# Test plan for the listing of converters (PCS) on the “Oesterreichs Energie” TOR Type A List

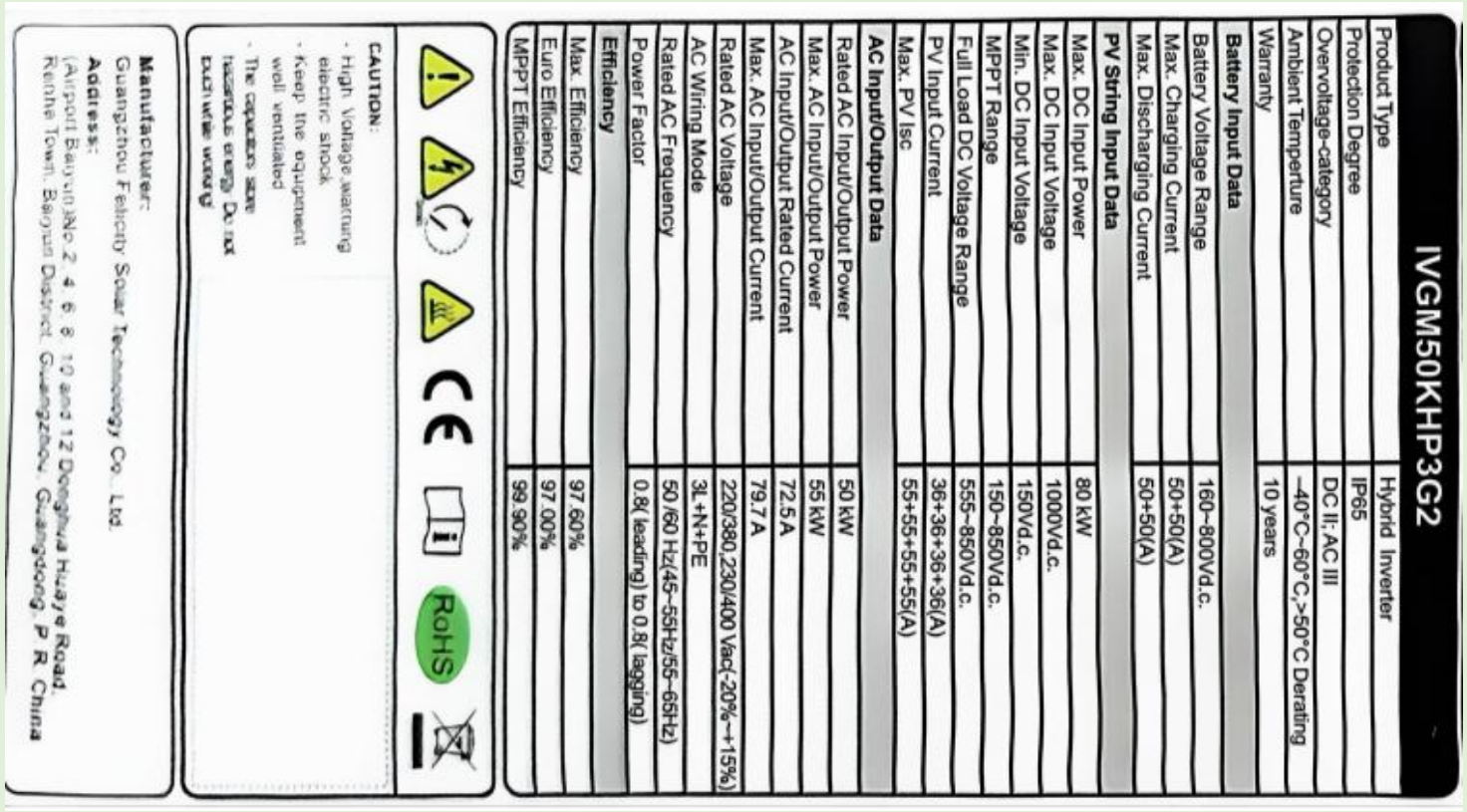
Version 7.14D version date 2026-07-02, including new definitions as per TOR Stromerzeugungsanlagen Type A V1.4 ,TOR Verteilernetzanschluss Niederspannung V1.3.1 and Erläuterungsdokument Version 2026/04 NC RfG / TOR Erzeuger

## Test location

| Test date | 21.01.2026 | Note |
|---|---|---|
| Test engineer | Roland Bründlinger (AIT)<br>Sandy Qian (DEKRA) | - |
| Manufacturer representatives present | N/A | - |
| Location of test | Test performed under witness of AIT at<br>DEKRA Testing and Certification (Suzhou) Co., Ltd.<br>No. 99 Hongye Road, Suzhou Industrial Park<br>Suzhou, 215006<br>Jiangsu Province<br>P.R. China | |

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## Information on Equipment Under Test

| EUT | | |
|---|---|---|
| Type of EUT | Hybrid Inverter | |
| Manufacturer | Guangzhou Felicity Solar Technology Co., Ltd. | |
| Model | IVGM50KHP3G2 | |
| Serial number | 100202012625120002 | |
| Nameplate |  | |
| FW-Version(s) | V100 M968 S309 | |
| HW-Version | 100 | |

| EUT | | |
|---|---|---|
| Web Portal Link | https://op-test.felicitysolar.com/ | |
| Additional software | N/A | |
| Additional hardware | Datalogger felicitysolar Wifi Stick IOTH2403, SN090101230024040005 FW V2.18<br>BMS FLH48100UCG2 SN, FW Version BCU 206-08-09 SCU 0-00-00 BMU 208-08-09 LCD 204<br>SmartMeter Chint DTSU666 SN 260522388368, FW Version N/A<br>Current Transducer CTSA050C 300A/5A SN P1241200060. | |
| Other information | - | |

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# Test Summary

## 1 Setup and commissioning – Verification of parameter settings

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| **1** | **Setup and commissioning** | | **TOR Stromerzeugungsanlagen V1.4 8.1** | | |
| 1.1 | 1. Installation of the inverter according to installation manual.<br>2. Setup and commissioning, verification of parameter settings, country setup Austria TOR Stromerzeugungsanlagen Type A according to installation manual<br>3. Visual inspection of parameter settings<br>4. Creation of a report documenting all settings for the automated report verification according to manual. | TOR Erz. Typ A A.3 | 1.1 All relevant settings are present according to TOR-Stromerzeugungsanlagen (Default settings as per Annex A3):<br>1 Reactive power settings<br>- a. fixed cosφ (default)<br>- b. cosφ(P)<br>- c. Q(U)<br>- d. fixed Q (Qfix)<br>2 Active power control<br>- LFSM-O (default enabled)<br>- P(U) (default enabled)<br>3 FRT<br>- U<0.8 Un: Zero-current<br>4 Reconnection<br>- U≥0.85 and U≤1.09 p.u.<br>- f >47,5 Hz and <50.10 Hz<br>5 Interface protection<br>- U>>; U> 10min;U<<; U<<br>- f>, f<<br>- Islanding protection | Visual Inspection (Screenshot from app/web, document ref, etc.)<br>• All settings present<br>• Default settings as per TOR Stromerzeugungsanlagen Type A Annex A3<br>1 Reactive power settings<br>- a. fixed cosφ (Enabled) Disabled<br>- b. cosφ(P) (Disabled)<br>- c. Q(U) (Disabled)<br>- d. fixed Q (Qfix) (Disabled)<br>2 Active power control<br>- LFSM-O (enabled)<br>- P(U) (enabled)<br>3 FRT<br>- U<0.8 Un: Zero-current<br>4 Reconnection (enabled)<br>- U≥0.85 and U≤1.09 p.u.<br>- f >47,5 Hz and <50.10 Hz<br>5 Interface protection (enabled)<br>- U>>; U> 10min;U<<; U<<br>- f>, f<<br>- Islanding protection (enabled) | PASS |
| | | | 1.2 All relevant parameters can be set? | Visual inspection (Screenshots, etc.)<br>• Description how parameters can be set and adjusted (e.g., through Web, Software, etc.)<br>• Results<br>• All relevant parameters can be set through Cloud Platform or Display | PASS |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | | | 1.3 Check if all relevant settings are permanently stored in the device | Visual inspection:<br>• Select country setup Austria Default (Q(U) should be disabled)<br>• Enable Q(U)<br>• Restart inverter (complete switch off and on all supplies)<br>• Verify that country setup is not changed. | PASS |
| | | | 1.4 protection against unauthorized modifications available? | Visual inspection (Screenshots, etc.)<br>• Description of the prevention against unauthorized access (password, account…)<br>• Results<br>• Access to parameters is only available for registered users with installer privileges<br>• Access to grid settings is protected via password | PASS |
| | | | 1.5 Export of settings in machine readable format as per TOR Stromerzeugungsanlagen 8.1 | Documentation of parameter export report (link to file)<br>• Results<br>• Export to Excel (.xlsx) file can be made via the Web Portal/App/OTHER<br>• All relevant parameter settings as per TOR Stromerzeugungsanlagen Type A Annex A3 are included in the export<br>• For reactive power related settings, it should be clearly indicated if settings are over-/under-excited<br>• Serial number, model name and ratings, software/firmware versions included in the export<br>• Export limit settings included in the export | PASS |
| 1.2 | For Storage Systems only:<br>EUT settings according to TOR Verteilernetzanschluss | TOR Verteilernetzanschluss 5.1.2.2 | P(f) at over- and under-frequency / LFSM-OC -UC functions are both enabled and set as per TOR Verteilernetzanschluss 5.1.2.2<br>Storage system can change from discharge to charge mode | Visual Inspection<br>• LFSM-OC (P(f) at over-frequency) setting:<br>Frequency threshold 50.2 Hz<br>Droop s = 5% (40% Pmax/Hz); Pref = Pmax;<br>• LFSM-UC (P(f) at under-frequency) setting:<br>Frequency threshold 49.8 Hz<br>Droop s = 1% (200% Pmax/Hz); Pref = Pmax<br>• Pref setting included in export. | PASS |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 1.3 | For Storage Systems and Hybrid Inverters with Feed in limitation | | Additional:<br>Feed in limit setting available | Visual inspection<br>• Parameters available in setup/App<br>• Parameters included in export | PASS |
| ~~1.3~~ | ~~For Storage Systems and Hybrid Inverters with UPS/EPS/Backup function~~ | | ~~Additional:<br>UPS/EPS/Backup setting available~~ | ~~Visual inspection~~<br>~~• N/A~~ | ~~N/A~~ |
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## 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 2 | **Measurement of the corner points of the P/Q diagram and accuracy of reactive power** | | | | |
| | Setup EUT Austria, Q-mode: Qfix | | TOR Stromerzeugungsanlagen V1.4 5.3.3 | Documentation of settings (screenshot of display/App/Web) | - |
| 2.1 | 1. U = 1.00 Un, Q = 0.436 Sn inductive/under-excited.<br>a. P =100%Pn<br>b. P =20%Pn<br>c. P = 5%Pn<br>d. P = 0% Pn (ESS+Hybrid)<br>2. U = 1.00 Un, Q = 0.436 Sn capacitive/over-excited.<br>a. P = 100%Pn<br>b. P = 20%Pn<br>c. P = 5%Pn<br>d. P = 0% (ESS+Hybrid)<br>3. U = 1.09 Un, Q = 0.436 Sn inductive/under-excited.<br>a. P = 100%Pn<br>4. U = 0.86 Un, Q = 0.436 Sn capacitive/over-excited.<br>a. P = 100%Pn | | • Active/reactive power range compliant with TOR-Stromerzeugungsanlagen 5.3.3 / according to manufacturer specs.<br>• Reactive power within tolerance band of +/- 4%Sn for P>20%Pn.<br>• Note: For P<0.2Pn, limitation of cosphi 0.4 is allowed but not mandatory. | Documentation of the P-Q diagram (DEWE)<br><br>**Summary of test results:**<br>• Test with Batt<br>• Active and reactive power range according to requirements<br>• For P<0.2Pn, limitation of cosphi 0.4 is active. | PASS (Batt) |
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## 3 Verification of the P(U) control

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 3 | **Verification of the P(U) control** | | | | |
| | Setup EUT Austria Default, Q-mode: cosphi=1 (Q(U) disabled)<br>*Note: Hybrid Inverters shall be tested with power from PV and Battery*<br>*Note 1: For ESS Inverters which allow setting a ramp time/rate for active power setpoint changes, this parameter shall be set to 0.5%Pn/s or equivalent.*<br>*Note 2: Tests shall be made with „external input“ enabled.* | - | TOR Stromerzeugungsanlagen V1.4 5.3.6 | Documentation Screenshot from Setup Software/Tool | - |
| 3.1 | **Verification of the P(U) control (balanced voltages)** | | | | |
| 3.1.1 | Steady state test at >90%Pn<br>1. L1/2/3: 1.00Un, 30s<br>2. L1/2/3: 1.09Un, 30s<br>3. L1/2/3: 1.10Un, 30s<br>4. L1/2/3: 1.11Un, 30s<br>5. L1/2/3: 1.12Un, 30s<br>6. L1/2/3: 1.13Un, 30s<br>7. L1/2/3: 1.12Un, 30s<br>8. L1/2/3: 1.11Un, 30s<br>9. L1/2/3: 1.10Un, 30s<br>10. L1/2/3: 1.09Un, 30s<br>11. L1/2/3: 1.00Un, 30s | R25 5.3.6 (mod.) | • Compliance with tolerance band of ±10%Pn and ±1%Un | Documentation P(U) diagram with tolerance band<br><br>**Summary of test results:**<br>• Test with Batt<br>• P(U) within tolerance band | PASS (Batt) |
| 3.1.2 | Dynamic test at >90%Pn and 20%Pn<br>*Note: For hybrid inverters, at least one test shall be performed with power from PV only and battery only*<br>1. L1/2/3: 1.00Un, 30s<br>2. L1/2/3: 1.09Un, 30s<br>3. L1/2/3: 1.13Un, 30s | | • Dynamic response within the P(U) tolerance band | Documentation Time series of P; U and tolerance band<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• Dynamic test at 100%Pn: P(U) within tolerance band<br>• Dynamic test at 20%Pn: P(U) within tolerance band | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | 4. L1/2/3: 1.09Un, 30s<br>5. L1/2/3: 1.11Un, 10s<br>6. L1/2/3: 1.13Un, 10s<br>7. L1/2/3: 1.11Un, 10s<br>8. L1/2/3: 1.00Un, 30s | | | | |
| 3.2 | **Verification of the P(U) control (unbalanced voltages)** | | Only for 3-phase inverters with neutral connection | | |
| 3.2.1 | 1. P=>90%Pn; cosφ=1<br>2. L1/2/3: 1.00/1.00/1.00Un, 15s<br>3. L1/2/3: 1.09/1.09/1.09Un, 15s<br>4. L1/2/3: 1.12/1.09/1.09Un, 15s<br>5. L1/2/3: 1.09/1.09/1.09Un, 15s<br>6. L1/2/3: 1.09/1.12/1.09Un, 15s<br>7. L1/2/3: 1.09/1.09/1.09Un, 15s<br>8. L1/2/3: 1.09/1.09/1.12Un, 15s<br>9. L1/2/3: 1.09/1.09/1.09Un, 15s<br>10. L1/2/3: 1.00/1.00/1.00Un, 15s | | • Step 4, 6: Highest L-N voltage used as reference for P(U) | Documentation Time series of P, U (L1, L2, L3)<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• P(U) uses highest L-N voltage as reference<br>• P(U) within tolerance band | PASS (PV+Batt) |
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## 4 Verification of the Q(U) control

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 4 | **Verification of the Q(U) control** | | | | |
| | Setup EUT Austria, Q-mode: Q(U) | | TOR Stromerzeugungsanlagen V1.4 5.3.4.2 | Documentation Screenshot from Setup Software/Tool | - |
| 4.1 | **Verification of the Q(U) control (balanced voltages)** | | | | |
| 4.1.1 | 1) Dynamic test at 100%Pn<br>1. Set U = 1.00Un, 15s<br>2. Set U = 1.04Un, 15s<br>3. Set U = 1.09Un, 15s<br>4. Set U = 1.13Un, 15s<br>5. Set U = 1.09Un, 15s<br>6. Set U = 1.00Un, 15s<br>7. Set U = 0.91Un, 15s<br>8. Set U = 0.86Un, 15s<br>9. Set U = 0.97Un, 15s<br>10. Set U = 1.00Un, 15s<br><br>2) Dynamic test at 20%Pn<br>1. Set U = 1.00Un, 15s<br>2. Set U = 1.04Un, 15s<br>3. Set U = 1.09Un, 15s<br>4. Set U = 1.13Un, 15s<br>5. Set U = 1.09Un, 15s<br>6. Reduce P to 15%, 15s<br>7. Reduce P to 10%, 15s<br>8. Reduce P to 5%Pn, 15s<br>9. Hybrid/ESS: Reduce P to 0%Pn<br>10. Increase P to 20%Pn,15s<br>11. Set U = 1.00Un, 15s<br>12. Set U = 0.91Un, 15s<br>13. Set U = 0.86Un, 15s<br>14. Reduce P to 15%, 15s<br>15. Reduce P to 10%, 15s | R25 5.3.10 (mod.) | • Dynamic response of Q within tolerance band<br>• Dynamic test at 20%Pn:<br>• Steps 7-9 and 14-16: Limitation of min cosφ = 0.4 as per OVE R25 5.3.10 | Documentation Time series of Q, P, U and tolerance band<br><br>**Summary of test results:**<br>• Dynamic test at 100%Pn:<br>• Test with PV+Batt<br>• Q(U) within tolerance band<br><br>• Dynamic test at 20%Pn:<br>• Test with PV+Batt<br>• Q(U) within tolerance band<br>• Steps 7-9 and 14-16: Limitation of min cosφ = 0.4 as per OVE R25 5.3.10 | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | 16. Reduce P to 5%Pn, 15s<br>17. Hybrid/ESS: Reduce P to 0%Pn<br>18. Increase P to 20%Pn,15s<br>19. Set U = 0.97Un, 15s<br>20. Set U = 1.00Un, 15s | | | | |
| 4.1.2 | Steady state test at 100%Pn<br>1. P=>90%Pn<br>2. L1/2/3: 1.00Un, 30s<br>3. L1/2/3: 1.03Un, 30s<br>4. L1/2/3: 1.04Un, 30s<br>5. L1/2/3: 1.05Un, 30s<br>6. L1/2/3: 1.06Un, 30s<br>7. L1/2/3: 1.07Un, 30s<br>8. L1/2/3: 1.08Un, 30s<br>9. L1/2/3: 1.09Un, 30s<br>10. L1/2/3: 1.00Un, 30s<br>11. L1/2/3: 0.97Un, 30s<br>12. L1/2/3: 0.96Un, 30s<br>13. L1/2/3: 0.95Un, 30s<br>14. L1/2/3: 0.94Un, 30s<br>15. L1/2/3: 0.93Un, 30s<br>16. L1/2/3: 0.92Un, 30s<br>17. L1/2/3: 1.00Un, 30s | R25<br>5.3.10<br>(mod.) | • Compliance with tolerance band of ±4%Sn and ±1%Un | Documentation Time series of Q, P, U and tolerance band<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• Q(U) within tolerance band. | PASS<br>(PV+Batt) |
| 4.1.3 | Only for ESS and Hybrid Systems which can charge from the grid<br>Dynamic test at 100% charge power<br>1. Set U = 1.00Un, 15s<br>2. Set U = 1.04Un, 15s<br>3. Set U = 1.09Un, 15s<br>4. Set U = 1.13Un, 15s<br>5. Set U = 1.09Un, 15s<br>6. Set U = 1.00Un, 15s<br>7. Set U = 0.91Un, 15s<br>8. Set U = 0.86Un, 15s<br>9. Set U = 0.97Un, 15s<br>10. Set U = 1.00Un, 15s | | • Compliance with tolerance band of ±4%Sn and ±1%Un<br>• Alternatively, Q = 0 is also allowed. | Documentation Time series of Q, P, U and tolerance band<br><br>**Summary of test results:**<br>• Test with Battery<br>• Q(U) within tolerance band. | PASS<br>(Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | | | | | |
| 4.2 | **Verification of the Q(U) control (unbalanced voltages)** | | Only for 3-phase inverters with neutral connection | | |
| 4.2.1 | 1. P=>90%Pn; Q(U) active<br>2. L1/2/3: 1.00/1.00/1.00Un, 15s<br>3. L1/2/3: 1.04/1.04/1.04Un, 15s<br>4. L1/2/3: 1.09/1.04/1.04Un, 15s<br>5. L1/2/3: 1.04/1.04/1.04Un, 15s<br>6. L1/2/3: 1.04/1.09/1.04Un, 15s<br>7. L1/2/3: 1.04/1.04/1.04Un, 15s<br>8. L1/2/3: 1.04/1.04/1.09Un, 15s<br>9. L1/2/3: 1.04/1.04/1.04Un, 15s<br>10. L1/2/3: 1.00/1.00/1.00Un, 15s | - | • Step 4, 6: Highest L-N voltage used as reference for Q(U) | Documentation Time series of Q, P, U (L1, L2, L3) and tolerance band<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• Q(U) uses highest L-N voltage as reference<br>• Q(U) within tolerance band. | PASS (PV+Batt) |

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| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 4.3 | **Verification of the Q(U) control (test of the min cos phi logic)** | | - | | |
| 4.3.1 | 1. Set P=30%Pn; Q(U) active<br>2. L1/2/3: 1.00Un, wait 30s<br>3. L1/2/3: Ramp U to 0.95Un in 30s<br>4. Wait for 30 s<br>5. Ramp P to 5%Pn in 60s<br>6. Wait for 30 s<br>7. L1/2/3: Ramp U to 1.00Un in 30s<br>8. Wait for 30 s<br>9. L1/2/3: Ramp U to 1.06Un in 30s<br>10. Wait for 30 s<br>11. Ramp P to 30%Pn in 60s<br>12. Wait for 30 s<br>13. L1/2/3: Ramp U to 1.00Un in 30s<br>14. Wait for 30 s | - | • Step 1-2: Q = 0<br>• Step 3-4 Q(U) response within tolerance band of ±4%Sn and ±1%Un *Note: Q response should be visible.*<br>• Step 5-6: no step changes or discontinuities in Q; Q must not exceed Q(U) tolerance band<br>• Step 7-8: Q change to Q = 0, limited by PT1 response.<br>• Step 9-10: no step changes or discontinuities in Q; Q must not exceed Q(U) tolerance band<br>• Step 11-12 Q(U) response within tolerance band of ±4%Sn and ±1%Un<br>• Step 13-14: Q change to Q = 0, limited by PT1 response. | Documentation Time series of Q, P, U (L1, L2, L3) and tolerance band<br><br>**Summary of test results:**<br>• Test with Batt<br>• Q(U) within tolerance band.<br>• No step changes or discontinuities in Q response throughout whole test. | PASS (Batt) |
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## 5 Reconnection after grid faults

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 5 | **Reconnection after grid faults**: | | | | |
| | Setup EUT Austria, Q-mode: Q(U) P>90%Pn<br>*Note: For single-phase inverters, voltage changes shall be applied on phase where inverter is connected.* | | TOR Stromerzeugungsanlagen V1.4 5.5.2 | • Documentation Screenshot from Setup Software/Tool | - |
| 5.1 | 1. U L1/2/3: 1.00/1.00/1.00Un, wait until normal operation<br>2. U L1/2/3: 1.13/1.13/1.13Un, 600 s (inverter shall trip due to U> protection; 10-min mean value)<br>3. U L1/2/3: 1.07/1.07/1.07Un, 240 s (grid OK, inverter must not reconnect)<br>4. U L1/2/3: 1.07/1.11/1.07Un, 30 s (grid not OK, inverter must not connect)<br>5. U L1/2/3: 1.07/1.07/1.07Un, 240 s (grid OK, inverter must not reconnect)<br>6. U L1/2/3: 1.07/1.11/1.07Un, 30 s (grid not OK, inverter must not connect)<br>7. U L1/2/3: 1.07/1.07/1.07Un, 1200 s (inverter shall connect after >300 s, verification of the soft start dP/dt and compliance of Q with min cosφ.)<br>8. U L1/2/3: 1.00/1.00/1.00Un, wait until inverter reaches nominal operation | | 1. Inverter shall connect after >300 s<br>2. Disconnection due to over voltage U> after 7-9 min<br>3. No reconnection allowed (wait time after grid-fault >300 s)<br>4. No reconnection allowed (grid voltage outside reconnection levels)<br>5. No reconnection allowed (wait time after grid-fault >300 s)<br>6. No reconnection allowed (grid voltage outside reconnection levels)<br>7. Reconnection after >300 s; max gradient dP/dt <10%Pn/min; Min cosφ=0.4<br>8. Inverter in normal operation. | Documentation Time series of P, Q, U (L1, L2, L3), Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• 1 Normal operation<br>• 2 Disconnection, 10-min OV fault<br>• 3-6 No reconnection<br>• 7 Reconnection after 05:03 min,<br>• 7 Q limited according to min cosφ=0.4, Q within Q(U) tolerance band<br>• 7 Gradient dP/dt 9.2%Pn/min<br>• 8 Normal operation | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 5.2 | 1. Set frequency to 51.6 Hz for 5 s (Trip inverter due to protection f>)<br>2. Set frequency to 50.0 Hz for 240 s (inverter must not reconnect)<br>3. Set frequency to 50.3 Hz for 30 s (inverter must not reconnect)<br>4. Set frequency to 50.0 Hz for 240 s (inverter must not reconnect)<br>5. Set frequency to 50.3 Hz for 30 s (inverter must not reconnect)<br>6. Set frequency to 50.0 Hz (inverter shall reconnect after >300 s, check soft start dP/dt) | | 1. Inverter must disconnect due to over-frequency (f>)<br>2. Inverter must not reconnect.<br>3. Inverter must not reconnect (frequency outside reconnect levels)<br>4. Inverter must not reconnect.<br>5. Inverter must not reconnect (frequency outside reconnect levels)<br>6. Reconnection after >300 s; max gradient dP/dt <10%Pn/min; | Documentation Time series of P, f, Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV+Batt<br>• 1 Disconnection due to over-frequency fault<br>• 2-5 No reconnection<br>• 6 Reconnection after 05:09 min<br>• 6 max gradient dP/dt 9.2%Pn/min | PASS (PV+Batt) |
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## 6 Verification of the LFSM-O/U, P(f) control

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 6a | **Verification of the LFSM-O for Generating Units (PV inverters)** | | | | |
| | Setup EUT Austria, Q-mode: Q(U)<br>*Note 1: Test shall be conducted with PV/PV simulator; active power shall be controlled through MPP power.*<br>*Note 2: Tests shall be made with „external input“ enabled.* | | TOR Stromerzeugungsanlagen V1.4 5.1.3 | Documentation Screenshot from Setup Software/Tool | - |

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| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 6a.1 | 1. Set P=50%Pn (power set by PV simulator)<br>2. Set frequency to f=50.00 Hz, 30 s<br>3. Ramp frequency to f = 51.20 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Set P = 100%Pn (increase available MPP power/irradiance on PV simulator)<br>5. Ramp frequency to f = 50.25 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>6. Ramp frequency to f = 50.00 Hz, RoCoF = 2.0 Hz/s, wait 120 s<br>7. Ramp frequency to f = 51.20 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>8. Ramp frequency to f = 50.25 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>9. Ramp frequency to f = 50.00 Hz, RoCoF = 0.1 Hz/s, wait 300 s<br><br>*Note: Step changes of frequency are not allowed.* | R25 5.3.4 (Test 2 mod.) | • Step 3: Inverter shall reduce active power output according to a gradient of 40%Pm/Hz<br>• Step 4: Inverter must not increase active power output.<br>• Step 5: inverter must not increase active power output above Pm<br>• Step 6: Inverter can increase power limited to a gradient of max. 10%Pn/min)<br>• Step 7: Inverter must reduce active power output according to a gradient of 40%Pm/Hz<br>• Step 8: inverter must not increase active power output above Pm<br>• Step 9: inverter can increase power limited to a gradient of max. 10%Pn/min) | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• N/A | N/A |
| | | | | | |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 6b | **Verification of the LFSM-O/U for Storage Units** | | | | |
| | Setup EUT Austria, Q-mode: Q(U)<br>*Note: Test shall be conducted with battery or battery simulator*<br>*Note 1: For ESS Inverters which allow setting a ramp time/rate for active power setpoint changes, this parameter shall be set to 0.5%Pn/s or equivalent.*<br>*Note 2: Tests shall be made with „external input“ enabled.* | | TOR Verteilernetzanschluss Niederspannung V1.3.1 5.1.2 | Documentation Screenshot from Setup Software/Tool | - |
| 6b.1 | 1. Set P=20%Pn (discharge) (power setting by active power setpoint)<br>2. Set frequency to f = 50.00 Hz, wait 30 s<br>3. Ramp frequency to f = 51.20 Hz, RoCoF = 2.0 Hz/s, 30 s<br>4. Set P = 100%Pn (discharge) (Adjust power setting/active power setpoint of inverter)<br>5. Ramp frequency to f = 50.25 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>6. Ramp frequency to f = 50.00 Hz, RoCoF = 2.0 Hz/s, wait 120 s<br>7. Ramp frequency to f = 51.20 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>8. Ramp frequency to f = 50.25 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>9. Ramp frequency to f = 50.00 Hz, RoCoF = 0.1 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are not allowed.* | R25 5.3.4 (Test 2 mod.) | • 3: inverter shall reduce active power output (gradient 40% Pmax/Hz)<br>• 4: inverter must not increase active power output.<br>• 5: inverter must not increase active power output > Pm<br>• 6: inverter shall increase power limited to a gradient of max. 10%Pn/min)<br>• 7: inverter shall reduce active power output (gradient 40% Pmax/Hz)<br>• 8: inverter must not increase active power output > Pm<br>• 9: inverter shall increase power limited | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• N/A | N/A |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | | | to a gradient of max. 10%Pn/min) | | |
| 6b.2 | 1. Set P=50%Pn (charge) (power setting by active power setpoint)<br>2. Set frequency to f=50.00 Hz, wait 30 s<br>3. Ramp frequency to f = 49.30 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Set P=100%Pn (charge) (power setting by active power setpoint)<br>5. Ramp frequency to f = 48.80 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>6. Ramp frequency to f = 49.70 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>7. Ramp frequency to f = 50.00 Hz, RoCoF = 2.0 Hz/s, wait 180 s<br>8. Ramp frequency to f = 49.30 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>9. Ramp frequency to f = 48.80 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>10. Ramp frequency to f = 49.70 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>11. Ramp frequency to f = 50.00 Hz, RoCoF = 0.1 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are not allowed* | R25 5.3.4 (Test 2 mod.) | • 3: Active power output change to 50%Pmax discharge (gradient -200% Pmax/Hz)<br>• 4: inverter must not decrease active power output.<br>• 5: Active power output change to 100%Pmax (discharge).<br>• 6: Active power output change to ~30%Pmax (charge).<br>• 7: Active power change to new operating point Pn (charging), limited to a gradient of max. 10%Pn/min<br>• 8: Active power output change according to gradient -200% Pmax/Hz)<br>• 9: Active power output change to aaprox. 100%Pmax (discharge).<br>• 10: Active power output change to approx. 20%Pmax (charge).<br>• 11: Active power output change to initial operating point Pn | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• N/A | N/A |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | | | ~~(charging), limited to a gradient of max. 10%Pn/min)~~ | | |
| 6c | **Verification of the LFSM-O/U control for Hybrid PV/Storage Units with integrated EMS** | | | | |
| | Setup EUT Austria, Q-mode: Q(U), EMS: Self consumption mode<br>Export power limit disabled or set to 100% Pn.<br>*Note 1: Test shall be conducted with PV input supplied by PV simulator and battery input supplied by battery/battery simulator*<br>*Note 2: Tests shall be made with „external input“ enabled.* | | TOR Verteilernetzanschluss Niederspannung V1.3.1 5.1.2<br><br>*Note: If max. charge or discharge power of the battery is limited to a value of less than 100%Pn, the settings and criteria shall be adapted accordingly.* | Documentation Screenshot from Setup Software/Tool | |
| 6c.1 | 1. Set $P_{PV}$ = 50%Pn<br>Condition battery to SOC 80% to 90% (battery charging with 100% power) shall be possible)<br>2. Set frequency to f=50.00 Hz, wait 30 s<br>3. Ramp frequency to f=51.20 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Ramp frequency to f=50.25 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>5. Ramp frequency to f=50.00 Hz, RoCoF = 2.0 Hz/s, wait 300 s<br><br>*Note: Step changes of frequency are not allowed* | - | 1. Resulting operating conditions (+/-5%Pn): $P_{batt}$ = 50%Pn charge, $P_{AC,INV}$ = 0% Pn $P_{AC,GRID}$ = 0% Pn<br>2. $P_{AC,GRID}$ 0% Pn<br>3. $P_{AC,INV}$ = 40% Pn charging (active power change according to gradient 40%Pmax/Hz)<br>4. $P_{AC,INV}$ = 2% Pn charge (active power change according to gradient 40%Pmax/Hz)<br>5. $P_{AC,INV}$ = 0% Pn Inverter must hold active power | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 2: No feed-in to grid<br>• 3: Change of active power (charging) according to LFSM-OC (Pref = Pmax) – increase charge power (If necessary, the inverter may reduce PV power) LFSM-OC response within 5% tolerance band.<br>• 4: Change of active power (charging) according to LFSM-OC (Pref = Pmax) LFSM-OC response within 5% tolerance band<br>• 5: No feed-in to grid, inverter must hold power at 0%Pn | PASS (PV+Batt) |
| 6c.2 | 1. Set $P_{PV}$ = 50%Pn | - | 1. Resulting operating | Documentation Time series of P, f, P tolerance band Gradient | PASS |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | Condition battery to SOC 90% to 95% (battery charging with 50% power shall be possible)<br>2. Set frequency to f = 50.00 Hz, wait 30 s<br>3. Ramp frequency to f = 51.20 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>4. Ramp frequency to f = 50.25 Hz; RoCoF = 0.1 Hz/s, wait until battery is fully charged (e.g. SOC = 100%, no further charging). $P_{PV}$ may be increased to speed-up charging of battery.<br>5. Ramp frequency to f = 50.00 Hz, RoCoF = 0.1 Hz/s, wait 300s<br><br>*Note: Step changes of frequency are not allowed*<br>*Note: Test procedure may be adapted depending on charging strategy of system* | | conditions (+/-5%Pn): $P_{batt}$ = 50%Pn charge, $P_{AC,INV}$ = 0% Pn $P_{AC,GRID}$ = 0% Pn<br>2. $P_{AC,GRID}$ 0% Pn<br>3. $P_{AC,INV}$ = 40% Pn charging (active power change according to gradient 40%Pmax/Hz)<br>4. $P_{AC,INV}$ = 2% Pn; No feed-in allowed once battery is fully charged (SOC = 100%)<br>5. Inverter shall increase power limited to a gradient of max. 10%Pn/min | dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 2: No feed-in to grid<br>• 3: Change of active power (charging) according to LFSM-OC (Pref = Pmax) – increase charge power (If necessary, the inverter may reduce PV power) LFSM-OC response within 5% tolerance band.<br>• 4: Change of active power (charging) according to LFSM-OC (Pref = Pmax) LFSM-OC response within 5% tolerance band;<br>No feed into the grid when battery is fully charged (LFSM-O is still active).<br>• 5: Active power increase to 50%Pmax (discharging), limited to a gradient of max. 10%Pn/min | (PV+Batt) |
| 6c.3 | 1. Set $P_{PV}$ = 50%Pn<br>Battery fully charged, no further charging possible (e.g. SOC = 100%).<br>2. Set frequency to f=50.00 Hz, wait 30 s<br>3. Ramp frequency to f=51.20 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Set $P_{PV}$ =100%Pn, wait 30 s<br>5. Ramp frequency to f=50.25 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>6. Ramp frequency to f=50.00 Hz, RoCoF = 2.0 Hz/s, wait 120 s<br>7. Ramp frequency to f=51.20 Hz, | R25 5.3.4 (Test 2 mod.) | 1. Resulting operating conditions (+/-5%Pn): $P_{batt}$ = 0%Pn $P_{AC,INV}$ = 50% Pn $P_{AC,GRID}$ = 50% Pn<br>2. $P_{AC,GRID}$ = 50% Pn<br>3. Active power change according to gradient 40%Pmax/Hz ($P_{AC,INV}$ = 10% Pn feed-in)<br>4. Inverter must not increase active power output due to change of PV power. ($P_{AC,INV}$ = 10% Pn feed-in) | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 3: Reduction of active power according to LFSM-OC (Pref = Pmax)<br>• 4: No increase of active power<br>• 5: No increase above Pm<br>• 6: Max gradient dP/dt 10%Pn/min<br>• 7: reduction of active power according to LFSM-OC (Pref = Pmax)<br>• 8: No increase above Pm<br>• 9: Max gradient dP/dt 10%Pn/min | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | RoCoF = 0.1 Hz/s, wait 30 s<br>8. Ramp frequency to f=50.25 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>9. Ramp frequency to f=50.00 Hz, RoCoF = 0.1 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are not allowed*<br><br>*Note: Test procedure may be adapted depending on charging strategy of system* | | 5. Active power change according to gradient 40%Pmax/Hz ($P_{AC,INV}$ = 48% Pn feed-in)<br>6. Inverter shall increase power (feed-in) limited to a gradient of 10%Pn/min<br>7. Active power change according to gradient 40%Pmax/Hz<br>8. Active power change according to gradient 40%Pmax/Hz; inverter must not increase active power output > Pm<br>9. inverter shall increase power (feed-in) to 100%Pn limited to a gradient of max. 10%Pn/min) | | |
| 6c.4 | 1. Set $P_{PV}$=50%Pn Discharge battery to SOC 80% to 90% (battery charging with 100% power) shall be possible)<br>2. Set frequency to f=50.00 Hz, wait 30 s<br>3. Ramp frequency to f=49.30 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Ramp frequency to f=49.75 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>5. Ramp frequency to f=50.00 Hz, RoCoF = 2.0 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are* | R25 5.3.4 (Test 2 mod.) | 1. Resulting operating conditions (+/-5%Pn): $P_{batt}$ = 50%Pn (charge) $P_{AC,INV}$ = 0% Pn $P_{AC,GRID}$ = 0% Pn<br>2. $P_{AC,GRID}$ = 0% Pn<br>3. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 100% Pn feed-in)<br>4. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 10% Pn feed-in) | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 3: Increase of active power feed-in according to LFSM-UC (Pref = Pmax) to 100% Pmax (feed-in) LFSM-UC response within 5% tolerance band.<br>• 4: Change of active power according to LFSM-UC (Pref = Pmax) to 10% Pmax (feed-in) LFSM-UC response within 5% tolerance band.<br>• 5: No feed-in to grid, inverter must hold power at 0%Pn. | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | *not allowed* | | 5. $P_{AC,INV}$ = 0% Pn Inverter must hold active power; | | |
| 6c.5 | 1. Set $P_{PV}$=50%Pn, Charge battery to SOC 100% (battery fully charged, no further charging possible).<br>2. Set frequency to f=50.00 Hz, wait 30 s<br>3. Ramp frequency to f=49.50 Hz, RoCoF = 2.0 Hz/s, wait until SOC < 95%<br>4. Ramp frequency to f=49.75 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>5. Ramp frequency to f=50.00 Hz, RoCoF = 2.0 Hz/s, wait 120 s<br>6. Ramp frequency to f=49.30 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>7. Ramp frequency to f=49.75 Hz, RoCoF = 0.1 Hz/s, wait 30 s<br>8. Ramp frequency to f=50.00 Hz, RoCoF = 0.1 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are not allowed*<br>*Note: Test procedure may be adapted depending on charging strategy of system* | R25 5.3.4 (Test 2 mod.) | 1. Resulting operating conditions (+/-5%Pn): $P_{batt}$ = 0%Pn $P_{AC,INV}$ = 50% Pn $P_{AC,GRID}$ = 50% Pn<br>2. $P_{AC,GRID}$ = 50% Pn<br>3. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 100% Pn feed-in); No change of active power when battery SOC <95%<br>4. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 60% Pn feed-in)<br>5. Inverter may reduce power to charge battery, power change limited to a gradient of 10%Pn/min<br>6. Active power change according to gradient 200%Pmax/Hz<br>7. Active power change according to gradient 200%Pmax/Hz<br>8. Active power change to 0% Pn (charging) until Battery charged, then output power change to 50%Pn, | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 3: Increase of active power feed-in according to LFSM-UC (Pref = Pmax) to 100% Pmax (feed-in); No change of active power when battery SOC <95% LFSM-UC response within 5% tolerance band.<br>• 4: Change of active power according to LFSM-UC (Pref = Pmax) to 60% Pmax (feed-in); LFSM-UC response within 5% tolerance band.<br>• 5: Active power decrease limited to a gradient of max. 10%Pn/min<br>• 6: Increase of active power to 100% Pmax (feed-in); LFSM-UC response within 5% tolerance band.<br>• 7: Change of active power according to LFSM-UC (Pref = Pmax) to Pm+10% Pmax (feed-in); LFSM-UC response within 5% tolerance band.<br>• 8: Active power change to 0%Pmax (charging) until Battery limits the charging power, then increase to 50%Pn. All power changes limited to a gradient of max. 10%Pn/min | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| | | | limited to a gradient of max. 10%Pn/min) | | |
| 6c.6 | 1. Set $P_{PV}$=0%Pn, set $P_{load}$ = 50%Pn Discharge battery to SOC 80% to 90% (battery charging with 100% power shall be possible)<br>2. f=50.00 Hz, 30 s<br>3. Ramp frequency to f=49.30 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>4. Ramp frequency to f=49.75 Hz, RoCoF = 2.0 Hz/s, wait 30 s<br>5. Ramp frequency to f=50.00 Hz, RoCoF = 2.0 Hz/s, wait 600 s<br><br>*Note: Step changes of frequency are not allowed* | R25 5.3.4 (Test 2 mod.) | 1. Resulting operating conditions (+/-5%Pn): $P_{batt}$ = 50%Pn (discharge) $P_{AC,INV}$ = 50% Pn $P_{AC,GRID}$ = 0% Pn<br>2. $P_{AC,GRID}$ = 0% Pn<br>3. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 100% Pn feed-in, $P_{AC,GRID}$ = 50% Pn feed-in)<br>4. Active power change according to gradient 200%Pmax/Hz ($P_{AC,INV}$ = 60% Pn feed-in, $P_{AC,GRID}$ = 10% Pn feed-in)<br>5. Active power output change to Pm ($P_{AC,INV}$ = 50% Pn feed-in, $P_{AC,GRID}$ = 0% Pn) | Documentation Time series of P, f, P tolerance band Gradient dP/dt<br><br>**Summary of test results:**<br>• Test with PV and Battery<br>• 3: Increase of active power feed-in according to LFSM-UC (Pref = Pmax) to 50% Pmax ($P_{AC,GRID}$, feed-in), LFSM-UC response within 5% tolerance band.<br>• 4: Change of active power according to LFSM-UC (Pref = Pmax) to 10% Pmax ($P_{AC,GRID}$, feed-in); LFSM-UC response within 5% tolerance band.<br>• 5: Change of active power to Pm ($P_{AC,INV}$ = 50% Pn feed-in; $P_{AC,GRID}$ = 0%Pn feed-in) | PASS (PV+Batt) |
| | | | | | |

## 7 Verification of the LVRT-response

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 7 | **Verification of the LVRT-response:** | | | | |
| | Setup EUT Austria, Q-mode: Q(U) P>90%Pn<br>*Note: Hybrid Inverters shall be tested with power from PV and Battery.*<br>*Note: For inverters with UPS/ EPS/ backup mode shall be enabled if available and the UPS-EPS mains disconnection should be set to >1500 ms if possible.*<br>*Note 1: For ESS Inverters which allow setting a ramp time/rate for active power setpoint changes, this parameter shall be set to 0.5%Pn/s or equivalent.*<br>*Note 2: Tests shall be made with „external input“ enabled.* | R25 5.6.3 (mod.) | TOR Stromerzeugungsanlagen V1.4 5.2<br><br>Erläuterungsdokument NC RfG / TOR Erzeuger 6 | Documentation Screenshot from Setup Software/Tool | |
| 7.1 | 1. Perform LVRT test 1.1 (Start voltage 1.00Un, Dip voltage U=0.15Un, 160 ms) 3-phase | | • AC output current <10%In after 100ms from start of fault<br>• No disconnection | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• AC output current <10%In<br>• No disconnection<br>• Active power recovery time < 1 s | PASS (PV+Batt) |
| 7.2 | 1. Perform LVRT test 1.3 (Start voltage 1.00Un, Dip voltage U=0.15Un, 160 ms) 2-phase | | • AC output current <10%In after 100ms from start of fault<br>• No disconnection | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• AC output current <10%In<br>• No disconnection<br>• Active power recovery time < 1 s | PASS (PV+Batt) |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 7.3 | 1. Perform LVRT test 2.1 (Start voltage 1.08Un, U=0.50Un, 0.86 s, end-voltage 1.08Un) 3-phase | | • AC output current <10%In after 100ms from start of fault<br>• No disconnection<br>• Q(U) within tolerance band | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• AC output current <10%In<br>• No disconnection<br>• Active power recovery time < 1 s | PASS (PV+Batt) |
| 7.4 | 1. Perform LVRT test 3.1 (Start voltage 1.00Un, Dip voltage U=0.85Un, 60 s) 3-phase | | • Normal operation<br>• Q = 0.436 Sn (capacitive/over-excited) inside Q(U) tolerance band | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• Normal operation<br>• Reactive power inside Q(U) tolerance band | PASS (PV+Batt) |
| 7.5 | Only for ESS and Hybrid systems <30 kW with UPS/ EPS/ backup mode and switching time <20ms<br>1. Set resistive load on EPS/UPS output to 50%Pn<br>2. Perform LVRT test 1.1 (Start voltage 1.00Un, Dip voltage U=0.15Un, 160 ms) 3-phase | | • Voltage on UPS/EPS output is between 80%Un and 110%Un within 20 ms. | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• N/A | N/A |
| 7.6 | Only for ESS and Hybrid systems which can charge from grid<br>1. Set active power to P = 100%Pn (charging from grid)<br>2. Perform LVRT test 1.1 (Start voltage 1.00Un, Dip voltage U=0.15Un, 160 ms) 3-phase | | • AC output current <10%In after 100ms from start of fault<br>• No disconnection | Documentation Time series of U, I (Waveforms), P, Q<br><br>**Summary of test results:**<br>• AC output current <10%In<br>• No disconnection<br>• Active power recovery time < 1 s | PASS (PV+Batt) |

## 8 Verification of the cosphi(P)

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| **8** | **Verification of the cosphi(P)** | **R25 5.3.8 (mod.)** | | | |
| | Setup EUT Austria, Q-mode: cosphi(P) | - | • TOR Stromerzeugungsanlagen V1.4 5.3.4.1 | Documentation Screenshot from Setup Software/Tool | - |
| 8.1 | 1. Increase of active power starting from 20% Pn to 100% Pn in 300 s | | • cosφ(P) within tolerance band | Documentation Time series of P, Q, cosphi tolerance band<br><br>**Summary of test results:**<br>• Test with Batt<br>• cosφ(P) within tolerance band | PASS (Batt) |
| 8.2 | 1. Step change of active power from 100% Pn to 50% Pn, wait for 30 s<br>2. Step change of active power from 50% Pn to 20% Pn | | • Dynamic response of cosφ(P) settling time <10 s | Documentation Time series of P, Q, cosphi tolerance band<br><br>**Summary of test results:**<br>• Test with PV/Batt/PV+Batt (select actual test configuration)<br>• Response time of cosφ(P) <10 s<br>• Note: Q response time manually adjusted to 10 s | PASS (Batt) |
| | | | | | |

FINAL

## 9 Verification of the external input port

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| **9** | **Verification of the external input port** | **R25 5.3.3** | | | |
| | Setup EUT Austria, Q-mode: Q(U) P>90%Pn<br>*Note: For ESS Inverters which allow setting a ramp time/rate for active power setpoint changes, this parameter shall be set to 0.5%Pn/s or equivalent.* | - | TOR Stromerzeugungsanlagen V1.4 6.2.1 | Documentation of external input port (from manual, photos) | |
| 9.1 | 1. Test activation of active power reduction | | • Active power reduced to <5% Pn within <5 s<br>• *Note: Active power must be reduced on inverter terminals*<br>• *Note: Disconnection or emergency stop is allowed but not required.* | Documentation Time series of P<br><br>**Summary of test results:**<br>• Test with Batt<br>• Active power reduced to <5%Pn within approx. 4.8 seconds | PASS (Batt) |
| | | | | | |

FINAL

## 10 Verification of the interface protection

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 10 | **Verification of the interface protection** | **R25** | | | |
| | Setup: Austria Q(U)<br>*Note: For ESS and hybrid Inverters UPS/ EPS/ backup mode shall be enabled if available*<br>*Note: In case of conflicts with LVRT response, test sequence may be adapted accordingly.*<br>*Note: For single-phase inverters, voltage changes shall be applied on phase where inverter is connected.* | | TOR Stromerzeugungsanlagen V1.4 6.3.2 | Documentation Screenshot from Setup Software/Tool | - |
| 10.1 | Verification of over-voltage protection U>> L1<br>1. Set active power to 10%Pn<br>2. Step voltage (L1, L2, L3) to 1.12 Un, wait 400 ms<br>3. Step voltage (L1-N) to 1.18 Un, wait 400 ms<br>4. Step voltage (L1, L2, L3) to 1.00 Un | | • Step 2: No disconnection<br>• Step 3: Disconnection within 0 s to 0.2 s after U>> threshold (264.5V) has been exceeded<br>• Step 4: No reconnection within 300 s | Documentation Time series of voltage and current<br><br>**Summary of test results:**<br>• Test with Batt<br>• Step 2: No disconnection<br>• Step 3: Disconnection 0.10 s after U>> threshold (264.5 V) has been exceeded<br>• Step 4: No reconnection within 300 s | PASS |
| 10.2 | Verification of under-voltage protection U< L2<br>1. Set active power to 10%Pn<br>2. Step voltage (L1, L2, L3) to 0.83 Un, wait 1700 ms<br>3. Step voltage (L2-N) to 0.77 Un, wait 1700 ms<br>4. Step voltage (L1, L2, L3) to 1.00 Un | | • Step 2: No disconnection<br>• Step 3: Disconnection within 1.4 s to 1.6 s after U< threshold (184.0 V) has been reached<br>• Step 4: No reconnection within 300 s | Documentation Time series of voltage and current<br><br>**Summary of test results:**<br>• Test with Batt<br>• Step 2: No disconnection<br>• Step 3: Disconnection 1.48 s after U< threshold (184.0 V) has been exceeded<br>• Step 4: No reconnection within 300 s | PASS |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 10.3 | Verification of under-voltage protection U<< L3<br>1. Set active power to 10%Pn<br>2. Step voltage (L1, L2, L3) to 0.28 Un, wait 700 ms<br>3. Step voltage (L3-N) to 0.22 Un, wait 700 ms<br>4. Step voltage (L1, L2, L3) to 1.00 Un | | • Step 2: No disconnection<br>• Step 3: Disconnection within 0.4 s to 0.6 s after U<< threshold (57.5 V) has been reached<br>• Step 4: No reconnection within 300 s | Documentation Time series of voltage and current<br><br>**Summary of test results:**<br>• Test with Batt<br>• Step 2: No disconnection<br>• Step 3: Disconnection 0.49 s after U<< threshold (57.5 V) has been exceeded<br>• Step 4: No reconnection within 300 s | PASS |
| | | | | | |

FINAL - PA

## 11 Verification of the feed-in limitation (dynamic) (TESTED ONLY IF FUNCTION IS AVAILABLE)

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 11 | **Verification of the feed-in limitation (static/dynamic) for Solar/PV units** | | | | |
| | Setup: Austria Q(U)<br>*Note 1: Test shall be made with smart-meter/ current-transducers/ measurement devices provided by manufacturer.*<br>*Note 2: Test shall be conducted with PV/PV simulator; active power shall be controlled by setting MPP power of PV simulator.*<br>*Note 3: Tests shall be made with „external input" enabled.* | | P limit curve as per VDE AR N 4105:2026-03 | Documentation Screenshot from Setup Software/Tool | - |
| 11a.1 | Test with feed-in limit set to 0% Pn<br>1. Set load to 10%Pn and PV/MPP power to 90%Pn<br>2. Change load from 10%Pn to 90%Pn (step change), wait 30s<br>3. Change load from 90%Pn to 10%Pn (step change), wait 30s<br>4. Set PV power to 10%Pn; wait until inverter reaches MPP<br>5. Increase PV/MPP power within 3s to 100%Pn, wait until inverter reaches MPP<br><br>Note: load changes shall be made in one step (active power change within <100 ms) | - | 1. No feed-in to grid (Pac,grid <5%Pn)<br>2. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>3. Transient feed-in to grid must not exceed limit curve<br>4. No feed-in to grid (Pac,grid <5%Pn)<br>5. Transient feed-in to grid must not exceed limit curve | Documentation Time series of Pac,grid and Pload (if available)<br><br>**Summary of test results:**<br>• N/A | N/A |

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 11a.2 | Test with feed-in limit set to 60% Pn<br>1. Set load to 10%Pn and PV/MPP power to 100%Pn<br>2. Change load from 10%Pn to 100%Pn (step change), wait 30s<br>3. Change load from 100%Pn to 10%Pn (step change), wait 30s<br>4. Set PV/MPP power to 10%Pn; wait until inverter reaches MPP<br>5. Increase PV/MPP power within 3s to 100%Pn, wait until inverter reaches MPP<br><br>Note: load changes shall be made in one step (active power change within <100 ms) | | 1. Feed-in to grid limited (Pac,grid <60%Pn)<br>2. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>3. Transient feed-in to grid must not exceed limit curve (60% limitation)<br>4. No feed-in to grid (Pac,grid <5%Pn)<br>5. Transient feed-in to grid must not exceed limit curve (60% limitation) | Documentation Time series of Pac,grid, Limit curve, Pload (if available)<br><br>**Summary of test results:**<br>• N/A | N/A |

FINAL - PASS

| | | | | | |
|---|---|---|---|---|---|
| 11 | **Verification of the feed-in limitation (static/dynamic) for Storage units** | | | | |
| | Setup: Austria Q(U);<br>*Note 1: Test shall be made with smart-meter/ current-transducers/ measurement devices provided by manufacturer.*<br>*Note 2: Test conditions may be adapted based on limitations of test object.*<br>*Note 3: Active power shall be controlled by setpoint.*<br>*Note 4: For ESS Inverters which allow setting a ramp time/rate for active power setpoint changes, this parameter shall be set to 0.5%Pn/s or equivalent.*<br>*Note 3: Tests shall be made with „external input" enabled.* | | P limit curve as per VDE-AR N 4105:2026-03 | Documentation Screenshot from Setup Software/Tool | - |
| 11b.1 | Test with feed-in limit set to 0% Pn<br><br>1. Charge or discharge battery until an SOC in the range between 30%-80% is reached; Set storage power setpoint to 0%Pn<br>2. Set load to 10%Pn<br>3. Set storage power setpoint 100% (discharge)<br>4. Change load from 10%Pn to 90%Pn (step change), wait 30s<br>5. Change load from 90%Pn to 10%Pn (step change), wait 30s<br>6. Set storage power setpoint 10% (charge), wait 30s<br>7. Set storage power setpoint 90% (discharge), wait 30s<br>Note: load changes shall be made in | - | 1. No feed-in to grid (Pac,grid <5%Pn)<br>2. No feed-in to grid (Pac,grid <5%Pn)<br>3. Transient feed-in to grid must not exceed limit curve<br>4. Response to load-step must be similar as for step 3.<br>5. Transient feed-in to grid must not exceed limit curve<br>6. No feed-in to grid (Pac,grid <5%Pn)<br>7. Transient feed-in to grid must not exceed limit curve | Documentation Time series of Pac,grid, Limit curve, and Pload (if available)<br><br>**Summary of test results:**<br>• N/A | N/A |

| | | | | | |
|---|---|---|---|---|---|
| | one step (active power change within <100 ms) | | | | |
| 11b.2 | Test with feed-in limit set to 60% Pn<br><br>1. Charge or discharge battery until an SOC in the range between 30%-80% is reached; Set storage power setpoint to 0%Pn<br>2. Set load to 10%Pn<br>3. Set storage power setpoint 100% (discharge)<br>4. Change load from 10%Pn to 90%Pn (step change), wait 30s<br>5. Change load from 90%Pn to 10%Pn (step change), wait 30s<br>6. Set storage power setpoint 10% (charge), wait 30s<br>7. Set storage power setpoint 90% (discharge), wait 30s<br>Note: load changes shall be made in one step (active power change within <100 ms) | - | 1. Feed-in to grid limited (Pac,grid <60%Pn)<br>2. Feed-in to grid limited (Pac,grid <60%Pn)<br>3. Transient feed-in to grid must not exceed limit curve<br>4. Response to load-step must be similar as for step 3.<br>5. Transient feed-in to grid must not exceed limit curve<br>6. Feed-in to grid limited (Pac,grid <60%Pn)<br>7. Transient feed-in to grid must not exceed limit curve. | Documentation Time series of Pac,grid, Limit curve, and Pload (if available)<br><br>**Summary of test results:**<br>• N/A | N/A |
| 11b.3 | Only if inverter supports setting a maximum consumption limit from the grid:<br>Test with consumption limit from the grid set to 60% Pn<br>1. Charge or discharge battery until an SOC in the range between 30%-80% is reached; Set storage power setpoint to 0%Pn<br>2. Set load to 10%Pn<br>3. Set storage power setpoint 100% (charge)<br>4. Change load from 10%Pn to 60%Pn (step change), wait 30s<br>5. Change load from 60%Pn to | | 1. Consumption limited (Pac,grid <60%Pn)<br>2. Consumption limited (Pac,grid <60%Pn)<br>3. Transient consumption must not exceed limit curve<br>4. Transient consumption must not exceed limit curve<br>5. Transient consumption must not exceed limit curve<br>6. Consumption limited (Pac,grid <60%Pn)<br>7. Transient consumption must not exceed limit curve. | Documentation Time series of Pac,grid, Limit curve, and Pload (if available)<br><br>**Summary of test results:**<br>• N/A | N/A |

| | | | | | |
|---|---|---|---|---|---|
| | ~~10%Pn (step change), wait 30s~~<br>~~6. Set storage power setpoint 10% (discharge), wait 30s~~<br>~~7. Set storage power setpoint 90% (charge), wait 30s~~<br>~~Note: load changes shall be made in one step (active power change within <100 ms)~~ | | | | |

FINAL - PASS

| | | | | | |
|---|---|---|---|---|---|
| 11 | **Verification of the feed-in limitation (static/dynamic) for hybrid units** | | | | |
| | Setup: Austria Q(U);<br>EMS Working Mode: Self-Consumption<br>*Note 1: Test shall be made with battery, and smart-meter/current-transducers/ measurement devices provided by manufacturer.*<br>*Note 2: PV input of inverter shall be supplied with PV/PV simulator.*<br>*Note 3: Test conditions may be adapted based on limitations of test object.*<br>*Note 4: Tests shall be made with „external input“ enabled.* | | P limit curve as per VDE AR N 4105:2026-03 | Documentation Screenshot from Setup Software/Tool | - |
| 11c.1 | Test with feed-in limit set to 0% Pn<br>1. Charge or discharge battery until an SOC of 90% is reached<br>2. Set load to 10%Pn<br>3. Set PV/MPP power to 0%Pn or switch off PV simulator<br>4. Change load from 10%Pn to 90%Pn (step change), wait 30s<br>5. Change load from 90%Pn to 10%Pn (step change), wait 30s<br>6. Set PV power to 10%Pn; wait until inverter reaches MPP<br>7. Increase PV/MPP power within 3s to 100%Pn<br>8. Wait until SOC = 100% (or maximum allowed SOC, no further charging of battery) is reached | - | 1. No feed-in to grid (Pac,grid <5%Pn)<br>2. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>3. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>4. Transient feed-in to grid must not exceed limit curve<br>5. Transient feed-in to grid must not exceed limit curve<br>6. No feed-in to grid (Pac,grid <5%Pn)<br>7. Transient feed-in to grid must not exceed limit curve<br>8. No feed-in to grid once SOC = 100% (or maximum allowed SOC) is reached. | Documentation Time series of Pac,grid, Limit curve and Pload (if available)<br><br>**Summary of test results:**<br>• 1. No feed-in to grid (Pac,grid <5%Pn)<br>• 2. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>• 3. No consumption from or feed-in to grid (Pac,grid <5%Pn)<br>• 4. Transient feed-in to grid must not exceed limit curve<br>• 5. Transient feed-in to grid must not exceed limit curve<br>• 6. No feed-in to grid (Pac,grid <5%Pn)<br>• 7. Transient feed-in to grid must not exceed limit curve<br>• 8. No feed-in to grid once SOC = 100% (or maximum allowed SOC) is reached. | PASS (PV+Batt) |
| 11c.2 | Test with feed-in limit set to 60% Pn<br>1. Set PV to 100% and charge | | 1. Feed-in to grid limited (Pac,grid <60%Pn) | Documentation Time series of Pac,grid, Limit curve and Pload (if available) | PASS (PV+Batt) |

| | | | | | |
|---|---|---|---|---|---|
| | battery until an SOC of 100% (or maximum allowed SOC) is reached<br>2. Set load to 10%Pn; wait 30 s;<br>3. Change load from 10%Pn to 100%Pn (step change); wait 30 s<br>4. Change PV/MPP power from 100%Pn to 10%Pn within 3 s; wait 30 s<br>5. Change load from 100%Pn to 0%Pn (step change); wait 30 s<br>6. Change load from 0%Pn to 100%Pn (step change); wait 30 s<br>7. Change load from 100%Pn to 0%Pn (step change); wait 30 s<br>8. Increase PV power within 3s to 100%Pn; wait 30 s | | 2. Feed-in to grid limited (Pac,grid <60%Pn)<br>3. Feed-in to grid limited (Pac,grid <60%Pn)<br>4. Feed-in to grid limited (Pac,grid <60%Pn)<br>5. Transient feed-in to grid must not exceed limit curve<br>6. Response to load-step must be similar as for step<br>7. Transient feed-in to grid must not exceed limit curve<br>8. Transient feed-in to grid must not exceed limit curve | **Summary of test results:**<br>• 1. Feed-in to grid limited (Pac,grid <60%Pn)<br>• 2. Feed-in to grid limited (Pac,grid <60%Pn)<br>• 3. Feed-in to grid limited (Pac,grid <60%Pn)<br>• 4. Feed-in to grid limited (Pac,grid <60%Pn)<br>• 5. Transient feed-in to grid must not exceed limit curve<br>• 6. Response to load-step must be similar as for step 5.<br>• 7. Transient feed-in to grid must not exceed limit curve<br>• 8. Transient feed-in to grid must not exceed limit curve | |
| 11c.3 | Only if inverter supports setting a maximum consumption limit from the grid and charging from the grid is possible in certain operating modes (e.g. Time of Use TOU Mode)<br>Test with consumption limit from the grid (or peak shaving) set to 60% Pn<br>1. Charge or discharge battery until an SOC in the range between 30%-80% is reached; Set storage power setpoint to 0%Pn<br>2. Set load to 10%Pn<br>3. Set SOC target (TOU mode) to 100% (force charge from the grid)<br>4. Change load from 10%Pn to 60%Pn (step change), wait 30s<br>5. Change load from 60%Pn to 10%Pn (step change), wait 30s<br>6. Set SOC target below current SOC (no charge from grid), wait 30s | | 1. Consumption limited (Pac,grid <60%Pn)<br>2. Consumption limited (Pac,grid <60%Pn)<br>3. Transient consumption must not exceed limit curve<br>4. Transient consumption must not exceed limit curve<br>5. Consumption limited (Pac,grid <60%Pn)<br>6. Consumption limited (Pac,grid <60%Pn) | Documentation Time series of Pac,grid, Limit curve and Pload (if available)<br><br>**Summary of test results:**<br>• 1. Consumption from the grid limited (Pac,grid <60%Pn)<br>• 2. Consumption from the grid limited (Pac,grid <60%Pn)<br>• 3. Transient consumption from the grid must not exceed limit curve<br>• 4. Transient consumption from the grid must not exceed limit curve<br>• 5. Consumption limited (Pac,grid <60%Pn)<br>• 6. Consumption from the grid limited (Pac,grid <60%Pn) | PASS (PV+Batt) |

FINAL - PASS

## 12 Further tests if required (optional)

| No. | Test | Ref. | Criteria (PASS/FAIL) | Test result – documentation | Verdict |
|---|---|---|---|---|---|
| 12 | **Further tests if required (optional)** | | | | |
| | Setup: N/A | | | Documentation Screenshot from Setup Software/Tool | - |
| 12.1 | | | | | |
| 12.2 | | | | | |
| | | | | | |

FINAL - PASS

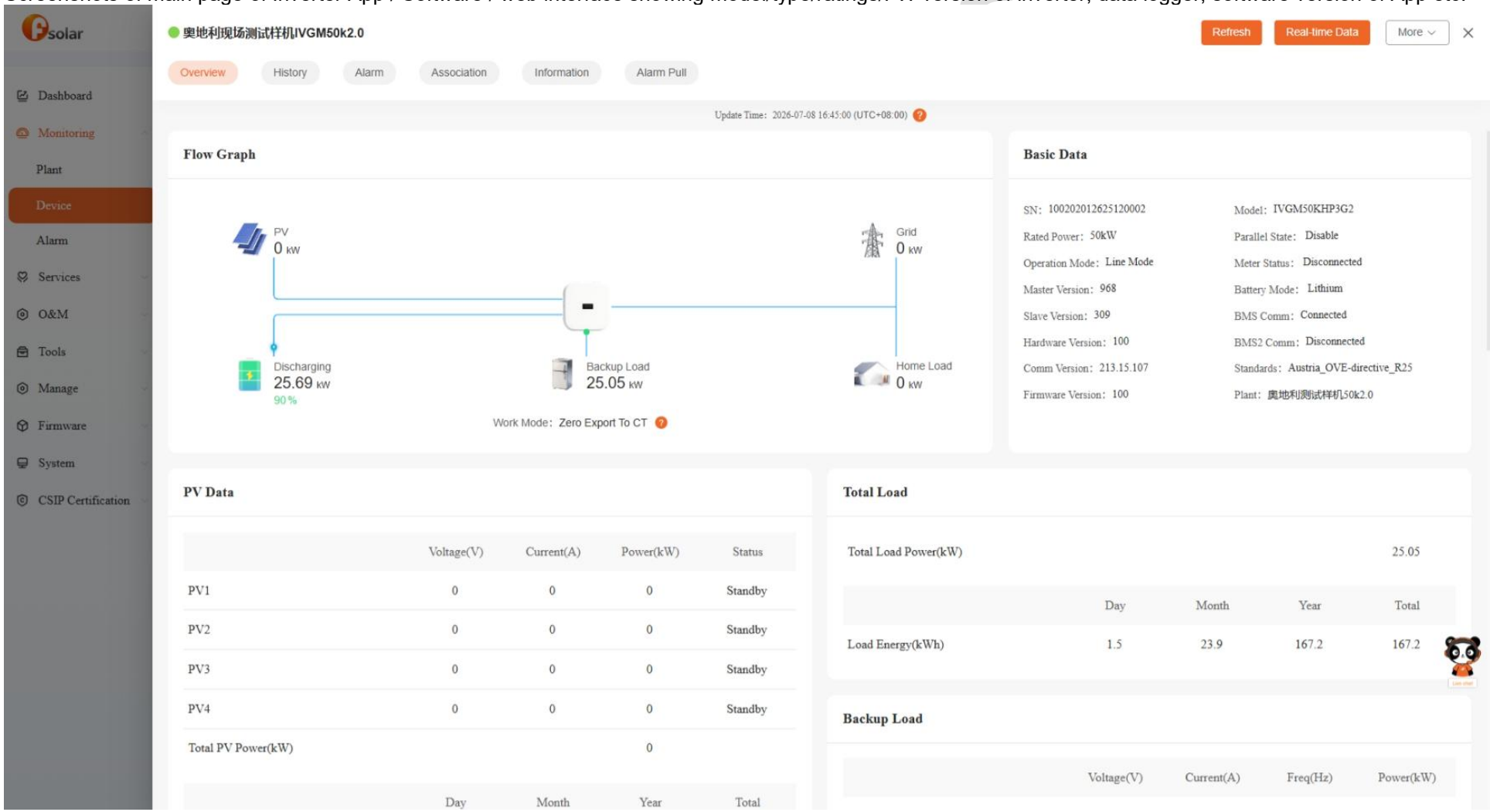
## Test results

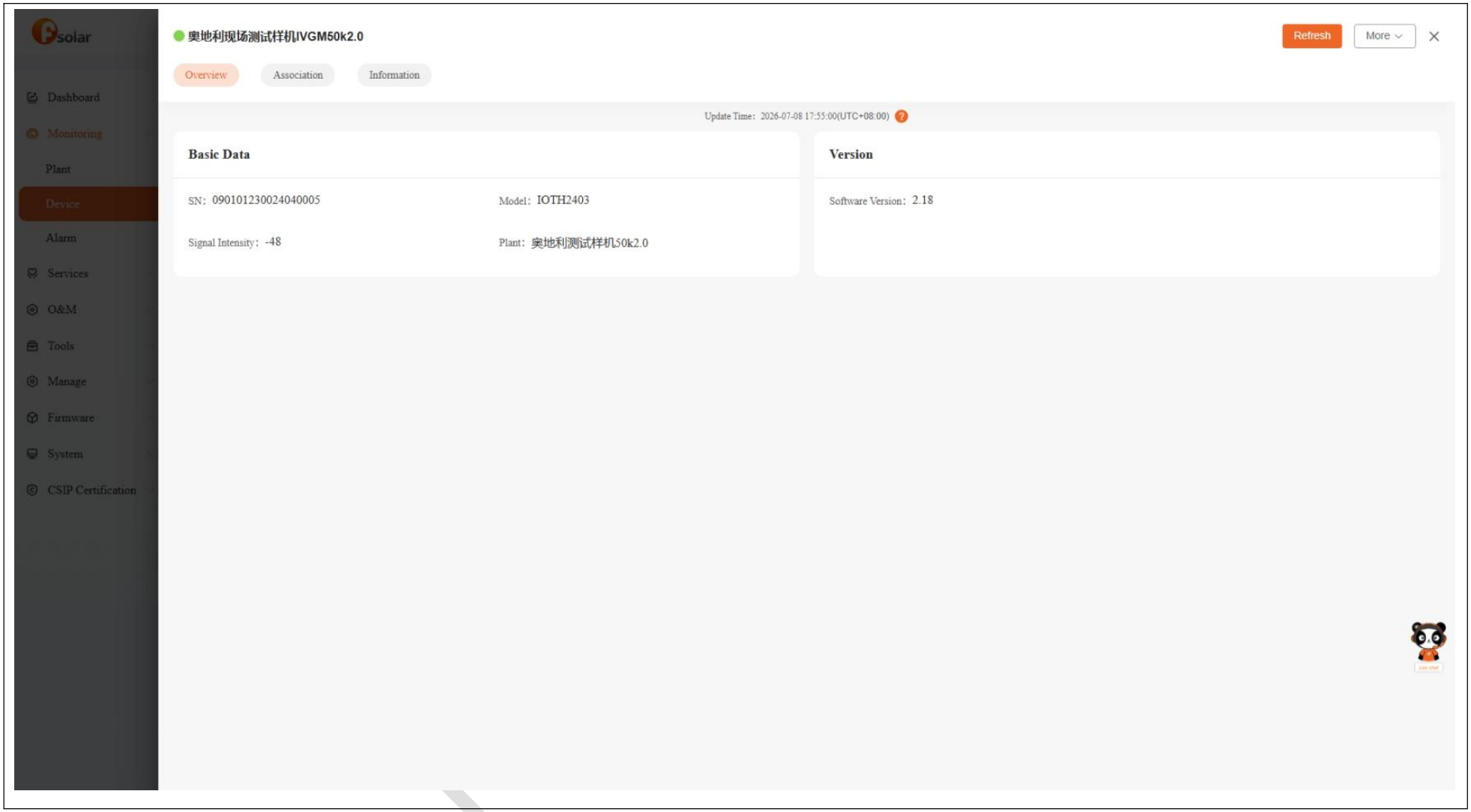
FINAL - PASS

# 1 Setup and commissioning

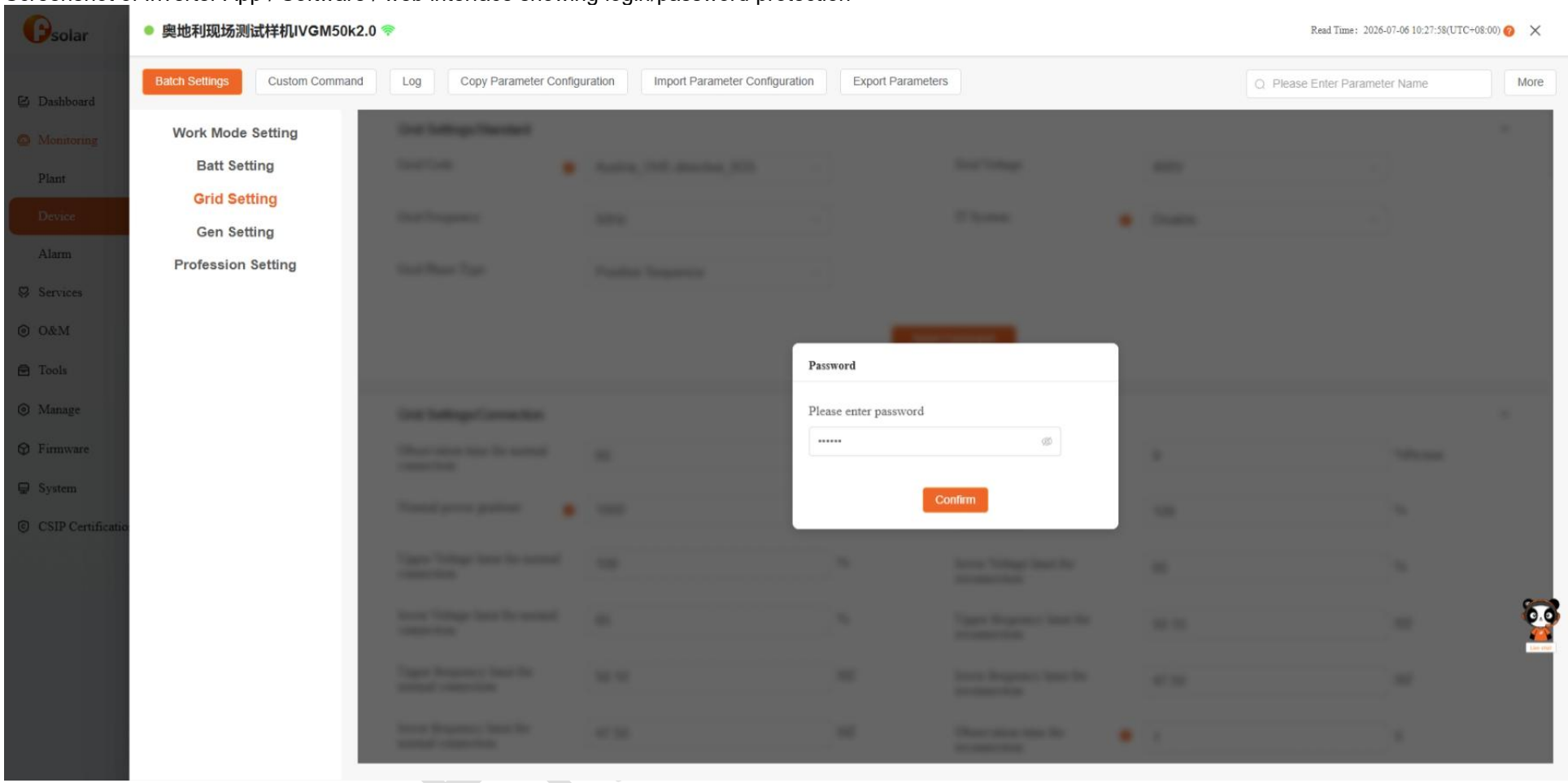
## 1 Setup and commissioning

Screenshots of main page of Inverter App / Software / web interface showing model/type/ratings/FW version of inverter, data logger, software version of App etc.

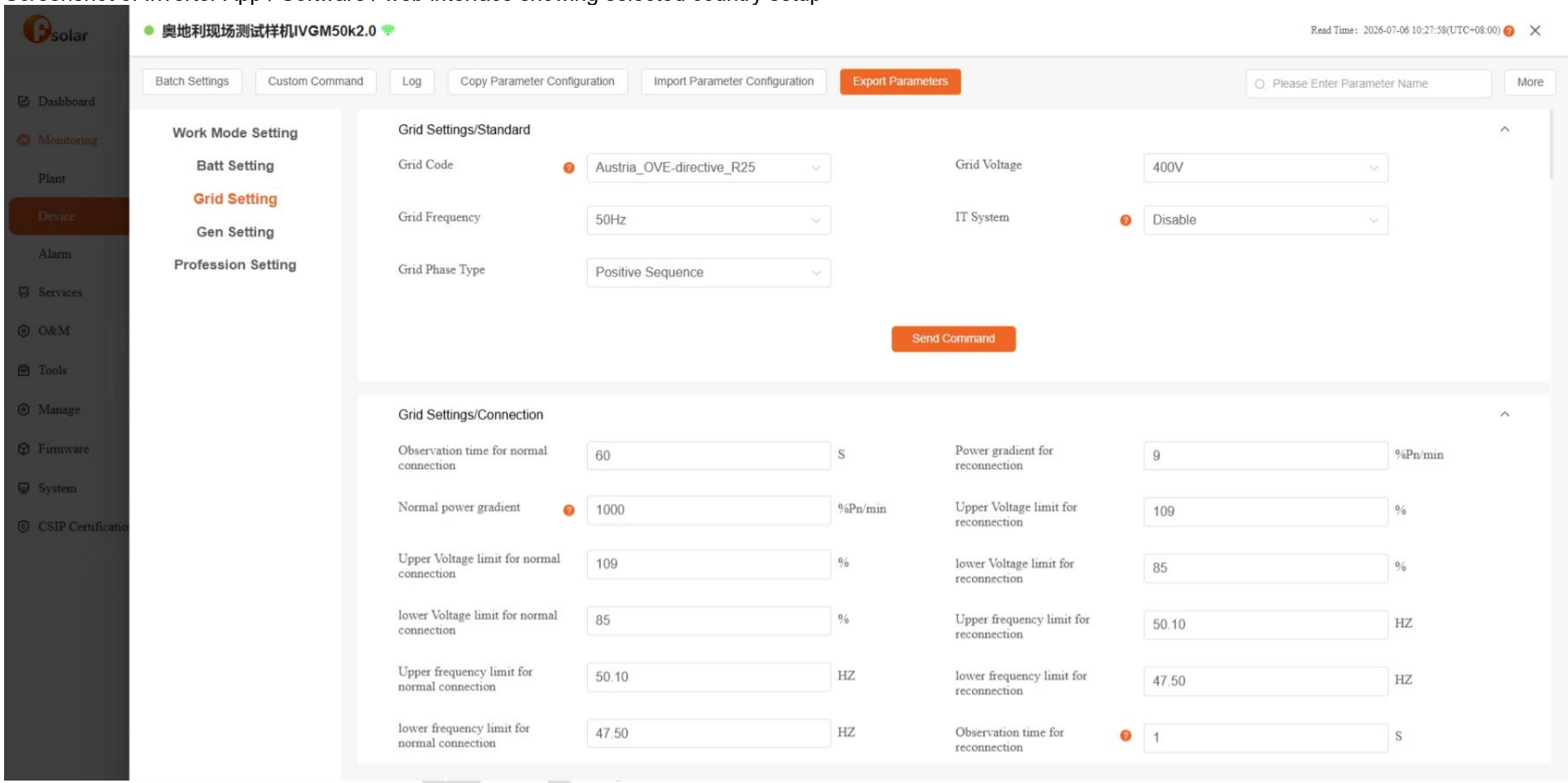



奥地利现场测试样机IVGM50k2.0
Refresh
More
Overview
Association
Information
Update Time: 2026-07-08 17:55:00(UTC+08:00)
Basic Data
SN: 090101230024040005
Model: IOTH2403
Signal Intensity: -48
Plant: 奥地利测试样机50k2.0
Version
Software Version: 2.18
Dashboard
Monitoring
Plant
Device
Alarm
Services
O&M
Tools
Manage
Firmware
System
CSIP Certification

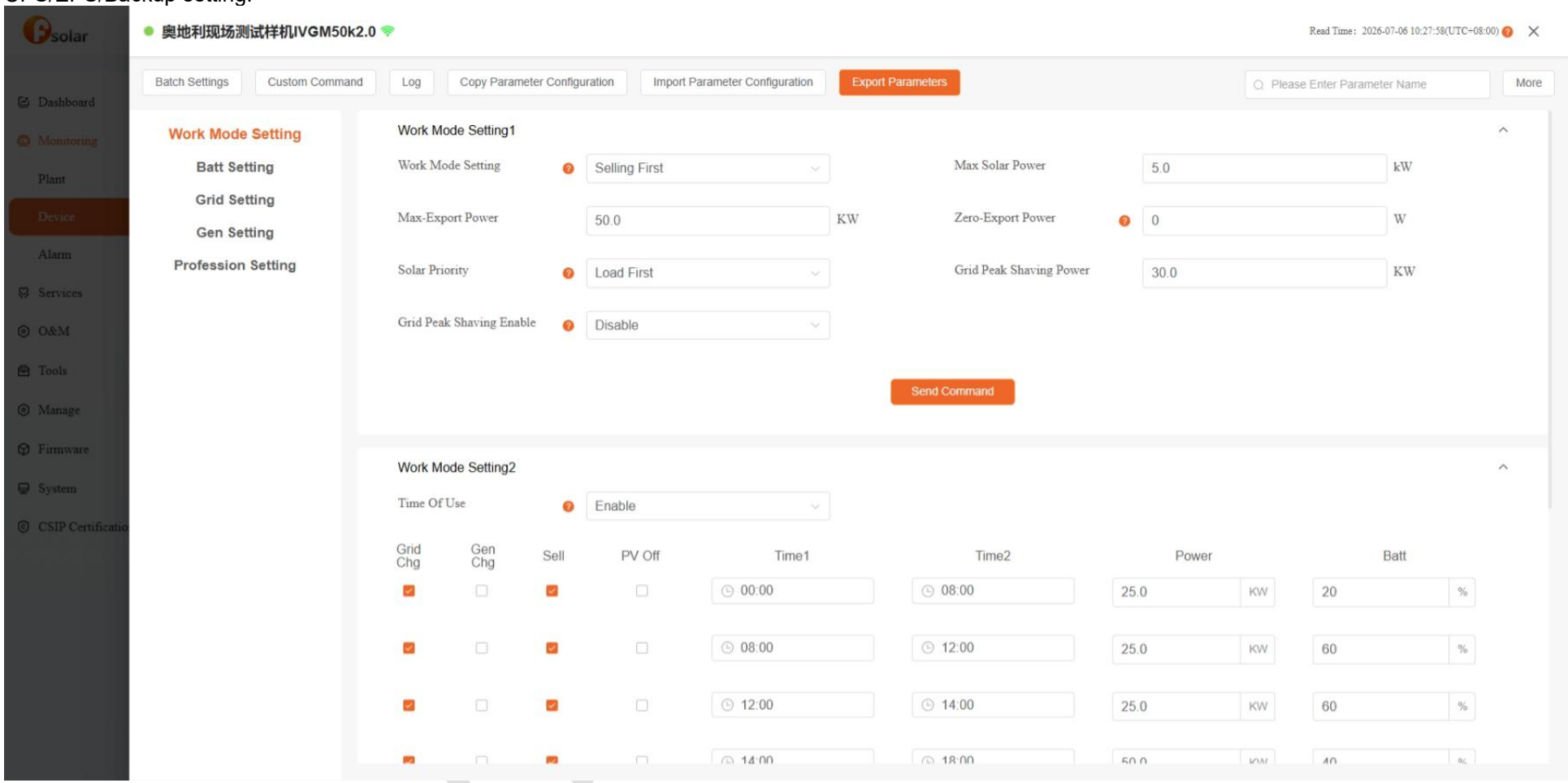
Screenshot of Inverter App / Software / web interface showing login/password protection

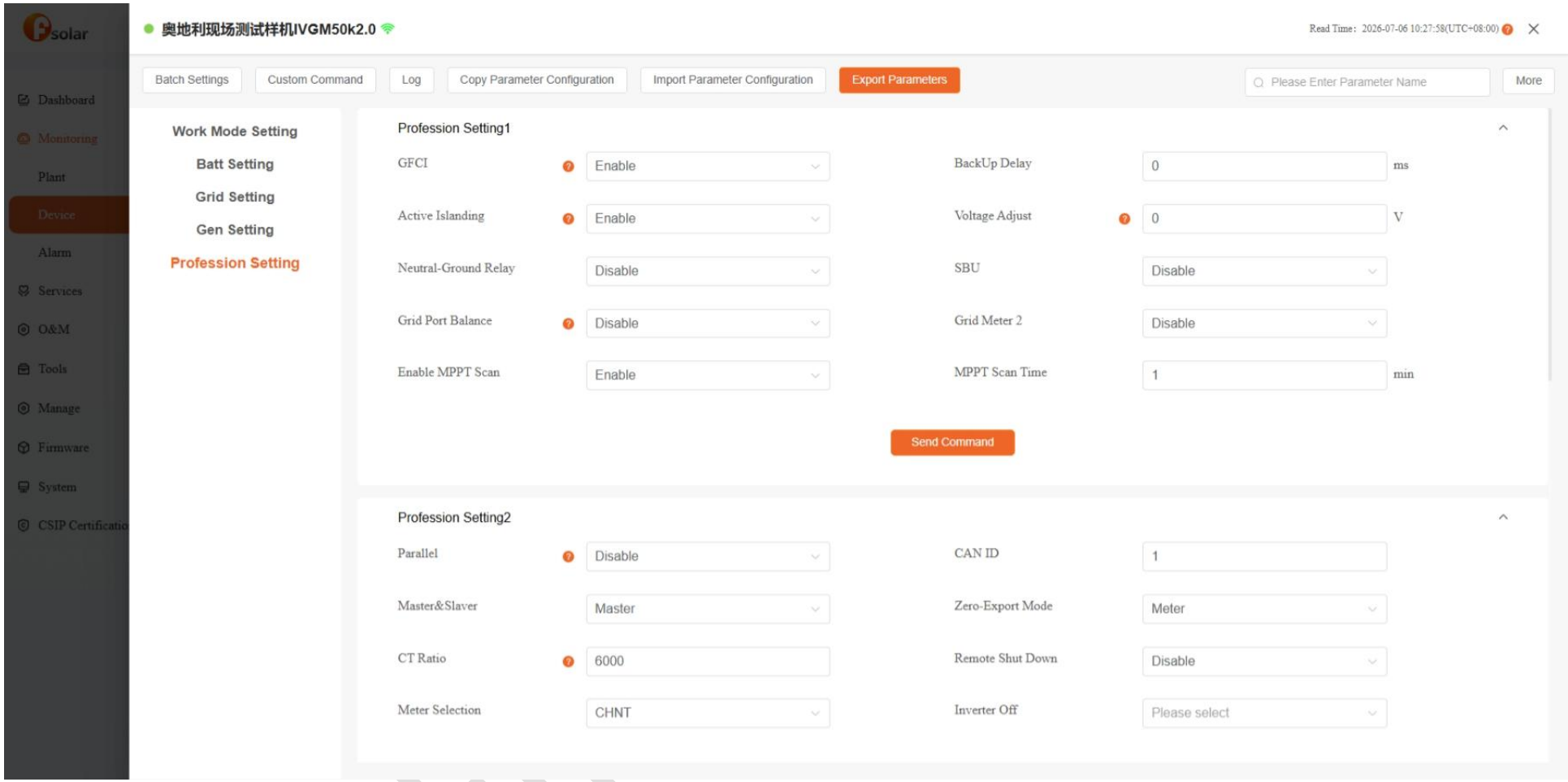


Screenshot of Inverter App / Software / web interface showing selected country setup



Hybrid and ESS with EMS only: Screenshot of Inverter App / Software / web interface showing battery and EMS/working mode settings (Self-Use Mode, etc.), UPS/EPS/Backup setting.




奥地利现场测试样机IVGM50k2.0
Read Time: 2026-07-06 10:27:58(UTC+08:00)
Batch Settings
Custom Command
Log
Copy Parameter Configuration
Import Parameter Configuration
Export Parameters
Please Enter Parameter Name
More
Dashboard
Monitoring
Plant
Device
Alarm
Services
O&M
Tools
Manage
Firmware
System
Work Mode Setting
Batt Setting
Grid Setting
Gen Setting
Profession Setting
Profession Setting1
GFCI
Enable
BackUp Delay
0
ms
Active Islanding
Enable
Voltage Adjust
0
V
Neutral-Ground Relay
Disable
SBU
Disable
Grid Port Balance
Disable
Grid Meter 2
Disable
Enable MPPT Scan
Enable
MPPT Scan Time
1
min
Send Command
Profession Setting2
Parallel
Disable
CAN ID
1
Master&Slaver
Master
Zero-Export Mode
Meter
CT Ratio
6000
Remote Shut Down
Disable
Meter Selection
CHNT
Inverter Off
Please select

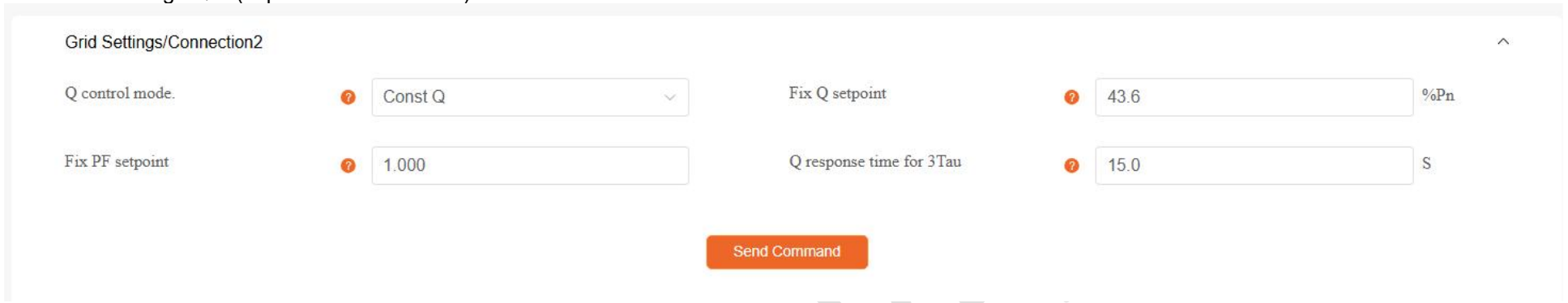
## 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power

| 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power |
|---|
| Parameter report: 2026-07-07 09_42_07 Qfix under-excited.xls  2026-07-07 09_51_25 Qfix over-excited.xls (export) |
| Screenshots Inverter App / Software / Web interface<br>Parameter settings Qfix (inductive/under-excited) |




FINAL

Screenshots Inverter App / Software / Web interface
Parameter settings Qfix (capacitive/over-excited)




FINAL-PASS

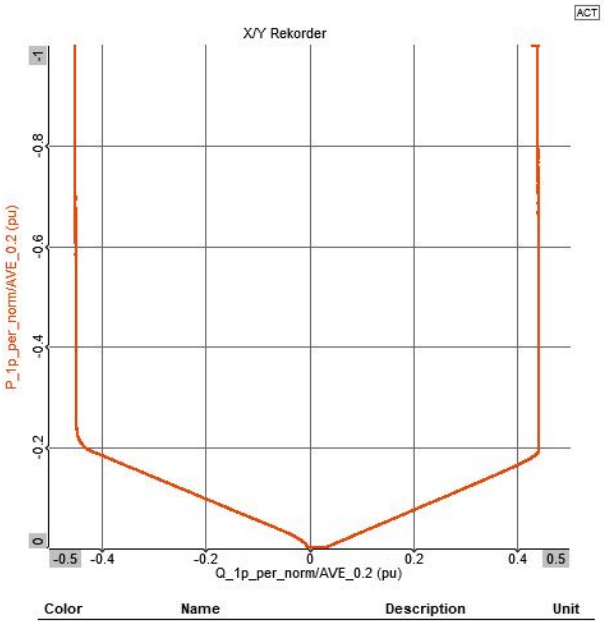
## 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power

### 2.1 Test 1 U=1.00 Un

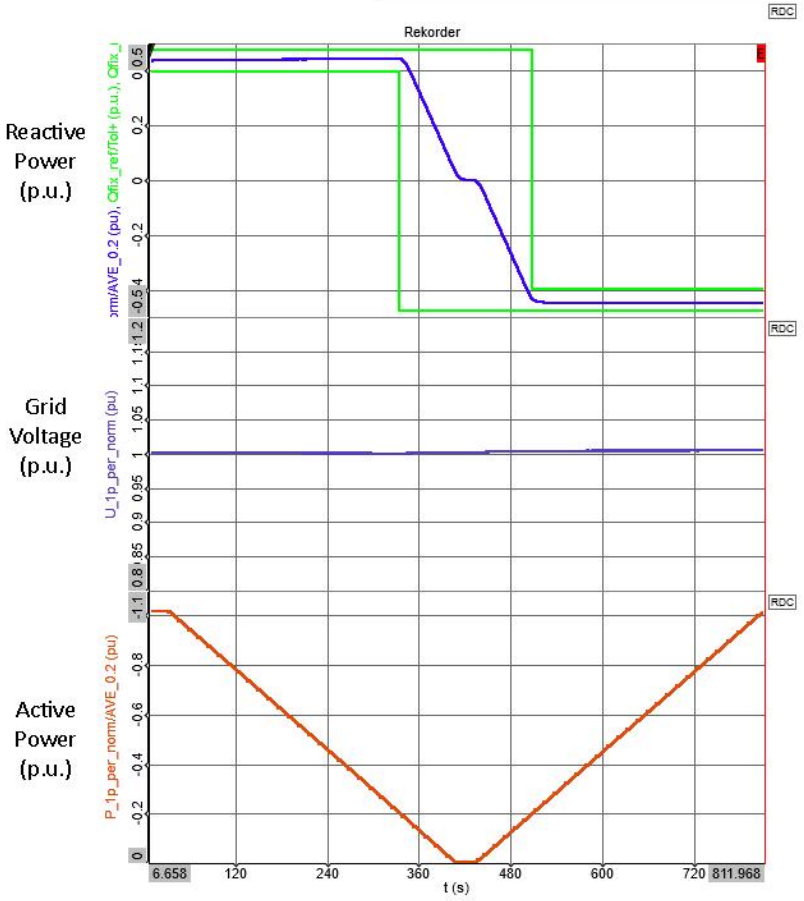
OE Tests 2.1-2.3 Qfix

OE_Tests_IVGM50KHP3G2_2_X_2026_07_07_094403_P.dxd

PASS




Color | Name | Description | Unit




Color | Name | Description | Unit

Label | Type | Channel | C... | Time | Value

Color | Name | Description | Unit

Color | Name | Description | Unit

Label | Channel | C... | Time | Value

EUT Info

| | | | | | |
|---|---|---|---|---|---|
| EUT Manufacturer INPUT | felicitysolar | EUT Nominal Active Power (kW) INPUT | 50.000 | Firmware Version INPUT | V100 M967 S309 |
| EUT Model INPUT | IVGM50KHP3G2 | EUT Nominal Apparent Power (kW) INPUT | 50.000 | Parameter Setup INPUT | Austria_OVE-directive_R25 Qfix |
| Serial Number INPUT | 100202012625120002 | EUT Nominal Voltage (L-N) (V) INPUT | 230.00 | Test Configuration INPUT | PV+Batt; Sell first |

| Current date | Current time |
|---|---|
| 07/07/2026 | 09:44:10.266 |

| Pn (kW) ACT | Sn (kVA) ACT | Qn (kVAr) ACT | Un (V) ACT |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

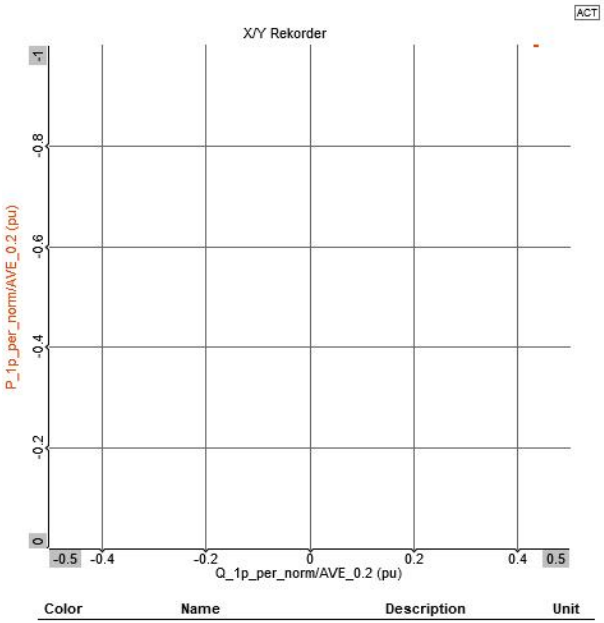
## 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power

### 2.1 Test 2 U=1.09 Un

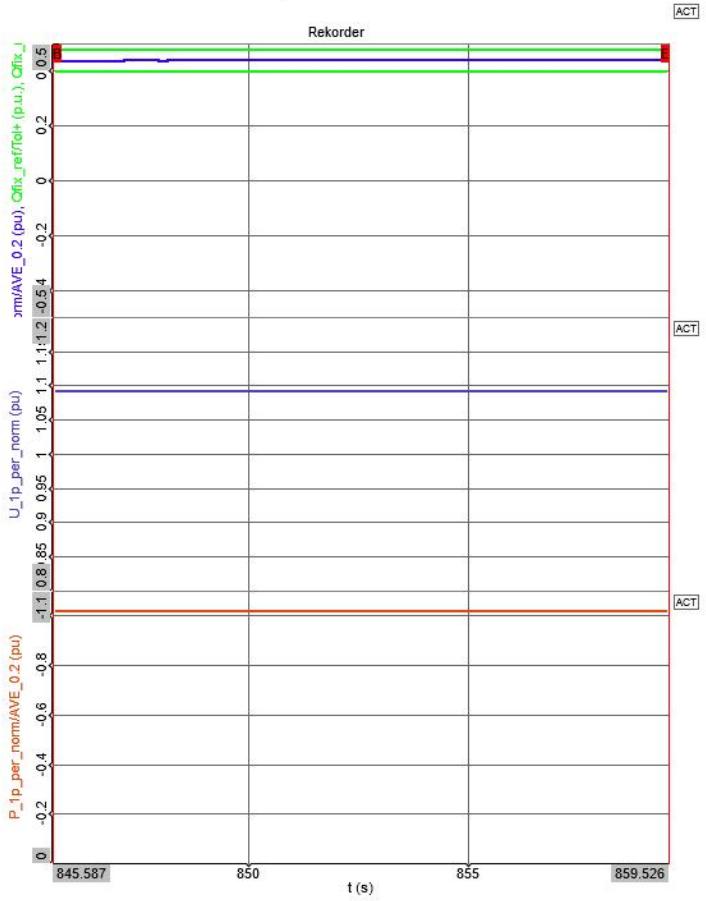
OE Tests 2.1-2.3 Qfix

OE_Tests_IVGM50KHP3G2_2_X_2026_07_07_094403_P.dxd

PASS




Color | Name | Description | Unit




Color | Name | Description | Unit

Label | Type | Channel | C... | Time | Value

Color | Name | Description | Unit

Color | Name | Description | Unit

Label | Channel | C... | Time | Value

EUT Info

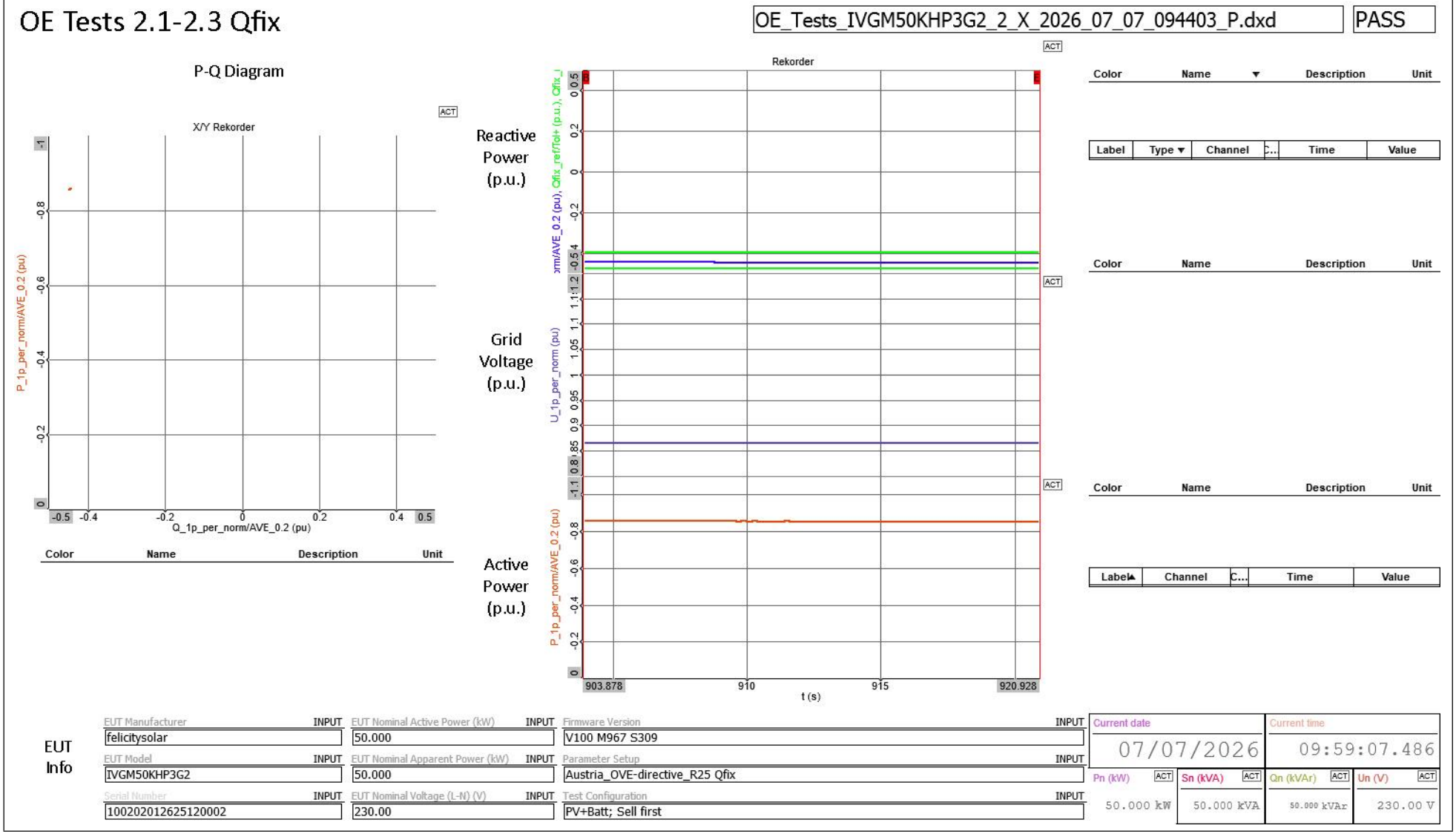
| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M967 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 Qfix |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; Sell first |

| Current date | Current time |
|---|---|
| 07/07/2026 | 09:58:09.195 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 2 Measurement of the corner points of the P/Q diagram and accuracy of reactive power

### 2.1 Test 3 U=0.86 Un

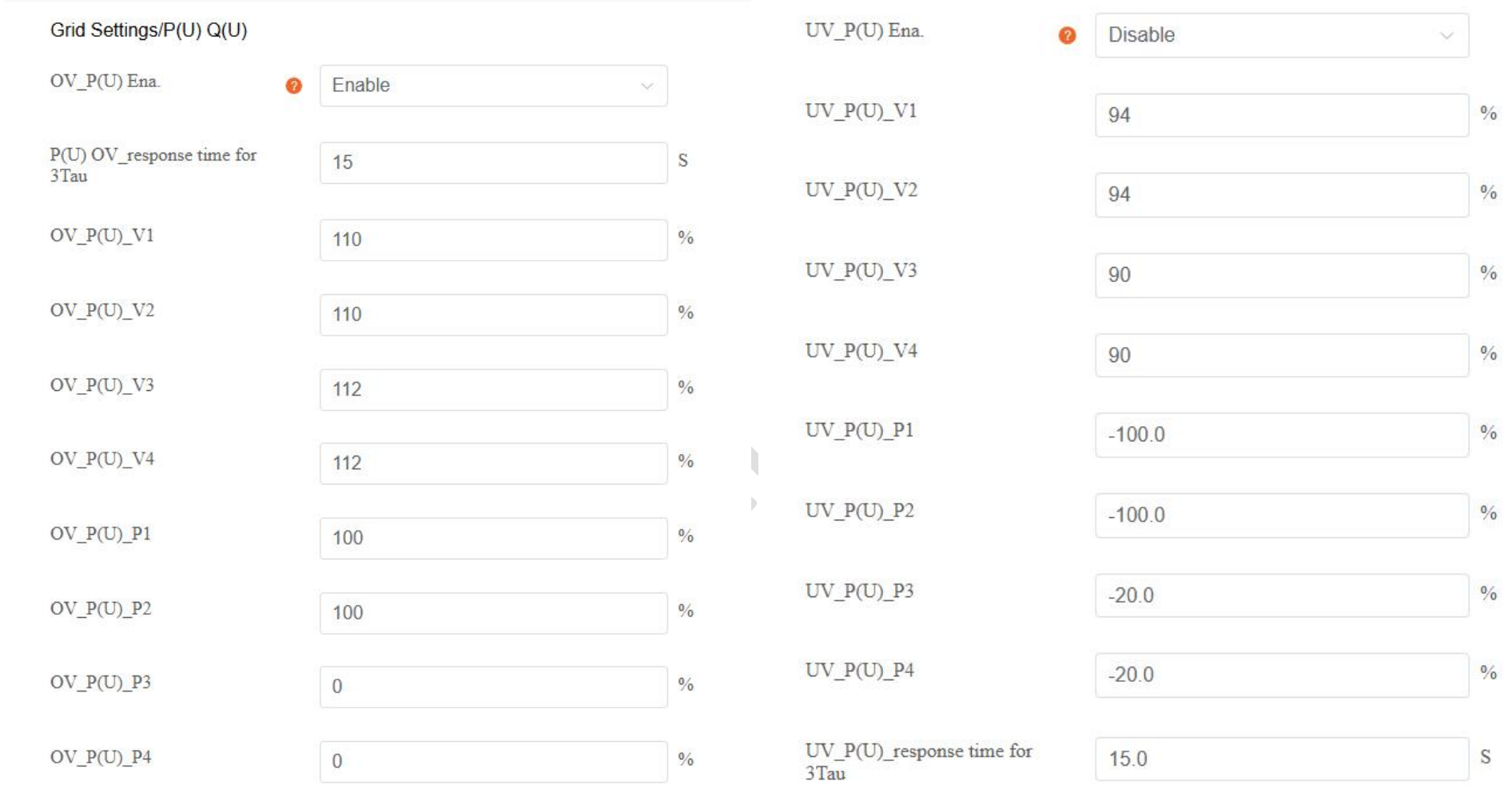


# 3 Verification of the P(U) control

## 3 Verification of the P(U) control

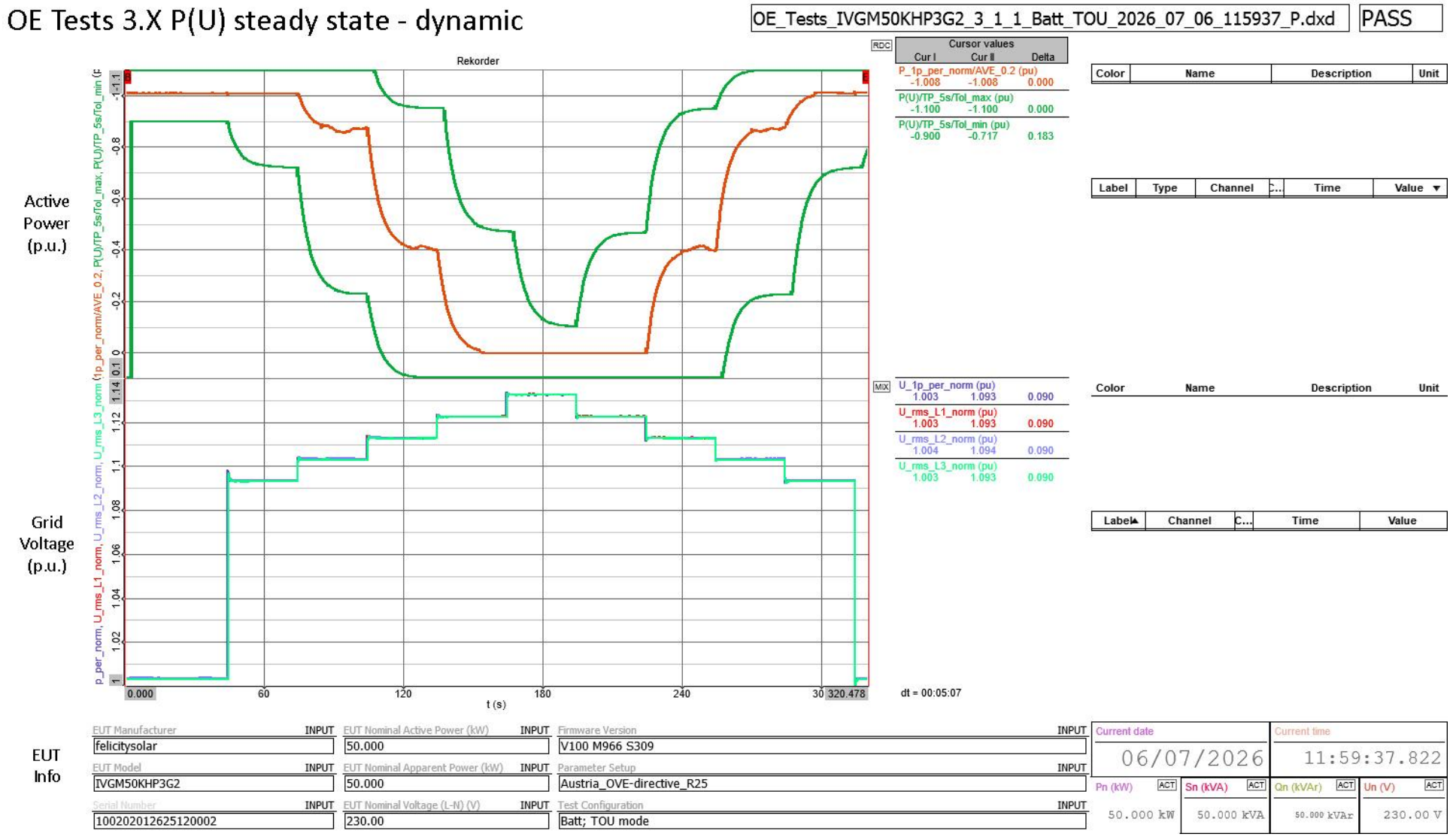
Parameter report: 2026-07-06 11_08_50 3 PU.xls (export)

Screenshots Inverter App / Software / Web interface



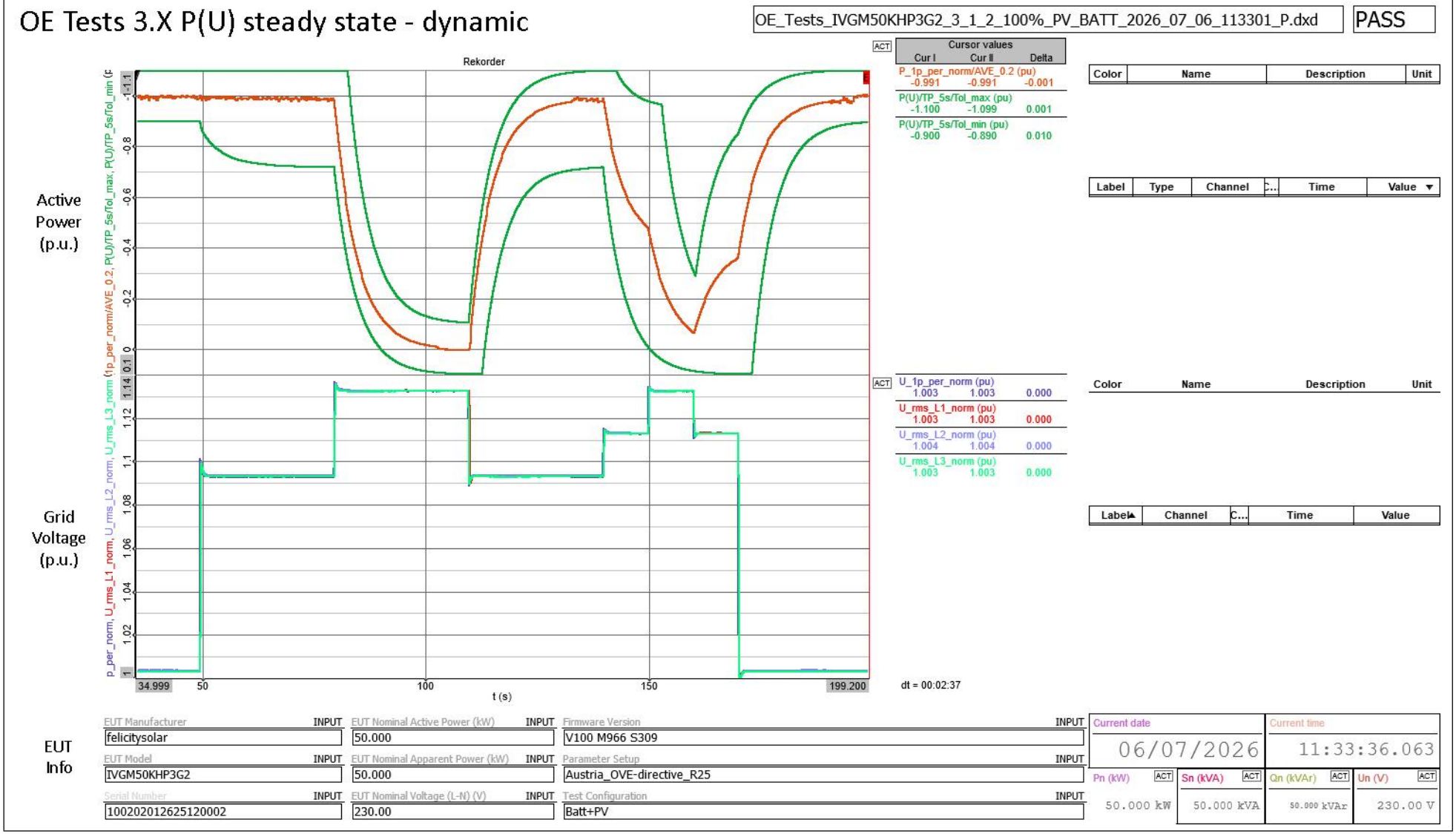
## 3.1 Verification of the P(U) control (balanced voltages)

### 3.1.1 Steady state test at 100%Pn

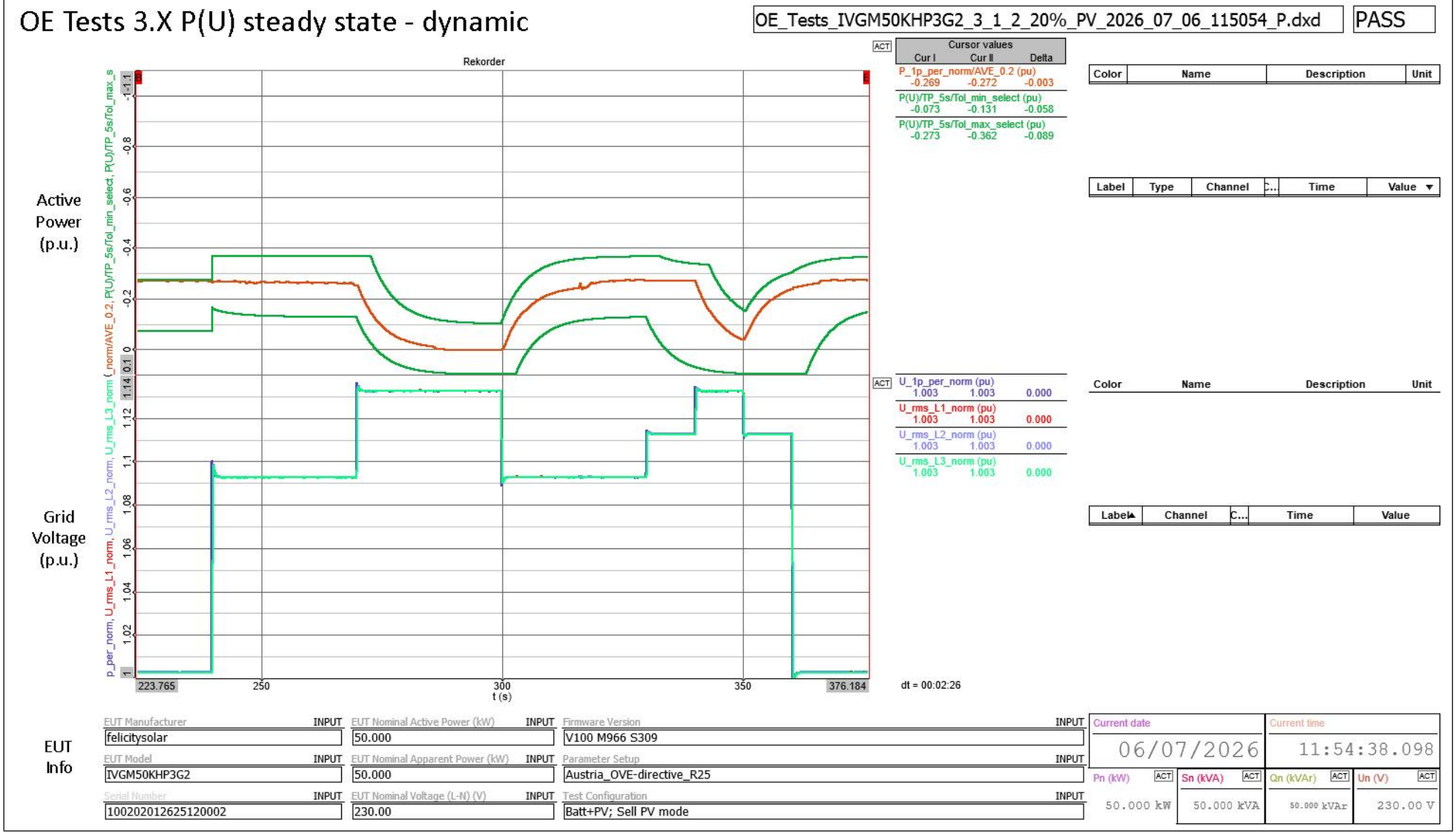


## 3.1 Verification of the P(U) control (balanced voltages)

### 3.1.2 Dynamic test at >90%Pn



## 3.1 Verification of the P(U) control (balanced voltages)
### 3.1.2 Dynamic test at 20%Pn



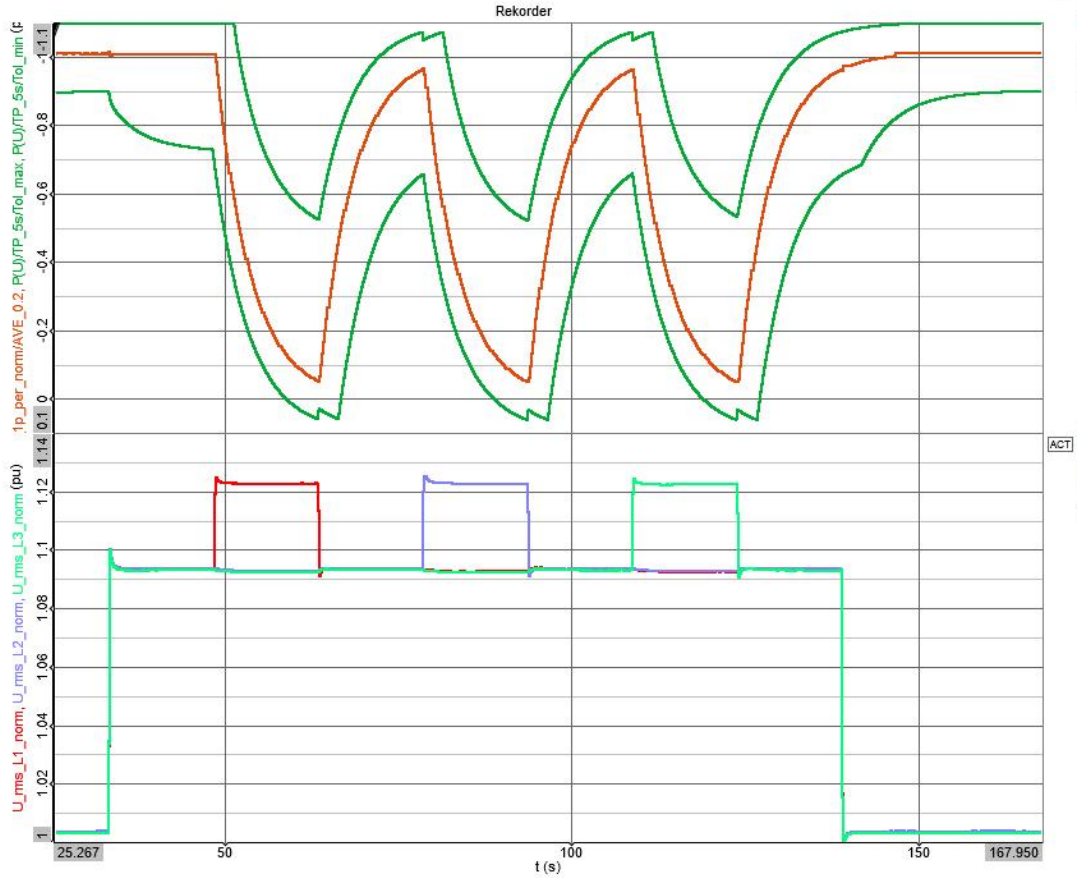
## 3.2 Verification of the P(U) control (unbalanced voltages)

### 3.2.1 Test

OE Tests 3.X P(U) steady state - dynamic

OE_Tests_IVGM50KHP3G2_3_2_1_Batt_TOU_2026_07_06_120506_P.dxd

PASS




Cursor values

| | Cur I | Cur II | Delta |
|---|---|---|---|
| P_1p_per_norm/AVE_0.2 (pu) | -1.008 | -1.009 | -0.001 |
| P(U)/TP_5s/Tol_max (pu) | -1.098 | -1.100 | -0.002 |
| P(U)/TP_5s/Tol_min (pu) | -0.896 | -0.898 | -0.002 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Type | Channel | C... | Time | Value |
|---|---|---|---|---|---|

| | Cur I | Cur II | Delta |
|---|---|---|---|
| U_rms_L1_norm (pu) | 1.003 | 1.003 | 0.000 |
| U_rms_L2_norm (pu) | 1.004 | 1.004 | 0.000 |
| U_rms_L3_norm (pu) | 1.003 | 1.003 | 0.000 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Channel | C... | Time | Value |
|---|---|---|---|---|

dt = 00:02:16

EUT Info

| | | |
|---|---|---|
| EUT Manufacturer: felicitysolar | EUT Nominal Active Power (kW): 50.000 | Firmware Version: V100 M966 S309 |
| EUT Model: IVGM50KHP3G2 | EUT Nominal Apparent Power (kW): 50.000 | Parameter Setup: Austria_OVE-directive_R25 |
| Serial Number: 100202012625120002 | EUT Nominal Voltage (L-N) (V): 230.00 | Test Configuration: Batt; TOU mode |

| Current date | Current time |
|---|---|
| 06/07/2026 | 12:05:33.863 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

# 4 Verification of the Q(U) control

## 4 Verification of the Q(U) control

Parameter report: 2026-07-06 12_42_50 4 QU.xls (export)

Screenshots Inverter App / Software / web interface

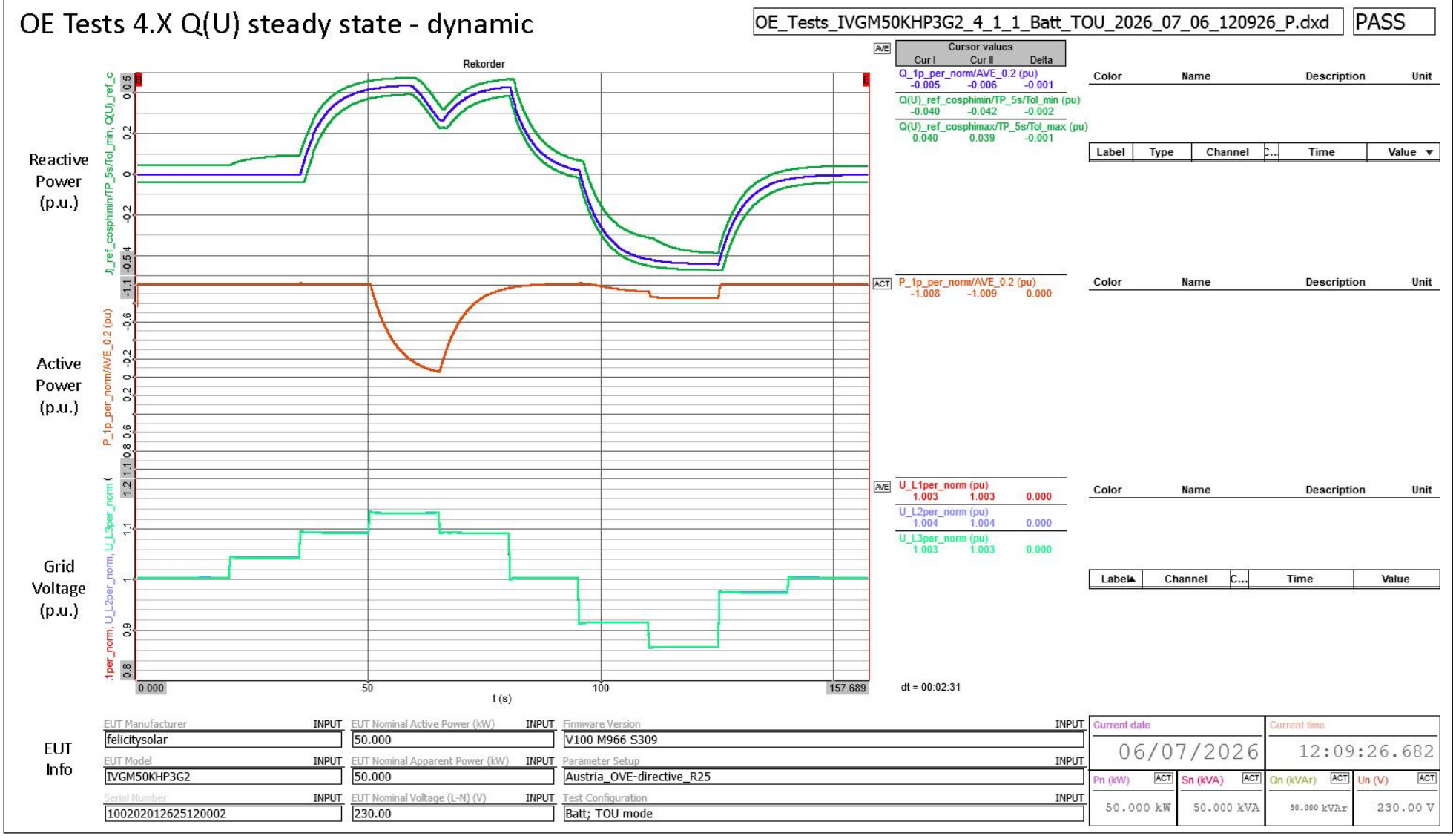
Grid Settings/P(U) Q(U)

| | | | | | |
|---|---|---|---|---|---|
| OV_P(U) Ena. | Enable | | Q(U) control Ena. | Enable | |
| P(U) OV_response time for 3Tau | 15 | S | QU lockin lockout Ena. | Disable | |
| OV_P(U)_V1 | 110 | %Un | QU lock-in power | 20.0 | %Pn |
| OV_P(U)_V2 | 110 | %Un | QU lock-out power | 5.0 | %Pn |
| OV_P(U)_V3 | 112 | %Un | QU Min Cos Ena. | Enable | |
| OV_P(U)_V4 | 112 | %Un | QU min cos ϕ below 20%Pn | 0.400 | |
| OV_P(U)_P1 | 100 | %Pn | Q(U) V1 | 92 | %Un |
| OV_P(U)_P2 | 100 | %Pn | Q(U) V2 | 96 | %Un |
| OV_P(U)_P3 | 0 | %Pn | Q(U) V3 | 105 | %Un |
| OV_P(U)_P4 | 0 | %Pn | Q(U) V4 | 108 | %Un |

| | | | | | |
|---|---|---|---|---|---|
| UV_P(U) Ena. | Disable | | Q(U) Q1 | 43.6 | %Pn |
| UV_P(U)_V1 | 94 | %Un | Q(U) Q2 | 0.0 | %Pn |
| UV_P(U)_V2 | 94 | %Un | Q(U) Q3 | 0.0 | %Pn |
| UV_P(U)_V3 | 90 | %Un | Q(U) Q4 | -43.6 | %Pn |
| UV_P(U)_V4 | 90 | %Un | Q(U) response time for 3Tau | 15.0 | S |
| UV_P(U)_P1 | -100.0 | %Pn | Q(U) Vref auto adjust Ena. | Disable | |
| UV_P(U)_P2 | -100.0 | %Pn | Q(U) Vref Manual adjust Ena. | Disable | |
| UV_P(U)_P3 | -20.0 | %Pn | | | |
| UV_P(U)_P4 | -20.0 | %Pn | | | |
| UV_P(U)_response time for 3Tau | 15.0 | S | | | |

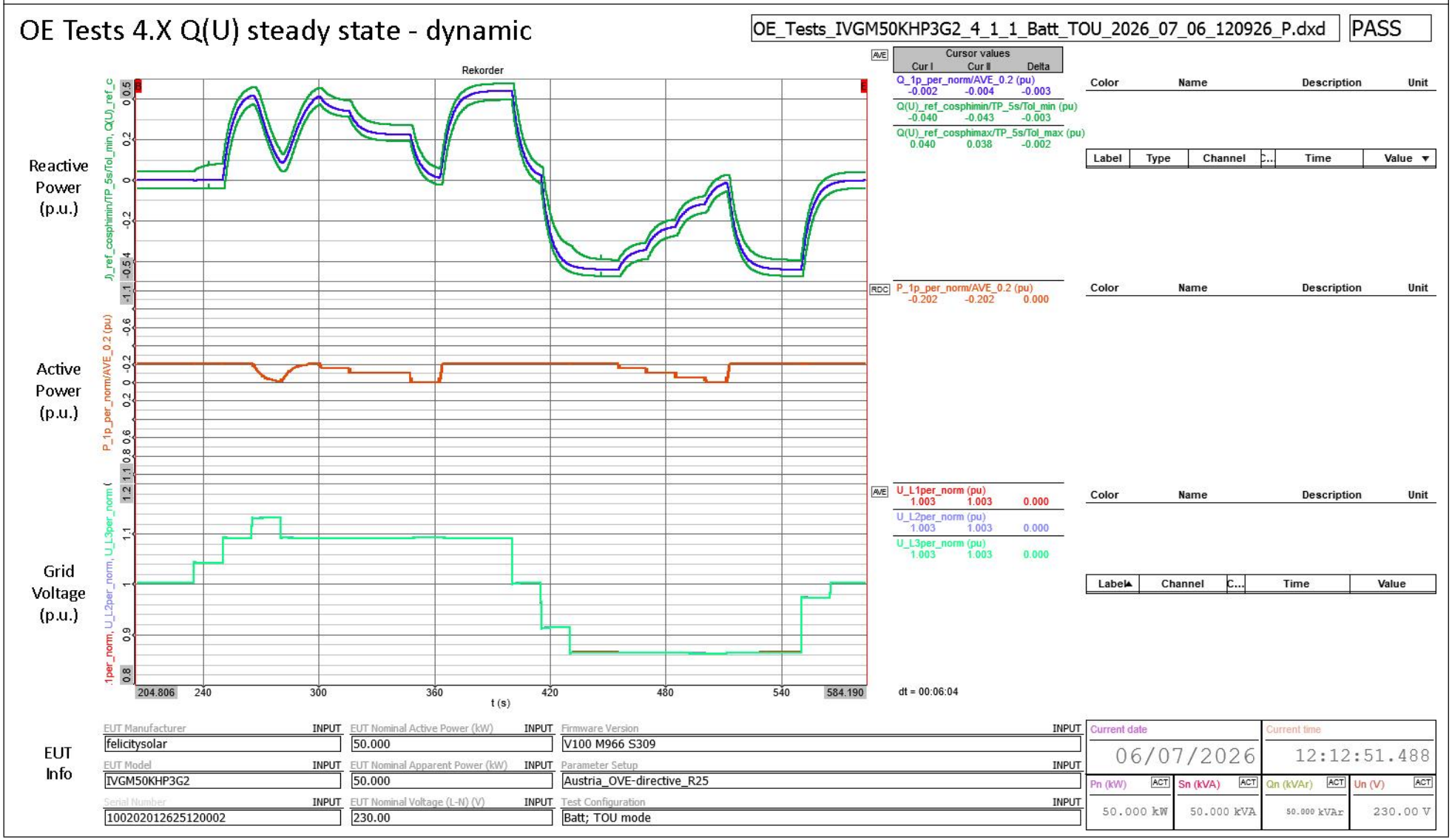
## 4.1 Verification of the Q(U) control (balanced voltages)

### 4.1.1 Dynamic test at 100%Pn



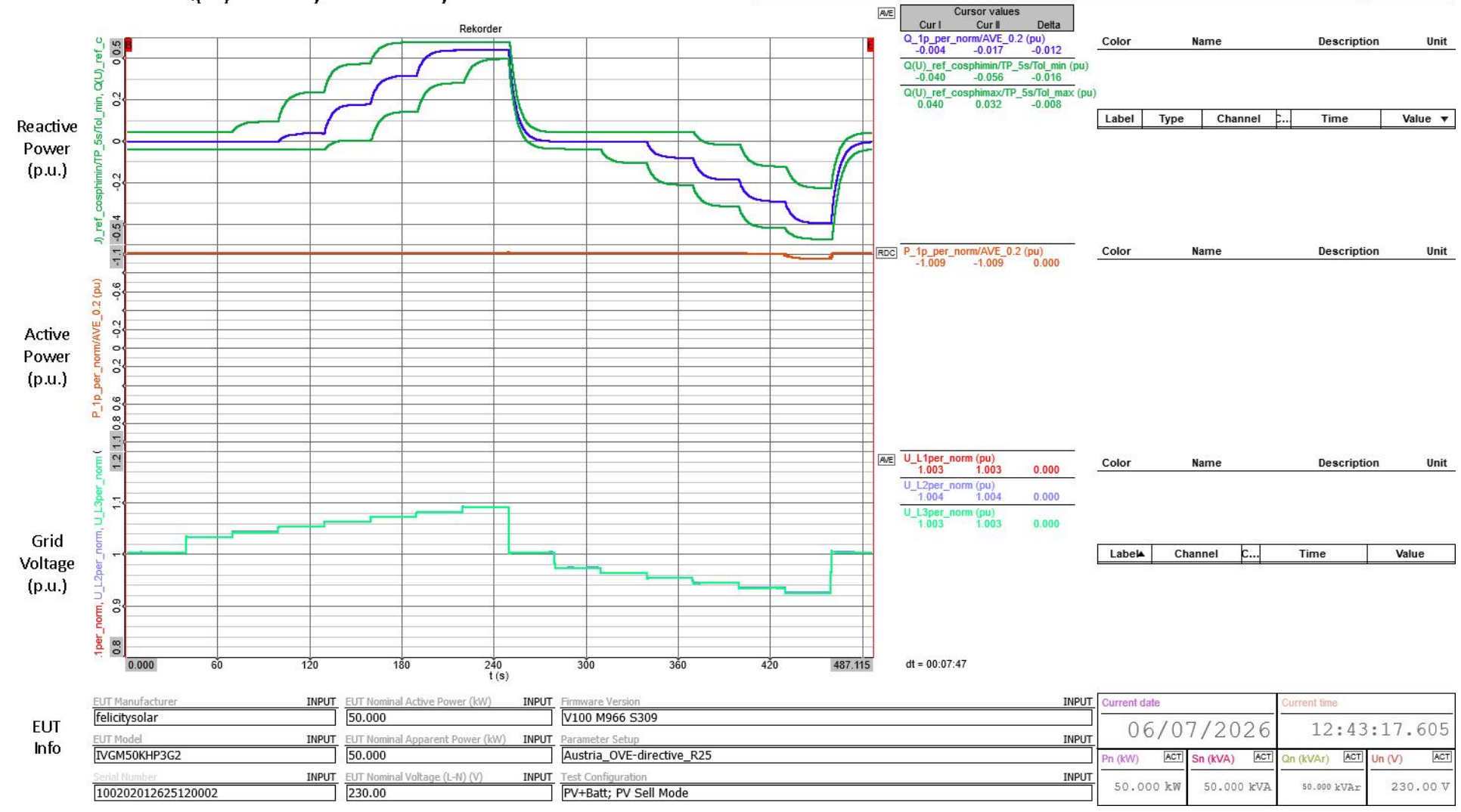
## 4.1 Verification of the Q(U) control (balanced voltages)

### 4.1.1 Dynamic test at 20%Pn



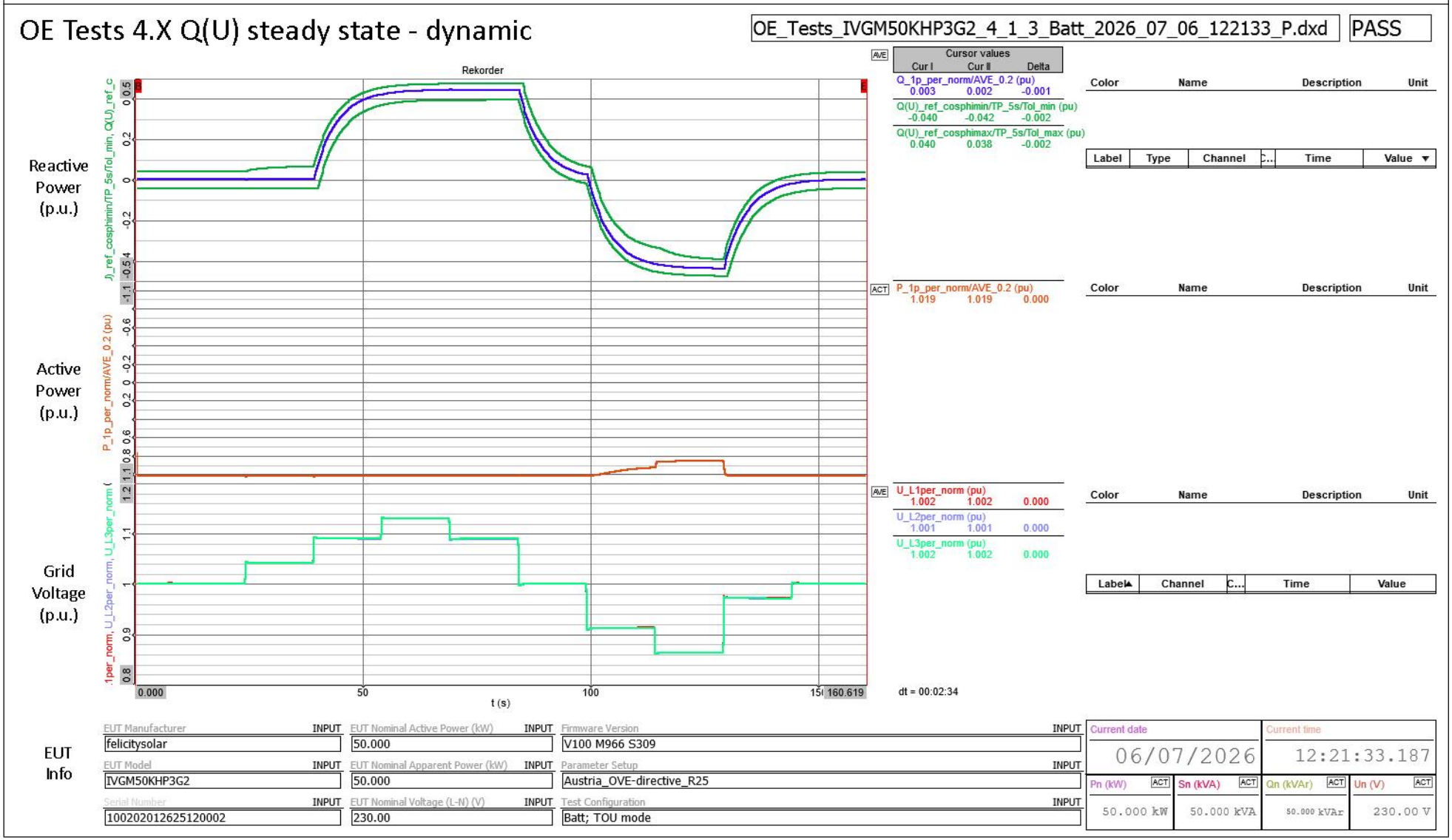
## 4.1 Verification of the Q(U) control (balanced voltages)

### 4.1.2 Steady state test at 100%Pn as per OVE R25 5.3.10



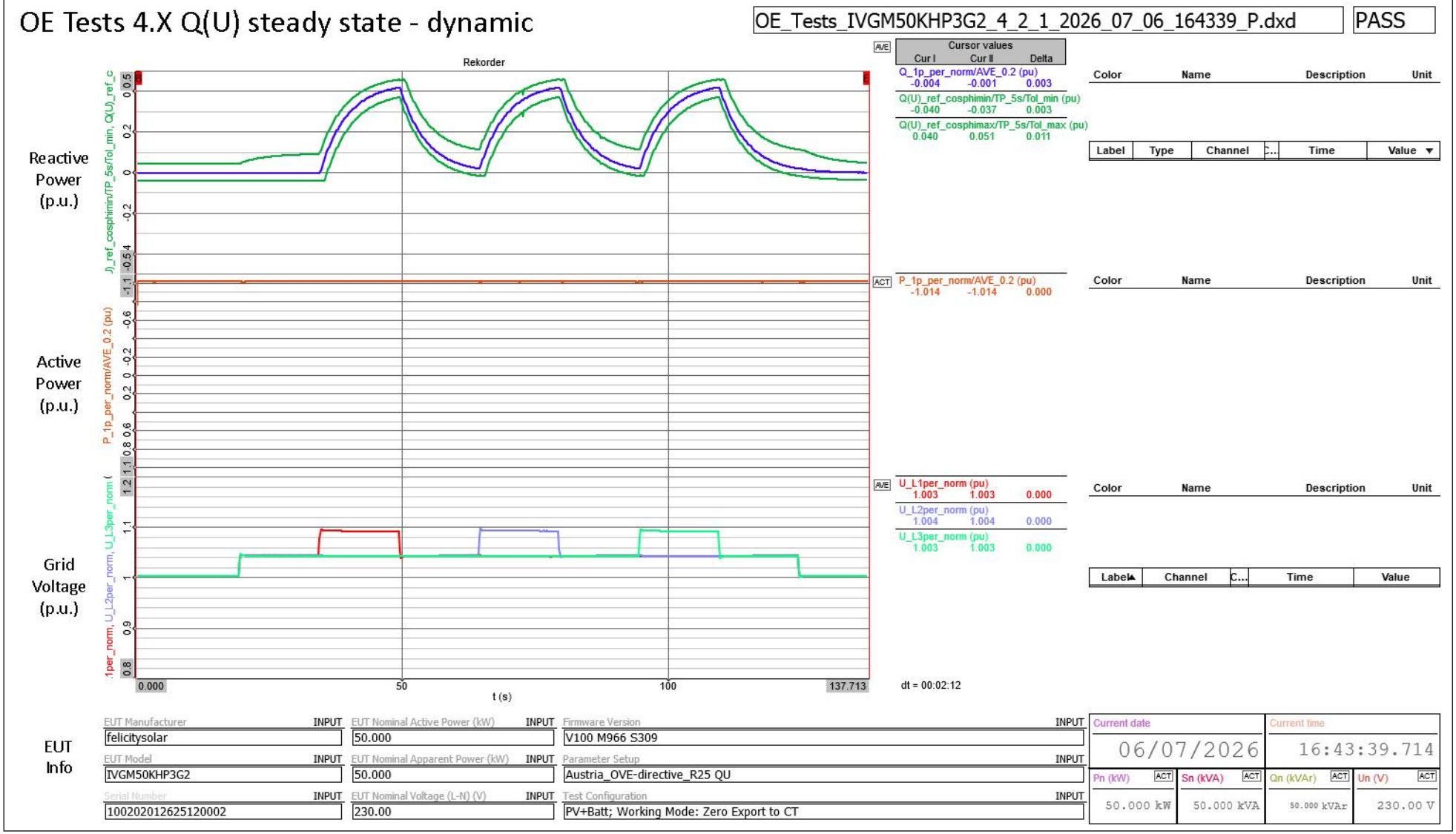
## 4.1 Verification of the Q(U) control (balanced voltages)

### 4.1.3 Dynamic test at 100%Pn charge from grid



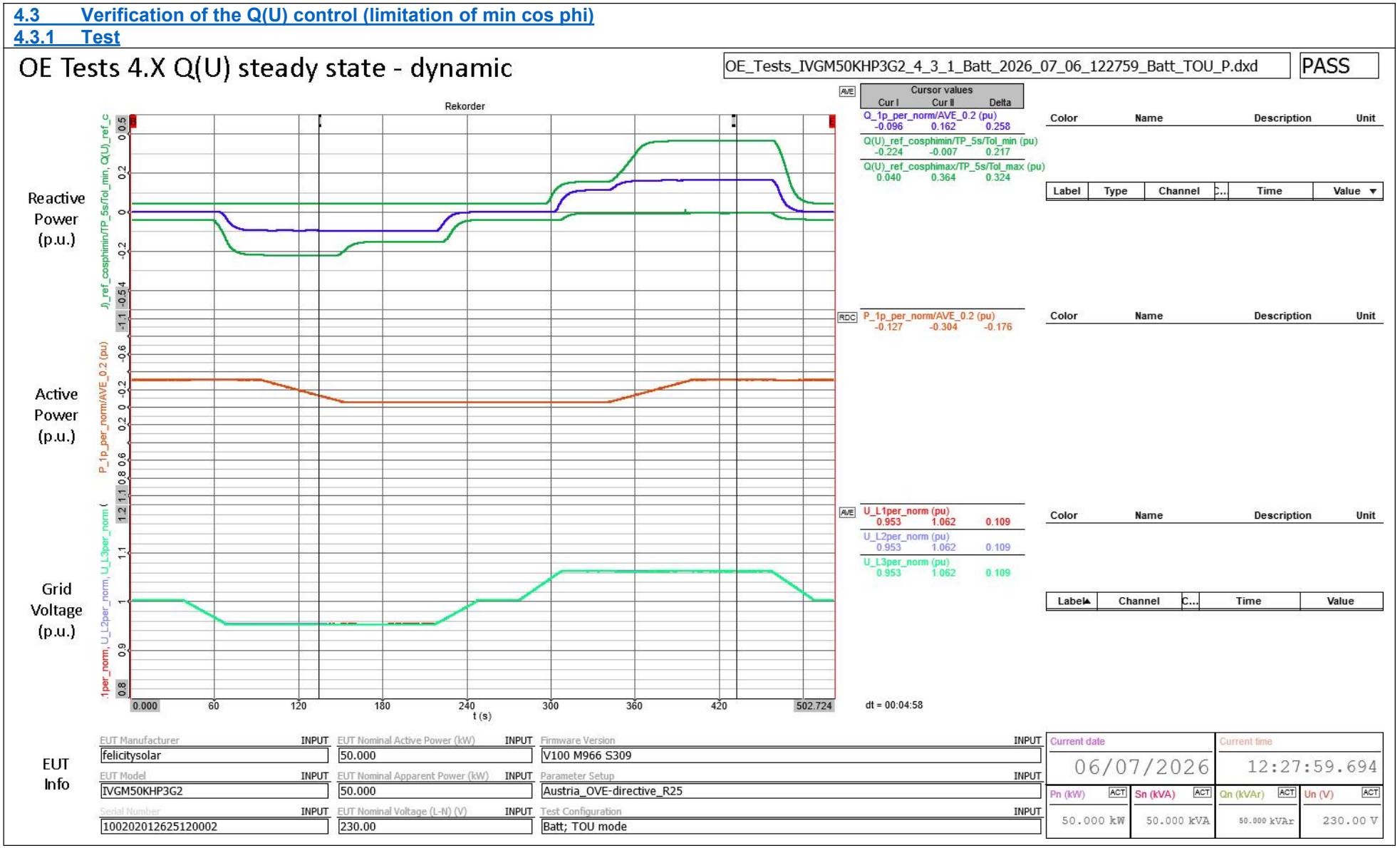
## 4.2 Verification of the Q(U) control (unbalanced voltages)

### 4.2.1 Test



## 4.3 Verification of the Q(U) control (limitation of min cos phi)

### 4.3.1 Test

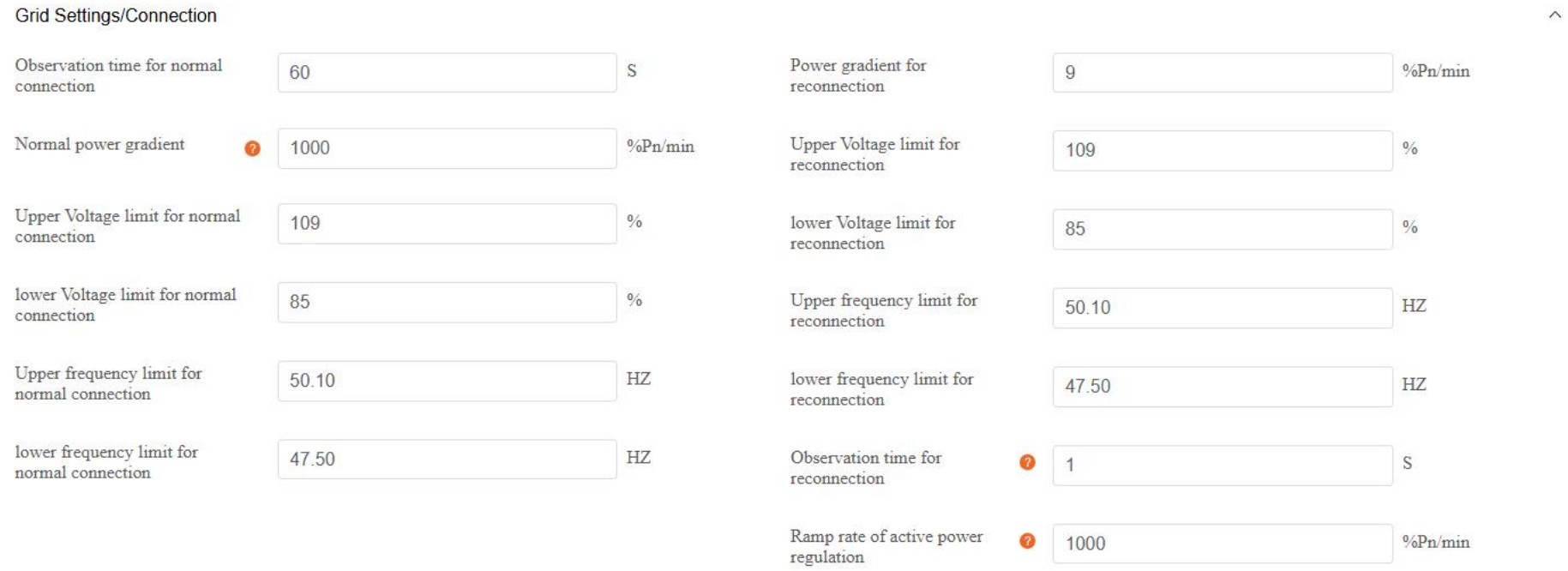


# 5 Reconnection after grid faults

## 5 Reconnection after grid faults

Parameter report: 2026-07-06 12_53_28 5 Reconnection.xls (export)

Screenshots Inverter App / Software / web interface



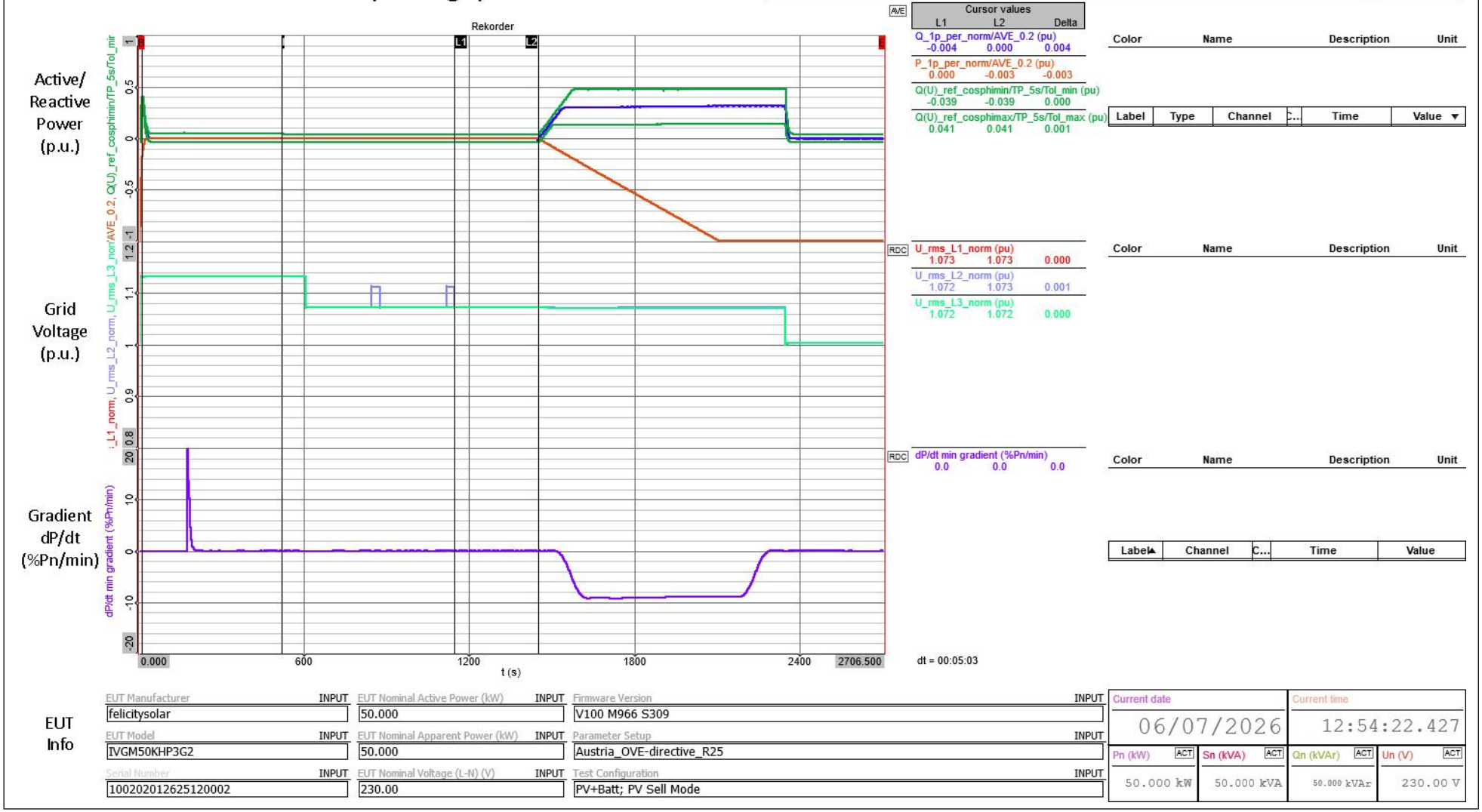
## 5 Reconnection after grid faults:

### 5.1 Reconnection after over-voltage fault

# OE Tests 5.1 Reconnection (Voltage)

OE_Tests_IVGM50KHP3G2_5_1_PV_BATT_2026_07_06_125422_P.dxd

PASS



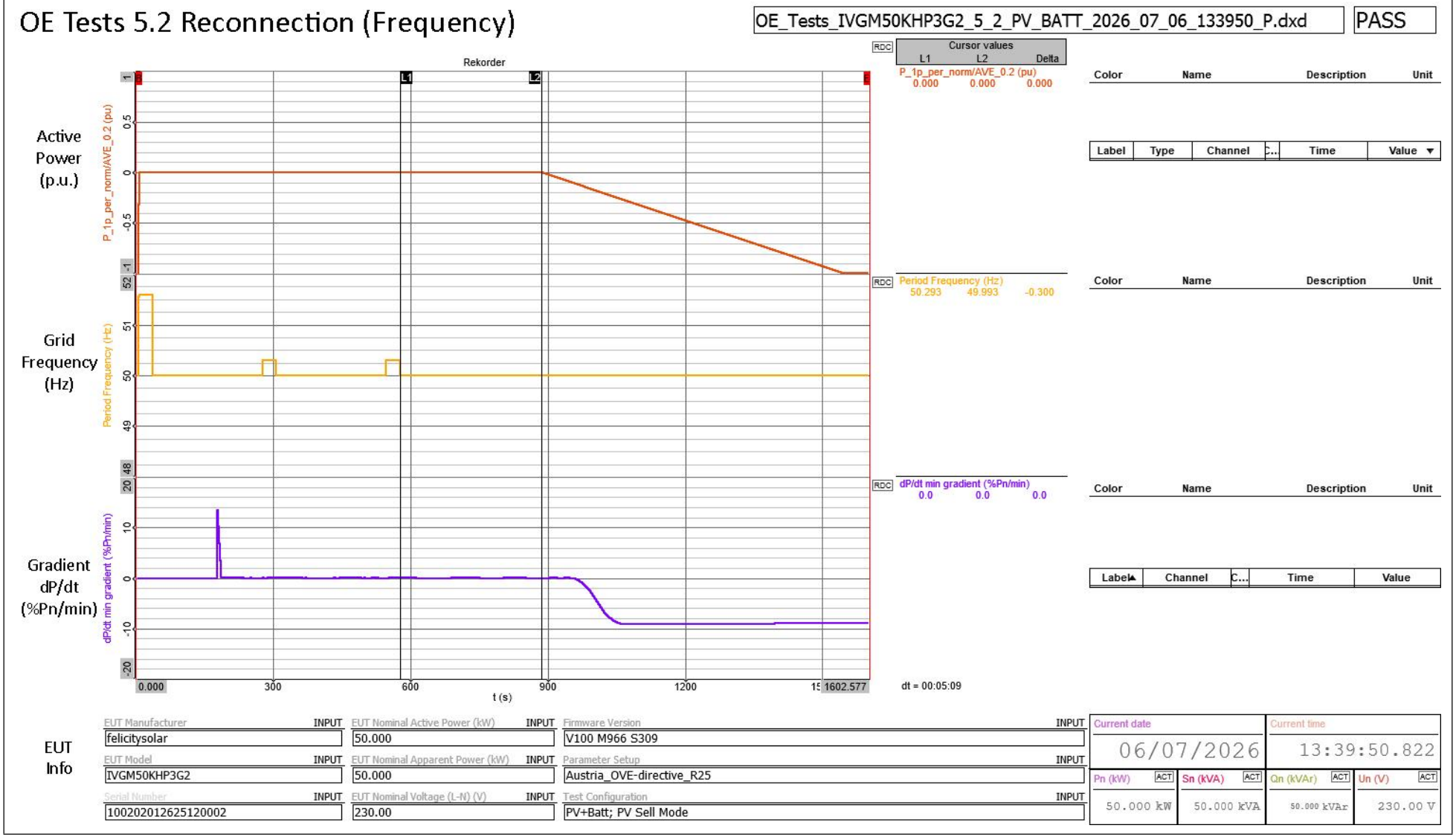

EUT Info

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M966 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; PV Sell Mode |

| Current date | Current time |
|---|---|
| 06/07/2026 | 12:54:22.427 |

| Pn (kW) ACT | Sn (kVA) ACT | Qn (kVAr) ACT | Un (V) ACT |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 5 Reconnection after grid fault:
## 5.2 Reconnection after over-frequency fault



# 6 Verification of the LFSM-O/U, P(f) control

## 6 Verification of the LFSM O/U, P(f) control

Parameter report: 2026-07-06 16_03_55 6c LFSM.xls (export)

Screenshots Inverter Software

Grid Settings/P(f)

| | | | | | |
|---|---|---|---|---|---|
| OF_P(f) Ena. | Enable | | P(f)_respond ramp rate | 10000.00 | %Pn/min |
| OF_start frequency | 50.200 | HZ | UF_P(f) Ena. | Enable | |
| OF_Power droop ramp rate | 5.00 | | UF_start frequency | 49.800 | HZ |
| Power response reference | Pmax | | UF_Power droop ramp rate | 1.00 | |
| OF_stop frequency Ena. | Disable | | UF_stop frequency Ena. | Disable | |
| OF_stop frequency | 50.200 | HZ | UF_stop frequency | 49.800 | HZ |
| OF_Recovery time delay | 0.00 | S | UF_ending frequency | 47.500 | HZ |
| OF_Response time | 0.00 | S | UF_ending power | 100.0 | % |
| OF_Recovery ramp rate | 10.00 | %Pn/min | | | |
| OF_ending frequency | 52.000 | HZ | | | |
| OF_ending power | -100.0 | % | | | |

**6 Verification of the LFSM-O/U, P(f)**
**6a.1 Test for Generating Units (PV)**

N/A

FINAL - PASS

**6 Verification of the LFSM-O/U, P(f)**
**6b.1 Test for Storage Units**

N/A

FINAL - PASS

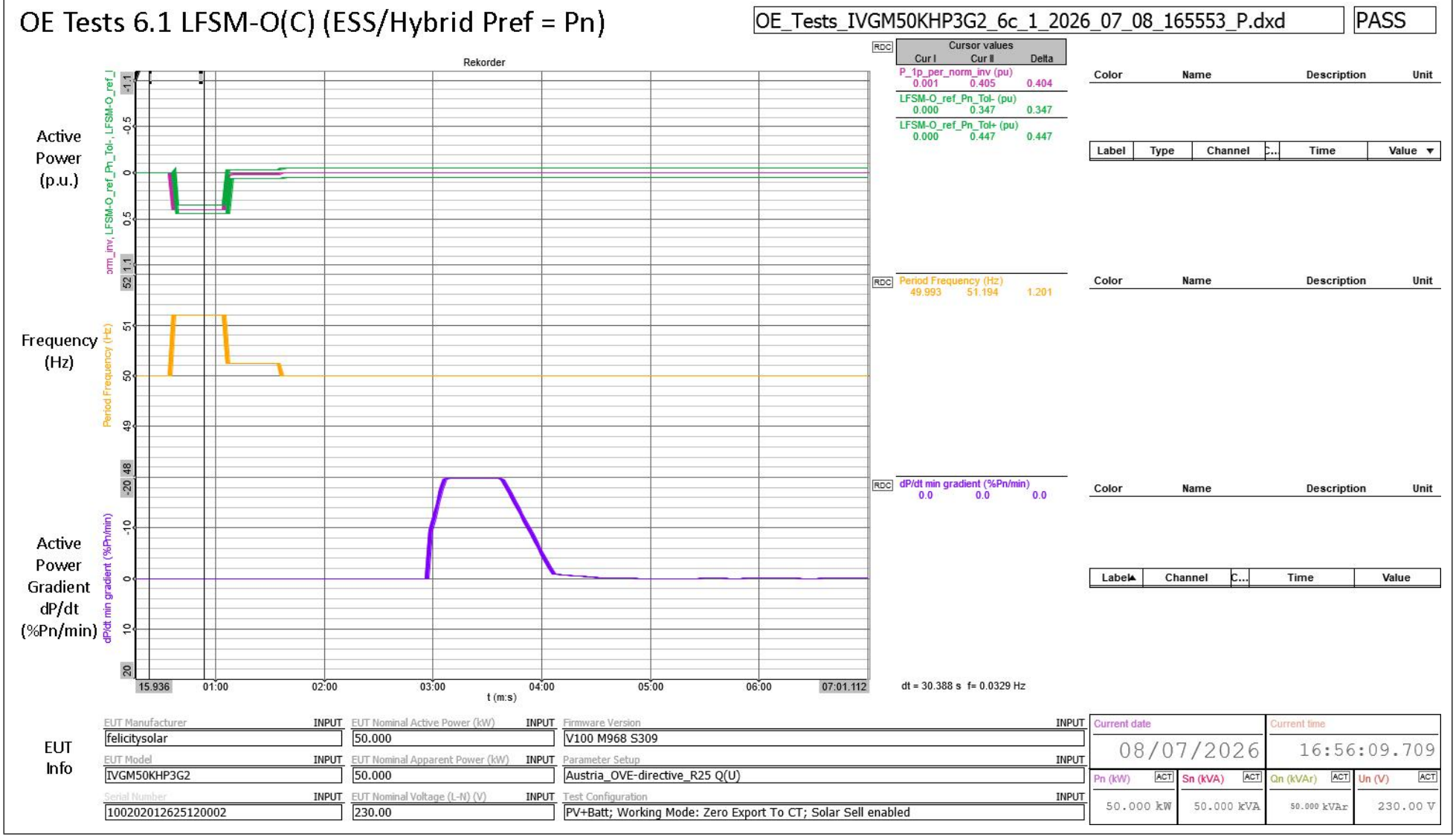
**6 Verification of the LFSM-O/U P(f)**
**6b.2 Test for Storage Units**

N/A

FINAL - PASS

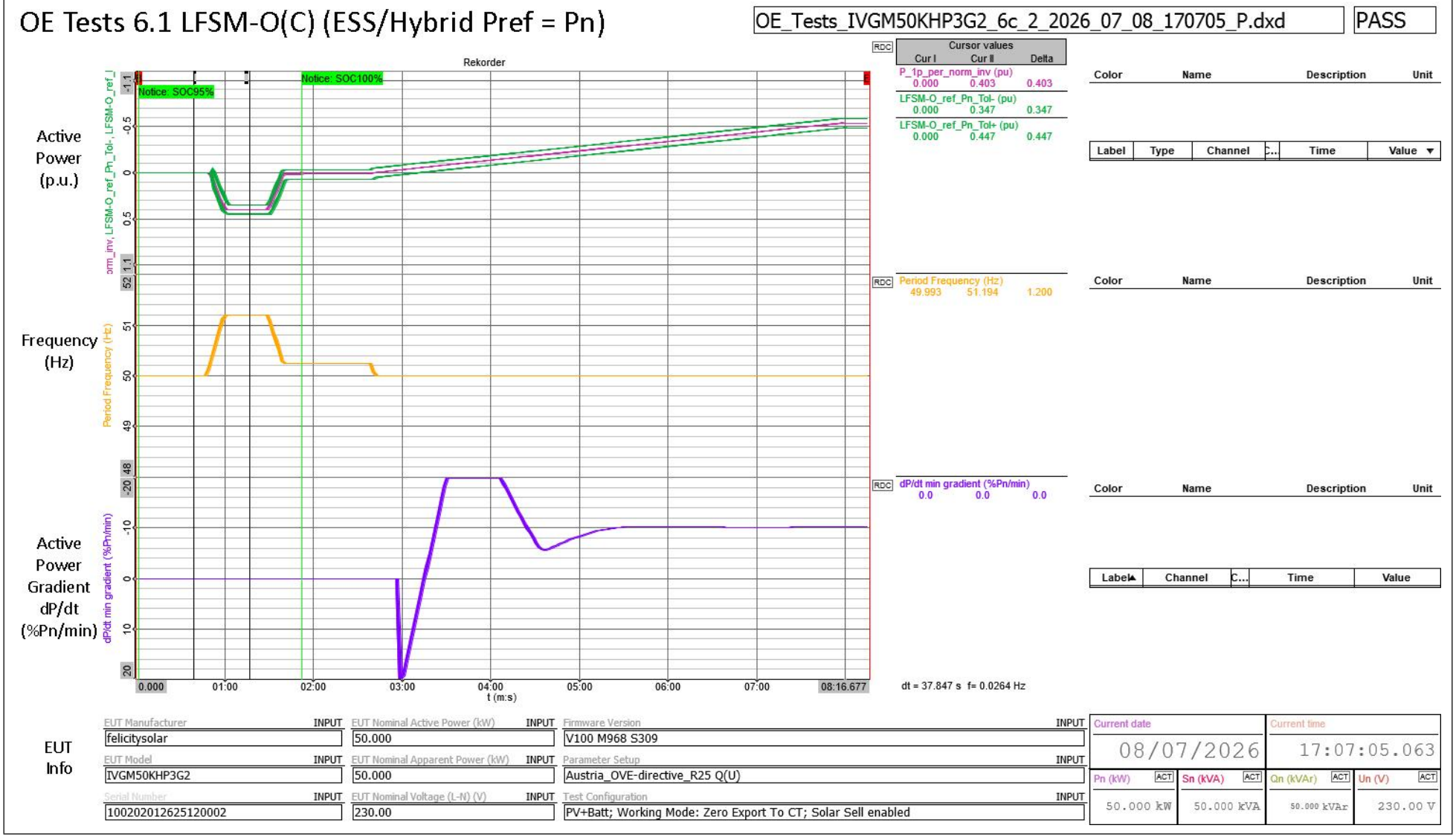
## 6 Verification of the LFSM-O/U, P(f)

### 6c.1 Test for Hybrid Units

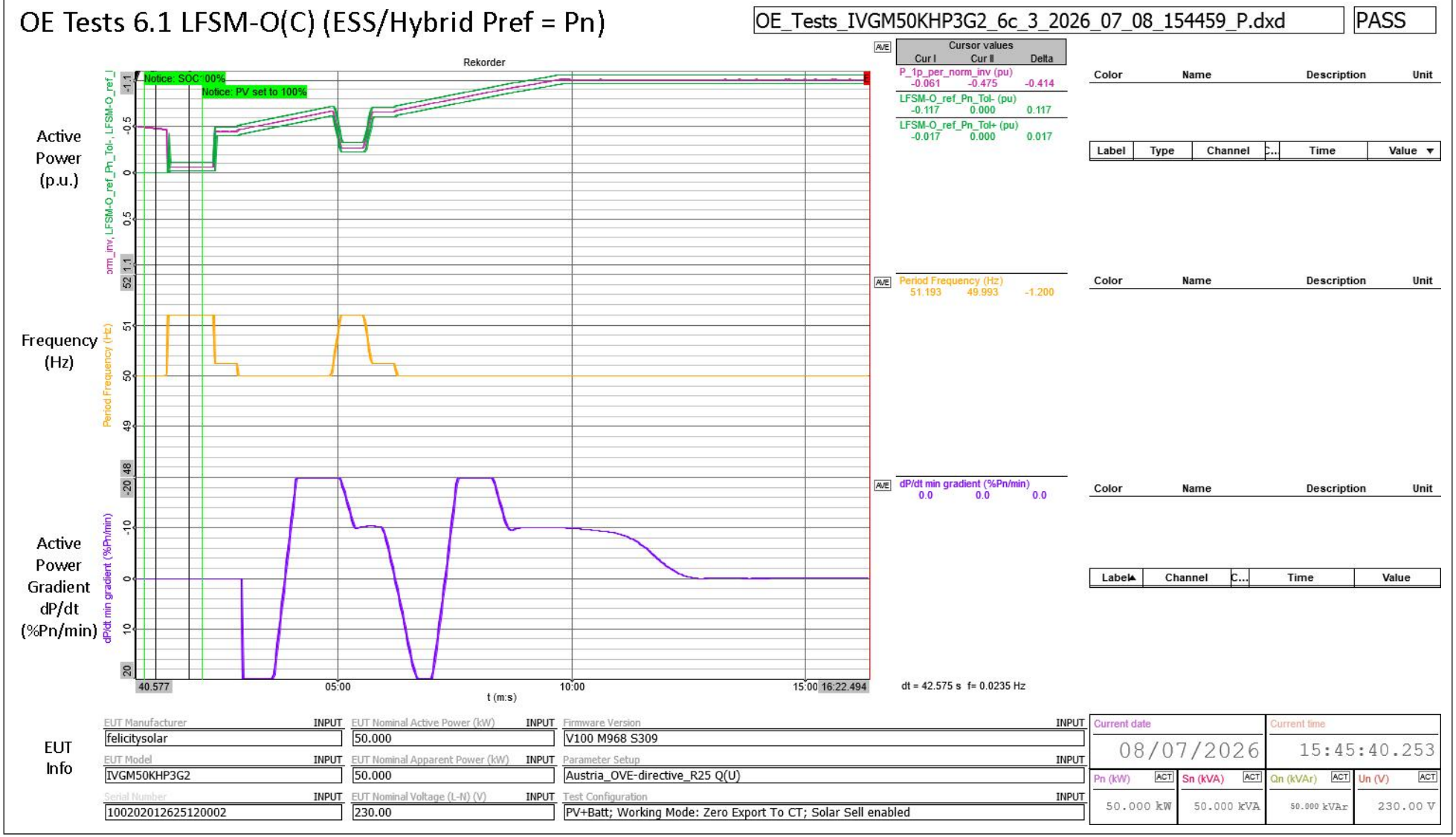


## 6 Verification of the LFSM-O/U P(f)

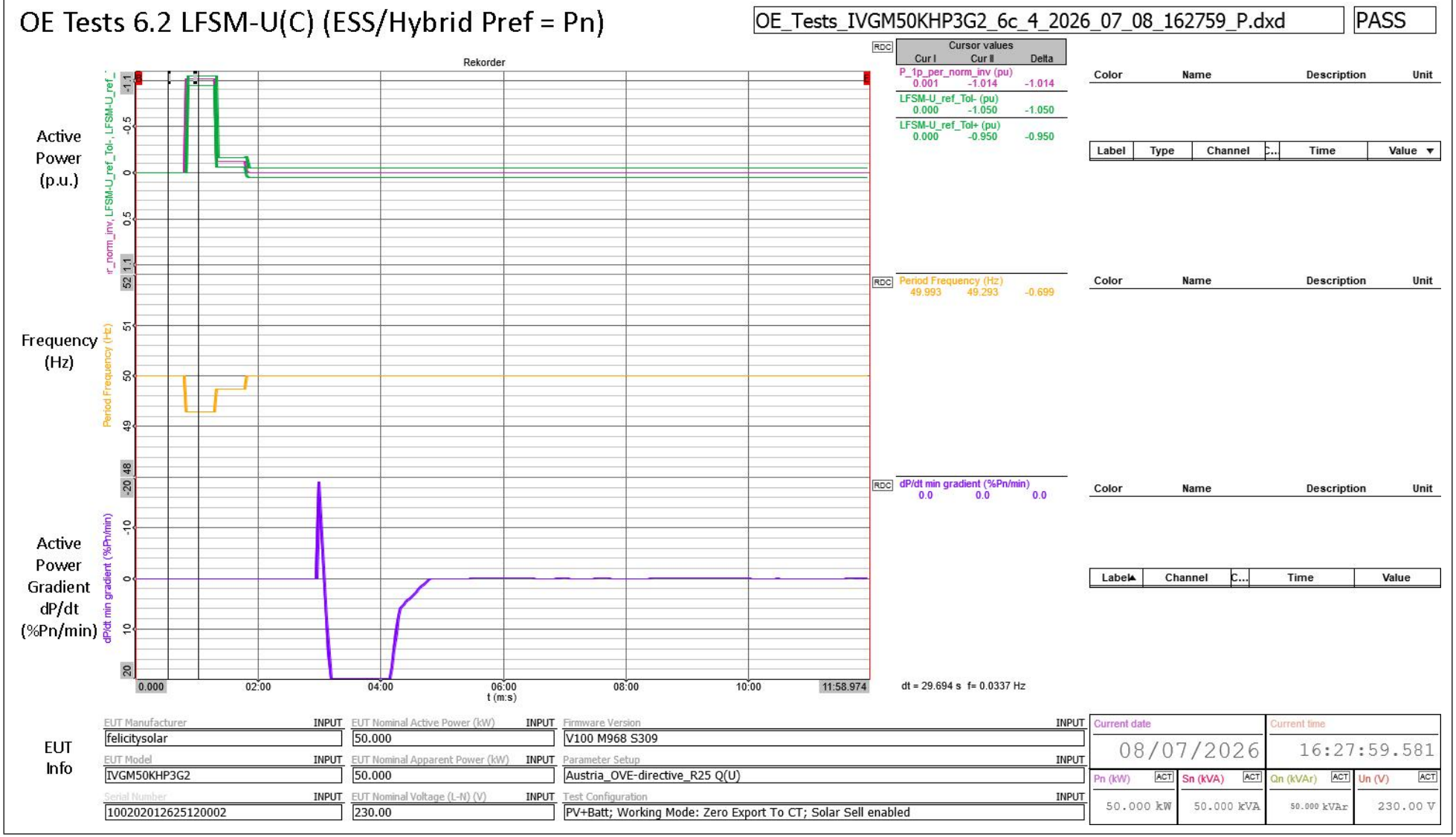
### 6c.2 Test Hybrid Units



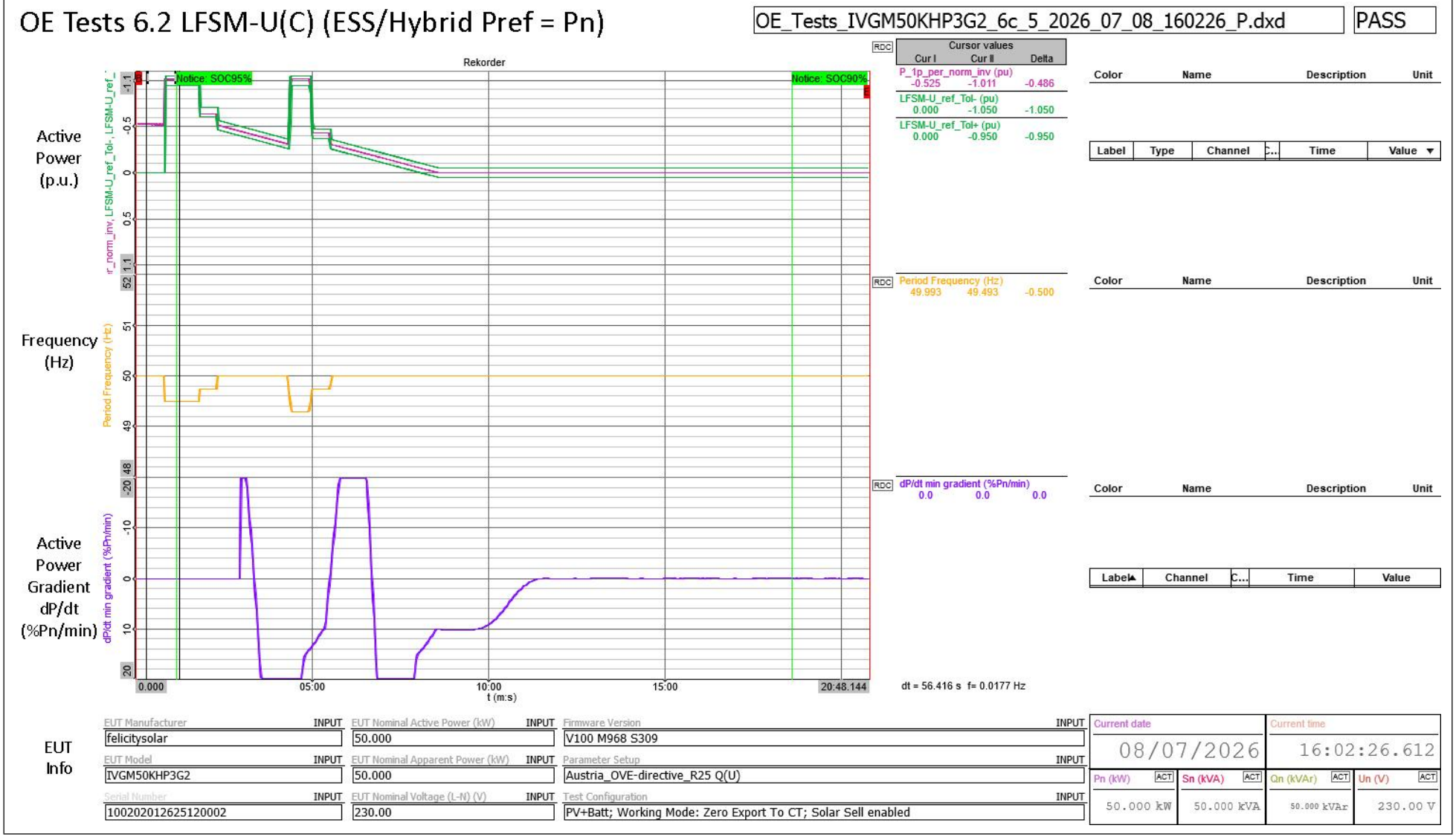
## 6 Verification of the LFSM-O/U P(f)
## 6c.3 Test for Hybrid Units



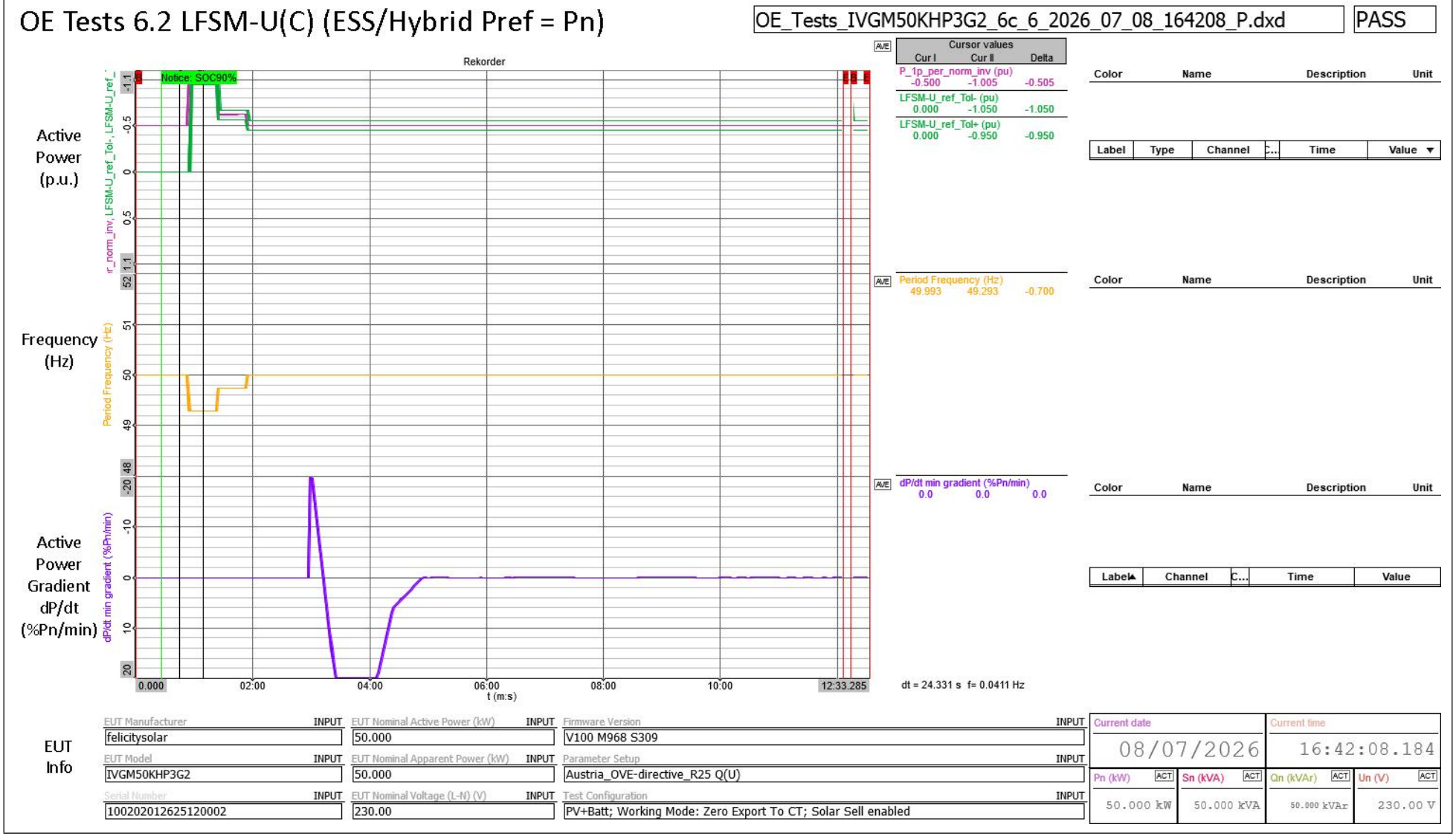
## 6 Verification of the LFSM-O/U P(f)
## 6c.4 Test for Hybrid Units



## 6 Verification of the LFSM-O/U P(f)
## 6c.5 Test for Hybrid Units



## 6 Verification of the LFSM-O/U P(f)
## 6c.6 Test for Hybrid Units



# 7 Verification of the LVRT capability

## 7 Verification of the LVRT capability

Parameter report: 2026-07-06 12_42_50 4 QU.xls (export)

Screenshots Inverter Software

Grid Settings/HVRT LVRT

| | | | | | |
|---|---|---|---|---|---|
| HVRT Ena. | Disable | | LVRT Ena. | Enable | |
| HVRT reactive power output Ena. | Disable | | LVRT reactive power output Ena. | Disable | |
| K1 factor | 0.00 | | K2 factor | 0.00 | |
| HVRT IQ Vtrig | 115 | % | LVRT IQ Vtrig | 85 | % |
| HVRT Zero current mode Ena. | Enable | | LVRT Zero current mode Ena. | Enable | |
| HVRT zero current mode Voltage | 115 | % | LVRT zero current mode Voltage | 80 | % |
| HVRT P Recovery Rate | 150.00 | %Pn/s | LVRT P Recovery Rate | 150.00 | %Pn/s |
| HVRT V1 | 115 | % | LVRT V1 | 80 | % |
| HVRT T1 | 0.10 | S | LVRT T1 | 1.50 | S |
| HVRT V2 | 120 | % | LVRT V2 | 25 | % |
| HVRT T2 | 0.10 | S | LVRT T2 | 0.50 | S |

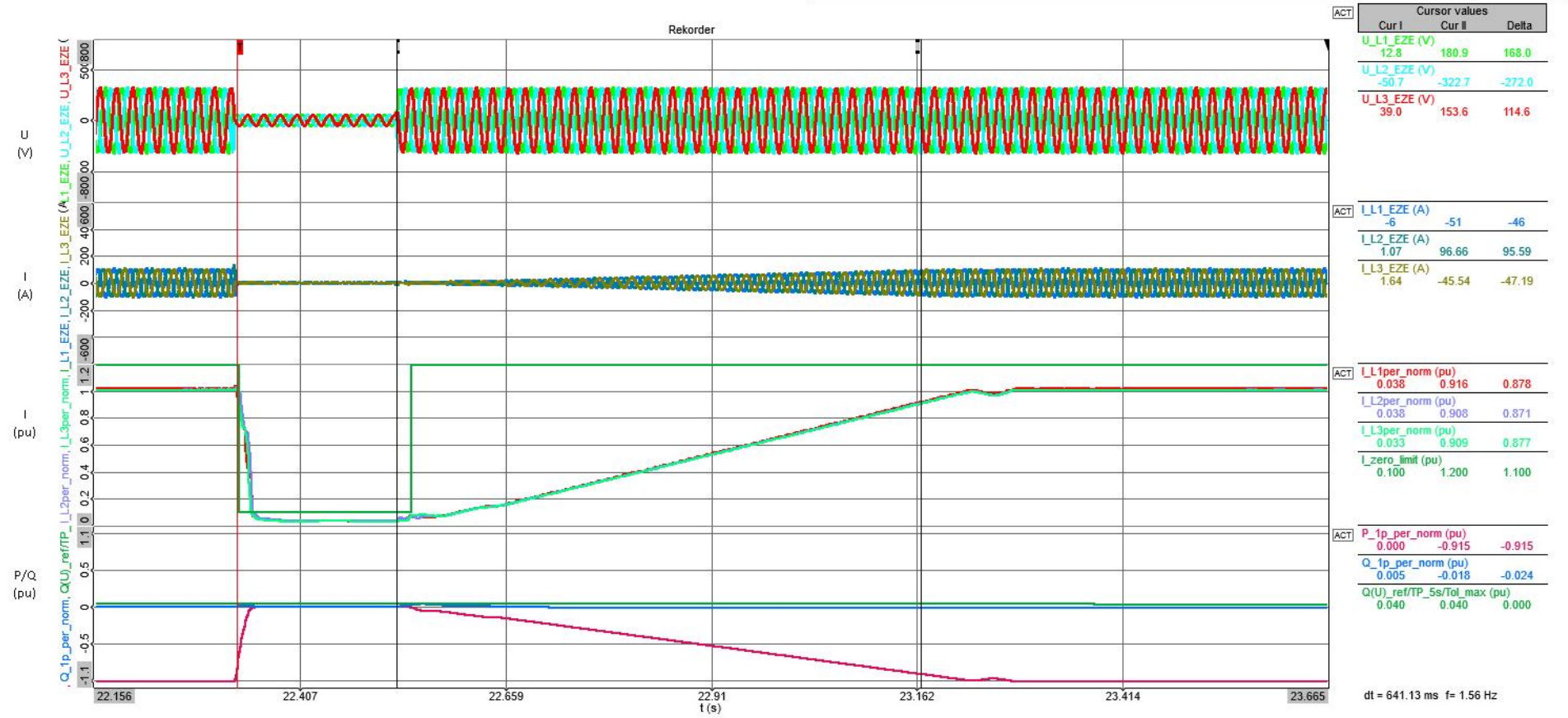
| | | | | | |
|---|---|---|---|---|---|
| HVRT V3 | 125 | % | LVRT V3 | 25 | % |
| HVRT T3 | 0.10 | S | LVRT T3 | 0.50 | S |
| HVRT V4 | 125 | % | LVRT V4 | 25 | % |
| HVRT T4 | 0.10 | S | LVRT T4 | 0.50 | S |

FINAL - PA

## 7 Verification of the LVRT capability:
## 7.1 Test 1.1 (U=0.15Un, 160 ms) 3-ph

7 FRT (Type A zero current)

OE_Tests_IVGM50KHP3G2_7_X_PV_BATT_2026_07_06_165023_P.dxd | PASS




EUT Info

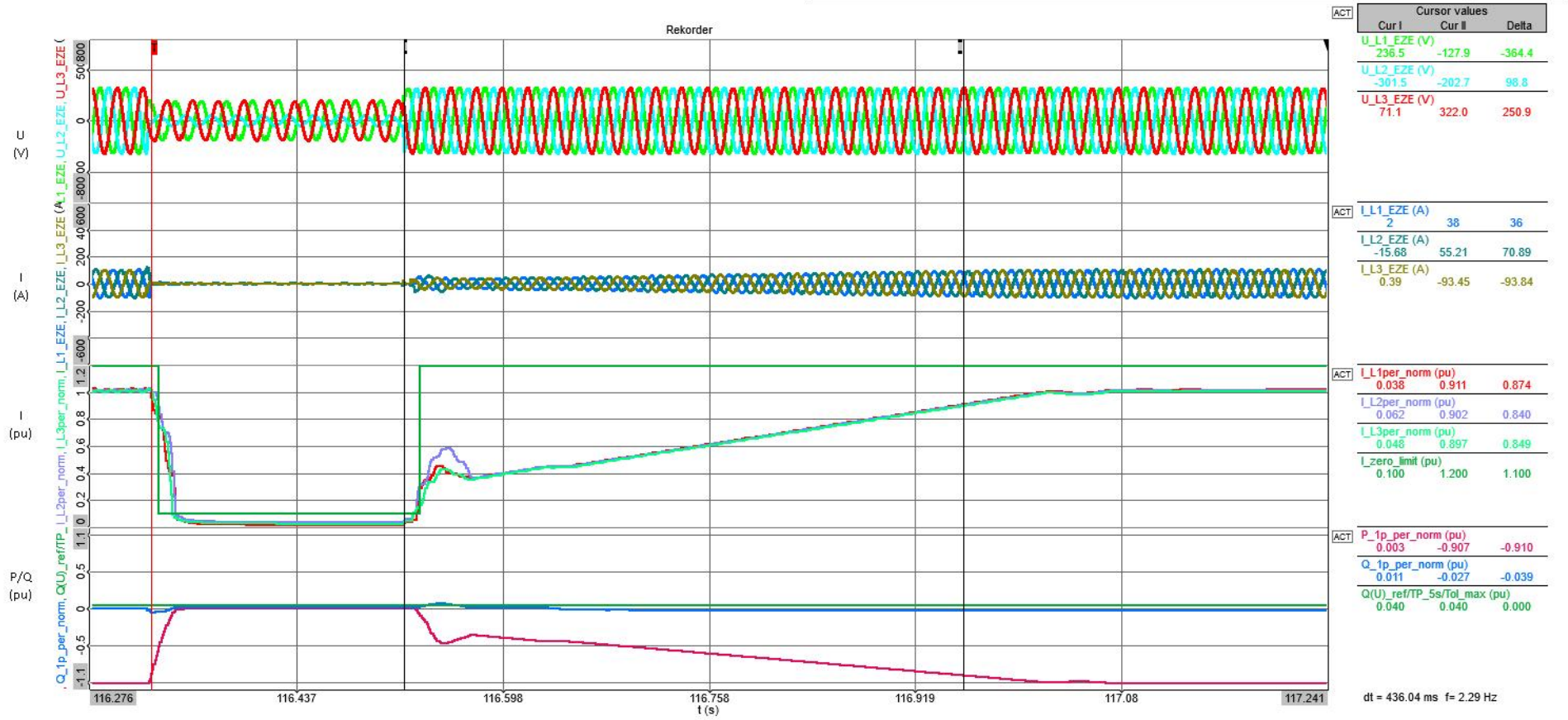
| | | | | | |
|---|---|---|---|---|---|
| EUT Manufacturer | felicitysolar | EUT Nominal Active Power (kW) | 50.000 | Firmware Version | |
| EUT Model | IVGM50KHP3G2 | EUT Nominal Apparent Power (kW) | 50.000 | Parameter Setup | Austria_OVE-directive_R25 QU |
| Serial Number | 100202012625120002 | EUT Nominal Voltage (L-N) (V) | 230.00 | Test Configuration | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time | Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|---|---|
| 06/07/2026 | 16:50:46.669 | 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 7 Verification of the LVRT capability:
## 7.2 Test 1.3 (U=0.15Un, 160 ms) 2-ph

7 FRT (Type A zero current)

OE_Tests_IVGM50KHP3G2_7_X_PV_BATT_2026_07_06_165023_P.dxd | PASS




EUT Info

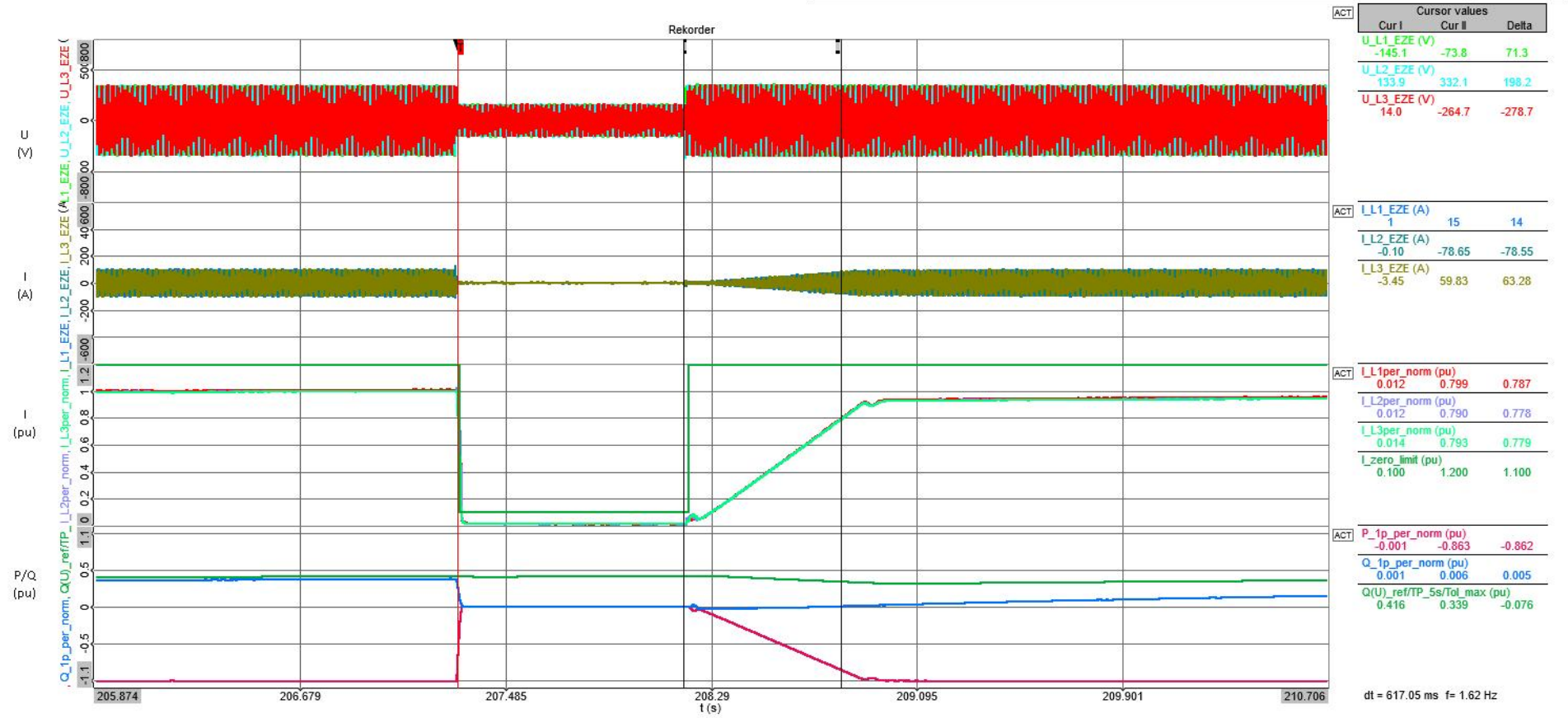
| | | | | | |
|---|---|---|---|---|---|
| EUT Manufacturer | felicitysolar | EUT Nominal Active Power (kW) | 50.000 | Firmware Version | |
| EUT Model | IVGM50KHP3G2 | EUT Nominal Apparent Power (kW) | 50.000 | Parameter Setup | Austria_OVE-directive_R25 QU |
| Serial Number | 100202012625120002 | EUT Nominal Voltage (L-N) (V) | 230.00 | Test Configuration | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time | Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|---|---|
| 06/07/2026 | 16:52:20.245 | 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 7 Verification of the LVRT-capability:
## 7.3 Test 2.1 (U=0.50Un, 860 ms) 3-ph

7 FRT (Type A zero current)

OE_Tests_IVGM50KHP3G2_7_X_PV_BATT_2026_07_06_165023_P.dxd | PASS




EUT Info

| | | | | | |
|---|---|---|---|---|---|
| EUT Manufacturer | felicitysolar | EUT Nominal Active Power (kW) | 50.000 | Firmware Version | |
| EUT Model | IVGM50KHP3G2 | EUT Nominal Apparent Power (kW) | 50.000 | Parameter Setup | Austria_OVE-directive_R25 QU |
| Serial Number | 100202012625120002 | EUT Nominal Voltage (L-N) (V) | 230.00 | Test Configuration | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time |
|---|---|
| 06/07/2026 | 16:53:50.302 |

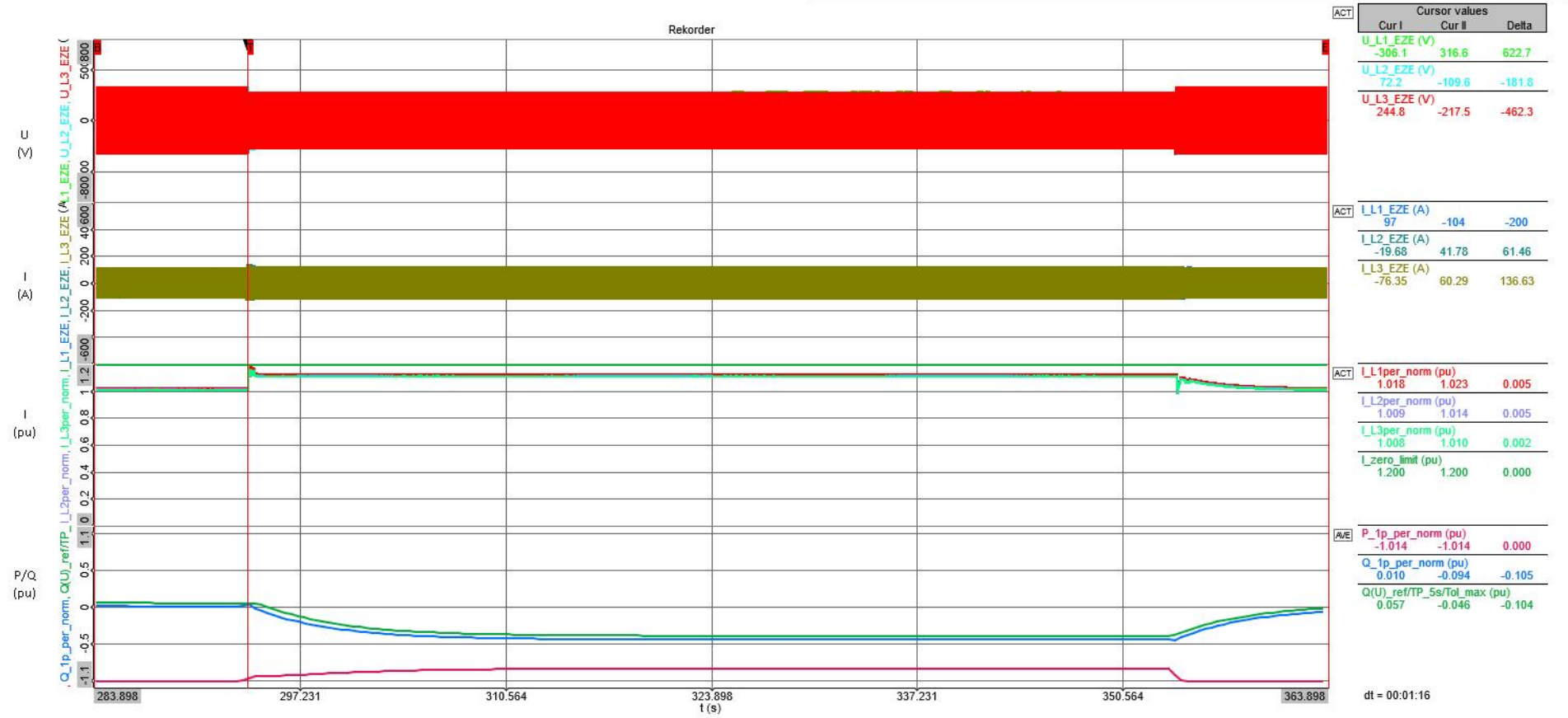
| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 7 Verification of the LVRT-capability:
## 7.4 Test 3.1 (U=0.85Un, 60 s) 3-ph

7 FRT (Type A zero current)

OE_Tests_IVGM50KHP3G2_7_X_PV_BATT_2026_07_06_165023_P.dxd

PASS




EUT Info

| | | |
|---|---|---|
| EUT Manufacturer: felicitysolar | EUT Nominal Active Power (kW): 50.000 | Firmware Version: V100 M966 S309 |
| EUT Model: IVGM50KHP3G2 | EUT Nominal Apparent Power (kW): 50.000 | Parameter Setup: Austria_OVE-directive_R25 QU |
| Serial Number: 100202012625120002 | EUT Nominal Voltage (L-N) (V): 230.00 | Test Configuration: PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time |
|---|---|
| 06/07/2026 | 16:55:16.902 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 7 Verification of the EPS Mode with switching time < 20ms:
## 7.5 Test (U=0.15Un, 160ms) 3-ph

N/A

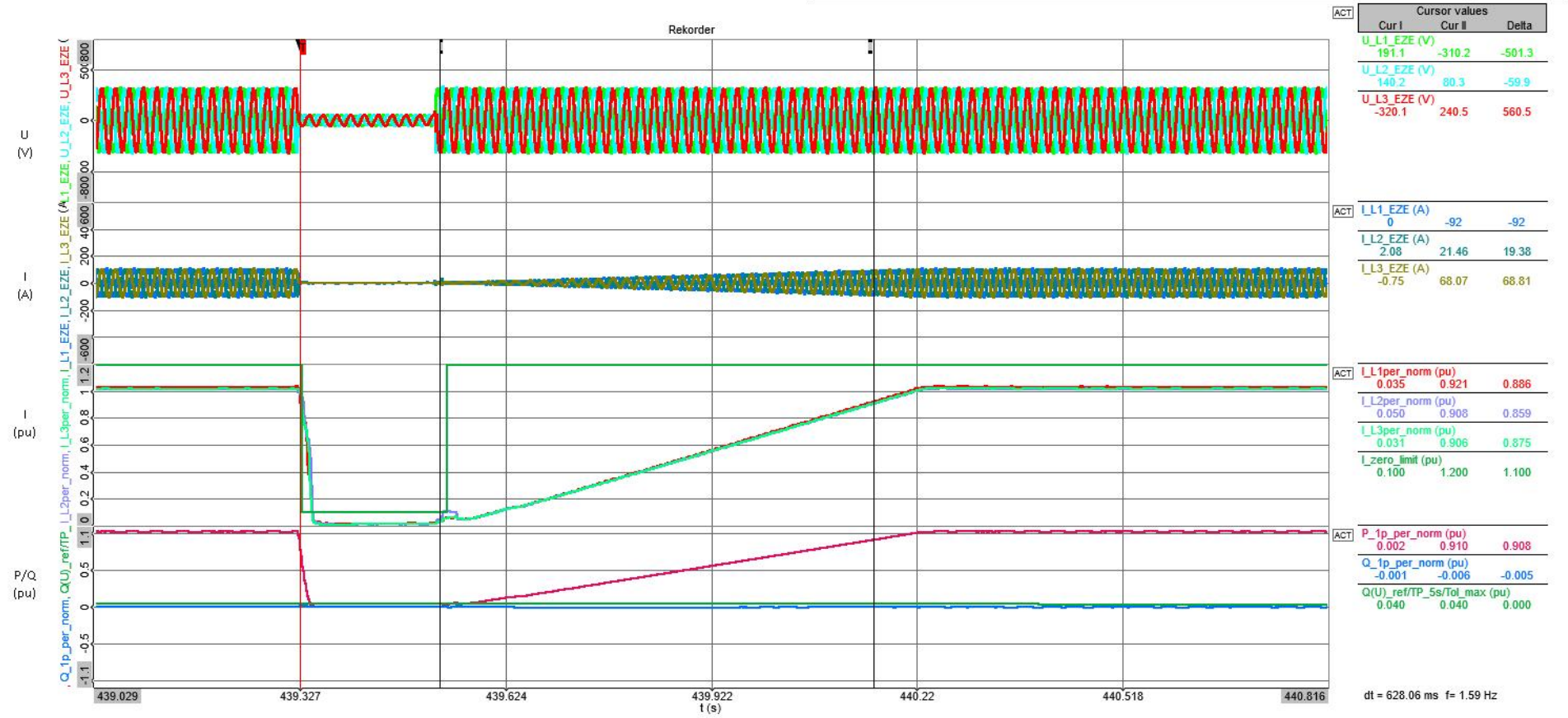
FINAL - PASS

## 7 Verification of the LVRT-capability when charging:
## 7.6 Test (U=0.15Un, 160ms) 3-ph

7 FRT (Type A zero current)

OE_Tests_IVGM50KHP3G2_7_X_PV_BATT_2026_07_06_165023_P.dxd

PASS




EUT Info

| | | | | | |
|---|---|---|---|---|---|
| EUT Manufacturer | felicitysolar | EUT Nominal Active Power (kW) | 50.000 | Firmware Version | V100 M966 S309 |
| EUT Model | IVGM50KHP3G2 | EUT Nominal Apparent Power (kW) | 50.000 | Parameter Setup | Austria_OVE-directive_R25 QU |
| Serial Number | 100202012625120002 | EUT Nominal Voltage (L-N) (V) | 230.00 | Test Configuration | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time | Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|---|---|
| 06/07/2026 | 16:57:42.331 | 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

# 8 Verification of the cosphi(P) control

## 8 Verification of the cosphi(P) control

Parameter report: 2026-07-07 10_02_33 cosphi(P).xls (export)

Screenshots Inverter Software

Grid Settings/Q(P) Cos(P)

| | | | | | |
|---|---|---|---|---|---|
| Q(P) Ena. | Disable | | CosP Ena. | Enable | |
| Q Output | Disable | | CosP lockin lockout power Ena. | Disable | |
| Q(P) P1 | -100.0 | %Pn | CosP lockin lockout voltage Ena. | Disable | |
| Q(P) P2 | -50.0 | %Pn | CosP lock-in voltage | 105 | %Un |
| Q(P) P3 | -20.0 | %Pn | CosP lock-out voltage | 95 | %Un |
| Q(P) P4 | 20.0 | %Pn | CosP lock-in power | 20.0 | %Pn |
| Q(P) P5 | 50.0 | %Pn | CosP lock-out power | 5.0 | %Pn |
| Q(P) P6 | 100.0 | %Pn | CosP P1 | 50.0 | % |
| Q(P) Q1 | 43.6 | %Pn | CosP P2 | 50.0 | % |
| Q(P) Q2 | 0.0 | %Pn | CosP P3 | 100.0 | % |
| Q(P) Q3 | 0.0 | %Pn | CosP P4 | 100.0 | % |

| | | | | | |
|---|---|---|---|---|---|
| Q(P) Q4 | 0.0 | %Pn | CosP PF1 | 1.000 | |
| Q(P) Q5 | 0.0 | %Pn | CosP PF2 | 1.000 | |
| Q(P) Q6 | -43.6 | %Pn | CosP PF3 | -0.900 | |
| Q(P) response time for 3Tau | 10.0 | S | CosP PF4 | -0.900 | |
| | | | CosP response time for 3Tau | 10.0 | S |

FINAL - T

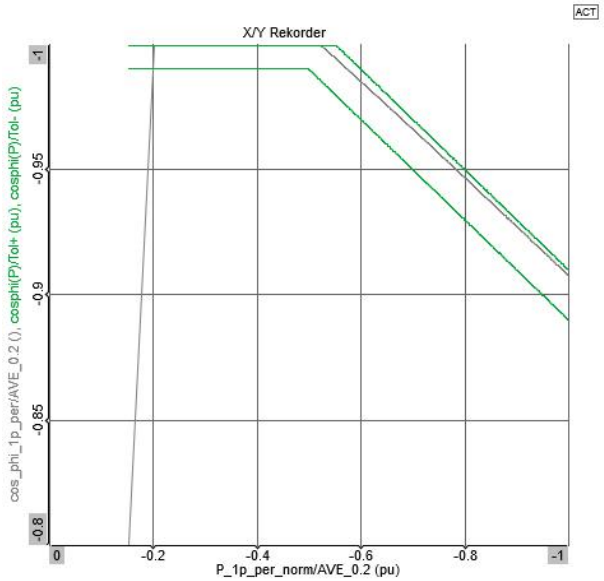
## 8 Verification of the cosphi(P) control:
## 8.1 Steady state test

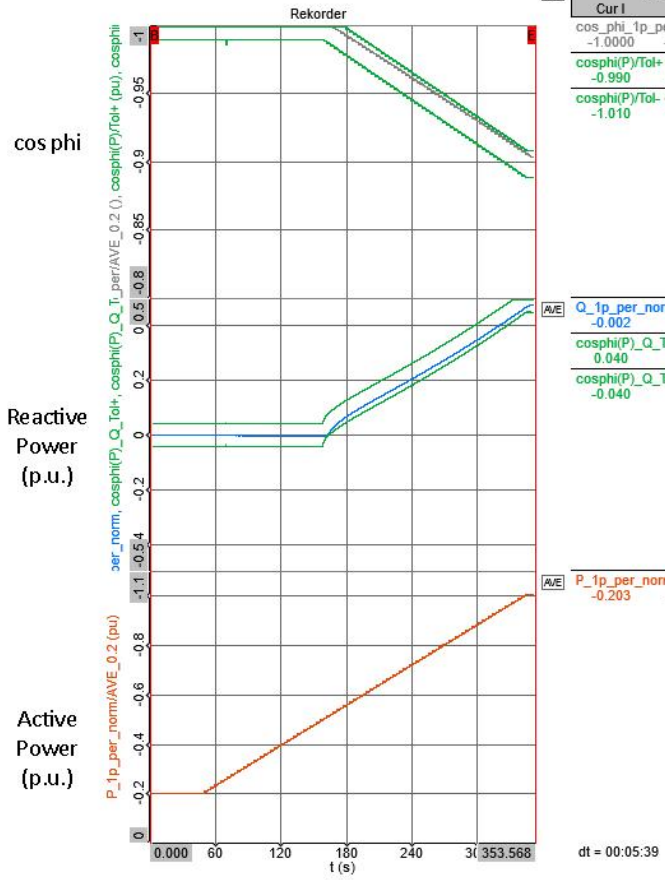
# OE Tests 8.1-2 cosphi(P)

OE_Tests_IVGM50KHP3G2_8_X_2026_07_07_100121_P.dxd

PASS

cos phi/P Diagram




Cursor values

| | Cur I | Cur II | Delta |
|---|---|---|---|
| cos_phi_1p_per/AVE_0.2 | -1.0000 | -0.9055 | 0.0944 |
| cosphi(P)/Tol+ (pu) | -0.990 | -0.889 | 0.101 |
| cosphi(P)/Tol- (pu) | -1.010 | -0.909 | 0.101 |
| Q_1p_per_norm (pu) | -0.002 | 0.471 | 0.473 |
| cosphi(P)_Q_Tol+ (pu) | 0.040 | 0.531 | 0.491 |
| cosphi(P)_Q_Tol- (pu) | -0.040 | 0.451 | 0.491 |
| P_1p_per_norm/AVE_0.2 (pu) | -0.203 | -1.006 | -0.803 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Type | Channel | C... | Time | Value |
|---|---|---|---|---|---|

| Color | Name | Description | Unit |
|---|---|---|---|

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Channel | C... | Time | Value |
|---|---|---|---|---|

**EUT Info**

| EUT Manufacturer | INPUT | EUT Nominal Active Power (kW) | INPUT | Firmware Version | INPUT |
|---|---|---|---|---|---|
| felicitysolar | | 50.000 | | V100 M967 S309 | |
| EUT Model | INPUT | EUT Nominal Apparent Power (kW) | INPUT | Parameter Setup | INPUT |
| IVGM50KHP3G2 | | 50.000 | | Austria_OVE-directive_R25 cosphi(P) | |
| Serial Number | INPUT | EUT Nominal Voltage (L-N) (V) | INPUT | Test Configuration | INPUT |
| 100202012625120002 | | 230.00 | | PV+Batt; TOU | |

| Current date | Current time |
|---|---|
| 07/07/2026 | 10:01:21.958 |

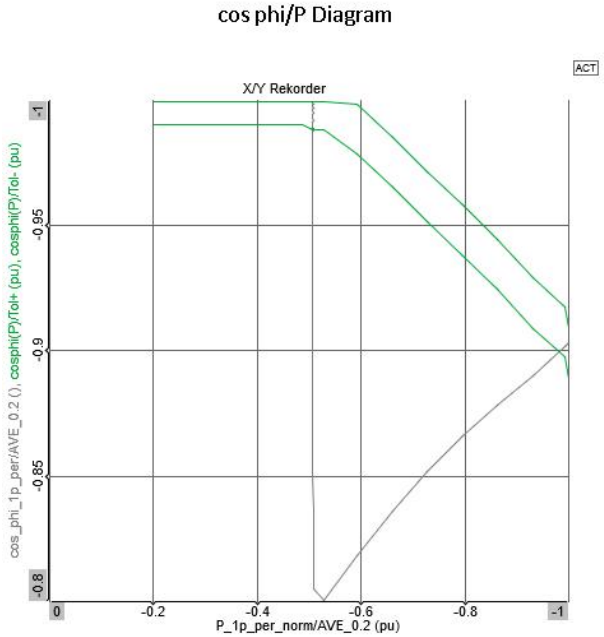
| Pn (kW) ACT | Sn (kVA) ACT | Qn (kVAr) ACT | Un (V) ACT |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

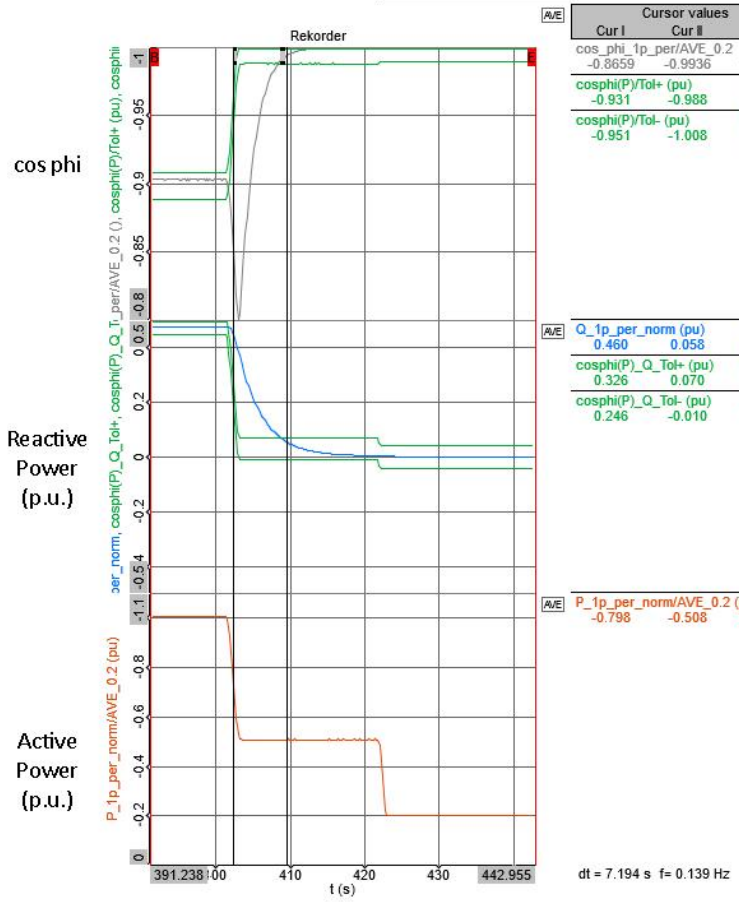
## 8 Verification of the cosphi(P) control:
## 8.2 Dynamic test

# OE Tests 8.1-2 cosphi(P)

OE_Tests_IVGM50KHP3G2_8_X_2026_07_07_100121_P.dxd

PASS




| Cursor values | Cur I | Cur II | Delta |
|---|---|---|---|
| cos_phi_1p_per/AVE_0.2 | -0.8659 | -0.9936 | -0.1277 |
| cosphi(P)/Tol+ (pu) | -0.931 | -0.988 | -0.057 |
| cosphi(P)/Tol- (pu) | -0.951 | -1.008 | -0.057 |
| Q_1p_per_norm (pu) | 0.460 | 0.058 | -0.402 |
| cosphi(P)_Q_Tol+ (pu) | 0.326 | 0.070 | -0.256 |
| cosphi(P)_Q_Tol- (pu) | 0.246 | -0.010 | -0.256 |
| P_1p_per_norm/AVE_0.2 (pu) | -0.798 | -0.508 | 0.290 |

dt = 7.194 s f= 0.139 Hz

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Type | Channel | C... | Time | Value |
|---|---|---|---|---|---|

| Color | Name | Description | Unit |
|---|---|---|---|

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Channel | C... | Time | Value |
|---|---|---|---|---|

**EUT Info**

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M967 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 cosphi(P) |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; TOU |

| Current date | Current time |
|---|---|
| 07/07/2026 | 10:07:53.196 |

| Pn (kW) ACT | Sn (kVA) ACT | Qn (kVAr) ACT | Un (V) ACT |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

# 9 Verification of the external input port

## 9 Verification of the external input port

Parameter report: 2026-07-06 12_42_50 4 QU.xls (export)

Documentation of the hardware implementation of the input port (screenshot from installation manual), picture of the hardware (input port)

### 4.6 DRMS Connection

DRMS(Demand response enabling device) is used for Australia and New Zealand installation (also used as remote shutdown function in European countries), in compliance with Australia and New Zealand safety requirements( or European countries). Inverter integrates control logic and provides an interface for DRMS. The DRMS is not provided by inverter manufacturer, Detailed connection of DRMS & Remote Shutdown are shown below:

**Step 1.**Screw this plate off from the inverter. See Figure 4.6-1.

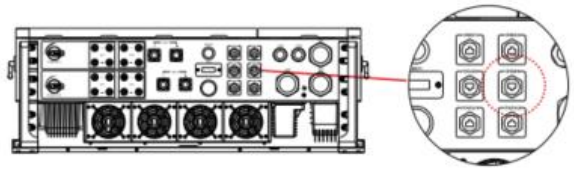


**Figure 4.6-1 DRMS interface**

**Step 2.** Plug out the RJ45 terminal and dismantle the resistor on it. Plug the resistor out, leave the RJ45 terminal for next step.



**Figure 4.6-2 operating steps**

The RJ45 terminal in the inverter has the same function as DRED.
Please leave it in the inverter if no external device is connected.

**Step 3-1** Pass the RJ45 cable through the steel plate and connect the DRED cable to the Rj45 terminal. As shown in Figure 4.6-3, Table 4.6-1describes the 6-pin port defnition.



**Figure 4.6-3 operating steps**

Table 4.6-1 Port pin definition table

| NO. | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
|---|---|---|---|---|---|---|---|---|
| Function | DRM1/5 | DRM2/6 | DRM3/7 | DRM4/8 | REF | COM | / | / |

**Step 3-2 For Remote Shutdown.** Run the cable through the steel plate , Then wire from pins 5 and 6. Table 4.6-1 describes the 6-pin port definition,Wiring is shown in Figure 4.6-4.



**Figure 4.6-4 Remotely close the cable connection**

**Step 4.** Connect RJ45 terminal to the right position onto the inverter.See Figure 4.6-5.

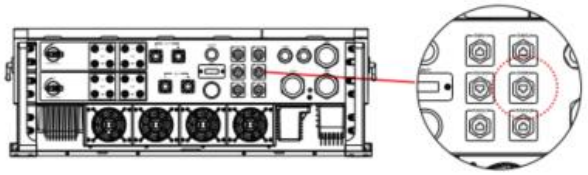


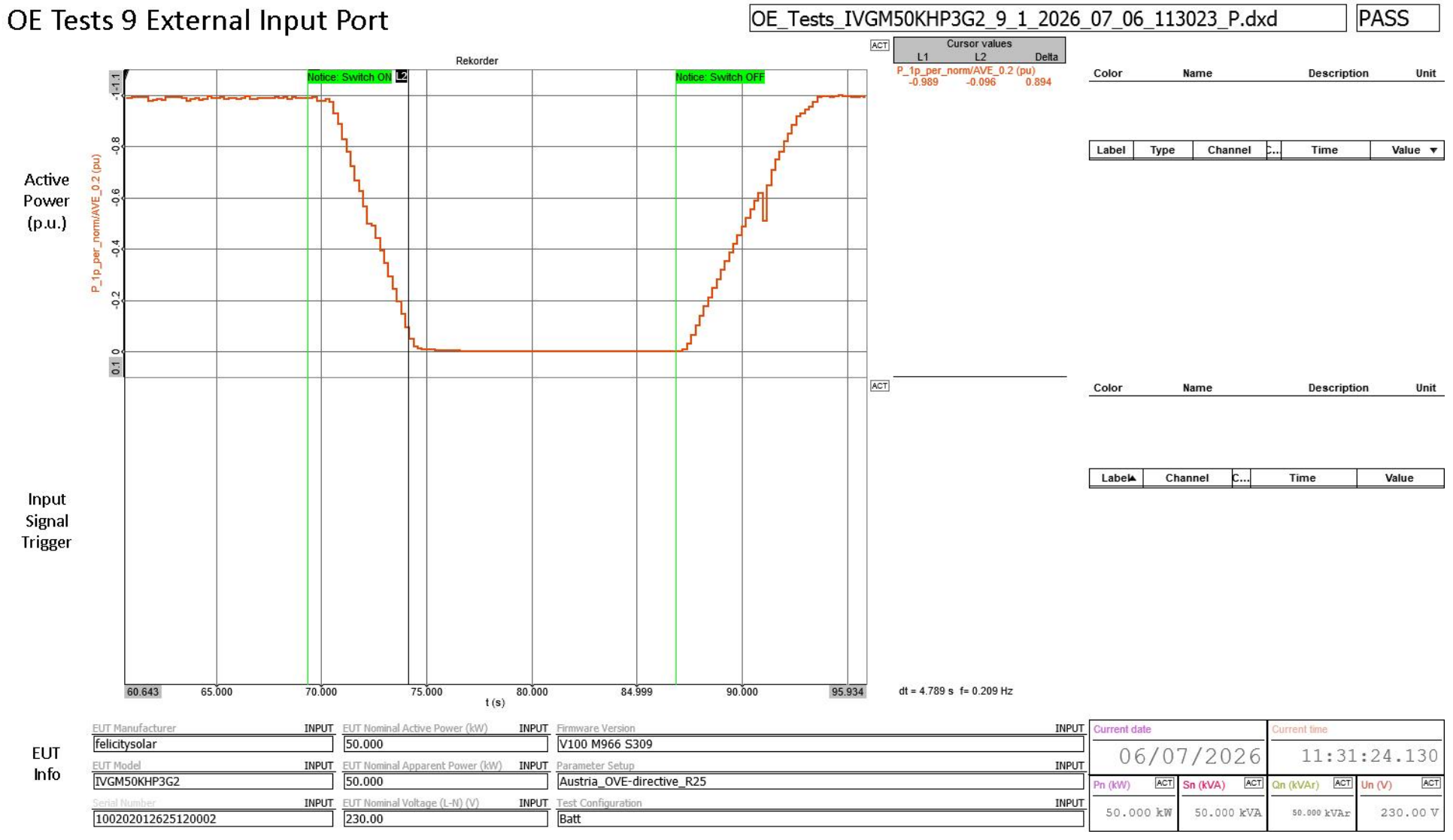
**Figure 4.6-5 RJ45 interface**

Screenshots Inverter Software (relevant parameter settings)




FINAL

## 9.1 Verification of the external input port
## 9.1 Test



# 10 Verification of the interface protection

## 10 Verification of the interface protection

Parameter report: 2026-07-06 12_42_50 4 QU.xls (export)

Screenshots Inverter Software

Grid Settings/IP Protection

| | | | | | |
|---|---|---|---|---|---|
| HV(10min.mean) value | 111 | % | HV(10min.mean) time | 0.100 | S |
| HF1 value | 51.50 | HZ | HV1 value | 115 | % |
| HF1 Time | 0.10 | S | HV1 Time | 0.10 | S |
| HF2 value | 51.50 | HZ | HV2 value | 115 | % |
| HF2 Time | 0.10 | S | HV2 Time | 0.10 | S |
| HF3 value | 51.50 | HZ | HV3 value | 115 | % |
| HF3 Time | 0.04 | S | HV3 Time | 0.10 | S |
| LF1 value | 47.50 | HZ | LV1 value | 80 | % |
| LF1 Time | 0.10 | S | LV1 Time | 1.50 | S |
| LF2 value | 47.50 | HZ | LV2 value | 25 | % |
| LF2 Time | 0.10 | S | LV2 Time | 0.50 | S |
| RoCoF Ena. | 0 | | LV3 value | 25 | % |

| | | | | |
|---|---|---|---|---|
| RoCoF vaule | 3.00 | Hz/s | LV3 Time | 0.50 S |
| RoCoF time | 5.150 | S | | |
| HV(10minOVP) | Please select | | | |

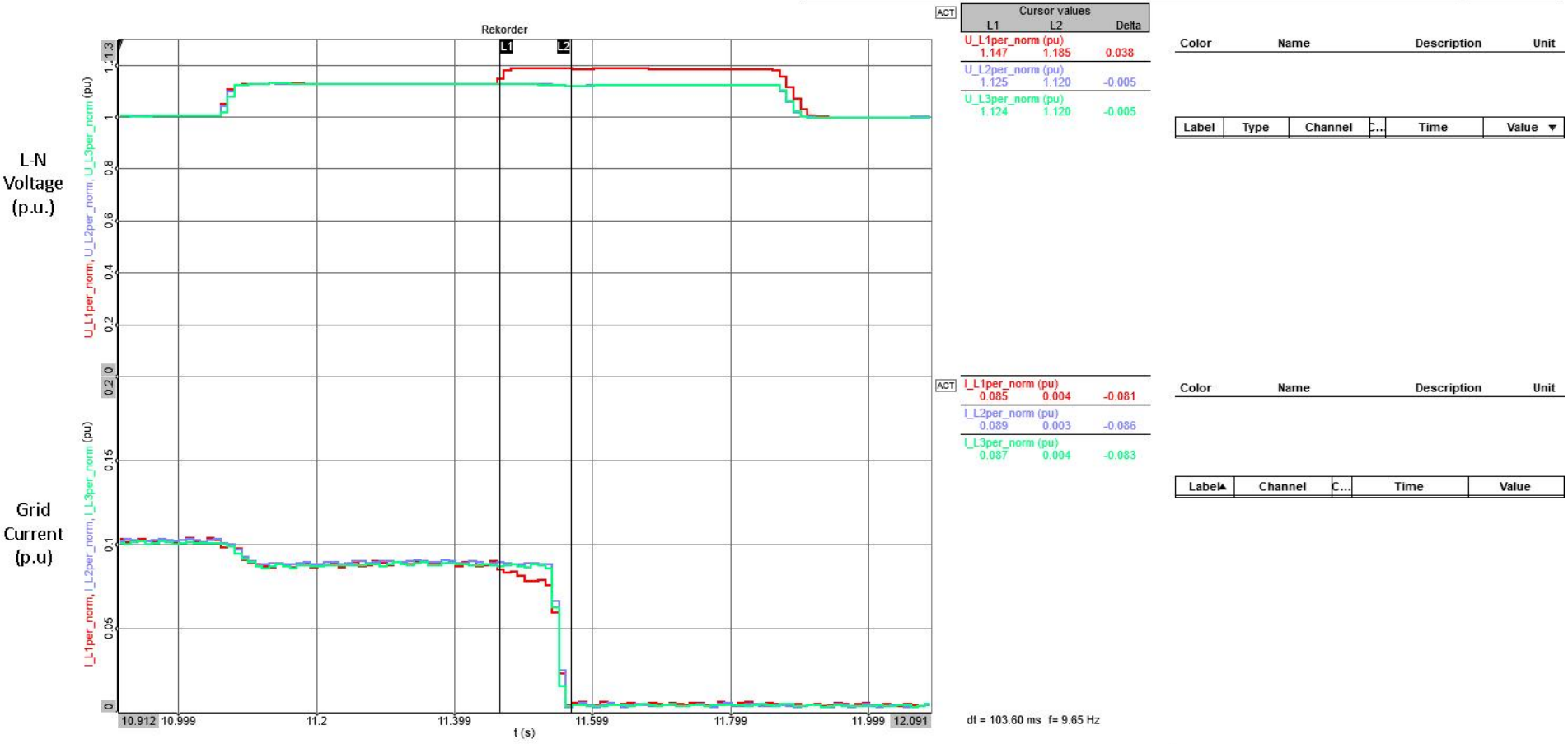
FINAL - PASS

## 10 Verification of the interface protection
## 10.1 Test

# OE Tests 10.X Interface Protection

OE_Tests_IVGM50KHP3G2_10_X_2026_07_06_150651_P.dxd

PASS




Cursor values

| | L1 | L2 | Delta |
|---|---|---|---|
| U_L1per_norm (pu) | 1.147 | 1.185 | 0.038 |
| U_L2per_norm (pu) | 1.125 | 1.120 | -0.005 |
| U_L3per_norm (pu) | 1.124 | 1.120 | -0.005 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Type | Channel | C... | Time | Value |
|---|---|---|---|---|---|

| | L1 | L2 | Delta |
|---|---|---|---|
| I_L1per_norm (pu) | 0.085 | 0.004 | -0.081 |
| I_L2per_norm (pu) | 0.089 | 0.003 | -0.086 |
| I_L3per_norm (pu) | 0.087 | 0.004 | -0.083 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Channel | C... | Time | Value |
|---|---|---|---|---|

**EUT Info**

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M966 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 QU |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; Working Mode: Sell first |

| Current date | Current time |
|---|---|
| 06/07/2026 | 15:07:02.454 |

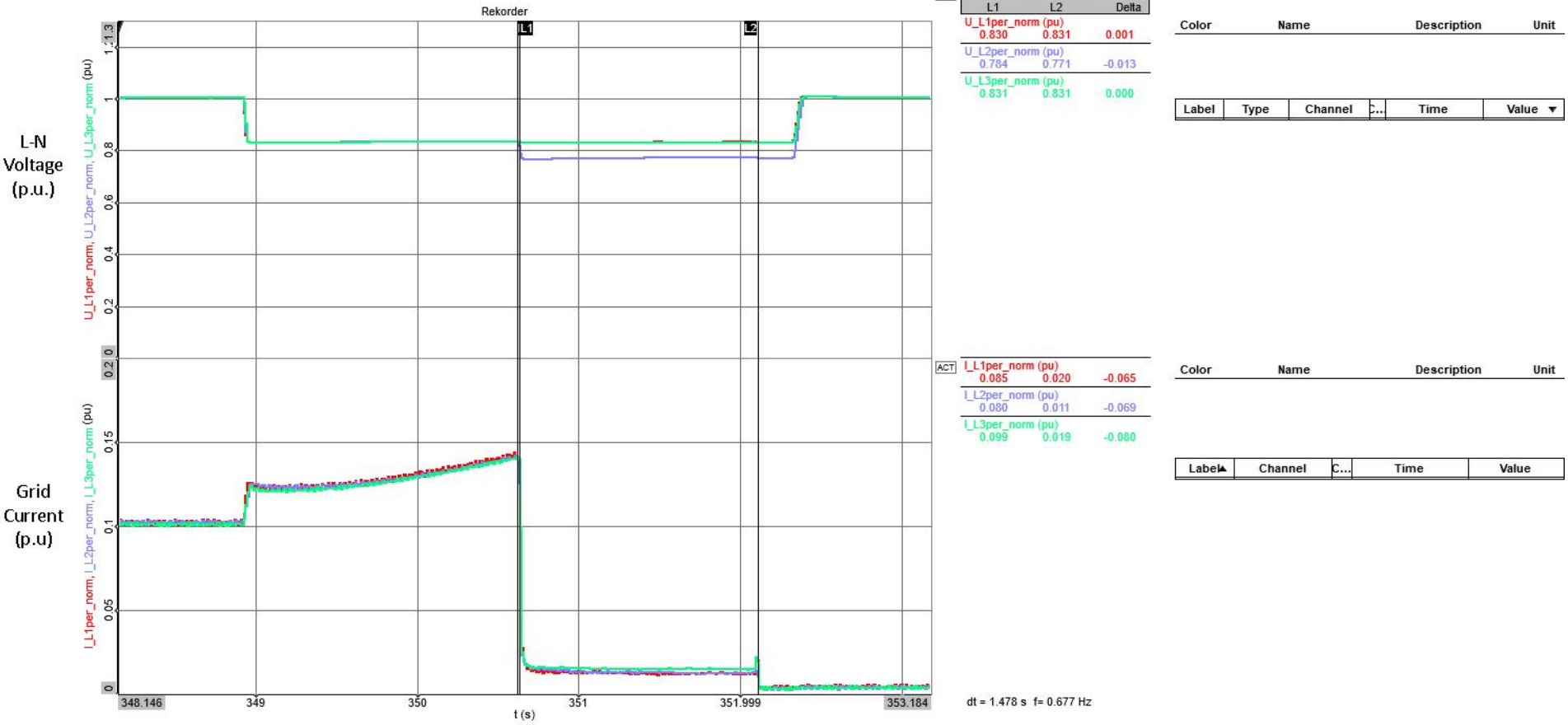
| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 10 Verification of the interface protection
## 10.2 Test

### OE Tests 10.X Interface Protection

OE_Tests_IVGM50KHP3G2_10_X_2026_07_06_150651_P.dxd

PASS




Cursor values

| | L1 | L2 | Delta |
|---|---|---|---|
| U_L1per_norm (pu) | 0.830 | 0.831 | 0.001 |
| U_L2per_norm (pu) | 0.784 | 0.771 | -0.013 |
| U_L3per_norm (pu) | 0.831 | 0.831 | 0.000 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Type | Channel | C... | Time | Value |
|---|---|---|---|---|---|

| | L1 | L2 | Delta |
|---|---|---|---|
| I_L1per_norm (pu) | 0.085 | 0.020 | -0.065 |
| I_L2per_norm (pu) | 0.080 | 0.011 | -0.069 |
| I_L3per_norm (pu) | 0.099 | 0.019 | -0.080 |

| Color | Name | Description | Unit |
|---|---|---|---|

| Label | Channel | C... | Time | Value |
|---|---|---|---|---|

**EUT Info**

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M966 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 QU |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; Working Mode: Sell first |

| Current date | Current time |
|---|---|
| 06/07/2026 | 15:12:39.688 |

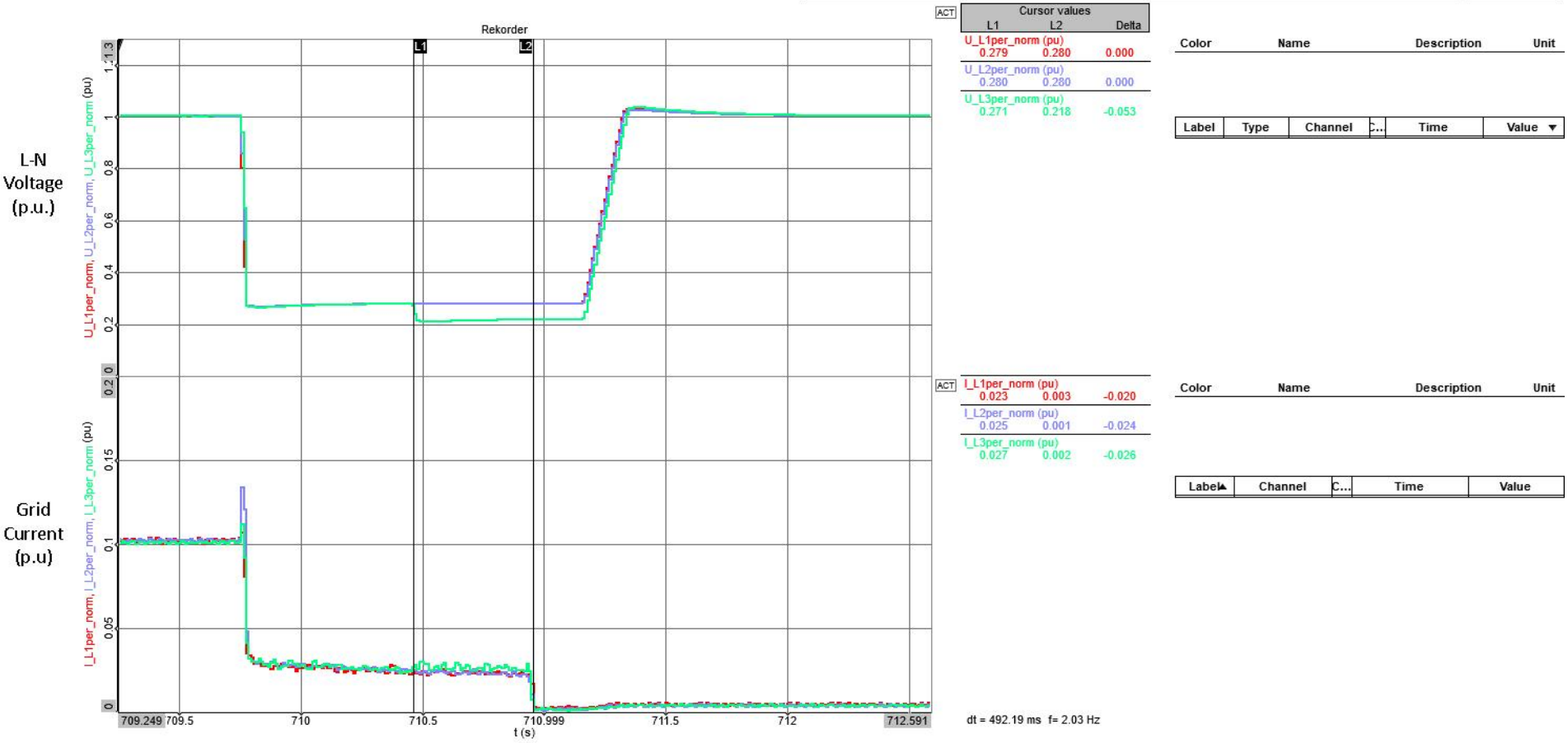
| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

## 10 Verification of the interface protection
## 10.3 Test

# OE Tests 10.X Interface Protection

OE_Tests_IVGM50KHP3G2_10_X_2026_07_06_150651_P.dxd

PASS




**EUT Info**

| | | |
|---|---|---|
| EUT Manufacturer: felicitysolar | EUT Nominal Active Power (kW): 50.000 | Firmware Version: V100 M966 S309 |
| EUT Model: IVGM50KHP3G2 | EUT Nominal Apparent Power (kW): 50.000 | Parameter Setup: Austria_OVE-directive_R25 QU |
| Serial Number: 100202012625120002 | EUT Nominal Voltage (L-N) (V): 230.00 | Test Configuration: PV+Batt; Working Mode: Sell first |

| Current date | Current time |
|---|---|
| 06/07/2026 | 15:18:40.791 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

# 11 Verification of the feed-in limitation

## 11 Verification of the feed-in limitation

Parameter report: 2026-07-06 14_42_42 11c2.xls (export)

Documentation of the hardware implementation of the feed-in limitation (screenshot from installation manual) or picture of the hardware (smart meter, CT)



### 4.5.3 Meter Connection with CTs

**Table:**4.5-2:RS485 interface

| NO. | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 |
|---|---|---|---|---|---|---|---|---|
| Function | / | / | RS_485_B | RS_485_A | / | / | Meter_485B | Meter_485A |

The Smart Meter with CT in product box is compulsory for IVGM system installation, used to detect grid voltage and current direction and magnitude, further to instruct the operationcondition of IVGM inverter via RS485 communication.See Table 4.5-2.
**NOTE:** The meter(Eastron and CHINT) must not be connected to CTs with secondary current exceeding 6A to prevent risk of damage.

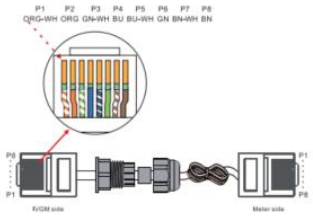



Figure 4.5-7 RS485 interface

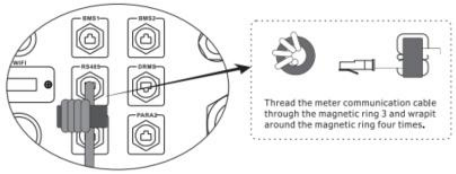



Figure 4.5-8 Meter connection with magnetic ring



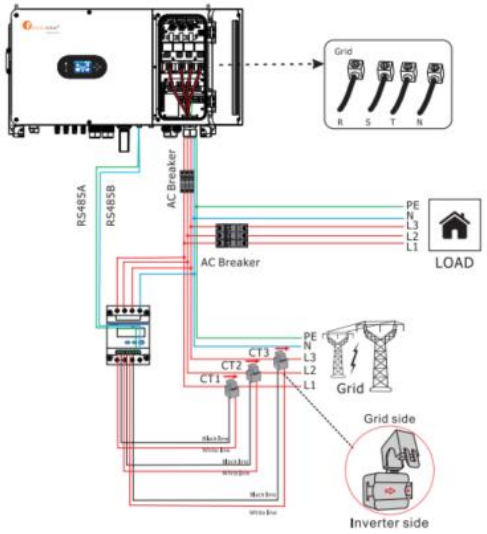
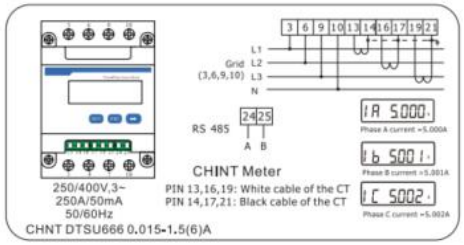
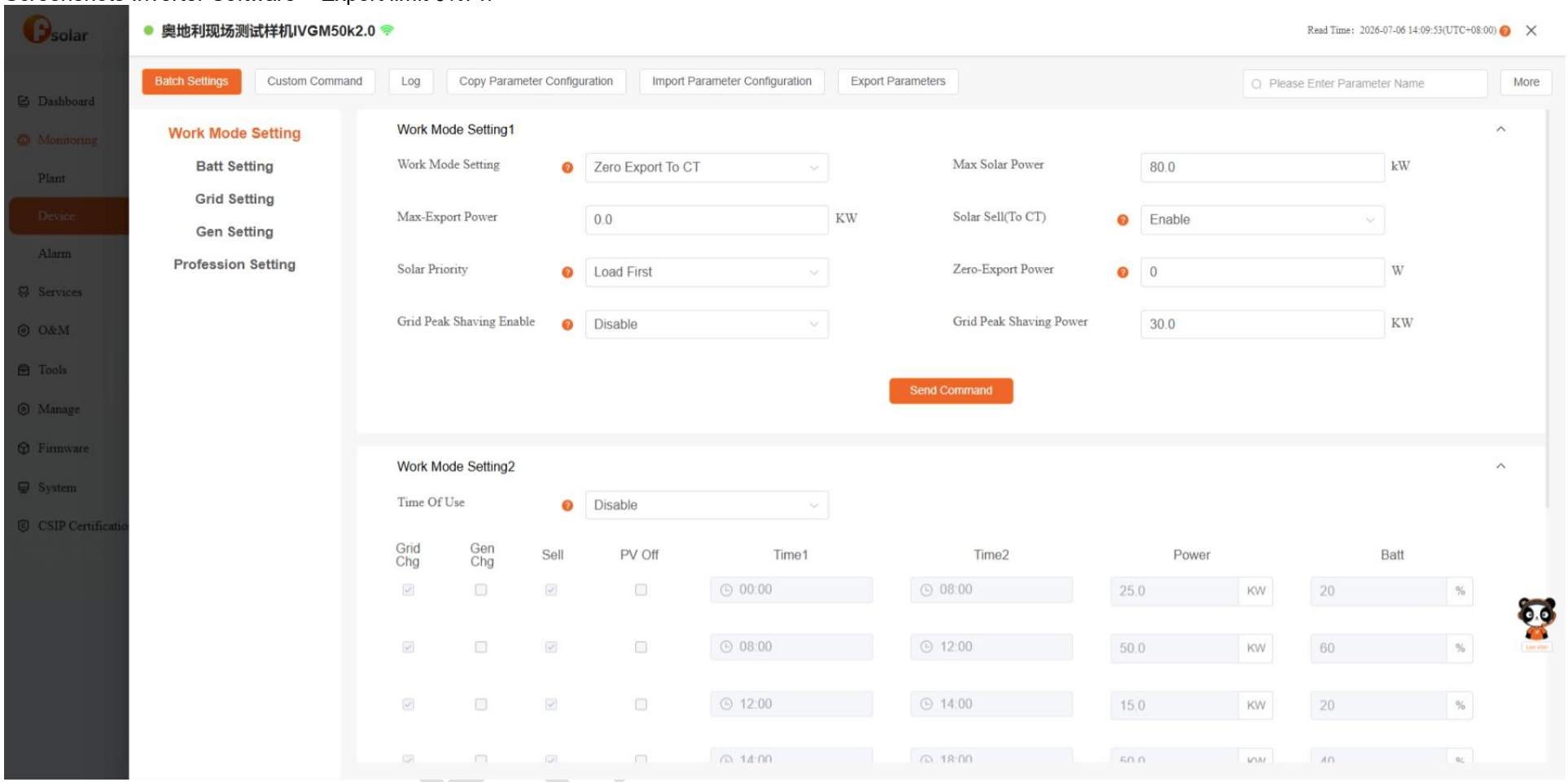


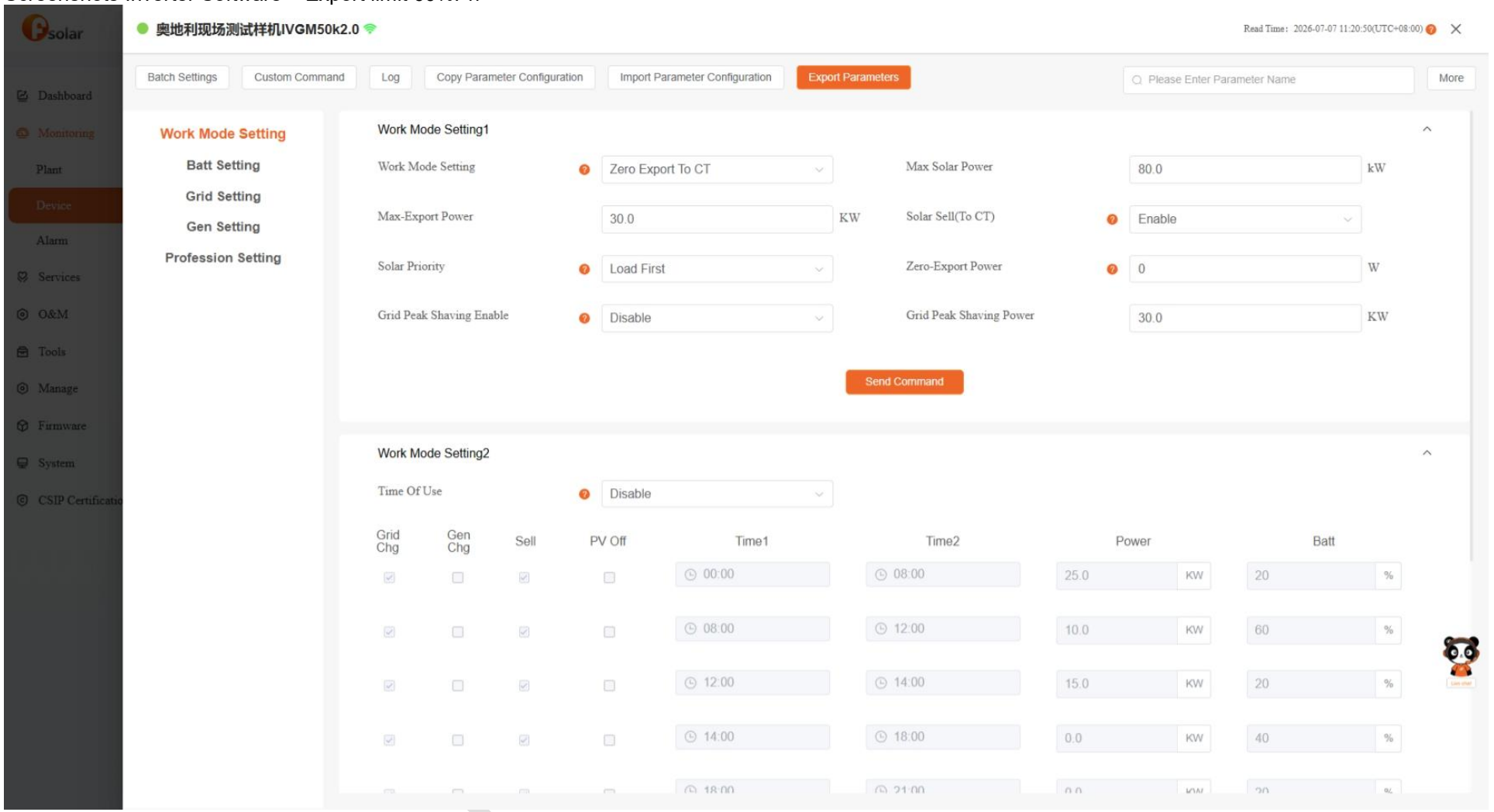

Figure 4.5-10 Smart Meter&CT Connection with CHINT meter



Screenshots Inverter Software – Export limit 0%Pn



Screenshots Inverter Software – Export limit 60%Pn



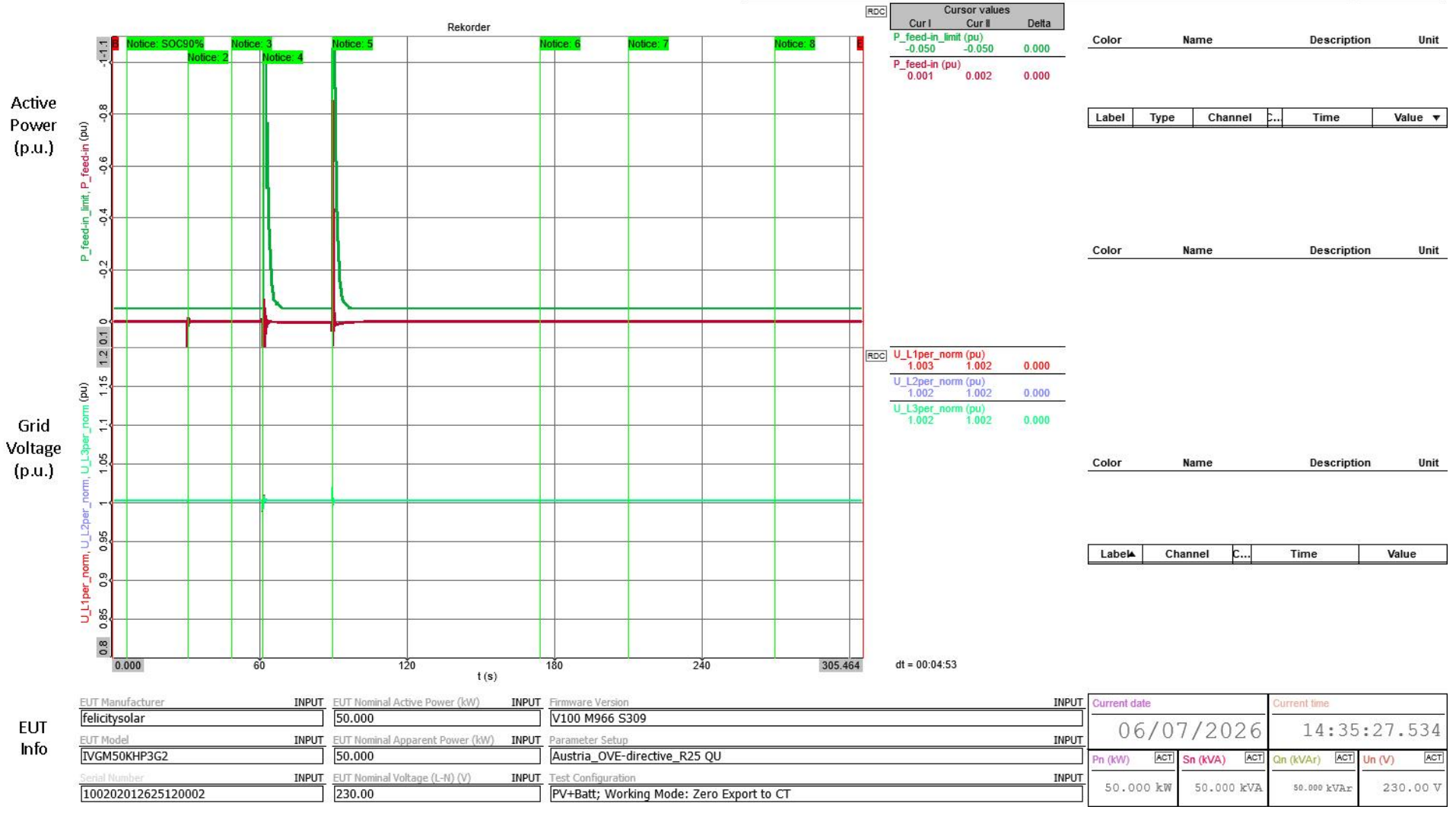
## 11 Verification of the feed-in limitation

## 11a.1 Test for Generating Units; 11b.1 Test for Storage Units; 11c.1 Test for Hybrid Units

# OE Tests 11.X Feed-In Limit

OE_Tests_IVGM50KHP3G2_11c_1_2026_07_06_143527_P.dxd

PASS



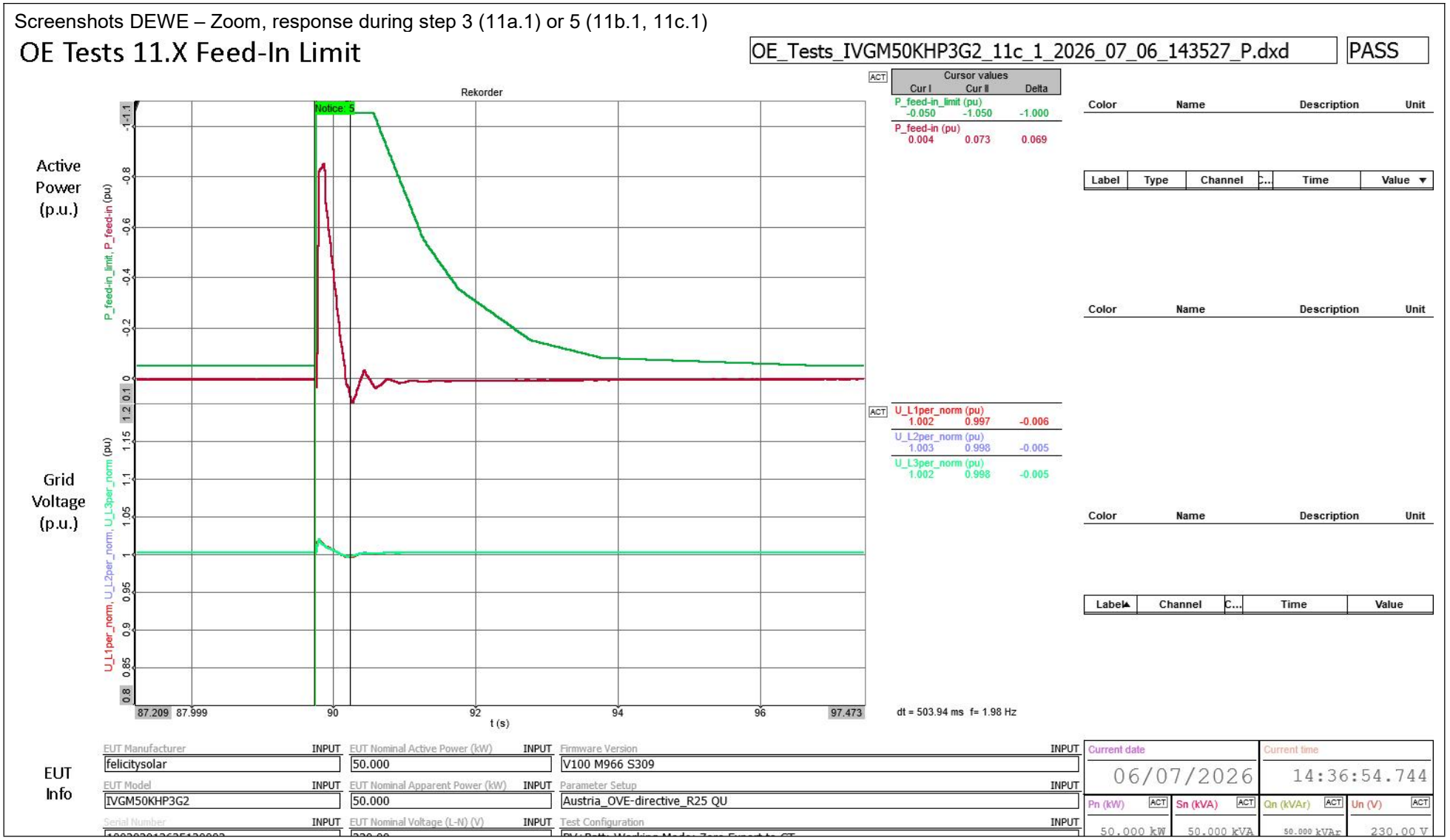

EUT Info

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M966 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 QU |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time |
|---|---|
| 06/07/2026 | 14:35:27.534 |

| Pn (kW) ACT | Sn (kVA) ACT | Qn (kVAr) ACT | Un (V) ACT |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

Screenshots DEWE – Zoom, response during step 3 (11a.1) or 5 (11b.1, 11c.1)



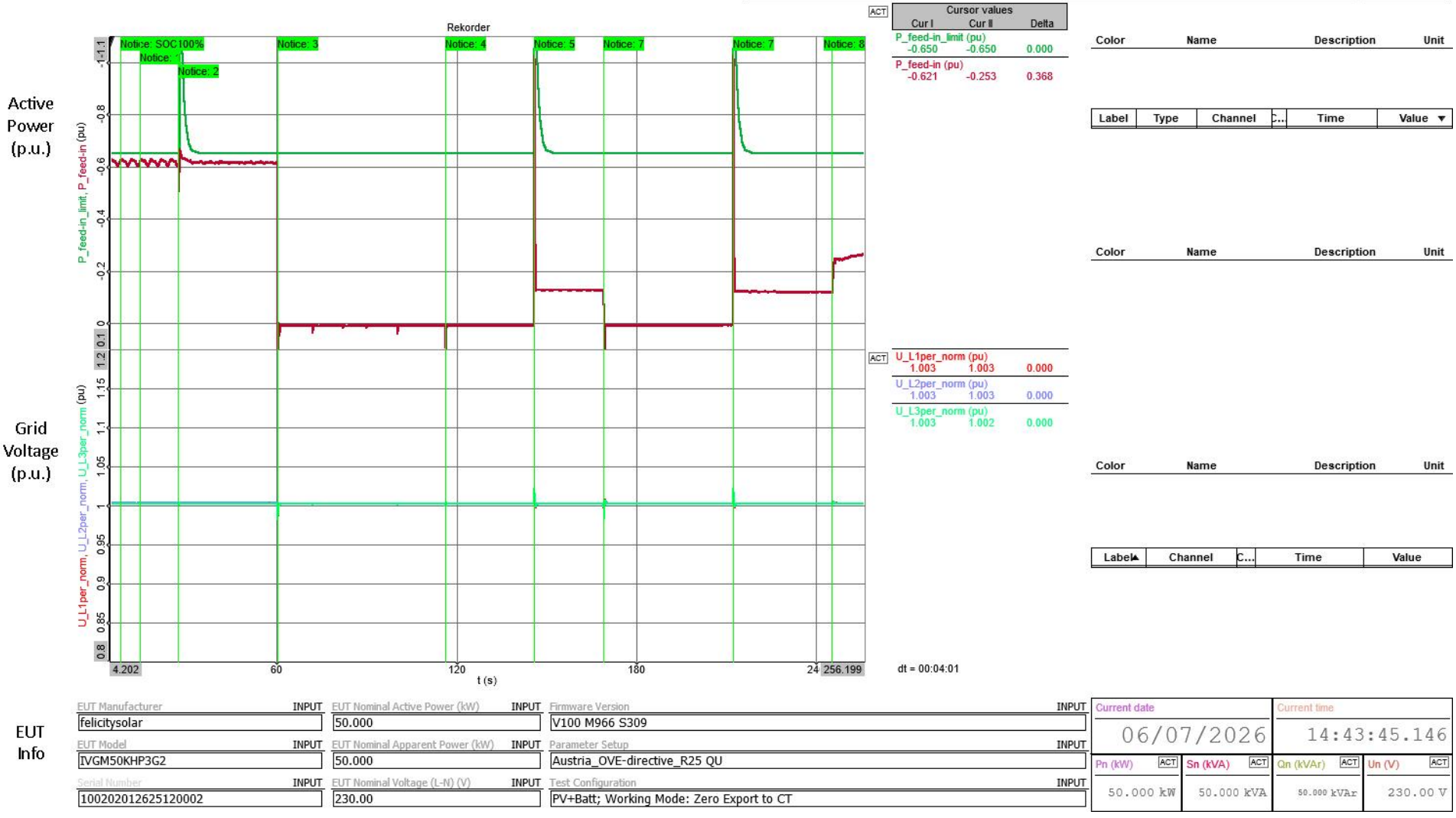
## 11 Verification of the feed-in limitation

## 11a.2 Test for Generating Units; 11b.2 Test for Storage Units; 11c.2 Test for Hybrid Units

# OE Tests 11.X Feed-In Limit

OE_Tests_IVGM50KHP3G2_11c_2_2026_07_06_144340_P.dxd

PASS



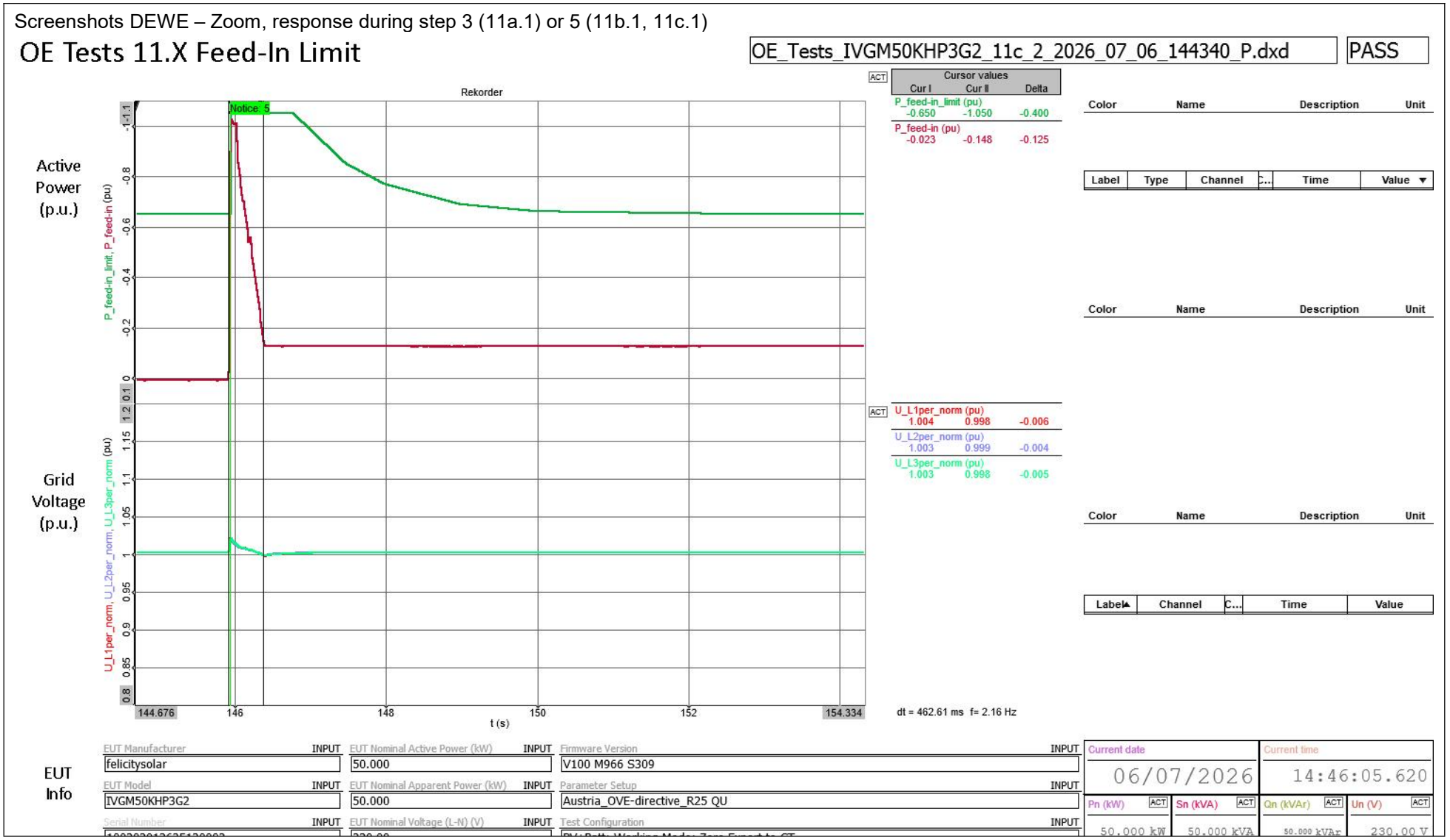

EUT Info

| EUT Manufacturer | EUT Nominal Active Power (kW) | Firmware Version |
|---|---|---|
| felicitysolar | 50.000 | V100 M966 S309 |
| **EUT Model** | **EUT Nominal Apparent Power (kW)** | **Parameter Setup** |
| IVGM50KHP3G2 | 50.000 | Austria_OVE-directive_R25 QU |
| **Serial Number** | **EUT Nominal Voltage (L-N) (V)** | **Test Configuration** |
| 100202012625120002 | 230.00 | PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time |
|---|---|
| 06/07/2026 | 14:43:45.146 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

Screenshots DEWE – Zoom, response during step 3 (11a.1) or 5 (11b.1, 11c.1)

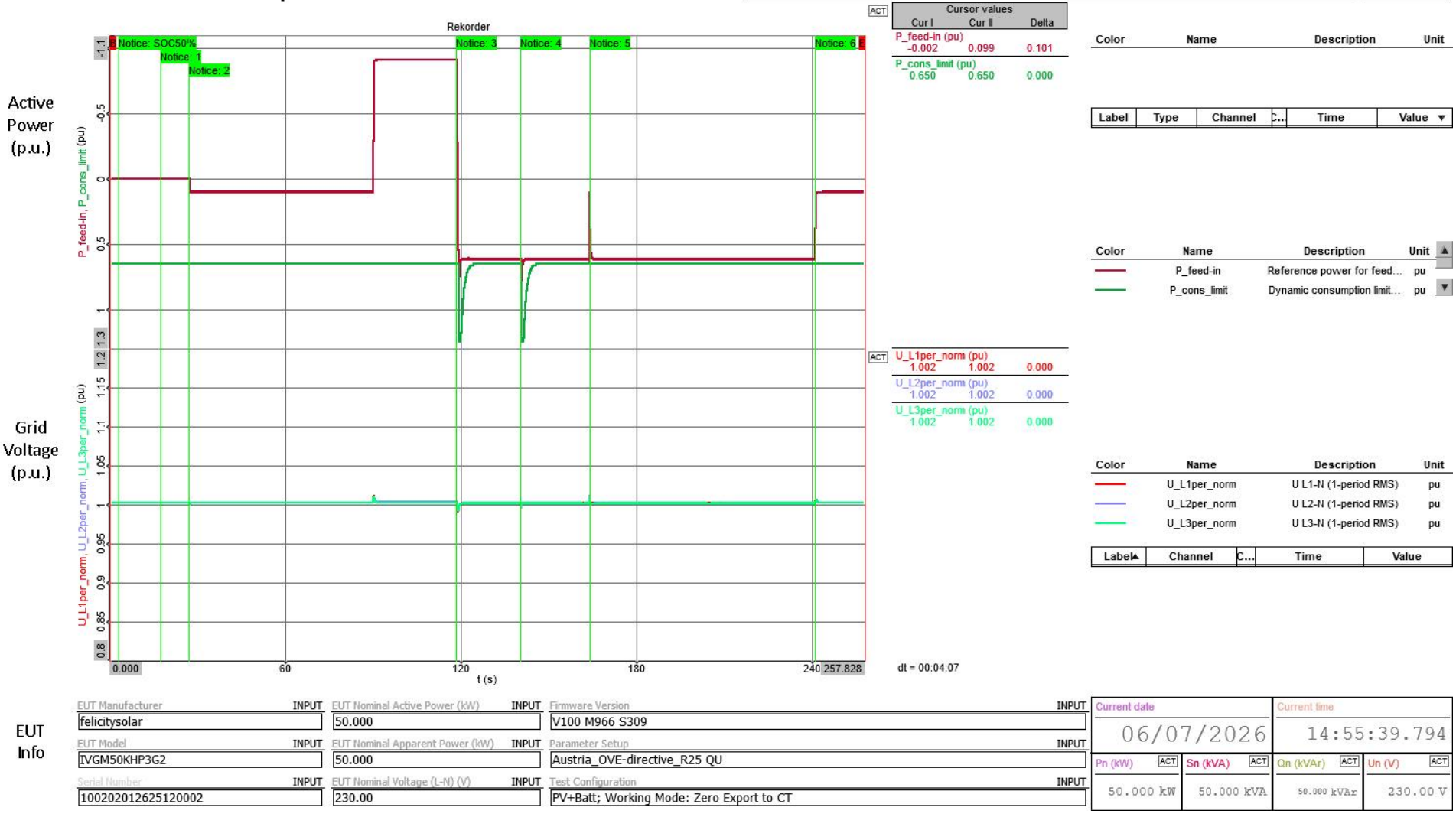


## 11 Verification of the consumption limitation
## 11b.3 Test for Storage Units; 11c.3 Test for Hybrid Units

# OE Tests 11.3 Consumption Limit

OE_Tests_IVGM50KHP3G2_11c_3_2026_07_06_145539_P.dxd

PASS



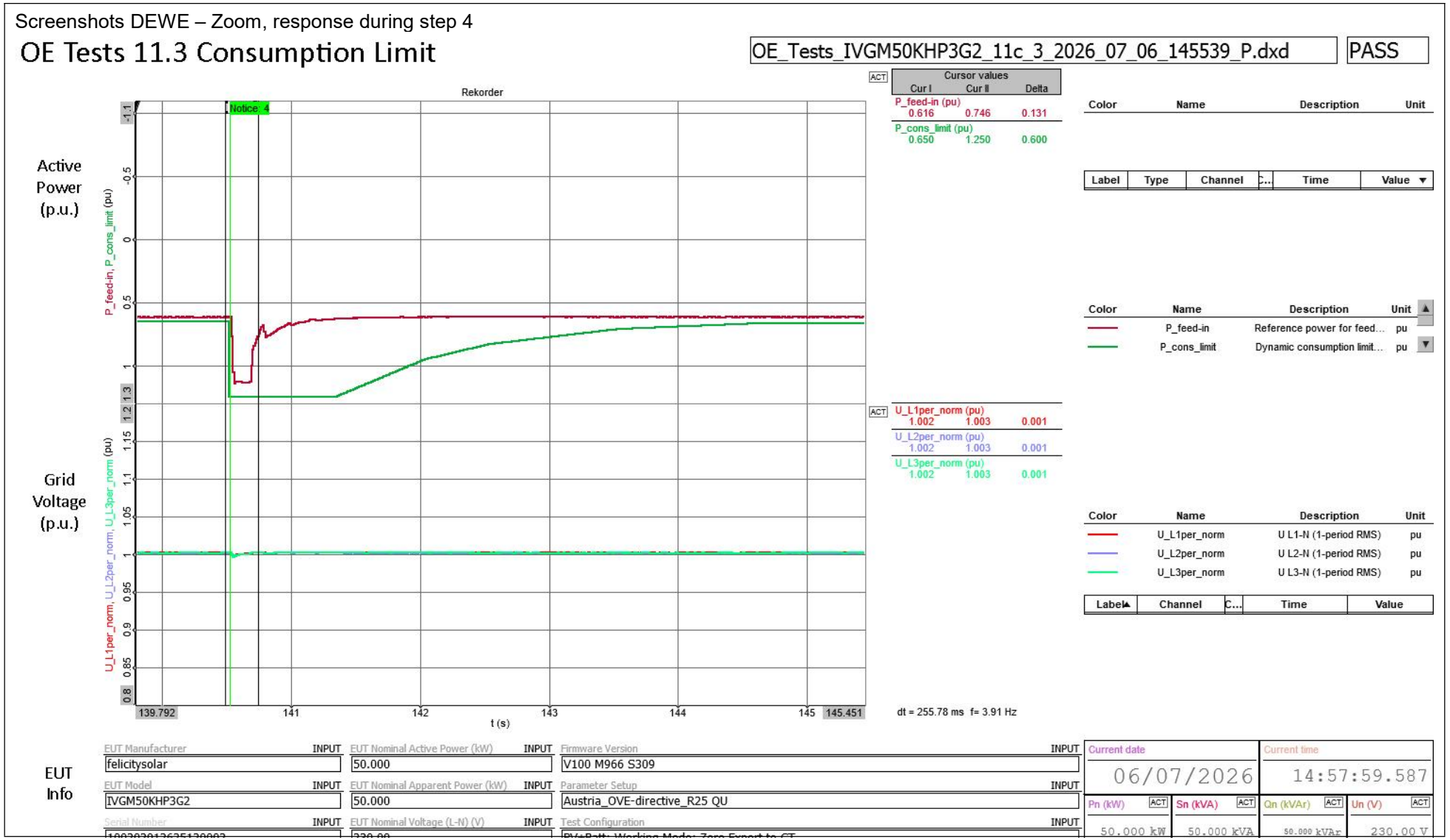

EUT Info

| | | |
|---|---|---|
| EUT Manufacturer: felicitysolar | EUT Nominal Active Power (kW): 50.000 | Firmware Version: V100 M966 S309 |
| EUT Model: IVGM50KHP3G2 | EUT Nominal Apparent Power (kW): 50.000 | Parameter Setup: Austria_OVE-directive_R25 QU |
| Serial Number: 100202012625120002 | EUT Nominal Voltage (L-N) (V): 230.00 | Test Configuration: PV+Batt; Working Mode: Zero Export to CT |

| Current date | Current time |
|---|---|
| 06/07/2026 | 14:55:39.794 |

| Pn (kW) | Sn (kVA) | Qn (kVAr) | Un (V) |
|---|---|---|---|
| 50.000 kW | 50.000 kVA | 50.000 kVAr | 230.00 V |

Screenshots DEWE – Zoom, response during step 4



## 12 Further Tests (optional)

| **12 Further Tests (optional)** |
| --- |
| Parameter report: filename (export) |
| N/A |

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## 12 Other Tests (optional)

### 12.1 Test

N/A

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# Default parameter settings AT Austria TOR Stromerzeugungsanlagen Typ A

**Default parameter settings AT Austria TOR Stromerzeugungsanlagen Typ A**

Parameter report: 2026-07-08 17_52_06 AT Default FINAL.xls (export)

Full documentation of all DEFAULT parameter settings (TOR Type A)

| | |
|---|---|
| Device SN | 100202012625120002 |
| Device Model | IVGM50KHP3G2 |
| Rated Power | 50000W |
| Version | 100 |
| Country | China |
| masterVersion | 968 |
| slaveVersion | 309 |

| Parameter Group | Order | Name | Value | Unit | Help Info |
|---|---|---|---|---|---|

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| | | | | | |
|---|---|---|---|---|---|
| Work Mode Setting1 | 1 | Work Mode Setting | Zero Export To CT | | Selling First: This Mode allows hybrid inverter to sell back any excess power produced by the solar panels to the grid. If Time Of Use is active, the battery energy also can be sold into grid.<br>The PV energy will be used to power the load and charge the battery and then excess energy will flow to grid.<br>Power source priority for the load is as follows:<br>1. Solar Panels.<br>2. Grid. when Energy Pattern tick Batt First.<br>Battery (until programable SOC discharge is reached). when Energy Pattern tick Load First and disable Grid charge.<br><br>Zero Export To Load: Hybrid inverter will only provide power to the backup load connected. The hybrid inverter will neither provide power to the home load nor sell power to grid. The built-in CT will detect power flowing back to the grid and will reduce the power of the inverter only to supply the backup load and charge the battery.<br><br>Zero Export To CT: Hybrid inverter will not only provide power to the backup load connected but also give power to the home load connected. If PV power and battery power is insufficient, it will take grid energy as supplement. The hybrid inverter will not sell power to grid. In this mode, a CT is needed. Please refer to manual CT connection for the installation method of CT. The external CT will detect power flowing back to the grid and will reduce the power of the inverter only to supply the backup load, charge battery and home load.<br><br>Scheduling mode: Based on system requirements and operating conditions, adjust the working status of the inverter and its coordinated operation with other devices through power allocation. Scheduling mode: Based on system requirements and operating conditions, adjust the working status of the inverter and its coordinated operation with other devices through power allocation |
| | 2 | Max-Export Power | 50.0 | KW | |

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| | | | | |
|---|---|---|---|---|
| 3 | Solar Priority | Load First | | Energy Pattern: Priority of PV power usage.<br>Batt First: PV power is firstly used to charge the battery and then used to power the load. If PV power is insufficient, grid will make supplement for battery and load simultaneously.<br>Load First: PV power is firstly used to power the load and then used to charge the battery. If PV power is insufficient, Grid will provide power to load, but neither the battery power to load nor the Grid charge to battery. |
| 4 | Grid Peak Shaving Enable | Disable | | Grid Peak Shaving:<br>1. To use Peak-Shaving on a generator, the equipment MUST be connected to the “GRID” terminal of the inverter.<br>2. Peak-Shaving helps reduce grid consumption during peak demand by utilizing battery backup power. It can also be used to prevent generator overload above a specified power threshold.<br>3. Install the CT sensors on grid / generator lines L1, L2. The arrows on the CTs MUST point toward the GRID.<br>4. The T-REX INVERTER supplies power from the batteries whenever the “Power” threshold is met.<br>5. This mode will automatically adjust the "Grid Charge” amperage (A) to avoid generator overloads during battery charging.<br>6. Grid Peak-Shaving will automatically enable “Time of Use” and MUST be configured. |
| 5 | Max Solar Power | 80.0 | kW | |

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| | | | | | |
|---|---|---|---|---|---|
| | 6 | Solar Sell(To CT) | Enable | | Solar export is supplement for zero export to load or zero export to CT: When this option is activated, surplus PV energy can be fed back into the grid. This option prioritizes load consumption and battery charging before feeding into the grid. |
| | 7 | Zero-Export Power | 0 | W | For Zero Export To Load or Zero Export To CT, and the “Solar sell” is not active. It tells the grid output power threshold to ensure the hybrid inverter won' t feed power to grid. |
| | 8 | Grid Peak Shaving Power | 30.0 | KW | |
| Work Mode Setting2 | 9 | Time Of Use | Enable | | Time Of Use: it is used to program when to use grid or generator to charge the battery, and when to discharge the battery to power the load. Only tick "Time Of Use" then the follow items (Grid, charge, time, power etc.) will take effect.<br>Note: when tick Selling First and click Time Of Use, the battery power can be sold into grid.<br>Charge Source: select grid or generator to charge the battery. |
| Rule 1 | 10 | Grid Charging | Enable | | |
| | 11 | Gen Charging | Disable | | |
| | 12 | Sell | Enable | | |
| | 13 | PVOFF | Disable | | |
| | 14 | Start Time | 00:00 | | |
| | 15 | End Time | 08:00 | | |
| | 16 | Target SOC | 20 | % | |
| | 17 | INV Power | 25.0 | KW | |

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| | | | | |
|---|---|---|---|---|
| Rule 2 | 18 | Grid Charging | Enable | |
| | 19 | Gen Charging | Disable | |
| | 20 | Sell | Enable | |
| | 21 | PVOFF | Disable | |
| | 22 | Start Time | 08:00 | |
| | 23 | End Time | 12:00 | |
| | 24 | Target SOC | 60 | % |
| | 25 | INV Power | 10.0 | KW |
| Rule 3 | 26 | Grid Charging | Enable | |
| | 27 | Gen Charging | Disable | |
| | 28 | Sell | Enable | |
| | 29 | PVOFF | Disable | |
| | 30 | Start Time | 12:00 | |
| | 31 | End Time | 14:00 | |
| | 32 | Target SOC | 20 | % |
| | 33 | INV Power | 15.0 | KW |
| Rule 4 | 34 | Grid Charging | Enable | |
| | 35 | Gen Charging | Disable | |
| | 36 | Sell | Enable | |
| | 37 | PVOFF | Disable | |
| | 38 | Start Time | 14:00 | |
| | 39 | End Time | 18:00 | |
| | 40 | Target SOC | 80 | % |
| | 41 | INV Power | 25.0 | KW |
| Rule 5 | 42 | Grid Charging | Enable | |
| | 43 | Gen Charging | Disable | |
| | 44 | Sell | Enable | |
| | 45 | PVOFF | Disable | |
| | 46 | Start Time | 18:00 | |
| | 47 | End Time | 21:00 | |
| | 48 | Target SOC | 20 | % |

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| | | | | |
|---|---|---|---|---|
| | 49 | INV Power | 0.0 | KW |
| | 50 | Grid Charging | Enable | |
| | 51 | Gen Charging | Disable | |
| | 52 | Sell | Enable | |
| Rule 6 | 53 | PVOFF | Disable | |
| | 54 | Start Time | 21:00 | |
| | 55 | End Time | 00:00 | |
| | 56 | Target SOC | 20 | % |
| | 57 | INV Power | 0.0 | KW |
| Work Mode Setting3 | 58 | Week Of Use | [-1, 1, 2, 4, 8, 16, 32, 64] | |

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End of the test protocol.

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