Upgrading Data Link Equipment from ARINC 724/724B to ARINC 758

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Introduction

ABSTRACT

Data link usage by airlines continues to increase at record-breaking rates. As upgrades to existing data link equipment are considered, a frequently asked question has been: "What will it take to install a new ARINC 758 Communications Management Unit (CMU) in our current installation?" This paper will outline considerations for installing an ARINC 758 CMU where an ARINC 724 or ARINC 724B Management Unit (MU) had been installed previously.

BACKGROUND

In the beginning, data link or Aircraft Communications and Reporting System (ACARS) existed largely to provide the function of a time clock. Its primary function was to record and automatically report when the major phases of flight transpired: Out, Off, On and In (OOOI). The reporting function required that the information be sent as digital information using the readily available VHF radios currently installed for voice communications. Early installations shared the existing VHF-2 radio with voice operations, although it became more common to provide a dedicated radio to ACARS. Once data link equipment was on the aircraft, it was soon drafted to provide other functions. In today's aircraft, data link represents a crucial tool to the airline by providing information about the aircraft to maintenance as well as uplinking flight plans and clearances.

As airlines and airframe manufacturers continue to find new uses for ACARS, traffic volume continues to increase. In busy terminal areas, service providers have implemented multiple data frequencies to alleviate the congestion. ACARS users encountering congestion will find increasing periods of NO COMM where it is not possible to maintain communications in crowded terminal areas. Where congestion is less severe, messages will be retransmitted more often, resulting in delays in delivery of uplink and downlink messages. These situations impact airlines through delays and the inability to access data link applications which provide them with their cost-saving advantages. The ultimate solution for the current congestion was to implement a higher data rate subnetwork. VHF Digital Link (VDL) Mode 2 utilizes Differential 8- Phase Shift Keying (D8PSK) with a raw data rate of 31.5 Kbits/second, compared with the 2.4 Kbits/second Minimum Shift Keying (MSK) used by Plain Old ACARS (POA). The first fielding of this new modulation was ACARS over AVLC (AOA). This first step allows airlines and service providers to utilize the VDL Mode 2 infrastructure being put in place to support the desired Aeronautical Telecommunications Network (ATN) solution without changes to their ground applications. To obtain these benefits, it is necessary to deploy true ARINC 758 CMUs. ARINC 758 includes the new interfaces required to support ATN applications and subnetworks.

How did we get here?

Data Link Specification Progression

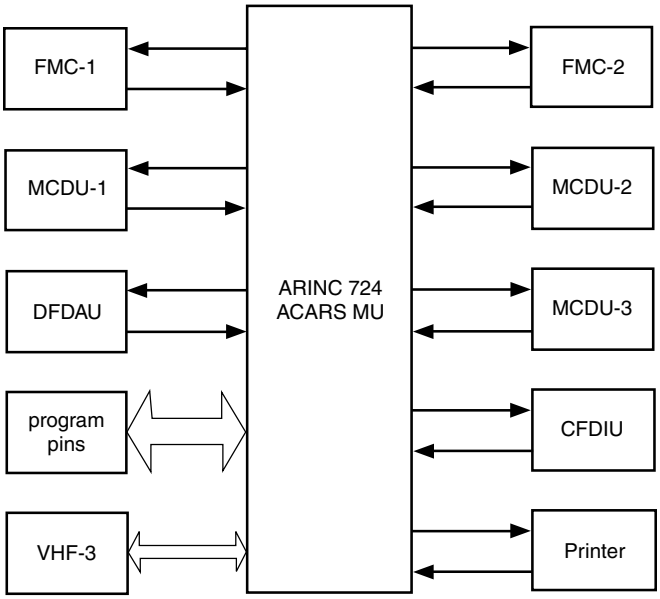
ARINC 597 - "ARINC Communications Addressing and Reporting System"

The original ARINC characteristic 597 (adopted December 1978) documents the original data link equipment deployed. True to the original design precepts, this is a limited function box without direct interfaces to other aircraft systems (e.g., FMC and DFDAU). The box was defined as a 3/8 Air Transport Racking (ATR) short form factor size, with a dual insert DPX connector.

An additional Line Replaceable Unit (LRU), an Optional Auxiliary Terminal (OAT), was defined to expand the capability of the original MU. The OAT was defined as a 4 MCU form factor, with a shell size 2 ARINC 600 connector. The OAT provides interfaces for dual FMCs, 717 DFDAU, 573 FDAU, I/O terminal and various other peripherals.

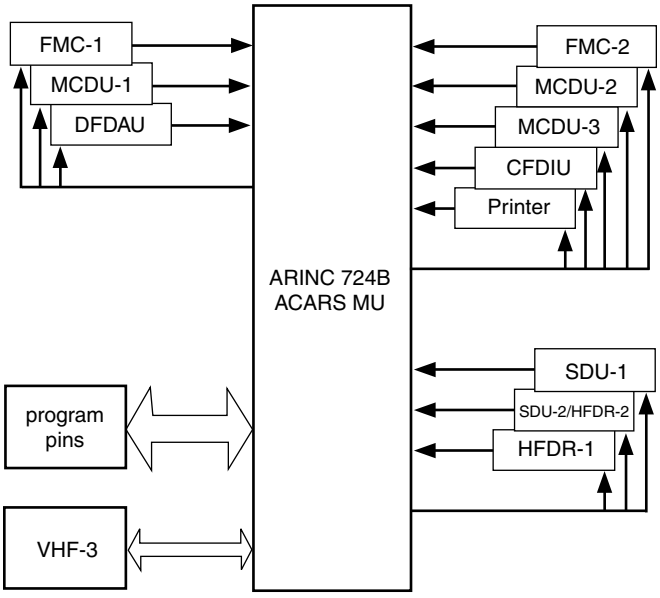
ARINC 724 - "Mark 2 Aircraft Communications Addressing and Reporting System"

ARINC 724 (adopted August 1979) defined an ACARS MU with interfaces to aircraft peripherals in a single 4 MCU form factor using a shell size 2 ARINC 600 connector. Dedicated ARINC 429 input and output data buses are provided for each aircraft interface. A large number of program pins are required (including 54 to define aircraft registration mark and airline ID) to define how the MU would function.



ARINC 724B - "Aircraft Communications Addressing and Reporting System"

ARINC 724B (adopted October 1987) defined an updated ACARS MU using the same single 4 MCU form factor with a shell size 2 ARINC 600 connector. ARINC 724B differs through its use of general output buses. In this arrangement, a single output bus from the MU is connected to multiple peripherals. Each peripheral is identified with a unique System Address Label (SAL) which allows it to distinguish data addressed to it. Additional buses are defined to accept aircraft information from ARINC 429 buses. OOOI data and aircraft information can be received in this manner, although most discrete interfaces are maintained. The MU is also provisioned to use MCDUs where available, rather than a dedicated ACARS CDU.



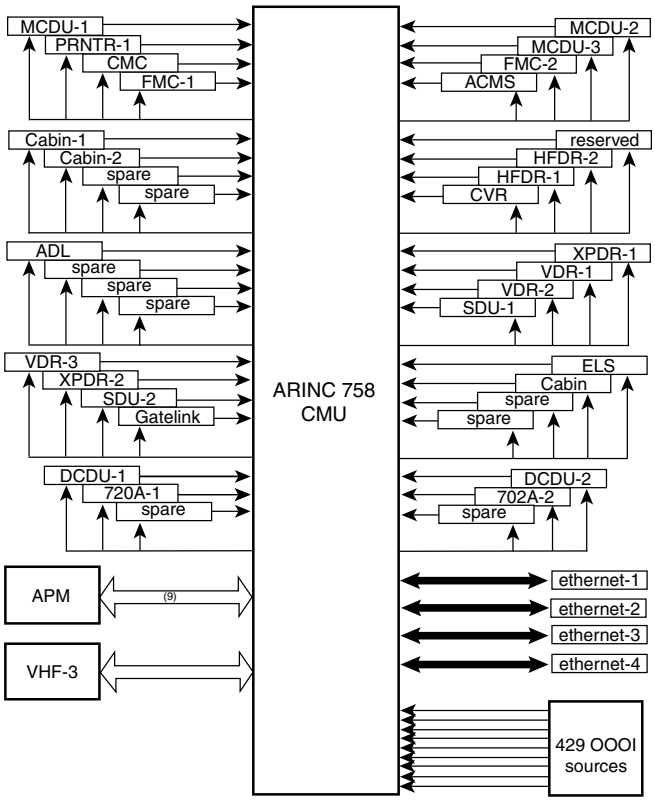
ARINC 758 - "Communications Management Unit (CMU) Mark 2"

ARINC 758 (adopted October 1996) was defined to create an airborne platform capable of supporting an ATN router as well as being an airborne end system. ARINC 758 is the first utilization of an Aircraft Personality Module (APM) as defined by ARINC 607. The APM allows information that was formerly strapped at the LRU connector with program pins to be stored in a non-volatile memory designed to become a physical part of the aircraft with an MTBUR exceeding the lifetime of the aircraft.

With an APM providing information which was previously supplied via rear connector program pins, the CMU provides a much greater number of interfaces to the aircraft. ARINC 758 defines

- 48 ARINC 429 input ports
- 12 ARINC 429 output ports
- 4 ARINC 646 Ethernet ports

The ARINC 758 CMU is the platform which supports ATN communication over VDL Mode 2 and other subnetworks in the future. The ATN will become the primary means of delivery of Air Traffic Control (ATC) communications to and from the aircraft. Ultimately, this will become required equipment for operation in specific environments.



Regulatory Requirements

Currently, the CMU-900 is a non-essential system and is certified to DO-178B, level D. As the CMU-900 incorporates ATC applications, the criticality of the system will be increased to essential and will result in certification at DO-178B, level C.

Regulatory requirements are currently being prepared which specify that data link communications must be recorded on board the aircraft using the ARINC 757 Cockpit Voice Recorder (CVR) for the benefit of accident investigation. The ARINC 758 CMU is the only data link equipment which provides a connection to the CVR for compliance with these directives. It is recommended that all ARINC 758 CMU installations include the wiring (capped and stowed if necessary) for future connection to the CVR.

CMU Functions

User Programmability

The CMU-900 Airline Operational Control (AOC) application is programmable by the user through the use of the Ground Support Equipment (GSE). The CMU-900 GSE provides the ability to modify an airline's AOC application without impact to the aircraft certification. Using this tool, it is possible to create and modify

- Display and data entry pages
- Downlink message formats
- Advisory messages
- Event triggers/OOOI logic
- Capture and use of ARINC 429 broadcast data

This results in the airline user having the flexibility required to create, modify and maintain their AOC application without requiring recertification.

Data Loading

The CMU-900 is data loadable through the use of an ARINC 615 Data Loader. Provisions exist to allow the data loader to be connected through the ARINC 600 rear connector in installations where a data loader is installed on the aircraft. A front panel connector is available for use on aircraft where data loading is accomplished with the use of a portable data loader which is carried on board when required. This allows the CMU-900 to be updated on the aircraft without the necessity for a shop visit to reprogram.

VDL Mode A

VDL Mode A (defined in ARINC 750, supplement 2) provides a digital interface between the CMU and the VHF Data Radio (VDR). In this configuration, the MSK modem required for POA resides in the VDR instead of the CMU. The intention of VDL Mode A is to provide a method to allow forward fitting CMUs and VDRs where new equipment is being installed. This configuration allows all of the hardware required for VDL Mode A to be installed and certified. Subsequent upgrades in capability, such as, VDL Mode 2, can be implemented by data load without any hardware changes being required on the aircraft.

VDL Mode 2

The ARINC 758 CMU contains the high speed ARINC 429 interfaces required to provide a digital interface to the VDRs needed to support VDL Mode 2. This high speed (31.5 Kbps) link will be initially deployed for AOA and later will be used as the VHF subnetwork for ATN.

Aircraft Implementation

AOA utilizes the VDL Mode 2 subnetwork for transmission of ACARS messages in a fashion transparent to the user. Messages to and from the aircraft are delivered to the respective Data Link Service Provider (DSP) using the VDL Mode 2 link and are subsequently provided to the airline in exactly the same format as is used currently.

CPDLC

The CMU-900 supports Controller - Pilot Data Link Communications (CPDLC) when operating in an ATN environment with the appropriate software configuration. The ATN CPDLC implemented by the CMU-900 is defined by International Civil Aviation Organization (ICAO) Standards and Recommended Practices (SARPs) and provides a predefined message structure and syntax which provides for information exchange between the pilot and controller in a concise format. These digitally transferred messages are not affected by radio static or interpretation problems induced by foreign dialects.

New Equipment Requirements

CMU

The existing ACARS equipment will be replaced with a Collins CMU-900 Communications Management Unit (CPN 822-1239-XXX). In cases where ARINC 724 or 724B MUs are being replaced, the existing tray and ARINC 600 connector will be reused. The physical characteristics of the CMU are identical to the 724/724B implementation: the connector key pattern will be changed from index pin code 09 (724/724B) to 58 (758) as specified by ARINC 758.

APM

An APM-900 (CPN 822-1424-001) is required by the CMU to provide on-aircraft storage of unique aircraft parameters, such as, registration mark, airline ID and ICAO address. This is a new addition required by ARINC 758 to provide a Cyclical Redundancy Check (CRC) protected source of information about the environment that the CMU is installed in. In previous generations of ACARS equipment, this function had been accomplished through the use of numerous program inputs on the rear connector, or using non-volatile data storage within the MU which required manual data entry whenever an MU was replaced on the aircraft.

A copy of the APM data is stored within the CMU to allow the data to be restored in the unlikely event of an APM failure. Data from the APM is validated against other on-board sources in addition to the stored copy. This ensures that the data used by the CMU is correct.

Typical mounting locations for the APM will be on the equipment shelf containing the CMU, either behind the CMU service connector or below the CMU tray on the shelf hardware. The APM is expected to have a Mean Time Between Unscheduled Removals (MTBUR) of approximately 640,000 hours (approximately 73 years). As a result, the APM is considered to be part of the aircraft and will not be removed with CMU pulls.

CMU Control/Display Unit

If the aircraft configuration does not currently utilize ARINC 739 compatible MCDU(s), a control/display unit will need to be provided to access the CMU functions. The Collins IDC-900 (CPN 822-1626-XXX) Integrated Data Link Control is recommended for these installations. The IDC-900 combines ARINC 739A color MCDU functions with primary radio tuning capabilities for dual ADF and VHF radios. The IDC-900 (6.375" tall) fits into the space vacated by the removal of an ACARS CDU (4.5") and a dedicated radio control panel (2.125"). The IDC-900 provides single-key access to ACARS application, as well as serving as an ARINC 739 display for other aircraft equipment such as SATCOM or ACMS equipment. An upgrade to the IDC-900 will provide support for video and graphics. The video capability allows cameras to be installed to view difficult locations in the aircraft (e.g., cargo hold). The graphics capability will allow the display of uplinked non-textual information, such as graphical weather information.

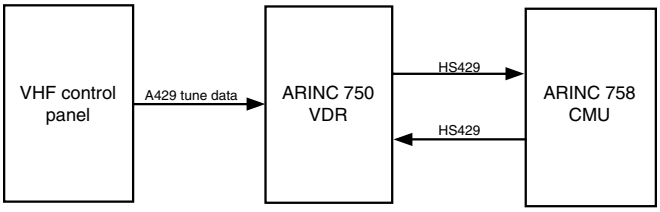
VDR

It is recommended that the CMU installation be accompanied by the installation of VHF Data Radios (VDRs) in order to provide the maximum benefit from their CMU installation. The VHF-900B (CPN 822-1047-XXX) supports VDL Mode A, and the VHF-920 (CPN 822-1250-XXX) and VHF-2100 (CPN 822-2168-XXX) supports VDL Modes A and 2. Service bulletins are available to update the earlier versions of the VHF-900 to later (VHF-900B and VHF-920) versions. Note that updates to the original VHF-900 retain the capabilities of the previous versions. For example, the VHF-920 is capable of operating in VDL Mode A as well as ARINC 716 compatibility.

Previous ARINC 716 radios require an analog interface, where the modem function resides in the MU. This interface requires three sets of twisted, shielded pairs (audio to VHF, audio from VHF and ARINC 429 tuning data) and four discrete wires. Implementation of the high speed 429 digital interface reduces the wiring complexity to the radio while providing access to existing ACARS (Mode A) and VDL Mode 2 (AOA and/or ATN). Digital selection of voice or data can now be accomplished by the Radio Control Panel (RCP) through the use of a new status word (defined by ARINC 750 supplement 2) to control the voice/data operating mode of the VDR. This status word will be provided by the VDR control and does not require any interaction from the CMU. By removing the CMU from any interaction in voice/data switching, any of the VDRs connected to the CMU will be available for use in voice mode without restriction and results in fewer wires being required in the RCP-VDR-CMU interface.

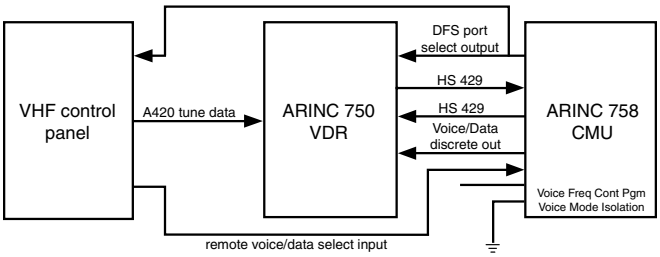
Aircraft with a radio control panel which provides label 276 for voice/data mode control.

This is the preferred configuration, since the radio manages its own voice/data state without any additional wiring required. The VHF control panel commands the voice or data operating state of the VDR without any interaction from the CMU. The CMU operation is solely based on the state information provided by the VDR. The VHF can be used in-voice without restriction. The VDR is able to detect this mode of operation by the presence label 276 appearing on its tuning input bus from the control panel. In this configuration, it is possible to reuse Twisted, Shielded Pair (TSP) wiring previously used for audio for ARINC 429 data.



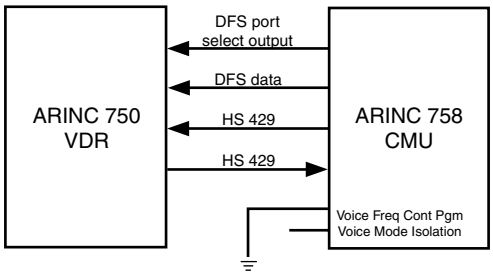
Aircraft with a radio control panel, single panel controlling multiple radios.

This configuration is based on the "normal" voice/data switching configuration used by ARINC 724/724B. In this configuration, a momentary ground applied to the Remote Voice/Data Select Input to the CMU to command it to toggle its current operating mode (either voice to data, or data to voice) of VHF-3. This wiring configuration has traditionally not allowed VHF-3 to be used for dispatch credit (in case of failure of either VHF-1 or VHF-2) with the ACARS MU on, since the MU is not certified to level C as required for VHF comm equipment. The CMU-900 avoids this problem through the use of a dedicated VHF mode controller which is certified to DO-178B, level C. The mode controller guarantees that the VHF will transition to voice mode upon command; if the CMU does not voluntarily relinquish control, it is configured to override the CMU discretes controlling this function. The VDR is able to detect this mode of operation by the lack of label 276 appearing on its tuning input bus from the control panel.



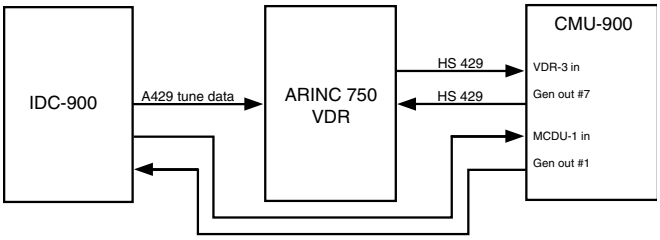
Aircraft with no VHF-3 control panel.

As in the case of ARINC 724B equipment, the CMU can be used to tune VHF-3 without any additional equipment (supported in legacy CMU-900 software versions only). In this mode of operation, the CMU provides the tuning data to the radio, and control of the radio is through a CMU display page. Used in this manner, the aircraft cannot be dispatched if VHF-1 or VHF-2 is not operational since a placard is required to indicate that VHF-3 cannot be used for ATC communications. In order to allow VHF-3 to be used without restriction in voice mode, a separate control is required due to the level C certification of the VHF comm controls.



Aircraft using IDC-900 as the VHF-3 control panel.

If the installation requires a dedicated control for the CMU, the IDC-900 Integrated Data Link Control also provides tuning functionality for ADFs and VHFs. It is certified to level B, so no VHF-3 placard will be required in this installation. In this installation, the IDC-900 utilizes label 276 to control the voice/data mode switching of the VDR. This eliminates the need to include the CMU in the process of changing between voice and data modes.



SATCOM

The standard SATCOM installation in ARINC 758 utilizes a high speed (100 Kbps) ARINC 429 interface rather than the low speed (12.5 Kbps) ARINC 429 interface used by ARINC 724B. When converting from a 724B installation, the SATCOM program pin controlling the ACARS interface speed (TP10D) needs to be grounded to enable high speed operation. In addition, the SATCOM parity program pin (TP11A) needs to be changed to reflect this program pin modification: If the parity pin is currently grounded, it will need to be opened; if currently open, it will need to be grounded. Note that this information assumes an ARINC 741 compliant SDU. Other SDUs may use different program pins or owners requirements table (ORT) settings to set the 429 interface speed or program pin parity.

HFDR

ARINC 758-2 defines connections for two independent High Frequency Data Radios (HFDR), where ARINC 724B allowed for the installation of either SDU-2 or HFDR-2, but not both. Use of an HFDR may be required for routes which operate beyond approximately 80° north or south latitude. These areas are not within the coverage area of SATCOM.

Mode S Transponder

A connection to at least one of the aircraft Mode S transponders is required for the CMU. The CMU obtains the ICAO address of the transponder and uses it to validate the contents of the APM (and provide an initial value). This is of particular importance so that the CMU can detect if the CMU or APM (or both) have been newly installed. The ICAO address is also required by the CMU for addressing of VDL Mode 2 and Satellite Data 3 messages. The CMU connects to the transponder high speed 429 output bus. No data is provided to the transponder from the CMU.

GPS

A connection to a source of GPS data is strongly recommended. This will provide the CMU with a precise source of time and position. ATN CPDLC operations require the CMU to have a highly accurate source of time.

An additional benefit is that the CMU has a source of aircraft position data. This can be used within user downlink messages as well as allowing the CMU to make decisions on frequency acquisition based on aircraft location. With the increasing availability of areas of dual DSP coverage, dependence on frequency scan techniques will be inadequate to select the airlines preferred choice.

CVR

Provisions for connection to an ARINC 757 CVR are strongly recommended. At this time, requirements are being finalized for data link communications to be recorded on the CVR. The aircraft wiring provisions include a twisted, shielded pair for an ARINC 429 bus to be provided to the CVR, and a single discrete out from the CMU to the CVR which indicates whether the CMU supports data link recording.

Aircraft Modifications

New Wiring

Note that the actual wiring required in a specific installation depends on aircraft type and equipage, CMU software configuration and other factors specific to the installation. The tables in this document are intended for reference and should not be used as the sole source of wiring information for an installation

From CMU	To	Wire	Comments
TP01H	APM-P1-1	Composite (shielded conductor bundle)	APM Serial Data Out
TP01E	APM-P1-2		APM Serial Clock Out
TP01C	APM-P1-3		APM Enable #1
TP01K	APM-P1-4		APM Write Protect # 1 Out
TP01D	APM-P1-5		APM Enable #2
TP02A	APM-P1-6		RSVD - APM Write Protect #2 Out
TP01A	APM-P1-7		APM Power
TP01B	APM-P1-8		APM Power Return
TP01J	APM-P1-9		APM Serial Data In
TP05A, TP05B	VDR-1: MP10C, MP10D	TSP	VHF-1 to CMU
MP12A MP12B	VDR-1: MP12A, MP12B VDR-2: MP12A, MP12B	TSP	CMU to VDR-1, VDR-2 (CMU output bus #6) [4]
TP10A, TP10B	VDR-2: MP10C, MP10D	TSP	VHF-2 to CMU
MP07C, MP07D	VDR-3: MP10C, MP10D	TSP	VHF-3 to CMU [1]
TP13H TP13J	VDR-3: MP12A MP12B	TSP	CMU to VDR-3, SDU-2 (CMU output bus #7) [1]
MP08C, MP08D	XPDR-1	TSP	Transponder-1 to CMU
MP10A, MP10B	XPDR-2	TSP	Transponder-2 to CMU
TP07G, TP07H	CVR: pins 33, 34	TSP	CMU to CVR [2,4]
MP06E, MP06F	GPS	TSP	GPS (CMU Digital Data Bus Input #7)
MP12E, MP12F	MCDU-3: pins 8, 9	TSP	CMU to MCDU-3 [3]
TP12F	CVR pin 56	Discrete	CMU to CVR “Data Link Valid”

Changed Wiring

Note that the actual wiring required in a specific installation depends on aircraft type and equipage, CMU software configuration and other factors specific to the installation. The tables in this document are intended for reference and should not be used as the sole source of wiring information for an installation

Original 724B MU Connection	New 758 CMU Connection	Destination Device Connection	Comments
TP07G TP07H	MP12A MP12B	SDU-1	Move MU general output bus #4 to CMU Comm Link Data Bus #6 out[4]
TP02C TP02D	TP06H TP06J	SDU-1	SDU #1 data to MU/CMU
TP02E TP02F	TP12D TP12E	SDU-2	SDU #2 data to MU/CMU[5]
MP15J MP15K	MP13G MP13H	CMC/CFDIU	CMC/CFDIU data to MU/CMU
MP13G MP13H	MP15J MP15K	FMC-1	FMC-1 data to MU/CMU
MP15G MP15H	MP12E MP12F	MCDU-2 MCDU-3 FMC-2 ACMS advisory display[6]	MU/CMU general output bus #2[3]
MP14C MP14D	MP12C MP12D	MCDU-2: pins 27, 28	MCDU-2 data to MU/CMU
MP14J MP14K	MP12G MP12H	MCDU-3: pins 27, 28	MCDU-3 data to MU/CMU[3]
MP13J MP13K	MP11C MP11D	FMC-2	FMC-2 data to MU/CMU
MP07J MP07K	MP11E MP11F	ACMS	ACMS/DFDAU data to MU/CMU
MP12C MP12D	MP14C MP14D	Cabin-1	Cabin-1 data to MU/CMU
MP12G MP12H	MP14J MP14K	Cabin-2	Cabin-2 data to MU/CMU
MP12E MP12F	MP15G MP15H	Cabin-1 Cabin-2	MU/CMU general output bus #3

Unchanged Wiring

While ARINC 758 does describe a new rear connector definition, there remains some commonality with the previous ARINC 724B characteristic. This table defines the connections which exist in the 724B connector and can be reused without change in the 758 installation. Note that the actual wiring required in a specific installation depends on aircraft type and equipage, CMU software configuration and other factors specific to the installation. The tables in this document are intended for reference and should not be used as the sole source of wiring information for an installation

MU/CMU Connection	Destination Device Connection	Comments
TP07G TP07H	HFDR-1 HFDR-2	MU/CMU general output bus #4[4]
TP10C TP10D	HFDR-1	MU/CMU HFDR-1 input bus
TP02E TP02F	HFDR-2	MU/CMU HFDR-2 input bus
TP06F TP06G	ADL	MU/CMU data to ADL
TP06E		ADL discrete input
TP05D TP05E		ADL data to MU/CMU
MP15E MP15F	MCDU-1 PRNTR CMC FMC-1 advisory display[6]	MU/CMU general output bus #1
MP14A MP14B	MCDU-1: pins 27, 28	MU/CMU MCDU-1 input bus
MP12J MP12K	PRNTR	MU/CMU PRNTR input bus
TP15A – TP15J	OOOI sensors	Discrete OOOI sensors
TP15K	Ground	OOOI sensor return
MP01A – MP01J	OOOI sensor programs	Discrete OOOI sensor program inputs
MP01K	Ground	Sensor/program common

MU/CMU Connection	Destination Device Connection	Comments
MP14E MP14F	A429 0001 DATA (e.g., EIU, EICAS, SDAC, FWC and etc.)	OOOI #1 data bus input
MP14G MP14H		OOOI #2 data bus input
TP01F TP01G		OOOI #3 data bus input
TP04J TP04K		OOOI #4 data bus input
TP04E TP04F		OOOI #5 data bus input
TP04G TP04H		OOOI #6 data bus input
TP03A TP03B	ARINC 597 Printer[9]	ARINC 597 Printer Data Bus Serial Data Out
TP03C		ARINC 597 Printer Paper Low In
TP03D		ARINC 597 Printer Ready/Busy In
TP03E		ARINC 597 Printer Status A In
TP03F		ARINC 597 Printer Status B In
TP03G		ARINC 597 Printer Status C In
TP03H		ARINC 597 Printer Common
TP07A TP07B	VDR-3: MP11A, MP11B	ARINC DFS tuning data from CMU to VDR[7]
TP07C		DFS port select[7]
TP07F		Voice/Data discrete out[7]
BP01		Primary Power 115 VAC Hot (400 Hz)
BP07		Primary Power 115 VAC Cold (400 Hz)
BP08		Chassis Ground
BP10		Standby Power 28 VDC Positive In[8]
BP11		Standby Power 28 VDC Return[8]

Removed Wiring

The following connections are no longer needed in an ARINC 758 installation. Note that the actual wiring required in a specific installation depends on aircraft type and equipage, CMU software configuration and other factors specific to the installation. The tables in this document are intended for reference and should not be used as the sole source of wiring information for an installation

MU Pin	Old Connection	Wire	Comments
BP02 BP03	28 VDC Primary	Power	Simultaneous connection of 115 VAC and 28 VDC, primary power may damage CMU
MP02A – MP06B		Local Program	Registration mark program pins
MP06C – MP07D		Local Program	Airline ID program pins
TP05A TP05B		Local Program	User defined program input
TP14A – TP14D		Local Program	Aircraft type identifier program inputs
TP14G		Local Program	ARINC 724/724B program input
TP05H		Discrete	PTT[7]
TP09A TP09B	VDR-3: MP05A MP05B	TSP	Audio from MU to VHF-3[1]
TP09C TP09D	VDR-3: MP13A MP13B	TSP	Audio from VHF-3 to MU[1]
TP07G TP07H	SATCOM HFDR	TSP	MU general output bus to SATCOM and HFDR
	SATCOM	TSP	SDU #1 data to MU
TP02E TP02F	SATCOM HFDR	TSP	SDU #2 or HFDR #2 data to MU
TP10C TP10D	HFDR	TSP	HFDR #1 data to MU

Mechanical Modifications

The connector keys installed in the existing ACARS service connector will need to be changed from index pin code 09 to index pin code 58.

The APM needs to be installed in proximity to the CMU mount. The APM is mounted with two screws and may be mounted to the existing CMU mount, either directly or with an adapter plate (to provide sufficient area to allow the APM to be mounted).

Footnotes

1. The TSP connections for “MU audio to VHF” and “VHF audio to MU” may potentially be reused to provide the HS429 connections required for connection to VDR-3.

2. No provision is made for data from the CVR to the CMU since ARINC characteristic 757 does not provide for an output to the CMU. Data will be provided by the CMU to the CVR using Williamsburg version 3 protocol which does not require acknowledgements from the receiving unit.

3. ARINC 758 moves MCDU-3 from MU general output bus #1 to CMU general output bus #2. New wiring will be required to insure continuity to MCDU-3 without disturbing existing general output bus #1 connections (i.e., printer).

4. The reuse of MU output bus 4 is only applicable to installations without connections to HFDR(s). 758 utilizes three separate output buses to connect to SDU-1 (CMU output bus 6), SDU-2 (CMU output bus 7) and HFDR-1 and HFDR-2 (CMU output bus 4). Note that CMU output bus 6 also is connected to VHF-1 and VHF-2 and output bus 4 is also connected to the CVR.

5. ARINC 724B allows only HFDR-2 or SDU-2. Therefore, connector pins TP02E and TP02F can either be reused without change for HFDR-2 or moved to TP12D and TP12E for SDU-2.

6. The MU/CMU general output bus routed to provide a “heads-up” advisory for MU/CMU status. Examples include MAWEA and FWC. These advisories are generated from information contained in the label 270 and 276 status words.

7. This connection may be required, depending on what voice mode control facilities are used in the installation. Refer to Aircraft Implementation, New Equipment Requirements, VDR, page 8.

8. The CMU-900 does not require a connection to a standby 28 VDC source. If 28 VDC is provided on these pins, it is of no consequence.

9. Software support for an ARINC 597 printer is not included in most CMU-900 software versions.

References

ARINC Characteristic 607
"Design Guidance for Avionic Equipment"

ARINC Characteristic 724B
"Aircraft Communications Addressing and Reporting System (ACARS)"

ARINC Characteristic 750
"VHF Data Radio"

ARINC Characteristic 758
"Communications Management Unit (CMU) Mark 2"

RTCA DO-178B
"Software Considerations in Airborne Systems and Equipment Certification"

Acronyms

ACARS	Aircraft Communications Addressing and Reporting System
ADF	Automatic Direction Finder
AOA	ACARS Over AVLC
AOC	Airline Operational Control
APM	Aircraft Personality Module (defined by ARINC 607-3)
ATC	Air Traffic Control
ATN	Airborne Telecommunications Network
ATR	Air Transport Racking
AVLC	Airborne VHF Link Control
CMU	Communications Management Unit (ARINC 758 compatible)
CPDLC	Controller - Pilot Data Link Communications
CPN	Collins Part Number
CRC	Cyclical Redundancy Check
CVR	Cockpit Voice Recorder
D8PSK	Differential 8 Phase Shift Keying
DSP	Data Link Service Provider
FWC	Flight Warning Computer
GPS	Global Positioning System
GSE	Ground Support Equipment (CMU user programming tool)
HFDR	HF Data Radio
HS429	High Speed ARINC 429 (100 Kbps)
ICAO	International Civil Aviation Organization
ICAO address	Unique 24-bit address assigned to the aircraft and used by the Transponder, SATCOM and CMU.
IDC	Integrated Data Link Control
LRU	Line Replaceable Unit
LS429	Low Speed ARINC 429 (12.5 Kbps)
MAWEA	Modular Avionics and Warning Electronics Assembly
MCDU	Multi-Purpose Control Display Unit
MCU	Modular Concept Unit
MSK	Minimum Shift Keying
MTBUR	Mean Time Between Unscheduled Removals
MU	Management Unit (ARINC 597, 724 and 724B compatible)
OAT	Optional Auxiliary Terminal
OOOI	Out, Off, On, In (aircraft movement times)
POA	Plain Old ACARS
RCP	Radio Control Panel
RTCA	Radio Technical Commission for Aeronautics
SAL	System Address Label
SARPs	Standards and Recommended Practices
TSP	Twisted, Shielded Pair
VDL	VHF Digital Link
VDR	VHF Data Radio

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