

Gas Genset Controls

Genset Control Panel (GCP2) with PCS™ (PowerCommand Supervisor)



Description

The Cummins Power Genset Control Panel (GCP2) is an integrated monitoring and control system for the Cummins Lean Burn Natural Gas Gensets. It is a free standing control panel consisting of a Human Machine Interface (HMI), the Cummins PowerCommand Supervisor (PCS™), and a Programmable Logic Controller. The GCP2 can be located either with the genset or remotely up to 40 m (130 ft) from the genset.

The Control is designed and tested to operate the generator set in single unit isolated bus, multiple unit isolated bus (load share) and utility parallel modes.

The PowerCommand control is UL508 Listed. All Cummins Power Generation systems are backed by a comprehensive warranty program and supported by a worldwide network of 170 distributors and service branches to assist with warranty, service, parts, and planned maintenance support.

Features

Cummins PowerCommand Supervisor (PCS) – The PowerCommand Supervisor Genset Control and protection system includes both analog and digital metering, digital voltage regulation, Power Command Digital Paralleling controls including synchronizing, load sharing, and import/export controls, Amp Sentry overcurrent protection, and genset fault monitoring.

Color Touchscreen Interface – Displays both engine and generator information. The touchscreen is provided to allow operator monitoring and control of the generator set and includes all information for the complete generator set including the alternator, engine, and auxiliary devices.

Programmable Logic Controller (PLC) – Functions as the communications gateway between the engine control, generator control, touchscreen, and auxiliary systems.

Network Capability – Standard Modbus Plus communications allow remote monitoring and control of the genset.

Emergency Stop Switch – Two position “mushroom” head switch for immediate shutdown in an emergency condition. Capability for additional remote Emergency Stop Switches.

Temperature Rated – Designed to operate in between 0-50°C (32-122°F)

Genset to GCP Harness – Standard 5 meter (10, 15, 20, 30, and 40 meter harnesses optional)

Enclosures – Steel enclosure minimum 14 gauge sheet metal with window for access to operation and monitoring of the generator set. It is environmentally protected to IP54/NEMA 3R

Warranty and Service - Backed by a comprehensive warranty and worldwide distributor service network.

PC Based HMI (Touchscreen)



The HMI is a combined industrial PC and 10.4" (264 mm) color touchscreen for monitoring and control of the generator set. The screen is mounted on a console on the front of the GCP2 with gaskets between the touchscreen and the enclosure for environmental protection. It is complete with a real time clock, with separate battery backup and incorporates flash memory.

The HMI's main role is to read and display data, the genset is still available and fully protected in the unlikely event of any loss of communication or function. Fault information and real-time data originates from the PCS, engine controller or PLC. The screens HMI will display a mixture of data from some or all of these devices.

There is one genset summary screen (with a popup control screen) and also an alarm summary and history screen. All the principle data required by an operator is available for these three screens.

There is a popup menu providing access to the genset summary screen, alarm screens, units selection, security access, operator display languages (English, French, German, Portuguese, Spanish and Dutch) and also restricted access to eight service screens.

The main screen is designed to enable the operator to determine the current genset status. It further allows access to the data embedded in the layered screens.

Programmable Logic Controller (PLC)

The PLC uses a DIN rail mounted card and rack arrangement to allow easy servicing and identification of system components.

Other features to enhance serviceability include:

- Capability for on-line program/data changes using a personal computer directly connected to the PLC,
- LED status indicators on each board for use in diagnosis of system condition and board level service,
- I/O cards include integral surge suppressors for greater system reliability,

PowerCommand Supervisor



The PCS is a microprocessor based genset monitoring, metering and control system. It is integrated into the GCP2 and incorporates the following key features ;

- Voltage Regulator
- Synchronizer (Freq, Phase & Volts)
- Iso-Bus kW and kVAR load sharing
- Utility Paralleling kW Load Control
- Utility Paralleling Power Factor Control
- Alternator Metering
- AmpSentry™ Alternator Protection
 - Overload,
 - Overcurrent [51],
 - Short circuit [50],
 - High AC Volts [59],
 - Low AC Volts [27],
 - Under frequency [81u],
 - Sync Check, Fail to Sync,
 - CB Fail to Close,
 - Reverse Power [32],
 - Loss of Excitation [40],
 - Phase Rotation

Environmentally Hardened Enclosure

The front panel of the unit is formed by a single membrane that covers the entire surface. The front face is easy to clean and impervious to water spray, dust and oil/exhaust residue. Switches for control are incorporated into the door which is gasketed with a dual moisture and RFI/EMI gasket to protect internal components from air born contaminants.

Control Switches and Functions

RUN/OFF/AUTO Mode Control Switch

An oil tight three position switch starts and stops the generator set locally or enables start/stop control from a remote position.

It provides the following functions:

- The 'OFF' position de-energizes all primary DC circuits. When the switch is in this position, the non-automatic indicator will flash continuously.
- The 'RUN' position energizes the control and initiates the genset starting operation.
- The 'AUTO' position enables the control to receive a start signal from a remote location.

Note : The non-automatic indicator will flash when the switch is in the "RUN" or "OFF" position.

System Control

Control arrows on the screen lead the operator to information. The control switches provide the operator with a positive indication that the switch is operated. The switches are totally sealed and designed to provide reliable service.

Menu selection Switches

These four switches allow the operator to select menu-driven control and monitoring information.

Menu 'HOME' Switch

Returns to the main menu selections screen regardless of the position in the menu logic.

Panel Lights Switch

Turns the back-lit panel illumination on and off for easy reading of the entire fascia in dark conditions. This feature automatically switches off after 5 minutes.

Test Switch

Prompts the PowerCommand Control to perform a self test and displays all fault messages.

Reset Switch

Clears the digital display and status panel and allows the genset to start after a fault condition has been corrected.

Adjustment Menu

Allows the operator to set basic genset parameters. Adjustments are limited to help prevent operator error and potential damage to equipment. Critical parameters are adjustable only via a security access code.

Adjustments include:

- Voltage (+/- 5%)
- Automatic Voltage Regulator Gain (access code protected)

Critical service level adjustments are possible only after entering an access code. All adjustments are made through digital raise/lower switches from the front of the fascia.

The adjustment being digitally displayed.

External Control Adjustments

Adjustments for automatic voltage regulation are performed directly at the control fascia by using the security code without the need to enter the GCP2 enclosure.

Alarm and Status Message Display

To compliment the HMI screen displays, PCS check data displays are provided for all critical genset parameters.

Digital messages provide a clear indication of potential problems. A two line 16 character-per-line, LED alphanumeric screen displays alarm and status messages along with data regarding AC output.

Status Indicators

Three dual element LED indicating lamps provide basic genset status data on the fascia. Solid state indicators on internal circuit boards provide further status and diagnostic data.

Non-Automatic Indicator

When the Run/Off/Auto switch is in the OFF or RUN position the red non-automatic indicator will flash on and off.

Warning Indicator

The amber light indicates the status screen is displaying a warning condition. The reset switch is used to clear the message after the warning condition is corrected.

Shutdown Indicator

A red light indicates the status screen is displaying a shutdown condition. The reset switch is used to clear the message after the shutdown condition is corrected.

Generator Set Monitoring - Warning and Shutdown Messages

The digital display provides status of the following critical engine functions :

- Battery voltage
- Speed
- Overspeed
- Magnetic pick up failure (shutdown)

On sensing a warning or shutdown condition the control displays the warning or shutdown message, lights the warning or shutdown indicator lamp on the front of the facia and displays a code number which is interpreted by the PLC and displayed at the HMI in an easy to understand format. These codes are also displayed on the PCC facia and can be cross-referenced using the genset manual.

The control has provisions for four programmable fault conditions. These may be either warning or shutdown conditions. Labels for customer faults can be programmed into the control.

The control maintains an historical data log of the latest alarm and status conditions on the genset.

Historical data

The control displays the last 20 alarm and/or shutdown messages.

AC Output Metering

Combines digital and analog metering to provide accurate digital readouts plus analog indication of trends and operating conditions.

Analog Meters

Analog metering on the control facia provides clear indication of generator set stability from a 'walk by' perspective to avoid the requirement to start the HMI screen if it is in screen save mode.

The kilowatt meter and ammeter are scaled in percent of AC output for easy recognition of genset status and load level (0 - 90% of rating ; green, 90 - 100% of rating ; amber =100% of rating ; red.)

Kilowatt Meter

Indicates 3-phase AC power output as a percent of rated load. Provides a true indication of total kW load on the genset, regardless of the load power factor.

Scale 0-125% of rated

Accuracy is +/-5%

Frequency Meter

Indicates genset output frequency in hertz. Calculated frequency is based on engine speed and alternator voltage zero-crossing and is not affected by voltage waveform distortion caused by non-linear loads.

Scale is 45 - 65 Hz.

Accuracy is +/- 5%.

AC Voltmeter

Dual scale AC voltmeter indicates alternator output voltage.

Accuracy is +/- 2%

Scales are 0 - 300VAC, 0 - 600VAC, 0 - 400 VAC, 0 - 750VAC, 0 - 5260VAC, 0 - 15,000VAC.

AC Ammeter

Indicates current output in percent of maximum rated standby current.

Accuracy is +/- 2%

Scale is 0 - 125%

Phase Select Switch

Allows the operator to select the phase monitored by the analogue ammeter and voltmeter. LED indicators display which phase is being monitored and which voltage scale is applied.

Digital Metering

The digital metering display provides access to alternator performance data and a more accurate readout of the AC output information displayed on the analogue meters. The following outputs are displayed:

- Genset Output Voltage (3-phase, line to line or line to neutral)
- Genset output current (3-phase)
- Power factor (0 to 1, leading or lagging)
- AC kilowatts
- AC kilowatt-hours
- Alternator exciter duty and governor duty (%)
- Genset output frequency (Hz)

The voltage and current data for all three phases is displayed simultaneously on a single screen so load and voltage balance is readily apparent.

Digital Voltage Regulation, Synchronizing and Load Sharing Controls

The PCS module includes all voltage regulation, synchronizing and load sharing control required for isolated or infinite bus paralleling applications, including demanding UPS and non-linear load applications.

Applications and Performance

Paralleling

Isolated Bus Paralleling control (set to set synchronising, isochronous kW and kVAR load sharing) and Base Load Utility Paralleling (synchronising to utility, base load kW control, VAR/PF control) features are provided.

Isochronous Real Load Sharing

Load sharing to within as low as 1% of equal. Load sharing controls operate directly on the engine governor actuator to provide zero droop in frequency for loads from zero to 100% of rated genset capacity.

Droop Real Load Sharing

Control may be configured for operation in droop mode, adjustable for no load to full load droop from 1% to 10%

Isochronous Reactive Load Sharing

Load sharing to within as low as 1% of equal. Load sharing controls operate directly on the excitation system to provide zero droop in voltage for loads to 100% of rated genset capacity.

Droop Reactive Load Sharing

Control may be configured for operation in droop mode, adjustable for no load to full load droop from 1% to 10%.

Synchronizer

Range:

The synchroniser can drive the genset frequency and voltage to a bus value which is -10% to +10% of selected voltage and frequency. The ramp speed for matching is 4% per second.

Frequency differential :

the set is controlled to match the bus frequency.

Voltage differential :

the set voltage is controlled to within 1% of system bus voltage with checks for correct phase rotation to bus.

Permissive protection :

Adjustable for a phase difference of 5 to 20 degrees with phase difference decreasing. Time delay is adjustable from 0.5 to 5 seconds.

Control System :

Automatically resets bus frequency and voltage to preset values after the paralleling breaker closes.

'Dead Bus' Sensor :

Allows closure of the generator set to an inactive system bus.

Battery Monitoring System

The control continually monitors the battery charging system for low and high DC voltage and runs a battery load test every time the engine is started. Functions and messages include:

- Low DC voltage (battery voltage less than 25VDC except during engine cranking)
- High DC voltage (battery voltage greater than 32 VDC)
- Weak battery (battery voltage less than 14.4 VDC for more than 2 seconds during engine cranking).

Warning and Shutdown Messages

Overload

When total kW load exceeds 100% of the standby rating of the genset (110% of prime rating) for 5 seconds a load shed signal is issued and a warning alarm activated.

Overcurrent (51)

When the current on any phase exceeds 110% of the genset rated current for more than 60 seconds a warning alarm is activated.

Overcurrent (51)

The genset is shutdown when the current on any phase is between 110 - 175% of rated and the time/current integral approaches alternator thermal limits.

Short Circuit (50)

The genset is shutdown when the current on any phase exceeds 175% of rated and the time/current integral approaches alternator thermal limits.

High AC Voltage (59)

Genset is shutdown when AC voltage exceeds 110% for 10 seconds or with no delay when voltage exceeds 130% of nominal.

Low AC Voltage (27)

Genset is shutdown when AC voltage falls below 85% of rated voltage for more than 10 seconds.

UnderFrequency (81U)

Genset is shutdown when AC frequency falls below 90% of rated frequency for more than 20 seconds.

Reverse Power (32)

Genset is shut down when kW flow into the genset exceeds an adjustable set point (5 - 15% of genset rating) for an adjustable amount of time (1 - 15 seconds).

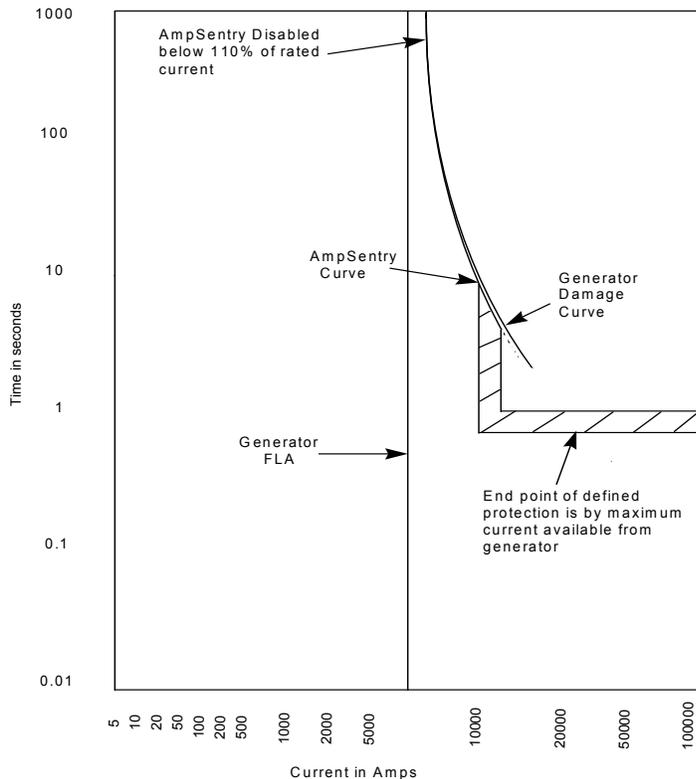
Loss of Excitation (40)

Genset is shut down when kVAR is less than 0.16 - 0.41 per unit kVAR (adjustable) for more than 2 - 10 seconds (adjustable).

AmpSentry Protection

AmpSentry protection is a comprehensive power monitoring and control system integral to the PCC that guards the electrical integrity of the alternator and power system from the effects of overcurrent, short circuit, over/under voltage, underfrequency and overload. Current is regulated to 300% for both single phase and 3 phase faults when a short circuit condition is sensed. An overcurrent alarm will sound if the genset is operating for an extended period at a potentially damaging current level, to warn the operator of an impending problem before it causes a system failure. If an overcurrent condition persists for the time pre-programmed in the time current characteristic for the alternator, the PMG excitation system is de-energised to avoid alternator damage.

The overcurrent protection is time delayed in accordance with the alternator thermal capacity allowing current to flow until secondary fuses or circuit breakers operate, isolating the fault and thus achieving selective co-ordination (discrimination). This enhances power service continuity by eliminating the need for a main line breaker mounted on the genset for genset protection and the possibility of nuisance tripping of that breaker.

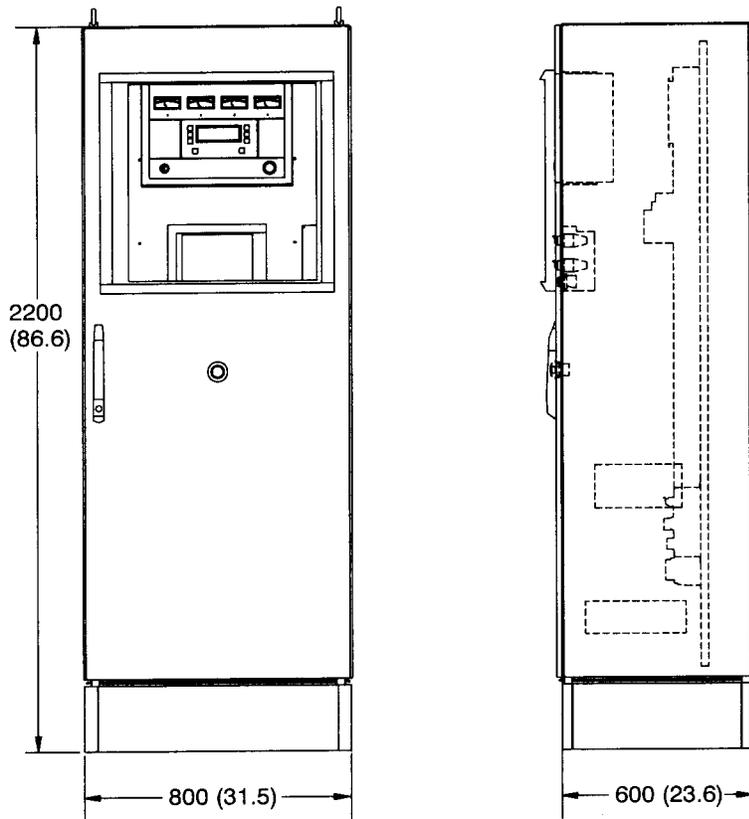


AmpSentry provides excellent, matched protection for the alternator without the danger of nuisance tripping. The exact time current characteristics of AmpSentry are shown in the PowerCommand Control AmpSentry Time-Over-Current Characteristic Curve, Form Number R-1053.

After the fault is cleared AmpSentry Protection softly loads the genset by a controlled ramping of output voltage to rated level, allowing the genset to resume normal operation without potentially damaging voltage overshoot.

Fixed over/under voltage and under frequency time delayed set points also provide a degree of protection for lead equipment. Over/under voltage conditions trigger a shutdown message on the digital display screen. Under frequency condition prompts both a warning and shutdown message depending upon the length of time and magnitude of variance under rated frequency.

AmpSentry Protection includes an overload signal that can be used in conjunction with proprietary transfer switches to automatically shed load, preventing a potential genset shutdown. The overload signal is programmable for operation at a specific kW level, on the basis of an under frequency condition, or both.



See your distributor for more information.

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Important: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.