PS ENGINEERING INCORPORATED®

9800 Martel Road

Lenoir City, TN 37772

TRA121

Tactical Radio Adapter

Document P/N 200-002-0002
Revision 9, October 2024

Part Number 12100

Installation and Operation Manual

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

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Section I GENERAL INFORMATION

1.1 INTRODUCTION

The TRA121 Tactical Radio Adapter (12100) Interface is a solution for the interface requirements of general aviation avionics and non-aviation communications radios. Before installing and/or using this product, please read this manual completely.

1.2 SCOPE

This manual provides detailed installation and operation instructions for the PS Engineering Radio Adapter Interface unit. This includes the following part number:

Model	Description	Part Number
TRA121	Radio Adapter Interface Accessory	12100

1.3 EQUIPMENT DESCRIPTION

The TRA121 Radio Adapter (12100) is designed to interface general aviation aircraft audio systems to either a commercial 2-way business transceiver or a public service communication transceiver.

NOTE:
Because of the variety and inconsistency between different equipment manufacturers, models and configurations, PS Engineering makes no expressed or implied guarantee that the TRA121 Radio Adapter will work satisfactorily in all cases. If the equipment fails to perform, you may return the unit to PS Engineering for a refund without a restocking charge within 30 days of the invoice date. PS Engineering is not responsible for any engineering or removal costs.

1.4 APPROVAL BASIS – FAA- **None**

The TRA121 Radio Adapter (12100) is designed and manufactured to exacting quality standards. However, it is designed as a specialty unit for specific applications outside of the existing Technical Standard Orders.

It is the installers' responsibility to ascertain and procure the necessary approvals. PS Engineering makes no assertions that the TRA121 Radio Adapter (12100) is approved for installation in certified aircraft.

Operation is subject to the following conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

1.5 SPECIFICATIONS

Input Power:	12 or 28 VDC, Current drain: <250 mA
Aircraft Radio Impedance:	510Ω
Weight:	10 Oz.
Dimensions:	1.5" h x 4.0" W x 5.50" D Including mounting flange
Maximum Audio Input	10 Watts

1.6 EQUIPMENT SUPPLIED

A. 1 ea. of the following units:

Model	Part Number
TRA121	12100

B. TRA121 Radio Adapter (12100) Installation Kit (250-802-0100):

Part Number	Description	Quantity
425-025-0010	DB-25 Female	1
425-020-5090	Female Crimp Pins	25
425-002-0002	DB Connector Thumbscrews	2
625-025-0001	25-Pin Connector Back Shell	1
575-998-0050	Gold Foil Circle (adjustment hole cover)	3
575-998-0020	Black Circle (adjustment hole cover)	5

1.7 EQUIPMENT REQUIRED BUT NOT SUPPLIED

A. Interconnect Wiring
G. Circuit Breaker: 1 ea. 1 Amp.

1.8 LICENSE REQUIREMENTS

None

NOTE:

The radio transceiver interfaced through the Radio Adapter may require a special operator and/or Radio Station License. Consult the specific transceiver operation manual or the Federal Communication Commission for more details.

Section II - Installation

2.1 GENERAL INFORMATION

2.1.1 SCOPE

This section provides detailed installation and interconnect instructions for the PS Engineering TRA121 Radio Adapter (12100)-Series Interface.

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. The equipment **must** be installed by an appropriately rated Certified Repair Station or other certified agency, in accordance with applicable regulations.

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 items, 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 TRA121 Radio Adapter (12100) is not required. However, the unit 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 TRA121 Radio Adapter (12100) must be rigidly mounted to the aircraft structure. Mounting orientation is not important, however we do recommend that the unit be close to the communications transceiver and that the wiring runs should be as short as practicable. Installation must comply with FAA Advisory Circular AC 43.13-2A. The unit may be mounted in any area where adequate clearance for the unit and associated wiring bundle exists.

2.3.3 Mounting Hole configuration

The unit is mounted with two mounting flanges. The hole pattern is shown in figure 2-1.

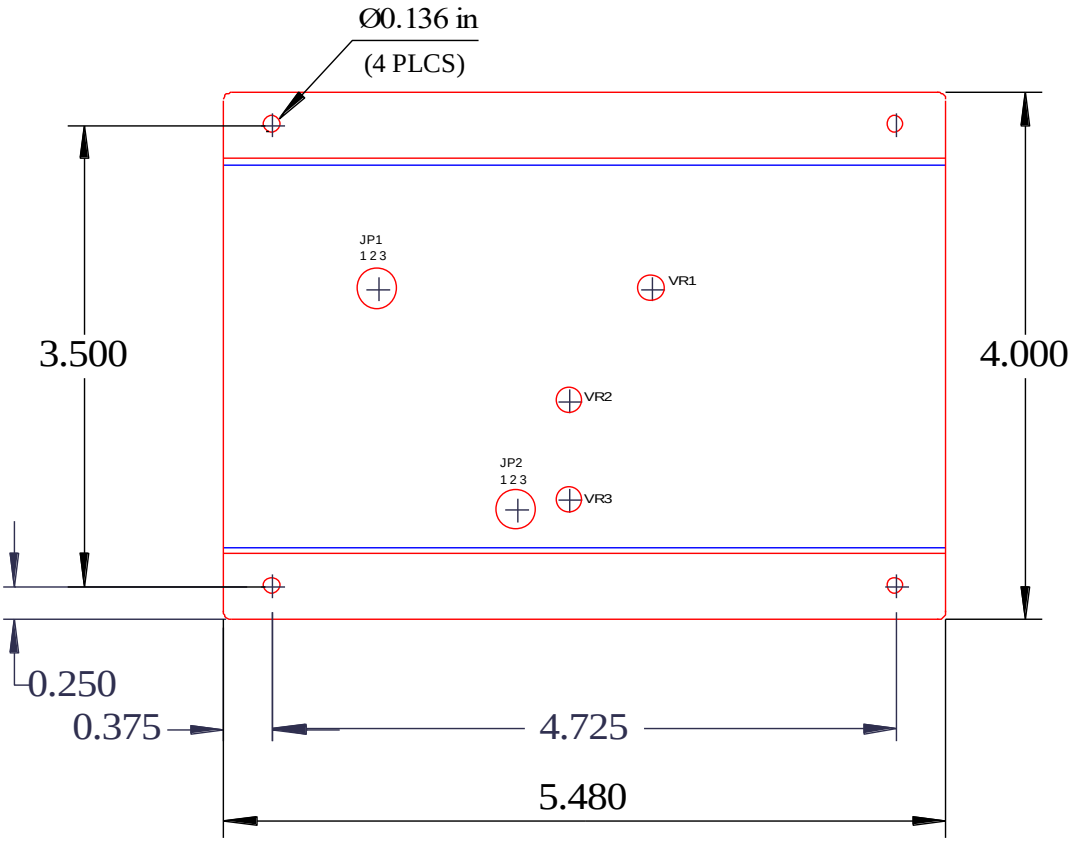


Figure 2-1 Mounting Diagram (not to scale)

2.3.4 Connector Assembly

The unit connector is DB25 type. The unit has a male connector, with the female on the harness.

2.3.5 Physical Installation

1. The unit is mounted using the flanges, in any position. Bolt the mounting flanges to the avionics shelf or other appropriate mounting surface, in accordance with AC-43.13-2B.
2. See Figure 2-1 for hole locations.
3. Fabricate an installation wiring harness in accordance with Appendix C.

2.4 Cable Harness Wiring

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

The shield should not be used as ground return. Terminate the shields with a short jumper to the appropriate pin as shown as close to the unit connector as practical.

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

2.4.1 Noise

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

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-27500, or better).

Do not run microphone audio and headphone audio in the same, shielded jacket, use separate shielded pair. Do not use the shield as a conductor, (audio low, etc) as this will create potential noise sources.

Radiated signals can be a factor when low level microphone signals are "bundled" with current carrying power wires. Keep these cables physically separated.

2.4.2 Power

The TRA121 Radio Adapter (12100) is compatible with both 13.8- and 28-Volt DC systems. A one (1) Amp circuit breaker is required. Fourteen-volt aircraft supply power through Pin 2, 28VDC aircraft through pin 1. Pins 14 and 15 are aircraft ground. Keep ground wires as short as possible.



Units with serial number ATRA3173 will have an amber LED “power on” indicator visible through the JP2 opening.

2.4.3 Interface to aircraft audio system

The aircraft-audio output from the TRA121 Radio Adapter is pin 4 with respect to (WRT) pin 17. This is a standard 500Ω audio output, similar to a VHF Communications transceiver.

The microphone audio input is pin 3, WRT 16. This is an aviation-standard dynamic mic input, similar to a VHF Communications transceiver input. The PTT input on pin 7 is ground-seeking, like an aviation microphone.

2.4.4 Interface to non-aviation transceiver

The TRA121 Radio Adapter audio input is transformer-coupled, pin 6, WRT pin 19. This can be configured for either a 150 Ω or 8 Ω speaker output from the transceiver.

The Microphone output from the TRA121 Radio Adapter to the transceiver mic input is pin 5 WRT 18. This can be configured for either an 8 Ω or 150 Ω mic, which is amplified or non-amplified, or 150 Ω, passed directly to the radio. The ground can be either audio low, or airframe ground referenced.

Many transceivers with hand microphones do not have a mic bias source, necessary for an aviation headset. Install the jumper at JP1 across pins 1 and 2 to generate a mic bias source, which will be connected to the aircraft microphone when the transceiver is selected for transmit.

If the commercial radio does not provide sidetone, the tactical radio can provide it. Move the jumper from the two farthest pins from the connector to the two pins closest to the connector (See Figure 2-3)

Then adjust potentiometer VR2 that is described as “Sidetone Level” so a desired sidetone level is achieved.

Transceivers with built-in speakers also do not provide sidetone, so VR2 can be adjusted to cause sidetone to be present during transmission.

The audio input to the radio adapter (pin 6 hi, pin 19 low) is transformer isolated. In some installations, it may be required to have a common ground to prevent loss of signal or distortion. In this case, connect pin 19 to pin 15.

2.4.4.1 Push to talk interface

The TRA121 Radio Adapter is configurable for hi-seeking, low-seeking, or 2-pin contact push-to-talk (PTT) systems.

Pin 7 is the key-line input from the aircraft audio system. Grounding this line in PTT causes a 2-pole relay to change states.

For instance, if the tactical radio has a ground seeking PTT line, you ground the common #1of the relay, Pin 10, and connect the normally open connection, Pin 9 to the unit PTT input. Keying the aircraft PTT then grounds Pin 9.

Connecting Pin 10 to logic high will pull Pin 9 high in PTT, and so on. If there are two PTT contacts, one can be connected to common, and the other to NO.

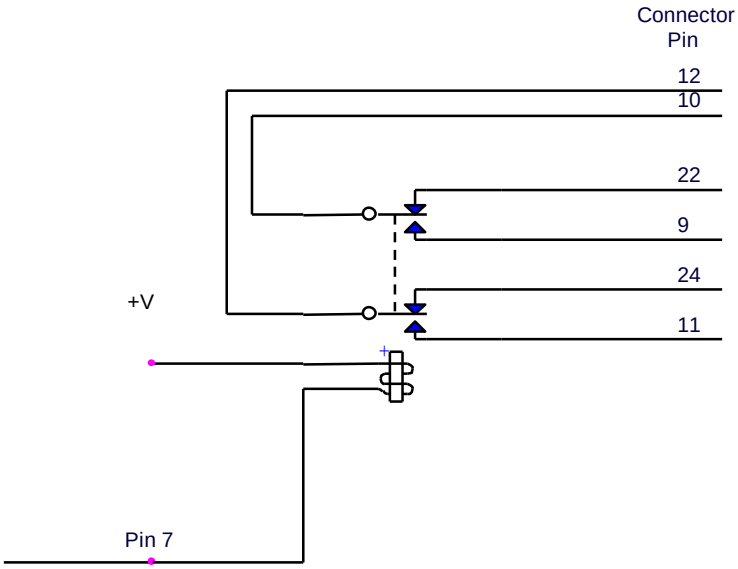


Figure 2 Mic Keying Relay Detail

2.5 Adjustments

The unit can be configured for several different interface combinations. Remove the unit from its mounting bracket by removing the four screws at corners near the upper edge.

The following adjustments are available, and marked on the silkscreen:

VR1	Mic Amplitude Control
VR2	Sidetone Adjust
VR3	Audio Output Adjust

The following switch positions are available to configure the unit for specific transceiver types.

S 1	
Switch 1	ON if 8Ω microphone
Switch 2	ON if microphone direct connect
Switch 3	ON if amplified mic
Switch 4	ON if Mic output ground referenced (or 8Ω)

S2	
Switch 1	Not Used
Switch 2	ON for 150Ω mic
Switch 3	ON for 8Ω mic
Switch 4	ON for 150Ω mic

S 3	
Switch 1	Not Used
Switch 2	ON for 150Ω speaker
Switch 3	ON for 8Ω speaker
Switch 4	ON for 150Ω speaker

The JP 1 header is connected to provide internal mic bias. These are the pins closest to the unit connector.

The JP2 header connect pins 1 and 2 if higher audio output gain is desired.

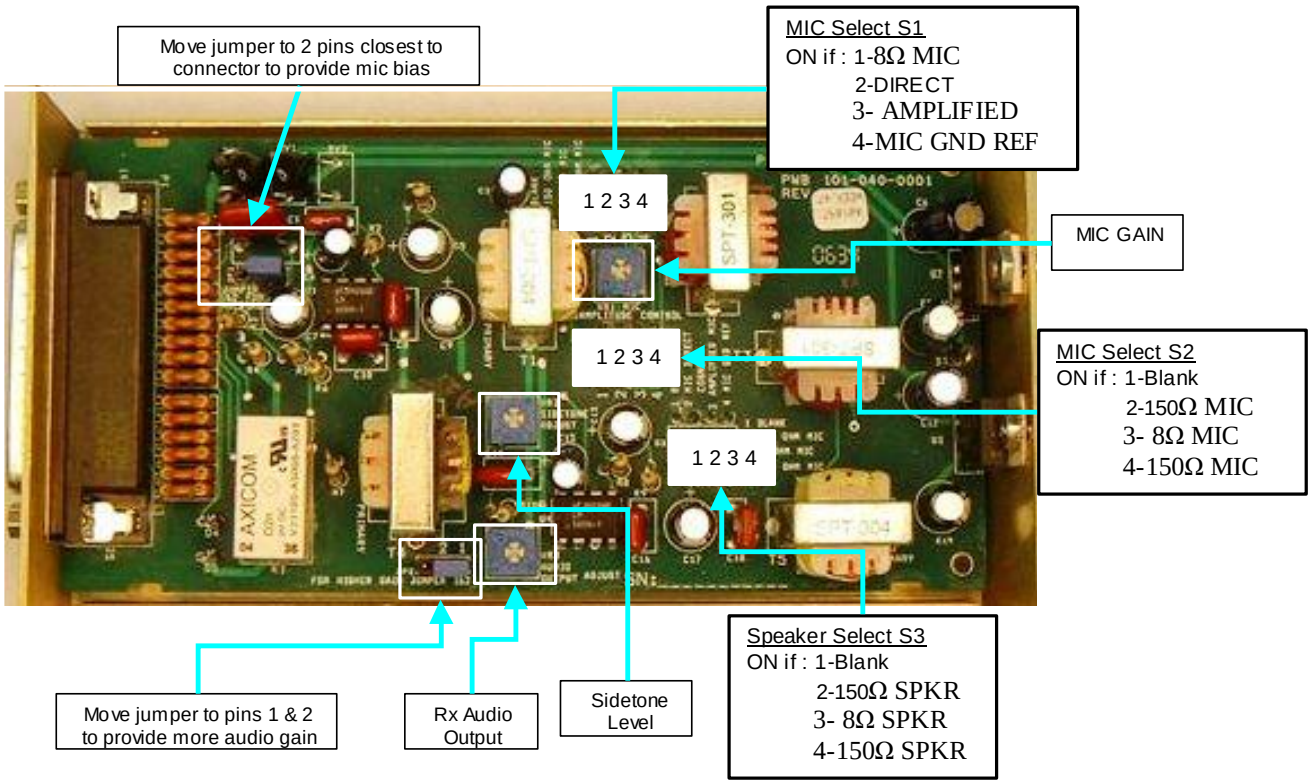
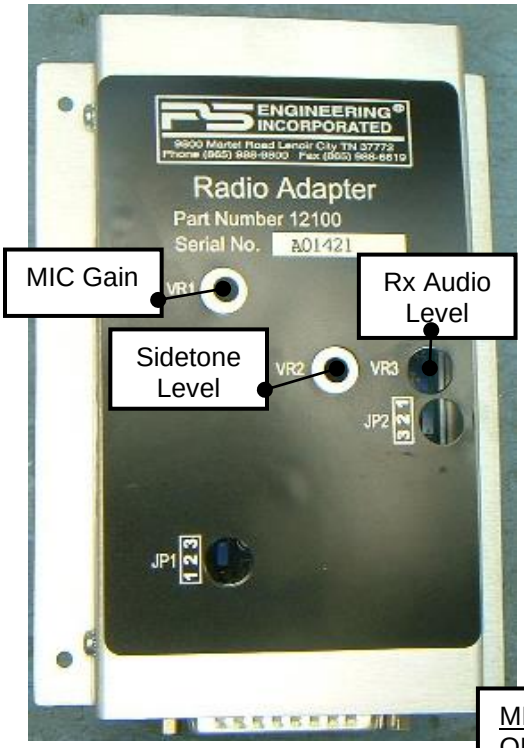
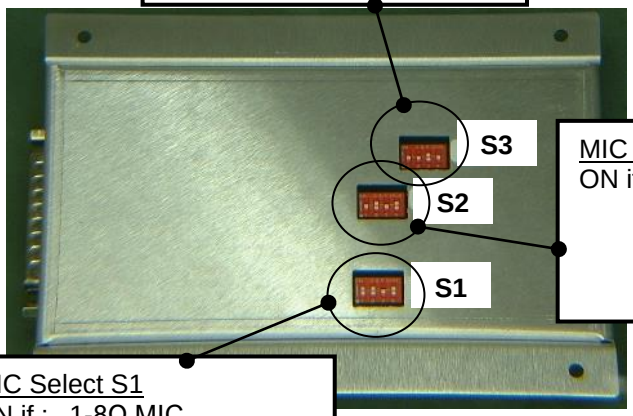


Figure 2-3 Internal Adjustments and settings



12100 Unit Top



12100 Bottom

Table of previously used switch combinations:

HELP US HELP YOU AND OTHERS!

PLEASE FAX OR MAIL OTHER SUCCESSFUL SWITCH COMBINATIONS FOR INCLUSION IN OUR DATABASE!

THANK YOU

	Midland LMR 70-1340B	Icom ICF121 VHF	YAESU FTM-400-DR	Kenwood LMR
Switch	Condition	Condition	Condition	Condition
S1 - 1	OFF	OFF	OFF	OFF
S1 - 2	ON	OFF	ON	ON
S1 – 3	OFF	ON	OFF	OFF
S1 – 4	OFF	ON	OFF	ON
S2 –1	OFF	OFF	OFF	OFF
S2 – 2	OFF	OFF	OFF	ON
S2 – 3	ON	ON	OFF	OFF
S2 – 4	OFF	OFF	ON	ON
S3 – 1	OFF	OFF	OFF	OFF
S3 – 2	OFF	ON	OFF	ON
S3 – 3	ON	OFF	ON	OFF
S3 – 4	OFF	ON	OFF	ON
JP1		Pins 1 & 2 (Mic bias enabled)	Pins 1 & 2 (Mic bias enabled)	Pins 1 & 2 (Mic bias enabled
JP2		Pins 1 & 2 (Higher gain)	Pins 1 & 2 (Higher gain)	Pins 1 & 2 (Higher gain)

NOTE: USE SPEAKER OUTPUT OF ICF121 AS AUDIO INPUT TO ADAPTER, AND TIE PIN 19 TO 15 (AUDIO LOW TO AF GROUND)

Use the table above as a worksheet. If you will send us your successful combination, we can add it to the list. Fax to: (865) 988-6619.

2.6 Operational Checkout

NOTE:
Because the TRA121 Radio Adapter is designed to interface with commercial or public service/safety transceivers, your testing may affect other radio services. Verify frequencies and operating procedures before attempting to transmit on unknown radios.

1. Verify that aircraft power is present only on Pin 1 (28 VDC) or pin 2 (14 VDC).
2. Apply power to the avionics and tactical transceiver.
3. Verify that the receive audio from the tactical radio is present in the aircraft audio system when selected.
4. With the transceiver connected to a dummy load, or to an antenna, and operated by properly rated personnel, press the aircraft PTT, and verify that the transceiver switches to transmit mode.
5. Verify that there is microphone audio through the system by making a radio check with an appropriate facility.

2.7 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. Verify that the cables are not exposed to any sharp edges or rough surfaces, and that all contact

points are protected from abrasion. Complete logbook entry, FAA Form 337, weight and balance computation and other documentation if required. Return completed warranty registration application to PS Engineering.

Section III- Operation

There are no operational controls in this unit.

Section IV- Warranty and Service

4.1 Warranty

In order for the factory warranty to be valid, the installations in a certified aircraft must be accomplished by an FAA- certified avionics shop and authorized PS Engineering dealer. If the unit is being installed by in an experimental aircraft by the owner/builder, a professionally made harness must be installed 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 one (1) year from the date of sale. 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.

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 or unreasonable use or maintenance as determined by us. This warranty is void if there is any attempt to dissemble this product without factory authorization. This warranty gives you specific legal rights, and you may also have other rights which may vary from state to state. Some states do not allow the exclusion of limitation of incidental or consequential damages, so the above limitation or exclusions may not apply to you.

4.2 Factory Service

The unit is covered by a one-year limited warranty. See warranty information. Call PS Engineering, Inc. at (865) 988-9800 before you return the 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:

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

Appendix A- Installation Information and Connector Layout

The TRA121 Radio Adapter can be installed in any orientation in a convenient location. Mount the unit using the flanges to a permanent aircraft structure, in accordance with AC 43.13-2B, *Acceptable Methods and Practices, Aircraft Alterations*, Chapter 2, Radio Installations.

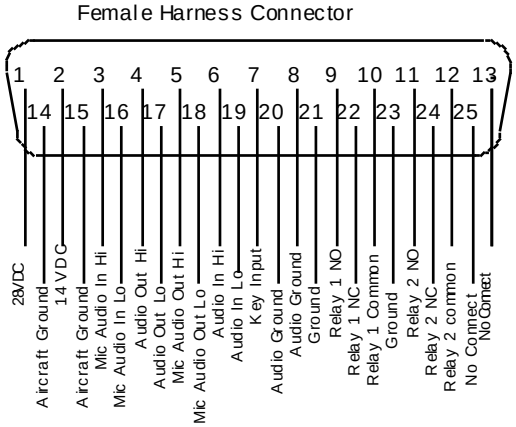


Figure 5-1 Connector Layout

Appendix B TRA121 Unit Wiring

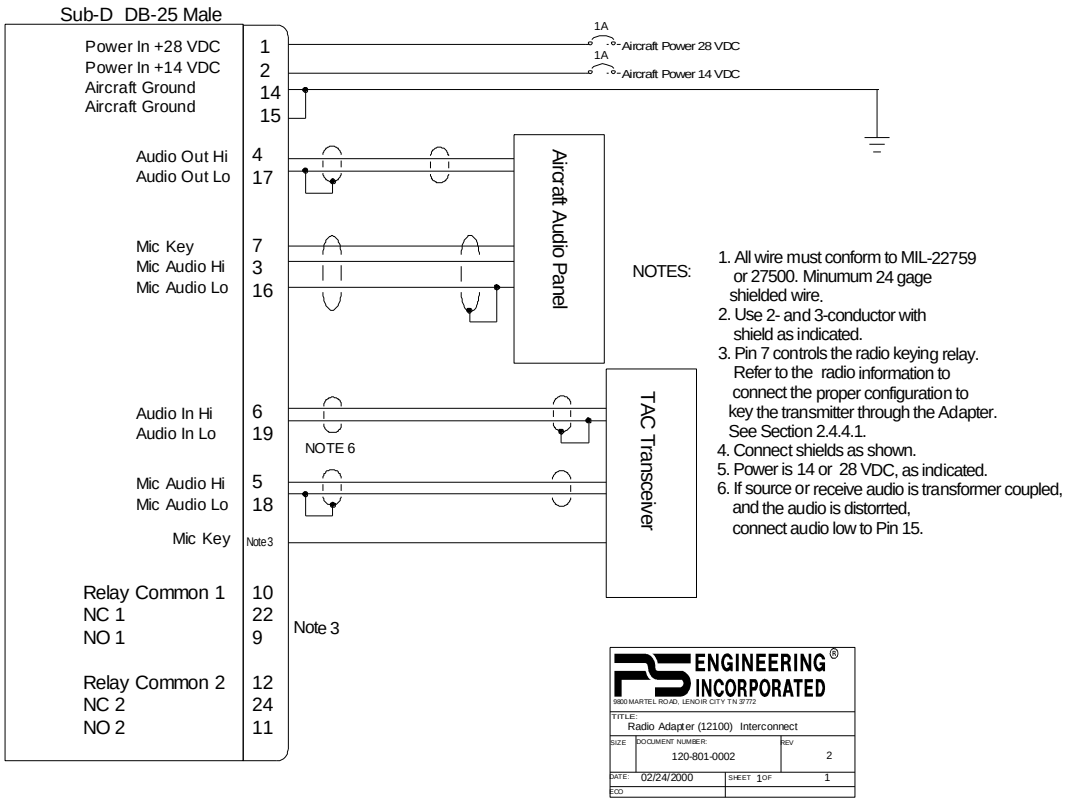


Figure 6-1 Installation Diagram

Appendix C -Instructions for Continuing Airworthiness

The TRA121 **Radio Adapter (12100)** is considered an “on-condition” maintenance item. It should be checked prior to each flight during normal operation. There are no additional considerations for continuing airworthiness other than the practices detailed in AC 43.13-1B, Chapter 11. This includes inspecting the unit to be sure it is securely fastened in its location, and that the wiring harness is not chafed or pinched and remains secure. All connections should be checked at each periodic inspection to ensure that they are tight and not in contact with other items in the aircraft.