



# Generator set control PowerStart 0600

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## Description

The PowerStart control is a microprocessor-based generator set monitoring and control system. The control provides a simple operator interface to the generator set, manual and remote start/stop control and shutdown fault indication and AMF (Auto Mains Failure) Functionality. The integration of all control functions into a single control provides enhanced reliability and performance compared to conventional generator set control systems. This control has been designed and tested to meet the harsh environment in which gensets are typically applied. The PowerStart generator set control is suitable for use on a wide range of generator sets in non-paralleling applications. It is suitable for use with reconnectable or non-reconnectable generators, can be configured for either 50 Hz or 60 Hz and voltage and power connection from 190-600 VAC line-to-line. This control includes an intuitive operator interface that allows Genset start/stop for complete genset control as well as system metering, fault annunciation, configuration and diagnostics. The interface includes seven generator set status LED lamps with both internationally accepted symbols and English text to comply with customer needs.

The interface also includes an LED backlit LCD display with tactile-feel soft-switches for easy operation and screen navigation. The manual/auto/stop switch function is integrated into overlay of the controller. All data on the control can be viewed by scrolling through Screens with the navigation keys. Screen can be viewed either by scrolling or non scrolling mode. Forward navigation and backward navigation is also provided. The control displays the current active fault, fault occurrences and time-ordered history of the five previous faults with respect to Real Time Clock Stamp, Engine Running Time. Power for this control is derived from the generator set Starting batteries and functions over a voltage from 8VDC to 32VDC.

## Features

- Integrated 128x64 Pixel monochrome graphic LCD Display
- 12 and 24V battery operation
- Genset monitoring-monitor status of all critical engine and alternator functions
- Digital genset metering (AC and DC)
- Genset battery monitoring system to warn against a weak battery connection
- Configurable for single phase or three phase or split phase AC metering
- Engine starting includes solid state output to operate external relay to start the engine, fuel shut off (FSO) and glow Plug
- Genset Protection: protects engine and alternator
- Real time clock for fault and event stamping
- Fuel level measurement using 4-20mA input sensor
- Exerciser clock and time of delay start/stop initiate a test without load
- Maintenance due alarm based on engine running time and real time clock
- Auto Main Failure (AMF) Provides load transfer operation in open transition mode
- AMF Test with or without load options
- Utility Voltage monitoring and protection
- Remote start capability in Auto mode
- Advanced serviceability using Inpower™ a PC based Software service tool
- Modbus interface for interconnecting to customer PLC/BMS
- Configurable Inputs and Outputs
- Environmental protection : The Control is designed for reliable operation in harsh environment
- Warranty and service backed by a comprehensive warranty and worldwide distributor service network
- Certification-suitable for use on generator sets that are designed, manufactured, tested and certified relevant ISO, IEC and CE standards.

# Control functions

## LCD capability

### LED indicating lamps

- For Genset Running, Remote Start, AMF Test Active, Genset Shutdown, Warning, Load connected to Genset, Load connected to Utility, Manual Mode, Stop Mode and Auto Mode.

### LCD display

- 128 x 64 Pixel Monochrome Graphics display

### Operation Interface

- Six tactile-feel soft switches for LCD navigation, genset operation and control setup. These switches are indicated by internationally accepted symbols and English text.

### Operator adjustments

- The LCD includes provisions for necessary set up and adjustment functions.
- Data Log includes engine run time and controller ontime Fault History.
- Provides a record of the most recent fault Condition with Engine run time stamp, RTC stamp and occurrences
- Up to 5 events are stored in the control non-volatile memory.

### AMF Functionality

- When Auto Mains Failure is enabled and controller is in Auto Mode and if utility goes off then control starts the Genset automatically and transfers load onto Genset. If Utility returns and is healthy then load again gets retransferred onto Utility. AMF provides load transfer operation in Open Transition transfer mode.

### Fuel Level Feature

- The Control will show the warning fault when the fuel level in the tank goes below the predefined threshold. Control includes time delays to prevent nuisance warning signals.

### Exercise Scheduler

- It is used only when genset is in Auto mode. It is used to start a Scheduler schedule at No Load condition. A trim Exercise Scheduler Enable is available to enable or disable the feature.

### Maintenance

- Maintenance due alarm based on Engine Running Time or Real time clock

### Control data

- Access to the control software part number and software version are provided from the LCD or InPower™.

### Alternator data

- Voltage (single or three phase line-to-line and line-to- neutral)
- Current (single or three phase)
- kVA, kVAR, kW, Power Factor (Three phase and total)
- Frequency
- Totalized positive and negative kWH, kVARH, kVAH

### Utility AC data

- Voltage (three/single phase LL and LN) -Frequency

### Engine data

- Starting battery voltage
- Engine running hours
- Engine temperature
- Engine oil pressure

### Service adjustments

- The control includes provisions for adjustment and calibration of generator set control functions. Functions include:
  - Voltage selection
  - Frequency selection
  - Genset and Utility AC Meter Calibration

### Engine control

- CT ratio, and Genset ratings setup
- Start/Stop time delay setup
- Real time clock setup with daylight saving
- AMF Setup with test mode and transfer/retransfer time delays
- Modbus baud rate, parity setup
- Exercise scheduler repeat interval, Day, time and duration setup
- Maintenance due setup
- LCD brightness and contrast control

### Battery operation

- Control will operate on 12V/24V batteries

### Auto start mode

- Accepts a ground signal from remote devices to automatically start the generator set. The remote start signal will also wake up the control from sleep mode. The control can incorporate a time delay start and stop.

### Emergency stop

- The control annunciates when an emergency stop signal is received and the generator set immediately shuts down. The generator set is prevented from running or cranking with the switch engaged E-stop switch.

### Sleep mode

- The control includes a configurable low current draw state to minimize starting battery current draw when the genset is not operating.

### Engine starting

- The control supports automatic engine starting. Primary and backup start disconnects are achieved by battery charging alternator feedback or main alternator output frequency. The control also supports configurable glow plug control when applicable.

### Cycle cranking

- Configurable for the number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging.

### Time delay start and stop (cooldown)

- Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal and for time delay of 0-600 seconds prior to shutdown after signal to stop in normal operation modes. Default for both time delay periods is 0 seconds.

### Auto Mains Failure functions

- AMF primarily means that the genset controller is controlling both the genset breaker and a utility breaker in a transfer pair arrangement. AMF is only for use in a single genset / single utility arrangement. AMF's primary job is to keep loads powered. AMF completely manages the system by automatically starting the genset and transferring load when it detects utility failure. AMF has numerous built-in configurable sensors to determine the availability of the utility and genset sources. Sensors include under voltage, overvoltage, over/under frequency and breaker failure. PS0600 control supports only open transition (Break before Make) AMF functionality.

### AMF Test mode

- AMF supports test mode with or without load options along with test mode duration.

### Load Transfer Switch Type

- AMF breaker outputs can be continuous (contact pair) or pulsed (GTEC) type based on load transfer switch selection.

## Undervoltage sensor

- Three phase LL and LN undervoltage sensing for pickup 85-100% and dropout adjustable from 75-98% of nominal and dropout adjustable delay from 0.1-30 sec

## Overvoltage sensor

- Three phase LL and LN overvoltage sensing for dropout adjustable from 105-135% of nominal and dropout adjustable delay from 0.5-120 sec

## Over/under frequency sensor

- Underfrequency sensing for pickup 85-100% and dropout adjustable from 70-85% of nominal and dropout adjustable delay from 0.1-15 sec
- Overfrequency sensing for dropout adjustable from 105-115% of nominal and dropout adjustable delay from 0.1-15 sec

## Timers

- Control provides transfer time delays including Time delay engine start (0-3600 sec), time delay normal to emergency (0-300 sec) and programmed transition delay (0-600 sec)
- Control provides retransfer time delays including time delay emergency to normal (0-1800 sec) and programmed transition delay (0-600 sec), time delay engine cooldown (0-3600 sec)

## Protective functions:

On operation of a protective function, the control will indicate a fault by illuminating the appropriate status LED, as well as display the fault code and fault description on the LCD. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower™ Service Tool provide service keys and procedures based on the service codes provided. In Power is used to configure settings.

### Configurable alarm input

- The control accepts maximum three alarm inputs (contact closed to ground) to cause a shutdown or warning response from the control.

### Emergency stop

- Annunciated whenever an emergency stop signal is received from external switch.

### Engine protection

- **Low lube oil pressure warning/shutdown** - Level is preset to match the capabilities of the engine used. Control includes time delays to prevent nuisance shutdown signals.
- **High coolant temperature warning/shutdown** - Level is preset to match the capabilities of the engine used. Control includes time delays to prevent nuisance shutdown signals.
- **Low coolant temperature warning** - Indicates that engine temperature may not be high enough for 1 min. and start or proper load acceptance.
- **Sensor failure indication** - Logic is provided on the base control to detect analog sensor or interconnecting wiring failures.

### General engine protection:

Low Fuel Level Warning - Indicates that engine fuel level reached the Low Fuel Level Warning Threshold (30% by default).

Charging Alternator Failure Warning - Indicates that engine charging alternator voltage reached the low/high charging alternator threshold when charging alternator enable trim is enabled.

- **Low and high battery voltage warning** - Indicates status of battery charging system (failure) by continuously monitoring battery voltage.
- **Weak battery warning** - The control will test the battery each time the generator set is signaled to start and indicate a warning if the battery indicates impending failure.
- **Cranking lockout** - The control will not allow the starter to attempt to engage or to crank the engine when the engine is running.
- **Fail to start shutdown** - The control will indicate a fault if the generator set fails to start by the completion of the engine crank sequence.

## Alternator protection

### Battleshort Mode

- When enabled and Battleshort switch is active, the control will allow non-critical shutdown faults to be bypassed. If a bypass shutdown fault occurs, the fault code and description will still be annunciated, but the genset will not shutdown. This will be followed by a fail to shutdown fault. Emergency stop critical shutdown faults are not bypassed. Please refer to control service and operator manual for list of critical faults

### High AC voltage shutdown (59)

- Output voltage on any phase exceeds preset values. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 1-10 seconds. Default value is 110% for 5 seconds.

### Low AC voltage shutdown (27)

- Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of voltage, time delay 2-20 seconds. Default value is 90% for 5 seconds.

### Under frequency shutdown (81 u)

- Generator set output frequency cannot be maintained. Settings are adjustable from 2-10 Hz below nominal governor set point, for a 500-2000 half cycles delay. Default: 5 Hz, 1000 half cycles.

### Over frequency shutdown/warning (81 o)

- Generator set is operating at a potentially damaging frequency level. Settings are adjustable from 2-10 Hz above nominal governor set point for 100-2000 half cycles delay. Default: 5 Hz, 1000 half cycles.

### Loss of sensing voltage shutdown

- Shutdown of generator set will occur on loss of voltage sensing inputs to the control.

### Current Imbalance Warning Fault

- Issues warning when current imbalance is observed per phase when genset is in running state.

### High Current warning/shutdown (51)

- Implementation of the thermal damage curve with instantaneous trip level calculated based on current transformer ratio and application power rating.

## Auto Mains Failure Protections:

- Breaker/ATS Switch fail to close warning - when the control signals a ATS switch to close, it will monitor the ATS switch feedback contacts and verifies that switch is closed. If the control does not sense ATS switch closure within an adjustable time period after the close signal, the fail to close warning will be initiated.
- Breaker/ATS Switch fail to open warning - when the control signals a ATS switch to open, it will monitor the ATS switch feedback contacts and verifies that switch is opened. If the control does not sense ATS switch opened within an adjustable time period after the open signal, the fail to open warning will be initiated.

## Environment

The control is designed for proper operation without recalibration in ambient temperatures from -15 °C (5 °F) to +70° C (158 °F), and for storage from -20 °C (-4 °F) to +80 °C (176 °F). Control will operate with humidity up to 95%, non-condensing. The control board is conformal coated to provide resistance to dust and moisture. The single membrane surface, which is impervious to effects of dust, moisture, oil and exhaust fumes. This panel uses a sealed membrane to provide long reliable service life in harsh environments. The control is specifically designed and tested for resistance to RFI/EMI and to resist effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

## Field control interface

### Input signals to the control include:

- Remote start
- Emergency stop
- Configurable customer inputs:

Control includes (1 Control includes 3 input signals which can be configured for diagnostic inputs. Out of which 1<sup>st</sup> input can also be configured as Battleshort input. 2<sup>nd</sup> and 3<sup>rd</sup> inputs gets configured to Utility CB status and Genset CB status when Auto mains failure is enabled.)

### Output signals from the control include:

Control includes 6 configurable outputs which can be configured to Diagnostic Output, Glow Plug, Ready to load, L series governor. Configurable output 3, Configurable output 4, Configurable output 5 and Configurable output 6 get configured to AMF specific outputs (Utility/ Genset CB Open/ Close driver) when Auto mains failure is enabled.

## Communications connections include:

Control provides one RS-485 port which can be used either for PCTool interface or modbus master interface based on protocol selection from LCD or Inpower™.

- Modbus RS485 port: Allows the control to communicate with external devices such as PLCs using modbus protocol.
- PC tool interface: This RS-485 communication port allows the control to communicate with a personal computer running InPower™ software.
- Note — An RS-485 or USB to RS-232 converter is required for communication between control and PC.

## Software

InPower (beyond 11.5.2.0 version) is a PC-based software service tool that is designed to directly communicate to PowerStart generator sets and transfer switches, to facilitate service and monitoring of these products.

## Certifications

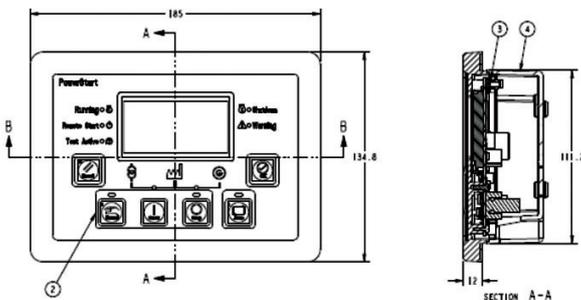
PowerStart meets or exceeds the requirements of the following codes and standards:

- CE marking: The control is suitable for use on generator sets to be CE-marked.
- EN 50081-1,2 residential/light industrial emissions or industrial emissions.
- EN 50082-1,2 residential/light industrial or industrial susceptibility.
- ISO 7637-2, level 2; DC supply surge voltage test.
- PowerStart control and generator sets are designed and manufactured in ISO 9001 certified facilities.

## Warranty

All components and subsystems are covered by an express limited one year warranty. Other optional and extended factory warranties and local distributor maintenance agreements are available.

## Mechanical





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PSBU/PS0600/HD/MP/Revision-0 (01-2018)



#### **Cummins Power Systems Offices**

Bengaluru: Tel.: (080) 2325 9161 / 63, 2325 9165 / 67  
Fax: (080) 2325 9164  
Chandigarh: Tel.: (0172) 224 0371-73  
Fax: (0172) 224 0372  
Chennai: Tel.: (044) 2446 8110 / 2446 8113  
Fax: (044) 2491 1120  
Gurgaon: Tel.: (0124) 391 0900-01  
Fax : (0124) 391 0916  
Hyderabad: Tel.: (040) 2340 9970 / 2340 9980  
Fax. (040) 2340 9990  
Jaipur: Tel.: (0141) 236 4944  
Fax: (0141) 403 8794  
Kolkata: Tel.: (033) 2287 8065 / 2287 2481  
Fax: (033) 2290 3839  
Lucknow: Tel.: (0522) 230 5049 / 230 5059  
Fax: (0522) 230 5035  
Mohali: Tel.: (0172) 224 0371 / 72 / 73  
Fax: (0172) 224 0371 / 72 / 73  
Vadodara: Tel.: (0265) 233 0627 / 3053627  
Fax: (0265) 234 0623



**Cummins India Limited  
Power Systems Business**  
Cummins India Office Campus  
Tower-A, 8<sup>th</sup> Floor, S. No. 21,  
Balewadi, Pune – 411 045 (India)

Email: [opgindia@cummins.com](mailto:opgindia@cummins.com)  
[www.cumminsindia.com](http://www.cumminsindia.com)