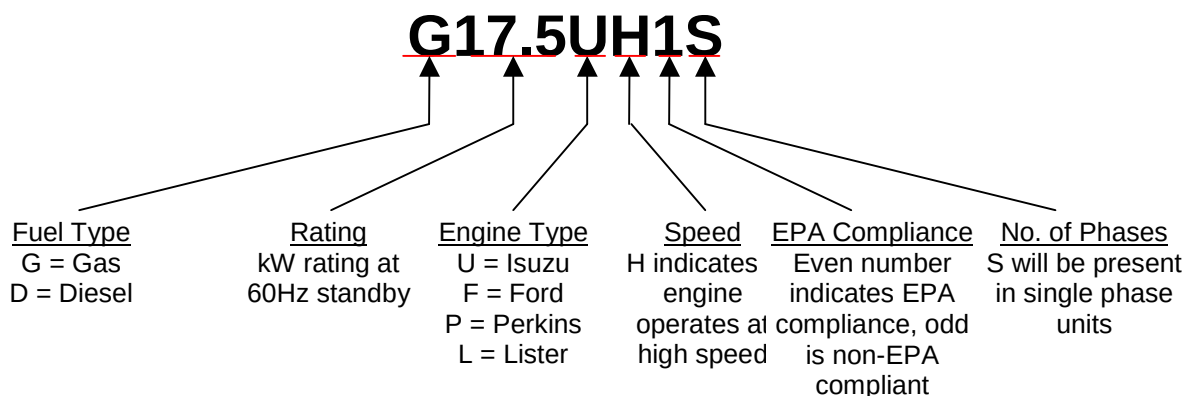


Model Identification

The Olympian range of generating sets consists of diesel and gas powered sets from 8kW to 230kW for use in standby, prime and rental applications.

The diesel powered generating sets range from 8kW to 230kW, the units at the lower end of the range use mainly Lister Petter engines where the larger units are powered by Perkins engines. The gas units range from 10kW to 100kW are powered by HM Isuzu or Ford engines using Liquefied Petroleum (LP) or Natural Gas (NG).

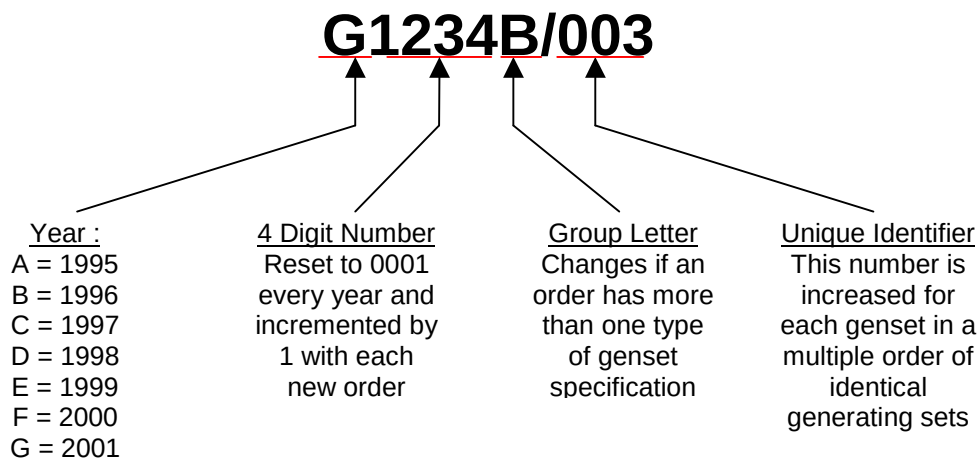
From the model code we can identify the kW rating, engine manufacturer, fuel type of engine, EPA compliance and number of phases of machine.



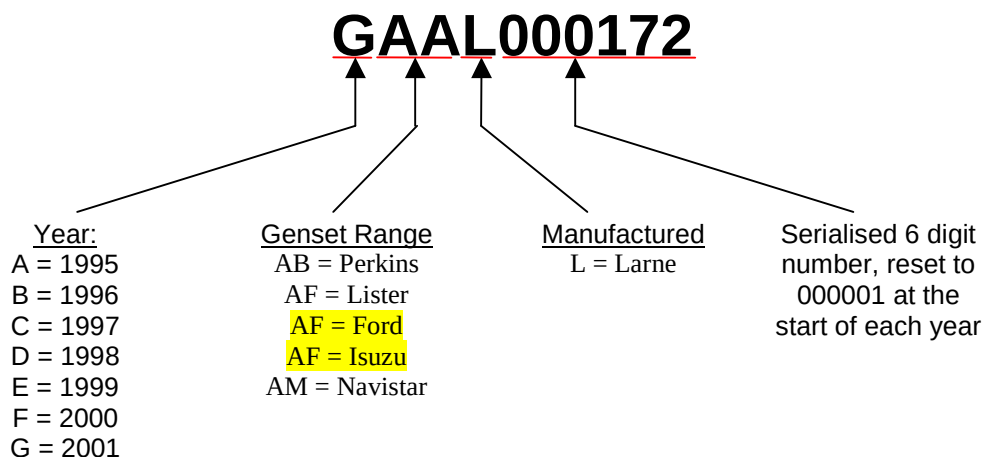
The Olympian units supplied for rental applications are the XQ series, this replaced the original range of rental generators from Olympian, the HX series. The series is easily identifiable by the first two letters of the model code, either QX or HX. All QX engines are EPA compliant Perkins powered sets that operate at single or three phase voltages simultaneously. The model designation is simply limited to the series identifier (XQ) and the kW rating. There are four models in the range XQ30, XQ60, XQ75 and XQ100.

Generating Set Serial Number

Each Olympian Generating Set will have a unique serial number which will correspond to the original sales records, engine, generator, specification and history of the set held at the factory. It is very important to quote this number when requesting technical support, dealing with warranty issues and completing commissioning or pre-delivery inspection records for return to Olympian. The serial number can take one of two formats which is found on the rating plate on the back of the control panel or on the generator.



The serial number above would indicate that there is at least two parts to the original order placed in 2001, A and B. This would mean that there is two different specifications of machine ordered hence the change in the group letter. We can see from the serial number also that part B of the order consisted of at least three identical specification generating sets due to the unique identification number. This type of serial number was found on all Olympian generating sets at one point. This identification system has now been updated and the new serial number system has been phased in over the last few years. This new system is shown below.



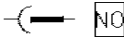
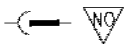
Electrical Schematics

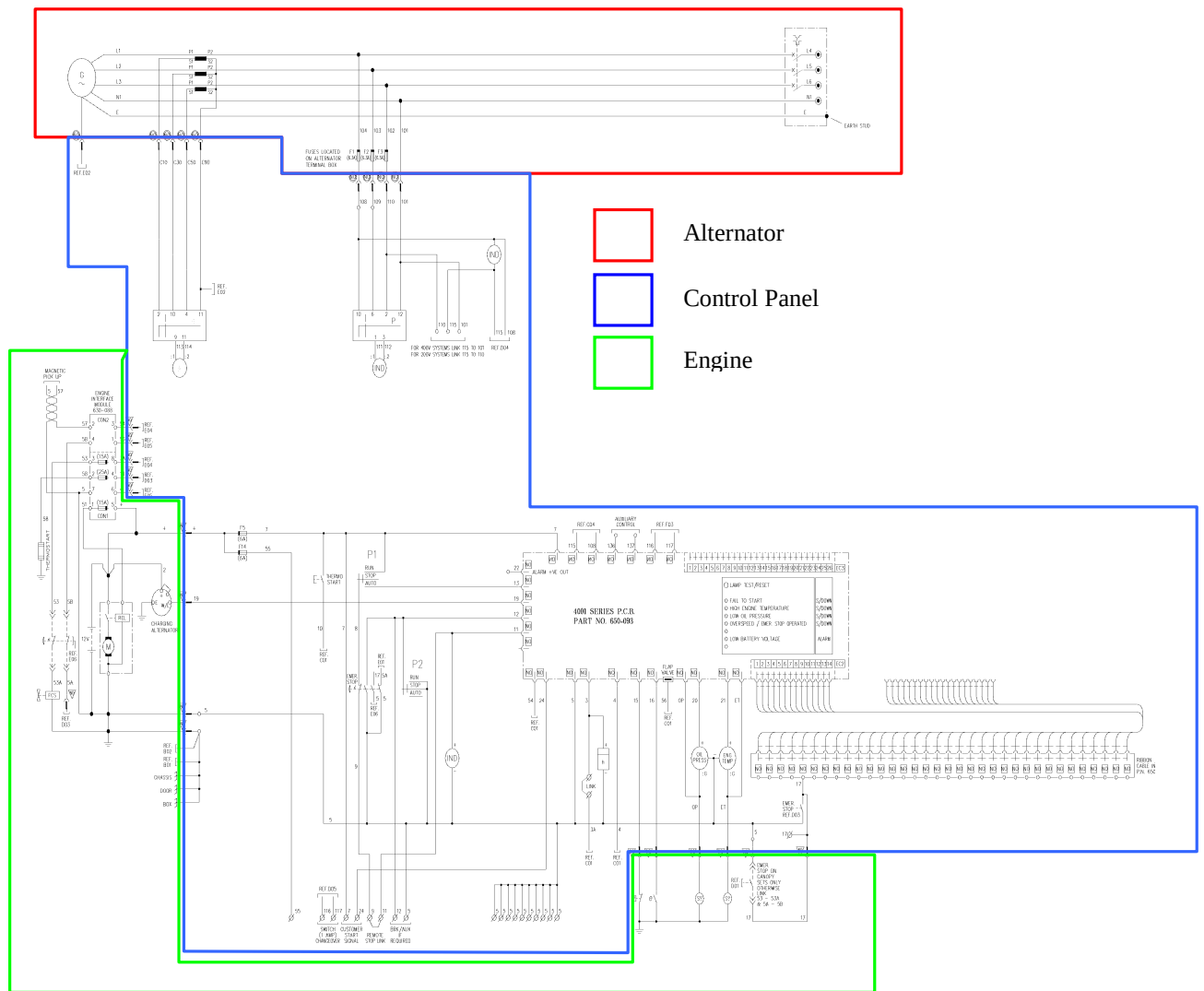
Each Olympian generating set is supplied with a print or map of the electrical system of the generating set. This electrical schematic contains a lot of information that will make an troubleshooting on the electrical system of the generating set much easier for the technician, provided that the information can be interpreted.

Olympian schematics use a system that utilises wire numbers as a means of identifying connections in the system. The actual wire on the generating set has printed on its number and also the location of where it should be terminated. All connections on the schematic are not shown as point to point connections and we use a grid reference system to identify the continuation of that wire.

The schematic may be divided into three main sections; Alternator, Engine and Control Panel. Each Olympian schematic has a common format with the main difference between schematics being the Control Panel section of the schematic.

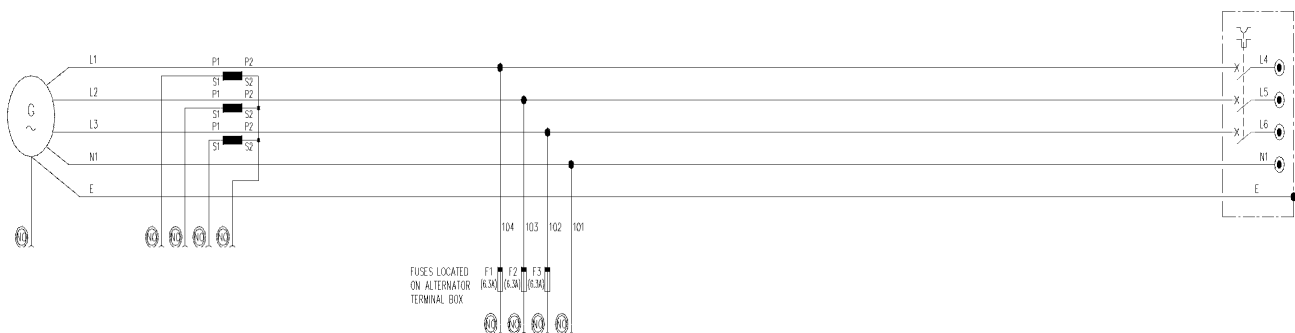
The schematics use the following key :

<u>Symbol</u>	<u>Description</u>
	Spade terminal on PCB
	Plug/Socket on PCB
	AC Connector from Alternator
	DC Connector from Engine
	Internal Panel Terminal
	Terminal to Changeover or ATS System
	Customer Power Connection Point
	Outgoing/Incoming Panel Terminal
	Spade Pin Connector on Engine
	Breaker Box Terminal

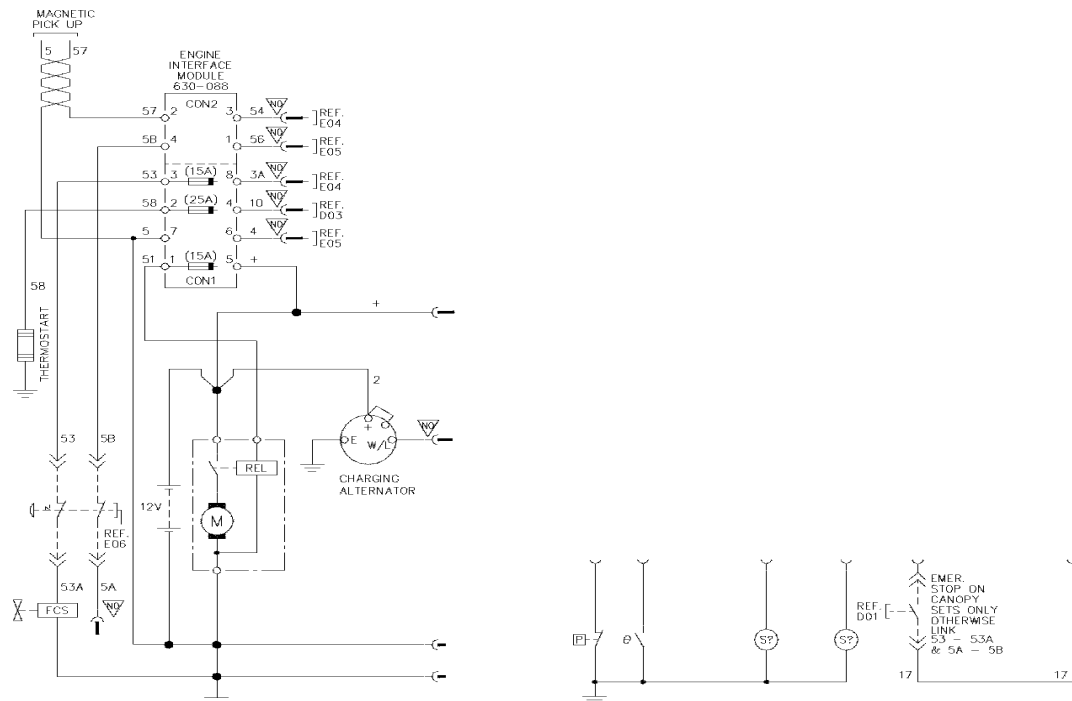


The three sections of the drawing are as defined above.

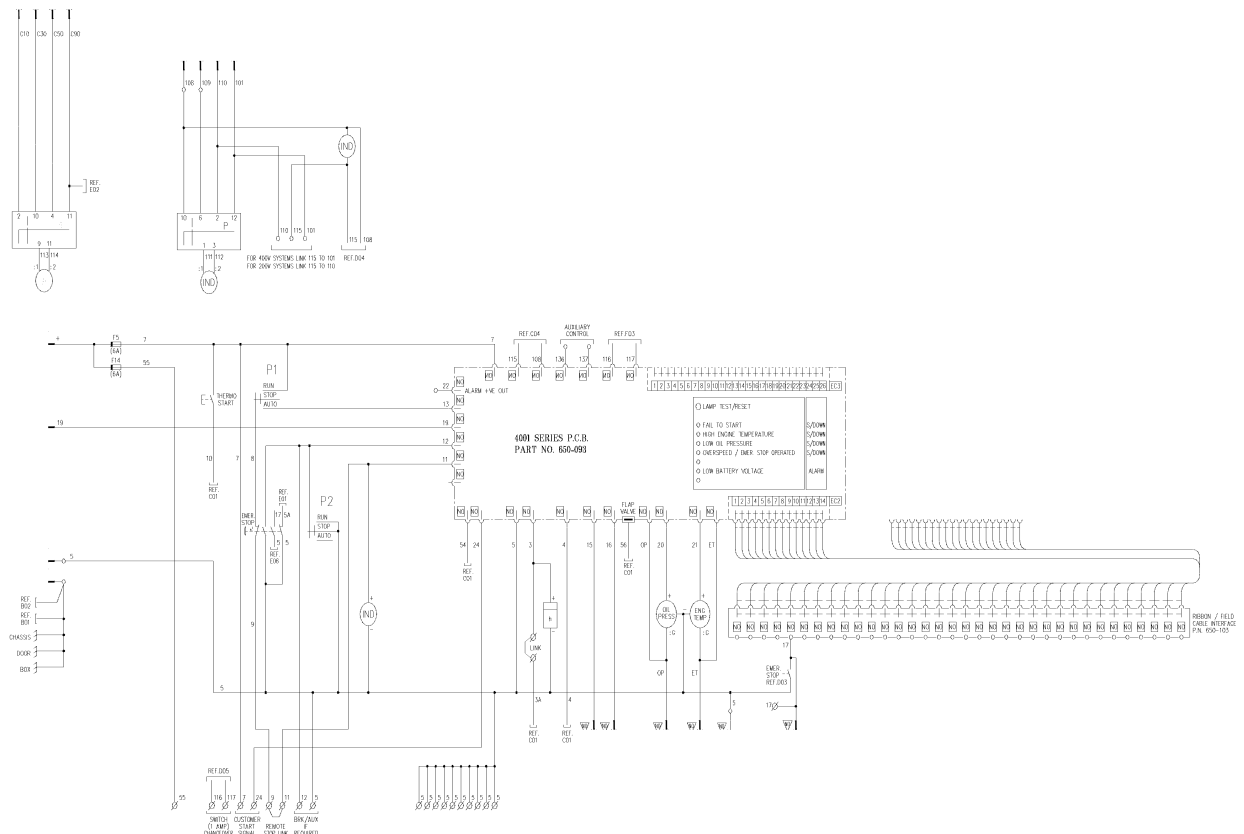
The alternator section includes the alternator, current transformers, AC voltage sensing fuses and the breaker.



The engine section includes starter motor, magnetic pickup, charging alternator, Engine Interface Module (EIM), glow plug, oil pressure sender, engine temperature sender and fuel control solenoid.



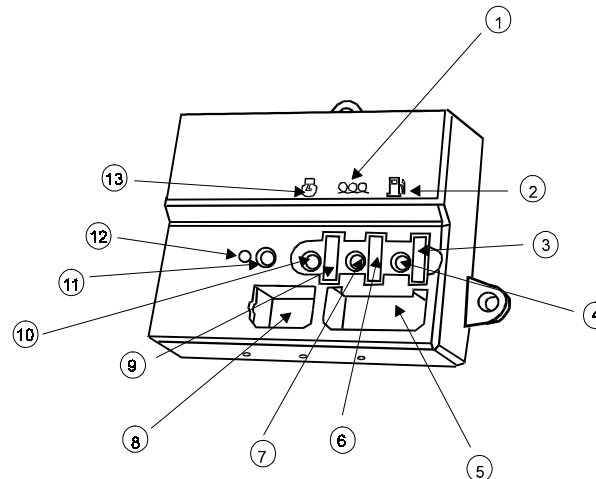
The control panel section contains gauges, panel fuses, PCB, switches and emergency stop



Engine Interface Module

The Engine Interface Module is a sealed, engine mounted module that provides switching relays for the Starter Motor Solenoid, Glow Plug and Fuel Solenoid. Each of these circuits is protected with individual automotive fuses mounted in the module. Individual LED's illuminate when each circuit is energized in addition these LED's greatly aid when fault finding.

This module is mounted on the engine with anti-vibration mounts and is easily connected to the engine via loom plugs. Use of the EIM means that heavy currents such as Fuel Solenoid power are isolated from the control panel thus enabling individual protection of each of the circuits.



<u>Item</u>	<u>Description</u>	<u>Item</u>	<u>Description</u>
1.	Glow Plug Symbol	8.	Secondary Socket
2.	Fuel Symbol	9.	Starter Solenoid Fuse
3.	Fuel Solenoid Fuse	10.	Starter LED
4.	Fuel LED	11.	Overspeed Set-up LED
5.	Main Connector Socket	12.	Overspeed Adjuster
6.	Glow Plug Fuse	13.	Starter Symbol
7.	Glow Plug LED		

Engine Interface Module

Functional Description

There are four versions of the Engine Interface Module available - the 12/24 volt EIM SR and the 12/24 volt EIM Plus.

The EIM SR is the basic level module that provides all the switching functionality; the EIM Plus provides the same functionality as the EIM SR plus the additional feature of Overspeed Sensing and an Overspeed Trip Adjuster. A magnetic pick-up on the engine flywheel housing provides the speed signal to the EIM Plus. When an overspeed situation is sensed, the EIM Plus signals the 2001, 4001 or 4001E generator set control panel to stop the engine. The Overspeed Trip Point can be easily set-up for 10% above the normal operating speed.

The overspeed feature on the EIM Plus, including the magnetic pickup is mandatory for all the Autostart control panels except the Access 4000 (2001, 4001 and 4001E).

Status Indication

LED's on the module correspond to the Starter Motor Solenoid supply, the Glow Plug supply (where used) and the Fuel Control Solenoid supply. Each illuminates to show that the indicated circuit is energized. A fourth LED (only operational on the EIM Plus) is used to set-up the Overspeed Trip Point.

Starter Motor Solenoid (EIM Plus)

During cranking the module receives a signal from the magnetic pick-up (MPU). When the signal from the MPU rises above 1090 Hz, the starter motor is disengaged by the EIM removing the supply to wire 51 (Starting Solenoid signal). At this time the EIM Plus also switches a zero volt signal to the generator set control panel to indicate that the engine is running, which in turn will remove the Starter Motor signal into the EIM. The zero volt signal is switched via wire 54.

Should the crank speed be less than 12 Hz, the module will only allow a crank of 0.6 seconds. This usually occurs due to one of the following:

- (i) The battery voltage is too low to enable the starter motor to crank the engine.
- (ii) The MPU is disconnected from the EIM (wires 5 & 57)
- (iii) The gap between the MPU and the flywheel of the engine is too great

If the engine speed falls below 350 Hz (i.e. the engine has stopped) the EIM Plus will allow cranking only after a 5 second delay (lockout) which compliments the generator set control panel's 3 attempt crank.

Starter Motor Solenoid (EIM SR, Access 4000 only)

When the three position (Run/Stop/Auto) switch is turned to Start, a relay in the EIM is energized after receiving a signal from the control panel, providing power to the Starter Motor Solenoid. The Starter Motor disengages when the Access 4000 removes its signal to the EIM i.e. Crank Cut Out setpoint has been reached. It is only the EIM Plus that will disengage the Starter Motor utilizing its own logic.

Glow Plug (pre-heat)

When the relay is energized power is provided to the Glow Plug (where fitted).

Fuel Control Solenoid

The generator set control panel energizes a relay in the module that provides power to the Fuel Control Solenoid allowing fuel flow to the engine.

Overspeed Signal (EIM Plus only)

The EIM Plus monitors the speed signal from the magnetic pick-up. If the engine speed rises above a certain pre-settable value, the module sends a zero volt signal to the generator set control panel to activate the Overspeed Fault circuitry.

The Overspeed Set Point is factory set for 10% above the rated speed of the engine i.e. 1980 for 1800rpm sets. This can be adjusted using the adjustment potentiometer accessed through the hole beside the Overspeed Set-Up LED. While the engine is running at the rated speed (1500 rpm for 50Hz or 1800 rpm for 60Hz) the adjustment screw should be adjusted until the Overspeed Set-Up LED just comes on. This sets the overspeed value at 10% above the speed at which the generator set is operating.

Safety “Relay” Feature

The EIM SR and EIM Plus provide a safety check for any damaged contacts (i.e. welded contacts) using a “safety” relay (SR).

When the emergency stop pushbutton on the generator set control panel is pushed the EIM module automatically checks Fuel Control Signal Out and Starter Motor Signal Out to see if the contacts of their switched relays are welded shut. A dimly lit LED on the module indicates the contacts are damaged and the module should be replaced. In the event that the contacts are welded shut, then the only way of stopping the Fuel or Starter Motor would be the Emergency Stop. The engaging of the Emergency Stop breaks the Negative to the coil of the Safety Relay therefore removing the signals to their respective Solenoids bypassing the faulty Fuel and Starter Motor Relays.

The Safety Relay is permanently energized when the battery is connected to the generating set and the Emergency Stop button(s) are not engaged.

EIM Plus Operation

The EIM obtains its supply directly from the battery via wires + and 5, the Safety Relay is also powered from the battery using + but the negative to its coil is from the battery via normally closed contacts on the Emergency Stop(s). This means that if any of the Emergency Stop buttons are pushed then the Safety Relay will de-energize and the Fuel and Starting signals be removed from their respective solenoids. This means whilst the battery is connected and the generating set is stopped the EIM will be drawing current from the battery. It is for this reason that it is advisable to disconnect the battery whilst the generating set is in storage or fit a Battery Isolator Switch to prime power units.

When we intend to start the generating set we turn the three position switch to Run, or if in Auto and the ATS/Changeover has signaled the generating set to start, the control panel will switch a positive supply to the EIM via wires 3A and 4. These signals will then energize the Fuel and Starter Motor relays to allow a positive supply to be switched out of the EIM to the Fuel Control Solenoid (FCS) on wire 53 and the Starting Solenoid (SS) on 51.

The speed of the engine is monitored via the MPU (wire 57) to determine when the engine has fired and the Starter Motor (SM) can be disengaged. The SM will be disengaged when 1090 flywheel teeth pass the MPU in one second (1090Hz). The EIM will then remove the positive supply to the SS on wire 51 and also switch a negative signal to the control panel via wire 54 to indicate to the control panel that the engine has started and the signal to the EIM via wire 4 can be removed.

2001 Control System



The 2001 control panel offers autostart capabilities along with 5 engine protection channels, 4 of which are configured as shutdowns and are allocated as Fail to Start, High Engine Temperature, Low Oil Pressure and Emergency Stop/Overspeed. The last channel of the five is a spare channel which may be configured at the factory when additional protections are requested by the customer. Otherwise this channel may be configured by the customer as an alarm or a shutdown, the protection can also be FPT (Fault Protection Timer) enabled. The FPT is factory set for 15 seconds and only begins to time out once the engine has reached its rated speed or the generator is producing its rated voltage. This FPT function will effectively prevent any channel that is FPT protected from alarming itself during the initially 15 second period of the genset starting.

Fail to Start: This protection activates when the engine has been given a start signal and the engine has failed to start. This is factory set to allow 3 attempts to start, each attempt is made up of a 5 second crank cycle followed by a 5 second rest period.

High Engine Temperature: The protection is activated externally by the VDO engine temperature sender. The sender typically switches between 103-105 degrees C (217 – 221 F). This channel is FPT protected which means that it will only become active 15 seconds after the engine has started.

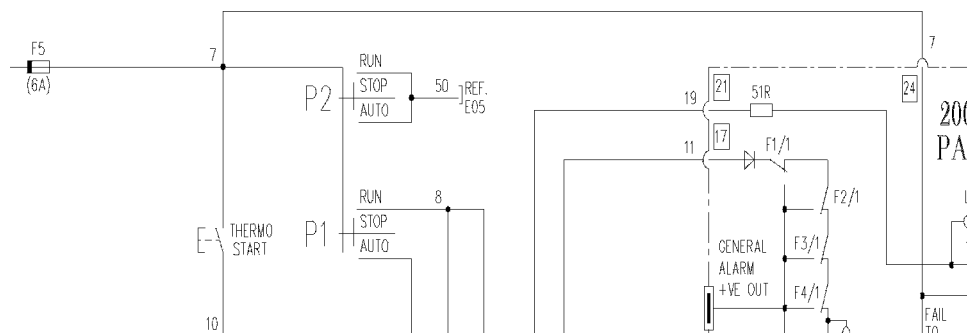
Low Oil Pressure: The protection is activated externally by the VDO oil pressure sender. The sender typically switches at 0.8 bar/ 11.75 psi on the 0-5 bar model fitted to Lister Engine based gensets and 1.25 bar/18.5 psi on the 0-10 bar model fitted to all other Olympian sets. This protection is also FPT protected.

Emergency Stop/Overspeed: This channel combines two protections, the emergency stop will activate once the panel or enclosure (if applicable) emergency stop push button is pressed. The overspeed signal is controlled by the EIM. Once the EIM via the Magnetic Pickup, determines the engine has exceeded the setpoint for maximum engine RPM, a signal is sent to the 2001 panel and the shutdown activates.

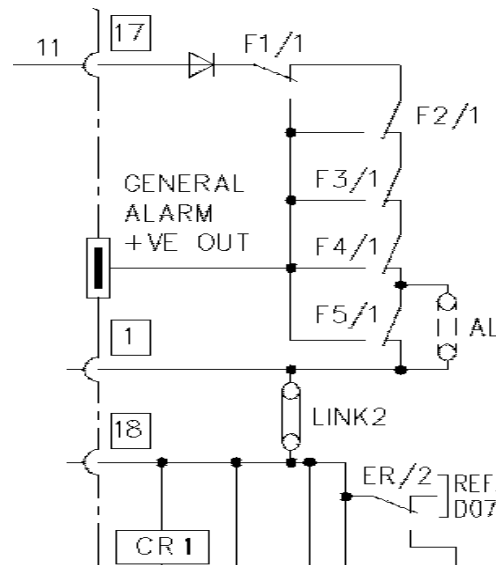
Spare Channel: This protection channel can be configured as either an alarm or shutdown by repositioning the blue two-prong link on the 2001 PCB. The protection may also be FPT protected by physically removing link 5A from the PCB.

Basic Operation

When the panel is powered by connecting a DC supply through Fuse 5, the positive supply is branched off 3 ways: (i) the glow plug (if applicable), (ii) the PCB through pin 24 and (iii) the three position switch (Run/Stop/Auto).

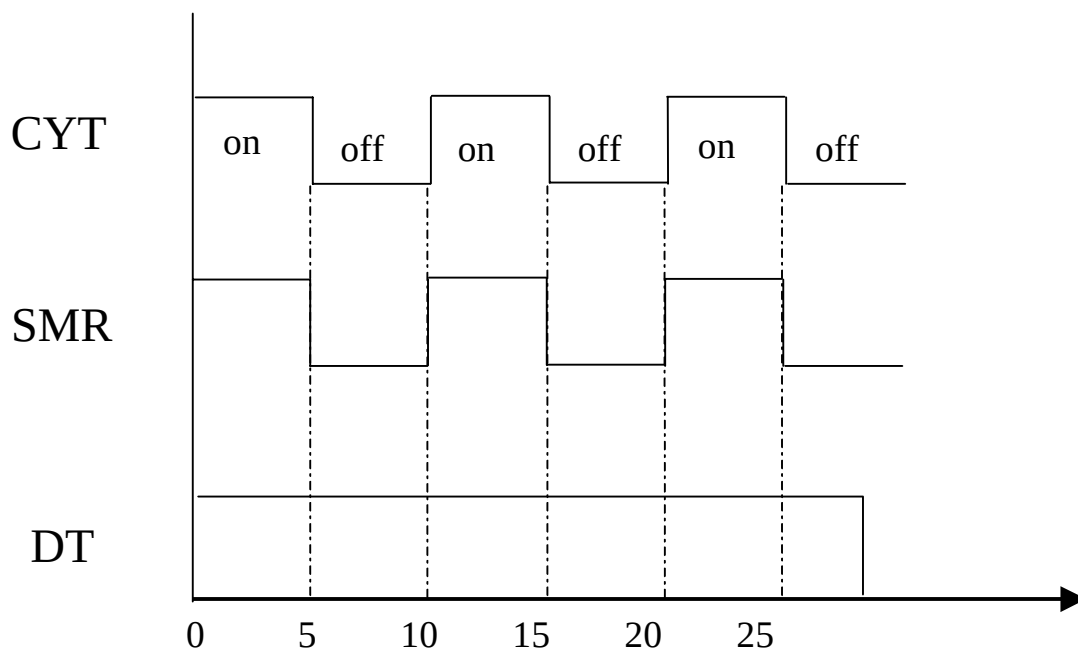


- (i) **Pre-glow:** Once the thermostart button on the front of the panel is pushed the positive will be connected to wire 10 through the n/o contact and then to the EIM to energise the glow plug.
- (ii) **Lamp Test:** The positive supply to the PCB through pin 24 will supply a +ve to the fault LED's, once the lamp test button is pushed a -ve will also be connected to the LED's and they will illuminate for test purposes.
- (iii) **Starting (Run):** When the three position switch is turned to the RUN position we will get +ve on wires 50 & 8. Wire 50 allows a + supply to the 5 faults relays F1, F2...F5 through pin 4 on the PCB. The relays will not switch as no dc -ve signal is connected to the coil of the relays. Wire 8 will effectively become the RUN signal, it firstly goes through a n/c contact on the emergency stop button, so if the button is locked in, the Run signal will not progress. Providing the button is not locked then the Run signal progresses along wire 11a through the remote stop link and onto wire 11. Wire 11 will supply a signal to the battery volt meter and also enter the PCB through pin 17. The run signal now enters the fault array, the section of the schematic made up of F1/1, F2/1, F3/1, F4/1 and F5/1; these are contacts on the fault relays i.e. F2/1 is contact 1 on fault relay 2.



The relays CR1, CR2 and CR3 (control relays) will energise providing we get a signal as far as link 2 i.e. none of the fault relays are energised. Due to CR1 energising contact CR1/1 will now switch. This will allow a positive supply to the hours run clock, oil pressure gauge, engine temperature gauge via wire 3 and then this signal links to wire 3A, this is the signal to the EIM to energise the fuel control solenoid. Simultaneously to this occurring we also get a positive supply through ER/2 shown above, this will in turn supply CYT, DT and SMR.

CYT is a cyclic timer with two states On & Off, these are usually set for 5 seconds each at the factory. When CYT is On contact CYT/1 closes allowing a supply to SMR (Starter Motor Relay). When CYT is in the Off state CYT/1 will open and prevent SMR from energising. When SMR does energise during the On state of CYT, contact SMR/1 switches to allow a positive supply onto wire 4 this is the signal input to the EIM to engage the starter motor and crank the engine.



DT is the duration timer that will limit the number of unsuccessfully crank attempts the engine will be allowed to make. If DT is allowed to time out (factory set for 27.5 seconds) then contact DT/1 closes and connects a –ve supply to fault relay 1 (Fail to Start). The relay will energise and contact F1/1 in the fault array will switch removing the signal from CR1 hence cancelling the fuel signal to the EIM. The Fail to Start LED will illuminate and the starting sequencing ends.

If the engine does fire during one of the crank cycles then we need to end the starting sequence and disengage the starter motor, this is achieved in one of three ways

- (i) The EIM - Engine Interface Module
- (ii) ER - Engine Relay
- (iii) AR - Alternator Relay

The speed of the engine is monitored by the EIM using the Magnetic Pick-Up (MPU) fitted to the engine flywheel housing. Once the EIM has received a frequency signal of 1090Hz from the MPU then the EIM will remove the signal to the Starting Solenoid. Also at this 1090Hz point the EIM switches a negative signal out to the control panel via wire 54 to energise ER, this is used as a backup if the EIM was not to remove the supply to the starter motor. Due to ER energising contacts ER/1 and ER/2 will switch, ER/1 removes any supply from reaching SMR, hence the starter motor signal to the EIM will also now be removed and ER/2 enables the FPT (Fault Protection Timer) to start timing out. The FPT has a default value of 15 seconds. If for some reason the EIM or the ER did not disengage the starter, then AR would. AR is the alternator relay and is energised by an ac supply to its coil via wires 108 and 115. If AR gets an AC supply of 180 volts or more, then its associated contacts will switch. AR/2 removes any +ve signal from reaching CYT, DT & SMR, hence removing the starter signal into the EIM. AR/3 enables the FTP timer and AR/4 opens to remove a –ve supply reaching F1 when the FPT relay energises and its contacts switch.

Autostart Mode

When the 3-position switch is turned to Auto a positive supply is connected to wires 50 & 24. Wire 50 is again used to allow a supply to the LED's for the Lamp Test, wire 24 will connect through the automatic transfer switch (ATS) or Changeover (C/O). When the ATS or C/O enters the condition to start the generator it closes a contact to link wire 24 to wire 8. Wire 8 will now become positive and the system operates as if the 3-position switch was in the Run mode.

Protection Activation

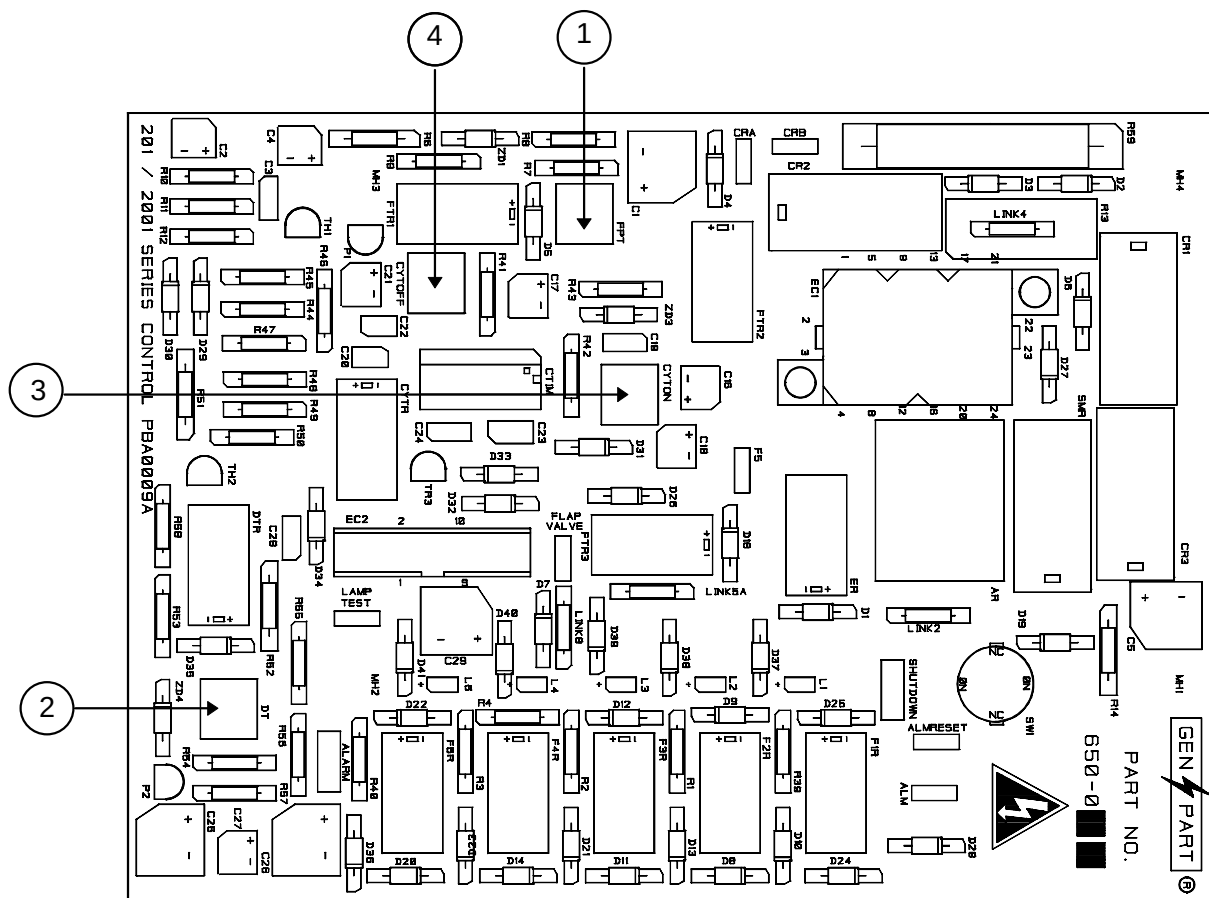
To activate any of the five protection channels we require a –ve to reach the corresponding relay. The relay will energise and at the same time the LED illuminates. Due to the relay energising contact Fx/1 in the fault array will

switch and cause CR1 to de-energise hence cutting of the fuel supply to the engine.

Timer Adjustments

It is possible to make adjustments to the following timing circuits on the 2001 PCB: Fault Protection Timer (FPT), On cyclic timer (CYTON), Off cyclic timer (CYTOFF) and duration timer (DT). To adjust the timers we turn the associated potentiometer, the default settings for the four timers are.

<u>Ref. No</u>	<u>Timer</u>	<u>Range</u>	<u>Settings</u>	<u>Tolerance</u>
1	FPT	1sec - 70sec	15sec	+/- 1sec
2	DT	1sec - 90sec	27.5sec	+/- 2.5sec
3	CYT ON	0.25sec - 20sec	5sec	+/- 1sec
4	CYT OFF	0.25sec - 20sec	5sec	+/- 1sec



Variations on 2001

There are two additional panels that use the 2001 PCB as the centre of their system. These panels are the LCP2 used on the Lister Engine range of gensets with enclosures and the 2001K Series control panel that is used on some gas engines with enclosures. The operation of these systems are identical to that of the 2001.



2001K Series



LCP2

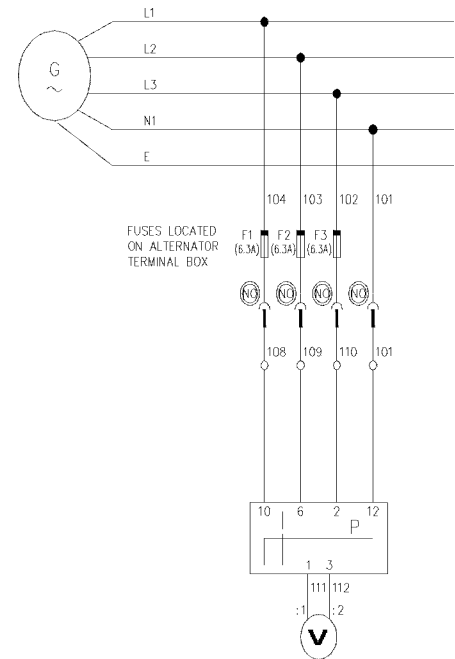
Both of these 2001 variations are designed to be used with alternator's that have no terminal box. These means items such as AVR's, sensing fuses, alternator terminal block, CT's etc are all fitted inside the control panel. In addition to these items normally fitted in the alternator terminal box, we have the breaker also fitted in the control panel.

The protections included as standard to the 2001K is slightly different to that on the standard 2001 panel. In addition to the 4 protections of the 2001, the 2001K has the addition of Low Coolant Temperature protection added to the spare channel, this is configured as an alarm. Also the 2001K combines High Engine Temperature (channel 2) with Low Coolant Level. Low coolant level is sensed via a probe fitted in the header tank of the radiator and will cause the engine to shutdown in the event of a coolant leak.

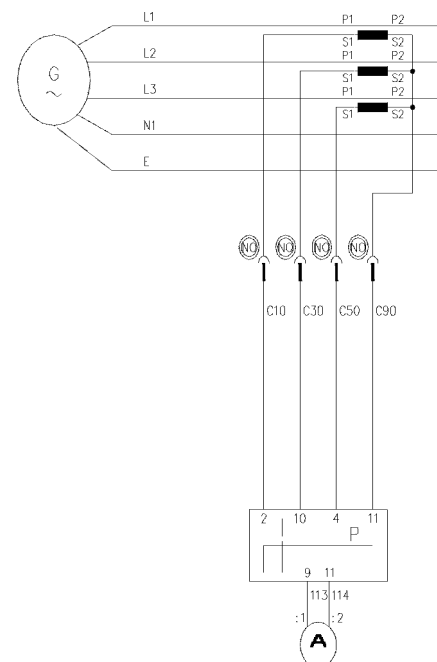
Instrumentation

The 2000 series of panels provides a voltmeter, ammeter, combined frequency/tachometer, hours run counter, battery condition voltmeter, coolant temperature, lube oil pressure gauge and. The coolant temperature

Voltmeter: The voltmeter will be either a 300V or 500V 90° deflection gauge dependant on voltage and configuration of the generator. Either a seven or four-position selector switch that is fitted on the control panel directly below the voltmeter controls the voltage displayed on the meter. The seven position switch will allow the operator to monitor L1-L2, L2-L3, L1-L3, L1-N, L2-N, L3-N or turn the meter to Off. The seven position switch is connected to wires 108, 109, 110 & 101 (L1, L2, L3 and Neutral respectively) via protection fuses that are fitted in the generator side plate. The four position switch is used when the generator is connect as a three wire system allow line-line voltages only as well as Off. If the generator is dedicated single phase unit then the voltage selector switch is not required.

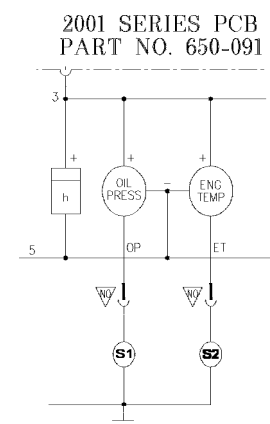


Ammeter: The ammeter is a 5 Amp / 90° deflection full scale deflection gauge operating in conjunction with current transformers (CT's) fitted on the power loom of the generator. The CT's have secondary winding outputs of 5 amps maximum, the primary winding rating is dependent on the current output of the generator. A four-position selector switch that is fitted on the control panel directly below the ammeter to allow the operator to monitor the current flow on L1, L2, L3 or turn the meter to Off. In a dedicated single phase machine the switch is not required. The switch is connected to the CT's via wires C10, C30, C50 and C90 (L1, L2, L3 and Common respectively)

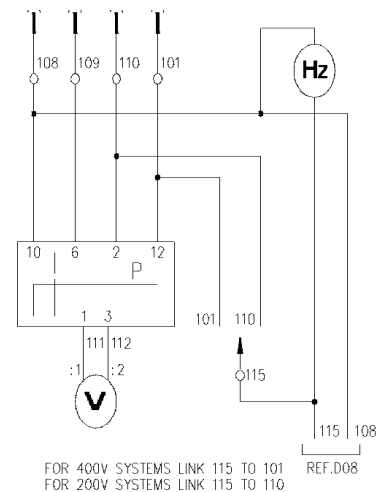


Hours Run, Engine Temperature and Oil

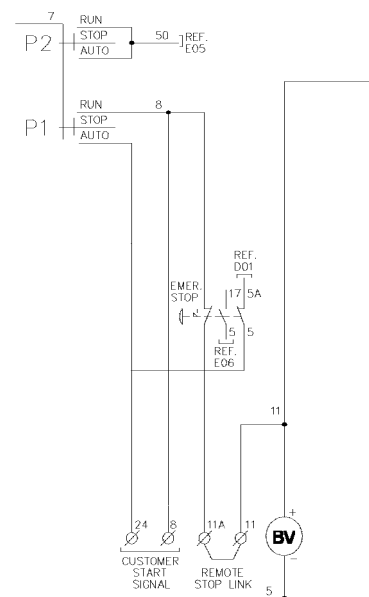
Pressure Gauges: All these gauges only become active when the generating is running or trying to start. The electrical supply for each of the gauges is given by wire 3 (the fuel signal from the PCB to the EIM). The oil pressure and engine temperature gauges are given a variable resistance signal from the engine mounted senders S1 and S2. The Oil Pressure gauge has a dual scale of Bar and PSI and the Engine Temperature scale is in both °C/°F.



Frequency Meter: The combined frequency/tachometer is a 90° deflection meter that senses the frequency of the AC electrical output of the generator. The meter is supplied via wires 108 (L1) and 115 (Neutral or L3 dependent on voltage of generator). The scale on the meter also states RPM as there is a direct relationship between the frequency of the electrical output and the speed of the engine. 115 is connect to Neutral (101) in 400v units and 110 (L3) in 200v units. This is done due to relay AR on the PCB, the supply to its coil must be within the range 200-300Vac. Too low and it wont energise, to high and it will burn out the coil, either way resulting in the generator shutting down with “Fail to Start”



Battery Condition Voltmeter: The battery voltmeter will be either rated for 12 or 24VDC depending on the engine electrical system. The gauge is supplied the DC battery voltage via wires 11 and 5. Wire 5 is taken directly from the battery negative, wire 11 is connected to wire 7 (battery positive) through 11A and 8 when the Run/Stop/Auto switch is turned to Run, or Auto with the ATS/Changeover systems having signalled the generating set to start. The gauge will therefore only be active whilst the generating set is running or attempting to start.

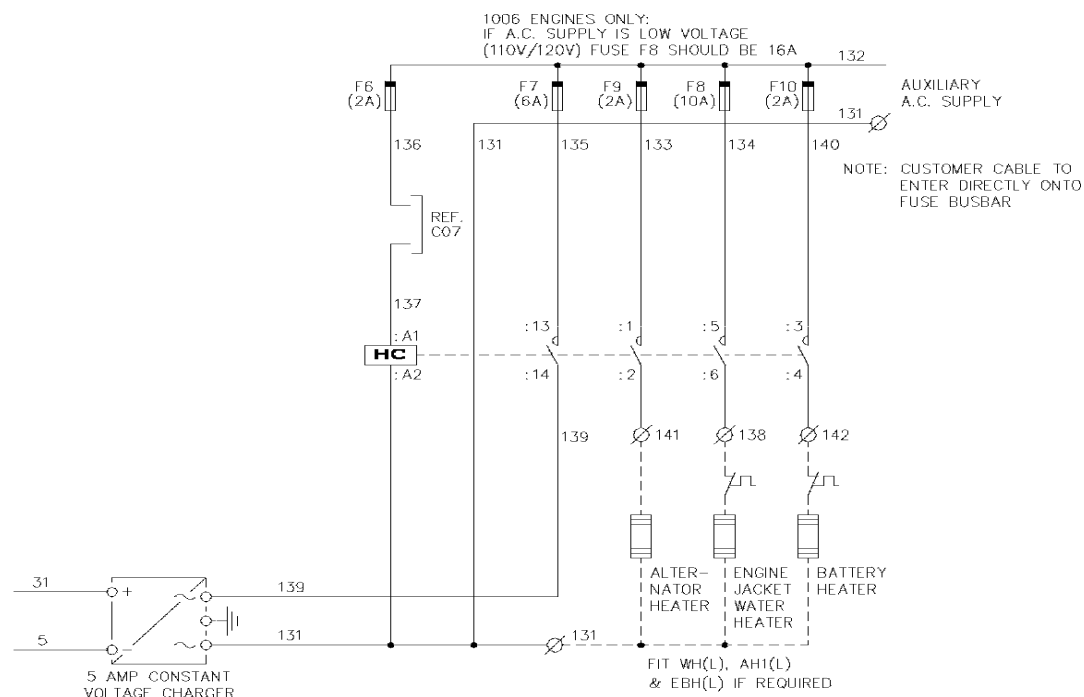


AC Auxiliary Options

Olympian Generating Sets offer various AC powered options to assist with starting, increasing initial load acceptance capability and improving the general operation of the generating set. These options include:

Battery Chargers
 Engine Coolant Heaters
 Lube Oil Sump Heaters
 Generator Anti-condensation Heaters
 Battery Heaters

These AC powered options are designed to operate when the generating set is in the off position. Once the generating attempts to start the control circuitry in the control panel will disconnect the AC supply to all the auxiliaries. A 4 pole electrical contactor is used to perform this function; the contactor is defined as HC (heater contactor) on the schematic. The customer live supply is connected to wire 132 and then fused onto wire 136 through a normally closed (N/C) contact on the control panel PCB (CR2/1), then connects to the contactor as 137. When the generating attempts to start the N/C contact opens breaking the supply to the contactor. The 4 contacts on the contactor will now open preventing the AC supply reaching the auxiliaries. As soon as the generating set stops or shuts down, the N/C contact will close again and the auxiliaries will be powered.



Battery Chargers

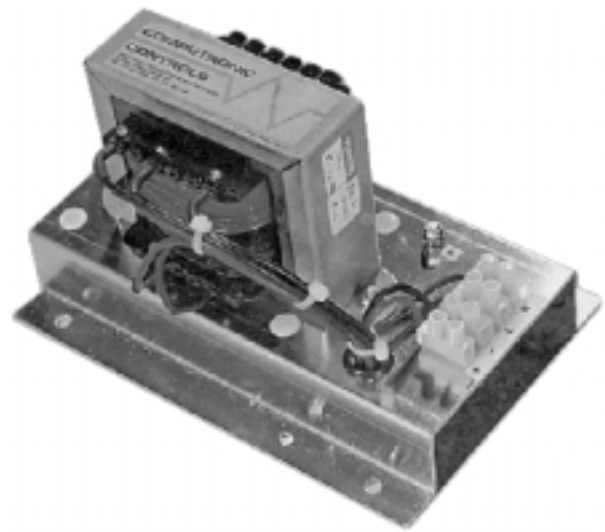
Battery Chargers are designed to keep the batteries full charged, so that when the generating set is required to start the battery can supply enough current to the starting motor. Once the engine is running the engine-mounted charger will keep the batteries charged. There are various battery charger options dependant on the AC supply voltage, output dc voltage, current rating output, UL listing and operation (constant, equalises/float).

Static Battery Chargers

Options: PBC5L 110-120V, PBC5 208-240V

Options with boost: PSB3L 110-120V, PSB3 208-240V

These nominal 5 Amp battery charger options are of the constant voltage type, providing a trickle charge to the generator set battery(s) to help maintain an optimum charged condition for starting. An important feature of the chargers is the controlled rate of charging which prevents over-charging and thereby maximizes battery life. For options PSB3L and PSB3, when battery condition has been severely depleted an additional boost feature permits a manual over-ride to a fast charging level, with an automatic return to the normal trickle charge when an optimum battery charge level has been reached.



UL Listed Battery Chargers

PBC3UL (LC), PBC10UL (FC)



LC 3.5 amp
Battery Charger

FC 10 amp
Battery Charger

Olympian UL battery chargers LC (3.5 amp) and FC (10 amp) offer accurate, completely automatic charging of lead-acid batteries. The output voltage automatically adjusts to changing input, load and ambient conditions. This prevents battery over-charging and consequent loss of battery electrolyte.

UL Listed Battery Chargers

PBCU6-AA, PBCU6L-AA, PBCU10-AA, PBCU10L-AA

Olympian UL battery chargers AA (6 amp and 10 amp) offer accurate, completely automatic charging of lead-acid batteries.

Fully Automatic float/equalizing without manual switching. Quickly restores charge after power failures and prevents overcharging.

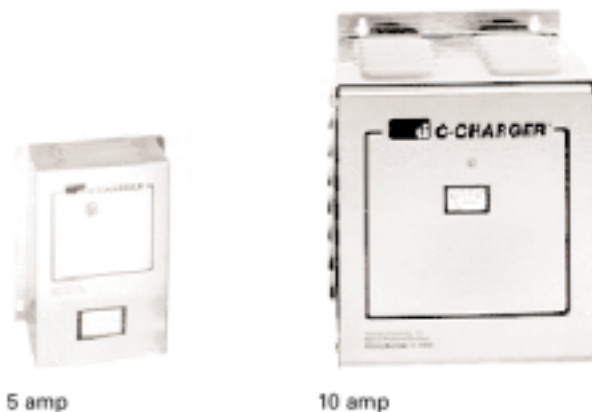
If the battery voltage drops below a set value, i.e. 25.5 VDC, the charger is switched to the equalize mode and the yellow equalize light is lit. The charger remains in the equalize mode until the battery voltage reaches another set value, i.e. 28 VDC. This ensures that the battery is completely recharged and not cycled. At this voltage the charger is switched to the float mode and the equalize light is extinguished.

If the battery voltage remains low, a red low voltage alarm light is lit. If battery voltage remains high, a red high voltage alarm is lit. Adjustable low and high voltages permit tailoring the charging system to specific batteries.



UL Listed Battery Chargers

PBCU5-CI, PBCU5L-CI, PBCU10-CI, PBCU10L-CI



Olympian UL battery chargers Ci (5 amp and 10 amp) offer accurate, completely automatic charging of lead-acid batteries.

The Ci battery charger is self-regulating. It uses a transformer to provide regulation without complicated circuitry. There are no tubes or delicate

electronics to fail or to cause radio frequency interference (RFI). Voltage output to the batteries remains at a safe and constant DC level from full load to no load.

Lube Oil Sump Heater

EOSL (110–120 V) or EOS (208–240 V)

Appropriate when the generator set is to be sited in a low ambient environment and maintains the engine lubricating oil at a temperature which facilitates rapid starting and load acceptance.



Battery Heater

EBHL (110–120 V) OR EBH (208–240 V)

Appropriate when the generator set is to be sited in a low ambient environment. The heater maintains the battery at an optimum operating temperature allowing full rated current to be drawn (providing that the battery is in a fully charged condition).



Engine Coolant Heater

WHL (110-120V) or WH (208-240)

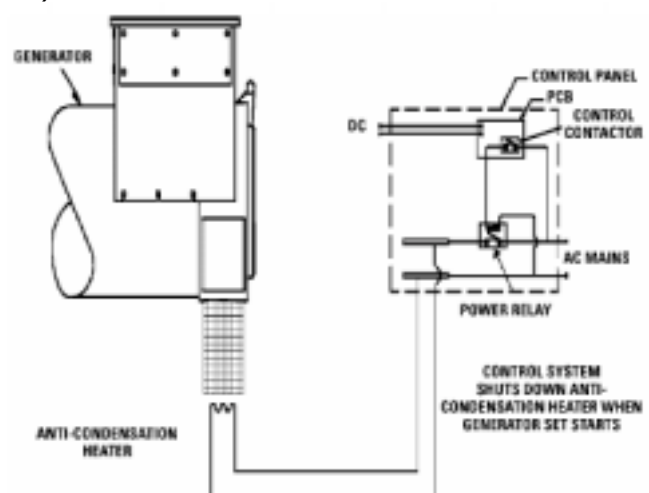


Appropriate when the generator set is to be sited in a low ambient environment, the heater maintains the engine coolant at a temperature (typically 100°F) which facilitates rapid starting and load acceptance. The heater assembly uses UL compliant components (to UL1030) and has CSA approval (LR7323-36) which is UL recognized.

Generator Anti-Condensation Heater

AH1L (110–120 V) or AH1 (208–240 V)

Appropriate when the generator set is to be sited in a low ambient and/or high humidity environment, the heater maintains the AC generator at a suitable temperature to prevent winding corrosion due to condensation.



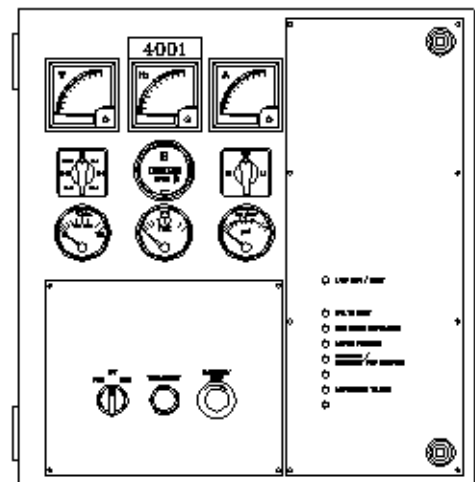
4001 & 4001E Control Systems

The 4001 and 4001E series control systems provide for automatic starting and stopping of the generator set from a remote signal as well as manual starting and stopping. This makes it appropriate for standby generating systems.

On the 4001 and 4001E systems we have the same basic protections as that on the 2001 control system with the addition of an alarm protection for Low Battery Voltage. On 4001E series control systems there are additional alarms for Approaching Low Oil Pressure, Approaching High Engine Temperature, Battery Charger Failure, Not in Auto Mode and High Battery Voltage (Programmable Channel 1). Both systems have spare additional protection channels as detailed below.

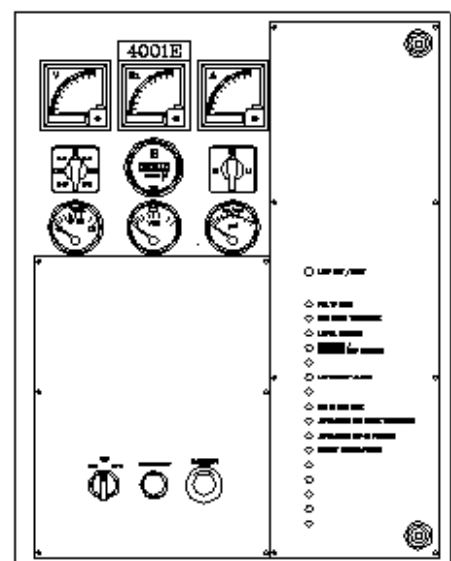
For the 4001 Series Control System, the Fault Indicating Lamps are grouped on the control panel as follows:-

- L1 Fail To Start Shutdown**
- L2 High Engine Temperature Shutdown**
- L3 Low Oil Pressure Shutdown**
- L4 Overspeed Shutdown**
- L5 Additional Shutdown**
- L6 Low Battery Alarm**
- L7 Additional Alarm**



For the 4001E Series Control Systems nine additional Fault Indicating Lamps are included on the separate 4001E expansion PCB which are grouped on the control panel as follows:-

- L8 Not In Auto Alarm**
- L9 Approaching High Engine Temperature Alarm**
- L10 Approaching Low Oil Pressure Alarm**
- L11 Battery Charger Failure Alarm**
- L12 Programmable Channel 1**
- L13 Programmable Channel 2**
- L14 Programmable Channel 3**
- L15 Programmable Channel 4**
- L16 Additional Shutdown**



Indicators L12-L14 are programmed for shutdown or alarm functions using the Di1 switches on the PCB

The DIL switches are assigned as follows:

Fault Channel	Dil Switch
L12	SW1
L13	SW2
L14	SW3
L15	SW4

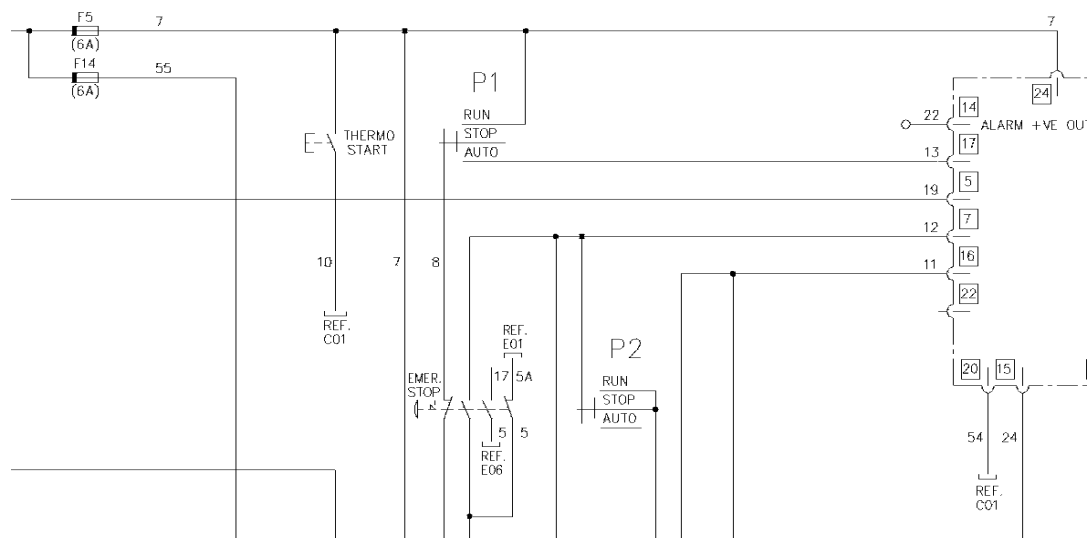
The setting of these programmable Fault Indicator Lamps can be checked on the PCB. With both poles in "SD" position, the fault channel is configured as a shutdown. With both poles in "ALM" position, the fault channel is configured as an alarm.

Since these control systems are designed for automatic starting, they are fitted with connections for remote control. Included are terminals for Remote Emergency Stop and an interface to an Automatic Transfer Switch (ATS). Additionally, the 4001 and 4001E Series Control Systems are fitted with an interface to Remote Annunciators.

Basic System Operation

The 4001E system is constructed by using the same PCB as that on the 4001 plus the addition of an expansion board (4000E). This means that the basic operation of both the systems is the same.

When the main control panel fuse is fitted the panel is powered by the battery. The battery positive is branched of to four areas (i) to the glow plug , if applicable (ii) to terminals to be connected to the ATS (iii) to the PCB via pin 24 (iv) 3 position switch.



- (i) When the thermostart button mounted on the front of the panel is pushed a signal will be sent to the EIM via wire 10 to energise the glow plug (if applicable).
- (ii) The supply to terminals is for the ATS, when the ATS wants to start the generator it will close a n/o contact and link 7 to 24.
- (iii) The supply to the PCB via pin 24 will enable the Low Battery Voltage monitoring circuit and also provide a supply for the LED's for the Lamp Test.
- (iv) The supply to the three-position switch plays no role until run or auto is selected.

RUN Mode

When the switch is turned to the run position wire 7 will be connected onto wire 8; this then goes through a n/c contact on the emergency stop button. If the button is locked in we do not progress. Provided the emergency stop is not locked, the run signal will transfer onto wire 9. Wire 9 is linked to wire 11 by the remote stop link. Wire 11 will supply a voltage to the battery volts gauge for display and also enters the PCB via pin 16.

On drawing D20449 we can see that the signal entering the PCB via pin 16 sends a supply to the oil and coolant gauges via pins 8 and 12. The signal also energises CR1 and CR2 via the fault array (F1R/1 to F5R/1).

When CR1 and CR2 energise contacts CR1/1 switches a positive supply to wire 3 via pin 3 and CR2/1 switches to enable a supply to CYT, DT and SMR. SMR will energise when contact CYT/2 closes i.e. during the CYTON cycle, this allows SMR/1 to close and send a starter motor signal to the EIM through pin 23 onto wire 4.

DT will limit the number of cranks as discussed in the system operation of the 2001 control system.

Autostart Mode

When the three-position switch is turned to the auto position wire 8 will connect to wire 13 and the system will wait on the ATS to close the contact between wire 7 and 24 before anything further happens. When the ATS closes the contact onto wire 24 a positive supply enters the PCB via pin 15 which will energise MSRA (mains sensing relay auxiliary). Contact MSRA/1 closes and allows a positive supply onto wire 13 via pin 17, wire 8 is connected to wire 13 as stated above and we are now operating as if the 3 position switch is in the run position.

When the ATS removes the link between 7 and 24, MSRA de-energises but the set does not stop because we will still have a positive signal on wire 13 due to contacts CR2/2 and ROT/2. When timer ROT (run on timer) times out, ROT/2 opens and the set shuts down due to CR de-energising and removing the fuel supply. The ROT is enabled when MSRA de-energises and MSRA/2 closes to enable the timer.

Protection Activation

The protection channels are activated by allowing a dc negative to the fault relay coil, which will switch the contacts on the relay. This will also illuminate the corresponding LED, the protection is cleared and reset by pressing the lamp test / reset button which will temporarily break the supply to the relay.

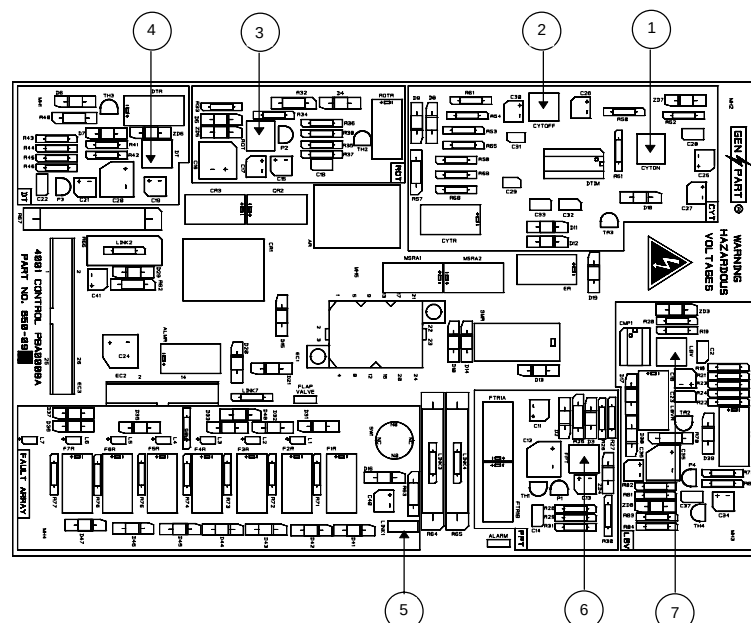
The two spare channels, L5 and L7 are permanently allocated as shutdown and alarm respectively.

Timer Adjustment

It is possible to make adjustments to the following timing circuits on the 4001 and 4001E PCB's:

Fault Protection Timer (FPT), Crank period (CYTON), rest period between Starter Motor cranks (CYTOFF), duration timer (DT), and the run on timer (ROT). The range and default settings are shown:

<u>Ref. No</u>	<u>Timer</u>	<u>Range</u>	<u>Settings</u>	<u>Tolerance</u>
1	CYT ON	0.25sec - 20sec	5sec	+/- 1sec
2	CYT OFF	0.25sec - 20sec	5sec	+/- 1sec
3	ROT	3 – 330sec	240sec	+/- 15sec
4	DT	1sec - 90sec	27.5sec	+/- 2.5sec
6	FPT	1sec - 70sec	15sec	+/- 1sec

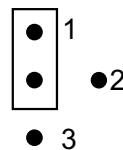


In addition to this we can adjust the setpoint of the Low Battery Volts trip point by adjusting the pot shown as item 7. This is usually set for 10.75 volts for 12v systems and 22.75 for 24v systems. This alarm has a built in time delay, LBVT set for 60 seconds to prevent spurious tripping of the alarm such as when the engine is cranking.

Link 1 (item 5) should always be removed on the 4001 PCB when an expansion board is fitted i.e. 4001E.

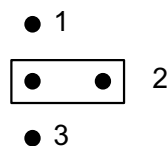
Four additional Alarm circuits are provided on the 4001E Series Control System. The Approaching Low Oil Pressure and Approaching High Engine Temperature alarms work off the sensors fitted for the gauges. The temperature alarm is factory set to go off at $203^{\circ}\text{F} \pm 2^{\circ}\text{F}$ but may be adjusted using the pot on 4001E PCB. The Not in Auto Mode Alarm senses the position of the Control Switch via P2. The Battery Charger Failure Alarm detects low voltage from the charger. This level (BCV) is factory set at 13 volts for 12-volt systems and 26 volts for 24-volt systems. This alarm can be operated in one of 3 modes depending on the position of Link 6 on the 4001E Expansion PCB (see diagrams below):

Mode 1: Link in Position 1



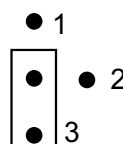
For generator sets with trickle charger and engine driven charging alternators. In this position the charger failure circuit monitors the engine mounted charger when the engine is running and the trickle charger when the engine is off.

Mode 2: Link in Position 2

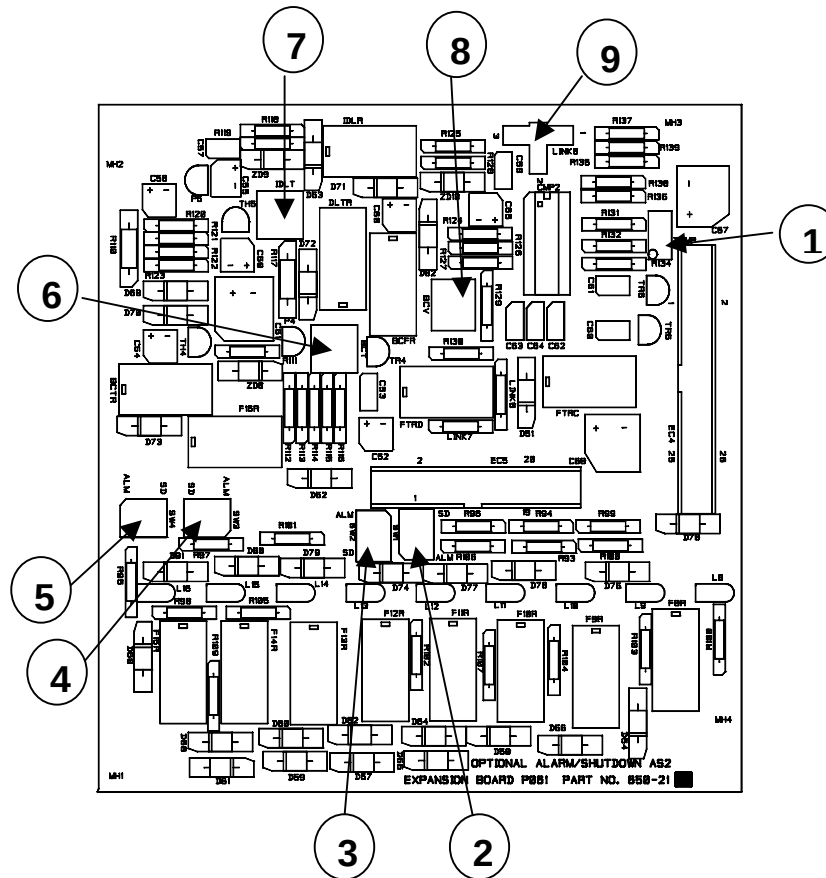


For generator sets fitted with AC powered chargers only (no engine driven charging alternator.)

Mode 3 Link in Position 3



For generator sets with no battery charger fitted. In this position the charger failure circuit is **disabled**.



Item	Description
1	TEMP: Approaching High Engine Temperature Set Point Set: 203°F ± 2°F
2	SW1: Shutdown/Alarm Selector for Fault L12
3	SW2: Shutdown/Alarm Selector for Fault L13
4	SW3: Shutdown/Alarm Selector for Fault L14
5	SW4: Shutdown/Alarm Selector for Fault L15
6	BCT: Battery Charger Timer Set Range: 3-330 seconds Set: 180 ± 15 seconds
7	IDLT: Input Delay Timer Set Range: 0.25-30 seconds Set: 1 ± 0.5 seconds
8	BCV: Battery Charger Failure Detection Set Point Set: 13 volts for 12 volt systems 26 volts for 24 volt systems
9	LINK 6: Battery Charger Failure Operating Mode

The 4001E also uses one of its programmable fault channels to display High Battery Voltage. The channel used is Programmable Channel 1 and is configured as an alarm. To monitor this protection we use a DC voltage sensing relay, which is mounted inside the control panel. The relay is shown below.



The setpoint at which the alarm will activate is 15.5volts for 12v systems and 29volts for 24v systems. The setpoint may be adjusted by removing the cover of the relay and adjusting the HIGH potentiometer.

Remote Annunciators

Olympian supply two remote annunciator panels to operate in conjunction with the 4001 and 4001E series control panels. These are the Pan 4 and Pan 5 Remote Annunciators.



Pan5 with options Pan6 & Pan7

The Pan 4 option has 8 channels and is used for the 4001 system whereas the Pan 5 has 16 channels and is used in conjunction with the 4001E.

The system operates when a negative signal is switched to the remote annunciator panel from the 4001/4001E control panel and the corresponding LED is illuminated.

The 4001 & 4001E systems are fitted with the ribbon/field cable interface board. The purpose of this interface is to allow the required signals to be transmitted from the control panel to the remote annunciator. Signals from both the 4001 & 4001E PCB's are terminated on this board and the details given in tabular form on the control panel schematic



Ribbon/Field Cable Interface

The signals from the interface are then hardwired to the remote annunciator ensuring that the correct signal is connected to the corresponding channel on the remote annunciator. The remote annunciator will have an engraved fascia detailing the faults as listed on the generating set control panel fascia.

On the PCB's inside the remote annunciator the customer has the ability to change the colour of the fault LED's from the following choices: red, yellow or green. Also each channel can be programmed to sound a siren when activated.

The supply for the remote annunciator panel is taken from the interface board. The positive supply is taken from pin 11 on the interface and connected to terminal 9 (Pos) on the annunciator PCB, the negative supply is obtained by taking a wire 5 from the control panel terminal rail to terminal 10 on the annunciator PCB.

The operating voltage of the remote annunciator panel is not indicated on the panel itself but the voltage can be determined by checking the rating of the relays on the annunciator PCB. This will state 24USB or 12USB depending on whether the system is 12 or 24 volts.

The remote annunciator panels may have optional remote start switches or emergency stops fitted. If the remote start switch is fitted then it is necessary to connect this switch to wires 7 & 24 in the control panel. If the emergency stop is fitted then the remote stop link should be removed in the control panel and wires 9 & 11 connected across to the remote annunciator panel.

The distance that the remote annunciator can be mounted from the genset depends on the voltage of the system and also the type of wire that is used to connect both parts of the system. To calculate the maximum length we first determine the operating voltage and how many channels we are using either 8 or 16. The maximum voltage drop for 12v systems is 2v and for 24v systems the maximum drop is 4v. We also have to allow 100mA per channel. We then apply Ohms law to get the overall maximum resistance of the connecting cable.

Example: 12v Pan 4 gives

Resistance = max volts drop / (100mA x number of channels)

Resistance = 2v / 800mA

Resistance = 2.5 ohms

We need to now refer to the cable manufactures handbook for the selected cable or an IEE/IEEE data table to determine the resistance per yard or metre for the selected cable. The resistance that we calculated is then divided by the manufacturers figure to obtain the theoretical maximum length that the annunciator can be from the generator.

If we were using 14wg then the resistance is approximately 0.00307 ohms per foot. This would then give us a maximum length of 815 feet / 272 yards. Allowances should be made as data tables quote resistance at a given temperature and you must allow for variance in the ambient temperature.

The Remote Annunciators are also available with an optional remote emergency stop (Pan 7) and Run/Normal control switch (Pan 6).

4000XQ Series Control System

There are 4 models in the XQ range of rental specification generating sets; XQ30, XQ60, XQ75 and XQ105. The series has a multi-voltage distribution system allowing 480/277V and 220/120V taken simultaneously.

The 4000XQ control system fitted to the XQ range is based around the Olympian 4001 control panel.

The panel provides for automatic starting and stopping of the generator set from a remote signal as well as manual starting and stopping. This makes it appropriate for standby generating systems.

On the 4000XQ system we have the same basic protections as that on the 4001 control system with the addition of Low Coolant Level combined with High Coolant Temperature on L2 and an alarm protection for Low Fuel Level/Fuel Leak on Battery Voltage.



For the 400XQ Series Control System, the Fault Indicating Lamps are grouped on the control panel as follows:-

- L1 Fail To Start Shutdown**
- L2 High Engine Temperature/Low Coolant Level Shutdown**
- L3 Low Oil Pressure Shutdown**
- L4 Overspeed Shutdown**
- L5 Additional Shutdown**
- L6 Low Battery Alarm**
- L7 Low Fuel Level/Fuel Leak Alarm**

Protection Activation

The additional protection channels to those of the 4001 are activated as follows:

Low Coolant Level: The Low Coolant Level shutdown combined with High Coolant Temperature on L2 uses a probe fitted into the top tank of the radiator to sense if coolant is present. If no coolant is present then the generating set will shutdown 15 seconds after starting as this channel is FPT protected.

Low Fuel Level/Fuel Leak: Low Fuel Level/Fuel Leak alarm uses L7, we have two float switches wired in parallel to this channel. One of the float switches is fitted in the fuel tank for sensing the low fuel level and another in the outer tank for fuel leakage. The low fuel level switch is a normally closed (N/C) switch, once the tank has been fuelled then the float switch will raise with the level of the fuel and the N/C will open. The fuel leak switch is a normally open (N/O) switch, if the fuel was to begin to fill due to a rupture or overfilling the tank then the float will raise with the fuel level and the N/O switch will close. Therefore either switch closing will indicate a fault. When the switch closes we send a battery negative signal to the control panel and channel L7 will activate.

Access 4000 Control System



The Access 4000 series control panel is a microprocessor based autostart generator set control system. The design provides for high accuracy for all metering and protection functions, together with the obvious benefits of a large alphanumeric LCD. The use of an open protocol communication interface ensures compatibility with most building management or supervisory control systems.

Fault Protections

The ACCESS 4000 control module utilises both analogue and digital inputs to generate fault conditions. Fault conditions are classified in one of two categories:

Shutdown: These critical faults cause the generating set to stop. They also prevent the generating set from starting and must be acknowledged and reset before any further generator set operation can occur. Note: A shutdown condition will prevent the generator set from starting in automatic mode.

Alarm: These non-critical faults do not interfere with the normal operation of the generating set but require operator acknowledgement. They therefore provide only a warning of a potential future shutdown condition.

In addition, faults can be constrained as follows:

Immediate: These fault conditions are armed at all time.

Time Delayed: These alarms are inhibited for a programmable transient time period following receipt of the first fault signal. If, following the time delay, the fault is still present the fault condition is latched.

Fault Protection Timer (FPT): These fault conditions are inhibited until the generating set has reached normal running conditions and the FPT time has expired.

In the event of a fault condition, regardless of category, the cause will be indicted on the LCD, the visual fault LED will flash and any optional siren will sound. When acknowledged the LED will become continuous and the audible alarm will become silent. Once activated all fault conditions are logged in the ALARM LOG and latched active until manually reset. When the entire contents of the ALARM LOG have been reset the fault LED will go out.

Internal Fault Conditions

Internal fault conditions are those which are activated internally by the system, many of them from the analogue instrumentation channels. The ACCESS 4000 is supplied from the factory with eight standard internal faults.

FAIL TO START (Overcrank) - [shutdown, immediate]. The fail to start fault condition is initiated when the engine fails to start after the selected crank time and number of crank cycle repeats. The fail to start fault condition is internally programmed as a shutdown fault and is not user programmable.

OVERSPEED [shutdown, immediate]. The overspeed fault condition is initiated when the engine's speed has increased above the overspeed setpoint as detected by the flywheel mounted magnetic pick-up. The overspeed fault condition is internally programmed as a shutdown fault and is user programmable as an engine speed approximately 10% above nominal for diesel engines and 12% above nominal for gas engines.

APPROACHING LOW OIL PRESSURE [alarm, FPT]. The approaching low lubricating oil pressure fault condition is activated when the lubricating oil pressure drops below a pre-determined setpoint. The approaching low oil pressure fault is internally programmed as an alarm condition and is user programmable for pressure setpoint level.

APPROACHING HIGH ENGINE TEMPERATURE - [alarm, FPT]: The approaching high engine coolant temperature fault condition is activated when the engine jacket coolant rises above a pre-determined setpoint. The approaching high coolant temperature fault is internally programmed as an alarm condition and is user programmable for temperature setpoint level.

HIGH BATTERY VOLTAGE [alarm, time delay]. The high battery voltage fault condition is activated when the engine battery voltage rises above a pre-determined setpoint for a specified time delay. The high battery voltage fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and transient time delay.

LOW BATTERY VOLTAGE [alarm, time delay]. The low battery voltage fault condition is activated when the engine battery voltage drops below a pre-determined setpoint for a specified time delay. The low battery voltage fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and transient time delay.

BATTERY CHARGER FAILURE [alarm, time delay]. The battery charger failure fault condition is activated when the engine battery voltage drops below a pre-determined setpoint for a specified time delay, indicating a failure in the battery trickle/float charging system. The battery charger failure fault is internally programmed as an alarm condition and is user programmable for voltage setpoint level and

transient time delay. The battery charger failure fault is normally programmed for a higher battery voltage setpoint than the low battery voltage fault condition.

NOT IN AUTO MODE [alarm]. The not in auto mode fault condition is activated when the control switch is changed from the AUTO position to any other position. The not in auto mode fault condition is internally programmed as an alarm condition and may be enabled or disabled by the user.

External Fault Conditions

The ACCESS 4000 controller provides up to seven digital fault inputs. Each digital fault input is activated via a remote sensing contact that is external to the controller. The ACCESS 4000 is factory fitted with five standard external fault inputs and the remaining two fault inputs are available for options or customer programming.

Each optional external fault input may be programmed with a unique fault label and must be specified at the time of equipment purchase. HIGH ENGINE TEMPERATURE [shutdown, FPT]. The high engine temperature fault condition is activated when the engine jacket coolant rises above a setpoint as determined by the engine mounted temperature switch. The high engine coolant temperature fault is internally programmed as a shutdown condition.

LOW OIL PRESSURE [shutdown, FPT]. The low lubricating oil pressure fault condition is activated when the engine oil pressure drops below a setpoint as determined by the engine mounted pressure switch. The low lubricating oil pressure fault is internally programmed as a shutdown condition and is inhibited until normal running conditions are established.

EMERGENCY STOP [shutdown, immediate]. The emergency stop fault condition is activated when the control panel mounted emergency stop push-button is pressed or the canopy mounted emergency stop push-button (if applicable) is pressed. The emergency stop fault condition is internally programmed as a shutdown condition. This shutdown fault can be reset by turning the control switch to the OFF position.

LOW COOLANT TEMPERATURE [alarm, time delay]. The low coolant temperature fault condition is activated when the coolant temperature falls below the switching point of the external coolant temperature sensing switch fitted to the engine block. The alarm would indicate a failure of the engine coolant heater.

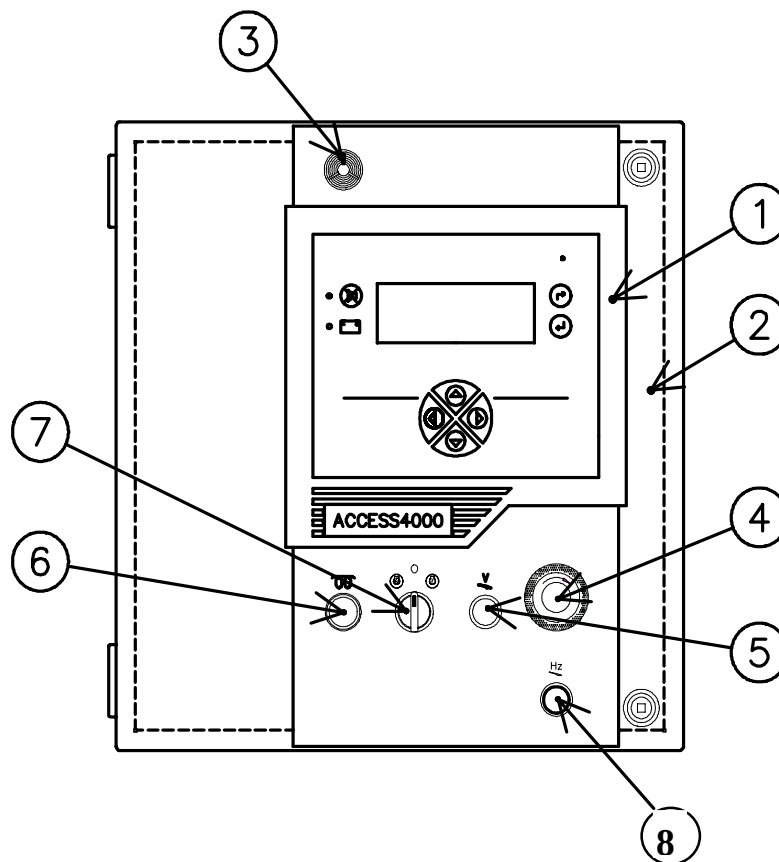
FUEL ALARM or LOW GAS PRESSURE or LOW FUEL ALARM [alarm, time delay]. The type of alarm that is programmed will depend on the fuel system of the generating set (Gas/Diesel) and also if the set is fitted with the UL Listed fuel tank. The fuel alarm combines the low fuel alarm and fuel leak switches on generating sets where a UL listed fuel tank is fitted. The alarm activates if either switch changes state.

Low Gas pressure alarm is standard on gas powered generating sets and the fault condition will activate if the gas supply pressure falls below the required pressure setting. Low Fuel Alarm is enabled on Diesel powered generating sets that do not have a UL Listed fuel tank.

USER PROGRAMMABLE EXTERNAL FAULT INPUTS

[alarm/shutdown, time delay, FPT]. The two user programmable external fault conditions are activated when their corresponding inputs are switched low. The fault conditions are fully user programmable for action and time delays.

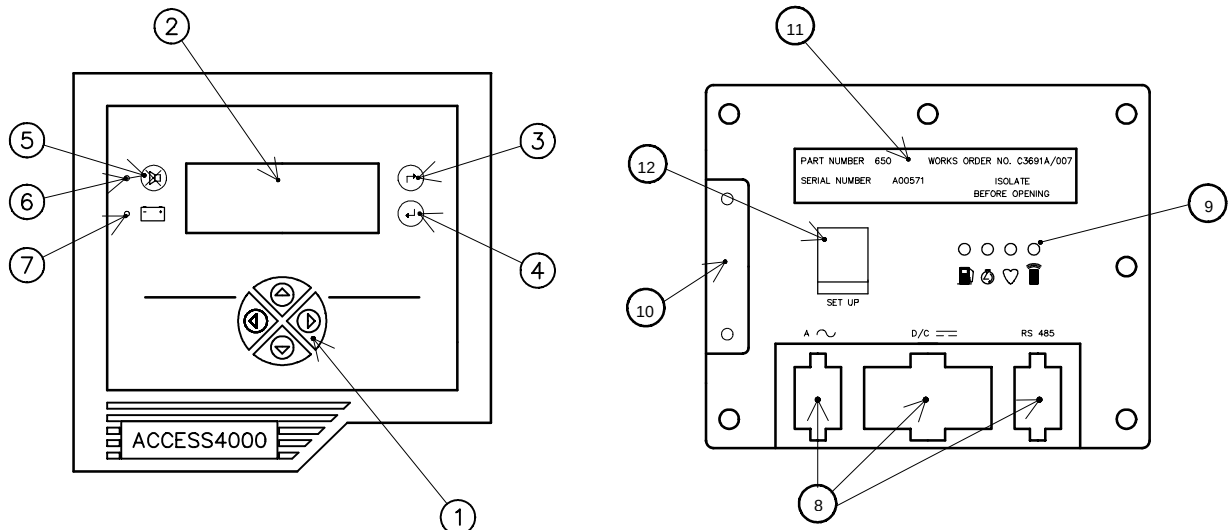
Panel Construction



1. Access 4000 Control module (see below)
2. Panel Enclosure
3. Audible Alarm
4. Emergency Stop
5. Voltage Adjust Control
6. Thermostart Control*
7. Control Switch
8. Speed Adjust Control[#]

* Only fitted to D20-D150P1

[#] Require option GE1



1. **CURSOR CLUSTER.** The arrow keys are used to navigate around the status menus or for programming values within the configuration menu. The “UP Key” will increase numerical values of parameters or setpoints. The “DOWN Key” will decrease numerical values of parameters or setpoints. The “LEFT Key” will move the cursor to the previous item in the menu screens or to the left when programming parameters or setpoints. The “RIGHT Key” will move the cursor to the next item in the menu screens or to the right when programming parameters or setpoints.
2. **LCD VIEWING WINDOW.** The backlit LCD display is mounted behind and visible through the clear Lexan viewing window.
3. **ESCAPE Key.** Pressing this key will exit from any menu or programming screen without saving the new value.
4. **ENTER Key.** Use of this pad selects the menu item or amends the new programmed parameter or setpoint. This key is also used to acknowledge and reset alarms or shutdowns from within the alarm log menu.
5. **ALARM MUTE.** De-energises the common alarm output relay thus muting any audible alarm (siren) if fitted.
6. **FAULT LED.** The fault LED illuminates when any pre-programmed fault has been activated. The LED will flash quickly alerting the user to a shutdown (critical) condition. The LED will flash slowly alerting the user to an alarm (non-critical) condition. Once all shutdowns have been acknowledged the LED will ‘go solid’ and de-energise once they are all reset.
7. **Power LED.** Illuminates when the unit is powered in the healthy state.
8. **Electrical Connections.** Connections to the ACCESS 4000 are via locking plug and sockets.
9. **Diagnostic LED’s.** The ACCESS 4000 provides four diagnostic Light Emitting Diodes to facilitate simple module diagnosis. Their functions and symbols are described as follows:



FUEL CONTROL SOLENOID.

This LED is illuminated whenever the module has called for the

engine to run. The LED mirrors the status of the output relay which controls the fuel control solenoid.

STARTER CONTROL SOLENOID

This LED is illuminated whenever the module is initiating an engine crank cycle. The LED mirrors the status of the output relay which controls the auxiliary starter solenoid.

WATCHDOG

This LED flashes on and off at regular intervals indicating that the microprocessor is functioning normally.

REMOTE CONTROL

This LED is illuminated whenever the module is being controlled from a remote signal i.e. via the communication facility or via the remote start input.

10. Expansion Port. Provision for expansion of the ACCESS 4000's functional capability is provided for using the expansion port.
11. Serial Number Label. A two part serial number label details the unit part number, individual unit serial number and generator set works order number. Please quote all three items of information when requesting dealer or factory support.
12. Communications Set Up. Set all dip switches to "ON" in a single ACCESS 4000 system. In a multiple ACCESS 4000 system, set dip switches to "ON" on the unit furthest away from the MCM2 / MCM3 leaving the switches on the intermediate units to "OFF" position.

Potential Transformers

The ACCESS 4000 is designed using a multi-tapped potential transformer for all AC voltage input in the range 60 - 300Vac, using one of fourappings on the high accuracy potential transformers fitted external to the ACCESS 4000. High voltage systems may be interfaced using additional specialised transformers.

WARNING

! The incorrect connection of the AC Voltage Inputs will damage the controller. Ensure that correct primary voltage tapping connections are made.

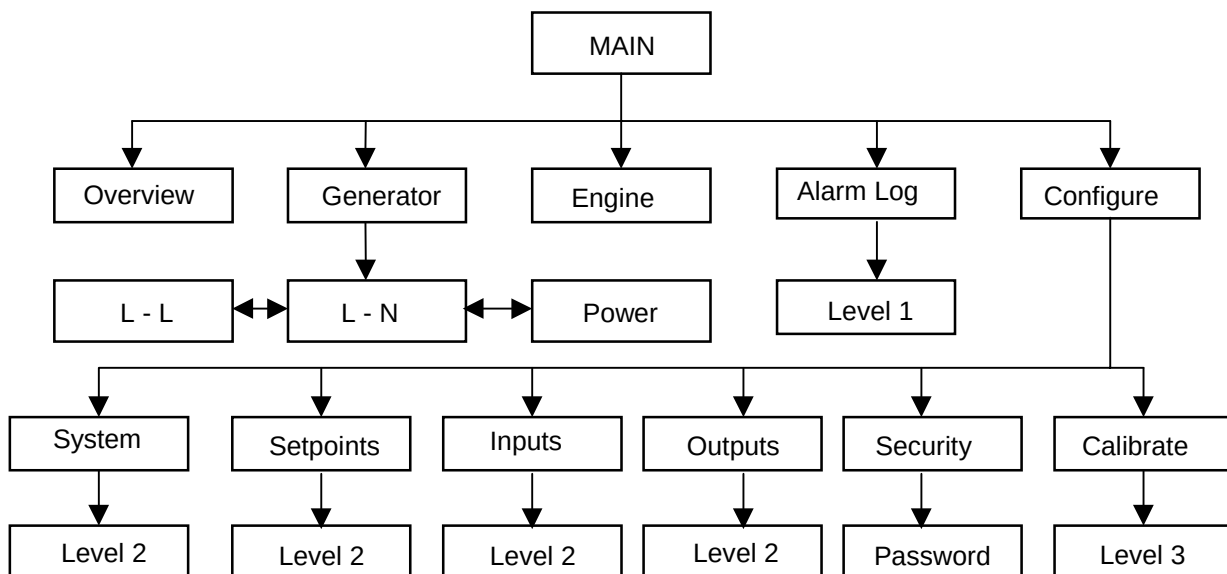
The tapping points for each winding configuration are given below.

Wiring Configuration	Tapping Points		
	Red (T1)	Yellow (T2)	Blue (T3)
Series Star 3Φ4W (<250V L-N)	250	250	250
Series Star 3Φ4W (250 – 320V L-N)	320	320	320
Series Star 3Φ4W (>320V L-N)	370	370	370
Parallel Star 3Φ4W	130	130	130
Series Delta 3Φ4W	250	130	130
Series Delta 3Φ3W	250	250	250
Double Delta 1Φ3W	130	130	250
Double Delta 1Φ2W	250	N/A	N/A
Parallel Delta 3Φ3W	130	130	130

Display Menus

The ACCESS 4000 displays all user interface information on a series of pre-programmed screens on the Liquid Crystal Display (LCD). On initial power-up, the controller enters a Bootstrap mode during which it initialises all system parameters.

After approximately five seconds the controller defaults to display the main menu. All further information relating to the generator system may be accessed through a series of main and subordinate menus, the selection of which is performed by the operator.



All sub-menus are password level protected. In total there are four levels, each giving the holder a greater degree of responsibility. The four levels are defined as follows:

Level	Default Password	<u>Authorisation</u>
One (Operator)	1111	Resetting alarms and shutdowns
Two (Technician)	2222	The above plus configuration of system, setpoints, inputs and outputs.
Three (Factory/Dealer)	****	The above plus re-calibration of the analogue channels
Remote [option]	9999	Permits control and monitoring access via the communication facility

System Operation

The ACCESS 4000 control system is required to operate with an external changeover system designed to handle all mains sensing and load transfer functions. The ACCESS 4000 controller will start and stop the engine in either a local “manual” or remote “automatic” mode. When a ‘required to run’ command is issued, the controller issues engine fuel control solenoid on and starter motor crank output signals. The engine speed is monitored and once engine firing speed has been reached the module terminates the crank signal. While the engine accelerates up to and runs at nominal speed, the ACCESS 4000 continually monitors the engine speed signal. Should the engine speed exceed the setpoint determined by the OVERSPEED fault condition, the engine is shutdown by termination of the fuel control solenoid on signal.

In addition to the OVERSPEED fault condition, the ACCESS 4000 continuously monitors all other necessary engine conditions, together with additional optional fault conditions as required by the customer.

On removal of the ‘required to run’ command, the engine will automatically stop.

The ACCESS 4000 includes all necessary user programmable timer functions to enable start, cranking and stop (cooldown) time delays.

Manual Mode of Operation

When the ACCESS 4000 control panel is selected for Manual (RUN) operation using the 3-position Control Switch, a N/O contact closes to connect wire 5 (zero volt signal) onto wire 12. The microprocessor senses the zero volt signal when it appears at pin 14 and the RUN sequence part of the software code is enabled. The code instructs two internal relays, relay 1 and relay 2 to switch. Relay 1 is the Fuel Control

relay and when it switches it will connect a DC positive from wire 7 to wire 27 via pins 1 and 19 respectively. The positive supply will then proceed to the EIM via a N/C contact on the emergency stop and the link connecting wires 3 and 3A. Relay 2 is the Engine Crank relay which will connect wire 7 (DC positive) to 18 and then to the EIM on wire 4 via a N/C contact on the emergency stop. Relay 2 will switch back and forth in sequence with the Crank and Crank Delay time values stored inside the Access. These values are factory set at 7 seconds and the sequence is terminated after 3 unsuccessful attempts to start the engine, Fail to Start protection will be enabled preventing any further action.

If the engine does fire during one of the crank attempts then the starter motor must be disengaged. The speed of the engine is sensed via a magnetic pickup (MPU) which is connect directly into the Access module via wires 41 & 42. When the Access determines that the signal frequency sensed from the MPU has exceeded the Crank Cut Out setpoint then internal relay 2 will return to its normal state, disconnecting the starting signal to the EIM and hence the starting solenoid. Note: the start sequence will NOT be initiated if any shutdown fault condition is present. Assuming the engine starts and accelerates successfully, the ACCESS 4000 will default to display on the LCD an OVERVIEW screen.

The generator continues to supply any load applied to it until the Control Switch is switched to the OFF or AUTO positions or a shutdown fault condition arises. If a shutdown fault condition arises, and before any further operation of the generator set can occur, an operator is required to acknowledge the fault and, within the ALARM LOG menu, reset the fault(s). In addition, the controller must be switched to OFF and back to RUN before the system will respond.

Automatic Mode of Operation

When the ACCESS 4000 control panel is selected for Automatic (AUTO) standby operation using the Control Switch the generating set will automatically start and run upon activation of the remote start contact input. The remote start contact will be connected across wires 5 & 24, when the zero volt signal is detected on pin 15 by the microprocessor, the starting sequence as that mentioned in the manual operation routine is enabled. The engine will only attempt to crank after the Start Delay Timer specified inside the Access 4000 configuration expires. Note: the start sequence will NOT be initiated if any shutdown fault condition is present. Assuming the engine starts and accelerates successfully, the ACCESS 4000 will default to display on the LCD an OVERVIEW screen. Once the generating set reaches rated voltage and frequency the disconnection of the mains from the load and connection of the generator to the load is handled by the changeover system.

The generator continues supplying the load until the remote start signal is removed, the panel is switched to OFF or a shutdown fault condition arises. If a shutdown fault condition arises, and before any further

operation of the generator set can occur, an operator is required to acknowledge the fault and, within the ALARM LOG menu, reset the fault(s). In addition the controller must be switched to OFF and back to AUTO before the system will respond to a new or continuing remote start signal.

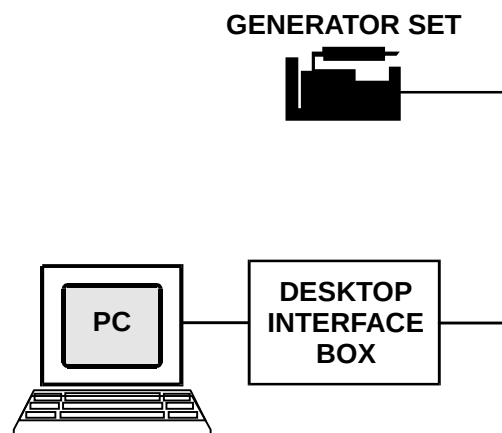
The generating set may continue to run on no load for cooling purposes before stopping automatically and returning to automatic standby.

Remote Communications

The Access 4000 system utilises an open protocol, details of the protocol can be found in the GenAccess manual. There are also 2 factory options for interfacing remotely with the Access 4000, MCM2 and MCM3.

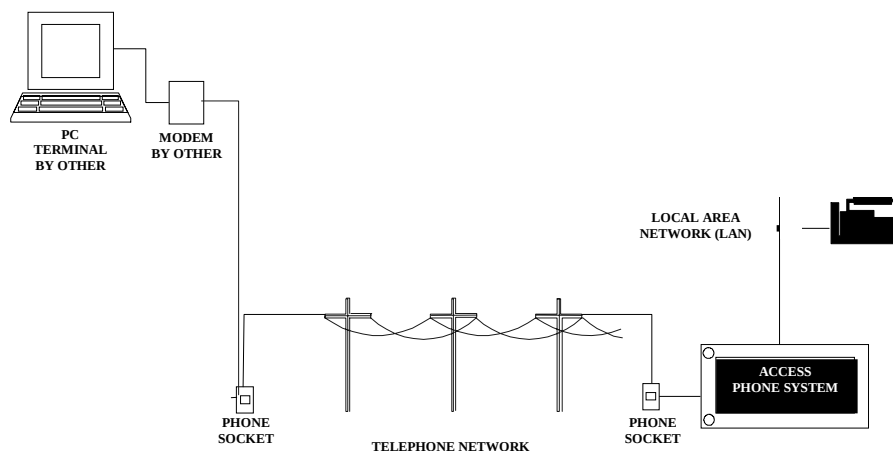
MCM2

Option MCM2 allows the Access4000 series control system to be connected to a personal computer (PC) up to 3/4 Mile away via a RS422/485 local area network (LAN). The option includes both the hardware and software required

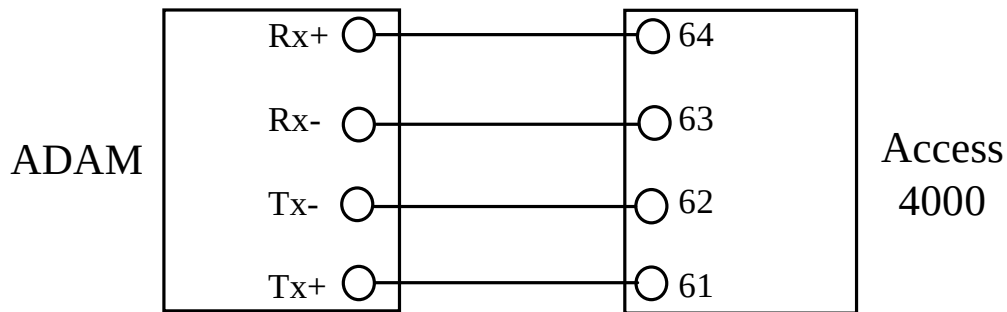


MCM3

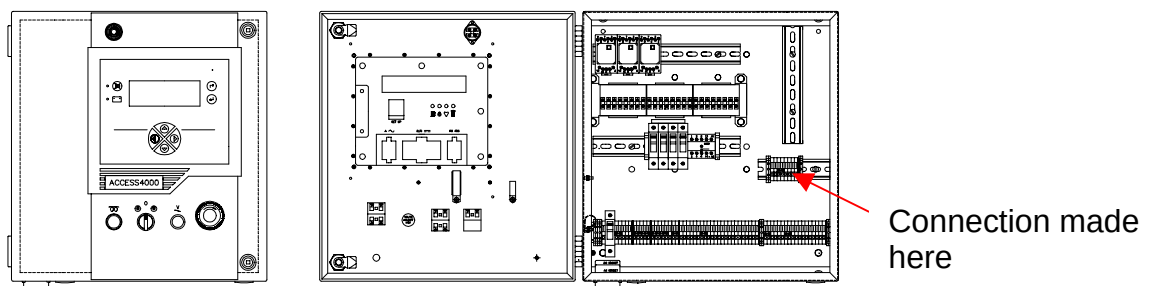
Option MCM3 enables the Access 4000 control system to be remotely connected to a personal computer (PC) via a Public Switched Telephone Network (PSTN).



The connection between the MCM2/3 panel to the Access 4000 control panel involves a simple four wire connection. The RS485/422 to RS232 converter inside the MCM2/3 panel is called an ADAM converter, it is from here that we will make the connection to the control panel.



Wires 61, 62, 63 and 64 will be terminated in the remote comms terminal block as shown. It is advisable to use screened twisted pairs to connect the control panel to the remote communications panel ensuring that the connection is only earthed at one end of the system.



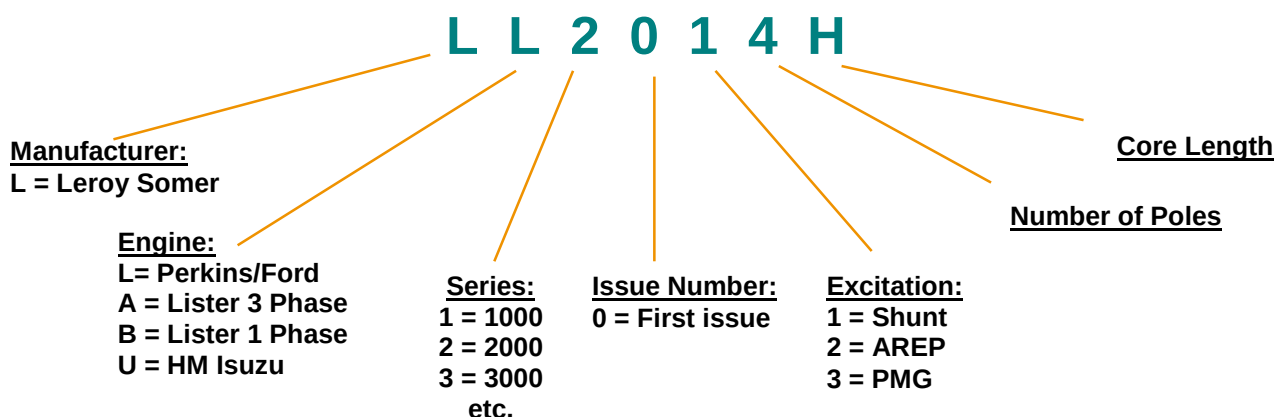
The software supplied with the factory remote communications options is called "GenAccess", this is a windows based system, further details are available in the GenAccess manual.

GEN ACCESS 1.0

Generators

The generator is the source of electrical power in a generating set, Olympian supply Leroy Somer generators with three different excitation systems; Shunt, Shunt with Permanent Magnetic Generator (PMG) and Auxiliary Winding Regulation Excitation Principle (AREP). The generators are split into different series' according to their output capacity. The range of generators currently fitted to Olympian Generating Sets is 1000, 2000, 3000 and 5000 series generators; 1000 being the smallest output capacity.

The model number of the generator supplies quite a lot of information about series, excitation system, number of poles, core length etc. A typical model number is defined below:

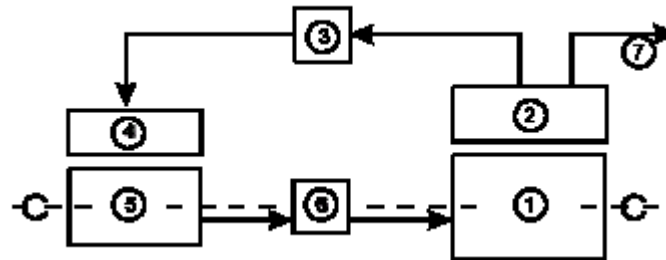


The speed that the engine drives the generator has a direct relationship to the frequency of the output voltage, the relationship between speed and frequency takes the following form:

$$\text{Frequency (Hz)} = \frac{\text{Speed (RPM)} \times \text{Number of pole pairs}}{60}$$

Shunt

The shunt system of excitation is the standard on Olympian sets, the shunt principle is often referred to the self-excited principle. The electrical power produced by the generator set is derived from a closed loop system consisting principally of the exciter rotor, the main revolving field and the automatic voltage regulator. A block diagram of the system is shown.



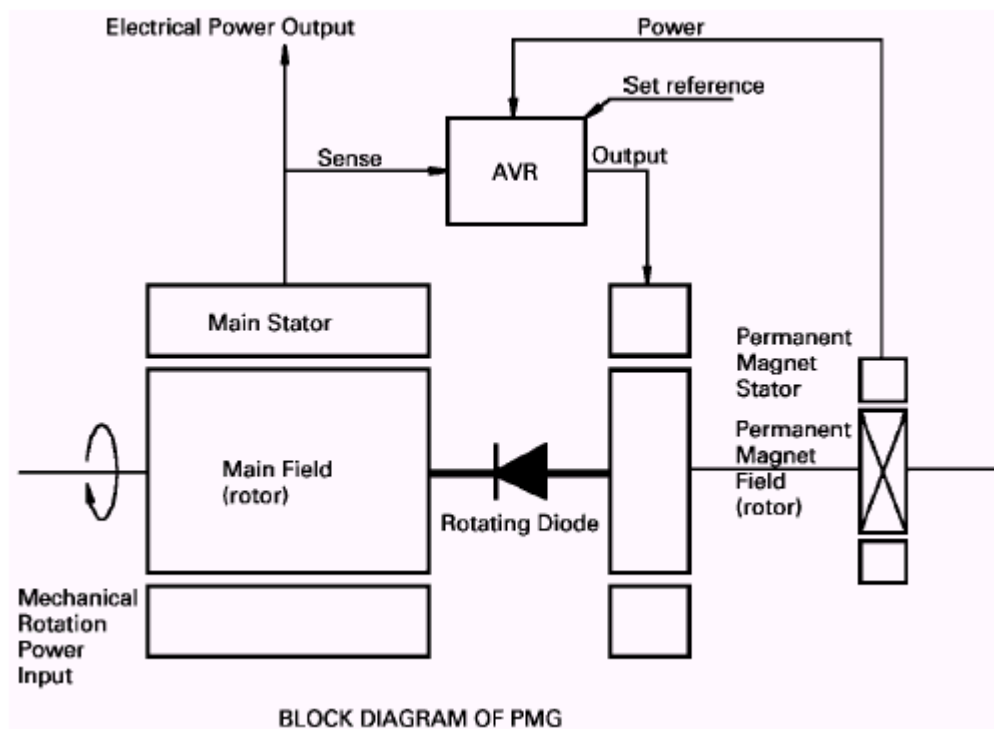
- | | |
|--------------------------------|--------------------|
| 1. Main Rotor | 5. Exciter Rotor |
| 2. Main Stator | 6. Rotating Diodes |
| 3. Automatic Voltage Regulator | 7. Power Output |
| 4. Exciter Stator | |

The process begins when the engine starts to rotate the internal components of the generator. The residual magnetism in the main rotor (item 1) produces a small alternating voltage (AC) in the main stator (item 2). The automatic voltage regulator (item 3) rectifies this voltage (converts it to DC) and applies it to the exciter stator (item 4). This DC current to the exciter stator creates a magnetic field, which in turn induces an AC voltage in the exciter rotor (item 5). This AC voltage is converted back to DC by the rotating diodes (item 6). When this DC voltage appears at the main rotor, a stronger magnetic field than the original residual field is created which induces a higher voltage in the main stator. This higher voltage circulates through the system inducing an even higher DC voltage back at the main rotor. This cycle continues to build up the voltage until it approaches the proper output level of the generator set. At this point the automatic voltage regulator begins to limit the voltage being passed to the exciter stator which, in turn, limits the overall power output (item 7) of the alternator. This build-up process takes place in less than one second.

The Automatic Voltage Regulator (AVR) maintains a no load to full load steady state voltage to tight tolerances, typically 0.5%. The AVR has a volts/hertz characteristic that proportionally reduces the regulated voltage at reduced speeds. This feature aids the engine during sudden large additions of load. The AVR both senses and takes its power supply from the output of the stator, therefore if the stator voltage collapses due to a very large load impact, the AVR cannot respond as it has no power supply. For load applications where this scenario may be encountered often it is advisable to use a separately excited generating system.

Permanent Magnetic Generator (AR12)

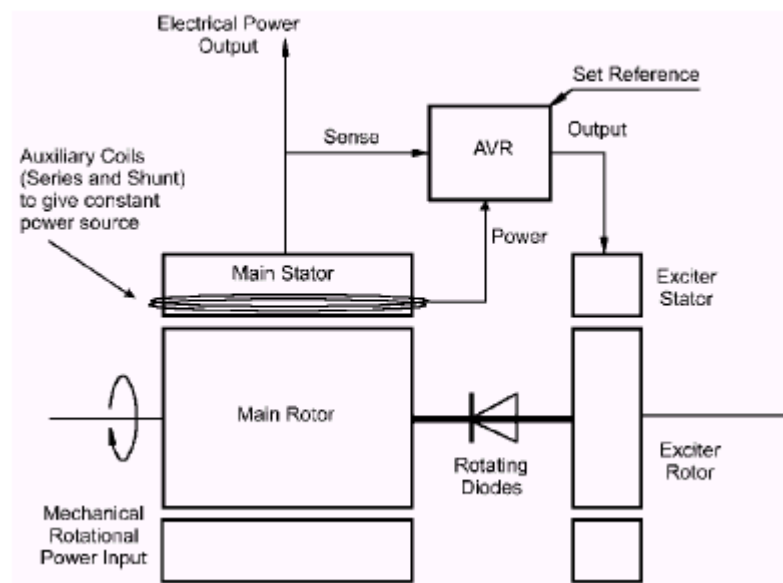
The fitting of this option converts the generator from a self exciting system (whereby the excitation power is taken from the main stator winding) to a separate excitation system whereby the Permanent Magnetic Generator is operating at the non drive end of the generator. The PMG provides an independent source of exciter power which is always available irrespective of load condition. The PMG exciter gives better motor starting capability, improved regulation and the ability to sustain a short circuit to allow protective devices to operate. The isolation of the excitation power source also improves the ability of the generator to handle non linear loads.



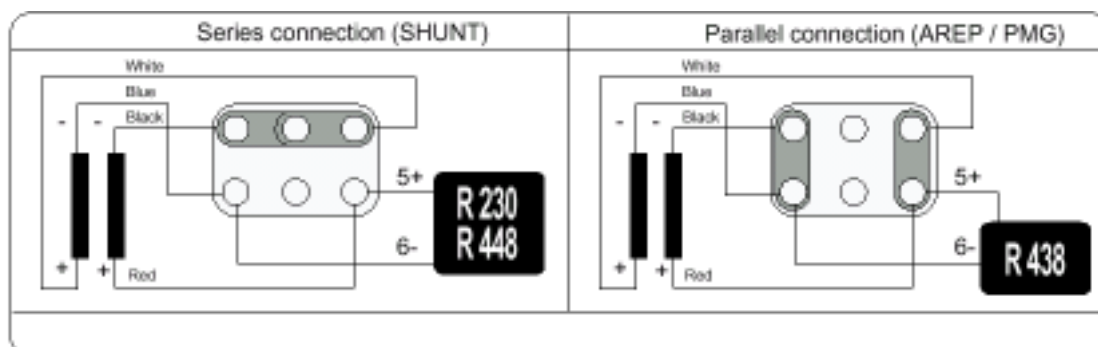
AREP Excitation System (AR14)

Selection of this option replaces the standard self-excited generator with an AREP (Auxiliary windings, Regulator, Excitation Principle) generator. With AREP excitation the electronic AVR is powered by two auxiliary windings which are independent of the voltage sensing circuit. This ensures that regulation is not affected by distortions generated by the load.

The AREP excitation system's two auxiliary windings, give a voltage in proportion to the generator's output voltage (shunt characteristic) this winding is called H1. The other winding in proportion to the stator current (compound or booster characteristic) called H3. This ensures good motor starting capability and a sustained short circuit current of 3 x FLC at 50 and 60 Hz.



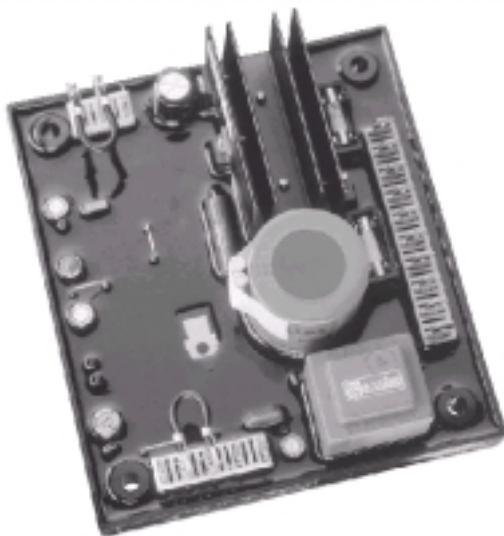
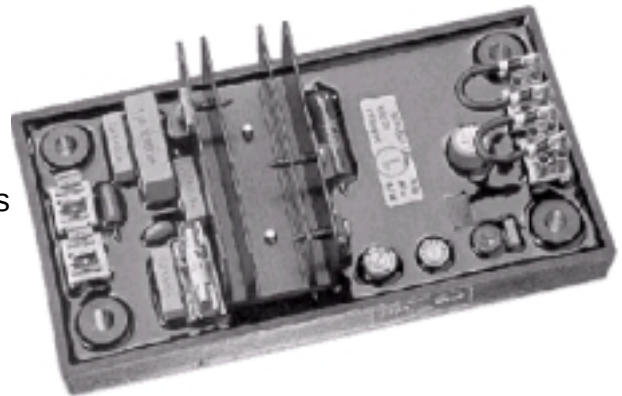
When either of the separate excitation systems are selected the AVR must be upgraded from the standard R230 to an R438 or R448 dependant on series of generator, this is to facilitate the extra sensing and power supply rails that are not available with the R230. Also on the 2000 and 3000 series of generators the exciter connection must be changed series to parallel. The connection block shown is found inside the generator terminal box.



Automatic Voltage Regulators

The R230A Automatic Voltage Regulator (AVR) is an advanced electronic component that controls the generator output voltage by monitoring the exciter excitation current as a function of the output voltage. Used when the generator is configured in the standard "Shunt" excitation, the R230A AVR is fitted on the following generators:

- 1000 Series Generators
- 2000 Series Generators
- 3000 Series Generators



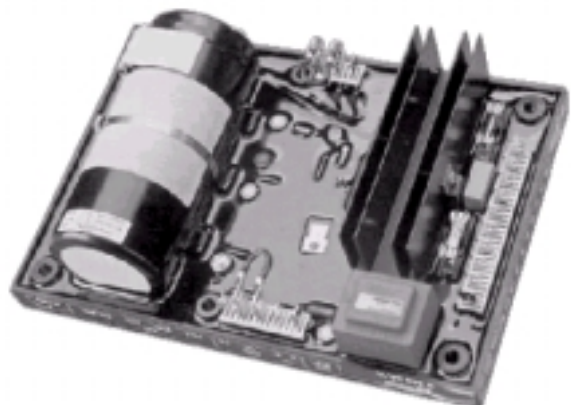
The R438A Automatic Voltage Regulator (AVR) is used when the generator is configured with the AREP excitation system (Option **AR14**) or the Permanent Magnet Generator (PMG) system (Option **AR12**) on the following generators:

- 1000 Series Generators
- 2000 Series Generators
- 3000 Series Generators

With the AREP excitation system the R438 AVR is powered by two auxiliary windings which are independent of the voltage detection circuit. With the PMG option the R438 AVR is powered by the PMG which is fitted at the rear end of the generator.

The R448A Automatic Voltage Regulator (AVR) is used when the generator is configured in the standard "Shunt" excitation or with the AREP excitation system (Option **AR14**) or the Permanent Magnet Generator (PMG) system (Option **AR12**), the R448 AVR is fitted on the following generators:

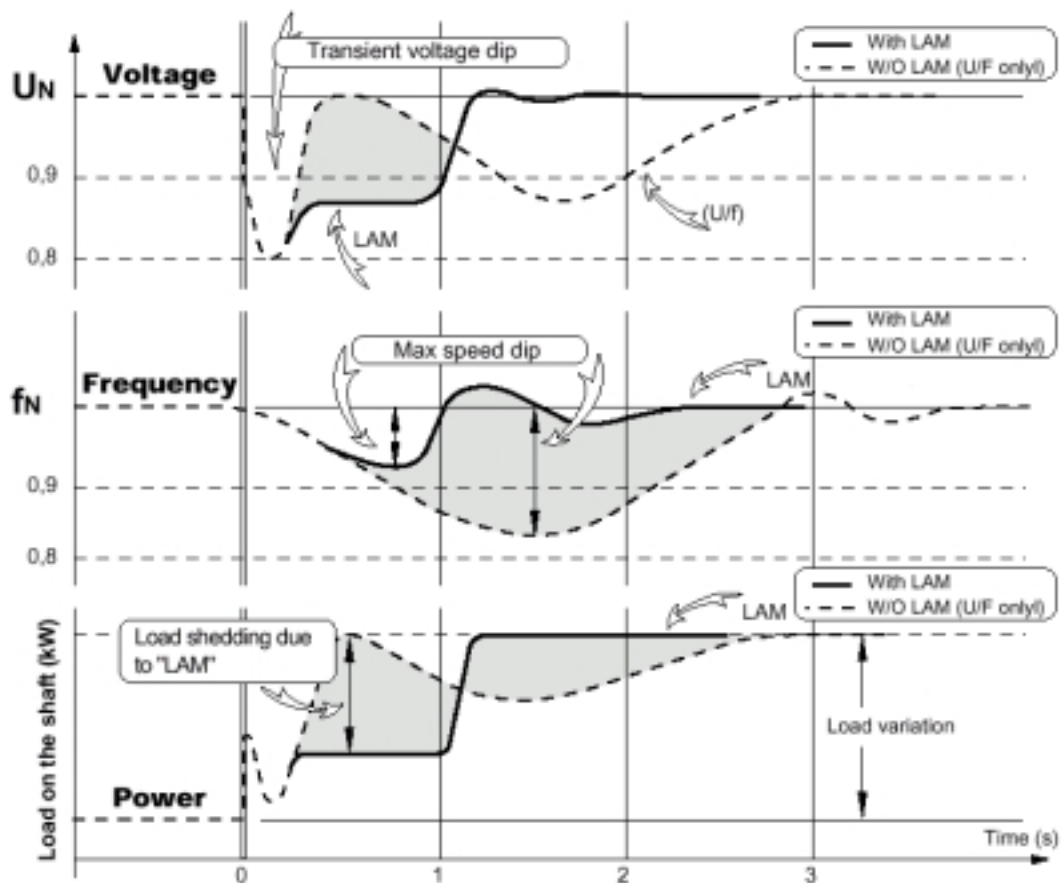
- 5000 Series Generators



Load Adjustment Module (LAM)

LAM is an integrated feature of both the R438 and R448 AVR's, it is enabled when the generating set leaves the factory but may be disabled by the customer by cutting link ST5 on the AVR.

On load impact, the rotation speed of the generator set decreases. When it passes below the pre-set frequency threshold, the LAM causes the voltage to drop by approximately 15% and consequently the amount of active load applied is reduced by approximately 25% until the speed reaches its rated value again. Hence the "LAM" can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine). To avoid voltage oscillations, the trip threshold is set approximately 2 Hz below the lowest frequency in steady state.



Gas Trains

The gas system for the generator set must be capable of delivering a clean and continuous supply of gas to the engine that will ensure instant availability of fuel to facilitate starting and keep the engine operating. In some cases gaseous fueled generators can be fueled either with natural gas or liquefied propane gas (LP). Local gas codes regulating the installation of such gas supply systems vary widely, and therefore, local gas distributors or installers must be consulted when installing such systems. It is the responsibility of the installer to ensure that all applicable regulations and codes are complied with when installing a gas supply system for use by a generator.

Gaseous fuel systems must be in compliance with all relevant codes, standards and other requirements concerned with the storage, piping, handling, installation and use of these hazardous fuels. It is also important that the generator set room is properly ventilated according to gas regulations. Use of a suitable leak detection system is also recommended.

In most cases gas generating sets will be supplied with a factory fitted fuel system. This will comprise of components that will enable operation on one gaseous fuel type, such as natural gas, LP vapor or LP liquid. Some gas generators are also available with dual fuel systems that will allow operation on either natural gas and LP vapor or natural gas and LP liquid. These factory fitted fuel system components must be considered as only part of an overall gas supply system. The installer is again responsible for ensuring that the complete fuel supply system is compliant with all applicable regulations and codes.

The Olympian range of gas powered generating sets have options for various gas trains to operate with varying types of fuels dependant on customer needs. There are currently 5 gas train options available to operate with:-

Natural Gas

Liquid LPG

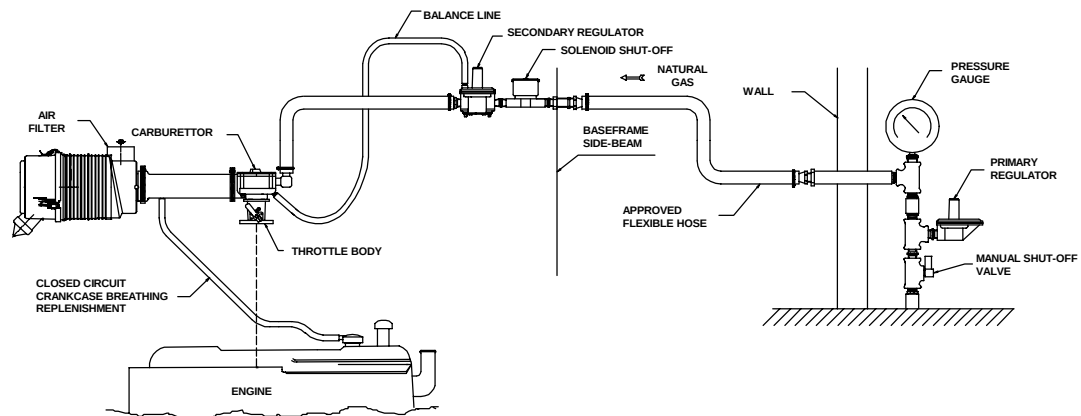
Vapour LPG

Dual Fuel – Natural/Liquid LPG

Dual Fuel – Natural/Vapour LPG

Natural Gas Fuel System

The illustration below shows a typical natural gas fuel supply system (please note that other components or system layouts may be required for compliance with local gas codes and regulations). Natural gas is usually piped from the main distribution system to the generator site by the local distribution company. The gas supply pressure in this piped supply will vary from area to area and from distribution system to distribution system and may be legislated by local gas codes. A primary regulator is typically required to reduce this piped gas supply pressure to a safe working level before it enters the generator site. This primary regulator can usually be obtained from the local gas distribution company.



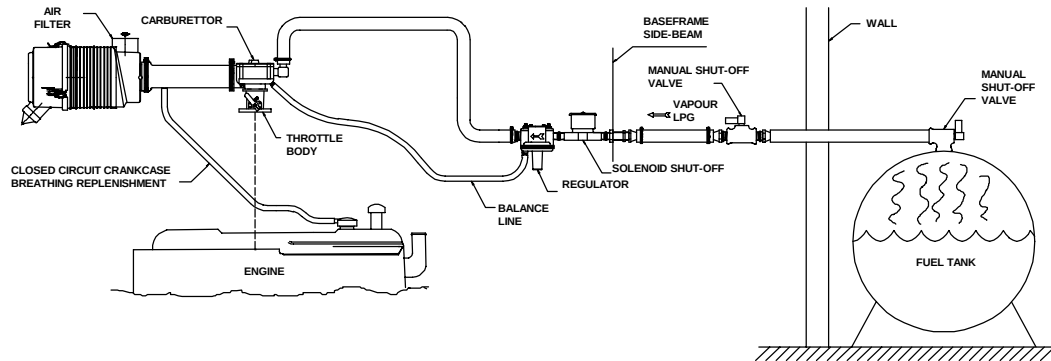
The primary regulator should be sized correctly to give a maximum outlet pressure of 20" water column and be of sufficient size to flow the specified maximum gas volume required by a particular gas generator at the required minimum dynamic pressure (typically 7" water column). The optimum natural gas supply pressure at the generator gas connection point (at the edge of the baseframe) is 11" water column. An approved flexible gas fuel line should be used for taking the gas supply to the generator's gas connection point. Manual shut-off valves should be fitted at appropriate points in the system and as specified by local gas codes and regulations.

A solenoid shut-off valve controls flow of gas supplied to the generator gas connection point. On generator operation, this allows gas to flow through the generator mounted secondary regulator to the generator carburetor. The solenoid shut-off valve automatically cuts-off gas flow during generator shut-down. The fuel supply is also sealed off within the carburetor when the generator is stopped.

If the B.T.U. content of the natural gas supply is low, an increase in the minimum gas inlet pressure to 15" water will typically compensate for fuel down to 900 - 950 BTU heating value. Natural gas with even less heating value, e.g. in the 800 BTU range, requires a special gas carburetor. The natural gas train consists of an electrical solenoid to isolate the supply from the engine when not required, a regulator to regulate the flow of gas to the engine and a carburetor to mix the gas and air supplies before entering the engine.

LP Vapor Fuel System

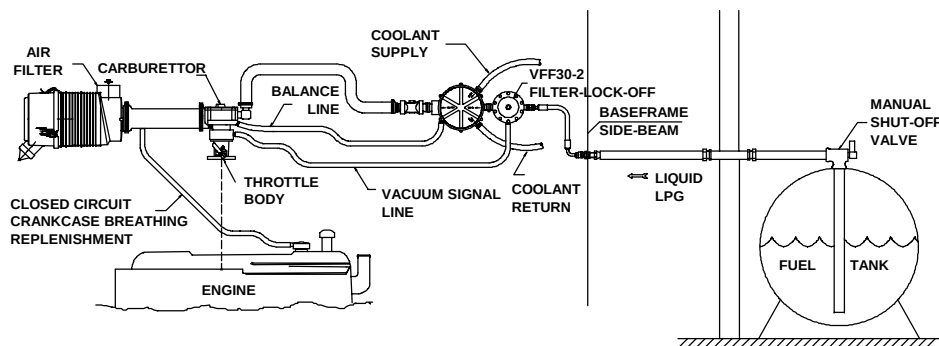
A schematic indicating the typical main components of this type of fuel system is shown below. An expansion section of the LP storage tank allows the LP fuel to expand from the liquid to the vapor state. The expansion section of the tank typically represents 10-20% of the total storage tank volume. Expanded LP vapors are then withdrawn from this section of the storage tank and are supplied to the gas generator.



Ambient temperatures must be high enough to provide adequate vaporization to sustain the draw-off rate. If the draw-off rate is high and ambient temperatures are low, the vaporization rate may not be sufficient to sustain the gas flow required. LP Vapor withdrawal systems are therefore typically suited for use with smaller engines. As a result care should be taken in matching LP storage tank size for vapor withdrawal systems and generator size. As with the natural gas system, a solenoid shut-off valve controls the flow of LP vapor supplied to the generating set. On generator operation, this allows gas to flow through the generator mounted secondary regulator to the generator carburetor. The solenoid shut-off valve automatically cuts-off gas flow during generator shutdown. The fuel supply is also sealed off within the carburetor when the generator is stopped.

LP Liquid Fuel System

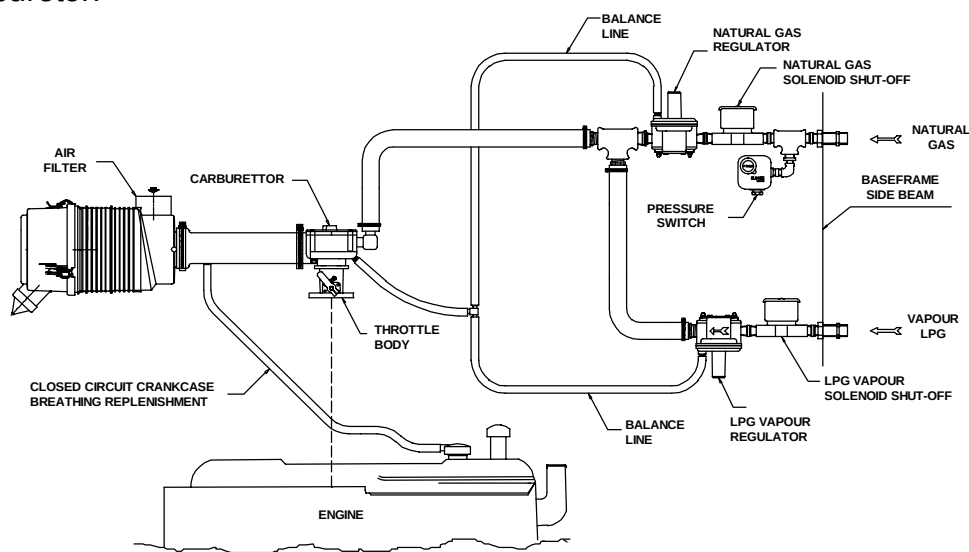
This type of system again utilizes LP fuel but with liquid withdrawal instead of vapor withdrawal as previously discussed. Liquid LP is delivered directly to



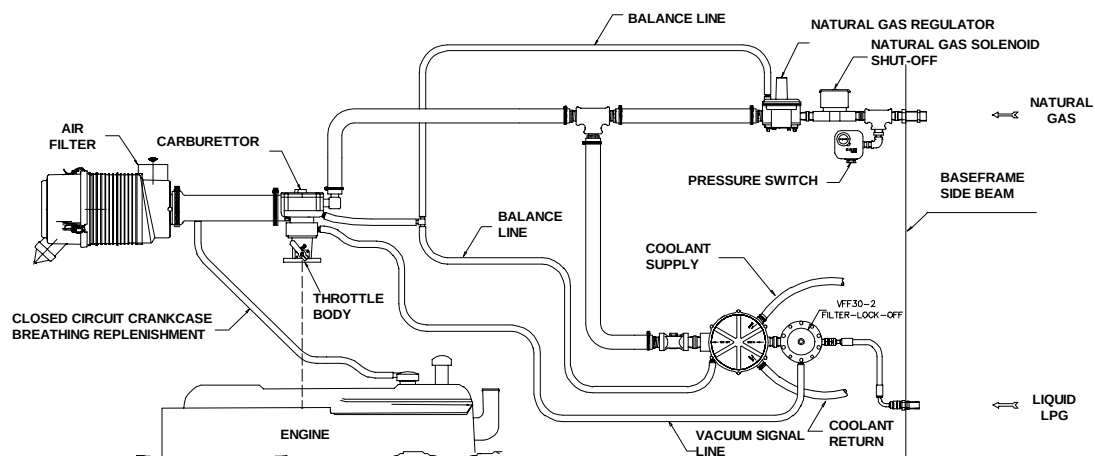
the generator where it passes through a fuel shut-off valve (typically operated via the engine manifold vacuum) to a 'vaporizer-regulator'. The vaporizer-regulator vaporizes the LP liquid fuel (using engine coolant as the heat source) and provides a regulated LP vapor supply to the generator carburetor. A typical system is illustrated above

Dual Fuel Systems

These systems allow operation on either natural gas and LP vapor or natural gas and LP liquid. Such systems are useful where there is a possibility of failure of the piped natural gas supply or where focused gas tariffs make generator operation on natural gas excessively costly during peak tariff periods. These dual fuel systems are factory fitted and provide for automatic changeover from natural gas operation to LP vapor or LP liquid operation. The figure below shows a typical natural gas / LP vapor dual fuel system. The natural gas supply pressure is monitored by a low pressure switch. When this supply pressure drops below an adjustable threshold level the LP vapor solenoid shut-off valve is opened and the natural gas solenoid shut-off is closed. The LP vapor then flows through a dedicated regulator to the engine carburetor.



The schematic below shows a typical natural gas / LP liquid dual fuel system. Its operation is similar to the dual fuel system already discussed. The natural gas supply pressure is monitored by a low pressure switch. When this supply pressure drops below an adjustable threshold level the natural gas solenoid shut-off is closed. The loss in pressure in the natural gas line causes the vaporizer-regulator to open, permitting regulated LP vapor to flow to the engine carburetor. LP liquid flow to the vaporizer-regulator is controlled by a vacuum operated shut-off valve.



Governing

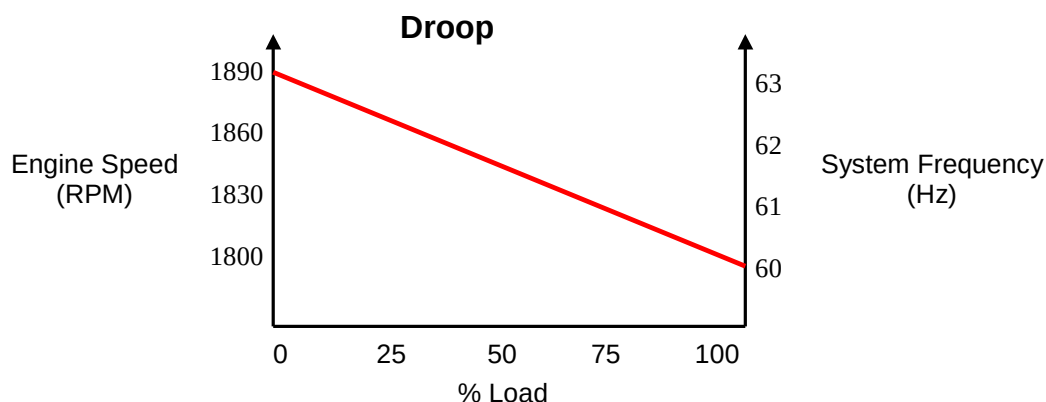
Normally Olympian Generating sets operate with a mechanical governing system conforming to Class A1 governing standards. A1 states that the following:

Maximum permitted permanent speed change from No Load to Full Load is 5% of the normal operating speed, this is referred to as *Droop*.

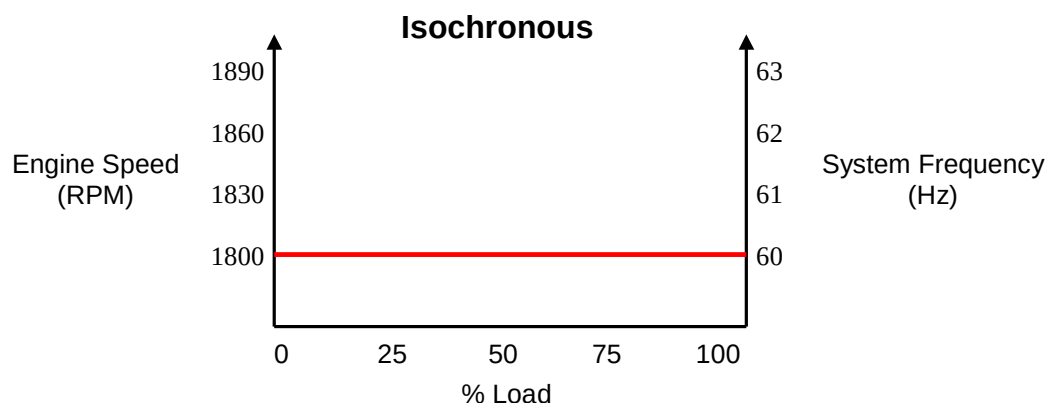
When Load is removed the maximum temporary speed change must be no more than 10% for 8 seconds and then the steady state speed must remain within a speed band of 1%.

When Load is applied the maximum temporary speed change must be no more than 10% for 8 seconds and then the steady state speed must remain within a speed band of 0.8%. This 0.8% steady speed band applies to all load conditions above 25%.

Mechanical governors usually have a percentage droop associated with them. Droop is the rate of change of engine speed with respect to load. All Olympian Generating Sets have maximum of 5% droop from no load to full load to conform to Class A1.



The addition of an electronic governor to a generating set will enable the output frequency of the voltage to remain constant, irrespective of percentage load. The generating set is then said to be operating in the Isochronous mode. Isochronous is derived from the Greek terms Iso and Chronous meaning "Same" and "Time". Isochronous machines usually operate within a tighter steady state speed band, typical $\pm 0.25\%$



The type of electronic governor fitted to a generating set depends on the engine used to power that specific set. Olympian currently fit four different types of electronic governors, namely TQ125 (to be replaced with LC50 from April 2001), ST125, 512 and 524. The 512 and 524 belong to the same family of governors called EPG Governors.

TQ125



The TQ125 Electronic Governor is currently fitted to all HM Isuzu and Ford gas engine based generating sets. The governor is a single unit that incorporates both the controller and actuator, the actuator has an operating output of 0.25ft/lbs. The TQ125 operates by sensing either a magnetic pickup (MPU) input or ignition sensing and then adjusting the actuator position to maintain the desired engine speed. The controller has 3 potentiometers that allow adjustment of the Speed, Gain and Stability as well as a set of 4 dip switches allowing the governor to operate over a wide range of frequency inputs from the MPU.



The correct dip switch settings are shown in the table.

<u>Engine</u>	<u>Switch Settings</u>		
HM Isuzu 1.8L (1800 RPM)	4 - CLOSED		•
	3 - OPEN	•	
	2 - OPEN	•	
	1 - CLOSED		•
HM Isuzu 1.8L (3600 RPM)	4 - OPEN	•	
	3 - CLOSED		•
	2 - CLOSED		•
	1 - OPEN	•	
Ford 2.5L	4 - OPEN	•	
	3 - OPEN	•	
	2 - OPEN	•	
	1 - CLOSED		•
Ford 4.9L	4 - OPEN	•	
	3 - OPEN	•	
	2 - CLOSED		•
	1 - OPEN	•	
Ford 7.5L	4 - CLOSED		•
	3 - CLOSED		•
	2 - OPEN	•	
	1 - OPEN	•	
Ford 7.5TL	4 - CLOSED		•
	3 - CLOSED		•
	2 - OPEN	•	
	1 - OPEN	•	

WARNING ! The engine must always be shut down during speed switch adjustments to prevent the possibility of engine overspeed during this process.

Speed Adjustment:

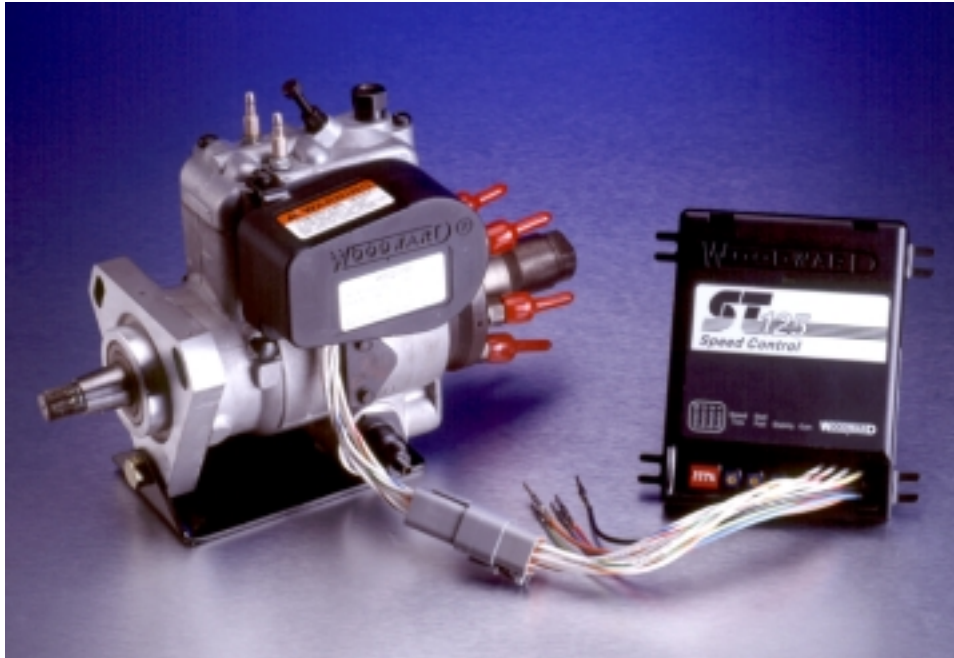
After the engine is stable, adjust the Speed Trim clockwise until the correct rated engine speed is obtained. If the rated engine speed cannot be obtained or if the engine speed is already above rated speed, the four-position DIP switch is not set correctly. If it is necessary to readjust the speed setting switch, the engine must be shut down during this procedure.

Stability and Gain Adjustments:

When either the Gain or Stability is increased, the other adjustment will have to be decreased to maintain a stable engine. It is desirable to have as high a Gain setting as possible at the selected Stability setting in order to reduce the amount of engine speed variations. Check the response of the engine after each adjustment by load stepping the engine. If it is not possible to load step the engine, bumping the actuator linkage to increase/decrease fuel rack position can check the engine stability. Repeat the following tuning procedure until the engine responds as desired. NOTE: Too high a gain setting may result in stable operation at normal temperatures but could cause oscillation

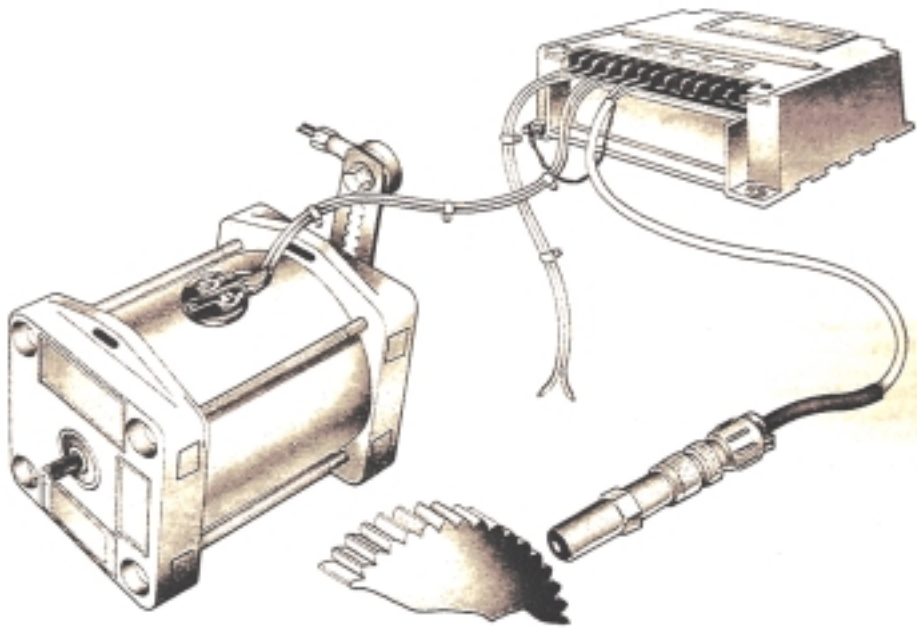
when the engine is cold. Readjustment may be required for satisfactory cold-start operation.

ST125



The ST125 Electronic Governor (option code GE4) is currently fitted to models D125P1, D125P2 and D150P1 as standard. The governor consists of two parts, the actuator which fits directly into the Stanadyne D series fuel pump and the controller. The actuator is bi-directional and has an operating output of 0.25ft/lbs. The ST125 operates by a frequency input from the MPU and then processes this signal to a bias signal to the actuator until the desired engine speed is reached and maintained. The controller is similar to that of the TQ125 with the addition of a fourth potentiometer for Start Fuel Limiting. The Start Fuel Limiting will enable the fuel pump to deliver just enough fuel for the engine to be able to start but not so much as to cause black smoke.

EPG Governors



The EPG series of governors consists of two models that are found on Olympian sets. The two models are the 512 and 1724, the last two digits of the model designation is the DC voltage rating and the 5 or 17 indicates the output of the actuator in ft/lbs, either 0.5 or 1.7.

The EPG system consists of a controller, MPU and actuator, the actuator links directly to the throttle lever of the fuel injection pump to increase/decrease fuel to keep the speed of the engine at the desired speed. The EPG governor systems can be specified by the customer to operate as either Isochronous or with droop. There is also an optional auxiliary input on the controller that may be used as for an external speed adjustment or for biasing the speed by an additional piece of equipment for synchronising or paralleling applications.

The controller has three adjustment potentiometers on the standard model; speed reference, gain and stability. The gain and stability adjustments ensure that the governing dynamics can be tailored for any engine.

