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To	DFDR Subcommittee	**Date**	December 5, 2014
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Subject

Draft Circulation
Draft 1 of Supplement 1 to ARINC Characteristic 757A: *Cockpit Voice Recorder (CVR)*

Summary

Supplement 1 to ARINC Characteristic 757A was prepared by the ARINC IA staff from inputs provided during web conferences held in 2013.

Technical Changes in Yellow:

The technical changes are summarized as follows:

- The definition of the On-board Maintenance System (OMS) interface was clarified.
- The CVR Status Word sent to the OMS was updated.
- Sign Status Matrix (SSM) updated per ARINC Specification 429
- Recorder Independent Power Supply (RIPS) guidance was updated.
- Notes pertaining to aircraft interwiring have been updated.

Technical changes to this draft are shown in blue bold ~~(and red strikeout)~~ with yellow highlight.

Document Alignment Changes in Gray:

Supplement 1 also introduces a variety of changes as a result of the publication of ARINC Characteristic 757-5 and the pending Supplement 6 to ARINC Characteristic 757. Because these documents are closely related, Supplement 1 includes changes which are intended to align the documents.

Changes intended to align ARINC 757 and ARINC 757A are shown in blue bold ~~(and red strikeout)~~ with gray highlight. These changes have already been approved for inclusion in ARINC Characteristic 757.

Action

This draft will be reviewed at the ad hoc CVR Working Group meeting to be held February 10-12, 2015 in Sarasota, Florida. Comments on the attached draft are invited. They should be directed to Paul Prisaznuk before **January 15, 2015.**

Preamble:

When this Supplement has been completed, adopted and published, Sections A, B and C will be affixed to the end of the published Characteristic. These pages, currently numbered a, b, c…, are used to explain the changes that will be made by this draft Supplement. The content of Sections A, B and C is under development in parallel with the changes to the body of the existing standard. Therefore, changes to their content are shown in blue bold in the same manner as changes to the body of the document.

Section A is written as it is expected to read when the Supplement is mature.

When the changes developed in this Supplement are integrated into the existing standard, they will be identified by blue bold.

Section C contains a cumulative list of entries describing the changes to be incorporated by this Supplement. Typically, Section C expands in size with each draft.

DRAFT 1 OF

SUPPLEMENT 1 TO

ARINC CHARACTERISTIC 757A

COCKPIT VOICE RECORDER (CVR)

Published: Month Day, Year

Prepared by the AEEC

PURPOSE OF THIS DOCUMENT

This supplement was prepared for the purpose of including both technical and non-technical changes to ARINC Characteristic 757A. The technical changes include that which redefine the ARINC 429 recorder status data word format used with Cockpit Voice Recorder (CVR) communications with the On-board Maintenance System (OMS).

Several changes introduced by Supplement 1 are intended to align ARINC Characteristic 757 and ARINC Characteristic 757A. The changes are intended to clarify the difference in the two respective CVR definitions.

B. ORGANIZATION OF THIS SUPPLEMENT

In this document **blue bold** text is used to indicate those areas of text changed by the current supplement only.

C. CHANGES TO ARINC CHARACTERISTIC 757A INTRODUCED BY THIS SUPPLEMENT

This section presents a complete listing of the changes to the document introduced by this supplement. Each change is identified by the section number and the title as it will appear in the complete document. Where necessary, a brief description of the change is included.

General Changes

The following changes were introduced in Supplement 1 to ARINC Characteristic 757A for the purpose of aligning the document to ARINC Characteristic 757.

- Common Table of Contents
- “Should” changed to “shall” as applicable.
- “Voice erase” changed to “audio erase.”
- Numerous editorial changes were introduced to clarify text.

1.2.1 Relationship to ARINC Characteristic 557

This section was added to maintain alignment with ARINC Characteristic 757.

1.2.2 Relationship to ARINC Characteristic 757

This section was renumbered and updated to clarify the role of the OMS interface, which is optional in ARINC Characteristic 757, but not optional in ARINC Characteristic 757A.

1.2.3 Relationship to ARINC Characteristic 747

This section was added to maintain alignment with ARINC Characteristic 757.

1.2.5 Relationship to ARINC Specification 429

This section was renumbered and updated to describe the OMS interface.

1.2.6 Other Documents

This section was renumbered per ARINC Characteristic 757.

1.3 Unit Description

This section was updated to clarify the differences in the equipment designed to ARINC Characteristic 757A versus those designed to ARINC Characteristic 757.

1.3.1 Additional Features (Optional)

This section was updated to say that the Cockpit Voice Recorder may provide the capability to store digital data link communications during the recording period stipulated by regulatory requirements. The wording was aligned to ARINC Characteristic 757.

1.6 Interchangeability

A cautionary statement was added pertaining to the use of an internal Recorder Independent Power Supply (RIPS). The wording was aligned to ARINC Characteristic 757.

2.1 General

A statement was added to address the need for compatibility of system components. The wording was aligned to ARINC Characteristic 757.

2.2.4 Input and output Signal Characteristics

The wording was aligned to ARINC Characteristic 757.

2.3 Standard Interwiring

Commentary added on the subject of connector keying.

2.5 Environmental Specification

The wording was aligned to ARINC Characteristic 757.

3.1.2 Audio Erase

Commentary added to prevent inadvertent erasure of the recorder. The wording was aligned to ARINC Characteristic 757.

3.1.3 Audio Levels

The wording was aligned to ARINC Characteristic 757.

3.3 Aircraft Configuration Interface

The use of Record Enable jumper wires was clarified. The wording was aligned to ARINC Characteristic 757.

3.5.1 Minimum Requirements

The Commentary on switches and lamp loads was corrected for accuracy.

3.5.3 FDR Fault (Pin 24)

Section added to recognize Spare pin 24, not used with ARINC 757A recorders.

3.5.4 FDR Status (Pin 36)

Section added to recognize Spare pin 36, not used with ARINC 757A recorders.

3.5.5 Indicator Power Input (Pin 4)

Section added to recognize Spare pin 4, not used with ARINC 757A recorders.

3.5.6 FDR Maintenance (Pin 46)

Section added to recognize Spare pin 46, not used with ARINC 757A recorders.

3.5.7 Data Link Fault (Pin 31)

This section was renumbered and updated to say that pin 31 should be left open when the data link function is not present.

3.5.8 OMS Compatibility

This section was renumbered.

3.7 Crash Protection

The wording was aligned to ARINC Characteristic 757.

3.8 Time Correlation

The wording was aligned to ARINC Characteristic 757.

3.9 Data Link Communication (Optional)

This section was updated to say that when this function is implemented, then it shall be implemented in a specific way.

3.10 Combined Voice and Flight Data Recorder

This section was added for the purpose of aligning the table of contents to ARINC Characteristic 757.

3.11 Recording Start/Stop

This section was updated to clarify requirements for recording start and stop. The wording was aligned to ARINC Characteristic 757.

4.0 Provisions for Test

This section was updated to clarify the requirement for OMS reporting.

ATTACHMENT 2 – CVR INTERWIRING DIAGRAM WITH REMOTE MICROPHONE (AC POWER SHOWN)

The drawing was modified to remove the direct wiring of ground connections between the CVR and the control unit. Each is grounded to the airframe within 1 foot of the connector.

ATTACHMENT 3 – CVR INTERWIRING DIAGRAM WITH REMOTE MICROPHONE (DC POWER SHOWN)

The drawing was modified to remove the direct wiring of ground connections between the CVR and the control unit. Each is grounded to the airframe within 1 foot of the connector.

The drawing showing the “AREA MIC” connection previously called out Note 12 in error. This is now corrected to read Note 11.

ATTACHMENT 5 – CVR STANDARD INTERWIRING PIN DESIGNATION

Voice Erase changed to Audio Erase per ARINC Characteristic 757.

ATTACHMENT 6 – NOTES TO STANDARD INTERWIRING

Note 3, Audio Monitor Out, aligned to ARINC Characteristic 757.

Note 8, Chassis Ground Connection was expanded with new language provided.

Note 19, Stop CVR Recording, aligned to ARINC Characteristic 757.

ATTACHMENT 10 – MICROPHONE AND CABLE

Drawing updated to describe 3-conductor microphone wiring.

ATTACHMENT 11 – CONTROL UNIT STANDARD INTERWIRING

Voice Erase changed to Audio Erase per ARINC Characteristic 757.

ATTACHMENT 12 – NOTES TO CONTROL UNIT STANDARD INTERWIRING

Note 5 was updated to correct a typographical error in the pin call-outs for Crew Area Microphone (CAM) gain selection, now reading: “pins p, r, or t.”

ATTACHMENT 19 – RECORDER STATUS/OMS COMMAND WORD FORMAT

This attachment contains the definition of the Recorder Status Word, per ARINC 429 label 350. Bit 23 is defined as the “FDR/CVR Inhibit” discrete.

The Sign Status Matrix (SSM) bits 30 and 31 were aligned to that defined by ARINC Specification 429.

ATTACHMENT 20 – FAULT AND STATUS OUTPUT CONDITIONS

Note 17, RIPS Fault, was modified to say that an internal RIPS fault may be reported to the OMS.

APPENDIX D – GUIDANCE MATERIAL FOR INSTALLATION OF COMBINED VOICE AND FLIGHT DATA RECORDERS

This appendix was added to align with ARINC Characteristic 757.

APPENDIX E – INTERNAL OR EXTERNAL RIPS IMPLEMENTATION

The appendix was renumbered to align with ARINC Characteristic 757.

APPENDIX F – GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

The appendix was renumbered to align with ARINC Characteristic 757.

APPENDIX G – ACRONYMS AND ABBREVIATIONS

This appendix was added by Supplement 1.

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DRAFT 1 OF
SUPPLEMENT 1 TO
ARINC CHARACTERISTIC 757A
COCKPIT VOICE RECORDER (CVR)

This draft dated: December 5, 2014

APPENDICES

1.0 INTRODUCTION

1.1 Purpose of this Document

This document is intended to provide design guidance for the development and installation of a new generation of Cockpit Voice Recorders (CVRs) which may utilize solid state memory and employ analog to digital conversions and related voice encoding techniques. The document supersedes the earlier ARINC Characteristic 557 and covers the overall Cockpit Voice Recorder system requirement but does take into consideration the detailed audio distributing system in the aircraft. The Cockpit Voice Recorder will be utilized to record aural communication between crew members and record the sounds of the acoustical environment of the cockpit. Attachment 1 shows a general system block diagram and the interfaces to the Cockpit Voice Recorder. The document provides specific guidance for the installation and for information to ensure customer controlled interchangeability of the equipment in a standard aircraft installation. Further, it assists in the functional verification and retrieval of the recorded information.

1.2 Basic Principles

The objective of this Characteristic is primarily to describe equipment and installation standards capable of meeting the mandatory recording requirement. Further considerations are given to the crash survival requirements and methods for system evaluation and information retrieval. This document makes provisions for a voice recorder, digital communication message recording and the operation with an optional external Recorder Independent Power Supply (RIPS).

1.2.1 Relationship to ARINC Characteristic 557

ARINC Characteristic 557 on Airborne Voice Recorders (1964) describes equipment and installation standards for the earlier Cockpit Voice Recorder (CVR). The characteristics of ARINC 557 systems have been considered in the ARINC 757A interwiring, though the units are not intended to be interchangeable.

~~1.2.1~~1.2.2 Relationship to ARINC Characteristic 757

ARINC Characteristic 757A covers implementation of a Cockpit Voice Recorder (CVR), configured for RIPS status monitoring and OMS reporting. In contrast, ARINC Characteristic 757 covers implementation of a Combined Voice and Flight Data Recorder (CVFDR)**, configured for RIPS status monitoring and optional OMS reporting.** For more details of the combined voice and flight data recording provisions, see ARINC Characteristic 757.

Also, in ARINC Characteristic 757A the AC and DC power returns are separated and isolated.

It is not intended that ARINC 757A recorders will be compatible with airplanes configured for ARINC 757 recorders.

1.2.3 Relationship to ARINC Characteristic 747

ARINC Characteristic 747 defines the Flight Data Recorder (FDR). The guidance is not applicable to this document.

~~1.2.2~~1.2.4 Relationship to ARINC Characteristic 777

ARINC Characteristic 777 includes provisions and considerations for interfacing the recorder with an external Recorder Independent Power Supply (RIPS). This document also describes optional inclusion of the RIPS functionality within the recorder. For more details of the RIPS requirements, see ARINC Characteristic 777.

~~1.2.3~~1.2.5 Relationship to ARINC Specification 429

Digital interface signals to the Onboard Maintenance System (OMS) **shall be provided per** ~~have been considered for~~ ARINC Specification 429**. The bit rate may be either** low-speed **or** ~~and~~ high-speed.

Digital interface signals from the source of Data Link messages are provided per ARINC Specification 429. Depending on the source, the bit rate may be either low-speed or high-speed. The file data transfer protocol used to deliver the data link messages may be either Williamsburg Version 1 or Version 3.

~~1.2.4~~1.2.6 Other Documents

EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems was developed by an international committee including many accident investigators. It is essentially an upgrade of the EUROCAE ED-55 and ED-56A MOPS. ED-112 addresses higher audio quality in Cockpit Voice Recorders with solid state memory and up to 2 hour recording time. It also specifies higher crash survival requirements and an extended fire test. The test procedures for crash survival testing are clarified to assure equal testing levels by different manufacturers. Recording quality on each of the four (4) separate audio channels is defined and performance during power interruption has been clarified.

1.3 Unit Description

The Cockpit Voice Recorder receives four (4) separate audio inputs, three (3) crew communication channels and one (1) area microphone input. The recorder processes and stores this information (data) in crash protected memory. The recording duration will be determined by market and regulatory requirements.

The recorder **shall** provide an ARINC 429 interface for BITE information to the On-board Maintenance Systems (OMS). The Cockpit Voice Recorder monitors the RIPS status and reports this status via the OMS ARINC 429 interface.

COMMENTARY

The word memory used in this section and through the remainder of the document is used to describe a nonvolatile storage medium into which information can be stored and held until some later time, and from which the entire original information can be retrieved.

1.3.1 Additional Features (Optional)

a. The Cockpit Voice Recorder may provide the capability to store digital **data link communications during the recording period stipulated by regulatory requirements.** ~~communication from ATC during the recording period of up to 2 hours~~ An ARINC 429 input has been reserved for this interface. Refer to EUROCAE ED-93.

b. The Cockpit Voice Recorder may provide the capability to record Universal Time Coordinated (UTC) from a suitable time source, via an ARINC 429 interface.

c. The functionality of a RIPS, as described in ARINC Characteristic 777, may be integrated as part of the CVR (internal RIPS).

1.3.2 Data Compression

Data compression, if utilized to reduce the size of the memory, shall meet the regulatory requirements.

COMMENTARY

EUROCAE ED-112 addresses audio quality in detail.

1.4 Reliability

The operational use of the CVR demands the utmost attention to the need for reliability in all phases of design, production, installation and operation of the equipment. Solid state memory elements inherently provide higher reliability over high maintenance electro-mechanical systems.

COMMENTARY

The designer may be surprised to find no elaborate requirements for reliability. The airlines are in a fortunate position in this regard, because they have found the pressures of the marketplace exert a truly meaningful influence upon the design and production quality control necessary to achieve high equipment reliability. The key advantage enjoyed by the vast majority of airlines is the ability to purchase existing, fully operational equipment “off the shelf” after the product has established itself in the market.

1.5 Maintainability

A high degree of maintainability is expected by the user. Therefore, the system and unit design should provide for optimal maintainability.

As a minimum, the design should provide for replaceable, functional modules as far as practical with Built-in-Test Equipment (BITE) incorporated to detect and isolate failures.

COMMENTARY

If the recorder incorporates replaceable energy storage (e.g., batteries), it should be possible to replace the storage element without replacing or opening the recorder or causing significant return-to-service testing. The storage element and its interface should be designed so that it can be installed or removed while supplying power or being charged without damage to the equipment or hazard to personnel.

The recorder and its installation should be designed such that no damage to equipment or aircraft or harm to personnel will result from installing or removing the recorder while power is applied (hot-plugging). This is especially of concern in aircraft where an external RIPS is used. Provisions should include proper grounding of equipment and unused connector pins, inrush-current limiting, and circuit protection to prevent damage from partial or intermittent engagement of the connector. Additional provisions should be included to minimize or eliminate sparking during engagement or

disengagement of the connector. Appropriate warning placards should be visible to notify personnel of the possible presence of power.

1.6 Interchangeability

The basic CVR specified by this characteristic should be electrically and mechanically interchangeable among manufacturers.

COMMENTARY

Interchangeability between system components from various manufacturers is not intended. Since different audio encoding techniques may be used, manufacturer dependent interface will be needed for information retrieval from the memory. A standard digital or analog output from retrieval equipment is recommended, providing thereby the interchangeability of equipment for voice and information analysis, data processing and storage.

~~Consideration should be given for use of~~ **Caution should be taken if using** a recorder that includes an internal RIPS on aircraft that are equipped with an external RIPS. Means should be provided to easily disable the internal RIPS or to make its operation benign. See Appendix E herein for discussion of this issue.

1.7 Regulatory Approval

The Cockpit Voice Recorder should meet all applicable regulatory requirements. For those recorders employing digital encoding, a validation test of the recorded information may be required as part of the normal approval of the original equipment on the aircraft or by a supplemental type certification. The equipment manufacturer should refer to the applicable regulation. The installation manual should provide guidance on aircraft system testing to show compliance with the appropriate regulations.

2.0 INTERCHANGEABILITY STANDARDS

2.1 General

It is of prime importance that the Industry establishes specific form factors, mounting provisions, interwiring, inputs and output signal levels, and power supply standards for the Cockpit Voice Recorder. The establishment of aircraft installation standards cannot await the completion of the new equipment developments by the manufacturers. Because of the very extensive potential cost savings involved, advance planning on the part of the airline customers has always been necessary and is particularly so with the many problems of adding equipment to present aircraft and planning future installation.

Manufacturers should note that although ARINC Characteristic 757A does not preclude the use of standards different from those set forth herein, the practical problems of redesigning what will then be a standard aircraft installation to accommodate some special installation could very well make use of that other design prohibitively expensive for the potential customer. Therefore, manufacturers should recognize the practical advantage of developing equipment in accordance with the standard form factors and the standard interwiring shown in this document.

To ensure compatibility between specific recorders, control units, and microphones, these items should be sourced from the same manufacturer.

2.2 Form Factors, Connectors and Index Pin Coding

2.2.1 Cockpit Voice Recorder (CVR)

The Cockpit Voice Recorder shall comply with all requirements of ARINC Specification 404A for the 1/2 ATR short form factor.

2.2.2 Weight

The maximum weight of the Cockpit Voice Recorder should be 20 pounds.

2.2.3 Connectors

The Cockpit Voice Recorder shall be provided with a rear mounted single-shell 57-pin connector as defined in the latest revision of MIL-C-81659. Also, see ARINC Specification 404A for information and guidance. For the Cockpit Voice Recorder the equivalent of index pin coding is provided as an integral part of the single shell connector assembly as called out in Attachment 13. The connector shall be positioned as shown in Attachment 13. ARINC Specification 404A does not provide mounting standards for use of this type of connector or others in the series.

A front mounted connector may be provided for ground support functions and should include an information monitoring capability and verification of the BITE status. Voice and audio data stored in memory should not be available from this connector unless the unit is removed from the aircraft.

The keying configuration shall be as shown in Attachment 13. It is defined by ARINC Specification 404B, Appendix B, position 22.

2.2.4 Input and Output Signal Characteristics

All inputs and outputs are specified in Section 3 and are needed to ensure electrical interchangeability among ARINC 757A recorders **built to the same supplement level**.

2.3 Standard Interwiring

The standard interwiring of Attachment 2 and 3 is defined to ensure compatibility of the recorder in basic ARINC 757A Cockpit Voice Recorder systems. Provisions for optional interfaces are also included (Reference Section 1.3.1).

COMMENTARY

An ARINC 757A recorder is incompatible with an ARINC 757 configured aircraft. The connectors are keyed differently to prevent installation of an incompatible recorder.

2.3.1 Wire Size

The equipment design should be such that currents in all interconnecting and power leads are less than 5 amps.

The equipment design should be such that for all interwiring with the exception of the specific wires exempted, cable runs up to 50 feet using wire no larger than No. 22 gauge will provide satisfactory operation of the equipment.

COMMENTARY

Suppliers should note that airframe manufacturers have planned to make use of wiring that allows correct operation of all CVR functions. The industry has generally preferred a minimum copper wire size of No. 22, but will support No. 24 gauge wire in those aircraft installations where special consideration is given to the manner of installation, the type of insulation used, and where the resistance of the wires actually employed is kept within the total allowable resistance authorized by the above specified limit of 50 feet (or 100 feet on some wires) of No. 22 gauge wire.

2.3.2 Shielding or Special Cabling

The standard interwiring of Attachment 2 and 3 specify certain shielded, twisted, or both twisted and shielded cabling which are expected to be provided in the standard aircraft installation. The equipment design should not require any shielded wire, specially twisted cables or other special installation treatment except as specifically shown in the interwiring diagram.

2.3.3 Standard Category Wiring

In developing a standard interwiring diagram, it is the practice to designate the functions of specific wires or specific pins on the connectors so they may be used for specific purposes. Where a specific Recorder Unit is used, only the same manufacturer's microphone and Control Unit should be used. Therefore, there is less need for specifying specific functions on each wire, particularly where the interconnecting wires run between major units of equipment. The interconnecting wires do not need to make connections in the junction box with power circuits or other aircraft control and instrumentation circuitry. Accordingly, it is often possible to merely specify the wire run rather that the specific use of certain wires to permit additional flexibility for the set designer. The important consideration is that the purchaser of the equipment and the airframe manufacturer planning an aircraft installation of the equipment should know the exact wiring required in an aircraft to permit any manufacturer's equipment to operate satisfactorily.

Thus, the user must know whether a particular wire is allocated to a specific function, for a standardized use by all manufacturers, or whether this wire is one which can be employed by different set manufacturers for different applications as long as it does not require any special shielding, special size or other special treatment which is not called out on Attachments 2 and 3, Standard Interwiring.

COMMENTARY

Consideration should be such that wires are routed for maximum survivability. Wires such as power circuits, common ground, standard inputs and standardized instrumentation functions fall in this category of Specified Function Wires which are those wires that have the runs designated and specific function labels assigned. The use is restricted to the specific function given on the standard interwiring drawing.

2.4 Primary Power Input

The equipment shall be designed to operate with input power of 28 Vdc.

In addition, the recorder may be designed to operate with input power of 115 Vac 400 Hz, or variable frequency 115 Vac (360 to 800 Hz) single phase, per the following:

ARINC Report 609: *Design Guidance for Aircraft Electrical Power Systems*

ARINC Report 607: *Design Guidance for Avionic Equipment*

In installations where the 10 minute continuation of recording requirement is satisfied using an external Recorder Independent Power Supply (RIPS) and the aircraft uses AC power, the recorder may be presented with AC power, DC power, or both. Failure of one part of the recorder power supply shall not affect operation of the other. Detailed guidance on primary power input can be found in EUROCAE ED-112.

AC Power Return, DC Power Return, and Chassis Ground shall all be electrically isolated from each other.

COMMENTARY

The power that may be consumed by the recorder is limited by the capacity of the RIPS. See ARINC Characteristic 777 for this limit. In installations with an internal RIPS, consideration should be given to limiting instantaneous power consumption during system power-up, since the combination of recorder inrush current and the storage recharge may overload the supply circuits.

The use of power interlocks to meet regulatory requirements may complicate implementation of a RIPS capability. Refer to Appendix E herein for further details.

2.5 Environmental Specification

~~The equipment should be designed to meet the environmental specifications applicable to the installation as set forth in the version of RTCA DO-160 agreed upon by the applicable certification authority. The recorder should meet the minimum performance requirements of EUROCAE ED-112, TSO-C-123b and other applicable regulations.~~

The equipment should be designed to meet the environmental minimum performance specifications as agreed upon by the applicable certification authority. DO-160, ED-112, TSO-C123, TSO-C124 and TSO-C177 provide further guidance.

COMMENTARY

An avionics manufacturer should survey the specifications presently in use by the airframe manufacturer and should be aware that the requirements of airframe manufacturers may differ from RTCA DO-160.

2.6 Software Design Guidance

Cockpit Voice Recorder equipment manufacturers should use RTCA DO-178/EUROCAE ED-12: Software Considerations in Airborne Systems and Equipment Certification and EUROCAE ED-112 for guidance during the design process.

2.7 Hardware Design Guidance

Cockpit Voice Recorder equipment manufacturers should use RTCA DO-254/EUROCAE ED-80: Design Assurance Guidance for Airborne Electronic Hardware for guidance during the design process.

3.0 RECORDER DESIGN

3.1 General

The Cockpit Voice Recorder shall be designed to receive, process, record, and preserve audio signals from four sources. It may also be used to record data link communication.

3.1.1 Recording Technology

No constraint is intended on the memory technology that is utilized. The method of recording and storage will be determined by market and regulatory requirements. Retrieval of the data shall not alter or rewrite the data in the storage medium. Data compression can be utilized to reduce the memory size but shall be reversible and shall meet the requirements specified by EUROCAE ED-112.

3.1.2 Audio Erase

A provision for erasing or disallowing normal playback operations of the recorded audio signal should be provided. Proper interlock will be required such that the erase function can only be activated at the conclusion of the flight. See Attachment 7. **Inadvertent activation should be minimized.** More detailed guidance on interlocks can be found in ED-112.

COMMENTARY

In addition to other interlocks, one method to help minimize inadvertent activation of this function is to require that the Erase button be held for a period of time before erase actually commences.

3.1.3 Audio Levels

Area mic **performance** ~~sensitivity~~ shall be as defined in ED-112 and the corresponding voltage presented to the recorder is defined by the recorder manufacturer. Input levels for crew audio **shall be as** ~~are~~ defined in Attachment 6, Note 11.

3.2 Information Recovery

The information recovery equipment or interface unit is outside the scope of this Characteristic. However, the interface is part of the system design consideration. Means should be provided to enable the aircraft crew to concurrently monitor the information which is being recorded. The means for copying the **CVR audio** information, which has been stored in the memory, should require that the recorder be removed from the aircraft. A recorder front panel connector or pins on the rear connector may be used for monitoring recorded information. The primary interface for information recovery is to be specified by the equipment manufacturer.

3.3 Aircraft Configuration Interface

~~No aircraft dependent interface is considered at this time. A Record Enable interface is provided in the aircraft connector (jumper pin 7 to 8). When the recorder is removed from the aircraft and power is applied, the recorder will not record or erase previously stored information. When installed on the aircraft, the CVR audio data cannot be downloaded.~~

A Record Enable interface is provided in the aircraft connector (jumper pin 7 to 8). When the recorder is removed from the aircraft (pins 7 and 8 not

jumpered) and power is applied, the recorder shall not record or erase previously stored information. When installed on the aircraft (pins 7 and 8 jumpered), the recorder shall inhibit audio replay.

COMMENTARY

If Record Enable (pins 7 and 8) is controlled with logic there is the possibility that audio replay could occur when pins 7 and 8 are open. In this configuration, additional steps should be taken to prevent audio replay on the aircraft.

3.4 Power Interruptions

Performance during power interruptions shall be as defined in ED-112.

3.5 Failure Warning and Functional Test

Basic industry philosophy and requirements applicable to failure monitoring and warning systems are set forth in ARINC Report 624. In particular, the reader is referred to ARINC Report 624 for a description of the relationship between “Minimum Requirements” and “Customer Needs” as used in this document.

3.5.1 Minimum Requirements

Means shall be provided in the equipment for preflight dispatch tests. As a minimum, such tests should determine that information is being stored in the recording medium.

Correct operational status shall be indicated by a standard ground signal on CVR Fault and Data Link Fault, as defined in Sections 3.5.2 and 3.5.7. These signals shall be capable of controlling a lamp or relay load within the range of 1 to 100 milliamperes where the power is derived from a standard +28 Vdc aircraft electrical system including the voltage transients described in ARINC Report 609.

The “Standard Ground” signal may be generated by either a solid state or mechanical type switch. In either case, a “contact potential” or residual voltage of 3.5 volts or less shall represent the “grounded” condition with 100 mA current. For additional information, refer to ARINC Specification 720.

COMMENTARY

Detailed requirements for built-in test equipment are not given since the pressures of the marketplace exert a compelling necessity for the designer to ensure a high maintainability for the equipment. It is expected therefore, that BITE equipment will detect at least 95% of failures and assign these to the correct LRU with a probability of at least 95%.

When a switch manufacturer specifies a steady state lamp load rating of 0.2 amps, it is implied that the switch is designed to handle the high lamp load inrush currents resulting from the low resistance of the filament when the lamp is cold. An estimate of the inrush current is widely accepted to be 10 times the steady state lamp load. **Therefore, a switch intended to carry a 0.2 amp lamp load must be rated for at least 2 amps** ~~0.2 amps~~**.**

3.5.2 CVR Fault (Pin 23)

The CVR monitoring circuitry shall provide a CVR fault signal as defined in Attachment 20.

COMMENTARY

In CVR installations where an internal independent power source is utilized to fulfill the requirement for 10 minute sustained recording, the CVR monitoring circuitry should be capable of monitoring and reporting the health of the internal independent power source.

3.5.3 FDR Fault (Pin 24)

Not used. Pin 24 is Spare.

3.5.4 FDR Status (Pin 36)

Not used. Pin 36 is Spare.

3.5.5 Indicator Power Input (Pin 4)

Not used. Pin 4 is Spare.

3.5.6 FDR Maintenance (Pin 46)

Not used. Pin 46 is Spare.

~~3.5.3~~3.5.7 **Data Link Fault (Pin 31)**

The data link monitoring circuitry shall provide a Data Link Fault signal as defined in Attachment 20. **If a data link function is not present, this pin shall be left open.**

~~3.5.4~~3.5.8 **OMS Compatibility**

The Cockpit Voice Recorder shall provide the necessary ARINC 429 input/output to interface with an On-board Maintenance System (OMS). This interface shall be used to transfer the data as defined in Section 4.2.1.

3.6 Recording Duration

The Cockpit Voice Recorder shall have a recording duration as specified by the applicable regulation and operating requirements for an aircraft of a certain size or weight and operating classification. See ED-112 for further details.

3.7 Crash Protection

The recorder shall meet the survival requirements of ED-112 with its defined test procedures and test sequence. **ED-112 also provides guidance on the location of the recorder installation.**

COMMENTARY

~~Most regulatory agencies require that an approved underwater locator device be securely fastened to the crash survival portion of the Cockpit Voice Recorder, and most airlines require that this device can be tested and serviced without disassembly of the recorder. Consideration should be given to the location of the CVR installation and associated wiring so as not compromise its serviceability. See ED-112 for more guidance.~~

Most regulatory agencies require that an approved underwater locator device be securely fastened to the crash survival portion of the recorder. Consideration should be given to ease of access for maintenance purposes.

3.8 Time Correlation

Accident investigators have experienced difficulties in establishing a time correlation between the Cockpit Voice Recorder and the Flight Data Recorder information. ICAO recommends that a means for accurate time correlation should be provided between the Cockpit Voice Recorder and the Flight Data Recorder.

One approach for CVR/FDR time synchronization is for the CVR to receive Universal Time Coordinated (UTC) directly from the captain's clock via a low-speed ARINC 429 channel. The label of this clock is 125 for BCD, and 150 for the Binary version. ~~This is highly desirable for time correlation of the recorded audio itself (during extended power interruptions) and for synchronization with other recording devices (e.g., the Flight Data Recorder).~~

COMMENTARY

When recording Digital Communications Data Link, airplane system designers should take measures **to ensure** that the time stamping contained in recorded data link messages addressed in ARINC Specification 619 can be correlated with the source for time input to the CVR input (UTC IN (429)).

Some aircraft are not equipped with ARINC Standard clocks. In these aircraft, the FDAU provides a time marker as a tone burst output, using Frequency Shift Key (FSK) modulation. The frequencies used are 3607 Hz (±30 Hz) and 4193 Hz (±30 Hz), which are outside the required audio pass-band. This tone is recorded on one of the CVR channels (3rd crew member/PA). Both 12-bit and 32-bit codes have been used. As an option, the CVR should be capable of recording these tone bursts. If new recorders employ sharp filters at the audio pass-band and they are unusable to record these tones, alternate methods may need to be used to meet these requirements.

COMMENTARY

In some existing CAA installations, the aircraft audio inputs are interchanged whereby the Pilot is wired to CHANNEL NO. 1 EXTRA and the 3rd Crew or PA (or TIME MARKER TONE) is wired to CHANNEL NO. 3 PILOT. This type of channel input wiring is applied for certain tape based CVRs to assure that the two innermost tape tracks are used for the most important channels. With solid state recorders this condition does not apply and either input wiring is acceptable.

Similarly, Helicopter Rotor Speed was often recorded on frequencies out of the band pass. Data within the recorder band pass is required for this information to be recorded. Consideration needs to be given to this fact when interchanging one recorder type with the other.

3.9 Data Link Communications (Optional)

Regulatory requirements define for the Cockpit Voice Recorder to record: "Voice Communications transmitted from or received in the airplane by radio." **In some installations,** communication with Air Traffic Control will encompass digital technologies.

When implemented, Data Link messages will be provided to the CVR on an ARINC 429 data bus. A pair of input pins (Data Link In pins 33 and 34) is reserved for an

ARINC 429 input bus. Data received on this bus may be either low-speed or high-speed and either Williamsburg V1 or V3 protocol. The recorder **shall** ~~should~~ automatically detect and adapt to the actual bus speed and protocol.

The specific message protocol is defined in Section 6.0 of **ARINC Specification 619:** *ACARS Protocols for Avionic End Systems.*

The recorder **shall** ~~should~~ record the data link source status data, identified by ARINC 429 labels 270 and 276, received at a rate of once per second. This data may either be recorded continuously or when the data changes, at the manufacturer's discretion.

The recorder **shall** ~~should~~ provide sufficient recording capacity to record the standard messages as defined in EUROCAE ED-112.

The recorder shall meet the ED-112 requirements for time correlation of these digital messages **relative** ~~in ratio~~ to voice information.

Internal BITE associated with this input and storage of digital communication (Data Link) information shall be reported via the Data Link Fault output (pin 31) and via the Data Link Recording bit (bit 16) of the CVR Status Word (label 350) of the OMS output as defined in Attachment 19.

When the Data Link Valid input (pin 56) is at Standard Ground, the recorder **shall** ~~should~~ expect digital communications recording and **shall** ~~should~~ validate bus operation via the presence of ARINC 429 label 270 (heartbeat) at a time interval of once per second. Absence of this label for three consecutive samples **shall** ~~should~~ be reported via the Data Link Fault output (pin 31) and via the Data Link Interface Status bit (bit 18) of the CVR Status Word of the OMS output (pins 50 and 51). If the Data Link Valid is open, the recorder **shall** ~~should~~ not report failures of the Data Link interface heartbeat. When Williamsburg V1 is used as the protocol, pins 50 and 51 will be shared with the OMS output for handshakes back to the CMU using label 304.

COMMENTARY

Optionally, pins 50 and 51 may be connected to the CMU even when Williamsburg V3 is used. This would allow the CMU to monitor the CVR 429 status word (label 350). There may be future enhancements that would make use of these wires, such as downloading data.

Whether the Data Link Valid signal is open or grounded, the recorder should continue to record Data Link communications normally.

For dual recorder systems one common bus will provide messages to both recorders (Data Link In pins 33 and 34). For Williamsburg V3 systems the same message will be sent once with the ARINC 429 label 157. If the messages are sent using Williamsburg V3, then both CVR #1 and CVR #2 should accept and record those messages.

For Williamsburg V1 systems, messages will be sent from the data link source to both CVRs using one common bus (pins 33 and 34). The label for the second recorder will be identified by ARINC 429 label 156. One bus from each CVR will connect back to the data link source for the handshakes. These buses will be shared with the OMS Out of each recorder (pins 50 and 51). A CVR Ident Pin Program (pin 42) will be used to identify the recorders as #1 (label 157) or #2

(label 156). An “open” indicates CVR #1. A “ground” indicates CVR #2. CVR #1 should record messages with label 157 and CVR #2 should record messages with label 156.

See Appendix F for installation guidance.

3.10 Combination Voice and Flight Data Recorder

See ARINC Characteristic 757 for guidance on the implementation of a Combination Voice and Flight Data Recorder.

3.11 Recording Start/Stop

~~The recorder shall start recording within 250 milliseconds when the following conditions are true:~~

~~1. Power becomes available on either the AC or DC inputs.~~

~~2. Record Enable loopback (jumper pins 7 and 8) is present.~~

Within the installation, a means should be provided to terminate recording after the aircraft is no longer moving under its own power, or after an accident. The Stop CVR Recording pin (Pin 10) is provided for this function. The recorder **shall** ~~will~~ stop recording 10 minutes (+0/-60 seconds) after a ground is applied to this pin. The ground must be held for the duration of the 10 minute period **for the recorder to stop recording. Upon** removal of the ground, ~~will cause~~ the recorder **shall** ~~to~~ resume recording within 250 milliseconds if power is available. The timer shall reset each time the ground is removed. See ED-112 for further details.

For installations where recording must be sustained for 10 minutes after loss of input power, the recording will continue until 10 minutes after a ground is applied to this pin or aircraft power is removed, whichever occurs first. In any case, recording will cease after 10 minutes. For installations where a Time Delay Relay is used instead of the input discrete to stop recording, additional provisions should be made as described in Section 3.15 to prevent cascading of the 10-minute delays.

COMMENTARY

For audio, the stop recording logic will be provided by the airframe as required to meet CVR recording regulations. Care should be taken to ensure that the stop recording logic for Pin 10 does not activate unintentionally and cause premature cessation of recording.

Additionally, several methods of ceasing CVR recording have been implemented by aircraft manufacturers that do not use Pin 10, such as controlling the Record Enable loopback (Pins 7 and 8) with logic or implementing a power interlock to control the recorder. In cases such as these, it is extremely important that system designers ensure that the logic implemented is robust enough to not induce a cessation of recording in a situation when the RIPS should keep the recorder operational because these methods bypass the protection provided with the Pin 10 functionality.

3.12 Cockpit Microphone Installation

Experience with CVR installations has shown that the placement of the area microphone in the cockpit is of vital importance for obtaining acceptable voice

quality and reduced levels of noise. ED-112 provides further details. Appendices A and B to this document provide guidance on microphone location.

Certain regulatory agencies require that flight crew speech be recorded directly from the boom or mask microphones used by each crew member, even when the crew member is not using the key switch. This method assures better voice quality than achievable from the area microphone. This requirement is implemented in the aircraft Audio/Interphone system.

3.13Aircraft Installation and Functional Verification

The Installation and Operating Instructions of the equipment manufacturer is the main guidance document. It contains the Environmental Qualification Form (EQF) which lists the categories in the various RTCA DO-160 sections to which the equipment has been certified. A functional verification is required which needs to include verification of all the audio signal inputs and warning sound signals. Periodic inspection and maintenance requirements are also detailed in the manufacturer's installation manuals and should be followed. Additional guidance can be found in the RTCA DO-214: Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems and Equipment. See ED-112 for further details.

3.14Rotor Speed (Optional)

As an option, a set of pins for direct rotor speed tachometer input has been reserved. ARINC Characteristic 573 defines the characteristics of the signal.

3.15Recorder Independent Power Supply (RIPS)

Regulations require some aircraft to be fitted with CVR installations that are able to sustain recording for 10 minutes following loss of recorder power from the aircraft. One means of accomplishing this is through implementation of a Recorder Independent Power Supply (RIPS) that is capable of sustaining CVR power needs for at least 10 minutes. The RIPS function may be integrated as part of the CVR (internal RIPS), or it may be an external energy source, which is located near the CVR (external RIPS). An internal RIPS shall provide the functionality described in ARINC Characteristic 777 and, by definition, does not interconnect with the CVR through the CVR rear connector. Refer to Appendix E.

COMMENTARY

Due to the complexity of ensuring that multiple RIPSs do not extend the shutdown time beyond 10 minutes, installing both an internal and an external RIPS for the same CVR is strongly discouraged.

CVRs fitted with an internal RIPS should be identified with a part number that is different from a CVR without an internal RIPS. This will help ensure that an internal RIPS is not installed into an aircraft which already has an external RIPS.

4.0 PROVISION FOR TEST

4.1 Built-In Test Equipment

The recorder shall ~~should, as an option,~~ contain Built-In Test Equipment (BITE) capability in accordance with **ARINC Report 624:** *Design Guidance for Onboard Maintenance System (OMS).*

The OMS described incorporates the traditional areas of failure monitoring and fault detection, BITE, BITE access, and an Airplane Condition Monitoring System (ACMS), formerly known as Aircraft Integrated Data System (AIDS). It further describes the capability to provide On-board Maintenance Documentation (OMD) and the need for total integration of these functions. It describes the needs for all elements of the OMS, including a Central Maintenance Computer (or CMC function) and all the member systems which interface with it.

Airframe manufacturers and equipment designers are encouraged to take advantage of this guidance information, beginning with the earliest design phases of new equipment. Users may also find this information helpful in standardizing maintenance planning and procedures and in securing appropriate recognition for such procedures from the regulatory agencies. It is particularly important that the guidelines set forth in ARINC Report 624 are considered in terms of the overall perspective of the users' needs, rather than some more limited objective.

4.2 Fault Reporting

4.2.1 OMS Compatibility

The recorder shall provide the necessary BITE circuits including an ARINC 429 transmitter and receiver to interface with an OMS as defined by ARINC Report 624. The recorder shall transmit the status at a nominal 1 Hz rate. The status shall be transmitted on Label 350 per ARINC 429 using the structure shown in Attachment 19. Label 354 is reserved for manufacturer-specific part/serial number reporting.

The CMC bus status bit shall be set when Label 227 is absent for three consecutive samples and/or when there is a parity error for three consecutive samples.

For faults detected during ground test, the recorder logic shall hold the fault for a minimum of 30 seconds after SSM is set to normal.

The recorder shall accept a test command word on Label 227, per ARINC Specification 429, using the structure shown in Attachment 19.

The recorder shall acknowledge the receipt of a valid ground test command word by setting the "Command Acknowledge," Bit 29, to 1 and by setting its SSM bits to "TEST." The Command Acknowledge bit and the SSM of TEST shall be held a minimum of 5 seconds or until the test is completed, whichever is longer.

The recorder shall set the "Test Inhibit" digital discrete, Bit 28, whenever the recorder has inhibited the initiation of the test. This discrete shall remain set for as long as the test is inhibited.

4.2.2 Monitor Memory Input

Fault data and relevant information should be inserted and held in a fault memory within the recorder. The presence of an internal fault, when detected, should be entered into the memory. If available to the recorder, other useful data such as time,

flight leg, etc. should also be recorded. These parameters are available on the CFDS input data bus.

4.3 Automatic Test Equipment

To enable Automatic Test Equipment (ATE) to be used in the bench maintenance, internal circuit functions not available at the unit service connector and considered by the equipment manufacturer necessary for automatic test purposes may be brought to pins on an auxiliary connector of a type selected by the equipment manufacturer. This connector should be fitted with only that number of contacts needed to support the ATE functions. The connector should be provided with a protective cover suitable to protect these contacts from damage, contamination, etc., while the unit is installed in the aircraft. The manufacturer should observe ARINC Specification 600 standards for unit projections, etc., when choosing the location for this auxiliary connector.

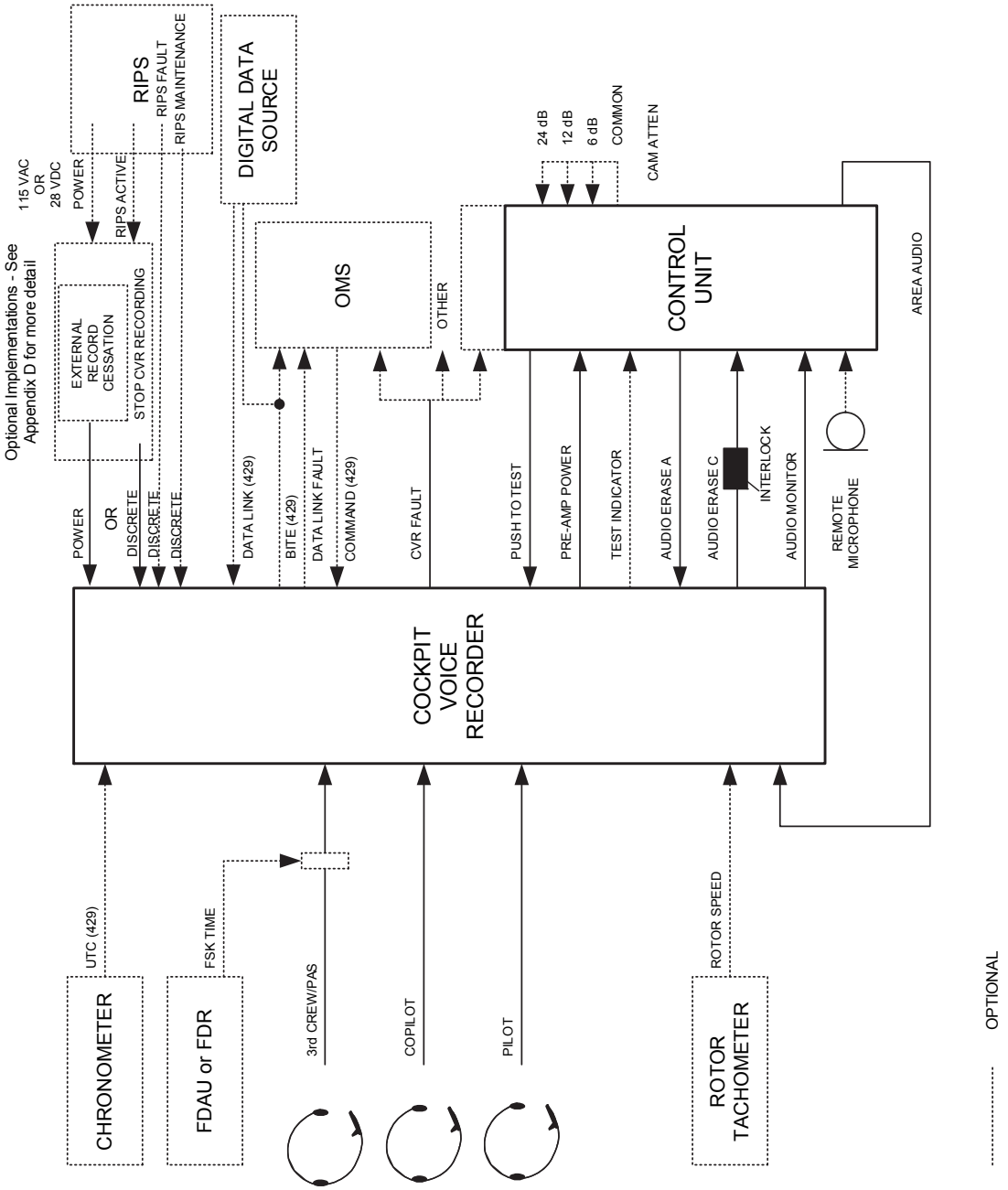
4.3.1 ATE Testing

The recorder should be ATE testable when removed from the aircraft. The industry suggests a test program written using the ATLAS language elements of **ARINC Specification 626:** *Standard ATLAS for Modular Tes*t developed in accordance with **ARINC Report 627:** *Programmers Guide for SMART™ System Using ARINC 626 ATLAS.*

The ATLAS test procedure should be designed to work on a test system built to comply with **ARINC Specification 608A:** *Design Guidance for Avionics Test Equipment.*

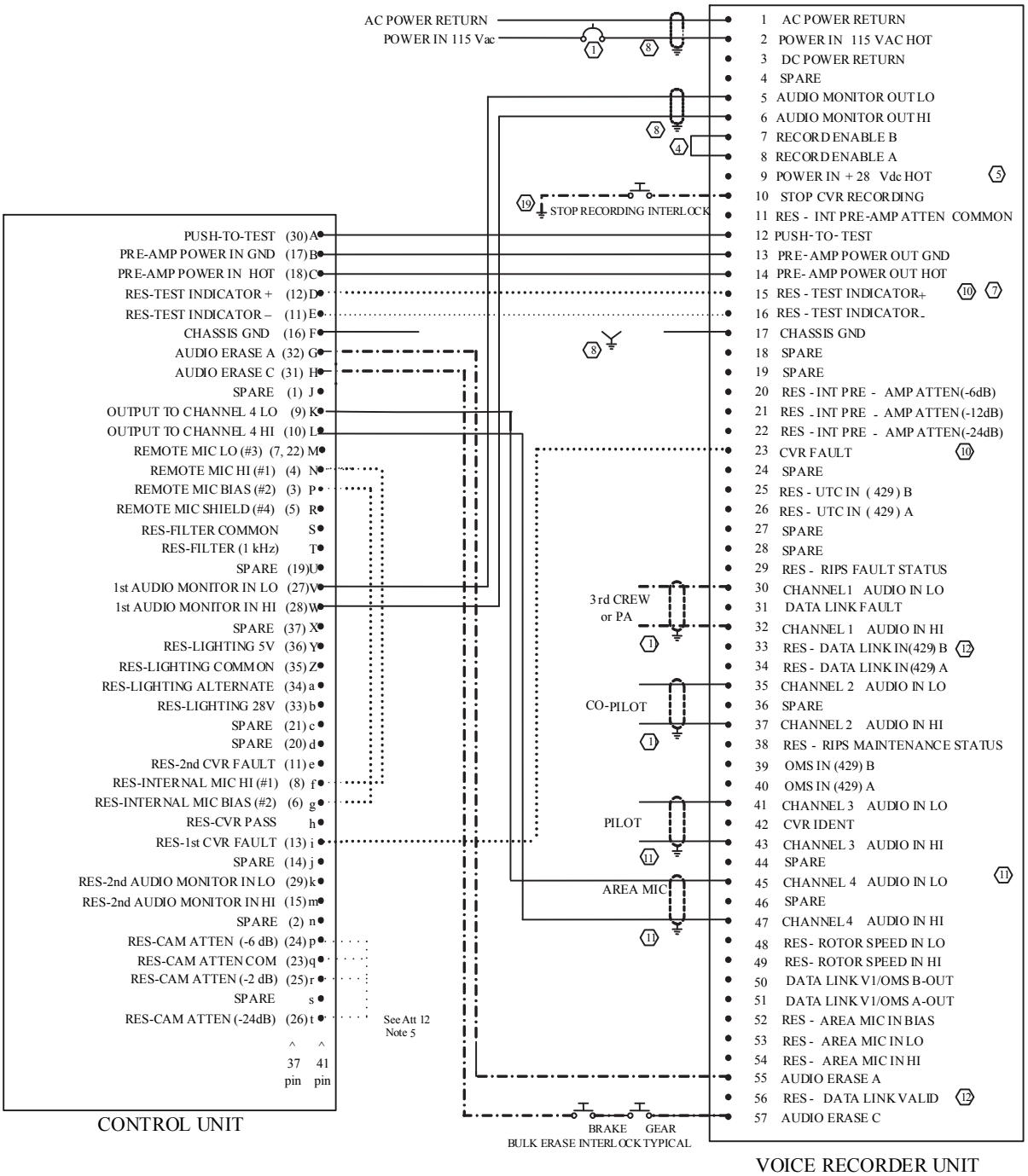
ATTACHMENT 1
SYSTEM BLOCK DIAGRAM

ATTACHMENT 1 SYSTEM BLOCK DIAGRAM



ATTACHMENT 2
CVR INTERWIRING DIAGRAM WITH INTERNAL MICROPHONE
(AC POWER SHOWN)

ATTACHMENT 2 CVR INTERWIRING DIAGRAM WITH INTERNAL MICROPHONE (AC POWER SHOWN)



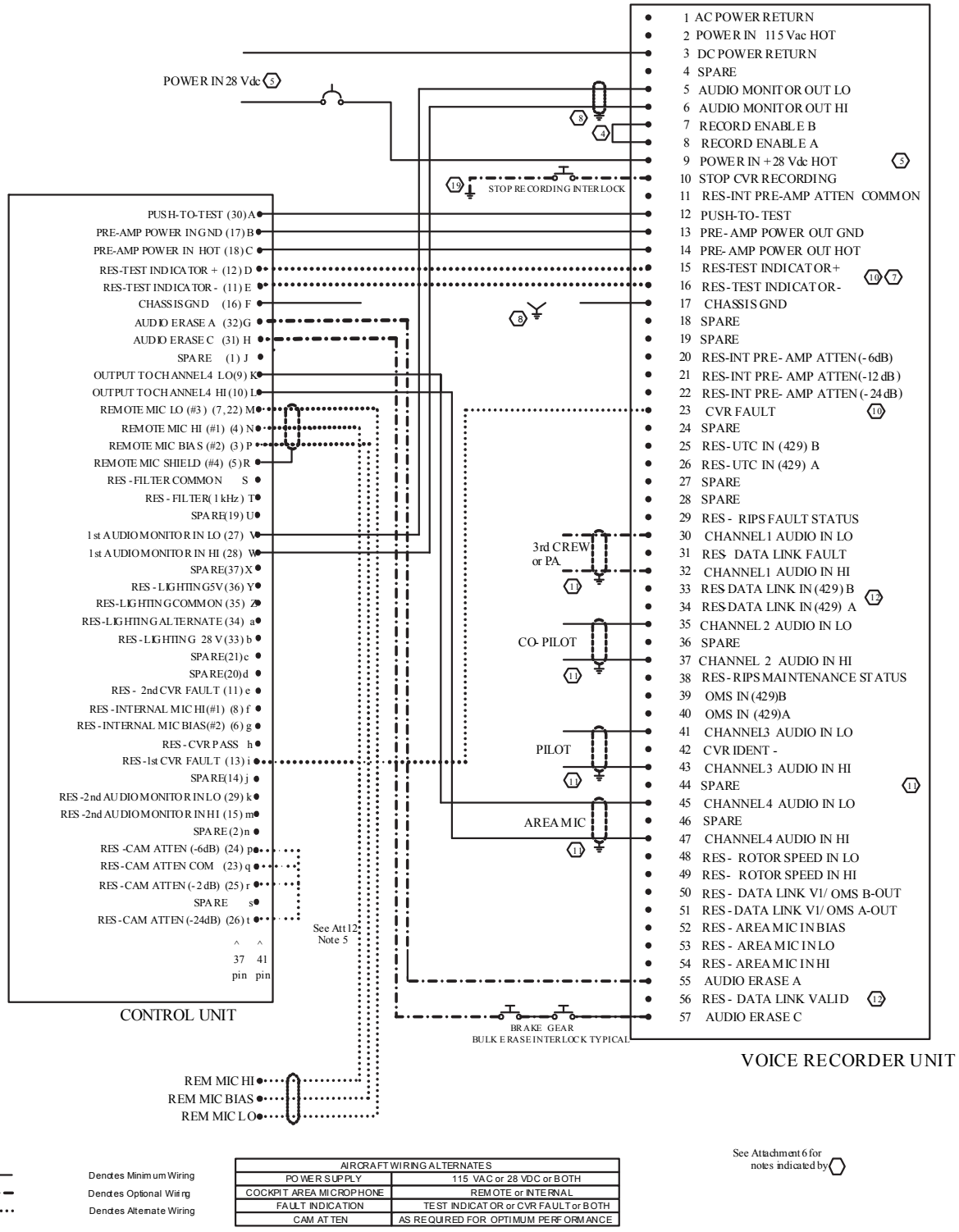
Denotes Minimum Wiring
Denotes Optional Wiring
Denotes Alternate Wiring

AIRCRAFT WIRING ALTERNATES	
POWER SUPPLY	115 VAC or 28 VDC or BOTH
COCKPIT AREA MICROPHONE	REMOTE or INTERNAL
FAULT INDICATION	TEST INDICATOR or CVR FAULT or BOTH
CAM ATTEN	AS REQUIRED FOR OPTIMUM PERFORMANCE

See Attachment 6 for notes indicated by ⬡

ATTACHMENT 3
CVR INTERWIRING DIAGRAM WITH REMOTE MICROPHONE
(DC POWER SHOWN)

ATTACHMENT 3 CVR INTERWIRING DIAGRAM WITH REMOTE MICROPHONE (DC POWER SHOWN)



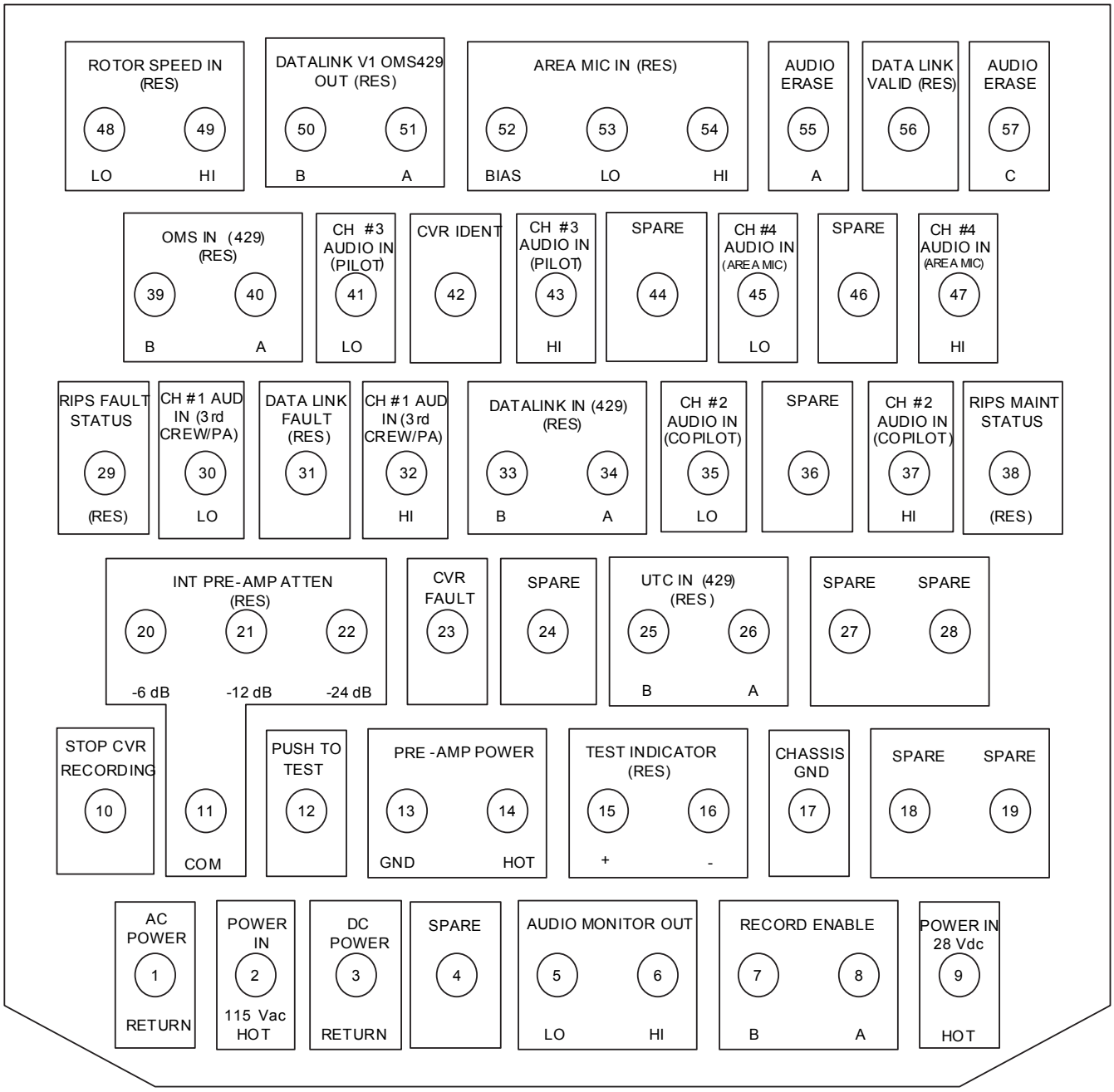
Denotes Minimum Wiring
Denotes Optional Wiring
Denotes Alternate Wiring

AIRCRAFT WIRING ALTERNATES	
POWER SUPPLY	115 VAC or 28 VDC or BOTH
COCKPIT AREA MICROPHONE	REMOTE or INTERNAL
FAULT INDICATION	TEST INDICATOR or CVR FAULT or BOTH
CAM ATTEN	AS REQUIRED FOR OPTIMUM PERFORMANCE

See Attachment 6 for notes indicated by ⬡

ATTACHMENT 4
CVR CONNECTOR LAYOUT
TYPE 57 PIN

ATTACHMENT 4 CVR CONNECTOR LAYOUT, TYPE 57 PIN



Engaging Face View as Viewed from Rear of Equipment

Res = Reserved pin provides functions additional to minimum standard

ATTACHMENT 5
CVR STANDARD INTERWIRING PIN DESIGNATION

ATTACHMENT 5 CVR STANDARD INTERWIRING PIN DESIGNATION

FUNCTION	PIN	CVR	NOTES	REMARKS
AC POWER RETURN	1	O	1	HEAVY GAUGE WIRE
POWER IN 115 VAC HOT	2	O	1	HEAVY GAUGE WIRE
DC POWER RETURN	3	M	5	HEAVY GAUGE WIRE
SPARE	4			
AUDIO MONITOR OUT LO	5	M	3	TO AUDIO MONITOR
AUDIO MONITOR OUT HI	6			
RECORD ENABLE B	7	M	4	JUMPER RECORD ENABLE PIN 7 TO 8 IN ALL AIRCRAFT
RECORD ENABLE A	8			
POWER IN 28 VDC HOT	9	M	5	HEAVY GAUGE WIRE
STOP CVR RECORDING	10	M	19	GND = STOPS WITHIN 10 MIN
RES - INT PRE-AMP ATTEN COMMON	11	O	6	
PUSH-TO-TEST	12	M		GND = TEST
PRE-AMP POWER OUT GND	13	M		
PRE-AMP POWER OUT HOT	14			
RES - TEST INDICATOR +	15	O	7	
RES - TEST INDICATOR -	16			
CHASSIS GND	17	M	8	
SPARE	18			
SPARE	19			
RES - INT PRE-AMP ATTEN (-6dB)	20	O	6	
RES - INT PRE-AMP ATTEN (-12 dB)	21			
RES - INT PRE-AMP ATTEN (-24dB)	22			
CVR FAULT	23	M	10	GND = GOOD CONTINUOUS TEST
SPARE	24			
RES - UTC IN (429) B	25	O	18	
RES - UTC IN (429) A	26			
SPARE	27			
SPARE	28			
RES – RIPS FAULT STATUS	29	O	20	
CHANNEL 1 AUDIO IN (3rd CREW OR EXTRA) LO	30	M	11	PILOT INPUT/TIME OR ROTOR SPEED
RES - DATA LINK FAULT	31	O		GND = GOOD
CHANNEL 1 AUDIO IN (3rd CREW OR EXTRA) HI	32	M	11	PILOT INPUT/TIME, OR ROTOR SPEED
RES - DATA LINK IN B	33	O	12	
RES - DATA LINK IN A	34			
CHANNEL 2 AUDIO IN (CO-PILOT) LO	35	M	11	
SPARE	36			
CHANNEL 2 AUDIO IN (CO-PILOT) HI	37	M	11	
RES - RIPS MAINTENANCE STATUS	38	O	20	
OMS IN (429) B	39	M	13	
OMS IN (429) A	40			
CHANNEL 3 AUDIO IN (PILOT) LO	41	M	11	
CVR IDENT	42	M		GND = CVR #2
CHANNEL 3 AUDIO IN (PILOT) HI	43	M	11	
SPARE	44			
CHANNEL 4 AUDIO IN (AREA MICROPHONE) LO	45	M	11	
SPARE	46			
CHANNEL 4 AUDIO IN (AREA MICROPHONE) HI	47	M	11	
RES - ROTOR SPEED IN LO	48	O	14	
RES - ROTOR SPEED IN HI	49			
DATA LINK V1/OMS (429) - OUT B	50	M	13	
DATA LINK V1/OMS (429) - OUT A	51			
RES - AREA MIC IN BIAS	52	O	15	
RES - AREA MIC IN LO	53			
RES - AREA MIC IN HI	54			
AUDIO ERASE A	55	M		
RES - DATA LINK VALID	56	O	12	GND = REPORT DATA LINK FAILURES
AUDIO ERASE C (+SUPPLY)	57	M		TO AIRCRAFT INTERLOCK

M = Function is basic to the minimum definition for this standard.
O = Function is optional.
See Attachment 6 for notes. See Attachments 2 and 3 for diagrams.

ATTACHMENT 6 NOTES TO STANDARD INTERWIRING

1. 115 Vac POWER

   Pin 2 is for AC power input of 115 Vac. Pin 1 provides the return connection for the AC power.

2. NOT USED

3. AUDIO MONITOR OUT

   To monitor information being stored, all channels combined, **capable of driving 10 mW into a 600 ohm load**, short circuit protected.

4. RECORD ENABLE

   Jumper in aircraft connector. Without this jumper the unit will not record or erase previously recorded information, audio erase will not activate and test will indicate NO-GO.

5. 28 Vdc POWER

   Pin 9 is for alternate DC power input of 28 Vdc. Pin 3 provides the return connection for the DC Power.

6. RESERVED INT PRE-AMP ATTEN

   For Cockpit Voice Recorder units with internal microphone preamplifier. The microphone gain selection is from common jumper Pin 11 to Pins 20, 21, 22 individually or combined.

7. RESERVED TEST INDICATOR (Use is optional)

   Pins 15 and 16 are reserved for test indicator (1mA equals “Good”). See Note 10.

8. **CHASSIS** GROUND CONNECTION

   Pin 17 (CVR) and Pin F (Control Unit) each grounded to the airframe within 1 foot of its respective connector using heavy gauge wire (#18 AWG or larger). For backward compatibility, the CVR and Control Unit Chassis Ground pins may be connected to each other by a wire. Shields are to be grounded at the recorder using short wires.

9. NOT USED

10. CVR FAULT

    Bite status output or recorder fault due to loss of power is indicated on Pin 23 for standard ground equals no fault, open equals fault or CVR not installed. Either the CVR Fault or the Test Indicator (or both) should be wired in the aircraft.

11. AUDIO INPUTS

    Differential audio input, 3V RMS maximum, impedance 5K ohm minimum. Twisted shielded cable. Shield grounded to airframe with short connection.

ATTACHMENT 6
NOTES TO STANDARD INTERWIRING

12. RESERVED DATA LINK INPUT (Optional)

    See Section 3.9.

13. OMS INPUT/OUTPUT

    For OMS, ARINC 624. This output is shared for the purpose of supplying the return (handshaking) for data link recording using the ARINC 429 Williamsburg V1 protocol.

14. RESERVED ROTOR SPEED INPUT (Optional)

    CVR may accept Rotor Speed signal 2 Vac to 122 Vac RMS from 7 to 6,000 Hz, 1 sample per 0.5 seconds minimum, Accuracy 2% minimum. This rotor speed input complies with the frequency input defined in ARINC 573-7, Section 4.2.4 with the exception of recording accuracy and sampling rate which are defined in ED-112.

15. RESERVED AREA MICROPHONE INPUT (Optional)

    For systems with internal microphone preamplifier and limited microphone cable length. This is a low level signal (3 mV) and requires short exposed wire length with careful shielding.

16. NOT USED

17. NOT USED

18. UTC IN (Universal Time - Optional)

    ARINC 429 clock input is optional. The label for the clock is 125 for BCD or 150 for binary.

19. STOP CVR RECORDING

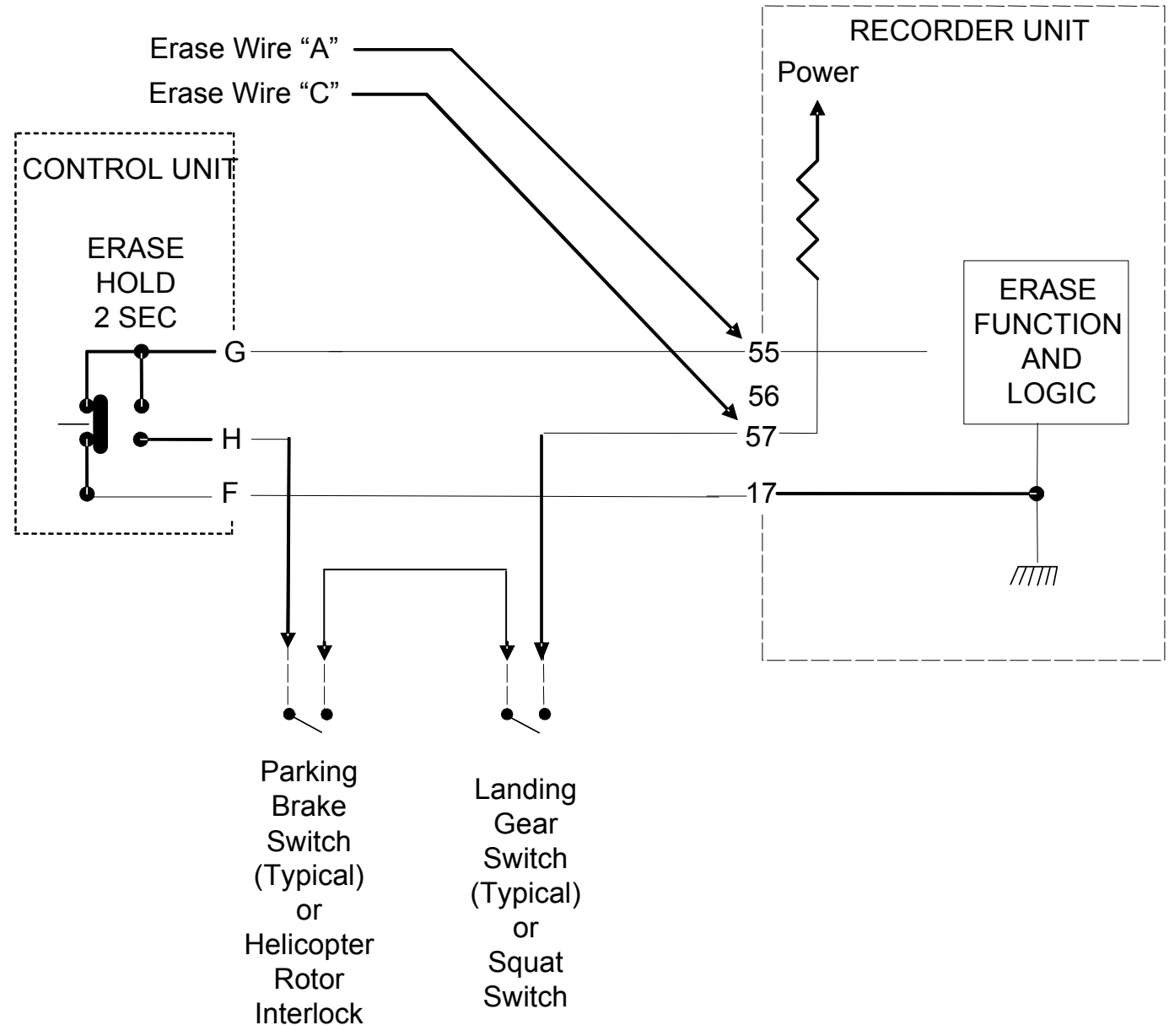
    Set to ground to stop **audio and data link** ~~CVR~~ recording in 10 minutes (see Section 3.11). May be connected to aircraft interlocks.

20. RIPS STATUS MONITORING (Optional)

Pin 29	RIPS FAULT
OPEN	Fault
GND	No Fault

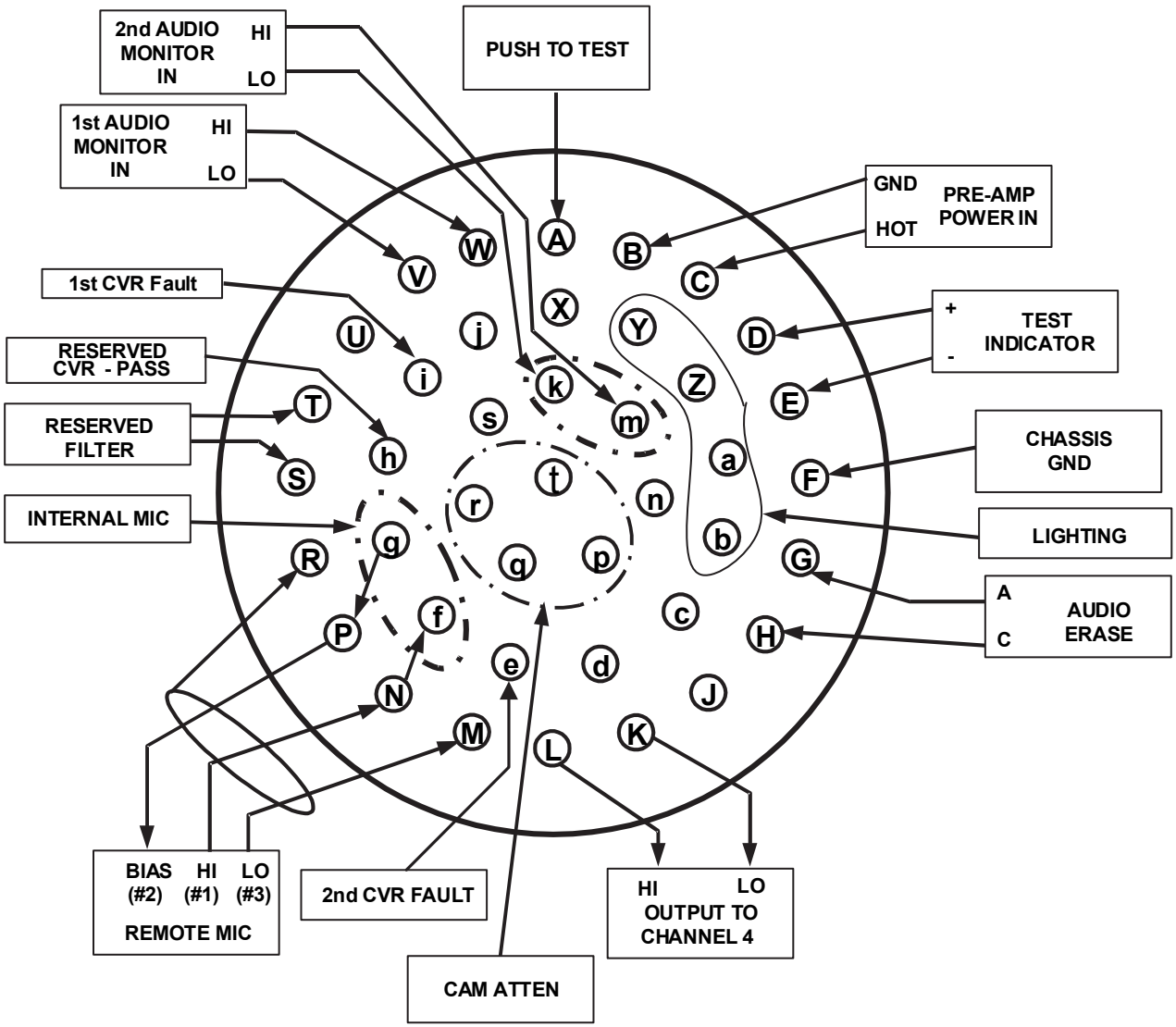
Pin 38	RIPS MAINTENANCE
OPEN	No Maintenance Required
GND	Maintenance Required

ATTACHMENT 7 AUDIO ERASE CIRCUIT DETAILS



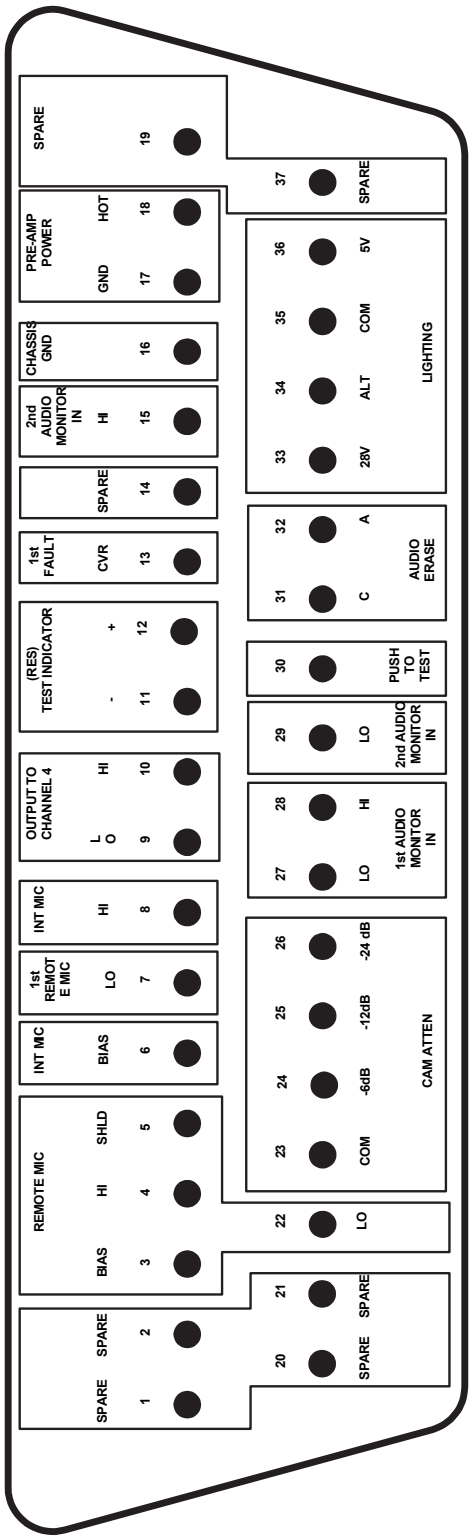
ATTACHMENT 8
CVR CONTROL UNIT CONNECTOR LAYOUT
TYPE MS3112-20-41P

ATTACHMENT 8 CVR CONTROL UNIT CONNECTOR LAYOUT, TYPE MS3112-20-41P



ATTACHMENT 9
CVR CONTROL UNIT CONNECTOR LAYOUT
MINIATURE CONTROL UNIT, 37 POSITION SIMILAR TO MIL-C-24308

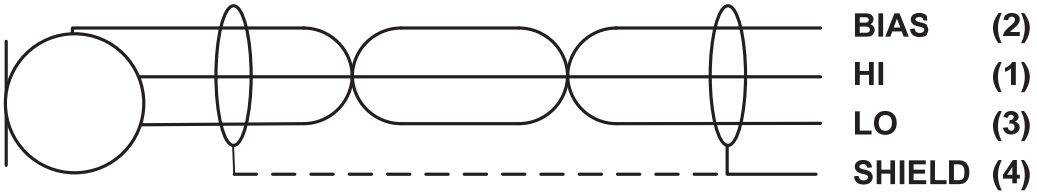
ATTACHMENT 9 CVR CONTROL UNIT CONNECTOR LAYOUT, MINIATURE CONTROL UNIT, 37 POSITION SIMILAR TO MIL-C-24308



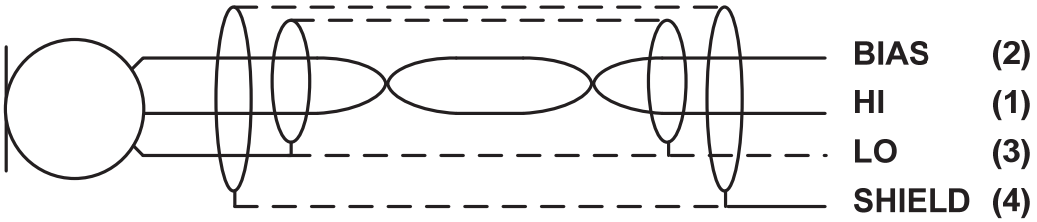
ATTACHMENT 10 MICROPHONE AND CABLE

MICROPHONE AND CABLE

3-CONDUCTOR TWISTED AND SHIELD



2-CONDUCTOR TWISTED WITH DUAL SHIELD



Microphone Sound Pressure Level (SPL) versus Record Level

(100 dB SPL = 20 DYNES/CM^2) = (Relative)
120 dB SPL = max (48 dB S/N)
90 dB SPL = (≈ 35 dB S/N)
60 dB SPL = min (0 dB S/N)

ATTACHMENT 11
CVR CONTROL UNIT STANDARD INTERWIRING
(41 AND 37) CONNECTOR

ATTACHMENT 11 CVR CONTROL UNIT STANDARD INTERWIRING (41 AND 37) CONNECTOR

FUNCTION		PIN 41-WAY CONN	PIN 37-WAY CONN	CVR	NOTES (See Att. 12)	REMARKS
PUSH - TO - TEST		A	30	M		
PRE-AMP POWER IN	GND	B	17	M	6	
PRE-AMP POWER IN	HOT	C	18			
RES - TEST INDICATOR	+	D	12	A	3	Alternate to 1st CVR Fault
RES - TEST INDICATOR	-	E	11			
CHASSIS GND		F	16	M		
AUDIO ERASE A		G	32	M		
AUDIO ERASE C		H	31	M		
SPARE		J	1			
OUTPUT TO CHANNEL 4	LO	K	9	M		
OUTPUT TO CHANNEL 4	HI	L	10			
REMOTE MIC	LO (#3)	M	7, 22	M	4	
REMOTE MIC	HI (#1)	N	4			
REMOTE MIC	BIAS (#2)	P	3			
REMOTE MIC	SHIELD (#4)	R	5			
RES - FILTER COMMON		S	-	O		
RES - FILTER (1 kHz)		T	-			
SPARE		U	19			
1st AUDIO MONITOR IN	LO	V	27	M		
1st AUDIO MONITOR IN	HI	W	28			
SPARE		X	37			
RES - LIGHTING 5V		Y	36	O	1	
RES - LIGHTING COMMON		Z	35			
RES - LIGHTING ALTERNATE		a	34			
RES - LIGHTING 28V		b	33			
SPARE		c	21			
SPARE		d	20			
RES – 2nd CVR FAULT		e	11	O	7	
RES - INTERNAL MIC	HI (#1)	f	8	O	2	
RES - INTERNAL MIC	BIAS (#2)	g	6			
RES - CVR PASS		h	-	O		
RES - 1st CVR FAULT		i	13	A	7	Alternate to Test Indicator
SPARE		j	14			
RES – 2nd AUDIO MONITOR IN	LO	k	29	O		
RES – 2nd AUDIO MONITOR IN	HI	m	15			
SPARE		n	2			
RES – CAM ATTEN (-6dB)		p	24	O	5	
RES – CAM ATTEN COMMON		q	23			
RES – CAM ATTEN (-12dB)		r	25			
SPARE		s	-			
RES – CAM ATTEN (-24dB)		t	26	O	5	

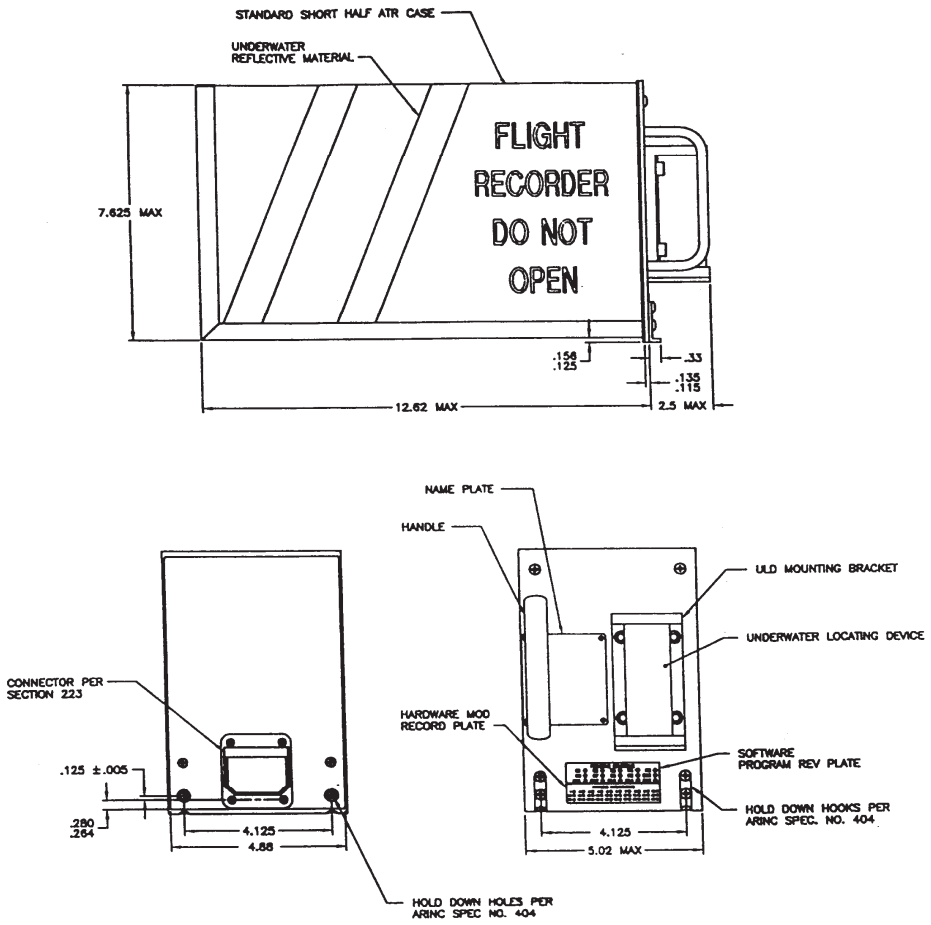
M = Function is a minimum requirement for this standard.
O = Function is optional.
A = Alternate configuration on 37-pin connector. One or both may be provided.

ATTACHMENT 12 NOTES TO CONTROL UNIT STANDARD INTERWIRING

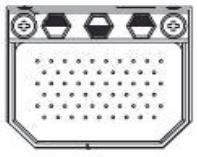
1. Control unit lighting or illumination is an optional feature and aircraft dependent. Pins for ±5 Vdc and 28 Vdc are reserved. For other voltage levels, use pin (a) (Pin 34 on the 37-pin connector).
2. The internal microphone is connected through two external jumpers, (which permit optional use of an external microphone). These two jumpers need to be short and inside the connector shield.
3. ARINC 757A systems using the CVR Fault BITE output connected to the control unit or other aircraft systems such as CMS, OMS, may omit this manual Test Indicator.
4. External microphones should use a 3-conductor shielded cable. Pin designations are given for analog microphone HI, BIAS, LO and SHIELD. Labels #1 through #4 are provided for alternate microphone types.
5. The control unit may permit selection of attenuation levels for the CAM preamplifier to accommodate the differing sound levels in various aircraft types. If used, the gain selection is from common jumper pin q (23) to pins p, r, or t, (24, 25, 26), individually or in combination. Attenuation values are additive.
6. DC power is provided by the recorder. The CVR system consists of a recorder together with its specific control unit. Intersystem interchangeability is not intended.
7. CVR Fault is the primary BITE status output of the ARINC 757A CVR. It may be wired to the control unit, or other aircraft systems, such as CMS, OMS, etc.

ATTACHMENT 13
OUTLINE AND DIMENSION

ATTACHMENT 13 OUTLINE AND DIMENSION



NOTE:
CONFIGURATION SHOWN IS TYPICAL. VARIATIONS MUST COMPLY WITH ARINC 404A.

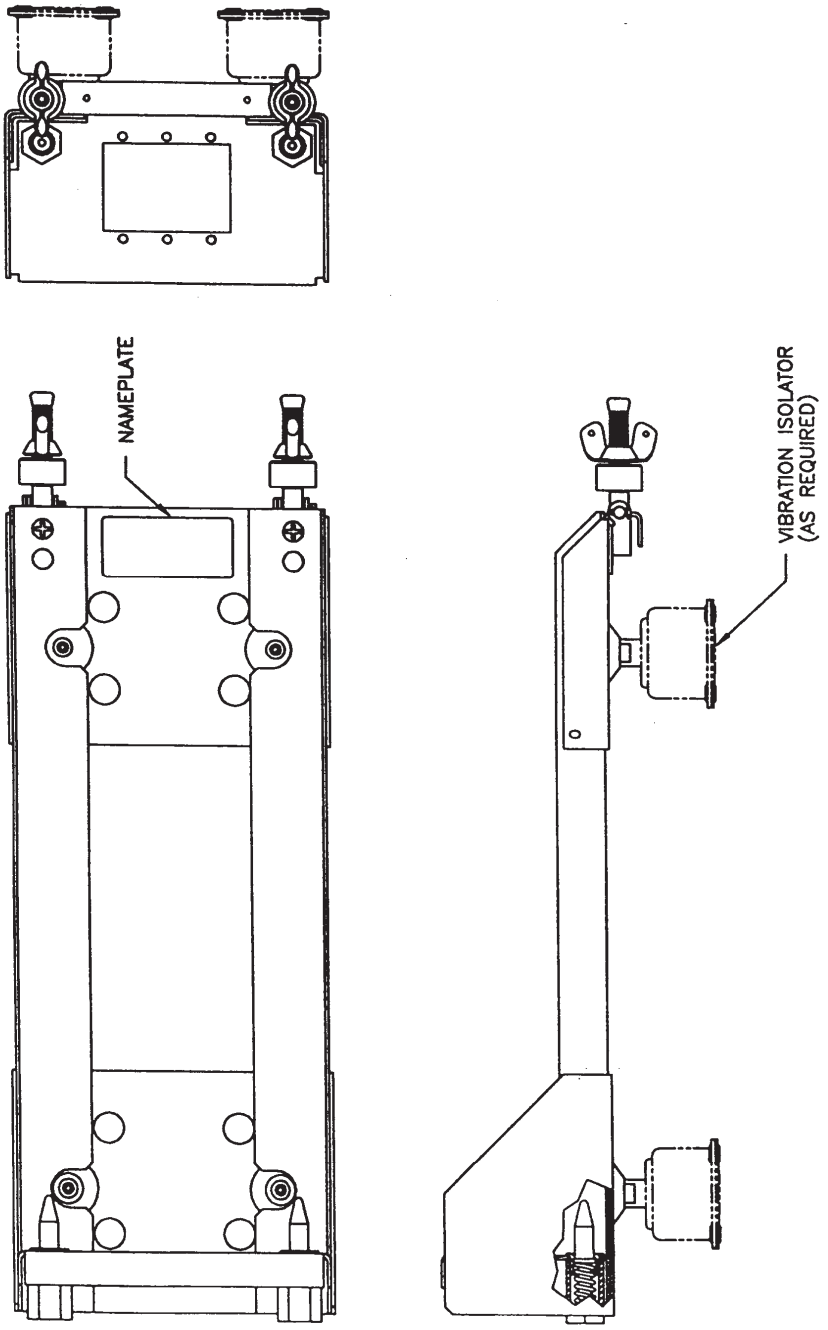


Keying Notes:

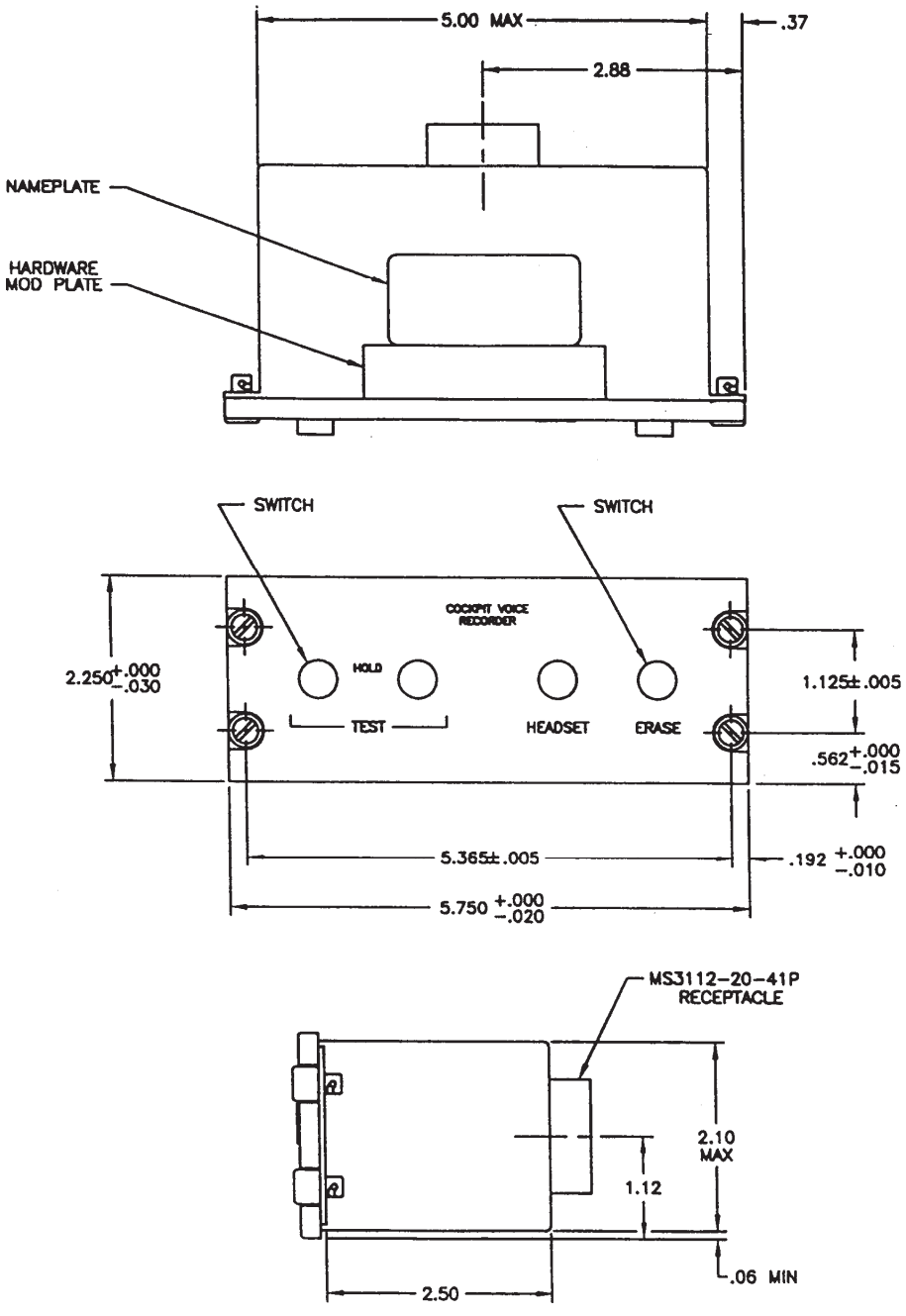
1. Darkened portion indicates extended part of post in receptacle. Light portion indicates key hole in receptacle.
2. Configuration shown is typical. Variations must comply with ARINC Specification 404A.

ATTACHMENT 14
CVR MOUNTING TRAY WITH OPTIONAL ISOLATORS

ATTACHMENT 14 CVR MOUNTING TRAY WITH OPTIONAL ISOLATORS



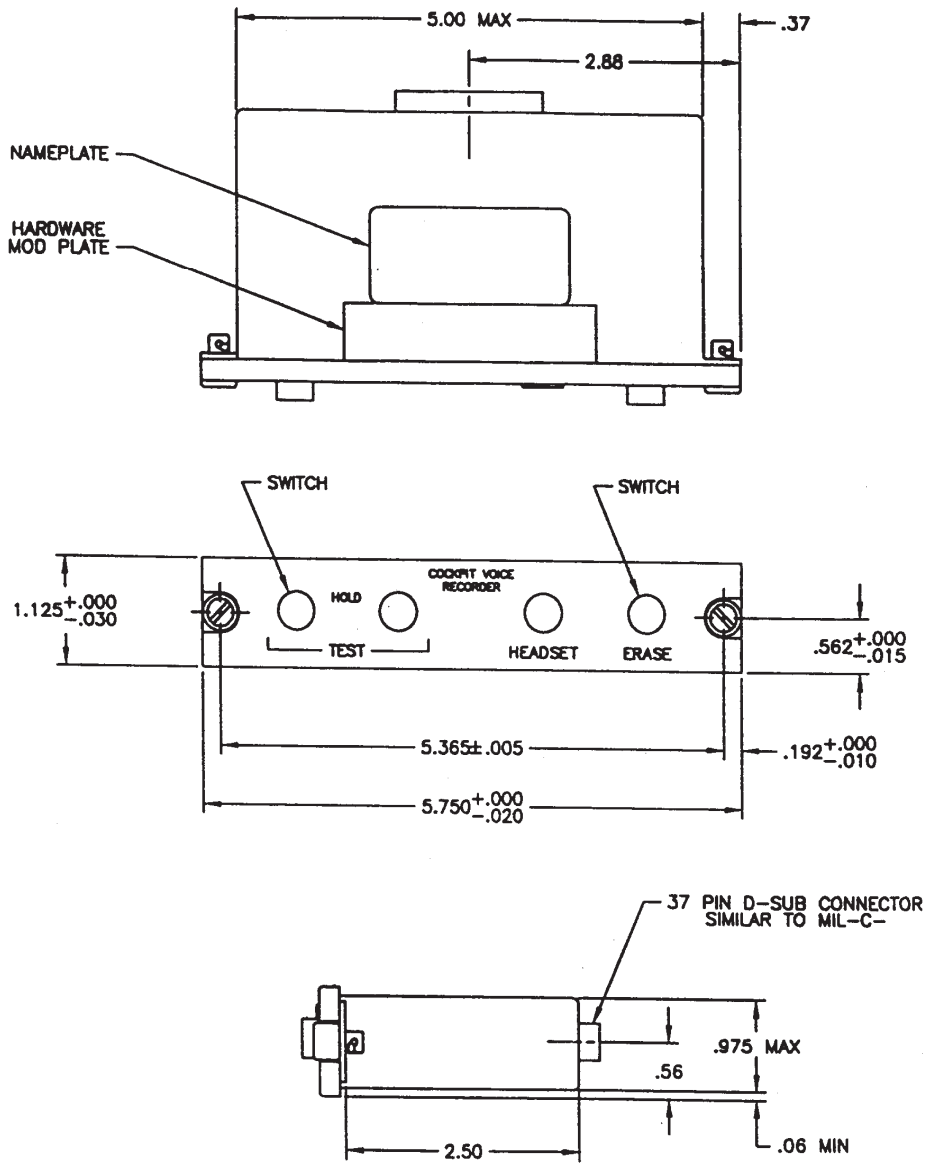
ATTACHMENT 15 OUTLINE AND DIMENSION, CONTROL UNIT



NOTE:
CONFIGURATION SHOWN IS TYPICAL.

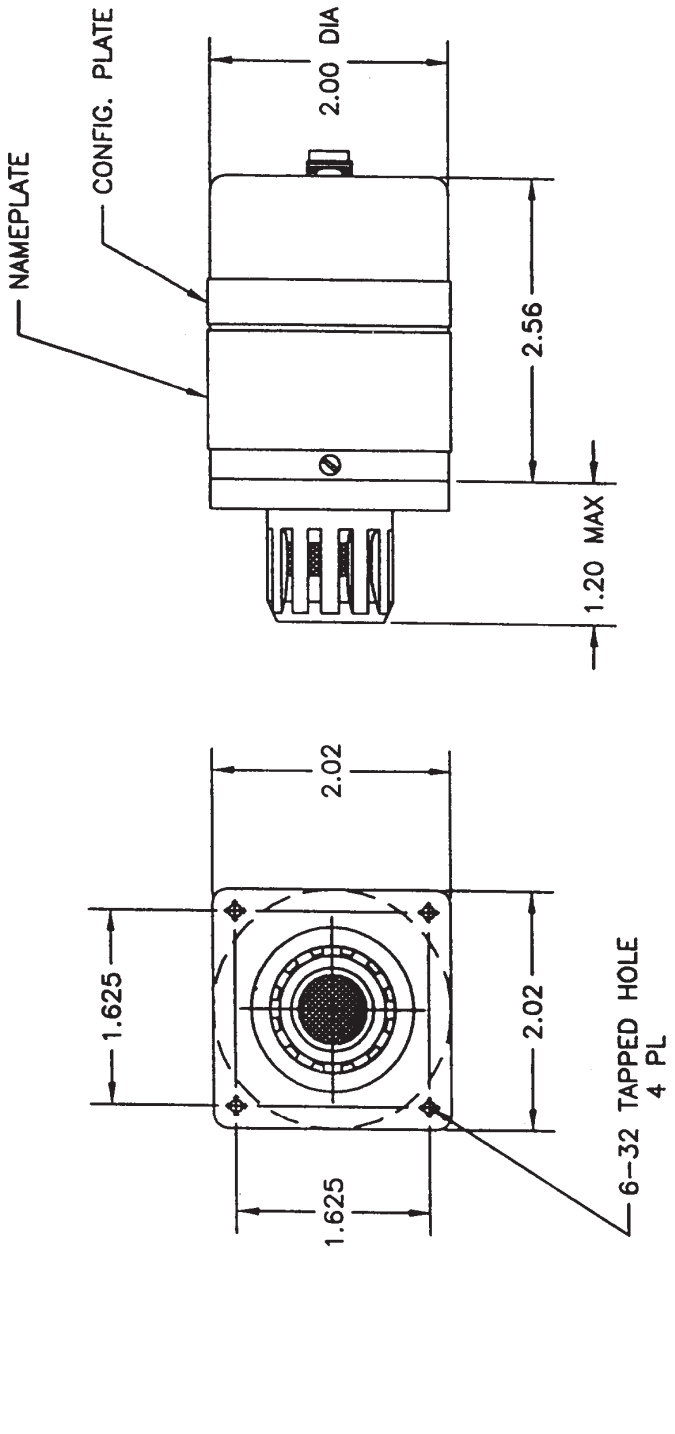
ATTACHMENT 16
OUTLINE AND DIMENSION, ALTERNATE MINIATURE CONTROL UNIT

ATTACHMENT 16 OUTLINE AND DIMENSION, ALTERNATE MINIATURE CONTROL UNIT

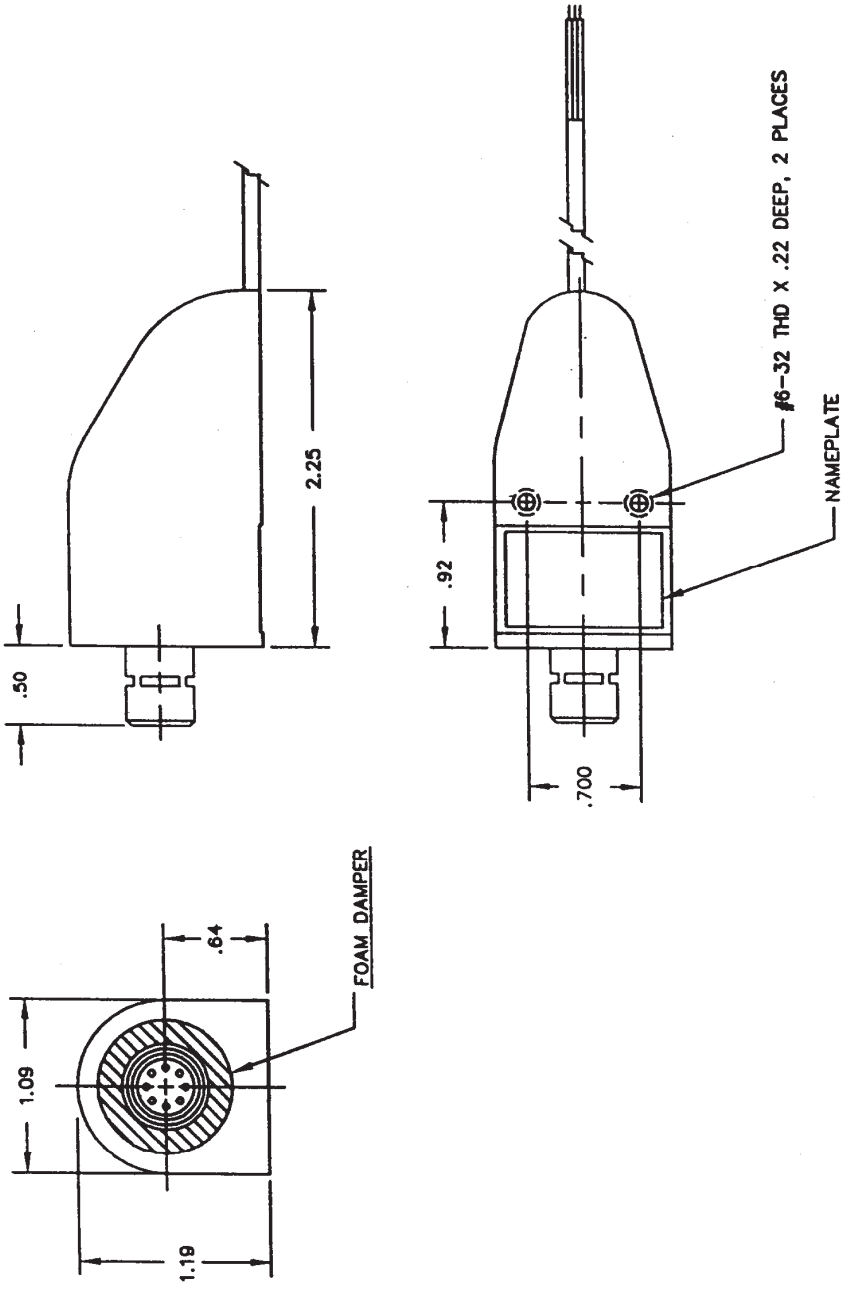


NOTE:
CONFIGURATION SHOWN IS TYPICAL.

ATTACHMENT 17 OUTLINE AND DIMENSION, STANDARD MICROPHONE



ATTACHMENT 18 OUTLINE AND DIMENSION, ALTERNATE MINIATURE MICROPHONES



NOTE:
CONFIGURATION SHOWN IS TYPICAL.

ATTACHMENT 19
CVR STATUS/OMS COMMAND WORD FORMAT

ATTACHMENT 19 CVR STATUS/OMS COMMAND WORD FORMAT

CVR Status Word

32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
P	SSM		SSM Ack	Test Inhibit	Reserved			Spare			Stop CVR Recording	RIPS Maint. Status	CVR Record Disabled	D/L Interface	Clock Status	Data Link Recording	RIPS Status	RSVD		Control Unit Status	OMS Bus Status	CVR Status	SDI		Label (350)							
																								LSB							MSB
Odd	see below				Pad 0			Pad 0			1= Active	1 = Maint Reqd	1 = Disabled	Status 0 = OK, 1 = Failure									see below	0	0	0	1	0	1	1	1

SSM Bits		
31	30	Status
0	0	Normal
0	1	NCD
1	0	Test
1	1	Failed

SDI Bits			
10	9	Device Ident	CVR Ident Pin
0	0	First Recorder	Open
0	1	Second Recorder	Gnd
1	0	Not Used	N/A
1	1	Not Used	N/A

NOTE: This definition of SSM bits is aligned with ARINC Specification 429 and shall be used with all new recorder designs.

Equipment built to previous versions of ARINC 757 (ARINC 757 to ARINC 757-5) may have used the older form of SSM encoding. This encoding may be found on legacy systems. It is provided below for information.

Reference Only		
SSM Bits		
31	30	Status
0	0	Not Used
0	1	Not Used
1	0	Test
1	1	Normal

OMS Command Word

BIT	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	P	Command							Equipment ID Code (057)												PAD		SDI		Label (227)							
									MSB											LSB					LSB							MSB
		(See Below)							MSD								LSD				0	0	0	0	1	1	1	0	1	0	0	1

31	30	29	28	27	26	25	**Command**
0	0	0	0	0	0	0	Not Used
0	0	0	0	0	1	0	Ground Test Command
0	0	1	0	0	1	0	New Flight Leg – 000 Equipment Code
1	1	1	1	1	1	1	Log Off - 000 Equipment Code or CVR Specific Code

ATTACHMENT 20
FAULT AND STATUS OUTPUT CONDITIONS

ATTACHMENT 20 FAULT AND STATUS OUTPUT CONDITIONS

	CVR								Data Link			OMS	CU	Clock
State	CVR Fault (1)	Test Ind (2)	Audio Echo (3)	CVR Status (4)	RIPS Status	RIPS Maint	CVR Record Disabled (16)	Stop Recording	Data Link Fault (9)	Data Link Status (10)	Data Link Interface Status	CMC Bus Status (11)	Control Unit Status	Clock Status
Pin Number	23	15/16	5/6	na	29	38			31	na		na		
CVR Status Word Bit Number				11	15	20	19	21		16	18	12	13	17
Recorder not installed	x	x	x	na	na				x	na		na		
Recorder not powered	x	x	x	na	na				x	na		na		
Recorder not functional (14)	x	x	x	na	na				x	na		na		
Audio circuit failure	x	x	x	x										
Recording medium or mechanism failure	x	x	x	x					x	x				
Failure to store in recording medium	x	x	x	x					x	x				
Insufficient audio, UTC or Rotor Speed recording duration	x	x	x											
Insufficient power holdup capacity or RIPS fault (17)					x									
RIPS Battery Charging Cycles Exceeded						x								
Pin 10 Grounded								x						
Pin 10 Grounded for >10 minutes	x		x	x			x	x	x	x				
Pin 7-8 not connected	x	x	x				x		x					
Missing Datalink heartbeat and Datalink Valid is asserted									x		x			
Datalink heartbeat present and Datalink Valid not asserted											x			
Insufficient Datalink recording duration									x	x				
No Data Link Function present									x	ox				
Missing OMS heartbeat (see Section 4.2.1)												x		
Missing Clock Information														x
Control Unit Failure													x	

ATTACHMENT 20
FAULT AND STATUS OUTPUT CONDITIONS

Notes applicable to table:

“x” means the signal is asserted.

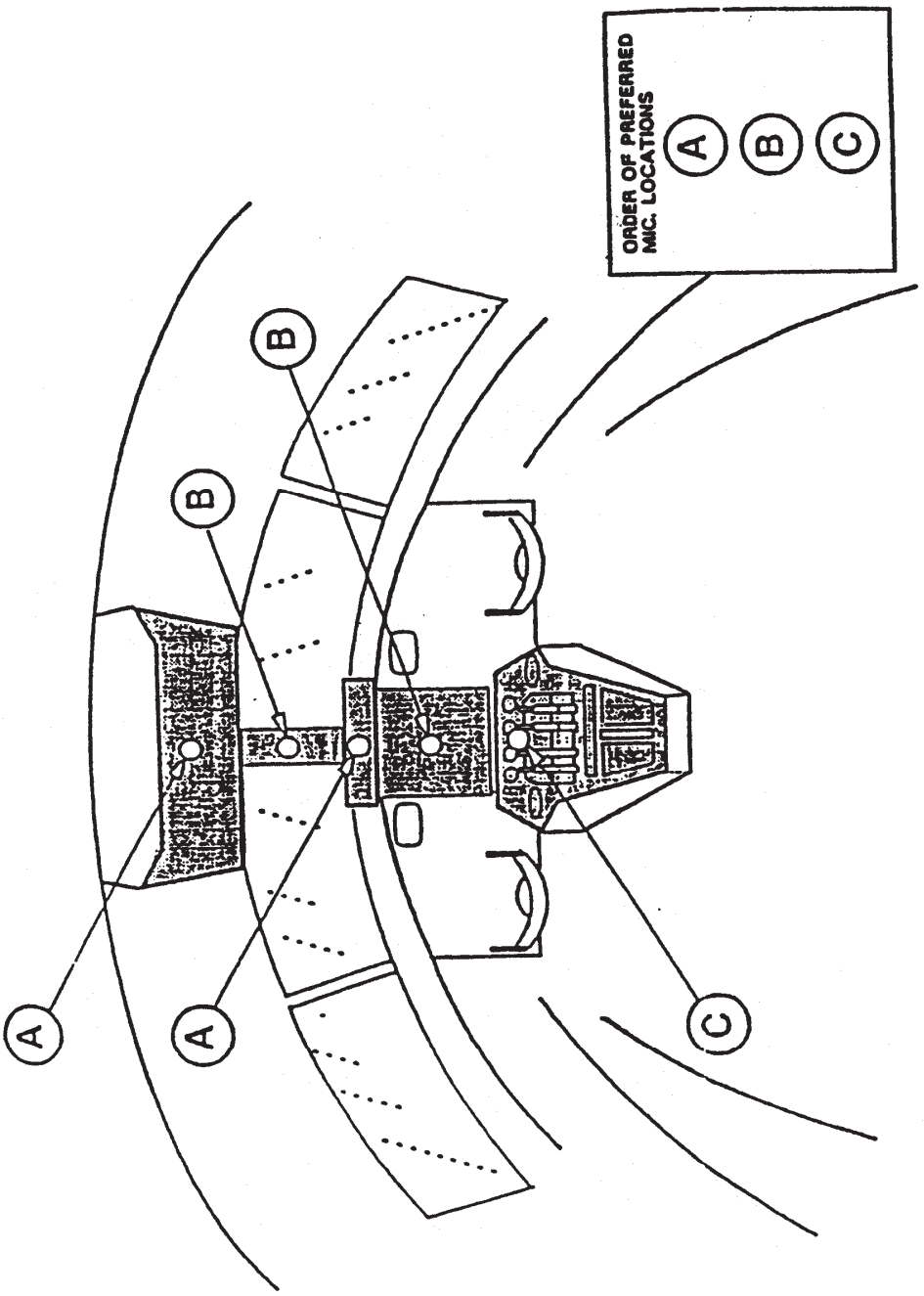
“na” means the signal cannot be asserted. For example, if the recorder is not present or powered, it cannot report any of the OMS faults.

A blank means the signal is not asserted.

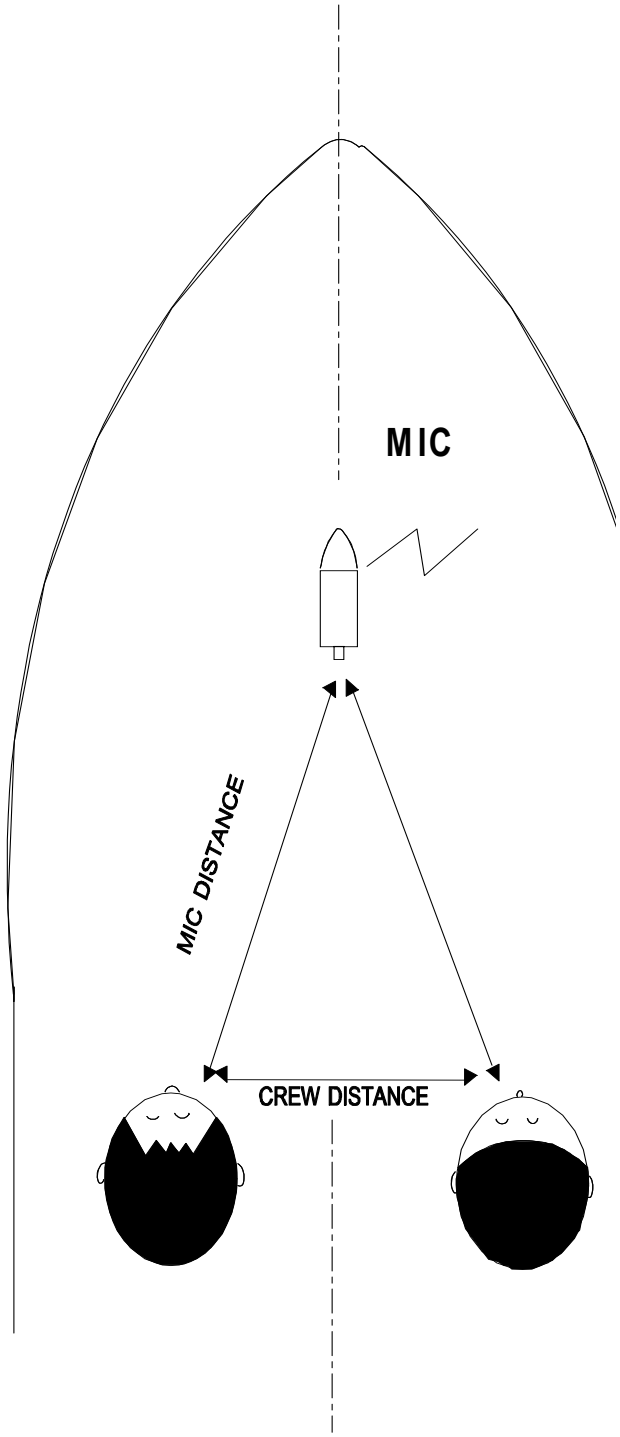
“ox” designates manufacturer option

1. CVR Fault = Open/Ground discrete, Asserted is Open.
2. Test Ind = 1 mA through 250 ohm means "Good", asserted = < 0.8 mA, only valid during Initiated Test.
3. Audio Echo asserted means that the echo is disabled.
4. OMS CVR bit asserted = 1.
5. Not Used.
6. Not Used.
7. Not Used.
8. Not Used.
9. Data Link Fault = Open/Ground discrete, Asserted is Open.
10. OMS Data Link bit asserted = 1.
11. OMS CMC bit asserted = 1.
12. Not Used.
13. Not Used
14. Recorder Not Functional means incapable of executing BITE
15. Not Used.
16. When CVR Record Disabled is asserted, recording is disabled, indicating that Pins 7-8 are open or that Pin 10 has been grounded for more than 10 minutes. See Section 3.11.
17. For definition of RIPS Fault, reference ARINC Characteristic 777. An internal RIPS may use pin 29 or **use an OMS to report this fault.**~~an internal means to set this bit.~~
18. Not Used.

APPENDIX A MICROPHONE LOCATIONS



APPENDIX B MICROPHONE SPACING



APPENDIX C LIST OF REFERENCE DOCUMENTS

Note: The latest revision of each document applies.

1. **ARINC Specification 404A:** *Air Transport Equipment Cases and Racking*
2. **ARINC Specification 404B:** *Air Transport Equipment Cases and Racking*
3. **ARINC Specification 429:** *Digital Information Transfer System (DITS)*
4. **ARINC Characteristic 573:** *Aircraft Integrated Data System Mark 2 (AIDS)*
5. **ARINC Characteristic 585:** *Aircraft Chronometer System*
6. **ARINC Specification 600:** *Air Transport Avionics Equipment Interfaces*
7. **ARINC Report 607:** *Design Guidance for Avionic Equipment*
8. **ARINC Specification 608A:** *Design Guidance for Avionics Test Equipment, Part 1, System Definition*
9. **ARINC Report 609:** *Design Guidance for Aircraft Electrical Power Systems*
10. **ARINC Report 624:** *Design Guidance for Onboard Maintenance System*
11. **ARINC Specification 626:** *Standard ATLAS for Modular Test*
12. **ARINC Report 627:** *Programmers Guidance for SMART™ Systems using ARINC 626 ATLAS*
13. **ARINC Characteristic 717:** *Flight Data Acquisition and Recording System*
14. **ARINC Specification 720:** *Digital Frequency/Function Selection for Airborne Electronic Equipment*
15. **ARINC Characteristic 747:** *Flight Data Recorder*
16. **ARINC Characteristic 757:** *Cockpit Voice Recorder*
17. **ARINC Characteristic 777**: *Recorder Independent Power Supply (RIPS)*
18. **ATA Specification 100:** *Specification for Manufacturers' Technical Data* dated June 1, 1956
19. **EUROCAE ED-93:** *Minimum Aviation System Performance Specification for CNS/ATM Message Recording Systems*
20. **EUROCAE ED-112:** *Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems*
21. **FAA TSO C-123b:** *Cockpit Voice Recorder System*
22. **RTCA DO-160/EUROCAE ED-14:** *Environmental Considerations and Test Procedures for Airborne Equipment*
23. **RTCA DO-178/EUROCAE ED-12:** *Software Considerations in Airborne Systems and Equipment Certification*
24. **RTCA DO-214:** *Audio System Characteristics and Minimum Operational Performance Standards for Aircraft Audio*
25. **RTCA DO-254/EUROCAE ED-80:** *Design Assurance Guidance for Airborne Electronic Hardware*
26. **SAE Report Committee S7:** *Cockpit Standardization Project*
27. **MIL-C-81659:** *Connectors, Electrical Rectangular, Crimp Contact*
28. **Military Standard No. MIL-STD-704:** *Characteristics and Utilization of Aircraft Electric Power*. (This document supersedes **MIL-E-7894A:** *Electric Power, Aircraft, Characteristics of*)

APPENDIX D GUIDANCE MATERIAL FOR INSTALLATION OF COMBINED VOICE AND FLIGHT DATA RECORDERS

For guidance in this area, see ARINC Characteristic 757, Appendix D.

APPENDIX E INTERNAL OR EXTERNAL RIPS IMPLEMENTATION

E-1 General

This appendix provides design consideration for both internal and external Recorder Independent Power Supply (RIPS) implementations. A RIPS internal to the CVR will eliminate the need for an additional LRU and any changes to aircraft wiring. An external RIPS implementation could avoid replacement of an existing CVR. The market may require both versions. See ARINC Characteristic 777 for detailed discussion of RIPS.

COMMENTARY

It is envisioned that a bank of batteries or capacitors may comprise the RIPS energy storage. Advances are being made in rechargeable batteries, as well as super-capacitors. The supplier is cautioned to consider life-cycle issues, such as periodic maintenance, wear-out, safety hazards, disposal, and multi-source availability, when choosing their RIPS technology.

E-1.1 Goals

The goals in an implementation of a RIPS (internal or external) are as follows:

a. Meet regulations for functionality
b. Require no (or minimal) changes to existing aircraft wiring
c. Require no (or minimal) changes to existing recorders

The advantages and disadvantages of each implementation are listed in Sections E-2 and E-3 below.

E-1.2 Cascading Considerations

Several problems can arise when installing a standalone RIPS or a CVR with an internal RIPS in aircraft installations with a delay implemented by aircraft logic. These problems stem from the various ways in which the 10 minute delay for cessation of recording can be implemented. For example, the engine-out discretes could be wired to a time delay relay, which shuts off power to the CVR 10 minutes after the engines stop. Alternatively, the engine out discretes could be wired to the Stop CVR Recording input on the CVR, which then internally waits 10 minutes and then stops recording.

To ensure that the recording will always stop at the appropriate time, the preferred approach is to utilize the Stop CVR Recording discrete. Use of the time delay relay, described above, can cause cascading of the delays, resulting in 20 minutes of recording after engines stop on the ground, 10 minutes due to the relay, and then 10 minutes due to the RIPS.

These problems can be addressed in the following manner:

- When installing an external RIPS in an aircraft that uses the time delay relay to stop recording, the power to the RIPS should not have the delay applied. The time delay relay should be removed or replaced with a similar relay that has no delay.
- When installing a recorder with an internal RIPS in an aircraft that uses the time delay relay to stop recording, the aircraft should be modified to use the Stop CVR Recording input discrete instead of the delay relay or the time delay relay should be replaced with a similar relay that has no delay. There is no way for the recorder to distinguish between power interruption due to an incident (when it is required to record for 10 minutes more) and normal engine shutdown (in which case the relay has already timed the 10 minutes and recording should cease immediately).

E-2 Internal RIPS

A recorder with an internal RIPS capability will store energy from the aircraft power supplied to the recorder, and use this stored energy to continue recording for 10 minutes after every normal or abnormal loss of power, subject to Cessation of Recording requirements. The input power can be either 115 Vac or 28 Vdc; the recorder accepts either or both at once. The recorder may segregate its functions such that only the CVR function continues, or it may sustain all functions (again subject to applicable Cessation of Recording requirements).

The recorder should monitor and report the health of the internal RIPS function. Reporting of the RIPS Fault and Maintenance Status is accomplished via the CVR OMS ARINC 429 output bus.

Any suitable energy storage technology may be used, but maintenance concerns may dictate that the storage element be replaceable without removing or opening the recorder. Also consideration should be given to limiting instantaneous power consumption during system power-up, since the combination of recorder inrush current and the storage recharge may overload the supply circuits.

In theory, the components of a RIPS are already present in a CVR due to the existing 200 millisecond holdup requirement. These include the voltage conversion, storage management, and supply functions. What changes is the capacity of the storage. In practice, the storage technology used may require different or additional circuitry.

E-3 External RIPS

Installing an external RIPS includes mounting the unit somewhere near the CVR, running wires from the aircraft 115 Vac and/or 28 Vdc supplies to the RIPS, and running wires from the RIPS to the 28 Vdc input on the CVR.

An external RIPS will store energy from the aircraft power (which may be separate from that supplied to the recorder) and use this stored energy to power the recorder for 10 minutes after every normal or abnormal loss of power. The input power can be either 115 Vac or 28 Vdc. The RIPS should monitor and report the health of the storage and supply functions.

RIPS Fault and Maintenance information is provided by the RIPS on ground / open discrete outputs. These may be input to the CVR on pins 29 and 38. Reporting of

the RIPS Fault and Maintenance Status is accomplished via the CVR OMS ARINC 429 output bus.

Pin 10 may also include a RIPS Active discrete input which functions as a trigger to stop CVR recording. This is reported on the CVR OMS ARINC 429 output bus.

Any suitable energy storage technology may be used, but maintenance concerns may dictate that the storage element be replaceable easily. Also consideration should be given to limiting instantaneous power consumption during system power-up, since the combination of recorder inrush current and the storage recharge may overload the supply circuits.

APPENDIX F GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

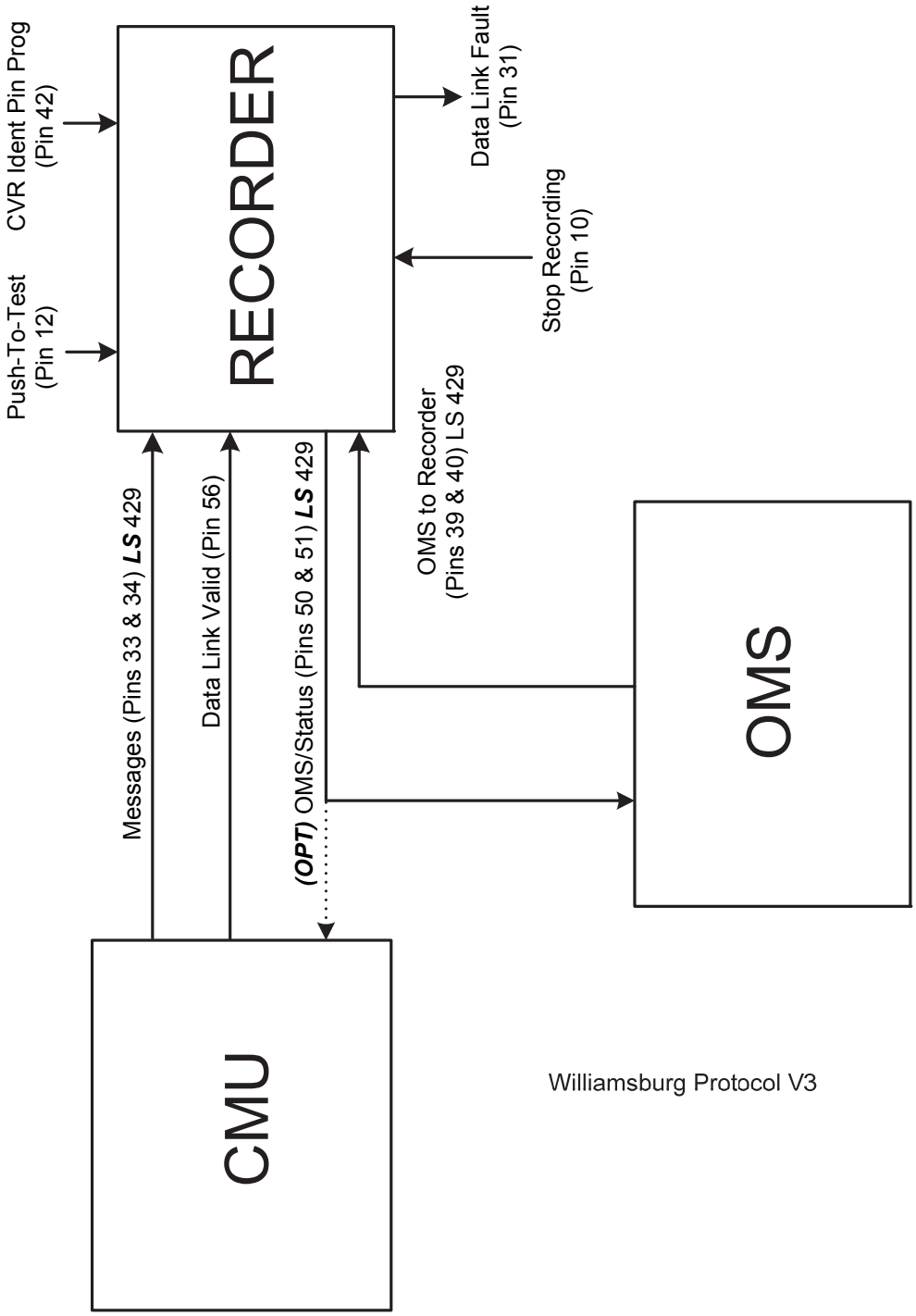


Figure F-1 – CMU Data Link System Block Diagram

APPENDIX F
GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

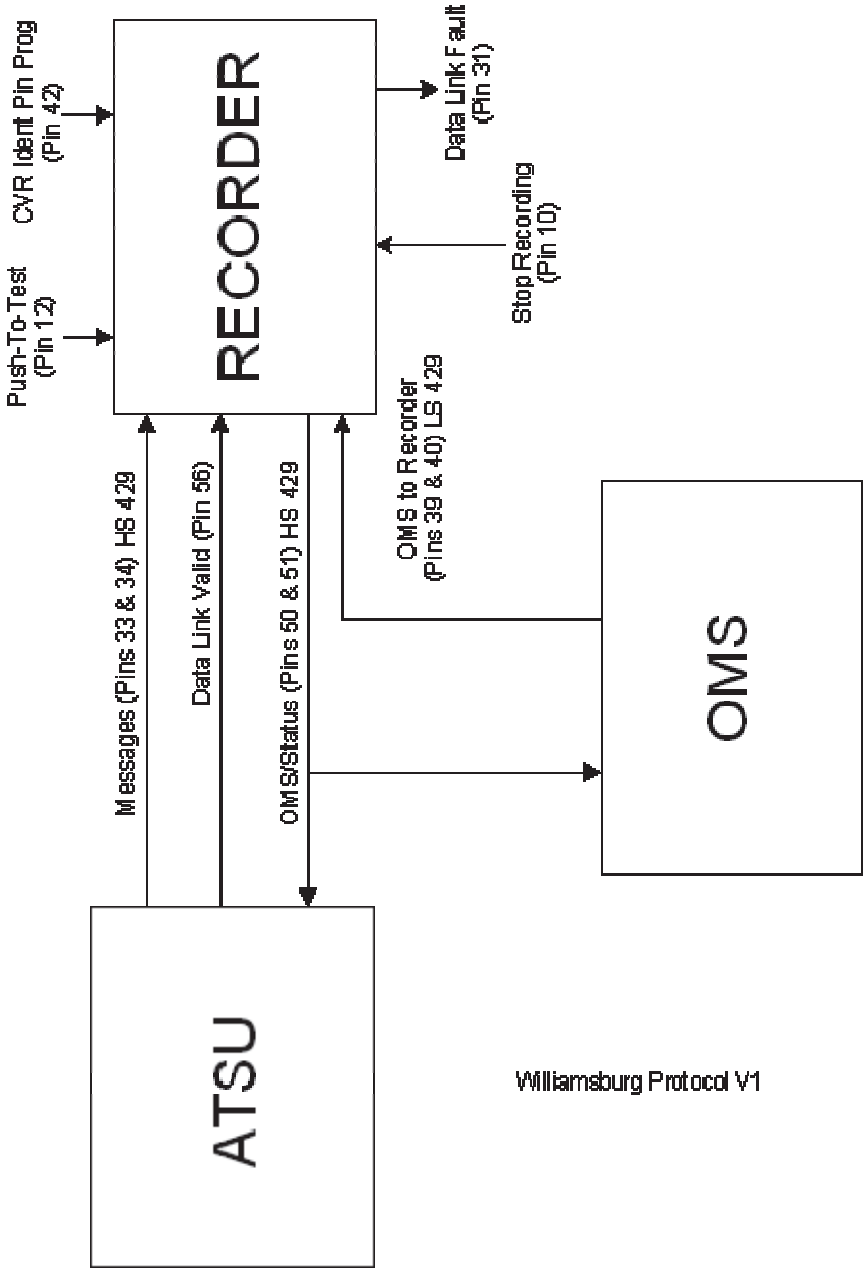


Figure F-2 – ATSU Data Link System Block Diagram

APPENDIX F
GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

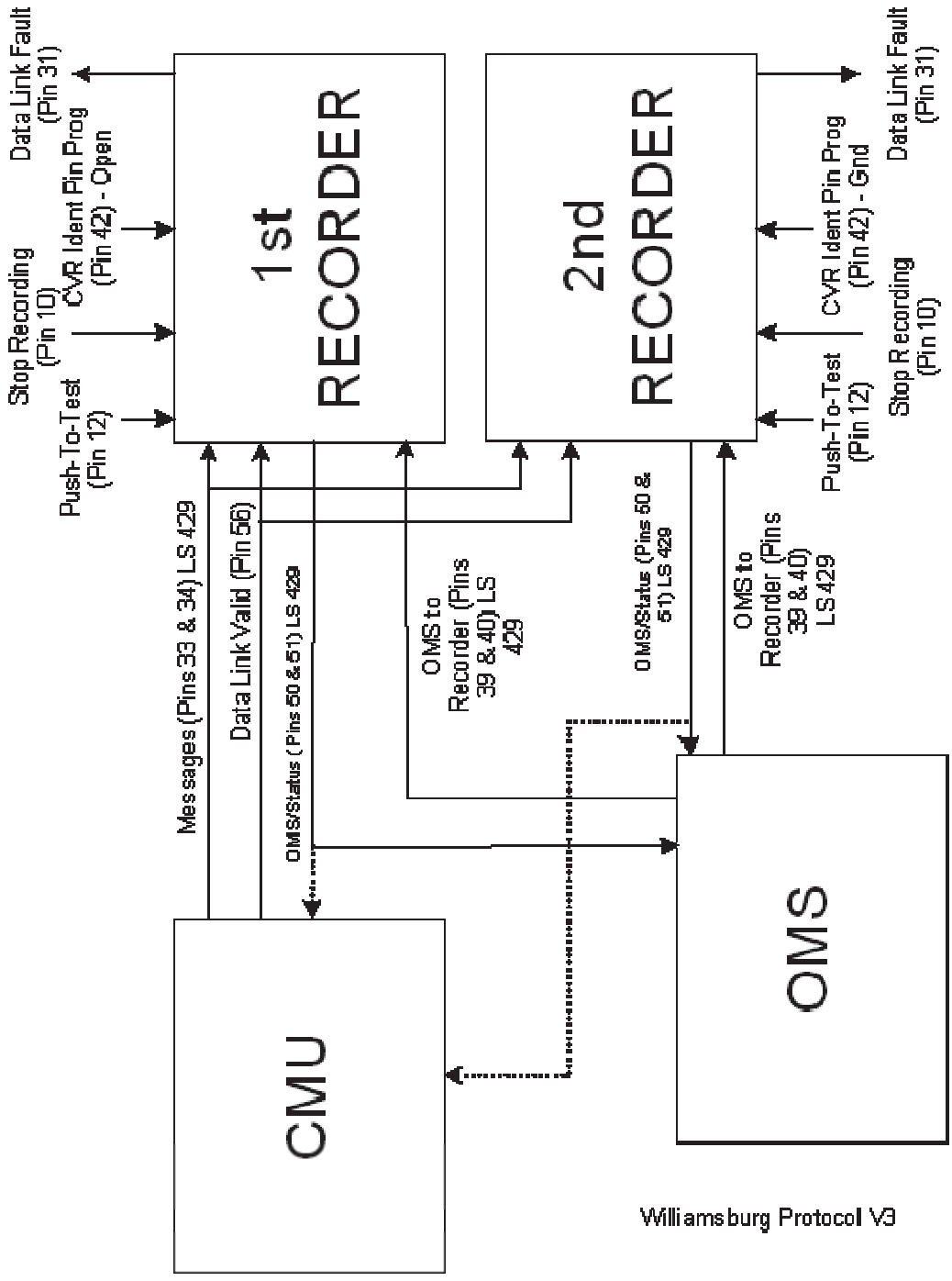


Figure F-3 – CMU Data Link System Block Diagram – Two Recorders

APPENDIX F
GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

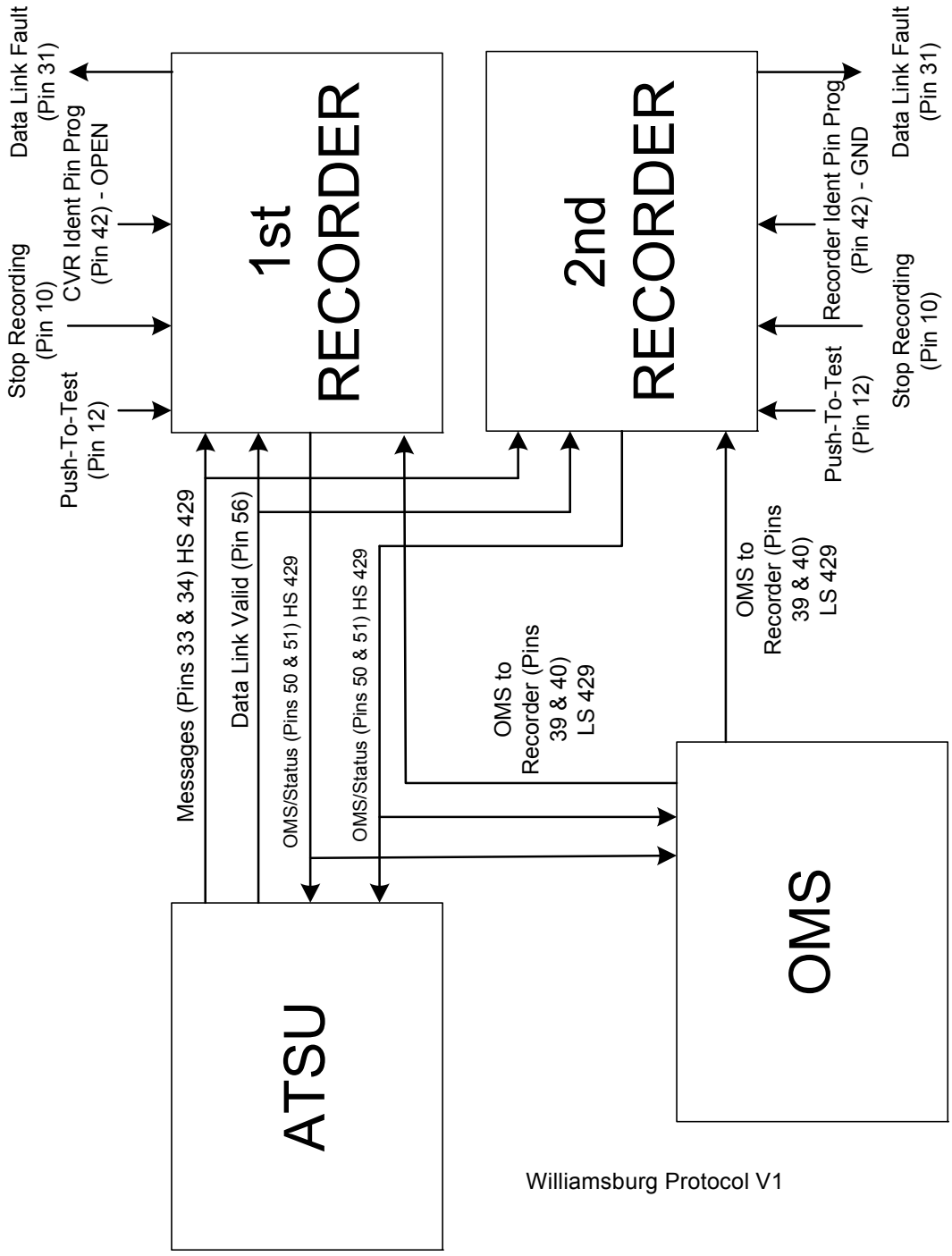


Figure F-4 – ATSU Data Link System Block Diagram – Two Recorders

APPENDIX F
GUIDANCE MATERIAL FOR INSTALLATION OF DATA LINK

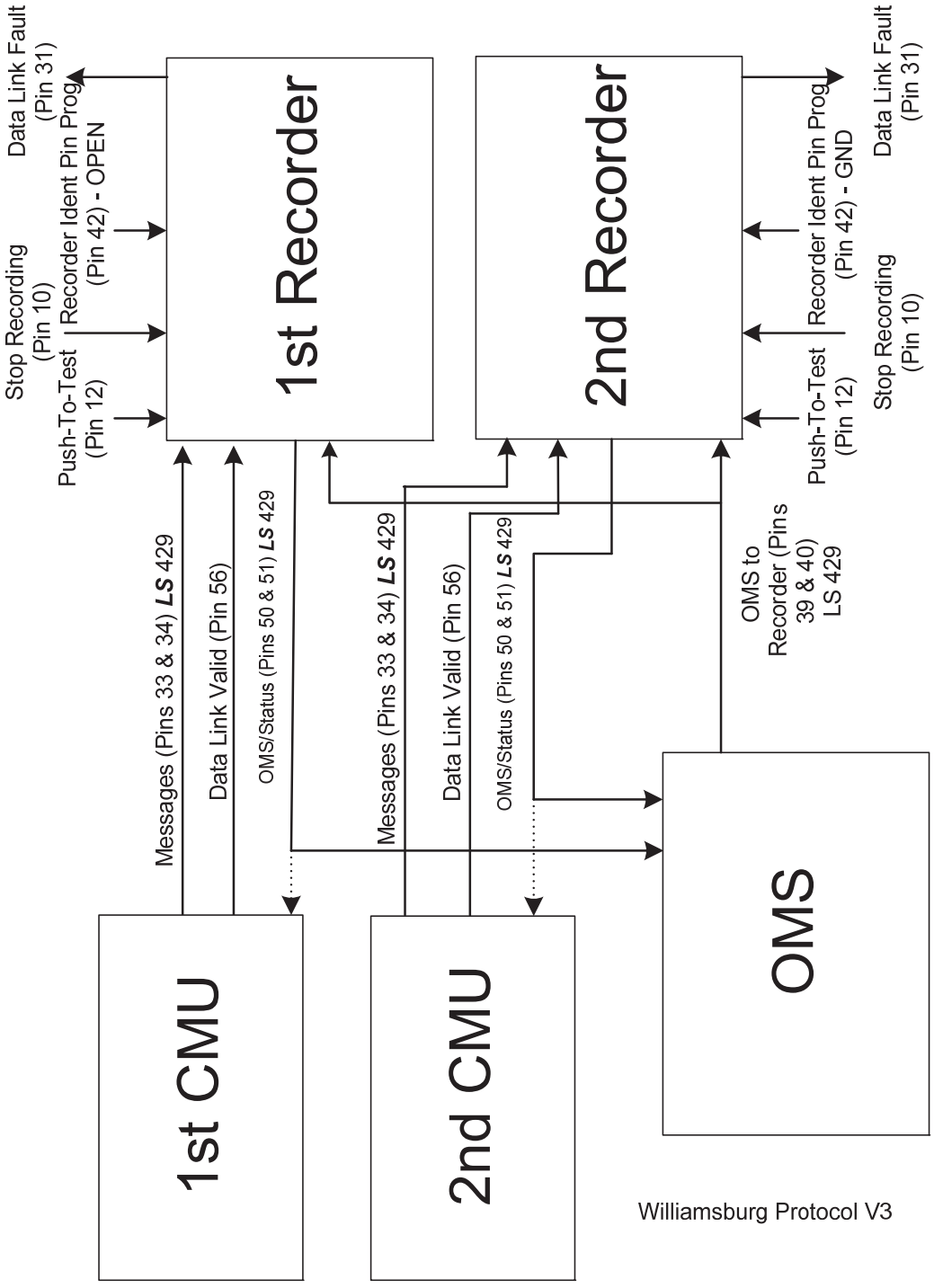


Figure F-5 – Dual CMU Data Link System Block Diagram – Two Recorders

APPENDIX G
ACRONYMS AND ABBREVIATIONS

APPENDIX G ACRONYMS AND ABBREVIATIONS

ACARS	Aircraft Communications Addressing and Reporting System
AEEC	Airlines Electronic Engineering Committee
ATE	Automatic Test Equipment
ATR	Air Transport Racking
ATSU	Air Traffic Services Unit
BITE	Built-in Test Equipment
CAM	Crew Area Microphone
CMU	Communications Management Unit
CU	Control Unit
CVR	Cockpit Voice Recorder
CVFDR	Cockpit Voice and Flight Data Recorder
D/L	Data Link
EUROCAE	European Organization for Civil Aviation Electronics
FAA	Federal Aviation Administration
FDAU	Flight Data Acquisition Unit
FDR	Flight Data Recorder
FSK	Frequency Shift Key
HS	High-Speed
ICAO	International Civil Aviation Organization
INT	Internal
LS	Low-Speed
LSB	Least Significant Bit
LSD	Least Significant Digit
MIC	Microphone
MSB	Most Significant Bit
MSD	Most Significant Digit
na	Not Asserted
N/A	Not Applicable
NCD	No Computed Data
OMS	On-board Maintenance System
ox	Manufacturer Option
RIPS	Recorder Independent Power Supply
S/N	Signal-to-Noise
SDI	Source Destination Identifier
SPL	Sound Pressure Level
SSM	Sign Status Matrix
TSO	Technical Standard Order
UTC	Universal Time Coordinated