

VFS101 Installation Instructions

VFS101-INSISTR3, Revision D



Revision History

Rev.	Date	Page	Description	Sig.
A	28-Dec-2012	All	Initial Release	JSM
B	13-Jul-2013	9 15 19, 29	Crossfill protocol must be GNS, not GTN. Expand max flightplan waypoints to 100. Add support for Main S/W Version 5.03.	JSM
C	8-Nov-2013	2, 7 18 29	Change “resettable” breaker to “pullable”. Add circuit breaker note to drawing. Remove 6,000 lbs. aircraft limitation.	JSM
D	3-Mar-2014	19, 29	Add support for Main S/W Version 5.10.	JSM

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VFS101-INSISTR3, Revision D

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1.0 Introduction

This document describes the installation procedure for the VFS101 speech recognition system.

1.1 Referenced Documents

1.1.1 External Documents

- FAA Advisory Circular 43.13-1B, *Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair*, Date: September 27, 2001
- FAA Advisory Circular 43.13-2B, *Acceptable Methods, Techniques, and Practices - Aircraft Alterations*, Date: March 3, 2008
- RTCA/DO-254, *Design Assurance Guidance for Airborne Electronic Hardware*
- RTCA/DO-178B, *Software considerations in airborne systems and equipment certification*, Date: December 1, 1992

1.1.2 Internal Documents

This section lists the referenced project documents. The final document revision letters applicable to this project will be defined in the project's Master Document List (VFS101-MDL003).

- VFS101-PMAN3, *VFS101 Pilot's Guide*
- VFS101-ICA3, *VFS101 Instructions for Continued Airworthiness*

2.0 System Description

The VFS101 is a speech-recognition system which allows aircraft pilots to enter aircraft navigational data using their voice. Voice entry of navigational data can be performed approximately ten times faster than by manual knob twisting. The VFS101 (Configuration 3) system operates with the Garmin 400 / 500 or 400W / 500W series of GPS navigational units, and supports installations with one and two GPS units present. See Appendix G for a complete list of compatible GPS units.

The VFS101 system consists of a single 3.3 in x 5.5 in x 1 in, unit which is mounted behind the aircraft's instrument panel. This unit has a single DB-25 connector and utilizes an installer-fabricated wiring harness with connections to:

- One or two Garmin 400 / 500 or 400W / 500W series GPS units (Mixed Non-WAAS and WAAS combinations are not supported)
- An audio panel with an available un-switched input having a nominal input impedance of at least 500 Ohms.
- A Universal Serial Bus (USB) jack used for navigational data and software updates
- A pushbutton switch (typically yoke-mounted) called the VoiceFlight Activation Switch (VAS)
- 14 or 28 Volt DC aircraft power via a separate 1 Amp pullable circuit breaker (A dedicated power switch and 1 Amp fuse is an acceptable alternative)

The VFS101 is suitable for operation only on aircraft with a negative ground battery.

3.0 System Specifications

Specification	Value
Weight	0.75 lbs
Overall Dimensions	Length: 5.44 in. (138.2 mm) Width: 3.24 in. (82.2 mm) Height: 0.95 in. (24.13 mm)
Power Requirements	14 – 28V DC, less than 1 Ampere
Temperature (operating)	-20° C - +55° C (-4° F - +131° F)
Temperature (storage)	-55° C - +85° C (-67° F - +185° F)
Maximum Altitude	25,000 ft (7620 m)
Audio Input	Impedance: 18K Ohms minimum
Audio Output	Power: 40 mW minimum into a 600 Ohm load
Regulatory Compliance	DO-160E categories tested: Temperature and Altitude: B1 Temperature Variation: C Humidity: A Operational Shock: B Vibration: S Magnetic Effect: Z Emission of RF energy: M DO-160E categories demonstrated by analysis: Crash Safety: B Fire and Flammability: C Hardware developed under DO-254: Level D Software developed under DO-178B: Level D

4.0 System Components

4.1 Included

As shipped, the VFS101 system (VFS101-KIT001) includes the following items:

- VFS101, The VFS101 Unit
- VFS101-Z001, USB mass storage drive (“thumb drive”) with VoiceFlight Logo
- VFS101-PMAN3, VFS101 Pilot's Guide
- VFS101-QRC3, VFS101 Pilot's Quick Reference Card
- Certificate of Conformance
- Product Registration Card
- GPL License and California Prop. 65 Disclosure

4.2 Optional Installation Accessories

The VFS101 Installation Accessory kit (VFS101-KIT003) includes:

- 24 contact sockets
- D-Sub 25 pin female connector, back-shell & screw locks
- VFS101-CA004, USB Jack and cable assembly
- VFS101-M007, USB Jack retention clip
- Two 4-40 screws for affixing retention clip

4.3 Additional Equipment

The following items are supplied by the installer. A list of specific part numbers which have been identified as acceptable for use with the VFS101 system are listed in Appendix C.

- Cables will be fabricated by the installer. See Appendix B for interconnect diagrams.
- Hardware for mounting the VFS101 unit in the chosen location, including #8 bolts
- Appropriate cable retention hardware (cable clamps, etc.)

5.0 Limited Warranty

VoiceFlight Systems LLC warrants its new products and parts against defects in material and/or workmanship for two years from the date of purchase. During this period, VoiceFlight Systems LLC will, at its sole option, repair or replace defective product or parts without charge to you, excluding shipping, or offer a full refund of the purchase price.

The warranties and remedies contained herein are exclusive and in lieu of all other warranties express or implied or statutory, including any liability arising under any warranty of merchantability or fitness for a particular purpose, statutory or otherwise. This warranty gives you specific legal rights, which may vary from state to state.

IN NO EVENT SHALL VOICEFLIGHT SYSTEMS LLC BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE, OR INABILITY TO USE THIS PRODUCT OR FROM DEFECTS IN THE PRODUCT. Some states do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

VoiceFlight Systems LLC retains the exclusive right to repair or replace the unit or software or offer a full refund of the purchase price at its sole discretion. Such remedy shall be your sole and exclusive remedy for any breach of warranty.

To obtain warranty service contact VoiceFlight Systems customer service at:

VoiceFlight Systems LLC
105 Jordan Road
Troy, NY 12180
Telephone: (518) 720-0060

6.0 Installation Procedures

This section describes the procedures for installing the VFS101 speech recognition system, and for verifying the unit has been installed correctly. Refer to the latest revision of the VFS101 STC for applicability information.

Installing the VFS101 requires specialized expertise and equipment, including the correct fabrication and installation of the complex wiring harness. An appropriately rated certified aircraft repair station must be employed to perform the installation. Failure to follow the procedures described here and in the referenced documents may result in voiding the VFS101 warranty and/or a non-airworthy installation.

6.1 Inspection

Unpack the unit and verify there has been no visible damage in shipping. Verify that all the items listed in section 4.1 are present. If the optional VFS101 Installation Accessory kit (VFS101-KIT003) was purchased, unpack the kit and verify that all items listed in section 4.2 are present. If the unit or the accessories have been damaged in shipment, save all packing material and contact the freight carrier. Contact VoiceFlight Systems for a replacement unit or kit. Do not install a damaged unit or accessories into an aircraft.

6.2 Mechanical Installation

1. Select an installation location. Three different installations are approved. A diagram of each is shown in Appendix E:
 - a) Tray mount: This is a simpler installation if space is available in the aircraft's avionics rack.
 - b) Sled Mount: This installation is the preferred method if space is available in the aircraft's avionics rack. It allows for easier access to the device in the event service is required.
 - c) Panel Mount: This installation can be used in the event no space is available in the aircraft's avionics rack.
2. Install the VFS101 unit using the selected method. This installation must be conducted in accordance with the guidance provided in FAA Advisory Circular 43.13-2B, chapter 2.

The VFS101 unit weighs .75 lbs., thus the location it is mounted must be capable of restraining this mass when subjected to the applicable G-forces as specified in FAA Advisory Circular(AC) 43.13-2B, chapter 1. Allow space for the DB-25 connector and back-shell that will be attached. Forced-air cooling of the VFS101 is not specifically required. Avoid mounting the VFS101 in a location where hot air will be blown directly on the unit.

Fabrication instructions for the Tray and Sled mounts can be found in Appendix F.

3. Locate a suitable location for installation of the VFS101 USB jack. This location does not need to be accessed by the pilot in-flight, but should be convenient for monthly database updates. Cut a hole in the panel and drill two screw holes as shown in Appendix D. Install the USB jack from behind the panel. If using the optional installation kit, the USB mounting plate fits behind the USB jack, and has two threaded holes to accept the #4-40 screws provided. Label the USB jack "VFS USB" using an appropriate placard.
4. Select a location for the VoiceFlight Activation Switch (VAS) on the aircraft yoke within easy reach of the pilot. Suitable switches are listed in Appendix C. Install the switch and label it "VAS" with an appropriate placard in accordance with FAR 23.1555(a).

The preferred location for the VAS is atop the left stalk of the pilot's yoke. In the event this location is occupied by other switches, position the VAS in a location where it will not be inadvertently triggered, or result in other switches being triggered by mistake. Some pilots, especially those with sophisticated autopilots, prefer to have the VAS located on the instrument panel or a side console.

Mount the switch as is customary for auxiliary switches and the model of yoke installed in the aircraft. This will involve threading wires through the body of the yoke and connecting those wires to the rest of the VFS101 wiring harness. If necessary, install a self-coiling cable to connect the yoke wiring to the aircraft panel. Recommended part numbers are listed in Appendix C. Verify the cable is long enough by moving the yoke through its full range of motion and verifying the cable does not restrict it in any way.

5. Locate an unused circuit breaker location on the aircraft's circuit breaker panel and install a 1 Amp pullable type circuit breaker which is approved for aircraft use. As this circuit breaker will be used to remove power from the VFS101 in the event of a malfunction, no other equipment may be tied to the VFS101 circuit breaker.

If no circuit breaker locations are available on the circuit breaker panel, install the breaker in a suitable location elsewhere on the instrument panel and within reach of the pilot.

A dedicated, readily accessible power switch, together with a similarly rated fuse may be used in lieu of a circuit breaker. As with the circuit breaker, no other equipment may be tied to the VFS101 fuse and power switch.

Label the circuit breaker or power switch "VFS" with an appropriate placard per FAR 23.1555(a).

6.3 Electrical Wiring Installation

1. Examine the wiring diagram in Appendix B. Assemble the necessary components, and plan the wires routes. The part numbers of appropriate parts are listed in Appendix C.
2. Fabricate the cable harness according to the wiring diagrams shown in Appendix B. The USB jack and cable assembly from the installation kit should be trimmed to the appropriate length.

The VFS101 is connected to aircraft power and aircraft ground. This is typically done by connection to the Avionics buss and Avionics ground so that the VFS101 is controlled by the Avionics Master switch. As described in Section 6.2, a dedicated circuit breaker or power switch is required for the VFS101.

The Aviation-out data port may be used to feed multiple pieces of equipment, however if no isolating RS-232 splitter is used, no other piece of equipment connected to the same bus may cause more than a “minor” hazard should that unit lose Aviation-out data. Note that the Garmin GPS units are not able to provide “Aviation” data on more than one output channel.

Pay special attention to connect the shields as shown in the wiring Diagram (Appendix B), as additional noise on the audio connections induced by incorrect grounding and shielding will degrade system performance. Avoid routing wire bundles near high-current wires to avoid inducing additional noise in the system. The splice connection to the pilot microphone jack should be done as close to the jack as possible. The shields leading to the VFS101 must not contact the shields leading to the audio panel to avoid undesirable ground loops (see the wiring diagram in Appendix B). Proper fabrication techniques must be used for all wires. Refer to FAA Advisory Circular 43.13-2B for further information.

3. Verify the correct wiring of the cable harness by performing continuity and voltage checks with a multi-meter before applying power to the unit. Incorrect wiring could damage the VFS101 or connected equipment. Pay special attention to verifying that aircraft power appears only on pin 13 of the VFS101 connector.
4. Verify that the aircraft's pilot headset jacks are electrically isolated from the aircraft panel and other mounting surfaces. If they are not, an isolation shoulder washer set must be installed at the jack. Appropriate part numbers can be found in Appendix C.
5. Restrain the cable harness as required by FAA Advisory Circular 43.13-1B Chapter 11. Verify that the cable bundles are restrained well away from all controls. Move all aircraft controls through their full range of motion to confirm that no interference exists.

6.4 Garmin GPS configuration

Before proceeding with the installation, be sure to verify that the the GPS units are running the correct Garmin “Main Software” version as listed in Appendix G. Attempting to operate the VFS101 with the wrong GPS firmware version will result in problems that are more difficult to diagnose at a later stage of the installation.

The VFS101 communicates with the Garmin 400 / 500 or 400W / 500W GPS unit(s) by way of the crossfill protocol typically used to transmit flightplans from one GPS to the other in a dual GPS installation. As such, the RS-232 channel(s) to which the VFS101 is to be connected must be configured as a “GNS Crossfill” port on the GPS. Channel 3 is recommended for this purpose, and this port's pin numbers are shown in the wiring diagrams.

The GPS crossfill input and output must reside on the same channel. Configuration information for the RS-232 data ports can be found in the Garmin GPS installation manuals. The GTN Crossfill protocol (added in Main S/W 5.03) is not supported by the VFS101.

In a single GPS installation the primary GPS must be configured for manual crossfill (not auto). In a dual GPS installation, it is strongly recommended that both GPS be configured for manual crossfill (not auto).

Note that when the primary GPS receives flightplan data from the VFS101 it assumes that the data was sent from the secondary GPS. As such the primary GPS will never “reflect” that data back to the secondary GPS, even if it is configured for auto crossfill.

Additionally, one RS-232 output port on the primary GPS must be configured to “Aviation”. The wiring diagram in Appendix B shows this connection using RS-232 channel 1, and the use of this channel is recommended. The information provided on this port is used by the VFS101 to determine the current position and speed of the aircraft.

6.5 Installation Verification

This procedure verifies the correct installation of the VFS101.

1. Park the aircraft in an outside, open area where it can receive GPS satellite signals. Power on the VFS101, the aircraft audio panel, and the connected Garmin GPS unit or units.
2. Verify the primary GPS is receiving GPS signals from at least five satellites. This information can be found on the satellite status page of the Primary GPS.
3. Plug a suitable aviation headset (with microphone) into the pilot station audio jacks. Position the microphone so that it is close to the lips.

4. After waiting at least one minute for the VFS101 to initialize, adjust the primary GPS to display the active flightplan. This is done by pressing the FPL control button.
5. Depress and hold the VoiceFlight Activation Switch (VAS). The VFS101 should play one or more of the following messages:
 - A rapid “double beep”: This indicates the unit is powered, the VAS is working, the system is receiving Aviation Data from the primary GPS, and the unit's navigational database matches the one installed on the primary GPS.
 - An audio message “WARNING: Navigation cycle dates do not match”: This is normal at this stage. Section 6.7 of this document describes how to update the navigational database. Note, you must hold down the VAS until the warning message completes, or it will repeat each time you depress the VAS. Return to this step after completing the navigation data update described in Section 6.7.
 - An audio message “GPS not ready”: This indicates the VFS101 can not communicate with the primary GPS. This may be due to an error in the crossfill wiring, that the primary GPS is misconfigured, that the primary GPS is turned off or that the GPS self-test screens have not been acknowledged.
 - (WAAS GPS units only) An audio message “Database Calibration required, double click to begin.”: This indicates that database calibration is required as described in Section 6.8. If the GPS and VFS101 database cycles do not match, it is best to perform the database update as described in Section 6.7 before proceeding with the calibration. Return to this step after completing the appropriate steps from Section 6.7 and 6.8.
 - An error tone, typically accompanied by an error message displayed on the the title line of the active flightplan. This indicates the VFS101 unit is powered, the VAS is working and the audio output system is functional. If the title line message reads “NO GPS POS DATA”, verify the GPS is receiving a GPS signal from at least 5 satellites. Other likely causes of this problem are a misconfigured GPS and a problem with Aviation-out wiring.
 - No sound: This indicates possible audio output problems, a problem with the VAS, or a VFS101 failure. Likely causes of audio output problems include incorrect settings on the audio panel, a wiring problem between the VFS101 and the audio panel or a failed headset or headset jack. Possible VAS problems include a failed switch or a wiring problem.
6. Depress and hold the VAS. The VFS101 should respond with a “double beep”. Speak the words “START NEW FLIGHTPLAN” clearly and distinctly. An audio message requesting confirmation of the command should be

heard. Promptly release and then double-click the VAS to confirm the command. Any contents of the active flightplan will be cleared.

A double-click is performed by releasing the VAS, and then depressing and releasing the VAS twice in rapid succession.

If an error tone is heard, consult the title line of the active flight plan for an explanation of the error.

If the VFS101 does not request confirmation of the command, address the following issues and try again:

- Microphone: position the headset microphone as close to the lips as possible.
- Excessive Background Noise: The VFS101 is resistant to background noise, but extremely high levels can cause a problem.
- Speech not consistent with VFS101 requirements: Be sure to speak slowly and clearly.

If several attempts generate error tones, this may indicate an audio input problem. This can be caused by excessive electrical noise on the audio lines, improperly shielded wiring, a failed headset microphone or jack, or a failed VFS101.

7. Enter a nearby aviation waypoint (such as an airport identifier) within 200 miles of the current location by spelling it out using the ICAO spelling alphabet (e.g. KBOS=K ILO BRAVO OSCAR SIERRA), followed by the word, "ENTER". Depress and hold the VAS, then speak slowly and clearly after the double-beep. If entering an airport identifier remember that many airports in the continental U.S. begin with a K ("KILO").

The ICAO spelling alphabet can be found on the back of the VFS101 Quick Reference card, or in the VFS101 Pilot's Guide. The VFS101 should generate a single beep, and the spoken waypoint should appear as the first waypoint in the active flightplan. If an error tone is heard, try a different waypoint, again followed by the word "ENTER". Release the VAS. Verify that the entered waypoint appears as the first waypoint in the active flightplan on the primary GPS.

If the single beep is heard, but the waypoint does not appear in the flightplan, this may indicate a crossfill wiring problem or a misconfigured GPS.

If the waypoint does appear this indicates the VFS101 unit is functioning normally.

8. In dual GPS installations initiate a manual crossfill of the active flightplan on the primary GPS by pressing the MENU control button, selecting "Crossfill?" from the menu using the large right knob, then pressing the ENT control button. Confirm that the flightplan was successfully transferred to the secondary GPS by viewing the contents of the active

flightplan on the secondary GPS. Verify that the waypoint entered on the primary GPS in step #7 appears here.

This step confirms that the crossfill wiring to the secondary GPS is correct.

9. Examine the primary GPS message display window by pressing the MSG button and confirm that no data transmission errors have been reported. In dual GPS installations, repeat the Crossfill Test for the secondary GPS.
10. The navigation update performed in Section 6.7 will verify proper installation of the USB jack.

6.6 Setting VFS101 Audio Volume

If the volume level of the VFS101's audio output requires adjustment relative to other audio sources, the following procedures may be used. These procedures are only to be used while the aircraft is not moving.

When the GPS is proceeding Direct-To a waypoint which does not appear as a waypoint in the active flightplan, the title line is not available (since it is displaying the Direct-To waypoint). To cancel an active Direct-To, press the Direct-To button, then MENU, then ENT.

To INCREASE the VFS101 audio output volume:

1. Plug a suitable aviation headset into the pilot headset jack.
2. With the aircraft audio panel, VFS101 and primary GPS powered up, enter a new title for the active flightplan on the primary GPS containing the letter "U" (for "UP") in the first character position and no other characters. Press ENT to install the new title. Wait at least 10 seconds. Briefly depress and release the VAS.
3. The title line will change to: "V <Volume Level 0-63> UP?" where the content in < > is replaced with a number indicating the current volume level.
4. Briefly press and release the VAS again. This will increase the volume by one step. A tone should be heard through the headset at the new volume level. Repeat until the volume is at the desired level.
5. Depress and hold the VAS for at least two seconds. This will return the VFS101 to normal operations, with the new volume output level.

To DECREASE the VFS101 audio output volume:

1. Plug a suitable aviation headset into the pilot headset jack.
2. With the aircraft audio panel, VFS101 and primary GPS powered up, enter a new title for the active flightplan on the primary GPS containing the letter "D" (for "DOWN") in the first character position and no other characters. Press ENT to install the new title. Wait at least 10 seconds. Briefly depress and release the VAS.

3. The title line will change to: "V <Volume Level 0-63> DOWN?" where the content in < > is replaced with a number indicating the current volume level.
4. Briefly press and release the VAS again. This will decrease the volume by one step. A tone should be heard through the headset at the new volume level. Repeat until the volume is at the desired level.
5. Depress and hold the VAS for at least two seconds. This will return the VFS101 to normal operations, with the new volume output level.

6.7 Update and Verify VFS101 navigation data

The VFS101 system uses navigational data to improve speech recognition accuracy and to communicate with the attached Garmin GPS units. The cycle number of the VFS101 navigational database must match the cycle number of the navigational database installed on the primary GPS. If they do not match the VFS101 will play a warning message the first time the VAS is pressed after the VFS101 is powered on, some waypoints may be unavailable for recognition, and airway expansions may be incorrect.

The navigation database should be updated to the current navigational cycle before the aircraft is returned to service. This is performed by the following procedure:

1. Download the navigational database from the "Navigation Update" section of the VoiceFlight Systems website (<http://www.voiceflight.com>) which corresponds to the Primary GPS navigation database. If the website is unavailable contact VoiceFlight systems customer support for assistance. Contact information can be found in section 5.0 of this document. The computer used for this should be running a recent version of Microsoft Windows, Apple OS X or Linux to insure proper support for the USB flash drive used in step 2.
2. Insert the supplied USB flash drive into a USB port on the computer. On most systems the flash drive should be automatically opened (mounted) by the operating system. Transfer the downloaded navigational database file to the Flash Drive. If other VoiceFlight files (files with the extension ".vfs") exist on the USB drive, erase them. Do not place the update file into any sub-directories on the flash drive. Eject the flash drive and remove it from the computer's USB port.
3. At the aircraft, plug a suitable aviation headset into the pilot's headset jacks so that audio responses from the VFS101 can be heard. Alternatively, the aircraft's cockpit speaker may be utilized.
4. If an updated GPS navigation data-card is available install it as per Garmin instructions.
5. With the aircraft stationary, apply power to the GPS unit(s), aircraft audio panel and the VFS101. Wait at least thirty seconds for the VFS101 to

initialize. Wait for the GPS(s) to initialize, and acknowledge their self-test screens as required. Display the active flightplan page on the GPS by depressing the FPL button.

6. Insert the USB flash drive into the VFS101 USB jack. Wait at least one additional minute for the update to be performed.
7. Depress and hold the VAS. An audio message indicating that the navigational update has completed should be heard through the audio system. If the audio message is not heard release the VAS, wait another full minute and try depressing the VAS again. If the message is still not heard, remove the USB drive, remove power from the units and repeat steps 5 through 7.
8. If the audio message “Database calibration required. Double-Click to begin” is heard immediately following the “Navigation update complete” message, complete the procedure described in section 6.8, then proceed with step 9 of this procedure.
9. Remove the USB flash drive from the VFS101 USB jack.
10. Depress and hold the VAS. If the explicit warning message “Warning: Navigation cycle dates do not match” is **not** heard, then the VFS101 has determined that the navigational databases have matching cycle dates.

6.8 Calibration (WAAS only)

This section is applicable only to VFS101 units used with Garmin 400W / 500W series GPS units. It is not required for VFS101 units used with Garmin 400 / 500 series GPS units.

Database calibration is a process that verifies the databases on the primary GPS and the VFS101 are synchronized and updates VFS101 information about the particular database in use on the GPS.

Recalibration is required whenever the navigational data of the primary GPS or VFS101 is changed. This process will typically complete quickly but may require up to five (5) minutes. The aircraft must remain stationary during this time.

1. Display the active flight plan page on the primary GPS by depressing the FPL button.
2. Depress and hold the VAS. An audio message “Database Calibration Required, Double-Click to Begin” will be heard.
3. Promptly double-click the VAS to begin the calibration process.

A double-click is performed by releasing the VAS, and then depressing and releasing the VAS twice in rapid succession.
4. The VFS101 will then begin a calibration cycle. During this time the flightplan on the primary GPS will fill with waypoints. Do not use the GPS during this time. After calibration is complete the original active flightplan will be restored.

6.9 Setting Airway Compression

The flightplan of Garmin 400 / 500 and 400W / 500W GPS units is limited to a maximum of 31 or 100 waypoints. This is insufficient to contain some airways if all waypoints, including intermediate waypoints on straight segments are included. Airway compression is an optional feature that eliminates those intermediate waypoints whose removal does not change the course of the airway more than 0.1 nautical miles, or cause a leg to be longer than 100 nautical miles. Radio Nav-aids are never eliminated. Airway compression is disabled by default.

To enable or disable airway compression:

1. Plug a suitable aviation headset into the pilot headset jack.
2. Adjust the primary GPS to display the active flightplan.
3. If the title line is obscured by a Direct-To operation, cancel the Direct-To.
4. With the aircraft audio panel, VFS101 and primary GPS powered up, enter a new title for the active flightplan on the primary GPS consisting of the letter "A" (for AIRWAY) in the first character position, and no other characters. Press ENT to install the new title.
5. Wait at least 10 seconds.
6. Depress and hold the VAS.
7. An audio message indicating the new status of airway compression will be heard through the audio system. Release the VAS.
8. Repeating the process will toggle airway compression to the opposite state. (Disabled if enabled, enabled if disabled.)

Note: With airway compression enabled, an audio caution message will be played the first time the VAS is depressed each time the VFS101 is powered on.

6.10 Pilot Familiarization

When returning the aircraft to service, the installer should provide the aircraft pilot(s) with a brief overview of the VFS101 installation and it's operation.

Assisting the pilot in completing the ground portion of the pilot qualification procedure (section 4.2 of the VFS101 Pilot's Guide) will be very helpful in reducing the initial learning curve and ensuring a successful user experience.

7.0 Maintenance and Continued Airworthiness

As a solid-state electronic device, no regular service actions are required. However, regular updates are required for the VFS101 navigational data. The responsible individual will ensure the VFS101 navigational database is updated to the current AIRAC charting cycle. This update must be performed using the steps listed in section 6.7 of this document. The procedure is also described in the VFS101 Pilot's Guide (VFS101-PMAN3).

For further information on VFS101 continued airworthiness, see the VFS101 Instructions for Continued Airworthiness (VFS101-ICA3). Section 5.2 of that document describes the periodic inspections that are performed to insure that the installation remains airworthy.

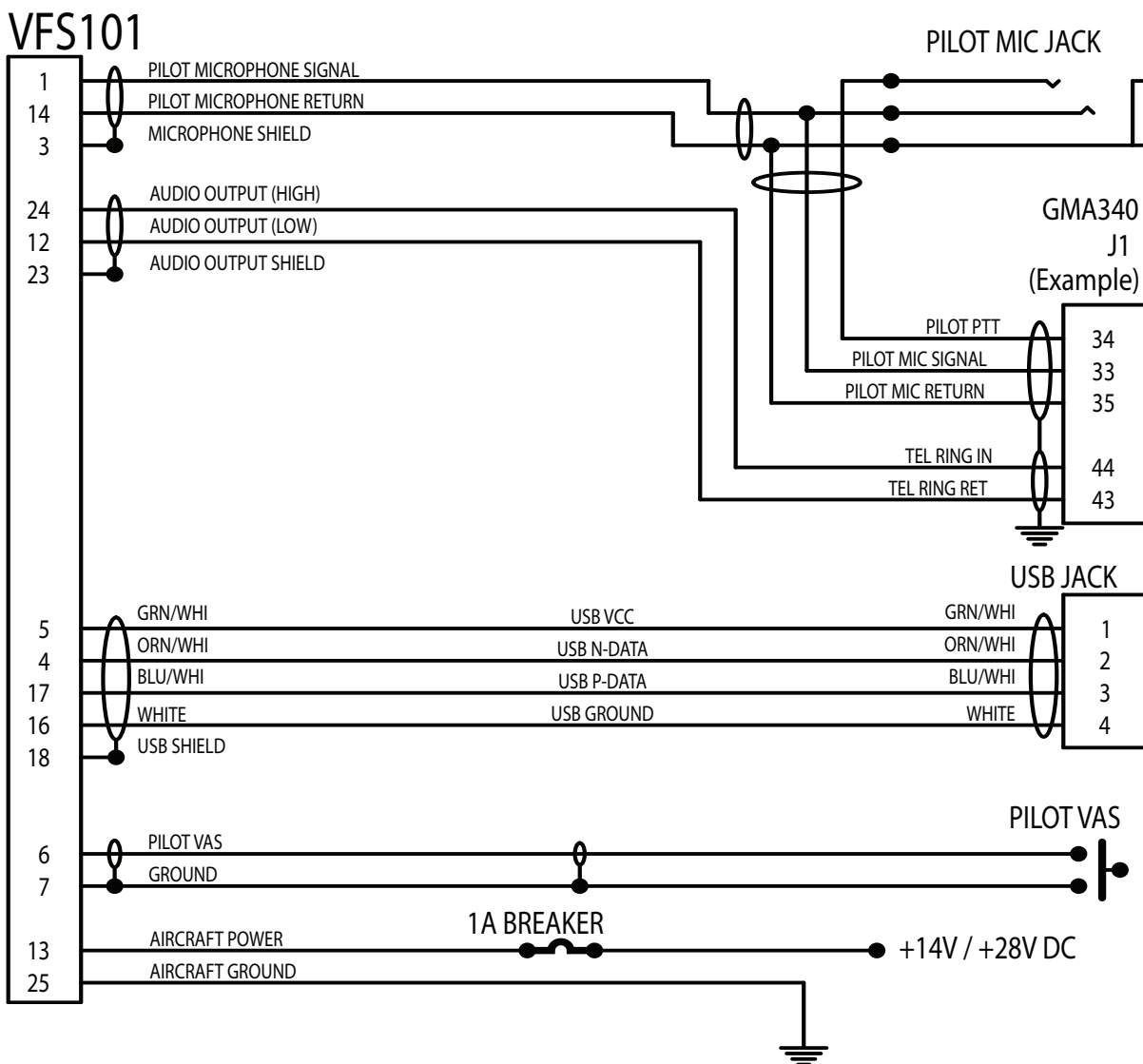
Appendix A: VFS101 Connector Pin-out

The VFS101 wiring harness uses a DB-25F Connector, AMP p/n: 5205207-1 or equivalent

See Appendix C for back-shell and other part information.

Pin #	Function
1	Pilot Microphone Signal
2	Reserved
3	Microphone Shield (Ground)
4	USB N-Data
5	USB VCC
6	Pilot's VoiceFlight Activation Switch (VAS)
7	Ground
8	Aviation Out Receive
9	Primary GPS Crossfill Receive
10	Secondary GPS Crossfill Receive
11	Secondary GPS Crossfill Shield (internal 0.1uF cap to ground)
12	Audio Output-Low
13	Aircraft Power (+14 / +28V DC)
14	Pilot Microphone Return
15	Reserved
16	USB Ground
17	USB P-Data
18	USB Shield
19	Reserved
20	Primary GPS Crossfill Shield (internal 0.1uF cap to ground)
21	Primary GPS Crossfill Transmit
22	Secondary GPS Crossfill Transmit
23	Audio Output Shield (internal 0.1uF cap to ground)
24	Audio Output (High)
25	Aircraft Ground
Connector Shell	Ground

Appendix B: Wiring Diagram



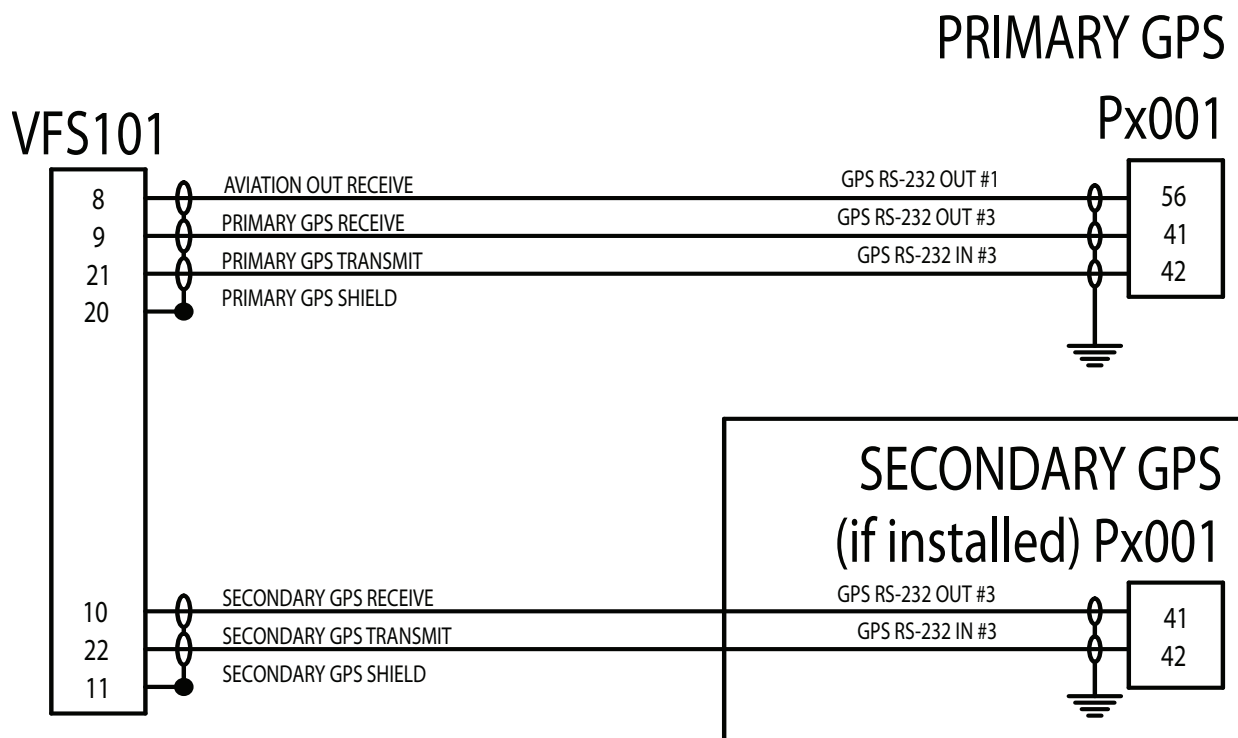
Note: VFS101 pin 23 (Audio Output Shield) is internally connected to Aircraft Ground by way of a 0.1 uF capacitor to prevent ground loops.

Note: When connecting the wires to the VFS101 and audio panel at the microphone jack, be sure not to connect the shields to avoid undesirable ground loops.

Note: The GMA340 is included here as an example. Any audio panel with an unswitched audio input with an impedance of at least 500 Ohms is acceptable.

Note: VFS101 must be powered through a separate 1 Amp pullable circuit breaker, or alternatively, a dedicated power switch and 1 Amp fuse.

Wire: See next page for wire type information.



Note: Approved software revision numbers for the Garmin GPS units are:

- **Garmin 400 / 420 / 420A / 430 / 430A** – “Main Software” version 5.04
- **Garmin 500 / 530 / 530A** – “Main Software” version 6.04
- **Garmin 400W / 500W Series** – “Main Software” version 3.30, 5.03 or 5.10

Note: Alternative RS-232 ports on the GPS units may be used. The ports and pin numbers shown are the recommended port assignments. See section 6.4 and the Garmin GPS installation manual for information on selecting an alternate port.

Note: If a secondary GPS is present it must be wired as shown above. The VFS101 can NOT be attached as a “tap” on an existing crossfill line.

Note: VFS101 pins 11 (Secondary GPS Shield) and 20 (Primary GPS Shield) are internally connected to Aircraft Ground by way of separate 0.1 uF capacitors to prevent ground loops.

Wire (Power and Aircraft Ground): MIL-C-27500 cable or equivalent wire from AC 43.13-1B table 11-11, in 20 AWG.

Yoke Coil Cable (VAS connection.): STEC p/n 3953 (5 conductor) or STEC p/n: 3934 (19 conductor) (or equivalent cable meeting the requirements of FAR 23.1359(c))

Wire (All other connections): MIL-C-27500 cable or equivalent wire from AC 43.13-1B table 11-11, in 24 AWG minimum. Shielded cable must be used as shown.

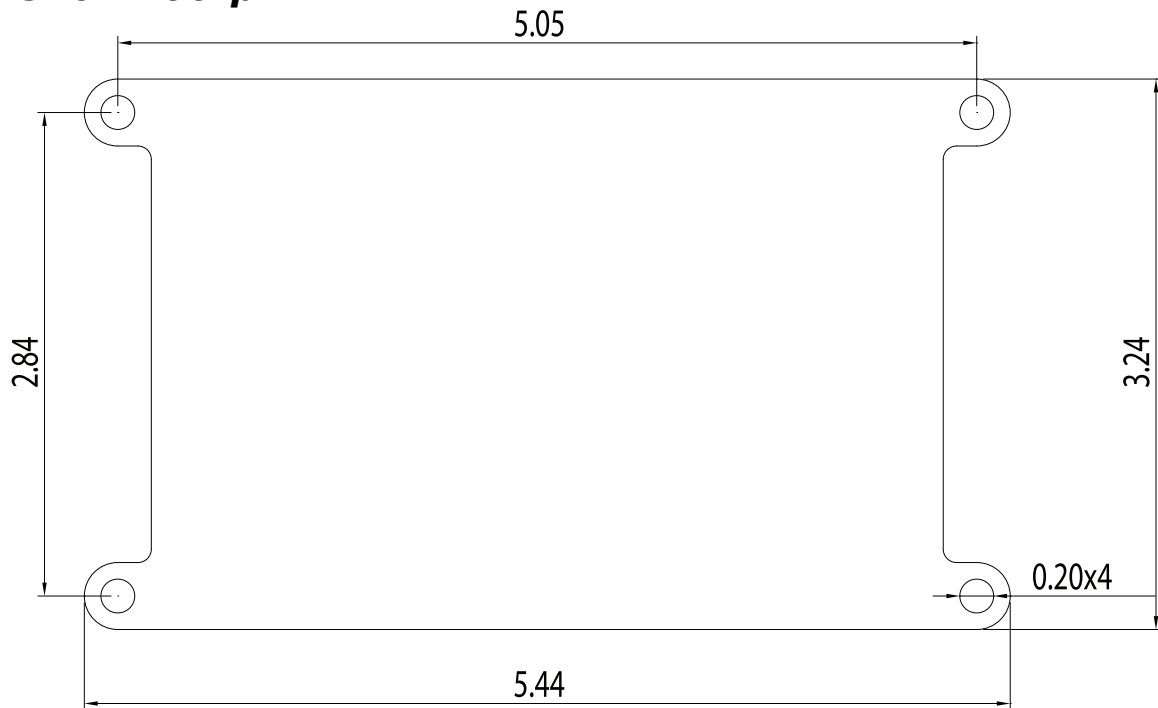
Appendix C: Part Numbers

Part Description	Acceptable Part Numbers and/or Part Characteristics
Wire (Power and Aircraft Ground)	MIL-C-27500 cable or equivalent wire from AC 43.13-1B table 11-11, in 20 AWG.
Yoke Coil Cable (VAS connection)	STEC p/n 3953 (5 conductor) or STEC p/n: 3934 (19 conductor) (or equivalent cable meeting the requirements of FAR 23.1359(c))
Wire (All other connections)	MIL-C-27500 cable or equivalent wire from AC 43.13-1B table 11-11, in 24 AWG minimum. Shielded cable must be used as shown.
DB-25 Connector	AMP p/n: 5205207-1 or equivalent
Crimp socket contacts (20-24 AWG)	AMP p/n: 205090-1 or equivalent
DB-25 Connector Backshell	AMP p/n: 5748676-3, Cannon p/n: 024659-0000 or equivalent
Circuit Breaker (1 Amp)	Klixon p/n: 7274-2-1 or equivalent
VoiceFlight Activation Switch (VAS) (normally open, momentary contact)	Any of the following switches or equivalent: Piper, p/n: 688-289 Cessna/Mason, p/n: S1985-1 C & K, p/n: 8631 C & K, p/n: MSPS103CO Grayhill, p/n: 23-1 Alco, p/n: MSPM-101B OTTO, p/n: T4
Pilot's Microphone Jack	Switchcraft p/n: 11 Switchcraft p/n: 111 Or other standard ¼ inch microphone jack
Microphone Jack Insulated shoulder washer	Switchcraft p/n: S1029 or equivalent
Microphone Jack Insulated flat washer	Switchcraft p/n: S1028 or equivalent
Alternative Power Switch (used instead of the Circuit Breaker, with Fuse Holder and Fuse)	Alco p/n: MTA-106E C & K p/n: 7101SH3ZQE or equivalent
Alternative Fuse Holder (used instead of the Circuit Breaker, with Power Switch and Fuse)	Littelfuse: FNY-1 Littelfuse: FHP-1 or equivalent
Alternative 1A Fuse (used instead of the Circuit Breaker, with Power Switch and Fuse Holder)	Littelfuse: AGC-1 or equivalent
Mounting Hardware	See parts list for appropriate configuration in Appendix E

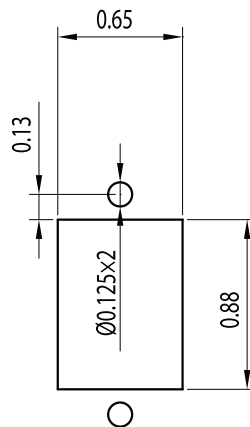
Appendix D: Mechanical Dimensions

All dimensions in inches.

VFS101 Footprint

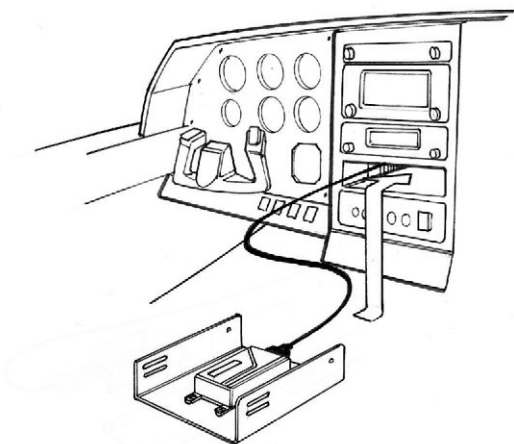


USB Jack Cutout



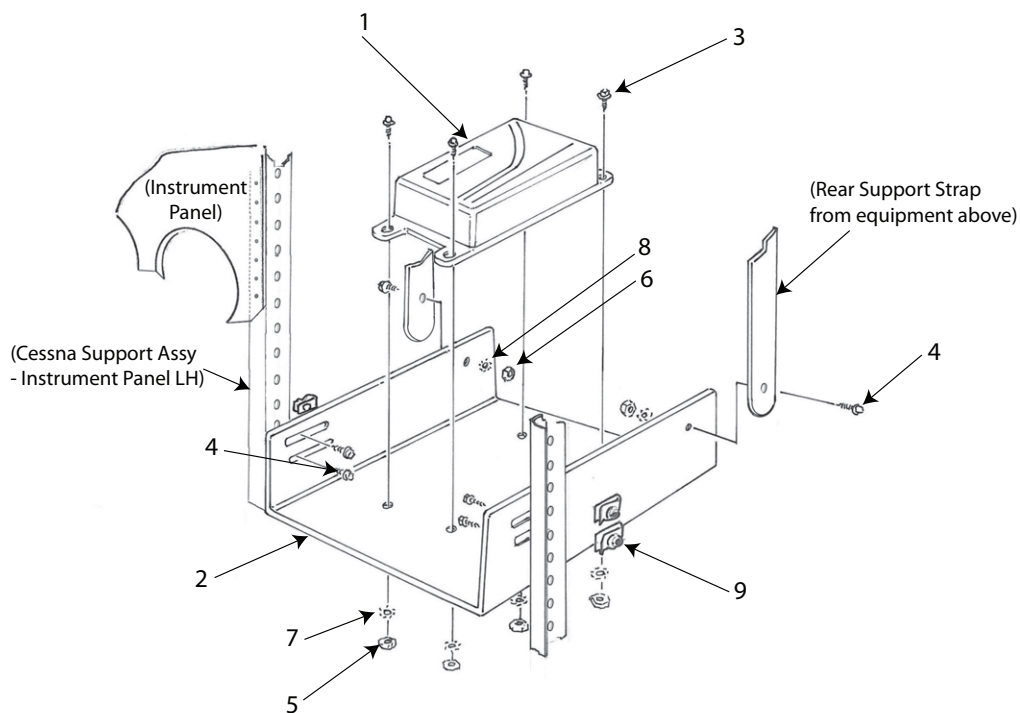
Appendix E: Installation Options

Tray Mount



Part Numbers:

- 1: VFS101 (VFS101 Unit) Qty: 1
- 2: VFS101-M006-A (Mounting Tray) Qty: 1
- 3: MS51957-41 (#8 Mach. Screws, 1/4 inch) Qty: 4
- 4: MS51957-30 (#6 Mach. Screws, 1/2 inch) Qty: 6
- 5: MS35649-284 (#8 Mach. Screw Nuts) Qty: 4
- 6: MS35649-264 (#6 Mach. Screw Nuts) Qty: 2
- 7: MS35333-72 (#8 Star Lock Washers) Qty: 4
- 8: MS35333-71 (#6 Star Lock Washers) Qty: 2
- 9: Monadnock 294667 (#6 Clip-Nuts) Qty: 4

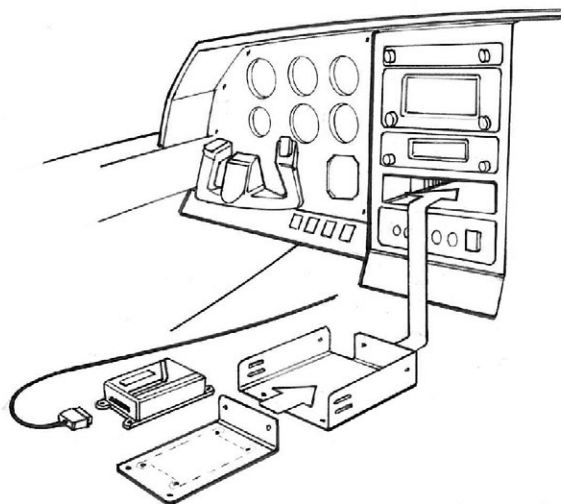


Notes:

Drill two 0.144 inch holes through supporting strap into Tray (VFS101-M006) to accommodate #6 rear mounting screws.

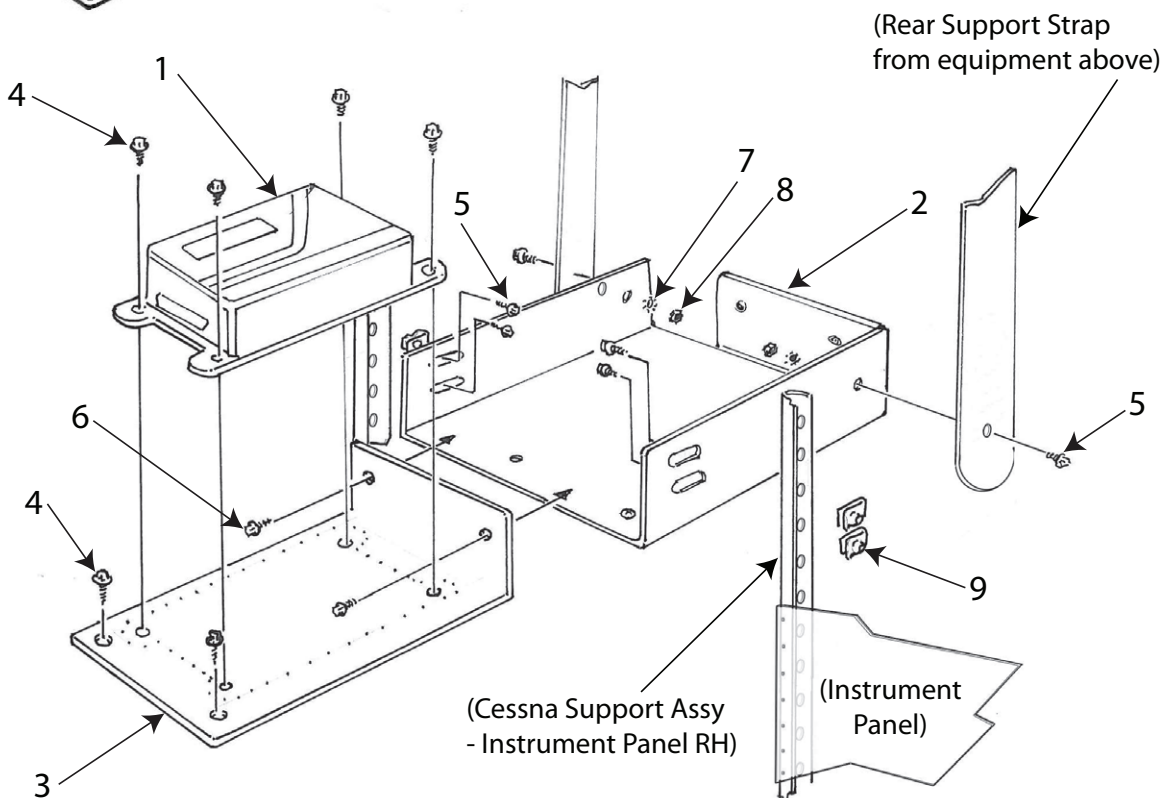
See Appendix B for Wiring Diagram.

Sled Mount



Part Numbers:

- 1: VFS101 (VFS101 Unit) Qty: 1
- 2: VFS101-M005 (Sled Mount/Base) Qty: 1
- 3: VFS101-M004 (Sled Mount/Sled) Qty: 1
- 4: MS51957-41 (#8 Mach. Screws, 1/4 in.) Qty: 6
- 5: MS51957-28 (#6 Mach. Screws, 3/8 in.) Qty: 6
- 6: MS51957-45 (#8 Mach. Screws, 1/2 in.) Qty: 2
- 7: MS35333-71 (#6 Star Lock Washer) Qty: 2
- 8: MS35649-264 (#6 Mach. Screw Nut) Qty: 2
- 9: Monadnock 294667 (Clip-Nuts) Qty: 4

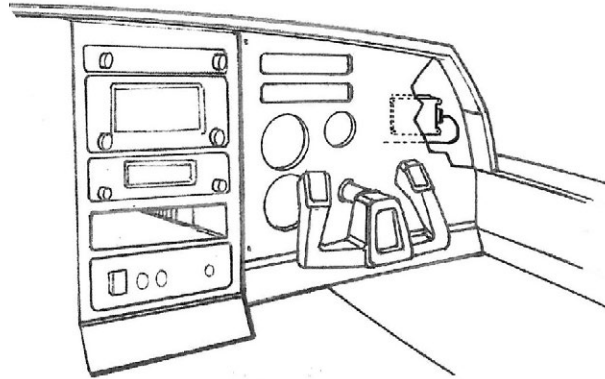


Notes:

Drill two 0.144 inch holes through the support straps into Tray (VFS101-M005) to accommodate two #6 rear mounting screws.

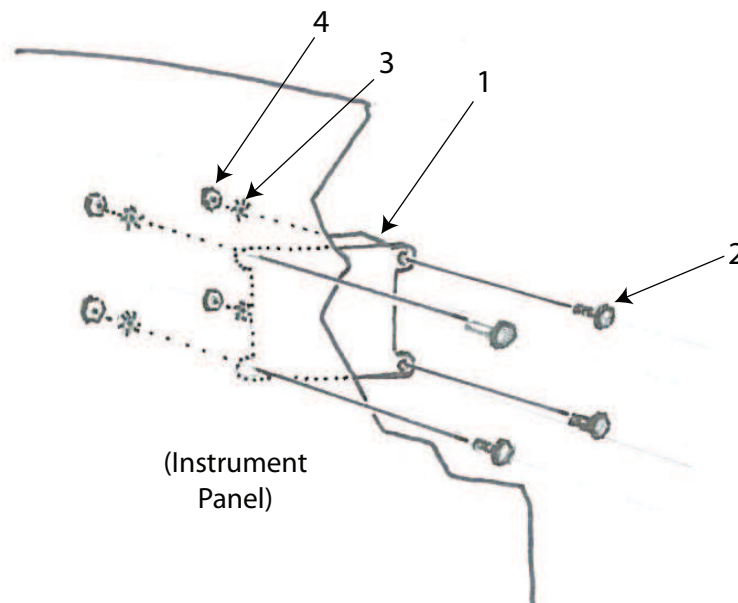
See Appendix B for Wiring Diagram.

Panel Mount



Part Numbers:

- 1: VFS101 (VFS101 Unit) Qty: 1
- 2: MS51957-45 (#8 Machine Screw, 1/2 in). Qty: 4
- 3: MS35333-72(#8 Star Lock Washer) Qty: 4
- 4: MS35649-284 (#8 Mach. Screw Nuts) Qty: 4



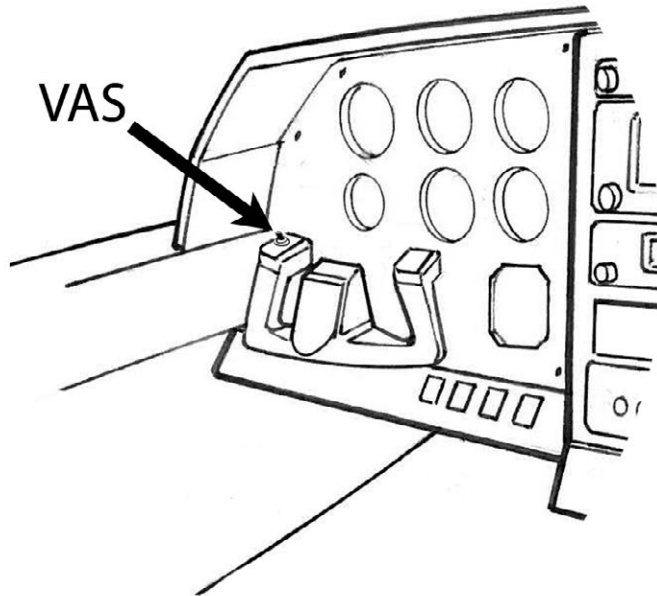
Notes:

Install on back of unused area of instrument panel.

Minimum panel thickness: 0.024 inches. Panel Material: AL2024-T3. (Alternatives: AL6061-T6, AL7075-T6)

See Appendix B for Wiring Diagram.

VAS Installation



Install VAS so as not to interfere with other yoke switches

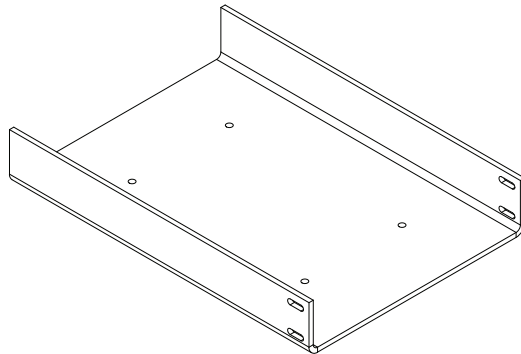
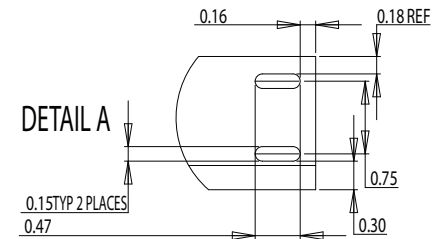
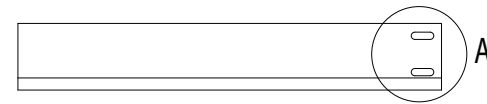
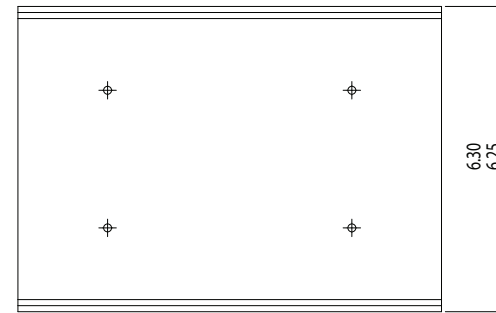
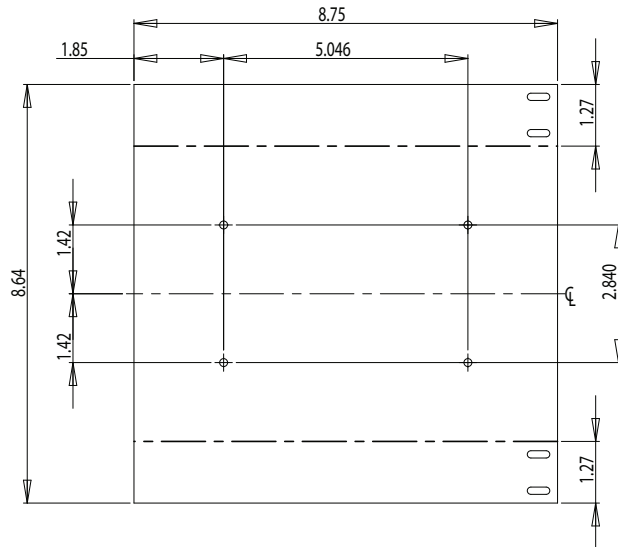
Label switch "VAS"

See Appendix B for Wiring Diagram.

Appendix F: Tray / Sled Fabrication Drawings

Tray Fabrication Drawing

Construct of minimum 0.024 inch thick AL2024-T3 (Alternatives: AL6061-T6, AL7075-T6)
Unless otherwise specified
Dimensions in inches
Tolerances: Decimal: X= ± 0.10 , XX= ± 0.03 , XXX= ± 0.010 , Fractional: $\pm 1/32$



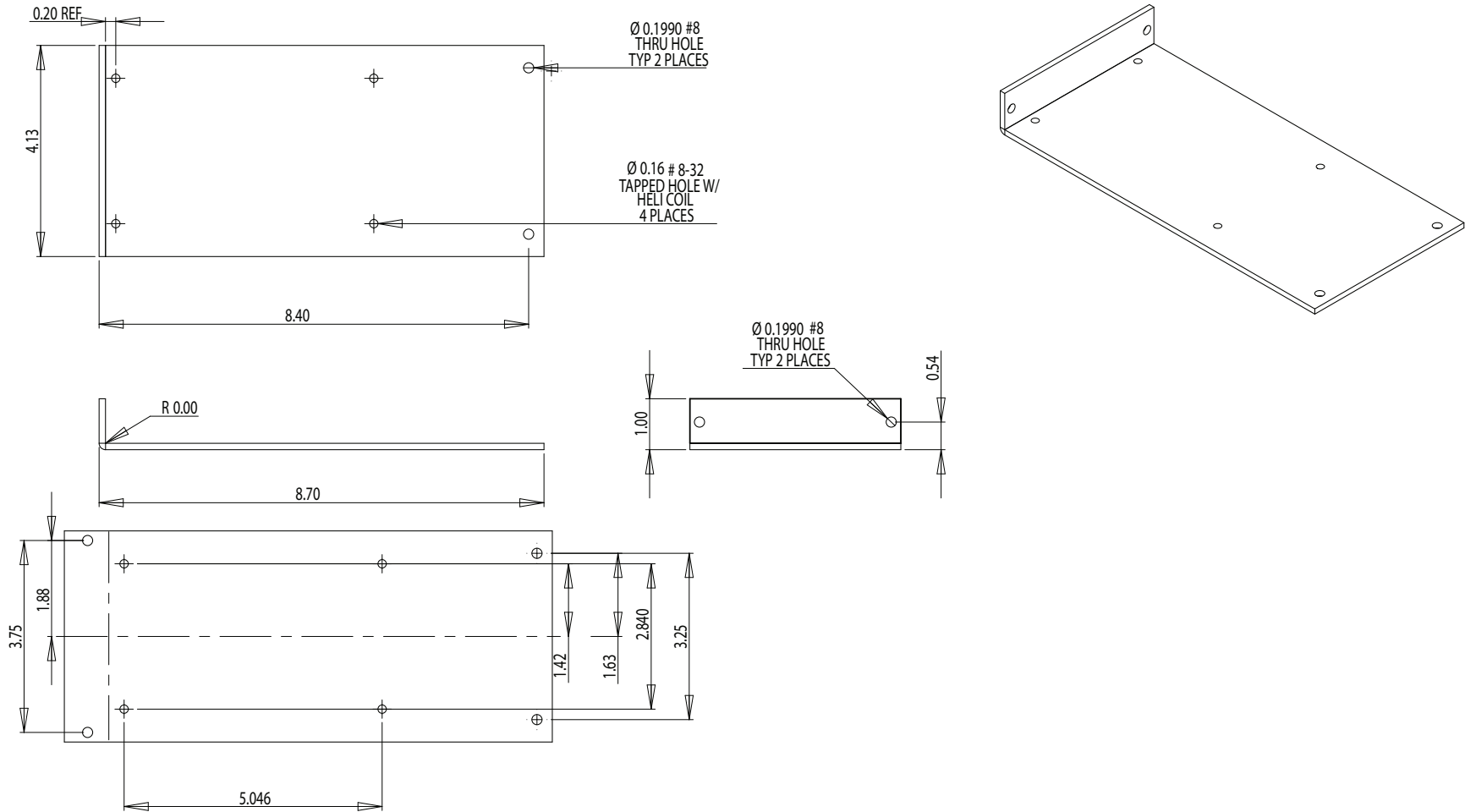
Sled Fabrication Drawing

Construct of 0.125 inch thick AL1100-H14

Unless otherwise specified:

Dimensions in inches

Tolerances: Decimal: X= \pm 0.10, XX= \pm 0.03, XXX= \pm 0.010, Fractional: \pm 1/32



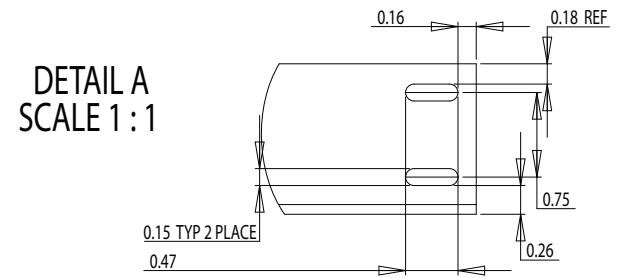
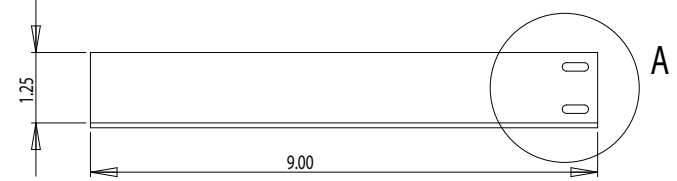
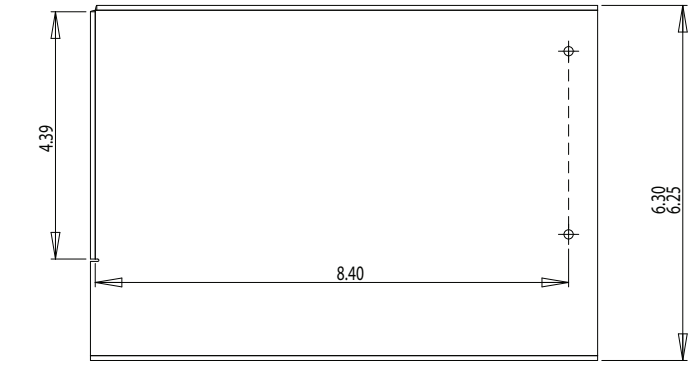
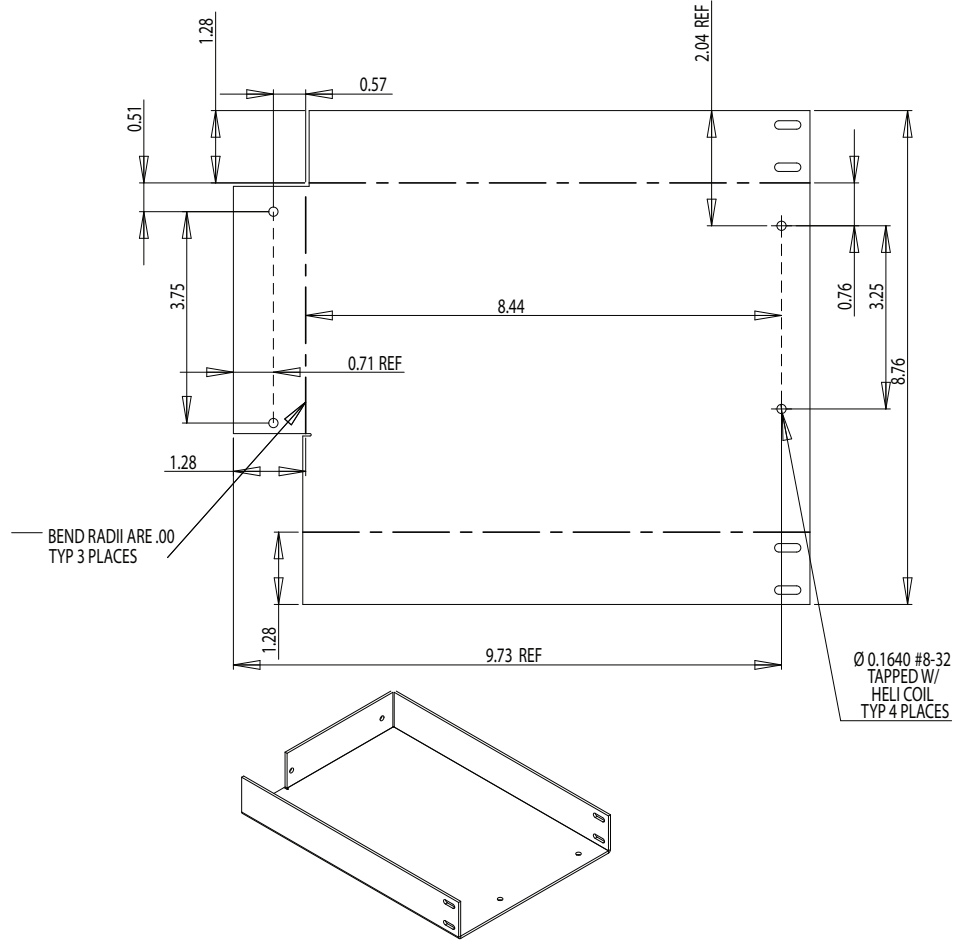
Sled Base Fabrication Drawing

Construct of 0.085 +/- 0.005 inch thick AL1100-H14

Unless otherwise specified:

Dimensions in inches

Tolerances: Decimal: X= +/- 0.10, XX= +/- 0.03, XXX= +/- 0.010, Fractional: +/- 1/32



Appendix G: Installation Requirements

Aircraft:

Refer to Supplemental Type Certificate Approved Model List.

Audio Panel:

Available un-switched input having a nominal input impedance of 500 Ohms or greater.

GPS units:

Single or dual installation:

- **Garmin 400 Series (Non-WAAS)** - "Main Software" version 5.04
GPS 400, GNC 420, GNC 420A, GNS 430, GNS 430A
- **Garmin 500 Series (Non-WAAS)** - "Main Software" version 6.04
GPS 500, GNS 530, GNS 530A
- **Garmin 400W Series (WAAS)** - "Main Software" version 3.30, 5.03 or 5.10*
GPS 400W, GNC 420W, GNC 420AW, GNS 430W, GNS 430AW
- **Garmin 500W Series (WAAS)** - "Main Software" version 3.30, 5.03 or 5.10*
GPS 500W, GNS 530W, GNS 530AW

* Note: VFS101 software version 3.2.0 or greater is required for operation with Garmin 400W / 500W Series units running "Main Software" version 5.03 or 5.10.