



TYPE 439

IEC Low Voltage Switchgear and Motor Control Centres



Powered by Safety®

OUR LOCATIONS





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Introduction

The pioneering of innovative products and system design has been at the heart of the organisation since the company's inception in 1959.

From strategic locations across the world, Powell Industries Inc. is focused to deliver superior value to its customers through a full range of differentiated IEC and ANSI products and services, designed to satisfy the ever more discerning requirements of the global market, in all industry sectors:

- Nuclear
- Energy, including Renewables and Biomass
- Oil & Gas
- Petrochemicals
- Pharmaceuticals
- Power Generation
- Paper & Pulp
- Food & Drinks
- Mining & Metals
- Data Centres

Powell's IEC activities are centred at the group's European factory in Bradford, UK. Continuing its unparalleled sales growth, Powell UK aims to lead the market in the design and manufacture of Low and Medium Voltage Motor Control Centres (MCCs) and Switchboards.

All engineering, design and development activities are backed by the company's various ISO accreditations and a commitment to the highest levels of customer satisfaction. Strict adherence to this fundamental principle is central to the design and manufacture of Powell's most technologically advanced IEC LV MCC and Switchboard design: type 439.

The type 439 design draws upon the latest technology and capability in base materials, precision mouldings and extruded parts to provide the user with the highest levels of operational safety, integrity and reliability.

The electrical power industry is amongst the most safetyconscious groups in the world. Powell's core philosophy, to be 'Powered by Safety', ensures Powell products and services are designed to develop and reinforce this position by bringing safety-related features to our customers, making switchgear safer to own and operate.

Operational Reliability

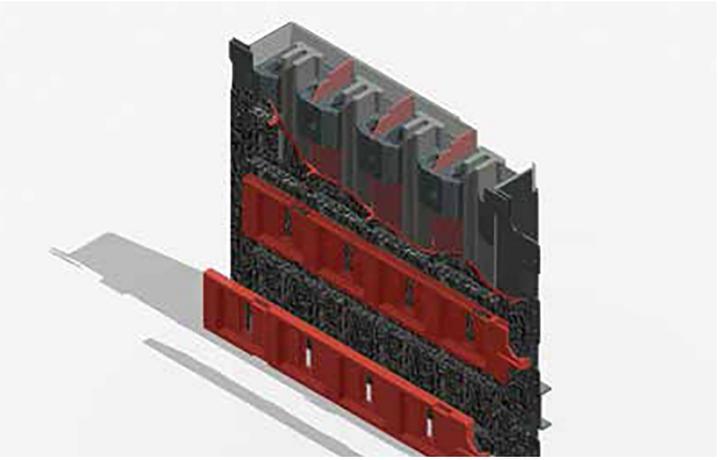
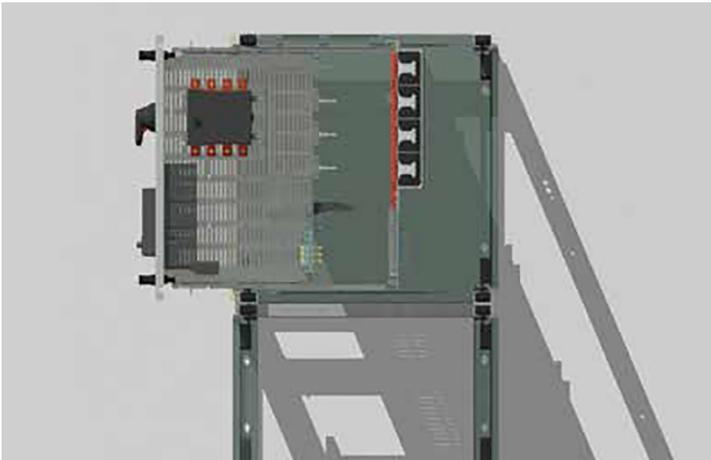


Flexibility

- Reconfiguration with live riser busbars
- Single front construction
- Back to back construction
- Front access
- Rear access
- Front access internal cable boxes
- Rear access internal cable boxes
- Rear access external cable boxes
- Variable width wire-way up to 400mm
- Incoming arrangements available utilising ACB, MCCB, Isolator, Fuseswitches, Direct Cable or Bus-duct
- Combination of fixed and withdrawable units within the same cubicle
- Modular design permits the simple and safe cubicle reconfiguration on site

Reliability and Safety

- Independently certified up to 100kA for 1 second 220kA peak withstand
- Designed and tested to meet the requirements of IEC/TR 61641 relating to internal arc faults (criteria 1 to 7)
- Seismic, shock and vibration tested to withstand the most onerous environmental conditions
- Fully compliant with EC Directives – LVD and EMC; 2014/35/EC and 2014/30/EU
- External degree of protection up to IP54 in accordance with IEC 60529
- Internal degree of protection up to IP4X
- Fully insulated main and fully segregated riser busbar systems reducing the remote possibility of busbar faults
- Up to Form 4 internal separation to IEC 61439-2



Operational Characteristics and Maintenance

- Internal IP ratings up to IP4X permit safe cabling and maintenance of functional units while adjacent units remain energised.
- Front access assemblies can be installed, operated and maintained from the front, with no access required from the rear.
- Independent, third party test and certification validating temperature rise performance with higher external and internal IP ratings and with electronic devices installed.
- Low maintenance busbar joints, ensuring the integrity of the busbar system is not compromised once the assembly is installed and commissioned at site.
- Silver plated riser busbars as standard. Other platings are available depending on the environmental conditions.
- Busbar connections between cubicles accomplished without the need for special tools, simplifying on-site erection.
- Fully in accordance with IEC 61439.



Construction



Cubicle Assembly

Cubicle frames are assembled from press formed steel vertical members joined to horizontal sections by a unique 3-way cast alloy jointing system.

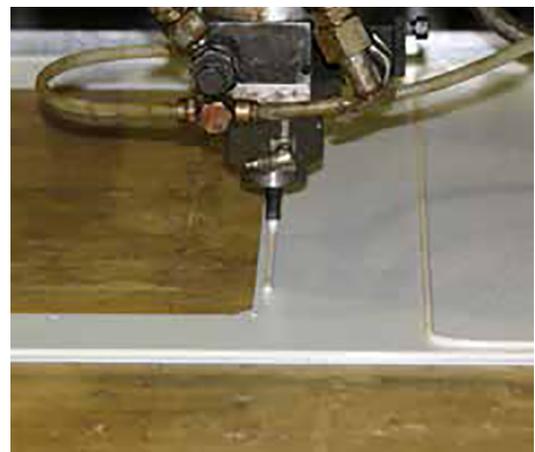
The cast joints are gasketed to achieve a degree of protection of IP54 before being enclosed with high grade press formed steel panels. The frame material is hot dip coated with a zinc/aluminium alloy to provide the highest corrosion resistance, up to four times the resistance afforded by conventional zinc coatings of equal thickness.

Horizontal dividers are bolted in position as required to achieve segregation of areas within the cubicle. All doors and cover plates are gasketed by robot application of polyurethane foam in a continuous joint free gasket providing a degree of protection of up to IP54.

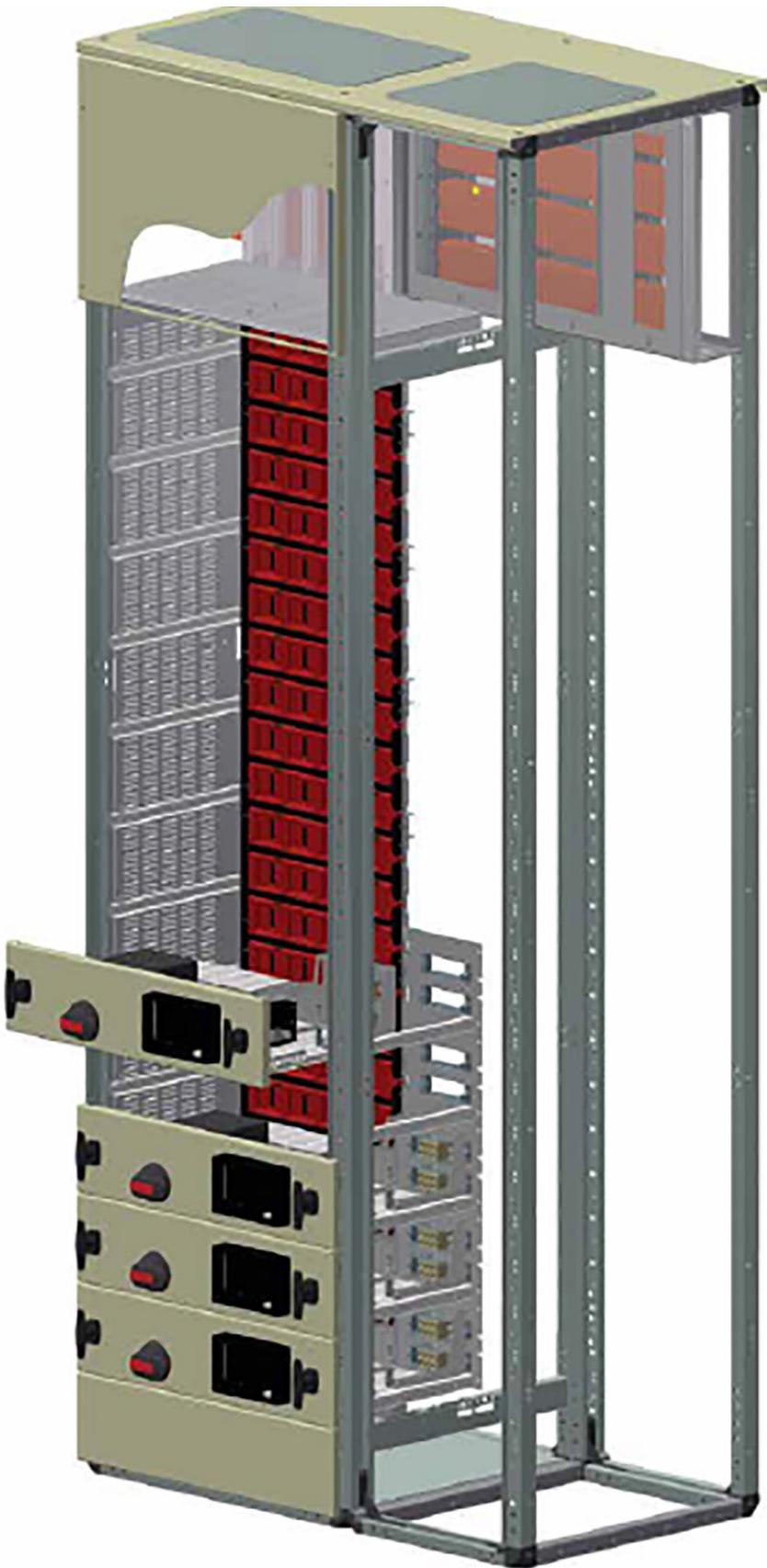
Powell's state-of-the-art Epoxy Polyester Powder paint plant provides the highest quality, durable paint finish suitable for use in even the most harsh industrial environments. Cubicles are coloured RAL7035 or can be supplied in any colour to BS4800 or RAL standard



High strength cast alloy 3 way joint system with gasket to achieve IP54



Robotic gasket application



Modular Cubicle Construction

The materials and advanced manufacturing techniques employed and utilised throughout its modular design, type 439 represents the cutting edge of LV switchgear technology.

Busbar System



Introduction

Main busbars are available in ratings from 1000A to 6300A and are installed in a fully segregated press-formed horizontal busbar chamber, minimising the possibility of internal contamination.

Busbars are braced and supported by a unique, high strength moulding design and have been independently tested and certified to withstand a prospective short circuit current of up to 100kA for 1 second, 220kA peak.

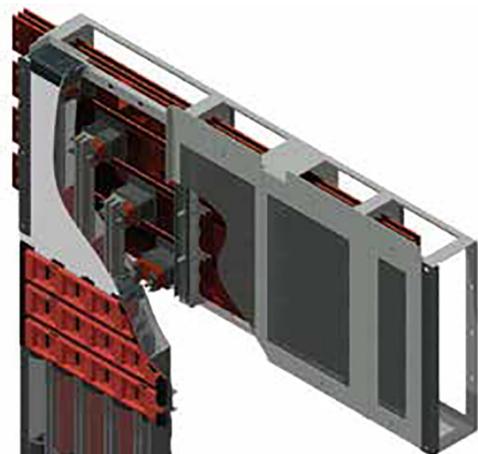
The busbar support mouldings require no punching or bending of the busbar system, irrespective of the number of busbar laminations, providing both ease of assembly and low operational maintenance. The moulding also provides an effective barrier to arc propagation within the busbar chamber.

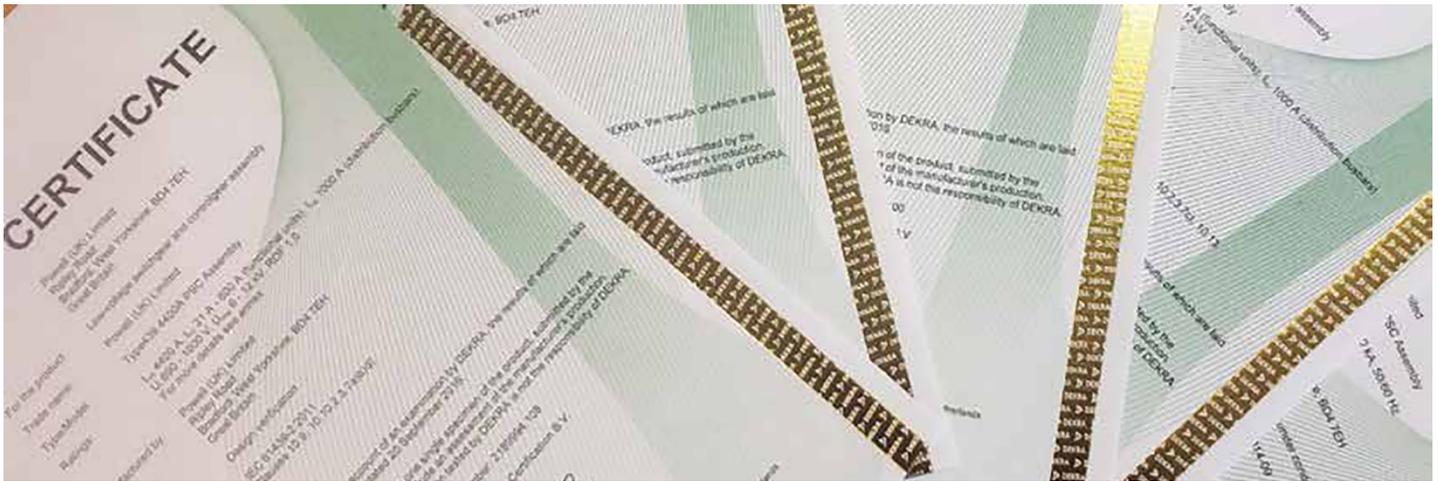
The philosophy of simple assembly and minimal maintenance is also applied to the crucial main busbar to riser busbar connections, which are accomplished utilising a unique clamp design comprising a solid copper block secured by high tensile studs.

Busbars are of hard drawn, high conductivity copper and are available as either epoxy insulated or uninsulated. Plating options are:

- Bare copper
- Tinned copper
- Tin or silver plated copper

Where insulated busbar systems are utilised, moulded boots are provided at joints to permit easy installation and maintenance.

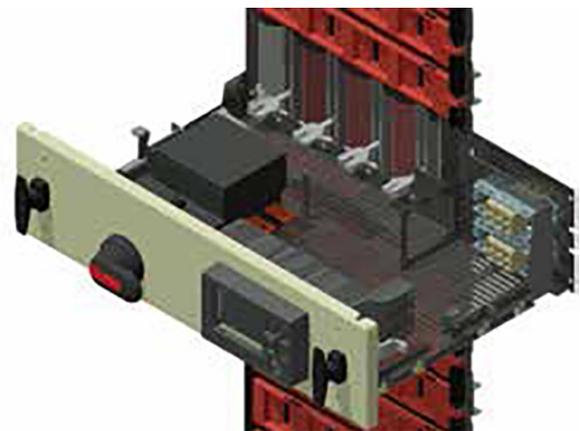




Vertical Riser Busbars

Riser busbars are housed in a completely segregated and insulated press-formed sheet steel enclosure. The riser busbars have been independently tested and certified to withstand a prospective short circuit current of 100kA for 1 second, 220kA peak.

The riser busbars are of 500mm² cross section and are rated up to 1000A. The riser busbar support mouldings also locate insulating barriers which, in conjunction with an interlocking front moulded assembly, reduce the remote possibility of an internal fault between phases or from any phase to earth.



The integrity of the riser busbar chamber design is further enhanced by the addition of a padlockable horizontal automatic sliding shutter assembly, providing a degree of protection of IP4X. The standard arrangement is for the riser busbars to be silver plated. These are used as the female connector in conjunction with the unique multiple contact plug-in connector. Positions are provided at 75mm intervals along the length of each riser busbar for maximum flexibility in cubicle content and to provide ease of reconfiguration on site. The plug-in connector is housed in an insulated two-piece moulding at the rear of a functional unit, which on insertion interlocks with the riser chamber shutter moulding. This, coupled with opening of the shutter only when the connector is in close proximity to the riser busbar, precludes the initiation of arcing faults at this point. Any immovable foreign body that was inadvertently lying across the plug-in connectors would prevent contact between the connector and the busbar, while any less rigidly held contaminant would be harmlessly pushed aside by the interaction of the connector moulding and the shutter assembly.

Air Circuit Breakers



Incoming Circuit Breakers

The inherently flexible type 439 design offers incoming circuit breaker arrangements rated up to 6300A in three or four pole, fixed or withdrawable configurations.

Air circuit breakers, complete with main and riser busbar systems, have been tested in type 439 cubicles at their maximum short circuit withstand current levels.

Incoming circuit breakers are provided with segregation barriers between the incoming side and the busbar connections to comply with maximum safety and operability.

Type 439 flexibility extends to the accommodation of other incoming arrangements:

- Moulded Case Circuit Breakers
- Fuse Switch
- Busduct
- Direct Cable





Bus-Section Circuit Breakers

Bus-section circuit breaker cubicles include barriers and supplementary bus transition sections to provide full segregation between 'A' and 'B' busbar sections. Busbar sections are fed from separate sources.

Feeder Circuit Breakers

Feeder circuit breaker cubicles are configured similarly to those utilised for incomers. Multi-tier feeder, feeder and incomer, and feeder arrangements are available at various rating combinations.

Circuit breakers with integrated protection and metering are used to optimise footprint.



Cabling Arrangements



Vertical Riser Busbars

IEC 61439-2:2011 defines the main criteria of Form 4 separation thus:

Separation of busbars from the functional units and separations of all functional units from one another. Separation of terminals for external conductors associated with a functional unit from those of any functional unit and the busbars.

It then provides two further sub criteria:

- Form 4a - Terminals for external conductors in the same compartment as the associated functional unit.

- Form 4b - Terminals for external conductors not in the same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments

BS EN 61439 includes additional information in the form of National annex NA (informative): Guide to Forms of Separation: Low Voltage Switchgear and Controlgear Assemblies to BS EN 61439-2. This annex utilises the same main and sub criteria as IEC 61439 but adds seven 'Types' as suffixes to Form 4 construction.





Form 4 Types 1, 2 and 3 are related to Form 4a construction, leaving Types 4, 5, 6 and 7 as further definitions of Form 4b.

Type 439 normally provides functional units as Form 4b and either Form 4 Type 5, 6 or 7 construction:

- Form 4 Type 5 - Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminal may be separated by insulated coverings and glanded in common cabling chamber(s)
- Form 4 Type 6 - As Type 7 as an internal gland box, but the armour is removed at the main gland plate. The inner cores are then passed into the gland box via a stuffing gland.
- Form 4 Type 7 - All segregation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glancing facility



Functional Units



Withdrawable chassis

Chassis are withdrawn on guide frame assemblies incorporating an interlocking system with two distinct positions:

- Connected
- Isolated

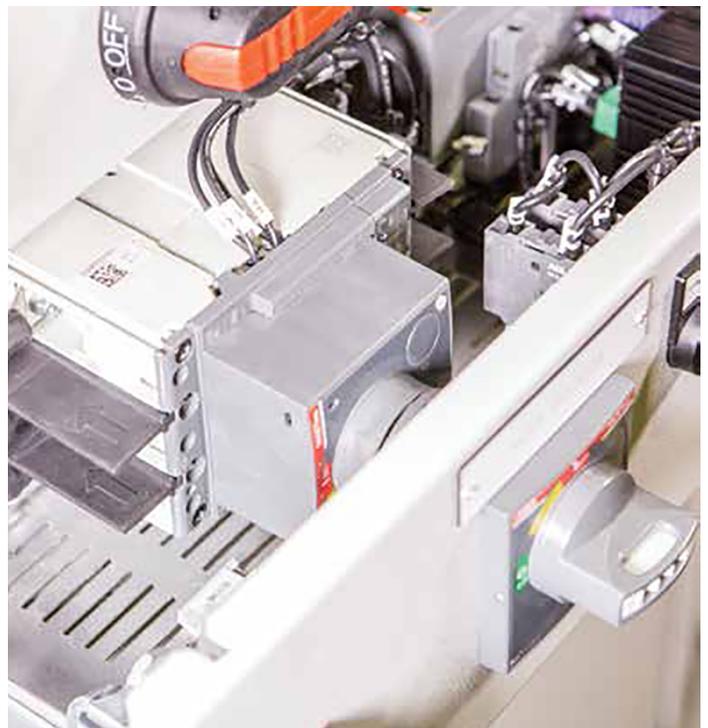
The withdrawal procedure requires the isolator / circuit breaker to be in the 'off' position to allow the compartment tray to be withdrawn.

Handles located at each side on the front of the chassis allow the unit to be easily withdrawn.

The chassis can only be inserted in an isolated position, in which all main and auxiliary connections are disconnected.

To withdraw the unit fully, finger-release catches on the slides at either side of the unit are depressed allowing removal from the cubicle.

A functional test facility is available on an integral test position when using fuse switches using the main handle/ lever. For MCCBs, the test position is achieved by using a separate key operated selector switch which is mounted on the functional unit cover or door.





Withdrawable chassis

Fixed compartments are formed utilising hot dipped alloy coated sheet steel to provide a complete enclosure within the type 439 cubicle framework.

Although the compartments are fixed, they utilise the fully insulated multiple contact plug-in connectors from the withdrawable functional unit design. This precludes the use of bolted cable connections to the busbars and contributes to the integrity of the 'unprotected, active conductors' as defined by IEC 61439-2. In addition to improving integrity and reliability, the use of plug-in busbar connections optimises flexibility and minimises downtime when reconfiguration of compartments is required. Switches or circuit breakers are mechanically interlocked with the compartment door which is solidly bonded to the type 439 main earthing system.



Intelligent Motor Control Systems - IMCS



Powell affords unparalleled expertise in the field of Intelligent Motor Control Systems (IMCS), having supplied, since 1990, over 60,000 Motor Managers, integrated with its Low and Medium Voltage IEC Switchgear, to applications in all industry sectors.

Powell's policy of safe, innovative and reliable switchgear, device and system design, in response to the increasingly sophisticated needs of its customers, ensures its continued position as market leader in the field of IMCS technology, incorporating both IEC and ANSI switchgear.

A typical IMCS in a large process environment may have a system architecture with the host process control system - typically a DCS - at the highest level and Motor

Manager 6 at device level within the switchgear.

A key element located between these levels is the CMAC (Communications Management and Control Computer), a dedicated front-end communications processor for the host control system, which is capable of simultaneously handling communications from a number of master and slave devices, irrespective of the communication protocol:

- IEC 61850
- Modbus RTU
- Modbus EtherNet
- Modbus+
- Profibus
- ControlNet
- EtherNet TCP/IP
- DeviceNet
- DF1
- OPC

Additionally, CMAC enables interfaces to the IMS SCADA, Engineering Workstation (EWS) and Power Management Systems (PMS).





Power Management Systems have been supplied to onshore and offshore applications worldwide, and provide complete electrical power system monitoring and control through:

- Synchronising
- Load Shedding
- Generator Control System Interface
- Turbine / Engine Control System Interface
- Graphical SCADA Interface

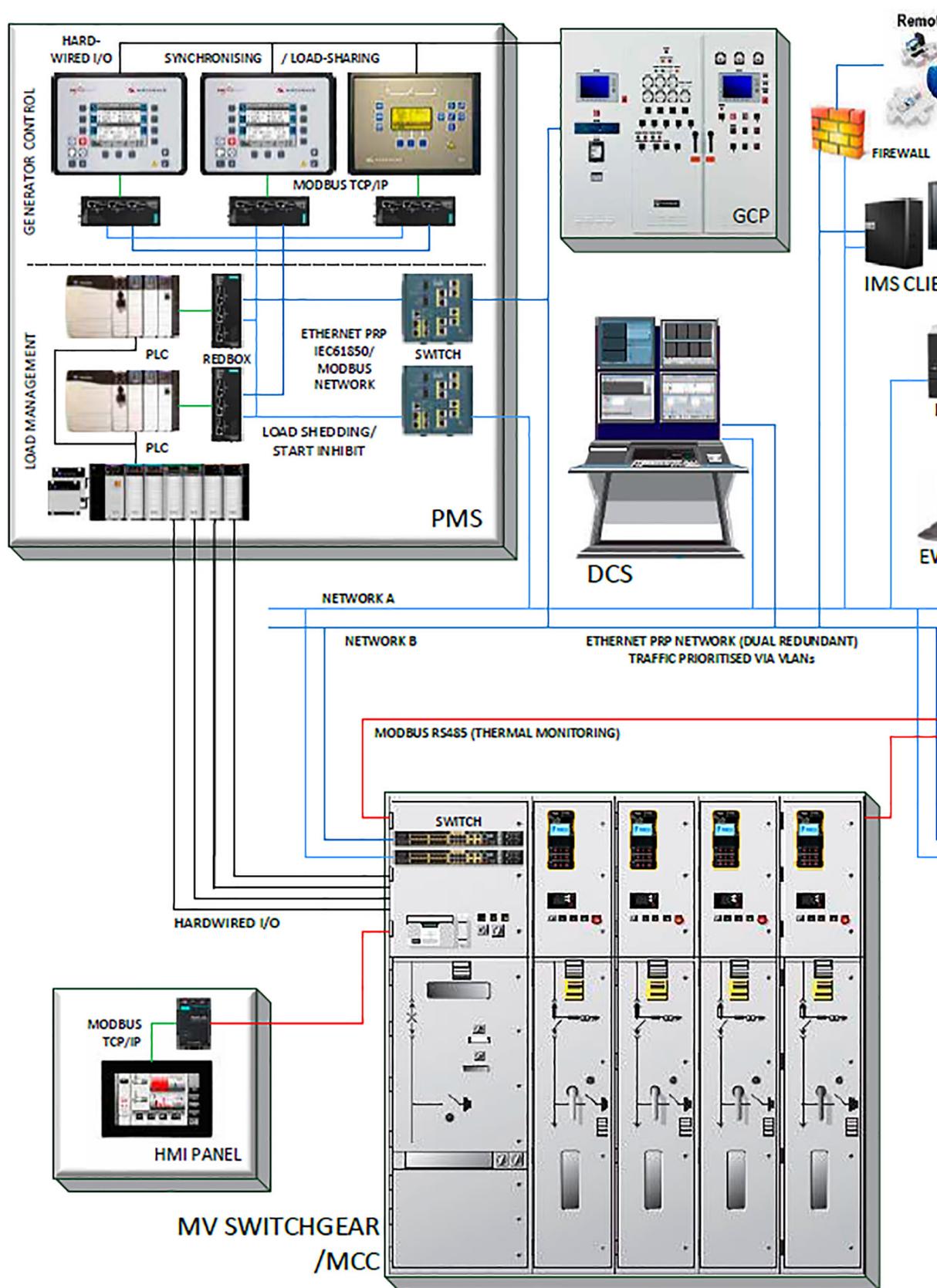
For smaller process applications, Motor Manager 6 has the optional capability to communicate directly with a PLC using three industry standard open protocols: Modbus RTU, Profibus DP or DeviceNet.

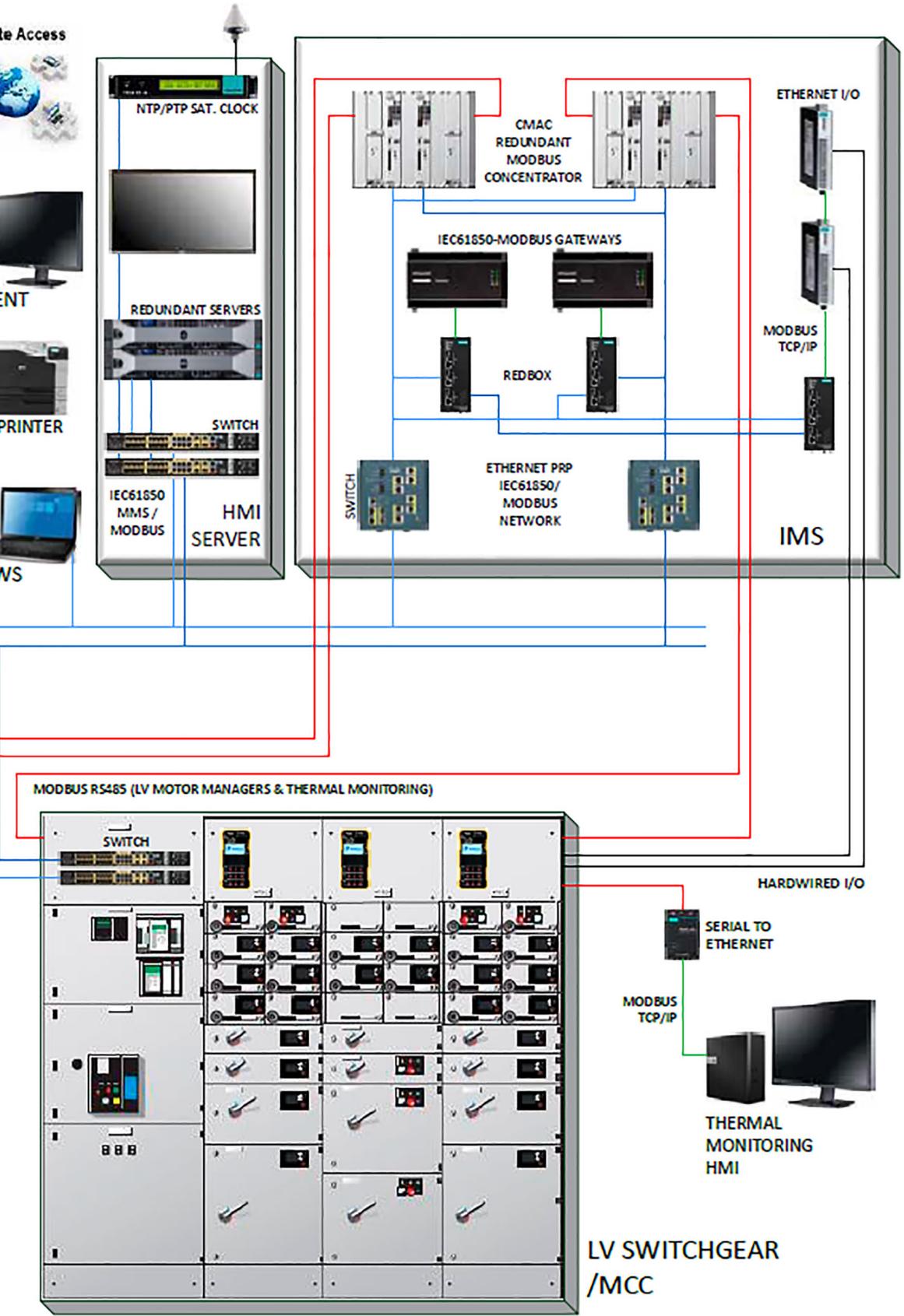
IEC61850

The IEC61850 interface for electrical substations and utilities automation is the international industry standard defining the communication between intelligent electronic devices and the related system requirements within the electrical system.

The IEC61850 standard benefits from the vast improvement in the networking technologies such as switched Ethernet, TCP/IP, high-speed wide area networks and high-performance low-cost computers.

The IEC61850 concept consists of a virtual model comprising both physical and logical device models and a set of standardised communications services. Through these standardised models, self-describing devices, object naming conventions, communication services and object-orient peer-to-peer data exchange, the IEC61850 standard brings significant advantages to the substation automation user. The IEC61850 standardised configuration language (SCL) enables the configuration of an intelligent device and its role in the power system to be precisely defined using XML files.





Complete Engineered Solutions



With an enduring commitment to the principle of identifying, anticipating and satisfying the requirements of our customers, and unsurpassed strength in engineering design, manufacture and multi-discipline project management, Powell is the natural choice of customers worldwide as providers of associated ancillary equipment to either house, or interface with, the core switchgear; where there is a requirement for Packaged Modular Substations, Transformers or UPS.

The Powell advantage is our ability, when given project management responsibility for the electrical system package, to provide best of breed technical and commercial solutions to fit specific requirements, at the same time reducing the client's engineering and expediting time.



At the time of contract award, a dedicated, experienced, project manager is appointed as the single point of contact, with full responsibility for all technical and commercial interfaces with the customer, colleagues and throughout the supply chain.

Design Considerations



Withdrawable chassis

When considering the design requirements of a solution for individual projects, it is essential that the right questions are not only asked, but the answers to those questions are fully and transparently explained. Comparing like-for-like proposals can be made complicated when not all aspects of the project are

properly scoped out and explored at the outset, leaving projects open to 'hidden extras' at a later date.

Thus, it is essential to make extensive enquiries surrounding the needs of your project:

Can the supplier demonstrate that their solution has been independently type tested?

Is the supplier willing to show you written evidence of their product and testing claims?

Has the supplier correctly applied the diversity factor to ensure the solution meets the test requirements for your particular project?

Has the ambient temperature been taken into consideration so the SCPD for your project meets the test requirements?

Can the supplier demonstrate past examples of projects compliant with IEC61850?

Does the product provide the correct degree of protection of enclosures?

Have the dielectric properties of the design been tested for powerfrequency and impulse withstand voltage?

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