# POWER FAILURE AT THE DATA CENTER NOW WHAT?

**Electrical outages can have major AC implications for computer rooms.**

BY STEVE WELLANDER

*Photos courtesy of Data Aire.*

Data centers are, in most cases, considered mission critical operations. The design and operation of the data center needs to be 100% operational from the first time the system is turned on until any planned shutdown and/or the conclusion of operations. Since any unplanned downtime is unacceptable, there must be a contingency plan built within the systems that will prevent or otherwise deal with power interruptions. The following article is designed to help technicians understand the whys and hows of a properly thought out system and educate them on the basics of a good design.

Techs should know the basics of power protection for data centers.

As for the power side of the data center, most facilities now have built-in backup power. This backup is typically either a generator or a second utility service or, in some cases, both. There are also various means of power distribution to both the building and to the equipment itself.

## General failures

There are different degrees of power failures at a facility to consider: 1) Is it complete failure of the grid entering the building? 2) Is it a phase loss where the building power can be determined as "single phasing"? Or 3) Is it a failure that is internal to the building and of a branch circuit? Any of these conditions will cause disruption of "mission critical" operations such as data centers. How, as a service technician, do you deal with the outcome and make sure that customers have minimal downtime and/or equipment damage.

The best way to deal with power failures is to be prepared for them. When done correctly, redundancy is built into the power system for the data center. When dealing with "mission critical" operations, there needs to be a plan in place for the worst case scenario. That includes earthquakes, floods, security breaches, power failures as well as other unforeseen failures.

All manufacturers of IT equipment for data centers offer different means of power protection for the data centers. Listed below are the most popular types of power protection in the IT world. Most of these means of protection should

be part of the design/installation during the construction phase of the data center. They can be added to a facility after the equipment has been installed but it is generally not cost effective.

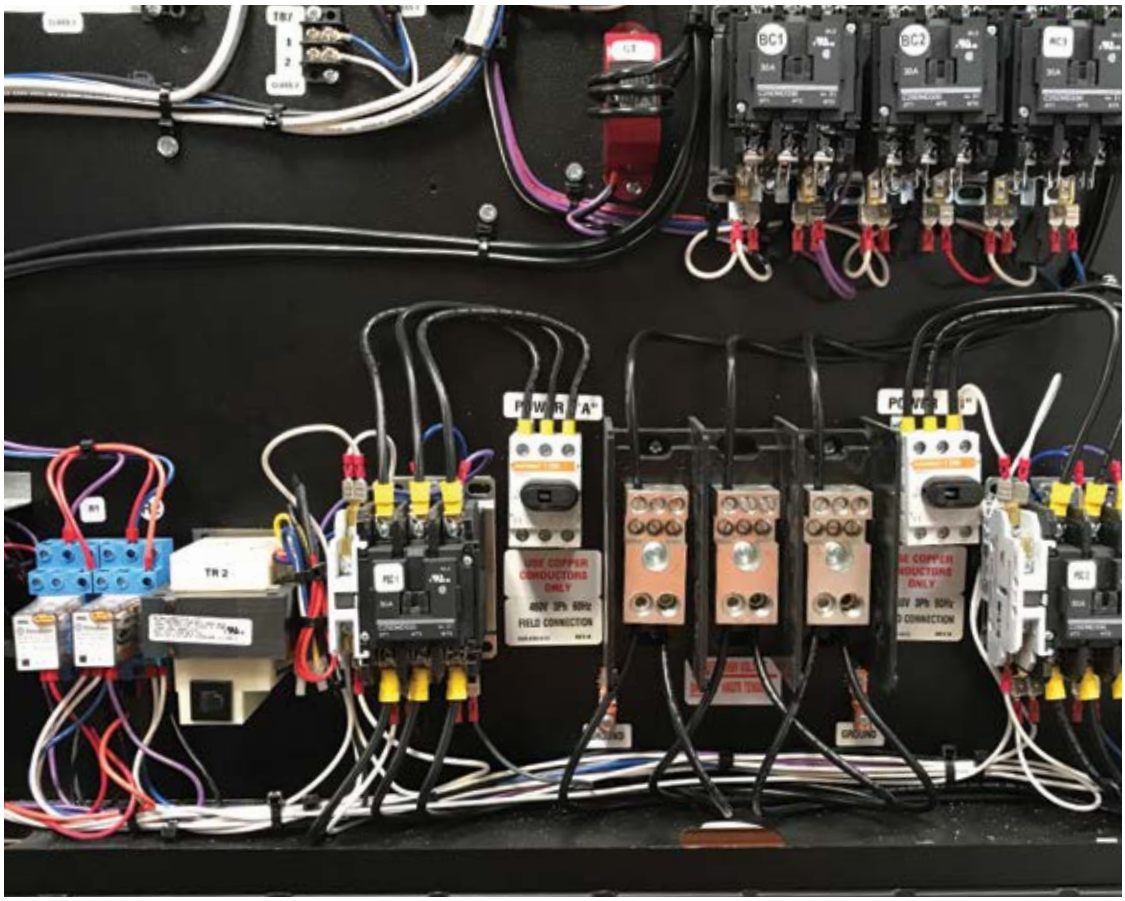
## UPS (uninterruptable power supplies)

Within the data center there are UPS systems that react when there is a power failure. The UPS is designed to prevent loss of power to the servers and other equipment in the server room. The UPS feeds the line voltage to the server and other equipment, there is a battery room that stores power that is connected to the UPS. If there is a power failure the systems switches to the battery backup and through an inverter immediately protects the servers and other equipment from the power outage.

Additionally, the UPS can also be used to maintain the computer room air conditioning (CRAC) units. When the UPS is used to operate the CRAC units, the CRAC will be programmed to use the minimum amount of power by operating the fans and the compressor/chilled water for cooling only. This accomplished by inhibiting the reheat, dehumidification and humidification. And this is completed by a signal sent to the microprocessor from the secondary power supply that will recognize the power switchover and then inhibit the operation of non-critical operations.

## Phase loss protection

Single phasing of a three phase motor can be disastrous to the equipment and, by extension, the process being cooled. If the motors or compressors are operating at the time of the single phase, the motors may continue to operate, however, due to the loss of a power phase, heat will be generated in the motor or compressor. If allowed to operate in a single phase condition, the motors or compressor may, at a minimum, trip on internal thermal overload. In a worst-case scenario it will burn out the motor or compressors that are operating in this single phase condition. Most manufacturers/contractors provide an option to prevent the equipment from operating when there is a phase loss to the CRAC units. Most phase loss monitors protect the systems for: loss




›› **A dual power input inside of a unit.**

of a phase loss, voltage imbalance and over/under voltage to the unit. The general logic for the phase-loss-monitor is upon a failure being detected, the control voltage is interrupted. This will prevent operation of the unit until the fault is corrected. Most of these devices can be added after the units have been installed and operating.

## The A/B switch

The backup power in some data centers is wired directly to the CRAC units. In this case, the CRAC unit(s) will have two disconnects mounted on the door of the unit. Be aware that both these power inputs need to be disconnected to turn power off when it is necessary to service the equipment. Air cooled condensers generally have a separate power supply, sometimes mounted remotely. The air cooled condenser will also have two disconnects that must be shut down to prior to any servicing.

The general logic for the system is that two separate power feeds are installed on the unit(s). These power feeds will be from completely different sources. For example, power feed "A" would originate from the local utility and power feed "B" would be supplied from a backup generator or perhaps a separate utility service.

The primary power feed is usually the "A" power although there may be exceptions. If the "A" power fails, a system of transformers, relays and contactors are switched to activate the "B" power to the unit. There are built-in time relays to prevent the microprocessor from locking up due to an incomplete shutdown of power. The CRAC unit is held in the off position for about five seconds. Then power on the "B" circuit is activated, the microprocessor will reboot, and then the system will restart and operate as normal. There is an interlock to prevent the "A" power from activating if power is back online until the "B" power has either failed and there is power available at the "A" circuit or both the "A" and "B" power has been disconnected manually to reset the primary power feed. You will need to check with the manufacture of the equipment to verify their control logic for the power input switch over.

## Dual power source

Essentially, there can be an A/B switch for the whole data center within the design and construction of the data center. The system will consist of a primary power feed from a utility, a secondary power from another utility or the same utility but from a different source. There is the possibility of a backup

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generator on-site so if both power feeds fail to prevent any power loss. This type of redundancy is generally limited to "enterprise" sized data centers.

## Testing the redundancy

During the routine maintenance of the units, the power protection system should be routinely tested to ensure that it is available and operational in case of an emergency. In units with A/B switchovers, the power should be turned off for the primary feed to test the sequence of operation. If there are any issues with the secondary power or the switchover components, it is better to catch it during the maintenance inspection than during a real power failure.

To ensure proper operation, consider inspecting the following: relays, contactors and timers to ensure proper operation. Replace contactors and relays the show signs of wear or pitting. Check the time delays to make sure they are set to the manufactures recommendations. Phase monitors need to be checked for the proper voltage settings (usually this is site specific) and that the device opens the control voltage upon a power failure.

## When all else fails

Even when all precautions are taken, there could be a total collapse of the systems in place in some instances. At this point you need to have a Plan B.

Plan B relies on bringing in temporary power and cooling equipment. The time to contact these specialized vendors is not when there is a failure. These resources need to be contacted and contracted with well in advance of a major failure. These contractors can be the difference between a minor interruption and a major melt down of the servers and a loss of communications.

To minimize interruption of service (both cooling and power to the servers) there needs to be a Plan B. The plan should include the redundant power, redundant cooling and a contingency plan for a power failure event. Without the foresight to plan for the worst case, the worst case may happen and the facility could fail. Failure to have a Plan B, ready to deploy is not acceptable. Expect failures including the failures of redundant systems. All are mechanical systems and all can fail.

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