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Product described:	Redundant Genset Control Panel RGCP-3400
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General

The power generation system shall be controlled by a microprocessor-based redundant genset control panel (RGCP). The RGCP must consist of two genset controllers (Woodward easYgen or equivalent) capable of bumpless transfer and hot swap serviceability. Each RGCP will be factory assembled, wired and tested as a complete turn-key assembly. The RGCP shall operate in a peer-to-peer system with up to 32 synchronous or asynchronous generators. This system shall provide:

- Automatic sequencing of multiple units, multiple segments, synchronization, generator, generator group and utility breaker control
- Soft loading and unloading for bumpless transfers
- Real KW load control
- Reactive KVAR control
- Metering
- Communications
- Protection
- Diagnostic tools

The RGCP shall be a commercially available control and not Programmable Logic Controller (PLC) based, and shall be configured for operation without the need for customized, proprietary programming or software. The system shall be configurable in either a simple island or utility paralleled arrangement. The RGCP shall have the capability to operate with advanced circuit breaker control (Woodward LS-5 or equivalent) for complex systems. Specific requirements are as follows:

Automatic Generator Set Sequencing

- Starts and stops generator sets upon utility failure or utility restoration.
- Starts and stops generator sets based on plant load to maintain the power interchange at the utility intertie within predetermined limits.
- Governs generator set loading and unloading for bumpless transfer
- Provides load dependent start/stop for improved generator system efficiency with configurable generator priority sequencing based on generator size, service hours, fuel efficiency or fixed sequence.
- Controls complex applications with multiple generator sets and utility/bus segment interties via the CAN bus, based upon the logic internal to the generator and circuit breaker controllers with optional control inputs from an external PLC.

Provides Synchronizing

- Independent phase match or slip frequency synchronization with voltage matching for control of multiple circuit breakers on generators, bus segments and utility mains.
- Adjustable phase and voltage window.
- Internal dead bus closing logic ensuring multiple units close safely within the synchronization parameters.
- Dead field paralleling (run up synchronization).
- Breaker or contactor control for generators.

Real KW Load Control

- True RMS voltage and current measurement for reduced susceptibility to harmonics.
- Speed bias signal to prime mover speed control freely configurable in the range of +/- 20 ma, +/- 10 volts, or 0-10 VDC, 500 Hz PWM, and discrete raise/lower to control prime movers of different types (diesel engine, gaseous or bio-fueled engine, gas turbine, micro-turbine, etc.).
- Configurable load and unload ramp rates for generators, bus segments, or the entire system at the utility ties.
- Proportional load sharing (isochronous or droop) of up to 32 generators, regardless of KW rating.
- Base load control.
- Process control.
- Import/export control at the utility mains breakers.
- Externally adjustable load or process references using analog inputs, Modbus RTU, or CAN open.
- Digital load sharing integral to the controller without external load sharing control modules.

Reactive KVAR Control

- Voltage bias signal to Automatic Voltage Regulator (AVR) freely configurable in the range of +/- 20 ma, +/- 10 volts, or 0-10 VDC, 500 Hz PWM, and discrete raise/lower.
- Configurable load and unload ramp rates for generators, bus segments, or the entire system at the utility ties.
- PF sharing on isolated buses using percentage base reactive load sharing
- VAR/PF control using percentage based load sharing during process, base load or import/export control.
- Externally adjustable Volt-Amp-Reactive (VAR) or Power Factor (PF) references using analog inputs, Modbus RTU, or CANopen.

Engine Control and Protection

- Configurable start and stop logic for diesel and gas engines with fully programmable settings.
- CAN SAE J1939 network communication/control to engine ECU.
- Engine over speed and under speed (ANSI 12 & 14).
- Cylinder temperature monitoring for in-line and V engines.
- Engine speed/frequency mismatch detection.
- Cool down timer. Customizable protection based upon J1939 or analog inputs.

Generator Protection

- Directional power (ANSI 32), reverse power (ANSI 32R), and reduced power (ANSI 32F)
- Unbalanced load (ANSI 46)
- Phase rotation (ANSI 47)
- Phase over current instantaneous (ANSI 50) and time (ANSI 51).
- Phase over current voltage restraint (ANSI 51V)
- Loss of excitation (40Q).
- Ground fault measured (50G)
- Power Factor (ANSI 55).
- Over/under voltage (ANSI 27/59)
- Over/under frequency (ANSI 81 O/U)

Mains Protection (Generator Decoupling)

- Over/under voltage (ANSI 27/59)
- Phase shift/rotation field (ANSI 78)
- Over/under frequency (ANSI 81O/U)
- Rate of Change of Frequency (ROCOF) with the circuit breaker controller on the Mains
- Q(U) monitoring to avoid import of inductive reactive power with the circuit breaker controller on the Mains

Breaker Protection/Monitoring With Circuit Breaker Controller

- Over/under voltage (ANSI 27/59)
- Phase shift/rotation field (ANSI 27/59)
- Over/under frequency (ANSI 81 O/U)
- Synchronization time out monitoring
- Breaker open/close monitoring

Measurement

- True RMS Voltage—L-N, L-L, per phase and average; 1-phase or 3-phase generator and mains, 1-phase load bus.
- True RMS current—Line current per phase and average; 1-phase or 3-phase generator, 1-phase mains
- Frequency
- Power—kVA, kVAR and KW per phase and total; PF per phase and average; total generator kWhr and kVARhr

RGCP Communications

- Dedicated firmware allowing auto-tracking of the two controllers operating in a primary/standby configuration.
- Three CAN communication networks shall be utilized:
 - System control and load share network with optional redundant fiber optic communications.
 - CANopen visualization and control.
 - Local input/output expansion, remote panel and engine J1939 ECU.
- Serial Modbus for slave Remote Terminal Unit (RTU) communication for Supervisory Control and Data Acquisition (SCADA) annunciation.
- Configuration via PC/laptop with Woodward Toolkit service tool.
- Multi-level password protection

Diagnostic Features

- In the event of a primary unit failure, control automatically transfers to the stand-by unit with bump-less transfer.
- The redundant generator control panel shall provide an alarm for the loss of redundancy.
- Indication showing which controller is actively controlling.
- Parameter settings alignment check between the primary and standby controllers.
- Configuration check in load dependent start/stop.
- Phase rotation mismatch
- Network communications error alarm
- Breaker/contact synchronization time out and reclose alarms
- Speed/frequency mismatch.
- Analog input out of range alarms
- Sequence of events recorder—300 events FIFO with real time clock.
- Graphical overview of generators, generator bus bar and mains with trending on door mounted remote panel.

Redundant Generator Control Panel Mounting and Features

- The RGCP shall be supplied as a fully wired and factory tested turn-key panel designed for mounting in a switchgear enclosure.
- Current Transformer (CT) shorting disconnects shall be integral to the panel for safety.
- Manual bumpless transfer between primary and standby controllers shall be possible through the key switch.
- Provisions for redundant power supply inputs shall be provided.