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Caterpillar Electrical Solutions

Custom Power Solutions





BUILT FOR IT.

Your Challenges...

- Synchronising multiple generators
- Synchronising generators to multiple Utilities
- Additional breakers (e.g. Load bank)
- User defined protection (shutdowns/alarms)
- PLC/SCADA control
- Remote monitoring
- Switchgear and Enclosures

Cat[®] Solutions

- Systems designed specifically to customer and consultant requirements



Agenda

• Solutions Electrical Design Team

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- Generator & Package Controls
- System Level Controls
- Switchgear
- Commissioning

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Solutions Electrical Design Team





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Solutions Electrical Design Team

- Systems designed specifically to Customer and Consultant Requirements
 - LV & HV Generator Protection & Control
 - Motor Protection & Control
 - Switchgear Design
 - System Integration





Solutions Electrical Design

- Supporting Services
 - Sales & Project Management
 - Witness Testing
 - Commissioning





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Generator and Package Controls





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EMCP4.1 Features

Controls

- Auto/Start/Stop
- Engine cooldown timer
- Emergency stop
- Engine cycle crank

• Digital (LCD) Indication

- Generator AC voltage
 - 3 phase (L-L&L-N)
 - ± 2% Accuracy
- RPM & battery voltage
- Gen. AC current (per phase & avg)
- Generator frequency
- Engine oil pressure (psi, kPa or bar)
- Engine oil temperature (° C or ° F)
- Engine coolant temperature (° C or ° F)
- Multiple language support
- Engine start & crank attempt counter
- Generator Protection
 - Over/under voltage
 - Over/under frequency
 - Generator phase sequence



Engine Protection

- Low oil pressure
- High coolant temp
- Low coolant level
- Fail to start
- Overspeed

• Other Features

- Programmable security levels
- Reduced power mode





EMCP4.2 Features

- Controls
 - Programmable cycle timer
- Digital (LCD) Indication
 - Generator AC voltage
 - 3 phase (L-L&L-N)
 - ± 1% Accuracy
 - Power metering (kW, kVA, kVAr, pf)
 - Hour meters (kW-Hour, kVAr-Hour)
 - Real time clock

Communication

- Accessory CAN data link
- RS-485 annunciator data link
- RS-485 SCADA (Modbus RTU)

Generator Protection

- Over current (timed & inverse)
- Reverse power (real & reactive



Other Features

- Programmable kW relay

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- Tier 4 integration

EMCP4.2B Features

- ATS Control
- PLC logic
- Custom display screens
- Configurable set point security levels
- Configurable resistance maps for analogue inputs
- Trip KWh and kVArh counters
- Keypad inactivity screen



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EMCP4.3 Features

- Controls
 - 5.5 inch Graphical Display
 - Generator AC voltage
 - 3 phase (L-L&L-N)
 - \pm 0.25% Accuracy
- Generator Protection
 - Current balance
- Communication
 - Ethernet SCADA (Modbus TCP)
- Other Features
 - Cat Switchgear integration
 - Status event log





EMCP4.4 Features

- Controls
 - Paralleling

Generator Protection

– Bus Phase Sequence

• Other Features

- Bus metering
- Dead bus arbitration
- Manual and automatic synchronization
- Real (kW) and reactive (kVAr) load sharing
- Load shed / load add
- Load sense / load demand
- MGDL (Ethernet) (with failsafe protection) or Hard-Wired paralleling





Paralleling Solutions



Functions/Features

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Customisable

• Options

- Control Panel/Breaker relocation
- Breaker Upgrade (Make / Type / Size)
- Additional breakers (Load bank)
- Alternator Upgrade (MV / IP55)
- Diode Failure module
- Earth Fault / Leakage
- Air Flap Valves
- Motorised Louvre control
- Dual/Air Starters and Dual/Air starter control
- Vibration sensors
- Differential Protection
- 3 Phase / Single Phase / Split Phase switch
 -And more





Alternative Controllers

- Why use?
 - Integrate With Existing Installations
 - Greater flexibility
 - Customer Preference







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Alternative Controllers

Additional Features

- Integrated Utility Synchronising and Load Sharing
- Load sharing multiple units (Up to 32 units)
- Dead Bus Synchronising
- Customisable Logic
- Additional breaker control



Packaged Solutions

- Cooling system control & protection
 - Electric driven set mounted Rad
 - Electric Driven Remote Rad
 - Cooling Pumps
- Fuel Transfer system control & protection
 - Fuel Solenoids
 - Motorised Valves
 - AC Fuel Pumps
 - Fuel Coolers





Packaged Solutions



Modular Set Mounted Control Panel: Designed to house the 3 standard 3500 Dogbox control modules

 IP55 or HV terminal box style Alt has been offered



Modular Floor Standing Control Panel:

- Remote to the generator Separate sections for:
- Generator controls
- Generator regulator
- Motor control
- Annunciator



Rental Control Panel: Separate sections for:

- Alternator connections
- Generator controls
- Outgoing breaker
- Customer Interface
- Battery charger



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System Level Controls

PLC/SCADA based Control Systems





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Why use PLC based Control Systems?

Complex Control Philosophies

- Modular system
 - Can be scaled to accommodate any application
- System Integration
 - 3rd Party Interfacing
- Remote Access
 - Monitoring
 - Control
 - Technical Support



Applications

- Multiple Utility Control
- Multiple Generator Groups
- Bus-Coupler Control
- AMF Applications
- Island/Utility Parallel
- Peak Lopping (Short Term Utility Paralleling)
- Peak Shaving (Long Term Utility Paralleling)

- Building load management/system control
 - Load Optimisation
 - Fully configurable from SCADA
 screen
 - Each breaker assigned a priority level (0 to 999)
 - Mains/Generator maximum priority
 levels
 - Predictive load steps
 - N + x (e.g. N+1, N+2, etc.,)
- Balance of Plant Control
- Configurable base code



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PLC Options

- Single PLC
 - Flexible
 - Scalable
- Dual 'Cold' Standby PLCs
 - Increased reliability
 - Typical 250ms to 1 sec switchover
- Dual 'Hot' Standby PLCs
 - Industry leading reliability
 - Bumpless switchover
 - Suitable up to SIL2 applications







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I/O and Networks

- I/O
 - Local I/O
 - Distributed I/O via Ethernet
 - Redundant I/O
 - Increased reliability
- Network
- Ethernet Network
- Flexible implementation
 - Star/Line Topology
 - Simple low cost installation
 - Ring Topology
 - Increased system resilience
- Range
 - 100 m between devices for copper twisted-pair wiring
 - Fibre cabling permits longer distances (Up to 2kM)





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Communication Protocols

- Modbus
- Profibus
- Canbus
- DeviceNet
- ControlNet
- EtherNet
- BacNet



SCADA/HMI

- SCADA Displays
 - Local/Remote displays
 - Single Interface for system overview &
 - Project specific screens
 - Gen/Auxiliary Equipment screens
 - Data Logging
 - Alarm/Event Logging
 - Password protection





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SCADA/HMI













SCADA/HMI











Master PLC and Generator panels





Master PLC and Outstation







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Switchgear





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Modular Switchboards

- Caterpillar design and manufacture
- Independently certified to IEC 61439-2
- Ingress protection IP23
- Internal Segregation Form 2a
- Floor standing ACBs up to 4000A





Modular Switchboards

Description	Option	MSW1600	MSW2000	MSW2500	MSW3200	MSW4000	
Breaker Models		ABB Emax2 E2 1600A	ABB Emax2 E2 2000A	ABB Emax2 E2 2500A	ABB Emax2 E4 3200A	ABB Emax2 E4 4000A	
Rated Current	@ 35°C	1600A	2000A	2500A	3200A	3700A	4000A
Poles	3 Pole	Standard					
	4 Pole	Option					
Fixed/ Withdrawable	Fixed	Standard					
	Withdrawable	Option					
Ingress Progression	IP23	Standard					
	IP54	Option					
Internal Segregation	Form 2a	Standard					
	Form 4b	Option					
Ventilation	Natural	Standard N/A					
	Forced	Option					Required
Short Circuit Fault Rating (I _{cw})	66kA, 1 sec	Standard					
	100kA, 1 sec	N/A Option					
Dimensions	Height	1800mm				2250mm	
	Width		600mm			750mm	
	Depth	900mm					
	Plinth	100mm					
Lifting	Fork Lift Pockets	Standard					
	Swivel Lifting Eye	Option					



Switchboard Options

- Ingress protection IP54 assembly.
- Internal segregation form 4b.
- Assembly tested up to 100kA
 I_{CW} fault current
- Control section for gen controller / protection relay etc.



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Modular Switchboards

- Collaborate with trusted 3rd Party suppliers to offer integrated package
- Based on Cubic modular system available up to 6300A
- Fault rating up to I_{cw}
 100kA @ 1 sec
- Certified to IEC 61439-2.





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Witness Testing & Commissioning





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Witness Testing

Customized tests can be catered for in our world class witness test facilities.

Customers can be hosted in our Caterpillar facilities to enable them to see first hand the Caterpillar production process; from sheet metal to full finished package.





Commissioning

- All Solutions products
 - Generators
 - Diesel
 - Gas
 - Medium Voltage
 - PLC Systems
 - Switchgear
 - Flywheel UPS modules











Conclusion

- Custom Power Solutions can provide the following:
 - Solutions designed, built and tested in a Caterpillar facility by Caterpillar engineers to Caterpillar standards
 - Flexible Solutions
 - Integration with 3rd party equipment
 - Full system test at factory
 - Sales/Project Management/Commissioning support
 - Full Caterpillar Warranty





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Questions?





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