



High Country Tek, Inc.

## Hardware Application Guide

Electro-Hydraulic Control Solutions - Mobile - Industrial - Marine



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Electro-Hydraulic Control Solutions - Mobile - Industrial - Marine

For the latest company and product information, visit us at:

[www.highcountrytek.com](http://www.highcountrytek.com)

or

For customer service and application support, contact us through **E-mail** at:

[info@highcountrytek.com](mailto:info@highcountrytek.com)



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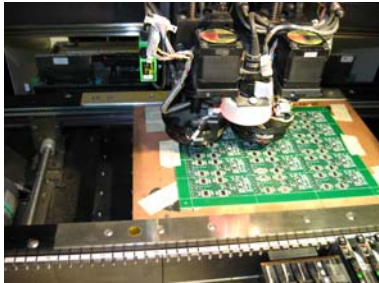
## Hints and Tips for applying Electro-Hydraulic Controllers

October 2008





- **Application Advice** - Our experienced Field Application Engineers ( FAE's) will work with you to optimize the controller solution and realize successful efficient implementation of your end configuration.
- **Training** - We offer product hardware and software information sessions, tailored to suit your level of need, making you self-sustaining on HCT modules.
- **Customized User Interfaces** - Our engineers can configure a custom Graphical User Interface ( GUI ) with your Logo offering unique identity and powerful marketing tools to your sales.
- **Private Labeled Product** - When ordered in reasonable quantities, All HCT products can be private labeled for you so the power of advertising your name in successful applications captures associated business.



- **Contract Manufacturing Service -**

Got an assembly or sub-system you need built ?

Our industry experienced people, cost effective, efficient production facilities and unique field proven in-house encapsulation techniques make sure your product or sub-system assembly is fit for use in the harshest electro-hydraulics and fluid engineering environment.

For customer service, product availability, pricing, order placement and application support, contact us through E-mail at: [info@highcountrytek.com](mailto:info@highcountrytek.com)

For the latest company and product technical information, visit us at:

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Thank you for choosing to use **High Country Tek, Inc. ( HCT )** products, we appreciate your business and hope this information booklet will be of use to you and your colleagues. If you have any comments on the content, please E-mail us at : [info@highcountrytek.com](mailto:info@highcountrytek.com).

Please take a few minutes to read the important information below before you start working on any system.

### Disclaimer:

***The information contained in this booklet is intended as a guide only.***

Installation and application of Electronic product supplied by High Country Tek, Inc. , should be only undertaken by trained, competent personel with a good understanding of Electro-Hydraulic system safety, requirements, system needs as well as making sure to fully comply at all times with the required local and national industry safety standards and installation laws.

All calculations and information contained here should be checked for validity by the user when applied due to individual circumstances arising from each unique application and system configuration.



**ALWAYS use safe working practices to ensure your own and others continued safety !**



**REMEMBER....  
'LINE VOLTAGE'  
CAN  
KILL !!!**

**Protect yourself and others by  
adopting and using safe working  
practices !**

Ensure you and other people know where the **EMERGENCY STOP** switches are for the application being worked on.

Be aware of your surroundings, other personel and the machine operating area— ALWAYS warn people before and ensure they are clear before starting to work on or with the application.

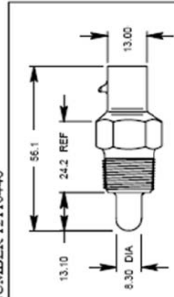
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## DELPHI TEMPERATURE SENSOR

PRODUCT DATA

### MANIFOLD AIR TEMPERATURE SENSOR

PART NUMBER 12110446



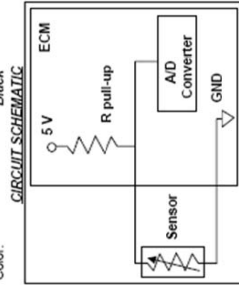
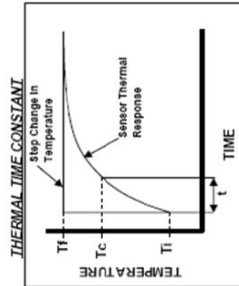
- FEATURES:**
- Design for Manufacturability
  - Cost Effective
  - Robust Design
  - Few Components
  - Few Assembly Processes
  - Thermistor Technology
  - 100% Calibration Certified

**THERMAL & ELECTRICAL PROPERTIES**

Typical Voltage Supply: 5V DC  
 Operating Temperature: -40 C to 135 C  
 Resistive Range (Ohms): See Table  
 Dissipation Constant: 18 mW/°C  
 Thermal Time Constant: \*\* See Table  
 Accuracy: See Table

**MECHANICAL PROPERTIES**

PEI 30% GF  
 Mating Connector & Seal: 15336024  
 Hex Size: 18.90 mm (3/4")  
 Thread Size: 3/8"-18 NPTF  
 Thread Sealant: GM0985473  
 Validated Sealing Pressure: 145 kPa  
 Installation Torque: 10.8 - 16.3 Nm  
 Thread Sealant: GM0985490  
 Overall Weight: 13.20 g  
 Color: Black



\*\* The ratio, at a specified ambient temperature, of the change in the power dissipation of the sensor to the resultant temperature change of the thermistor. Test medium: dry air stream flowing at 5000 mm/sec.  
 \*\* The time required for the sensor to achieve 63.2% of its steady state value when subjected to a step change in ambient temperature [(C-Ti)/(Tf-Ti)] (63.2%+T). Test medium: dry air stream flowing at 5000 mm/sec.

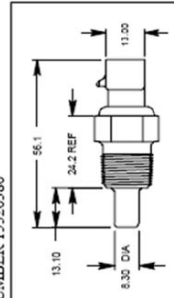
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 Data Sheet Revision Date: 10/17/2001

## DELPHI TEMPERATURE SENSOR

PRODUCT DATA

### COOLANT TEMPERATURE SENSOR

PART NUMBER 13326386



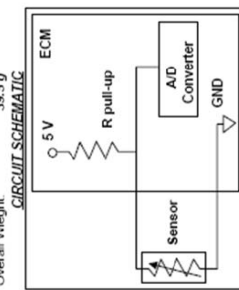
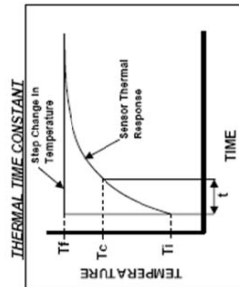
- FEATURES:**
- Design for Manufacturability
  - Cost Effective
  - Robust Design
  - Few Components
  - Few Assembly Processes
  - Thermistor Technology
  - 100% Calibration Certified

**THERMAL & ELECTRICAL PROPERTIES**

Typical Voltage Supply: 5V DC  
 Operating Temperature: -40 C to 135 C  
 Resistive Range (Ohms): See Table  
 Dissipation Constant: 24 mW/°C  
 Thermal Time Constant: \*\* 18 to 24 seconds  
 Accuracy: See Table

**MECHANICAL PROPERTIES**

Brass  
 PBT 30% GF  
 Connector: 15336024  
 Hex Size: 18.90 mm (3/4")  
 Thread Size: 3/8" - 18 NPTF  
 Thread Sealant: GM0985473  
 Sealing Pressure: 145 kPa  
 Installation Torque: 20 Nm  
 Overall Weight: 39.5 g



\*\* The ratio, at a specified ambient temperature, of the change in the power dissipation of the sensor to the resultant temperature change of the thermistor. Test medium: silicone oil.  
 \*\* The time required for the sensor to achieve 63.2% of its steady state value when subjected to a step change in ambient temperature [(C-Ti)/(Tf-Ti)] (63.2%+T). Test medium: silicone oil.

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 Part Revision Level:  
 Data Sheet Revision Date: 6/15/2004

- High Country Tek products are generally NON-Reparable due to the 'Potting' or encapsulation process.
- The encapsulating material is flame retardant and rated to exceed the operating temperature of the controller.
- ALL inputs and output connections on HCT controllers are protected against open and short circuits, but care must be taken by the user to avoid these situations.
- HCT cannot take responsibility for software or settings made by the user of the controller. We offer training courses and application advice but have no control over the quality or effectiveness of programming authored by a third party.

### RS232 Hookup to Controller:

The majority of HCT products are programmable and the user can observe, set and data log parameters and certain operational information available to and from the controller by using the software **Graphical User Interface ( GUI )**. The GUI is a Windows™ PC based program meaning that the host PC has to be connected to the controller to allow access. On 'Specialty Controllers' there may be an Opto-Link interface used or for others, a direct RS232 cable connection is supplied—please see the controller manual for more details.

The data is transmitted in serial format so a few moments may be needed for the controller to be recognized by the GUI, please be patient during this period.

Whichever interface is provided, the following is the Recommended sequence of connection and power-up to get correct results:

1. Power up the controller and allow it a few moments to stabilize, THEN
2. Connect the RS232 cable from the host PC with Graphical User Interface (GUI).
3. Start the application GUI on the host PC
4. This connection order will ensure correct initiation/handshake of the controller with the PC and prevent false diagnostic indicator status or erroneous operating modes.

### SAE-J1455 - 'Load Dump' Protection:

Newer HCT controllers will all comply with the SAE-J1455 standard for mobile equipment regarding transients seen from a vehicle alternator load dump event. Other controllers are designed to manage high levels of transients but may require external protection circuitry in some specific circumstances. Please contact HCT customer support for more details and guidance on your application.



### DVC Series Controllers

- Mount the controller with the connector in a downward position to avoid dust, debris and liquid buildup.
- Mount the DVC controllers using the recommended hardware and torques listed below.
- Ensure controllers are mounted to a flat surface to avoid 'bending' stresses.
- Check correct make, assembly and manufacture quality of mating connector before connection to the DVC controller.
- Always ensure mating connector is firmly and securely located to avoid ingress of dirt and liquids that will cause issues.
- Use connector securing screws to make sure all seals are made and working correctly.
- Never solder wires directly to any part or connector pins on the controller as this will void warranty.



### IMPORTANT NOTE:-

- **Recommended tightening torques for securing bolts on the DVC series modules are as follows:-**

Dry Torque = 8 Ft-Lbs

Lubricated Torque = 6.3 Ft-Lbs

- **Recommended Mounting Hardware:**

2 off 1/4-20 bolt, SAE Grade 5

### ALWAYS do the following:

- FULLY read any supplied information / data sheets **BEFORE** starting and visit our website at [www.highcountrytek.com](http://www.highcountrytek.com) for any updated information.
- Select the correct driver for the intended system environment ( i.e. IP/NEMA rating, size, housing etc )
- Ensure that the driver installation instructions are followed **EXACTLY** for the best results.
- Make sure the driver supply voltage is sufficient for the coils on the valve being driven ! ( 24V supply is OK for both 24V & 12V coils while 12V supply is only good for 12V coils ).  
*NOTE: Coil resistance changes with heat, and even modules with 'Current Feedback' for auto- correction, may NOT have sufficient supply voltage to maintain maximum or correct valve operation .*
- Check that the power supply voltage is CORRECT, ' ELECTRICALLY CLEAN ' and STABLE.
- **Totally 'Isolate' the driver module from all other equipment and disconnect all power supplies BEFORE any form of welding or battery charging takes place or damage may occur.**
- Ensure that any external link / switch options have been correctly selected BEFORE applying power.
- Unless specified, ensure that each valve coil has 'dedicated' wires to the driver connector for correct operation
- Use 'Screened / Shielded' cable where recommended in the application data sheets
- Check ALL cables to and from this unit to ensure correct, firm connections with NO loose wires and NO short or open circuits.
- Ensure that any unused wires / terminals are isolated safely and not shorted together
- Fit correctly rated ' In-Line ' fuses on all Power supply lines to protect the system and controller unit as recommended in the HCT detailed literature.
- Operate the driver modules WITHIN the specified operating temperature range for best, longest and most reliable performance.
- Contact HCT for additional information if you are still unsure of connecting and usage of the driver electronics chosen for your application
- Keep notes on final parameters, connections and modifications to allow drawings to be updated and replacement parts to be quickly adjusted/set and installed if ever needed.

### NEVER do the following:

- Attempt to use the driver or controller product if you are unsure of I/O connections or expected application operation.
- Attempt to use the driver product in areas or systems where AC or DC inductors HAVE NOT been fully suppressed ( I.e. relay coils, motor starters e.t.c.).
- Use a controller in areas of 'Radio Frequency' (RF) without adequate screening /shielding.
- Attempt to use a power supply that is not rated for the correct required output current and voltage under full load conditions as damage may occur to the driver card / module.
- Allow wires TO or FROM the controller to be short circuited to each other or shorted to chassis/cabinet e.t.c.
- Disconnect or connect wires to a driver unless it is fully isolated from the power supply ( I.e. turned OFF ).
- Operate electronics in environments not specified in the drivers literature ( I.e. high humidity, Intrinsically safe or hazardous, explosive gasses e.t.c. )
- Allow unauthorized or unqualified personnel to connect, set-up, use, modify or repair any driver or controller.

### Wherever Possible do the following:

- Keep High Voltage AC cables **separate** from Low Voltage DC signal and power supply cables.
- Use the largest practical wire size ( gage ) with the biggest cross sectional area ( mm<sup>2</sup> ) possible to minimize losses over cable length.
- Use a 'Switch-Mode-Power supply, their wide Input voltage range and built in filters on input and outputs make them ideal for today's systems.
- Mount the controller or driver separately to motor starters, contactors and relay switches to minimize electrical noise pickup and other noise ( RF ) related problems. .

### Specialty Modules

- Specialty controllers have different connectors depending on their application area.
- Mount the controller with the connector in a downward position where possible to avoid dust, debris and liquid buildup.
- Mount the modular controllers using the recommended hardware listed below.
- Ensure controllers are mounted to a flat surface to avoid 'bending' stresses.
- Where necessary, check correct make, assembly and manufacture quality of mating connector before connection to the controller.
- Always ensure mating connector is firmly and securely located to avoid ingress of dirt and liquids that will cause issues.
- Use connector securing screws to make sure all seals are made and working correctly.
- Never solder wires directly to any part or connector pins on the controller as this will void warranty.
- With screw type connectors, use a wire 'ferrule' to crimp and support multi-strand cables.
- Use correct screwdriver to tighten all the connector screws to ensure good connections.



### IMPORTANT NOTE:-

- **Reccomended Mounting Hardware:** 3 off #6 self tapping screw

### General Guidance.

Many reports of controllers that do not perform or of reliability concerns can be traced to the quality of connectors used on the application.

To ensure reliable operation and long life of the equipment, please ensure the following is followed:

- The correct manufacturer of the mating half connector is used.
- Connectors are supplied by recognized dealers and are brand new, not re-cycled.
- The correct 'crimp' tools are used at all times.
- The correct wire gage is used to suit the Application and the connector pin/socket.
- DO NOT force connectors together, pins can break or worse, be pushed back into the housing causing short circuits and potentially further damage to the system and controllers.
- Always check the connectors before mating for debris and foreign objects that could cause damage or misconnections.
- Ensure the cable selected is right for the intended job, chose a cable that is correct for the clamp as well as electrically sound for the application – consider the operating environment such as vibration e.t.c..

***High Country Tek can supply the correct connectors as required, please contact out customer service people for part numbers, price and delivery.***

- Know and understand clearly what 'Electro-Hydraulic Control' is expected for the application being worked on.
- Locate and check that all the '**Emergency Stop**' circuits are installed, connected and working correctly.
- Become as familiar as possible with the systems controllers graphical user interface ( GUI )
- Learn and find the system mechanical adjustments and be aware of the operational hydraulic ( i.e. pressure, flow, speed e.t.c. ) changes to be expected when altered.
- Read the complete data information/data sheet supplied with the electronic driver/controller **BEFORE** attempting any connection, adjustment or operation.
- Ensure that you are complying with all of the required standards and directives for the equipment that is being designed ( I.e. Low voltage, Health & Safety, Machinery e.t.c. )
- Check all electronic measurement equipment for calibration and correct working order to avoid false readings during set-up.
- Ensure that the command and feedback signals are the correct type(s), stable, controllable and accurate.
- Check that the driver /controller is the correct one or an equivalent for the hydraulic product being controlled.
- Make sure you know the individual hydraulic system components needs ( i.e. currents, voltages, dither frequency e.t.c. )
- Have ALL of the correct tools and related test equipment ready and available for the job being done !!
- Ensure that you are familiar with the test equipment being used, especially 'Range' settings and 'Measurement Techniques'.
- Ensure that moving parts / machinery or parts that may move unexpectedly are guarded for your own and others safety.

The electronic components used in the standard range of controllers produced and released by HCT, conform to the Commercial temperature range which is 0° to +70° Centigrade. Some controllers offer a wider operating temperature range and specific details can be found in the individual data sheets. This rating means that the components will work reliably and give a good life span if the operating temperature is kept within these ( 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 +70°C maximum operating temp or that specified in the literature, the user must 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 operationally caused temperature rise need only be quite small to reach the maximum specified levels.*

Special versions of most controllers can be provided with 'Military' grade temperature compo-

**Over Temperature Protection Feature** — Some of HCT's controllers have internal temperature sensors for protection. If the unit gets too hot, it will first warn the user and if heating continues, will shut down in a safe manner to protect the system and itself from damage. The unit will NOT restart until it has cooled down sufficiently. Please contact HCT technical help for details concerning this feature on each controller.

**NOTES:**

- • Enclosures should have an 'IN' and an 'OUT' vent for correct cooling air circulation.
- • Use ' fan-blown ' air wherever possible to increase air exchange rate.
- • Mount controllers with 'air-gaps' underneath and around to allow correct ventilation.
- • Do not mount controllers in non-ventilated sealed box's especially in high ambient temperature application areas, such that they exceed operating temperature limits.
- • DO NOT mount controllers ' face-face ' as this could cause over-heating problems.
- • **Read the literature and observe the max operating temp figures and work to them.**

**RS232 Serial connection Information**

DB9 - RS232 - PC signal set		4 way WeatherPak connector	
Pin No.	Description	Pin Designation.	Description
Pin 1	Received Line Signal Detector ( Data Carrier Detect )		
Pin 2	Received Data	A	Received Data
Pin 3	Transmit Data	C	Transmit Data
Pin 4	Data Terminal Ready		
Pin 5	Signal Ground	B	Signal Ground
Pin 6	Data Set Ready		
Pin 7	Request To Send	D	Request To Send
Pin 8	Clear To Send		
Pin 9	Ring Indicator		

**NOTE:-**

The weather pack connector from the controller has Male pins, therefore the mating cable needs to terminate in a Female Weather Pack connector

**HCT part number :- 999-10075**



Pin	Function
A	Received data
B	Signal ground ( Common )
C	Transmit data
D	Request to send

**NOTE:-**

The WeatherPak connector from the controller has Male pins, therefore the mating cable needs to terminate in a Female WeatherPak connector

**USB to Serial Converters.**

- The success of installing a USB to serial converter depends on the version of Windows® you are using and the manufacturer of the converter. Below are some suggested converters that have been tested by our technical staff for compatibility with the Opto-Link 2000.

**Belkin - Part Number - 'F5U409'**

**IO Gear - Part Number - 'GUC232A'**

Both of these units can be sourced at your local Radio Shack. Please contact HCT head office for further details

## Troubleshooting guide

- **Set-up program does not reflect user changes made immediately:-**

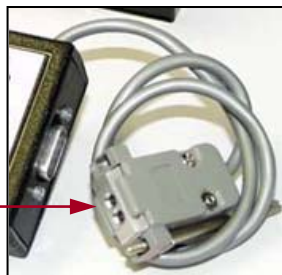
If the controller is in any mid sequence ( i.e. reverse timer was set to a long period and now a new shorter period is entered ), the controller will normally only reflect the new settings once the currently running sequence has ended. The only way to 'reset' this type of occurrence is to physically power the controller down and then back up. Once Opto-link communications have been re-established, the new settings will be valid and seen.

- **The Opto 2000 keeps losing communication or keeps resetting:-**

This is normally caused by a bad 'mechanical' connection between the Opto 2000 head not being attached to the controller securely or by the Opto 2000 battery level being too low or external power supply not being connected.

To remedy, Check that the communications head is attached firmly, that the two small holes are NOT filled with foreign matter and that the controller LED's are not damaged or dirty.

Replace the internal 9V battery or check the external power supply for connection and operation.



- **The controller shows an error saying "unit not communicating":-**

This error is reported usually if the PC is connected or the set-up program is started after the controller is working.

Cycle the controller power ON/OFF to reset the link or wait to see if the communications will synchronise after a few minutes.

If the problem still persists, look at the Opto-Link power supply and ensure this is correct.

- **The controller does NOT recognise open circuits on the valve coils":-**

The controller senses open circuits by passing a very small current all the time through the connected coils to ensure connectivity and winding integrity. This 'non reporting' error is caused by the valve coil plug having a light bulb fitted that appears to the controller to be an electrical load. Remove the light bulb or use an LED variety that uses less current.

It is a legal requirement that equipment, installations and systems destined for use in the European Community must conform to the relevant European 'CE' standards such that the equipment design minimizes the EMISSIONS and SUSCEPTIBILITY to induced & radiated radio frequency ( R.F. ) signals.

Newer HCT Electronic Drivers are designed tested to comply with the following Euro-Norm standards:- EN-50081-1, EN-50081-2, EN-50082-1 & EN-50082-2. and also comply to SAE-J1455 for mobile power supply 'Load-Dump' protection.

HCT is also voluntarily testing to extra standards and field strengths higher than recommended to ensure reliable operation under extreme field duress.

Older controllers and drivers that do not have the CE marking are designed and hardened to be transient tolerant and can be used as part of a system sold to Europe as long as once installed, the entire application has a CE certification test and passes.

- If in doubt regarding screening, enclosures or driver mounting, please contact HCT customer support for advice and assistance.
- ALWAYS find, isolate and suppress electrical noise at the source.
- ALWAYS use suppression diodes ( Flyback ) on D.C. coils, inductors and relays.
- Wherever possible, use suppression style connectors on D.C. solenoids ( ON/OFF, 'Bang-Bang' & Proportional ).
- ALWAYS use 'SNUBBER' networks on A.C. coils and relays ( see coil / relay data sheet for information )
- ENSURE that adequate 'mains / line input voltage' filtering is fitted when using a linear or simple transformer / rectifier / capacitor unregulated power supply.
- USE screened / shielded cables wherever possible and especially on applications in high Radio Frequency (R.F.) areas.

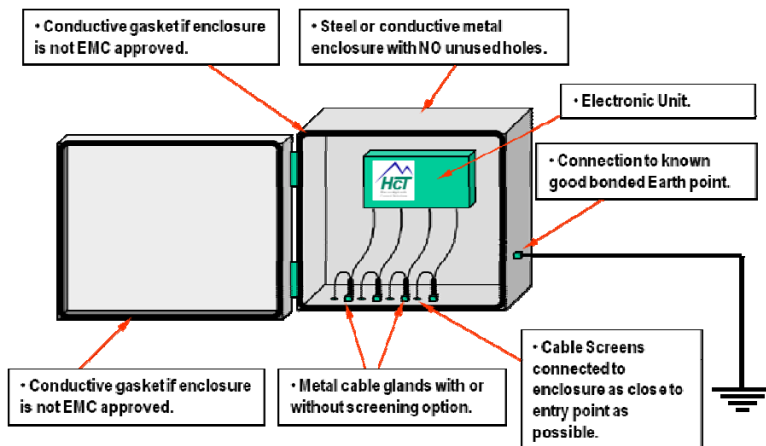
### Recommendations:

Electrical noise filters are now available in many mechanical package styles and can be bought easily from any good electrical components supplier / wholesaler normally under sections covering ' EMC, Filters and Suppression '. The filter should be selected to suit the electronic equipments intended operating environment, required test standards, input voltage as well as the expected current flow through the device, considering the wattage rating or VA.

The electronic units, modules and controllers supplied by HCT, **MUST** be mounted in the manner described in this information sheet to conform with current regulations on EMC. By issuing this document, HCT are showing their commitment and due diligence to the published rules concerning EMC.

### ALWAYS follow the rules below:

- Follow connection, application and usage instructions provided with the controller.
- Mount the controller inside a steel or conductive enclosure with NO unused open holes.
- Ensure that the enclosure is EMC approved OR sealed with conductive gaskets.
- Use screened / shielded cables of the correct rating for ALL input and output connections.
- Connect the cable 'Screen / shield' to Earth points INSIDE the enclosure as shown.
- Connect the cable screen / shield at only the 'enclosure end' of the cable as shown below.
- Ensure that ANY Earth connection is to clean, bare metal and NOT a paint finish.
- Ensure the screen / shield is taken as close as possible to the 'coil' but not connected.
- Ensure that the enclosure is securely connected to a known good bonded 'Earth' point.
- **Ensure that ALL cables enter and exit the enclosure through 'METAL' cable glands.**
- **ALWAYS ensure that NO High Power RF is used near or inside an open enclosure.**



High Country Tek's Opto 2000 ( P/No. 999-10064 ) is required to interface between the controllers infrared communications LED port and the PC / laptop RS-232 port.

This optically coupled interface is provided as an external item which must be ordered separately from the controller unit and allows setup, monitoring and limited data logging from the controller unit on the bench, or in the system, via a laptop PC running standard Windows® software.

The unit is fully compatible with Windows® 2000 , NT and XP versions.

If the user has only USB port styles available on the host PC / Laptop, the USB to DB 9 interface must be supplied by the user, with the correct driver software installed onto the host PC / Laptop ( see page 23 on this booklet for recommended USB to Serial converters ).

This style of 'non contacting, non electrical communications port' has been chosen and developed because it 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 other communications alternatives used by others.

The optical communications also allows high speed data transfer between the host PC and the controller for real time diagnostics and fast set-up programming and allows all the available units inputs, outputs and options to be displayed from within the user software which is supplied with the controller unit.

The Opto-Link 2000 and controller requires that the correct interface software is loaded onto the host PC and run to establish communications with a compatible controller.

The program will automatically poll all of the com ports available ( In Windows 2000,NT & XP versions, the software will establish and display all free communications ports but the user will have to manually select one of these ), detect and check the Opto-Link 2000 unit for operation, allocate the respective port for communications while at the same time setting the fastest reliable baud rate and default port settings.

**The Opto 2000 software provides an 'EXIT' button on the user screen ( not the 'X' in normal Windows top left corner ). This should be used as this not only exit's the current program but also turns OFF the Opto 2000 unit to preserve battery life.**

The Opto 2000 driver software monitors the battery voltage and indicates to the user on the PC / Laptop screen that there is a problem. If this warning is not seen or ignored, and if the Opto 2000 battery voltage is becoming low, the communications will be unstable with typically, the port being re-initialized on a regular basis. If this situation occurs, switch to the external power adapter provided or change the battery.

The Opto 2000 unit comes complete with DB 9 Male / Female extension cable, standard 9V battery and external power supply unit ( 110VAC @ 60 Hz )

The latest software updates and current versions for your particular controller can be requested if required by e-mail at: [info@highcountrytek.com](mailto:info@highcountrytek.com)





## LED Indicators and Backup

### Diagnostic LED display

The sealed low voltage and current LED's on many of the HCT controllers will display at all times the current controller operational status of the unit, state of the inputs and outputs and if any errors are detected, the 'error code' LED ( if fitted ) will use a blink code announcing that there is a problem that needs attention and what and where the issue can be found.

***It should be noted that damaged or missing LED's have NO impact on the controller operation, but will result in module status and potential error codes not being indicated.***

Field observation is possible as NO connection to any external equipment or PC is needed for the user to evaluate a detected error and decide if the fault is critical ( i.e. needing immediate attention ) or non-critical ( i.e. a fault that can be tolerated and will allow work to continue until service can be provided at the earliest opportunity).

### Saving Your Program

#### IMPORTANT NOTE:

It is essential that after changing any settings or characteristics through the PC GUI, the user remembers to download and permanently store the information using this 'Save' option to either PC to controller memory or PC to controller memory & file. If this step is NOT carried out, the new data will not be permanently saved in the controller causing operation of the system that may not be as expected.

If at any time the power to the controller is turned OFF before a 'Save' is carried out, the program will default to the last saved data in the modules memory.

**Some controllers save the changes immediately as a 'live' change is made through the GUI—please consult the relative controller manual for full information on this feature.**



## Digital Command Signals

### Switch De-bounce:

All digital inputs have a hardware or software de-bounce *timer* of 150mS allocated to ensure no false triggers are actioned.

The de-bounce timer starts on seeing the first rising ( or falling ) edge of an input transition and only re-looks at the input state after the 150mS timer has elapsed to ensure a stable state is registered.

### Digital Logic Levels:

Digital inputs on the HCT controller recognize the following voltage levels for Hi and Lo signals:

- Hi level = +4.5 to +Supply VDC.
- Lo level = 0V to +0.5VDC

### Digital Input Impedance:

Digital inputs on the controllers all have an input impedance of approx. 33KΩ

### J1939 Data:

The engine MUST be running on the application for correct J1939 data to be observed at all times.

### CAN and J1939 Terminator:

Note: A single 120Ω resistor may be needed as a terminator depending on the configuration of the bus connections and whether the HCT controller is the last active item connected to the bus. Consult the J1939 controller specifications in the engine supplier manual for further details and guidance.

### CAN and J1939 Terminology:

- **SPN** = Suspect parameter number
- **PGN** = Parameter group number
- **DM** = Diagnostic Message

Choice of command signal type can be usually broken down into two (2) categories, Voltage, Current. Analog commands have several industry standard levels such as 0–10V, 0±5V and 4-20mA.

Which one of the types used can be based on several criteria such as availability, compatibility and continuity with existing equipment, environment ( electrical noise level ) and distance between signal source and driver.

Various types of command signal can be used by HCT depending on the controller and configured to control Uni-directional ( pressure ) or Bi-directional valves ( Directional flow control ). If the choice of signal type is 'Free', In general the following rules apply:-

Circumstance	Voltage	Current	Reason
High electrical noise environment ( i.e. industrial application )	NO	YES	Current commands will ignore external electrical noise to give a true command signal value at the driver input.
Distance between signal source and driver is in excess of 3 metres / 10 foot.	NO	YES	Current commands are less effected by resistance in the cable length between signal source and driver card.
Command signal is from a potentiometer or joystick and is within 3 metres / 10 foot of the driver	YES	NO	Voltage command is easy as the references can usually be supplied by the driver. Ensure that screened / shielded cable is used .
Customer requires continous continuity checking on command signal wires for process safety	NO	YES	The 4-20mA current loop allows the wires to be monitored for the 4mA level. If the wire is broken, the 4mA disappears and an alarm can be shown.

- If 4-20mA is selected as the command type, ensure that each driver used has a separate connection to the command sources output. DO NOT attempt to parallel or series connect several drivers using the 4-20mA option as this will result in non or erratic operation and possible overload of the current source.
- Voltage command inputs on the HCT controllers are normally high impedance ( Approx. 10kOhms or more ) and therefore require minimal current from the command voltage source. Care must be taken when selecting a potentiometer or joystick to ensure that
  - A) the reference voltage outputs are not overloaded by a resistance to low and
  - B) the potentiometer or joystick resistance is not to high as to limit the current into the driver input. A typical value for a potentiometer style joystick control would be 5+5 KOHms ( 10KOhms total ).
- Check if external command signal input 0V line needs to be connected to System 0V.
- Ensure that if several controllers are to be commanded from one external voltage source, that the 0V of the command source is referenced / commoned to the controllers 0V.

## Commissioning and Set-up Tips !

- **There is no hydraulic change with adjustment of the 'I Max' setting.**
  1. Reduce the respective 'I Min' setting as it is to high to get control with 'I Max'.
  2. Check that the 'Ramp Generator' settings are set to zero (long ramps may appear as no adjustment ).
- **The unit has both outputs 'A' & 'B' on together.**
  1. Check that the command signal is not oscillating at a high frequency.
  2. Ensure that the supply voltage is correct ( low supply voltage can cause internal operating problems )
  3. The unit is damaged and needs to be replaced.
- **The unit is completely dead with no led's on at all.**
  1. Check that the supply voltage is present & correct at the actual controller connector.
  2. Check the supply input fuse for continuity and correct fitting.
  3. Check continuity of all supply wires to the unit from the power supply.
  4. The unit is damaged and needs to be replaced.
- **The unit is very slow to respond to command input signals.**
  1. Re-adjust the driver units 'Ramp Generator' settings to get required response
  2. Ensure that the proportional valves 'Coils' have been fully 'Purged' of air ( some newer valves have 'Self Purging' coils, see valve manufacturer respective literature

## Frequently Asked Questions

- Q How to see if the valve/pump is giving full flow or to full pressure?.**
- A** Most of the controllers used today give a Pulse Width Modulated ( PWM ) output to the valve coil which makes the measurement of 'Coil Voltage' a much less accurate measure of the valves actual performance. To see if the valve coil is being saturated, measure the '**Coil Current**' at the coil and compare this maximum value with the figures stated in the valve performance literature.
- Q If ALL the equipment is 'CE' marked and connected as recommended, does this mean the system is 'CE' approved?.**
- A** CE + CE does NOT = CE. You must test the whole system once assembled. Take further advice on specific problems from your local Fluid Power association or test facility on requirements.

### Commissioning and Set-up Tips !

- **Proportional product starts with a large flow or pressure for a small command input.**
  1. Reduce the respective 'I Min' setting ( A or B ) on the controller.
- **There is Not enough flow or pressure at maximum command input.**
  1. Increase the respective 'I Max' setting ( A or B ) until the required levels are achieved.
  2. Ensure that the command signal is correct and really at maximum.
- **Cannot achieve full flow or pressure at full command and full 'I Max' adjustment.**
  1. Check that the I Max setting is correct in the controller.
  2. Check supply voltage is fully 12 or 24V and is stable under full load conditions.
  3. Ensure that the coils fitted to the valve are correct for the supply voltage( I.e. 12 or 24V ).
  4. Check system 'relief' valve is set correctly.
  5. Check that the system pump flow is set correctly.
- **If fitted, the 'Emergency stop' is always active and no controller output is available.**
  1. Check that the E-Stop button is working mechanically and wired correctly.
- **The unit does not respond to an external command voltage.**
  1. Ensure that the external command source's 0V is connected to the controllers 0V terminal.
  2. Check continuity of command cables between source and controller at the connection pins.
- **The output from the driver goes between zero and full on only with no proportionality.**
  1. Check that the coil wires are correctly connected to the driver unit.
  2. Check that the wires / cables to different coils have NOT become transposed.
  3. Check that the command is proportional into the controller.

- HCT controllers typically operate between 10–30VDC unless specified, please consult the units specific application literature for full details.
- Instantaneous currents can be high due to valve performance and driver controller instantaneous demands. Ensure that the power supply selected or designed allows for at least three ( 3 ) to four ( 4 ) times the total rated valve current ( from valve literature ).
- DO NOT use unregulated DC power supplies as there is a strong possibility of undervoltage when under 'loaded' conditions and overvoltage when the load is removed.
- Reduced supply voltages will normally result in reduced output current from the controller which will result in reduced valve performance ( max pressure or flow will be reduced )
- Always fit input noise filters to 'Linear' power supplies as this type of supply will pass any electrical noise present on the high voltage input through to the low voltage output and onto the controller and may cause disturbance in the units operation.
- Never use a power supply which is marginal on output voltage, current or performance. If the output voltage 'Sags' under loaded conditions, the valve performance is compromised and the system / controller may suffer internal damage.
- As a general rule, 12VDC solenoids / applications use approx. twice the current of 24V solenoids and/or applications.
- Wire the installation with separate 'Power' , 'Signal' and 'Screen / shield' 0V lines from a common 'STAR' connection point in the cabinet to ensure correct paths for potentially high return currents.
- Ensure that the enclosure / housing 'Earth-Tab' is electrically and mechanically properly and securely connected to power supply Ground or 0 Volts.
- If provided, ensure that the controllers 'Ground' connection is connected correctly to ensure correct EMC compliance.
- Use wires with the largest gage or 'Cross-Sectional' area that is practical to avoid voltage-drop problems.

### Power Supply Suggestions:

For 12 or 24VDC applications, look at using a **Switch Mode Power Supply ( SMPS )** as this cost effective type of power supply has a wide input range for both AC Voltage and frequency and comes complete with all necessary input and output filters that will ensure reliable operation of the controller connected to it. This type of power supply also caters for the fast currents demanded by the controller, allowing the valve(s) to respond quickly with no degradation of the output voltage.

- Ensure that ALL 'High Voltage' cables are in good working order, safe and in a serviceable condition ( NO cuts, joints, bare wires e.t.c. ).
- Ensure that ALL 'high Voltage' cables being used are to the correct rating for both voltage and current ( to avoid overheating and/or burn-out ).
- Ensure that ALL 'High Voltage' cables are the correct type for the intended working environment ( I.e. heat, cold, humidity, water e.t.c. )
- Always take extra care when working with or applying or using 'Line Powered' equipment due to personal 'shock risk'.
- Ensure adequate precautions are taken when using or handling driver cards having 'High Voltage' outputs.
- Always check that if fitted, the 'Voltage Select' switch is set correctly BEFORE applying power to the unit or system destruction could result.
- Check that the whole system ( including housing ) is 'EARTHED' and bonded correctly.
- Always ensure that the 'High Voltage' supply input can be isolated safely and that where used, the correct fuses or rated circuit breakers are fitted and working.
- **Ensure that ALL 'High Voltage' ( HV ) cables and signals are installed on a separate wire tray or conduit to any of the low voltage and system signal cables and wires.**



### What to do if there are problems with a controller.

- Take as many details as possible of the following as this will speed up the 'help' process:-
- Physical Circumstances when, where and how fault occurred ( I.e. Location, humidity, temperature e.t.c. ).
- How the fault exhibited itself ( I.e. smoke, fuse blown, machine stopped e.t.c. )
- Is the fault repeatable ?
- Supply voltages to controller ( I.e. Value and type ).
- Type and known specifications of hydraulic products being controlled ( I.e. flow, pressure or pump stroker, 12 or 24V ).
- Command signal type and origin ( I.e. Voltage, current or digital and value ).
- Once this has been done, contact HCT customer service using information on the back sheet of this booklet.
- Please **DO NOT FORGET** to tell us your name, company's name, postal address, phone numbers and E-mail address.

### Training on High Country Tek products.

In order to get the maximum benefits from the programmable range of HCT controllers and learn the best ways to use and write your own system control software, we strongly recommend you attend one of our training and familiarization courses to make sure you are successful with your designs..

- Q How do I find out more information on the application, use and working of High Country Tek Products?**
- A *High Country Tek, Inc.*** is a U.S. based company that supplies controls product globally and we are committed to providing you the user with the best possible quality, delivery, products, technology and support available. With this in mind, your local HCT distributor or if you already deal direct or would like to open an account, ( please see rear cover for contact details ) can organize training on all areas of proportional products with courses where necessary 'Tailored' to suit your specific industry, application needs or workforce. The courses can also vary from basic concepts right through to more in-depth explanations of