



High Country Tek, Inc.

Hydraulic Fan System Controller: HFS

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

Application, Set-up & Information Manual.





Important Notes:

This product has been designed by **High Country Tek, Inc (HCT)** to interface directly **with any manufacturers** range of proportional pressure and/or flow control valves, variable pumps, motors and manifold blocks currently available for type of

Please contact the factory by the e-mail address given below or nearest High Country Tek, Inc. distributor for further technical information and availability.

Application Areas:

- ON and OFF road applications
- OEM, re-power and retro-fit markets
- Mining equipment
- Drill, exploration and blast hole rigs
- Chassis, bus and RV builders
- Static applications – standby generators
- Industrial cooling operations
- Fluid temperature conditioning
- Hydraulic system oil.
- Automatic Transmission fluid.
- Engine sump oil.
- Air conditioner refrigerant.
- Engine water jacket.
- Engine charge air
- ‘External Attachment’ system fluids.
- Diesel fuel.

System Part Numbers:

- Controller Module:-..... HFS
- Female 12 way Deutsch connector:-..... 999-10088
- Opto 3000 interface Unit:-..... Opto3000
- HFS controller software CD:-..... TBA – Contact HCT customer service for info
- Controller info manual:-..... 021-00135 Rev B

IMPORTANT NOTE:-

High Country Tek, Inc. reserves the right to upgrade, revise or better any controller as technology improves without notice being given.

Wherever possible, full downwards compatibility for both hardware and software on replaced controllers will be maintained but it is the users responsibility to ensure that the latest technical details or literature is being used for application reference.

If you are unsure of the literature, hardware or software revisions you have, or suspect that it is an older revision, please send an e-mail request for the latest releases to info@highcountrytek.com

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System Overview:

This product has been designed specifically for Hydraulic Fan Drive control and gives the user new levels automation while integrating seamlessly into a typical discrete cooling system.

It can control a hydraulically driven fan proportionally or in an ON/OFF manner based on user settings, system configuration and cooling needs with three independent inputs (zones) that will interface with industry standard NTC, two wire thermistors. Two (2) switch inputs, suitable for over temperature switches, retarder switches and air conditioning clutch switches are also provided for added system flexibility

Standard features include a robust vibration, flame proof package, Waterproof single heavy duty connector (DT15-12PA Deutsch 12 pin header), Alarms interface, intelligent diagnostics, self protection that enable the controller to operate reliably under arduous environmental conditions and a 'real-time' graphing and data logging facility that allows the user to observe and then record several operating parameters that are saved in a common file format for later examination in Microsoft Excel®.

Local on-board diagnostic LED indicators are available for power ON, each thermistor input, Two on/off override inputs, proportional output and a specific error code LED which all show through observation, the current status of the controller and connected peripheral devices.

Easy to use 'set-up' and diagnostic software that is provided with the unit, works in conjunction with the HCT 'Opto 3000' interface unit to provide high speed data communications between the controller and the host computer and runs on any PC with a Windows® O/S platform.

Once the profile for a particular cooling requirement has been established, the software allows the developer to up/download the complete personality into other blank controllers giving the user a high level of application specific security and keeping company confidential information in-house.

The inputs can be configured to interface directly with pre-set range ON/OFF Bi-metallic temperature switches without the proportional control offered by the thermistors but giving savings advantages where absolute accuracy is not required and system cost is at a premium.

There are no external or onboard potentiometers, switches or adjustments for user settings to ensure controller integrity and operation under harsh environmental and operator conditions.

The set-up software allows the controller to be very flexible regarding settings and system configuration with password levels invoked to ensure that characteristics cannot be changed without the proper authority.

Each password level entered, affords the user more options and available settings that are kept transparent to the operator or observer to avoid confusion.

ALL inputs and outputs on the controller are fully protected, continuously monitored and when connected, displayed by the software in the 'Status' window.

Readings are also taken and stored of highest temperatures seen in each active zone, supply voltages and other parameters to allow event correlation and system diagnostics if required at a later date.



Product Features:

- Fail safe design gives full fan cooling even with NO electrical power
- Wide supply voltage range (10 – 32VDC)
- Industry standard Deutsch 12 pin connector DT15-12PA.
- User settings inputted via provided software package – NO software to be written.
- Set-up & unit configuration up/downloadable to any backup media via PC.
- NO external adjustments to maintain system integrity in the field.
- Three independently selectable and configurable temperature sensing inputs
- Two on/off ‘override’ switch inputs for full cooling if required.
- ALL Inputs and Outputs fully protected (shorts, opens and reverse connection).
- Unit status ‘Diagnostic’ LED’s user visible and functional at all times.
- Coded error indicator for real time diagnostics at the controller.
- Full remote (PC) and local ‘smart’ visual diagnostics (with optional Opto 3000).
- Product integrity maintained under extreme operational environments.
- Fully ‘isolated’ design for improved safety and ease of application in difficult areas.
- Very cost effective compared to other available modules with comparative functions.
- Ruggedized’ design allowing use on either in-cab or external applications.
- Flame retardant resin encapsulation.
- Mount ‘anywhere’ mechanically hardened modular format.

The information in this guide is the intellectual property of High Country Tek, Inc. and should be considered at all times as strictly company confidential.
It shall not be copied or transmitted by any format to any third parties without our knowledge and express written permission.

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 !

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- 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 !



Electrical Specifications

1) Board Style:	HCT Unique Size and Mounting.
2) Connector Types:	DT15-12PA Deutsch 12 pin
3) Input Supply Voltage:	10 – 32VDC (Absolute Maximum)
5) Input Supply Current (Max):	Valve Current Setting + 200mA Quiescent (Max)
6) Command Input Type(s):	2 wire Thermistor, temperature switch (software selectable) 2 x on/off inputs for fan speed override (software selectable).
7) Command Input Value(s):	Ohms only (Max temp = 50 Ω Min temp = 2M Ω) 2 x Contact closure.
8) Available adjustments:	All adjustments in software, see attached literature.
9) Dither Frequency :	Software adjustable, ~30 to 250Hz (menu selectable)
10) Environmental:	Totally 'ENCAPSULATED' Printed Circuit Board.
11) IP Rating (module only):	Designed to meet IP 68 (MIN) derate connector as required.
12) NEMA Rating (module only):	Designed to meet NEMA 6P derate connector as required.
13) Humidity:	95 - 100% Non Condensing.
14) Storage temp.:	-40 to +85 Deg C (Max)
15) Working temp.:	-30 to +75 Deg C (Max) Inc Ambient.

Thermistor Requirements:



The controller operation is based on input from up to three temperature measured zones.

One, two or all three inputs can be used depending on the system requirements with all three thermistor inputs able to be enabled or disabled independently within the set-up software.

The inputs can be from NTC (Negative Temperature Coefficient) Thermistors or Bi-Metallic temperature switches and the choice can be made in the set-up software.

Two wire NTC thermistors sensors with both wires brought back to the unit are required for each zone being monitored.

DO NOT use thermistors with one lead grounded as the sensor and the measuring accuracy will be severely degraded !

The controller is compatible with most automotive type thermistors with Borg Warner, Delphi and Ford IAT sensors being pre-configured and selectable on a drop down menu.

Other transducers not pre-set may have their profiles added and stored under user selectable names for future use by HCT factory personnel.

If other thermistors are to be added, the acceptable Ohmic range is 50ohms at the maximum temperature that can occur in the system to 2Mohm at the minimum temperature that can occur in the system.

Open ($> 2 \text{ M ohm}$) or shorted ($< 50 \text{ ohms}$) thermistor inputs will be detected and cause full fan speed output and indicate with the appropriate alarm response and error code to aide diagnosis of the problem.

Each thermistor input can also be configured and used as simple contact closure switch inputs.



Temperature 'Switched' Inputs



Switch inputs to the controller **MUST** indicate HIGH temperature by disconnecting (open circuit) or tying the input(s) to the units power supply voltage and indicate LOW temperature by grounding the input.

This switching convention is required to provide 'Fail-safe' operation as the input(s) is normally internally pulled to +5VDC with a current limiting resistor.

When a input(s) reads a HIGH temperature (NOT grounded), it produces a fixed error value that is acted upon by the controller to determine the fan speed (on or off).

Switched Inputs (Fan Speed Override):

These inputs are ON/OFF in nature and are additional to the proportional thermistor inputs. They allow the application to have two 'Emergency' maximum fan speed selector channels. These inputs can be connected to simple temperature switches and used to give full fan speed if the actuation point of the temperature switch is reached. Alternative operation could be manually triggered from in-cab or when a particular vehicle operation is activated, the fan goes to full speed for the duration of the cycle.

Power Supply & Valve 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):-

8 – 14VDC:- Use 12V valve coil.

20 – 36VDC:- Use 24V valve coil.

CE and EMC Notes:

This unit has been electrically designed to pass the latest CE tests but has not yet been certified for stand-alone usage.

This unit can however, confidently be used as part of a larger system which will then be tested to the relevant CE standards.

Opto 3000 Notes

The Opto 3000 interface unit is the equipment by which the fan controller is set-up and monitored, and is intended for temporary use during static system set-up, commissioning and HFS module programming only.

It is not designed for continuous connection and operation, and should not be used or applied in areas where harsh environmental or intense radio Frequency fields (RF) are present as unit resetting may occur, system diagnostic information sent or received may be corrupted or the Opto 3000 unit damaged.

If any of the above problems are seen, dis-continue operation until the source of the RF has been identified and stopped.

The Opto 3000 unit must be ordered separately to the main controller but this is a universal communications adapter which will be used with other HCT controllers and products.



Fan Control Logic:

The controller uses "PI" to regulate the temperatures to be no more than the Set points entered by the user.

The 'P' and I terms act on temperature difference between set point and actual temperatures, with the P term used to change the amount of response at the control valve and should be adjusted to respond smoothly to smaller temperature changes. The larger the number set, the more aggressive the change will be for a small difference.

The 'I' term tracks the temperature difference and automatically adjusts the control valve to increase or de-crease fan speed while attempting to get as close as possible to the set point. The larger the number set, the bigger corrective step to the control valve will be seen.

General operation default values for the P & I terms are embedded in the software but may be altered by users with the proper password level of authorization to fine tune a system.

Temperature error is the difference between the actual measured temperature and the 'temperature set point', scaled by the difference between the 'temperature set point' and the '**Overtemp**' alarm set point.

The scaling is required to allow comparison of all the thermistor inputs on an equal basis.

The active thermistor input with the largest scaled error above its set point will be used by the PI process.

If all temperatures are below their user set points, the thermistor closest to it's set point will be used to give control.

In a properly tuned system, this process will result in the fan turning just fast enough to keep one temperature regulated to its set point and all other temperatures less than their Set points.

If a thermistor input is shorted or open, the unit will ramp to full fan speed. This error behavior will continue until power is turned off if the user programmable 'Retry All Faults' is **NOT** selected, otherwise, it will resume normal operation when the fault is cleared.

A thermistor reaching 'Overtemp' is an error that results in ramping to full fan speed. The 'Overtemp' error condition is automatically cleared if the thermistor drops below 'Overtemp', ramping to the PWM% value demanded by the PI loop.

Password Protection:

Password protection has been provided to ensure that damage cannot be caused once commissioning is completed. There are three levels of security, all of which may only be accessed via the Opto 3000 and PC software and with the proper password level of authorization:

- Level 1:-** (**NO Password**) Monitor controller operation only, no change in parameters allowed, can data log for system diagnosis if required.
- Level 2:-** (**OEM Password**) Authorized user has access to the functions that are needed for programming and set-up.
- Level 3:-** (**Professional Password**) HCT Engineering level which allows access to ALL base controller settings and some RESET functions.

Contact High Country Tek , Inc. on the e-mail address (info@highcountrytek.com) for password .



Proportional Output:

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

BOTH wires from the valve coil must be connected to the controller where indicated by '+Prop Valve O/P' and '-Prop Valve O/P'.

The output is 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.

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 approx. 3A coil current maximum at the connected supply voltage.

The software allows user selection of driving normally open and normally closed proportional valves.

For data and integrity protection, the controller and proportional output is turned off if the units internal temperature sensor temperature exceeds 80 C (176 F).

Fan MAX Speed Setting:

This is called ' Max Vlv Current %' in the software and allows current to be adjusted from 0 – 100 % PWM output.

If Max Valve Current is set to zero (0) all other settings will also go to zero.

Fan MIN speed Setting:

This is called ' Min Vlv Current %' in the software and allows current to be adjusted from 0 – 100 % PWM output set by 'Max Vlv Current' above.

Ramp Settings :

The user programmable ramp Up and Down times are applied to limit the controllers rate of change in output current to a value that prevents damaging the hydraulic system components and the fan blades.

The ramp rate is set in seconds (s) for a full scale current output change in the range of 1 to 10 seconds.

This ramp time should be set low enough not to interfere with the temperature control loop response but high enough to give smooth system operation.

Dither Frequency Setting (Valve Coil):

The set-up software allows the dither frequency (PWM frequency) to be set from 31.5 to 250Hz to cater for the known range of proportional valves that could be used for this application.

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 3000 Transmit LED:

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 3000 unit.

Opto 3000 Receive LED:

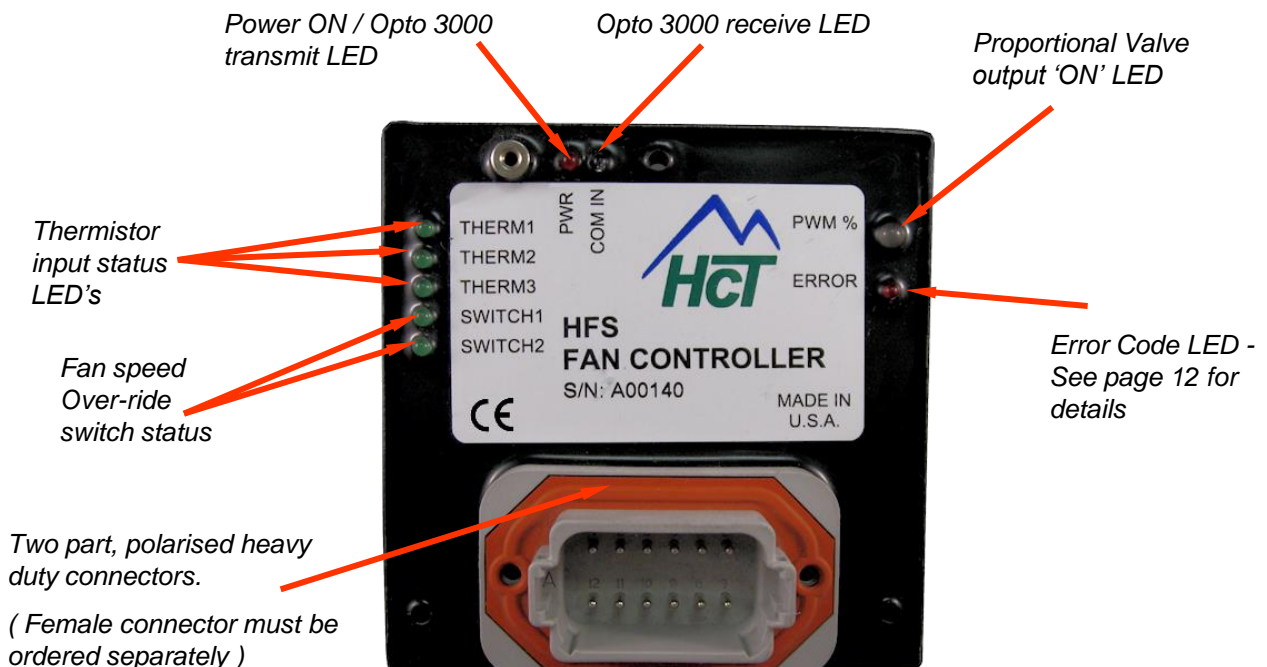
The clear LED is used only for 'Infra-Red' communications when connected to the Opto 3000 unit and never shows any visible light.

Proportional Valve Output LED:

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.

Thermistor Input Status LED's:

The **GREEN** LED for the thermistor that is controlling the fan comes on steadily while the other thermistor LEDs are off, if no more than one thermistor is above set point. If multiple thermistors are above set point, the thermistor that is controlling the PI process has a blinking LED and the others above set point are on steady.



Error Code Indicator LED:

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 (176F) 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, and flash ALL LEDs except for the Power LED which is required for Opto 3000 communication.

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 HCT 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 LED 'Blink' Description:



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



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:

The connector used on this controller are **DT15-12PA Deutsch 12 pin family** and are of the two part, polarised, heavy duty screw variety to suit the intended application environment while still allowing easy cable access, installation, pre-looming and normal maintenance.

The controller comes with the integral male (on the unit) while the female is either customer supplied or can be ordered from High Country Tek (Part No.:- 999-10088)

Connector:- Mating connector Parts:- (Ordered separately)

Deutsch # DT06-12SA Plug

Deutsch # W12S – Lock

Deutsch # 0462-201-16141 – Socket pins

Deutsch distributor – Ladd Industrial sales – 1-800-223-1236.

General Maintenance:

The controller printed circuit board and components are sealed and impervious to hydraulic oils, other non corrosive liquids and hostile environments.

If the controller is dirty, wipe clean with a cloth only. DO NOT use abrasive cleaners as this will degrade the units information label.

If the controllers diagnostic indicator LED's are broken, the unit will continue to function normally with no adverse effects and will maintain the fully sealed rating.

The unit should be replaced as soon as possible if any of the LED indicators are damaged or broken to allow full local diagnostic information on controller operation.

• E-Mail to : info@highcountrytek.com

• General Info : www.highcountrytek.com

Retry All Faults Option:

The user setting “**retry all faults**” determines if the unit will retry faults that are detected with the controller or peripheral devices after 4 seconds or if **NOT selected**, the unit will stop operation until the power supply is turned OFF and back ON.

If after a power reset, the fault is cleared, the unit will return to normal operation. If the fault persists, the controller will once again stop and repeat the procedure above.

PC Hardware Requirements:

- Windows® NT & 2000 operating system (Vista compatibility to be confirmed – contact HCT customer service).
- 2mB free hard disk.
- 68mB memory(min)
- Unallocated DB9 serial communication port **OR**
- Unallocated USB port with user supplied USB to DB 9 hub, powered and with USB driver software installed correctly.

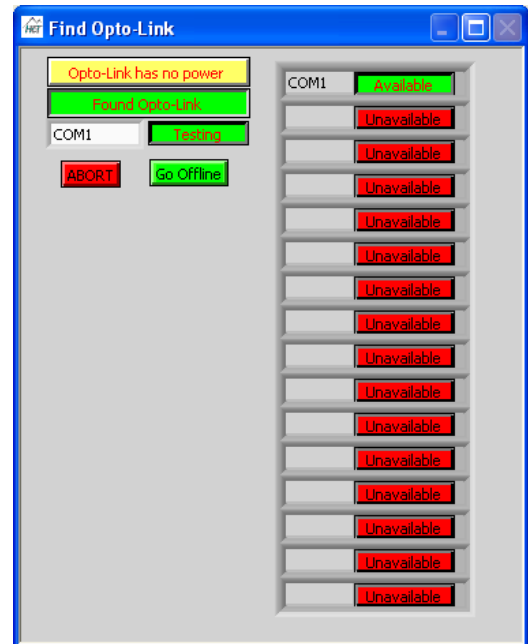
Set-Up Software:

High Country Tek Inc. has realized that digital electronics comes with the need for the user to communicate with the controller and with this comes a new set of practical problems associated with having to learn and become proficient with the set-up software and hardware connections.

The software for this product is available from HCT and loads itself into a subdirectory (the user is urged to allow the default directory paths).

This new generation of controller setup programs is specifically designed to be easy-to-use with a non threatening approach and with only the necessary items displayed (determined by password levels) to give a non-cluttered display that is clear and understandable to both the professional and casual user.

The controller-to-PC communications is taken care of by the Opto 3000 unit which is plug and play in that all the user needs to do is physically connect the unit and run the provided software for the full automatic setup.

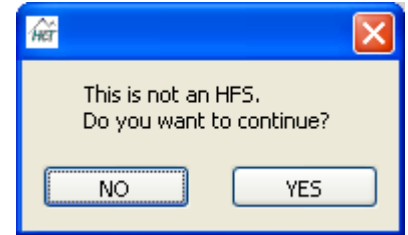


The Opto 3000 should be connected to the host PC first and the HFS software started. The PC will immediately check the available ports, display a list (shown right) of available serial ports, find the Opto 3000 and connect. If the Opto 3000 is connected to an HFS that has power applied, the program will take a few seconds to check module validity and then display the settings from that module. At this point, the user may enter a password if changes to settings are required.

Software Set-Up Guide (Menu Bar):

For added system security, as soon as the Opto 3000 recognizes that the user has connected any powered High Country Tek controller unit, it requests the modules identity to compare to information stored in the graphical user interface. If this identity does NOT match the expected information, the program will display the message seen to the right to inform the user that the unit is not the one anticipated.

If the module sends the correct identification to the program, the user is allowed to enter passwords and operate the software as normal.



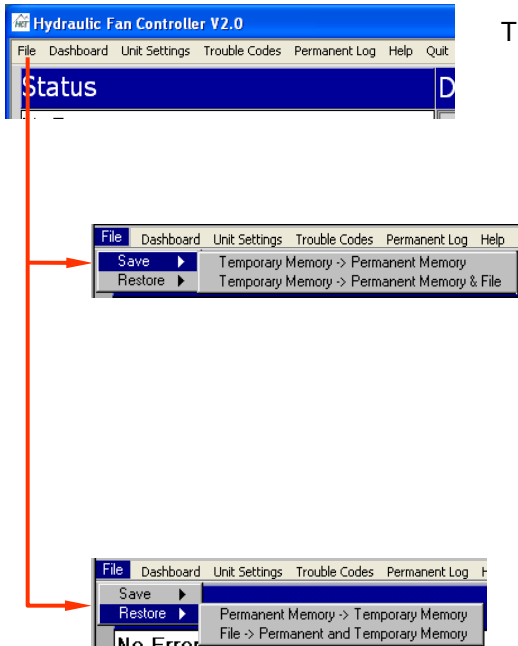
Saving / Restoring Profile data file

The GUI software and module allows the user to set-up and optimize the units characteristics as required and then save the profile as a backup or for future download into new modules so that they are all set identically.

This feature should be used to save a backup copy for operational security.

Below are the options available to the user.

Please contact HCT customer support for details on how you can request an optimized file you have developed and saved to be pre-loaded into a controller for your application by the factory.



The 'FILE' tab brings the 'SAVE' and 'RESTORE' options to the user.

SAVE:

Temporary Memory -> Permanent Memory:- transfers all data from PC to the connected module for onward unattended operation at the current profile settings ONLY. NO backup copy is made !

Temporary Memory -> Permanent Memory & File:- transfers all data from PC to the connected module for onward unattended operation at the current profile settings ONLY. Opens window to allow user to select stored file name and location for backup copy of profile.

RESTORE:

Permanent Memory -> Temporary Memory:- transfers all data from the connected module to the PC for editing the current profile being used.

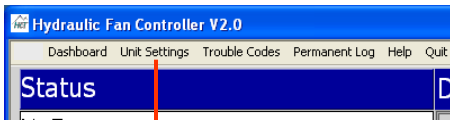
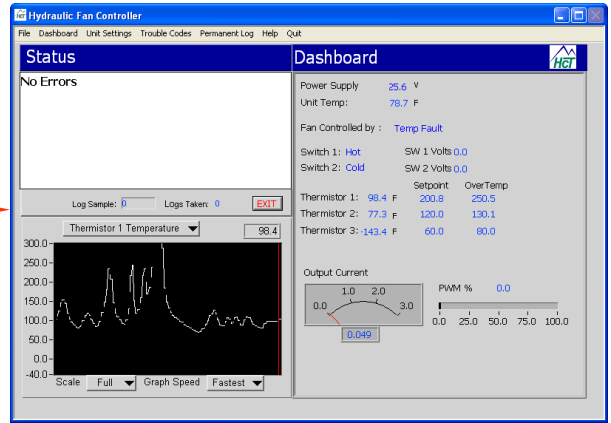
File -> Permanent and Temporary Memory:- transfers all data from a hard copy PC file to the connected module and onto the PC for editing.

Software Set-Up Guide (Menu Bar):



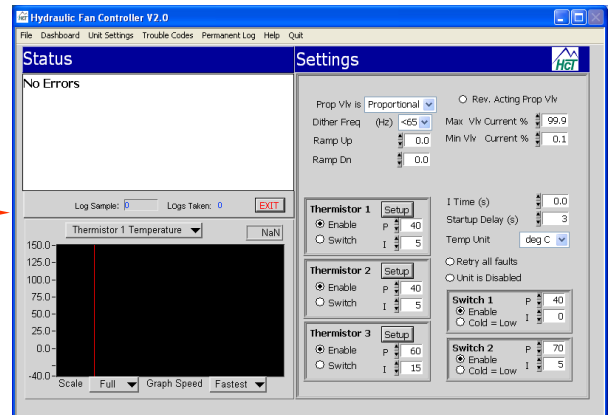
Clicking the **DASHBOARD** tab brings up the 'real-time' controller information page which allows the user to observe the status, alarms and access the diagnostic features.

- NO adjustments can be done from this page.

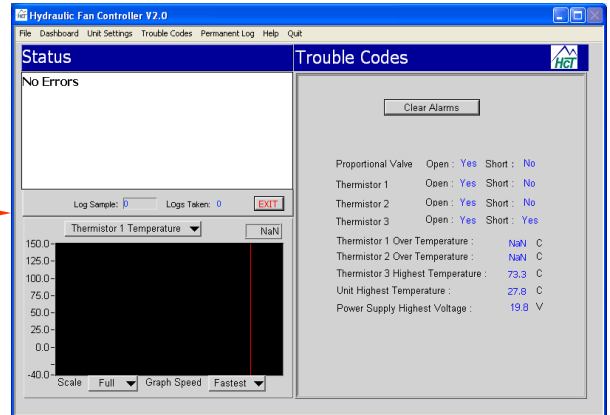
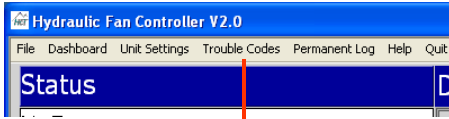


Depending on the password level, Clicking the **UNIT SETTINGS** tab brings up the available user adjustable windows for setting the controller profile.

(shown here at 'professional' level with ALL options displayed).

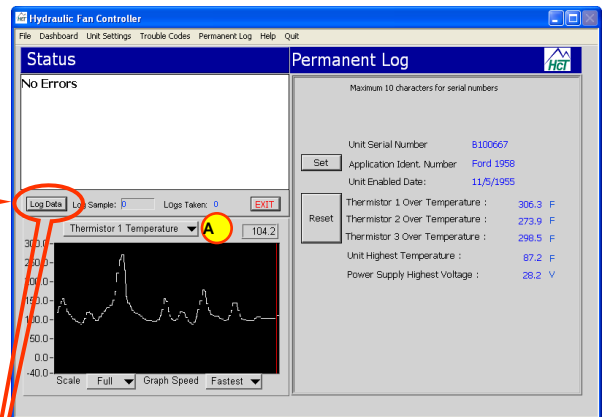
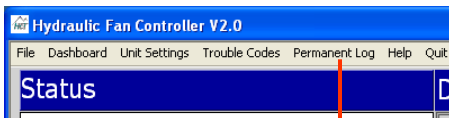


Software Set-Up Guide (Menu Bar):



At 'OEM' and 'Professional' password levels only, Clicking the **Trouble Codes** tab allows the user to observe a log of any OPEN or SHORT circuit error codes that have been triggered and stored. The currently displayed event log can be reset from both of these levels.

Event times and number of occurrences are NOT recorded, rather that the error occurred at least once from the last log reset.



At 'OEM' password level and above only, Clicking the **Permanent Log** tab allows the user to observe list of 'Stored' data that indicate the maximum levels that the controller has ever seen from initiation:-

1. The '**Unit Serial Number**' is unique to every controller.
2. The '**Application Ident Number**' is entered at commissioning if required.
3. '**Date First Set Up with PC**' is the 'Born Date of the controller for warranty uses.
4. The **DATA LOG** button is now only available on this screen

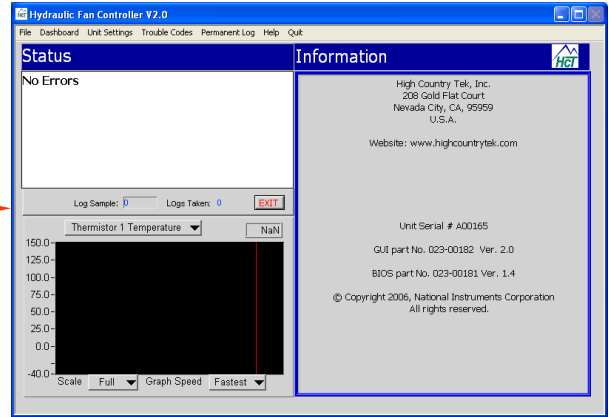
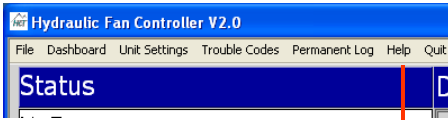
• At 'OEM' password level only, items 2,3 can be observed and reset.

Clicking this button starts the data logging process.

ALL of the parameters available in the item **A** drop down menu as well as other profile settings are logged for a period of 255 samples . After the logging period, a popup window asks for file name and storage location.

This file is saved with a *.csv extension which allows direct import, reading and graphing in Microsoft Excel.

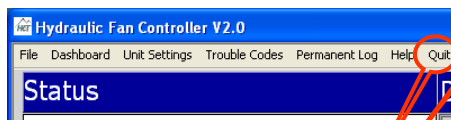
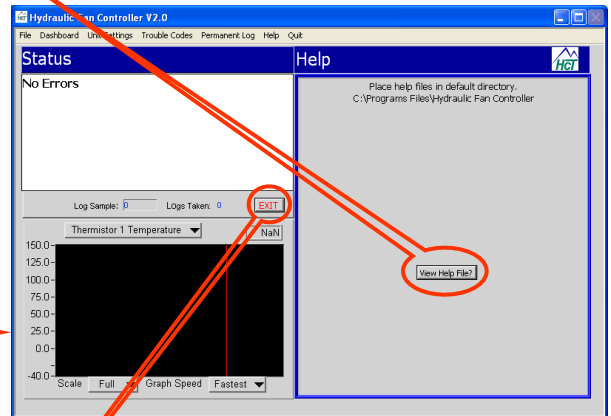
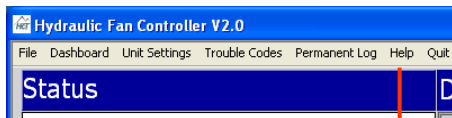
Software Set-Up Guide (Menu Bar):



At any password level, Clicking the **Help** tab allows the user to see contact information, web and e-mail addresses as well as software and hardware revisions for the actual product currently in use.

This information should be available if contacting HCT for advice or requesting product support.

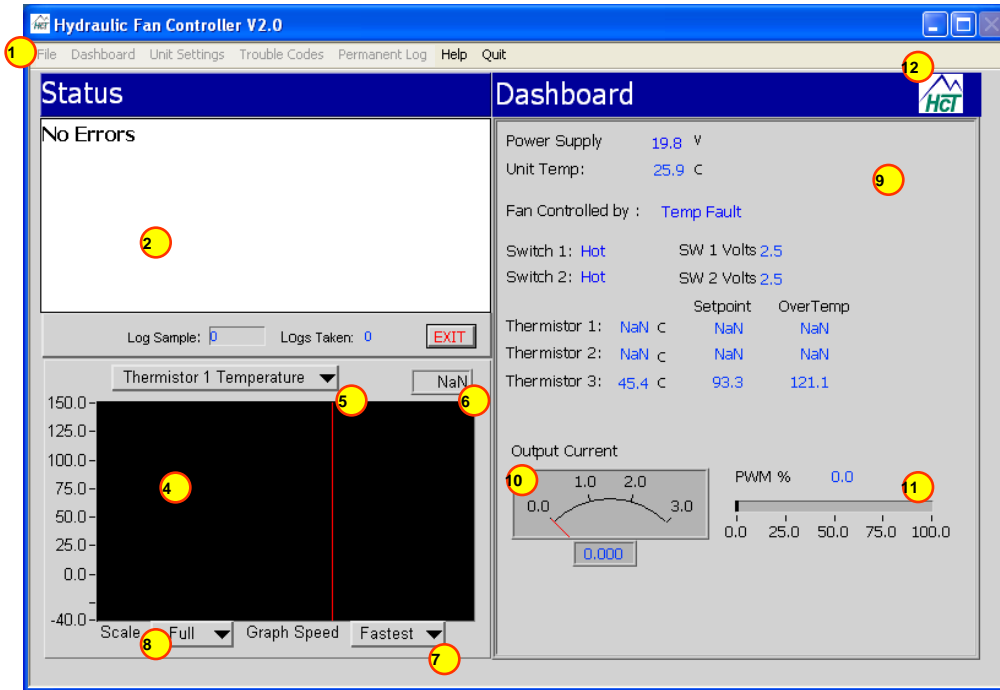
When '**Help**' is selected from the dropdown menu, the user can click the 'View Help File' button to see the text version of the manual or other file. This can be very useful for other languages other than English.



NOTE:

At any password level, Clicking the "Quit" tab or "EXIT" button turns exits the program in the correct manner

Software Set-Up Guide (Dashboard):



1 At the observer level, I/O Display, Help and Quit is the only options available on the menu bar.

2 Alarm and Error text window.
Error messages are in RED text.
The window stays as above while there are no errors or alarms reported by the system and/or controller.

3 Window where 'Real-time' graphing of selected parameter in 5 is displayed.

4 Real time graphing window

5 Drop down list of available parameters for display.

6 Digital representation of the parameter being displayed in 4

7 Selects Slow, Medium or Fast graph time base setting.

8 Selects Graphic window scaling between FULL scale or AUTO. Auto gives better resolution for lower values.

9 General display area for controller information and input / output status.

10 Analogue needle display and digital readout of 'real-time' output current to proportional valve drive.

11 Analogue bar graph and digital readout of 'real-time' output current as a % of the maximum set.

12 Clicking the HCT logo, prompts the user for the password level required:-



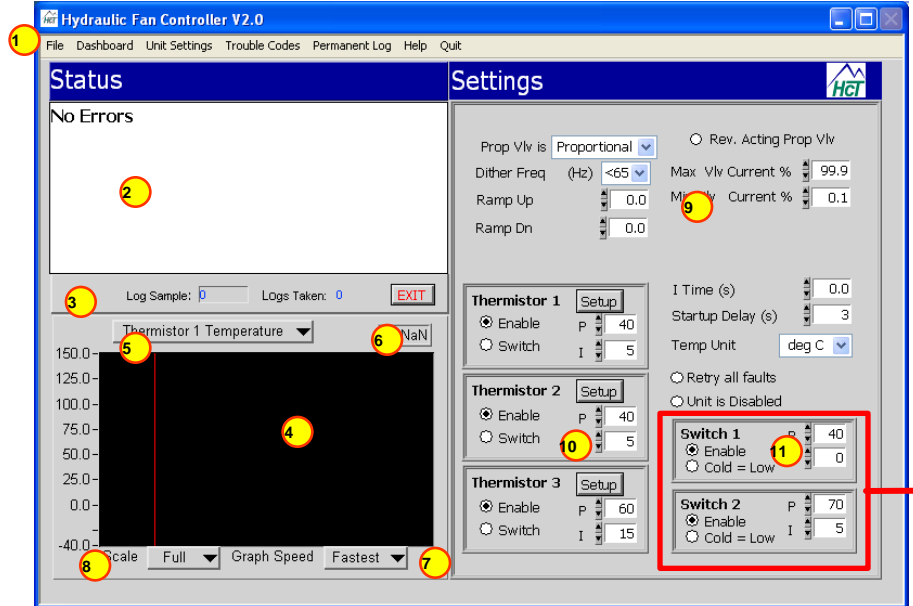
- When the HCT logo is clicked, this window will open and reset the access level to NONE.
- You must enter a password to enter a new level.

Software Set-Up Guide (OEM page):

NOTE:


The main differences between the OEM level and the Professional level passwords is the ability at the Professional level to 'RESET' data values in the 'Permanent Log' that have been stored during the controllers operation.

Both levels allow the user full access to all controller parameters so password confidentiality should be of a high priority.



- 1 At OEM and Professional password levels, the full menu bar options are displayed and available.
- 2 Alarm and Error text window.
Error messages are in RED text.
The window stays as above while there are no errors or alarms reported by the system and/or controller.
- 3 Clicking this button starts the data logging process.
ALL of the parameters available in the item 5 drop down menu as well as other profile settings are logged for a period of 255 samples . After the logging period, a popup window asks for file name and storage location.
This file is saved with a *.csv extension which allows direct import, reading and graphing in Microsoft Excel.
- 4 Window where 'Real-time' graphing of selected parameter in 5 is displayed.
- 5 Drop down list of available parameters for display.
- 6 Digital representation of the parameter being displayed in 4
- 7 Selects Slow, Medium or Fast graph time base setting.
- 8 Selects Graphic window scaling between FULL scale or AUTO. Auto gives better resolution for lower values.
- 9 General parameter set-up area for controller. See following section in this manual for further details.
- 10 Thermistor Enable and set-up controls. See following section in this manual for further information.
- 11 **2 x Fan speed over-ride switch set-up controls.**
Set to the option shown here, the fan will be fully ON if the switch is OPEN CIRCUIT and fully OFF if the switch is connected to +V controller supply.
If the Cold = Low button is selected, the fan will be fully ON if the switch is OPEN CIRCUIT and fully OFF if the switch is connected to 0V controller supply.

Software Set-Up Guide:

- 1 Click the 'down arrow'  and select from the menu for 'Proportional or ON/OFF' type output current. In ON/OFF mode, no Min, Max, Test or Rev Vlv current settings are available and the output will be dependent on the supply voltage to the controller.

In ON/OFF mode the ramps are left active to aide the use of a 'soft-shift' valve if used.

- 2 Click the down arrow and select from the drop down menu, the dither frequency between 31.5Hz and 250Hz that is nearest to the recommended value for the proportional valve product being driven.

- 3 Use the up/down arrows on each box or directly enter a value (in seconds) in the range 0 – 60S for the ramp UP and DOWN.
- 4

- 5 See the next page for 'Thermistor' set-up details

- 6 Sets the units of temperature displayed throughout the software from Degrees Centigrade (C) to Degrees Farenhieght (F).

- 7 Sets the overall 'Integral' time constant of the controller. Update loop

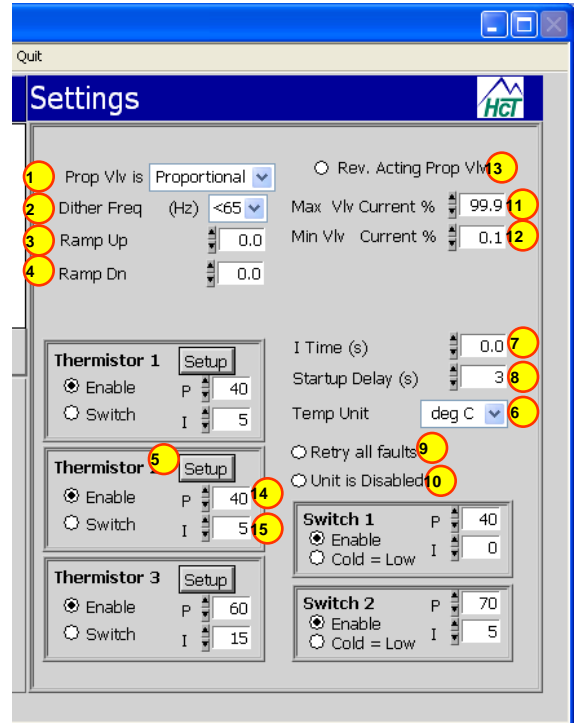
- 8 This feature is intended to allow vehicle starting with minimum loading and holds OFF controller action until the time entered her in seconds (0 – 60S) expires.

- 9 Click this button to enable 'retry all faults' which will allow the controller to automatically try an error reset every 4 seconds to see if the fault has cleared.

If this feature is disabled, any error will trigger the controller to shutdown and stop functioning until a 'Power On Reset' is applied.

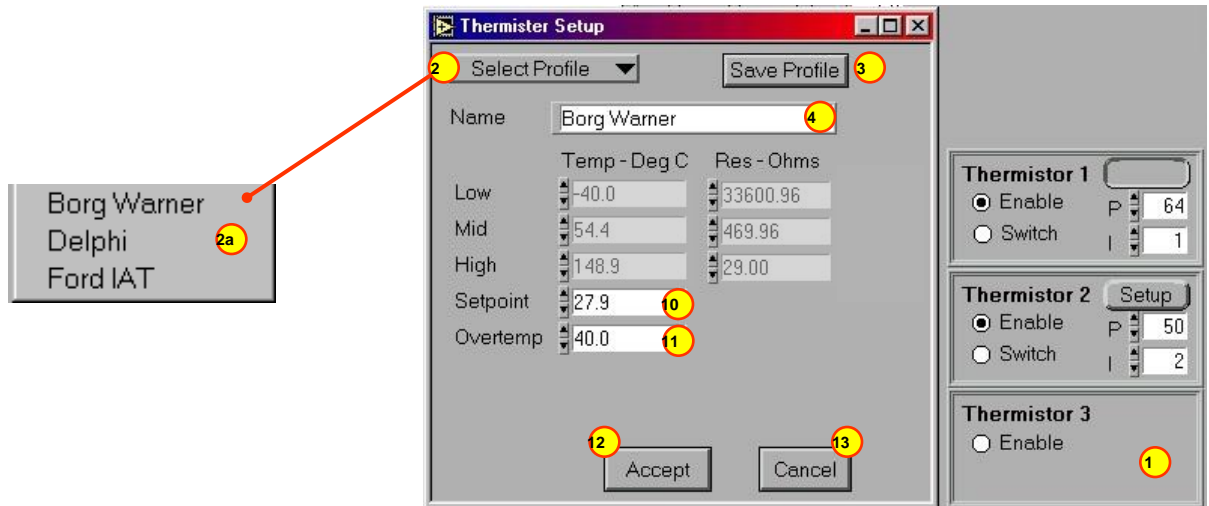
- 10 Click this button to enable or disable the entire controller. This button on a new controller is defaulted to disabled.

The first time that a controller is enabled, the date from the connected PC is 'Trapped' and taken as activation date information.



- 11 Set the Maximum valve current here from 0 – 100%. Maximum current (100%) depends on coil Ohmic value and supply voltage and will determine the **fans maximum speed**.
This setting must be entered first and the software ensures that no other settings can be greater than this.
- 12 Set the Minimum valve current here from 0 – 100% of the maximum current in. 11 This current will determine the **fans starting speed**.
Software ensures that this setting cannot be greater than the maximum setting.
- 13 Click this button to allow inverted current output to control **reverse acting proportional** valves.
- 14 This is the 'Proportional' value that sets how 'Aggressive' the change in fan speed is to a change in temperature.
There is a 'P' adjustment for each channel
- 15 This is the 'Integrator' value that sets the 'Accuracy' of the change in fan speed to a change in temperature.
There is an individual 'I' adjustment for each channel.

Thermistor Selection:



The HFS software includes several pre-characterized thermistor calibration profiles. These are accessed by pressing <Unit Settings>, <Setup> (for the thermistor to be calibrated), <Select Profile>. This allows selecting one of these thermistors from a drop down list.

This procedure is carried out for each channel which will allow different sensors to be used for different liquid / medium measurement.

- 1 The window showing **Thermistor** settings is only available with **OEM** and **Professional** password levels and when the menu bar 'Unit Settings' tab is clicked.

The figure to the right shows the three thermistor inputs with Thermistor 1, enabled as a thermistor and with the 'Setup' button depressed. Clicking on the radio button marked '**Setup**' opens a box called 'Thermistor Setup' shown to the right.

Thermistor 2 is shown enabled as a thermistor and with the 'setup' button as normal.

Thermistor 3 is shown NOT enabled. In this state, the options associated with the thermistor are removed from the screen for clarity.
- 2 Clicking this arrow will roll down a menu list [Select Profile] (see 2a above) of transducer profiles available. Default profiles are supplied and all other 'user created' files will be shown if stored in the default file locations.
- 3 Clicking the 'Save Profile' button, saves the thermistor points to a file called [Name].dtp in the same directory and will then appear in the [Select profile] list.
- 4 This window displays the current profile selected for the relevant channel. To change the profile, follow step 2 and press accept.
- 10 The value in this window is the '**Set point**' that the controller will attempt to maintain by altering fan speed. This value must be between -40 or +300 Degrees F.
- 11 The value in this window is the '**Overtemp**' alarm threshold that will cause the alarm output to activate if reached. This value must be greater (>) than the 'Set point' value. If the difference between Set point and Overtemp is too small, the controller may keep going into alarm condition as the actual temperature is controlled around optimum.
- 12 Push this button to accept displayed data and return to the main program.
- 13 Push this button to disregard all displayed data and return to the main program.

NOTE:-

The set-up software has embedded default settings for Borg Warner, Delphi and Ford AIT sensors available. These files are write protected to prevent accidental editing and should be left in this state for 'Reset to Datum Operation' purposes.

Opto 3000 Interface Information

The unit is fully compatible with Windows® XP Professional and Vista Business and Ultimate versions. Please contact your distributor or HCT for information on Vista compatibility.

This unit is designed to operate directly from any of the host PC's USB ports. **The user must take care to install the correct USB drivers, either supplied with the HCT user software or by visiting the HCT website and downloading the required drivers free of charge.**

This style of 'non contacting, non electrical communications' offers full isolation between PC and controller and is extremely rugged in physical nature. The method is not prone to connector breakage or 'clogging' with foreign matter from the working environment and is free from failure caused by electrolysis or common short circuits as seen with communications alternatives used by others.

The optical communications also allows high speed data transfer between the host PC / laptop and the controller for real time diagnostics and fast set-up or programming.

All the controller units inputs, outputs and options are available for display within the GUI software (GUI - Graphical User Interface) which is available for the controller unit.

The Opto 3000 and controller requires that the correct interface software (GUI) is loaded onto the host PC and run to establish communications.

The program will automatically poll all of the com ports available (*In Windows® XP Professional and Vista Business and Ultimate versions, the software will establish and display all free communications ports* , detect and check the Opto 3000 unit for correct operation, allocate the respective port for communications while at the same time setting the fastest reliable baud rate and default port settings.

When using the Opto 3000 with any HCT user software, the GUI provides an 'EXIT' button on the user PC screen (not the RED 'X' in normal Windows top left corner). This should be used as this not only exit's the current program but also releases the USB communications port.



- Wipe controller transmit and receive LED's with soft cloth before attaching the Opto 3000 communications head to ensure good infra-red communications.
- Ensure the Opto 3000 send/receive head is firmly and correctly attached to chosen HCT controller before starting the PC graphical user interface software.
- Ensure the controller supply voltage is present and it is powered-up correctly to allow communications to take place.
-

- If communications become unstable (i.e. controller reports non communication OR the Opto 3000 keeps resetting) , check that the Opto 3000 power supply is correct and that no foreign matter is blocking the optical communications head or controller LED's.
- DO NOT expose the Opto 3000 unit to liquids or damp/humid operating conditions as it is NOT sealed.
- The Opto 3000 is not designed to be used for continuous communications. If this mode of operation is required, please contact HCT engineering for a solution.

Controller Operation:

The HFS controller has been designed to integrate into a typical cooling system and control a hydraulically driven fan system proportionally or in an ON/OFF manner based on user settings.

There are three (3) independent industry standard two wire thermistor inputs, two (2) fan speed over-ride inputs and one (1) proportional valve output.

The thermistor inputs can also interface directly with pre-set ON/OFF temperature switches without the finer more accurate proportional control offered by the thermistors.,

The unit once calibrated and set-up with the supplied software, uses the fan speed to regulate the temperature that is measured as being the highest above its' user selected set point back towards the desired temperature set value.

User settings and adjustments to the regulation process are made via a laptop PC to allow precise customizing the unit for specific applications.

There are available settings for Minimum and Maximum coil current, Dither frequency and amplitude and ramp up and down to ensure smooth control of the fan.

Once commissioned, the entire controller 'profile' can be saved as a file on the PC for backup purposes or serial production uses as this can be directly uploaded into a new 'Blank' fan controller unit.

There are no onboard potentiometers or switches for user settings to ensure best controller integrity and operation under harsh environmental conditions.

Connector Information:

Mating connector Parts:-

Deutsch # DT06-12SA Plug

Deutsch # W12S – Lock

Deutsch # 0462-201-16141 – Socket pins

Deutsch distributor – Ladd Industrial sales – 800-223-1236.

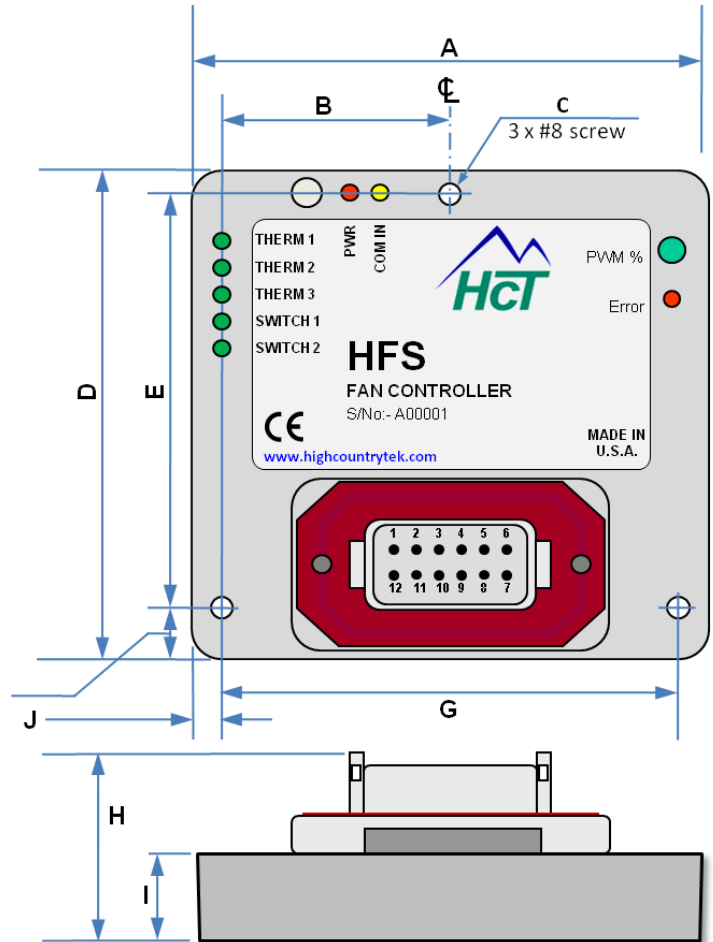
- Pin 1:- Thermistor #1 +signal I/P.
- Pin 2:- Thermistor #2 +signal I/P.
- Pin 3:- Thermistor #3 +signal I/P.
- Pin 4:- Over-ride Switch #1 I/P.
- Pin 5:- +8 – 40VDC Power supply Input.
- Pin 6:- +Proportional Valve Output.
- Pin 7:- -Proportional Valve Output.
- Pin 8:- 0V Power Supply Input.
- Pin 9:- Over-ride Switch #2 I/P.
- Pin 10:- Thermistor #1 -signal I/P.
- Pin 11:- Thermistor #2 -signal I/P.
- Pin 12:- Thermistor #3 -signal I/P.



Dimensional Information:

Label	Inches	Millimeters
A	3.77	96.0
B	1.89	48.0
C	∅ 0.186	5.0
D	3.82	97.0
E	3.10	78.8
F	0.46	12.0
G	3.25	82.6
H	1.6	41.5
I	0.64	16.5
J	0.26	6.5

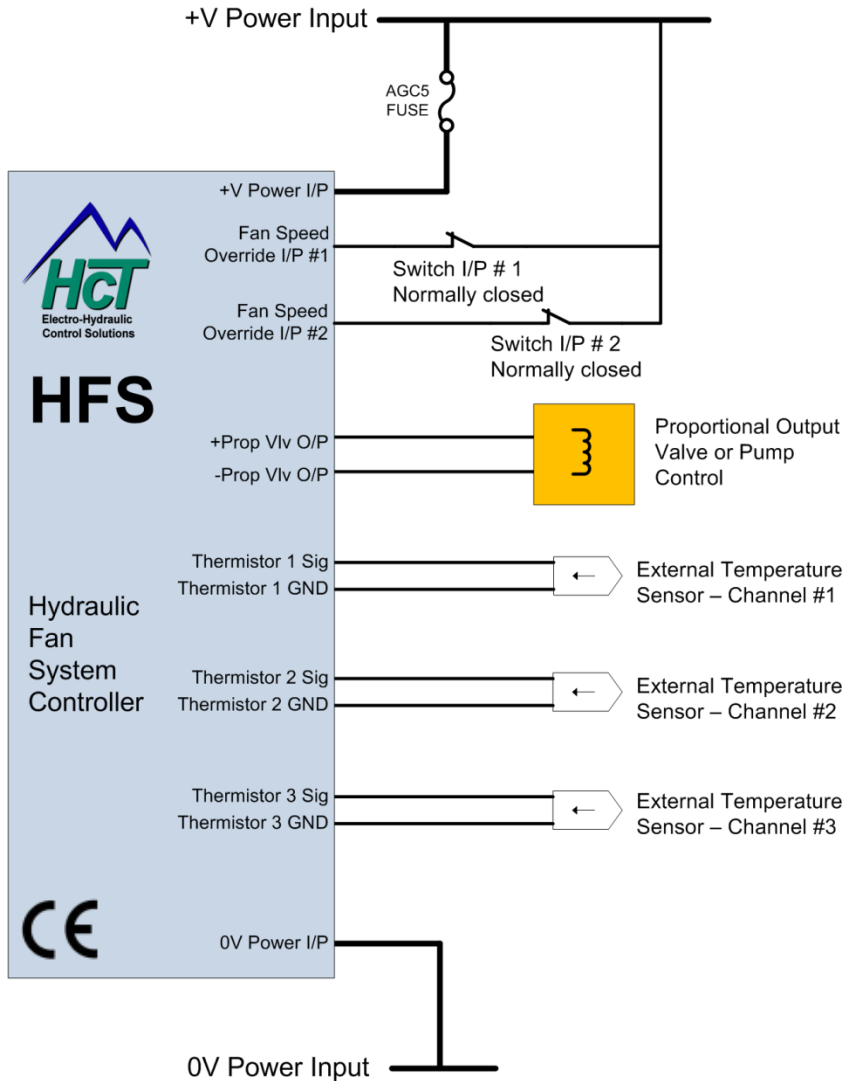
NOT to scale, contact HCT customer service for exact dimensions



Mechanical Information:

Housing Type:-	HCT unique 'encapsulated' block.
Housing Material:-	Polycarbonate
Housing Color:-	Black
Surface Finish:-	Semi-Gloss
Housing Thickness:-	12mm (main module) 25mm incl. Connectors.
Unit size:-	See above size detail drawings.
Unit Weight:-	Approx.... 250 grams (including Encapsulation material)
Wire entry:-	Via heavy duty, polarized, two part 'Deutsch' connector.
Encapsulation:-	Flame Resistant, Black , Two Part Epoxy Resin.
Mounting:-	Via through holed (3) suitable for No. 10 (4mm) screw .
Temperature range:-	- 40 to +75 degrees Centigrade (operational)

Electrical Connection Information:



odule supply voltage to coil voltage.

erse acting valve for default to full
ed if electrical power is lost.

IMPORTANT NOTES:

- 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.

Condition	Error LED	Alarm Output	Proportional Valve Output	PWM Output LED	Power LED	Thermistor Leds	Cleared By
Memory Checksum Failure	One Blink	Same As Error	Off	Green / Off With 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	Power Off Till Unit Temperature < 70c
Unit Temperature > Than 80C	Two Blinks	Same As Error	Off	Red / Off With 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	Shorted Same As Error	Power Off Till Fault Corrected
Thermistor Input Open	Four Blinks	On	Full Fan	No Change	No Change	Open Same As Error	Power Off Till Fault Corrected
Thermistor Input Over Temp	Six Blinks	On	Full Fan	No Change	No Change	Temp Same As Error	Corrected
PWM Output Shorted	Off	On	Off	Flashing Red / Off	No Change	No Change	Power Off Till Fault Corrected
PWM Output Open	Off	On	Off	Flashing Green / Off	No Change	No Change	Power Off Till Fault Corrected
Power Supply < 8 Volts	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	On	No Change	
Power Supply > 40 Volts	No Change	On	No Change	No Change	Blinking	No Change	Set Power Supply Between 8 And 40 V
Fan Min, All Thermistors Below Set point	Off	Off	Minimum	No Change	No Change	All Off	
Fan Slowing, All Thermistors Below Set point	Off	Off	Slowing	No Change	No Change	Closest To Set point Is On	
Only One Thermistor Input Above Set point	Off	Off	Regulating	No Change	No Change	Selected Is On	
Several Thermistor Inputs Above Set point	Off	Off	Regulating	No Change	No Change	Selected Is Flashing, Others Above Set points Are On	

Unit diagnostics, Error Codes and Alarm Conditions

Controller Mounting:

The electronic components used in this controller released by HCT, conform to the Commercial temperature range which is -40° to +75 ° Centigrade. This rating means that the components will work reliably and give a good life span if the operating temperature is kept within these (absolute maximum) limits.

The controllers when in operation do generate and dissipate internal heat. The amount of heat generated is dependent on the amount of work that the controller is being asked to do as well as other factors such as supply voltage, type and voltage of coil being driven e.t.c. with the worst case combination being a 24VDC supply with a 12V coil.

In order for the unit not to exceed the +75°C maximum operating temp and cause a 'self-protection' shut down situation, the user must mount the controller in a position that is ergonomically preferred especially for visual inspection and system maintenance and also provide for adequate ventilation to ensure that the unit is cooled to maintain operation.

In addition to ventilation, the system designer must also look at the mounting arrangement for the cards / controllers and be aware that adequate space should be left around, in-front and behind to allow the above ventilation to take effect.

It should be noted that temperatures are 'Additive' which means that with a high ambient temperature, the units internal temperature rise need only be quite small to reach the maximum specified levels.

If controllers are going to be used in High ambient temperature or unusual application areas, please contact the customer service personnel at HCT for advice on cooling and mounting.

Notes:-

- Enclosures should have an 'IN' and an 'OUT' vent for correct cooling air circulation.
- Mount the controller so the operator can see it if required to do so.
- Use 'fan-blown' air wherever possible to increase air exchange rate.
- DO NOT mount controllers in direct sunlight.
- Mount controllers with 'air-gaps' to allow correct ventilation.
- Do not mount controllers in non-ventilated sealed box's especially in high ambient areas.
- DO NOT mount controllers 'face-face' or densely as this will cause over-heating problems.
- Read the literature and observe the max operating temp figures and work to them.
- Remember...High temp. ambient air used for 'cooling' is not a good solution !!



Temperature Sensor Information:

HFS - Thermistor Compatibility Chart



Coolant/Oil Sensors			
	Description	Part number	Comments
1	Delphi Packard Temp Sensor Connector, Female GT-150 (unshrouded) Terminal, Female 16AWG SXL Cable Seal, 16AWG SXL Wire, 16AWG SXL	Packard #15326386 Packard #15336024 Packard #15326267 Packard #12191229	3/8-18 NPTF thread (-40C to 130C)
2	Borg-Warner Temp Sensor Circular Push on Connector w/ 5" pigtails or Connector Assy TF Metri-Pak 280 series TPA (part of connector assy) Terminal, Female Sealed 16AWG SXL Cable Seal, 16AWG SXL Wire, 16AWG SXL	Borg Warner #5028-01666-02 Kysor #1530-00027 Packard #15300027 Packard #15300014 Packard #12077411 Packard #12015359	Preassembled connector

Air Sensors			
	Description	Part number	Comments
1	Delphi Packard Temp Sensor Connector, Female GT-150 (unshrouded) Terminal, Female 16AWG SXL Cable Seal, 16AWG SXL Wire, 16AWG SXL	Packard #12110446 Packard #15336024 Packard #15326267 Packard #12191229	1/4-18 NPTF (-40C to 130C)
2	Ford IAT Temp Sensor Plug Assembly Receptacle Cable Seal, 18AWG SXL Wire, 18AWG SXL	#F6SZ-12A697-AA or #F6SZ-12A697-AB Amp #184004-1 Amp #184030-1 Amp #184141-1	Also had 0A06A stamped on Part. Contact Ford dealer for part.

Parts can be bought directly from Delphi by calling 1-800-packard (1-800-722-5273)

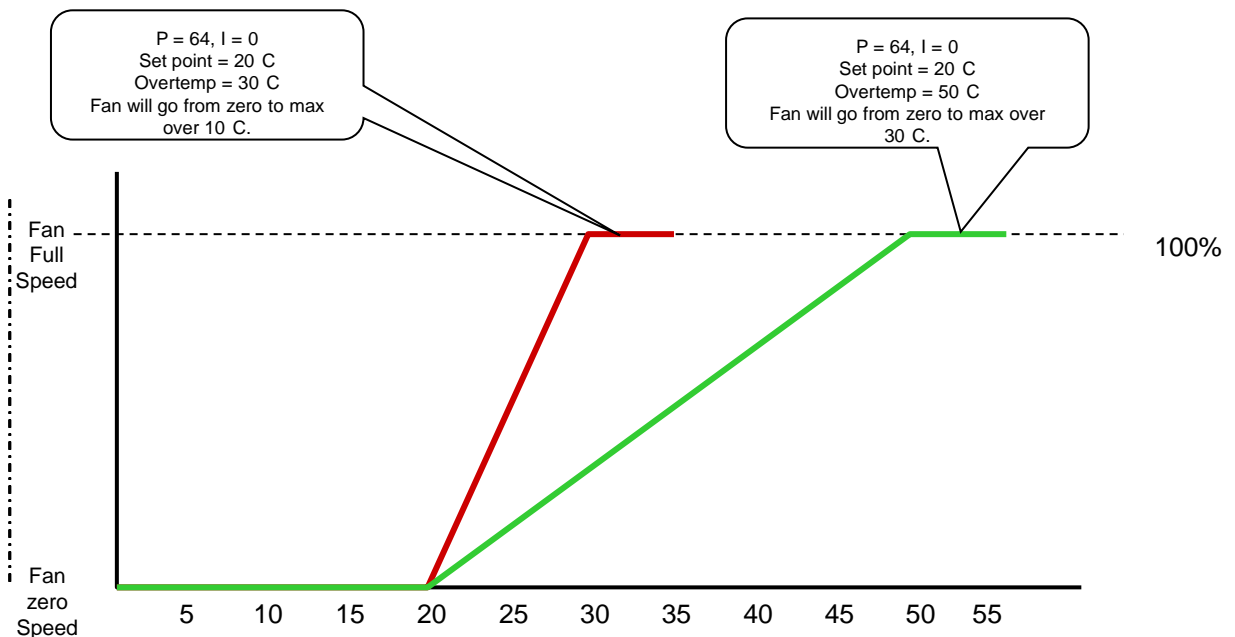
Please e-mail info@highcountrytek.com for additional information if required, stating your question clearly and giving a valid return e-mail address.

Temperature Sensor Information - Cont:

Supplier / Manufacturer:	Coolant Temperature Sensors:		Air Temperature Sensors:	
	Part Number:	Notes:	Part Number:	Notes:
NAPA Autoparts	ECHTSC200	-	ECHTSC300	-
AutoZone	(0)47131	-	-	-
AC Delco	213-928	-	213-190	-
GM	15326386	Was 12146312	25036751	Was 12110446
Standard	TX3	-	AX1	-
GP Sorensen	TSU81	-	779-19001	-
Niehoff	DR134AK	-	TS83631	Was DR-136W
Wells	SU109	Includes connector	SU107	-
Wells	254		235	
Conductite/Dorman				
MSD	2310	Includes connector	2320	Includes connector
				
	= Supplier			
	= Manufacturer			

System Set-Up Hints:

Setting the P term to 64 and the I term to 0, calibrates the controllers output to start giving current (at the I Min setting %) at the 'set point' temperature and to be at 100% output current (I max setting %) at the 'Overtemp' temperature. This relationship is linear and (depending on whether positive or negative logic is applied) at 100% controller output, the fan will be going at the fastest speed possible.



High Country Tek, Inc has been working with the fluid power industry for many years, solving the tough problems and producing unique and mechanically robust products that continue to work reliably in the most extreme and hostile environments that we see hydraulics being applied in today.

Our controllers are ALL designed, manufactured and tested in the U.S.A. and can be sent anywhere in the world.



We currently supply to virtually all areas of the fluid power industry, increasing product integration and growing our customers business, by allowing them to approach new, profitable electro-hydraulic markets successfully.

Please contact us to discuss your next project, product training or system application; we would be pleased to work with you and your team.

Need More Information ?

For customer service, pricing, order placement and application support, contact us through E-mail at:
info@highcountrytek.com

www.highcountrytek.com



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