ONESTEP POWER

DCShortCUT Sample Test Report

OSP-023-ENREP-0108

Client:	Sample
Facility:	Sample
Date:	04 Oct 2023

1. Executive Summary

OneStep Power were invited by CLIENT to perform DCShortCUT testing on *VESSEL*. The following is a summary to provide CLIENT with a brief understanding of the testing performed. OneStep Power's full analysis of test results is contained in this report.

Table 1 - Summary of Results

Location	Result	Comment
I/O Cabinet 01	Pass	Did not exceed WCFDI
I/O Cabinet 02	Pass	Did not exceed WCFDI - unexpected loss of pump XX during Output #3 earth fault test
I/O Cabinet 03	Pass	Did not exceed WCFDI

The vessel was found to have suitable protection arrangements to ensure a fault does not propagate beyond the Worst Case Failure Design Intent after failure of a single 24V cross-connected system.

This report is applicable to *VESSEL* only, and while results may be indicative of the expected results of sister vessels, the results should not be construed as representing the results of other vessels.

Disclaimer

This document, created by OneStep Power Solutions Inc (OneStep Power) is confidential. It has been prepared on behalf of the client mentioned on the cover page ("CLIENT") and is issued pursuant to an agreement between OneStep Power and this client. It has been produced according to the contracted scope of work and is only suitable for use in connection therewith.

All measures and decisions based on this analysis and these findings are the sole responsibility of the client.

OneStep Power does not accept:

- *any liability for the identification, indication or elimination of dangers and non-compliances (in the broadest sense of the word), nor for any damage caused by any of these;*
- *any obligation to report all facts or circumstances established during the visit. This obligation comes completely under the authority and responsibility of the client;*
- *any liability for the client's obligations resulting from (legal) rules and/or statutes;*
- *any liability or responsibility whatsoever in respect of or reliance upon this report by any third party.*

Terms such as "can," "could," "will," "would," "should," etc. are used throughout this report and are included to emphasize importance or likelihood. They are not intended to imply the imperative, or to reflect requirements or regulations unless attached to a specific reference.

The execution of improvements recommended by OneStep Power does not indemnify the client against any legal or contractual obligations and offers no safeguard against the elimination of dangers or damages resulting from the client's products, services, company assets, et cetera.

In no instance should the recommendations provided herein take precedence over applicable Regulation, Flag State, Class Society, manufacturer, established owner / operator protocols or contractual covenants unless specifically discussed and agreed upon with all responsible parties. These recommendations do not take precedence over rules and requirements established by Class Societies, Flag State agencies, and other regulatory bodies.

Record of Amendments

Date	Section	Amendment
1 Jan 21	All	Sample document developed for external distribution
29 Oct 21	All	Updated document for external distribution
4 Oct 23	All	Updated Logos and refreshed text

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2. OneStep Power Solutions Inc.

OneStep Power provides testing and engineering solutions for companies within the offshore dynamic positioning sector. OneStep Power is dedicated to providing high-quality testing systems and solutions to maximize customer satisfaction.

Robust

OneStep Power offers comprehensive system testing and engineering packages designed to comply with class and industry best practice.

Reliable

These solutions are peer-reviewed prior to implementation with a view to completeness, efficiency and compliance.

Repeatable

OneStep Power provides comprehensive programs and utilizes a detailed record keeping and lessons learnt process to ensure testing protocols are maintained for continuity. Our test systems provide a consistent test and a predictable outcome.

At OneStep Power, we believe that the offshore industry is long overdue for a change in the methods and expectations for power system testing and we are dedicated to bringing the industry into a new era of engineered solutions and reliable outcomes.

OneStep Power is a Delaware Corporation.

What to Expect

- Knowledgeable & professional team
- Clear and definitive pass/fail criteria
- A safe solution to voltage dip ride through testing
- Support for remedial action if needed.

3. Project Description

OneStep Power were invited by CLIENT to perform DCShortCUT testing on *FACILITY*. This testing was performed on TEST DATE.

The following cross-connections were tested as part of the program:

- Cabinet #1
- Cabinet #2
- Cabinet #3
- [List all panels here]

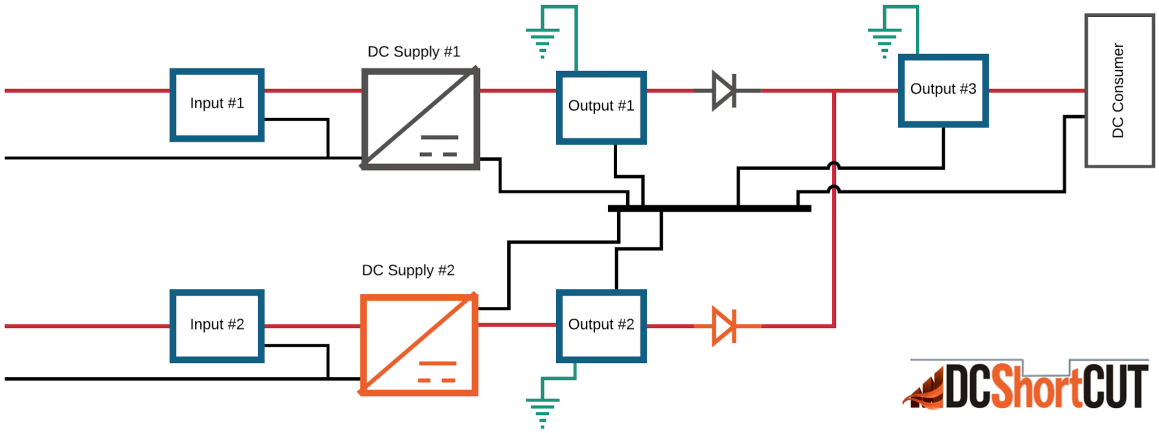
Each cross-connection was subjected to DCShortCUT testing, and the results recorded. Data analysis was performed and results graphed for ease of interpretation. Each test was reviewed against the pre-set acceptance criteria and marked as either “Pass” or “Requires further investigation” or “RFI”. Test results requiring further investigation were flagged for engineering review and further comment on these tests is provided. Where the test results passed the acceptance criteria, no additional comment is provided, and the corresponding test descriptions should be reviewed for more information.

This testing was performed on DATE and the results are included in the appendix for each cabinet.

4. Test Methodology

Using OneStep Power's DC Cross-connection Short Circuit Under Test (DCShortCUT) device, the test technicians completed the pre-agreed Onsite Test Plan (OTP).

The DCShortCUT was connected to the system in following general configuration:



A series of tests were conducted on the system after installation of the DCShortCUT:

1. Load test Output #1
2. Load test Output #1 - Boost mode (if applicable)
3. Load test Output #1 - Overload
4. Load test Output #2
5. Load test Output #2 - Boost mode (if applicable)
6. Load test Output #2 - Overload
7. Load test Output #3
8. Load test Output #3 - Boost mode (if applicable)
9. Load test Output #3 - Overload
10. Earth fault Output #1
11. Earth fault Output #2
12. Earth fault Output #1 & 2
13. Earth fault Output #3
14. Short circuit - positive to negative: Output #1
15. Short circuit - positive to negative: Output #2
16. Short circuit - positive to negative: Output #1 & 2
17. Short circuit - positive to negative: Output #3
18. Short circuit - positive to negative to ground: Output #1
19. Short circuit - positive to negative to ground: Output #2
20. Short circuit - positive to negative to ground: Output #1 & 2
21. Short circuit - positive to negative to ground: Output #3
22. Overvoltage to 120%* Output #1
23. Overvoltage to 120%* Output #2
24. Overvoltage to 120%* Output #3
25. Loss of Power Supply Input #1
26. Loss of Power Supply Input #2

* increase to 130% for arrangements directly connected to a UPS.

After each test the results were analysed by OneStep Power's technician to ensure compliance with the pre-agreed acceptance criteria before progressing to the next test.

5. Test Descriptions

5.1. Load Test Single Power Supply

Aim	DCShortCUT load testing of a single power supply is used to verify: 1. The power supply under test is in good condition and capable of supplying the rated voltage at the rated current. 2. Diodes do not conduct in reverse bias
Acceptance Criteria	1. Input voltages on both power supplies do not vary by more than 5% 2. Input currents on both power supplies are proportional to output power 3. Input current on supply under test does not exceed inrush current rating 4. Output voltage on supply under test does not drop below regulation percentage 5. Output current of supply under test increases to test load 6. Output voltage of supply not under test remains within regulation limits 7. Output current of supply not under test does not increase beyond system load requirements 8. No loss of equipment in normal operation
Method	Apply a load step to the output of the power supply under test. The total load will be a combination of the test load applied and the existing system load.

5.2. Load Test at Diode Output

Aim	DCShortCUT load testing at the diode is used to verify: 1. Diodes conduct in forward bias 2. Voltage drop across the diodes is not excessive 3. Power supplies are producing balanced power output
Acceptance Criteria	1. Input voltages on both power supplies do not vary by more than 5% 2. Input currents on both power supplies are proportional to output power 3. Input current on supply under test does not exceed inrush current rating 4. Output voltage on supply under test does not drop below regulation percentage 5. Output current of supply under test increases to test load 6. Output voltage of supply not under test remains within regulation limits 7. Output current of supply not under test does not increase beyond system load requirements 8. No loss of equipment in normal operation
Method	Apply a load step to the diode output. The total load will be a combination of the test load applied and the existing system load.

5.3. Load Test of Boost Mode Single Power Supply

Aim	DCShortCUT load testing of boost mode is used to verify: 1. Power supply under test operates according to design specifications 2. Diodes do not conduct in reverse bias 3. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input current of supply under test does not exceed inrush current rating 4. Output current of supply under test increases to boost mode for the time specified in the data sheet then the supply enters it's protection mode 5. Loss of equipment connected between power supply and diode module is acceptable 6. No loss of equipment supplied by power supply not under test or diode module
Method	Apply a load step to the output of the power supply under test that is above the rated current but equal to or below the rated boost current.

5.4. Load Test Above Rated Current of Single Power Supply

Aim	DCShortCUT load testing above rated current is used to verify: 1. Power supply under test operates according to design specifications 2. Diodes do not conduct in reverse bias 3. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input current of supply under test does not exceed inrush current rating 4. Output of power supply under test enters protection mode 5. Loss of equipment connected between power supply and diode module is acceptable 6. No loss of equipment supplied by power supply not under test or diode module
Method	Apply a load step to the diode output of the power supply under test that is above the rated nominal or boost mode current. The overcurrent is to be held for a time that is greater than the trip time of the circuit breaker feeding the power supply.

5.5. Short Circuit Positive to Negative of Single Power Supply

Aim	DCShortCUT load testing at the diode is conducted to verify: 1. Power supply under test operates according to design specifications 2. Diodes do not conduct in reverse bias 3. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input current of supply under test does not exceed inrush current rating 4. Output of power supply under test enters protection mode 5. Loss of equipment connected between power supply and diode module is acceptable 6. No loss of equipment supplied by power supply not under test or diode module
Method	Apply a short circuit from the positive to the negative at the output of the power supply under test. The short circuit needs to be applied for a time period that exceeds the trip time of the circuit breaker that feeds the power supply.

5.6. Short Circuit Positive to Negative of Both Power Supplies or Diode Module

Aim	DCShortCUT load testing at the diode is conducted to verify: 1. Power supplies under operate according to design specifications 2. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input currents of both power supplies do not exceed inrush current rating 4. Output of both power supplies enter protection mode 5. Loss of cabinet under test
Method	Apply a short circuit from the positive to the negative at the output of the diode module or at the output terminals of both power supplies. The short circuit needs to be applied for a time period that exceeds the trip time of the circuit breaker that feeds the power supply.

5.7. Earth Fault - Floating System

Note: The negative of a DC system can either be detached from the protective earthing system, referred to as floating, or connected to the protective earth, referred to as a bonded system.

Aim	DCShortCUT earth fault testing of a floating system: 1. Confirm system is floating and DC Negative is not referenced to ground 2. Verification that earth fault alarms are operational if installed 3. No loss of equipment on earth fault
Acceptance Criteria	1. No change to system on application of earth fault 2. Alarm generated if earth fault detection installed
Method	Apply a short circuit from the positive to protective earth at the output of the output terminals of the power supply/ies or diode module under test. The short circuit needs to be applied for a time period that exceeds the alarm register time if an earth fault detection system is installed.

5.8. Earth Fault - Bonded System

Note: The negative of a DC system can either be detached from the protective earthing system, referred to as floating, or connected to the protective earth, referred to as a bonded system.

Aim	DCShortCUT earth fault testing of a floating system: 1. Confirm correct operation of power supply 2. Confirm correct operation of earth fault detection if installed 3. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input current of power supply/ies under test do not exceed inrush current rating 4. Output of power supply/ies under test enter protection mode 5. Loss of equipment up to loss of cabinet 6. No loss that exceeds worst case design intent
Method	Apply a short circuit from the positive to protective earth at the output of the output terminals of the power supply/ies or diode module under test. The short circuit needs to be applied for a time period that exceeds both the alarm register time if an earth fault detection system is installed and the trip time of the circuit breaker that feeds the power supply.

5.9. Short Circuit Positive to Negative to Ground Single Power Supply

Aim	DCShortCUT Short Circuit Positive to Negative to Ground at a single power supply is conducted to verify: 1. Power supply under test operates according to design specifications 2. Diodes do not conduct in reverse bias 3. If installed earth fault alarms operate correctly 4. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input current of supply under test does not exceed inrush current rating 4. Output of power supply under test enters protection mode 5. Output of power supply not under test varies with system load only 6. Loss of equipment connected between power supply and diode module is acceptable 7. No loss of equipment supplied by power supply not under test or diode module
Method	Apply a short circuit from the positive to negative to protective earth at the output terminals of the power supply under test. The short circuit needs to be applied for a time period that exceeds both the alarm register time if an earth fault detection system is installed and the trip time of the circuit breaker that feeds the power supply.

5.10. Short Circuit Positive to Negative to Ground Both Power Supplies or Diode Module

Aim	DCShortCUT Short Circuit Positive to Negative to Ground at two power supplies or at the diode is conducted to verify 1. Power supplies under test operates according to design specifications 2. If installed earth fault alarms operate correctly 3. No loss of equipment that exceeds WCFDI
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Input currents of both power supplies do not exceed inrush current rating 4. Output of both power supplies enter protection mode 5. Loss of cabinet under test
Method	Apply a short circuit from the positive to negative to protective earth at the output terminals of both power supplies or the diode module. The short circuit needs to be applied for a time period that exceeds both the alarm register time if an earth fault detection system is installed and the trip time of the circuit breaker that feeds the power supply.

5.11. Overvoltage Single Power Supply

Aim	DCShortCUT overvoltage at a single power supply is conducted to verify: 1. equipment on the system is capable of withstanding 120% overvoltage if no batteries are connected or 130% in cases where batteries are connected to the system 2. Diodes conduct in forward bias 3. Diodes do not conduct in reverse bias
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Output terminals of power supply under test increases to test voltage 4. Voltage at at output of diodes increases to test voltage 5. Output voltage of power supply not under test remains constant 6. No loss of any equipment
Method	Apply a voltage at either 120% or 130% of nominal at the output terminals of the power supply under test.

5.12. Overvoltage Diode

Aim	DCShortCUT overvoltage at the diode module is conducted to verify: 1. equipment on the system is capable of withstanding 120% overvoltage if no batteries are connected or 130% in cases where batteries are connected to the system 2. Diodes do not conduct in reverse bias
Acceptance Criteria	1. Input voltages of both power supplies do not vary by more than 5% 2. Input currents of both power supplies are proportional to output power 3. Output voltages of both power supplies remain constant 4. Voltage at at output of diodes increases to test voltage 5. No loss of any equipment
Method	Apply a voltage at either 120% or 130% of nominal at the output terminals of the diode module.

5.13. Loss of Single Power Supply

Aim	DCShortCUT loss of supply is conducted to verify that 1. Loss of a single power supply does not exceed WCFDI 2. Diodes do not conduct in reverse bias
Acceptance Criteria	1. Input voltage of power supply not under test does not vary by more than 5% 2. Input current of power supply not under test is proportional to output power 3. Output voltage of power supply not under test remains constant 4. Loss of equipment connected between power supply under test and diode module 5. No loss of equipment after diode module 6. No loss of equipment that exceeds WCFDI
Method	Remove voltage supply to input of power supply under test

5.14. Loss of Two Power Supplies

Aim	DCShortCUT loss of supply is conducted to verify that 1. Loss of both power supplies does not exceed WCFDI
Acceptance Criteria	1. Loss of all equipment in panel under test 2. No loss of equipment that exceeds WCFDI
Method	Remove voltage supply to input of power supplies under test

6. Analysis of Results

Test results are passed through OneStep Power's DCShortCUT Acceptance Criteria algorithm described in section 4 and are considered either a "Pass" or "Requiring further investigation". Those tests which were compliant with all acceptance criteria are attached in the relevant appendices.

The following test results were identified as requiring additional review:

[Description of any tests requiring additional review]

6.1. Alarm logs

OneStep Power's DCShortCUT process included running the VMS alarms from the vessel through an algorithm to match the alarms with their tests. Based on the timestamp of the test, the algorithm collated all alarms for a period 10 seconds prior, until 120 seconds after a test based on the timestamp of the DCShortCUT test. As a result of the speed of alarms in the ICMS and other systems, some alarms may be observed to carry over between tests if tests are performed too rapidly.

As the VMS log was taken in its entirety, there were vessel alarms unrelated to the testing captured in the logs.

7. Further Investigation

[Additional action if required]

No further action is necessary for the tested cross-connections to be considered as meeting the requirements for verifying and validating effective protections are in place to mitigate fault transfer on the cross-connected 24V DC systems.

In no instance should the recommendations provided herein take precedence over applicable Regulation, Flag State, Class Society, manufacturer, established owner / operator protocols or contractual covenants unless specifically discussed and agreed upon with all responsible parties. These recommendations do not take precedence over rules and requirements established by Class Societies, Flag State agencies, and other regulatory bodies.

Terms such as “can,” “could,” “will,” “would,” “should,” etc. are used throughout this report and are included to emphasize importance or likelihood. They are not intended to imply the imperative, or to reflect requirements or regulations unless attached to a specific reference.

8. Conclusion

The DCShortCUT testing performed aboard *VESSEL* on DATE provided qualitative evidence of the vessel's ability to withstand faults on the cross-connected power supplies identified in the vessel's cross-connection analysis. The system was able to protect the vessel power distribution network from these disturbances and faults did not propagate beyond the worst case failure design intent described in the DP FMEA. While some improvements may be possible to ensure a more robust system, the vessel may be considered to have verified and validated effective protections in place to mitigate fault transfer on the cross-connected 24V DC systems.

Appendix 1: Cabinet ID

Cabinet Arrangement

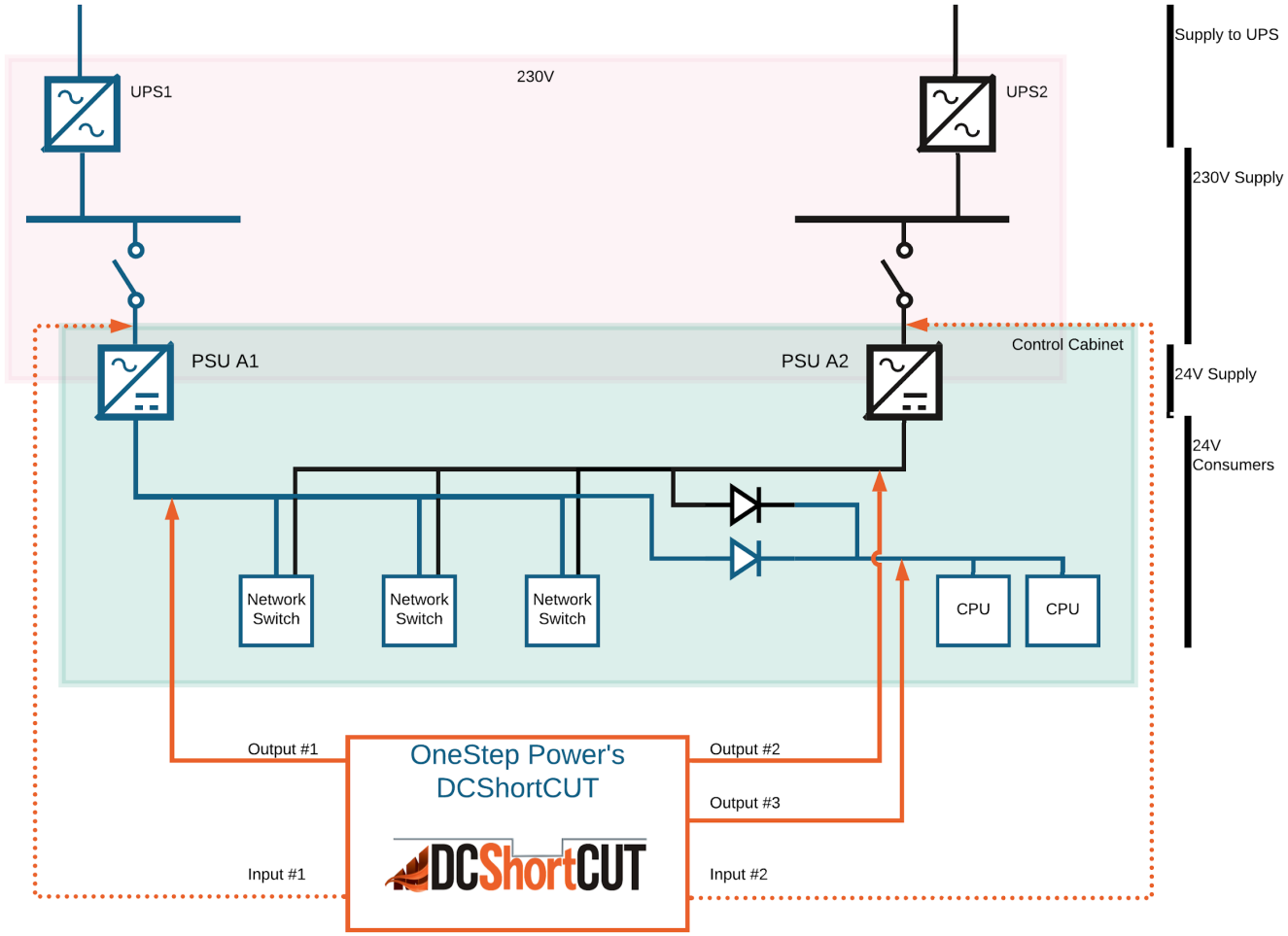


Figure 1. Cabinet #1 Arrangement

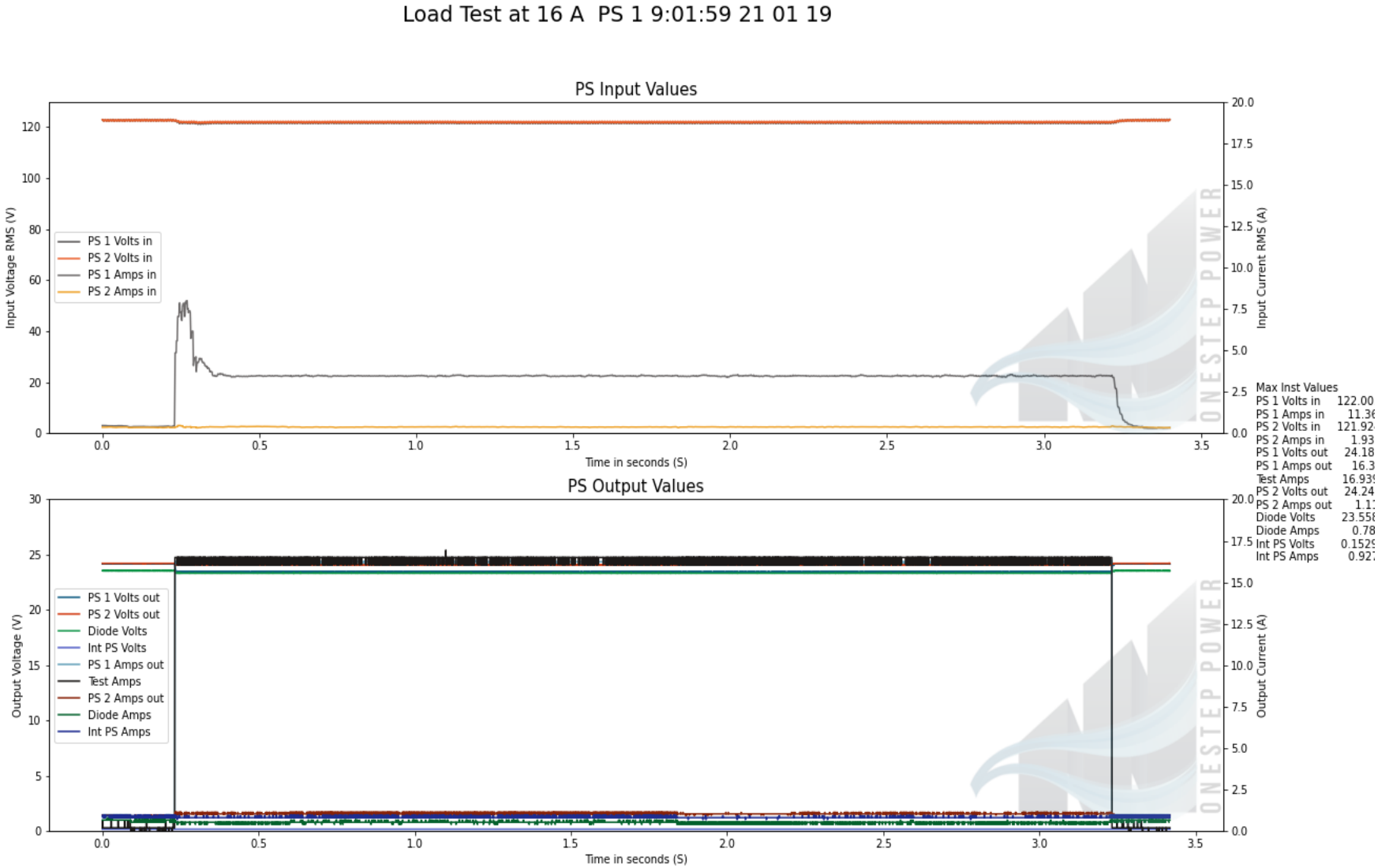
Cabinet Specification

Cabinet ID	Cabinet ID
Power Supply #1 Spec	Quint 20A 220VAC to 24VDC
Power Supply #2 Spec	Quint 20A 220VAC to 24VDC
Protection Module Spec	Individual diodes
Comments	

Testing Summary

Test ID	Result	Comment
16A Load test - Power Supply #1	Pass	
16A Load test - Power Supply #2	Pass	
32A Load test - Protection Module	Pass	
32A Load test - Power Supply #1 Above Rated Current	Pass	
32A Load test - Power Supply #2 Above Rated Current	Pass	
63.5A Load test - Protection Module Above Rated Current	Pass	
Earth Fault - Floating System - Power Supply #1	Pass	
Earth Fault - Floating System - Power Supply #2	Pass	
Earth Fault - Floating System - Protection Module	Pass	
Earth Fault - Floating System - Power Supply #1 & #2 Simultaneously	Pass	
Short Circuit - Positive to Negative - Power Supply #1	Pass	
Short Circuit - Positive to Negative - Power Supply #2	Pass	

Short Circuit - Positive to Negative - Protection Module	Pass	
Short Circuit - Positive to Negative - Power Supply #1 & #2 Simultaneously	Pass	
Short Circuit - Positive to Negative to Ground - Power Supply #1	Pass	
Short Circuit - Positive to Negative to Ground - Power Supply #2	Pass	
Short Circuit - Positive to Negative to Ground - Protection Module	Pass	
Short Circuit - Positive to Negative to Ground - Power Supply #1 & #2 Simultaneously	Pass	
120% Overvoltage - Power Supply #1	Pass	
120% Overvoltage - Power Supply #2	Pass	
120% Overvoltage - Protection Module	Pass	
Loss of power supply - Power Supply #1	Pass	
Loss of power supply - Power Supply #2	Pass	
Loss of power supply - Power Supply #1 & #2 Simultaneously	Pass	


Load Test at 16 A PS 1 9:01:59 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.00
PS 1 Amps in 11.36
PS 2 Volts in 121.92
PS 2 Amps in 1.93
PS 1 Volts out 24.18
PS 1 Amps out 16.3
Test Amps 16.93
PS 2 Volts out 24.24
PS 2 Amps out 1.1
Diode Volts 23.55
Diode Amps 0.78
Int PS Volts 0.152
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
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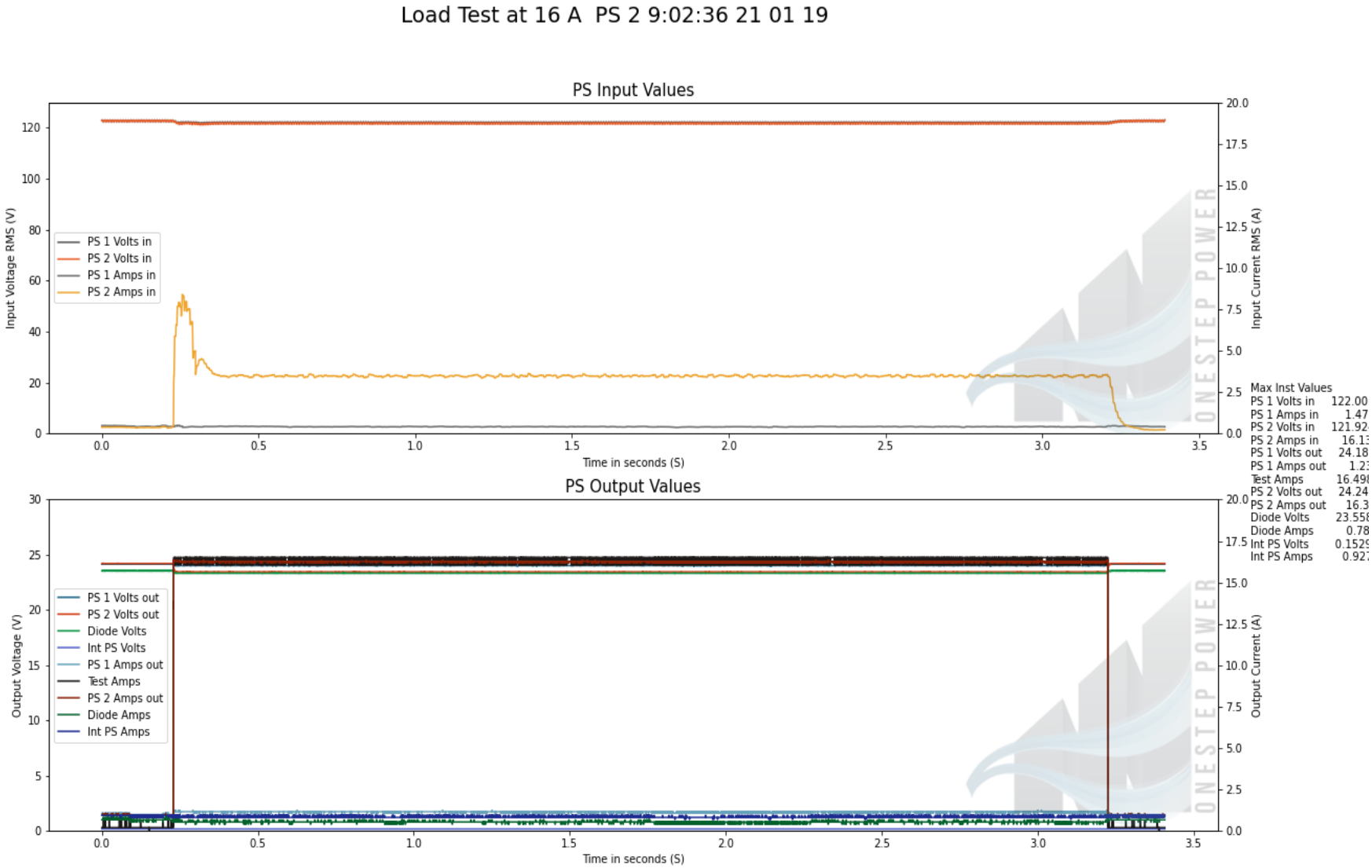
SAMPLE ONLY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PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
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PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.00
PS 1 Amps in 1.47
PS 2 Volts in 121.92
PS 2 Amps in 16.13
PS 1 Volts out 24.18
PS 1 Amps out 1.23
Test Amps 16.49
PS 2 Volts out 24.24
PS 2 Amps out 16.3
Diode Volts 23.55
Diode Amps 0.78
Int PS Volts 0.152
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
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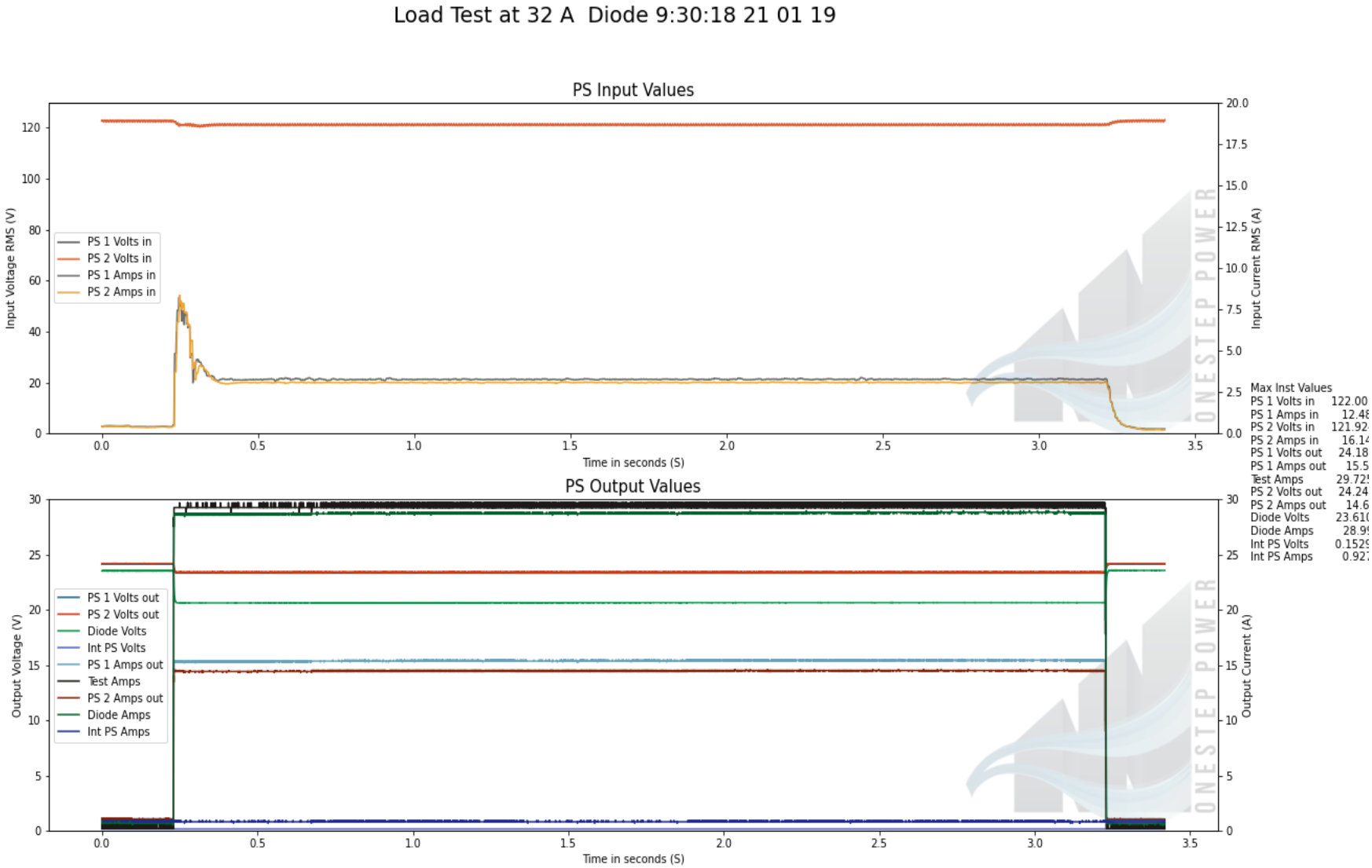
SAMPLE ONLY


Load Test at 32 A Diode 9:30:18 21 01 19
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Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
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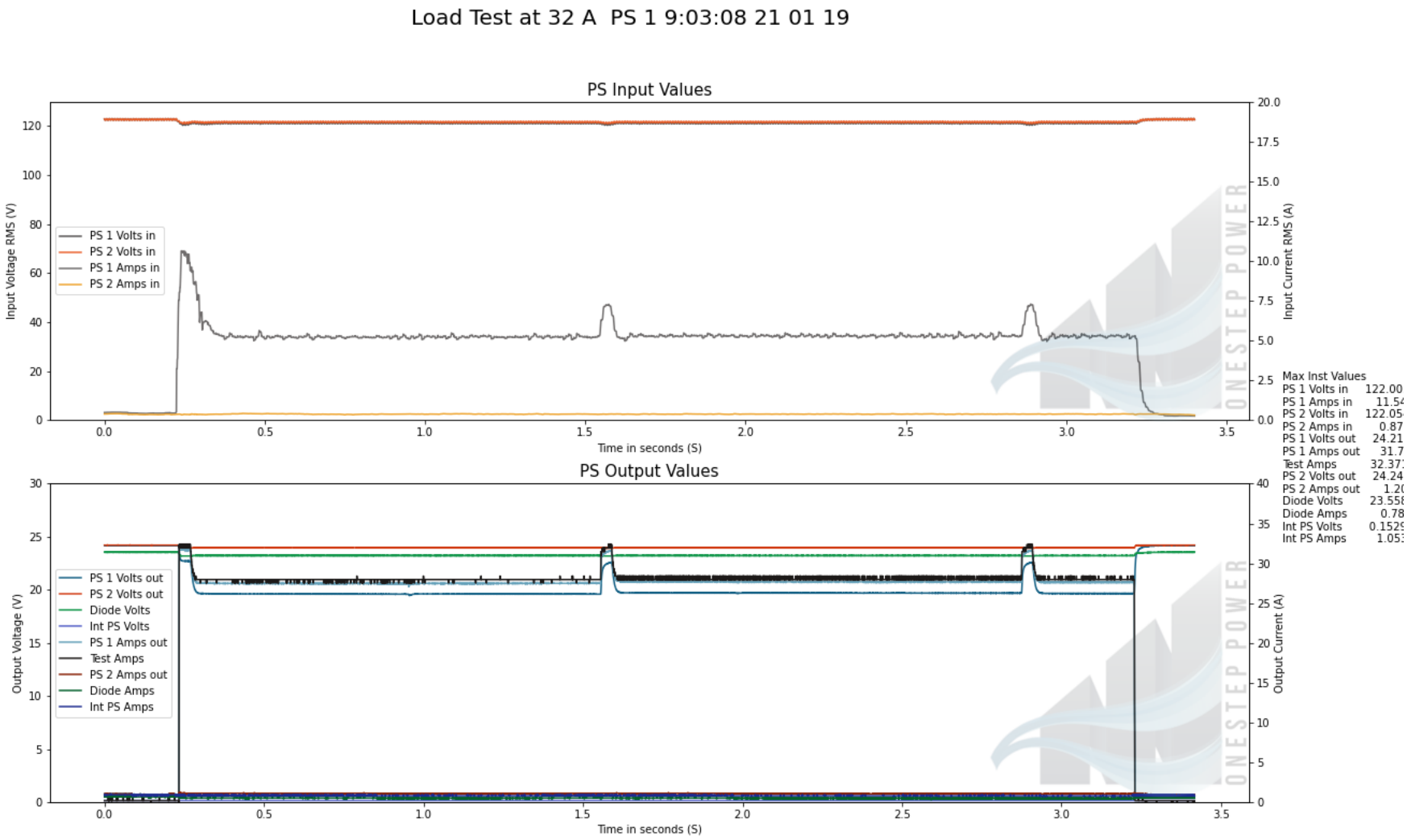
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.00
PS 1 Amps in 12.48
PS 2 Volts in 121.92
PS 2 Amps in 16.14
PS 1 Volts out 24.18
PS 1 Amps out 15.5
Test Amps 29.72
PS 2 Volts out 24.24
PS 2 Amps out 14.6
Diode Volts 23.61
Diode Amps 28.9
Int PS Volts 0.152
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

SAMPLE ONLY


Load Test at 32 A PS 1 9:03:08 21 01 19
PS Input Values
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Input Current RMS (A)
Time in seconds (S)
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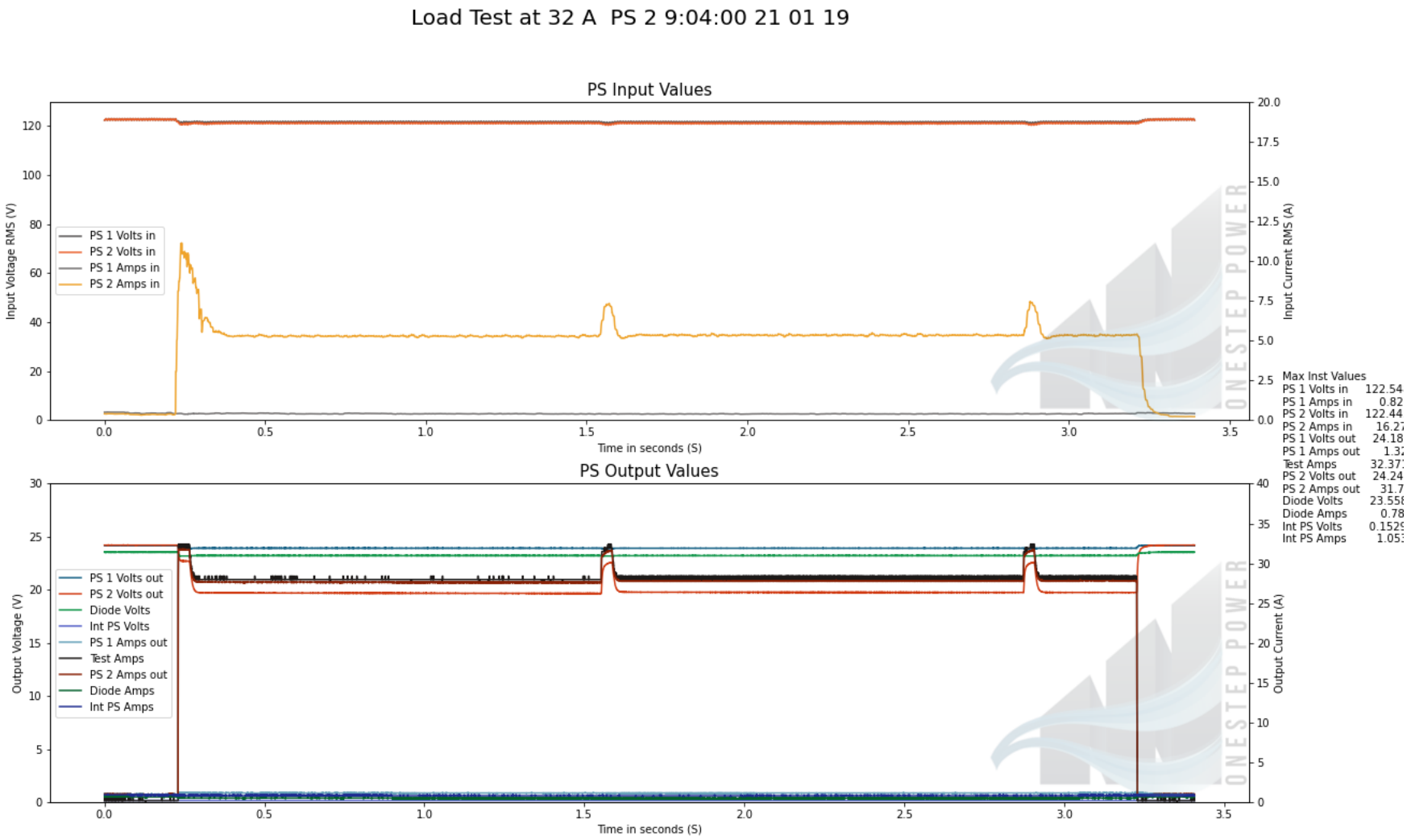
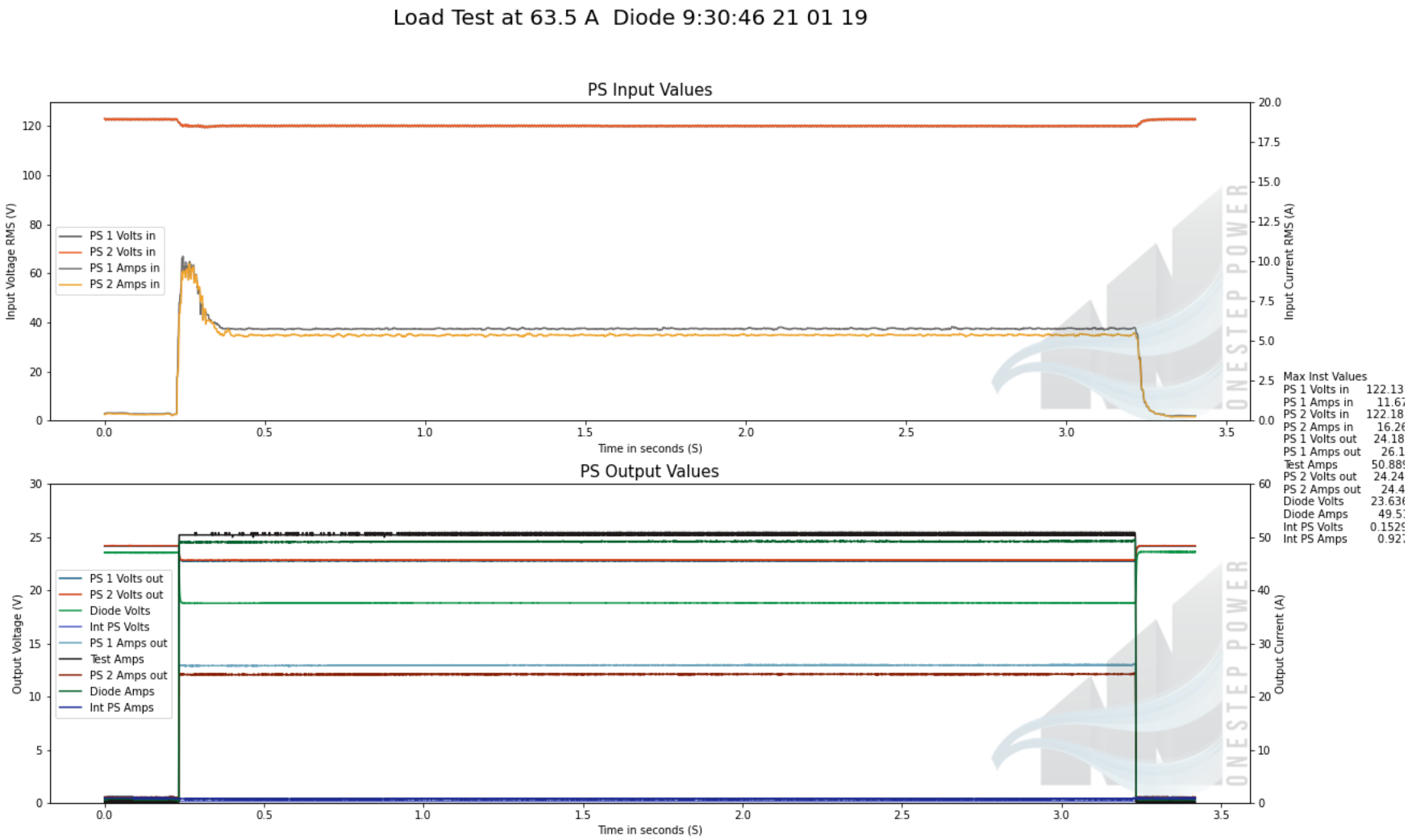
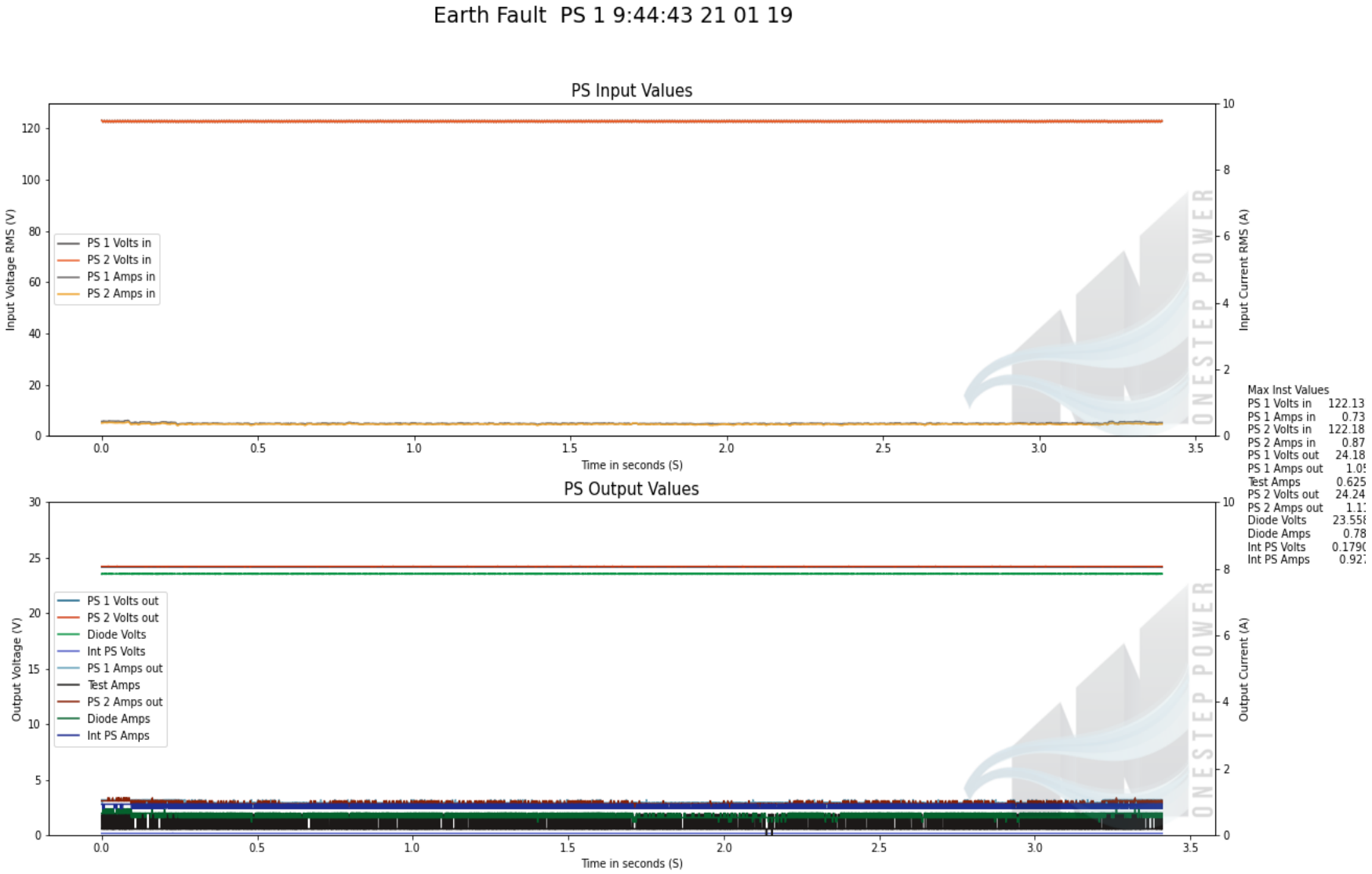
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.00
PS 1 Amps in 11.54
PS 2 Volts in 122.05
PS 2 Amps in 0.87
PS 1 Volts out 24.21
PS 1 Amps out 31.7
Test Amps 32.37
PS 2 Volts out 24.24
PS 2 Amps out 1.20
Diode Volts 23.558
Diode Amps 0.78
Int PS Volts 0.1529
Int PS Amps 1.053
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

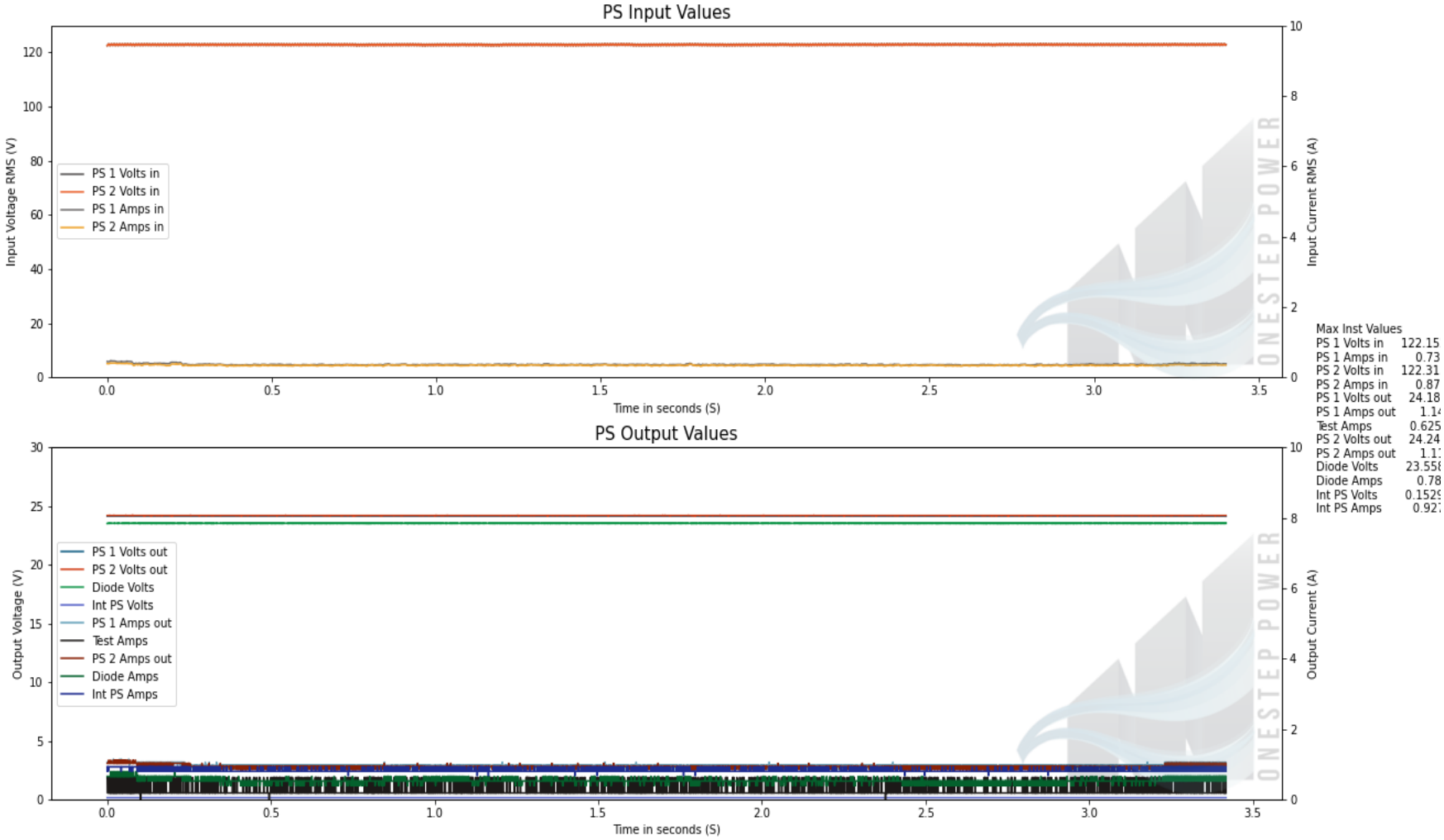

Load Test at 32 A PS 2 9:04:00 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.54
PS 1 Amps in 0.82
PS 2 Volts in 122.44
PS 2 Amps in 16.2
PS 1 Volts out 24.18
PS 1 Amps out 1.3
Test Amps 32.37
PS 2 Volts out 24.24
PS 2 Amps out 31.7
Diode Volts 23.55
Diode Amps 0.78
Int PS Volts 0.152
Int PS Amps 1.05
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER

SAMPLE ONLY

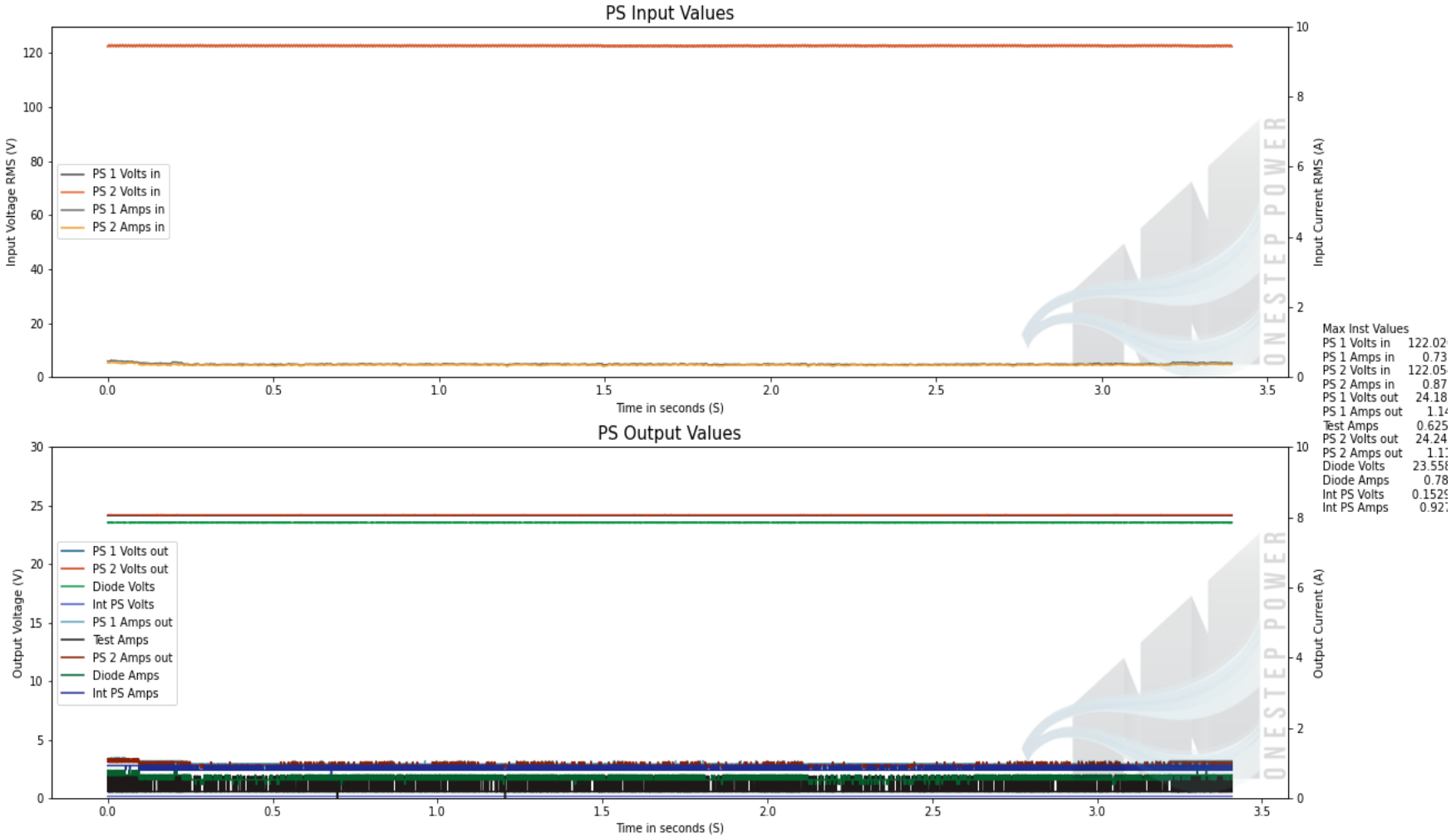

Load Test at 63.5 A Diode 9:30:46 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.13
PS 1 Amps in 11.67
PS 2 Volts in 122.18
PS 2 Amps in 16.26
PS 1 Volts out 24.18
PS 1 Amps out 26.1
Test Amps 50.88
PS 2 Volts out 24.24
PS 2 Amps out 24.4
Diode Volts 23.63
Diode Amps 49.5
Int PS Volts 0.152
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

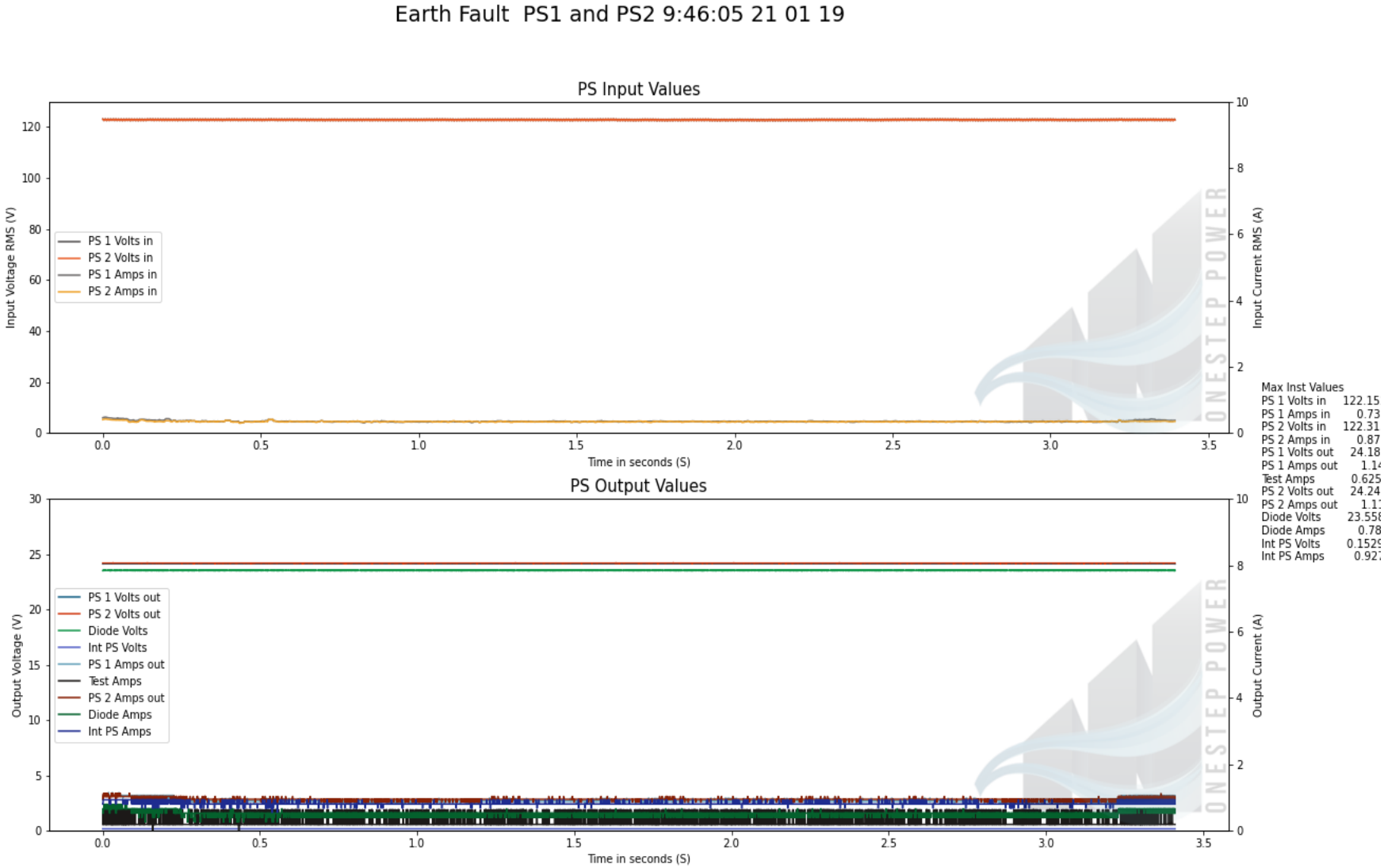

Earth Fault PS 1 9:44:43 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.13
PS 1 Amps in 0.73
PS 2 Volts in 122.18
PS 2 Amps in 0.87
PS 1 Volts out 24.18
PS 1 Amps out 1.05
Test Amps 0.625
PS 2 Volts out 24.24
PS 2 Amps out 1.1
Diode Volts 23.558
Diode Amps 0.78
Int PS Volts 0.179
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

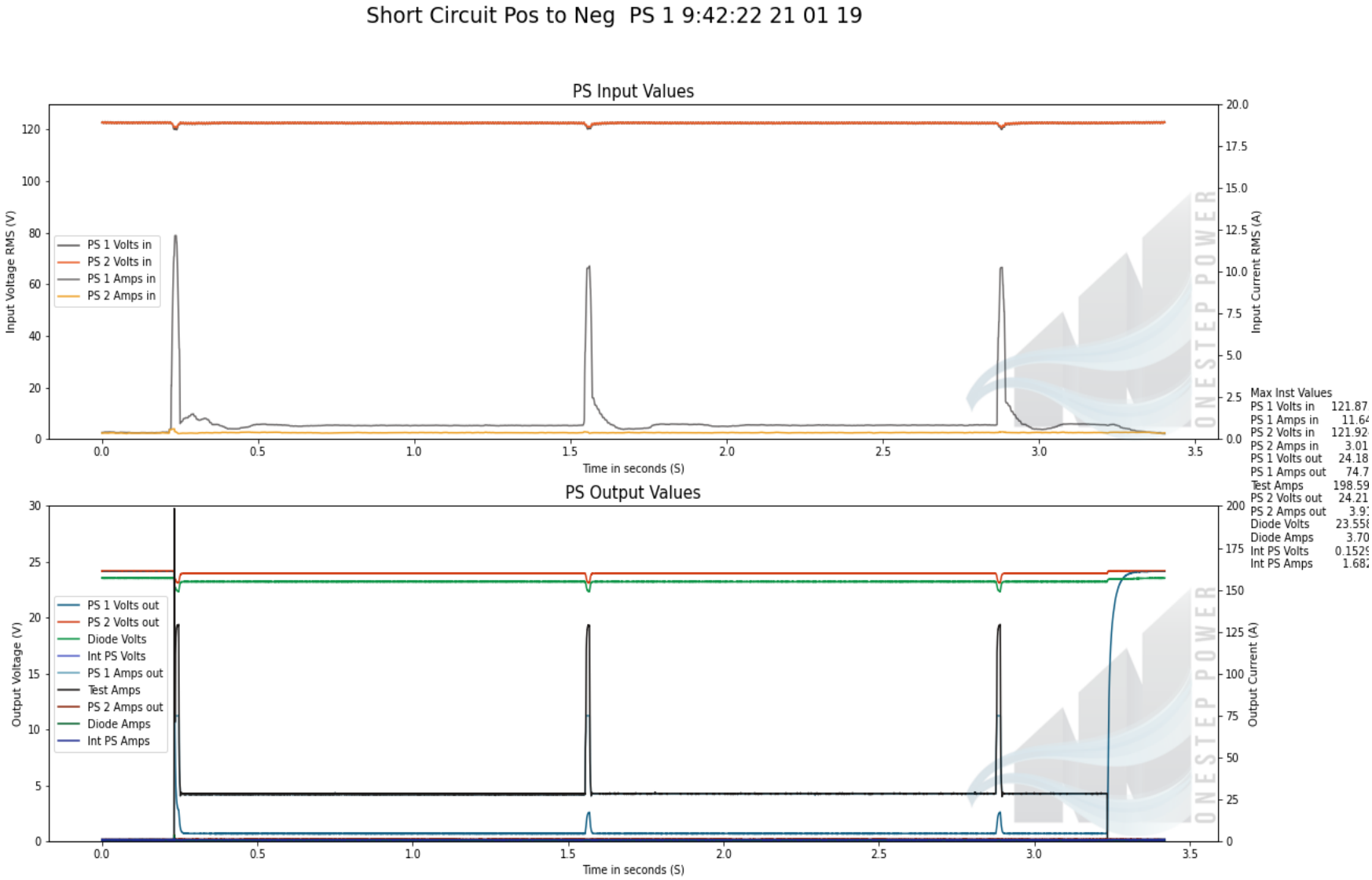
Earth Fault PS 2 9:45:08 21 01 19

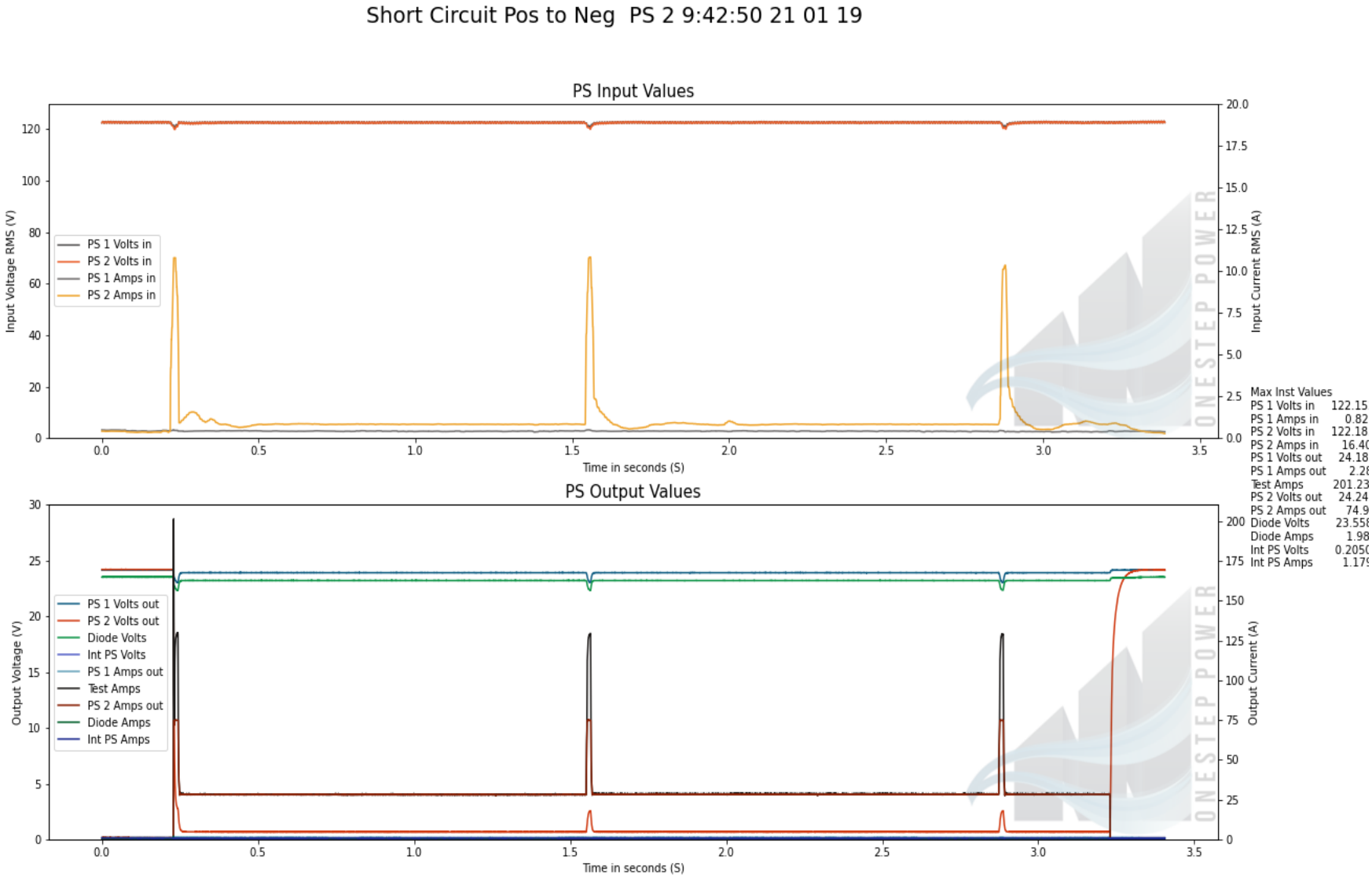


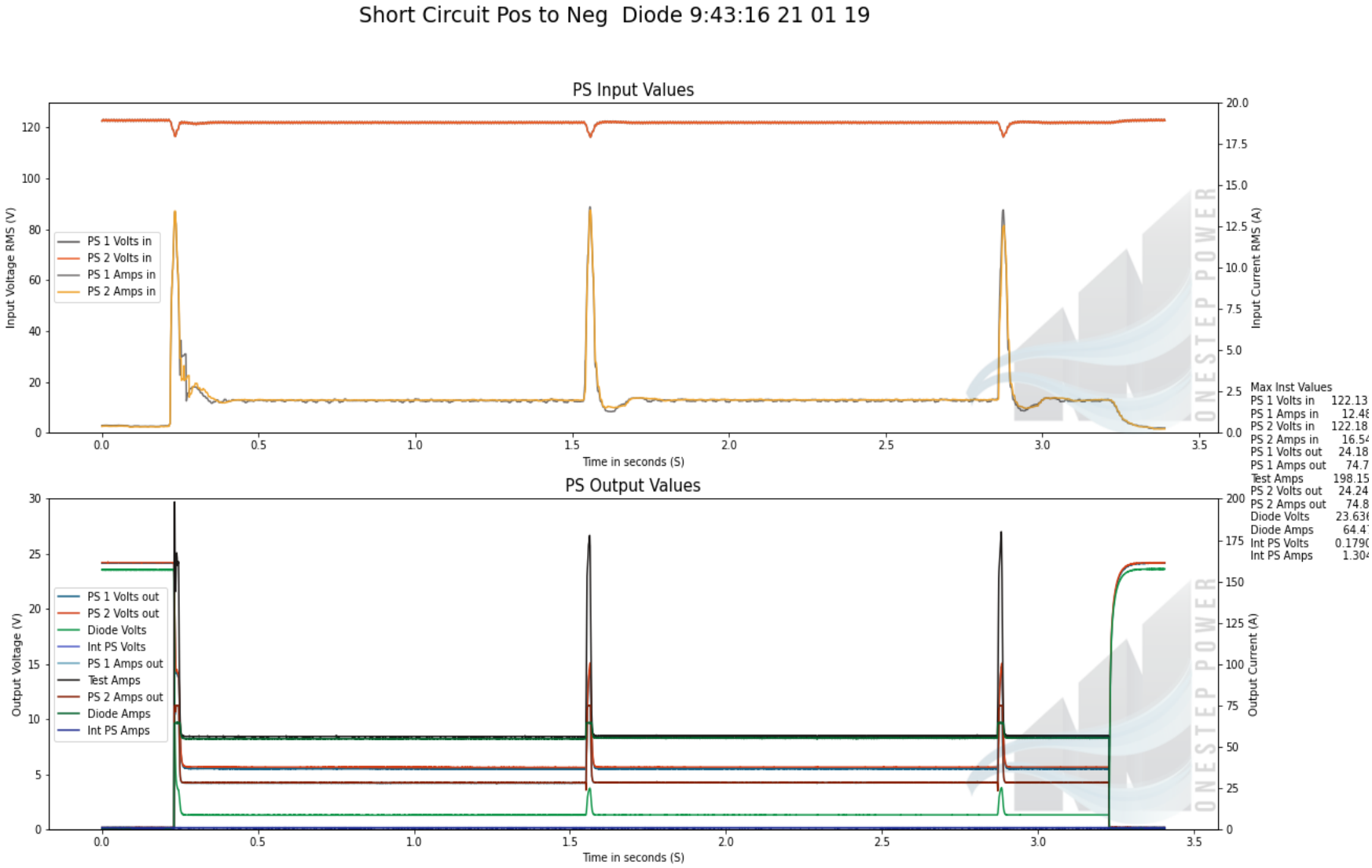
Earth Fault Diode 9:45:37 21 01 19



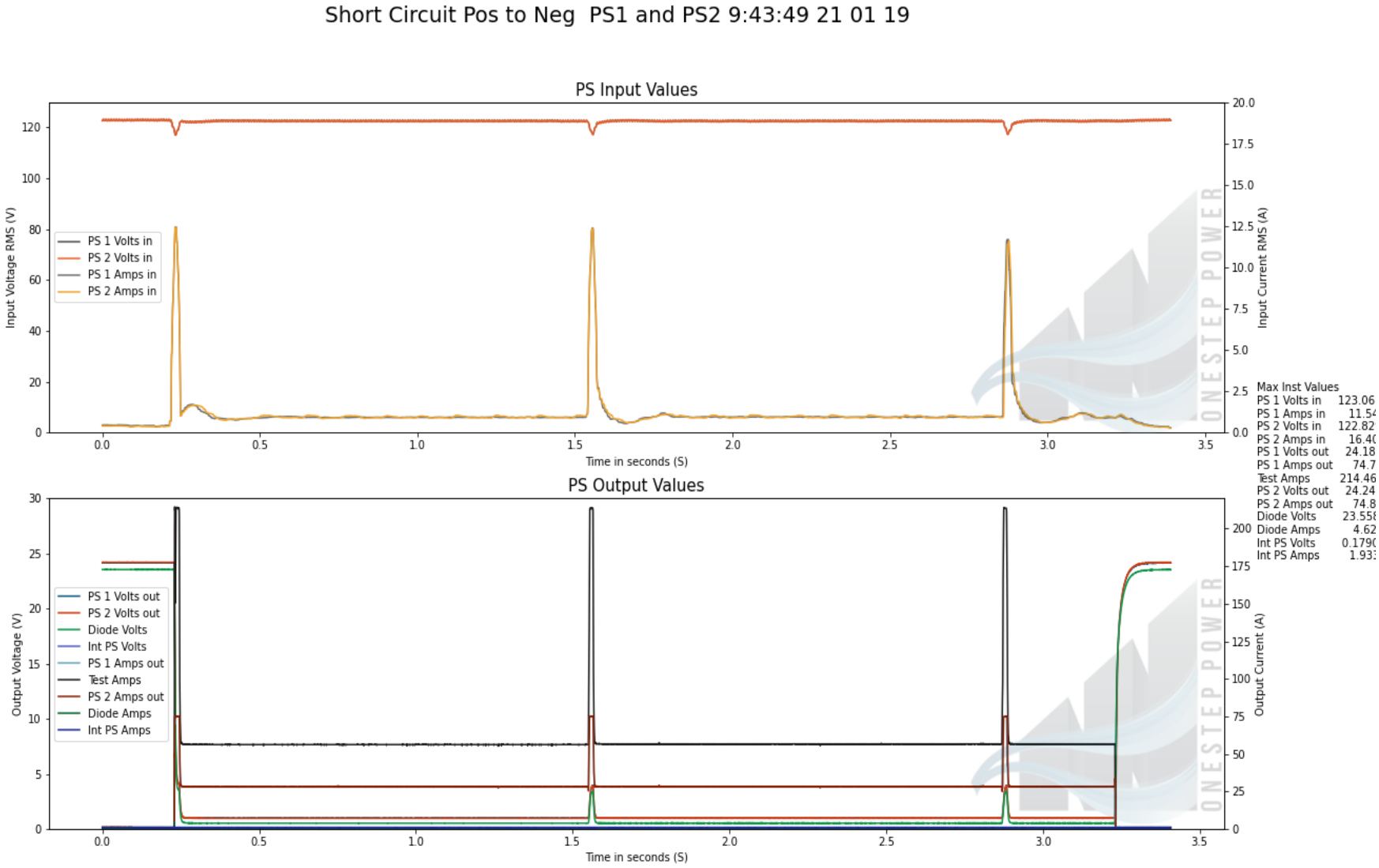

Earth Fault PS1 and PS2 9:46:05 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.15
PS 1 Amps in 0.73
PS 2 Volts in 122.31
PS 2 Amps in 0.87
PS 1 Volts out 24.18
PS 1 Amps out 1.14
Test Amps 0.625
PS 2 Volts out 24.24
PS 2 Amps out 1.1
Diode Volts 23.55
Diode Amps 0.78
Int PS Volts 0.152
Int PS Amps 0.92
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

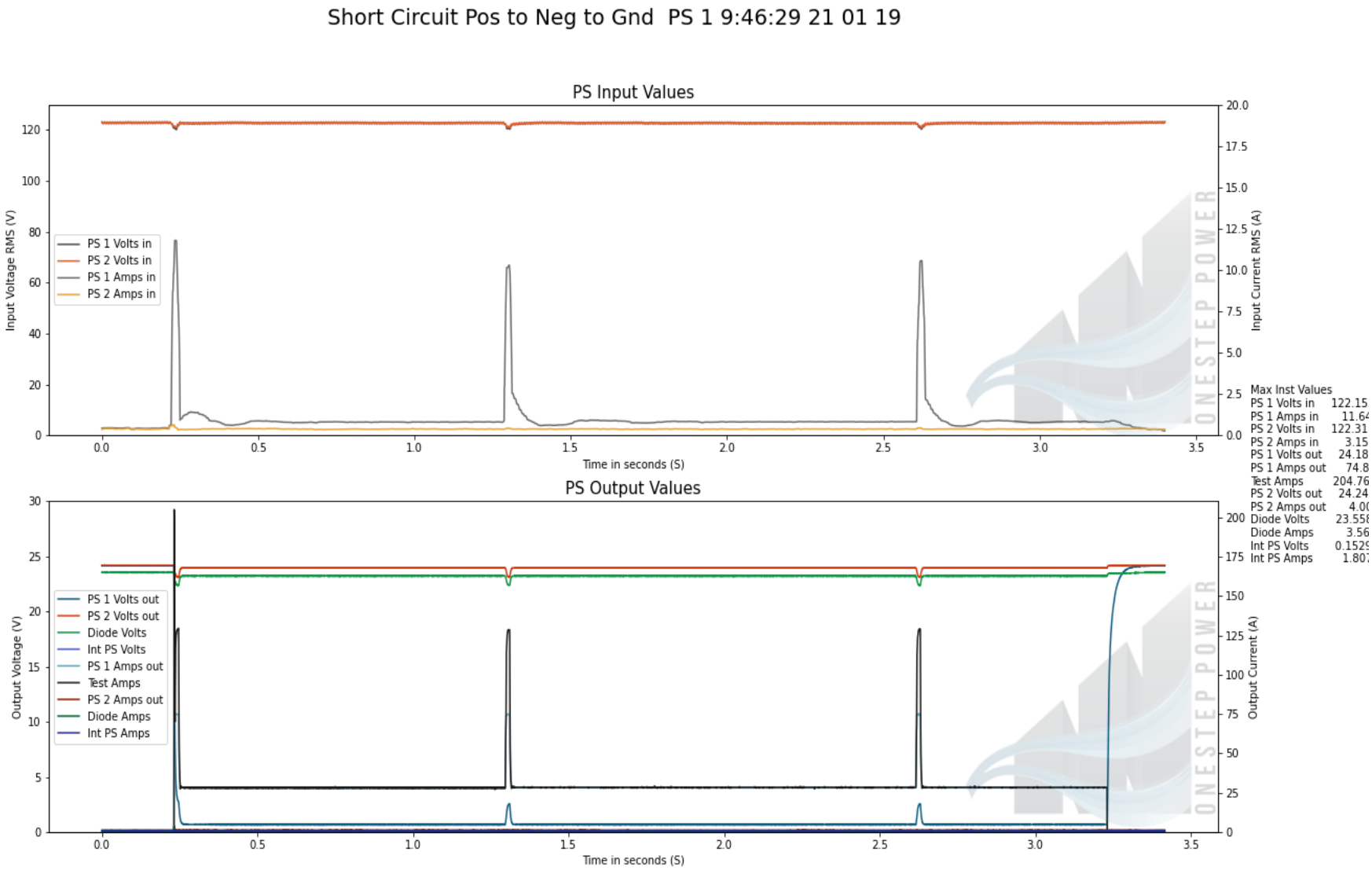

Short Circuit Pos to Neg PS 1 9:42:22 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Time in seconds (S)
Max Inst Values
PS 1 Volts in 121.87
PS 1 Amps in 11.64
PS 2 Volts in 121.92
PS 2 Amps in 3.01
PS 1 Volts out 24.18
PS 1 Amps out 74.7
Test Amps 198.59
PS 2 Volts out 24.21
PS 2 Amps out 3.9
Diode Volts 23.558
Diode Amps 3.70
Int PS Volts 0.1529
Int PS Amps 1.682
PS Output Values
Output Voltage (V)
Output Current (A)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
Time in seconds (S)
ONESTEP POWER

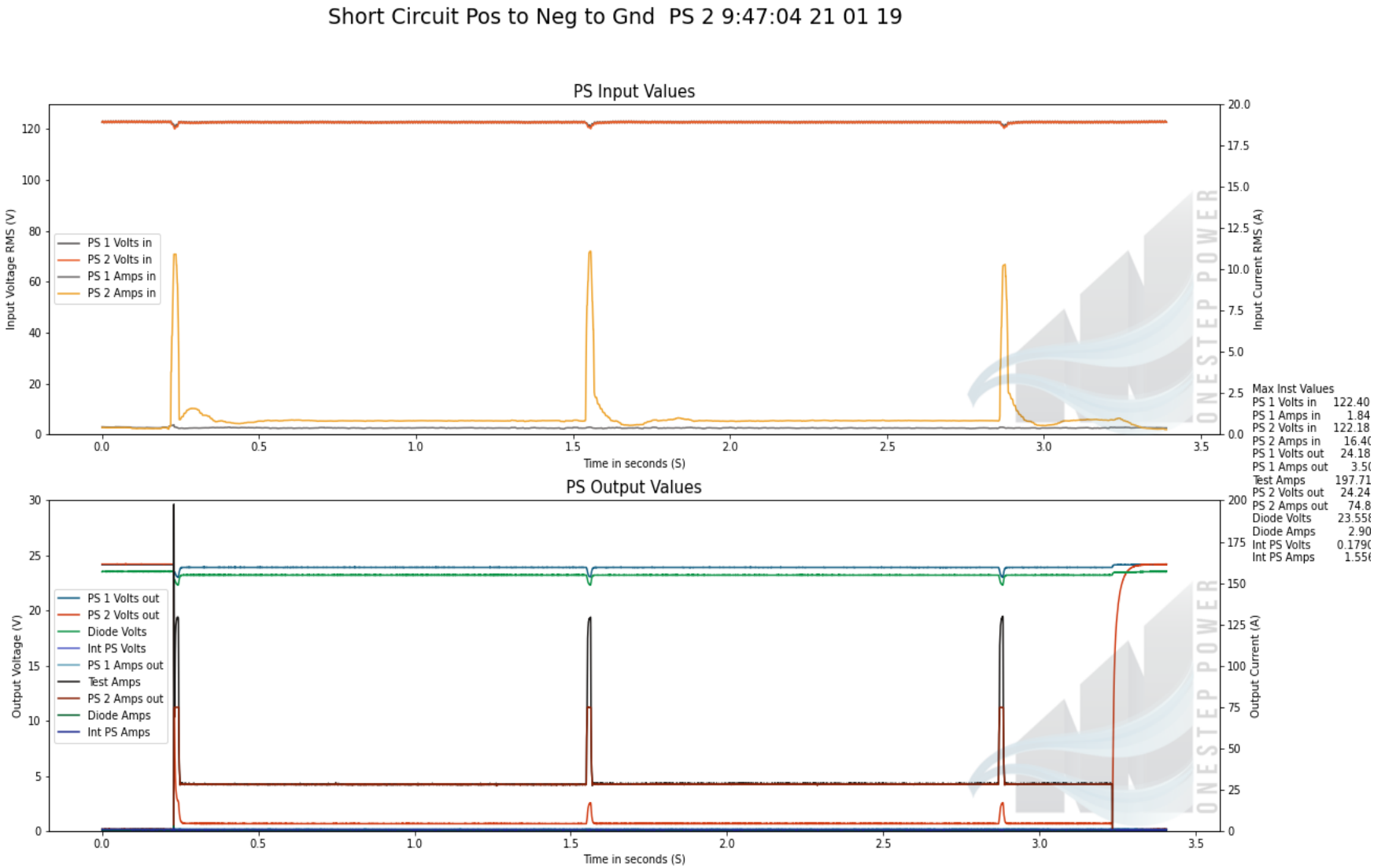

Short Circuit Pos to Neg PS 2 9:42:50 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
PS Output Values
Output Voltage (V)
Output Current (A)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
Max Inst Values
PS 1 Volts in 122.15
PS 1 Amps in 0.82
PS 2 Volts in 122.18
PS 2 Amps in 16.4
PS 1 Volts out 24.18
PS 1 Amps out 2.2
Test Amps 201.23
PS 2 Volts out 24.24
PS 2 Amps out 74.9
Diode Volts 23.55
Diode Amps 1.98
Int PS Volts 0.205
Int PS Amps 1.17

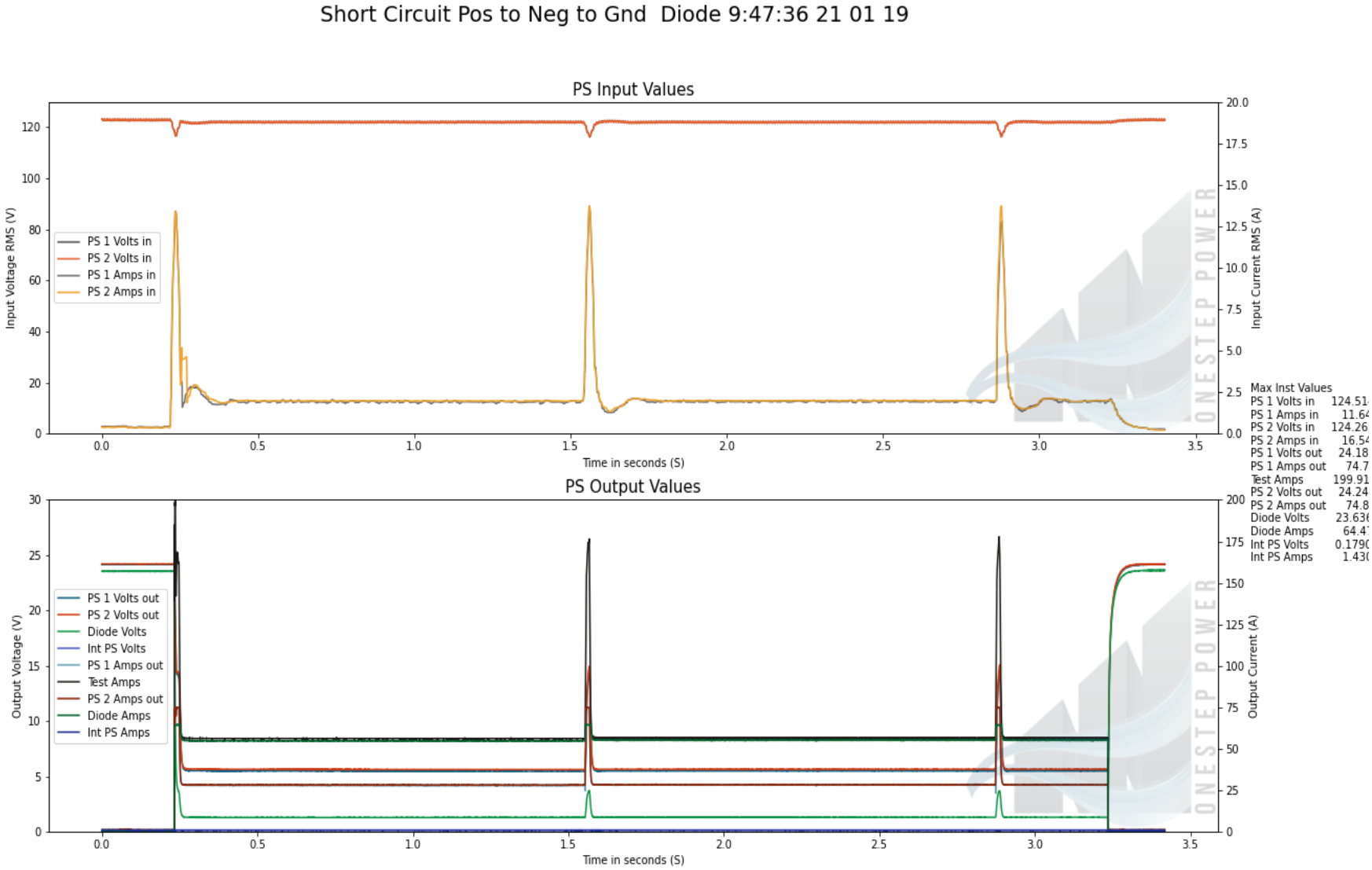

Short Circuit Pos to Neg Diode 9:43:16 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.13
PS 1 Amps in 12.48
PS 2 Volts in 122.18
PS 2 Amps in 16.54
PS 1 Volts out 24.18
PS 1 Amps out 74.7
Test Amps 198.15
PS 2 Volts out 24.24
PS 2 Amps out 74.8
Diode Volts 23.63
Diode Amps 64.4
Int PS Volts 0.179
Int PS Amps 1.304
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER

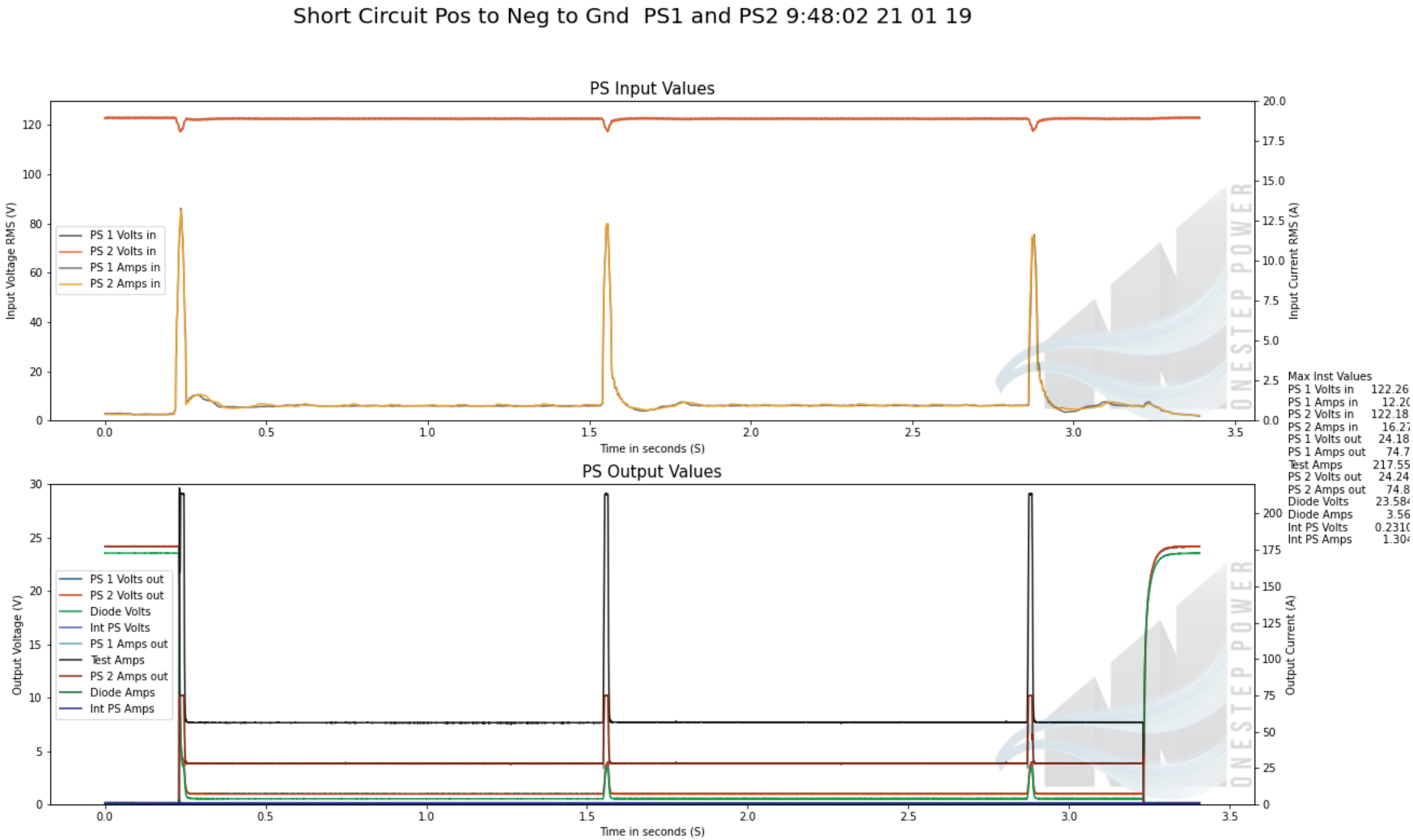
SAMPLE ONLY


Short Circuit Pos to Neg PS1 and PS2 9:43:49 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 123.06
PS 1 Amps in 11.54
PS 2 Volts in 122.82
PS 2 Amps in 16.4
PS 1 Volts out 24.18
PS 1 Amps out 74.7
Test Amps 214.46
PS 2 Volts out 24.24
PS 2 Amps out 74.8
Diode Volts 23.55
Diode Amps 4.62
Int PS Volts 0.179
Int PS Amps 1.93
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER

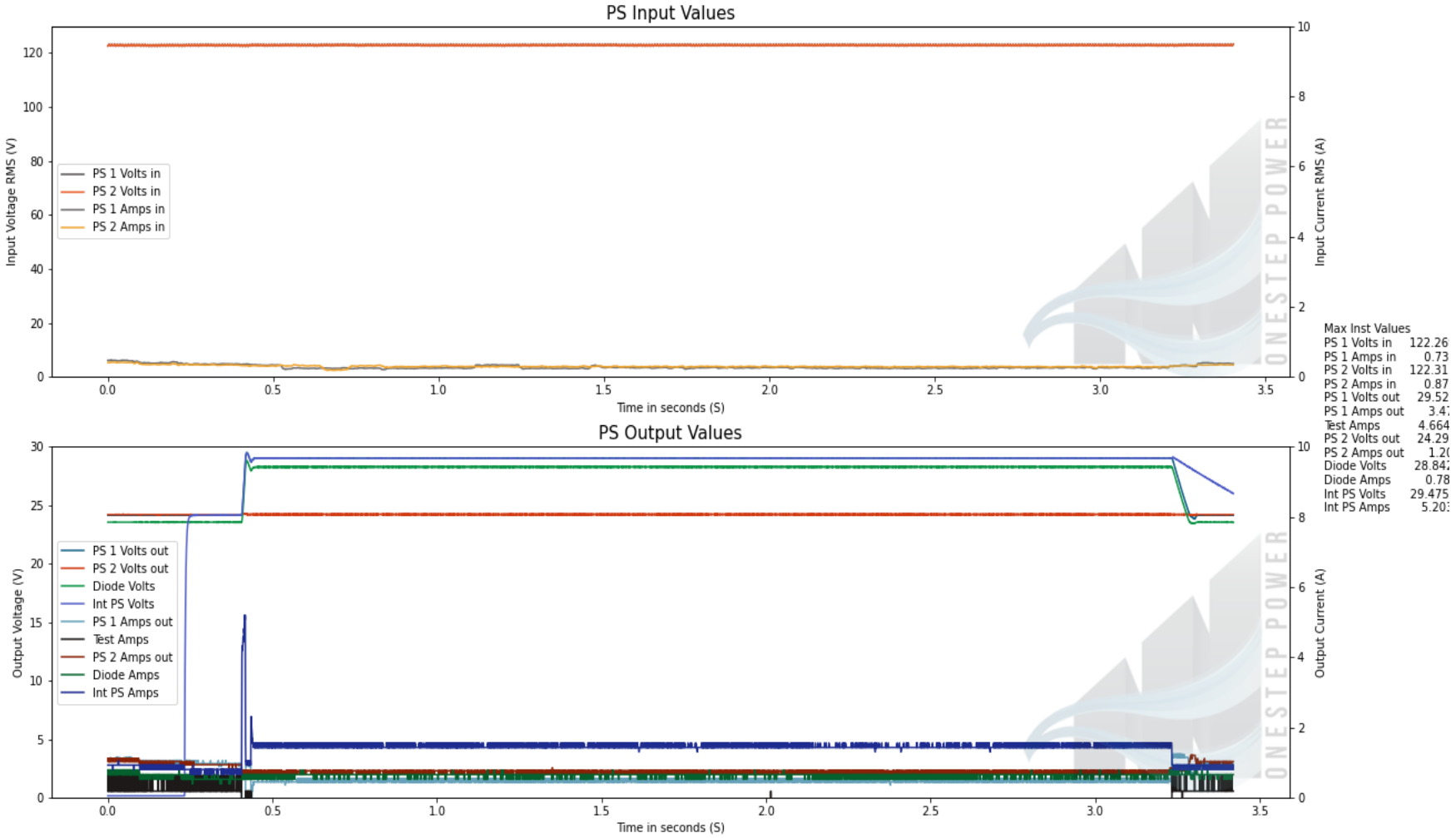

Short Circuit Pos to Neg to Gnd PS 1 9:46:29 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.15
PS 1 Amps in 11.64
PS 2 Volts in 122.31
PS 2 Amps in 3.15
PS 1 Volts out 24.18
PS 1 Amps out 74.8
Test Amps 204.76
PS 2 Volts out 24.24
PS 2 Amps out 4.0(
Diode Volts 23.55(
Diode Amps 3.56
Int PS Volts 0.152(
Int PS Amps 1.80(
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps


Short Circuit Pos to Neg to Gnd PS 2 9:47:04 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Time in seconds (S)
Max Inst Values
PS 1 Volts in 122.40
PS 1 Amps in 1.84
PS 2 Volts in 122.18
PS 2 Amps in 16.4(
PS 1 Volts out 24.18
PS 1 Amps out 3.5(
Test Amps 197.71
PS 2 Volts out 24.24
PS 2 Amps out 74.8
Diode Volts 23.55(
Diode Amps 2.90
Int PS Volts 0.179(
Int PS Amps 1.55(
PS Output Values
Output Voltage (V)
Output Current (A)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
Time in seconds (S)

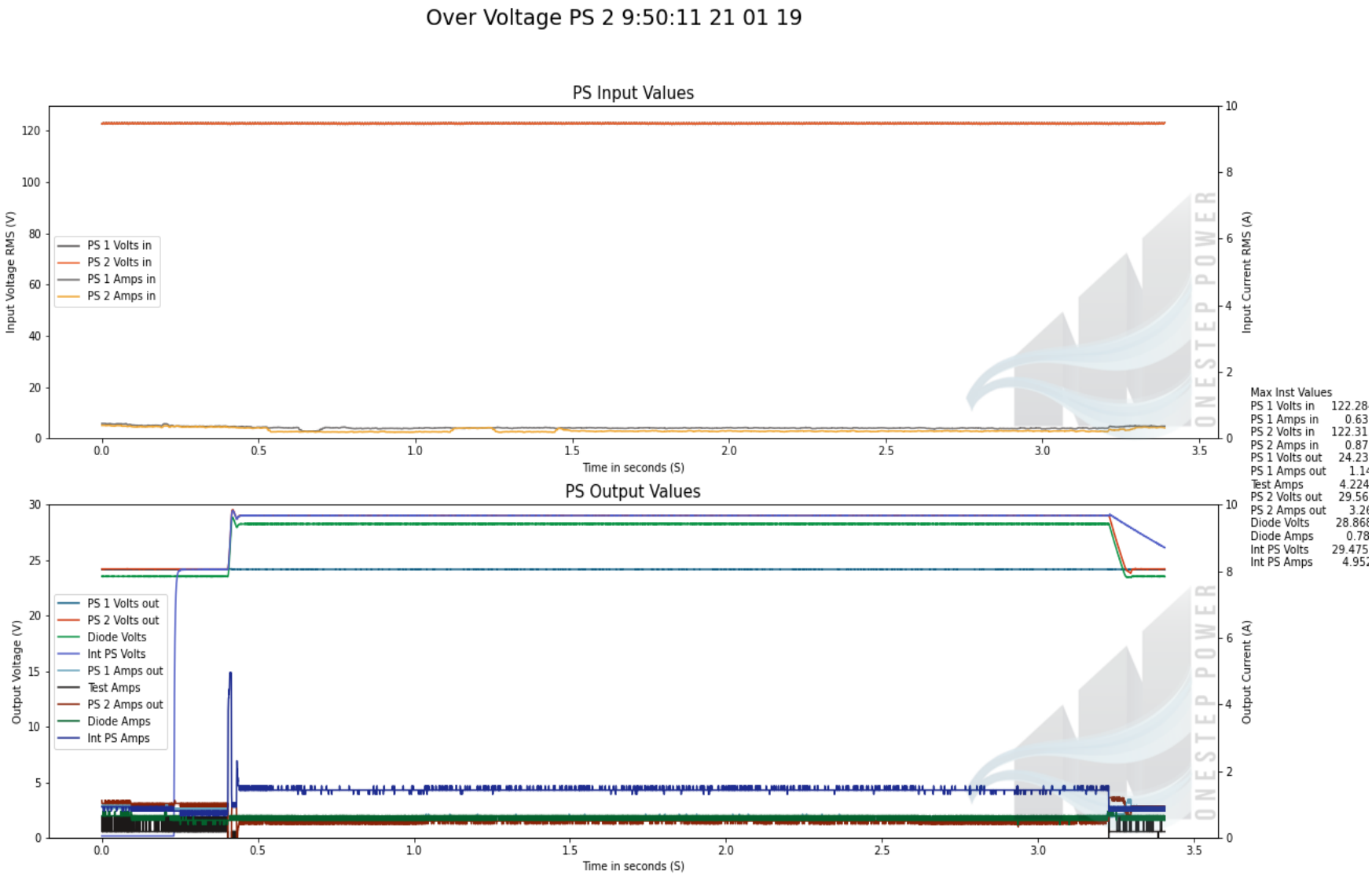

Short Circuit Pos to Neg to Gnd Diode 9:47:36 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 124.51
PS 1 Amps in 11.64
PS 2 Volts in 124.26
PS 2 Amps in 16.54
PS 1 Volts out 24.18
PS 1 Amps out 74.7
Test Amps 199.91
PS 2 Volts out 24.24
PS 2 Amps out 74.8
Diode Volts 23.63
Diode Amps 64.4
Int PS Volts 0.179
Int PS Amps 1.43
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps

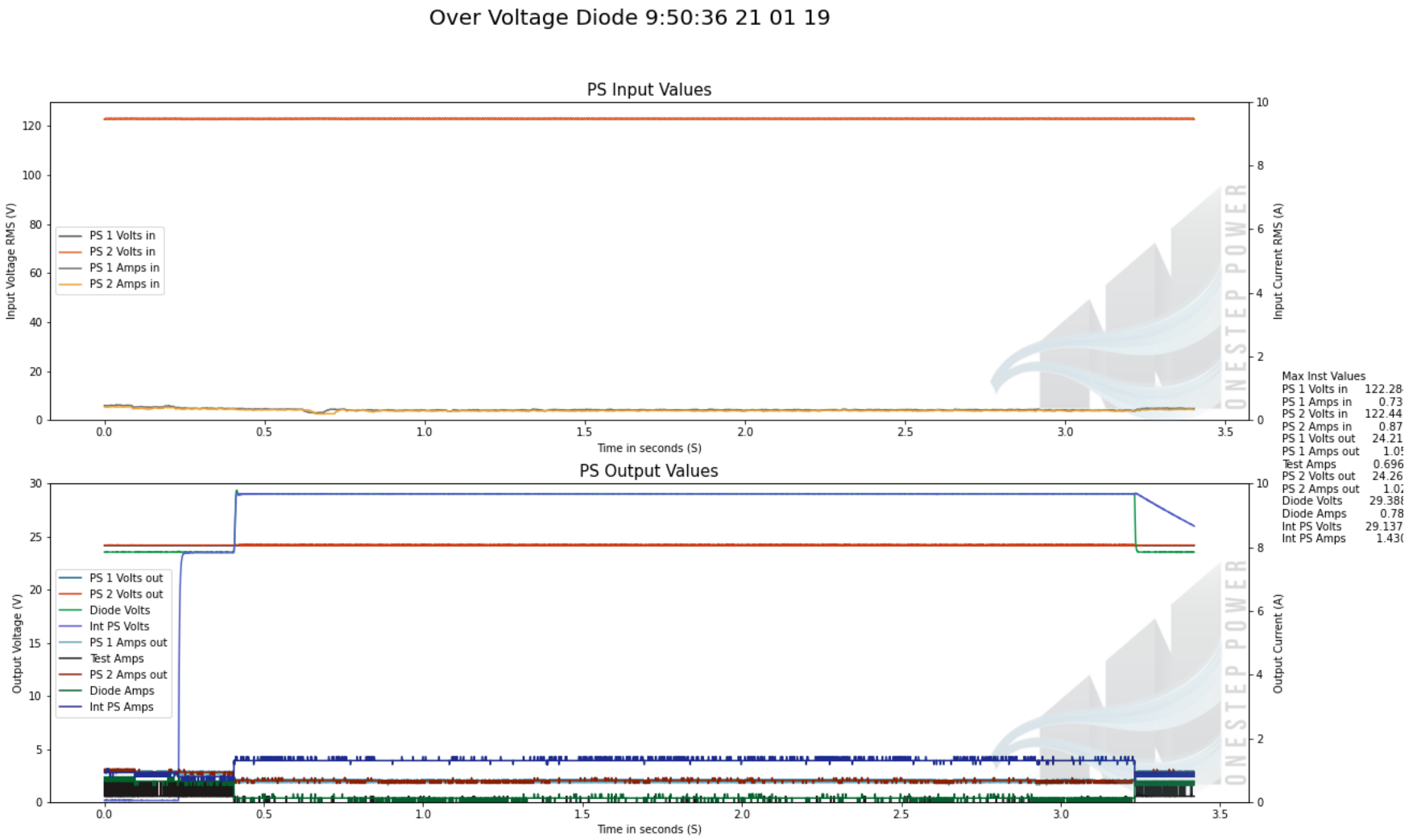

Short Circuit Pos to Neg to Gnd PS1 and PS2 9:48:02 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Time in seconds (S)
Max Inst Values
PS 1 Volts in 122.26
PS 1 Amps in 12.2
PS 2 Volts in 122.18
PS 2 Amps in 16.2
PS 1 Volts out 24.18
PS 1 Amps out 74.7
Test Amps 217.55
PS 2 Volts out 24.24
PS 2 Amps out 74.8
Diode Volts 23.58
Diode Amps 3.56
Int PS Volts 0.231
Int PS Amps 1.30
PS Output Values
Output Voltage (V)
Output Current (A)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
Time in seconds (S)
ONESTEP POWER

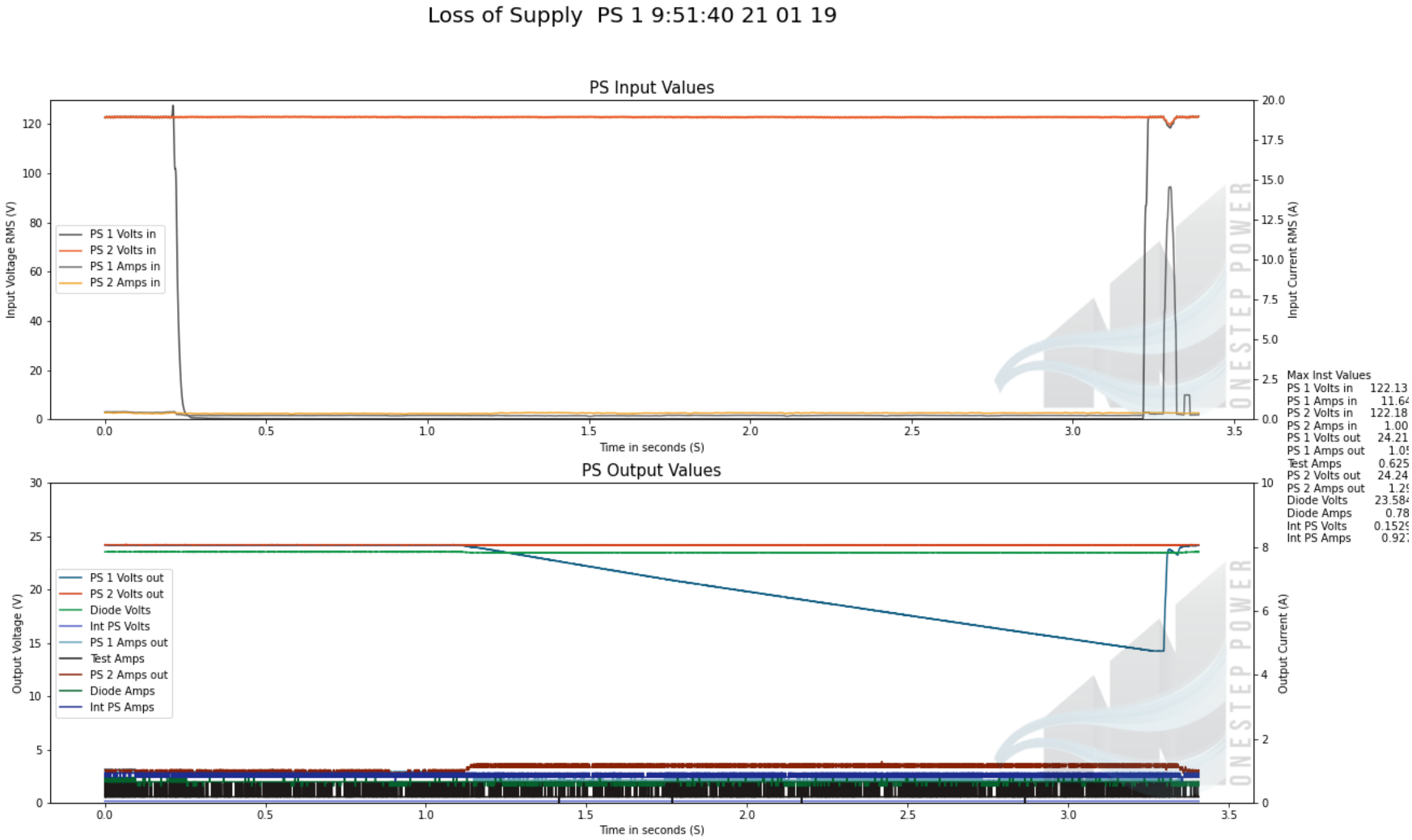
Over Voltage PS 1 9:48:55 21 01 19

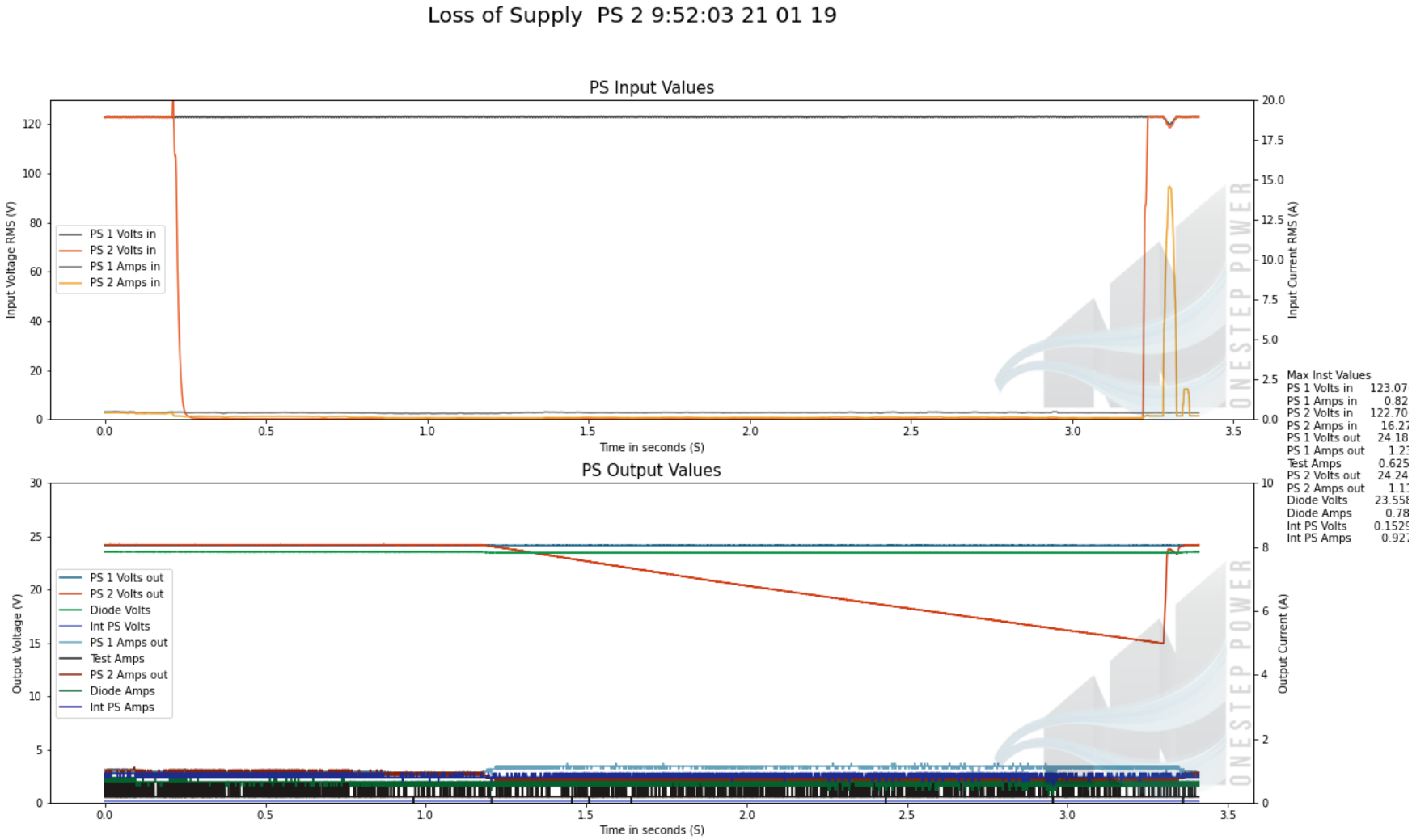


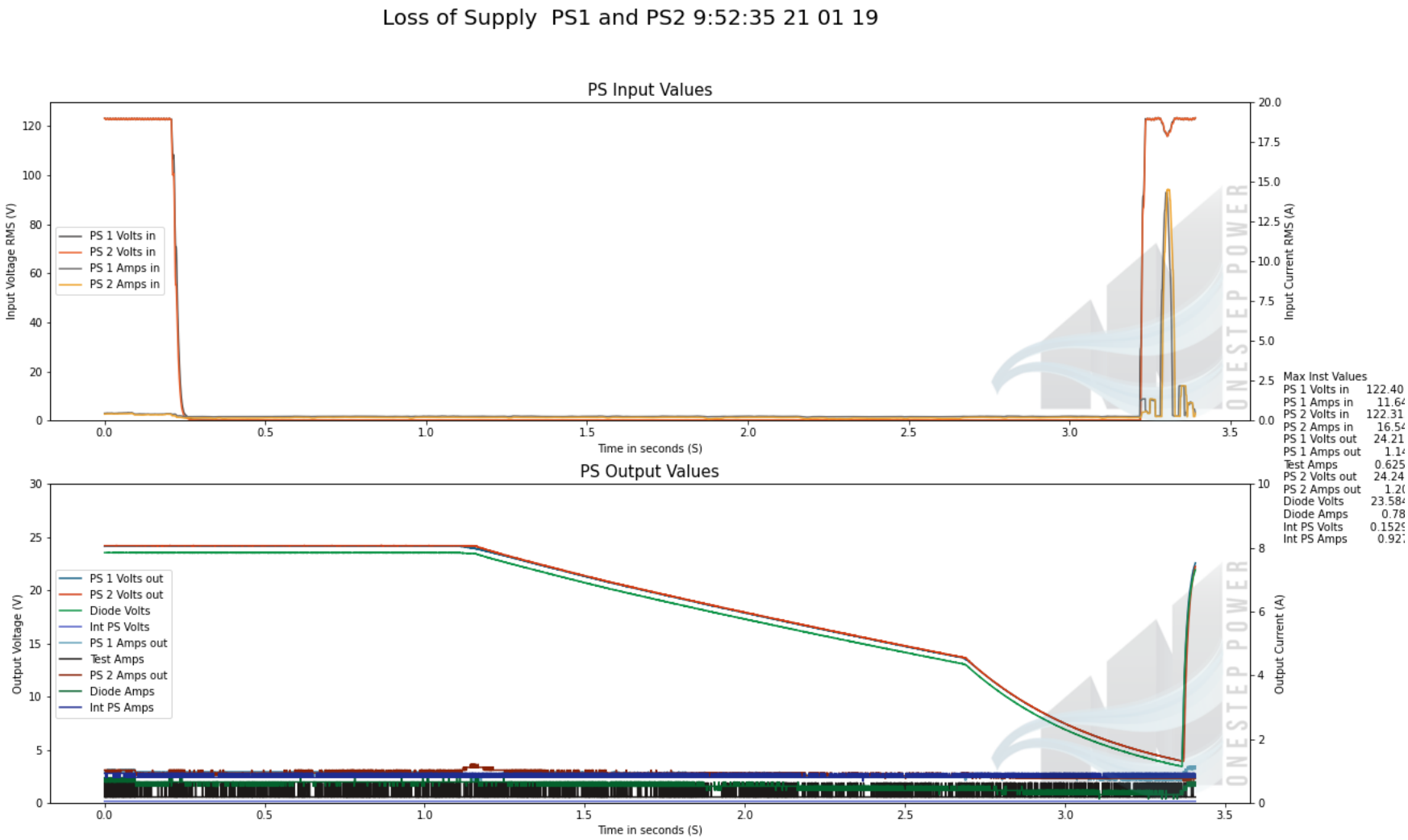
SAMPLE ONLY


Over Voltage PS 2 9:50:11 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.28
PS 1 Amps in 0.63
PS 2 Volts in 122.31
PS 2 Amps in 0.87
PS 1 Volts out 24.23
PS 1 Amps out 1.14
Test Amps 4.224
PS 2 Volts out 29.56
PS 2 Amps out 3.26
Diode Volts 28.868
Diode Amps 0.78
Int PS Volts 29.475
Int PS Amps 4.952
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER


Over Voltage Diode 9:50:36 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
PS Output Values
Output Voltage (V)
Output Current (A)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
Max Inst Values
PS 1 Volts in 122.28
PS 1 Amps in 0.73
PS 2 Volts in 122.44
PS 2 Amps in 0.87
PS 1 Volts out 24.21
PS 1 Amps out 1.05
Test Amps 0.696
PS 2 Volts out 24.26
PS 2 Amps out 1.02
Diode Volts 29.388
Diode Amps 0.78
Int PS Volts 29.137
Int PS Amps 1.430


Loss of Supply PS 1 9:51:40 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.13
PS 1 Amps in 11.64
PS 2 Volts in 122.18
PS 2 Amps in 1.00
PS 1 Volts out 24.21
PS 1 Amps out 1.05
Test Amps 0.625
PS 2 Volts out 24.24
PS 2 Amps out 1.29
Diode Volts 23.584
Diode Amps 0.78
Int PS Volts 0.1529
Int PS Amps 0.927
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER


Loss of Supply PS 2 9:52:03 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 123.07
PS 1 Amps in 0.82
PS 2 Volts in 122.70
PS 2 Amps in 16.27
PS 1 Volts out 24.18
PS 1 Amps out 1.23
Test Amps 0.625
PS 2 Volts out 24.24
PS 2 Amps out 1.17
Diode Volts 23.558
Diode Amps 0.78
Int PS Volts 0.1529
Int PS Amps 0.927
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps


Loss of Supply PS1 and PS2 9:52:35 21 01 19
PS Input Values
Input Voltage RMS (V)
Input Current RMS (A)
Time in seconds (S)
PS 1 Volts in
PS 2 Volts in
PS 1 Amps in
PS 2 Amps in
Max Inst Values
PS 1 Volts in 122.40
PS 1 Amps in 11.64
PS 2 Volts in 122.31
PS 2 Amps in 16.54
PS 1 Volts out 24.21
PS 1 Amps out 1.14
Test Amps 0.625
PS 2 Volts out 24.24
PS 2 Amps out 1.20
Diode Volts 23.584
Diode Amps 0.78
Int PS Volts 0.1529
Int PS Amps 0.927
PS Output Values
Output Voltage (V)
Output Current (A)
Time in seconds (S)
PS 1 Volts out
PS 2 Volts out
Diode Volts
Int PS Volts
PS 1 Amps out
Test Amps
PS 2 Amps out
Diode Amps
Int PS Amps
ONESTEP POWER

Appendix 2: Cabinet ID

Repeat for all other cabinets.