Hydraulic Fan System Controller : HFS - 2

Electro-Hydraulic Solutions for Mobile, Industrial & Marine Applications.

Application, Set-up

&

Information Manual.

Index:

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Important Notes:

ALWAYS - Take a few minutes to FULLY read THESE information / data sheets BEFORE starting.

ALWAYS - Keep High Voltage AC cables separate from Low Voltage DC signal and supply cables.

ALWAYS - Make sure the unit supply voltage is the same as the coils on the valve being driven !

ALWAYS - Ensure that you are aware of the available adjustments and on the electronics and hydraulics.

ALWAYS - Make sure you have the correct tools to do the intended job (i.e. P.C., software) e.t.c.

ALWAYS – 'Isolate' this unit from all other equipment BEFORE any form of welding takes place.

ALWAYS - Check ALL connections to and from this unit to ensure NO short or OPEN circuits.

ALWAYS - Check the units supply voltage is CORRECT, ' ELECTRICALLY CLEAN ' and STABLE.

ALWAYS - Operate the units within specified operating temperature for best & reliable performance.

ALWAYS - Ensure that any unused wires / terminals are terminated safely and not shorted together.

ALWAYS - Isolate the controller if ANY form of battery charging or boosting takes place on the vehicle.

ALWAYS - Ensure ALL valve connectors are wired correctly, secure, locked and connected to correct coils.

ALWAYS - Observe the set-up procedures in this manual for best operational results.

ALWAYS - Follow and abide by local and country health and safety standards – protect yourself and others !

NEVER - Arc Weld or Charge Batteries with this driver unit connected as damage can occur.

NEVER - Attempt to use this unit if you are unsure of electrical OR hydraulic connections.

NEVER - Attempt to use this unit if you are unsure of the expected system operation.

NEVER - Attempt to use this unit in Areas where other AC or DC coils HAVE NOT been fully suppressed.

NEVER - Use a power supply that is not rated for the correct required O/P current under full load.

NEVER - Allow wires TO or FROM the unit to short circuit (to each other or chassis/cabinet e.t.c.).

NEVER - Attempt to use this unit in areas of intense RF without adequate screening measures.

NEVER - Disconnect or connect wires to or from this unit unless it isolated from the power supply.

NEVER - Use this unit in temperatures that exceed those specified as operation may be effected.

NEVER - Start this unit without ensuring ALL work areas are clear of personnel !

Fan 'Noise Test' Feature:

The controller allows the user to set a pre-determined value of output current to the proportional valve that will equate to the required 70% forward fan speed required for the noise inspection.

Once set to the desired level, this value is saved to the controller then allows the user to quickly demonstrate the noise level of a forward driven fan by following the sequence below:-

1) Turn controller power supply OFF.

2) Depress and hold the 'Manual purge' sequence button.

3) Apply power to the controller.

4) Continue to hold the 'manual purge' button down for approx. 5 seconds after power application then release to enter the ' Test mode '.

5) This ' Test mode ' will drive the fan in the forward direction for 3 minutes (this time is fixed).

6) When the time period has expired, the fan will return to normal system operation and cannot be put back into test mode unless points 1) thro 4) are re-applied.

Important Notes:-

- This is an OPEN LOOP test feature which even after accurate factory setting, can be marginally effected by external conditions such as ambient and oil temperature, oil viscosity and system condition.
- The sequence can be stopped / reset at any time during the 3 minute test period by removing the power supply.
- The 'Test mode' period is pre-set to 3 minutes by the manufacturer and is not changeable by the user.
- The set-up software allows the user to pre-set the fan forward speed that is used during this ' Test mode '.

Power Supply and Coil Voltage:

For most accurate smooth control with best resolution, protection and product reliability, the following combinations of power supply and valve coil voltage should be adhered to:-

Proportional coils (fan speed control.... *NO PURGE OPTION FITTED*):-

8 – 14VDC:- Use 12V valve coil.

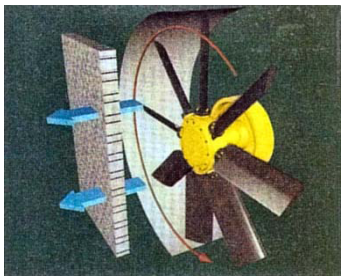
20 – 36VDC:- Use 24V valve coil.

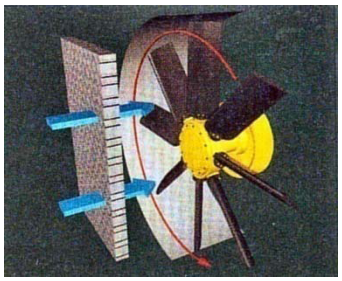
Directional coil (Fan direction control.. *NEEDED FOR PURGE OPTION*) :-

8 – 14VDC:- Use 12V valve coil.

20 – 36VDC:- Use 24V valve coil.

Proportional Output:





A variable current output is used for driving a proportional valve to control the fan speed.

The value of the valve drive current is derived from a closed loop calculation relative to the temperature set-points that the user has entered in the set-up.

BOTH wires from the valve coil must be connected to the controller where indicated by '+Prop Vlv O/P' and '-Prop Vlv O/P'. At NO time should any coil wires be connected to 0V or application chassis e.t.c. as this will effect the operation of the controller and could have damaging effects.

The output is internally fully protected against shorted or mis-wired coils with errors being both indicated locally on the associated LED and annunciated on the controller software if the program is running on a PC connected to the unit.

Shorted coils or connection wires are detected only when the controller tries to drive the coil and is indicated with a RED FLASHING output LED.

Open circuit coils or connection wires are detected only when the controller tries to drive the coil and is indicated with a GREEN FLASHING output LED.

In either of the above cases, the '**Alarm output'** comes 'ON Steady' to indicate an error and if connected, the PC program will show annunciators.

The proportional valve coil selected must be capable of withstanding the power supply's maximum voltage or the user must set the maximum output current (I Max) to a safe value.

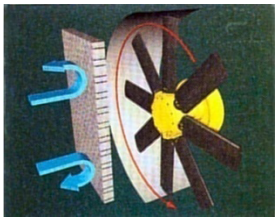
User adjustable minimum current (I Min) and selectable PWM frequency (31 to 250 Hz) allows tuning for smoothly starting the fan from a stop.

The proportional output is rated for a 3.3A coil current maximum at the connected supply voltage.

The software allows user selection of driving normally open and normally closed proportional valves, this sets the system default fan speed in the event of an electrical power loss to the controller module.

The proportional output is turned off if the units internal temperature sensor temperature exceeds 80 C.

Fan Reverse Output:



This feature is designed to 'de-clog' the fan protection guard and cooling elements and not as a permanent running option.

The output drive to the coil is rated to 3.3Amps maximum (at controller supply voltage) and is either ON or OFF with no proportionality or ramp functions associated.

The 'Purge' sequence will cancel if at any time, an overtemp alarm is detected. The two individual 'Purge' methods and the possible adjustments are noted below.

Reverse Sequence:

The 'Reverse' sequence is specific to avoid damage to the fan blades and the motor/hydraulic system and is a follows (see page 30 of this manual for more details):-

1. Reverse command detected (manual or Auto reverse signal) .
2. Fan proportional control valve ramped DOWN to give zero fan speed at ramp rate set in software
3. Fan stopped 'Dwell' time starts if (seconds) value set in software.
4. Reverse valve O/P switched ON (change hydraulic state)
5. Proportional valve ramped UP to reverse current limit set in software
6. Reverse command released (manual or Auto reverse signal).
7. Fan proportional control valve ramped DOWN to give zero fan speed at ramp rate set in software
8. Reverse valve O/P switched (change hydraulic state to original)
9. Proportional valve ramped UP to required Forward speed.

Manual Reverse Initiation:

For this feature to be activated, the operator must initiate the sequence by sending a momentary or pulsed voltage signal (vehicle supply level) to the input marked '**REVERSE I/P +**' on the controller. Upon receiving this signal, the controller will follow the purge sequence to ensure correct and safe operation.

Re-initiation of the manual 'Purge' signal during a 'Purge' sequence will be ignored by the controller.

Fan Reverse Notes:

The software controls the purge feature such that if the momentary manual input is continuously activated (I.e. short circuited), the sequence will complete once, ensure the fan is re-activated in the forward direction and wait until the input is cleared and then re-initiated before another purge sequence is allowed.

Auto Fan Reverse:

This automated feature can be used to ensure free air flow through the radiator on a regular basis without operator intervention.

Adjustments are available in the set-up software for:-

- Auto Purge feature ON/OFF select
- Auto Repetition rate (set in minutes up to a maximum of 180)
- Time to run in reverse (Purge time) direction set in seconds (60 max).
- Speed of fan in reverse (as a % of fan maximum forward speed)

The manual 'Purge' feature can be actioned between automated operations as required.

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Diagnostic Indicators:

The unit is fitted with LED indicators to show real time diagnostic information and indicate by error codes in a visual manner the current operational status and if a fault develops with the system, where the fault may be originating from.

Power ON / Opto 2000 transmitter:

The red LED indicates power supply status with the LED 'OFF' for less than 8 volts and flashes 'ON/OFF' for more than 40 volts. This LED also acts as the communications transmitter when connected to the Opto 2000 unit.

Opto 2000 Receiver:

The clear LED is used only for 'Infra-Red' communications when connected to the Opto 2000 unit and never shows any visible light.

Proportional Valve Output:

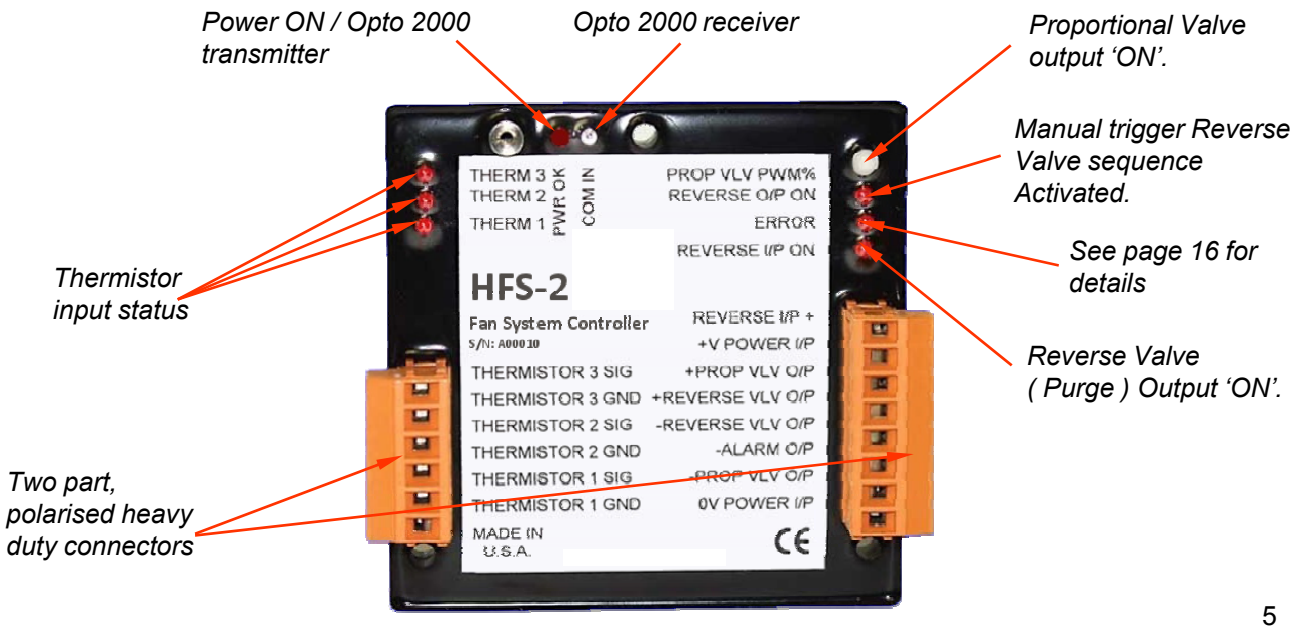
The proportional coil PWM% LED is fully **RED** for 0% PWM and fully **GREEN** for 100% PWM, with shades of red, orange, yellow and green indicating intermediate values.

Manual Reverse Trigger:

The **RED** LED for the reversing coil trigger input comes ON only when the input is connected to the +Supply voltage indicating that the manual reverse sequence has been initiated. Once this sequence has been started, and in the duration of the purge cycle, new or multiple manual trigger inputs will be ignored as will any automatic purge sequence signals.

Reverse Valve Output:

The **RED** LED for the reversing coil output comes on with the output.
The LED blinks on for about 0.1 seconds and then off for about 0.1 seconds to indicate shorts and blinks on for about 0.5 seconds and then off for about 0.5 seconds to indicate opens. In either cases, the alarm output comes on 'Steady' to indicate an error.



Error Indicator:

The RED error led that flashes an 'Error code' when fault conditions that have no other visual indicator have been detected.
The LED blinks error codes if faults have been detected with the thermistor inputs, module temperature, module memory and alarm output.
The blink code will occur at a rate of 0.5 seconds on and 0.5 seconds off with a two second pause before repeating.
Only the highest priority blink code will be displayed.
See table below for blink codes, with the lower number of blinks having higher priority.
A controller unit temperature greater than 80C will be indicated by the error LED 'ON' until retried if "retry fault" is selected, or until power is cycled OFF then back ON.
The unit calculates the checksum of the internal FLASH program and the user settings data file at power up.
If the checksum is incorrect, the unit is corrupt and will turn OFF all outputs (except for alarm) and flash ALL LEDs except for the Power LED which is required for OptoLink communication and the Reverse Input LED that is driven directly by the Reverse Input.
This condition is cleared by re-loading the FLASH program and/or the stored user characteristic data file.
This above situation should never occur unless power is lost during file storage or up or download.
If memory checksum failure occurs without an attempt to update FLASH or the user data file, the corrupted unit should be returned without correcting the problem to factory for failure analysis.
The other fault conditions stop flashing when the triggering error is cleared or if unit power is cycled depending on the **'Retry Fault'** user setting.

Error Indicator 'Blink' Code:

No. of blinks	Fault / Error
1	Memory checksum error
2	Unit temperature greater than (>) 75C
3	Selected thermistor input shorted
4	Selected thermistor input open
5	Alarm output shorted
6	Over temp reached on one or more thermistor inputs.

Alarm Output:

This low side on / off output is able to output 3.3A current maximum, and is capable of driving inductive or resistive loads and is Protected against shorted and misfired loads with shorted load detection only able to be detected when driven.
The output has two modes of operation, 'Steady ON ' and 'Pulsing ON/OFF'.
The '**Steady ON'** mode is linked to **NON critical errors** or those that would allow the unit to keep functioning. This type of error can be dealt with in due time.
The **'Pulsed ON/OFF'** state is intended to show that a **critical error** has been detected and that the controller/system MUST be stopped and examined immediately or damage may result.

Data Logging Option:

The facility exists to allow the user to 'LOG' data of the thermistors and several other controller functions for later or fault / trend examination.
The files can be individually named to suit the application and is suffixed with a *.csv extension for direct and easy reading into Microsoft® Excel® for graphical plotting and mathematical calculations as required.

Internal Data Logging:

The unit records the controller serial number, date first setup (born date) with a PC, highest supply voltage, the highest temperature of each thermistor input (other than during calibration) and the highest module temperature.
The user can not reset these values without a password.
Shorted or open thermistor faults will not be recorded as a high temperature.

Connectors – HFS-2 and HFS-2Q:

The connectors used on the HFS-2 controller are Weidmuller two part, polarised, heavy duty screw variety to suit the intended 'in-cab' application environment while still allowing easy cable access, installation, pre-harness assembly and normal maintenance.

The controller comes complete with all the connectors, male (on the unit) & female user wire connections, necessary for immediate installation.

Connector:- Weidmuller style SLA and BLS.

The HFS-2Q option offers the user the choice of Weatherpack sealed connectors, with a 6 way for thermistor inputs and 2 x 4 way for all other connections, allowing the controller module to be mounted in an external environment.

The user can also specify any other connector required to match the intended application arena, please contact the HCT factory for further details.

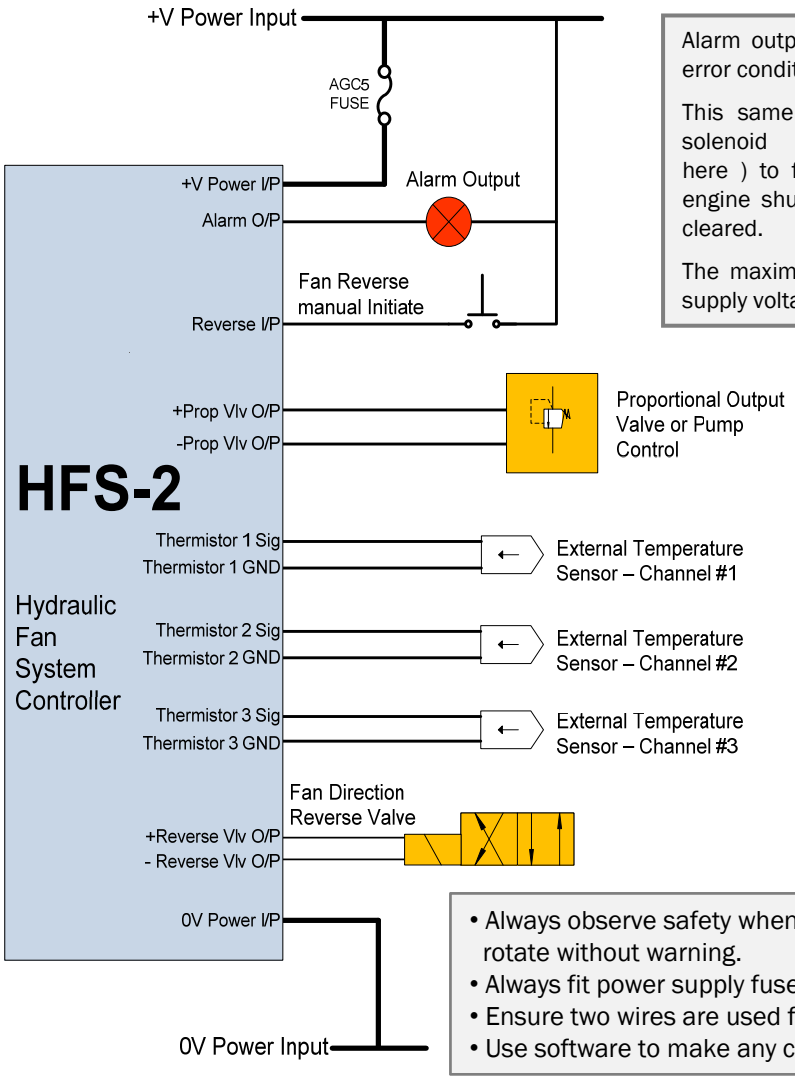
Startup Delay Feature:

This is a timed function and is intended to allow the vehicle to be started and running before applying the extra the load of the hydraulic fan and associated hydraulic pump demand.

The delay time can be adjusted in the set-up software and is calibrated in seconds from zero (0) to a maximum of 60S.

This feature is initiated at every power ON/OFF cycle.

Electrical Connection Information:



Alarm output shown driving a simple lamp to indicate fault / error condition has occurred.

This same connection circuit can be used with a relay or solenoid (Always use suitable' Flyback' or suppression diode here) to facilitate system integration as required such that engine shutdown could be initiated if the fault continued un cleared.

The maximum switching current of this output is 3.3amps at supply voltage.

- Always observe safety when adjusting this controller – fan may start to rotate without warning.
- Always fit power supply fuse (as shown) externally to controller.
- Ensure two wires are used for every temperature sensor.
- Use software to make any changes to system configuration and/or options.

Fan Max Speed Manual Override:

The system using the 'Reverse acting' proportional pressure relief valve (as shown in this manual) is designed to default to full fan speed in the event of a power supply, fuse or connection failure.

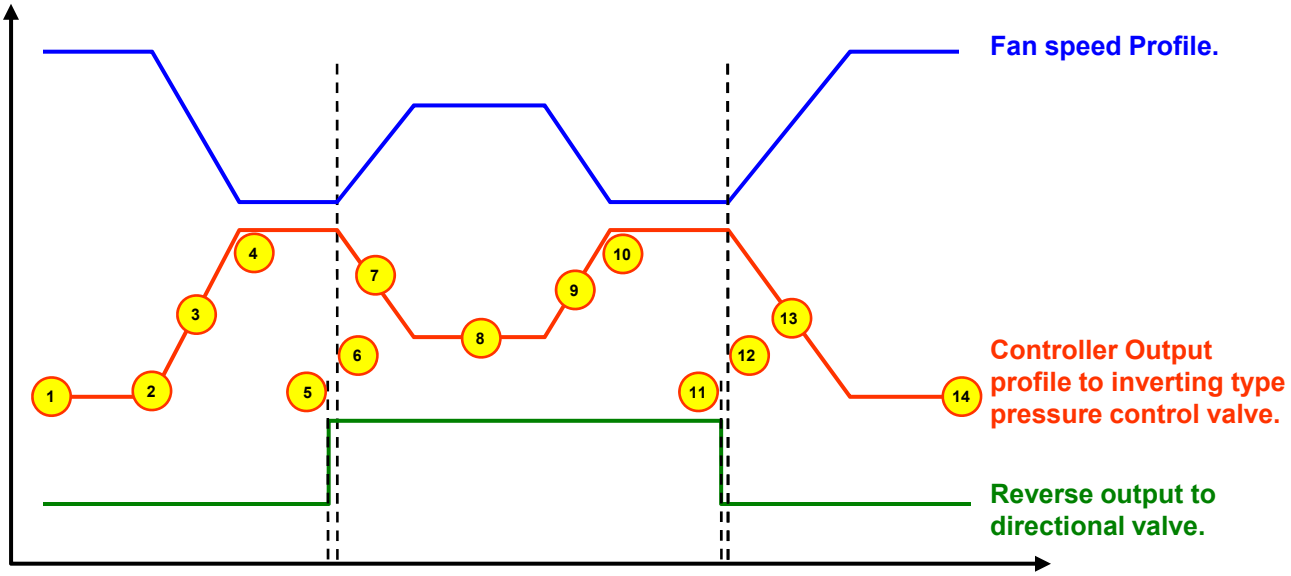
The user may also initiate full fan speed regardless of the controller settings by simply turning the unit ' OFF ' via a simple switch.

This option can be used on initial commissioning or during service to prove the hydraulic continuity circuit if required.

Once the unit is switched back ' ON ' , the controller will re-initialize and the real time temperature measurements in each zone used once again to dictate the ideal fan speed.

NOTE:- If the unit power supply is turned ' OFF ' to force fan full speed, the 'Purge' function, diagnostic indicators and alarm output will not operate until power is restored to the unit.

Fan 'Reverse' profile (reverse acting control valve):



1. Normal '**Forward**' running fan speed determined by controller.
2. Manual or automatic '**Purge**' or reverse fan trigger detected here.
3. Fan speed decays to zero at '**Ramp Down'** rate set in software.
4. '**Dwell**' timer started to allow fan inertia to fully dissipate and fan stop.
5. Reverse output turned ON to energize directional valve.
6. Output signal to proportional valve started fixed mS after reverse valve signal to prevent hydraulic 'lock'
7. Fan rotation increased to 'Reverse' running speed determined by user setting at 'Ramp Up' rate set in software.
8. Fan at maximum speed for Reverse time period set in software. This speed may be less than forward to protect fan.
9. 'Purge' timing cycle expired, ramp fan to zero at 'Ramp Down' rate set in software.
10. '**Dwell**' timer started to allow fan inertia to fully dissipate and fan stop.
11. Reverse output turned OFF to de-energize directional valve.
12. Output signal to proportional valve started fixed mS after reverse valve signal to prevent hydraulic 'lock'
13. Fan rotation increased to 'Forward' running speed determined by user setting at 'Ramp Up' rate set in software.
14. Normal '**Forward**' running fan speed determined by controller.

Condition	Error LED	Alarm Output	Proportional Valve Output	PWM Output LED	REVERSE Output	REVERSE Output LED	Power LED	Thermistor Leds	Cleared By
Memory Checksum Failure	One Blink	Same As Error	Off	Green / Off With Error	Off	Same As Error	No Change	All Same As Error	Reload Flash Or Data File
Unit > Than 75C	Two Blinks	Same As Error	Regulating	No Change	No Change	No Change	No Change	No Change	Power Off Till Unit Temperature < 70c
Unit Temperature > Than 80C	Two Blinks	Same As Error	Off	Red / Off With Error	Off	Same As Error	No Change	All Same As Error	Power Off Till Unit Temperature < 70c
Thermistor Input Shorted	Three Blinks	On	Full Fan	No Change	No Change	No Change	No Change	Shorted Same As Error	Power Off Till Fault Corrected
Thermistor Input Open	Four Blinks	On	Full Fan	No Change	No Change	No Change	No Change	Open Same As Error	Power Off Till Fault Corrected
Alarm Output Shorted	Five Blinks	Off	Regulating	No Change	No Change	No Change	No Change	No Change	Power Off Till Fault Corrected
Thermistor Input Over Temp	Six Blinks	On	Full Fan	No Change	No Change	No Change	No Change	O'temp Same As Error	Corrected
PWM Output Shorted	Off	On	Off	Flashing Red / Off	No Change	No Change	No Change	No Change	Power Off Till Fault Corrected
PWM Output Open	Off	On	Off	Flashing Green / Off	No Change	No Change	No Change	No Change	Power Off Till Fault Corrected
Reverse Output Shorted	Off	On	No Change	No Change	Off	Flashing Quickly	No Change	No Change	Power Off Till Fault Corrected
Reverse Output Open	Off	On	No Change	No Change	Off	Flashing Slowly	No Change	No Change	Power Off Till Fault Corrected
Power Supply < 8 Volts	Off	Off	Off	Off	Off	Off	Off	Off	Set Power Supply Between 8 And 40 V
Power Supply Between 8 And 40 Volts	No Change	No Change	No Change	No Change	No Change	No Change	On	No Change	
Power Supply > 40 Volts	No Change	On	No Change	No Change	No Change	No Change	Blinking	No Change	Set Power Supply Between 8 And 40 V
Running In Reverse	Off	Off	Purge	No Change	On	On	No Change	No Change	
Fan Min, All Thermistors Below Setpoint	Off	Off	Minimum	No Change	No Change	No Change	No Change	All Off	
Fan Slowing, All Thermistors Below Setpoint	Off	Off	Slowing	No Change	No Change	No Change	No Change	Closest To Setpoint Is On	
Only One Thermistor Input Above Setpoint	Off	Off	Regulating	No Change	No Change	No Change	No Change	Selected Is On	
Several Thermistor Inputs Above Setpoint	Off	Off	Regulating	No Change	No Change	No Change	No Change	Selected Is Flashing, Others Above Setpoints Are On	

Unit diagnostics, Error Codes and Alarm Conditions