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PAR100EX

Document P/N 200-760-0000

Revision 12, January 2014

Audio Selector Panel with VHF Communications Transceiver and
High-fidelity Stereo Intercom
System Installation and Operation Manual
Patented under one or more of the following;
No. 4,941,187; 5,903,227; 6,160,496 and 6,493,450

For use in Experimental/LSA/Non-certified aircraft ONLY
Not intended for installation in aircraft with standard airworthiness certification
The product warranty is not valid unless this product is installed by an
Authorized PS Engineering dealer.

Table of Contents

Rev	Date	Change
1	3/28/2011	Initial release
2	May 2011	First production release
3	June 2011	Clarified radio operating voltage
4	July 2011	Added RFI filter information
5	August 2011	Changed as shipped voltage from 12 to 28V and added conversion instructions
6	January 2012	Corrected typos §2.9 & Appendix C
7	June 2012	Updated requirement for ferrite core RFI suppression §2.14.1
8	October 2012	Corrected §2.6.1, Cell Phone Sidetone
9	December 2012	Clarified Music 1 & Music 2, Muting, and Bluetooth operation.
10	December 2012	Corrections and clean-up
11	February 2013	Revised §2.10 for new cover with adjustment locations
12	January 2014	Revised § 2.5.2 for clarity

Section I – GENERAL INFORMATION

1.1 INTRODUCTION

The PAR100EX represents another evolutionary step in cockpit audio control and intercommunications utility. Using our patented *IntelliVox®* design and pilot programmable configurations, this marks 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 PAR100EX.

1.2 SCOPE

This manual provides detailed installation and operation instructions for the PS Engineering PAR100EX-series of Audio Selector Panel/Intercom Systems. This includes the following unit:

Model	Description	PS Engineering Part Number
PAR100EX	Stereo Audio Selector Panel with control for VHF Communications radio. Includes stereo intercom, with Bluetooth Interface	050-760-0100
M760REM	VHF Communications Transceiver	050-760-6476

1.3 EQUIPMENT DESCRIPTION

The PAR100EX is a state-of-the-art audio isolation amplifier and audio selector that contains an automatic voice activated (VOX) intercom system and serial data control/indication for a MiroAir VHF communications receiver. It can switch two transceivers (Com 1, Com 2) and two receivers (Nav 1, Nav 2).

A Bluetooth ® TELEPHONE mode allows the PAR100EX to act as an audio interface between aircraft headphone and microphones and Bluetooth enabled cellular telephone equipment. .

> **Warning**: Use of non-aviation approved cellular telephone equipment may be prohibited by regulation.
> PS Engineering is not responsible for unauthorized airborne use of cellular telephones.
> For airborne use, the PAR100EX must be interfaced with an approved system.

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

Pushbutton switches select one of the communication transceivers for the pilot and copilot position, and allows radio transmission. In "Split Mode" the PAR100EX 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 in fail-safe

A four-station voice activated (VOX) intercom is included in the PAR100EX. 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 concentric rotary data input knob on the right side of the unit controls less essential functions and configurations.

1.4   APPROVAL BASIS — <u>NONE</u>

The PAR100EX is not intended, or approved for installation on US Registered Civilian Aircraft with normal airworthiness certificates.

1.5   SPECIFICATIONS

DIMENSIONS:	Height: 1.3 in. (3.3 cm) Width: 6.25 in. (16.9 cm) Depth behind panel 7.15 in. (18.16 cm)
WEIGHT *PAR100EX Unit*	1.34 lb. (0.61 kg)
Rack with connectors	0.51 lb. (0.24 kg)
AUDIO PANEL POWER REQUIREMENTS (Including Internal Lighting):	
Voltage:	12 VDC *The audio panel and Microair M760REM operate from +12VDC Only If installed in 28V Aircraft, damage will result. Contact PS Engineering if you wish to install in 24V system.
Maximum Current:	2.5 Amp (Externally protected by a 3A pull-type breaker)

Audio Selector Specifications	
Audio selector panel input impedance:	510 Ω
Input Isolation:	-60 dB (min.)
Receiver Inputs:	4 (Com 1, Com 2, Aux 1, Aux 2)
Unswitched Inputs:	4
Transmitter Selections:	3 (Com 1, Com 2, Com1/2)
Headphone Impedance:	150 – 1000 Ω
Headphone Output:	38 mW each headset, no clipping <1% THD typical into 150
Microphone Impedance:	150 - 600 Ω
Intercom Specifications	
Intercom Positions:	4 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 @ 38 mW into 150Ω
Mic Freq. Response, 3 dB:	300 Hz - 6000 Hz
Music Freq. Response, 3 dB:	10 Hz – 26 kHz

M760REM VHF Transceiver Specifications	
Radio Type	Amplitude Modulation (AM) Aircraft Transceiver
Channels (Transmit & receive)	760 channels, 25KHz spacing 118.000 – 136.975MHz
Frequency Selection	On PAR100EX Audio Panel
Frequency Display	Alpha/numeric LCD display (with backlighting) on PAR100EX
Frequency control	PLL frequency synthesis, which is microprocessor controlled Memory is store in non-volatile EPROM
Power consumption Receive (no signal) *Transmit*	140 mA (no backlighting) 1.9 A
Input Voltage	Provided by PAR100EX from a second 3A Circuit Breaker.
Power output	5 watts (nominal) VSWR Tolerance < 2:1 for best operation (5:1 without damage)

Receiver sensitivity	-12dB SINAD @ 0.3µV (1KHz audio with 70% modulation)
Receiver Selectivity	-70dB
Squelch Range	0.5 - 10.0µV
Data Interface	RS232
Speaker volume output	Nominal 4 watts output to 4 ohms
Headset volume output	Nominal 100 milliwatts output to 600 Ω
Temperature range	-20 to +55 degrees Celsius
Stability	< +/- 4.00 ppm
Dimensions	W-3.4" x H-2.5" x D-4.7" (plus 1.5" for harness) W-87mm xH-64mm x D-119mm (plus 35mm for harness)
Weight	13.0 ounces 338 grams
FCC ID:	QNEM760REM

1.6   EQUIPMENT SUPPLIED

1 ea. of the following items:

Model	Description	Part Number
PAR100EX	PAR100EX Audio Panel with intercom and radio function control	050-760-0100
M760REM	VHF Communications Transceiver	050-760-6476

Installation Kit: 250-890-0000, containing:

Description	Quantity	Part Number
PAR100EX installation rack assembly	1	430-890-0040
PAR100EX Rack back plate	1	430-890-0050
44-pin connector kit	2	120-891-2045-
Backshell, connector	2	625-025-2465
Backshell Retainer	2	431-891-0100
4 40 X 7/16 screw w/nylon patch	4	475-440-0007
4 40 X 3/8 screw w/lock washer	4	475-440-1038
4 40 X 1/8 screw w/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

Installation Kit 250-760-6476, Containing:

Description	Quantity	Part Number
DB 15 Connector , Solder type	1	425-016-0001
DB 15 Connector back shell	1	425-015-0003
Ferrite RFI suppressor	1	507-000-0065

1.7   EQUIPMENT REQUIRED BUT NOT SUPPLIED
a. Circuit Breaker: 1 ea; 3 amp PULL TYPE REQUIRED for PAR100EX
b. Circuit Breaker: 1 ea; 3 amp PULL TYPE REQUIRED for transceiver power (to PAR100EX)
c. Headphone Jacks (up to 4 Stereo, as Required)
d. Microphone Jacks (up to 4 as Required)
e. Headphones, 150 Ω (Stereo), up to 4 as required
f. Microphones, up to 4 as required
g. VHF Communication antenna 118-137 MHz, VSWR <2:1 (FAA-TSO approved is recommended)
h. BNC Connector for M760REM, Amphenol 31-2 or equivalent (PS PN 425-262-0312)
i. Mounting hardware for M760REM, as appropriate
j. Interconnect Wiring, coaxial cable

1.8   *LICENSE REQUIREMENTS*

In some localities other than the United States, an Aircraft Radio Station license may be required. In the United States, you do not need a license to operate a two-way VHF radio aboard aircraft operating domestically. Aircraft operating domestically do not land in a foreign country or communicate via radio with foreign ground stations. Flying in international or foreign airspace is permitted, so long as the previous conditions are met. If you travel to a foreign destination, however, (e.g., Canada, Mexico, Bahamas, British Virgin Islands) a license is required. Visit http://wireless.fcc.gov for more information.

Section II - INSTALLATION

2.1 GENERAL INFORMATION

2.1.1 SCOPE

This section provides detailed installation and interconnection instructions for the PS Engineering PAR100EX Audio Selector Panel/Intercom/ with VHF communication radio controls.

Please read this manual carefully before beginning any installation to prevent damage and post-installation problems. Installation of this equipment requires special tools and knowledge.

2.1.2 Certification Requirements

NOTE

The PAR100EX is not approved for installation in aircraft with a standard airworthiness certificate.
The M760REM is not intended for use where a FAA-Approved VHF Communications transceiver is required by operating rule.

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 Section 1.6 (B). 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 PAR100EX 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 PAR100EX must be rigidly mounted to the instrument panel of the aircraft structure, within view and reach of the pilot position(s). 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 Micro Air M760REM mounting requirements

The M760REM remote VHF Communications radio is mounted to the aircraft structure with 4 ea #6-32 (not supplied) screws through the mounting flange. Guidance can be found in AC 43.13-2B, Chapter 2.
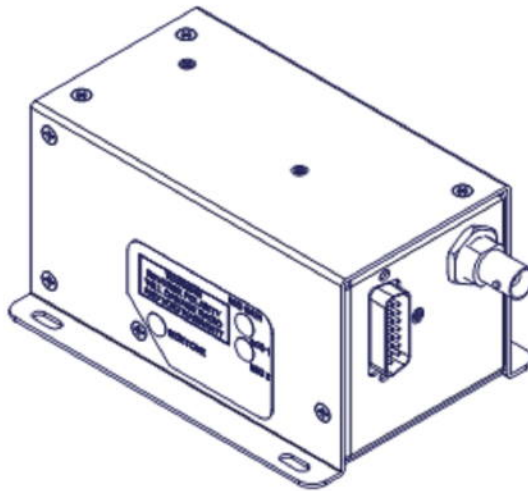
Figure 2-1 M760REM VHF Transceiver (Remote Mount)

2.3.4 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.

2.4 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 <u>shielded wire must be used where indicated</u>, 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 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 PAR100EX 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 PAR100EX 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 PAR100EX 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 center of the back plate.

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

PAR100EX units utilize differential music inputs 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 PAR100EX. The power for IFE and audio panel should be a common bus.

If a music jack is installed for Music 1 or 2, we strongly recommend isolating the jack from airframe ground, by using an insulated mounting plate.

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   Audio Panel Tray and Connector Assembly

The rack connectors mate with two 44-pin connectors in the PAR100EX. The connectors are a subminiature 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).

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 PAR100EX Connector Pin crimping tools

2.4.3 Input Power (+12VDC)

As shipped from PS Engineering, the PAR100EX is compatible with 28 Volt DC systems. If 12-volt system operation is desired, see section 2.9.

NOTE:
If the PAR100EX/M760REM is installed in 28V aircraft without properly configuring the unit, the M760REM will be damaged. See §2.9.

A three (3) 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.

The PAR100EX internal regulator supplies DC power to the M760REM VHF transceiver (12 VDC), and has a dedicated three (3) amp circuit breaker from aircraft bus input into J2, Pin 44 for this supply.

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 PAR100EX 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 PAR100EX is designed to interface with standard aircraft avionics, and presents a 500 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.

Inputs A1 and A2 can be used to control navigation receiver audio, J1 Pins 17 WRT 18 and J1 19 WRT 20, respectively.

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.

2.5   M760REM VHF COM Interface

2.5.1   M760REM Connector

The M760REM has a 15-pin solder type connector.

1	Mic Audio Hi
2	RS232 TX (data out)
3	No Connect
4	No Connect
5	RS232RX (data in)
6	No Connect
7	PTT
8	No Connect
9	Radio Power
10	No Connect
11	Aircraft Ground
12	No Connect
13	No Connect
14	COM audio Output Hi
15	No Connect

2.5.2   Interfacing the M760REM as Single, COM 1 or COM 2

The PAR100EX/ Microair M760REM can be configured to be a stand-alone COM, or as COM 1 or COM 2 in a multiple radio installation.

PS Engineering recommends that the PAR100EX/M760REM be used as COM 2. In the event of a failure, the PAR100EX will be in fail-safe, and COM 1 can be used.

If the M760REM is used as COM 1, the PAR100EX can fail-safe to it, because it is divided internally as audio panel and COM control. In addition, the M760REM power supply is provided by an independent circuit breaker and power supply in the PAR100EX. See § 3.2 for operational information.

As shipped from the factory, the PAR100EX is configured to use the M760REM as COM 2. The PAR100EX must be reconfigured at installation to be used as COM 2, by removing the top cover, and placing the DIP switches as shown.

| J4 Switch 6 | COM 1 | OFF |
| | COM 2 | ON |

Table 2-2 Radio Selection
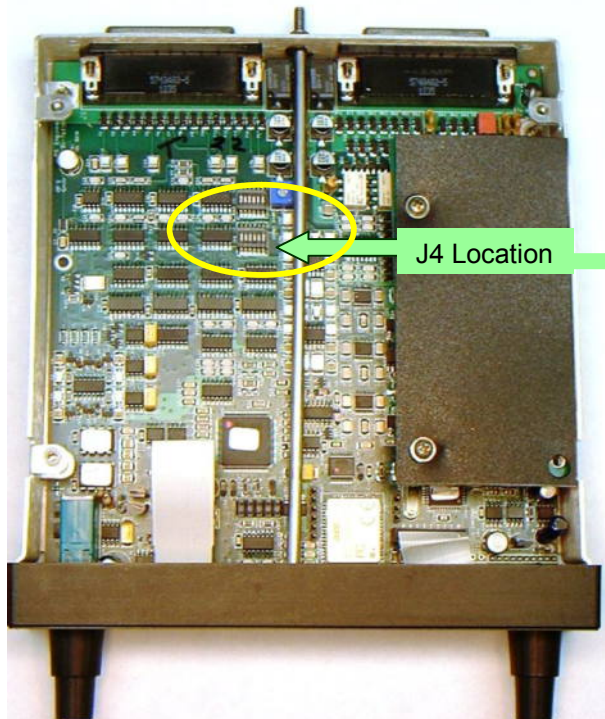
Figure 2-2 DIP Switch Locations	**Figure 2-3 Switch J4, SW 6 location**
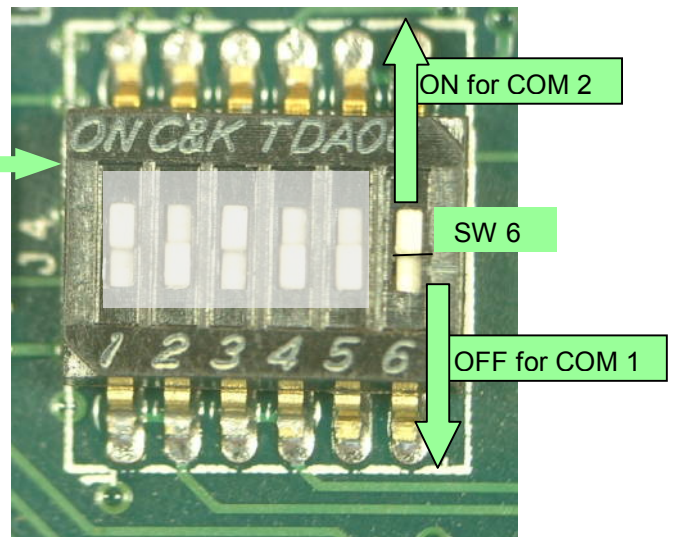
Refer to § 2.8 for disassembly instructions.

When properly selected, the PAR100EX LCD display will read either COM 1, or COM 2.

2.5.3 R760REM Antenna connection

The VHF Com radio uses a solder/crimp BNC connector, Amphenol 31-2. Assemble the RF connector as shown:
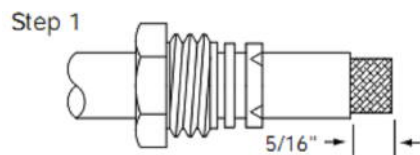
Step 1 Place nut, washer and gasket over cable and strip jacket to 5/16" (7.9 mm).
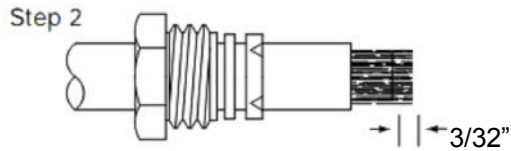
Step 2 Comb out braid and fold out. Trim insulation off center conductor to 3/32" (2.4 mm). Tin center conductor.
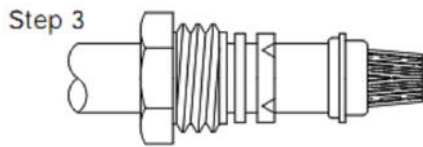
Step 3 Pull braid wires forward and taper toward center conductor. Place clamp over braid and push back against cable jacket.
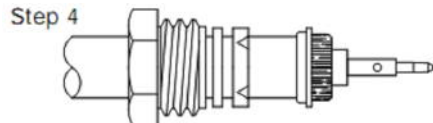
Step 4 Fold back braid wires as shown, trim to proper length [approximately .1/8" (3.2mm) long] and form over clamp as shown. Braid wire should not extend beyond step of braid clamp. Solder contact to center conductor, sliding the bushing first (when supplied) over center conductor.
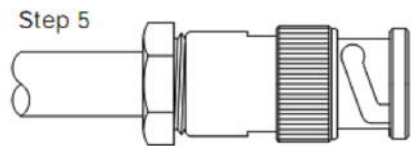
Step 5 Insert cable and parts into connector body. Make sure sharp edge of clamp seats properly in gasket. Tighten nut to approximately 15 inch pounds.

2.6   *TELEPHONE (Duplex) Function for Bluetooth ® capable Cell Phones*

The TELEPHONE mode in the PAR100EX is also compatible with cellular telephones with Bluetooth®. hands-free headset interface. There is no wiring required, all functions are handled in the Bluetooth telephone.

The PAR100EX Bluetooth® interface is always "discoverable", so you just need to search for the PAR100EX from your Bluetooth-equipped phone or music source. The default access code is 0000, if needed. Once the PAR100EX has been "paired" with your Bluetooth device.

The telephone is distribution as dictated by the ISO, ALL, CREW.
> ISO mode - only the Pilot is on the telephone.
> CREW mode - only the Pilot and Copilot are on the telephone.
> ALL mode - everyone is on the telephone.

You can answer a call when you hear the "telephone ringing" in your headset. To answer the phone call will require you to have access to your phone and selecting the answer function of that telephone. There is no front panel button that will allow you to answer the phone.

2.6.1   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, the music source must be paired **first**, *before* the telephone, if the telephone also has music streaming capability. Otherwise, the Smartphone will also take over the music streaming.

Only one can be a phone. If the telephone can provide both telephone and streaming music, when the phone is connected, it will automatically disconnect the music device. If it is possible to turn off the music streaming function on the telephone, then both the telephone and a separate Bluetooth® enabled music device can be use at the same time.

If Bluetooth connections become unreliable or do not connect, you may need to reset the PAR100EX. Turn the unit off, and hold the A1 & A2 buttons while turning the unit the unit back on. You should hear a chime to indicate a successful Bluetooth reset.

> **NOTE**
> FCC Regulations (47 CFR 22.925) prohibit airborne operation of cellular phones;
> 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. The use of cellular telephones while aircraft is on the ground is subject to FAA regulations.
> FAA Regulation 14 CFR 91.21(5) allows for use of portable electronic devices 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.
> 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. For a list of phones that have been tested, visit www.ps-engineering.com.

2.6.2   Telephone sidetone

The PAR1000EX will provide cell phone sidetone (your side of the telephone conversation) in the factory configuration. Some telephones do provide sidetone the PAR100EX can be configured to remove this sidetone by placing the DIP switch in the proper configuration. See Figure 2-2 for locations.

J5 Switch 6	Cell phone sidetone created by audio panel	OFF
	No cell phone sidetone	ON

Table 2-3 Telephone sidetone switch

2.6.3   "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.

2.6.4   Backlighting

The PAR100EX has an automatic dimming of the pushbutton annunciation LEDs controlled by a photo-cell. Control of the unit backlighting is through the aircraft avionics dimmer. For 12-Volt aircraft, connect J2 Pins 6 and 7 to the aircraft dimmer bus, and pin 5 to ground.

As shipped from PS Engineering, the PAR100EX is **ONLY** compatible with 12 Volt DC systems. Contact PS Engineering at 1.865.988.9800 or contact@ps-engineering.com if 24V operation is desired. For 24-volt backlighting systems, connect pin 7 to the aircraft dimmer, and pins 5 and 6 to ground.

> **NOTE:**
> **If the PAR100EX/M760REM is installed in 28V aircraft without properly configuring the unit,
> the M760REM radio will be damaged. See § 2.9**

The LCD display backlighting is controlled by the automatic photocell dimming. In addition, the text inverts for nighttime mode when the ambient light is low.

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 annunciation LEDs.

2.6.5 Unswitched inputs

J1, pins 31, 29 and J2 pin 15 are unswitched, unmuted (by transmitter keying), inputs # 1, 3 and 4, respectively. These inputs are presented to the pilot and copilot regardless of the audio configuration, and will mute the entertainment inputs based on the mode. These 510 Ω 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 crew headphones, and is available to the pilot in fail-safe (off) mode. Unswitched 3 and 4 inputs are always presented to the crew headphones.

Unswitched Input	Hear in Fail Safe	Hear in Crew Headset	Gain
1	Yes	Yes	1:1(fixed)
2	No	Yes	1:1(fixed)
3	No	Yes	Adjustable
4	No	Yes	1:1(fixed)

Table 2-4 Unswitched input table

J1, pins 31, 29 and J2 pin 15 are unswitched, unmuted inputs # 1, 3 and 4, respectively. These inputs are presented to the pilot and copilot regardless of the audio configuration, and will always mute the entertainment inputs. These 510Ω inputs can be used for altimeter DH audio, GPS waypoint audio, autopilot disconnect tones, or any other critical audio signal.

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.

Unswitched #1 is presented to the pilot headphone in fail-safe (off) mode.

> **NOTE**
> Inputs 1, 2 and 4 are fixed (1:1), and any audio level adjustments must be made at the input source. Unswitched #3 has a variable adjustment control located on the bottom side of the unit. This control allows you to control the volume level of that unswitched input from 50% to 200% of the input level. Refer to Adjustments section.

2.7 Intercom wiring

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 system 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.

2.7.1 Entertainment Inputs

The PAR100EX has two INDEPENDENT inputs wired into the rear connectors, in addition to the Bluetooth® music streaming (which is presented as Music 1). Entertainment input number 1 is J2 pins 23 (left channel) and 24 (right channel), with respect to pin 25, and Entertainment number 2 is connected to 26 (left channel), 27 (right channel), with respect to 28.

Music #1 is available to the pilot and copilot positions, only, in normal configuration. Music 1 can be hear by all aircraft occupants, if Music 1 all headsets is activated. See §2.7.1.1

Music 2 is only heard by the passengers.

See § 3.9 for music distribution information.

NOTE

Use the <u>low level</u> output of any additional entertainment 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.

2.7.1.1 Music 1 all headsets (J2, Pin 22)

If J2, Pin 22 is connected to aircraft ground, Music 1 will also be heard in the passengers' headsets. Music 2 will be disabled when J2, Pin 22 is grounded.

2.7.2 Entertainment muting

The PAR100EX-system incorporates a "Soft Mute™" system. This will mute the entertainment devices during intercom conversation or radio reception. The four muting modes are controlled by the front panel "Mute" button. See §3.9 for more information.

CAUTION

Local oscillators and internal signals from entertainment 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 entertainment devices must be switched off for both takeoff and landing.

2.7.2.1 Entertainment 2 Mute (J2 Pin 13 & 14)

Connecting J2 pin 13 to pin 14 (or ground) through a SPST switch places the entertainment #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 allows uninterrupted music during casual conversation.

2.8 Disassembly

Remove the top cover, by removing four (4) or five (5) Phillips head screws from the PAR100EX top.

NOTE: THE SCREW IN THE REAR OF THE PANEL (if present) IS A DIFFERENT LENGTH THAN THE OTHER FOUR. YOU MUST PUT THIS SHORTER LENGTH SCREW BACK IN THE SAME LOCATION OR DAMAGE WILL OCCUR. See Figure #2-2.

There is a spacer on the screw on the front right corner that will fall out. Save and retain for later.

Long screws
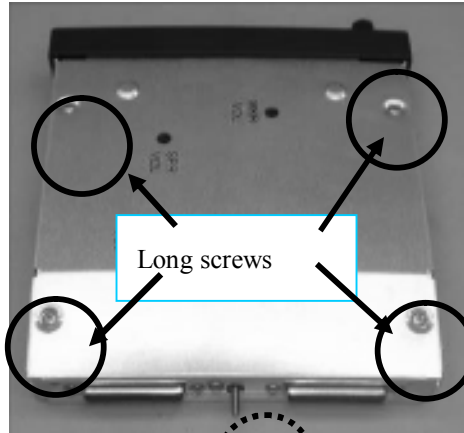
Figure 2-4 Screw Location and disassembly

Short screw (if present)

2.9   Conversion to 12V electrical system.

As shipped from PS Engineering, the PAR100EX is configured to operate in 24 aircraft. This protects the M760REM from damage if installed in 24 volt aircraft.

If operation in a 12-volt aircraft is desired, internal jumpers must be changed to allow operation of the M760REM. Disassemble the unit as described in §2.8.

1.   The operating voltage is configured with selection jumpers located in the back corner near the left sub-D connector. See Figure #2.

Jumpers in 24V location
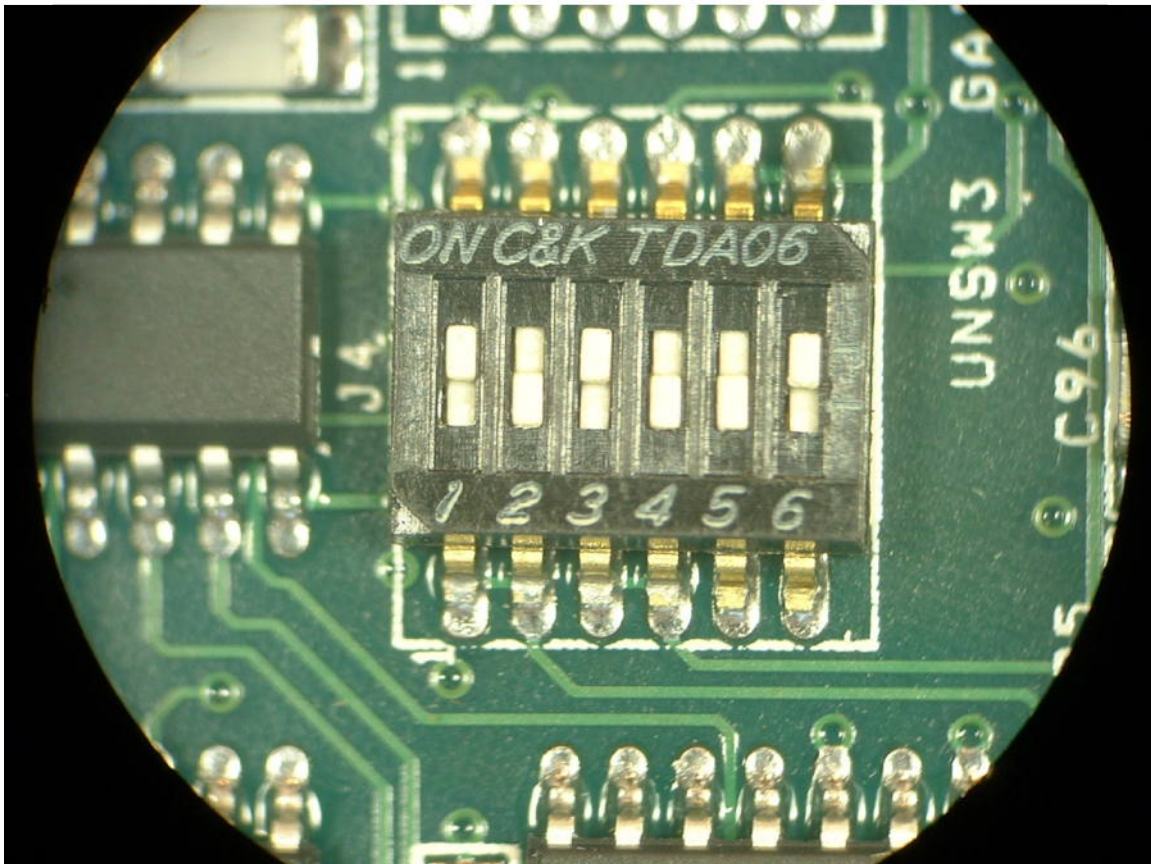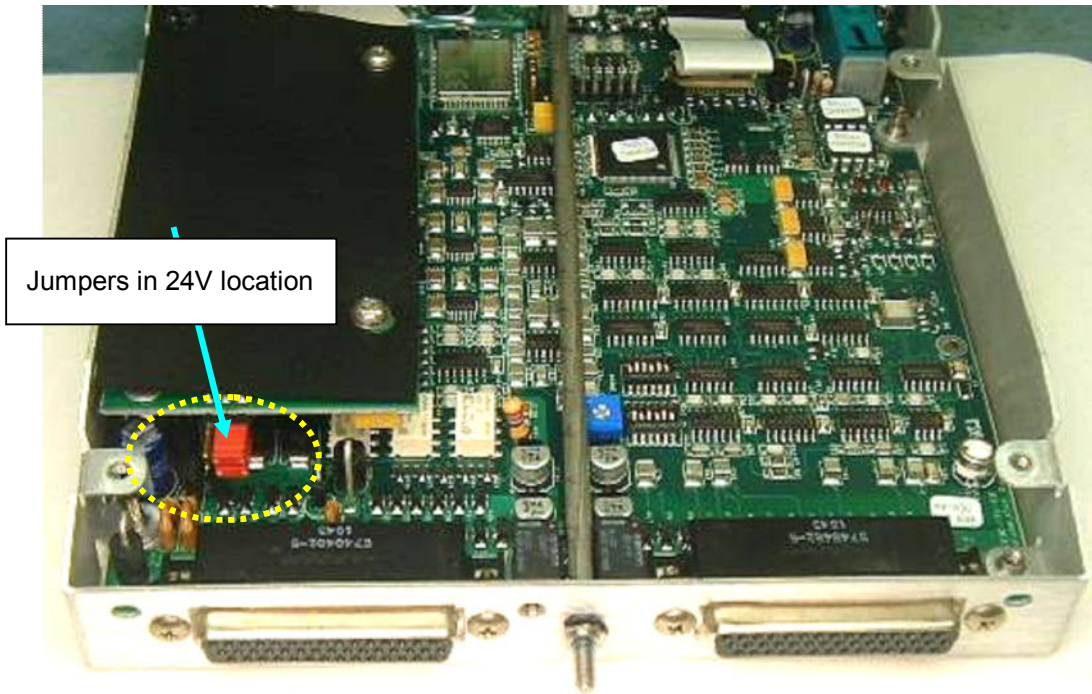
Figure #2

2. Relocate the red jumpers so it matches the picture below.
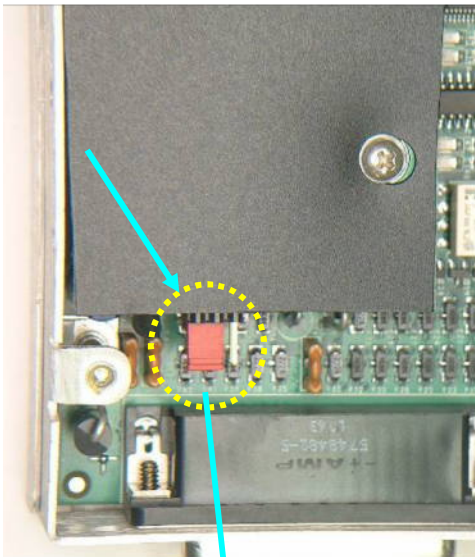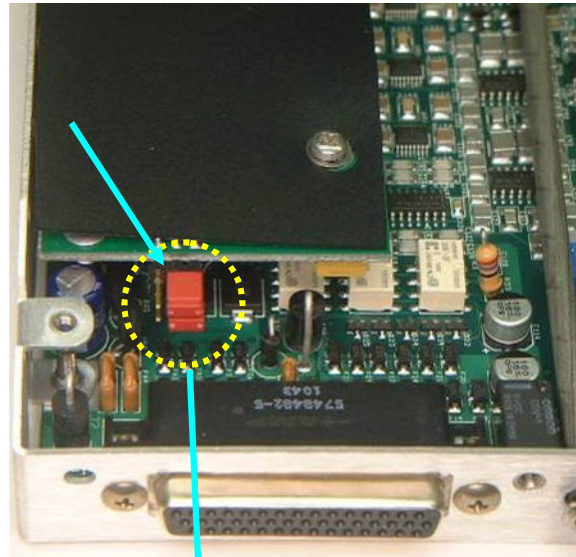
Jumpers set for 12 V Operation   Jumpers set for 24V operation
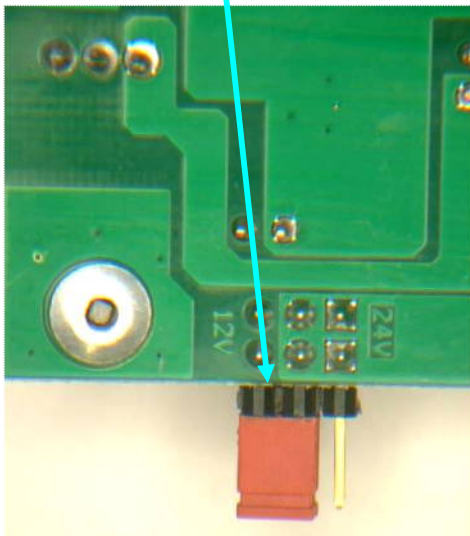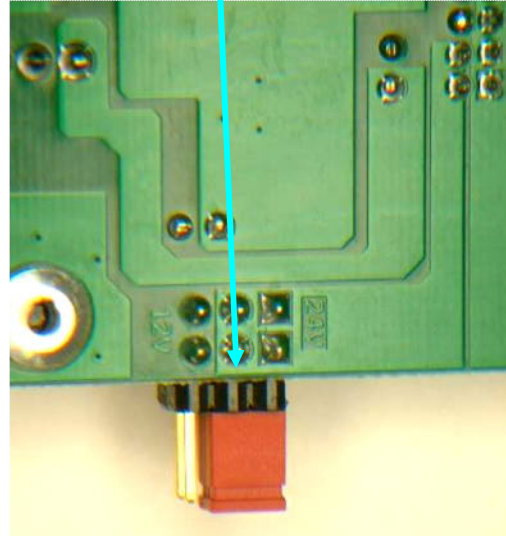
Jumpers set for 12V operation   Jumpers set for 24V operation

2.10 Adjustments

The PAR100EX is factory adjusted to accommodate the typical requirements for most aircraft configurations. There are three adjustments accessible through the top cover (see §2.8) that allow the installer to fine tune the specific functions.

- Unswitched Input 3 Volume (US3), adjust from 50% to 200% of input value. Turn *counterclockwise* to increase gain.

- TEL VOL- The received telephone volume. The unit is set at the factory for 75% of volume. Turn *Clockwise* to increase the TEL receive volume.

- LCD CST: adjusts display contrast to suit individual preferences and ambient light.
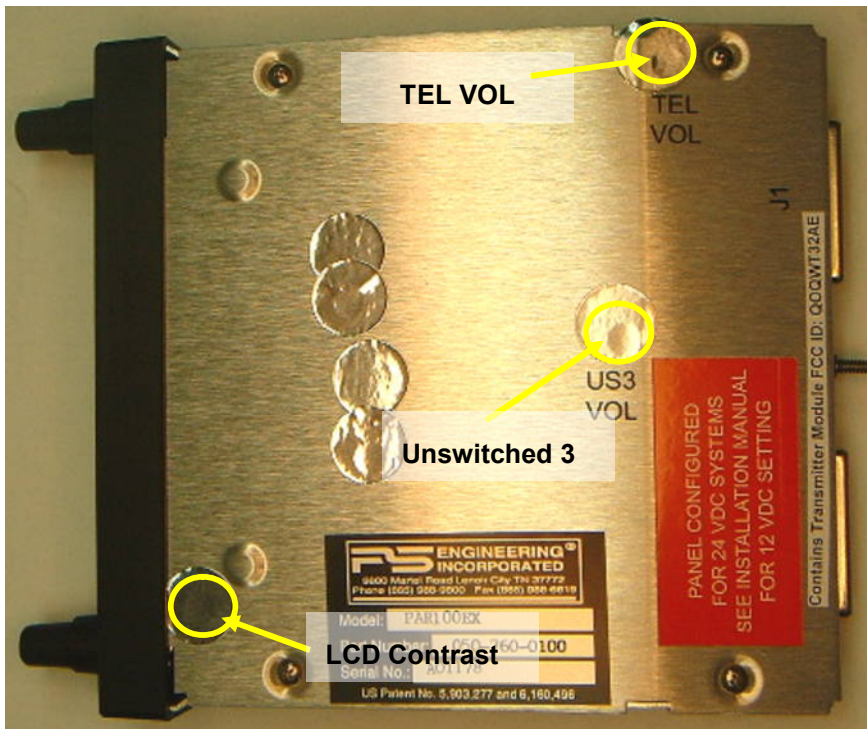
Figure 2-5 PAR100EX Cover adjustment locations

2.11 Microphone gain reduction

For installations in very noisy aircraft, a reduction in the intercom microphone input gain may be desirable. The PAR100EX has two DIP switches located on the main board that can switch the inputs to a lower gain setting.

Remove the top cover (see §2.8), and locate the two DIP switches near the mounting rod at the rear of the unit.

NOTE:

If top cover is removed for ANY reason, you MUST replace the cover screws with the proper length, otherwise damage will result.
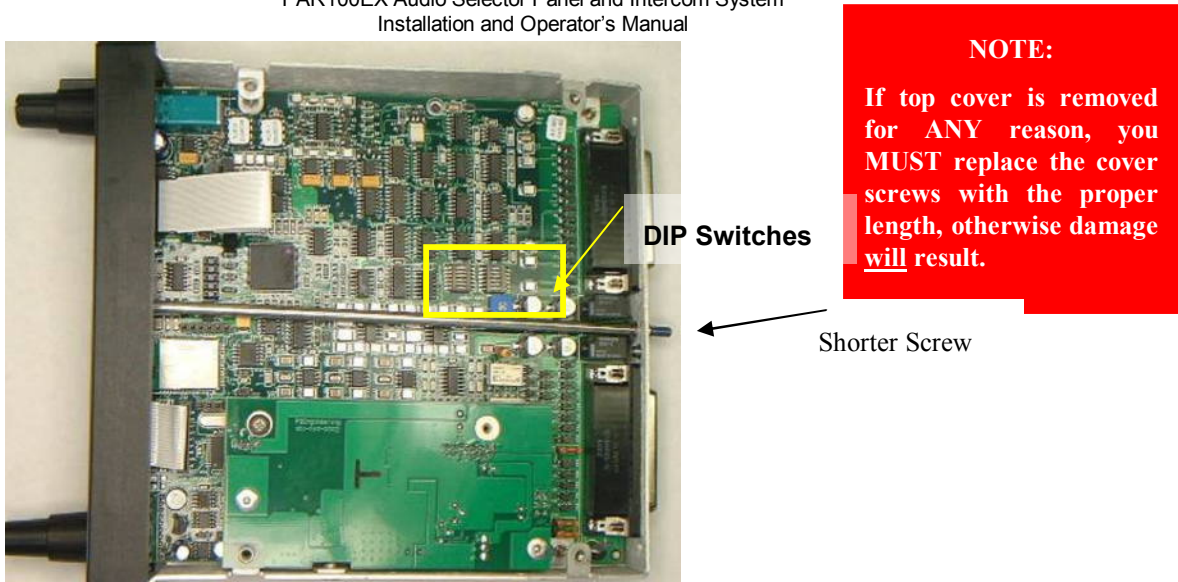
Figure 2-6 – PAR100EX DIP Switches
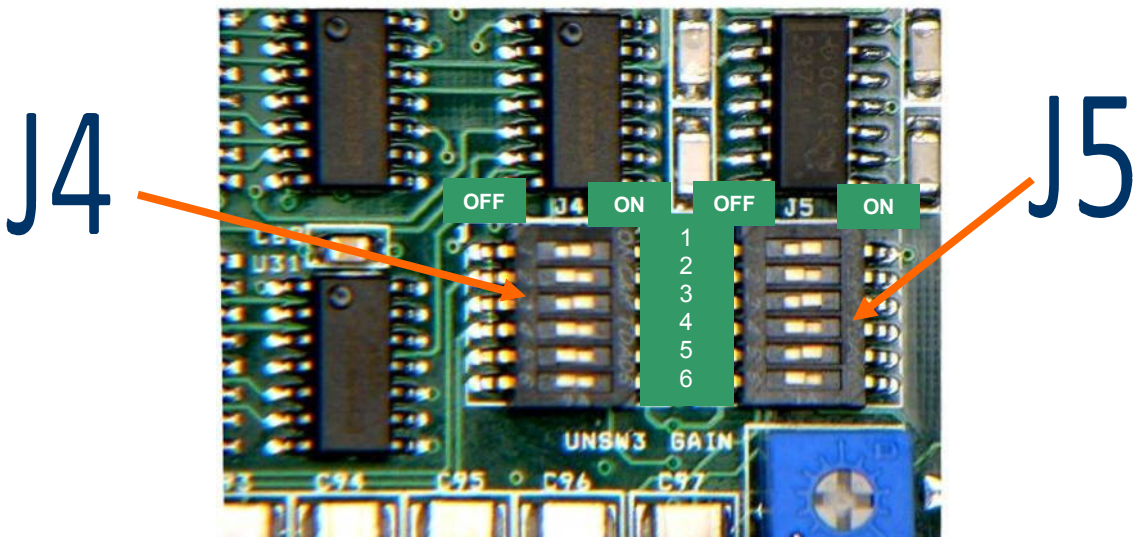
Figure 2-7 DIP switches

Change the settings as shown in the table below.

Switch Bank	Switch	Noisy Cockpit	Normal Cockpit
	Pilot Microphone		
J5	1	OFF	ON
	2	ON	OFF
	Copilot Microphone		
	3	OFF	ON
	4	ON	OFF
J4	Passenger 1 Microphone		
	1	OFF	ON
	2	ON	OFF
	Passenger 2 Microphone		
	3	OFF	ON
	4	ON	OFF

Table 2-5 Microphone gain settings

Carefully reassemble the unit.

2.12 Reassembly

3. Using the nylon spacer removed in step 2, compress the spacer so it becomes ob-long.
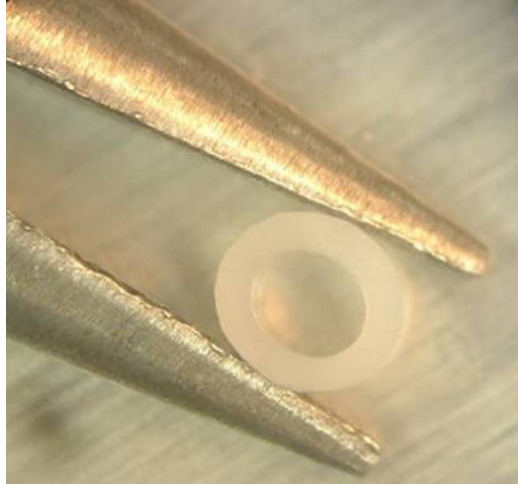
Figure #3

a. Install one long screw through the top lid, near the front edge on the power supply board side, and add then add the nylon spacer from § 2.8.
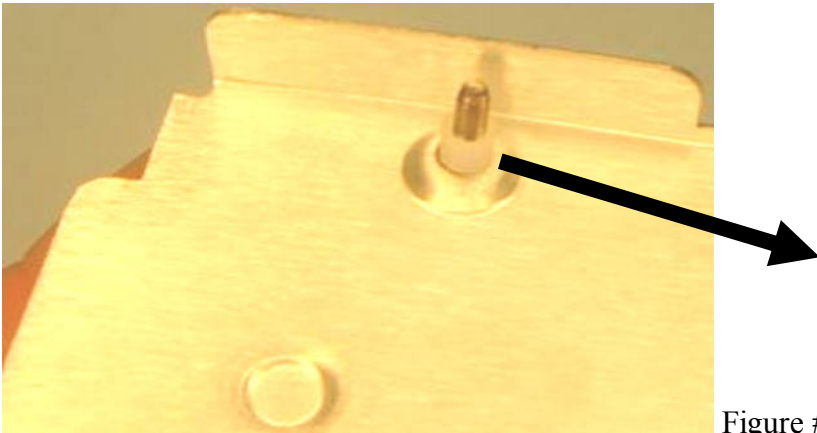
Figure #4

4. Place the lid back on the unit aligning holes.
5. Install qty. 3 more long thread screws into the lid.
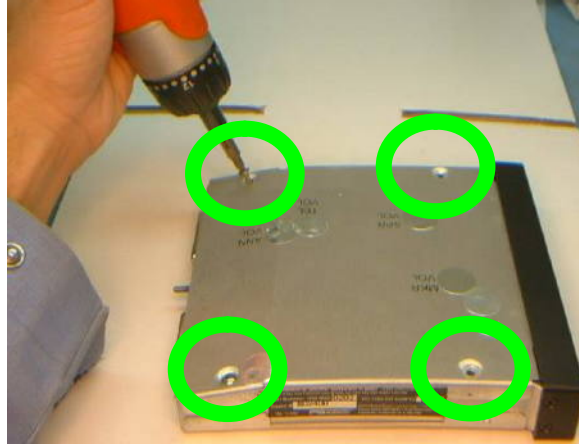
6. Install qty. 1 short thread screw to the rear of the unit.

2.13 Communications Antenna Installation Notes

2.13.1 Metal Skin Aircraft

For metal skin aircraft a ¼ wave whip is the easiest antenna to fit. Ensure that the antenna base and the coax shield are firmly grounded to the skin of the airframe, on the inside of the aircraft. Ensure that any anti-corrosion product, which may be used to seal the exterior surface, does not isolate the antenna base from the airframe. For best performance, the whip should be straight and vertical, when mounted on the airframe.
Refer to the Microair Avionics website www.microair.com.au for more detail on antennas suitable for metal skin airframes.

2.13.2 NON-METAL SKIN AIRFRAMES

For non-metal airframes, a ¼ wave whip may still be used, but a ground plane must be installed, on the inside face of the aircraft skin. The ground plane should ideally be circular, and as a minimum, have a diameter of half the height of the whip. The ground plane should be fabricated from a lightweight metal, eg thin aluminum sheet. For best performance, the whip element should be as vertical as possible. An alternative antenna for non-metal airframes is the Ground Plane independent dipole. This antenna is physically similar to the ¼ wave whip, but has a small flexible stub antenna pointing downwards from the antenna base. The stub section of the antenna takes the place of the ground plane, and simplifies installation. Avoid mounting locations which position the antenna parallel to nearby metallic airframe structures such as tube framing, brackets, ribs, or frames. Metal objects which are close and parallel to the antenna will adversely affect performance. If the installation has two radios, the two antennas should be separated horizontally by at least the length of the antenna. In the case of airband antennas this should be approx 1m (3ft). The further apart the better.

Beware of fabric surfaces with silver dope finishes. The silver dope is a conductive surface, and will screen antennas which are mounted internally. Refer to the Microair Avionics website www.microair.com.au for more detail on antennas suitable for non-metal skin aircraft.

2.13.3 Antenna Location

For best results while in Split Mode, we recommend that the one VHF communications antenna is located on <u>top</u> of the aircraft while the other communications antenna is installed on the <u>bottom</u>. Any antenna relocation must be accomplished in accordance with AC 43.13-2B, aircraft manufacturers' recommendations, and other 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 PAR100EX in Split Mode.**

2.14 M760REM Adjustments

The microphone gain and sidetone are adjustable via the trim pot(s) which can be accessed via the small hole(s) in the side of the chassis.

Figure 2-8 Radio Adjustment Locations

Figure 2-9 Sidetone adjustment range

The radio receive audio level is adjusted at the rear of the case.

Figure 2-10 Radio Output Level Adjustment

2.14.1 Installation of Ferrite Core Suppressor.

The RFI suppressor must be installed on the audio/data cable as shown to prevent RFI.

These devices are fitted over wiring harnesses to "attenuate" the RF noise signals passing along the wires.

Symptoms may include:
1. Squelch light stays illuminated (without any transmit or receive).
2. Excessive noise heard in the headset (in transmit or receive),
3. Garbled or otherwise poor transmit audio, particularly when engine is running or revving higher.

In addition, if symptoms occur, check all ground connections (do a visual and physical check) to ensure that they are making proper contact (if any are even slightly suspect rework them); this includes any circuit breakers, batteries etc.

Figure 2-11 Ferrite Installation

2.15 PAR100EX Pin assignments

J1	Function	J2	Function
1	No Connect	1	Pilot Phones Lo
2	No Connect	2	Copilot Phones Lo
3	No Connect	3	Copilot Phones (L)
4	No Connect	4	Copilot Phones (R)
5	No Connect	5	Lights lo
6	No Connect	6	12/28 V Lights
7	No Connect	7	12/28 V Lights
8	No Connect	8	Aircraft Power (12 VDC)
9	Com 1 Audio	9	Aircraft Power(12 VDC)
10	Com 1 Audio Lo	10	Aircraft Ground
11	Com 1 Mic	11	Aircraft Ground
12	Com 1 Mic Key	12	No Connect
13	Com 2 Audio	13	Music 2 Mute Inhibit
14	Com 2 Audio Lo	14	Music 2 Mute Inhibit Lo
15	Com 2 Mic	15	Unswitched #4
16	No connect	16	Pilot Phones (L)
17	Aux 1 Audio	17	**RS232 RXD**
18	Aux 1 Audio Lo	18	No connect
19	Aux 2 Audio	19	No connect
20	Aux 2 Audio Lo	20	Swap
21	No Connect	21	Swap Low
22	Unswitched #3 Lo	22	Music 1 All Headsets
23	No Connect	23	Music 1 (L)
24	No Connect	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	**RS232 TX**
30	Com 2 Mic Key	30	**+12 VDC Radio Out**
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	No Connect	36	Pass 1 Mic Audio Lo
37	No Connect	37	Pass 2 Mic Audio
38	No Connect	38	Pass 2 Mic Audio Lo
39	No Connect	39	No Connect
40	Pass HP (L)	40	Unswitched #4 Lo
41	Pass HP (R)	41	No Connect
42	Pass HP Lo	42	**+12 VDC Radio Lo**
43	Unswitched 2 Lo	43	**Radio Power Ground**
44	Unswitched 2 Audio	44	**Radio power**

2.16 Post Installation Checkout

After wiring is complete, verify power is ONLY on pins 8, 9 and 44 of the J2 and airframe ground on connector pins 10, 11 and 43. Failure to do so will cause serious internal damage and void PS Engineering's warranty.

2.17 Unit Installation

To install the PAR100EX, 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.**

2.18 Operational Checkout

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.

1. Apply power to the aircraft and avionics.
2. Plug 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 Com 1 Xmt select button (lower row).
7. Verify that both of the **Com 1** buttons 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 Com 1 Xmt button blinks when transmitting.
9. Verify that pushing the **COM 2** 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 Com 1 Xmt button. While holding the Com 1 button, press the Com 2 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 means. The A1 and A2 indicators illuminate to show which navigation audio source is in use.
13. Verify that the appropriate LED in the lower button row blinks when either push to talk is keyed.
14. Verify proper Intercom system operation in the **ALL, ISO** and **CREW** modes (see Table 3-1).
15. 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.

2.18.1 M760REM Checkout

2.18.1.1   Ground check:

1. Connect an in-line type watt meter and verify that the antenna VSWR does not exceed 2:1 across the frequency band from 118.000 to 137.975 MHz.

2. Select the frequency of a local communications facility and verify that the receiver output is clear and intelligible.

3. Establish communication with a local facility and verify that the transmission is reliable, and quality is clear and intelligible. Verify that sidetone is present for the appropriate crewmembers and passengers (depending on intercom mode).

2.18.1.2   Flight check:

1. Maintain at least 1500 feet AGL, and establish reliable contact with a facility at least 25 nm away.

2. Contact a facility within five nm and verify reliable contact.

3. Open the radio squelch by pushing the right knob for more than 2 seconds (or until the volume and squelch bars appear), and listen for any unusual electrical noise that might reduce the communications receiver sensitivity.

4. Verify operation at both high and low end of the frequency band (118.000 to 136.975 MHz) if possible.

2.18.2 TELEPHONE Checkout

Activate the TELEPHONE mode using the Bluetooth 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 place any person heard by the pilot on the intercom, also heard on the telephone.

2.19 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.

Return completed warranty registration application to PS Engineering, or complete online at www.ps-engineering.com.

Section III OPERATION

3.1 SCOPE

This section provides detailed operating instructions for the PS Engineering PAR100EX, Audio Selector Panel/Intercom/VHF Communication Control 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 PAR100EX systems. They are Communications Transceiver Selection, Audio Selector, Intercom, VHF COM, entertainment, telephone, and display.
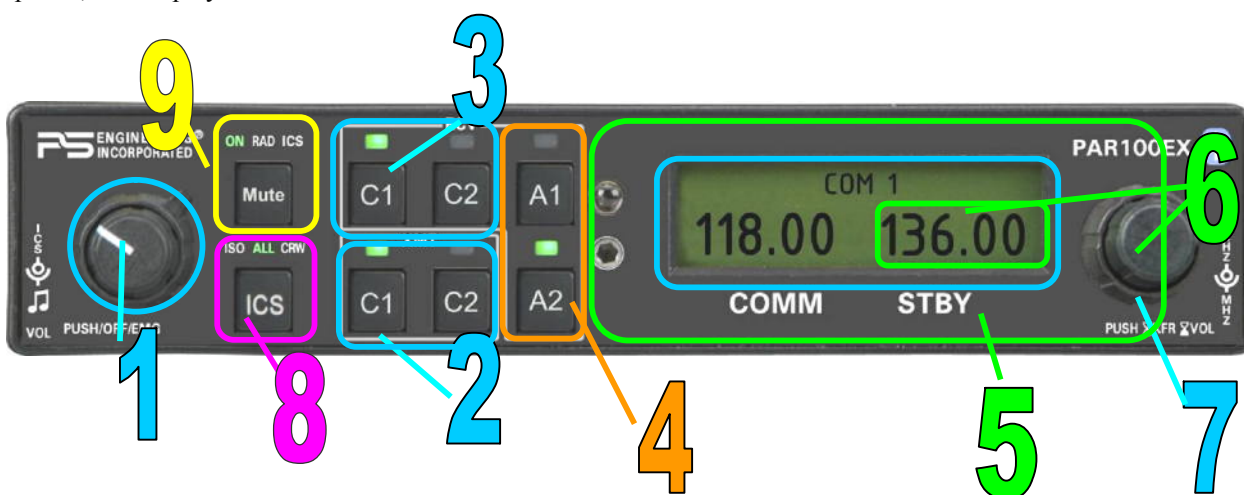
Figure 3-1 PAR100EX Operating controls

3.2 Power and Fail Safe (1)

Unit power is turned on and off by pushing the volume (left) knob. 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 portion will revert to fail-safe mode.

The power switch controls all audio selector panel functions and the intercom. All pushbutton selections and menu modes (except Bluetooth telephone association) will be remembered and return to the last state when turned on.

3.2.1 ICS and Music Volume Controls (1)

The inner knob (ICS) controls the volume of the intercom audio. It does **not** affect the radio, telephone, or music volume.

The outer knob (♫) controls the volume of the Music 1 input (and Bluetooth music). It has no effect on the radio, intercom, telephone, or Music 2 input for the passengers.

Adjust the radios 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.

3.2.2 M760REM Radio power (as COM 1)

The power supply for the M760REM communication transceiver is separate from the audio panel power and control. When the M760REM is installed as COM 1, or as a stand-alone COM, it can be controlled

separately in the event of a problem in the audio panel portion, or audio panel power.

If the audio panel is turned off by the left knob (or the audio panel breaker is opened), the display will indicate "Push radio knob within 6 (countdown") seconds to keep radio on" If the knob is not pushed, the com radio will also turn off, but if the data knob is pushed within, the radio display, volume and frequency control will remain active.

3.3   Communications Transmit (XMT) Selection (2)

The two buttons **C1** and **C2** (# 2) in the XMT section control which communications radio is selected for transmit. The top row of pushbuttons (# 3) allows selection of the receiver audio. Push the lower button to select the desired COM transmitter. A green LED above the button illuminates to indicate that the audio is selected.

The PAR100EX-Series has an automatic com receiver selector system. Audio from the selected transceiver is automatically heard in the headsets and speaker (if selected). You can check this function by switching from Com 1 transmitter to Com 2 transmitter by pressing the COM 2 transmitter selector pushbutton. See that the associated Com 2 receive pushbutton indicator light that is located immediately above the Com 2 transmitter pushbutton turns green. This guarantees that the pilot will *always* hear the audio from the transceiver selected for transmit.

The PAR100EX "remembers" the receiver selection, so that when switching transmitters from COM 1 to COM 2, if COM 2 audio was previously selected, COM 1 audio will continue to be heard. This eliminates the pilot having to switch Com 1 audio back on, after changing transmitters.

When switching from COM 1 to COM 2 while Com 2 was not previously selected, COM 1 audio will be switched off. In essence, switching the mic selector will not override prior selection of COM receiver audio.

In normal (not split) modes, the PAR100EX gives priority to the pilot's radio Push-To-Talk (PTT). If the copilot it transmitting, and the pilot presses his PTT, the pilot's microphone will be heard over the selected com transmitter.

3.3.1.1 Split Mode

The split mode can be activated at any time by pressing the **C1** and **C2** <u>**XMT**</u> buttons <u>at the same time</u>. This places the pilot on COM 1 and the Copilot on COM 2.

Pilot on COM 2 and Copilot on COM 1 is not possible.

NOTE
Due to the nature of VHF communications signals, and the size constraints in general aviation aircraft, it is probable that there will be some bleed-over in the Split mode, particularly on adjacent frequencies. PS Engineering makes no warranty about the suitability of Split Mode in all aircraft conditions.

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

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

3.4   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 <u>always</u> hear the audio from the selected transceiver.

In SPLIT mode, only the pilot will hear selected navigation audio (A1 & A2).

3.5   Navaid Audio selection (4)

VHF Navigation receiver audio is selected through two momentary, push-button, backlit switches.

The users can identify which receivers are selected by noting which green LEDs are lit above the button.

Navigation aid audio push buttons are labeled **A1**, **A2**.

The **MKR** (Marker), **ADF AUX** (auxiliary) and **DME** audio is available is interfaced through an unswitched input.

3.6 VHF Transceiver control (5)

The right side of the PAR100EX is dedicated to control of the VHF communications transceiver. Frequency selection is always directed to the STANDBY side of the display.

3.6.1 Frequency Selection (6)

Turn the large (outer) knob to change the frequency whole MHz, and the smaller, inner knob to change the .100 MHz frequency.

Push the small knob momentarily to transfer standby frequency to the active frequency.

Push momentarily to transfer.

3.6.2 Radio Volume and Radio Squelch (7)

To change the radio volume, or defeat the automatic radio squelch, push and hold the frequency-select knob for one second, until the display changes to the menu.

Push/hold for >1 sec.
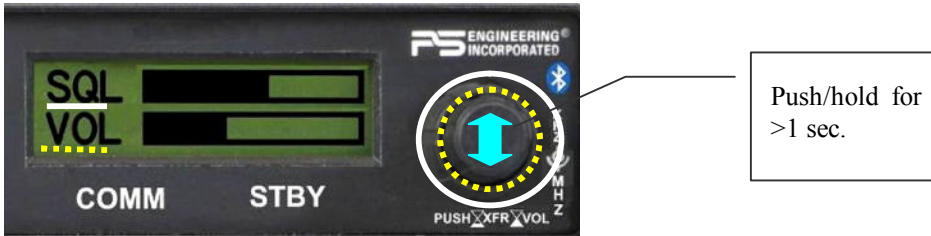
Turn the large knob to turn the radio squelch on or off (to listen for weak signals), and the small knob to adjust the radio receive audio level. You can push the knob again to return to the frequency display, or the display will revert automatically after five seconds without any activity.

3.6.3 Monitor Mode (COM 1 or stand alone only)

If the M760REM is interface as a stand alone COM or as COM 1, the radio's standby frequency monitor can be used. To activate the monitor mode, press and hold the C2 RCV button until "**MON**" appears in the display.

When MON is active, the receiver is tuned to the Standby frequency and passes received audio on that channel. When the Active frequency receives a signal, the signal from the active frequency is automatically provided to the audio.

Both active and standby frequencies are monitored at the same time for a signal. A signal can be received on either the active or the standby frequency.

While receiving a signal on the active frequency - the standby channel is **NOT** monitored.

While receiving a signal on the standby frequency - the active channel is periodically monitored. If a signal is found on the active frequency the **M760REM** will revert to the active frequency. After a signal has been received, the **M760REM** will return to monitoring both frequencies.

It will be important to remember which frequency is active and which is standby, to avoid answering a transmission on the standby frequency by transmitting a response on the active frequency.

> NOTE:
> Although the M760REM can select and receive on the VHF NAV frequencies (108.00 to 117.95 MHz), transmission is inhibited.

3.7 Intercom Operation (8)

3.7.1 *IntelliVox®* VOX-Squelch

No manual adjustment of the *IntelliVox®* squelch control is possible. Through individual signal processors, the ambient noise appearing in all four 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 intercom can be configured for high noise environment by internal switching. See § 2.10 for more information.

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.

Table 3-1 Mic Muff ™ Part Numbers

Manufacturer	Model	Mic Muff™ Part Number
Bose	Dynamic	90010
	Electret	90015
	M87 Dynamic	90020
David Clark	H10-30	90010
	H10-20, H10-40	90015
	H10-13.4	90015
Lightspeed	All	90015
Peltor	7003	90010
	7004	90015

Manufacturer	Model	Mic Muff™ Part Number
Pilot	11-20 & 11-90	90015
Sennheiser		90015
Telex	Airman 750, Echelon	90015
	AIR3000	90010

3.7.1.1

3.7.2 Mono headsets in Stereo Installation

The pilot and copilot positions work with stereo or mono headsets. All passenger headsets are connected in parallel. Therefore, if a monaural headset is plugged in to a PAR100EX Stereo installation, one channel will be shorted. Although no damage to the unit will occur, passengers with stereo headsets will only hear in one ear, unless they switch to the "MONO" mode on their headset.

3.7.3 Intercom Modes (8)

The "**ICS**" pushbutton switch on the left side of 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. An LED behind the text shows which mode is currently active.
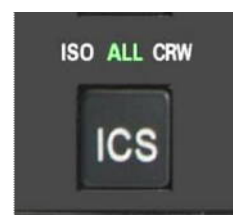
ISO: The pilot is isolated from the intercom and is connected only to the aircraft radio system. He will hear the aircraft radio reception (and sidetone during radio transmissions). Copilot will hear passengers' intercom and entertainment, while passengers will hear copilot intercom and entertainment. Neither will hear aircraft radio receptions or pilot transmissions.

When the audio panel is put into the "Split Mode" (pilot on COM 1, copilot on COM 2), the intercom automatically enters the ISO mode to prevent confusion with two intercom conversations. The intercom can be changed to the CRW or ALL mode if desired.

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

3.8 Telephone Mode

3.8.1 Bluetooth Telephone Connection

Before the PAR100EX can be used in TELEPHONE mode with a wireless Bluetooth connection, the unit must be associated with a specific phone.

Activate the "seek device" function on the cell phone, and then enter the access code "**0000**" when the phone detects the "PAR100EX" on the list of available devices.

When the PAR100EX is paired with the Bluetooth device, the letters "**BT**" appears in the display.

This process will be necessary for any phone to be used, and only one cell phone can be associated with the audio panel at a time. If the additional phones are associated with the PAR100EX at the same time, only the *first* phone will transfer audio to the panel.

If the Bluetooth connection fails to reconnect, or becomes unreliable for any reason, you can reset all connections by turning off the PAR100EX, holding the A1 and A2 buttons down, and turning the unit back on. This clears out all paired devices.

3.8.2 Telephone (TEL) Operation

When the Bluetooth-enabled phone receives an incoming call, the PAR100EX will play a ring tone. Answer the call from your telephone handset. The PAR100EX exits the telephone mode automatically when the cellular phone hangs up.

In TELEPHONE mode, the pilot microphone and headphones are connected to the cell phone. The pilot PTT will switch the pilot mic to the selected com transceiver, and allow continued aircraft communications to continue.

The copilot will also be able to transmit on the other selected radio with his PTT as well.

Entering the TEL mode connects the telephone to the users as follows:

In **ALL** intercom mode, all crew and passengers will be heard on the phone when they speak. Com and other selected radio audio is also heard in the headsets. If the pilot or copilot pushes the radio PTT, their mic will be transferred to the selected Com radio. The telephone party will not hear ATC communications, and vice versa.

In **CREW** mode, only the pilot and copilot are connected to the telephone. Passengers will not hear the telephone. The pilot and copilot will also have transmit capability on the other selected transceiver.

In **ISO** intercom mode, when the PAR100EX 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 to the pilot.

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.

WARNING

Federal Communications Commission regulation 47 CFR 22.925 prohibits the use of 800MHz Cellular handsets in any aircraft that is airborne. Violation of this rule could result in suspension of service and/or a fine.

3.9 Entertainment Inputs

The PAR100EX has two *independent* music inputs at the rear connector. The PAR1000EX also has the ability to receive streaming music from a Bluetooth-enabled device. If both inputs are active, both will be heard in the headset at the same time, there is not any prioritization.

Music #1 will be normally heard by the pilot and copilot positions ONLY. Music 2 is ONLY available to the two passenger positions.

Music #1 can also be distributed to the passengers using the rear connector control (See § 2.7.1.1). The streamed music in the PAR100EX is also Music 1.

Music Distribution Mode	Standard Music Distribution			Music 1 All Headsets		
Music Source ⟋ ⟋ ⟋ ICS Mode	All	Crew	ISO	All	Crew	ISO
Music 1 & (Bluetooth) Input	Crew	Crew	Copilot	Crew & Pass.	Crew & Pass.	Copilot& Pass.
Music 2 Input	Pass.	Pass.	Pass.	**NONE**	**NONE**	**NONE**

Figure 3-2 Music distribution

NOTE:
All music devices should be turned off for take off, 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

3.10 Music Muting (9)

There are two SoftMute™ muting circuits. The front panel "Mute" button has four modes, and controls the Mute function for music 1. Music 2 muting is controlled by an external switch, and has two modes, mute on and mute off.

The SoftMute™ circuit will cut the music out 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.
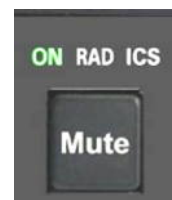
The Music 1 mute mode functions are controlled through sequential pushes of the Mute button, and include LED indication of the mode selected.

MUTE ON - music **will** mute with *either* intercom *or* radio – MUTE ON button is lit.

RADIO MUTE – Intercom will **not** mute music, radio *will* mute music. RAD LED indicator is on

INTERCOM MUTE - Radio will **not** mute music, intercom *will* mute music - MUTE ICS LED is ON.

MUTE OFF - "Karaoke" mode - music will not mute except during outgoing transmissions.- All Indicators off.

♫ **Music**	**Intercom**	**Radio**	**LED INDICATOR**
Mute ON	Muted	Muted	ON
Mute OFF	♫	♫	None
Radio Mute	♫	Muted	RAD
ICS Mute	Muted	♫	ICS

The passenger's intercom also has a SoftMute™ circuit. If the passengers hear the radio, or talk on the intercom, the music will mute. If the audio panel is in CREW mode, then the radio reception will not affect the passenger music.

3.10.1 Music 2 Mute Control

Passengers also have a Karaoke Mode. If the passengers are listening to the music 2 input, their Karaoke Mode is activated by an external switch. See § 2.7.2.1

If the passengers are listening to the Music 1 input, their Karaoke Mode is controlled by the front panel "Mute" button.

3.10.2 Liquid Crystal Display Control

The contrast on the LCD display can be controlled by using a service adjustment located inside of the unit. See § 2.10 for adjustment information.

Section IV – Warranty and Service

4.1 Warranty

In order for the factory warranty to be valid, the installations **must be accomplished under the supervision of an authorized PS Engineering dealer**. **If the unit is being installed by a non-certified individual in an experimental aircraft, a PS Engineering authorized dealer, or 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 <u>date of sale</u>. During the two-year warranty period, PS Engineering, Inc., at its option, <u>will send a replacement unit</u> at our expense if the unit should be determined to be defective after consultation with a factory technician.

<u>All transportation charges for returning the defective units are the responsibility of the purchaser</u>. 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 – External PTT Hook Up

Part of the installation includes the installation of PTT (Push To Talk) switches that allow the use of your aircraft radio for communications transmissions.

There are three possible configurations ; you must select the case that best fits your installation.

NOTE: Only the person who presses their PTT switch will be heard over the radio.

CASE I

The PTT is built into the pilot and copilot yokes

Simply install the plugs from the headset into the aircraft headphone jacks. Then use the yoke mounted PTT to transmit. No other action is required.

CASE II

Built in PTT only on the pilot side only

This configuration requires a modified external PTT switch plugged into the copilot's mic jack. (See Details Below) When the copilot's PTT is depressed, this activates an internal relay that switches the mic audio to the aircraft radio from the pilot to the copilot.

Case III

No built in PTT switch at all.

Two built-in PTT must be installed, or two external, modified PTT switches will be required for both the pilot and copilot. Modifications to the PTT are required. (See details below)

Push To Talk Modifications

When received from the manufacturer, an after-market PTT switch opens the mic audio path to the "ring" connection of the PTT mic plug until the button is pressed. When the PTT is between the intercom and the headset, the intercom function will not work unless the PTT switch is depressed. A simple modification can be performed to allow proper intercom operation. NOTE: This mod does not alter normal operation.

Below are some examples of typical modifications. Contact the PTT manufacturer for more details if necessary.

Procedures For David Clark PTT
Unscrew the round black plastic cover from the jack.
Connect the joined black wires to the red wire.
Replace the round black plastic cover.

Procedures for Telex PT-200
Unscrew the round black plastic cover from the jack.
Cut the red wire in the middle of the wire.
Strip both ends of the insulation.
Solder the two ends to the ground lug to the PTT jack.
Replace the round black plastic cover.

Procedures for Telex PT-300
Unscrew the round black plastic cover from the plug jack.
Remove the heat shrink material from the joined black wires.
Solder these two wires to the lug that has a white wire already soldered to it.
Replace the round black plastic cover

Appendix B – PAR100EX Installation Drawings

431-891-0100 Retaining Block (2 ea)
44-pin connector (2 ea)
475-440-0007 (4 ea)
475-440-1038 (4 ea)
Ø0.20 in 8 plcs
Ø0.50 in 2 plcs
Rack 430-890-0040
Rack back plate 430-890-0050
Solder lug 475-009-0001
Nut (1 ea) 475-013-0001

J2
Ground Lug 475-440-0001 (x2)
J1
Back plate assy
475-440-0001 (x2) Screw w/washer
475-009-0001 ground lug (x2)
Viewed from Back
Ground Lug
Ground lug detail

Rear plate detail (not to scale)
6.31 in
1.28 in

1.28 in
0.96 in
0.36 in
0.37 in
3.87 in
5.53 in
6.04 in

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

M760REM Radio Installation Drawings

3.70 in

3.40 in   2.99 in

.160 x .400 in
4 places

4.60 in

Appendix C – J1 Connector Interconnect

PAR100EX Connector, J1 (Sub-D 44-pin, male on tray)

Primary Communications Transceiver

Com 1 Audio Hi	9
Com 1 Audio Lo	10
Com 1 Mic Audio Hi	11
Com 1 Mic Key	12

Ferrite RFI Supressor (507-000-0065) see Note 7

Secondary Communications Transceiver (R760)

R760 pin	Signal	J1 pin
14	Com 2 Audio Hi	13
12	Com 2 Audio Lo	14
1	Com 2 Mic Audio Hi	15
7	Com 2 Mic Key	30
2	RS232 TX	
5	RS232 RX	
9	Radio Power	
11	Radio Ground	

J2

29	
17	
30	
42	
11	

See Note 6

VHF Nav 1

Nav 1 Audio Hi	17
Nav 1 Audio Lo	18

VHF Nav 2

Nav 2 Audio Hi	19
Nav 2 Audio Lo	20

Unswitched Audio #1

Unswitched Input #1 Hi	31
Unswitched Audio Lo	32

Unswitched Audio #2

Unswitched Input #2 Hi	44
Unswitched Audio Lo	43

Unswitched Audio #3

Unswitched Input #3 Hi	29
Unswitched Audio Lo	22

See Note 5

Pilot PTT

Pilot Mic Audio Hi	33
Pilot Mic PTT	34
Pilot Mic Lo	35

Pass. 1 Phones Jack

41	Pass. Phones (R)
40	Pass Phones (L)
42	Pass. Phones Lo

Pass. 2 Phones Jack

Notes:
1. All shields should be grounded at audio panel only. Other end remains floating.
2. All Power, and Ground wires shall be #22 gage wire Lighting #22 AWG, other wires minimum #24 AWG
3. All mic and headphone jacks must be isolated from ground.
4. All shielded wires must be MIL 22750 or 27500.
5. Unswitched inputs are always presented to crew headphones, regardless of SPR switch or PTT. Unswitched #3 is adjustable
6. All connections for R760 Radio shown for convenience. Shown as COM 2. Can be connected as COM 1. See 2.5.2.
7. Ferrite RFI Supressor, 507-000-0065 must be installed on radio audio and data lines. See Sect. 2.14.1

Appendix D – J2 Connector Interconnect

PAR100EX J2 CONNECTOR
(Sub-D 44-pin male on tray)

Pin	Signal
31	Pilot Phones (R)
16	Pilot Phones (L)
1	Pilot Phones Lo
4	Copilot Phones (R)
3	Copilot Phones (L)
2	Copilot Phones Lo

Pilot PhonesJack

Copilot PhonesJack

Communications Transceiver (R760)

Pin	Signal	R760 Pin
29	RS232 TXD	2
17	RS232 RXD	5
30	Radio Power	9
42	Radio Ground	11

Unswitched Audio #4
- Unswitched Input #4 Hi — 15
- Unswitched Audio Lo — 40

Pass. 1 Mic Jack
- Pass. Mic Hi — 35
- Pass. Mic Lo — 36

Pass. 2 Mic Jack
- Pass. Mic Hi — 37
- Pass. Mic Lo — 38

Copilot Mic Jack
- Copilot Mic Audio — 32
- Copilot PTT — 33
- Copilot Mic Lo — 34

Copilot PTT

Ent. #1 Input
- Ent. #1 Audio (R) — 24
- Ent. #1 Audio (L) — 23
- Ent. #1 Audio Lo — 25

Note 6

PASS Music   Ent. #2 Input
- Ent. #2 Audio (R) — 27
- Ent. #2 Audio (L) — 26
- Ent. #2 Audio Lo — 28

Ground Lug — 10
Airframe Ground — 11, 43

Audio Panel Power (Shipped for 24V) — 8, 9
3A Breaker See Note 3, 7

Radio Power — 44
3A Breaker See Note 3 & 7

14
13
Ent. #2 Mute

Music 1 All headsets — 22
Swap — 20
Swap Switch

Backlighting See Sect. 2.4.2 — 5, 6, 7

Backlighting See Sect. 2.6.3

12 V Lights Hi
7
6
5
12-Volt lights lo

Notes:

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 3 A breaker to aircraft power
   for the audio panel.
   Pin 44 is connected through a SEPARATE 3A breaker to aircraft
   power for communication radio.
   Breakers must be pull-type.
4. All shielded wires must be MIL 22750 or 27500.
5. For music distribution information, see Section 2.5.1.
6. Use care when connecting music signal and ground inputs.
   Refer to section 2.4.1.1 for more information.
   Failure to properly interface music can result in
   added noise.
7. This system shipped configured for 24VDC.
   See section 2.9 for 12V operation.

CAUTION
TO PREVENT DAMAGE TO THE M760REM, THE PAR100EX MUST BE PROPERLY CONFIGURED FOR 12 OR 24 OR 24 VDC OPERATION.