and BE4	118 to 136.975 MHz	136.975 MHz	25 kHz
Channel	1 to 100	–	1
RF power	3 to 25 W	25 W	1 W
Reference frequency	0 to 100%	–	0.4%
LCD display backlight time-out	15 to 120 s, On or Off	30 s	15 s
Modulation depth	5 to 95%	90%	1%
PTT	On (key) or Off (dekey)	Off	–
PTT Polarity	STD (active low) or INV (active high)	STD	–
Phantom PTT Polarity	STD (active low) or INV (active high)	STD	–
PTT reference voltage	+14, 0, or -14 V	+14 V	–
Audio line input	-20 to +10 dBm	-13 dBm	1 dB
TX inhibit	On or Off	Off	–
Transmit time-out	2 to 510 s, or Off	180 s	2 s
RF pre-attenuator	On or Off	Off	–
Audio line output	-20 to +10 dBm	-13 dBm	1 dB
Loudspeaker/ Headset volume	0 to 100%	30%	5%
Initiate BIT interruptive test	On or Off	–	–
DHCP	On or Off	Off	–
IP address	000.000.000.000 to 255.255.255.255	192.168.0.2	–
IP subnet mask	000.000.000.000 to 255.255.255.255	255.255.255.000	–
Default gateway address	000.000.000.000 to 255.255.255.255	192.168.0.1	–
Control application TCP port number	5001 to 65535	30000	–

**Table 5 Digital ACARS Functions and Parameters**

Function	Adjustment Range	Factory Default	Step Size
Frequency	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE1 and BE3	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE2 and BE4	118 to 136.975 MHz	136.975 MHz	25 kHz
Channel	1 to 100	–	1
RF power	3 to 25 W	25 W	1 W
Reference frequency	0 to 100%	–	0.4%
LCD display backlight time-out	15 to 120 s, On or Off	30 s	15 s
Modulation depth	5 to 95%	90%	1%
RF pre-attenuator	On or Off	Off	–
Loudspeaker/ Headset volume	0 to 100%	30%	5%
MAC TM1 (Inter-access delay)	0.5 to 125 ms	75.5 ms	0.5 ms
MAC TM2 (Channel busy)	1 to 120 s	60 s	1 s
MAC TM3	1 to 120 s	20 s	1 s
MAC p (Persistence)	1/256 to 256/256	50/256	1/256
MAC M1 (maximum number of access attempts)	2 to 9999	10	10
TX enable	On or Off	Off	–
Loop back	On or Off	Off	–
DHCP	On or Off	Off	–
IP address	000.000.000.000 to 255.255.255.255	192.168.0.2	–
IP subnet mask	000.000.000.000 to 255.255.255.255	255.255.255.000	–
Default gateway address	000.000.000.000 to 255.255.255.255	192.168.0.1	–
Control application TCP port number	5001 to 65535	30000	–

**Table 6 VDL Mode 2 Functions and Parameters**

Function	Adjustment Range	Factory Default	Step Size
Frequency	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE1 and BE3	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE2 and BE4	118 to 136.975 MHz	136.975 MHz	25 kHz
Channel	1 to 100	–	1
RF power	3 to 25 W	25 W	1 W
Reference frequency	0 to 100%	–	0.4%
LCD display backlight time-out	15 to 120 s, On or Off	30 s	15 s
RF pre-attenuator	On or Off	Off	–
MAC TM1 (Inter-access delay)	0.5 to 125 ms	4.5 ms	0.5 ms
MAC TM2 (Channel busy)	6 to 120 s	60 s	1 s
MAC p (Persistence)	1/256 to 256/256	13/256	1/256
MAC M1 (maximum number of access attempts)	1 to 65535	135	1
Scramble vector	0000 to 7FFF (hex) 0 to 32767 (decimal)	4D4B (hex) 19787 (decimal)	1
TX enable	On or Off	Off	–
Loop back	On or Off	Off	–
Reed Solomon Decoding	On or Off	On	–
DHCP	On or Off	Off	–
IP address	000.000.000.000 to 255.255.255.255	192.168.0.2	–
IP subnet mask	000.000.000.000 to 255.255.255.255	255.255.255.000	–
Default gateway address	000.000.000.000 to 255.255.255.255	192.168.0.1	–
Control application TCP port number	5001 to 65535	30000	–

**Table 7 AM-Voice Functions and Parameters**

Function	Adjustment Range	Factory Default	Step Size
Frequency	118 to 136.975 MHz	118.000 MHz	25 or 8.33 kHz
Band edges BE1 and BE3	118 to 136.975 MHz	118.000 MHz	25 kHz
Band edges BE2 and BE4	118 to 136.975 MHz	136.975 MHz	25 kHz
Front panel step size	25, 8.33 kHz, or both	25 kHz	25 or 8.33 kHz
Channel	1 to 100	–	1
Channel spacing	25 or 8.33 kHz	25 kHz	-
Offset carrier	2 offset, $\pm 5$ kHz 3 offset, 0 and $\pm 7.5$ kHz 4 offset, $\pm 2.5$ kHz and $\pm 7.5$ kHz	-	-
RF power	3 to 25 W	25 W	1 W
Reference frequency	0 to 100%	–	0.4%
LCD display backlight time-out	15 to 120 s, On or Off	30 s	15 s
Modulation depth	5 to 95%	90%	1%
VOGAD	On or Off	On	-
Mute	On or Off	On	-
PTT	On (key) or Off (dekey)	Off	–
Tone keying	2175, 2300 Hz, or Off	Off	-
Microphone type	Active or passive	Passive	-
Keying priority	Local-remote, or remote-local	Local-remote	-
Local PTT enable	Enabled or disabled	Enabled	-
Remote PTT enable	Enabled or disabled	Enabled	-
Remote phantom PTT enable	Enabled or disabled	Disabled	-
PTT Polarity	STD (active low) or INV (active high)	STD	–
Phantom PTT Polarity	STD (active low) or INV (active high)	STD	–
PTT reference voltage	+14, 0, or -14 V	+14 V	–
Audio line input	-20 to +10 dBm	-13 dBm	1 dB
TX inhibit	On or Off	Off	–
Transmit time-out	2 to 510 s, or Off	180 s	2 s
Audio AGC	On or Off	On	-
Squelch	-110 to -60 dBm (-104 to -54 dBm with RF pre-attenuator selected)	-110 dBm	1 dB

**Table 7 AM-Voice Functions and Parameters (Continued)**

Function	Adjustment Range	Factory Default	Step Size
Squelch polarity	STD (n/o) or INV (n/c)	STD	-
Squelch noise compensation	On or Off	On	-
Squelch carrier override	On or Off	Off	-
Squelch defeat	On or Off	Off	-
RF pre-attenuator	On or Off	Off	—
Audio line output	-20 to +10 dBm	-13dBm	1 dB
Loudspeaker/Headset volume	0 to 100%	30%	5%
Self-receive transmit audio on line output	On or Off	Off	
Initiate BIT interruptive test	On or Off	—	—
DHCP	On or Off	Off	—
IP address	000.000.000.000 to 255.255.255.255	192.168.0.2	—
IP subnet mask	000.000.000.000 to 255.255.255.255	255.255.255.000	—
Default gateway address	000.000.000.000 to 255.255.255.255	192.168.0.1	—
Control application TCP port number	5001 to 65535	30000	—

### **Downloading Software Fills**

Four software fills are available as detailed in [Fig 4](#) on [page 13](#). Any two fills can be stored in the MDR at any one time.

All software fills are available on the user's network and can be downloaded via the MDR's Ethernet port.

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## **Installation**

## Introduction



The instructions given in this topic involve connecting dangerous voltage to the MDR. Installation must be carried out only by suitably qualified personnel.



The antenna used with the MDR must be installed such that the resultant radiated field strength is below 10 W/m<sup>2</sup> in areas normally accessible to personnel.

The RF field strength from the antenna can be predicted from the equation  $S = 1.4PG/4\pi R^2$

[Where S = power density; P = power input to antenna; G = antenna gain; R = distance to centre of radiation and 1.4 = multiplication factor for average power based on a modulation index of 90%.]

Based on this formula a 2 dBi antenna, the predicted safe distance from the centre of radiation would be approximately 0.75 m for a field strength of 10 W/m<sup>2</sup> (1 mW/cm<sup>2</sup>).

This meets the requirements of Health Canada Safety Code 6 for RF and microwave exposed workers. For persons not classed as RF and microwave workers and including the general public the limit is 2 W/m<sup>2</sup> (0.2 mW/cm<sup>2</sup>) which increases the minimum safe distance to 1.7 m.

Further information on calculating the field strengths and power levels can be found in Health Canada Safety Code 6 'Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range 3 kHz to 300 GHz', and also in FCC document OET Bulletin 65.



Ensure an antenna, or dummy load, is connected before switching on the MDR. There is high RF voltage present at the antenna connector when the radio is keyed.



During installation an MDR may have to be lifted, possibly to head height, to fit onto telescopic slides. At least two people should be used to lift the equipment. Failure to use sufficient people when lifting equipment can result in personal injury.



The MDR's circuitry contains Electrostatic Sensitive Devices (ESDs). Personnel must be aware of the precautions necessary to prevent damage to such devices. During installation all precautions necessary to prevent ESSD damage must be taken.



Changes or modifications made to this equipment that are not expressly approved by Park Air, or parties authorized by Park Air, could void the user's authority to operate the equipment.

The procedures in this document describe how to install an MDR. The procedures necessary during installation are listed in Table 8.

**Table 8 Installation Procedures**

Procedure		Reference
1	Perform an initial inspection of the MDR.	<a href="#">page 39</a>
3	Fit the MDR into an equipment cabinet.	<a href="#">page 40</a>
4	Connect the remote signals (as required).	<a href="#">page 41</a>
5	Connect the chassis stud to the cabinet or system earth.	<a href="#">page 46</a>
6	Connect an antenna	<a href="#">page 46</a>
7	Checking the ac input fuse	<a href="#">page 47</a>
8	Connect the ac supply.	<a href="#">page 47</a>

### Fuses and Connectors

Table 9 lists the radio's supply fuse and the connectors. Some of the connectors (depending on your particular configuration) are required during installation.

**Table 9 Fuses and Connectors**

Component	Type	Park Air Part Number
<b>Fuse:</b>		
AC input fuse	T4AH 250V IEC	29E01120108S
<b>Connectors:</b>		
AC supply connector	IEC	20-02030102
Antenna connector	N-type plug (straight)	19-01030301
	or, N-type plug (right-angle)	19-01030401
Ethernet connector	RJ45 plug	20K01080100
Facilities connector	25-way D-type plug	Plug: 20-01250100 Cover: 20-09250101
Auxiliary connector	9-way D-type plug	Plug: 20-01090100 Cover: 20-09090101
Reference connector	BNC to SMB 2 metre long lead	17K11000004
Diagnostics connector	7-pin DIN plug to 9-way D-type, radio to PC interconnection lead	17E12600001

### Initial Inspection of the MDR

On receipt of the MDR from Park Air, remove all transit packaging and check that there is no damage. If damage is evident, contact Park Air immediately and retain the original transit packaging. It is helpful if photographs of any damage can be taken and then forwarded to Park Air in support of any claim.

## Fitting an MDR into an Equipment Cabinet

**WARNING**

**Heavy Item**

During installation an MDR may have to be lifted, possibly to head height, to fit onto telescopic slides. At least two people should be used to lift the equipment. Failure to use sufficient people when lifting equipment can result in personal injury.

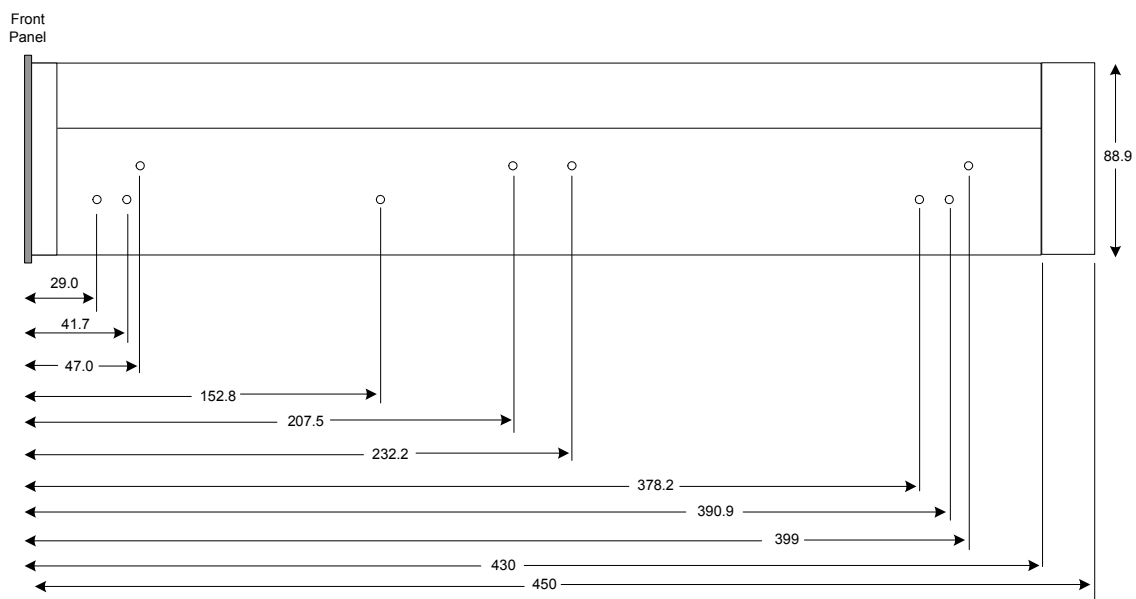
**Caution**

**Mechanical Support**

It is essential that the chosen mechanical installation provides adequate support along the depth (front to rear) of the unit. The MDR must not be supported by the front panel; doing so can cause damage.

The MDR can be installed on telescopic slides, or on fixed runners, within a standard 483 mm (19 inch) equipment rack. M4 tapped holes, each 10 mm deep (see [Fig 7](#)) are provided on each side of the equipment to accept the slides. Details of suitable telescopic slides are available from Park Air.

When fitted in the rack, the MDR's front panel must be secured to the cabinet's chassis using four M6 x 16 mm screws and plastic washers.



All measurements in mm

**Fig 7 Slide Fittings**

## Rear Panel Interfaces

The rear panel Ethernet, Facilities and Auxiliary interfaces (Fig 8) are used to connect remote signals as follows:

- |                       |   |
|-----------------------|---|
| For AM-Voice          | The line, PTT and squelch inputs and outputs connect via the Facilities interface.  |
| For AM Analogue ACARS | The analogue ACARS waveform connects between an external modem and the line inputs and outputs via the Facilities interface.                  |
| For AM Digital ACARS  | The digital ACARS data connects via the Ethernet interface.   |
| For VDL Mode 2        | All control information and data to be transmitted and received is transferred via the Facilities (HDLC connections) and Ethernet interfaces. |

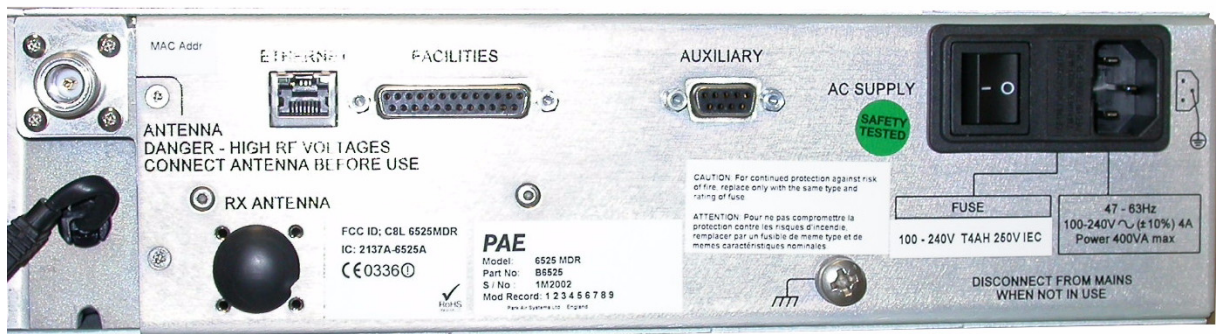
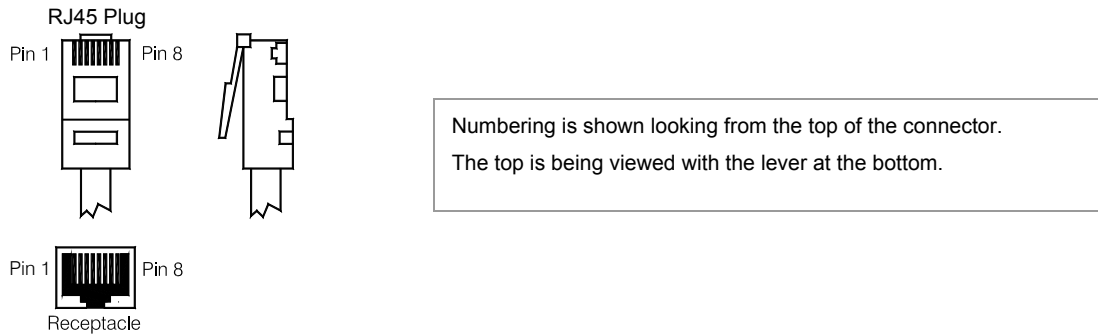


Fig 8 Rear Panel Connectors

### Ethernet Connector

The Ethernet RJ socket connects to a 10/100Base-T Ethernet network. The connector is shown in Fig 9 and the pin-out listed in Table 10.



**Fig 9 Ethernet Connector Pin-out**

**Table 10 Ethernet Connector Pin-out**

Pin	Signal Name	Characteristic	Input or Output
1	TD +	Balanced 100 ohm $\pm 10\%$ , 10/100 Mbps	Output
2	TD -		Output
3	RD +	Balanced 100 ohm differs from the reference by more than 10%, 10/100 Mbps	Input
4	Not connected		
5	Not connected		
6	RD -	Pair with pin 3	Input
7	Not connected		
8	Not connected		

### Table 11 Facilities Connector

31-3MDR00HB

**Table 11 Facilities Connector (Continued)**

Pin	Signal Name	Characteristic	Input or Output
11	HDLC 1 CL B	RS422 differential synchronous data at 128 kbits per second.	Output
12	Squelch	Solid state relay configurable to be normally open or normally closed. Between +60 and -60 V ac or dc may be applied drawing 100 mA maximum.	Output
13	Ground	0 V.	
14	Line in +	Pair to pin 2.	Input
15	Ground	0 V.	
16	Ground	0 V.	–
17	Line out –	Pair to pin 4.	Output
18	HDLC 0 TX A	Pair to pin 6.	Output
19	HDLC 0 RX A	Pair to pin 7.	Input
20	HDLC 0 CL A	Pair to pin 8.	Output
21	HDLC 1 TX A	Pair to pin 9.	Output
22	HDLC 1 RX A	Pair to pin 10.	Input
23	HDLC 1 CL A	Pair to pin 11.	Output
24	Time 0	5 V CMOS	Input
25	PTT	<p>Active when the input differs from the reference by more than 10 V. Reference voltage (common to phantom PTT input on pin 2) is programmable to be +14, 0 or -14 V (all <math>\pm 1</math> V).</p> <p>Inactive when the input differs from the reference by less than 1 V</p> <p>Maximum input level <math>\pm 60</math> V with respect to reference.</p> <p>Input requires at least 1 mA to operate and draws no more than 6 mA.</p> <p>Configurable active high or low.</p>	Input

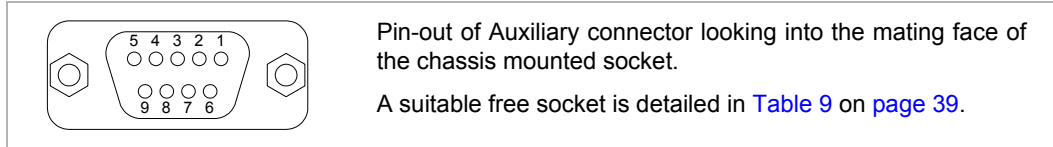
**Note:**

HDLC 0 is used for VDL Mode 2 operation.

HDLC 1 is reserved.

### Auxiliary Connector

A 9-way D-type filtered socket for future interface expansion. The connector is shown in Fig 11 and the pin-out listed in Table 12. A suitable 25-way D-type plug to connect to this interface is listed in [Table 9](#) on [page 39](#).



**Fig 11 Auxiliary Connector Pin-out**


**Table 12 Auxiliary Connector Pin-out**

Pin	Signal Name	Characteristic	Input or Output
1	Ground	0 V	—
2	Antenna change-over	Open collector NPN transistor grounding output, normally open, 200 mA maximum.	Output
3	Reserved	Open collector NPN transistor grounding output, configurable to be normally open or normally closed, 200 mA maximum.	Output
4	Reserved	TTL with 4.7 kohm pull-up to 5 V. Configurable to be active high or low.	Input
5	Reserved	TTL with 4.7 kohm pull-up to 5 V. Configurable to be active high or low.	Input
6	Not connected		
7	Not connected		
8	Not connected		
9	dc supply	Between 21.6 and 32 Vdc. Fused at 500 mA.	Output

## Connecting the Chassis Stud



**A chassis stud is fitted to the MDR's rear panel. This stud is used to connect the equipment to the equipment rack, or to the user's system earth point. The stud must not be used as the safety earth.**

In order not to compromise the MDR's Electromagnetic Compatibility (EMC) the chassis stud, marked  and fitted to the rear panel must be connected to the equipment cabinet (if a cabinet is being used) or to the user's system earth point. The connection should be made using a single tri-rated, green-and-yellow cable having a cross-sectional area of 2.5 mm<sup>2</sup>. The cable should have CSA and UL1015 approval, and be connected to the chassis stud through an M6 eyelet (for example, Park Air part number 20-08010103).

**Failure to comply with this instruction could result in non-compliance with the European Commission EMC Directive 89/336/EEC.**

## Connecting an Antenna



**The antenna used with the MDR must be installed such that the resultant radiated field strength is below 10 W/m<sup>2</sup> in areas normally accessible to personnel.**

The RF field strength from the antenna can be predicted from the equation  $S = 1.4PG/4\pi R^2$

[Where S = power density; P = power input to antenna; G = antenna gain; R = distance to centre of radiation and 1.4 = multiplication factor for average power based on a modulation index of 90%.]

Based on this formula a 2 dBi antenna, the predicted safe distance from the centre of radiation would be approximately 0.75 m for a field strength of 10 W/m<sup>2</sup> (1 mW/cm<sup>2</sup>).

This meets the requirements of Health Canada Safety Code 6 for RF and microwave exposed workers. For persons not classed as RF and microwave workers and including the general public the limit is 2 W/m<sup>2</sup> (0.2 mW/cm<sup>2</sup>) which increases the minimum safe distance to 1.7 m.

Further information on calculating the field strengths and power levels can be found in Health Canada Safety Code 6 'Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range 3 kHz to 300 GHz', and also in FCC document OET Bulletin 65.



**Ensure an antenna, or dummy load, is connected before switching on the MDR. There is high RF voltage present at the antenna connector when the radio is keyed.**

The MDR uses a common antenna for transmission and reception. The rear panel N-type (female) antenna connector accepts a straight or right-angle N-type plug as listed in [Table 9](#) on [page 39](#). Park Air recommends that RG214 1/2" flexible feeder cable, part number 10-05120610, be used for that part of the feeder circuit that is within a building.

## Checking the ac Input Fuse



**For continued protection against risk of fire, replace only with the same type and rating of fuse.**

The ac input fuse is located in a pull-out holder that is an integral part of the ac connector. Check that the fuse type is of the correct rating:

100 - 240V T4AH 250V IEC (Park Air part number, 29E01120108S)

## AC Supply Connection



**The equipment is permanently connected to the mains supply when the mains connector is attached. Switching the rear panel Power switch to Off does not isolate all internal circuits from the mains supply. For this reason, a mains isolating switch should be fitted close to, and easily accessible from, the MDR's position. The isolation switch should isolate both live and neutral supplies, be clearly labelled, and adequately rated to protect the equipment.**



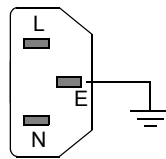
**This equipment must be earthed. The earth terminal of the ac connector should be used as the safety earth.**

An ac input connector (see [Fig 8](#) and Fig 12) is fitted to the equipment's rear panel. The cable used to connect between the equipment and the user's ac power source should be 3-core (to IEC 227) rated 250 Vac at 8 amps, and have a minimum cross-sectional area of 1.0 mm<sup>2</sup> per core. Park Air recommends the use of polyvinyl chloride (PVC) insulated cable. The cable must be fitted with the IEC approved equipment connector (Park Air part number 20-02030102) and conform to the following specification:

- If PVC insulated, be not lighter than ordinary polyvinyl chloride sheathed flexible cord according to IEC publication 227 (designation H05 VV-F, or H05 VVH2-F).
- If rubber insulated, be of synthetic rubber and not lighter than ordinary tough rubber-sheathed flexible cord according to IEC publication 245 titled 'Rubber Insulated Cables of Rated Voltage up to and Including 450/750 V (designation H05 RR-F)'.

The MDR is a Class 1 equipment. The ac supply cable should have a green-and-yellow protective earthing conductor electrically connected to the protective earthing terminal of the equipment connector and the mains plug. Park Air recommends the ac supply cable is colour coded in accordance with the electrical appliance (colour code) regulations for the UK. That is:

- ❑ The core coloured green-and-yellow must be connected to the terminal in the plug that is marked with the letter E or by the earth symbol or coloured green-and-yellow.
- ❑ The core coloured blue must be connected to the terminal that is marked with the letter N or coloured black.
- ❑ The core coloured brown must be connected to the terminal that is marked with the letter L or coloured red.



**Fig 12 ac Connector Pin-out**

Draft

## **Maintenance**

## Maintenance Policy

Apart from the scheduled maintenance detailed in this topic, and replacing a faulty cooling fan, the maintenance policy for the MDR is to return faulty units to Park Air.



There are no user serviceable parts within the MDR. Breaking the seals on the top and bottom covers voids the MDR's warranty.

## Unscheduled Maintenance

Unscheduled maintenance is limited to replacing a faulty cooling fan (see [page 54](#)).

## Scheduled Maintenance

Park Air recommends that scheduled maintenance be carried out at twelve-monthly intervals. Schedule maintenance comprises:

- (1) Ensuring the equipment is clean.
- (2) Ensuring that the external connectors are securely fitted to the MDR.
- (3) Checking and resetting (if required) the MDR's frequency standard (see [page 51](#)).
- (4) Performing an interruptive BIT test (see [page 52](#)).

## Cleaning the Equipment

Remove all dust and dirt from the equipment's exterior using cleaning cloths and a camel hair brush. Clean the front panel indicators and LCD face.

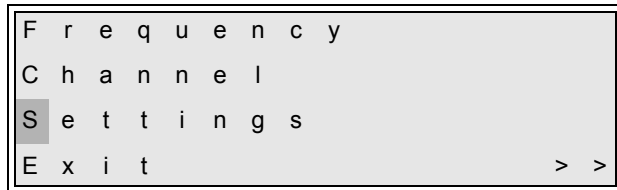
## Security of External Connections

Check all external connections are secure and free from damage.

### Checking the MDR's Internal Reference Frequency

To set the MDR's internal reference frequency, use the following procedure. Note that references to the switch in the procedure mean the Scroll/Select switch.

- (1) If the MDR is used in AM-Voice mode with a frequency offset, reset the offset to 0 kHz.
- (2) Connect a high impedance frequency counter to the front panel Reference connector.
- (3) From the Main screen, press the switch to display the Control screen. Turn the switch until Settings is highlighted. Press the switch.



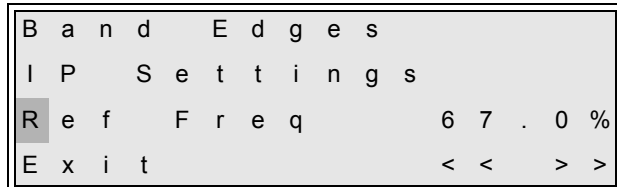
**Control Screen**

- (4) Ensure the Settings screen is displayed. Turn the switch until Ref Freq is highlighted, then press the switch.



**Settings Screen (First Page)**

- (5) With Ref Freq selected turn the switch clockwise or anti-clockwise until the frequency counter reads 20.950000 MHz  $\pm 10$  Hz, then press the switch.
- (6) Turn the switch clockwise until Exit is highlighted, then press the switch. You are returned to the Main screen.
- (7) Disconnect the frequency counter.



**Settings Screen (Second Page)**

### Initiating an Interruptive BIT Test

An interruptive BIT test is available only in AM-Voice and AM analogue ACARS modes.

Use the following procedure to initiate an interruptive BIT test from the MDR's front panel. A BIT test cannot be initiated while the MDR is keyed.

**During an interruptive BIT test, the MDR radiates modulated carrier waves at the set power. Users should therefore obtain the necessary authority before initiating a test.**

**If the test is to be carried out with the antenna disconnected, ensure a load is fitted to the MDR's Antenna connector.**

**In order to test the line input stages, an internally generated 1 kHz tone is injected into the line input circuit. Any other audio present on the line input will cause the test to be inaccurate. Therefore the MDR must not be keyed during the test.**

- (1) From the Main screen, press the switch to display the Control screen. Turn the switch until BIT is highlighted. Press the switch.

F	r	e	q	u	e	n	c	y	
C	h	a	n	n	e	l			
S	e	t	t	i	n	g	s		
E	x	i	t					>	>

**Control Screen (Page 1)**

- (2) Ensure the BIT screen is displayed. Turn the switch until BIT Initiate is highlighted. Press the switch.

B	I	T							
S	/	W		C	o	n	f	i	g
E	x	i	t					<	<

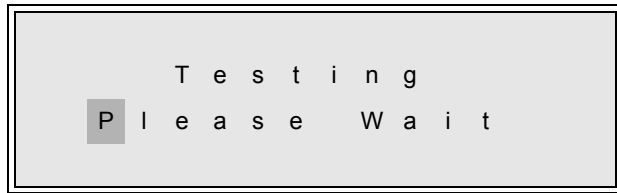
**Control Screen (Page 2)**

B	I	T		I	n	i	t	i	a	t	e
E	T	I		0	0	0	1	0	1	:	3
S	u	p	p	l	y					2	5
E	x	i	t							>	>

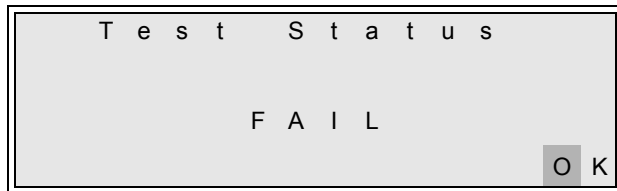
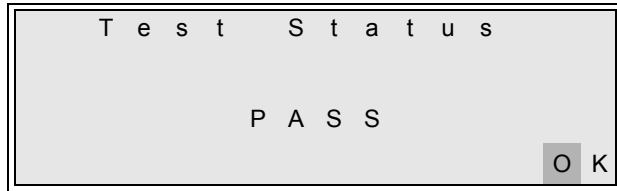
**BIT Screen**

(continued)

- (3) During the test, which takes approximately two seconds, the Testing screen is displayed.



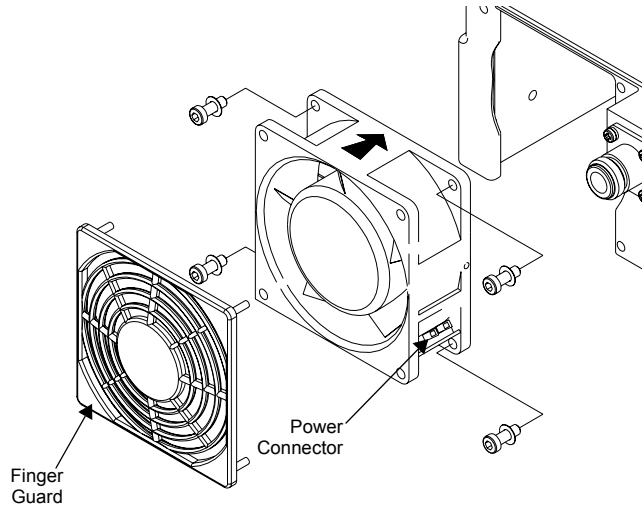
- (4) When the test is complete, either Pass or Fail is displayed.



## Removing and Refitting the Cooling Fan

The cooling fan is at the rear of the MDR as shown in [Fig 13](#).

The part number of the fan is: 69J1208314H



**Fig 13 Cooling Fan Removal**

### Removal

Before attempting to remove the fan, ensure that the MDR is isolated from the ac input supply. Then proceed as follows:

- (1) Disconnect the two-pin power connector.
- (2) Remove the fan's finger guard.
- (3) Using an Allen key, inserted through the holes in the fan exposed with the finger guard removed, remove the four M4 x 12 mm caphead Allen screws that secure the fan to the PA module heatsink.
- (4) Remove the fan from the PA module.

### Refitting

To refit the cooling fan, proceed as follows:

- (1) Locate the fan in position and using a suitable Allen key inserted through the holes for the fan's finger guard, secure using the four M4 x 12 mm caphead Allen screws.
- (2) Secure the finger guard to the fan.
- (3) Connect the 2-pin fan connector to the fan. Ensure the + marked socket mates with the + marked plug on the fan.
- (4) Re-establish the ac supply.
- (5) Switch power on at the MDR using the rear mounted Power switch.
- (6) Ensure the front panel Ready indicator is lit and the Alarm indicator is unlit.