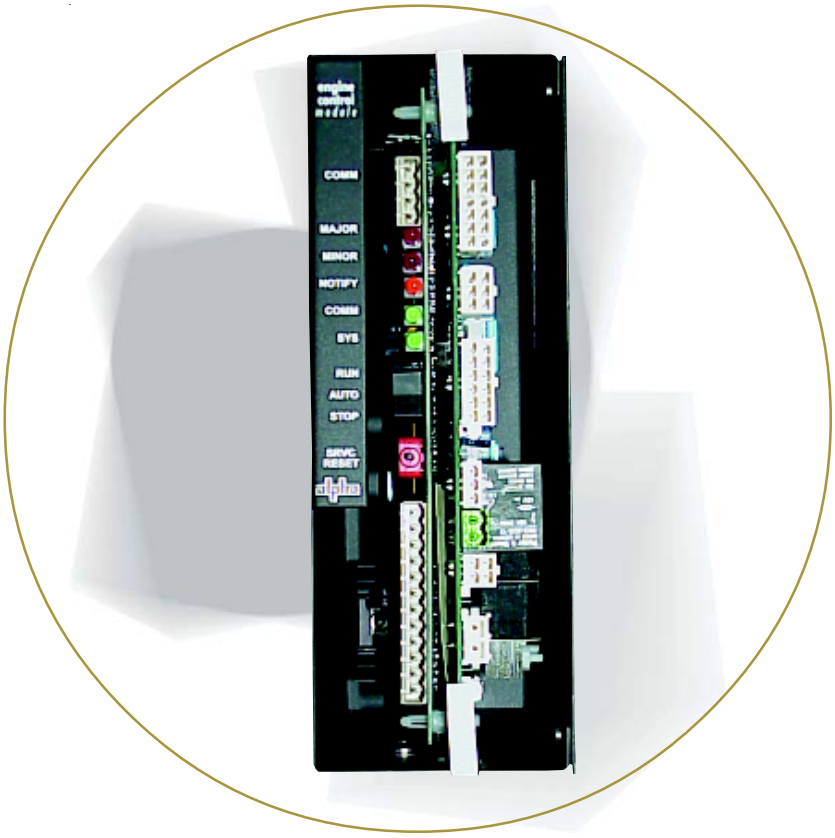
ALPHAGEN™ Cable Series



Engine Control Module (ECM)
Operation and Maintenance Manual

Effective: October, 2003

ALPHAGEN™

Overview: The purpose of the AlphaGen ENGINE CONTROL MODULE(ECM) Operation and Maintenance Manual is to provide a high-level overview of the system and to detail the operation and maintenance of the module.

Audience: This manual intended for the operator of the system.

This Operation and Maintenance Manual is comprised of five sections:

Section 1. System Overview. This section describes the theory of operation of the ECM.

Section 2. ECM Indicators and Controls. Describes the various module controls.

Section 3. ECM Alarms and Notifications. Describes the functions monitored and reported by the ECM.

Section 4. ECM Configuration and system interface. Describes the setup and connection of the module.

Section 5. System self-test and maintenance. Describes testing of the engine generator and module.

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IMPORTANT SAFETY INSTRUCTIONS CONTAINED IN THIS MANUAL

CAUTION

HAZARDOUS CONDITION

To reduce the risk of electrical shock, injury or death caused by explosion of fuel or moving parts, and to ensure the safe operation of this unit, the following symbols have been placed throughout the manual. Where these symbols appear, servicing must be performed only by qualified personnel.

DANGEROUS VOLTAGE
This symbol indicates a “dangerous voltage” exists in this area of the product. Use caution whenever working in the area to prevent electrical shock.

ATTENTION
This symbol indicates important installation, operation or maintenance instructions. Always follow these instructions closely.

ELECTROSTATIC DISCHARGE SENSITIVITY
This symbol indicates the need for following approved procedures for handling electrostatic-sensitive components.

INHALATION HAZARD
This symbol indicates an “inhalation hazard” exists in this area of the product. Use caution whenever working in the area to prevent possible inhalation of harmful (fuel or exhaust) vapors.

NO MATCHES OR OPEN FLAMES
This symbol indicate a fire or explosive hazard exists in this area of the product. Use caution whenever working in the area to prevent the possible combustion of fuel or vapors.

MECHANICAL OR MOVING PARTS HAZARD
These symbols indicate the presence of a “mechanical or moving parts hazard” in this area of the product. Use caution whenever working in the area to prevent possible injury to the operator or service personnel.

LEAK HAZARD
This symbol indicates a “leak hazard” exists in this area of the product. Use caution whenever working in the area to prevent and correct any leaks detected.

HOT SURFACES
This symbol indicates the presence of high temperatures which result from the operation of the system. To prevent burns, do not touch these areas while the system is in operation or immediately after it has been turned off.

SAFETY PRECAUTIONS

NOTE: Failure to follow these precautions could result in injury or death caused by the explosion of fuel, moving parts hazards or electrocution.

CAUTION: This set of procedures will require the operation of the generator and should only be performed by qualified, experienced personnel in a well-ventilated area.

- Technicians must have easy access to a fire extinguisher at all times.
- Propane/Natural Gases are highly explosive. Use extreme caution while handling and operating the Generator gas package and equipment. Keep flame or spark away from Propane bottles. Do not smoke during assembly of gas package.
- Any test equipment used in the testing of the CE Series system must have isolated inputs to prevent shock hazards and short circuits with the enclosure or other grounded objects.
- Run Generator only in properly ventilated areas. Exhaust gasses can be lethal. Prolonged exposure can cause nausea, headaches, dizziness, or Carbon Monoxide poisoning.
- All pipe connections must be leak tested immediately.
- Output of upper air dam must be unobstructed.
- "Test" Propane bottles **MUST** not come into contact with the cabinet(s). Use a Digital Voltmeter (DVM) to ensure proper cabinet grounding.
- "Test" Propane bottles must remain upright at all times.
- All generator grid screens, covers, and access panels on the generator must be closed before operation. Moving parts are a hazard.
- Both generator compartment fans must be operational any time gas pressure is applied.

SAFETY PRECAUTIONS

- The Engine Control Module (ECM) must be serviced only by qualified personnel.
- Remove all rings, watches and other jewelry before servicing batteries or installing the ECM.
- Verify the voltage requirements of the equipment to be protected (load), the AC input voltage to the power supply (line), and the output voltage of the system prior to installation.
- The utility service panel must be equipped with a properly rated circuit breaker for use with this power supply.
- When connecting the load, DO NOT exceed the output rating of the system.
- Always use proper lifting techniques whenever handling units, modules or batteries.
- If batteries are being stored prior to installation, they should be charged at least once every three months to ensure optimum performance and maximum battery service life.
- The battery pack, used to provide backup power, contains dangerous voltages. Battery inspection and replacement must be performed by qualified personnel.
- Always wear protective clothing, insulated gloves and eye protection (i.e. safety glasses or a face shield) whenever working with batteries.
- Always carry a supply of water, such as a water jug, to wash the eyes or skin in the event of exposure to battery electrolyte.
- Do not allow live battery wires to contact the enclosure chassis. Shorting battery wires can result in a fire or possible explosion.
- Batteries must be inspected every three to six months for signs of cracking, leaking or swelling.
- Always replace batteries with those of an identical type and rating. Never install old or untested batteries.
- Avoid using uninsulated tools or other conductive materials when handling batteries or working inside the enclosure.
- Spent or damaged batteries are considered environmentally unsafe. Always recycle used batteries or dispose of in accordance with all Federal, State, and local regulations.

IMPORTANT INSTALLATION NOTES

- The system must be installed ONLY by qualified service personnel.
- Consult local utility codes for additional cabinet grounding and utility requirements.
- ALPHA TECHNOLOGIES is not responsible for broken welds or other damage to the cabinet caused by improper installation.
- All dimensions are given in inches.
- For further information regarding this installation, contact ALPHA TECHNOLOGIES or your nearest ALPHA representative.

For general product information and Customer Service
7:00AM to 5:00PM Pacific Time
1-800-863-3930

To obtain complete Technical Support,
7:00AM to 5:00PM Pacific Time
or
For after-hours Emergency support
7 days per week, 24 hours a day
1-800-863-3364

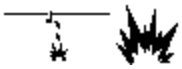
NOTE: Alpha Technologies' products are subject to change through continual improvement processes. Therefore, specifications and/or design layouts may vary slightly from descriptions included in this manual. Updates to the manual will be issued when changes affect form, fit or function.

Retain these instructions for future reference

Auxiliary Power Unit (APU) Notes

NOTE: When the engine is stopping, a small amount of unburned fuel may be detected by the odor of gas fumes. Fans are used to expel these fumes from the enclosure and may be detected outside the enclosure for a short period of time after engine shutdown. This is a normal condition and does not present a hazard.

NOTE: Most utilities add a chemical agent to the gas which produces a strong odor so leaks can be detected before they reach a dangerous or explosive level. It may be possible to detect this gas additive odor even though the gas hazard sensor does not issue an alarm. The gas sensor will issue an alarm when the detected levels of gas reaches 10% - 20% of the Lower Explosive Limit (LEL). The gas hazard sensor has a 10 minute delay for periods of purging and power up. During the purge phase, the Green alarm light will flash. When the purge phase is completed, the light will glow steadily. In the event the detector has been disconnected from power for more than 24 hours, it may require a period of more than 10 minutes to complete its purge phase. In that event, push the reset button to disable the alarm for repeated purge cycles. Also, the reset button may be used to disable the alarm for 10 minutes at any time.



NOTE: If gas fumes are detected before the engine is run, or in excess of approximately 10 minutes after running the engine, you must check the system for leaks as described in the INSTALLATION manual and correct as necessary.

Battery Safety Notes

Chemical Hazards

Any gelled or liquid emissions from a Valve-Regulated Lead-Acid (VRLA) battery is electrolyte which contains dilute sulfuric acid which is harmful to the skin and eyes; is electrically conductive; and is corrosive.

If electrolyte contacts the skin, wash immediately and thoroughly with water. If electrolyte enters the eyes, wash thoroughly for 10 minutes with clean water or a special neutralizing eye wash solution and seek immediate medical attention.

Neutralize any spilled electrolyte with the special solutions contained in a “spill kit” or with a solution of 1 lb. Bicarbonate of soda to 1 gal. of water.

Fire, Explosion, and Heat Hazards

Lead acid batteries can contain an explosive mixture of hydrogen gas which can vent under overcharging conditions.

Do not smoke or introduce sparks in the vicinity of the battery.

Prior to handling the batteries, touch a grounded metal object, such as the rack, to dissipate any static charge that may have developed in your body.

Do not charge batteries in a sealed container. The individual batteries should have 0.5 inches of space between them to allow for convection cooling. If contained, assure the container or cabinet and room have adequate ventilation to prevent an accumulation of potentially dangerous gas.

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Section 1, System Overview

1.1 Introduction

The primary purpose of Alpha's Engine Control Module (ECM) is to control and monitor an AlphaGen Auxiliary Power Unit (APU) set, such as the CE-3X2 3.0kW and 5.0kW Series Engine-Generators. The ECM is used in conjunction with a Generator Remote Interface (GRI) PCBA, often referred to as the Power Board. The ECM/Power Board Assembly is mounted to the top of the Engine-Generator housing, to the left of the ignition battery. The Power Board is attached to the ECM via three ribbon cables.

The GRI provides power to the ECM, steps down high voltages for the ECM, and provides interface connectors for the enclosure sensors, engine controller, battery sense, line sense, and other equipment. Depending upon the standby powering configuration, the ECM and generator combination are installed remotely, or co-located, with other Alpha equipment such as power supplies and batteries.

The Engine Control Module monitors AC line and DC bus status to determine when to start and stop the APU. In the event of an extended power outage or low battery bus voltage, the ECM will start the APU to prevent the backup batteries from discharging to a reduced voltage level which would compromise the ability of the system to provide a continuous, reliable source of power.

In addition to starting the APU, the ECM monitors the entire system for abnormal operating conditions such as low engine oil pressure, engine over-temperature, gas leak, enclosure pad shear, etc. If certain abnormal conditions or alarms are present, the ECM will either prevent the generator from starting or shut it down immediately. This provides for public safety, while preventing any serious damage to the APU. The system operator also has the ability to override the ECM and control the APU manually or remotely.

Finally, the ECM provides the interface between the APU and Alpha Technologies' communication devices. The ECM is designed to control and monitor the APU while responding to commands and queries from a system controller via an isolated RS-485 data bus. Status information and alarms can be read from the ECM remotely via the data bus, locally from the Light Emitting Diodes (LEDs) on the unit's front panel, or by an optically isolated transponder interface. The ECM is capable of reporting 9 major alarms, 8 minor alarms, and 2 notifications.

1.1 Introduction, *continued*

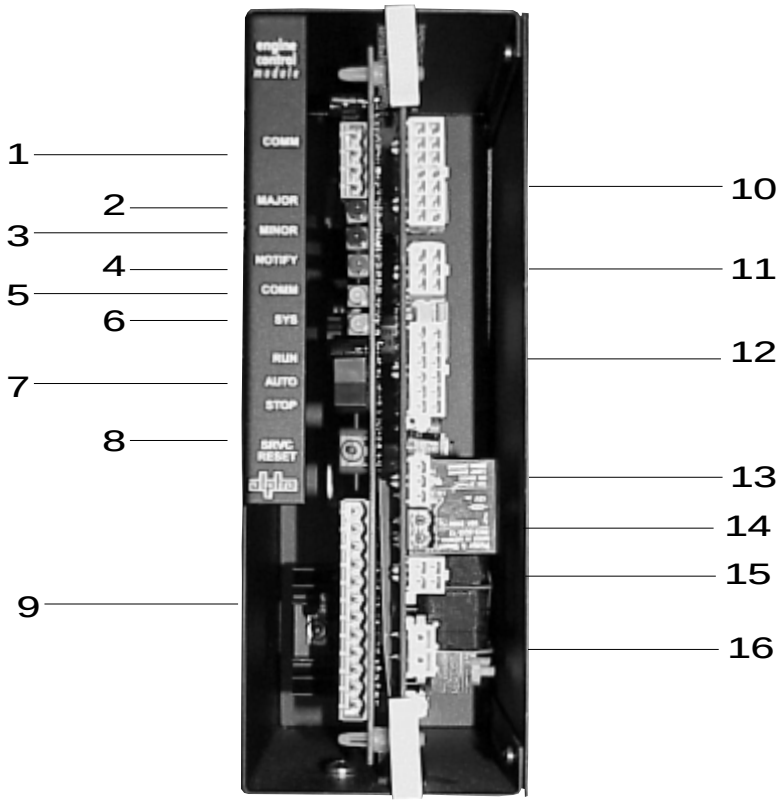

Fig. 1-1, Front view, Engine Control Module (ECM)

Engine Control Module LED Indicators and switches:

1. Communications Input (J4) *Note: Pin #1 at bottom of connector.*
2. "Major" Alarm Indicator (Red LED)
3. "Minor" Alarm Indicator (Red LED)
4. "Notify" Indicator (Amber LED)
5. "Comm" Indicator (Green LED)
6. "System" Indicator (Green LED)
7. "Run-Auto-Stop" (RAS) switch
8. "Service/Reset" Push button switch (SW3)
9. Transponder Interface (J6) *Note: Pin #1 at bottom of connector.*

GRI Power Board Connectors:

10. Enclosure Alarm Input connector (J10)
11. Fuel Enclosure Alarm connector (J5)
12. Interface Input connector from APU (J4)
13. Inverter battery string connector (J8)
14. Battery Charger Control Interface (J9) - *(5.0kW APU only)*
15. AC generator Voltage, Current connector (J7)
16. AC Line Input connector (J6) - Connected at all times

1.1 Introduction, *continued*

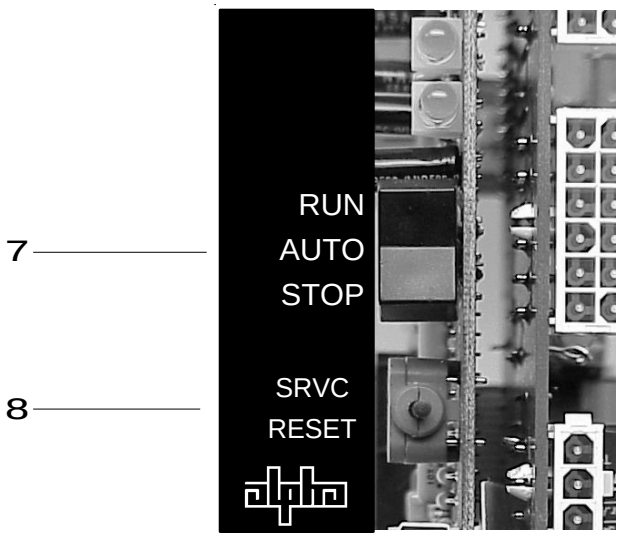

Fig. 1-2, Run/Auto/Stop and Service/Reset switches

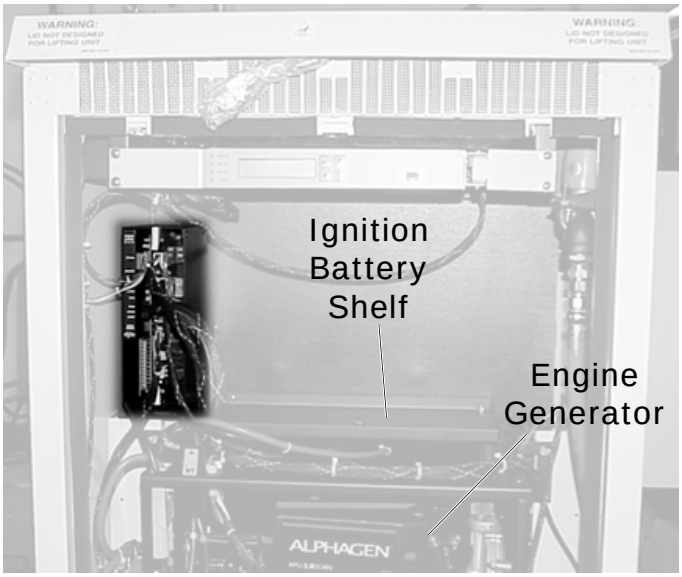

Fig. 1-3, Location of Engine Control Module (ECM) within the Engine-Generator Cabinet.

1.1 Introduction, *continued*

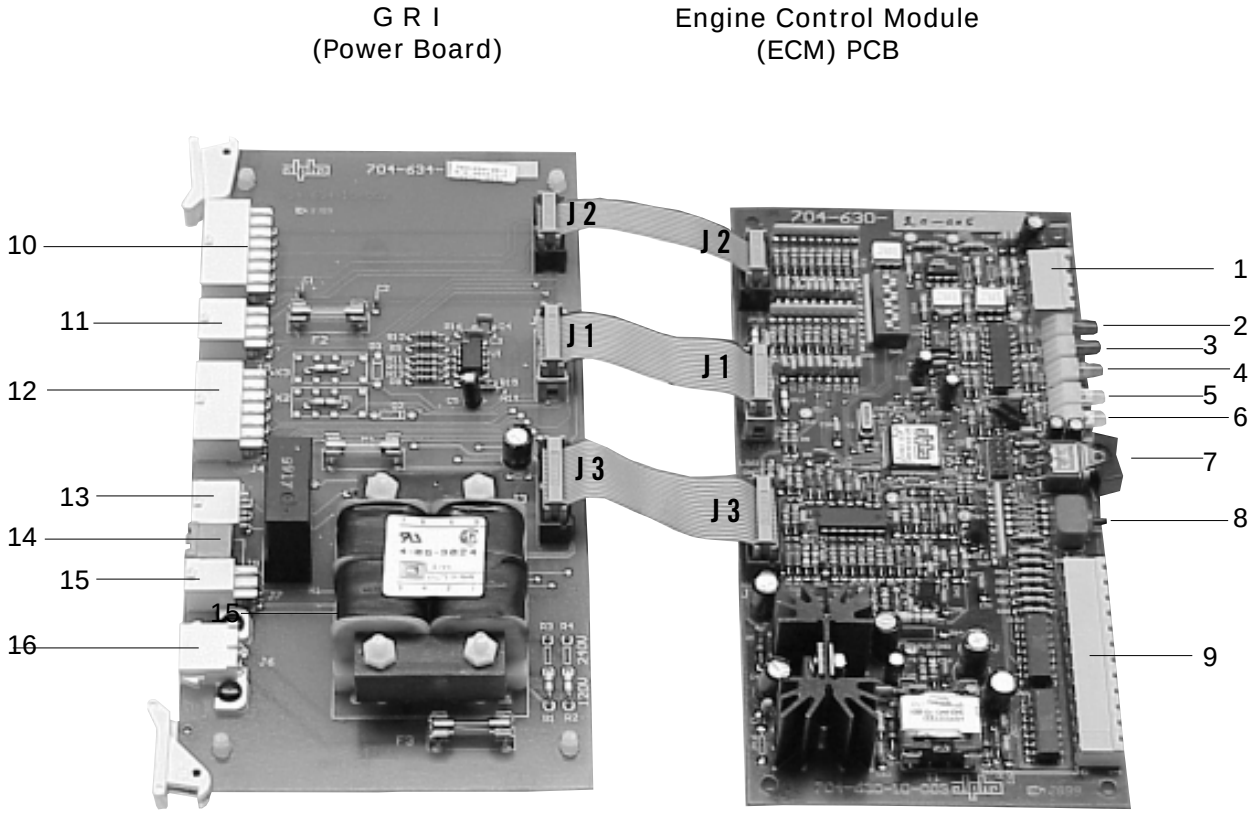

Fig.1-4 Open view, ECM Printed circuit boards

Engine Control Module LED Indicators and switches:

1. Communications Input (J4) *Note: Pin #1 at bottom of connector.*
2. "Major" Alarm Indicator (Red LED)
3. "Minor" Alarm Indicator (Red LED)
4. "Notify" Indicator (Amber LED)
5. "Comm" Indicator (Green LED)
6. "System" Indicator (Green LED)
7. "Run-Auto-Stop" switch
8. "Service/Reset" Push button switch (SW3)
9. Transponder Interface (J6) *Note: Pin #1 at bottom of connector.*

GRI Power Board Connectors:

10. Enclosure Alarm Input connector (J10)
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12. Interface Input connector from APU (J4)
13. Inverter battery string connector (J8)
14. Battery Charger Control Interface (J9) - *(5.0kW APU only)*
15. AC generator Voltage, Current connector (J7)
16. AC Line Input connector (J6) - Connected at all times

1.2 Theory of Operation

1.2.1 Normal Operating Condition

Under normal operating conditions (no alarms) the ECM's Run-Auto-Stop (RAS) three-position rocker switch will be in the "center" or AUTO position as shown in figure 1-2. The ECM has complete control over the APU while in the AUTO mode. Also, each time the RAS switch is moved from the STOP position, to the center or AUTO position, the ECM will run the APU for one minute after a short delay. This is an indicator to the system operator that the ECM is truly in the AUTO mode and is fully capable of starting and stopping the APU automatically.

NOTE: **The Run / Stop switch on the 5.0kW Generator Control Board MUST be in the center (ECM) position before the ECM will automatically control the Auxiliary Power Unit.** *(On older versions, the center position may be marked "AUTO" or left blank.)*

The APU can be controlled manually by placing the RAS switch in the "up" or RUN position and the "down" or STOP position. If a system controller is attached to the ECM via the RS-485 bus, the APU can be controlled remotely. Similarly, the APU can be started via the transponder interface on the ECM.

In the AUTO mode, the ECM continuously monitors the AC line voltage, and DC bus voltage, enclosure sensors, and the APU status. If a fault occurs, the ECM will determine whether to start or inhibit the APU based on the type of failure.

1.2.2. Standby Operating Condition (less than 10 minutes)

If an AC line disturbance or outage is less than 10 minutes, the ECM will not start the APU unless the battery bus voltage drops below a programmable threshold (Low DC Bus Level) which defaults to 1.95 Volts per cell or 35.1/46.8/93.6 Volts for 36/48/96 Volt systems respectively. However, the ECM will notify the system operator of a line failure via the front panel LED's (see alarm section). Otherwise, the ECM will appear to be in a "normal" operating condition.

1.2.3. Standby Operating Condition (more than 10 minutes)

If an AC line disturbance or outage is greater than 10 minutes, the ECM start delay timer will expire and the ECM will attempt to start the APU. The ECM will attempt to start the engine 9 times with either a 30 second or a 60 second pause between attempts (See Table 1-1). If the engine fails to start, the ECM will report an "Engine Over-crank" alarm. Otherwise, the ECM will start and continue to run the APU until either a normal shutdown or Major alarm occurs (refer to Alarm section 3.1).

1.2 Theory of Operation, *continued*

Crank Cycle									
Crank Attempt	1	2	3	4	5	6	7	8	9
Cranking Engine	15 Sec	15 Sec	15 Sec	15 Sec	15 Sec	15 Sec	15 Sec	15 Sec	15 Sec
Pause (no crank)	30 Sec	30 Sec	60 Sec	30 Sec	30 Sec	60 Sec	30 Sec	30 Sec	Engine Overcrank Alarm

Table 1-1 Normal Mode Crank Cycle

1.2.4. Normal APU Shutdown

The ECM will initiate a normal APU shutdown when AC line is qualified, DC bus alarm is not active, the 12 minute cool-down period has elapsed, and the Engine Run command is not active. Otherwise, the ECM will continue to run the APU until the above conditions are met or a major alarm occurs. Also, the APU will run for a minimum of 30 minutes if started due to low DC Bus voltage.

1.2.5. Abnormal APU Shutdown

The ECM will immediately shutdown the APU under the following conditions:

- Major alarm
- Activation of manual engine stop switch
- Receipt of software engine stop command
- General generator failure

1.2 Theory of Operation, *continued*

1.2.6. ECM Operating Mode Summary

The ECM monitors the status of the AC line and DC bus to make a determination when to start and stop the generator. The ECM also monitors APU status while the engine is running and will immediately shut down the unit if certain alarm conditions are detected. The ECM reports status information via a parallel data interface and/or an Alpha-Bus serial data (RS-485) interface.

Any of the following conditions can cause the ECM to start the generator:

1. Loss of AC line for a period of time in excess of *Start Delay* (programmable).
2. DC bus voltage drops below 1.95 Volts/cell (35.1/46.8/93.6 VDC for 36/48/96 Volt systems, respectively).
3. Manual run switch is activated.
4. Software run command received.
5. Engine run is commanded via the transponder interface.
6. A self-test is initiated manually.
7. An automatic self-test is initiated.

The following conditions are required for normal engine shutdown:

1. AC line is qualified.
2. DC bus voltage is greater than nominal +2 Volts (i.e., 50V for a 48V system).
3. Cool-down period has expired.
4. Engine Run command is not active.
5. Engine has run for a minimum of 30 minutes if it started due to low DC bus voltage.

The following conditions will cause immediate engine shutdown:

1. Manual engine stop switch is activated.
2. Software engine stop switch is received.
3. Any of the following engine alarms become active:

   · Low oil
   · Engine over-temperature
   · Low fuel
   · Over-speed
   · Over-crank
   · Overvoltage

4. Any of the following system alarms become active:

   · Gas hazard
   · Pad shear
   · Water intrusion
   · General APU failure

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Section 2, ECM Indicators and Control Functions

2.1 Indicators

Refer to the illustration on the following page:

The ECM user interface consists of 5 LEDs (2-6), a three-position rocker switch (7), and a momentary contact, push-button switch (8). The COMM Interface (1) can be used to attach an Alpha Technologies system controller. Provisions are made for Transponder connections through the Interface connector (9).

The **Major** and **Minor** alarm LEDs (2,3) are red and reflect the state of the discrete major and minor alarms monitored by the ECM.

A **Major** alarm indicates failure of a critical component or some other situation (pad shear, for example) where the system either has gone off-line, or system failure and/or shutdown is imminent. Major alarms cause the engine to shutdown immediately and generally prevent further operation. Most major alarms are latched by the ECM. A site check by service personnel is required to repair the fault and clear the system.

A **Minor** alarm indicates a system fault which, though not indicative of imminent system failure or shutdown, requires service attention as the fault condition could worsen to shut down the system. A site check by service personnel is recommended.

The amber ***Notify*** LED (4) represents status information that is not significant enough to be classified as an alarm. At present, only two items fit into this category: AC line status and Engine Service Required.

The ***COMM****unications* LED (5) illuminates for two seconds after each communications session on the Alpha bus. This is a standard that is used throughout the Alpha bus communications system.

The green ***SYS****tem* status LED (6) indicates that the microprocessor has power and is operating normally. This LED flashes at a 1 Hz rate with a 50% duty cycle. When the ECM is in factory test mode, this LED will flash at a 0.5 Hz rate.

NOTE: Early versions of the ECM *(prior to 12/99)*, the Communications and System Status functions were swapped.

2.1 Indicators, *continued*

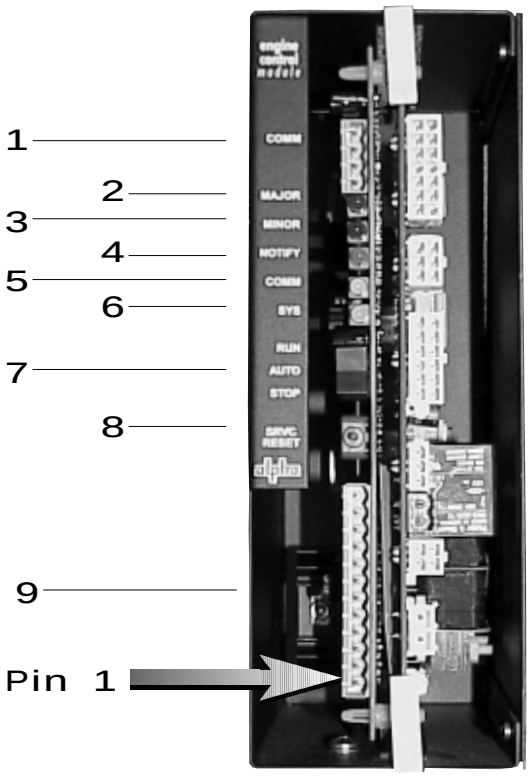


Fig. 2-1 Engine Control Module LED indicators and switches.

Engine Control Module LED Indicators and switches:

1. Communications Input (note: Pin #1 at bottom of connector)
2. "Major" Alarm Indicator (Red LED)
3. "Minor" Alarm Indicator (Red LED)
4. "Notify" Indicator (Amber LED)
5. "Comm" Indicator (Green LED)
6. "System" Indicator (Green LED)
7. "Run-Auto-Stop" switch
8. "Service/Reset" Push button switch (SW3)
9. Parallel Transponder Interface (note: Pin #1 at bottom of connector)

2.2 Control Functions

Refer to Figure 2-2 on the following page:

The three positions of the rocker switch (7) are RUN - AUTO - STOP (RAS). The RAS switch is normally left in the center, AUTO, position so that the ECM has control of the generator set. A minor alarm is indicated when the RAS switch is not in the AUTO position. The STOP ("down") position is used to stop or prevent APU operation during maintenance. **Placing the RAS switch in the STOP position for three (3) seconds, then switching back to AUTO will clear any latched alarms and start the generator if the cause of the alarm has been corrected.** Placing the RAS switch in the RUN ("up") position will cause the engine to start and run until this switch is released to AUTO. The engine may not shut down immediately when the switch is returned to AUTO from RUN, because the ECM's shutdown criteria must be met in order to shutdown the engine. Also, each time the RAS switch is placed in the AUTO position (from the STOP position), the ECM will start and run the APU for one minute after a short delay.

The service reset push-button switch (8) has two purposes. It resets the engine service timer when depressed for 5 seconds and can be used to determine which alarms are active (see ***"Alarms"*** section 3.3). The service interval is a programmable counter within the ECM that defaults to 100 hours **after** the initial 25-hour break-in period. When 100 hours of engine run time elapses, the *Service Required* notification is set and the notification LED illuminates. After the engine has been serviced, pressing and holding the service reset switch for 5 seconds will reset the 100-hour service counter. All of the LEDs flash, while the switch is depressed, until a five-second timer elapses at which time all of the LEDs remain on solid until the switch is released. This provides feedback to the technician, indicating the effective resetting of the engine service counter.

2.2 Control Functions, *continued*

The service reset push-button is also used to obtain information about active alarms. The Major and Minor alarm LEDs are very general and a technician will need more detailed information upon arrival to the site of an alarming ECM. To retrieve details about an active alarm, the user presses and releases the service-reset switch. An active alarm (Major or Minor) will be indicated by the LEDs as indicated in Figure 3-1. Note that depressing the service-reset switch for 5 seconds will cause the service timer to clear possibly disrupting the preventive maintenance schedule. When the service-reset button is pressed again, the LEDs will represent the next active alarm. Pressing the button when there are no more active alarms will reset the LEDs to their normal usage. Several quick flashes of all five LEDs will indicate end of the alarm list before the LEDs return to normal operation. If the service reset button is not depressed again when an alarm is indicated, the LEDs will return to normal operation after 30 seconds have elapsed. Resetting alarms via status monitoring or via the manual stop switch will also clear the alarm pattern indicated by the LEDs.

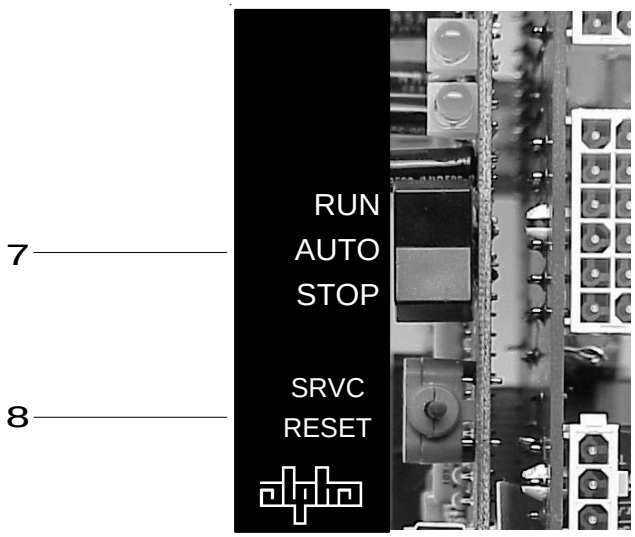


Fig. 2-2, Run/Auto/Stop and Service/Reset switches

Section 3, ECM Alarms and Notifications

3.1 Alarms Classifications

The ECM is capable of reporting 9 "Major" alarms, 8 "Minor" alarms and 2 "Notifications". The following are detailed descriptions of each.

Major Alarm:

A Major alarm indicates failure of a critical component or some other situation (pad shear, for example) where the system either has gone off-line, or system failure and/or shutdown is imminent. Major alarms cause the engine to shutdown immediately and generally prevent further operation. Most major alarms are latched by the ECM. A site check by service personnel is required to repair the fault and clear the system. **Placing the RAS switch in the STOP position for three (3) seconds, then switching back to AUTO will clear any latched alarms and start the generator if the cause of the alarm has been corrected.**

MAJOR ALARMS:

Low Oil Pressure (Latching)

Indicates engine oil pressure is below safe limits and operation of the unit has been suspended. The alarm is cleared when the *Reset* command is issued or when the manual stop switch is activated.

Engine Over-Temp

Indicates engine temperature has exceeded safe limits and operation of the unit has been suspended. The alarm is reset when the engine temperature falls below safe limits.

Engine Over-speed (Latching)

Indicates engine RPM has exceeded safe limits, and operation of the unit has been suspended. The alarm is cleared when the *Reset* command is issued or when the manual stop switch is activated.

Engine Over-Crank (Latching)

Indicates the failure of the engine to start when commanded to do so. The alarm is cleared when the *Reset* command is issued or when the manual stop switch is activated.

3.1 Alarms Classifications, *continued*

MAJOR ALARMS *(continued)*:

Alternator Over-voltage (Latching)

The generator set has detected that the alternator output voltage is too high. Depending on generator type, this likely means that the voltage regulator or the engine speed governor has failed. Operation of the unit has been suspended. The alarm is cleared when the *Reset* command is issued or when the manual stop switch is activated.
The alternator over-voltage alarm can be triggered in any of three ways:

1.) The generator controller can signal the ECM that an over-voltage condition exists.
2.) A programmable threshold of 57 VDC (Hi DC Bus Level) is exceeded for 15 seconds.
3.) A fixed threshold of 2.7V/cell is exceeded for five (5) seconds. The programmable threshold defaults to 2.5V/cell.

Gas Hazard (Latching)

The concentration of hydrocarbon fuel in the power system's enclosure air space has exceeded safe limits or 10%-20% of the Lower Explosive Limit (LEL) for more than three (3) seconds. APU operation is suspended. The alarm is cleared when the *Reset* command is issued or when the manual stop switch is activated.

Water Intrusion

Water level within the main or fuel enclosure has exceeded safe limits for generator operation. APU operation is suspended while this alarm is active. The alarm is reset when the water level falls below maximum limits.

Pad Shear (Latching)

Indicates that the main or fuel enclosure has shifted from its pad mounting position. APU operation is suspended. The alarm is reset when the unit is returned to its original position and the reset command is issued or when the manual stop switch is activated.

NOTE: APU will not start if Pad Shear magnet is not correctly installed below the Pad Shear sensor.

Low Fuel Pressure (Latching - after 5 activations)

Indicates that site fuel supply (Propane-fueled APU only) is insufficient for extended engine operation. The alarm is reset 5 minutes after the fuel supply is replenished.

3.1 Alarms Classifications, *continued*

Minor Alarm:

These alarms indicate a system fault which, though not indicative of imminent system failure or shutdown, require service attention as the fault condition could worsen to shut down the system. A site check by service personnel is recommended.

MINOR ALARMS:

Control Fail (Latching - *after 5 activations*)

Indicates a control failure between the ECM and the generator set. Typically this means that the engine did not start or stop when commanded to do so. The alarm is cleared when the Reset command is issued or when the manual stop switch is activated.

Alternator Off

This alarm is active if the generator controller has disabled the alternator output. A generator controller may disable the alternator output if the output voltage cannot be held above some threshold.

Self-Test Fail (Latching)

Status of most recent generator test. The alarm is cleared when the *Reset* command is issued, the manual stop switch is activated or another *Self-Test* command is issued.

Low Ignition Battery

Indicates that the generator's ignition battery voltage has fallen below 11.5VDC. Alarm is cleared when battery voltage rises above 12.0VDC indicating battery recovery has begun. Note that low ignition battery voltage is not alarmed during engine cranking.

3.1 Alarms Classifications, *continued*

Auto Mode Disabled

Indicates the position of the ECM control select switch. When the Run-Auto-Stop (RAS) switch is in a manual (STOP or RUN) position, the ECM has no control over engine operation and therefore raises an alarm. This is a hardware 'lockout' input and cannot be changed via status monitoring.

Tamper

One of the doors on enclosure is open. The alarm clears when the door is closed.

DC Bus Fault

Indicates that the power system DC bus voltage, as measured at the ECM, is less than 1.95 volts per cell. This alarm clears automatically when the bus voltage exceeds 2 volts above nominal (i.e., 50VDC in a 48V system).

Engine Disabled

Command to disable normal operation of the generator set. When set to DISABLE the engine is shutdown and will remain so under all conditions. A *Minor Alarm* indicator will be active if this switch is set to DISABLE.

The engine is disabled by software after five consecutive "Low Fuel" alarms or five consecutive "Control Fail" alarms. This alarm is cleared by issuing a "Reset" command or when the "Manual Stop" switch is activated.

3.2 Notifications

Additionally, the ECM will report the following "Notification" information.

Line Failure

The ECM's determination of the state of AC line voltage. Loss of AC utility input is one of the criteria for starting the generator.

Service Required

Indicates that routine maintenance of the engine - generator is overdue. This alarm activates when *Service Countdown* reaches 0. It is cleared by depressing the service timer reset button for five seconds. *(Refer to Section 5.2 "System Maintenance" for further information)* .

3.3 Alarm and Notification Indications

Alarms are indicated in three ways: ECM LEDs, RS-485 communications and alarm contact closures on ECM transponder interface. Alarm indication on the ECM LEDs is obtained by pressing the service reset button momentarily and noting the combination of illuminated LEDs. Pressing the service reset switch again will reveal the next alarm in the list. When the alarm list has been exhausted, all LEDs will flash several times and then return to their normal functions. **Placing the RAS switch in the STOP position for three (3) seconds, then switching back to AUTO will clear any latched alarms and start the generator if the cause of the alarm has been corrected.** The following figure shows the LED patterns and the alarms they represent:

Major Alarms	1	2	3	4	5	6	7	8	9
Abbreviation	LO	OT	OS	OC	OV	GH	WI	PS	LP
Major	●	●	●	●	●	●	●	●	●
Minor	●	●	●		●	●		●	
Notify	●	●		●	●				●
Comm	●		●	●			●	●	
System		●	●	●		●	●		●

Major Alarms	10	11	12	13	14	15	16	17	18	19
Abbreviation	CF	AO	TF	IB	AD	TP	DC	ED	LF	SR
Major										
Minor	●	●	●		●	●	●			
Notify	●	●		●	●			●		
Comm	●		●	●			●			●
System		●	●	●		●		●	●	

Fig. 3-1 Major, Minor Alarm Indications, and Notifications
(LEDs as displayed on the ECM)

1. Low Oil Pressure (LO)*
2. Engine Over-Temp (OT)
3. Engine Over-Speed (OS)*
4. Engine Over-Crank (OC)*
5. Alternator Over-Volt (OV)*
6. Gas Hazard (GH)*
7. Water Intrusion (WI)
8. Pad Shear (PS)*
9. Low Fuel Pressure (LP)***
10. Control Fail (CF)***
11. Alternator OFF (AO)
12. Self-Test Fail (TF)*
13. Low Ignition Battery (IB)
14. Auto-mode Disabled (AD)
15. Tamper (TP)
16. DC Bus fault (DC)
17. Engine Disable (ED)
18. Line Failure (LF)**
19. Service Required (SR)**

Legend:
* = Latching Alarm
** = Notifications
*** = Alarm “latches” after 5 activations

3.4 ECM Transponder Interface

The ECM also provides a transponder interface for remote status monitoring as shown in figure 2-1, item 9. The transponder interface consists of a 12-position terminal block with 8 optically-isolated output signals and one switch closure input signal. The wiring diagram for the transponder interface is shown in Figure 3-2, with the following signals mapped to the transponder interface terminal block as shown in below.

PIN	INPUT / OUTPUT	DESCRIPTION	ACTIVE STATE
1	Output	Major Alarm (note 1)	Open with respect to Pin 9
2	Output	Minor Alarm (note 1)	Open with respect to Pin 9
3	Output	Engine Alarm (note 3)	Open with respect to Pin 9
4	Output	Gas Hazard	Open with respect to Pin 9
5	Output	Test Fail	Open with respect to Pin 9
6	Output	Enclosure Alarm (note 4)	Open with respect to Pin 9
7	Output	Engine Status (Running, Stopped)	Closed to Pin 9
8	Output	Tamper	Closed to Pin 9
9		Output Common	
10	Input	Engine Run	Connect to Pin 11
11	Ground	Engine Run Return	
12		To Be Determined	

Table 3-1 ECM Transponder interface

Notes:

1. Major Alarms:
   - Low Oil Pressure
   - Engine over-temperature
   - Engine Overspeed
   - Overcrank
   - Output Over-voltage
   - Low Fuel
   - Water Intrusion
   - Pad Shear
   - Gas Hazard

2. Minor Alarms
   - ECM Control Fail
   - Alternator OFF (at the time it should be ON)
   - Self-test failed
   - Low Ignition Battery
   - ECM Run/Auto/Stop switch not in AUTO position
   - Tamper
   - DC bus voltage out of range
   - Engine disabled by software
   - Engine Service Required

3. Engine Alarms:
   - Low oil pressure
   - Engine over-temperature
   - Engine Overspeed
   - Overcrank
   - Engine disabled by software

4. Enclosure Alarms:
   - Water Intrusion
   - Pad Shear

3.5 Standard ECM-Transponder Interconnection

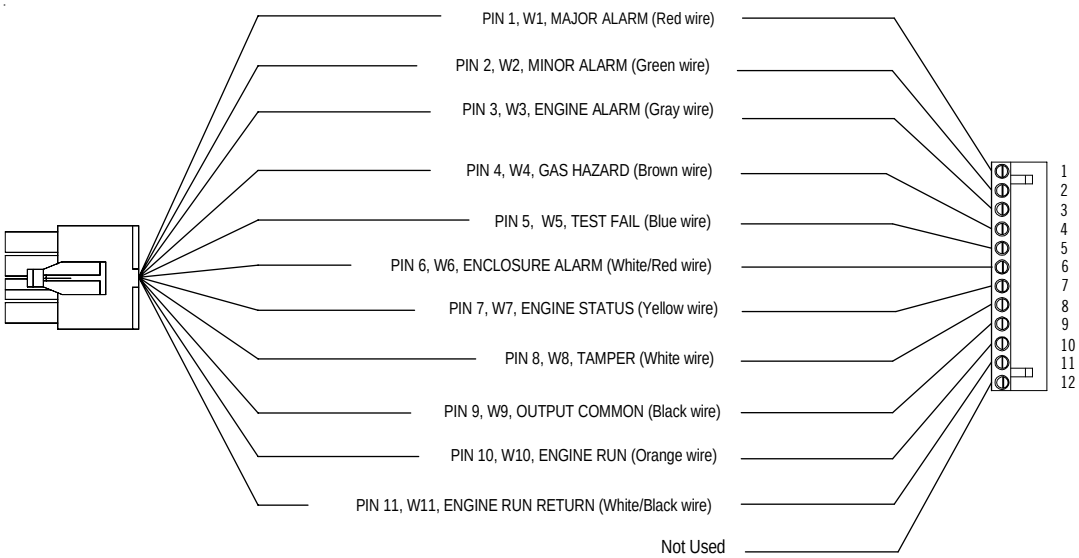


Fig. 3-2 Standard Transponder-to-ECM interconnect cable, **collocated** applications

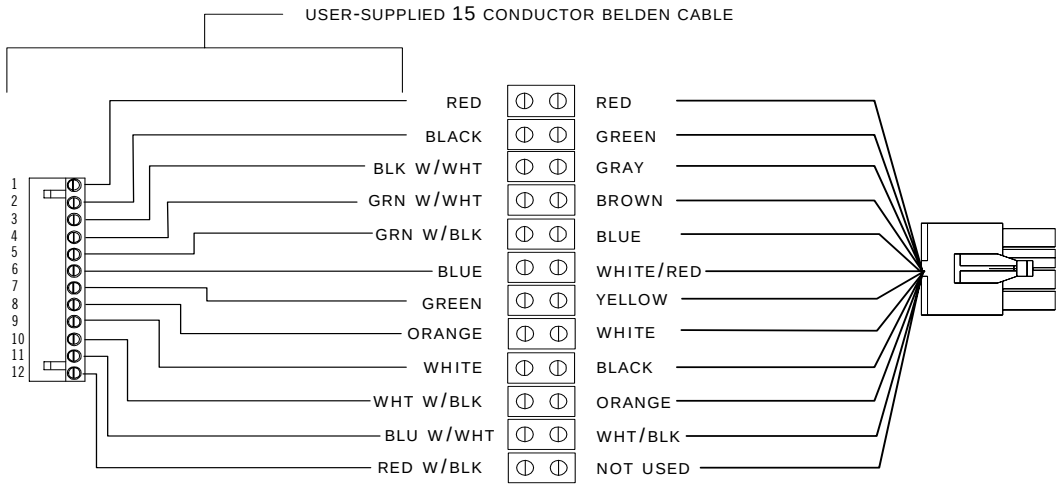


Fig. 3-3 Standard Transponder-to-ECM interconnect cable, **remote** applications

3.5 Standard ECM-Transponder Interconnection, *cont'd*

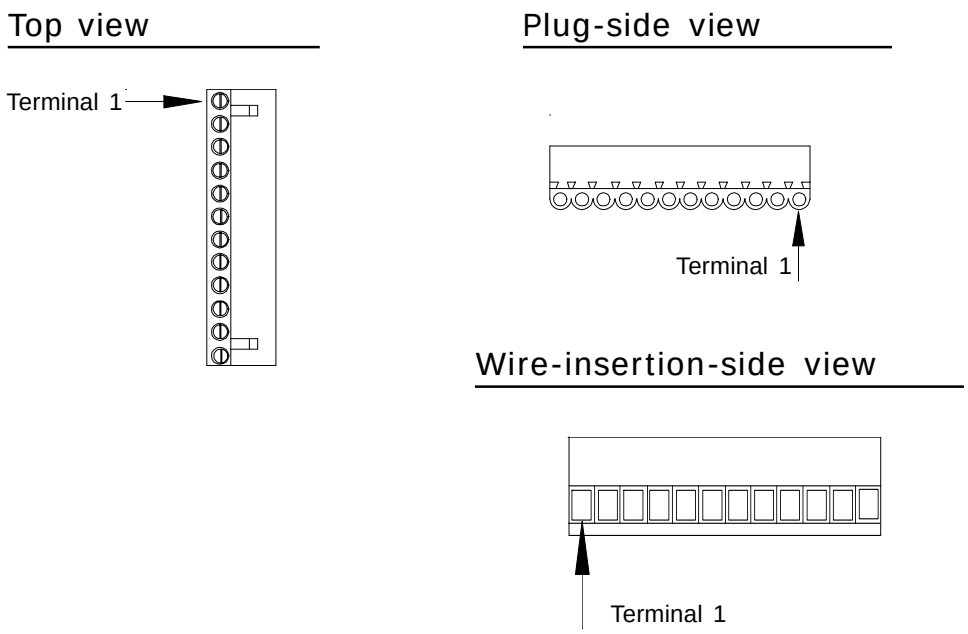


Fig. 3-4 ECMconnector arrangement

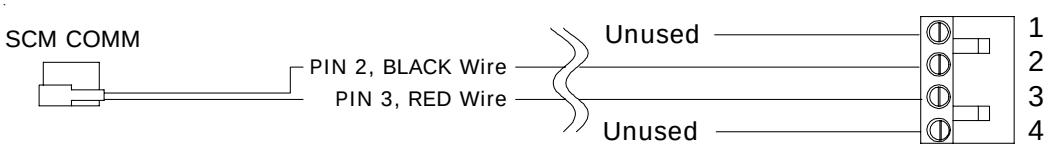


Fig. 3-5 SCM-to-ECM interconnect cable

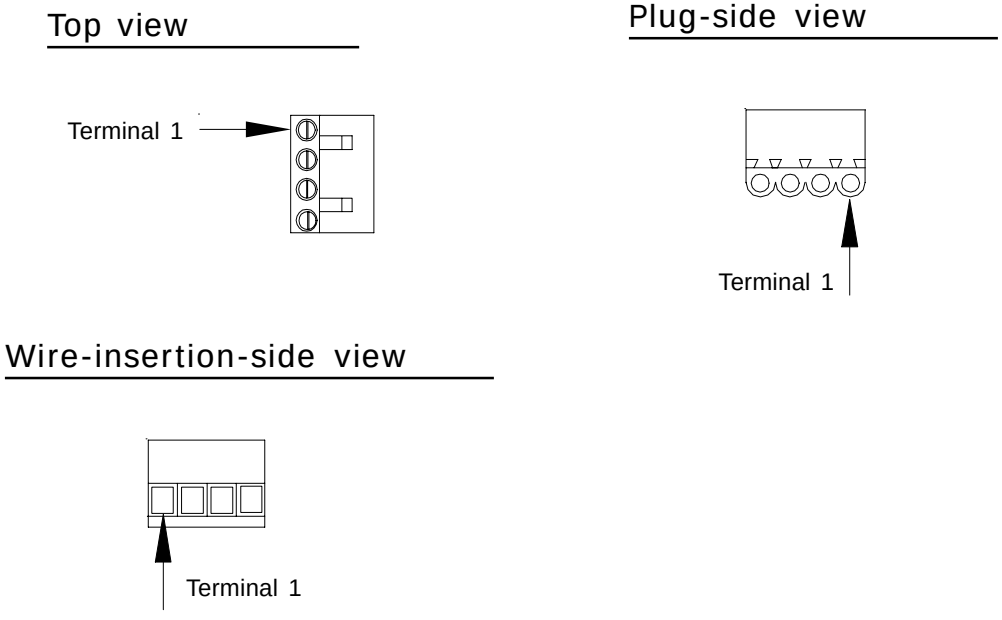
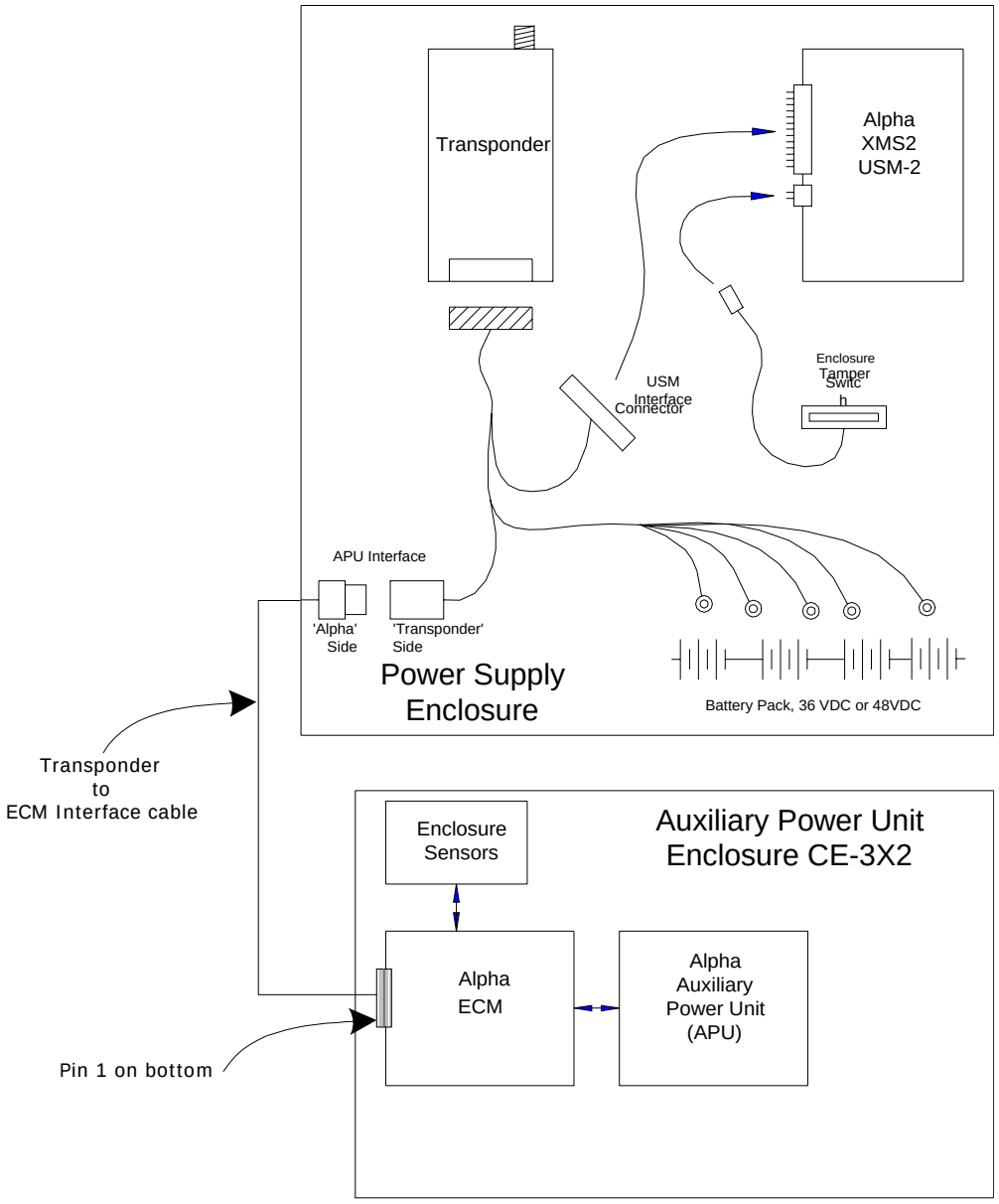


Fig. 3-6 ECM-to-SCM connector arrangement

3.6 Transponder System Block Diagram



Section 4, ECM Configuration / System Interface

4.1 ECM Configuration DIP Switch, Fuses

The ECM has an 8 position DIP switch (SW5) which is used to configure the type of Generator Interface, APU output voltage (AC or DC), and the utility voltage. Please refer to Section 4.4, "Input Voltage and Line Sense", prior to configuring utility voltage and line sense voltage. Also, the ECM power board contains three fuses, F1, F2, and F3.

The fuses protect the following circuits:

F1: 12V input from the APU. (P/N 460-204-10)
F2: 12V output to the APU fan and enclosure gas detector. (P/N 460-205-10)
F3: 120/240 VAC input to the ECM logic transformer. (P/N 460-166-10)

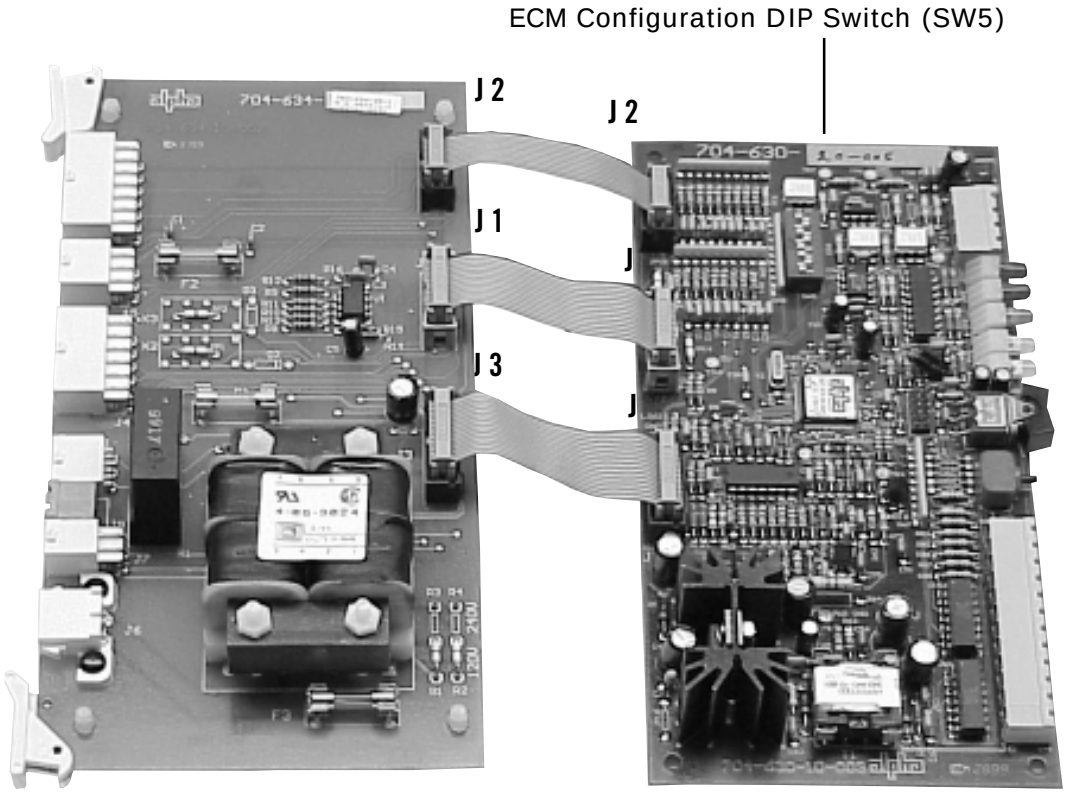


Fig. 4-1 ECM Configuration DIP Switch and fuse locations

Fuses and Switches:

F1 1.5A, 250V (Slo-Blo)
F2 1.0A, 250V (Slo-Blo)
F3 250mA, 250V (Slo-Blo)
SW5 Configuration DIP switch

4.2 ECM Configuration

The ECM configuration is required for interface type, output voltage, input voltage and reserved functions. The following should be used to configure the ECM:

ECM Switch 5 Settings								Meaning
1	2	3	4	5	6	7	8	1 = ON, 0 = OFF
0								Non standard GRI interface (7.5kW Series)
1								Standard GRI interface, CE-3X2
	0	0	0					Invalid output voltage configuration
	0	0	1					24 VDC Output
	0	1	0					36 VDC Output
	0	1	1					48 VDC Output
	1	0	0					96 VDC Output
	1	0	1					120 VDC Output
	1	1	0					208 VDC Output
	1	1	1					240 VDC Output
				0	0			Invalid input voltage configuration
				0	1			120 AC input
				1	0			208 3-phase input
				1	1			240 VAC input
0						0		No affect
0						1		No affect
1						0		ECM Drives starter with the "Engine Start" Signal.
1						1		"Engine Start" Signal becomes "Engine Run" and is held low by ECM
							0	Autotest turned OFF.*
							1	Autotest sequence enabled with 14-day test interval

Table 4-1 ECM switch configurations.

(Switch settings shown below are for a CE-3X2 with 120 VAC input and 36VDC output.)

***NOTE:** Programming parameters that affect the Autotest feature via Status Monitoring will override this switch setting.

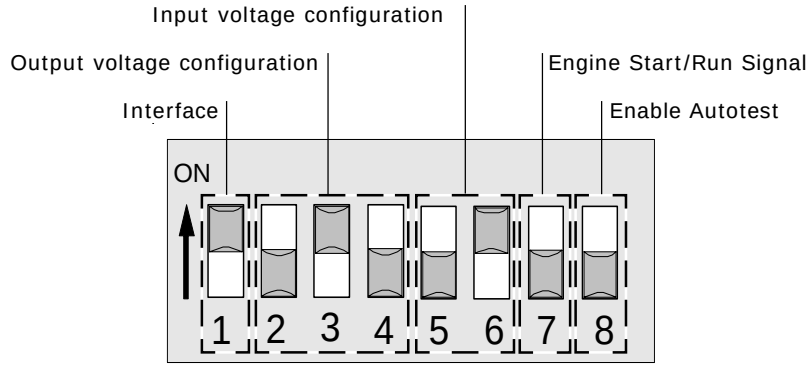


Fig. 4-2 SW5, ECM PCBA
(Alpha p/n 704-630-xx-xxx)

4.3 System Interface

The illustration below shows the interconnection between the ECM, engine-generator controller, and enclosure safety sensors.

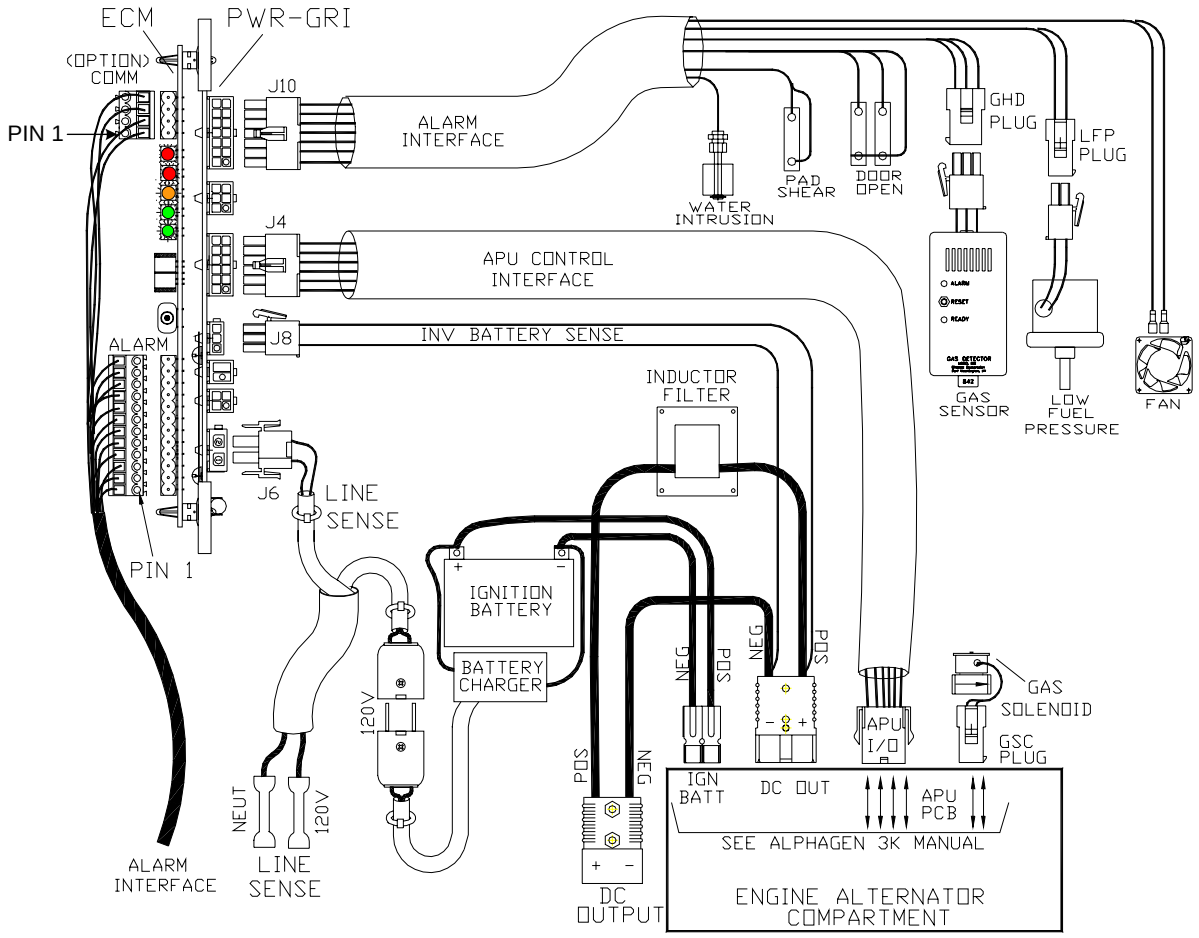


Fig. 4-3 ECM/APU Interconnection, **2.7kW / 3.0 kW** configuration

4.3 System Interface, *continued*

The illustration below shows the interconnection between the ECM, engine-generator controller, and enclosure safety sensors.

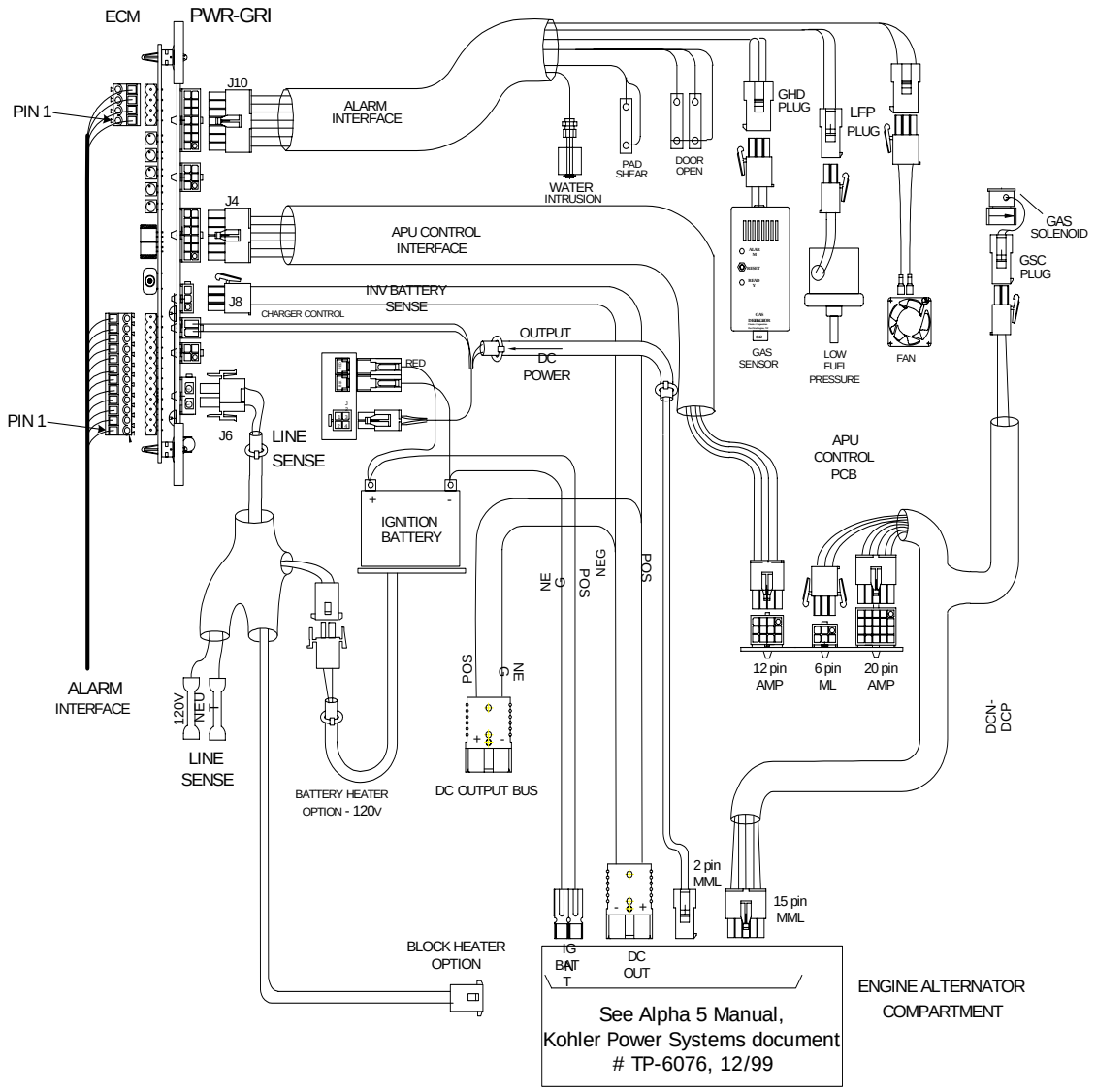


Fig. 4-4 ECM/APU Interconnection, **5.0 kW** configuration

4.4 ECM input voltage and line sense configurations

The ECM has 120/240VAC ***input voltage*** and ***line sense*** capabilities, which must be configured ***separately***. The ECM PCBA part number 704-630-XX must be configured for 120/208/240VAC ***line sense*** via DIP Switch SW5-5 and SW5-6 as shown in table 4-1. The default setting is 120VAC. The logic transformer (T1) located on the GRI power board part number 704-634-XX must also be configured for the correct ***input voltage*** by installing zero ohm jumpers R1-R4. Install R1 & R2 for 120VAC operation or R3 & R4 for 240VAC operation as shown in figure 4-4. The default setting is 120VAC. The following two options are provided for clarification:

Option 1 (Recommended)

Configure ECM power board for an ***input voltage*** of 120VAC by installing R1 & R2 and removing R3 & R4 (default). Configure DIP SW5 on the ECM board for either 120VAC or 240VAC ***line sense*** depending on the ***input voltage configuration*** of the XMS2 power supplies being used. In other words, always power the ECM with 120VAC and set DIP SW-5 for the input voltage of the XMS2 power supplies being used (120VAC or 240VAC). As long as SW-5 is set correctly, the ECM will properly scale the voltage for status monitoring purposes.

Install the 120VAC power cable (y-adapter) to both the input line sense of the ECM and the input power to the ignition battery charger (L1 to neutral) as shown in Figure 4-3. This is the preferred configuration since the battery charger is only rated for 120VAC operation and the ECM's default configuration is 120VAC. The 120VAC ignition battery charger is only used on the 2.7/3.0kW APUs.

Note: The ECM will properly sense a line loss on a 240VAC (L1-L2) system even though it's only monitoring 120Vac (L1-Neutral) as long as SW-5 is set for 240VAC. This is based on the fact that the ECM is monitoring the secondary winding of a centered tapped single-phase transformer from utility power.

Option 2

Configure the power board jumpers R3 and R4 and the DIP SW-5 on the ECM for 240VAC operation. Install a 240VAC line sense cord for the ECM and a separate 120VAC power cord for the ignition battery charger. When R1 and R2 are installed, VAC=120. When R3 and R4 are installed, VAC=240.

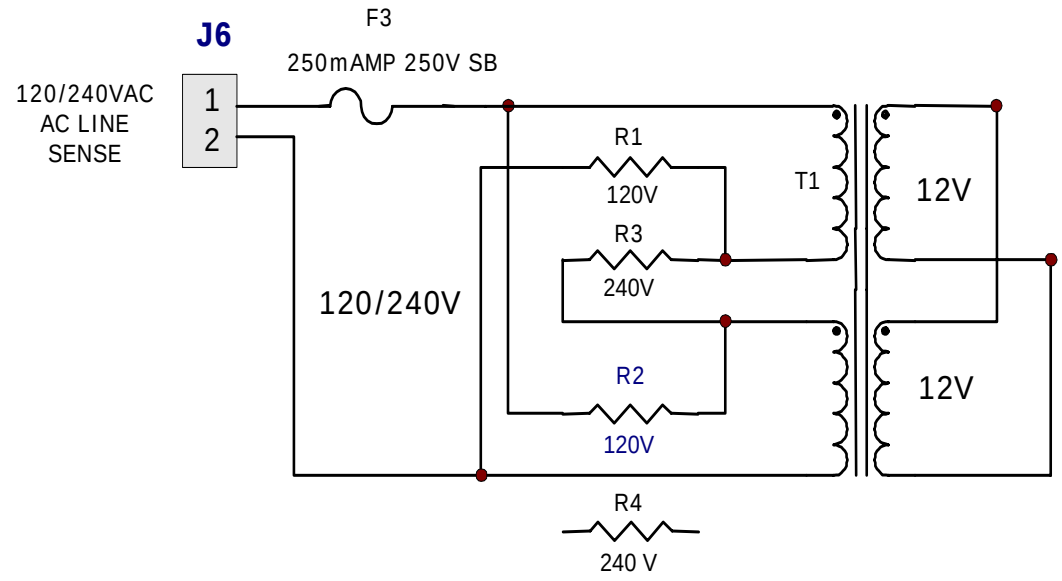


Fig. 4-5 ECM Power Board
(p/n 704-634-XX)

4.5 ECM System Parameters

The following is a listing of programmable parameters used by the ECM. They may be changed via the Telecom Power Monitor (TPM). Refer to the Telecom Power Monitor Technical Manual (p/n 744-781-B0) for additional information.

4.5.1 Low DC Bus Level

Description: If the power system battery voltage goes below this threshold voltage for a certain period of time, the ECM will start the generator.
Range: 0V to 127VDC
Default setting: 1.95 volts/cell

4.5.2 High DC Bus Level

Description: If the power system battery voltage goes above this threshold voltage for a certain period of time, the ECM will shut down the generator.
Range: 0V to 127VDC
Default setting: 2.5 volts/cell

4.5.3 Service Interval

Description: Number of engine run hours between required services.
Range: 0 to 65535 hours
Default setting: 100 hours

4.5.4 Service Countdown

Description: The number of engine run hours remaining until the next periodic maintenance is required. This parameter is reset to *Service Interval* when the service timer reset button is depressed for at least five seconds. Run time since last service is simply *Service Interval* minus *Service Countdown*.
Range: 0 to 65535 hours
Default setting: N/A

4.5.5 Total Engine Runtime

Description: This counter keeps track of total in-service hours on the generator set. It can be programmed to an initial value that matches a mechanical hour-meter that is often found on the generator's prime mover or it can be used in place of such a meter.
Range: 0 to 65535 hours
Default setting: N/A

4.5 ECM System Parameters, *continued*

4.5.6 Auto-test Interval

Description: Interval between automatic self tests in days. *Auto-test Countdown* is reset to this value (multiplied by 24 hours) when this parameter is written or upon completion of an automatic self test. Setting this value to zero will disable the automatic self-test.
Range: 0 to 65535 days
Default setting: 0 days (automatic self tests disabled) *See table 4-1 for Autotest enable.*

4.5.7 Auto-test Countdown

Description: The number of hours remaining until the next automatic self-test. This parameter is an indicator but also can be used to program the time of the next automatic self-test. Subsequent tests will occur *Auto-test Interval* days later at the same time of the day (if a real time clock is installed in the ECM).
Range: 0 to 65535 hours
Default setting: N/A

4.5.8 Auto-test Duration

Description: The number of minutes that the engine will run when a test is requested.
Range: 0 to 65535 minutes
Default setting: 10 minutes

4.5.9 Start Delay

Description: The period of time between detection of utility failure and start of the engine - generator. If utility power returns before the start delay timer expires (counts down to 0), the timer will start to count up after 30 minutes and continue to increment 1 count per minute until it returns to the *Start Delay* value.
Range: 0 to 65535 seconds
Default setting: 600 (10 minutes)

4.5.10 Shutdown Delay

Description: Cool-down period between determination by the ECM that the generator can be shutdown and the time actual shutdown occurs.
Range: 0 to 65535 seconds
Default setting: 720 (12 minutes)

Section 5, System Self-test and Maintenance

5.1 Self-Test

Generator testing can be initiated in four ways:

1. The ECM can be programmed to periodically run an automatic test *(Default OFF)*.
2. A Self-Test can be commanded via status communications.
3. Momentary activation of the Engine Run command will cause the ECM to effectively run a test. Note that this method is the least desirable because the *Self-Test Fail* alarm will not be set if an alarm condition arises.
4. A one-minute automatic test is performed when the manual control switch is returned to *Auto* from *Stop*.

Generator testing consists of starting and running the generator for a programmable period of time (the default test duration is 10 minutes). The ECM monitors all engine-related signals and will declare a self-test as failed if any of the following alarms activate during the test:

- Low Oil Pressure
- Engine Over-temperature
- Engine Over-speed
- Engine Over-crank
- Low Fuel
- Alternator Over-voltage
- ECM Control Failure
- Alternator Not On
- Low Ignition Battery
- Low DC Bus Voltage

The ECM will not start a self-test if the engine is disabled, the stop switch is asserted, or the engine is already running.

5.1 Self-Test, *continued*

If AC line should fail during a test, the test will terminate normally but the engine will continue to run until line returns. If the test fails because the DC Bus alarm activates, the test will terminate, the self-test fail alarm will activate but the generator will continue to run until the DC Bus alarm clears.

The Self-Test Fail alarm may be cleared via a reset command or by successfully running a subsequent test.

The programmable, internal ECM variables listed below control automatic self-tests.

Auto-Test Interval

This feature represents the number of days between automatic tests. Programming this variable to 0 disables the automatic test feature (0 is the default value).

Auto-Test Countdown

This countdown timer is monitored by the ECM to determine when the next automatic test should be initiated. Although this timer is normally used as a status indicator, it can be used to set the start time for the next auto-test. For example, if the user wants to start the automatic test sequence at 12:30pm and it is presently 10:15am, they can wait until 10:30 and program Auto-Test Countdown to 2 hours. Subsequent tests will begin at nearly the same time of day so long as the ECM doesn't lose power in the interim. The ECM sets Auto-Test Countdown whenever the Auto-Test Interval is changed. Thus, if the Auto-Test Interval is programmed to 10 days, the ECM will set Auto-Test Countdown to 240 hours.

Auto-Test Duration

The length of each Auto-test is measured in minutes. The default test duration is 10 minutes. The test duration may be set between 10 and 120 minutes.

Manually enabling the Autotest feature

Switch SW5-8 is used to enable the autotest feature with a 14-day test interval. The first autotest will begin 14 days from the time the ECM is powered up with the configuration switch changed from 0 to 1 (OFF to ON). To disable the autotest sequence, place switch SW5-8 in the OFF position and restart the ECM. It is important to understand that upon power up, the ECM looks for a ***change*** in the switch position before it changes the test control parameters. *(Please refer to Fig. 4-2)*

5.2 System Maintenance

The ECM monitors time between periodic maintenance of the engine-generator. The *Service Interval* internal ECM variable represents the number of hours of engine-run-time between periodic services. When the engine runs for a number of hours equal to *Service Interval*, the ECM sets the *Service Required* Alarm and turns on the amber notification LED. The default value of *Service Interval* is 100 hours but may be programmed from 0 to 250.

Service Due represents the number of engine run time hours before the next periodic maintenance will be required. Pressing and holding the service-reset switch for 5 seconds resets the service counter and *Service Due* is updated with the current value of the service interval.

An exception to the standard *Service Interval* occurs when the engine is new. At 25 hours of *Engine Run Time*, the ECM will set the *Service Required* flag. 25 hours represents the break-in period of the engine, which should be serviced at this point. Note that if a service-reset is performed before the *Engine Run Time* counter reaches 20 hours, the Service Required flag will still be set at 25 hours. If, on the other hand, a service-reset is issued when the engine has run for more than 20 hours, the *Service Countdown* will be set to *Service Interval*.

NOTE: 5.0kW APUs are shipped with synthetic oil which does not require changing after the initial 25 operational hours. The oil should be changed after each 72- to 100-hour period of continuous operation in accordance with the generator manufacturer's owners manual. Exact times will vary as a function of temperature and operating conditions.

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Engine Control Module Alarm Table

Remove page and use for quick reference

Alarms are indicated in three ways: ECM LEDs, RS-485 communications and alarm contact closures on ECM transponder interface. Alarm indication on the ECM LEDs is obtained by pressing the service reset button momentarily and noting the combination of illuminated LEDs. Pressing the service reset switch again will reveal the next alarm in the list. When the alarm list has been exhausted, all LEDs will flash several times and then return to their normal functions. **Placing the RAS switch in the STOP position for three (3) seconds, then switching back to AUTO will clear any latched alarms and start the generator if the cause of the alarm has been corrected.** The following figure shows the LED patterns and the alarms they represent:

Major Alarms	1	2	3	4	5	6	7	8	9
Abbreviation	LO	OT	OS	OC	OV	GH	WI	PS	LP
Major	●	●	●	●	●	●	●	●	●
Minor	●	●	●		●	●		●	
Notify	●	●		●	●				●
Comm	●		●	●			●	●	
System		●	●	●		●	●		●

Major Alarms	10	11	12	13	14	15	16	17	18	19
Abbreviation	CF	AO	TF	IB	AD	TP	DC	ED	LF	SR
Major										
Minor	●	●	●		●	●	●			
Notify	●	●		●	●			●		
Comm	●		●	●			●			●
System		●	●	●		●		●	●	

Refer to the list below for the type of alarm indicated by the LEDs.

1. Low Oil Pressure (LO)*
2. Engine Over-Temp (OT)
3. Engine Over-Speed (OS)*
4. Engine Over-Crank (OC)*
5. Alternator Over-Volt (OV)*
6. Gas Hazard (GH)*
7. Water Intrusion (WI)
8. Pad Shear (PS)*
9. Low Fuel Pressure (LP)***
10. Control Fail (CF)***
11. Alternator OFF (AO)
12. Self-Test Fail (TF)*
13. Low Ignition Battery (IB)
14. Auto-mode Disabled (AD)
15. Tamper (TP)
16. DC Bus fault (DC)
17. Engine Disable (ED)
18. Line Failure (LF)**
19. Service Required (SR)**

Legend:

* = Latching Alarm
** = Notifications
*** = Alarm “latches” after 5 activations

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Power Node/ECM Certification

Power Node Location_____**Node**_____ **Model#**_____
Technician_____**Date** _____ **Serial #**_____

Ignition Battery Check *(Record Results)*

Verify correct Ignition Battery and Charger cables attachment ..... Pass / Fail
Verify Battery Terminal surfaces clean, tight, and covered with approved corrosion inhibitor (NCP-2) ..... Pass / Fail
Battery Voltage Range 12.5-14.1Vdc. ..... Actual= _____
Battery Charger LED is OFF when charge reaches 14.1V and ON when discharge reaches 13.1V ***See note 1*** ..... Pass / Fail
Verify Enclosure Fan Running? ***See note 2*** ..... Pass / Fail

ECM Interface Checks

Line sense Voltage. ****See note 3*** ..... Actual = _____
Line sense Frequency Range 60Hz +/- 1Hz. ..... Actual = _____
Verify all connectors correctly installed and locked into place. ..... Pass / Fail
Run-Auto-Stop (RAS) rocker switch set to Auto. ***See note 4*** ..... Pass / Fail
Verify Pad Shear Magnet is correctly installed. ..... Pass / Fail
Verify Gas Detector is correctly installed. ..... Pass / Fail
Verify Water Intrusion sensor is correctly installed. ..... Pass / Fail

ECM Alarm Verification

ECM has "Heart Beat"? ***See note 5*** ..... Pass / Fail
Verify no Major alarms are reported. ..... Pass / Fail
Verify the only Minor alarm reported is "Tamper" (Enclosure Door Open). ..... Pass / Fail
Water Intrusion Sensor (Hold float up to activate major alarm). ..... Pass / Fail
Pad Shear Sensor *(Place metal object between sensors to activate major alarm).* ..... Pass / Fail
Gas Detector *(Use a cloth moistened with Isopropyl alcohol to active major alarm).* ..... Pass / Fail
Verify Line Failure Notification by disconnecting Line Sense. ***See Note 6*** ..... Pass / Fail
Verify DC Bus Fault alarm by disconnecting Battery Sense. ***See Note 7*** ..... Pass / Fail

Generator Functional Verification *(Record Results)*

Verify oil clean and filled to capacity. ..... Pass / Fail
Verify air filter clean and installed. ..... Pass / Fail
Verify no oil leakage from oil filter, drain plug, and oil fill tube. ..... Pass / Fail
Perform one minute self-test. ***See note 4*** ..... Pass / Fail
Engine does not "hunt" excessively during idle/no load conditions. ..... Pass / Fail
Enclosure properly grounding. ..... Pass / Fail

Power Supply Verification

XMS2 Power Supply checked per section 5 of the operator's manual ..... Pass / Fail
Battery pack voltage *(no load, generator off)* range.
See note 8, note 9 ..... Actual =_____
Battery Terminals clean, tight, and covered with approved corrosion inhibitor (NCP-2). ..... Pass / Fail
Service Entrance, Enclosure, and Power Supply grounded properly. ..... Pass / Fail
Successful completion of 10 minute Self-test. ..... Pass / Fail
No Major or Minor alarms reported on XMS2 Smart Display. ..... Pass / Fail

NOTES:

1. Some older 5kW chargers do not have an LED.
2. During initial installation, the fan will completely discharge the ignition battery if utility power is not available.
3. The ECM can be configured for 120 or 240 VAC line sense. Refer to Section 4.4 of the ECM Manual for details.
4. Each time the RAS switch is placed in Auto, a one minute self-test is performed.
5. ECM's built after 12/99 use a flashing SYS LED in lieu of the COM LED for the "Heart Beat".
6. The generator will not start unless a line failure is greater then 10 minutes.
7. The generator will start immediately and run for a minimum of 30 minutes (Use RAS to stop Gen).
8. The difference between any battery in the string should not exceed 0.3 Vdc under load (XMS2 self-test).
9. Typical battery pack voltage ranges are 39.6-42.3Vdc, 52.8-56.4Vdc, and 105.6-112.8Vdc for 36/48/96 volt systems, respectively.

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Notes:

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