OpenVVVF

TEST REPORT

PMSM Resistance Calibration Validation

> Validation of the inverter motor-resistance calibration routine against a bench LCR reference.

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1. PMSM Resistance Calibration Validation

This report validates the inverter's `cal Motor.Resistance` routine by comparing its estimate against a direct bench LCR measurement of the test motor. The test was run on the C2 chassis test fixture, but the routine itself is shared across all OpenVVVF chassis; motor-specific validation is only needed when a different motor or harness is used.

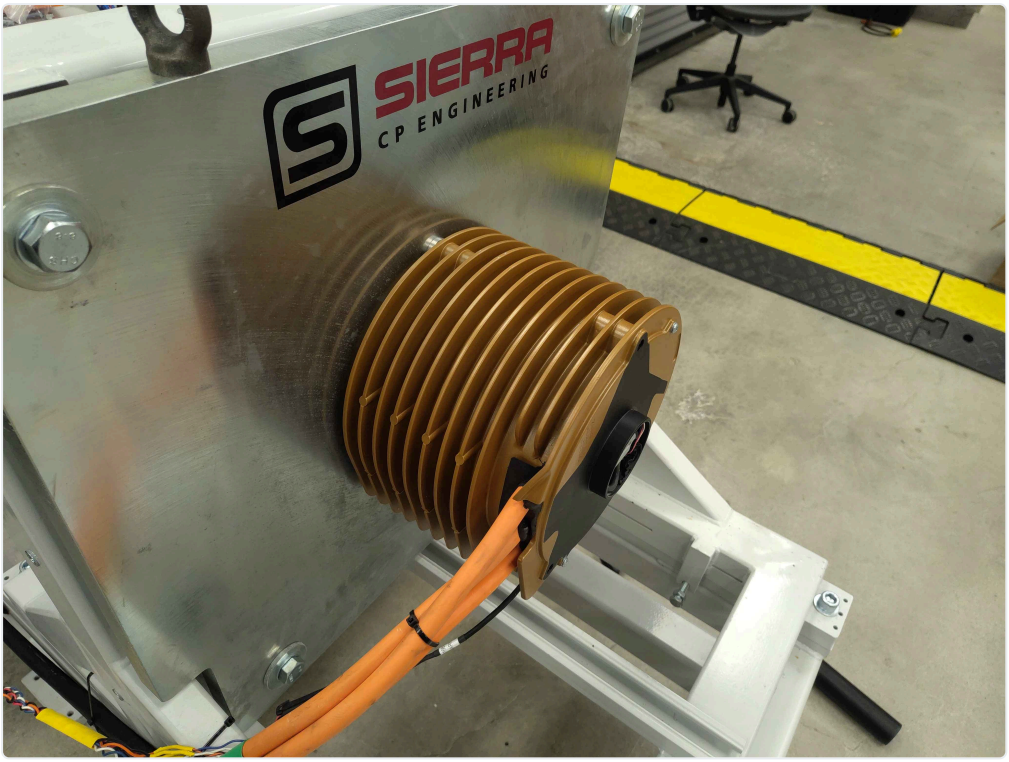
Inductance reference measurements are kept in the PMSM Inductance Calibration Validation report.

A separate high-resistance load sanity check is documented in Power Resistor Sanity Check. A separate induction-machine test report is in Induction Motor Testbed.

1.1. Test setup

The motor is mounted on the Sierra CP Engineering test fixture with phase leads accessible for direct LCR measurement.

Motor mounted on the Sierra CP Engineering test fixture



Side view of the motor and fixture

1.2. Instrument

- **Instrument:** BK Precision 894 20 Hz - 500 kHz LCR Meter
- **Function:** DCR
- **Range:** AUTO

1.3. Measurements

1.3.1. Phase resistance (DCR)

Parameter	Value	Instrument settings
Rd	15.293 mΩ	FUNC: DCR, RANGE: AUTO, SPEED: MED

LCR meter DCR reading: Rd = 15.293 mΩ

1.4. Inverter-calibrated resistance

The inverter's `cal Motor.Resistance` routine was run to estimate the motor resistance and compare it against the LCR reference. Two runs were made at different DC-link voltages to check consistency.

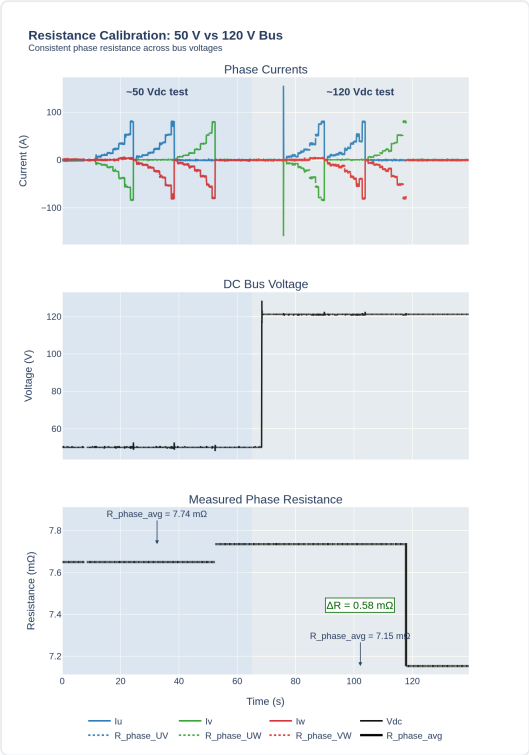
1.4.1. Summary

Run	Vdc	UV Rll	UW Rll	VW Rll	Average Rll	Per-pl
1	~50 V	15.2301 mΩ	15.5424 mΩ	15.6386 mΩ	**15.4704 mΩ**	7.735
2	~120 V	13.5548 mΩ	13.7229 mΩ	15.6423 mΩ	**14.3067 mΩ**	7.153
LCR reference	-	-	-	-	**15.293 mΩ**	7.646

- Run 1 at ~50 V is within **+1.2 %** of the LCR reference (15.4704 mΩ vs 15.293 mΩ).
- Run 2 at ~120 V reads lower on UV and UW, pulling the average **-6.5 %** below the LCR reference. The VW pair is consistent with run 1 and the reference.
- The raw command log is available: Resistance-Command-Log.txt.

1.4.2. Calibration graph

The plot below shows phase currents, DC bus voltage, and the per-phase resistance estimate for both bus voltages.



Resistance calibration: 50 V vs 120 V bus

> **OPEN TELEMETRY LOG:**
>
> View this calibration in the Telemetry Viewer

From the plotted telemetry:

- **50 V run:** R_phase_avg = **7.74 mΩ**
- **120 V run:** R_phase_avg = **7.15 mΩ**
- **ΔR between runs:** 0.58 mΩ

1.4.3. Observations

- The 50 V result (7.74 mΩ average phase) is within **+1.2 %** of the LCR reference (7.6465 mΩ per phase).
- The 120 V result reads lower by **-6.5 %**. The per-phase traces in the plot are stable and consistent with each other, so the shift appears to be a systematic offset between the two runs rather than a noisy measurement.
- Possible causes for the 120 V offset:

- current-sensor offset or scaling drift at the higher DC-link voltage,
- connection/cable resistance differences between setups,
- temperature or settling differences between runs.
- The raw telemetry log is available for further analysis: ResistanceCalResult.jsonl - open in Telemetry Viewer.

1.5. Notes

- The DCR reading is the DC resistance measured directly by the meter.
- The line-to-line resistance is twice the per-phase value reported by the calibration routine.