

CHAPTER

44

Cabin Systems

CHAPTER 44
CABIN SYSTEMS

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44-EFFECTIVE PAGES

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**CHAPTER 44
CABIN SYSTEMS**

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PASSENGER ENTERTAINMENT INTRODUCTION

General

The Passenger Entertainment System (IFES) or Multiplexed Entertainment System (MPES) give high-quality digital programs for the passengers.

The programs have video and audio. The video and audio signal goes to the monitors throughout the cabin through a standard 100 Mbps fast Ethernet Local Area Network (LAN). Passengers receive this audio through headsets attached to the passenger service units in the seats. The audio can go through the passenger address system. Passengers receive this audio through speakers in the passenger service units.

Audio/Video-On-Demand (AVOD) services can also be available to all passenger seat locations. AVOD allows a passenger to use the Handset located in the seat to make AVOD selections that are independent from the selections made by other passengers. The video signals have digital audio sound that comes from MPEG encoded video files.

The IFES or MPES also supply an interface to the Passenger Service System (PSS). The system lets the passengers turn on the reading light and the attendant call function.

Abbreviations and Acronyms

- AC - alternating current

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- ACOU - AC outlet unit

AKS ALL

- ADIRU - air data inertial reference unit
- AI - Aircraft Interface

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- AMCU - advanced master control unit

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- BITE - built-in test equipment
- CB - circuit breaker
- CONT - control

- CP - crew panel
- DC - direct current

AKS 001-025, 027

- FS - file server

AKS ALL

- PCU - passenger control unit
- RJU - remote jack unit

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- SDU - smart display unit

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- VSEB - video seat electronics box

AKS 022-025, 027

- ISPS - in seat power supply

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- LED - light emitting diode

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- OML - Onboard Media Loader

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- OU - outlet unit
- RJM - remote jack module
- PED - personal electronic device

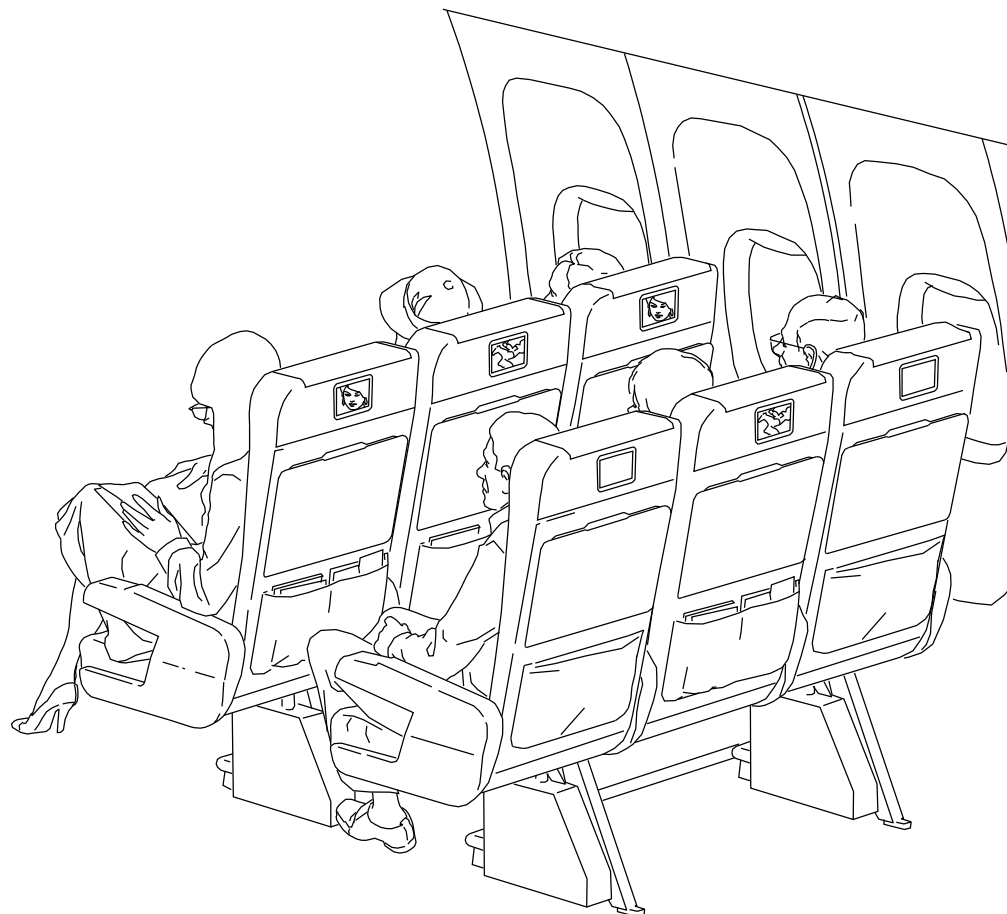
AKS 001-006, 009, 010, 013, 015-018, 020, 021

- SPM - seat power module

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SERVER BASED ENTERTAINMENT SYSTEM

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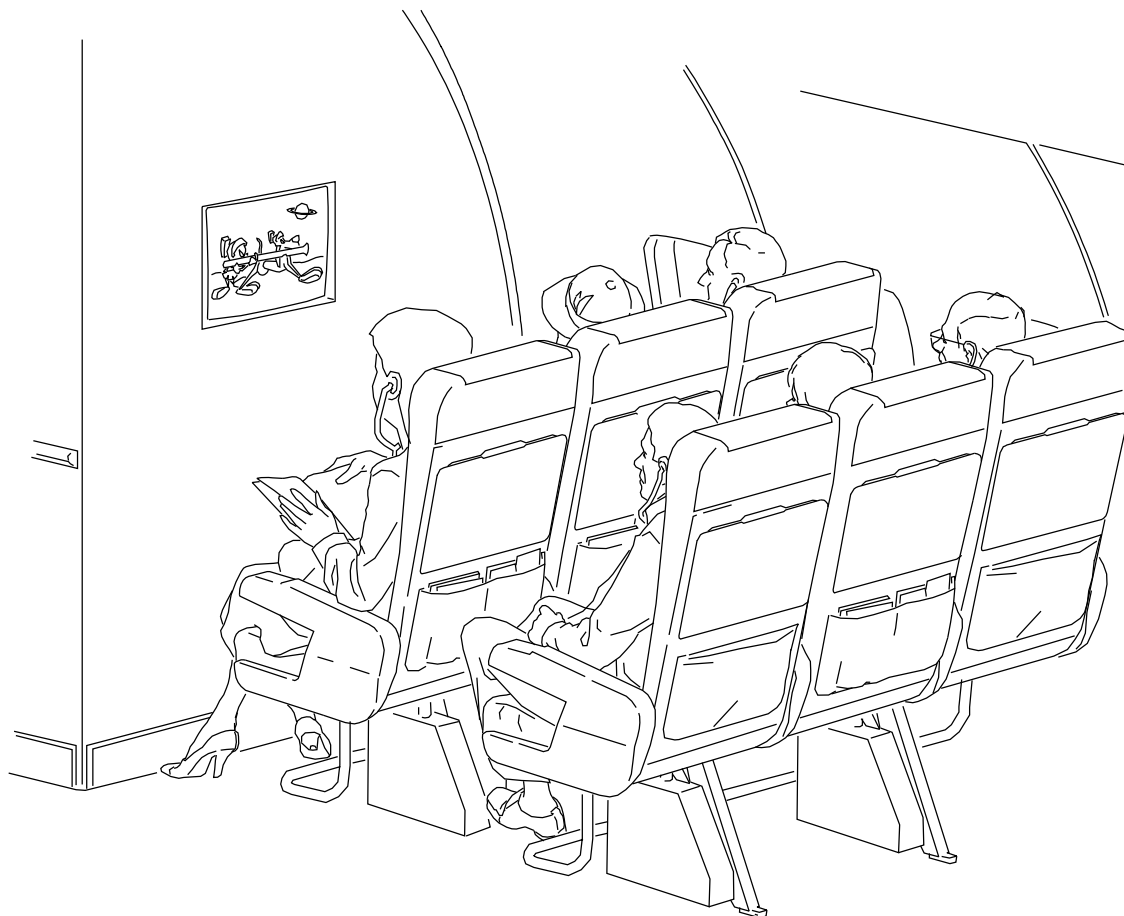
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PASSENGER ENTERTAINMENT SYSTEM - INTRODUCTION

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AKS 007, 008, 011, 012, 014, 019, 026, 028-999

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GENERAL DESCRIPTION

General

The passenger entertainment system provides digital audio, audio/video on demand (AVOD), video games and PC power system to the passengers, if available.

In the emergency stowage box, located in the Aft face of Lav A is the Crew Panel (CP). The CP has a cabin interface to control and monitor the IFES or MPES while in-flight and on the ground. The CP also has an interface for maintenance personnel to perform maintenance on the IFES or MPES.

Components

These are the major components of the server based entertainment system:

- Aircraft Interface

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- Advanced Master Control Unit (AMCU)

AKS ALL

- Crew Panel

AKS 001-025, 027

- File Server

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- Passenger Control Unit (PCU)
- Onboard Media Loader (OML)
- Smart Display Unit (SDU)
- Seat Electronics Box
- Video Seat Electronics Box

AKS 001-025, 027

In-Seat Audio and Video System

In-seat entertainment provide programs to the passengers. The audio and video signals are distributed from a File Server through a standard 100 Mbps fast Ethernet (LAN). Power and network signals are then routed as streamed data throughout the aircraft cabin to the passenger seat and cabin crew interface components.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

PC Power System

The PC Power System receives 115 VAC/400 Hz aircraft power and converts it to 110 VAC/60 Hz power for passenger and crew use. Outlet Units (OU) installed in selected passenger seats provide the interface to the PC Power System. Users can connect laptop computers or other personal electronic device (PED) to the outlet to get access to the PC Power System. The PC Power System is activated by the PC OUTLETS switch located at the forward attendant panel.

AKS ALL

Control

The In-seat audio and video channels and volume can be selected and adjusted by the passenger using a PCU. The passengers can listen to the selected audio and video channels by connecting a headset to the RJU.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

When a video program plays, the SC turns on the VIDEO ON light in the flight compartment.

AKS ALL

The CP is the primary control interface between the entertainment system and cabin and maintenance crews. Configuration and commands are done at the CP for the IPES or MPES.



GENERAL DESCRIPTION

Ethernet Network

The IFES or MPES Ethernet network have a set of units serially connected by two balanced and twisted pair wire. All units attached to an Ethernet but are connected to a shared signalling system. The Ethernet signals are transmitted serially, one bit at a time, over the shared signal channel to every attached unit. To send data a unit first listens to the channel and when the channel is idle the unit transmits its data in the form of an Ethernet frame or packets, thereby preventing data collisions on the data bus. If the channel is busy, the unit continues to listen until the channel is idle.

The Ethernet data frame consist of a set of bits organized into several fields. These includes address field, a variable size data field that carries from 46 to 1500 bytes of data and an error checking field that checks the integrity of the bits in the frame to make sure that the frame has arrived.

The first two fields in the frame carry 48-bit addresses, called the destination and source addresses. All units connected on the network look at the destination address. The unit with the same address as the destination address in the frame reads in the entire frames. All other units stop reading the frame when the destination address does not match their own address.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

ACARS Interface

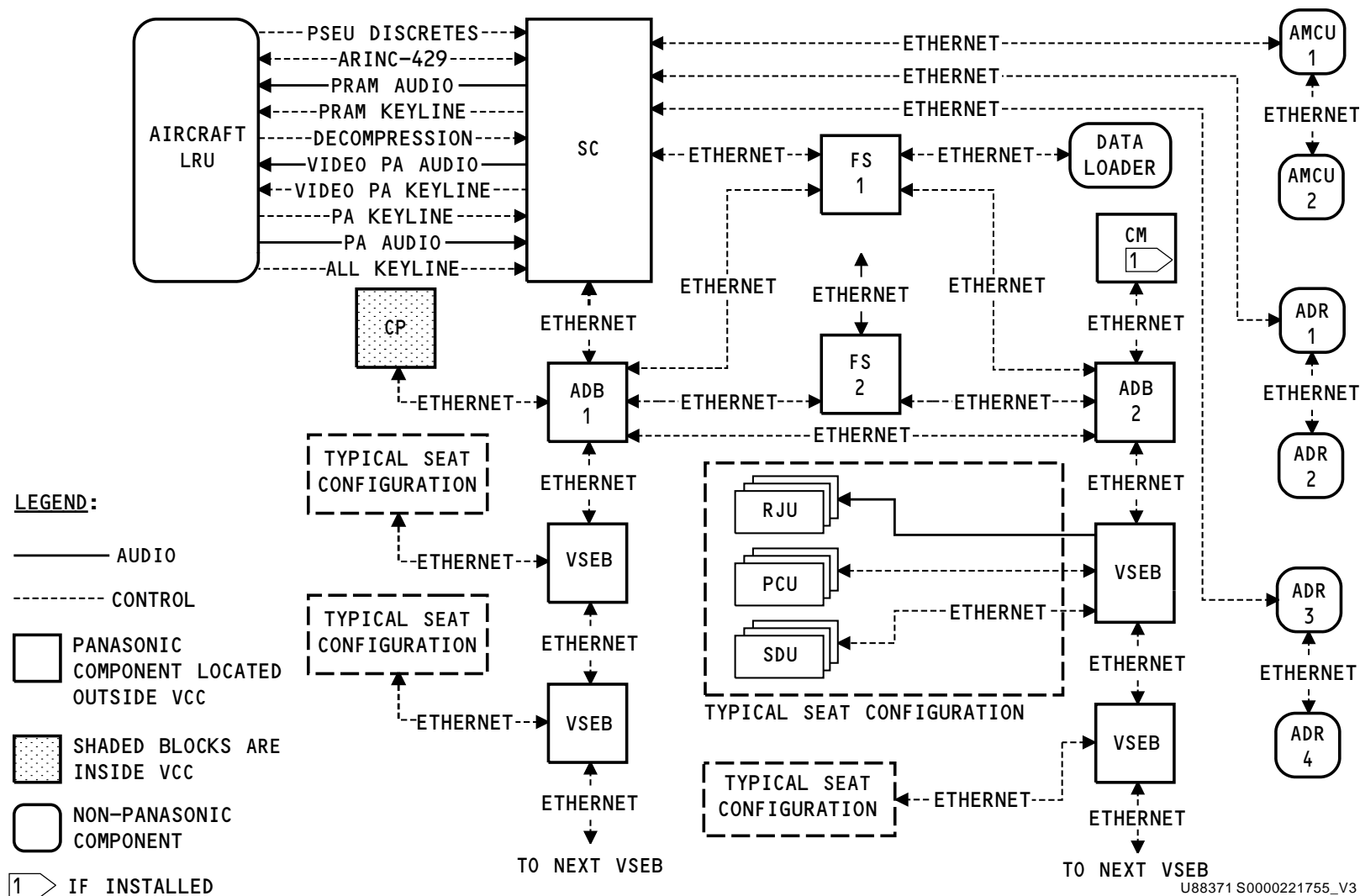
ACARS Interface between the IFE system and the Communication Management Unit (CMU) provides ground communication from the IFE system to a ground station.

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SERVER BASED VIDEO SYSTEM- GENERAL DESCRIPTION

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COMPONENT DESCRIPTION

General

The In-Flight Entertainment System (IFES) or Multiplexed Entertainment System (MPES) consist of these Line Replaceable Units (LRUs):

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- Advanced Master Control Unit (AMCU)

AKS ALL

- Aircraft Interface (AI)
- Crew Panel (CP)

AKS 001-025, 027

- File Server (FS)

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- In-Seat Power Supply
- Onboard Media Loader (OML)
- Outlet Unit
- Passenger Control Unit (PCU)

AKS ALL

- Proximity Switch Electronics Unit (PSEU)
- Remote Jack Unit (RJU)

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- Seat Electronics Box (SEB)

AKS 001-006, 009, 010, 013, 015-018, 020, 021

- Seat Power Module (SPM)

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- Smart Display Unit (SDU)

Advanced Master Control Unit

The Advanced Master Control Unit (AMCU) provides power management and distribution for the IFES. The basic functions of the AMCU are to supply and distribute 3 phase 115 VAC power to five output columns, maintain configurable current limits using tri-level control line on each of the five independent columns, measure and report, through and Ethernet connection, downstream column wiring Ground Fault Interrupt (GFI) protection for both passengers and equipment, detect and isolate external power faults, master system cut-off control to turn 115 VAC power off to five column, and independent OFF/ON control of each column by external discretes.

AKS ALLAircraft Interface (AI)

The AIs provide data connection paths between the IFE cabin equipment and the aircraft avionics. The AI has these interfaces/functions:

- Video and Audio Encoding
- Real-time encoding of analog video sources
- Aircraft Discrete Input/Output
- Ethernet Local Area Network (LAN) distribution
- RS-485
- RS-232 interface for maintenance
- USB
- Telephone Interface (CEPT-E1)
- Two microprocessors to control the unit activities
- ARINC-429 interfaces to aircraft subsystems
- Camera Interface
- PA audio zones and overriding entertainment audio during PA announcements
- Keyline Input/Output from aircraft subsystem
- Provides audio outputs to aircraft subsystem
- Routes passenger service data aircraft subsystem

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COMPONENT DESCRIPTION

The IFE can have multiple AIs per system. Each provides redundancy for aircraft interfaces. One AI operates in normal mode, the others operate in an alternate mode. The AI redundancy logic determines when to switch modes.

Crew Panel

The Crew Panel (CP) gives the aircraft crew access to configuration and maintenance control of the IFES or MPES. The CP has a color TFT - LCD display with optional built-in function keys for user interface. There is also a touchscreen user interface available.

The CP has the capability of multiple CP installations in a single aircraft and provides the capability of storing data and cabin zone control. The CP uses an Ethernet interface to communicate with other components of the IFES or MPES. The CP provides these functions, all of which are controlled through the CP software screens. The functions are control of cabin zone to video source mapping, control of the entertainment and passenger address cabin zone configuration, initiation of Built-in Test Equipment (BITE) requests to all peripherals and storage of resulting BITE data for fault isolation, and control of all peripherals, including preview of video and audio programs. The CP also provides two USB ports for connecting peripheral devices (keyboard, floppy drive or smart card reader) and two mono audio outputs for previewing audio or video.

The CP is also equipped with an external RJ-45 jack, a noise canceling audio jack and updated USB 2.0 jacks. The CP also has a handset interface and a DSP feature for processing audio (telephone, entertainment, PA) and video functions.

AKS 001-025, 027

File Server

The File Server (FS) is a high performance, high capacity network server providing extensive audio, video and cached web content. It also contains interactive menus, media content, electronic catalog, sales to passengers, and unit-downloadable software, as appropriate. The File Server also handles all of the on-demand applications available to passengers with in-seat audio and video.

AKS 001-007, 009, 010, 013, 015-018, 020-025, 027

The FS contains solid state drive (SSD). The SSD is a 2.5-in. form-factor SATA Multi Level Cell SSD with a minimum of 300 GB. The SSD is used to store media content and support read only mode. The FS uses a 5 V power supply for each individual SSD. Each power distributor provides a minimum of 1.5 A continuous current to each SSD.

AKS 001-025, 027

The unit also serves as the direct interface with the air-to-ground narrow band or broadband equipment and other key airplane system including overhead loading scenarios by using 100 Mbps Ethernet.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

In-Seat Power Supply

The In-Seat Power Supply (ISPS) supplies power to the outlet units to power and operate a laptop computer or PED and recharge its battery. There is one ISPS installed at each seat group and each ISPS can supply power to 2 or 3 outlet units. The ISPS are installed below the seats.

Onboard Media Loader

The On-board Media Loader is a Hard Disk drive (HDD) responsible for loading or delivering monthly and/or daily content (movies, games, web pages, etc.) to the head-end video servers. Content is copied onto the removable hard disk drive, USB, Compact Flash (CF) memory card, or Secure Digital (SD) memory card prior to being loaded on the aircraft. These storage devices are carried on the aircraft and inserted directly into the HDD. The content is then automatically accessible to the head end servers.

Outlet Unit

The AC Outlet Unit (OU) allows passengers to connect a Personal Electronic Devices (PED) to a 110Vac/60Hz power source. Each OU is equipped with a multi-color LED indicator that lets users know when the OU is active, inactive or in use.

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COMPONENT DESCRIPTION

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027 (Continued)

Each OU is connected to the seat group in-seat power supply (ISPS) or the seat power module (SPM). For user safety, a ground fault interrupter circuit in the ISPS or SPM makes sure that the user is protected if mishandling occurs or if there are defective PEDs or defective PED harness connectors.

Passenger Control Unit

The Passenger Control Unit (PCU) is one system for passengers to interface the IFES or MPES. The PCU can be installed in a top-mount or side-mount position.

The basic function of the PCUs are audio volume control, and audio and video channel selection. Each PCU is equipped with a 2 digit, 7 segment LCD display to indicated the PCU status. The PCU display provides status indication such as audio channel selection status and video channel selection status.

AKS ALL

Proximity Switch Electronics Unit

The PSEU provides these discretes to the SC or SC-A:

- Air/Ground discrete - set when the airplane is on the ground.
- Engine On/Off discrete - set when the engines are on.
- Parking Brake discrete - set when the parking brake is set and the airplane is on the ground.
- Nose Landing Gear discrete - set when the nose landing gear is down and locked.

Remote Jack Unit

The Remote Jack Unit (RJU) is a headset jack for connection of an audio headset to allow the passengers to listen to entertainment audio at each seat.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

Seat Electronics Box

The Seat Electronics Box (SEB) provides distribution of data, audio and video entertainment, telephone, and passenger service functions to the passenger seats. The basic functions of the SEB are to support Ethernet connection to the Area Distribution Box and to adjacent SEBs, support for Ethernet interfaces to laptop, support for interfaces to USB passenger control units, support for interfaces to USB peripherals, support for an interface to one USB telephone, support for PA override functionality, and support for Ethernet interface to the Smart Display Unit (SDU).

AKS 001-006, 009, 010, 013, 015-018, 020, 021

Seat Power Module

The Seat Power Module (SPM) supplies power to the outlet units to power and operate a laptop computer or PED and recharge its battery. The SPM also has the capability of providing DC power to the SEB and IFE in-seat peripheral equipment. There is a SPM installed at every seat group and each SPM can provide PC power for up to 3 outlet units. The SPM is also equipped with a Built-In Test (BIT) functionality.

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

Smart Display Unit

The Smart Display Unit (SDU) provides the video presentation to the passenger by converting streaming digital video into baseband video for display. The SDU can support a touch screen interface or a credit card reader.

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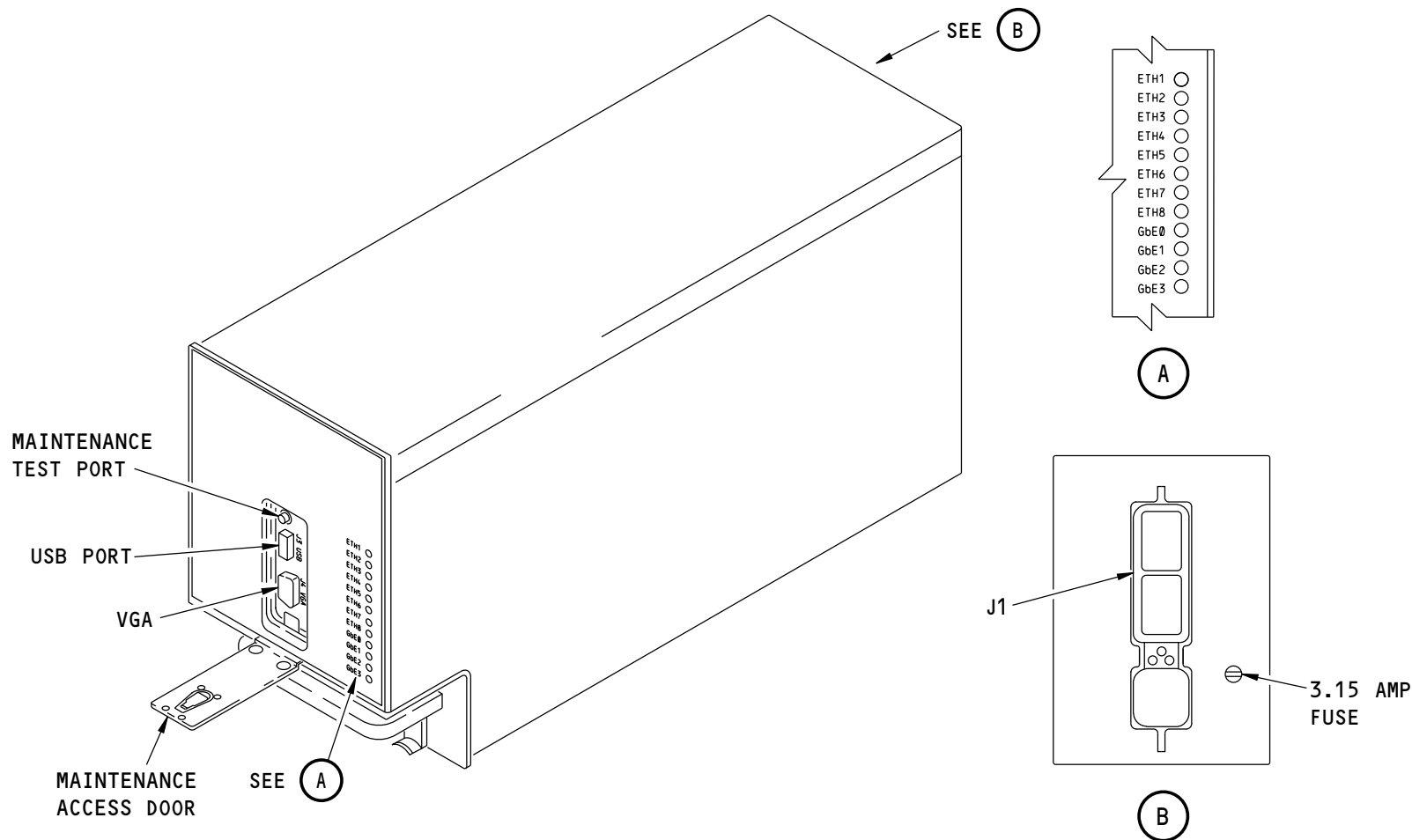
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AIRCRAFT INTERFACE

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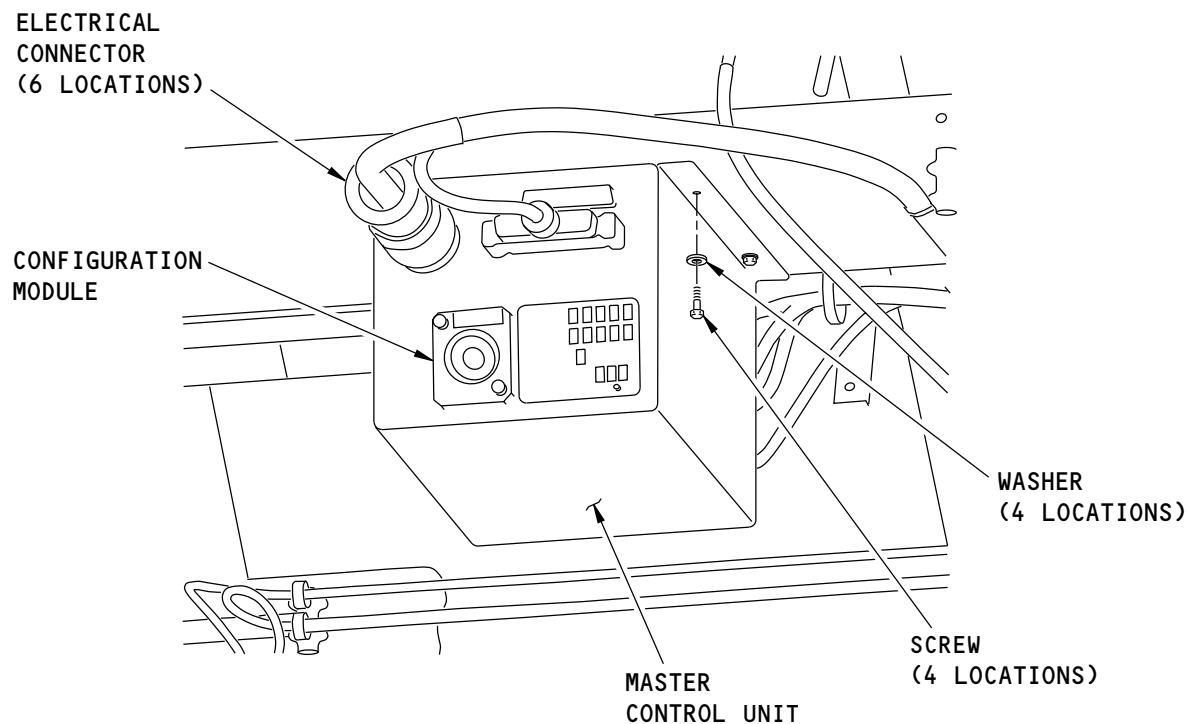
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EQUIPMENT RACK COMPONENTS

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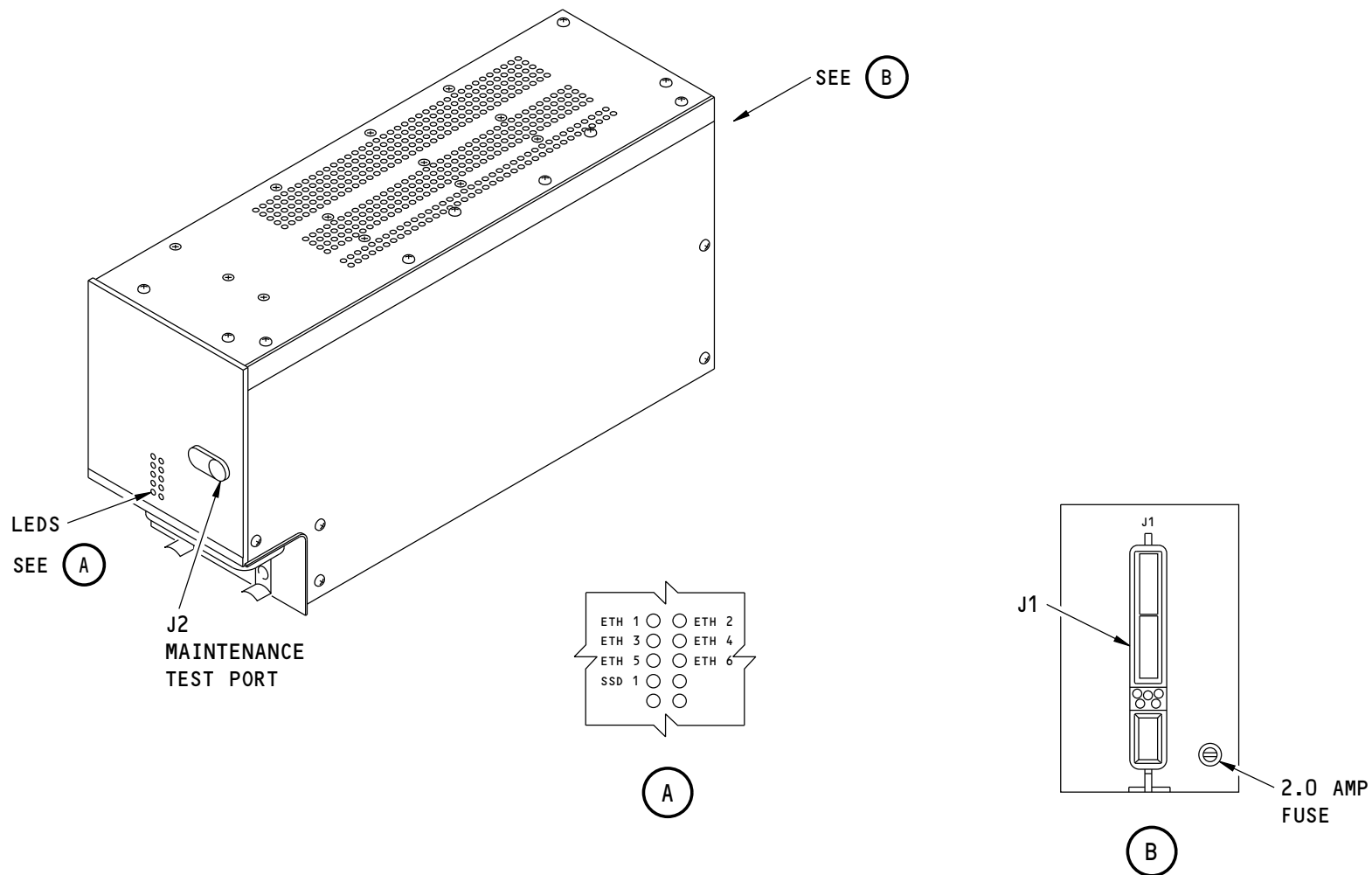
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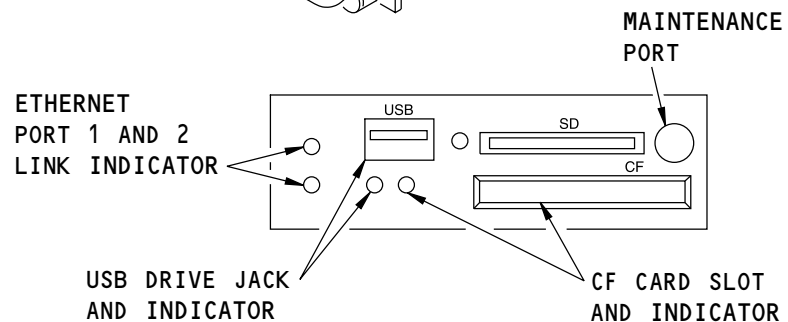
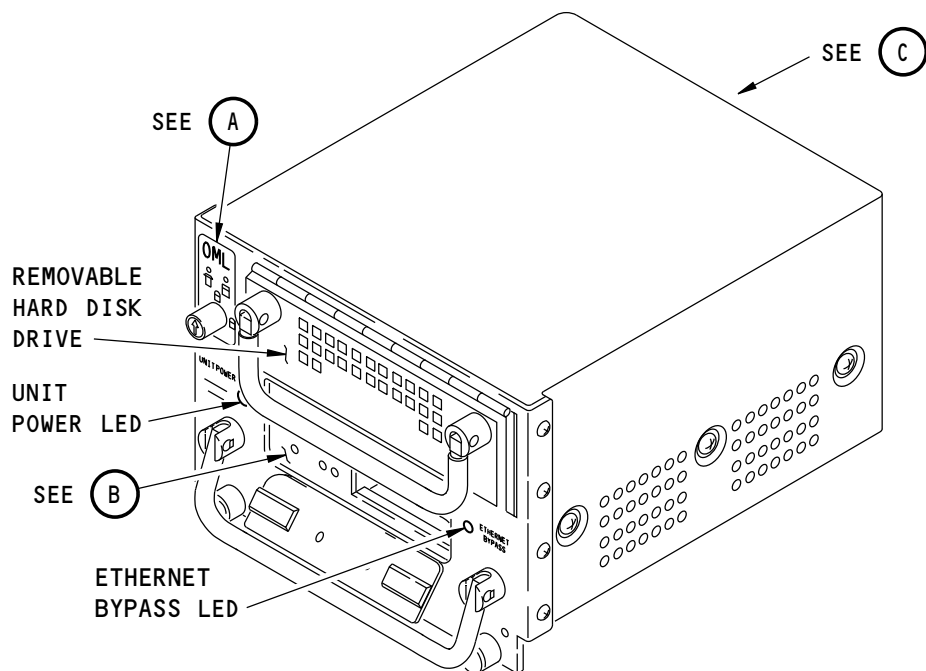
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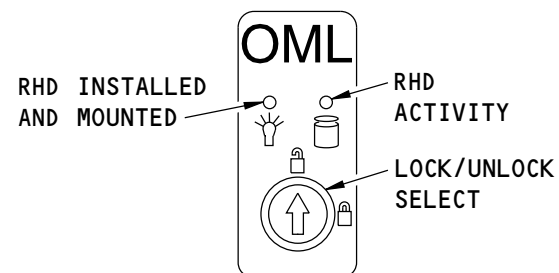
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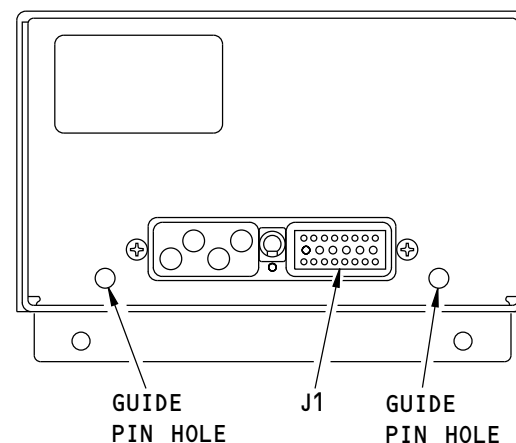


(B)

ONBOARD MEDIA LOADER



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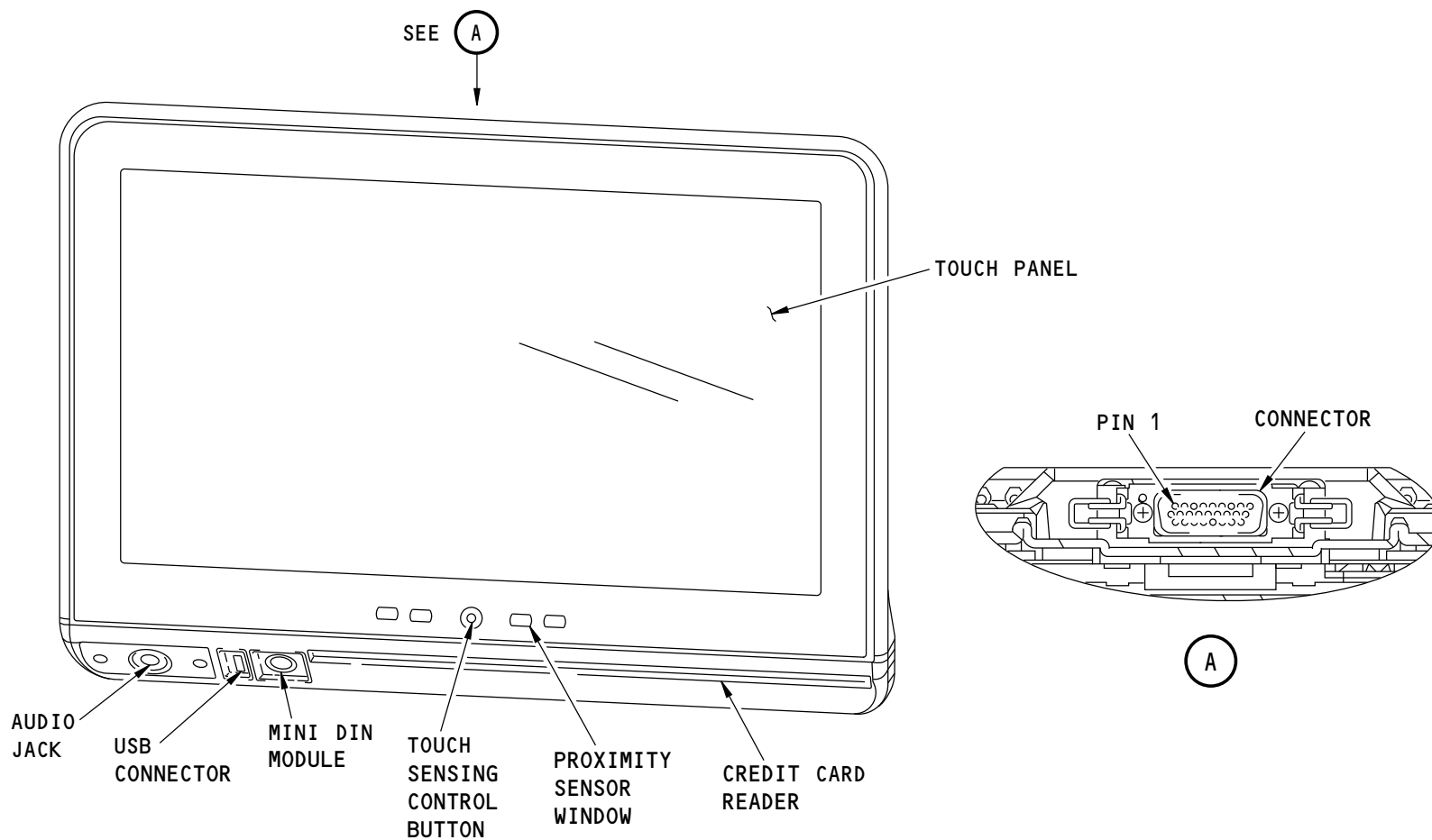
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SMART DISPLAY UNIT

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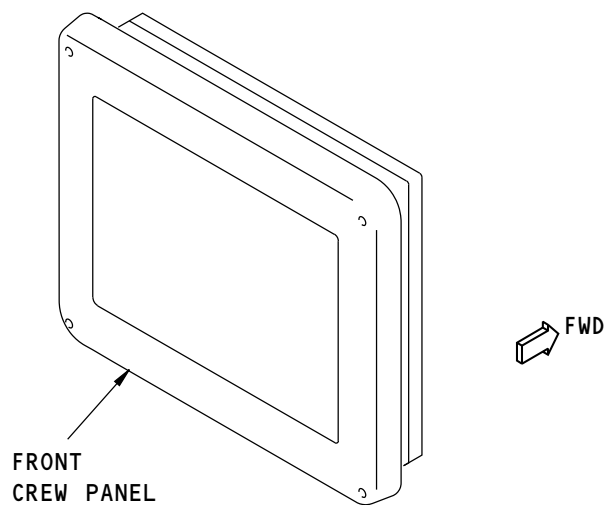
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CREW PANEL

SYSTEM COMPONENTS

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CONTROL INTERFACES

General

The IFES or MPES control components send and receive data on an Ethernet LAN or data bus. The system control functions for the IFES or MPES are done by the following:

- Attendant Control Panel (ACP)
- Crew Panel (CP)

AKS 001-025, 027

- File Server (FS)

AKS ALLAttendant Control Panel

The Attendant Control Panel (ACP) is used by the crew to control the IFE power functions for the following system:

- IFE/Entertainment

AKS 001-006, 009, 010, 013, 015-018, 020-025, 027

- PC Power

AKS ALL

- External Communication System

Crew Panel

The Crew Panel (CP) is the primary interface between the IFES or MPES and cabin and maintenance crews. IFES or MPES configuration and commands are accomplished at the CP.

AKS 001-025, 027File Server

The File Server (FS) is a high performance, high - capacity network server providing extensive audio, video, and cached web content. It also contains interactive menus, media content, electronic catalog, sales to passengers, and unit downloadable software. The FS also handles all of the AVOD applications available to passengers with in-seat audio and video.

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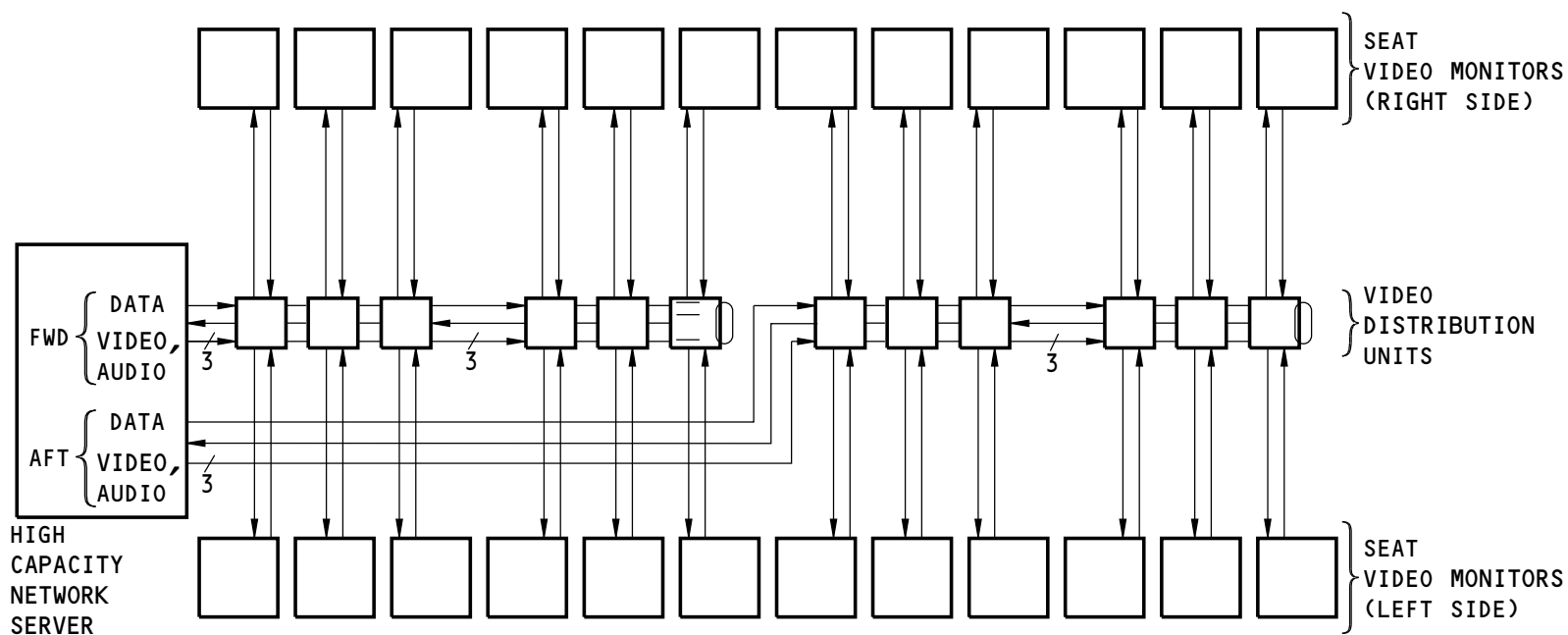
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PES - BLOCK DIAGRAM
(EXAMPLE)

VIDEO AND CONTROL INTERFACES

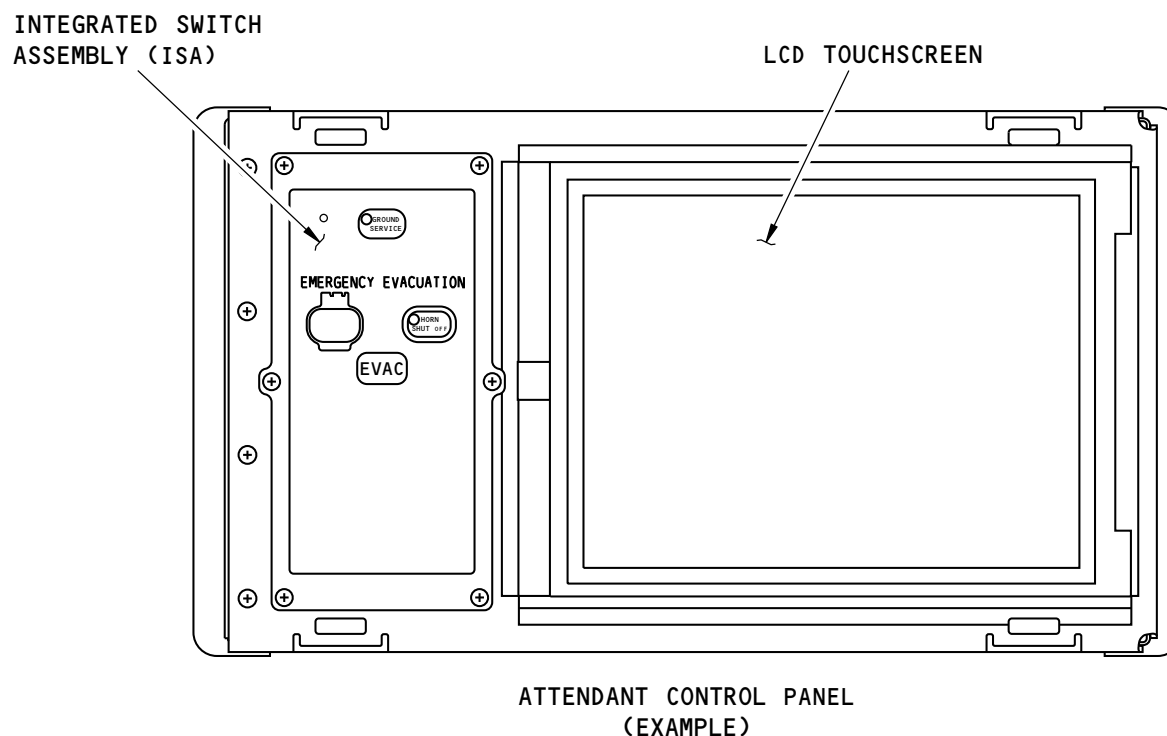
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ATTENDANT CONTROL PANEL

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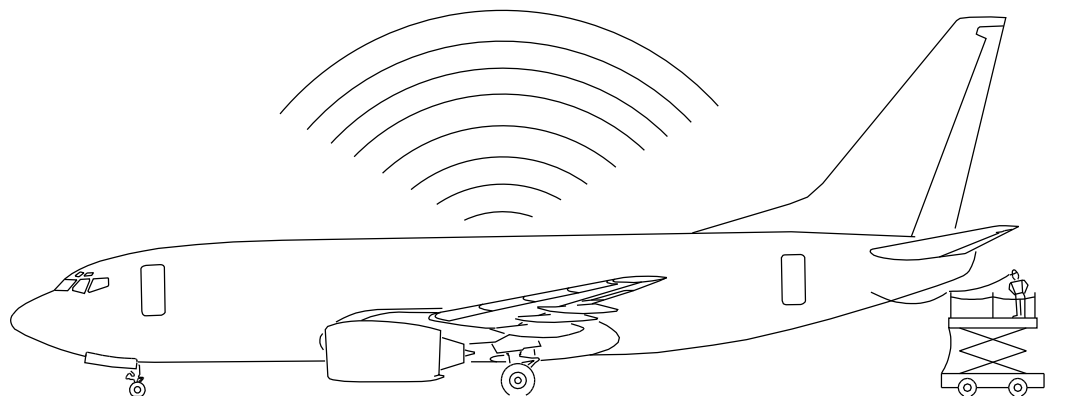
EXTERNAL COMMUNICATION SYSTEM INTRODUCTION

General

The external communication system provides reliable means of communicating with the aircraft while grounded. Through the use of the GSM Cell Data Mode (CDM), also referred to as Cell Modem (CM), data can be transferred wirelessly from the In-Flight Entertainment (IFE) system on the aircraft to a terminal receiving station.

Abbreviations and Acronyms

- ADB - Area distribution box
- CMD/CM - Cell Data Modem/Cell Modem
- CP - Crew Panel
- IFE - In-Flight Entertainment
- SC - System Controller



EXTERNAL COMMUNICATION SYSTEM INTRODUCTION

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**COMPONENT DESCRIPTION****General**

The following components are part of the external communication system:

- GSM Cell Modem

The following components are part of the In-Flight Entertainment system but work in conjunction with the external communication system components:

- Aircraft Interface
- Area Distribution Box
- Crew Panel

GSM Cell Modem

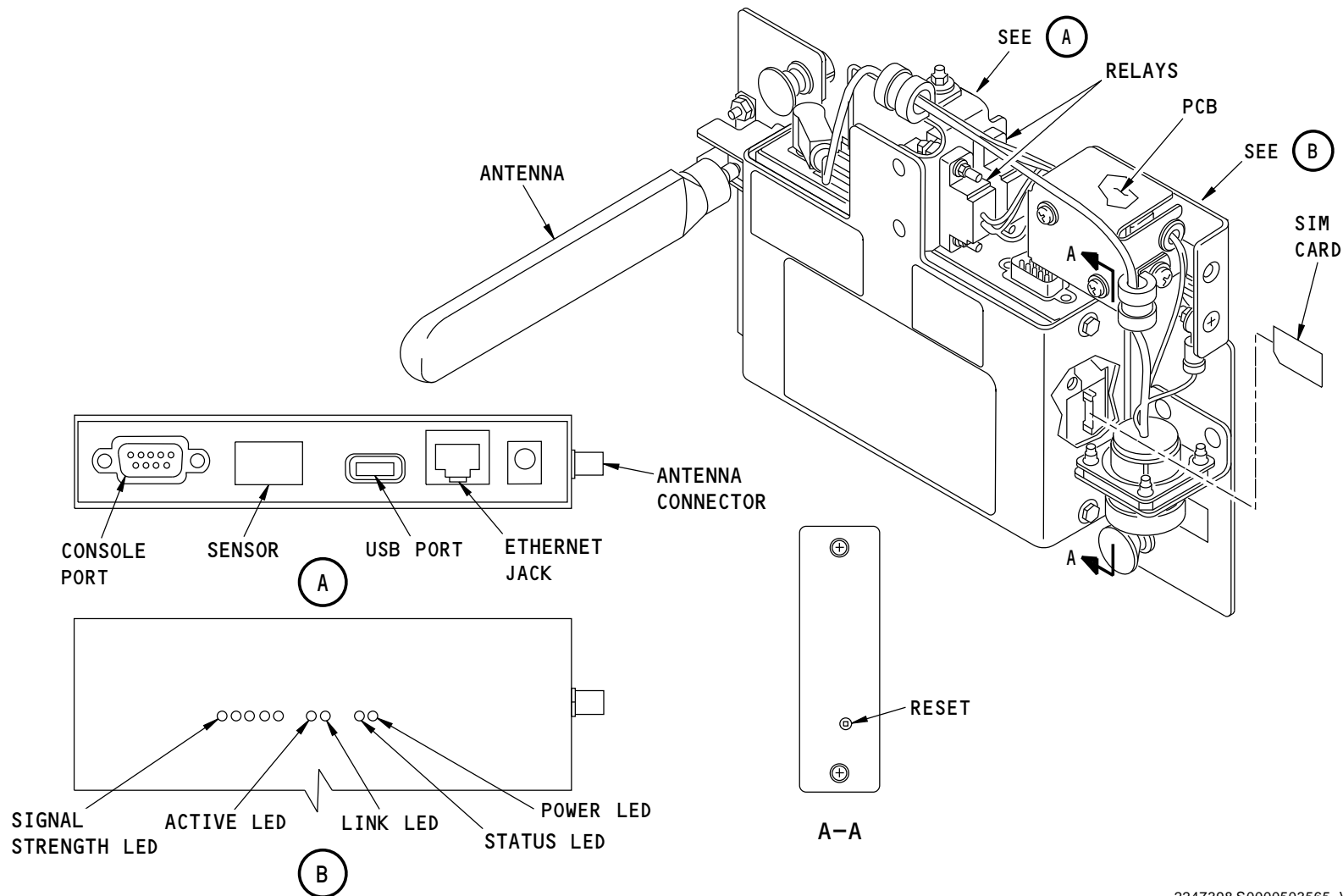
The Global System for Mobile Communications (GSM) Cellular Data Modem (CM) is a component of the IFE system that provides a private Internet Protocol (IP) networking connection with the Panasonic Network Operations Center (NOC) using GSM Wireless packet Data Services. The CM has an integrated antenna that can automatically and securely transmit and receive data (i.e. BITE, software configuration files, OneMedia, crew manuals) from the aircraft while it is on the ground.

The CM communicates with the IFE system through an RJ-45 connection and the existing Ethernet data bus with the Aircraft Interface. Any data received from the CM, media files for example, can then be distributed to on board passengers. The crew panel is used to perform operational and functional test of the CM.

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CELL MODEM COMPONENT DESCRIPTION

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GLOBAL COMMUNICATIONS SUITE INTRODUCTION

General

Global Communications Suite is comprised of the following:

The eXConnect (also called eXW) provides two-way broadband connectivity to an aircraft. It supports a wide range of passenger and crew applications, including Internet access, voice, data, and the ability to monitor and transmit airline operational data in real time.

Abbreviations and Acronyms

- BITE - Built-In-Test Equipment
- CMI - Cabin Management Interface
- CP - Crew Panel
- DSSS - Direct Sequence Spread Spectrum
- FS - File Server
- GHz - Gigahertz
- GPRS - General Packet Radio Service
- IEEE - Institute of Electrical and Electronics Engineers, Inc.
- IFES - In-Flight Entertainment System
- MPEG - Moving Picture Experts Group
- PA - Passenger Address
- PED - Portable Electronic Device
- SMS - Short Message Service
- SNR - Signal-to-Noise Ratio
- TNC - Threaded Neill–Concelman
- USB - Universal Serial Bus
- WAP - Wireless Access Point
- WLAN - Wireless Local Area Network

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GLOBAL COMMUNICATIONS SUITE GENERAL DESCRIPTION

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GENERAL DESCRIPTION

Media and Data Communication

- Media Streaming

The eXW IFES supports the delivery of media content and services to passenger devices over an IEEE 802.11 wireless network at 2.4 GHz and 5 GHz frequencies in the cabin.

The eXW IFES supports streaming MPEG4 format H.264 encoded video at a bit rate of 600 kbps. The bit rate increases to approximately 850 kbps when audio and overhead files are added.

- Pause Function

Upon receipt of a Passenger Address (PA), or Video PA, all applicable media passenger media pauses. A pop-up message is shown on the passenger devices, and all media player controls are unavailable.

- Load Balancing

eXConnect supports streaming media at a bit rate of 1 Mbps. The audio and video media is streamed from a WAP to a PED.

eXConnect dynamically assigns PEDs to WAP radios based upon the number of PED connections per WAP radio and Signal Strength (SNR).

- Media Content and Software Loading

eXConnect media content and software are loaded at the Ethernet port. A light media content or software load can be done from the USB port.

- BITE/Maintenance Function

The CMI allows the operator to command built-in test equipment, to check software configuration and do various maintenance activities.

- Security Function

eXConnect includes a public network. The PEDs do not have access to the Aircraft system network.

Wireless Communication

eXConnect allows supported passenger devices to connect to the system and supports wireless protocol of IEEE 802.11 for the devices' wireless connection.

Portal Access Methods

eXConnect supports six WAP allocation using six 5 GHz channels and three to four 2.4 GHz channels.

The eXConnect Portal and public network can be accessed wirelessly via the WAPs.

Control

The CP is the primary control interface between the Global Communication Suite and cabin or maintenance crews. Global Communication Suite configuration and commands are done at the CP.

The eXConnect power supply is controlled through CABIN WIRELESS switch.

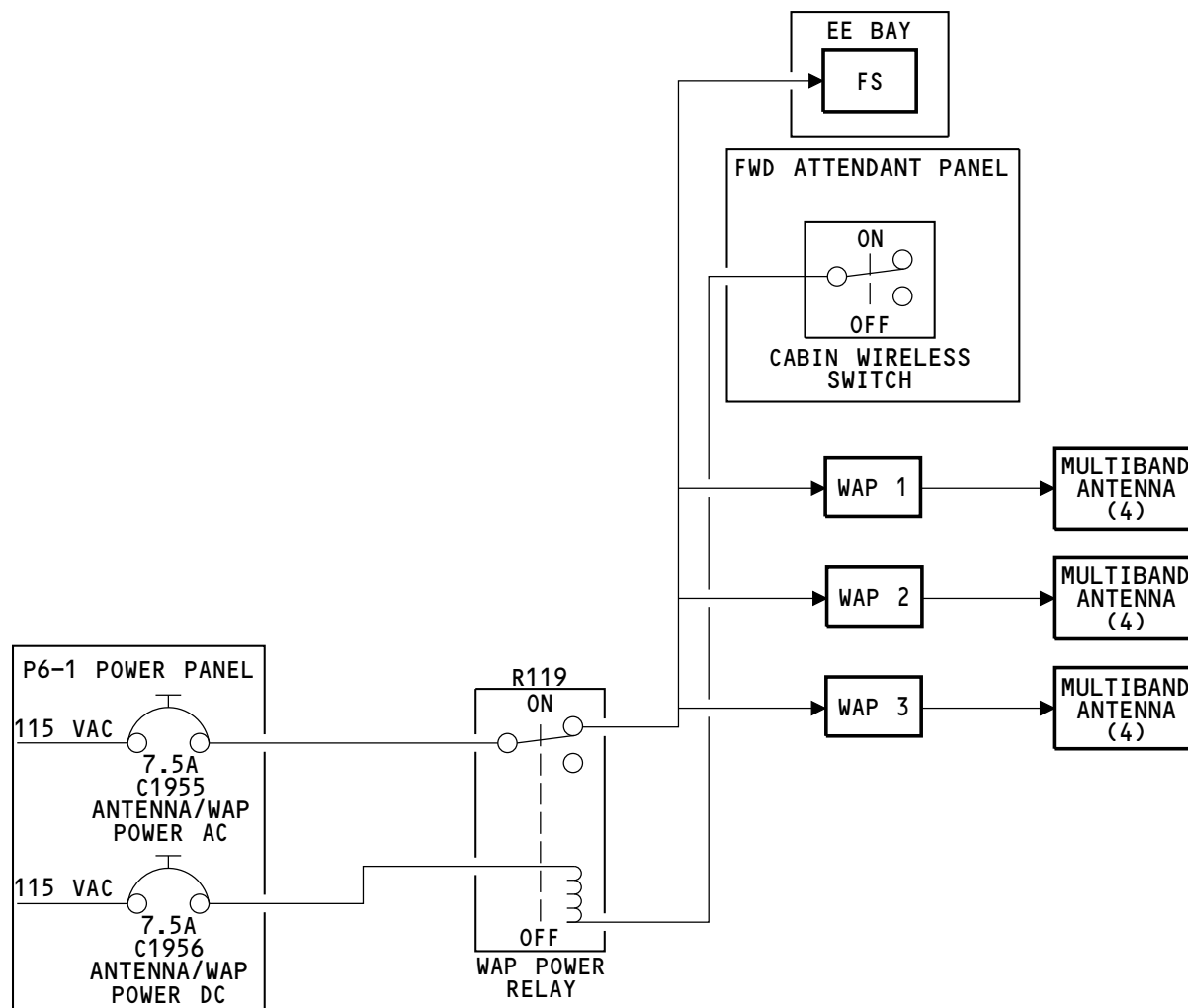
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GLOBAL COMMUNICATION SUITE - INTRODUCTION

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**COMPONENT DESCRIPTION****General**

The following components are part of the Global Communication Suite system:

- Wireless Access Point (WAP)
- Wireless Access Point (WAP) Antenna
- File Server (FS)

The following components are part of the In-Flight Entertainment system but work in conjunction with the Global Communication Suite system components:

- Crew Panel

Wireless Access Point (WAP) Antenna

The Multiband Antenna is a horizontally polarized antenna that is designed to provide worldwide IEEE 802.11 Wireless Local Area Network (WLAN) coverage. The Multiband Antenna operates in the lower (2.39 - 2.49 GHz) and upper (4.9 - 5.9 GHz) WLAN bands.

Wireless Access Point (WAP)

The Wireless Access Point (WAP) is a wireless communication device. The WAP uses DSSS radio technology in the 2.4-GHz ISM radio frequency spectrum to communicate with IEEE 802.11 compliant wireless devices.

The WAP can be configured as follows:

- For operation as a Cabin Wireless LAN Unit (CWLU) to create a Wireless Local Area Network (WLAN) on an aircraft
- For operation as a CWLU with access control capability such as a firewall, full-featured router, or captive portal redirection
- For operation as a Terminal Wireless LAN Unit (TWLU) to establish a wireless bridge between the aircraft network and a ground-based network

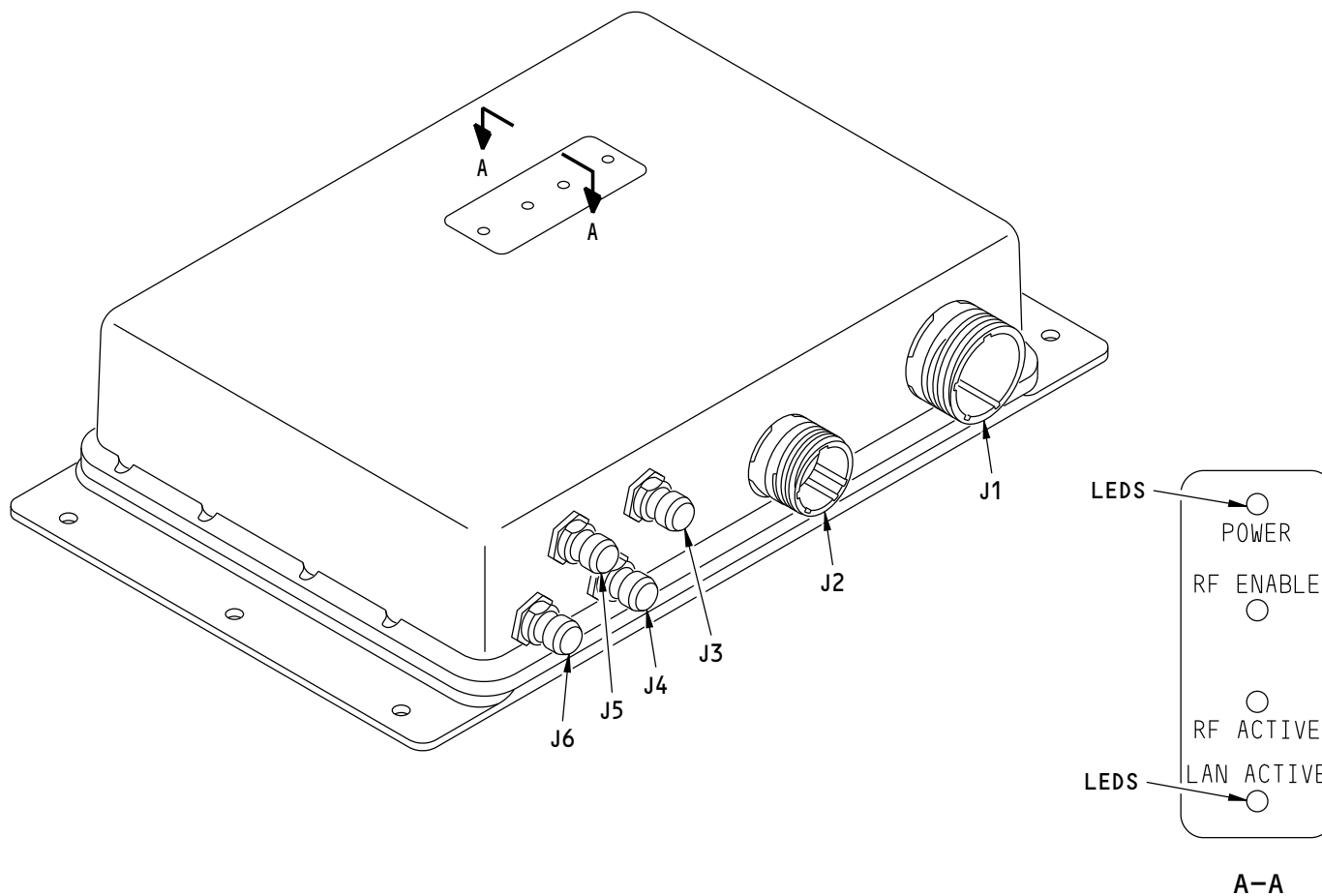
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WIRELESS ACCESS POINT (WAP)

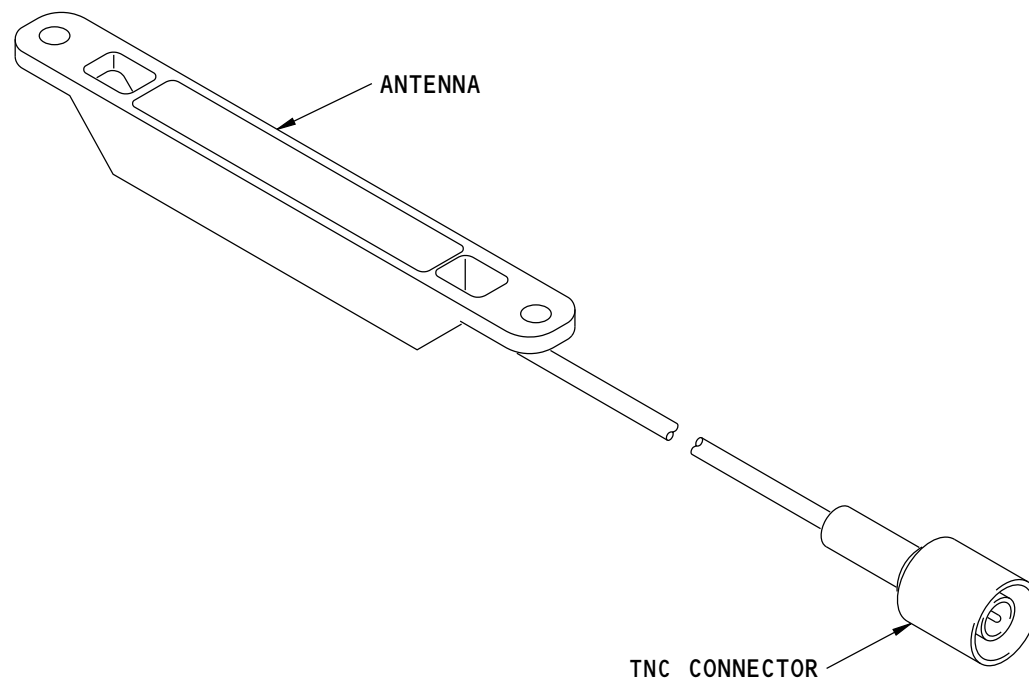
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WIRELESS ACCESS POINT (WAP) ANTENNA

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