



High Country Tek, Inc.

Hydraulic Fan System Controller - HFS-3-24v

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

Hydraulic Fan System Controller – 24V – 600mA

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 this type of system.

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 application suitability
- OEM, re-power and retro-fit markets
- Mining equipment – above and below ground
- Drill, exploration and blast hole rigs
- Chassis, bus and RV builders
- Static applications – standby generators
- Industrial cooling operations
- Liquid nitrogen/oxygen 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 conditioning

System Part Numbers:

- Controller Module with DIN 43650 connector :-.....P/No: HFS-3-24v
- Controller info manual:-.....P/No: HFS-3-24v RevC

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



Product Overview:

This driver unit has been designed to interface and operate with:-

- Wide supply range 18VDC to 32VDC (24V nominal)
- Engine Control Unit (ECU) 5% to 95% PWM output with 0.5 to 4.5V (based on 5V maximum) and
- **PWM frequency input from 20 – 125Hz.**
- Fan system control manifold blocks.
- Vane and Gear motors with internal or external pressure control valves.
- Piston pump with remote compensator using proportional pilot pressure valves.
- Systems with 24VDC cartridge valves as fluid controlling elements Positive or Negative logic.

Product Features:

- Self contained controller plug for Mobile, Industrial or Marine Hydraulic fan cooling systems.
- Interfaces directly with engine PWM fan speed signal.
- Space saving - 'ON-Valve' mounting using standard DIN 43650 connector.
- **EMC compliant product to EN50081-1 and EN50082-2 (heavy industrial)**
- 1 x proportional MosFet driver output (PWM) at upto 600mA (@24VDC).
- Sealed and environmentally protected to IP68 or NEMA 6P
- Flame proof resin 'Encapsulated' version to suit application environment.
- No extra DIN housing or 'Card Holder' to buy.
- Pre-wired with 3 meters (≈10 ft) of colour coded cable for fast reliable connection.
- Fully 'isolated' design for improved safety and ease of application difficult areas.
- Unit status 'Diagnostic' LED visible through opaque plug cover.
- Low cost compared to other available modules with comparative functions.
- Easy to use 'top entry' adjustments for all major parameters..
- Single turn potentiometer (1 turns) 'I Min' adjustment for driven solenoid
- Multiturn potentiometer (20 turns) 'I Max' adjustment for driven solenoid.
- 'Dither' frequency Variable (single turn) from 100Hz to 250Hz (+/-20%).
- Heavy duty approved cable for all application environments.
- Protected inputs and user outputs for maximum reliability and product life.



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 consequences 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 battery boosting takes place on the vehicle.
 - ALWAYS** - Ensure ALL valve connectors are wired correctly, secure, locked and connected to correct coils.
 - ALWAYS** - **Observe the set-up procedures in this manual for best operational results.**
 - ALWAYS** - **Follow and abide by local and country health and safety standards – protect yourself and others !**
-
- NEVER** - Arc Weld or Charge Batteries with this driver unit connected as damage can occur.
 - NEVER** - Attempt to use this unit if you are unsure of electrical OR hydraulic connections or expected 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 !

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:

High Country Tek, Inc (HCT) recognizes that fan drive systems are an important part of the protection needed for the engine and associated peripheral components to ensure maximum reliability, productivity and long term operation. The fan drive system controller, HFS-3-24v offered by HCT will save fuel, reduce emissions (particle and noise) and increase application productivity by only operating the fan when required and matching the fan speed to the heat load that requires dissipation.

For fail-safe operation, HCT strongly recommends that the hydraulic valves used are of the ‘Negative logic’ variety. This means that the valve gives less pressure for an increasing drive current. This choice results in full pressure and therefore **defaults to full fan speed** in the event of the electronic controller or the fan speed requirement signal being dis-connected or disabled.

There are situations where full fan speed with no drive current may not be optimal so the controller in this manual allows the user the choice of either ‘negative logic’ or positive logic (Increasing pressure with increasing current) valves by a simple link setting, found under the units lid.

Because the controller is designed to connect directly to the engine ECU, all the decisions on ramp rates, proportionality, slope angle e.t.c. are already calculated to suit the application. This means that adjustment of the controller is simple with only **five potentiometers** –

- **Dither frequency** (which is needed to ensure correct, repeatable and smooth valve operation).
- **I Min** (which sets the Max fan speed on Negative logic valves or Min fan speed in positive logic circuits).
- **I Max** (which sets the Min fan speed on Negative logic valves or Max fan speed in positive logic circuits).

To maintain operational integrity and prevent unauthorized adjustments once set, the assembly of the driver is such that the enclosure containing the electronics (electronic printed circuit board and components are fully isolated from the casing) must be assembled as described in this manual and mounted to the valve coil with the correct length screw.

The controller electronics are fully encapsulated in black flame proof resin to allow continuous operation in adverse conditions while protecting them from vibration and external environmental influences.

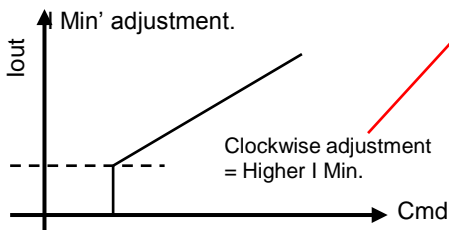
This unit has been designed to meet all the current EMC requirements and is a well proven control circuit with many years of field and time proven operation.

Important Note:-

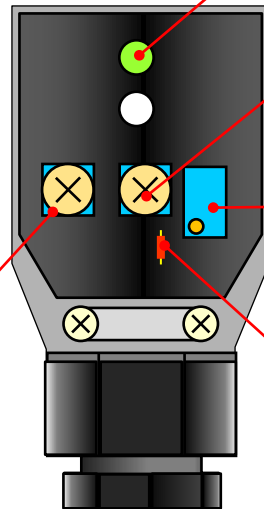
Please be aware that fan blades can start rotating without warning and may cause personal injury if precautions are not taken and safe working practices observed.

Note:

The output ramp UP and DOWN rate is decided by the engine ECU rate of change to the PWM signal. The HFS3 controller is designed to track and follow this command as closely as possible to give optimized fan speed operation.



TOP VIEW OF PLUG DRIVER WITH LID REMOVED.



'Output ON' led

Dither Frequency Adjustment.

Fully Anti-Clockwise = ~100Hz
Fully Clockwise = ~250Hz

Output Current Adjustment 'I Max'

Clockwise adjustment = Increase Output Current

Output invert Select link

Default

Inverted valve drive O/P drive = link intact

Non-inverted valve O/P drive = link cut

Product Specifications:

- | | |
|----------------------------------|---|
| 1) Board Style: | HCT Unique Size and Mounting. |
| 2) Connector Type: | DIN 43650 |
| 3) Cable Type: | Pre-connected 3M (~10ft) colour coded cable fitted. |
| 4) Input Supply Voltage(s): | 24V D.C. (+18 - +32VDC absolute maximum) |
| 5) Input Supply Current (Max): | Maximum Valve Current Setting + 50mA Quiescent (Max) |
| 6) Command Input Type: | PWM (From ECU). |
| 7) Command Input Value: | 5V (10% to 90% PWM typical range). |
| 8) Command Input Frequency: | 20 to 125Hz |
| 9) Available adjustments: | I Max, I Min,
Dither Frequency adjust. |
| 10) 11) Dither Frequency : | Variable from 100Hz to 250Hz (+/- 20%) |
| 12) Environmental: | Totally 'ENCAPSULATED' Printed Circuit Board. |
| 13) IP Rating: | IP68 (Min) (When assembled correctly) |
| 14) NEMA Rating: | NEMA 6P |
| 15) Humidity: | 95% Non Condensing. |
| 16) Storage temp.: | 120 Deg C (Max) |
| 17) Working temp.: | -20 Deg C (max) to +70 Deg C (Max) Inc Ambient. |

Adjustment Guide: INVERTED valve control operation (Default setting).

INVERTED operation means that the output current is inverse to the input command signal.

i.e. 10% PWM = Max O/P

90% PWM = Min O/P

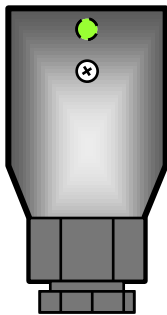
This option is intended for use with a **reverse acting proportional control valve**.

In this configuration, if the power supply fails, the fan unit will default to the FULL ON speed.

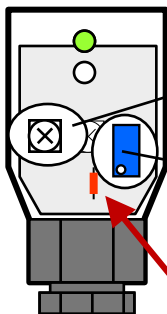
This option is the default for the plug top controller and link 'A' MUST be intact and not removed. the location of link 'A' is shown in the picture at the bottom of this page.

CAUTION:-

Link 'A', once removed, CANNOT be replaced.



- Plug driver unit onto valve coil to be driven.
- Remove 'HFS-3-24v' securing screw
- Remove 'HFS-3-24v' opaque lid to reveal internal adjustments.
- Ensure command PWM signal is set to zero.
- Ensure that all wire connections are correct and secure.
- Turn I Min potentiometer 1 turn Anti-Clockwise (Minimum).
- Turn I Max potentiometer 20 turns Clockwise (Maximum).
- Apply 24VDC (+18 to +32VDC absolute Maximum) to the driver plug.

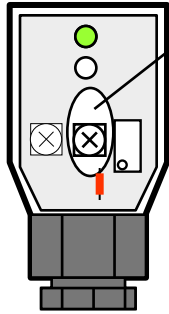


- Slowly increase command to approx 90% of maximum PWM.
- Use the I Min adjustment to give minimum motor speed required.
- Slowly Increase command signal to 10% of maximum setting.
- Adjust I Max until desired motor maximum speed is achieved.
- Check that 'Output ON' led is functioning proportionally by varying the command signal.
- **Ensure link is intact and NOT removed.**

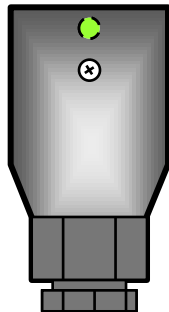
Link 'A'

Adjustment Guide:

INVERTED valve control operation (Default setting).



- Adjust Dither frequency to suit valve product being driven.
- Fully Anti-clockwise = approx. 100Hz
- Fully Clockwise = Approx.... 250Hz.
- Set command to Zero Volts.
- Isolate plug from +24VDC supply.

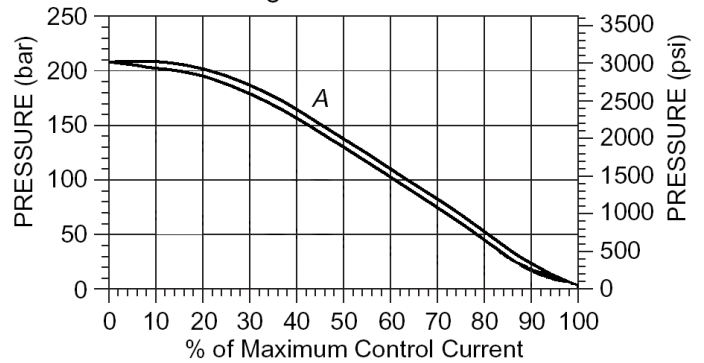


- HFS-3-24v Plug top controller is now set.
- Replace opaque lid carefully ensuring that seal is maintained.
- Replace securing screw and tighten
- Do not over tighten or lid damage is seen.
- Unit is now ready for continuous application use.

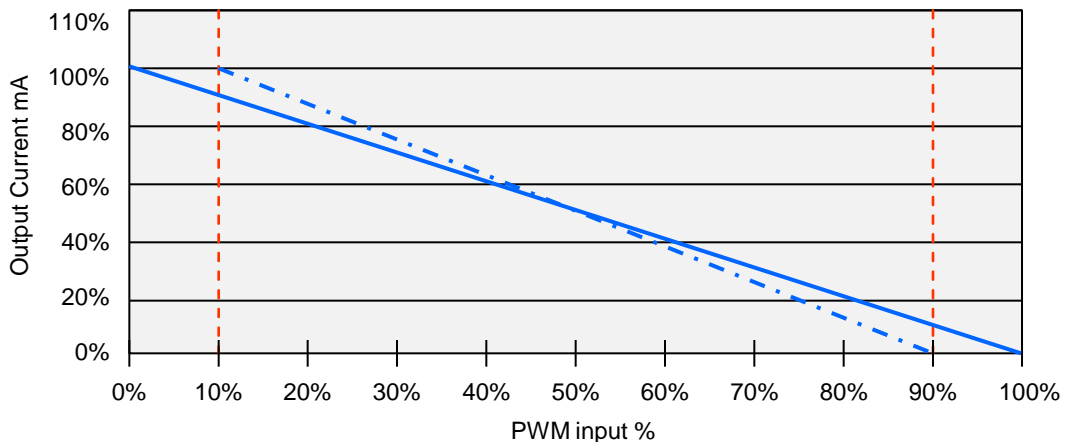
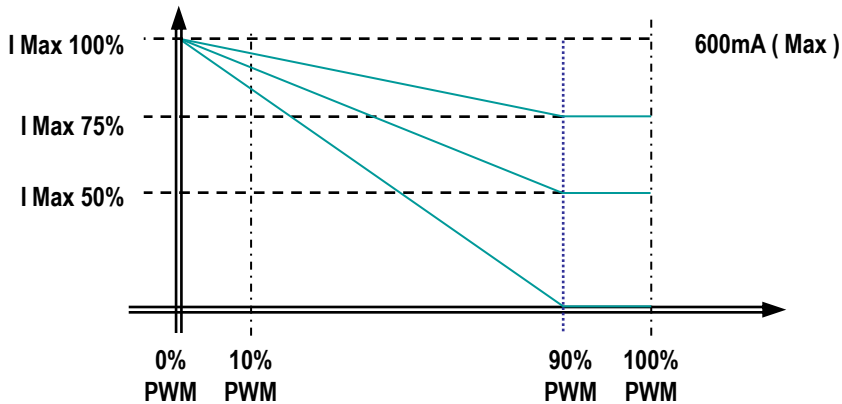
Adjustment Guide: **INVERTED** valve control operation.

Typical characteristic of an inverted pressure control valve This option will allow 'fail-to-full-speed' safety operation.

Relief Pressure vs. Current (DC) Characteristic
Relieving Pressure ① to ②



Output Characteristics: INVERTED Valve operation.



Typical input / output current linearity graph of this controller.

Adjustment Guide: **NON-INVERTED valve control operation.**

NON-INVERTED operation means that the output current follows the input command signal.

i.e. 10% PWM = Min O/P

90% PWM = Max O/P

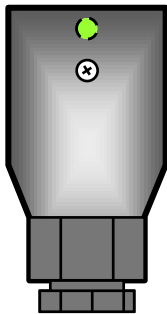
This option is intended for use with a proportional flow control or variable pump electro-hydraulic stroker.

In this configuration, if the power supply fails, the fan unit will default to the OFF speed.

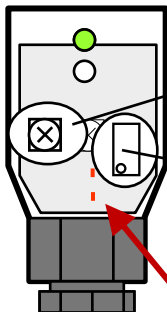
For this option to be activated, the user must remove (by cutting) link 'A', the location of which is shown at the bottom of this page.

CAUTION:-

Link 'A', once removed, CANNOT be replaced.



- Plug driver unit onto valve coil to be driven.
- Remove 'HFS-3'-24v securing screw
- Remove 'HFS-3-24v' opaque lid to reveal internal adjustments.
- Ensure command PWM signal is set to zero.
- Ensure that all wire connections are correct and secure.
- Turn I Min potentiometer 1 turn Anti-Clockwise (Minimum) .
- Turn I Max potentiometer 20 turns Clockwise (Maximum) .
- Apply 24VDC (+18 to +32VDC absolute Maximum) to the driver plug.

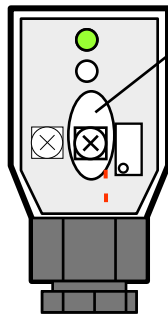


- Slowly increase command to approx 90% of maximum PWM.
- Use the I Min adjustment to give minimum motor speed required.
- Slowly Increase command signal to 10% of maximum setting.
- Adjust I Max until desired motor maximum speed is achieved.
- Check that 'Output ON' led is functioning proportionally by varying the command signal.
- **Ensure link 'A', is cut and REMOVED**

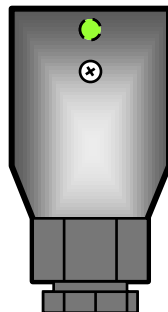
Link 'A'

Adjustment Guide:

NON-INVERTED valve control operation.

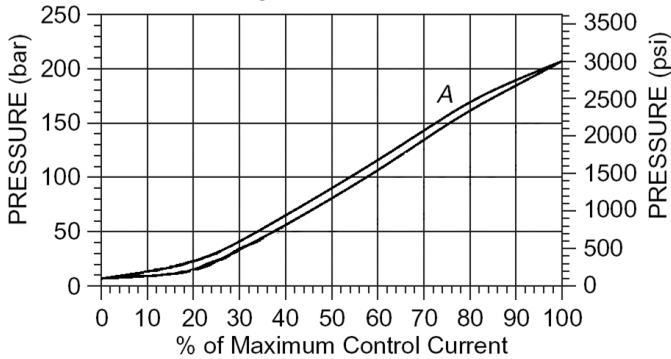


- Adjust Dither frequency to suit valve product being driven.
- Fully Anti-clockwise = approx. 100Hz
- Fully Clockwise = Approx.... 250Hz.
- Set command to Zero Volts.
- Isolate plug from +24VDC supply.



- HFS-3-24v Plug top controller is now set.
- Replace opaque lid carefully ensuring that seal is maintained.
- Replace securing screw and tighten
- Do not over tighten or lid damage is seen.
- Unit is now ready for continuous application use.

Adjustment Guide: **NON-Inverting valve control operation.**

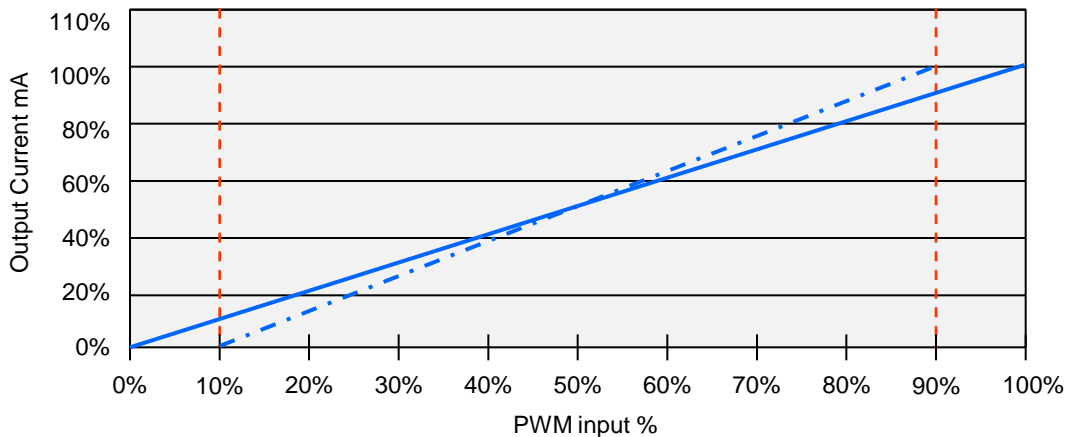
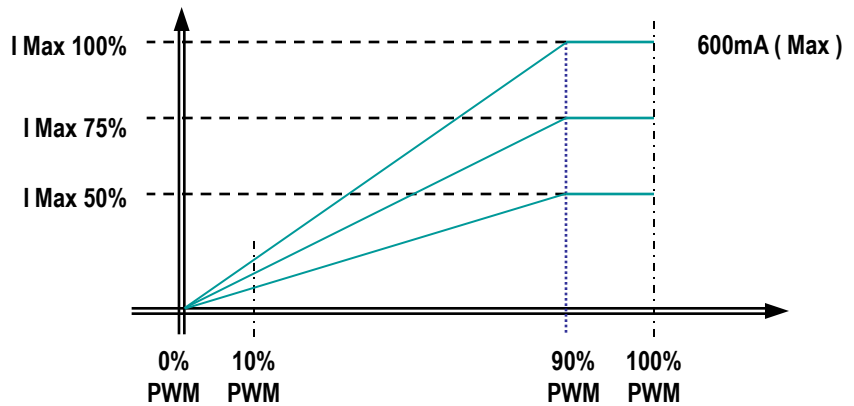


Typical characteristic of a normal pressure or flow control valve or variable piston pump Electro-hydraulic stroker. This option will **NOT** allow 'fail-to-full-speed' safety operation.

It is strongly recommended that the **INVERTED** option is used in conjunction with a reverse operating pressure control valve to allow 'fail-to-full-speed' operation.

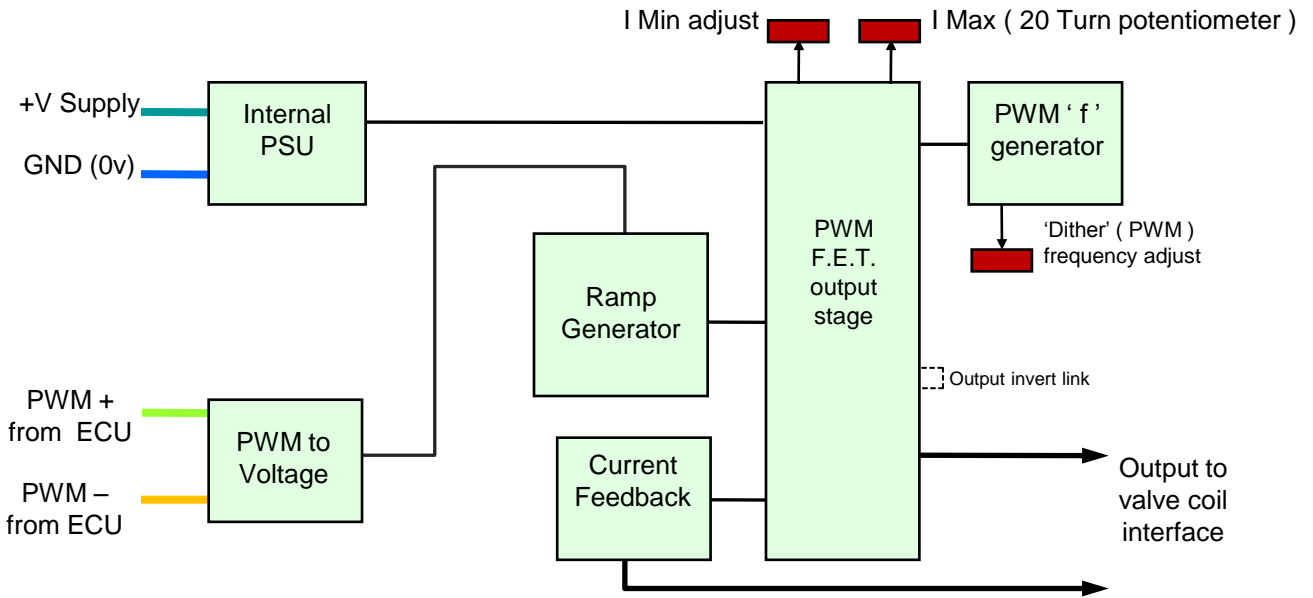
Output Characteristics: NON Inverted Valve operation.

This graph shows the typical adjustments for the PWM input signal

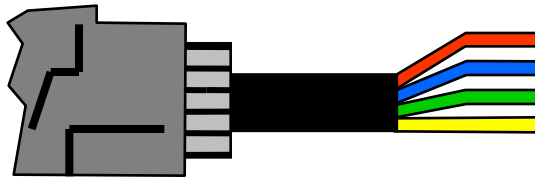


Typical input / output current linearity graph of this controller.

Block Diagram:

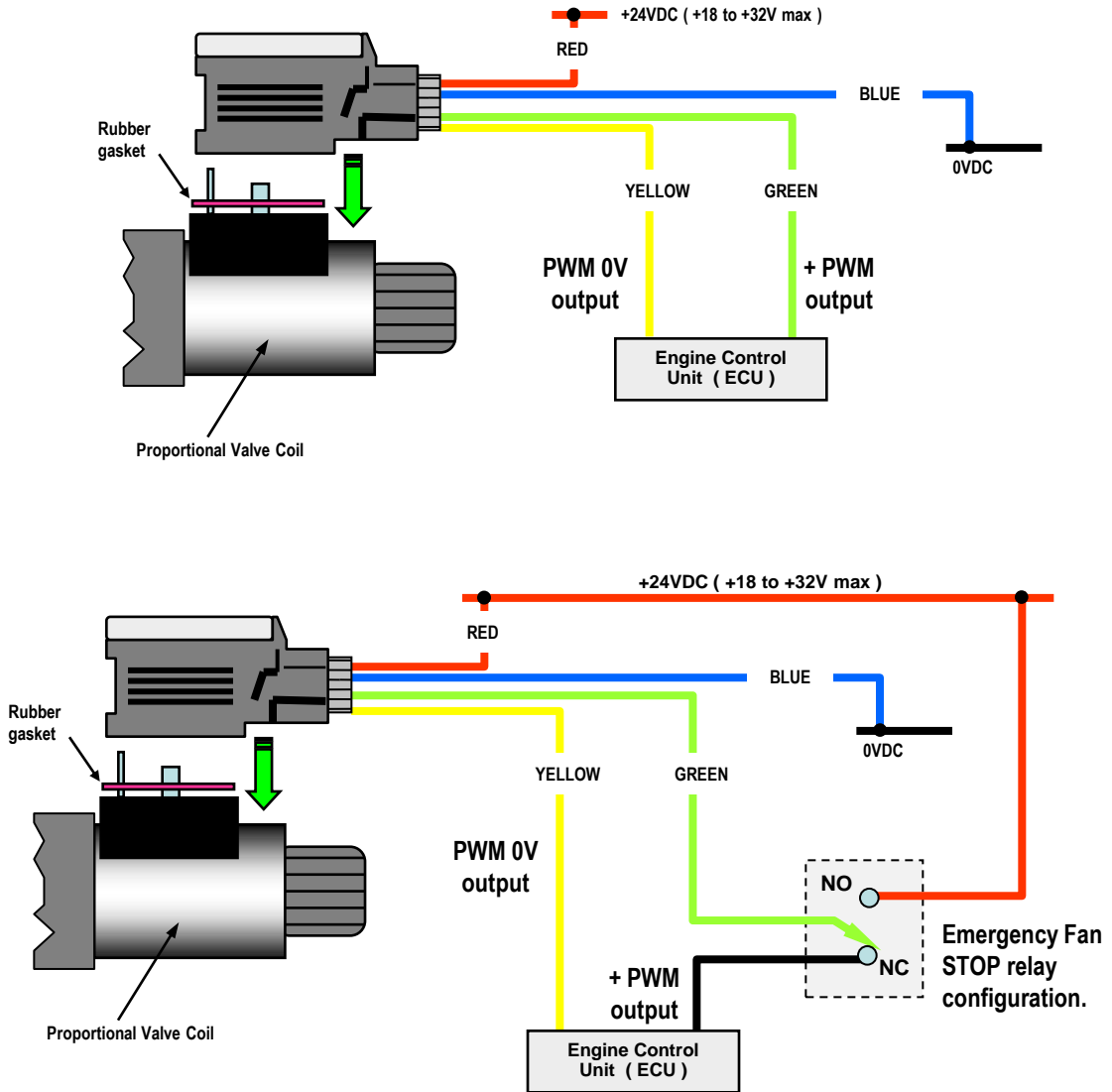


Wiring Information:



Wire Color	Function
RED	+24VDC (18 to 32VDC) Supply I/P
BLUE	0V (GND) Supply I/P
GREEN	PWM+ Signal I/P from ECU
YELLOW	PWM 0V (GND) I/P from ECU

Connection Options:



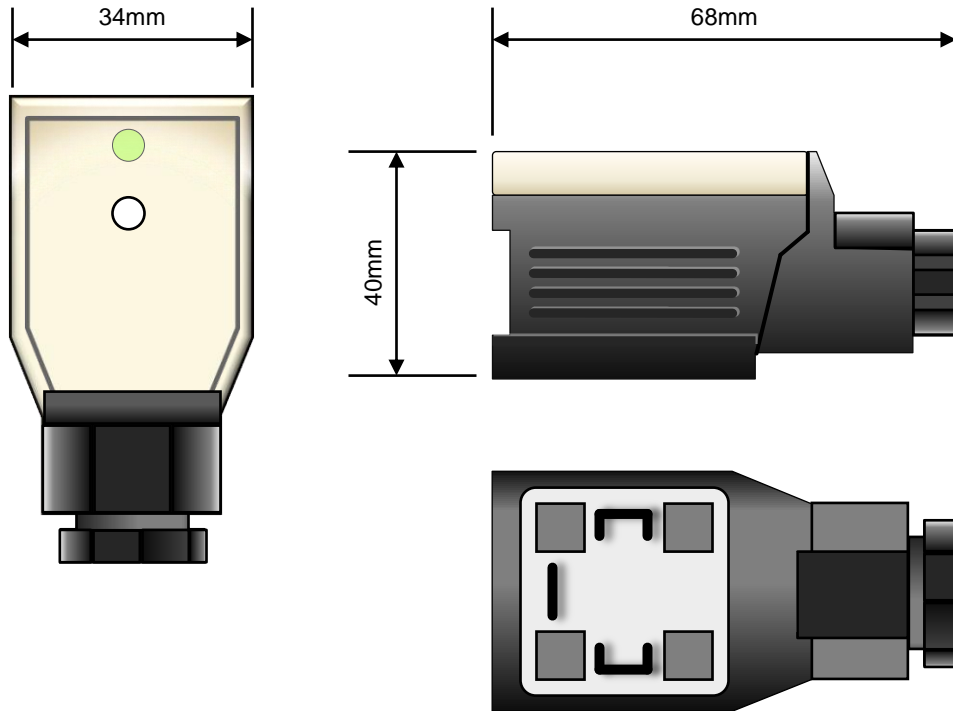
NOTE:- The 'Emergency Fan STOP' configuration shown above assumes that the controller is being used in Inverted mode i.e. :

10% PWM = fan full on, 90%PWM = fan full off.

Closing the relay will force the input to 24V supply voltage and the fan will be controlled to fully OFF and will remain in this state until the relay is released.

If the NON-Inverted mode is selected, the relay should be connected to 0V to achieve fan OFF when relay energized.

Mechanical Information:

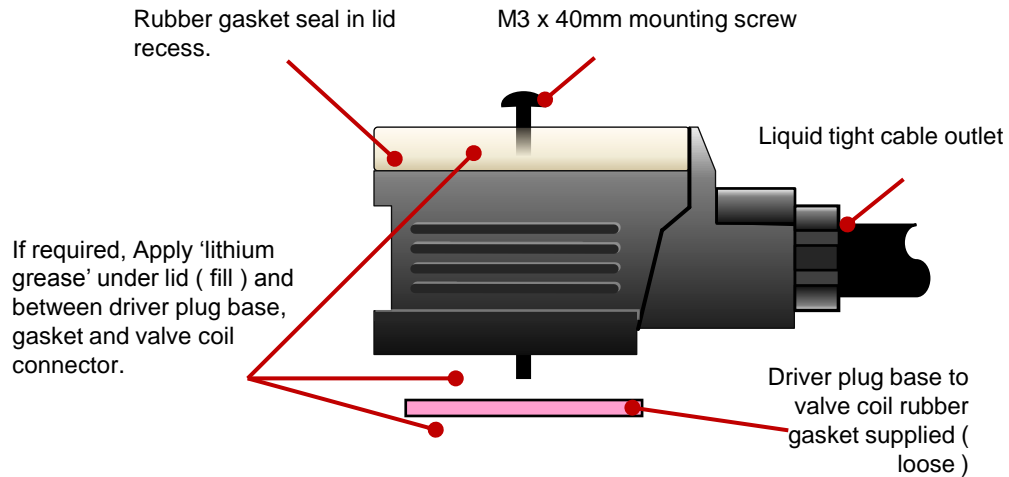


View showing connector configuration.

Mechanical specifications.

Housing Type:-	Self contained DIN 43650 'Plug Top'
Housing Material:-	High Impact Resistant Molded ABS.
Housing Colour:-	Black / dark Grey.
Surface Finish:-	Matt.
Housing Thickness:-	2mm (Mounting Flange and Face), 1.7mm All Internal Dividers.
Lid material:-	High Impact Resistant Molded ABS.
Lid Colour:-	Opaque clear.
Lid finish:-	Matt.
Unit size:-	See above size detail drawings.
Unit Weight:-	Approx.... 400 grams (including Encapsulation material & Cable)
Wire entry:-	Via PG11 gland to fixed cable.
Encapsulation:-	Flame Resistant, Black , Two Part Epoxy Resin.
Wire length:-	Approx..... 3 Meters (10Ft), colour coded cable
Wire specification:-	4 core, 16/02 with PVC outer protection to Def Standard 16-12 Part 5 (Screened) 2.5 Amps/core @ 70°C Max Operating Temp.

Assembly Information:



Harsh Environment Information:

- Use care when re-assembling unit after adjustment and ensure that lid gasket is in place.
- DO NOT over tighten the central M3 x 40mm mounting screw.
- Ensure that flat rubber gasket (supplied) is fitted between valve coil and driver plug.
- For 'high moisture' applications apply 'lithium grease' between valve coil and driver plug base before final assembly and mounting screw tightening process.
- For total immersion applications, follow above step and additionally fill driver plug lid with 'lithium grease' after adjustment and before final assembly to form liquid proof seal around all potentiometers and units plug base / valve coil joint.



Page left intentionally blank



Page left intentionally blank



Page left intentionally blank



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, orders and application support, contact us through E-mail at:
info@highcountrytek.com

www.highcountrytek.com



High Country Tek, Inc.
208 Gold Flat Court
Nevada City, CA, 95959
Tel: (1) 530 265 3236
Fax:(1) 530 265 3275