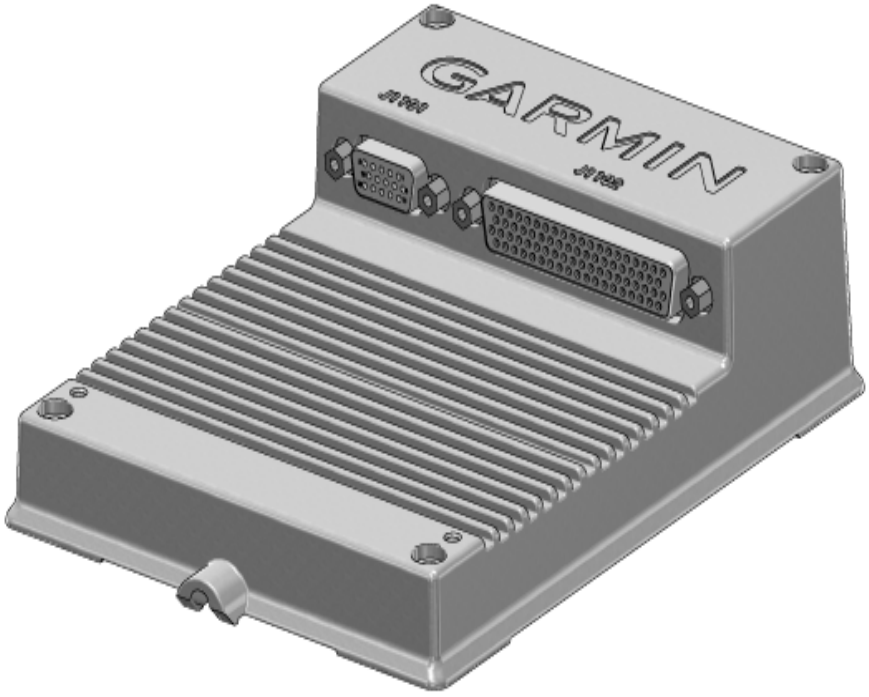
GEA 110
TSO Installation Manual



190-01825-00 April 2020 Revision 7

For information about the Aviation Limited Warranty refer to Garmin's website.

For aviation product support, refer to flyGarmin.com.

RECORD OF REVISIONS

REVISION	DATE	CHANGE DESCRIPTION
7	04/01/20	Updated pin names and added two notes about sealed connector kits.
6	08/07/19	Added new GEA 110 model, P/N 010-01329-01.
5	12/21/18	Updated figure B-1, figure B-2, figure B-3, and other minor edits.
4	04/18/18	Updated figure 4-1, figure B-3, and other minor edits.
3	05/26/17	Updated connector kit part numbers and configurable voltage ranges.
2	02/21/17	Updated TSO/ETSO deviations.
1	12/01/16	Initial release of document.

REVISION 7 CHANGE DESCRIPTION

SECTION	CHANGE DESCRIPTION
2.1	Added note about using the sealed connector kit.
3.4	Added note about using the sealed connector kit.
4.2	Updated pin names in table 4-3 "J1102 Pins."
4.7	Updated pin names in table 4-9 "Digital Inputs."
Appendix B	Updated pin names in figure B-3 "Sensor Interconnect."

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DEFINITIONS OF WARNINGS, CAUTIONS, AND NOTES

WARNING

A WARNING MEANS INJURY OR DEATH IS POSSIBLE.

CAUTION

A CAUTION MEANS THAT DAMAGE TO THE EQUIPMENT IS POSSIBLE.

NOTE

A note provides additional information.

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 WEBSITE AT WWW.GARMIN.COM/PROP65.

WARNING

PERCHLORATE MATERIAL – SPECIAL HANDLING MAY APPLY. REFER TO HTTPS://DTSC.CA.GOV/PERCHLORATE/

WARNING

THIS PRODUCT CONTAINS A LITHIUM BATTERY THAT MUST BE RECYCLED OR DISPOSED OF PROPERLY. BATTERY REPLACEMENT AND REMOVAL MUST BE PERFORMED BY A GARMIN AUTHORIZED REPAIR STATION.

CAUTION

TO AVOID DAMAGE TO THE GTR 225 OR GNC 255, TAKE PRECAUTIONS TO PREVENT ELECTROSTATIC DISCHARGE (ESD) WHEN HANDLING THE GTR, CONNECTORS, FAN, AND ASSOCIATED WIRING. ESD DAMAGE CAN BE PREVENTED BY TOUCHING AN OBJECT OF THE SAME ELECTRICAL POTENTIAL AS THE UNIT BEFORE HANDLING THE UNIT ITSELF.

NOTE

Garmin recommends installation of the GEA 110 by a Garmin authorized installer. To the extent allowable by law, Garmin will not be liable for damages resulting from improper or negligent installation of the unit.

Acronyms and Initialisms

API	Appliance Project Identifier
CCS	Constant Current Source
DC	Direct Current
EIS	Engine Instrument Systems
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EQF	Environmental Qualification Form
GDU	Garmin Display Unit
HIRF	High Intensity Radiated Field
LRU	Line Replaceable Unit
MFD	Multifunction Display
OEM	Original Equipment Manufacturer
PFD	Primary Flight Display
RTD	Resistance Temperature Detectors

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1 System Overview

This manual provides mechanical and electrical information for the planning and installation of a GEA 110 into an aircraft. It is not equivalent to an approved airframe-specific maintenance manual, installation design drawing, or installation data package. Garmin recommends installation by a Garmin-authorized installer using standard maintenance procedures in accordance with Title 14 of the Code of Federal Regulation.

1.1 Equipment Description

The GEA 110 is a micro-processor based input/output Line Replaceable Unit (LRU) used to monitor sensor inputs and is designed for aircraft engine assessment. It interfaces with various sensors on the aircraft and communicates airframe and engine information via RS-485 digital interface to a Garmin display. The display can be a Primary Flight Display(s) (PFD), Multi-Function Display (MFD) or a dedicated Engine Indication System (EIS) display. The display(s) serve as the user interface for the GEA 110. All configuration settings are controlled via software settings accessed by the display(s).

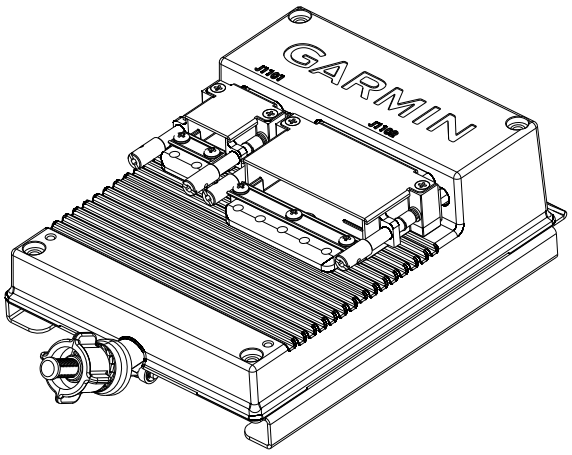


Figure 1-1 GEA 110 Unit

1.2 Unit Specifications

NOTE

Unless otherwise noted, P/N 011-03941-01 is equivalent to P/N 011-03941-00.

Table 1-1 Unit Specifications

CHARACTERISTIC	SPECIFICATION
Width with P/N 011-03941-00 install tray	4.8 in. (121.9 mm)
Height with P/N 011-03941-00 install tray	6.4 in. (162.6 mm)
Depth with P/N 011-03941-00 install tray and connectors	1.63 in. (41.4 mm)
Unit weight	1.208 lbs. (0.548 kg)
Weight of P/N 011-03941-00 install tray	0.628 lbs. (0.285 kg)
Connector kit weight P/N 011-03527-50	0.272 lbs. (0.123 kg)
Sealed connector kit weight P/N 011-03527-51	0.272 lbs. (0.123 kg)
Operating temperature range	-55°C to +85°C
Short term operating	-55°C to +95°C
Altitude range	55,000 ft. max
Software compliance	RTCA/DO-178B Level B
Hardware compliance The GEA 110 does not contain any complex or programmable logic devices.	N/A
Environmental conditions	RTCA/DO 160F

1.3 Power Specifications

NOTE

The initial power-up current is approximately 200 mA at 28 VDC higher than power requirement values during the first ten seconds due to the backup capacitor's charge.

NOTE

For details on surge ratings and minimum/maximum operating voltages refer to the EQF.

Table 1-2 Power Requirements

CHARACTERISTIC	SPECIFICATION
Input voltage	28.0 or 14.0 VDC
Maximum current draw with no external loading	0.15 A at 28.0 VDC 0.30 A at 14.0 VDC
Maximum current draw with maximum external loading	0.30 A at 28.0 VDC 0.60 A at 14.0 VDC

Table 1-3 Interface Current Draw Increase Under Load

POSSIBLE INTERFACE CURRENT DRAW INCREASE UNDER LOAD	CURRENT DRAW 28 VDC INPUT VOLTAGE	CURRENT DRAW 14 VDC INPUT VOLTAGE
One transducer output at 5 V with 0.2 A load	0.055 A	0.11 A
One transducer output at 10 V with 0.2 A load	0.12 A	0.25 A
One transducer output at 12 V with 0.2 A load	0.135 A	0.28 A

1.4 Certification

Conditions and tests of this article are required to meet minimum performance standards for TSO/ETSO approval. It is the responsibility of those installing this article to determine that the aircraft installation conditions are within the TSO/ETSO standards either on or within a specific type or class of aircraft. TSO/ETSO articles must have separate approval for installation in an aircraft and be performed under 14 CFR Part 43, or the applicable airworthiness requirements.

Installations of this TSO/ETSO approved article are only approved when installed as part of a Garmin Integrated Flight Deck at the time of this publication.

The GEA 110 API is GMN-01329. This alpha character does not represent a version number. The FAA and EASA use the API for project identification. To identify appliance approvals refer to the applicable hardware and software part numbers.

Table 1-4 TSO/ETSO Compliance

FUNCTION	TSO/ETSO	CATEGORY	MOPS	LRU SW P/N	BOOT BLOCK SW P/N	REGION LIST SW P/N
Temperature Instruments	TSO-C43c ETSO-C43c	Class IIIb	SAE AS8005A	006-B2364-0( )	006-B2364-B( )	006-D5826-0( )
Fuel Flow Meters	TSO-C44c ETSO-C44c	Type I	SAE AS407D			
Manifold Pressure Instruments	TSO-C45b ETSO-C45b	Type II	SAE AS8042			
Fuel, Oil, Hydraulic Pressure Instruments	TSO-C47a ETSO-C47a	Type II	SAE AS408C			
Electric Tachometer	TSO-C49b ETSO-C49b	N/A	SAE AS404C			
Fuel and Oil Quantity Instruments	TSO-C55a ETSO-C55	Class 3	SAE AS405C			

Table 1-5 TSO/ETSO Deviations

TSO/ETSO	DEVIATION
TSO-C43c	1. Garmin is granted a deviation from TSO-C43c to use SAE AS 800SA instead of SAE AS 8005 as the Minimum Performance Standard.
	2. Garmin is granted a deviation from TSO-C43c paragraph a.2 to use RTCA DO-160F in place of RTCA DO-160C for the Environmental Standard.
	3. Garmin is granted a deviation from TSO-C43c for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
TSO-C44c	1. Garmin is granted a deviation from TSO-C44c paragraph 3 to use SAE AS 407D in place of SAE AS 407C for the Minimum Performance Standards.
	2. Garmin is granted a deviation from TSO-C44c paragraph 3.c to use DO-160F in place of SAE AS 407C, SAE AS 1055D, and DO-160E as the standard for Environmental Qualification.
	3. Garmin is granted a deviation from TSO-C44c for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
	4. Garmin is granted a deviation to allow the unit to be permanently and legibly marked with a serial number and not the date of manufacture.
TSO-C45b	1. Garmin is granted a deviation from TSO-C45b paragraph 3.c to use DO-160F instead of SAE AS 8042 and DO-160E as the standard for the Environmental Qualification.
	2. Garmin is granted a deviation from TSO-C45b for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
	3. Garmin is granted a deviation to allow the unit to be permanently and legibly marked with a serial number and not the date of manufacture.
TSO-C47a	1. Garmin is granted a deviation from TSO-C47a paragraph 3.c to use DO-160F in place of SAE AS 408C and D0-160E as the standard for Environmental Qualification.
	2. Garmin is granted a deviation from TSO-C47a for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
TSO-C49b	1. Garmin is granted a deviation from TSO-C49b paragraph a.1 to use SAE AS 404C instead of SAE AS 404B to demonstrate compliance for Electric Tachometer Instruments.
	2. Garmin is granted a deviation from TSO-C49b paragraph a.3 to use D0-160F instead of SAE AS 407B as the standard for the Environmental Qualification.
	3. Garmin is granted a deviation from TSO-C49b for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
TSO-C55a	1. Garmin is granted a deviation from TSO-C55a paragraph 3 to use SAE AS 405D in place of SAE AS 405C for the Minimum Performance Standards.
	2. Garmin is granted requests a deviation from TSO-C55a paragraph 3.c to use D0-160F instead of SAE AS 405C and D0-160E as the standard for the Environmental Qualification.
	3. Garmin is granted a deviation from TSO-C55a for marking Product Type, TSO Numbers, Equipment Class, "Dev. See IM" (deviation abbreviations), Environmental Categories, accuracy classification, function, power and Software Part Number on the exterior of the unit.
	4. Garmin is granted a deviation to allow the unit to be permanently and legibly marked with a serial number and not the date of manufacture.

1.5 Operating Instructions

The GEA 110 is a remote-mount LRU with no user controls or indicators. The unit converts airframe and engine sensor measurements and transmits the information via a RS-485 digital interface to a display with PFD, MFD, and EIS functionality. If the unit fails a system message displays. There are no further specific operational procedures. For instructions refer to the applicable airframe specific pilot documentation at Garmin's Dealer Resource Center.

1.6 Continued Airworthiness

Maintenance of the GEA 110 is "on condition" only. For regulatory periodic functional checks, including aircraft maintenance requirements, refer to the approved aircraft maintenance manuals or manual supplements.

1.6.1 Environmental Qualification Form

It is the responsibility of the installing agency to obtain the latest revision of the GEA 110 EQF. To obtain a copy of the EQF, P/N 005-00851-04, refer to Garmin's Dealer Resource Center.

2 Installation Materials

This section provides installation requirements for the GEA 110 related hardware. Where applicable, AC 43.13-1B and AC 43.13-2B provides FAA compliant regulatory guidance for retrofit installations.

2.1 Materials Provided

The GEA 110 is a single unit, P/N 010-01329-00 or P/N 010-01329-01. If the unit is installed in the fuselage use P/N 011-03527-50 connector kit listed in table 2-1, If the unit is installed in an area that subjects it to moisture or fluids use P/N 011-03527-51 sealed connector kit listed in table 2-2.

Table 2-1 GEA 110 Connector Kit for Installations in Fuselage

ITEM	P/N	QTY
Sub-assembly, backshell with hardware, jackscrew, 9/15 Pin	011-01855-00	1
Sub-assembly, backshell with hardware, jackscrew, 50/78 pin	011-01855-04	1
Connector, hi-density D-sub, MIL crimp,15 ckt	330-00185-15	1
Connector hi-density D-sub, MIL crimp, 78 ckt	330-00185-78	1
Contact, pin, MIL crimp, size 22D [1]	336-00021-00	100
Sub-assembly, config module, w/EEPROM, jackscrew, Teflon harness	011-00979-17	1

Notes:

[1] Equivalent military part number is M39029/58-360.

Table 2-2 GEA 110 Sealed Connector Kit

NOTE

When using the sealed connector kit, all holes in the connector must have pins.

ITEM	GARMIN P/N	QTY
Sub-assembly, backshell with hardware, jackscrew, 9/15 pin	011-01855-00	1
Sub-assembly, backshell with hardware, jackscrew, 50/78 pin	011-01855-04	1
Connector, high-density D-sub, male, straight, MIL crimp, sealed with ground indents, 78-pin	330-00776-78	1
Pin contact, MIL crimp, size 22D [1]	336-00021-00	100
Sub-assembly, configuration module with EEPROM, jackscrew, Teflon harness	011-00979-17	1
Connector, high-density D-sub, male, straight, MIL crimp contacts, sealed, 15-pin	330-01384-00	1

Notes: Equivalent military part number is M39029/58-360.

2.2 Available Materials

Equipment accessories are provided separately for the GEA 110 unit.

Table 2-3 Available Materials

ITEM	P/N
GEA 110 Install Tray	011-03941-00
GEA 110 Connector Kit	011-03527-50
GEA 110 Sealed Connector Kit	011-03527-51

2.3 Required Materials Not Supplied

Table 2-4 Required Material Not Supplied

ITEM	P/N
Wire	MIL-W-22759/16 or equivalent
Shielded wire	MIL-C-27500 or equivalent
Steel nutplate	MS21071-06 or equivalent
Steel nutplate	MS21071-08 or equivalent
Circuit breakers	2 A for 14 V and 28 V installations
Tie wraps or lacing cord	N/A
Ring terminals for grounding	N/A
Screws for tray	MS35206-245 or equivalent
Washers for tray	NAS1149F or equivalent
Screws for unit	MS35206-237, MS35206-233, or equivalent

2.4 Recommended Crimping Tool

Table 2-5 Recommended Crimp Tools

MANUFACTURER	HAND CRIMPING TOOL	18/20 AWG		22/28 AWG	
		POSITIONER	INSERTION/ EXTRACTION TOOL [1]	POSITIONER	INSERTION/ EXTRACTION TOOL
Military P/N	M22520/2-01	N/A	M81969/1-04	M22520/2-09	M81969/1-04
Positronic	9507	9502-11	M81969/1-04	9502-4	M81969/1-04
AMP	601966-1	N/A	91067-1	601966-6	91067-1
Daniels	AFM8	K774	M81969/1-04	K42	M81969/1-04
Astro	615717	N/A	M81969/1-04	615725	M81969/1-04

Notes:

[1] Extracting the #16, #18, and #20 contact requires that the expanded wire barrel be cut off from the contact. It may also be necessary to push the pin out from the face of the connector when using an extractor due to the absence of the wire. A new contact must be used when reassembling the connector.

3 Installation Procedures

3.1 HIRF/Lightning Protection and EMC

To maintain HIRF/Lightning and EMC protection, the electrical equipment, supporting brackets, and installation tray must be electrically bonded to the aircraft's main structure. To prepare the surface for an electrical bond refer to SAE ARP 1870 section 5.

Bond electrical equipment, supporting brackets, and racks to the airframe structure to achieve direct current (DC) resistance less than or equal to 2.5 milliohms (5.0 milliohms for ICA maintenance intervals). Use a milliohm meter to measure the resistance of the bond between the equipment and the adjacent aircraft structure. Multi-meters are not acceptable for making these measurements.

It is recommended that all Garmin Integrated Avionics System equipment be electrically bonded. Remote equipment interfacing to the GEA 110 should also be electrically bonded. Bonding mechanisms may be provided at the installation level with use of bonding straps.

When allowable, the unit should remain on the mount. If not, reinstall the unit after the check is performed. Disconnect the harness so that the shielded harness does not mask the chassis bond. No additional electrical bond checks are required.

3.2 Wire Harness Build

CAUTION

INCORRECT WIRING CAN CAUSE INTERNAL COMPONENT DAMAGE.

The installer must supply and fabricate all of the cables. Allow adequate space for installation of cables and connectors. Electrical connections are made through the 78-pin and 15-pin D-subminiature (D-sub) connectors provided by Garmin.

When routing cable consider:

1. Wires routed too close to spark plugs, plug wires, or magnetos may result in erratic readings.
2. Ensure that EGT, CHT, and other sensor wires do not come in contact with exhaust manifolds or any other extreme heat sources.
3. Ensure each sensor's requirements for polarity, voltage, wire type, and mounting.
4. Route wires and cables as short and as direct as possible.
5. Avoid sharp bends and routing near fluorescent lighting and power sources (e.g., 400 Hz generators, trim motors, etc.).

3.3 Jackscrew Backshell Instructions

NOTE

When using the sealed connector kit all holes in the connector must have pins.

The backshell assembly houses the configuration module. To assemble:

1. Strip back approximately 0.17 inches of insulation from each wire of the wire harness (2).
2. Crimp a pin (3) or socket (8) to each conductor.
3. Insert wires into the connector housing (4).
4. Attach the configuration module (1) to the backshell (5) with screw (9).
5. Plug the wire harness into the connector on the module (1).
6. Attach cover (6) to backshell with screws (7).

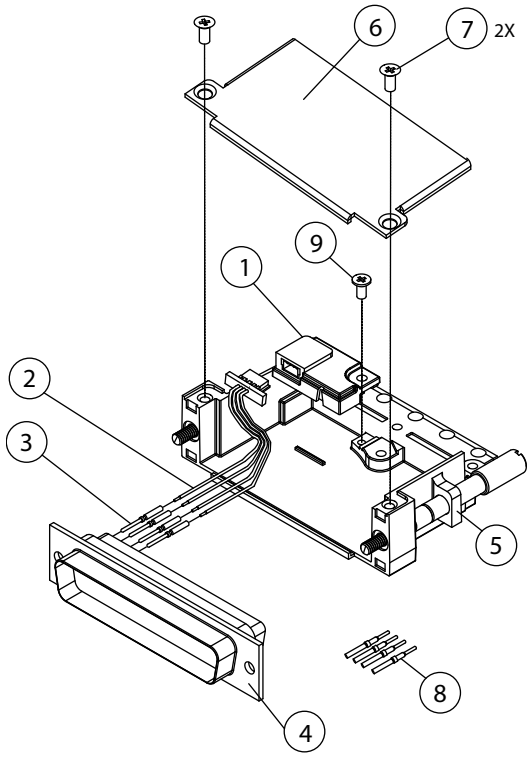


Figure 3-1 Jackscrew Backshell

3.4 Unit Installation

CAUTION

DO NOT USE EXCESSIVE FORCE WHEN INSERTING THE GEA 110 INTO THE INSTALL TRAY. DAMAGE MAY OCCUR TO THE UNIT, AND/OR INSTALL RACK. DO NOT MOUNT DIRECTLY BENEATH A FUEL, OIL, OR HYDRAULIC LINE.

CAUTION

TO AVOID CROSS THREADING ENGAGE THE SCREW BY HAND INTO THE HOLE. IF TORQUE EXCEEDS 14 IN-LBS TO THE SCREW, DAMAGE MAY RESULT TO THE LRU CASE AND/OR RETAINING HARDWARE.

NOTE

To prevent fluids from pooling, mount in a direction that allows for drainage out the backshell. Use kit P/N 011-03527-51 if installed in an area where the unit is sprayed with fluids.

NOTE

When using the sealed connector kit, all holes in the connector must have pins.

3.4.1 Mounting Locations

To minimize radiated EMI, and provide protection from HIRF, the mounting surface must provide a sufficient electrical bond to the aircraft. The GEA 110 does not require forced air cooling. Internal temperature sensors may be used to verify temperature. Any one of the following locations is acceptable in fixed wing aircraft:

- Fuselage
- Instrument panel
- Console
- Equipment rack
- Pylon
- Wing
- Engine compartment

Any one of the following locations is acceptable in rotorcraft:

- Fuselage
- Instrument panel
- Console
- Equipment rack

3.4.2 Mounting Options

The GEA 110 can be mounted in any one of the following methods.

1. Using the install tray P/N 011-03941-00.
2. To the airframe using four, #6 bolts.
3. To an equipment shelf using four, #6 bolts.
4. To the back of the GDU 1060 (figure 3-4) using four, #6 bolts with the following considerations:
   - Location is at least 0.3 m (1 ft.) from a compass or flux gate
   - Instrument panel is structurally sufficient to accommodate the weight of the GEA 110 and the GDU 1060
5. Where the unit is thermally shielded and the temperature does not exceed 185°F (85°C) during normal operation.
6. In the engine compartment where all wire passing through a firewall are routed via existing holes, unless other FAA approval is obtained. Use 0.020 safety wire to secure the jackscrew on each connector.
7. In a location that does not block airflow for engine cooling.

3.4.3 Installation With an Install Tray

1. Use six, #8 screws and washers to mount the install tray to a suitable location. For proper orientation refer to figure 3-2.
2. Torque screws to 13.0 lbs. ±1.0 lbs.
3. Insert the GEA 110 into the install tray. Refer to figure 3-2.
4. Use the ratcheting latch mechanism to lock the GEA 110 in place.
5. Connect J1101 and J1102.

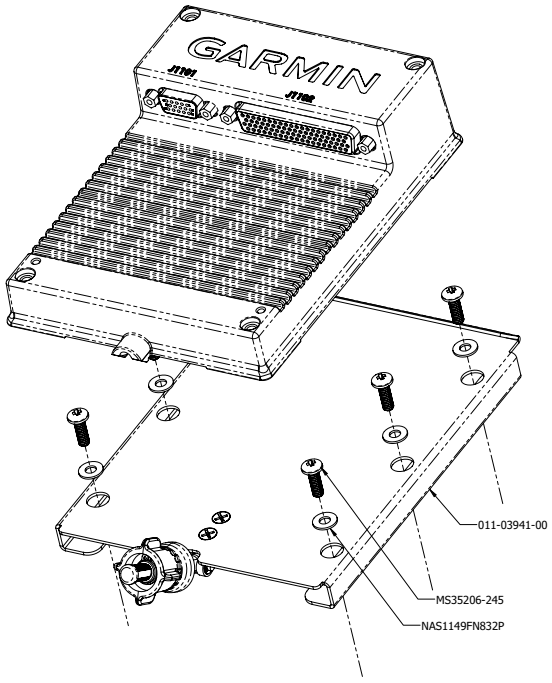


Figure 3-2 Installation with Install Tray

3.4.4 Installation Without an Install Tray

1. Use four, #6 screws to mount the GEA 110 directly to a suitable surface.
2. Torque screws to 8.0 lbs. ±1.0 lbs.
3. Connect J1101 and J1102.

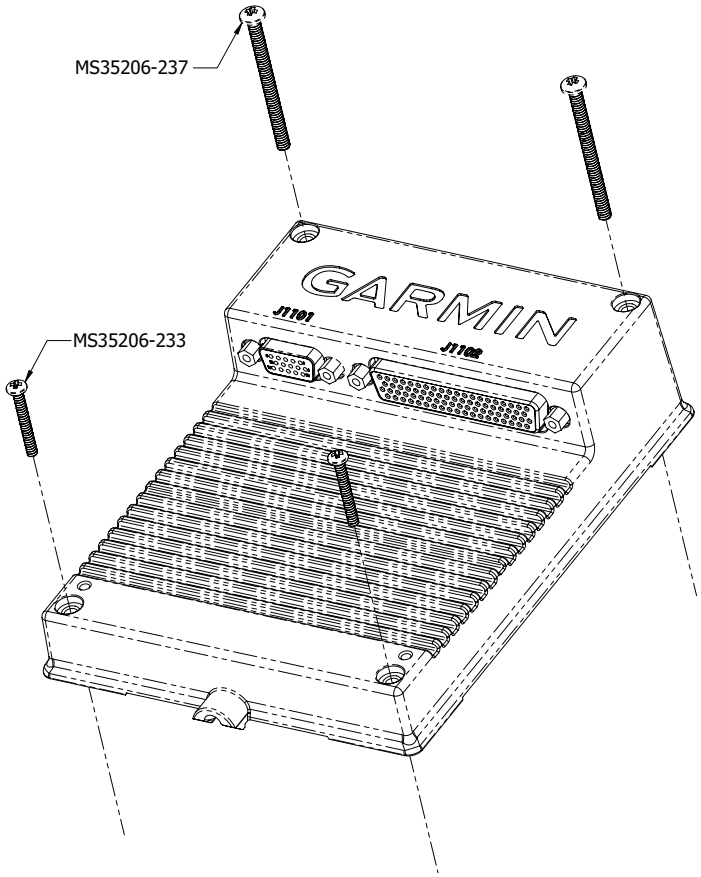


Figure 3-3 GEA 110 Installation

3.4.5 Installation on a GDU 1060

1. Use four, #6 screws to mount the GEA 110 to the back of the GDU 1060. For orientation refer to figure 3-4.
2. Torque screws to 8.0 ±1.0 lbs.
3. Connect J1101 and J1102.

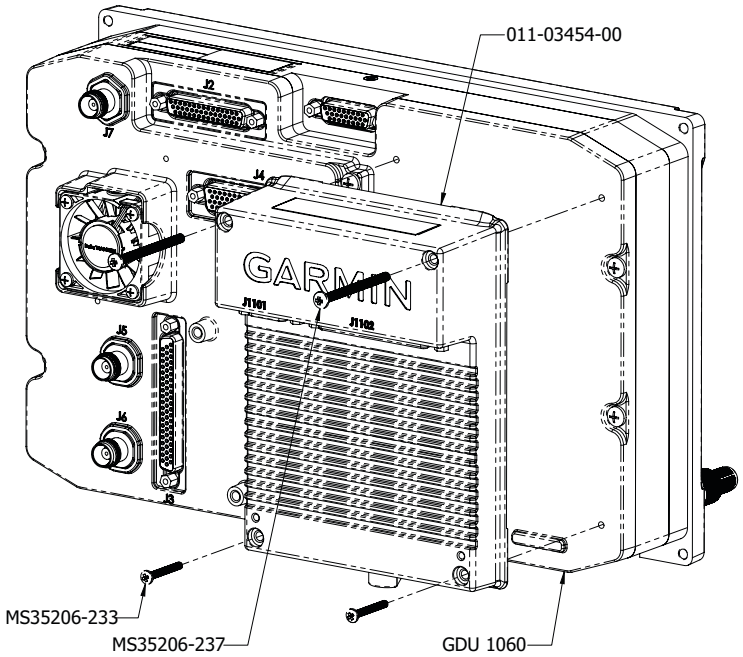


Figure 3-4 GEA 110 Installation on GDU 1060

3.5 Post Installation Configuration and Checkout

The GEA 110 will not provide valid outputs until the aircraft post installation configuration procedures are completed. The GEA 110 configuration can be saved to an SD card that can be loaded through a GDU for configuration.

4 Pinout Information

Table 4-1 Interface Summary

INTERFACE DESCRIPTION	QUANTITY
Digital inputs	8
Analog inputs	25 [1]
25 volt excitation outputs	2
12 volt excitation outputs	2
10 volt excitation output	1
Configurable discrete inputs	5
Configurable discrete outputs	2

Notes:

[1] Eight analog inputs provide a constant current source and two monitor current.

4.1 J1101 Connector - DB 15

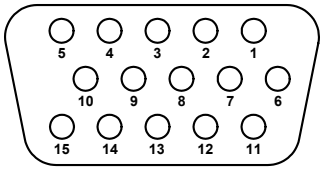


Figure 4-1 DB 15 Connector
Orientation: Looking at Front of Unit

Table 4-2 J1101 - DB 15 Connector Pins

PIN	PIN NAME	I/O
1	AIRCRAFT POWER 1	In
2	RESERVED	In
3	DISCRETE OUT 1	Out
4	RS-485 2 A	I/O
5	RS-485 1 A	I/O
6	AIRCRAFT POWER 2	In
7	RESERVED	Out
8	DISCRETE OUT 2	Out
9	RS-485 2 B	I/O
10	RS-485 1 B	I/O
11	CONFIG DISCRETE IN 5	In
12	GEA SYSTEM ID PROGRAM* 1	In
13	GEA SYSTEM ID PROGRAM* 2	In
14	POWER GROUND	---
15	POWER GROUND	---

4.2 J1102 Connector - DB 78

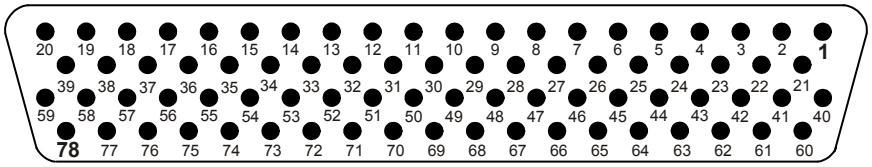


Figure 4-2 DB 78 Connector
Orientation: Looking at Front Unit

Table 4-3 J1102 Pins

PIN	PIN NAME	I/O
1	ANALOG IN 1 HI	In
2	ANALOG IN 2 HI	In
3	ANALOG IN 3 HI	In
4	ANALOG IN 4 HI	In
5	ANALOG IN 5 HI	In
6	ANALOG IN 6 HI	In
7	ANALOG/CCS IN 1 HI	In
8	ANALOG/CCS IN 2 HI	In
9	+10 VDC TRANSDUCER POWER OUT	Out
10	ANALOG IN 13 HI	In
11	CONFIG DISCRETE IN 1	In
12	ANALOG/CCS/DIGITAL IN 1 HI [3][4]	In
13	ANALOG/CCS/DIGITAL IN 3 HI [3][4]	In
14	SIGNAL GROUND	--
15	DIGITAL IN 3 HI	In
16	DIGITAL IN 4 HI	In
17	+12 VDC TRANSDUCER POWER OUT [2]	Out
18	DIGITAL IN 1 HI	In
19	DIGITAL IN 2 HI	In
20	CONFIG MODULE POWER	Out

PIN	PIN NAME	I/O
21	ANALOG IN 1 LOW	In
22	ANALOG IN 2 LOW	In
23	ANALOG IN 3 LOW	In
24	ANALOG IN 4 LOW	In
25	ANALOG IN 5 LOW	In
26	ANALOG IN 6 LOW	In
27	ANALOG/CCS IN 1 LOW	In
28	ANALOG/CCS IN 2 LOW	In
29	+5 VDC TRANSDUCER POWER OUT [1]	Out
30	ANALOG IN 13 LOW	In
31	CONFIG DISCRETE IN 2	In
32	ANALOG/CCS/DIGITAL IN 1 LOW [3][4]	In
33	ANALOG/CCS/DIGITAL IN 3 LOW [3][4]	In
34	SIGNAL GROUND	--
35	CURRENT MONITOR IN 1 HI	In
36	CURRENT MONITOR IN 2 HI	In
37	DIGITAL IN 1 LOW	In
38	DIGITAL IN 2 LOW	In
39	CONFIG MODULE DATA	In
40	ANALOG IN 7 HI	In
41	ANALOG IN 8 HI	In
42	ANALOG IN 9 HI	In
43	ANALOG IN 10 HI	In
44	ANALOG IN 11 HI	In
45	ANALOG IN 12 HI	In
46	ANALOG/CCS IN 3 HI	In
47	ANALOG/CCS IN 4 HI	In

PIN	PIN NAME	I/O
48	ANALOG IN 14 HI	In
49	SIGNAL GROUND	--
50	ANALOG IN 15 HI	In
51	CONFIG DISCRETE IN 3	In
52	ANALOG/CCS/DIGITAL IN 2 HI [3][4]	In
53	ANALOG/CCS/DIGITAL IN 4 HI [3][4]	In
54	SIGNAL GROUND	---
55	CURRENT MONITOR IN 1 LOW	In
56	CURRENT MONITOR IN 2 LOW	In
57	VOLTAGE BUS 1	In
58	VOLTAGE BUS 2	In
59	CONFIG MODULE CLOCK	Out
60	ENGINE TEMP ANALOG IN 7 LO	In
61	ENGINE TEMP ANALOG IN 8 LO	In
62	ENGINE TEMP ANALOG IN 9 LO	In
63	ENGINE TEMP ANALOG IN 10 LO	In
64	ENGINE TEMP ANALOG IN 11 LO	In
65	ENGINE TEMP ANALOG IN 12 LO	In
66	ANALOG/CCS IN 3 LOW	In
67	ANALOG/CCS IN 4 LOW	In
68	ANALOG IN 14 LOW	In
69	+12 VDC TRANSDUCER POWER OUT [2]	Out
70	ANALOG IN 15 LOW	In
71	CONFIG DISCRETE IN 4	In
72	ANALOG/CCS/DIGITAL IN 2 LOW [3][4]	In
73	ANALOG/CCS/DIGITAL IN 4 LOW [3][4]	In
74	SIGNAL GROUND	---

PIN	PIN NAME	I/O
75	RESERVED	---
76	+5 VDC TRANSDUCER POWER OUT [1]	In
77	VOLTAGE BUS 3	In
78	CONFIG MODULE GROUND	---

Notes:

[1] When calculating power output limitations the two, 5 VDC outputs are connected internally and count as one output.

[2] When calculating power output limitations the two,12 VDC outputs are connected internally and count as one power.

[3] Other sensors can be connected to this port, but fuel quantity can only be connected to this input.

[4] On P/N 010-01329-01 the CCS can only be configured for 4.032 mA.

4.3 Power

The GEA 110 operates on 28 VDC or 14 VDC. After initial power on, the GEA 110 will operate normally to a minimum of 11 VDC. Current draw is dependent on I/O usage and output loading, power wire gauge should be determined for each specific installation based upon these criteria.

AIRCRAFT POWER 1 and AIRCRAFT POWER 2 are "diode OR'ed" to provide power redundancy. AIRCRAFT POWER 2 connects to an alternate aircraft source (i.e., on an aircraft with two electrical buses or a display that can supply power).

Table 4-4 Power Pins

PIN	PIN NAME	CONNECTOR	I/O
1	AIRCRAFT POWER 1	J1101	In
6	AIRCRAFT POWER 2	J1101	In
14	POWER GROUND	J1101	---
15	POWER GROUND	J1101	---

4.4 Configuration Module

The GEA 110 stores installation specific configuration information in an aircraft configuration module located in the backshell of J1102. This eliminates the need to set up additional aircraft specific configuration items if a new GEA 110 is installed. The configuration module is mounted in the connector backshell.

Table 4-5 Configuration Module

PIN	PIN NAME	CONNECTOR	I/O
20	CONFIG MODULE POWER	J1102	Out
39	CONFIG MODULE DATA	J1102	I/O
59	CONFIG MODULE CLOCK	J1102	Out
78	CONFIG MODULE GROUND	J1102	--

4.5 Analog Inputs

The analog input interface is a differential input. There are two differential voltage inputs. Each are configurable for one of three voltage ranges, totaling six configurable voltage ranges. The differential voltage inputs and the configurable voltage ranges are listed in table 4-6.

Table 4-6 Configurable Voltage Ranges

DIFFERENTIAL VOLTAGE INPUT	CONFIGURABLE VOLTAGE RANGE
-1.8 V to +2.5 V	±155 mV ±0.6 V -1.8 to +2.5 V
±80 V	±5 V ±20 V -60 to +80 V

When an analog input is used to monitor a voltage with respect to ground, connect the monitored voltage of the sensor to the HI pin of the analog input and connect the LO pin of the analog input to the sensor ground or a ground near the sensor. Differential wiring minimizes the error due to the interconnect. Due to the difference in ground potential between the sensor and the GEA grounding the LO pin at the GEA can introduce errors. The cable assembly should include shielded twisted pairs for each analog input HI/LO pair, and the shields should be grounded at both ends of the cable.

For analog inputs configured for ±5 V, ±20 V, or -60 to 80 V the input resistance is 113.40 +/- 0.11 kilohm across the specified temperature range of the unit. If the source resistance for the applied voltage is greater than 10 ohm, the error due to the voltage drop across the source resistance starts to be significant. The source resistance error can be accounted for in the conversion equation if the value of the source resistance and its tolerance is known.

For analog inputs configured for ±155 mV, ±0.6 V, or -1.8 to +2.5 V it is more appropriate to specify a bias current. The bias current for the analog in inputs is ± 12 nA max. The bias current multiplied by the source resistance gives the error due to voltage drop across the source resistance in an installation. It is not possible to compensate for the bias current in the conversion equation.

The configured range depends on the connected sensor. Below are typical ranges of thermocouples, pressure transducers, and bus voltages.

- Thermocouples use the ±155 mV range
- Pressure transducers use the ±5 V and ±20 V ranges
- Bus voltages use the -60 V to +80 V range

Table 4-7 Analog Inputs

PIN	PIN NAME	CONNECTOR	I/O
1	ANALOG IN 1 HI [1]	J1102	In
21	ANALOG IN 1 LOW [1]	J1102	In
2	ANALOG IN 2 HI [1]	J1102	In
22	ANALOG IN 2 LOW [1]	J1102	In
3	ANALOG IN 3 HI [1]	J1102	In
23	ANALOG IN 3 LOW [1]	J1102	In
4	ANALOG IN 4 HI [1]	J1102	In
24	ANALOG IN 4 LOW [1]	J1102	In
5	ANALOG IN 5 HI [1]	J1102	In
25	ANALOG IN 5 LOW [1]	J1102	In
6	ANALOG IN 6 HI [1]	J1102	In
26	ANALOG IN 6 LOW [1]	J1102	In
40	ANALOG IN 7 HI [1]	J1102	In
60	ANALOG IN 7 LOW [1]	J1102	In
41	ANALOG IN 8 HI [1]	J1102	In
61	ANALOG IN 8 LOW [1]	J1102	In
42	ANALOG IN 9 HI [1]	J1102	In
62	ANALOG IN 9 LOW [1]	J1102	In
43	ANALOG IN 10 HI [1]	J1102	In
63	ANALOG IN 10 LOW [1]	J1102	In
44	ANALOG IN 11 HI [1]	J1102	In
64	ANALOG IN 11 LOW [1]	J1102	In
45	ANALOG IN 12 HI [1]	J1102	In
65	ANALOG IN 12 LOW [1]	J1102	In
10	ANALOG IN 13 HI [2]	J1102	In
30	ANALOG IN 13 LOW [2]	J1102	In

PIN	PIN NAME	CONNECTOR	I/O
48	ANALOG IN 14 HI [1] [2]	J1102	In
68	ANALOG IN 14 LOW [1] [2]	J1102	In
50	ANALOG IN 15 HI [2]	J1102	In
70	ANALOG IN 15 LOW [2]	J1102	In

Notes:

[1] Input voltage configuration options are ±155 mV, ±0.6 V, or -1.8 to +2.5 V.

[2] Input voltage configuration options are ±5 V, ±20 V, -60 to 80 V.

4.6 Constant Current Source (CCS)

CAUTION

WHEN INTERFACED TO A RESISTIVE FUEL QUANTITY SENSOR THE CCS MUST BE CONFIGURED FOR EITHER 4.032 mA OR 10.04 mA. THIS PREVENTS CORROSION BUILD UP ON THE FLOAT LEADS. WHEN INTERFACING TO A RESISTIVE FUEL QUANTITY SYSTEM ONLY ANALOG/CCS/DIGITAL IN 1-4 MAY BE USED, REFER TO SECTION 4.9.

When the CCS is configured ON, the input on the LOW side must be spliced and connected to ground near the GEA. It is recommended that the ground connection is made as close as practical to the GEA to reduce error due to voltage drop in the wiring. If not practical, near the sensor is acceptable.

Unless otherwise noted, each CCS input is capable of suppling 10.55 uA, 250 uA, 4.032 mA, or 10.04 mA from the positive differential input that is used to measure resistive sensors. When CCS is enabled the voltage input is -1.8 V to 2.5 V. For the resistance range that each CCS setting is capable of reading refer to table 4-8.

Use the CCS anytime a resistance is required to be measured. These sensors are typically RTDs, linear transducers, and resistive fuel quantity systems.

Table 4-8 Resistance Range

CCS VALUE	RESISTANCE RANGE
10.55 uA	0 to 236966 ohm
250 uA	0 to 10,000 ohm
4.032 mA	0 to 620 ohm
10.04 mA	0 to 249 ohm

4.7 Digital Inputs

Any digital input is configurable as a discrete input.

All cable assemblies should include shielded wires for each digital input, with the shield grounded at both ends.

Each digital input may be configured as a frequency counter. The frequency counter inputs operate from 0 Hz to 100 kHz, however the range from 0 Hz to 1 Hz may not be accurate.

All digital inputs can measure the frequency of signals from 0.25 Vpp up to 150 Vpp. Two of the digital inputs can be configured to measure the frequency of signals from 0.025 Vpp up to 20 Vpp.

The digital inputs are used when a frequency is needed to be measured. The input is typically connected to RPM, fuel flow, and some capacitive based fuel quantity systems.

Table 4-9 Digital Inputs

PIN	PIN NAME	CONNECTOR	I/O
18	DIGITAL IN 1 HI	J1102	In
19	DIGITAL IN 2 HI	J1102	In
15	DIGITAL IN 3 HI	J1102	In
16	DIGITAL IN 4 HI	J1102	In
37	DIGITAL IN 1 LOW [1]	J1102	In
38	DIGITAL IN 2 LOW [1]	J1102	In

Notes:

[1] Input is only used when the port is configured for differential mode.

[2] When configured as differential digital the voltage range is 0.025 Vpp to 20 Vpp.

4.8 Analog/CCS

The Analog/CCS inputs have the same capabilities as the analog inputs described in section 4.5.

Table 4-10 Analog/CCS

PIN	PIN NAME	CONNECTOR	I/O
7	ANALOG/CCS IN 1 HI [1] [2]	J1102	In
27	ANALOG/CCS IN 1 LOW [1] [2]	J1102	In
8	ANALOG/CCS IN 2 HI [1] [2]	J1102	In
28	ANALOG/CCS IN 2 LOW [1] [2]	J1102	In
46	ANALOG/CCS IN 3 HI [1] [2]	J1102	In
66	ANALOG/CCS IN 3 LOW [1] [2]	J1102	In
47	ANALOG/CCS IN 4 HI [1]	J1102	In
67	ANALOG/CCS IN 4 LOW [1]	J1102	In

Notes:

[1] Input voltage configuration options are ±155 mV, ±0.6 V, or -1.8 to +2.5 V.

[2] Input voltage configuration options are ±5 V, ±20 V, -60 to 80 V.

4.9 Analog/CCS/Digital

Analog/CCS/digital channels are designed and tested for no arcing to any nodes internal to the GEA 110 or to any unit pins during a lightning transient. This is an additional safety requirement to support direct interface with fuel system sensors.

When using P/N 010-01329-00 and interfaced to a resistive fuel quantity sensor configure the CCS for either 4.032 mA or 10.04 mA This prevents corrosion build-up on the float leads.

When using P/N 010-01329-01 the only CCS configuration option available is 4.032 mA.

If replacing P/N 010-01329-00 with P/N 010-01329-01, verify that the sensors are compatible with the 4.032 mA CCS. If the sensor cannot use the 4.032 mA CCS setting, the sensor must be moved to another CCS capable port. If connected to a resistive fuel quantity sensor using the 10.04 mA CCS setting, the port must be reconfigured for the 4.032 mA CCS setting.

Table 4-11 Analog/CCS/Digital

PIN	PIN NAME	CONNECTOR	I/O
12	ANALOG/CCS/DIGITAL IN 1 HI	J1102	In
32	ANALOG/CCS/DIGITAL IN 1 LOW [1]	J1102	In
52	ANALOG/CCS/DIGITAL IN 2 HI	J1102	In
72	ANALOG/CCS/DIGITAL IN 2 LOW [1]	J1102	In
13	ANALOG/CCS/DIGITAL IN 3 HI	J1102	In
33	ANALOG/CCS/DIGITAL IN 3 LOW [1]	J1102	In
53	ANALOG/CCS/DIGITAL IN 4 HI	J1102	In
73	ANALOG/CCS/DIGITAL IN 4 LOW [1]	J1102	In

Notes:

[1] When the port is configured for a digital input the low input is used when configured for differential mode.

4.10 Current Monitor

The current monitor inputs are configured to monitor the current draw of an aircraft power bus with the use of an external sense resistor. In high side current monitor mode, the current monitor measures differential voltages in the -1.5 to +2.5 V range with a common mode voltage of ±80 V.

Table 4-12 Current Monitor

PIN	PIN NAME	CONNECTOR	I/O
35	CURRENT MONITOR IN 1 HI	J1102	In
55	CURRENT MONITOR IN 1 LOW	J1102	In
36	CURRENT MONITOR IN 2 HI	J1102	In
56	CURRENT MONITOR IN 2 LOW	J1102	In

4.11 Discrete Outputs

The discrete outputs are active low type discrete outputs that present a high impedance (110 kilohm) in an inactive state.

When active the outputs sink up to 500 mA in the active state with a voltage drop of 0.5 VDC or less. Include an inline resistor to ensure the current remains below 500 mA.

Table 4-13 Configurable Discrete Output

PIN	PIN NAME	CONNECTOR	I/O
3	DISCRETE OUT 1	J1101	Out
8	DISCRETE OUT 2	J1101	Out

4.12 Configurable Discrete Inputs

The configurable discrete inputs can be individually configured as active high or active low type.

When configured for the active low state, a voltage of 0 to 3.5 V, or a resistance of less than 375 ohm to ground, is considered an active signal. A voltage of 8 V to 36 V or a resistance of greater than 100 kilohm is considered an Inactive signal.

When configured for the Active High state, a voltage of 8 to 36 V is considered an Active signal. A voltage of 0 to 3.5 V or open is considered an Inactive signal.

The configurable discrete inputs source or sink a wetting current to mitigate oxidation that may exist on switch contacts. When connected to ground, two high current configurable discrete Inputs are designed to sink 5 mA. The remaining standard current inputs source 1 mA each when connected to ground.

Table 4-14 Discrete Input

PIN	PIN NAME	CONNECTOR	I/O
11	CONFIG DISCRETE IN 1 [1]	J1102	In
31	CONFIG DISCRETE IN 2 [1]	J1102	In
51	CONFIG DISCRETE IN 3 [2]	J1102	In
71	CONFIG DISCRETE IN 4 [2]	J1102	In
11	CONFIG DISCRETE IN 5 [1][3]	J1101	In

Notes:

[1] Can sink 1 mA to ground.

[2] Can sink 5 mA to ground.

[3] Discrete IN 5 can only be configured as Active LOW.

4.13 RS-485 Channels

The RS-485 channels provide communication between the GEA 110 and the display. The cable assembly includes shielded twisted cable for every RS-485 channel. Ground the shield at both ends of the cable.

Table 4-15 RS-485 Channels

PIN	PIN NAME	CONNECTOR	I/O
5	RS-485 1 A	J1101	I/O
10	RS-485 1 B	J1101	I/O
4	RS-485 2 A	J1101	I/O
9	RS-485 2 B	J1101	I/O

4.14 Transducer Power Out

The GEA 110 supplies fixed DC output power for engine/airframe sensors that require supply voltage excitation. The +5 VDC outputs and +12 VDC outputs are internally connected to each other. The GEA 110 provides a total of 150 mA for 5 VDC outputs, the 10 VDC output, and the +12 VDC outputs.

Table 4-16 Power Input Requirements

SUPPLIED POWER	TRANSDUCER OUTPUT
5 VDC	150 mA each power output [1]
10 VDC	150 mA for the power output
12 VDC	150 mA each power output [2]

Notes:

[1] When calculating power output limitations the two, 5 VDC outputs are internally connected and count as one output.

[2] When calculating power output limitations the two, 12 VDC outputs are internally connected and count as one power. Transducer Power Outputs

PIN	PIN NAME	CONNECTOR	I/O
29	+5 VDC Transducer Power Out [1]	J1102	Out
76	+5 VDC Transducer Power Out [1]	J1102	Out
9	+10 VDC Transducer Power Out	J1102	Out
69	+12 VDC Transducer Power Out [2]	J1102	Out
17	+12 VDC Transducer Power Out [2]	J1102	Out

Notes:

[1] When calculating power output limitations the two 5 VDC outputs are internally connected and count as one output.

[2] When calculating power output limitations the two 12 VDC outputs are internally connected and count as one power.

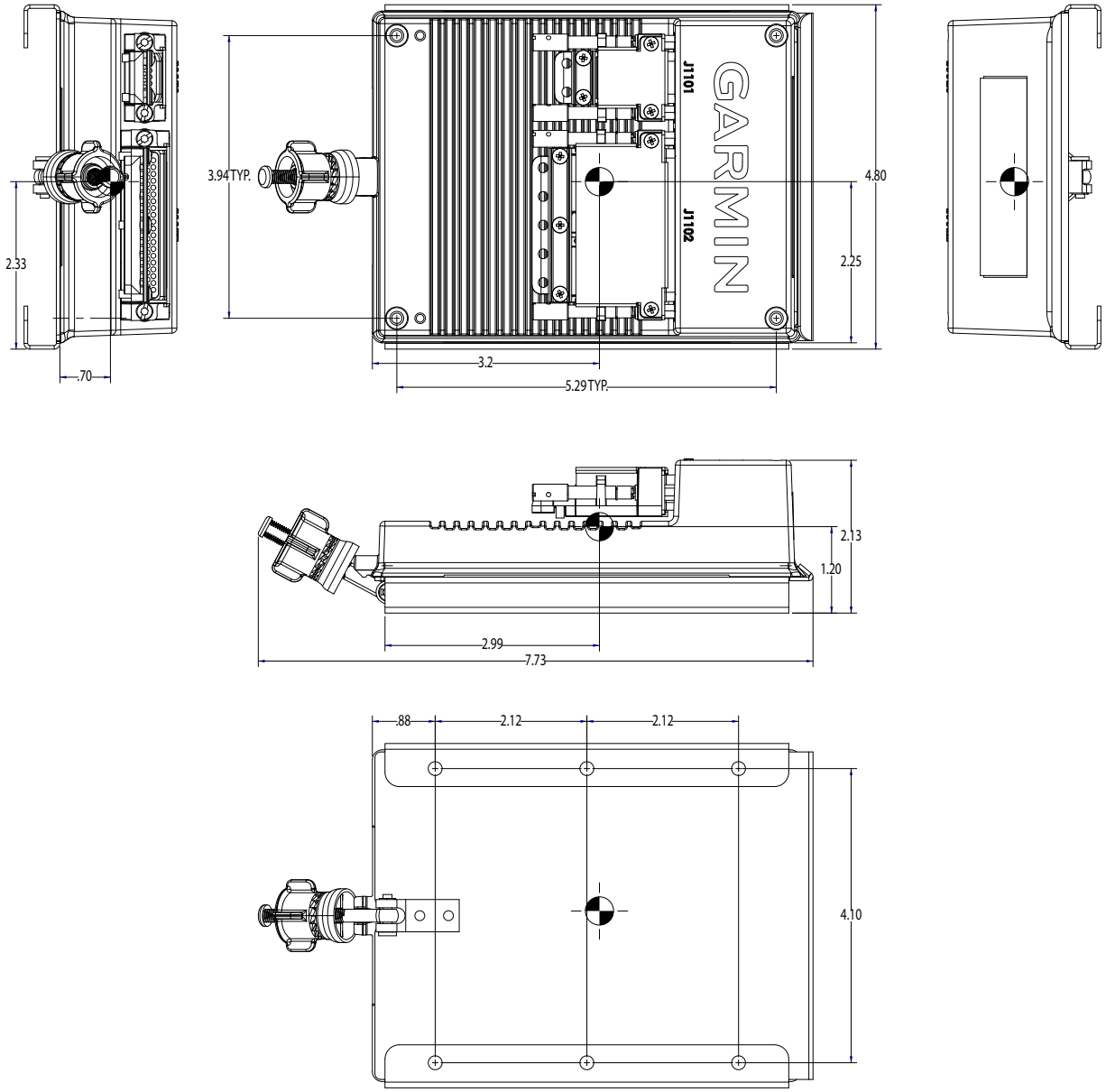
4.15 GEA System ID Program

For installations that have more than one GEA, ground SYS ID #1 to identify GEA #1 and ground SYS ID #2 for GEA #2.

Table 4-17 GEA System ID Program Pins

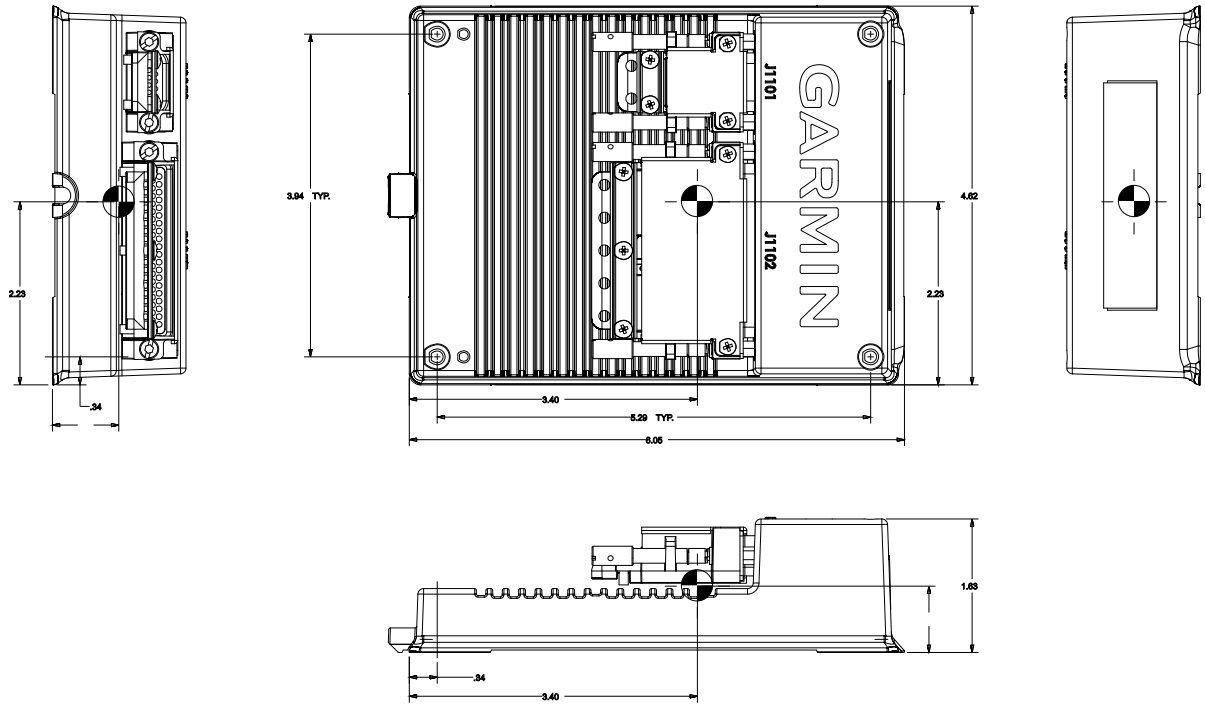
PIN	PIN NAME	CONNECTOR	I/O
12	GEA SYSTEM ID PROGRAM* 1	J1102	In
13	GEA SYSTEM ID PROGRAM* 2	J1102	In

Appendix A Mechanical Drawings



NOTES:
1. DIMENSIONS: INCH
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS OTHERWISE STATED.
3. MOUNTING HOLES FOR #6 PAN HEAD SCREW.

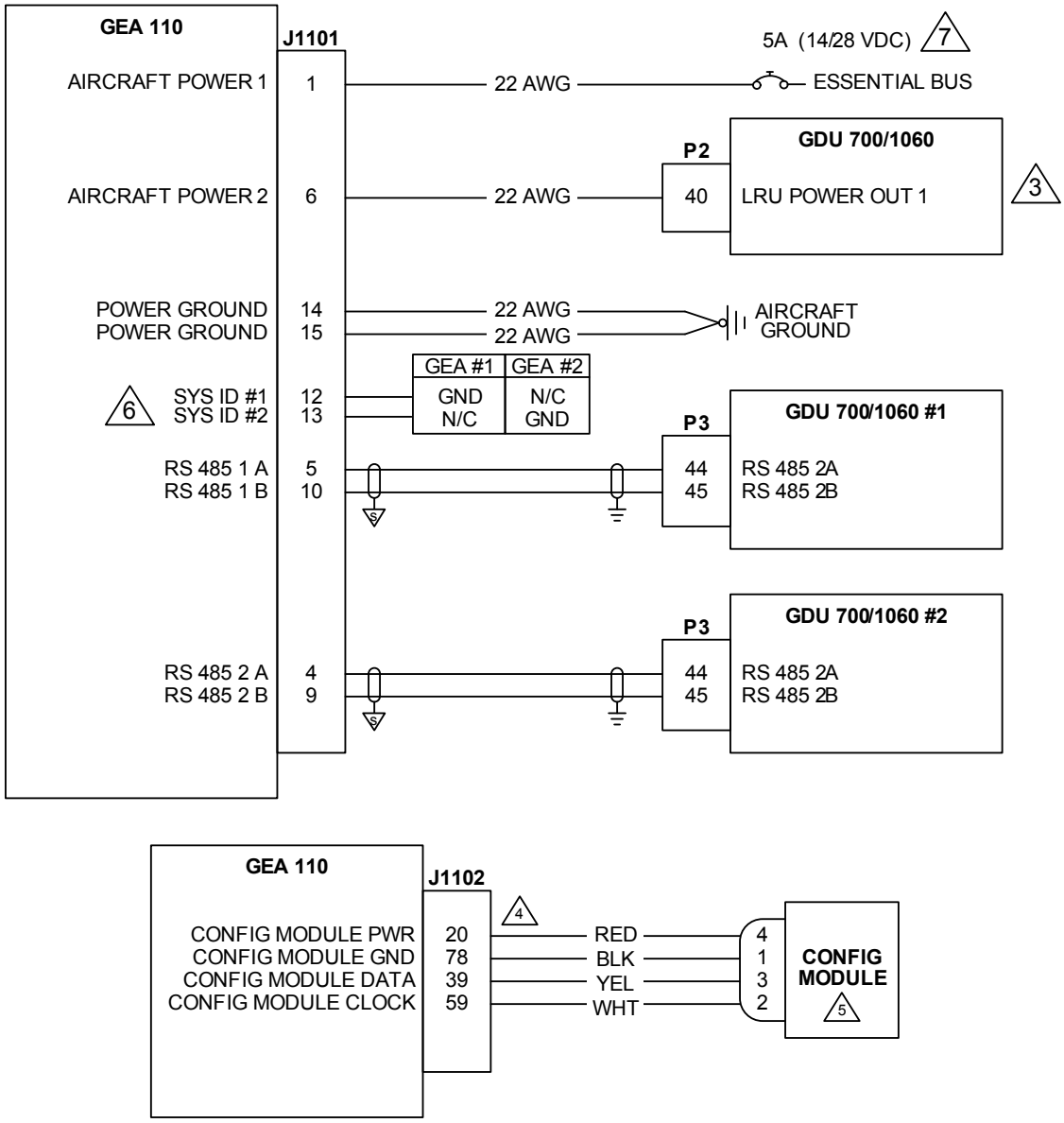
Figure A-1 GEA 110 Center of Gravity with Install Rack



NOTES:
1. DIMENSIONS: INCH
2. DIMENSIONS ARE NOMINAL AND TOLERANCES ARE NOT IMPLIED UNLESS OTHERWISE STATED.
3. MOUNTING HOLES FOR #6 PAN HEAD SCREW.

Figure A-2 GEA 110 Center of Gravity

Appendix B Interconnect Diagrams



NOTES

1 ALL WIRES 22 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: S SHIELD BLOCK GROUND ⏚ AIRFRAME GROUND

3 ONLY ONE POWER LEAD AND ONE GROUND LEAD ARE REQUIRED. THE SECOND INPUT IS FOR REDUNDANCY AND CAN BE POWERED BY A ELECTRICAL BUS, GDU 700 OR GDU 1060.

Figure B-1 GDU 700/GDU 1060 Interconnect
Sheet 1 of 2

NOTES CONTINUED

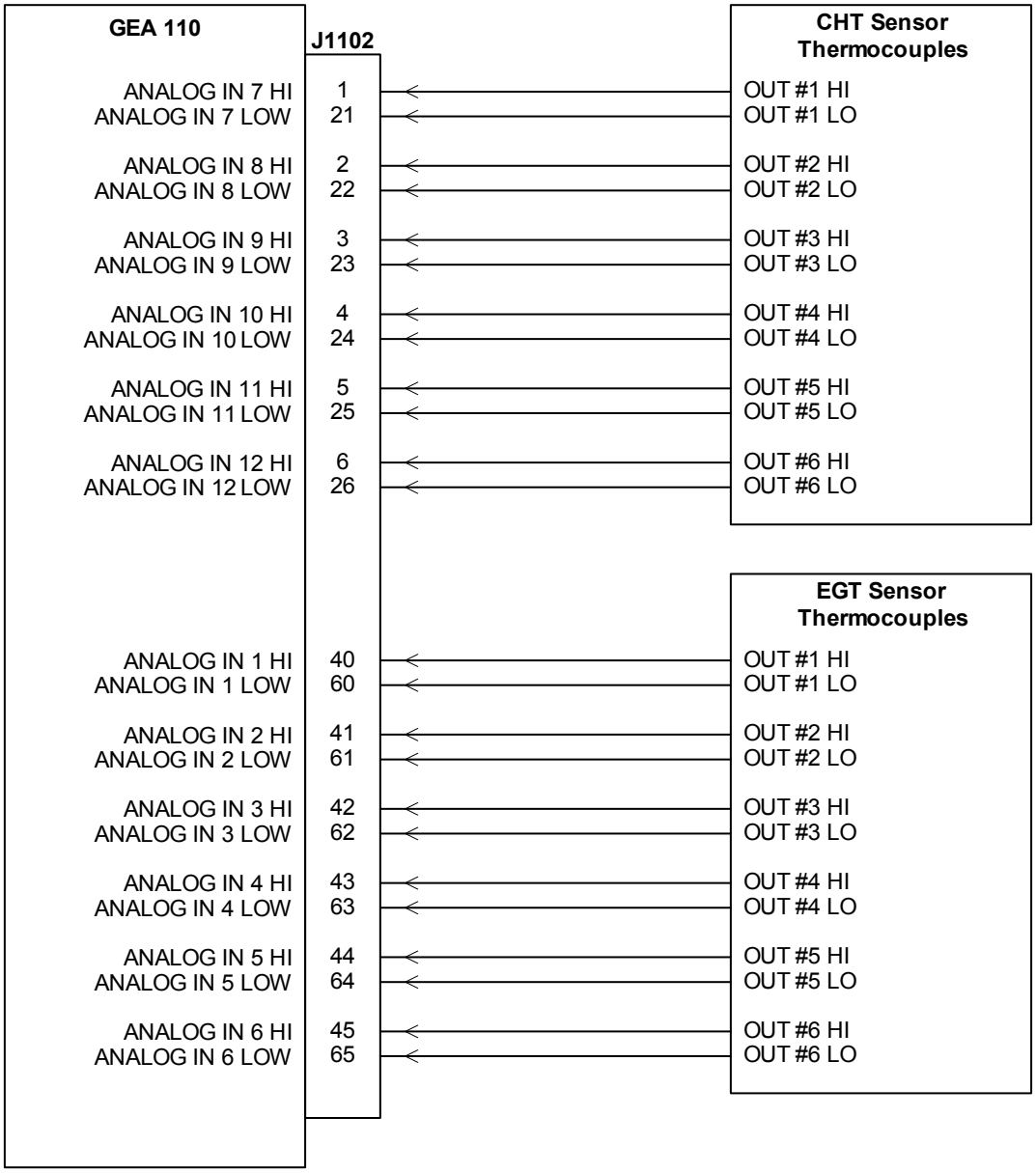
4 THE CONFIGURATION MODULE IS MOUNTED IN THE BACKSHELL OF THE J1102 CONNECTOR.

5 CONTACTS SUPPLIED WITH CONFIGURATION MODULE MUST BE USED FOR CONNECTING CONFIGURATION MODULE HARNESS TO J1102.

6 FOR SYSTEM ID DESIGNATION REFER TO SECTION 4.15.

7 A 2 AMP BREAKER MAY BE USED.

Figure B-1 GDU 700/GDU 1060 Interconnect
Sheet 2 of 2



NOTES

1 IF INSTALLING AN UNGROUNDED THERMOCOUPLE TO AN ANALOG IN INPUT, A DC REFERENCE MUST BE ADDED TO THE LO INPUT. THIS CAN BE ACCOMPLISHED BY ADDING A RESISTANCE OF 1 MEGOHM OR LESS BETWEEN GROUND AND THE ANALOG IN LO INPUT THAT THE UNGROUNDED THERMOCOUPLE IS INSTALLED.

Figure B-2 CHT and EGT Sensor Interconnect

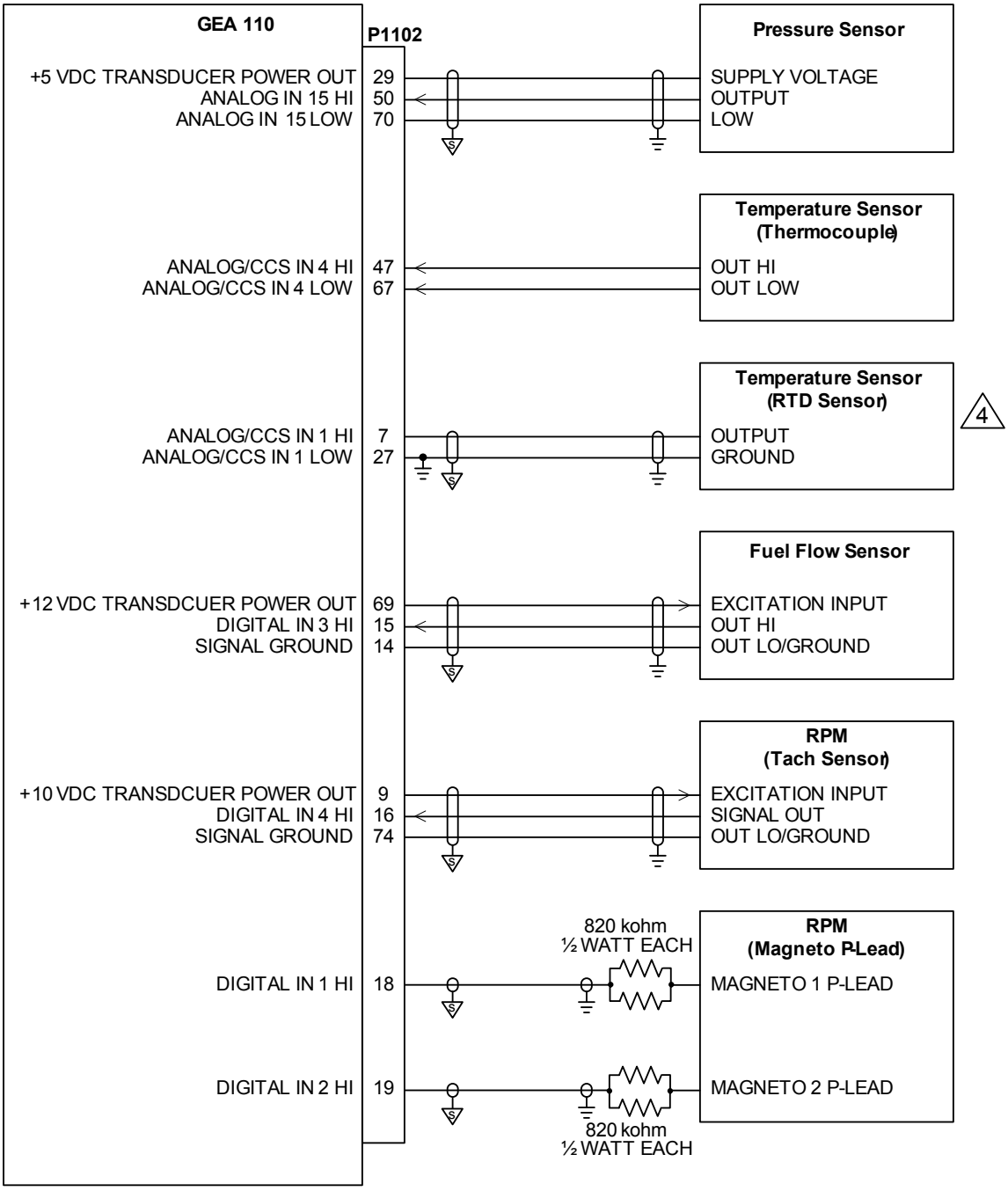


Figure B-3 Sensor Interconnect
Sheet 1 of 2

NOTES

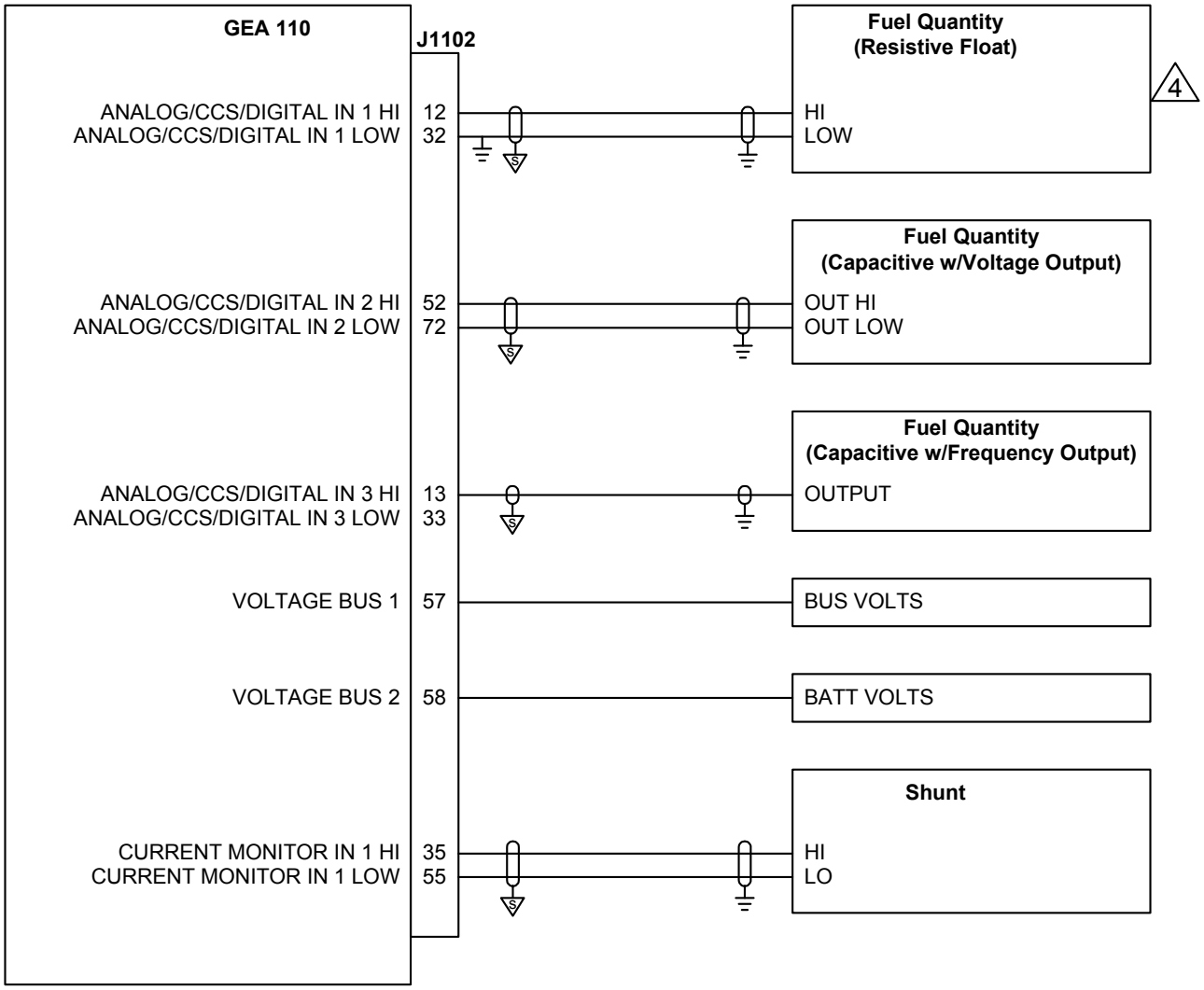
1. ALL WIRES 22 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2. GROUND DESIGNATIONS: SHIELD BLOCK GROUND AIRFRAME GROUND

3. THE SENSOR INTERCONNECTS ARE GENERIC, FOR THE CAPABILITIES OF EACH PORT REFER TO CONFIGURATION SECTION 4.

4. IF THE CONSTANT CURRENT SOURCE IS CONFIGURED ON, THE LOW SIDE OF THAT PORT MUST BE SPLICED AND GROUNDED NEAR THE SENSOR TO PROVIDE THE CURRENT A RETURN PATH.

Figure B-3 Sensor Interconnect
Sheet 2 of 2



NOTES

1 ALL WIRES 22 AWG OR LARGER UNLESS OTHERWISE SPECIFIED.

2 GROUND DESIGNATIONS: SHIELD BLOCK GROUND AIRFRAME GROUND

3 THE SENSOR INTERCONNECTS ARE GENERIC, FOR THE CAPABILITIES OF EACH PORT REFER TO CONFIGURATION SECTION 4.

4 IF THE CONSTANT CURRENT SOURCE IS CONFIGURED ON, THE LOW SIDE OF THAT PORT MUST BE SPLICED AND GROUNDED NEAR THE GEA TO PROVIDE THE CURRENT A RETURN PATH.

Figure B-4 Fuel Sensor Interconnect


GARMIN