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PAR200

With Trig Avionics TY91(L)

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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

FAA-TSO C139, TSO C169a (PARTIAL)

**The product warranty is not valid unless this product is installed by an
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Rev	Date	Change
New	June 2013	Release for TSO Submittal
1	July 2013	Update with FAA-TSO Information
1.1	August 2013	Changed A1 and A2 to N1 and N2
2	August 2013	Updated with 8.33 kHz channeling information
3	December 2013	Corrected wording in §2.15, changed note in §2.9 for small screws.
4	December 2013	Added Alternate TY91(L) Part number, harmonize TY91 pin descriptions, and ETSO information

Section I – GENERAL INFORMATION

1.1 INTRODUCTION

The PAR200 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 PAR200.

1.2 SCOPE

This manual provides detailed installation and operation instructions for the PS Engineering PAR200-series of Audio Selector Panel/Intercom Systems. This includes the following units:

<u>Model</u>	<u>Description</u>	<u>PS Engineering Part Number</u>
PAR200	Stereo Audio Selector Panel with control for VHF Communications radio. Includes stereo intercom, with Bluetooth Interface	050-228-0100
TY91(L) 00882-00-05	VHF Communications Transceiver	050-228-8744
	or	
TY91(L) 01193-00-01	VHF Communications Transceiver	

1.3 EQUIPMENT DESCRIPTION

The PAR200 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 Trig VHF communications receiver. It can switch two transceivers (Com 1, Com 2) and two receivers (Nav 1, Nav 2).

A Bluetooth ® TELEPHONE feature allows the PAR200 to interface the aircraft headset(s) and Bluetooth enabled cellular devices.

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 PAR200 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 PAR200 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 PAR200. 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 knob controls the intercom volume level for the all headsets, while the large knob controls the music 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 — FAA TSO

1.1.1 PAR200

The PAR200 Intercom is FAA approved under TSO C139 (*Aircraft Audio Systems and Equipment*) and contains partial elements of TSO C169a (*VHF Radio Communications Transceiver Equipment Operating Within Radio Frequency Range 117.975 To 137.000 Megahertz*).

The partial TSO applies to C169a, because the PAR200 unit provides control and display only for the TY91-series of VHF communications equipment.

The PAR200-series Audio Selector Panels are FAA approved under TSO C139 (*Aircraft Audio Systems and Equipment*). The VHF Communication Transceiver portion of the PAR200 is **TSO approval** under TSO C169a.

The audio system complies with relevant portions of ED-14C/DO-160G (*Environmental Conditions and Test Procedures for Airborne Equipment*), DO-254, (*Design Assurance Guidance for Airborne Electronic Hardware*) and ED-18/DO-214 (*Audio Systems Characteristics and Minimum Operational Performance Standards for Aircraft Audio Systems*).

NOTE:

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards. The article may be installed only following 14 CFR Part 43 or the applicable airworthiness requirements.

1.1.2 Trig TY91-Series:

The VHF Communication Radio (Trig Avionics TY91L) is **EASA and FAA-approved** under ETSO 210.10042695, Rev. B or Subsequent Revision, under 2C169a Class C, E, H1, H2, 4, 6, ETSO 2C128, TSO C169a Class C, E, 4, 6, TSO C128a TSO-C169a, ETSO 2C169a Class C, E, H1, H2, 4, 6, ETSO 2C128, TSO C169a Class C, E, 4, 6, TSO C128a EUROCAE ED-23C, EUROCAE ED-67, EUROCAE ED-14F (RTCA DO-160F), RTCA DO-186B, RTCA DO-207 ED-12B (RTCA DO-178B) Level B DO-254 Level C

FCC Identification VZI00882

Applicable documents EUROCAE ED-23C, EUROCAE ED-67, EUROCAE ED-14F (RTCA DO-160F), RTCA DO-186B, RTCA Software ED-12B (RTCA DO-178B) Level B Hardware DO-254 Level C

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

Audio Selector/Intercom	FAA TSO C139
Communications Transceiver	FAA TSO-C169a (PARTIAL)
Environmental Qualification DO-160G	A1C1BAESRXXXXXXZ B(XX)ABATTBXXA2E2 XXX
<i>Operating Temperature Range:</i>	-20° C to 55° C , short term -40° C to +70° C
<i>Altitude:</i>	Up to 35,000 feet in a non-pressurized area
WEIGHT	
<i>PAR200 Unit</i>	1.1 lb. (0.49 kg)
<i>Rack with connectors</i>	0.51 lb. (0.24 kg)
AUDIO PANEL POWER REQUIREMENTS (Including Internal Lighting):	
<i>Voltage:</i>	11-33 VDC
<i>Maximum Current:</i>	2.5 Amp (Externally protected by a 3A pull-type breaker)

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Audio Selector Specifications	
<i>Audio selector panel input impedance:</i>	510 Ω
<i>Input Isolation:</i>	-60 dB (min.)
<i>Receiver Inputs:</i>	4 (Com 1, Com 2, Nav 1, Nav 2)
<i>Unswitched Inputs:</i>	4
<i>Transmitter Selections:</i>	3 (Com 1, Com 2, Com1/2)
<i>Headphone Impedance:</i>	150 – 1000 Ω
<i>Headphone Output:</i>	38 mW each headset, no clipping <1% THD typical into 150
<i>Speaker Output (into 4 Ω) with no clipping</i> 14 VDC: 28 VDC:	3 Watts (min.) 10 Watts (min.)
<i>Microphone Impedance:</i>	150 - 600 Ω
Intercom Specifications	
<i>Intercom Positions:</i>	4 places (with individual <i>IntelliVox</i> ® circuits)
<i>Music Inputs:</i>	2, (Independent, Stereo)
<i>Music Muting:</i>	>-30 dB "Soft Mute" when Com or intercom active.
<i>Distortion:</i>	<1% THD @ 38 mW into 150Ω
<i>Mic Freq. Response, 3 dB:</i>	300 Hz - 6000 Hz
<i>Music Freq. Response, 3 dB:</i>	10 Hz – 26 kHz

TY91 VHF Transceiver Specifications	
<i>Radio Type</i>	Amplitude Modulation (AM) Aircraft Transceiver
<i>Channels (Transmit & receive)</i>	760 channels, 25KHz spacing 2280 channels, 8.33 kHz spacing 118.000 – 136.992MHz
<i>Frequency Selection</i>	On PAR200 Audio Panel
<i>Frequency Display</i>	Alpha/numeric LCD display (with backlighting) on PAR200
<i>Frequency control</i>	PLL frequency synthesis, which is microprocessor controlled Memory is store in non-volatile EPROM
<i>Power consumption Receive (no signal)</i> <i>Transmit</i>	2.8W @ 14VDC 3.2A
<i>Input Voltage</i>	11-33 VDC 5A Circuit Breaker.
<i>Power output</i>	5 watts (nominal) VSWR Tolerance < 2:1 for best operation (5:1 without damage)
<i>Receiver sensitivity</i>	-6dB SINAD @ 5µV (1KHz audio with 70% modulation)
<i>Data Interface</i>	RS232
<i>Headset volume output</i>	Nominal 100 milliwatts output to 600 Ω
<i>Temperature range</i>	-20 to +70 degrees Celsius
<i>Stability</i>	< +/- 4.00 ppm
<i>Dimensions</i>	W-2.5" x H-1.9" x D6.3" (plus 1.5" for harness) W-66mm xH-48mm x D-160 (plus 35mm for harness)
<i>Weight</i>	.77 lbs .350 kg
<i>FCC ID:</i>	VZI00882

1.6 EQUIPMENT SUPPLIED

1 ea. of the following items:

Model	Description	PS Part Number	Trig P/N
PAR200	PAR200 Audio Panel with intercom and radio function control	050-228-0100	
TY91(L)	VHF Communications Transceiver	050-228-8744	00882-00-05

Installation Kit: 250-890-0000, containing:

Description	Quantity	Part Number
PAR200 installation rack assembly	1	430-890-0040
PAR200 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 1/2" Flat head Philips screw	6	475-632-0012
#6-32 Clip Nut	6	475-630-0002

TY91 Installation Kit 250-228-0200, Containing:

Description	Quantity	Part Number
DB 25 Connector , Crimp type	1	425-025-0010
DB 25 Connector hood	1	625-025-0001
DB 25 Thumb Screws 4-40 x 1.94	2	475-002-0002
Crimp female sockets	25	425-020-5090
TNC Crimp Connector	1	425-400-1223

1.7 EQUIPMENT REQUIRED BUT NOT SUPPLIED

- a. Circuit Breaker: 1 ea; 3 amp PULL TYPE REQUIRED for PAR200
- b. Circuit Breaker: 1 ea; 5 amp PULL TYPE REQUIRED for transceiver power (to TY91)
- 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. Mounting hardware for TY91, as appropriate
- i. Interconnect Wiring, coaxial cable (RG400 or RG142B or equivalent)

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 PAR200 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 PAR200 Intercom is FAA approved under TSO C139 (*Aircraft Audio Systems and Equipment*) and contains partial elements of TSO C169a (*VHF Radio Communications Transceiver Equipment Operating Within Radio Frequency Range 117.975 To 137.000 Megahertz*).

The partial TSO applies to C169a, because the PAR200 unit provides control and display only for the TY91-series of VHF communications equipment.

The conditions and tests for TSO approval of this article are minimum performance standards. Those installing this article, on or in a specific type or class of aircraft, must determine that the aircraft installation conditions are within the TSO standards.

The article may be installed only following 14 CFR Part 43 or the applicable airworthiness requirements.

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 PAR200 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 PAR200 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 Trig TY91 mounting requirements

The TY91 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.

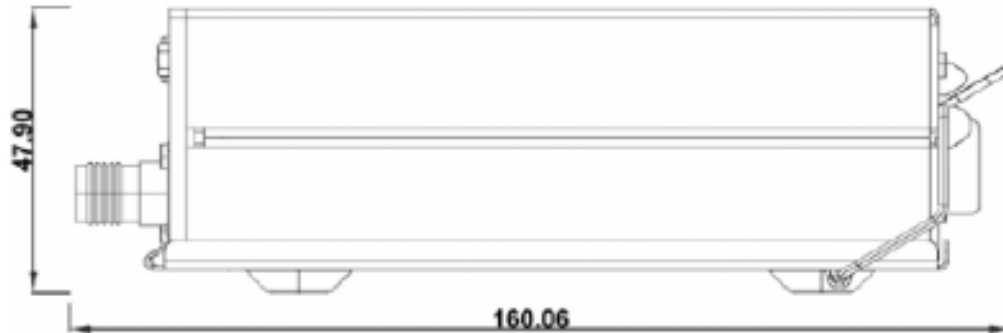


Figure 2-1 TY91 VHF Transceiver (Remote Mount)

2.3.4 Audio Panel Mounting Rack Installation

Remove the audio panel 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 1/2" 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 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.

Custom factory wiring harnesses can be purchased from PS Engineering, call 865-988-9800 for details or visit our website <http://www.ps-engineering.com/downloads.shtml> and click on Work Sheet for the appropriate product.

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 PAR200 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 PAR200 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 PAR200 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

PAR200 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 PAR200. 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 PAR200. The connectors are a sub-miniature crimp-type, and require the use of 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 PAR200 Connector Pin crimping tools

Manufacturer	Crimping Tool	Positioner	Extraction tool
Mil-Spec	M22520/2-01	M22520/2-08	
Daniels	AFM8	K13-2	

Table 2-2 TY91 Connector Crimping tools

2.4.3 Audio Panel interface

The PAR200 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 N1 and N2 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 TY91 VHF COM Interface

2.5.1 TY91 Connector (Trig TY91(L) -05 only)

The TY91 has a 25-pin crimp type connector.

1	Com Audio Low
2	COM Audio High
3	No Connect
4	No Connect
5	RS232RX (data in-TX)
6	RS232TX (data out-RX)
7	No Connect
8	No Connect
9	Aircraft Ground
10	No Connect
11	No Connect
12	Controller Radio Power
13	Radio On
14	No Connect
15	COM Mic Key
16	No Connect
17	No Connect
18	Transmit Interlock
19	Airframe Ground
20	No Connect
21	No Connect
22	Ground (Not Used)
23	COM Mic Audio Hi
24	Aircraft Power
25	Aircraft Power

2.5.2 Interfacing the TY91(L) as Single, COM 1 or COM 2

The PAR200/ Trig TY91(L) can be configured to be a stand-alone COM, or as COM 1 or COM 2 in a multiple radio installation. In this case, PS Engineering recommends that the PAR200/TY91(L) be used as COM 2. In the event of a failure, the PAR200 will be in fail-safe, and COM 1 can be used.

If the TY91(L) is used as COM 1, the PAR200 can fail-safe to it, because it is divided internally as audio panel and COM control. In addition, the TY91(L) power supply is provided by an independent circuit breaker and power supply in the PAR200. See § 3.2.1 for operational information.

The PAR200 must be configured at installation to be used as COM 1 or COM 2, by removing the top cover, and placing the DIP switches as shown in Figure §2-4 (page 2-11).

J4 Switch 6	COM 1	OFF
	COM 2	ON

Table 2-3 Radio Selection

When properly selected, the PAR200 LCD display will read either COM 1, or COM 2.

2.5.3 Antenna Cable

Use a high quality 50 ohm coaxial cable, such as RG400 or RG142B. When routing the cable, ensure that you:

- Route the cable away from sources of heat.
- Route the cable away from potential interference sources such as ignition wiring, 400Hz generators, fluorescent lighting and electric motors.
- Allow a minimum separation of 300mm (12 inches) from an ADF antenna cable.
- Keep the cable run as short as possible.
- Avoid routing the cable round tight bends.
- Avoid kinking the cable even temporarily during installation.
- Secure the cable so that it cannot interfere with other systems.

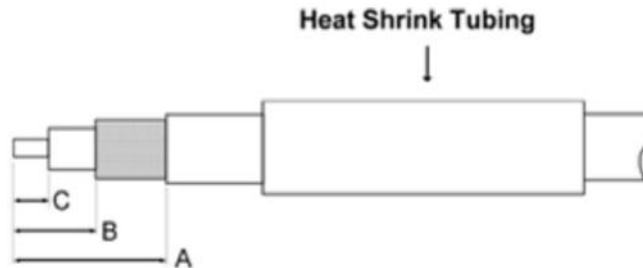
2.5.4 TY91 TNC Antenna connection

The VHF Com radio uses a solder/crimp TNC connector, Amphenol 31-2.

This section describes the technique for attaching the antenna cable to the supplied TNC connector.

The supplied connector can be completed using a wide range of commercial crimp tools (for example the Tyco 5-1814800-3). The die apertures for the inner pin and the outer shield should be approximately 1.72 mm and 5.41 mm respectively.

1. Strip back the coax cable to the dimensions in the table, as shown in the diagram below. Slide 25 mm (1 inch) of heat shrink tubing over the cable.



Dimension	Cut size (mm)	Cut size (inches)
A	17.5	0.69
B	7.2	0.28
C	4.8	0.19

2. Slide the outer crimp sleeve over the cable – it must go on before securing the center contact.
3. Crimp the center contact to the cable.

4. Insert the cable into the connector – the centre contact should click into place in the body, the inner shield should be inside the body of the connector and the outer shield should be outside the body.
5. Crimp the outer sleeve over the shield.
6. Slide heat shrink tubing forward (flush to connector) and heat to shrink the tubing.

2.5.5 VHF Communications Antenna Installation

The antenna should be installed according to the manufacturer's instructions. The following considerations should be taken into account when locating the Antenna.

- The antenna should be well removed from any projections, the engine(s) and propeller(s). It should also be well removed from landing gear doors, access doors or others openings which will break the ground plane for the antenna.
- Avoid mounting the antenna within 2 feet of a GPS antenna, and as far as practical from any ELT antenna.
- If the simultaneous use of two radio units is required then each antenna should be as far apart as practicable for maximum isolation. We would recommend placing one antenna on top and one on the bottom of the airframe. The Transmit Interlock function should also be used in this case (section 5.6.8).
- Where practical, plan the antenna location to keep the cable lengths as short as possible and avoid sharp bends in the cable to minimize the VSWR.

Electrical connection to the antenna should be protected to avoid loss of efficiency as a result of the presence of liquids or moisture. All antenna feeders shall be installed in such a way that a minimum of RF energy is radiated inside the aircraft.

2.5.5.1 Antenna Ground Plane

When a conventional aircraft monopole antenna is used it relies on a ground plane for correct behavior. For ideal performance the ground plane should be as large as practical; in any case at least one square meter. In a metal skinned aircraft this is usually easy to accomplish, but is more difficult in a composite or fabric skinned aircraft. In these cases a metallic ground plane should be fabricated and mounted under the antenna.

The thickness of the material used to construct the ground plane is not critical, providing it is sufficiently conductive. A variety of proprietary mesh and grid solutions are available. Refer to Advisory Circular AC43.13-2B, Chapter 3.

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

The TELEPHONE mode in the PAR200 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 PAR200 Bluetooth® interface is always “discoverable”, so you just need to search for the PAR200 from your Bluetooth-equipped phone or music source. The default access code is 0000, if needed. Once the PAR200 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 PAR200. Turn the PAR200 off, press & hold the N1 & N2 buttons while turning the unit back on, continue to hold the N1 & N2 for 3 seconds.

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 PAR200 will provide cell phone sidetone (your side of the telephone conversation) in the factory configuration. Some telephones do provide sidetone the PAR200 can be configured to remove this sidetone by placing the DIP switch in the proper configuration.

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

Table 2-4 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 PAR200 has an automatic dimming of the pushbutton annunciation LEDs controlled by a photocell. 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.

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 night-time 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 green 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 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 2-5 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 Music Inputs

The PAR200 has two INDEPENDENT inputs wired into the rear connectors, in addition to the Bluetooth® music streaming (which is presented as Music 1). 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.

Music #1 is available to the pilot and copilot positions, only, in normal configuration. Music 1 can be heard 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 low level 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 Music muting

The PAR200-system incorporates a "Soft Mute™" system. This will mute the music 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 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 allows uninterrupted music during casual conversation.

2.8 Disassembly

Remove the top cover, by removing five (5) Phillips head screws from the PAR200 top.

NOTE: IF PRESENT, THE SCREW IN THE REAR OF THE PANEL IS A DIFFERENT LENGTH THAN THE OTHER FOUR. IF PRESENT, YOU MUST REINSTALL THE SHORTER LENGTH SCREW BACK IN THE SAME LOCATION OR DAMAGE WILL OCCUR..

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

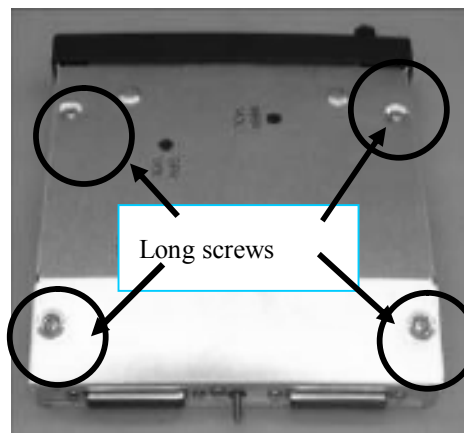


Figure 2-2 Screw Location and disassembly

2.9 Adjustments

The PAR200 is factory adjusted to accommodate the typical requirements for most aircraft configurations. There are three adjustments under the top cover (see §2.8) that allow the installer to tailor the specific functions.

- Unswitched Input 3 Volume, 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.

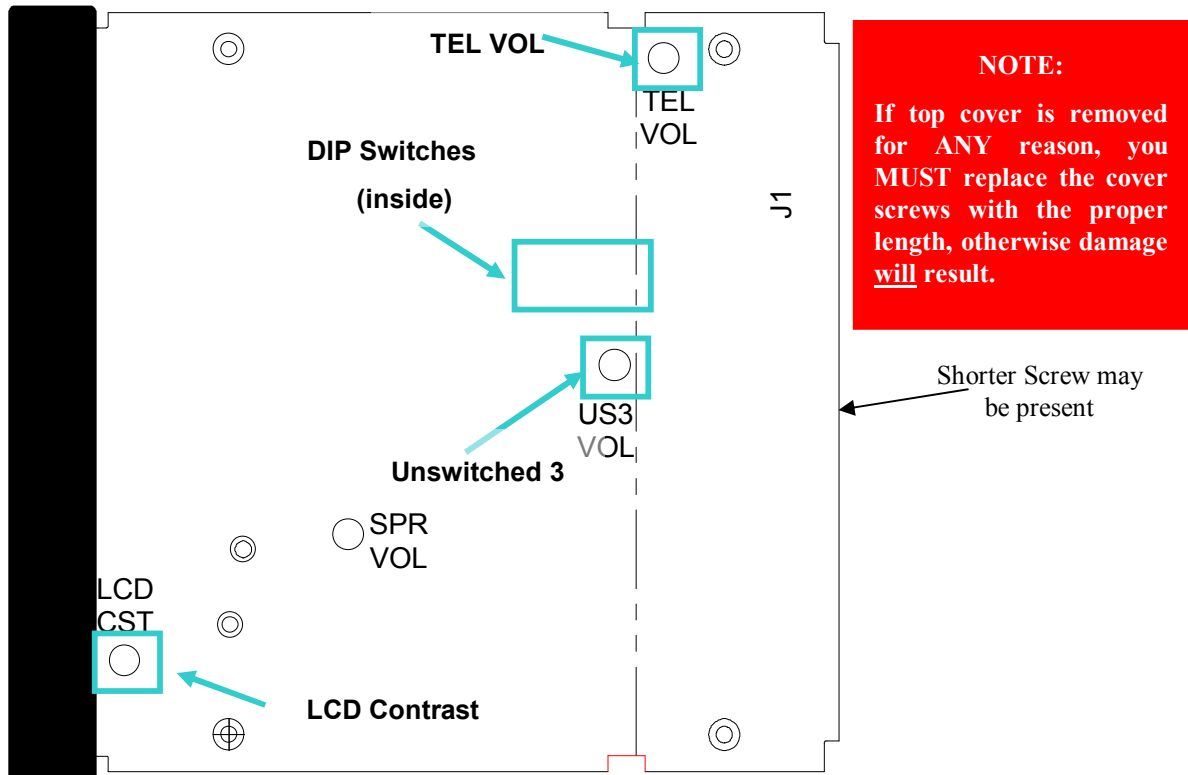


Figure 2-3 – PAR200 Adjustments

2.10 Microphone gain reduction

For installations in very noisy aircraft, a reduction in the intercom microphone input gain may be desirable. The PAR200 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 above), and locate the two DIP switches near the mounting rod at the rear of the unit.

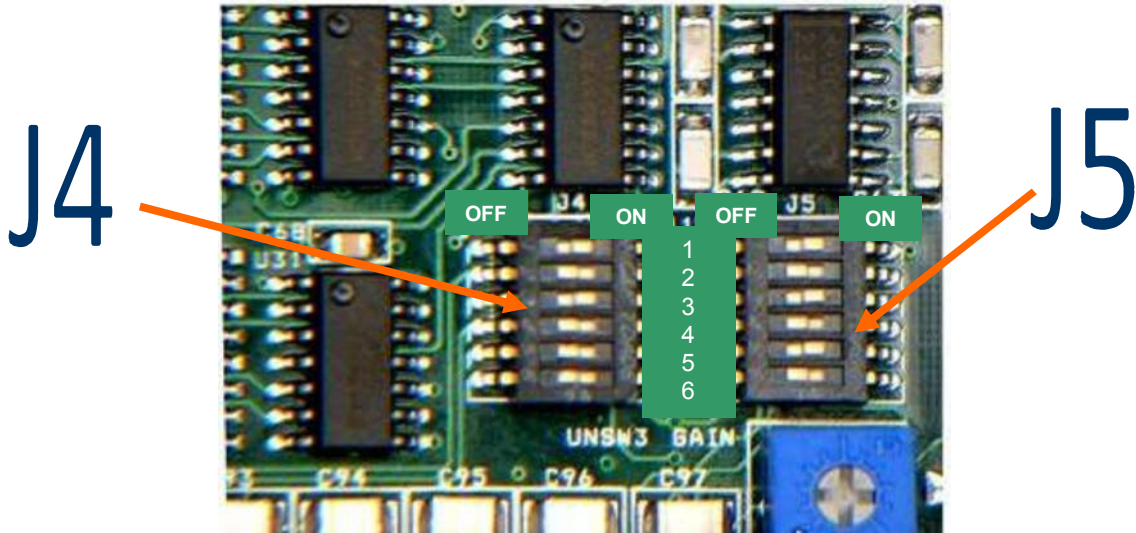


Figure 2-4 DIP switches

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			
J4	3	OFF	ON
	4	ON	OFF
Passenger 1 Microphone			
J4	1	OFF	ON
	2	ON	OFF
Passenger 2 Microphone			
J4	3	OFF	ON
	4	ON	OFF

Table 2-6 Microphone gain settings

Carefully reassemble the unit.

2.11 Reassembly

1. Using the nylon spacer removed in step 2, compress the spacer so it becomes oblong.

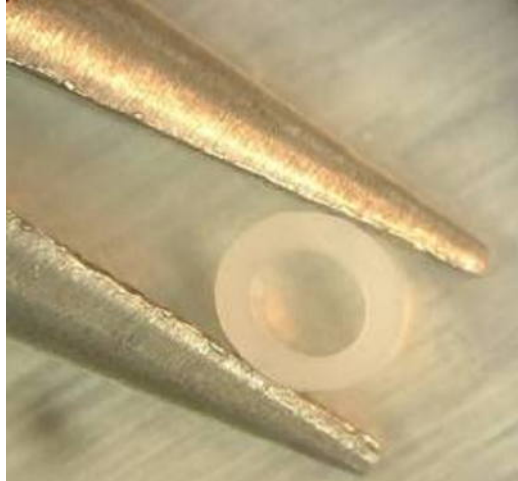


Figure #3

- 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.

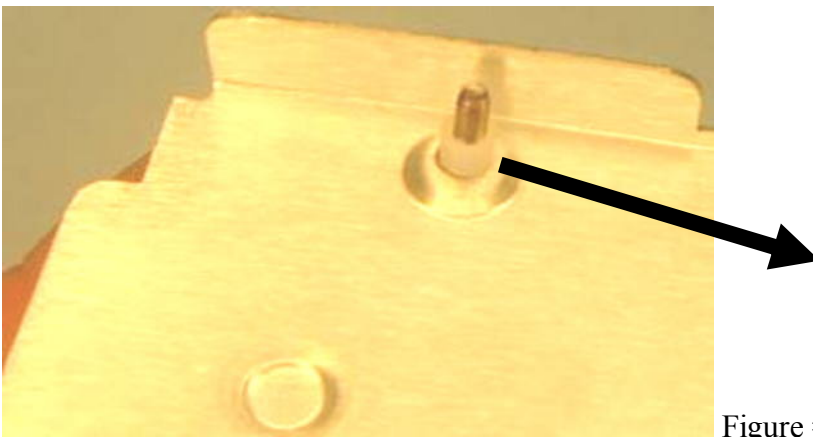
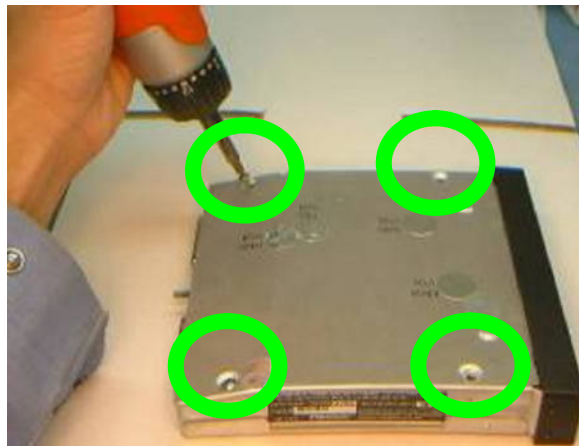


Figure #4

4. Place the lid back on the unit aligning holes.
5. Install qty. 3 more long thread screws into the lid.



2.12 Communications Antenna Installation Notes

2.12.1 Antenna Location

For best results while in Split Mode, we recommend 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 other FAA-approved technical data.

WARNING

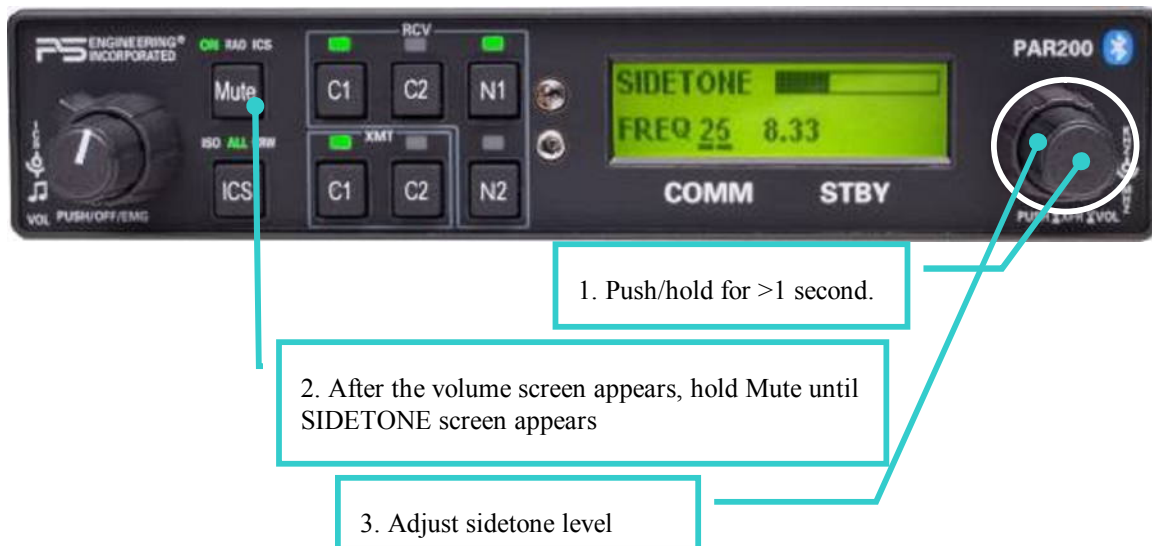
It is probable that radio interference will occur in the split mode when the frequencies of the two aircraft radios are adjacent, and/or the antennas are physically close together. **PS Engineering makes no expressed or implied warranties regarding the suitability of the PAR200 in Split Mode.**

2.13 TY91(L) Adjustments

2.13.1.1 TY91(L) Sidetone Level

The radio transmit sidetone level is adjustable via the PAR200.

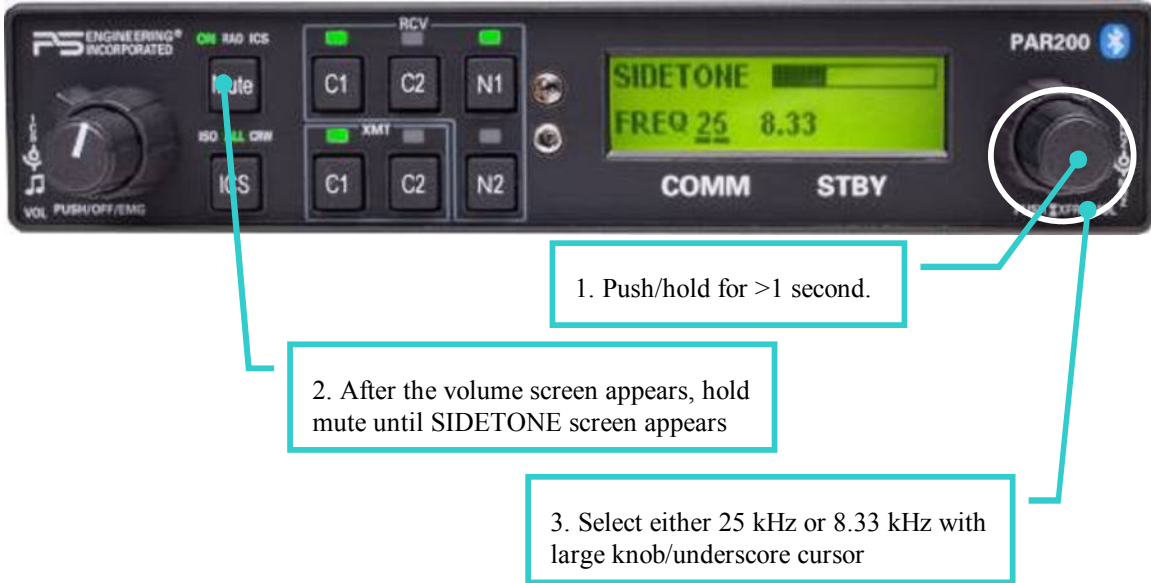
Push and hold the right hand knob until the volume screen appears. Then hold the "MUTE" button on the left side until a sidetone level adjustment screen appears. Turn the small knob to increase or decrease the sidetone level from the TY91(L).



2.13.1.2 Radio Frequency spacing, 25 kHz or 8.33 kHz

Push and hold the right hand knob until the volume screen appears. Then hold the "MUTE" button on the left side until a sidetone level/channel spacing screen appears.

Turn the large knob to select either 25 kHz spacing or 8.33 kHz spacing.



2.13.1.3 Channel Assignment under 8.33 kHz spacing:

The following table provides an example of the 8.33 Channel assignments as displayed on the PAR200, when in the 8.33 mode.

Bandwidth (kHz)	Frequency	Displayed
25	118.00000	118.000
8.33	118.00000	118.005
8.33	118.00833	118.010
8.33	118.01666	118.015
25	118.02500	118.025
8.33	118.02500	118.030
8.33	118.03333	118.035
8.33	118.04166	118.040
25	118.05000	118.050
8.33	118.05000	118.055
8.33	118.05833	118.060
8.33	118.06666	118.065
25	118.07500	118.075
8.33	118.07500	118.080
8.33	118.08333	118.085
8.33	118.09166	118.090
25	118.10000	118.100
8.33	118.10000	118.105
This format is continued through to 136.990		
8.33	136.99166	136.990

2.14 PAR200 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	Radio On Control
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	Nav 1 Audio	17	RS232 RXD
18	Nav 1 Audio Lo	18	No connect
19	Nav 2 Audio	19	No connect
20	Nav 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 In
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	Speaker Ground
44	Unswitched 2 Audio	44	Speaker Output

2.15 Post Installation 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.

2.16 Unit Installation

To install the PAR200, 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.**

2.17 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 **C1** 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 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 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 N1 and N2 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.

2.17.1 TY91 Checkout

2.17.1.1 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 137.000 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).
4. If appropriate, verify selection of 8.33 kHz channel selection. Refer to §3.6.1.2

2.17.1.2 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.

2.17.2 TELEPHONE Checkout

On the ground (not flying), 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.

2.18 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 PAR200, 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.

The following is divided into sections covering the basic operating areas of the PAR200 systems. They are Communications Transceiver Selection, Audio Selector, Intercom, VHF COM, music, telephone, and display.



Figure 3-1 PAR200 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 TY91(L) Radio power (as COM 1 only)

The power supply for the TY91 communication transceiver is separate from the audio panel power and control. When the TY91 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.

3.2.1.1 Radio Power, TY91(L) as COM 2

If the Trig TY91 is configured as Com 2, it will turn off when the audio panel is off, and the pilot will be connected directly to Com 1.

3.2.2 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.

3.3 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 PAR200-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 PAR200 “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.

3.3.1.1 Split Mode

The split mode can be activated at any time by pressing the **C1** and **C2** **XMT** buttons at the same time. 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 always hear the audio from the selected transceiver.

In SPLIT mode, only the pilot will hear selected navigation audio (N1 & N2).

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 N1 & N2.



Other audio sources such as Marker Beacon, ADF or DME audio if installed are available if interfaced through an unswitched input.

3.6 VHF Transceiver control (5)

The right side of the PAR200 is dedicated to control of the VHF communications transceiver. Frequency selection is always directed to the STANDBY side of the display.

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

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.



Figure 3-2 Frequency Control

3.6.1.1 Frequency Memory Storage

The PAR200 will store five frequencies for future recall.

To store frequencies:

1. Enter the desired frequency in the **STBY** frequency.
2. Press and hold the **N1** button until the display changes **FREQ SELECT**, to show only the **STBY** side.
3. Momentarily push the small (kHz) knob to display the list of locations.
4. Turn the small knob to select the location (1 through 5).



5. Either momentarily push the small knob again, or do nothing; the display will revert and the frequency is stored in that location.

To recall stored frequencies:

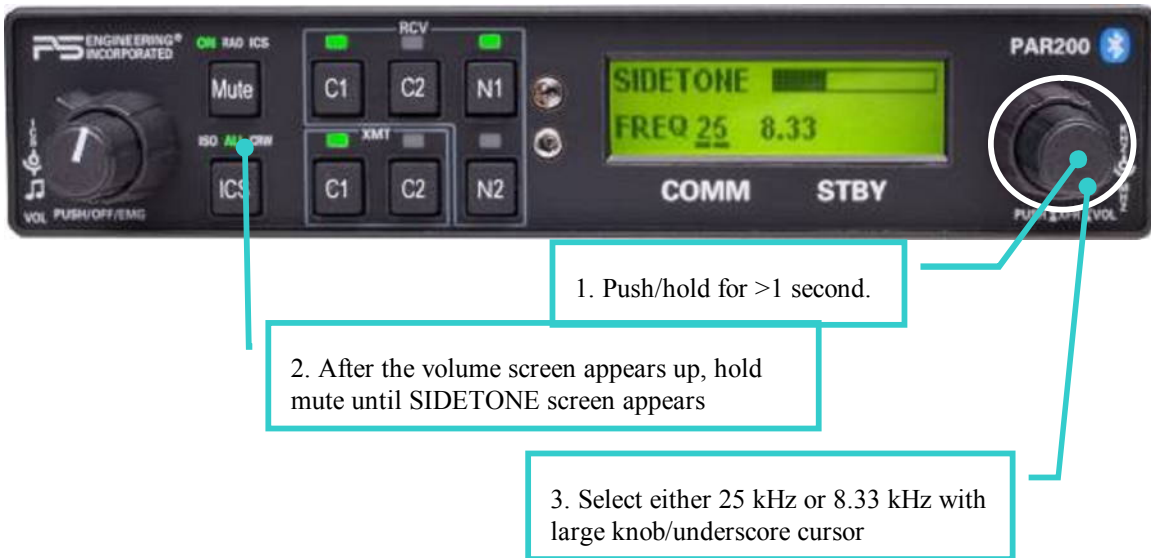
1. Press and Hold the N2 button until the display changes to **FREQ RECALL**.
2. Using the small knob, select the desired location in **MEM** field.
3. Push the small knob to accept this as **STBY** frequency. NOTE: If you do not push the small knob the frequency will not change to the stored, and reverts to **STBY**.



3.6.2 Tuning 8.33 kHz channel Spacing

Push and hold the right hand knob until the volume screen appears. Then hold the “MUTE” button on the left side until a sidetone level/channel spacing screen appears.

Turn the large knob to select either 25 kHz spacing or 8.33 kHz spacing.



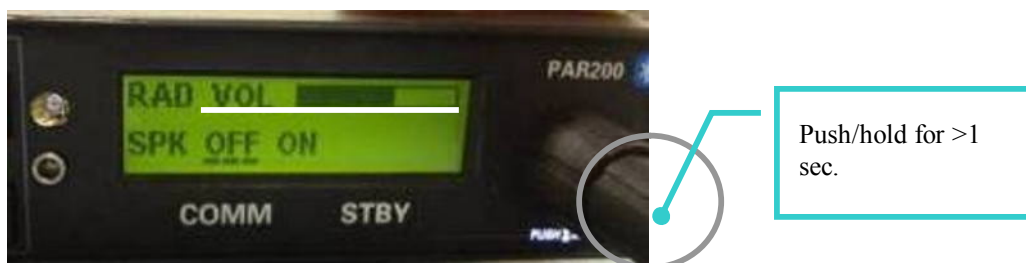
3.6.2.1 Channel Assignment under 8.33 kHz spacing:

The following table provides an example of the 8.33 Channel assignments as displayed on the PAR200, when in the 8.33 mode.

Bandwidth (kHz)	Frequency	Displayed
25	118.00000	118.000
8.33	118.00000	118.005
8.33	118.00833	118.010
8.33	118.01666	118.015
25	118.02500	118.025
8.33	118.02500	118.030
8.33	118.03333	118.035
8.33	118.04166	118.040
25	118.05000	118.050
8.33	118.05000	118.055
8.33	118.05833	118.060
8.33	118.06666	118.065
25	118.07500	118.075
8.33	118.07500	118.080
8.33	118.08333	118.085
8.33	118.09166	118.090

Bandwidth (kHz)	Frequency	Displayed
25	118.10000	118.100
8.33	118.10000	118.105
This format is continued through to 136.990		
8.33	136.99166	136.990

3.6.3 Radio Volume (7)



Push and hold the small frequency-select knob for one second, until the display changes to the menu.

Turn the large knob to adjust the aircraft radio volume.

You can push the knob again to return to the frequency display, or the display will revert automatically after five seconds without any activity.

3.6.4 Radio Squelch

To defeat the automatic radio squelch, push and hold the frequency knob until the display changes to **ASQ OFF**, which defeats the squelch and you will hear any weak signals.

Press the right hand side rotary selector knob again until you get the **ASQ ON**, to restore the Automatic Squelch.



Figure 3-3 Radio Squelch on/off

3.6.5 Cockpit Speaker

When the cockpit speaker is turned on, any receiver audio selected will be heard in the speaker. Any unswitched audio will always be present in the cockpit speaker regardless of the speaker on/off selection.

To activate the cockpit speaker, push and hold the frequency knob until the display changes. Push the small momentarily to move the cursor under the **SPR OFF** display. Turn the larger knob clockwise until the **SPR** is **ON**.



Figure 3-4 Cockpit Speaker Control

3.6.6 Monitor Mode (when PAR200 is COM 1 or stand alone only)

If the TY91 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 **TY91** will revert to the active frequency. After a signal has been received, the **TY91** will return to monitoring both frequencies.

The standby monitoring frequency sends an audible "ticking" to make you aware which is the active & standby. 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.

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
Pilot	11-20 & 11-90	90015
Sennheiser		90015
Telex	Airman 750, Echelon	90015
	AIR3000	90010

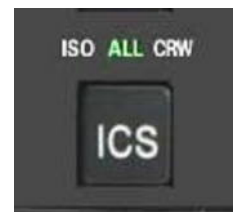
3.7.2 Mono headsets in Stereo Installation

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 PAR200 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 music, while passengers will hear copilot intercom and music. 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 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 Telephone Mode

3.8.1 Bluetooth Telephone Connection



Before the PAR200 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 “PAR200” on the list of available devices.

When the PAR200 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 PAR200 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 PAR200, holding the N1 and N2 buttons down, and turning the unit back on. This clears out all paired devices.

PS Engineering recommends this clearing process if you’re having difficulties interfacing the PAR200 audio panel to your Bluetooth phone or device.

3.8.2 Telephone (TEL) Operation

When the Bluetooth-enabled phone receives an incoming call, the PAR200 will play a ring tone. Answer the call from your telephone handset. The PAR200 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 microphone 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 PAR200 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 Music Inputs

The PAR200 has two *independent* music inputs at the rear connector. The PAR200 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 PAR200 is also Music 1.

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

Figure 3-5 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. . .

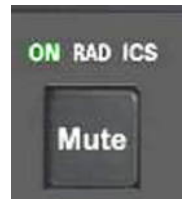
“(b)(5) Any other portable electronic device that the operator of the aircraft has determined will not cause interference with the navigation or communication system of the aircraft on which it is to be used.”

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 has been factory set, but you can tweak 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 date of sale. During 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.

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 disassemble 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.

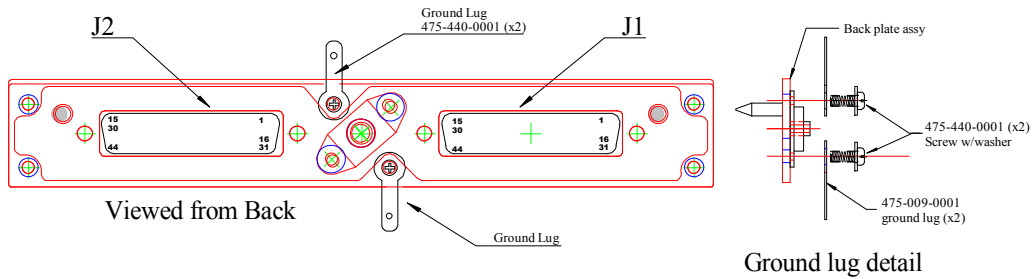
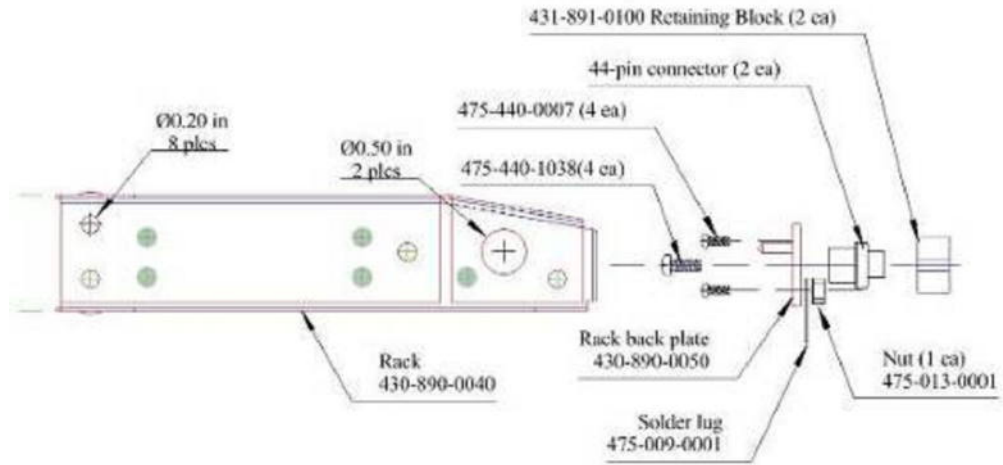
Procedures for Telex PT-200

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.

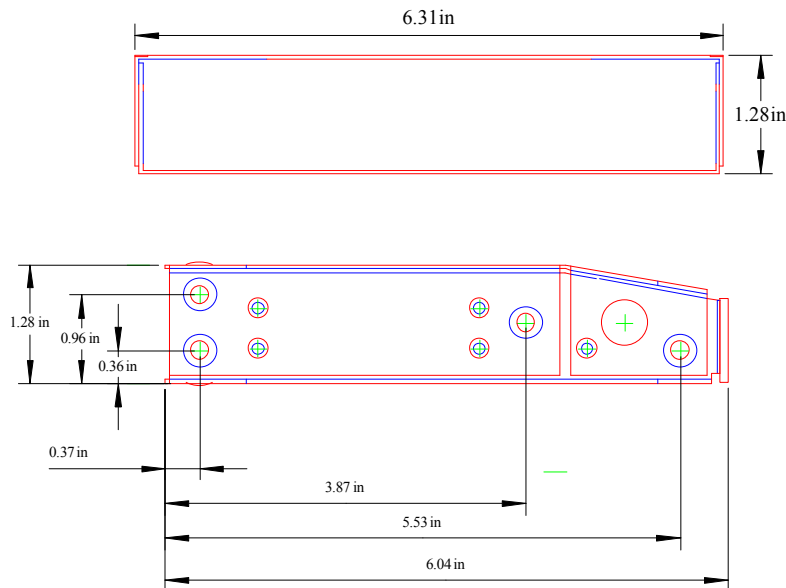
Procedures for Telex PT-300

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 – PAR200 Installation Drawings



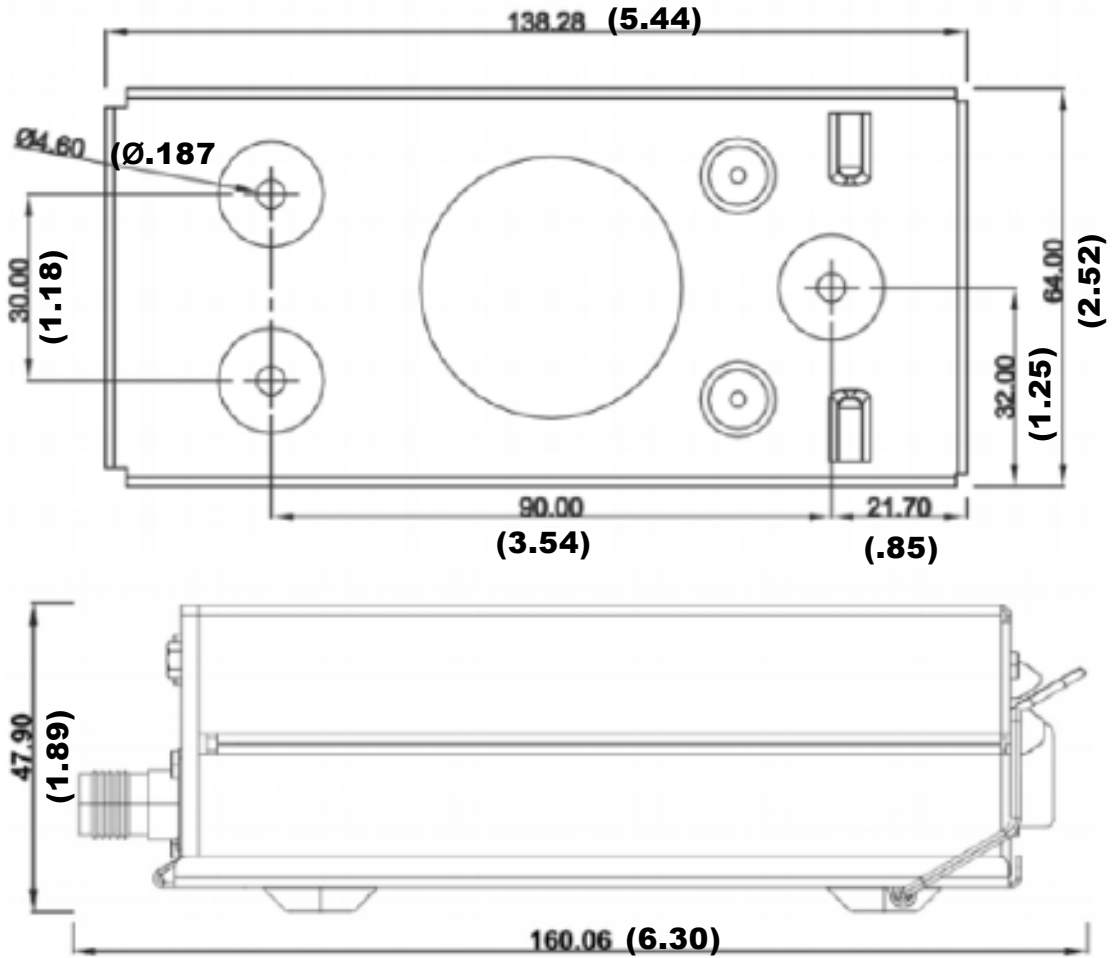
Rear plate detail (not to scale)



Tray and cutout dimensions

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

6.1 TY91 Radio Installation Drawings



Not to Scale. Dimensions in millimeters, (inches)

Appendix C – J1 Connector Interconnect

Figure 7-1 J1 connections, TY91(L)-05 as COM 2

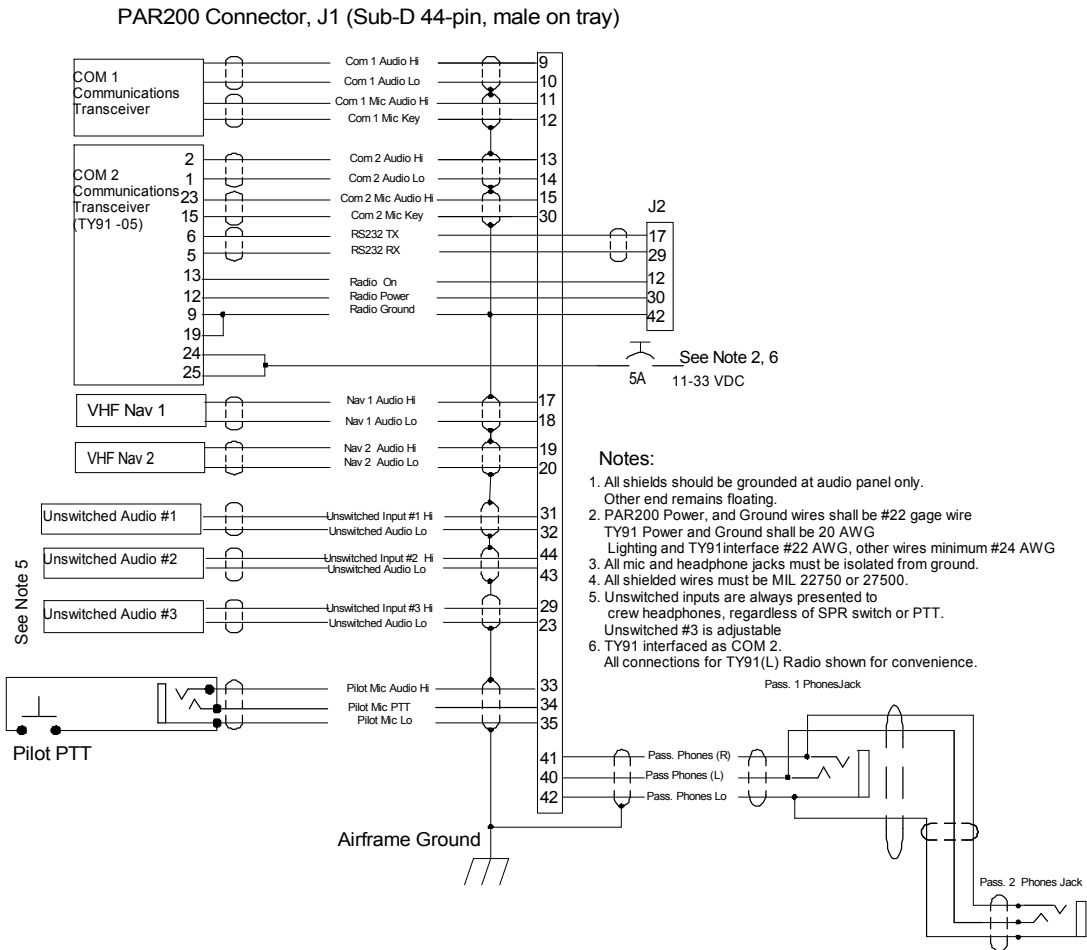
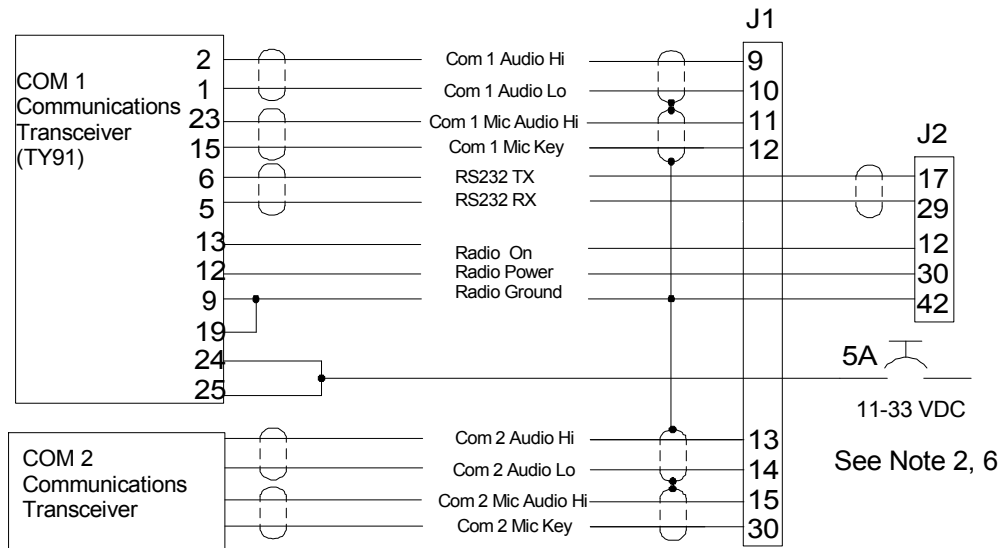
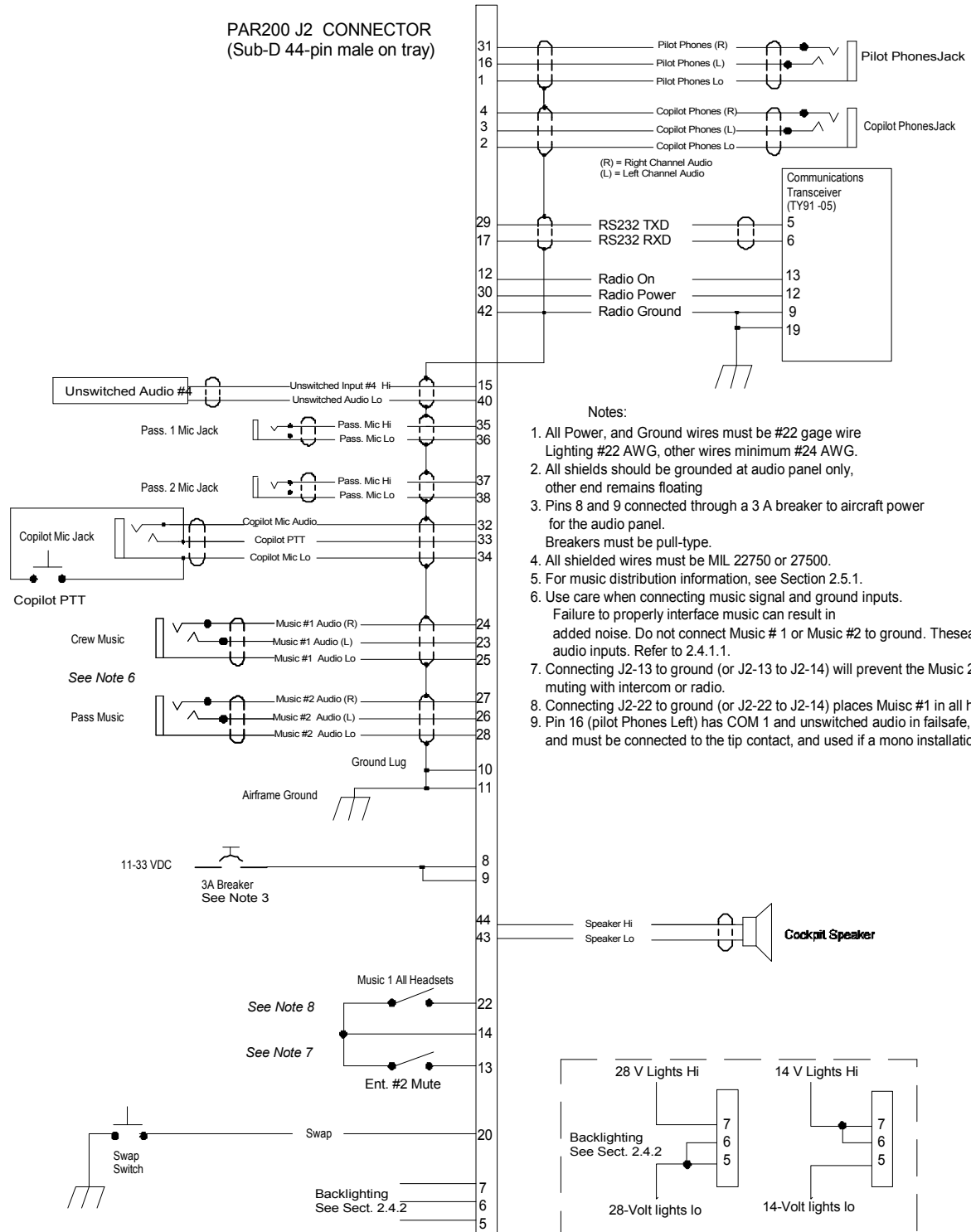


Figure 7-2 PAR200 Using TY91(L) as COM1 or stand alone



Appendix D – J2 Connector Interconnect



Appendix E – Instructions for FAA Form 337 and continuing airworthiness

9.1 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 PAR200, you may use the following text as a guide.

Installed audio selector and 6-place intercom, PS Engineering PAR200, part number 050-228-(XXXX) in (location) at station _____. Installed per *AC43.13-2B, Chapter 2, paragraph 23* (Instrument Panel Mounting). Installed per PS Engineering *Installation Operators Manual* p/n 200-228-(XXXX), revision (), dated ().

These units are FAA-Approved under TSO C139 for audio amplifiers, and a partial TSO C169a for communications transceivers, and meets appropriate environmental qualifications outlined in RTCA DO-160G as appropriate for this aircraft.

Interface to existing aircraft radios in accordance with installation manual and in compliance with practices listed in *AC43.13-2B, 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 PAR200 added.

Aircraft equipment list, weights and balance amended. Compass compensation checked. A copy of the operation instructions, contained in PS Engineering document 202-228-(), revision (), dated (), is placed in the aircraft records. All work accomplished listed on Work Order _____.

9.2 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 VHF communications controller 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	<u>Removal:</u> 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. <u>Installation:</u> 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

9.3 ICA for Trig TY91/92 Radio:

Other than for periodic functional checks required by the regulations, the TY91/TY92 VHF radio has been designed and manufactured to allow “on condition maintenance”. This means that there are no periodic service requirements necessary to maintain continued airworthiness, and no maintenance is required until the equipment does not properly perform its intended function. When service is required, a complete performance test should be accomplished following any repair action. Repairs should only be carried out in accordance with Trig Avionics Limited service procedures.

Appendix F – RTCA DO160G Environmental Qualification Form

Audio Selector Panel/Intercom/Communications Transceiver Controller

Part Number: 050-228-()

FAA TSO Number: C139, C169a

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 & C1
Low Temperature	4.5.1	-55° C Survival, -20°C Low Operating (A1)
	4.5.2	-40 Low Short Term Operating
High Temperature	4.5.4	+85°C Survival, +70°C High Short Time Operating + 55°C High Operating
In-flight Loss of Cooling	4.6.1	Not Applicable, no cooling required
Altitude	4.6.2	35,000' unpressurized (C1)
Decompression	4.6.3	Not Applicable
Overpressure		Not Applicable
Temperature variation	5.2	Equipment tested to Category B (5°/Minute)
Humidity	6.0	Equipment tested to Category A
Shock	7.0	Equipment tested Standard B
Operational	7.2	Equipment tested to Category E
Crash Safety	7.3	Equipment tested to Category E
Vibration	8.0	Equipment tested to Category S & R
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(X)(X)
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 TT
Radio Frequency Emission	21.0	Equipment tested to Category M
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category XXA2E2
Lightning Direct Effects	23.0	Category X, not tested
Icing	24.0	Category X, not tested
ESD	25.0	Category X, not tested