Automated Test Bench for an EV Charger

GW Instek APS-7200 · PEL-3111AH · GPP-7250 + Total Phase Komodo CAN Duo

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Application overview

A single four-instrument bench validated a CAN-controlled EV scooter charger across the full Indian grid envelope — with no live battery pack in the loop, unattended overnight regression, and one automated compliance report covering grid sweep, state-of-charge (SoC) sweep, mode switching and protections. Compact AC chargers for 14S Li-ion scooters (~50.4 V nominal, ~3 kWh pack) must hold regulation from 140 V to 270 V mains while negotiating charge modes with the vehicle BMS over CAN, and testing this safely requires simultaneous, scripted control of AC input, DC output and the CAN channel.

GSAS Micro Systems designed, integrated and scripted the bench end-to-end, combining GW Instek power instruments with Total Phase CAN tooling into a single turnkey, scriptable validation platform — a capability no individual instrument vendor supplies off the shelf.

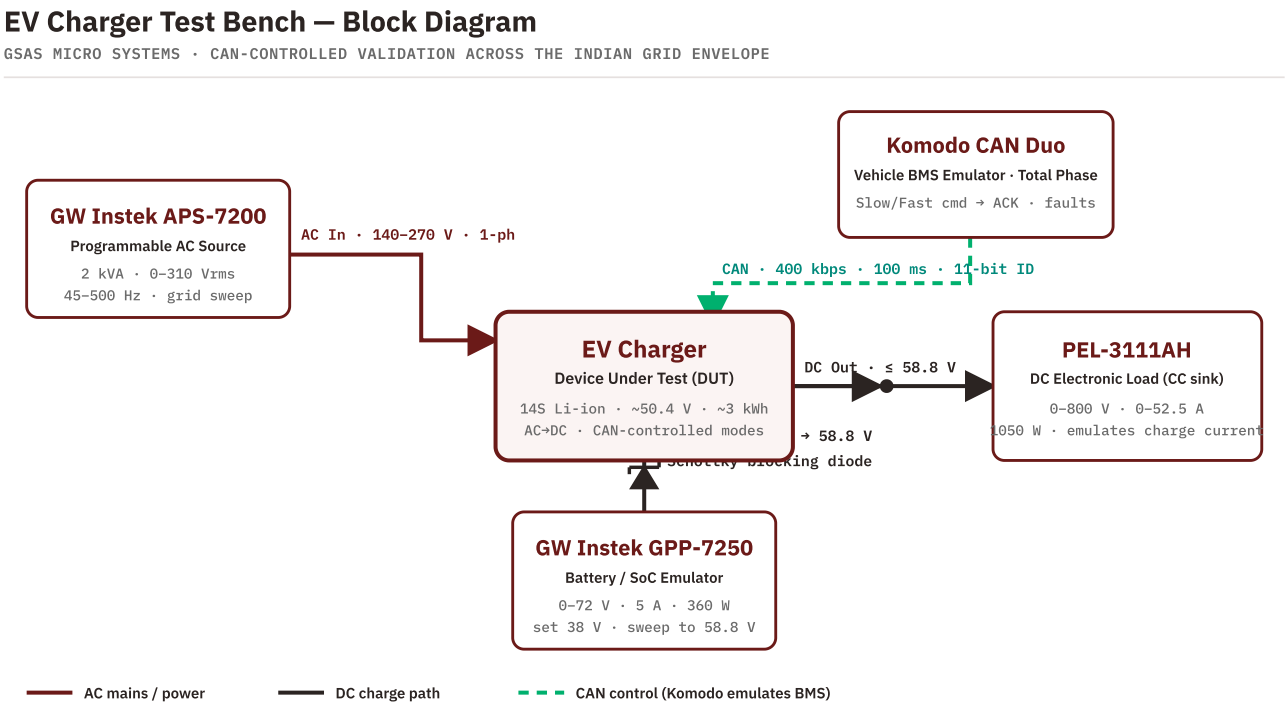

Figure 1 — Single four-instrument bench; no live battery pack in the loop. Komodo CAN Duo emulates the vehicle BMS at 400 kbps, 100 ms periodic frames.

Figure 1 — Test bench block diagram. The Komodo CAN Duo emulates the vehicle BMS at 400 kbps, 100 ms periodic frames.

Equipment & roles

Block	Instrument	Role in the setup
AC Source	GW Instek APS-7200	Programmable AC supply; sweeps 140–270 V mains across the full input range (2 kVA, 0–310 Vrms, 45–500 Hz).
DC Load	GW Instek PEL-3111AH	0–800 V / 0–52.5 A / 1050 W DC electronic load; CC sink emulating charging current.
Battery Emulator	GW Instek GPP-7250	0–72 V / 5 A / 360 W programmable DC supply, set at 38 V (deep-discharge); swept to 58.8 V to mimic state of charge.
Bus Isolation	Schottky blocking diode	Prevents reverse current from the charger output back-feeding the GPP-7250; forward drop is modest and heatsunk at ≤15 A (an ideal-diode stage would suit higher-current benches).
CAN Control	Total Phase Komodo CAN Duo	Vehicle BMS emulator — sends Slow/Fast mode commands @100 ms; receives charger ACK, current, voltage, faults @400 kbps.
DUT	AC EV Charger	AC in 140–270 V; DC out up to ~58.8 V at 3/15 A; CAN-controlled mode selection.

CAN communication profile — Komodo's critical role

Bit rate 400 kbps · bit time 2.5 µs · standard 11-bit identifier, 7-byte payload (per the DUT protocol) · frame period 100 ms (10 frames/s). The Komodo commands Slow/Fast modes; the charger responds with current, voltage and faults. This eliminates the need for a real vehicle BMS and enables fully automated, unattended compliance testing across the full grid/SoC envelope. The 400 kbps rate is non-standard (common CAN rates are 125/250/500/1000 kbps), specified by the DUT, and was confirmed by a successful charger ACK during testing.

Methodology

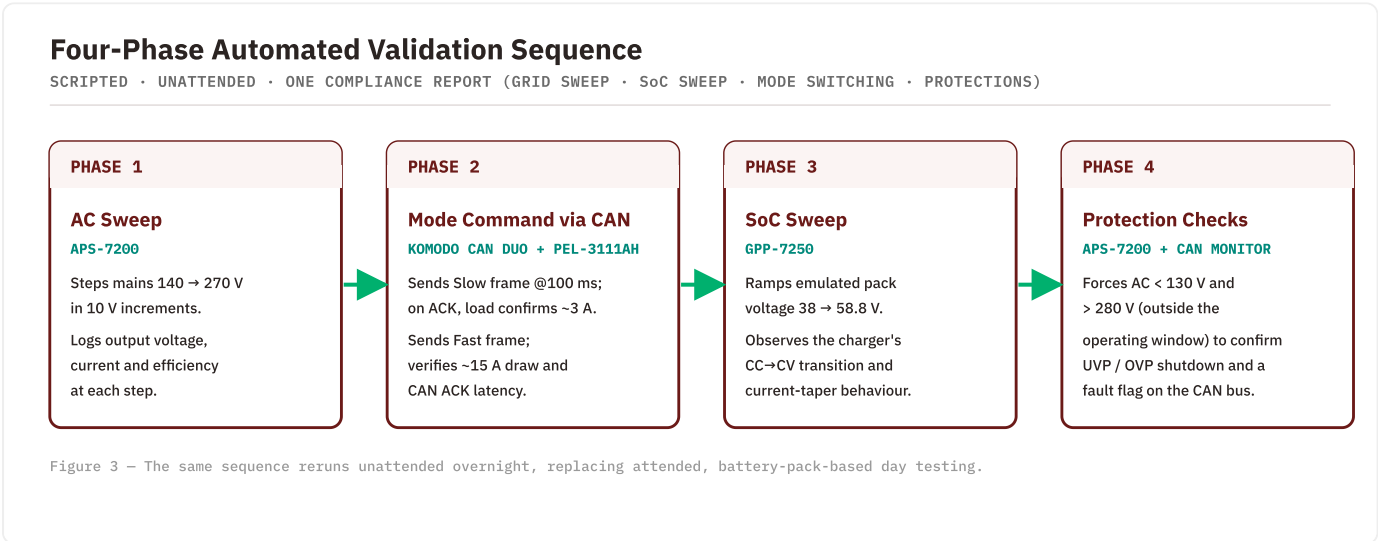

Figure 3 — Four-phase scripted sequence; reruns unattended overnight.

- **Phase 1 — AC sweep:** APS-7200 steps mains from 140 V to 270 V in 10 V increments; output voltage, current and efficiency logged at each step.
- **Phase 2 — mode command via CAN:** Komodo transmits the Slow-charge frame every 100 ms; on charger ACK, PEL-3111AH confirms ~3 A draw. The Fast-charge frame is issued and ~15 A is verified.
- **Phase 3 — SoC sweep:** GPP-7250 ramps the emulated pack voltage 38 V → 58.8 V; the charger's CC→CV transition and taper behaviour are observed.

- **Phase 4 — protection checks:** AC input is forced below 130 V and above 280 V to confirm UVP/OVP shutdown and a fault flag on the CAN bus.

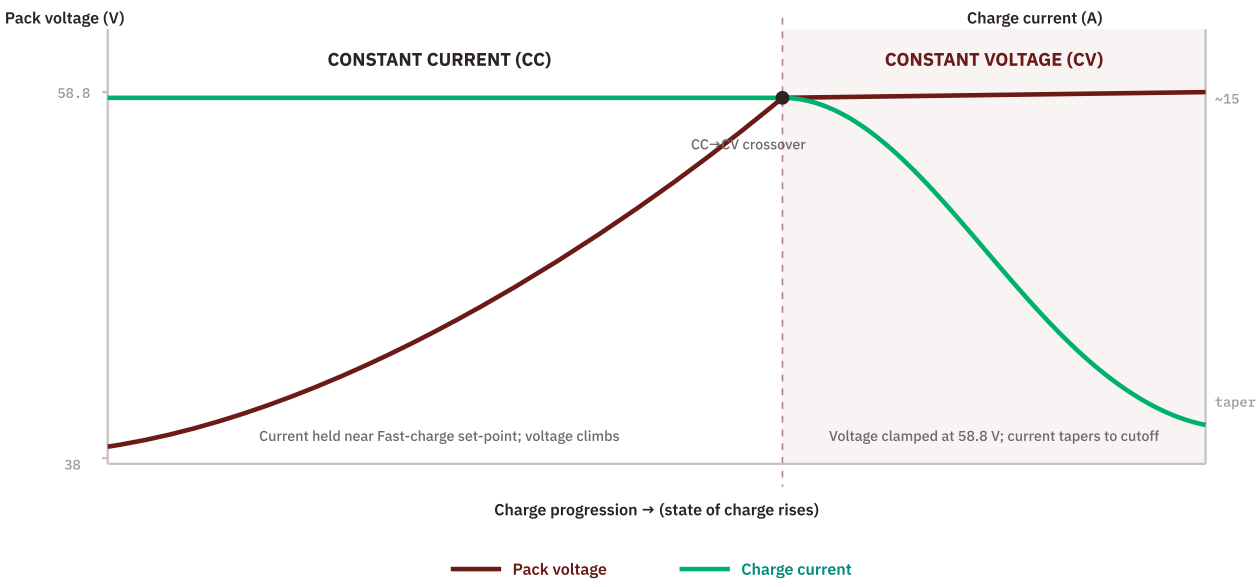

Figure 2 — Mechanism, not measured data. Termination at a set taper-current cutoff (commonly ≈ C/10); exact value is BMS/OEM-defined.

Figure 2 — CC→CV charge profile (mechanism, not measured data). Termination at a set taper-current cutoff (commonly ≈ C/10); exact value is BMS/OEM-defined.

Test results

Parameter	Condition	Spec	Measured
Output regulation	AC sweep 140–270 V	±2 %	**±1.4 %**
Conversion efficiency	230 V AC, Fast mode	≥ 90 %	**92.6 %**
Input current THD	230 V AC, full load	< 10 %	**4.1 %**
Power factor	230 V AC, full load	> 0.95	**0.982**
CAN ACK latency	Mode cmd → ACK, 400 kbps	< 200 ms	**~110 ms**
UVP / OVP trip	AC < 130 V / > 280 V	Shutdown + CAN flag	**Pass**

Outcomes & value delivered

- A single bench replicates Indian grid edge cases (140 V brown-out to 270 V over-voltage) without a real battery pack — safer and faster than pack-based testing.
- The GPP-7250 as a programmable battery emulator allows a full SoC sweep (38 → 58.8 V), exercising CC→CV transition and taper logic without waiting for a real pack to charge.
- The Komodo CAN Duo enables scripted mode commands and fault-flag verification at 400 kbps / 100 ms cadence — unattended overnight regression is possible.
- Automated logging produces one compliance report covering grid sweep, SoC sweep, mode switching, CAN ACK latency and protections — replacing attended, pack-based day testing.

> **Extending the bench:** The bench is DUT-agnostic — revalidating a different charger needs only new instrument set-points and a new CAN command profile, no hardware changes. The same architecture scales to DC fast chargers and battery lines with higher-power GW Instek instruments (PEL-5000C, AEL-5000, ASR-6500).
