Dual Input Data Acquisition Flight Recorder

Type D51615-203-XXX and Type D51615-203-XXX-090

with

Cockpit Control Unit Type D51616-XXXX

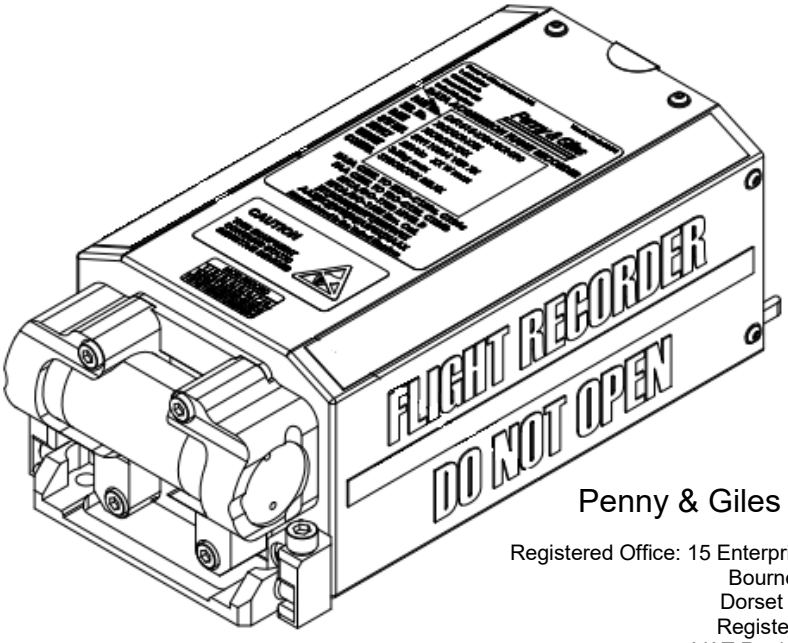
and

Cockpit Area Microphone Type D51623-XXXX or Type D51702-XX

Installation and Operating Manual

PIM454-I

Revision 17, February 2026



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This manual is provided for information and guidance only. It does not supersede the Aircraft Maintenance Manual (AMM), which remains the prime reference source for any work to be done on aircraft systems.

The operating procedures given in this manual have been written on the assumption that personnel performing the procedures have received training of a standard adequate to enable them to do so, and are qualified in the appropriate operating techniques. Such personnel are deemed also to be competent to act at all times with due regard to the safety of themselves and of the equipment.

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AMENDMENT RECORD

Document Revision No.	*Document Change No.*	*Amendment Date*	*Amendment*
0	DS935	Jun 2012	Initial Issue
1	DS0975	Mar 2013	Note added to Table 4
2	DS0990	Sep 2013	Clarify the version of PGS required (Version or Analysis) in para 6.6.1
3	DS1008	Dec 2013	Change P/N of Crash Box Assembly in the IPL from SA110713 to SA112100
4	DS1079	Jun 2015	Addition of raw .fdr data file conversion process for PGS Vision & Analysis release 5.2.0 or later. Document layout & Company Logo amended.
5	DS1110	April 2016	Addition of 90-Day ULB beacon battery (kit)
6	DS1119	Aug 2016	Clarification of D51615-203-XXX-090 Iss 1 Part Number
7	DS1126	Oct 2016	Figures 4 & 5 changed to reflect DIDAFR configuration
8	DS1134	Aug 2017	Introduction of Cockpit Area Microphone D51702-XX
9	DS1175	Apr 2018	Clarification of Mic. Polar Response & Area Mic. Testing.
10	DS1188	June 2018	Clarification of Periodic Maintenance periods
11	DS1217	Nov 2018	Table 7 updated to detail Type F battery details
12	DS1273	Sep 2019	CCU Installation procedure clarified
13	DS1287	Nov 2019	Note added to document to remind users to use the current version of this manual
14	DS1397	Dec 2020	IPC removed from PIM. Document format changed and re-issued.

Document Revision No.	*Document Change No.*	*Amendment Date*	*Amendment*
15	DS1409	Jan 2021	Installation, Cleaning & Testing of Type DK290-11 ULB details added. Document re-issued in current format/layout. 72 month inspection section revised to include latest information. CVR & FDR Download / Replay sections completely revised. Several figures / diagrams replaced to improve clarity.
16	DS1439	Nov 2021	Export Classification Matrix updated and EAR control statement added
17	DS1547	Feb 2026	72 month inspection section revised to include latest information

INSTALLATION AND OPERATING MANUAL

DUAL INPUT DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX AND TYPE D51615-203-XXX-090

Document Revision No.	*Document Change No.*	*Amendment Date*	*Amendment*

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FIGURES

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PREFACE

About this manual

This Installation and Operating Manual, PIM454-I, relates to Dual Input Data Acquisition Flight Recorder (DIDAFR) Part Numbers D51615-203-XXX and D51615-203-XXX-090, Cockpit Control Unit Type D51616-XXXX and Cockpit Area Microphone Type D51623-XXX or Type D51702-XX.

Who should read this manual?

Installers, operators and maintenance personnel of DIDAFR equipment should read this manual.

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

Please contact Penny & Giles Aerospace Technical Services if any difficulty is experienced in using this manual, or in following any of the instructions defined herein (see page 18 for contact information).

How to use this manual

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

Conventions used in this manual:

Convention	*Usage*
Arial Bold	Headings
Arial	Normal Text
Arial Italic	Cross-references to Figures, Tables and Appendices.
Verdana Bold	Strings you should type, field names you should type into and dialog buttons you should click on. Example: Enter **Filename** in the **Save As** field. Click **OK**

Mouse operations used in this manual are defined below:

Operation	*Description*
Click	Click the left mouse button
Double-click	Click the left mouse button twice in quick succession
Right-click	Click the right mouse button
Drag	Click and hold down the left mouse button whilst moving the mouse

Curtiss-Wright (P&G) Website

The Curtiss-Wright website at www.curtisswrightds.com contains information relating to the company product range, services and contact information.

INTRODUCTION

NOTE:

Before installing, operating or performing any of the required maintenance tasks using this equipment, please ensure that you are using the latest (current) version of this manual. Check the revision status of the manual by accessing the following link:

https://www.curtisswrightds.com/support/technical/christchurch.html

You will be able to view the Technical Publications Registers and, if necessary, request a copy of the current revision.

This document fulfils the requirement called for in the introduction to ATA iSpec. 2200, by providing a description of the Penny & Giles Aerospace Ltd, Dual Input Data Acquisition Flight Recorder (DIDAFR) Type D51615-203-XXX or Type D51615-203-XXX-090 in Part 1, Cockpit Control Unit (CCU) Type D51616-XXXX in Part 2 and Cockpit Area Microphone Type D51623-XXXX or Type D51702-XX in Part 3. This document includes the installation and operating procedures required supporting the unit and associated equipment in service.

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

The DIDAFR is configurable to support different user applications through a configuration table upload. Different customer configurations are identified by dash number suffix from the main D51615-203 Part number. Each variant fulfils the requirements of the minimum CVR/FDR as identified by EUROCAE document ED112.

The DIDAFR is designed to operate without a Flight Data Acquisition Unit (FDAU). Instead, it acquires data through integral acquisition circuitry and dedicated aircraft bus interfaces. For aircraft in situ retrieval, suitable Portable Replay Equipment (PRE) is required.

With the limitations set out in DDP 3064, the DIDAFR Type D51615-203-XXX meets the requirements of European Organization for Civil Aviation Electronics (EUROCAE) specification ED-112 for Flight Data Recorder and Cockpit Voice Recorder, European Aviation Safety Agency (EASA) and Federal Aviation Administration (FAA) specifications ETSO-C123b/TSO-C123b and ETSO-C124b/TSO-C124b.

With the limitations set out in DDP 3077, DIDAFR Type D51615-203-XXX-090 meets the requirements of EUROCAE specification ED-112 Flight Data Recorder and Cockpit Voice Recorder, EASA Specifications ETSO-C123b and ETSO-C124b.

The Cockpit Control Unit Type D51616-XXXX may be used in conjunction with each variant of the Penny & Giles Aerospace Ltd Data Acquisition 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 document, please contact the following for assistance:

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The abbreviations used throughout this document are defined in *Table 1*.

Table 1 Abbreviations and Definitions of Terms and Symbols

Abbreviation	*Definition*
AMM	Aircraft Maintenance Manual
A / Amps	Amperes
AC	Alternating Current
AF	Audio Frequency
ARINC	Air Radio, Incorporated
ATA	Air Transport of America
BIT	Built-In Test
BITE	Built-In Test Equipment
BS	British Standards
CAA	Civil Aviation Authority
CAM	Cockpit Area Microphone
CCS	Customer Configuration Specification
CCU	Cockpit Control Unit
CFE	Customer Furnished Equipment
CMM	Component Maintenance Manual
CSMM	Crash Survivable Memory Module
CVR	Cockpit Voice Recorder
DIDAFR	Dual Input Data Acquisition Flight Recorder
dB	Decibel
DC	Direct Current

Abbreviation	*Definition*
DEF STAN	Defence Standard
EASA	European Union Aviation Safety Agency
ED	EUROCAE Document
EMC	Electro Magnetic Compatibility
ESD	Electro-Static Discharge
EEPROM	Electrically Erasable / Programmable Read Only Memory
EPROM	Erasable / Programmable Read Only Memory
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
IPC	Illustrated Parts Catalogue
ISO	International Standards Organisation
JAA	Joint Aviation Authority
JAR	Joint Aviation Requirements
k	kilo

Abbreviation	*Definition*
kHz	Kilo Hertz
kN	Kilo Newton
M / mtr	Metre
m	milli
Max	Maximum
Mic	Microphone
Min	Minimum
MIL	Military Standard
MKS	Metre-kilogram-second
mm	Millimetres
ms	Milliseconds
MTBF	Mean Time Between Failures
MTBO	Mean Time Between Overhauls
N/A	Not Applicable
N/C	Not Connected
Nm	Newton Metres
NOVRAM	Non-Volatile Random Access Memory
OC	On Condition
P&G	Penny & Giles
PC	Personal Computer
PCB	Printed Circuit Board
PEC	Printed Electronic Circuit
PRE	Portable Replay Equipment

Abbreviation	*Definition*
PSU	Power Supply Unit
PTT	Push To Test
RAM	Random Access Memory
RIPS	Recorder Independent Power Supply
RMS	Root Mean Square
ROM	Read Only Memory
RTCA	Radio Technical Commission for Aeronautics
Rx	Receive (signal)
s	Second
SINAD	Signal to Noise and Distortion Ratio
SK	Socket
TBA	To Be Allocated
TCP	Transmission Control Protocol
THD	Total Harmonic Distortion
TSO	Technical Standard Order
Tx	Transmit (signal)
ULB	Underwater Locator Beacon
UTC	Universal Time Code
V	Volts
VDC	Volts Direct Current
V_{pk-pk}	Volts Peak to Peak
WDM	Wiring Diagram Manual
WPS	Words Per Second

Table 2 Definitions of Symbols

Symbol	*Definition*
º	Degree(s)
±	Plus or Minus
<	Less than
≤	Less than or equal to
>	Greater than
≥	Greater than or equal to
“	Inches
Ω	Ohms

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PART 1: DATA ACQUISITION FLIGHT RECORDER

1 DESCRIPTION, OPERATION AND SPECIFICATION

1.1 DESCRIPTION

1.1.1 GENERAL

The DIDAFR Type D51615-203-XXX or Type D51615-203-XXX-090, is a crash protected airborne recorder that is installed to meet customer requirements. The DIDAFR meets or exceeds the requirements of EUROCAE ED112, and satisfies the United Kingdom Civil Aviation Authority (CAA) specifications 10, 10A, 11 and 18. The requirements of FAA TSO-C123b and TSO-C124b are satisfied where regulations allow the fitting of a combined voice and data recorder.

The equipment is compatible with interface requirements of ARINC 757 Supplement 2 for CVR functions. FDR data acquisition is supported via three high or low speed ARINC 429 interfaces, 4 analogue inputs, 6 discrete inputs, a single rotor tachometer input and an accelerometer input. DIDAFR Type D51615-203-XXX is illustrated in *Figure 1*. DIDAFR Type D51615-203-XXX-090 is illustrated in *Figure 2*.

The DIDAFR is mounted direct to the airframe. Anti-vibration mounting is not required.

The DIDAFR 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.

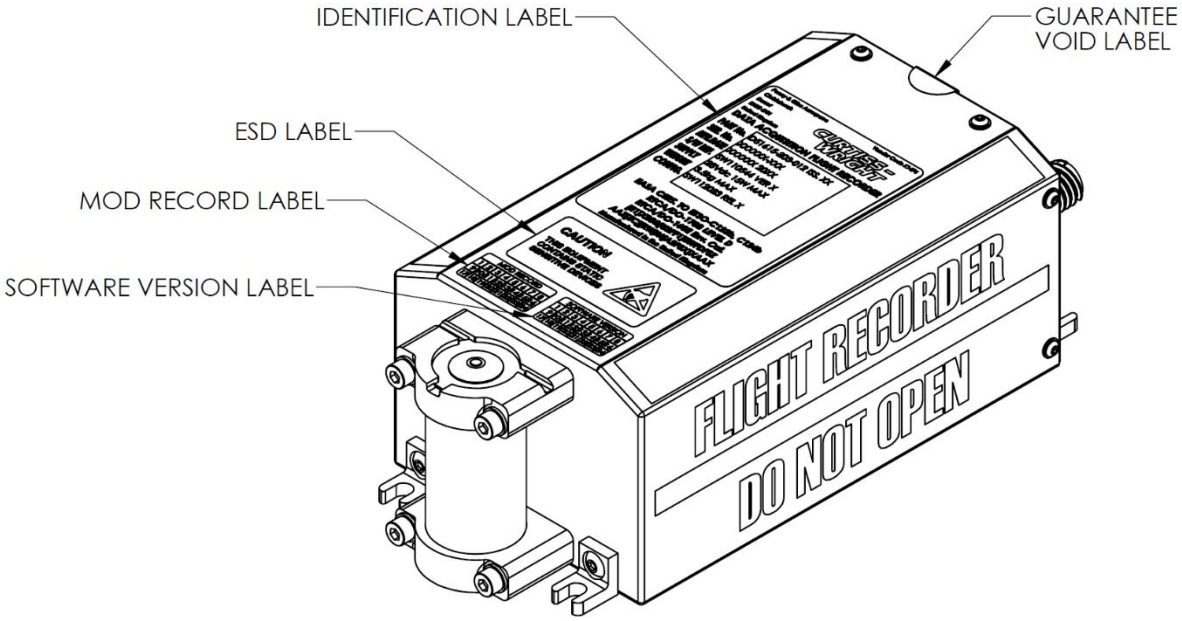

Figure 1 DIDAFR Type D51615-203-XXX

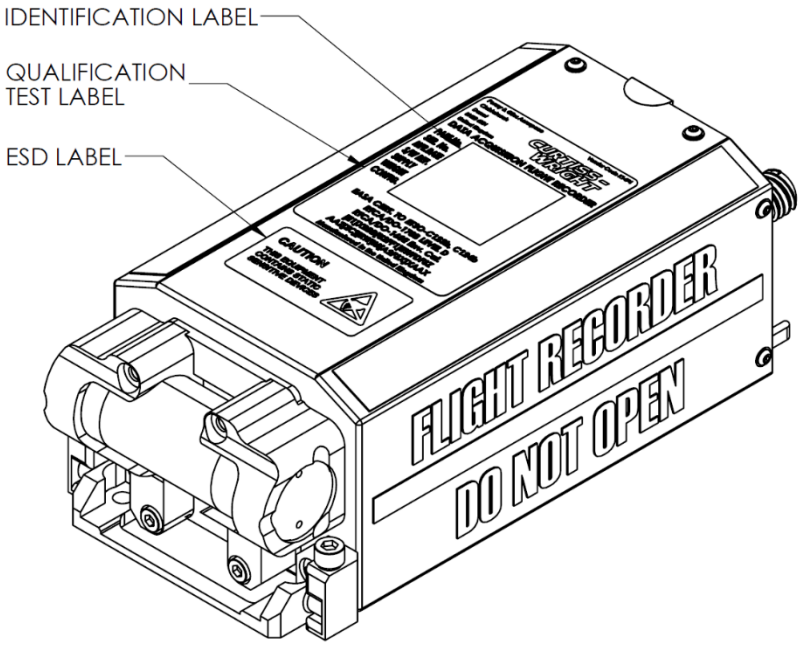

Figure 2 DIDAFR Type D51615-203-XXX-090

The DIDAFR is capable of downloading stored flight data, audio, rotor speed and configuration data digitally at high speed across the 10Base-T/100Base-Tx Fast Ethernet Ground Support Interface (GSI).

The main power supply to the DIDAFR is +28VDC with aircraft electrical power characteristics of RTCA DO-160E, Section 16, Category A.

Additionally, the DIDAFR may be used with a Recorder Independent Power Supply (RIPS), which is a separate Line Replacements Unit (LRU). Refer to Part 4 of this document for additional information on the RIPS. The RIPS provides 10 minutes ±1 minute of electrical back-up power to operate both the Combined Cockpit Voice and Flight Data Recorder (CVR/FDR) and the Cockpit Area Microphone (CAM). The CVR/FDR and the CAM are switched automatically to the RIPS in the event that all other power to CVR is interrupted.

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 DIDAFR is painted International Orange with high visibility white strips as an aid to its location.

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

The DIDAFR Type D51615-203-XXX or Type D51615-203-XXX-090 satisfies the minimum operating requirements for a Cockpit Voice Recorder and Flight Data Recorder as defined by ED112 and ARINC 757 Supplement 2.

1.1.2 EQUIPMENT PART NUMBERING

The Penny & Giles Aerospace Ltd DIDAFR is identified by the convention shown in *Figure 3*.

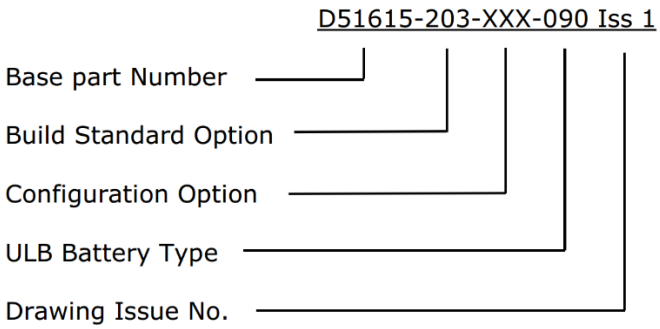

Figure 3 DIDAFR Type D51615-203-XXX-090 Iss 1 Part Numbering Convention

1.1.2.1 CONFIGURATION OPTIONS

OPTION XXX: Refer to the Customer Configuration Specification (CCS) for details relating to the recorder configuration.

1.1.2.2 BEACON BATTERY OPTIONS

OPTION 090: D51615-203 fitted with a 90-Day ULB.

1.1.3 MECHANICAL DESCRIPTION

The DIDAFR 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 DIDAFR 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. For those DIDAFR fitted with a 30-Day ULB all mounting feet are slotted to accept a 6.35mm (¼ inch) bolt for fixing the DIDAFR to the airframe.

DIDAFR units fitted with the 90-Day ULB have the rear mounting feet detailed as above but the two front mounting feet are as shown in *Figure 11*.

1.1.4 ELECRICAL DESCRIPTION

1.1.4.1 MAIN POWER SUPPLY

The main power supply to the DIDAFR is +28VDC with aircraft electrical power characteristics of RTCA DO-160E Section 16, Category A.

1.1.4.2 SYSTEM BLOCK DIAGRAM

Figure 4 shows the system block diagram of how the power is distributed for the system.

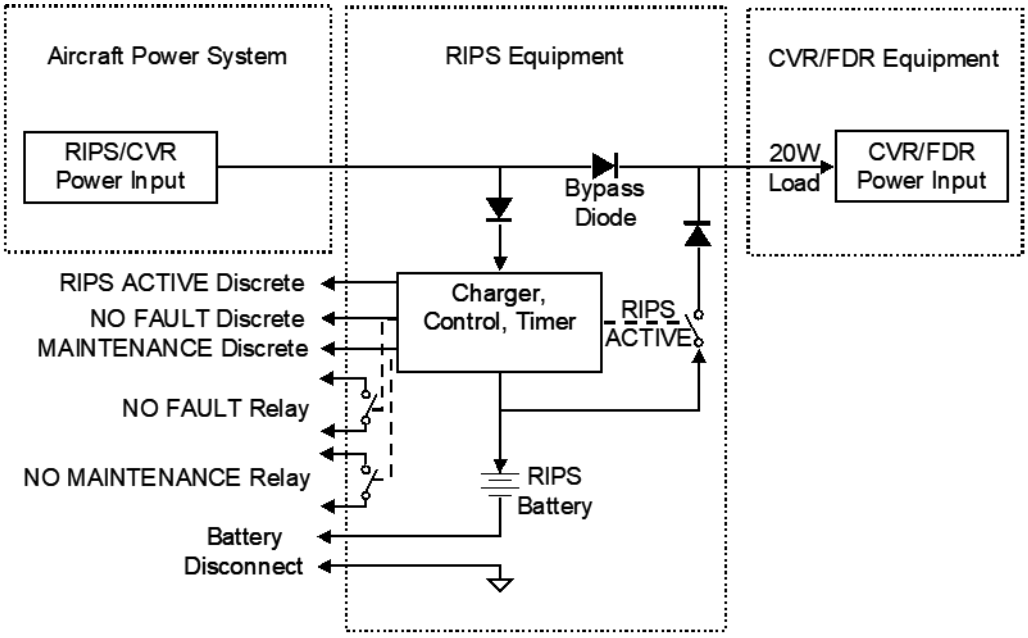

Figure 4 DIDAFR System Block Diagram

1.1.5 INTERFACE DESCRIPTION

1.1.5.1 GENERAL

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

The DIDAFR 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 5*, and *Figure 6*).

The primary 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 4*.

The connector provides Lightning Transient Protection and EMC filtering.

The secondary external electrical connector is a 6-Pin MIL-C38999 series III (D38999/20FA35PN) style receptacle. Pin connections and external cable requirements are shown in Table 5.

Table 3 Aircraft Mating Connector Details

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

NOTE:

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

1.1.5.2 BONDING

Two pins are allocated within the primary connector for bonding the DIDAFR chassis to the airframe. Bonding is also achieved through the equipment mounting feet.

The DIDAFR has a DC bonding resistance of ≤25mΩ at 1A.

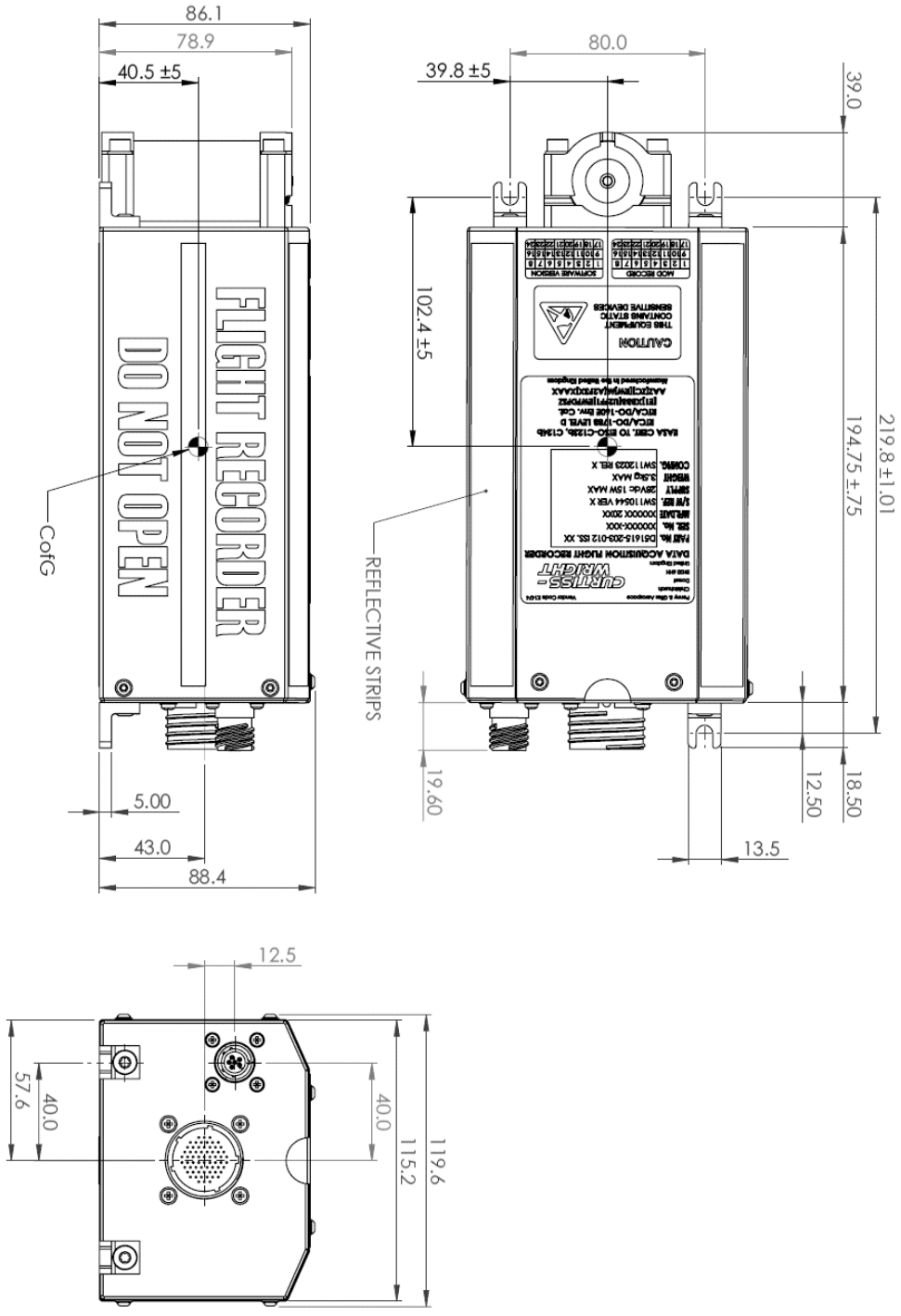

Figure 5 Installation drawing for DIDAFR Type D51615-203-XXX

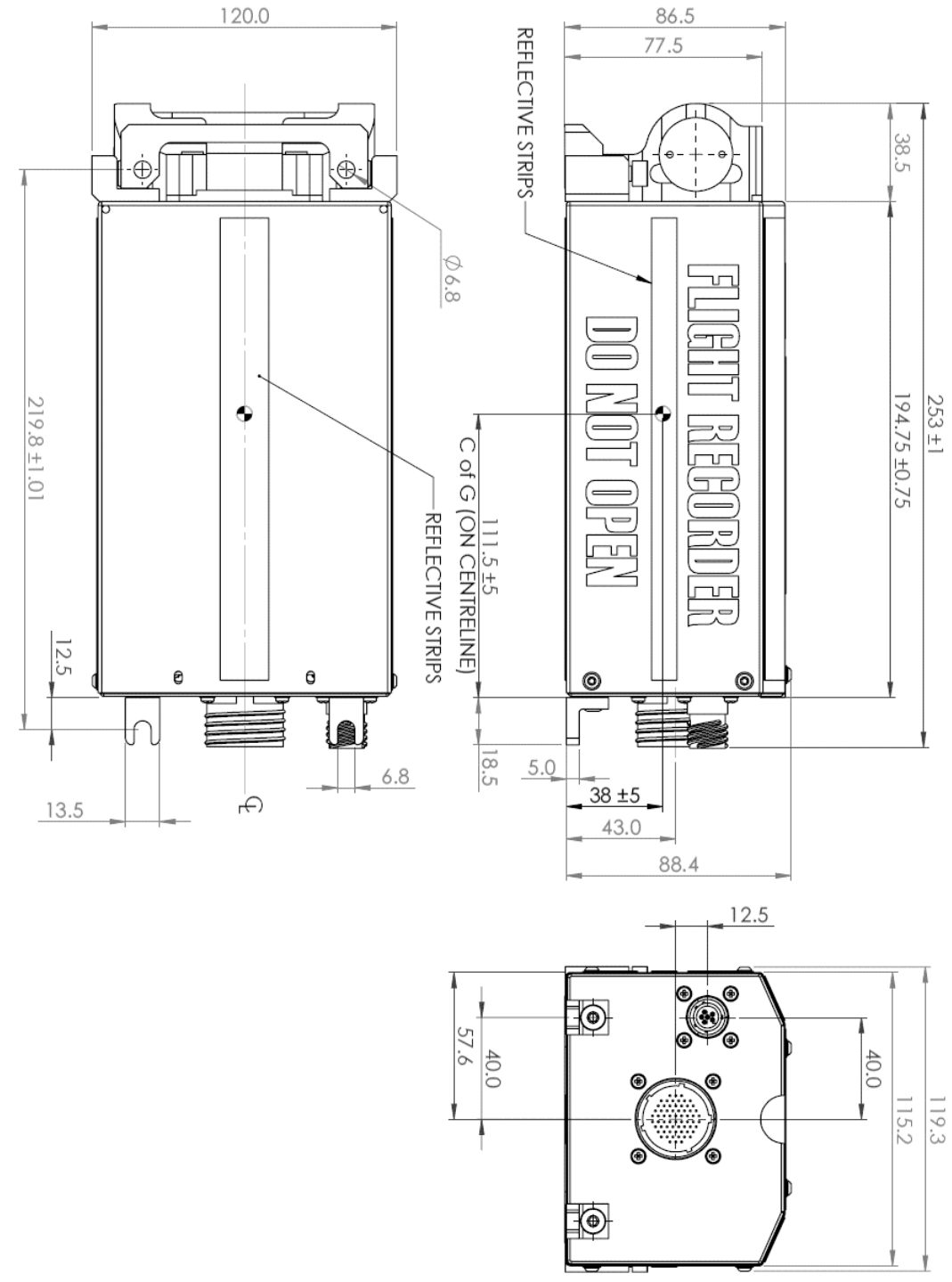

Figure 6 Installation drawing for DIDAFR Type D51615-203-XXX-090

Table 4 DIDAFR Primary Connector Pin Allocation (D38999/26FF35SN or equivalent)

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
1	Potentiometer #1 +3.3V		Configurable[5]
2	Reserved		
3	Potentiometer #1 Return		Configurable[5]
4	Chassis GND[1]	22 AWG	
5	Chassis GND[1]	22 AWG	
6	Pre-Amp Power Out Hot	24 AWG	Configurable[5]
7	Pre-Amp Power Out GND	24 AWG	Configurable[5]
8	0V Signal[1]	22 AWG	
9	Accelerometer In Lo	22 AWG	Configurable[5]
10	Rotor Speed In Hi	24 AWG S.T.P.	Configurable[5]
11	Rotor Speed In Lo		Configurable[5]
12	28 VDC Power In - FDR	22 AWG	
13	FDR Fault Out	24 AWG	Configurable[5]
14	CVR Fault Out	24 AWG	Configurable[5]
15	Voice Erase A	24 AWG	Configurable[5]
16	Voice Erase C	24 AWG	Configurable[5]
17	Audio Out Hi	24 AWG S.T.P.	Configurable[5]
18	Audio Out Lo		Configurable[5]
19	Push-to-Test	24 AWG	Configurable[5]
20	MTI Tx+[3]	24 AWG F.T.P.	
21	MTI Tx-[3]		
22	MTI Rx+[3]	24 AWG F.T.P.	
23	MTI Rx-[3]		
24	Stop CVR Recording	24 AWG	
25	ARINC 429 Channel #1 In A		Configurable[5]
26	ARINC 429 Channel #2 In A		Configurable[5]

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
27	Channel 1 Audio In Hi	24 AWG S.T.P. WITH 36	Configurable[5]
28	Channel 2 Audio In Hi	24 AWG S.T.P. WITH 37	Configurable[5]
29	Channel 3 Audio In Hi	24 AWG S.T.P. WITH 38	Configurable[5]
30	Channel 4 Audio In Hi	24 AWG S.T.P. WITH 39	Configurable[5]
31	Accelerometer In Hi		Configurable[5]
32	Potentiometer #2 +3.3V		Configurable[5]
33	Reserved[4] (Force IP Address)		
34	ARINC 429 Channel #1 In B		Configurable[5]
35	ARINC 429 Channel #2 In B		Configurable[5]
36	Channel 1 Audio In Lo	24 AWG S.T.P. WITH 27	Configurable[5]
37	Channel 2 Audio In Lo	24 AWG S.T.P. WITH 28	Configurable[5]
38	Channel 3 Audio In Lo	24 AWG S.T.P. WITH 29	Configurable[5]
39	Channel 4 Audio In Lo	24 AWG S.T.P. WITH 30	Configurable[5]
40	Potentiometer #3 Return		Configurable[5]
41	Potentiometer #2 Return		Configurable[5]
42	Reserved		
43	ARINC 429 Channel #3 In A		Configurable[5]
44	ARINC 429 Channel #3 In B		Configurable[5]
45	Discrete Input #4		Configurable[5]
46	Discrete Input #2		Configurable[5]
47	Discrete Input #6		Configurable[5]
48	FDR Inhibit	24 AWG	Configurable[5]
49	Potentiometer #3 +3.3V		Configurable[5]
50	Discrete Input #5		Configurable[5]
51	Potentiometer #1 In		Configurable[5]
52	Potentiometer #2 In		Configurable[5]
53	Potentiometer #3 In		Configurable[5]
54	Reserved		

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
55	Discrete Input #3		Configurable[5]
56	Reserved		
57	Discrete Input #1		Configurable[5]
58	Potentiometer #4 In		Configurable[5]
59	Record On[2]	24 AWG	
60	0V Signal[2]	24 AWG	
61	Power In Return[1] - FDR	22 AWG	
62	Reserved		
63	Reserved		
64	Potentiometer #4 +3.3V		Configurable[5]
65	Reserved		
66	Potentiometer #4 Return		Configurable[5]

NOTES:

1) **Link to be less than 30 cm (12") on aircraft (Pins 4, 5, 8 and 61)**
2) **Link to be kept as short as possible (Pins 59 and 60).**
3) **Category 5 Foil Twisted Pair (Pins 20 to 21 and 22 to 23).**
4) **Force IP Address (Pin 33)**
5) **Refer to the Customer Configuration Specification (CCS) for details relating to the recorder configuration.**

Table 5 DIDAFR Secondary Connector Pin Allocation (D38999/26FA35SN or eqivalent)

PIN	SIGNAL	CABLE REQUIREMENTS	NOTES
1	Power In Return – CVR	22 AWG	
2	28V dc Power In – CVR	22 AWG	
3	Reserved		
4	Reserved		
5	Reserved		
6	Reserved		

1.1.6 EQUIPMENT INPUTS

1.1.6.1 POWER SUPPLY

The nominal power supply to the DIDAFR shall be +28VDC with aircraft electrical power characteristics of RTCA/DO-160E, Section16, Category A.

Equipment Operation: +18.0 VDC to +32.2VDC

Power Consumption: 15W maximum

The DC supply to the DIDAFR should be protected by a 5A circuit breaker. The DIDAFR 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.

1.1.6.2 EQUIPMENT INPUTS - CONTROL INPUTS

Polarity of control inputs is configurable. Default is as follows:

(i) STOP CVR RECORDING:

A High to Low transition inhibits CVR recording within 10 minutes (see Section *0,*

TERMINATION OF RECORDING).

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 DIDAFR 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

Linking VOICE ERASE A 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 RECORD ON A and RECORD ON B inputs enables the recording function of the equipment.

(v) FDR INHIBIT:

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

If interlocks or function not implemented, leave open circuit.

(vi) FORCE IP ADDRESS:

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

1.1.6.3 FDR DATA INPUTS

The DIDAFR acquires FDR data from multiple input sources. These collectively comprise:

- 3 x ARINC 429 input channels, configurable for both low and high speed.
- 4 x analogue potentiometer input channels
- 1 x analogue accelerometer input source.
- 6 x discrete input sources

The source of data to be recorded is determined by a configuration file uploaded at time of manufacture, the source of this data is defined in the appropriate customer configuration specification. The acquired data is formatted into a means suitable for download, processing and replay in support of an incident.

1.1.6.4 CVR AUDIO CHANNEL INPUTS

All audio inputs are balanced and have input impedance of 10kΩ at 1kHz (nominal). Signal characteristics are defined in

AUDIO CHARACTERISTICS. The audio inputs are compatible with the requirements of ARINC 757 Supplement 2.

1.1.6.5 ROTOR SPEED

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

Input voltage Range:	$1.6V_{pk-pk}$ to $221.4V_{pk-pk}$ with respect to unit chassis.
Input impedance:	≥ 10kΩ

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 the range.

The Rotor speed signal period, the time between recorded pulses, is valid for periods between 100ms and 1.1ms, equivalent to a rotor frequency of 10Hz to 900Hz.

1.1.7 EQUIPMENT OUTPUTS

1.1.7.1 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 +18.5VDC ±1VDC at a maximum current of 100mA.

1.1.7.2 POTENTIOMETER EXCITATION

The DIDAFR provides power for four external potentiometers.

1.1.7.3 STATUS OUTPUTS

NOTE:

FDR and CVR Fault Output polarity is configurable.

(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.

1.1.7.4 POTENTIOMETER OUTPUTS

The DIDAFR provides four +3.3V DC supplies, one per supported potentiometer input.

1.1.7.5 AUDIO MONITOR OUTPUT

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

Maximum drive level:	2.45V_{RMS} into 600Ω
Frequency range:	150Hz to 6kHz

The Audio monitor output is clamped to 0V when a CVR fault indication is given.

1.1.8 GROUND SUPPORT INTERFACE

1.1.8.1 GENERAL

The Ground Support Interface (GSI) is a serial interface operating on an Ethernet 10Base-T/100Base-Tx four wire link to IEEE Std 802.3u-1995.

1.1.8.2 ELECTRICAL INTERFACE

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

1.1.8.3 CLOCK RATE

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

1.1.8.4 INFORMATION PROTOCOL

The GSI 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:

1.2.1.1 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. GSI operation is supported during the idle mode.

RECORD ON	-	Jumper not fitted

1.2.1.2 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)
PUSH TO TEST	-	Open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	Open circuit

Input data is continuously acquired as defined by the configuration file. The data is formatted and sequentially written to the protected memory array in a manner consistent with the segregation and partitioning requirements of ED112 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 internal to the recorder only.

1.2.1.3 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
PUSH TO TEST	-	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 ED112 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.

1.2.1.4 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.
PUSH TO TEST	-	High
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	(Don't care)

OR

STOP CVR RECORDING	-	Low
PUSH TO TEST	-	High to Low transition
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	(Don't care)

NOTE:

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

Audio information is digitized and sequentially written to the crash survivable memory module in a method consistent with the segregation and partitioning requirements of ED112 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.

1.2.1.5 DOWNLOAD - ON AIRCRAFT

The On-Aircraft Download mode allows the high-speed recovery of all stored aircraft parameter data via the Ground Support Interface (GSI). 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)
PUSH TO TEST	-	High
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	(Don’t care)

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

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

1.2.1.6 DOWNLOAD - OFF AIRCRAFT

The Off-Aircraft Download mode allows the high-speed recovery of all recorded aircraft parameter data or audio information via the GSI. 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)
PUSH TO TEST	-	High
VOICE ERASE A	-	Low or open circuit
RECORD ON	-	Jumper not fitted
FDR INHIBIT	-	(Don’t care)

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.

1.2.1.7 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)
PUSH TO TEST	-	High
VOICE ERASE A	-	Connect to VOICE ERASE C for >2 seconds, via suitable aircraft interlocks
RECORD ON	-	Jumper fitted
FDR INHIBIT	-	(Don't care)

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

1.3 SPECIFICATION

1.3.1 FUNCTIONAL CHARACTERISTICS - PERFORMANCE

1.3.1.1 FLIGHT DATA CHARACTERISTICS

DATA INPUTS

The DIDAFR acquires FDR data from multiple input sources. These collectively comprise;

(i) ARINC 429 INPUT CHANNELS:

Three ARINC 429 input channels are provided, designated channels 1, 2 and 3. FDR parameter data is acquired from the three inputs from label data identified in the configuration file. Each input channel is configurable for both low and high speed.

(ii) POTENTIOMETER INPUT CHANNELS:

Four potentiometer inputs are supported, each consisting 3 signals, an excitation output, signal return and 0V return. Data is sampled in accordance with the frequency, resolution, and accuracy as required by ED112.

Excitation voltage:	3.3VDC ±0.5V
Maximum source current:	50mA
Source impedance:	100Ω
Input impedance:	100kΩ
Accuracy:	±3%
Resolution:	0.5% of full scale

(iii) ACCELEROMETER INPUT:

A single accelerometer input channel is provided that comprises two signals;

Input voltage range:	3.3Vdc representing a range between -3g to +6g
Accuracy:	±0.09g (excluding datum error of ±0.45g)
Resolution:	0.004g
Input impedance:	100kΩ

(iv) DISCRETE INPUT SOURCES:

Six discrete inputs are available for data acquisition over and above those that are available for recorder control purposes. These inputs are typically connected to Push To Transmit or Engine status signals. The inputs are sampled and recorded in accordance to the frequency, resolution and accuracy of ED112.

Enable:	Standard Ground
Disable:	Standard Open

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 DIDAFR is available with a single memory capacity of 192MB; the D51615-203-XXX and D51615-203-XXX-090 variants will retain as a minimum at all times the last 25 hours of aircraft data when recorded in a method consistent with that defined in the Customer Configuration Specification.

DATA DURATION - MAXIMUM

As a result of the method of using redundant memory for error correction and capacity to support a 25-hour record duration, the DIDAFR may retain more than the mandated recording duration.

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 DIDAFR 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.

1.3.1.2 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

(i)	Audio Channel 1:	120 minutes
(ii)	Audio Channel 2:	120 minutes
(iii)	Audio Channel 3:	120 minutes
(iv)	Audio Channel 4:	120 minutes

INPUT LEVEL

Minimum signal level:	78 μV_{RMS} differential
Maximum signal level:	2.45 V_{RMS} differential
Common mode:	±100mVDC maximum
Source impedance:	100Ω to 600Ω

INPUT REFERENCE LEVEL

All audio channels:	2.00 V_{RMS} (8.239dBu)

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 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 ED112, Part I-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 ED112, Part I-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.

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 ED112, Part I-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 DIDAFR, 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 ED112, Part I annex D, 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:	0.75

AUDIO OUTPUT

Summed output of all audio channels. Nominal 10mW ($2.45V_{RMS}$) into 600 Ω 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 by normal replay means.

AUDIO RETENTION

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

1.3.1.3 ROTOR TACHOMETER INPUT

A single-ended rotor speed input is supported by the DIDAFR.

Input voltage:	Range: 1.6Vpk-pk to 221.4Vpk-pk
Input impedance:	≥10kΩ
Tail rotor speed 0V return:	ROTOR_SPEED_IN_LO connected internally to 0V_Signal
Pulse frequency range:	10Hz to 900Hz
Sensor source impedance:	100 to 130Ω in series with 33mH or 1200 to 1500Ω in series with 360mH (Typical)
Accuracy:	Measured to better than ±2%

1.3.1.4 DATA TO AUDIO CORRELATION

The DIDAFR 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 GSI.

1.3.1.5 STATUS MONITORING

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

- FDR FAULT
- CVR FAULT

1.3.1.6 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 configured)

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.

1.3.1.7 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 configured)

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.

1.3.1.8 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 configured)

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.

1.3.1.9 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 DIDAFR. 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.

1.3.1.10 POWER INTERRUPTIONS

(i) POWER INTERRUPTION ≤200 MILLISECONDS:

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

(ii) POWER INTERRUPTION >200 MILLISECONDS:

At normal, abnormal and emergency power levels, interruptions with durations 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.

1.3.1.11 DOWNLOAD

Selection of an FDR download interrupts the recording process of the DIDAFR. 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 GSI 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 DIDAFR has been removed from the aircraft. Audio is recovered via the GSI requiring the replay equipment detailed in Section *6.6*.

Recovery of the digitized audio record using such equipment can be achieved within 2 minutes per channel.

CAUTION:

Recovery of audio can only be performed off aircraft.

1.3.2 PHYSICAL AND OTHER CHARACTERISTICS

1.3.2.1 WEIGHT

The weight of the unit does not exceed 3.8kg (8.3lb). This includes the ULB.

1.3.2.2 DIMENSIONAL LIMITS

255 (L) x 120 (W) x 89 (H) mm, this includes the ULB.

1.3.2.3 EXTERNAL FINISH

To aid location of the DIDAFR, the case is finished in International Orange to BS381C colour number 592.

1.3.2.4 MARKING

The DIDAFR 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-160E, with test categories as shown in

Table 6.

Table 6 Non-Cockpit Equipment Environmental Test Levels

SECTION	REQUIREMENT	DAFR CATEGORY
4	Temperature/Altitude	E1(1)
4.5.4	Loss of Cooling	X
5	Temperature Variation	B
6	Humidity	B
7	Operational Shock & Crash Safety	B
8	Vibration	U2 curves F & F1
9	Explosion proofness	E
10	Waterproofness	W
11	Fluids Susceptibility	F(2)
12	Sand and Dust	D
13	Fungus Resistance	F
14	Salt Fog	S
15	Magnetic Effect	Z
16	Power Input	A
17	Voltage Spike	A
18	AF Conducted Susceptibility	Z
19	Induced Signal Susceptibility	ZC
20	RF Susceptibility	WW
21	Emission of RF Energy	M
22	Lightning Induced Transient Susceptibility	A2F3X
23	Lightning Direct Effects	X
24	Icing	A
25	ESD	A
26	Fire	X

NOTES:

1. **Operating temperature: -55°C to +71°C.**

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

   Survival Temperature: -55°C to +85°C (30 minutes)

   Altitude: -15,000ft to 80,000ft
2. **Aircraft fluids are listed in Table 6.**
3. **Lightning induced Transient Susceptibility only meets the requirements of Category A2F3X if the aircraft connector cables are bundled together for as long a distance as possible.**

Table 7 Aircraft Fluids

CLASS	DESCRIPTION	°C (±3)	REMARKS
Fuels	Aviation Turbine Fuel	40	AVTUR/FS11
Hydraulic Fluids	Mineral Based	80	OM-15
Hydraulic Fluids	Phosphate Ester-Based	70	OX-20 Skydrol
Lubricating Oils	Synthetic	150	OX-27
Lubricating Oils	Synthetic Hydrocarbon	70	
Solvents and Cleaning Fluids	Denatured Alcohol	23	
Solvents and Cleaning Fluids	Aircraft Cleaning Compound	23	Ardrox 6092 – 1:9 mix with water
De-Icing Fluid	Ethylene Glycol	50	
De-Icing Fluid	Propylene Glycol	50	
Insecticides	Pyrethroid Pesticide	23	
Sullage	Formaldehyde Based	23	Toilet Flushing fluid
Disinfectant (Heavy Duty Phenolics)	Black Fluid	23	Jeyes Fluid diluted as recommended.
Coolant Dielectric Fluid	PAO Dielectric	70	

CLASS	DESCRIPTION	°C (±3)	REMARKS
Fire Extinguishants	Fluroprotein	23	FLUROFOAM 906
Fire Extinguishants	Aqueous Film-Forming Foam (AFFF)	23	FILMFOAM 916

1.3.3.1 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-112, section 1, 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-112, section 1, 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-112, section 1, 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 in ED-112, section 1, Chapter 2-4.2.4.

LOW TEMPERATURE FIRE

Subjected to a 260°C “low temperature” fire test of 10 hours duration, as defined in in ED-112, section 1, 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 in ED-112, section 1, 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 in ED-112, section 1, Chapter 2-4.2.7.

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2 STORAGE

The DIDAFR Type D51615-203-XXX and Type D51615-203-XXX-090 are delivered in a trade container, as specified by packing drawing DR-SK110316, 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 DIDAFR units that have been in storage for periods in excess of 36 months, refer to Section *0* for details of the maintenance procedures which need to be carried out.

NOTE:

If the DIDAFR is to be stored at temperatures expected to exceed +71°C, 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°C or incinerate. Dispose of batteries promptly.

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3 UNPACKING

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE DUAL INPUT DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX AND TYPE D51615-203-XXX-090 TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

The Dual Input Data Acquisition Flight Recorder Type D51615-203-XXX and Type D51615-203-XXX-090 are packed in a trade container as specified by Penny & Giles Aerospace Ltd packing drawing DR-SK110316, unless otherwise negotiated with the Customer. The unit should not be removed from the packaging until required for use.

After unpacking the unit, the packaging should be retained for future use.

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4 INSTALLATION

CAUTION:

CARE MUST BE TAKEN WHEN UNPACKING AND HANDLING THE DUAL INPUT DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX OR TYPE D51615-203-XXX-090 TO ENSURE THAT THE UNIT DOES NOT SUFFER UNDUE SHOCK.

4.1 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 performing the installation of 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 an acceptable installation is documented and is approved by the Administrator.

4.2 SYSTEM DESIGN

A detailed system design is beyond the scope of this manual. For guidance, a typical system block diagram for a DIDAFR system is shown in *Figure 7*.

Typical wiring diagram for single DIDAFR installation with a Control Unit is shown in *Figure 8*. Aircraft specific drawings will be provided on request.

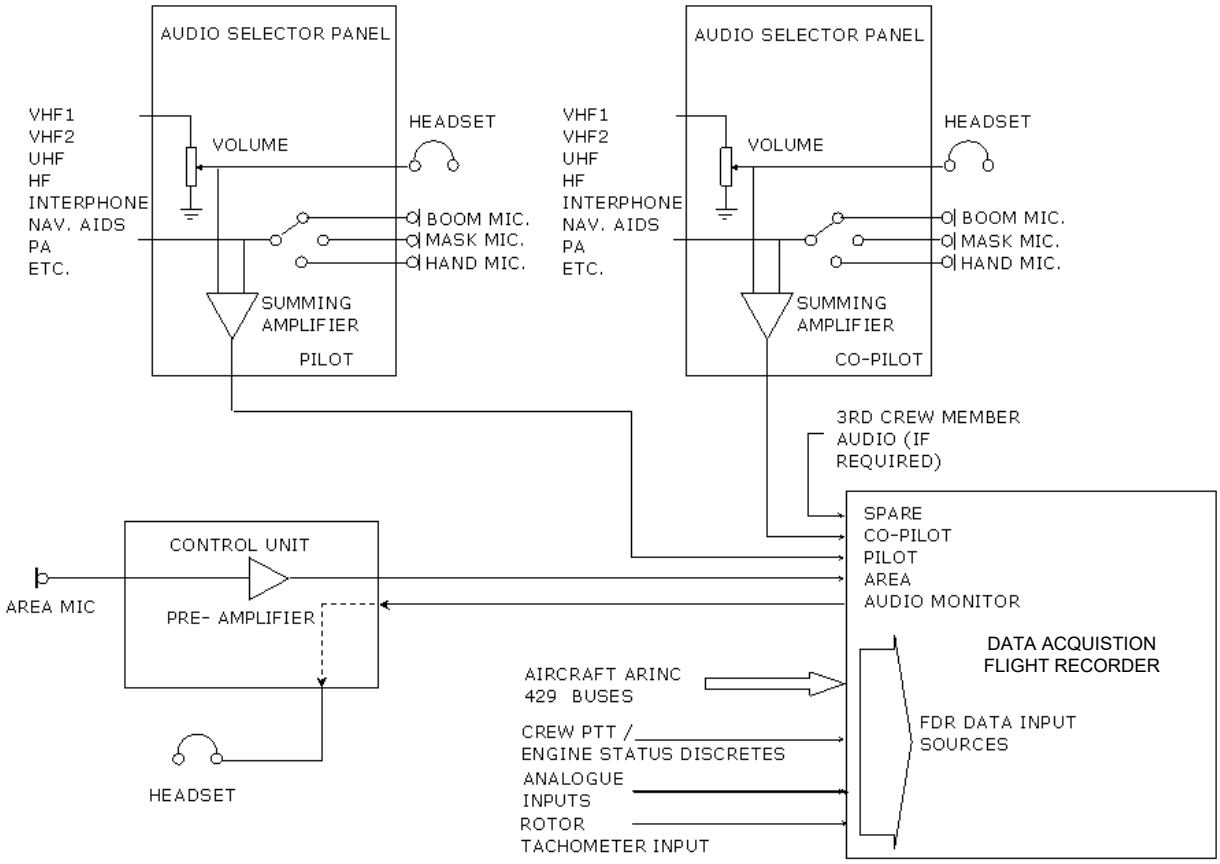

Figure 7 Typical DIDAFR System Block Diagram

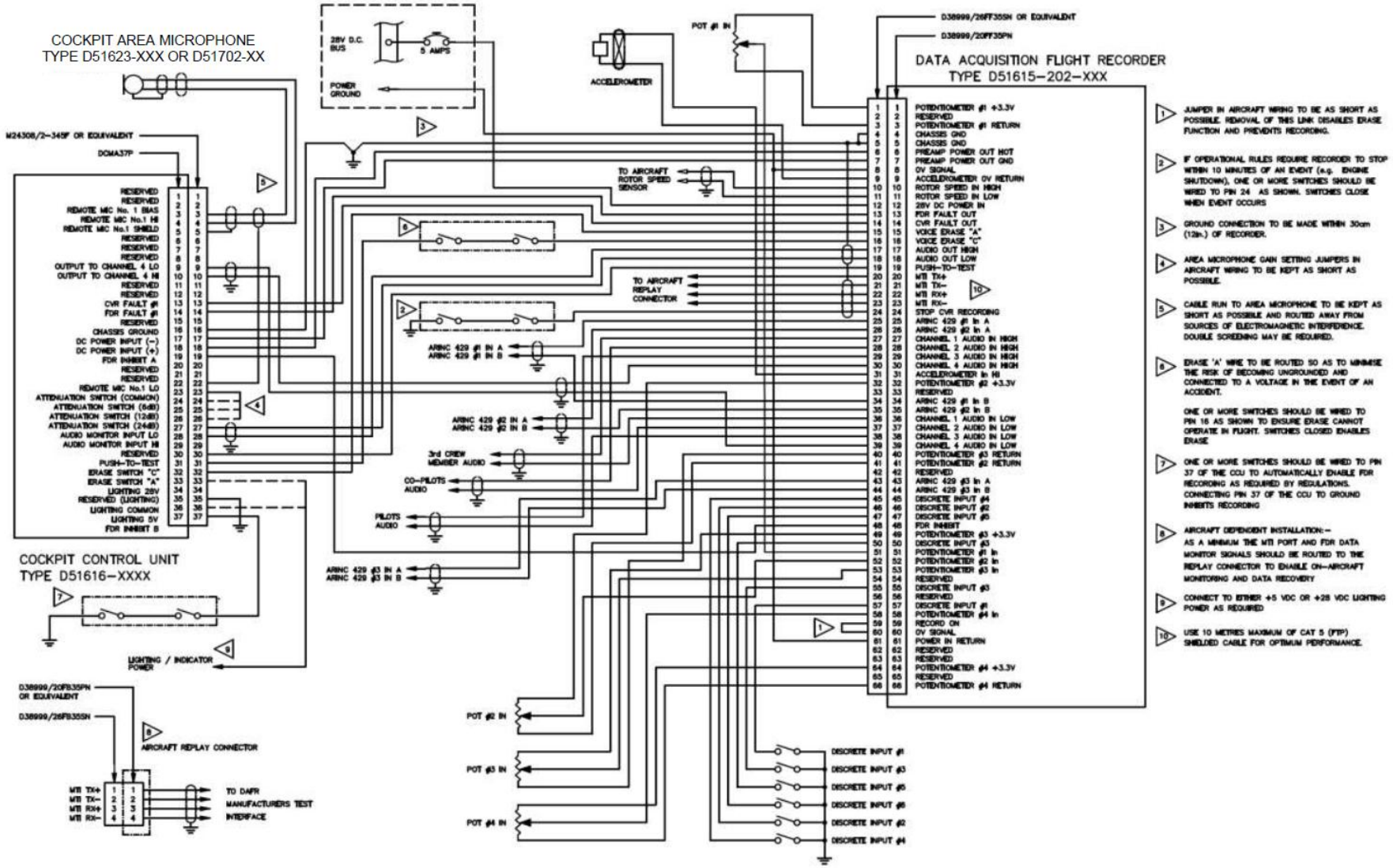

Figure 8 Wiring Diagram for DIDAFR Type D51615-203-XXX and Type D51615-203-XXX-090

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4.3 SIGNAL LEVELS

The CVR function of the DIDAFR 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 DIDAFR. 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.

4.4 WIRING

The recommended minimum wiring sizes are shown in *Table 4* and *Table 5*.

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 must be connected on both AC and DC installations.

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

The DIDAFR utilises 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 Aircraft Replay Cable part number SA109654.

4.5 POWER SUPPLY

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

The DIDAFR should be powered from the aircraft bus which provides maximum reliability for the operation of the DIDAFR without jeopardizing services to essential or emergency loads. See EUROCAE ED 112 for further guidance.

For DC powered installations, the supply to the DIDAFR 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.

4.6 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 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, ED112 strongly discourages 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 DIDAFR.

4.7 START OF RECORDING

Recording will automatically start on the application of power to the DIDAFR. 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. Remove power from the DIDAFR 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 DIDAFR 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.

4.8 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.

4.9 RECORDER LOCATION

Operating rules give guidance on the recorder location. The environment at the chosen location must be within the DIDAFR specification limits. For long-term reliability, it is strongly recommended that, for aircraft, the DIDAFR 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.

4.10 MOUNTING

The DIDAFR 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.

4.11 POST INSTALLATION CHECK

4.11.1 CONTINUITY CHECK

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

4.11.2 SYSTEM CHECK

(1) Carry out the Daily Functional Check as described in Section *6.3*

(2) Carry out the CVR System Check as described in Section *6.6*

(3) Carry out the FDR System Check as described in Section *6.7*

4.12 FLIGHT TEST

Each newly installed DIDAFR 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-112 Part I Chapter 6 and Part II Chapter 6.

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5 OPERATING INSTRUCTIONS

NOTE:

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

5.1 GENERAL

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

CAUTION:

WHEN IT IS NECESSARY TO REMOVE THE DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX OR TYPE D51615-203-XXX-090 FOR MAINTENANCE, POWER MUST BE SWITCHED OFF AT LEAST FIVE SECONDS BEFORE THE UNIT IS DISCONNECTED FROM THE AIRCRAFT.

5.2 CONTROLS AND INDICATORS

The Cockpit Control Unit Type D51616-XXXX 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.

5.2.1 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.

NOTE:

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

5.2.2 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.

5.2.3 FDR RCRD SWITCH (FDR INHIBIT)

Operation of the FDR RCRD (FDR INHIBIT) switch provides an enable signal to the DIDAFR overriding aircraft installation interlocks for the purpose of FDR subsystem ground test.

5.2.4 CVR FAIL INDICATOR

Steady illumination of the CVR FAIL indicator, indicates either that a fault in the CVR subsystem has been detected by the DIDAFR BIT function, or that the DIDAFR 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 Section *1.2.1 OPERATIONAL MODES* for further details.

5.2.5 FDR FAIL INDICATOR

Steady illumination of the FDR FAIL indicator indicates either that a fault in the FDR function has been detected by the DIDAFR BIT function, or that the DIDAFR 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 data is not received at the input.

Flashing of the FDR FAIL indicator occurs during data recovery modes. Refer to *1.2.1 OPERATIONAL MODES* for further details.

5.2.6 HEADPHONE JACK

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

6 MAINTENANCE

CAUTION:

WHEN IT IS NECESSARY TO REMOVE THE DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX OR TYPE D51615-203-XXX-090 FOR MAINTENACE, POWER MUST BE SWITCHED OFF AT LEAST FIVE SECONDS BEFORE THE UNIT IS REMOVED FROM THE AIRCRAFT.

6.1 GENERAL

The concept of On Condition (OC) maintenance applies to the DIDAFR 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 Equipment (BITE) is provided within the equipment which identifies any subsystem failures and facilitates fault finding down to module (circuit board) level. The BITE can be interrogated using Portable Replay Equipment (PRE).

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

6.2 DIDAFR PERIODIC MAINTENANCE TASKS

The DIDAFR periodic maintenance tasks are to be carried out at Pre-flight, six monthly, 12 monthly, 24 monthly and 72 monthly intervals and are shown in *Table 8*.

The periodic maintenance tasks shown in *Table 8* except CVR checks can be performed with the recorder on aircraft.

The CVR checks at 24 months require the recorder to be removed from the aircraft.

Table 8 Periodic Maintenance Tasks for DIDAFR Type D51615-203-XXX and Type D51615-203-XXX-090

EQUIPMENT	TASK	MAXIMUM INTERVAL	ACTION
DIDAFR	Functional Check	Daily (see Note below)	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.
DIDAFR	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
DIDAFR	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.
DIDAFR	CVR Replay	24 months	Remove recorder immediately post flight. Replay and evaluate the quality of the in-flight recording.
DIDAFR	FDR Replay	24 months	Copy and replay complete data memory contents. Check all mandatory parameters are active and are of acceptable quality.
ULB	Check	36 months	Carry out the checks detailed in Section *0*
DIDAFR	Inspection	72 months	Strip Down, Mechanical Inspection, Reassembly and recertification. Carry out verification test.
ULB Battery	Check	72 months	Check the expiry date of the ULB Beacon Battery. Replace if necessary.

NOTE:

The ULB battery is life limited. The battery life is 6 years, but when dispatched from Curtiss Wright, the battery is guaranteed to have at least 4.5 years of life remaining. Although this maintenance task has been identified as having a maximum interval of 72 months, it is important that the task is carried out before the expiry date that is specified on the ULB battery itself.

6.2.1 INSPECTIONS

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 DIDAFR), but may be postponed until the next suitable planned maintenance period so long as the DIDAFR 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 9)

• 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 6.4.4, “ULB Removal and Replacement”. If the DIDAFR does not meet the above criteria and cannot be made to meet the criteria by the operator, the DIDAFR should be returned to Penny & Giles Aerospace Ltd for evaluation at the earliest opportunity. Carry out the check as detailed in Table 8 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.**

6.3 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 DIDAFR or its associated interface.

NOTE:

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

6.3.1 PROCEDURE

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

(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 DIDAFR must be removed from the aircraft for servicing.

NOTE:

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

6.4 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:

6.4.1 ULB SWITCH CLEANING

CAUTION:

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

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(s).

NOTE:

The Type DK290-11 ULB has both a positive (+) and a negative (-) switch contact.

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

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

6.4.2 ULB BATTERY TEST

6.4.2.1 EQUIPMENT REQUIRED

The following equipment is required to carry out the ULB checks:

(1) Dukane Seacom TS200 or TS500 Test Set (or equivalent), or High-impedance Voltmeter (input impedance of ≥10MΩ)

(2) DK290 Test Probe (p/n: 3-115-0527) for TS200 / TS500 Test Set (for ULB Type DK290-11 only)

6.4.2.2 PROCEDURE

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

NOTE:

The ULB may be either be removed or remain installed for battery testing.

(1) Ensure the case and water switch contacts are clean and dry prior to testing. If in doubt, clean in accordance with Para. *6.4.1*.

(2) If using the TS200 or TS500 Test Set:

Type DK140 and Type DK120/90 – Connect the Test Probe Clip to the TS200 / TS500 Test Set, then turn on the power to the Test Set. Attach the Test Probe Clip to the case of the ULB, such that the metal tape on the inside of the Clip makes contact with the metal of the ULB case. Place the tip of the pointed probe onto the switch contact.

Type DK290-11 – Connect the DK290 Test Probe to the TS200 / TS500 Test Set. Place the tip of the pointed probe of the Test Set onto the Negative (-) side switch contact and the tip of the DK290 Test Probe onto the Positive (+) side switch contact (see *Figure 9* for correct orientation).

(3) If using the high-impedance voltmeter:

Type DK140 and Type DK120/90 - Place the negative lead of the high-impedance voltmeter on the switch contact and the positive lead of the meter on the ULB case or the mounting kit (if already installed).

Type DK290-11 – Place the negative lead of the high-impedance voltmeter on the Negative (-) side switch contact and the positive lead of the voltmeter on the Positive (+) side switch contact (see *Figure 9* for correct orientation).

(4) Measure the battery voltage.

NOTE:

Refer to

Table 9 for voltage specifications. The ULB is operable at the given minimum acceptable voltage.

Table 9 ULB Voltage Code and Minimum Acceptable Voltage

ULB TYPE	CODE	MINIMUM ACCEPTABLE VOLTAGE
DK140	D	2.97 VOLTS
DK120/90	F	2.97 VOLTS
DK290-11	N/A	2.75 VOLTS

Figure 9 Typical Examples of ULB Labels

6.4.3 ULB FUNCTIONAL TEST

6.4.3.1 EQUIPMENT REQUIRED

The following equipment is required to carry out the ULB checks:

(1) Dukane Seacom TS200 or TS500 Test Set (or equivalent), or Dukane Seacom 42A12A Ultrasonic Test Set (or equivalent)

(2) DK290 Test Probe (p/n: 3-115-0527) for TS200 / TS500 Test Set (for ULB Type DK290-11 only)

6.4.3.2 PROCEDURE USING 42A12A TEST SET

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

NOTES:

1. **The ULB should be tested both prior to and post installation onto the DIDAFR.**
2. **Alternate test equipment and test procedures may be used.**

(1) Set the switches on the Ultrasonic Test Set 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) Apply a short circuit as follows:

Type DK140 and Type DK120/90 - Short circuit the switch contact to the ULB case.

Type DK290-11 - Short circuit the Positive (+) side switch contact to the Negative (-) side switch contact.

(4) Check that an audible signal is heard from the Test Set. A normal tone equates to one ‘blip’ every second. If the repetition rate is greater, the battery is exhausted and requires replacement.

NOTE:

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

(5) Disconnect the short circuit from the switch contact to the ULB case.

6.4.3.3 PROCEDURE USING TS200 / TS500 TEST SET

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

NOTES:

3. **The ULB should be tested both prior to and post installation onto the DIDAFR.**
4. **Alternate test equipment and test procedures may be used.**

(6) Place the TS200 or TS500 Test Set approximately 1m (3 feet) from the ULB.

(7) Connect the probes as follows:

Type DK140 and Type DK120/90 – Connect the Test Probe Clip to the TS200 / TS500 Test Set, then turn on the power to the Test Set. Attach the Test Probe Clip to the case of the ULB, such that the metal tape on the inside of the Clip makes contact with the metal of the ULB case. Place the tip of the pointed probe onto the switch contact.

Type DK290-11 – Connect the DK290 Test Probe to the TS200 / TS500 Test Set. Place the tip of the pointed probe of the Test Set onto the Negative (-) side switch contact and the tip of the DK290 Test Probe onto the Positive (+) side switch contact (see *Figure 9* for correct orientation).

(8) Press and hold the “PUSH TO TEST” button on the front of the Test Set for a period of approximately 10 seconds.

NOTE:

When the “PUSH TO TEST” button is pressed, the digital display on the Test Set will be blank.

(9) Check that an audible signal is heard from the Test Set. A normal tone equates to one ‘blip’ every second. If the repetition rate is greater, the battery is exhausted and requires replacement.

(10) Disconnect the probes from the ULB.

6.4.4 ULB REMOVAL AND REPLACEMENT (30-DAY BEACON BATTERY)

This section is applicable to the Type DK140 ULB assembly.

Refer to *Figure 10* for Parts Identification.

At the intervals specified, or whenever the ULB or battery fails its periodic test, the ULB assembly must be removed and a replacement installed.

6.4.4.1 REMOVING THE ULB FROM THE RECORDER

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 MOISTURE TRIGGERING THE ULB AND THUS DRAINING THE ULB BATTERY. CARE MUST BE TAKEN WHEN REASSEMBLING THE ULB TO THE DIDAFR TO ENSURE THAT THE CORRECT BRACKET IS USED IN THE CORRECT POSITION.**
3. **DIDAFR TYPE D51615-203-XXX OR TYPE D51615-203-XXX-090 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.**

(1) Remove the four M5 socket head cap screws (80) together with the four M5 washers (90) from the beacon brackets (60 and 70).

(2) Remove the ULB (50), together with the beacon brackets (60 and 70), from the recorder main cover.

(3) Remove the two beacon brackets (60 and 70) from the ULB (50) and remove the fluorosilicone ring (100) from the bottom bracket (60).

(4) Obtain a certified ULB (50) with a new battery from the Manufacturer (Dukane Seacom) and perform the ULB Battery Test as described in para. *6.4.2* and the ULB Test in para. *6.4.3*.

6.4.4.2 RE-FITTING THE ULB TO THE RECORDER

NOTE:

All screws are to be secured with Loctite 222 adhesive (P&G P/N 500000039) or equivalent alternative unless otherwise specified.

WARNINGS:

1. **WHEN USING LOCTITE 222 ADHESIVE, THE FOLLOWING PRECAUTIONS MUST BE OBSERVED: AVOID BREATHING FUMES AND USE WITH ADEQUATE VENTILATION. DO NOT GET IN EYES. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH RUNNING WATER AND SEEK IMMEDIATE MEDICAL ATTENTION.**
2. **AVOID SKIN CONTACT. IF CONTACT OCCURS, IMMEDIATELY WASH WITH SOAP AND LUKEWARM WATER. NO ATTEMPT IS TO BE MADE TO REMOVE THE ADHESIVE FROM THE SKIN WITHOUT SOAP AND WATER. DO NOT USE A SOLVENT FOR THIS PURPOSE.**

(1) Assemble the fluorosilicone ring (100) in bottom beacon bracket (60) only. Assemble beacon brackets (60, 70) on the ULB (50).

(2) Rotate the ULB (50) so that the battery replacement date can be read easily.

(3) Attach the beacon brackets (60 and 70) to the main assembly with four M5 cap head socket screws (80) and washers (90).

(4) Apply a small amount of Loctite 222 to the threads of the four screws (80), tighten the screws until the bracket makes contact with the DIDAFR Case.

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

(6) 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).

(7) Perform the ULB Battery Test and the ULB Test (Para. *6.4.2* & *6.4.3* respectively).

NOTE:

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

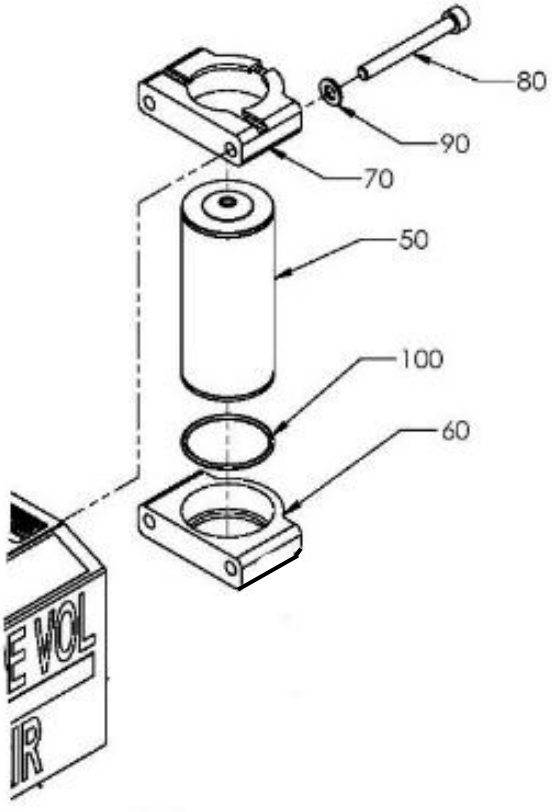

Figure 10 30-Day ULB Removal/Fitting

6.4.5 ULB REMOVAL AND REPLACEMENT (90-DAY BEACON BATTERY)

This section is applicable to Type DK120/90 and Type DK290-11 ULB assemblies.

Refer to *Figure 11* for parts identification.

At the intervals specified, or whenever the ULB or battery fails its periodic test, the ULB assembly must be removed and a replacement installed.

6.4.5.1 REMOVING THE DIDAFR FROM THE AIRCRAFT STRUCTURE

(1) Release the two cap-head screws (60) securing the retention foot fittings (20 & 80) to the retention plate (70).

(2) Remove the two screws securing the DIDAFR to the aircraft structure from the foot fittings adjacent to the 66-way connector.

(3) Lift the connector-end of the recorder and gently slide the unit away from the retention plate (70).

NOTE:

The retention plate (70) will remain fixed to the aircraft structure.

6.4.5.2 REMOVING THE ULB FROM THE RECORDER

(1) Remove and retain the longer cap-head screw (100) and washer (50) from the upper location on the mounting bracket (110).

(2) Remove and retain the shorter cap-head screw (90) and washer (50) from the lower location on the mounting bracket (110).

(3) Remove the mounting bracket (110) from the ULB assembly (120) and slide the ULB out from the mounting bracket (10) which remains secured to the front cover of the DIDAFR.

(4) Remove and retain the fluorosilicone ring (130) from the bracket assembly (10).

NOTE:

No further disassembly is required when removing/replacing the ULB.

6.4.5.3 RE-FITTING THE ULB TO THE RECORDER

(1) Replace the fluorosilicone ring (130) into the bracket assembly (10).

(2) Replace the ULB assembly (120) into bracket assembly (10), ensuring that the battery replacement date can be read easily.

(3) Fit mounting bracket (110) into position.

(4) Apply a small amount of Loctite 222 to the threads of cap-head screws (90) and (100).

(5) Secure mounting bracket (110) using cap-head screws (90) and (100), and washers (50). Tighten both cap-head screws to 6.6-7.0 Nm.

6.4.5.4 RE-FITTING THE DIDAFR TO THE AIRCRAFT STRUCTURE

(1) Ensure that the retention plate (70) is fitted to the aircraft structure using two cap-head screws 6.35mm diameter and washers (locally sourced).

(2) Gently slide the DIDAFR onto the retention plate (70) and secure with the two cap-head screws (60). Tighten screws to 5.0-5.5Nm.

(3) Secure the foot fittings adjacent to the 66-way connector to the aircraft structure with the existing fasteners.

(4) Perform the ULB Battery Test and the ULB Functional Test (Para. *6.4.2* & *6.4.3* respectively).

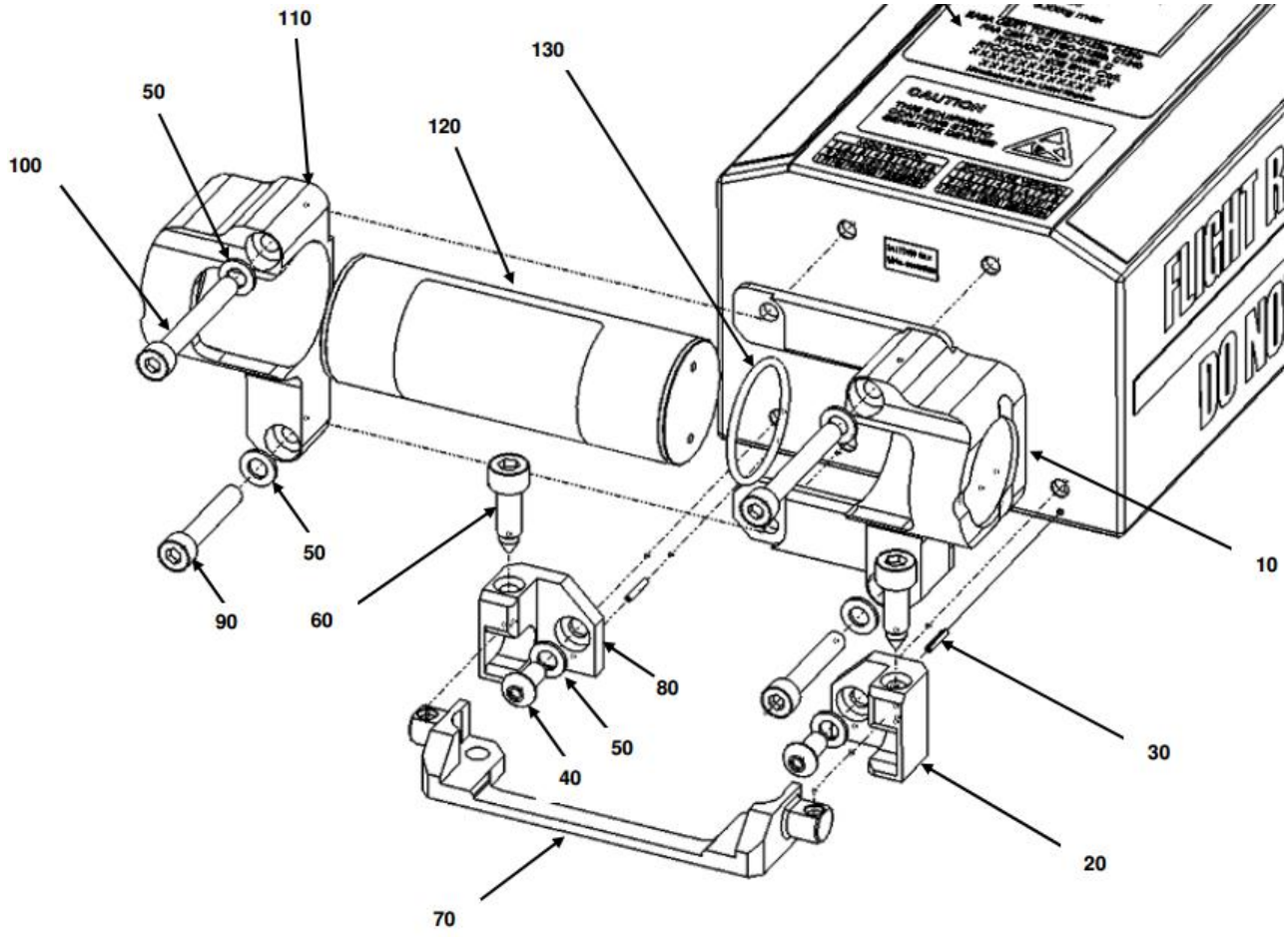

Figure 11 90-Day ULB Removal/Fitting

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6.5 36 MONTH CHECK

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

6.5.1 ULB BATTERY CHECK

Carry out a full ULB Battery Test as detailed in Section *6.4.2*.

6.5.2 ULB FUNCTIONAL TEST

Carry out a ULB Functional Test as detailed in Section *6.4.3*.

6.6 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.

In addition, 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 DIDAFR 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.

6.6.1 EQUIPMENT REQUIRED

The following equipment is required to carry out the check:

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

6.6.2 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 audio.

6.7 FDR SYSTEM CHECK

CAUTION:

DIDAFR TYPES D51615-203-XXX AND D51615-203-XXX-090 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.

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.

In addition, 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 DIDAFR 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.

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 possible interface card should the PC not provide as standard. The software includes Engineering Unit conversion and display functions. Consult Penny & Giles Aerospace Ltd for further details.**
2. **Refer to the Ground Support Interface (GSI) Operating Manual PIM428-O 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 PC with equivalent specification may be used in addition to the power supply and replay cables identified.**
5. **It is possible to download the FDR information from the DIDAFR 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 DIDAFR 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 suite.**

6.7.1 EQUIPMENT REQUIRED

The following equipment is required to carry out the check:

(1) Personal Computer (PC) with the following minimum specification:

- (a) Processor: Intel® Core™ i3 / i5
- (b) Network: 10Base-T/100Base-Tx Ethernet Interface
- (c) RAM: 4GB
- (d) Storage: 500GB
- (e) Display Adapter: ATI or NVIDIA based, Direct-X 9 compatible graphics card with min. 1GB GDDR memory (mandatory for PGS 3D replay)
- (f) Operating System: Windows 7, 8 or 10

(2) PRE Type D51620, comprising:

- (a) Professional Ground Station (PGS) replay software release 5.2.2 (or later)
- (b) Ground Replay Cable Type SA109680
- (c) Aircraft Replay Cable Type SA109654

(3) 28VDC 4A regulated power supply

6.7.2 FDR DATA DOWNLOAD PROCEDURE USING INTERNET EXPLORER

NOTE:

The following procedure assumes that the PC has been configured to support communications between the DIDAFR and PC as detailed in the Ground Support Interface (GSI) operating manual, PIM 428-O.

6.7.2.1 FDR DATA DOWNLOAD

(1) Connect the PC to the DIDAFR in one of two ways:

a. If the DIDAFR remains installed on the aircraft, connect the PC to the CVFDR replay panel / maintenance port on the aircraft using Aircraft Replay Cable Type SA109654 (or equivalent).

b. If the DIDAFR has been removed from the aircraft, connect the PC to the 66-way connector on the unit using Ground Replay Cable Type SA109680. Connect the two 4mm plugs on the Ground Replay Cable to the associated sockets on the bench power supply.

(2) Apply power to the DIDAFR and the PC.

NOTE:

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

(3) On the PC, run **Internet Explorer** and navigate to the GSI Home page at **http://10.0.0.100**.

(4) Internet Explorer will attempt to connect to the DIDAFR. If successful, the GSI Home page will be displayed.

(5) From the **Navigation** menu on the left-hand side of the GSI window, select **File Download** to navigate to the GSI Download page.

(6) Under the **Flight Data Recorder** heading, click on **Flight Data Master** (for fd1.fdr) or **Flight Data Backup** (for fd2.fdr) to initiate the download.

(7) When the download is complete, repeat steps (5) to (6) inclusive to download any additional files as required.

(8) Once all desired files have been downloaded, switch off the power to the DIDAFR and disconnect the replay cable.

6.7.3 FDR DATA REPLAY

The ability to replay the recorded Flight Data is provided by the Professional Ground Station (PGS) software suite.

Processing of the DIDAFR FDR 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.

This section of the manual assumes the following;

a) That the PGS software has previously been installed on to the replay PC

b) That a suitable FDR parameter database has already been established and that the aircraft equipment has been defined

NOTES:

1. **The PGS software suite is protected by a USB Security Dongle. The Dongle should be inserted into a USB port on the host PC prior to installation of the software. Post installation, the Dongle must be inserted into the host PC each time the software is used. If PGS is started without the dongle inserted, an error message will be displayed and the software will not run.**
2. **The following instructions were created using PGS release 5.8.0. Some features may not be available in earlier releases.**

(1) Run PGS. From the **Aircraft** drop-down menu, select **Fleet** to open Fleet Management.

(2) Highlight the appropriate aircraft profile, then select **Download** from the menu on the right-hand side, followed by **Crash Recorder #1 [Curtiss-Wright MPFR/D51615-202-XXX]**.

(3) Under the **Select Data Source** heading, check the **FDR Source File** radio button, then click on the Yellow Folder Icon adjacent to the *"FDR Source File"* field.

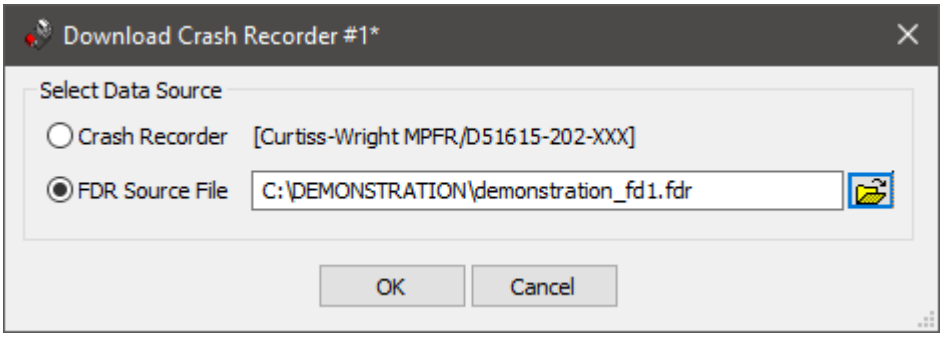

Figure 12 Select Data Source options in PGS

(4) Navigate to the location where the raw *.bin file is stored, then select **OK** to return to the *"Download Crash Recorder #1"* window.

(5) Click on **OK** to continue. The FDR data will now be processed into the native format for PGS (*.xff).

(6) Once the data has been processed, a pop-up window will be displayed reporting the percentage of bits retrieved. This should be ≥98%. Click **OK** to return to Fleet Management.

NOTE:

If the percentage of bits retrieved is less than 98%, it could be that an incorrect Parameter Database file was used.

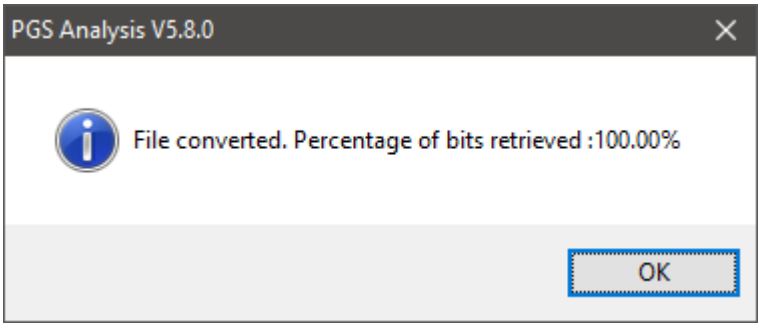

Figure 13 Percentage of bits retrieved Confirmation in PGS

(7) With the appropriate aircraft profile highlighted, select **Flights** from the menu on the right-hand side.

(8) Click on the appropriate Flight Data file to highlight, then click on **Select** from the right-hand menu.

(9) The Flight Data parameters will now be displayed in the main window in Plot view.

(10) As far as practicable, ensure all mandatory parameters are active (as defined by EUROCAE ED-112).

6.7.4 DOWNLOAD PROCEDURE USING PORTABLE REPLAY EQUIPMENT (PRE) TYPE D51620

This section of the manual assumes the following;

a) That the PGS software has previously been installed on to the replay PC

b) That a suitable FDR parameter database has already been established and that the aircraft equipment has been defined

NOTE:

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

6.7.4.1 FDR DATA DOWNLOAD

NOTE:

The following instructions were created using PGS release 5.8.0. Some features may not be available in earlier releases.

(1) Connect the PC to the DIDAFR in one of two ways:

a. If the DIDAFR remains installed on the aircraft, connect the PC to the CVFDR replay panel / maintenance port on the aircraft using Aircraft Replay Cable Type SA109654 (or equivalent).

b. If the DIDAFR has been removed from the aircraft, connect the PC to the 66-way connector on the unit using Ground Replay Cable Type SA19680. Connect the two 4mm plugs on the Ground Replay Cable to the associated sockets on the bench power supply.

(2) Apply power to the DIDAFR and the PC.

NOTE:

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

(3) Run PGS. From the **Aircraft** drop-down menu, select **Fleet** to open Fleet Management.

(4) Highlight the appropriate aircraft profile, then select **Download** from the menu on the right-hand side, followed by **Crash Recorder #1 [Curtiss-Wright MPFR/D51615-202-XXX]**.

(5) Under the *"Select Data Source"* heading, check the **Crash Recorder [Curtiss-Wright MPFR/D51615-202-XXX]** radio button, then select **OK**.

(6) Under the **Select Data to Download** heading, check the **FDR** radio button.

(7) Under the **FDR Options** heading, choose to download **Flight Data Master** (for fr1.fdr) and/or **Flight Data Backup** (for fd2.fdr), then click on the **Download** button.

(8) Once the download is complete, select **Close** from the menu on the right-hand side to return to Fleet Management.

6.7.4.2 FDR DATA REPLAY

(1) With the appropriate aircraft profile highlighted, select **Flights** from the menu on the right-hand side.

(2) Click on the appropriate Flight Data file to highlight, then click on **Select** from the right-hand menu.

(3) The Flight Data parameters will now be displayed in the main window in Plot view.

(4) As far as practicable, ensure all mandatory parameters are active (as defined by EUROCAE ED-112).

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6.8 CVR REPLAY

CAUTION:

DIDAFR TYPES D51615-203-XXX AND D51615-203-XXX-090 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.

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

In addition, 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 DIDAFR 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.

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 in accordance with Data Protection law.**
4. **This procedure requires the DIDAFR to be removed from the aircraft.**

6.8.1 EQUIPMENT REQUIRED

The following equipment is required to carry out the check:

(1) Personal Computer (PC) with the following minimum specification:

- (a) Processor: Intel® Core™ i3 / i5
- (b) Network: 10Base-T/100Base-Tx Ethernet Interface
- (c) RAM: 4GB
- (d) Storage: 500GB
- (e) Display Adapter: ATI or NVIDIA based, Direct-X 9 compatible graphics card with min. 1GB GDDR memory (mandatory for PGS 3D replay)
- (f) Operating System: Windows 7, 8 or 10

(2) PRE Type D51620, comprising:

- (a) Professional Ground Station (PGS) replay software release 5.2.2 (or later)
- (b) Ground Replay Cable Type SA109680
- (c) Aircraft Replay Cable Type SA109654

(3) 28VDC 4A regulated power supply

6.8.2 CVR DATA DOWNLOAD PROCEDURE USING INTERNET EXPLORER

NOTE:

The following procedure assumes that the PC has been configured to support communications between the DIDAFR and PC as detailed in the Ground Support Interface (GSI) operating manual, PIM 428-O.

6.8.2.1 CVR DATA DOWNLOAD

(1) Connect the PC to the 66-way connector on the DIDAFR using Ground Replay Cable Type SA109680. Connect the two 4mm plugs on the Ground Replay Cable to the associated sockets on the bench power supply.

(2) Apply power to the DIDAFR and the PC.

NOTE:

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

(3) On the PC, run **Internet Explorer** and navigate to the GS Home page at **http://10.0.0.100**.

(4) Internet Explorer will attempt to connect to the DIDAFR. If successful, the GSI Home page will be displayed.

(5) From the **Navigation** menu on the left-hand side of the GSI window, select **File Download** to navigate to the GSI Download page.

(6) Under the **Voice Recorder** heading, click on **Channel 1** (for cv1.cvr), **Channel 2** (for cv2.cvr), **Channel 3** (for cv3.cvr) or **Channel 4 Wide Band** (for hqc.cvr) to initiate the download.

NOTE:

Channels 1 to 3 are the Crew Channel recordings, and Channel 4 is the Cockpit Area Microphone (CAM) recording.

(7) When the download is complete, repeat steps (5) to (6) to download any additional files as required.

(8) Once all desired files have been downloaded, switch off the power to the DIDAFR and disconnect the replay cable.

6.8.2.2 PROCESSING RAW CVR DATA

In order to play back the downloaded CVR audio data, it must first be decoded. This is achieved using a utility within PGS called Wave Converter.

NOTE:

Decoding of the DIDAFR CVR data may be performed on the download PC if installed with PGS or alternatively on a remote PC once the source files have been transferred.

(1) Open a new Windows Explorer window and navigate to **C:/Program Files(x86)/PGS/UTILITES**.

(2) Run **WaveConverter.exe**.

(3) From the menu on the right-hand side, click on the **Browse** button.

(4) Navigate to the file location where the *.cvr files are stored. Highlight the desired file, then click **OK**.

(5) Under the **Output Format** heading, check the **16 bits** radio button, then click on **Convert** from the right-hand menu.

(6) Once complete, a standard Wave file (*.wav) will be stored in the same file location as the original *.cvr file. Repeat steps (3) to (5) inclusive to decode all remaining *.cvr files.

(7) Once all *.cvr files have been decoded, copy the associated *.wav files into the **Flights** sub-directory of the appropriate aircraft directory, found within the **C:/ProgramData/PGS/AIRCRAFT** directory.

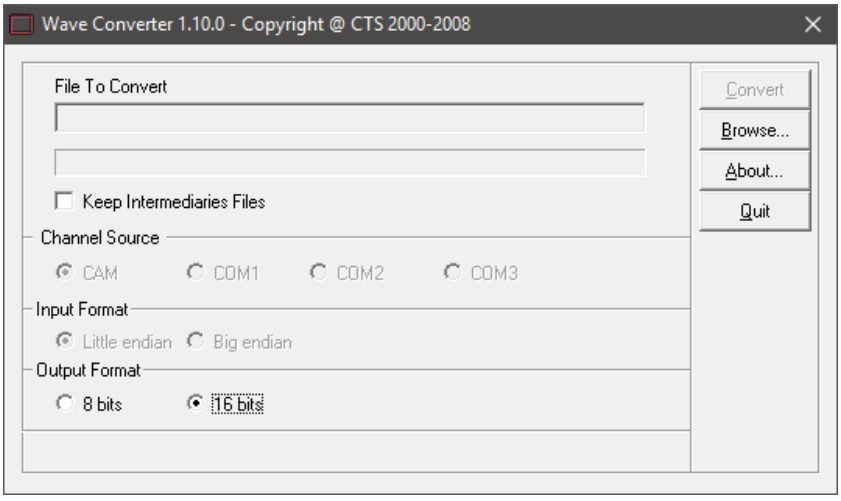

Figure 14 Wave Converter Utility

6.8.2.3 CVR DATA REPLAY

NOTE:

The following instructions were created using PGS release 5.8.0. Some features may not be available in earlier releases.

(1) Run PGS. From the **Flight** drop-down menu, select **Audio Player**.

(2) Click on the **Yellow Folder Icon** and browse to the sub-directory containing the downloaded and processed CVR files.

(3) Highlight the desired files for replay, then click **Open**.

NOTE:

Up to 5 audio files may be displayed simultaneously at any one time.

(4) Use the various playback controls to review the audio data (see *Figure 15* for playback control definition).

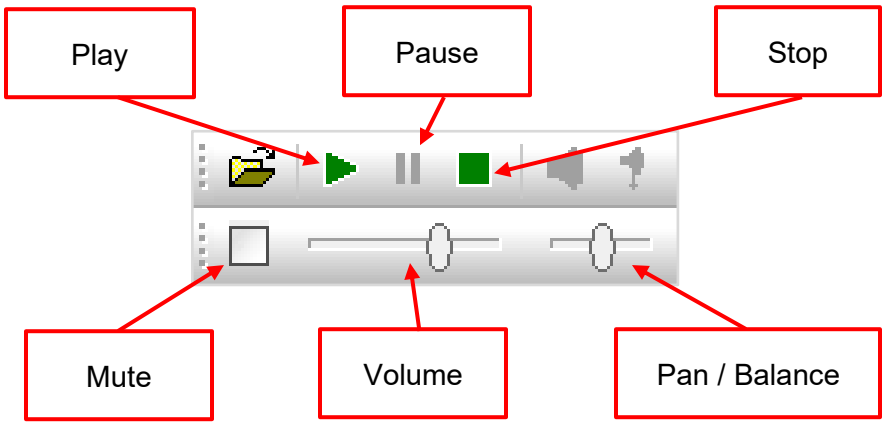

Figure 15 Playback Controls in PGS Audio Player

6.8.3 CVR DATA DOWNLOAD PROCEDURE USING PRE TYPE D51620

NOTE:

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

This procedure may be performed on the download PC if installed with PGS, or alternatively on a remote PC once the source files have been transferred.

This section of the manual assumes the following;

a) That the PGS software has previously been installed on to the replay PC

b) That a suitable FDR parameter database has already been established and that the aircraft equipment has been defined

6.8.3.1 CVR DATA DOWNLOAD

NOTE:

The following instructions were created using PGS release 5.8.0. Some features may not be available in earlier releases.

(1) Connect the PC to the 66-way connector on the DIDAFR using Ground Replay Cable Type SA109680. Connect the two 4mm plugs on the Ground Replay Cable to the associated sockets on the bench power supply.

(2) Apply power to the DIDAFR and the PC.

NOTE:

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

(3) Run PGS. From the **Aircraft** drop-down menu, select **Fleet** to open Fleet Management.

(4) Highlight the appropriate aircraft profile, then select **Download** from the menu on the right-hand side, followed by **Crash Recorder #1 [Curtiss-Wright MPFR/D51615-202-XXX]**.

(5) Under the *"Select Data Source"* heading, check the **Crash Recorder [Curtiss-Wright MPFR/D51615-202-XXX]** radio button, then select **OK**.

(6) Under the **Select Data to Download** heading, check the **CVR** radio button.

(7) Under the **CVR Channels & Options** heading, choose to download **Ch. 1** (for cv1.cvr), **Ch. 2** (for cv2.cvr), **Ch. 3** (for cv3.cvr) and/or **Ch. 4** (for hqc.cvr), then click on the **Download** button.

NOTE:

Channels 1 to 3 are the Crew Channel recordings, and Channel 4 is the Cockpit Area Microphone (CAM) recording.

(8) Once the download is complete, select **Close** from the menu on the right-hand side to return to Fleet Management.

6.8.3.2 CVR DATA REPLAY

(1) Run PGS. From the **Flight** drop-down menu, select **Audio Player**.

(2) Click on the **Yellow Folder Icon** and browse to the appropriate sub-directory, found within the **C:/ProgramData/PGS/AIRCRAFT** directory.

(3) Highlight the desired files for replay, then click **Open**.

NOTE:

Up to 5 audio files may be displayed simultaneously at any one time.

(4) Use the various playback controls to review the audio data (see *Figure 15* for playback control definition).

6.9 FDR REPLAY

CAUTION:

DIDAFR TYPES D51615-203-XXX AND D51615-203-XXX-090 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.

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 must be performed by suitably qualified personnel.**
2. **Refer to the Ground Support Interface (GSI) Operating Manual PIM428-O 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 supply and replay cables identified.**
5. **It is possible to download the FDR information from the DIDAFR 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 DIDAFR 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 suite.**

6.9.1 EQUIPMENT REQUIRED

See Para. *6.7.1*.

6.9.2 PROCEDURE

(1) Repeat FDR data Download and Replay in accordance with Section *6.7.*

(2) As far as practicable, ensure all mandatory parameters are active (as defined by EUROCAE ED-112) for the entire FDR recording.

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6.10 INSPECTION

CAUTIONS:

1. **IT IS NECESSARY TO REMOVE THE DUAL INPUT DATA ACQUISITION FLIGHT RECORDER TYPE D51615-203-XXX OR TYPE D51615-203-XXX-090 FOR THE RECOMMENDED 72 MONTHS PERIODIC INSPECTION. POWER MUST BE SWITCHED OFF AT LEAST FIVE SECONDS BEFORE THE UNIT IS REMOVED FROM THE AIRCRAFT.**
2. **DIDAFR TYPES D51615-203-XXX AND D51615-203-XXX-090 CONTAIN ELECTROSTATIC SENSITIVE DEVICES. EITHER CARRY OUT COMPANY PROCEDURES OR REFER TO BS IEC 61340-5-1:2007.**

Inspection is to be carried out at intervals not exceeding 72 months elapsed time.

The 72-month inspection has been put in place, not only to ensure the continued airworthiness of the recorder and to give the best chance of recovering the recorded data in the case of an accident, but also to show compliance to EASA Safety Information Bulletin 2009-28R1 issued in 2015 which states:

“Safety Investigation Authorities have reported several cases in which the FDR or CVR have not recorded data as expected, due to a malfunction of the unit or the dedicated equipment.

Such failures may remain hidden for a certain amount of time and it may be difficult or not possible to determine the full functionality of a system while fitted on board the aircraft.

This behaviour is described as a dormant failure”.

EASA also recommends the following:

“Design Approval Holders of (Supplemental) Type Certificates that include FDR and CVR installation(s) should review the relevant instructions for continued airworthiness and should ensure that they provide sufficient information to European aircraft operators for maintaining the serviceability of flight recorders, allowing them to be compliant with Commission Regulation (EU) No 965/2012”.

The recommended 72-month inspection will include full production ATE verification testing, and, depending on the result of the initial evaluation, sub-assembly testing may be required, as well as other internal/external mechanical checks. These inspections are not only carried out to check for dormant failures, but they are also intended to examine the integrity of the insulation material within the crash protection for evidence of damage and/or moisture ingress.

Depending on the result of the initial evaluation, the CPMM memory devices may be subjected to a series of read, write and erase tests designed to determine whether they perform within specification. It is possible that, although the memory may be fully functional (i.e. data can be written and retrieved successfully, in which case the recorder would not report a fault), the time in which it takes read/write/erase could fall out of our specification. This would indicate degradation of the devices and, thus, the memory would need to be replaced.

By confirming that the memory performs to specification, we reduce the risk of the memory degrading to the point of failure whilst the recorder is in active service.

NOTE:

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.

7 TESTING AND FAULT ISOLATION

7.1 GENERAL

This section covers the method used to confirm that an equipment is fit for service (verification) and procedures to isolate faulty electronic assemblies within the equipment (fault isolation).

Verification of the DIDAFR equipment utilises the internal status and built-in test (BIT) display provided by the web server, and embedded diagnostic functions that may be run remotely over the web interface.

Fault isolation is approached on two levels. First, using the embedded diagnostic functions provided by the web server and, second, through partial disassembly and observation of internal indicators and test points.

These operations shall be carried out with the equipment removed from the aircraft. The recording functions of the DIDAFR cannot be verified directly without special to type test equipment or, alternatively, fitment in a known good aircraft installation. Procedures for verifying the recording functions as part of the installation check can be found in Section *4.11, POST INSTALLATION CHECK.*

The equipment should be returned to the manufacturer for repair if a fault is present that cannot be isolated to subassembly level using these instructions.

7.2 VERIFICATION TEST

7.2.1 GENERAL

This section details how the web-based GSI Status Page display and internal diagnostics functions may be accessed and interpreted.

Verification is performed at a level which checks the operation of the low-level hardware and software functions used to implement the FDR and CVR functions visible to the operator, such as recording and download.

Following successful verification, it is recommended that the unit under test is subjected to recording and download checks as described in sections *6.7* and *0* of this manual.

7.2.2 EQUIPMENT REQUIRED

The following equipment is required to carry out the check:

(1) Personal Computer (PC) with the following minimum specification:

(a) Processor: Intel® Core™ i3 / i5

(b) Network: 10Base-T/100Base-Tx Ethernet Interface

(c) RAM: 4GB

(d) Storage: 500GB

(e) Display Adapter: ATI or NVIDIA based, Direct-X 9 compatible graphics card with min. 1GB GDDR memory (mandatory for PGS 3D replay)

(f) Operating System: Windows 7, 8 or 10

(2) PRE Type D51620, comprising:

(a) Professional Ground Station (PGS) replay software release 5.2.2 (or later)

(b) Ground Replay Cable Type SA109680

(c) Aircraft Replay Cable Type SA109654

(3) 28VDC 4A regulated power supply

7.2.3 STATUS CHECK

The DIDAFR maintains an internal register of the current status of key functions, including the results of self-tests. This register may be accessed via the Status Page of the Ground Support Interface (GSI).

(1) Connect the PC to the 66-way connector on the DIDAFR using Ground Replay Cable Type SA109680. Connect the two 4mm plugs on the Ground Replay Cable to the associated sockets on the bench power supply.

(2) Apply power to the DIDAFR and the PC.

NOTE:

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

(5) Allow one minute for DIDAFR operation to stabilise and then verify that the current reading on the DMM is in the range 250mA to 350mA.

(6) Open Internet Explorer on the PC using the icon on the desktop.

(7) Navigate to http://10.0.0.100.

(8) When the DIDAFR GSI Home Page is displayed, select the **Status** option from the **Navigation** menu on the left. The Status page will now be displayed. An example of the Status page is shown in *Figure 16*.

(9) Verify that the 'Recorder Mode' parameter in the 'General' status group reads 'NOT RECORDING'.

(10) Verify that both the 'CVR Recorder' and 'FDR Recorder' groups show the following:

Mode:	PASSIVE
Fault:	INDICATED
Fault Count:	0
Last Fault Source:	NO FAULT

(11) Verify that all sections of the 'CRASH PROTECTED MEMORY' group display 'RUNNING'.

(12) Verify that the 'Manager' status in the 'Built In Test' group shows 'READY' and that all other tests show 'OK'.

(13) Verify that each of the 'Last 5 Trace Messages' entries reads 'None'.

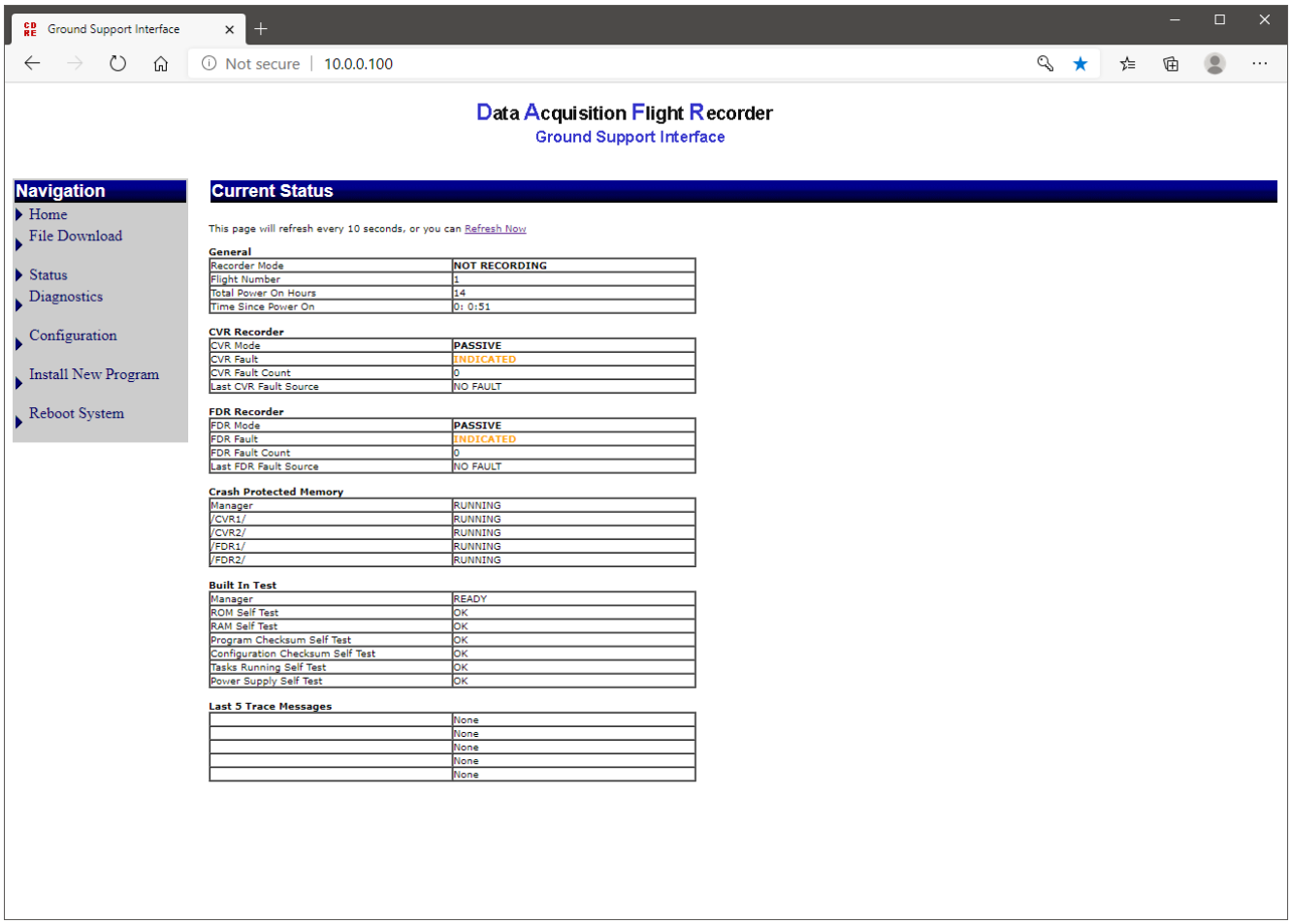

Figure 16 DIDAFR GSI Status Page

7.2.4 DIAGNOSTIC CHECKS

The built-in test manager will indicate a status of 'READY' following boot-up with the equipment in 'NOT RECORDING' mode, as shown in FIGURE. This indicates that the tests have not yet been carried out.

The 'Diagnostics' page of the GSI offers the following options for initiating self-tests for memory operation, memory contents, and validating the configuration settings.

7.2.4.1 RUN DISK CHECK

This function verifies that each disk drive in the crash protected memory is working correctly. The disk check also indicates how much disk space is available in total, and how much is currently used.

When the Disk Check is invoked, the DIDAFR will generate statistics on the GSI for each of the 4 disk drives; FDR1, FDR2, CVR1 and CVR2. If no errors are detected, and messages at the end saying 'Disk Check Complete' and 'The system will now reboot'.

If errors were detected, it may be possible to fix them. If this is the case there will be a link at the bottom of the page instead of the 'Disk Check Complete' message: 'Errors were detected, click here to attempt to fix them'. This link invokes the same operation as the 'Run Disk Repair' diagnostic function.

NOTE:

It may be possible for the repair function to identify and 'map out' the sectors causing a disk check failure. If the DIDAFR is unable to fix the errors when the disk repair is run, the fault is most likely to be in the Crash Box assembly and the DIDAFR is to be returned to Penny & Giles Aerospace Limited for repair.

7.2.4.2 RUN DISK REPAIR

This option allows the operator to attempt to fix disk errors without running the disk check first.

7.2.4.3 RUN BENCHMARKING

This function is reserved for use by the manufacturer.

7.2.4.4 ROM TEST

This function verifies that a series of test patterns in the program storage area of internal memory can be read correctly.

7.2.4.5 RAM TEST

This function verifies that a series of test patterns can be written to the data storage area of internal memory and that they can be read back correctly.

7.2.4.6 PROGRAM CHECKSUM TEST

This function computes a checksum from the contents of the program storage area of internal memory and compares the result with the checksum already programmed in the DIDAFR.

7.2.4.7 CONFIG CHECKSUM TEST

This function computes a checksum from the contents of the equipment configuration storage area of internal memory and compares the result with the checksum already programmed in the DIDAFR.

7.3 FAULT ISOLATION

7.3.1 GENERAL

Carry out the verification sequence detailed in Section *7.2.3*, *STATUS CHECK*.

Refer to the fault isolation flowcharts *Figure 17* and *Figure 18* if an entry in the status table is different from the expected value.

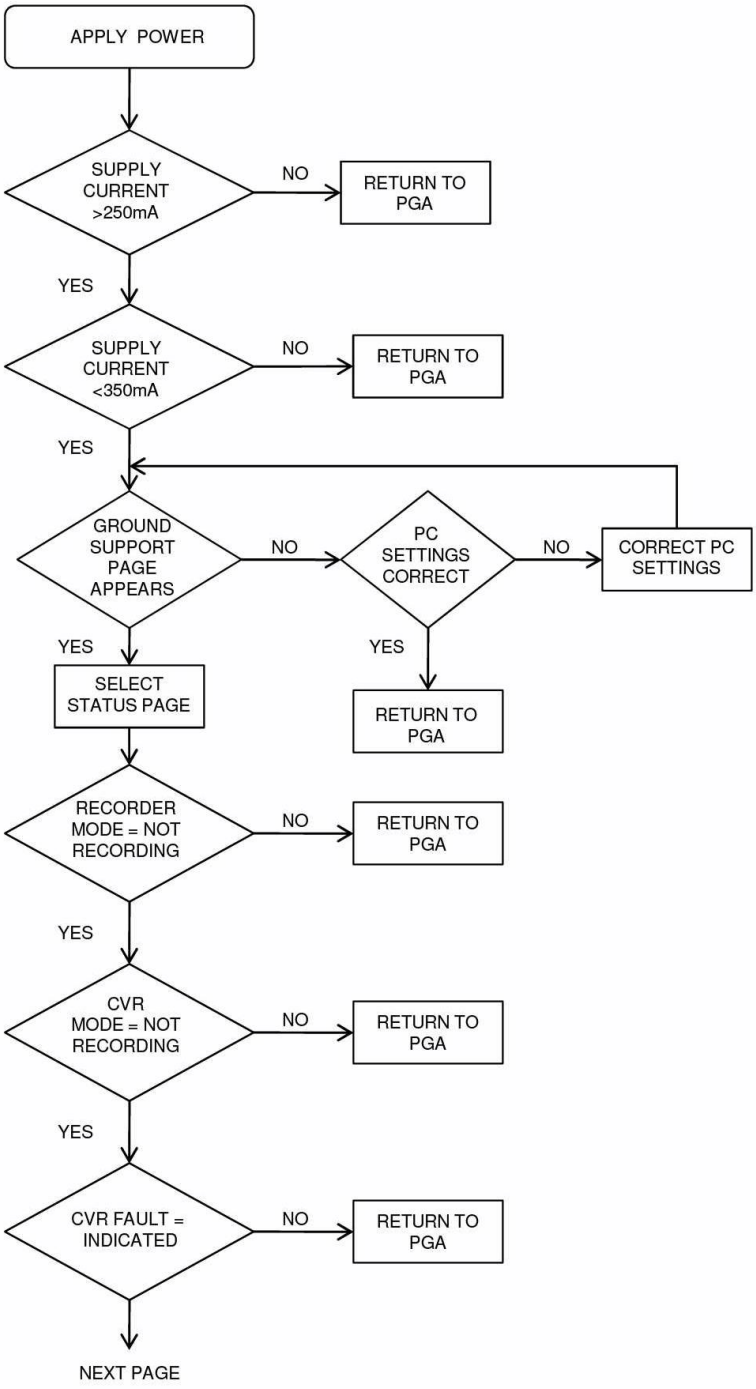

Figure 17 Fault Isolation Flowchart, Sheet 1

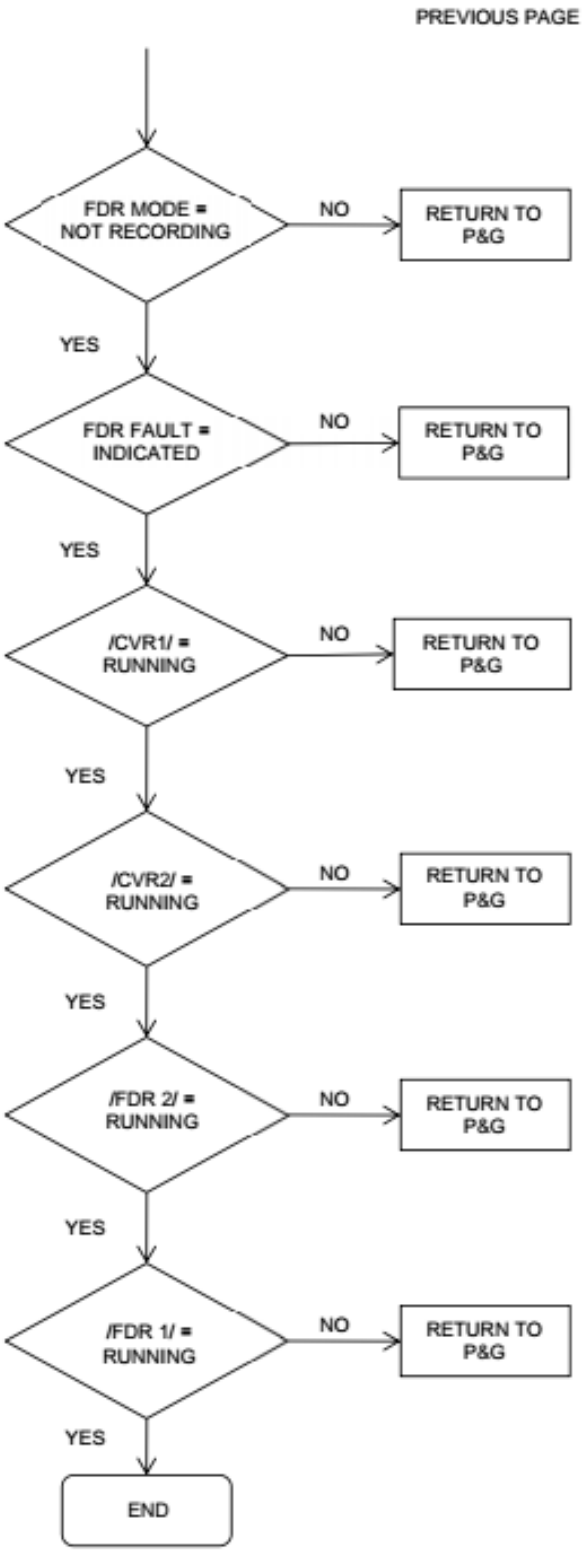

Figure 18 Fault Isolation Flowchart, Sheet 2

8 CLEANING

8.1 MATERIALS

The materials necessary for cleaning are given in *Table 10*.

NOTE:

Equivalent alternatives can be used for these items.

Table 10 Cleaning Materials

DESCRIPTION	PART No./SPEC	VENDOR
Soft cloth	-	CFE
Mild detergent	-	CFE

8.2 GENERAL CLEANING

General cleaning of the DIDAFR is restricted to a wipe over the case with a damp (not wet) cloth.

8.3 ULB SWITCH CLEANING

CAUTION:

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

The ULB inspection is to be carried out at intervals not exceeding six months elapsed time or as agreed with the relevant regulatory authority.

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

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

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

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9 REPAIR

Repair of Dual Input Data Acquisition Flight Recorder (DIDAFR) Types D51615-203-XXX and D51615-203-XXX-090 is by return to the P&G UK facility:

Penny & Giles Aerospace Ltd.

Curtiss-Wright

15 Enterprise Way,

Aviation Park West,

Bournemouth International Airport,

Dorset, BH23 6HH

UNITED KINGDOM

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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 DIDAFR.

Cockpit Control Unit Type D51616-1XXX for single DIDAFR installation support is illustrated in *Figure 19* and Type D51616-2XXX for dual DIDAFR installation support in *Figure 20*.

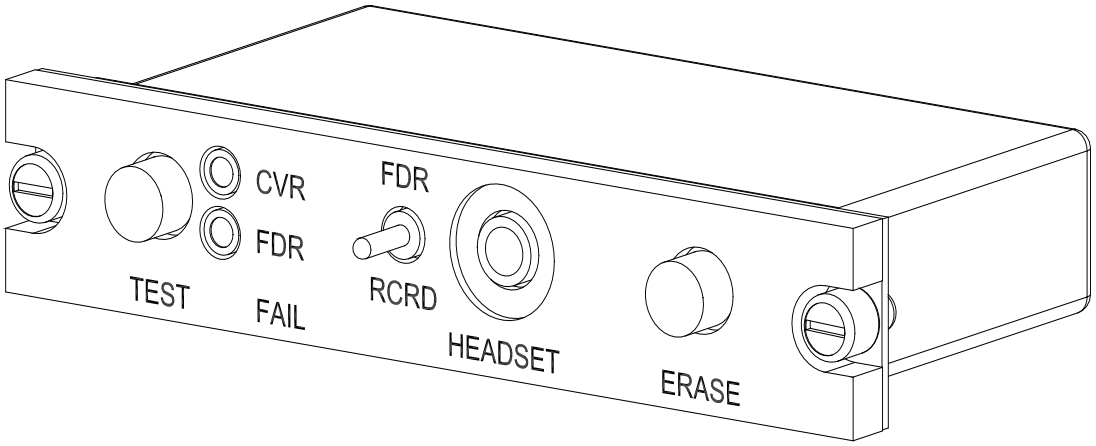

Figure 19 Cockpit Control Unit Type D51616-1XXX

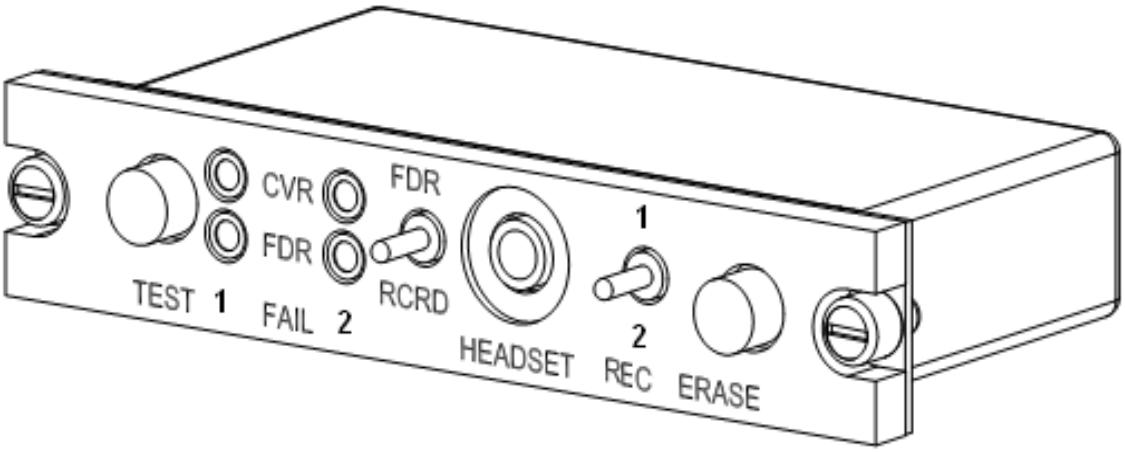

Figure 20 Cockpit Control Unit Type D51616-2XXX

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, FDR 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 11* and

Table 12 for connector pin outs and cable requirements.

Table 11 Cockpit Control Unit Type D51616-1XXX Connector Details for Single DIDAFR Installation Support

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	22 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

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
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
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 12 Cockpit Control Unit Type D51616-2XXX Connector Details for Dual DIDAFR Installation Support

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
CHASSIS GROUND	16	22 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

FUNCTION	37 PIN CONN	CABLE REQUIREMENTS
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

1.2.2 EQUIPMENT INPUTS

1.2.2.1 D.C. POWER INPUT

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

1.2.2.2 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.

1.2.2.3 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.

1.2.2.4 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.

1.2.3 EQUIPMENT OUTPUTS

1.2.3.1 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.

1.2.3.2 SIGNAL OUTPUTS

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

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1.3 SPECIFICATION

1.3.1 FUNCTIONAL CHARACTERISTICS - PERFORMANCE

1.3.1.1 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.

1.3.1.2 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. Cockpit Control Units are identified by the convention shown in *Figure 21*.

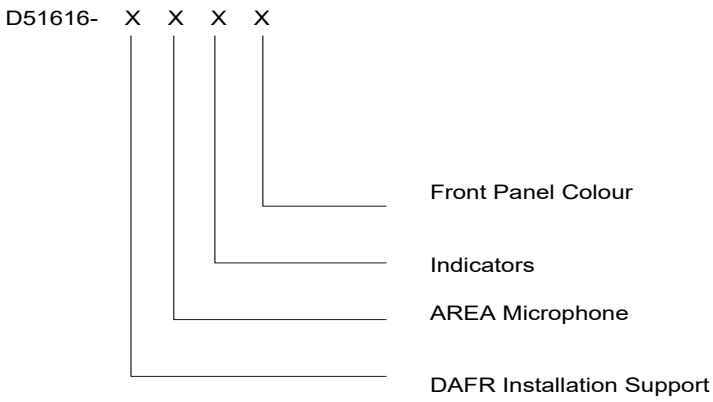

Figure 21 Cockpit Control Unit Part Number Options

1.3.2.1 DIDAFR INSTALLATION SUPPORT

Option 1:	Single DIDAFR
Option 2:	Dual DIDAFR installation

1.3.2.2 AREA MICROPHONE

Option 0:	External Cockpit Area Microphone
Option 1:	Internal Cockpit Area Microphone

1.3.2.3 FRONT PANEL INDICATOR OPTIONS

Option 1:	Yellow. Night Vision Goggle compatible to MIL-L-85762A
Option 2:	Yellow. Sunlight Readable to MIL-S-22885

1.3.2.4 FRONT PANEL COLOUR

Option 0:	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)

1.3.2.5 CASE STYLE

Panel Option:	Slim
Microphone:	External
Features:	FDR RCRD switch, TEST and ERASE Push-buttons and Headset Jack
	The CCU Type D51616-2XXX is provided with a toggle switch to select between the two DIDAFR units
Annunciators:	Separate FDR FAIL and CVR FAIL indicators
Panel Dimensions:	28.2mm (H) x 145.8mm (W) x 63.0mm (D) (excluding connector)
Connector:	DCM37P (or equivalent)

1.3.3 ENVIRONMENTAL CHARACTERISTICS

The CCU satisfies the requirements of RTCA DO-160D, with test categories as shown in *Table 13*.

Table 13 Cockpit Control Unit Environmental Test Levels

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

NOTES:

1. **The CCU and CAM derive power from the DIDAFR 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).**

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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.

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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.

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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 detail for the Cockpit Control Unit depends on case configuration and is detailed in *Figure 22* and *Figure 23*.

4.1 WIRING

The recommended minimum wiring sizes are shown in *Table 11* for CCU Type D51616-1XXX and

Table 12 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.

A typical installation wiring diagram for a generic DIDAFR and CCU installation is shown in *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.

Use the Wiring diagram *Figure 8* and the “Control Inputs” information given in Part 2, Para. *1.2.2.3*, 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.

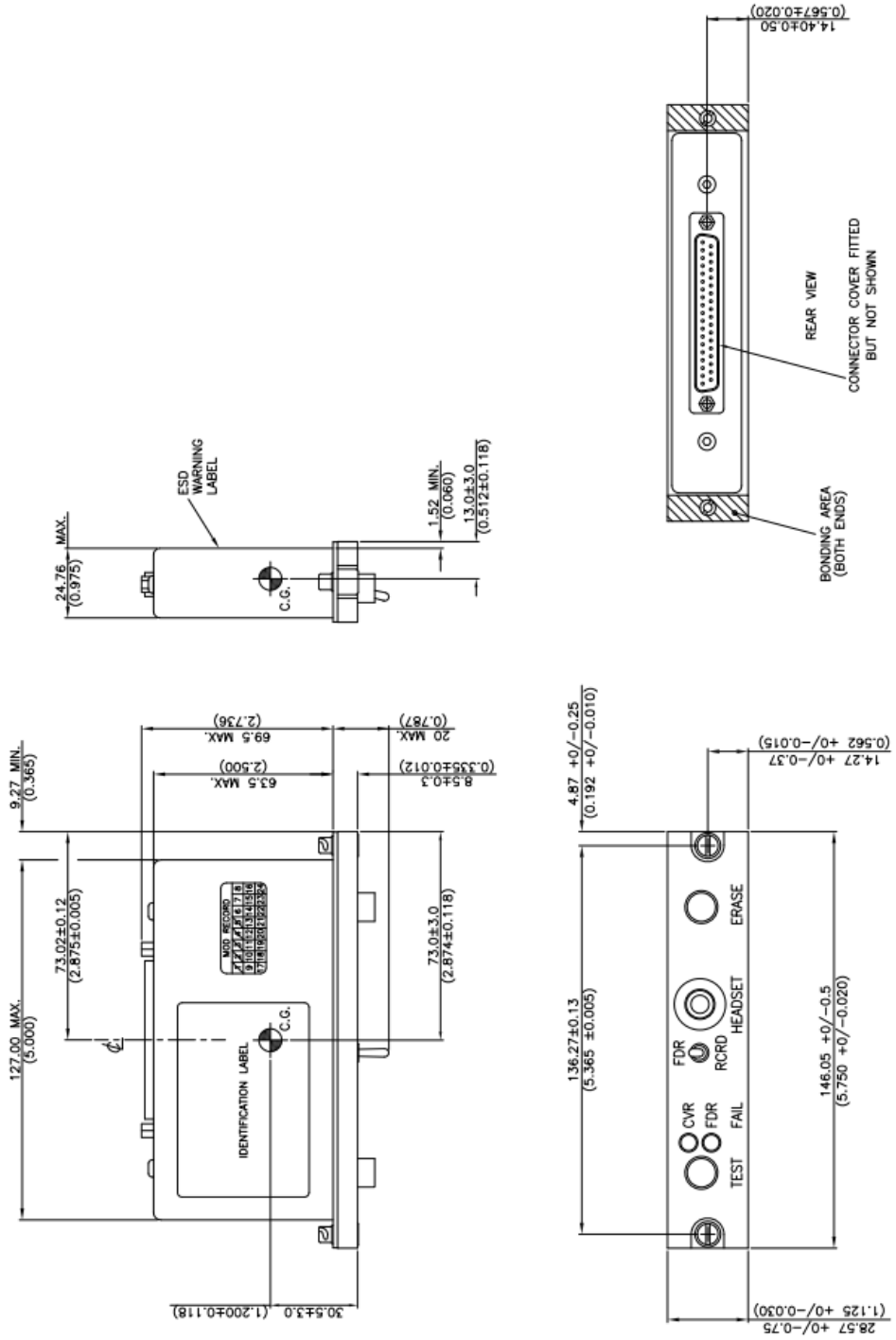

Figure 22 Cockpit Control Unit with Single DIDAFR Support

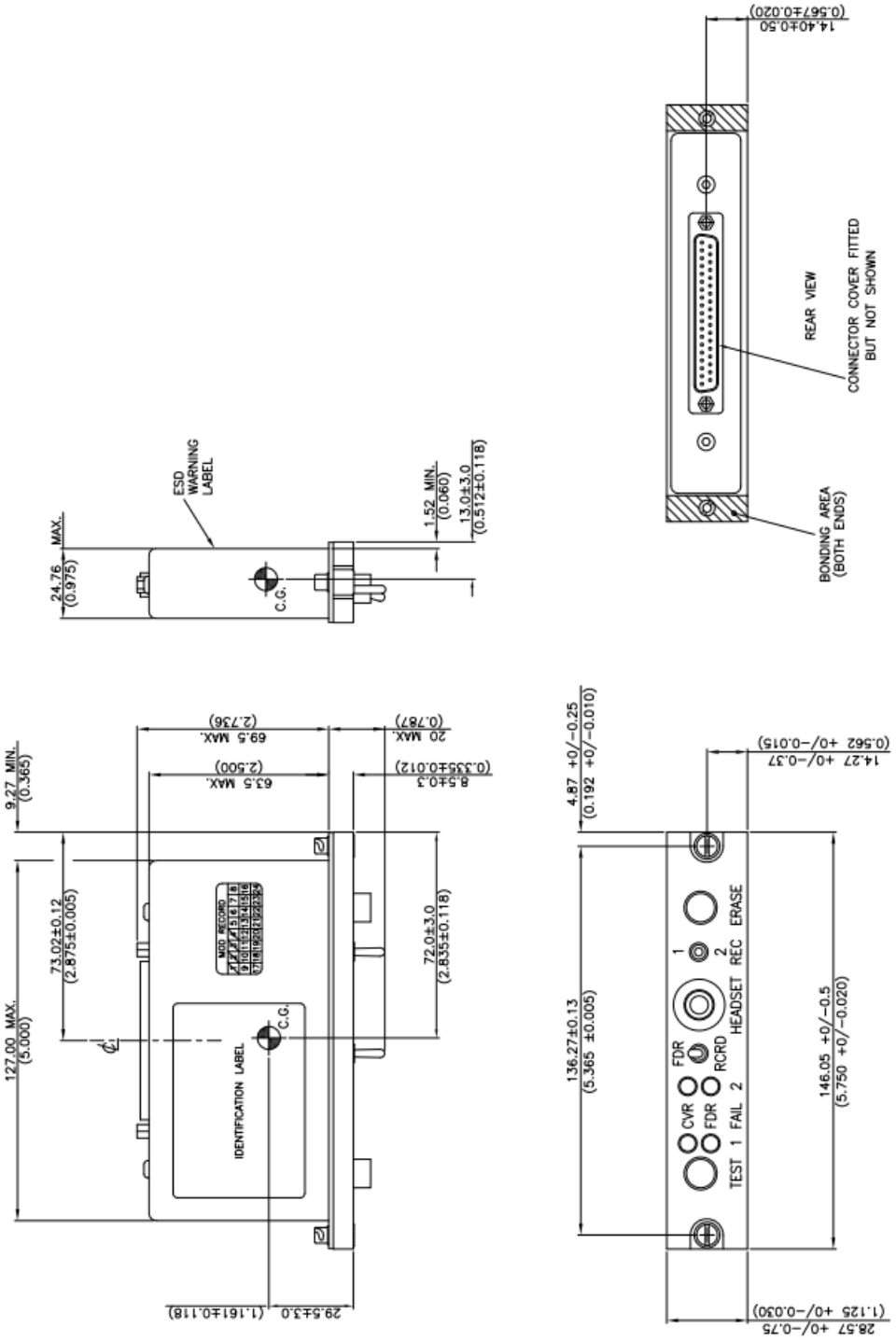

Figure 23 Cockpit Control Unit with Dual DIDAFR support

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5 MAINTENANCE

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

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6 REPAIR

Repair of Cockpit Control Unit Type D51616-XXXX is by return to the P&G UK facility**:**

Penny & Giles Aerospace Ltd.

Curtiss-Wright

15 Enterprise Way,

Aviation Park West,

Bournemouth International Airport,

Dorset, BH23 6HH

UNITED KINGDOM

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 Cockpit Area Microphone (CAM) 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 CAM can 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. Cockpit Area Microphones are identified by the convention shown in *Figure 24* and *Figure 25*.

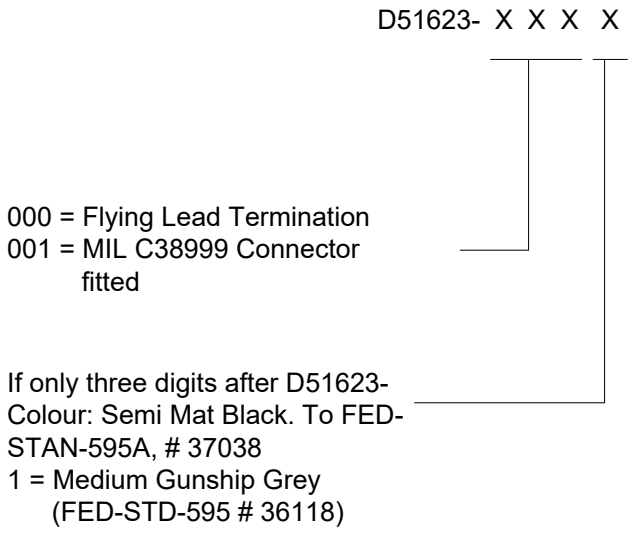

Figure 24 CAM Type D51623 Part Number Options

Figure 25 CAM Type D51702 Part Number Options

1.3.3 ENVIRONMENTAL CHARACTERISTICS

1.3.3.1 CAM TYPE D51623-XXXX

The CAM Type D51623-XXXX satisfies the requirements of RTCA DO-160D, with test categories as shown in *Table 14*.

Table 14 Cockpit Area Microphone Environmental Test Levels

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

1.3.3.2 CAM TYPE D51702-XX

The CAM Type D51702-XX satisfies the requirements of RTCA DO 160G, with test categories as shown in *Table 15*.

Table 15 Cockpit Area Microphone D51702-XX Environmental Test Levels

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

SECTION	REQUIREMENT	Category
25	ESD	A
26	Fire and flammability	C

NOTES:

1. **The CCU and CAM derive power from the DIDAFR 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 26* and *Figure 27* for Installation Drawing and connection details. Pin allocation and cable requirements are shown in *Table 16* and

Table **17.**

Table 16 Type D51623 Microphone Cable Details

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

Table 17 Type D51702 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	

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 26* and *Figure 27*.

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 16* and

Table **17** for the remote Area Microphone. The electromagnetic environment will set the limit on cable length to the microphone. The microphone is supplied with a 293±10 mm long cable as standard.

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

A typical installation wiring diagram for a generic DIDAFR, CCU and CAM installation is shown in *Figure 8*.

2.2 CAM LOCATION

The preferred locations and spacing for the Cockpit Area Microphone are shown in *Figure 28* and *Figure 29*.

2.3 BONDING (RECOMMENDED)

If installing the Type D51702-XX CAM, fit the earth bonding lead to the CAM housing bonding pad, see *Figure 27* for details (screw not supplied).

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

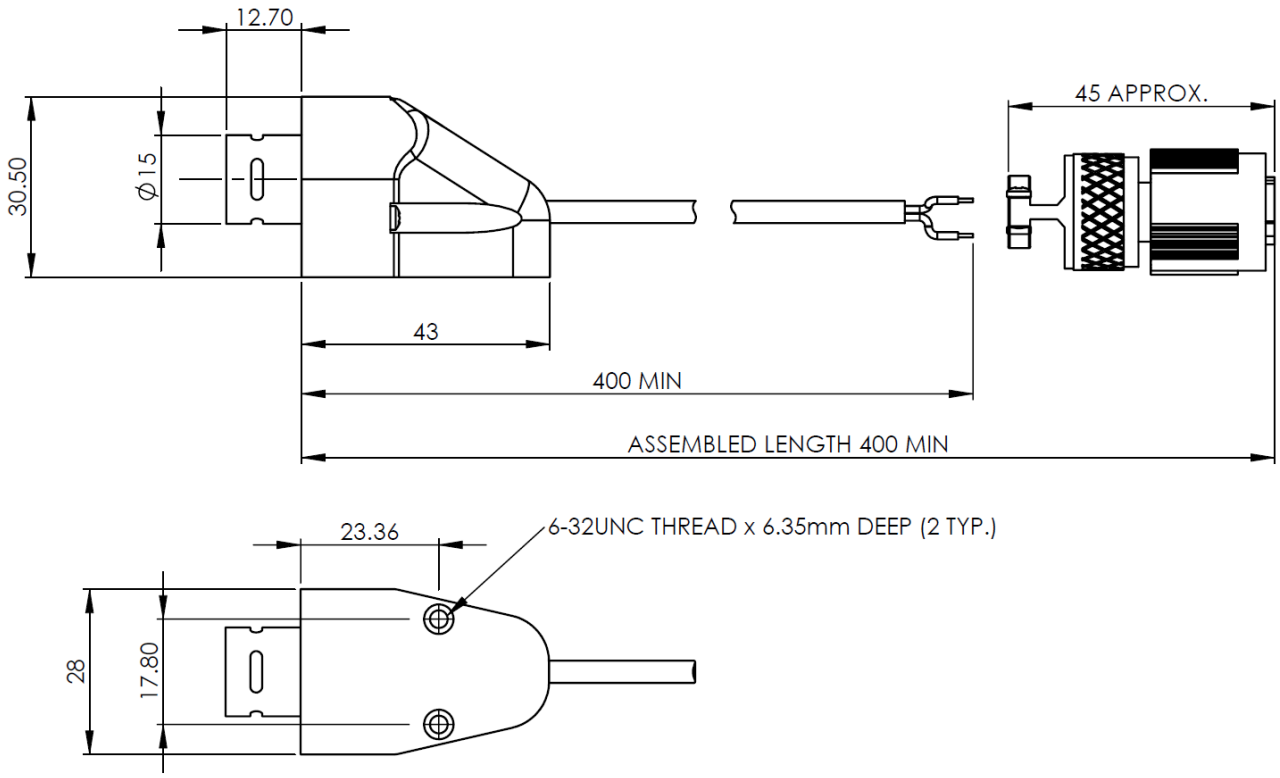

Figure 26 Installation Drawing for the D51623-XXXX Microphone

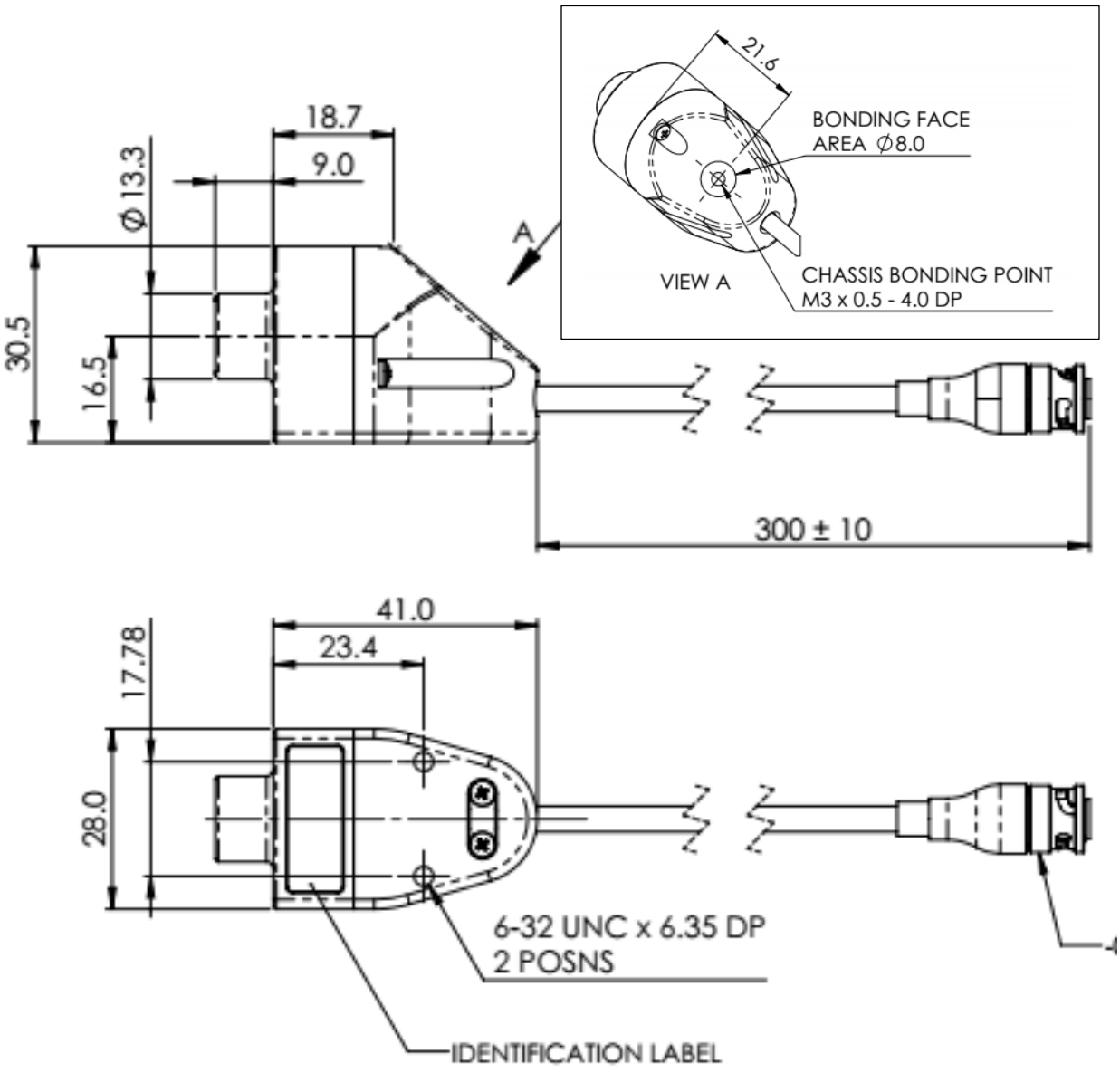

Figure 27 Installation Drawing for the D51702-XX Microphone

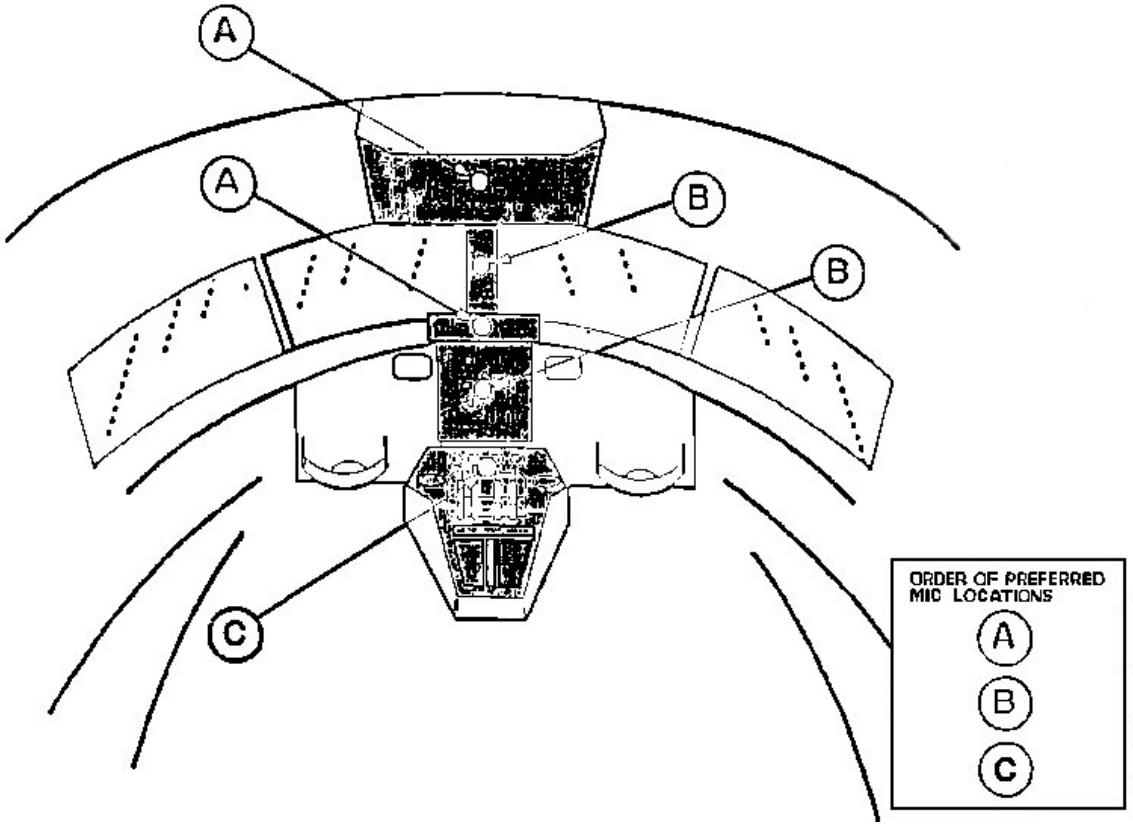

Figure 28 Preferred Locations for the Cockpit Area Microphone

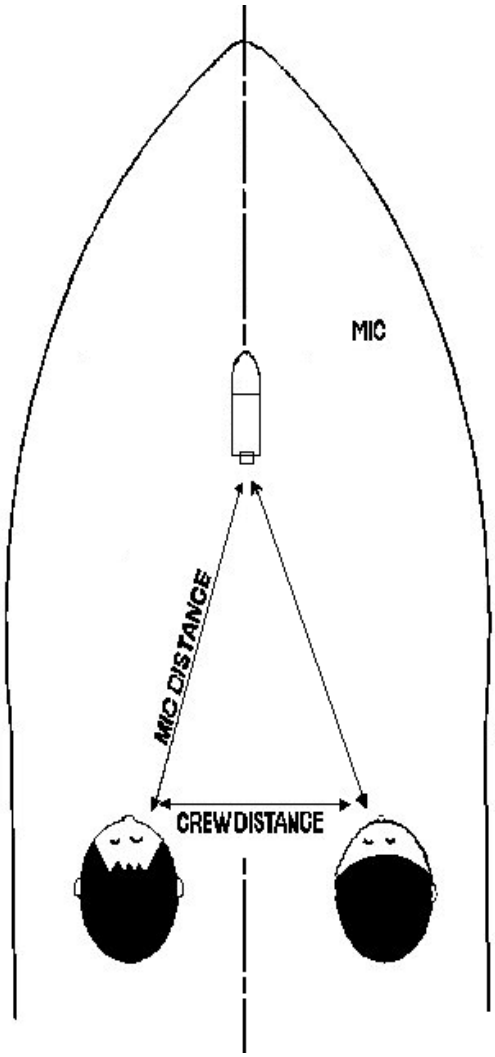

Figure 29 Recommended Microphone Spacing

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3 TESTING

3.1 GENERAL

The Dual Input Data Acquisition Flight Recorder (DIDAFR) has a built-in test capability that detects faults, where possible, within the system via a discrete output.

Table 18 Equipment Required

Item	Equipment
1	Fully Functioning Headset with standard jack socket

Table 19 Referenced Documentation

Item	Description
1	Aircraft Maintenance Manual (AMM)
2	Aircraft Wiring Diagram Manual (WDM)

3.1.1 AUDIO TEST PROCEDURE

(1) Apply power to the system in accordance with the instructions given in the relevant AMM.

(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.

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

(7) Remove headset jack from the CCU socket.

3.1.2 REQUIREMENTS AFTER JOB COMPLETION

(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 Cockpit 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.

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5 UNPACKING

CAUTION:

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

The Cockpit 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.

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6 MAINTENANCE

The concept of on-condition (OC) maintenance applies to the Cockpit Area Microphone. 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.

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7 REPAIR

The Cockpit Area Microphone is not repairable.

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PART 4: RECORDER INDEPENDENT POWER SUPPLY (RIPS)

1 DESCRIPTION, OPERATION AND SPECIFICATION

1.1 DESCRIPTION

The DIDAFR Type D51615-203-XXX and Type D51615-203-XXX-090 have the capability to be connected to a Recorder Independent Power Supply (RIPS), which will provide 10 minutes ±1 minute of electrical back-up power to the CVR/FDR when aircraft systems are inoperative or malfunction.

The RIPS monitors the aircraft 28VDC bus voltage, charges and maintains its internal battery pack. If the aircraft main battery voltage drops to approximately 18VDC, indicative of a normal loss of aircraft electrical power (and/or main battery power) or abnormal aircraft electrical malfunction, the RIPS power switch circuits toggles to discharge the RIPS internal battery power to the recorder equipment at more than 25VDC for a period of 10 minutes ±1 minute. If the aircraft power input and/or main battery voltage increases to 25VDC, or if the 10 minute period elapses, the RIPS ceases to deliver power to the recorder equipment.

The RIPS batteries are charged, if needed, when aircraft power is re-applied.

The RIPS equipment, serving as a back-up power source to the CVR/FDR system, should be installed in close proximity to the recorder equipment.

1.2 RIPS OPERATIONAL MODES

The RIPS operates from the 28VDC bus.

Generically there are four operating modes for the RIPS, depending on the condition of the power input voltage, the ambient temperature and the state of charge on the RIPS internal battery pack. The RIPS operating modes are shown in Table 22.

Table 20.- RIPS Operating Modes

MODE	OPERATING MODE
ACTIVE	RIPS ACTIVE power delivery for 10 minutes.
OFF	RIPS resets the 10 minute timer, charger is disabled.
Heating	Battery pack heater activates when battery pack temperature is less than 0°C.
Charge	RIPS recharges the battery when is not fully charged.

For more specific details refer to the Installation and Operation manual of the RIPS manufacturer.

1.3 SPECIFICATION

For more specific details refer to the Installation and Operation manual of the RIPS manufacturer.

2 INSTALLATION

The RIPS equipment consists of two assemblies, the Charger and the removable/replacement Battery Pack.

The RIPS is hard mounted to the aircraft structure, or suitable adaptor plate, in close proximity to the CVR/FDR system.

For more specific details refer to the Installation and Operation manual of the RIPS manufacturer.

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3 STORAGE

To discharge/recharge the RIPS battery pack in storage, refer to the Installation and Operating manual of the RIPS manufacturer.

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4 UNPACKING

The RIPS contains electronic components that can be damaged by ESD and rough handling.

For general handling precautions and instructions, refer to the Installation and Operation manual of the RIPS manufacturer.

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5 MAINTENANCE

There is no scheduled maintenance required for the RIPS. All of the RIPS functions are automatic (i.e. MAINTENANCE Self-Test).

For more specific details on maintenance, refer to the Installation and Operation manual of the RIPS manufacturer.

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6 REPAIR

The RIPS is a non-repairable unit.

For more specific details on repair, refer to the Installation and Operation manual of the RIPS manufacturer.

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