**ON A/C ALL

23–00–00–001

COMMUNICATIONS, GENERAL

Introduction

The aircraft communication systems have different sub–systems to do the functions that follow:

- Communications in the Very High Frequency (VHF) band
- Communications in the High Frequency (HF) band
- ARINC Communication Addressing and Reporting System (ACARS)
- Noise and vibration control
- Announcements to the passengers by the pilots or flight attendants
- Audio management
- Cockpit Voice Recording (CVR)
- Radio management.

General Description

Refer to Figure 1.

The communication system has the sub–systems that follow:

- 23–11–00 VHF Communication
- 23–12–00 HF Communication
- 23–21–00 ARINC Communication Addressing and Reporting System (ACARS)
- 23–31–00 Passenger Address and Communication Interphone System (PACIS)
- 23–32–00 Passenger Entertainment System (PES)
- 23–35–00 Active Noise and Vibration Control System (ANVC)
- 23–50–00 Audio Integration System (AIS)
- 23–60–00 Static Discharge System
- 23–71–00 Cockpit Voice Recording System
- 23–72–00 Cabin Video Monitoring and Surveillance System (CVMSS)
- 23–80–00 Radio Management System (RMS).

VHF Communication

The VHF communication system gives line–of–sight, two way voice and data communication.

There are two VHF communication systems (VHF 1 and VHF 2) installed on the aircraft. The VHF 3 system is optional. Each system operates in the 118.00 to 137.00 MHz frequency spectrum. The VHF 1 and VHF 2 system provide the channel spacing of 25 KHz. The VHF 3 system provides the channel spacing of 8.33 KHz and 25 KHz. The VHF communication system uses the Amplitude Modulation (AM) for voice transmission.

HF Communication

The HF communication system gives long−range, two way single sideband AM, voice and data communication.

The HF communication system transmits and receives high frequency communication signals in the 2.0 to 29.9999 MHz frequency radio spectrum with 100 Hz channel spacing. It is controlled by a control unit and the Audio and Radio Control Display Units (ARCDUs). The control unit controls most HF communication functions and the ARCDUs only control the HF audio and transmitter selection.

ARINC Communication Addressing and Reporting System (ACARS)

ACARS provides a two−way digital data link between the aircraft and the operator ground stations. The unilink UL−70X communication system includes a Communication Management Unit (CMU) with an externally mounted configuration module, Multifunction Crew Display Unit (MCDU) as part of the Flight Management System (FMS), VHF radio, a printer and a data transfer unit.

Passenger Address and Communication Interphone System (PACIS)

The PACIS gives the functions that follow:

- Passenger Address (PA) announcements to the passengers
- Interphone communications between the flight attendants and pilots for private conversations
- Flight attendant calls from switches in the Passenger Service Units (PSUs) and lavatory.

Passenger Entertainment System (PES)

The PES supplies different programmed voice PA and music to the PACIS and AIS.

Active Noise and Vibration Control System (ANVC)

The ANVC decreases the noise level in the passenger cabin caused by the aircraft propellers. The system supplies secondary noise and vibrations in the passenger compartment. These secondary noise and vibrations cancel the initial noise and vibrations. The initial and secondary noise and vibrations mix to give lower cabin noise and vibrations.

Audio Integration System (AIS)

The AIS controls the audio functions that follow:

- Monitor radio communications receivers and make transmissions
- Monitor the radio navigation receivers
- Interphone communications between pilot, copilot, observer, and ground crew members.

The AIS uses the ARCDUs and observer's Audio Control Panel (ACP) to control the Remote Control Audio Unit (RCAU) that interfaces with the systems that follow:

- Communication transceivers
- Navigation receivers

- Pilot, copilot, observer’s, and ground crew jack boxes
- Passenger Address Amplifier (PAA)
- Flight compartment speakers
- Solid State Cockpit Voice Recorder (SSCVR).

Static Discharge System

The static discharging system consists of dischargers which dissipate electrostatic charges from the aircraft structure to the surrounding air, to minimize the radio interference caused by these charges.

Static discharger consists of a resistive coated fiberglass rod with a pellet of composite−carbon based material at the tip. The pellet is fitted into an aluminum alloy sleeve, which in turn is fitted onto the discharger rod by means of conductive epoxy cement. A resistant sheathing is heat−shrunk over the entire length of the discharger rod and tip assembly, leaving approximately 1/8 in. (3.2 mm) carbon tip material exposed.

Cockpit Voice Recording System

The SSCVR system records the last two hours of flight compartment audio and clock data.

It records audio in a digital format in crash−survivable Non−Volatile Memory (NVM).

Cabin Video Monitoring and Surveillance System (CVMSS)

The CVMSS lets the flight crew see all of the area that is outside of the flight crew compartment. The system lets the flight crew identify persons near the flight compartment entry door and to detect suspicious behavior or possible threats. The CVMSS uses the Control Display Unit (CDU) of the FMS to display the video images from two cameras in the cabin.

The camera No. 1 is located in the ceiling panel immediately above the flight crew compartment entry door. The camera No. 2 is located in the ceiling panel, approximately 10 ft (3 m) aft of the flight crew compartment entry door. The camera No. 1 looks down and the camera No. 2 looks down and forward.

On aircraft with ModSum 4−458529 incorporated, the cabin video monitoring and surveillance system is removed.

Radio Management System

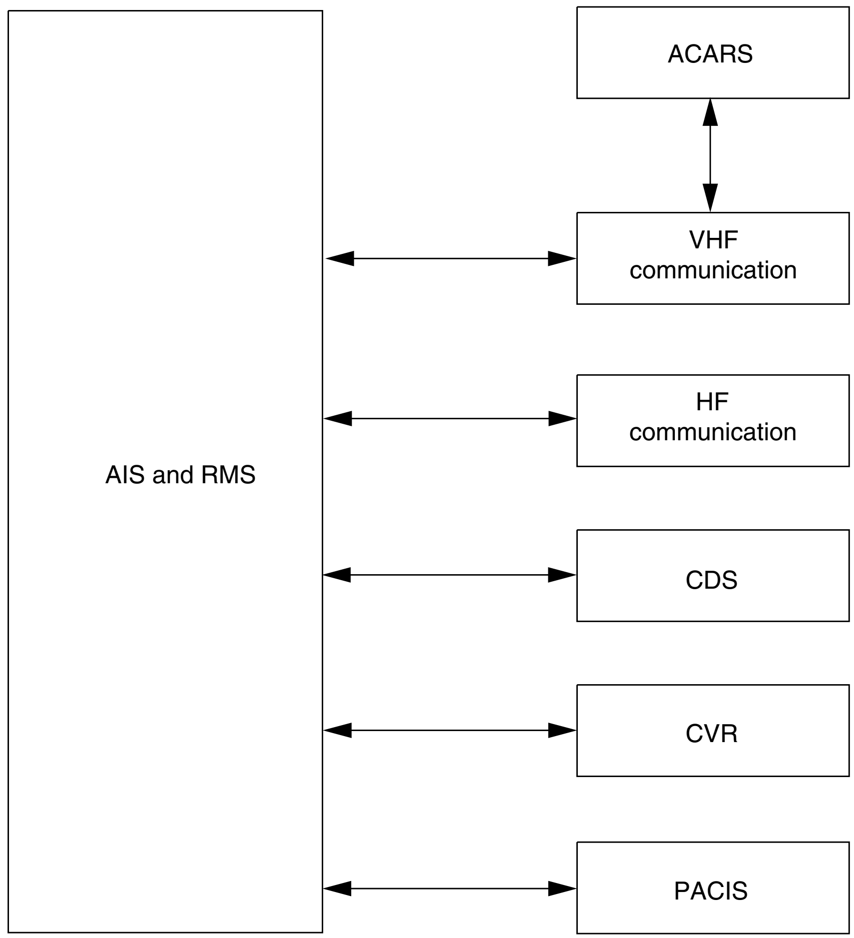
The radio management system is used to control and monitor the Radio Communication (RCOM) and Radio Navigation (RNAV) systems.

The radio management system has two ARCDU 1 and ARCDU 2 that have the functions that follow:

- Tunes the radio communication and radio navigation systems and controls their operational modes
- Shows all data that is related to the operation of the radio communication and navigation systems
- Monitors the operation of the RCOM and RNAV systems to show malfunctions
- Controls the operation of the PACIS (Refer to SDS 23–31–00)
- Controls the operation of the AIS (Refer to SDS 23–50–00)

– Controls the operation of the Central Diagnostics System (CDS) (Refer to SDS 45–00–00).

The ARCDU front panel has the controls and indications to let the pilots control the audio and radio systems installed.



fsq45a01.dg, js/gw, dec28/2011

Communication System Block Diagram
Figure 1

**ON A/C ALL

23–11–00–001

VHF COMMUNICATION

Introduction

The Very High Frequency (VHF) communications system is for primary Amplitude–Modulated (AM) voice communication with the ground–based Air Traffic Control (ATC) and for aircraft–to–aircraft communication.

General Description

Refer to Figures 1 , 2 and 3.

The VHF communications system operates in the aeronautical VHF radio spectrum, from 118.000 MHz to 135.975 MHz in frequency increments of 25 KHz or 8.33 KHz (optional).

The VHF communications system is a dual system that interfaces with the Audio Integration System (AIS), Radio Management System Audio and Radio Control Display Units (ARCDU1 and ARCDU2) and the Flight Management System (FMS1 and FMS2).

NOTE

The No.3 VHF communications system is optional.

Detailed Description

System Description (System Overview):

The VHF communication system has the units that follow:

- Transceiver (EVR 716–11–0350A tunes in frequency increments of 25 KHz)
- Transceiver (EVR 716–11– 0300A tunes in frequency increments of 8.33 KHz and 25 KHz)
- STBY VHF1 COMM control and display unit
- VHF Antenna.

Each transceiver is connected by a coaxial cable to an antenna.

The VHF COM1 and VHF COM2 are usually tuned by ARCDU1, ARCDU2, FMS1, or FMS2, but VHF COM1 is also tuned by the STBY VHF1 COMM control and display unit.

The squelch is disabled by an ARCDU1, ARCDU2, or STBY VHF1 COMM control and display unit selection.

The transceivers interface with the Remote Control Audio Unit (RCAU) of the AIS for:

- Received audio and side tone out
- Push to Talk (PTT)
- Microphone audio in.

NOTE

The audio from the transceivers is supplied to the Remote Control Audio Unit (RCAU) to select the audio and change its level to the flight compartment speakers and to the pilot, copilot, and observer jack boxes.
To make a VHF communication transceiver transmit, a PTT selection and microphone audio is needed. These signals are supplied through the RCAU to the VHF communication transceivers.

The health of the transceiver is monitored by ARCDU1 and ARCDU2.

VHF COM1 is energised by the left battery bus and VHF COM2 is energised by the right main bus.

The STBY VHF1 COMM control and display unit is energised by the left battery bus.

Transceiver

Refer to Figure 4.

The transceivers are installed in mounting trays in the avionics rack.

The transceiver has the modules that follow:

- Receiver
- Transmitter
- Power supply
- Data processing
- High Intensity Radio Frequency (HIRF)
- Power storage

The front panel assembly has a push button switch for test and LED indicators that follow:

- FAIL LRU (Red)
- FAIL IN (Red)
- PASS (Green)
- VSWR (Red)
- TX (Green)
- RX (Green).

The transceivers are conventional super heterodyne, AM double–sideband radios and are compatible with ARINC 724 or 724A ACARS management units.

The transceiver operates in the modes that follow:

- 0A Analog voice transmission, 25 kHz
- 0B Analog voice transmission, 8.33 kHz
- 1A Data, 25 kHz channel.

STBY VHF1 COMM Control and Display Unit

Refer to Figure 5.

The display unit is installed in an adapter in the centre console.

VHF Antenna

Refer to Figure 6.

The VHF antennas are installed as follows:

- The VHF1 antenna is installed on top of the fuselage
- The VHF2 antenna is installed on the bottom forward of the fuselage

- The VHF3 antenna is installed on the bottom centre of the fuselage.

NOTE

Make sure that the surfaces are clean with no corrosion, paint or grease. Make sure that the bare metal on the mounting surface is alodined.

NOTE

It is recommended to use the ’cloth wipe’ supplied with the antenna to clean the antenna and the mounting surface. The ’cloth wipe’ contains a release agent which will ease the removal process of the antenna.

A new gasket is put on the bottom of the VHF antenna and then the antenna is attached to the aircraft structure with the screws.

The antenna is vertically−polarized and operates in the VHF frequency spectrum, from 118 MHz to 156 MHz. It is made of thermoplastic and contains pre−formed radiating elements encapsulated in the antenna. The antenna has an aluminium base plate located in the antenna housing with an N−type female connector.

Controls and Indications

Refer to Figure 7.

An active frequency is set on the ARCDU for VHF communications.

NOTE

The active frequency will be the same in ARCDU1 and ARCDU2.

The audio switch on the ARCDU is pushed and a green bar graph is shown.

The microphone selector knob is set to the VHF1 or VHF2 position and a radio PTT selection is made. A green TX indication is shown during transmission.

NOTE

The microphone stuck key monitoring is done by the RCAU in the AIS.

Refer to Figure 8.

To make sure that the transceiver is working for a test, the automatic squelch control is set off. This lets the pilots listen to the background noise of the radio.

The rotary switch on the COM 1 standby control−panel is set to the ON position. All the segments (888.888), TX, and the arrow symbol come into view for a self−test. Then, the preset and active frequency indications are shown in the display and a STBY CNTL indication is shown in the VHF1 window of ARCDU1 and ARCDU2. The double rotary frequency−adjust−knob is turned to change the preselect frequency to a new frequency. Then, the transfer push button switch is pushed to activate the new frequency.

The transfer switch of the COM 1 standby control−panel has the functions that follow:

- When pushed for less than 2 seconds, the active frequency in the upper display and preset frequency in the lower display toggle
- If pushed for 2 to 3 seconds, the preset frequency is blanked and frequency selection is made directly in the upper display
- If pushed for more than 7 seconds, the Emergency Locator Transmitter (ELT) frequency 121.5 MHz is shown in the upper display.

Refer to Figure 9.

The COM 1 standby control–panel compares the commanded frequency with that received back from the transceiver. If a discrepancy is sensed, a triangular transfer annunciator is shown adjacent to the preset frequency and the active frequency changes to dashes.

Operation

BITE Retrieval:

Refer to Figure 4.

On the front panel of the VHF Communication transceiver, push and hold the TEST push button and make sure the six Light Emitting Diodes (LEDs) come on.

Make sure only the PASS and the RX green LEDs stay on when the TEST push button switch is released.

If any other LEDs stay on, refer to the table for the cause.

Table 1: Transceiver Front Panel

LED	COLOR	CAUSE
PASS	Green	No malfunction sensed
FAIL LRU	Red	Internal malfunction
FAIL IN	Red	ARINC 429 or discrete input malfunction
VSWR	Red	VSWR is more than 2:1
TX	Green	Transmit mode
RX	Green	Receive mode

MEL/CDL:

Any communication systems transmitters and receivers (VHF, HF and UHF) in excess of those required by regulations and not powered by an essential bus may be inoperative.

The COM 1 standby control–panel tunes in 25 KHz or 25 KHz and 8.33 KHz increments. The selected format is a function of a ground discrete at the COM 1 standby control–panel.

The transceiver is tuned to the last burst of ARINC VHF communication frequency data received on either of its two 429 inputs and for VHF COM1, the last frequency from the COM 1 standby control–panel.

The last frequency used is memorized by the unit and at power up, it will be tuned on it. This last frequency used is shown on the ARCDU1, ARCDU2, FMS1, FMS2 and the COM 1 standby control–panel from the continuous ARINC 429 output of the unit.

The ground/air logic discrete signal of the VHF transceiver is set to give pilot and maintenance initiated self–tests of the system and to enable the continuous in–flight monitoring.

DIAGNOSTICS:

The main functions of the Built–In Test Equipment (BITE) are to detect, store in memory and transmit failures of the transceiver. This shows the condition of the unit during power−up and when in maintenance mode to:

- Reduce troubleshooting time
- Prevent no−fault−found removals
- Record defects in a Non−volatile Memory (NVRAM).

The BITE interfaces with LEDs on the front panel of the LRU for line maintenance and with LEDs on the digital board for shop maintenance.

During operation, tests are done to monitor:

Transmission

- Transmitter synthesizer lock
- Voltage Standing Wave Ratio (VSWR) of less than 2:1
- Heat sink temperature (Threshold 1 reduces output power and threshold 2 inhibits transmission)
- Output power level
- Presence of transmitted power and audio

Reception

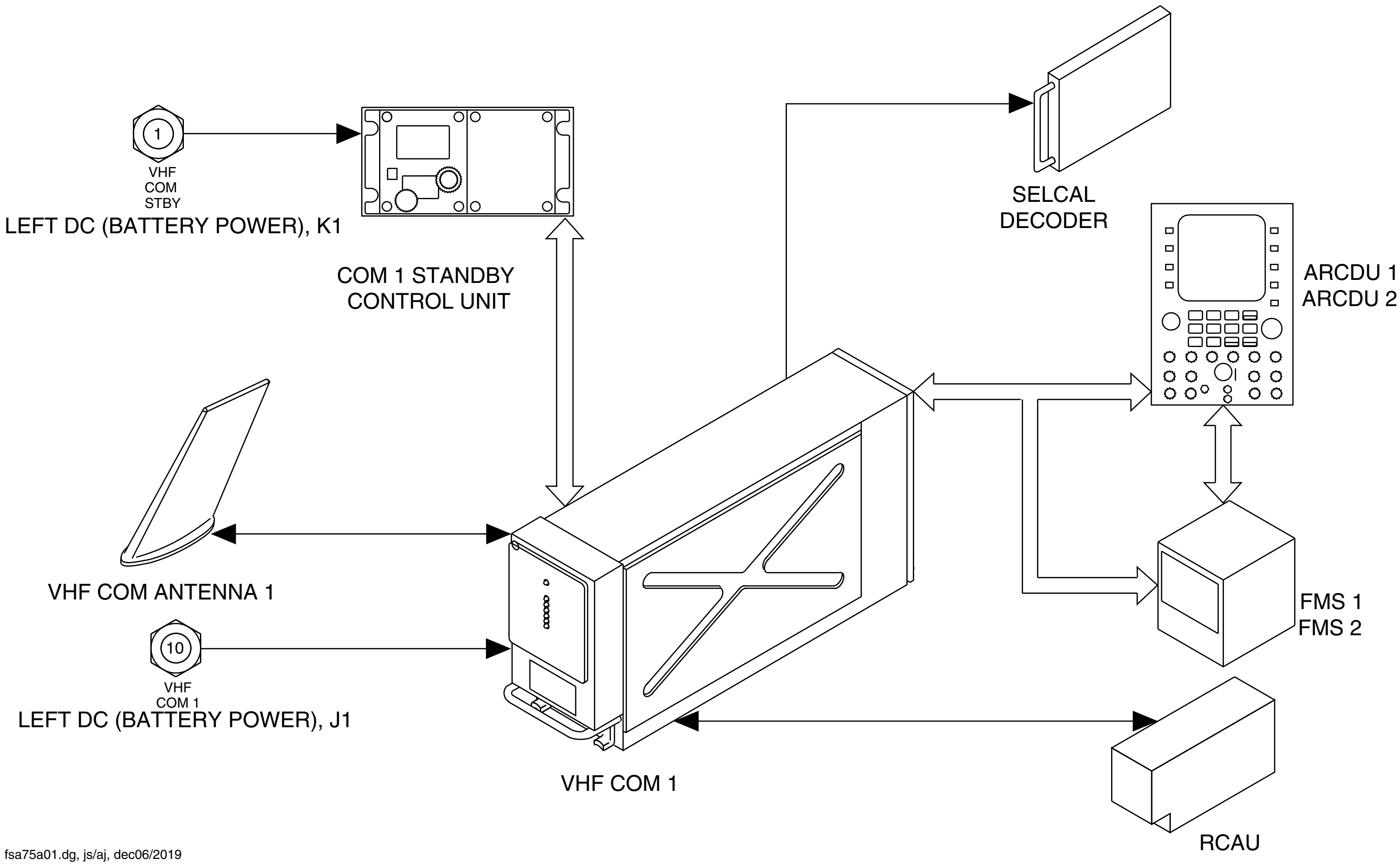
- Receiver synthesizer lock
- 2nd Local Oscillator (LO) level
- 3rd LO level
- Presence of received signal and audio

Data Processing

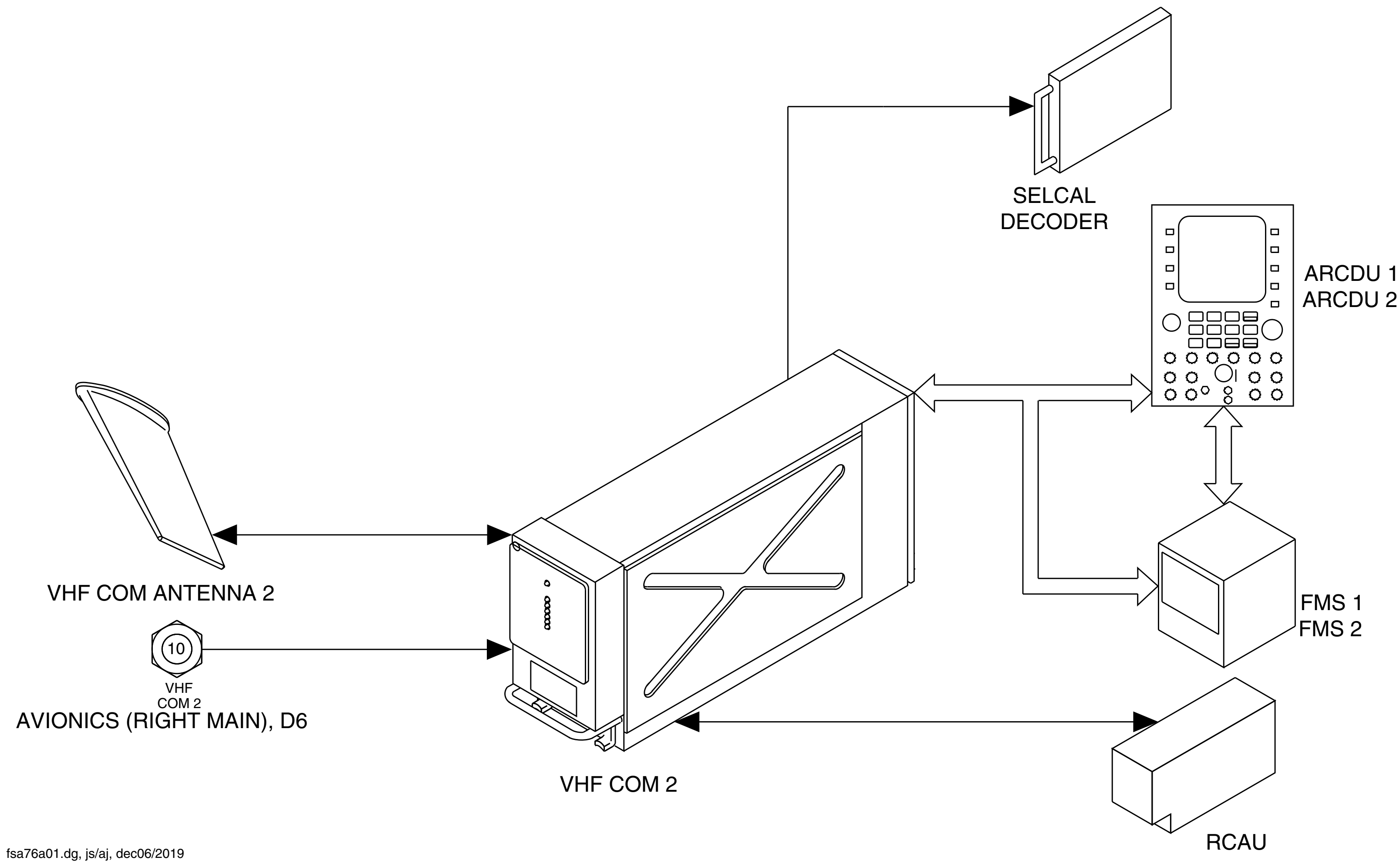
- Logic circuits
- ARINC 429 output lines
- Software watchdog timers

Power Supply

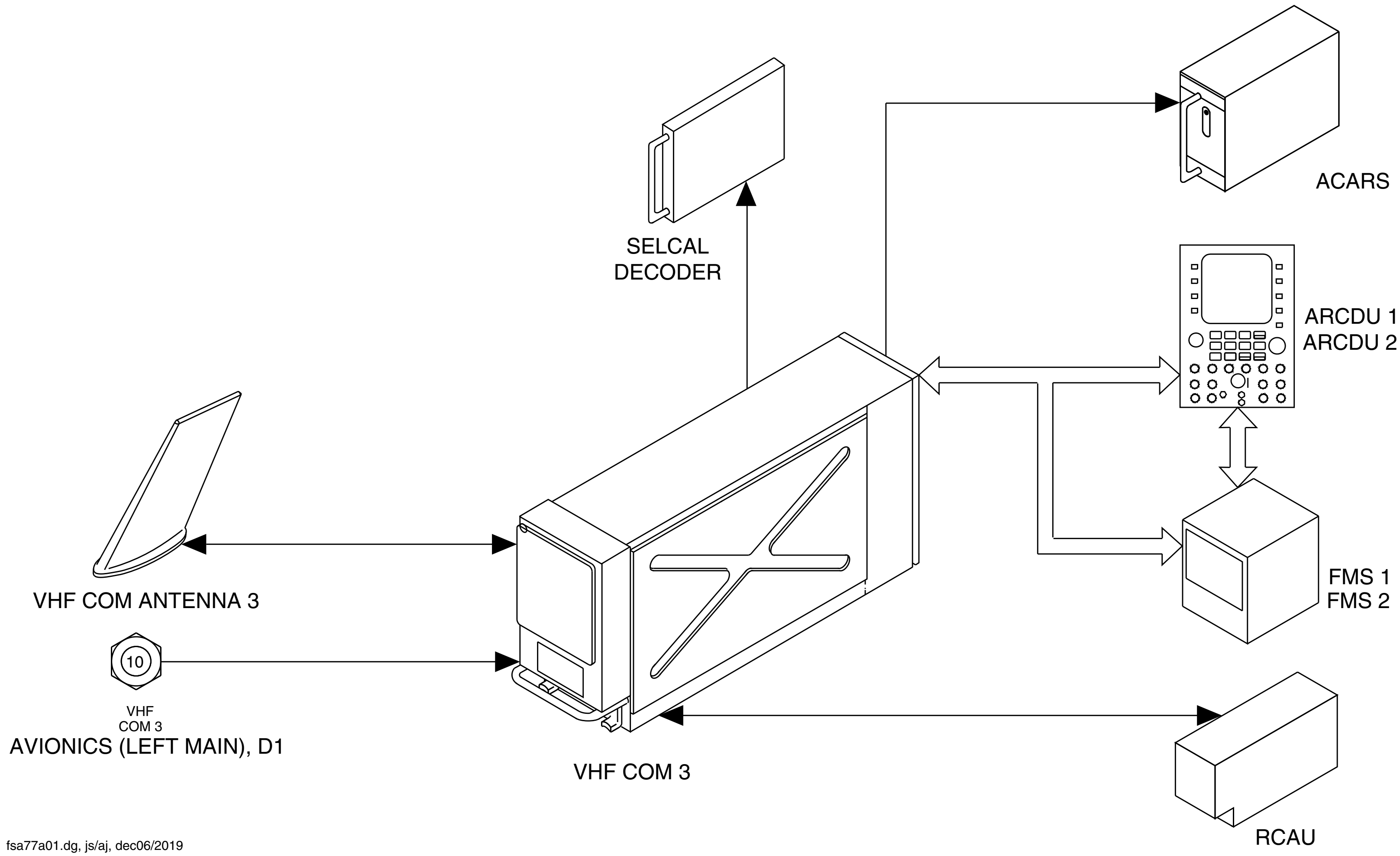
- Output level tests
- Reserve capacity levels.



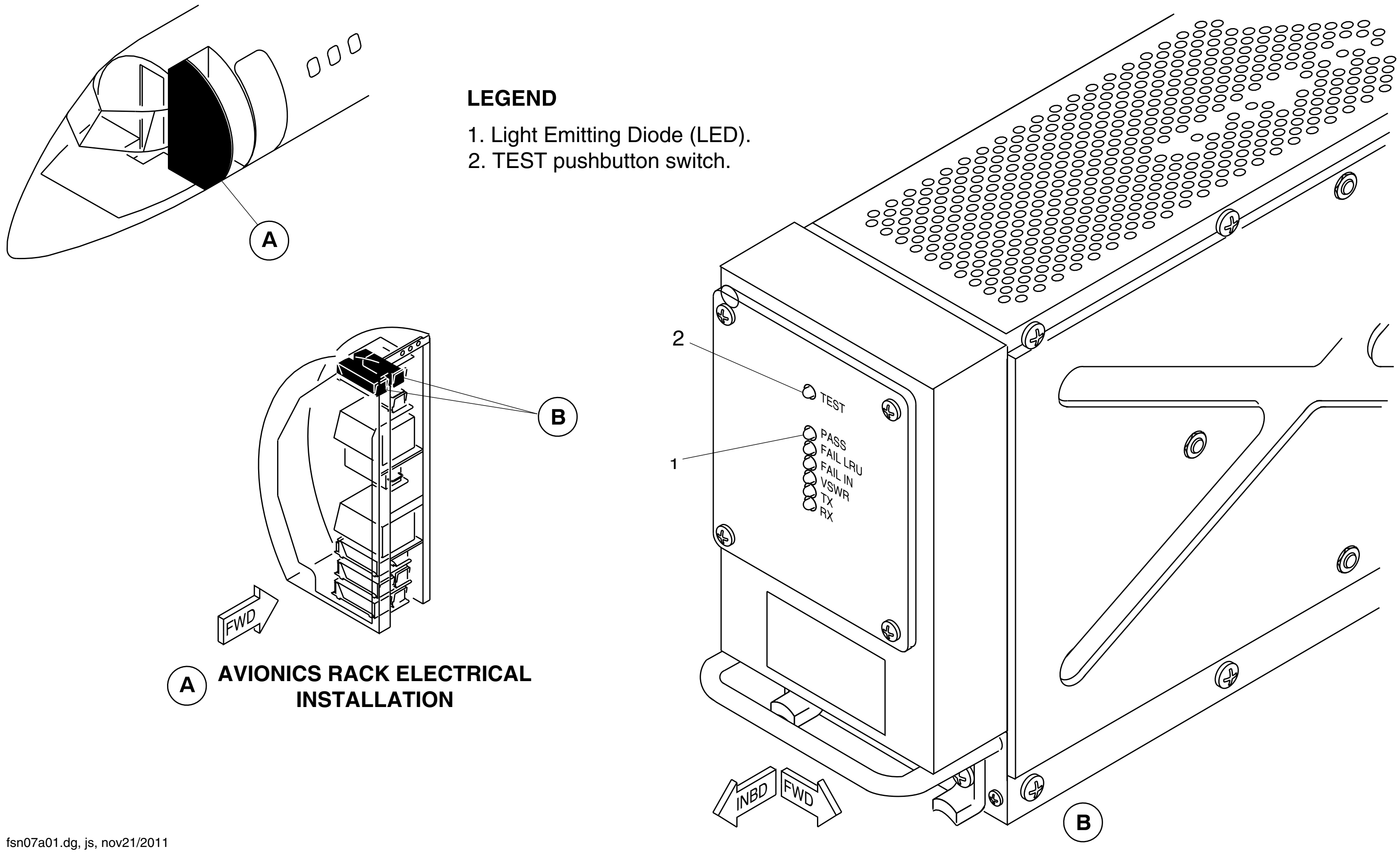
VHF1 Communication System Block Diagram
Figure 1



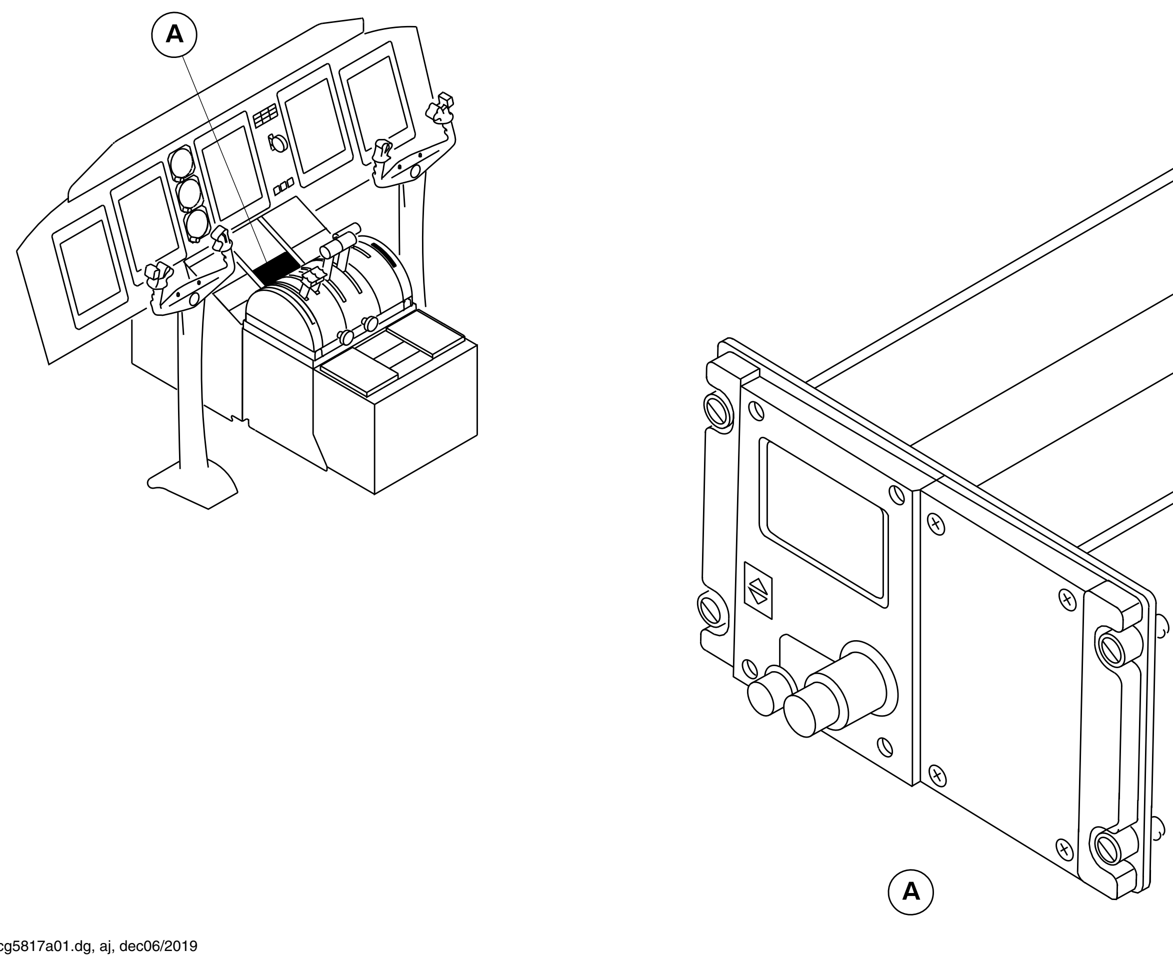
VHF2 Communication System Block Diagram
Figure 2



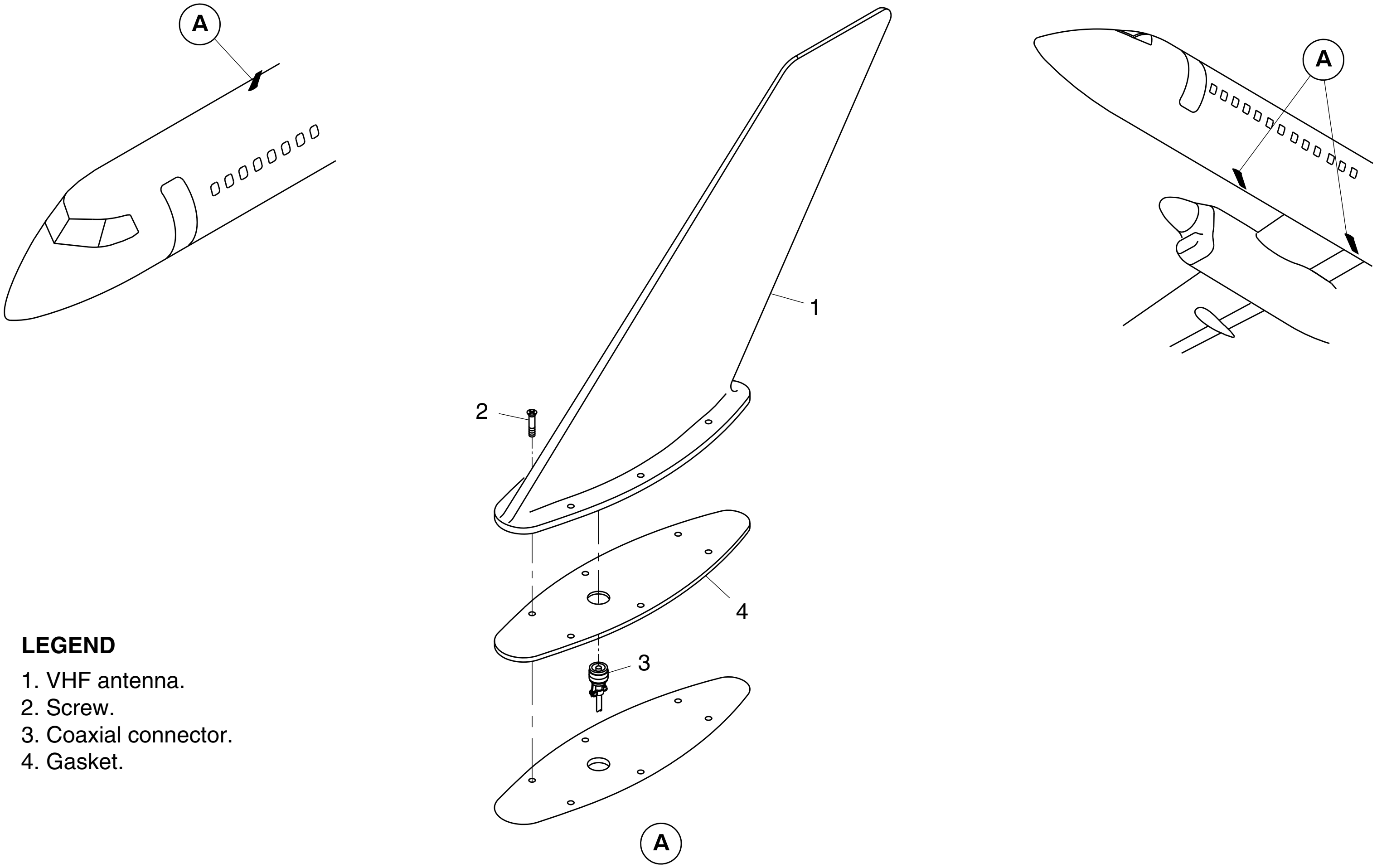
VHF3 Communication System Block Diagram
Figure 3



VHF Communication System, Transceiver
Figure 4



Standby Control Unit
Figure 5

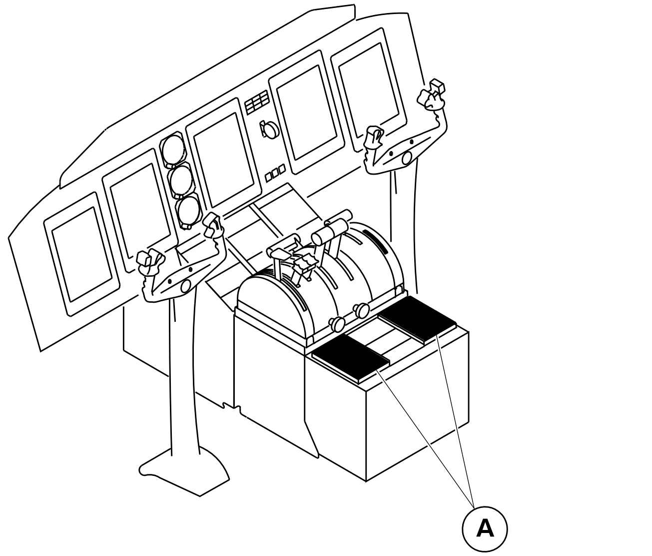


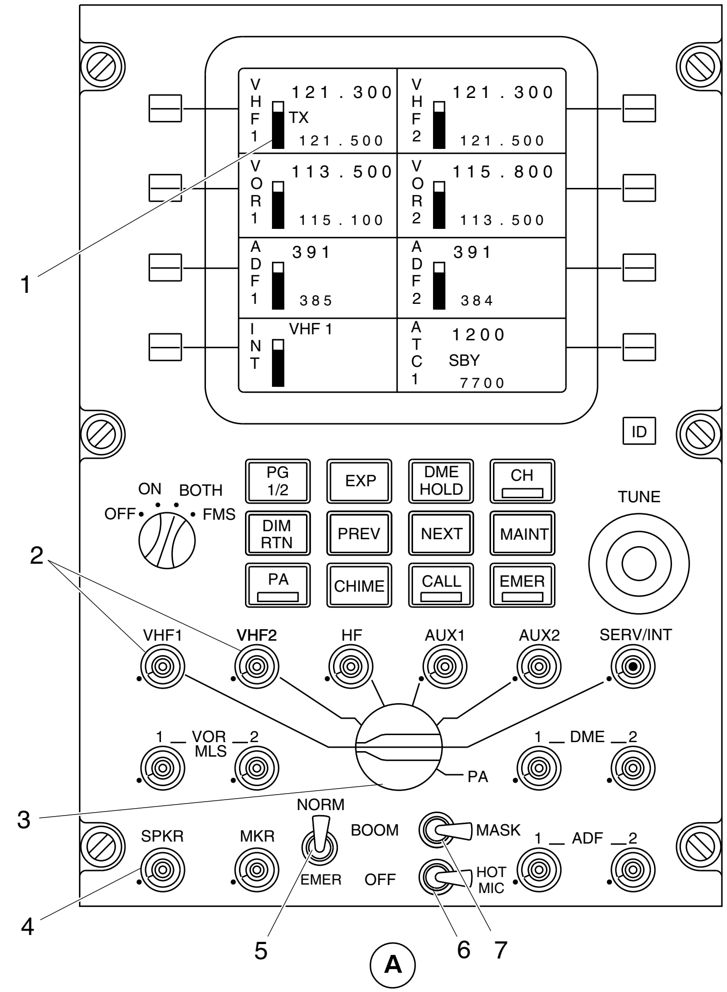
LEGEND

1. VHF antenna.
2. Screw.
3. Coaxial connector.
4. Gasket.

fs604a01.dg, js/gv, mar17/2020

VHF Antenna
Figure 6



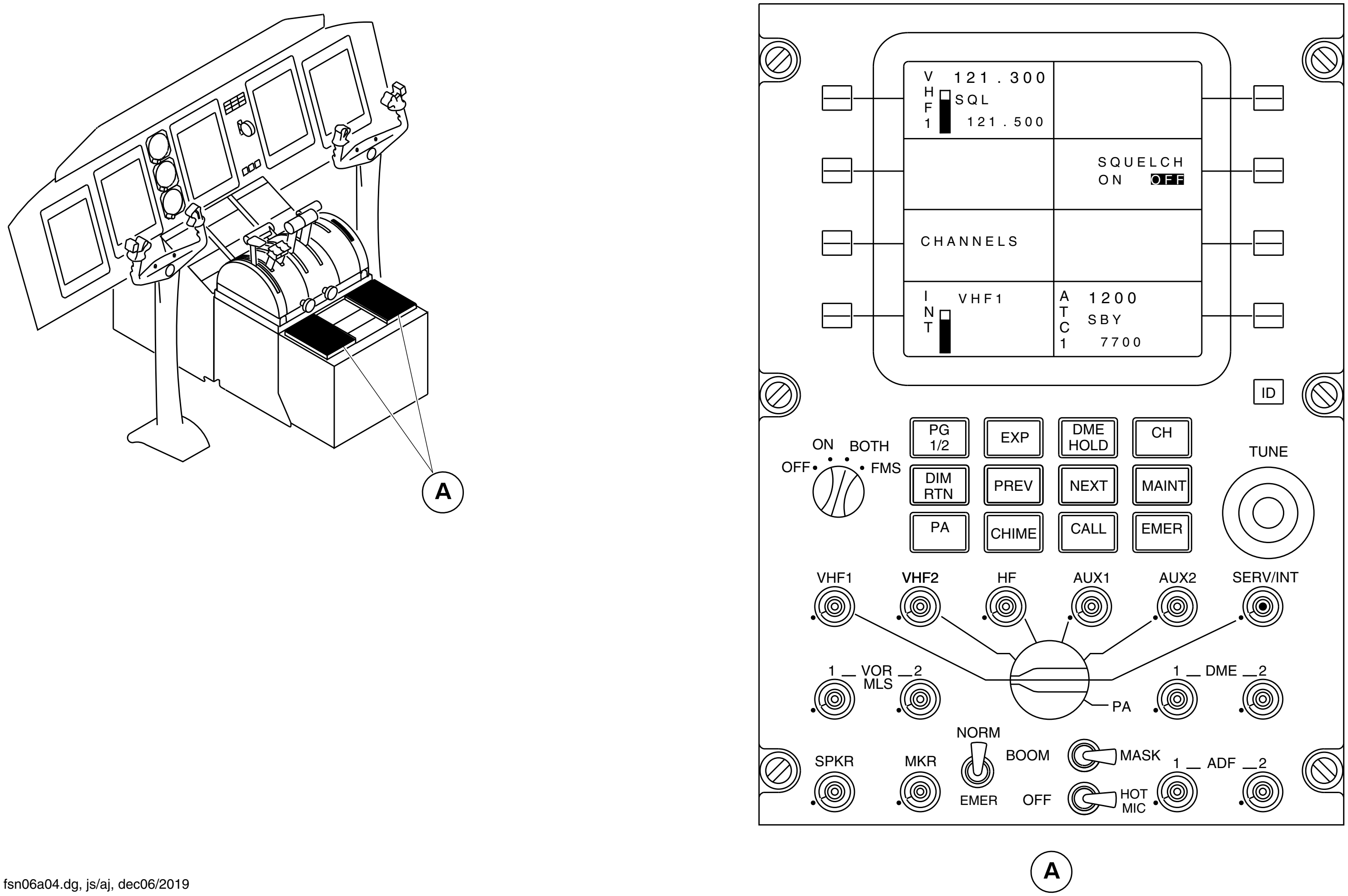


LEGEND

1. Level adjust bar graph.
2. VHF Potentiometer/Pushbutton switch.
3. Microphone/Interphone selector switch.
4. Speaker Potentiometer/Pushbutton switch.
5. Normal/Emergency toggle.
6. Hot microphone switch.
7. BOOM/MASK toggle switch.

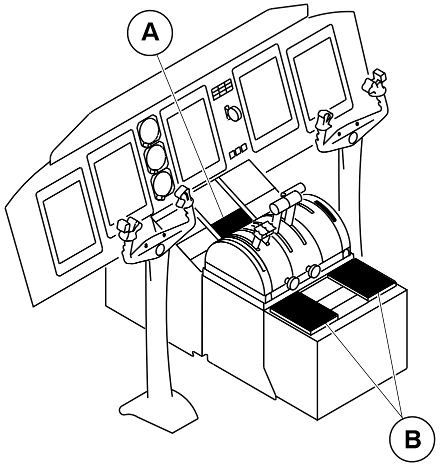
fsn06a09.dg, js/aj, dec06/2019

ARCDU VHF Communication Audio Control
Figure 7



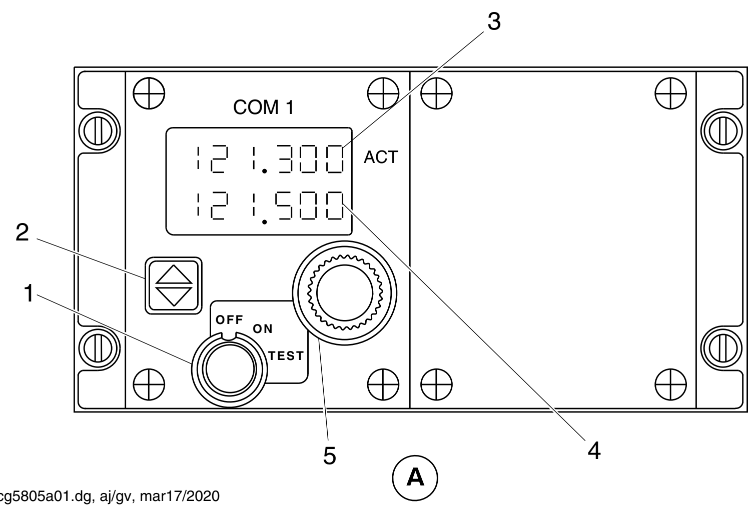
fsn06a04.dg, js/aj, dec06/2019

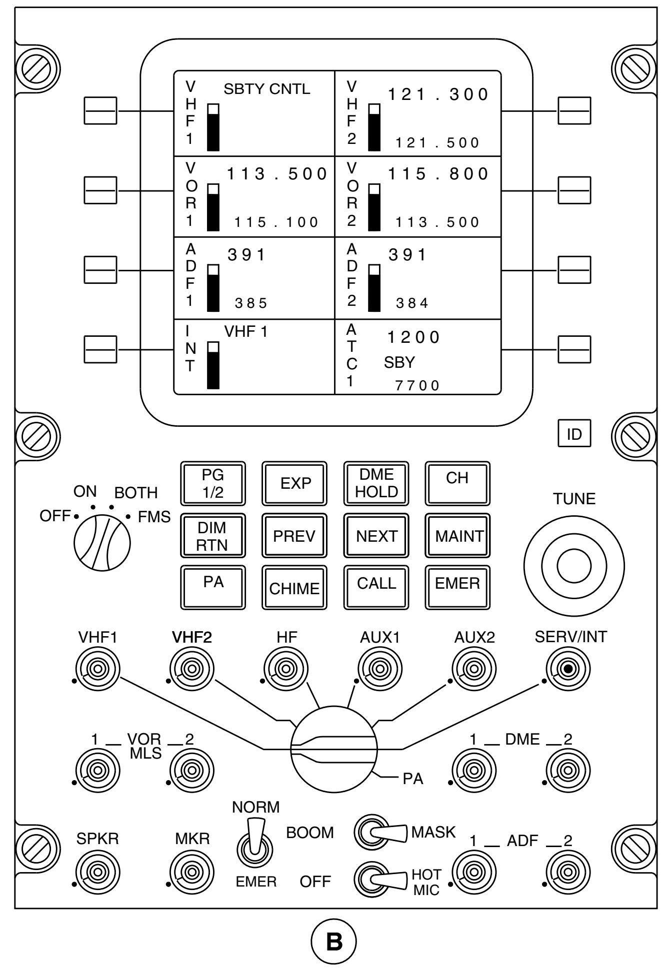
ARCDU VHF Communication Particular Page
Figure 8



LEGEND

1. ON/OFF/TEST rotary switch.
2. Frequency transfer pushbutton switch.
3. Active frequency indication.
4. Preset frequency indication.
5. Frequency rotary selector.





cg5805a01.dg, aj/gv, mar17/2020

COM 1 and Standby Control Panel
Figure 9

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–12–00–001

HF COMMUNICATION

Introduction

The High Frequency (HF) communication system provides long–range, two way Single Sideband (SSB), Amplitude Modulation (AM), voice and data communication.

On aircraft with ModSum 4–406800 and SB84–23–05 incorporated, the 950 HF system is installed and on aircraft with SB84–23–40 OR ModSum 4–309234 OR 4–309246 OR 4–458688 OR SB84–23–48 OR SB84–23–58 OR SB84–23–59 incorporated, the 1050 HF system is installed.

On aircraft with ModSum 4–458777 incorporated, the 1050 HF system is removed.

General Description

For the 950 HF system, Refer to Figures 1 and 2.

For the 1050 HF system, Refer to Figures 3 and 4.

The HF communication system transmits and receives high frequency communication signals in the 2.0 to 29.9999 MHz frequency range of the radio spectrum with 100 Hz channel spacing. The HF is controlled by a control unit and the Audio and Radio Control Display Units (ARCDUs). The control unit setup the functions of the HF and the ARCDUs utilizes the HF audio and transmitter setup.

The HF communication system transmits and receives signals through a single omnidirectional HF shunt antenna, that is part of the leading edge vertical stabilizer. The shunt antenna function by developing a very high RF current up to 50 Amps at very low RF voltages.

The 950 HF communication system consist of the following components:

- Unit, Control (23–12–01)
- Receiver/Exciter (23–12–06)
- Tray, Mounting – Receiver/Exciter (23–12–11)
- Coupler, HF Power Amplifier (23–12–16)
- Tray, Mounting – Coupler (23–12–21)
- Capacitor, HF Antenna (23–12–26).

The 1050 HF communication system consist of the following components:

- Unit, Control (23–12–01)
- Receiver/Exciter (23–12–06)
- Tray, Mounting – Receiver/Exciter (23–12–11)
- HF Power Amplifier (23–12–16)
- Coupler, Antenna (23–12–19)
- Tray, Mounting – Power Amplifier (23–12–21).

Detailed Description

The HF communications system operates in AM or Upper Sideband (USB) modes. The Lower Sideband (LSB) operating option is not approved for airborne HF operation.

High frequency communication provides long range transmission and reception over distances of thousands of miles. It uses skywave propagation that directs the HF radio waves towards the ionosphere that reflects it back to the earth's surface. The AM Mode of the HF system transmits the whole wave, the Carrier Wave (CW), LSB and the USB signal. The SSB mode of the HF system removes the CW, LSB and transmit only the intelligent portion of the USB signal.

Solar disturbances, atmospheric conditions like precipitation and thunderstorms can cause propagation of the HF radio waves to deteriorate resulting in poor communication.

The aircraft has a single antenna located in the leading edge vertical stabilizer. When two HF communication systems are installed the antenna is shared by both the systems. The two systems can receive HF radio signals simultaneously, but only one system can transmit at a time. The ARCDU microphone selector switch is set to HF1 or HF2 to determine which system will transmit. When one receiver/exciter is transmitting, the other is inhibited to protect the receiver.

The HF communication system operates in the modes that follow:

- Amplitude Modulation Equivalent (AME)
- SSB
- A3A
- Simplex
- Semi−duplex
- Receive only.

AME Operation: The selected frequency and two sidebands are transmitted. Approximately 2/3 of the transmitted power is used to transmit the carrier frequency which contains none of the voice frequencies. The sidebands have voice frequencies.

SSB Operation: Before transmission, the receiver/exciter electronically removes the carrier wave and one sideband. The remaining single sideband is transmitted. When the receiver/exciter receives a SSB signal, the required carrier frequency is combined with the received upper sideband signal and then demodulated to get the required audio.

A3A (USB Reduced Carrier Telephone Mode) Operation: This public correspondence mode is seldom used and is annunciated by the display of both AM and USB at the same time. The mode is usually not necessary for ITU channel communication but older base stations may require its use. When selected, a small amount of carrier frequency is transmitted and used by the ground station to activate the ringer and lock the receiver to the transmit frequency.

Simplex Operation: The simplex operation uses the same frequency for transmission and reception. Each can be set to operate in simplex AM or USB mode. It is usually used for communication with ATC and ARINC.

Semi−duplex Operation: The semi−duplex operation uses different frequencies for transmission and reception. Semi−duplex operation is usually used by the maritime radiotelephone network (public correspondence) stations.

Receive Only Operation: Channels can be programmed for receive−only operations by not programming a transmit frequency for the selected channel. Receive−only operations are used where transmission on the assigned frequency is not approved (weather information stations).

Refer to Figure 5.

The 950 HF control unit has the following control functions:

- Off/Volume Control
- Squelch Control
- Clarifier Control
- Mode Selection
- Frequency/Channel Transfer
- Channel and Frequency Control Knobs
- Program Selection
- Store Selection.

OFF/VOLUME Control: The OFF/VOLUME control turns the system off and on and controls the setup volume, the ARCDUs controls the overall volume. A clockwise rotation past the first click turns the system on. Further rotation increases audio level. It take about two minutes for the unit to warm up. Until then, no frequencies are shown on the display. The last frequency used is shown if the FREQ/CHAN push–button switch is out. The last active channel used is shown if the FREQ/CHAN button–down switch is in. All preset channels are stored in non–volatile memory and can be used when the system comes on. The HF control unit volume is setup at its maximum level and the ARCDU is used to control the overall audio level.

NOTE

ARCDU does not show an HF volume level.

SQUELCH: The squelch control supplies a variable squelch threshold control, to help eliminate nuisance background noise.

CLARIFIER: The clarifier control shifts local oscillator up to 250 Hz during the receive operation. This shift is used to adjusts the synthesized reinserted carrier frequency oscillator, to correct the speech pitch due to drift or inaccuracy of the reinserted carrier frequency.

MODE: This control is used to set the emission mode (AM and USB). The switch is active at all times except during transmission. A3A is indicated by displaying AM and USB messages at the same time beneath the HF frequency display.

FREQ/CHAN: Transfers the HF system from a direct frequency operation to a channel form of operation.

During channel operation, the channel number, emission mode and active frequency are shown. When transmitting in the channel mode, the transmit frequency and an added TX message are shown.

During direct frequency mode, the desired frequency is set with a cursor/digit increment–decrement switch. The HF system in simplex mode, receives in increments 100 kHz within the 2–30 MHz frequency range and Transmits in increments 100 kHz within the 2–30 MHz frequency range except for restricted bands. A TX message is shown along with the emission mode.

Channel/Frequency Select: Two concentric dials act as increment–decrement switches.

Channel Control: The inner concentric knob varies the channels from 1 to 99 when the FREQ/CHAN switch is in CHAN position (in). The outer knob is not functional in this mode.

Frequency Control: With the FREQ/CHAN knob in the FREQ position (out), the outer concentric knob changes the cursor position one step to the digit that the pilot desires to change. The inner knob changes the frequency in increments or decrements of 1 MHz steps from 2 to 29 MHz.

PGM (Program): This control is used only in channel operation. In the program mode, the channel number, emission mode and transmit frequency are shown on the control unit display. Transmission is inhibited, but the transmission frequency may be viewed when the microphone key is pushed.

STO (Store): The STO push−button switch has the functions that follow:

- Supplies the audio of the transmit frequency of a duplex channel. The STO button is pushed to show TX and the transmit frequency on the control head. The receiver monitors the transmit frequency.
- When the STO button and microphone key are pushed, a 1000 Hz tone is transmitted to break the squelch at some ground stations.
- When in the program mode, the STO button is pushed to enter the selected frequency into the channel to be programmed.
- The STO button is pushed to clear error conditions (errors are annunciated by a flashing E displayed for more than three seconds).

The control unit uses a high voltage gas discharge display that shows all frequencies and preset channel numbers. Smaller gas discharge characters (TX, PGM, LSB, AM, USB) show the emission mode, the transmit indicator and the program mode indication.

A photocell on the face of the control display unit adjusts the display light intensity automatically according to ambient lighting.

Refer to Figure 6.

The 1050 HF control unit has the following control functions:

- ON/OFF volume control
- Test button
- Squelch control
- Frequency tuning
- Mode selection
- Channel operation
- Clarifier
- Maritime radio telephone network operation
- Transmit power selection
- Data communications.

ON/OFF Volume Control: The smaller inner concentric knob (lower left) turns the system off and on and controls volume. Pressing the inner knob turns the system on. Pressing and holding the inner knob for 3 seconds turns the system off. Rotating the inner knob clockwise increases the volume. Counterclockwise rotation decreases the volume. A bulit−in function test is performed at the power up. The test should take no longer than 30 seconds. If any problems are found, the system will enter a Fail Mode.

TEST Button: The function test may also be initiated by pressing and holding the TEST button for three seconds. After three seconds, all display segments will be lit and the TX lamp will be illuminated. It takes at least 30 seconds for the test to complete. Press the TEST button again to exit the test mode.

If there is a failure in the control unit the bottom row on the display will show PANEL. A failure elsewhere in the system will display FAIL (ACP in the case of an Antenna coupler pressure warning or failure) on the top row of the display. Depending on the nature of the failure, the system will display the following on bottom row of the display:

- RXEX – Receiver/Exciter failure
- PA – Power amplifier failure
- CPLR – Antenna coupler failure
- PRS W – Antenna coupler pressure warning
- PRS F – Antenna coupler pressure failure.

SQL (Squelch): The HF communication system offers four types of squelch with corresponding values as follows:

SBH (Syllabic Squelch High) – This is the default squelch and is usually best for normal voice communications. A syllabic squelch opens upon receiving a signal with voice–like characteristics while ignoring other signals. With syllabic squelch, there is the possibility that the first syllable of a voice reception may be partially squelched. The possible adjustment levels are open (OPN) – meaning no squelch action, minimum (MIN), medium (MED), and maximum (MAX).

SBL (Syllabic Squelch Low) – This squelch is also a syllabic squelch and is intended for voice communications where the desired signal is very weak and noisy. This squelch is more prone to opening on noise than the SBH squelch. The possible adjustment levels are open (OPN), minimum (MIN), medium (MED) and maximum (MAX).

SQH (Signal/Noise Squelch High) – This is a traditional signal–to–noise squelch best suited for listening to non–voice signals, or voice signals that do not respond well to one of the syllabic squelches. Compared to the syllabic squelches, a higher signal level is generally required for this squelch to perform well. The possible adjustment levels are 1–32, where 1 is open squelch.

SQL (Signal Level Squelch) – This is a signal strength squelch which opens on any strong input signal. It opens quickly on strong signals, but also opens on strong noise or static. Use of SQL is recommended for use only with strong signals and under low noise conditions. This squelch is well suited for music broadcasts. The possible adjustment levels are 1–32, where 1 is open squelch.

To set the squelch, rotate the left outer concentric knob to the SQL position. The value of the active squelch is displayed on the right bottom row of the display. At system power–up the last selected squelch will be active. Press the FUNC button to cycle through the four types of squelch. Turn the right inner knob to select the desired value for the selected squelch type.

Frequency Tuning – Simplex Direct Tuning: Turn the left outer knob to FREQ position. The frequency shown in the upper row of the display is the receive frequency indicated by the RX on right of the display. Select the desired frequency using the right inner and outer concentric knobs. The outer knob changes the frequency in 0.1 MHz increments. The inner knob changes the frequency in 0.001 MHz (1 KHz) increments or 0.0001 MHz (100 Hz) increments, depending on the configuration selected when the system was installed. The transmit frequency will automatically track the receive frequency when tuning, providing for simplex operation. To verify the transmit frequency, press and hold the ENT button located at the end of the right knobs. RX and TX will be illuminated on the display and the transmit frequency will be displayed in the upper row. Momentarily push PTT button to initiate antenna tuning.

Frequency Tuning – Semi–Duplex Direct Tuning: If operating in a situation that requires a transmit frequency that is different than the receive frequency (semi–duplex) a different transmit frequency may be tuned. Turn the left outer knob to FREQ. The frequency shown in the upper row of the display is the receive frequency indicated by the RX on right of the display. Press and hold the ENT button. Momentarily press the FUNC button, then release the ENT button. The transmit frequency can now be tuned independent of the receive frequency. Note that TX is now illuminated on the display indicating that the displayed frequency is the transmit frequency. Select the desired frequency using the right inner and outer concentric knobs. The outer knob changes the frequency in 0.1 MHz increments. The inner knob changes the frequency in 0.001 MHz (1 KHz) increments or 0.0001 MHz (100 Hz) increments, depending on the configuration selected when the system was installed. Press the ENT button again to accept the new transmit frequency. If the ENT button is not pressed and the system detects no further activity, the system will revert to the previous transmit frequency. Momentarily push the PTT to tune the antenna to the new channel frequency.

Mode Selection: Emission mode selection options include Upper Side Band Voice (USB V), Lower Side Band Voice (LSB V), Upper Side Band Data (USB D), Lower Side Band Data (LSB D), AM Voice (AM) and Reduced Carrier (RC). The USB V will always be available, but availability of the other choices depends upon options selected when the system was installed. It is important to know the correct mode that matches the requirements of the ground station. USB V and data are considered the standard and most commonly used. Some older stations may still use AM Voice. Also, AM voice is best for listening to voice broadcast stations. Some stations have the ability to lock on to a transmitted carrier to avoid frequency errors. When communicating with one of these stations, Reduced carrier may be used. To select the desired mode turn the left outer knob to MOD. Pressing the FUNC button will toggle between modes. Also, turning the right inner or outer knob will advance through the modes.

Channel Operation: The 100 programmable channels available with the control unit are easily programmed on the ground or in the air. Channels are 00–99. Channel 00 is always tuned to 2.182 MHz. In addition, there are six emergency channels, five of which can be programmed. Channels are EMR 2 – EMR 6. EMR 1 is tuned to 2.182 MHz. It is the default channel and cannot be changed. Simplex and semi–duplex frequency tuning also applies when programming channels. It is important to know the requirements of the desired ground station when programming frequencies. In addition to assigning frequencies to a channel, a mode is also assigned. To select the already programmed channels, turn the left outer knob to CHAN. The last selected channel will be displayed. Turn the right inner or outer knob to select the desired channel number. Momentarily push the PTT to tune the antenna to the new channel frequency. Emergency channels typically use simplex operation. However channels 2 – 6 can be programmed for semi–duplex operation. To select already programmed emergency channels, press and hold the EMER button for approximately 2 seconds. The display will appear with EMR 1 as the default channel. If other than EMR 1 is desired turn the right inner or outer knob to select the desired emergency channel number. Even if the selected channel has previously been programmed for semi–duplex operation, simplex operation will initially be selected. If desired, press the ENT button to select semi–duplex operation. SPLT will be displayed for two seconds in the lower part of the display. Press the ENT button again to return to simplex operation. SIMP will now be displayed for two seconds in the lower part of the display. Repeated pressing of the

ENT button will toggle between simplex and semi−duplex operation. Momentarily push PTT to tune the antenna to the new channel frequency. Press the EMER button to exit the emergency channels.

Clarifier: The purpose of the clarifier is to help eliminate the unnatural "tinny sound" found at times with SSB audio voice quality as a result of off−frequency ground station transmissions. The clarifier works by allowing frequency adjustment of ±250 Hz whether the channel involved is semi−duplex or simplex tuned. It is not normally used in the AM mode. Long range HF signals received under less than optimum propagation conditions may still vary in quality and volume. To use clarifier, turn the left outer knob to OPT. The clarifier will be displayed first, denoted by the C. Turn the right inner knob to adjust the clarifier frequency up or down for reception. Select any other function to exit the clarifier. When another frequency or channel is selected the clarifier value will return to 000.

Maritime Radiotelephone Network (Public Correspondence) Channel Operation: All 246 ITU public correspondence channels in the maritime radiotelephone network are programmed permanently in the electronic memory of the HF communication system. These channels may be used by aircraft to make telephone calls through the High−Seas−Operator Network. To use the ITU channels, turn the left outer knob to OPT. The Clarifier will be displayed first, denoted by C. Press the FUNC button until the last tuned ITU channel appears in the lower right of the display. The lower left will be blank. Turn the right inner or outer knob to select the desired ITU channel. Momentarily push the PTT to tune the antenna to the new channel frequency. Select any other function to exit.

Transmit Power Selection: The HF communication system transmit power can be adjusted for optimum communication quality dictated by conditions such as ionospheric conditions and distance to station. Available settings are Minimum (MIN – 50 Watts), Medium (MED – 100 Watts) and Maximum (MAX – 200 Watts). To change the transmit power, turn the left outer knob to OPT. The clarifier will be displayed first, denoted by C. Press the FUNC button until transmit power is selected, denoted by the P and a value in the lower part of the display. Turn the right inner or outer knob to select the desired transmitter power output. Select any other function to exit.

Data Communications: The HF communication system will transmit and receive data, such as fax transmissions, etc. Data communication requires an external modem be installed with the system. Before transmitting or receiving data, select the appropriate mode (USB D, LSB D or possibly AM). Check the requirements of the desired station.

Refer to Figure 7.

The ARCDUs have the radio and audio controls for the HF transceivers that follows:

- Potentiometer push−button switches
- Rotary microphone (transmitter) selector
- BOOM/MASK toggle switch.

Potentiometer Push−button Switches: The HF potentiometer push−button switches control the audio parameters that follow:

- On
- Off
- Level.

The top part of the potentiometer is pushed to switch the specific audio signal to the headphone on or off. The HF push−button switch is pushed on the ARCDU to switch the audio to the flight crew. When the SPKR push−button potentiometer switch is pushed, the HF communication audio is switch to the two flight compartment speakers. A loudspeaker graphic is shown in the INT window.

Rotary Microphone (Transmitter) Selector: The rotary microphone selector switch is turned to the HF to select the HF radio transmitter. The rotary microphone selector switch is used to select the desired radio transmitter followed by pushing the Push to Talk (PTT) switch to transmit.

BOOM/MASK Toggle Switch: When the BOOM/MASK toggle switch is set to BOOM, the headset boom microphone supplies audio to VHF transceiver through the Remote Control Audio Unit (RCAU).

When the BOOM/MASK toggle switch is set to MASK, the oxygen mask microphone supplies audio to the Audio and Radio Management System (ARMS).

Refer to SDS 23–51–00, Audio Integrating System (AIS). The ARCDUs and the observer's Audio Control Panel (ACP) interface with the RCAU to control the parameters that follow:

– PTT
– Microphone audio
– Headphone audio
– Speaker audio.

The HF audio output is sent to the RCAU for flight compartment distribution.

WWV and WWVH are two of the ground stations that broadcast time and frequency standard signals around the world. Other stations, all run by government agencies in their respective countries.

The frequency 2182 kHz has been designated as an international distress frequency. It is monitored worldwide and should be used only in the case of an emergency. If repeated calls on 2182 kHz do not bring a response, the flight crew may wish to try the U.S. coast guard on the channels that follow:

ITU CHANNEL NO.	AIRCRAFT RECEIVE (KHZ)	AIRCRAFT TRANSMIT (KHZ)
424	4428.7	4134.3
601	6506.4	6200.0
816	8765.4	8241.5
1205	13113.2	12342.4
1625	17307.3	16534.4

Unit, Control for the 950 HF System

Refer to Figure 8.

The HF control unit is used to set the frequency and mode of operation of the system. The unit shows this information to the flight crew.

During normal operation, the channel number, receive and transmit frequencies and emission mode are recorded in the internal Random Access Memory (RAM) of the microprocessor. This gives rapid access for frequency changes and synthesizer calculations. The channel number, emission mode and frequency mode are also recorded in the EEPROM for non–volatile storage when the system power is off. These data are recorded during initiation of a transmit/tune sequence.

The control unit has 99 programmable channels and 280,000 crew–selected frequencies. All channels can be set to operate as semi–duplex, simplex, or receive–only.

The control unit is installed with four dzus fasteners in the aft centre pedestal area of the flight compartment, aft of the ARCDU(s).

Unit, Control for the 1050 HF System

Refer to Figure 9.

The HF control unit is used to set the frequency and mode of operation of the system. The unit shows this information to the flight crew.

The control unit is a new ARINC 429 HF control head and operates as a stand alone controller. Selections of frequency or channel operation, emission modes, squelch and various options (i.e. ITU, clarifier, HF data link, etc.) are made by rotating two concentric knobs on the front panel. Two other concentric knobs, with a center push button, are used to select the operating frequency or programmed channel, and entering information into memory. Also, three push buttons are used for selecting emergency frequencies, performing self–tests, and selecting various settings. Information is displayed on a series of LCDs occupying two rows along the top of the controller.

During normal operation, the channel number, receive and transmit frequencies and emission mode are recorded in the internal RAM of the microprocessor. This gives rapid access for frequency changes and synthesizer calculations. The channel number, emission mode and frequency mode are also recorded in the EEPROM for non volatile storage when the system power is off. These data are recorded during initiation of a transmit/tune sequence.

The control unit has 99 programmable channels and 280,000 crew–selected frequencies. All channels can be set to operate as semi–duplex, simplex, or receive–only.

The control unit is installed with two allen head screws which are recessed into the front bezel.

Receiver/Exciter

For the 950 HF system, Refer to Figure 10.

For the 1050 HF system, Refer to Figure 11.

The receiver/exciter has receiver and low–level transmitter circuits. Frequencies are controlled by a temperature–compensated crystal oscillator which supplies an immediate frequency reference.

The receiver/exciter has the five modes that follow:

- AM Receive
- AM Transmit
- SSB Receive
- SSB Transmit
- Tune.

AM Receive: The received signal from the antenna passes through the antenna coupler and the low–pass filter sections of the PA/coupler to the receiver/exciter. The signal is then sent through one of six high–pass filters. The low and high pass filters supply the spurious response characteristics of the HF system. The signal is then mixed with Local Oscillator (LO1) in the double–balanced first mixer to give a difference in frequency of 45.045 MHz, the first Intermediate Frequency (IF). This IF is then amplified by a broadband amplifier prior to passing through the selective IF 4–pole monolithic filter, the purpose of which is to provide cross−modulation rejection. Following this filter is a second IF amplifier which is AGC controlled. The signal is then mixed with LO2 operating at 45.05 MHz, resulting in the second IF frequency of 455 kHz. This signal is further amplified twice prior to additional AM filter processing which supplies the necessary selectivity.

Further amplification is supplied by two additional gain stages before being detected in the diode AM detector. AM audio is recovered at this stage, as is required AGC voltage to control the IF sections. AM audio is amplified and converted to a 500 Ω output impedance. Synthesizer data and mode logic is provided from the control unit. The synthesizer supplies the local oscillator signals to the two mixers for correct signal conversion.

AM Transmit (AM Equivalent−AME) − Microphone audio is sent to the microphone audio compressor where it is modified to an automatically−controlled level and routed to the balanced modulator and switched to the audio amplifier for side−tone output. The audio is mixed in the balanced modulator with the 455 kHz LO3 signal to form a 455 kHz double sideband suppressed−carrier signal, followed by amplification and filtering in the 455 kHz upper−sideband filter. The purpose of this filter is to remove the lower sideband.

The 455 kHz carrier is reinserted at a controlled level with respect to the peak SSB signal and then mixed with LO2 at 45.5 MHz in the first mixer to supply the 45.05 MHz IF frequency. This signal is amplified and filtered and modified with AGC to control the output power. The signal is further mixed with LO1 for conversion to the actual required transmission frequency, amplified with a broadband amplifier and high−pass filtered prior to reaching the Power Amplifier and low−pass filtering stages.

SSB Receive: The signal is mixed in the second mixer with LO2 at 45.5 MHz for upper sideband and at 444.59 MHz for lower sideband. The signal in the second IF passes through the upper sideband mechanical filter and after amplification, it is sent to the product detector where it is mixed with the 455 kHz LO3 with the resultant audio signal selected for amplification. SSB is the only mode where the clarifier can be enabled for fine tuning of the received signal for the most natural voice sound.

SSB Transmit: The 455 kHz LO3 is not reinserted prior to the first mixer. The first mixer injection LO is at 45.5 MHz for upper sideband and 44.59 MHz for lower sideband.

In SSB transmission, only one sideband is used to carry the intelligence. The carrier RF frequency is suppressed and the unwanted sideband is filtered out, to leave the desired sideband. The entire power capability of the transmitter is therefore used to transmit only the necessary part of the signal. There is no output from the transmitter unless modulation is present and it is for this reason that SSB transmitters are rated in peak envelope power. The power contained in the signal at the maximum peak amplitude is called the Peak Envelope Power (PEP). The PEP of a given transmitter is related to the distortion considered tolerable. Typically, the lower the signal−to−distortion ratio, the lower the attainable PEP.

Tune: The tune mode is the same as the AM Transmit mode except the microphone audio is disabled into the 455 kHz balanced modulator. The AM mode is used to supply a continuous carrier with which the antenna coupler discriminators can operate.

Tray, Mounting – Receiver/Exciter and HF Power Amplifier

The mounting tray is attached to four shock mounts, and to the aircraft structure with grounding straps. Solid conductive metal straps, typically 1 in. (2.54 mm) thick, are used for RF bonding. The grounding straps are kept as short as possible and attached so that operation of the shock mounts are not interfered.

Coupler, HF Power Amplifier

For the 950 HF system, Refer to Figure 12.

For the 1050 HF system, Refer to Figure 13.

The power amplifier coupler (PA/coupler) unit amplifies the signal from the receiver/exciter unit.

For the 950 HF system, two different power detectors are designed into the system. One is an average power detector which is set to approximately 38 W. Other is a peak power detector set to 150 W PEP. With single tone modulation (Carrier Wave–CW) the average power detector limits the output power to approximately 38 W. With multiple simultaneous modulating tones such as voice (or data) where average power is less than 38 W, the peak power detector monitors the output power levels and limits maximum power to 150 W. The amplified signal is then sent to the coupler section where it is matched to the antenna impedance (50 Ω). The coupler is capable of matching with less than 2:1 VSWR, the 50 Ω power amplifier output to the antenna impedance. The matching network includes an inductor/capacitor network which either matches the antenna to 50 Ω or supplies 12.5 Ω plus an additional inductance of a transformer to increase the impedance to 50 Ω.

For the 1050 HF system, the PA amplifies the signal from the receiver/exciter into a 200 W PEP transmitted signal in single side band operation or 50 W of carrier power in AM operation. After filtering, the amplified signal is fed to the antenna coupler. In the receive mode, the signal is passed through the PA to the receiver/exciter.

To get maximum efficiency, proper RF bonding of the PA/coupler to the airframe is supplied four ways:

- The PA/coupler mounting tray is bonded to the mounting surface or shelf with two ground straps.
- The ground stud on the PA/coupler is directly bonded to the mounting surface or shelf with a ground strap.
- The ground stud on the PA/coupler is bonded directly to the skin or the airframe structure with a ground strap.
- The PA/coupler is bonded to the skin of the aircraft through the shield of the antenna feed coax.

Tray, Mounting Coupler

The PA/coupler is attached to a mounting tray. Four shock mounts and two tray ground straps connect the unit and the mounting tray. The airframe to unit ground strap is attached to a ground stud and extends to an area on the airframe located near the antenna feed through.

Capacitor, HF Antenna for the 950 HF System

Refer to Figure 14.

The capacitor lets the antenna coupler efficiently tune short grounded antennas.

The shunt antenna is an electrically isolated section of the leading edge of the vertical stabilizer. An external capacitor isolates the high current. The unit has a porcelain feed through termination and is attached to the vertical stabilizer in series with and close to the output of the PA/coupler.

Antenna Coupler for the 1050 HF System

Refer to Figure 15.

The antenna coupler is mounted vertically near the HF antenna to maximize transmission efficiency. The antenna coupler matches the impedance of the antenna to the 50Ω output of the transmitter. A microprocessor in the antenna coupler controls the antenna coupling function and exchanges information with the controller via the receiver/exciter. The antenna coupler also keeps data in on–board nonvolatile memory of all previously successful tuning solutions and uses this tuning data on subsequent tunes within the same frequency range.

Power Supply

Refer to Figure 2.

On aircraft without SB84–23–39 incorporated, for the 950 HF system, the receiver/exciter unit is powered from the 28 V dc left main bus, through a 5 A circuit breaker (HF #1 RCVR/XMTR). The circuit breaker HF #1 RCVR/XMTR is located on the avionics circuit breaker panel at position M2. The HF PA/coupler is powered from the 28 V dc left main bus, through a 25 A circuit breaker (HF #1 PA/CPLR). The circuit breaker HF #1 PA/CPLR is located on the avionics circuit breaker panel at position N2.

On aircraft with SB84–23–39 incorporated, for the 950 HF system, the receiver/exciter unit is powered from the 28 V dc left main bus, through a 5 A circuit breaker (HF COMM). The circuit breaker HF COMM is located on the left DC circuit breaker panel at position B1. The HF PA/coupler is powered from the 28 V dc left main bus, through a 25 A circuit breaker (HF AMP). The circuit breaker HF AMP is located on the left DC circuit breaker panel at position C1.

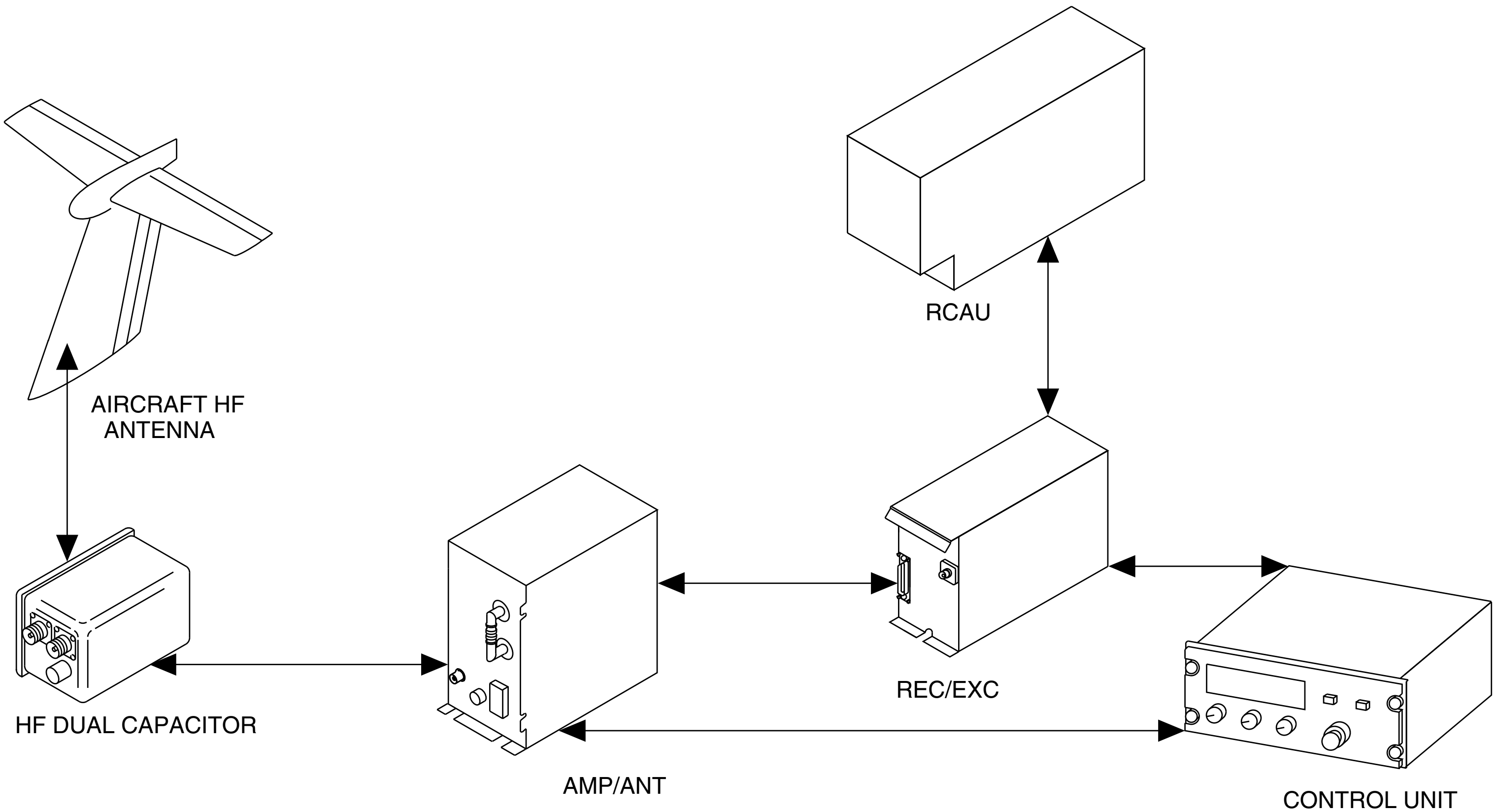
Refer to Figure 4.

On aircraft without SB84–23–36 and ModSum 4–903174 incorporated, for the 1050 HF system, the receiver/exciter unit, control unit and antenna coupler are simultaneously powered from the 28 V dc left main bus, through a 5 A circuit breaker (HF COMM). The circuit breaker (HF COMM) is located on the avionics circuit breaker panel at position M2. The HF power amplifier is powered from the 28 V dc left main bus, through a 30 A circuit breaker (HF AMP). The circuit breaker HF AMP is located on the avionics circuit breaker panel at position N2.

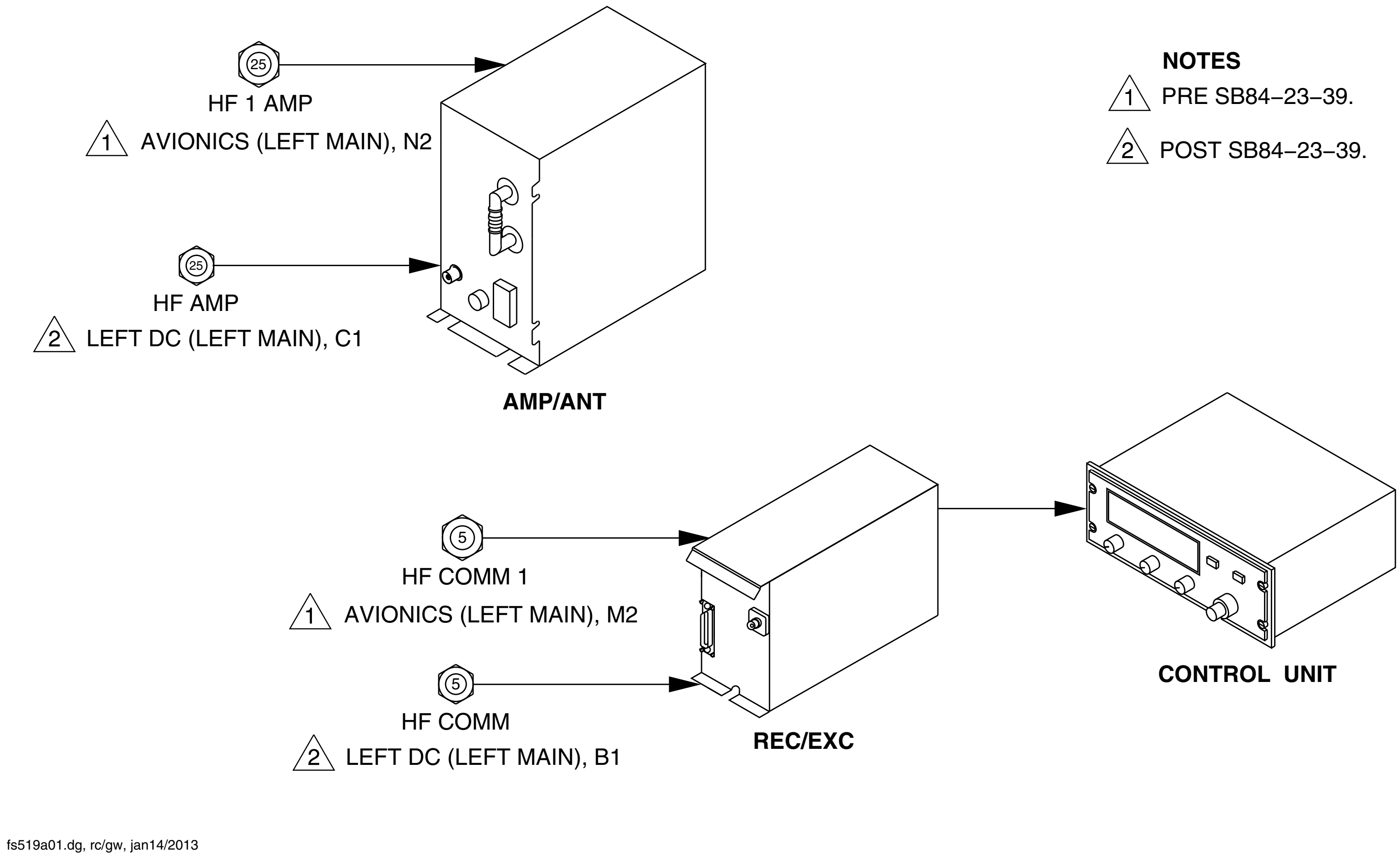
On aircraft with SB84–23–36, SB84–23–40, ModSum 4–903174, ModSum 4–458688, SB84–23–48, SB84–23–58, SB84–23–59 and without ModSum 4–458777 incorporated, for the 1050 HF system, the receiver/exciter unit, control unit and antenna coupler are simultaneously powered from the 28 V dc left main bus, through a 5 A circuit breaker (HF COMM). The circuit breaker (HF COMM) is located on the left DC circuit breaker panel at position B1. The HF power amplifier is powered from the 28 V dc left main bus, through a 30 A circuit breaker (HF AMP). The circuit breaker HF AMP is located on the left DC circuit breaker panel at position C1.

Fault Indication and Annunciation

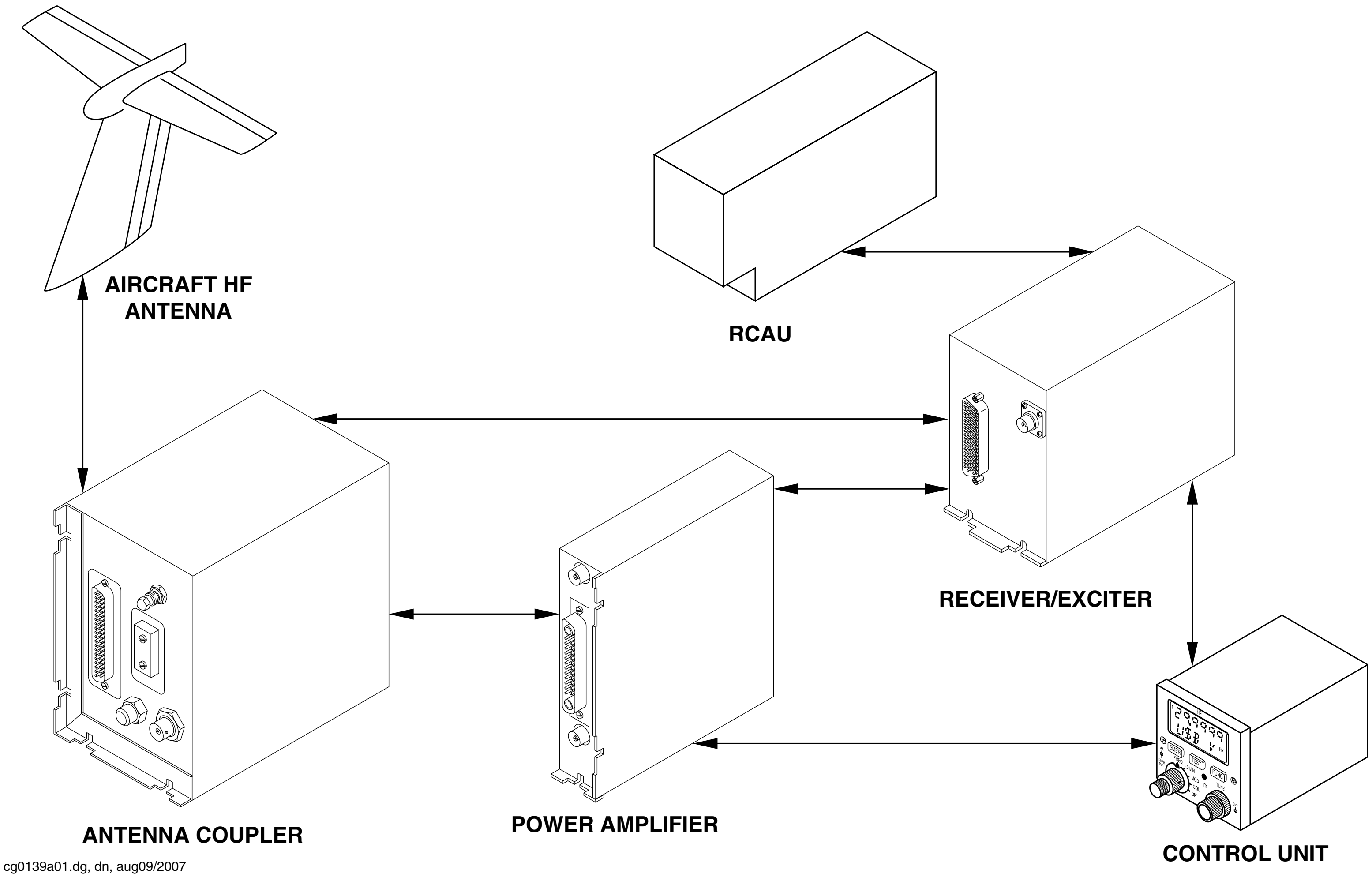
Fault indication is given in the HF system for problems related to tuning (failure to achieve impedance matching between the antenna and PA/coupler output) during initial tuning attempts or subsequent to a tuned condition and after VSWR degradation. The malfunction condition is shown on the controller display wherein all digits will flash. An attempt to clear the condition may be made by a second tuning attempt (keying microphone line) but subsequent failures to load indicate equipment malfunction. Additional causes for failure indication can be due to a generated fault signal within the antenna coupler which is input to the microprocessor when excessive amplifier temperature is detected or during bias regulator malfunction. Bias regulation is achieved through temperature monitoring and monitoring of average output power in order that bias voltages may be lowered during high duty–cycle power waveforms such as is required for AM transmissions.



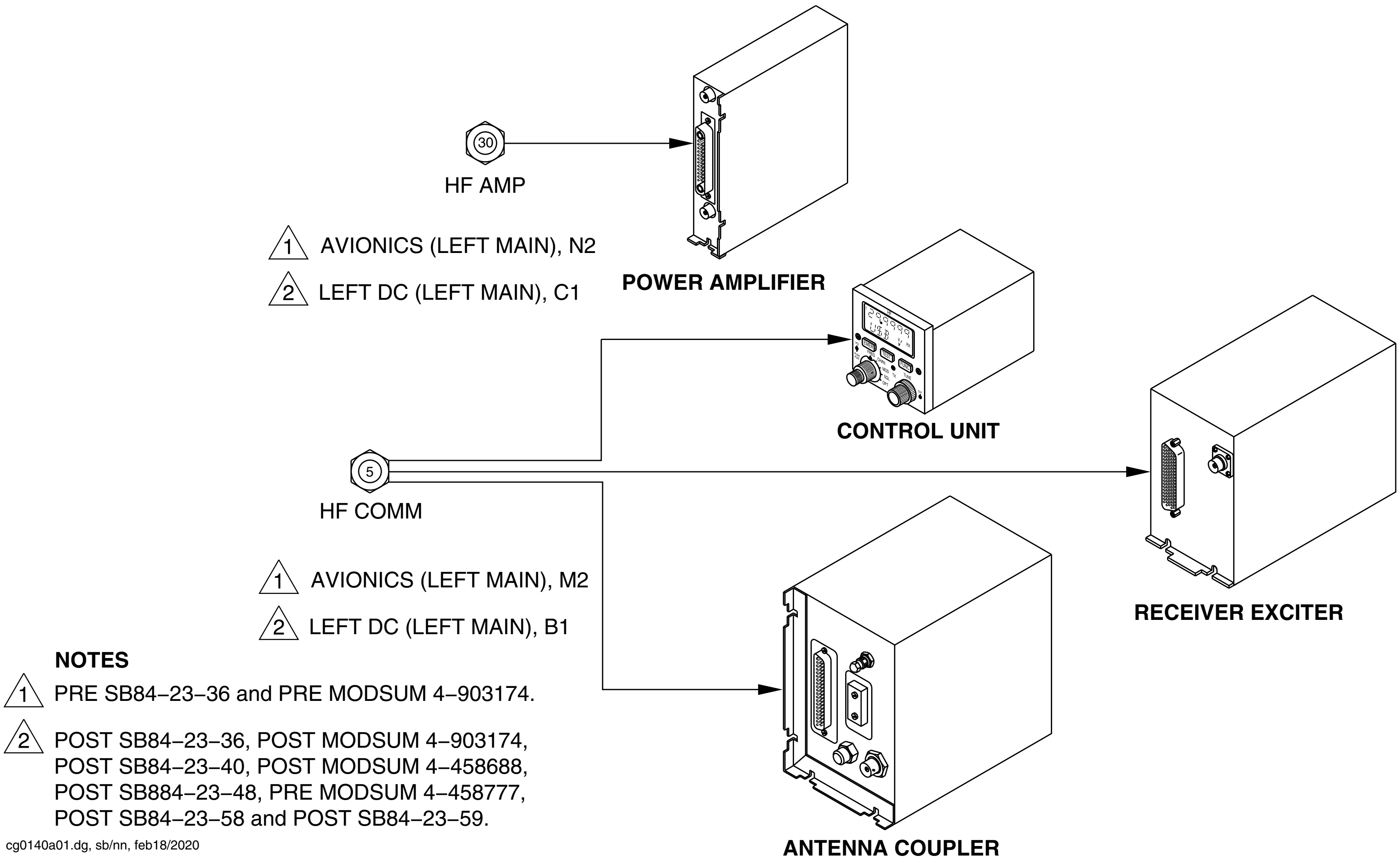
HF COMMUNICATION SYSTEM BLOCK DIAGRAM, SINGLE INSTALLATION
Figure 1



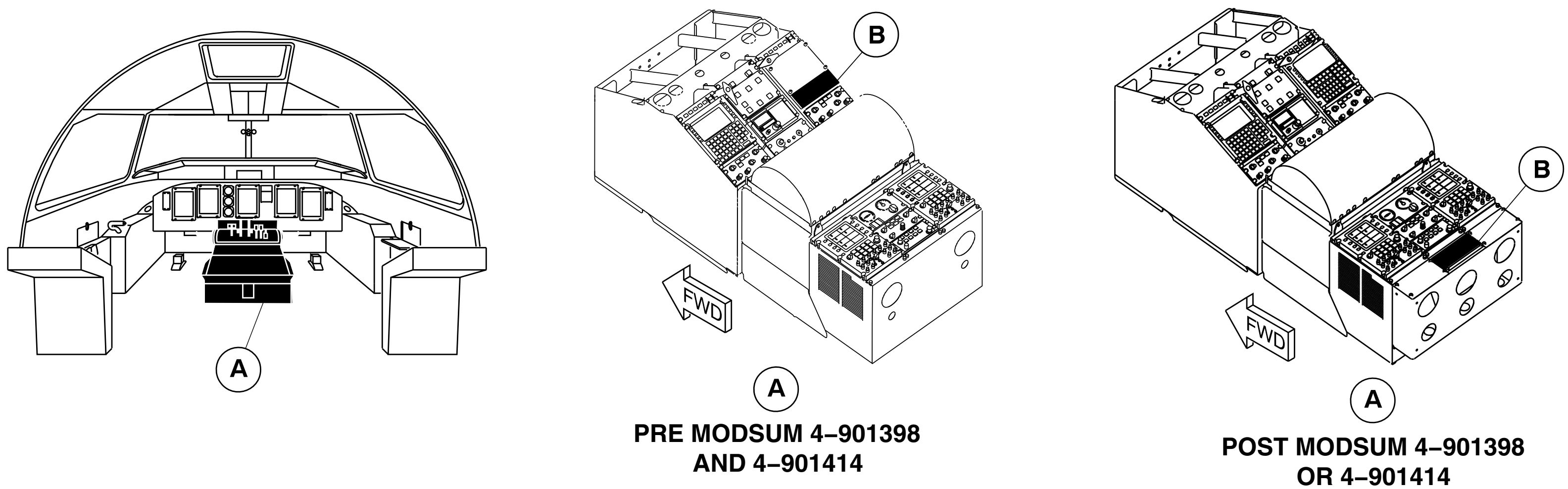
HF Communication System Block Diagram, Power, Single Installation
Figure 2



HF COMMUNICATIONS SYSTEM BLOCK DIAGRAM – KHF1050
Figure 3

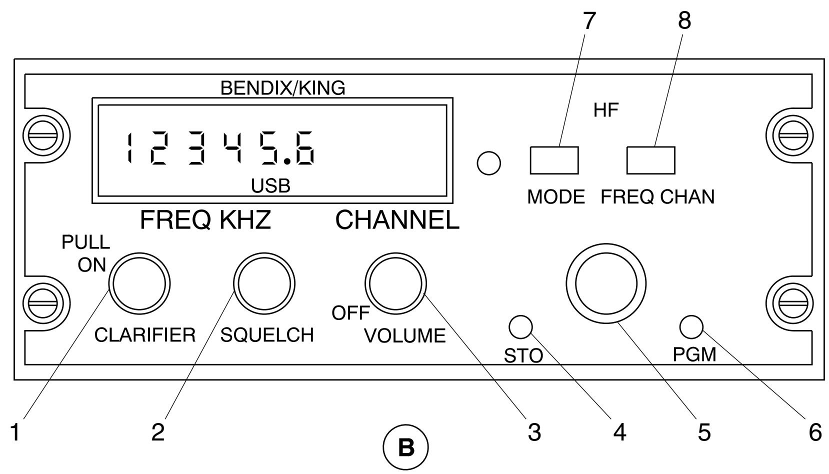


HF Communications System Power Diagram – KHF1050
Figure 4



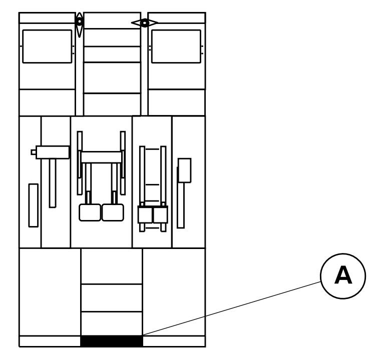
LEGEND

1.Clarifier.
2. Squelch.
3. Off/volume.
4. STO switch.
5. Frequency direct tuner.
6. PGM switch.
7. Mode button.
8. Frequency/channel button.

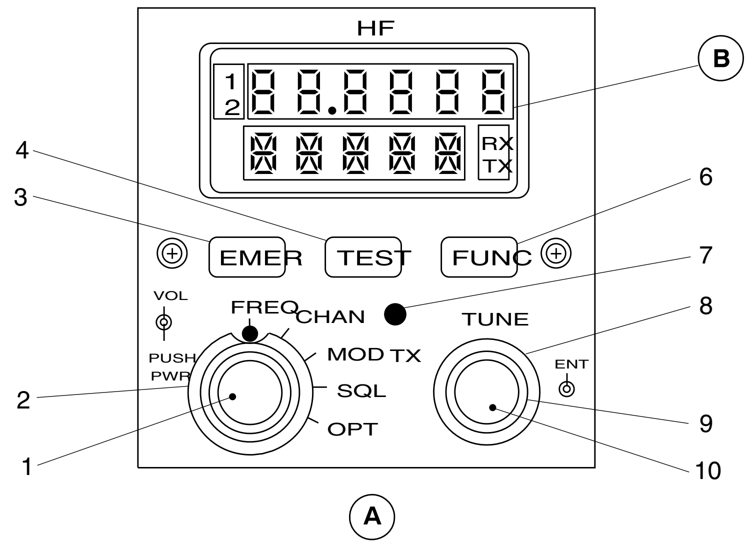


fs578a01.dg, rc/sb, dec20/2012

HF Communication Control Unit
Figure 5

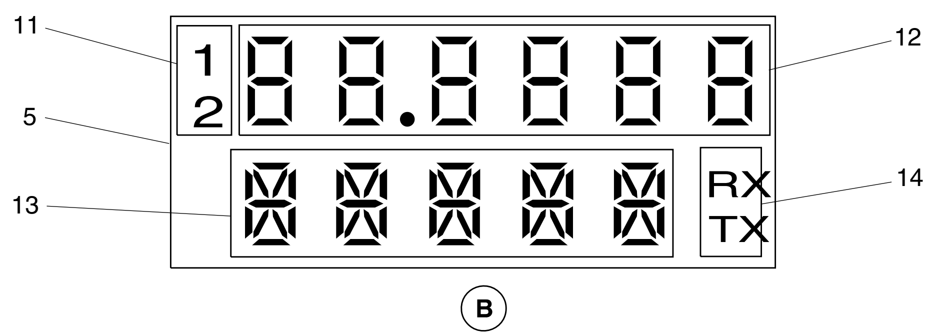


CENTRE CONSOLE



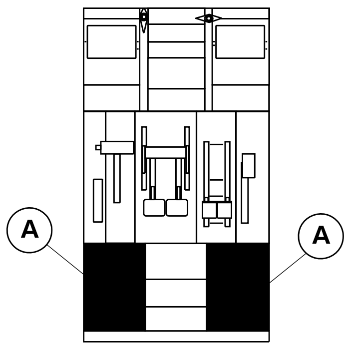
LEGEND

1. ON/OFF/Volume.
2. Function selector.
3. Emergency channel access button.
4. Functional test button.
5. Display area.
6. Sub–function select button.
7. Transmit lamp.
8. Outer selector knob.
9. Inner selector knob.
10. Enter button.
11. Controller number.
12. Frequency display.
13. Transmit or receive.
14. Information display.

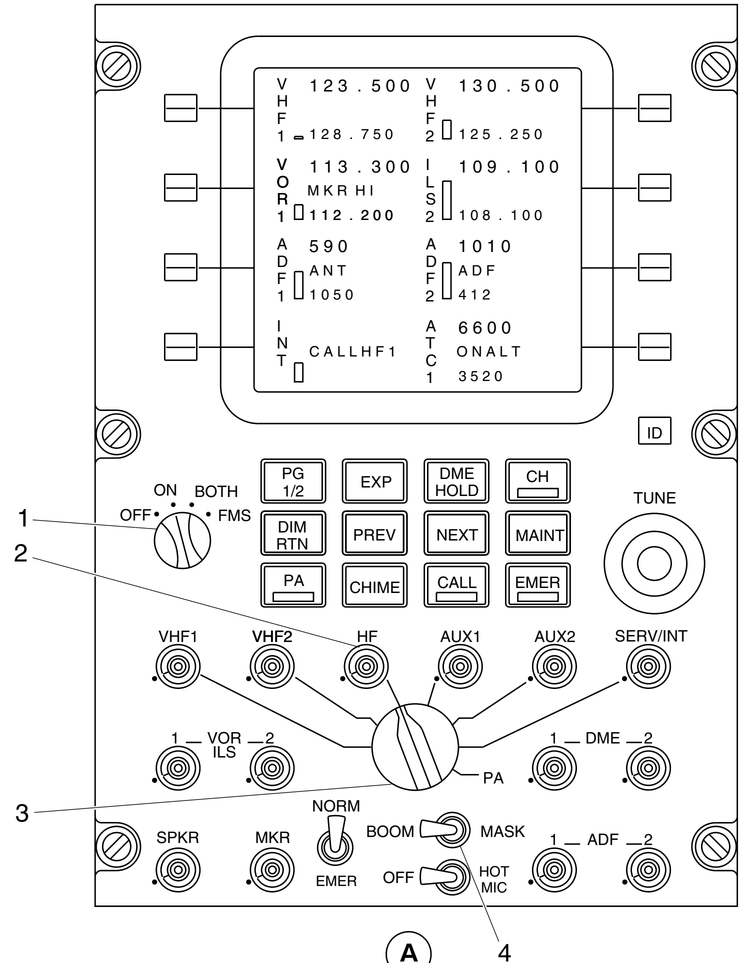


cg0141a01.dg, dn, aug09/2007

HF COMMUNICATIONS CONTROL UNIT – KHF1050
Figure 6



CENTER CONSOLE

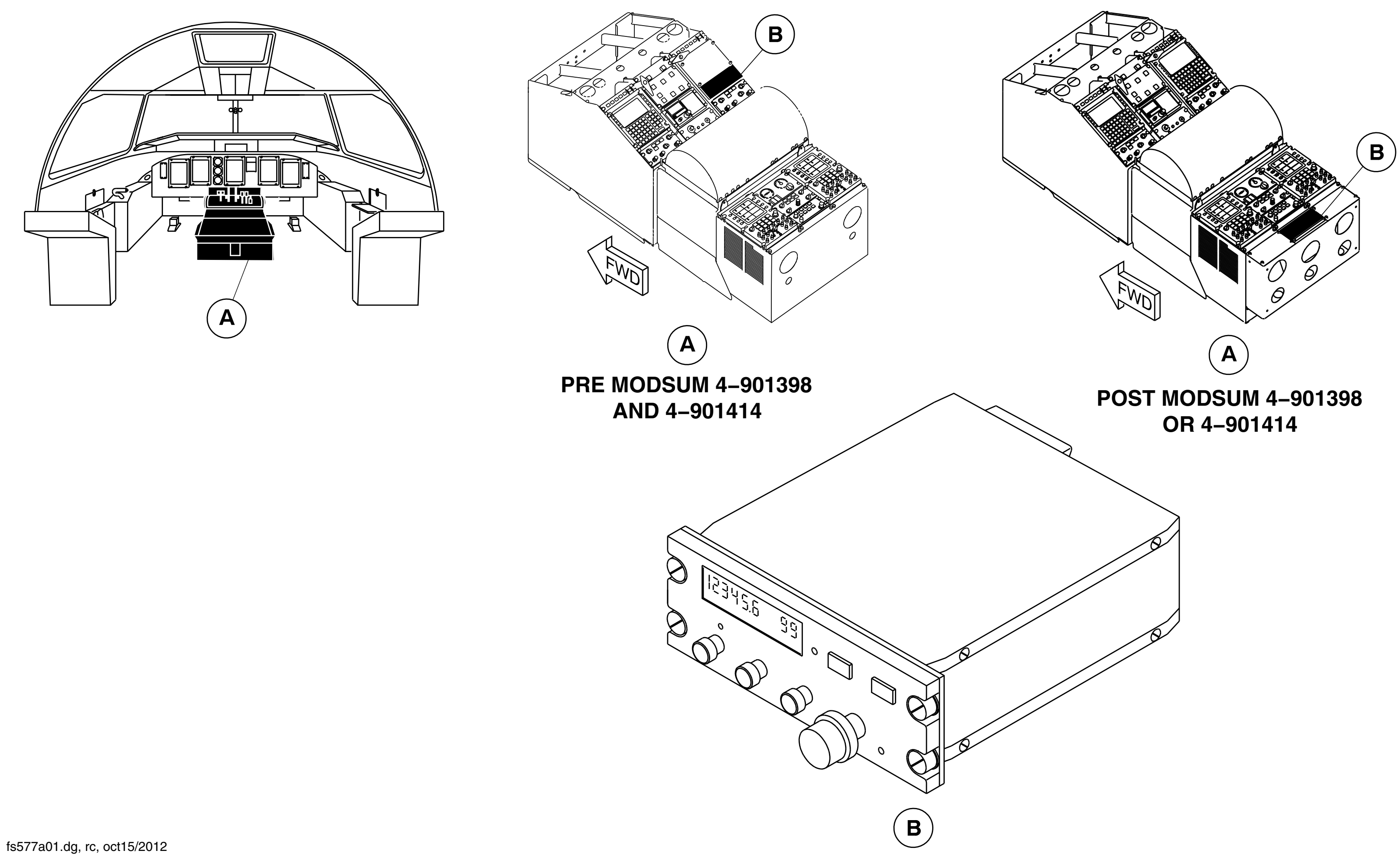


LEGEND

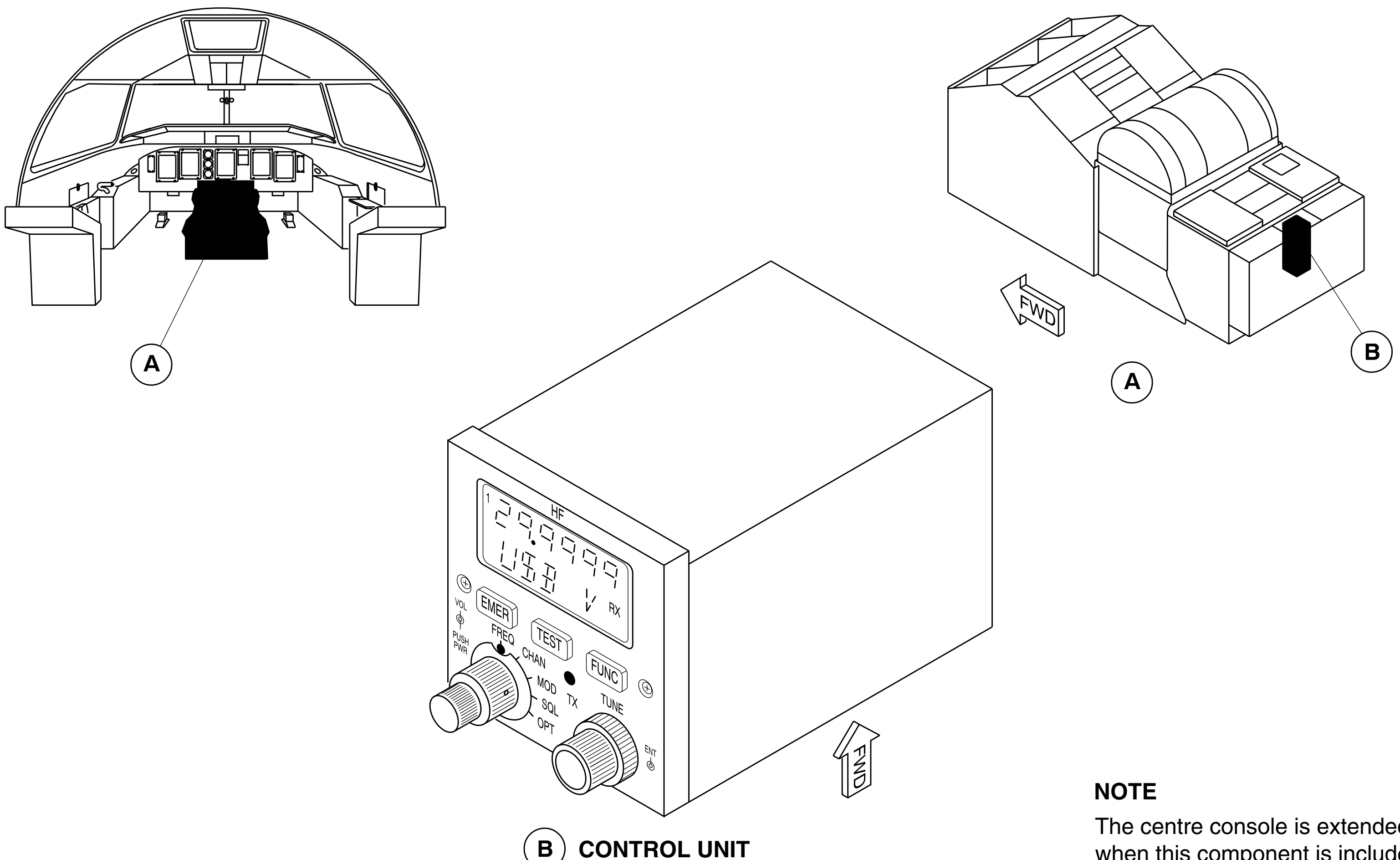
1. Rotary switch.
2. HF potentiometer/Push–button switches.
3. Microphone/Interphone selector switch.
4. BOOM/MASK toggle switch.

cg5737a01.dg, sk, jul08/2019

HF COM, ARCDU
Figure 7



Control Unit Locator
Figure 8

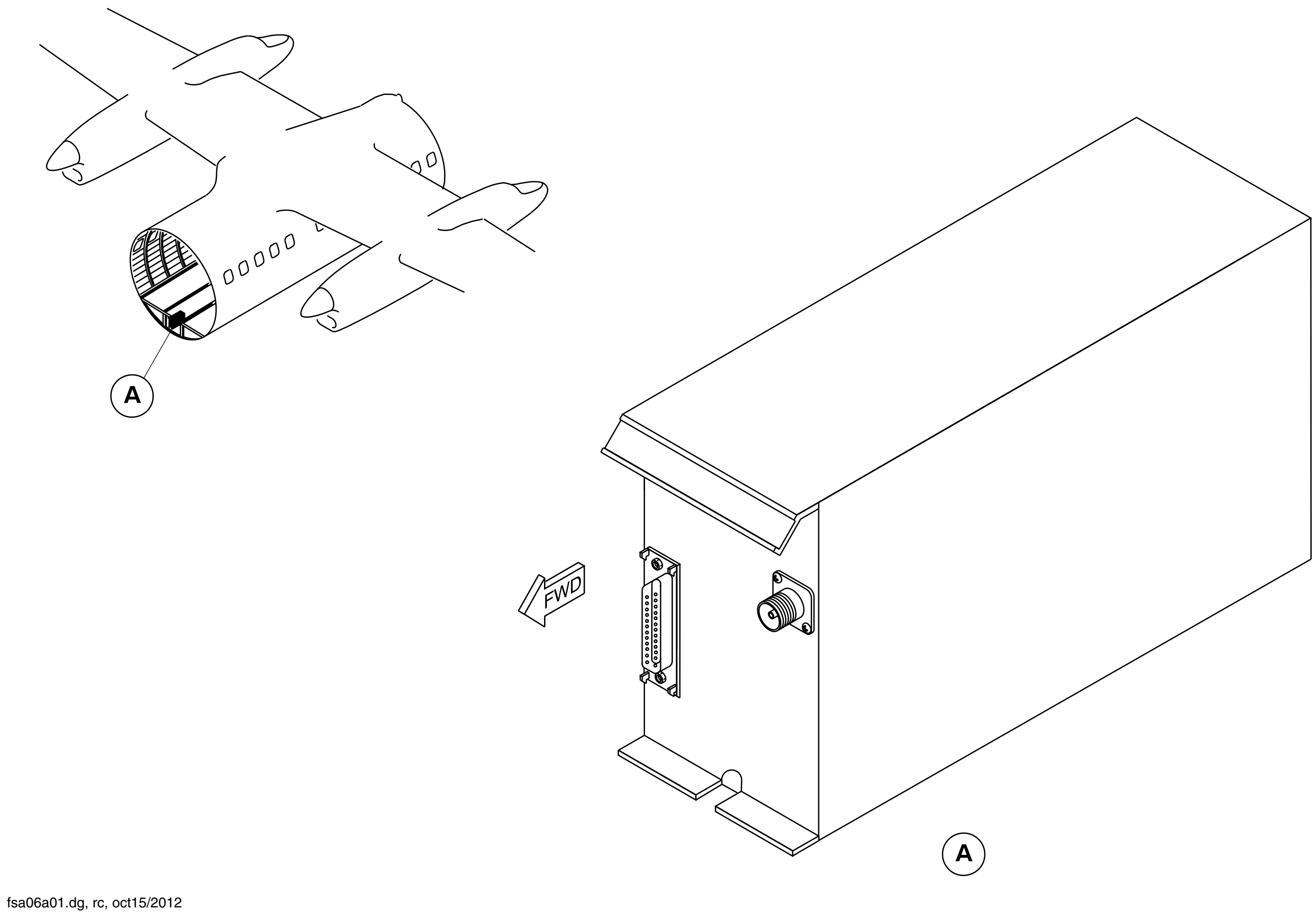


NOTE

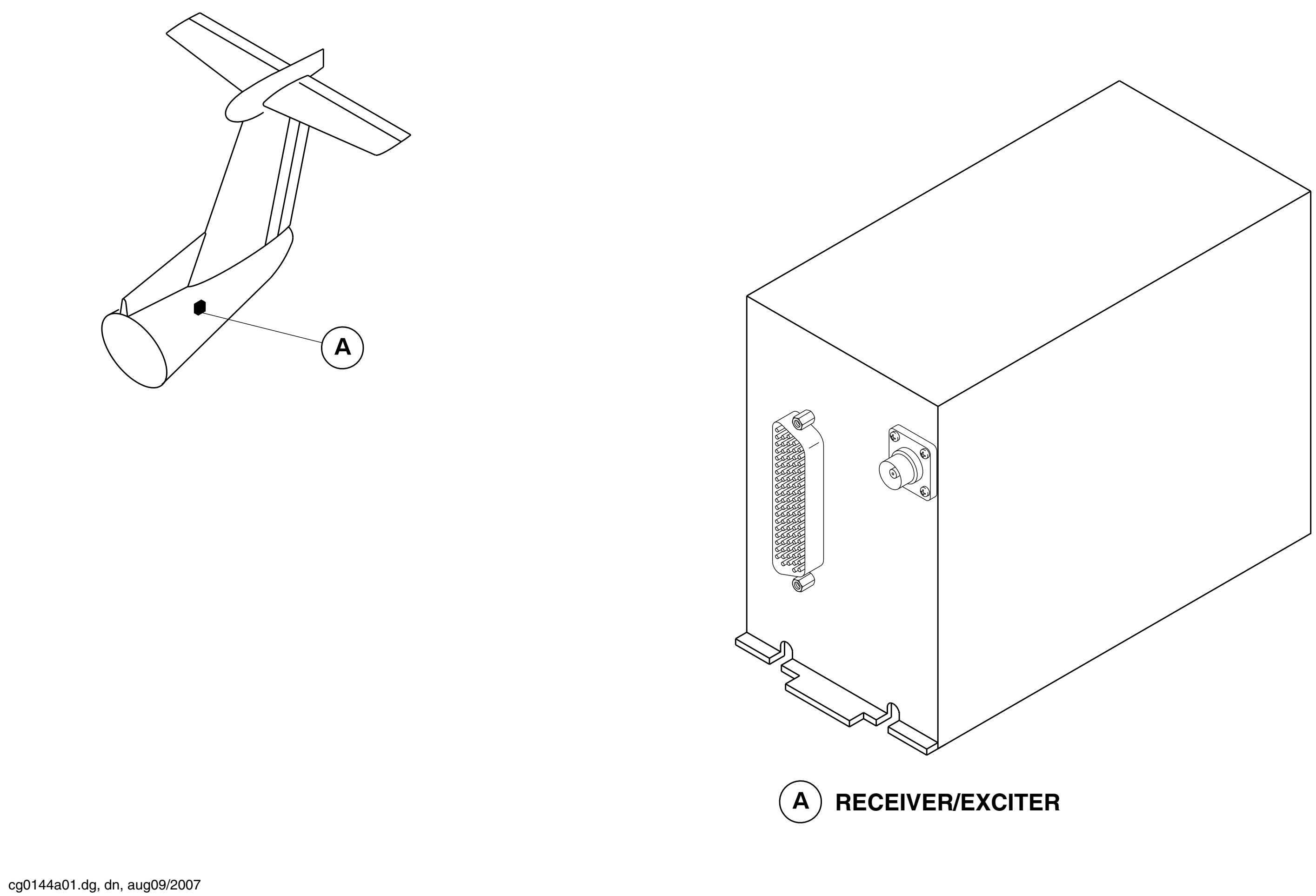
The centre console is extended when this component is included.

cg0143a01.dg, dn, aug09/2007

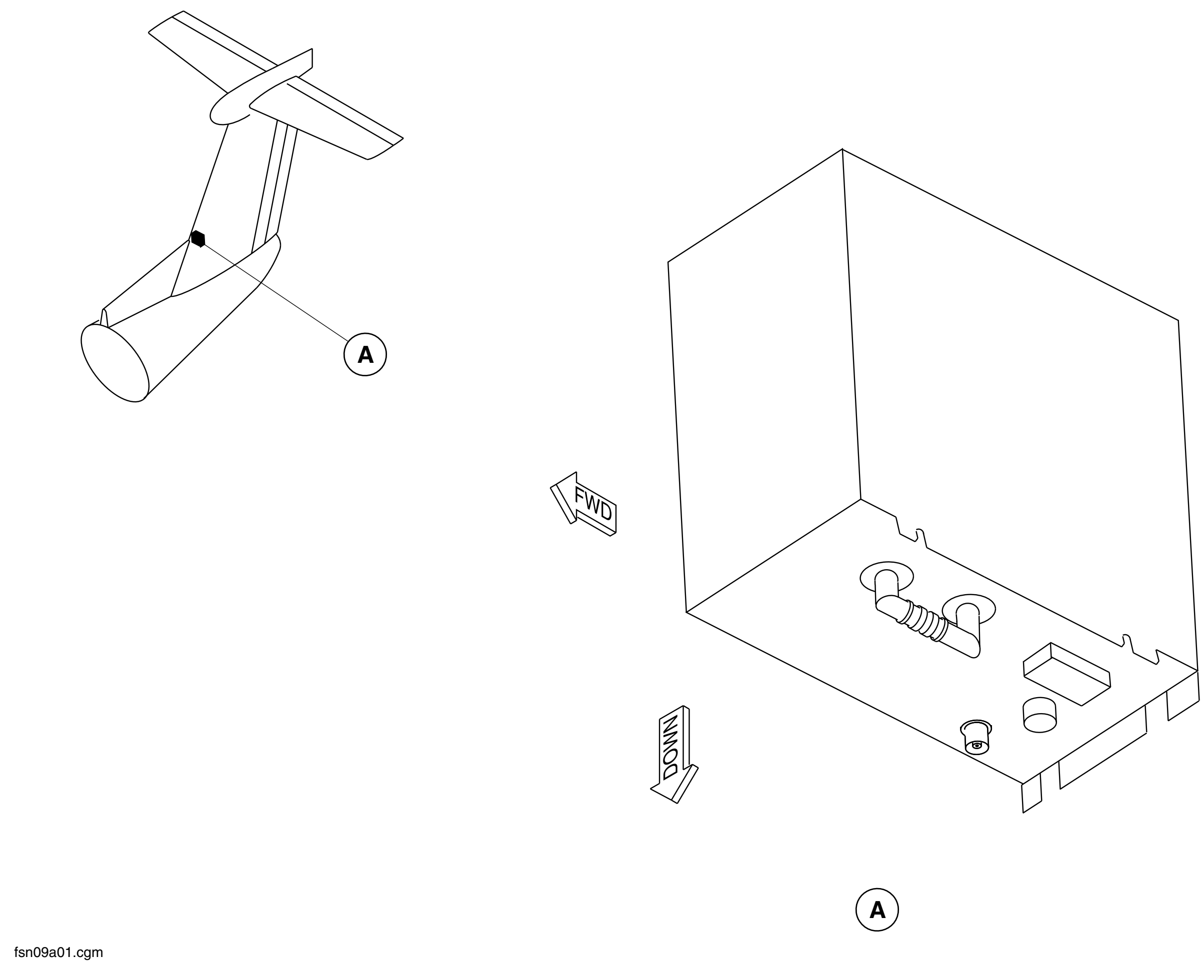
HF COMMUNICATIONS CONTROL UNIT LOCATOR – KHF1050
Figure 9



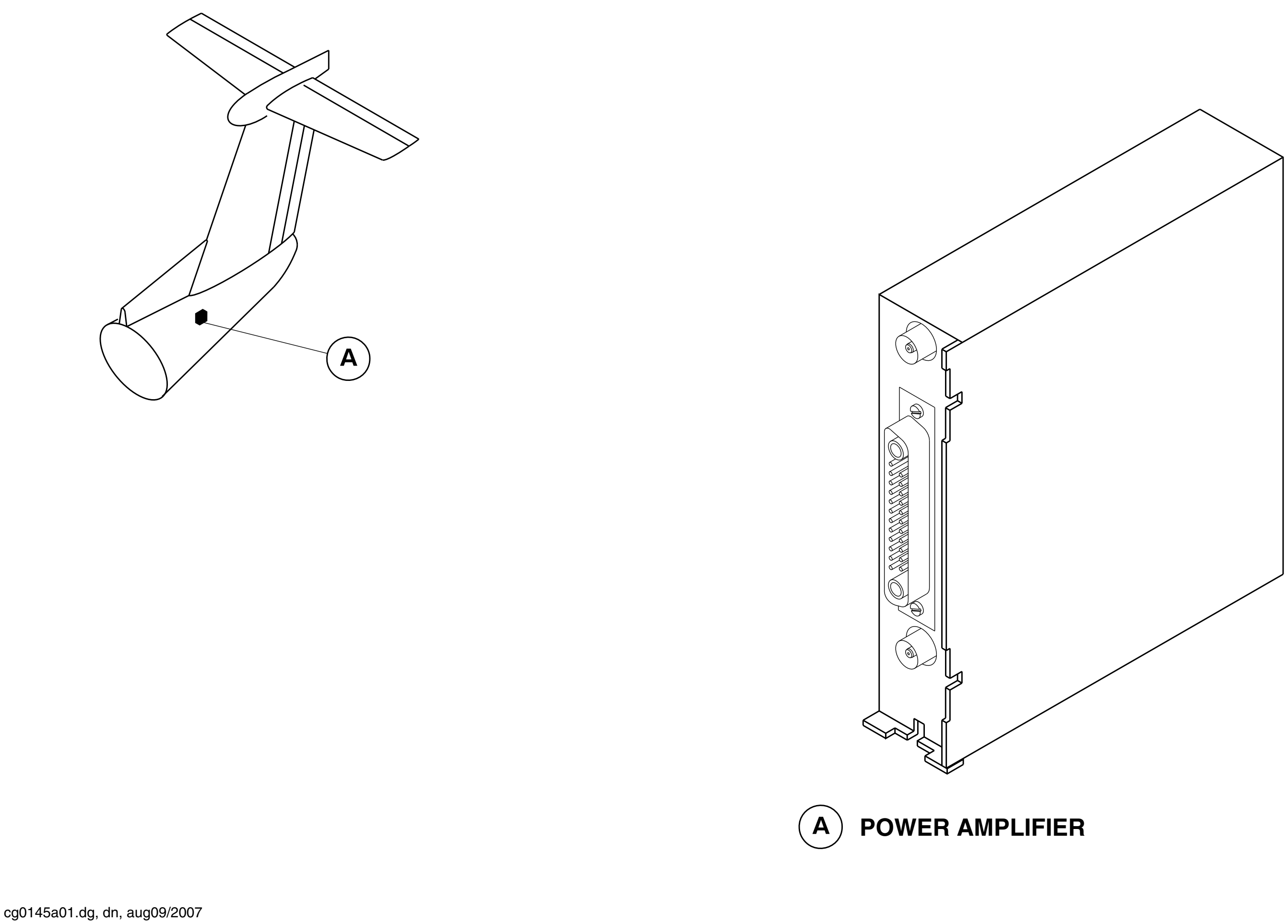
Receiver/Exciter Locator
Figure 10



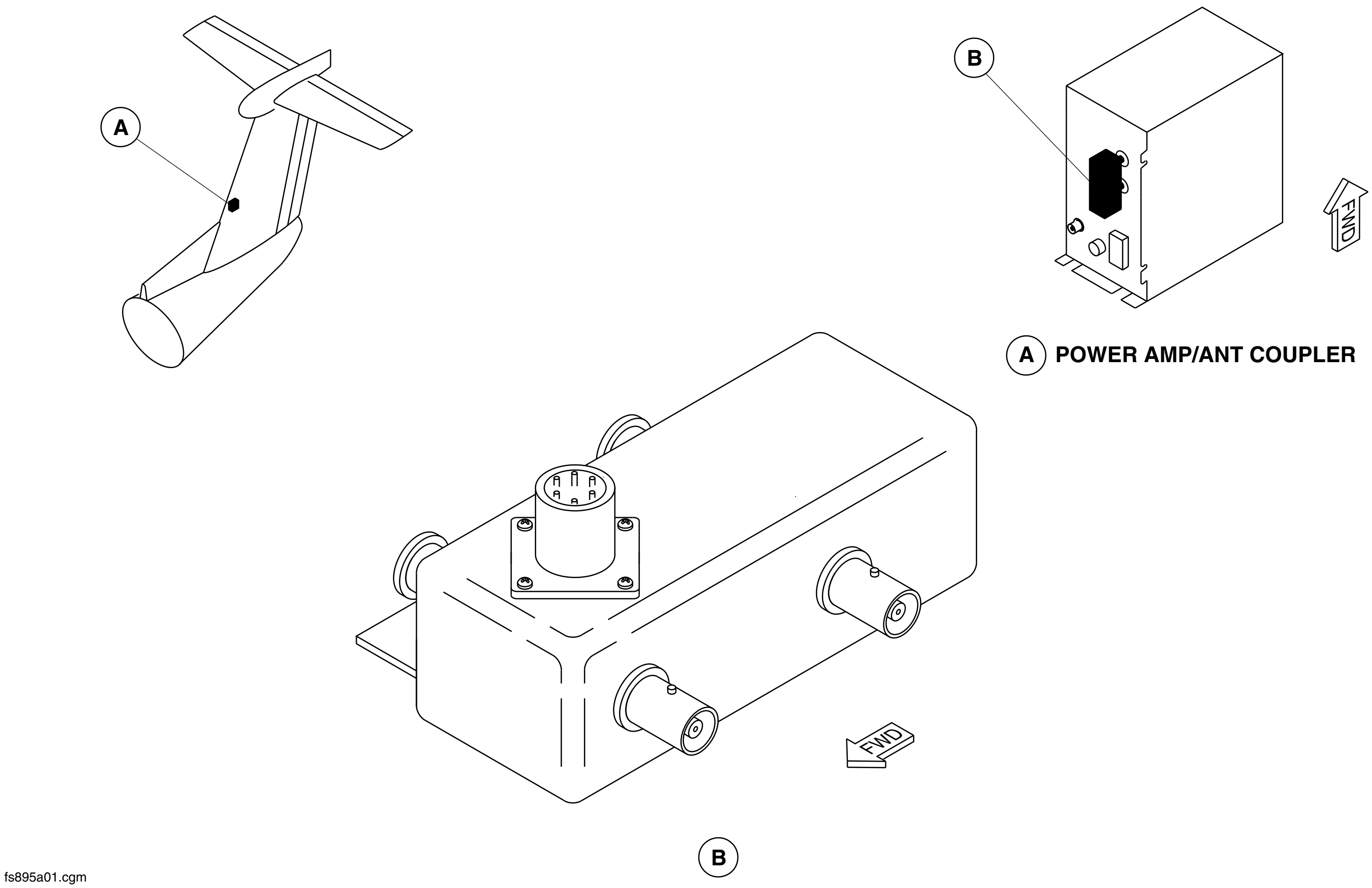
HF COMMUNICATIONS RECEIVER/EXCITER LOCATOR – KHF1050
Figure 11



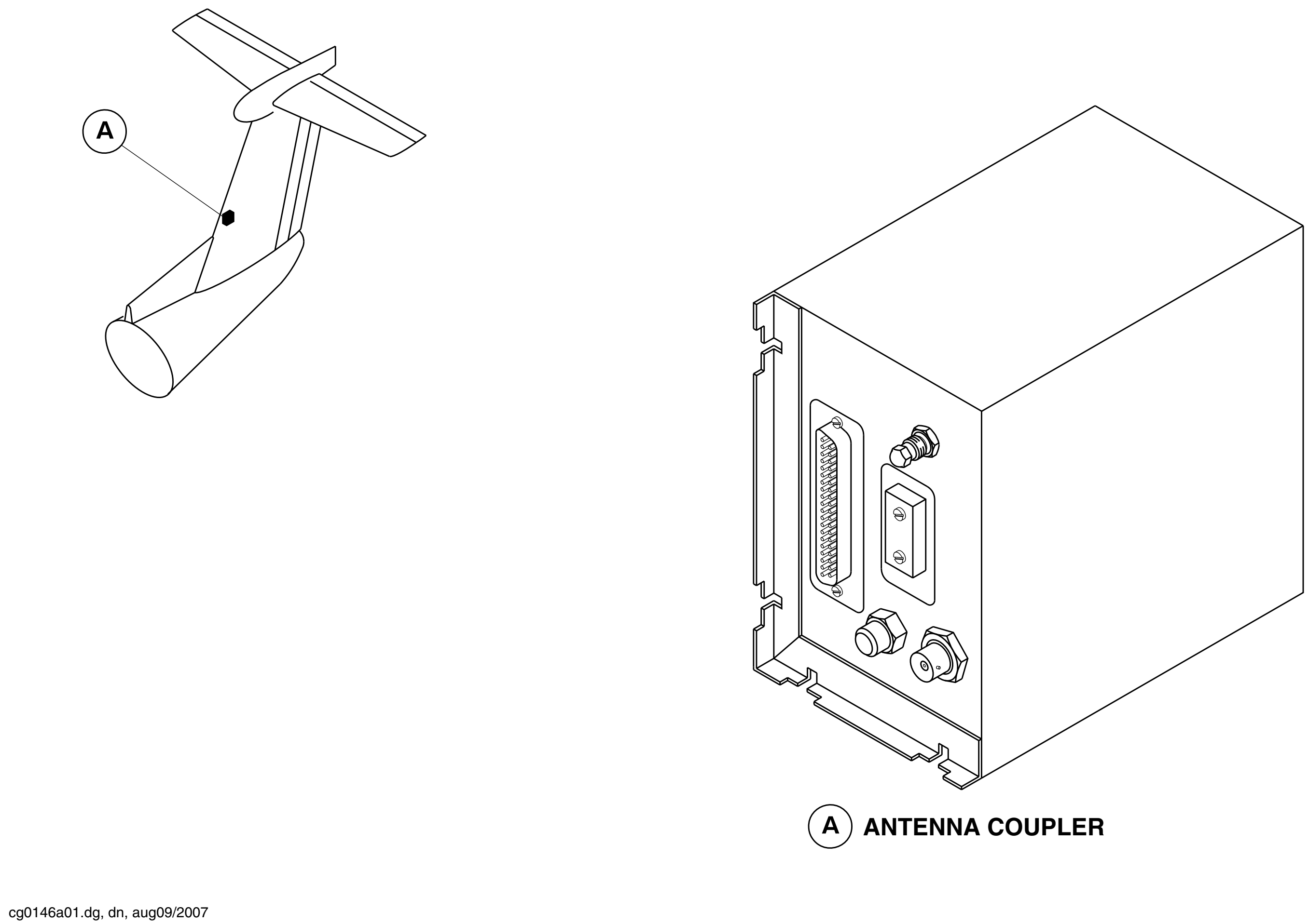
HF POWER AMPLIFIER COUPLER
Figure 12



HF COMMUNICATIONS POWER AMPLIFIER – KHF1050
Figure 13



HF ANTENNA CAPACITOR LOCATOR (DUAL)
Figure 14



HF COMMUNICATIONS ANTENNA COUPLER – KHF1050
Figure 15

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–21–00–001

ARINC COMMUNICATION ADDRESSING AND REPORTING SYSTEM (ACARS)

General

Universal Avionics Systems Corporation (UASC) Unilink UL–70X or UL–80X series communication units provides a two–way digital data link between the aircraft and the operator's ground stations. The communication messages are processed through an external service provider. The messages formats supported include the ARINC Communication Addressing and Reporting System (ACARS) messages or unilink supported messages. Specialized weather requests or graphical weather maps are part of the unilink supported messages. The unilink communication unit is a Line Replaceable Unit (LRU).

On aircraft with SB84–23–37 or ModSum 4–458640 or 4–458646 or 4–459020 or 4–309271 or SB84–23–52 or 4–309259 or SB84–23–55 incorporated, the Unilink UL–801 is installed and have exactly the same features as the Unilink UL–701.

General Description

Refer to Figures 1 , 2 and 3.

The unilink UL–70X or UL–80X communication system includes a Communication Management Unit (CMU) with an externally mounted configuration module, Multifunction Crew Display Unit (MCDU) as part of the Flight Management System (FMS), Very High Frequency (VHF) radio, a printer and a data transfer unit. The unilink UL–700 and UL–701 or UL–801 units installed on the Dash 8–400 share the same functionality, with the UL–700 linked to an external VHF radio and where the UL–701 or UL–801 contains an embedded VHF radio. With the UL–700 the embedded VHF radio is normally used for data only but the pilot can use it for voice communication if necessary. The UL–701 or UL–801 internal VHF radio is only used for data transmission.

The CMU contains a Built–In Test Equipment (BITE) to test the operational integrity of the system.

The unilink LRU is installed between Sta. X321 and Sta. X341 below the cabin floor. The unilink operation is controlled from the MCDU in the FMS located in the flight–deck centre–pedestal. The VHF #3 (UL–700 only) is located under floor between Sta. X94.80 and Sta. X116.00. A printer is installed on the copilot side panel and a data loader is mounted on the cockpit rear bulkhead.

Detailed Description

The unilink system supports three different transmission media: VHF, SATCOM, and telephony. In the Dash 8–400 application the VHF medium is used for all communications. The uplink messages are generated on the ground and sent to the aircraft or downlink messages from the aircraft are sent to the ground station. The downlink messages are generated internally by the CMU or by any one of the peripheral units that can generate messages. After an uplink message is received, the system automatically determines if the message should be sent to an internal device or peripheral device by the message sub–level address. The messages are pre–defined as ARINC ACARS messages or unilink supported messages such as graphical weather maps. The graphical capability is not part of the UL−701 or or UL−801 application for the DHC−8 400 series aircraft.

The database driven user interface and message set is field−loaded through the data loader unit and customized to each airline's operational requirements. The customer application involve transfer of data between the aircraft and an airline ground host computer via the ACARS network. Some of the types of data exchanged include:

- Estimated time of arrival reports
- Diversion reports
- Maintenance reports
- Weather data links
- Airline operational data reports.

Graphical weather information is available only when the unilink is interfaced with a telephony or SATCOM service.

The unilink UL−70X or UL−80X series has an external configuration module to store aircraft specific information. The module contains non−volatile EEPROM memory and is used to store unilink system configuration data. It includes aircraft identity data, destination of uplink messages and the origin of downlink messages. It also defines the aircraft equipment configurations for FMS, printer outputs and radio interface.

The unilink system automatically records and transmits Out, Off, On and In (OOOI) event times. These event times, determined by inputs from various aircraft system sensors are:

- OUT (of the gate)
- OFF (the ground)
- ON (the ground)
- IN (the gate).

It is a general purpose thermal line printer that supports both graphic and text.

In addition to the automatic acquisition and transmission of data, the pilots can manually enter data through the FMS MCDU. When a message is entered manually, the aircrew initiates the downlink process. Screen forms are shown for data entry such as flight data or crew data in predefined.

The unilink UL−701 or or UL−801 supports text data output to an ARINC 740/744/744A printer via the ARINC 429 data bus. It also supports text data output on a serial printer via a RS−232 port. If the printer fails the messages are sent to FMS CDU. This will let the pilots have access to the printer data.

On aircraft with ModSum 4−309223 or 4−309270 or 4−309271 or SB84−23−25 or 4−309259 incorporated, the Honeywell PTA−45B cockpit printer is installed. It is a general purpose thermal line printer that supports both graphic and text.

On aircraft with ModSum 4−458425 or 4−458646 or 4−459020 or SB84−31−68 or SB84−23−46 or SB84−23−52 or SB84−23−55 incorporated, the Miltope TP−4429 printer is installed. It is a compact, rugged, highly reliable thermal printer. The Miltope TP−4429 printer features a solid−state multiple junction print head that has no moving parts.

The printer is mounted on the copilot side console. A printer failure message is shown on the bottom left corner of the unilink menu page as a NEW ERROR MESSAGE. The message activation is by pressing the Line Select Key (LSK) 5L on the unilink page. Only one advisory message will display at a time in the order of priority that includes error and advisory messages. Press the LSK (5L) to view the unread error messages.

The UL−701 or UL−801 supports several forms of crew alerts. The alerts are sent to events such as receipt of an uplink message, messages related to the customer application and system failures related to peripheral units. The first form of alert is a digital discrete data output in the ARINC 429 bus. When the discrete is activated, the FMS MSG annunciator flashes in the upper right corner of the CDU. The second discrete data output is to external visual or aural annunciators. These output discretes are configured through the configuration module. In this application the discretes provide an ARCDU message CALL AUX1 and a tone alert (option). The final form of crew alert is displayed in the unilink page bottom left LSK (5L) field reserved for unilink advisories. All unilink programmed alerts are inhibited for altitudes below 10,000 feet (3050 m).

Uplinks

Uplink messages from the ground stations to the aircraft contain information such as:

– Weather reports
– Automatic Terminal Information Services (ATIS)
– Flight plan updates
– Free text messages.

The messages are routed by the CMU to either the MCDU for display or the printer. Uplink messages also contain an alpha character code to assign an annunciation priority level. The priority level determines how the message is shown in the cockpit. This includes the message color on the MCDU scratchpad and it will trigger the ARCDU visual and WTG SELCAL chime. The table that follows shows the priority levels:

Table 1: Annunciation Priority Levels

CODE	LEVEL	DESCRIPTION	SCRATCH PAD MESSAGE	ARCDU/ WTG CHIME	COLOR
A	Highest	ACARS alert	Yes	Yes	Amber
C	.	ACARS call	Yes	Yes	Cyan
B	.	Voice busy	Yes	No	Cyan
M	.	ACARS message	Yes	No	White
S	.	Report to be saved for the next flight	No	No	–
Z	Lowest	Low priority message	No	No	–

Aircraft recognition and flight number data are sent in the uplink preamble so the CMU will only process uplinks intended for the aircraft on which it is installed.

Downlinks

Downlinks from the aircraft–to–ground stations consist of the information that follows:

- Estimated Time of Arrival (ETA)
- Engine monitoring data
- Text messages entered on the MCDU by the pilot.

The CMU transmits the aircraft registration and flight number specific to the aircraft as part of the downlink message. This identifies the intended airline host to which the message is to be delivered.

Radio Tuning and Control

The CMU uses latitude and longitude data to establish its location. It uses this data along with its internal database of valid frequencies to tune the VHF to the correct frequency. The CMU will change frequencies as the aircraft moves through airspace. The pilot can interface manually with the CMU through the MCDU to view the communication status or change the selected frequency. If the CMU loses latitude and longitude data, it uses stored VHF data frequencies from its database table to scan each frequency in turn for a given period of time. The system listens for an ALL CALL squitter transmission that is output periodically by the ground service providers. When the CMU locks on to a frequency, it will stay on that frequency for uplinks and downlinks until the frequency is lost. It will then repeat the scan–and–listen routine for another signal.

VHF COMM R/T Operation

On aircraft with unilink–700 installed, other than the CMU, control of the VHF No. 3 R/T is an automatic function. The CMU supports display and manual tuning through the MCDU so the pilot can view the communication status or change the selected frequency. The No. 3 VHF system is for ACARS data communication only. It is interlocked with the No. 1 and No. 2 VHF systems to prevent simultaneous transmissions. Only 25 KHz frequencies are used for the ACARS purposes. The VHF R/T is keyed to transmit over a discrete input from the CMU once the Permission to Send and Channel Access Authorization has been established through its air/ground protocol procedure.

On aircraft with unilink–701 or UL–801 installed, the internal radio will cease to transmit after 5 seconds of continuous keying to prevent its use for the voice communications. Frequencies for the unilink UL–701 or UL–801 are spaced at 25 KHz and are in the range of 117.95 –137.00 MHz.

MCDU Operation

Refer to Figure 4.

The ACARS main menu is accessed when the ACARS push–button on the upper, left corner of the MCDU is pressed. The main menu consists of up to four pages that may differ due to the aircraft's flight phase. The page numbers are shown in the top, right corner of the screen. All the available submenus are shown on the main menu and are accessed when the LSK next to the submenu is pressed.

Each menu has its related title shown across the top of the MCDU and some menus have more than one page. To change the page, press the NEXT or PREV push–button below the screen. The RETURN TO ACARS MENU selection allows the user to go back to the ACARS main menu.

To enter the data, use the alpha and numerical keys on the MCDU. The data are entered at the field highlighted by the cursor. When no data fields are highlighted, pressing the ENTER key will place the cursor over the first enterable field on the page. Data are then entered into the field with the alphanumeric keys. When flight progress and related data from the FMS are filled into the field, subsequent presses of the ENTER key will move the cursor to the next entry field. The adjacent LSK also highlights the subsequent entry fields. Pressing the ENTER key when the last data field on the page is highlighted will result in the cursor parking off the page.

ACARS Printer

Refer to Figure 5.

On aircraft with ModSum 4–309223 or 4–309270 or 4–309271 or SB84–23–25 or 4–309259 incorporated, the Honeywell PTA–45B cockpit printer is installed. The printer front panel contains a paper content indicator window, six switch/indicators, a handle and a paper feed with dual cutter blades for two–way paper tear. The printer paper is non–perforated to let messages of various lengths to be readily removed. To load printer paper, release the knurled captive nut on the front and lift the hinged cover to get access to the paper spindle. Print requests are sent to the printer via the ARINC 429 data bus from the unilink CMU. When the message is printed, the paper is automatically advanced. Each print message is completely printed before the next message is started.

The printer front panel contains backlit push–button switches and indicator lights. The power is supplied by the 5 Vdc lighting bus and the intensity is varied by the lighting control knob COPILOTS FLT PNL knob mounted on the side console panel. The front panel switch and indicator lights are as follows:

– SLEW switch – The switch lets the paper advance when depressed. The indicator color is green.

– TEST switch – This switch checks the internal circuitry and ARINC 429 interface. It prints out a test pattern and fault messages. The indicator color is green.

– RESET switch – It resets the printer alert relay contacts outputs and message waiting bits. The indicator color is green.

– MSG indicator– It illuminates when a message is received. The message light is extinguished by the RESET button. The indicator color is blue.

– PAPER indicator – It illuminates when the printer is out of paper. The indicator color is yellow.

– FAIL indicator – The indicator color is yellow and comes on when the printer built–in–test fails.

– PAPER FULL/EMPTY indicator – A mechanical indicator shows the amount of paper left in the printer. A sensor light module will deactivate the print–head when there is no paper left on the spindle to prevent print–head damage.

On aircraft with ModSum 4–458425 or 4–458646 or 4–459020 or SB84–31–68 or SB84–23–46 or SB84–23–52 or SB84–23–55 incorporated, the Miltope TP–4429 printer is installed. The printer front panel contains five switch/indicators and a paper feed with a cutting edge to ensure a clean paper cut to prevent paper jam.

The print head and paper feed is controlled through the microprocessor based circuits. This enables the option of a variety of character fonts and an optional high resolution full dot line graphics.

The communication processor accepts data from the ARINC 429/740–1 data channel and transfers the printable data to the print processor. The print processor manages the actual print process that transfers images of received characters on to the heat sensitive paper. This includes the operation of the stepper–motor for paper advance, font data translation, energizes the thermal print head, and manages the front panel indicators and switches.

Each print message is completely printed before the next message is started. The end of the paper is marked with a warning strip to indicate a low paper condition. To load the printer paper, turn the captive fastener on the front panel to counter–clockwise and push it down to unlatch. Slide down the front panel to get access to the paper spindle.

The printer front panel contains push–button switches and indicator lights. The front panel switches and indicator lights are as follows:

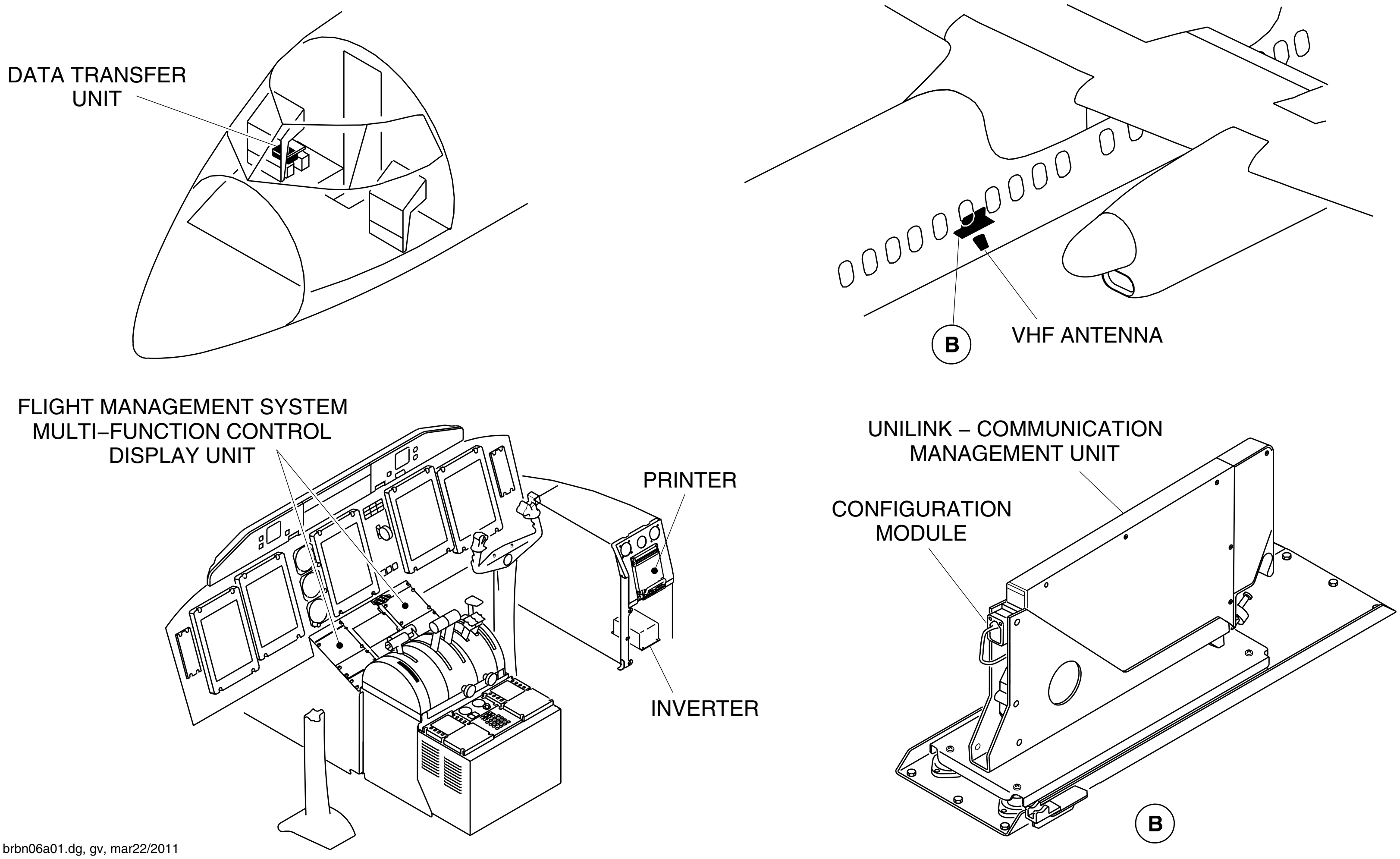
- PPR ADV switch – The switch lets the paper slew continuously when depressed.
- SELF TEST switch – This switch prints out a test pattern when depressed.
- ALERT RESET switch – It extinguishes the flashing PTR BUSY indicator when depressed.
- POWER ON indicator – It illuminates when the external power is applied to the printer. The indicator color is green.
- PTR BUSY indicator – It illuminates continuously when the printer is printing data or flashes when the printing is completed. Push the ALERT RESET switch to extinguish the flash. The indicator color is amber.

Power Supply

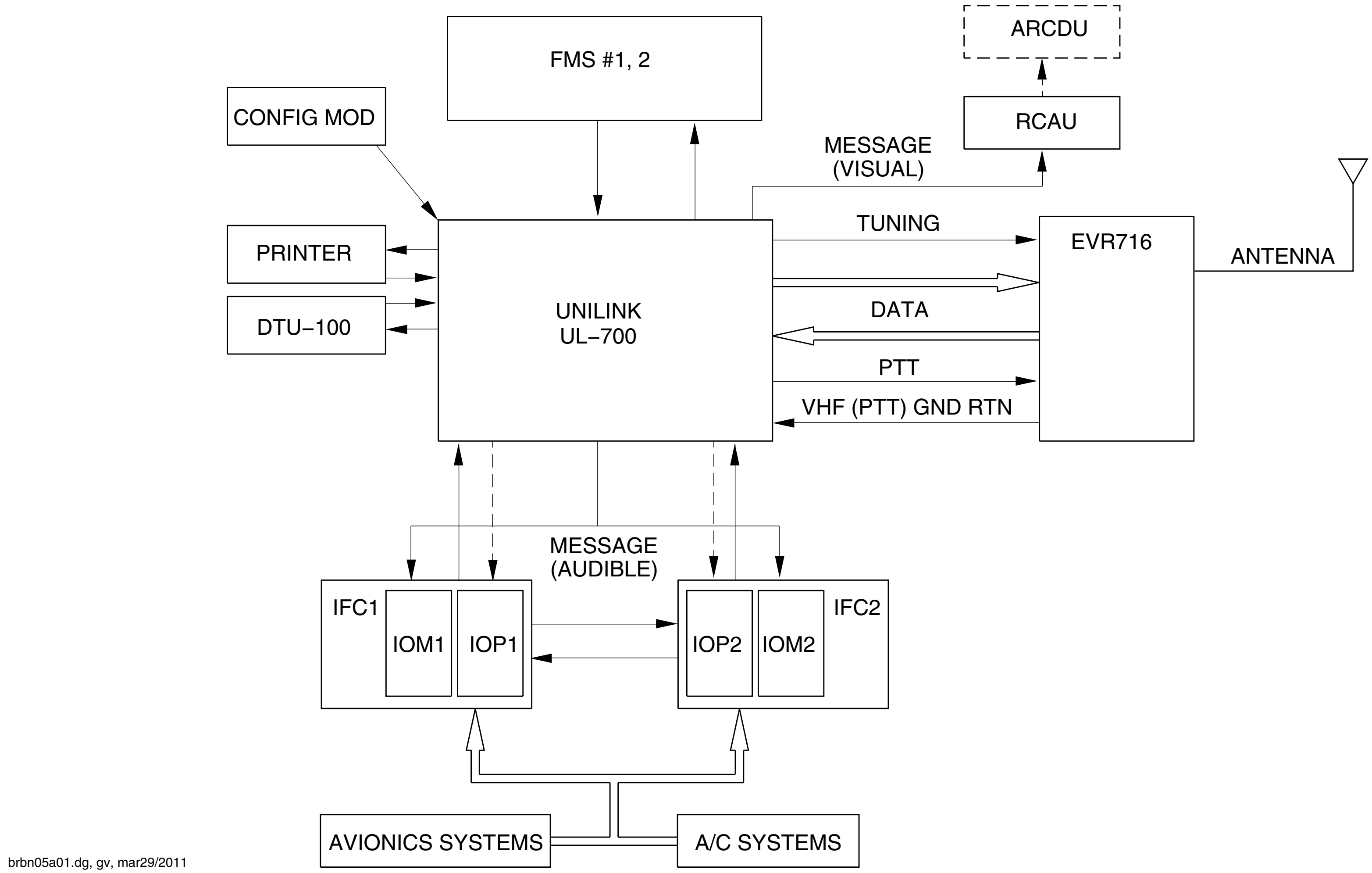
On aircraft with unilink–700 installed, the 28 V dc power for the CMU is from the left main bus through 3A circuit breaker. The circuit breaker is located at G1 on the avionics circuit breaker panel. The printer receives 115 V ac from the 115 V ac left bus through 1A circuit breaker. The circuit breaker is located on the 115 V ac variable frequency circuit breaker panel. The No. 3 VHF R/T receives 28 V dc from the left main bus through 10A circuit breaker. The circuit breaker is located at D1 on the avionics circuit breaker panel.

On aircraft with unilink–701 installed, the 28 V dc power for the unilink UL–701 is from the left main bus through 3A circuit breaker. The circuit breaker is located at G1 on the avionics circuit breaker panel. The printer receives 115 V ac from the static inverter that is located at the co–pilot side console panel. The static inverter receives the 28 V dc from the left secondary bus through 5A circuit breaker. The circuit breaker is located at R6 on the left DC circuit breaker panel.

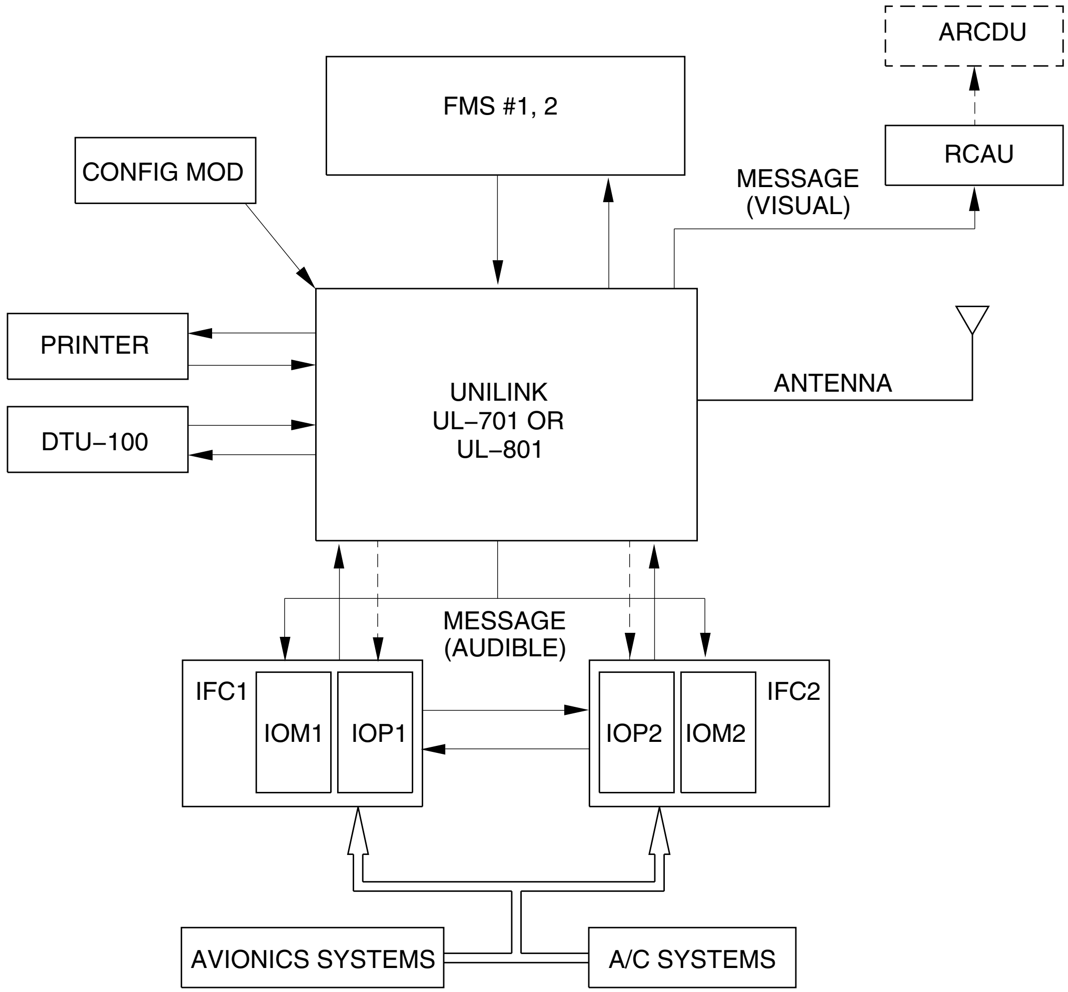
On aircraft with unilink–801 installed, the 28 V dc power for the unilink UL–801 is from the left main bus through 5A circuit breaker. The circuit breaker is located at G1 on the avionics circuit breaker panel. The printer receives 115 V ac from the static inverter that is located at the co–pilot side console panel. The static inverter receives the 28 V dc from the left secondary bus through 5A circuit breaker. The circuit breaker is located at R6 on the left DC circuit breaker panel.



Unilink ACARS Component Locations
Figure 1

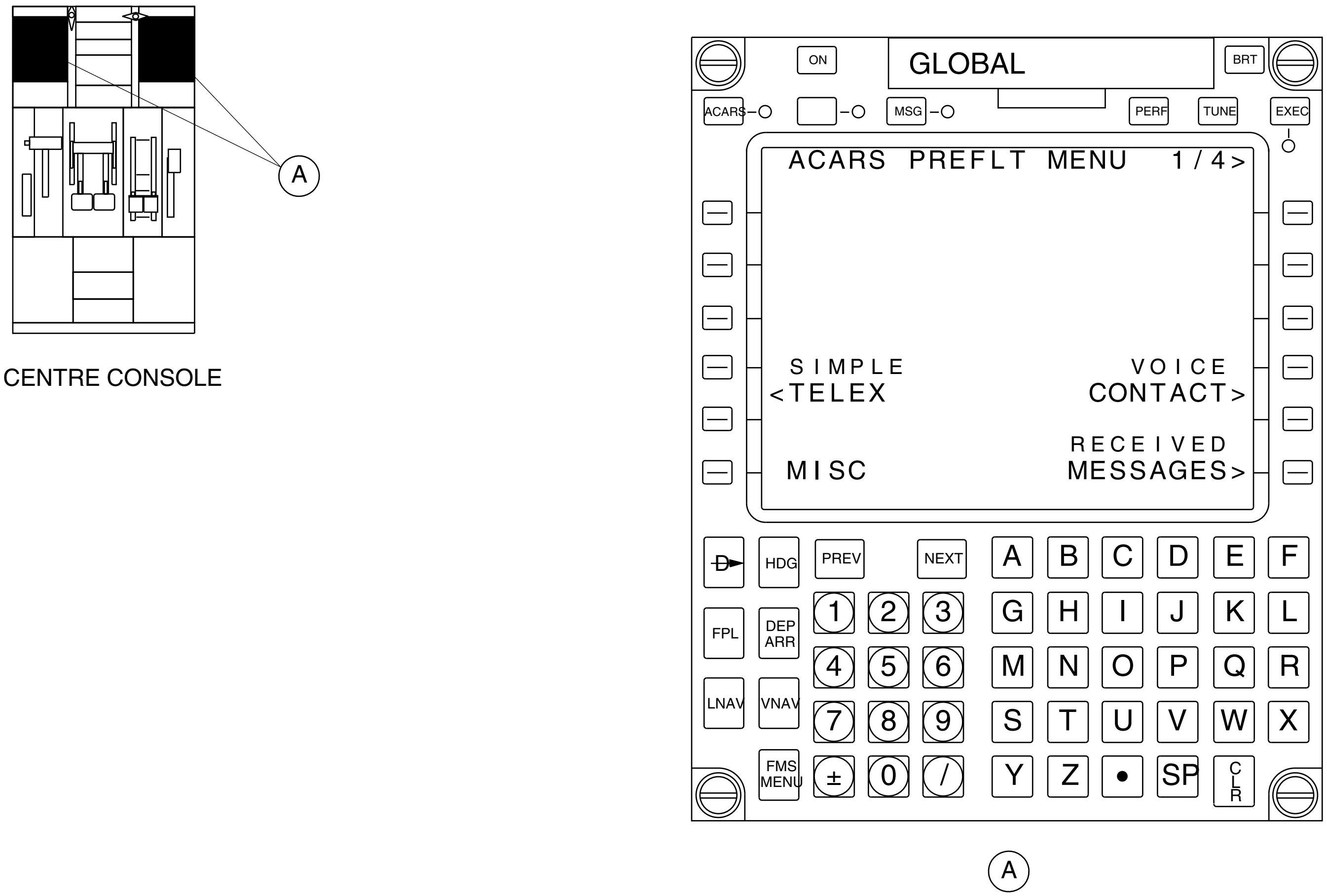


Unilink UL–700 Block Diagram
Figure 2



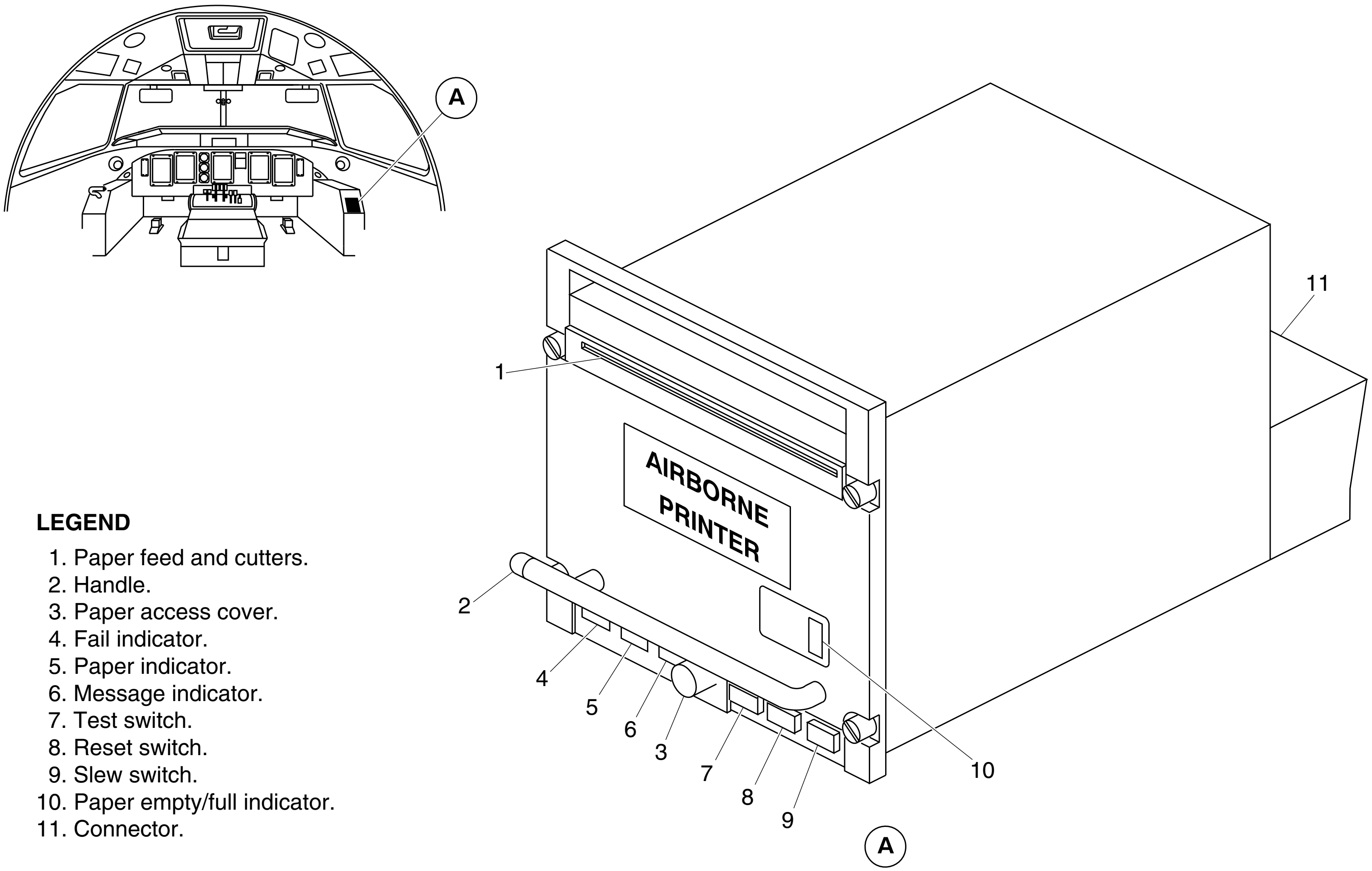
brbn04a01.dg, gv/kmw, nov02/2012

Unilink UL–701 or UL–801 Block Diagram
Figure 3



ap236a01.cgm

ACARS Main Menu
Figure 4



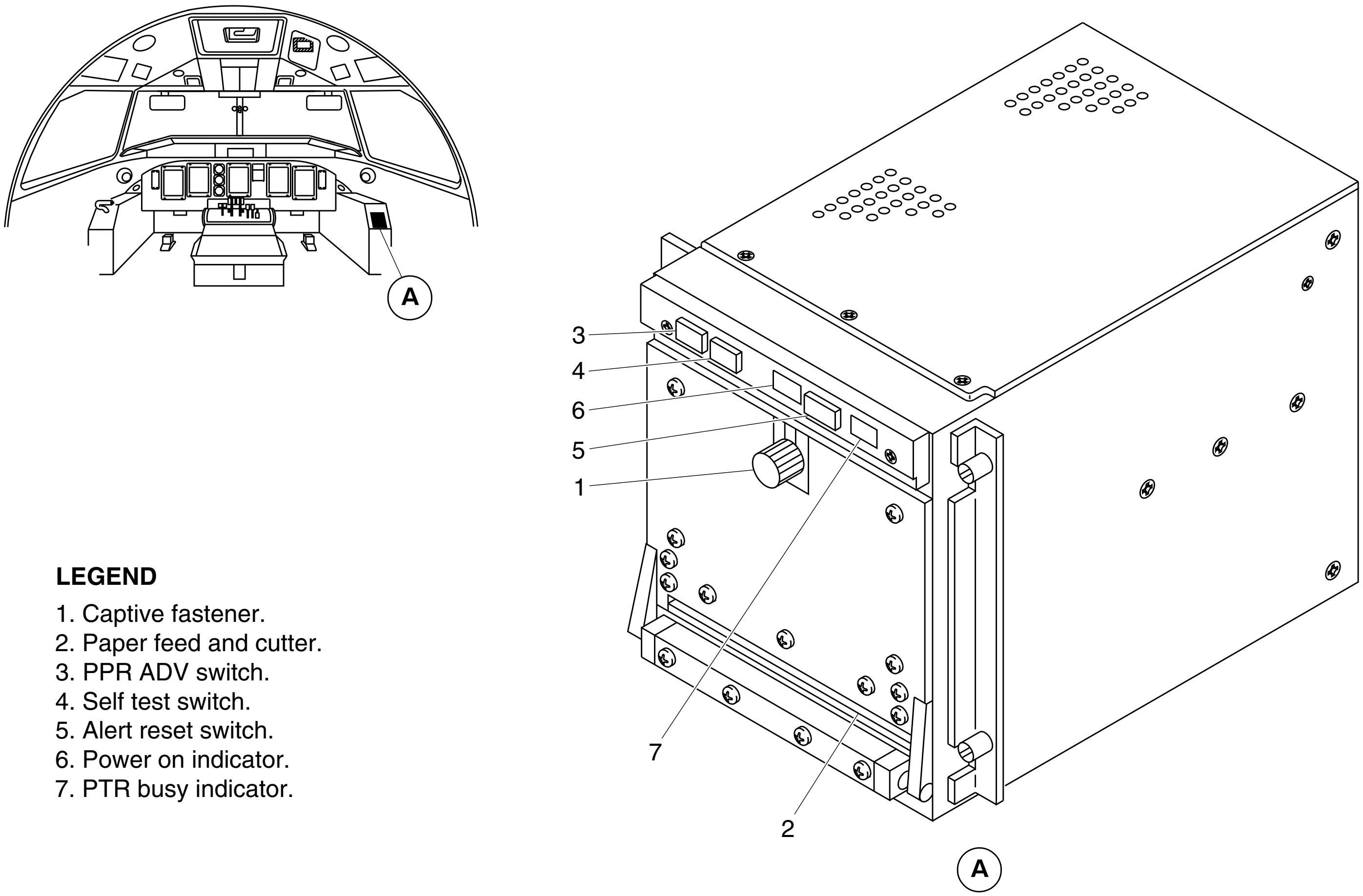
LEGEND

1. Paper feed and cutters.
2. Handle.
3. Paper access cover.
4. Fail indicator.
5. Paper indicator.
6. Message indicator.
7. Test switch.
8. Reset switch.
9. Slew switch.
10. Paper empty/full indicator.
11. Connector.

brbn03a01.dg, gv/cm, sep23/2016

MODSUM 4–309223 OR 4–309270 OR 4–309271 OR 4–309259 OR SB84–23–25

ACARS Cockpit Printer
Figure 5 (Sheet 1 of 2)



LEGEND

1. Captive fastener.
2. Paper feed and cutter.
3. PPR ADV switch.
4. Self test switch.
5. Alert reset switch.
6. Power on indicator.
7. PTR busy indicator.

MODSUM 4–458425 OR 4–458646 OR 4–459020 OR SB84–31–68 OR SB84–23–46 OR SB84–23–52 OR SB84–23–55

brbn03a02.dg, bm/sk, jun06/2017

ACARS Cockpit Printer
Figure 5 (Sheet 2 of 2)

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–31–00–001

PASSENGER ADDRESS AND COMMUNICATION INTERPHONE SYSTEM

Introduction

The Passenger Address and Communication Interphone System (PACIS) does the functions that follow:

– Passenger Address (PA) announcements to the passengers
– Sound chimes
– Interphone communication between the attendants and the pilots or between the forward and aft attandant
– Attendant calls from the lavatory and passenger seats.

General Description

The PACIS interfaces with the pilots headsets of the Audio Integration System (AIS), left and right cabin loudspeaker networks, cabin Advisory Light Panels (ALP), Cockpit Voice Recorder (CVR) through the AIS and the Passenger Entertainment System (PES).

The maximum output power of the system is 60W for 5 minutes with a frequency bandwidth of 200 Hz to 6 KHz.

The PA announcements from the flight compartment and the cabin are automatically recorded on channel 1 of the CVR with the observer's audio.

Detailed Description

System Description (System Overview):

Refer to Figure 1.

The PACIS has the units that follow:

– Passenger Address Amplifier (PAA)
– Attendant's Handset
– Forward attendant keyboard.

For PA announcements, the PAA is controlled by the components that follow:

– Audio and Radio Control Display Units (ARCDU1 and ARCDU2) through the Remote Control Audio Unit (RCAU) of the AIS
– Forward attendant handset and remote control panel
– Aft attendant handset
– PES.

NOTE
The attendant handsets are connected to the PAA when it is used for PA.

NOTE
The PAA needs a push–to–talk (PTT) to set the PA mode.

The pilot and copilot PTT selections and microphone audio are supplied through the RCAU to the PAA, but the forward and aft attendant PTT selections and microphone audio are supplied directly. The PAA then supplies the left and right loudspeaker networks.

The aft attendant speaker is muted when an aft attendant handset PTT selection is made and the forward attendant speaker and lavatory speaker are muted for a forward attendant handset PTT selection.

The PES supplies a PTT signal to the PAA when it sounds announcements or music.

The PAA uses the PTT selections to set the PA priority as follows:

- Pilot or copilot
- Forward attendant
- Aft attendant
- Passenger entertainment.

An engine stopped signal is supplied from the input/output modules (IOM1 and IOM2) to the PAA to make the PA announcement sound louder when an engine is operating.

NOTE
Single–engine operation will also give an increase.

For chimes, the PAA is controlled by the units that follow:

- High and low from the audio and radio control display units (ARCDU) sections through the remote control audio unit (RCAU)
- High and low from the forward and aft attendant handsets
- High from the attendant call switches on the passenger service units and lavatory
- Low from the FASTEN SEAT BELTS and NO SMOKING toggle switches
- High from the lavatory smoke detector
- High and low from the PAA TEST pushbutton switch on the MAINTENANCE panel.

For interphone conversations, the RCAU is controlled by the components that follow:

- ARCDUs
- Forward attendant handset with its remote control panel
- Aft attendant handset.

NOTE
The attendant handsets are connected to the RCAU when it is used to set the interphone mode.

NOTE
The interphone selections from the cabin do not need a PTT selection.

NOTE
An interphone selection also causes a chime to sound.

The ALPs in the cabin ceiling show indications for the different PACIS modes of operation as follows:

Table 1: ALP light assembly colors and functions

COLOR	FUNCTION
Yellow	Passenger–to–Attendant Call
Green	Oxygen (flashing)
Red	Lavatory Smoke Detector Alert

COLOR	FUNCTION
Red	Normal Call/Emergency Call
Green	Passenger Address in Use
Amber	Lavatory Call

The PAA is usually energized by the left essential bus. When the emergency lights are on, an emergency lights power supply energizes a relay to change the electrical power source to right battery power bus.

Passenger Address Amplifier

Refer to Figure 2.

The passenger address amplifier (PAA) is installed in a mounting tray in the wardrobe top shelf.

The PAA assembly is contained in an aluminum 1/4 ATR short case. A single hook is installed at the base of the front panel to secure the PAA to its mounting tray. The front panel also has gain and sensitivity potentiometers to adjust the system.

The PAA has ventilation holes in the upper and lower surfaces to allow it to cool by convection. All electrical connections are made through a connector that is attached to the rear of the PAA.

Refer to Figure 3.

The PAA has the assemblies that follow:

- Audio power amplifier
- Audio and priority management module
- Chime generator
- Power supply.

Audio Power Amplifier: The audio power amplifier supplies audio directly to the cabin speakers from the sources that follow:

- Pilot PA announcements
- Flight attendant announcements
- Chimes
- When installed, music or recorded passenger briefing messages from the PES.

One power amplifier stage supply outputs to the left and right speaker network. It has a threshold detection circuit to automatically vary the power supply output as a function of microphone input.

A thermal circuit limits output power when it senses high temperatures.

Audio and Priority Management Module: The audio and priority management module does the functions that follow:

- Calculates the audio output priority
- Supplies DC power to each attendant handset microphone
- Limits the signal level after a threshold level
- Supplies sidetones.

Chime Generator: The chime generator makes low, high, and high/low chimes. The low tone has a frequency of 494 Hz and the high tone has a frequency of 587 Hz.

Tones are generated in the sequences that follow:

- Sequence 1: A high chime sounds for an attendant call from a PSU or lavatory switch selection. The chime also sounds when the smoke detector in the lavatory is triggered. These tones are not heard in the flight compartment.
- Sequence 2: A high and low tone is generated for a pilot or attendant interphone CALL, EMER, or ATT selection. These tones are heard in the target area for CALL and in the cabin and flight compartment for EMER. The high and low chime also sounds in the cabin for a CHIME selection on the ARCDU.
- Sequence 3: A low chime sounds for a fasten seat belt or no smoking sign is set to on or off.

Power Supply Module: The power supply module receives 28 V DC. The module has two isolated DC–to–DC converters. One converter supplies power to the output power amplifier and the other converter supplies power to the audio and priority management module and the chime generator.

Forward Attendant Handset and Keyboard

Refer to Figure 4.

The forward attendant handset and control panel are installed in the aft face of the lower wardrobe, adjacent to the forward door in the passenger compartment.

The forward attendant handset assembly has a handset and a cradle. The handset has a microphone, an earphone and a PTT switch. The microphone bias and audio amplification circuits for the handset are located in the cradle assembly. The cradle secures the handset when it is not in use.

Refer to Figure 5.

The control panel give control and indication of the PACIS modes. The microphone and earphone of the forward attendant handset is connected to the RCAU for the interphone CALL, EMER, and ATT modes and the microphone and push to talk is connected to the PAA for the PA mode.

The handset must be off–hook to enable a mode selection.

Aft Flight Attendant's Handset

Refer to Figure 6.

The handset is installed adjacent to the rear door in the passenger compartment.

Controls and Indications

The PACIS mode gives communications from the different locations that follow:

- Pilot
- Copilot
- Forward attendant
- Aft attendant
- Lavatory

– PSU.

Refer to Figure 7.

PA mode: The microphone rotary selector on ARCDU1 or ARCDU2 is set to the PA position and then the related PA annunciator switch is pushed to set the PA mode in the flight compartment.

A PTT switch is pushed to transmit to the passengers.

The mode is cancelled at this location when the PA annunciator switch is pushed again or by moving the microphone selector from the PA position.

The passenger address mode is also set when an attendant handset is removed from its cradle and then the related PA switch is pushed. The mode is cancelled at this location when the attendant handset is hung up.

When the PA mode is set, advisory lights come on in the locations that follow:

– ARCDU1
– ARCDU2
– Forward attendant keypad
– Aft attendant handset
– Three ALPs

Chimes: The CHIME key on ARCDU1 or ARCDU2 is pushed to sound high and low chime in the flight compartment and cabin.

The attendant call switch in the lavatory or PSU is pushed to sound a high chime in the cabin and a light in the switch and an attendant call light (amber or yellow) in the forward advisory light panel comes on. The lights go off when the attendant call switch is pushed again.

Call interphone mode: The microphone rotary selector on ARCDU1 or ARCDU2 is set to the PA position and then the related CALL annunciator switch is pushed to set the call interphone mode in the flight compartment.

A PTT switch is pushed to transmit to the attendants.

The mode is cancelled at this location when the CALL annunciator switch is pushed again or by moving the microphone selector from the PA position.

The call interphone mode is also set when an attendant handset is removed from its cradle and the related CALL switch is pushed. The mode is cancelled at this location when the attendant handset is hung up.

When the call interphone mode is set, advisory lights come on in the locations that follow:

– ARCDU1
– ARCDU2
– Forward attendant keypad
– Aft attendant handset
– Three ALPs

A high and low chime sounds in the cabin when the call interphone mode is set from ARCDU1 or ARCDU2, but if the mode is set from a forward or aft attendant location, a high and low chime sounds in the flight compartment.

The chime sounds in pilot headsets and in the flight compartment loudspeakers if set on.

The SERV/INT potentiometer/switch on the ARCDU is set to listen to the attendant.

Emergency interphone mode: The operation of the emergency interphone mode is similar to the call interphone mode. The advisory lights flash and a high and low chime sounds in the cabin and flight compartment.

The chime always sounds in pilot headsets and in the flight compartment loudspeakers.

Attendant interphone mode: The attendant interphone mode is set when an attendant handset is removed from its cradle and the related ATT switch is pushed. The mode is cancelled at this location when the attendant handset is hung up.

When the attendant interphone mode is set, advisory lights come on in the locations that follow:

- Forward attendant keypad
- Aft attendant handset.

NOTE

The interphone light (red) in the advisory light panels does not come on.

A high and low chime sounds in the cabin and will also sound in the flight compartment if the PA mode is set with an ARCDU.

Operation

BITE Retrieval:

The AVIONICS STATUS page of the central diagnostic system (CDS) gives the list of currently failed avionics subsystems.

If no failure is detected, the page NO FAULT DETECTED is shown.

MEL/CDL:

PA system may be inoperative provided:

- Alternate procedures are established and used,
- Flight deck/cabin interphone (two way) with associated calls (e.g. chimes) is operative and
- Megaphone(s) is/are readily available and operative.

Cabin interphone system (Flight Deck / Cabin and Cabin / Cabin) may be inoperative provided:

- An operative flight deck/cabin interphone (two way) is at an operative flight attendant seat and
- Alternate communications procedures between the affected flight attendant station(s) are established and used.

Cabin interphone system (Flight Deck/Cabin and Cabin/Cabin) may be inoperative for non–passenger carrying operations for one flight day provided:

- Crew members are the only occupants of the aircraft and
- Alternate procedures are established and used.

For dB gain, the PAA senses engine oil pressure from the two engines. An operating oil pressure discrete signal is supplied from FADEC1 and FADEC2, through the flight data processing system (FDPS) to the PAA. A high logic state (open oil pressure switch) causes the PAA to give a 6 dB increase in gain.

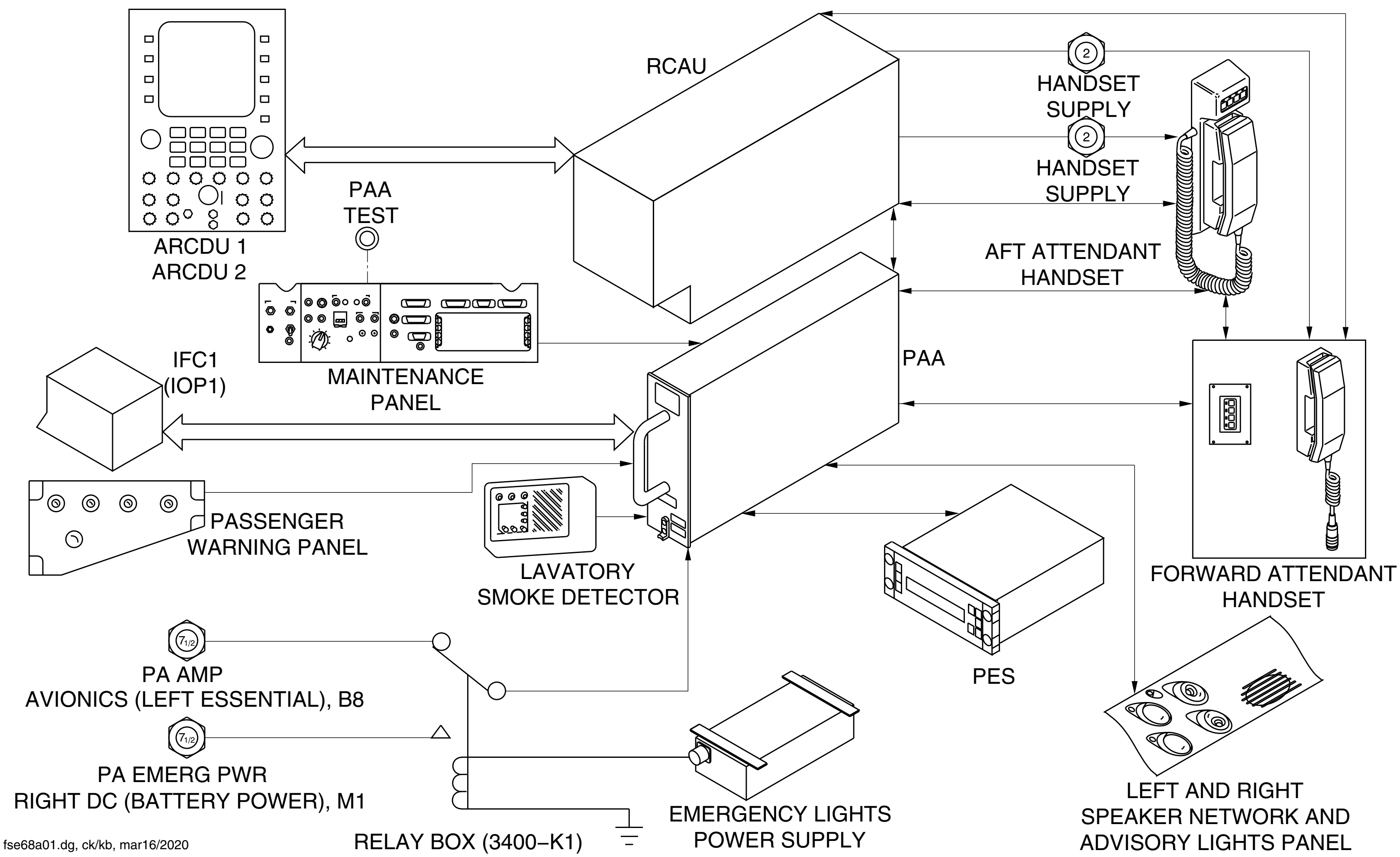
The PAA interfaces with 44 loudspeakers, in a series/parallel electrical network for an impedance of 8.4 ohms. The left and right side speaker networks are driven from two separate PAA outputs from one power amplifier.

Individual speaker has an impedance of approximately 10 ohms.

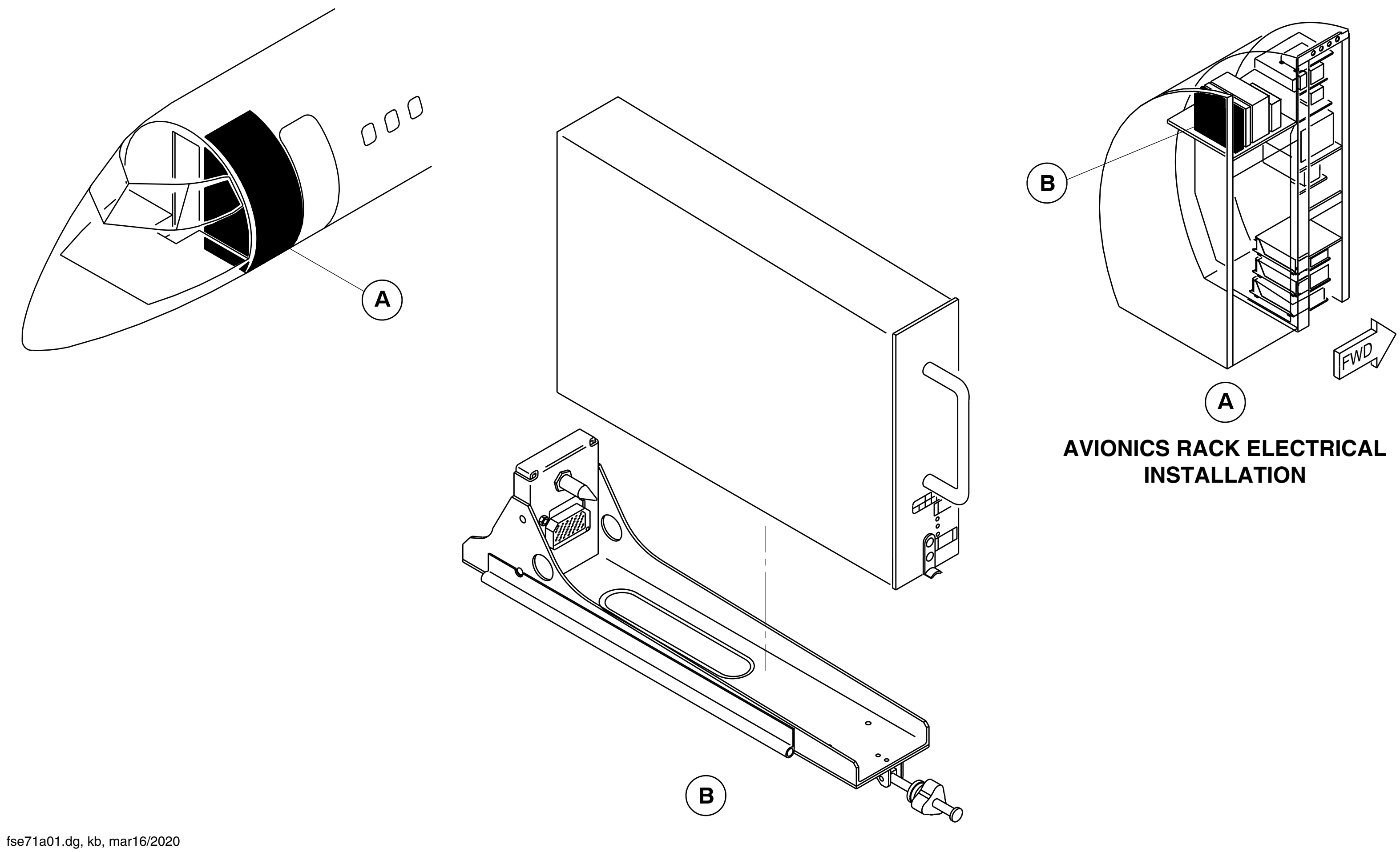
A low–level voltage source from the emergency lights energizes relay K1 on the relay panel to connect the PAA, the forward attendant keyboard, aft attendant handset, ARCDU No.1 and the pilot's circuit card of the RCAU through a 7.5 A circuit breaker labelled PA EMER PWR directly to the Battery Bus.

DIAGNOSTICS:

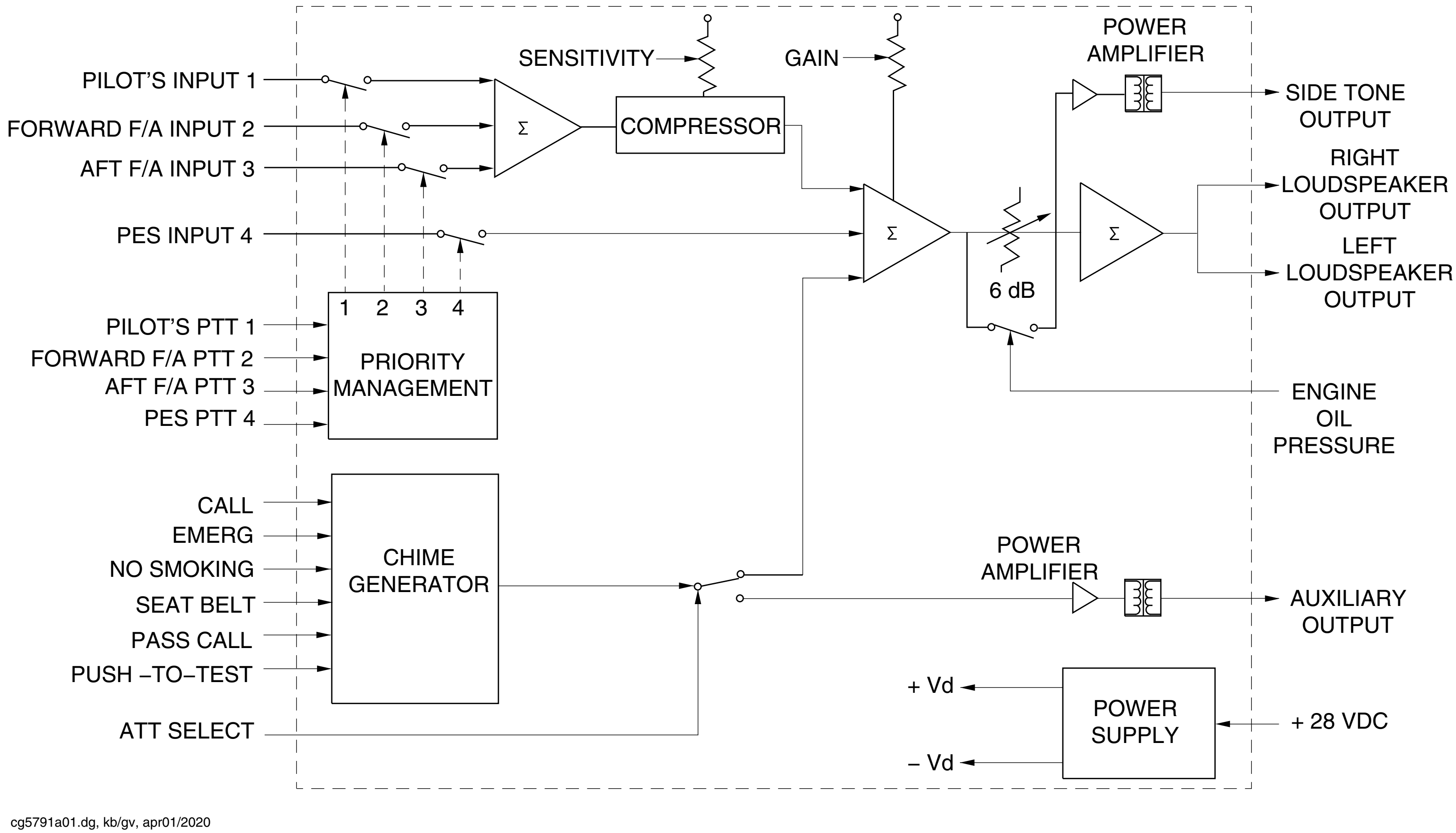
The power supply module of the passenger address amplifier supplies the system signal to the central diagnostics system (CDS). A logic low output signal from the PAA to the CDS is for a valid condition.



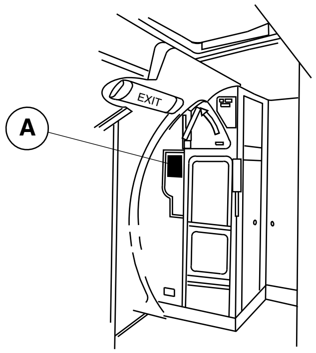
PACIS Block – Diagram
Figure 1



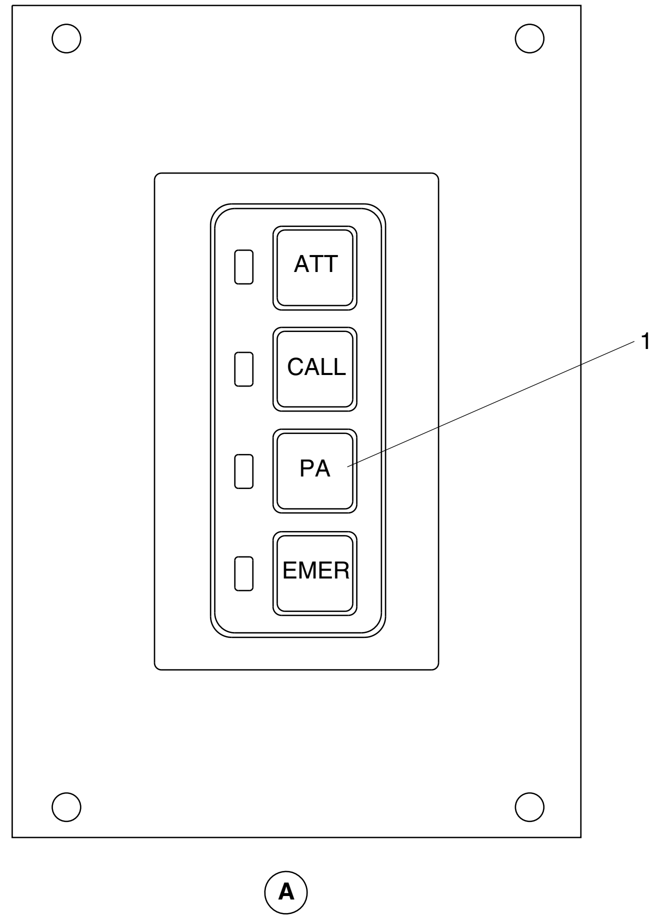
PASSENGER POWER AMPLIFIER (PAA) LOCATOR
Figure 2



Electronic Schematic: PAA Architecture
Figure 3



FORWARD FLIGHT ATTENDANT'S STATION

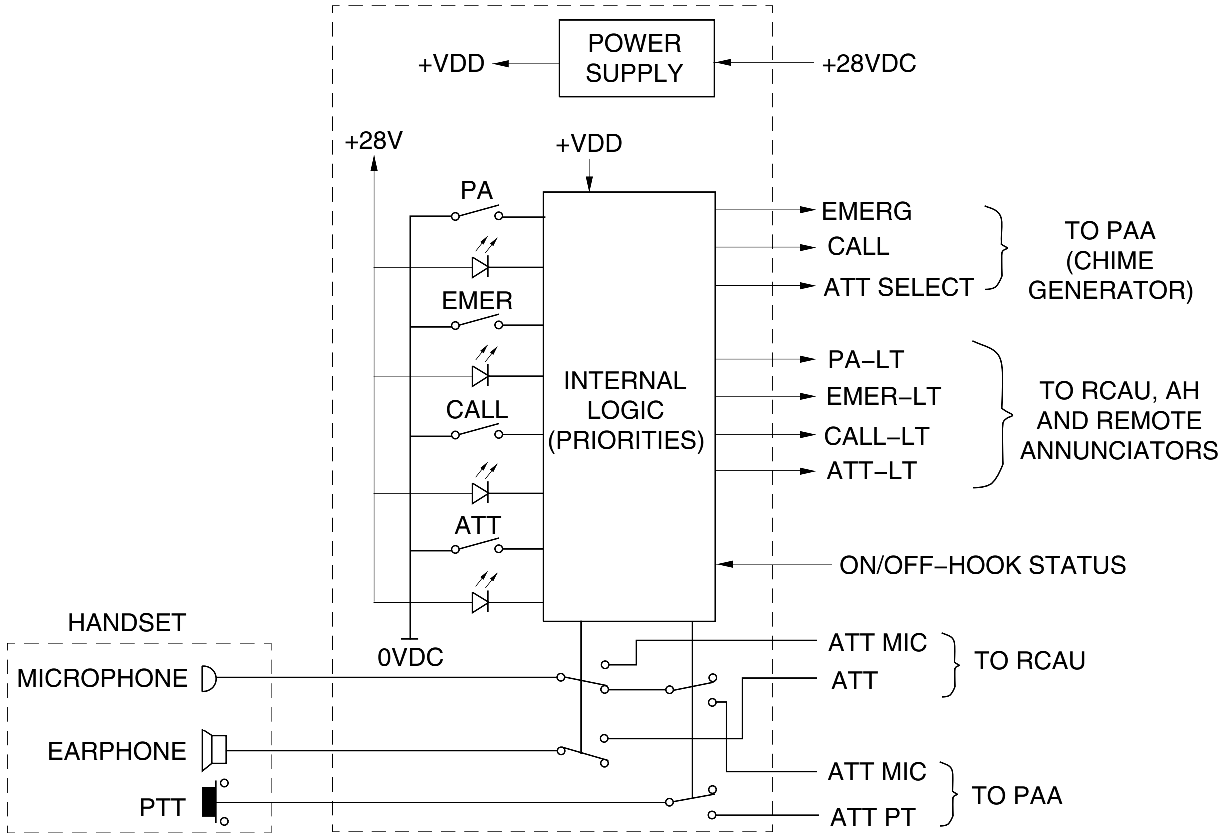


LEGEND

1. PA Key.

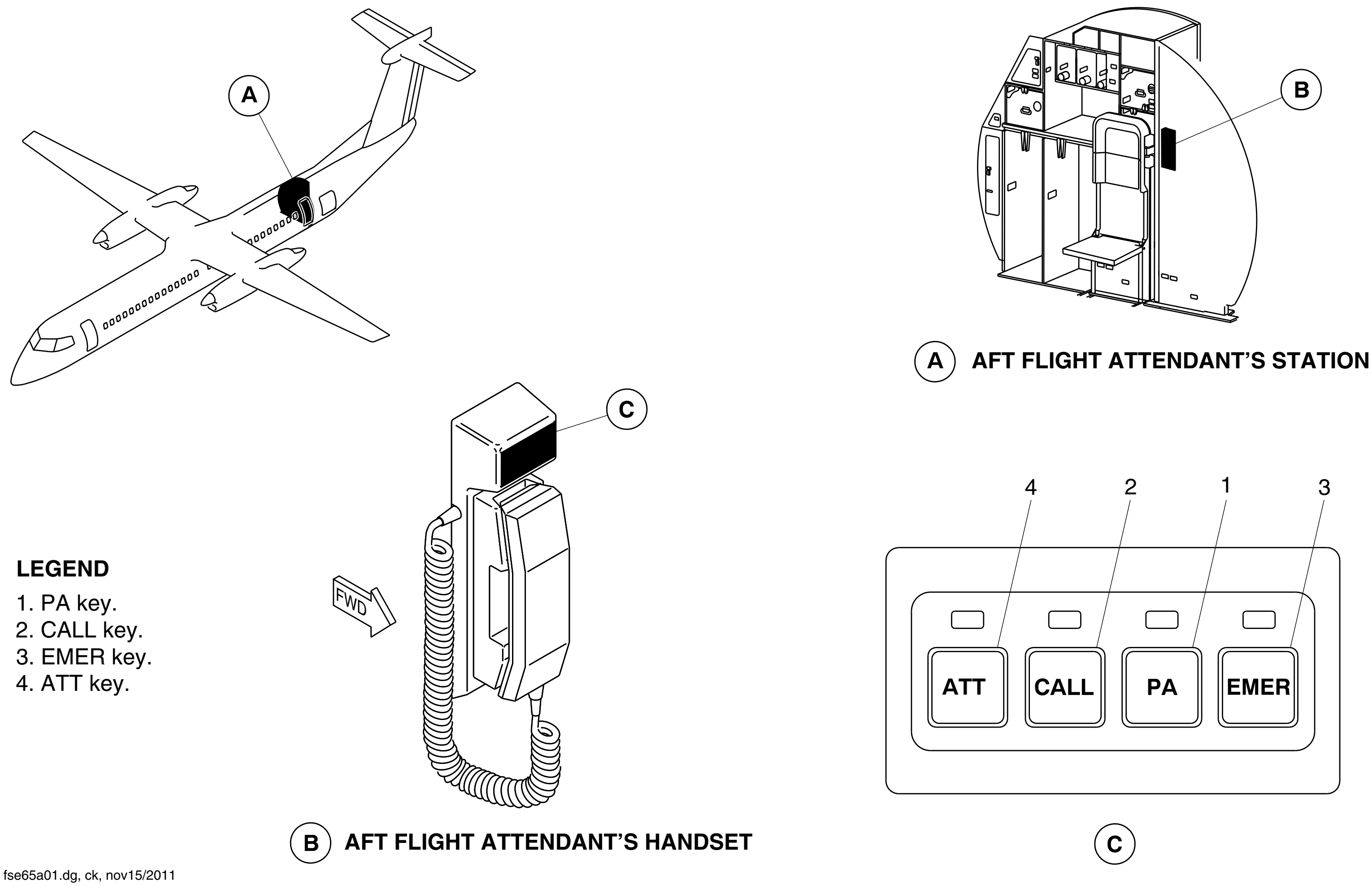
fse64a01.cgm

FORWARD FLIGHT ATTENDANT HANDSET, PA MODE CONTROL
Figure 4

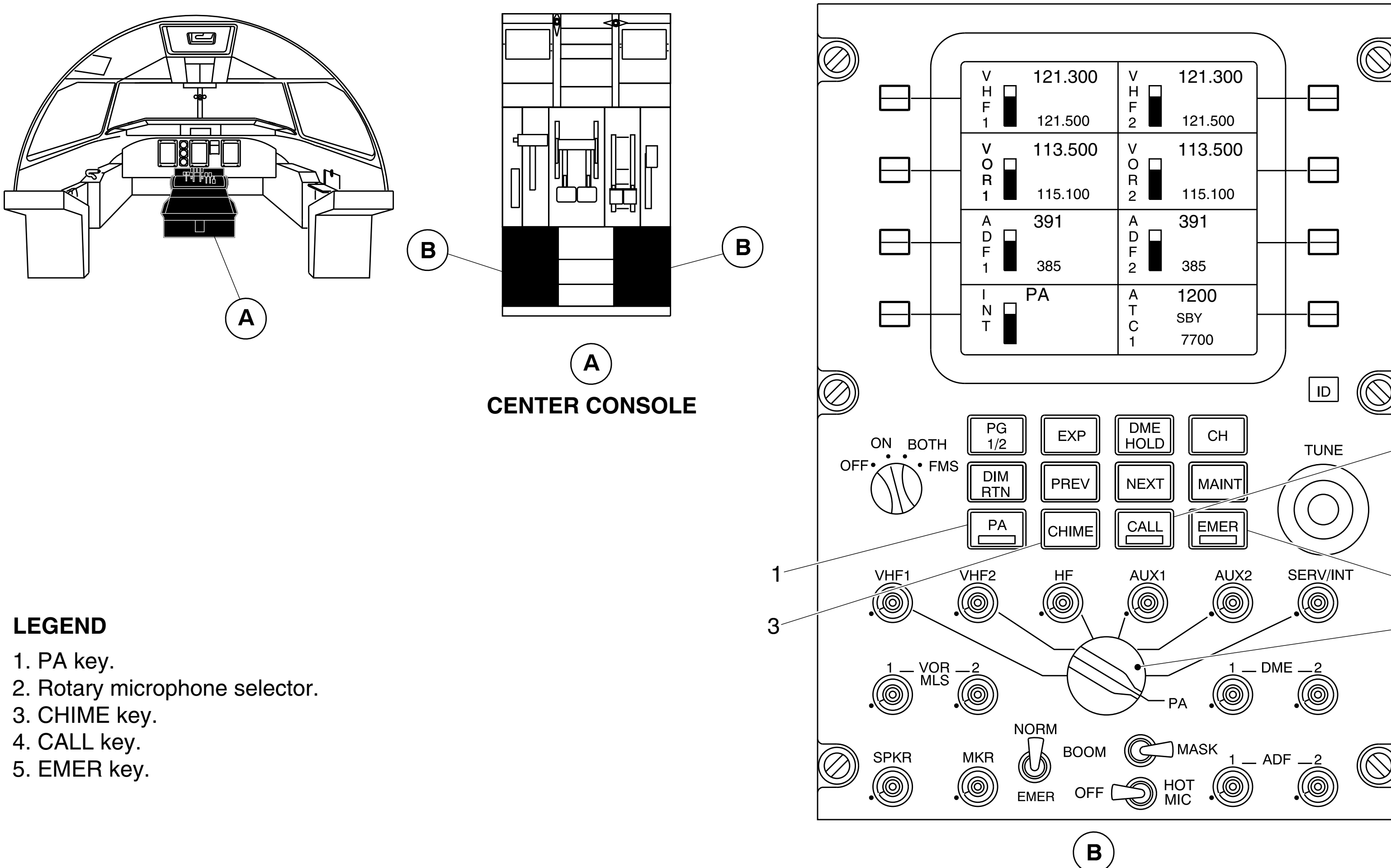


cg5792a01.dg, kb/gv, apr01/2020

Handset Functionality
Figure 5



AFT Flight Attendant Handset, PA Mode Control
Figure 6



LEGEND

1. PA key.
2. Rotary microphone selector.
3. CHIME key.
4. CALL key.
5. EMER key.

cg5925a01.dg, ck/kb, dec04/2019

ARCDU, PA Mode Control
Figure 7

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–32–00–001

PASSENGER ENTERTAINMENT SYSTEM

Introduction

The passenger entertainment system (PES) is manufactured by TEAM and installed by option CR823SO00169. The PES system is designed to broadcast announcements in up to four selectable languages and music audio selected by the operator. The PES interfaces with the passenger address amplifier (PAA) which is part of the cabin interphone system (PACIS) and audio integrating system (AIS). The system also supports public address (PA) announcements and safety broadcasts from the flight or cabin crew. The digital passenger announcement system (DPAS) is a line replaceable unit (LRU) that contains a separate flash memory card for customer programmable audio.

The personal computer memory card international association (PCMCIA) flash memory card on average can store up to 99 announcements and 40 audio selections based on memory capacity. The DPAS supports a total of 15 languages with announcements in four languages available at a given time. The interfacing passenger address amplifier (PAA) system is designed such that PA announcements from the flight deck or flight attendant stations have priority over operator broadcasts.

Component Location

Refer to Figure 12.

The DPAS unit is installed on the maintenance panel above the forward wardrobe at stations X12.69, Y–20.06 and Z168.6 by four dzus fasteners. The unit weighs 1.87 lb (0.85 kg). The subassemblies are contained in an 2.25 in. (57.15 mm) high, 5.75 in. (146.1 mm) wide by 6.43 in. (166.3 mm) deep aluminum enclosure.

The PES has the components that follow:

- Digital Passenger Announcement System (DPAS) unit which is line replaceable (LRU)
- Flash Memory Card for recorded music and announcements as defined by the operator. The flash memory card can have memory capacities of 10, 20 and 40 MB or higher.

Front Control Panel Description

The front panel keys and indicators include the following:

- ON key turns the unit on. The second push turns the unit OFF
- STOP key to stop recorded music or announcements
- PLAY key to start recorded music or announcements
- UP scroll key
- DOWN scroll key
- A (announcement) key for selection of announcements or music audio
- L/V (language and volume) key to select languages or volume control
- SEL (selection) key for language or music selection

- GREEN LED indicator with the ON key for ON/OFF condition
- GREEN LED indicator with the PLAY key to show an active broadcast.

DPAS Component Description

Refer to Figure 1.

The DPAS unit is mounted on the maintenance panel with four screws and uses the front panel keys for control. An ON/OFF switch is provided for unit operation. It interfaces with the remote control audio unit (RCAU), passenger address amplifier (PAA), forward and aft attendant handsets to provide public address (PA) announcements, prerecorded passenger announcements and music audio. The unit contains a removable flash memory card that can save up to 99 announcements and 40 audio selections. Fifteen languages are supported by the unit with four languages programmable at a given time by the operator. The power is supplied to the unit from the left main 28 vdc circuit breaker A1.

PES Overview

Refer to Figure 3.

In flight or on the ground the operator can select announcements and music to broadcast over the cabin speaker system. The system is designed such that PA broadcasts from the flight deck or flight attendant station takes priority over the PES audio. The selected announcements are available for broadcast in up to four languages. The order of the language broadcast is determined by the operator. For the language menu the operator selects the L/V (language/volume) key and scrolls up or down to select or cancel a language with the SEL key. The announcement (A) key returns the operator to the announcement and broadcast menu. To broadcast an announcement, the operator must first scroll the title list with the up and down scroll keys for announcement selection. The PLAY key is then pressed and the green LED will illuminate beside the key and remain on during the announcement broadcast.

Press the L/V key two times from the announcement mode or one time from the language mode to access the volume adjustment menu. The volume is adjusted by the up and down scroll keys.

Music audio is selected by pressing the SEL key when the MUSIC title is displayed in the announcement selection and broadcast menu. Music is broadcast continuously until the STOP key is pressed. The music is interrupted by the flight or cabin crew announcements or by the discrete inputs from the NO SMOKING and FASTEN SEAT BELT annunciations. The NO SMOKING and FASTEN SEAT BELT announcements generate tones only with the illumination of appropriate signs inside the cabin.

The PES can be manually switched off by operator or in the event of a malfunction. The unit can generate up to 99 announcements and up to 40 music selections. Total of fifteen languages are supported with a maximum of four languages available at a given time.

PES Detailed Description

Language Selection Mode

Refer to Figure 4.

The language selection is applicable to all messages stored in the PES. To access the language selection mode the L/V key is pressed once. If there is no key stroke activity for three minutes the system automatically returns to the announcement selection and broadcast mode. In this mode the DPAS display will show a maximum of 4 language selection titles instead of announcement titles, one language at a time. A language is identified by its title and the letter placed between the parentheses, e.g. English is shown as (E)NGLISH, or at the end of the title when the letter is not in the title, e.g. German is shown as GERMAN(D).

The up and down arrow keys are used to scroll through the list of language titles and the SEL key is then pressed to select the languages. The languages are selected in the preferred order for message broadcast. A language selection is canceled when the title is displayed and the SEL key is pushed. If four languages are chosen, one must be canceled before another is selected. The language mode always starts with the language indication previously shown. During announcement broadcast the SEL key is not available for language selection but will function during music playback.

Volume Adjustment Mode

Refer to Figure 5.

The volume adjustment mode is used to set the audio level. To adjust the volume press the L/V key two times to start from the announcement selection mode or press one time to select from the language selection mode. The system automatically returns to the announcement selection and broadcast mode if no further key is pressed for 30 seconds. For example the display will show VOLUME 7/10 if the volume is set to 7. The up and down scroll keys are used to increase or decrease the volume in steps and the change is shown on the display. The displayed range of volume is 1 to 10 where 10 represents 0 dB nominal at the system output and 1 equals to −20 dB. Press the L/V key again to return to the language selection mode.

Announcement Selection and Broadcast Mode

Refer to Figure 3.

This mode is for the broadcast of announcements. Individual announcement titles are shown one at a time in a stored list. The scroll keys are used to select the stored announcements. To play an announcement, the PLAY key on the front panel is pressed and the STOP key is used to stop the broadcast. To stop an announcement in progress the STOP key is pressed once. The announcement will resume when the PLAY key is pressed again and will follows the order of the announcement schedule.

The announcement titles consists of up to ten characters. Four character spaces after the title is reserved to show the languages selected for broadcast. The sequence of letters show the language broadcast order. The broadcast of an announcement is activated by the PLAY key or automatically via discretes controlled by inputs such as NO SMOKING or FASTEN SEAT BELT. During the announcement, the PLAY LED is illuminated and the Press−To−Talk (PTT) discrete output is activated to allow the PAA to receive, amplify and output the message over the cabin speakers. The NO SMOKING and FASTEN SEAT BELT discrete inputs take priority over the recorded announcements. Also the PAUSE discrete generated by a PA announcement from the flight deck or cabin take priority over the recorded announcements. The prerecorded announcement will automatically resume at the end of the interruption.

The announcements activated by the discrete inputs are not displayed in the message title list. A ground input or a 28 V dc discrete will initiate the PTT output discrete, the announcement and the illumination of the PLAY LED. The message is broadcast sequentially in all languages or the default language if no languages were selected. However, the STOP key will not stop a PA message broadcast. During an announcement broadcast you can scroll through the message list to select the next message. Additional operation of the PLAY key has no effect on the active announcement. Prior to message playback, the system would add a one second interval to accommodate any system delays or operator corrections.

Selection of the PLAY key will have no effect if no languages have been programmed or unless the TEST ALL RECORD or MUSIC titles are displayed. The title TEST ALL RECORD when selected will broadcast all messages stored in the memory in the selected languages.

The announcement mode is automatically started after completion of the Power−On Self−Test (POST). The mode is also selectable by the announcement key A from the modes that follow:

– Language selection
– Volume adjustment
– Music selection
– Diagnostic (except when there is a TEST discrete signal).

Music Selection Mode

Refer to Figure 6.

The music selection is done through the announcement selection and broadcast mode. The title MUSIC provides the operator with the option of selecting from the list of music titles stored in the memory. If music files are not stored in memory, the MUSIC title will not appear in the announcement list. The list will show in alphabetical order and the selection is made by the up and down scroll keys followed by the SEL key. The current music title is displayed to the right of the MUSIC legend. If no particular music title is selected and the PLAY key is pressed, the system will select all the music titles for playback starting from the beginning of the music list. The PLAY LED light will come on and the push to talk (PTT) discrete will allow the PAA to channel the music to the cabin speakers. During music playback, selection of an announcement and the push of the PLAY key will stop the music to allow broadcast of the announcement. The music selection is not available at system start up. If there are no keystrokes for three minutes after the MUSIC title is displayed the system will go back automatically to the announcement mode. Each musical title is defined a sequential number for play back. If an announcement is selected for playback during music audio it will stop until the broadcast is over and continue from the point of interruption. The STOP key will also interrupt the music play back.

Diagnostic Mode

Refer to Figure 9.

The diagnostic mode is used to test the analog and digital circuits in the DPAS unit. Only the digital circuits can be tested while the unit is installed in the aircraft and is achieved by the Built−In−Test Equipment (BITE). A BITE memory is used to save failure conditions and the order in which they occur during system operation. Only one type of malfunction is saved at a time.

Access to BITE memory is achieved by simultaneous selection of the up and down arrow keys while the system power is turned on. A list of failures if available is presented in the order of occurrence. Use the up and down arrow keys to scroll through the list of failures. At the end of the list, a BITE CLEARING message is shown. If the SEL key is pressed, all failure messages saved in memory are erased. From the diagnostic mode the system will return to the announcement and broadcast mode if no panel keystroke activity takes place after more than three minutes.

Discrete Functions

Refer to Figure 11.

As per ARINC 715, up to five discretes can input to the PES to trigger specific functions automatically. Two discrete inputs are used to initiate the FASTEN SEAT BELT and NO SMOKING aural alerts in addition to the normally generated tones. The additional discrete inputs generated by the flight and cabin crew during public address announcements take priority over the FASTEN SEAT BELT and NO SMOKING discretes. The PES initiated announcements and music selections have the lowest priority.

During a passenger address announcement from the flight or cabin crew, the PAUSE discrete input causes the PES PTT output signal to change state to disable the PES PAA channel and for the PLAY LED to flash slowly. When the interrupting discrete is removed, the PES PTT output is applied and the PLAY LED will illuminate. The passenger announcements will start from the beginning in the language in progress and follow through with the languages not yet broadcast. The music audio continues from the point of interruption.

The PES interfaces with the discretes that follow:

PARAMETER	SOURCE
FASTEN SEAT BELT (28 V dc)	FASTEN SEAT BELT Toggle Switch
NO SMOKING (28 V dc)	NO SMOKING Toggle Switch
Pilot Interrupt (Ground)	RCAU
Forward FA Interrupt (Ground)	Forward FA Handset
Aft FA Interrupt (Ground)	Aft FA Handset
PES PTT	PAA

Failure Mode and Annunciation

Refer to Figure 2.

The DPAS unit performs internal monitoring and displays its status on power–up. The system monitoring capabilities are described by the modes listed.

System Test

The self–test mode automatically starts on the power–up after the ON key is pushed. All display readout pixels are activated for one second and the PLAY LED indicator will flash and the self test will start. If there are no errors detected usually within five seconds after the test mode is started, the message TEST OK is annunciated for two seconds and the system enters into the announcement and broadcast mode.

If a fault is detected, the system will display one of the five messages that follow:

- SYSTEM FAULT
- FALSE CARD
- CARD MISSING
- KEYBOARD ERROR
- NO LANGUAGES.

To bypass the self–test power–up, press any front panel key other than the ON key. The system will then by default enter into announcement selection and broadcast mode. If the L/V key is pressed the system will enter into the language selection mode. If the system is energized but not in operation, it will continuously monitor for faults and show the applicable error message.

The error messages with failure descriptions are shown in the troubleshooting table that follows:

BITE MEMORY	DISPLAY MESSAGE	FAILURE DESCRIPTION
—	NO LANGUAGES	No language selection
KEY PRESSED	KEYBOARD ERROR	Key pressed too long in normal operation
KEYBOARD ERROR	KEYBOARD ERROR	Key pressed at power up
EXTERNAL RAM	SYSTEM FAULT	External memory failed
INTERNAL RAM	SYSTEM FAULT	Internal memory failed
MEMORY FAULT	SYSTEM FAULT	Program memory error
CARD FAULTY	SYSTEM FAULT	Memory card checksum error
CARD BUSY	FALSE CARD	Cannot read card data
CARD MISSING	CARD MISSING	Memory card not installed
FALSE CARD	FALSE CARD	Use of a non–valid memory card
BITE ERROR	—	Read/Write error in BITE memory
DISPLAY ERROR	—	Screen data different from written value
DISPLAY BUSY	—	Cannot write to display
BUS ERROR	SYSTEM FAULT	Bus malfunction
CONVERSION ERROR	SYSTEM FAULT	D/A converter error
ADDRESSING ERROR	SYSTEM FAULT	Error on address decoder
ARITHMETIC ERROR	SYSTEM FAULT	Error in arithmetic and logic unit

PES Failure Mode

Refer to Figure 7.

Refer to Figure 8.

The system failure mode is entered when a failure message is posted on the DPAS display. When there are several failures the most important failure is displayed first. For minor failures the system operation can continue by pressing any key except the ON and L/V keys. The key selection will remove the failure message and allow system operation. For any major failures, the DPAS unit will remain disabled and deactivate any PTT discrete and audio outputs. Then ON key will only allow system shut–off.

The minor failures will show the messages that follows:

- NO LANGUAGE
- CARD MISSING
- FALSE CARD
- KEY BOARD ERROR

PES System Interface

The passenger announcement system interfaces with the components that follow:

- PAA for channel enable (PTT) and audio amplification
- RCAU for flight crew PES interrupt signal
- Forward attendant handset for PES interrupt signal
- Aft attendant handset for PES interrupt signal

Power Supply

The aircraft left main DC bus supplies 28 V dc electrical power through the A1 circuit breaker to the DPAS unit.

PCMCIA Memory Card

Refer to Figure 12.

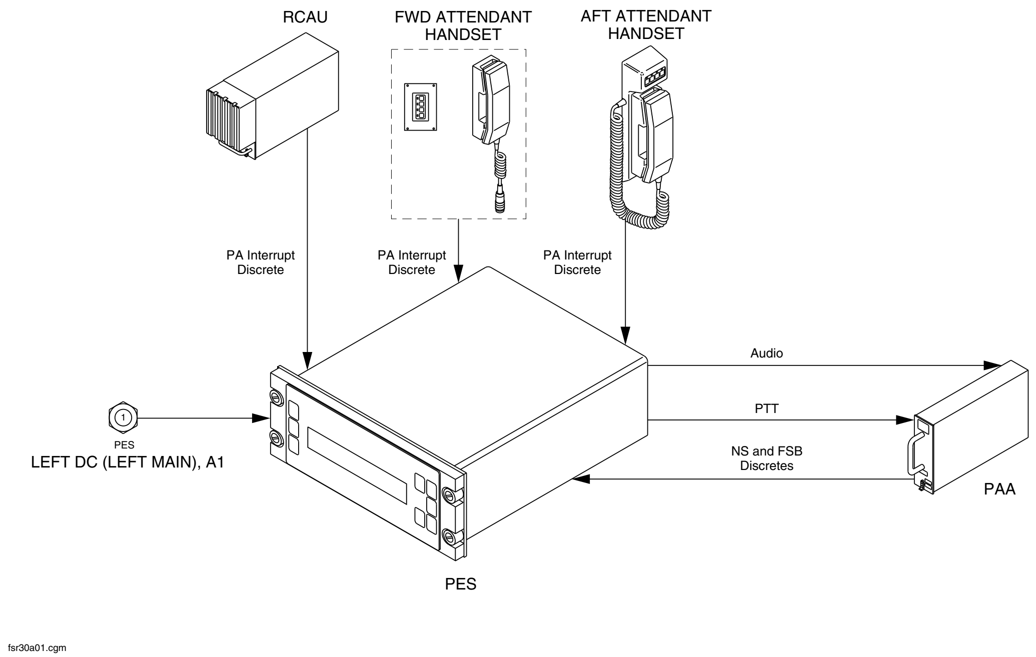
New DPAS units do not contain a PCMCIA memory card. The card is inserted in a slot located on the left side of the unit and is necessary for system operation. The passenger address and music selections are changed by reprogramming the card memory. A separate recording bench with a PC computer with integrated software allows recording, formatting and loading of announcements and music audio by the end user.

It can be programmed for a maximum of 279 minutes of passenger announcements or 139 minutes of music audio. Programing can include a combination of passenger addresses and music together that is less than or equal to a maximum of 279 minutes.

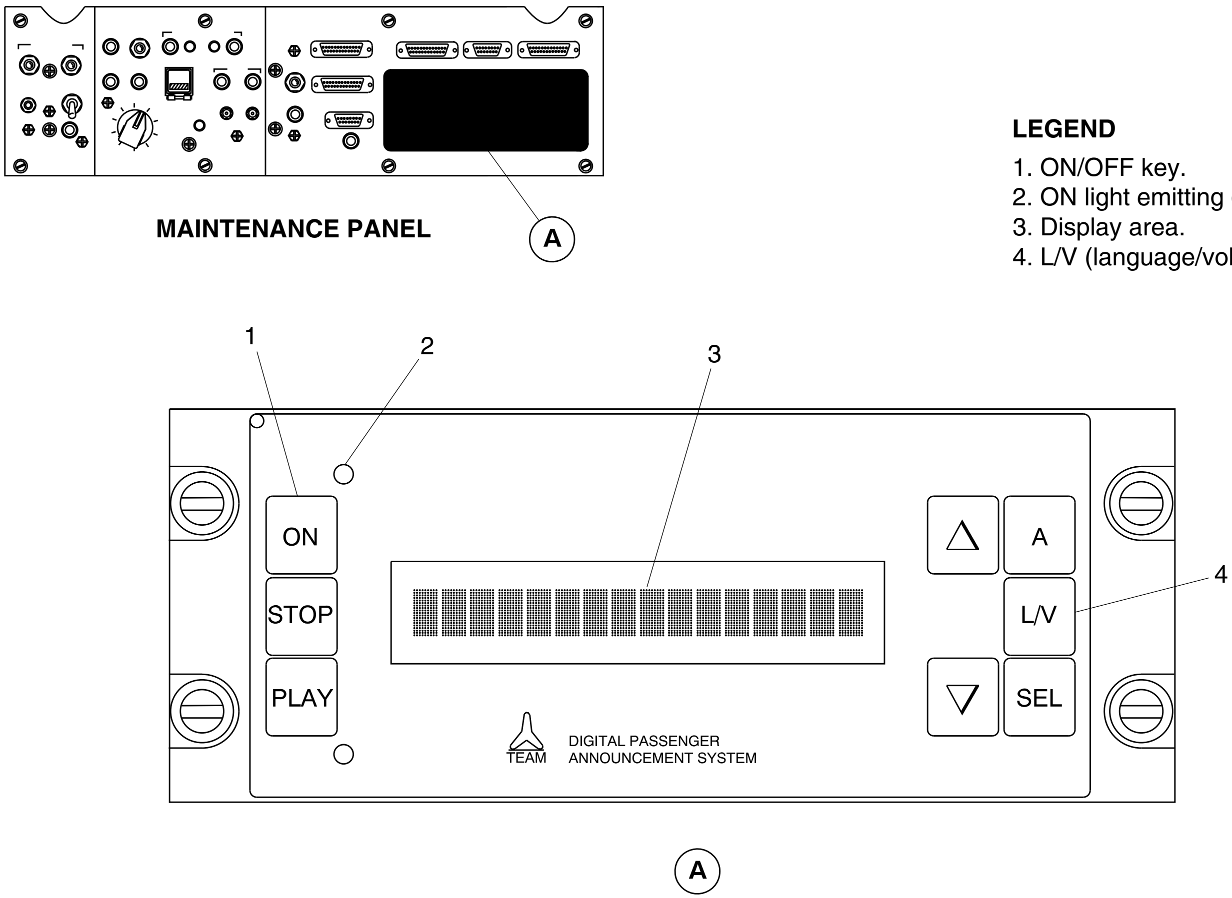
PCMCIA Memory Card Configuration Options

The memory card allows for configuration options that follow:

- Music is continuous and wraps around from the end of the playlist
- Music stops at the end of the playlist
- Music resumes after the announcement broadcast interruption
- If the music resumes after an interruption, it may do so from the beginning or from the point of interruption
- The title MUSIC and TEST ALL RECORD are placed in alphabetical order or at the end of the menu
- The duration period before the broadcast of an announcement can be varied.



PASSENGER ENTERTAINMENT SYSTEM (PES) BLOCK DIAGRAM
Figure 1

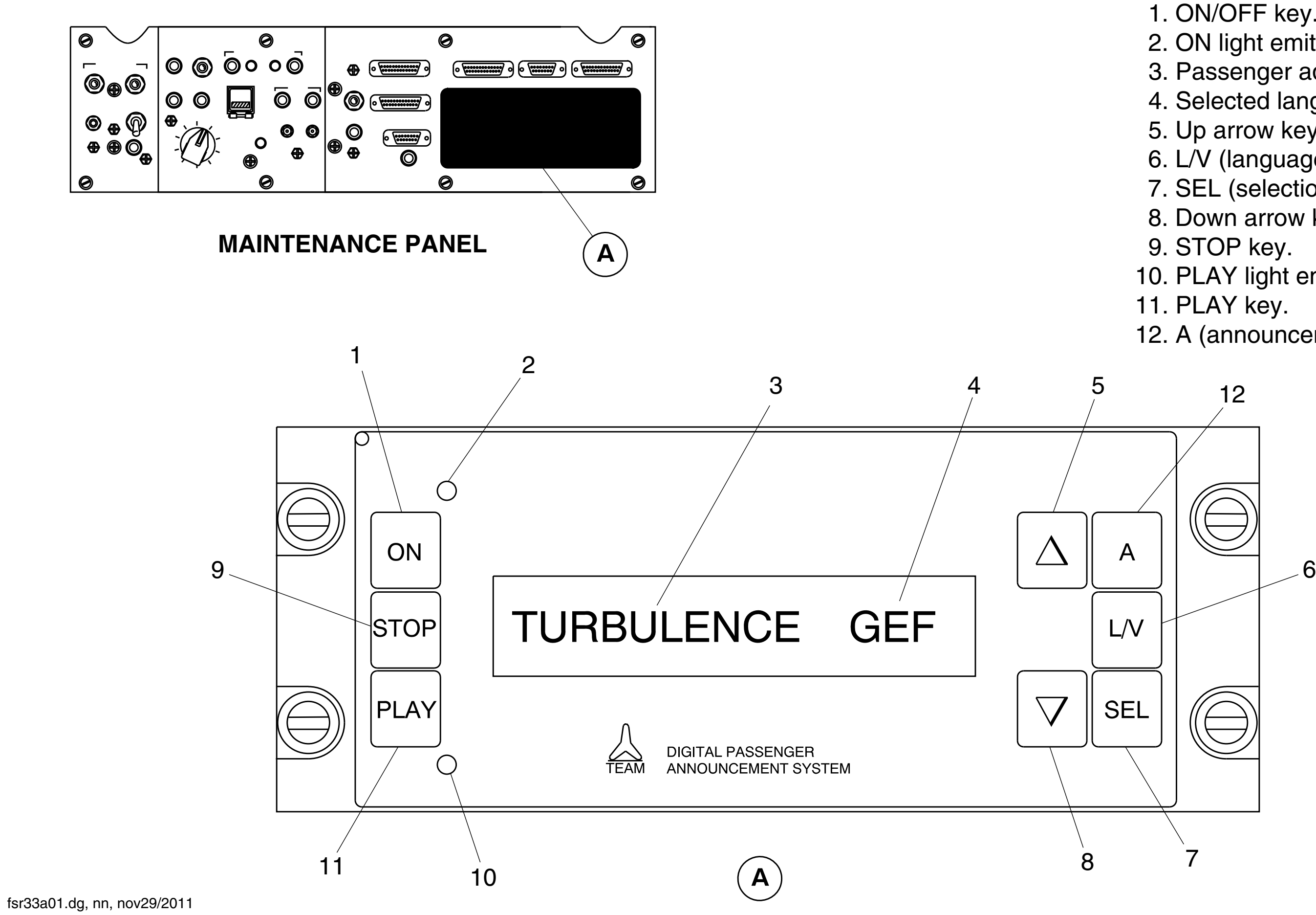


LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Display area.
4. L/V (language/volume) key.

fsr40a01.dg, nn, nov29/2011

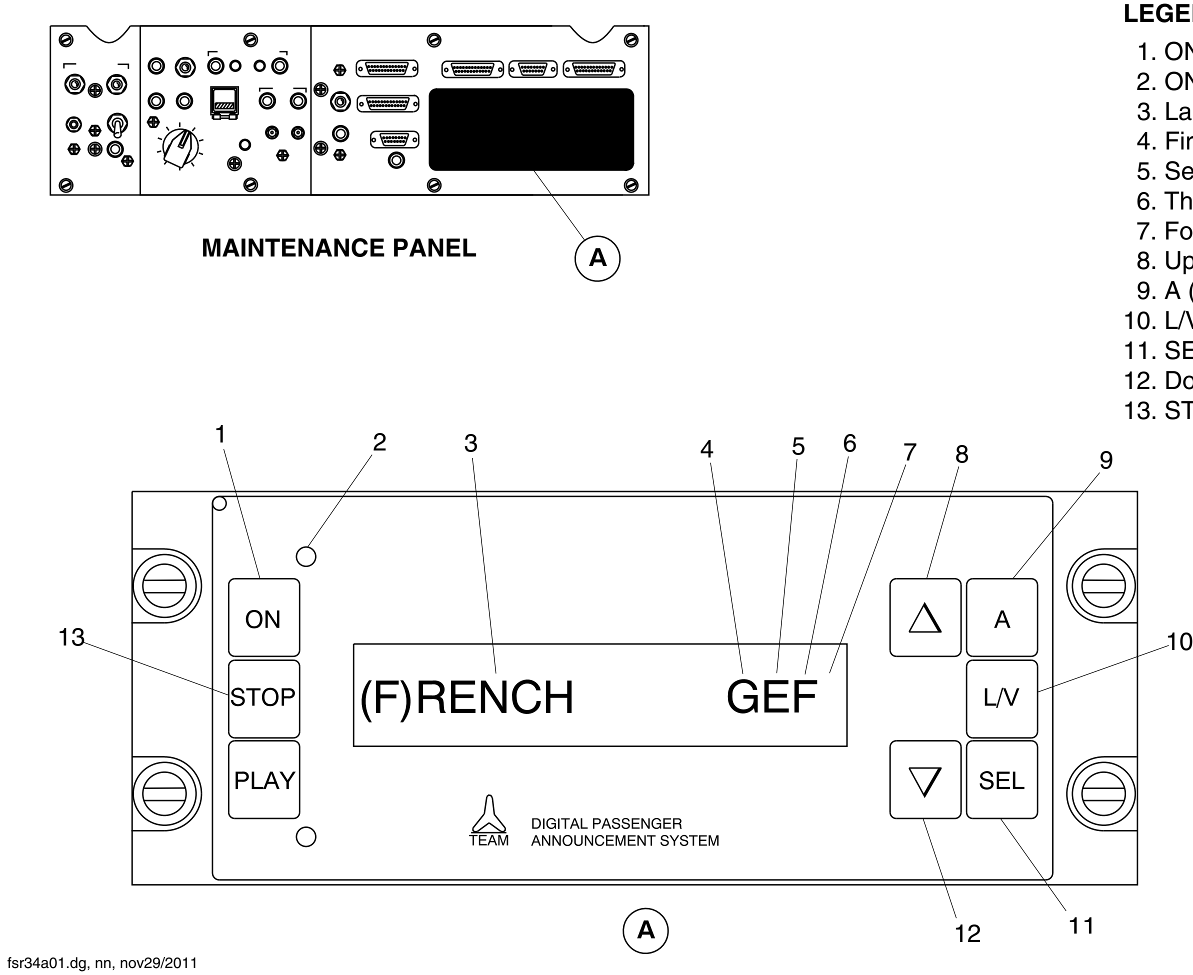
PES, Test Mode
Figure 2



LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Passenger address title.
4. Selected language indication.
5. Up arrow key.
6. L/V (language/volume) key.
7. SEL (selection) key .
8. Down arrow key.
9. STOP key.
10. PLAY light emitting diode (LED).
11. PLAY key.
12. A (announcement) key.

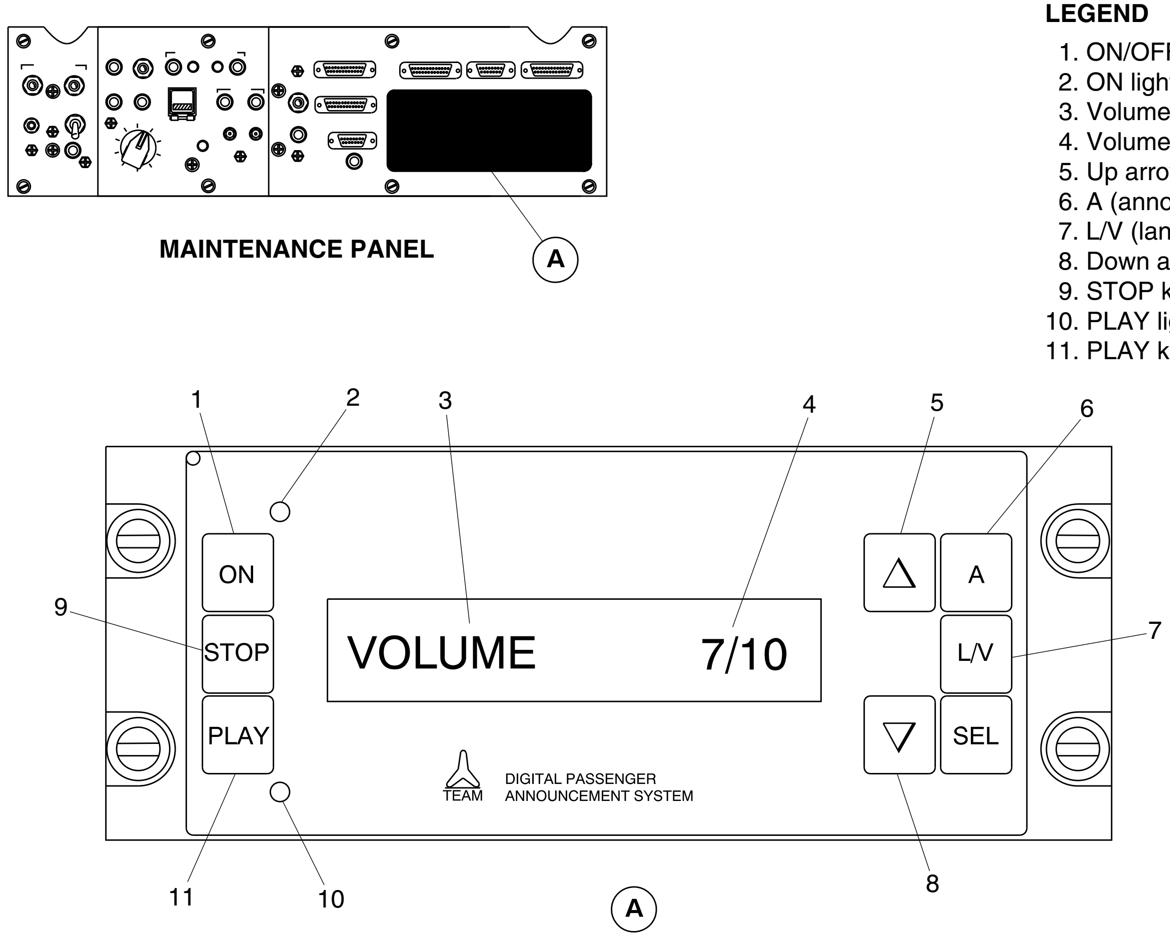
PES, Announcement Selection and Broadcast Mode
Figure 3



LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Language title.
4. First language.
5. Second language.
6. Third language.
7. Fourth language (NEW).
8. Up arrow key.
9. A (announcement) key.
10. L/V (language/volume) key.
11. SEL (selection) key.
12. Down arrow scroll key.
13. STOP key.

PES, Language Selection Mode
Figure 4

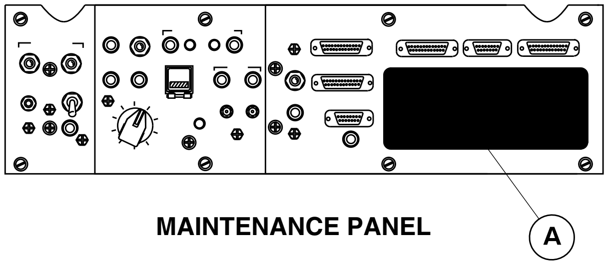


LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Volume title.
4. Volume level indication.
5. Up arrow key.
6. A (announcement) key.
7. L/V (language/volume) key.
8. Down arrow key.
9. STOP key.
10. PLAY light emitting diode (LED).
11. PLAY key.

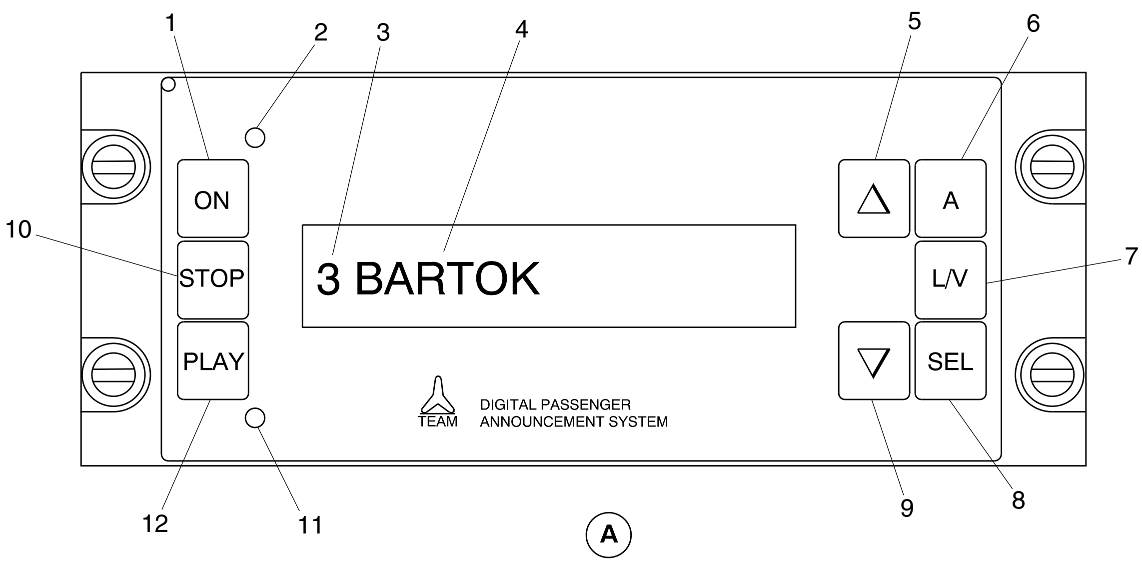
fsr36a01.dg, nn, nov29/2011

PES, Volume Adjustment Mode
Figure 5



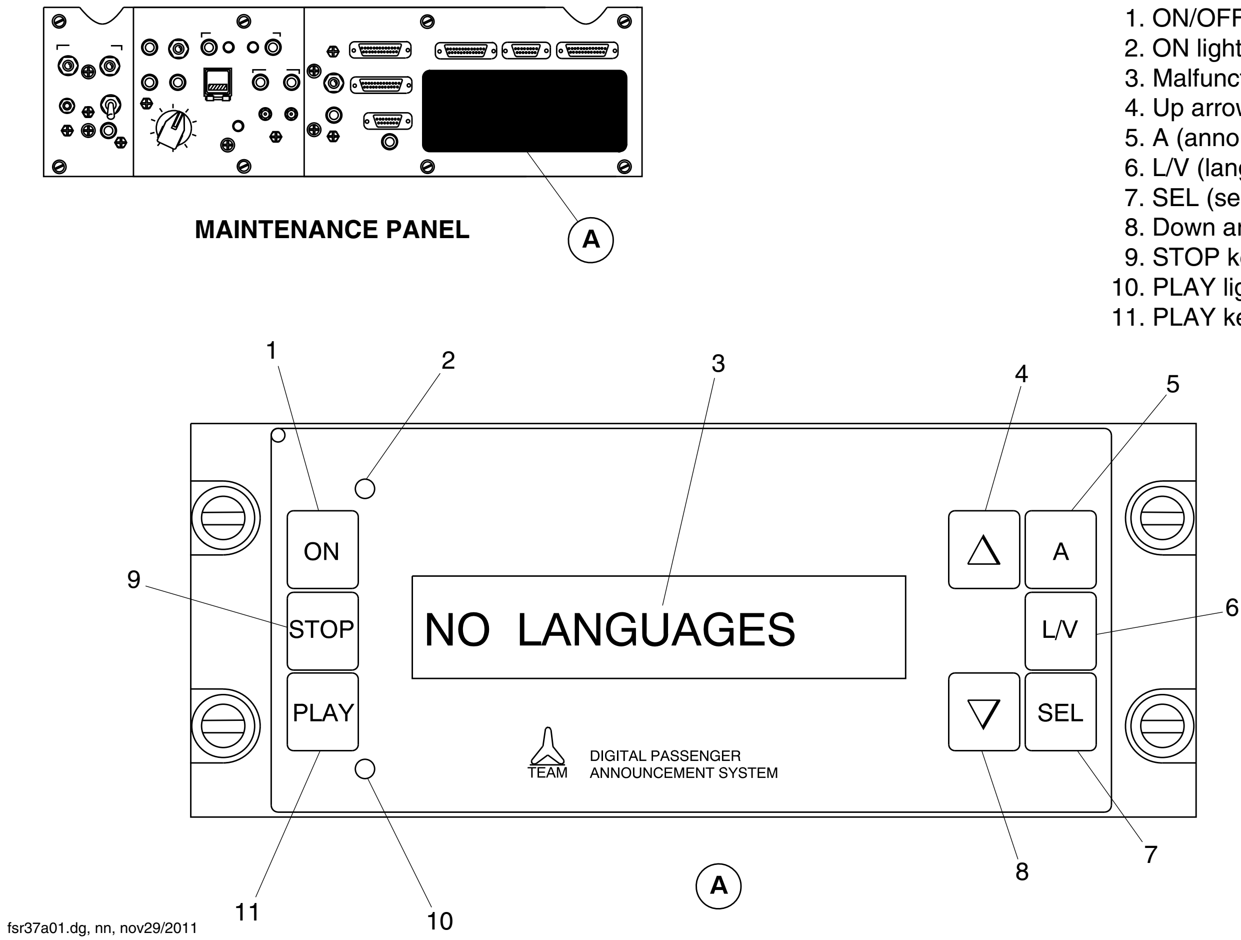
LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Music selection.
4. Music title.
5. Up arrow key.
6. A (announcement) key.
7. L/V (language/volume) key.
8. SEL (selection) key.
9. Down arrow key.
10. STOP key.
11. PLAY light emitting diode (LED).
12. PLAY key.



fsr35a01.dg, nn, nov29/2011

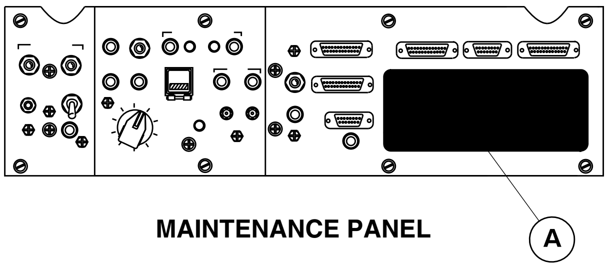
PES, Music Selection Mode
Figure 6



LEGEND

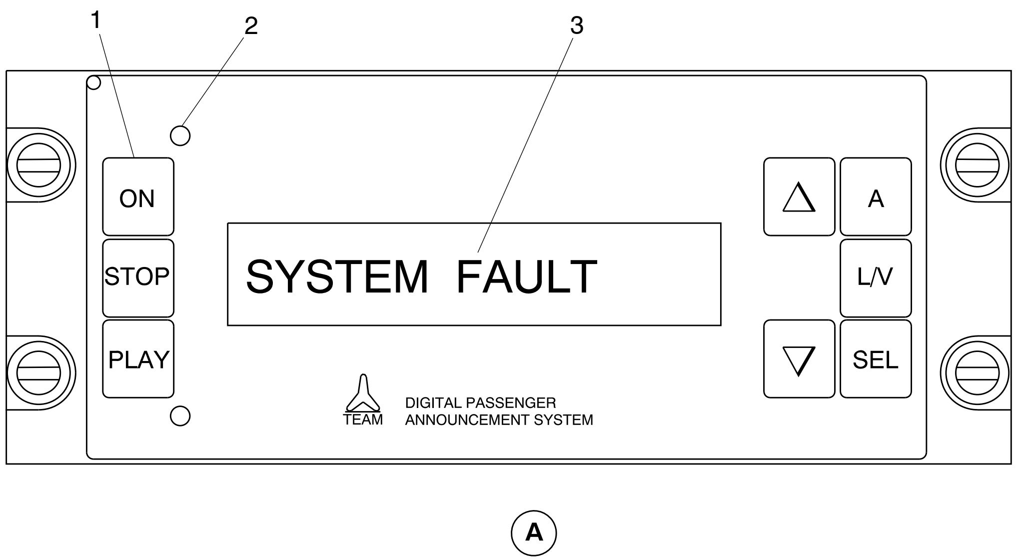
1. ON/OFF key.
2. ON light emitting diode (LED).
3. Malfunction message.
4. Up arrow key.
5. A (announcement) key.
6. L/V (language/volume) key.
7. SEL (selection) key.
8. Down arrow key.
9. STOP key.
10. PLAY light emitting diode (LED).
11. PLAY key.

PES, Failure Mode, Minor
Figure 7



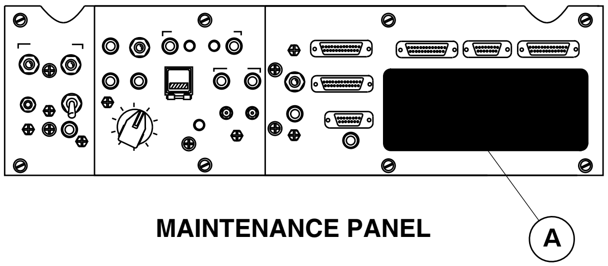
LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Malfunction message.



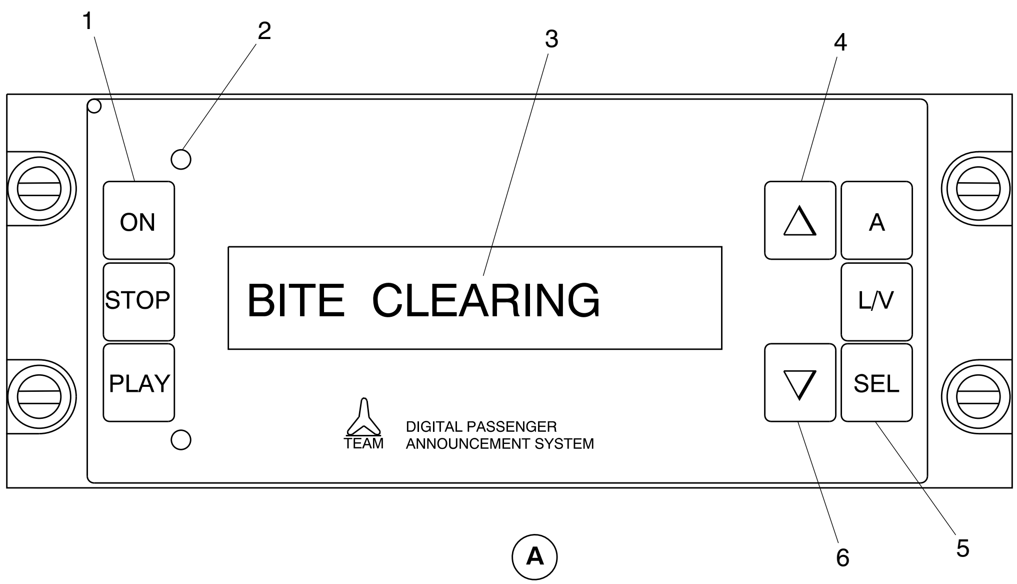
fsr38a01.dg, nn, nov29/2011

PES, Failure Mode, Major
Figure 8



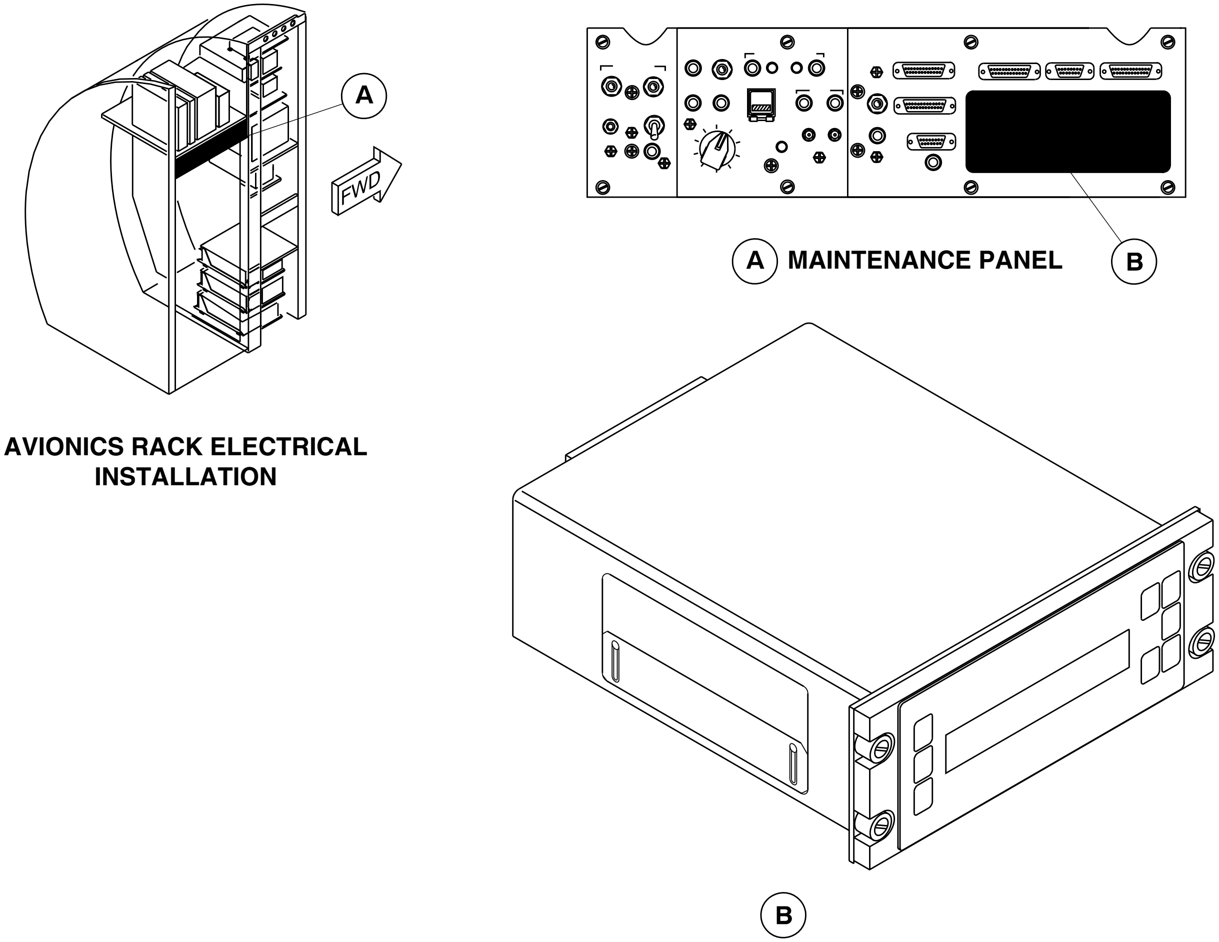
LEGEND

1. ON/OFF key.
2. ON light emitting diode (LED).
3. Bite clearing message.
4. Up arrow key.
5. SEL (selection) key.
6. Down arrow key.



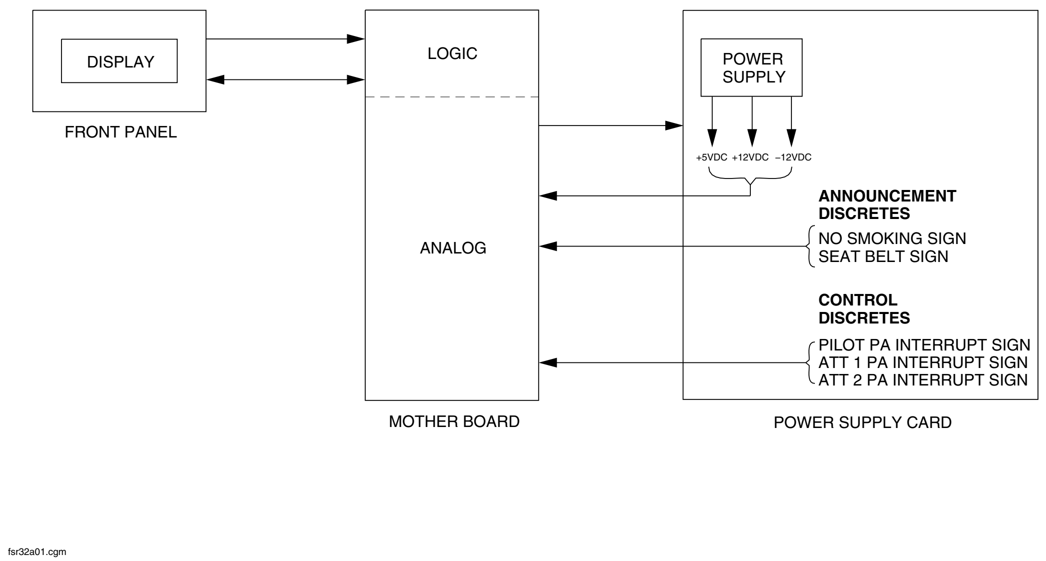
fsr39a01.dg, nn, nov29/2011

PES, Diagnostic Mode
Figure 9

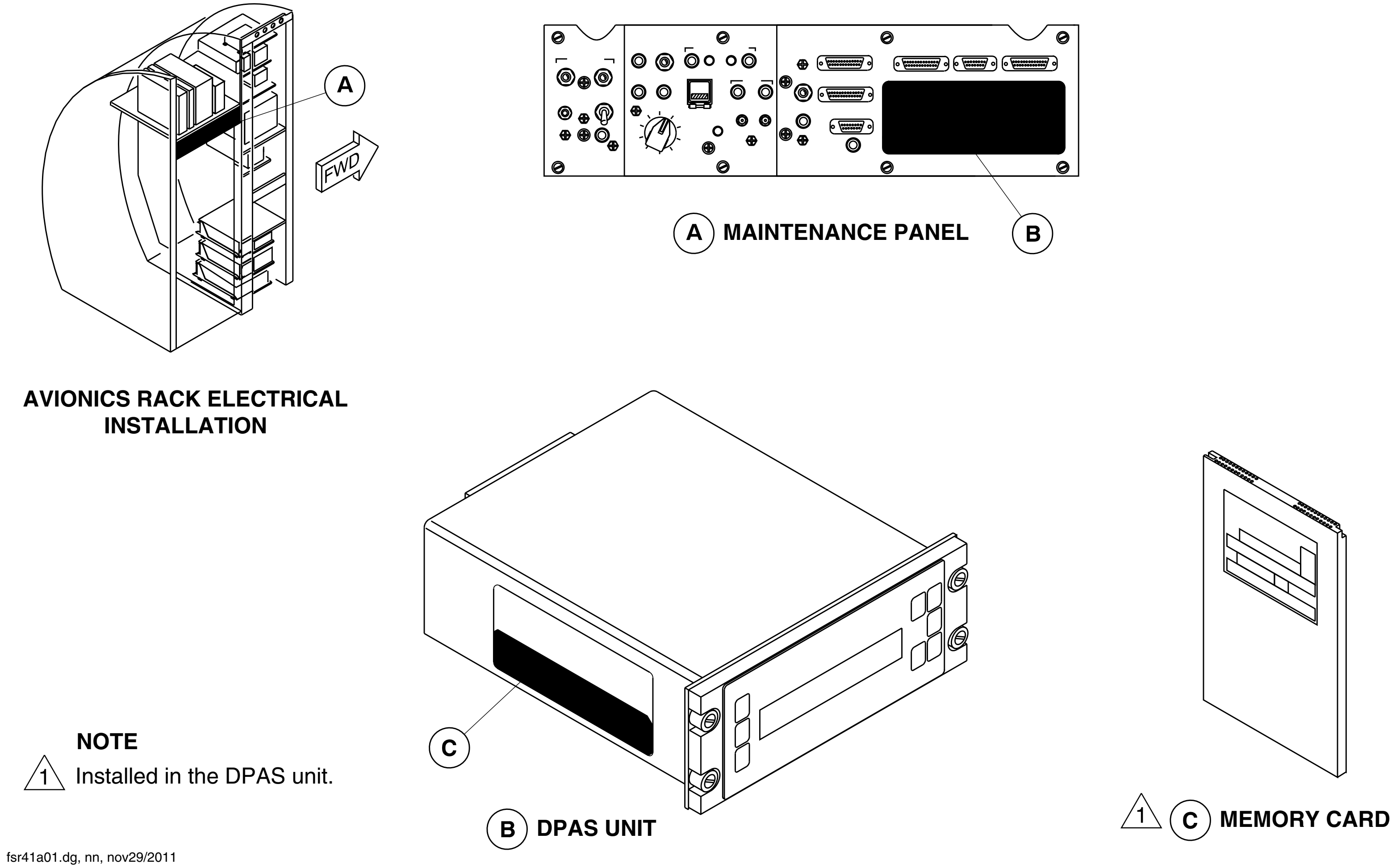


fsr31a01.dg, nn, nov29/2011

Digital Passenger Announcement System (DPAS) Unit, Locator
Figure 10



DIGITAL PASSENGER ANNOUNCEMENT SYSTEM (DPAS) UNIT INTERNAL BLOCK DIAGRAM
Figure 11



PCMCIA Memory Card
Figure 12

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–32–11–001

WIFI IN–FLIGHT ENTERTAINMENT SYSTEM (IFES)

General

The wireless In–Flight Entertainment System (IFES) is designed to communicate with passenger Portable Electronic Devices (PED) with WiFi only active in all phases of the flight.

On aircraft with the SB84–23–49 or SB84–23–51or ModSum 4Q459545 incorporated, the wireless IFES is installed.

General Description

Refer to Figure 1.

The wireless IFES is designed to communicate with passenger PED at the frequency of 2.4 GHz and 5 GHz. The passenger PED shall be operated in "AIRPLANE MODE" with WiFi only active in all phases of the flight. But the passenger PED shall be powered off during the take–off, climb, cruise, approach and the landing.

The wireless IFES consists of these components:

- IFE Crew Terminal (23–32–11)
- File Server (23–32–11)
- Cell Modem (23–32–11)
- Cabin Wireless Access Point (CWAP) (23–32–11)
- Cell Modem Antenna (23–32–11).

Detailed Description

Refer to Figure 2.

The wireless IFES supports the delivery of media content and services to passenger devices over an 802.11a/g/n wireless network at 2.4 GHz and 5 GHz frequencies in the cabin. It also supports the streaming of the MPEG4 format H.264 encoded video.

The media content and software are loaded at the ethernet port. The software allows passenger devices to play, pause or jump within a video or audio stream through slider control. The IFES includes a public network. The PED does not have access to the aircraft system network. The IFES allows supported passenger devices to connect to the system and supports wireless protocol for the devices wireless connection.

The IFES provides a browser based portal and is accessible with WiFi when the wireless network is enabled. The portal shows various warnings and error codes as dispatched by the media player. The portal provides a landing page and an auto redirect feature to the landing page. The portal supports audio and video overlays.

Portal Services: The portal provides a method for accessing audio and video content and can filter the content by the rating.

Portal Viewing: The portal supports laptops, smart phones, and tablets. The portal is able to detect the device type and contains an intranet domain tailored to that specific device. The intranet domain can identify the screen resolution of the device and scale the portal accordingly.

The cabin crew control functions are provided through the Smart Monitor (SM) utilizing on–screen icons. The SM uses a touch screen interface to provide access to crew services and maintenance of the services. The cabin crew control functions are:

- Screen Saver: The Cabin Management Interface (CMI) provides a screen saver feature that operates after 300 seconds of no activity. Touching the screen returns the CMI from the screen saver mode.
- Control Function: The CMI provides a method to enable and disable the Wireless Access Point (WAP) radios. Enabling the WAP radios also enables the public SSID, eXW streamer, and portal availability.
- System Status Function: The CMI allows the personnel to show the status of the system functions/aircraft interfaces, such as the WAP and IFES portal.
- Maintenance Function: The CMI provides a method to access the diagnostic and maintenance functions for the IFES.

IFES Crew Terminal

Refer to Figure 3.

The IFES crew terminal provides the service crew with the controls necessary to configure and maintain the IFES. The crew terminal has 11.1 in (281.94 mm) color display with a touch screen user interface. The IFES crew terminal provides these functions that are controlled through the crew terminal application screens:

- Control of the cabin lighting
- Control of the cabin zone to video source mapping
- Control of the boarding music
- Control of the PRAM
- Control of the passenger address cabin zone configuration
- Control of the data loading
- Initiate BITE requests to all peripherals and store resulting BITE data for the fault location and the unit type
- Preview of the video and audio programs.

File Server

Refer to Figure 4.

The file server is a high performance and a high capacity network server that provides extensive audio, video and cached web content. It also contains interactive menus, media content, electronic catalog sales to passengers, and unit downloadable software.

The file server also handles all of the on–demand applications available to passengers with in–seat audio and video. In interactive applications, the file server is capable of decryption of the MPEG video and audio information stored on the file server. The file server provides a minimum hard drive storage capacity of 1.2 TB.

The file server serves as the direct interface with the air–to–ground narrow band or broadband equipment and other key aircraft systems by using 10/100/1000 Mbps ethernet. The file server has these functions:

- Stores all passenger revenue data collected during a flight (if available)
- Decrypts 3DES hardware from the stored MPEG files

- Sends text and graphics information through the Area Distribution Box (ADB) to the passenger's Seat Display Unit (SDU) screen.

Cell Modem

Refer to Figure 5.

The cell modem provides a private internet protocol networking connection with the Panasonic Network Operations Center (NOC). The cell modem sends and receives data using a GSM network only when the ENGINE OFF and AIR/GND (WOW) discretes are true. The cell modem is used for the data load and offload.

The cell modem is a cellular router and is designed for the Wide Area Network (WAN) connectivity including 2.5G/3G/4G LTE networks. The cell modem is compliant to the 4G LTE standard with 3GPP, HSPA and GPRS/EDGE support.

The cell modem has these functions:

- Communicates between the base station and the host computer
- One ethernet connection to the host computer
- One RS–232 port for the factory test
- Supports dual antennas for the Single–Input, Multiple–Output (SIMO) operation.

The cell modem enables a cellular wireless IP network connection between an equipped aircraft and the Panasonic Ground Network. The cell modem is powered by 28 V dc of the aircraft supply. When power is applied to the cell modem, it automatically searches for suitable cellular base station broadcasts. The cell modem chooses first 4G/LTE bands. If none of LTE bands are available, it then chooses 3G/UMTS bands and finally 2G/GSM bands.

The cell modem is configured to monitor and autonomously maintain a connection with the Panasonic Enterprise ground server. This generally includes detecting the periodic presence or absence of data traffic, with the ability to automatically reset the cellular hardware and data connections autonomously if a disruption is detected.

Cabin Wireless Access Point (CWAP)

Refer to Figure 6.

The CWAP is a wireless Local Area Network (LAN) router. The CWAP communicates with an on–board wired LAN through the ethernet port. A second ethernet port is provided to enable the connection of additional CWAP units or a second on–board LAN.

Communication with the wireless client stations is also accomplished with the use of Orthogonal Frequency Division Multiplexing (OFDM) that communicates in the 2.4 GHz ISM radio frequency spectrum and 5 GHz ISM radio frequency spectrum.

Cell Modem Antenna

The cell modem requires a compatible antenna to connect to each of its antenna connectors. Two antennas are required for each unit.

Power Supply

The CWAPs, file server and the crew terminal receive 115 V ac from the static inverter that is installed on the lower fuselage. The static inverter receives 28 V dc from the left main bus through 15A circuit breaker IFE PWR and 5A circuit breaker IFE CONT. The circuit breaker IFE PWR is located at 5A and the circuit breaker IFE CONT is located at 5B on the left DC circuit breaker panel.

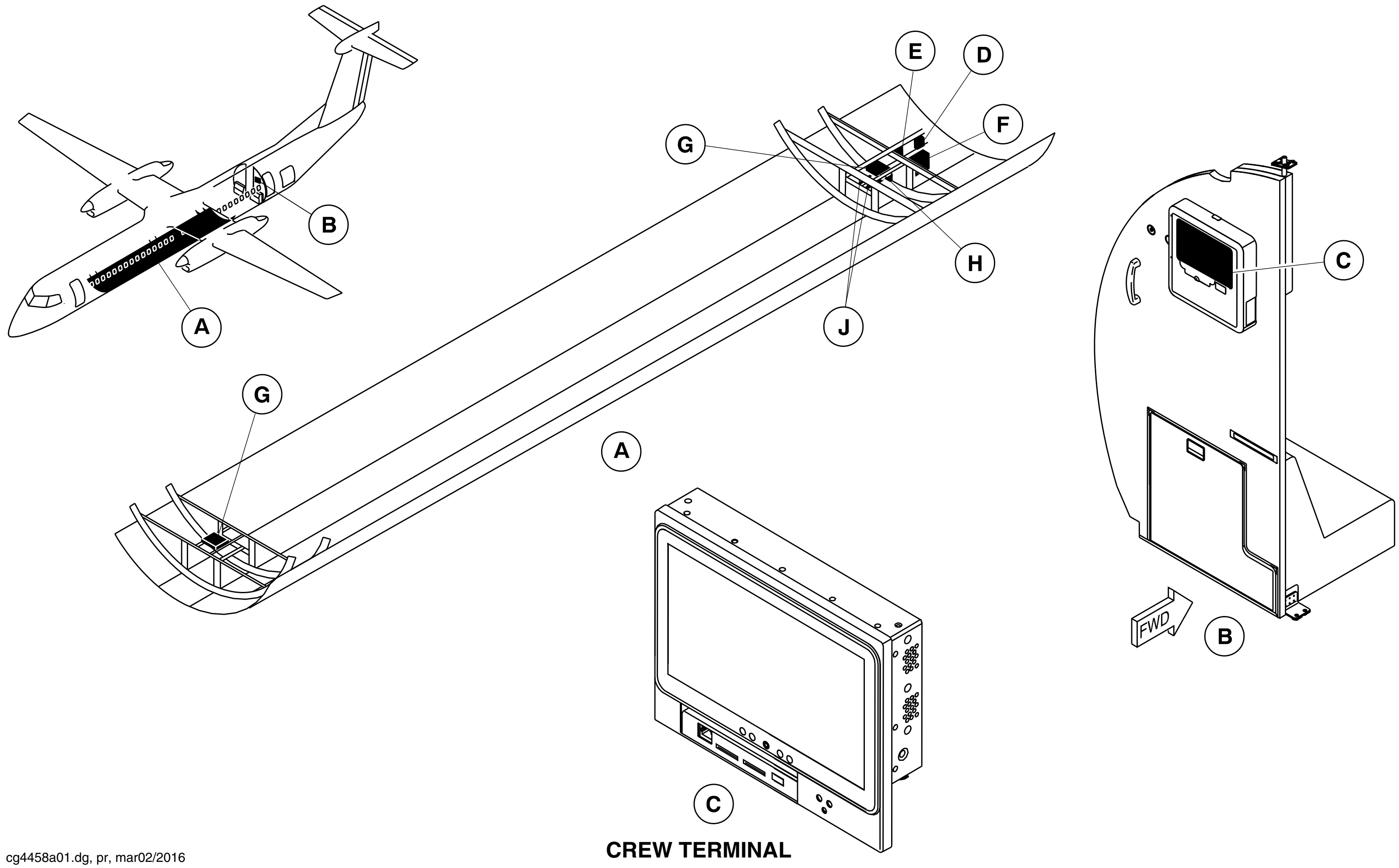
The cell modem receives 28 V dc from the left main bus through 1A circuit breaker IFE MODEM. The circuit breaker IFE MODEM is located at 4A on the left DC circuit breaker panel.

Limitations and Restrictions

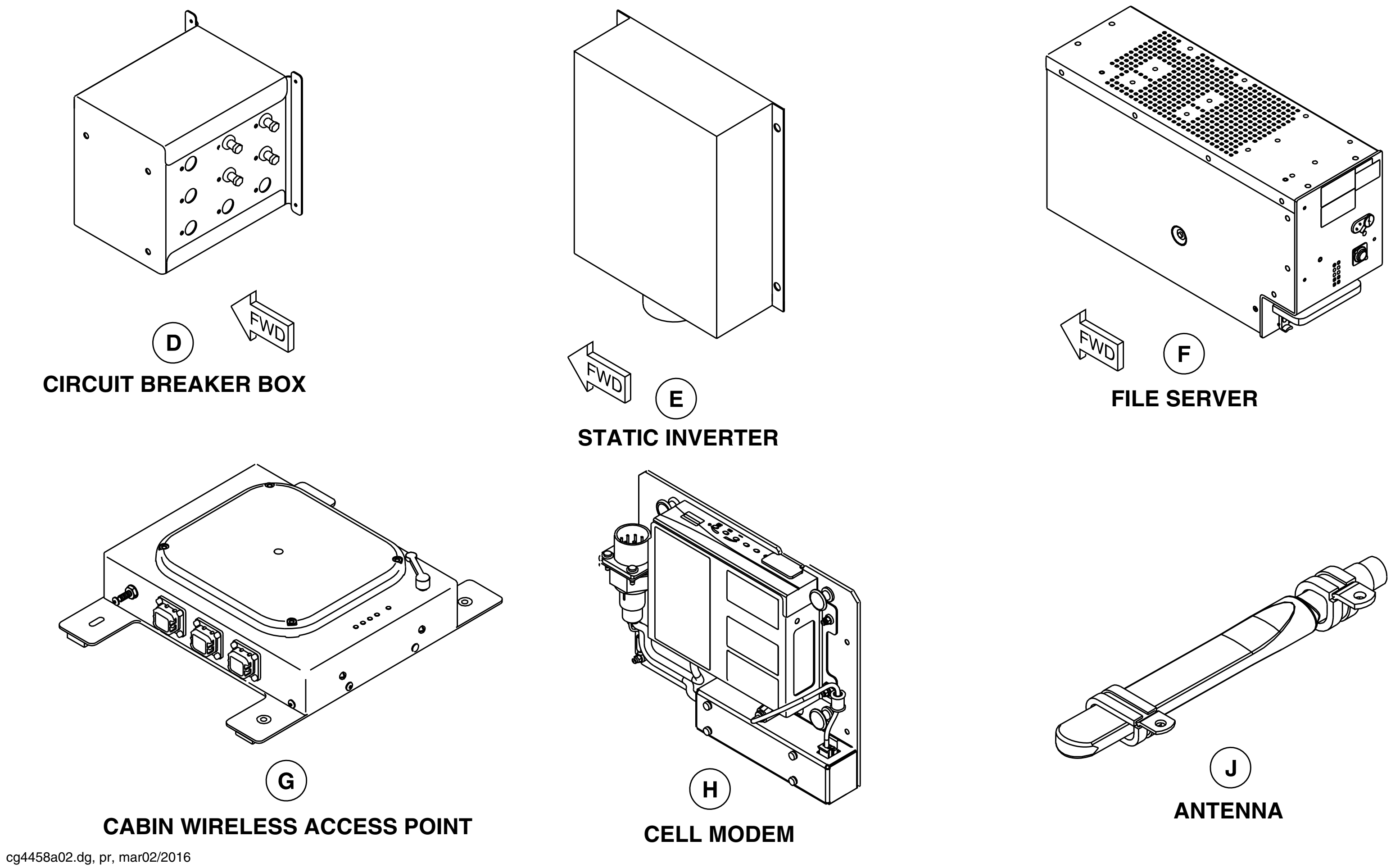
The information that follows supplies the operator with the operating restrictions and/or limitations as well as the acceptable aircraft configuration to support the operation of the IFE with passenger PEDs:

– Only the aircraft with the configuration specified (Refer to Figure 7 and 8) can operate the IFE system with passenger PEDs.

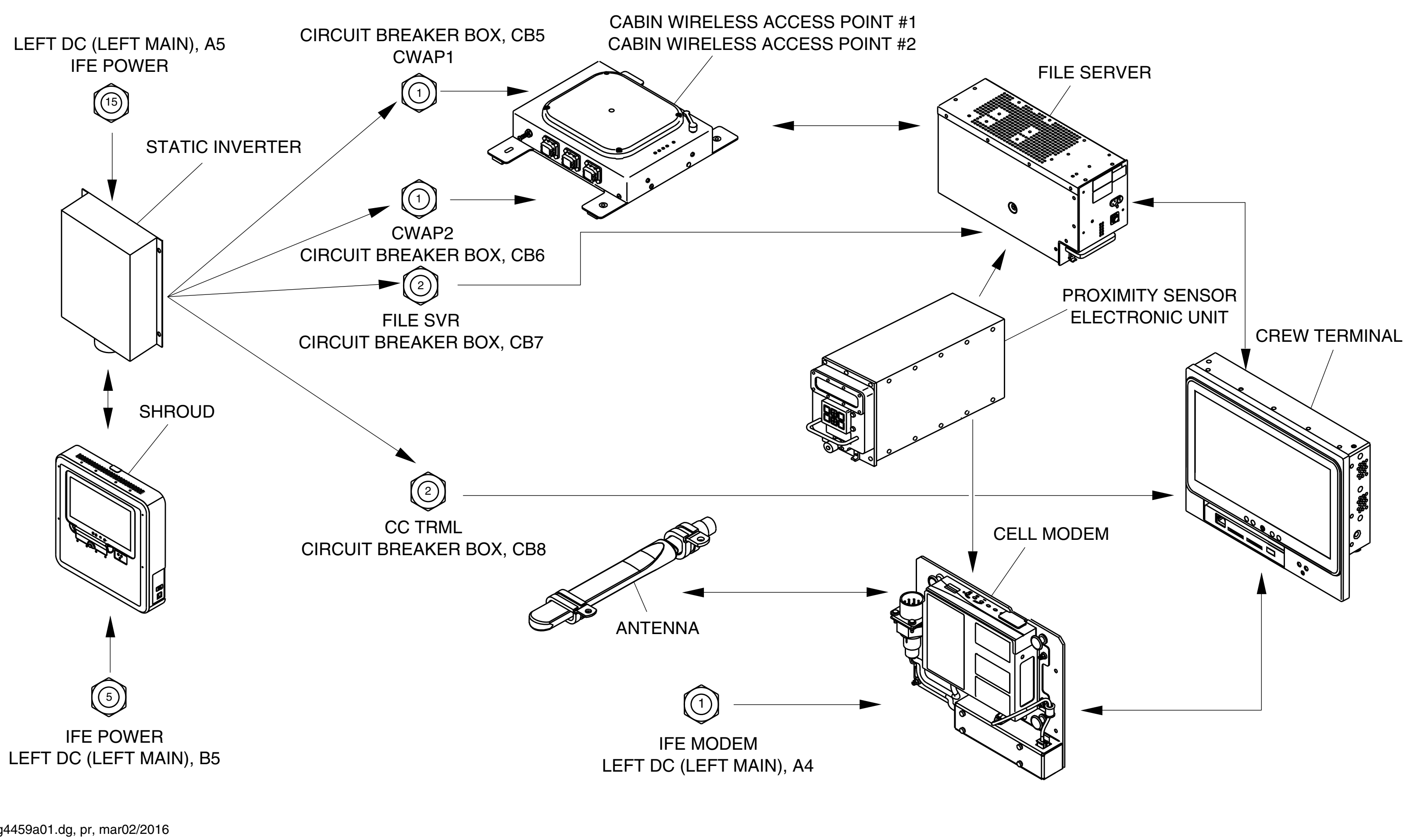
– The passenger PEDs installed within the forward wardrobe must be removed from the wardrobe or powered off during the take−off, climb, cruise, approach and landing.



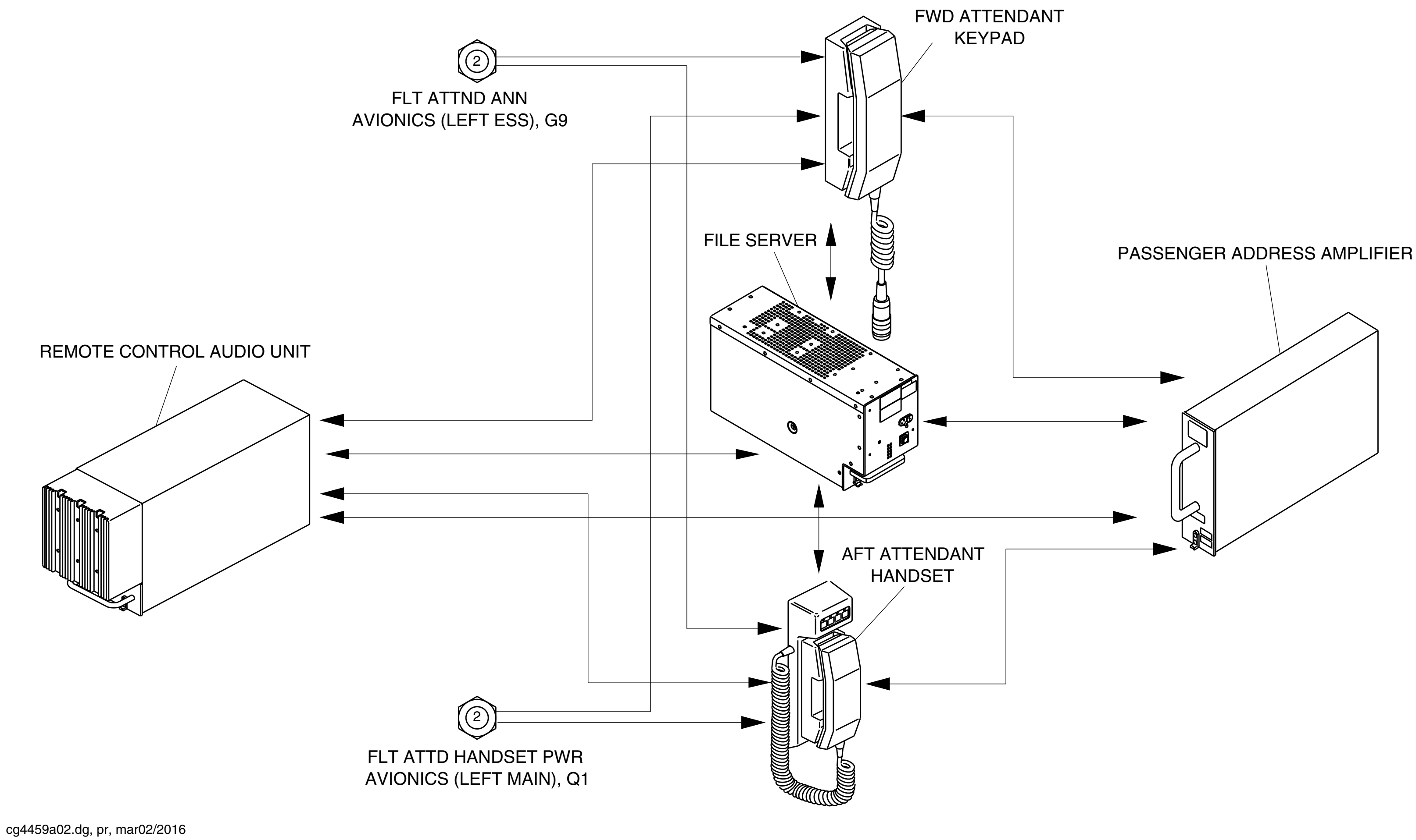
Component Location Index of WIFI In–Flight Entertainment System
Figure 1 (Sheet 1 of 2)



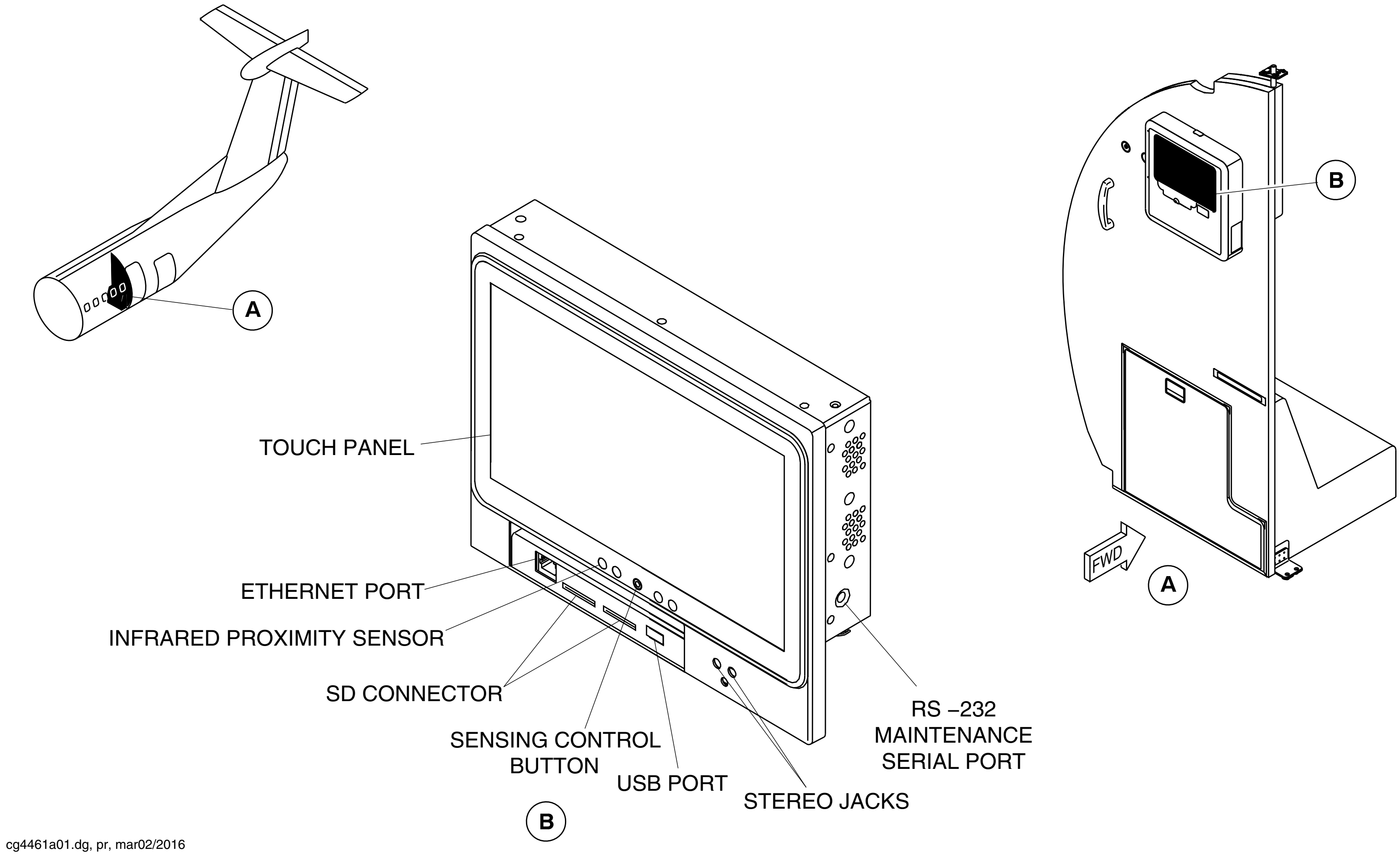
Component Location Index of WIFI In−Flight Entertainment System
Figure 1 (Sheet 2 of 2)



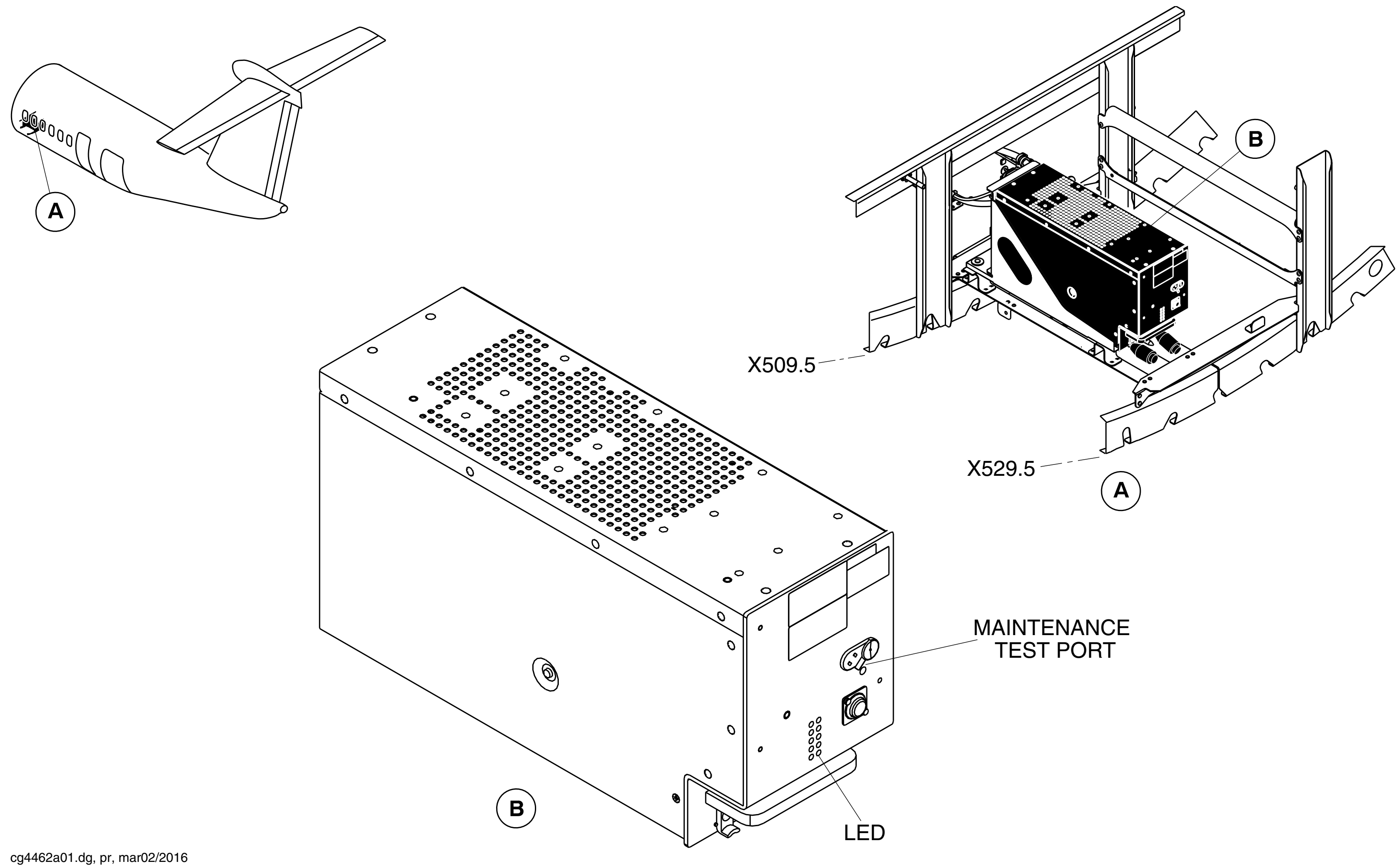
Block Diagram of the WIFI In–Flight Entertainment System
Figure 2 (Sheet 1 of 2)



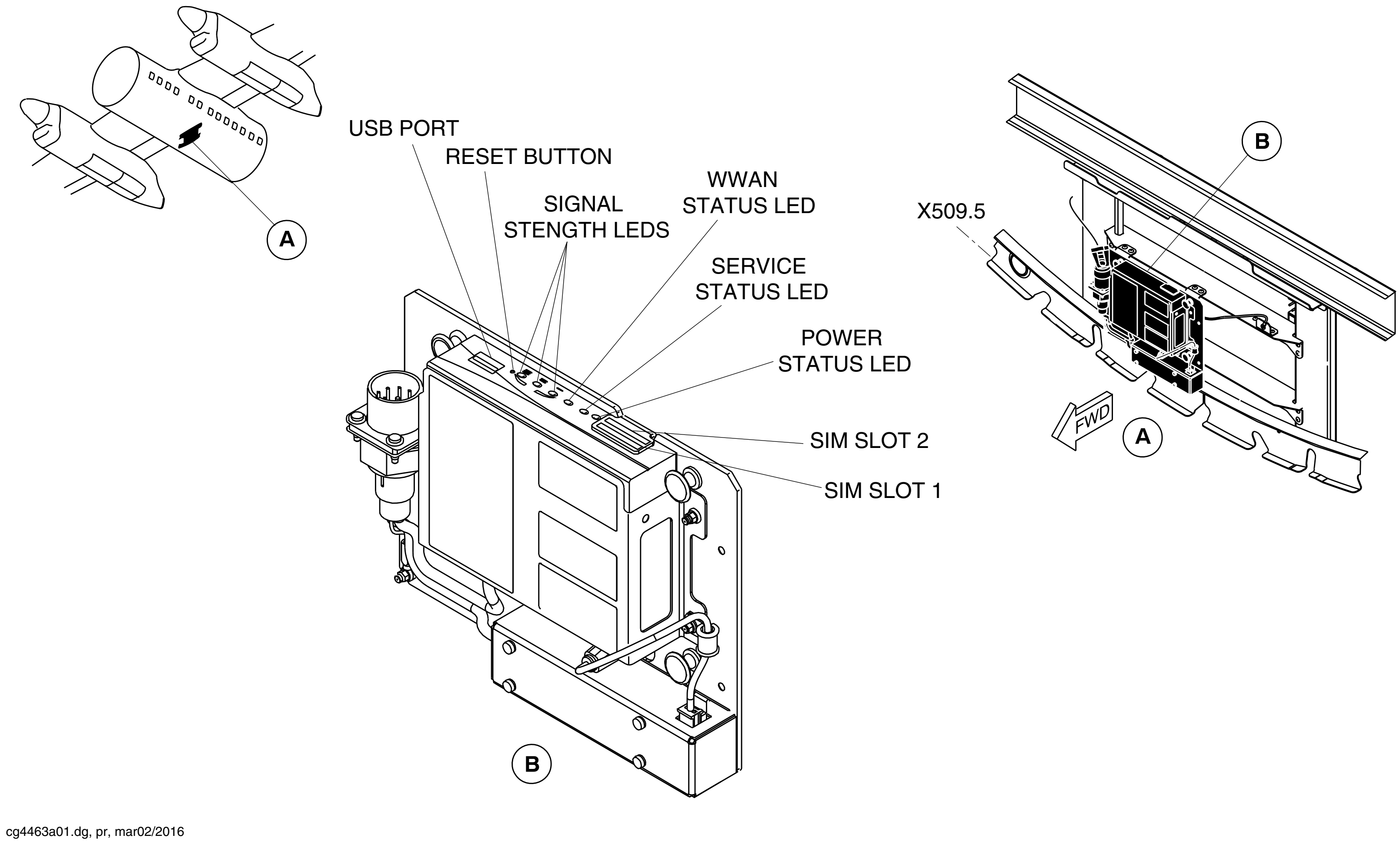
Block Diagram of the WIFI In–Flight Entertainment System
Figure 2 (Sheet 2 of 2)



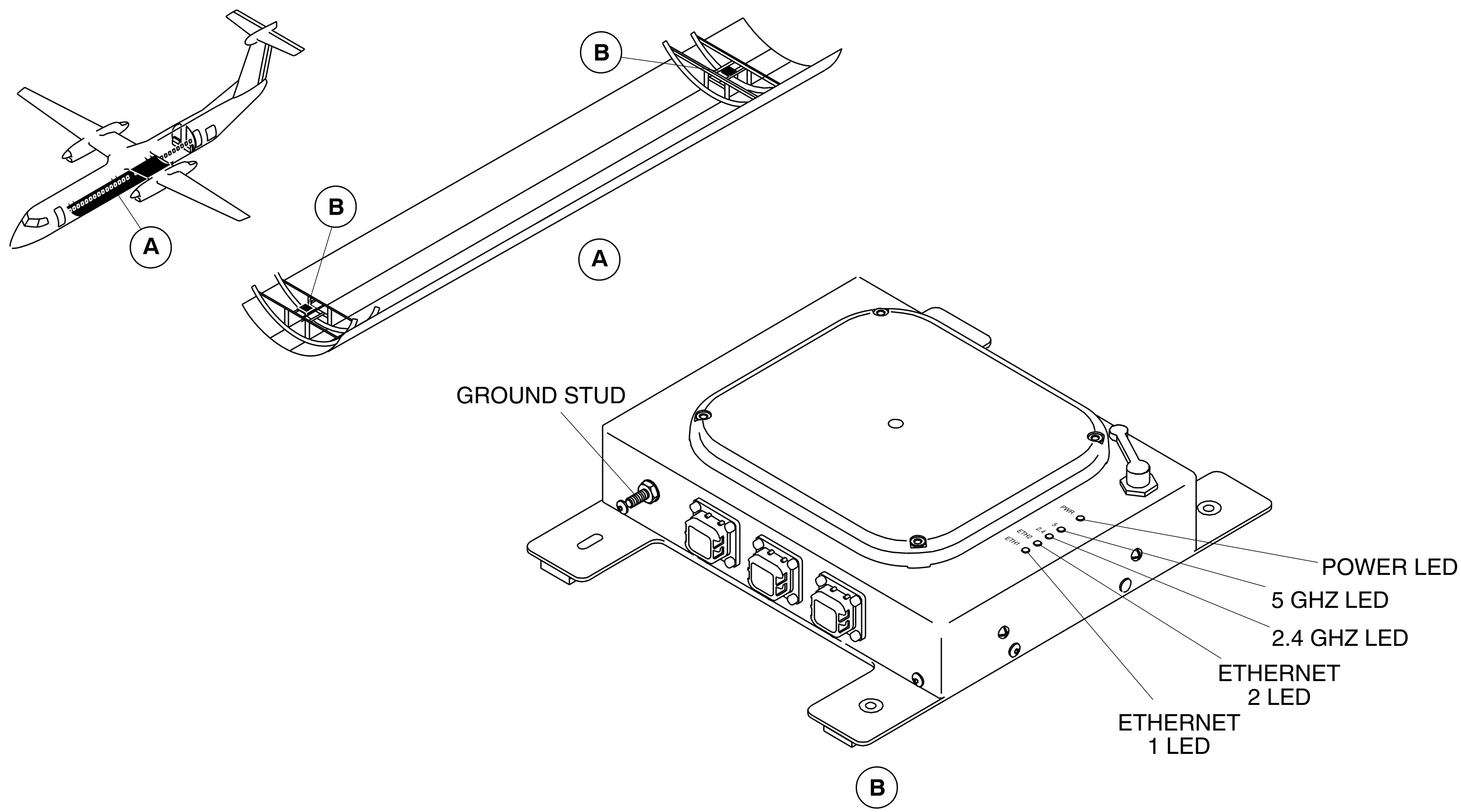
IFES Crew Terminal
Figure 3



File Server
Figure 4



Cell Modem
Figure 5



cg4460a01.dg, pr, mar02/2016

Cabin Wireless Access Point (CWAP)
Figure 6

EQUIPMENT	PART NUMBERS TESTED OR ACCEPTABLE
FWD Flight Attendant Handset	IS4Q2350014–001, 89–01–002–001–002
AFT Flight Attendant Handset	IS4Q2350015–001, 8Z5910–001

cg5037a01.dg, nn/kb, jun05/2018

Equipment Evaluated for Backdoor Coupling Test
Figure 7

SYSTEM	ANTENNAS	PART NUMBERS TESTED
VHF Voice communication	VHF Comm Antennas	10–105–31AN2, S65–8280–68
Distance Measuring equipment	DME Antennas	10–203–32H2
Transponder Mode A/C/S	ATC Antennas	10–203–32H2
TCAS Interrogator Receiver	TCAS Antennas	071–01548–0100, 7514081–901, AT910
Global Navigation Satellite System GNSS L1	GPS Antennas	10705, 10706, 10708
ILS Glideslope (CAT 1 DH and Coverage Limit)	Glideslope Antenna	10–204–6T2D
ILS Localizer (CAT 1 DH and Coverage Limit) VHF Omni range	VOR/LOC Antennas	10–250–9B2, S65–247170–7

cg5038a01.dg, nn/kb, jun05/2018

Communication/Navigation Equipment Evaluated during Front Door Coupling Test
Figure 8

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–35–00–001

ACTIVE NOISE AND VIBRATION SYSTEM (ANVS)

Introduction

The Active Noise and Vibration System (ANVS) decreases the noise level in the passenger cabin caused by the aircraft propellers. The system supplies secondary noise and vibrations in the passenger compartment. These secondary noise and vibrations field cancel the primary noise and vibration field. The primary and secondary noise and vibration field mix to produce lower cabin noise and vibrations.

General Description

Refer to Figure 1.

The ANVS goes into the control mode when the aircraft is in flight. The system clears when the Weight–On–Wheels (WOW) input shows that the aircraft is on the ground.

The ANVS interfaces are as follows:

– Proximity Sensor Electronic Unit (PSEU) – WOW input
– Cabin Pressurization Control System (CPCS) – pressure input
– Propeller Electronic Control Unit (PECU) – tachometer outputs
– Maintenance Panel – ANVS SYS DEGRADED LED
– Flight Attendant Panel – ANVS control
– Aircraft ID Variant – storage code for aircraft identification.

The ANVS contains the components that follow:

– Controller
– The ANVS Control Panel
– Actuators – Active Tuned Vibration Attenuators (ATVA)
– Power Amplifiers (PA)
– Sensors – Microphones and Accelerometers
– Vibration Transducers (installed on the engine gearbox)
– Power Distribution Box – electrical power distribution

The location of the ANVS components is as follows:

– The controller is installed below the floor panels between stations X258.500 and X281.000 in the passenger compartment.
– The ATVAs and PAs are installed between the aircraft structure and the internal part of the trim panels.
– The sensors are installed in the ceiling panels, sidewall panels, overhead stowage bins, Passenger Service Units (PSU) and flight attendant seat.
– The ANVS control panel is a part of the flight attendant panel.

The controller monitors inputs from these sources:

– Weight–on–wheels
– Sensors
– Aircraft propeller frequency reference signals

- Pressure
- Vibration transducers.

Detailed Description

A detailed description of the ANVS components follows.

Controller (ANCU – Active Noise Control Unit)

Refer to Figure 2.

The controller is an ARINC 600 4MCU unit attached to the aircraft structure through four support legs.

The controller processes the propeller frequency data and the cabin noise levels from the sensors. The outputs are control signals that go to the actuators through the power amplifiers.

The controller processes the basic frequencies of the propeller related noise. The frequency data is supplied by the PECU (tachometer outputs).

Electrical connections to the controller are through five radial EPX connectors and one circular MIL–C–38999 connector. The radial connectors are identified as J1 through J4 and J6. The circular connector is identified as J7. Connectors J1 through J4 and J6 are installed on the rear panel of the controller housing. Connector J7 is installed on the controller front panel.

Propeller Balance Monitoring System (PBMS) electrical connections to the controller are through connector J7. A D–type connector (J5) is also installed on the front panel for connection to a maintenance terminal.

A secondary function of the ANVS is to record and process propeller balance data as follows:

- Vibration data is collected from a vibration transducer mounted on each propeller gearbox.
- Vibration data is collected automatically during flight or with the PBMS terminal during an engine ground run. The data is read from the controller with the PBMS terminal software.
- The PBMS terminal software automatically calculates and stores the vibration data necessary to make sure of the level of propeller unbalance during usual revenue flight operations.
- The PBMS terminal software then calculates the propeller balance data. This is used to calculate the redistribution of weights in the propeller balance plane necessary for propeller balance in the specified limits during ground maintenance.

Active Tuned Vibration Attenuator/Actuator (ATVA)

Refer to Figure 3.

The ATVA is an electromagnetic actuator that is connected to a power amplifier. The power amplifier drives the ATVA. The ATVA gives vibration levels related to the amplitude and frequency of the signals from the PA.

Power Amplifier

Refer to Figure 4.

The unit is a high efficiency class D switching amplifier. It is connected to the controller output drive signal with a “quick–disconnect” connector twisted pair cable.

Power Amplifiers (PA) are contained in sealed aluminum housings. Each amplifier is attached to the actuator bracket and gusset plate.

The aircraft 28 V dc bus supplies electrical power to the PA. It also supplies up to 20 watts (rms) of power to its associated ATVA.

Feedback signals from the actuators to the controller control the vibration intensity levels.

Sensors – Microphones

Refer to Figure 5 and Figure 6.

Miniature electric microphones connected to interface circuitry are encapsulated in sealed molded enclosures. Each enclosure is attached to a trim panel through a mounting plate and gasket on the side wall, ceiling panel and overhead storage bins.

There are 25 microphones installed on the side wall, 13 microphones installed on ceiling panel and 42 microphones installed on overhead storage bins.

The controller supplies a bias voltage of 22 to 28 V dc to each microphone through a twisted pair cable. The microphone output signals are sent back to the controller superimposed on the bias voltage.

Sensors – Accelerometers

Refer to Figure 7.

The accelerometers used in the ANVS are small piezo electric sensors. The sensors are connected to interface circuitry and contained in sealed metal enclosures. Each enclosure is held in position with a bracket installed on the seat rail at stations LHS X 176 and X 236 and RHS X 204 and X 301.

The controller supplies a bias voltage of 22 to 28 V dc to each accelerometer through a twisted pair cable. The accelerometer output signals are sent back to the controller superimposed on the bias voltage.

Vibration Transducers

Refer to Figure 8.

The vibration transducer is a small piezo electric sensor with interface circuitry contained in a sealed metal case. The transducer is attached with a bracket to the engine gearbox.

Electrical power is supplied to the transducer from the controller as a bias voltage from the ANCU circular connector J7. Feedback signals from the vibration transducer to the controller also control the vibration intensity.

Power Distribution Box

Refer to Figure 2.

The Power Distribution Box is installed adjacent to the controller. It contains circuit breakers and relays for the application and control of electrical power to the system.

ANVS Control Panel (Part of the Flight Attendant Panel)

Refer to Figure 9.

The ANVS is labelled NVS SYSTEM on the flight attendant panel. The panel is located on the left side of the passenger compartment on the overhead bin end cap assembly adjacent to the airstair door.

The ANVS control panel contains two push−button switches and four lights for control and indication of the status of the ANVC system. The two switches are labelled ON/OFF and PAUSE. The LED labelled NVS INOP is installed below the push−button switches.

When the ON/OFF switch is pushed, its indicator comes on and the ANVS is energized. This switch should be left on at all times, unless the a system failure occur that requires the ANVC system to be shut down.

The ANVC system should be switched off during the aircraft maintenance. The off status light is illuminated when the ANVC system is powered down using the ON/OFF switch.

NOTE

The ON/OFF switch turns the ANVS on or off. This switch must be pushed and held for 4−5 seconds for it to change condition.

When the PAUSE push−button switch on the flight attendant panel is pushed, its indicator comes on and the ANVS goes into the standby mode. The power is supplied to the ANVC system, however it is not controlling the noise and vibration levels in the aircraft.

The pause switch is used for maintenance of the ANVC system.

NOTE

The PAUSE function can only be activated when the ANVS is on.

NOTE

The NVS INOP LED comes on when there is a fault in the NVS system or when the NVS is off.

There are two types of flight attendant panels:

- Flight attendant panels without sleep mode (Wessex Advanced Switching Products)
- Flight attendant panels with sleep mode (EMTEQ)

The flight attendant panel with the sleep mode has a power−saving feature to conserve the battery power when the aircraft is not in use. When only aircraft battery power is available, the flight attendant panel will monitor the status of the boarding lights only. The boarding lights are the only system controlled from the flight attendant panel that gets electrical power directly from the aircraft batteries. If the boarding lights are in the off position, the panel will go into the sleep mode. In the sleep mode the panel minimizes power consumption and appears de−energized.

When the boarding lights pushbutton is pushed, the boarding lights will come on and the panel comes out of the sleep mode. The panel will also come out of the sleep mode when the electrical busses that supply the other systems controlled from the flight attendant panel are energized. The cabin temperature, the NVS, and the lights other than the boarding lights, get their electrical power from the 28 VDC main, essential or secondary busses. When power is applied, these functions will remember their last condition (on or off).

Maintenance Panel

Refer to Figure 10.

The maintenance panel is a part of the Central Diagnostics System (CDS). It is used to access and clear (reset) fault and degraded conditions. The panel is used only when the ANVS is in the Maintenance Mode and with the aircraft on the ground.

The ANVS SYS DEGRADED LED is installed on the maintenance panel. The maintenance panel is installed in the avionics rack on the left side of the aircraft between stations X−1.75 and X−21.75.

Propeller Balance Monitoring System (PBMS)

During flight, the controller processes the outputs of the two vibration transducers. The controller also processes engine speed and amplitude data.

The controller automatically records and stores the data necessary to make sure the level of unbalance is within specified limits.

The ANCU continuously monitors the PBMS vibration transducer inputs.

Defective vibration transducers can be confirmed with the Maintenance Terminal before any balance data is used for propeller balance. Propeller balance data can be collected on the ground during an engine ground run with the PBMS Terminal.

The unbalance data stored in the controller can be retrieved through a serial interface to the PBMS Terminal. Up to 70 hours of rolling flight data can be stored at any one time.

The PBMS Terminal interprets the data to display vibration levels and calculate balance solutions. The balance solutions define a distribution of masses necessary to get the balance within specified limits.

Components of the PBMS include the ANCU, the engine transducers, the PECU tachometers, the PSEU, and the PBMS Terminal.

The controller input signals (through connector J1) use the same WOW signal as used by the ANVS. This is used to identify when the aircraft is on the ground. Other ANCU input signals through connector J1 are:

- Tachometer signals – supply the controller with propeller rpm data
- Indicated Air Speed (IAS) – supplied by the PECU
- External temperature – supplied by the PECU
- PBMS engine transducer “health” – When flight/vibration data is sampled, the “health” of each engine transducer is also recorded. If the engine transducer health is “bad” at the time of the sample, then that sample will not be used in the balance solution.

The PBMS Terminal contains Ultra Electronics proprietary software that runs on a PC. The basic functions that follow are supplied:

- Reads data from the controller and stores the data on the terminal hard drive.
- Shows the initial moment and vibration levels.
- Calculates the balance weight installation necessary to keep propeller vibrations at a minimum.
- Prints out the initial and final moment and vibration data.

ANVS Operation

The ANVS has four modes of operation:

- Start−Up
- Standby
- Active Control

– Maintenance.

Start–Up Mode

When power is applied to the ANVS or the system is reset, the controller does a series of self–tests. This is done to make sure all the components are operating correctly.

If the controller fails any of the tests, the system STATUS LED on the ANCU front panel changes from green to red. The NVS INOP LED on the flight attendant panel comes on and the controller goes into the maintenance mode.

If all tests are passed, the controller is initialized from configuration data, calibration data, and system status data stored in its nonvolatile memory.

Configuration Data

The configuration data contains all the parameters that define the system configuration for the series of aircraft installation. Each aircraft installation is identified by the aircraft identification variant (aircraft ID) inputs to the controller. The aircraft ID variant is an 8–bit hard wire code on aircraft connector J1A.

The code is stored with the configuration parameters and on initialization, the ANCU checks the identity of the configuration data against the aircraft ID.

If the configuration data is correct, the calibration data is expanded from the compressed form stored in the controller nonvolatile memory. Its format is then checked against the necessary format of the configuration parameters.

If the configuration data is invalid, the system STATUS LED on the controller front panel changes from green to red. The NVS INOP LED on the flight attendant panel comes on and the controller goes into the maintenance mode.

System Status Data

After the calibration data has been checked, the system status is read. The data gives information on the status of the microphones and ATVAs. Any microphone and/or ATVA that has failed is disabled and will not be used in the active control mode.

The number of failed microphones and ATVAs is compared with two limits set in the system configuration data.

If the number of failures is more than the degraded limit, the system STATUS LED on the controller front panel changes from green to orange. The ANVS SYS DEGRADED lamp on the maintenance panel comes on. The system will still operate in the control mode with degraded performance. No maintenance action is necessary.

If the number of failures is more than the failed limit, the system STATUS LED on the controller front panel changes from green to red, the NVS INOP LED on the flight attendant panel comes on and the controller goes into the maintenance mode. The system will not operate until a maintenance session has been done and all faults are corrected.

When the ANVS is serviceable, the system STATUS LED on the controller front panel is green.

If there is a system or controller fault that the system cannot clear automatically, then the system goes into the maintenance mode. The system STATUS LED on the controller front panel changes from green to red, and the NVS INOP LED on the flight attendant panel comes on.

Standby Mode

The system goes into the standby mode when there are no output control signals from the ATVAs through the power amplifiers.

The controller continually monitors the propeller tachometer and cabin pressure inputs. Pressure data is supplied by the Cabin Pressurization Control System (CPCS) through the ARINC 429 bus. If the tachometer or pressure inputs are within range, the system goes into the active control mode. If the tachometer or pressure input goes out of range, the system goes into the standby mode.

NOTE

The system goes into the control mode when the tachometer input frequency goes from 85 – 102 Hz (angular speed of 850 – 1020 rpm) and the cabin pressure input goes from 0–6 psi.

Active Control Mode

During the control mode the controller monitors the microphone channels, which send an inaudible test tone to each ATVA. The tone is measured at each microphone.

If faulty actuators or microphone channels are found, those actuators or channels are disabled for the remainder of the flight. The faulty actuators or microphones are restored when the WOW signal changes from air to ground.

Any actuator or microphone that is faulty for three successive flights is permanently failed until maintenance action is taken.

If the number of permanent failures is more than the degraded limit, the system STATUS LED on the controller front panel changes from green to orange. The ANVS SYS DEGRADED LED on the maintenance panel comes on. The system still operates in the control mode with degraded performance. The degraded limit is set at two failed channels.

If the number of ATVA or microphone channels is more than the failed limit, the system STATUS LED on the controller front panel changes from green to red. The NVS INOP LED on the flight attendant panel comes on and the controller goes into the maintenance mode. The failed limit is set at four failed channels.

One failed ATVA or microphone channel does not cause the ANVS SYS DEGRADED LED or the NVS INOP LED to come on.

Two failed channels cause the ANVS SYS DEGRADED lamp to come on, and four failed channels cause the NVS INOP LED to come on.

When the PAUSE push–button switch on the flight attendant panel is pushed, its indicator comes on and the system is held in the standby mode. In this condition, if the aircraft power is switched off and on again, the system continues to be in the standby mode until the PAUSE switch is pushed again. At that time, its indicator goes off and the system starts again.

The end of a flight is identified when the WOW input shows the aircraft has landed. The controller goes off, then comes on again and completes the start–up mode.

If the propeller tachometer and cabin pressure inputs are in range, the system goes into the control mode with the aircraft on the ground.

NOTE

No faults occur with the aircraft on the ground and the system in the control mode.

If there is a system or controller fault that the system cannot clear automatically, then the system goes into the maintenance mode. The system STATUS LED on the controller front panel changes from green to red.

Maintenance Mode

Maintenance mode provides first line tests for the complete ANC system and second line tests for the ANCU.

First line testing is achieved with the ANC Maintenance Terminal (MT) (Part Number 8–800–01–001) and the System Installation Test Set (Part Number 8–800–09–001). Second line testing is achieved with the ANC MT used in conjunction with the ANCU Second Line Test Set (Part Number 8–800–19–005).

The controller goes into the maintenance mode if a MT is connected to connector J5 on the ANCU front panel, or at system start–up.

If the ANVS is not in the active control mode or if there is a system fault, the controller also goes into the maintenance mode.

A self–test function lets the maintenance terminal start a Built–In–Self Tests (BIST) using MT Software Part Number SW–800–99–013. The results are shown on the maintenance terminal display.

The inputs that follow are shown on the MT display:

– Propeller rpm frequency
– Weight–on–wheels inputs
– Aircraft identification variant
– Pause
– Pressure
– Cabin configuration.

The tests that follow are included in the maintenance mode of operation:

– Configuration Parameters
– Automatic Actuator and Microphone Test
– Step Through Actuator Test and Manual Actuator Test
– System Calibration Test.

Configuration Parameters

The controller is configured for different aircraft types and different ANVS installations. All the configuration parameters are stored in the maintenance terminal in a database.

The configuration parameters are stored in the controller nonvolatile memory by downloading data files that contain specific aircraft configuration parameters.

The MT does the tasks that follow:

– Finds the data to be loaded with the aircraft variant identity inputs to the controller.
– Makes sure that the configuration parameters loaded in the controller are valid for the installation.
– If the parameters are valid, automatically loads the correct configuration parameters.

Automatic Actuator and Microphone Test

The controller sends an audible test tone sequentially to each ATVA and measures the response at each microphone. Any ATVA or microphone that fails the thresholds set in the configuration parameters is disabled and will not be used in the control mode.

NOTE

This test clears previously disabled channels that have been repaired. A system fault is shown if the calibration procedures have not been done on a failed channel that is serviceable.

Step Through Actuator and Manual Actuator Test

The controller sends an audible test tone to an ATVA selection. Each ATVA can be manually enabled or disabled. In the Step Through Actuator Test, the actuators are sequenced in a set pattern by operator input. In the Manual Actuator Test, the only actuator tested is chosen at the start of the test by the operator.

System Calibration Test

The controller sends audible test tones to all actuators at the same time. The control unit calculates and stores the acoustic transfer function of the loudspeaker/microphone array.

NOTE

Calibration is not performed on ATVAs and microphones that have previously failed. A calibration test cannot clear failed channels.

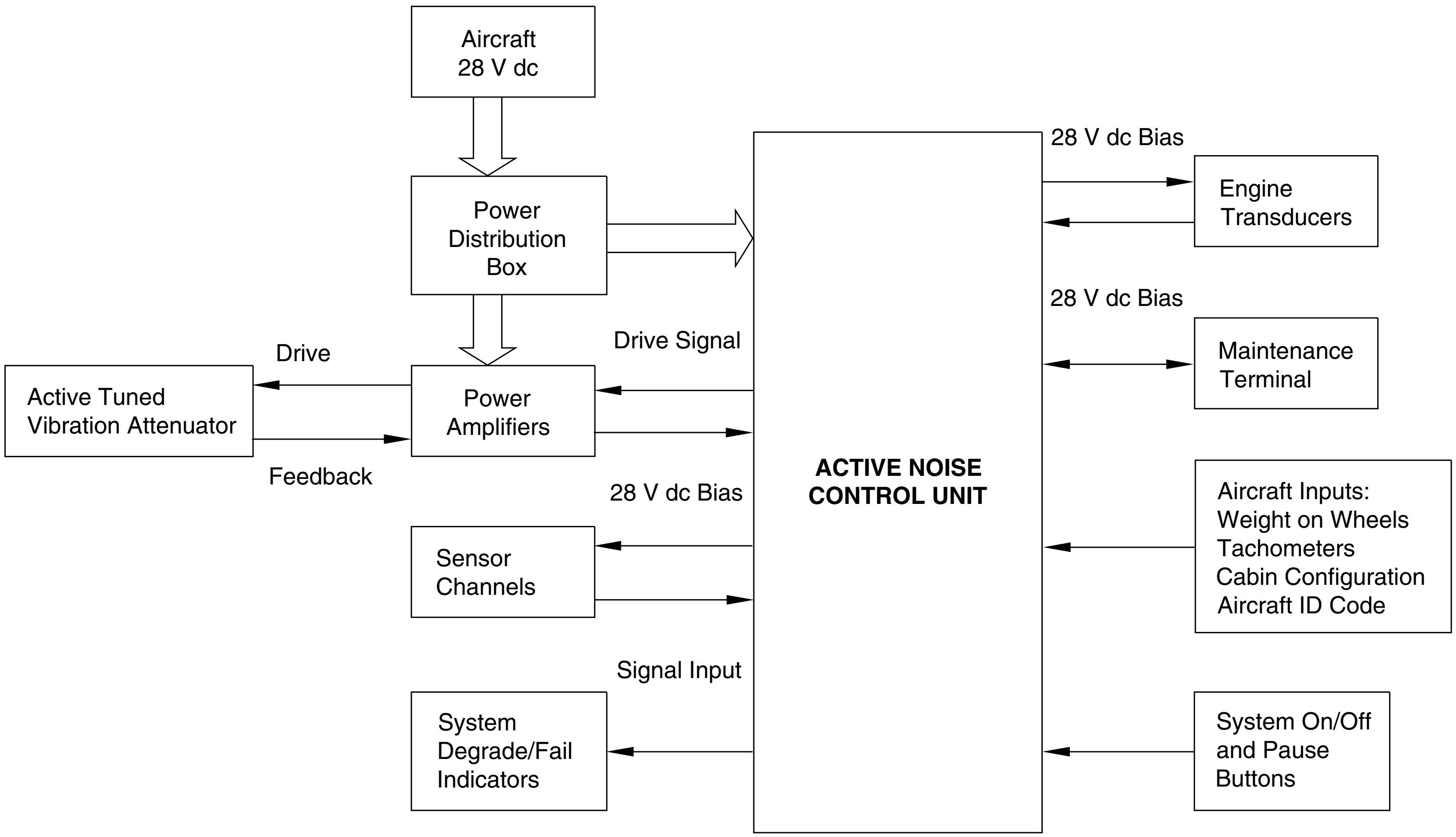
The read transfer function lets the calibration data stored in the controller non–volatile memory to be downloaded and stored in the maintenance terminal.

The load transfer function lets the calibration data stored in the MT to be loaded in the controller non–volatile memory.

Other attributes of the maintenance terminal are:

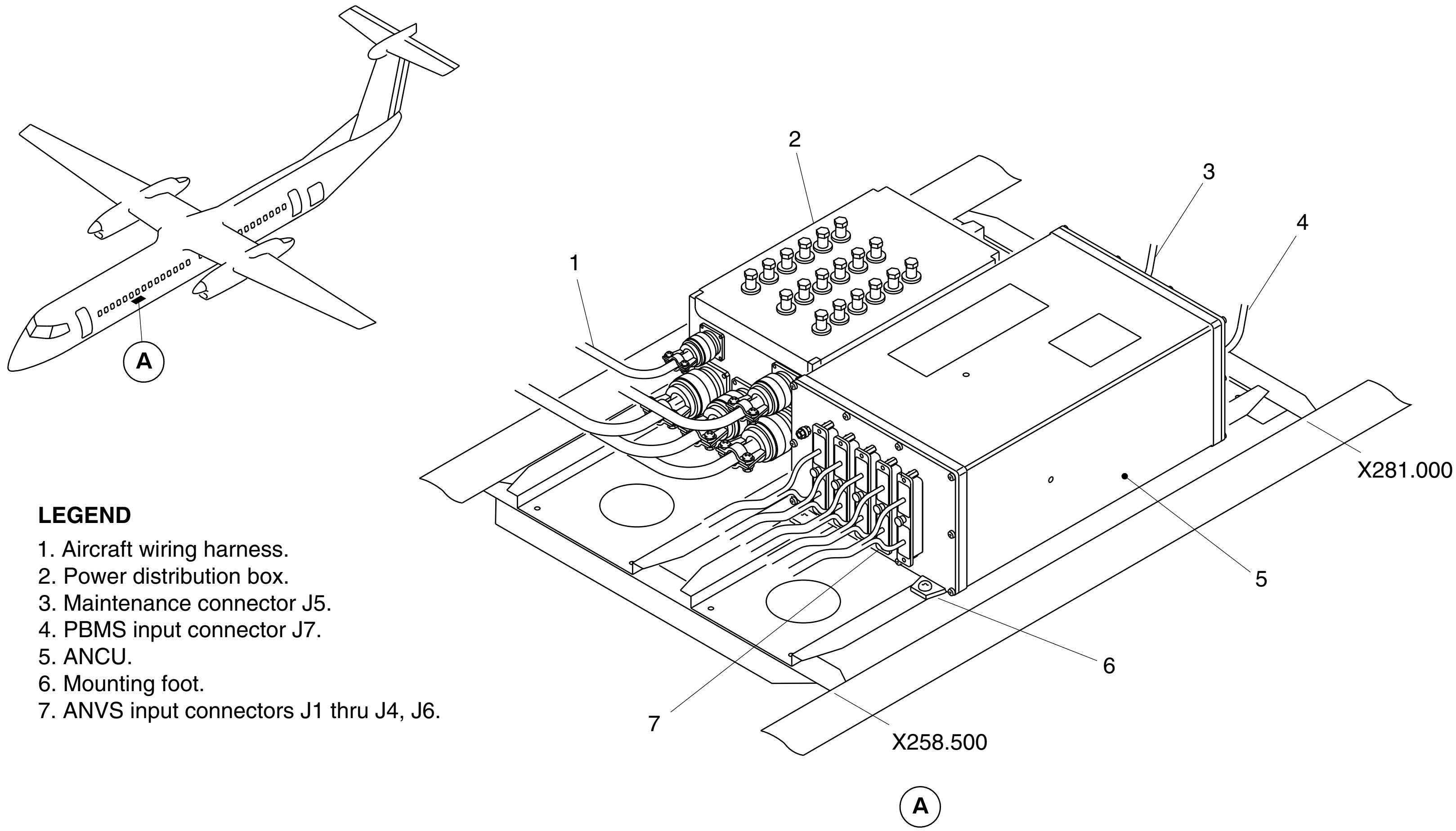
– System Diagnostics Screen – Used to show aircraft inputs to the controller, which are then shown on the maintenance terminal display.

– System Hours and Number of Flights – Gives the number of hours and number of flights recorded by the ANCU. The data is shown on the maintenance terminal display.



nv030a01.dg, gv/rc, dec05/2011

Active Noise and Vibration System (ANVS) – Block Diagram
Figure 1

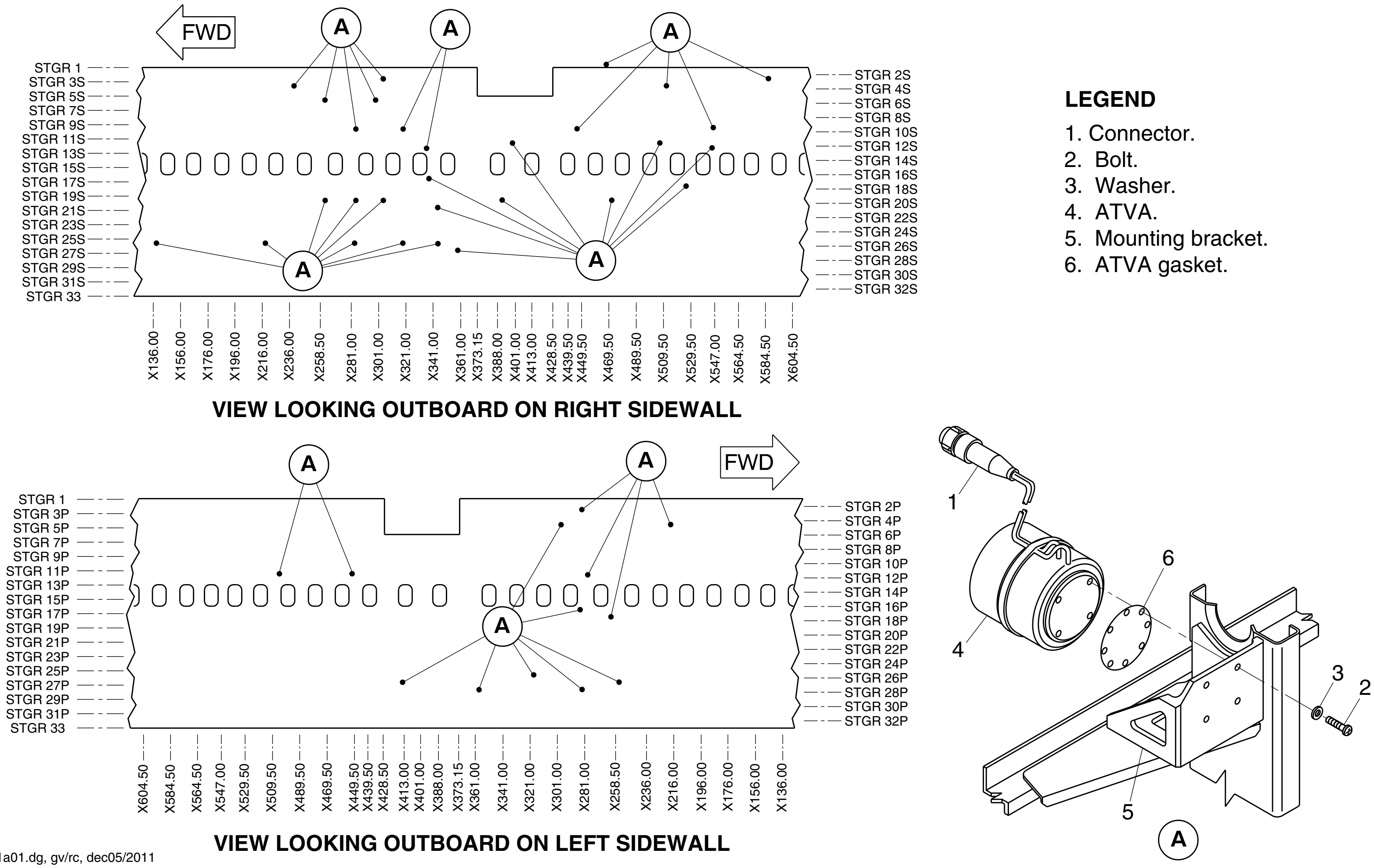


LEGEND

1. Aircraft wiring harness.
2. Power distribution box.
3. Maintenance connector J5.
4. PBMS input connector J7.
5. ANCU.
6. Mounting foot.
7. ANVS input connectors J1 thru J4, J6.

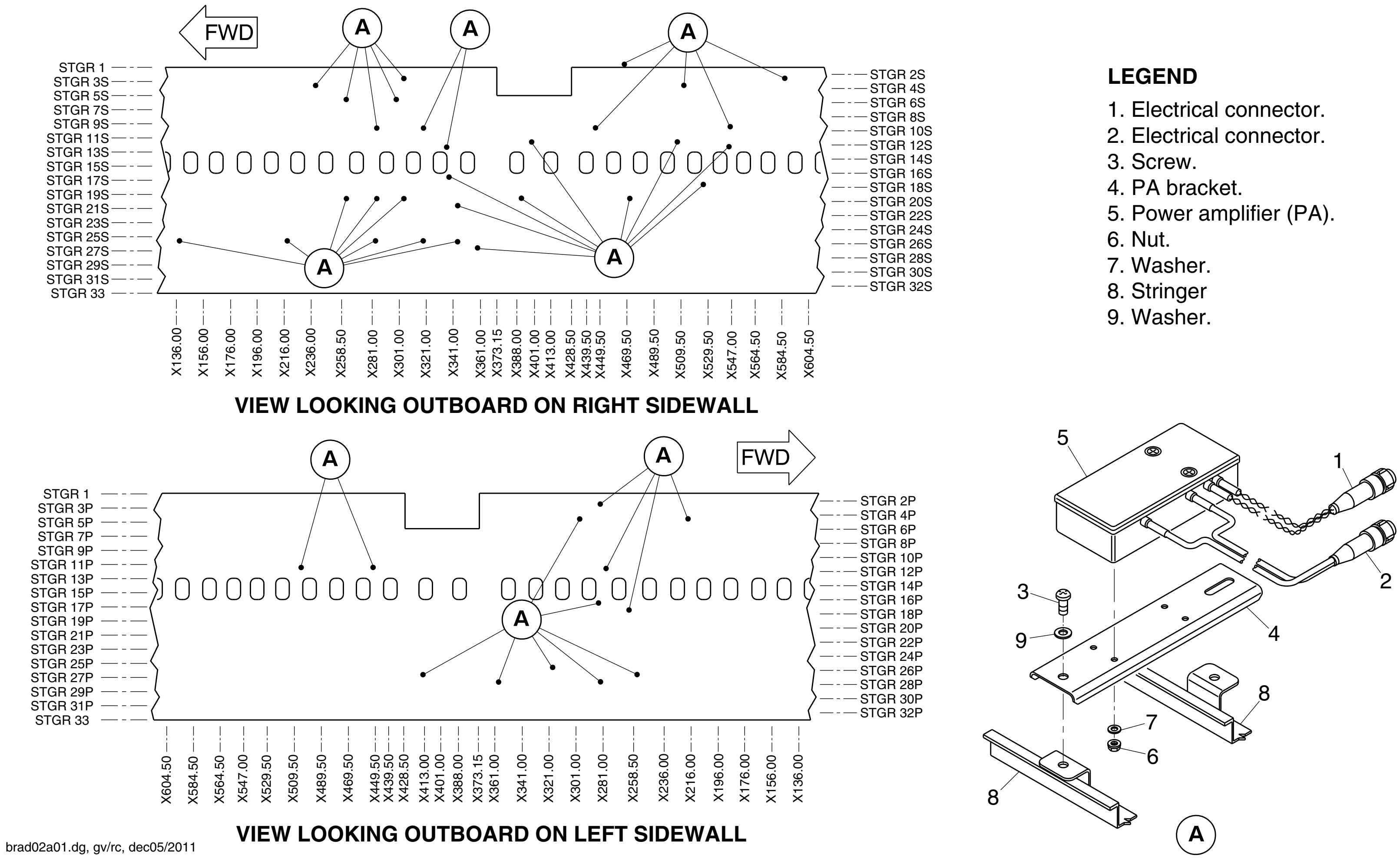
brad06a01.dg, gv, 12/07/01

Active Noise Control Unit (ANCU) Installation
Figure 2



brad01a01.dg, gv/rc, dec05/2011

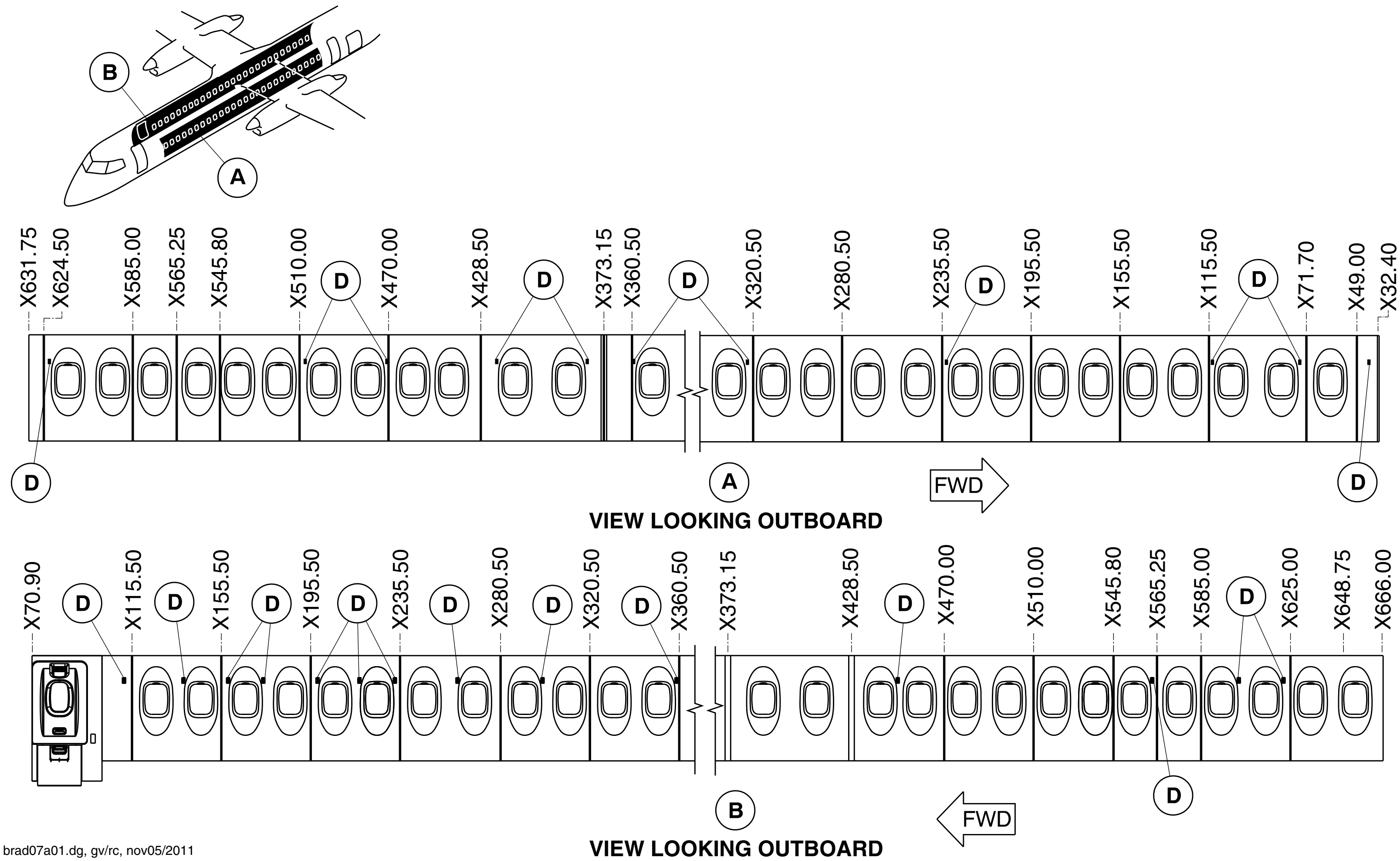
Active Tuned Vibration Attenuator (ATVA) Installation
Figure 3



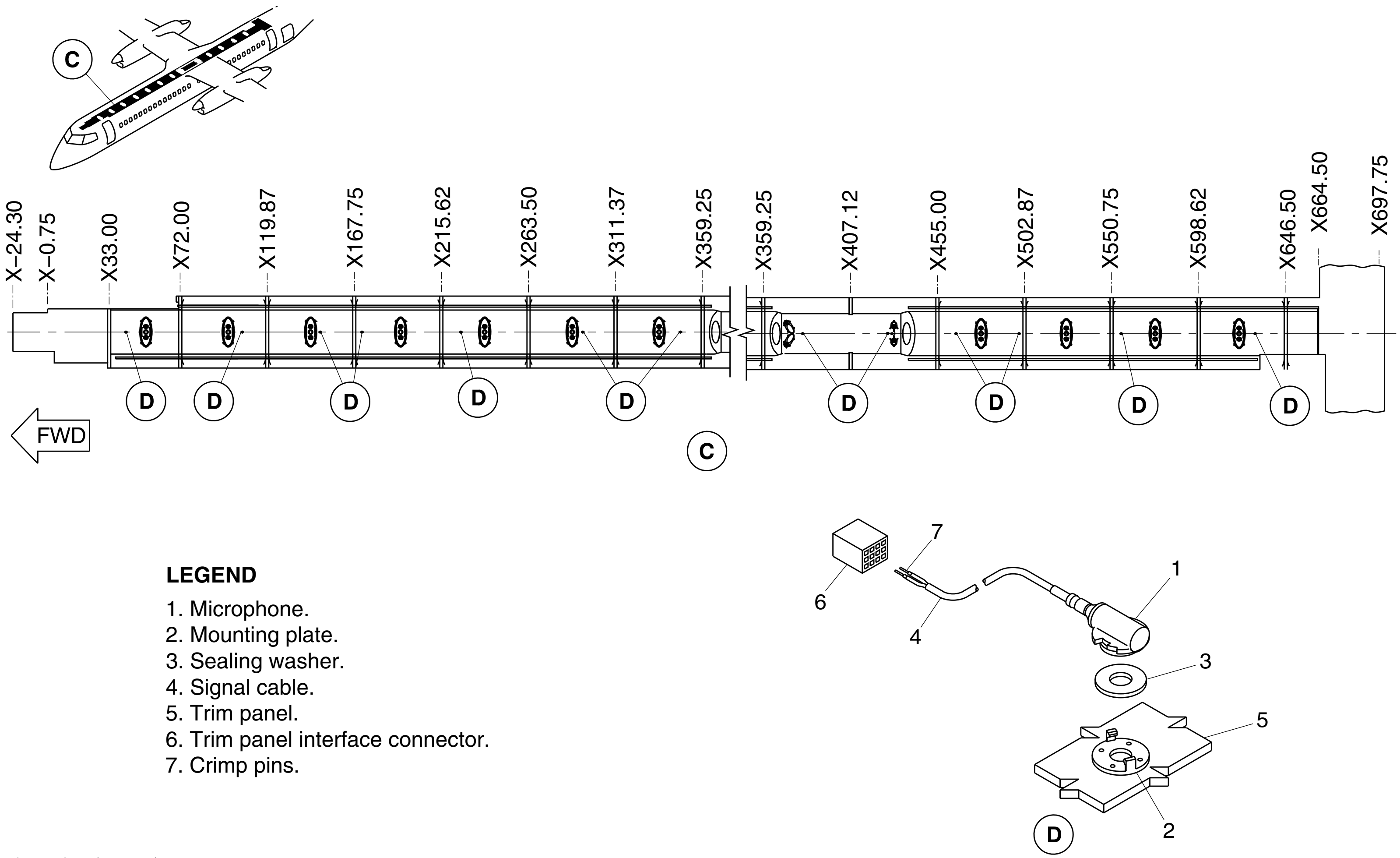
LEGEND

1. Electrical connector.
2. Electrical connector.
3. Screw.
4. PA bracket.
5. Power amplifier (PA).
6. Nut.
7. Washer.
8. Stringer
9. Washer.

Power Amplifier (PA) Installation
Figure 4



Sensor Installation – Side Walls and Ceiling Panels (Typical)
Figure 5 (Sheet 1 of 2)

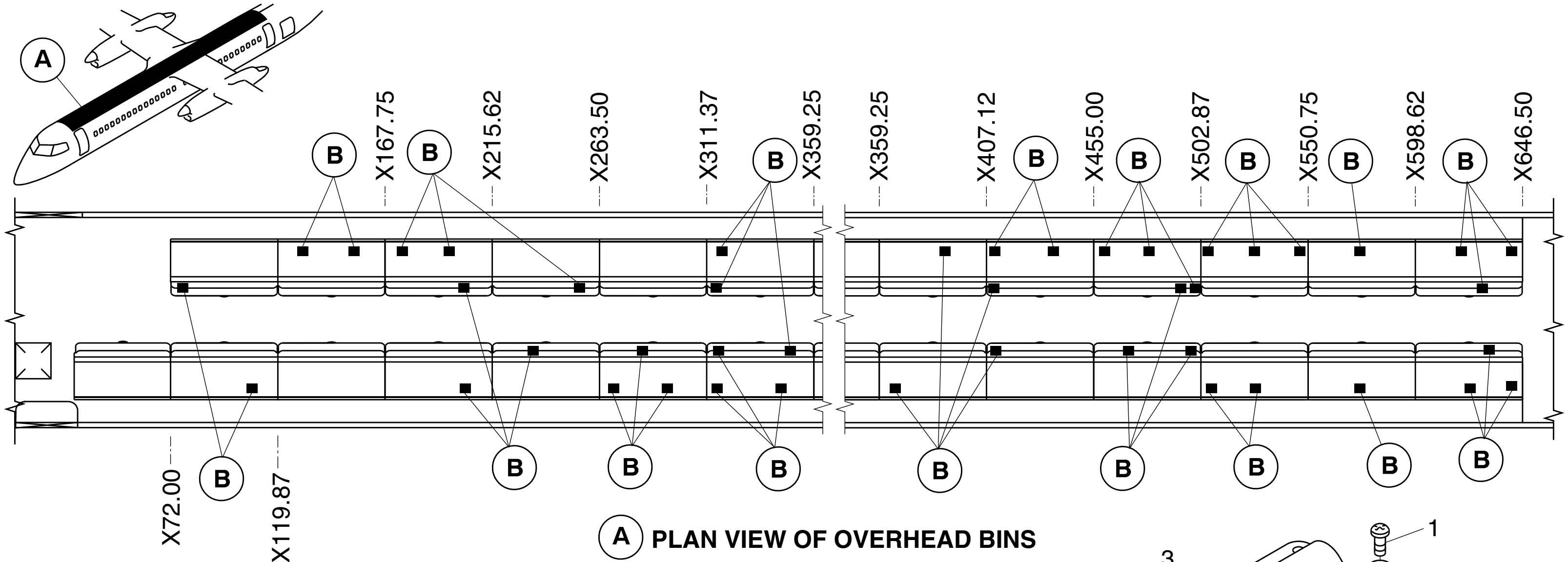


LEGEND

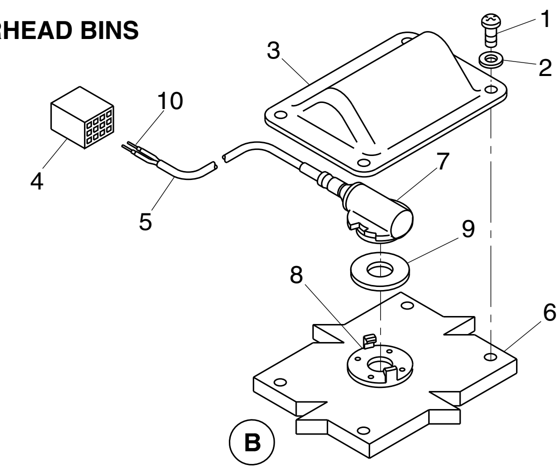
1. Microphone.
2. Mounting plate.
3. Sealing washer.
4. Signal cable.
5. Trim panel.
6. Trim panel interface connector.
7. Crimp pins.

brad07a02.dg, gv/rc, nov05/2011

Sensor Installation – Side Walls and Ceiling Panels (Typical)
Figure 5 (Sheet 2 of 2)



A PLAN VIEW OF OVERHEAD BINS

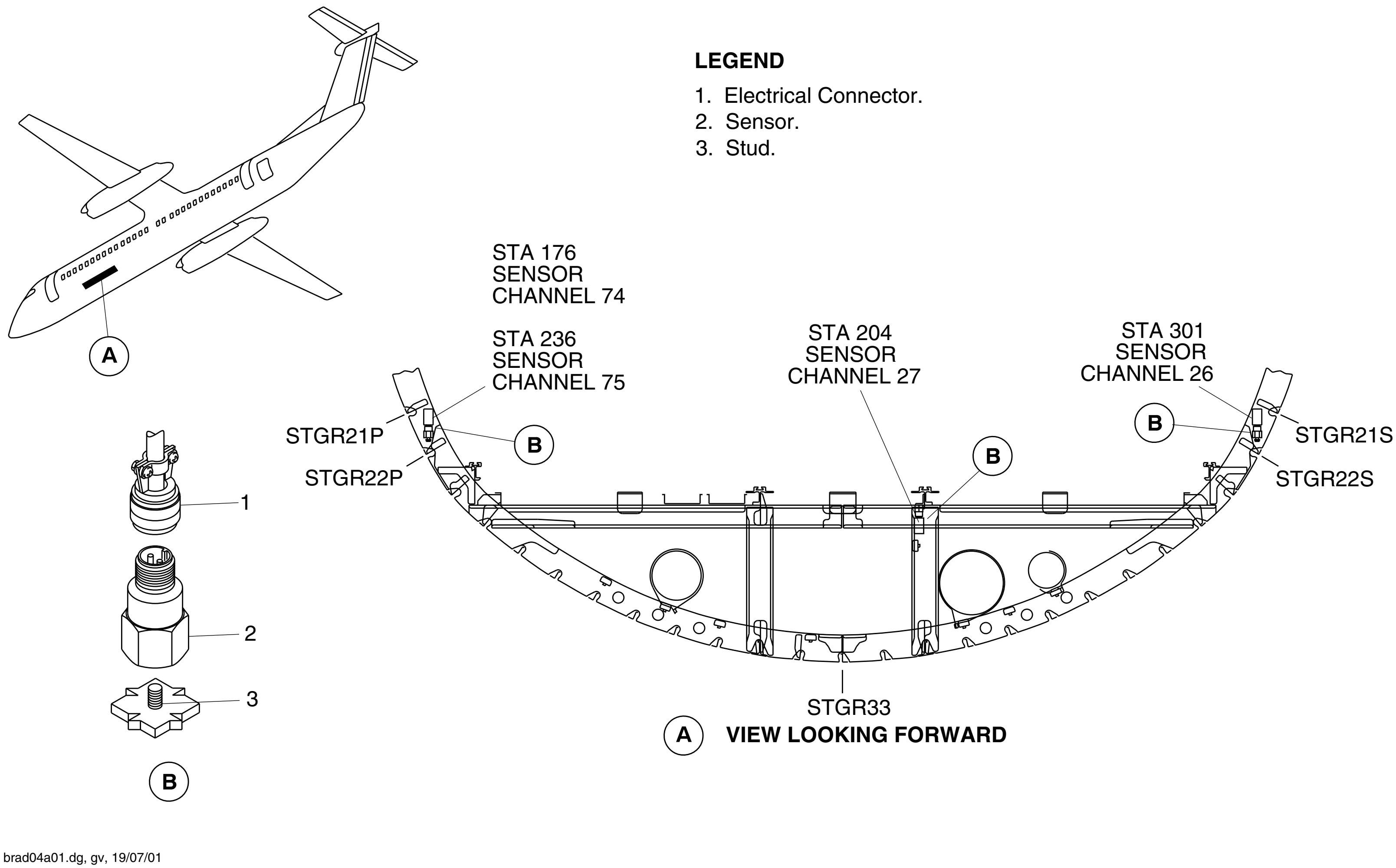


LEGEND

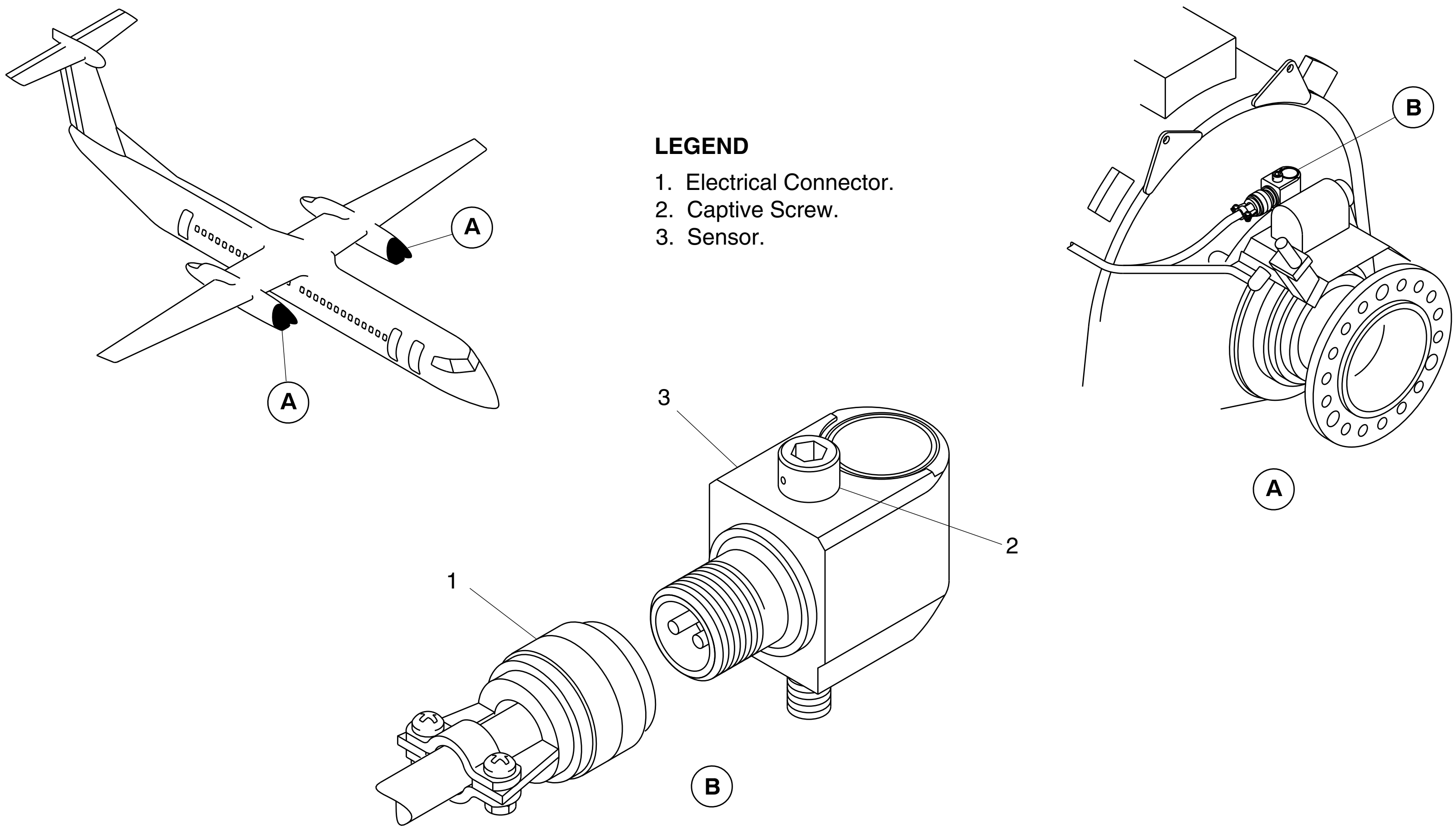
1. Screw.
2. Washer.
3. Cover.
4. Trim panel interface connector.
5. Signal cable.
6. Overhead storage bin.
7. Microphone.
8. Mounting plate.
9. Sealing washer.
10. Crimp pins.

brad08a01.dg, gv/rc, dec05/2011

Sensor Installation – Overhead Storage Bins (Typical)
Figure 6



Sensors/Accelerometer (Floor Sensor) Installation
Figure 7

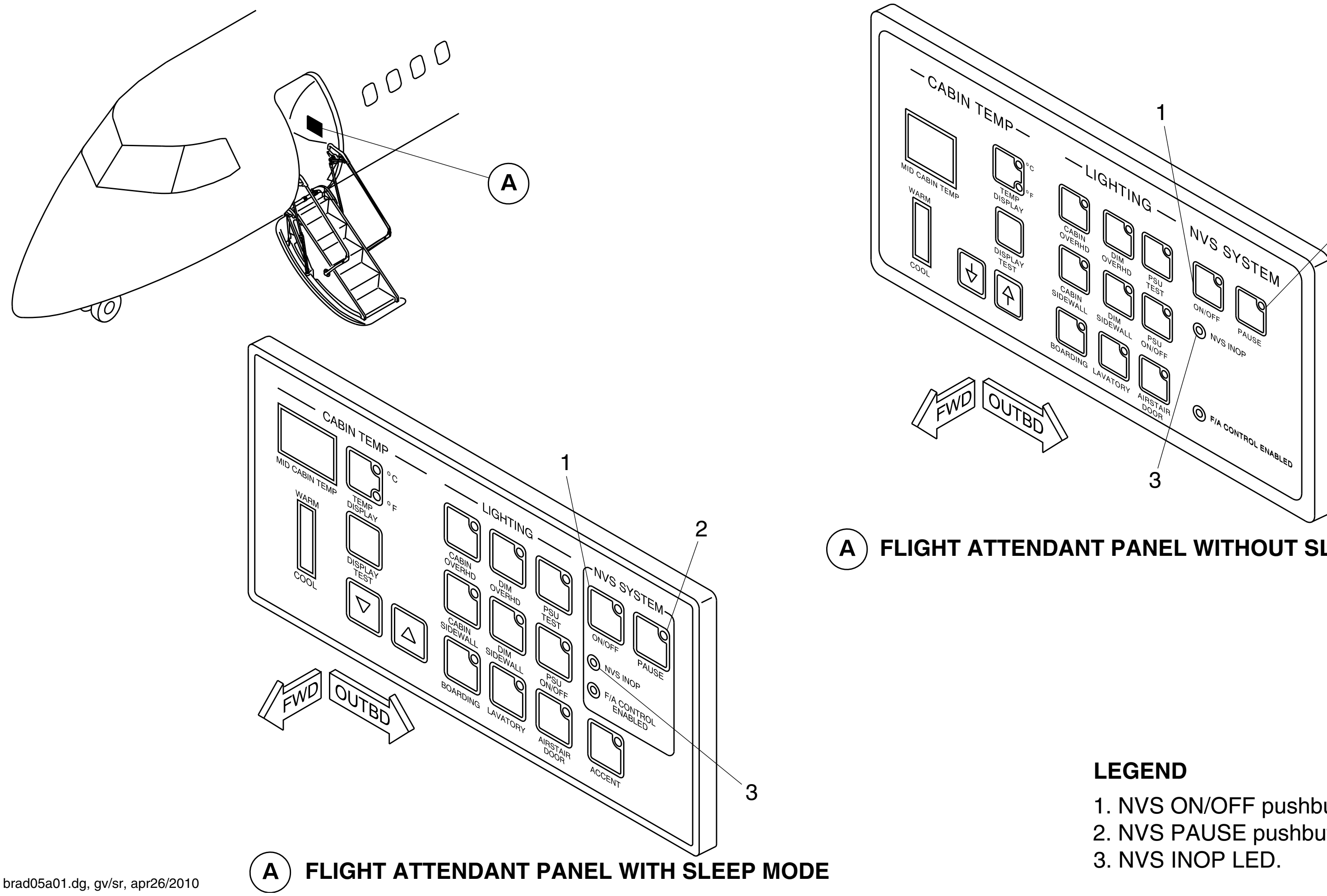


LEGEND

1. Electrical Connector.
2. Captive Screw.
3. Sensor.

brad03a01.dg, gv, 12/07/01

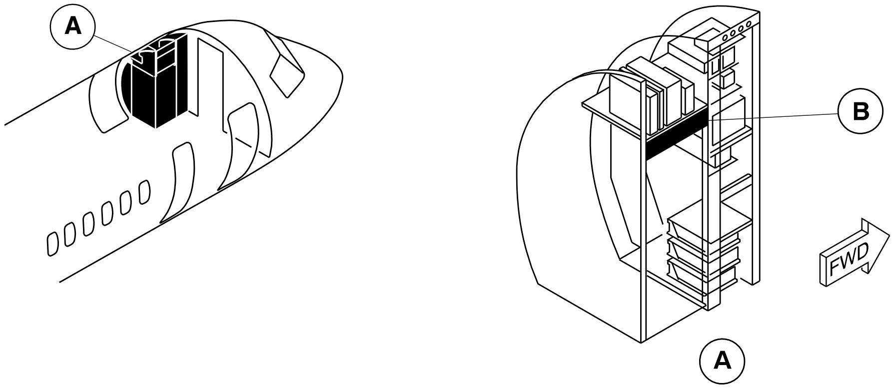
Vibration Transducer Installation
Figure 8



LEGEND

1. NVS ON/OFF pushbutton switch.
2. NVS PAUSE pushbutton switch.
3. NVS INOP LED.

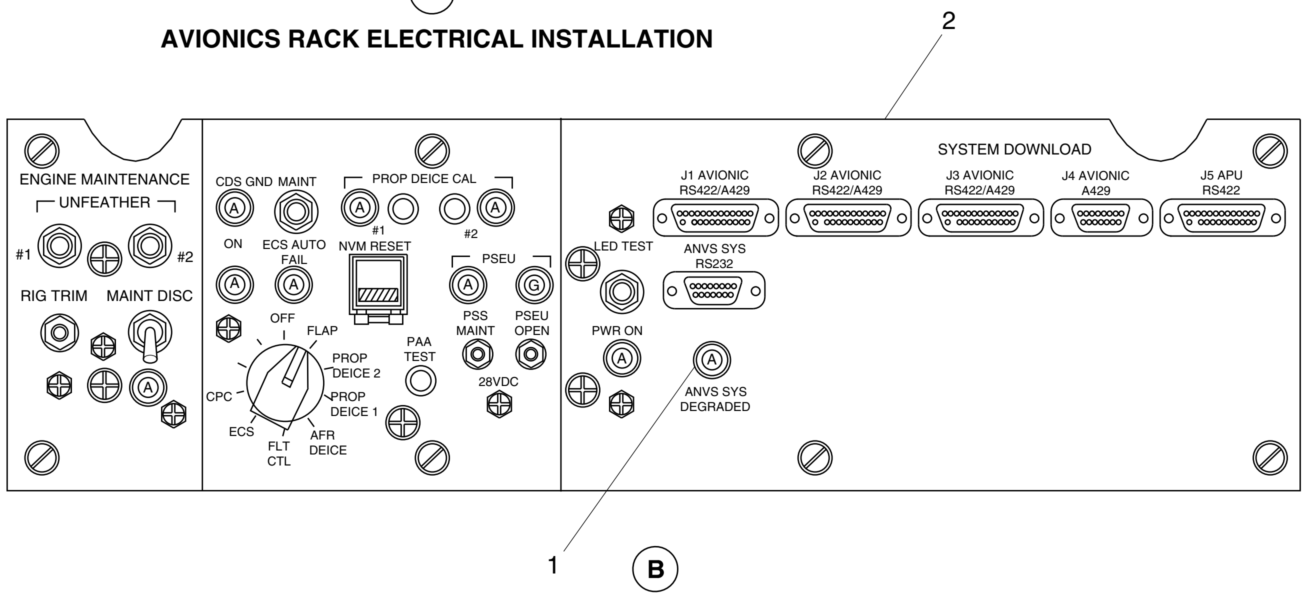
Flight Attendant Control Panel
Figure 9



AVIONICS RACK ELECTRICAL INSTALLATION

LEGEND

1. ANVS SYS DEGRADED Indicator.
2. Maintenance panel.



nv032a01.dg, gv, 19/07/01

Maintenance Panel
Figure 10

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–50–00–001

AUDIO INTEGRATION SYSTEM

Introduction

The Audio Integration System (AIS) controls the audio functions that follow:

- Monitor radio communications receivers and make transmissions
- Monitor the radio navigation receivers
- Interphone communications between pilot, copilot, observer and ground crew members.

The system also supplies voice from the Enhanced Ground Proximity Warning System (EGPWS) and warning tones from the Flight Data Processing System (FDPS1 and FDPS2).

General Description

Refer to Figure 1.

The AIS interfaces with the Audio and Radio Control Display Units (ARCDU1 and ARCDU2) of the radio management system, Passenger Address Amplifier (PAA) of the Passenger Address and Communications Interphone System (PACIS) and Cockpit Voice Recorder (CVR).

Detailed Description

System Description (System Overview):

The AIS has the components that follow:

- Unit, Remote Control Audio (RCAU) (23–51–01)
- Panel, observer's audio control (23–51–11)
- Speaker, flight compartment (23–51–16)
- Microphone, hand (23–51–21)
- Boxes, jack – flight compartment (23–51–26)
- Box, jack – observer's (23–51–31)
- Boxes, jack – ground crew (23–51–36)
- Switch, PTT – copilot's side console (23–51–41)
- Switch, transmit/interphone – hand wheel (23–51–43)

The RCAU is controlled by ARCDU1, ARCDU2, and the observer's Audio Control Panel (ACP).

Audio received by the RCAU is supplied to the speakers and pilot's and copilot's jack boxes from the systems that follow:

- Ground crew jacks
- Navigation and communication radios (VHF1, VHF2, VHF3, HF, VOR1, VOR2, ADF1, ADF2, DME1, DME2 and marker beacon)
- PAA
- EGPWS
- Traffic Collision and Avoidance System (TCAS)

– Warning tones from Input/Output Modules (IOM1 and IOM2).

Audio and an interphone push–to–talk (PTT) are supplied to the RCAU for interphone communication, and audio and a radio PTT to communication radios for transmission.

The RCAU controls the lights in the attendant handsets and advisory lights panels for PACIS.

A weight–on–wheels signal is supplied from the Proximity Sensor Electronics Unit (PSEU) to disconnect the ground crew interphone connections when the aircraft is airborne.

The pilot, copilot, observer and passenger address audio is supplied to the CVR.

The Flight Data Recorder (FDR) receives a transmit keying signal through IOM2 to record the transmit parameter.

ARINC 429 BITE data is supplied to Input/Output Processor (IOP1) for data for pilot, copilot and observer's audio cards.

Refer to Figure 2.

The RCAU contains the circuit cards that follow:

– Pilot audio card
– Copilot audio card
– Observer audio card
– Pilot speaker amplifier card
– Copilot speaker amplifier card
– Adaptation card.

The pilot's audio card of the RCAU is usually energized by the left essential or right main bus, but when the emergency lights are on, an emergency lights power supply energizes a relay to change the electrical power source to right battery power bus.

The copilot's audio card is energized by the right essential and the left main bus, and the observer's by the right main bus.

The pilot's speaker card is energized by the left essential bus and the copilot's from the right essential dc bus.

The buses are isolated with diodes.

The adaptation card has an interface with:

– The units connected to the CAU (radio transceivers, receivers and PACIS system)
– The audio cards.

The adaptation card includes the functions that follow:

– Adaptation of the reception inputs and earphone emergency part
– Interphone amplifier part
– PACIS light controls and discretes part
– Transmission of cockpit amplifier signals.

Unit, Remote Control Audio (RCAU)

Refer to Figure 3.

The RCAU is installed on a mounting tray on the wardrobe shelf.

The RCAU assembly is contained in an aluminium case. Two hooks are installed at the base of the front panel to secure the RCAU to its mounting tray.

The RCAU contains the components that follow:

- Filter
- Mother board
- Input processing card
- Audio cards
- Cockpit amplifier circuit cards

Filter: A filter section gives protection against High Intensity Radio Frequency (HIRF), lightning and other electromagnetic effects.

Mother board: The mother board gives electrical connections between other boards and the rear panel connector. It has circuitry to protect the other cards from transient voltages.

Input processing card: The input processing card receives inputs and supplies to the pilot, copilot and observer audio cards. This card also supplies power to the boom/mask relays, attendant handset and ground–crew microphones, and interphone amplifiers.

NOTE

The ground crew interphone function is disabled when a weight–off–wheels condition is sensed to prevent interference when airborne.

The input processing card controls the passenger address, call and emergency modes. An input signal is received from ARCDU1 or ARCDU2 and a logic 1 (20 VDC to 30 VDC) is supplied to the PAA for the chime function.

Audio cards: Audio selections are supplied from ARCDU1, ARCDU2 and the observer's ACP to a related pilot, copilot and observer audio card in the RCAU and the RCAU output ARINC 429 busses return confirmatory data to each ARCDU.

The card has protection against polarity reversals and transient voltage. Power is removed if the emergency mode is set by a NORM/EMER toggle switch selection on ARCDU1 or ARCDU2.

Refer to Figure 4.

The pilot, copilot, and observer's audio card have input signals that pass through a low–pass filter and are digitized for Digital Signal Processing (DSP). The DSP receives selection and volume level inputs from the ARCDUs and the ACP. It uses digital processing to give applicable analog outputs to headsets and flight compartment speakers.

Power–up tests are done by the audio cards and comprise the generation of wraparound test signals which are amplified, sensed at the output and fed back to DSP to conform the identical characteristics.

Boom, oxygen mask and hand microphone excitation is supplied by the audio cards for interphone operation only.

Radio transmission microphone bias is supplied by the applicable radio. The microphone selection is controlled by the DSP circuitry and if the keyline is activated for more than 3 minutes, it is automatically disabled. Also simultaneous transmission of two or more transmitters is not possible.

Audio is automatically supplied from the audio card to the applicable CVR channel. It has a hot microphone so a keyline selection is not necessary for the microphone audio to be recorded. So, when wearing headsets, the conversations of the pilots are recorded without the use of the interphone.

The audio supplied to the CVR relates to the audio and volume selection of ARCDU1, ARCDU2 and the ACP.

When the NORM/ EMER toggle switch on ARCDU1 or ARCDU2 is set to the EMER position, power to the related audio card is removed and relays route the pilot and copilot headset audio, microphones and keylines directly to VHF1 or VHF2. In this mode, CVR inputs are not available and the stuck–microphone function is disabled.

The discrete output signals to control the PACIS CALL, EMER, and PA annunciations and SELCAL message (CALL HF1) on ARCDU1 and ARCDU2 are controlled by the DSP.

Refer to Figure 5.

The RCAU has two amplifier cards to receive low level signals and after amplification, are supplied to the flight compartment speakers. It has the functions that follow:

- Power Supply
- Audio and Aural alerts
- Muting Circuit
- Power Amplifier

Panel, observer’s audio control

Refer to Figure 6.

The observer’s ACP is installed in the rack behind the copilot’s seat.

The front panel has a transmitter keyboard with switches that are mechanically interlocked so that only one can be pushed at a time, an INT/RAD toggle switch, and potentiometers for volume control.

The observer’s ACP changes the front panel audio and PTT selections into ARINC 429 data for transmission to the RCAU.

Speaker, flight compartment

Refer to Figure 7.

The speakers are installed in a recess in the ceiling.

Each flight compartment speaker can output 10 watts audio power. The speaker impedance is 4 ohms.

Microphone, hand

Refer to Figure 8.

The hand microphones are put on mounting brackets on the control columns.

Jack Boxes – flight compartment

Refer to Figure 9.

The jack boxes are installed in the flight compartment, on the wall behind the pilot’s and copilot’s seat.

Jack Box – observer

Refer to Figure 10.

The observer’s jack box is installed in the rack behind the copilot’s seat.

Jack Boxes – ground crew

Refer to Figures 11 , 12 and 13.

The jacks are installed in three locations on the aircraft. The nose jack is located above the door for dc ground power. The nacelle jack is located on the refuel/defuel panel in the aft right nacelle. The tail jack is located in the tail maintenance area.

The ground crew jack box has a single headphone and microphone jack with a switch to control the advisory lights in the flight compartment.

Switch, PTT – copilot's side console

Refer to Figure 14.

The PTT switch is located in the flight compartment on the copilot's side console.

Switch, transmit/interphone – hand wheel

Refer to Figure 15.

There is a switch on the outboard side of each of the hand wheels.

Controls and indications

Refer to Figure 16.

The pilot and copilot's headset microphone plug is connected to the BOOM jack and the headset audio plug is connected to the NORMAL. The quick–don oxygen mask plug is connected to the MASK jack.

The AUX jack is used to supply audio from the opposite audio card of the RCAU if the related card has malfunctioned. So, if the pilot's headphone audio plug is connected to the AUX jack, the ARCDU2 is used to control the audio selections.

Headphone audio is received from:

- VHF communications 1
- VHF communications 2
- HF communications 1
- VHF communications 3 or UHF communications
- HF communications 2 or VHF–FM communications
- VHF navigation 1
- VHF navigation 2
- Sum of marker audio from VHF navigation 1 and VHF navigation 2
- Distance Measuring Equipment (DME1)
- DME2 (if installed)
- Automatic Direction Finding (ADF1)
- ADF2 (if installed)
- Interphone.

Microphone audio is supplied to:

- VHF communications 1
- VHF communications 2
- HF communications 1

- VHF communications 3 or UHF communications
- HF communications 2 or VHF–FM communications
- Interphone.

The observer's headset is connected to the PHONES and MIC jacks, with the BOOM/ MASK switch set to BOOM for normal operation. For oxygen mask operation, the toggle switch is set to the MASK position.

Refer to Figure 17.

A radio PTT selection is necessary for a VHF or HF communication transmission and an interphone PTT for the service interphone.

NOTE

A transmit PTT selection also causes the flight compartment speakers to mute by 6 dB to prevent feedback.

NOTE

The transmit selection is controlled by the RCAU and it will allow only one transmission at a time. The RCAU automatically deselects the hand microphone PTT switch after 3 minutes for the stuck microphone sensing function.

Refer to Figure 18.

When the ARCDU rotary microphone selector switch is set to the SERV/INT position, all PTT selections give interphone communications.

The interphone system gives communication between the stations that follow:

- Pilot
- Copilot
- Observer
- Forward fuselage ground crew
- Aft fuselage ground crew
- Fuelling panel ground crew

The audio level indication for INT on ARCDU1 and ARCDU2 is green for ON and white for OFF and the level of the bar graph relates to volume selection.

NOTE

The ground crew jacks are disconnected when the airplane is airborne.

The OFF/HOT MIC toggle switch is set to the HOT MIC position for continuous interphone PTT operation.

Refer to Figure 19.

When the ground crew headset is plugged into a service interphone jack, the GND CREW advisory light on the pilot's side console comes on with an applicable FWD or AFT indication to show a service interphone connection.

When the ground crew headset is plugged into the forward fuselage ground crew jack, the FWD advisory light comes on. When the ground crew headset is plugged into the aft fuselage ground crew or fueling panel ground crew jack, the AFT advisory light comes on.

Refer to Figure 20.

The BOOM/MASK toggle switch is set to the BOOM position to use the headset boom microphone or to the MASK position for the microphone in the oxygen mask.

The switch for SPKR is pushed for speaker ON/OFF control and turned for volume.

The display area for the INT (interphone) shows a green speaker symbol for the selection.

The microphone switch is set to VHF1, VHF2, HF, AUX1, AUX2, or SERV/INT and then a PTT selection is made for a radio transmission.

NOTE

The radio PTT selections operate as an interphone PTT when the microphone switch is set to SERV/INT position.

The microphone switch selection is shown with green letters in the INT display area of ARCDU1 and ARCDU2.

A green TX message is shown in the related VHF communication display area for the radio transmission.

A red FAIL message is shown in the INT (interphone) display area for malfunctions or power loss of the RCAU.

The NORM/EMER (Normal/Emergency) toggle switch is set to the EMER position to connect the headphone and microphone (hand, boom/mask) directly to the related VHF transceiver.

NOTE

The interphone continues to operate.

A red EMER message replaces the FAIL message.

NOTE

There is no audio level and microphone control.

An automatic reconfiguration for the pilot, copilot or observer is activated if the data bus between the audio channel of the AIS and the related ARCDU or ACP has malfunctioned. In this mode, transmission and reception are set by the audio channel as follows:

- For transmission, the interphone selection is enabled
- For reception, VHF1, VHF2, and INT at a pre–programmed audio output level.

BITE Retrieval:

The AVIONICS STATUS page of the central diagnostic system (CDS) gives the list of currently failed avionics sub–systems.

If no failure is detected, the page NO FAULT DETECTED is shown.

MEL/CDL:

Service Interphone System (Flight Compartment to Ground Crew) may be inoperative provided alternate procedures are established and used or procedures are not dependent on its use.

Boom Microphone Push–To–Talk (PTT) Switches may be inoperative provided one switch at each pilot's position is verified operative.

One Headset is required at each pilot's station.

Flight Compartment Speakers may be inoperative provided:

- Procedures are not dependent on their use,
- Headsets are installed and used by each person on flight deck duty,
- All aural alerts, messages and other communication which are normally routed through the flight deck speakers must be audible through headsets, and
- A spare headset must be readily available for crew use.

Boom Microphones (including Headset microphones) may be inoperative provided:

- The FDR operates normally, and

- Repairs are made within three flight days.

Cockpit Handheld microphones may be inoperative provided associated boom microphones are operative.

Cabin Handsets may be inoperative provided:

- One cabin handset operates normally,
- Operative handset is located at an operative flight attendant seat, and
- Alternate communication procedures between the affected flight attendant station(s) are established and used.

NOTE

Any station that operates normally may be used.

Operation:

Refer to Figure 21.

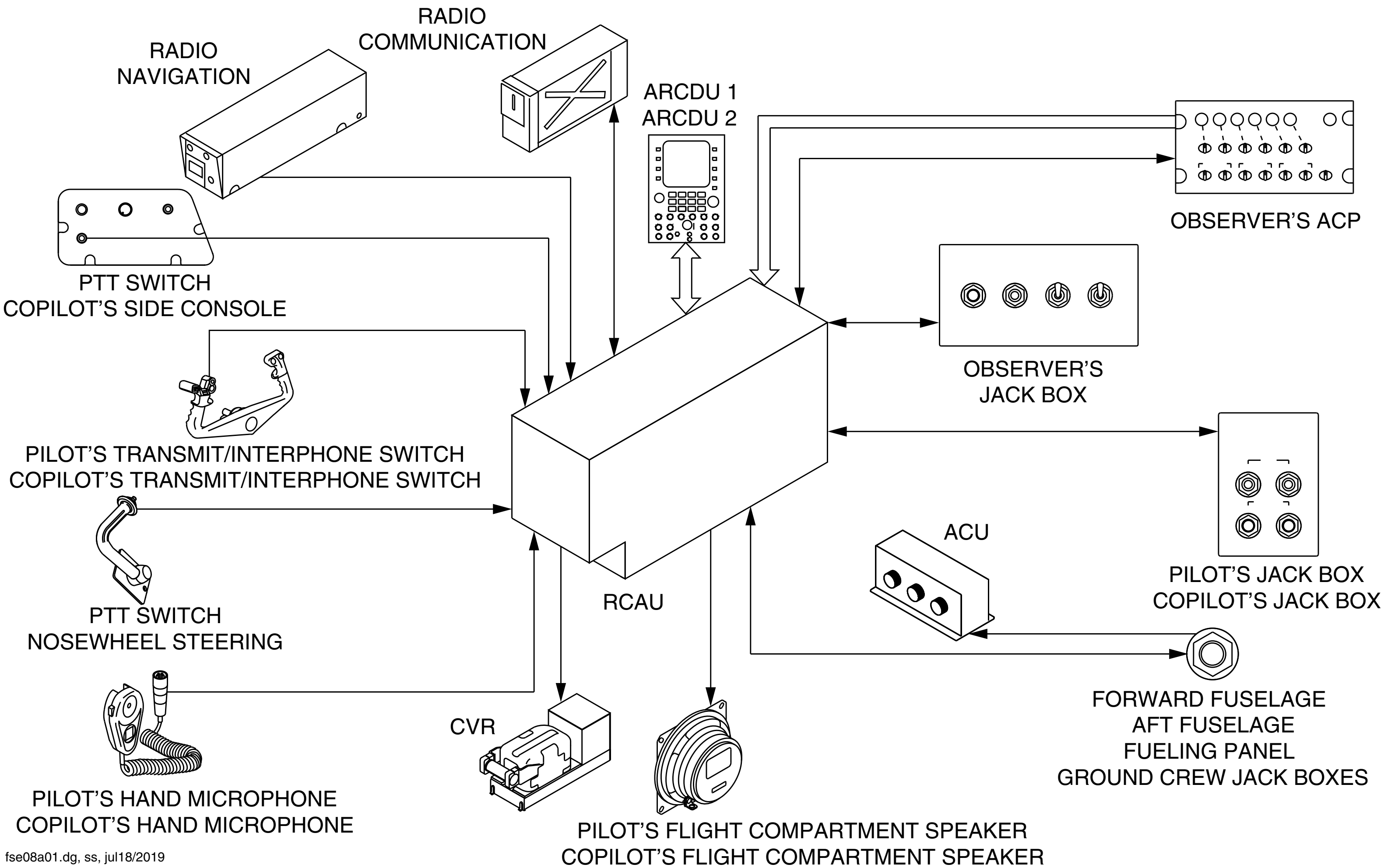
The RCAU controls the EMER, CALL, and PA lights in the forward and aft attendant handsets and the red (CALL or EMER) and green (PA) lights in the three advisory signs in the cabin.

It supplies power for the ATT light in the attendant handsets.

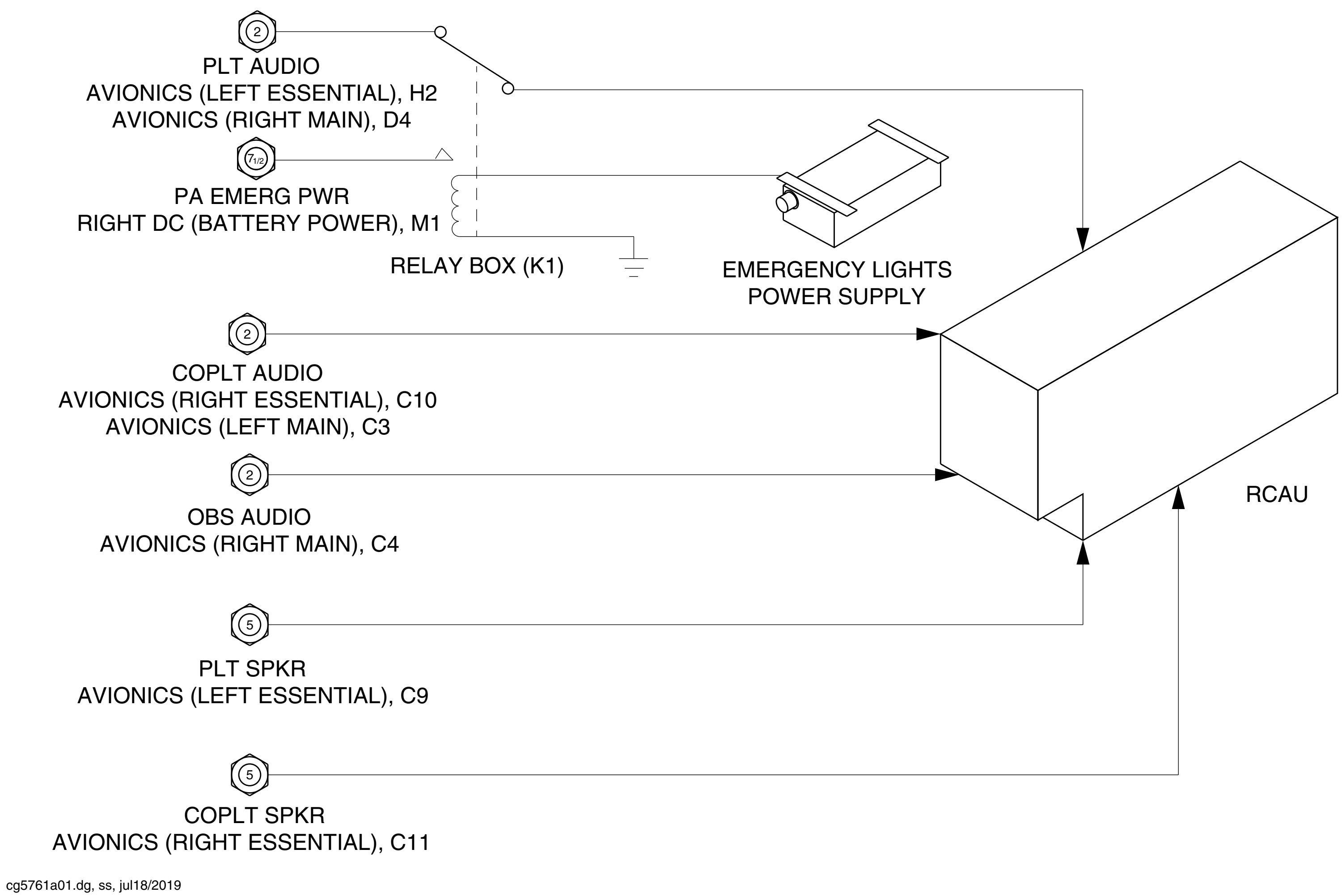
DIAGNOSTICS:

The audio and radio control display unit (ARCDU) can show the central diagnostic system (CDS) messages that follow:

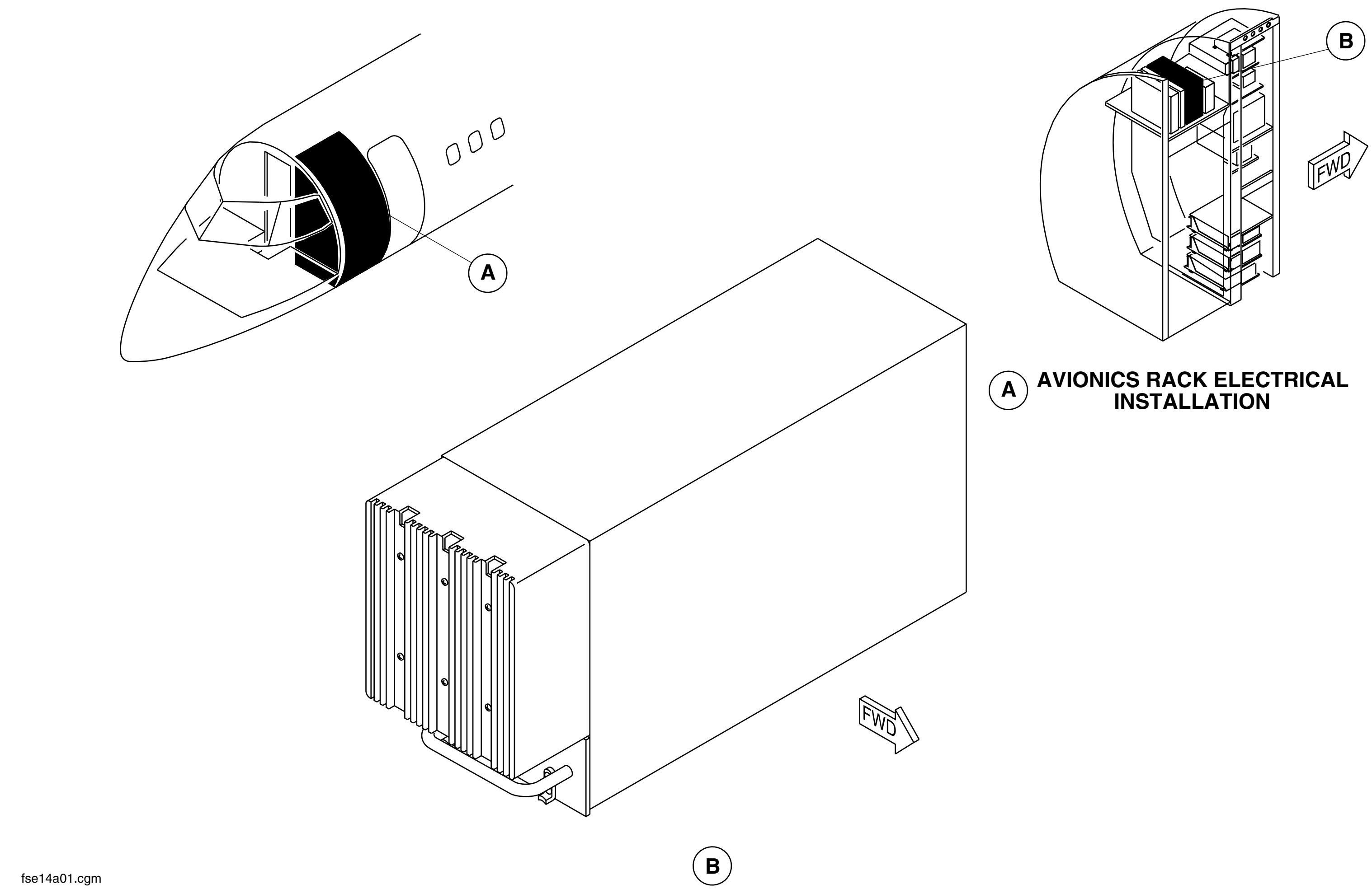
- ADU1
- ADU1 OUTPUT BUS
- ADU1 PIN PROG
- ADU1/MFD1
- ADU1/IOP1
- ADU1/IOP2
- ICP1/ADU1
- ADU2
- ADU2 OUTPUT BUS
- ADU2 PIN PROG
- ADU2/MFD1
- ADU2/IOP1
- ADU2/IOP2
- ICP2/ADU2
- PITOT 1 FAIL
- PITOT 2 FAIL
- PITOT STBY FAIL
- NO SSEC LAW.



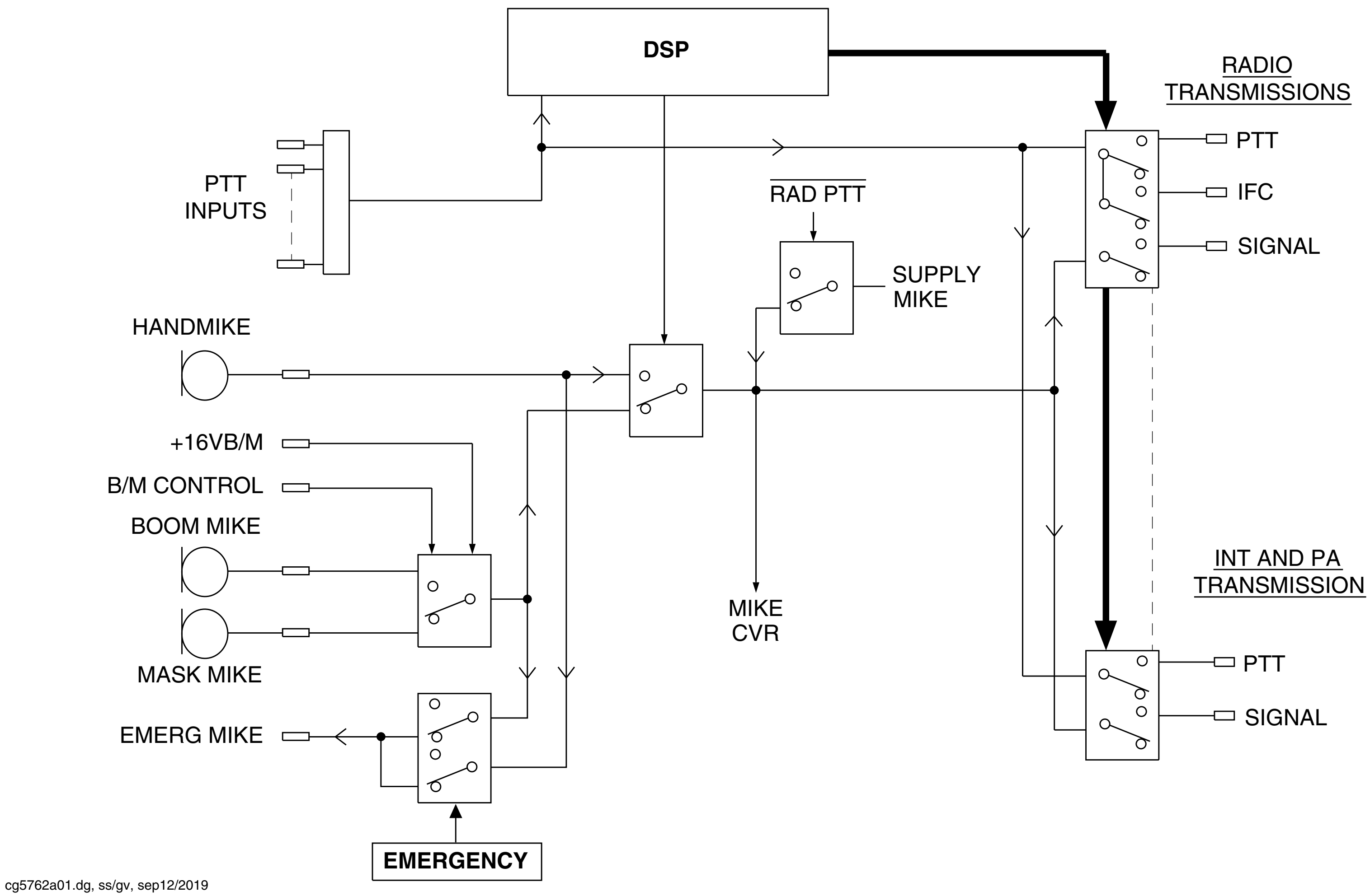
AIS Block Diagram
Figure 1



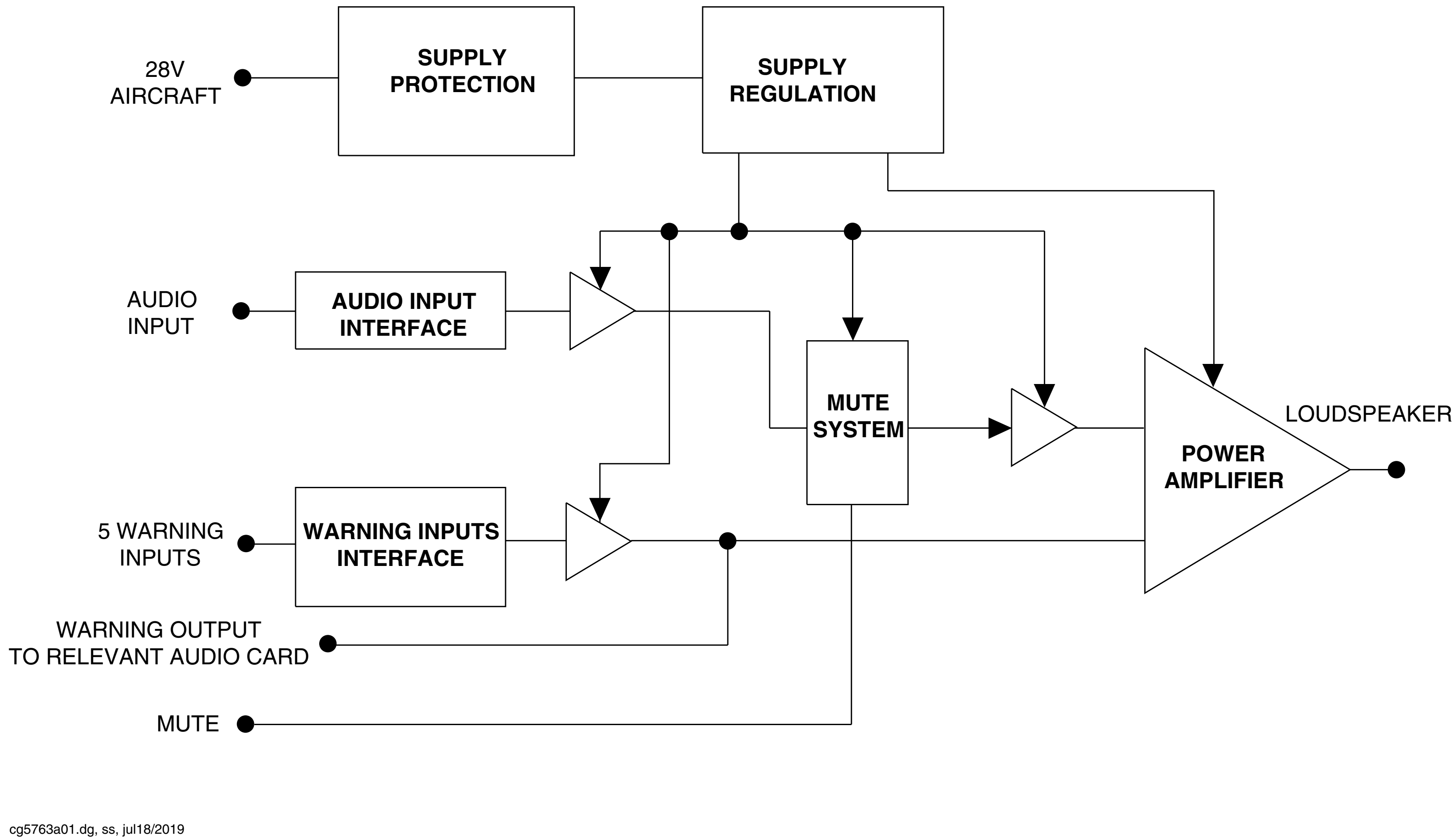
AIS Block Diagram, Power
Figure 2



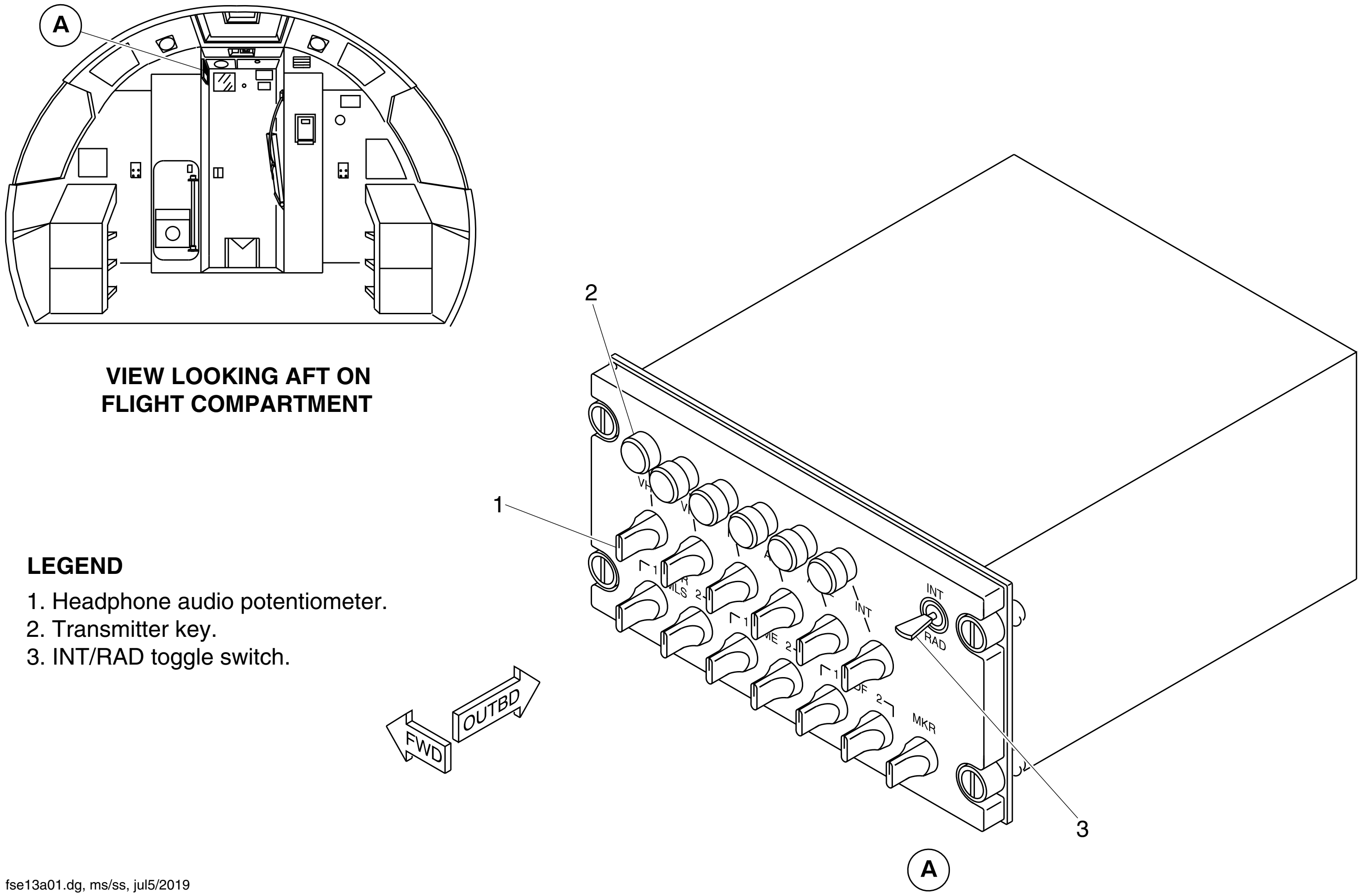
REMOTE CONTROL AUDIO UNIT (RCAU) LOCATOR
Figure 3



Digital Signal Processing (DSP)
Figure 4



Functions of RCAU
Figure 5

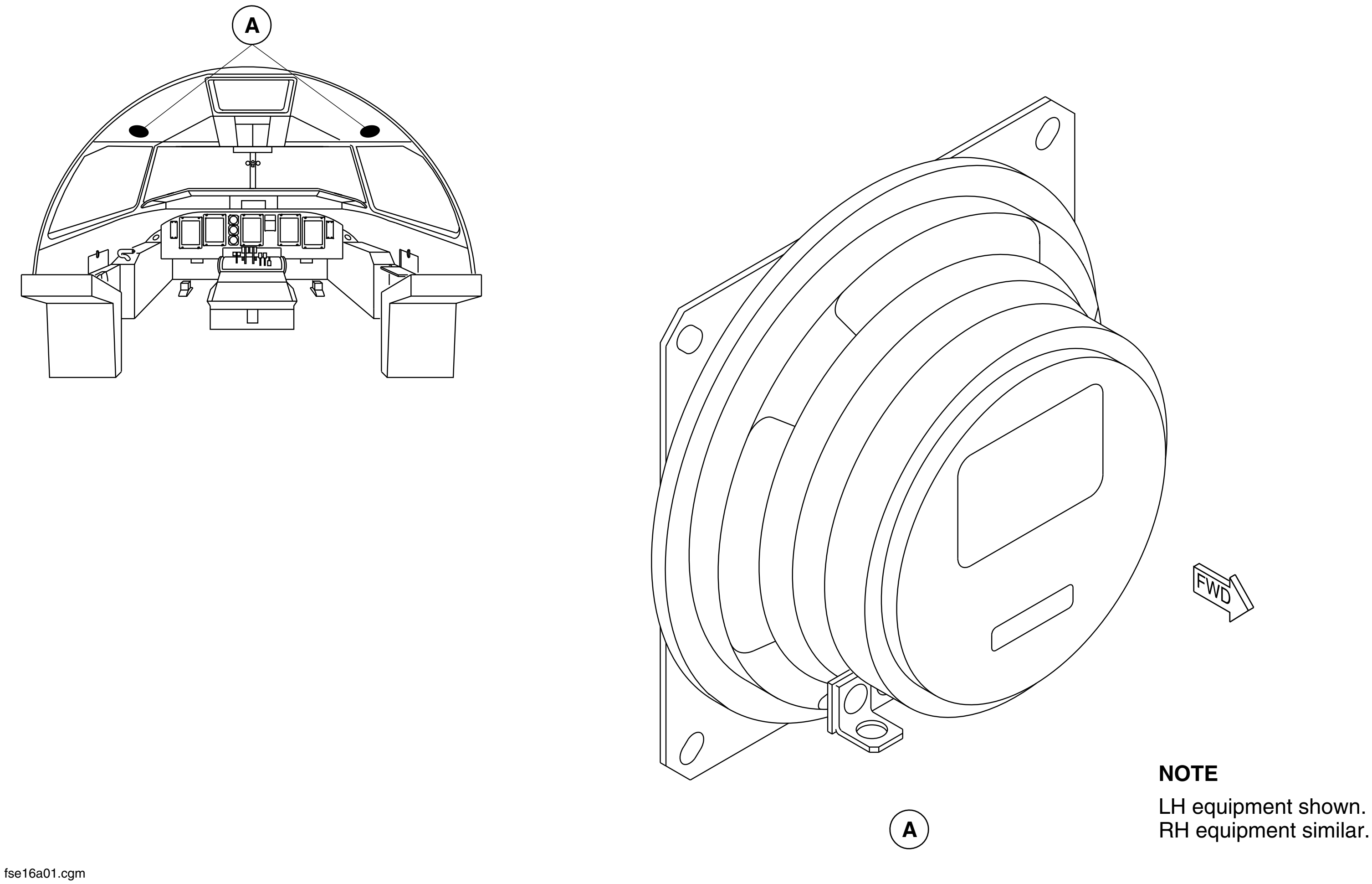


LEGEND

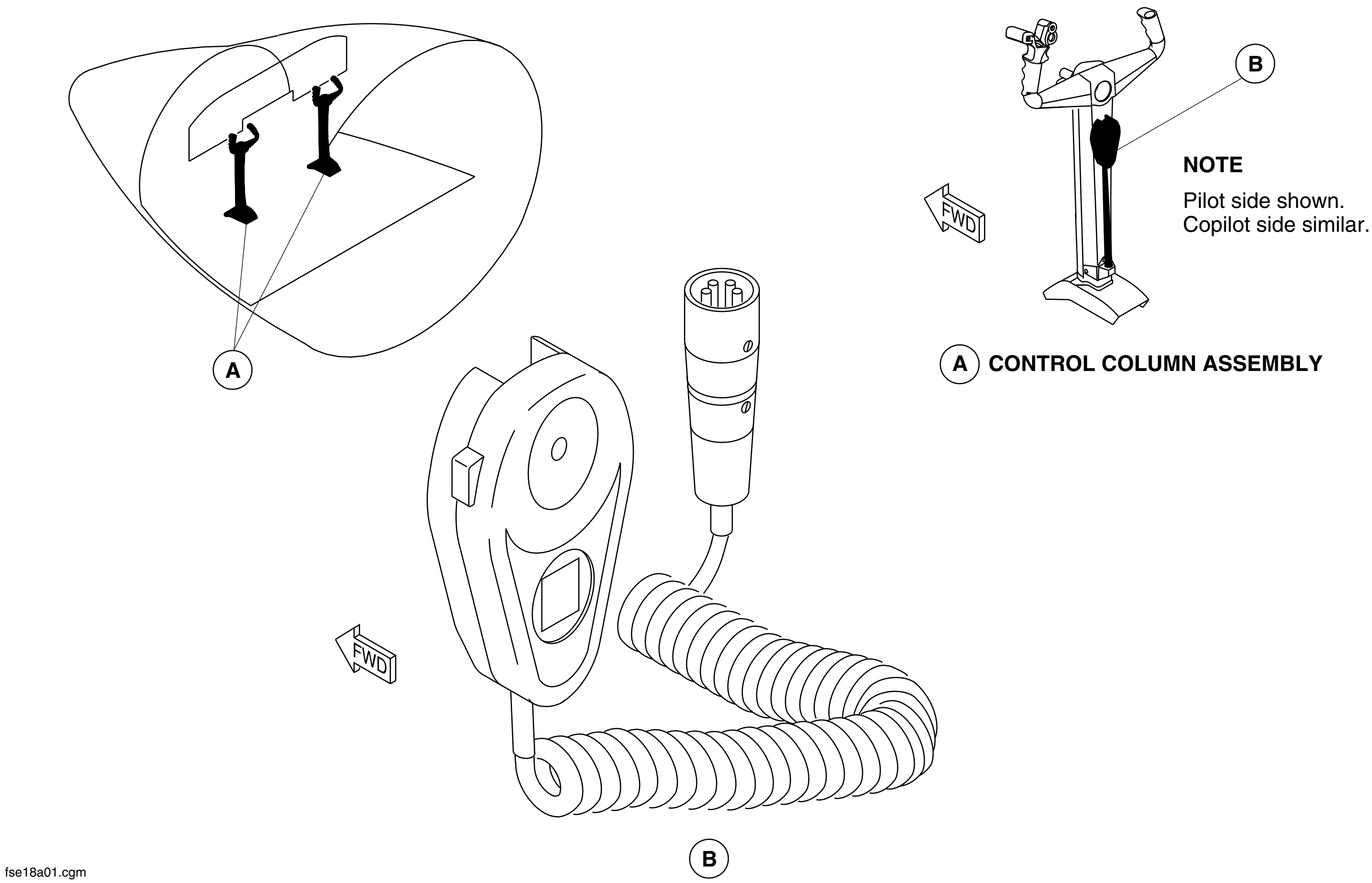
1. Headphone audio potentiometer.
2. Transmitter key.
3. INT/RAD toggle switch.

fse13a01.dg, ms/ss, jul5/2019

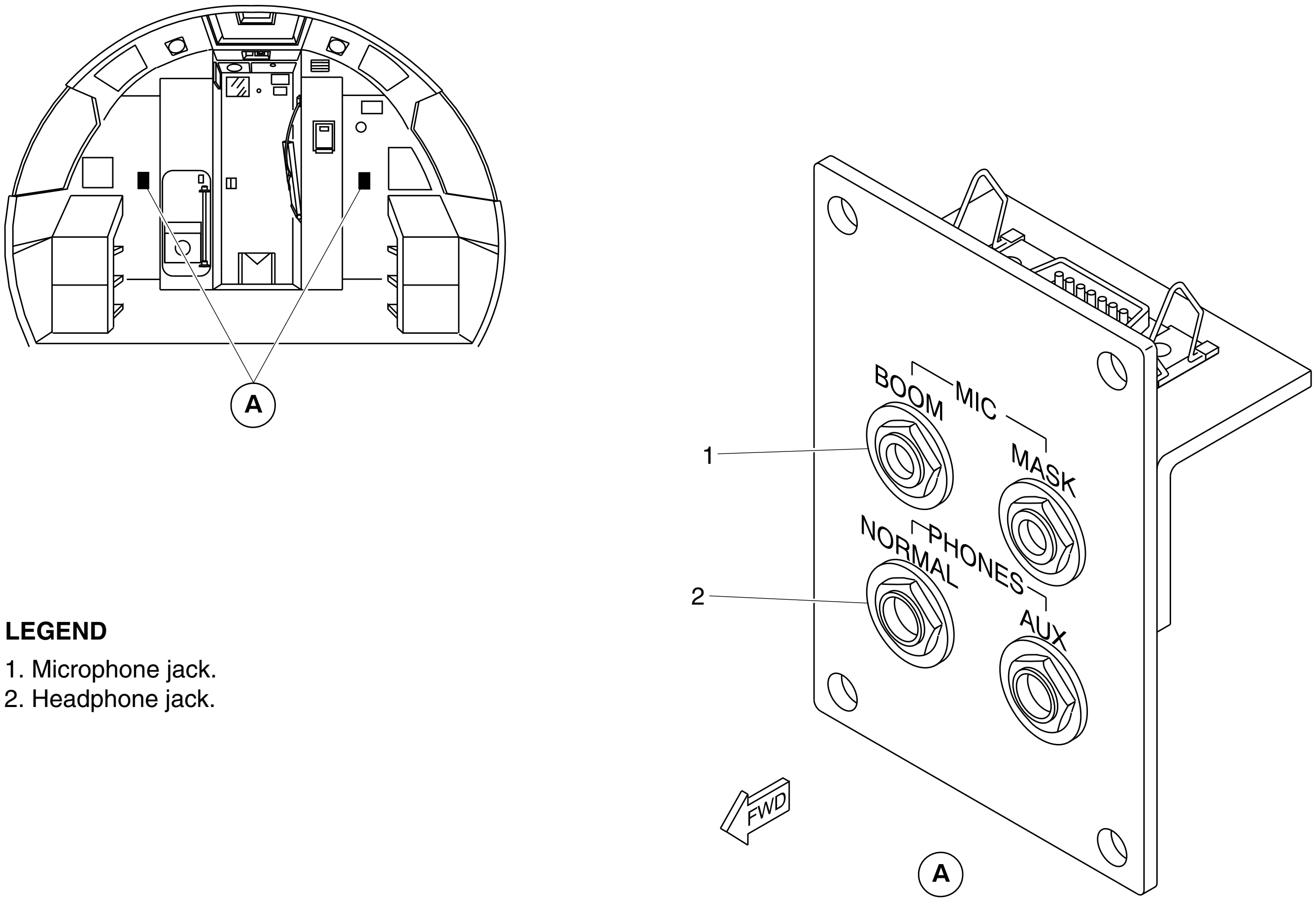
Observer's Audio Control Panel
Figure 6



FLIGHT COMPARTMENT SPEAKERS LOCATOR
Figure 7



HAND MICROPHONES LOCATOR
Figure 8

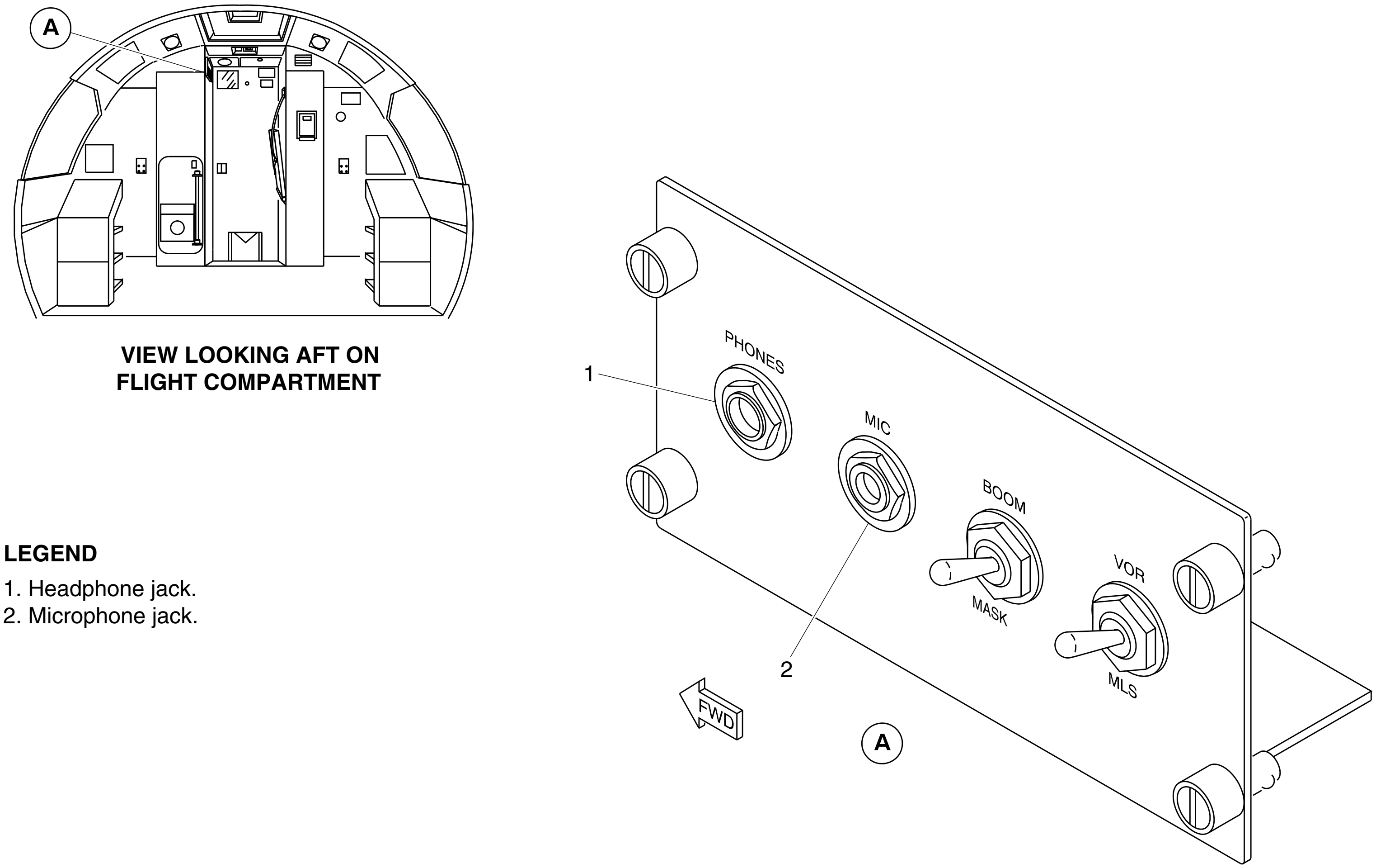


LEGEND

1. Microphone jack.
2. Headphone jack.

fse22a01.dg, ms, oct12/2011

Flight Compartment Jack Box
Figure 9

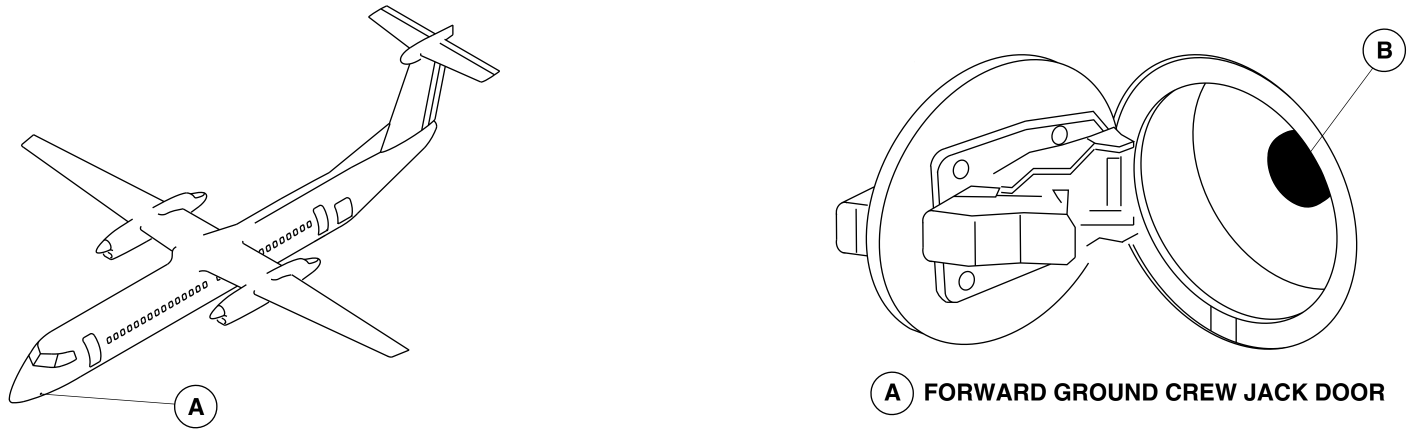


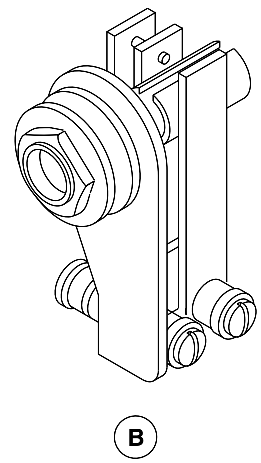
LEGEND

1. Headphone jack.
2. Microphone jack.

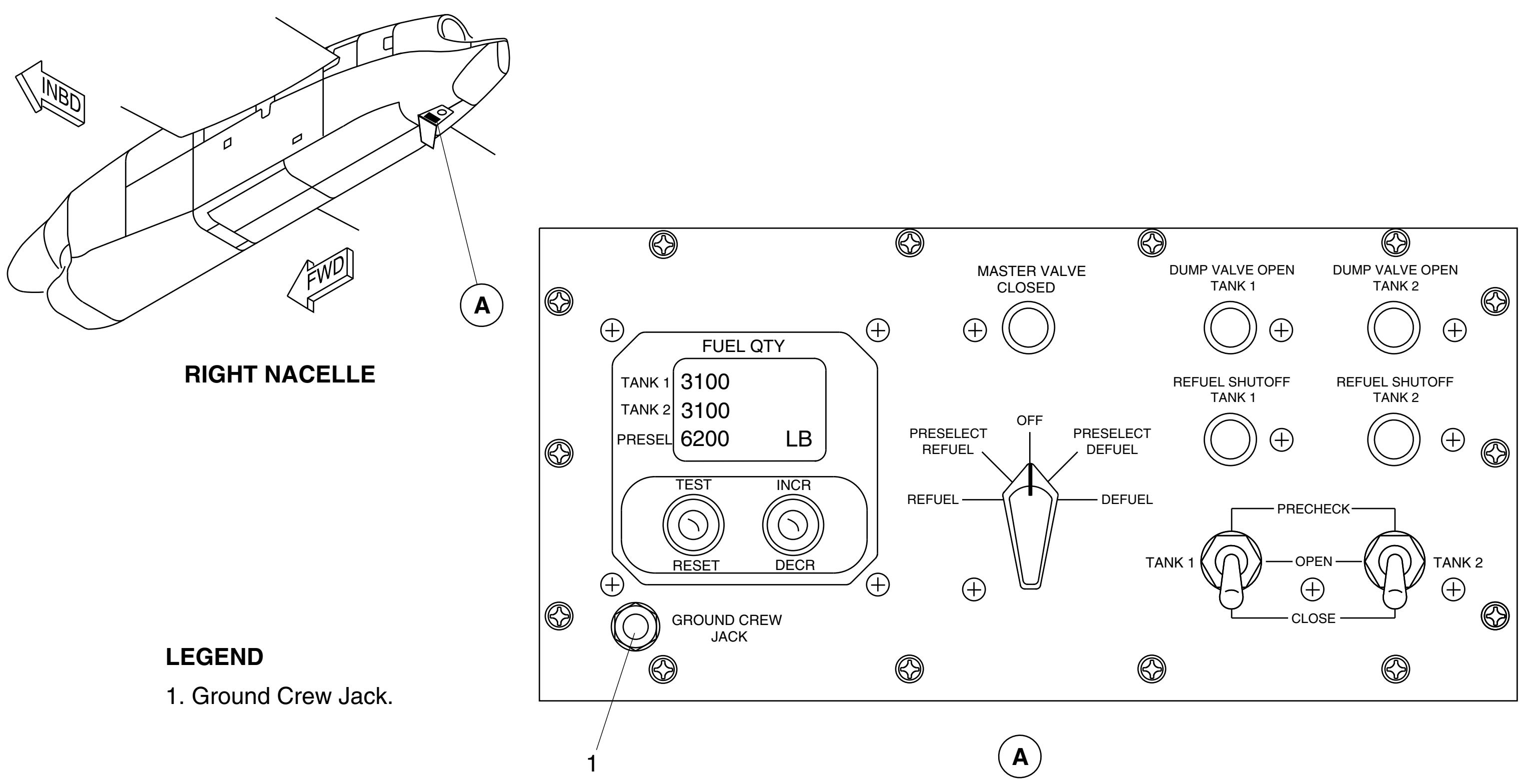
fse15a01.dg, ms/ss, jul15/2019

Observer's Jack Box
Figure 10





FORWARD GROUND CREW JACK BOXES LOCATOR
Figure 11

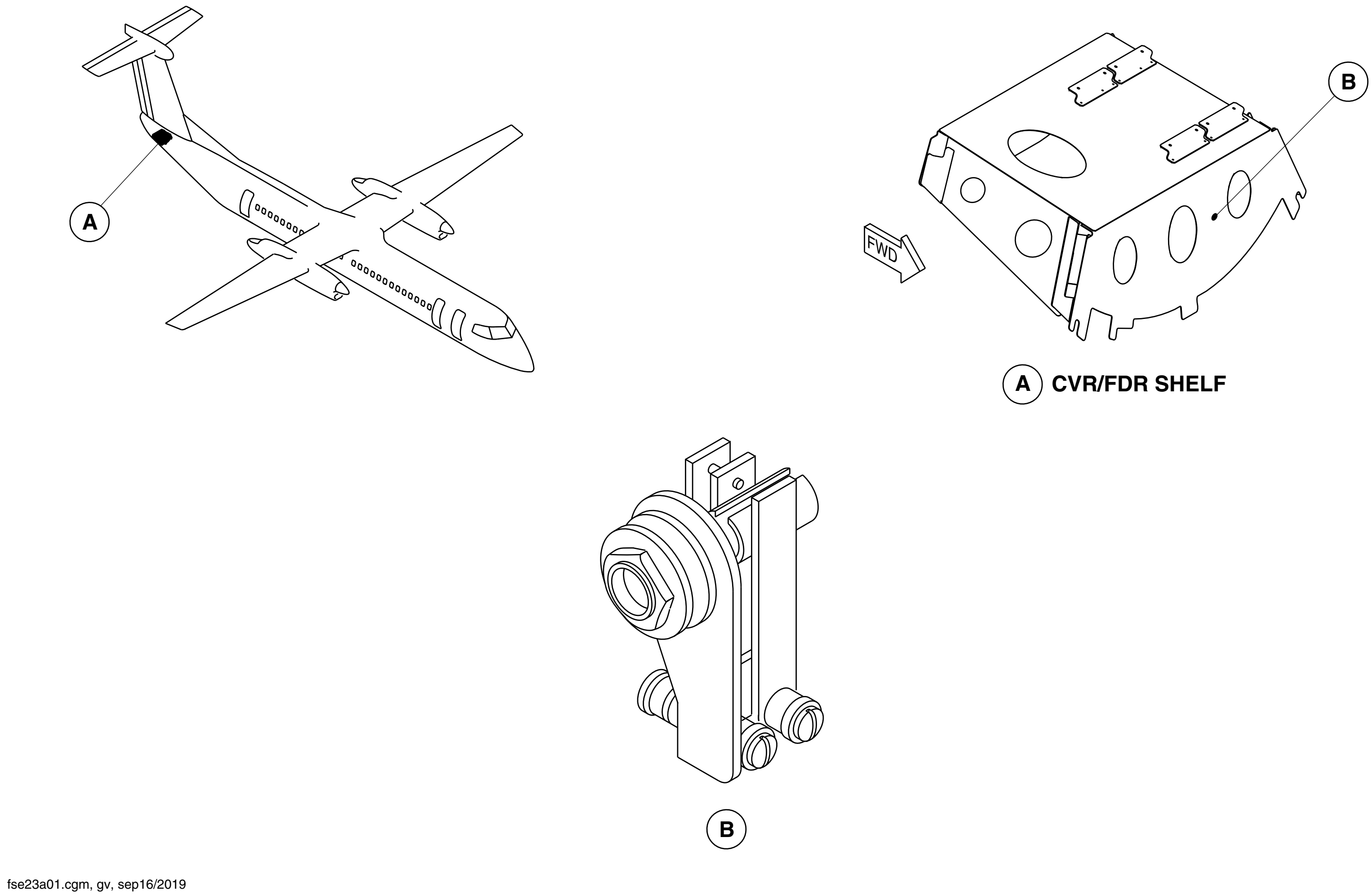


LEGEND

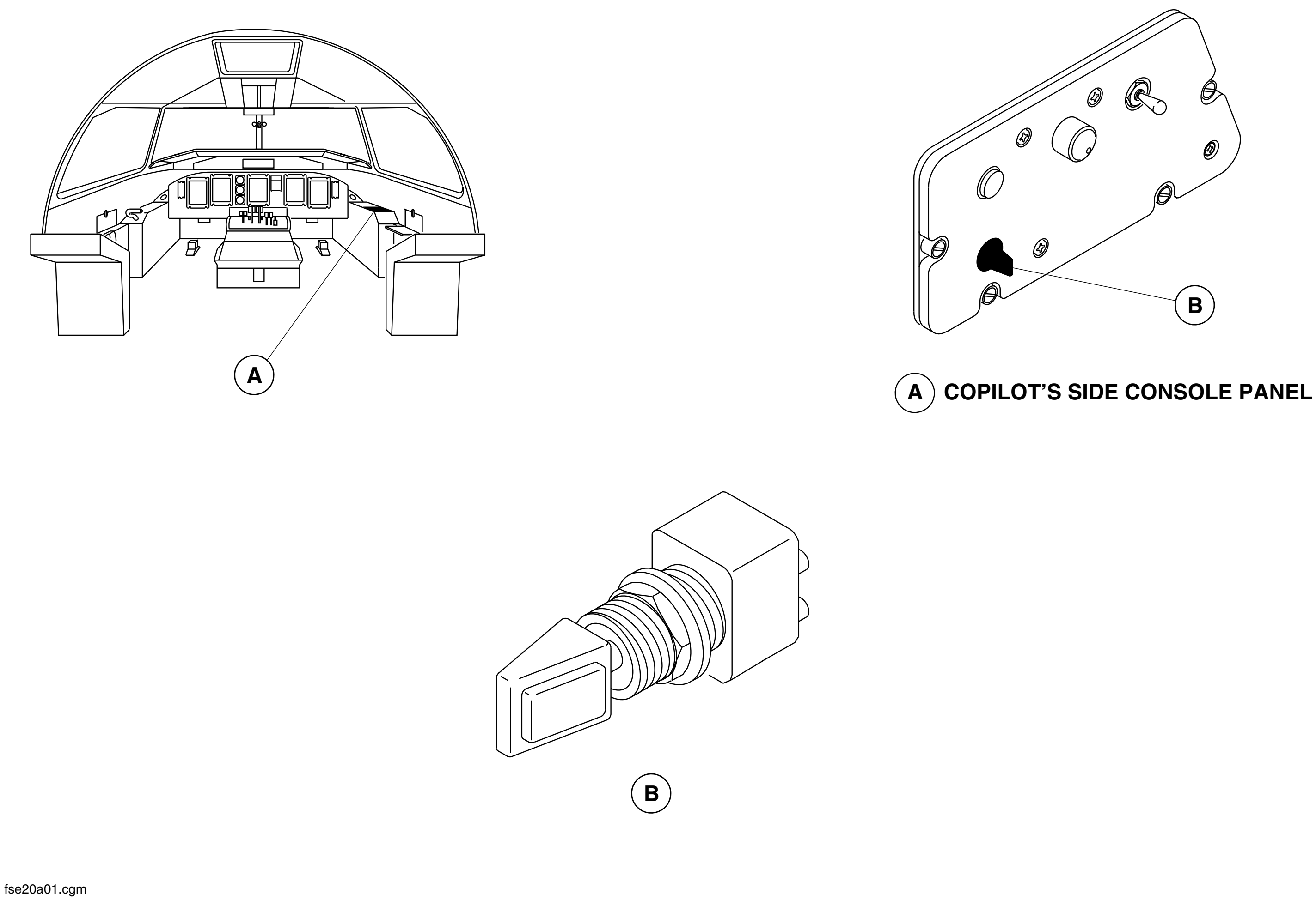
1. Ground Crew Jack.

fse04a01.cgm

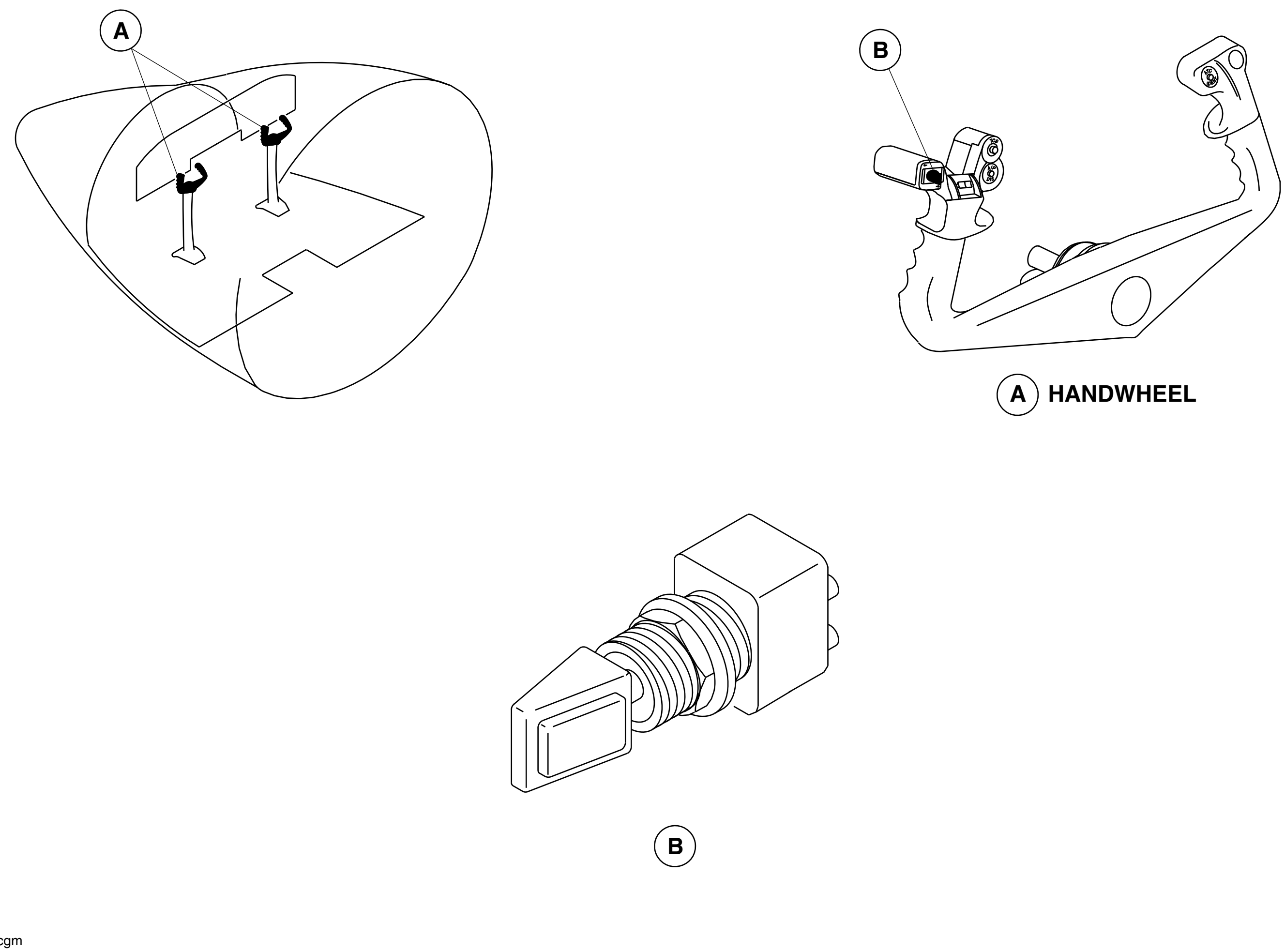
FUELING PANEL GROUND CREW JACK BOXES LOCATOR
Figure 12



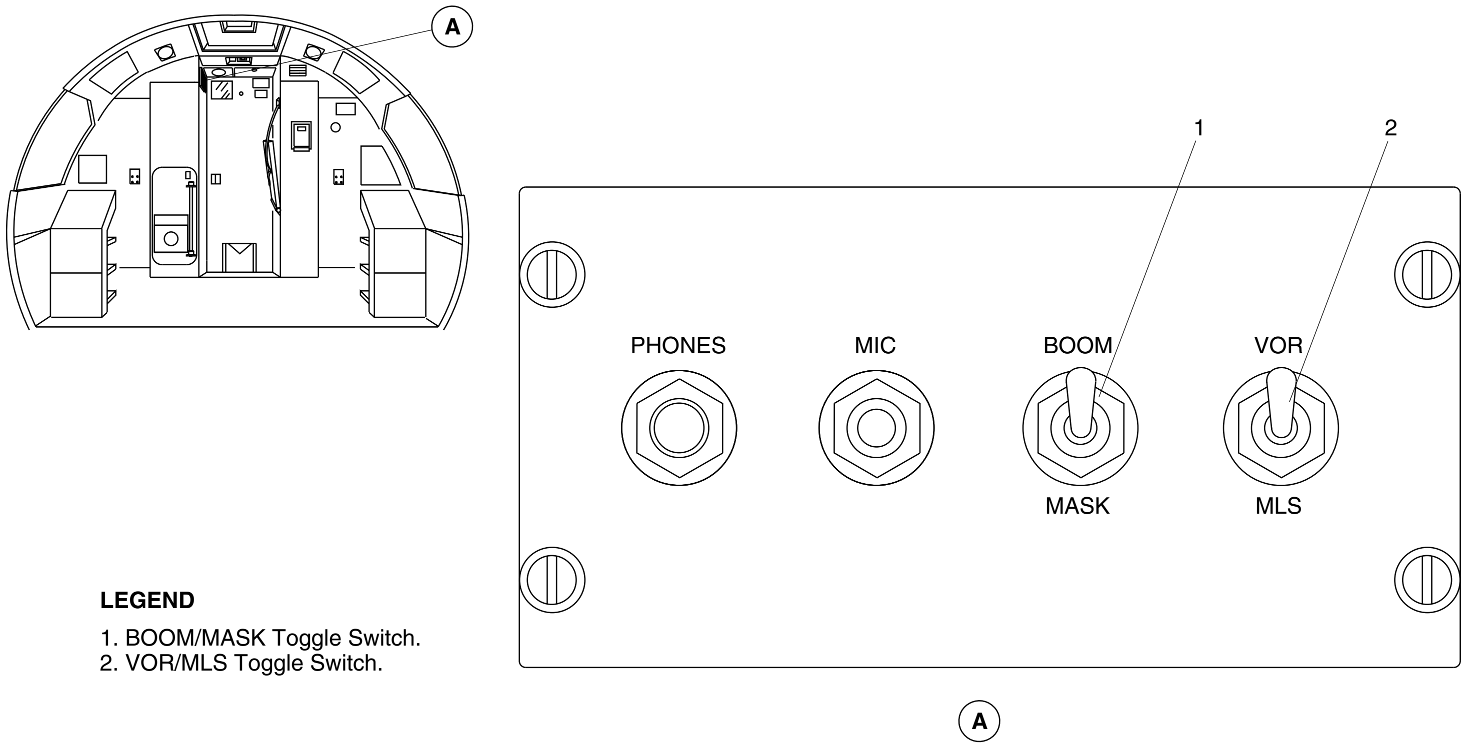
AFT GROUND CREW JACK BOXES LOCATOR
Figure 13



COPILOT'S SIDE CONSOLE PTT SWITCH LOCATOR
Figure 14



HAND WHEEL TRANSMIT/INTERPHONE SWITCHES LOCATOR
Figure 15



LEGEND

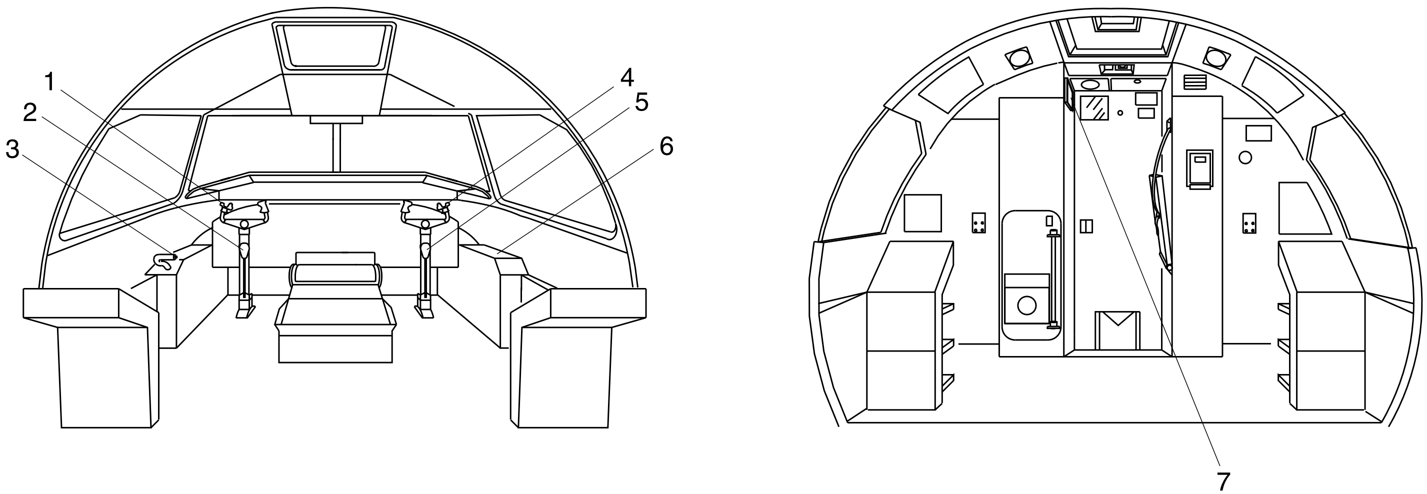
1. BOOM/MASK Toggle Switch.
2. VOR/MLS Toggle Switch.

fsd46a02.cgm

OBSERVER'S JACK BOX DETAIL 2
Figure 16

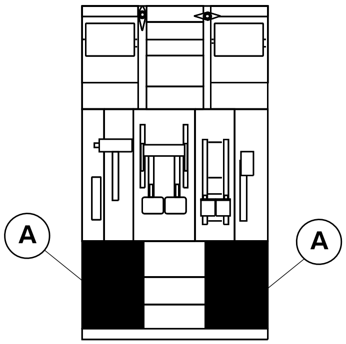
LEGEND

1. Pilot's Hand Wheel Transmit/Interphone Switch.
2. Pilot's Hand Microphone.
3. Pilot's Nose Wheel Steering PTT Switch.
4. Copilot's Hand Wheel Transmit/Interphone Switch.
5. Copilot's Hand Microphone.
6. Copilot's Side Console Transmit/Interphone Switch.
7. Observers Transmit/Interphone Switch.

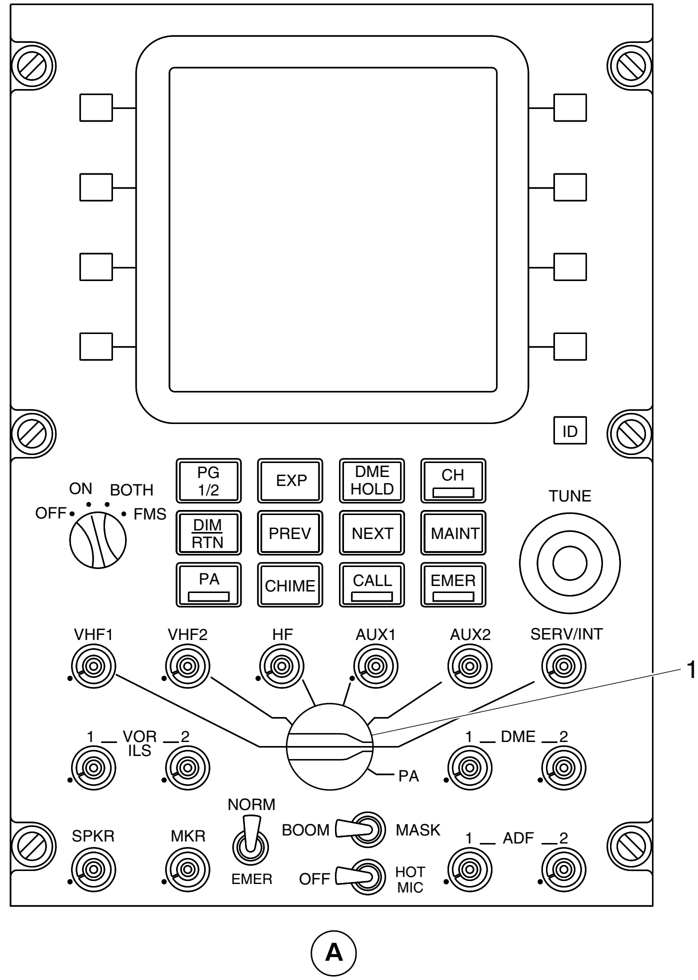


fse07a01.cgm

PUSH TO TALK INPUTS
Figure 17



CENTER CONSOLE

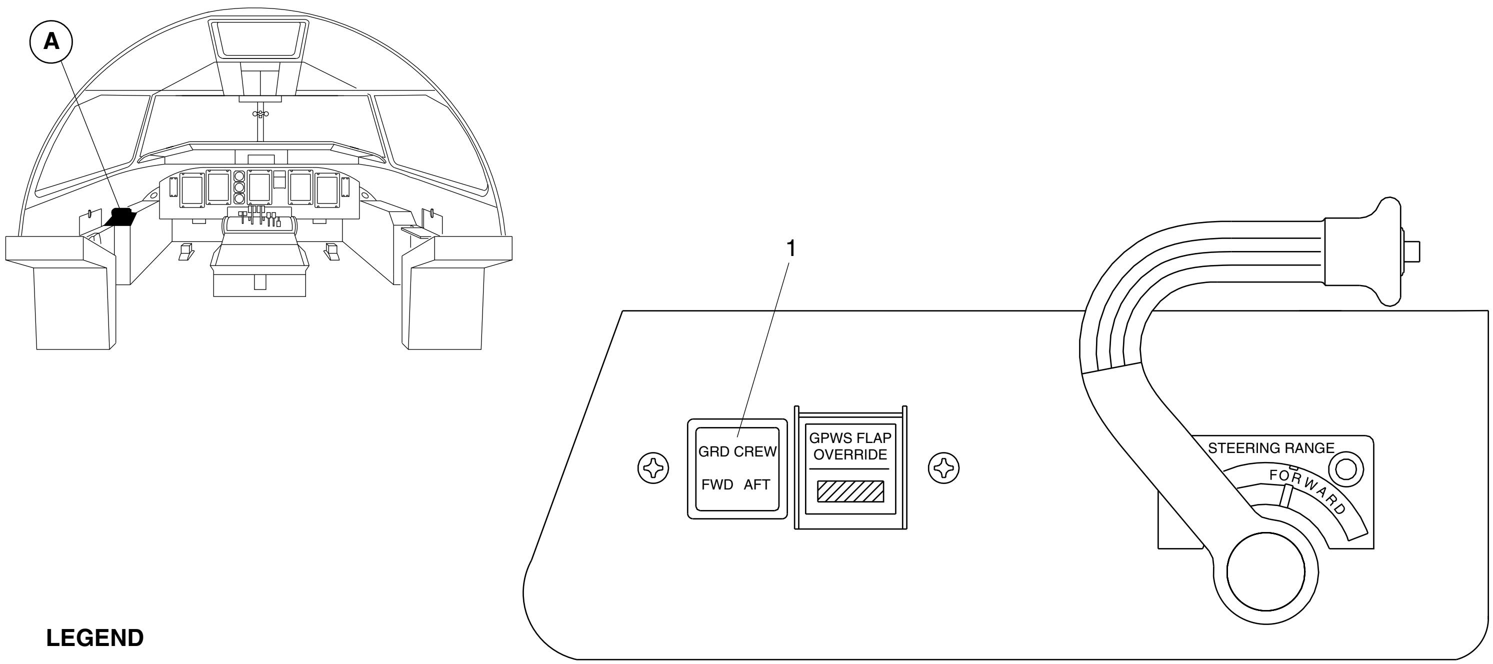


LEGEND

1. Rotary microphone selector.

cg5738a01.dg, sk, jul08/2019

ARCDU, Interphone Control
Figure 18

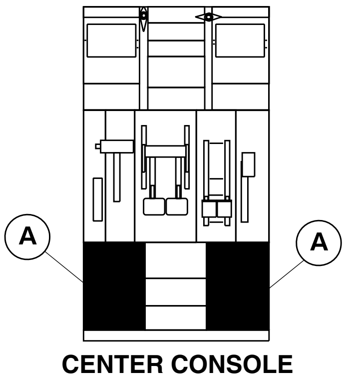


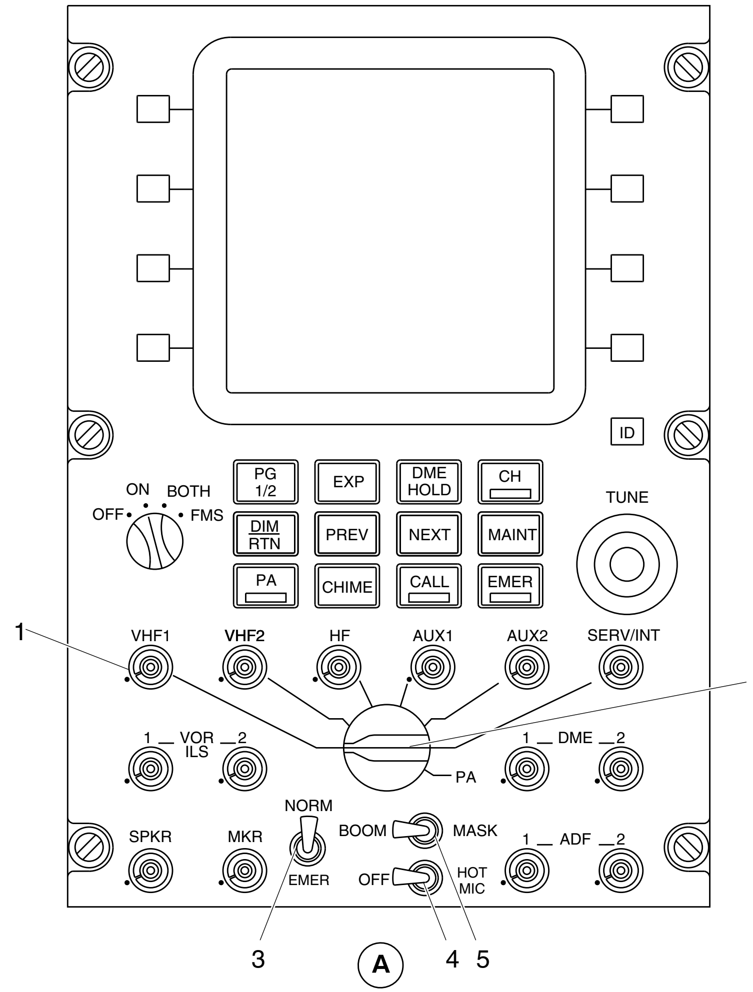
LEGEND

1. GND CREW Interphone Advisory Light.

fse05a01.cgm

GROUND CREW INTERPHONE INDICATION
Figure 19



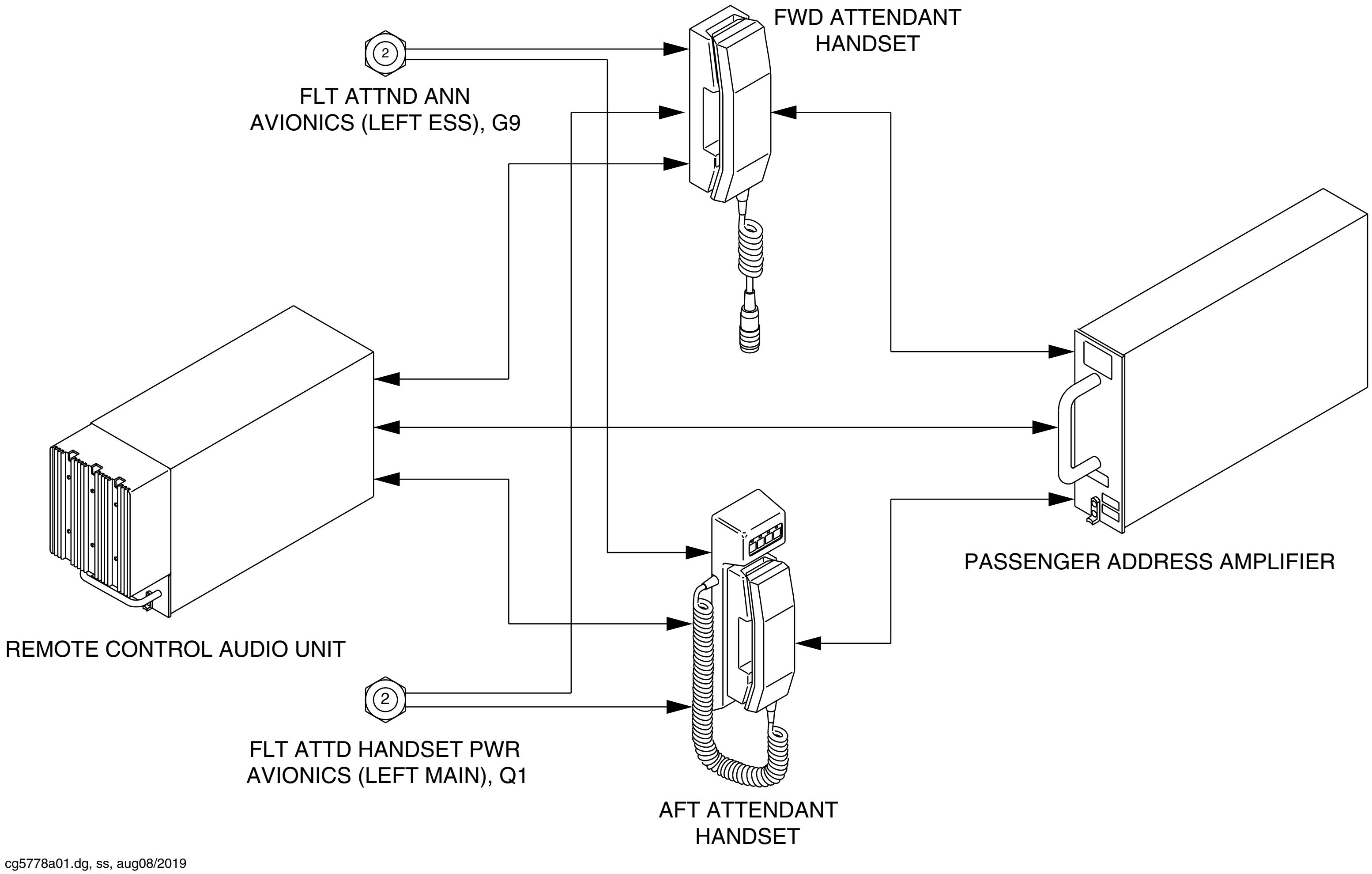


LEGEND

1. Potentiometer pushbutton switches.
2. Rotary microphone selector.
3. NORM/EMER toggle switch.
4. HOT MIC toggle switch.
5. BOOM/MASK toggle switch.

cg5739a01.dg, sk, jul08/2019

ARCDU AIS Control
Figure 20



Forward and Aft Attendant Handset
Figure 21

**ON A/C ALL

23–60–00–001

STATIC DISCHARGE SYSTEM

Introduction

The static discharging system consists of dischargers which dissipate electrostatic charges from the aircraft structure to the surrounding air, to minimize radio interference caused by these charges.

Description

Two types of static dischargers are used: type 2–11SC–1 and type 2–18SC–1. Type 2–11SC–1 is approximately 8 inches in length, with a straight taper sleeve fitting. The type 2–18SC–1 is approximately 6 inches in length with an angled tapered sleeve fitting.

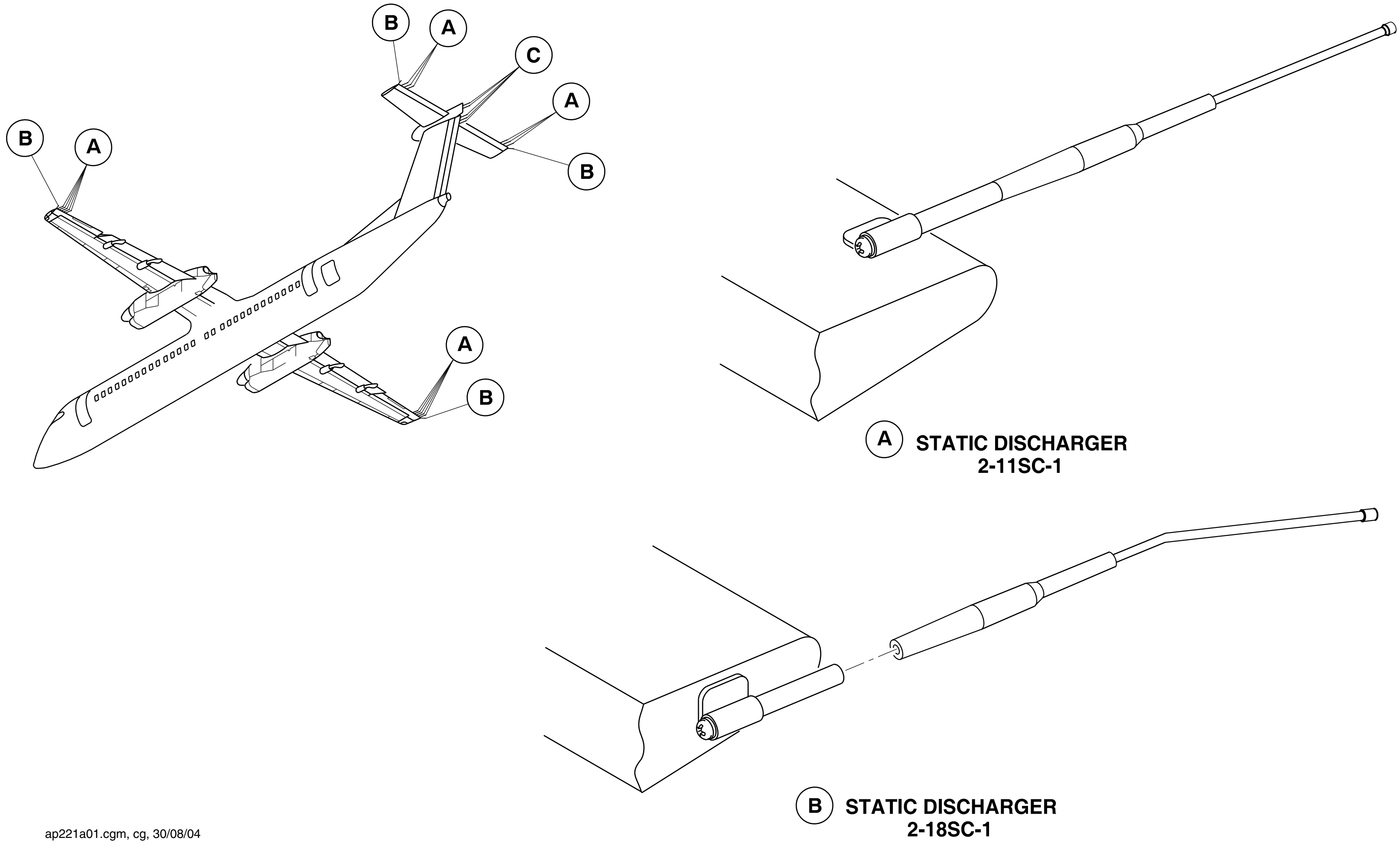
Twelve type 2–11SC–1 dischargers are installed: three on each aileron trailing edge, two on each elevator trailing edge, and two on the rudder trailing edge.

Four type 2–18SC–1 dischargers are installed: one on each wing tip, and one on the tip of each elevator.

Each static discharger consists of a resistive coated fiberglass rod with a pellet of composite carbon–based material at the tip. The pellet is fitted into an aluminum alloy sleeve, which in turn is fitted onto the discharger rod by means of conductive epoxy cement. A resistant sheathing is heat–shrunk over the entire length of the discharger rod and tip assembly, leaving approximately 1/8 in. (3.2 mm) carbon tip material exposed.

Operation

As the aircraft moves through the air, the aerodynamic end cap at the trailing end of each discharger creates an area of low pressure around the slightly protruding carbon tip. This reduction in pressure increases discharge efficiency, and allows ionization to take place in the slipstream, due to the impressed potential between the electrified aircraft and the surrounding air dielectric.



STATIC DISCHARGER LOCATOR
Figure 1

THIS PAGE INTENTIONALLY LEFT BLANK

**ON A/C ALL

23–71–00–001

COCKPIT VOICE RECORDING SYSTEM

Introduction

The Solid State Cockpit Voice Recorder (SSCVR) system records the last two hours of flight compartment audio and clock data.

It records audio in a digital format in crash–survivable Non–Volatile Memory (NVM).

The SSCVR is installed in the lower aft fuselage of the aircraft.

On aircraft with ModSum 4–309257 OR SB84–31–88 incorporated, the SSCVR with Recorder Independent Power Supply (RIPS) (Universal) is installed.

On aircraft with ModSum 4–201624 OR SB84–31–82 incorporated, the SSCVR without Recorder Independent Power Supply (RIPS) (Universal) is installed.

On aircraft with ModSum 4–458442 incorporated, the bulk erase mode is disabled.

General Description

The SSCVR system records the following channels of audio inputs:

- Pilot
- Copilot
- Observer and Passenger Address (PA)
- Flight compartment area microphone.

Refer to Figure 1.

The SSCVR system (Honeywell) has the components that follow:

- Recorder, Solid State Cockpit Voice (SSCVR) (23–71–01)
- Unit, Microphone Monitor (MMU) (23–71–11)
- Switch, Inertia (31–32–16)
- Remote Microphone (23–71–03).

Refer to Figure 2.

The SSCVR system (Universal) has the components that follow:

- Recorder, Solid State Cockpit Voice (SSCVR) (23–71–01)
- Unit, Cockpit Control (CCU) (23–71–11)
- Switch, Inertia (31–32–16)
- Remote Microphone (23–71–03).

The SSCVR receives audio data from the Audio and Radio Management System (ARMS).

A clock supplies Universal Time Coordinated (UTC) time reference data to the SSCVR.

A wideband flight compartment area microphone records the ambient flight compartment audio.

Detailed Description – SSCVR System (Honeywell)

The SSCVR functions in the states that follow:

- Power–On Self Test

- Operation
- Maintenance
- Data Download.

Power–On Self Test: The SSCVR system does a power–on self test (POST) after a time long–term power interruption.

The power–on self test senses SSCVR hardware malfunctions that are not continually monitored in the operational state or apparent to the flight crew.

Operation Mode: The Operation Mode is subdivided into the modes that follow:

- Functional Test Mode
- Audio Monitoring
- Bulk Erase Mode
- Failure Indication.

Functional Test Mode: The TEST button located on the front panel of the MMU is pushed to start the test mode.

The SSCVR gives the results that follow within 3 seconds of successfully completing the self–test:

- An 800 Hertz aural tone for 2 seconds at the audio monitor HEADPHONE output jack
- The red STATUS indication turns on for 1 second on the MMU.

Audio Monitoring: The SSCVR system record the parameters that follow at the same time:

- Three narrowband voice channels
- One wideband area audio channel.

It supplies an audio and playback performance that is shown in the table that follows:

CHANNEL	AUDIO INPUT	BANDWIDTH HZ
1	Observer / PA	150 – 3,500
2	Copilot	150 – 3,500
3	Pilot	150 – 3,500
4	Area	150 – 6,500

The SSCVR system supplies all four audio input channels through an audio HEADPHONE output jack at the same time for monitoring purposes. The output jack is located on the front panel of the MMU. As a secondary function, the jack socket output gives an aural tone to indicate a successful completion of erase and self–test functions.

The SSCVR receives and records timing data from the pilot clock through a low speed data bus. The clock input gives timing correlation between the SSCVR and the Flight Data Recorder (FDR). The SSCVR stores the clock input in a crash–survivable memory.

Audio Monitoring: The SSCVR records 2 consecutive hours of four audio input channels and time data into crash–protected memory. The SSCVR begins storing digital audio data upon application of electrical power to the system.

The SSCVR gives a continuous audio output channel which is the composite of the four audio input channels in real time. It is available at the audio monitor HEADPHONE output jack located on the front panel of the MMU. A secondary function of this output is to give an aural tone to indicate successful completion of initiated self–test and erase functions. The audio monitor channel has an output impedance compatible with a standard 600 ohms headset. The output levels of the SSCVR channels do not vary more than 3 dB.

Bulk Erase Mode: The bulk erase mode is started by pushing a switch located on the front panel of the MMU. The bulk erase mode is inhibited while the aircraft is moving under its own power to prevent an inadvertent erasure. Interlocks controlled by the parking brake and a Weight–On–Wheels (WOW) status prevent this from occurring.

Failure Indication: The SSCVR starts Built–In–Test (BIT) functions using the methods that follow:

- Power on initialization
- Initiated Self–Test
- Continuous Monitoring.

Power on initialization: When power is applied to the aircraft, the SSCVR system performs an automatic power on self–test.

Initiated Self–Test: A functional self–test of the SSCVR system is possible in order to assure the operator that the system is serviceable. The test mode can be activated by depressing a push–to–test button that is located on the front panel of the SSCVR MMU.

Continuous Monitoring: The CVR performs a continuous background test to make sure that the system is functioning properly. The CVR system records this information in the Crash Survivable Memory Unit (CSMU) and the Central Diagnostic System (CDS).

The crash protected solid state memory stores a history of the BIT status of each component for product trend analysis purposes. Also, the SSCVR gives a maintenance status discrete output to show an internal failure. The CDS monitors the maintenance status discrete output and the MMU gives a STATUS indication. A successful completion of initiated self–test and erase functions is indicated by:

- 800 Hz tone, for two seconds
- STATUS light on.

When a failure condition exists, the status discrete output is not activated and the aural tone does not sound and the front panel STATUS indicator is continuously on. The failure condition is recorded in the CSMU and a signal is sent to the CDS.

Data Download: The SSCVR has a download and test function to supply an interface for the Ground Support Equipment (GSE).

The Playback and Test Station (PATS) is a Personal Computer (PC) based system. It performs the functions that follow:

- Downloads solid state memory
- Playback of audio data and stored digital timing in a audio and visual format
- Functional acceptance testing of the SSCVR.

The digitized data is downloaded from the CSMU to a Playback and Test Station (PATS) Ground Support Equipment (GSE). The data download and analysis facility uses a high speed serial interface to download.

The PATS software applications is Microsoft Windows compatible. The functional acceptance test application is fully automatic.

Refer to Figure 3.

The TEST switch on the MMU is momentarily pushed to test the SSCVR. The STATUS LED comes on and a 800 Hz tone sounds for 2 seconds to show satisfactory operation.

The ERASE switch on the MMU is pushed for 0.5 seconds or longer to erase all audio data when the parking brake is set and the aircraft is on the ground. The erase continues for 5 seconds of the selection. The erase function is verified by a 400 Hz tone for 2 seconds in the HEADPHONE jack.

The aircraft right main bus supplies 28 VDC power through a 5 A circuit breaker and inertia switch to the SSCVR. The circuit breaker labelled SSCVR is located in position F4 on the 28 VDC avionics circuit breaker panel. The SSCVR typically consumes less than 8.5 W.

The SSCVR provides 18 VDC output and return with a continuous current capability of 100 mA for the SSCVR MMU and provides short circuit protection for this output.

Recorder, Solid State Cockpit Voice

Refer to Figure 4.

The SSCVR consists of the following LRUs, not including the basic chassis:

- An Interface and Control Board (ICB)
- A Crash–Survivable Memory Unit (CSMU)
- A Power Supply (PS).

The ICB is a single card located in the base housing of the SSCVR. The ICB controls all states and modes of the SSCVR. It performs the following functions:

- Record
- Erase
- Data download
- Test functions.

The CSMU is a solid state, non–volatile, mass storage device enclosed in a protective case. The CSMU provides storage for all input data. Each physical memory device in the crash–protected memory includes an electrically embedded identification to ensure proper sequencing of the data in the unlikely event that the memory device dislodge from their correct positions on the circuit board.

Recording of data to the solid state memory array is partitioned such that the narrowband voice channels are stored in physically separate devices from the wideband area channel. This provides data redundancy in the unlikely case of memory device failure. As further protection, a recording algorithm only stores a maximum of eleven continuous seconds of audio in any memory device. It embeds digital timing data within the audio data as it is received.

The power supply converts the 28 VDC aircraft power to secondary power for the following components:

- Line Replaceable Units (LRU)
- Microphone Monitor Unit (MMU).

The SSCVR provides 18 VDC to the MMU. It is capable of 100 mA continuous current to the MMU.

The SSCVR is painted bright international orange and has reflective tape to aid its discovery following an accident. All sheet metal parts and fasteners are protected to inhibit corrosion and the crash survivable portion of the LRU displays the message "FLIGHT RECORDER DO NOT OPEN" and "ENREGISTREUR DE VOL NE PAS OUVRIR".

The SSCVR weighs 16 lb (7.27 kg) and is packaged in a 1/2 Air Transport Rack (ATR) Short form. The SSCVR is a remote mounted LRU. It is located with the FDR in the aft fuselage section. It is attached to the aircraft using thumbscrew fasteners in the aft fuselage at station X948.9, Y–10.1 and Z138. 4. 39 in. (111.5 mm) above the lower fuselage outer contour at the airplane center.

The SSCVR is cooled by convection and radiation to ambient air conditions. No forced air–cooling is required for the SSCVR.

Refer to Figure 5.

The SSCVR has an Underwater Locator Beacon (ULB) (also known as Underwater Locating Device (ULD)) secured to the container. It is securely attached to prevent separation during crash impact. The ULB is self contained and powered.

The ULB is automatically activated when immersed in either fresh water or salt water at the depths from 0.5 to 20,000 feet (0.15 to 6096 meters). The ULB transmits an acoustic signal to help locate the SSCVR.

On aircraft without ModSum 4Q903309 and 4Q903310 incorporated, when the ULB is activated, it will transmit an acoustic signal of 37.5± 1 kHz frequency for a duration of 30 days or more. The ULB is self–powered by a battery with a typical service life of six years from the date of manufacture. A label that shows the battery expiry date is attached to the ULB

On aircraft with ModSum 4Q903309 or 4Q903310 incorporated, when the ULB is activated, it will transmit an acoustic signal of 37.5± 1 kHz frequency for a duration of 90 days or more. The ULB is self–powered by a battery with a typical service life of seven years from the date of manufacture. A label that shows the battery expiry date is attached to the ULB

The ULB is accessible from the front face for easy removal and replacement.

Unit, Microphone Monitor

Refer to Figure 6.

The MMU contains a compliant pre–amplifier circuit.

It interfaces and provides control and monitor functions of the SSCVR system.

The MMU is one LRU. It has a pre–amplifier card and the chassis components. The components that follow are attached to the pre–amplifier card:

- SSCVR system status light
- Erase switch
- Test switch
- Headphone jack
- Cockpit area microphone.

The pre–amplifier card contains the circuitry of the cockpit area microphone monitor amplifier and performs the following functions:

- Amplification of the microphone audio input signal

- Filtering of the microphone audio input signal to a 150 to 10,000 Hz bandwidth
- Automatic Gain Control (AGC) of the audio output to the SSCVR
- Selectable attenuation of output audio in 6 dB increments from 6 to 24 dB
- Status Light Emitting Diode (LED) circuit and switch circuits.

The MMU weighs 0.75 lb (0.34 kg). It is packaged in a standard ARINC control panel form factor. The MMU is attached to the forward centre console at station X–85.3, Y0 and Z125.3 using four Dzus fasteners.

The SSCVR MMU is cooled by convection and radiation to ambient air conditions. No forced air cooling is required for this LRU.

Detailed Description – SSCVR System (Universal)

The SSCVR perform the functions that follow:

- Initialization
- Built–In–Test
- Audio Bulk Erase
- Audio Recording
- Data Link Recording
- Data Transfer.

Initialization: The system initialization module runs after a cold start and calls initialization procedures in the various other software components.

Built–In–Test: The built–in test module performs power–up, periodic software and hardware tests. Safety monitoring is part of the built–in test function, including memory testing and verifying stored checksums.

Audio Bulk Erase: Audio bulk erase marks every audio data record, such that it becomes unrecoverable via normal data–recovery methods.

Audio Recording: Audio recording stores the processed audio data in crash–protected memory.

Data Link Recording: Data link recording stores the unprocessed data in crash protected memory.

Data Transfer: The data transfer feature is used with the SSCVR ramp loader or a compatible data loader. This function provides an ethernet interface, Transmission Control Protocol/Internet Protocol (TCP/IP), and Trivial File Transfer Protocol (TFTP) for loading data from the SSCVR.

The SSCVR has different operating states as follow:

- Start–Up
- Recording
- Maintenance
- Erase
- IBIT/Test.

Start–Up: The SSCVR always starts in this state when the power is applied.

Recording: This state is entered from the start–up state or when returning from IBIT/Test. The SSCVR records audio and data link in this state.

Maintenance: This state is entered from the stopped state when the CVR is powered and a request has been made by the PC. Audio data can not be downloaded when the CVR is installed on the aircraft.

Erase: This state is entered from the stopped state when the erase button on the CCU is held for more than 2 seconds and then released, and the CVR on the aircraft is not recording. The erase function is also available while in the recording state provided the ground interlock equation (WOW * park brake on) is satisfied.

IBIT/Test: This state is entered from the stopped state or the recording state, when the test button is pressed on the CCU. When the IBIT is complete, the CVR transitions to the recording state.

The SSCVR system record the parameters at the same time that follow:

– Three narrowband voice channels
– One wideband area audio channel.

It supplies an audio and playback performance that is shown in the table that follows:

CHANNEL	AUDIO INPUT	BANDWIDTH HZ
1	Observer / PA	150 – 3,500
2	Copilot	150 – 3,500
3	Pilot	150 – 3,500
4	Area	150 – 6,000

The SSCVR system supplies all four audio input channels through an audio HEADPHONE output jack at the same time for monitoring purposes. The output jack is located on the front panel of the CCU. As a secondary function, the jack socket output gives an aural tone to indicate a successful completion of erase and self–test functions.

The SSCVR receives and records timing data from the pilot clock through a low speed data bus. The clock input gives timing correlation between the SSCVR and the Flight Data Recorder (FDR). The SSCVR stores the clock input in a crash–survivable memory.

The SSCVR records 2 consecutive hours of four audio input channels and time data into crash–protected memory. The SSCVR begins storing digital audio data upon application of electrical power to the system.

The SSCVR gives a continuous audio output channel which is the composite of the four audio input channels in real time. It is available at the audio monitor HEADPHONE output jack located on the front panel of the CCU.

The SSCVR performs the following BITE functions:

– Power–up Self–Test
– Continuous Monitoring
– Push–To–Test
– Reporting of failures to the CCU

- Recording of failures in the crash–protected memory.

The CVR failure is recorded in the status log and a fail indicator is displayed on the CCU. The status log is stored in the crash protected memory.

Power–Up Self–Test: The SSCVR performs the power–up self–test when the power is applied.

Continuous Monitoring: The SSCVR continuous monitoring function starts within 5 seconds of power–up and is performed during normal operation of the SSCVR.

Refer to Figure 7.

Push–To–Test: The push–to–test function is used to verify proper operation of the SSCVR when the TEST button on the CCU is pressed for more than 2 seconds and then released. During the push–to–test function, cockpit audio is not recorded. The SSCVR fault indicator on the CCU will rapidly flash green. When the push–to–test function has successfully been completed, the SSCVR fault Indicator on the CCU will remain green for 10 seconds. If a failure occurs, the fault indicator will flash yellow then remain yellow indicating that the push–to–test function has failed.

On aircraft without ModSum 4–458442 incorporated, the ERASE switch on the CCU is pushed for two seconds or longer to erase all audio data when the parking brake is set to ON and the aircraft is on the ground. The erase function continues for 5 seconds of the selection. The erase function is verified by a 400 Hz tone for 2 seconds in the HEADPHONE jack.

The aircraft left essential bus supplies 28 VDC power through a 5 A circuit breaker and inertia switch to the SSCVR. The circuit breaker labelled SSCVR is located in position D9 on the 28 VDC avionics circuit breaker panel. The SSCVR typically consumes less than 8 W power.

Recorder, Solid State Cockpit Voice

Refer to Figure 8.

The SSCVR consists of the following LRUs, not including the basic chassis:

- An Interface and Control Board (ICB)
- A Crash–Survivable Memory Unit (CSMU)
- A Power Supply (PS).

The SSCVR provides 28 VDC to the CCU.

The SSCVR is painted bright international orange and has reflective tape to aid its discovery following an accident. All sheet metal parts and fasteners are protected to inhibit corrosion and the crash survivable portion of the LRU displays the message "FLIGHT RECORDER DO NOT OPEN" and "ENREGISTREUR DE VOL NE PAS OUVRIR".

The SSCVR with RIPS weighs 8.68 lb (3.94 kg).

The SSCVR without RIPS weighs 7.9 lb (3.58 kg).

The SSCVR is a remote mounted LRU. It is located with the FDR in the aft fuselage section. It is attached to the aircraft using thumbscrew fasteners in the aft fuselage at station X948.5, Y–10.2 and Z138.4 and 24 in (600 mm) above the lower fuselage outer contour at the airplane center.

The SSCVR is cooled by convection and radiation to ambient air conditions. No forced air–cooling is required for the SSCVR.

On aircraft with 4–309257 OR SB84–31–88 incorporated, SSCVR with Recorder Independent Power Supply (RIPS) is installed. The RIPS monitors the aircraft power supplied to the SSCVR. When aircraft power is lost, the RIPS maintains power to the SSCVR. It supplies 10 minutes of power after 15 minutes of charging or at least 6 minutes of power to the SSCVR after 10 minutes of charging from any discharge condition.

Refer to Figure 9.

The SSCVR has an underwater locating device secured to the container. It is rigidly attached to prevent separation during crash impact. The Underwater Locator Beacon (ULB) is self contained and powered.

The ULB is automatically activated when it is immersed in either fresh water or sea water at all depths from 0.5 to 20,000 ft (.152 to 6096 m). When activated, the ULB radiates an acoustic signal for 30 days or more.

The ULB batteries require periodic replacement to ensure that they perform for 30 days in actual use. The ULB battery has a typical service life of 6 years from date of manufacture. Fabrication date of the battery is stamped on the ULB casing. The ULB must be sent to the manufacturer for battery replacement.

The ULB is accessible from the front face for easy removal and replacement.

Unit, Cockpit Control

Refer to Figure 10.

The CCU contains amplifier circuit.

It interfaces and provides control and monitor functions of the SSCVR system.

The CCU is an LRU. It contains amplifier for the components that follow:

- CVR PASS/FAIL light
- Erase switch
- Test switch
- Headphone jack
- AUDIO signal strength light.

The SSCVR provides 28 VDC to CCU.

The CCU weighs 0.62 lb (0.28 kg). The CCU is installed in the forward centre console using two Dzus fasteners.

The CCU is cooled by convection and radiation to ambient air conditions. No forced air cooling is required for this LRU.

Switch, Inertia (Honeywell and Universal)

Refer to Figure 11.

The normally closed inertia switch contains an inertia/impact activated double pole latching switch. The inertia switch is latched in an open circuit state when activated.

On aircraft without ModSum 4–309257 OR SB84–31–88 incorporated, one inertia switch is installed. One pole of the switch is connected in series with the 28 VDC aircraft supply to the SSCVR. The other pole is connected in series with the 28 VDC aircraft supply to the SSFDR.

On aircraft with ModSum 4–309257 OR SB84–31–88 incorporated, two inertia switches are installed. One switch is for SSCVR. Another switch is for SSFDR. One pole of SSCVR inertia switch is connected in series with the 28 VDC left essential bus to the SSCVR. The other pole is open.

The inertia switch is a highly reliable double pole normally closed inertia switch. It is factory preset to activate at 5.5 g (gravity). It incorporates a manual reset capability that is accessed through a push–to–reset switch.

The inertia switch is attached to the aircraft inclined at 45 degrees. The reset switch points towards the ground and the front of the aircraft, for upward and downward acceleration sensing.

When the aircraft exceeds the preset acceleration level, the inertia switch will latch to its open circuit state and automatically stop the SSCVR from functioning.

The inertia switch weighs 0.3 lb (0.14 kg). It is packaged in an environmentally–sealed housing and is installed to the aircraft using four screws. The downward facing side of the inertia switch contains a push–to–reset switch to facilitate manual reset when the switch is in the open circuit latched state.

A label attached to the front face of the inertia switch states:

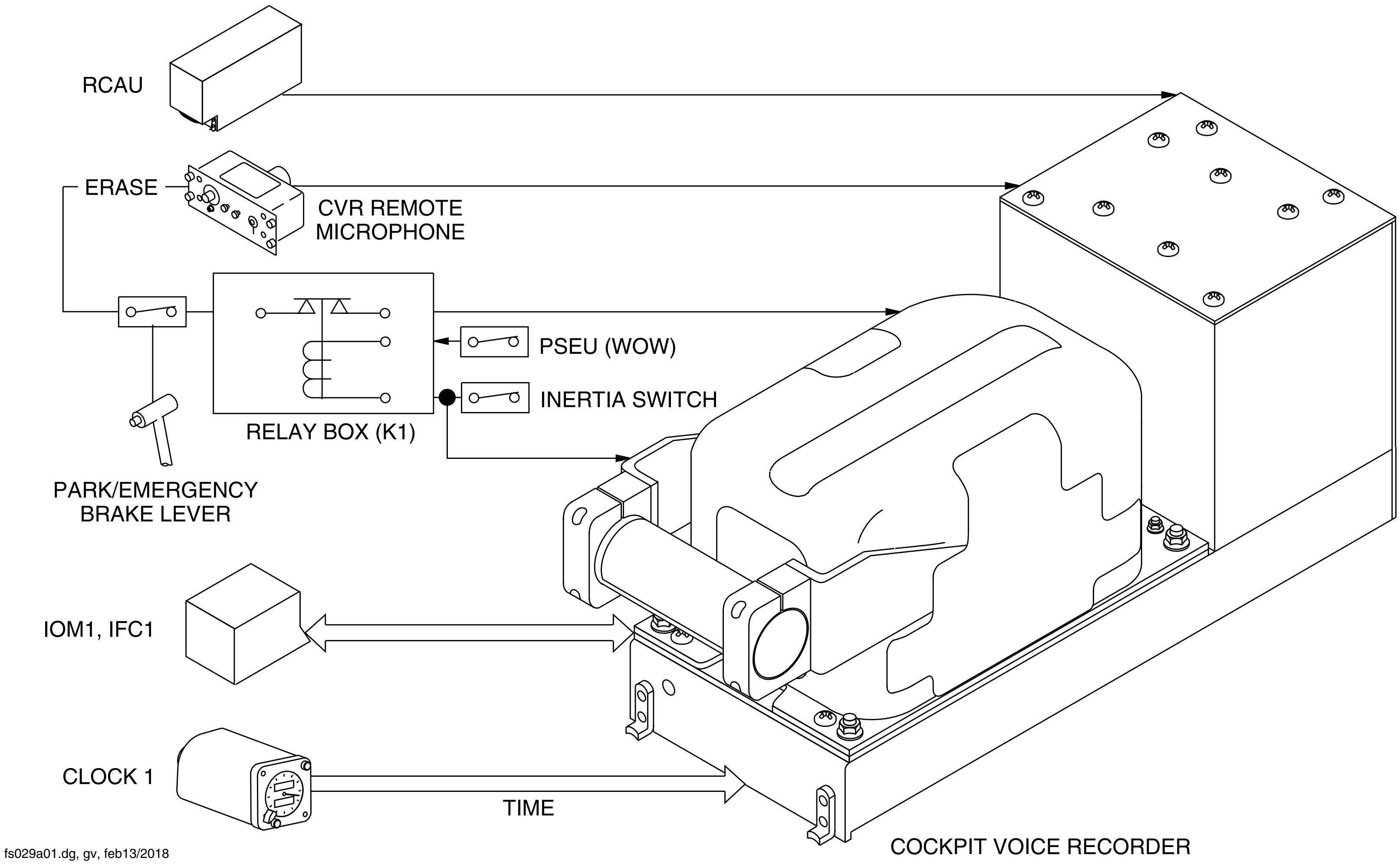
- Serial number
- Manufacturers name and address
- Model number.

The inertia switch is attached on a 45 degree bracket. The bracket is attached to the structure under the floor in the center of the aircraft at station X196.

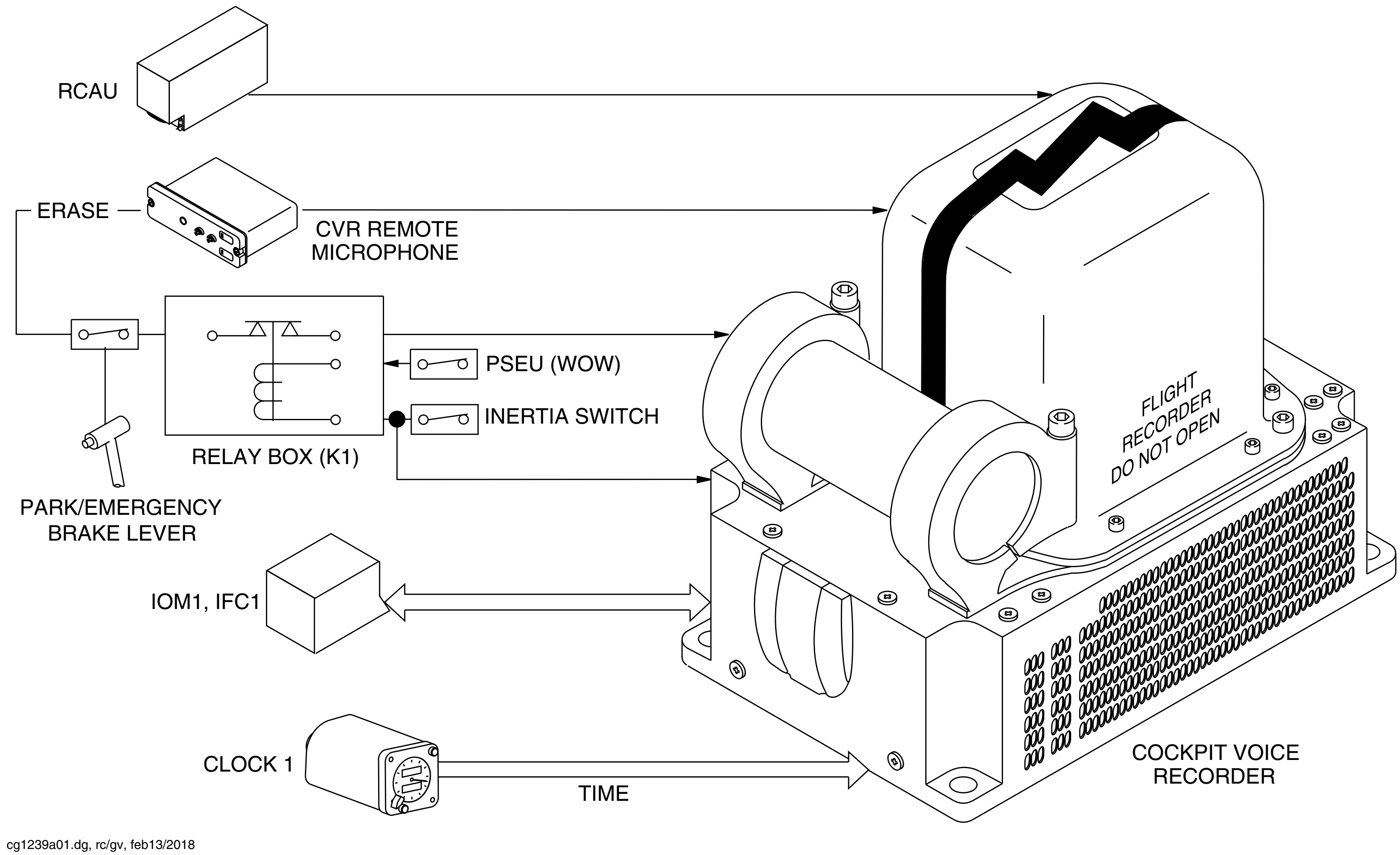
Remote Microphone (Honeywell and Universal)

Refer to Figure 12.

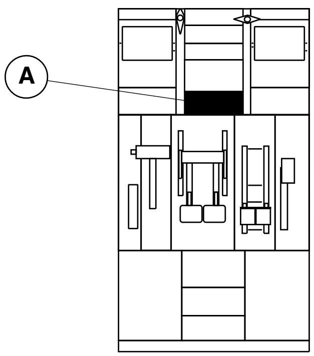
The remote microphone is installed on the glareshield. The remote microphone transmits cockpit audio signals to the MMU.



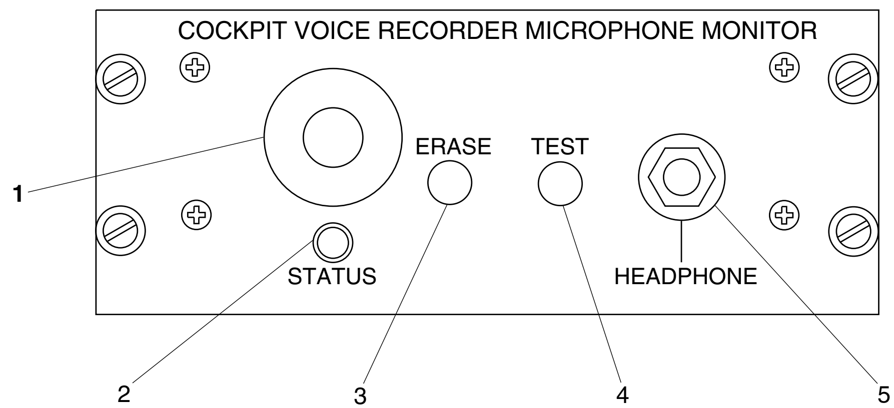
COCKPIT VOICE RECORDER BLOCK DIAGRAM
Figure 1



Cockpit Voice Recorder (Universal) Block Diagram
Figure 2



CENTRE CONSOLE

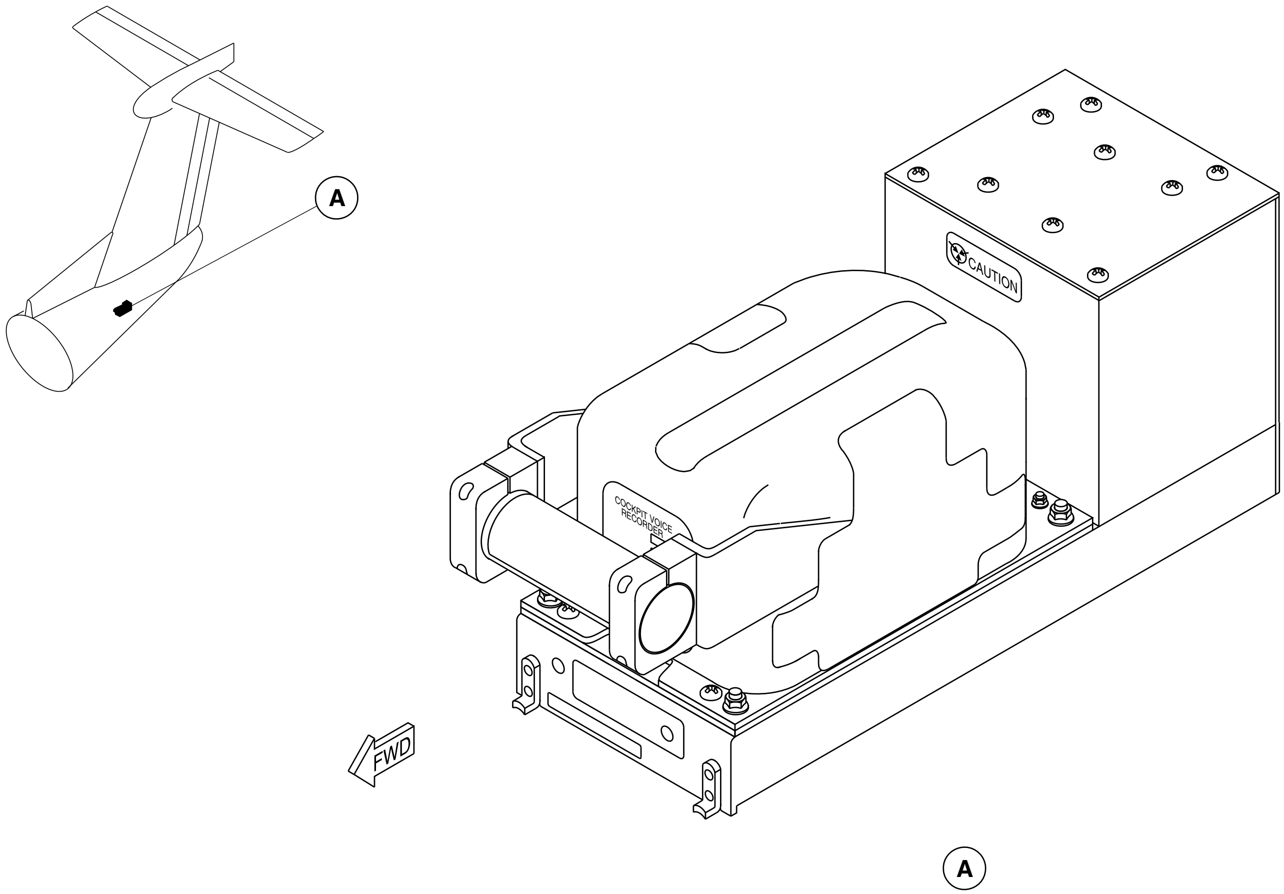


LEGEND

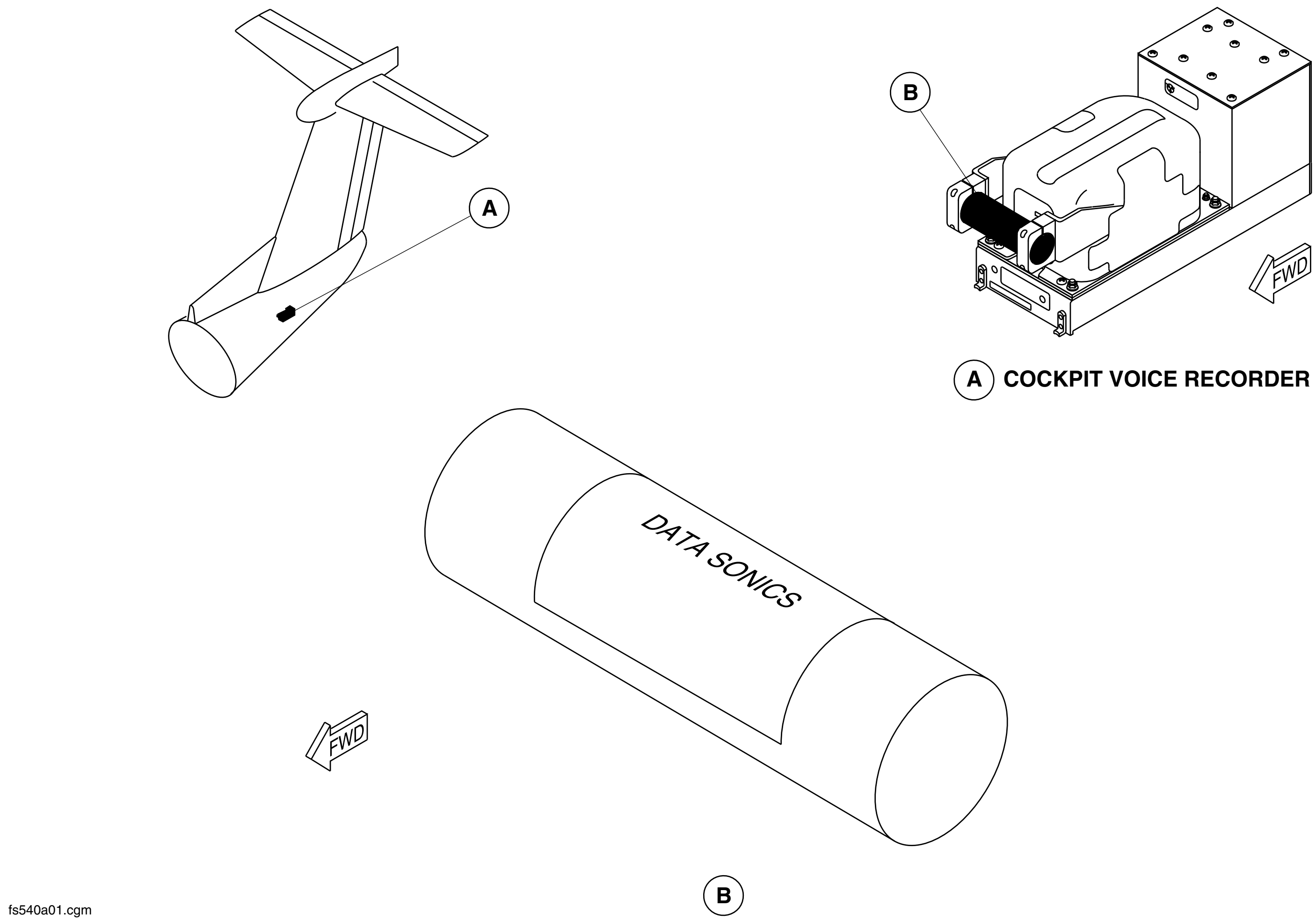
1. Area Microphone.
2. STATUS Annunciator.
3. ERASE Push–Button Switch.
4. TEST Push–Button Switch.
5. Headphone Jack.

fs038a01.cgm

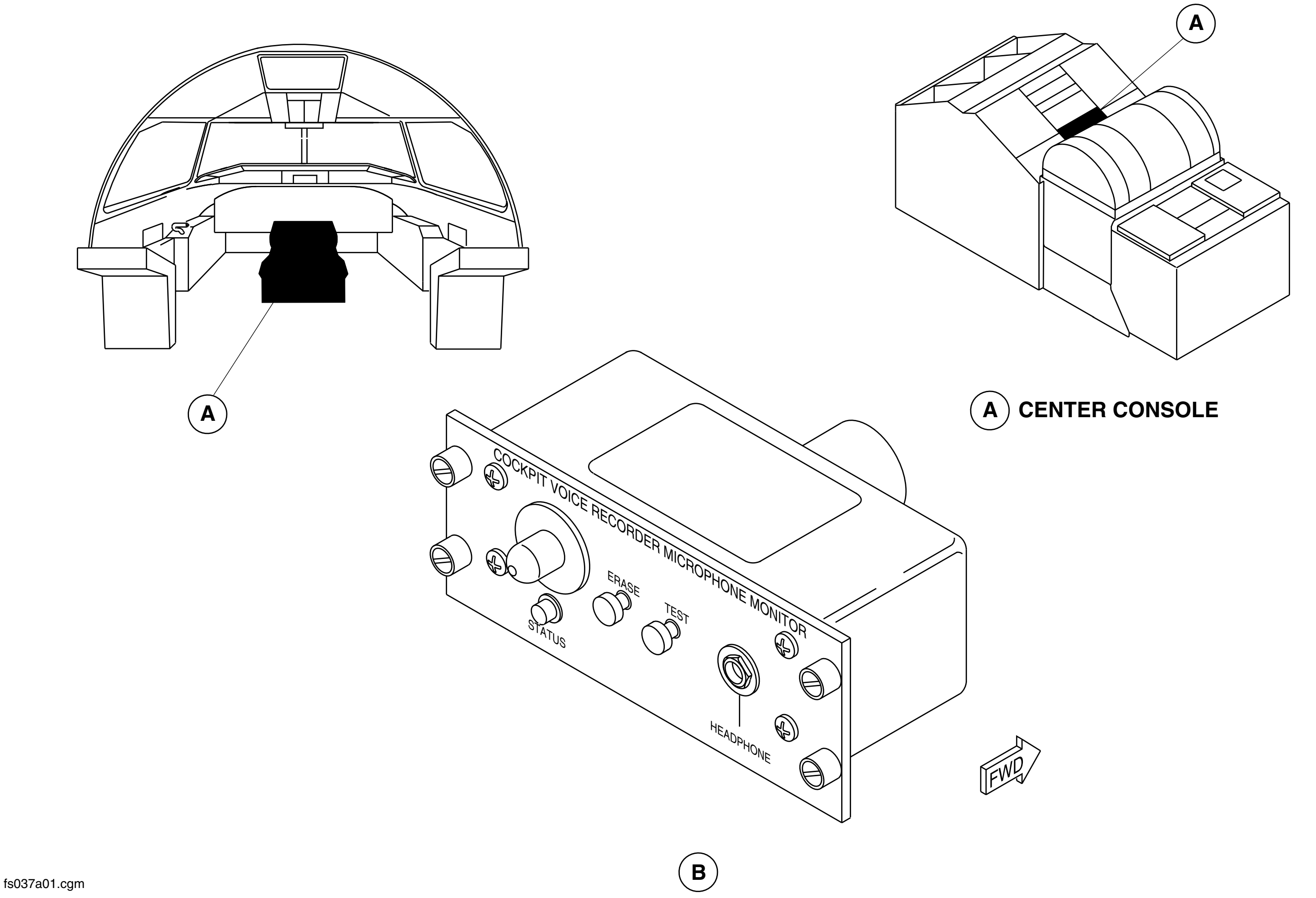
MICROPHONE MONITOR UNIT (MMU)
Figure 3



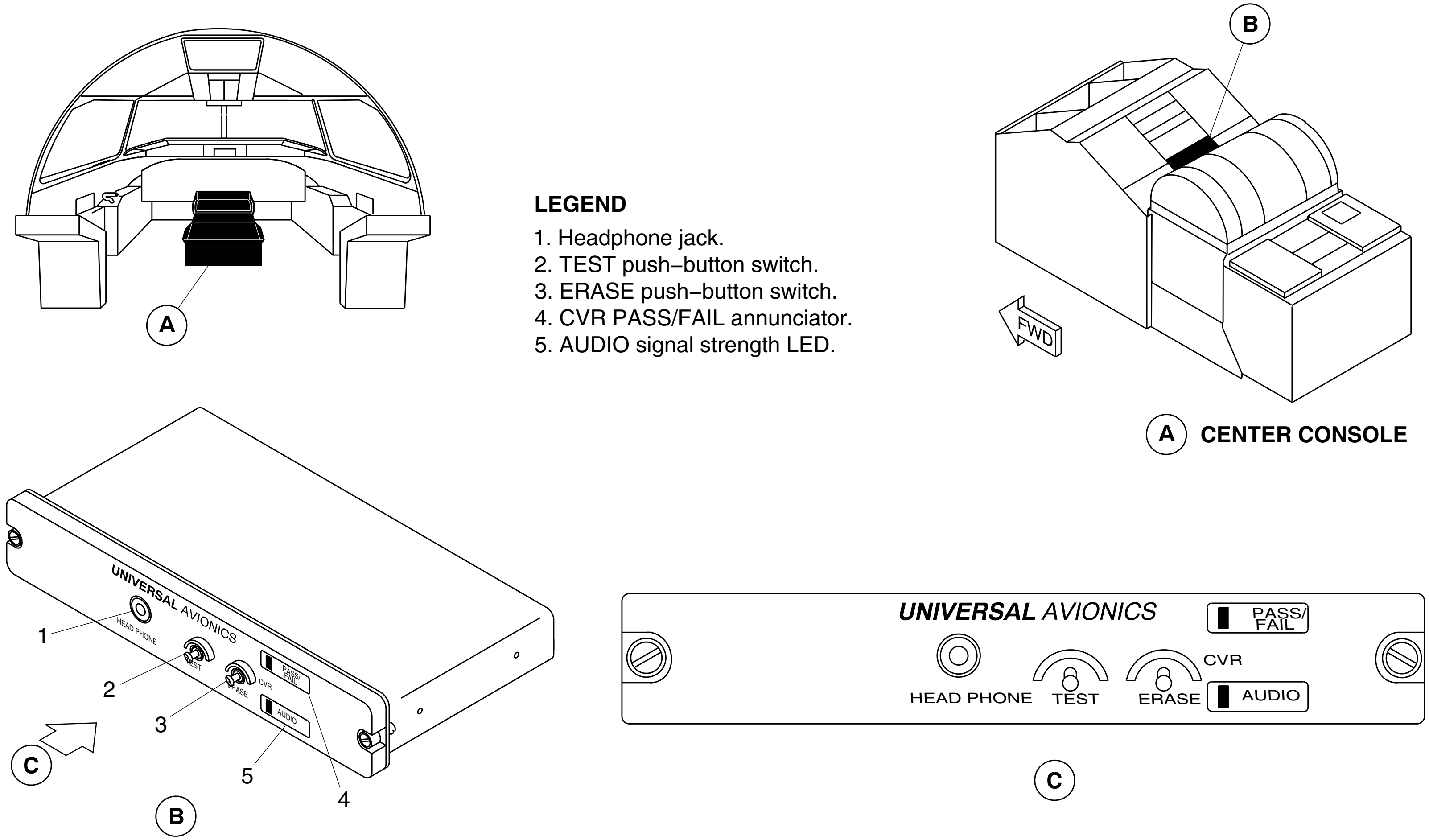
COCKPIT VOICE RECORDER LOCATOR
Figure 4



UNDERWATER LOCATOR BEACON LOCATOR
Figure 5



MICROPHONE MONITOR UNIT LOCATOR
Figure 6

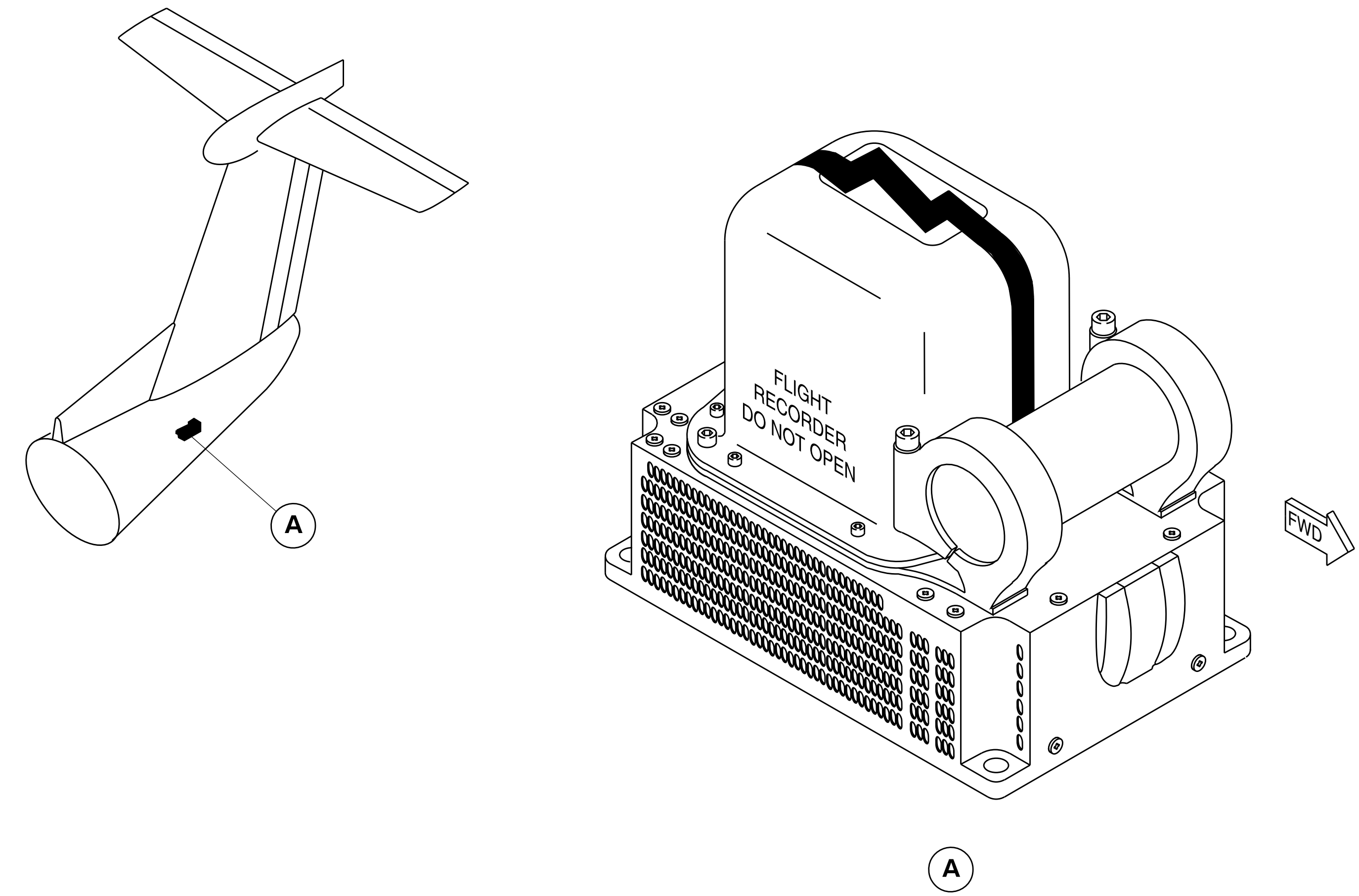


LEGEND

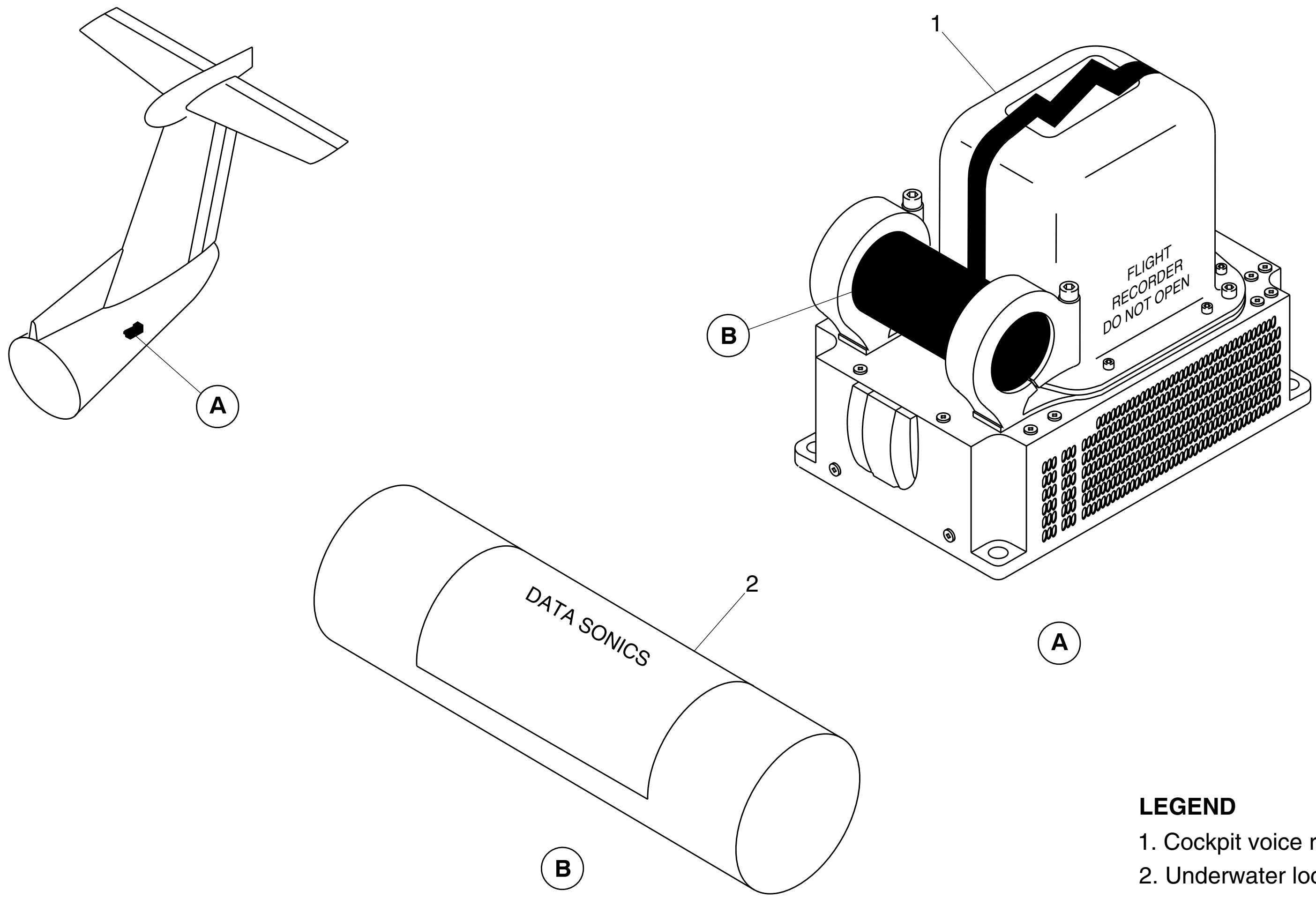
1. Headphone jack.
2. TEST push–button switch.
3. ERASE push–button switch.
4. CVR PASS/FAIL annunciator.
5. AUDIO signal strength LED.

cg1242a01.dg, rc/gv, mar16/2020

Cockpit Control Unit (CCU)
Figure 7



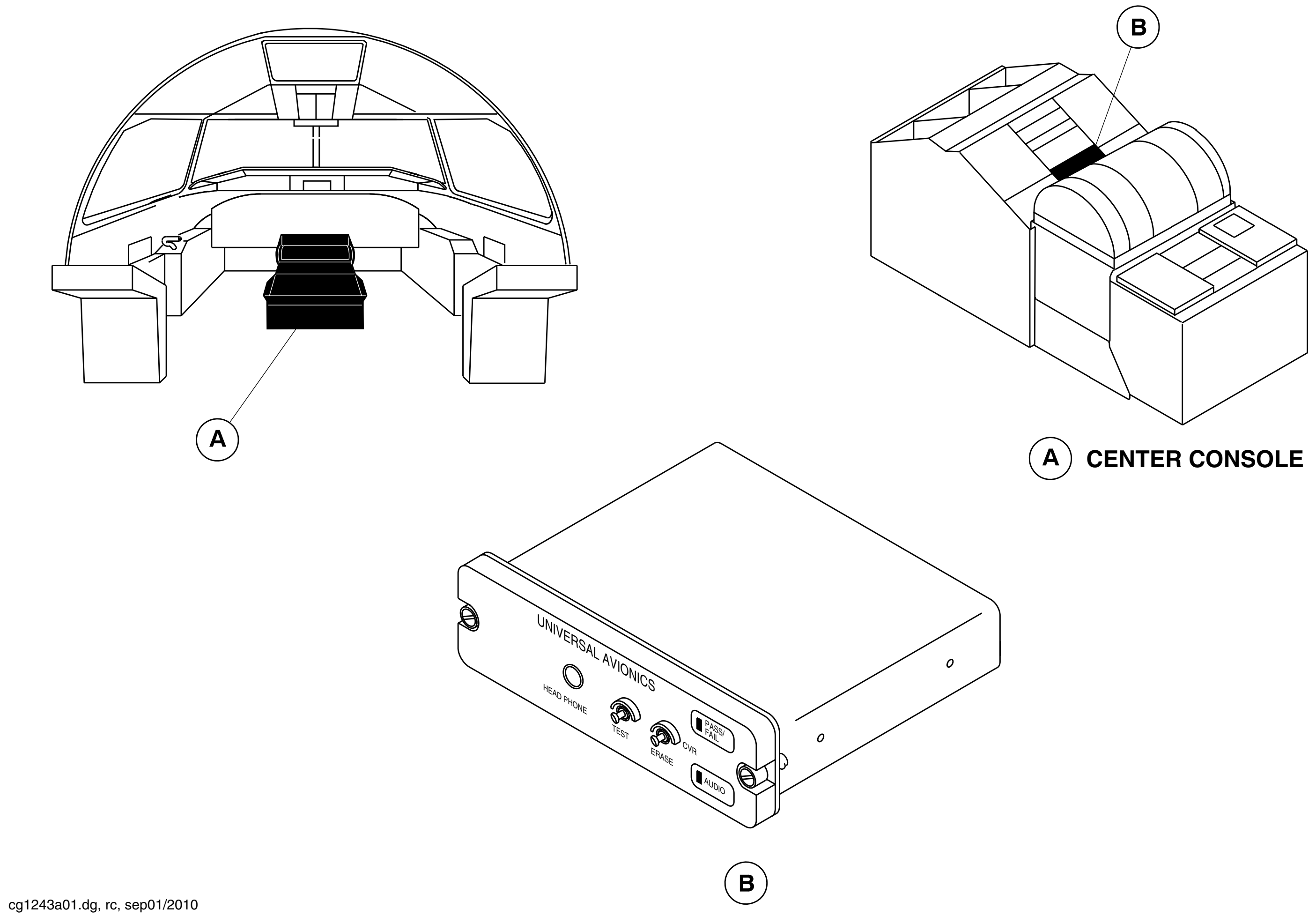
Cockpit Voice Recorder (Universal) Locator
Figure 8



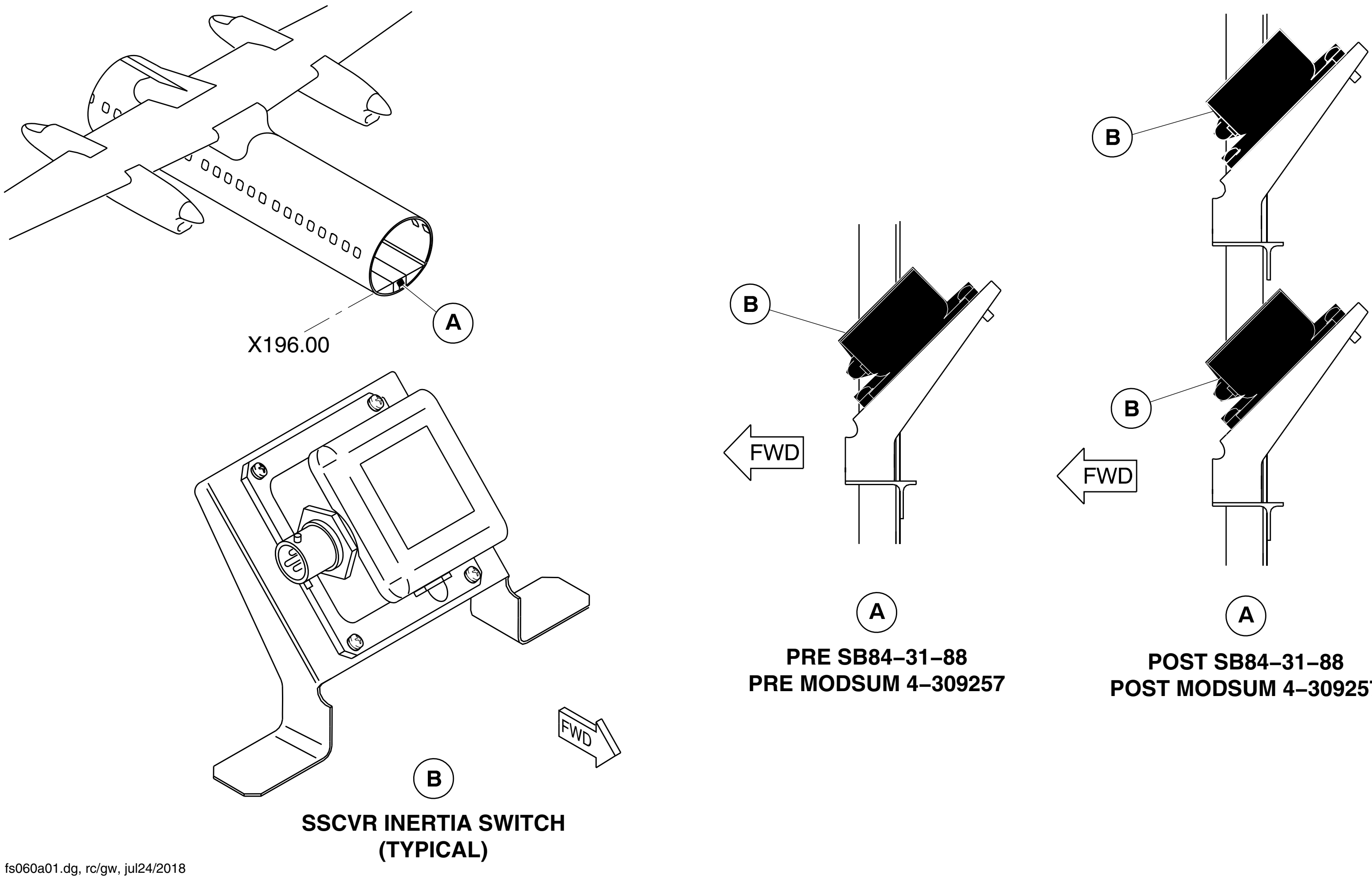
LEGEND

1. Cockpit voice recorder.
2. Underwater locator beacon.

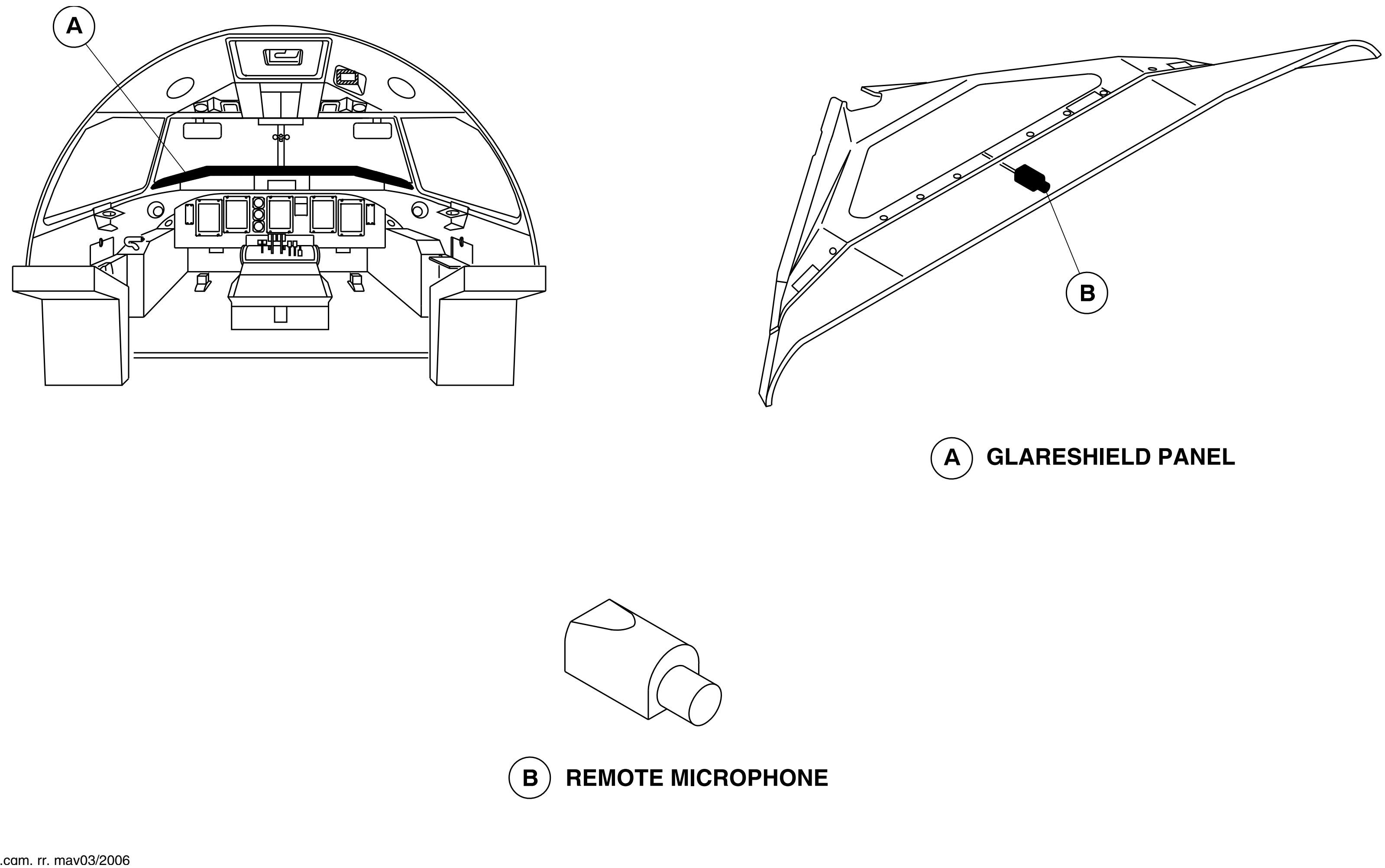
Underwater Locator Beacon (Universal) Locator
Figure 9



Cockpit Control Unit Locator
Figure 10



SSCVR Inertia Switch Locator
Figure 11



CVR Remote MIC Locator
Figure 12

**ON A/C ALL

23–72–00–001

CABIN VIDEO MONITORING AND SURVEILLANCE SYSTEM

Introduction

The Cabin Video Monitoring and Surveillance System (CVMSS) lets the flight crew see all of the area that is outside of the flight crew compartment. The system lets the flight crew identify persons near the flight compartment entry door and to detect suspicious behavior or possible threats.

The CVMSS uses the Control Display Unit (CDU) of Flight Management System (FMS) to display the video images from two cameras in the cabin.

Camera No. 1 is located in the ceiling panel immediately above the flight crew compartment entry door. Camera No. 2 is located in the ceiling panel, approximately 10 ft (3 m) aft of the flight crew compartment entry door. Camera No. 1 looks down and camera No. 2 looks down and forward.

On aircraft with ModSum 4–309245 OR SB84–23–45 OR SB84–23–54 OR SB84–23–56 incorporated, the cabin video monitoring and surveillance system is installed.

On aircraft with ModSum 4–458529 incorporated, the cabin video monitoring and surveillance system is removed.

General Description

Refer to Figures 1 and 2.

The CVMSS is designed to let the flight crew monitor the flight compartment door entry area, forward galley and cabin areas from a seated position.

Redundant controls are provided at the center console that helps flight crew to control the system, power the cameras and monitor the video distribution.

The CVMSS is powered by the aircraft's left secondary bus.

On aircraft without ModSum 4–459648 OR with SB84–23–57 incorporated, the CVMSS has the components that follow:

- Two cameras located in the ceiling panels (23–72–11)
- A Camera Control Unit (CCU) (23–72–01)
- A camera power switch located in the center console (23–72–06)
- Two video converters located in under floor on the left side of the flight crew compartment (23–72–16).

On aircraft with ModSum 4–459648 OR SB84–23–56 incorporated, the CVMSS has the components that follow:

- Two cameras located in the ceiling panels (23–72–11)
- A Camera Control Unit (CCU) (23–72–01)
- A camera power switch located in the center console (23–72–06)
- A video converter located in under floor on the left side of the flight crew compartment (23–72–16).

Detail Description

Refer to Figures 3 and 4.

Refer to Figure 5.

Camera Power Switch

The CVMSS uses a camera power switch to control the power to the CCU, which in turn supplies the power to the cameras and the video converters. The power switch is located at aft of the weather radar (WXR) control panel in center console of the flight crew compartment.

Camera Control Unit

The Camera Control Unit (CCU) is used to select the video from the two cameras and display on the FMS CDU. The output from each individual camera can be selected on the CCU. The output images selected on the CCU are displayed on the FMS 1 and FMS 2 (if installed).

On aircraft without ModSum 4–459648 OR with SB84–23–57 incorporated, the CCU has two independent sets of controls allowing the pilot and the copilot to view either of the cameras via a select switch.

On aircraft without ModSum 4–459648 OR with SB84–23–57 incorporated, the left camera knob controls camera selection to FMS 1 and the right camera knob controls camera selection to FMS 2.

On aircraft with ModSum 4–459648 OR SB84–23–56 incorporated, the CCU has one control allowing the pilot or the copilot to view either of the cameras via the select switch.

On aircraft with ModSum 4–459648 OR SB84–23–56 incorporated, the camera knob controls camera selection to FMS 1.

The CCU power distribution architecture has been designed so that the failure of a single component will not cause a total system failure. The camera gets 12V DC from the CCU.

The CCU is located at the extended center console in the flight compartment.

Camera

The CVMSS uses two near infrared cameras to capture video at the flight compartment door entry area, forward galley and cabin areas. The two near infrared cameras used are black and white cameras.

The use of a highly sensitive Closed Circuit Device (CCD) sensor assures visibility in the low light conditions (approximately 100 times more sensitive than a standard low light camera). This extreme low light capability provides clear visibility in all the normal and the emergency aircraft lighting conditions. The near infrared cameras are used to obtain visual images of different locations of the aircraft.

Two cameras are installed on the cabin ceiling outside of the flight crew compartment entry door.

Camera No. 1 is located in the ceiling panel immediately above the flight crew compartment entry door, looking down. Camera No. 1 is positioned so that an image of the head and features of the person standing at the flight crew compartment entry door can be seen.

The area that is seen by camera No. 2 is the area bounded by the flight compartment door, lavatory, wardrobe, forward baggage compartment and the airstair door. The video images produced by the two cameras are displayed on the FMS CDU.

The two cameras operate as follows:

- Power is applied to the camera whenever power is applied to the CCU. When power is applied to the camera, the cameras will produce an output video signal.
- The output video signal from the camera is a 0.7V peak–to–peak NTSC formatted composite video signal.

The mounting assembly for the cameras No. 1 and No. 2 allows for easy installation and quick mounting or adjustment of the cameras.

Video Converters

On aircraft without ModSum 4–459648 OR with SB84–23–57 incorporated, the CVMSS uses two video converters. The video converters will convert the camera NTSC video signal from the CCU to RGB–S (Red, Green, Blue – Synchronized) video signal, which will be used by the FMS to display images that can be viewed by the flight crew on the FMS CDU.

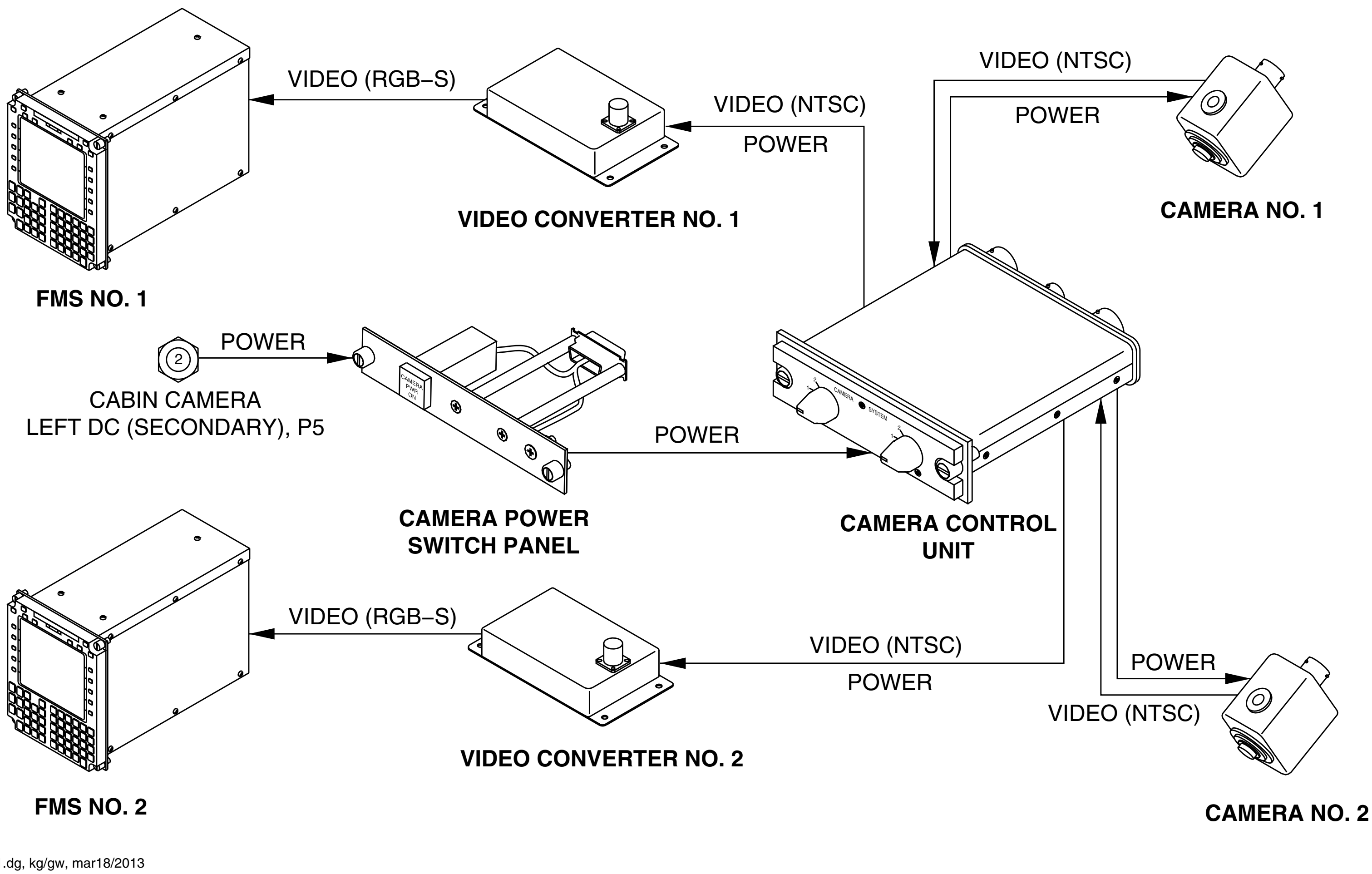
On aircraft with ModSum 4–459648 OR SB84–23–56 incorporated, the CVMSS uses one video converter. The video converter will convert the camera NTSC video signal from the CCU to RGB –S (Red, Green, Blue – Synchronized) video signal, which will be used by the FMS to display images that can be viewed by the flight crew on the FMS CDU.

The CVMSS uses the FMS CDU to display the video captured by the cameras.

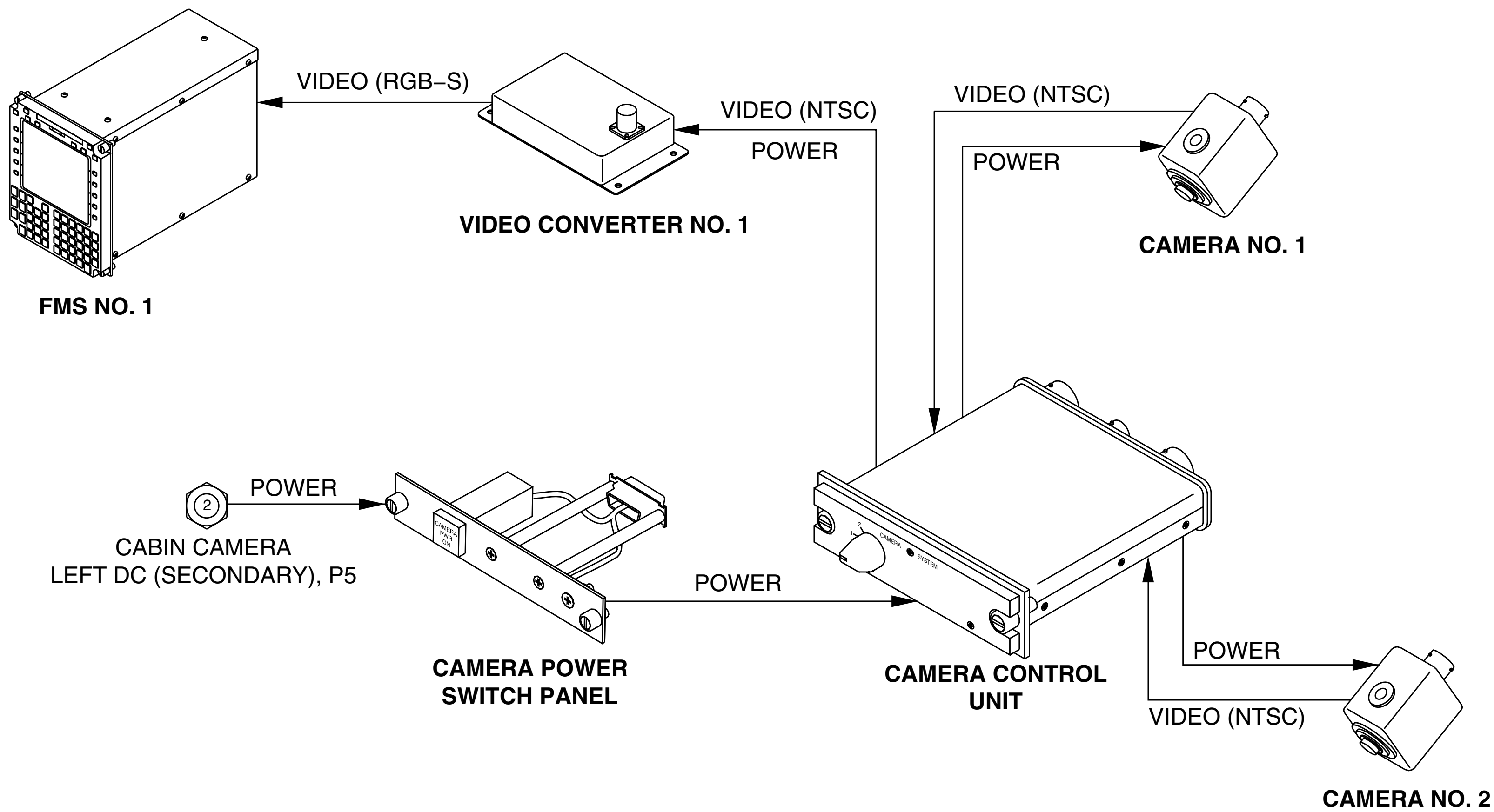
To access the active video display on the CDU of FMS, the ON/OFF–DIM key is pressed on the FMS and the DISPLAY LSK [4R] and the VIDEO LSK [4R] are selected. The FMS enters into the video mode.

In the FMS video mode, the Line Shift Keys (LSK) [1R] and [2R] are used to control the brightness of the video displayed. The LSK [1R] is used to brighten the display and the LSK [2R] is used to dim the display.

While the FMS is in video mode, the FMS will continue to navigate in normal condition and no CDU messaging will occur. If any keys other than LSKs [1R] and [2R] are selected, the FMS will exit the FMS video mode.

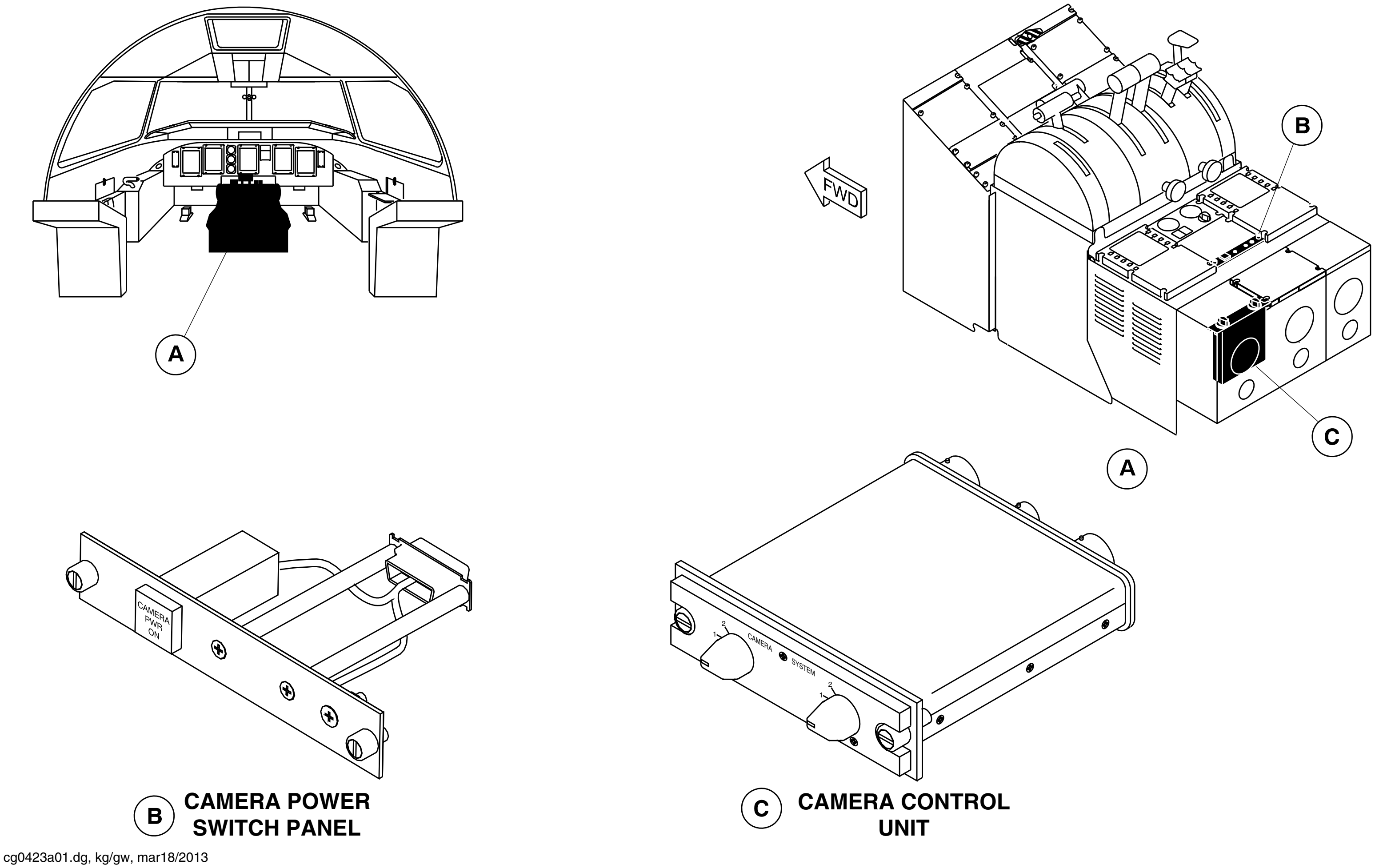


CABIN VIDEO MONITORING AND SURVEILLANCE SYSTEM – BLOCK DIAGRAM
Figure 1

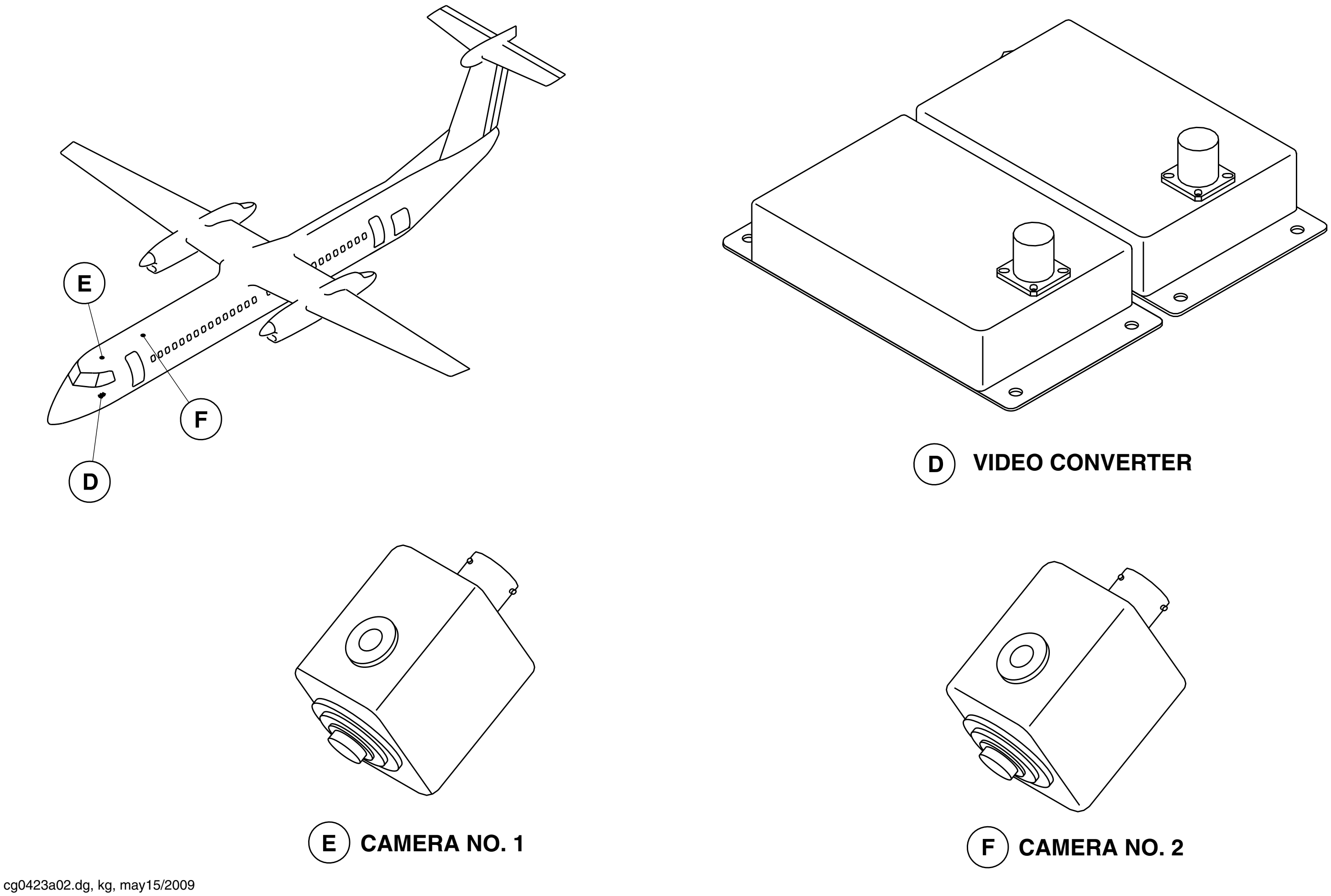


cg5107a01.dg, rc, jun03/2017

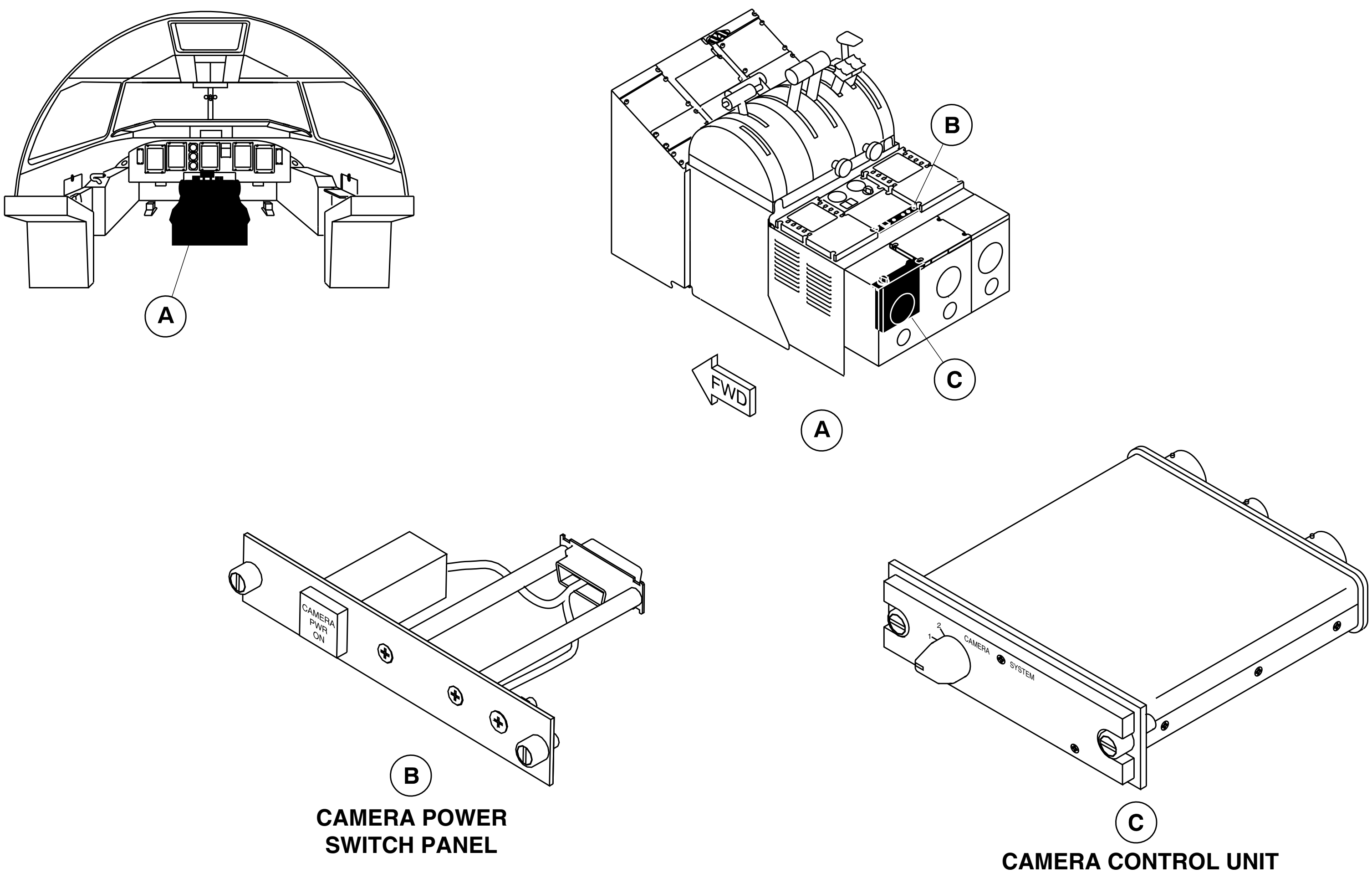
Cabin Video Monitoring and Surveillance System – Block Diagram
Figure 2



CABIN VIDEO MONITORING AND SURVEILLANCE SYSTEM – COMPONENT LOCATOR
Figure 3 (Sheet 1 of 2)

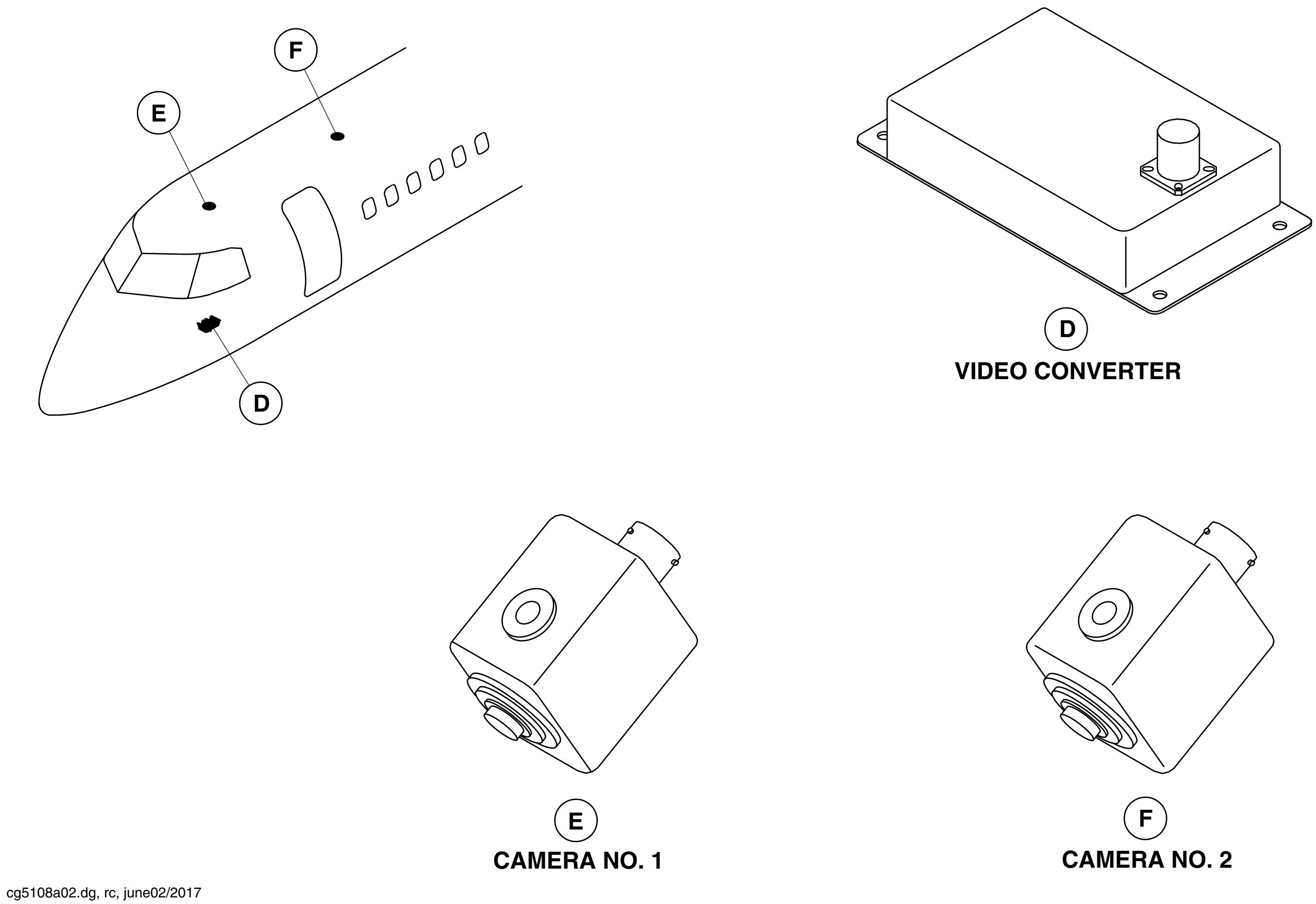


CABIN VIDEO MONITORING AND SURVEILLANCE SYSTEM – COMPONENT LOCATOR
Figure 3 (Sheet 2 of 2)

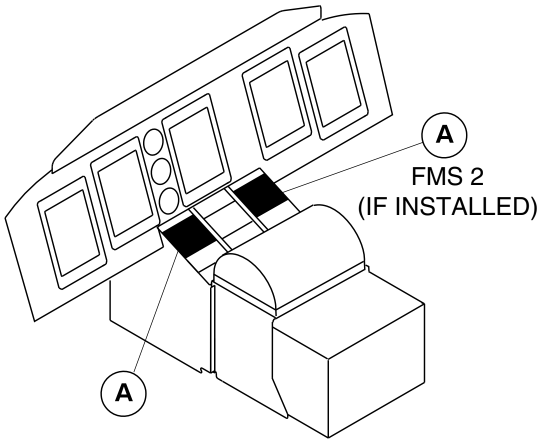


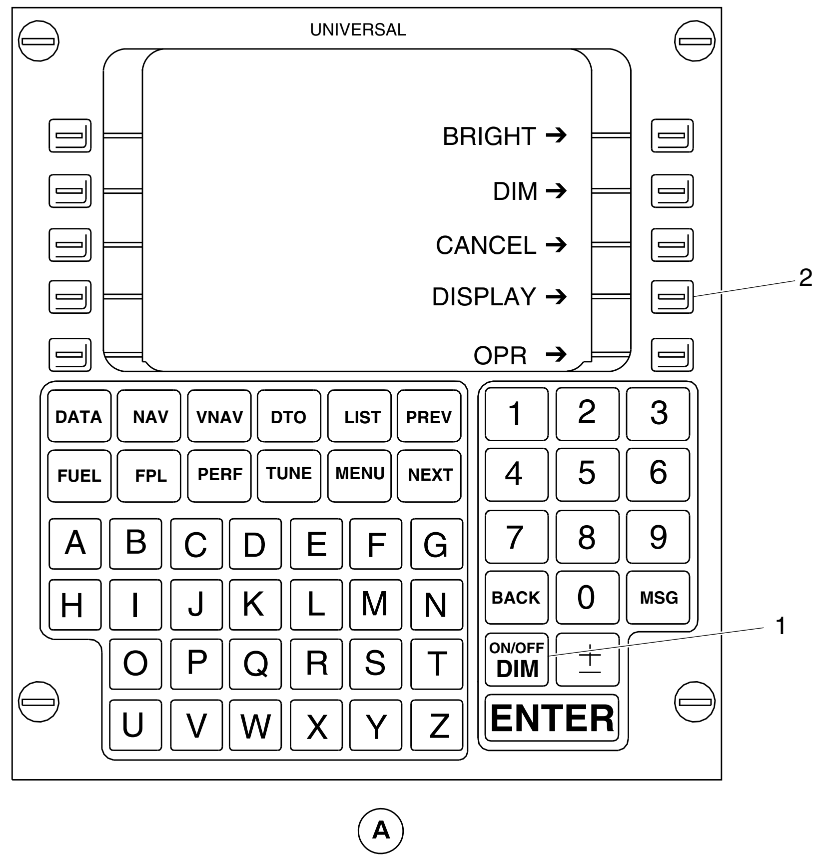
cg5108a01.dg, rc, june02/2017

Cabin Video Monitoring and Surveillance System – Component Locator
Figure 4 (Sheet 1 of 2)



Cabin Video Monitoring and Surveillance System – Component Locator
Figure 4 (Sheet 2 of 2)



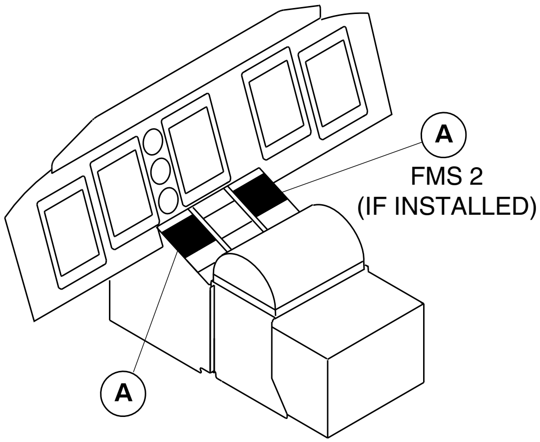


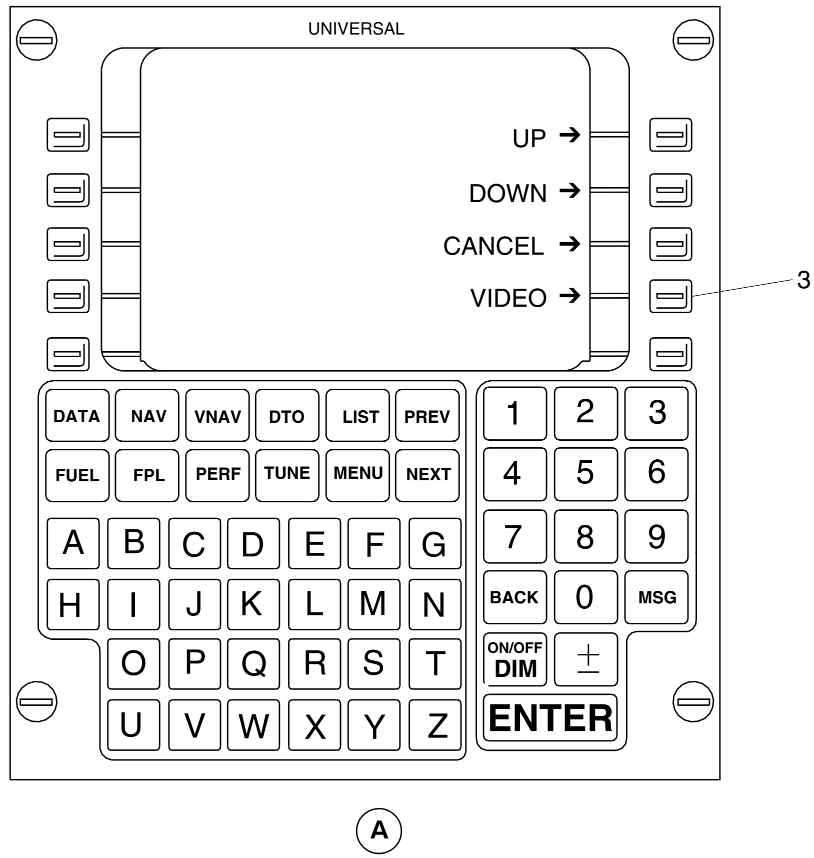
LEGEND

1. ON/OFF – DIM key.
2. Display LSK.

cg0424a01.dg, kg/rc, jun03/2017

VIDEO MODE SELECTION – FMS
Figure 5 (Sheet 1 of 2)





LEGEND
3. Video LSK.

cg0424a02.dg, kg/rc, jun03/2017

VIDEO MODE SELECTION – FMS
Figure 5 (Sheet 2 of 2)

**ON A/C ALL

23–80–00–001

RADIO MANAGEMENT SYSTEM

Introduction

The Radio Management System controls the communication and navigation radios, Central Diagnostic System (CDS), Passenger Address and Communication Interphone System (PACIS) and the Audio Integrating System (AIS).

General Description

The radio management system has the functions that follow:

– Tune the communication and navigation radios and sets their mode of operation
– Control the operation of the CDS
– Control the operation of the PACIS
– Control the operation of the AIS
– Senses the condition of the communication and navigation radios for indication of malfunctions.

Detailed Description

Audio and Radio Control Display Unit (ARCDU):

Refer to Figure 1.

The ARCDU is a Line Replaceable Unit (LRU) that has all electronic circuitry necessary for its operation.

The ARCDU has a 2.95 in^2 (1903 mm^2) active matrix LCD with 480 by 480 pixels of resolution.

The display operates with three characters sizes that follow:

– Large Font, Operational mode (LFOP), 14 lines of 20 characters
– Small Font, Operational mode (SFOP), 17 lines of 21 characters
– Tiny Font, Operational mode (TFOP), 18 lines of 26 characters.

The font typeface is Futura medium for LFOP and SFOP fonts.

The ARCDU faceplate also has switches and controls with lettering and function dividing lines in white. The ARCDU weighs 8 lb (3.62 kg). Its subassemblies are contained in an 8.25 in. (209.4 mm) high, 5.75 in. (146.0 mm) wide by 7.1 in. (180.0 mm) deep aluminum enclosure with a satin grey faceplate.

The ARCDUs are installed in the aft part of the center console and are secured with six Dzus fasteners.

System Description (System Overview):

Refer to Figure 2.

The radio management system has two Audio and Radio Control Display Units (ARCDU1 and ARCDU2) and has the interfaces that follow:

- Advisory lights unit for test and dim of the PACIS keys
- Variable 5 VDC for the backlighting dimming function of the front panel
- Input/Output Modules (IOM1 and IOM2) for sensing failures of ARCDU1 and ARCDU2 (discrete)
- Input/Output Processors (IOP1 and IOP2) for the CDS function and wraparound radio function (validities)
- Remote Control Audio Unit (RCAU) for selection of the emergency audio mode, microphone selection (boom/mask) and primary ARINC 429 communication for audio and radio control
- Opposite ARCDU, for cross–side control of audio and radios
- Proximity Switch Electronics Unit (PSEU) for on ground or airborne condition
- Maintenance switch, to enable the CDS function
- Communication and navigation radios with ARINC 429 for tuning
- Transponder relays, to switch between No.1 and No.2 transponders
- Pilot and Copilot control wheel for the remote transponder identification function
- Flight Management Systems (FMS1 and FMS2) for radio frequency control.

Refer to Figure 3.

ARCDU1 is usually energised by the left essential or right main bus, but when the emergency lights are on, an emergency lights power supply energises a relay to change the electrical power source to right battery power bus.

ARCDU2 is energised by the right essential and the left main bus.

The buses are isolated with diodes.

The ARCDU has the modes that follow:

- Operational
- CDS Display
- Initiated Built–in Test (IBIT).

Operational mode: The operational mode is set by the position of the OFF/ON/BOTH/FM and NORM/EMER switches.

Continuous test is done and its status is sent to the other ARCDU.

CDS display mode: The CDS display mode can be activated on each ARCDU when set to ON, BOTH, or FMS mode.

There is no radio control because the display of the ARCDU is controlled by the CDS.

Only one ARCDU can be controlled by the CDS at a time.

IBIT (Initiated Built–in Test) mode: The CDS can activate the built–in–test (BIT) mode of the ARCDU by a request transmitted through the RCAU. When in this mode the ARCDU only receives the requested test and sends test results to the RCAU for the CDS BIT.

Controls and Indications

Refer to Figure 4.

The ARCDU has a configuration knob with the positions that follow:

Table 1: OFF/ON/BOTH/FMS rotary switch selection

POSITION	FUNCTION
OFF	Unit is not energised
ON	ARCDU is energised and can control its own–side radios
BOTH	ARCDU is energised and can control radios on both sides
FMS	FMS and the ARCDU can control radios on both sides

A TEST IN PROGRESS (white) message is shown in the center of the display during a power on self test (POST) and if the test fails, an ARCDU FAILED (red) message is shown.

If the ACM configuration is invalid, the ARCDU shows a BAD A/C CONF (red) message.

Refer to Figures 5 and 6.

The display of the ARCDU has the different pages that follow:

- Main 1 and 2
- Particular
- Channel (memory) programming
- Menu to control the CDS.

The main pages have display areas for:

- Communication and navigation radios
- INT (interphone)
- ATC (transponder and TCAS).

NOTE

The indications at the bottom of the display for INT and ATC are always shown.

Each display area has:

- A vertical label to identify the display area
- A vertical bar graph to show audio selection
- Three lines of data to show the active frequency (green), preset frequency (cyan) and mode selection (white).

Main page 2 has the controls and indications for the optional radios such as HF1 and vertical bar graphs for all audio selections.

The particular pages give control of the different modes and functions for radios that follow:

- VHF
- VHF NAV (VOR or ILS)
- ADF

– ATC/TCAS

Refer to Figure 7.

The side key adjacent to the display area of the radio is pushed to select it for tuning. The same key is pushed again to toggle the active and preset frequencies, or the double rotary knob is turned to change the preset frequency of the radio.

The CH key is pushed to toggle the tuning mode of the radio between frequency and channel tuning modes. The double rotary knob is turned for the channel selection.

A channel number (CH1 to CH8) is shown during tuning if the preset frequency is the same as the programmed frequency. If not, then only CH is shown.

NOTE

Both knobs have a roll over function but only the inner knob has a variable rate for quick tuning.

Potentiometers are pushed to set audio on and off and turned to control the headset and speaker volume as follows:

Table 2: Audio Selection and Volume Control

POTENTIOMETER	AUDIO SOURCE
VHF1	VHF COM1
VHF2	VHF COM2
HF	None, or HF1 if installed
AUX1	None, or VHF3 if installed
AUX2	None, or HF2 if installed
SERV/INT	Pilot, copilot, attendant and ground crew interphone
VOR1	VHF NAV1
VOR2	VHF NAV2
SPKR	Own–side cockpit speaker volume
MKR	Sum of marker beacon audio from VHF NAV1 and VHF NAV2
DME1	DME1 Channel 1
DME2	DME1 Channel 2, or DME2 Channel 2 if DME2 installed
ADF1	ADF1
ADF2	None, or ADF2 if installed

The potentiometers identified as AUX1 and AUX2 are used to control optional radios which do not have their own potentiometer.

The bar graph is white when the audio off and green when it is on and the level relates to the potentiometer position.

When in PA mode, the PA side tone audio is automatically set.

Bar graphs for HF1 and AUX2 are only shown if the radios are installed.

The transmission rotary selector enables the transmission selection that follows:

Table 3: Rotary Microphone Selection

SELECTOR POSITION	TRANSMITTER
VHF1	VHF COM1
VHF2	VHF COM2
HF	None, or HF1 if installed
AUX1	None, or VHF3 if installed
AUX2	None, or HF2 if installed
SERV/INT	Flight compartment and ground crew interphone
PA	Flight compartment and cabin crew interphone (CALL or EMER), or PACIS PA mode

A message for the position of the transmit selector knob is shown in the INT display area.

A TX (green) annunciator is shown in the display area of the radio when a radio push to talk switch is activated. It is also shown if the radio is defective.

Refer to Figure 8.

The side key adjacent to the display area of the radio is pushed to select it and then the EXP key is pushed to go to the particular page.

The side key adjacent to CHANNELS on the particular page is then pushed to go to the channel programming page for the radio.

The page is identified at the top of the display with black letters and numbers on white background.

The side key adjacent to a channel area is pushed once for the first channel and pushed again for the other channel.

The double rotary knob is turned to change the frequency of the channel. Then, the new frequency is saved in the NVM and sent to the other ARCDU.

The side key adjacent the radio set is pushed to go to the next channel programming page, the PG 1/2 key is pushed to go back to the main page 1, or the EXP key is pushed to go to the particular page.

NOTE

The PG 1/2 key also toggles main page 1 and 2.

Refer to Figure 9.

The DIM/RTN key is pushed and while the DIM/BRT message is shown, a selection of the double rotary knob changes the display brightness.

NOTE

The initial brightness of the display is between minimum and maximum brightness.

Operation

BITE Retrieval:

The AVIONICS STATUS page of the central diagnostic system (CDS) gives the list of currently failed avionics subsystems.

If no failure is detected, the page NO FAULT DETECTED is shown.

MEL/CDL:

ARCDU radio tuning function (on aircraft with at least one FMS installed) may be inoperative provided:

- FMS radio tuning function of the inoperative ARCDU in "FMS" mode is verified operative.
- The operative ARCDU radio tuning function is verified operative in "BOTH" or "FMS" mode.

The location of the ARCDU is set by pin–programming.

DIAGNOSTICS:

A radio is failed when a communication link is failed (ARINC FAILURE state) or a radio sends a failed condition (RADIO FAILURE state).

An ARINC failure condition is set if:

- any part of the continuously ARINC word is not received
- a numeric value used by ARCDU in an ARINC word is received with an out of range value
- a numeric value used by ARCDU in the ARINC word is invalid.

The ARINC failure condition is reset when ARCDU receives three consecutive transmissions of a previously failed word without a failure condition.

If a radio is failed, a FAIL message is shown in the related display area, preset values are not shown, but the last correct received active value is shown.

These commands are still available when a radio cannot be tuned or controlled because of the FAIL state.

Table 4: Radio Tests

RADIO	COMMAND ALLOWED WHEN IN FAIL STATE
VHF	TEST
VHF NAV	Marker commands
DME	None

RADIO	COMMAND ALLOWED WHEN IN FAIL STATE
ADF	TEST
ATC	None
TCAS	None

For a RCAU ARINC Failure, a FAIL message is shown in the INT display area and the ARCDU audio control is still supplied to the RCAU.

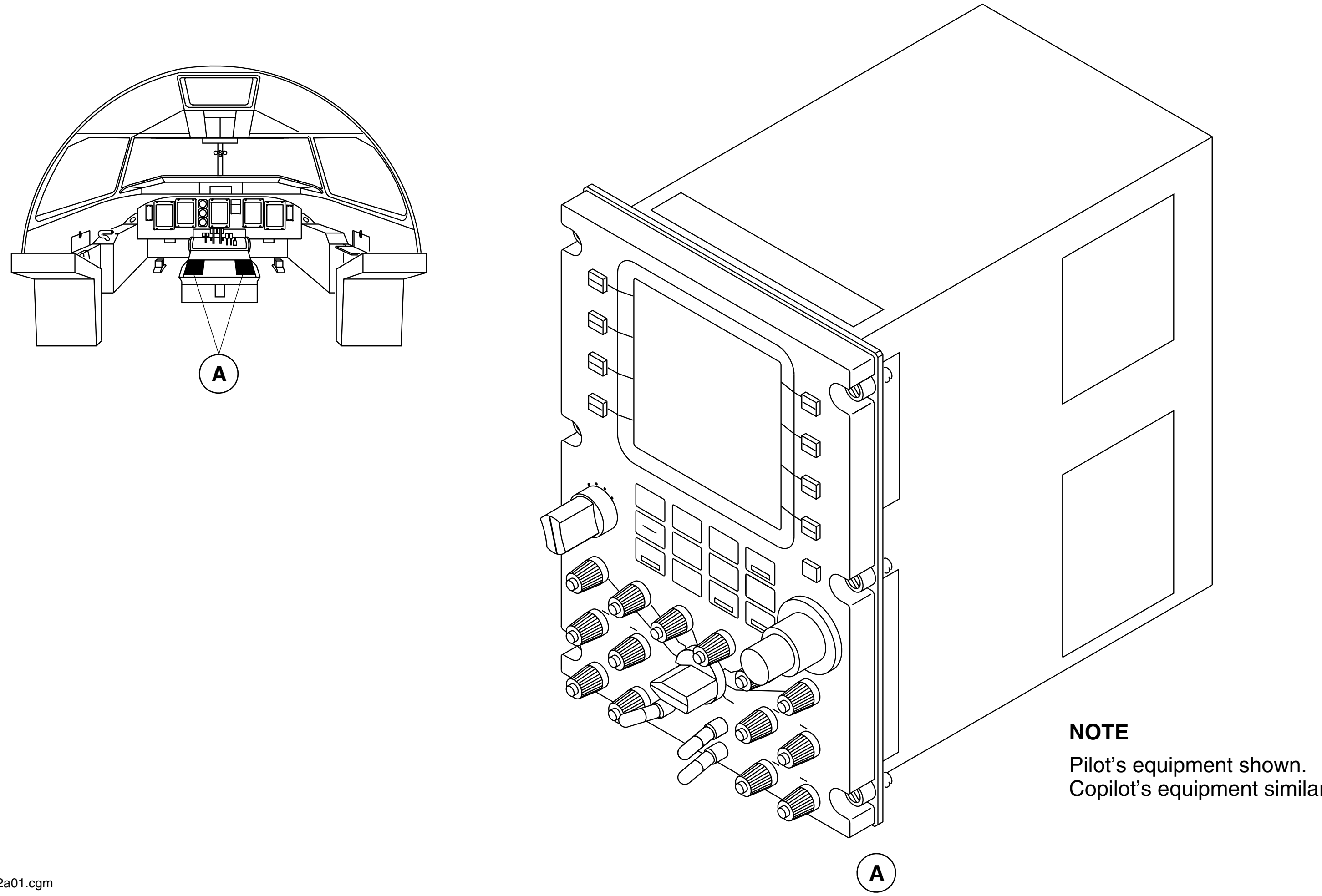
RCAU automatic reconfiguration: If the RCAU sends an automatic reconfiguration:

- FAIL message is shown in INT display area
- Audio control is disabled
- Preset audio level and selection is shown
- PACIS control is disabled.

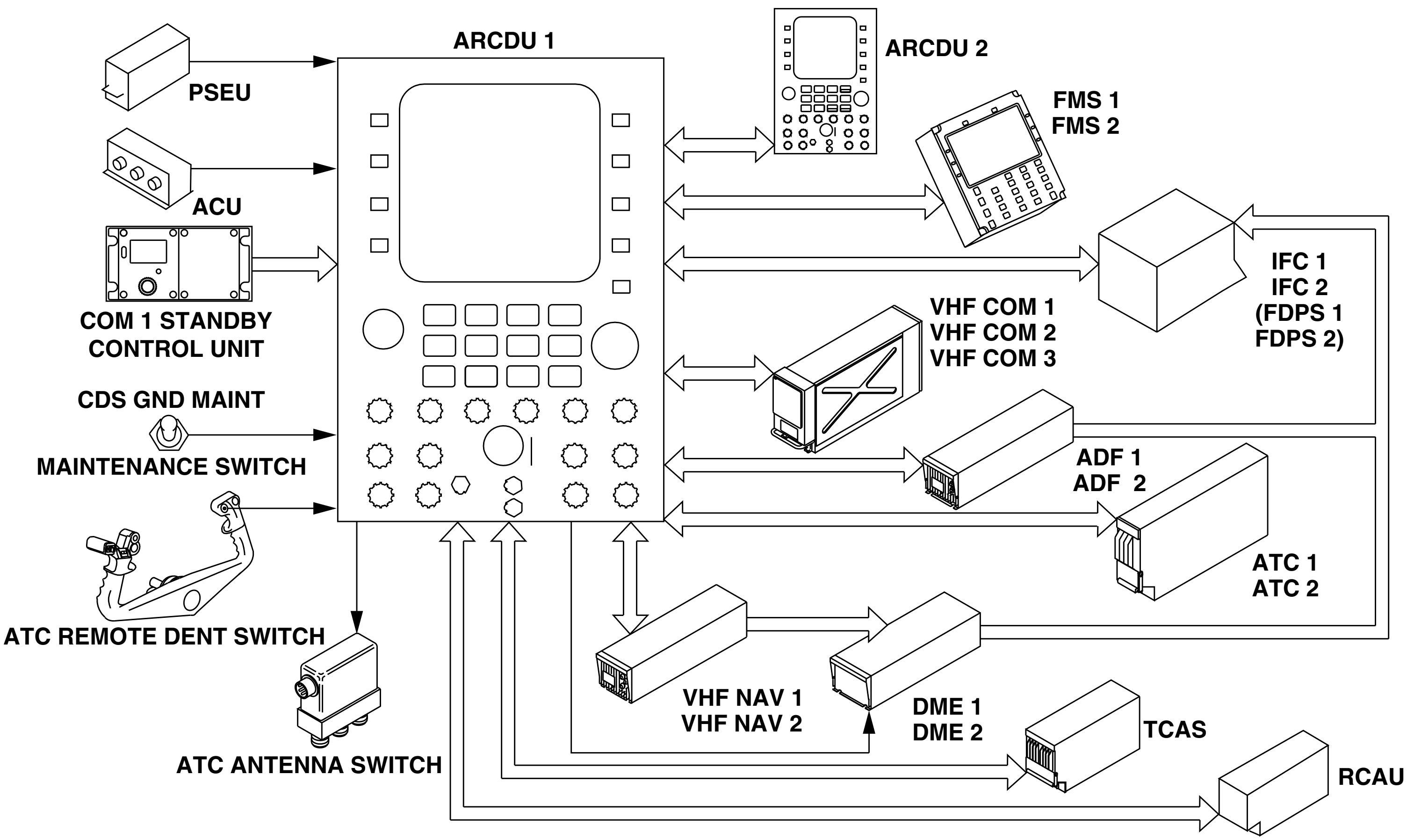
If the power–up tests sense a discrepancy or when powered, a pin–programming change, an ARCDU FAILED message is shown.

If the continuous tests sense a discrepancy, a FAIL message is shown in the INT display area.

For a CDS ARINC failure, a CDS SYSTEM FAILED message is shown but if the CDS sends a failed condition, a CDS NOT AVAILABLE message is shown.

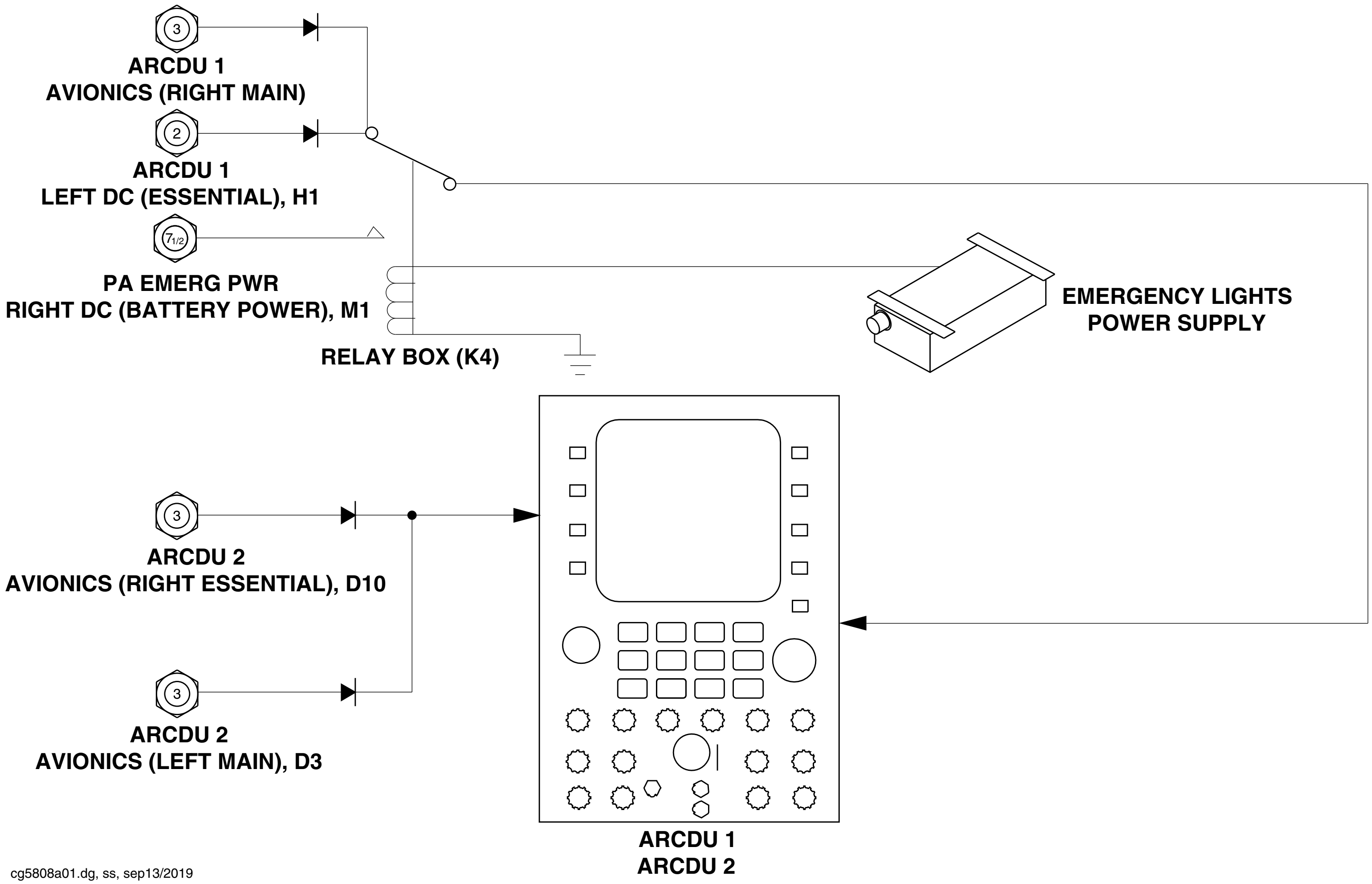


Audio and Radio Control Display Unit (ARCDU)
Figure 1

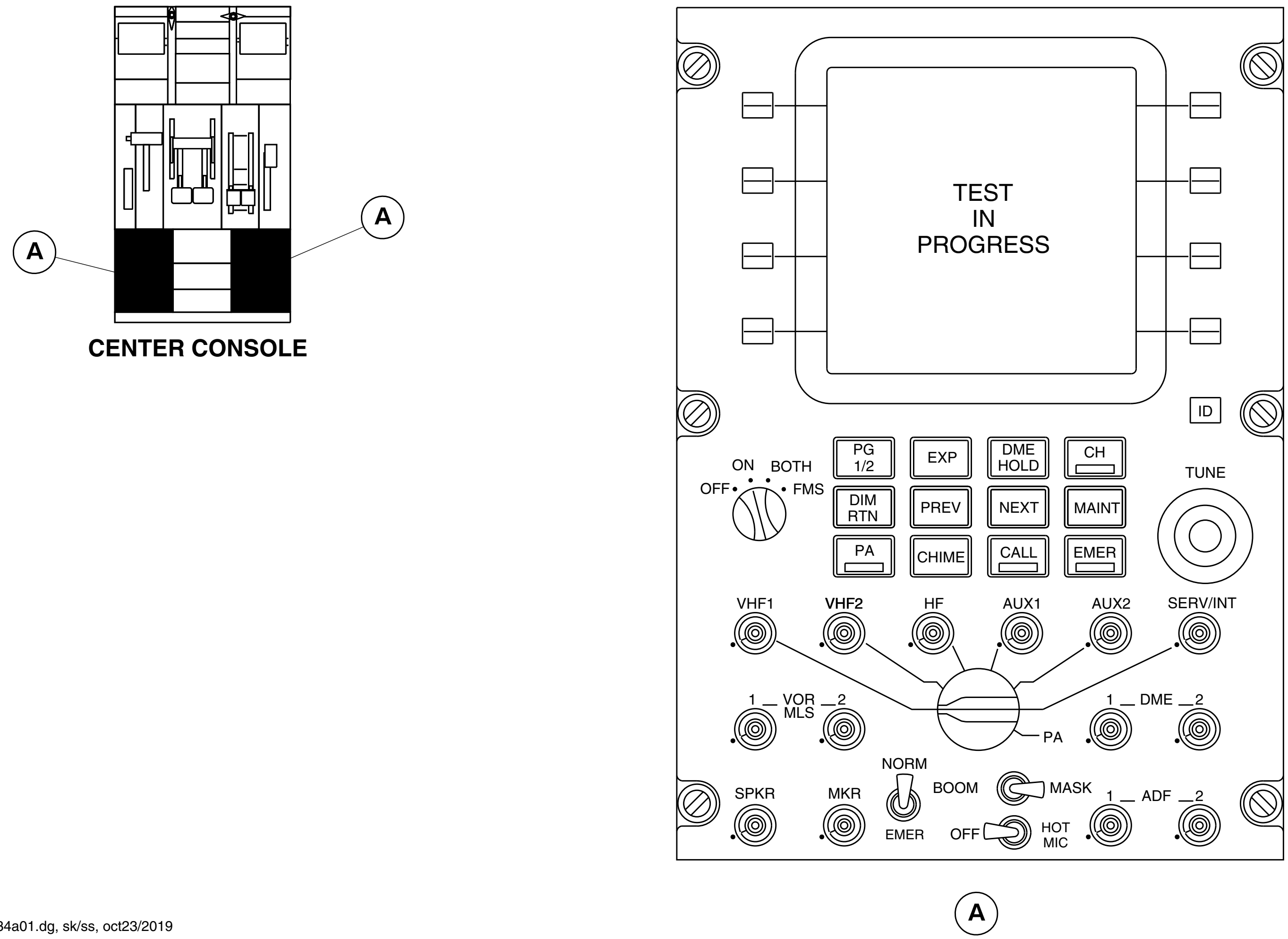


cg5807a01.dg, ss, sep13/2019

Block Diagram, Radio Management System
Figure 2

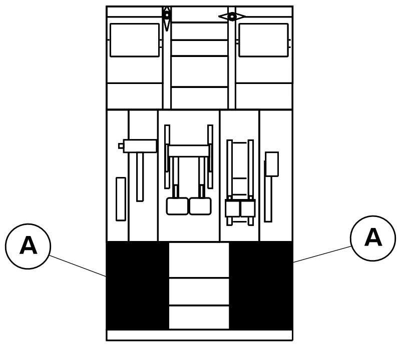


Radio Management Electrical Power Interface
Figure 3

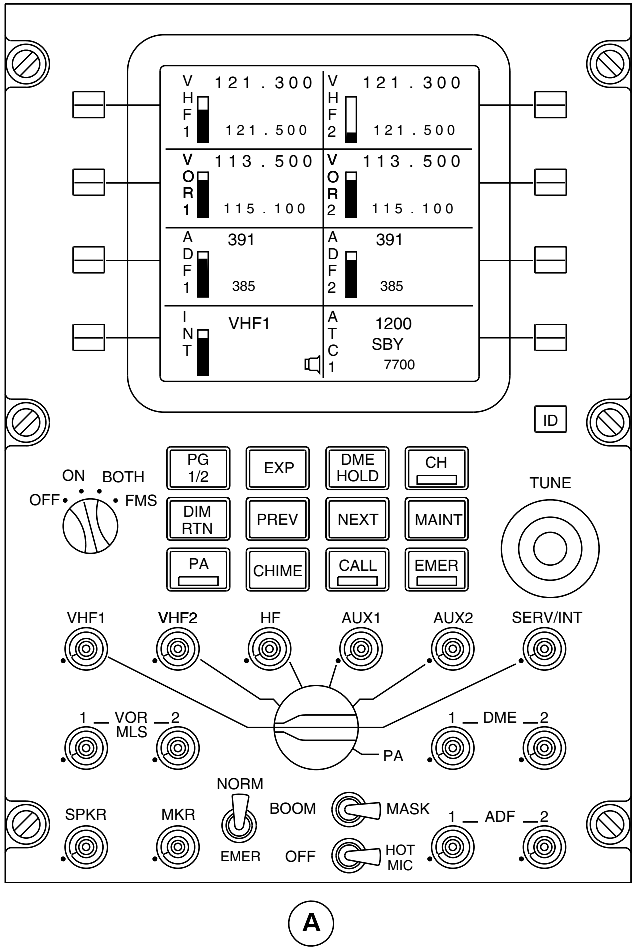


fsc34a01.dg, sk/ss, oct23/2019

ARCDU, ON Selection
Figure 4

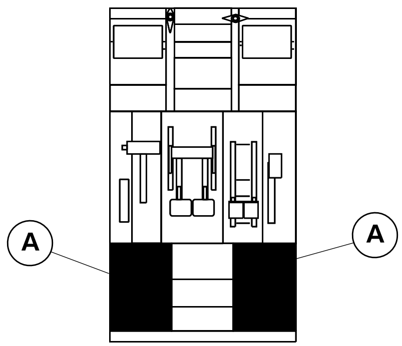


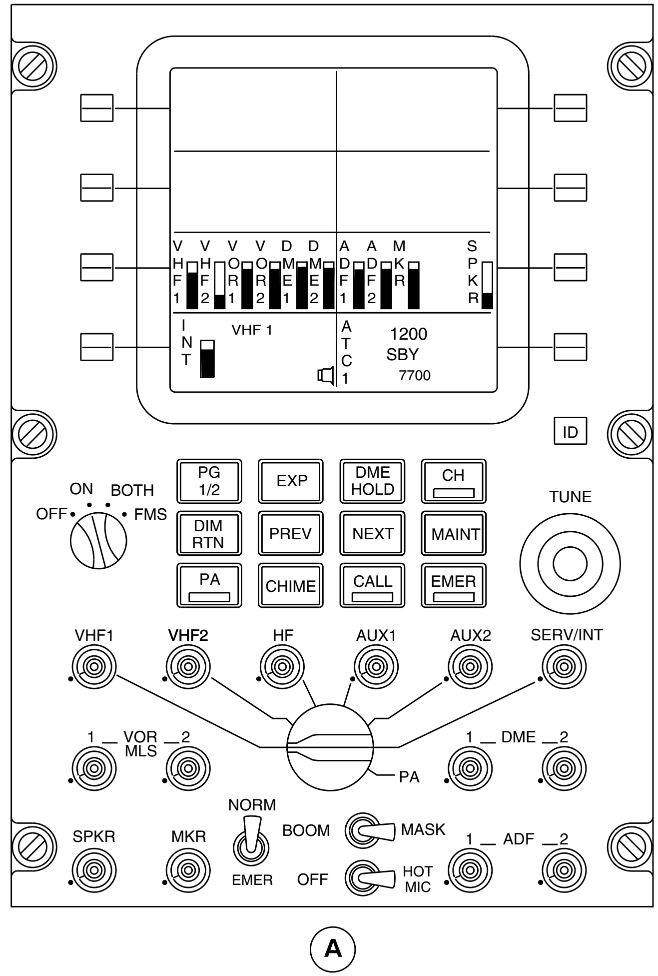
CENTER CONSOLE



cg5708a01.dg, sk/ss, oct15/2019

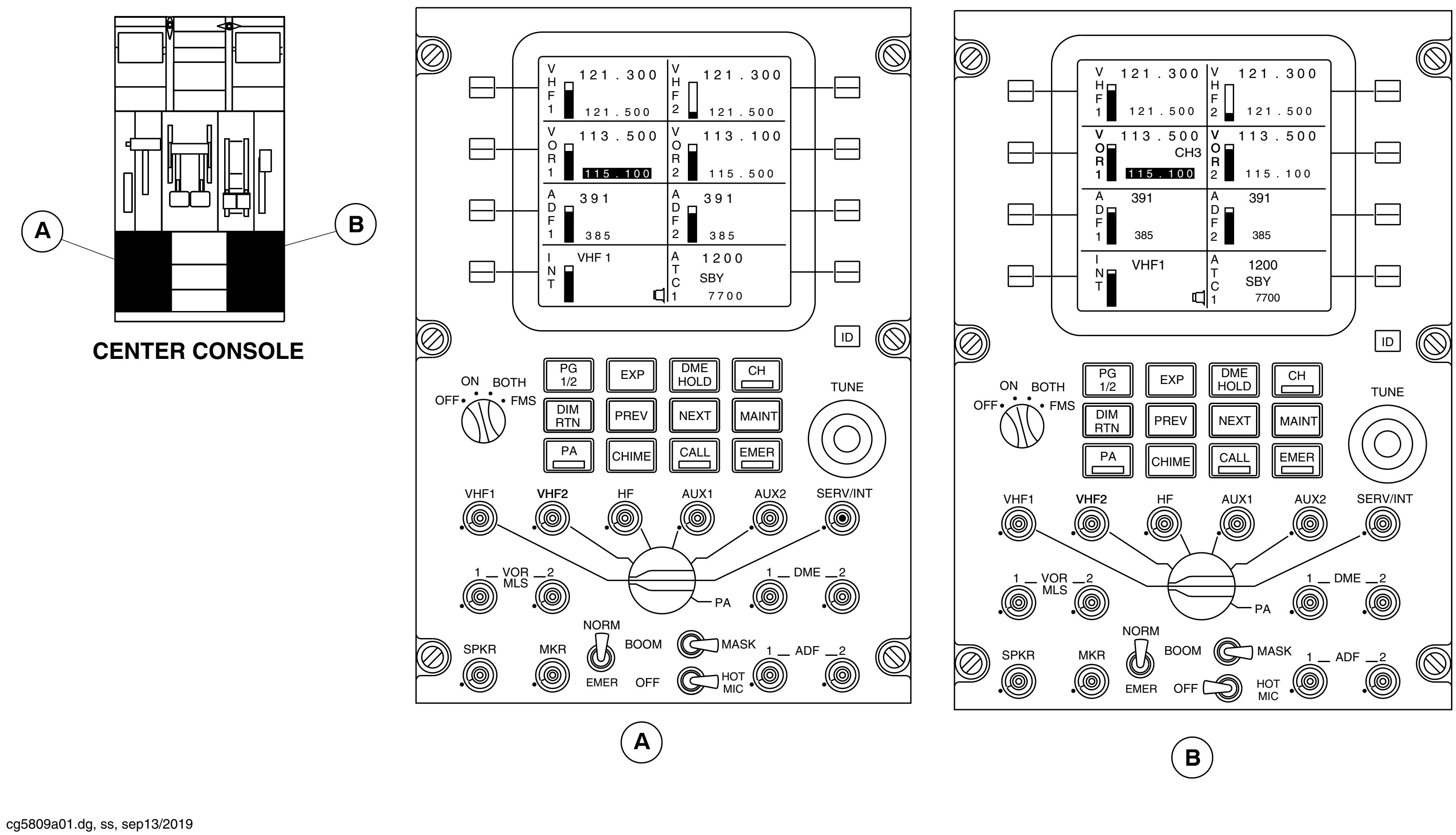
ARCDU, Main Page 1
Figure 5



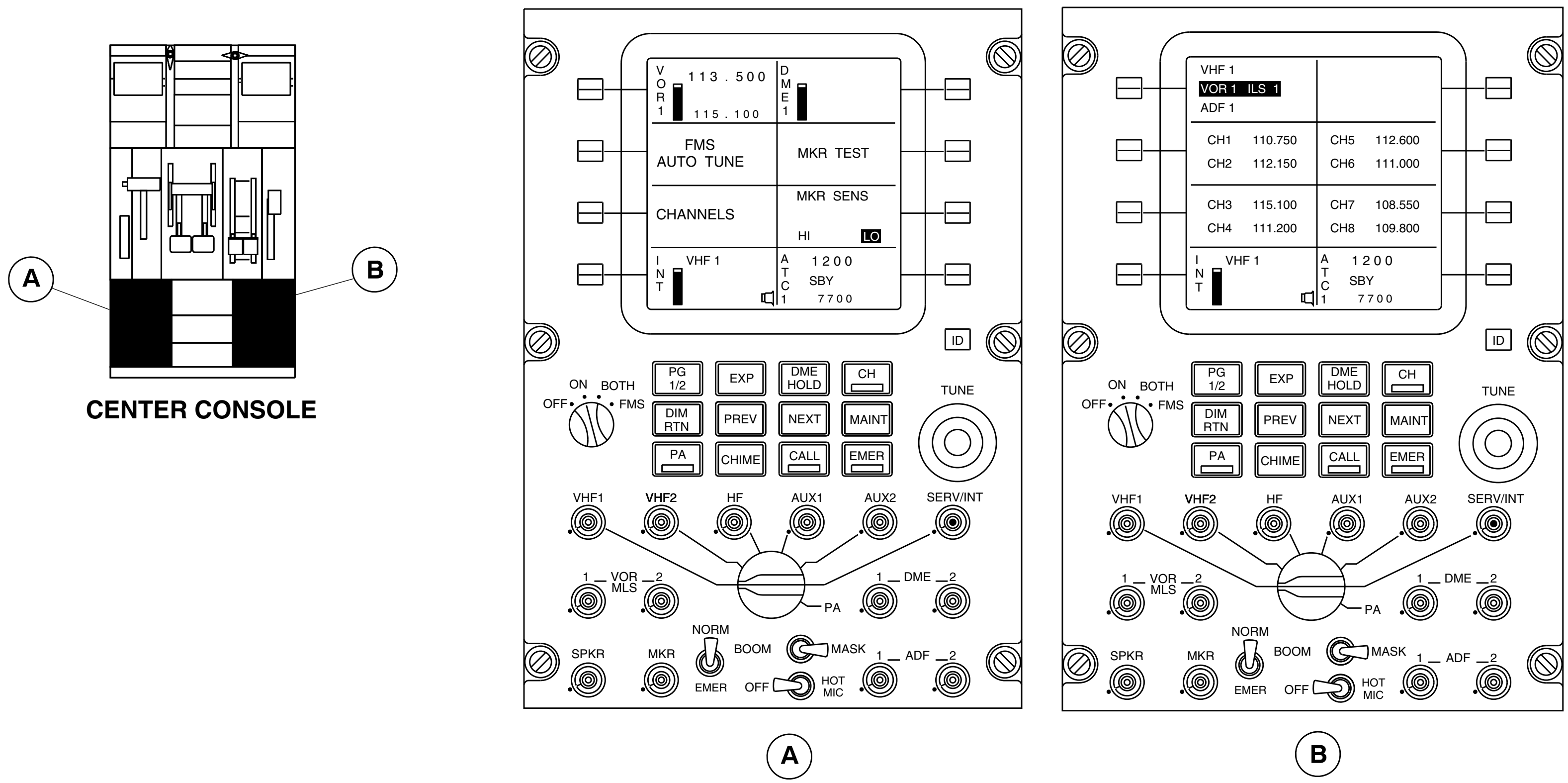


cg5709a01.dg, sk/ss, oct15/2019

ARCDU, Main Page 2
Figure 6

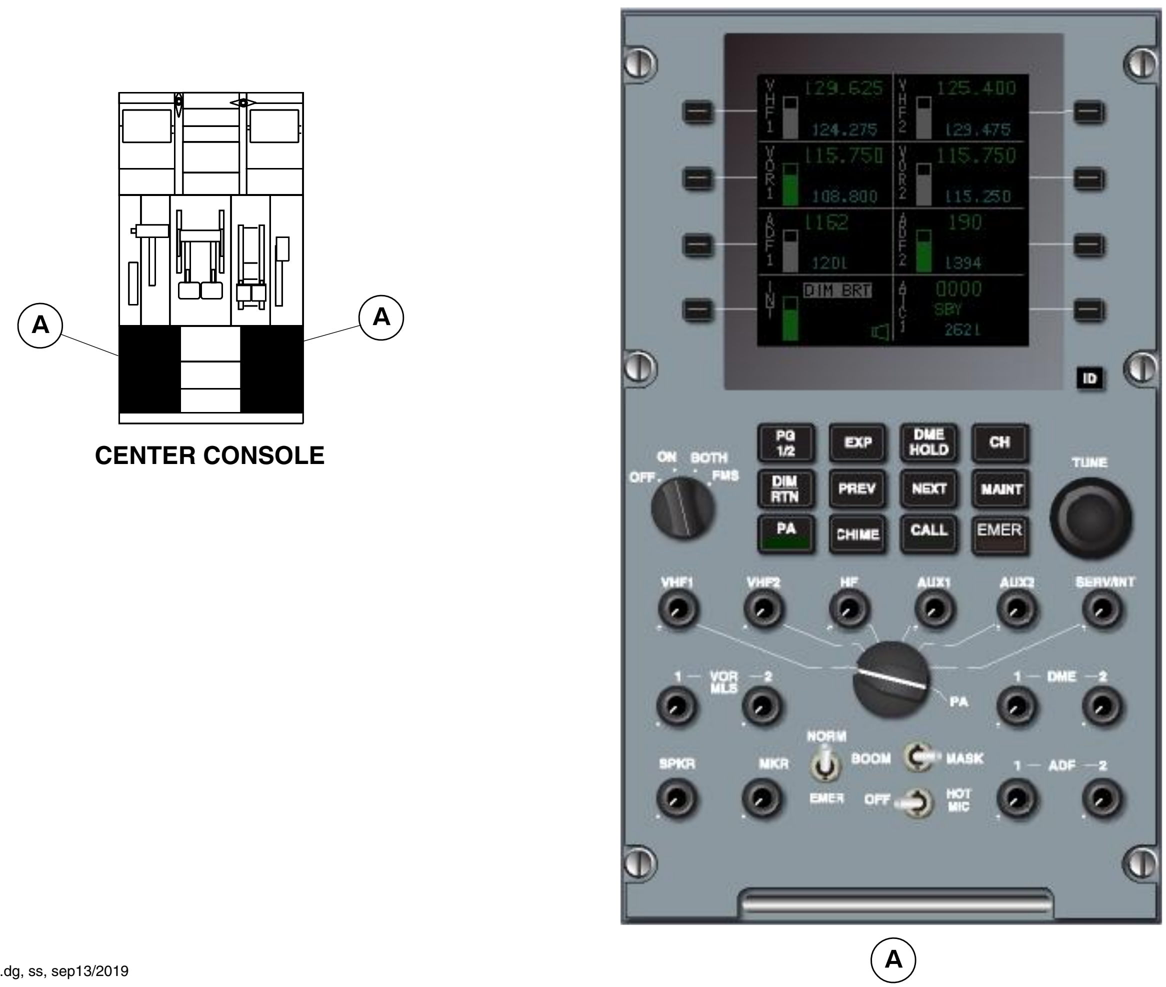


ARCDU Frequency and Audio Control
Figure 7



cg5810a01.dg, ss, sep13/2019

ARCDU Channel Programming
Figure 8



cg5811a01.dg, ss, sep13/2019

ARCDU DIM / BRIGHT Control
Figure 9

THIS PAGE INTENTIONALLY LEFT BLANK