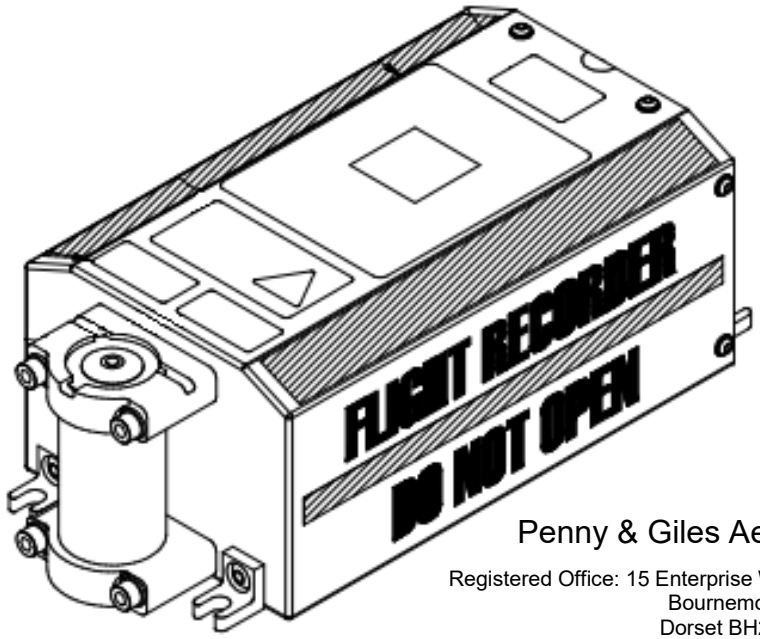
Multi-Purpose Flight Recorder
Type D51615-XXX
with
Cockpit Control Unit Type D51616-XXXX
and
Area Microphone Type D51623-XXXX
or Type D51702-XX

Installation and Operating Manual

PIM422-I

Revision 22, February 2026



Penny & Giles Aerospace Limited

Registered Office: 15 Enterprise Way, Aviation Park west,
Bournemouth International Airport,
Dorset BH23 6HH, United Kingdom
Registered in England No. 2336358
VAT Registration No. GB 806 6586 08

Tel +44 (0) 1202 034000
Website: http://www.curtisswrightds.com/avionics

Jurisdiction	*Classification*	*Date*	*Re-Export Only?*
USA	7E994	18 Feb 2026	~~Y~~ / N
UK	Not Listed	18 Feb 2026	~~Y~~ / N

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Product Support

Penny & Giles Aerospace Limited

15 Enterprise Way, Aviation Park West,

Bournemouth International Airport,

Dorset BH23 6HH,

United Kingdom

Telephone +44 (0)1202 034000

e-mail: avs_technicalservices@curtisswright.com

Amendment Record

Document Change No.	Amendment Date	Amendment
DS528	Aug 04	Change of company details and logo
DS532	Aug 04	Update drawings to show new ULB bracket, insert part no. options. Include PGS FDR/CVR download procedures. Include dual recorder CCU details.
DS609	Aug 04	Signal Gnd details updated
DS621	Aug 04	Delete 72 month inspection instructions.
DS666	Aug 04	Correct ULB test procedure.
DS709	Feb 06	Update to include D51615-122 details
DS730	May 06	Updated to clarify references to FDR Inhibit/FDR RCRD functionality.
DS842	Feb 10	PGS updates and reference to D51651 (CTS MDU379) added. 72 month inspection instructions updated.
DS875	Jun 10	72 monthly inspection instructions added to table 6.
DS909	Sep 11	Addition of note regarding current limiting when powering the recorder with a 28V PSU.
DS0925	Mar 14	Mass of unit corrected (ECR09028). Change to Company logo.
DS1062	Jan 2015	Inclusion of 36 Month checks
DS1106	Aug 2016	Incorporation of 90-Day beacon assembly
DS1134	Aug 2017	Introduction of D51702-XX Cockpit Area microphone
DS1175	Apr 2018	Clarification of Polar Response and Area Mic. Testing
DS1183	Apr 2018	Document re-issued; Removed all reference to 90-day ULB for this equipment
DS1188	Jun 2018	Clarification of Periodic Maintenance periods
DS1239	Mar 2019	ULB bolt/washer clarification and torque settings. Storage period clarified.
DS1273	Sep 2019	CCU Installation procedures clarified
Document	**Amendment**	**Amendment**

Change No.	Date	
DS1287	Nov 2019	Note added to document to remind users to use the current version of this manual
DS1493	Apr 2022	Export Classification Matrix and EAR statement added to title page
DS1547	Feb 2026	72 Month Inspection section revised to include latest information.

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Preface

About this manual

This manual, MPFR Installation and Operation Manual, relates to Multi-Purpose Flight Recorder Types D51615-101, D51615-102, D51615-112 and D51615-122, Cockpit Control Unit Type D51616-XXXX and Cockpit Area Microphone Type D51623-XXXX or Type D51702-XX.

Who should read this manual?

First time users and installers of MPFR equipment should read this manual.

It introduces the features of MPFR, CCU and CAM interfacing and operation that you need to understand to become competent in the use of these products.

How to use this manual

Each chapter in the manual builds on concepts introduced in previous chapters, so work through the chapters sequentially.

Conventions used in this manual

Convention	Usage
Ariel Bold	Headings
Verdana	Normal text

'Verdana Bold'	Strings you should type, field names you should type into and dialog buttons you should click on of the Windows recovery and replay software. Example: Enter *'Filename'* in the *'Save As'* field. Click *'OK'*
Margin notes	To show and name tools that are described in adjacent body text.

Mouse operations used in this manual are defined below:

Operation	**PC**
Click	Click the left mouse button
Double click	Click the left mouse button twice
Right Click	Click the right mouse button
Drag	Click and hold down the left button whilst moving the mouse

What do I need before I begin?

Before starting to work with the MPFR and its ground support interface you must have a PC with Internet Explorer version 5 or later installed on the machine as a minimum and a Fast (10Base-T/100Base-Tx) Ethernet interface either integrated into the machine or supported via a dedicated card (PCI or PCMCIA format as determined by host PC).

You also need Penny & Giles Replay equipment to process the downloaded information into a usable format. This can be achieved either through the use of PGS Discovery, PGS Vision or PGS Analysis.

A typical replay system (Type D51620) comprises; Replay Software, (Part No 010000320), Ground/Aircraft replay leads (Part Nos. SA109680 and SA109654 respectively), and operating manuals.

Penny and Giles (Christchurch) Website

The Penny and Giles website at www.pennyandgiles.com contains information relating to the company product range, services and contact information.

INTRODUCTION

This document fulfils the requirement called for in the introduction to ATA iSpec. 2200, by providing a description of the Penny & Giles Aerospace Ltd, Multi-Purpose Flight Recorder (MPFR) Types D51615-101, 102, 112 and 122 in Part 1, Control Unit Type D51616-XXXX in Part 2 and Cockpit Area Microphone Type D51623-XXXX or Type D51702-XX in Part 3. This document also includes the installation, operating and maintenance procedures required supporting the unit in service.

The MPFR is used to record selected aircraft parameters, including audio, into Solid State Non-volatile Memory. The recording is protected to survive stipulated crash conditions, to enable the subsequent retrieval and decoding by suitable replay equipment following an incident.

Facilities exist within the MPFR for aircraft in-situ data retrieval. The MPFR retains, as a minimum, both the most recent 25 hours of aircraft data and the most recent 120 minutes of four audio sources.

Various build standards of MPFR are available, identified by dash number suffix from the main part number. This manual is currently written in support of MPFR Types D51615-101, D51615-102, and D51615-112 variants that fulfil the requirements of the minimum CVR/FDR as identified by EUROCAE documents ED-56A and ED-55 Amendment 1 and MPFR Type D51615-122 that fulfils the requirements of the CVR/FDR as identified by EUROCAE document ED112.

The MPFR is designed to operate in conjunction with a Flight Data Acquisition Unit (FDAU) and, for aircraft in situ retrieval, suitable Portable Replay Equipment (PRE).

With the limitations set out in the equipment Declaration of Design and performance documents, the MPFR identified herein meet the requirements of European Organization for Civil Aviation Electronics (EUROCAE) specifications ED-55 for Category A1 Flight Data Recorder, ED-56A, Cockpit Voice Recorder, ED-112 Flight Recorder Systems,

Federal Aviation Administration (FAA) specifications TSO-C123a and TSO-C124a and Joint Aviation Requirements JTSO-123a and JTSO-124a.

The Cockpit Control Unit Type D51616-XXXX may be used in conjunction with each variant of the Penny & Giles Aerospace Ltd Multi-Purpose Flight Recorder and provides features compatible with ARINC 757, Supplement 2.

The Cockpit Control Unit provides facilities to monitor and display the operational status of the recorder and also contains the preamplifier for the Cockpit Area Microphone. A jack socket is available to monitor the summed audio output of the audio recording system.

The Cockpit Control Unit is designed to function in accordance with the requirements of ARINC 757 Supplement 2 and EUROCAE documents ED-56A, Amendment 1 and ED-112.

If any difficulty is experienced in the use of this manual, contact the following for assistance:

Customer Support

Penny & Giles Aerospace Limited

15 Enterprise Way, Aviation Park West,

Bournemouth International Airport,

Dorset BH23 6HH,

United Kingdom

Telephone: +44 (0) 1202 034000

E-mail: avs_technicalservices@curtisswright.com

Part 1: - Multi Purpose Flight Recorder

1 DESCRIPTION, OPERATION AND SPECIFICATION

1.1 DESCRIPTION

1.1.1 General

The MPFR is a crash protected airborne recorder that is installed to meet mandatory requirements. The MPFR meets or exceeds the requirements of EUROCAE ED-55, ED-56A Amendment 1, ED-112 as identified within this document and satisfies the United Kingdom Civil Aviation Authority (CAA) specifications 10, 10A, 11 and 18. The requirements of FAA TSO-C123a and TSO-C124a are satisfied where regulations allow the fitting of a combined voice and data recorder. The equipment is compatible with the interface requirements of ARINC 757 Supplement 2. MPFR Type D51615-101, D51615-102, D51615-112 and D51615-122 is illustrated in Figure 1.

The MPFR is mounted direct to the airframe or on an ARINC 404A 1/2 ATR Adaptor tray, such as Penny & Giles Adaptor Tray part number D51618. Anti-vibration mounting is not required.

The MPFR consists of a solid state crash survivable memory module and an electronic interface.

The solid state memory module is protected for crash survivability. The electronic interface is not crash protected and is not required to survive conditions exceeding the specified operating and storage environment.

Facilities exist within the equipment to monitor all aspects of operation for diagnostic purposes, reporting this information through built in web pages accessible via commercially available hardware and Windows™ Software.

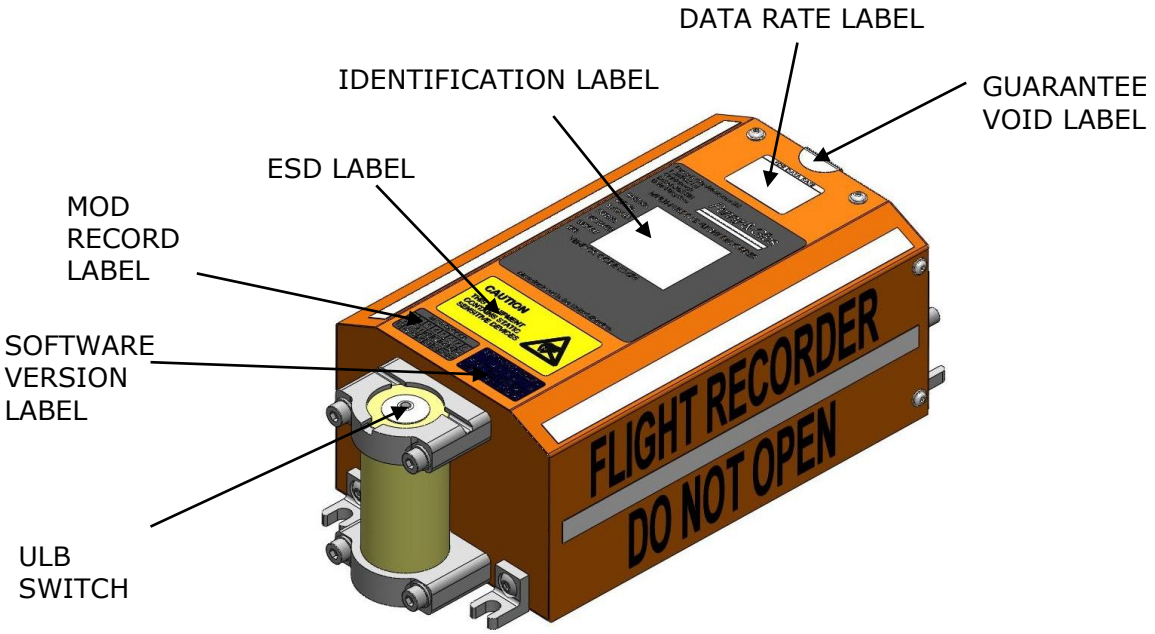

Figure 1 Multi-Purpose Flight Recorder Type D51615-XXX

The MPFR is capable of downloading stored data and audio information digitally at high speed across the 10Base-T/100Base-Tx Fast Ethernet Manufacturer's Test Interface (MTI).

An Underwater Locator Beacon (ULB) is fitted to the Crash Survivable Memory Module as an aid to location in the event of an accident over water.

The MPFR is painted International Orange as an aid to its location.

No external controls are provided on the MPFR as operation is automatic upon the application of power.

The MPFR Types D51615-101, D51615-102 and D51615-112 satisfy the minimum operating requirements for a combined Cockpit Voice Recorder and Flight Data Recorder as defined by ED-55, ED-56A amendment 1 and ARINC 757 Supplement 2.

The MPFR Type D51615-122 satisfies the minimum operating requirements for a combined Cockpit Voice Recorder and Flight Data Recorder as defined by ED-112.

The MPFR is designed to operate with Control Unit Type D51616-XXXX and Cockpit Area Microphones Type D51623-XXXX & D51702-XX. See Part 2 and 3 for details.

1.1.2 Equipment Part Numbering

The Penny & Giles Aerospace Ltd MPFR are identified by the convention shown in Figure 2:

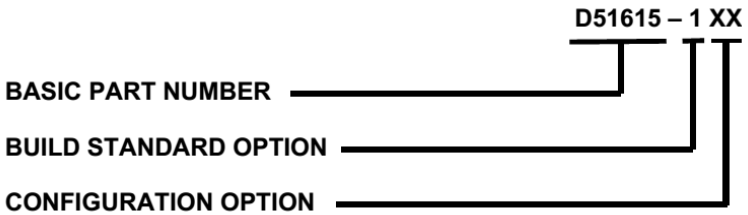

Figure 2 MPFR Type D51615 Part Numbering Convention

Build Standard Options

OPTION 1: Compact form factor, Low Weight, 4 Audio channel - 2 hour CVR, 25 Hour FDR, 28 VDC Power supply, Rotor Speed Recording.

OPTION 2: Data Acquisition Flight Recorder detailed in Penny and Giles Publication PIM 434-I.

Configuration Options

OPTION 00: Reserved

OPTION 01: CVR Termination on loss of Rotor Speed signal not STOP CVR RECORDING input. All other operations compatible with ARINC 757 Supplement 2.

OPTION 02: Combined Cockpit Voice and Flight Data Recorder Operation in accordance to ED-55, ED-56A and ARINC 757 Supplement 2.

OPTION 03–21: Reserved.

OPTION 12: CVFDR operation in accordance with ED 112 and ED-56a. Increase in FDR recording capacity to 512 wps for 25 hours duration. Improved environmental performance.

OPTION 22: Combined Voice and Flight Data Recorder operation in accordance with ED-112 and ARINC 757 Supplement 2. FDR capacity supporting 25 hrs @ 512 words per second, CVR capacity

supporting 4 channels, 120 minutes each, enhanced environmental qualification categories to MIL STD 810F and MIL STD 461. DC Power Return connected to Case Ground.

OPTION 23–99: Reserved.

1.1.3 Mechanical Description

The MPFR consists of a stainless steel case, and a removable end lid through which the unit main connector is fitted. The case is painted International Orange as an aid to its location. Additionally, reflective tape is attached to the external surfaces. The MPFR is marked with the following warning in black letters:

FLIGHT RECORDER - DO NOT OPEN

ENREGISTREUR DE VOL - NE PAS OUVRIR

Fitted through the case front panel to the Crash Survivable Memory Module (CSMM) is the ULB, and two hold-down feet. The unit identification label, a modification label, a Software Version Label and electrostatic discharge warning label are fitted to the top face of the lid. Mounted through the case rear panel is 66-way connector SK1, which provides the interface with the aircraft systems and two further mounting feet. All mounting feet are slotted to accept a 6.35mm (¼ inch) bolt for fixing the MPFR to the airframe.

1.1.4 Electrical Description

Figure 3 shows the MPFR system block diagram.

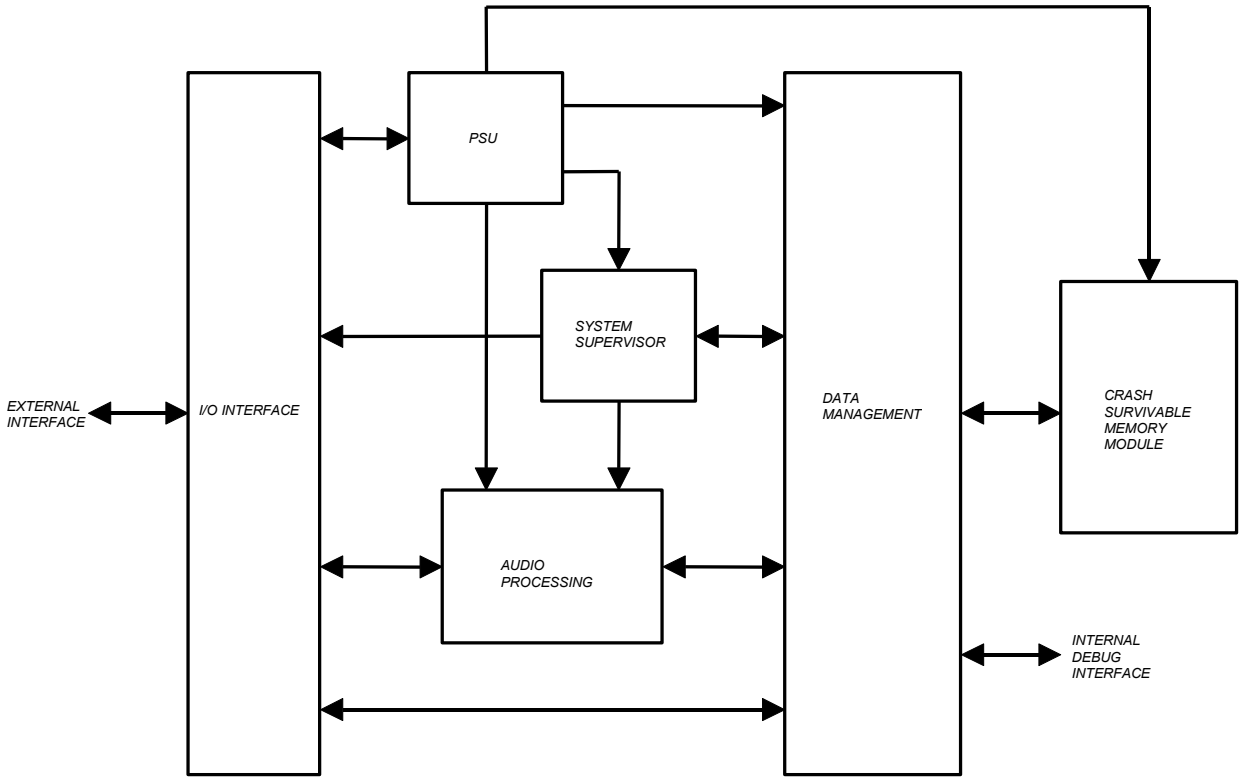

Figure 3 MPFR System Block Diagram

1.1.5 Interface Description

General

All status outputs and control inputs with the exception of VOICE ERASE and RECORD ON operate with respect to CHASSIS GROUND.

The MPFR is direct mounted to an aircraft bulkhead/equipment shelf.

NOTE:

Anti-vibration mounting is not required.

Electrical connection is automatically achieved via the single connector mounted at the rear of the unit (see Installation Drawing Figure 44).

The external electrical connector is a 66-pin MIL-C38999 series III style receptacle, P&G part number W107820.

Pin connections and external cable requirements are shown in Table 2. The connector provides Lightening Transient Protection and EMC filtering.

Suitable mating connectors and crimp tools for pin inserts for MPFR and associated equipment are identified in Table 1.

EQUIPMENT	MPFR	COCKPIT CONTROL UNIT	MPFR REPLAY CONNECTOR
CONNECTOR	D38999/26FF35SN	M24308/2-345F	D38999/20FB35PN
STRAIGHT CABLE CLAMP (1)	M85049/38-19A	Not required	Not required
ELBOW CABLE CLAMP (1)	M85049/39-19A	Not required	Not required
DUST CAP	Not required	Not required	D38999/33 W 11R
CRIMP TOOL	M22520/2-01	M22520/2-01	M22520/2-01
CRIMP TOOL LOCATOR	M22520/2-07	M22520/2-08	M22520/2-09

Table 1 Aircraft Mating Connector Details

NOTE:

(1) The cable clamp is offered in two styles. The straight cable clamp comes as standard.

Bonding

Two pins are allocated within the main connector for bonding the MPFR chassis to the airframe. Bonding is also achieved through the equipment mounting feet. The D51615-112 and D51615-122 variants also have a bonding stud adjacent to the connector.

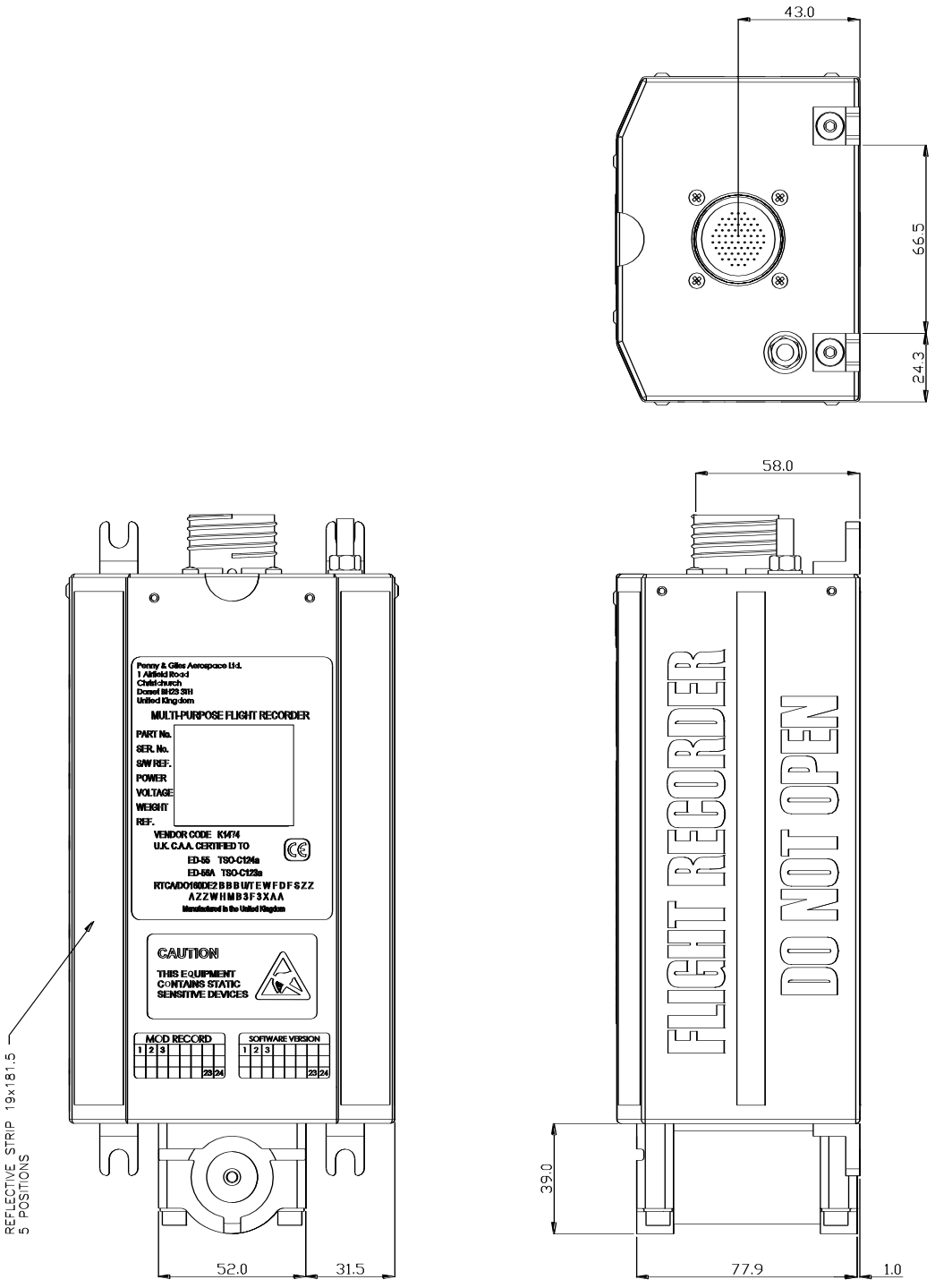

Figure 4 Installation drawing for MPFR Type D51615-XXX (Part 1)

NOTE:

Figure 4 shows the D51615-122 variant with the earth bonding stud fitted. The D51615-112 also has the earth bonding stud. The D51615-102 and D51615-101 variants do not have the bonding stud fitted.

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
1	Reserved		
2	Reserved		
3	Reserved		
4	Chassis GND	24 AWG	Link to be less than 30cm (12”) on aircraft
5	Chassis GND	24 AWG	
6	Pre-Amp Power Out Hot	24 AWG	
7	Pre-Amp Power Out GND	24 AWG	
8	0v Signal	24 AWG	Link to be less than 30cm (12”) on aircraft
9	0v Signal	24 AWG	
10	Rotor Speed In Hi	24 AWG S.T.P.	
11	Rotor Speed In Lo		
12	28 VDC Power In	22 AWG	
13	FDR Fault Out	24 AWG	
14	CVR Fault Out	24 AWG	
15	Voice Erase A	24 AWG	
16	Voice Erase C	24 AWG	
17	Audio Out Hi	24 AWG S.T.P.	
18	Audio Out Lo		
19	Push-to-Test	24 AWG	
20	MTI Tx+	24 AWG F.T.P.	Cat. 5 Foil Twisted Pair
21	MTI Tx-		
22	MTI Rx+	24 AWG F.T.P.	
23	MTI Rx-		
24	Stop CVR Recording	24 AWG	
25	Reserved		Reserved for GMT
26	Reserved		Reserved for OMS

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
27	Channel 1 Audio In Hi	24 AWG S.T.P. WITH 36	
28	Channel 2 Audio In Hi	24 AWG S.T.P. WITH 37	
29	Channel 3 Audio In Hi	24 AWG S.T.P. WITH 38	
30	Channel 4 Audio In Hi	24 AWG S.T.P. WITH 39	
31	Reserved		Reserved for Area Mic
32	FDR Data In A	24 AWG S.T.P. WITH 41	
33	FDR Data Out A	24 AWG S.T.P. WITH 42	
34	Reserved		Reserved for GMT
35	Reserved		Reserved for OMS
36	Channel 1 Audio In Lo	24 AWG S.T.P. WITH 27	
37	Channel 2 Audio In Lo	24 AWG S.T.P. WITH 28	
38	Channel 3 Audio In Lo	24 AWG S.T.P. WITH 29	
39	Channel 4 Audio In Lo	24 AWG S.T.P. WITH 30	
40	Reserved		Reserved for Area Microphone
41	FDR Data In B	24 AWG S.T.P. WITH 32	
42	FDR Data Out B	24 AWG S.T.P. WITH 33	
43	Reserved		Reserved for Data link
44	Reserved		Reserved for Data link
45	Reserved (Force IP Address)		Not connected in aircraft
46	Reserved		
47	Reserved		
48	FDR Inhibit	24 AWG	
49	Reserved		Reserved for Area Microphone

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
50	Reserved		Reserved for Datalink enable
51	Reserved		Reserved for CVR Rec Level
52	Reserved		Reserved for CVR Rec Level
53	Reserved		Reserved for CVR Rec Level
54	Reserved		Reserved for OMS
55	Reserved		Reserved for AC Power
56	Reserved		Reserved for OMS
57	Reserved		
58	Reserved		Reserved for CVR Rec Level
59	Record On	24 AWG	Link to be kept as short as possible
60	Record On	24 AWG	
61	Power In AC Cold	24 AWG	Link to be less than 30cm (12”) on aircraft
62	Power In AC Cold	24 AWG	
63	Power In AC Cold	24 AWG	
64	Reserved		
65	Reserved		
66	Reserved		

Table 2 MPFR Connector pin allocation

Equipment Inputs

Power Supply

The power supply to the MPFR shall be +28VDC with aircraft electrical power characteristics of RTCA/DO-160D, Section 16, Category A.

Normal Operation: +22.0 VDC to +30.3 VDC

Abnormal Operation: +20.5 VDC to +32.2 VDC

Emergency: +18.0 VDC

Operational Power Consumption: 12W MAX

The DC supply to the MPFR should be protected by a 5A circuit breaker. The MPFR is protected against accidental reversal and loss or degradation of the +28VDC supply.

NOTE:

The type of circuit breaker used, together with any other protection devices, must be capable of passing an inrush current of 30 amps for 2 milliseconds without tripping.

Control Inputs

(i) STOP CVR RECORDING:

A High to Low transition inhibits CVR recording within 10 minutes (see Termination of Recording in the INSTALLATION section).

NOTE:

Some operating rules require the recorder to start recording as early as possible and to stop automatically within 10 minutes of an event, such as engine shutdown or safe landing. Suitable interlocks should be provided in accordance with local operating rules.

(ii) PUSH TO TEST:

A High to Low transition causes the MPFR to reset and commence its power up test sequence. During the start-up sequence the CVR and FDR Fault outputs are asserted. This action also initiates automatic recording.

(iii) VOICE ERASE A

Connection to VOICE ERASE C for greater than two seconds initiates a voice erase for all channels assuming aircraft interlocks are satisfied and the recorder is in a recording mode. The input characteristics are defined in ARINC 757 Supplement 2.

(iv) RECORD ON:

Connection of a jumper across these two inputs enables the recording function of the equipment.

(v) FDR INHIBIT:

Grounding this input will inhibit the operation of the FDR recorder (if available). This may be wired via an appropriate interlock such as parking brake.

A test switch to open the circuit and enable the recorder may be desired to facilitate ground testing (see Part 2 Cockpit Control Unit pins FDR INHIBIT A, FDR INHIBIT B).

If interlocks or function not implemented, leave open circuit.

(vi) FORCE IP ADDRESS:

Used for ground support equipment only. When open circuit the MPFR responds to MTI commands addressed at the MPFR default IP address of 10.0.0.100. Low forces the MPFR to use the configured IP address for MTI communications and permits the user to change the configurable address via the web interface.

FDR Data Inputs

The data input is a RS422 line receiver and is compatible with the Harvard Biphase signal shown in ARINC 573-7 attachment 10.4. The data rate is 768, 1536, 2304, 3072, 6144, 12288, 24576 or 49152 bits/second, whichever is currently selected.

CVR Audio Channel Inputs

All audio inputs are balanced and have input impedance of 10kohms at 1kHz (nominal). Signal characteristics are defined in Audio Characteristics. The audio inputs are compatible with the requirements of ARINC 757 Supplement 2.

Rotor Speed

The MPFR accepts an analogue signal from the Rotor Speed Input.

Input voltage range: 2VRMS to 122VRMS

The Rotor Speed signal may be recorded as an integral part of the Audio record as a parameter representing the signal frequency with a maximum tolerance of ±2% over two separate ranges:

Low Frequency: 6 Hz to 192 Hz

High Frequency: 128 Hz to 8188 Hz

Hysteresis is provided by the overlap between the two ranges.

Starting in the Low Frequency mode, the detector only changes from the low range to the high range when the frequency detected exceeds 192 Hz. It only changes from the high range to the low range when the frequency detected falls below 128 Hz.

Frequencies lower than 6 Hz and higher than 8188 Hz produce outputs equivalent to the minimum and maximum frequency limits respectively.

Equipment Outputs

Preamplifier Power Supply

A regulated DC output is provided as defined by ARINC 757 Supplement 2 to supply power to a Preamplifier/Area Microphone. The voltage is 18VDC ±1VDC at a maximum current of 100mA.

Status Outputs

(i) FDR FAULT:

Open circuit until the data recording system is operating satisfactorily at which time it is connected to CHASSIS GROUND. When open circuit the FDR Data out signals are clamped to 0v. Maximum current = 100mA.

(ii) CVR FAULT:

Open circuit until the audio recording system is operating satisfactorily at which time it is connected to CHASSIS GROUND. When open circuit the Audio Monitor output signal is clamped to 0v. Maximum current = 100mA.

FDR Data Output

The FDR Data output is a RS422 line driver and is compatible with the Harvard Biphase signal shown in ARINC 573-7 attachment 10.4. The data rate is 768, 1536, 2304, 3072, 6144, 12288, 24576 or 49152 bits/second, whichever is currently selected.

Audio Monitor Output

This output is the sum of all audio channels. It is unbalanced. Signal levels are defined in 1.3.1. Headphones of 600 ohms impedance or greater may be driven directly.

Manufacturer's Test Interface

General

The Manufacturer's Test Interface (MTI) is a serial interface operating on an Ethernet 10Base-T/100Base-Tx four wire link to IEEE Std 802.3u-1995.

Electrical Interface

The electrical interface consists of two differential pairs, one for transmitted and one for received data.

Clock Rate

The Ethernet interface will operate at either 10 MHz or at a maximum MTI clock rate of 100 MHz. The link will auto negotiate to whichever rate is determined at equipment start up.

Information Protocol

The MTI implements TCP/IP.

1.2 OPERATION

1.2.1 Operational Modes

The following are the operational modes for each of the separate recording subsystems. The voice recording section can operate completely independently of the data recording section, i.e. data can be replayed whilst audio is recorded:

Idle (Data or Audio)

The idle mode is a non-recording mode with no transfer of information to or from the protected memory array. The relevant FAULT status output(s) are asserted. MTI operation is supported during the idle mode.

RECORD ON - Jumper not fitted

Record (FDR Data Only)

The Record (FDR Data Only) mode is the normal operational mode for the Flight Data Recorder subsystem.

The state of the control inputs to initiate this mode is as follows:

STOP CVR RECORDING - (Don't care)

PTT - Open circuit

RECORD ON - Jumper fitted

FDR INHIBIT - Open circuit

Input data bits are continuously detected and timed within the input data stream to ensure that good data is being received. The decoded data is sequentially written to the protected memory array in a manner consistent with the segregation and partitioning requirements of ED-56A/ED-112 for combined voice and data recorders.

If valid data is not detected, then the FDR FAULT output will be asserted. Should valid data be detected then the FDR FAULT output will go inactive. If the FDR FAULT output is asserted then Data Monitor output signal is held grounded.

Data is validated on a 'read-after-write' basis and the input stream is echoed on FDR OUT.

Record (CVR Audio Only)

The Record (CVR Audio Only) mode is the normal operational mode for the Cockpit Voice Recorder subsystem.

The states of the control lines to initiate this mode are as follows:

STOP CVR RECORDING	-	High
RECORD ON	-	Jumper fitted
PTT	-	High
VOICE ERASE A	-	Low or open circuit
FDR INHIBIT	-	Don't Care

Audio information is digitized and sequentially written to the crash survivable memory module in a method consistent with the segregation and partitioning requirements of ED-56A/ED-112 for combined voice and data recorders. An output is provided that is a summed signal of all four input channels. Any failure in the digitizing or storage process exceeding a continuous period of 100 milliseconds or cumulative period of 250 milliseconds will cause the CVR FAULT output to become active. Should the failure clear, then the CVR FAULT output will go inactive. If the CVR FAULT output is asserted the Audio Monitor output signal is held grounded.

Models D51615-101, 102 and 112 record information within the Crash Protected Memory Module in accordance with ED-56A section 2.6.11 and figure 2.2.

Model D51615-122 records information within the Crash Protected Memory Module in accordance with ED-112 Chapters 4-1.2.1 and figure 4-1.1.

Timed Record (Audio)

The Timed Record mode is intended to prevent the audio information recorded from being overwritten in the event of the power remaining present after an event. If the Record mode has not been initiated within 10 minutes, Timed Record terminates and the CVR subsystem enters the Idle mode.

The states of the control inputs to initiate this mode are as follows:

STOP CVR RECORDING - A high to low transition will terminate recording within 10 minutes (typically 9 minutes 55 seconds) at which point it will enter the Idle mode.

PTT	-	High
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	Don't Care

OR

STOP CVR RECORDING	-	Low
PTT	-	High to Low transition
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	Don't Care

This mode is also entered upon power being applied to the MPFR.

Audio information is digitized and sequentially written to the crash survivable memory module in a method consistent with the segregation and partitioning requirements of ED-56A for Cockpit Voice Recorders. An output is provided that is a summed signal of all four input channels. Any failure in the digitizing or storage process exceeding a continuous period of 100 milliseconds or cumulative period of 250 milliseconds will cause the CVR FAULT output to become active. Should the failure clear, then the CVR FAULT output will go inactive. If the CVR FAULT output is asserted the Audio Monitor output signal is held grounded.

Download - On Aircraft

The download - on aircraft mode allows the high speed recovery of all stored aircraft parameter data via the MTI. Initiating this mode aborts any current FDR Record mode operation for the duration of the download process.

The states of the control inputs to initiate this mode are as follows:

STOP CVR RECORDING	-	Don't Care
PTT	-	High
VOICE ERASE A	-	Low or open circuit
FDR INHIBIT	-	Don't Care
RECORD ON	-	Jumper fitted

During the data recovery process, the FDR FAULT output will be asserted whilst the voice recording section of the MPFR will continue to record.

Operating rules prevent the recovery of digitised audio information while the MPFR is installed within the aircraft.

Download - Off Aircraft

The off aircraft Download mode allows the high speed recovery of all recorded aircraft parameter data or audio information via the MTI. Download options are provided for the individual files recorded within the CSMM. These comprise of files for each input audio channel, the combined communications channels, the reduced bandwidth CAM channel, Flight Data (master and back-up copy), fault log files and Supplementary Flight Information.

The states of the control inputs to initiate this mode are as follows:

STOP CVR RECORDING	-	Don't Care
PTT	-	High
VOICE ERASE A	-	Low or open circuit
FDR INHIBIT	-	Don't Care
RECORD ON	-	Jumper not fitted

An option is provided on the download web page to select either the complete data file for the record duration or information recorded since the previous download.

During the data recovery process, the relevant FAULT output will be asserted whilst the section of the recorder not currently replaying will remain in the idle state.

Voice Erase (Audio Only)

The Voice Erase mode of operation allows the erasure of audio information only without affecting the data.

The states of the control inputs to initiate this mode are as follows:

STOP CVR RECORDING	-	Don't Care
PTT	-	High
VOICE ERASE A	-	Connect to VOICE ERASE C for >2 seconds, via suitable aircraft interlocks
FDR INHIBIT	-	Don't Care
RECORD ON	-	Jumper fitted

During the erase cycle, CVR FAULT output will toggle at a frequency of 0.5Hz.

1.3 SPECIFICATION

1.3.1 Functional Characteristics - Performance

Flight Data Characteristics

Data Input

A single ARINC 573/717 differential input is provided.

Data Output

A single ARINC 573/717 differential output is provided.

Data Format

The MPFR auto-detects the input data stream for the FDR data rate or alternatively it is configurable via the MTI. Harvard Biphase serial data rates supported are either 64, 128, 192, 256, 512, 1024, or 2048 12-bit words per second (wps).

Data Storage Delay

The delay between the availability of data at the input and the storing of the data in the protected memory does not exceed 0.5 seconds.

Data Duration - Minimum

The MPFR is available with two memory capacities; the D51615-101 and D51615-102 variants will retain as a minimum at all times the last 25 hours of aircraft data when recorded at a data rate of 64, 128, 192 or 256 wps. The D51615-112 and D51615-122 variants will retain at all times the last 25 hours of aircraft data when recorded at a data rate of 64, 128, 192, 256 or 512 wps.

With all models, the data recording duration for higher rates is reduced on a pro-rata basis for data rates up to a maximum of 2048 wps.

Data Duration - Maximum

Due to the method of using redundant memory for error correction and capacity to support a 25 hour record duration, the MPFR may retain far more than the mandated recording duration. For example the D51615-101 and D51615-102 variants may retain up to 96 hours of data at 64 wps or 190 hours of data at 64 wps with the D51615-112 and D51615-122 variants.

Data Error Rate

The bit error rate caused by corruption between input and replay does not exceed one bit in 10^5. The memory is organised in such a way that the failure of a single memory device does not lead to the loss of more than 16 seconds of contiguous data in any period of 256 seconds.

Data Retention

Following the removal of power from the MPFR the recorded information is retained for at least two years for the stipulated operational and storage environment. Except for the overwriting of the oldest data by new information, no means for the erasure of the record is provided.

Audio Characteristics

Audio Inputs

Four independent, balanced inputs are provided.

Audio Storage Delay

The delay between the availability of audio information at the input and the storing of it in the crash survivable memory does not exceed 50 milliseconds.

Audio Duration – Minimum (D51615-101, & 112 variants)

(i)	Audio Channel 1 (isolated)	-	30 minutes
(ii)	Audio Channel 2 (isolated)	-	30 minutes
(iii)	Audio Channel 3 (isolated)	-	30 minutes
(iv)	Channels 1, 2, & 3 combined	-	120 minutes
(v)	Audio Channel 4 (full bandwidth)	-	30 minutes
(vi)	Audio Channel 4 (reduced bandwidth)	-	120 minutes

Audio Duration – Minimum (D51615-122 & 122 variant)

(i)	Audio Channel 1 (isolated)	-	120 minutes
(ii)	Audio Channel 2 (isolated)	-	120 minutes
(iii)	Audio Channel 3 (isolated)	-	120 minutes
(iv)	Audio Channel 4 (full bandwidth)	-	120 minutes

Input Reference Level

All audio channels: 0.775V RMS (0dBu).

Input Reference Signal

This is defined for this equipment as a 1kHz sine wave at the Input Reference Level.

Audio Frequency Response

The difference between the signal recovered and the audio source is ≤ 6dB for the audio channel frequency ranges below.

(i)	Audio Channel 1:	150Hz to 3.5kHz
(ii)	Audio Channel 2:	150Hz to 3.5kHz
(iii)	Audio Channel 3:	150Hz to 3.5kHz
(iv)	Audio Channel 4:	150Hz to 6.0kHz

Noise Level - Signal to No Signal ('A' weighted)

With no signal applied to any input channel, the reproduced signal is at least 48dB below the Reference Level when measured

in accordance with the method described in EUROCAE ED-56A, paragraph 5.2.6 and ED-112 chapter 1-3.2.5.

This performance is also achieved for out-of-band signals applied to the inputs in accordance with the method described in EUROCAE ED-56A, paragraph 5.2.6 and ED-112 chapter 1-3.2.5.

Continuity of Recording

Loss of recorded signal does not exceed any contiguous period of 100 milliseconds per channel and the cumulative loss does not exceed 250 milliseconds per channel per half hour.

Wow and Flutter

The weighted wow and flutter on the recorded signal does not exceed 2% peak.

Noise Level - Signal-to-Noise and Distortion

The reproduced Signal-to-Noise Ratio, including Total Harmonic Distortion (THD), is at least the value given below when measured by the method described in EUROCAE ED-56A, paragraph 5.2.7 and ED-112 chapter 1-3.2.6:

(i) Audio Channel 1: 24dB

(ii) Audio Channel 2: 24dB

(iii) Audio Channel 3: 24dB

(iv) Audio Channel 4: 24dB.

Crosstalk - Audio to Audio

With the Reference Signal applied to one audio channel, the recorded crosstalk on the other audio channels is at least 40dB below the Reference Level.

Crosstalk - Data to Audio

With a valid data signal applied to the data recording channel of the MPFR, the recorded crosstalk on any audio channel is at least 40dB below the Reference Level.

Audio Channel Balance

With half of the Reference Signal applied to all audio channels, the signals recovered differ by no more than 3dB.

Quality Index

The speech transmission index of the audio channels, when assessed using the method described in EUROCAE ED-56A, Appendix 4 and ED-112 Chapter 1-3.2.4, is at least the values given below:

(i) Audio Channel 1: 0.75

(ii) Audio Channel 2: 0.75

(iii) Audio Channel 3: 0.75

(iv) Audio Channel 4: 0.85.

Audio Output

Summed signal of all audio channels. Nominal 10mW (2.45V RMS) into 600 ohm load.

Replay Audio Outputs

0.77V RMS (0dBu) ±5dB at Input Reference Level (0dBu).

Audio Channel Synchronization

The relative time synchronization between audio channels is better than 4.0 milliseconds.

Audio Timebase

The timebase of the recorded signals is reproducible with an accuracy of better than 0.1%.

Voice erase

Following the use of the provided voice erase facility, audio information cannot be accessed.

Audio Retention

Following the removal of power from the MPFR, the recorded information is retained for at least two years for the stipulated operational and storage environment.

Data to Audio Correlation

The MPFR records synchronizing information embedded within the digitized audio record such that, with appropriate replay

equipment, the relative time between the data and audio channels can be deduced to within 500 milliseconds.

The source of this synchronizing information is derived from an internal clock source.

The recorded synchronisation data is embedded within the audio files downloaded from the recorder via the MTI.

Status Monitoring

Two separate outputs are provided for status monitoring of the equipment as follows:

FDR FAULT

CVR FAULT

Power-up Tests

A Built-In Test (BIT) routine is executed whenever power is applied to the system. This routine performs the following:

(i) Data processor initialization and self-check

(ii) Audio processor initialization and self-check

(iii) Program Memory validation for both processors

(iv) Non-volatile housekeeping validation

(v) Audio encoding circuitry initialization

(vi) Interface integrity checks (if option fitted).

Any failure of the above tests causes a corresponding FAULT status for the audio or data (or both) recording system which is latched until power is removed or a subsequent test is passed satisfactorily.

Continuous Tests (Data)

During normal operation BIT routines are executed to continuously monitor the following aspects of the data recording system:

(i) Data processor program sequence

(ii) Protected memory 'read-after-write'

(iii) Valid recording of flight data

(iv) Ability to meet statutory minimum storage duration

(v) Interface integrity checks (if option fitted).

The presence of a failure of any of the above tests causes an FDR FAULT status to be asserted. Should the fault clear, the FDR FAULT indication is removed.

Continuous Tests (Audio)

During normal operation BIT routines are executed to continuously monitor the following aspects of the audio recording system:

(i) Audio processor program sequence

(ii) Protected memory 'read-after-write'

(iii) Audio channel operation

(iv) Audio recording continuity

(v) Ability to meet statutory minimum storage duration

(vi) Interface integrity checks (if option fitted)

The presence of a failure of any of the above tests for more than 100 milliseconds will cause a CVR FAULT status to be asserted. Should the fault clear, the CVR FAULT indication will be removed.

Pilot Initiated Tests

At any time after the power-up tests a full system check, as detailed in the Status Monitoring section above, may be initiated from the cockpit by the Push-to-Test (PTT) control input to the MPFR. This action has the effect of resetting the processors and thus aborts any current operation. The FDR and CVR FAULT outputs will be asserted for the duration of the BIT function, after which each is asserted only if its associated tests were failed.

Power Interruptions

Power Interruption ≤200 milliseconds

At normal power level, interruptions with duration of 200 milliseconds or less have no effect.

Power Interruption >200 milliseconds

At normal, abnormal and emergency power levels, interruptions with duration of more than 200 milliseconds may cause a reset condition. When power is restored, a power-up BIT routine is initiated as defined the Power-up Tests section above.

Download

Selection of an FDR download interrupts the recording process of the MPFR. The CVR is prohibited from downloading recorded information while recording on the aircraft.

Data Recovery

FDR data can be downloaded without removing the equipment from the aircraft via the MTI to suitable Portable Replay Equipment (PRE), details of which are the subject of a separate operating manual. Recovery of the aircraft data record using such equipment can be achieved within three minutes.

CAUTION:

During recovery of data no data recording takes place.

Audio Recovery

Audio can be recovered only when the MPFR has been removed from the aircraft via the MTI requiring the PRE detailed in the Audio Recovery section above. Recovery of the digitized audio record using such equipment can be achieved within four minutes per channel.

CAUTION:

Recovery of audio can only be performed off aircraft.

1.3.2 Physical and Other Characteristics

Mass

The mass of the unit does not exceed 3.3kg (7.3lb). This includes the ULB.

Dimensional Limits

253 (L) x 118 (W) x 89 (H) mm, this includes the ULB.

External Finish

To aid location of the MPFR, the case is finished in International Orange, colour number 592.

Marking

The MPFR is marked with the following warning in black letters 25mm high:

FLIGHT RECORDER - DO NOT OPEN

ENREGISTREUR DE VOL - NE PAS OUVRIR

Reflective tape is also attached to the external surfaces.

1.3.3 Environmental Conditions

The equipment satisfies the requirements of RTCA DO-160D, with test categories as shown in Table 3.

Sect.	Requirement	MPFR Category -101 & -102	-112	-122
4	Temperature/Altitude	E2 (1) (2)	E2 (1) (2)	E2 (1) (2)
5	Temperature Variation	B	B	B
6	Humidity	B	B	B(4)
7	Operational Shock & Crash Safety	B	B	B(5)
8	Vibration	U & T (zones 1 & 2)	U & T (zones 1 & 2)	(6)
9	Explosion-proofness	E	E	E
10	Waterproofness	W	W	W
11	Fluids Susceptibility	F (3)	F (3)	F (7)
12	Sand and Dust	D	D	D
13	Fungus Resistance	F	F	F
14	Salt Spray	S	S	S
15	Magnetic Effect	Z	Z	Z
16	Power Input	Z	Z	Z
17	Voltage Spike	A	A	A
18	AF Conducted Susceptibility	Z	Z	Z
19	Induced Signal Susceptibility	Z	Z	Z
20	RF Susceptibility	W	W	W
21	Emission of RF Energy	H	H	M

Sect.	Requirement	MPFR Category -101 & -102	-112	-122
22	Lightning Induced Transient Susceptibility	A2F3	A2F3	A2F3
23	Lightning Direct Effects	X	X	X
24	Icing	A	A	A
25	ESD	A	A	A

Table 3 Non-Cockpit Equipment Environmental Test Levels

NOTES:

1. **Category E2 applies during normal operation. During a data download operation Category A4 applies.**
2. **Operating temperature: -55°C to + 71°C**

   Maximum short term (<30 minutes) operating temperature -55°C to + 71°C

   Survival Temperature: -55°C to +88°C

   Altitude: -15,000ft to 80,000ft
3. **Aircraft fluids are listed in Table 4**
4. **Unit operational during test.**
5. **Operational impact shock 6g for 11ms**
   Crash Impulse 20g for 11ms
   Sustained 20g for 3 seconds.
6. **Customer specific vibration requirement, refer to equipment environmental test procedure.**
7. **See Table 5 for specific aircraft fluids.**

Fluid	Description	Specification	Joint Services Designation
Fuels	Aviation Turbine	DERD 2453	Avtur/FSII
Lubricating Oil		DERD 2499	OX-27
Hydraulic Fluid		Def-Stan 91-48/2	OM-15

Fluid	Description	Specification	Joint Services Designation
	Skydrol 500B4	DTD900/4881D	OX-20
De-Icing Fluid		DTD 900/4907	AL-34
Solvent	1,1,1 Trichloroethane	BS 4487	
Cleaning Fluid	White Spirit	BS 245	
Sullage	Commercially available		

Table 4 General Aircraft Fluids

Fluid	NATO Ref. No.	UK Specification	Joint Services Designation	Notes
Fuel		D.Eng R.D. 2485	AVGAS 115/145, AVGAS 100/130 LL	DEF STAN 91-90
	F.34	D.Eng R.D. 2453	AVTUR/FSII	DEF STAN 91-87
	F.40	D.Eng R.D. 2454	AVTAG/FSII	DEF STAN 91-88
	F.44	D.Eng R.D. 2452	ACCAT/FSII	DEF STAN 91-86
Engine and Gearbox Oil	O-160	D.Eng R.D. 2497	OX-26	DEF STAN 91-100
	O-149	D.Eng R.D. 2487	OX-38	DEF STAN 91-98
	O-142		OM-12	MIL-L-7808
	0-156		OX-27	MIL-L-23699
Hydraulic Fluid				MIL-H-83282A (Equiv to OX-19)
	H.515	D.T.D. 585B	OM-15	DEF STAN 91-48
Cleaning Fluids				DEF STAN 79-18 DEF STAN 79-17
De-icing Fluid	S737	BS 1595 amdt 1	AL 11	Isopropanol

Fluid	NATO Ref. No.	UK Specification	Joint Services Designation	Notes
	S747	BS 506 amdt 1	AL 14	Methanol Kilfrost
		D.T.D. 900/4907	AL 34	Kilfrost ABC
Windscreen Washer Fluid		D.T.D. 900/4939 (RAF Ref. 34B/1488)	AL 36	WWF/Mod 2
Coolants		D.T.D. 900/4931		Coolanol 25R

Table 5 Aircraft Fluids

The D51615-112 MPFR variant is further qualified to the following MIL-STD-810F methods and procedures.

Temperature:	Method 501.4 and 502.4 Procedure II
Temperature, Humidity and Altitude:	Method 520.2 Procedure III.
Salt Spray:	Method 509.4
Acoustic Noise:	Method 515.3 Procedure I Diffuse field Acoustic Noise, 130dB.
Sand and Dust:	Method 510.4 Procedure I - Blowing dust
Peak Shock:	Method 516.5, Procedure I.
Random Vibration:	Method 514.5 Procedure I.
Gunfire Vibration:	Method 519.5 Procedure IV.
Linear Acceleration:	Method 513.5 Procedure II.
EMC	MIL STD 461C.

Crash Survival

Impact Shock

Subjected as a minimum to an acceleration pulse with the energy content of a half sine wave of 6.5 millisecond duration and a peak acceleration of 3400 'g', as defined in ED-56A, Amendment 1 section 5.3.2.a and ED-112 Chapter 2-4.2.1.

Penetration Resistance

Subjected to a penetration force produced by a 227 kg (500 lb.) weight dropped from a height of 3m (10 ft, 2 in) with a point of contact being a circular steel pin of 6.5 mm (0.25 in) diameter, as defined in ED-56A, Amendment 1 section 5.3.2.b and ED-112 Chapter 2-4.2.2.

Static Crush

Subjected to a 22.25 kN (5000 lb.) static crush on at least four points and all diagonals for a continuous period of 5 minutes

each, as defined in ED-56A, Amendment 1 section 5.3.2.c and ED-112 Chapter 2-4.2.3.

High Temperature Fire

Subjected to a "high temperature" fire test of 60 minutes duration producing a minimum thermal flux of 158 kW/m^2 (50,000 Btu/ft^2/hour) and a typical flame temperature of 1100°C, as defined in ED-56A, Amendment 1 section 5.3.2.d and ED-112 Chapter 2-4.2.4.

Low Temperature Fire

Subjected to a 260°C "low temperature" fire test of 10 hours duration, as defined in ED-56A, Amendment 1 section 5.3.2.b and ED-112 Chapter 2-4.2.5.

Deep Sea Pressure

Subjected to a pressure of 60 MPa (equivalent to immersion in seawater at a depth of 20,000 ft) for a period of 30 days, as defined in ED-56A, Amendment 1 section 5.3.2.f and ED-112 Chapter 2-4.2.6.

Sea Water Immersion

Subjected to a sea water immersion test at a depth of 3m (10 ft 2 in) for a period of 30 days.

Fluid Immersion

Subjected to a variety of aircraft fluid immersion tests for a period of 48 hours, as defined in ED-56A, Amendment 1 section 5.3.2.g and ED-112 Chapter 2-4.2.7.

2 STORAGE

Multi-Purpose Flight Recorder Types D51615-101, D51615-102, D51615-112 and D51615-122 are delivered in a trade container, as specified by packing drawing DR-SK105092/PG018, unless otherwise negotiated with the Customer. The equipment should remain in this container until required for use. With the units packaged as received from Penny & Giles Aerospace Ltd., the storage life is unlimited over the temperature range of -25°C to +40°C with a relative humidity not exceeding 75%.

For MPFR units that have been in storage for periods in excess of 36 months, refer to Sections 4.7.2 & 4.7.3 for details of the maintenance procedures which need to be carried out.

NOTE:

If the MPFR is to be stored at temperatures expected to exceed 71 degrees Celsius, then the ULB should be removed and stored separately at a lower temperature. To mitigate the risk of an ULB battery fire, explosion or burns, do not recharge, disassemble or heat above 71 degrees Celsius or incinerate. Dispose of batteries promptly.

3 UNPACKING

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE MULTI PURPOSE FLIGHT RECORDER TYPES D51615-101, -102, -112 AND -122 TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

Multi-Purpose Flight Recorder Type D51615-1XX is packed in a trade container as specified by Penny & Giles Aerospace Ltd packing drawing DR-SK105092/PG018, unless otherwise negotiated with the Customer. Units should not be removed from the packaging until required for use. After unpacking the unit the packaging should be retained for future use.

3.1 INSTALLATION

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING MULTI PURPOSE FLIGHT RECORDER TYPES D51615-1XX TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

3.2 INSTALLATION APPROVAL

The design of each aircraft installation will need to comply with the requirements of the relevant Certification Authority.

The conditions and tests required for TSO approval of this article are minimum performance standards. It is the responsibility of those desiring to install this article either on or within a specific type or class of aircraft to determine that the aircraft installation conditions are within the TSO standards. The article may be installed only if further evaluation by the applicant documents an acceptable installation and is approved by the Administrator.

3.3 SYSTEM DESIGN

A detailed system design is beyond the scope of this manual. For guidance a typical system block diagram for a CVR/FDR system is shown in Figure 5. Typical wiring diagrams for systems with a Control Unit are shown in Figure 6, Figure 7 and Figure 8, aircraft specific drawings will be provided on request.

3.4 SIGNAL LEVELS

The CVR function of the MPFR utilises digital audio recording techniques. These do not have the inherent 'soft' overload characteristics which analogue magnetic tape recorders had. It is therefore particularly important that the input signal levels are within the specification for the MPFR. Signal levels at the recorder input should be verified with the use of an oscilloscope.

When setting the Attenuation Links for the Cockpit Area Microphone Preamplifier, it must be remembered that signal

levels encountered in flight will be higher than those encountered on the ground and the attenuation therefore set accordingly. Confirmation of optimum attenuation level should be established by subjective evaluation of recordings made during flight.

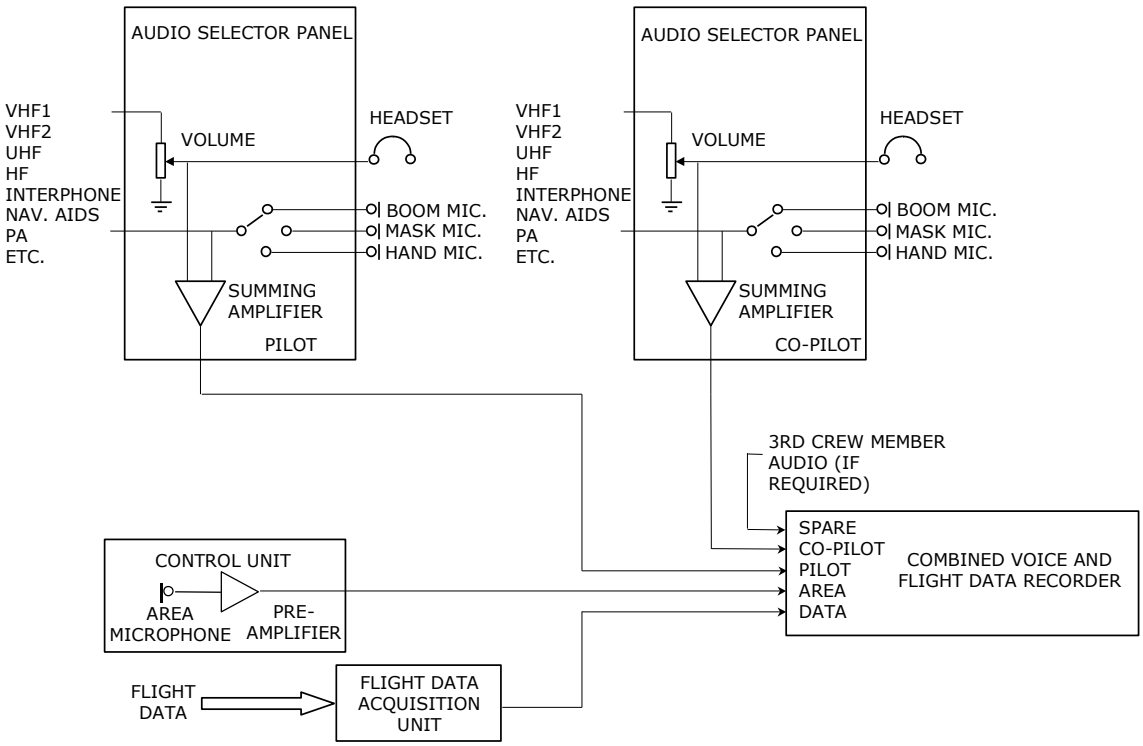

Figure 5 Typical CVR/FDR System Block Diagram

3.5 WIRING

The recommended minimum wiring sizes are shown in Table 2. These sizes are applicable for runs of up to 100 metres. For variants with an Internal Preamplifier and remote Area Microphone, the limit on cable length to the microphone will be set by the electromagnetic environment.

The ground connection to the recorder should be within 30cm of pins 4 and 5.

Power Ground (pins 61, 62 and 63) must be connected on both a.c. and d.c. installations.

The Area Microphone Record Level (attenuation) setting links and Record On link are to be as short as possible.

All MPFR utilise a single connector, for the purposes of on aircraft data recovery it is necessary to include a replay panel comprising at least of a replay interface connector and audio jack socket (if desired). The proposed wiring for the replay panel is shown on the wiring installation diagrams included as part of this manual. Connection from this panel to a portable computer for the purpose of data recovery and status can be achieved using Penny & Giles Replay Lead part number SA109654.

3.6 POWER SUPPLY

The MPFR is designed to operate from a 28VDC supply.

The MPFR should be powered from the aircraft bus which provides maximum reliability for the operation of the MPFR without jeopardizing services to essential or emergency loads. See EUROCAE ED-55, ED-56A and ED-112 for further guidance.

For d.c. powered installations, the supply to the MPFR should be protected by a 5 Amp circuit breaker. The type of circuit breaker used together with any other protection devices must be capable of passing an inrush current of 30 Amps for 2 milliseconds without tripping.

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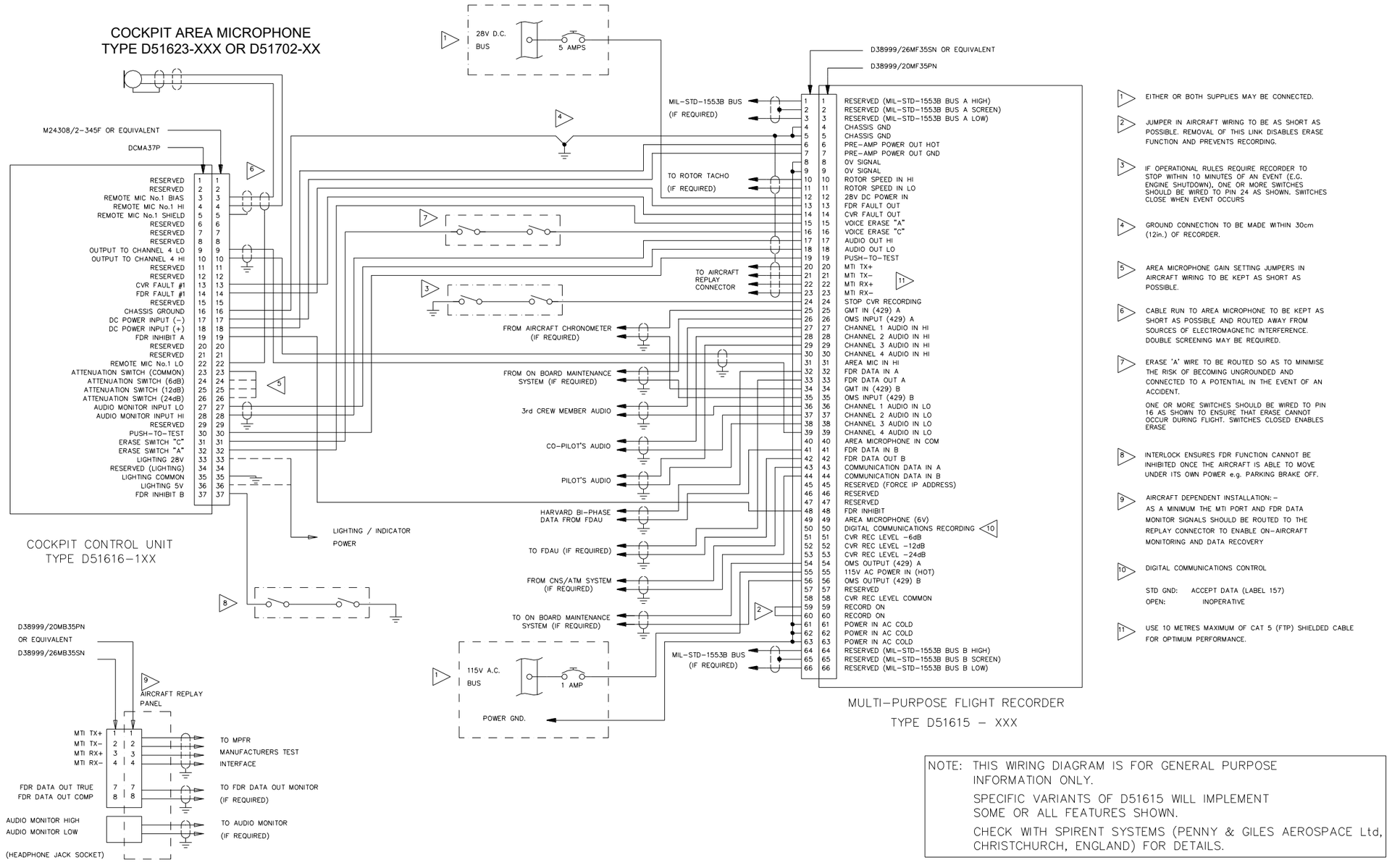

Figure 6 Generic MPFR Installation Wiring Diagram

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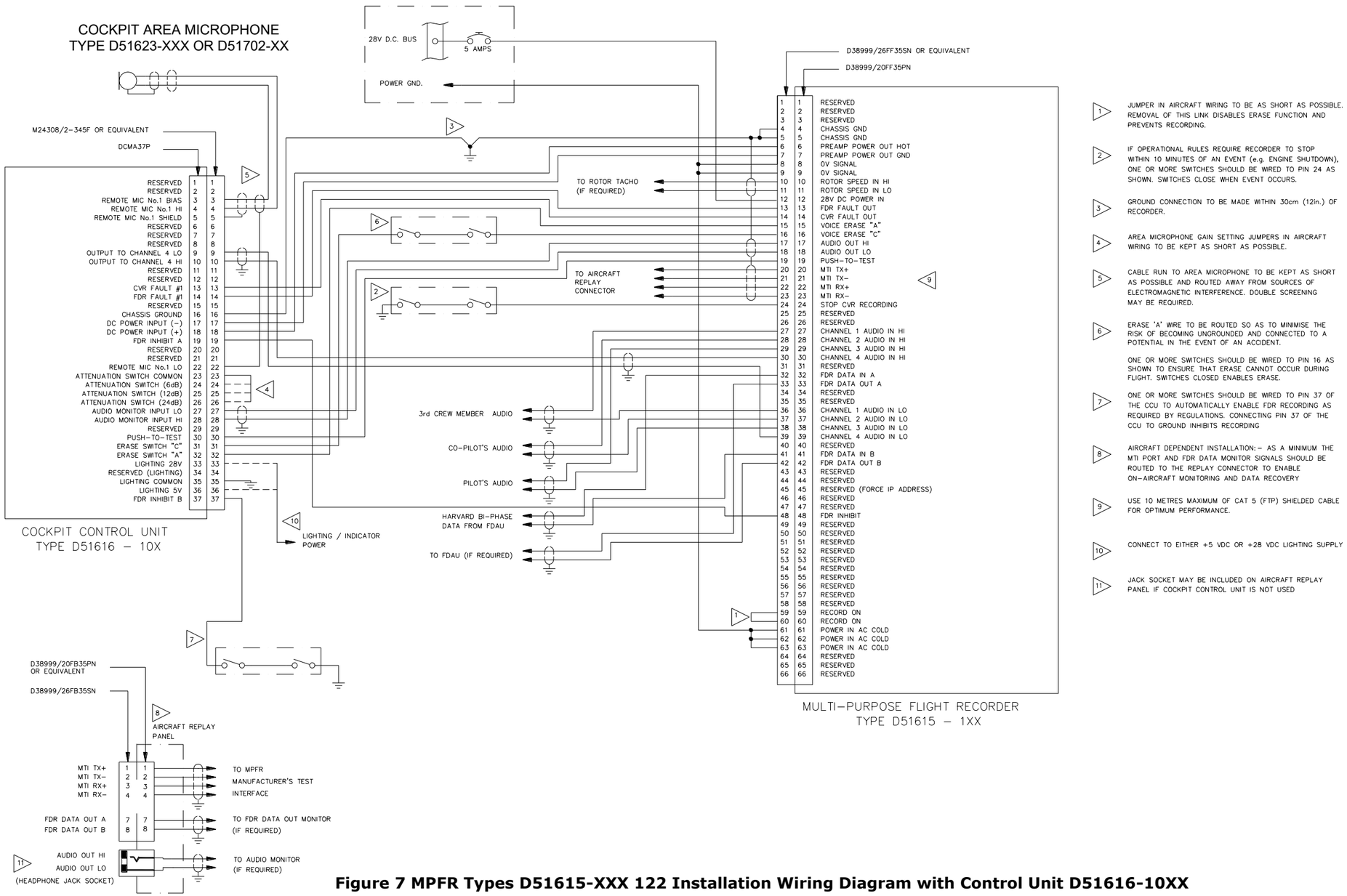

Figure 7 MPFR Types D51615-XXX 122 Installation Wiring Diagram with Control Unit D51616-10XX

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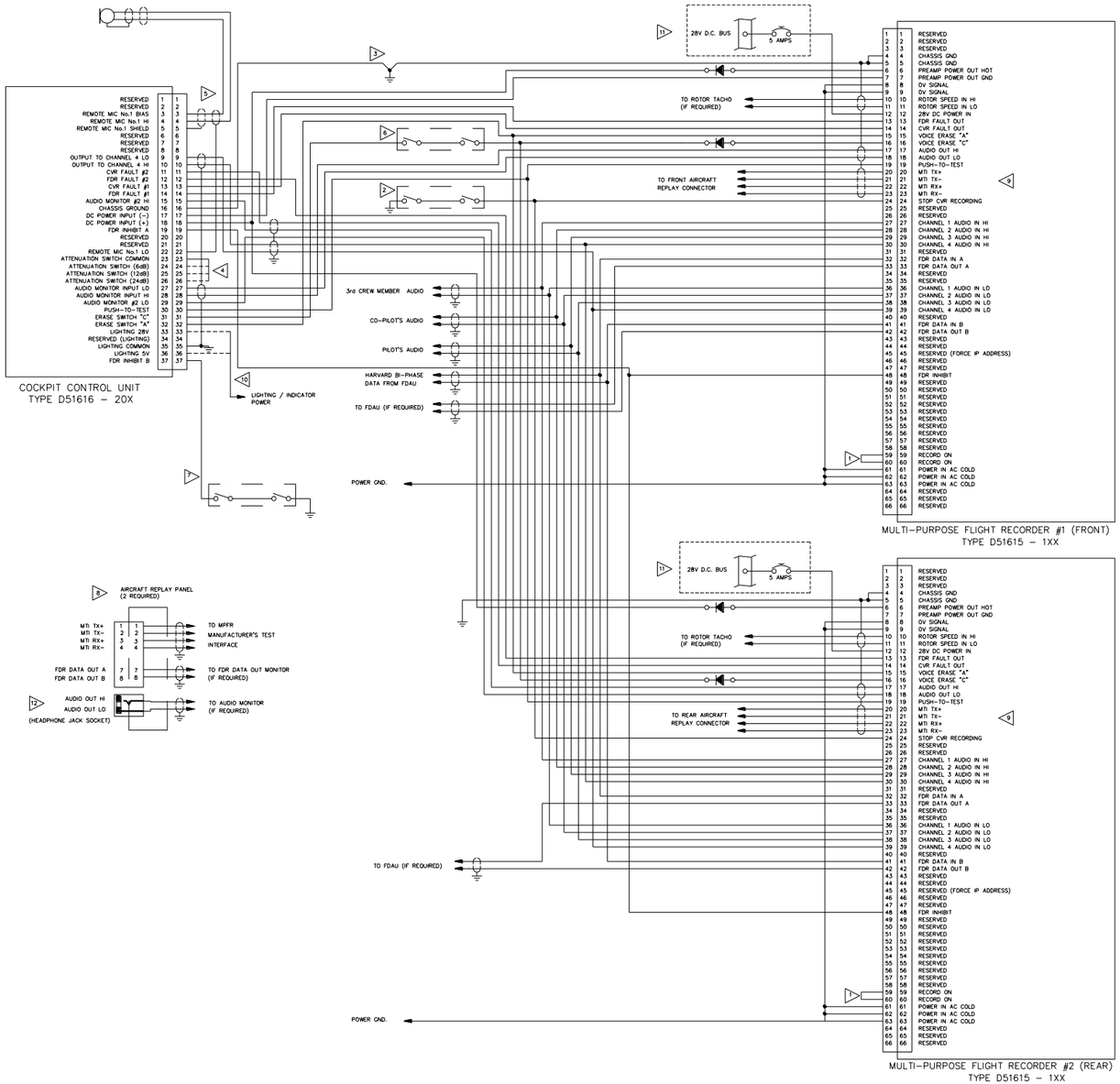

EQUIPMENT TYPE	EQUIPMENT CONNECTOR	AIRCRAFT CONNECTOR
MULTI PURPOSE FLIGHT RECORDER	D38999/20FF35PN	D38999/26FF35SN
COCKPIT CONTROL UNIT	DCMA37P	M24308/2–345F
AIRCRAFT REPLAY CONNECTOR	D38999/26FB35SN	D38999/20FB35PN

1. JUMPER IN AIRCRAFT WIRING TO BE AS SHORT AS POSSIBLE. REMOVAL OF THIS LINK DISABLES ERASE FUNCTION AND PREVENTS RECORDING.
2. IF OPERATIONAL RULES REQUIRE RECORDER TO STOP WITHIN 10 MINUTES OF AN EVENT (e.g. ENGINE SHUTDOWN), ONE OR MORE SWITCHES SHOULD BE WIRED TO PIN 24 AS SHOWN. SWITCHES CLOSE WHEN EVENT OCCURS.
3. GROUND CONNECTION TO BE MADE WITHIN 30cm (12in.) OF RECORDER.
4. AREA MICROPHONE GAIN SETTING JUMPERS IN AIRCRAFT WIRING TO BE KEPT AS SHORT AS POSSIBLE.
5. CABLE RUN TO AREA MICROPHONE TO BE KEPT AS SHORT AS POSSIBLE AND ROUTED AWAY FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE. DOUBLE SCREENING MAY BE REQUIRED.
6. ERASE 'A' WIRE TO BE ROUTED SO AS TO MINIMISE THE RISK OF BECOMING UNGROUNDED AND CONNECTED TO A POTENTIAL IN THE EVENT OF AN ACCIDENT.

   ONE OR MORE SWITCHES SHOULD BE WIRED TO PIN 16 AS SHOWN TO ENSURE THAT ERASE CANNOT OCCUR DURING FLIGHT. SWITCHES CLOSED ENABLES ERASE.
7. ONE OR MORE SWITCHES SHOULD BE WIRED TO PIN 37 OF THE CCU TO AUTOMATICALLY ENABLE FDR RECORDING AS REQUIRED BY REGULATIONS. CONNECTING PIN 37 OF THE CCU TO GROUND INHIBITS RECORDING
8. AIRCRAFT DEPENDENT INSTALLATION:– AS A MINIMUM THE MTI PORT AND FDR DATA MONITOR SIGNALS SHOULD BE ROUTED TO THE REPLAY CONNECTOR TO ENABLE ON–AIRCRAFT MONITORING AND DATA RECOVERY
9. USE 10 METRES MAXIMUM OF CAT 5 (FTP) SHIELDED CABLE FOR OPTIMUM PERFORMANCE.
10. CONNECT TO EITHER +5 VDC OR +28 VDC LIGHTING SUPPLY
11. THE TWO RECORDERS SHOULD BE CONNECTED TO DIFFERENT POWER BUSSES
12. JACK SOCKET MAY BE INCLUDED ON AIRCRAFT REPLAY PANEL IF COCKPIT CONTROL UNIT IS NOT USED

Figure 8 MPFR Types D51615-XXX Dual Installation Wiring Diagram with Control Unit Type D51616-20XX

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3.7 TERMINATION OF RECORDING

Some Operational Rules require a means of automatically terminating the recording and erasure functions within 10 minutes of an event, such as all engines stopped or safe landing. A built-in timer is provided for this purpose. A ground on pin 24 of the rear panel connector (STOP CVR RECORDING) will stop any CVR recording and erasure within 10 minutes. This may be achieved by wiring pin 24 to ground via appropriate switches.

Previously, inertia ('g') switches have been used to terminate the CVR recording in the event of an accident. Due to cases of inadvertent operation, ED-56A and ED-112 strongly discourage the use of such items.

For helicopters that operate over water, a device to terminate recording in the event of ditching may be mandated. This may be implemented by including a float switch in the power feed to the MPFR.

3.8 START OF RECORDING

Recording will automatically start on the application of power to the MPFR. If pin 24 (Stop CVR Recording) is held at ground potential (e.g. by engine oil pressure switch) recording will stop within 10 minutes. Recording will restart if one of the following actions is taken:

A. Momentarily remove the ground from pin 24 (Stop CVR Recording).

B. Operate the Control Unit TEST pushbutton.

C. Remove power from the MPFR for more than one second.

Operating Rules require the CVR function to start operating as soon as possible during the check list procedure. If power is likely to have been applied to the MPFR more than 10 minutes before commencement of this procedure, then it will be necessary to carry out one of the actions detailed above, early in the check list procedure.

3.9 VOICE ERASE

A Voice Erase feature is provided. Once initiated it prevents access to the Cockpit Voice recording. The corresponding Flight Data recording is not affected.

Operating Rules do not mandate a Voice Erase function; it is therefore an installation option. If implemented it is, however, mandatory to provide a safety interlock to prevent accidental operation. Further guidance is contained in ARINC 757.

3.10 RECORDER LOCATION

Operating rules give guidance on the recorder location. The environment at the chosen location must be within the MPFR specification limits (see DESCRIPTION, OPERATION AND SPECIFICATION paragraph 3.). For long term reliability, it is strongly recommended that, for aircraft, the MPFR is mounted in a heated, pressurized area of the fuselage, as far aft as practical. For helicopters, where the operational environment is not so severe, space and weight considerations may determine a suitable location. In either case, access to the replay panel and headphone jack should be considered.

3.11 MOUNTING

The MPFR is designed to perform to its published specification when attached directly to the airframe. Mounting in this manner is achieved using four 6.35mm (¼") bolts.

However, it is possible to install MPFR into existing ARINC 404A rack systems by the inclusion of a Penny & Giles Aerospace Ltd Adaptor Tray, Part Numbers D51614, D51618 and D51619. Anti-vibration mounting is not required.

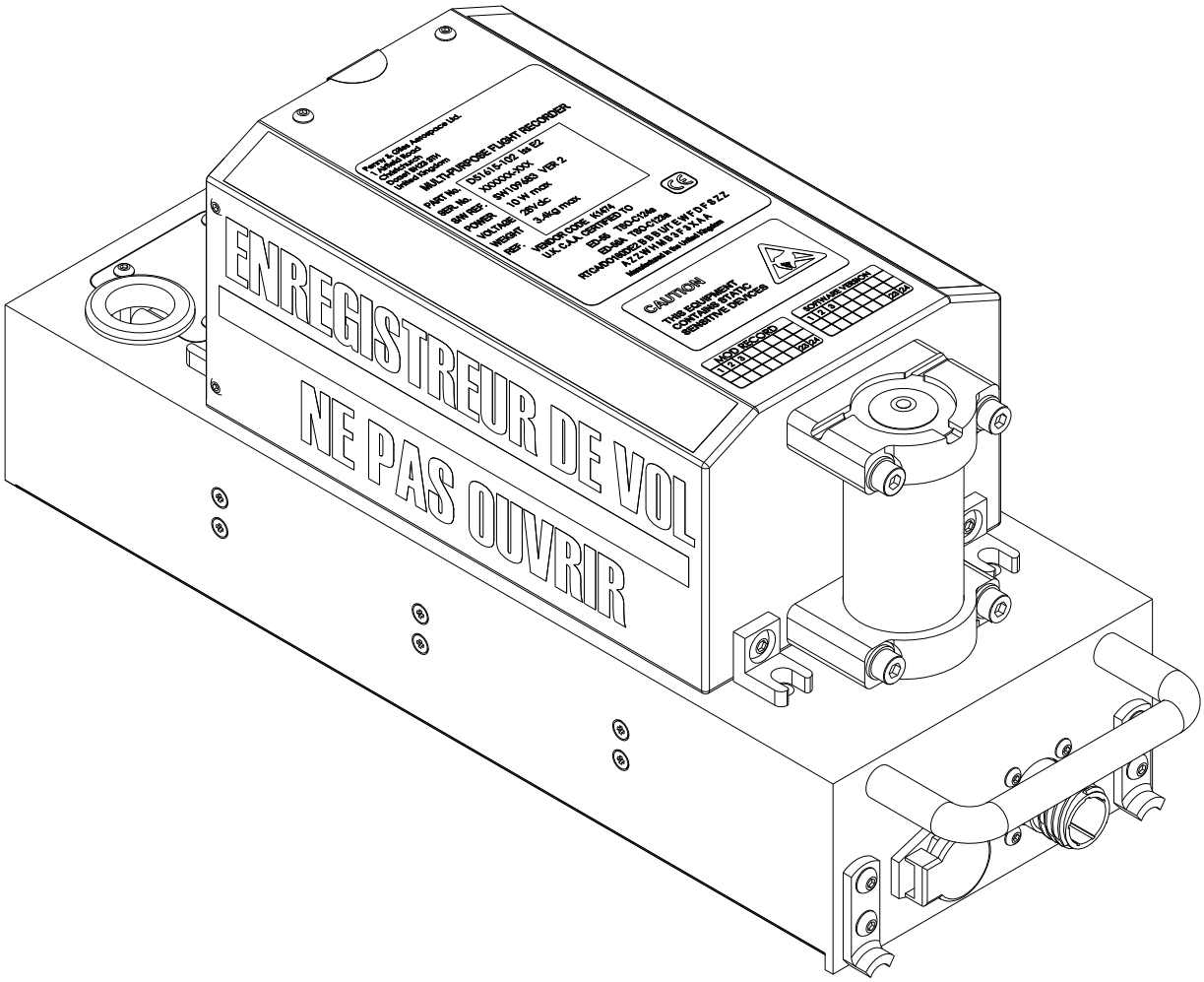

Figure 9 MPFR Mounting with Adaptor Tray D51614 or D51618

The three types of mounting tray are available as follows:

D51614: ARINC 757 Mounting tray with integral 115VAC 400Hz power adaptor.

D51618: ARINC 757 compatible mounting tray.

D51619: ARINC 747 compatible mounting tray.

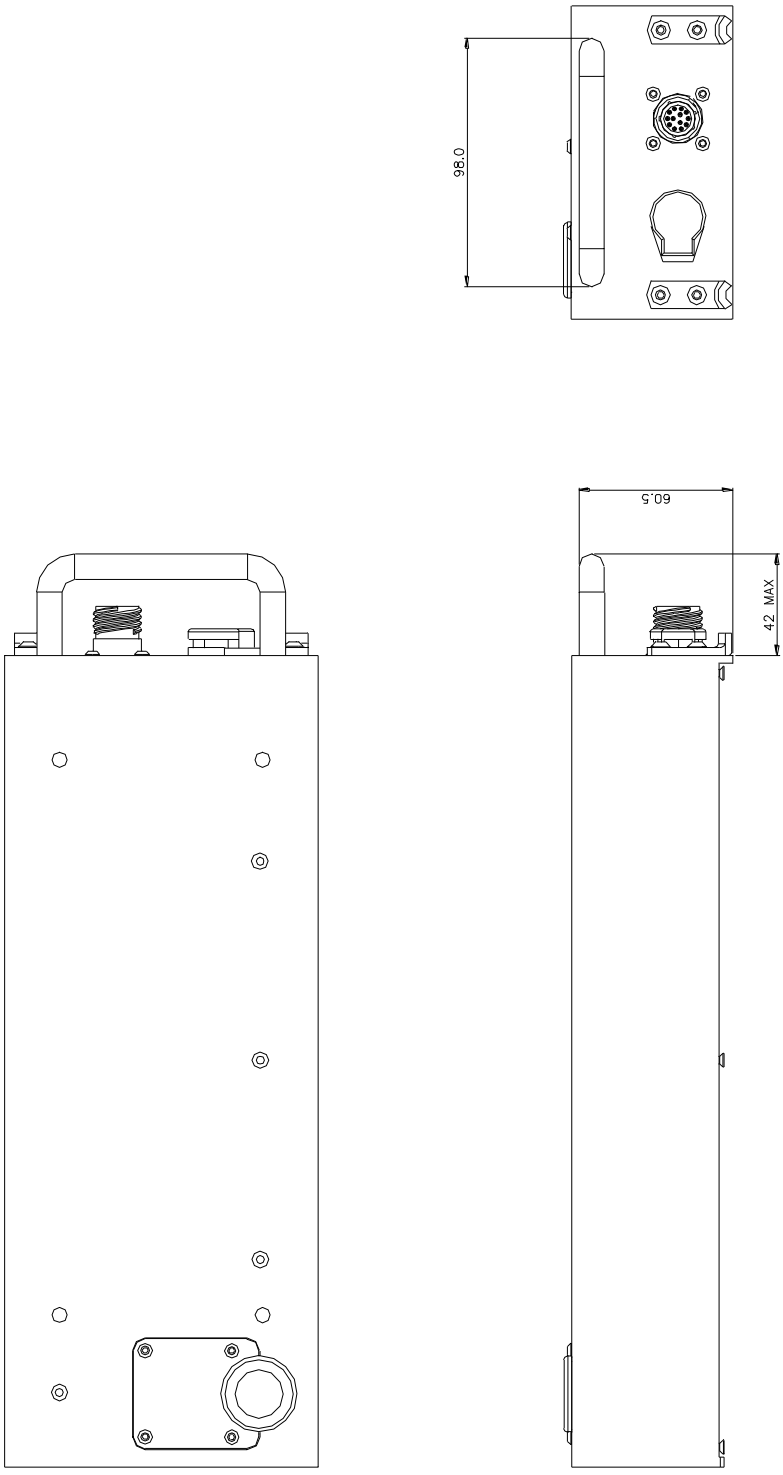

Figure 10 MPFR Adapter Tray (Excluding MPFR wiring loom)

3.12 POST INSTALLATION CHECK

3.12.1 Continuity Check

Before applying power to the MPFR, verify that all connections are secure and that continuity or other interconnection assurance check has been carried out.

3.12.2 System Check

(1) Carry out the Daily Functional Check described in the MAINTENANCE section.

(2) Carry out the CVR System Check described in the MAINTENANCE section.

(3) Carry out the Installation Check using the Monitoring and Download Unit (MDU379) Type D51651 using the Real Time Monitoring function as follows:

NOTE:

To enable FDR Parameter Real Time Monitoring function the source of the ARINC 717 data stream has to be set for the aircraft. For further information refer to the Ground Interface Manual PIM 428-O Section 12.5.

(a) Click on the *'Real Time, Monitoring'* button on the fleet management panel.

(b) Click on *'Input Source'* and select *'FDAU'.*

(c) To select the parameters to the monitor window click on the *Parameters'* button. The window will list down the right hand side the parameters defined in the database of the FDAU.

(d) Double click on a parameter to add to the list.

(e) When all desired parameters are selected click on the *'Start'* button to monitor the data. The system will begin to monitor the data looking for frame synchronisation words. As these are found the four Synchro indicators will step through 1, 2, 3 and 4 illuminated green as the sub-frame values are detected. Loss of sync will turn these indicators red.

(f) To record the monitored parameters click the *'Output File'* button. This will bring up the *'Save As'* window. Browse to find the appropriate directory and identify the filename. Click on *Save'* to return to the monitor window.

(g) Click on the *'Record' button.* The real time data is displayed in the window and also recorded in the data file.

(h) The parameters monitored can be verified against the aircraft configured parameters

(4) Carry out the FDR System Check described in the MAINTENANCE section.

3.13 FLIGHT TEST

Each newly installed MPFR system on each aircraft type will need to be flight tested and, for the audio recording, evaluated to demonstrate adequate recording quality during all normal regimes of flight. In the case of helicopter installations, spectral analysis of the CAM channel should be undertaken to ensure satisfactory recording of engine and transmission signatures.

The flight data recording will need to be evaluated to demonstrate correct recording of all data parameters.

The replay and evaluation will need to be performed by a replay centre acceptable to the Certification Authority.

Further guidance on Flight Test can be found in EUROCAE ED-55 Annex 3, ED-56A, Amendment 1 Chapter 6 and ED-112 Parts I and II Chapters I-6 and II-6 for CVR and FDR respectively.

4 OPERATING INSTRUCTIONS

NOTE:

The procedure described here refers to installations with a separate Penny and Giles Aerospace Ltd Cockpit Control Unit type D51616-XXXX.

4.1 GENERAL

CAUTION:

IT IS NECESSARY TO REMOVE THE MULTI PURPOSE FLIGHT RECORDER TYPES D51615-101, -102, -112 AND -122 FOR MAINTENANCE. POWER MUST BE SWITCHED OFF AT LEAST FIVE SECONDS BEFORE THE UNIT IS DISCONNECTED FROM THE AIRCRAFT.

Operation of the MPFR is automatic when power is applied via the connector.

4.2 CONTROLS AND INDICATORS

The Cockpit Control Unit provides two push-buttons for 'TEST' and 'ERASE, a biased toggle switch for 'FDR RCRD' (ARINC 757 FDR INHIBIT function), two cockpit mounted indicators 'CVR FAIL' and 'FDR FAIL', and a Headphone Jack.

4.2.1 TEST Pushbutton

Momentary operation of the TEST pushbutton initiates the Built-In-Test (BIT) function. Both the CVR FAIL and FDR FAIL indicators should illuminate for eight seconds and then extinguish.

NOTES:

1. **The FDR FAIL indicator illuminates if valid Harvard Biphase data is not received from the FDAU.**

2. **The BIT function is automatic on application of power to the MPFR. It is therefore not mandatory to have a cockpit mounted TEST Pushbutton.**

4.2.2 ERASE Pushbutton

Operation of the ERASE pushbutton for at least two seconds will initiate a Voice Erase Cycle, providing any external interlocks are satisfied. The erase cycle lasts for approximately five seconds during which period the CVR FAIL indicator will flash. The erase function is applicable to the Cockpit Voice Recorder audio information only, FDR parameter data is not affected by Voice Erase.

4.2.3 FDR RCRD Switch (FDR INHIBIT)

Operation of the FDR RCRD (FDR INHIBIT) switch, provides an override signal to the MPFR overriding aircraft installation interlocks (if appropriate) for the purpose of FDR subsystem ground test.

Grounding this input will inhibit the operation of the FDR recorder (if available). This may be wired via an appropriate interlock such as parking brake when in the aircraft is able to move under its own power the interlock is open circuit and short circuit when not.

The FDR RCRD switch opens the circuit when asserted and enables the FDR record function.

4.2.4 CVR FAIL Indicator

Steady illumination of the CVR FAIL indicator, indicates either that a fault in the CVR subsystem has been detected by the MPFR BIT function, or that the MPFR has been put into a non-recording mode. A non-recording mode may be enabled when the Record On link is not fitted or within 10 minutes of the assertion of the Stop CVR Recording control input.

Flashing of the CVR FAIL indicator occurs during data recovery or voice erase modes. Refer to DESCRIPTION, OPERATION AND SPECIFICATION 1.2.1 Operational Modes for further details.

4.2.5 FDR FAIL Indicator

Steady illumination of the FDR FAIL indicator, indicates either that a fault in the FDR function has been detected by the MPFR BIT function, or that the MPFR has been put into a non-recording mode e.g. the Record On link is not fitted.

The FDR FAIL indicator will also illuminate if valid Harvard Biphase data is not received from the FDAU.

Flashing of the FDR FAIL indicator occurs during data recovery modes. Refer to DESCRIPTION, OPERATION AND SPECIFICATION 1.2.1 Operational Modes for further details.

4.2.6 Headphone Jack

The Headphone Jack allows monitoring of the received audio signals. The audio signal is the sum of all channels.

NOTE:

It is advisable that headphones are not plugged into the Control Unit jack socket during the application of power or at system reset as this may cause the CVR POST to fail.

4.3 MAINTENANCE

CAUTIONS:

1. **IT IS NECESSARY TO REMOVE THE MULTI PURPOSE FLIGHT RECORDER TYPES D51615-101, -102, -112 AND -122 FOR MAINTENANCE.**

2. **POWER MUST BE SWITCHED OFF AT LEAST FIVE SECONDS BEFORE THE UNIT IS REMOVED FROM THE AIRCRAFT.**

4.4 GENERAL

The concept of On Condition (OC) maintenance applies to the MPFR as far as is practicable. OC is a maintenance process having repetitive inspections or tests to determine the condition of an assembly with regard to continued serviceability. Corrective action is taken when required by assembly condition. Comprehensive Built-In Test (BIT) is provided within the equipment which identifies any subsystem failures and facilitates fault finding down to module (circuit board) level. The BIT can be interrogated using Portable Replay Equipment (PRE).

Maintenance includes periodic inspections of the MPFR and the Underwater Locator Beacon (ULB) and servicing and maintenance of the ULB.

4.5 MPFR PERIODIC MAINTENANCE TASKS

The following MPFR periodic maintenance tasks are to be carried out at Pre-flight, six monthly, 12 monthly, 24 monthly, 36 monthly and 72 monthly intervals, or as agreed between the Operator and the applicable Regulatory Authority.

The periodic maintenance tasks shown in **Table 6**, except CVR Replay, 36 monthly and 72 monthly Inspection, can be performed on aircraft.

EQUIPMENT	TASK	MAXIMUM INTERVAL	ACTION
MPFR	Functional Check	Daily (pre-flight and/or post flight)	Confirm serviceability using test function on the control unit(flight crew check) or check for no FAIL indication for Built in test
ULB	Check/Functional Test	6 months	Clean switch contact. Check battery voltage. Check operation.
MPFR	CVR System Check	6 months	Confirm, by means of the control unit monitor jack, proper recording on each voice channel from the area microphone(s), receiver audio, side-tone, interphone, public address (if recorded) and boom microphone (including 'hot mic' function of the inhibit logic for bulk erase.
MPFR	FDR System Check	12 months	Copy and replay the last 15 minutes of flight recording. Check all mandatory parameters are active and are of acceptable quality.
MPFR	CVR Replay	24 months	Remove recorder immediately post flight. Replay and evaluate the quality of the in-flight recording.
MPFR	FDR Replay	24 months	Copy and replay complete data memory contents. Check all mandatory parameters are active and are of acceptable quality.
ULB (units in storage only)	Check	36 months	Carry out the checks detailed in Section 4.7.2 & 4.7.3
MPFR (units in storage only)	Check	36 months	Refer to Sections 3, 4 and 6 of PIM 428-O to access the recorder's Ground Support Interface.
MPFR	Inspection	72 months	Mechanical inspection. Carry out a verification test.
ULB Battery	Check	72 months	Check the expiry date of the ULB Beacon Battery. Replace if Necessary

Table 6 Periodic Maintenance Tasks for MPFR Types D51615-XXX

4.5.1 Inspections

Shall be carried out at intervals not exceeding 72 months elapsed time. Carry out the check as detailed in Table 6 above.

NOTE: Because of the specialized Test Equipment required to perform this check, the MPFR must be returned to the P&G UK facility for the 72 month inspection to be carried out

4.6 FUNCTIONAL CHECK

The Functional Check is to be performed daily either pre-flight and/or post-flight, or whenever maintenance has been performed on the aircraft, which may affect the performance or operation of the MPFR or its associated interface.

NOTE: The procedure described herein refers to installations with a separate Penny and Giles Aerospace Ltd Cockpit Control Unit type D51616-XXXX.

4.6.1 Procedure:

(1) Momentarily operate the TEST pushbutton on the Control Unit.

(2) Check that the associated CVR FAIL and FDR FAIL indicators illuminate for approximately eight seconds and then extinguish.

(3) If either of the FAIL indicators remain illuminated the Functional Check has failed and the MPFR must be removed from the aircraft for servicing.

NOTES:

1. **The Built-In-Test function is automatic on the application of power to the MPFR. Provided power has been cycled pre-flight, it is sufficient to just check for a 'NO FAIL' indication.**

2. **It is advisable that headphones are not plugged into the Control Unit jack socket during the application of power or at system reset as this may cause the CVR POST to fail.**

4.7 ULB PERIODIC INSPECTIONS

ULB periodic inspections are to be carried out at intervals not exceeding six months elapsed time or as agreed with the relevant Regulatory Authority. Carry out the check as follows:

4.7.1 ULB Switch Cleaning

At the intervals specified, and at any other time considered necessary, the ULB switch is to be cleaned as follows:

(1) Using a soft cloth and mild detergent, clean the ULB switch contact.

(2) Using a second, dry soft cloth, thoroughly dry the ULB switch contact.

(3) Check that the battery date stamp indicates an in-date battery.

CAUTION:

DIRT ON THE ULB SWITCH CONTACTS CAN CREATE A PATH FOR BATTERY CURRENT DRAIN.

4.7.2 ULB Battery Test

At the intervals specified, and at any other time considered necessary, the ULB battery is to be tested as follows:

(1) Using a high impedance voltmeter (input impedance of 10 M ohms) (not required when using the Dukane TS200 Test Set) to perform the procedure make sure the case and water switch are clean and dry prior to testing. If in doubt, wipe clean using mild detergent and a soft cloth.

(2) Place the negative lead of the high impedance voltmeter on the water switch pin and the positive lead of the meter on the beacon case or the mounting kit, if already installed.

(3) Measure the battery voltage. Note: Inspect label on beacon to determine battery code. See Figure 111 (shaded area) and refer to Figure 12 for voltage specifications. The beacon is operable at the given minimum acceptable voltage.

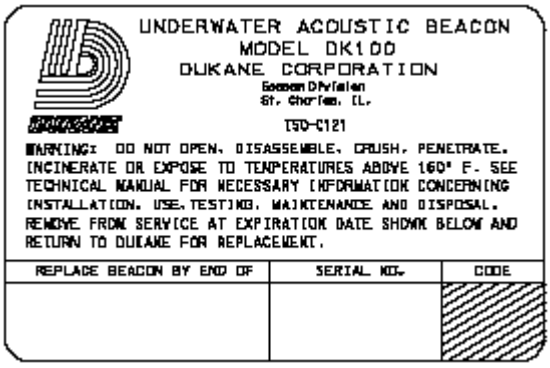

Figure 11 Typical Beacon Label

NOTE:

The beacon may be either installed or removed for battery testing.

CODE	MINIMUM ACCEPTABLE VOLTAGE
A	3.55 VOLTS
B	2.97 VOLTS
C	2.97 VOLTS

Figure 12 Beacon Voltage Code

4.7.3 ULB Test

At the intervals specified, and at any other time considered necessary, the ULB is to be tested as follows:

NOTES:

1. **The beacon should be tested both prior to and after installation on the MPFR.**

2. **Alternate test equipment and test procedures may be used.**

(1) Set the switches on the Dukane Ultrasonic Test Set Model 42A12A, or equivalent, as follows:

(a) INT/EXT switch to INT

(b) kHz TUNING to between 35 kHz and 40 kHz

(c) Gain control clockwise to MAX.

(2) Place the Test Set approximately 30cm (12 inches) from the ULB.

(3) Short circuit the central pin of the ULB to the beacon case.

(4) Check that an audible signal is heard from the Test Set.

(5) Adjust the Test Set kHz tuning to give the best audible tone.

(6) A normal tone equates to one 'blip' every second. If the repetition rate is greater, the battery is exhausted and requires replacement.

(7) Disconnect the short circuit from the central pin to the beacon case.

4.7.4 ULB Removal and Replacement

At the intervals specified, or whenever the beacon or battery fails its periodic test, the beacon assembly must be removed and a replacement installed. ULB removal and replacement is as follows:

CAUTIONS:

1. **CARE MUST BE TAKEN TO ENSURE THAT THE PAINT AROUND THE FIXING NUTS IS NOT DAMAGED DURING THIS PROCEDURE.**

2. **THE ULB BRACKETS ARE DIFFERENT, THE TOP BRACKET IS SLOTTED TO PREVENT THE BUILT UP OF MOIST TRIGGERING THE ULB AND THUS DRAINING THE ULB BATTERY. CARE MUST BE TAKEN WHEN REASSEMBLING THE ULB TO THE MPFR TO ENSURE THAT THE CORRECT BRACKET IS USED IN THE CORRECT POSITION.**

(1) Gain access to the ULB.

(2) Unscrew the four 5mm socket headed screws. Remove the screws and washers.

(3) Remove the two mounting brackets with the ULB noting the bracket orientation.

(4) Slide the ULB out of the brackets, and remove the 'O' ring chord from the lower bracket.

(5) Obtain a certified ULB with a new battery from the Manufacturer (Dukane), and perform the ULB Battery Test and the ULB Test.

(6) Insert the new beacon into the mounting brackets and replace the 'O' ring chord between the beacon and lower bracket.

(7) Rotate the beacon so that the battery replacement date can be read easily.

(8) Attach the brackets and beacon to the MPFR with the four 5mm socket headed screws and stainless steel washers.

(10) Apply a small amount of Loctite 222 to the threads of the screws, tighten the screws until the bracket makes contact with the MPFR Case.

(11) If the ULB securing screws are stainless steel, torque the screws to approximately 3.9 - 4.3 Nm (34.5 - 38.1 lbf in).

(12) If the ULB securing screws are high tensile steel, torque the screws to approximately 6.5 – 7.0 Nm (57.5 – 61.9 lbf in).

(13) Perform the ULB Battery Test and the ULB Test.

NOTE:

Return the removed ULB to the manufacturer for safe disposal of the internal Lithium battery.

4.8 CVR SYSTEM CHECK

The CVR System Check is to be carried out at intervals not exceeding six months elapsed time, or as agreed with the relevant Regulatory Authority. Carry out the Audio System Check as follows:

4.8.1 Equipment Required

The following equipment is required to carry out the check:

(1) 600 ohm Headphone with 1/4 in. mono jack plug.

4.8.2 Procedure

(1) Connect the headphone jack to the Cockpit Control Unit or Replay panel (if appropriate).

(2) Check the Cockpit Area Microphone by speaking in a normal voice 15cm (six inches) away from the microphone and note that the speech can be heard without any significant distortion.

(3) For each non-area microphone channel, check for proper recording of receiver audio, side-tone, interphone, public address (if recorded) and boom microphone (including 'hot mic.' function, i.e. Interphone OFF).

NOTE:

There will be no delay between speaking and hearing the audio.

Whenever unscheduled maintenance has been performed on the aircraft, which may have affected any of the audio input signals or the performance or operation of the MPFR or its associated interface, accessories or components, this test should be performed. Upon satisfactory completion of this test, an entry should be made in the maintenance records for the aircraft.

4.9 FDR SYSTEM CHECK.

The FDR System Check is to be carried out at intervals not exceeding 12 months elapsed time, or as agreed with the relevant Regulatory Authority.

NOTES:

1. **This procedure describes the use of Portable Replay Equipment (PRE) Type D51620 to carry out the FDR System Check. The PRE available from Penny & Giles Aerospace Ltd. comprises software and cables. In addition to this, the hardware required to perform this check includes a portable PC, and interface card. The software includes Engineering Unit conversion and display functions. Consult Penny & Giles Aerospace Ltd for further details.**

2. Refer to PIM 428-O, the PRE Installation and Operating Manual for guidance on carrying out this procedure.

3. If the procedure is to be carried out in situ on the aircraft, the PC should be a laptop for ease of portability.

4. If the procedure is to be carried out in a lab environment, a desktop with equivalent specification may be used in addition to the power and replay cables identified. FDR Check following refers.

5. It is possible to download the FDR information from the MPFR on to a copy PC. The downloaded data can then be transferred to an analysis PC for investigation.

6. The FDR System Check is carried out with the MPFR in situ on the aircraft. It should not be carried out with the aircraft in flight.

7. Two forms of download are identified below; the first describing an Internet Explorer based download the second a PRE based download. An Internet Explorer download is included for operators of aircraft who do not have immediate access to the PGS replay software.

4.9.1 Equipment Required

The following equipment is required to carry out the check:

(1) Pentium 200 MHz PC, IBM or compatible, with the following minimum specification:

(a) 10Base-T/100Base-Tx Ethernet Interface.

(b) 128 Mbytes RAM.

(c) 250 Mbytes minimum free disk space (after program installation).

(d) CD ROM drive.

(e) Microsoft Windows XP.

(f) Professional Ground Station (PGS).

(2) Ground Replay Interconnect Cable SA109680

(3) Aircraft replay interconnect Cable SA109654

(4) 28V DC 4A regulated power supply

4.9.2 Procedure Using Internet Explorer

NOTE:

The following procedure assumes that the PC has been configured to support communications between the MPFR and PC as detailed in the Ground Support Interface manual PIM 428-O.

FDR Data Download

(1) Ensure that Internet Explorer has been installed on to the download PC.

(2) Connect the PC to the MPFR replay panel MTI connector using either Cable Type SA109654.

(3) Apply power to the MPFR and the PC.

(4) Download is started by either selecting the Internet Explorer icon on the desktop or by selecting the Internet Explorer task bar from the Task menu.

(5) Enter the recorder IP address of 10.0.0.100 in the address box, and click *'go'*.

(6) Internet Explorer attempts to connect to the recorder. If successful, the Recorder 'Home' page is displayed.

(7) With communications established, Internet Explorer displays the home page on which the navigation menu on the left of the screen.

(9) Select the '*File Download*' option and from the 'File Download' page select the *'Flight Data Master'* option. Download the entire FDR memory content as the length of recording since the previous download cannot be guaranteed. Save the file to an appropriate directory on the host PC.

(10) On completion of the download, click the *'OK'* button in the download complete message box, return to the Home page by selecting 'Home on the Navigation menu. Select *'File,*

Close' or click on the window close box to the top right of the window.

(11) Switch off power to the MPFR. Disconnect the MTI cable.

FDR Data Analysis

This procedure may be performed on the download PC or on a desktop PC on to which the recovered data has been copied. It is assumed that a database with appropriate parameter definitions has been defined.

(1) Invoke the PRE Professional Ground Station (PGS) software on the analysis PC by selecting the PGS desktop icon with the mouse.

(2) From the menu options, select the *'Aircraft, Equipment'* option from the drop down menu.

(3) From the *'Equipment List'* table, select the Applicable MPFR option.

(4) Click the *'Select'* button to enable equipment type.

(5) From the menu options, select the *'Databases, Database Manager'* option from the drop down menu.

(6) Select the appropriate database.

(7) Click the *'Select'* button to confirm selection database.

(8) From the menu options, select the *'Flight, Open Flight'* option from the drop down menu.

(9) Select the *'Files of Type:'* drop down list, and select the *'MPFR (*.fdr)'* option to reveal all downloaded FDR files. Select the appropriate directory in which the download file is held.

(10) Select the *'FDR1.fdr'* file by both highlighting the filename with the mouse and selecting the *'Open'* button or double clicking on the *'FDR1.fdr'* filename.

(11) Select the *'Yes'* option of the following dialogue box to enable conversion to the PGS *'.xff'* file format.

Enter a suitable archive directory and filename for the *'.xff'* file to be saved as and select the *'Save'* button to enable the save operation.

(12) From the Menu, select the *'Databases, Edit Parameter Groups'* option from the drop down menu. If a group is already defined it will be displayed automatically. If no groups are defined, click on *'New Group'* and type in appropriate name in the text box. Click *'OK'* to save the selected group.

(13) Select parameters from the list in the left window and click *'Add'* to display *'selected parameters'* window on the right. Click *'OK'* to exit the function and display the group parameters on the screen.

(14) When selecting the parameter group, each parameter trace shall be displayed in a colour against a white background. The entire file is displayed in the replay screen window.

(15) As far as practicable ensure all parameters are active and are in range.

Whenever unscheduled maintenance has been performed on the aircraft, which may have affected any of the data input signals or the performance or operation of the MPFR or its associated interface, accessories or components, this test should be performed. Upon satisfactory completion of this test, an entry should be made in the maintenance records of the aircraft.

4.9.3 Procedure Using PGS Only

NOTE:

The following procedure assumes that the PC has been configured to support communications between the MPFR and PC as detailed in the Ground Support Interface manual PIM 428-O.

This procedure may be performed on the download PC or on a desktop PC on to which the recovered data has been copied. It is assumed that a database with appropriate parameter definitions and aircraft equipment configuration has been defined.

(1) Invoke the PRE Professional Ground Station (PGS) software on the analysis PC by selecting the PGS desktop icon with the mouse.

(2) From the toolbar/drop down menu select the *'Fleet Management'* option.

(3) From the Fleet Management window, highlight the appropriate aircraft for download.

(4) Click on the *'Download'* button and select the '*crash recorder'* option.

(5) Click on the *'Configuration'* button and ensure that the default IP address of 10.0.0.100 is specified. Click *'OK'* to exit.

(6) From the check box options presented within this window, select the '*FDR'* Data to download option, followed by the *'Flight data Master'*, *'System Log Files'* and *'Keep Compressed Files'* options.

(7) Click on *'Download'* button. Wait for the progress to complete as identified by the progress bars at the bottom of the window.

(8) On completion click on the *'Cancel'* button to return to the *'Fleet Management'* window.

(9) The aircraft should remain highlighted, therefore click on the *'Flights'* button to identify the list of downloads performed for this aircraft. Highlight the appropriate flight (which should be the last in the list of flights available.

(10) Click on the *'Plot'* button and select the appropriate parameter group, if configured. If parameter display groups have not been configured, click on the *'Select'* option and chose parameters from those presented for display.

4.10 CVR REPLAY

CAUTION:

MPFR TYPES D51615-101, -102, -112 AND -122 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.

NOTES:

1. **This procedure must be performed by suitably qualified personnel.**

2. **The applicable Regulatory Authority may require this procedure to be carried out by an approved Replay Centre.**

3. **Confidentiality of the recording must be preserved.**

4. **This procedure has to be performed with the MPFR removed from the aircraft.**

4.10.1 Equipment Required

The following equipment is required to carry out the check:

(1) Desktop PC - Pentium 200 MHz PC, IBM or compatible, with the following minimum specification:

(a) Sufficient PCI Slots to support soundcard requirements.

(b) 128Mbytes RAM.

(c) 250 Mbytes minimum free disk space (after program installation).

(d) CD ROM drive.

(e) Soundcard and driver software.

(f) 10Base-T/100Base-Tx Ethernet Interface.

(g) Microsoft Windows XP.

(h) Professional Ground Station (PGS).

(2) Ground Replay Cable SA109680

(3) 28V DC 4A regulated power supply

4.10.2 Procedure Using Internet Explorer

CVR Download

(1) Connect the Ground replay Cable SA109680 to the MPFR main connector.

(2) Connect the Power Input plugs to the 28V power supply (white wire to positive, black wire to negative).

Note: The recorder draws up to 4A on initial switch-on. To avoid any possible damage to the unit, please ensure that any power supply current limiting is disabled before applying power.

(3) Apply power to the MPFR and the PC.

(4) PRE is started by either selecting the Internet Explorer icon on the desktop or by selecting the Internet Explorer task bar from the Task menu.

(5) Enter the recorder IP address of 10.0.0.100 in the address box, and click *'go'*.

(6) Internet Explorer attempts to connect to the recorder. If successful, the Recorder 'Home' page is displayed.

(7) With communications established, PRE displays the home page on which the navigation menu on the left of the screen.

(8) Select the *'File Download'* option and from the 'File Download' page select the *'Channel 1'* option. Download the entire memory content as the length of recording since the previous download cannot be guaranteed. Save the file to an appropriate directory on the host PC.

(9) Repeat for the remaining Channels 2, 3 and 4 (0 - 30 minutes) options

(10) On completion of the download, click the *'OK'* button in the download complete message box, return to the Home page by selecting *'Home'* on the Navigation menu. Select *'File, Close'* or click on the window close box to the top right of the window.

(11) Switch off power to the MPFR. Disconnect the MTI cable.

CVR File Processing

The processing of the MPFR CVR files may be performed on the download PC if installed with PGS, or alternatively on a remote PC once the source files have been transferred.

CVR files downloaded using Internet Explorer cannot be converted to a .wav file format using PGS. There is however, a Wave Converter embedded with the PGS.

To access the Wave Converter use the following procedure:

(1) Click *'Start, My Computer, C:, Program Files, PGS'.*

(2) From the list of files select: *'Wave Converter'*.

(3) In the displayed dialog box, click the *'Browse'* button and locate the downloaded MPFR cvr files from above.

(4) Select the 16 bit resolution option and click *'Convert'.*

(5) Repeat for all downloaded files.

(6) Quit from the Wave Converter utility.

The converted files can be now replayed and analysed using the process described in paragraph 4.10.4.

4.10.3 Procedure Using PGS

NOTE:

The following procedure assumes that the PC has been configured to support communications between the MPFR and PC as detailed in the Ground Support Interface manual PIM 428-O.

This procedure may be performed on the download PC or on a desktop PC on to which the recovered data has been copied. It is assumed that the appropriate aircraft equipment configuration has been defined.

(1) Invoke the PRE Professional Ground Station (PGS) software on the analysis PC by selecting the PGS desktop icon with the mouse.

(2) From the toolbar/drop down menu select the *'Fleet Management'* option.

(3) From the Fleet Management window, highlight the appropriate aircraft for download.

(4) Click on the new *'Download'* button, entry and select the *'Crash Recorder'* option.

(5) Click on the *'Configuration'* button and ensure that the default IP address of 10.0.0.100 is specified.

(6) From the check box options presented within this window, select the *'CVR'* Data to download option followed by the appropriate CVR channels to download. These are typically the *'Ch. 1', 'Ch. 2', 'Ch. 3', 'Ch. 4 (0-30 min)', 'Ch. 4 (0-120 min)', Keep Compressed Files', 'Highest Quality', 'Supplementary Flight Information'* and *'Keep Compressed Files'* options.

(7) Click on the *'Download'* button. Wait for the process to complete as identified by the progress bars at the bottom of the window.

(8) On completion click on the *'Cancel'* button to return to the *'Fleet Management'* window.

4.10.4 CVR Audio Analysis

The analysis of the CVR files may be performed on the download PC or on an alternative PC once the files have been copied.

(1) Within PGS, click on the *'Audio Player'* icon.

(2) Click on the *'File Open'* icon and the browse to the folder containing the downloaded and processed CVR files.

(3) Select the file for replay, during the load period a progress bar will be displayed on the bottom right of the window.

(4) If desired, further audio files from the same download may be opened by repeating the steps (2) and (3) above.

(5) Using the *'Play', 'Pause'* and *'Stop'* buttons the replay may be reviewed.

(6) To archive the recorded audio, insert a writeable CDROM disk into the drive and use a suitable application to transfer the downloaded audio onto the CDROM disk.

4.11 FDR REPLAY

The FDR Replay is to be carried out at intervals not exceeding 24 months elapsed time, or as agreed with the relevant Regulatory Authority.

NOTES:

1. This procedure may be carried out with the MPFR either in situ or removed from the aircraft.

2. If the FDR Check is to be performed in situ, the procedure for FDR System check identified above should be performed. A lab FDR Replay is identified following.

4.11.1 Equipment Required

The following equipment is required to carry out the check:

(1) Desktop PC - Pentium 200 MHz PC, IBM or compatible, with the following minimum specification:

(a) 250 Mbytes minimum free disk space (after program installation).

(b) 128Mbytes RAM.

(c) CD ROM drive

(d) 10Base-T/100Base-Tx Ethernet Interface

(e) Microsoft Windows XP.

(f) Professional Ground Station (PGS).

(2) Ground Replay Cable SA109680.

(3) 28VDC 4 Amp Regulated Power Supply.

4.11.2 Procedure

NOTE:

If the MPFR is in situ on the aircraft omit Steps (1) and (2).

(1) Connect the Ground replay Cable SA109680 to the MPFR main connector.

(2) Connect the Power Input plugs to the 28V power supply (white wire to positive, black wire to negative).

Note: The recorder draws up to 4A on initial switch-on. To avoid any possible damage to the unit, please ensure that any power supply current limiting is disabled before applying power.

(3) Perform the data download procedure identified in FDR Data Download above.

(4) Perform the data analysis procedure identified in FDR Data Analysis above.

4.12 36 MONTH CHECK

The following checks are to be carried out on MPFR units which have been held in storage for periods in excess of 36 months.

4.12.1 ULB Battery Check

Carry out a full ULB battery test as detailed in Section 4.7.2 of this PIM.

4.12.2 ULB Test

Carry out a ULB function test as detailed in Section 4.7.3 of this PIM.

4.12.3 Recorder Status Check

Refer to Sections 3, 4 and 6 of the PIM 428-O to access the Status Page of the Recorder's Ground Support Interface.

The Recorder Status should be as detailed in Figure 13 below.

If the Status of the Recorder is not as detailed, contact Penny & Giles Product Support pg-support@curtisswright.com for further advice.

Figure 13 MPFR Ground Support Interface

4.13 INSPECTION

Recommended to be carried out at intervals not exceeding 72 months elapsed time from the date of manufacture (as identified on the Main Ident Label on the top face of the MPFR), but may be postponed until the next suitable planned maintenance period so long as the MPFR meets the following criteria:

• No CVR and/or FDR fault indication is present whilst the unit is in operation (this excludes indications set by discrete inputs such as “FDR Inhibit” and “Record Stop”)

• The remaining maintenance tasks are still carried out (daily, 6-, 12- and 24-month checks, refer to Table 8 above)

• The Underwater Locator Beacon (ULB) battery has not expired (the expiry date is indicated on the ULB label, refer to Figure 11)

• The ULB remains fully functional (refer to Section 6.4.2, “ULB Battery Test” and Section 6.4.3, “ULB Functional Test”)

NOTES:

1. **The ULB can be replaced by the operator in accordance with Section 4.5, “Periodic Maintenance Tasks”. If the MPFR does not meet the above criteria and cannot be made to meet the criteria by the operator, the MPFR should be returned to Penny & Giles Aerospace Ltd for evaluation at the earliest opportunity. Carry out the check as detailed in Table 6 above.**

2. **Because of the specialised Test Equipment required to perform this check, the 72-month inspection can only be carried out at the P&G UK facility.**

CAUTION:

MPFR TYPES D51615-101, -102, -112 AND -122 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.

NOTES:

1. **This procedure must be performed by suitably qualified personnel.**

2. **This procedure has to be performed with the MPFR removed from the aircraft.**

4.13.1 Equipment Required

Refer to CMM 31-34-22.

4.13.2 Procedure

Refer to CMM 31-34-22.

5 REPAIR

If facilities are available to carry out the procedures detailed in the Penny & Giles Component Maintenance Manual 31-34-22, then repairs may be carried out to the MPFR. If the necessary facilities are not available then the unit must be returned to the Manufacturer, Penny & Giles Aerospace Ltd.

Equipment is to be repaired at second line by the replacement of modules.

Part 2: - Cockpit Control Unit

1 DESCRIPTION, OPERATION AND SPECIFICATION

1.1 DESCRIPTION

1.1.1 General

The Cockpit Control Unit Type D51616-XXXX forms part of the aircraft Combined Voice and Flight Data Recording System and is usually installed in the cockpit.

The unit is a panel mounted enclosure containing the Area Microphone Pre-amplifier, provision for an integral or externally mounted Area Microphone, a Headphone jack socket together with pushbuttons and indicators for the self-test and voice erase facilities of the MPFR.

Cockpit Control Unit Type D51616-1XXX for single MPFR installation support is illustrated in Figure 14 and Type D51616-2XXX for dual MPFR installation support in Figure 15.

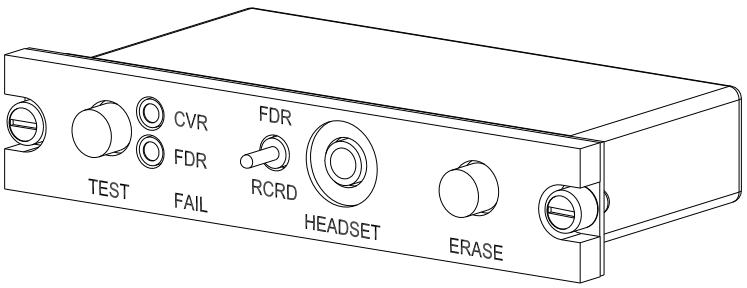

Figure 14 Cockpit Control Unit Type D51616-1XXX

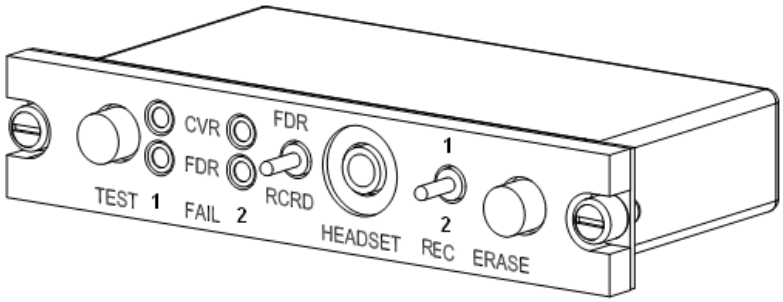

Figure 15 Cockpit Control Unit Type D51616-2XXX

1.1.2 Mechanical Description

The unit is of modular construction and consists of a metal frame to which the printed circuit board and the front panel are fixed. The electronics are protected from mechanical damage by a metal dust jacket.

The front panel assembly consists of a metal support plate to which the front panel assembly is fixed. The integral microphone (if fitted) together with the indicators, switches and the headset jack socket are fixed to this combined assembly.

1.2 OPERATION

1.2.1 Interfaces

All signal inputs and outputs except VOICE ERASE A, VOICE ERASE C, FD INHIBIT and PUSH-TO-TEST operate with respect to DC POWER INPUT -. PUSH-TO-TEST and FDR RCRD (FDR INHIBIT) operate with respect to CHASSIS GROUND. Refer to **Table 7** and **Table 8** for connector pin outs and cable requirements.

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
RESERVED (REMOTE MIC No.2 SHIELD)	1	N.C.
RESERVED (REMOTE MIC No.2 LO)	2	N.C.
REMOTE MIC No.1 BIAS	3	24 AWG SCREENED TWISTED TRIPLE 1
REMOTE MIC No.1 HI	4	24 AWG SCREENED TWISTED TRIPLE 1
REMOTE MIC No.1 SHIELD	5	24 AWG SCREENED TWISTED TRIPLE 1
RESERVED (INTERNAL MIC No.1 BIAS)	6	N.C.
RESERVED (INTERNAL MIC No. 1 HI)	7	N.C.
RESERVED (INTERNAL MIC No.1 HI)	8	N.C.
OUTPUT TO CHANNEL 4 LO	9	24 AWG SCREENED TWISTED PAIR 3
OUTPUT TO CHANNEL 4 HI	10	24 AWG SCREENED TWISTED PAIR 3
RESERVED (CVR FAULT No. 2)	11	N.C.
RESERVED (FDR FAULT No. 2)	12	N.C.
CVR FAULT No. 1	13	24 AWG
FDR FAULT No. 1	14	24 AWG
RESERVED (AUDIO MONITOR No. 2 HI)	15	N.C.
CHASSIS GROUND	16	20 AWG
DC POWER INPUT (-)	17	24 AWG
DC POWER INPUT (+)	18	24 AWG
FDR INHIBIT A	19	24 AWG
RESERVED (REMOTE MIC No.2 BIAS)	20	N.C.
RESERVED (REMOTE MIC No.2 HI)	21	N.C.
REMOTE MIC No.1 LO	22	24 AWG SCREENED TWISTED TRIPLE 1
ATTENUATION SWITCH (COMMON)	23	24 AWG
ATTENUATION SWITCH (6dB)	24	24 AWG
ATTENUATION SWITCH (12dB)	25	24 AWG
ATTENUATION SWITCH (24dB)	26	24 AWG
AUDIO MONITOR INPUT LO	27	24 AWG SCREENED TWISTED PAIR 4
AUDIO MONITOR INPUT HI	28	24 AWG SCREENED TWISTED PAIR 4

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
RESERVED (AUDIO MONITOR No. 2 LO)	29	N.C.
PUSH-TO-TEST	30	24 AWG
ERASE SWITCH "C"	31	24 AWG
ERASE SWITCH "A"	32	24 AWG
LIGHTING 28V	33	24 AWG
RESERVED LIGHTING	34	24 AWG
LIGHTING COMMON	35	24 AWG
LIGHTING 5V	36	24 AWG
FDR INHIBIT B	37	24 AWG

Table 7 Cockpit Control Unit Type D51616-1XXX Connector Details for Single MPFR Installation Support – Remote Mic

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
RESERVED (REMOTE MIC No.2 SHIELD)	1	N.C.
RESERVED (REMOTE MIC No.2 LO)	2	N.C.
REMOTE MIC No.1 BIAS	3	24 AWG SCREENED TWISTED TRIPLE 1
REMOTE MIC No.1 HI	4	24 AWG SCREENED TWISTED TRIPLE 1
REMOTE MIC No.1 SHIELD	5	24 AWG SCREENED TWISTED TRIPLE 1
RESERVED (INTERNAL MIC No.1 BIAS)	6	N.C.
RESERVED (INTERNAL MIC No. 1 HI)	7	N.C.
RESERVED (INTERNAL MIC No.1 HI)	8	N.C.
OUTPUT TO CHANNEL 4 LO	9	24 AWG SCREENED TWISTED PAIR 3
OUTPUT TO CHANNEL 4 HI	10	24 AWG SCREENED TWISTED PAIR 3
CVR FAULT No. 2	11	24 AWG
FDR FAULT No. 2	12	24 AWG
CVR FAULT No. 1	13	24 AWG
FDR FAULT No. 1	14	24 AWG
AUDIO MONITOR No. 2 HI	15	24 AWG SCREENED TWISTED PAIR 2

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
CHASSIS GROUND	16	20 AWG
DC POWER INPUT (-)	17	24 AWG
DC POWER INPUT (+)	18	24 AWG
FDR INHIBIT A	19	24 AWG
RESERVED (REMOTE MIC No.2 BIAS)	20	N.C.
RESERVED (REMOTE MIC No.2 HI)	21	N.C.
REMOTE MIC No.1 LO	22	24 AWG SCREENED TWISTED TRIPLE 1
ATTENUATION SWITCH (COMMON)	23	24 AWG
ATTENUATION SWITCH (6dB)	24	24 AWG
ATTENUATION SWITCH (12dB)	25	24 AWG
ATTENUATION SWITCH (24dB)	26	24 AWG
AUDIO MONITOR INPUT LO	27	24 AWG SCREENED TWISTED PAIR 4
AUDIO MONITOR INPUT HI	28	24 AWG SCREENED TWISTED PAIR 4
AUDIO MONITOR No. 2 LO	29	24 AWG SCREENED TWISTED PAIR 2
PUSH-TO-TEST	30	24 AWG
ERASE SWITCH "C"	31	24 AWG
ERASE SWITCH "A"	32	24 AWG
LIGHTING 28V	33	24 AWG
RESERVED LIGHTING	34	24 AWG
LIGHTING COMMON	35	24 AWG
LIGHTING 5V	36	24 AWG
FDR INHIBIT B	37	24 AWG

Table 8 Cockpit Control Unit Type D51616-2XXX Connector Details for Dual MPFR Installation Support – Remote Mic

1.2.2 Installation

The installation details of the unit depend on unit configuration and are detailed in the INSTALLATION section on page 99.

1.2.3 Equipment Inputs

D.C. Power Input

The Preamplifier power supply is supplied by the MPFR and is +12VDC ±5% or +18VDC ±5% at a maximum current of 100mA. This includes the current for the FAIL indicator relays.

Warning Indicator Power Supply

The supply for the warning indicators is LIGHTING POWER and is nominally +28VDC or +5V. Maximum current at +28VDC is 250mA.

Control Inputs

(a)	6dB ATTENUATION:	Connect to ATTENUATION COMMON to attenuate microphone input signal by 6dB. May be used in addition to the 12dB and 24dB ATTENUATION control inputs to give attenuation of between 0dB and 42dB.
(b)	12dB ATTENUATION:	Connect to ATTENUATION COMMON to attenuate microphone input signal by 12dB. May be used in addition to the 6dB and 24dB ATTENUATION control inputs to give attenuation of between 0dB and 42dB.
(c)	24dB ATTENUATION:	Connect to ATTENUATION COMMON to attenuate microphone input signal by 24dB. May be used in addition to the 6dB and 12dB ATTENUATION control inputs to give attenuation of between 0dB and 42dB.
(d)	ATTENUATION COMMON:	See (a) to (c) above.
(e)	CVR FAULT:	High causes the 'CVR FAIL' indicator to be extinguished.
(f)	FDR FAULT:	High causes the 'FDR FAIL' indicator to be extinguished.

Signal Inputs

(a)	MIC 1 INPUT HI MIC 1 INPUT LO MIC 1 INPUT BIAS MIC 1 INPUT SHIELD	These inputs are either for connection to the integral microphone (part number option X1XX) or the main remote microphone (part number option X0XX). If a two-microphone installation is used then the signals from the two will be summed.
(b)	MIC 2 INPUT HI MIC 2 INPUT LO MIC 2 INPUT BIAS MIC 2 INPUT SHIELD	These inputs are for connecting an additional remote microphone. If a two-microphone installation is used then the signals from the two will be summed.
(c)	INTERNAL MIC HI INTERNAL MIC BIAS	Not used as the integral microphone (if fitted) is internally routed to MIC 1 connections.
(d)	AUDIO MONITOR HI AUDIO MONITOR LO	Summed audio input from CVR.
(e)	FDR INHIBIT B:	Normally connected to aircraft interlocks such that interlocks are open circuit when aircraft can move under its own power and ground when not capable of moving. If interlocks or function not implemented, leave open circuit.

1.2.4 Equipment Outputs

Control Outputs

(a)	PUSH-TO-TEST:	Normally open circuit but is connected to CHASSIS GROUND when TEST pushbutton is depressed.
(b)	ERASE SWITCH A:	Normally connected to CHASSIS GROUND but is connected to ERASE SWITCH C when ERASE pushbutton is depressed.
(c)	ERASE SWITCH C:	Normally open circuit but is connected to ERASE SWITCH A when ERASE pushbutton is depressed.

Signal Outputs

(a)	OUTPUT HI OUTPUT LO	Area Microphone Preamplifier output.
(b)	FDR INHIBIT A:	Normally connected to FDR Inhibit input of MPFR. If interlocks or function not implemented, leave open circuit.

1.3 SPECIFICATION

1.3.1 Functional Characteristics - Performance

Microphone (If fitted)

Frequency Response:	150Hz to 10kHz (10dB range) at Sound Pressure Levels (SPL) between 60dB to 94dB over 20 µPa.
Harmonic Distortion (over 150Hz to 8kHz):	Less than 5% for SPL up to 90dB over 20 µPa.

Harmonic Distortion (at 1kHz):	Less than 10% for SPL at 120dB over 20 µPa.
Polar Response:	**Type D51623-XXXX** Ratio of front to ±60 degrees response less than 6dB range. Ratio of front to rear response >10dB. **Type D51702-XX** Microphone is omnidirectional.

Microphone Preamplifier

Frequency Response:	150Hz to 10kHz (6dB range) Continuous decrease in output level outside this range.
Harmonic Distortion at Maximum Gain (over 150Hz to 8kHz):	Less than 5% for input level equivalent to SPL at 120dB over 20 µPa.
Signal to Noise:	At least 48dB for maximum input signal.
Output Level:	Adjustable between 0.25V RMS (-10dBm) and 1.4V RMS (+5dBm) for input level equivalent to 120dB SPL over 20 µPa. At input level equivalent to 70dB SPL over 20 µPa the output level is no more than 25dB below the output level stated above.

1.3.2 Physical and Other Characteristics

The Penny & Giles Aerospace Ltd. Control Units are identified by the convention shown in Figure 16.

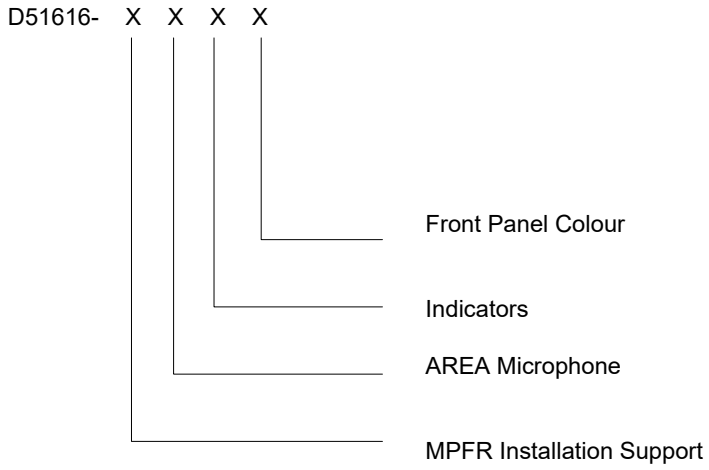

Figure 16 Cockpit Control Unit Part Number Options

MPFR Installation Support

Option 1: Single MPFR

Option 2: Dual MPFR installation

AREA Microphone

Option 0: External Cockpit Area Microphone

Option 1: Internal Cockpit Area Microphone

Front Panel Indicator Options

Various indicator options are available as follows:

Option 1: Yellow. Night Vision Goggle compatible to MIL-L-85762A.

Option 2: Yellow. Sunlight Readable to MIL-S-22885.

Front Panel Colour

If only three digits after D51616-, the front panel colour is in semi mat Black (FED-STAN-595A, Colour 37038).

Option 1: Medium Gunship Grey (FED-STD-595, Colour 36118).

Case Style

Panel Option: Slim

Microphone: External

FDR RCRD switch, TEST and ERASE Push-buttons and Headset Jack.

The CCU Type D51616-2XXX is provided with a toggle switch between the MPFRs.

Separate FDR FAIL, CVR FAIL indicators.

Panel dimensions: 28.2mm (H) x 145.8mm (W) x 63.0mm (D) (excluding connector)

Connector DCM37P or equivalent. (See Table 7 or Table 8 for Connector Details).

1.3.3 Environmental Characteristics

The CCU satisfies the requirements of RTCA DO-160D, with test categories as shown in Table 9.

Section	Requirement	Category
4	Temperature/Altitude	A2
5	Temperature Variation	C
6	Humidity	A
7	Operational Shock & Crash Safety	B
8	Vibration	U (zone 2, curves F & F1) S (zone 2, curves M & C)
9	Explosion proofness	X
10	Waterproofness	X
11	Fluids Susceptibility	X
12	Sand and Dust	X
13	Fungus Resistance	F

Section	Requirement	Category
14	Salt Spray	X
15	Magnetic Effect	A
16	Power Input	X(1)
17	Voltage Spike	X(1)
18	AF Conducted Susceptibility	X(1)
19	Induced Signal Susceptibility	Z (2)
20	RF Susceptibility	UUU(3)
21	Emission of RF Energy	M
22	Lightning Induced Transient Susceptibility	XXF1
23	Lightning Direct Effects	X
24	Icing	X
25	ESD	A

Table 9 : Cockpit Control Unit Environmental Test Levels

NOTES

1. **The CCU and CAM derive power from the MPFR and these tests are not applicable**

2. **The microphone pre-amplifier Signal to Noise ratio may be reduced to 35 dB under this test condition. The CAM induced signal level shall not exceed a level equivalent to an applied sound pressure level of 50 dB above 20μPa.**

3. **The microphone pre-amplifier Signal to Noise ratio may be reduced to 35 dB under this test condition. For the CAM, the test level for radiated susceptibility shall be 2V/m from 30 MHz to 1.215 GHz. For the CAM, the test level for conducted susceptibility shall be 3 mA (2V/m) from 500 kHz to 400 MHz, and from 500 kHz to 10 kHz shall fall at the rate of 6 dB per octave (20 dB per decade).**

2 STORAGE

The Cockpit Control Unit is delivered in a standard Penny & Giles trade container, unless otherwise negotiated with the Customer, and should remain in this container until required for use. With the units packaged as received, the storage life will be unlimited over the temperature range of -25°C to +40°C with a relative humidity not exceeding 75%. The packaging should be retained for future use.

3 UNPACKING

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE CONTROL UNIT TYPE D51616-XXXX TO ENSURE THAT THE UNIT NOT SUFFER UNDUE SHOCK

The Cockpit Control Unit is packed in a Penny & Giles standard trade container, unless otherwise negotiated with the Customer. The unit should not be removed from the packaging until required for use. When unpacking the unit, care should be taken to ensure that it does not undergo undue shock. The packaging should be retained for future use.

4 INSTALLATION

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE CONTROL UNIT TYPE D51616-XXXX TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

The installation of the Control Unit depends on case configuration, identified within Figure 17 and Figure 18, as detailed in Table 7 and Table 8.

4.1 WIRING

The recommended minimum wiring sizes are shown in **Table 7** for CCU Type D51616-1XXX and **Table 8** for CCU Type D51616-2XXX. These sizes are applicable for runs of up to 100 metres. For variants with an Internal Preamplifier and remote Cockpit Area Microphone, the electromagnetic environment will set the limit on cable length to the microphone.

Typical installation wiring diagrams for generic, single and dual MPFR and CCU installations are shown in Figure 6, Figure 7 and Figure 8.

4.2 SIGNAL LEVELS – Attenuation Links

NOTE: When setting the Attenuation Links for the Cockpit Area Microphone Preamplifier, it must be remembered that signal levels encountered in flight will be higher than those encountered on the ground and the attenuation therefore set accordingly. Confirmation of optimum attenuation level should be established by subjective evaluation of recordings made during flight. Keep the attenuation links as short as possible

Attenuation Links

Use the Wiring diagrams Figure 6, Figure 7 & Figure 8 located on Pages 51, 53 & 55 (depending on CCU type installed) and the "Control Inputs" information given in paragraphs (a) to (d) located on Page 91 of this manual in conjunction with the Note above to set the attenuation links in order to achieve the best performance for the Audio output to be recorded.

4.3 POWER SUPPLY

The Cockpit Control Unit is designed to be powered from the CVR Recorder derived Pre Amp supply. This supply is nominally +12VDC ±5% or +18VDC ±5% with maximum current of 100mA.

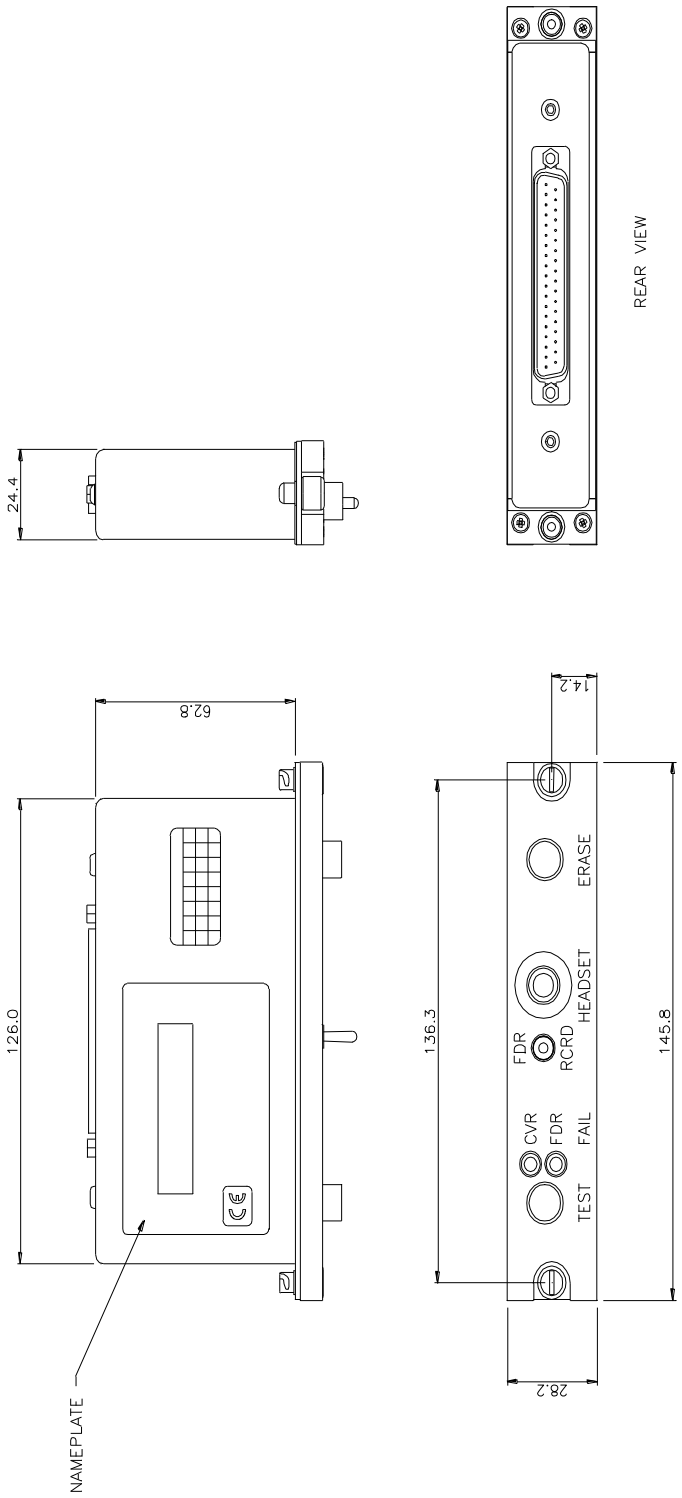

Figure 17 Cockpit Control Unit with Single MPFR Support

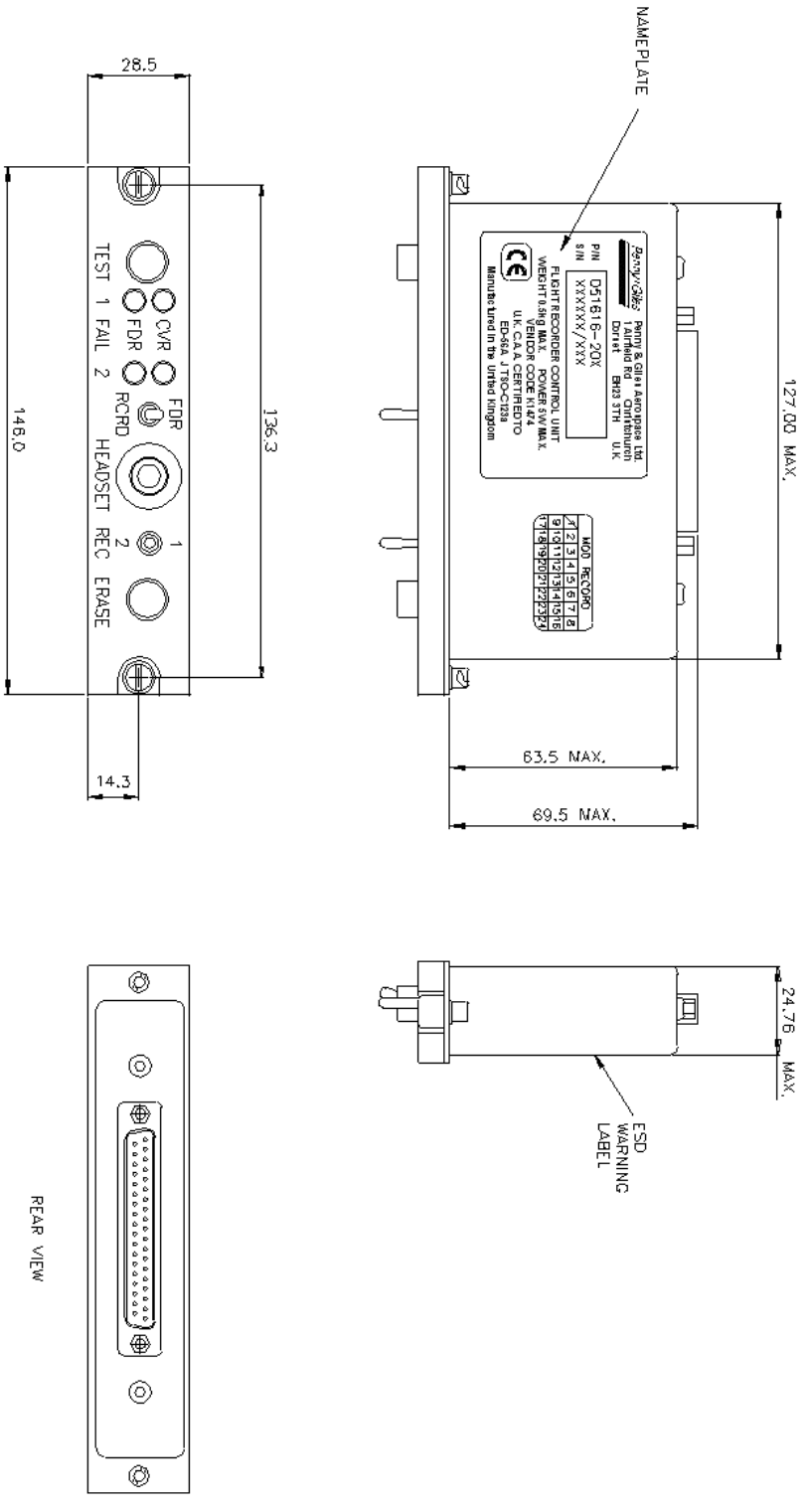

Figure 18 Cockpit Control Unit with Dual MPFR support

5 MAINTENANCE

The concept of on-condition maintenance applies to the Cockpit Control Unit.

6 REPAIR

The Cockpit Control Unit may be repaired at third line.

7 FAULT FINDING

If facilities are available to carry out the procedures detailed in the Penny & Giles Aerospace Ltd. Component Maintenance Manual 31-34-22, then repairs may be carried out to the Cockpit Control Unit. If the necessary facilities are not available then the unit must be returned to Penny and Giles Aerospace Ltd.

NOTE:

It is advisable that headphones are not plugged into the Control Unit jack socket during the application of power or at system reset as this may cause the CVR POST to fail.

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Part 3: - Cockpit Area Microphone

1 DESCRIPTION, OPERATION AND SPECIFICATION

1.1 DESCRIPTION

The Remote Microphone Type D51623-XXXX or Type D51702-XX provides the conversion between sound pressure waves and analogue voltage signals. The active element of the microphone is housed in anti-vibration rubber which itself is housed in a two part epoxy body. Two bushes are provided on the bottom surface to aid mounting.

1.2 OPERATION

The Remote Microphone may be mounted in a suitable location in the cockpit as the main audio source.

1.3 SPECIFICATION

1.3.1 Functional Characteristics - Performance

Frequency Response:	150Hz to 10kHz (10dB range) at SPL between 60dB and 94dB over 20 µPa.
Harmonic Distortion (over 150Hz to 8kHz):	Less than 5% for SPL up to 90dB over 20 µPa.

Harmonic Distortion (at 1kHz):	Less than 10% for SPL at 120dB over 20 µPa.

1.3.2 Physical and Other Characteristics

The Penny & Giles Aerospace Ltd. Area Microphones are identified by the convention shown in Figure 22 or Figure 23:

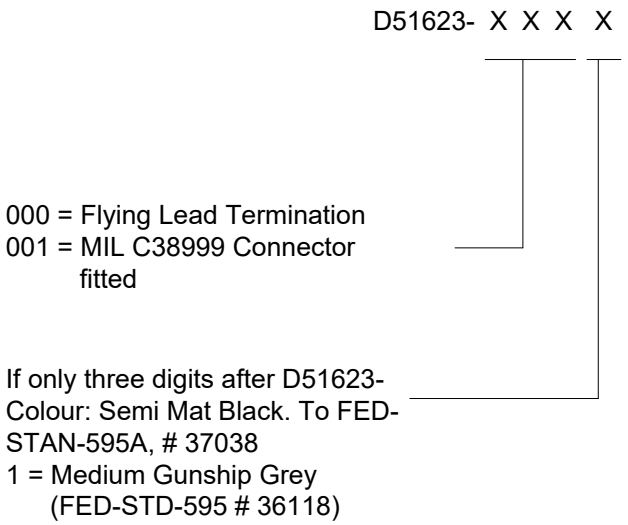

Figure 19 CAM Type D51623 Part Number Options

Figure 20 CAM Type D51702 Part Number Options

1.3.3 Environmental Characteristics

The CAM satisfies the requirements of RTCA DO-160D, with test categories as shown in Table 10.

SECTION	REQUIREMENT	Category
4	Temperature/Altitude	A2
5	Temperature Variation	C
6	Humidity	A
7	Operational Shock & Crash Safety	B
8	Vibration	U (zone 2, curves F & F1) S (zone 2, curves M & C)
9	Explosion proofness	X
10	Waterproofness	X
11	Fluids Susceptibility	X
12	Sand and Dust	X
13	Fungus Resistance	F
14	Salt Spray	X
15	Magnetic Effect	A
16	Power Input	X(1)
17	Voltage Spike	X(1)
18	AF Conducted Susceptibility	X(1)
19	Induced Signal Susceptibility	Z (2)
20	RF Susceptibility	UUU(3)
21	Emission of RF Energy	M
22	Lightning Induced Transient Susceptibility	XXF1
23	Lightning Direct Effects	X
24	Icing	X
25	ESD	A

Table 10 : Cockpit Area Microphone D51623-XXXX Environmental Test Levels

CAM type D51702-XX satisfies the requirements of RTCA DO 160G, with test categories as shown in Table 11.

SECTION	REQUIREMENT	Category
4	Temperature/Altitude	A2, B2
5	Temperature Variation	C, B
6	Humidity	A, B
7	Operational Shock & Crash Safety	E, B
8	Vibration	U (zone 2, curves F & F1) S (curves B & M)
9	Explosion proofness	X
10	Waterproofness	X
11	Fluids Susceptibility	X
12	Sand and Dust	X
13	Fungus Resistance	F
14	Salt Spray	X
15	Magnetic Effect	Z
16	Power Input	X
17	Voltage Spike	X
18	AF Conducted Susceptibility	X
19	Induced Signal Susceptibility	ZC(X)
20	RF Susceptibility	SS, RR
21	Emission of RF Energy	M
22	Lightning Induced Transient Susceptibility	XXJ3L3
23	Lightning Direct Effects	XXXX
24	Icing	X
25	ESD	A
26	Fire and flammability	C

Table 11 : Cockpit Area Microphone D51702-XX Environmental Test Levels

NOTES

1. The CCU and CAM derive power from the MPFR and these tests are not applicable

2. **The microphone pre-amplifier Signal to Noise ratio may be reduced to 35 dB under this test condition. The CAM induced signal level shall not exceed a level equivalent to an applied sound pressure level of 50 dB above 20μPa.**

3. **The microphone pre-amplifier Signal to Noise ratio may be reduced to 35 dB under this test condition. For the CAM, the test level for radiated susceptibility shall be 2V/m from 30 MHz to 1.215 GHz. For the CAM, the test level for conducted susceptibility shall be 3 mA (2V/m) from 500 kHz to 400 MHz, and from 500 kHz to 10 kHz shall fall at the rate of 6 dB per octave (20 dB per decade).**

1.4 COMPATIBILITY/INTERFACES

The Remote Microphone functions in accordance with the performance specification of ED-56A, Amendment 1. See ARINC 757 Appendices 1 & 2 for guidance on microphone location. Further guidance on wiring can be found in ARINC 757 Attachments 3 and 10.

See Figure 21 and Figure 22 for Installation Drawing and connection details. Pin allocation and cable requirements are shown in Table 12 and Table 13.

Wire	Signal	Cable Requirements
White	Bias	22 AWG Screened Twisted Pair (captive with microphone)
Black	Signal Out Hi	
Green/Shield	Signal Out Lo	

Table 12 : Type D51623 Microphone Cable Details

Wire	Connector D38999/26MA98SN	Connector 8STA6-0235PN	Signal	Cable Requirements
White	PIN A	PIN 1	Bias	22 AWG Screened Twisted Pair (captive with microphone)
Black	PIN B	PIN 2	Audio Hi	
Inner Screen	PIN C	PIN 3	Audio Lo	
Outer Screen	CONNECTOR SHELL	CONNECTOR SHELL	Shield	

Table 13 : Type D51702 Microphone Cable Details

2 INSTALLATION

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE AREA MICROPHONE TYPE D51623-XXXX or Type D51702-XX TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

The installation details for the Remote Microphone are detailed in Installation Drawing Figure 21 and Figure 22.

Outline dimensions and fixing centres for the Remote Microphone are shown in ARINC 757, Attachment 18.

2.1 WIRING

The recommended minimum wiring sizes are shown in Table 12 and Table 13 for the remote Area Microphone. The electromagnetic environment will set the limit on cable length to the microphone. The microphone is supplied with 300mm of cable as standard.

The Area Microphone Record Level (attenuation) setting links are to be as short as possible.

Typical installation wiring diagrams for generic, single and dual MPFR, CCU and CAM installations are shown in Figure 6, Figure 7 and Figure 8.

2.2 CAM LOCATION

Figure 26 and Figure 27 show the preferred locations and spacing for the Cockpit Area Microphone (CAM).

Carry out an earth bonding test to establish that the bonding is within the defined limits (2.5 mΩ).

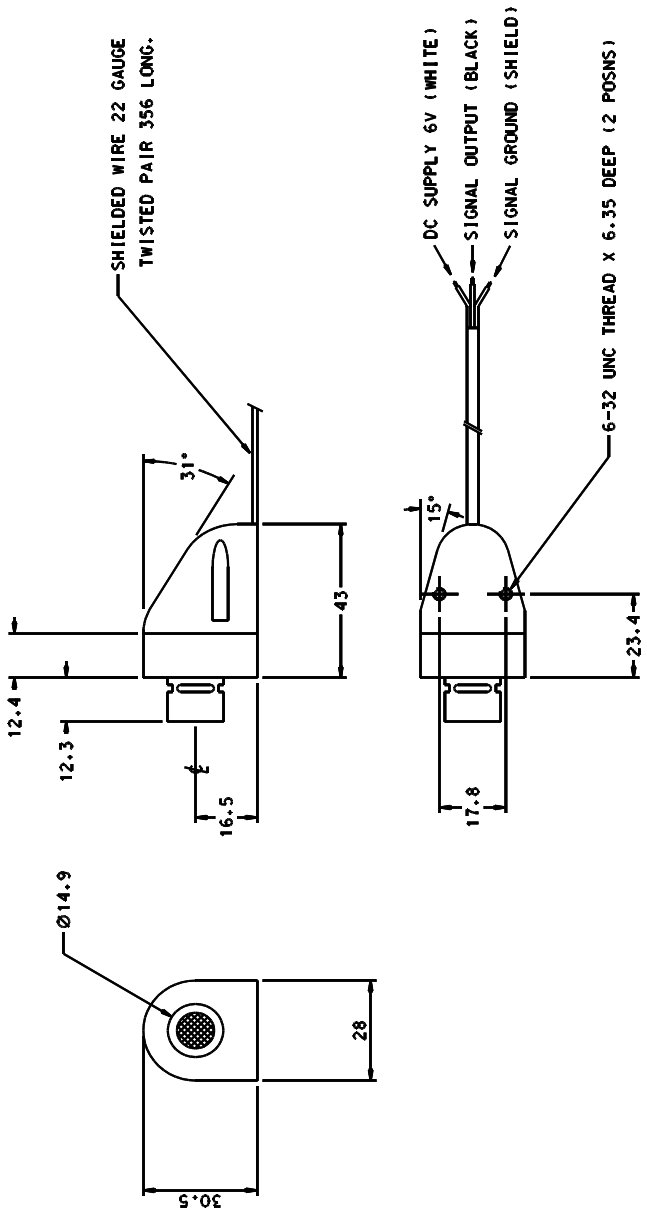

Figure 21 Installation Drawing For D51623 Remote Microphone

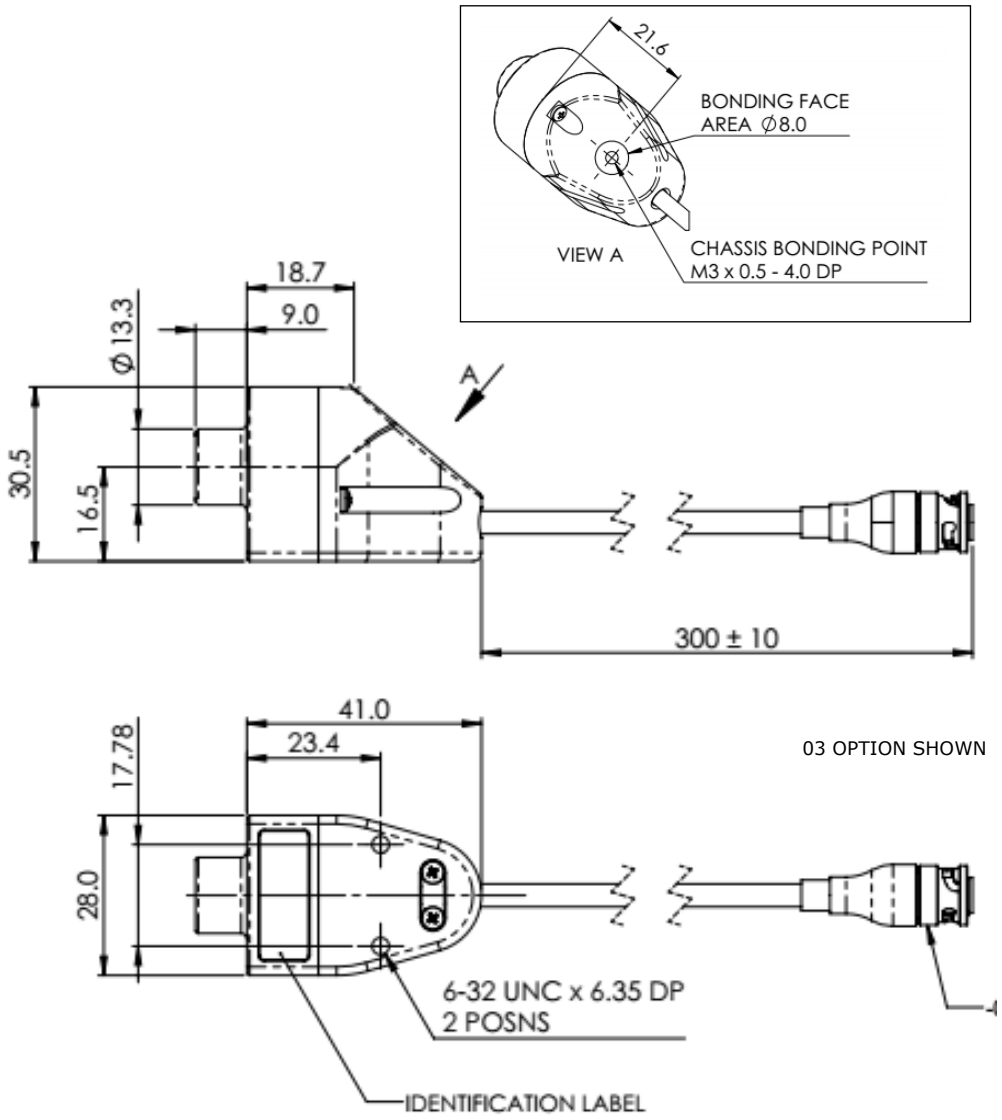

Figure 22 Installation Drawing For D51702-XX Remote Microphone

BONDING (Recommended)

Fit the earth bonding lead to the CAM housing bonding pad, see Figure 25 for details (screw not supplied).

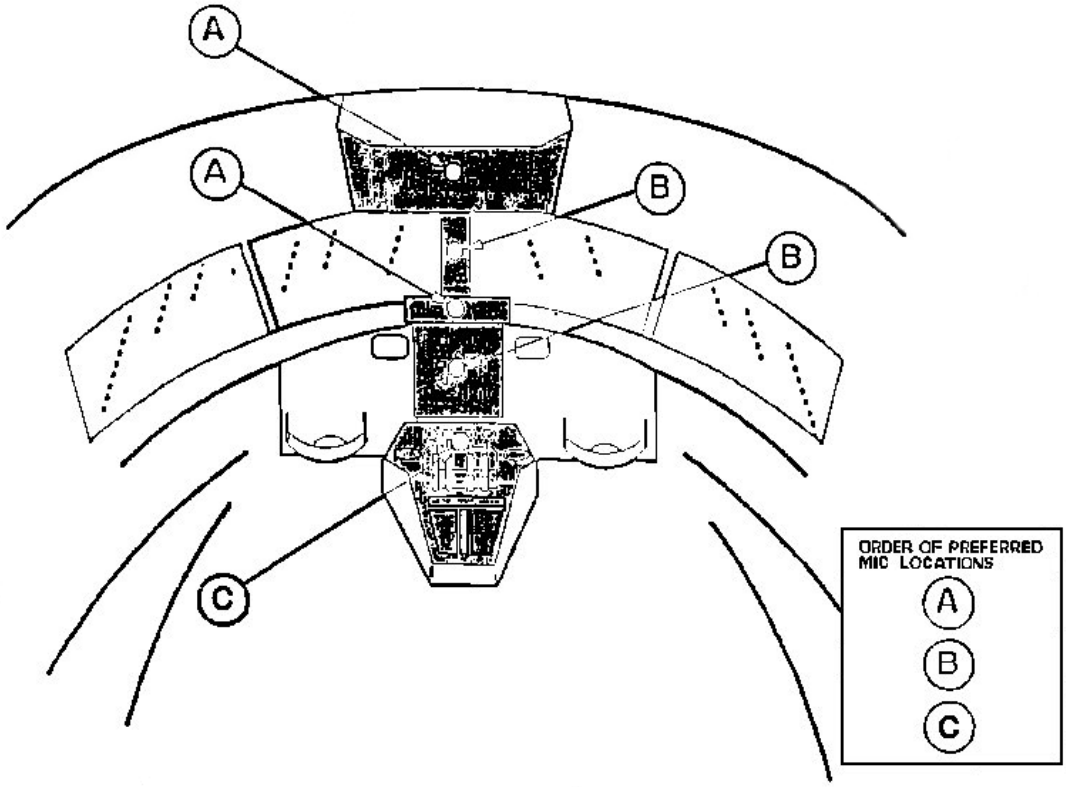

Figure 23 Preferred Locations for CAM

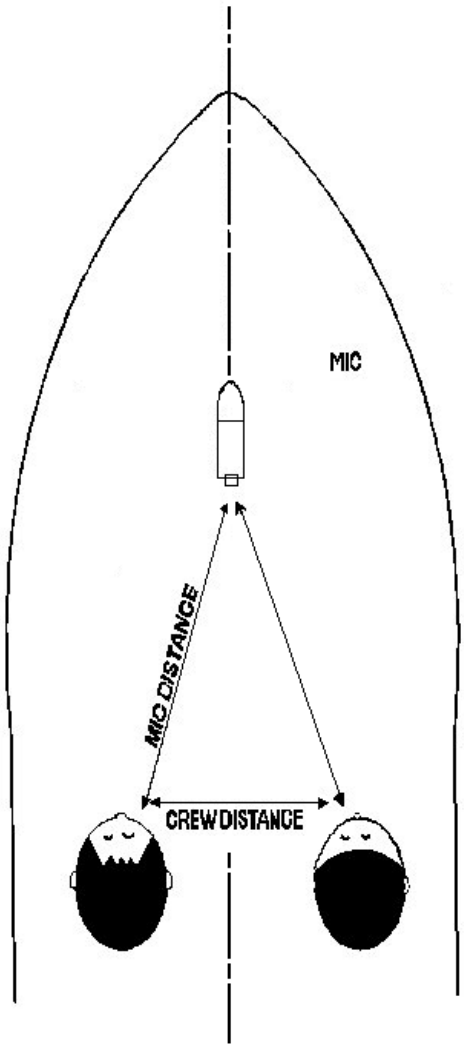

Figure 24 Microphone Spacing

3 Testing

1 GENERAL

The Multi-Purpose Flight Data Recording system (MPFR) has a built in test capability that detects faults, where possible, within the system via a discrete output.

1.1 Equipment Required

Table 1 – Equipment Required

Item	Equipment
1	Fully Functioning Headset with standard jack socket

Table 2 – Referenced Documentation

Item	Description
1	Aircraft AMM
2	Aircraft WDM

2. AUDIO TEST PROCEDURE

1. Apply power to the system in accordance with the instructions given in the aircraft AMM (Ref: Table 2, Item 1).

2. On the Cockpit Control Unit (CCU), insert the functioning headset jack into the 'HEADSET' socket.

3. Place headset firmly over both ears.

4. Tap the microphone and confirm audio is heard in the headset, if the required audio response is not heard, repeat this step.

5. If the required audio response is still not heard, the non-functioning Cockpit Area Microphone should be replaced.

Note: It the Aircraft is fitted with a Recorder Independent power Supply (RIPS), in the event of an aircraft power loss. Do not attempt to remove an MPFR component if the aircraft has had power applied within the previous 10 minutes.

6. After completion of the above tests, remove the power to the Aircraft system.

7. Remove Headset jack from the CCU socket.

3. REQUIREMENTS AFTER JOB COMPLETION

3.1 Required Actions

1. Remove all tools, materials and equipment from the work area.

2. Make sure that the work area is clean.

3. Complete all documentation related to this procedure.

4 STORAGE

The Area Microphone is delivered in a standard Penny & Giles Aerospace Ltd trade container, unless otherwise negotiated with the Customer, and should remain in this container until required for use. With the units packaged as received, the storage life will be unlimited over the temperature range of -25°C to +40°C with a relative humidity not exceeding 75%. The packaging should be retained for future use.

5 UNPACKING

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE AREA MICROPHONE TYPE D51623-XXXX TO ENSURE THAT THE UNIT NOT SUFFER UNDUE SHOCK

The Area Microphone is packed in a Penny & Giles standard trade container, unless otherwise negotiated with the Customer. The unit should not be removed from the packaging until required for use. When unpacking the unit, care should be taken to ensure that it does not undergo undue shock. The packaging should be retained for future use.

6 MAINTENANCE

The concept of on-condition maintenance applies to the Area Microphone.

7 REPAIR

The Area Microphone is not repairable.

APPENDIX

1 ABBREVIATIONS

A	Amperes
AAM	Aircraft Maintenance Manual
AC	Alternating Current
AF	Audio Frequency
ARINC	Air Radio INCorporated
ATA	Air Transport Association of America
ATR	Air Transport Racking
BIT	Built In Test
BS	British Standards
CAA	Civil Aviation Authority
CAM	Cockpit Area Microphone
CMM	Component Maintenance Manual
CSMM	Crash Survivable Memory Module
CVR	Cockpit Voice Recorder
dB	Decibel
DC	Direct Current
DEF STAN	Defence Standard
DDP	Declaration of Design and Performance

DSP	Digital Signal Processor
Dukane	Dukane Corporation St. Charles Illinois 60174, USA
ED	EUROCAE Document
ESD	Electrostatic Sensitive Device
EUROCAE	European Organisation for Civil Aviation Electronics
FAA	Federal Aviation Agency
FDAU	Flight Data Acquisition Unit
FDR	Flight Data Recorder
GMT	Greenwich Mean Time
GND	Ground
GRE	Ground Replay Equipment
Hz	Hertz
in	inches
in/s	inches per second
IP	Internet Protocol
ISO	International Standards Organisation
JAA	Joint Aviation Authority
JAR	Joint Aviation Requirements
k	kilo
kN	kiloNewton
Max	Maximum
Min	Minimum
MKS	Metre-kilogram-second
M	Mega

m	milli
mm	millimetres
MPFR	Multi Purpose Flight Recorder
MTBF	Mean Time Between Failures
MTBO	Mean Time Between Overhauls
MTI	Manufacturers Test Interface
mtr	metre
n	nano
NC	Not Connected
OC	On Condition
P&G	Penny and Giles
Pa	Pascal
PCB	Printed Circuit Board
PEC	Panel Electronic Circuit
PRE	Portable Replay Equipment
PSU	Power Supply Unit
RAM	Random Access Memory
RF	Radio Frequency
RFI	Radio Frequency Interference
RMS	Root Mean Square
ROM	Read Only Memory
RTCA	Radio Technical Commission for Aeronautics
s	Second
SINAD	Signal to Noise and Distortion Ratio
SK	Socket

SPL	Sound Pressure Level
TBA	To Be Allocated
THD	Total Harmonic Distortion
TSO	Technical Standing Order
ULB	Underwater Locator Beacon
V	Volts
W	Watts
wps	Words per Second

2 SYMBOLS

o	Degree(s) Temperature
µ	micro
±	Plus or minus
<	Less than
≤	Equal to or less than
>	Greater than
≥	Equal to or greater than

Penny & Giles Aerospace Ltd.

15 Enterprise Way, Aviation Park West, Bournemouth International Airport, Dorset BH23 6HH
United Kingdom

Telephone (01202) 034000