

Providing critical power protection for Diamond Light Source



Case study:

Site: Diamond Light Source

Application: Scientific facility

Chloride capabilities displayed:

- Expert design
- Management of complex delivery & installation

Chloride products used:

- 90-NET
- 70-NET
- ManageUPS CIO

Chloride's extensive experience and expertise in providing power protection for mission critical applications led to it being commissioned to design and install a robust system for Diamond Light Source. Built on the Harwell Science and Innovation Campus, Diamond Light Source is the biggest scientific facility to have been built in the UK for over 40 years. It has, at its heart, a giant machine called a synchrotron - a series of 'super microscopes' - which is housed in a futuristic doughnut-shaped building covering the area of five football pitches. This is a particle accelerator using electrons to generate powerful light through a beamline to enable scientists to look inside matter at the molecular and atomic scale.

System design

The synchrotron light at Diamond Light Source can be diverted into a number of specific experimental stations that are located around the 560 metre circumference of the main ring for conducting material and other scientific testing. Currently there are seven cutting edge experimental stations/beamlines, with funding secured for another fifteen. It is anticipated that the facility will ultimately host up to forty, supporting the life, physical and environmental sciences.

Chloride was commissioned to design and install a total solution for critical power protection at this complex site which is being shared by the scientific community and industrial users. Beamline time is at a premium so maximum power availability is vital to support the integrity of data acquisition and the functioning of control systems and building services.

Following an extensive review of the facility and its power protection requirement, Chloride project engineers built a high-integrity 2.1 MVA Uninterruptible Power Supply (UPS) network to protect and maintain power integrity throughout the site.

High reliability solution

The scientific beamlines, data acquisition and the Control and Instrumentation area from which the synchrotron is operated are being protected by a total of seventeen 100 kVA UPS units from Chloride's advanced 90-NET series. A significant benefit for Diamond Light Source is its power conditioning function, as sensitive electronic equipment operated at the site needs to run on clean, conditioned power at all times. These state-of-the-art UPS units also feature Digital Vector Control, the most technically advanced microprocessor DSP control available in any UPS machine, which enables all overloads, frequency variations, transient disturbances, brief interruptions and blackouts to be eliminated in real-time. Ten times quicker than current analogue methods, 90-NET is a high reliability solution for the protection of mission critical loads with outstanding performance.

The unique features of the 90-NET system were a key factor in Chloride being awarded the contract for such a prestigious project. The state-of-the-art design and control architecture was particularly important in this case, as there was a potential requirement for each of the eight main systems to be dynamically reconfigured as and when certain experiments require either more or less electrical supply capacity.

The native "plug and play" feature of the 90-NET units, coupled with the unique digital control technology allow this process to take place without any electrical interruption to the load, and therefore very little or no interruption to the experiments being undertaken.

Using multiple 100 kVA modules to build each system, it is not only possible to dynamically expand or reduce the electrical capability of each supply section, but the system redundancy can also be varied to provide full fault tolerance to suit the particular demands and importance of the process that is being protected.

Delivery and installation

The modular nature of each of the UPS systems resulted in not only a more flexible approach to the electrical installation and future maintenance, but also allowed each of the systems to be delivered, installed and commissioned with minimal impact to the surrounding building fabric or other site personnel working nearby.

Although each of the modular UPS sections only weighed in at around 1,000kg, and the associated self-contained battery systems at 1,300kg, the site delivery was far from standard.

The laboratory complex was still in the final stages of construction at the time the UPS equipment was delivered and installed, so as well as contending with all the normal risks and hazards associated with any large construction area, there were also some unique challenges. At the point of delivery the main problem to overcome was that of positioning the systems. All of the large UPS equipment is located within the central zone - on the inside of the concrete encapsulated beam line than runs around the entire complex. This huge continuous tunnel, approx 3 metres high and over 4 metres wide posed an issue for the delivery teams involved with the positioning of the units within the building.

Working closely with Diamond staff and the building contractor, the Chloride team on site was able to utilise the huge travelling cranes within the building. They manoeuvred almost 65 tonnes of equipment over the huge walled tunnel in just one day, without causing disruption and, more importantly, without modifying the already constructed fabric of the building or the beamline tunnels.

Once delivery to all the locations had been successfully completed, the more complex task of commissioning the units arose. Due to the highly resilient nature of the building, the UPS modules not only feed local equipment, but also some in remote areas. This method of distribution is utilised to ensure total electrical reliability to the experiments.



In certain locations laboratories were being set up and with these additional risks came new challenges. It was particularly important not to cause any disruption to these areas. At the same time it was necessary to provide the customer with a source of clean and reliable power to enable them to commission their own equipment and make the laboratory ready for operation on schedule.

Quiet and compatible

The backup power to smaller systems throughout the main building and also communications and data cabinets within auxiliary offices has been achieved using Chloride 70-NET 30 kVA UPS units. Due to their quiet operation and compatibility with a wide range of communication interfaces, they integrate perfectly into computing environments. Using an identical digital control architecture to the 90-NET series units, they are well proven in delivering secure power protection in critical environments including networks, industrial applications and management systems.

These Chloride 70-NET UPS units are employed at various locations and carry out an important role. Although not directly associated with the equipment on the beamlines, they perform the equally critical task of supporting the laboratory control areas, providing clean electrical supplies to such items as fire and safety systems, experiment monitoring and the IT infrastructure around the building.

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As with the larger systems, by working closely with the customer, the Chloride site team of engineers was able to ensure that each of these systems was fully operational and available for use at the critical points within the construction programme.

The commissioning, final acceptance testing and handover of all the UPS modules was achieved within the schedule, ensuring a project that has been completed successfully, in terms of quality, time and cost. All of these points were critical for the customer as they took ownership of a critical power system that can be fully relied on for many years to come.



One of the 48 bending magnets used to maintain the 3GeV electron beams.

Whole-of-life support

As part of its total power protection package, Chloride offers customers a range of support service options including monitoring, diagnostics and maintenance. At Diamond Light Source, Chloride's proprietary ManageUPS CIO software package is being employed to simplify the central management of the whole UPS system. This high integrity monitoring tool is easy to set up and can be operated with minimal training by those responsible for ICT infrastructure and the power systems foundation that supports it.

Effective monitoring is the key to maintaining awareness of the status of the power infrastructure and receiving alerts to any condition or variable with the potential to adversely impact on load operation or the readiness of stand by systems.

ManageUPS CIO provides the means of overseeing the entire critical power infrastructure, whether it is within a single facility,

at remote sites or across an enterprise-wide network. It comes with a variety of features designed to enhance appreciation and communication of data. A multi-level pin map helps visualise problem locations with geographic maps, floor plans, Visio drawings and even digital photographs of specific installations. The alarm view function automatically organises UPS devices by current alarm type. There are also Smart Groups, rules-based containers for dynamic inventory analysis and silent condition monitoring with email exchange notification.

Chloride's connectivity team completed a site asset audit to establish an inventory of which UPS were in which location. Once this had been done the team installed and configured all the ManageUPS interface modules before preparing the digitised floor plans, and geo maps needed to reflect the client's installation. Further on-site services included setting up the CIO server and end user training to ensure that the client was fully equipped to utilise this new monitoring tool.

The adoption of ManageUPS CIO software means that there is a very relieved electrical engineer at Diamond Light Source who doesn't need to walk 13km every day to individually check upon the operating status of each UPS!

Diamond Light Source is installing a building management system which will include an interface to CIO via BACnet IP protocol to allow the facilities team to also monitor the UPS systems on the central Building Management System (BMS).

The value of Chloride's ManageUPS CIO software for large projects and complex facilities is becoming widely acknowledged and leading to its implementation in a number of major installations. It is, for example, being successfully used in the new terminal at Dubai International Airport overseeing all 500+ individual UPS connected directly to the premises LAN via ManageUPS net adapters (Ethernet connection with embedded SNMP/WEB functionality). Information from ManageUPS CIO servers is retrieved by the Building Information System (BIS) via BACnet IP protocol. The BIS then sends selective information to the airport BMS and flight control system that monitors baggage handling systems/check-in and other operational activities.

Easy as it is to install and set up ManageUPS CIO monitoring software, some end users still choose to outsource the complete supervision and responsibility for the health of their UPS network to vendors offering a full service capability. For these customers Chloride offers a full range of professional service options through its Chloride Harath engineering arm. These services include maintenance contracts, continuous system monitoring, diagnostics and emergency response with on-site and/or telephone based support.

For more information please visit our website

www.chloridepower.com

Chloride is an international provider of secure power solutions for business continuity for customers worldwide. Our innovative solutions and services protect business critical systems and processes from the damaging effects of poor quality electrical power and power interruptions.