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)

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.

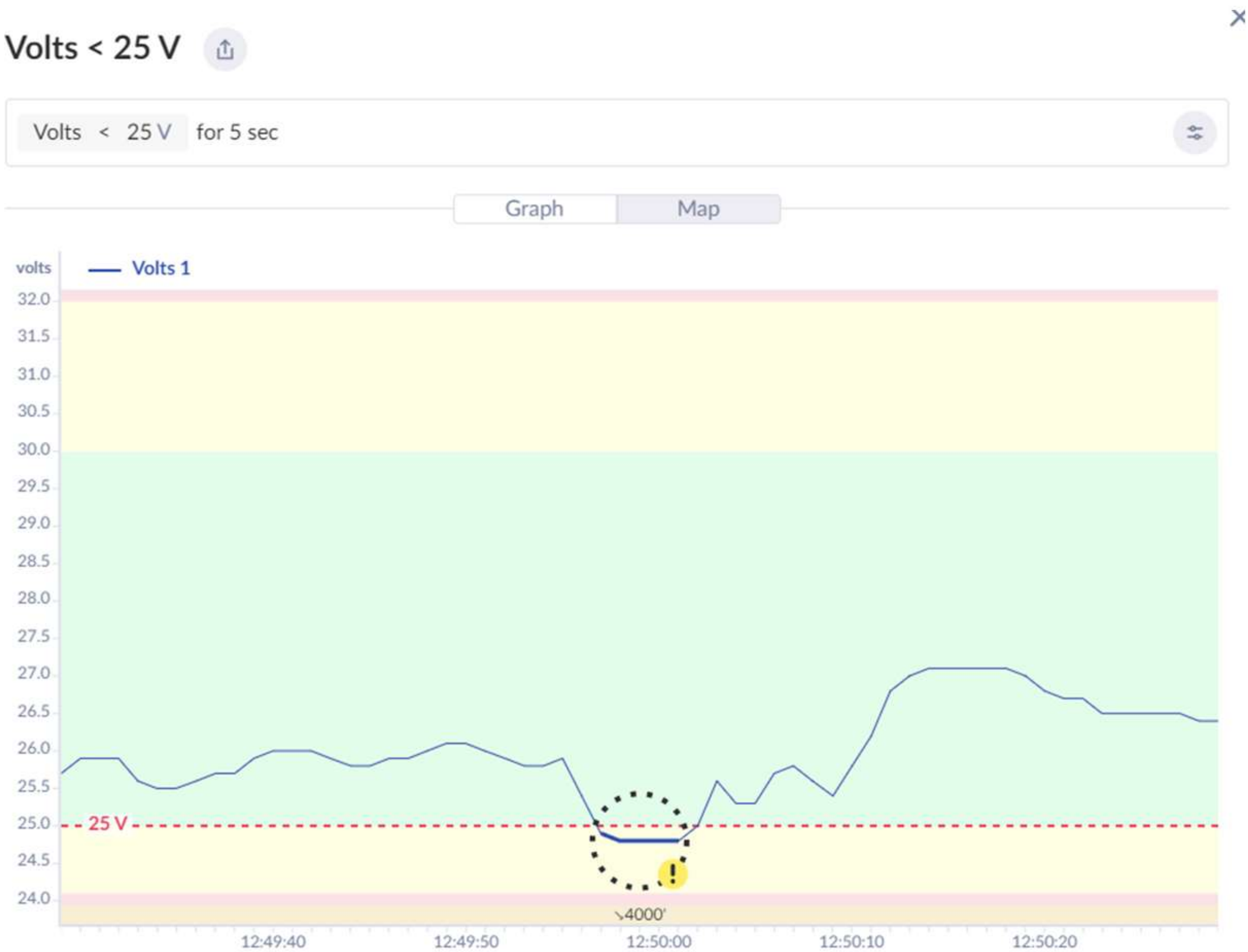
FlySto LOW VOLTS Events (In-Flight)

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:


Volts < 25 V
Volts < 25 V for 18 sec in total
Graph
Map
volts
Volts 1
AP OFF
500'
50'
Touchdown
Threshold 09L
25 V
Base
Final
→3000'
↘1200'
→1200'
↘RWY09L
Taxi
16:35
16:40
16:45


Volts < 25 V
Volts < 25 V for 5 sec
Graph
Map
volts
Volts 1
25 V
↘4000'
12:49:40
12:49:50
12:50:00
12:50:10
12:50:20

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)	HOT BUS — direct battery	**28.3V**	Correct
ECU battery voltage (engine computer)	ECU BUS — own ground to GS-RP	**27.8V**	Correct
G1000 volt1	AVIONIC BUS — ground through GS-IP 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.

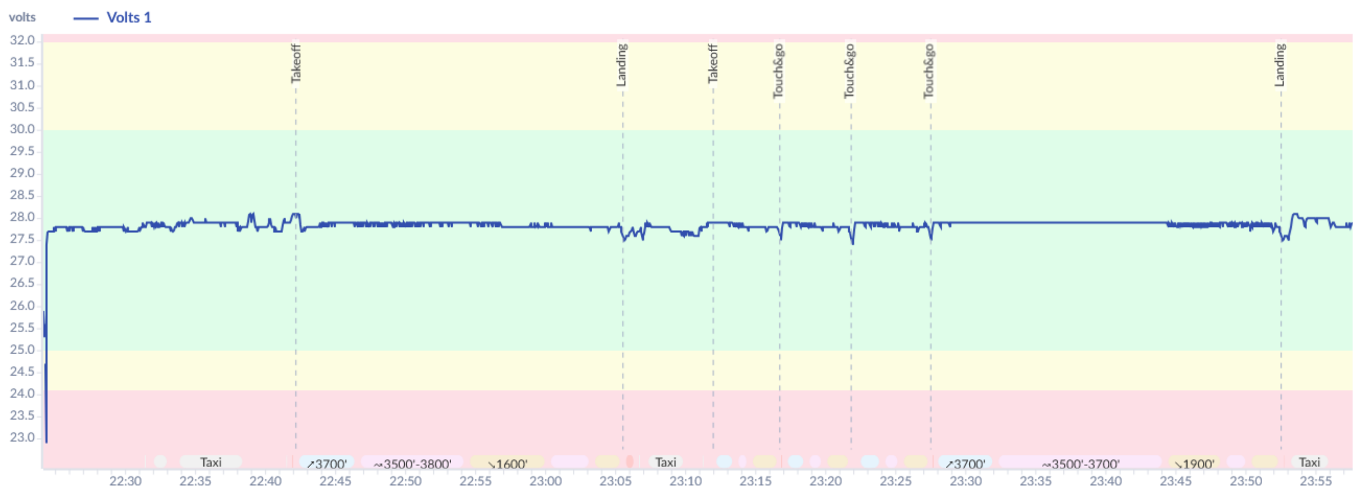
Ground Test (Aug 18, 2025 — battery only, no engine)

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.

Another DA40NG for Comparison (N541SA)

A FlySto voltage graph from another DA40NG (N541SA) shows rock-steady voltage at ~27.8V with barely any fluctuation. The G1000 is capable of reading stable, accurate voltage — the problem is specific to N238PS.



N238PS has **never** been this stable — not even on the delivery flight. Comparing voltage stability across the entire history:

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 (σ)	~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.

Where the Voltage Is Actually Measured

The G1000 bus voltage ("volt1") is measured by the **GEA 71S** (Engine/Airframe unit) on the avionics rack in the aft bay. Per the Garmin GEA 71 Installation Manual (190-00303-40) and AMM CH.92 schematic D44-9231-60-03_01 (Sheet 4/6, page 1910):

- The GEA 71S **measures its own power supply voltage internally** — there is no separate external sense wire
- **Power input:** Pin 35 (AIRCRAFT POWER) via wire **77015A22** from the Essential Bus 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 arrives at Pin 35 minus what's at Pin 20

The G1000 configuration shows Analog In 5 with **Slope (m) = 1.0** and **Offset (b) = 0.0** — no software correction is applied. The G1000 displays exactly what the GEA 71S measures. The offset is a **hardware voltage drop**, not a calibration or firmware problem. Adjusting the offset (b) parameter would only mask the symptom — the underlying problem would remain and continue to degrade.

What's Causing It

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

The GEA 71S measures its own power supply voltage at **Pin 35** relative to its own ground at **Pin 20**. 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 → 5A ENG INST breaker → wire 77015A22 → GEA 71S Pin 35 (POWER)
                                                                  ↓
                                                       GEA measures voltage internally
                                                                  ↓
                                             GEA 71S 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 takes a long path through the instrument panel structure, fuselage, and airframe to reach the battery negative terminal.

The ECU and alternator ground through the **GS-RP** (Relay Panel) ground studs, which have a short, direct path to battery negative. That's why the ECU reads correctly.

```
GEA 71S → GS-IP-14 → IP bus bar → fuselage → battery negative  (reads low)

ECU     → GS-RP studs → short ground strap → battery negative   (reads correctly)
```

When the Problem Got Worse

The ground path was never perfect (see N541SA comparison above), but it got **significantly worse** after the Feb 2024 shop visit.

Statistical analysis of **184 flight logs** (Jul 2023 – Feb 2026) detected a change-point on **February 29, 2024** ($p < 0.001$):

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.

What Happened During That Shop Visit (Feb 2024)

The engine R&R (oil leak) was not the only work performed. During the same visit:

1. **Engine removed and reinstalled** — oil sump gasket and cylinder head cover (firewall connectors disconnected/reconnected)
2. **Alternator #2 replaced** — the RACC (AC system) wasn't turning on and wasn't getting power to the AUX switch
3. **RACC relay troubleshooting** — relays in the **aft avionics bay** were inspected to diagnose the RACC power issue
4. **GSA 91 pitch servo replaced** — autopilot pitch servo (also in the aft area)

This is critical: The G1000 avionics rack (GEA 71S, GIA 63W, GRS 79, etc.) is mounted in the **aft avionics bay, near the battery**. While troubleshooting the RACC relays in that same bay, someone likely bumped, loosened, or failed to fully reseat a G1000 ground connection — particularly the GEA 71S connector P701 or its ground wire to GS-IP-14. The RACC got fixed, the engine went back on, 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)	No improvement
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.

Where to Look

Aft Avionics Bay (CHECK FIRST)

The G1000 LRU rack (GEA 71S, GIA 63W, GRS 79, etc.) is mounted in the **aft avionics bay near the battery**. This is the same area where RACC relays were troubleshot during the Feb 2024 shop visit — someone was working right on top of the G1000 units when the problem started.

Inspect in the aft bay:

- **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 other G1000 LRU connectors on the rack
- Any other ground studs in the aft bay
- Look for anything that appears disturbed, loose, or not fully reconnected
- Check for tool marks, scuffing, or signs that connectors were pulled and reseated

Ground Stud Locations (GS-IP Series)

All G1000 components ground to the **GS-IP** (Instrument Panel) ground stud 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 through these specific units. The GEA 71S is the actual sensor — its ground pin is the most critical:

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
GIA 63W #1	1P604	Pin 14 (POWER GROUND)	23011A20N (20 AWG)	GS-IP-6	Primary avionics computer — receives voltage data from GEA
GIA 63W #2	2P604	Pin 14 (POWER GROUND)	23001A20N (20 AWG)	GS-IP-6	Redundant avionics computer
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

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

Resistance Measurements

Setup: Battery master OFF, **battery negative cable physically disconnected from the battery post**.

Why disconnect the battery? A multimeter in ohms mode works by pushing a tiny known current through its probes and measuring the voltage drop. If the battery is still connected:

- The battery's 28V overwhelms the meter's test signal — you get garbage readings
- On milliohm ranges, external voltage can damage the meter
- Current can flow through other powered paths (relays, avionics), making a bad connection appear good

Battery master OFF alone is not enough — the HOT BUS and BATT BUS remain live. Disconnecting the negative cable physically isolates the battery so the meter reads only the wire and connection resistance.

Meter setup: Use a digital multimeter on the lowest ohm range (milliohm mode preferred). Before testing, short the two leads together and note the reading — subtract this lead resistance from all measurements.

Test	From	To	Expected	If High
1. End-to-end	GEA 71S ground pin (P701 pin 20)	Battery negative terminal	**< 0.050 Ω**	Confirms ground path problem — continue testing
2. Fuselage path	Bare fuselage metal near IP	Battery negative post	< 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):

- **Red probe:** Touch the back of **pin 20** on connector P701 (the aircraft-side harness connector for the GEA 71S). 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.
- **Black probe:** Touch the **battery negative terminal post** — the bolt on the battery itself, not the cable end.

- 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:

- **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.
- **Black probe: Battery negative terminal post.**
- Tests the fuselage structure itself as a conductor from front to back.

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). Then test pin 14 on 1P604 (GIA 63W #1).
- **Black probe:** The **GS-IP stud** that wire runs to — **GS IP-14** for the GEA 71S, GS IP-6 for both GIA 63W units.
- Tests the wire, crimp, and connector pin between the LRU and its ground stud.

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

End-to-End Resistance	Voltage Drop at 20A	What It Means
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 with VDL48** (same test setup as our Feb 8 analysis):
   - Install VDL48 on AUX POWER plug
   - Fly at least 30 minutes with varied loads (radio TX, autopilot, flaps)
   - Compare G1000 log vs VDL48 log
   - **Pass:** Mean offset < 0.3V, no dips > 1.0V, noise < 0.30V
   - The analysis scripts in this repository can process the data automatically

AMM References

Reference	Content
AMM 24-60-00	Bus structure, power distribution, troubleshooting table
AMM CH.92, D44-9224-30-01 through -05	Electrical system wiring diagrams (power distribution)
AMM CH.92, D44-9231-60-03_01	G1000 NXi wiring diagrams (Sheets 2-6, pages 1908-1912)
AMM CH.31	GDU 1050/1060 connector pinouts
AMM CH.34	GIA 63W connector pinouts
AMM CH.23	GMA, GTX, GDL connector pinouts

Summary

The G1000 reads low because of high-resistance ground connections — not a calibration issue, not a charging system issue, not a firmware issue. The voltage was never as stable as other DA40NGs (even from delivery), and it got significantly worse after the Feb 2024 shop visit when RACC relays were troubleshot in the aft avionics bay — the same bay where the G1000 rack is mounted. Three voltage regulators, two alternators, and two pitch servos have been replaced unnecessarily. The fix is to **clean and retorque all G1000 ground**

connections — both in the aft avionics bay and at the GS-IP ground studs. Don't stop after finding one bad connection; the data shows there may be more than one marginal joint.