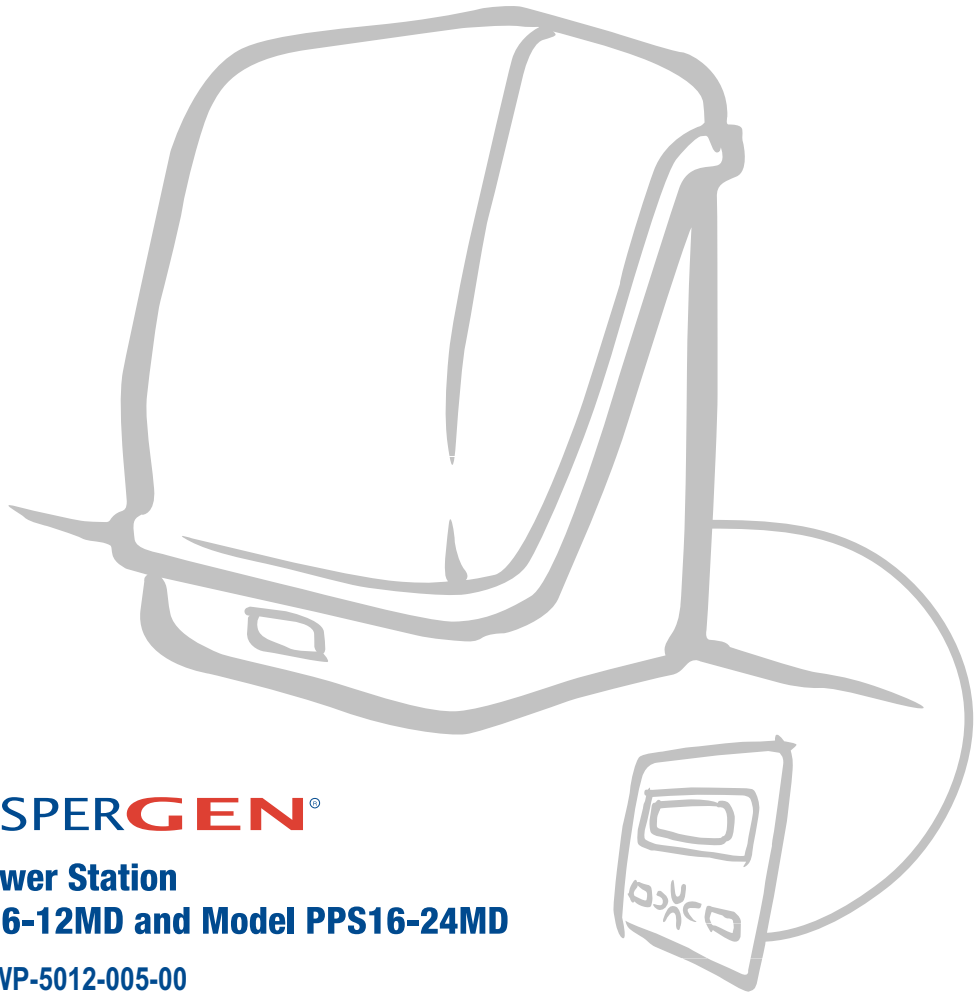
troubleshooting manual



WHISPERGEN®

Personal Power Station
Model PPS16-12MD and Model PPS16-24MD

Part Number: WP-5012-005-00
For Authorised Personnel Only

Whisper Tech reserves the right to revise or change product specifications at any time. This publication describes the state of this product at the time of its publication and may not reflect the product at all times in the future.

Patents granted and pending worldwide.

Title Troubleshooting Manual - Models PPS16-12MD, PPS16-24MD

Part No. WP-5012-005-00

Application

WhisperGen™ PPS16-12MD

- Diesel fired
- 12 V DC output
- Marine

WhisperGen™ PPS16-24MD

- Diesel fired
- 24 V DC output
- Marine

WhisperGen is designed and manufactured by

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Conditions of use

Read this manual completely before commissioning the WhisperGen™.

The WhisperGen™ must be commissioned only by an authorised WhisperGen™ representative. Whisper Tech accepts no liability for personal injury or property damage resulting from incorrect or unauthorised installation, commissioning and servicing of the WhisperGen™. Unapproved installations may be dangerous, result in poor performance and void any WhisperGen™ warranty.

Along with any warnings, instructions and procedures in this manual, the user should also observe any such other common sense procedures generally applicable to equipment of this type.

Failure by the user to comply with any warnings, instructions, procedures, or any such other common sense procedures may result in injury, equipment damage, property damage or poor performance of the WhisperGen™. The major hazards involved with operating the WhisperGen™ include explosion, fire, carbon monoxide fumes and electrical shock. These hazards can be avoided if the user adheres to the procedures in this manual and exercises all due care.

Whisper Tech accepts no liability for direct, indirect, incidental, special, or consequential damages resulting from failure by the user, installer or service technician to follow any warnings, instructions and procedures in this manual, or any such other common sense procedures generally applicable to equipment of this type. The foregoing limitation extends to damages to person or property caused by the WhisperGen™, or damages resulting from the inability to use the WhisperGen™, including loss of profits, loss of products, loss of power supply, the cost of arranging an alternative power supply and loss of time, whether incurred by the user, its employees, the installer, a service technician or any third party.

Whisper Tech reserves the right to change the specifications of its products, or the information in this manual, without necessarily notifying its users.

Variations in installation and operating conditions may affect the WhisperGen™'s performance. Whisper Tech has no control over each installation's unique operating environment. Hence, Whisper Tech makes no representations or warranties concerning the performance of the WhisperGen™ under the actual operating conditions prevailing at the installation. All operating parameters for each application should be validated by a technical expert of the user's choosing.

Whisper Tech has made every effort to explain all installation, commissioning, operating, maintenance, troubleshooting procedures, warnings and safety precautions as clearly and completely as possible. However, due to the range of operating environments it is not possible to anticipate every issue that may arise. Therefore, Whisper Tech is not able to guarantee that this manual will address every issue that may arise. This manual is intended to provide general guidance. For specific guidance and technical support, contact your authorised WhisperGen™ supplier.

Information in this manual shall not be deemed a warranty, representation or guarantee. For warranty provisions applicable to your WhisperGen™, please refer to the warranty provided by the supplier of your WhisperGen™.

Every effort has been made to ensure the accuracy of this document, however it may contain technical inaccuracies or typographical errors. Whisper Tech assumes no responsibility for and disclaims all liability of such inaccuracies, errors, or omissions in this publication.

Use of the WhisperGen™ shall constitute your acceptance of the conditions above

Contents

Introduction **4**

Engine Numbering **4**

Sequence of Operation **4**

Battery Charging Operation **6**

Heat Management Operation **6**

Sensor Operation **7**

Controlled Components **9**

Warning Codes (numbered from 102 to 199) **11**

102 Texhaust 12
104 Tblock 13
107 Tpcb 14
126 Hot Reset 15
135 Vbattery 16
182 Vbattery 17
183 Tbattery 18
190 V_error 19
195 Ah 20

Fault Codes (numbered from 2 to 99) **21**

2 Exh overtemp 22
4 Block overtemp 23
6 Heatsink overtemp 25
7 Electronics too hot 26
12 Air supply failed 27
14 O2 sensor failure 28
16 Fuse/DaisyCh fail 29
18 Low battery volts 30
19 High batt volt 31
20 Bus not charged 32
24 Isolator open 33
30 Low battery volts 34
32 Bus not charged 35
34 Isolator stuck on 36
35 Low battery volts 37
36 Glowplug cct flt 38
38 Bus not charged 39
40 Isolator open 40
44 Fuel sense fail 41
44 Fuel sense fail 42
46 Flame sense fail 43
48 Drive bridge fail 44
52 Fuel supply fail 45
54 Flame sense fail 46

56 O2 sensor fail ... 47
58 Ignition failure ... 48
59 Flame failure ... 50
60 Flame failure ... 51
61 Flame failure ... 52
62 Flame failure ... 53
64 Heatup failure ... 54
66 Crank failure ... 55
68 Engine sluggish ... 56
72 Drive bridge fail ... 57
74 Low engine power ... 58
76 O2 sensor OOL ... 59
80 Clamp failed On ... 60
82 Excess volt drop ... 61
83 Battery overtemp ... 62
84 Clamp failed Off ... 63
85 High batt volts ... 64
90 Clamp control flt ... 65
92 ParChg V too high ... 66

Non Warning or Non Fault Code Problems ... 67

Temp Setpoint ... 67
Stop Button ... 68
Control panel LED's ... 69
No automatic start ... 70
No start / No bleed ... 71
No standby ... 72
Battery not fully charging ... 73
No automatic stop ... 74
Exhaust howling noise ... 75

Wiring Diagram for PSS16 12MD / PSS16 24MD ... 76

Introduction

Whisper Tech Ltd. reserves the right to revise and improve its products as it sees fit. This publication describes the state of this product at the time of its publication and may not reflect the product at all times in the future.

This manual applies to the following WhisperGen™ systems manufactured by Whisper Tech Ltd New Zealand 5000, 3000, and 7000 series WhisperGen PPS16-12MD and PPS16-24MD.

This Manual should be used in conjunction with the User's Manual and the Installation and Commissioning Manual.

Engine Numbering

Engine Serial Numbers

12 and 24V	5000 to 5034
12V	3000 onwards
24V	7000 onwards

Engine number coding

The full engine number is stamped on the front right hand side of the engine block.

All of the 5000 series and the early 3000 and 7000 series have the full engine number stamped on the back left had side of the engine block.

Based on the following example the engine code is;

M 4 08 5005 01 5

M	=	Marine system, (R = RAPS, C = MCHP)
4	=	24VDC, (2 = 12VDC, 3 = 230VAC, 1 = 110VAC)
08	=	Month (August)
5005	=	Engine Serial Number
01	=	Year (2001)
5	=	Batch No. (M5)

Occasionally, you may encounter an "R1 01 00" (as an example) stamped below the main engine stamp. In this case it indicates the first rebuild (R1) occurred first month (01) of the year 2000 (2000).

Sequence of Operation

This section details the sequence of events that the WhisperGen™ goes through during a normal start, run and stop from the push of the start button through to the WhisperGen™ going into Standby after the stop button has been pushed.

IDLE mode [Mode=2.1]

The WhisperGen is in the Standby condition, awaiting a Start signal, and monitoring the battery condition. A Start signal might come from the Start button, or from the WhisperGen's measurements on battery state of charge, or from an external control line.

Whilst in the IDLE mode it also possible to initiate the bleed sequences for air, water and fuel. [Mode=2.2 to 2.6]

STARTUP mode [Mode=3.1 to 3.9]

The WhisperGen has received a Start signal. All LEDs on the control panel are flashed on momentarily. A sequence is begun [Mode=3.1] to 'power up the bus', so the isolate relay can be closed. Battery power is then available for the water pump, fan, glowplug etc. Part of this sequence involves a test to ensure the glowplug is not burned out.

Once the bus is powered up a pre-check is carried out [Mode=3.3] to ensure that electrical conditions are normal then the glowplug is turned on to pre-heat the burner evaporator [Mode=3.4].

When the glowplug has been on long enough, a final no-flame electrical check is carried out then the air and fuel supply to the burner is turned on [Mode=3.5]. Fuel is supplied at maximum rate for a second or so, then dropped back to the standard rate, in order to fill the evaporator reservoir space. The FID signal is monitored for the presence of a flame [Mode=3.6] then after a waiting period for flame stabilization [Mode=3.8] the lambda control system is turned on, to adjust the fuel level based on exhaust oxygen concentration. From this point on [Mode=3.9] the burner runs at a gradually increasing firing rate (increasing air value), until the engine is hot enough to crank.

Part of the startup sequence is a software routine that modifies the starting fuel value slightly, to improve future starts. This 'learning' function will cause the initial StartFuel1 value to move slowly away from its initial value, toward a more optimum value for the engine.

CRANK mode [Mode=4.1 & 4.2]

Once the engine is hot enough, it is cranked [Mode=4.1], then the power output checked over the next short period [Mode=4.2] to ensure it is operating correctly.

RUN mode [Mode=5.1 & 5.2]

Once the engine has commenced running, the heat exchanger washer is turned on [Mode=5.1] in a few short bursts, then stopped [Mode=5.2]. The wash function is repeated every 10 hours.

During the engine run time, burner power level and generator output voltage are controlled to meet heat management and battery charging requirements.

At any stage after startup, a shutdown sequence will be initiated if a shutdown signal is received. This signal may come form the Stop button, from completion of a battery charging cycle, from an external control signal, from expiry of a maximum engine run time, or from detection of a parallel charger operating at a high charging voltage that interacts adversely with the WhisperGen.

SHUTDOWN mode [Mode=6.1 to 6.5]

When a shutdown signal is received, fuel is turned off immediately, and a message displayed on the LCD, either "Normal Shutdown" or an error message [Mode=6.1]. Air is increased to 100% [Mode=6.3] to assist with burner cooling, and the engine is brought to a stop over several minutes [Mode=6.4]. After the engine is stopped, another cooling period [Mode=6.5] allows the engine (exhaust and water circuit) to cool down further, before the fan and water pump are stopped.

At completion of Shutdown, the engine returns to the Idle condition, and is available for restart.

If several faults have occurred with no fault-free runs between, the system enters a Lockout mode [Mode=7.1], which requires manual reset of the fault condition before the engine reverts the Idle condition and can restart.

Battery Charging Operation

At any time that the WhisperGen™ is started for any reason a battery charging cycle is commenced and continued until complete or until the WhisperGen™ is stopped for any reason.

1. The WhisperGen™ runs at full power in Bulk Charge mode until the battery voltage is lifted to the Absorb Voltage as set in the Hidden Service Menu. If the Battery Temperature Sensor is fitted then the Absorb Voltage will vary a little depending on the temperature of the Battery Temperature Sensor.

2. When the battery has been lifted to the Absorb Voltage the WhisperGen™ will then run in Absorption Charge mode holding the battery at the Absorb Voltage by reducing the current going into the battery until the current going into the battery has reduced to the Tail Current set point as set in the Hidden Service Menu. If the Heat Management requirements are met then the WhisperGen™ will also slowly throttle down

3. When the battery is held at the Absorb Voltage and the current going into it has reduced to the Tail Current then the battery cycle is deemed to be complete and depending on the heat management settings the WhisperGen™ will do one of two things. 1 Shuts down and goes to Standby. 2 continue running to meet the Heat Management requirements while holding the battery voltage at the Float Voltage as set in the Hidden Service Menu until a stop signal is received. During this time The WhisperGen™ will throttle up and down to meet the minimum requirements of both the battery voltage and Heat Management.

Heat Management Operation

At any time that the WhisperGen™ is started for any reason a the WhisperGen™ will try and maintain the Coolant Temperature at close to the Temp Setpoint as set in the User Menu. When the Heat Manage function is turned On the WhisperGen™ will continue to run after the battery charging cycle is completed and continued to run maintaining the Coolant Temperature at close to the Temp Setpoint until the WhisperGen™ is stopped for any reason. During this time The WhisperGen™ will throttle up and down to meet the minimum requirements of both the battery voltage and Heat Management. The Coolant Temperature will only ever be held at close to the Temp Setpoint and may be up to 5 to 14 C above it depending on operating conditions.

Sensor Operation

1. Exhaust Temperature Sensor

   The exhaust temperature sensor is a K-type thermocouple mounted in the exhaust gas stream after the burner and just before it goes into the exhaust cooler, it is not the temperature of the exhaust exiting the WhisperGen™ enclosure. The temperature of the exhaust exiting the WhisperGen™ enclosure is usually about 5 to 10 C hotter than the coolant temperature. The exhaust temperature sensor is used by the microprocessor to:

- Determine when to crank the engine during Heatup.
- Determine when to produce an over temperature warning and/or fault at any time.
- Determine when to switch the WhisperGen™ to Standby during Cool Down.
- Determine how long the glow plug needs to be on before turning on the fuel to the burner.
- Determine when to switch off the glow plug after the burner has successfully started.
- Determine how much air needs to go through the burner when igniting the burner.
- Control the maximum exhaust temperature to not more than the ExhaustSetpt (exhaust temperature set point currently 480 C). 480 C is not the normal maximum running temperature and most systems run well below (about 400 to 460 C) this when the fan is on 100%.

2. Exhaust Heat Exchanger Thermal Switch Block

- The exhaust heat exchanger thermal switch block contains both a self-resetting normally closed 100 C thermal switch and a 150 C thermal fuse. It is mounted on the bottom left hand side of the exhaust heat exchanger.
- The exhaust heat exchanger thermal switch block is one of the 4 microprocessor independent thermal cut out switches that are used to cut off the fuel supply by removing the supply voltage to the fuel pump should an over temperature situation occur.
- Should the thermal fuse blow then the exhaust heat exchanger thermal switch block must be replaced.

3. Fan Thermal Switch (Internal Ambient Thermal Switch)

- The fan thermal switch is a self-resetting normally closed 100 C thermal switch and is mounted on the burner fan guard.
- The fan thermal switch is one of the 4 microprocessor independent thermal cut out switches that are used to cut off the fuel supply by removing the supply voltage to the fuel pump should an over temperature situation occur.

4. Oxygen Sensor (O2 Sensor)

- The oxygen sensor measures the amount of oxygen in the exhaust gas stream and is mounted on the top of the exhaust cooler from the left-hand side.
- The oxygen sensor is used by the microprocessor to control the air to fuel ratio (mixture) in the burner.
- The oxygen sensor plays no part in the initial ignition of the burner during start up.
- During the initial starting of the burner the air rate and the fuel rate remain constant until the end of the Stabilize period.
- It is only used to control the mixture from the end of the Stabilize period through to the shut down sequence being activated.

5. FID Sensor

- The FID (Flame Ionization Detector) is an insulated electrode that protrudes into the flame and detects when the flame is present. It is mounted to the evaporator on the top of the burner. The FID is used by the microprocessor to:
  - Determine no flame is present prior to ignition.
  - Determine that ignition has taken place and that a flame is present during start up and operation of the burner.

6. Coolant Temperature Sensor

- The coolant temperature sensor is a small "potted" temperature sensing integrated circuit, which is mounted into the coolant circuit where the coolant exits the engine block. The coolant temperature sensor is used by the microprocessor to:
  - Control the coolant temperature to close to the Temp Setpoint.
  - Shut the WhisperGen™ down if the coolant temperature reaches the over temperature alarm set point (Currently 84 C).
  - Turn on all pumps and the fan when the coolant temperature is higher than the over temperature alarm set point.

7. Coolant Temperature Switch

- The coolant temperature switch is a self-resetting normally closed 95 C thermal switch, which is mounted into the coolant circuit where the coolant enters the engine block.
- The coolant temperature switch is one of the 4 microprocessor independent thermal cut out switches that are used to cut off the fuel supply by disconnecting the electrical supply to the fuel pump should an over temperature situation occur.

8. Fan Tacho

- The Fan tacho measures the speed of the burner fan. The fan tacho is used by the microprocessor to determine that the burner fan is rotating.

9. Battery temperature sensor

- The Battery temperature sensor measures the battery temperature to compensate the absorption voltage with regard to temperature when the battery is being charged.

10. Battery current shunt

- The current shunt measures the current going into and coming out of the battery. This measurement is used to keep track of the state of charge of the battery.

Controlled Components

1. Burner Fan

The burner fan is a Pulse Width Modulation (PWM) speed controlled fan. Its speed of operation is controlled by the WhisperGen™ microprocessor. When the WhisperGen™ is required to produce more power the speed of the burner fan is increased. If the WhisperGen™ is required to produce less power or the exhaust temperature is going to exceed the exhaust temperature set point then the speed of the burner fan is decreased. Normal operation range is 10 to 100% as required to meet the above conditions.

2. Fuel Pump

The fuel pump is a piston / solenoid type positive displacement pump. Its speed of operation is controlled by the WhisperGen™ microprocessor. When the oxygen content in the exhaust increases above the set point the speed of the fuel pump is increased. When the oxygen content in the exhaust decreases below the set point the speed of the fuel pump is decreased. Normal operating frequency is between 2 and 16 Hz. If the fuel pump is ever required to operate above 15Hz then the speed of the burner fan will begin to decrease until the fuel pump frequency is below 15 Hz.

3. Flushing Valve

The flushing valve is a solenoid operated on/off water valve and is used to control the flow of fresh water to the flushing nozzle in the top of the exhaust cooler. It is controlled by the WhisperGen™ microprocessor and opened and closed:

- For 10 seconds just after the WhisperGen™ has cranked
- For 10 seconds 1 minute after the WhisperGen™ has cranked
- Repeated once every 10 hours if the WhisperGen™ is running continuously

4. Primary Coolant Pump

The primary coolant circulation pump is usually a small centrifugal type circulation pump. The power supply to this pump is from the battery but it also a has a diode feed directly from the WhisperGen™ alternator so that even if the WhisperGen™ is disconnected from the battery while it is running the pump will continue to run while the WhisperGen™ is rotating. The primary coolant pump is turned on as the WhisperGen™ powers up after receiving a signal to start. It is turned off when the WhisperGen™ goes into standby after receiving a signal to stop.

5. Secondary Coolant Pump or Heat Dump Fan

Marine systems

The secondary coolant pump (marine water) is usually a small centrifugal circulation pump or a membrane positive displacement pump which pumps marine water through one side of the marine heat exchanger inside the WhisperGen™ enclosure and then back out into the marine water. The secondary coolant pump's speed is Pulse Width Modulation (PWM) speed controlled by the WhisperGen™ microprocessor to maintain the coolant temperature close to the coolant temperature set point.

Mobile or land based systems

The heat dump fan is usually an automotive type electrical radiator fan bolted to an appropriately sized radiator.

The heat dump fan's speed is a Pulse Width Modulation (PWM) speed controlled by the WhisperGen™ microprocessor to maintain the coolant temperature close to the coolant temperature set point.

Either the secondary coolant pump or the heat dump fan is connected to the same terminal on the side of the WhisperGen™ electronic enclosure. There is no selection of the fan or the pump to be made when commissioning the WhisperGen™.

6. Auxiliary Heater (if fitted)

The WhisperGen™ controls a set of contacts that can be used to control an ancillary water heater connected in series with the WhisperGen™. The ancillary heater is only turned on if the heat management option has been selected on and if only if it is required.

Warning Codes (numbered from 102 to 199)

One Warning is shown per page in the following format:

- The Warning number and message displayed.
- The definition of the Warning as the WhisperGen™ microprocessor sees it.
- During which Mode this Warning can be produced.
- A further clarification of the Warning condition if needed.
- Possible causes of the Warning.
- Possible ways to fix the cause of the Warning.

All Warnings are conditions that are registered by the WhisperGen™ microprocessor and are described in this section, as is the action to take to correct the Warning. The possible causes of the Warning's are listed in order of likelihood.

All variables used by the WhisperGen™ microprocessor are written/spelt as they are in the variable screen of Micromon.

102 Texhaust

Texhaust has been greater than ExhaustAlarm-15 for at least 1 second.

Warning occurs anytime during engine operation.

Although the WhisperGen™ microprocessor will always try and keep Texhaust below the ExhaustSetpt under certain abnormal conditions it will not be able to back the burner fan off fast enough to stop the exhaust temperature reaching the alarm level. The ExhaustAlarm is currently set at 545 C giving a warning at 530 C.

Possible Causes

1. Low nitrogen gas pressure.
2. Oxygen sensor reading may have drifted giving a very rich mixture.
3. Faulty exhaust temperature sensor.
4. The top burner ceramic rope is leaking.

Possible Fixes

1. Top up with nitrogen gas to the recommended filling pressure for that series of WhisperGen™.
2. Check oxygen sensor fresh air reading and if below 1300 or above 2500 then replace. If fresh air reading, nitrogen gas pressure and exhaust temperature sensor are ok and problem still exists then replace any way. After the WhisperGen™ has been running for at least 20 minutes and if you have a combustion analyzer then check that the excess air reading is around 9.5% O2. This is equivalent to an 80% + - 10% excess air reading. The mixture can be adjusted to a limited extent by adjusting the O2Runfact in the "hidden menu" on the control panel. A smaller number makes the mixture richer.
3. Replace exhaust sensor.
4. Remove the burner and check the seal. Note that any time the burner is removed the top burner ceramic rope seal must be replaced.

104 Tblock

Tblock has been greater than BlockAlarm-3 for more than 1 second.

Warning occurs anytime during engine operation.

Tblock is actually the temperature of the coolant measured just after it exits the engine block and before it enters the exhaust cooler. The BlockAlarm is currently set at 84 C giving a Warning at 81 C.

Possible Causes

1. The secondary coolant pump is not pumping enough water maybe because the intake or circuit is blocked or partially obstructed or it maybe air locked.
2. The secondary coolant water intake is not submerged.
3. The secondary coolant pump has not primed after the intake was out of the water.
4. The primary or secondary coolant sides of the marine heat exchanger are partially or fully obstructed. Note that both the primary and secondary sides of the marine heat exchanger can be 2/3rds blocked but still have a large amount of coolant flowing through them. This is because there are 3 parallel paths through the marine heat exchanger for both the primary and secondary coolant and two of them could be blocked.
5. The wires to the primary or secondary coolant pump are broken or disconnected.
6. The secondary coolant intake water is above 40 C.
7. Faulty temperature sensor.

Air-cooled systems (Possible Causes)

The above may apply along with:

8. The radiator air passages are blocked.
9. The fan is not working.
10. The fan and/or radiator is too small.
11. The ambient air temperature is above 40 C.

Possible Fixes

1. Check the flow rate through the secondary coolant circuit. It should be greater than 4 liters per minute.
2. Make sure that the inlet is submerged when the error occurs.
3. Make sure that the pump is self priming or that any air that collects in the intake to the pump can escape.
4. If the flow rate through both the primary (greater than 4 liters per minute) and the secondary are sufficient then remove the marine plate heat exchanger from inside the WhisperGen™ and disassemble and check for blockage.
5. Check wires for continuity and or voltage.
6. Make sure that the secondary coolant outlet is not feeding back into the inlet.
7. Replace coolant temperature sensor

Air-cooled systems (Possible Fixes)

8. Clean air passages.
9. Make sure that the fan has power to it and that it working order.
10. Make sure that the fan and radiator combination are rated to transfer 6 Kw of heat into the air with a coolant temperature of 70 C and an air temperature of 40 C.
11. If running the WhisperGen™ in ambient air temperatures greater than 40 C then a larger fan and radiator combination may be needed.

107 Tpcb

Tpcb has been greater than 75 for more than 1 second.

Warning occurs anytime during engine operation.

Tpcb is the temperature measured on the main electronics board by a small temperature sensing integrated circuit.

Possible Causes

1. The air ducts on the back of the heat sink on the back of the WhisperGen™ electronics module is blocked or partially blocked.
2. The air inlet holes on the bottom of the WhisperGen™ electronics module are blocked or partially blocked.
3. The WhisperGen™ is being run at ambient air temperatures that are too high. Rated to 40 C.
4. The airflow under the bottom of the WhisperGen™ is obstructed.
5. The WhisperGen™ has been running with the enclosure lid off.
6. The enclosure lid rubber seal is badly damaged.
7. Faulty temperature sensor.
8. Some electronic components in the electronics module failed creating heat.

Possible Fixes

1. Unscrew electronics module mounts and then clean fins and passageway to fins.
2. Unscrew electronics module mounts and then clean holes and passageway to holes.
3. Reduce the ambient air temperature.
4. Remove the obstruction from under WhisperGen™.
5. Re-fit the enclosure lid.
6. Re-place the rubber seal.
7. Replace the electronics module.
8. Replace the electronics module.

126 Hot Reset

Engine is hot and might be running.

Warning occurs when the controller is restarted, and the engine temperatures are already high (exhaust temperature higher than TopCool, block temperature is higher then BlockAlarm, or the engine actually running). Controller reset under these conditions is abnormal.

Possible causes

1. A bad connection in comms cable between control panel and controller

Possible fixes

1. Replace comms cable between control panel and controller.

135 Vbattery

Vbattery is less than 10 Volts for 12 Volt WhisperGen™'s or 20 Volts for 24 Volt WhisperGen™'s for more than 1 second.

Warning occurs during "STARTUP". [Mode=3.1]

The battery voltage (Vbattery) is measured at the battery using the battery voltage sense leads.

Possible Causes

1. The battery is flat.
2. There is a very large load being applied to the battery, which is causing the battery voltage to drop below the allowed limit.
3. The battery voltage sense wires have a bad or no connection to the battery.
4. The fuse in the battery voltage sense wire has blown.
5. There is a very bad connection in the battery cables between the battery and the WhisperGen™.

Possible Fixes

1. Charge the battery.
2. Reduce the electrical load and or charge the battery.
3. Fix the broken or poor connection.
4. Replace the fuse and check the sense wire for chaffing between the fuse and the WhisperGen™.
5. Fix the bad connection.

182 Vbattery

Vbattery is more than 0.55Volts less than Vbus for more than 1 second.

Warning occurs during "Charging". Mode 2 and higher.

This results in electrical energy being lost and wasted (>30W) and may also result in the WhisperGen™ not being able to lift the battery right up to the Absorption voltage.

Possible Causes

1. Bad connections on the battery cables between the terminals on the inside of the WhisperGen™ electronics enclosure and the batteries.
2. Bad connection in the battery voltage sense wire.
3. Use of battery cables that are too long or too small in cross-sectional area.

Possible Fixes

1. Check the voltage drop across all connections and switches etc.
2. Fix the broken or bad connection.
3. Use the recommended minimum cable size and maximum length for battery cables.

183 Tbattery

Tbattery is greater than 48 C.

Warning occurs during "Charging". Mode 2 and higher.

The battery temperature sensor which is fitted to the negative battery terminal registers that the battery temperature is getting close to the maximum normally recommended maximum temperature for batteries.

Possible Causes

1. There is an internal fault with the battery.
2. There is not enough fresh air circulating around the batteries.
3. The batteries are being operated in an environment that is just too hot.
4. The batteries are being charged or discharged to rapidly for there size.
5. The sensor is reading incorrectly.

Possible Fixes

1. Replace the battery.
2. Increase the air circulation around the batteries.
3. Cool the batteries down some how or stop charging or discharging them.
4. Reduce the current going into or out of the batteries.
5. Replace the sensor.

190 V_error

V_error is greater than 0.2 for 12 Volt WhisperGen™'s or 0.4 Volts for 24 Volt WhisperGen™'s for more than 1 second.

Warning occurs during "VOLTCONTROL". [Mode=3]

Verror is a time-averaged difference between Vbattery and Vcontrol which is the set point for the battery voltage during absorption and float charging. If this error gets too big, then this is because the clamp controller is not capable of controlling the battery voltage.

Possible Causes

1. High power WhisperGen™ running at full power due to high heat demand but very low electrical demand and clamp element is not able to dump all the electrical power at the set float voltage.
2. Faulty clamp element.
3. Faulty control electronics.

Possible Fixes

1. Reduce the power the WhisperGen™ by setting a leaner fuel mixture or add some DC load.
2. Replace clamp element.
3. Replace the electronics.

195 Ah

Ah is more negative than (MaxDisch% + 0.15)*Battsize for more than 1 second. ie the battery has been discharged 15% more than the "commissioner" set auto charge level.

Warning occurs at anytime.

Possible Causes

1. The Auto-charge function is not turned on and the WhisperGen™ was not manually started before the alarm level was reached.
2. The WhisperGen™ has started but the current draw from the batteries is higher than what the WhisperGen™ can produce. (This may be normal operation for some systems).
3. The WhisperGen™ may have failed to start for some other reason and during the time that the WhisperGen™ has not been running the battery has discharged enough to trigger the alarm. When the original fault is cleared this warning immediately comes up.

Possible Fixes

1. Turn on the Auto-charge function.
2. Reduce the electrical load if the WhisperGen™ is never going to keep up and the batteries are just going to go flat or start up another battery charger.
3. Start WhisperGen™ and/or another battery charger.

Fault Codes (numbered from 2 to 99)

One Fault is shown per page in the following format:

- The Fault number and the message displayed on the WhisperGen™ control panel.
- The definition of the Fault as the WhisperGen™ microprocessor sees it.
- During what Mode this Fault can be produced.
- A further clarification of the Fault condition if needed.
- Possible causes of the Fault.
- Possible ways to fix the cause of the Fault.

All Faults are conditions that are registered by the WhisperGen™ microprocessor and are described in this section, as is the action to take to correct the Fault. The possible causes of the Fault's are listed in order of likelihood.

All variables used by the WhisperGen™ microprocessor are written/spelt as they are in the variable screen of Micromon and are shown in Italics.

Note that in a lot of cases a loose wire to a sensor may be the cause of a fault and the wiring in all cases should be considered as a possible cause of the fault.

Most alarm conditions have to be present for at least 5 seconds before they register as alarms and cause engine shutdown. Exceptions are some checks made at a specific point in the startup sequence, eg the no-flame check of the FID signal before fuel is started. Once the engine is running however, no abnormal conditions of less than 5 seconds duration will be registered.

2 Exh overtemp

Texhaust has been greater than ExhaustAlarm for >5 seconds.

Fault occurs anytime during engine operation.

Although the WhisperGen™ microprocessor will always try and keep Texhaust below the ExhaustSetpt under certain abnormal conditions it will not be able to back the burner fan off fast enough to stop the exhaust temperature reaching the alarm level. The ExhaustAlarm is currently set at 545 C giving a warning at 530 C.

Possible Causes

1. Low nitrogen gas pressure.
2. Oxygen sensor reading may have drifted giving a very rich mixture.
3. Faulty exhaust temperature sensor.
4. The burner may have been lifted off its inner burner seal.

Possible Fixes

1. Top up with nitrogen gas to the recommended filling pressure for that series of WhisperGen™.
2. Check oxygen sensor fresh air reading and if below 1300 or above 2500 then replace. If fresh air reading, nitrogen gas pressure and exhaust temperature sensor are ok and problem still exists then replace any way. After the WhisperGen™ has been running for at least 20 minutes and if you have a combustion analyzer then check that the excess air reading is around 9.5% O2. This is equivalent to an 80% + - 10% excess air reading. The mixture can be adjusted to a limited extent by adjusting the O2Runfact in the "hidden menu" on the control panel. A smaller number makes the mixture richer.
3. Replace exhaust sensor.
4. Remove the burner and replace the braded rope ceramic burner seal. This must always be replaced when removing the burner.

4 Block overtemp

Tblock has been greater than BlockAlarm for more than 5 seconds.

Fault occurs anytime during engine operation.

Tblock is actually the temperature of the coolant measured just after it exits the engine block and before it enters the exhaust cooler. The BlockAlarm is currently set at 84 C giving a Warning at 81 C.

Possible Causes

1. The secondary coolant pump is not pumping enough water maybe because the intake or circuit is blocked or partially obstructed or it may be air locked.
2. The secondary coolant water intake is not submerged.
3. The secondary coolant pump has not primed after the intake was out of the water.
4. The primary or secondary coolant sides of the marine heat exchanger are partially or fully obstructed. Note that both the primary and secondary sides of the marine heat exchanger can be 2/3rds blocked but still have a large amount of coolant flowing through them. This is because there are 3 parallel paths through the marine heat exchanger for both the primary and secondary coolant and two of them could be blocked.
5. The wires to the primary or secondary coolant pump are broken or disconnected.
6. The secondary coolant intake water is above 40 C.
7. Faulty temperature sensor.

Air-cooled systems (Possible Causes)

The above may apply along with:

8. The radiator air passages are blocked.
9. The fan is not working.
10. The fan and/or radiator is to small.
11. The ambient air temperature is above 40 C.

Possible Fixes

1. Check the flow rate through the secondary coolant circuit. It should be greater than 4 litres per minute.
2. Make sure that the inlet is submerged when the error occurs.
3. Make sure that the pump is self-priming or that any air that collects in the intake to the pump can escape.
4. If the flow rate through both the primary (greater than 4 liters per minute) and the secondary are sufficient then remove the marine plate heat exchanger from inside the WhisperGen™ and disassemble and check for blockage.
5. Check wires for continuity and or voltage.
6. Make sure that the secondary coolant outlet is not feeding back into the inlet.
7. Replace coolant temperature sensor.

Air-cooled sytems (Possible Fixes)

8. Clean air passages.
9. Make sure that the fan has power to it and that it working order.
10. Make sure that the fan and radiator combination are rated to transfer 6 Kw of heat into the air with a coolant temperature of 70 C and an air temperature of 40 C.
11. If running the WhisperGen™ in ambient air temperatures greater than 40 C then a larger fan and radiator combination may be needed.

6 Heatsink overtemp

HeatsinkTemp is greater than 95 C for >5 seconds.

Fault occurs anytime during engine operation.

Possible Causes

1. The air ducts on the back of the heat sink on the back of the WhisperGen™ electronics module are blocked.
2. The air ducts into the electronics module are blocked.
3. The WhisperGen™ is operating in an ambient air temperature of greater that 40 C.
4. The airflow under the bottom of the WhisperGen™ is obstructed.
5. The WhisperGen™ has been running with the enclosure lid off.
6. The enclosure lid rubber seal is badly damaged.
7. Faulty temperature sensor.
8. Some electronic components attached to the heat sink have failed creating heat.

Possible Fixes

1. Unblock the air ducts to the heat sink.
2. Unblock the air ducts to the electronics module.
3. Reduce the ambient air temperature.
4. Remove the obstruction from under WhisperGen™.
5. Re-fit the enclosure lid.
6. Re-place the rubber seal.
7. Replace the electronics module.
8. Replace the electronics module.

7 Electronics too hot

Tpcb is greater than 80 C for >5 seconds.

Fault occurs anytime during engine operation.

Tpcb is the temperature measured on the main electronics board by a small temperature sensing integrated circuit.

Possible Causes

1. The air ducts on the back of the heat sink on the back of the WhisperGen™ electronics module are blocked.
2. The air ducts into the electronics module are blocked.
3. The WhisperGen™ is operating in an ambient air temperature of greater than 40 C.
4. The airflow under the bottom of the WhisperGen™ is obstructed.
5. The WhisperGen™ has been running with the enclosure lid off.
6. The enclosure lid rubber seal is badly damaged.
7. Faulty temperature sensor.
8. Some electronic components in the electronics module failed creating heat.

Possible Fixes

1. Unblock the air ducts to the heat sink.
2. Unblock the air ducts to the electronics module.
3. Reduce the ambient air temperature.
4. Remove the obstruction from under WhisperGen™.
5. Re-fit the enclosure lid.
6. Re-place the rubber seal.
7. Replace the electronics module.
8. Replace the electronics module.

12 Air supply failed

BlowerTaco not between 4 and 150 for >5 seconds.

Fault occurs anytime during engine operation.

During normal operation of the burner fan there is a signal from it to indicate that it is going around.

Possible Causes

1. There is something obstructing the burner fan from going around.
2. The burner fan is defective.

Possible Fixes

1. Remove obstruction.
2. Replace burner fan.

14 O2 sensor failure

O2value not between 200 and 2500 for at least 120 seconds.

Fault occurs anytime during engine operation.

The reading from the oxygen sensor is outside its normal operating.

Possible Causes

1. The exhaust pipe has been obstructed while the burner is operating causing a very rich mixture in the burner.
2. A large air / vapor bubble has passed through the fuel pump or burner.
3. The oxygen sensor is defective.

Possible Fixes

1. Remove or stop obstruction from occurring during burner operation.
2. Use the correct size of fuel line to ensure that bubbles do not collect in it.
3. Replace the oxygen sensor.

16 Fuse/DaisyCh fail

Fault occurs anytime during engine operation.

This fault occurs when either the Daisy Chain safety circuit has been cut or an electrical fuse has blown, after a delay of 5 seconds.

Note:

- The Daisy Chain is a safety back up system that is independent of the WhisperGen™'s microprocessor control system and on no account should the thermal switches or thermal fuses be bypassed.
- That if this fault occurs while the WhisperGen™ is running but is not present after the WhisperGen™ has cooled down then it is most likely to be a self-resetting thermal switch opened and then closed again.
- The continuity of the whole Daisy Chain circuit can be checked by removing the J5 connector in the electronics enclosure and checking the continuity between pin 1 (red wire) and pin 2 (brown wire) on the yellow plug.

Possible Cause

1. An electrical fuse has blown.
2. The self-resetting thermal switch on the engine block has opened or is defective. (Opens at about 95 C and closes at about 91 C).
3. The self-resetting thermal switch on the burner fan has opened or is defective. (Opens at about 100 C and closes at about 96 C).
4. The self-resetting thermal switch in the thermal switch/fuse block on the bottom of the exhaust cooler has opened or is defective. (Opens at about 100 C and closes at about 96 C).
5. The one time only thermal fuse in the thermal switch/fuse block on the bottom of the exhaust cooler has blown. (Blows at about 150 C).
6. There is a loose or bad connection in the Daisy Chain circuit.

Possible Fixes

1. Ensure that none of the electrical fuses have blown.
2. Ensure that both the primary and secondary coolant circuits are flowing and that the heat exchanger is not partially blocked. Replace thermal switch if defective.
3. Ensure that both the primary and secondary coolant circuits are flowing and that the heat exchanger is not partially blocked. Replace thermal switch if defective. Check that the red silicon rubber burner seal is in place and is not leaking. Check that no high temperature exhaust gases are leaking from the around the Evaporator and exhaust cooler. Check that the ambient air temperature around the WhisperGen™ is below 40 C.
4. Ensure that both the primary and secondary coolant circuits are flowing and that the heat exchanger is not partially blocked. Replace thermal switch/fuse block if defective.
5. Ensure that both the primary and secondary coolant circuits are flowing and that the heat exchanger is not partially blocked. Replace thermal switch/fuse block if defective.
6. Ensure that there are no bad connections in the Daisy Chain.

18 Low battery volts

Vbattery is less than: 8 volts for 12 Volt WhisperGen™'s, and 16 volts for 24 Volt WhisperGen™'s at power-up.

Possible Causes

1. The battery is flat.
2. There is a very large load being applied to the battery, which is causing the battery voltage to drop below the allowed limit.
3. The battery voltage sense wires have a bad or no connection to the battery.
4. The fuse in the battery voltage sense wire has blown.
5. There is a very bad connection in the battery cables between the battery and the WhisperGen™.

Possible Fixes

1. Charge the battery.
2. Reduce the electrical load and or charge the battery.
3. Fix the broken or poor connection.
4. Replace the fuse and check the sense wire for chaffing between the fuse and the WhisperGen™.
5. Fix the bad connection.

19 High batt volt

Vbattery is higher than: 18 volts for 12 Volt WhisperGen™'s, and 36 volts for 24 Volt WhisperGen™'s at power-up.

Possible Causes

1. Incorrectly wired battery bank giving higher than 18 Volts.
2. Faulty battery voltage sensing.
3. 12V WhisperGen connected to 24V battery.

Possible Fixes

1. Correctly wire battery bank.
2. Check battery voltage sensing wire to WhisperGen™ or replace electronics.
3. Connect 24V WhisperGen to 24V battery.

20 Bus not charged

Vbus has not reached Vbattery - 1.75V.

Fault occurs during WAKEUP, Mode 1.3 when the engine is hot and attempts to power up in order to cool down.

Possible Causes

1. The clamp element has a low resistance path to earth.
2. The glow plug relay is stuck on.
3. The Power relay is stuck on.

Possible Fixes

1. When the WhisperGen™ is in Standby and all other loads disconnected from the battery, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage. Remove both Clamp Element wires from the terminals in the Electronic Module and then note the Bus Voltage. If the bus voltage rises more than 0.5V then the Clamp Element has a low resistance path to earth and should be replaced. Check the above a few times and make certain that it is the problem.

2. When the WhisperGen™ is in Standby and all other loads disconnected, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage and then remove the Glow Plug wire from the glow plug. If the Bus Voltage increases by more than 0.5V then it is likely that the Glow Plug relay is stuck on. Try tapping the relays in the electronics module until the Bus Voltage does not drop when the Glow Plug wire is connected.

3. Check for a stuck power relay by measuring the DC voltage at the auxiliary DC output. If it is the same as the bus voltage when the WhisperGen is in the Idle state, it is likely that the Power relay is stuck on. Try tapping the relays in the electronics module.

24 Isolator open

Vbus has not reached Vbattery - 0.35V, 2 seconds after turning on the Isolator.

Fault occurs during WAKEUP, Mode 1.3 when the engine is hot at power-up and is attempting to cool down.

Possible Causes

1. Isolate relay is not operating.

Possible Fixes

1. Try tapping relay with screwdriver handle, or replace the electronics.

30 Low battery volts

Vbattery is less than 8V for 12 Volt WhisperGen™ systems or less than 16V for 24 Volt WhisperGen™ systems, for more than 5 seconds.

Fault occurs during "STARTUP". [Mode=3]

Possible Causes

1. The battery is flat.
2. There is a very large load being applied to the battery, which is causing the battery voltage to drop below the allowed limit.
3. The battery voltage sense wires have a bad or no connection to the battery.
4. The fuse in the battery voltage sense wire has blown.
5. There is a very bad connection in the battery cables between the battery and the WhisperGen™.

Possible Fixes

1. Charge the battery.
2. Reduce the electrical load and or charge the battery.
3. Fix the broken or poor connection.
4. Replace the fuse and check the sense wire for chaffing between the fuse and the WhisperGen™.
5. Fix the bad connection.

32 Bus not charged

Vbus has not reached 7.2V for a 12V system or 14.4V for a 24V system within 30 seconds of the glowplug being turned off after it had been turned on for a few seconds to discharge the bus.

Fault occurs during "STARTUP". [Mode=3.1]

Possible Causes

1. The clamp element has a low resistance path to earth.
2. The glow plug relay is stuck on.

Possible Fixes

1. When the WhisperGen™ is in Standby and all other loads disconnected from the battery, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage. Remove both Clamp Element wires from the terminals in the Electronic Module and then note the Bus Voltage. If the bus voltage rises more than 0.5V then the Clamp Element has a low resistance path to earth and should be replaced. Check the above a few times and make certain that it is the problem.

2. When the WhisperGen™ is in Standby and all other loads disconnected, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage and then remove the Glow Plug wire from the glow plug. If the Bus Voltage increases by more than 0.5V then it is likely that the Glow Plug relay is stuck on. Try tapping the relays in the electronics module until the Bus Voltage does not drop when the Glow Plug wire is connected.

34 Isolator stuck on

Vbus has not dropped below 7V within 30 seconds of turning the Glowplug and the Power relay on.

Fault occurs during "STARTUP". [Mode=3.1]

Possible Causes

1. The Isolator relay is stuck in the closed position.

Possible Fixes

1. Try tapping relay with screwdriver handle, or replace the electronics.

35 Low battery volts

Vbattery is less than 8V for 12 Volt WhisperGen™'s or less than 16V for 24 Volt WhisperGen™'s for more than 1 second.

Fault occurs during "STARTUP". [Mode=3.1]

Possible Causes

1. The battery is flat.
2. There is a very large load being applied to the battery, which is causing the battery voltage to drop below the allowed limit.
3. The battery voltage sense wires have a bad or no connection to the battery.
4. The fuse in the battery voltage sense wire has blown.
5. There is a very bad connection in the battery cables between the battery and the WhisperGen™.

Possible Fixes

1. Charge the battery.
2. Reduce the electrical load and or charge the battery.
3. Fix the broken or poor connection.
4. Replace the fuse and check the sense wire for chaffing between the fuse and the WhisperGen™.
5. Fix the bad connection.

36 Glowplug cct flt

Vbus has not dropped below 7V within 30 seconds of the Glowplug being turned on.

Fault occurs during "STARTUP". [Mode=3.1]

Possible Causes

1. The glow plug has burnt out.
2. The glow plug fuse has blown.
3. There is a bad connection between the electronics and the glow plug.
4. There is an electronic failure.

Possible Fixes

1. Replace the glow plug and check the glow plug fuse for failure.
2. Replace the glow plug fuse and check the glowplug for failure.
3. Check the continuity from the connection at the electronics through to the glowplug.
4. Replace the electronics.

38 Bus not charged

Vbus has not reached Vbattery - 1.75v within 30 seconds of the glowplug being turned off after it had been turned on for a few seconds to discharge the bus.

Fault occurs during "WAKEUP" [Mode=3.1]

Possible Causes

1. The clamp element has a low resistance path to earth.
2. The glow plug relay is stuck on.

Possible Fixes

1. When the WhisperGen™ is in Standby and all other loads disconnected from the battery, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage. Remove both Clamp Element wires from the terminals in the Electronic Module and then note the Bus Voltage. If the bus voltage rises more than 0.5V then the Clamp Element has a low resistance path to earth and should be replaced. Check the above a few times and make certain that it is the problem.

2. When the WhisperGen™ is in Standby and all other loads disconnected, Vbus (Bus Voltage) should always be about 0.6V less than Vbattery. With the WhisperGen™ in Standby note the Bus Voltage and then remove the Glow Plug wire from the glow plug. If the Bus Voltage increases by more than 0.5V then it is likely that the Glow Plug relay is stuck on. Try tapping the relays in the electronics module until the Bus Voltage does not drop when the Glow Plug wire is connected.

40 Isolator open

Vbus has dropped below 7V after the Glowplug is turned on for the preheating of the evaporator.

Fault occurs during "Preheat" [Mode=3.4]

Possible Causes

1. Isolate relay has malfunctioned.

Possible Fixes

1. Replace electronics if this fault recurs.

44 Fuel sense fail

The supply voltage to the fuel pump is on when it should not be.

Fault occurs during "STARTUP". [Mode=3.3]

Possible Cause

1. Fuel pump relay is stuck in the closed position.
2. Electronics failure.

Possible Fixes

1. Try tapping relay with screwdriver handle, or replace the electronics.
2. Replace electronics.

44 Fuel sense fail

The supply voltage to the fuel pump is on when it should not be.

Fault occurs during "STARTUP". [Mode=3.3]

Possible Causes

1. Fuel pump relay is stuck in the closed position.
2. Electronics failure.

Possible Fixes

1. Try tapping relay with screwdriver handle, or replace the electronics.
2. Replace electronics.

46 Flame sense fail

FIDcurrent is greater than 0.05 for more than 1 sec.

Fault occurs during "STARTUP". [Mode=3.3]

Possible Causes

1. There is a flame present in the burner before the fuel has been turned on.
2. The FID circuit is receiving some interference from something.
3. The FID circuit has failed in the electronics.

Possible Fixes

1. Ensure that there is no fuel in the burner before the fuel pump is turned on.
2. Check the FID current reading while the glow plug is on and is pre-heating the burner before the fuel is turned on. The actual FID reading should be between 0.00 and 0.05. If it is dancing around and is sometimes above 0.05 then it is likely receiving interference from something. Check electrical and electronic equipment in the area (such as radio transmitters) and turn off if necessary.
3. Check the FID current reading while the glow plug is on and is pre-heating the burner before the fuel is turned on. If there is a constant reading above 0.05 then it is likely that there is a fault with the electronic circuit and if this condition can be repeated then the electronics module should be replaced.

48 Drive bridge fail

The BridgeRunning signal is present before the WhisperGen has been cranked.

Fault occurs during "STARTUP". [Mode=3.3]

Possible Causes

1. Electronic failure.

Possible Fixes

1. Replace electronics.

52 Fuel supply fail

The supply voltage to the fuel pump has not been sensed 3 seconds after it was turned on.

Fault occurs during "No-flame check". [Mode=3.5]

Possible Causes

1. The electronics are faulty.

Possible Fixes

1. Replace the electronics.

54 Flame sense fail

FIDcurrent is greater than 0.05 for more than 1 sec.

Fault occurs during "No-flame check". [Mode=3.5]

Possible Causes

1. There is a flame present in the burner before the fuel has been turned on.
2. The FID circuit is receiving some interference from something.
3. The FID circuit has failed in the electronics.

Possible Fixes

1. Ensure that there is no fuel in the burner before the fuel pump is turned on.
2. Check the FID current reading while the glow plug is on and is pre-heating the burner before the fuel is turned on. The actual FID reading should be between 0.00 and 0.05. If it is dancing around and is sometimes above 0.05 then it is likely receiving interference from something. Check electrical and electronic equipment in the area (such as a radio transmitter) and turn off if necessary.
3. Check the FID current reading while the glow plug is on and is pre-heating the burner before the fuel is turned on. If there is a constant reading above 0.05 then it is likely that there is a fault with the electronic circuit and if this condition can be repeated then the electronics module should be replaced.

56 O2 sensor fail

O2value is not between 1300 and 2500 for more than 1 second

Fault occurs during "No-flame check". [Mode=3.5]

The fresh air reading of the oxygen sensor is outside the above limits. During the pre-heat period when the glow plug is on the burner fan is also on at a low speed blowing fresh air through the burner and over the oxygen sensor. Just before the fuel is turned on the oxygen sensor is checked and calibrated.

Possible Causes

1. There is a built up of fuel in the burner from previous failed starts and this is causing an out of limits reading when the oxygen sensor is checked.
2. The exhaust pipe is blocked and fresh air cannot flow through the exhaust system when the fan is on at low speed.
3. The oxygen sensor has failed.

Possible Fixes

1. Turn on the air bleed function in the installation menu to try and dry out any diesel. Also remove the oxygen sensor and place in fresh air while still plugged in. (caution the end gets to about 250 degree's Celsius) While the WhisperGen™ is powered up with any of the bleed functions the oxygen sensor will also be turned on. Check the oxygen sensor reading after being in the fresh air for at least 5 minute to see if it is within limits. If it is not then replace it.
2. Check that there is air flowing through the exhaust system during the heat up period. If there is no airflow then remove the obstruction. Also check that the fan is operating during the heat up period.
3. Remove the oxygen sensor and place in fresh air while still plugged in. (caution the end gets to about 250 degree's Celsius). Power up the WhisperGen™ and the oxygen sensor by turning on the coolant 1 bleed function. Check the oxygen sensor reading after being in the fresh air for at least 5 minute to see if it is within limits. If it is not then replace it.

58 Ignition failure

The FIDcurrent has not been above 0.125 for 10 consecutive second's 2 minutes after the fuel was first turned on.

Fault occurs during "Flame-detect". [Mode 3.6]

Possible Causes

1. The evaporator is blocked.
2. The exhaust pipe is blocked.
3. The exhaust cooler is blocked.
4. The FID is set too high or too low.
5. There is no fuel flowing through the evaporator into the burner.
6. There is no fuel in the fuel tank and/or an air bubble in the fuel line.
7. The fuel line is blocked or has a kink in it.
8. The fuel filters are blocked.
9. The fuel pump has failed.
10. The wrong type of fuel is being used.
11. The fuel has been contaminated.
12. The centre hole in the bottom of the evaporator (close to the bottom of the glow plug) is blocked or obstructed.
13. The air supply to the WhisperGen™ is blocked.
14. It is possible that very strong winds may blow the flame out.

Possible Fixes

1. Remove the fuel line from the evaporator and turn on the fuel bleed function and check that the fuel flow rate is about 10 cc ± 1.5 per minute. If the fuel flows when the evaporator is disconnected but does not flow when the evaporator connected then the evaporator is blocked. Replace the evaporator.

2. Check that the exhaust pipe is not blocked or obstructed. Listen for gurgling noises when the WhisperGen™ is trying to start and when it is cooling down with the fan on at 100%. Remove any obstructions.

3. Remove the top plate from the exhaust cooler and check to see if it is blocked. Clean/flush if necessary. (can switch on flushing nozzle from control panel) Also check flushing nozzle for blockage. Remove and clean if necessary.

4. If you can hear that the burner is burning well but there is no FID reading, then remove the FID and check its height setting. Also check the continuity of the FID wire back to the electronics and that it is not shorting to earth. Also check that the FID is not shorting through to earth because of a carbon build up on its end.

5. This is general to the others shown below. Remove the evaporator and with the fuel line connected to it turn on the fuel bleed function and check that the fuel flow rate is about 10 cc ± 1.5 per minute.

6. Check the fuel level in the fuel tank is high enough. Check that all connections in the fuel line are tight.

7. Remove the kink or replace the fuel line.

8. Clean and/or replace fuel filters. Clean fuel tank if necessary.

9. Check pulse signal to fuel pump when turned on. If signal is present but fuel pump does not work then replace fuel pump.

10. Use correct fuel.

11. Clean out the fuel system. The evaporator may also need to be replaced.

12. Remove obstruction.

13. Remove obstruction.

14. Try restarting.

59 Flame failure

The FIDcurrent has been less than 0.075 for more than 10 consecutive seconds.

Fault occurs during "Stabilizing". [Mode=3.8]

Possible Causes

1. The FID is set too high or too low.
2. See 58 Ignition failure.

Possible Fixes

1. If you can hear that the burner is burning well but there is no FID reading, then remove the FID and check its height setting. Also check the continuity of the FID wire back to the electronics and that it is not shorting to earth. Also check that the FID is not shorting through to earth because of a carbon build up on its end.
2. See 58 Ignition failure.

60 Flame failure

The FIDcurrent has been less than 0.2 for more than 10 consecutive seconds.

Fault occurs during "Heatup". [Mode=3.9]

Possible causes

1. The FID is set too high or too low.
2. See 58 Ignition failure.

Possible fixes

1. If you can hear that the burner is burning well but there is no FID reading, then remove the FID and check its height setting. Also check the continuity of the FID wire back to the electronics and that it is not shorting to earth. Also check that the FID is not shorting through to earth because of a carbon build up on its end.
2. See 58 Ignition failure.

61 Flame failure

The FIDcurrent has been less than 0.4 for more than 10 consecutive seconds.

Fault occurs during "CRANK". [Mode=4]

Possible Causes

1. The FID is set too high or too low.
2. See 58 Ignition failure.

Possible Fixes

1. If you can hear that the burner is burning well but there is no FID reading, then remove the FID and check its height setting. Also check the continuity of the FID wire back to the electronics and that it is not shorting to earth. Also check that the FID is not shorting through to earth because of a carbon build up on its end.
2. See 58 Ignition failure.

62 Flame failure

The FIDcurrent has been less than 0.6 for more than 10 consecutive seconds.

Fault occurs anytime during engine operation. [Mode=5]

Possible Causes

1. The FID is set too high or too low.
2. See 58 Ignition failure.

Possible Fixes

1. If you can hear that the burner is burning well but there is no FID reading, then remove the FID and check its height setting. Also check the continuity of the FID wire back to the electronics and that it is not shorting to earth. Also check that the FID is not shorting through to earth because of a carbon build up on its end.
2. See 58 Ignition failure.

64 Heatup failure

Texhaust has failed to reach the crank temperature in 500 seconds.

Fault occurs during "Heatup". [Mode=3.9]

Possible Causes

1. Fuel flow to the burner is restricted.
2. Air flow to the burner is restricted.
3. Exhaust flow from the burner is restricted.
4. Faulty exhaust temperature sensor.
5. Faulty oxygen sensor.

Possible Fixes

1. Remove the evaporator and with the fuel line connected to it turn on the fuel bleed function and check that the fuel flow rate is about 10 cc +- 1.5 per minute.
2. Check that the air intake to the WhisperGen™ is not obstructed.
3. Check that the exhaust pipe is not blocked or obstructed. Listen for gurgling noises when the WhisperGen™ is trying to start and when it is cooling down with the fan on at 100%. Remove any obstructions. Remove the top plate from the exhaust cooler and check to see if it is blocked. Clean/flush if necessary. If blocked also check flushing nozzle for blockage. Clean/replace if necessary.
4. Check that exhaust temperature reading looks right. Replace if in any doubt.
5. Check/ replace the oxygen sensor. If the oxygen sensor is faulty and causes the burner to run with a very lean mixture then the temperature of the exhaust will not rise quick enough.

66 Crank failure

The BridgeRunning signal is not present 6 seconds after an attempt to crank was made.

Fault occurs during "CRANK". [Mode 4.2]

Possible causes

1. There is a fault in the electronics.
2. The electronics have just been replaced and the 3 phases from the alternator to the electronics have been wired incorrectly.
3. Nitrogen gas pressure is too high.
4. Internal mechanical failure of WhisperGen™.
5. Open circuit or short-circuit of an alternator phase to ground.

Possible fixes

1. Replace the electronics.
2. Change the positions of any 2 wires from the alternator at the electronics.
3. Check and reduce the nitrogen pressure to the recommended value if necessary.
4. Replace the core engine or whole WhisperGen™.
5. Check the connections of the alternator phase wires to the electronics board. Remove all three wires and check insulation to ground. Replace WhisperGen if there is an internal phase-to-earth contact.

68 Engine sluggish

Ialt is less than -25 or PowerOutput is less than [(elapsed time * 3)-300], where "elapsed time" is in seconds and starts counting up from zero when the WhisperGen™ cranks.

Fault occurs during "Runup". [Mode=4.2]

Possible Causes

1. Low nitrogen pressure.
2. Fuel flow to the burner is restricted.
3. Air flow to the burner is restricted.
4. Exhaust flow from the burner is restricted.
5. Faulty exhaust temperature sensor.
6. Faulty oxygen sensor.
7. The burner has been lifted or the ceramic rope burner seal has been damage and is allowing the hot gasses from the burner to by-pass the heater head and go directly into the exhaust reducing the power output of he WhisperGen™.
8. Internal mechanical failure of WhisperGen™.

Possible Fixes

1. Check and increase the nitrogen pressure to the recommended value if necessary.
2. Remove the evaporator and with the fuel line connected to it turn on the fuel bleed function and check that the fuel flow rate is about 10 cc +- 1.5 per minute.
3. Check that the air intake to the WhisperGen™ is not obstructed.
4. Check that the exhaust pipe is not blocked or obstructed. Listen for gurgling noises when the WhisperGen™ is trying to start and when it is cooling down with the fan on at 100%. Remove any obstructions. Remove the top plate from the exhaust cooler and check to see if it is blocked. Clean/flush if necessary. If blocked also check flushing nozzle for blockage. Clean/replace if necessary.
5. Check that exhaust temperature reading looks right. Replace if in any doubt.
6. Check/ replace the oxygen sensor. If the oxygen sensor is faulty and causes the burner to run with a very lean mixture then the temperature of the exhaust will not rise quick enough.
7. Remove the burner and check the burner seal. The ceramic rope burner seal must always be replaced whenever the burner is removed.
8. Replace the core engine or whole WhisperGen™.

72 Drive bridge fail

The BridgeRunning signal indicates that the generator is not rotating while in RUN.

Fault occurs anytime during engine operation. [Mode=5]

Possible Causes

1. Failure of the electronics.
2. Internal mechanical failure of WhisperGen™.
3. Open circuit or short-circuit of an alternator phase to ground.

Possible Fixes

1. Replace the electronics module.
2. Replace the core engine or whole WhisperGen™.
3. Check the connections of the alternator phase wires to the electronics board. Remove all three wires and check insulation to ground. Replace WhisperGen if there is an internal phase-to-earth contact.

74 Low engine power

PowerOutput is less than [(Air*2)-100] for more than 5 seconds.

Fault occurs at anytime during engine operation. [Mode=5]

Possible Causes

1. Exhaust flow from the burner is restricted.
2. Air flow to the burner is restricted.
3. Fuel flow to the burner is restricted.
4. Low nitrogen pressure.
5. Faulty oxygen sensor.
6. The burner has been lifted or the ceramic rope burner seal has been damage and is allowing the hot gasses from the burner to by-pass the heater head and go directly into the exhaust reducing the power output of he WhisperGen™.
7. Internal mechanical failure of WhisperGen™.

Possible Fixes

1. Check that the exhaust pipe is not blocked or obstructed. Listen for gurgling noises when the WhisperGen™ is trying to start and when it is cooling down with the fan on at 100%. Remove any obstructions. Remove the top plate from the exhaust cooler and check to see if it is blocked. Clean/flush if necessary. If blocked also check flushing nozzle for blockage. Clean/replace if necessary.
2. Check that the air intake to the WhisperGen™ is not obstructed.
3. Remove the evaporator and with the fuel line connected to it turn on the fuel bleed function and check that the fuel flow rate is about 10 cc +- 1.5 per minute.
4. Check and increase the nitrogen pressure to the recommended value if necessary.
5. Check/ replace the oxygen sensor. If the oxygen sensor is faulty and causes the burner to run with a very lean mixture then the temperature of the heater heads may not be stay hot enough.
6. Remove the burner and check the burner seal. The ceramic rope burner seal must always be replaced whenever the burner is removed.
7. Replace the core engine or whole WhisperGen™.

76 O2 sensor OOL

ABS (O2value - O2run - 1050) is greater than 300 for more than 1 second, i.e. the fresh air reading at the end of a run is such as to indicate that the sensor is no longer operating correctly.

Fault occurs during "Cooloff". [Mode=6.5]

Possible causes

1. The oxygen sensor characteristic has drifted substantially.
2. The oxygen sensor has failed.

Possible fixes

1. Check exhaust excess air and re-calibrate the O2run value.
2. Replace the oxygen sensor.

80 Clamp failed On

The clamp current is greater than 5 amps for a 12 Volt WhisperGen™ or 2.5 amps for a 24 Volt WhisperGen™ when there should be no clamp current, and the condition persists for 25 seconds.

Fault can occur any time.

Possible Causes

1. The clamp element is shorting to earth.
2. Faulty electronics.

Possible Fixes

1. Check the resistance of the clamp element to earth.
2. Replace electronics.

82 Excess volt drop

Vdrop (voltage drop between WhisperGen and battery) is greater than 2V for more than 5 seconds

Fault occurs during any time during charging. Mode=2 or higher.

Possible Causes

1. Very high resistance in the battery cables from the WhisperGen™ to the battery (poor connections or battery cables too thin or too long).
2. Faulty battery voltage sensing.

Possible Fixes

1. Check for battery cable connections, switches, fuses for poor connections. Also check battery cable size is large enough.
2. Check battery voltage sensing wire to WhisperGen™ or replace electronics.

83 Battery overtemp

Tbattery is greater than 55 for more than 5 seconds.

Fault occurs at any time during engine operation. Mode=2 or higher.

Possible causes

1. The battery temperature sensor is faulty.
2. The battery is hotter than 55 degrees Celsius.
3. The battery is located in a place with a very high ambient temperature and is over heating.
4. There is an internal fault in the battery.
5. The battery is being charged at to higher rate.
6. The battery is being discharged at to higher rate.

Possible fixes

1. Replace the battery temperature sensor.
2. Reduce the temperature of the battery.
3. Provide some form of cooling to the area that the battery is located or place the battery in a cooler location.
4. Replace the battery.
5. Reduce charging rate. It is unlikely that the WhisperGen™ charging the battery by its self could charge it at to higher rate.
6. Reduce the discharge rate of the battery.

84 Clamp failed Off

Vbus is greater than [Vclamp + 0.35] (for 12 V WhisperGen™'s) and [Vclamp + 0.7] (for 24 V WhisperGen™'s) for more than 25 consecutive seconds.

Fault occurs during "BULK" [Mode=2]

Possible causes

1. Failure of the clamp element (open circuit).
2. Connection problem between the clamp element and electronics board (loose wire).
3. Electronic failure.

Possible Fixes

1. Replace clamp element.
2. Check wiring and repair defects.
3. Replace electronics.

85 High batt volts

Vbattery is greater than (temperature compensated Absorb voltage + 0.5) for 12V WhisperGen™'s for more than 5 seconds and Vbattery is greater than (temperature compensated Absorb voltage+ 1.0) for 24V WhisperGen™'s for more than 5 seconds.

Fault occurs at any time during engine operation. Mode=2 or higher.

Possible causes

1. Low electrical load, high heat load and high engine power, leading to clamp trying to dissipate more power than is possible for it, leading to battery voltage rise.
2. Electronic fault.

Possible fixes

1. Add electrical load or change engine settings.
2. Replace electronics.

90 Clamp control flt

Verror is greater than 0.25 for 12 Volt WhisperGen™'s or 0.5 for 24 Volt WhisperGen™'s for more than 3 minutes.

Fault occurs during "VOLTCONTROL". [Mode=3]

Verror is the difference between Vbattery and Vcontrol which is the set point for the battery voltage. If this error gets to big, then this is because the clamp controller is not capable of controlling the battery voltage.

Possible causes

1. High power WhisperGen™ running at full power due to high heat demand but very low electrical demand and clamp element is not able to dump all the electrical power at the set float voltage.
2. Faulty clamp element.
3. Faulty control electronics.

Possible fixes

1. Reduce the power the WhisperGen™ by setting a leaner fuel mixture or add some DC load.
2. Replace clamp element.
3. Replace the electronics.

92 ParChg V too high

Vcontrol is greater than Vabs_comp + 0.5 for 12 Volt WhisperGen™'s or Vabs_comp + 1.0 for 24 Volt WhisperGen™'s for more than 30 Seconds.

Fault occurs during "VOLTCONTROL:parallel charge". [Mode=3.4]

When A parallel charger is detected, the Control voltage is slowly increased, until the Clamp Current is less than or equal to the Alternator Current, to make sure not to much current goes through the clamp.

If however the same Control voltage (Vcontrol) goes up too high because of this, then error 92 is raised.

Possible causes

1. The external charger has its charging voltage set substantially higher than the WhisperGen Absorption voltage.

Possible fixes

1. Reduce the charging voltage of the external charger, or do not operate it and WhisperGen simultaneously.

Non Warning or Non Fault Code Problems

Temp Setpoint

- The Temp Setpoint is set at 60 but the Coolant Temp runs at 68 while the WhisperGen™ is running.

Possible causes

1. To ensure that the control system remains stable when using a large range of different secondary coolant pumps or different heat dump fans the WhisperGen™ modulates the pump or fan in the following way:

    - When the Coolant Temp reaches the Temp Setpoint + 3 the WhisperGen™ turns the pump or fan to 30% RMS of the battery voltage.

    - The RMS voltage to the pump or the fan is then proportionally increased relative to the Coolant Temp so that it will be at 100% when the Coolant Temp is at the Temp Setpoint + 14. This results in there always being an error between the Coolant Temp and the Temp Setpoint while the WhisperGen™ is running.

    - Any time the pump of fan are turned on, it is turned on to 100% RMS of the battery voltage for 1 second to ensure that the pump has started and is not stalled.

Possible fixes

1. There is no fix for this it's just the way it is.

Stop Button

- Whenever the stop button is pushed and the WhisperGen™ goes into Standby it tries to start again.

Possible Causes

1. The WhisperGen™ is receiving a signal from other than the start button telling it to start.

Possible Fixes

1. This signal could be an Auto-charge start signal or an Ext. Control start signal. If you don't want the WhisperGen™ to try and start again then either turn the Auto-charge and the Ext. Control function off in the User Menu or set Enable Starts in the Installation Menu to 0 or 1.

Control panel LED's

- The LED's on the control panel are flashing.

Possible Causes

1. The Enable Starts function in the Installation Menu is switch to 0 or 1 to prevent the WhisperGen™ starting to enable maintenance to be carried out.

Possible Fixes

1. Ensure that it is safe for the WhisperGen™ to start and then Set Enable Starts to 1 or 2.

No automatic start

- The WhisperGen™ will not automatically start and charge the battery when it is discharged.

Possible Causes

1. The Auto-charge function in the User Menu has not been turned on.
2. The battery parameters have not been set correctly in the hidden Service Menu.
3. The battery current shunt in the negative battery cable has been wired incorrectly.
4. The Enable Starts function in the Installation Menu is switch to 0 or 1 to prevent the WhisperGen™ starting to enable maintenance to be carried out.

Possible Fixes

1. Turn the Auto-charge function on.
2. Ensure that the battery parameters are correctly set.
3. Ensure that the battery current shunt is correctly wire into the battery cable. Also check that the battery current sense wires are connected correctly to the WhisperGen™ and to the current shunt.
4. Ensure that it is safe for the WhisperGen™ to start and then Set Enable Starts to 1 or 2.

No start / No bleed

- The WhisperGen™ will not attempt to start when the start button is pushed.
- When first installed the WhisperGen™'s bleed functions will not operate.

Possible Causes

1. Enable Starts in the Installation Menu is switched to 0.
2. The start button is faulty.

Possible Fixes

1. Ensure that it is safe for the WhisperGen™ to start and then Set Enable Starts to 1 or 2.
2. Replace the control panel.

No standby

- After receiving a stop signal the WhisperGen™ will not go to standby.

Possible Causes

1. The Coolant Temp or the Exhaust Temp is still too high.
2. The Coolant Temperature sensor or the Exhaust Temperature sensor is faulty.

Possible Fixes

1. Ensure that the WhisperGen™ is receiving adequate cooling.
2. Replace the faulty sensor.

Battery not fully charging

- The battery is not getting fully charged
- When Auto-charge is turned on the battery goes flat before the WhisperGen™ starts.

Possible Causes

1. The battery voltage sense wires are not connected to the battery terminals.
2. The battery parameters have not been set correctly in the hidden Service Menu.
3. The battery current shunt in the negative battery cable has been wired incorrectly.
4. The load on the battery and the WhisperGen™ is greater than the output of the WhisperGen™.

Possible Fixes

1. Ensure that the battery voltage sense wires are connected to the battery terminals and not anywhere else.
2. Ensure that the battery parameters are correctly set.
3. Ensure that the battery current shunt is correctly wire into the battery cable.
4. Reduce the load on the system.

No automatic stop

- WhisperGen™ starts automatically but will not stop a by itself.

Possible Causes

1. The battery is very flat or the load on the battery and the WhisperGen™ is so high that the battery is only being charged very slowly.
2. Heat Manage is turned on and Max Run Hours is set to 25.

Possible Fixes

1. Reduce the load on the system.
2. Turn Heat Manage off or set the Max Run Hours to less than 25.

Exhaust howling noise

- The Exhaust is making a howling noise.

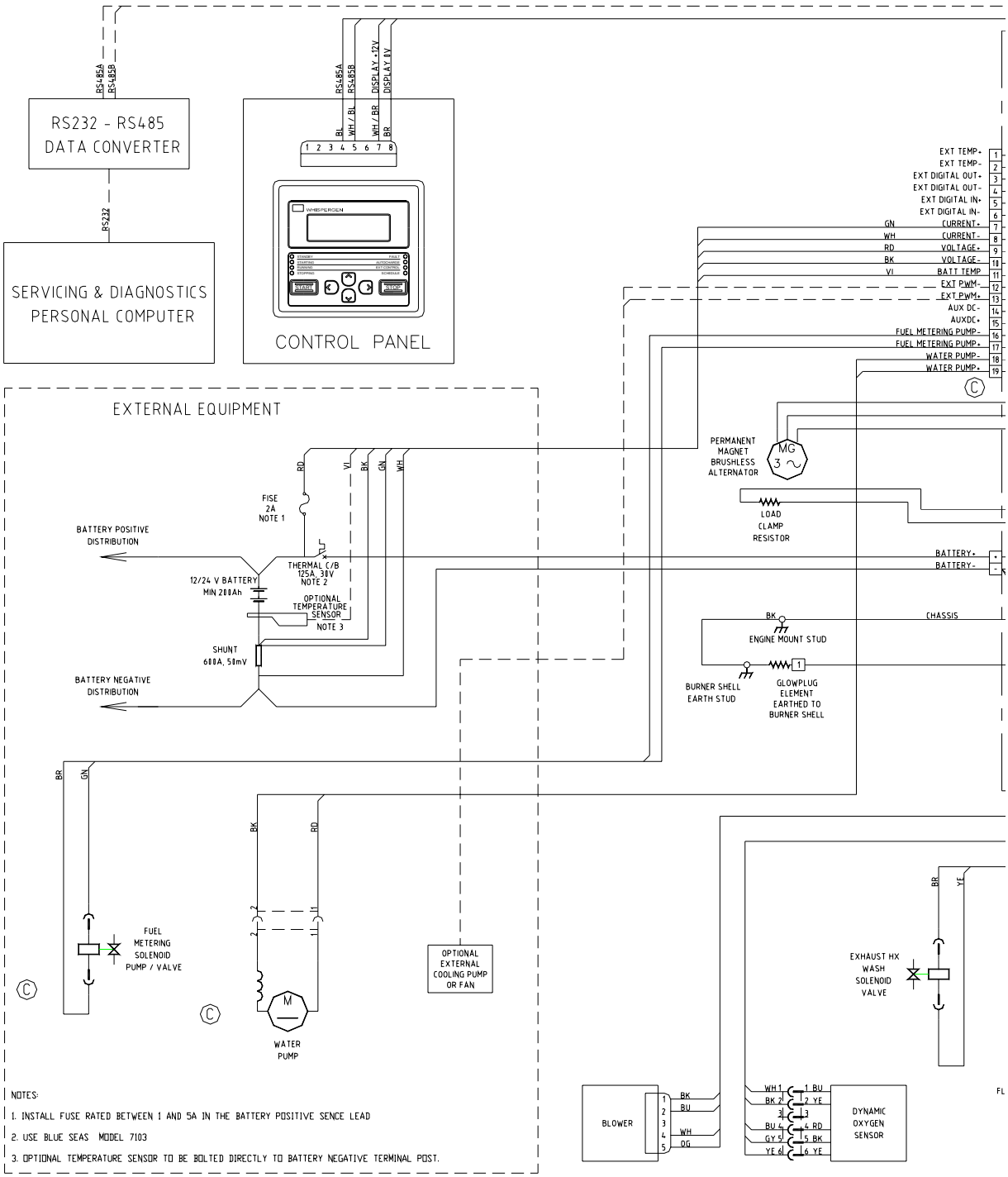
Possible causes

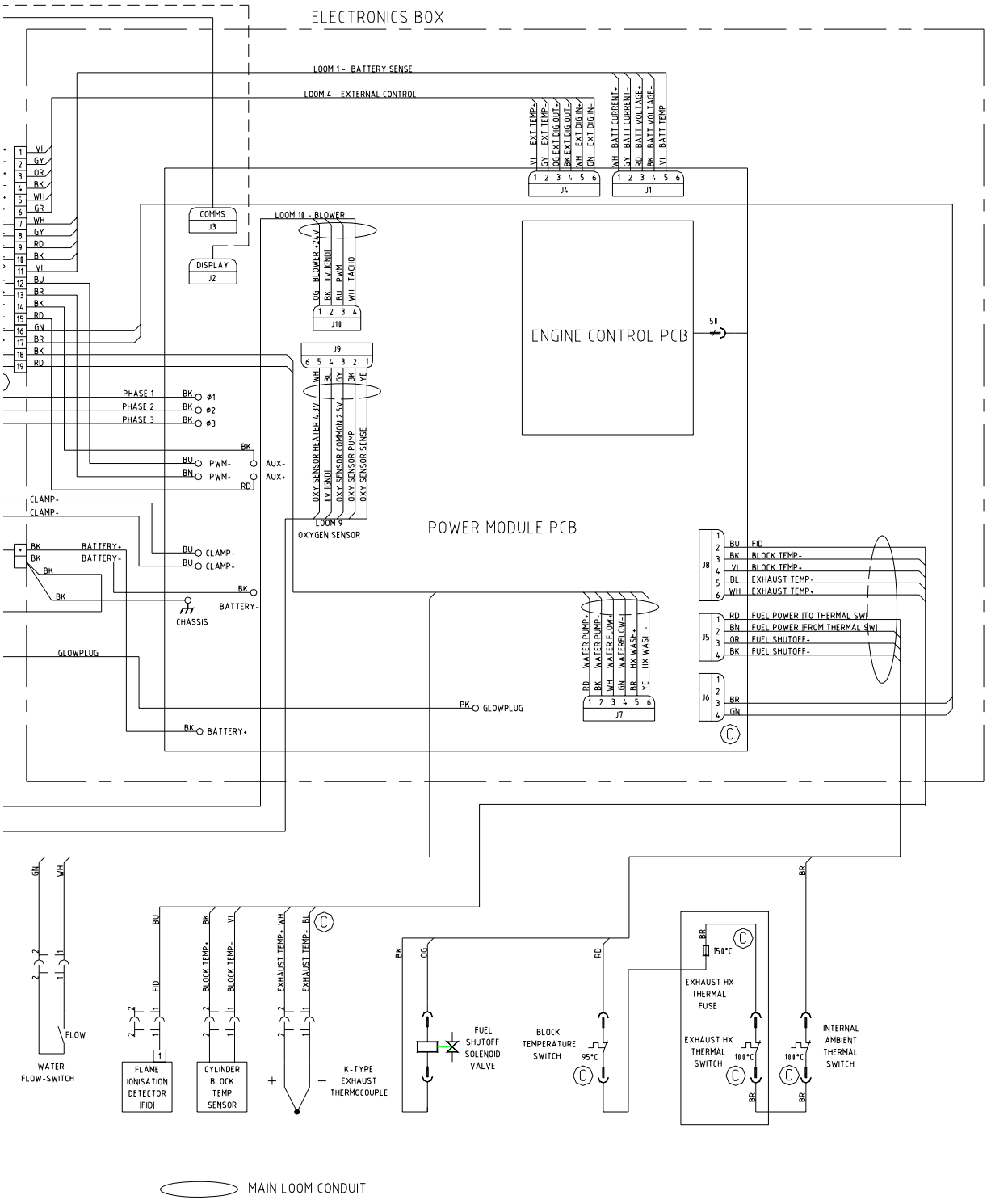
1. The mixture is not set correctly.
2. A combination of the burner and the exhaust system is causing a resonance to occur.

Possible fixes

1. Try adjusting the mixture after the WhisperGen™ has been running for at least 20 minutes and if you have a combustion analyzer then check that the excess air reading is around 9.5% O2. This is equivalent to an 80% + - 10% excess air reading. The mixture can be adjusted to a limited extent by adjusting the O2Runfact in the "hidden menu" on the control panel. A smaller number makes the mixture richer.
2. Fit a muffler to the exhaust system. The muffler should be a "flow through" type. This means that when you look into one end of the exhaust pipe you should be able to see straight through it.

Wiring Diagram for PSS16 12MD / PSS16 24MD




ELECTRONICS BOX
LOOM 1 - BATTERY SENSE
LOOM 4 - EXTERNAL CONTROL
COMMS
J3
DISPLAY
J2
LOOM 10 - BLOWER
J10
ENGINE CONTROL PCB
50
POWER MODULE PCB
J9
LOOM 9
OXYGEN SENSOR
J4
J1
J8
J5
J6
J7
PHASE 1
PHASE 2
PHASE 3
PWM-
PWM+
AUX-
AUX+
CLAMP+
CLAMP-
BATTERY+
BATTERY-
CHASSIS
GLOWPLUG
FLOW
WATER FLOW-SWITCH
FLAME IONISATION DETECTOR (FID)
CYLINDER BLOCK TEMP SENSOR
K-TYPE EXHAUST THERMOCOUPLE
FUEL SHUTOFF SOLENOID VALVE
BLOCK TEMPERATURE SWITCH
95°C
EXHAUST HX THERMAL FUSE
150°C
EXHAUST HX THERMAL SWITCH
100°C
INTERNAL AMBIENT THERMAL SWITCH
100°C
MAIN LOOM CONDUIT

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