

Wilson Engineered Systems, Inc.

Long Utility Outage Success Case Study

February 4, 2016 we experienced a classic utility outage at our offices. Being in the UPS and monitoring business we were prepared and captured excellent data for review and analysis. Most of the small businesses near us were dark, some even sent their employees home. Our office smiled with success that our lights, computers and phones were all normal.

Our backup system is a 10 kVA, online, high quality UPS with (20) batteries in a separate cabinet. We monitor the UPS status via a Falcon network monitor. The batteries have a BTECH S5 monitoring system.

The utility power interruption was actually three sequential outages as follows:

- 1) Utility power loss at 13:17:10, restored at 13:17:12, 2 seconds duration
- 2) 4 seconds later, power loss at 13:17:16, restored at 14:14:49, 57 minutes 33 seconds duration
- 3) 31 seconds later, power loss at 14:15:20, restored at 14:35:35, 20 minutes 15 seconds duration.

Our monitoring initiates alarm emails and text messages immediately upon a transfer to battery. The same occurs for clearing of an alarm condition. Below is the email body received on the first power loss. The same message was delivered via text messaging. This ensured both onsite and offsite personnel were immediately aware of the issue.

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Wilson Engineered Systems UPS 10 kVA Monitor
AH048-086-On -02/04/16 13:17:10 UPS On Battery (Warehouse)
|
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Alarms are also logged into the alarm history of our Falcon which is shown below. No human recollection of what happened when and in what order is needed later during review. Everything is captured automatically.

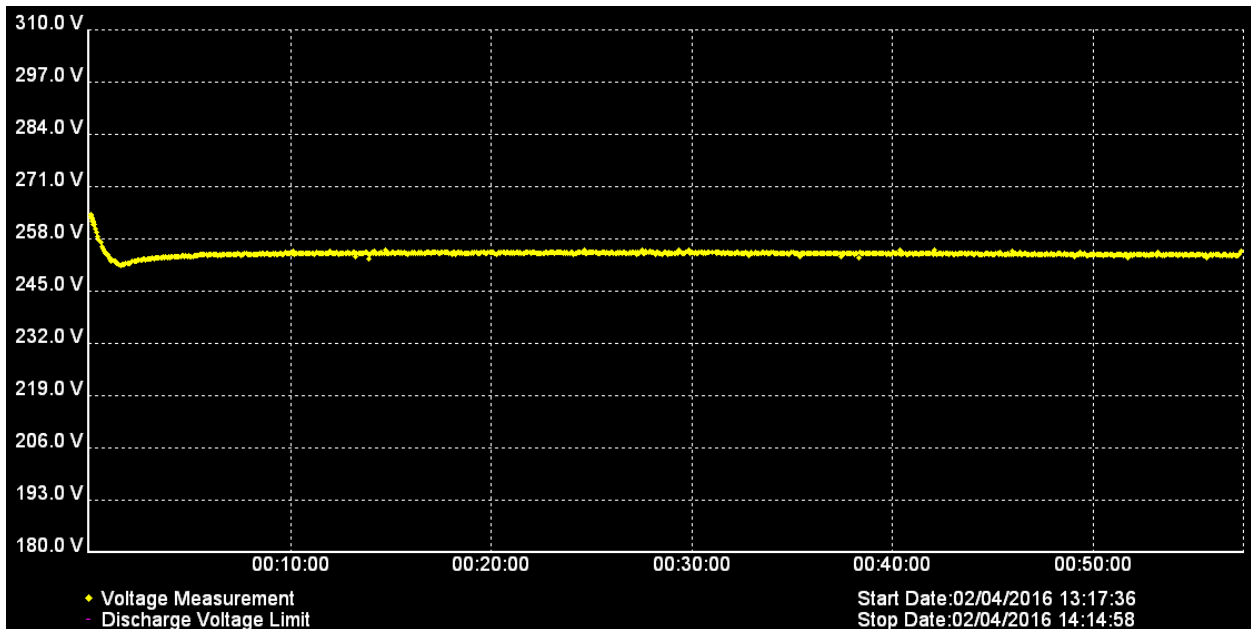
Wilson Engineered Systems UPS 10 kVA Monitor (Warehouse)

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Color Code: Unacknowledged -- Acknowledged -- Return to Normal
AH053-086-RTN -02/04/16 14:35:35 UPS Not On Battery (Warehouse)
AH052-086-On -02/04/16 14:15:20 UPS On Battery (Warehouse)
AH051-086-RTN -02/04/16 14:14:49 UPS Not On Battery (Warehouse)
AH050-086-On -02/04/16 13:17:16 UPS On Battery (Warehouse)
AH049-086-RTN -02/04/16 13:17:12 UPS Not On Battery (Warehouse)
AH048-086-On -02/04/16 13:17:10 UPS On Battery (Warehouse)
```

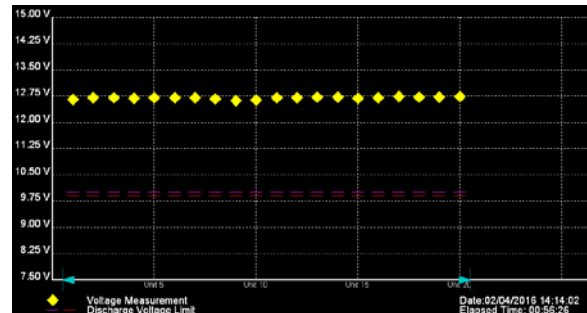
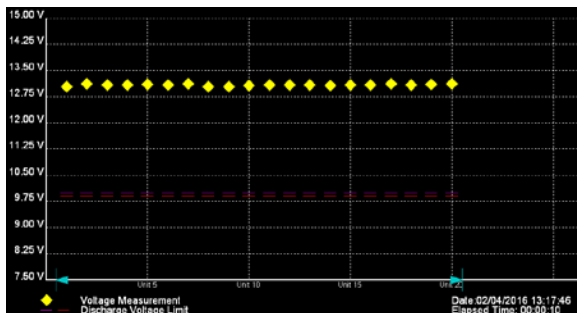
Our BTECH system provides a real time mode where we can view the health of the overall battery system as well as each of the individual battery's voltage at any time. This allows a view to the specific status of each of the 20 batteries during the outage. We have designed for several hours of battery

support with a goal that if we lose power at 8 AM we stay on line till 5 PM. With 20 batteries in series our nominal DC voltage is 240 VDC. We checked the real time health of the batteries during the outage and saw all was fine.

When batteries are fully charged the DC voltage is 271 VDC. To protect the batteries from damage a low cutoff voltage threshold is controlled by the UPS. If the batteries drop below 200 VDC the UPS will shut off to protect the batteries. The battery performance is shown below. A classic initial drop, followed by a recovery, occurs in the first couple minutes. Then the batteries will drop in voltage until utility power is restored or battery cutoff voltage is reached. The nearly level battery voltage line over the hour of data below shows the overall battery plant performed well and it appears our 9 hour goal is well founded by the equipment we have in place. The yellow line would have to drop to 200 VDC before the UPS would shut off.



We can also check how each individual battery performed during the outage. The goal is relatively equal performance and voltage drop by each battery. The two graphs below show the values for the 20 batteries early in the outage and at the end of the outage.



These show the batteries performed well individually as well as a group. If a battery was weak the graph would show it dropping as an outlier more quickly than others. The graph would look like a group of surface ships and the weak battery would look like an anchor headed below the surface. As time progresses the weak battery would drop lower and lower beneath the others.

What makes this narrative a success story versus a simple case study is that the BTECH S5 had recently alarmed that 2 batteries were weak based upon impedance readings. Due to that we had recently replaced the 2 batteries. Without having done so we likely would not have had hour long battery support. The fact the batteries were still at 254 VDC after an hour of discharging suggests a high chance that our goal of 9 hours of support is possible.

Three things we took away from this success were,

- 1) Having monitoring notifying us (both onsite and remotely) of the conditions and health of our UPS is very comforting. We knew we had no utility power but we also knew in real time that we were in good shape as our backup system was working well.
- 2) Having a good plan and equipment in place ensures our small business stays available. Business near us were dark and employees were outside looking around wondering when power would come back. Some even sent their employees home. It was satisfying being properly in control of the situation.
- 3) The audit trail provided by our monitoring captured what happened well. If things had not gone so well we would be able to review the data and events to modify our design for success. As it turned out everything worked as designed and no modifications are necessary.

Since everything worked well this is not an exciting case study story. That is exactly what we want and plan for, no exciting negative events. This is a very satisfying story to tell. Being in the business of providing UPS systems and critical monitoring we provide this type of security to our customers. With this event we now are better able to personally relate events putting more meaning into what we deliver every day to our customers.