MORRISON HERSHFIELD

Electrical Metering Issues During Commissioning

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Authored by:
Victor Carlson, PE
Senior Electrical Commissioning Authority

For more information contact:

Morrison Hershfield
1500 S Edgewood Street | Baltimore, MD 21227
Phone: 410-525-0010

www.morrisonhershfield.com

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Discussion

Electricity unlike anything else is not something that can be seen, like the flow of water. Nor can it be smelt, like the breeze bringing odors. It can however certainly be felt usually with disastrous results. As humans we rely on the five senses of sight, smell, touch, taste, hearing – electricity in general defies the ability to use most of those senses directly. We can however indirectly observe electricity through the use of meters to determine the presence of it.

Metering allows a 'window' in which to measure the electricity. Placement of metering devices inclusive of current and potential transformers, relays, protective devices etc. is of paramount importance as it can accurately inform the observer of what is taking place. Unfortunately, too often the accuracy of meters, of which there may be multiple meters looking at the same point, is called into question. There are many factors that need to be taken into consideration when designing a monitoring system that employs meters such as current transformer (CT) ratios, meter accuracy and placement within equipment to name a few. If the manufacturer of say the switchgear uses CT's and meters with an accuracy of say 2%, additional metering which may utilize different CT's and meters at the same location with a different set of accuracies, will most likely produce conflicting results. Depending on the nature of the facility (installation) this could result in actions being taken that do not reflect what is truly occurring in the facility, more specifically the data center, among those being changes in cooling and/or shifting of loads from one Remote Power Panel / Power Distribution Units / Uninterruptible Power Supply (RPP/PDU/UPS) to another.

During commissioning, there is usually the need to place independent meters in various locations to monitor system and equipment transitions. These meters do no rely on the already installed CT's, PT's or meters for the capture of data but are performing this function independently. The output of these meters is then used to determine the viability of the various pieces of equipment of systems and how the installed designed metering is functioning. When there are differences amongst the various meters, more specifically values, it begs the question, what is really happening? Determining if loads were inadvertently lost during a particular transition or operation is of prime concern.

Some of the answers lie in determining accuracy of the meters and the magnitude of the difference(s). In some cases, particularly as one moves from a piece of IT equipment supported by an RPP to a PDU to the UPS system to the main switchboard, due to the nature of what is attempted to be monitored, a small drop in load would most likely be observed at the RPP/PDU and may not be indicated at the UPS or switchboard level. If the facility operations staff is only viewing the 'upstream' meters, losses may not be determined for a period of time. If the monitoring systems, like a PMCS or EPMS, are connected down at the RPP/PDU level, software could be adjusted to indicate these 'small' values and therefore issue an alarm or notification.

Case Study

During the commissioning of a data centers' new PDU's and RPP's, it became necessary to install portable load banks at the individual RPP's to provide not only electrical loading but mechanical loading as well. For this project it was determined that based on the test parameters, the individual load banks were required to be loaded to 65kW each. The load bank operators engaged the controls and with the metering available at the individual load bank, were able to zero in on about 65kW (most often the readings from the meters on the load banks indicated a range of from 58kW to 70kW). For purposes of the testing, an exact load was not necessary. The other meters and control and monitoring systems in place registered readings that ranged from approximately 58kW to 72kW. Permanently installed metering was located at the RPP main circuit breaker, the PDU branch circuit breaker and the PDU main circuit breaker. The meter with the largest discrepancy was at the PDU main.

If it becomes necessary to rely on the meter output to determine plant/facility operations adjustments, the most accurate reading, due to the CT ratios and meter accuracies, would be at the RPP branch circuit breaker. If there is no monitoring point at this location, the next 'better' location would be the RPP main circuit breaker. Since the loading would be indicative of a fully loaded RPP, lesser loads would most likely create larger discrepancies and therefore this information would not be as useful to the operations staff for making any facility-wide adjustments. In this case, multiple RPP's and attendant load banks were connected. Discrepancies in the total load readings at the PDU became smaller when more RPP's were engaged.

Another concern with the permanently installed metering was the ability to communicate with the meter in an expeditious manner. With more devices being connected and their information being communicated back to a centralized monitoring and controls system, information speed is often a topic of concern. An operator at the meter or viewing the control system Human Machine Interface (HMI – 'computer screen') may not see the correct information until the system has had a chance to query 'ping' it. This may result in false data being assessed. During the commissioning process, the use of external meters without the necessity of tying into the communications network, is heavily relied on to determine system status. After waiting a reasonable time, if the permanent meters and/or monitoring system do not reflect what the external meters does, the testing is suspended until an explanation is found. If there is agreement that the explanation is correct and/or at least reasonable, testing continues.

Conclusion

Relying on permanently installed meters should not be considered for facility operations until after careful testing performed during the commissioning process as well as any required recalibration. It is important that the designer know what information is the most useful for the operating facility to act on and insure that the design documents accurately reflect the locations and devices to be utilized.