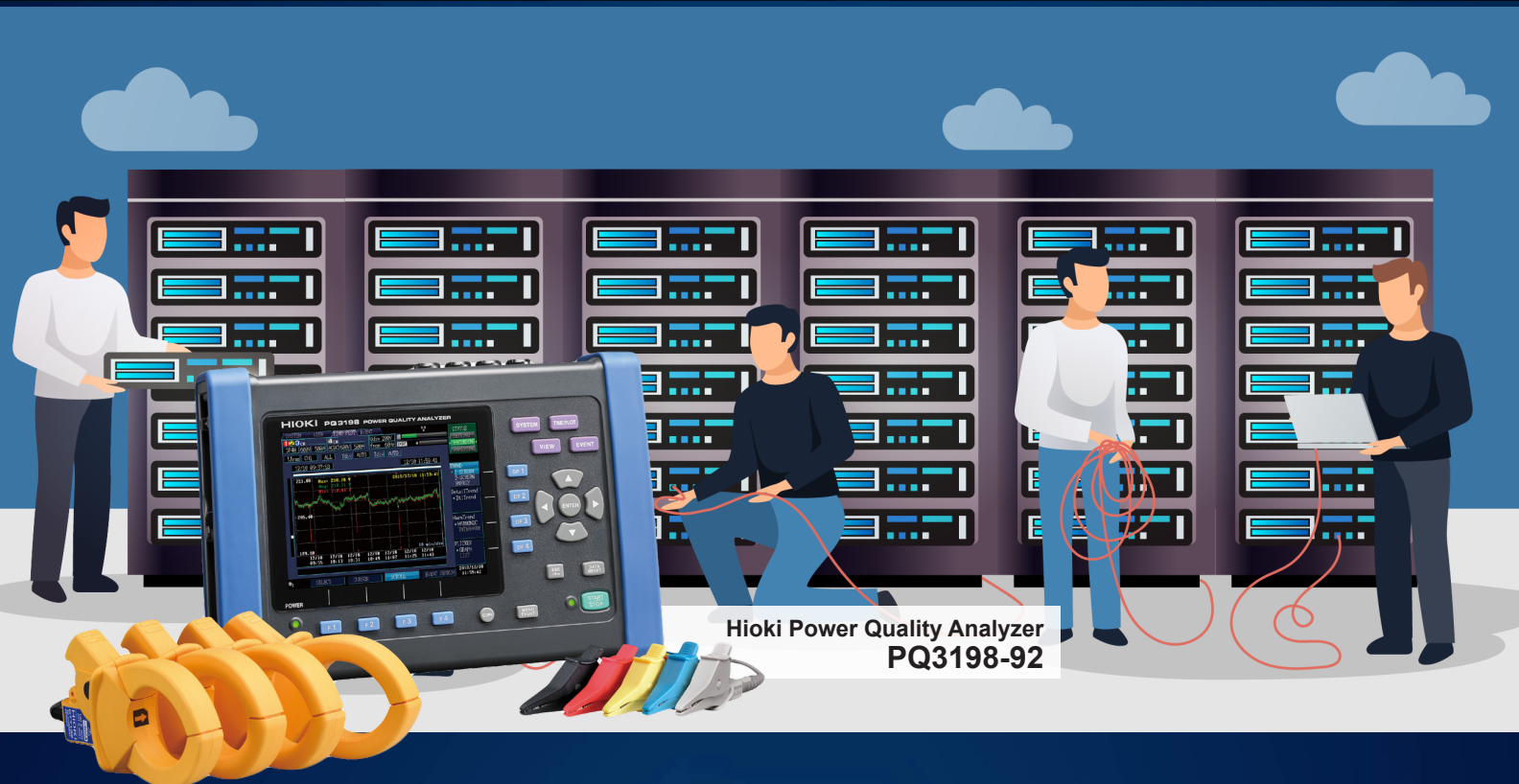


Application Note

HIOKI POWER QUALITY ANALYZER PQ3198 FOR DATA CENTER REDUNDANCY STATIC TRANSFER SWITCH TESTING



What is Data Center Redundancy ?

A data center is a physical facility in an organization containing a network of computing and storage resources to **deliver uninterrupted critical applications and data**. The key components include routers, switches, firewalls, storage systems, servers, and application-delivery applications ^[1]. Due to the critical role of a Data Center, **the system is designed beyond its minimum capacity (hence the term 'Data Center Redundancy')** to ensure continuity of operation even if part of the system fails ^[2]. Figure 1.0 on the next page illustrates four redundant designs for a UPS system providing 200 kVA power to a data center and the various failure modes. The 2N design is a fully redundant architecture with two independent UPS that can support critical IT applications without interruption even if one of them fails.

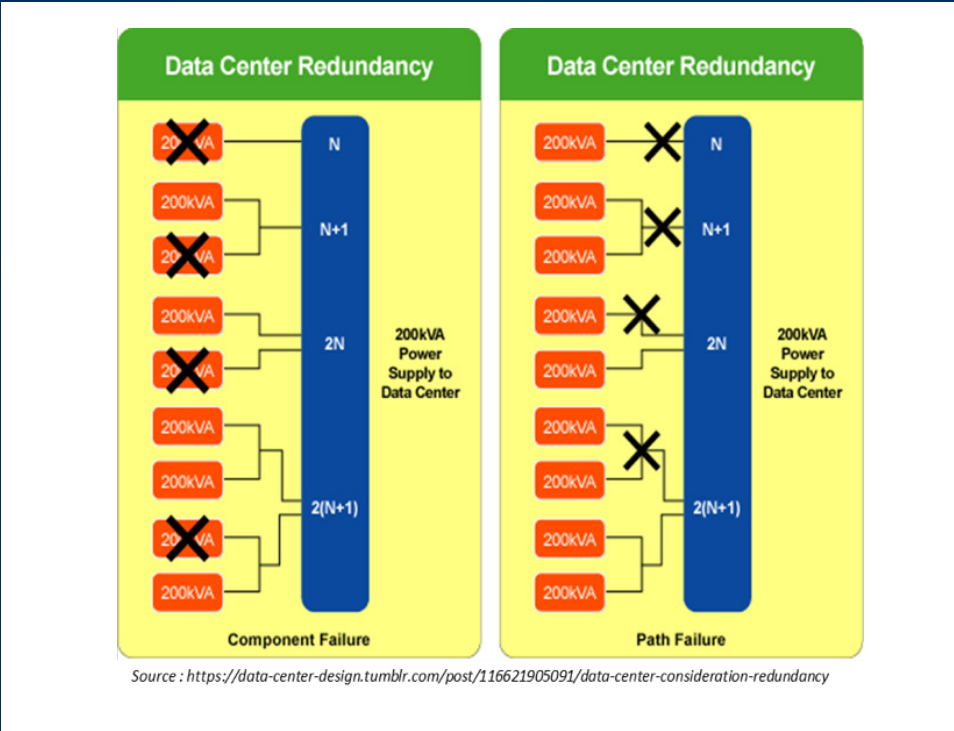


Figure 1.0 Data Center UPS System Redundancy Designs and Failure Modes

Static Transfer Switch Testing and Its Importance

A data center requires an uninterrupted power supply to ensure continuous critical application and data support. A transfer switch functions to divert the power supply source from utility to emergency power during a power disruption. There are two types of transfer switch – Static Transfer Switch (STS) and Automatic Transfer Switch (ATS). The STS is preferred over the ATS in Data Center Redundancy design due to the following advantages (Figure 2.0).

Static Transfer Switch (STS)	Automatic Transfer Switch (ATS)
Sensor circuit detection induced switching	Mechanical movement switching
3 to 5 milliseconds switching	Depends on time delay setting (> 1 s)
Uninterrupted power supply	Interrupted power supply

Figure 2.0 Static Transfer Switch (STS) Advantages Over Automatic Transfer Switch (ATS)

The fast power source switching of STS during power disruption could result in voltage dip or transient voltage due to the sudden changes in the voltage supply if the STS is not operating according to its designation. Both events happen for a brief duration but could damage the data center machines, depending on their severity, duration, magnitude, and ability of the equipment to withstand the sudden voltage reduction or increase. Therefore STS testing is critical as a form of maintenance, particularly in a fully redundant data center.

Hioki Power Quality Analyzer PQ3198 for Static Transfer Switch Testing

Figure 3.0 below shows the set up for testing of STS in a 2N design of Redundant Data Center. The Hioki Power Quality Analyzer PQ3198 measures the following points concurrently:

Point A: If there's a problem during switching from STS A to STS B or vice versa, a Voltage Dip or Transient Voltage will be detected via the PQ3198

Point B: If the power is lost or restored before STS A, this measurement point can detect it through a voltage phase measurement

Point C: If the power is lost or restored before STS B, this measurement point can detect it through a current phase measurement

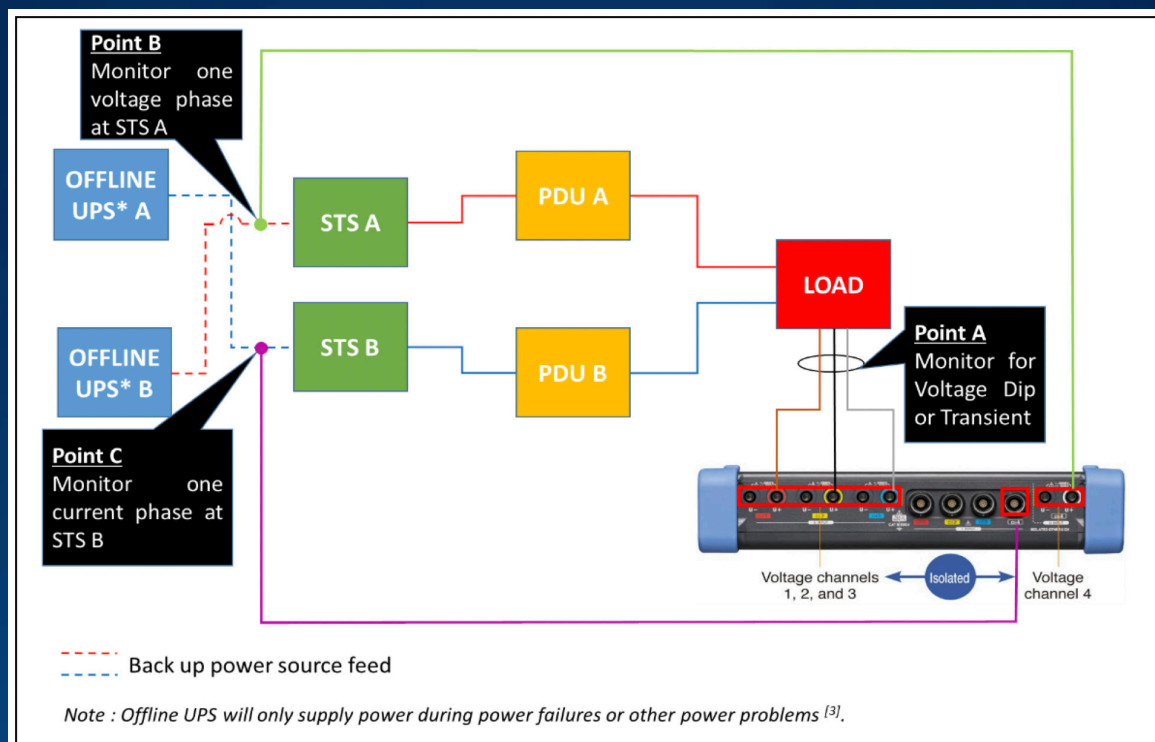


Figure 3.0 Static Transfer Switch (STS) testing points in a redundant data center design

The three measurement points enable the correlation of the STS switching to the voltage dip or transient voltage events. Figure 4.0 and Figure 5.0 shows screenshots of voltage dip and transient voltage captured during testing of STS in a redundant Data Center using PQ3198.

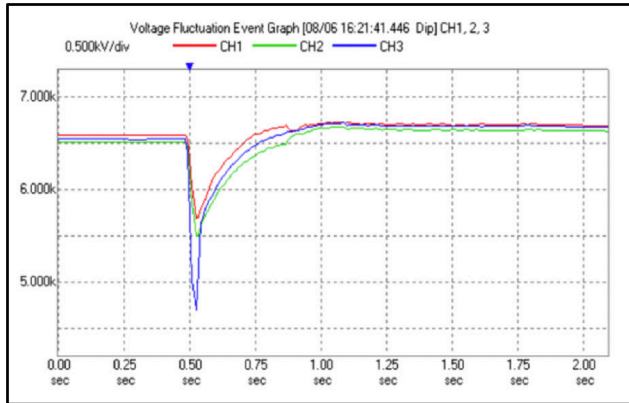


Figure 4.0 Voltage Dip Detection

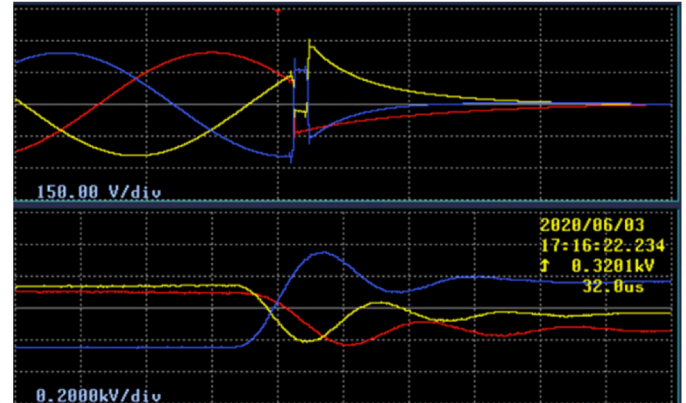


Figure 5.0 Transient Voltage Detection

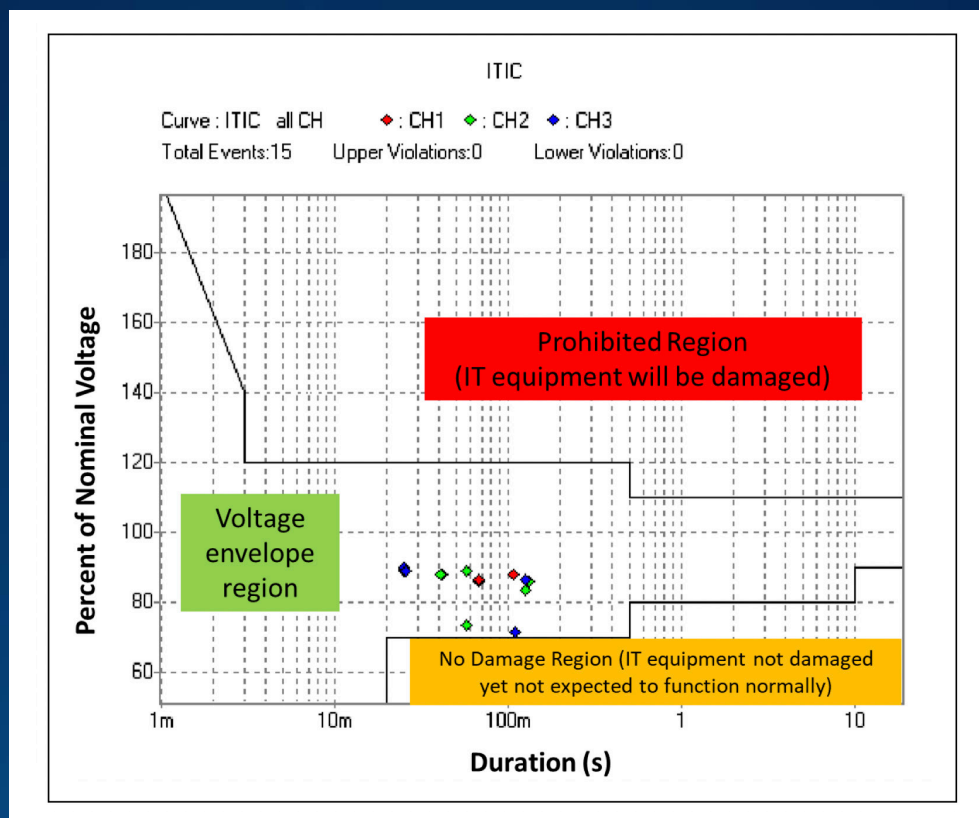


Figure 6.0 Dip Analysis with ITIC curve Using Hioki's PQ ONE Software

Hioki's PQ ONE software provides value-added analysis of the Voltage Dip with the ITIC curve analysis. The ITIC curve is useful in analyzing the incoming power quality ^[4] – in this case, the incoming voltage during power switching. The STS contains a rectifier to convert AC (from the UPS) to DC for storage in the bus capacitor before conversion to the required voltage. However, during incidents of voltage dips or transient voltage, the DC bus voltage could go very low or very high; this could affect the operation of the load. Figure 6.0 shows the ITIC curve analysis using Hioki's PQ ONE software with the voltage dips plotted for each phase independently.

PQ3198 has a built-in HTTP Remote server function that allows users to configure and monitor the instrument from a browser. Remote data retrieval is also a breeze with the built-in FTP server function.

The remote function is only available through a router and local data sim card connected to the PQ3198.

Alternative Hioki Products For STS Testing

Hioki Memory HiCorders are another alternative to Power Quality Analyzer PQ3198 for a similar application. Besides the same ability to measure voltage dip and transient voltage, it has several other advantages:

- Multi channels (up to 32 analog channels)
- High vertical resolution (16 Bit)
- Long recording time
- Multi-modular
- Isolated channels

APPLICATION NOTE :

HIOKI POWER QUALITY ANALYZER PQ3198 FOR DATA CENTER REDUNDANCY STATIC TRANSFER SWITCH TESTING

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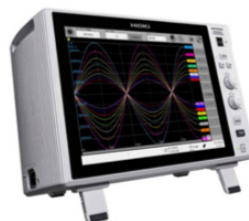
Below are the Hioki Memory HiCorder models suitable for the same application.



MR8847A



MR8827



MR6000

A fully redundant UPS system for Data Center will not be able to operate to its intended function unless the Static Transfer Switches (STS) are functioning according to its designation during a power disruption. Hence, the testing of STS is critical to ensure the uninterrupted service of the data center equipment.

For more information on Hioki Power Quality Analyzer PQ3198, please click the link here: [Hioki Power Quality Analyzer PQ3198](#)

References

1. <https://www.cisco.com/c/en/us/solutions/data-center-virtualization/what-is-a-data-center.html>
2. <https://data-center-design.tumblr.com/post/116621905091/data-center-consideration-redundancy>
3. <https://www.livetolearn.in/site/forum/hardware-troubleshooting/difference-between-online-ups-and-offline-ups#:~:text=Online%20UPS%20supply%20power%20to,is%20known%20as%20Online%20UPS>
4. <http://voltage-disturbance.com/voltage-quality/itic-curve/>

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