

Sigtronics Dual Bus Kit Installation & Operation Instructions

INTRODUCTION

ATTENTION INSTALLER: To assure a trouble free installation, please read the entire instructions through once before beginning.

The Sigtronics Dual Bus Kit includes two Model SPA-4Si intercoms specifically designed for permanent installation in aircraft using dual (separate) audio buss' systems (i.e. aircraft with two audio panels). The SPA-4Si units allow each pilot, operating separate radios, the convenience of voice activated inter cabin communication. In addition to operating their respective radio systems independently, the SPA-4Si units add independent music inputs and full stereo aviation headset capability. Optional passenger connections allow intercom and stereo music positions with radio receive — *No radio transmit.*

The kit consists of two SPA-4Si intercoms (*with the option of adding up to 4 more SPA-4Si units*) each with their own operating controls and radio interface. An interconnect line allows intercom communication between the units yet keeps the VHF audio systems separate. When transmitting through their respective radios, each side will hear the other's transmission unless transmitting simultaneously. Radio transmission is also possible through either unit even when the units are "OFF."

The SPA-4Si units may also be used as a dual intercom system in aircraft without dual audio panels. This is convenient where it is desired to have separate conversations between pilots and passengers. Contact Sigtronics for information.

GENERAL FEATURES AND SPECIFICATIONS

Voice Activated: Allows "hands free" intercommunication between pilot(s) and passengers. Start speaking and the intercom instantly turns on to relay your message clearly to the other headsets; stop talking and it turns off to reduce background noise. There is no need to raise your voice or turn your head anymore!

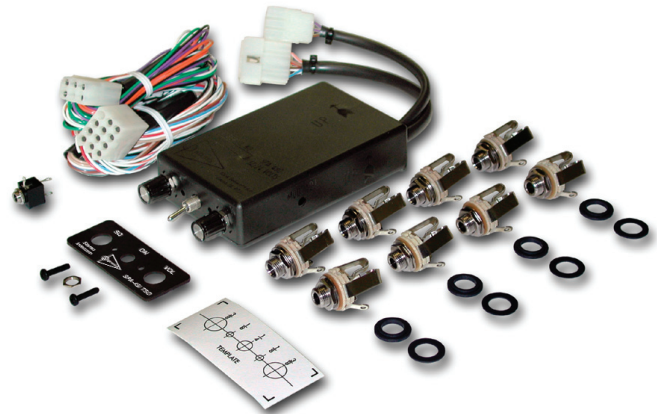
Transmit Capability: Both pilot and co-pilot can transmit to air traffic control via push-to-transmit switches and headset boom microphones. The intercom function is automatically disabled during transmit, so that only the voice of the person transmitting can be heard.

Radio Monitoring Capability: Radio output can be heard whether intercom power switch is "ON" or "OFF."

DUAL BUS KIT SYSTEM SPECIFICATIONS

CONFIGURATION – The Sigtronics Dual Bus Kit Intercom system is specifically designed for multiple audio bus systems. Each SPA-4Si unit in the kit provides voice activated (VOX) intercom and music input for up to four headset positions in a small, permanent, panel mounted installation in the aircraft.

STEREO MUSIC INPUT – Music input accepts standard portable music headphone or line level outputs. May use one input for all SPA-4Si units in the system or each SPA-4Si can have a independent music source. Automobile Speaker level outputs can be adapted for use with SPA-4Si intercoms.



COMPATIBILITY – Sigtronics SPA-4Si intercoms have been designed to operate with all standard general aviation aircraft radios and headsets.

SIZE: Panel 1" x 2.5". Chassis - 1" high x 2.5" wide x 4" deep. Can be mounted either horizontally or vertically in the aircraft panel.

WEIGHT: 5.5 ounces (SPA-4Si intercom unit with panel and knobs). Jacks and wiring harness weigh 7.0 ounces

INPUT POWER: 11 VDC through 32 VDC. Maximum current drain 0.11 Amps

DISTORTION: Less than 1% total harmonic distortion.

WARRANTY: SPA-4Si intercoms are constructed of high quality components and carry a five year parts and labor warranty.

HARDWARE SUPPLIED

Besides the intercom and instructions, each SPA-4Si unit comes with the following hardware:

Headphone Output Jacks - Accept standard 0.250" aircraft stereo headphone plugs.	4
Microphone Input Jacks - Accept standard 0.206" aircraft microphone plugs. (U93 plug compatible jacks can be used in place of the jacks provided – monaural installations only).	4
Mic Jack Insulating Washers, Flat	4
Mic Jack Insulating Washers, Shoulder	4
Intercom Panel - lettered on both sides.	1
Intercom Control Knobs	2
Mounting Screws 4-40 x 1/2	2
Drill Template - Adhesive backed hole size pattern for drilling aircraft panel.	1
Intercom / Aircraft Interface Cable (4 feet long)	1
Headphone / Music Interface Cable (4 feet long)	1
Stereo music input jack 3.5mm	1



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MUSIC MUTE OPTIONS

FACTORY DEFAULT - PARTIAL MUSIC MUTE DURING ICS - When listening to music and someone speaks on the intercom the default factory operation is to partially mute the music so you can hear the conversation.

FULL MUSIC MUTE DURING ICS OPTION - The music can be completely muted during intercom conversations. To enable this option, small jumper wires are installed on the solder side of the circuit board. See page 5.

HIGH NOISE VERSION

Model SPA-4SiH - The "H" version of the SPA-4Si has all the above features but is specifically configured for very high noise environments.

CHASSIS INSTALLATION

UNIT PLACEMENT

For ease of operation we recommend that you place the pilot's SPA-4Si unit on the pilot's side of the aircraft panel and the co-pilot's unit should be placed on his side. This eliminates any confusion about which half of the system each pilot has to operate. Also, the location selected for each SPA-4Si unit requires a minimum front panel area of 2-1/2" by 1". Depth required behind panel is 4" plus cable access.

CAUTION: Move the aircraft flight controls through the limits of travel while observing the selected area and making sure that the rear of the intercoms and cables will not interfere with any aircraft control components.

PANEL PREPARATION EACH UNIT:

1. Position the adhesive drill template on the aircraft panel in the selected area.
2. Center punch each hole at the cross lines. (Five holes are in a straight line and equally spaced 0.4" apart)
3. Drill 1/8" pilot holes in all five places.
4. Enlarge holes to 1/4" and 3/8" per the template.

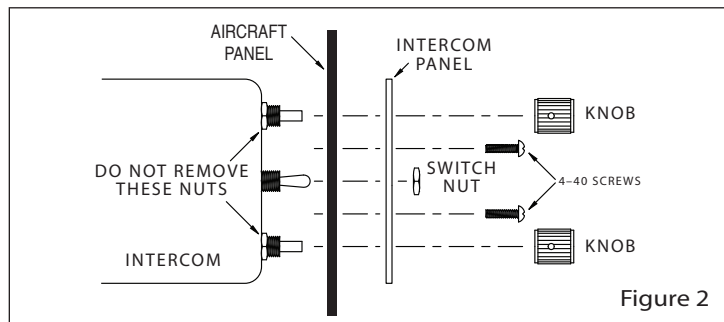


Figure 2

MOUNTING CHASSIS (See Figure 2)

1. Remove the knobs from the Volume and Squelch controls using a 0.05 inch Allen wrench. Remove the nut from the ON/OFF switch. **NOTE: DO NOT REMOVE** the nuts from the Volume and Squelch controls.
2. Insert the SPA-4Si unit from the rear of the aircraft panel with the appropriate arrow on the unit chassis pointing upwards.
3. Install the printed SPA-4Si panel and lightly thread the two 4-40 screws through the holes in intercom panel. The nuts on the Volume and Squelch controls will fit inside the 3/8" diameter holes.
4. Tighten the two screws and switch nut.
5. Install the knobs on the Volume (VOL) and Squelch (SQ) control shafts and tighten the Allen screws.

MOUNTING HEADPHONE AND MICROPHONE JACKS (See Figure 3)

1. Locate the mounting areas. (One mic and one headphone jack required for each headset). Again, make sure that the jacks will not interfere with

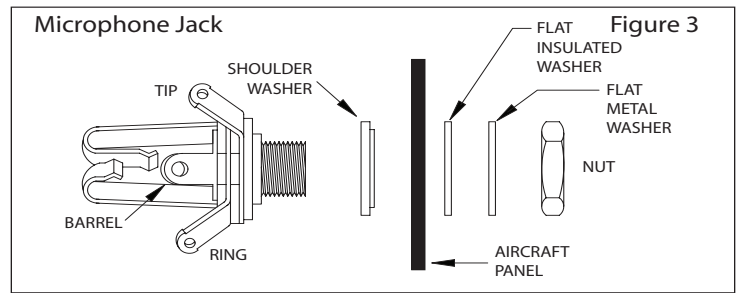


Figure 3

any aircraft control components. (Note that the jack contacts will expand when a plug is inserted into the jack and must have clearance to prevent shorting.)

2. Drill 3/8" diameter holes for headphone jacks and install.
3. Drill 1/2" diameter holes for the mic jacks and install with the insulating washers supplied. (See Figure 3).

Note: If the aircraft already has pilot headset jacks, the location can be used for intercom with the following changes. The mic jack must be re-wired as follows:

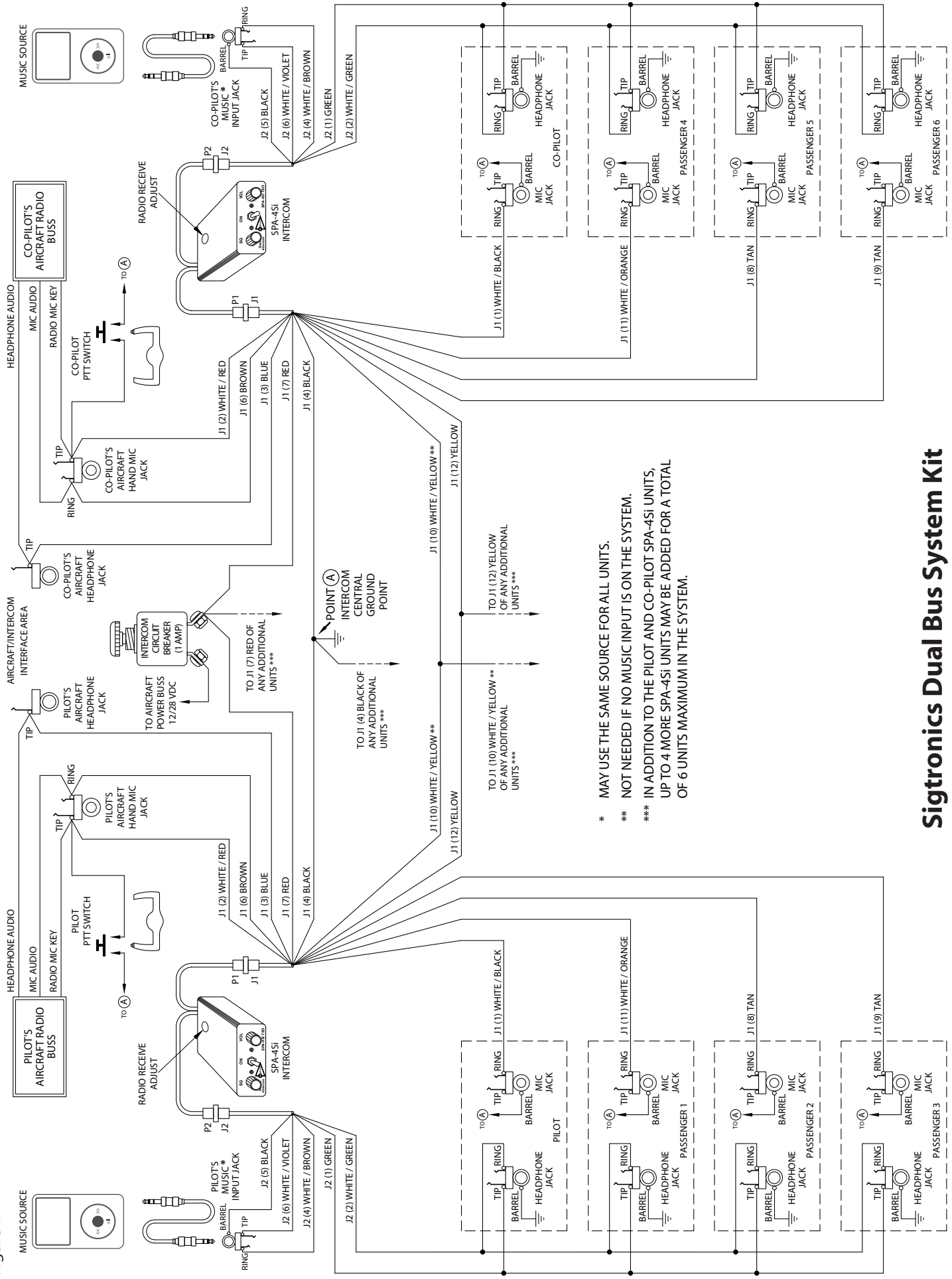
1. Remove any existing wires from the tip, ring, and barrel connections.
2. Connect the intercom white/black wire to the ring terminal.
3. Connect one end of a ground wire to the barrel terminal of the mic jack and connect the other end to Intercom Central ground Point "A".
4. Install insulating washers as necessary if the barrel of the mic jack is mounted in metal. For the headphone jack, replace the mono headphone jack with the stereo headphone jack. Connect the green wire (P2 pin 1) to the tip connection. Connect the white/green wire (P2 pin 2) to the ring connection.

WIRING INSTRUCTIONS

Connections should be made as shown in Figure 4 and indicated in Tables 1 and 2. Read also the referenced notes below. If longer wire lengths are required, use a good quality multi stranded hook-up wire - 22 gauge or larger. Although not necessary, shielded audio wire can be used if desired.

1. The blue wire (J1 pin 3) must be connected to the aircraft radio headphone output - NOT the speaker output. **NOTE** - If aircraft radio volume heard in the headsets changes significantly when switching the ON/OFF switch a minor adjustment to the radio receive potentiometer will fix this. See "INSTALLATION CHECK-OUT AND ADJUSTMENTS" Radio Receive Adjust section on page 4.
2. Connect all intercom mic jack grounds to a single aircraft chassis ground point - Intercom Central ground Point "A" - as shown in Figure 4. (Use the black washers supplied to insulate the intercom mic jacks from aircraft chassis ground). Note this intercom central grounding point is used to eliminate any unwanted electrical noises, such as alternator whine or strobe noise, from being induced into the intercom system through the grounds. All intercom mic jack barrels must be insulated from ground where they are mounted and connected back to Intercom Central Ground Point "A" on their own individual ground wire. Similarly, **all intercom ground wires** (J1 pin 4) and **all PTT switch ground returns must** also be connected back to Intercom **Central Ground Point "A"**. It is not necessary, however, to connect the headphone jack barrels to Intercom Central Ground Point "A". They can either be grounded where they are mounted or some place nearby.
3. The red wire may be connected to either 12V (14V) or 24V (28V) power source. No switching or adjustments are required to operate from either source.
4. Tan wires (J1 pins 8, 9) and White/Orange (J1 Pin 11) are only used on installations that require passenger intercom positions.

Figure 4



* MAY USE THE SAME SOURCE FOR ALL UNITS.

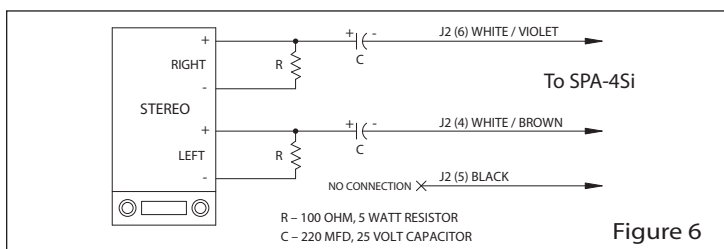
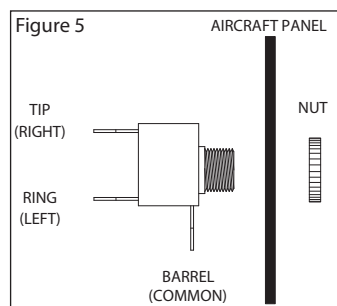
** NOT NEEDED IF NO MUSIC INPUT IS ON THE SYSTEM.

*** IN ADDITION TO THE PILOT AND CO-PILOT SPA-451 UNITS, UP TO 4 MORE SPA-451 UNITS MAY BE ADDED FOR A TOTAL OF 6 UNITS MAXIMUM IN THE SYSTEM.

TABLE 1 - P1/J1 - See Wiring Instructions			
PIN	WIRE COLOR	FUNCTION	CONNECT TO
1	White/Black	Pilot Mic Input	Ring Terminal of Pilot Mic Jack
2	White/Red	Radio Transmit Key Output	Tip Terminal of Aircraft Hand Mic Jack, or Key Input of Aircraft Radio or Audio Panel
3	Blue *1	Radio Headphone Input	Radio Headphone Output
4	Black *2	Intercom Central Grounding Point "A"	Aircraft Chassis Ground
5	N/C	—	—
6	Brown	Transmit Mic Audio Output	Ring Terminal of Aircraft Hand Mic Jack or Mic Input of Aircraft Radio or Audio Panel
7	Red *3	12 through 28 VDC Power Input	Intercom Circuit Breaker
8	Tan *4	Passenger #2 Mic Input	Ring Terminal of Passenger #2 Intercom Mic Jack
9	Tan *4	Passenger #3 Mic Input	Ring Terminal of Passenger #3 Intercom Mic Jack
10	White/Yellow	Music Mute Link	White/Yellow of any Other Units
11	White/Orange *4	Passenger #1 Mic Input	Ring Terminal of Passenger #1 Intercom Mic Jack
12	Yellow	Bidirectional Intercom Link	Yellow of any Other Units

TABLE 2 - P2/J2 - See Wiring Instructions			
PIN	WIRE COLOR	FUNCTION	CONNECT TO
1	Green *7	Intercom Right Headphone Output	Tip Terminal of Headphone Jack
2	White/Green *7	Intercom Left Headphone Output	Ring Terminal of Headphone Jack
3	N/C	—	—
4	White/Brown *5	Music Input Left Channel	Left Music Source Headphone or Line output
5	Black *5	Music Input Common	Music Source Common Headphone or Line Output
6	White/Violet *5	Music Input Right Channel	Right Music Source Headphone or Line Output

5. Each SPA-4Si unit provides a stereo music input. This music input accepts portable music Headphone or Line level music sources. The wiring diagram shows how to wire the SPA-4Si for use with a portable stereo music source. A small stereo input jack is supplied for this purpose. Connect the White/Brown, White/Violet, and Black wires to one jack as shown in Figure 4. Identify the jack terminals using Figure 5. Drill a 1/4 inch hole for the jack and mount on the aircraft panel. To use, connect an adapter cable between the music input jack and the output of the portable stereo. Suitable cables are available at your local stereo or electronics store as well as from Sigtronics. Speaker level output car stereo music sources can also be used with the SPA-4Si units. A Floating Ground Adapter or a four wire to three wire converter will have to be used between the Stereo and the SPA-4Si music input (either separate or single inputs). Figure 6 shows such an adapter and how it is wired into the SPA-4Si.



- If using only a single portable music source there are two different methods that can be used. For a system with two SPA-4Si units the easiest way is to wire just like the wiring drawing and use a mini-jack "Y" or splitter (available at your local stereo or electronics store). Use the splitter and dual cables to go from the music source into both SPA-4Si input jacks. The second way is to use just one of the supplied music input jacks and connect all inputs to it. Do this by connecting all (J2) White/Violet wires to the TIP terminal, all (J2) White/Brown wires to the RING, and all (J2) Black wires to the BARREL. This method will work for systems with two or more SPA-4Si units.
- The Sigtronics Dual Bus Kit can be installed as shown for use with Stereo headsets. Alternatively, monaural general aviation type headsets can be used. To use monaural headsets follow the installation instructions as normal except for the wiring of the stereo headphone jacks. Use the stereo headphone jacks supplied with the Sigtronics SPA-4Si units but leave the "RING" connections open. Instead connect both headphone wires to the "TIP" of the respective jacks. Connect both the WHITE/GREEN and GREEN on to the TIP of the headphone jack.

INSTALLATION CHECK-OUT AND ADJUSTMENTS

After the units are installed, again check that the SPA-4Si unit chassis, jacks, and wiring harness are clear of all aircraft operating controls and cause no interference with them.

Next, to check out the SPA-4Si unit installations, plug in all the headset mic and phone plugs into the respective intercom jacks. Put on the pilot's headset and position the boom mic close to the mouth. Voice clarity is best when the mic is at one side of the mouth and 1/4" from the lips.

To assure that the aircraft radios, pilot's headsets, and PTT switches are connected and functioning properly, switch all SPA-4Si ON/OFF switches to the "OFF" position. Set both audio panels to "Headphone" position. Then turn on the aircraft radios as usual, and verify that the pilot and co-pilot can hear the radios and can transmit using their respective push-to-transmit switches and headsets. Aircraft radios and both audio panels should operate exactly as they did before the SPA-4Si units were installed. Aircraft radio reception should also be heard in the passenger headsets if used. There should be no intercom between headsets with the SPA-4Si units "OFF".

Next turn both SPA-4Si units "ON". Set the SPA-4Si volume controls to mid-position. Set SPA-4Si squelch controls fully clockwise. Verify that all headset positions, including the passenger positions if used, can intercom to each other.

MIC OUTPUT ADJUST

It may be necessary at this time to adjust the SPA-4Si units mic output to the aircraft radios. A small adjustable potentiometer is provided inside the units for this purpose. It is accessible through a hole in the side of the SPA-4Si chassis. It is marked "Mod. Adj.," and can be adjusted with a small blade screwdriver. In the event of over-modulation (garbled) or reports of weak transmissions over the aircraft radio, an appropriate adjustment can be made. Clockwise rotation increases the output level to the aircraft radio mic input. Counter-clockwise rotation decreases modulation level. This adjustment sometimes needs to be made after the initial installation of the intercom or if a new radio is installed. (The output is set for unity gain at Sigtronics).

RADIO RECEIVE ADJUST

It may also be necessary to adjust the unit's radio receive input from the aircraft radio. A small adjustable potentiometer is provided inside the unit for this purpose. It is accessible under a sticker on top of the chassis box (see Figure 4), and can be adjusted with a small blade screwdriver. In the

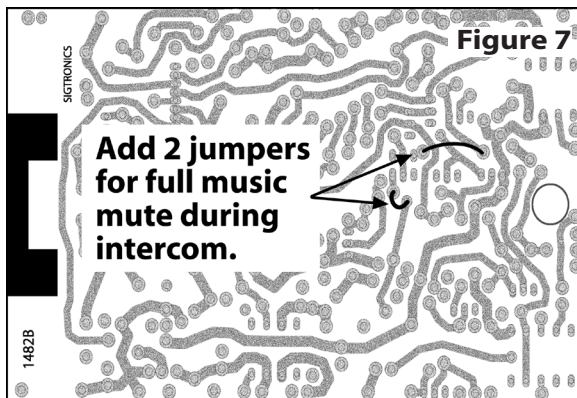
event of low aircraft radio volume in the "ON" mode relative to "OFF" mode, an appropriate adjustment can be made. Clockwise rotation increases the input level to the SPA radio receive input. Counter-clockwise rotation decreases input level. This adjustment sometimes needs to be made after the initial installation of the intercom or if a new radio is installed that has a low output impedance or low output power. The adjustment is best made with all headsets plugged in. (The input is set full CCW which is unity gain for 500Ω radios). **Note:** Be sure to replace the sticker when you have completed the adjustment.

MUSIC (IF USED)

You are now ready to check for proper wiring of the music source. First, make sure squelch is off (full counter clockwise) and the intercoms are "ON". Turn on the music source and listen for music through pilot and co-pilot headsets, and passenger headsets. There should be music.

If everything checks out, refer to the OPERATING INSTRUCTIONS section for proper use and other operating modes of the Sigtronics Dual Bus Kit intercom system. If something does not work as described, carefully go over the intercom wiring again. If something is still not right or you have any questions regarding the installation and operation of the Sigtronics SPA-4Si intercoms or any other Sigtronics product feel free to contact us directly or E-mail us at tech@sigtronics.com. Technicians are available Monday through Friday 8 am to 4:30 PM Pacific time.

See the OPERATING INSTRUCTIONS for complete operation information.



FULL MUSIC MUTE DURING ICS OPTION

To select full music mute during intercom, the unit must be removed from the aircraft. This is done by first removing the volume and squelch control knobs with a 0.05 inch Allen wrench. Then remove the two mounting screws and switch nut that holds the unit in the panel. The unit is now free for removal from the aircraft after disconnecting the cables at the plugs.

To enable this option, modification to the bottom of the units' circuit board is required. **CAUTION** – a qualified technician should perform this modification. First remove the three screws securing the bottom cover to the case and carefully lift and remove the cover. Note that the circuit board does not have to be removed from its case to complete the modifications.

To select full mute during intercom solder the two small-insulated jumper wires at the locations specified in Figure 7.

Replace the cover and secure it with the three screws as before. Install the unit back into the panel and plug in the two cables.

OPERATING INSTRUCTIONS

INTRODUCTION

This section describes the operation of the Sigtronics Dual Bus intercom system. For information on SPA-4Si installation see the INSTALLATION INSTRUCTIONS section beginning on page 2.

The SPA-4Si intercoms for dual audio buss systems incorporate voice activated (VOX) intercom with "transmit through the aircraft radio capability" using your push-to-transmit (PTT) switches. In addition they allow for stereo music input.

CONTROLS

Three controls are provided on each SPA-4Si unit:

ON/OFF Switch - Turns the intercom "ON" or "OFF".

INTERCOM VOL - Volume Control - Controls the intercom volume. (Except in OFF mode when the intercom is switched off)

INTERCOM SQ - Squelch Control - Sets the intercom turn-on threshold for voice activated intercom (VOX) mode.

Each unit will function as an independent intercom with pilot, co-pilot, and any additional SPA-4Si units having their own ON/OFF switch. When all intercoms are "ON", pilot, co-pilot, and passengers (if used) can intercom. Also, when either pilot or co-pilot transmit over the radio, they will hear each other. If both transmit simultaneously, neither will hear the other. The purpose of this feature is to allow independent VHF communication. Transmitting is also possible with the intercom OFF.

INTERCOM OPERATION

CAUTION - As is standard practice with all aircraft avionics equipment, be sure that the aircraft radio master switch is turned off when you start up the aircraft engine.

SQUELCH SETTING - To use the SPA-4Si intercoms voice activated (VOX) feature, the Squelch Controls will have to be set. This can be performed by the following procedure:

1. To set the Squelch controls it is helpful to have some background noise present and music sources off. With aircraft electrical power on, set all SPA-4Si ON/OFF switches to the "ON" position. Turn the SPA-4Si unit volume (VOL) controls to the 10 o'clock position.
2. To adjust the intercom squelch controls for voice activated operation (VOX), it may also be necessary to turn up the intercom volume controls. Turn all intercom squelch controls all the way counter clockwise. Now, without speaking, rotate one of the squelch controls clockwise until you hear the background noise in your headset. Next, using the same control, rotate counter clockwise small, incremental amounts until the background noise disappears. (This procedure is necessary because the squelch is a "fast on, slow off" system). The squelch control is now set on that intercom unit.
3. Adjust the other intercom squelch controls similarly by turning clockwise until you hear background noise. Rotate counter clockwise **incremental amounts** until the background noise disappears. Small adjustments may be necessary if aircraft background noise changes significantly - such as from idle to maximum power.

Once set, the intercom stays silent until someone speaks in their headset microphone (mic). Then it instantly turns on and relays the conversation. After about a second of no conversation the intercom goes silent again.

In most aircraft the squelch controls will not need to be set again unless you change the number or type of headsets used with the system. In some high noise aircraft it is better to set the squelch during climb or cruise.

VOLUME SETTING - The Volume controls should be set to the minimum level for best performance. Intercom Volume levels set too high allow excessive background noise to enter the headset. This promotes whispering into the headset microphone. Excessive background noise and whispering combine to degrade what is called the "signal to noise ratio". This decreases intelligibility and interferes with proper Squelch (VOX) operation.

RADIO TRANSIT MODE

Because of the dual intercom design of the Sigtronics Dual Bus Kit, transmitting from both pilot and co-pilot positions is possible simultaneously or one-at-a-time. Each pilot selects the radio he wishes to use via his audio panel. When he presses his PTT switch, his headset mic is routed through the intercom to the radio he selected. Only his mic will be live. The microphone of any passengers connected to the pilot's side of the system (*i.e. the pilot's SPA-4Si*) will be muted when the pilot transmits. Similarly, when the co-pilot transmits, only the co-pilot's mic signal will go out on the radio selected by the co-pilot. When transmitting, the pilots will hear their own voice via the aircraft radio side-tone return. If the radio does not provide transmit side-tone, then they will not hear their voice when transmitting.

RADIO MONITORING

Radio monitoring is automatic. The radio monitor circuit is always active; even with the SPA-4Si unit power switch "OFF". Each pilot will only hear the radio selected by his respective audio panel.

MUSIC OPERATION

Music is controlled at the music source itself. To adjust the music volume level set the volume control on the music source. Similarly, to turn on or off the music use the appropriate control on the music source. When the music source is "ON" the SPA-4Si system automatically mutes and restores the music to the headsets at the appropriate time. The SPA-4Si default mode of operation is to partially mute during intercom conversations and full mute during any aircraft radio communications

MUSIC MUTE OPTIONS

MUSIC MUTE LEVEL DURING ICS - During normal intercom operation there are two possible muting levels, full or partial. Partial mute is the factory default. Alternately, "full mute" mode is user selectable prior to intercom installation. **Note:** during radio transmission and reception, the music will always full mute. This is for communication safety reasons.

SOLO FLIGHTS

Since the intercoms are not needed during solo flights, they may be turned to the "OFF" position. The pilot will still hear the aircraft radio(s), since this circuit is always active, and may transmit to ATC via his headset and push-to-transmit switch. To hear music, the intercom will have to be in the "ON" mode.

FAIL-SAFE

If power to the SPA-4Si units fails, the pilots can still transmit and receive on the aircraft radio(s) (assuming the radio(s) are still functioning). If a problem is ever suspected, switch the intercoms "OFF". In this mode you will still be able to transmit and receive on the aircraft radio(s) from the pilot's position. If the radio does not provide sidetone, then the pilot will not hear his voice in this "FAIL-SAFE" or "OFF" mode.

STEREO MUSIC SYSTEMS

Most automotive stereo units operate from 12V-14V sources. If you want to use a 12 volt music source in a 28 volt aircraft do not connect them directly to power. Regulators or converters are available to permit operation from 24V-28V sources.

Some AM-FM music receivers are capable of causing interference with aircraft COM and NAV receivers. The aircraft panel should be placarded accordingly. Most player only units (MP3 or CD) do not cause interference with aircraft receivers.

Line level stereo music outputs can also be used into the SPA-4Si system. Some line level outputs however, are a fixed level and are not adjusted by the devices volume control. If this is the case you will not be able to change the volume of the music you hear in the headsets. Headphone level or Speaker level outputs would be better in this case.

STEREO HEADSETS

The Sigtronics Dual Bus Kit systems are designed for use with general aviation Stereo headsets with high impedance speakers (300 to 600 ohms). Headsets with low impedance (less than 100 ohms) speakers should not be used with SPA-4Si systems intercoms without modification. Contact Sigtronics for details. In general, headsets with speakers of high and low impedance and / or unmatched audio efficiencies should not be used together without modifications.

Sigtronics stereo headsets are specifically designed for the aircraft high noise environment and give excellent noise attenuation. They also provide full frequency response stereo for maximum enjoyment. They are compatible with aircraft mic circuits and can be used as general aviation headsets in aircraft that are not equipped with stereo headphone jacks. This is because they include a switch to change from "Stereo" to "Monaural". No adapters required.

NOTE: General aviation headset (monaural) phone plugs should not be plugged into SPA-4Si stereo phone jacks. A monaural plug in a stereo jack shorts out one of the audio channels. This will not damage the SPA-4Si units in any way but will cause reduced performance. General aviation headsets may be used only if one of the following three changes are made:

1. Monaural to stereo adapters are used on the headset headphone plugs. (Only monaural music will be heard.)
2. The general aviation headsets are re-wired for stereo reception.
3. Install the Sigtronics SPA-4Si units for monaural operation. See note 7 in the "WIRING INSTRUCTIONS" section on page 4.

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