NOTES: 1. All wire must conform to MIL-22759 or 27500. Minumum 24 gage shielded wire.
2. Use 2-, 3-, and 4-conductor with shield as indicated.
3. Use insulating washers on all jacks. Jacks must be electrically floating.
4. Connect shields at intercom end only
5. AUX headphone and microphone jacks are required.

PS ENGINEERING® INCORPORATED

Sound Quality. Sound Engineering.

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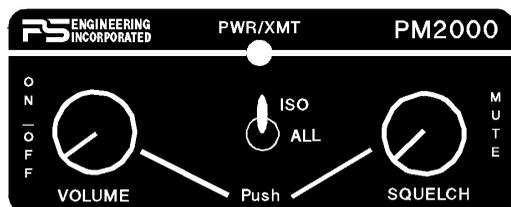
PM2000

4-Place Stereo
Panel Mounted Intercom

Operator's and Installation Manual

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

Document Number 200-195-0002
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Introduction

Congratulations on your purchase of a PM2000 intercom! We at PS Engineering welcome you to our family.

Front Panel of PM2000

The PM2000 is a panel mounted, 4-place intercom that offers features that make this the intercom of choice by pilots who demand quality sound. This manual provides information on the installation and operation of the PM2000. Please read it completely before installation to reduce the risk of damage to the unit and maximize your enjoyment of its use.

Description

The PM2000 is a 4-place, STEREO, panel mount intercom with individual volume and VOX circuits for the pilot, copilot, and passengers 1 & 2.

Although there is only a single control knob for the volume and squelch circuits, when an adjustment is made to the volume control, eight output amplifiers are being changed simultaneously. Likewise, when the squelch control knob is adjusted, three individual squelch circuits are being changed at the same time.

A 2-position mode switch allows the pilot to select one of two configurations. The "ALL" mode places all headsets on a party line, hearing intercom conversation and the aircraft radios.

In the "ISO" mode, the pilot is isolated from all others and is connected to the aircraft radio allowing un-interrupted radio communications. The passengers continue to communicate with themselves without distracting the pilot.

The PM2000 has an automatic fail-safe interconnect to the aircraft radio. If power is disrupted to the intercom for any reason, an internal relay will connect the pilot's headset to the aircraft radio, permitting continued radio communications.

A 2-color LED glows green when power is on and changes to red when someone presses their Push To Talk.

Provision for an entertainment input allows the pilot, copilot and passengers the option to listen to music during flight. During intercom or aircraft radio activity, this music automatically mutes to permit easy communications. When the activity ceases, the "*Soft Mute*™" circuit gradually returns the music to the original listening volume. By depressing the mute control (located on the VOX control) once, it is possible to have the music remain at the unmuted level.

During various phases of flight, the degree of importance of the aircraft radio will vary. Because the "ISO" mode directly connects the pilot to the aircraft radio, select the "ISO" mode when the pilot must have top priority on radio transmissions.

Both pilot and copilot have transmit capabilities. The PM2000 only allows the audio of the person who presses their PTT to be transmitted over the aircraft radio. If both pilot and copilot press the PTT at the same time, the copilot will override. Placing the unit in fail-safe (turning off) will return control to the pilot position. When either pilot or co-pilot presses PTT,

may need several rotations before the adjustment is complete. When the aircraft radio becomes active, the music should mute.

Warranty

PS Engineering, Inc. warrants this product to be free from defect in material and workmanship for a period of one year from the date of installation. In certified aircraft, an FAA Form 337 must accompany the warranty card for this warranty to be in effect. During the warranty period, the unit must be returned to PS Engineering, Inc. and, at their option, it will send a replacement at no charge.

This warranty is not transferable. Any implied warranties expire at the expiration date of this warranty. WE SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. This warranty does not cover a defect that has resulted from improper 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 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 your state.

Service

Call PS Engineering, Inc. at (423) 988-9800 and ask for a technician. He may be able to diagnose the problem and offer a solution without the possible need for returning the unit. If the unit does need servicing, ship product in UPS approved packaging to:

PS Engineering, Inc.
Attn.: Service Department
9800 Martel Road
Lenoir City, TN 37772
(423) 988-9800
FAX (423) 988-6619

Appendix A

PTT Modifications

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

Procedures For David Clark's PTT

1 Unscrew the round black plastic cover from the jack.

2 Connect the joined black wires to the red wire.

3 Replace the round black plastic cover.

Procedures for the Telex's PT-200

1 Unscrew the round black plastic cover from the jack.

2 Cut the red wire in the middle of the wire

3 Strip both ends of the insulation

4 Solder the two ends to the ground lug to the PTT jack

5 Replace the round black plastic cover

Procedures for the Telex's PT-300

1 Unscrew the round black plastic cover from the plug jack

Adjusting The Volume

The volume control knob adjusts the loudness of the intercom and music for all headsets. Turning the control clockwise increases the audio. The PM2000 has two individual output amplifiers for each headset in the system that

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NOTE: In the event of a power failure to the PM2000, or if the power switch is turned off, the copilot will not hear the aircraft radio. Only the pilot is connected to the aircraft radio.

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provide plenty of undistorted audio output power.

NOTE: Volume level does not change with the number of headsets installed.

The volume control on the PM2000 does not affect the volume level of the aircraft radio. This gives the pilot ability to adjust the aircraft radio and the ICS volume independently, adding flexibility to the system.

Adjusting The Squelch Control

This VOX operated intercom keeps all microphone channels off while the pilot, copilot or passengers are not speaking. This reduces background noise from the aircraft. Only when someone speaks will their microphones automatically turn on, passing the audio through the system. Although there is just one squelch control, there are actually three distinct squelch circuits. One each for the Pilot, Copilot, and Passengers 1 & 2.

Set the Squelch control knob by slowly rotating the squelch knob clockwise until you no longer hear the engine noise in the earphones. When the microphone is positioned properly near your lips, normal speech levels should open the channel. When you stop talking, there is a delay of about a half second before the channel closes. This prevents closure between words and eliminates choppy communications.

Mode Select

The center switch is a 2- position mode switch that allows the pilot to tailor the intercom function to best meet the pilot's needs. Regardless of configuration, the pilot will always hear the aircraft radio.

ISO (Up Position): The pilot is isolated from the intercom and is connected to the aircraft radios only . He will hear only the aircraft radio reception and sidetone (only during radio transmissions). Copilot and passengers will hear the intercom and music but not the aircraft radio receptions or transmissions.

All (Middle position): All parties will hear the aircraft radio reception and transmissions, intercom, and music. However, during any intercom or radio communications, the music volume automatically decreases. The music volume increases gradually back to the original level after communications have been completed. There is a lower switch position that is the same as ALL.

NOTE: When either the pilot or copilot PTT is depressed, all microphones are off except for the transmitting one.

Adjustment of Aircraft Radio Mute Level

The audio level that mutes the entertainment when the radio is active is determined by the setting of the aircraft radio mute circuit. This circuit is adjusted at the factory for optimum sensitivity. If the entertainment appears to be always muted (music stays at a constant low level even when the ICS is not being used) the mute trigger level must be adjusted. The mute level is changed by adjusting the small potentiometer located at the rear of the intercom. This is a 20-turn pot ,so you

all other mics are disabled. For pilot override, the unit can be switched off.

Specifications

Input power:	12-28 Volts DC
Current Drain:	< 150 mA Externally fused at 1 Amp
Headphone Impedance:	150-1000 Ω Typical
Audio Distortion:	<10% @ 150mW into 150 Ω load
Aircraft Radio Impedance:	1000 Ω Typical
±3 dB Mic Frequency Response:	350 Hz-6000 Hz
±3 dB Music Frequency Response:	200 Hz - 15 kHz
Net weight:	12 Ounces (.340 kg)
Dimensions:	1.25" H X 3.00" W X 5.50" D (3.2 cm x 7.7 cm x 14 cm)

Installation

Note: Approval basis for installing a PM2000 in certified aircraft is the responsibility of the installer.

The PM2000 was carefully inspected mechanically and thoroughly tested electrically before shipment. It should be free electrical or cosmetic defects. Upon receipt, verify that the parts kit contains the following:

A. Two # 4-40 Black machine screws

B. One reversible face plate

C. Two black knobs with white lines

D. One 25 pin Sub-D female connector with hood

C. Two connector thumbscrews

D. One hole placement template

E. One stereo/mono switch for pilot headset.

F. Four complete sets of jacks with insu-
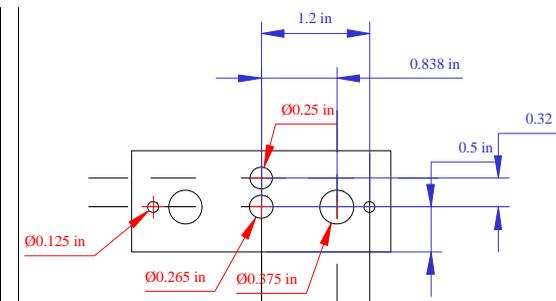
Hole placement diagram

lating washers and 1/8" music jack

1. Drill six holes as indicated in a location convenient to the pilot position(s).

2. Once the holes have been drilled, insert the PM2000 from behind the instrument panel through the four holes for the knobs, LED, and switch.

3. Place the aluminum face plate over the knob shafts, and secure with the two black #4-40 screws provided.

NOTE: A custom wire harness can be custom made to your specifications by the factory. Call the factory for more details.

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4. Next install the two knobs by pressing them on the shafts.

5. To complete the installation, a wire harness must be made and routed as depicted at the back of the manual.

IMPORTANT: You must use separate shielded cable for the microphone and headphone jacks. Combining these two wires WILL cause loud oscillations and degrade the intercom functions. The cause of the oscillation is due to the fact that there is a much larger signal being

carried by the headphone wire than the microphone wire. When these two wires are within the same shielded cable, cross-coupling allows the output to get back into the input, causing oscillations to occur.

If the aircraft already has pilot and copilot headset jacks installed, you may re-use the hardware. Remove all wires from the copilot jacks and discard them. NOTE: You may elect to use the existing pilot headset jacks as the auxiliary jacks.

NOTE: Auxiliary microphone and headset jacks are **required** for a complete installation. These provide troubleshooting and a back-up access to the aircraft radios.

To hook the intercom into the system, simply parallel a set of mic and headphone wires from this set of auxiliary jacks directly to appropriate points to the PM2000. Finally, install a new set of pilot headset jacks and hook directly to the appropriate points to the PM2000.

Electrical Noise Issues

Due to the variety of radio equipment found in today's general aviation aircraft, there is the potential for both radiated and conducted noise interference. The PM2000 has a power supply designed to reduce conducted electrical noise on the power bus by over 50 dB. Although this is a large amount of attenuation, it may not eliminate all noise when the amount of noise is excessive. In addition, there must be at least 13.8 Volts DC present at the PM2000 for the power supply to work in its designed regulation. Otherwise, it will not be able to adequately attenuate all noise.

Shielding can prevent radiated noise (i.e. beacon, electric gyros, switching power supplies) however, installation combinations can occur wherein minor interference is possible. The

PM2000 was designed in a RFI hardened chassis and has internal bypass capacitors on all input lines. RFI can still cause problems, like low or distorted sidetone, if correct shielding techniques are not observed.

Ground loop noise occurs when there are two ground paths for the same signal, i.e. airframe and ground return wire. Large cyclic loads such as strobes, inverters, etc., can inject audible signals onto the airframe. **Follow the wiring diagram very carefully** to help insure a minimum of ground loop potential. Radiated signals can also be a factor when low level mic signals are "bundled" with current carrying power wires. Keep these cables separated as much as possible.

Mil-spec 2– and 3-conductor shielded wire MUST be used as shown in the installation diagram for proper operation.

It is very important that you use insulating washers on all microphone and headphone jacks to isolate the audio signal ground from the aircraft ground.

Power Requirements

The PM2000 is designed to work with either 12 or 28 volt DC negative ground systems. The PM2000 must be externally fused with a 1 ampere circuit breaker.

Side Tone

Note: Use the low level (or line) output from any music device to connect to the PM2000. Maximum input level is 1 V peak-to-peak. **DO NOT USE SPEAKER OUTPUT.**

If the aircraft radio does not have sidetone (the ability to hear your voice during radio

transmissions) the PM2000 can be modified to provide sidetone for you. Call the factory for details.

Entertainment Hook Up

A stereo entertainment device (CD player, cassette player, etc.) can be connected to the PM2000. You may want to install a " stereo connector (provided) somewhere in the panel so that you can easily plug in an entertainment device.

The entertainment will be automatically muted when the ICS or aircraft radio becomes active. The "Soft Mute™" feature slowly returns the music to full volume when the ICS or radio becomes quiet. The muting feature is selectable by depressing squelch control (PUSH-MUTE switch).

External Push to Talk Installation

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

There are three configurations that can be used. You select the case that best fits your installation requirements.

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

CASE I
PTT built into the pilot and copilot yokes
Simply install the plugs from the headset into the aircraft headphone jacks. Use the yoke mounted PTT to transmit. No other action is required.
**CASE II**

Built-in PTT on the pilot side only, but copilot transmit capabilities desired.
This configuration requires a *modified* external PTT plugged into the copilot's mic jack. See Appendix A for modification details. When the copilot's PTT is depressed, this activates an intercom relay that switches the mic audio input to aircraft radio to the copilot.
CASE III
No built-in PTT switch at all
If there is no built-in PTT switch at all, an external, properly modified PTT switch is required. Both the pilot and
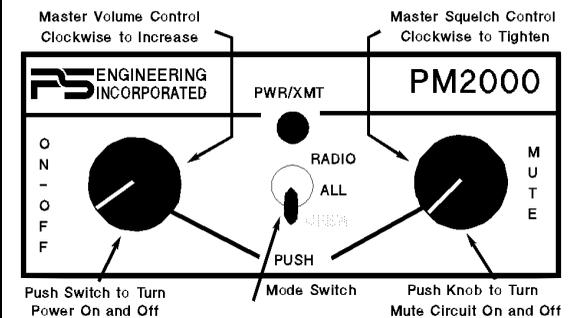
Front Panel Controls

copilot may use an external PTT. (See Appendix A.)

OPERATING INSTRUCTIONS

With the installation complete, turn the PM2000 on by pushing in the left knob (volume control). This also engages the automatic fail-safe system.