

The Battery Reads 24 V. Why Does the Camera Still Restart?

The battery and the camera do not see the same voltage



The battery reading does not include the losses between the source and the equipment input.

The camera works with the engine stopped. Start the engine or switch another load, and the picture disappears. A meter across the battery still shows a reassuring voltage. These observations can all be true: the meter, the power cable and the camera may be revealing different parts of the event.

First establish whether the camera actually restarted. A restart counter or device uptime can support that diagnosis. A lost video stream with unchanged uptime instead points toward the link, display or another subsystem. A blank image alone does not identify a power fault.

Next separate voltage **at the source** from voltage **across the equipment's power pins**. Current passing through wires, contacts and the return path creates a difference between them. The difference grows when current rises, even if the battery voltage stays unchanged.

The Inventra S³ [PED08 product page](#) lists an 18-32 V DC operating range and 10 W typical consumption. Neither figure specifies the

complete installation's peak current or proves how the camera, network equipment and positioner together behave during an engine start. Obtain those limits for the ordered configuration.

For 28 V equipment on military ground vehicles, [MIL-STD-1275F](#), sections 5.1.1-5.1.2, distinguishes steady operation from starting disturbances at equipment input terminals. Where its starting requirement applies, equipment must operate without degradation or damage.

Its starting envelope can extend below a product's ordinary operating band. For installations governed by other requirements, agree whether continuous operation, a controlled interruption or another recovery behaviour is required.

That is why a nominal voltage label is only the beginning of a power specification.

A blank picture is a symptom. Record whether power, the device or the video path failed.

The return path can move the signal reference



A return connection has contact surfaces hidden when assembled; measure its voltage drop under load.

For a simple branch carrying one current, the resistive voltage loss is:

Voltage loss = current × total path resistance

Total path resistance includes the outgoing wire, return wire and their connections. Measuring cable length in one direction and forgetting the return underestimates the loss. A shorter run or larger conductor reduces wire resistance, but a poor contact can remain the dominant problem. These relationships follow [resistance and conductor geometry](#).

The return has a second job in many installations: it helps establish the voltage reference between communicating boxes. If a camera and a motor share part of that path, a motor-current change can move the camera's reference even when its own current barely changes.

Consider a separate calculated example: a 12 A change through 0.05 Ω of shared return resistance produces a **0.60 V reference shift**. This is a reference offset; it does not automatically become a 0.60 V error in the

data. The effect depends on the receiver, isolation and complete return network.

Differential links measure the difference between two signal wires and reject some voltage that moves both together. Their permitted common voltage still has limits. NASA's [2025 grounding handbook, section 5.2.3](#), explains both shared-return noise and this limit. These circuit principles are useful here; a spacecraft grounding arrangement should not be copied into a vehicle without reviewing its interfaces.

Trace the intended power return, chassis bonds and signal shields separately on the installation drawing. Identify any shared section. Choose changes with the equipment's grounding design in view. Simply adding another chassis connection can create an extra current path.

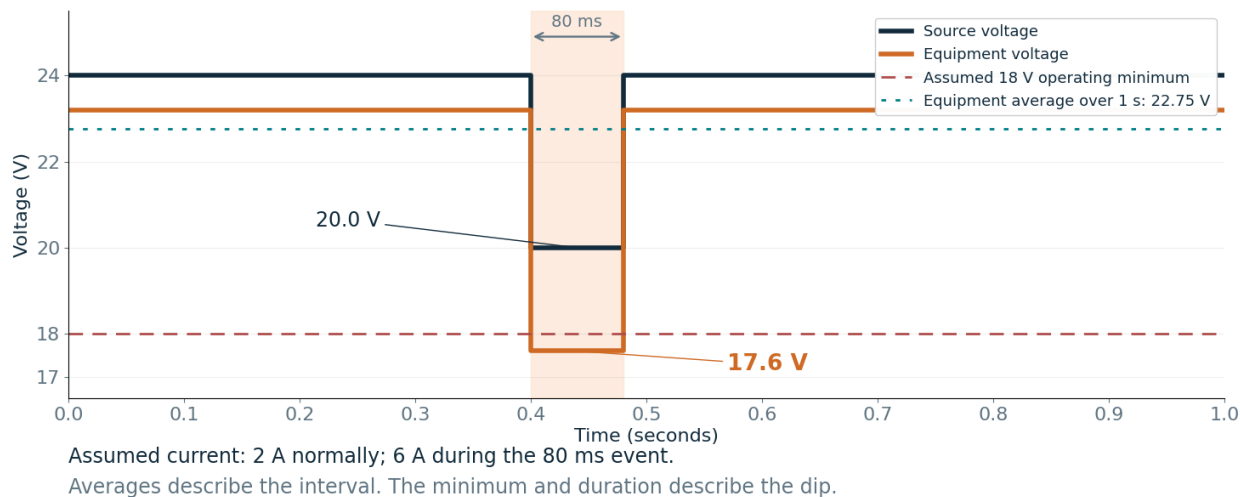
A visible contact surface helps locate an inspection point. Its appearance alone cannot tell you its electrical resistance.

A return conductor is part of the power circuit and can also influence the signal reference.

An 80 ms dip can disappear inside a healthy average

A brief dip can hide inside a healthy average

Calculated example • 0.40 Ω total outgoing and return resistance



Calculated from the stated 0.40 Ω path, source voltages and currents. The 18 V line is an assumed operating minimum.

Use the following calculation to see why a normal reading can be misleading. Assume a generic equipment branch with 0.40 Ω total path resistance. Its current rises from 2 A to 6 A for 80 milliseconds while the source falls from 24 V to 20 V. These are chosen example values, not measured Inventra S³ performance.

At 2 A, the path loses **0.8 V**, leaving **23.2 V** at the equipment. At 6 A, the path loses **2.4 V**.

During the event, the source remains above an assumed 18 V equipment operating minimum. The equipment does not: **20.0 - 6 $\times$ 0.40 = 17.6 V**. Whether this causes a reset depends on the actual device's stored energy, protection thresholds and allowed dip duration. Crossing a stated operating minimum establishes a requirement gap, not a guaranteed reboot.

Now average one complete second containing that event. The equipment is at

23.2 V for 0.92 seconds and 17.6 V for 0.08 seconds. The result is **22.75 V**. A slow or averaged reading can therefore look comfortable while missing the minimum that matters. Different meters use different acquisition methods; this arithmetic is not a prediction of every meter's display.

Halving path resistance to 0.20 Ω raises the event voltage to **18.8 V** under the same assumptions. That leaves 0.8 V above the assumed minimum. Check tolerances, temperature and other operating states before calling it enough.

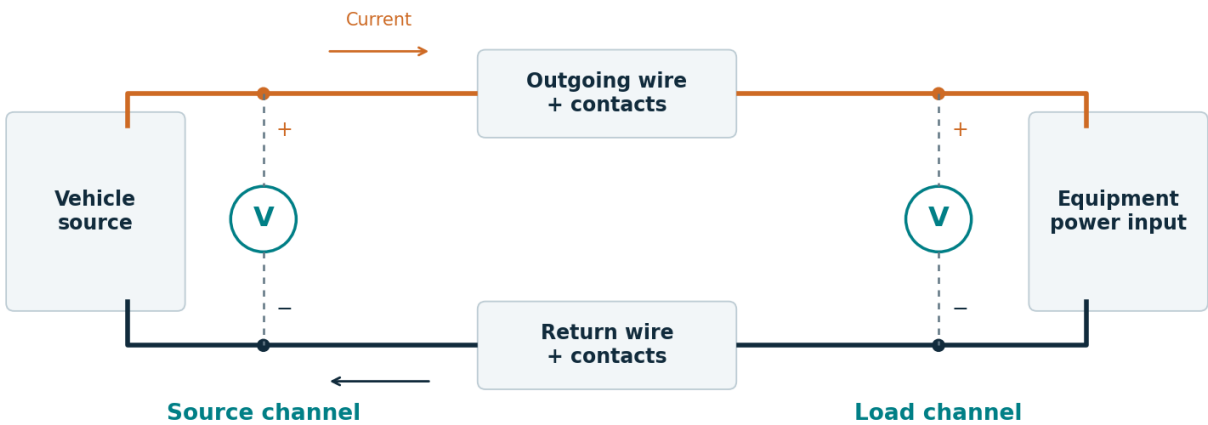
This resistive model explains the plateau of the dip. Fast edges also involve wiring inductance and equipment capacitance, so it does not predict every spike or ringing waveform.

The calculated one-second average is 22.75 V, while the minimum is 17.6 V.

Capture the event, then change the right part

Measure both ends of the same power path

Two voltage channels, one shared timebase



Each channel reads positive to its own return at that end.

Use rated differential probes or isolated inputs; ordinary scope grounds can join the returns.

Functional measurement map. Use the ordered connector pinout for the physical connections.

Measure across each local positive and return pair without joining the returns through the instrument.

Record two voltages simultaneously: source positive to source return, and equipment input positive to its own input return. Use approved access points or a suitable breakout connection so the installed load stays connected. Record branch current as well when available, and mark the engine-start, heater or movement command on the same timeline.

Use differential probes or independently isolated acquisition channels. Check differential-voltage and common-mode ratings, bandwidth and isolation between channels in the instrument documentation. Ordinary oscilloscope ground clips may be connected together internally. Placing them on different returns can join those points and change the circuit being measured. [Penn State's troubleshooting guide](#) highlights this grounding mistake and the need to check triggering, scale and probe settings.

Trigger on the equipment voltage falling, retaining data before and after the event. If the fault occurs without a voltage dip, trigger on the load command or a recorded fault signal, or use continuous acquisition. Choose the sampling interval, bandwidth and recording length for the disturbance you need to resolve. An 80 ms drop and a fast spike need different measurement capabilities. Save the acquisition settings with the trace.

What the traces show	Where to investigate next
Both voltages fall together	Source behaviour and upstream distribution
Their difference grows with current	Wires, contacts and return losses
Supply remains acceptable but data fails	Return-reference shift, coupling and the data path

Capture the event, then change the right part - continued

These patterns guide the next test; more than one mechanism can occur together. Where access permits, measure the outgoing and return drops separately under the same load to locate the contribution.

Apply one documented change and repeat the event with the complete installed harness. Then check control response and

fresh video through recovery. The [image-readiness guide](#) explains why a reconnected link alone is not sufficient evidence of a usable image.

Measure at both ends at the same time; use the difference to choose the next investigation.

Sources and further reading

[PED08 published product information](#)

Inventra Inc. | 2026

[MIL-STD-1275F: Characteristics of 28 Volt DC Input Power to Utilization Equipment in Military Vehicles](#)

U.S. Department of Defense | 2022

[NASA-HDBK-4001A: Electrical Grounding Architecture for Uncrewed Spacecraft](#)

NASA | 2025

[University Physics, Volume 2: Resistivity and Resistance](#)

OpenStax, Rice University | 2016

[Why my circuit does not work?](#)

Penn State

[Read this article online](#)

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