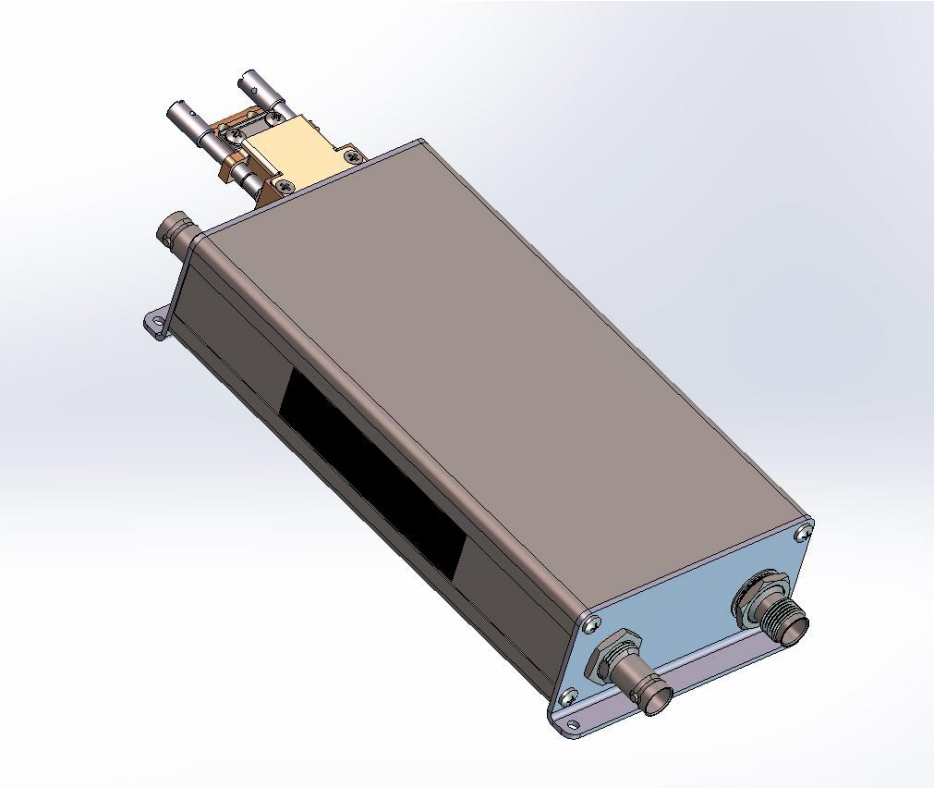
GDL 82

Mooney M20( ) Series

STC Installation Manual



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RECORD OF REVISIONS

Revision	Revision Date	Description
1	12-12-2017	Initial Release
2	09-20-2019	Updated GDL 82 to v2.01, GPS/SBAS to v7.0, and added GPS 175/GNC 355 as GPS position sources.

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DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

WARNING

Warnings indicates that personal injury or death is possible if the instructions are not obeyed.

CAUTION

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

NOTE

Notes provide further information about preceding steps and/or reasons for the particular operation.

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.

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 DESCRIPTION

The GDL 82 is a remote mounted UAT transmitter designed for in-line installation between an existing Mode A/C transponder and L-Band antenna. The GDL 82 installed in accordance with this manual meets the operational requirement of equipping for ADS-B Out per 14 CFR §91.225 and §91.227 with guidance from AC 20-165B.

This manual includes the description of the GDL 82 physical, mechanical and electrical characteristics, and provides instructions for installation in Mooney M20( ) series aircraft only (TCDS 2A3). Conditions and limitations of airworthiness approval are also detailed in this manual.

This STC and the data contained in this manual are the basis of airworthiness approval only for the installation of equipment listed in Table 1-1, and the interfaces between the Garmin GDL 82 and equipment listed in this manual.

Table 1-1: Approved Equipment

Model	Manufacturer	Unit Part Number	Catalog Part Number
GDL 82	Garmin	011-03946-00	010-01560-01
GDL 82 w/ GPS	Garmin	011-03946-40	010-01560-31

Some Mooney M20( ) aircraft may have been modified over the years to include systems which are not approved for use with the GDL 82. The installer is responsible for making the final determination of applicability of this STC for each aircraft, including limitations. No aircraft modifications should take place before this determination is made.

A permission letter to use this STC data is available for download for each authorized GDL 82 installation from Garmin's Dealer Resource Center and flyGarmin.com.

The software version and information in this document are subject to change without notice. Visit www.flyGarmin.com for current updates and supplemental information concerning the operation of this and other Garmin products.

1.1 References

Table 1-2: Reference Documents

Document 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 F2490-05
FAA Memorandum dated March 2, 2016, "Installation Approval for ADS-B OUT Systems"	AFS-360_2016-03-02
GTN 625/635/650 TSO Installation Manual	190-01004-02
GTN 725/750 TSO Installation Manual	190-01007-02
GNS 400W Series Installation Manual	190-00356-08
GNS 500W Series Installation Manual	190-00357-08
GNS 480 (CNX80) Color GPS/NAV/COM Installation Manual	560-0982-01
GPS 175 Part 23 AML STC Installation Manual	190-02207-A1
GNC 355 Part 23 AML STC Installation Manual	190-02207-A5
Garmin GPS and XM® Antenna STC Installation Manual	190-01284-00
Instructions for Continued Airworthiness & Maintenance Manual, GDL 82 Mooney M20() Series STC	190-01810-11
Master Drawing List GDL 82 Mooney M20( ) Series STC	005-01008-A1
AFMS for the Garmin GDL 82 Mooney M20 Series	190-01810-12
GDL 82 Pilot's Quick Start Guide	190-01810-13

The following acronyms and abbreviations are used in this manual:

AC	Advisory Circular	**GPS**	Global Positioning System
ADS-B	Automatic Dependent Surveillance – Broadcast	**GTN**	Garmin Touch Navigator
AFM	Airplane Flight Manual	**ICA**	Instructions for Continued Airworthiness
AFMS	Airplane Flight Manual Supplement	**ICAO**	International Civil Aviation Organization
ALT	Altitude	**I/O**	Input/Output
ATC	Air Traffic Control	**LRU**	Line Replaceable Unit
BL	Butt-Line	**MM**	Maintenance Manual
CFR	Code of Federal Regulations	**PC**	Personal Computer
CG	Center of Gravity	**POH**	Pilot Operating Handbook
CL	Center-Line	**PVT**	Position, Velocity & Time

DC	Direct Current	**SBAS**	Satellite-Based Augmentation System
DME	Distance Measuring Equipment	**STC**	Supplemental Type Certificate
ELA	Electrical Load Analysis	**SW**	Software
ELT	Emergency Location Transmitter	**TCDS**	Type Certificate Data Sheet
EMC	Electro-Magnetic Checkout	**TSO**	Technical Standard Order
EMI	Electro-Magnetic Interference	**UAT**	Universal Access Transceiver
ENT	Enter	**USB**	Universal Serial Bus
EQF	Environmental Qualification Form	**VFR**	Visual Flight Rules
FAA	Federal Aviation Administration	**Vs0**	Aircraft Stall Speed (in landing configuration)
FS	Fuselage Station	**VSWR**	Voltage Standing Wave Ratio
GDL	Garmin Datalink Transceiver	**WAAS**	Wide Area Augmentation System
GNS	Garmin Navigator Series	**XPDR**	Transponder

1.2 System Overview

The GDL 82 is a remote-mounted unit that contains 978 MHz and 1030 MHz transmitters, and a 1090 MHz receiver. It is installed in-line with the existing transponder and L-Band antenna. The GDL 82 transmits ownship ADS-B Out data via the UAT data link using the existing transponder's L-Band antenna. The GDL 82 utilizes the direct in-line connection to synchronize with the aircraft transponder via 1030 MHz interrogations to obtain the transponder Squawk (Mode 3/A) code, IDENT status and pressure altitude.

ADS-B equipment requires GPS/SBAS data for ADS-B Out transmissions. Only the following GPS/SBAS data sources (and their software versions) are approved by this STC to interface with the GDL 82:

- GTN 6XX/7XX series navigators with software version 6.41 (or later)
- GNS 4XXW/5XXW series navigators with software version 5.30 (or later)
- GPS 175 navigator
- GNC 355 navigator/COM radio
- GNS 480 navigator with software version 2.4 (or later)
- Existing approved GPS antenna installation (See Section 3.4.2)

The GDL 82 uses the following interfaces:

- Aircraft Power and Ground
- Transponder Coaxial Connection
- L-Band Coaxial Connection
- GPS Coaxial Connection – Used only for internal GPS source
- 1 RS-232 I/O – Used only for external GPS source
- 1 Discrete Output – Failure Annunciator (optional)
- 2 Discrete Inputs – Anonymous Mode Switch and Squat Switch (optional)

- USB Interface – Configuring GDL 82 and Loading Software from PC

The GDL 82 System Interface Diagram is shown in Figure 1-1.

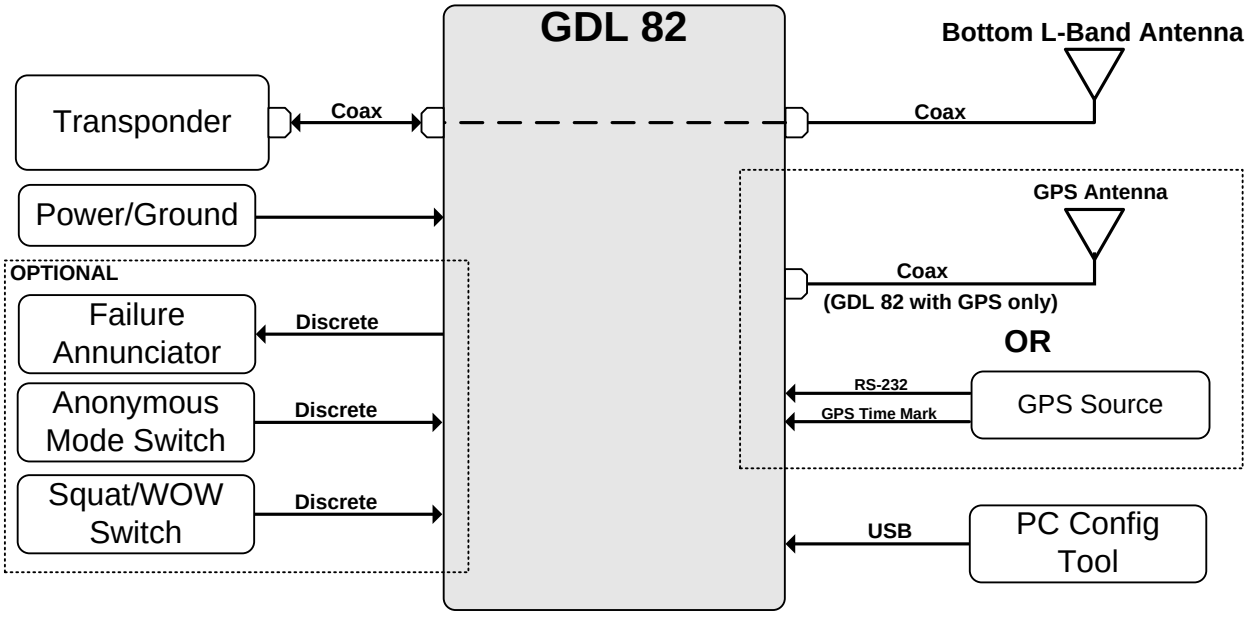


Figure 1-1: GDL 82 System I/O Interfaces

1.3 Technical Specifications

The GDL 82 environmental qualification form (EQF) is available at Garmin's Dealer Resource Center and flyGarmin.com.

Table 1-3: Power Requirements

Unit	Characteristic	Specification	
		14 VDC	28 VDC
GDL 82	Input Current, Typical	0.35 A	0.2 A
	Input Current, Maximum	0.4 A	0.25 A
GDL 82 w/ GPS	Input Current, Typical	0.45 A	0.25 A
	Input Current, Maximum	0.5 A	0.3 A

Table 1-4: Physical Characteristics

Unit	Width	Height	Length	Weight of Unit and Connectors
GDL 82	3.39 in	1.48 in	7.99 in	0.99 lbs
GDL 82 w/GPS				1.22 lbs

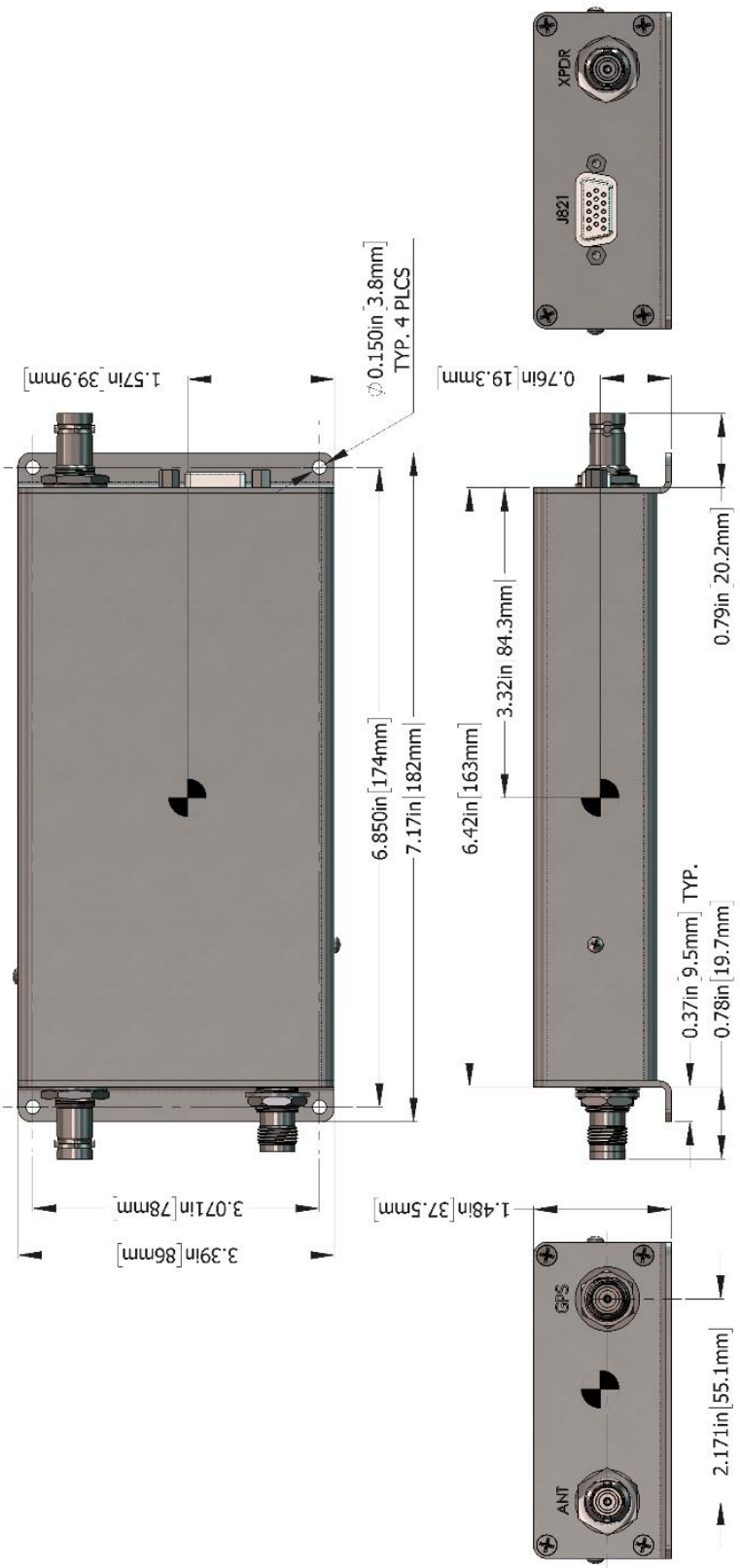


Figure 1-2: GDL 82 Unit Dimensions and Center of Gravity

2 LIMITATIONS

2.1 Installation Limitations

This STC approves the GDL 82 unit to be installed on the existing equipment shelf located in the aft section of the fuselage behind the cargo hold or underneath the instrument panel, attached to the tubular structure.

This STC does not provide the data, neither is the basis of the airworthiness approval for antenna installation. Installation of GPS/SBAS or L-Band antennas as part of GDL 82 system requires separate airworthiness approval.

2.2 Operational Limitations

Refer to the Airplane Flight Manual Supplement (AFMS) (Garmin Document Number: 190-01810-12) for operational limitations. It is available at Garmin's Dealer Resource Center and flyGarmin.com.

3 OVERVIEW

Steps required to install the GDL 82 are discussed in this section. These steps include verification of the existing transponder system performance (including the antenna) and completion of an aircraft Electrical Load Analysis. Equipment location, required support structure, and electrical wiring are also discussed in this section.

NOTE

The instructions to install GDL 82, including fabrication of required wiring harness, are intended to follow aircraft manufacturer requirements as specified in Aircraft Maintenance Manual. Alteration and wiring practices detailed in AC 43.13-1B and AC 43.13-2B are acceptable alternatives. Sound mechanical and electrical methods and practices are required to achieve optimum system performance.

Options for the GDL 82 installation in a Mooney M20( ) series aircraft are depicted in Figure 3-1, Figure 3-2, and Figure 3-3. These options reflect location of existing L-Band antenna and type of transponder (panel mounted or remote). Other than the GDL 82 unit, all other equipment shown is for reference only and is neither intended to convey requirements for the GDL 82 installation, nor is the GDL 82 installation predicated on other equipment shown. A list of acceptable L-Band and GPS antennas are shown in Table 3-5 and Table 3-6, respectively.

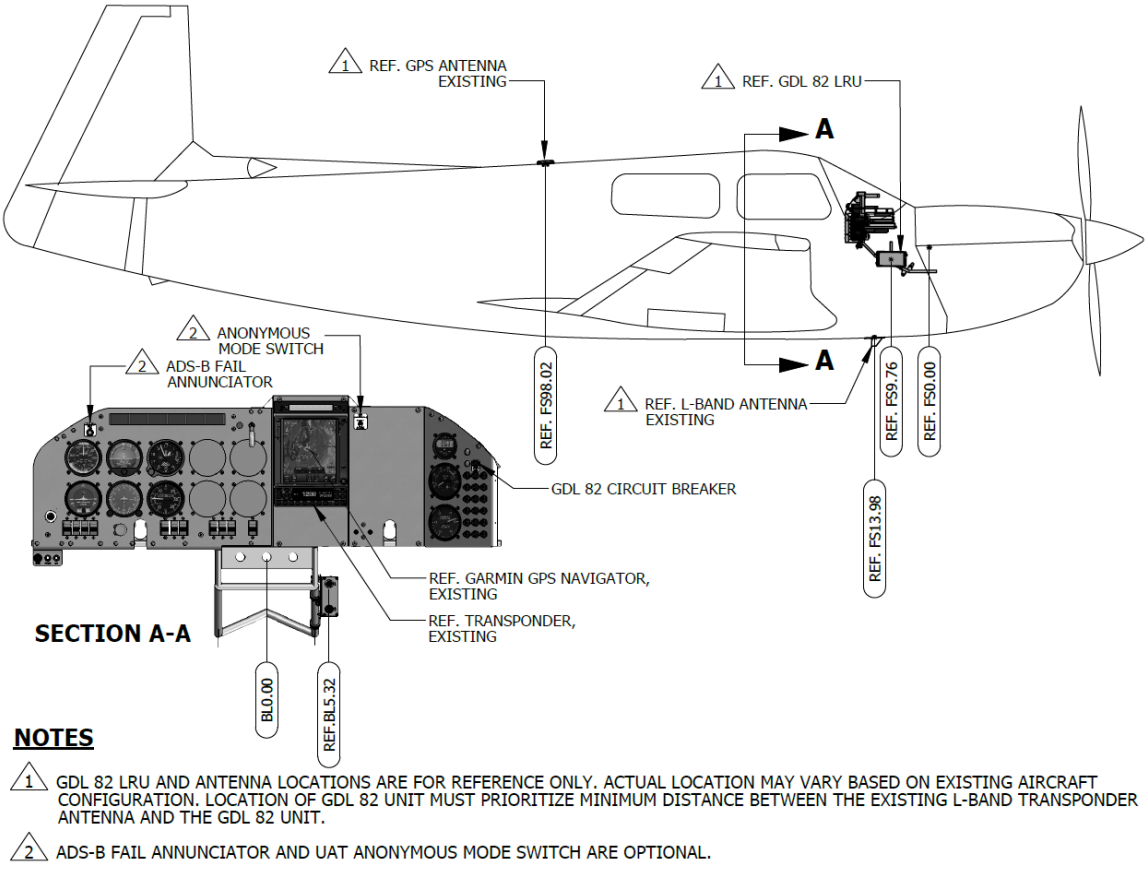
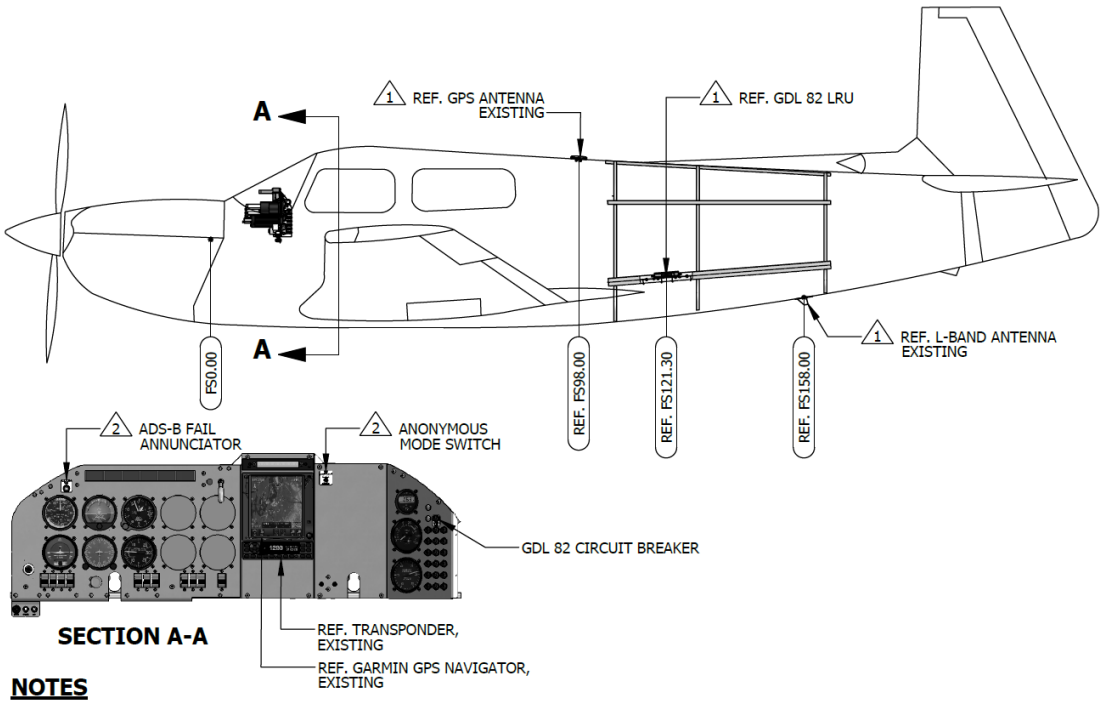


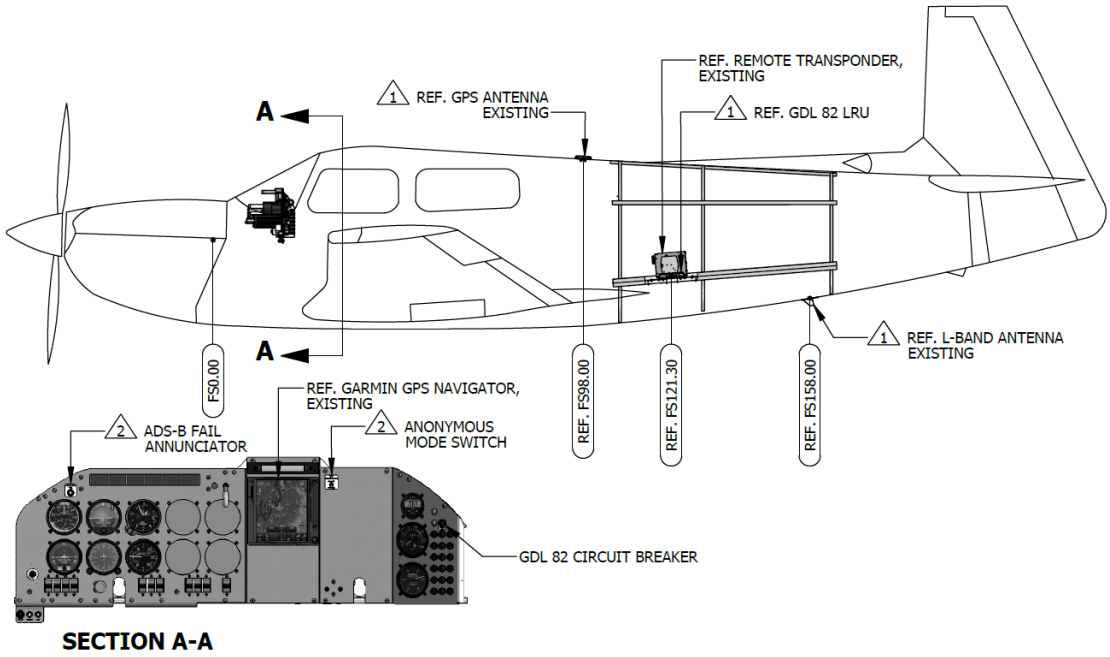
Figure 3-1: GDL 82 Installation Option 1



NOTES

1. GDL 82 LRU AND ANTENNA LOCATIONS ARE FOR REFERENCE ONLY. ACTUAL LOCATION MAY VARY BASED ON EXISTING AIRCRAFT CONFIGURATION. LOCATION OF GDL 82 UNIT MUST PRIORITIZE MINIMUM DISTANCE BETWEEN THE EXISTING L-BAND TRANSPONDER ANTENNA AND THE GDL 82 UNIT.
2. ADS-B FAIL ANNUNCIATOR AND UAT ANONYMOUS MODE SWITCH ARE OPTIONAL.

Figure 3-2: GDL 82 Installation Option 2



NOTES

1. GDL 82 LRU AND ANTENNA LOCATIONS ARE FOR REFERENCE ONLY. ACTUAL LOCATION MAY VARY BASED ON EXISTING AIRCRAFT CONFIGURATION. LOCATION OF GDL 82 UNIT MUST PRIORITIZE MINIMUM DISTANCE BETWEEN THE EXISTING L-BAND TRANSPONDER ANTENNA AND THE GDL 82 UNIT.
2. ADS-B FAIL ANNUNCIATOR AND UAT ANONYMOUS MODE SWITCH ARE OPTIONAL.

Figure 3-3: GDL 82 Installation Option 3

3.1 Garmin Supplied Materials

Garmin supplied materials required for the GDL 82 installation are listed in Table 3-1. Other commercially available materials required for installation of GDL 82 are shown in Section 4.

Table 3-1: Materials for GDL 82 Installation

Part Number	Description
011-03946-00 OR 011-03946-40	GDL 82 OR GDL 82 w/GPS (depicted in Figure 4-1 and Figure 4-3)
011-03945-00	Connector Kit, GDL 82
006-B2343-01	GDL 82 System Software Version 2.01
006-C0177-23	GDL 82 FPGA Software Version 2.3
006-B1827-10	GDL 82 Internal GPS Software Version 7.0
006-A0248-20	GDL 8X Install Tool [1]

[1] GDL 8X Install Tool is available for download at flyGarmin.com

3.2 Test Equipment

GDL 82 Pre- and Post- installation system checkouts require the following equipment:

- Ground power source (capable of supplying sufficient power to the aircraft systems and avionics).
- Transponder Ramp Test Set (e.g., Aeroflex IFR-6000 or TIC TR-220).
- ADS-B Test Set (e.g., Garmin GDL 39(R/3D)/52 and Garmin Pilot application on iOS device) if a transponder ramp test set is not capable of receiving UAT (978MHz) ADS-B Out messages.

NOTE

For the post-install ADS-B Out checks (see section 5.4.2) the Ramp Test Set must be capable of receiving ADS-B Out messages on UAT (978MHz).

- A Milliohm meter with a precision of ±0.1 mΩ, or better, to measure the electrical bonding between system components and aircraft ground.
- An ammeter with a precision of ±0.5 amps and a current capacity sufficient for the total aircraft load for the ELA.

3.3 Pre-Installation: Existing Transponder System Check

The existing Mode A/C (ATCRBS) transponder to be interfaced to the GDL 82, must meet the following:

- The transponder complies with TSO-C74().
- The installation of the transponder was previously FAA-Approved.
- The existing transponder's altitude source (altitude serializer/encoder) must comply with TSO-C10(), TSO-C106() or TSO-C88() and have prior FAA approval.
- The transponder must pass the pre-installation check procedures in Table 3-2.

The existing transponder system's peak output power and receiver sensitivity must be verified to determine compatibility with the GDL 82 before the system is installed in the aircraft. The GDL 82 introduces no more than 1.5 dB loss in the transmission line as measured at the antenna output. Measurement is performed with a utilized radiated ramp tester, such as an Aeroflex IFR-6000 or TIC TR-220, operated in accordance with the applicable operator's manual.

Table 3-2: Pre-Installation Check Procedures

Step	Description	Notes
1	Determine the RF Peak Output Power and Receiver Sensitivity IAW Part 43, Appendix F, for existing ATCRBS system (i.e., transponder system). Record the observed values of RF Peak Output Power and Receiver Sensitivity.	RF Peak Output Power: _____ Class A: > 21.0 dBw (125 Watts) Class B: > 18.5 dBw (70 Watts) Receiver Sensitivity (MTL): _____ Any Class: MTL = -73 ±4 dBm
2	Subtract the anticipated maximum loss (1.5dB) from the peak output power and add 1.5dB to the sensitivity values determined in step 1.	<*Output Power*>dBw - 1.5dB = _____dBw <*Sensitivity*>dBm + 1.5dB = _____dBm
3	Verify that the peak output power and sensitivity are not reduced below the required minimums.	Class A: > 21.0 dBw (125 Watts) Class B: > 18.5 dBw (70 Watts) Any Class: MTL = -73 ±4 dBm

Consider the following modifications to help reduce loss in the transponder system, if the results of the procedure in Table 3-2 do NOT meet the minimum performance specifications of Part 43, Appendix F. Any of the steps, or their combination, can be used.

NOTE

Performance of any or all of the following recommendations does not necessarily ensure compliance with 14 CFR §43, Appendix F.

- Due to the nature of antenna radiation patterns, nulls or marginal conditions may be observed when measuring a utilized radiated signal from the aircraft. In these cases, tests from different positions should be performed to determine an acceptable angle for measurement.
- Replace transponder coaxial cable and connectors with MIL-C-17 type F low-loss cable (e.g., RG-400 or RG-393). For older installations it may be necessary to replace the existing coaxial cable assembly with a low-loss cable type to pass the transponder ramp check in accordance with Part 43, Appendix F. See Section 3.4 for specifications of recommended coaxial cable.
- Ensure the existing transponder and L-Band antenna are properly installed in accordance with manufacturer's specifications (e.g., units are properly grounded, the coaxial cables are adequately routed and that the L-Band antenna ground plane is appropriate). Any corrosion in the coaxial cable connection, or ground plane will diminish performance.
- Ensure the existing L-Band antenna meets the minimum performance specifications. New L-Band antenna maybe required. Refer to Section 3.4.1 for specifications of acceptable L-Band antenna.
- If the existing transponder is Class A (i.e., operational ceiling is > 15,000 feet), but the results of the existing transponder system check meet only the requirements for Class B equipment (i.e., operational ceiling is < 15,000 feet), the operating ceiling can be limited to 15,000 feet MSL if deemed acceptable. This method does not affect the transponder's equipment certification, but it does limit the aircraft's operating ceiling based on the overall system performance specifications under 14 CFR §91.215. Placards and/or an entry in the aircraft's AFMS specifying the limitation must be made.

3.4 Antennas

This section summarizes the key antenna installation parameters necessary to meet the GDL 82 and ADS-B Out requirements.

NOTE

This STC does not provide the data or airworthiness approval for antenna installation. Antenna installation requires separate airworthiness approval.

NOTE

For the particular antenna model, refer to the antenna manufacturer's data for installation guidance and minimum performance specifications.

NOTE

The GDL 82 will introduce no more than 1.5dB of loss in the transmission line between the transponder and L-Band antenna. The GDL 82 should be located as close to the L-Band antenna as practical to minimize the length of coaxial cable between the GDL 82 unit and L-Band antenna. Reference Section 3.3 for the pre-installation checkout procedures and additional modification considerations.

Examples of the recommended antenna cable types and cable vendors are shown in Table 3-3. Any of the cable types shown in Table 3-3 will work depending on installation configuration and cable length. For example, installations with longer coaxial cable runs or lower power transponders may require the usage of cable with a loss lower than RG-400.

Any standard 50Ω, double-shielded coaxial cable assembly that meets the attenuation requirements (with connectors) can be used between the GDL 82, existing transponder and L-Band antenna. Use the connector losses specified in Table 3-4 for each connection when calculating cable loss. Cables that meet specifications in Table 3-3 are adequate for GDL 82 installations.

Table 3-3: Coaxial Cable Specifications

Insertion Loss (dB/100ft) [1]	Carlisle IT Type [2]	MIL-C-17 Type	RG Type [3]
18.5	N/A	M17/128-RG400	RG-400
11.1	N/A	M17/112-RG304	RG-304
9.2	N/A	M17/127-RG393	RG-393
15.2	3C142B	N/A	N/A
9.2	311601	N/A	N/A
7.5	311501	N/A	N/A
5.8	311201	N/A	N/A
3.8	310801	N/A	N/A

[1] RG Type coaxial cable insertion loss can changed significantly between manufacturers. The insertion loss for RG Type cables shown in this column is considered the worst case scenario. Refer to the cable manufacturers' specifications for actual attenuation (insertion loss) for the cable being used.

[2] Supplier information (for reference only);
Carlisle Interconnect Technologies
5300 W. Franklin Drive, Franklin WI 53132
TEL: 800-327-9473
www.carlisleit.com/

[3] RG Types are obsolete and are shown for reference only; replaced by M17 Type numbers.

Table 3-4: Typical Cable Connector Loss

Connector Type	Approximate dB Loss
TNC	0.08 dB
BNC	0.20 dB
C	0.15 dB
N	0.05 dB

3.4.1 Transponder Antenna

The existing transponder L-Band antenna and/or the antenna coaxial cables do NOT require changes if the antenna meets the following requirements and the existing transponder system passes the pre-installation check specified in Section 3.3. The existing transponder antenna must be:

1. TSO-C74(), C112(), or C166().
2. 50 ohm vertically polarized with a VSWR ≤ 1.7:1 at 978 MHz, and ≤ 1.5:1 at 1090 MHz.
3. Installed on a ground plane that is electrically bonded to the airframe ground with a direct current (DC) resistance less than or equal to 2.5 milliohms with connector disconnected.

Additionally, the antenna location is:

1. Away from major protrusions.
2. As far away as practical from landing gear doors, access doors, or other openings that can affect its radiation pattern.
3. At least 20 inches from any other transponder, TAS/TCAS, DME or 1030/1090 MHz antenna.

Table 3-5: L-Band Antennas

Manufacturer	P/N	Model/ Description	Connector Type	Notes
Aero Antenna	AT130-16	DME Transponder	TNC	DC Grounded
Comant	CI-100 [1]	DME Transponder	BNC	Open Circuit
	CI-100-2 [1]		TNC	Open Circuit
	CI-105 [1]		BNC	Open Circuit
	CI-105-3 [1]		BNC	Open Circuit
	CI-105-16 [1]		BNC	Open Circuit
	CI-110-40-30		C	Open Circuit
	CI-110-41-30		C	DC Grounded
	CI-110-60-30		C	Open Circuit
	CI-110-61-30		C	DC Grounded
Dayton-Granger	L10-611-()	L-Band blade	C	DC Grounded
Garmin	590-0052 or 013-00219-00 [1]	A-40	TNC	Open Circuit
	590-0051 or 013-00174-00	A-41	TNC	Open Circuit

[1] Due to the lack of lightning protection, these antenna are not recommended for new installations.

3.4.2 GPS Antenna

Operation of the GDL 82 with internal GPS/SBAS receiver depends on the performance of the GPS antenna. GPS antenna that meet minimum performance specifications are listed in Table 3-6. Installation instructions for the Garmin GA 35, GA 36 or GA 37 GPS antennas can be found in the *GA 35, GA 36, GA 37 Antenna Installation Instructions*, 190-00848-00. The GPS antenna must be installed on a ground plane that is electrically bonded to the airframe ground with a direct current (DC) resistance less than or equal to 2.5 milliohms with connector disconnected.

Table 3-6: GPS Antennas

Manufacturer	Part Number	Description	Connector
Garmin	013-00235-()	GA 35, GPS/WAAS [1]	TNC
Aero Antenna	AT575-93G()-TNCF-000-RG-27-NM		
Garmin	013-00244-()	GA 36, GPS/WAAS	TNC
Aero Antenna	AT575-126G()-TNCF-000-RG-27-NM		
Garmin	013-00245-()	GA 37, GPS/WAAS/XM	TNC
Aero Antenna	AT2300-126G()-TNCF-000-RG-27-NM		
Comant	CI-2580-200	GPS/VHF	TNC/BNC [2]
	CI-2728-200	GPS/VHF	TNC/BNC [2]
	CI-2580-410	GPS/XM/VHF	TNC/TNC/BNC [3]
	CI-2728-410	GPS/XM/VHF	TNC/TNC/BNC [3]
	CI-428-200	GPS/WAAS	TNC
	CI-428-410	GPS/XM	TNC/TNC

[1] Same mounting hole pattern as the GA 36, but GA 35 antenna has a physically larger footprint.
[2] The GPS connector is a TNC type, the VHF connector is a BNC type.
[3] The GPS connector is a TNC type, the XM connector is a TNC type, the VHF connector is a BNC type.

An aircraft EMC check, part of the system performance checkout detailed in Section 5.4.3, can show if there is a degradation of GPS in the presence of interference signals. A different GPS antenna or a GPS notch filter in line with the VHF COM or (re-radiating) ELT transmitter can correct unsatisfactory interference.

To reduce or eliminate signal interference, signal loss of GPS antenna cable assembly, including connectors and adapters (e.g., TNC to BNC), must be within the limits listed in Table 3-7. See Table 3-4 for typical losses of connectors for calculating cable loss.

Table 3-7: GPS dB Loss Allowance

Unit	Minimum	Maximum
GDL 82 w/GPS	1.5 dB	6.5 dB

To maintain integrity of the WAAS signal, the GPS antenna coaxial cable must have a minimum of two shields (e.g., RG-400 or RG-142B). For example, a 6.5 foot section of RG-142B or RG-400 cable with a connector on each end has approximately 1.5 dB loss, so RG-142B or RG-400 can be used for a maximum 35 feet antenna cable length. For longer cable sections, a lower loss 50 ohm coaxial cable must be used.

For very short cables with less than 1.5 dB loss, cable length must be increased until the loss is between 1.5 dB and 6.5 dB, and any extra cable must be coiled. Susceptibility to harmonics of VHF COM transmitters is analyzed through the post installation checkout, as detailed in section 5.3.2. GPS and COM antennas may require greater separation distance, if problems occur. A 1575.42 MHz notch filter installed in series with VHF COM transceiver antenna cable can decrease or eliminate the harmonic interference and is available from Garmin (P/N 330-00067-00). On the selected frequencies, as listed in section 5.3.2, the ELT can be a source of VHF COM transmitter interference with GPS signal. The ELT antenna cable must be disconnected from the ELT unit to verify. Consult the ELT manufacturer if the ELT is found to cause the problem.

3.5 Electrical Load Analysis

Before the GDL 82 is installed, an Electrical Load Analysis (ELA) must be completed on the aircraft to verify the electrical system can support the GDL 82. The purpose of the ELA is to show compliance with 14 CFR 23.1351 by demonstrating that the maximum electrical system demand does not exceed 80% of the alternator data plate rating. Satisfactory completion of the ELA must be recorded on FAA Form 337. GDL 82 current draw values are listed in Table 1-3.

The net change to the electrical load with the GDL 82 installed must be determined. The amended electrical load calculation documenting the load change should be filed with the aircraft permanent records.

A complete electrical load analysis must be performed to show that the capacity of the alternator or generator is sufficient for the electrical load. For guidance on preparing an ELA, refer to ASTM F2490-05, *Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis*.

3.5.1 Aircraft with Existing Electrical Load Analysis

If there is an existing aircraft 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. Add the maximum current draw of the GDL 82 to the ELA and verify that the electrical load remains at or below 80% of the rated alternator (or generator) current. 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

As an alternative to adding the GDL 82 to an existing ELA (Section 3.5.1), an ELA can be determined by load measurement, under different operating conditions, using the tabulation form provided below and the following steps. During measurement, applied electrical system loads must account for combinations and durations probable in aircraft operation.

CAUTION

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

CAUTION

The Pitot Heat must only be switched on long enough to take the current measurement and then switched off. The Pitot probe can get hot so care must be exercised to avoid burns or damaging the unit.

NOTE

***Normal Operation** is when the primary electrical power generating system is operating normally.*

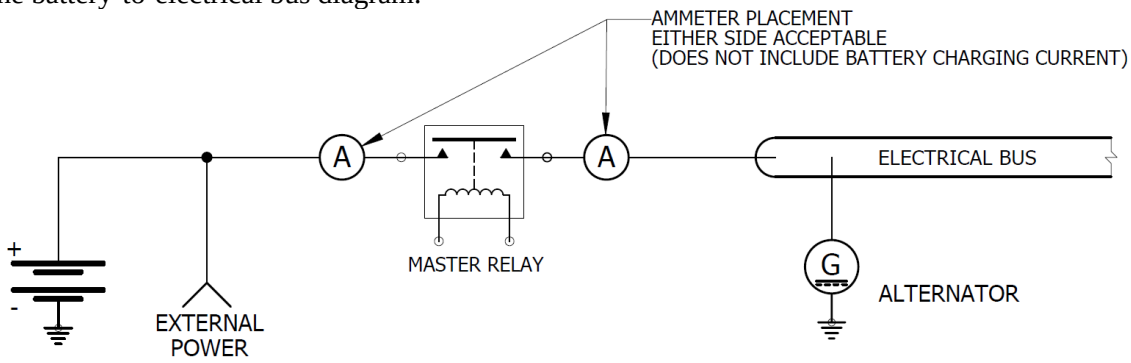
***Emergency Operation** is when the primary electrical power generating system is inoperative and a back-up electrical power generating system is being used. This typically requires load shedding of non-essential equipment to provide adequate electrical power to essential required equipment for safe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

NOTE

Current measurement is best accomplished with an in-circuit or clamp-on, calibrated ammeter with 0.5A, or better precision.

The aircraft electrical system is adequate for a GDL 82 installation if maximum demand, as documented on the tabulated ELA form (Figure 3-4 and Figure 3-5), does not exceed 80% of the alternator capacity as installed. It is permissible for the electrical load to exceed 80% of the alternator capacity as installed when Pitot heat and landing light are switched on simultaneously during the takeoff/landing phase of flight. In this case the electrical load must not exceed 95% of the alternator capacity as installed. With only the Pitot heat on (and the landing light off), the electrical load may not exceed 80% of the alternator capacity as installed.

1. The tabulated form, Figure 3-4 and Figure 3-5, can be used to compile a list of electrical loads on the aircraft. Typically, the list would be comprised of existing circuit breakers and circuit breaker switches. Continuous (e.g., GPS) or intermittent (e.g., stall warning horn, landing gear) loads must be identified.
2. Worst-case flight scenario must be used to identify which equipment is used in a particular phase of flight in normal operation. From mutually exclusive equipment that will not be energized simultaneously (e.g., pitot heat and air conditioning), only the highest worst-case condition loads must be considered.
3. Worst-case flight scenario must be used to identify which equipment is used in a particular phase of flight in emergency operation. As a minimum the list of equipment must include:
    a. COM Radio #1
    b. NAV Radio #1
    c. Transponder and Associated Altitude Source
    d. Audio Panel
    e. Stall Warning System (if applicable)
    f. Pitot Heat
    g. Landing Light (switched on during landing only)
    h. Instrument Panel Dimming
4. The calibrated ammeter must be connected in line between the external power source and the master relay circuit to eliminate errors from charging current drawn by the battery, as shown in the battery-to-electrical bus diagram.



5. With all circuit breakers closed, external power must be applied to the aircraft and voltage set to nominal alternator voltage (usually 13.8 V (DC) or 27.5 V (DC)).

6. Battery master switch must be turned on. For short duration demand battery is assumed to supply power beyond alternator capacity (intermittent electrical loads are not measured).
7. The following lighting settings must be applied throughout entire electrical load measurement:
    a. All instrument panel and flood lights set to maximum brightness
    b. Any other backlit display set to 50% brightness
8. With all equipment used continuously in taxiing phase switched on, ammeter current reading must be recorded in tabulated ELA form (COLUMN 1, Figure 3-5). Note that the autopilot circuit breaker must be closed, but autopilot not be engaged during the measurement.
9. With all equipment used continuously in the normal takeoff/landing phase, ammeter current reading must be recorded in tabulated ELA form (COLUMN 2, Figure 3-5). Measurements must be taken with the landing lights ON and OFF, and autopilot circuit breaker closed with autopilot engaged.
10. With all equipment used continuously in the normal cruise phase, ammeter current reading must be recorded in tabulated ELA form (COLUMN 3, Figure 3-5).
11. With all equipment used continuously in the emergency cruise phase, ammeter current reading must be recorded in tabulated ELA form (COLUMN 4, Figure 3-5). Measurements must be taken with the landing lights ON and OFF.
12. With all equipment used continuously in the emergency landing phase, ammeter current reading must be recorded in tabulated ELA form (COLUMN 5, Figure 3-5). Measurements must be taken with the landing lights ON and OFF.

ELECTRICAL LOAD TABULATION FORM

DATE: _____ TAIL NUMBER: _____

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 (Calculated)	Land 10 min
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Figure 3-4: Electrical Load Tabulated Form, Sheet 1 of 2

ELECTRICAL LOAD TABULATION FORM

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 (Calculated)	Emergency Operation – Land 10 min
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
_____	_____	_____	☐	☐	☐	☐	☐
Total Current Used (amps):			_____ (a)	_____ Ldg Lt. ON (b1) _____ Ldg Lt. OFF (b2)	_____ (c)	_____ Ldg Lt. ON (d1) _____ Ldg Lt. OFF (d2)	_____ Ldg Lt. ON (e1) _____ Ldg Lt. OFF (e2)
+ 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 3-5: Electrical Load Tabulated Form, Sheet 2 of 2

3.5.3 Battery Capacity Analysis

An increase in electrical load to the aircraft electrical system must be verified to remain in compliance which includes both electrical generation capacity and that reserve battery capacity remains adequate to support loads essential to continued safe flight and landing. If the existing battery does not meet the battery capacity requirements, a battery that has sufficient capacity must be installed.

Refer to ASTM document F2490-05, *Standard Guide for Aircraft Electrical Load and Power Source Capacity Analysis*, for more information.

a) Examine the nameplate capacity of the battery and assume 75% is available.
For example, $12\text{A-h} = 720\text{A-min}$, therefore, $720\text{A-min} \times 75\% = 540\ \text{A-min}$

b) Estimate the normal or pre-loadshed cruise condition (assume worst case cruise at night).
For example, 15A X 5min = 75A-min. This assumes 5 minutes for the pilot to shed non-essential loads. Any automatic load shedding can be assumed to be immediate and need not be considered in the pre-loadshed calculations.

c) Determine the minimum cruise load necessary to maintain flight after the generator/alternator has failed. For example, 10A.

d) Determine the consumption required during the landing approach.
For example, 20A for 5min = 100A-min. The cruise duration is therefore:

$$\frac{\text{Battery Capacity} - \text{Pre-loadshed} + \text{Landing Load}}{\text{Cruise Load}} = \frac{(a) - \big((b) + (d)\big)}{(c)}$$

$$= \frac{540\ \text{A-min} - (75\ \text{A-min} + 100\ \text{A-min})}{10\ \text{A}}$$

$$= \frac{365\ \text{A-min}}{10\ \text{A}}$$

$$= 36.5\ \text{min}$$

Figure 3-6: Battery Capacity Analysis Example

4 INSTALLATION

NOTE

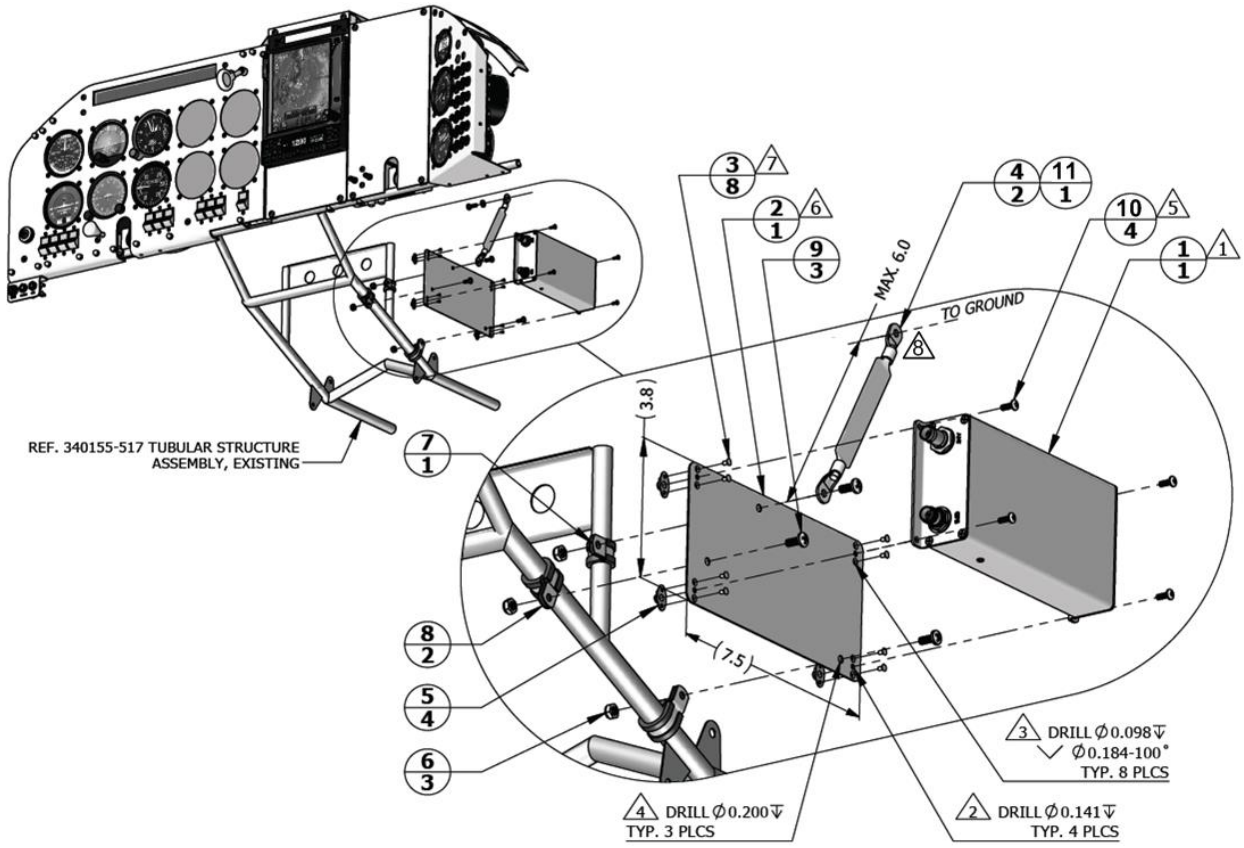
Dimensions are in inches unless otherwise specified.

NOTE

Any added placards or labels must have text size, style, and colors that match existing placards and must be:

1. *Located adjacent to added switch, annunciator, and/or circuit breaker,*
2. *Readable in all cockpit lighting conditions.*
3. *Not easily erased, damaged, or obscured.*

4.1 GDL 82 Unit Installation



ITEM	PART NUMBER	QTY	DESCRIPTION
1	011-03946-40	1	GDL 82 WITH GPS
2	--	1	PLATE, MOUNTING, GDL 82
3	MS20426AD3-3	8	RIVET, SOLID, COUNTERSUNK 100 DEG, PRECISION HEAD, 3/32 IN OD, 3/16 IN LONG
4	MS20659-130	2	TERMINAL, LUG, CRIMP STYLE, COPPER, UNISULATED, RING TONGUE, NO. 6 WIRE, 0.190 IN STUD
5	MS21075L-06	4	NUT, SELF-LOCKING, PLATE, TWO LUG, FLOATING, REDUCED RIVET SPACING, LOW HEIGHT, STEEL, 0.1380-32 UNJC-3B
6	MS21083N3	3	NUT, SELF-LOCKING, HEXAGON, NON-METALIC INSERT, LOW HEIGHT, STEEL, 0.1900-32 UNJF-3B
7	MS21919WDG8	1	CLAMP, LOOP TYPE, CUSHIONED, 1/2 IN TUBE
8	MS21919WDG10	2	CLAMP, LOOP TYPE, CUSHIONED, 5/8 IN TUBE
9	MS27039-1-07	3	SCREW, MACHINE, PAN HEAD, STRUCTURAL, CROSS RECESSED 0.1900-32 UNF-3A, 0.469 IN
10	MS35206-228	4	SCREW, MACHINE, PAN HEAD, CROSS RECESSED, CAD PLATED 0.1380-32 UNC-2A, 0.375 IN LONG
11	QQB575F36T375	1	BRAID, WIRE, COPPER, TIN-COATED, FLAT, 0.375 IN, QQ-B-575

NOTES

1. THE RESISTANCE BETWEEN THE GDL 82 UNIT AND THE EXISTING TUBULAR STRUCTURE ASSEMBLY MUST BE LESS THAN 2.5 mΩ WITH ALL GDL 82 CONNECTORS DISCONNECTED AND MUST BE VERIFIED WITH A MILLIOHM METER. FOLLOW SECTION 5 OF SAE ARP 1870, *AEROSPACE SYSTEMS ELECTRICAL BONDING AND GROUNDING FOR ELECTROMAGNETIC COMPATIBILITY AND SAFETY*, FOR PROCEDURES ON ELECTRICAL BOND PREPARATION.
2. LOCATION OF FASTENER HOLES TO MATCH GDL 82 UNIT (REF. ITEM 1)
3. LOCATION OF RIVET HOLES TO MATCH NUTPLATES (REF. ITEM 4)
4. LOCATION OF FASTENER HOLES TO MATCH CLAMPS (REF. ITEM 6 AND ITEM 7)
5. TORQUE 0.1380-32 UNC-3A SCREWS 8.0±1.0 LBF-IN
6. PLATE IS MADE FROM SHEET OF 6061-T6 ALUMINUM PER AMS 4025, AMS 4027, AMS-QQ-A-250/11, 0.040 IN THICK MINIMUM. CORROSION PROTECTION INCLUDES:
   (1) CHEMICAL CONVERSION COAT PER MIL-DTL-5541 TYPE II, OR MIL-DTL-81706 TYPE II.
   (2) [OPTIONAL] PRIME WITH HIGH-SOLIDS CHEMICAL AND SOLVENT RESISTANT EPOXY PRIMER PER MIL-PRF-23377, CLASS N.
   (3) [OPTIONAL] COAT WITH POLYURETHANE PAINT PER MIL-PRF-85285, TYPE III.

7 RIVETS ARE INSTALLED PER MIL-R-47196 (NASM47196) RIVET, BUCK TYPE, *PREPARATION FOR AND INSTALLATION*, OR PER MIL-STD-403 *PREPARATION FOR AND INSTALLATION OF RIVETS AND SCREWS, ROCKET MISSILE, AND AIRFRAME STRUCTURES*.

8 ELECTRICAL EQUIPMENT CHASSIS AND SUPPORTING BRACKETS AND RACKS MUST BE ELECTRICALLY BONDED TO THE AIRCRAFT'S GROUND REFERENCE. REFER TO SAE ARP 1870 SECTION 5 WHEN SURFACE PREPARATION IS REQUIRED TO ACHIEVE ELECTRICAL BOND. THE BONDING STRAP LENGTH MUST NOT EXCEED SIX INCHES. SEE BELOW FOR AIRFRAME BONDING EXAMPLE..

Figure 4-1: GDL 82 Unit Installation, Option 1 Example

Table 4-1: Airframe Bonding Hardware

Item Number in Figure	Description
1	Tinned copper flat braid, ¾", QQB57F36T781 OR Tinned copper tubular braid, 7/16", QQB575R30T437
2	Terminal Lug, 5/16 inch, uninsulated, MS20659-131
3	Bolt, 5/16 inch, AN5-XA
4	Lock washer, 5/16 inch, NASM35338-45
5	Flat washer, 5/16 inch, NAS1149F0563P
6	Flat washer, 0.063 inch thick, NASM970-5 (AN970-5)
7	Locknut, 5/16 inch, AN363-524

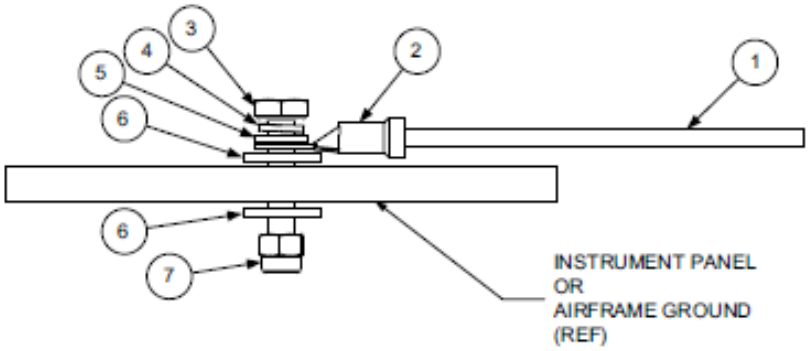
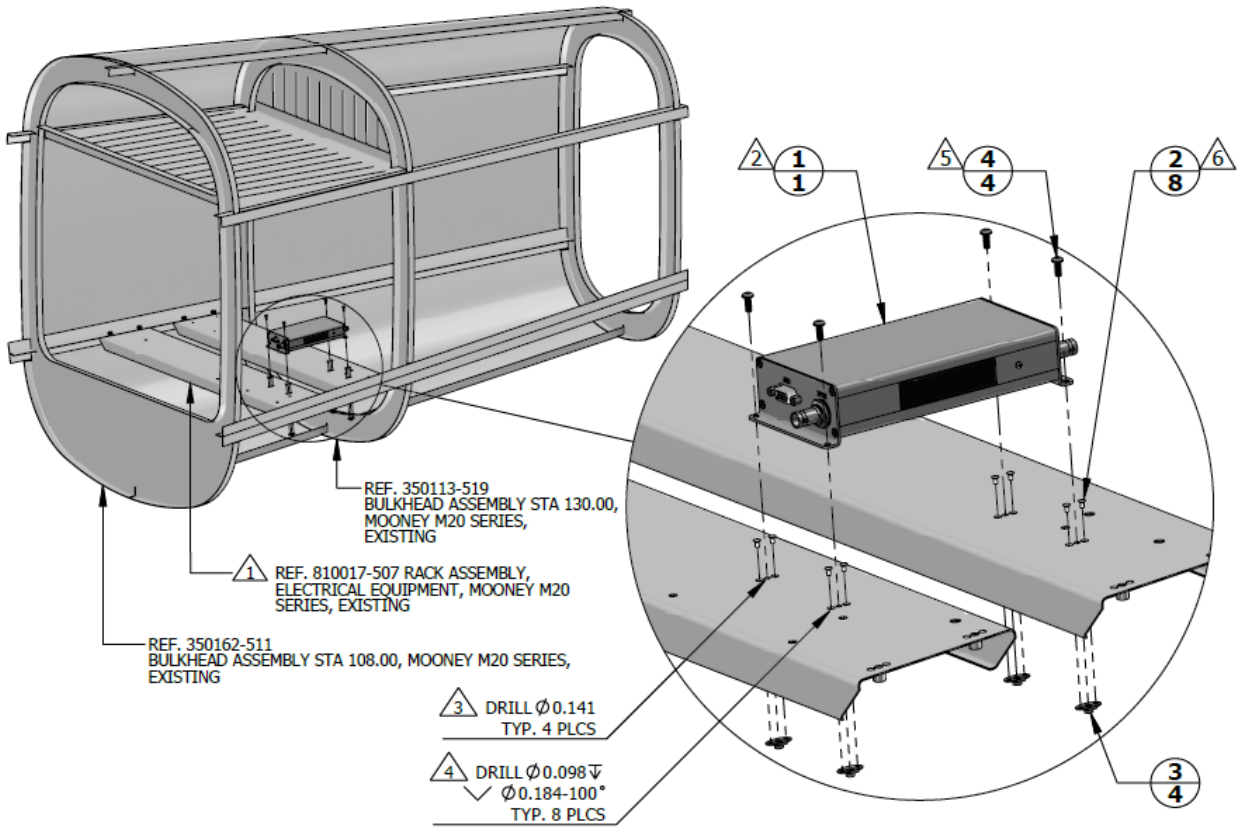


Figure 4-2: Bonding Strap Example

The GDL 82 Installation Examples 2 and 3 (shown in Figure 3-2 and Figure 3-3) can both be installed in accordance with Figure 4-3.



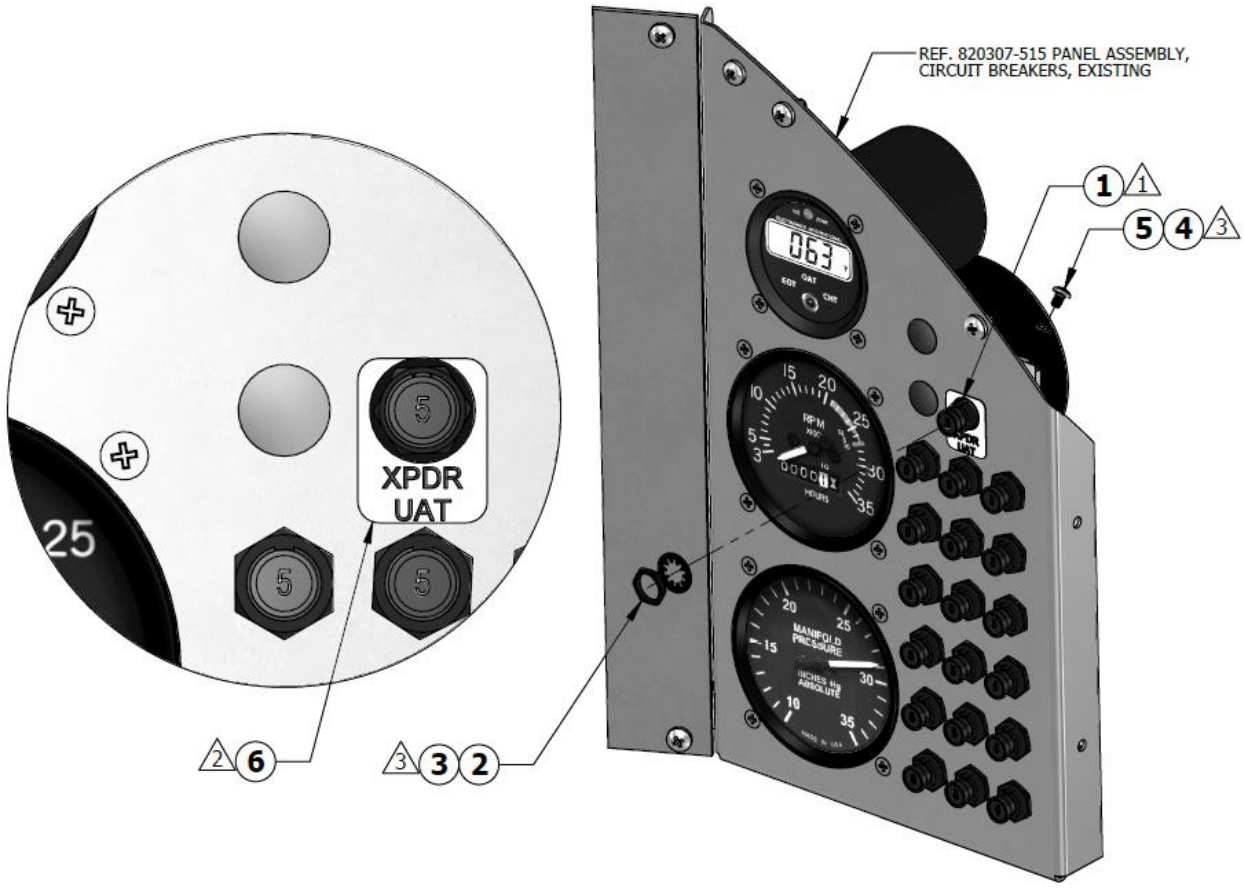
ITEM	PART NUMBER	QTY	DESCRIPTION
1	011-03946-40	1	GDL 82 WITH GPS
2	MS20426AD3-3	8	RIVET, SOLID, COUNTERSUNK 100 DEG, PRECISION HEAD, 3/32 IN OD, 3/16 IN LONG
3	MS21075L-06	4	NUT, SELF-LOCKING, PLATE, TWO LUG, FLOATING, REDUCED RIVET SPACING, LOW HEIGHT, STEEL, 0.1380-32 UNJC-3B
4	MS35206-228	4	SCREW, MACHINE, PAN HEAD, CROSS RECESSED, CAD PLATED 0.1380-32 UNC-2A, 0.375 IN LONG

NOTES

1. THE TOTAL WEIGHT OF THE GDL 82 UNIT AND THE EXISTING EQUIPMENT INSTALLED ON THE RACK ASSEMBLY MUST REMAIN WITHIN THE RACK ASSEMBLY WEIGHT LIMIT AS DETERMINED BY THE AIRCRAFT MANUFACTURER.
2. THE RESISTANCE BETWEEN THE GDL 82 UNIT AND THE EXISTING RACK ASSEMBLY MUST BE LESS THAN 2.5 mΩ WITH ALL GDL 82 CONNECTORS DISCONNECTED AND MUST BE VERIFIED WITH A MILLIOHM METER. FOLLOW SECTION 5 OF SAE ARP 1870, *AEROSPACE SYSTEMS ELECTRICAL BONDING AND GROUNDING FOR ELECTROMAGNETIC COMPATIBILITY AND SAFETY*, FOR PROCEDURES ON ELECTRICAL BOND PREPARATION.
3. LOCATION OF FASTENER HOLES TO MATCH GDL 82 UNIT (REF. ITEM 1)
4. LOCATION OF RIVET HOLES TO MATCH NUTPLATES (REF. ITEM 3)
5. TORQUE 0.1380-32 UNC-3A SCREWS 8.0±1.0 LBF-IN.
6. RIVETS ARE INSTALLED PER MIL-R-47196 (NASM47196) RIVET, BUCK TYPE, *PREPARATION FOR AND INSTALLATION*, OR PER MIL-STD-403 *PREPARATION FOR AND INSTALLATION OF RIVETS AND SCREWS, ROCKET MISSILE, AND AIRFRAME STRUCTURES*.

Figure 4-3: GDL 82 Unit Installation, Option 2 & 3 Example

4.2 Circuit Protection



ITEM	PART NUMBER	QTY	DESCRIPTION
1	Klixon 7274	(1)	TRIP-FREE RESETTABLE MS26574 OR MS22073 CIRCUIT BREAKER, PUSH-PULL, TYPE I, 5.0 AMP
2	MS25082-B18	(1)	NUT, PLAIN, HEXAGON, ELECTRICAL, THIN, 0.4375-32 UN-2B
3	MS35333-41B	(1)	WASHER, LOCK, FLAT INTERNAL TOOTH, CARBON STEEL, BLACK FINISH, 0.312 IN DIAMETER
4	MS35338-41	(2)	WASHER, LOCK-SPRING, HELICAL, REGULAR SERIES 0.138 IN DIAMETER
5	MS51957-25	(2)	SCREW, MACHINE, PAN HEAD, CROSS-RECESSED, CORROSION RESISTANT STEEL, 0.1380-32 UNC-2A, 0.1875 IN LONG
6	--	1	PLACARD, CIRCUIT BREAKER, GDL 82

NOTES

1. THE GDL 82 IS PROTECTED BY THE EXISTING TRANSPONDER CIRCUIT BREAKER. THE COMBINED TRANSPONDER AND GDL 82 CURRENT MUST NOT EXCEED 80% OF THE CIRCUIT BREAKER RATED CURRENT. REPLACE EXISTING CIRCUIT BREAKER IN ACCORDANCE WITH AC 43.13-1B, CHAPTER 11, SECTION 4, IF REQUIRED. THE CIRCUIT BREAKER MUST BE MS26574, MS22073, OR OTHER TYPE AS SPECIFIED IN THE AIRCRAFT MANUFACTURER'S PARTS CATALOG.

2. GDL 82/TRANSPONDER CIRCUIT BREAKER MUST BE LABELED AS SHOWN. THE PLACARD OR LABEL FOR ADDED GDL 82 UNIT MUST MAINTAIN THE FONT SIZE AND COLOR OF EXISTING CIRCUIT BREAKER LABELS AND MUST BE VISIBLE UNDER ALL LIGHTING CONDITIONS.

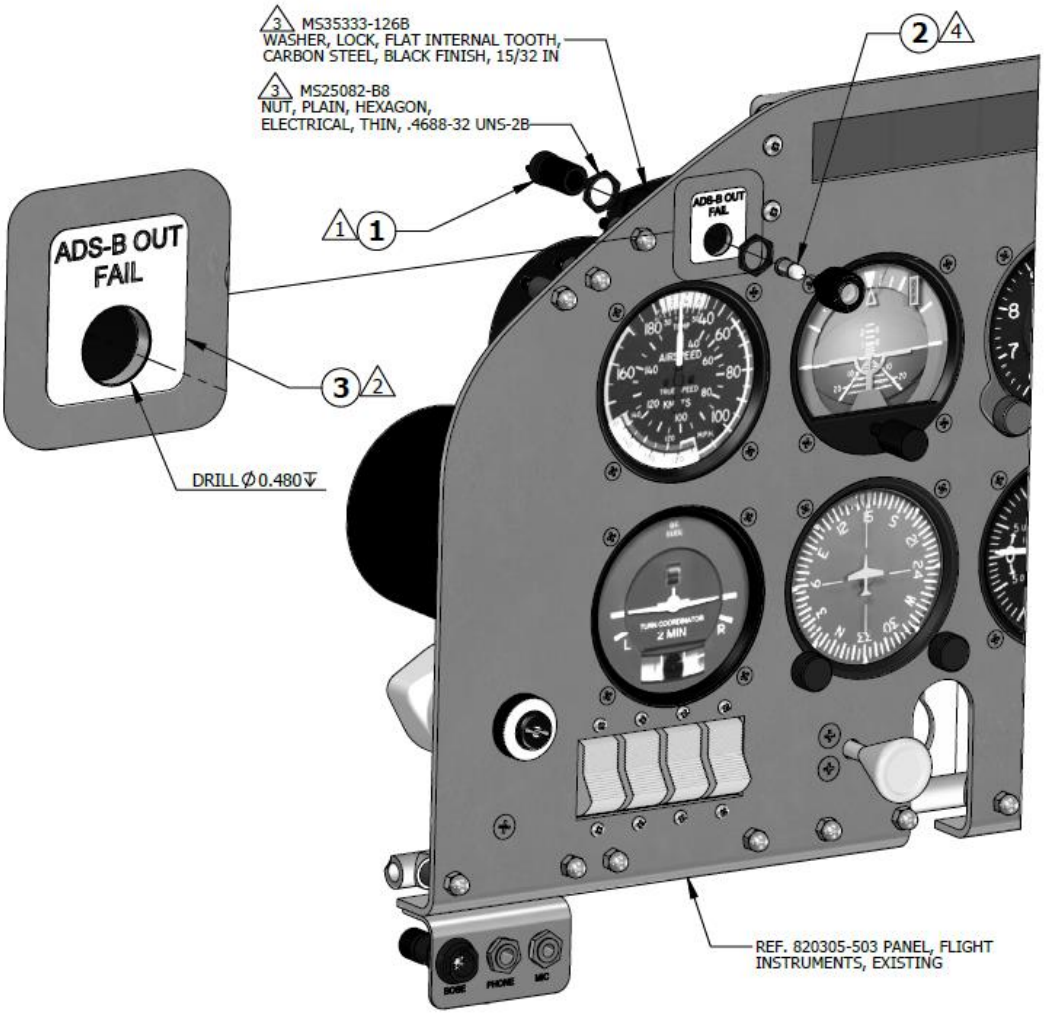
3. NUT (ITEM 2), WASHER (ITEMS 3 AND 4), AND SCREW (ITEM 5) ARE PART OF CIRCUIT BREAKER (ITEM 1).

Figure 4-4: GDL 82 Circuit Breaker Installation Example

4.3 ADS-B Out Fail Annunciator and Anonymous Mode Switch

The ADS-B OUT FAIL annunciator indicates that the ADS-B out transmission is not operational. The anonymous mode allows the GDL 82 to transmit a temporary address instead of the aircraft assigned ICAO 24-bit address, when the interfaced Mode A/C transponder is tuned to the VFR Code (1200).

Installation of the Anonymous Mode switch and ADS-B OUT FAIL annunciator is optional. If selected, the switch and annunciator must be installed and labeled as shown in Figure 4-5 and Figure 4-6, and wired as shown in Figure 4-7.

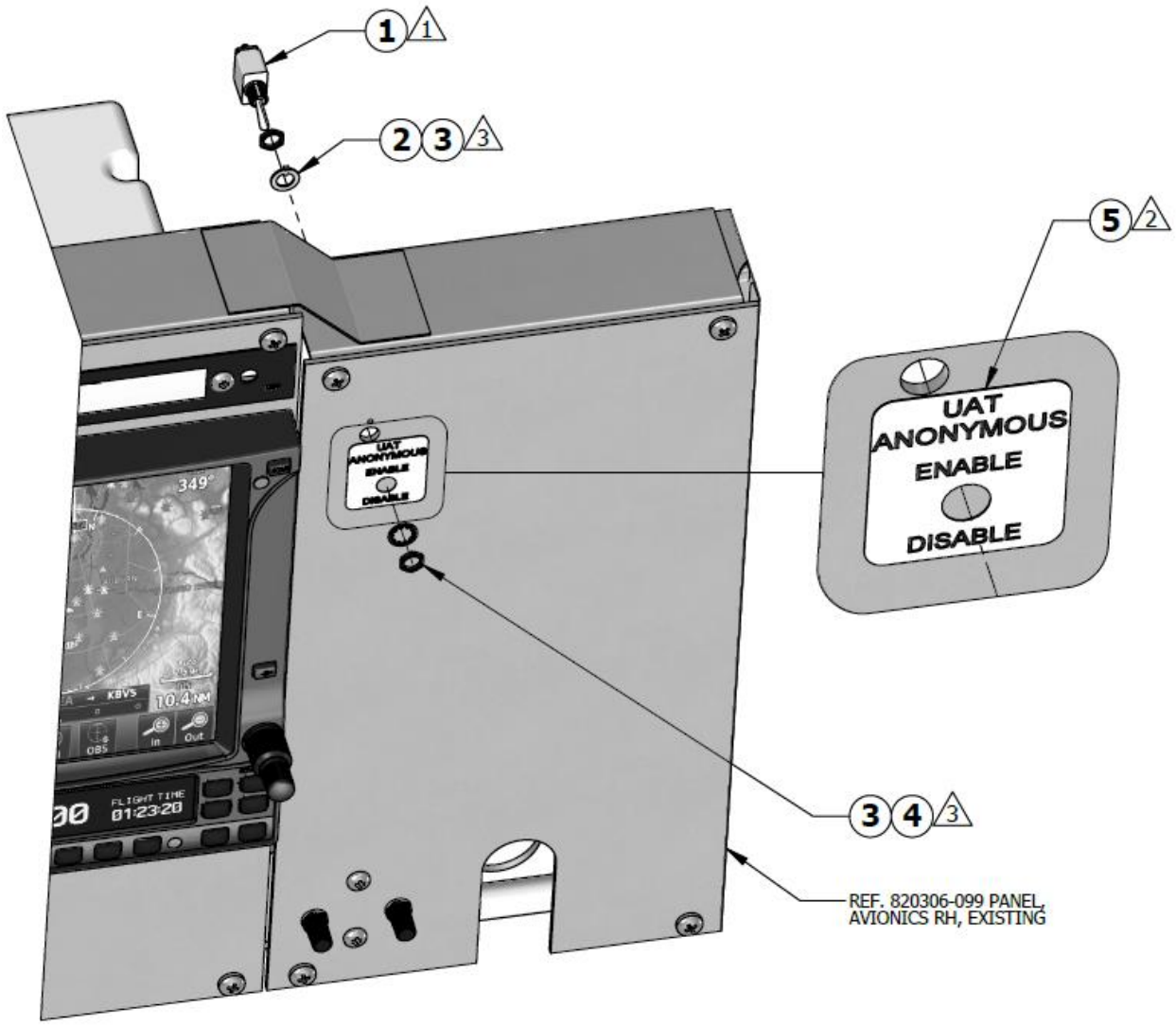


ITEM	PART NUMBER	QTY	DESCRIPTION
1	MS25041-4	(1)	LIGHT, INDICATOR, PRESS TO TEST, SMALL, AMBER WITH DIMMER
2	MS25237-330	(1)	LAMP, INCADESCENT, SINGLE CONTACT, MIDGET FLANGED BASE, 14 VDC, CLEAR
	MS25237-327		LAMP, INCADESCENT, SINGLE CONTACT, MIDGET FLANGED BASE, 28 VDC, CLEAR
3	--	1	PLACARD, ADS-B FAIL ANNUNCIATOR, GDL 82

NOTES

1. INSTALLATION OF THE ADS-B OUT FAIL ANNUNCIATOR IS OPTIONAL. IF INSTALLED, THE ANNUNCIATOR LOCATION MUST BE SUCH THAT THE PILOT HAS CLEAR UNOBSTRUCTED AND UNDISTORTED VIEW OF THE ANNUNCIATOR.
2. ADS-B OUT FAIL ANNUNCIATOR MUST BE LABELED AS SHOWN. THE ANNUNCIATOR PLACARD OR LABEL MUST MAINTAIN THE FONT SIZE AND COLOR OF EXISTING PLACARDS OR LABELS, AND MUST BE VISIBLE UNDER ALL LIGHTING CONDITIONS.
3. PART OF THE ANNUNCIATOR (ITEM 1).
4. SELECT THE LAMP WITH VOLTAGE RATING APPROPRIATE TO AIRCRAFT ELECTRICAL SYSTEM.

Figure 4-5: ADS-B OUT Fail Annunciator Installation Example



ITEM	PART NUMBER	QTY	DESCRIPTION
1	MS27716-22-1 Or MS27718-22-1	(1)	SWITCH, TOGGLE, MINATURE, SINGLE POLE, SEALED OR UNSEALED, OFF-NONE-ON
2	MS25081C0	(1)	WASHER, KEY, 0.255 IN DIAMETER
3	MS25082-B14	(2)	NUT, PLAIN, HEXAGON, ELECTRICAL, THIN, 0.2500-40 US-2B
4	MS35333-125B	(1)	WASHER, LOCK, FLAT INTERNAL TOOTH, CARBON STEEL, BLACK FINISH, 1/4 IN
5	--	1	PLACARD, UAT ANONYMOUS SWITCH, GDL 82

NOTES

1. INSTALLATION OF THE UAT ANONYMOUS SWITCH IS OPTIONAL. IF INSTALLED, THE SWITCH MUST BE IN A LOCATION THAT IS READILY ACCESSIBLE TO THE PILOT.

2. UAT ANONYMOUS SWITCH MUST BE LABELED AS SHOWN. THE ANONYMOUS SWITCH PLACARD OR LABEL MUST MAINTAIN THE FONT SIZE AND COLOR OF EXISTING PLACARDS OR LABELS, AND MUST BE VISIBLE UNDER ALL LIGHTING CONDITIONS.

3. NUT (ITEM 3) AND WASHERS (ITEM 2 AND 4) ARE PART OF THE SWITCH (ITEM 1).

Figure 4-6: UAT Anonymous Mode Switch Installation Example

4.4 Electrical

CAUTION

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

NOTE

All balloon numbers in Figure 4-7 *refer to* Table 4-2.

NOTE

Ground Designations:

⏚ *Shield Block Ground*

⏚ *Airframe Ground*

NOTE

At GDL 82, connect shield grounds to the connector backshell – the shield termination leads must be less than 3.0". Connect other end of the shield per the remote equipment installation requirements. If no shield termination requirement exists for the remote equipment, terminate shields as short as possible, not to exceed 3.0".

Table 4-2: Electrical Wiring Material List

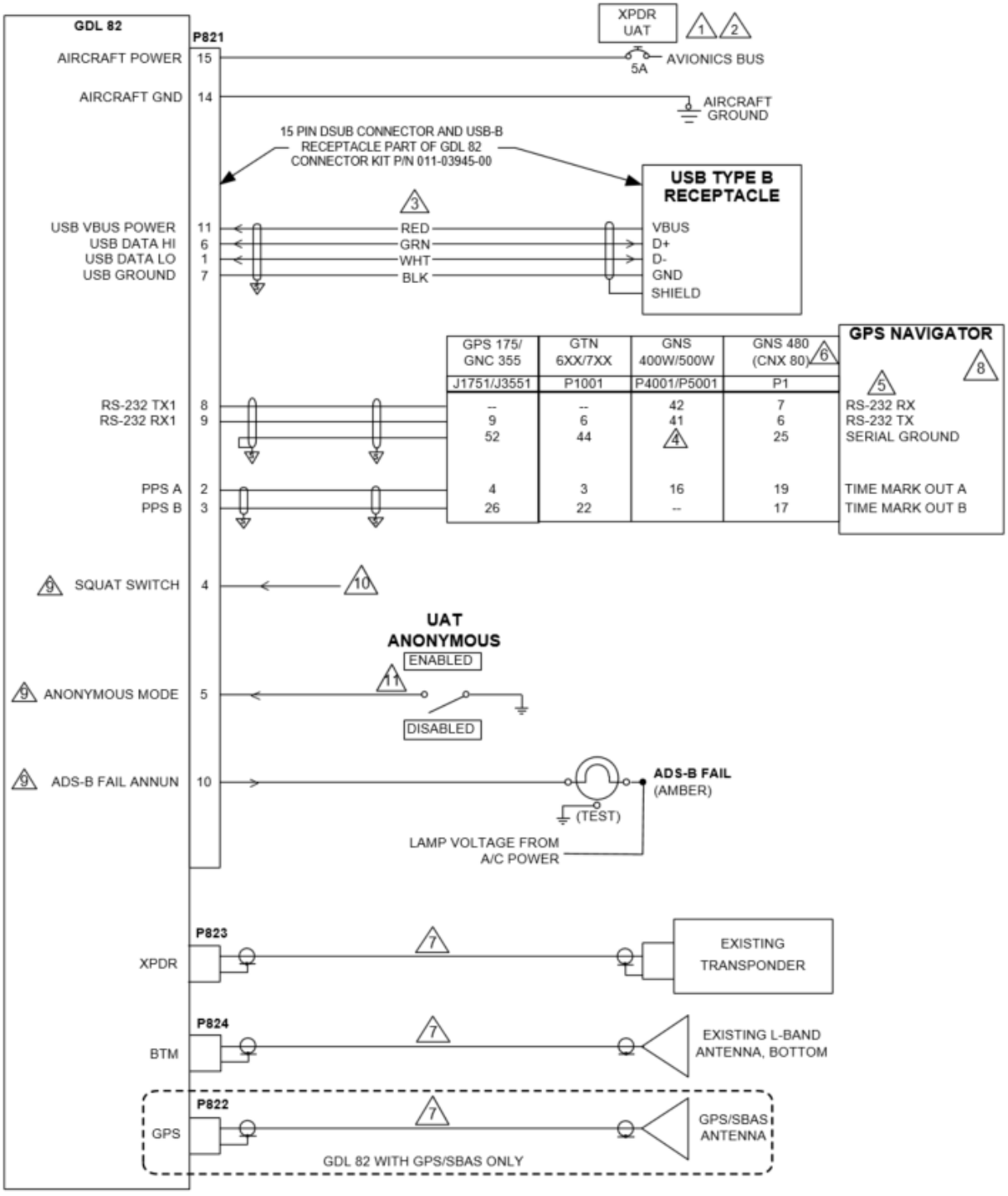
ITEM	PART NUMBER	QTY	DESCRIPTION
1 [1]	M27500-24-2	A/R	CABLE, POWER, ELECTRICAL, SHIELDED AND UNSHIELDED, MIL-DTL-27500, 2-CORE
2 [1]	M27500-24-3	A/R	CABLE, POWER, ELECTRICAL, SHIELDED AND UNSHIELDED, MIL-DTL-27500, 3-CORE
3 [2]	M22759/16-10-9	A/R	WIRE, ELECTRICAL FLUOROPOLYMER, INSULATED, COPPER OR COPPER ALLOY, MIL-W-22759
4 [3]	M17/128-RG400	A/R	CABLE, COAXIAL, RG-400
5	112514	2	CONNECTOR, BNC, DUAL CRIMP, MALE
6	31-4452	1	CONNECTOR, TNC, DUAL CRIMP, MALE
7 [4]	330-00067-00	(1)	GPS NOTCH FILTER, TELEGARTNER INC (J01006B0017)
8 [1]	M83519/2-X	(4)	SHIELD TERMINATOR, CONDUCTOR SOLDER SLEEVE

[1] ONLY REQUIRED IF USING EXTERNAL GPS SOURCE. All Cable is MIL-C-27500 24 AWG, or larger, utilizing M22759/18 wire (TG) and ETFE Jacket (14), Shield coverage 85% or higher (A or -) and shield material tin plated copper round (T), unless otherwise noted. (Reference Section 1.2 for approved external GPS sources and Section 4.4.1 and 4.4.2 for Cable Bundle Termination and Backshell Assembly guidance.)

[2] All wire is MIL-W-22759/16 22 AWG, or larger, unless otherwise noted.

[3] Other types of coaxial cable that meet the minimum performance specifications in Section 3.4, can be used.

[4] Only required if GPS post-install checkout reveals unsatisfactory interference, see Section 3.4.2.



NOTES

1. CIRCUIT BREAKER MUST BE LABELED AS SHOWN, DIRECTLY ADJACENT TO THE CIRCUIT BREAKER. THE CIRCUIT BREAKER MUST BE READILY ACCESSIBLE TO THE PILOT. SEE SECTION 4.2 FOR CIRCUIT BREAKER INSTALLATION.
2. USB TYPE B RECEPTACLE PIGTAIL (P/N 011-01782-00) MUST BE WIRED DIRECTLY TO P821 TO MINIMIZE LIGHTNING EXPOSURE. LABEL AND PLACE IN ACCESSIBLE LOCATION.
3. THERE IS NO NEED FOR THE GROUND WIRE BETWEEN THE GDL 82 AND GNS 400W/500W SERIES GPS SOURCE.

4. IF THE SPECIFIED RS-232 PORT ON THE GTN 6XX/7XX, GPS 175/GNC 355, OR GNS 400W/500W SERIES NAVIGATORS IS ALREADY USED FOR ANOTHER PURPOSE, ANY RS-232 PORT ON THESE NAVIGATORS MAY BE CONNECTED IN LIEU OF THE SPECIFIED PORT.

5. FOR THE GNS 480 (CNX80) THE SERIAL PORT (RS-232) CHANNEL 3 IS THE ONLY PORT THAT ALLOWS FOR THE ADS-B OUT+ FORMAT TO INTERFACE AS AN EXTERNAL GPS SOURCE TO THE GDL 82.

6. REFER TO SECTION 3.4 FOR L-BAND AND GPS ANTENNA COAXIAL CABLE SPECIFICATIONS.

7. EXTERNAL GPS SOURCE IS ONLY REQUIRED FOR GDL 82 UNITS NOT EQUIPPED WITH INTERNAL GPS AND/OR INTERFACED TO GPS ANTENNA.

8. OPTIONAL INSTALLATION: THESE SWITCH INPUTS MUST BE CONFIGURED IF INSTALLED. REFER TO SECTION 5.2 FOR CONFIGURATION SETTINGS.

9. THE SQUAT SWITCH INPUT CAN BE USED TO CONTROL AIR/GROUND STATUS. AN AIRSPEED GEAR SAFE SWITCH COULD BE USED INSTEAD OF A WEIGHT ON WHEELS OR SQUAT SWITCH IF AVAILABLE.

10. THE ANONYMOUS MODE SWITCH MAY BE USED TO CONTROL THE GDL 82 ANONYMITY FEATURE. THE SWITCH MUST BE LABELED AS SHOWN DIRECTLY ADJACENT TO THE SWITCH. SEE SECTION 4.3 FOR ANONYMOUS MODE SWITCH INSTALLATION.

11. THE ADS-B OUT FAIL ANNUNCIATOR MAY BE USED TO INDICATE A FAILURE IN THE ADS-B OUT TRANSMISSION. THE ANNUNCIATOR MUST BE LABELED AS SHOWN DIRECTLY ADJACENT TO THE ANNUNCIATOR. SEE SECTION 4.3 FOR ADS-B OUT FAIL ANNUNCIATOR INSTALLATION.

Figure 4-7: GDL 82 Wiring Interconnect

4.4.1 Shielded Cable Preparation

1. At the end of the shielded cable, strip back 1.5 inch maximum length of the jacket to expose the braid.
2. Remove the exposed braid.
3. Score the jacket 1/4 inches to 5/16 inches from the end and remove the jacket to leave the braid exposed.
4. Connected a 20 or 22 AWG wire to the exposed braid of the prepared cable using one of the below methods. For termination techniques, refer to AC 43.13.

   PREFERED METHOD

   Slide a solder sleeve (1) onto the prepared cable and shrink using heat gun. The chosen size of solder sleeve must accommodate the number of conductors present in the cable assembly. Refer to Table 4-2 for materials; use M83519/2-2 for 2-conductor and M83519/2-3 for 3-conductor solder sleeve. Solder sleeves with preinstalled leads are acceptable.

   ALTERNATE METHOD

   Solder an insulated (20-22AWG; 3 inch maximum length) wire (2) to the exposed braid of the prepared cable. Slide a piece of shrink tube (1) onto the prepared cable and shrink using a heat gun. The chosen size of shrink tube must accommodate the number of conductors present in the cable.

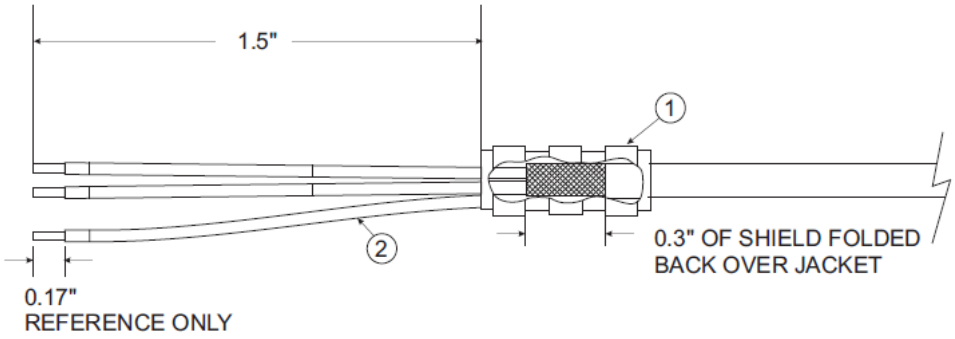


Figure 4-8: Shield Termination

5. Repeat steps 1 through 4 as needed for the remaining shielded cables.

4.4.2 Backshell Assembly

CAUTION

Place the smooth side of the strain relief clamp across the cable bundle. The concave side against the cable bundle will damage wires.

- Each tapped hole on the backshell may accommodate up to two ring terminals.
- Each ring terminal may accommodate up to three wires, but two wires are preferred.
- For two wires, use a 14-16 AWG, #8 insulated ring terminal (MS25036-153)
- For single wires, use a 18-22 AWG, #8 insulated ring terminal (MS25036-149)

1. Wrap the cable bundle with silicone fusion tape (not included) where the strain relief clamps the bundle.
2. Place the connector (6) edge inside of the backshell groove (5).
3. Place the smooth side of the backshell strain relief clamp (4) across the cable bundle and secure using two 4-4-40 x 0.375 panhead screws (3).
4. Attach the backshell cover (2) to the backshell using the supplied screws (1).
5. Install a ring terminal onto the cable shield drains, grouping wires as appropriate for the connector.
6. Place the following items (not included) on the 8-32 x 0.312 panhead shield terminal screw in the order they are presented.
   a. Split washer – MS35338-137, #8, (0.045" compressed thickness)
   b. Flat washer – NAS 1149CN832R or NAS 1149FN832P, #8, 0.032" thick, 0.174" ID, 0.327" OD, stainless or cad-plated steel
   c. First ring terminal – MS25036-149, #8, insulated, 10-22AWG, 14-16 AWG, 12-10 AWG
   d. Second ring terminal (if needed)
7. Insert the panhead shield terminal screw into the tapped holes on the shield block.

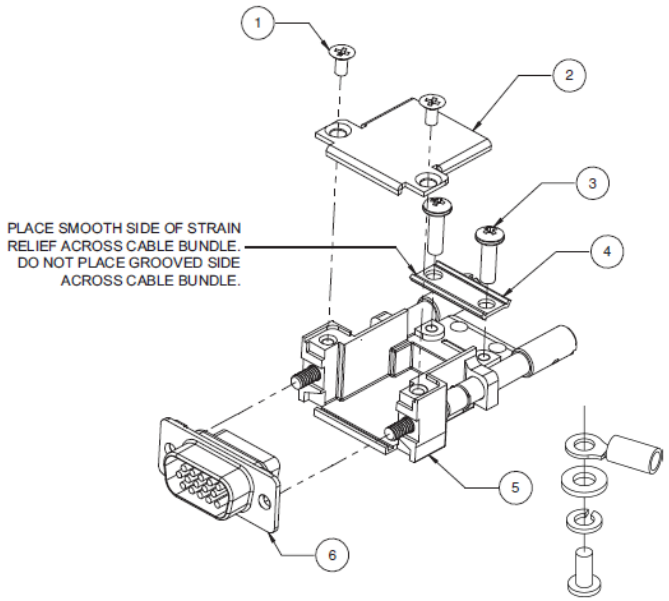


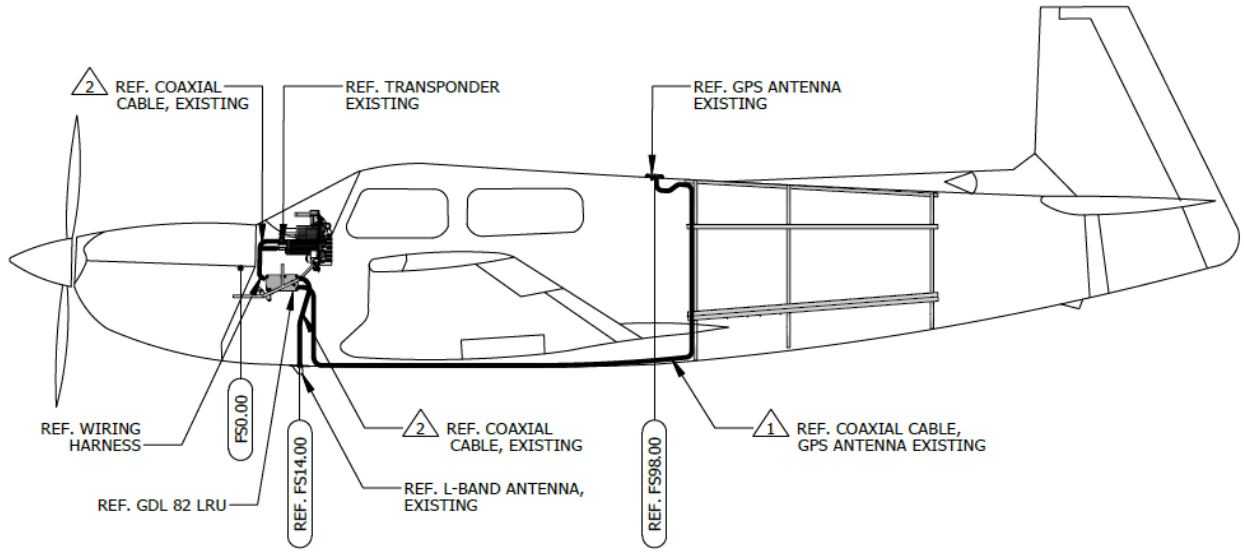
Figure 4-9: Jackscrew Backshell Assembly

4.4.3 Wiring Harness Routing

Route wire harness from the 15 pin D-sub (J821) on the GDL 82 unit to existing aircraft wire harness. Breakout the USB dongle cable wiring and secure near the GDL 82 unit. Continue routing wiring along existing harness to instrument panel/CB console. Terminate all wiring as shown in wiring diagram (Figure 4-7).

If the existing coaxial cable meets the minimum requirements in Section 3.4, then no change is required in coaxial cable routing. If new coaxial cable is required:

1. Route coaxial cable from XPDR (J823) connection on the GDL 82 unit to existing A/C wire harness, using existing clamping stations, to the existing transponder.
2. Route coaxial cable from ANT (J824) connection on the GDL 82 unit to existing A/C wire harness, using existing clamping stations, to the existing L-band antenna.
3. If required, route GPS coaxial cable from the GPS (J822) connection on the GDL 82 unit to the GPS antenna in accordance with the specifications in Section 3.4.2.

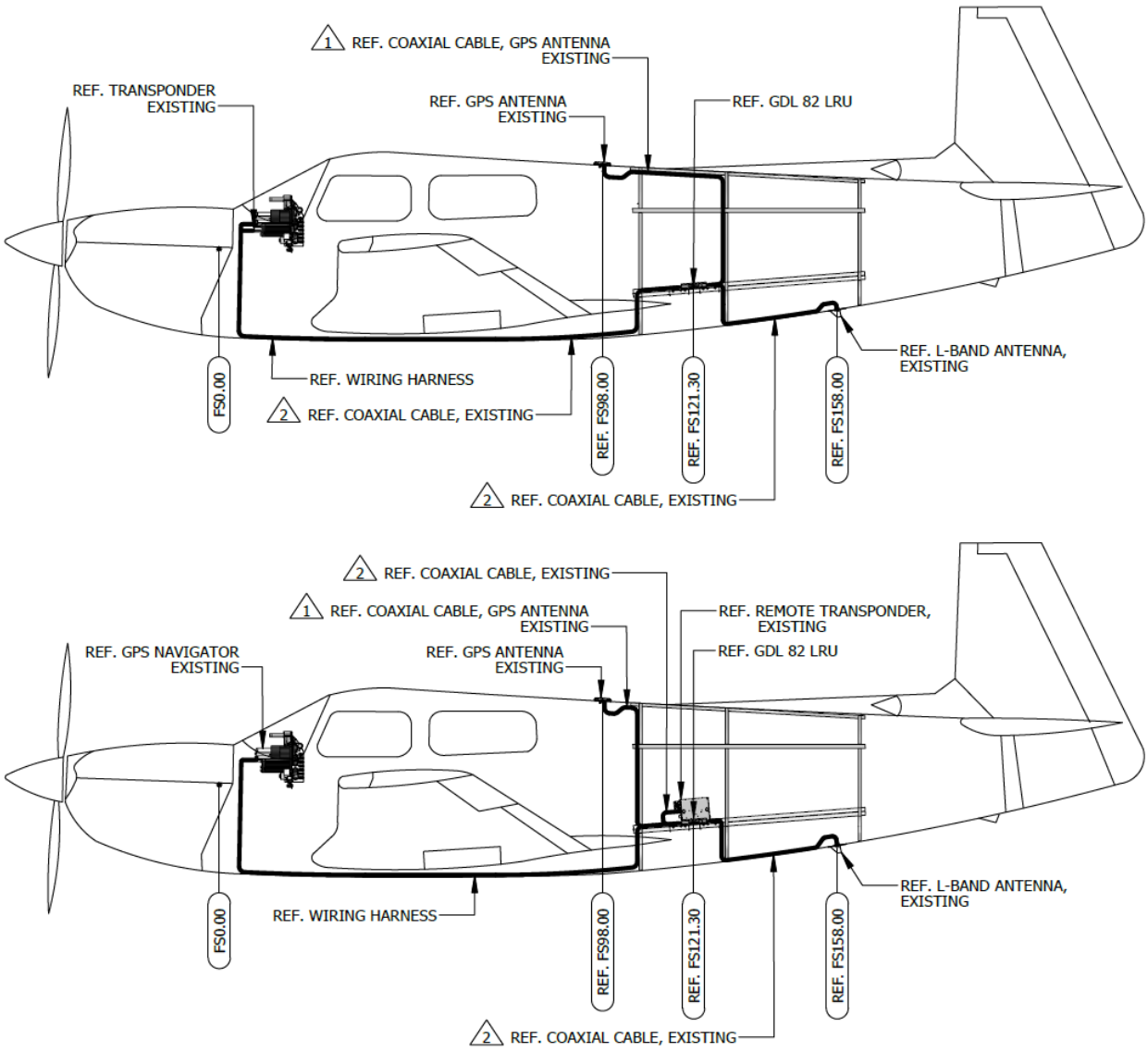


NOTES

1. THE DIRECT CONNECTION TO A GPS ANTENNA IS ONLY AVAILABLE WITH THE GDL 82 WITH INTERNAL GPS. GPS SOURCE DATA CAN ALSO BE PROVIDED VIA RS-232 FROM AN APPROVED EXISTING GARMIN NAVIGATOR. SEE SECTION 1.2 FOR APPROVED EXTERNAL GPS SOURCES.

2. EXISTING TRANSPONDER TRANSMISSION COAXIAL CABLE NEEDS TO BE MODIFIED TO ALLOW FOR INSTALLATION OF THE GDL 82 UNIT IN SERIES BETWEEN THE EXISTING TRANSONDER AND THE L-BAND ANTENNA. SEE SECTION 3.4 FOR COAXIAL CABLE SPECIFICATIONS.

Figure 4-10: Option 1 Wire Harness Routing Example



NOTES

1. THE DIRECT CONNECTION TO A GPS ANTENNA IS ONLY AVAILABLE WITH THE GDL 82 WITH INTERNAL GPS. GPS SOURCE DATA CAN ALSO BE PROVIDED VIA RS-232 FROM AN APPROVED EXISTING GARMIN NAVIGATOR. SEE SECTION 1.2 FOR APPROVED EXTERNAL GPS SOURCES.

2. EXISTING TRANSPONDER TRANSMISSION COAXIAL CABLE NEEDS TO BE MODIFIED TO ALLOW FOR INSTALLATION OF THE GDL 82 UNIT IN SERIES BETWEEN THE EXISTING TRANSONDER AND THE L-BAND ANTENNA. SEE SECTION 3.4 FOR COAXIAL CABLE SPECIFICATIONS.

Figure 4-11: Options 2 and 3 Wire Harness Routing Example

5 SYSTEM CONFIGURATION AND CHECKOUT

This section contains instructions for configuration and checkout of the GDL 82 system after installation. The following steps are required to configure and verify the system is properly installed and functioning correctly:

1. Perform Mounting, Wiring & Power Checks (see section 5.1)
2. Configure the GDL 82 (see Section 5.2)
3. Perform post-installation checkout (see Section 5.3 and 5.4)
4. Complete installation documentation (see Section 6)

5.1 Mounting, Wiring and Power Checks

CAUTION

Check the movement of the flight and engine controls to verify the wire harness is not touching any moving parts.

CAUTION

Verify all wire harnesses are properly secured and shields are connected to the shield blocks of the connectors.

Before powering up the GDL 82, the wire harnesses must be checked for proper connections to the aircraft systems and other avionics. Point-to-point continuity must be checked to verify the connections are in accordance with the interconnect diagrams. Any faults or discrepancies (such as shorting to ground) must be corrected before proceeding.

After accomplishing a continuity check, perform power and ground checks to make sure there is proper power distribution to the GDL 82. Once continuity and power checks are complete, power should be disconnected from the aircraft.

The GDL 82 unit can be installed after completion of the continuity and power checks. The GDL 82 should be installed and secured in a similar fashion as shown in Figure 4-1 and Figure 4-3.

5.2 GDL 82 Configuration

The procedures detailed in this section verify the approved software and configuration settings for the proper operation of the GDL 82. The person performing these checks should be familiar with the aircraft, have a working knowledge of typical avionics systems, and experience using the required test equipment.

NOTE

Calibration of all test equipment must be current . See Section 3.2 for recommended test equipment.

NOTE

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

NOTE

For GDL 82 operational instructions, see 190-01810-13, GDL 82 Pilot Quick Start Guide.

Configuration procedures detailed in this section require the GDL 82 unit to be in configuration mode. This is accomplished by connecting the GDL 82 unit to the PC, applying power to the GDL 82 and activating the GDL 8X Install Tool on the PC. Connection to a PC requires a cable (not provided) with USB-A and USB-B plugs.

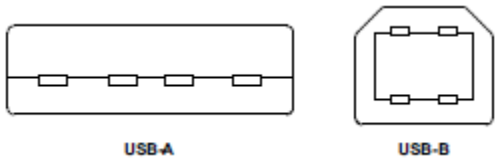


Figure 5-1: USB-A and USB-B Connectors

NOTE

When the GDL 82 unit is connected to the PC (via USB) and the GDL 8X Install Tool is active, the GDL 82 will automatically be placed in Configuration Mode. To reset the GDL 82 into Normal Mode, power down the unit, disconnect it from the USB and reapply power to the GDL 82.

The GDL 82 PC Install Tool is used to configure system settings, perform diagnostics and upload GDL 82 software. Refer to the GDL 82 TSO Installation Manual (Garmin document 190-01810-00) for instructions on installation and use of the GDL 8X Install Tool (Garmin P/N 006-A0248-20).

To use the GDL 8X Install Tool:

1. Power off the GDL 82 unit.
2. Connect the USB-A to USB-B cable between the PC and the USB-B receptacle installed in the aircraft wire harness.
3. Power on the GDL 82 unit.
4. Launch the GDL 8X Install Tool; the install tool will prompt the user to select the *type of unit to configure*; select the **GDL 82**.

5.2.1 Verify Software Version

Before configuring the GDL 82, verify that the current version of software on the GDL 82 unit matches the software version identified in the Table 3-1.

1. In the GDL 8X Install Tool, go to the **Diagnostics / Unit Information** page. Reference the **Software / Version** and **Software / Part Number**.
2. Verify that the software version listed in Table 3-1 is installed on the GDL 82 unit.
3. If necessary, reference the *GDL 82 TSO Installation Manual*, 190-01810-00, for instructions on acquiring the GDL 82 software and loading software to the GDL 82.

NOTE

If the GDL 82 unit/install tool reports the same software P/N and version as indicated in Table 3-1, *no further action is required to update or load software.*

5.2.2 Configuration Settings

The **Configuration / System** page displays configuration data and allows the installer to change the installation configuration. Once the configuration options are selected, power-cycle the GDL 82 unit to apply the settings. The configuration settings can be saved to a plain text file for logging purposes by selecting the *Save Configuration To File* button.

Go to the **Configuration / System** page in the GDL 8X Install Tool and apply the settings listed in Table 5-1.

Table 5-1: GDL 82 Configuration Settings

ITEM	CONFIGURATION	NOTES
Aircraft		
Tail Number: [1]	Enter Aircraft Tail Number	This is the US registration number (N-number).
ICAO Address: [1]	HEX	Sets the ICAO address in octal or hex format. Verify value with aircraft registration records.
	OCTAL	
Emitter Category:	Light	Only approved setting under this STC. For aircraft with a maximum gross weight less than 15,500 lbs.
Light Category Stall Speed: [2]	30 – 100 (Knots)	Stall speed is used in the air/ground determination. Select closest option.
Squat Switch:	Not Installed	This input determines the on-ground status of the aircraft (i.e., airborne/on-ground switch).
	GND (0V) = On Ground	
	GND (0V) = Airborne	
Transponder		
VFR Squawk Code:	1200	Only approved setting under this STC.
GPS		
Source:	Internal	Select if GDL 82 with GPS/SBAS is used.
	GNS Series	Select if external GPS source (via RS-232) is a GNS 400W/500W Series Navigator.
	ADS-B+ Format 2	Select if external GPS source (via RS-232) is a GTN 6XX/7XX, GNS 480, GPS 175, or GNC 355.
Lon Antenna Offset:	1 – 50 (Feet from nose)	Installer must measure to determine an accurate GPS (longitudinal) Antenna Offset from the nose of the aircraft.
ADS-B		
Anonymous Mode Switch: [3]	Not Installed	Select if optional switch is installed and connected to discrete.
	Installed	
1090 ES Receive Capable:	Capable	Select Capable if there is an ADS-B IN receiver in the aircraft, such as a GDL 39() or GDL 51/52.
	Not Capable	
UAT Receive Capable:	Capable	

	Not Capable	

[1] If the tail number is recognized as a US registered tail number, the ICAO address can be automatically filled by the GDL 82 by selecting the *Compute ICAO* button. It must be verified against the aircraft registration records.

[2] Use the aircraft landing configuration stall speed (Vs0) as specified in the aircraft pilot operating handbook (POH) or aircraft approved flight manual supplement (AFMS).

[3] The discrete input/output are active-low that are grounded when active/set and open when inactive/clear.

5.2.3 External GPS Source Configuration

The GDL 82 can be interfaced to a Garmin GTN 6XX/7XX series navigator, GNS 400W/500W series navigator, or GNS 480 navigator as an external GPS sources. GPS navigators interfaced to GDL 82 provide GPS PVT data via RS-232. Required navigator software version and configuration setting are shown in Table 5-2. Interfacing a GDL 82 to a navigator other than that listed in Table 5-2 requires separate airworthiness approval. For the Garmin GPS navigators, the GPS/WAAS engine software must be 5.0 (or later) to meet the ADS-B Out position source requirements specified in 14 CFR 91.227.

Table 5-2: External GPS Source Configuration Settings

ITEM	CONFIGURATION	NOTES
GTN 6XX/7XX		
RS-232 Configuration / Output / RS-232 1 – 6	ADS-B+ Format 2	SW version 6.41 (or later)
GNS 4XXW/5XXW		
MAIN RS232 CONFIG / OUTPUT / CHNL 1 – 5	ADSB TFC	SW version 5.30 (or later)
GNS 480		
SERIAL SETUP CH 3	TX: ADS-B OUT+ BAUD: 38400	SW version 2.4 (or later)
GPS 175		
RS-232 Configuration / Output / RS-232 1 – 2	ADS-B+ Format 2	SW version 2.01 (or later)
GNC 355		
RS-232 Configuration / Output / RS-232 1 – 2	ADS-B+ Format 2	SW version 3.02 (or later)

To configure the **GTN 6XX/7XX**:

1. Push and hold the HOME key of the GTN 6XX/7XX unit.
2. Power on the GTN 6XX/7XX unit.
3. Release the HOME key when the display shows.
4. Select the GTN Setup page.
5. Select the RS-232 page.
6. Configure the RS-232 Port that is interfaced to the GDL 82 as specified in Table 5-2.

To configure the **GNS 400W/500W** Series Navigators:

1. Push and hold the ENT key of the GNS 400W/500W Series unit.
2. Power on the GNS 400W/500W Series unit.
3. Release the ENT key when the display activates.
4. While in configuration mode, rotate the small right knob to select pages.

To change data on the configuration page:

1. Push the small right knob to select the cursor.
2. Rotate the large right knob to move between data fields.
3. Rotate the small right knob to change a highlighted field.
4. Push the ENT key to accept the entry.
5. Configure the RS-232 Port that is interfaced to the GDL 82 as specified in Table 5-2.

To configure the **GPS 175/GNC 355**:

1. Push and hold down the inner knob located at the bottom-right of the GPS 175/GNC 355 unit, then press the Power/Home Button
2. Release the inner knob when the display activates.
3. Select the Setup page.
4. Select the Interfaces page
5. Select the RS-232 page.
6. Configure the RS-232 Port that is interfaced to the GDL 82 as specified in Table 5-2.

To configure the **GNS 480**:

1. Power on the GNS 480 unit.
2. Push, in sequence, line select key 1, line select key 4, and the MENU/ENTER key to enter Ground Maintenance mode.
3. From the SETUP page, select SERIAL PORTS.
4. Configure the Serial (RS-232) Port Channel 3 as specified in Table 5-2.

NOTE

The GNS 480 Serial Port Channel 3 is the only port that provides the ADS-B OUT+ format for an external GPS source to the GDL 82.

5.3 Ground Checks (Configuration Mode)

Each installation of the GDL 82 must be checked by performing the following procedures:

- GDL 82 System Faults
- Internal GPS Receiver
- External GPS Source
- Transponder (ADS-B) Interface
- Discrete Input and Output

5.3.1 GDL 82 System Faults

Diagnostics / Faults and **Diagnostics / ADS-B** pages in the GDL 8X Install Tool can be used to check that the GDL 82 is receiving data from the interfacing system(s).

Any annunciated failures on the **Faults** page should be corrected prior to proceeding with the ground checks. The *Configuration Fault* will activate if the GDL 82 system configuration was not set properly. See Table 5-1 for proper GDL 82 configuration settings.

Refer to the *Instructions for Continued Airworthiness & Maintenance Manual, GDL 82 Mooney M20() Series STC* (Garmin document 190-01810-11), for troubleshooting, if needed.

5.3.2 Internal GPS/SBAS Receiver

The GPS checkouts described in this section are applicable for installations of the GDL 82 unit with internal GPS/SBAS receiver (Garmin P/N 011-03946-40). GDL 82 and transponder should be powered on while all other avionics be turned off at the start of this test.

NOTE

After initial installation, the initial acquisition of GPS position can take up to 20 minutes. Subsequent acquisitions should not take as long.

NOTE

A VHF COM interference check must be completed on all GDL 82 with GPS/SBAS installations.

Go to the **Diagnostics / GPS** page in the GDL 8X Install Tool and verify the following:

- Source: Internal (green)
- Time Mark: Active (green)
- Interface Status: Receiving (green)
- Nav Status: 3D Fix or 3D Diff Fix (green)

If the unit is unable to acquire satellites, move the aircraft away from obstructions which might be shading GPS reception. If the GPS solution does not improve, check the GPS antenna installation.

Special care should be taken to ensure there is no interference with the GDL 82 system that is installed in the aircraft equipped with non-aviation radios. If interference is found, it may be addressed by relocating the antennas, rerouting cables, using filters to attenuate unintentional harmonic frequency transmissions, or using various other techniques for elimination of the interference. It may be necessary to remove or replace the interfering radio with a model that does not interfere with the proper functioning of the GDL 82.

Once GPS position information is available, perform the following steps:

1. On the **Diagnostics / GPS** page, verify the Latitude and Longitude with a known reference position.
2. While monitoring the GPS page, turn on other avionics one at a time and check the "Nav Status," and ensure a *3D Fix* or *3D Diff Fix* is maintained.
3. Select 121.150 MHz on the COM transceiver and transmit for a period of 35 seconds.
4. Verify that Nav Status remains 3D Fix or 3D Diff Fix.
5. Repeat steps 3 and 4 for the following frequencies:

   - 121.170 MHz
   - 121.200 MHz
   - 121.220 MHz
   - 121.250 MHz
   - 131.200 MHz
   - 131.220 MHz
   - 131.250 MHz
   - 131.270 MHz
   - 131.300 MHz
   - 131.320 MHz
   - 131.350 MHz

6. For VHF radios with 8.33 KHz channel spacing, in addition to frequencies in step 5, include the following frequencies:

- 121.185 MHz
- 121.190 MHz
- 130.285 MHz
- 131.290 MHz

7. Repeat steps 3 through 6 for all remaining COM transceivers in the aircraft.
8. If the aircraft is SATCOM-equipped, use the SATCOM system and verify the GPS remains valid.

5.3.3 External GPS Source

The GPS checkouts described in this section are applicable to installations with external GPS source providing position information. The GDL 82 can only receive GPS data from one source. If the following steps do not perform correctly, check the electrical connections on Figure 4-7 and the GDL 82 and GPS Source configuration settings in Table 5-1 and Table 5-2.

Allow the external GPS source to acquire a position fix. In the GDL 8X Install Tool, go to the **Diagnostics / GPS** page, verify the following:

- Source: External (green)
- Time Mark: Active (green)
- Interface Status: Receiving (green)
- Nav Status: 3D Fix or 3D Diff Fix (green)

5.3.4 Transponder (ADS-B) Interface

Perform the following steps to verify the GDL 82 receives the correct transponder information:

1. In the GDL 8X Install Tool, go to **Diagnostics / ADS-B** page.
2. Select ON or ALT mode on the transponder.
3. Verify that the **Interface Status** field indicates *Receiving*.
4. Verify that the **Mode** field indicates the same as the active transponder (e.g., ON or ALT).
5. Verify that the **Pressure Altitude** field agrees with the active altitude source.
6. Verify the selected **Squawk Code** agrees with the active transponder.
7. Activate the IDENT function on the transponder and verify the **IDENT Status** changes from inactive to active.
8. If the transponder is not already in ALT mode, switch it to ALT mode.
9. Verify the following in the UAT section:
    a. **Address** matches the ICAO address of the registration certificate of the aircraft.
    b. **Flight ID** is the correct N-number of the aircraft.
    c. **Air/Ground Status** indicates *On Ground*.

Verify the electrical connections in Figure 4-7 and configuration settings in Table 5-1 and Table 5-2 if the check does not perform correctly.

5.3.5 Discrete Inputs and Output

Discrete input and output checks verify that optional external switches and/or annunciator are correctly interfaced to the GDL 82. Wiring should be verified to ensure there is no ground shorted if the check does not perform correctly.

The GDL 8X Install Tool's **Diagnostics / Discretes** page displays the status of the two discrete inputs and single output. The state of the discrete output may be selected for checking the failure annunciator.

1. If the Airspeed Gear Switch (i.e., Squat Switch for air/ground determination) is installed, verify the **Squat Switch** indicates *Active – GND (0V)* when the switch provides a ground signal, and *Inactive - Open* when the switch provides an open signal.
2. If an Anonymous Mode switch is installed, verify the **Anonymous Mode Switch** discrete indicates *Active - GND (0V)* when the switch is in the ENABLED position and *Inactive – Open* when the switch is in the DISABLED position.
3. If an ADS-B Failure Annunciator is installed and connected to the GDL 82, deselect the **Failure Annunciation** discrete (corresponding box is not checked and displays *Inactive - Open*), and verify the annunciator indicates no failure (lamp is extinguished).
4. Select the **Failure Annunciation** discrete to active (corresponding box is checked and displays *Active – GND (0V)*), and verify the annunciator indicates an ADS-B OUT FAIL (lamp is illuminated).
5. Deselect the **Failure Annunciation** discrete (corresponding box is not checked and displays *Inactive*).

5.4 Ground Checks (Normal Mode)

Each installation of the GDL 82 must be checked by performing the following procedures:

- Regulatory Test
- ADS-B Out Test
- EMC Check

NOTE

The GDL 82 must be disconnected from the GDL 8X Install Tool and USB to be in Normal Mode and continue with the regulatory and ADS-B Out ground check procedures.

NOTE

It may take the GPS source several minutes to acquire a GPS signal.

If the optional ADS-B OUT FAIL annunciator was installed, verify that no failure indication is present, with all avionics powered on including the GDL 82, in normal mode. Operate the test function of each annunciator lamp and verify the annunciator illuminates.

5.4.1 Regulatory Test

Regulatory ATC Transponder Tests and Inspections are required in accordance with 14 CFR Part 91.413 and Part 43 Appendix F. Aircraft transponder and GDL 82 must operate in normal mode during the test.

The test requires the use of a Mode A/C transponder ramp tester such as an Aeroflex IFR-6000 or TIC TR-220.

5.4.2 ADS-B Out Test

The ADS-B Out test procedures require the use of an ADS-B Out ramp tester such as an Aeroflex IFR-6000 or GDL 39(R/3D)/52 combined with the Garmin Pilot Application on an iOS device. The aircraft must be located where a GPS signal is receivable (e.g., outdoors with a clear unobstructed view of the sky).

1. Power on the aircraft/avionics.
2. Ensure the GPS source has acquired a position.
3. Ensure the transponder is in ALT mode.
4. Using the ADS-B test set, verify the following ADS-B Out parameters are transmitted:
    a. Aircraft emitter category is Light Airplane (< 15,000 lbs).
    b. Aircraft is transmitting *On-Ground* status.
    c. Aircraft Length & Width code is **1**. [1]
    d. NACv ≥ 1
    e. SDA ≥ 2
    f. SIL ≥ 3
    g. NACp ≥ 8
    h. NIC ≥ 7
5. Verify the ADS-B Out parameter for Pressure Altitude is transmitted.

[1] An aircraft length/width code of '1' corresponds to aircraft length ≤ 15m and width ≤ 23m.

5.4.3 Electromagnetic Compatibility (EMC) Check

An EMC check must be performed after all interfaces between GDL 82 and external equipment connected to it have been verified to function properly. The EMC check verifies the GDL 82 is not producing unacceptable interference to the other avionics systems, and other avionics systems are not producing unacceptable interference to the GDL 82. An example EMC Source/Victim matrix is shown in Figure 5-2.

NOTE

Removing power from systems interfaced to the GDL 82 may cause the ADS-B OUT FAIL annunciator to illuminate. This is normal behavior and does not constitute a test failure.

NOTE

Before applying power to the next system, wait for the current system start up sequence to finish.

For each installed avionics unit, verify that no Electromagnetic Interference (EMI) is present by observing operation of the other installed avionics equipment while the GDL 82 is powered on.

1. Make a list of equipment installed in the aircraft and prepare a form with each item listed in the Source row and Victim column, as shown in the example form in Figure 5-2.
2. Apply power to all systems except the Transponder and GDL 82 pair and verify they all function properly.
3. Connect a PC to the GDL 82 via USB.
4. Apply power to the Transponder/GDL 82 pair and launch the GDL 8X Install Tool.
5. Remove power from all other avionics systems.
6. One at a time, apply power and operate the systems listed in the installed equipment form.
7. Verify there are no active faults on the GDL 8X Install Tool **Diagnostics / Faults** page and each system functions properly.

For VHF COM Radios:

a. Monitor one local frequency, one remote (far field) frequency, and one unused frequency.
b. Verify no unintended squelch breaks or audio tones interfere with communications.

For VHF NAV Radios:

a. Monitor one local frequency, one remote (far field) frequency, and one unused frequency.
b. Verify there are no guidance errors.
c. Verify no audio tones interfere with the station ID.

8. Repeat steps 6 through 8 until every applicable system listed in the form has been checked.

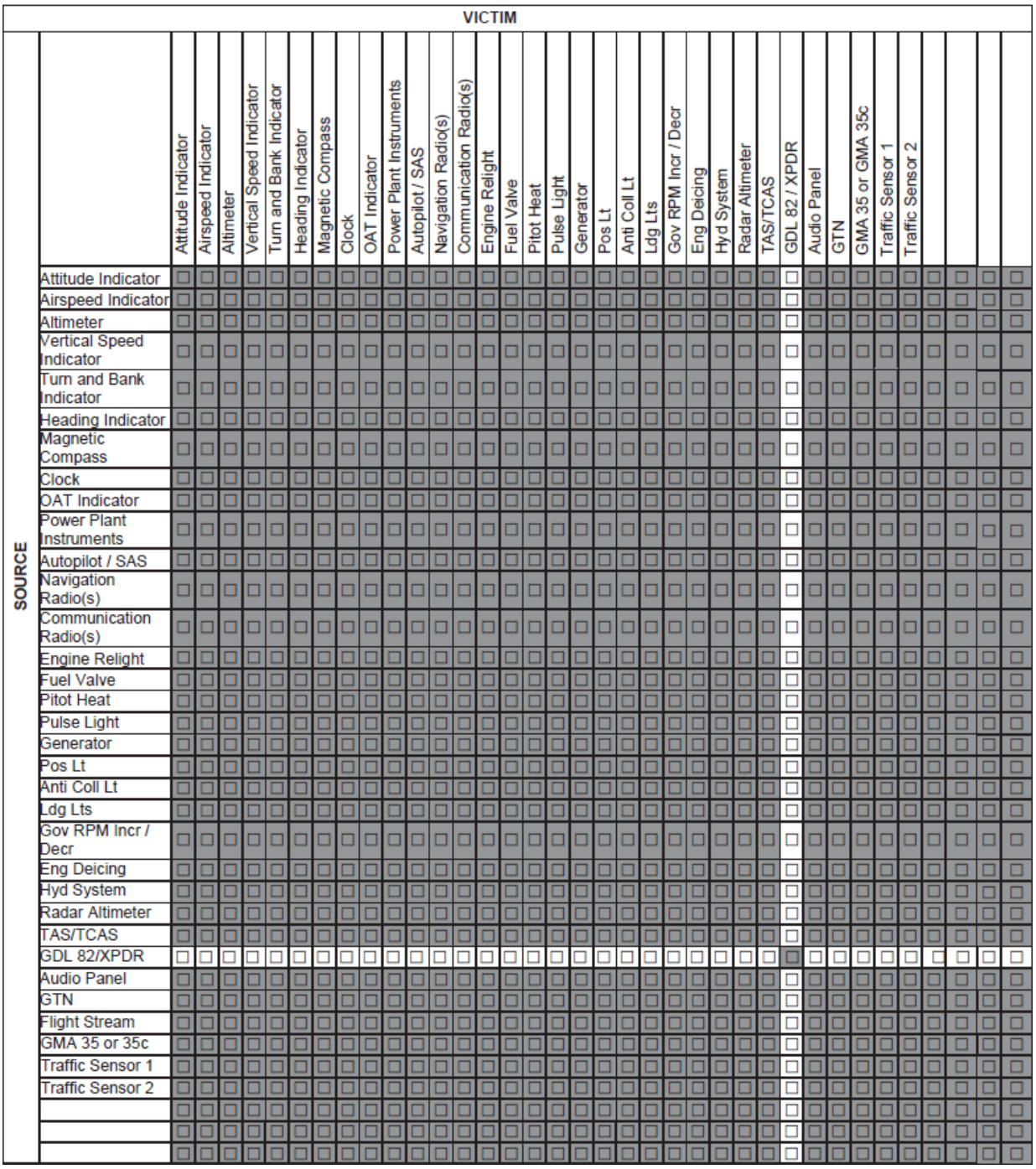


Figure 5-2: Example EMC Source / Victim Matrix

6 RETURN TO SERVICE

Aircraft return to service with GDL 82 system installed can be accomplished after the following aircraft documentation is updated:

- Instruction for Continued Airworthiness
- Aircraft Weight & Balance
- AFMS

6.1 Instructions for Continued Airworthiness (ICA)

Use checkout log sheet contained in Appendix A of the *Instructions for Continued Airworthiness & Maintenance Manual, GDL 82 Mooney M20() Series STC*, Garmin P/N 190-01810-11 to record aircraft information and system configuration settings, including the following:

1. Aircraft and GDL 82 unit information:
    a. Aircraft make
    b. Aircraft model
    c. Aircraft registration number
    d. Aircraft serial number
    e. GDL 82 part number
    f. GDL 82 serial number
    g. GDL 82 software version
    h. Fill in the configuration settings log (documented in Section 5.2.2)
2. Electrical load analysis (documented in Section 3.5).
3. List of equipment interfaced to the GDL 82.
4. Wire routing diagram documenting the actual location in the aircraft (diagram from the installation manual with marked-up detail of routing is acceptable).
5. Interconnect diagrams for GDL 82 and all interfaced equipment (interconnect diagrams from the installation manual with marked-up details of connections to installed equipment are acceptable).
6. GDL 82 Post Installation Checkout Log.

Completed STC ICA/MM log sheet must be retained with aircraft permanent records.

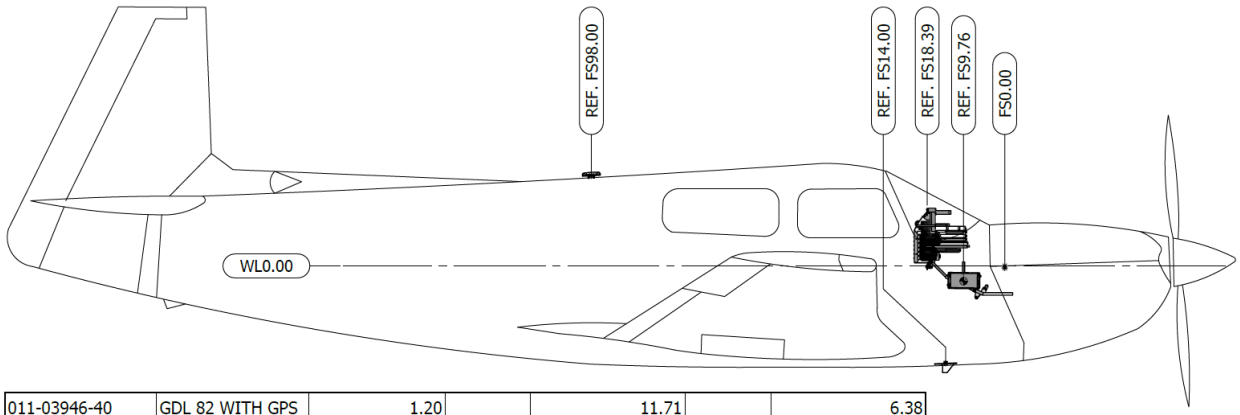
6.2 Aircraft Weight and Balance

Aircraft weight and balance must be updated after the installation of the GDL 82 is complete. Figure 6-1 lists the unit weight and example arm and moment values for the GDL 82 Option 1 installation example shown in Figure 3-1. Figure 6-2 shows the example arm and moment values for the GDL 82 Option 2 & 3 installation example shown in Figure 3-2 and Figure 3-3, respectively.

The arm and moments must be verified for every installation.

Aircraft weight and balance must be performed in accordance with the aircraft maintenance or flight manual procedures for leveling and weighing. The aircraft empty weight center of gravity (CG) with GDL 82 installed must be within type design limits, as specified in aircraft POH or AFM.

NOTE
Weights specified in Figure 6-1 *and* Figure 6-2 *include GDL 82 unit and connectors. Refer to* Table 1-4 *for basic dimensions of the unit.*



011-03946-40	GDL 82 WITH GPS	1.20	9.76	11.71	5.32	6.38
011-03946-00	GDL 82	0.98		9.56		5.21
PART NUMBER	**DESCRIPTION**	**WEIGHT [LBS]**	ARM [IN]	MOMENT [IN-LBS]	ARM [IN]	MOMENT [IN-LBS]
			③ **LONGITUDINAL**		④ **LATERAL**	

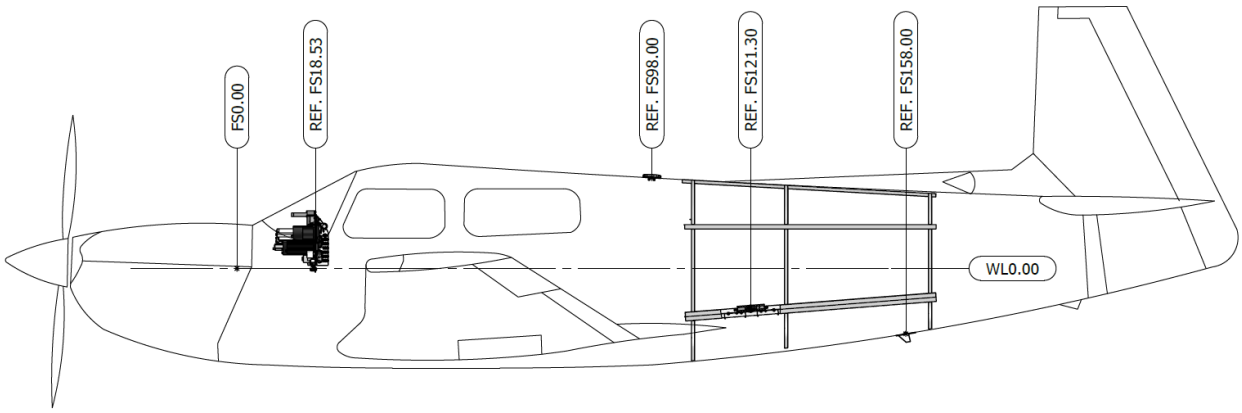
NOTES

1. DEPICTED FUSELAGE STATIONS AND BUTT LINES ARE FOR MODEL M20J AND ARE FOR REFERENCE ONLY. REFER TO TCDS 2A3 FOR FUSELAGE STATIONS ON OTHER M20() SERIES MODELS.
2. GDL 82 LOCATION IS MEASURED FROM THE UNIT CENTER OF GRAVITY.

③ THE LONGITUDINAL ARM IS THE FUSELAGE STATION (FS).

④ THE LATERAL ARM IS THE BUTT LINE (BL). AIRCRAFT CENTERLINE IS BL0.00. MOMENT ARM TO THE LEFT (WHEN LOOKING FORWARD) IS NEGATIVE (-), AND MOMENT ARM TO THE RIGHT (WHEN LOOKING FORWARD) IS POSITIVE (+).

Figure 6-1: Option 1 Weight & Balance Example



011-03946-40	GDL 82 WITH GPS	1.20	121.30	145.56	⑤	⑤
011-03946-00	GDL 82	0.98		118.87		
PART NUMBER	**DESCRIPTION**	**WEIGHT [LBS]**	ARM [IN]	MOMENT [IN-LBS]	ARM [IN]	MOMENT [IN-LBS]
			③ **LONGITUDINAL**		④ **LATERAL**	

NOTES

1. DEPICTED FUSELAGE STATIONS AND BUTT LINES ARE FOR MODEL M20J AND ARE FOR REFERENCE ONLY. REFER TO TCDS 2A3 FOR FUSELAGE STATIONS ON OTHER M20() SERIES MODELS.
2. GDL 82 LOCATION IS MEASURED FROM THE UNIT CENTER OF GRAVITY.

③ THE LONGITUDINAL ARM IS THE FUSELAGE STATION (FS).

④ THE LATERAL ARM IS THE BUTT LINE (BL). AIRCRAFT CENTERLINE IS BL0.00. MOMENT ARM TO THE LEFT (WHEN LOOKING FORWARD) IS NEGATIVE (-), AND MOMENT ARM TO THE RIGHT (WHEN LOOKING FORWARD) IS POSITIVE (+).

⑤ GDL 82 INSTALLED ON THE EXISTING ELECTRICAL EQUIPMENT RACK ASSEMBLY CAN BE LOCATED WITH LATERAL ARM WITHIN ±13.50 INCHES FROM BL0.00. ACTUAL LOCATION IS DETERMINED BY EQUIPMENT ALREADY INSTALLED ON THE RACK.

Figure 6-2: Option 2 & 3 Weight and Balance Example

6.3 Airplane Flight Manual Supplement (AFMS)

The Airplane Flight Manual Supplement (AFMS) must be completed and inserted in the Airplane Flight Manual (AFM) or Pilot's Operating Handbook (POH), along with any operating limitations of the aircraft.

Section 1.4 of the *Airplane Flight Manual Supplement for the Garmin GDL 82 Mooney M20 Series*, 190-01810-12, is intended to specify the installation configuration for the GDL 82 system. It is the responsibility of the installer to mark in the appropriate boxes in the AFMS with indelible ink using the following information for guidance.

1. Fill in the required airplane information in the AFMS.
2. Fill in the appropriate check boxes in the Installation Configuration section of the AFMS as described below:
    a. Equipment Installed:
        i. [1] GDL 82 (external GPS/SBAS source required) [Garmin P/N: 011-03946-00]

        OR

        ii. [2] GDL 82 w/ Internal GPS/SBAS [Garmin P/N: 011-03946-40]

        AND

        iii. Fill in the Make & Model of the companion Mode A/C transponder.
    b. Interfaced GPS/SBAS Position Source:
        i. [1] Internal

        OR

        ii. [2] GTN 6XX/7XX
        iii. [3] GNS 400W/500W Series
        iv. [4] GNS 480
        v. [5] GPS 175/GNC 355
3. Fill in the appropriate check boxes in the Limitations Section of the AFMS corresponding to the maximum aircraft operating altitude and Anonymous Mode Switch Installation:
    a. Aircraft Operational Ceiling:
        i. [1] 18,000 feet (UAT Operating Altitude Limit per AC 20-165B)

        OR

        ii. [2] 15,000 feet (Class B Transponder Equipment Operating Altitude Limit per 14 CFR Part 91.413). Reference Section 3.3. This option must be selected if the transponder does not meet the transmit power requirements for Class A Equipment specified in 14 CFR Part 91.413.
    b. Anonymous Mode Switch Installed
        i. [1] YES (comply with anonymous mode operation limitations in AFMS)

        OR

        ii. [2] NO
4. Insert the completed AFMS into the AFM or POH.