CHAPTER 23 - COMMUNICATIONS

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LIST OF FIGURES

GENERAL

Enables crew members to communicate between them, and with:

– Passengers.

– Ground-personnel.

– Other aircraft.

– Ground stations.

The system has:

– **Radio Communications:** includes HF and V/UHF radio communications.

– **Secure Communications:** enables secure voice and data communications.

– **PA System:** permits the crew to communicate with the passengers.

– **Interphone System:** permits crew members to communicate between them as well as with the ground personnel.

– **Integrated Audio Control System:** the system gives crew communication links, integrates navigation receivers, aural warnings, and allows activation and modulation of radios for transmission and reception.

– **Static Discharge System:** permits to remove electrostatic charge as gathered by the aircraft through flight operations.

RADIO COMMUNICATIONS

The radio communications system uses electromagnetic waves to transmit and/or receive messages into air-to-air and or air-to-ground modes.

The available radio communications selections include:

– **_High Frequency (HF) Communications:_** permits long-range communications within the 2 MHz to 30 MHz frequency range

– **_Very/Ultra High Frequency (V/UHF) Communications:_** to carry on communications in short-range VHF for the 30 MHz to 173.975 MHz frequency range, and UHF communications for the 225 MHz to 400 MHz frequency range, modulating signals on Amplitude (AM) or/and Frequency (FM).

HF COMMUNICATIONS

The HF communications system is a transmission/reception equipment, for communications on a long range. The aircraft includes one system (HF1).

DESCRIPTION

Main components are:

–   **Transceiver:** one transceiver for HF1 that gives the capability for transmitting HF radio signals.

–   **Antenna:** one aerial antenna consisting of a cable attached to the vertical stabilizer and the fuselage. It receives signals from the transceiver through an antenna coupler and transform them into electromagnetic waves (refer to ANTENNAS, in CHAPTER 01).

–   **Multifunction Control Units (MCDUs):** located on the pedestal, one is for C/M-1 and another for C/M-2.

The system provides 35 user-programmable channels, and 280000 operating frequencies in steps of 100 Hz wide, covering a frequency range from 2 to 29.9999 MHz. In addition, there are six pre-programmed emergency channels, and 249 pre-programmed channels more for the ITU radiotelephone maritime network, stored in a non-volatile memory. Frequencies can be manually tuned from the MCDU, or automatically, when running a transmission schedule, from the FMS.

Communications are possible when using any of the following modes of operation:

–   Data Upper side-band (UD/SSB)

–   Data Lower side-band (LD/SSB)

–   Voice Upper side-band (UV/SSB)

–   Voice Lower side-band (LV/SSB)

–   Amplitude modulation equivalent (AME)

–   Continuous wave (CW)

The system develops Automatic Link Establishment (ALE) and SELCAL functions. The ALE mode data and codes can be deleted acting over the HF ZERO switch on the MAINTENANCE panel located in the FR10, the MASTER selector located on pedestal or from the correct HF page of the MCDU.

The system has a SQUELCH function with different levels (not available in standby mode).

The system has modem connections on the copilot station and on the front station at the cargo compartment, to transmit/receive data via HF. These connections allow to load modem configuration parameters and ALE codes and data as well.

The system has a modem connection, located on the front station at the cargo compartment. This connection allows to load ALE codes and data as well.

The system also has one HFM connector, located on the front station at the cargo compartment, to allow data transmission using HF Messenger software installed on a PC.

HF Messenger provides thus connectivity between wireless HF networks and wired ground networks.

The necessary HF Messenger elements are:

– PC (Microsoft Windows 2000 SP2, Windows XP, Windows 2003 Server) with HF Messenger software.

– RS-232 cable in order to connect the PC to the HF radio.
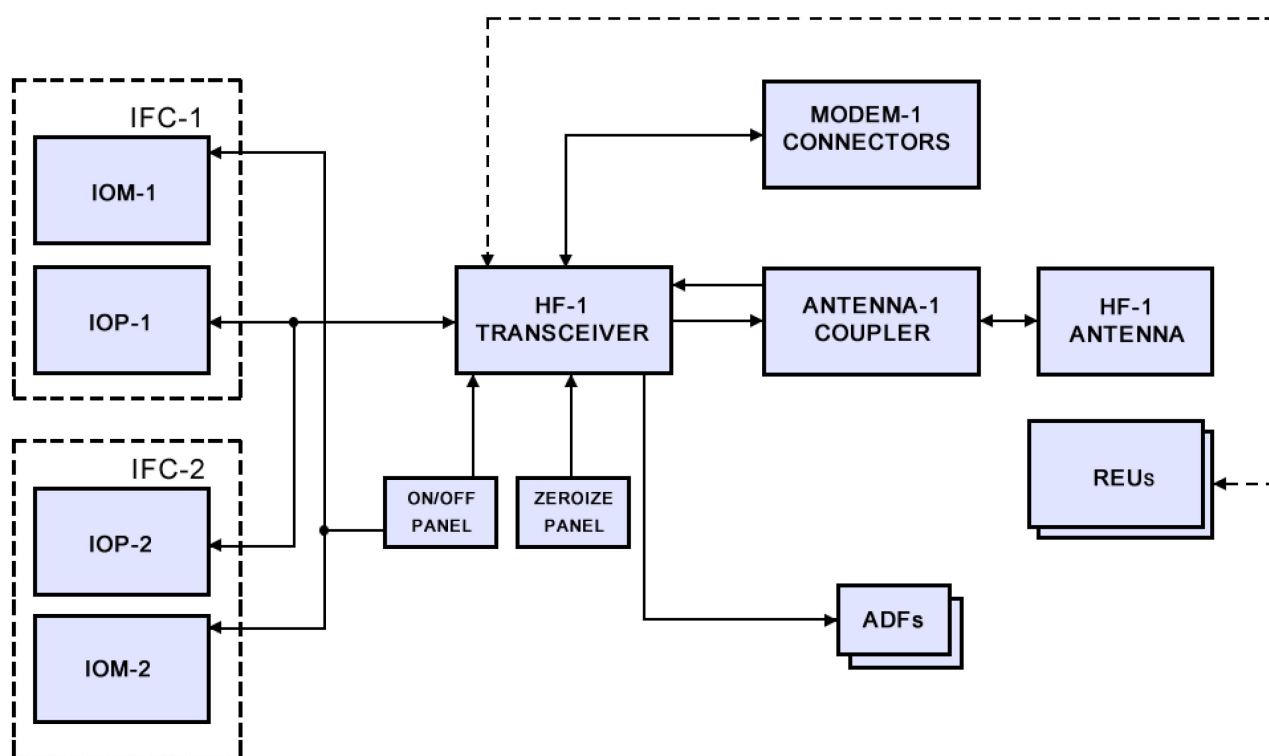
– Quatech PCMCIA card.

Figure   23-1   HF Communications - Architecture

OPERATION

The system is activated by the HF switch at the AVIONICS1/AVIONICS2 circuit breaker and switches panel.

The HF system is managed from any MCDU using the HF control pages of the RMS radio management function. Frequencies are displayed on the Navigation Data (ND) screens as well. Volume is separately adjusted for each station from its respective audio control panel.

System functioning is subdivided into the following modes of operation:

–   SELF-TEST Mode: displays on the MCDU the results of the self-test.

–   MANUAL Mode: allows manual selection of the transmission/reception frequency.

–   PROGRAM Mode: used to load channel data on one or more of the 35 user-programmable pre-setting channels.

–   CHANNEL Mode: allows selection of the channels previously programmed by the user.

–   EMERGENCY Mode: enters selection of one from the six emergency frequencies programmed in the non-volatile memory.

–   STANDBY Mode: mutes system audio output.

–   MARITIME Mode: selects one of the 249 semi-duplex channels of the ITU maritime radiotelephone network, stored in the non-volatile program memory.

–   ALE Mode: it provides automatic link establishment. ALE protection and ALE connection tracks can be downloaded from a PC connected to the sockets installed on the frame 10.

When an ALE link is performed with other HF transceiver, ALE visual warning shall be activated during 2 seconds.

When an ALE link is stabilized and PTT is pressed, "HF FAIL" will be displayed in RCOM page while PTT is pressed.

–   LINK Mode: it brings ALE address security, and prevents communication shutoff and deletion of ALE data and protection tracks, via switches of the code deletion control unit, located at the central console.

–   SELCAL Mode: Provides SELCAL indication giving the current state and allowing modification of SELCAL parameters detecting the modes.

When a SELCAL communication is asked from other HF transceiver, SELCAL visual warning shall be activated until HF mode is modified.

–   TIME Mode: allows viewing and modifying system clock parameters.

–   POWER Mode: sets one of the three levels of rating power: 200, 50 and 10 W maximum instantaneous power.

–   OFF Mode: the mode is fixed via the switch at the central console. The Receiver/Transmitter is out in this mode.

The system can process voice or data in USB, LSB and AME modes.

Duty cycle for voice USB and LSB shall not exceed 1/3 for transmission and 2/3 for reception (Tx/Rx ratio: 1/2).

Duty cycle for data USB and LSB, CW and AME shall not exceed 1/7 for transmission and 6/7 for reception (Tx/Rx ratio: 1/6).

NOTE

If the duty cycle limits are exceeded, the transmitted power will be reduced and the HF radio could report a fail state.

The operator shall make sure that the presets defined on ground and loaded by the DTM include a proper modem name which has previously been defined on the HF radio.

The HF Messenger is managed from a PC connected to the HFM connector located in Frame 10 cabinet using the RS-232 cable. RS-232 connector shall be connected to the serial port of the PC and the DB-25 connector to the Quatech PCMCIA card.

Besides, a mail application (for instance Microsoft Outlook) must be used and a mail account must be defined inside.

HF Messenger allows proper operation of HF communication system using a PC and proper transmission/reception of mails through HF radio system. HF selector, located on instruments central panel, disables HF radio control from RMS and enables HF radio control from the HF Messenger.

Operation to manage HF Messenger will be described as follows:

1. Connect a PC with HF Messenger software to the HFM connector.

2. Open HF Messenger Device Controller application on the PC.

3. Choose both HF radio and serial port to connect to on "Device Selection".

4. Select "Monitor" option under Device Control.

5. Select "Shared" option on Key Control.

6. Press CONNECT button in order to connect to HF radio.

7. Enable HF radio control from HF Messenger by switching to HFM position the HF selector.

8. On the respective MCDU verify that "DATA" label is displayed on the RCOM page. HF page cannot be selected any more using MCDU.

9. Select "Command" option under Device Control in order to start sending commands to the HF radio.

10. Control the different communication parameters, modes, TX/RX frequency, volume, squelch, power level...

11. Select "Command" option under Device Control in order not to send any command to the HF radio.

12. Disable HF radio control from HF Messenger by switching to NORM position the HF selector.

13. Press DISCONNECT button on Device Controller Application.

14. Close HF Messenger Device Controller application on the PC.

15. Disconnect the PC with the HF Messenger software from the HFM connector.

Operation to transmit/receive mails using HF Messenger will be described as follows:

1. Connect a PC with HF Messenger software to the HFM connector.

2. Enable HF radio control from HF Messenger by switching to HFM position the HF selector.

3. Open SMS user interface, and press START in order to start SMS service. The application provides real time information on the current state of the radio and modem.

4. Open HF Delivery Agent application and press START to start Delivery Agent service. This application manages the sending and receiving of mail.

5. Open Outlook or any similar application to create, receive and send mails.

After mail transmission/reception disconnects applications as follows:

1. Press STOP button and close HF Delivery Agent application.

2. Press STOP button and close "SMS" application.

3. Close Outlook or similar application.

4. Enable HF radio control from RMS by switching to NORM position the HF selector.

5. Disconnect the PC.

NOTE

If HF Messenger application is used to control the radio in Manual Mode or ALE Manual Mode, and the field "Audio Mode" is changed to DATA, this field shall be set back to VOICE before ending the use of this application.

CONTROLS AND INDICATORS

MCDU

The MCDU allows performing the functions as previously described for each mode of operation, on the following pages:

– **RCOM Page:** enables access to the radio communication equipment pages.

– **DATA XFER Page:** allows uploading the radio data from the DTM to the IOP.

– **HF Main Pages 1/2:**

HF ALE Page: shows and permits modification of the ALE address, the network, displays the CALLER address, etc. If an ALE scrolling pressing is performed, the active frequency is modified in accordance to HF ALE scrolling command.

HF CHANNEL Page: shows and selects the active preselected channel, and thus the emission and reception frequencies associated to the selected channel.

HF MANUAL Page: manual mode and frequencies are selected and displayed.

HF MARITIME Page: for ITU channels, this allows choice, and displays the related transmission frequencies.

HF EMERGENCY Page: selects and displays emergency channel number and associated frequency.

HF STANDBY Page: the standby state presentation, and allows active mode selection.

– **HF Main Pages 2/2:** displays and allows to ZEROIZE LP, DATA or both; to modify POWER and SQUELCH levels; to activate TEST and PROGRAM pages.

NOTE

In Emergency mode the power shall be automatically set to 3 (maximum) and shall not be changed. In Standby mode squelch line is not available and the power shall be automatically set to 0 (Silent) and shall not be changed.

– **HF PROGRAM Page:** ALE and SELCAL addresses are selectable here, and the same for time and date updating L; this page enables access to PRESET and DATA FILL pages.

– **HF PRESET Page:** to modify and display preset channels and its associated frequencies.

– **HF Data Filling Page:** it allows data acquiring from an external source.

– **HF1 TEST Page:** activates TEST mode, and shows the results.

  • RX TEST: during the test ">RUN" is replaced by "RUNNING". After test completion, the result "PASS" (in green) or "FAILED" (in amber) is displayed during 10 seconds. In case of no response after 2 minutes, the "failed" message shall be displayed.

  • TX TEST: during the test ">RUN" is replaced by "RUNNING". After test completion, the result "PASS" (in green) or "FAILED" (in amber) is displayed during 10 seconds. Before the TX test, the RX test will be performed and the RX result will also be displayed. In case of no response after 3 minutes, the "failed" message shall be displayed.
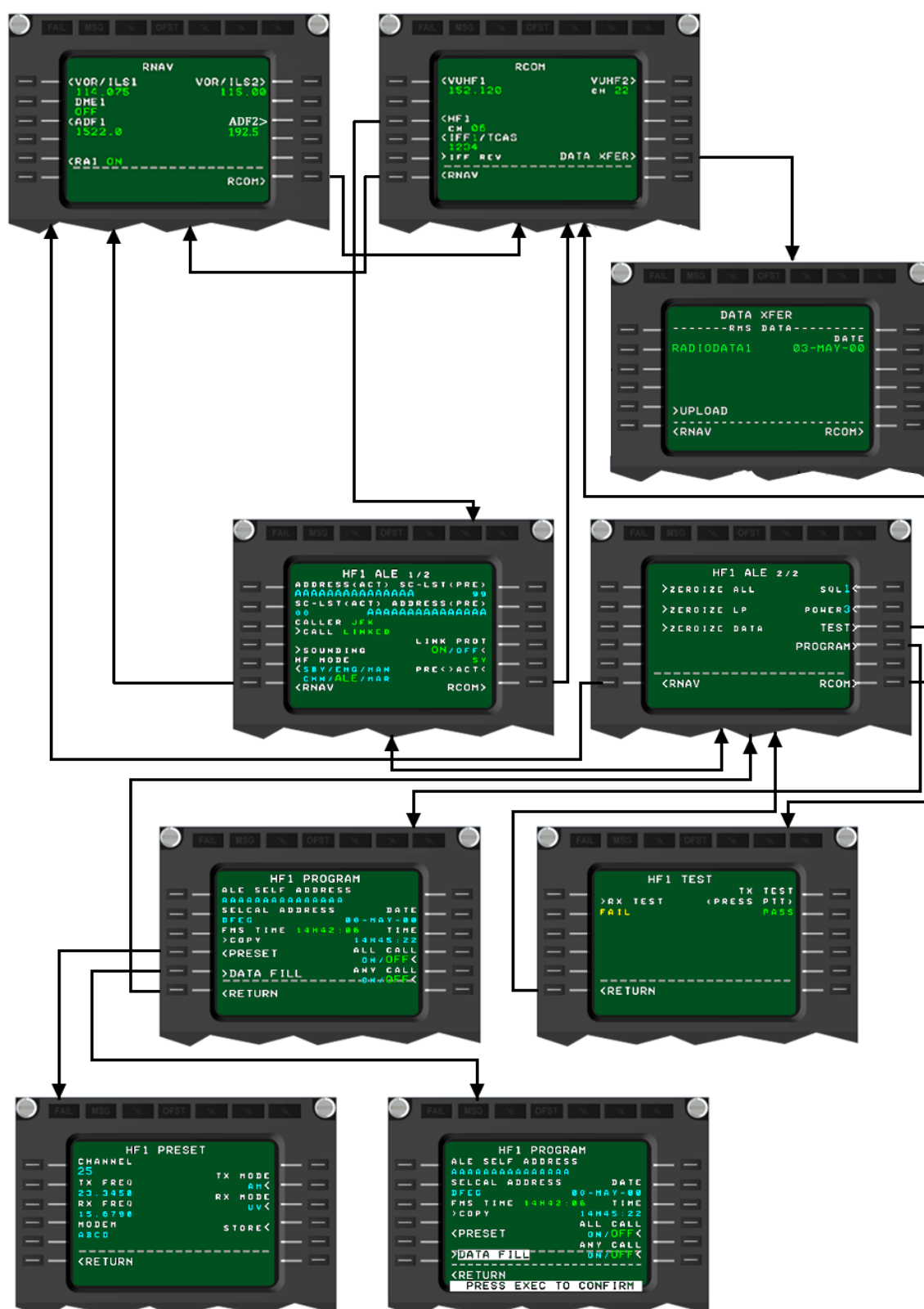
Figure   23-2   MCDU HF Pages - Controls and Indicators

HF COMMUNICATIONS

(1) SELCAL / ALE Indicators:

- *ALE light on (for two seconds):* an ALE link has been performed with other HF transceiver.
- *SELCAL light on:* a SELCAL communication is asked from other HF transceiver.

(2) HF Selector:

- *NORM:* HF radio is controlled from RMS and control from HF Messenger is disabled.
- *HFM:* disables HF radio control from RMS and enables HF radio control from HF Messenger.
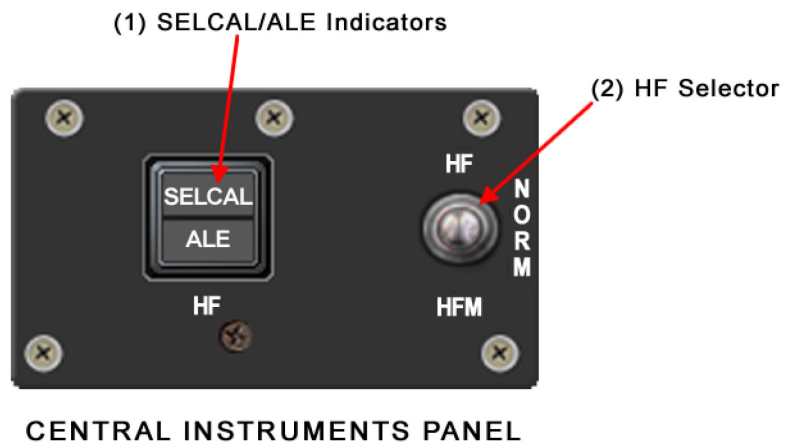

Figure   23-3   HF Communications - Controls and Indicators

COM CTL

(1) EMCON Pushbutton:

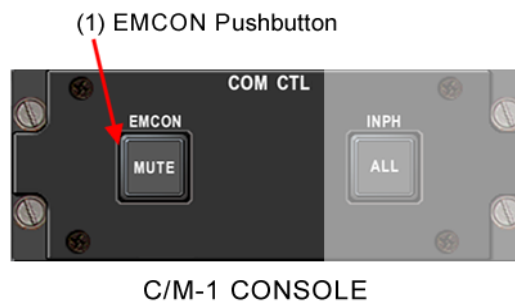(refer to SECURE COMMUNICATIONS, in this chapter)

Figure   23-4   HF Communications (EMCON function) - Controls and Indicators

V/UHF COMMUNICATIONS

The system includes two AN/ARC-210 (V) units for V/UHF communications.

DESCRIPTION

The V/UHF system runs AM or FM in the 30 to 400 MHz frequency range, with tuning steps of 25 kHz. The system also drives tuning steps of 8.33 kHz in the ATC band (118 to 137 MHz).

The system is competent for air-to-air operations in all operating bands, and ground-air operations within a range of 180 NM in the 108 to 174 MHz band, or 160 NM in the 225 to 400 MHz band, whenever atmospheric and geographical conditions being appropriate.

The V/UHF system allows channel mode operation with the following options:

– 25 simplex channels plus 5 additional half-duplex user-programmable Channels

– 57 maritime channels

To reduce the detection susceptibility, transmission power can be adjusted.

Main components of the system are:

– **Transceivers:** two of them providing V/UHF radio ability, one for the V/UHF1 unit, a second one for the V/UHF2 unit.

– **Antennas:** two of them, one for the V/UHF1 unit and one for the V/UHF2 unit. (refer to ANTENNAS, in CHAPTER 01).

– **V/UHF2 Control Panel:** located on the right side of the glare shield.

– **Multifunction Control Units (MCDUs):** located on the pedestal, one for C/M-1 and another for C/M-2.

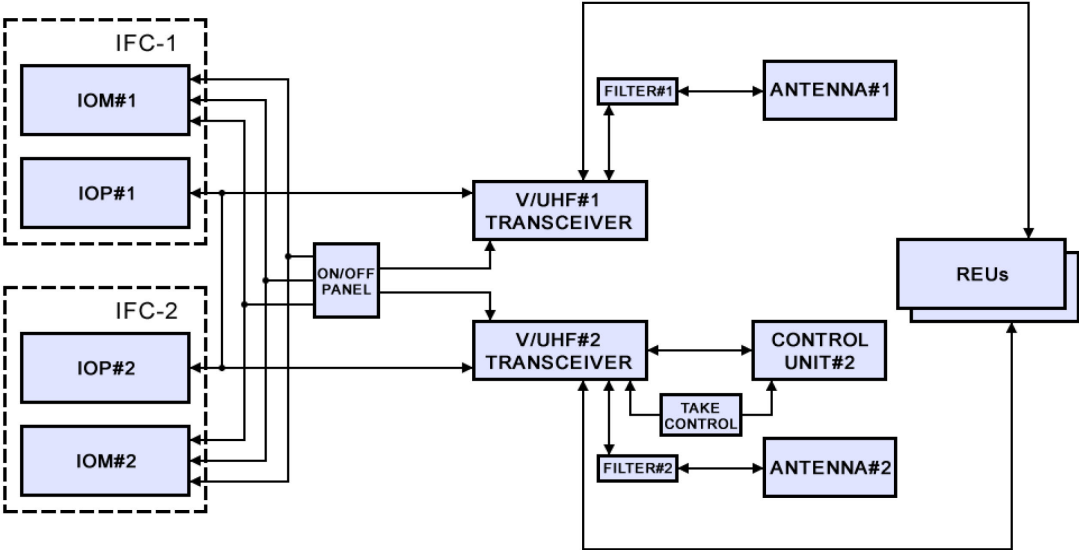– **COM CTL Control Panel:** located on the C/M-2 console.

Figure   23-5   V/UHF Communications - Architecture

OPERATION

The V/UHF system is managed from either MCDU, through the V/UHF control pages of the RMS radio management function.

The V/UHF2 unit can also be managed from a control panel placed on the instruments-panel of the glare shield (right side). Control transference for V/UHF2 is made when the V/UHF2 CTL pushbutton is pushed-in on the control panel COM CTL of the C/M-2 console. When the glare shield control panel is selected to manage the radio 2, both frequencies and selected modes-of-operation are displayed on the MCDUs; however, control for this radio signal will not be available from there. The selected V/UHF frequencies are displayed on the ND as well. Volume adjustment can be done separately for each station from the respective audio control panel, or from the V/UHF2 control panel, in such case.

Operation of the V/UHF radio from the panel located on the glare shield will be described as follows.

Normal radio operating procedure:

1. Set the operation-mode selector to TR.

2. Set the frequency-mode selector to MAN.

3. Select the operating frequency, press CHAN/FREQ CRSR (PUSH) until the cursor displays below the desired frequency digit. Turn this knob until the desired value is obtained on the correct digit. Repeat the same procedure for each digit, down to the desired operating frequency.

4. Turn on the radio and establish communication.

5. Set the operating mode selector in TR+G to check the emergency channel for the operating frequency band. Adjust the potentiometer VOL/SQ OFF for the appropriate transmission.

From this panel the radio can also be operated in the following modes:

– Scan operation

– Maritime operation

– Operation on the ATC 8.33 KHz channel spacing

CONTROLS AND INDICATORS

MCDUs: enable V/UHF system from the following pages:

–   ***RCOM Page:*** enable access to the radio communication equipment pages.

–   ***DATA XFER Page:*** allows to upload the radio data from the DTM to the IOP.

–   ***V/UHF MAIN PAGE 1/2:***

VUHF MANUAL Page: for the manual control of the radio (frequency selection, modulation, transmission mode, output power...)

VUHF CHANNEL Page: to manage the channel mode of radio, it displays respective frequencies for channel emitting and receiving. SCAN function.

VUHF MARITIME Page: allows management of the maritime channels, and selects either the ground station or on-board station.

VUHF VGUARD Page: displays and tunes the emergency frequency for VHF, 121.500 MHz.

VUHF UGUARD Page: displays and tunes the emergency frequency for UHF, 243.000 MHz.

–   ***V/UHF MAIN PAGE 2/2:*** displays and allows to get to the V/UHF preset channels, and to activate Time-of-day initialization, and V/UHF test, to select and verify Word-of-day, to select and active and/or preset frequency/channel, and to select the maritime transmit mode in channel or manual modes.

During the test, the label ">RUN" is replaced by "RUNNING". After test completion the result "PASS" (in green) or "FAIL" (in amber) is displayed during 10 seconds. In addition, if a failure of transceiver is detected, a T label is displayed in amber, if a failure of the antenna or converter is detected, an A label is displayed in amber, if a failure of the antijam is detected, a J label is displayed in amber. If the test of V/UHF lasts for more than 40 seconds, the result of the test shall be considered failed.

–   ***VUHF PRESET Page:*** grants frequency change and display, with reference to every preset channel.
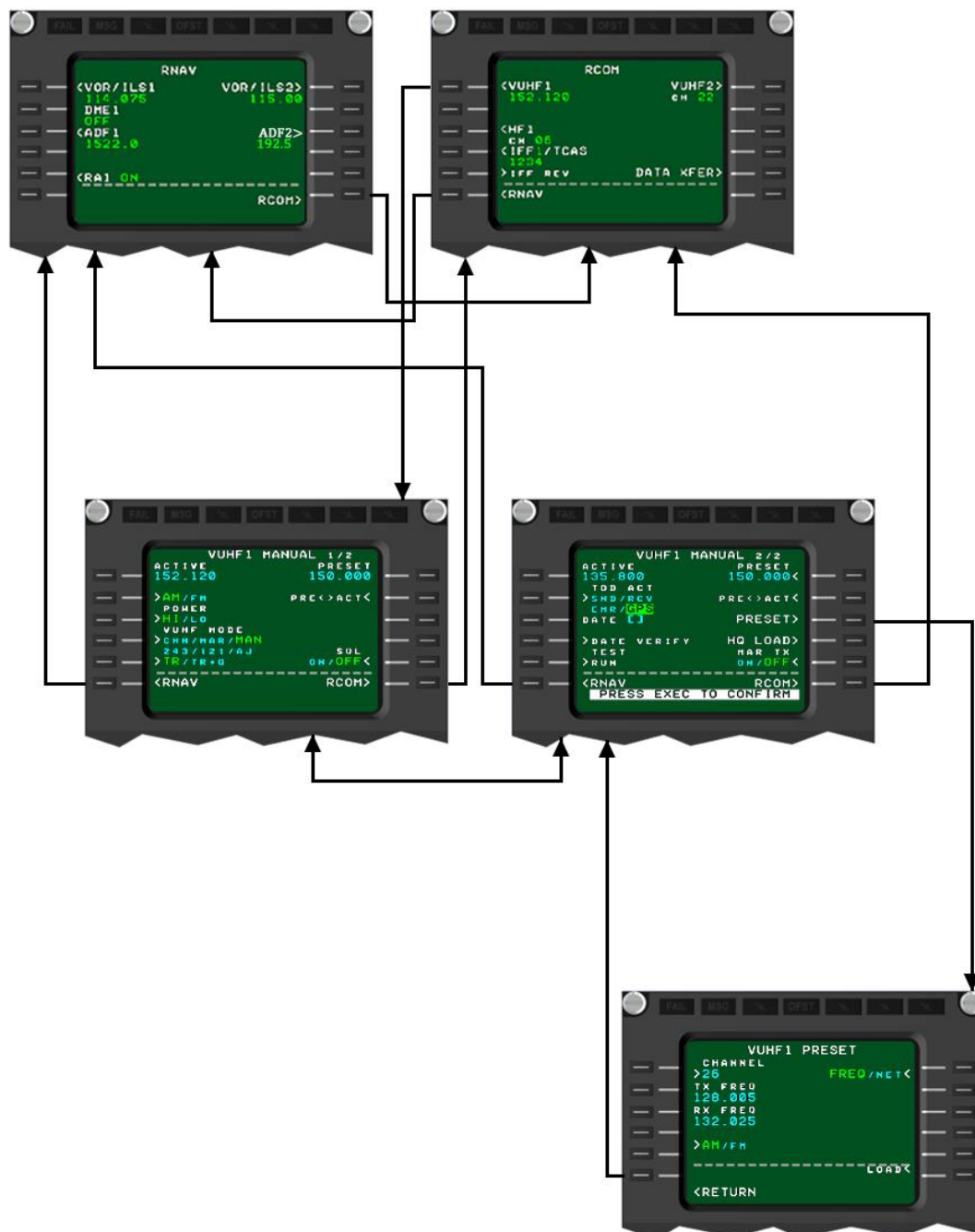
Figure   23-6   MCDU V/UHF Pages - Controls and Indicators

V/UHF2 CONTROL PANEL

(1) VOL/ SQ OFF Potentiometer:

adjusts the audio output level. In the pushed position, it turns the automatic squelch to on for the main receiver, and turns it off when pulled.

NOTE

The activation state of SQUELCH function in the V/UHF control unit will not be displayed in the MCDU.

(2) Display:

displays the frequency, selected channel, network, time and auxiliary mode.

(3) CHAN/FREQ Selector:

each time the selector is pushed-in, the cursor position changes. Turning the selector, the frequency or the channel changes, depending on the selected mode and cursor position.

(4) LOAD/OFST Pushbutton:

depending on the mode selected:

- loads new data or frequencies.

- on frequency selection mode allows choosing different frequency offsets.

- while on Maritime mode, toggles between shore and ship.

- while on time setting, loads new time from the related source.

(5) Frequency Modes Selector:

it consists of an ultra-thin seven-position selector:

- *121 (pulled):* selects VHF emergency mode, tuning the main transmitter and receiver to a frequency of 121.500 MHz. While operating in this mode, all the controls are disabled, except the potentiometer VOL/SQ OFF.

- *243:* selects UHF emergency mode, tuning the main transmitter and receiver to a frequency of 243.000 MHz. All the controls, except the potentiometer VOL/SQ OFF, are disabled. In this position the radio also comes on if the operational mode selector is in the OFF position.

- *MAN:* manual change of frequency, using the frequency switches. During frequency change, the transmitter/receiver is disabled.

- *PRST:* enables the CHAN/FREQ control to select any of the 30 preset channels. The preset channel number is shown on the display as tenths of a MHz for channels under 10, and as units and tenths of a MHz for channels over 10.

- *MAR:* controls the selection of any of the 57 operational maritime channels, with the CHAN/FREQ selector. The channel number and the transmission frequency appear on the display.

- *AJ:* not applicable.

- *AJ/M (pulled):* not applicable.

(6) Indicator Pushbutton:

it enables the Auxiliary Mode button to select and deselect the auxiliary mode identified by the cursor position.

(7) Auxiliary Mode Pushbutton:

stepping-key that allows to place the cursor under the desired mode. Used with the Indicator Button to select and deselect the auxiliary modes:

- *TIME:* SINCGARS BASE / NET TIME is displayed as days, hours and minutes.

- *GPS:* global positioning system in time mode. Enables the hard wire reception of time from a GPS receiver.

- *AM / FM:* AM / FM mode selection. Identifies modulation to be employed in the VHF band and UHF band.

- *H / L:* SINCGARS Hop set or Lockout set. Display represents range selected.

- *SND / RCV:* send and receive mode. Used for over-the-air transfers between radios on the same frequency.

- *LE:* SINCGARS Late Entry mode. Allow SINCGARS radio that does not have precise time synchronization to be synchronized with SINCGARS net time.

- *OFST:* Offset mode. Enables selection of any frequency in the valid operating bands. Different offsets can be selected.

(8) Operational Modes Selector:

it has an ultra-thin seven-position selector:

- *ZRO (PULL):* used to clear the ECCM parameters.

- *OFF:* disconnects the receiver/transmitter.

- *TEST:* starts the self-test. The results of the check are shown on the screen of the Master Control Display Unit (MCDU).

NOTE

If a V/UHF 2 test is performed from the control unit, the "RUNNING" label will not be displayed in the MCDU.

- *TR+G:* activates the standby receiver, and the functions described in TR. The standby receiver is tuned to the appropriate frequency for the band selected on the main receiver.

- *TR:* activates the main receiver/transmitter.

- *ADF:* not applicable.

- *CHNG PRST:* allows the change of the preset channels.

COM CTL CONTROL PANEL

(9) V/UHF2 CTL Pushbutton:

- *Pressed (light B/U illuminated):* it enables selection of the radio control unit B/U of V/UHF2 installed on the glareshield.
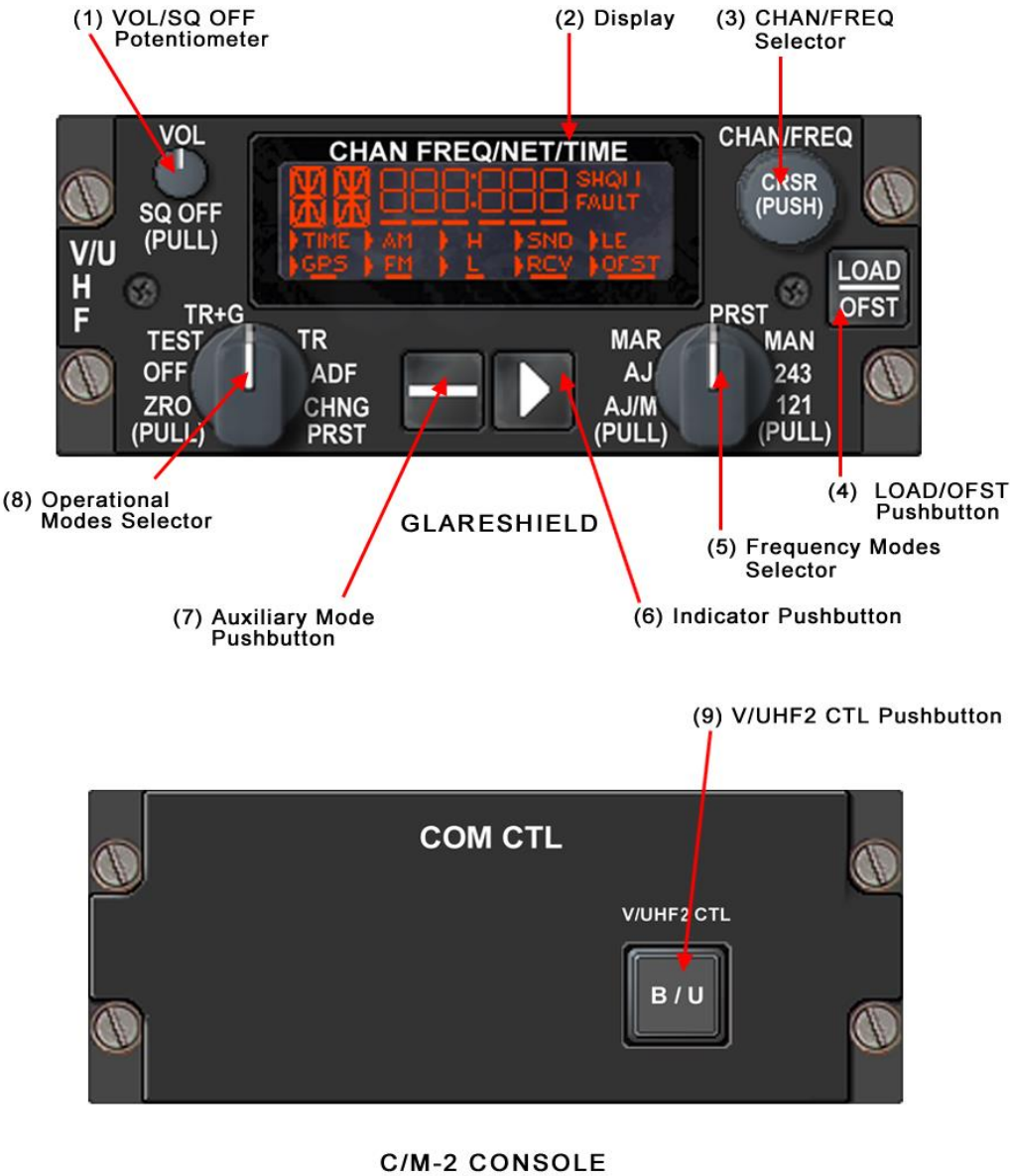
Figure   23-7   V/UHF Control Panel - Controls and Indicators

SECURE COMMUNICATIONS

DESCRIPTION

Main components of the system are:

– **COM CTL Control Panel:** located on the C/M-1 console.

– **CRYPTO ZEROIZE Control Panel:** located on the pedestal, erases the equipment codes.

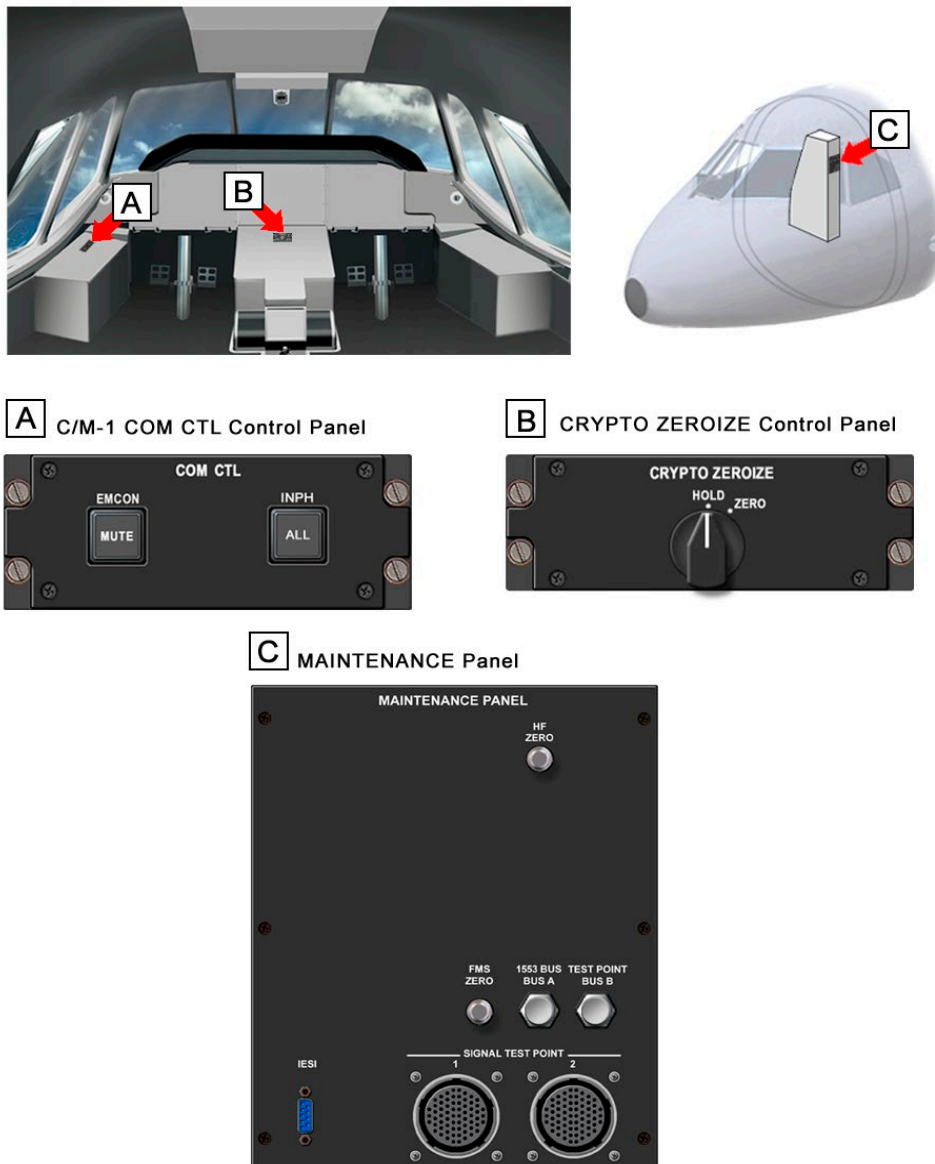– **MAINTENANCE Control Panel:** located in the FR10 rack.

Figure   23-8   Secure Communications - Components

OPERATION

The system is managed through the COM CTL control panel of the C/M-1, the CRYPTO ZEROIZE and MAINTENANCE Control Panels, and the following functions may be done:

– *EMCON function:* silencing all automatic transmissions from the aircraft (from HF in ALE mode, DME, RADALT, TCAS and IFF equipment). Manual transmissions shall be controlled by the crew (V/UHF, HF and WXR).

– *Erase codes:* erasing the codes of a specific system and erasing the codes on all the equipment.

CONTROLS AND INDICATORS

(1) EMCON Pushbutton:

• *Pressed (MUTE light on):* enables EMCON function.

(2) MASTER Selector:

• *ZERO:* erases simultaneously the codes on all the equipment.

(3) HF ZERO Switch:
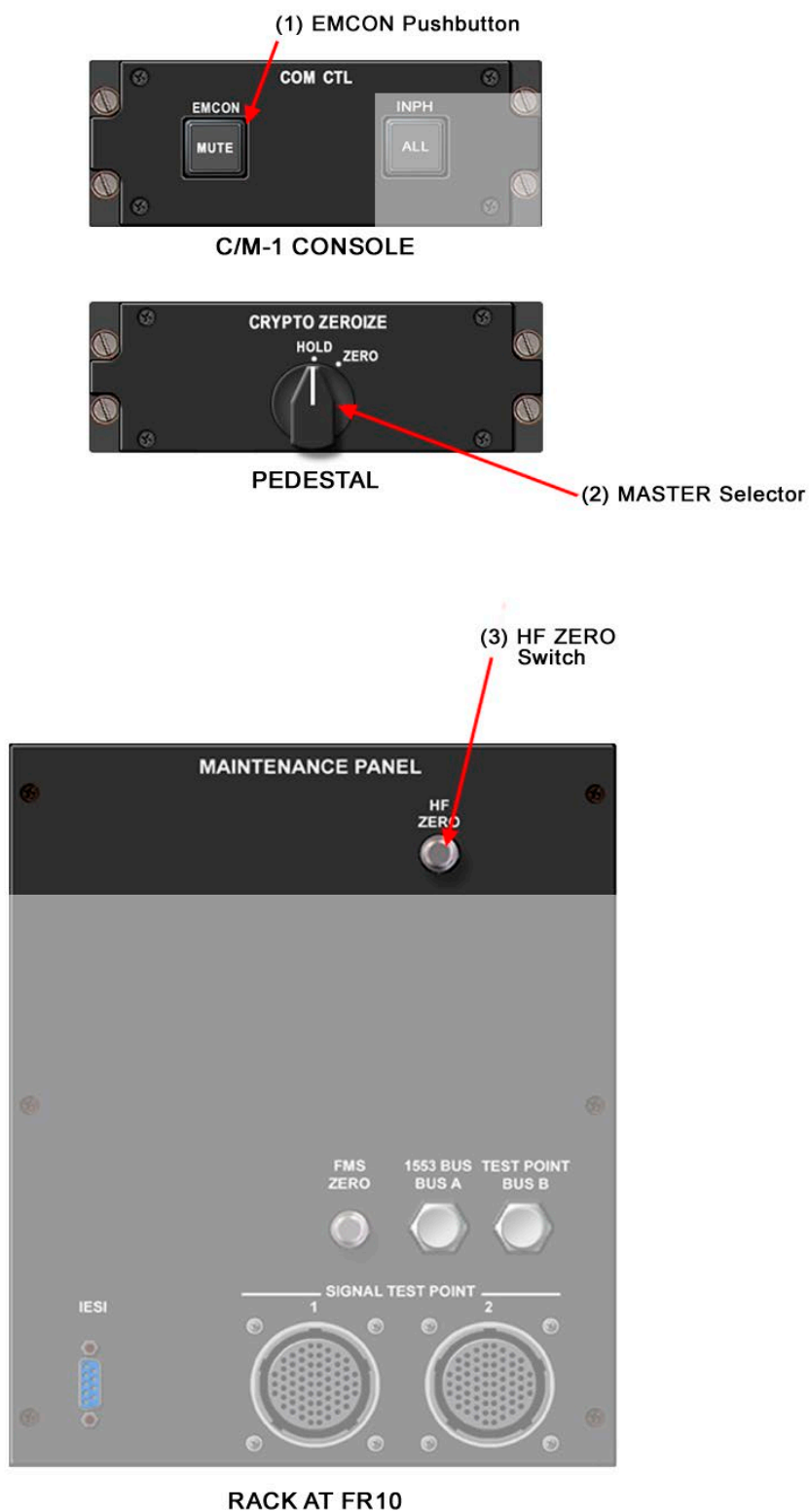
erases ALE codes and protection data.

Figure   23-9   Secure Communications - Controls and Indicators

PASSENGER ADDRESS

The PA system allows messages broadcasting to the passengers, through the speakers at the cargo compartment, from the cockpit and from the front station in the cargo cabin.

DESCRIPTION

The PA system receives audio signals from the Integrated Audio Control System (refer to INTEGRATED AUDIO CONTROL SYSTEM, in this chapter) and forwards these signals to the speakers from the cockpit and cargo-compartment interphone stations.

Main components of the system are:

–   *PA Amplifier:* located in the left avionics rack, processes received signals, amplifies them, and sends them to the speakers in the cargo cabin.

–   *Speakers*: there are ten speakers, distributed in two rows of five, along the ceiling of the cargo cabin and the toilet. The speakers convert the electrical signals from the amplifier into audible signals.

–   *Audio Control Panels:* the system is managed from the three audio control panels on the cockpit, and from the panel located at frame 10 in the cabinet.

CONTROLS AND INDICATORS

(refer to INTEGRATED AUDIO CONTROL SYSTEM, in this chapter).
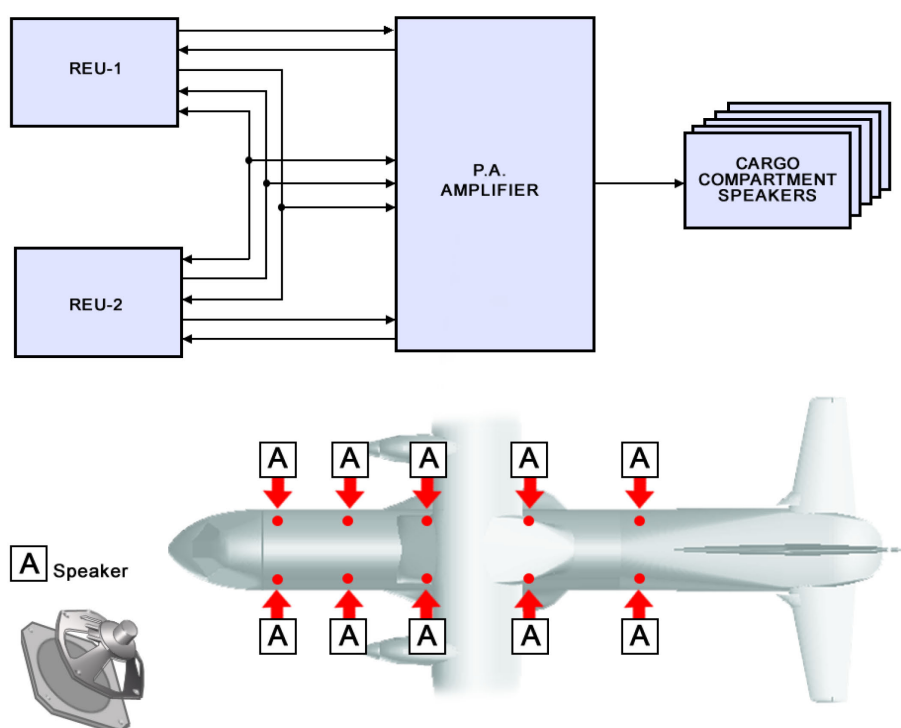
Figure   23-10   PA System - Architecture

INTERPHONE

The Interphone system allows communication among all the members of the crew, likewise between the crew and the maintenance personnel on ground.

The Interphone system is not an separate system, but an integral part of other systems on the aircraft.

– PA System

– Integrated Audio Control System

(refer to INTEGRATED AUDIO CONTROL SYSTEM - DESCRIPTION and OPERATION, in this chapter)

INTEGRATED AUDIO CONTROL SYSTEM

The system provides audio control to the following crew members:

–   Three stations in the cockpit: Pilot, copilot and third crew-member.

–   A station at the fore cargo cabin.

–   Two stations at the rear section of the cargo cabin.

–   Two external stations for the ground maintenance team.

The audio control system provides the following functions from the cockpit stations:

–   Transmission and reception using the radio communications systems.

–   Reception of audio signals from the radio navigation systems.

–   Reception of audible warnings from the aircraft and avionics.

–   Interphone communications with all crew members, and with the maintenance team.

–   Audio messages broadcasting through the cargo cabin speakers.

The audio control system provides the following functions from the fore station on the cargo cabin:

–   Reception using the radio communications systems.

–   Interphone communications with all crew members and with the maintenance team on the ground.

–   Audio messages broadcasting through the cargo cabin speakers.

The audio control system gives the following function from the rear cargo cabin station:

–   Interphone communications with all crew members, and with the maintenance team.

The audio control system gives the following function from the outdoor stations:

–   Interphone communications with crew members.

DESCRIPTION

Main system components are:

- **Remote Electronic Units (REUs):** located at the left avionics compartment, these manage the distribution of audio signals between the avionics equipment and audio stations on the aircraft.

- **Audio Control Panels (ACPs):** four units give control and selection of the audio signals enabled for each station. On the cockpit, there is one for the C/M-1, another for the C/M-2 (side consoles) and other for the third crew member (next to his seat). The fourth is at the fore front of the cargo cabin (cabinet at frame 10); this last ACP is not equipped for radio transmissions.

- **Junction Boxes (JBs):** six units provide connection for the various microphones and headphones of the system. On the cockpit, there is one at each of the C/M-1, and the C/M-2 side consoles, and other for the third crew member. At the cargo cabin, there is one in the cabinet at frame 10, and two at the rear part next to the doors.

- **Interphone Service Points:** two stands permit activation of the interphone, and volume control for the rear end of the cargo cabin. Located at the back of the cabin, next to the aircraft doors.

- **Push-to-Talk (PTT) Pushbuttons:** The system includes the following PTT pushbuttons that allow speaking when pushed:

  - Two PTT to be used by the pilots, one on either control wheel.

  - One PTT on the nose wheel steering control.

  - One PTT close to the seat of the third crew member.

  - One PTT at the front of the cargo cabin.

  - Two PTT at the rear end of the cargo cabin, one on each interphone service point.

- **Audio Jacks in the Cargo cabin:** there are two jack sockets, in the ceiling of the aircraft, which provide additional headphone connection to the personnel at the rear part of the cargo cabin.

- **External audio Jacks:** there are two headphone jacks to be used by maintenance personnel. One is located on the right side of the nose, and the other at the fairing of the right main landing gear, close to the fuelling intake.

- **Tone Generator:** its function is to generate the audio alert signals from received data, and transfer them to the cockpit speakers and/or the headphones of the flight crew. The Tone Generator receives audio alert signals from the avionics, the IEDS and TCAS alerts.

- **Cockpit Speakers:** there are two speakers, located on both the right and left sides of the cockpit ceiling.

- **Headphones and Microphones:** allow the crew to hear/speak audio information.

Figure   23-11   Integrated Audio Control System - Components (Sheet 1 of 4)

A Third Crew-Member PTT Control Panel

A Audio Control Panel

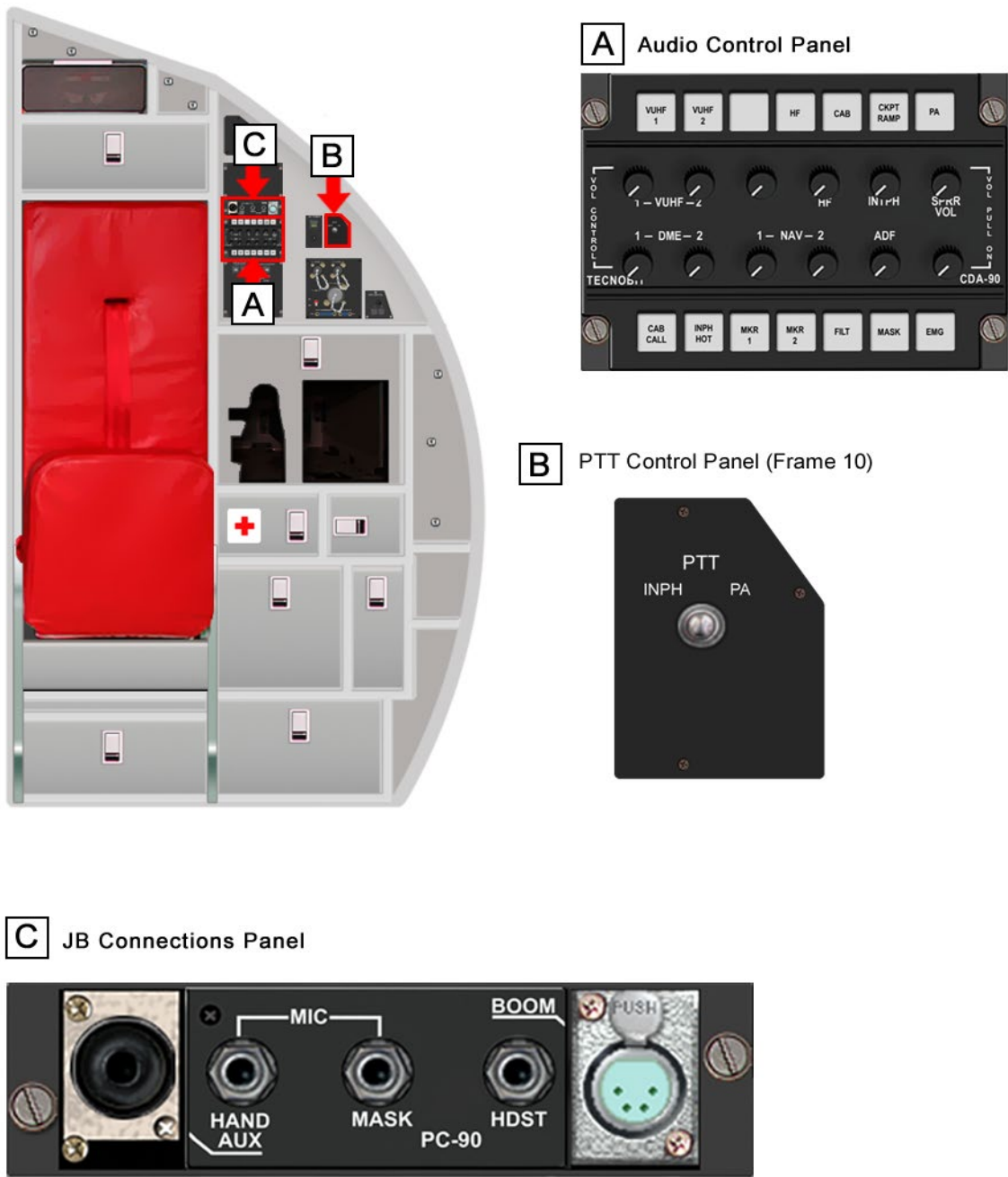Figure 23-11 Integrated Audio Control System - Components (Sheet 2 of 4)

A Audio Control Panel

B PTT Control Panel (Frame 10)

C JB Connections Panel

Figure   23-11   Integrated Audio Control System - Components (Sheet 3 of 4)

CARGO CABIN

CARGO CABIN

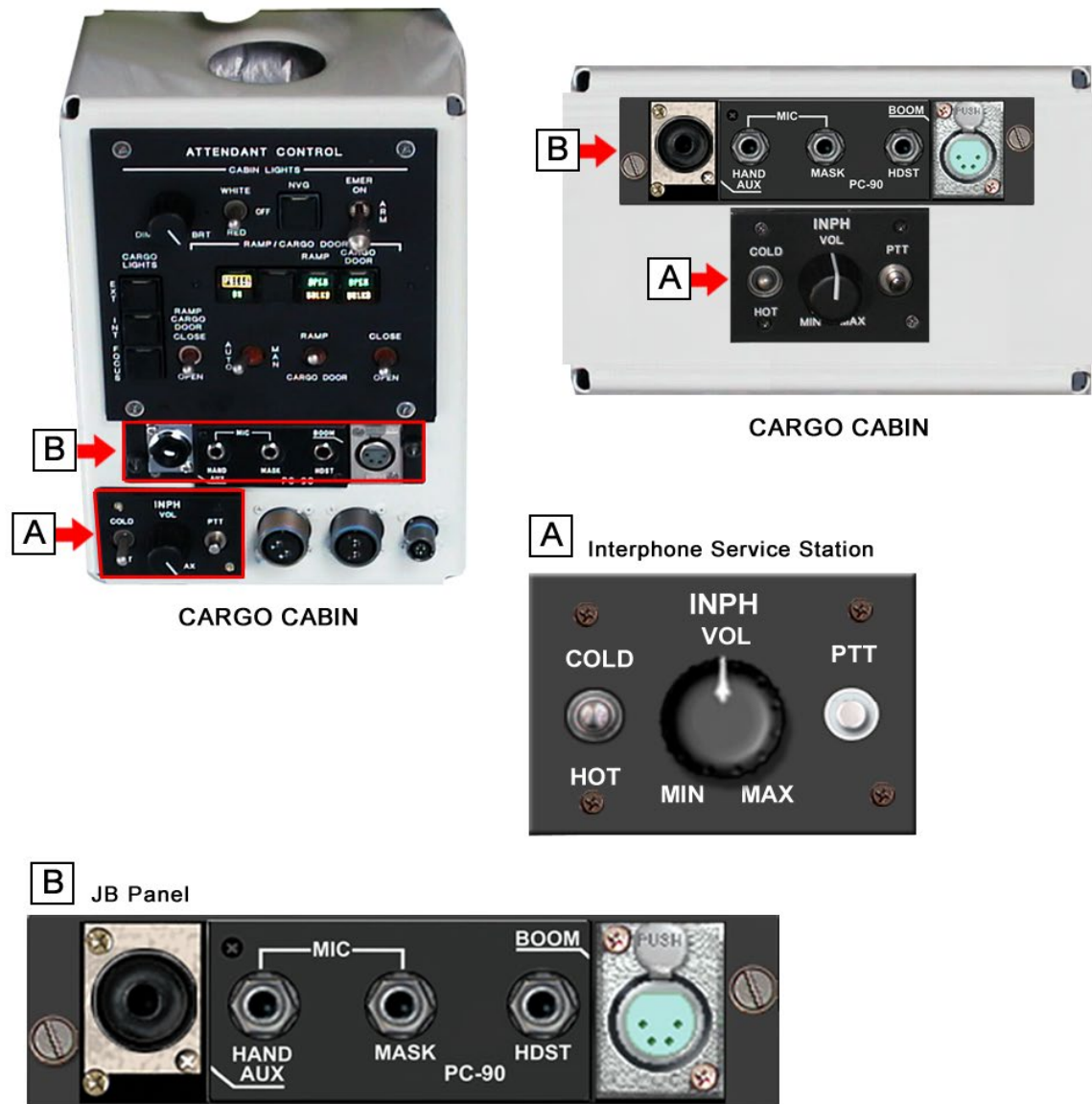A Interphone Service Station

B JB Panel

Figure   23-11   Integrated Audio Control System - Components (Sheet 4 of 4)
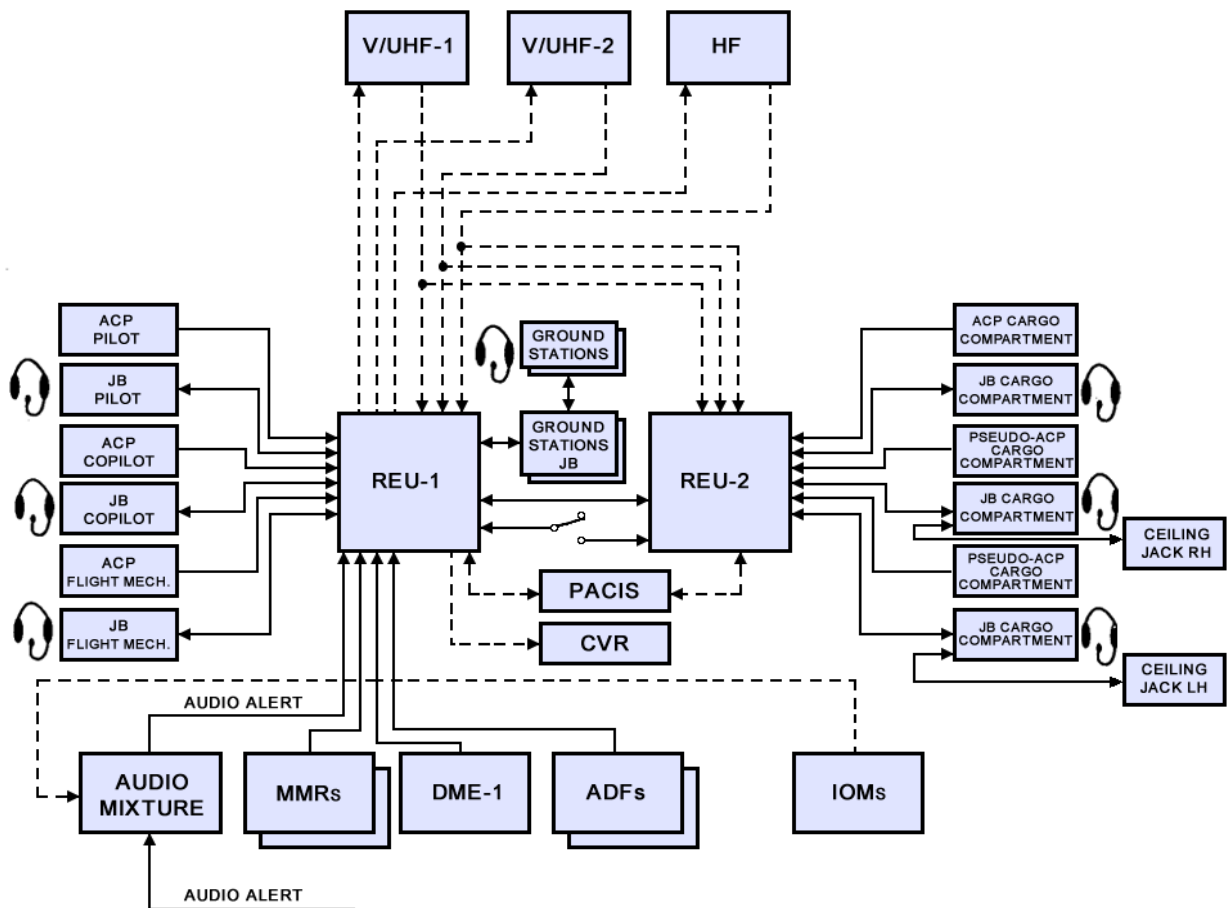
Figure   23-12   Integrated Audio Control System - Architecture

OPERATION

The following describes the management of the interphone system with the audio integrated system. The system can be operated in Normal or Emergency modes.

NORMAL MODE OPERATION

When a system is selected, the suitable volume is adjusted using the respective volume control. The Audio integrated System allows the following communications:

–   Communications in the cockpit through the interphone line:

Conversation is possible when the audio jack of the headphones is plugged into the AUX jack socket on any one of the JBs, and pressing any PTT pushbutton (control column, nose wheel steering control, or third-crew-member PTT) at the INPH outfit. The transmission is made from that station where the PTT button has been pushed-in.

It is also possible to talk without using the PTT buttons, by acting the INPH HOT on any one of the three ACP.

–   Communications from the three cargo cabin stations through the interphone line:

To talk, plug the audio jack of the headphones into the AUX jack socket on any one of the JBs, and set the COLD/HOT selector to the COLD position, on the intercom service point (INPH). Transmission is also possible pushing any PTT button. The transmission is made from the station at which the button is pushed-in.

Conversation can be made without using the PTT pushbuttons, pressing the INPH HOT pushbutton on the ACP at the front station of the cargo cabin, and setting the COLD/HOT selectors of the intercom-service-point to the HOT position.

–   Communication among the six crew-stations through the interphone line:

For conversation between the cockpit and the cargo cabin, press the INPH pushbutton of the panel COM-CTL at the pilot console (the ALL reading comes on). Communication between the stations is possible using the microphones and headphones (Headsets).

–   Communication between the cockpit and the front station at the cargo cabin:

Conversation can be held by pressing the CAB pushbutton on the ACPs of the specific interphone stations wanting to communicate.

–   Communication between any stations and the ground crew:

Conversation is feasible plugging the headphones into the ground jack sockets, and pressing the CKPT RAMP pushbutton of the ACPs.

–   Audio broadcast through the cockpit speakers:

Audio broadcast is enabled using the SPKR control on the ACPs. Transmissions from any of the stations are received on every station at the headphones, and the station speaker where the control is activated.

–   Communications between the cockpit and the ground crew, speaking through a hand-held microphone:

This communication is made with the V/UHF1 system selected to activate a frequency. Microphones are plugged into the HAND connectors on the JBs, and both V/UHF1 pushbuttons and V/UHF1 volume controls on the ACPs must be turned on.

–   Communications between the crew stations through a mask microphone:

To communicate, plug the mask microphones into the MASK jack on the JBs. Transmission is enabled with the MASK pushbutton on the ACPs. Messages are received through headphones plugged into the AUX jack on the JBs.

–   Communications between the crew stations received through the headphones:

Plug the headphones into the HDST jack on the JBs to allow communication. Speaking is done through headset microphones plugged into the AUX jack on the JBs.

–   Communications between the crew stations through headphones plugged in to the BOOM jack:

To allow communication, the headphones must be plugged into the BOOM jack on the JBs.

EMERGENCY MODE OPERATION

In the event of a loss of power, or malfunction on the Integrated Audio Control System, the EMG pushbutton on the ACPs routes the audio signals from the microphone, headphones and PTT of the pilot, directly to the V/UHF1 communication system, and the same signals (microphone, headphones and PTT) from the copilot directly to the V/UHF2 communication system.

The Integrated Audio Control System is interconnected with the Communication and Navigation systems.

When a Communication or Navigation system is selected, the previously selected system is disconnected automatically. The required Navigation or Communication system is selected on the Audio Control Panel. The Tone Generator in the Audio integrated System receives alert signals from the TCAS System, the Electrical System, the IFF Electrical System, the DCF System and the In-Flight Failure Warning System. These alarms are transmitted to the flight crew. All the audio signals are sent by the PA amplifier, and broadcast through the cockpit speakers.

Finally, communication between the flight crew and a ground station is possible transmitting through the V/UHF1 (V/UHF2) system or the HF system, selected to activate a frequency. Communication can be maintained by selecting the V/UHF1 (V/UHF2) pushbuttons and controls, or the HF pushbuttons and controls, on the Audio Control Panels.

CONTROLS AND INDICATORS

AUDIO CONTROL PANEL

(1) VUHF1 Pushbutton:

- *Pressed:* selects the V/UHF1 System for transmission.

(2) VUHF2 Pushbutton:

- *Pressed:* selects the V/UHF2 System for transmission.

(3) Blank Pushbutton: (inoperative)

(4) HF Pushbutton

- *Pressed:* allows transmission through the HF system.

(5) CAB Pushbutton:

- *Pressed:* sets communication only between those interphone stations where CAB has been pushed-in on the ACP.

(6) CKPT/RAMP Pushbutton:

- *Pressed:* brings communication between the cockpit and the front and rear ground-crew jacks.

(7) PA Pushbutton:

- *Pressed:* allows the PA system to be selected.

(8)(9)(10) Selection/Volume Controls (HF, INTPH and SPKR):

volume controls are used to select the pertinent system, and to control the volume of the received audio signals, as well.

(11) Blank Selector: (inoperative)

(12)(13) Selection/Volume Controls (ADF and NAV2):

volume controls are used to select the pertinent system, and to control the volume of the received audio signals, as well.

(14) EMG Pushbutton:

- *Pressed:* drives an immediate connection of the V/UHF communication system to the emergency channel, in case of an emergency. On the pilot´s ACP, connects the pilot to the V/UHF1 system, on co-pilot´s ACP connects the copilot to the V/UHF2 system. V/UHF1 signals are received in the ACP located in the cabinet at frame 10.

(15) MASK Pushbutton:

- *Pressed:* selects the mask microphone for use.

(16) FILT Pushbutton:

- *Pressed:* allows identification tone filtering, from the audio navigation signal.

(17) MKR2 Pushbutton:

- *Pressed:* selects audio signal reception from the radio beacon.

(18) MKR1 Pushbutton:

- *Pressed:* selects audio signal reception from the radio beacon.

(19) INPH HOT Pushbutton:

- *Pressed:* allows communication through the interphone system without using the PTT button.

(20) CAB CALL Pushbutton:

- *Pressed:* sends the generated HI-LO tone, to the speakers in the passengers cabin.

(21)(22)(23)(24)(25) Selection/Volume Controls (NAV1, DME2, DME1, VUHF1 and VUHF2):

volume controls are used to select the pertinent system, and to control the received audio signals volume, as well.

(26) Blank Selector: (inoperative)

JUNCTION BOX (JB)

(27) AUX Connection

(28) HAND Connection

(29) MASK Connection

(30) HDST Connection

(31) BOOM Connection

STEERING WHEEL

(32) PTT Pushbutton in Steering Wheel:

- *INPH:* permits to communicate with the crew members, through the interphone.
- *RAD:* allows radio transmission through the equipment selected on the associated ACP. It is required to press and hold down while talking.

NOSE WHEEL STEERING WHEEL

(33) PTT Pushbutton on the Nose-Wheel Steering Wheel:

- *INPH:* permits to communicate with the crew members, through the interphone.
- *RAD:* allows radio transmission through the equipment selected on the associated ACP. It is required to press and hold down while talking.

C/M-3 PTT

(34) Third Crew Member PTT:

- *INPH:* permits to communicate with the crew members, through the interphone.
- *RAD:* allows radio transmission through the equipment selected on the associated ACP. It is required to press and hold down while talking.

PTT CONTROL PANEL (FRAME 10)

(35) PTT Selector:

- *INPH:* sets interphone communication.
- *PA:* starts broadcasting through the PA system.

INTERCOM SERVICE POINT

(36) PTT Pushbutton:

allows the connected microphone. It has to be pushed-in and held down while talking.

(37) Volume Control:

a knob to adjust the volume at the headphone.

(38) COLD/HOT Selector:

- *HOT:* it permanently allows the connected microphone.
- *COLD:* this selects control from the PTT pushbutton.

C/M-1 COM CTL CONTROL PANEL

(39) INPH Pushbutton:

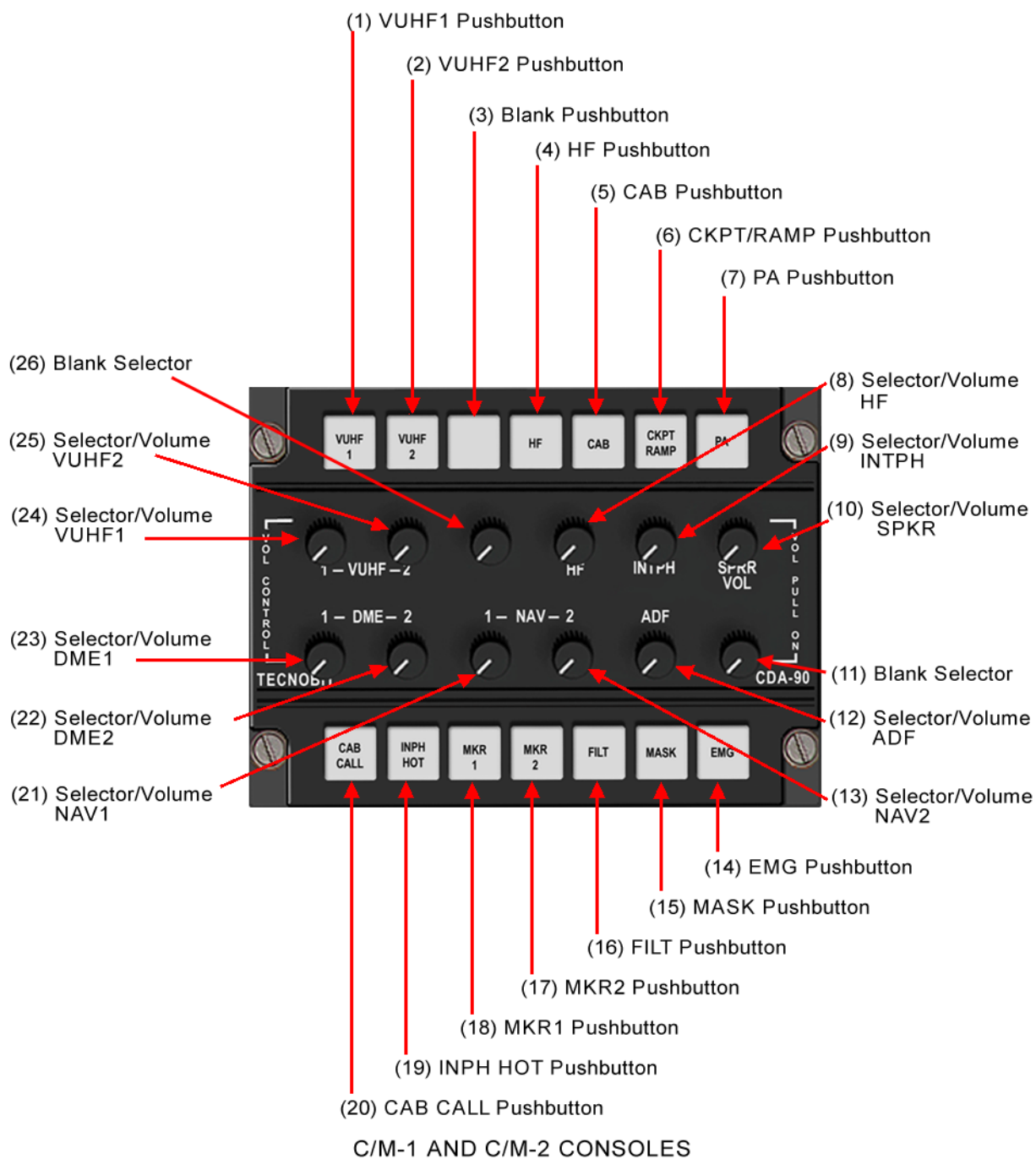- *Pressed (ALL light on):* allows communication among all the six crew stations.

Figure   23-13   Integrated Audio Control System - Controls and Indicators (Sheet 1 of 3)

(27) AUX Connector

(28) HAND Connector

(29) MASK Connector

(30) HDST Connector

(31) BOOM Connector

C/M-1 AND C/M-2 CONSOLES, AND PEDESTAL

(32) PTT Pushbutton in Steering Wheel

C/M-1 CONSOLE

(33) PTT Pushbutton in Nose-Wheel Steering Control

(34) Third Crew Member PTT Selector

C/M-3 PTT CONTROL PANEL

(38) COLD/HOT Selector

(36) PTT Pushbutton

(37) Volume Control

CARGO CABIN

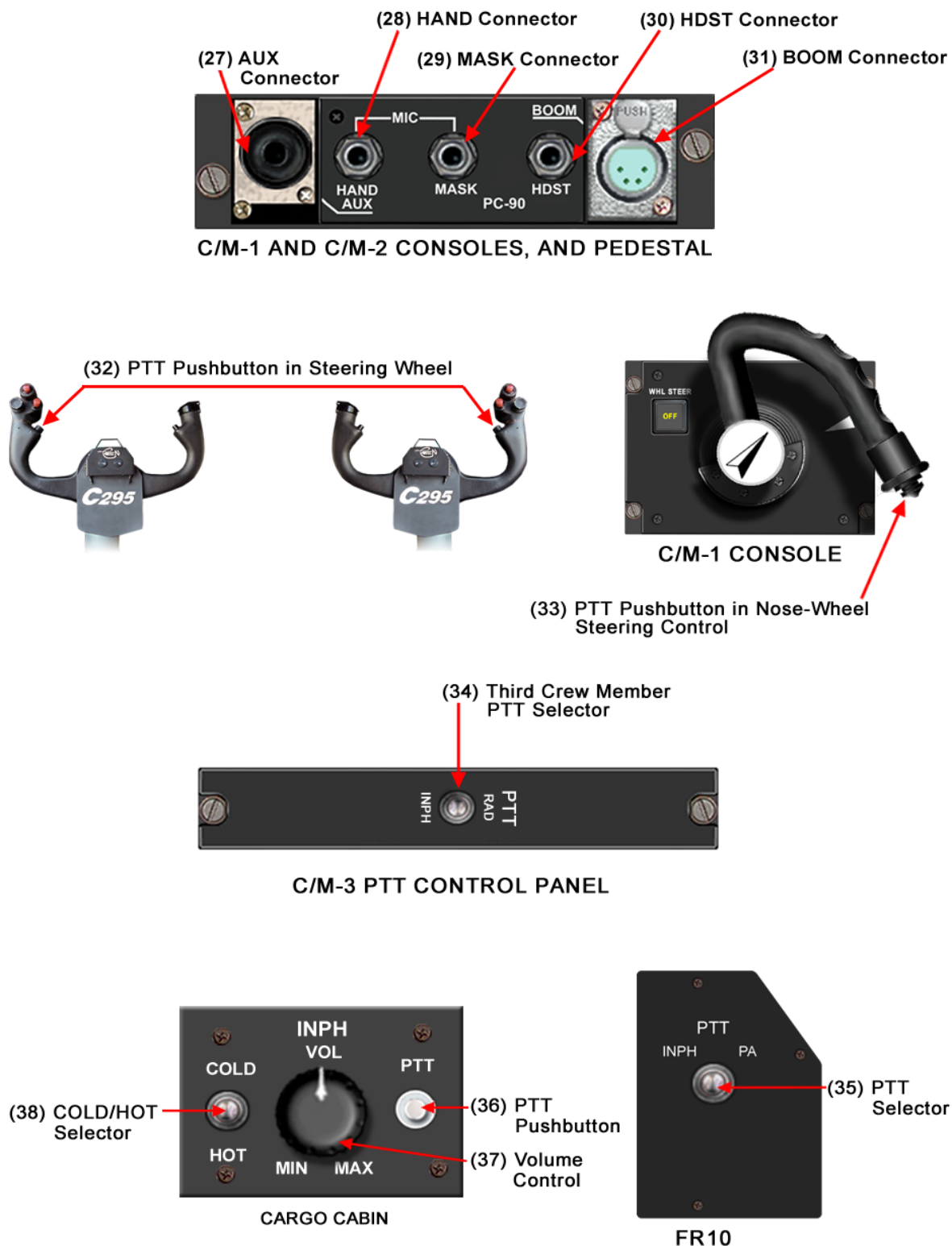**(35) PTT Selector**

FR10

Figure   23-13   Integrated Audio Control System - Controls and Indicators (Sheet 2 of 3)
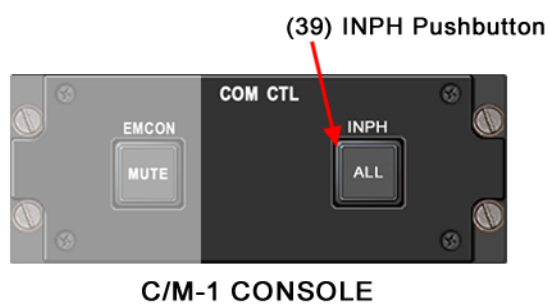
Figure   23-13   Integrated Audio Control System - Controls and Indicators (Sheet 3 of 3)

STATIC DISCHARGING

The aircraft is equipped with twenty eight electrostatic dischargers, to reduce the noise that can interfere the electronic equipment operation.

DESCRIPTION

Twenty eight dischargers are mounted on ailerons, elevators and rudder, and can be put into groups curved and straight.

OPERATION

Static dischargers create a low resistance path, thus allowing to discharge into the atmosphere any static electricity that might have been collected.
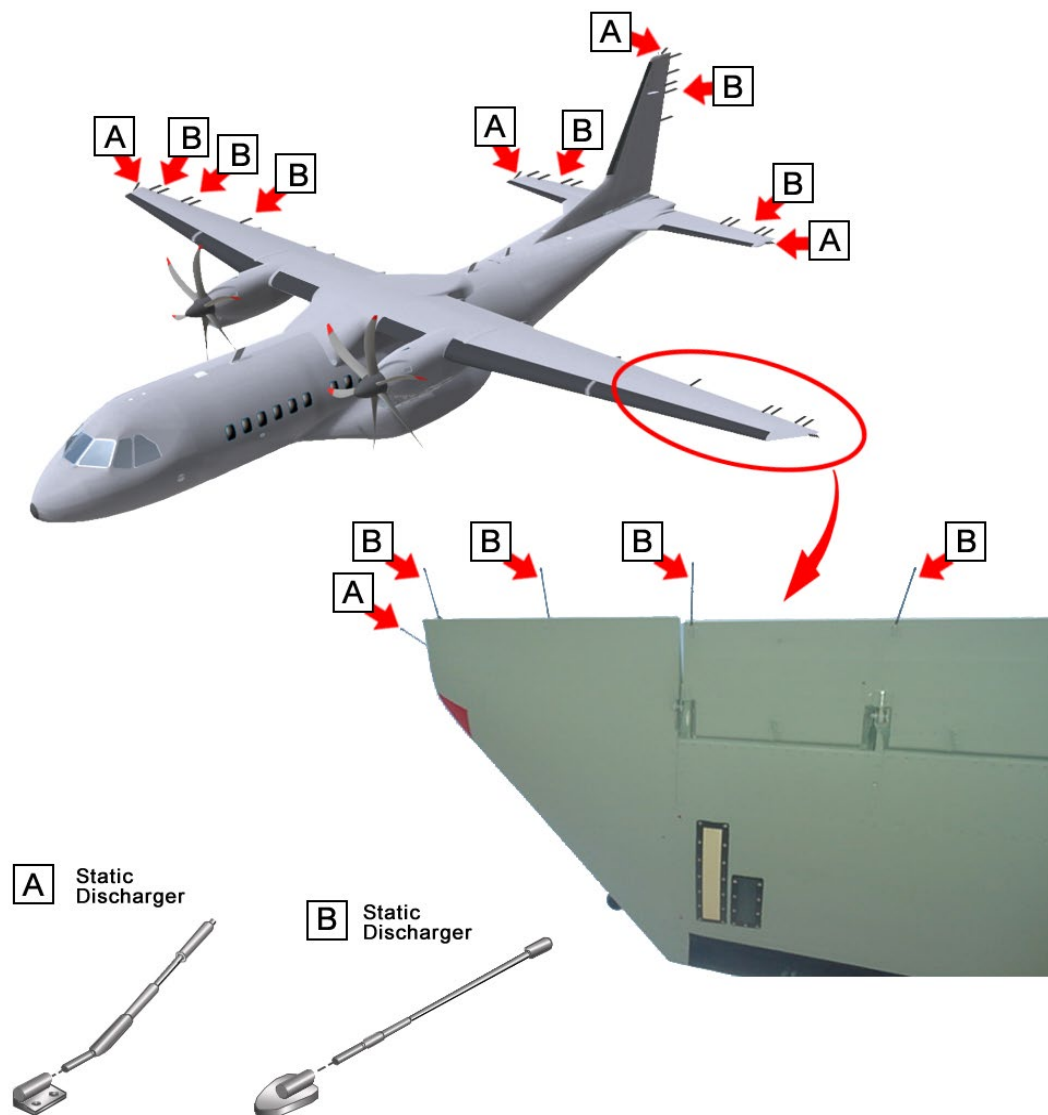
Figure   23-14   Static Discharge

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