PS ENGINEERING INCORPORATED

Sound Quality. Sound Engineering.

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PAC45A System

With IntelliVox® and MultiTalker®
Flying Never Sounded So Good!®

Pilot's Guide
and
Operation Manual

FOR <u>DUAL</u> CONTROL HEAD SYSTEMS

202-045-1200   Revision 1   Oct. 2021

FAA TSO C139a

Bluetooth®

This pilot guide provides detailed operating instructions for the PS Engineering PAC45A, Audio Selector Panel/Intercom Systems. Please read it carefully before using the equipment so that you can take full advantage of its capabilities. **NOTE: Because of user customization of the labels, appearance may differ from illustrations**
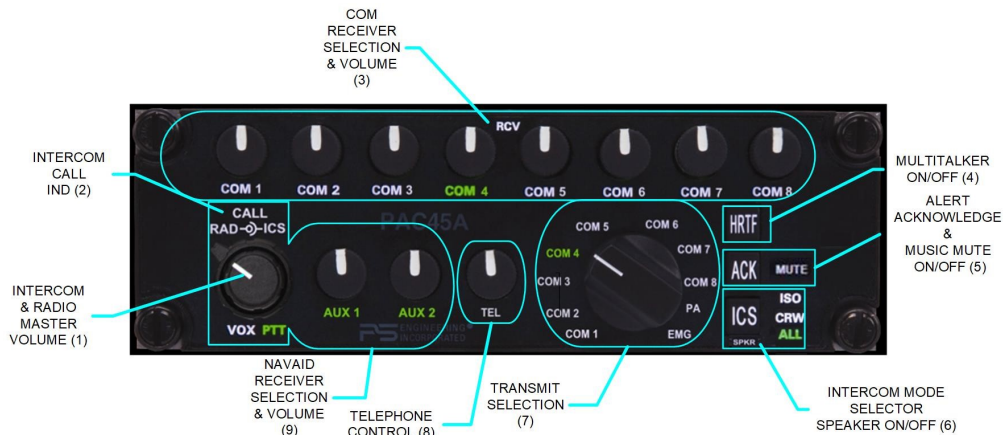
CTL45P Operating Controls

PAC45A Operating Controls

Power and Fail Safe

Unit power is controlled by the transmitter (XMT)(7) selector knob. In the "EMG" or off (fully clockwise) position, the pilot headset is connected directly to COM 1 as well as alerts and unswitched input #1. This allows communication capability regardless of unit condition. NAV1 audio is also provided to the pilot in the other ear of a stereo headset. If NAV 1 is not present, verify tat the headset is in stereo and that the installation is configured for stereo operation.

In Fail Safe (EMG) on the Copilot panel, that position will hear COM 2. The copilot can place the control panel in EMG without affecting pilot operation.

Any time power is removed or turned off, the audio selectors will revert to fail-safe mode. If fail-safe audio is present in both ears of a stereo headset, or completely absent, verify that a stereo headset is used and is selected for stereo mode.

The power controls all audio selector panel functions, and intercom.

Communications Transmit (XMT) Selection (7)

The PAC45A has a rotary control knob to select communications transceiver functions. To select a transceiver for transmit; turn the knob to select the desired radio.
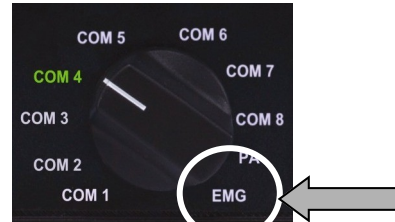
The radio is automatically selected to receive incoming radio calls when the XMT is selected. With a PAC45A, you will never transmit on a radio that you are not receiving. The selected audio is indicated by both knob position and the green text. The pilot and copilot controllers can select any of the installed transceivers. In the case where both have selected the *same* radio for transmission, the pilot will have priority when he uses the radio push to talk.

COM Audio Selector (3)

The communications receiver audio sources are controlled by a combination switch/volume control. Communication audio from another radio, not selected for transmit, can be heard by placing the associated RCV switch in the out position. The selected audio is indicated by both knob position and the green nomenclature text.

You will always hear the audio from the selected transceiver, even if the selected comm audio is turned all the way down on the audio controller because it cannot turn the selected receive audio all the way off.

The Radio Master Control Volume (small inner knob labeled RAD) should always be at MAX volume.

The volume controls for the individual radios is the preferred way of setting respective radio volumes. The **RAD** volume control is to allow an easy way to reduce all radio volumes temporarily to assist in intercommunications (intercom).

The preferred sequence of volume setting is:

1. Headset volume controls – all the way up

2. Master radio volume (if applies) – all the way up

3. Intercom volume – noon

4. Individual comm selection/volume – 3 o'clock (unity gain)

5. Set Radio volumes to comfortable levels, no higher than 80%

Receiver Activity Indication (-RXI)

PAC45A systems have a Receive Activity Indicator that flashes the *selected* receiver indicator when a signal is present on that receiver. This allows the user to spot an active radio, even if the volume is turned down. This function is set at installation.

MultiTalker® Head Related Transfer Function (HRTF) (3)

Communication receiver audio signals are presented to the DSP and processed to "appear" in a different location to the crew. "MultiTalker"® (US Patent #7,391,877) specifies up to nine locations. This helps the crew to better comprehend speech by locating it in a manner more easily differentiated by the human brain.

Intercom and other audio is not spatially processed, only the eight communications transceivers.

The installation must be configured for stereo, and you must use stereo headsets, in stereo mode for this feature.

MultiTalker® places the communications receiver audio in one of nine apparent locations in the crew's headset. This has been scientifically shown to allow the brain to focus on multiple conversations and improve comprehension for the listener.

Pressing the HRTF button toggles the PAC45A MultiTalker spatial function on (receiver sources distributed) or off (receiver audio sources neutral). The HRTF button on the pilot and copilot panels control the function for the user of that panel.
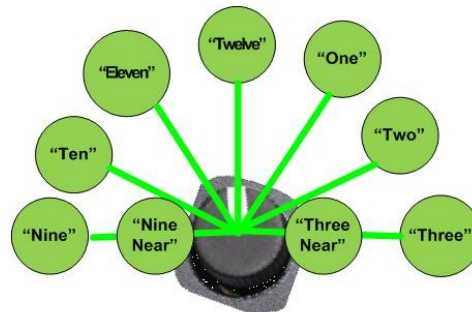
Audio Location

This adjustment allows the eight Spatial Audio inputs to be "relocated" on any of nine (9) predefined "Head Related Transfer Function" (HTRF) locations.

The *pilot CTL45A control panel* will control the locations for the six receive audio locations for all users. Press and hold the HRTF button for > 1 second on the pilot's panel until the HRTF button and all COM nomenclature start blinking green.

Rotate the desired COM receive volume knob so the pointer indicates the approximate location of the desired location. A voice announcement will accompany the knob rotation with the clock positions. Received audio will then be presented from that location.

Press the HRTF button again to save the settings. This will stop the flashing and activate the HRTF mode. The audio controller will remember last state through power cycles.

Navaid Audio Selection

Navigation receivers are selected in the same manner as the communication receiver, pull on/push off the knob associated with the desired navigational aid, and rotate to adjust the receiver volume.

There are three navaid controls, and up to eight navaid inputs available.

Telephone control (8)

The volume control selector connects the audio controller to either a Bluetooth®-enabled cell phone or a wired cellular/satellite phone.

Place the volume control in the out position to select (answer or make phone call) and adjust the receive audio volume. This knob must be out to use the telephone function.

To hear the ringer of the Bluetooth phone, the volume control should be around the 12 o'clock position. Selecting the TEL switch in the OUT position is not required for Bluetooth, but must be out to hear a wired satcom ringer.

Intercom Operation

IntelliVox® Intercom VOX-Squelch

No adjustment of the IntelliVox® squelch control is necessary. Through individual processors, the ambient noise appearing in all microphones is constantly being sampled. Non-voice signals are blocked. When someone speaks, only their microphone circuit opens, placing their voice on the intercom.

The system is designed to block continuous tones; therefore people humming or whistling in monotone may be blocked after a few moments.

For consistent performance, any headset microphone must be placed within ¼-inch of your lips, preferably against them. (ref: RTCA/DO-214A, §1.3.1.1 (a)).

NOTE

It is also a good idea to keep the microphone out of a direct wind path. Moving your head through a vent air stream may cause the IntelliVox® to open momentarily. This is normal.

The IntelliVox® is designed to work with normal aircraft cabin noise levels (70 dB and above). It loves aircraft noise! Therefore, it may not recognize speech and

clip syllables in a quiet cabin, such as in the hangar, or without the engine running. This is normal.

For optimum microphone performance, PS Engineering recommends installation of a Microphone Muff Kit from Oregon Aero (1-800-888-6910). This will not only optimize VOX performance, but will improve the overall clarity of all your communications.

Push to talk intercom (PTT ICS) (1)

Pressing the intercom volume knob (ICS VOL) will place the system into the Push-to-talk (PTT for Intercom use) mode. This will disable the voice activation (VOX) and require that the external push to talk intercom buttons for each position be used to speak on the intercom.

Push the knob again and the systems toggles back to voice activation. The mode is shown by the green indication in the text.

Intercom Volume Control (1)

The outer concentric volume control knob adjusts the loudness of the intercom for the intercom stations(s) connected to the audio controller panel. It has no effect on selected radio levels, or music input levels.

Monaural headsets

The pilot and copilot positions work with stereo or mono headsets. However, MultiTalker will not be presented correctly unless stereo headsets are used, and oriented correctly on the head, left and right.

NOTE: For the full effect of MultiTalker® Dimensional Sound, stereo headsets must be used, and the left/right orientation observed.

Some passenger headset stations are connected in parallel. Therefore, if a monaural headset is plugged in to a PAC45A Stereo installation, one channel will be shorted. Although no damage to the unit will occur, all passengers with stereo headsets will not hear one channel, unless they switch to the "MONO" mode on their headset.

Intercom Modes (6)

The "**ICS**" pushbutton switch on the panel provides the selection of the intercom modes

The intercom mode defaults to "ALL" at power up. Then the button cycles through the intercom modes, from bottom to top, then top to bottom: ALL CRW ISO, CRW. A green indicator shows which mode is currently active.
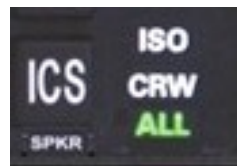
Iso: Each control head has their own ISOLATE selection. The control head is isolated from the intercom stations and is connected only to the aircraft radio's that are selected system. They will hear the aircraft radio reception (and sidetone during radio transmissions).

All: Each control head has their own ALL selection. When in the ALL mode, all parties will hear the aircraft radio, intercom and music. The pilot or copilot control head will decide when the system will be in the ALL mode by pressing their ICS switch. During any radio or intercom communications, the music volume automatically decreases. The music volume increases gradually back to the original level after communications have been completed.

Crew: Pilot and copilot are connected on one intercom channel and have exclusive access to the aircraft radios. The pilot or copilot control head will decide when the system will be in the ALL mode by pressing their ICS switch. The observers can communicate with each other and passengers in ALL or Crew mode or select ISO mode.

Intercom Operation with 4 CTL45A

The PAC45A was designed for the special mission market (forestry, law enforcement, EMS, etc.) with the ability to allow controls heads to remove themselves and pull in other intercom stations during working/high communication special mission operations as needed. This was our goal and design purpose of the intercom states and is very practical to this environment.

Pilot and copilot have priority commands over the Observer 1 & Observer 2 in regard to the intercom states. The intercom system reacts to whomever initially selects the intercom mode, meaning if the OBS 1 or OBS 2 selects ALL to CRW then it will move all control heads to that location. If the pilot selects ALL to CRW, it does the same, but now the OBS 1 and OBS 2 can never select ALL mode again until the pilot or copilot forces the change.

If four control heads are used, the following rules apply:

- System defaults to ALL at power up.
- The pilot, copilot, and Observer 1 can select ISO and be removed from the intercom.
- If the 4th control head (Observer #2) selects ISO, that position will be connected to any passengers, but disconnected from the pilot, copilot, and Observer 1.
- Any control head can select CRW, and place <u>all</u> panels in Crew mode, unless the pilot and copilot are in ISO, and will remain in ISO.
- Either pilot or copilot panel can select ALL and add everybody to the intercom.
- The Observer 1 and Observer 2 panels can leave and return to ALL, unless a pilot or copilot has selected ISO or CREW.

The observer/mission personnel can isolate their audio feed from the crew by pressing the ICS button. When the CTL45A is in ISO mode, the observ-

er/passengers will have intercom among themselves, and be able to use the selected radios.

If the observer personnel would like to CABIN CALL the crew intercom stations. On the observer control head (CTL45A), pressing "ACK" button will activate an ICS call light and a chime in the crew headsets and crew control head. For intercom stations without access to a control head, a remote Call switch can be installed.
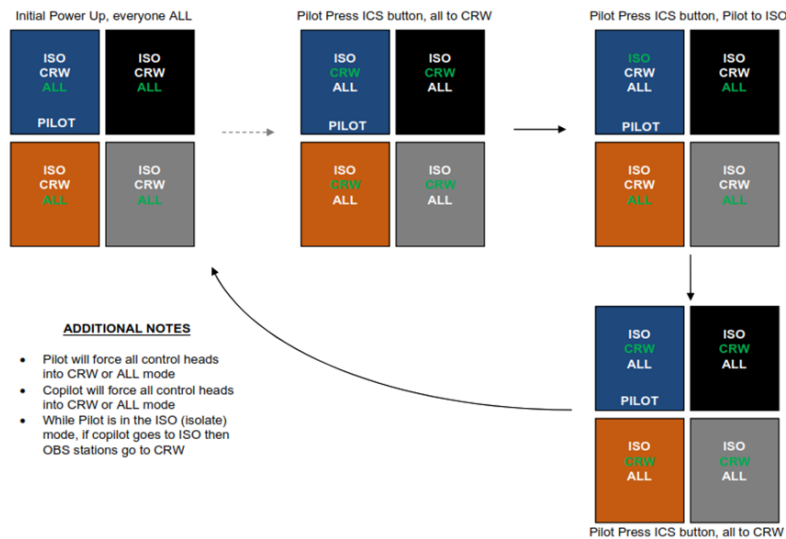

Figure 1: Pilot ICS States

PAC45A Intercom State Rules

The following charts show the intercom mode state rules with a four CTL45A control heads, for pilot, copilot, OBS1 & OBS2.

At the top of each section, it states these button presses below. For explanation we will use "Pilot ICS States"
1. On initial power up, all control heads in ALL mode.
2. Pilot presses ICS button, all control heads to CRW mode.
3. Pilot presses ICS button, Pilot to ISO, while all other control heads to ALL mode.
4. Pilot pressed ICS button, all control heads to CRW mode

This is consistent on the CTL45A control heads, so the pilot (and any other control head) can select all steps 1 thru 4 as above.

Additional Notes:
1. Pilot & Copilot can force all control heads to ALL mode, regardless of

ICS selections are on the OBS1 & OBS2 control head.

2. When all control heads are in the ALL mode, any control head can force all locations to CRW mode.
3. **All four** control heads can select ISO mode at the same time.
4. If pilot & copilot are in ISO mode, then the OBS 1 & OBS 2 can only select ISO or CRW

    If pilot & copilot are in CRW mode, then the OBS 1 & OBS 2 can only select ISO or CRW

While the pilot & copilot are in either ISO or CRW mode then the OBS 1 and OBS 2 has the "cabin call" feature, either by pressing external CALL switch or pressing the ACK button on their control head.

Remote ICS Mode Control

An optional external switch can act as a remote intercom mode selector for the *Pilot Control Head*. Pressing the switch will increment the intercom mode selector from ISO-ALL-CRW-ISO-ALL, etc. each time the button is pressed.

Speaker operation (6)

To activate the cockpit speaker, press and hold the ICS button for one second. This will place all received audio from that control head (CTL45A) over the cockpit speaker.
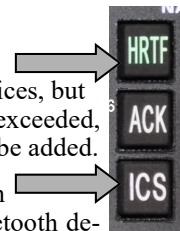
Bluetooth® connection

The PAC45A has an internal Bluetooth module, no external boxes required, but external antenna will be required. The audio controller is always "discoverable," so you just need to search for the PAC45A from your Bluetooth-equipped phone or music source. Default access code is not required. Once the PAC45A has been "paired" with your Bluetooth device, the TEL distribution will act as described below.

Pairing Bluetooth® devices

The PAC45A can be paired with up to eight individual devices, but will only connect to one at a time. When that number is exceeded, the PAC45A will drop a device to allow the new device to be added.

If the audio controller is turned on before the Bluetooth device, you will have to manually connect from your Bluetooth device. Otherwise once paired, the audio controller should connect automatically.

Hint, if your devices are not recognized by the PAC45A, you may need to reset the Bluetooth module, Press and hold HRTF and ICS buttons for more

than three (>3) seconds, ten 'forget" the PAC45A from your device and re-pair.

Bluetooth® Telephone Mode

The PAC45A serves as a full duplex interface for telephone systems such as portable cellular phones with Bluetooth connectivity.

Warning: United States FCC Regulations contained in 47 CFR § 22.925 currently contain prohibition on airborne operation of cellular telephones. "Cellular telephones installed in or carried aboard airplanes, balloons or any other type of aircraft must not be operated while such aircraft are airborne (not touching the ground). When any aircraft leaves the ground, all cellular telephones on board that aircraft must be turned off."

Answering or placing a call is done from the mobile phone. Once connected, the audio is routed through the headset(s) by pulling the TEL knob out. This knob also adjusts the volume of the telephone audio.

For a <u>single</u> CTL45A installation:

In **ALL** intercom mode, all crew and passengers will be heard on the phone when they speak.

In **CREW** mode, the pilot and copilot are connected to the telephone.

In **ISO** intercom mode, when the PAC45A is in the **TEL** mode, the pilot position is in the "Phone Booth." Only the pilot will hear the telephone, and only he will be heard.

For <u>multiple</u> CTL45A installation:

Each user's CTL45A controls their access to the telephone audio.

NOTE

PS Engineering does not guarantee compatibility with personal cellular telephones.

Bluetooth Reset

If the Bluetooth stops connecting to a device, or operates incorrectly first try turning Bluetooth off, and back on from your device. If also me be necessary to reset the Bluetooth module, clearing out the connected devices. Press HRTF and ICS for more than three seconds. This may be necessary if the Bluetooth stops connecting to a device, or operated incorrectly.
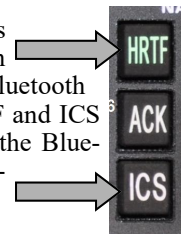
Music Muting Control (5)

The PAC45A incorporates PS Engineering's trademark "SoftMute. The SoftMute™ circuit will mute the music whenever there is conversation on

the radio or the intercom. When that conversation stops, the music returns to the previous level comfortably, over a second or so.

Holding down ACK button for three (3) seconds will turn the music muting on/off.

When in mute off mode, the intercom, radio & PTT will <u>not</u> mute the music. The music muting will reset to mute on mode at each power cycle. *Any* control head will switch the muting on or off for *all* users.

Wired Satcom/Cell Phone input

The PAC45A can accommodate a wired telephone input as well as a Bluetooth connection. This operates the same as the Bluetooth Telephone, although the audio must be selected on to hear the ringer.

Alert Audio

The PAC45A incorporates an independent alert audio system that can store nine audio messages recorded by the user and played back when triggered by an external source.

Once triggered, the alert audio will continue until the ACK button (front panel or external) on the CTL45A control panel is pushed, or the trigger input returns to normal. During failsafe mode (no HUB or Control Head power), when dedicated Alert power is provided, edge-triggered alerts will play 3 times or until ACK is pushed, whichever occur first.

The PAC45A system can store nine audio alerts, default audio is stored at the factory. These are "Master Caution," "Alert," a simple chime, 1000 Hz tone, Doorbell Chime, Ring Tone, "Timer at Zero," "Intercom Call," and " Check Engine Instruments."

PS ENGINEERING® INCORPORATED

Stereo Helmet Conversion

For optimum performance, and for any effective Head Related Transfer Function, stereo headphones must be used.

Several companies modify flight helmets to add stereo capability, and change the microphone to high impedance civil aviation if it is military, or low impedance.

Companies Include:

acousticom

Phone: 574-293-0534

www.acousticom.com

FLIGHTHELMET.COM

Phone: (800) 531-4898
www.FlightHelmet.com

Headsets Inc.

Phone: 800-876-3374

www.headsetsinc.com

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Warranty & Service

In order for the factory warranty to be valid, the installations in a certified aircraft must be accomplished by an FAA-(or other ICAO agency) certified avionics shop and authorized PS Engineering dealer. If the unit is being installed by a non-certified individual in an experimental aircraft, a factory-made intercom harness must be used for the warranty to be valid.

PS Engineering, Inc. warrants this product to be free from defect in material and workmanship for a period of two (2) years from the date of retail sale by authorized PS Engineering dealer. During the first **twelve (12) months** of the two-year warranty period, PS Engineering, Inc., at its option, will send a replacement unit at our expense if the unit should be determined to be defective after consultation with a factory technician. For the remaining **twelve (12) months** of the two-year warranty period, PS Engineering will send a no-cost replacement unit at customer shipping expense.

All transportation charges for returning the defective units are the responsibility of the purchaser. All domestic transportation charges for returning the exchange or repaired unit to the purchaser will be borne by PS Engineering, Inc. The risk of loss or damage to the product is borne by the party making the shipment, unless the purchaser requests a specific method of shipment. In this case, the purchaser assumes the risk of loss.

This warranty is not transferable. Any implied warranties expire at the expiration date of this warranty. PS Engineering SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. This warranty does not cover a defect that has resulted from improper handling, storage or preservation, or unreasonable use or maintenance as determined by us. This warranty is void if there is any attempt to dissemble this product without factory authorization. This warranty gives you specific legal rights, and you may also have other rights, which may vary from state to state. Some states do not allow the exclusion of limitation of incidental or consequential damages, so the above limitation or exclusions may not apply to you.

All items repaired or replaced under this warranty are warranted for the remainder of the original warranty period. PS Engineering, Inc. reserves the rights to make modifications or improvements to the product without obligation to perform like modifications or improvements to previously manufactured products.

Factory Service

The units are covered by a two-year limited warranty. See warranty information. Call PS Engineering, Inc. at (865) 988-9800 before you return any unit. This will allow the service technician to provide any other suggestions for identifying the problem and recommend possible solutions.

After discussing the problem with the technician and you obtain a Return Authorization Number, ship product to:

PS Engineering, Inc.
Attn: Service Department
9800 Martel Rd.
Lenoir City, TN 37772
(865) 988-9800   FAX (865) 988-6619
Email: contact@ps-engineering.com

Units that arrive without an RMA number, or telephone number for a responsible contact, will be returned un-repaired. PS Engineering is not responsible for items sent via US Mail.