Garmin G5

Electronic Flight Instrument

Part 23 AML STC Installation Manual

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RECORD OF REVISIONS

Revision	Revision Date	Description
1	07-14-2016	Initial Release
2	07-21-2016	Revised to incorporate comments and changes driven by document reviews.
3	08-08-2016	Removed shock mount installation limitation in section 2.1, removed shock mount replacement instructions in section 4.1 and added engine run up details in section 5.3.7.2.
4	01-05-2017	Updated Section 1.5 to show software P/N 006-B2304-02, revised section 3.4.1 to add clarification on GPS receiver configuration, updated Table 5-1 to add clarification on GPS receiver configuration.

INFORMATION SUBJECT TO EXPORT CONTROL LAWS

This document may contain information which is subject to the Export Administration Regulations ("EAR") issued by the United States Department of Commerce (15 CFR, Chapter VII, Subchapter C) and which may not be exported, released, or disclosed to foreign nationals inside or outside of the United States without first obtaining an export license. A violation of the EAR may be subject to a penalty of up to 10 years imprisonment and a fine of up to $1,000,000 under Section 2410 of the Export Administration Act of 1979. Include this notice with any reproduced portion of this document.

DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

WARNING

Warnings are used to bring to the installer's immediate attention not only damage to the equipment but personal injury may occur if the instruction is disregarded.

CAUTION

Cautions are used to alert the individual damage to equipment may result if the procedural step is not followed to the letter.

NOTE

Notes are used to expand and explain the preceding step and provide further understanding of the reason for the particular operation.

GARMIN

WARNING

This product, its packaging, and its components contain chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. This notice is being provided in accordance with California's Proposition 65. If you have any questions or would like additional information, please refer to our web site at www.garmin.com/prop65.

WARNING

Perchlorate Material – special handling may apply, See www.dtsc.ca.gov./hazardouswaste/perchlorate.

BATTERY WARNINGS:

If these guidelines are not followed, the lithium-ion battery may experience a shortened life span or may present a risk of damage to the device, fire, chemical burn, electrolyte leak, and/or injury.

Do not leave the battery exposed to a heat source or in a high temperature environment. To help prevent damage, store the battery out of direct sunlight.

For maximum battery longevity, store within a temperature range of 32˚ to 77˚F (from 0˚ to 25˚C).

Do not use a sharp object to remove the battery.

Do not disassemble, puncture, damage, or incinerate the device or battery.

Keep the battery away from children.

Only replace the battery with the approved replacement from Garmin. Using another battery presents a risk of fire or explosion. To purchase a replacement battery, see you Garmin dealer or the Garmin website.

Contact your local waste disposal department to dispose of the device and battery in accordance with applicable local laws and regulations.

CAUTION:

The display uses a lens with a special coating that may be sensitive to skin oils, waxes, and abrasive cleaners. CLEANERS CONTAINING AMMONIA WILL HARM THE ANTI-REFLECTIVE COATING. It is very important to clean the lens using a clean, lint-free cloth and a cleaner that is specified as safe for anti-reflective coatings. Avoid any chemical cleaners or solvents that can damage plastic components.

CAUTION:

The G5 does not contain any user-serviceable parts. Repairs should only be made by an authorized Garmin service center. Unauthorized repairs or modifications could result in permanent damage to the equipment and void both the warranty and the authority to operate this device under FAA, FCC, and other applicable regulations.

NOTE:

Use of polarized eyewear may cause the display to appear dim or blank.

NOTE

All screen shots used in this document are current at the time of publication. Screen shots are intended to provide visual reference only. All information depicted in screen shots, including software file names, versions, and part numbers, is subject to change and may not be up to date.

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1 GENERAL DESCRIPTION

1.1 Introduction

The G5 is an electronic instrument display capable of operating as a primary attitude indicator or rate-of-turn indicator. This STC will approve the installation of the G5 as an attitude indicator or rate-of-turn indicator in the existing instrument panel.

The Garmin G5 indicator can replace an existing vacuum attitude indicator. The G5 is designed to be installed into a standard 3 1/8" instrument hole in place of the existing attitude indicator. The other primary flight instruments remain in the current approved locations. The G5 cannot replace an existing primary attitude indicator that has a Flight Director; however, if the existing attitude indicator is interfaced to the autopilot and it does not include a Flight Director, that existing attitude indicator can be moved to the rate-of-turn indicator location and the G5 installed as the primary attitude indicator.

Alternatively, for installations that do not install the G5 as a replacement primary attitude indicator, the G5 can be installed as a second attitude indicator in place of the existing rate-of-turn indicator. If the existing rate-of-turn indicator is interfaced with the autopilot, it cannot be replaced by a G5. Only one G5 per airframe can be installed in the locations specified in this STC. It is the installer's responsibility to ensure the installation limitations are considered prior to modifying the aircraft..

NOTE

Throughout this document the term "rate-of-turn indicator" will be used and could be speaking to either a turn coordinator or turn and bank indicator. Typically these instruments are used to cross-check the attitude indicator and directional gyro for bank information. However, these instruments only provide information that the aircraft is in a turn and whether the turn is at the standard rate (a standard rate turn is 3 degrees per second, or 2 minutes for a full 360-degree circle). They do not provide information on the bank angle. Regardless of the specific instrument installed the G5 is capable of replacing either configuration of a turn coordinator or turn and bank indicator.

The software versions and information in this document are subject to change without notice. Visit www.Garmin.com and navigate to the Aviation Product/General Aviation/Indicators/G5 page for current updates and supplemental information concerning operation of the G5 attitude indicator.

1.2 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this manual:

AFMS	Airplane Flight Manual Supplement	**ICA**	Instructions for Continued Airworthiness
ALT	Altitude (mode)	**I/O**	Input/Output
AML	Approved Model List	**LRU**	Line Replaceable Unit
CFR	Code of Federal Regulations	**STC**	Supplemental Type Certificate
FAA	Federal Aviation Administration	**TSO**	Technical Standard Order
GPS	Global Positioning System	**WAAS**	Wide Area Augmentation System

1.3 Reference Documents

Table 1-1: Reference Documents

Title	Document Number
FAA Advisory Circular, Acceptable Methods, Techniques, and Practices – Aircraft Inspection and Repair	AC 43.13-1B
FAA Advisory Circular, Acceptable Methods, Techniques, and Practices – Aircraft Alterations	AC 43.13-2B
Aerospace Systems Electrical Bonding and Grounding for Electromagnetic Compatibility and Safety	SAE ARP1870
Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis	ASTM F 2490-05
GTN 6XX/7XX Install Manual	190-01007-A3
GNS 400W Series Installation Manual	190-00356-08
GNS 500W Series Installation Manual	190-00357-08
Garmin GPS and XM® Antenna STC Installation Manual	190-01284-00
Garmin G5 Electronic Flight Instrument Part 23 AML STC Maintenance Manual including Instructions for Continued Airworthiness	190-01112-11
Pilots Guide, Garmin G5 Electronic Flight Instrument, Part 23 AML STC	190-01112-12
Airplane Flight Manual Supplement Garmin G5 Electronic Flight Instrument Part 23 AML STC	190-01112-13

1.4 STC Permission

A permission letter to use this STC data is available for download for each authorized G5 installation. The STC Installation Kit P/N K10-00280-00 contains instructions for downloading the STC permission letter from www.Garmin.com.

1.5 Scope

This manual applies to the modification of an aircraft listed on the Part 23 AML STC SA01818WI for the installation of equipment listed below. Only the interfaces between the Garmin G5 Electronic Flight Instrument and equipment listed in this manual are approved by the STC.

Table 1-2: G5 Equipment

Model	Nomenclature	Unit P/N	Catalog P/N
G5	Electronic Instrument	011-03809-00	010-01485-00
G5	Installation Kit	011-03892-00	010-12493-10
G5	Battery pack	011-03893-00	010-12493-00

The approved G5 Part 23 AML STC Electronic Flight Instrument software is P/N 006-B2304-XX. XX denotes the specific version P/N, i.e. 006-B2304-02 is software version 2.60. The G5 Electronic Instrument listed above is shipped with approved software. To verify the latest approved software visit www.Garmin.com and navigate to the Aviation Product/General Aviation/Indicators/G5 page.

1.6 System Overview

1.6.1 Equipment Description

The G5 Electronic Flight Instrument is shown in Figure 1-1. The G5 is an electronic instrument display operating as a standalone flight display. It features a bright, sunlight readable, 3.5-inch color display which is sized to fit in a standard 3-1/8-inch instrument cutout. The G5 contains integrated attitude/air data sensors that provide display of attitude and secondary display of air data information. The G5 has battery backup and in the case of aircraft power loss will sustain G5 operation with up to 4 hours of emergency power.

Figure 1-1 G5 Electronic Flight Instrument

1.6.1.1 Attitude

The G5 calculates aircraft attitude using information from its built-in inertial sensors. If the G5 senses that the attitude solution is valid, but not yet within the internal accuracy limits, "ALIGNING" is displayed. The G5 can align itself both while taxiing and during level flight.

The G5 will also use GPS and airspeed data to provide the most accurate attitude information. If none of these additional sources of information are available, attitude calculations will still be valid but accuracy may be slightly affected.

The G5 attitude functions are shown below:

- Pitch
- Roll

1.6.1.2 Turn Rate

The Turn Rate Indicator is located at the bottom of the display. A magenta Turn Rate Trend Vector shows the current turn rate. A standard-rate turn (3 deg/sec) is shown on the indicator by the trend vector stopping at the standard turn rate tick mark.

1.6.1.3 Slip/skid

The Attitude Indicator displays slip/skid information as indicated by the location of the ball at the lower center portion of the indicator.

1.6.1.4 GPS

The G5 requires GPS for attitude aiding. It contains an internal GPS receiver that can be connected to an external antenna or optionally can use external GPS input if available.

As installed in this STC, the G5 receives the GPS via the following methods:

- Previously installed and approved GPS antenna (See Section 3.4.1)
- GTN 6XX/7XX series navigators (See section 1.6.2.1)
- GNS 4XXW/5XXW series navigators (See section 1.6.2.2)

Additionally, the G5 functions provided by the GPS are shown below:

- Ground Track
- Ground Speed (GS)

1.6.1.5 Air Data

The G5 unit is connected to the aircraft Pitot / Static system. See section 4.3.2 for details.

The G5 functions provided by the air data are shown below:

- Secondary Airspeed indicator
- Secondary Barometric altimeter
- Secondary Vertical speed
- Secondary Altimeter Barometric Setting
- Secondary Altimeter
- Secondary Altitude Display
- Selected altitude setting, bug and visual altitude alerting
- Secondary Vertical Speed Indicator
- Vspeed references

1.6.1.6 Standby Battery

The standby battery is required. The G5 has an externally mounted lithium – ion battery that sustains the G5 flight display with up to 4 hours of emergency power.

Figure 1-2 G5 Standby Battery

1.6.2 G5 Interface Summary

The G5 Electronic Flight Instrument in this STC installation uses 14VDC or 28 VDC power, ground, RS-232[(2)], and coax[(1)] connection for external mounted GPS antennas. The following list is a summary of interfaces used by the G5.

- Aircraft Power and Ground
- Aircraft Pitot/Static
- GPS Coax connection [(1)]
- One RS-232 Input [(2)]
- Standby battery

[(1)] Used only in installations utilizing an external GPS antenna for GPS input to G5

[(2)] Used only in installations utilizing a GTN 6XX/7XX or GNS 4XXW/5XXW for GPS input to G5

1.6.2.1 GTN 6XX/7XX Interface Summary

The G5 can utilize a RS-232 connection to an existing GTN 6XX/7XX when available to receive GPS data. The RS-232 port used on the GTN 6XX/7XX needs to be configured to MAPMX Format 1. If an existing connection is made to the required GTN RS-232 port, the G5 connection can be spliced into the existing wiring at the GTN connector. Refer to Section 1.7.1.2.

1.6.2.2 GNS 4XXW/5XXW Interface Summary

The G5 can utilize a RS-232 connection to an existing GNS 4XXW/5XXW when available to receive GPS data. The RS-232 port used on the GNS 4XXW/5XXW needs to be configured to MAPMX. If an existing connection is made to the required GNS RS-232 port, the G5 connection can be spliced into the existing wiring at the GNS connector. Refer to section 1.7.1.2.

1.6.3 OUTLINE AND INSTALLATION DRAWINGS

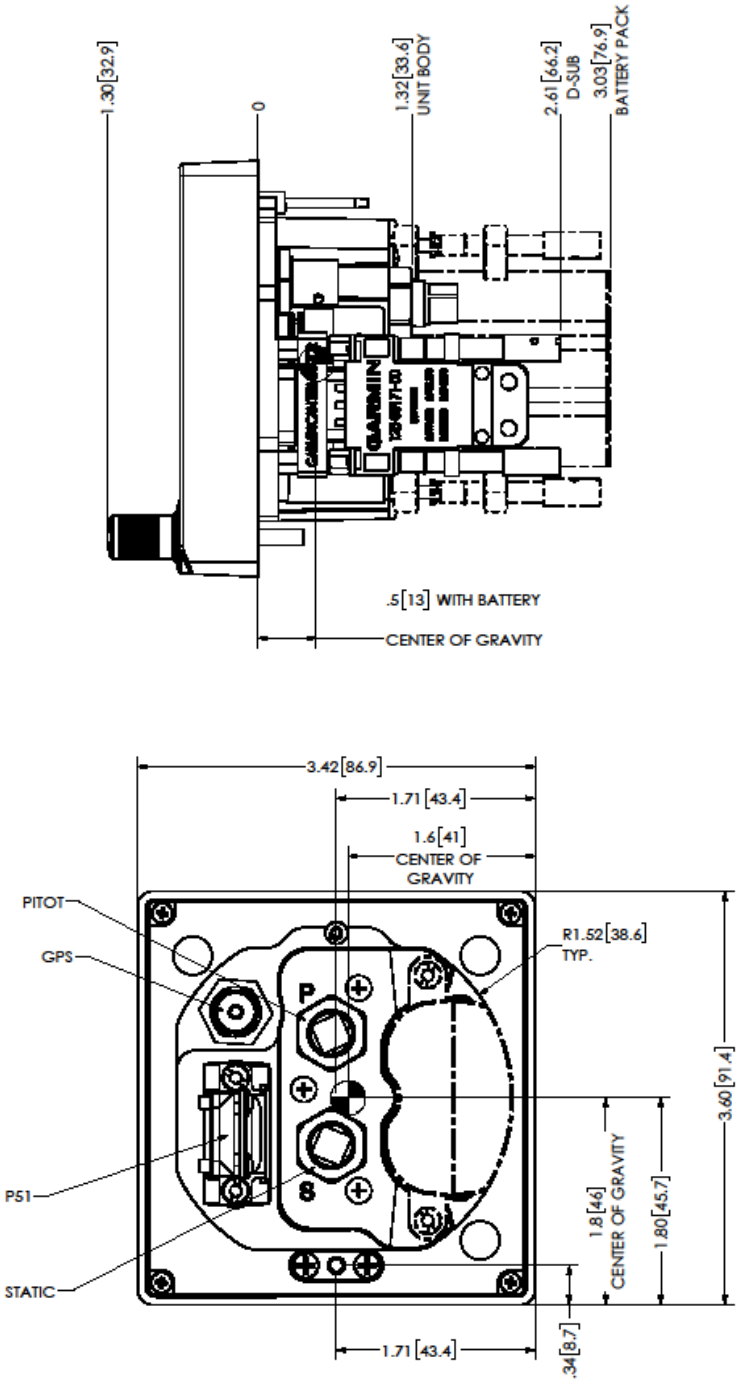


Figure 1-3 G5 Outline Drawing

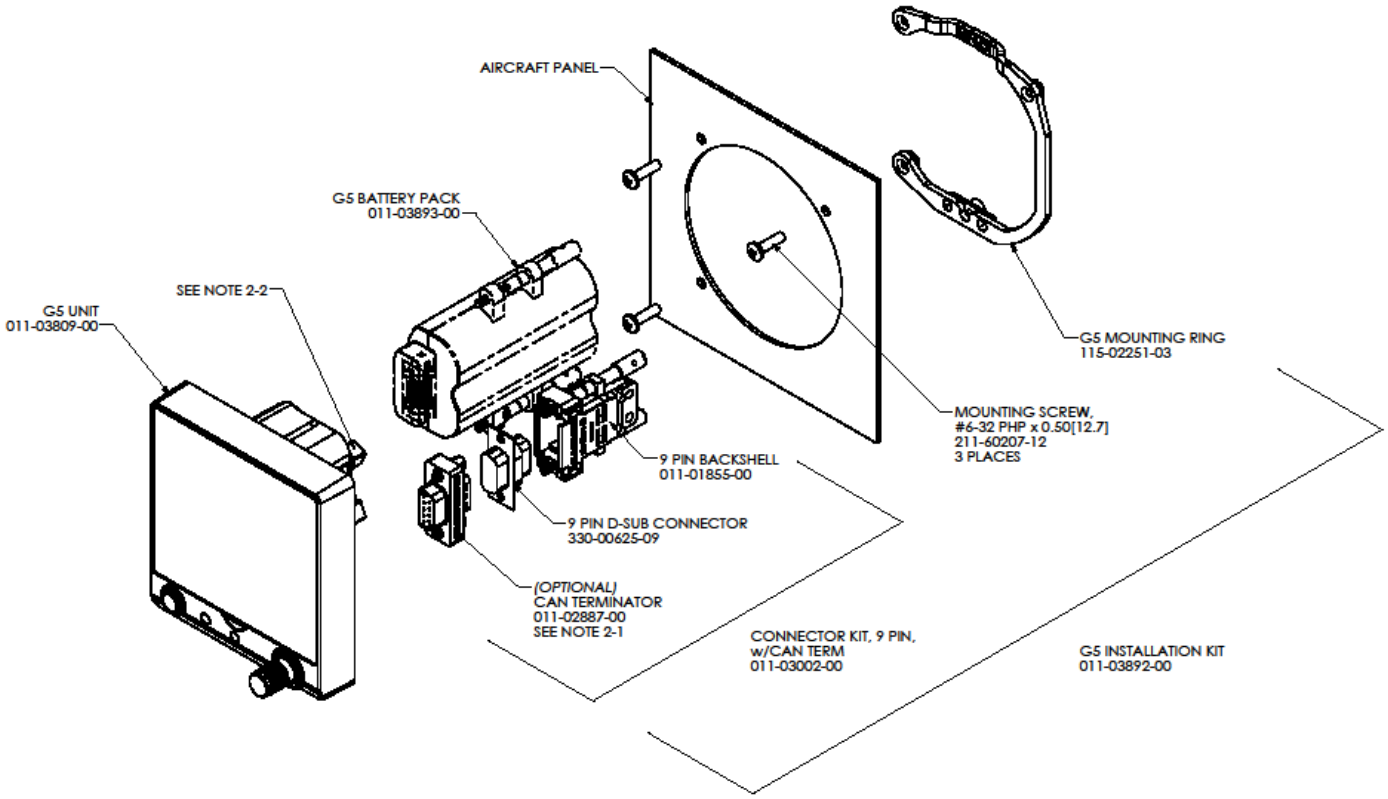


Figure 1-4 G5 Installation Drawing

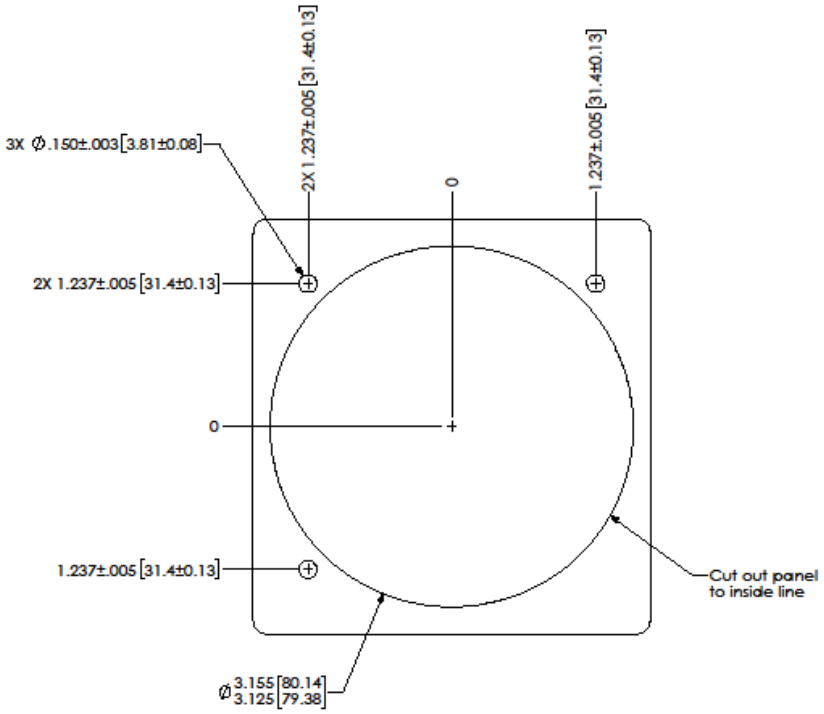


Figure 1-5 G5 Panel Cutout Measurements (Not to Scale)

1.7 G5 Pinout

Use the information in this section with other applicable sections/appendices to construct the wiring in accordance with FAA approved standard practices.

1.7.1 J51

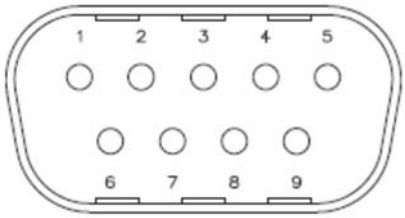


Figure 1-6 J51 on the G5

Table 1-3 J51 Pin Descriptions

Pin	Pin Name	I/O
1	CAN-H	I/O
2	CAN-L	I/O
3	UNIT ID	In
4	RS-232 RX 1	In
5	RS-232 TX 1	Out
6	SIGNAL GROUND	--
7	AIRCRAFT POWER 1	In
8	AIRCRAFT POWER 2	In
9	POWER GROUND	--

1.7.1.1 Aircraft Power

The G5 operates using power from one 14 / 28 VDC input. Pin 8 (AIRCRAFT POWER 2) is not used as a part of this STC.

NOTE

AIRCRAFT POWER 2 is for connecting to an alternate power source, such as on aircraft with two electrical buses.

1.7.1.2 RS-232

The G5 has one RS-232 channel that may be used to output and/or receive GPS data from an existing GTN 6XX/7XX or GNS 4XXW/5XXW. The G5 can utilize a RS-232 connection to an existing GTN or GNS when available to receive GPS data instead of an external GPS antenna. The RS-232 port used on the GTN or GNS needs to be configured to MAPMX Format 1. If an existing connection is made to the required GTN RS-232 port, the G5 connection may be spliced into the existing wiring at the GTN connector.

1.7.1.3 CAN Bus

CAN Bus is not used or approved for use by this STC.

1.7.1.4 Unit ID

The G5 detects its assigned unit type at startup by checking the UNIT ID pin. Only one G5 may be installed by this STC. Ensure pin 3 is not connected to allow the G5 to properly detect its assigned unit type.

Table 1-4: Unit ID Configurations

Unit ID	Comment
G5 #1	Pin 3 No Connection
G5 #2 (Not Used)	Ground pin 3 to pin 6 or pin 9 (Not Used)

1.8 Technical Specifications

1.8.1 Physical Characteristics

Table 1-5: Physical Characteristics

Configuration	Width	Height	Depth*	Unit Weight	Weight of Unit and Connector**
G5 with Battery	3.42 in	3.60 in	3.03 in	0.83 lb	0.98 lb
*Depth behind aircraft panel			**Weight includes mounting ring		

1.8.2 Power Requirements

Table 1-6: Power Requirements

LRU	Characteristics	Specifications
G5	Average Current Draw @ 14 VDC	.200 A
	Max Current Draw @ 14 VDC	.250 A
	Average Current Draw @ 28 VDC	.100 A
	Max Current Draw @ 28 VDC	.125 A

2 LIMITATIONS

2.1 Installation Limitations

It is the installer's responsibility to ensure the installation will meet the requirements in this manual prior to modification the aircraft.

As installed by this STC, the G5:

- is NOT approved in FAA certified aircraft that:
  - are approved for Flight Into Known Icing (FIKI) conditions
  - have a gross take-off weight more than 6000 lbs
  - can seat more than 6 passengers
- cannot replace a primary attitude indicator that includes a flight director or is part of an autopilot system (an existing attitude indicator in the primary location that is part of an autopilot but without flight director may be moved to the rate of turn indicator location and a G5 installed in the primary location)
- cannot replace the rate-of-turn indicator that is part of an autopilot system
- must be installed in an instrument panel constructed of aluminum with a minimum thickness of .040 inches.
- is only approved to interface with aircraft systems specified in this manual
- cables and wiring interfaced to the G5 must not be installed in fuel bays

2.2 Operational Limitations

Refer to the Airplane Flight Manual Supplement (AFMS) for operational limitations.

3 INSTALLATION OVERVIEW

3.1 Introduction

The following section contains an overview of the steps required for the installation of the G5 Electronic Flight Instrument. This section includes requirements for selection of proper locations in the aircraft, as well as requirements for supporting structure, mechanical alignment and wiring. Any restrictions on nearby equipment and requirements are also specified.

3.2 Installation Materials

The installation kit listed in Table 3-1 is required for each G5 installation.

Table 3-1: Contents of the G5 Installation Kit (011-03892-00)

Item	Garmin P/N	Quantity
Connector Kit, 9 Pin, w/CAN Term	011-03002-00	1
Mounting Ring, G5	115-02251-03	1
Screw, 6-32, 0.500”	211-60207-12	3

Table 3-2: Contents of the Connector Kit (011-03002-00)

Item	Garmin P/N	Quantity
Sub-Assy, Bkshl w/Hdw, Jackscrew, 9 pin	011-01855-00	1
Sub Assy, CAN Termination Kit*	011-02887-00	1
Conn, Rcpt, D-Sub, Crimp Socket, 9 Ckt	330-00625-09	1
Contact, Sckt, D-Sub, Crimp, Size 20, 20-24 AWG	330-00022-02	9

*NOTE: Not all items included in kit P/N 011-02887-00 are used in this installation

3.2.1 Materials Required but Not Supplied

The following installation materials are required, but are not available from Garmin:

- Insulated stranded wire (M22759/34-22-9 or equivalent)
- Shielded wire (M27500-24SD3T23 or equivalent)
- Push/pull manually resettable circuit breakers.

  Aircraft with 14 VDC or 28 VDC electrical systems require the following circuit breaker:

  - MS26574-5 (5 Amp, G5)

- Tie wraps or lacing cord
- MS25036 ring terminals (for grounding and circuit breaker connections)
- Shield terminators (AS83519/1-X or equivalent)
- Silicon fusion tape, A-A-59163 (MIL-I-46852C or equivalent)
- Environmental splice (M81824/1-X, where X=size or equivalent)
- Flat braid, 1/16" (AA59569F36T0062 or equivalent)

Tubing and fittings are required to connect pitot air and static air to the G5.

3.3 Test Equipment

The following test equipment is required to complete the G5 installation and to perform post-installation checkout of the system:

- Ground power cart (capable of supplying power to the aircraft systems and avionics)
- Air data test set (e.g. Barfield DPS450 or similar)
- Low resistance ohmmeter
- Digital Level (or equivalent)

3.4 Installation Considerations

The installation instructions are intended to be used in coordination with the avionics installation practices in AC 43.13-1B and AC 43.13-2B. Modification of existing plastic instrument panel overlays may be required to install the G5 electronic flight instrument. Fabrication of a wiring harness is required. Sound mechanical and electrical methods and practices are required to achieve optimum system performance.

3.4.1 GPS Antenna

A GPS signal is required. The G5 can use an external GPS antenna or GPS data from a GTN6XX/7XX or GNS4XXW/5XXW. Refer to Section 1.6.2 for the GTN and GNS interface. If a GTN6XX/7XX or GNS4XXW/5XXW is used for a GPS signal, disable the internal GPS receiver of the G5. If an external GPS antenna is connected to the G5, enable the internal GPS receiver. See Table 5-1 for configuration settings. This STC approves the interface to antennas shown in Table 3-3 and Table 3-4.

This STC does not approve the installation of a GPS antenna. A separate airworthiness approval for antenna installation is required except for existing or previously approved installations. One means of installation approval is Garmin Antenna STC SA02018SE-D for mounting GPS antennas.
Other antennas that meet the specifications listed in Table 3-5 will work with the G5, but it is the installer's responsibility to ensure that their choice of antenna meets FAA standards according to this specific installation.

3.4.1.1 GARMIN ANTENNAS

Table 3-3 lists Garmin antennas supported by the G5. The GA35 and GA36 meet the requirements of TSO/ETSO-C144.

Table 3-3 Supported Garmin Antennas

Model	Part Number
GA35	013-00235-0X
GA36	013-00244-0X
GA56	011-00134-00

3.4.1.2 NON-GARMIN ANTENNAS

Table 3-4 lists non-Garmin antennas supported by the G5. For non-Garmin antennas, follow the manufacturer's installation instructions.

Table 3-4 Supported Non-Garmin Antennas

Model	Antenna Type	Mfr	Part Number
Comant 2480-201 VHF/GPS*	VHF COM/ GPS	Comant	CI 2480-201

*The GPS antenna connector is TNC type. The VHF COM antenna connector is BNC type.

An antenna meeting the specifications in Table 3-5 is capable of receiving both GPS and WAAS signals when connected to the G5.

Table 3-5 GPS Antenna Minimum Requirements

Characteristics	Specifications
Frequency Range	1565 to 1585 MHz
Gain	16 to 25 dB typical, 40 dB max
Noise Figure	Less than 4.00 dB
Nominal Output Impedance	50 Ω
Supply Voltage	4.5 to 6.5 VDC
Supply Current	up to 60 mA

3.4.2 Considerations for Vacuum System

If a vacuum driven instrument is removed. The vacuum source must be capped and the system checked for leaks. See the aircraft specific maintenance manual for procedure.

3.4.3 Cooling Considerations

The G5 does not require external cooling.

3.4.4 Switches

There are no switches added by this STC installation.

3.4.5 Placards and Labels

The new circuit breaker installed for the G5 unit must be labeled as noted in the interconnect drawing in section 4.6.

3.4.6 Cable and Wiring Considerations

Select wire in accordance with AC 43.13-1B Chapter 11, Sections 5 through 7. Mark wire in accordance with AC 43.13-1B Chapter 11 Section 16. Mark harness connectors in accordance with AC 43.13 Chapter 11 Section 17. Install wiring in accordance with AC 43.13-1B Chapter 11, Sections 8 through 13. Use the following guidelines to prevent damage to the aircraft and systems:

- Do not route the wire harness near flight control cables, high electrical capacity lines, high-energy sources or fuel lines.
- Locate the wire harness in a protected area of the aircraft.
- Make sure the wire harness does not come in contact with sources of high heat or be routed adjacent to RF coaxial cables.
- Make sure there is ample space for the wire harness and mating connectors.
- Avoid sharp bends.

3.4.7 Cooling Requirements

While no forced cooling air is required for the G5, it is highly recommended that the air behind the panel be kept moving (by ventilation or a fan). Units tightly packed in the avionics stack heat each other through radiation, convection, and sometimes by direct conduction. Even a single unit operates at a much higher temperature in still air than in moving air. Fans or some other means of moving the air around electronic equipment are usually a worthwhile investment.

NOTE

Avoid installing LRUs near heat sources. If this is not possible, ensure that additional cooling is provided. Allow adequate space for installation of cables and connectors. The installer will supply and fabricate all of the cables. Install wiring in accordance with FAA AC 43.13-1B and AC 43.13-2B.

3.4.8 Compass Safe Distance

After reconfiguring the avionics in the cockpit panel, if the unit is mounted less than 12 inches from the compass, recalibrate the compass and make the necessary changes for noting correction data.

3.4.9 Shield Termination Considerations

For G5 installations utilizing the RS-232 interface from a GTN6XX/7XX or GNS4XXW/5XXW, terminate the shield to the G5 connector backshell as shown in Figure 4-8 and Figure 4-9.

3.4.10 Audio Interference

This STC installation does not interface to audio signals. Attention to harness installation and routing as specified in Section 3.4.6 should be considered for Audio interference mitigation.

3.5 Electrical Load Analysis

If the current draw of the G5 unit is less than the removed equipment, then the aircraft's electrical load capacity can be shown to be adequate by analysis. If it is determined the modification results in an increase in electrical load, then it must be verified the electrical generation and reserve battery capacity remain adequate to support electrical loads essential to safe flight and landing of the aircraft.

3.5.1 Aircraft with Existing Electrical Load Analysis

If there is an existing electrical load analysis for the aircraft, it must be updated to reflect the modification. It must show the electrical system has adequate capacity to supply power to the modified systems in all expected conditions. Refer to the aircraft manufacturer's documentation for guidance on revising and maintaining the electrical load analysis.

3.5.2 Aircraft without Existing Electrical Load Analysis

Prior to undertaking a complete electrical load analysis, the net change to the electrical load resulting from the G5 installation should be determined. See Table 3-6 for a sample calculation. The results of this analysis will be used to determine how to proceed further.

3.5.2.1 Electrical Load is Reduced Following Modification

If calculations show the overall load on the electrical system is reduced as shown in the following example, no further analysis is required. This assumes the electrical system was within all limits prior to the G5 installation. Record the new electrical load calculations.

Table 3-6: Sample Net Electrical Load Change Calculation

Items **removed from** aircraft:		**Electrical Load (Amps)** [1]
SUBTOTAL		

Items added to aircraft

G5	14 V (typical) (1)	.200 A
	28 V (typical) (1)	.100 A
SUBTOTAL		

NET CHANGE IN BUS LOAD
(NEW BUS LOAD – OLD BUS LOAD) _____

Notes:

1. Use 14 V or 28 V typical current draw depending on aircraft system when performing this calculation.

3.5.2.2 Electrical Load is Increased Following Modification

If it is determined the electrical load has increased an appreciable amount, a complete electrical load analysis must be performed to show the capacity of the electrical system is sufficient for the additional electrical load. For guidance on performing an electrical load analysis, refer to ASTM F 2490-05, Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis. Alternatively, the loads under various operating conditions may be measured, as described in Section 3.5.2.3.

3.5.2.3 Performing an Electrical Load Analysis by Measurement

This section describes how to perform an electrical load analysis for a single alternator-single battery electrical system. These procedures may be modified accordingly for aircraft with multiple batteries or alternators, and it must be shown the maximum electrical demand does not typically exceed 80% of the electrical system capacity.

In this section the following definitions are used:

normal operation: the primary electrical power generating system is operating normally.

emergency operation: the primary electrical power generating system is inoperative and a back-up electrical power generating system is being used. This typically requires load shedding of non-essential equipment to provide adequate electrical power to essential required equipment for safe flight and landing of the airplane.

Either an in-circuit or clamp-on ammeter can be used for current measurement. The instrument used must be calibrated and must be capable of reading current to the nearest 0.5 A, or better.

1. Record the continuous load rating for the alternator and battery.
2. Compile a list of electrical loads on the aircraft (generally, this is just a list of circuit breakers and circuit breaker switches). See example in Figure 3-4 and Figure 3-5.
3. Identify whether each load is *continuous* (e.g. GPS) or *intermittent* (e.g. stall warning horn, landing gear).
4. Using the worst-case flight condition, identify whether each load is used in a particular phase of flight for *normal* operation. If some loads are mutually exclusive and will not be turned on simultaneously (e.g. pitot heat and air conditioning), use only those loads for the worst-case condition.
5. Identify whether each load is used in a particular phase of flight for emergency operation. As a minimum, these systems generally include:
   - COM Radio #1
   - NAV Radio #1
   - Transponder and associated altitude source
   - Audio Panel
   - Stall Warning System (if applicable)
   - Pitot Heat
   - Landing Light (switched on during landing only)
   - Instrument Panel Dimming
6. Insert/attach the ammeter in the line from the external power source to the master relay circuit as shown in Figure 3-1. This will eliminate errors due to the charging current drawn by the battery.

CAUTION

To avoid damage to equipment, ensure the ammeter is capable of handling the expected load.

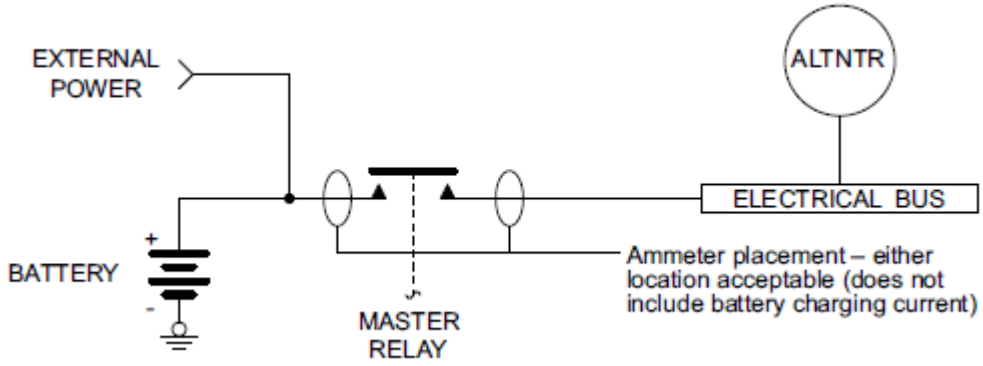


Figure 3-1 Ammeter Placement for Current Measurements

7. Ensure all circuit breakers are closed.
8. Apply external power to the aircraft. The voltage of the power source should be set to the nominal alternator voltage (usually 13.8 VDC or 27.5 VDC).
9. Turn on the battery master switch.

NOTE

Intermittent electrical loads are not measured. It is assumed if additional current is required beyond what the alternator can supply, this short-duration demand will be provided by the battery.

10. Set the lighting as described below. These settings will be used for every current measurement which follows:
    - Set instrument panel and flood lights to maximum brightness.
    - Set displays with a backlight to 50% brightness
11. Using the tabulation completed above, switch on all *continuous* electrical loads used for the taxiing phase and record the current measured by the ammeter (measurement (a) in Figure 3-3). The autopilot circuit breaker (if installed) should be closed, but the autopilot should not be engaged.

WARNING

Pitot heat should be switched on only long enough to take the current measurement and then switched off to avoid injury to personnel or damage to the Pitot tube.

12. Using the tabulation completed above, switch on all continuous electrical loads used for the ***normal*** takeoff/landing phase and record the current measured by the ammeter. Measurements must be taken with the landing lights ON and OFF (measurements (b1) and (b2) in Figure 3-3).
13. Engage the autopilot (if installed).

14. Using the tabulation completed above, switch on all continuous electrical loads which are used for the ***normal*** cruise phase and record the current measured by the ammeter (measurement (c) in Figure 3-3).
15. Using the tabulation completed above, switch on all continuous electrical loads used for the ***emergency*** cruise phase and record the current measured by the ammeter.
16. Using the tabulation completed above, switch on all continuous electrical loads used for the emergency landing phase and record the current measured by the ammeter.
17. Using the values measured and recorded, complete the ELA using the blank form in Figure 3-2 and Figure 3-3.
18. Verify the maximum electrical load does not exceed 80% of the electrical system capacity. See example in Figure 3-4 and Figure 3-5.

NOTE

Electrical loads in excess of 80% but not greater than 95% of electrical system capacity are permitted during the takeoff/landing phase of flight when landing light(s) are switched on.

GARMIN

AIRPLANE ELECTRICAL LOAD TABULATION FORM

Date: __________ Tail Number: __________

			Phase(s) of flight during which circuit/system is used				
			Normal Operation			Emergency Operation	
Circuit/System	Circuit Breaker Number	Operating Time	Taxiing 10 min	TO/Land 10 min	Cruise 60 min	Cruise	Land 10 min

Figure 3-2 Blank Electrical Load Tabulation Form, Sheet 1 of 2

GARMIN

AIRPLANE ELECTRICAL LOAD TABULATION FORM (CONTINUED)

Date: _____ Tail Number: _____

Circuit/System	Circuit Breaker Number	Operating Time	Phase(s) of flight during which circuit/system is used: Normal Operation – Taxiing 10 min	Normal Operation – TO/Land 10 min	Normal Operation – Cruise 60 min	Emergency Operation – Cruise	Emergency Operation – Land 10 min
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
_____	_____	_____					
Total current used (amps):			_____ (a)	Ldg Lt ON (b1) _____ / Ldg Lt OFF (b2) _____	_____ (c)	_____ (d)	_____ (e)
÷ Alternator rating (amps):							
x 100% = Percent of alternator capacity used:			_____ % (< 80%)	_____ % Ldg Lt ON (< 95%) / _____ % Ldg Lt OFF (< 80%)	_____ % (< 80%)	N/A	N/A
Pass/Fail:			_____	_____	_____		

Notes:

Figure 3-3 Blank Electrical Load Tabulation Form, Sheet 2 of 2

GARMIN

ELECTRICAL LOAD TABULATION FORM

Date: 02/14/14 Tail Number: NXXXX

Circuit/System	Circuit Breaker Number	Operating Time	Phase(s) of flight during which circuit/system is used				
			Normal Operation			Emergency Operation	
			Taxiing 10 min	TO/Land 10 min	Cruise 60 min	Cruise	Land 10 min
ALTERNATOR FIELD		Continuous	☒	☒	☒	☐	☐
ANNUNCIATOR PANEL		Continuous	☒	☒	☒	☒	☒
VACUUM WARNING		Intermittent	☐	☐	☐	☐	☐
GEAR WARNING		Intermittent	☐	☐	☐	☐	☐
GEAR ACTUATOR		Intermittent	☐	☐	☐	☐	☐
CLUSTER GAUGE		Continuous	☒	☒	☒	☒	☒
IGNITION		Intermittent	☐	☐	☐	☐	☐
PFD		Continuous	☒	☒	☒	☒	☒
TURN COORDINATOR		Continuous	☒	☒	☒	☐	☐
GEAR RELAY		Intermittent	☐	☐	☐	☐	☐
ADC		Continuous	☒	☒	☒	☒	☒
PANEL LIGHTS		Continuous	☒	☒	☒	☒	☒
GLARESHIELD LIGHTS		Continuous	☒	☒	☒	☒	☒
AHRS		Continuous	☒	☒	☒	☒	☒
FLAP ACTUATOR		Intermittent	☐	☐	☐	☐	☐
COM 1		Continuous	☒	☒	☒	☒	☒
GPS/NAV 1		Continuous	☒	☒	☒	☒	☒
COM 2		Continuous	☒	☒	☒	☐	☐
GPS/NAV 2		Continuous	☒	☒	☒	☐	☐
AUTOPILOT [1]		Continuous	☒	☒	☒	☐	☐
AUDIO PANEL		Continuous	☒	☒	☒	☒	☒
RADIO BLOWER		Continuous	☒	☒	☒	☐	☐
ADF		Continuous	☒	☒	☒	☐	☐
TRANSPONDER		Continuous	☒	☒	☒	☒	☒
GDL 69		Continuous	☒	☒	☒	☐	☐
GTS 8X5		Continuous	☒	☒	☒	☐	☐
JPI ENGINE MONITOR		Continuous	☒	☒	☒	☒	☒
BOSE HEADSETS		Continuous	☒	☒	☒	☒	☒
ALTITUDE ENCODER		Continuous	☒	☒	☒	☒	☒
STROBE LIGHT		Continuous	☒	☒	☒	☒	☒
NAV LIGHTS		Continuous	☒	☒	☒	☒	☒
RECOGNITION LIGHTS		Continuous	☒	☒	☒	☒	☒
LANDING LIGHT		Continuous	☒	☒	☐	☐	☒
PITOT HEAT		Continuous	☒	☒	☒	☒	☒
BOOST PUMP		Continuous	☐	☒	☒	☒	☒

Figure 3-4 Sample Completed Electrical Load Tabulation Form, Sheet 1 of 2

ELECTRICAL LOAD TABULATION FORM (CONTINUED)

Date: 02/14/14 Tail Number: NXXXX

Circuit/System	Circuit Breaker Number	Operating Time	Phase(s) of flight during which circuit/system is used: Normal Operation – Taxiing 10 min	Normal Operation – TO/Land 10 min	Normal Operation – Cruise 60 min	Emergency Operation – Cruise	Emergency Operation – Land 10 min
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
			☐	☐	☐	☐	☐
Total current used (amps):			47.5 (a)	60 Ldg Lt ON (b1) 44.7 Ldg Lt OFF (b2)	43.5 (c)	34.0 (d)	48.1 (e)
÷ Alternator rating (amps): 70							
x 100% = Percent of alternator capacity used:			68 % (< 80%)	86 % Ldg Lt ON (< 95%) 64 % Ldg Lt OFF (< 80%)	62 % (< 80%)	N/A	N/A
Pass/Fail:			PASS	PASS	PASS		

Notes:

Figure 3-5 Sample Completed Electrical Load Tabulation Form, Sheet 2 of 2

4 INSTALLATION PROCEDURES

NOTE

It is critical that the G5 is installed perpendicular to the aircraft's longitudinal axis (display bezel parallel to the wing spar) and as close to level in the roll axis as possible. Small roll offsets and pitch offsets, up to 30°, can be corrected for during calibration.

4.1 Mounting Requirements

In addition to the installation limitations in Sec. 2, consider the following when selecting a mounting location:

- The G5 can replace the existing attitude indicator or the rate-of-turn coordinator only if the instrument being replaced was not interfaced to the autopilot (e.g., flight director, attitude, etc). Only one G5 per aircraft can be installed.
- The G5 must be installed in an instrument panel constructed of aluminum with a minimum thickness of .040 inches.
- Protect the mounting location for the G5 from rapid thermal transients, in particular large heat loads from nearby high-power equipment.
- Do not install the G5 within 1 inch of magnetically mounted antennas, speaker magnets, or other strongly magnetic items.

4.2 Mounting Ring Installation

The G5 Mounting Ring (115-02251-03) can be used as a template when marking the panel for cutout. See for complete cutout dimensions (the dimensions on Figure 1-5 are to verify the accuracy of the printout only).

Secure the mounting ring to the aircraft panel using the supplied #6-32 pan head Phillips mounting screws. Evenly torque the mounting screws to 10-12 in-lbs.

- The G5 must be leveled to within 15.0° of the flight level cruise attitude. An aircraft leveling and offset calibration procedure must additionally be carried out prior to flight.
- Mount the G5 with the connector aligned to within 1.0° of the longitudinal axis of the aircraft (display bezel parallel to the wing spar).

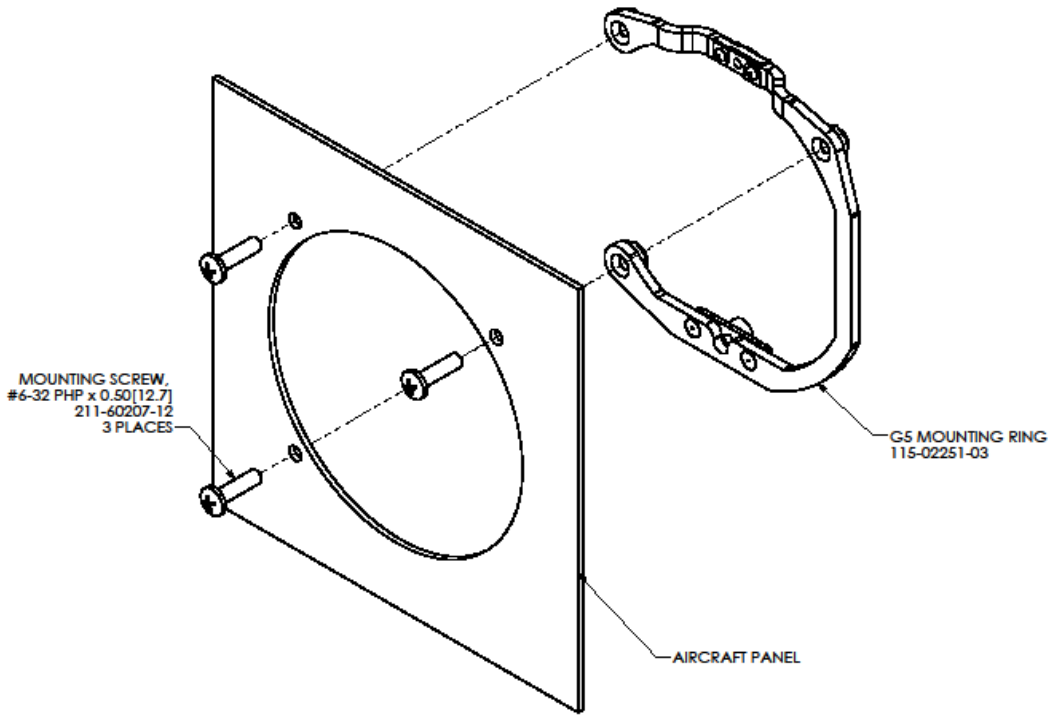


Figure 4-1 G5 Mounting Ring

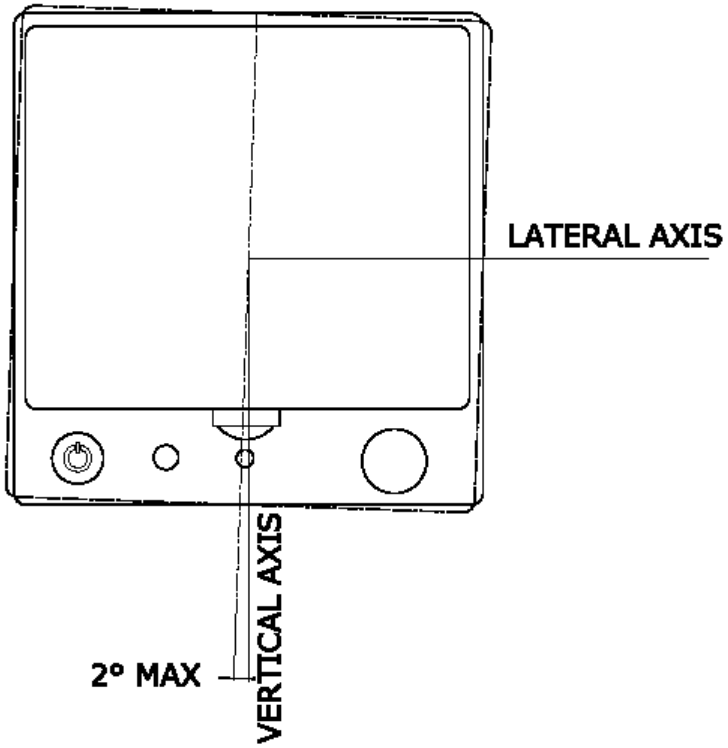


Figure 4-2 MAXIMUM MISALIGNMENT OF THE G5 IN THE LATERAL AXIS

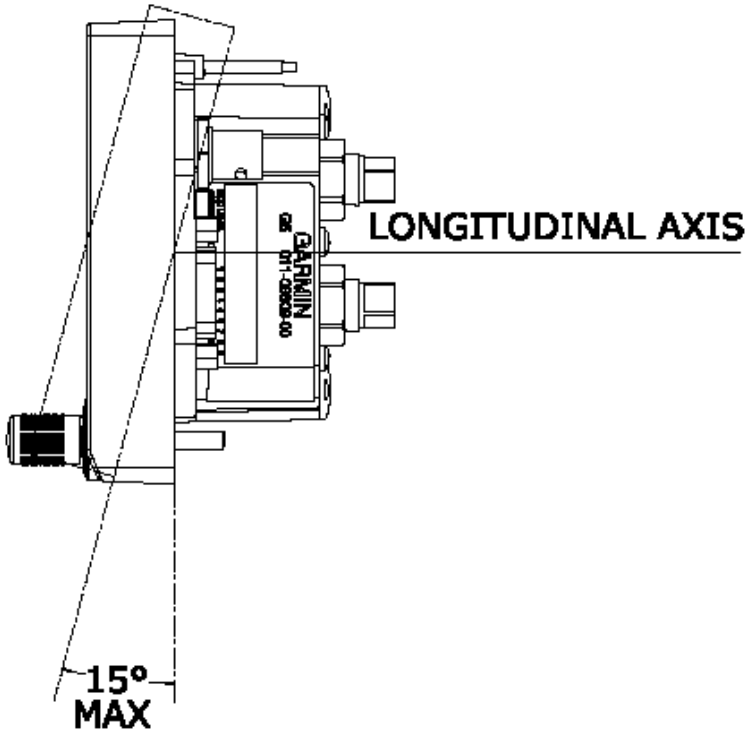


Figure 4-3 MAXIMUM MISALIGNMENT OF THE G5 IN THE LONGITUDINAL AXIS

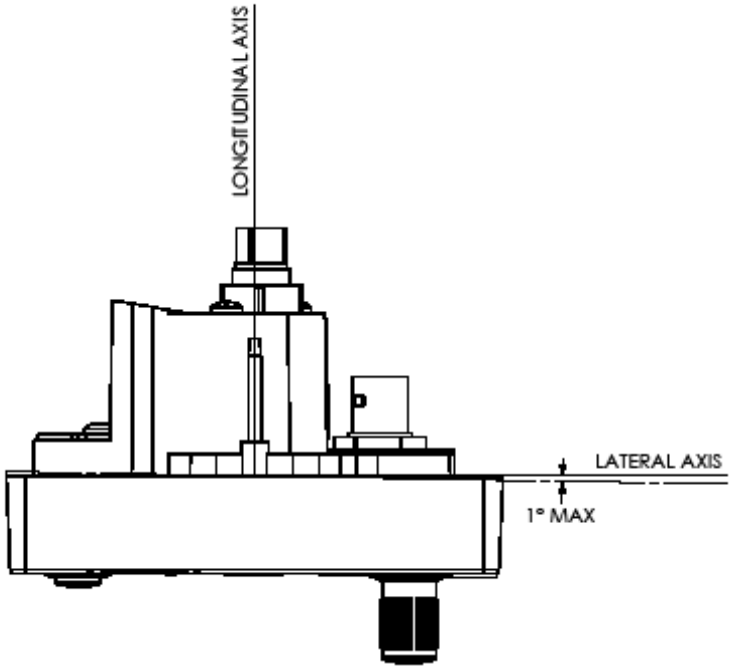


Figure 4-4 MAXIMUM MISALIGNMENT OF THE G5 IN THE VERTICAL AXIS

4.3 G5 Installation

The G5 is installed by inserting the alignment pin located at the top of the unit into the mating hole in the mounting ring, pushing the unit flush with the instrument panel, and fastening the captive 3/32" hex socket head screw to the mounting ring as shown in Figure 4-5. To fasten the captive screw to the mounting ring, insert a 3/32" hex drive tool through the access hole in the front cover of the G5 as shown in Figure 4-6. Torque the captive mounting screw to 10-12 in-lbs.

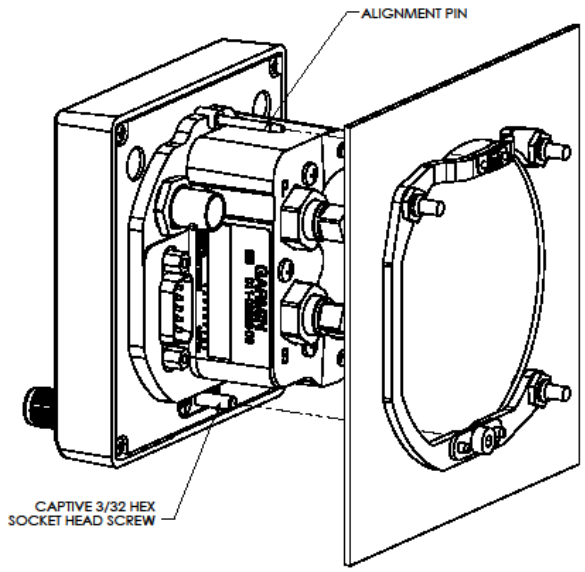


Figure 4-5 G5 Alignment Pin

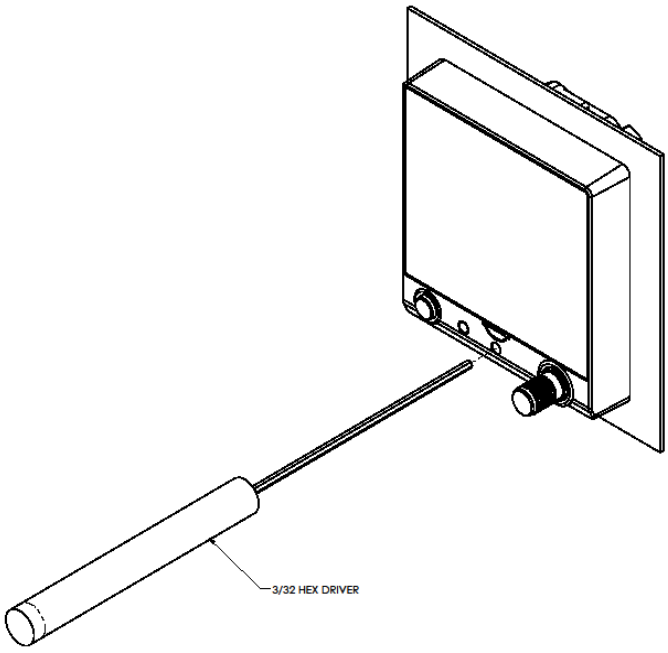


Figure 4-6 G5 Hex Driver Insertion

4.3.1 Optional #6-32 Captive Mounting Screw

The captive 3/32" hex socket head screw can be used for panel thicknesses up to 0.150". For installations with a panel thickness greater than 0.150", the captive mounting screw can be replaced with a standard #6-32 hex socket head screw (MS16995). To replace the screw, remove the two #4-40 flat head Phillips mount plate screws, the G5 screw mount plate, and the captive screw as shown in Figure 4-7. Reverse this process to install the longer #6-32 hex socket head screw. Ensure correct orientation of the screw mount plate before applying 6-8 in-lb. of torque to the #4-40 mount plate screws.
NOTE: Standard #6-32 hex socket head screws use a 7/64" hex drive feature. The access hole in the G5 bezel is large enough to accommodate this increase in hex tool size.

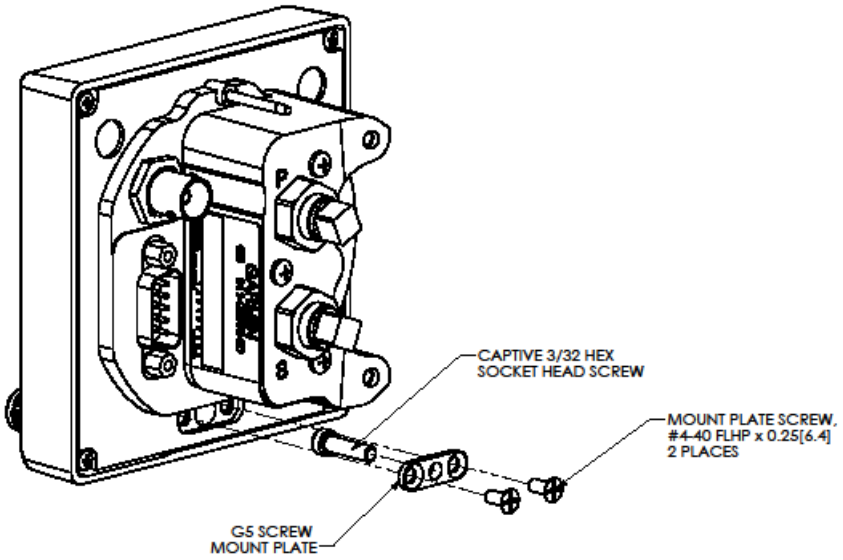


Figure 4-7 G5 Captive Mounting Screw Replacement

4.3.2 Pneumatic Connections

The G5 has two ports that are connected to the aircraft's pitot and static pressure sources. The ports are labeled on the unit using the abbreviations "P" and "S" respectively (Figure 1-3). The pressure ports have 1/8-27 ANPT female threads. The mating fitting must have 1/8-27 ANPT male threads.

Determine the hose/connection material that best interfaces with the existing aircraft installation. Reference the appropriate aircraft parts manual to determine the current part numbers associated with the aircraft installation of hose and connections used in the pitot/static system.

Use appropriate tubing and fittings to connect the pitot and static lines to the unit. Avoid sharp bends in the tubing and route hoses clear of aircraft control cables. The G5 must not be at the low point of the pneumatic plumbing lines to avoid moisture or debris collecting at or near the unit. Ensure that no deformations of the airframe surface have been made that would affect the relationship between static air pressure and true ambient static air pressure for any flight condition. Refer to 14 CFR Part 43, Appendix E and AC43.13-1B, Chapter 12, Section 4 for approved practices while installing hoses and connections. If this static source had an alternate static source selector switch, it must be retained.

For aircraft equipped with a single Pitot-static system, the G5 must be connected to the Pitot-static system used by the pilot's instruments. For aircraft equipped with a dual Pitot-static system, the G5 must be connected to the Pitot-static system that is independent from the pilot's instruments.

CAUTION

To avoid damaging the G5 pressure sensors, both the pitot and static ports must be connected to the test set.

CAUTION

Verify sealant/tape is not present inside the plumbing upon assembly. Use care to avoid getting fluids or particles inside the pneumatic lines or G5 ports.

4.4 Weight and Balance

Weight and balance computations are required after the installation of the G5. Table 4-1 lists the weights associated with the G5 Electronic Flight Instrument. Refer to AC 43.13-1B, Chapter 10, for the weight and balance procedure covering the addition of equipment to the aircraft.

Table 4-1: Weight

Item	Weight
G5 with Battery, connector and mounting ring	.98 lbs

4.5 Electrical Installation

4.5.1 Special Tools

Crimp tools and positioners are required to ensure consistent, reliable crimp contact connections for the D-sub connectors. The following crimp tools are recommended:

Table 4-2: Socket Contact Crimp Tooling

Manufacturer	Crimp Tool P/N	Positioner P/N	Insertion/Extraction Tool P/N
MIL-Spec	M22520/2-01	M22520/2-08	M81969/1-02
Daniels	AFM8	K13-1	

4.5.2 Power Distribution

The circuit protection device for the G5 must be a push-pull manually resettable circuit breaker (MS26574-5) or identically rated circuit protection device approved by the aircraft type certificate. See Section 3.2.1 for required circuit breaker part numbers. The G5 must be connected to the battery bus to supply power . (Note: some aircraft manufacturers may label the battery bus as “essential bus” or “main bus”).

4.5.3 Wiring Harness Assembly

Allow adequate space for installation of the wiring harness and connectors. Construct the wiring harness in accordance with the information contained in this and the following sections. Mark wire in accordance with AC 43.13-1B Chapter 11 Section 16. Strip and insert the wire into the contact and crimp with the recommended (or equivalent) crimping tools. Insert the contacts into the connector as specified by the interconnect diagrams in Section 4.6. Verify the contacts are properly engaged into the connector by gently tugging on the wire. Mark harness connectors in accordance with AC 43.13 Chapter 11 Section 17. Route and secure the wiring harness away from sources of electrical interference.

Table 4-3 lists the parts required to complete the assembly of the G5 wiring harness connector. Some of the parts required for this installation are included in the connector kit, and some are to be provided by the installer. See the notes below the tables for parts that are included in the connector kit. The Garmin connector backshell gives the installer the ability to easily terminate shield grounds at the connector backshell as shown in and Figure 4-9. Numbers referenced in Figure 4-8 and Figure 4-9 correspond to items listed in Table 4-3.

Table 4-3: G5 Connector Parts

Item	Description	Part Number	Notes
1	Shield Termination, Solder Style, Insulated, Heat-Shrinkable, Environment Resistant (X = size)	AS83519/1-X (SAE-AS83519)	1
2	Contact, Socket, MIL Crimp, Size 20	M39029/63-368, or	
		336-00022-02	2
3	Insulation Tape, Electrical, Self-Adhering, Unsupported Silicone Rubber	A-A-59163 (MIL-I-46852C)	
4	Terminal, Lug, Crimp Style, Copper, Insulated, Ring Tongue, Bell Mouthed, Type II, Class I	MS25036-149	
5	Connector, Plug, D-Sub, MIL Crimp Socket	330-00625-09	2
6	Backshell, Jackscrew, 9/15 Pin	125-00171-00	2
7	Clamp, Backshell, Jackscrew, 9/15 Pin	115-01078-00	2
8	Screw, 4-40x.375, PHP, SS/P, w/Nylon	211-60234-10	2
9	Cover, Backshell, Jackscrew, 9/15 Pin	115-01079-00	2
10	Screw, 4-40x.187, FLHP100, SS/P, w/Nylon	211-63234-06	2
11	Screw, PHP, 8-32 x 0.312", Cad-Plated Steel, or Screw, PHP, 8-32 x 0.312", Stainless	MS35206-242, or MS51957-42	

12	Split Washer, #8 (0.045" compressed thickness), Cad-plated Steel, or Split Washer, #8 (0.045" compressed thickness), Stainless	MS35338-42, or MS35338-137	
13	Flat washer, Cad-plated Steel, #8, 0.032" thick, 0.174" ID, 0.375" OD, or Flat Washer, Stainless, #8, 0.032" thick, 0.174" ID, 0.375" OD	NAS1149FN832P, or NAS1149CN832R	
14	Flat Braid, 1/16”	AA59569F36T0062	1

Notes:

1. A preferred solder sleeve is the TE Connectivity/Raychem S02 series. These solder sleeves come with a pre-installed shield drain. For detailed instructions on product use, refer to TE Connectivity/Raychem process standard RCPS-100-70.

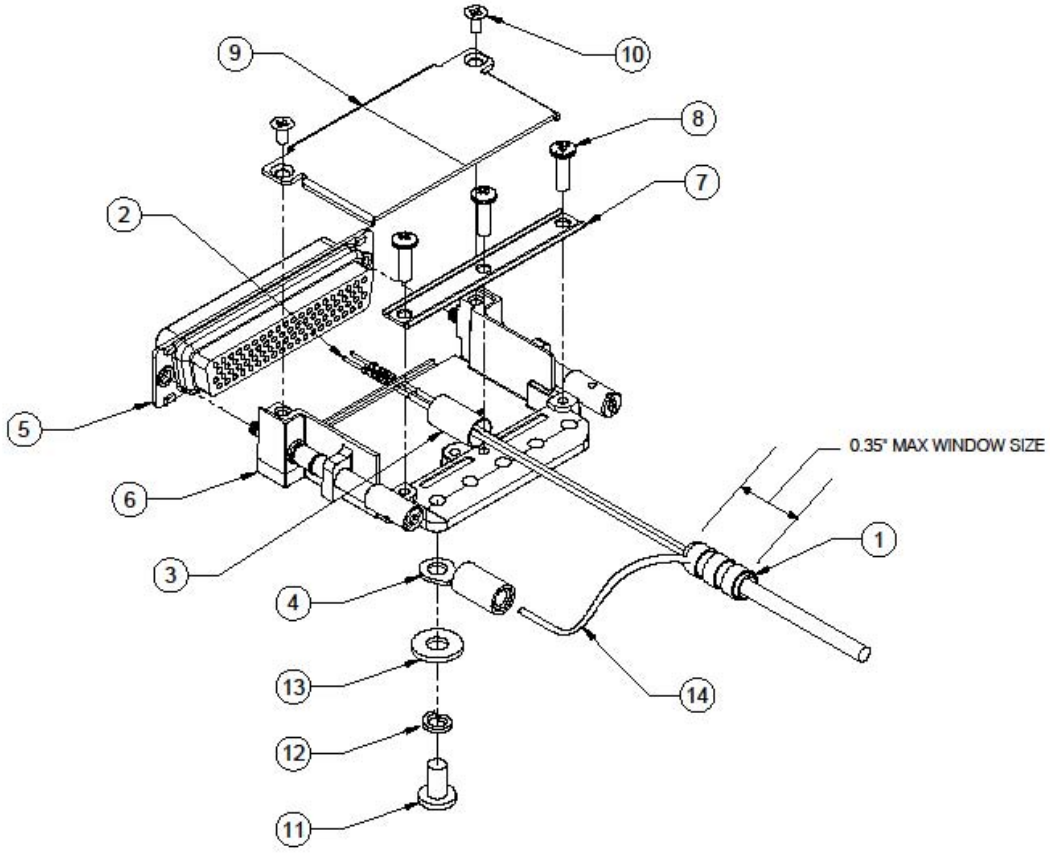
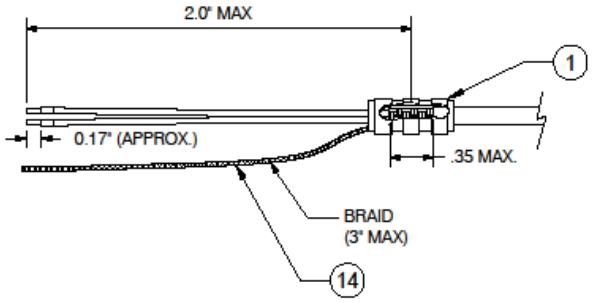


Figure 4-8 Wiring Harness Connector Assembly

NOTE: 78 pin D-sub connector shown, 9 pin D-sub connector similar.

PREFERRED METHOD



ALTERNATE METHOD

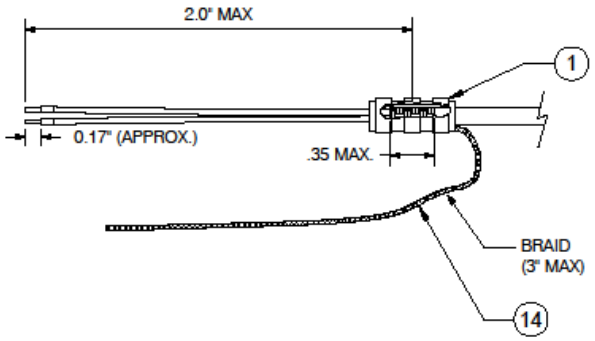


Figure 4-9 Shield Termination Methods

Prepare all of the shielded wires using one of the shield termination methods shown in Figure 4-9. Keep the shield drains as short as practical (3" max total length). See Table 4-3 regarding numbers in parentheses in the following procedure.

1. Strip 2.5 inches (maximum) of the jacket to expose the shield braid.
2. Remove the exposed braid.
3. Carefully score the jacket 1/4 to 5/16 inches and remove the jacket to leave the braid exposed.
4. Slide a shield terminator (1) onto the exposed shield braid and insert shield braid drain (14) into shield terminator. Secure the shield terminator and braid drain to the shield using a heat gun approved for use with solder sleeves.
5. Strip the signal wires approximately 0.17 inches.
6. Crimp socket contacts (2) on to the signal wires.
7. Crimp ring terminals (4) on to the shield drain wires.
8. Repeat steps 1 through 7 as needed for the remaining shielded wires.
9. Insert the signal wire socket contacts into the appropriate locations in the D-sub connector (5).
10. Attach the shield drain ring terminals to the connector backshell shield block using the supplied screws and washers (11)(12)(13).

11. Wrap the wiring harness with silicone fusion tape (3) at the point where the strain relief clamp (7) and connector backshell (6) will contact the wiring harness.
12. Attach the strain relief clamp (7) to the connector backshell (6) using the supplied screws (8).

CAUTION

Placing the concave side of the strain relief clamp across the wiring harness will damage the wiring harness.

NOTE

Only two ring terminals should be attached to each screw on the connector backshell shield ground. It is preferred that only two wires be terminated in each ring terminal. This will necessitate the use of a ring terminal, #8, insulated, 14-16 AWG (MS25036-153). If only a single wire is left or if only a single wire is needed for this connector a ring terminal, #8, insulated, 18-22 AWG (MS25036-149) can be used. If more wires exist for the connector than two per ring terminal, it is permissible to terminate three wires per ring terminal.

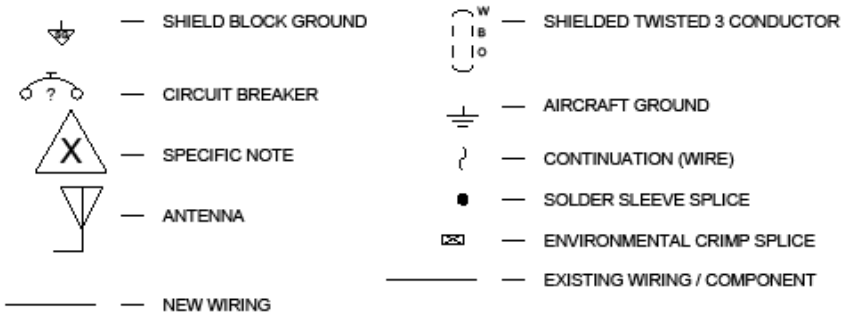
13. Install the connector backshell cover (9) using the supplied screws (10).

4.6 G5 Interconnect Drawings

1. UNLESS OTHERWISE SPECIFIED, REFER TO SAE AS50881, REV F ; WIRING AEROSPACE VEHICLE.

2. UNLESS OTHERWISE SPECIFIED, ALL STRANDED WIRE IS 24 GAUGE MINIMUM AND SHALL MEET OR EXCEED M22759/35 SPEC OR EQUIVALENT. STRANDED WIRE 22 GAUGE AND LARGER SHALL MEET OR EXCEED M22759/34 SPEC OR EQUIVALENT. UNLESS OTHERWISE SPECIFIED, ALL SHIELDED WIRE SHALL MEET OR EXCEED M27500 SPEC OR EQUIVALENT USING THE M22759/34 WIRE AND INSULATION TYPE.

3. THE FOLLOWING SYMBOLS ARE USED ON THIS DRAWING:



4. CRIMP SPLICE M81824/1-1 IS USED FOR SINGLE 26-20 GAUGE WIRE OR UP TO QTY 3 24 GAUGE (TWISTED TOGETHER).

5. A SINGLE SHIELD BRAID IS TERMINATED USING AN 18-22 GAUGE TERMINAL.
TWO SHIELD BRAIDS ARE TERMINATED USING A 14-16 GAUGE TERMINAL.
THREE SHIELD BRAIDS ARE TERMINATED USING A 10-12 GAUGE TERMINAL.

   IN ALL CASES, CHOOSE THE TERMINAL THAT FITS THE MOUNTING STUD.

   FOR GARMIN D-SUB BACKSHELLS, NO MORE THAN TWO TERMINALS PER SCREW ARE TO BE INSTALLED.

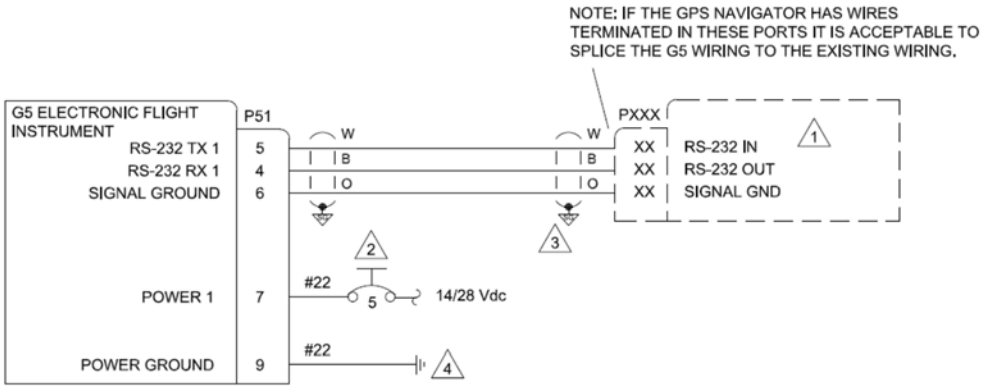
6. FOR COAXIAL CONNECTOR TERMINATION, REFER TO SPECIFIC CONNECTOR MANUFACTURER INFORMATION.

Figure 4-10 G5 Interconnect Notes

CAUTION

Check wiring connections for errors before connecting the wiring harness to the LRUs. Incorrect wiring could cause component damage.

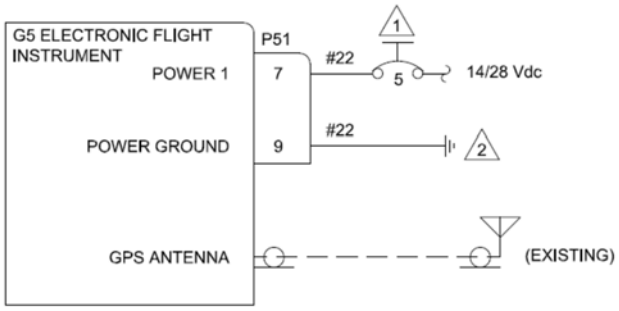
4.6.1 G5 with RS-232 Interface



1. CONNECT TO APPROPRIATE RS-232 PORT AS DESCRIBED BELOW:
   - FOR GTN 6XX/7XX INTERFACE:
     CONNECT TO RS-232 PORT CONFIGURED TO MAPMX FORMAT 1.
   - FOR GNS 4XXW/5XXW INTERFACE:
     CONNECT TO RS-232 PORT CONFIGURED TO MAPMX.
2. CIRCUIT BREAKER SHOULD BE LABELED DIRECTLY ADJACENT TO THE CIRCUIT BREAKER AS "ATT" WHEN G5 IS INSTALLED IN ATTITUDE INDICATOR POSITION OR "TURN COORD" WHEN G5 IS INSTALLED IN TURN COORDINATOR POSITION. THE CIRCUIT BREAKER MUST BE READILY ACCESSIBLE TO THE PILOT. ALTERNATE SPELLINGS OR ABBREVIATIONS OF ATTITUDE INDICATOR AND TURN COORDINATOR ARE ACCEPTABLE.
3. TERMINATE SHIELD GROUNDS TO CONNECTOR BACKSHELL. FOR GNS 4XXW/5XXW USE CARD-EDGE CONNECTOR TO TERMINATE SHIELD GROUNDS TO BACK PLATE. SHIELD LEADS MUST BE MAX 3.0 INCHES. REFER TO UNIT INSTALLATION MANUALS FOR MORE INFORMATION.
4. G5 POWER GROUND MUST BE INDEPENDENT FROM THE POWER GROUND USED BY THE RATE OF TURN INDICATOR IF THE RATE OF TURN IS RELIANT ON ELECTRICAL POWER.

Figure 4-11 G5 with RS-232 Interface

4.6.2 G5 with External GPS Antenna



1. CIRCUIT BREAKER SHOULD BE LABELED DIRECTLY ADJACENT TO THE CIRCUIT BREAKER AS "ATT" WHEN G5 IS INSTALLED IN ATTITUDE INDICATOR POSITION OR "TURN COORD" WHEN G5 IS INSTALLED IN TURN COORDINATOR POSITION. THE CIRCUIT BREAKER MUST BE READILY ACCESSIBLE TO THE PILOT. ALTERNATE SPELLINGS OR ABBREVIATIONS OF ATTITUDE INDICATOR AND TURN COORDINATOR ARE ACCEPTABLE.
2. G5 POWER GROUND MUST BE INDEPENDENT FROM THE POWER GROUND USED BY THE RATE OF TURN INDICATOR IF THE RATE OF TURN IS RELIANT ON ELECTRICAL POWER.

Figure 4-12 G5 with External GPS Antenna

5 SYSTEM CONFIGURATION AND CHECKOUT PROCEDURES

5.1 Overview

This section contains instructions for configuration and checkout of the G5 Electronic Flight Instrument. The steps which are not applicable to a particular installation may be skipped. A summary of the steps required for checkout of the G5 is as follows:

- Perform mounting, wiring, and power checks (see section 5.2)
- Configure the G5 (see Section 5.3)
- Perform post-installation checkout procedures (see Section 5.3)
- Perform documentation checks (see section 5.4)

NOTE

Throughout the next sections, many screenshots and examples are used to illustrate the software loading and configuration and checkout process. Changes may occur which result in the examples being out of date.

5.2 Mounting, Wiring, and Power Checks

Verify all wire harnesses are properly secured and shields are connected to the shield blocks of the connectors. Check the movement of the flight and engine controls to verify there is no interference. Prior to powering up the G5, the wire harnesses must be checked for proper connections to the aircraft systems and other avionics equipment. Point to point continuity must be checked on all wiring to expose any faults such as shorting to ground. Any faults or discrepancies must be corrected before proceeding.

After accomplishing a continuity check, perform power and ground checks. Remove power from the aircraft upon completion of the wire harness checkout.

The G5 equipment can be installed after completion of the continuity and power checks.

5.3 Post-Installation Checkout Procedures

The following procedures will verify the proper operation of the G5. It is assumed that the person performing these checks is familiar with the aircraft, has a working knowledge of typical avionics systems, and has experience using the test equipment defined in this section.

NOTE

For G5 operational instructions, see 190-01112-12, Pilot's Guide, Garmin G5 Electronic Flight Instrument, Part 23 AML STC.

NOTE

Some procedures in this section require that the GPS receiver is receiving sufficient satellite signal to compute a present position. This requires outdoor line-of-site to GPS satellite signals or a GPS indoor repeater.

NOTE

As these procedures involve engine run-up and moving the aircraft, it is recommended that the installer read this entire section before beginning the checkout procedure.

NOTE

All test equipment should have current calibration records.

5.3.1 Recommended Test Equipment

The following test equipment is recommended to conduct and complete all post installation checkout procedures in this section:

- Pitot/static ramp tester
- Digital Multi-Meter (DMM)
- Ground power unit capable of supplying 14/28 Vdc power to the aircraft systems and avionics
- Outdoor line-of-sight to GPS satellite signals or GPS indoor repeater
- Digital Level or equivalent

5.3.2 Configuration Mode

All of the configuration and calibration procedures in this section are performed in configuration mode. To enter configuration mode, hold down the knob while powering on the G5. Configuration selections are made by rotating and pressing the knob on the face of the G5 as necessary to select the correct configurations.

5.3.3 Software Loader Card Creation

The software image is an executable self-extracting file which builds the correct file structure onto a microSD card for use loading software to the G5. To obtain the current software image is an executable self-extracting file follow the procedures outlined below.

NOTE

If the G5 unit reports the same software P/N and version as indicated on the Aviation Product/General Aviation/Indicators/G5 page, it is not required to complete this section.

1. To obtain the latest software version approved for this STC, visit www.Garmin.com and navigate to the Aviation Product/General Aviation/Indicators/G5 page. Do not download software from the Experimental Aircraft web page.
2. Download the self-extracting update file onto your hard drive.
3. Insert a FAT32-formatted micro SD card with at least 20 MB of free space into your card reader.
4. Open the self-extracting update file and follow the instructions provided by the installer application. You will be prompted to specify the drive letter of the SD card you wish to use for the update. When the transfer is complete, safely eject the SD card.

5.3.4 Initial Power On

1. Apply power to the G5 unit.
2. Verify the attitude is displayed and there are no invalid parameters (no red-X shown).
3. Continue to Section 5.3.5.

5.3.5 SOFTWARE LOADING PROCEDURE

G5 software loading can be performed in either normal or configuration mode.

NOTE

If the G5 unit reports the same software P/N and version as indicated on the Aviation Product/General Aviation/Indicators/G5 page, it is not required to complete this section.

1. Power on the G5, then insert a properly formatted microSD™ card into the microSD™ card slot.

NOTE

It is also acceptable to insert the microSD™ card before powering on the unit.

2. A software update pop-up will appear on the screen. Select OK to begin the update.

NOTE

The software update pop-up will only be displayed if the version of software to be loaded is newer than the version currently on the unit.

3. The unit will reboot to the software update screen and the software update will begin automatically. This screen will show the progress of the software update.
4. Ensure power is not removed while the update is being performed.
5. The unit will reboot after the update is complete.
6. The new software version will be displayed while the unit powers on or in the configuration mode menu.

5.3.6 CONFIGURATION PAGES

5.3.6.1 Configuration Pages Summary

When in configuration mode the G5 displays the following configurations pages:

- Device Information – used to display LRU (device) specific information such as the software version and basic indicator configuration.
- Attitude – used to configure Indicator Type, Pitch Display preferences, and User Pitch offset.
- Air Data – used to enable/ disable the G5 Air Data Sensors and configure the Vertical Speed rate.
- Airspeed – allows for configuration of the reference speeds.
- Flight Controls – used to configure the system for autopilot servos if installed.
- Backlight – used to configure backlight configuration parameters.
- Display – used to configure the display format of the G5.
- Battery – used to set backup battery status and power off modes.
- GPS – used to configure the internal GPS receiver.

- Navigation – used to configure the display of navigation information.
- Units – This page is used to configure the units type to display altitude, airspeed, ground speed, vertical speed and pressure displays.
- RS-232 – used to configure the RS-232 input and output ports used of the G5.
- ARINC 429 - used to configure the ARINC 429 input and output ports used of the G5.
- Exit Configuration Mode – used to exit configuration mode.

5.3.6.2 G5 configuration

Configure the G5 as shown in Table 5-1. See Section 5.4.1 for information about recording the configuration settings to keep in the aircraft records for future reference.

Table 5-1: G5 Configuration Settings

Config Page	Config Option	Configuration Setting
Device Information	Installation Type	Standalone Instrument
	Diagnostics/Data Log	Enabled
Attitude Configuration	Indicator Type	Normal
	Pitch Display	Normal
	User Pitch Offset	Disabled
Air Data	Air Data Sensors	Enabled
	Vertical Speed Indicator	(1)(2)
Airspeed **Note: Configure Units prior to setting airspeeds.**	VNE	(1)(2)
	VNO	(1)(2)
	VSO	(1)(2)
	VS1	(1)(2)
	VFE	(1)(2)
	VA	(1)(2)
	VX	(1)(2)
	VY	(1)(2)
	VG	(1)(2)
	VR	(1)(2)
	VMC	(1)(2)
	VYSE	(1)(2)
Flight Controls	Autopilot Servos	None
Backlight	Current Mode	Automatic
	Default Mode	Automatic
	Minimum Photocell Input	Default
	Minimum Display Brightness	Default
	Maximum Photocell Input	Default
	Maximum Display Brightness	Default
	Filter Time Constant	Default
Display	HSI Page	Disabled
	Power Up Page	PFD
Battery	Show Status on PFD	Always
	Automatic Power Off	On Ground Only

Config Page	Config Option	Configuration Setting
GPS	Internal GPS Receiver	Enabled (Installations with an external GPS antenna connected) Disabled (Installations connected to a GTN or GNS for GPS position)
Navigation **Note: This configuration Page is only present when RS-232 Input Format is configured for MapMx**	Navigation Data	Disabled
Units	Altitude	Feet (ft)
	Distance	Nautical (nm) or Statute (mi)
	Airspeed	Nautical (kt) or Statute (mph)
	Ground Speed	Nautical (kt) or Statute (mph)
	Ground Track	Magnetic
	Vertical Speed	Feet/Minute
	Pressure	Inches (Hg)
RS-232	Input Format	None (Installations with an external GPS antenna connected) MapMx (Installations connected to a GTN or GNS for GPS position)
	Output Format	None
ARINC 429	Output 1	None
	Output 2	None
	Input 1	None
	Input 2	None
	Input 3	None
	Input 4	None
Exit Configuration Mode		

Note 1: Set configuration values and units to match the values indicated in the appropriate AFM and document settings in the space provided.

Note 2: If the aircraft has no AFM set the values as determined by the existing placards, instrument bugs or instrument markings.

5.3.7 G5 POST-INSTALLATION CALIBRATION PROCEDURES

After mechanical and electrical installation of the G5 has been completed, prior to operation, a set of post-installation calibration procedures must be carried out. Table 5-2 describes the required and optional calibration procedures.

Table 5-2: Post-Installation Calibration Procedure Summary

Calibration Procedure	Procedure Name	Procedure Description	Installations Requiring Procedure
A	Pitch/Roll Offset Compensation	Level aircraft	Procedure A is required for all installations
B	Engine Run-Up Vibration Test	Validate vibration characteristics of installation	Procedure B is required for all installations
C	Air Data Static Pressure Calibration	Altitude Calibration	Procedure C is only required if Section 5.3.9 results for the G5 fall outside the tolerances of the Part 43 Appendix E tests.

5.3.7.1 CALIBRATION PROCEDURE A: PITCH/ROLL OFFSET COMPENSATION BY AIRCRAFT LEVELING

NOTE

This procedure requires orienting the aircraft to normal flight attitude. This can be done by using jacks or placing wood blocks under the nose-wheel, for example. As another example, if the number of degrees 'nose high' the aircraft flies in straight and level cruise is known, a digital level can be used to orient the aircraft to normal flight attitude prior to the calibration.

NOTE

The G5 must be leveled within 15.0° of the aircraft in-flight level cruise attitude. In-flight level cruise attitude is not necessarily the same as the level reference provided by the manufacturer (such as fuselage longerons).

1. Select the Attitude configuration page.
2. Select Calibrate Pitch/Roll.
3. Ensure that aircraft and the unit comply with all on-screen instructions then select Start.
4. A progress screen will then be displayed. There is a 30 second countdown timer for the procedure that resets when the aircraft moves.
5. When the calibration is complete, a successful status message will be displayed along with the new pitch and roll offsets.

5.3.7.2 CALIBRATION PROCEDURE B: ENGINE RUN-UP VIBRATION TEST

NOTE

Calibration Procedure B is required for all installations to validate the vibration characteristics of the installation.

Conduct the Engine Run-Up Vibration Test. The test is intended to help discover mounting issues and does not account for all possible vibration profiles that may be encountered during normal aircraft operation.

1. Select the Attitude configuration page.
2. Select Vibration Test.
3. Ensure the aircraft complies with all on-screen instructions, then select Start.
4. Gradually increase engine power from idle to full power and back to idle in 1-2 minutes. A screen will be displayed showing the test in progress.
5. After the gradual increase and decrease in aircraft power verify for passing or failing results.
    a. If the green check mark remains during the engine power sequence, this indicates Passing results, select Done. This checkout is complete.
    b. Failing results will be indicated by a red "X" as shown in Figure 5-1 below. Select Done when the test has been completed and follow the instructions in Step 6 below.

Figure 5-1 Engine Vibration Test Failure Indication

6. If failures are indicated, repeat the test. If failures persist, the installation is unreliable until the source of the vibration problem is identified and remedied. Record the out of range limit values for future reference.

The following are potential causes for failures of the engine run-up test:

a. Excessive flexing of the G5 mechanical mounting with respect to airframe
b. Vibration or motion of the G5 caused by neighboring equipment and/or supports.
c. Mounting of the G5 in a location that is subject to severe vibrations (e.g. close to an engine mount).
d. Instrument panel shock mounts worn, broken, or permit excessive movement.
e. Mounting screws and other hardware for G5 not firmly attached.
f. G5 connector not firmly attached to unit.
g. Cabling leading to the G5 not firmly secured to a supporting structure.
h. An engine/propeller combination that is significantly out of balance.

NOTE

In some aircraft, attempting the engine run-up test on a day with very strong and/or gusty winds may cause the test to occasionally fail. However, a failure during windy conditions cannot not be taken as evidence that the test would pass in calm conditions; an actual pass is required before the installation can be considered adequate.

5.3.7.3 CALIBRATION PROCEDURE C: AIR DATA STATIC PRESSURE CALIBRATION

NOTE

Procedure C is only required if Section 5.3.9 results for the G5 fall outside the tolerances of the Part 43 Appendix E tests.

The Air Data configuration page has a selection for static pressure calibration. This procedure is used to perform an altimeter calibration.

The static pressure calibration requires the use of a pressure control system (test set) with an altitude accuracy of at least ±5 ft. at sea level and ±20 ft. at 30,000 ft. It is necessary to re-calibrate to sea level (0 ft.), 10,000 ft., 20,000 ft., and optionally to 30,000 ft. The operator is allowed to finish the calibration at the end of the 20,000 ft. calibration if the aircraft operational ceiling is below 20,000 ft.

CAUTION

To avoid damaging the G5 pressure sensors, both the pitot and static ports must be connected to the test set.

1. Prior to running the calibration procedure below perform a static system leak check in accordance with 14 CFR Part 43 Appendix E.
2. Select the Air Data configuration page.
3. Select Calibrate Static Pressure.
4. Ensure all on-screen instructions have been complied with, then press Start.
5. At each calibration point the display will present a screen indicating the pressure altitude to set. Once the altitude is set, select Ready to calibrate this pressure.
6. During the calibration at each pressure, the pressure must be held constant for 30 seconds for the calibration step to be successful. The calibration may be cancelled at any point should the test setup require adjustment before repeating. A progress screen will be displayed showing the status of the test.
7. Select Done when the static pressure calibration is successfully completed.

5.3.8 Pitot Static System Leak Check

Perform a pitot static system leak check in accordance with the aircraft manufacturer's approved data.

CAUTION

To avoid damaging the G5 pressure sensors, both the pitot and static ports must be connected to the air data test set.

5.3.9 Altimeter System Test

For aircraft that are IFR certified, perform an altimeter system test of the G5 in accordance with 14 CFR Part 43 Appendix E.

5.3.10 GPS Receiver COM Interference Test

This test must be conducted outside, as the use of a GPS repeater inside a hangar may result in a failed test.

1. Enter configuration mode on the G5 and navigate to the GPS Configuration Page.
2. Ensure a valid GPS position fix is obtained by monitoring the GPS status. The following status indications are valid fixes for this test.
   - 3D GPS
   - 3D DIFFERENTIAL
3. Select 121.150 MHz on the COM transceiver.
4. Transmit for a period of 30 seconds while monitoring the GPS status.
5. During the transmit period, verify that the GPS status does not lose a valid GPS position fix.
6. Repeat steps 2 through 4 for the following frequencies:
   - 121.175 MHz
   - 121.200 MHz
   - 131.250 MHz
   - 131.275 MHz
   - 131.300 MHz
7. Repeat steps 2 through 5 for all other installed COM transceivers (if applicable).
8. If an installed COM supports 8.33 MHz channel spacing, increase the transmit period to 35 seconds and repeat steps 3 through 5 for the following frequencies:
   - 121.185 MHz
   - 121.190 MHz
   - 130.285 MHz
   - 131.290 MHz
9. Repeat step 7 for all other installed COM transceivers supporting 8.33 MHz channel spacing (if applicable).

5.3.11 Electromagnetic Compatibility (EMC) Check

An EMC check must be conducted once the G5 is installed and all interfaces to external equipment are verified to be correctly working. The EMC check makes sure the equipment is not producing unacceptable interference to the other avionics systems, and other avionics systems are not producing unacceptable interference to the G5.

An example EMC Source/Victim matrix is shown in Figure 5-2.

1. Enter equipment installed in the aircraft into the Source row and Victim column of the fillable form.
2. Apply power to all avionics systems except the equipment installed under this STC.
3. Make sure all existing avionics systems are properly functioning.
4. Apply power to the G5.
5. Remove power from all other avionics systems.
6. Apply power and/or operate the systems listed on the fillable form, one system at a time. Make sure to pull/push circuit breakers or turn on/off large loads, e.g. heaters, cycling flaps (if electrical) etc.
7. Make sure the G5 properly functions.
    a. When the VHF COM is operating as a source, transmit on low/med/high unused frequencies.
8. Make sure each radio properly functions.
    a. For VHF COM radio, monitor one local frequency, one remote (far field) frequency, and one unused frequency.
    b. Make sure there are no unintended squelch breaks or audio tones interfere with communications.
    c. For each VHF NAV radio, monitor one local frequency, one remote (far field) frequency, and one unused frequency.
    d. Make sure there are no guidance errors.
    e. Make sure there are no audio tones that interfere with the station ID.
9. Make sure all other avionics properly function.

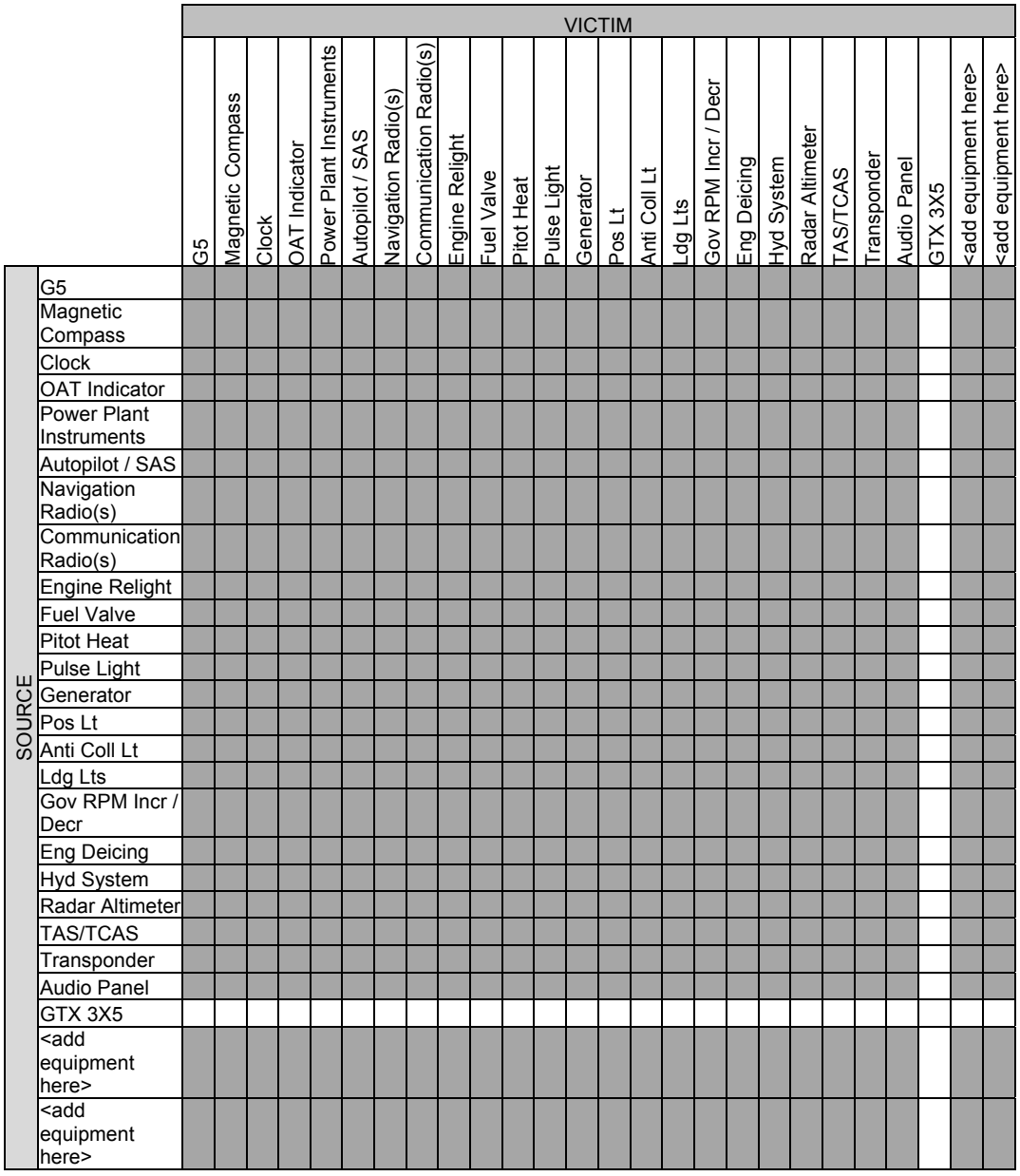


Figure 5-2 Example EMC Source/Victim Matrix

5.3.12 Vacuum System Pressure Setting

If a vacuum instrument was removed by the installation of the G5 Electronic Flight Instrument and there are other instruments using the vacuum system, follow the aircraft manufacturers procedure to set instrument vacuum system pressure.

5.4 Documentation Checks

5.4.1 Instructions for Continued Airworthiness (ICA)

Ensure the appropriate aircraft information is recorded in *Garmin G5 Electronic Flight Instrument Part 23 AML STC Maintenance Manual including Instructions for Continued Airworthiness*, P/N 190-01112-11, Table 7-1 and is retained with the aircraft permanent records.

In Table 7-1 record the following:

- Aircraft make
- Aircraft model
- Aircraft registration number
- Aircraft serial number
- G5 part number
- G5 serial number
- G5 software version
- Fill in the configuration settings log

Insert the completed Table 7-1 of the STC MM/ICA into the aircraft permanent records.

5.4.2 Weight and balance

Addition of the G5 equipment must allow the empty weight center of gravity (CG) to fall within the aircraft's acceptable range (refer to the aircraft's POH or AFM). Perform a weight and balance computation and update the aircraft records.