



4600 Apple Street
Boise, Idaho 83716
Phone: (208) 947-2942
Fax: 208-947-4812
www.qtron-wabtec.com

QEG 1000 AUTOSTART System

The QEG 1000 *AUTOSTART* System provides reduced fuel consumption and exhaust emissions by monitoring engine operating parameters and automatically shutting down and restarting the engine during locomotive idle periods. This results in significant fuel savings while always maintaining the locomotive in a state of readiness.

Standard Features

The QEG 1000 *AUTOSTART* System includes the following standard features and benefits:

- Reduced engine fuel consumption, resulting in significant fuel savings and reduced exhaust emissions.
- Integrated recording function, which records fuel report statistics, locomotive statistics, events, and alarm logs.
- System indicator lights (Red and Green LEDs), which indicate the status of the *AUTOSTART* system.
- *AUTOSTART* Siren Panels (2), which sound to warn locomotive personnel that a locomotive auto-shut down or auto-restart will occur.
- Governor Assist Pump, which works in conjunction with the engine governor during auto-restarts to provide sufficient fuel necessary to start the locomotive.
- EPD Override, which overrides the engine protection device (EPD) during auto-restarts thereby preventing an unnecessary (or false) engine shutdown as a result of a false low water pressure condition.
- Automatic Ground Relay Reset function that resets the Ground Relay once following each locomotive auto-restart.
- Load Shedding function that, following a locomotive auto-shutdown, automatically turns off the locomotive's headlights after the preset time-out period elapses. By shutting down the lighting system Load Shedding eliminates repeated and unnecessary locomotive auto-restarts.

Optional Features

Together with optional ancillary equipment, the QEG 1000 *AUTOSTART* System can also provide the following features and benefits (Note, a limited number of optional channels are available and the selection of some options limits the availability of others):

- Fan Control function that monitors water temperature and activates the cooling fans at specified temperatures, while cycling through the fans to share fan operation.
- Low/High Idle function that monitors water and ambient temperatures to reduce idling costs in above freezing temperatures, and maintain engine operating temperature during colder periods.
- Locomotive kilowatt-hour logs/records: these statistics can be used to compare locomotive maintenance costs against locomotive working time.
- Locomotive speed and distance recording to provide travel statistics.

System Overview

The QEG 1000 *AUTOSTART* is a complete system, providing improved fuel savings. The number of system components varies depending on the application requirements and options. The MCU monitors and controls all of the various functions through the ancillary devices (see Figure 1).

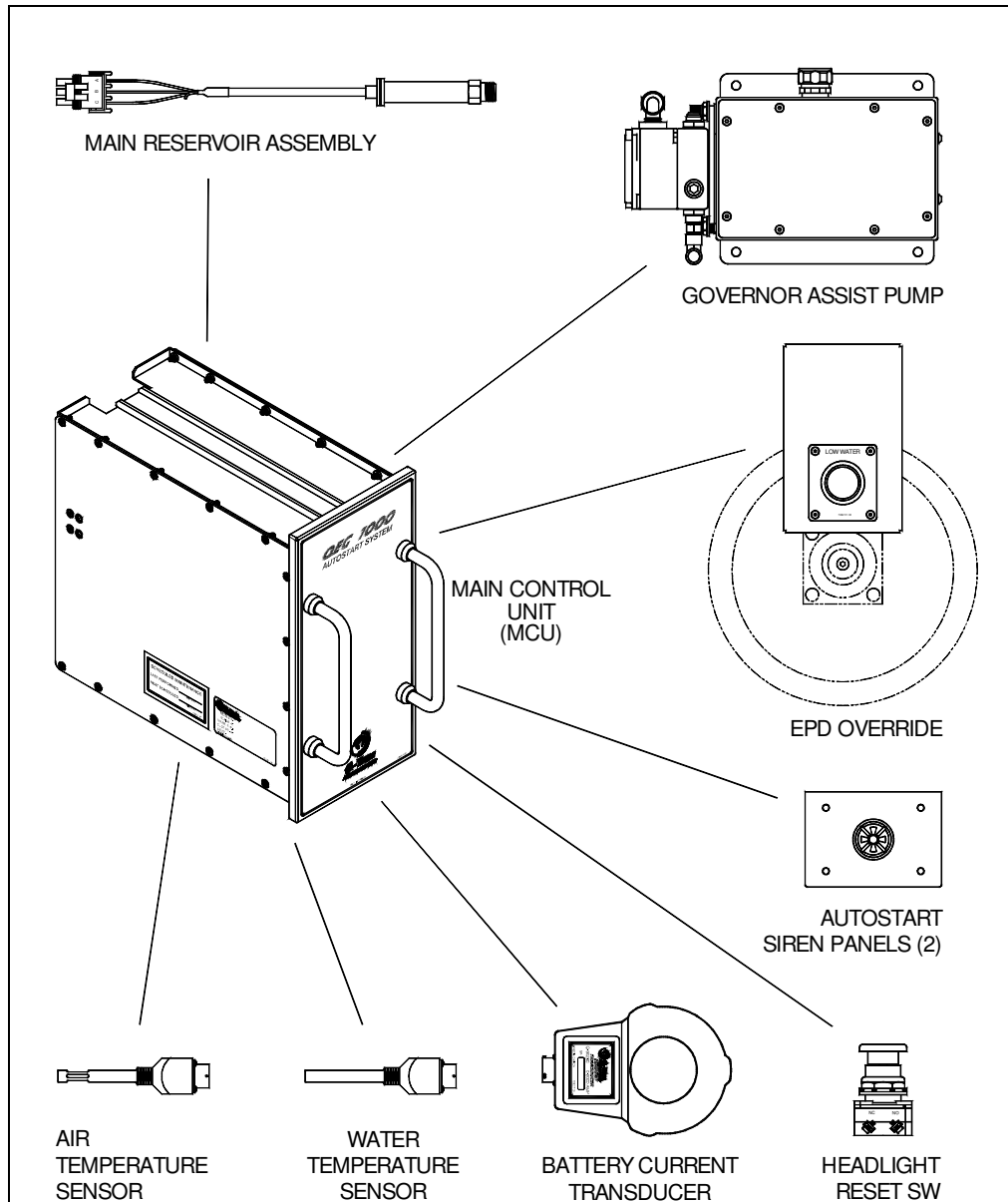


Figure 1. QEG 1000 *AUTOSTART* System and ancillary equipment

AUTOSTART System Operations

The QEG 1000 *AUTOSTART* System monitors and controls all of the system functions through the various ancillary devices. It also records system information and alarm data, which can be viewed using the Q-Tron Universal Analysis/Download Software (QUADS) program. For more information about how the *AUTOSTART* system records data, see Information Recorded By the *AUTOSTART* System later in this section.

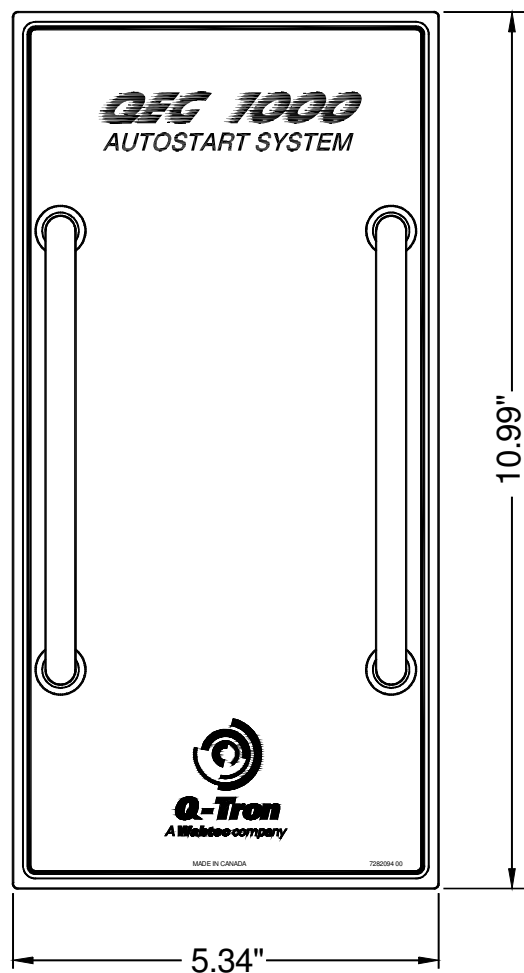


Figure 2. QEG 1000 *AUTOSTART* System

AUTOSTART System Functions

The *AUTOSTART* system reduces fuel consumption and exhaust emissions by monitoring locomotive operating parameters and automatically shutting down and restarting the engine during locomotive idle times. When combined with the companion QUADS software program, it provides information on total dollar savings and other Shutdown and Restart Statistics.

Locomotive Class Detection

The *AUTOSTART* system has the capability of controlling several types locomotives, from GP38 to SD40-2 locomotives, thereby allowing the system to be interchanged between units. To determine the locomotive type, the *AUTOSTART* system reads the information stored in a serial EEPROM located on the *AUTOSTART* system (MCU) cable. This serial EEPROM contains the required locomotive class information, as well as locomotive statistical data. If this information is missing, undefined, or corrupt, the system will not operate. A corresponding system alarm occurs if the *AUTOSTART* system is unable to access the serial EEPROM.

Enabling/Disabling the AUTOSTART System

The *AUTOSTART* system is *enabled* when ALL of the following conditions are true:

- *AUTOSTART* Enable Breaker is closed.
- Locomotive is set up as a trailing unit.
- Locomotive has been in Idle for a predetermined period of time.
- Reverser handle is centered (no direction).
- Main Reservoir pressure is at sufficient level.
- Brake Cylinder pressure is at a sufficient level (Independent Brakes applied).
- Locomotive has not been shut down manually, nor has an engine protection shutdown occurred.
- No *AUTOSTART* system alarms are present.
- *AUTOSTART* system restarts the locomotive in less than three cranking attempts.

The *AUTOSTART* system is *disabled* when any **ONE** of the following conditions is true:

- Locomotive is set up as lead unit.
- Locomotive is not in Idle (in throttle Notch 1–8 or Dynamic Brakes).
- Reverser handle is in Forward or Reverse.
- Main Reservoir pressure falls below a certain level.
- Brake Cylinder pressure is removed (Independent Brakes released).
- Locomotive has been shut down manually, or an engine protection shutdown has occurred.
- An *AUTOSTART* system alarm(s) is present.
- *AUTOSTART* system is unable to restart the locomotive after three cranking attempts.

AUTOSTART System Indicators

The *AUTOSTART* system provides visual and audio indicators to inform operating personnel of the current system status.

- Lights indicate *AUTOSTART* enabled/disabled conditions, system status, and whether a locomotive shutdown or restart is in progress. An *AUTOSTART* system fault can also be indicated.
- The Siren Panels sound an audible warning to alert personnel when the engine is shutdown, and when the system is about to shut down or restart the engine.

Automatic Ground Relay Reset

The optional Automatic Ground Relay Reset function resets the Ground Relay once following each locomotive auto-restart. This feature is primarily designed for *AUTOSTART* systems installed on older locomotives. Older locomotives commonly use a starting winding in the main generator to start the engine, which occasionally causes the Ground Relay to trip.

Load Shedding

Following an *AUTOSTART* system locomotive shutdown, the optional Load Shedding function eliminates repeated, and unnecessary, locomotive restarts resulting from a low battery condition (below 63 volts). To conserve battery voltage, the Load Shedding feature turns off the locomotive headlights 2 minutes after the auto-shutdown. Lighting can be restored at anytime by pressing the Headlight Reset button, located on the control panel. Pressing this button restarts the 2-minute headlight shutdown time-out period.

AUTOSTART System Options

Fan Control

The optional Fan Control feature controls the cooling fan cycle on certain locomotive types. With this option, the *AUTOSTART* system controls the temperature at which cooling fan contactors pick up and drop out.

The system monitors water temperature via a water temperature sensor, activating the appropriate number of fans to maintain proper water coolant temperature.

The fans operate in a start-shared manner in order to keep their start-ups equal. The actual operating times are recorded in the Statistics Log of the QUADS software program. The fan control system waits 10 seconds before turning on each fan, to avoid excessive AC loads which occur during fan start-up. Fans only turn on while the engine is running.

Low/High Idle Control

In addition to Fan Control, Low and High Idle operation are two other means of controlling engine temperature. Low Idle is typically used in above-freezing conditions to increase fuel savings when the *AUTOSTART* system is prevented from being shut down. High Idle is used in freezing conditions when maintaining adequate engine temperature is a concern.

Low/High Idle operation is enabled 30 minutes after engine start-up, and only when the locomotive is in Idle with the Reverser handle centered. Low/High Idle Control is dependent on the ambient air temperature. Low Idle is available when the ambient air temperature is in the “summer” operation range, and High Idle only when the air temperature is in the “winter” operation range.

Kilowatt-Hour Logging

The *AUTOSTART* system’s Kilowatt-Hour Log option tracks the total kilowatt-hours produced by the locomotive engine. These statistics are totaled for the current Trip and since the *AUTOSTART* system was installed on the locomotive (Lifetime). These statistics are useful for comparing locomotive maintenance costs against locomotive working time.

Speed and Distance Recording

With the addition of speed equipment, this optional feature records and logs speed and distance traveled. Up to two additional speed outputs are available with this option (one 20 PPR output and one 60 PPR output) for other devices.

Information Recorded By the AUTOSTART System

The QEG 1000 *AUTOSTART* System has a continuous, integrated recording function that operates while the system is functional. The *AUTOSTART* system records the following information and stores each type in its own log. This information can be viewed using the QUADS software program.

- Fuel Statistics (Fuel Report).
- Locomotive Statistics (Statistics Log).
- Events (Extended Log).
- Alarms (Alarm List/Record and Extended Log).

The *AUTOSTART* system scans all inputs and outputs – digitals and analogs – 10 times each second, and updates each log as required. The information contained within the Fuel Report, Statistics Log, Extended Log, and Alarm List/Record is described in the following pages.

Fuel Report

The Fuel Report contains statistical information relating to fuel conservation. This statistical information includes:

FUEL SAVINGS statistics which display fuel savings, engine starts (shut downs), and locomotive specific information, including: *Collected On Time/Date, Trip Since Time/Date, Lifetime Since Time/Date, Fuel Consumption in Idle, Lifetime and Trip Fuel Savings statistics, and Unrealized (fuel) Savings.*

ENGINE RESTART COUNT statistics that include the *Reason* for each engine restart and the *Lifetime* and *Trip* statistics.

UNABLE TO SHUT DOWN TIMES statistics include the *Reason* why the *AUTOSTART* system was unable to shut down the locomotive engine.

THROTTLE statistics including the *Time* (hours and days) spent at the various throttle modes (*Manual Shutdown, AUTOSTART Shutdown, and Engine Run*) and throttle positions (*Idle Parked, Idle Working, Low Idle, High Idle, Throttles 1–8, and Dynamic Braking*), and the *Lifetime* and *Trip* statistics.

Statistics Log

The Statistics Log records various information that relates to the locomotive and its operation. Most of this information is accumulative and is referred to as statistics, while some information defines the parameters of the locomotive and the QEG 1000 *AUTOSTART* System. All Lifetime Statistics as well as Locomotive Information are also stored in an external, non-volatile memory device which remains on the locomotive at all times.

Statistics information recorded and displayed in the Statistics Log includes:

- THROTTLE STATISTICS.
- FAN CONTROL TIMES (optional).
- POWER STATISTICS.
- SPEED and DISTANCE STATISTICS.

Extended Log

The Extended Log contains the long-term analog and digital information that the QEG 1000 *AUTOSTART* System monitors and records. This information can be used to search for specific recordings at the time of an occurrence.

The minimum memory size of 512 KB typically provides 2–4 days of long-term data, depending on locomotive duties and analog threshold resolution.