N238PS — G1000 LOW VOLTS Troubleshooting Guide

Aircraft: N238PS (Diamond DA40NG, MAM40-858) Problem: G1000 NXi displays lower voltage than actual bus voltage, causing intermittent LOW VOLTS annunciations Date: February 2026 Prepared by: Aircraft Owner (Ingram Leedy)

Table of Contents

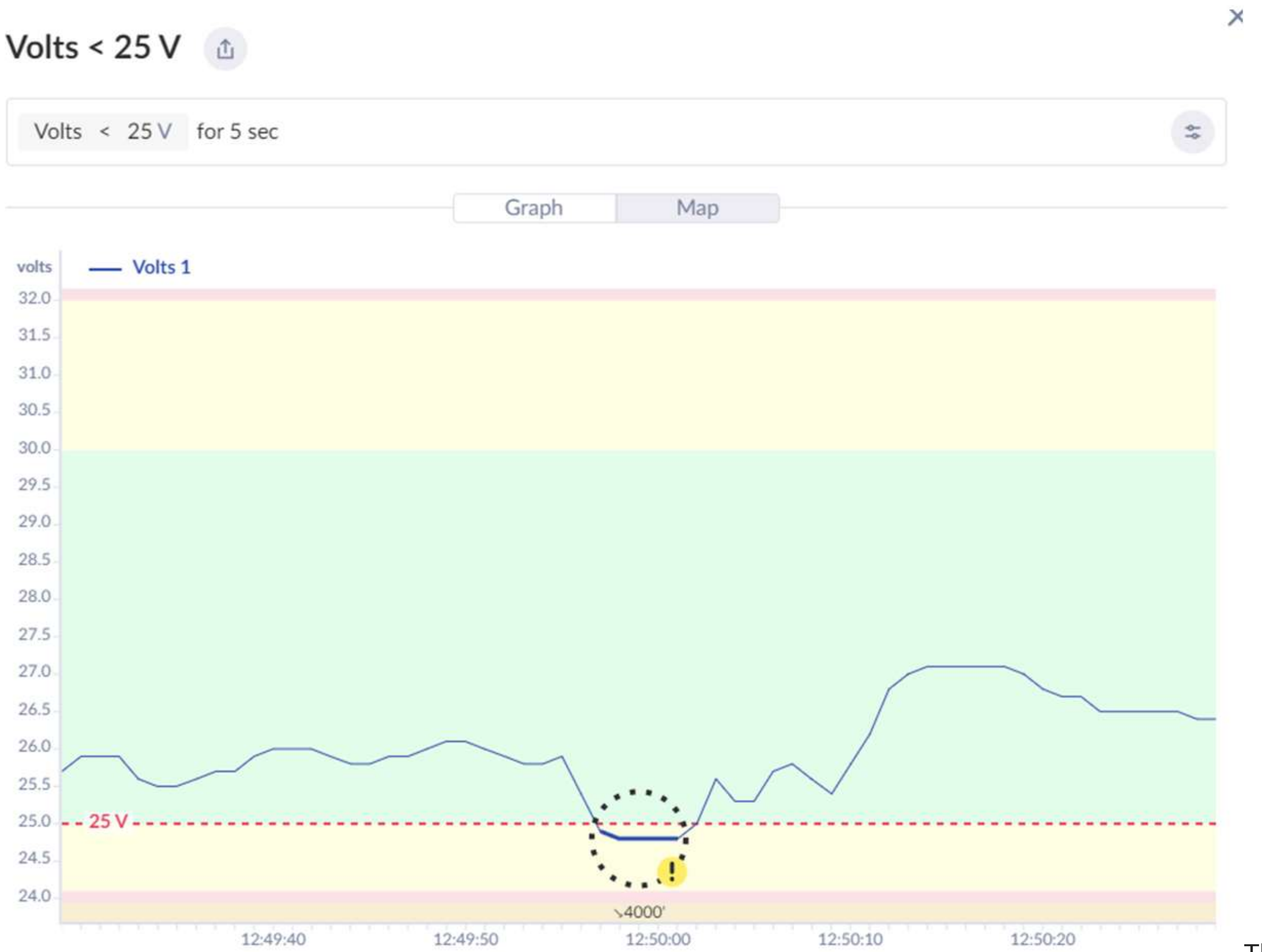
The Problem

The G1000 consistently reads 1–2 volts lower than actual bus voltage, with transient dips up to 5.6 volts low during high-current events. This causes false LOW VOLTS annunciations in flight even though the electrical system is charging normally.

FlySto LOW VOLTS Events (In-Flight)

These FlySto screenshots show actual LOW VOLTS events captured from G1000 flight logs. The voltage drops below the 25V threshold repeatedly during normal flight operations: 85 seconds below 25V — approach and taxi at KBOW, voltage swinging wildly between 24–27V:

18 seconds below 25V — during landing, and 5 seconds below 25V — at altitude during cruise:



These dips are not real — the independent VDL48 logger shows the bus voltage is steady at ~28V during these same periods. The G1000 is the only instrument seeing these drops. **How We Know It's Real** Three independent measurements were taken on the same aircraft, on the same flights. Two agree. One doesn't.

Source	Where It Measures	Average Reading	Verdict
VDL48 data logger (plugged into AUX POWER)	Direct battery voltage	28.3V	Correct
ECU battery voltage (engine computer)	Separate bus and ground path	27.8V	Correct
G1000 volt1	Through instrument panel ground studs	26.9V	Reads low

The VDL48 and ECU agree — the bus voltage is normal (~28V with alternator). The G1000 is the only instrument reading low.

How the Data Was Collected

Data Source	Collection Method	Sample Rate	Coverage
G1000 NXi flight logs	Automatically collected every flight by the Flight Stream 510 (AirSync) and uploaded to FlySto.net. CSV source files downloaded from FlySto.	1 second	184 flights, Jul 2023 – Feb 2026 (entire aircraft history since delivery)
AE300 ECU data logs	Extracted from the ECU's built-in data logger via USB using AE300-Wizard software (Austro Engine's download tool). The encrypted `.ae3` binary log files were then decrypted and parsed into readable CSV using AustroViewer (github.com/ingramleedy/AustroViewer, private repo). The ECU records 16 channels including battery voltage (channel 808) every engine run automatically.	1 second	265 sessions, Oct 2023 – Feb 2026
VDL48 voltage logger	Triplett VDL48 standalone data logger plugged into AUX POWER plug (HOT BUS, direct battery)	2 seconds	2 flights on Feb 8, 2026 (3.5 hours flight time + 1.4 hours ground idle)

The G1000 logs `volt1` — the bus voltage displayed on the PFD/MFD, measured by the GEA 71S via its voltage sense input (Pin 46/47) from the Essential Bus The ECU logs `Battery Voltage` (channel 808) — the AE300 engine computer's own battery voltage reading, measured through a separate bus (ECU BUS) and separate ground path (GS-RP studs) The VDL48 measures voltage at the AUX POWER plug on the HOT BUS — a direct connection to the battery through only a 5A fuse, no relays or breakers. This gives the cleanest reference of actual bus voltage.

All three sources were time-aligned and compared using paired statistical analysis. The full analysis scripts and raw data are available in the project repository at github.com/ingramleedy/volts.

Ground Test (Aug 18, 2025 — battery only, no engine)

Condition	Meter at AUX POWER	G1000 Display	Difference
Master ON, G1000 on, no other loads	25.2V	23.7V	-1.5V

The offset exists on the ground with battery only. This rules out the alternator, voltage regulator, and charging system entirely.

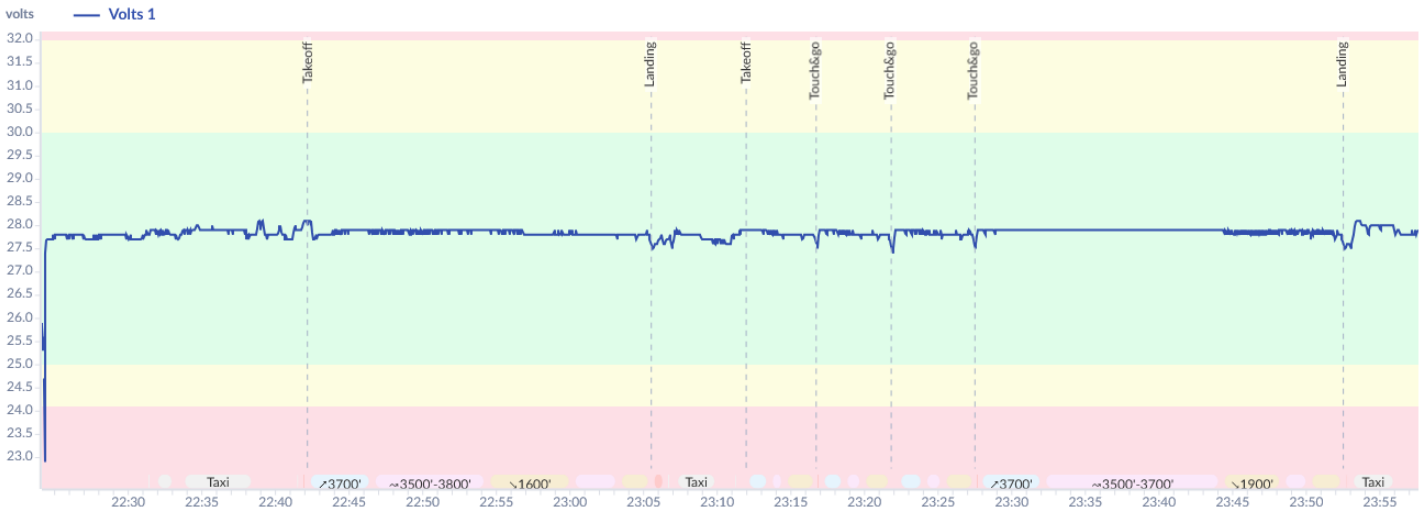
Why the Battery Matters (but isn't the cause)

The ground path drops ~1.4V regardless of battery condition. But the higher the starting bus voltage, the more headroom the G1000 has before hitting the 25V LOW VOLTS threshold. A fully charged battery with alternator running keeps the bus at ~28V, so the G1000 reads ~26.6V — above the threshold most of the time. If the battery is weak or undercharged, the bus sits lower and the G1000 dips below 25V more easily. A BatteryMinder trickle charger and keeps the battery fully maintained between flights. This maximizes voltage headroom and keeps the G1000 reading within operational margins most of the time — but it's a workaround, not a fix. HIGH-current transient loads (radio TX, autopilot servos, flaps) still cause dips that break through even that margin, which is what triggers the LOW VOLTS annunciations seen in the FlySto screenshots above.

When It Started and How It's Getting Worse

The Problem Existed From Day One

Comparing N238PS to another DA40NG (N541SA) shows something was never right — even from the delivery flight:



N541S

G1000 reads rock-steady voltage at ~27.8V with barely any fluctuation. N238PS has never been this stable:

Metric	N541SA	N238PS Brand New (Jul 2023)	N238PS Pre-Feb 2024	N238PS Post-Feb 2024
Mean voltage	~27.8V	27.55V	27.44V	26.86V
Noise	~0.05–0.10V	0.36V	0.38V	0.51V
Peak-to-peak range	~0.3V	4.4V	4.6V	5.2V
Time below 27V	~0%	6.2%	6.2%	53.5%

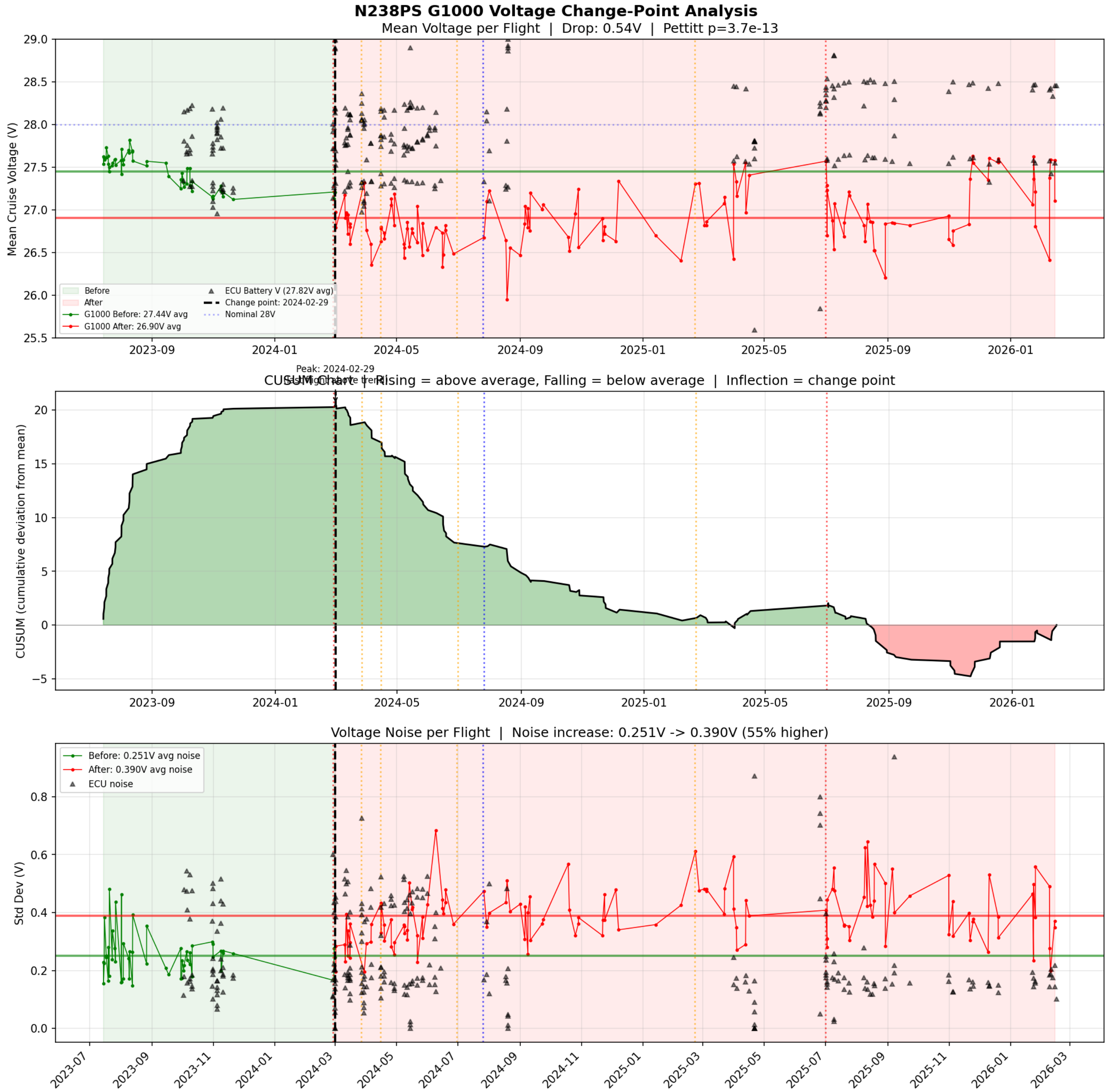
Even from delivery, N238PS was reading 0.25V low and had 4–5x more voltage noise than N541SA. This suggests a marginal ground connection has existed since the factory — the Feb 2024 shop visit then made it significantly worse.

The Change-Point: February 2024

Statistical analysis of 184 flight logs (Jul 2023 – Feb 2026) pinpoints exactly when the readings shifted. A statistically significant change-point was detected on February 29, 2024:

Period	Mean G1000 Voltage	Voltage Noise
Before shop visit (53 flights)	27.44V	0.25V
After shop visit (131 flights)	26.90V	0.39V
Change	-0.54V	+55% noisier

The ECU voltage did NOT change — it reads a steady 27.82V throughout the entire period. The problem is G1000-specific. The Feb 2024 shop visit made a pre-existing marginal connection worse, pushing it into LOW VOLTS territory.



How to read this chart: Top panel — Each dot is one flight's average voltage. Green = before Feb 2024, red = after. The ECU dots along the top stay flat at ~27.8V the entire time — the actual bus voltage never changed. Only the G1000 dropped. Middle panel — A trend line showing the problem is getting progressively worse over time, with a clear inflection at Feb 2024. Bottom panel — Voltage noise (how much the reading jumps around during each flight). After Feb 2024, noise increased 55% — consistent with a loose or corroded connection that vibration makes worse.

What Happened During That Shop Visit (Feb 2024)

The engine R&R (oil leak) was not the only work performed. During the same visit: Engine removed and reinstalled — oil sump gasket and cylinder head cover (firewall connectors disconnected/reconnected) Alternator #2 replaced — the RACC (AC system) wasn't turning on and wasn't getting power to the AUX switch RACC relay troubleshooting — relays in the aft avionics bay were inspected to diagnose the RACC power issue GSA 91 pitch servo replaced — autopilot pitch servo (also in the aft area)

The scope of this visit was extensive — engine R&R, alternator swap, relay troubleshooting in the aft bay, servo replacement. Panels were opened, harnesses were moved, and connectors were handled throughout the aircraft. Something during this visit disturbed a ground connection, and nobody noticed the G1000 was now reading a volt low. A second engine R&R in Jul 2025 (piston crack) did not fix the problem, ruling out the firewall pass-through connectors (which were reconnected during that work). The GSA 91 pitch servo was also replaced a second time — also with no improvement.

What Has Already Been Tried (and didn't fix it)

Date	Action	Result
Feb 2024	Replaced alternator #2 (RACC) + RACC relay troubleshooting	Fixed RACC — but G1000 voltage problem started here
Feb 2024	Replaced GSA 91 pitch servo	No improvement on voltage
Apr 2024	Replaced voltage regulator	No improvement
Jun 2024	Replaced voltage regulator again + repaired wire at P2208	No improvement
Jul 2024	Replaced P2413 connector (repinned HSDB harness)	Fixed COM/NAV/GPS cycling issue — no improvement on voltage
Feb 2025	Replaced main alternator AND voltage regulator (3rd time)	No improvement
Jul 2025	Engine R&R #2 + new battery + GSA 91 pitch servo replaced again	No improvement
Feb 2026	Cleaned GDL 69A pins (CH.23)	No improvement — wrong unit

None of these addressed the ground path. The alternator and regulators were never the problem — the ECU confirms the charging system works correctly. The Feb 2026 pin cleaning targeted the GDL 69A (SiriusXM datalink transceiver, CH.23). The voltage measurement comes from the GEA 71S (Engine/Airframe unit, connector P701) — its power ground pin (Pin 20, wire 77016A22N to GS-IP-14) was not inspected. Note: This aircraft has a history of connector/pin problems. In May 2023, the G1000 experienced repeated COM/NAV/GPS/AHRS cycling and autopilot disconnects during an IFR flight — that issue was resolved by cleaning pins and reseating the P2413 HSDB harness connector (Jul 2024). Connector issues are a known problem on this airframe. The voltage problem is the same type of issue — a bad connection — just at a different connector/stud that hasn't been addressed yet.

What's Causing It

A high-resistance ground connection somewhere in the GEA 71S's ground return path.

Where the Voltage Is Actually Measured

The G1000 bus voltage ("volt1") is measured by the GEA 71S (Engine/Airframe unit), which is mounted on the instrument panel shelf (AMM 31-40-00, p.985, Figure 6): GEA 71S Installation Location (AMM 31-40-00, Figure 6):

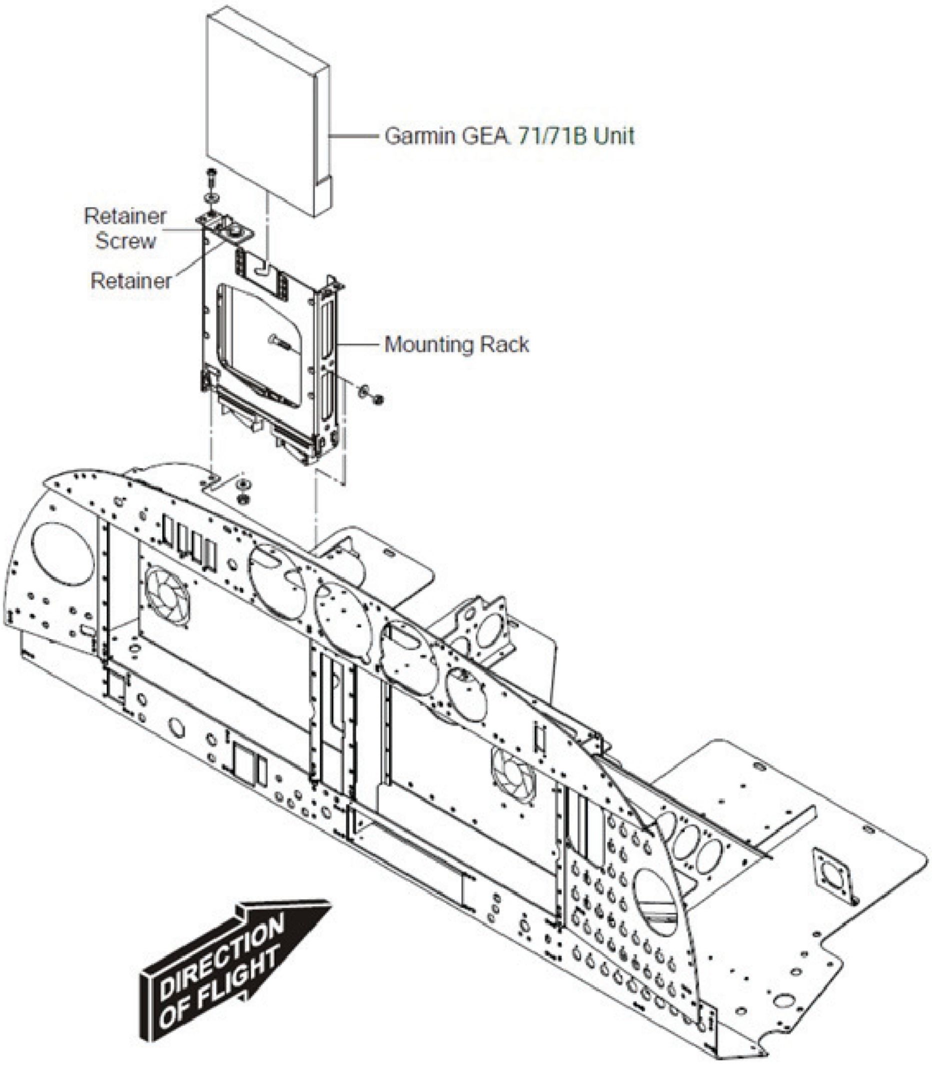
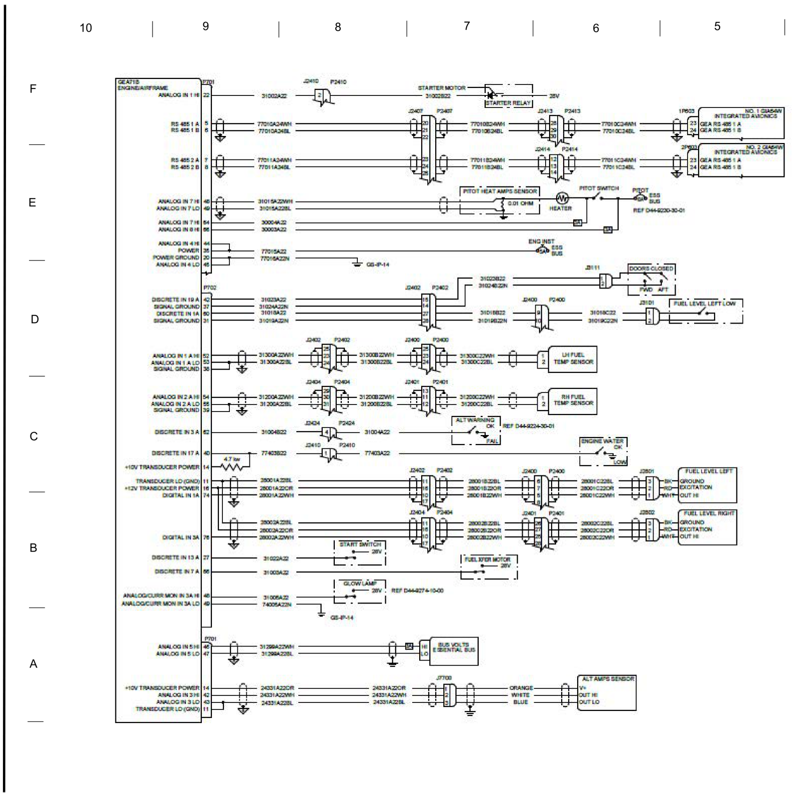


Figure 6 : GEA 71 / 71B Processor Installation

AMM

Schematic — G1000 NXi GEA 71S Wiring (D44-9231-60-03_01, Sheet 4/6):



REV.	SCHEMATIC	DRAWING NO.	SHEET
–	G1000 NXi (Phase III)	D44-9231-60-03_01	4/6

The GEA 71S senses bus voltage via a dedicated analog input — Pin 46 (ANALOG IN 5 HI) and Pin 47 (ANALOG IN 5 LO), connected to the Essential Bus GEA power: Pin 35 (AIRCRAFT POWER) via wire 77015A22 through the 5A ENG INST breaker Ground reference: Pin 20 (POWER GROUND) via wire 77016A22N to ground stud GS-IP-14 The displayed voltage = what Pin 46 sees on the Essential Bus, relative to the Pin 47/Pin 20 ground reference

No software calibration or correction is applied — the G1000 displays exactly what the GEA 71S hardware measures. The offset is a hardware voltage drop, not a calibration or firmware problem. Adjusting the software offset would only mask the symptom — the underlying problem would remain and continue to degrade.

How a Bad Ground Creates a False Low Reading

If there's extra resistance in the ground path, current flowing through that resistance creates a voltage drop that only the GEA sees: `V_displayed = V_actual - (I_load × R_bad_ground)` At 20 amps of avionics load, just 0.05 ohms of extra ground resistance = 1.0 volt of under-reading. That's all it takes.

The Voltage Measurement Path

```
Essential Bus ██→ GEA 71S Pin 46 (ANALOG IN 5 HI — voltage sense) ↓ GEA measures V(Pin 46) - V(Pin 47) ↓ GEA 71S Pin 47 (ANALOG IN 5 LO) / Pin 20 (POWER GROUND) ↓ wire 77016A22N → GS-IP-14 → bus bar → fuselage → battery negative ^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^^ HIGH RESISTANCE somewhere in here
```

Why Only the G1000 Reads Low

The GEA 71S grounds through GS-IP-14, which routes through the instrument panel bus bar, IP frame, and fuselage structure to reach the battery negative terminal. Every joint in that chain adds potential resistance. The ECU (located under the pilot's seat) grounds through the GS-RP (Ground Stud — Relay Panel) studs, which use a separate ground path to battery negative. The ECU reads correctly — its ground path doesn't share the instrument panel's bus bar, frame bonds, or GS-IP studs.

```
GEA 71S → GS-IP-14 → IP bus bar → IP frame → fuselage → battery negative (reads low) ECU → GS-RP studs → separate ground path → battery negative (reads correctly)
```

Where to Look

Instrument Panel

The GEA 71S — the unit that actually measures the voltage — is on the instrument panel shelf (AMM 31-40-00, p.985). Its connector P701 and ground stud GS-IP-14 are both in this area. Inspect: - GEA 71S connector P701 — is it fully seated with lock engaged? This is the voltage sensor unit. Check Pin 20 (power ground) and Pin 35 (aircraft power) specifically. - Ground stud GS-IP-14 — this is where the GEA 71S power ground wire (77016A22N) terminates. Check for loose nut, corrosion, or paint under the ring terminal. - All GS-IP ground studs on the IP bus bar (see table below) - Look for anything that appears disturbed, loose, or not fully reconnected

Ground Stud Locations (GS-IP Series)

All G1000 components ground to the GS-IP (Ground Stud — Instrument Panel) group. These are the specific studs and what's connected to each:

Ground Stud	What's Connected	Priority
GS IP-14	GEA 71S (wire 77016A22N, 22 AWG) — Pin 20 POWER GROUND	CHECK FIRST — this is the voltage sensor's ground reference

GS IP-6	GIA 63W #1 (wire 23011A20N, 20 AWG) + GIA 63W #2 (wire 23001A20N, 20 AWG)	CHECK SECOND — both avionics computers share this one stud
GS IP-4	GDU 1050 PFD + GDU 1060 MFD + GMA 1360 Audio + COM 1 (4 LRUs)	Check third — most heavily loaded stud
GS IP-5	GRS 79 AHRS #1 + AHRS #2 (via GS AVB bus bar)	Check fourth
GS IP-3	GPS/NAV 1 + Wx 500 Stormscope	Lower priority
GS IP-10	GPS/NAV 2	Lower priority

What to Look For at Each Ground Stud

Loose nut (vibration loosens over time) Corrosion under the ring terminal (green/white buildup) Paint, primer, or anodize between the ring terminal and the stud surface Cracked or deformed ring terminal Multiple ring terminals stacked on one stud not all making good contact Lock washer missing or flattened

LRU Connectors to Inspect

The voltage reading comes from the GEA 71S — its ground pin is the most critical. The displays (GDU) are on the instrument panel and share the same GS-IP bus bar:

Unit	Connector	Ground Pin	Wire	Ground Stud	What It Does
GEA 71S	P701	Pin 20 (POWER GROUND)	77016A22N (22 AWG)	GS-IP-14	THIS IS THE VOLTAGE SENSOR — measures its own power supply internally
GDU 1050 PFD	1P1600	Pin 27 (POWER GROUND)	31106A22N (22 AWG)	GS-IP-4	Primary flight display
GDU 1060 MFD	2P1601	Pin 27 (POWER GROUND)	31158A22N (22 AWG)	GS-IP-4	Multi-function display

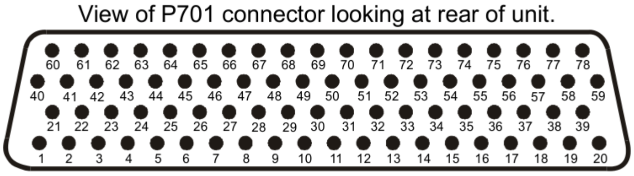
GEA 71S P701 Pin Reference (Garmin 190-00303-40) P701 Connector — view looking at rear of unit:

4 SYSTEM INTERCONNECTS

4.1 Pin Function List

4.1.1 P701 Connector

View of P701 connector looking at rear of unit.



Pin	Pin Name	I/O
1	CONFIG MODULE GROUND	--
2	DIGITAL IN* 1	In
3	DIGITAL IN* 2	In
4	SIGNAL GROUND	--
5	RS 485 1 A	I/O
6	RS 485 1 B	I/O
7	RS 485 2 A	I/O
8	RS 485 2 B	I/O
9	GEA SYSTEM ID PROGRAM* 1	In
10	GEA SYSTEM ID PROGRAM* 2	In
11	TRANSDUCER POWER OUT LO (GROUND)	--
12	TRANSDUCER POWER OUT LO (GROUND)	--
13	TRANSDUCER POWER OUT LO (GROUND)	--
14	+10 VDC TRANSDUCER POWER OUT	Out
15	+5 VDC TRANSDUCER POWER OUT	Out
16	+12 VDC TRANSDUCER POWER OUT	Out
17	ENGINE TEMP ANALOG IN 6 HI	In
18	ENGINE TEMP ANALOG IN 6 LO	In
19	SIGNAL GROUND	--
20	POWER GROUND	--
21	CONFIG MODULE POWER	Out
22	ANALOG IN 1 HI	In
23	ANALOG IN 1 LO	In
24	ANALOG IN 2 HI	In
25	ANALOG IN 2 LO	In
26	ENGINE TEMP ANALOG IN 1 HI	In
27	ENGINE TEMP ANALOG IN 1 LO	In
28	ENGINE TEMP ANALOG IN 2 HI	In
29	ENGINE TEMP ANALOG IN 2 LO	In
30	ENGINE TEMP ANALOG IN 3 HI	In
31	ENGINE TEMP ANALOG IN 3 LO	In
32	SIGNAL GROUND	--
33	ENGINE TEMP ANALOG IN 4 HI	In
34	ENGINE TEMP ANALOG IN 4 LO	In
35	AIRCRAFT POWER 1	In
36	ENGINE TEMP ANALOG IN 5 HI	In
37	AIRCRAFT POWER 2	In
38	ENGINE TEMP ANALOG IN 5 LO	In

Full pin listing: GEA 71 Installation Manual (190-00303-40) — pages 23–26 When you have the GEA 71S connector P701 in hand, these are the pins relevant to the voltage problem:

Pin	Function	What It Does
20	POWER GROUND	Ground reference for voltage measurement — this is the suspect pin

78	POWER GROUND	Second power ground — same ground network
35	AIRCRAFT POWER 1	Power input from Essential Bus (5A ENG INST breaker)
37	AIRCRAFT POWER 2	Second power input
46	ANALOG IN 5 HI	Bus voltage sense (high side)
47	ANALOG IN 5 LO	Bus voltage sense (low side)
42	ANALOG IN 3 HI	Alt amps sensor signal (not affected by bad ground)
43	ANALOG IN 3 LO	Alt amps sensor signal (not affected by bad ground)
14	+10V TRANSDUCER POWER	Powers the alternator current sensor
11–13	TRANSDUCER GROUND	Ground return for current sensor
5–8	RS 485 1A/1B, 2A/2B	Digital data bus to GIA computers

The amps reading on the G1000 MFD uses a separate Hall-effect current transducer with its own power (Pin 14) and differential output (Pins 42/43). The bad ground at Pin 20 does not affect the amp reading — only the voltage reading. At each connector, check for: - Backed-out pins (look from the rear of the connector) - Corrosion on pin or socket contacts - Connector not fully seated or lock not engaged - Damaged strain relief (wires pulling on connector)

Ground Bus Bar

The GS-IP studs connect to a ground bus bar mounted on the instrument panel frame. Check: - Bus bar mounting bolts tight - Clean metal-to-metal contact between bus bar and IP frame - No cracks in the bus bar

IP Frame to Fuselage Bond

The instrument panel frame connects to the fuselage structure. Check: - Bonding strap present and tight (if required by AMM) - No paint between bonding surfaces - Metal-to-metal contact confirmed

How to Test

ESS BUS Switch Test (Quick Isolation — No Tools Required)

This test isolates the power path from the ground path using only a cockpit switch, with the engine running on the ground. Background: The GEA 71S senses voltage from the Essential Bus (via Pin 46/47). In normal operation, the Essential Bus is fed from the Main Bus: `Battery → BATT BUS → Power Relay → MAIN BUS → Main Tie → Ess Tie Relay → ESSENTIAL BUS → GEA Pin 46 (sense)` When the ESS BUS switch is activated, the Essential Bus is fed directly from Battery Bus 2, bypassing the Main Bus, Power Relay, Main Tie breaker, and Essential Tie Relay entirely: `Battery → BATT BUS 2 → (direct) → ESSENTIAL BUS → GEA Pin 46 (sense)` Critically, the ground path does not change either way — the GEA 71S voltage sense reference (Pin 47 / Pin 20) still returns through GS-IP-14 → bus bar → fuselage → battery negative. Procedure: 1. Engine running at normal idle (alternator charging, bus voltage stable) 2. Note the G1000 voltage reading on the MFD 3. Flip the ESS BUS switch ON 4. Observe the G1000 voltage reading for 30–60 seconds 5. Return the ESS BUS switch to normal

Interpreting results:

Result	What It Means
Voltage stays the same (still reads low)	Ground path confirmed — the power source changed but the reading didn't, so the drop is on the ground side. Proceed to resistance measurements at GS-IP-14.
Voltage improves noticeably (reads closer to 28V)	Some resistance is in the power path (Main Bus relay contacts, Main Tie breaker, Essential Tie Relay)
Voltage improves partially	Both the power path and ground path contribute resistance

Based on all prior analysis (ECU and VDL48 both read correctly, variable offset with load, elevated noise), we expect the reading to stay low — confirming the ground path.

Resistance Measurements

Setup: Battery master OFF, battery negative cable physically disconnected from the battery post. Why disconnect the battery? The meter needs to be the only source of current in the circuit. If the battery is still connected, its 28V overwhelms the meter's tiny test signal and readings will be wrong. Battery master OFF alone is not enough — the HOT BUS and BATT BUS remain live. Physically disconnecting the negative cable is the only way to fully isolate the circuit. Recommended meter: Fluke 289 or similar DMM with 0.01Ω resolution and REL (relative) mode for auto-zeroing lead resistance. Set the meter to the lowest ohm range (600Ω range on the Fluke 289 gives 0.01Ω resolution). Practical setup for long-distance measurements: The GEA 71S is on the instrument panel shelf (front) while the battery is in the aft bay — too far apart for standard 1-meter test leads. To reach both points: Get a length of heavy gauge wire (12–14 AWG, 4–5 meters) with alligator clips on each end Clip one end to the black DMM lead Clip the other end to the red DMM lead Zero the leads: Press REL on the Fluke 289 — this zeros out the red lead + extension wire + black lead. The display should read 0.00Ω. The aircraft is not in the circuit during zeroing. Unclip the extension wire from the red DMM lead. Lay the extension wire through the cabin from instrument panel to aft bay. Clip the free end to the disconnected battery negative cable lug — this is the cable end you just pulled off the battery post. It's still connected to the aircraft's ground network. Do NOT clip to the battery post itself (it's isolated once the cable is removed). Place the red probe on the test point (e.g., P701 pin 20) — the meter current flows from the red probe through the aircraft's ground wiring to the cable lug. The reading is the true ground path resistance with lead resistance already zeroed out.

Test	From	To	Expected	If High
1. End-to-end	GEA 71S ground pin (P701 pin 20)	Battery negative cable lug	< 0.050 Ω	Confirms ground path problem — continue testing
2. Fuselage path	Bare fuselage metal near IP	Battery negative cable lug	< 0.010 Ω	Check battery cable, fuselage ground point
3. IP-to-fuselage	IP frame metal	Bare fuselage metal	< 0.005 Ω	Check bonding strap, IP mounting
4. Each GS-IP stud	Each GS-IP stud terminal	IP frame metal	< 0.005 Ω	Clean and retorque that stud
5. Each LRU ground	LRU ground pin (at connector)	Its GS-IP stud	< 0.010 Ω	Check connector pin, harness wire, crimp

Where to Put the Probes (Step by Step)

Test 1 — End-to-End (most important, do this first): - Black probe: Connected via extension wire to the disconnected battery negative cable lug in the aft bay (see setup above). REL should already be set from the zeroing step. - Red probe: Touch the back of pin 20 on connector P701 (the aircraft-side harness connector for the GEA 71S, on the instrument panel shelf). This is the power ground pin — the ground reference for the voltage measurement. If the connector is mated to the unit, you'll need to back-probe or disconnect it to access the pin. - This measures the entire ground path at once. If it reads good (< 0.050 Ω), the ground path is fine and the problem is elsewhere. If high, continue with Tests 2–5 to find which segment has the resistance. Test 2 — Fuselage Path: - Black probe: Still connected via extension wire to disconnected battery negative cable lug (REL still active). - Red probe: Bare/scraped fuselage metal near the instrument panel — find an unpainted screw head or lightly sand a small spot to get bare metal contact. - Tests the fuselage structure itself as a conductor from front to back. Tests 3–5 are all at the instrument panel — no extension wire needed. Disconnect the extension, touch the standard leads together, and press REL again to re-zero with just the standard leads. Test 3 — IP Frame to Fuselage: - Red probe: Bare metal on the instrument panel frame — the structural part the ground studs are mounted to. - Black probe: Bare fuselage metal nearby (same spot from Test 2). - If this reads high, the bonding strap between the IP frame and fuselage is the problem. Test 4 — Each GS-IP Ground Stud: - Red probe: The nut/terminal surface of each GS-IP stud — where the ring terminals are stacked. - Black probe: Bare IP frame metal right next to that stud. - Test each stud individually: GS IP-14 (GEA voltage sensor ground — most critical), GS IP-6, GS IP-4, GS IP-5, GS IP-3, GS IP-10. If one reads high while others read near-zero, that's your culprit — clean all surfaces and retorque. Test 5 — Each LRU Ground Wire: - Red probe: The ground pin at the aircraft-side harness connector — start with P701 pin 20 (GEA 71S, the voltage sensor). - Black probe: The GS-IP stud that wire runs to — GS IP-14 for the GEA 71S. - Tests the wire, crimp, and connector pin between the LRU and its ground stud. Repeat for each connector on the instrument panel.

Isolation Strategy

Start with Test 1. If high, the bad segment will stand out — everything else reads near-zero while the problem connection shows the bulk of the resistance. Work through Tests 2–5 in order to narrow down which segment carries the extra resistance. Important: Don't stop after finding one bad connection. The data shows the ground path was never as clean as other DA40NGs — even from the factory. There may be more than one marginal connection. Clean and retorque all GS-IP ground studs and reseat all G1000 LRU connectors while the panels are open.

What the Numbers Mean

End-to-End Resistance	Voltage Drop at 20A	What It Means
< 0.010 Ω	< 0.2V	Normal — clean ground path
0.010 – 0.025 Ω	0.2 – 0.5V	Marginal — may worsen with vibration
0.025 – 0.050 Ω	0.5 – 1.0V	Degraded — consistent with the ~1.4V average offset we measured
0.050 – 0.100 Ω	1.0 – 2.0V	Failed — consistent with the -5.6V worst-case dips
> 0.100 Ω	> 2.0V	Severe

We estimate the total ground path resistance is approximately 0.05–0.09 ohms based on the observed voltage offsets and typical avionics current draw.

How to Verify the Fix

A ground test alone cannot reproduce the problem reliably. The offset is worse in flight due to vibration and thermal effects on the bad connection. After repair: 1. Repeat the end-to-end resistance measurement — should be < 0.010 Ω 2. Power on avionics and check G1000 voltage reads within 0.3V of a meter at the AUX POWER plug 3. Flight test — fly at least 30 minutes with varied loads (radio TX, autopilot, flaps), then compare: - Option A — ECU data (easiest): The AE300 ECU logs battery voltage every flight automatically. Download the ECU session log and compare against the G1000 log. No extra equipment needed. - Option B — VDL48 (independent reference): Install VDL48 on AUX POWER plug, same setup as the Feb 8 analysis. - Pass criteria: G1000 vs reference mean offset < 0.3V, no dips > 1.0V, noise < 0.30V - The analysis scripts in this repository can process either data source automatically

AMM References

Reference	Content
AMM 24-60-00	Bus structure, power distribution, troubleshooting table
AMM 31-40-00, p.985-986	GEA 71S location (instrument panel shelf), Figure 6
AMM CH.92, D44-9224-30-01X03	Electrical system wiring diagram — N238PS configuration: p1859. Other variants: p1857 · p1858 · p1861
AMM CH.92, D44-9231-60-03_01	G1000 NXi wiring diagrams (Sheets 2-6): p1908 · p1909 · p1910 · p1911 · p1912
AMM CH.31	GDU 1050/1060 connector pinouts
AMM CH.34	GIA 63W connector pinouts
AMM CH.23	GMA, GTX, GDL connector pinouts
Garmin 190-00303-40	GEA 71 Installation Manual — P701/P702 connector pin function lists (pages 23-26)