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PMA450

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Audio Selector Panel with Marker Beacon Receiver
High-fidelity Stereo Intercom, USB Charging Port
System Installation and Operation Manual
FAA- TSO C139a, C35d, C71
Patented under one or more of the following;
No. 4,941,187; 5,903,227; 6,160,496 and 6,493,450, 7,391,877

In certified aircraft, warranty is not valid unless this product is installed by an Authorized PS Engineering dealer.

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Rev	Date	Change
0	5/25/2014	New Release of manual
1	July 2014	Revise after TSOA
2	September 2014	Update with no marker version information
3	November 2014	Change Marker High sense operation (S/N E01150 and above)
4	February 2015	Update for added satcom/TEL input (s/n F01201 and above)
5	August 2015	Change Menu screen appearance (s/n J01402 and above)
6	December 2015	Update Bluetooth PIN function for legacy LG phones (Vrs. 2.012 and above)

Section I – GENERAL INFORMATION

1.1 INTRODUCTION

The PMA450 represents a revolutionary step in cockpit audio control and intercommunications utility. IntelliAudio®, using the USAF patented technology, provides True Dimensional Sound, helping pilots to more easily discern from simultaneous radio receptions. Our patented *IntelliVox*® design, front panel USB power jack, and pilot programmable configurations, marks this panel as the next level of audio control. The unit is designed for outstanding ergonomics and visually defined mode annunciation and selection.

Before installing and/or using this product, please read this manual completely. This will ensure that you will take full advantage of all the advanced features in the PMA450.

1.2 SCOPE

This manual provides detailed installation and operation instructions for the PS Engineering PMA450-series of Audio Selector Panel/Intercom Systems. This includes the following units:

Model	Description	Part Number
PMA450	Digital Stereo Audio Selector Panel with Marker Beacon, USB Charging port	050-450-0100
PMA450	Digital Stereo Audio Selector Panel with USB Charging port *without* Marker Beacon	050-450-0200

1.3 EQUIPMENT DESCRIPTION

The PMA450 is a state-of-the-art audio isolation amplifier and audio selector that contains an automatic voice activated (VOX) intercom system and integral marker beacon receiver. It can switch two transceivers (Com 1, Com 2) and six receivers (Nav 1, Nav 2, MKR, and three additional inputs which can be individually labeled, for use with ADF, DME, AUX, etc.).

Warning: Use of non-aviation approved cellular telephone equipment may be prohibited by FCC regulation. PS Engineering is not responsible for unauthorized airborne use of cellular telephones. For airborne use, the PMA450 must be interfaced with an approved system.

There are four unswitched inputs, available for traffic or EGPWS, autopilot disconnect, and/or radar altimeter warning.

Pushbuttons select the receiver audio source provided to the headphones. A SPR button allows the user to listen to the receiver(s) selected on the cabin speaker. Except for the unswitched inputs, all speaker audio is muted during transmit. Unswitched inputs 1& 2 are always presented to the aircraft speaker. Unswitched input 3 & 4 will be presented to the speaker when the front panel SPR push button has been selected.

Pushbutton switches select one of the communication transceivers for the pilot and copilot position, and allows radio transmission. In "Split Mode" the PMA450 has the ability to allow the pilot to transmit on Com 1 while the copilot can transmit on Com 2. A fail-safe mode connects the pilot headphone and microphone to COM 1 if power is removed for any reason, or if the power switch is placed in the Off (Fail-safe) position. Unswitched input #1 is also provided to the pilot headphone (left side headset ear cup) in fail-safe

A six-station voice activated (VOX) intercom is included in the PMA450. This system has PS Engineering's patented *IntelliVox*® circuitry that eliminates manual adjustments. The intercom system incorporates pilot isolate, all and crew modes, two independent stereo music inputs with "SoftMute™". Intercom volume control is through two concentric front panel knobs and a pushbutton intercom mode switch. The small volume knob controls the intercom level for the pilot and copilot, while the large knob controls the passenger intercom volume. Intercom squelch is automatic.

A, 75 MHz Marker Beacon receiver and 3-light indicator is integrated in the PMA450 (050-450-0100 only). This provides the necessary Marker Beacon lights and audio indications necessary for that portion of an

Instrument Landing System (ILS) approach. A pushbutton labeled MKR allows the pilot select audio on as well as test and mute modes. Marker high sensatvoty is also controlled by this button (see § S/N and above). Below S/N high sense is switched externally (see §2.6.2 for details.

The front panel USB-type connector is available for charging devices, such as iPad or cell phones. Up to 10 Watts are available. This connector *does NOT* provide any data interface.

In the PMA450, a Bluetooth® wireless interface is available for wireless telephone and music connection.

1.4 APPROVAL BASIS

FAA TSO Approval

The PMA450-series Audio Selector Panels are FAA approved under TSO C139A (Audio Amplifiers) TSO C35d (Marker Beacon Receivers) and C71 (DC Power Supplies)

All systems comply with relevant portions of EUROCAE RTCA MPS WG No. 7/70, DO-143 and (*Marker Beacon Receivers*), ED-14C/DO-160G (*Environmental Conditions and Test Procedures for Airborne Equipment*), ED12B/DO-178B, Level D (*Software Considerations for Airborne Equipment*) and ED-18/DO-214A (*Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems*).

1.1.1 Limitations

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval.
Refer to Advisory Circular 20-41A for information on TSO installation approval.

Operation is subject to the following conditions:
This device may not cause harmful interference.
This device must accept any interference received, including interference that may cause undesired operation.

1.5 SPECIFICATIONS

TSO COMPLIANCE	
Marker Beacon:	FAA TSO C35d, Class A
Audio Selector/Intercom:	FAA TSO C139a, Class 1a
DC Charging Jack	FAA TSO C71
APPLICABLE DOCUMENTS:	RTCA/DO-214A RTCA/DO-143 RTCA/DO-160G RTCA/DO-178C, DO-254
ENVIRONMENTAL Qualifications:	A1D1CABSMXXXXXXZBABATBXXE2XXX
Operating Temperature Range:	-15º C to 55ºC
Altitude:	Up to 35,000 feet in an non-pressurized area
DIMENSIONS:	Height: 1.3 in. (3.3 cm) Width: 6.25 in. (15.9 cm) Depth behind panel 7.15 in. (18.16 cm)
WEIGHT *PMA450 Unit* *Rack with connectors*	 1.34 lb. (0.61 kg) 0.51 lb. (0.24 kg)
POWER REQUIREMENTS (Including Internal Lighting):	
Voltage:	11 to 33 VDC
Maximum Current:	3.5 Amp (Externally protected by a 5A pull-type breaker)

Audio Selector Specifications	
Audio selector panel input impedance:	510 Ω
Input Isolation:	-60 dB (min.)
Speaker Muting:	-60 dB (min.)
Speaker Output (into 4 Ω) with no clipping 14 VDC: 28 VDC:	 3 Watts (min.) 10 Watts (min.)
Receiver Inputs:	7 (Com 1, Com 2, Nav 1, Nav 2, 3 ea. Switched Inputs available)
Unswitched Inputs:	4
Transmitter Selections:	3 (Com 1, Com 2, Com1/2)
Speaker Impedance:	4 Ω
Headphone Impedance:	150 – 1000 Ω
Headphone Output:	30 mW each headset, no clipping <.5% THD typical
Microphone Impedance:	150 - 600 Ω
Bluetooth Radio (PMA450 -1702 only)	Class 3, FCC ID QOQWT32AE
Intercom Specifications	
Intercom Positions:	6 places (with individual *Intelli*Vox® circuits)
Music Inputs:	2, (Independent, Stereo)
Music Muting:	>-30 dB "Soft Mute" when Com or intercom active.
Distortion:	<1% THD @ 30 mW into 150Ω
Mic Freq. Response, 3 dB:	300 Hz - 6000 Hz
Music Freq. Response, 3 dB:	10 Hz – 26 kHz
MARKER BEACON RECEIVER (-0100 only)	
Frequency:	75 MHz Crystal Controlled
Sensitivity: Low: High:	Capable of: (preset at factory for field application) 1000 μVolts (Hard) (360 to 570 μV soft) 200 μVolts (Hard) (130 to 200 μV soft)
Selectivity:	-6 dB at ±10 kHz -40 dB at ±120 kHz
External Lamp Output:	7.5 (±4 VDC unloaded, at maximum brightness) VDC positive when active, max. current 125 mA
MM Sense:	Active high (4.5 ± 1.0VDC)
USB Charging Port	
Available Current	2.0A (10W Maximum) output, short circuit and over-current protected
Voltage	5 VDC

1.6 EQUIPMENT SUPPLIED

1 ea. of the following units:

Model	Description	Part Number
PMA450	PMA450 Digital Audio Panel with Marker, Stereo Intercom, USB Charging jack, and Bluetooth connectivity	050-450-0100
PMA450	Same as above, without Marker Beacon capability	050-450-0200

PMA450 Installation Kit: 250-890-0000

Description	Quantity	Part Number
Installation rack assembly	1	430-890-0040
Rack back plate	1	430-890-0050
44-pin connector kit	2	120-891-2045-
Backshell, connector	2	625-025-2465
Backshell Retainer	2	431-881-0100
4 40 X 7/16 screw w/nylon patch	4	475-440-0007
4 40 X 3/8 screw w/nylon patch	4	475-440-1038
4-40 x ¼" screw with lock washer	2	475-440-0001
Solder Lug	2	475-009-0001
Cable Clamp	1	625-001-0002
#6-32 x ½" Flat head Philips screw	6	475-632-0012
#6-32 Clip Nut	6	475-630-0002

1.7 EQUIPMENT REQUIRED BUT NOT SUPPLIED

a. Circuit Breaker: 1 ea; 5 amp PULL TYPE REQUIRED for PMA450
b. Speaker, 4 Ω as desired
c. Headphone Jacks (Stereo, as Required)
d. Microphone Jacks (as Required)
e. Headphones, 150 Ω (Stereo), up to 6 as required
f. Microphones, up to 6 as required
g. Marker Antenna (75 MHz, VSWR <1:1.5, and appropriate for the airspeed) (-0100 Only)
h. Interconnect Wiring

1.8 LICENSE REQUIREMENTS

None

PMA450 Bluetooth™ Radio approval:

- FCC ID: QOQWT32AE
- Industry Canada ID: 5123A-BGTWT32AE
- CE EMC Directive 89/336/EEC as amended by Directives 92/31/EEC and 93/68/EEC

Section II - INSTALLATION

2.1 GENERAL INFORMATION

2.1.1 SCOPE

This section provides detailed installation and interconnection instructions for the PS Engineering PMA450 Audio Selector Panel/Intercom/ with internal Marker Beacon.

Please read this manual carefully before beginning any installation to prevent damage and post-installation problems.

Installation of this equipment requires special tools, test equipment (refer to §2.12.1) and installer knowledge as required by 14 CFR 65.81 (b).

2.1.2 Certification Requirements

NOTE

The PMA450 requires specialized knowledge and tools for an effective installation. An appropriately rated Certified Aircraft Repair Station **must** install this equipment in accordance with applicable regulations. PS Engineering, Incorporated warranty is not valid unless the equipment is installed by an authorized PS Engineering, Incorporated dealer.
Failure to follow any of the installation instructions, or installation by a non-certified individual or agency will void the warranty, and may result in an **unairworthy** installation.

This article meets the minimum performance and quality control standards required by a technical standard order (TSO). Installation of this article requires separate approval. Refer to AC 20-41A for information regarding Substitute TSO Aircraft Equipment.

2.2 Unpacking and Preliminary Inspection

Use care when unpacking the equipment. Inspect the units and parts supplied for visible signs of shipping damage. Examine the unit for loose or broken buttons, bent knobs, etc. Verify the correct quantity of components supplied with the list in §1.6. If any claim is to be made, save the shipping material and contact the freight carrier. Do NOT return units damaged in shipping to PS Engineering. If the unit or accessories show any sign of external shipping damage, contact PS Engineering to arrange for a replacement. Under no circumstances attempt to install a damaged unit in an aircraft. Equipment returned to PS Engineering for any other reason should be shipped in the original PS Engineering packaging, or other UPS approved packaging.

2.3 Equipment Installation Procedures

2.3.1 Cooling Requirements

Forced air-cooling of the PMA450 is not required. However, the units should be kept away from heat producing sources (i.e. defrost or heater ducts, dropping resistors, heat producing avionics) without adequate cooling air provided.

2.3.2 Mounting Requirements

The PMA450 must be rigidly mounted to the instrument panel of the aircraft structure, within view and reach of the pilot position(s). Installation must comply with FAA Advisory Circular AC 43.13-2B, or other FAA-approved aircraft technical data. The unit may be mounted in any area where adequate clearance for the unit and associated wiring bundle exist.

To prevent noise, avoid installing the unit close to high current devices or systems with high-voltage pulse type outputs, such as DME or transponders. Avoid running the interconnecting bundles near any high current wires.

2.3.3 Audio Panel Mounting Rack Installation

Remove the unit from the mounting tray by unscrewing the 3/32" hex-head screw that is in the center of the unit. Use caution to avoid hitting the photo-detector lens. Carefully slide the unit free of the tray. Set the unit aside in a safe location until needed. Install the tray using six clip nuts (475-630-0002), and six FHP 6-32 x ½" screws (475-632-0012). The audio selector panel must be supported at front and rear of the mounting tray.

2.3.4 Audio Panel Tray and Connector Assembly

The rack connectors mate with two 44-pin connectors in the PMA450. The connectors are a sub-miniature crimp-type, and require the use a hand crimp tool, from table below (or equiv.). The connectors are mounted to the tray back plate with #4-40 screws (475-440-1038), from the inside of the tray and the mounting block, 431-891-0100. Ensure that proper strain relief and chafing precautions are made during wiring and installation, using the cable clamp (625-001-0002).

Two grounding lugs are provided, which may be attached to the rear mounting plate with 2 ea #4-40 x ¼" screws with captivated lock washers. These provide a convenient location to connect the shield ground terminations.

Manufacturer	Crimping Tool	Positioner	Extraction tool
AMP	601966-1	601966-6	91067-1
Daniels	AFM8	K42	M24308-1
ITT-Cannon	995-0001-584	995-0001-739	91067-1

Table 2-1 Connector Pin crimping tools

2.4 Cable Harness Wiring

Referring to the appropriate Appendix, assemble a wiring harness as required for the installation. All wires must be MIL-SPEC in accordance with current regulations. Two- and three-conductor shielded wire must be used where indicated, and be MIL-C-27500 or equivalent specification. Proper stripping, shielding and soldering technique must be used at all times. It is imperative that correct wire be used.

Refer to FAA Advisory Circular 43.13-2B for more information. Failure to use correct techniques may result in improper operation, electrical noise or unit failure. Damage caused by improper installation will void the PS Engineering warranty.

2.4.1 Electrical Noise

Due to the variety and the high power of radio equipment often found in today's general aviation aircraft, there is a potential for both radiated and conducted noise interference.

The PMA450 power supply is specifically designed to reduce conducted electrical noise on the aircraft power bus by at least 50dB. Although this is a large amount of attenuation, it may not eliminate all noise, particularly if the amplitude of noise is very high. There must be at least 13.8 VDC present at the connector, J2 pins 8 & 9, of the PMA450 for the power supply to work in its designed regulation. Otherwise, it cannot adequately attenuate power line noise. Shielding can reduce or prevent radiated noise (i.e., beacon, electric gyros, switching power supplies, etc.) However, installation combinations can occur where interference is possible. The PMA450 was designed in a RFI hardened chassis and has internal Electromagnetic Interference (EMI) filters on all inputs and outputs.

Ground loop noise occurs when there are two or more ground paths for the same signal (i.e., airframe and ground return wire). Large cyclic loads such as strobes, inverters, etc., can inject noise signals onto the airframe that are detected by the audio system. Follow the wiring diagram very carefully to help ensure a minimum of ground loop potential. Use only Mil Spec shielded wires (MIL-C-275000, or better). Under no circumstances combine a microphone and headphone wiring into the same shielded bundle. Always use a 2- or 3-conductor, shield wire as shown on the installation-wiring diagram.

The shields can be daisy-chained together, and then connected to the ground lugs mounted on the back plate shown in Appendix B.

Radiated signals can be a factor when low level microphone signals are "bundled" with current carrying power wires. Keep these cables physically separated. It is very important that you use insulated washers to isolate the ground return path from the airframe to **all** headphone and microphone jacks.

2.4.1.1 Music Inputs and Noise

PMA450 units utilize a differential input to help prevent noise from entering the music system. This feature is usually transparent to the installer; however, it is important that the appropriate music signal and ground connections are made directly to the dedicated music signal and ground inputs on the PMA450. The power for IFE and audio panel should be a common bus.

If a music jack instead of a music source is installed for Music 1 or 2, we recommend grounding the jack to airframe ground.

NOISE NOTE

Adding a high-performance audio control system, particularly in conjunction with high-performance active noise canceling headsets, cannot improve on older avionics that were designed for cabin-speaker use. PS Engineering makes no claim that the audio panel will provide a noise-free audio quality under all installation conditions, particularly with older avionics.

2.4.2 Existing GMA340 and PMA8000 Installations

If the installation replaces a GMA340 or any of the PMA8000 series, no changes are necessary as long as the existing installation meets the requirements (applies to S/N E01150 and above). All existing functions of the GMA340 as afforded by the PMA450 will become instantly available. However, if the previous installation had three COMs, the PMA450 will not support the third COM, the PMA450 handles only two COM transceivers. The PMA8000C will support three coms.

2.4.2.1 Differences with GMA340 connector

Connector	Pin	GMA340 Function	PMA450 Function
J1	3	COM 3	TEL Audio Hi
J1	4	COM 3	TEL Lo
J1	5	COM 3	TEL Mic Audio Hi
J1	6	COM 3	No Connection
J1	16	MASQ Inhibit	No Connection
J1	23	COM 3 Speaker Load	AUX Audio Input
J1	24	COM 3 Speaker Load	CNX80 Inhibit
J1	25	COM Speaker Load	No Connection
J1	26	COM Speaker Load	No Connection
J1	27	COM Speaker Load	No Connection
J1	28	COM Speaker Load	No Connection
J1	29	No Connection	Unswitched #3
J2	15	High Music Gain Select	Unswitched #4
J2	17	8Ω Speaker Select	No Connection
J2	18	No Connection	Aux Enable Output
J2	19	Tone Enable	PA Enable
J2	29	Failsafe warn	No Connection
J2	30	Com TX Mute	No Connection

Table 2-2 GMA340–PMA450 connector differences

Installations where the external marker outputs are connected to a Sandel 3308 Navigation Display will require additional loading resistors. Refer to the Sandel installation data for more information.

2.4.3 Power

The PMA450 is compatible with both 14 and 28 Volt DC systems. A five (5) Amp circuit breaker is required for all installations. Power and ground wires should be #22 connected to J2 Pins 8 and 9. Connect airframe ground to J2 Pin 10 and 11 only. No dropping resistors are required.

2.4.4 Communications Push-to-Talk

An important part of the installation is the PTT (Push-To-Talk) switches that allow the use of your aircraft communications radio for transmissions. There are three typical configurations that can be used. Select the case that best fits the installation. Only the person who presses their PTT switch will be heard over the radio. If the pilot and copilot both use the PTT, the only pilot position has access to the radio. The pilot position will have PTT control regardless of the mic selector switch or copilot PTT when the PMA450 is in the OFF/EMG mode.

CASE I: PTT is built into both pilot and copilot yokes.

CASE II: PTT is in pilot yoke only. This configuration requires a modified external PTT switch plugged into the copilot's microphone jack. (See Appendix A). When the copilot's PTT is pressed, the intercom switches the microphone audio from pilot to copilot mic.

CASE III: No built in PTT. This requires two built in PTTs to be installed, or modified external PTT switches to be used. Modify external PTT as required. See Appendix A.

2.4.5 Audio Panel interface

The PMA450 is designed to interface with standard aircraft avionics, and presents a 510 Ω receiver impedance. For best results, a twisted-shielded cable is recommended from the avionics audio source to the audio panel, with the shield grounded at the audio panel end.

Some avionics do not provide a separate audio low, and may introduce additional electrical noise into the system. For best results, connect the audio low from the audio panel to the radio ground, using one conductor of the twisted-shielded cable.

2.4.5.1 Speaker Load

The PMA450 contains a speaker amplifier. The PMA450 **does not** contain any resistive speaker loads.

Some older aviation radios units with internal speaker amplifiers, require a resistive load if their speaker amplifier is not used. If needed, connect the radio speaker output from the transceiver to a 16Ω, 3W resistor in the harness.

2.4.5.2 Installation with Monaural Headsets

Not recommended, because the benefit of IntelliAudio is lost. However, if desired, the PMA450 can be installed monaurally by using the LEFT audio connections only (left side contains Fail-Safe audio). Do NOT short left and right together.

NOTE: Mono headsets that short the tip and ring (i.e. older models) will introduce audio distortion when used. Modern, stereo headsets are recommended in all positions.

2.4.6 Transmit Interlock

Some communications transceivers use a transmit-interlock system. To fully utilize the Split Mode feature, this function must be disabled. Consult the radio manufacturer's installation manual.

2.4.7 Backlighting

The PMA450 has an automatic dimming of the pushbutton annunciation LEDs and marker lamps controlled by a photocell. Control of the unit nomenclature backlighting is through the aircraft avionics dimmer For 14 V aircraft, connect J2 Pins 6 and 7 to the aircraft dimmer bus, and pin 5 to ground. For 28-volt systems, connect pin 7 to the aircraft dimmer, and pins 5 and 6 to ground.

If an external dimmer control is **not** used, a constant back light illumination can be established for nighttime viewing. Pin 6 or 7 (depending on system voltage) must be tied to power (J2, pin 8 or 9) for the

back lighting system to work. The photocell mounted in the unit face will automatically adjust the intensity of the push-button annunciator LEDs.

2.4.8 Unswitched inputs

J1, pins 31 (Unsw 1), 44 (Unsw 2) 29 (Unsw 3) and J2 pin 15 (Unsw 4) are unswitched, unmuted (by transmitter keying), inputs.

These inputs are presented to the pilot and copilot regardless of the audio configuration, and will always mute the crew entertainment inputs. These 510Ω inputs can be used for altimeter DH audio, GPS waypoint audio, autopilot disconnect tones, or any other critical audio signal.

Unswitched #1 is always presented to the speaker, plus to the crew headphones, and is available to the pilot in fail-safe (off) mode.

Unswitched 1 & 2 are always presented to the speaker, plus to the crew headphones.

*Unswitched 3 and 4 inputs are always presented to the crew headphones but presented to the aircraft speaker *only* when the speaker is selected.

Unswitched Input	Hear in Fail Safe	Hear in Crew Headset	Hear in SPR	Adjustable at installation
1	Yes	Yes	Yes	No
2	No	Yes	Yes	No
3	No	Yes	When SPR Selected	Yes
4	No	Yes	When SPR Selected	Yes

Table 2-3 Unswitched inputs

The audio low for unswitched #4 (J2, pin 15) should be connected to a convenient audio low. However, this should NOT be connected to Music Low.

NOTE

Inputs 1 and 2 are fixed (1:1), and any audio level adjustments must be made at the input source. Unswitched #3 and #4 can be adjusted at installation. Refer to Adjustments §2.7.

2.4.9 "Swap" Mode

When a momentary, normally open, push-button switch is connected between pin 20 on the J2 connector and aircraft ground, the user can switch between Com 1 and 2 by depressing this switch without having to turn the mic selector switch. This yoke-mounted switch eliminates the need to remove your hands from the yoke to change transceivers. The transfer of TX indication from Com 1 to Com 2 shows that the swap has been initiated; there is no dedicated swap indicator.

2.4.9.1 Cell phone Sidetone

The PMA450 can provide cellular telephone sidetone (the user's voice fed back to the headset). Some cell phones provide sidetone, and may have poor audio quality if both sources are combined. The cell phone sidetone is adjustable in the Bluetooth® operation screen See §2.7.

NOTE

Unauthorized use of unapproved cellular telephone devices in aircraft is subject to FCC enforcement action, which may include a $10,000 fine per incident.
FCC Regulation 47 CFR § 22.925 *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.
PS Engineering, Inc. does not endorse using unapproved cellular telephone equipment in flight, and takes no responsibility for the user's action.
PS Engineering does not guarantee compatibility with personal cellular telephones.

2.4.10 Public Address Mode

By holding the middle line-select pushbutton for more than one (1) seconds, the PMA450 will be placed into public address (PA) mode. In this mode, the pilot will be talking over the cockpit speaker when he presses his PTT switch. Copilot will still continue on the selected COM radio.

The display will include **PA** & SPR on the right side, and change to **PUBLIC ADDRESS** when the pilot's PTT is pressed.

2.4.10.1 PA Active Output (J2, Pin 19)

PA Active Out is a discrete output on J2 Pin 19 which will go low when PA mode is selected, providing a logic level that can be used to incorporate a speaker-switching scheme. This 50 mA circuit (10Ω Z) can control a switching means such as a small relay or other switching means that can transfer the speaker output amplifier from the cockpit speaker to drive another cabin speaker. If the PA mode is used with a microphone in proximity to an active cockpit speaker, feedback might result.

2.4.10.2 PA Mute (J2, Pin 12)

Pin 12 of J2 is a TTL logic *output* that is pulled low during PTT operation. This is used to control external public address or external entertainment systems and prevent **feedback** during radio transmission.

2.4.11 COM Receive Active Output (J1, Pin 24)

Pin 24 on the J1 connector (and PA Mute Pin 12 on J2) should be connected to Apollo CNX80 for audio message prioritization. The output is logic low when radio audio is present. Refer to CNX80 installation manual for details.

2.4.12 Wired Telephone/Satellite Communication input (Serial Number F01201 and above)

The PMA450 (Serial Number F01201 and above) can accommodate a wired cell phone interface on J1 Pins 3,4 and 5.

Hold the N2 button for 1 second to activate the Telephone screen. Telephone volume and sidetone can be controlled from this screen.

Both Bluetooth and wired Telephone and be accommodated, however, only ONE can be active at a time.

NOTE: The audio input is always active to receive a ringer input, so any audio noise on the input (J1- pin 3) will be heard.

See Appendix C and D for intercom connection configurations. It is critical to the proper operation of this system to have this connector wiring made in accordance with these diagrams. Use 2- and 3-conductor, MIL-spec cable as shown. Connect the shields at the audio panel end only, and tie to the audio low inputs as shown.

NOTE

The intercom harness can be custom made by PS Engineering, Inc. Simply call the factory or www.ps-engineering.com to obtain a wire harness work sheet. The harness will be made to your specifications and fully functionally tested. Harness can be ordered with jack, or without the intercom jacks installed, for easier wire routing through the aircraft.

2.4.13 Music Inputs

The PMA450 has two INDEPENDENT music inputs. Music input number 1 is J2 pins 23 (left channel) and 24 (right channel), with respect to pin 25, and Music number 2 is connected to 26 (left channel), 27 (right channel), with respect to 28.

PMA450 has Bluetooth® connectivity to stream music from a paired device. This stream is distributed as Music 1 and is connected in parallel with Music number 1. Refer to §3.9 for more information.

NOTE

Use the low level output of any additional Music device to connect to the audio panel. Maximum signal level is **3 VAC** p-p. **DO NOT** use a speaker-level output, this will cause internal damage in the audio panel.

CAUTION

Local oscillators and internal signals from Music equipment can cause undesired interference with other aircraft systems. Before takeoff, operate the entertainment devices to determine if there is any adverse effect within the aircraft systems. If any unusual operation is noted in flight, immediately switch off the entertainment devices.

All additional entertainment devices must be switched off for both takeoff and landing.

2.4.13.1 Music 2 Mute (J2 Pin 13 & 14)

Connecting J2 pin 13 to pin 14 (or ground) through a SPST switch places the Music #2 music source into the Karaoke Mode. In this mode, incoming music and intercom conversation will not mute the music for the passengers' intercom net. This is useful for passenger-area control of the music muting, and overrides the menu-controlled setting.

However, Music 2 Mute control is also available in the PMA450 Music Mute Menu.

2.4.14 Playback button Installation

The pilot and copilot can hear the aircraft radio playback.

The Internal Recorder System can be played back from the front panel by pressing the RCV button of the radio selected for transmission.

Or a remote, momentary, normally open (NO) push button switch may be installed if desired to activate the Recording System playback. This switch can be located anywhere in cockpit convenient to the pilot's reach. The NO switch should be connected to pin 22 of J2 of the PMA450, and ground. When installed, this button will act as in §3.12.

2.5 Marker Beacon Installation

2.5.1 Marker Antenna Installation

A marker beacon antenna, appropriate to the type and speed of the aircraft, is required (not included). Refer to aircraft and antenna manufacturer's installation instructions, as well as AC43.13-2B (or later revision), Chapter 3, for information on proper antenna installation techniques. The marker beacon antenna must be mounted on the bottom of the aircraft.

2.5.2 Marker Beacon High Sense select (J2, Pin 30)(S/N D01150 and below only)

The default marker sensitivity for the PMA450 is low sense, or a threshold of 1000µV. To enable High sensitivity, ground J2, Pin 30 through a toggle switch.

NOTE: Unless this switch is installed, the PMA450 (s/n D01150 and below) will always be in Low Sense mode)

2.5.3 External Marker Lights

For installations that require external marker beacon lights, there are three outputs that can drive 12-Volt lamps only. The external output lamps are driven high (typically +7.0 VDC ±4.0 VDC unloaded, at MAX brightness) when active. Maximum source current per lamp is 125 mA. Voltage varies with photocell dimming.

2.5.4 Middle Marker Sense

A Middle Marker Sense output signal is available from the PMA450 to certain flight control systems. This function will not operate during the test mode. This output will go to +4.5 VDC (± 1.0 VDC) when a valid Middle Marker signal is received. This output is J1, pin 39.

2.6 User Adjustments

To access the user adjustment menus, turn the PMA450 off, and then back on. While the **version** screen is displayed, push and hold the bottom line-select button (there is an indicator bar in the display indicating that a menu is available). This places the unit into the "User Configurable Mode – home screen". This allows adjustment for:

- LCD Screen Adjustment
- Rename Switched Inputs
- Bluetooth menus

Note: in this mode, the audio panel functions will be inoperative

2.6.1 Adjust Screen

The first items are adjustments to the Liquid Crystal Display, allowing the installer or user to tailor the contrast and backlight intensity to suit the cockpit conditions, and set the time period before the menus revert to the "home" screen.

There are two screen visibility modes: LCD Brightness & LCD Contrast.

2.6.1.1 Brightness and Contrast

Adjusting either the Brightness or Contrast level requires selecting either of the two line select buttons and then turning the inner knob. Counter clockwise to lower the number (level of Brightness & Contrast) and clockwise to increase the number (level of Brightness & Contrast).

To change the display:

Press the line select for the desired item

Turn the small, inner knob to change the contrast and brightness as desired. Recommended settings are Brightness 10, and Contrast 5.

LCD will change in real time while adjustments are made.

It will stay in this screen until the menu times out and returns to the adjustment home screen.

2.6.1.2 Display Timeout

This is a feature that allows the end user to adjust how quickly the screen levels menus timeout (revert to main menu).

NOTE: A long press (> 1 second) will also back up one menu level.

This allows adjustment of the timeout screen and can be configured from 1 second to 30 seconds when turning the inner knob.

For a user that is unfamiliar with the product, this will give them enough time to learn the system. After being familiar then the user can speed up the timeout screen as needed.

It will stay in this screen until the menu times out and returns to the adjustment home screen.

To exit the home screen and return to normal operation, turn the PMA450 off, and back on again.

2.6.2 Rename "Switched" Inputs

The system is factory set to default as ADF, DME & AUX as shown.

The three inputs are from top to bottom:

1. Switched input #1 J1, Pin 7 wrt Pin 8 (Default ADF)
2. Switched input #2 J1, Pin 21 wrt Pin 22 (Default DME)
3. Switched input #3 J1, Pin 23 wrt Pin 43(Default AUX)
   NOTE: In PMA 450 -0200 (No Marker) Switched #1 , #2 or #3 can be renamed to MKR for a remote input.

The customer will have access to rename. Maximum 9 letters per line and *A thru Z & 0 thru 9* will be available.

- Press the line select for desired input.
- Turn the large outer knob to select the letter to change. A cursor appears under the active letter position.
- Turn the small, inner knob to increment or decrement the letter.
- You can select 9 alphanumeric digits.
- To add a blank space:
  - Blank spaces can't be added to the end of a strink, but you can add a temporary character and go back and change it to a space:
  - TACARADIOA1
  - Change extra "A"s to spaces TAC RAD 1

It will stay in this screen until the menu times out and returns to the adjustment home screen.

Cycle PMA450 power to exit the setup screen.

2.6.3 Bluetooth® menu

The Bluetooth menu allows the user to:

- Reset (remove) all paired devices
- Set or disable a pairing pass code
- Change the PMA450's device ID

2.6.3.1 Un-pair All (Resets Bluetooth)

Pressing the line select next to Un-pair All removes all Bluetooth devices. This is used when the pairing of devices becomes unreliable.

2.6.3.2 Pair:

This allows the user to set any desired pass code that users will use to pair Bluetooth devices. Four digits, 1 to 9 can be used.

2.6.3.3 PIN Disable (Version 2.012 and above only)

Some phone will not pair is a Personal Identification Number (PIN) is required. To disable the PIN:

- Enter configuration menu, select Bluetooth.
- Select PIN code for editing. Press PIN button one more time.
- "Bluetooth Reset" will appear on screen. When the menu returns, the PIN code will report "Disabled".
- To re- enable the PIN code for a different device, press the PIN button.

2.6.3.4 "Bluetooth Reset" will appear on screen. When the menu returns, the last stored PIN code will be shown.ID:

This allows the user to set the name of the audio panel as it will appear on devices searching for the PMA450. Seven alphanumeric digits are available. Factory default is PMA450, but you could set "N1245," or "Skyhawk, as an example."

2.7 Communications Antenna Installation Notes

For best results while in Split Mode, it is recommended that the one VHF communications antenna is located on top of the aircraft while the other communications antenna is installed on the bottom. Any antenna

relocation must be accomplished in accordance with AC 43.13-2B, aircraft manufacturers' recommendations and FAA-approved technical data.

WARNING

It is probable that radio interference will occur in the split mode when the frequencies of the two aircraft radios are adjacent, and/or the antennas are physically close together. **PS Engineering makes no expressed or implied warranties regarding the suitability of the PMA450 in Split Mode.**

2.8 PMA450 Pin assignments

J1	Function	J2	Function
1	Marker Antenna	1	Pilot Phones Lo
2	Marker Ant Lo	2	Copilot Phones Lo
3	TEL Audio Hi	3	Copilot Phones (L)
4	TEL Audio Lo	4	Copilot Phones (R)
5	TEL Mic Audio	5	Lights lo
6	No Connect	6	14/28 V Lights
7	SW#1 (ADF Audio) In	7	14/28 V Lights
8	SW#1 (ADF Audio) Lo	8	Aircraft Power
9	Com 1 Audio	9	Aircraft Power
10	Com 1 Audio Lo	10	Aircraft Ground
11	Com 1 Mic	11	Aircraft Ground
12	Com 1 Mic Key	12	PA Mute
13	Com 2 Audio	13	Mute Inhibit
14	Com 2 Audio Lo	14	Mute Inhibit Lo
15	Com 2 Mic	15	Unswitched #4
16	No Connect	16	Pilot Phones (L)
17	Nav 1 Audio	17	No Connect
18	Nav 1 Audio Lo	18	RESERVED
19	Nav 2 Audio	19	PA Enable Out
20	Nav 2 Audio Lo	20	Swap
21	SW#2 (DME) Audio	21	Swap Lo
22	SW#2 (DME) Audio Lo	22	IRS Playback
23	SW#3 (Aux) Audio	23	Music 1 (L)
24	CNX80 Inhibit	24	Music 1 (R)
25	No Connect	25	Music 1 Lo
26	No Connect	26	Music 2 (L)
27	No Connect	27	Music 2 (R)
28	No Connect	28	Music 2 Lo
29	Unswitched #3	29	No Connect
30	Com 2 Mic Key	30	RESERVED
31	Unswitched Audio 1	31	Pilot Phones (Rt)
32	Unswitched Lo	32	Copilot Mic Audio
33	Pilot Mic Audio	33	Copilot Mic PTT
34	Pilot Mic PTT	34	Copilot Mic Lo
35	Pilot Mic Lo	35	Pass 1 Mic Audio
36	Ext IM MKR	36	Pass 1 Mic Audio Lo
37	Ext OM MKR	37	Pass 2 Mic Audio
38	Ext MM MKR	38	Pass 2 Mic Audio Lo
39	MM Sense	39	Pass 3 Mic Audio
40	Pass HP (L)	40	Pass 3 Mic Audio Lo
41	Pass HP (R)	41	Pass 4 Mic Audio
42	Pass HP Lo	42	Pass 4 Mic Audio Lo
43	Unswitched 2 Lo	43	Speaker Lo
44	Unswitched 2 Audio	44	Speaker Output

Table 2-4: PMA450 Pin Assignments

2.9 Wiring Checkout

After wiring is complete, verify power is ONLY on pins 8 and 9 of the J2 and airframe ground on connector pins 10 and 11. Failure to do so will cause serious internal damage and void PS Engineering's warranty.

2.10 Unit Installation

To install the PMA450, gently slide the unit into the mounting rack until the hold-down screw is engaged. While applying gentle pressure to the face of the unit, tighten the 3/32" hex-head in the center of the unit until it is secure. DO NOT OVER TIGHTEN.

CAUTION

Apply steady pressure to the bezel while screwing the unit into the tray to ensure even seating of the unit and connectors. **WARNING** Do not over-tighten the lock down screw while installing the unit in tray. **Internal damage will result.**

2.11 Operational Checkout

2.11.1 Required Test Equipment

In order to return an aircraft to service after installation of the PMA450, the installer must have access to a Marker Beacon signal generator:

a. IFR NAV401L, NAV402AP, IFR4000
b. TIC T-30D, T-36C

Equivalent test equipment is acceptable as long as the testing requirements can be met.

2.11.2 Audio Panel Test

NOTE

The *IntelliVox*® is designed for ambient noise levels of 80 dB or above. Therefore some clipping may occur in a quiet cabin, such as without the engine running, in a hangar. This is normal.
Use of a Stereo headset is **required** to obtain full effect of IntelliAudio processing in the crew positions.

1. Apply power to the aircraft and avionics.
2. Plug **stereo** headsets into the pilot, copilot, and occupied passenger positions.
3. Verify fail-safe operation by receiving and transmitting on com 1 from the pilot position, with the audio panel power off. The Com audio will be present in one ear cup only.
4. Switch on the unit by pressing the volume (VOL) knob.
5. Check intercom operation.
6. Push the C1 Xmt select button (lower row).
7. Verify that both of the **C1** indicators light. Verify that transmit button LED (Light Emitting Diode) near the mic selector is not blinking. If the LED is blinking, stop testing and troubleshoot the microphone PTT installation.
8. Verify proper transmit and receive operation from the copilot position, noting that the copilot PTT switch allows proper transmission on the selected transceiver. Verify that the C1 Xmt button blinks when transmitting.
9. Verify that pushing the **C2** button causes the button to illuminate, and the Com 2 receiver to be heard. Verify operation on Com 1 from the pilot position.
10. Repeat for Com 2
11. Press and hold the C1 Xmt button. While holding the C1 button, press the C2 Xmt button. This places the unit in "Split Mode;" Verify that the pilot can transmit and receive on Com 1, while the copilot transmits and receives on Com 2.
12. Verify proper operation of all receiver sources by selecting them using the appropriate button or menu.
13. Activate the cockpit speaker by holding the lower line select for 1 seconds SPR should appear on the LCD display. Verify that all selected audio is heard in the cockpit speaker. Verify that the audio mutes when the mic is keyed.
14. Verify that the appropriate LED in the lower button row blinks when either push to talk is keyed.

15. Verify proper Intercom system operation in the **ALL, ISO** and **CREW** modes (see Table 3-1).
16. Verify that the audio selector panel system does not adversely affect any other aircraft system by systematically switching the unit on and off, while monitoring the other avionics and electrical equipment on the aircraft.

2.11.3 Marker Checkout (050-450-0100, only)

1. Connect a ramp generator at the antenna end of the marker coax. With the unit under test, verify that a 430 μVolt, modulated 95% with 1300 Hz, signal will illuminate the amber (M) marker light, and that marker audio is present in the headphones when the Marker Audio (MKR) push-button has been depressed. Select SPR for speaker to verify marker audio availability on the cabin speaker. Verify that the white (I) and blue (O) lights will illuminate within ± 3dB of the amber lamp, with 3000 HZ and 400 Hz applied, respectively.
2. Put unit in High Marker sensitivity (See §3.7). Repeat with the unit in HIGH sensitivity, 160 μV with applied.
3. Connect the marker antenna and verify proper operation.

2.11.4 Bluetooth Checkout

Verify that the PMA450 will "pair" with a Bluetooth device, and interface with cellular phone and Music source. See section 3.12 for more information.

2.11.4.1 TEL Checkout

Pair the PMA450 with a Bluetooth telephone device. Verify that the pilot headset is connected to the cellular telephone system (if installed). Verify that by using the pilot side PTT, the pilot can transmit on the other selected radio (Com 1 or Com 2). The telephone function will allow any person heard by the pilot on the intercom, also heard on the telephone.

2.11.5 Internal Recorder Checkout

With headset plugged into pilot's side jacks, tune COM 1 to local frequency, such as FSS or ATC ground. Select Com 1 on mic selector switch, and record several incoming radio transmissions.
Press the Com receiver pushbutton (C1 or C2) that corresponds to the selected radio transmitter and *hold* for approximately one second. This action will then automatically play back the last recorded message. The appropriate line-select buttons can be used to stop, skip or beack up playback.
This audio should appear in the pilot and copilot headsets, and only be incoming transmissions from the transceiver selected in the mic select switch. Depress the audio panel or yoke mounted playback switch, and verify that messages play, in the order received. Repeat for other COM. The playback will be stopped by audio on the selected com. The message can be replayed from the beginning, and audio received during the playback will not be stored.

2.12 Final Inspection

Verify that the wiring is bundled away from all controls and no part of the installation interferes with aircraft control operation. Move all controls through their full range while examining the installation to see that no mechanical interference exists. Verify that the cables are secured to the aircraft structure in accordance with good practices, with adequate strain relief. Ensure that there are no kinks or sharp bends in the cables and coaxial cables. Verify that the cables are not exposed to any sharp edges or rough surfaces, and that all contact points are protected from abrasion.

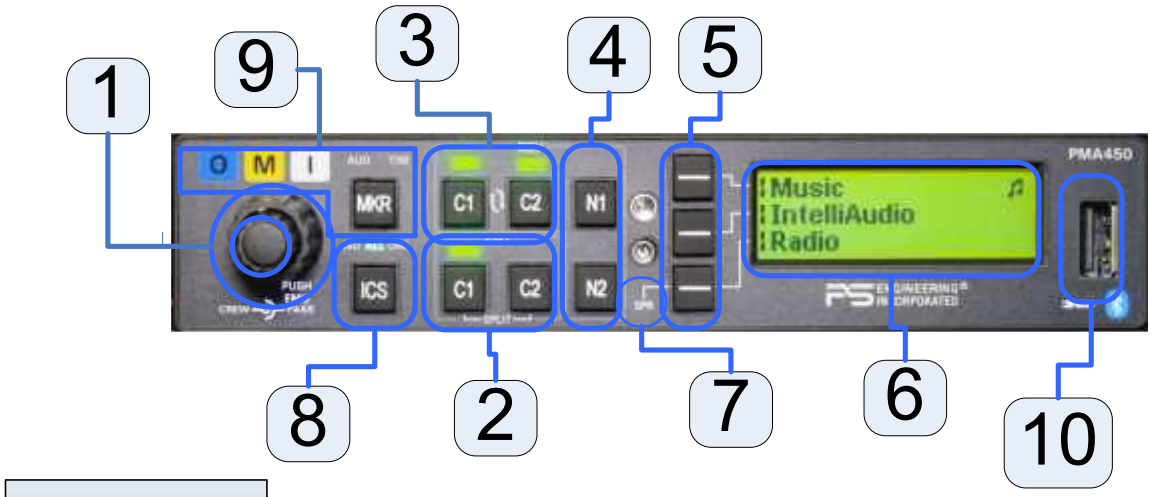
Complete documentation that may be required, such as a logbook entry, weight and balance computation and FAA Form 337. Sample text for FAA Form 337, and instructions for continuing airworthiness can be found in Appendix F. Return completed warranty registration application to PS Engineering, or complete online at www.ps-engineering.com.

Section III OPERATION

3.1 SCOPE

This section applies to units with Serial Number J01402 and above. Other operation instructions can be found at www.ps-engineering.com It provides detailed operating instructions for the PS Engineering PMA450, Audio Selector Panel/Marker Beacon Receiver/Intercom Systems. Please read it carefully before using the equipment so that you can take full advantage of its capabilities.

This section is divided into sections covering the basic operating areas of the PMA450 systems. They are Communications Transceiver Selection, Audio Selector, Intercom, Marker Beacon Receiver and special functions, including the Bluetooth® functionality in the PMA450.



1. Volume on/off
2. Transmit Selection
3. Receiver Selection
4. Navaid Selection
5. Line Select buttons
6. LCD Display
7. Speaker Selection
8. Intercom Mode
9. Marker
10. USB Power Port

Figure 3-1 PMA450 Operating Controls

3.2 Power and Fail Safe (1)

Unit power is turned on and off by pushing the volume knob (1). There is a built in delay to prevent accidental shut off while adjusting the intercom volume in turbulent conditions. In the OFF or "**EMG**" position, the pilot headset is connected directly to Com 1 as well as unswitched input #1. This allows communication capability regardless of unit condition. Any time power is removed or turned OFF, the audio selector 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 switch controls all audio selector panel functions, intercom and marker beacon receiver. All transceiver and receiver selections will be remembered and return to the last state when turned on.

Unit power is turned on and off by pushing the volume knob (1). There is a built in delay to prevent accidental turn off.

3.3 Display Menu Selection (6)

The PMA450 uses a Liquid Crystal Display and three line-select buttons to access advanced functionality in a very logical manner. Press the line select key to select a specific item on each menu. Items are toggled on and off by pressing the line select key as well. A long press (> 1 second) will also back up one menu level (S/N J01402 and above only).

When navigating the menus, the screen will automatically return to this "home" screen after a period of inactivity. This delay time is configurable from the initialization menu as well, for between 1 and 10 seconds.

A vertical **bar** next to a button indicates the button can perform a function on that menu.

A **split bar** indicates that a secondary function is available when that button is held for more than one second. These functions are:

- Music on/off for the pilot (top button)
- Public Address (PA – middle button)
- Speaker (SPR – lower button)

Figure 3-2 Top level Menu

3.4 Communications Transmit (XMT) Selection (2)

The PMA450 has four buttons to select communications transceiver functions, two each C1 and C2. C1 refers to VHF COM 1, and C2, to VHF COM 2. To select a VHF COM for transmit; push the lower button in the XMT (transmit) section. The radio is automatically selected to receive incoming radio calls when the XMT is selected. With a PMA450, you will *never* transmit on a radio that you are not receiving.

To select a VHF COM radio to listen only, push the C1 or C2 button in the RCV (Receive) section.

The PMA450 will remember when you have selected a radio for receive only, and then switch to it for transmission and switch back.

3.4.1 Split Mode

In the SPLIT mode, the pilot position transmits and receives on COM 1, and the copilot can transmit and receive on COM 2 independently.

Pressing the C1 and C2 XMT buttons (above the ⌞ SPLIT ⌟ legend), puts the PMA450 into SPLIT com mode.

In split mode:

Position	COM 1 Receive	COM 1 Transmit	COM 2 Receive	COM 2 Transmit	Switched Audio	Unsw. Audio	Copilot Intercom	Passenger Intercom
Pilot	Yes	Yes	NO	NO	Yes	Yes	NO	NO
Copilot	NO	NO	Yes	Yes	NO	Yes	NO	NO
Passengers	NO	NO	NO	NO	NO	NO	NO	YES

- The intercom is deactivated automatically when you enter SPLIT mode.
    - Push the ICS button until the green LED lights up CRW to restore intercom between pilot and copilot.
    - Intercom between crew and passengers is not possible in split mode
- *The spatial component of IntelliAudio is defeated in split mode.*
- To exit SPLIT mode, reselect C1 or C2 XMT button

3.5 COM Audio Selector (3)

Communication audio from the other radio, not selected for transmit, can be heard by pressing the associated RCV button. You will always hear the audio from the selected transceiver.

3.5.1 Swap Mode (Switch from Com 1 to Com 2 remotely)

With an optional yoke mounted, normally open momentary switch, the pilot can change from the current Com transceiver to the other by pressing this switch. To cancel "Swap Mode," either press the yoke mounted switch again, or select a different Com with the XMT buttons.

3.5.2 IntelliAudio® Dimensional Audio

Various audio signals are presented to the DSP and processed to "appear" in a different location to the crew. "Multi-Talker" (US Patent #7,391,877) specifies up to nine locations. This helps the crew to better comprehend speech by locating it in a manner easier differentiated by the human brain.

Intercom and other audio is not spatially processed, only the pilot and copilot VHF COM audio.

You must use stereo headsets, in stereo mode for this feature.

The spatially processed dimensional sound in the PMA450 can be adjusted to accommodate the user preferences.

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

Push **IntelliAudio → IntelliAudio Config** to access. In the IntelliAudio® mode, repeated pressing of the COM 1 or COM 2 line select buttons moves the corresponding half-circle cursor to the locations relative to the listener graphic in sequence.

Pressing the **Done** button exits the configuration setting mode. This setting is recalled at system power up.

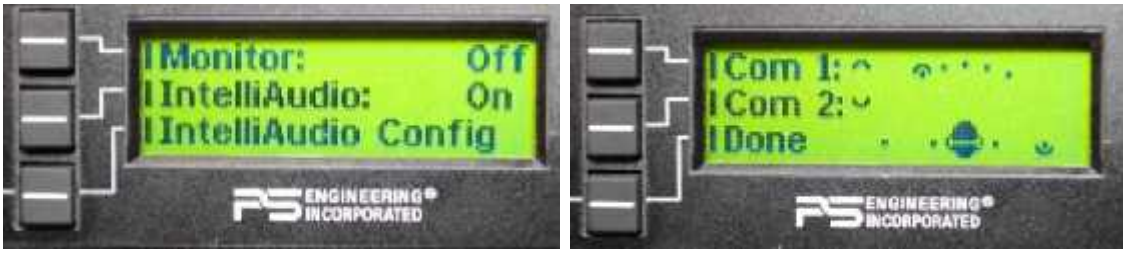
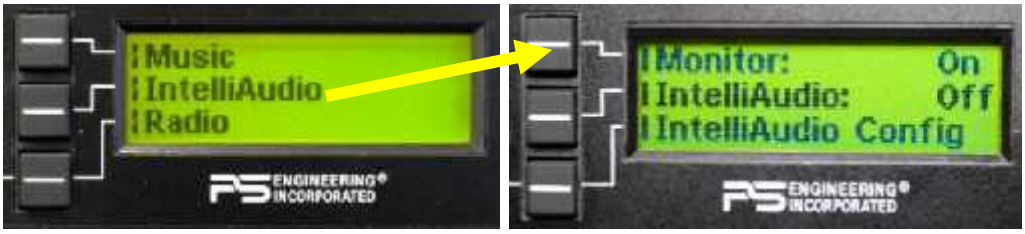


Figure 3-3 IntelliAudio – True Dimensional Sound, Spatial Location Display, showing C1 at 30°left and C2 at 90° right of center.

3.5.3 Com Monitor Mode

The PMA450 is equipped with a Monitor function, which allows a secondary com radio audio to be muted by the primary radio (selected for transmit).

To toggle the Monitor mode on and off, Press **IntelliAudio → MONITOR**



NOTE: Monitor Mode and Spatial Audio Processing (IntelliAudio) are mutually exclusive – entering one mode will cancel the other.

3.5.4 Navaid Selection (4)

VHF Navigation receivers can be selected directly from the front panel with the N1 and N2 (VHF Navigation receiver 1 and 2) buttons. The selected source is indicated by a green LED.

Additional navigation aid or other audio sources can be selected using the LCD menus.

Press the bottom line select **RADIO → SWITCHED INPUTS,** → and desired audio source.

NOTE: Switched Inputs can be renamed at the configuration set up. See §3.13 for more information.
*In **SPLIT** mode, only the pilot will hear selected navigation audio.*

3.6 Speaker Amplifier (7)

To activate the PMA450 cockpit speaker output, press and hold the bottom line-select button (SPR) for one second or until SPR appears in the display.

In "Split Mode" all audio that the pilot hear will also be present in the speaker.

Unswitched audio #1 & #2, (the inputs dedicated to autopilot disconnect, altimeter warning, etc.) will come through the speaker regardless of the speaker button position.

When a cell phone call is active, the selected radio audio is removed from the speaker.

Depending on installation, important audio annunciations such as radar altimeter or autopilot disconnect will come over the speaker even if it is not selected, while other unswitched, but muted inputs, such as GPS alerts, will only be present if the SPR button is selected. Consult your professional avionics installer for these important configuration details.

Unswitched Input	Hear in Fail Safe (Pilot)	Hear in Crew Headset	Hear in SPR
1	Yes	Yes	Yes
2	No	Yes	Yes
3	No	Yes	When SPR selected
4	No	Yes	When SPR selected

3.6.1 Public Address Function

To access PA function, press and hold the center line select button for more than 1 second, until the display changes to PUBLIC ADDRESS.

When PA mode is active, all microphones except for the Pilot will be disabled for complete and uninterrupted announcements.

The pilot microphone will be heard on the speaker and headsets when the pilot PTT is used.

The copilot can continue to use the selected com radio while the pilot will be heard over the speaker.

To exit PA mode, push and hold the middle line-select button again until **PUBLIC ADDRESS** is off or cycle power on the audio panel.

3.7 Marker Beacon Operation (9) (unit part number 050-450-0100, only)

The Marker Beacon Receiver uses visual and audio indicators to alert you when the aircraft passes over a 75 MHz transmitter.

The audio from the Marker Beacon Receiver can be heard by pushing the "**MKR**" button. AUD will light up green.

The Blue lamp, labeled "O", is the Outer Marker lamp and has an associated 400-Hertz 'dash' tone. The lamp and tone will be keyed at a rate of two tones/flashes per second when the aircraft is in the range of the Outer Marker Beacon.

The Amber lamp, labeled "M", is the Middle Marker lamp and is coupled with a 1300 Hertz tone. It is keyed alternately with short 'dot' and long 'dash' bursts at 95 combinations per minute.

The White lamp, labeled "I", is the Inner marker and has a 3000 Hertz 'dot' tone. The lamp and tone will be keyed at a rate of six times per second.

Holding the **MKR** button for one second activates marker test lamp, labeled "T/M" and illuminates all three lamps simultaneously to assure the lamps (internal and external) are in working order. TST does not activate MM autopilot sense output. Releasing the button returns to the last sensitivity.

Pressing the marker mode select ("T/M") for one second, while beacon audio is active, will also cause the marker audio to mute for that beacon. The next beacon received will re-activate the audio.

The marker beacon receiver audio volume can be adjusted from the menu.

Press **RADIO → VOLUMES → MARKER**, and turn the small knob to adjust the marker beacon volume.

The green volume bar and numerical readout will indicate the receiver volume in this menu. NOTE: marker Volume cannot be turned completely off.

NOTE: PMA450, P/N 050-450-0200, without Marker Beacon, will not have a Volume selection.

3.7.1 Marker Beacon Sensitivity

Press and hold the MKR button for about two seconds, or the letter **H** appears in the LCD display, indicating that the Marker beacon sensitivity in in the High Sense Mode. Repeat to switch back to Low Marker Sense ("H" disappears.)

[Serial Number D1150 and below only: Marker Beacon sensitivity is set using an external toggle switch, if desired. The PMA450 defaults to low sensitivity, and will be in high sensitivity if the switch is closed, connecting J2-Pin 30, to ground.]

3.8 Intercom Operation (8)

3.8.1 *IntelliVox*® Intercom VOX-Squelch

No adjustment of the *IntelliVox*® squelch control is necessary. Through three individual signal processors, the ambient noise appearing in all six 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-214, 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 airplane 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.

Manufacturer	Model	Mic Muff™ Part Number
Bose	Dynamic Electret M87 Dynamic	90010 90015 90020
David Clark	H10-30 H10-20, H10-40 H10-13.4	90010 90015 90015
Lightspeed	All	90015
Peltor	7003 7004	90010 90015
Pilot	11-20 & 11-90	90015
Sennheiser		90015
Telex	Airman 750, Echelon AIR3000	90015 90010

Table 3-1 Mic Muff ™ Part Numbers

3.8.2 Intercom Volume Control (1)

The smaller inner volume control knob adjusts the loudness of the intercom for the pilot and copilot. It has no effect on selected radio levels, music input levels or passengers' volume level. The green volume bar indicator shows the level of the crew volume by default.

The outer, larger volume control knob controls intercom volume for the passengers. It has no effect on radio or music levels. When the outer knob is moved, the green volume bar indicator will switch to show the level of the passenger's intercom volume, reverting to the crew after a few seconds.

Adjust the radios (at the radio itself) and intercom volume for a comfortable listening level. Most general aviation headsets today have built-in volume controls; therefore, volume also can be further adjusted at the individual headset.

3.8.2.1 Monaural headsets

The pilot and copilot positions work with stereo or mono headsets. However, IntelliAudio 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 IntelliAudio® Dimensional Sound, stereo headsets *must be used*, and the left/right orientation observed.

All *passenger* headsets are connected in parallel. Therefore, if a monaural headset is plugged in to a PMA450 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.

NOTE: Mono headsets that short the tip and ring (i.e. older models) will introduce some audio distortion when used. Modern, stereo headsets are recommended in all positions.

3.8.3 Intercom Modes (8)

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

This button cycles through the intercom modes, from left to right, then right to left as: ISO, ALL CRW and CRW, ALL, ISO. A green indicator shows which mode is currently active.

The description of the intercom mode function is valid only when the unit is not in the "Split" mode. Then, the pilot and copilot intercom is controlled by the ICS button selecting CRW.

ISO: The pilot is isolated from the intercom and is connected only to the aircraft radio system. He will hear the aircraft radio reception (and sidetone during radio transmissions). Copilot will hear passengers' intercom and Music, while passengers will hear copilot intercom and Music. Neither will hear aircraft radio receptions or pilot transmissions. The pilot can hear music if desired. See §3.9.3

ALL: All parties will hear the aircraft radio and intercom. Crew and passengers will hear selected Music. 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. They may also listen to Music 1. Passengers can continue to communicate with themselves without interrupting the Crew and may listen to Music as configured.

3.8.3.1 Alternate Intercom Mode

The PMA450 includes an Alternate Intercom Mode. This mode allows intercom communications between crew and passengers, without interrupting the crews radio communications. The passengers do not hear the aircraft radio audio. The passenger microphones are muted, such that the crew cannot hear the passengers' microphone audio while the radio is active. Passengers can still talk to each other.

To enable the Alternate Intercom Mode, press RADIO Intercom: to toggle between Standard and Alternate modes. This state is remembered during power cycles.

3.9 Music Control, Distribution and Muting

The top menu, top line select button toggles the music on or off for the **pilot**. When pilot music is active, a music icon **(♫)** appears in the display.

The PMA450 has two independent music inputs at the rear connector, and a front panel jack. The PMA450 also has the ability to receive streaming music from a Bluetooth-enabled device which will be connected into Music #1.

The Music 1 and Music 2 inputs can be selectively delivered to the pilot, copilot and/or passengers using the music distribution menu.

Streaming Bluetooth® Music is in parallel with Music 1

Figure 3-4 Top Music Menu

Press Music → Music Distribution→ and select desired combination.

Figure 3-5 Music distribution menu

NOTE:
All music devices should be turned off for takeoff, landing, or any critical phase of flight. FAA Regulation 14 CFR 91.21 restricts the use of portable electronic devices.
§91.21 "(a) Except as provided in paragraph (b) of this section, no person may operate, nor may any operator or pilot in command of an aircraft allow the operation of, any portable electronic device on any of the following U.S.-registered civil aircraft. . .

"(b)(5) Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used."
You can refer to Advisory Circular 91.21-1A for more information, at http://www.faa.gov

3.9.1 Music Muting

The SoftMute™ circuit will mute the music whenever there is conversation on the radio, the intercom, or both, depending on the "Mute" mode selected. When that conversation stops, the music returns to the previous level comfortably, over a second or so.

The mute mode functions are controlled through Music Mute Menu which has **three** modes for each music input. Mute ALL, Karaoke & Radio Mute.

The PMA450 always defaults to *Mute ALL* when turned on.

In Mute- music **will** mute with *either* intercom *or* radio

"Karaoke" mode - music will not mute except during radio transmissions.

Radio (Rad) Mute - *Radio* will mute music, but intercom will **not** mute music.
In addition to the panel mute menu, a remote switch may be installed to allow the passengers local access to their Karaoke mode. When this switch is grounded, the menu choice is overridden.

3.9.2 Music Volume

The volume of the music inputs can also be adjusted from the menu of the PMA450:

Press Music → Music Volume → Desired music input. The LED Volume bar and the numeric volume will show the volume level.

Figure 6 – Music Volume screen

3.9.3 Music in Pilot ISO mode

When the isolate (ISO) mode is activated, the music for the pilot is automatically disabled.. If desired, the pilot can elect to hear Music #1 or #2, in the ISO mode, by toggling the Music line select with a long press or holding the ICS button, while in the ISO mode.

The pilot can select either music source from the Music distribution menu.

3.10 Bluetooth® connection

The PMA450 has a Bluetooth interface. The audio panel is always "discoverable," so you just need to search for the PMA450 from your Bluetooth-equipped phone or music source. The default access code is 0000, if needed. Once the PMA450 has been "paired" with your Bluetooth device, the TEL distribution will act as described in § 3.11.1.

When Bluetooth is active, a Bluetooth icon and the battery status of the device is displayed in the upper right corner of the home display.

3.10.1 Pairing and unpairing Bluetooth devices

The PMA450 can be paired with up to eight individual devices. When that number is exceeded, the PMA450 will randomly drop a device to allow the new device to be added.

If the audio panel is turned on before the Bluetooth device, you will have to turn the audio panel off and back on to automatically connect.

Hint, if your old phone is not recognized by the PMA450, you may need to reset from the Bluetooth menu.

3.10.1.1 Paring separate music and telephone devices

It is possible to use a different music source (iPad, iPod with Bluetooth adapter, Bluetooth enabled laptop, etc) and telephone. However, only one music source can be streaming at a time.

3.11 Bluetooth® Telephone Mode

The PMA450 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."

In **ALL** intercom mode, all crew and passengers will be heard on the phone when they speak. All will hear selected audio. Com audio is automatically heard in the headsets.

In **CREW** mode, the pilot and copilot are connected to the telephone. The pilot and copilot will have transmit capability on the other selected transceiver Com 1 or 2, simply by using their respective PTT switch.

In **ISO** intercom mode, when the PMA450 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. He will also have access to Com 1 or 2, and will transmit on that radio using the PTT. All selected audio is provided.

NOTE

Because the cell phone uses an intercom circuit, all stations on that circuit will lose intercom capability when the cell phone is in use. Intercom conversations will still be present if the cell phone provides sidetone, or if the audio panel is modified for telephone sidetone.
PS Engineering does not guarantee compatibility with personal cellular telephones.

3.11.1 Bluetooth Reset

If the Bluetooth devices have trouble connecting, it may be necessary to reset the Bluetooth Module. The PMA450 Bluetooth Reset function is accessible from the setup menu.

During the unit boot up process (while the version numbers appear on the screen), hold the lower line select button until the setup screen appears.

This places the unit into the “User Setup Mode- home screen”, and allows resetting the Bluetooth Module

When **Unpair All** is pushed, the Bluetooth Module is reset and ***ALL*** Bluetooth devices are erased from the audio panel, and can then be added back as desired. This is useful in some cases where the unit or operator lose track of the devices paired, and cannot get them to connect.

Cycle the PMA450 power to exit setup screen.

3.11.2 Bluetooth Cellular telephone sidetone

Some cell phones do provide sidetone, and when combined with unit sidetone can cause audio distortion. In PMA450 Telephone sidetone can be enabled or disabled on the Telephone menu when a call is active.

3.12 Wired Satcom/Cell Phone input (Serial No F01201 and above)

The PMA450 can accommodate a wired telephone input as well as a Bluetooth connection. However, only one can be active at a time. The Bluetooth symbol is absent from wired menu.

The wired telephone screen menu is activated when audio is detected from the phone. Sidetone and telephone volume can be controlled from this menu. The telephone audio distribution is the same as Bluetooth, above.

This menu will switch off 25 seconds after the *incoming* conversation ends, or press End Call.

NOTE: The PMA450 does NOT answer or hang up the wired phone from this menu.

3.13 Internal Recorder and playback

The PMA450 comes equipped with an internal recorder. This digital system stores the last incoming audio from the radio you have selected for transmit. It can store as many of 8 incoming messages, and up to 45 seconds of audio. The pilot and copilot hear the playback.

Recording is automatic. To play back the last recorded message, press and hold the COM Receive pushbutton associated with the selected radio transmitter for about one (1) second. You can either wait for the message to finish playing before accessing the prior message, or cancel the current playback and step backward. To cancel the playback, press and hold the COM receive playback button for two seconds (2). The next time the button is pressed for one (1) second, the next earlier message will be heard. The playback will stop whenever there is more incoming selected com audio, and the message can be replayed from the beginning by pressing the selected Com Receive button again for 1 second.

Figure 3-7 Playback Controls

Figure 3-8 Playback Display

3.14 User Setup menus

The PMA450 has several user adjustable functions accessible from a setup menu.

Figure 3-9 User Configuration Menu

During the unit boot up process, press the lower line select button until the setup screen appears.

Cycle the PMA450 power to exit setup screen.

During the unit boot up process, hold the lower line select button until the setup screen appears. This shall place the unit into the "User Configurable Mode- home screen". This allows adjustment for:

- • Adjust Screen (LCD)
- • Rename Switched Inputs
- • Bluetooth

Cycle the PMA450 power to exit setup screen.

3.14.1 Adjust Screen (LCD Adjustment)

The first items are adjustments to the Liquid Crystal Display, allowing the installer or user to tailor the contrast and backlight intensity to suit the cockpit conditions.

There are two modes: LCD Brightness & LCD Contrast.

LCD will vary in real time while adjustments are made. LED bar & numeric indication will vary.

3.14.1.1 Brightness and Contrast

Adjusting either the Brightness or Contrast level requires selecting either of the two smaller buttons and then turning the inner knob. Counter clockwise to lower the number (level of Brightness & Contrast) and clockwise to increase the number (level of Brightness & Contrast).

To change the display:

Press the line select for the desired item

Turn the small, inner knob to change the contrast or brightness as desired.

Cycle the PMA450 power to exit setup screen.

Figure 3-10 LCD Menu

3.14.1.2 Display Timeout

This is a feature that allows the end user to adjust how quickly the screen menus timeout (revert to main menu).

NOTE: A long press (>1 second) will back up the menu one level (serial number J01402 and above),

This allows adjustment of the timeout screen and can be configured from 1 second to 30 seconds by turning the inner knob.

For a user whom is unfamiliar with the product, this will give them enough time to learn the system. After becoming more familiar the user can speed up the menu screen timeout as desired.

Cycle the PMA450 power to exit setup screen.

Figure 3-11 Display Timeout Menu

3.14.2 Rename "Switched" Inputs

The system is factory set to default as ADF, DME & AUX as shown.

The three inputs are from top to bottom:

- Switched input #1 J1, Pin 7 wrt Pin 8 (Default ADF)
- Switched input #2 J1, Pin 21 wrt Pin 22 (Default DME)
- Switched input #3 J1, Pin 23 wrt Pin 43(Default AUX)

The customer will have access to rename. Maximum 9 letters per line and *A thru Z & 0 thru 9* will be available. Note: If no marker version PMA450 (-0200) an external marker can be connected to these inputs.

- Press the line select for desired input.
- Turn the large outer knob to select the letter to change.
- Turn the small, inner knob to increment or decrement the letter.
- You can select 9 characters, A through Z, 1 through 9.
- You can quickly clear the whole line by turning the outer knob to move the cursor all the way to the right until the line clears.

Cycle the PMA450 power to exit setup screen.

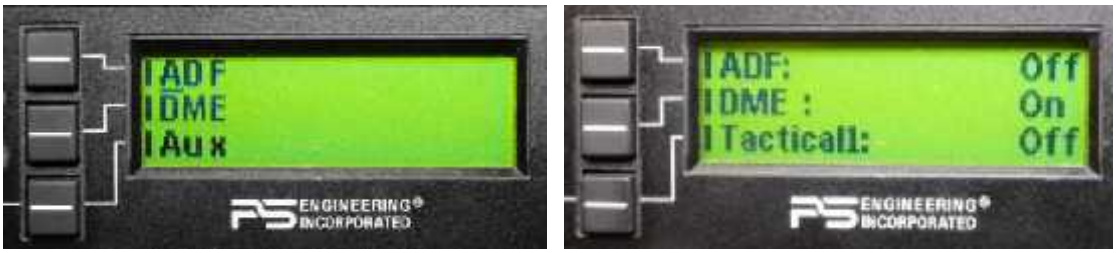


Figure 3-12 Rename Input Menu

3.14.3 Bluetooth Setup

There are three Bluetooth functions that can be changed in the user setup screen, Unpair All, Paring PIN, and device ID.

3.14.3.1 Unpair All (Bluetooth Reset)

When **Unpair All** is pushed, the Bluetooth Module is reset and ***ALL*** Bluetooth devices are erased from the audio panel, and can then be added back as desired. This is useful in some cases where the unit or operator lose track of the devices paired, and cannot get them to connect.

3.14.3.2 PIN:

The 4-digit PIN code can be changed to any number desired. This is useful if the owner wants to restrict access to the audio panel Bluetooth functions.

Some phone will not pair is a Personal Identification Number (PIN) is required. To disable the PIN PMA450 Version 2.012 and later):

- Enter configuration menu, select Bluetooth.
- Select PIN code for editing. Press PIN button one more time.
- "Bluetooth Reset" will appear on screen. When the menu returns, the PIN code will report "Disabled".
- To re- enable the PIN code for a different device, press the PIN button.

"Bluetooth Reset" will appear on screen. When the menu returns, the last stored PIN code will be shown.

ID: The PMA450 can be renamed using this mode to show up on the devices with a personalized identifier.

3.15 USB Charging Port (10)

The PMA450 contains a USB charging port that is capable of providing 5 VDC, 2.1 amps of current (at least 10 watts) to power or charge the batteries in smart phones and tablets used as Personal Electronic Devices. This is NOT a data transfer jack.

Section IV – Warranty and Service

4.1 Warranty

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 sale. 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, Inc., at its option, will send a similar replacement unit at the customers' expense if the unit should be determined to be defective after consultation with an authorized PS Engineering dealer.

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.

4.2 Factory Service

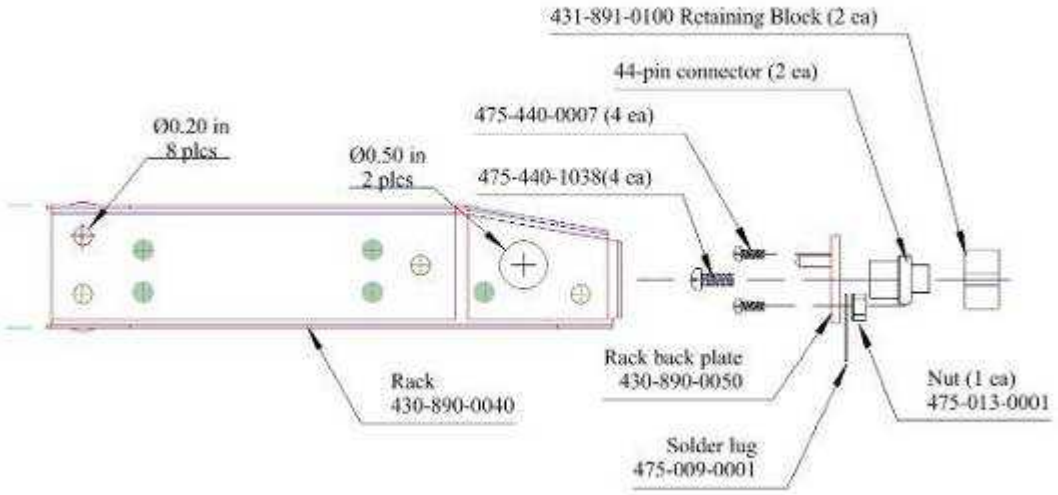
The units are covered by a two-year limited warranty. See warranty information. Call PS Engineering, Inc. at (865) 988-9800 before you return any unit. This will allow the service technician to provide any other suggestions for identifying the problem and recommend possible solutions.

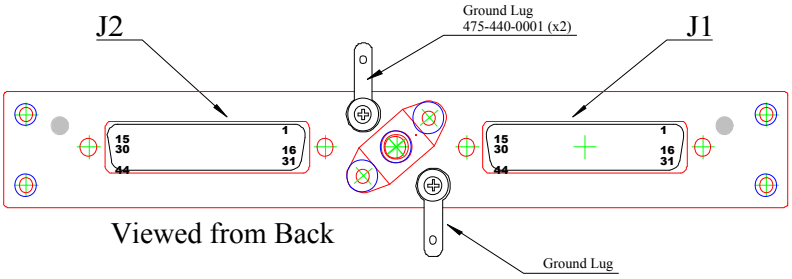
After discussing the problem with the technician and you obtain a Return Authorization Number, ship product to:

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

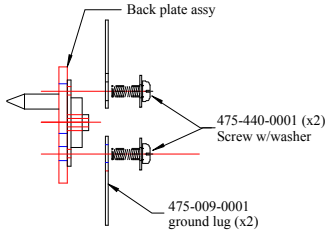
Units that arrive without an RMA number, or telephone number for a responsible contact, will be returned un-repaired. PS Engineering is not responsible for items sent via US Mail.

Appendix A – PMA450 Installation Drawings

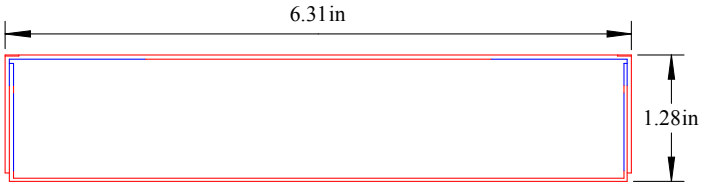


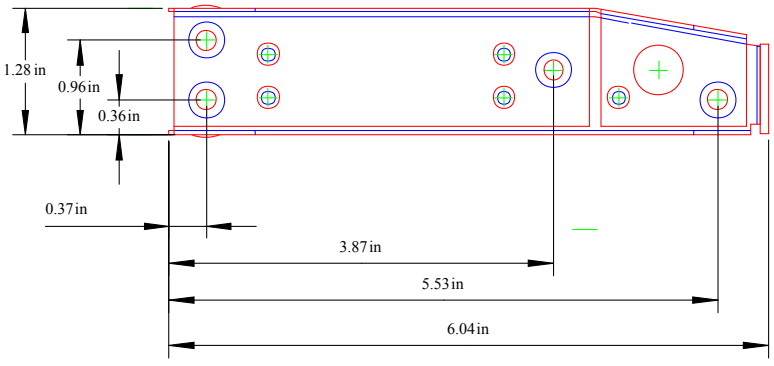


Rear plate detail (not to scale)



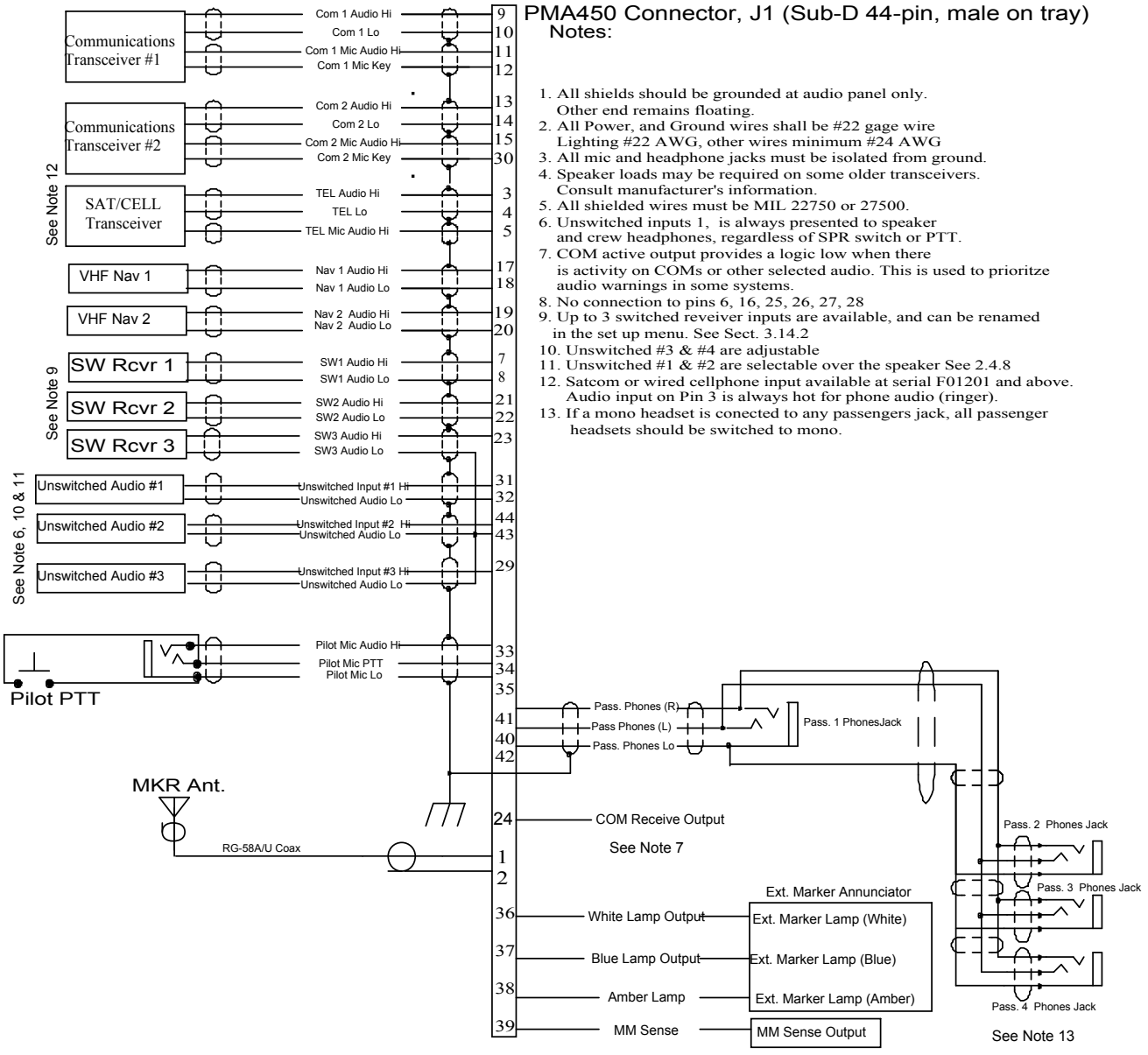
Ground lug detail



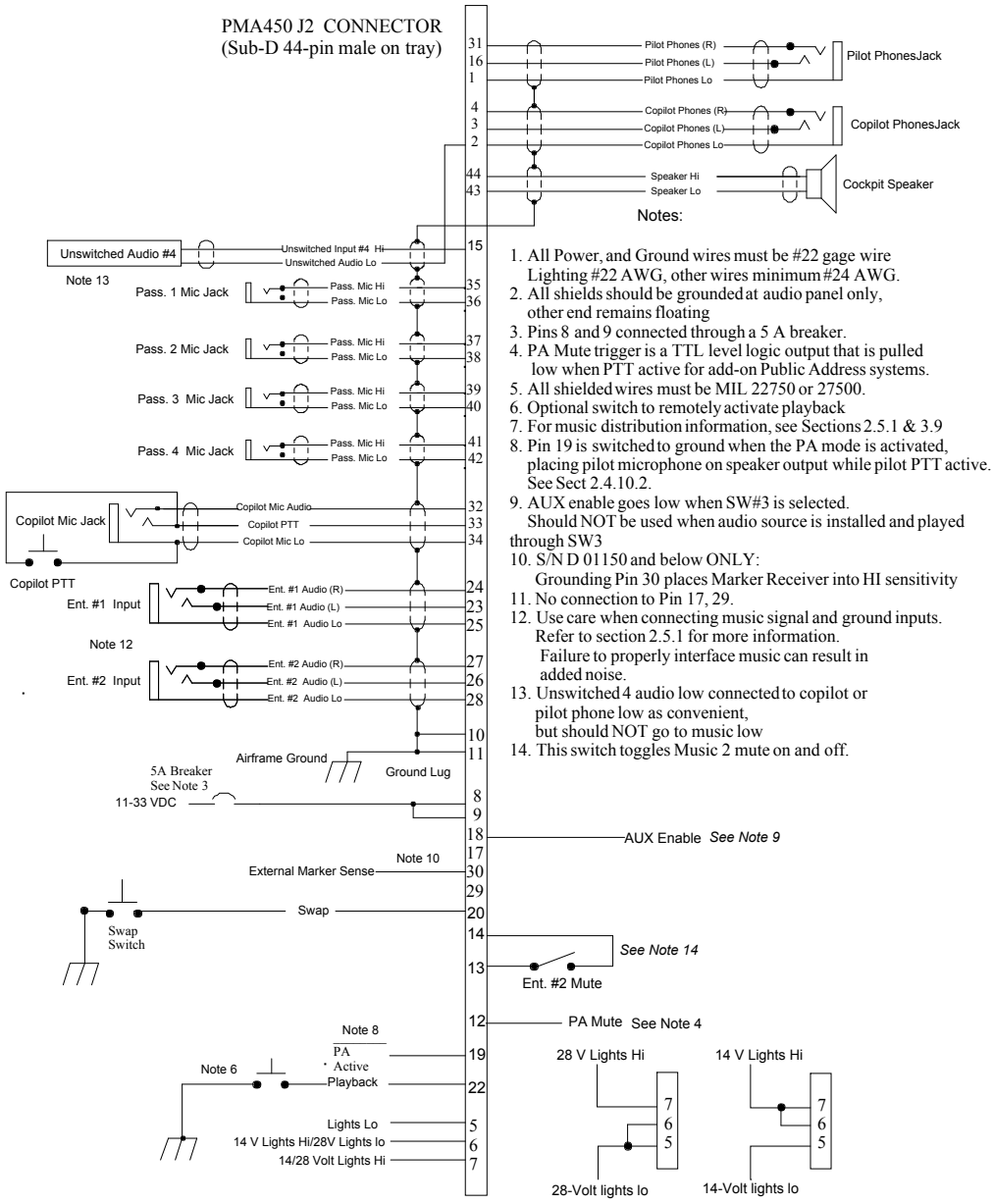


Caution: Apply steady pressure to the bezel while screwing the unit into the tray to ensure even seating of the unit and connectors.

Appendix B – J1 Connector Interconnect



Appendix C – J2 Connector Interconnect



1. All Power, and Ground wires must be #22 gage wire Lighting #22 AWG, other wires minimum #24 AWG.
2. All shields should be grounded at audio panel only, other end remains floating
3. Pins 8 and 9 connected through a 5 A breaker.
4. PA Mute trigger is a TTL level logic output that is pulled low when PTT active for add-on Public Address systems.
5. All shielded wires must be MIL 22750 or 27500.
6. Optional switch to remotely activate playback
7. For music distribution information, see Sections 2.5.1 & 3.9
8. Pin 19 is switched to ground when the PA mode is activated, placing pilot microphone on speaker output while pilot PTT active. See Sect 2.4.10.2.
9. AUX enable goes low when SW#3 is selected. Should NOT be used when audio source is installed and played through SW3
10. S/N D 01150 and below ONLY: Grounding Pin 30 places Marker Receiver into HI sensitivity
11. No connection to Pin 17, 29.
12. Use care when connecting music signal and ground inputs. Refer to section 2.5.1 for more information. Failure to properly interface music can result in added noise.
13. Unswitched 4 audio low connected to copilot or pilot phone low as convenient, but should NOT go to music low
14. This switch toggles Music 2 mute on and off.

Appendix D – Instructions for FAA Form 337 and continuing airworthiness

8.1 Instructions for FAA Form 337, Audio Panels

One method of airworthiness approval is through an FAA Form 337, *Major Repair and Alteration (Airframe, Powerplant, Propeller, or Appliance)* In the case of the PMA450, you may use the following text as a guide.

Installed audio selector and 6-place intercom, PS Engineering PMA450, part number 050-450-(XXXX) in (*location*) at station . Installed per *AC43.13-2, Chapter 2, paragraph 23* (Instrument Panel Mounting). Installed per PS Engineering *Installation Operators Manual* p/n 200-450-(XXXX), revision (), dated ( ).

These units are FAA-Approved under TSO C139A for audio amplifiers, and/or TSO C35d for Marker Beacon Receivers, C71 for DC power supply and meets environmental qualifications outlined in RTCA DO-160G as appropriate or this aircraft.

Interface to existing aircraft radios in accordance with installation manual and in compliance with practices listed in *AC43.13-2*, Chapter 2. All wires are Mil-Spec 22759 or 27500. Connection to aircraft dimmer bus is _____. Power is supplied to the unit through a 3A circuit breaker (type and part number), and total electrical load does not exceed _____% of the electrical system capacity with the PMA450 added.

Aircraft equipment list, weights and balance amended. Compass compensation checked. A copy of the operation instructions, contained in PS Engineering document 202-450-( ), revision ( ), dated ( ), is placed in the aircraft records. All work accomplished listed on Work Order_____.

8.2 Instructions for Continuing Airworthiness, Audio System

Sample ICA Checklist for PS Engineering Audio System:

Section	Item	Information
1	Introduction	Installation of audio control panel with integrated marker beacon receiver and intercommunications system.
2	Description	Installation as described in manufacturer's installation manual referenced on FAA Form 337, including interface with other avionics audio as required.
3	Controls	See installation and operator's guide referenced on FAA Form 337.
4	Servicing	None Required
5	Maintenance Instructions	On Condition, no special instructions
6	Troubleshooting	In the event of a unit problem, place the unit into "off," "fail-safe" and/or "emergency" mode. This allows pilot communications using COM 1. Follow checkout instructions in the installation manual referenced on the FAA Form 337. For a specific unit fault, contact the manufacturer at (865) 988-9800 for special instructions.
7	Removal and replacement information	Removal: Using a 3/32" Allen-head wrench, carefully unscrew the locking screw located in the center of the unit. While turning the wrench CCW, gently pull on the EDGES of the bezel until the unit is free from the mounting tray. Installation: Engage the locking screw at the back. Turn the locking screw CW, while applying slight pressure to the edges of the bezel. Do not over tighten!
8	Diagrams	Not applicable
9	Special Inspection Requirements	Not Applicable
10	Protective Treatments	Not Applicable
11	Structural Data	Not Applicable
12	Special Tools	None
13	Not Applicable	Not Applicable
14	Recommended Overhaul Periods	None
15	Airworthiness Limitations	Not Applicable
16	Revision	To be determined by installer

Appendix E – RTCA DO160G Environmental Qualification Form

Audio Selector Panel/Intercom/Marker Beacon Receiver

Part Number: 050-450-( )

FAA TSO Number: C139a, C35d, C71

Manufacturer: PS Engineering Incorporated 9800 Martel Road Lenoir City TN 37772

Conditions	Section	Conducted Tests
Temperature and Altitude	4.0	Equipment tested to CAT A1 & D1
Low Temperature	4.5.1	-55° C Survival, -15°C Low Operating (A1)
High Temperature	4.5.2	+85°C Survival, +70°C High Short Time Operating
In-flight Loss of Cooling	4.5.4	Not Applicable, no cooling required
Altitude	4.6.1	50,000' unpressurized (D1)
Decompression	4.6.2	Not Applicable
Overpressure	4.6.3	Not Applicable
Temperature variation	5.2	Equipment tested to Category C
Humidity	6.0	Equipment tested to Category A
Shock	7.0	Equipment tested to Operational test only
Operational	7.2	Equipment tested to Operational test only
Crash Safety	7.3	Equipment tested to Operational test only
Vibration	8.0	Equipment tested to Category M & N
Explosion	9.0	Category X, not tested
Waterproofness	10.0	Category X, not tested
Fluids Susceptibility	11.0	Category X, not tested
Sand and Dust	12.0	Category X, not tested
Fungus	13.0	Category X, not tested
Salt Spray	14.0	Category X, not tested
Magnetic Effect	15.0	Equipment tested to Category Z
Power input	16.0	Equipment tested to Category B
Voltage Spike	17.0	Equipment tested to Category A
Audio Frequency Susceptibility	18.0	Equipment tested to Category B
Induced Frequency Susceptibility	19.0	Equipment tested to Category A
Radio Frequency Susceptibility	20.0	Equipment tested to Category T
Radio Frequency Emission	21.0	Equipment tested to Category B
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category XXE2
Lightning Direct Effects	23.0	Category X, not tested
Icing	24.0	Category X, not tested
ESD	25.0	Category X, not tested