![HCT logo — Electro-Hydraulic Control Solutions]

High Country Tek, Inc.

Hydraulic Generator Controller – HGC-2

Electronic Controller Solutions for Mobile, Industrial & Marine Applications.

Application Guide, Set-up &

Information Manual

Important Notes:

This product has been designed to interface directly with proportional pressure/flow control valves, variable pumps, motors and manifold blocks currently available.

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

Application Limitations:

High Country Tek, Inc. (HCT) designs and supplies products for use specifically in commercial, industrial and mobile control applications with products only warranted for this type of use. HCT distributors are not authorized to approve the use of any HCT product in any of the following applications:

• *Any product that comes under the Federal Highway Safety Act, i.e., steering/braking systems for passenger carrying vehicles or on-highway*

• *Aircraft (private, military, commercial or other) or space vehicles.*

• *Ordnance equipment (fixed or mobile).*

• *Any end product that, when sold, comes under the U.S. Nuclear Regulatory Commission rules and regulations.*

Specific written approval for any application of HCT products in any of the above named applications should be obtained from High Country Tek, Inc. and consultation with our factory engineers is advised in unusual situations where applicability is questionable.

System Part Numbers:

• Controller Module :-……………………………………………… See page 23 for ordering info. key code

• Controller Graphical User Interface (GUI):-……………………… P/No: 023-00228

• HGC2 controller software CD:-………………….………….……...... Contact HCT customer service for info

• Controller info manual:-………………………………………….….. P/No: 021-00160

• Programming Cable:-…………………………………………………… P/No: 999-10166

• HGC-2, 8-pin Connector Kit:-…………….…….………………………… P/No: 999-10073

Important Notes:

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

ALWAYS - **K**eep High Voltage AC cables separate from Low Voltage DC signal and supply cables.

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

ALWAYS - **E**nsure that you are aware of the available adjustments and consequences on the electronics and hydraulics.

ALWAYS - **M**ake 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 <u>BEFORE</u> any form of welding takes place.

ALWAYS - **C**heck **ALL** connections to and from this unit to ensure <u>NO</u> short or OPEN circuits.

ALWAYS - **C**heck the units supply voltage is **CORRECT**, ' **ELECTRICALLY CLEAN** ' and **STABLE**.

ALWAYS - **O**perate the units within specified operating temperature for best & reliable performance.

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

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

ALWAYS - **E**nsure 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 - **A**ttempt to use this unit if you are unsure of electrical connections, hydraulic connections or expected operation.

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

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

NEVER - **A**llow wires TO or FROM the unit to short circuit (to each other or chassis/cabinet etc.).

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

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

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

NEVER - **S**tart this unit without ensuring ALL work areas are clear of personnel !

⚠ **WARNING**
Hazardous voltage.
Disconnect Power before servicing.

Hydraulic generators can produce LETHAL voltages when operating.
Remember to abide by all health and Safety rules and keep yourself and work colleagues safe !

Product Features:

- ❖ Digital architecture for repeatability, reliability and accuracy in your application
- ❖ Accuracy is dependent on the modules tuning and the type of hydraulic circuit used
- ❖ 100 to 250VRMS generator output compatible
- ❖ 50 or 60 Hz settable for global sales opportunities (ability to trim frequency to +/-3Hz in 0.1Hz increments)
- ❖ User configurable Under and Over frequency handling.
- ❖ Wide supply voltage 9 to 28VDC and full reverse polarity protection.
- ❖ -40ºC (-40ºF) to +80ºC (+176ºF) controller operational temperature range.
- ❖ Valve dither frequency selectable up to 1000Hz
- ❖ Fully adjustable PID closed loop control for smooth speed control with fast correction and accuracy
- ❖ Designed to meet CE criteria to latest standards.
- ❖ Diagnostic 'Status' LED shows I/O status and module operation at a glance.
- ❖ 'Blinking' error code LED for fast on-site system wiring / coil fault detection
- ❖ Solenoid PWM current output is short circuit protected.
- ❖ IP67 (NEMA 6) rating on module for harsh environment reliability (connector IP rating may differ).
- ❖ Single Deutsch DT series connector for easy system wiring.
- ❖ Isolated Infra-red communications connector for programming, monitoring and diagnostics.
- ❖ Field programmable
- ❖ Intuitive Graphical User Interface (GUI), easy and fast to use for set-up and diagnostics
- ❖ Runs on any PC with Windows® XP Professional , Vista Business, Ultimate and Windows 7 software.
- ❖ Compatible with most major hydraulic manufacturers products.

Manual Variations Note:

PC Screen shots shown in this manual may have small differences compared to the picture being displayed on the Graphical User Interface you are using, This is normal and is due to the PC software being updated as we add more functionality.

High Country Tek, Inc. reserve the right to improve this product at any time and without notice. This manual may contain mistakes and printing errors. The information in this publication is regularly checked and corrections made in the next issue. Please check our website or contact our customer support for latest version. HCT accepts NO liability for technical mistakes or printing errors, or their consequences.

Software and PC requirements

Min Requirements,
Disk space: 165MB (Software, GUI and National Instruments embedded drivers required).
Physical Memory: 2.5MB
Screen Resolution: 1024X768

Important Note:

• The unit is supplied with 3 default .dat files, one for each of the three HGC-2 module versions available from HCT.
• When 'On-line' with a controller, you may only edit the .dat file for the model that s connected.
• When 'Off-line' you may open and save customized settings to any Data Flie.

Hydraulic Circuit Guidelines:

Hydraulic Configurations Used in Hydraulic Generator Applications:

There are three commonly known approaches to hydraulic generator circuits:

1. Load sense.
2. Bypass flow control.
3. Pressure control.

Field experience shows the most common circuit design is load sense (with proportional two way acting as the LS orifice).

This design has difficulty with piston motors and the spikes induced by the low number of power elements.

Both the load sense and the bypass flow control approach require a fixed displacement motor of some technology (gear, vane, bent axis piston etc.).

Motors with integrated cartridge valves make for a cleaner installation and reduce the need for leak paths, manifolds, hoses and fittings etc. in confined spaces normally seen in generator sets.

5
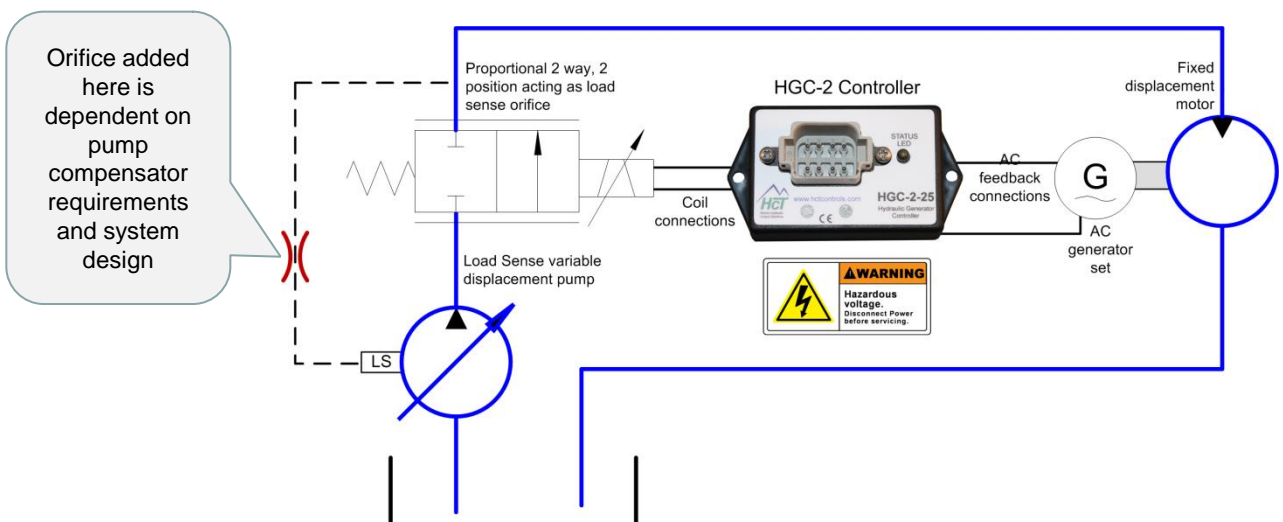
About the HGC-2 Controller:

The HGC-2 Hydraulic Generator Controller is the latest addition to the HCT family of rugged control modules, designed for reliability under extreme conditions.

The highly cost effective HGC-2 is designed to control a generator driven by a hydraulic motor where speed is controlled by a proportional solenoid valve, either directly at the motor or as part of the pump compensator.

The HGC-2 is a closed loop controller that monitors the AC line frequency and controls current to a valve coil in order to maintain the desired frequency. A single LED indicator on the top of the unit provides an overview of the operating status

The HGC-2 has enough processing power and functionality to support a wide range of hydraulic generator applications. As with all HCT modules, the HGC-2 is packaged in a small rugged enclosure. All connectors are sealed and the module is encapsulated to withstand extreme conditions in the harsh mobile operating environment.

The GUI has been organized into various user screens that are logical and easy to understand. Terminology has been used that is commonplace through the industry to allow easy configuration and is intended to cater for a wide range of users with varying levels of computer familiarity.

Once configured, all settings are permanently stored in the units memory.

The HGC-2 is housed in a small, rugged housing and is fully encapsulated for maximum protection. All I/O connections are made through a heavy duty DT series Deutsch connector.

PC Graphical User Interface (GUI):

HGC-2 set-up, monitoring, and diagnostics can be accessed through the supplied GUI. This program will operate on PCs using Windows® based operating systems and is **password protected** to maintain module parameter integrity by only allowing authorized users to access different levels of the controllers settings.

The interface is designed to be simple to use and follows the familiar Windows® menu format with drop down option screens used to select the various options available at the current user level.

Explanation of the screens are covered in detail, later in this guide.

PC com ports are automatically selected when communications are initialized.

After communications have been established, the user will be presented with the initial information screen that will give all the basic information needed to assess the health of the system.

Real time graphing is available here to monitor a wide range of items (selectable from a drop down and select list). When logging data, files are saved in an Excel compatible format (.csv).

Loading the HGC-2 GUI onto your PC:

Visit hctcontrols.com or contact HCT customer service on (530) 265-3236 to ensure you have the latest revision of the HGC-2 Graphical User Interface (GUI)

The Installation program for the GUI is a self extracting installation program that will install the GUI onto the PC's hard drive. It is recommended that the user allow the defaults to be used for easy installation.

It is recommended that this program be run locally on the machine it is installing to as it needs access to certain files available only in the local Windows directories.

To start the installation process, simply insert the CD into the computer that you would like to install to and the installation should begin automatically. If this does not work, select and run the Setup.exe file on the CD.

GUI Overview:

HGC-2 'Dashboard' view:

Once the PC is connected to the HGC-2 module and the GUI started, communications will be established and this 'Dashboard' screen will appear.
From here the user can observe all operations of the controller as well as see the settings for individual characteristics that have been programmed.
If the user is authorized and has the correct password(s), the unit settings and other information May also be configured from here.
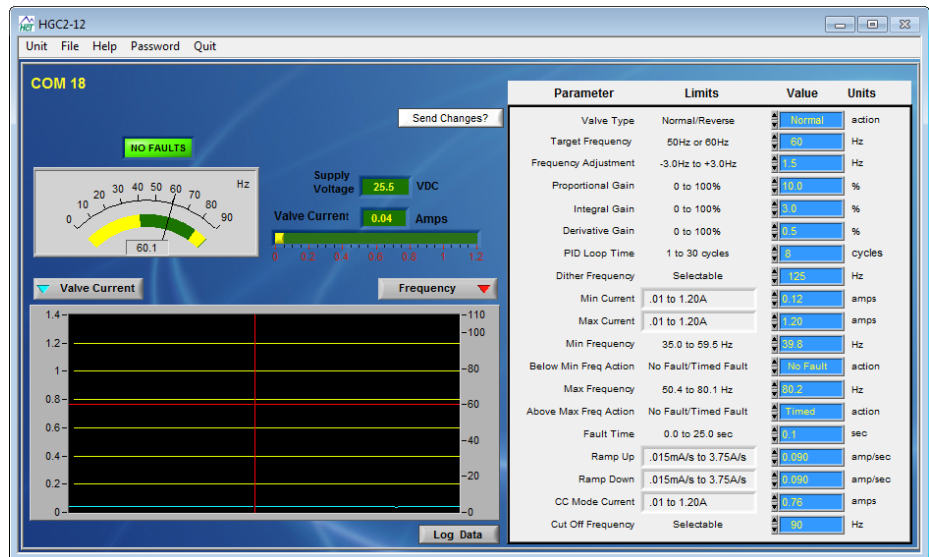
OFF-LINE:

Visible when there is no communication with a HGC-2 module.

When the PC is connected to the controller, and the GUI is started, there may be several seconds while the PC establishes communications with the module. During this time, the 'OFF LINE' indicator will be present. This indicator also displays if communications are lost or dropped during connection between the PC and the module. Under normal circumstances, re-connection of communication will be automatic. If the module fails to re-connect, the user may have to cycle power to the HGC-2 to perform a hard reset.
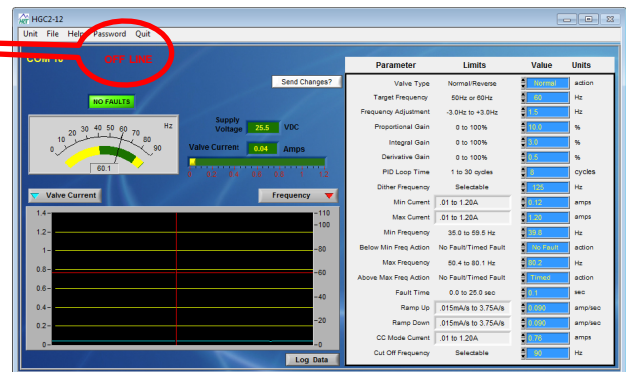
Explanation of major windows:

1. The header of the GUI window indicates the type of the controller that is connected to the host PC.

2. This main indicator should be bright GREEN to show a correct operational function of the controller, with the light showing real-time status of the units operation. If there is an error of any type, this indicator will be bright RED and the fault description shown above the indicator until the fault is cleared.

3. This digital display shows the DC supply voltage to the HGC-2 controller.

4. This meter shows the user the actual feedback frequency that is being measured from the generator under control. The needle should be in the 'GREEN' band for correct operation.

5. This bar-graph and digital meter indicate the PWM DC current that is being supplied to the control valve used to regulate the generator rotational speed.

6. This graph area allows the user to monitor the operation of various parameters.

7. This table shows all adjustable parameters that may be used. If the table window has a blue background with yellow text, the user may enter a values directly or use the up/down arrows to adjust the value as desired.

8. Changes made to the parameters in the table mentioned above will only take effect when this 'Send Changes' button is clicked.

9. This button allows the user to 'LOG' controller functionality directly to the connected PC hard drive. The data is saved in CSV format (Excel compatible).
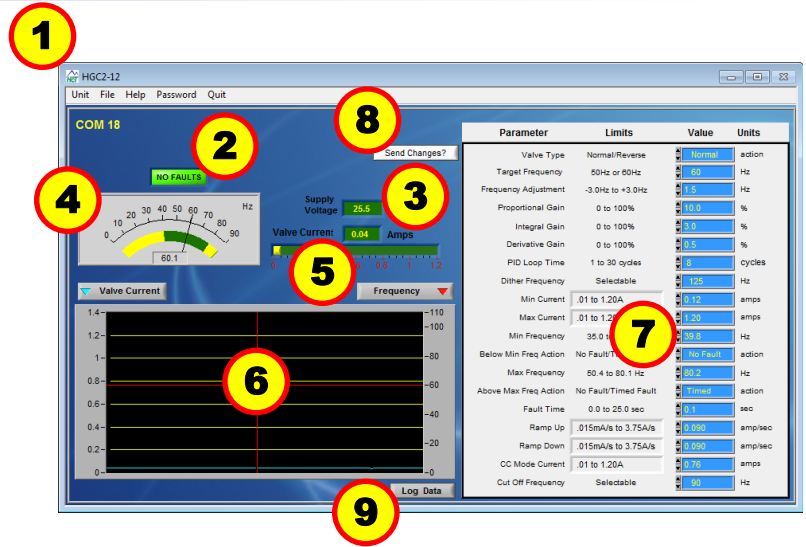
NOTE:

With NO password entered, the options bar will only show 'Help' and 'Quit' highlighted as these are the only choices available to the un-authorized user.
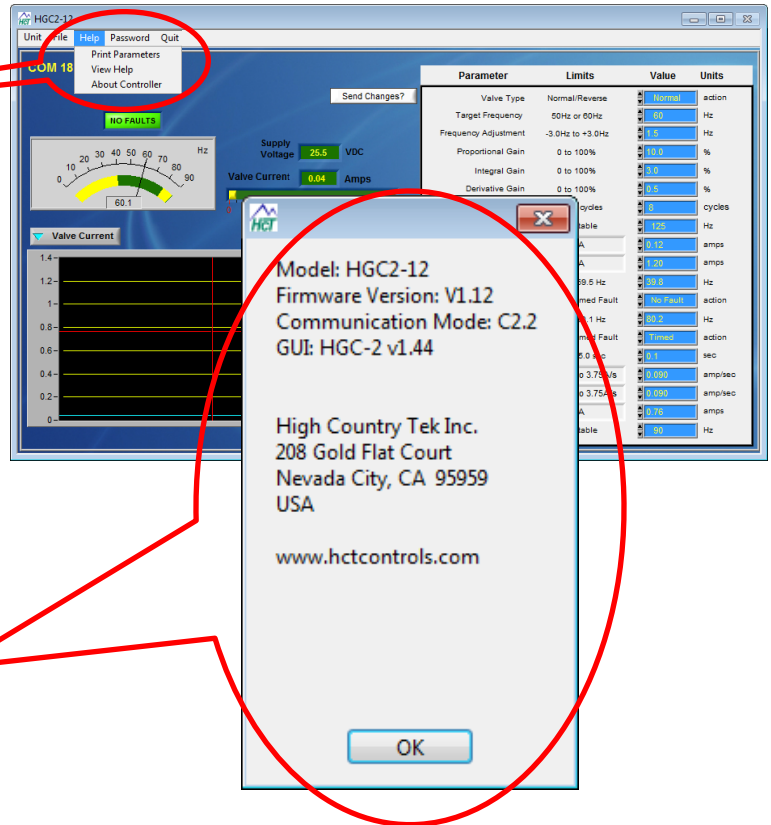
'Help' Menu Options:

The 'Help' menu contains three options:

1. Print Parameters
2. View Help.
3. About Controller.

'***Print Parameters***', this option will send copy of the controller settings to the default printer connected to the PC.

'***View Help***', will open a PDF file containing the complete manual for the HGC-2 controller.

'***About Controller***', will open a window that will show the user relative information on the controllers model, Firmware, GUI and communications versions as well as contact information and web address for support.

'QUIT' Menu Options:

The 'Quit' menu options:

1. Quit.

'***Quit***', Shuts Down the GUI correctly and releases any communications ports that may have been used during operation.

NOTE:
It is important to note that if 'Quit' is clicked before the 'Send Changes' button, the GUI will close and the controller will default to the previous settings stored in the internal memory with no permanent changes taking place.
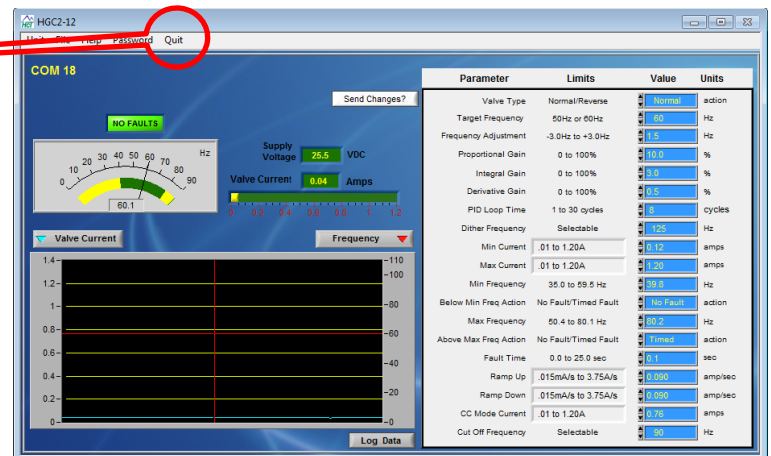
## Controller Setting Security - Passwords:

Password Protection:

Select to enter a Password. This opens another window where the password is entered.

NO Password – User Level:
This level allows the user to only observe operation but not allow any changes to parameter settings.

OEM level:
This level allows the equipment OEM access to all settings and controller functions.
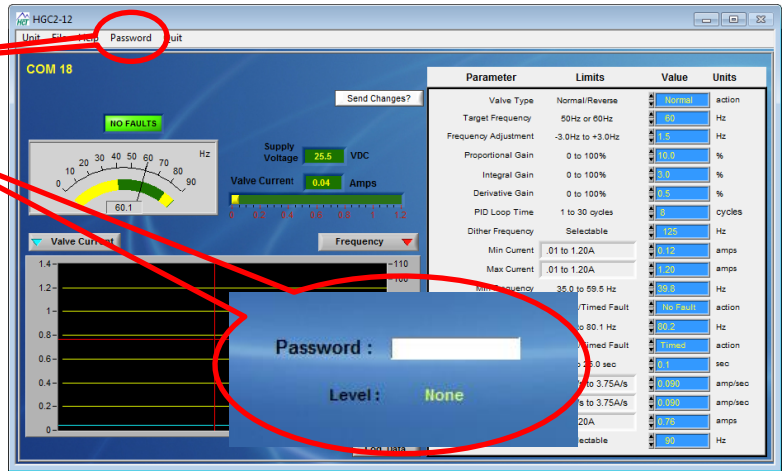
NOTE:
Passwords may be obtained by contacting High Country Tek, Inc. sales and support department
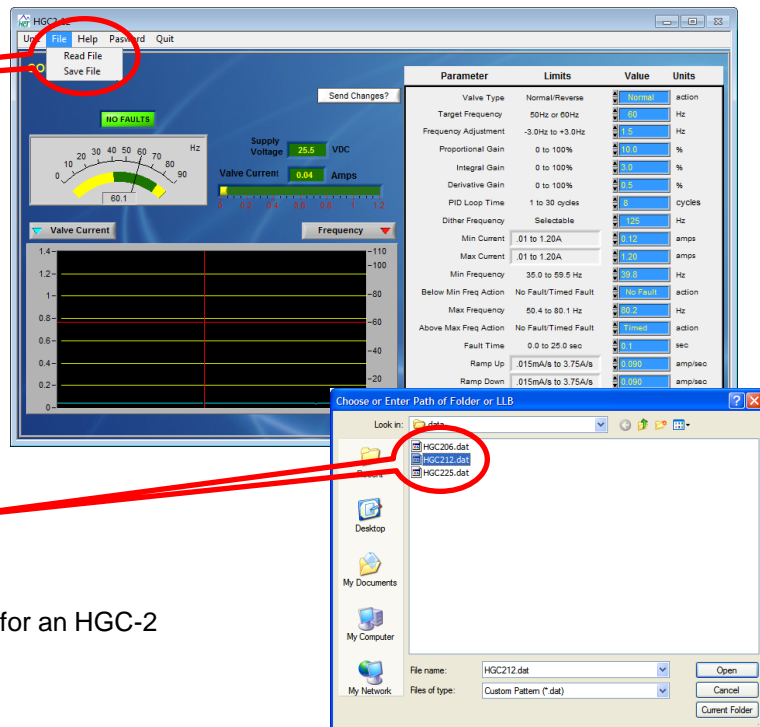
'File' Menu Options:

The 'File' menus have two drop down options:

1. Read File.
2. Save File.

'***Read File***', Allows the user to open previously saved HGC-2 settings profiles and up-load these into the PC and then into any HGC-2 controller.

NOTE:

When editing the default data file that comes with the controller, ensure that you choose the correct file name for the model of HGC-2 ordered and used. For example: Use data file name "HGC-2-12.dat" for the "HGC-2-12"

'***Save File***', Allows the user to save a data file for an HGC-2 controller to the PC for later use.

'Unit' Menu Options:

The 'Unit' menu has three drop down options:

1. Read Parameters.
2. Send parameters.
3. Find Controller.

'***Read Parameters***' Selecting this option commands the GUI to read in the parameters from a connected controller.

'***Send Parameters*** ' This option writes all the parameters currently shown on the screen to the controllers permanent memory.

'***Find Controller*** ' This option will actively search communications ports for a genuine HGC controller and then refresh the parameter screen with the settings from that module.

60 or 50Hz Screen Differences:

The HGC-2 controller is designed for use with both both 110VAC and 240VAC generators at either 50 or 60Hz.

The line AC frequency feedback is taken directly from the generator output without external equipment or components needed.

After selecting feedback voltage and frequency, the GUI meters and displays will automatically adjust their scaling to present the best resolution possible.
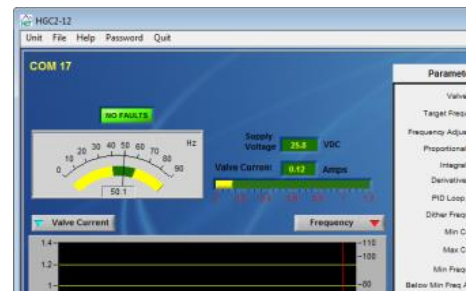
'Data Logging' Options:

The HGC-2 GUI can log operational data as long as it is actively communicating with a HGC-2 module. The data is saved onto the PC as a .CSV file, into a location that can be selected by the user.

Logging is started by the user clicking the 'Log Data' button

The controller logs the following data:

1. Valve coil Current
2. Power Supply Voltage
3. Feedback Frequency

Information transfer rate from the controller to the .CSV file is governed by the host PC's performance
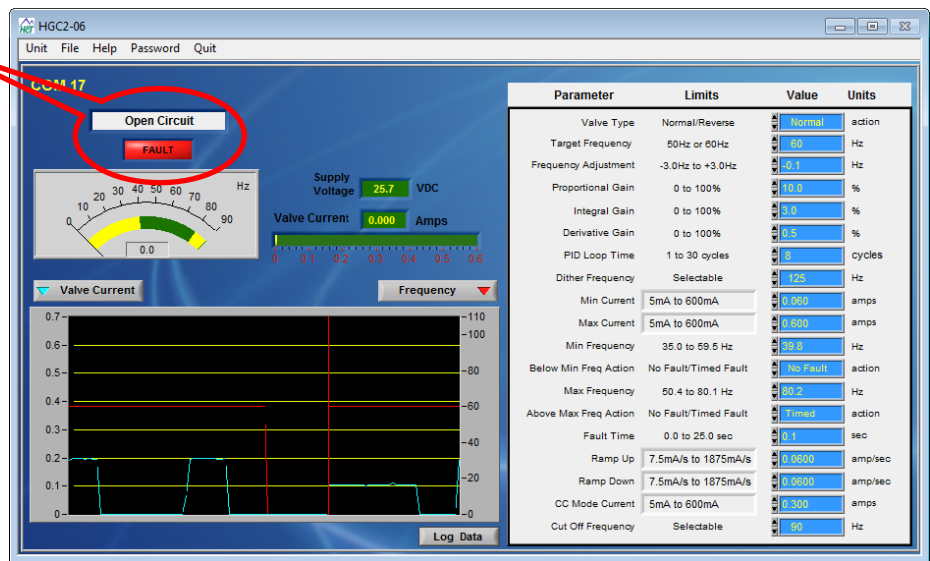
Fault Screens:

OPEN CIRCUIT FAULT DETECTED:

This fault is displayed when the controller detects that the proportional coil or wiring being driven by the PWM output has become dis-connected.

If this fault is triggered, the HGC-2 PWM output will be set to zero output (i.e. minimum generator speed) until the HGC-2 is either disabled and re-enabled or the supply power to the unit is cycled and no further open circuit is detected.

To correct this issue, the operator should first stop the generator and check all connections to the coil.

If the fault still exists after verifying the wiring, check the solenoid coil for the correct resistance value (see manufacturer data sheet) or change the solenoid coil.

'Fault' Screens:

SHORT CIRCUIT FAULT DETECTED:

This fault is displayed when the controller detects that the proportional coil or wiring being driven by the PWM output has become shorted.

If this fault is triggered, the HGC-2 PWM output will be set to zero output (i.e. minimum generator speed) until the HGC-2 is either disabled and re-enabled or the supply power to the unit is cycled and no further open circuit is detected.

To correct this issue, the operator should first stop the generator and check all connections to the coil. Repair connections or replace the coil as necessary.

Fault Screens:

FREQ. FAULT DETECTED:

This fault is displayed when the controller detects the high voltage feedback frequency is either below or above the Min and Max frequency settings selected.

The fault indicator only appears after a time period to allow for minor fluctuations in frequency that may occur during 'load-no-load' transitions.

If this fault is triggered, the HGC-2 PWM output will be set to zero output (i.e. minimum generator speed) until the HGC-2 is first disabled and re-enabled or the supply power to the unit is cycled.

To correct this issue, the operator should check the high voltage feedback connections to and the HGC-2 controller for correct and firm connection. If these are secure, the settings for the HGC-2 may need to be adjusted.

Connecting the HGC-2 to the Programming Cable:

In order for the HGC-2 to communicate with the PC User Interface, a programming cable (999-10166) must be temporarily connected between the PC's USB port and the HGC-2 controller.

The controller and programming cable use Infra-red transmission technology for isolated data transfer. The programming head must be correctly aligned to the controller for successful communications.
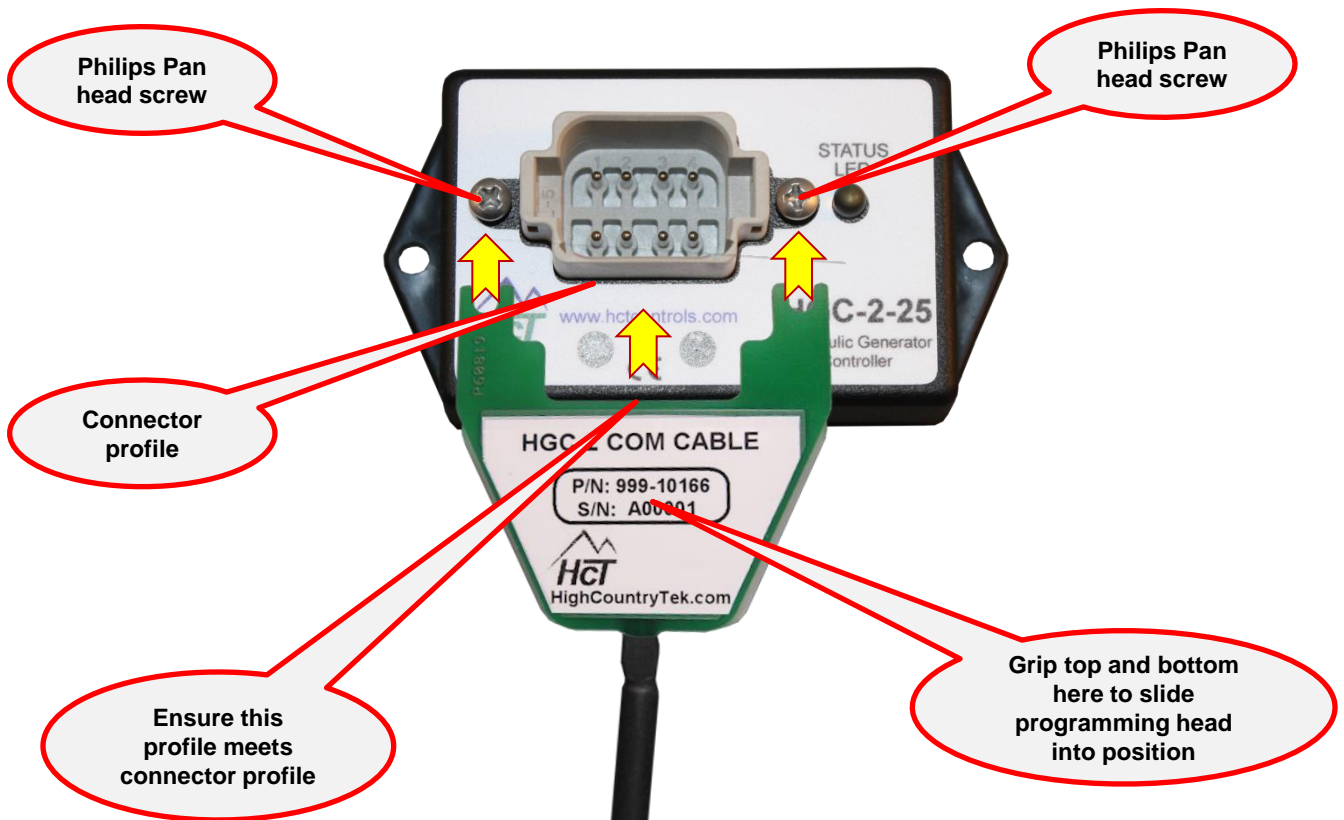
1. Clean both the surface of the HGC-2 module, directly under the connector and the underside of the 'Programming head', making sure there is no debris or material that could interfere with communication.

2. Install the 'Programming head' with the label facing upwards as shown in the picture to the above.

3. Holding the ' Programming head' firmly, top and bottom between thumb and forefinger, slide it **UNDER** the two Philips Pan head screws (see bubbles above) until the Programming Head meets the connector.

HGC-2 Controller Settings and GUI Descriptions:

TARGET FREQUENCY – Selects the desired output frequency of the generator, 50Hz or 60Hz.

FREQUENCY ADJUSTMENT – This acts as an offset to the Target Frequency, above, and may be adjusted by up to +/-3Hz in 0.1Hz increments if desired – normal setting is 0Hz.

PROPORTIONAL GAIN. – Sets the proportional gain in the control loop. The proportional gain represents the P term in a PID control loop. The proportional term is simply a multiplication of the error which is added to the output.

INTEGRAL GAIN – Sets the integral or I term in the PID control loop. The integral term is the accumulation of error over a period of time. The integral term is generally used to overcome an offset in the output or to correct for very small deviations over time at a fixed command.

DERIVATIVE – Sets the derivative gain in the control loop. The derivative gain represents the D term in a PID control loop. The derivative term is the rate of change of the error. The derivative term is generally used to increase the responsiveness of a system.

PID LOOP TIME – Represents how often the PID loop is calculated in number of PWM cycles. Therefore, the lower the number, the more quickly the system will respond to error.

RAMP UP RATE – Sets the rate at which the controller will increase current to the solenoid when first enabled. Once the AC frequency is within approximately 10% of the target frequency the closed loop control algorithm will take priority over the Ramp Up Rate.

RAMP DOWN RATE – Sets the rate at which the controller will decrease current to the solenoid after the enable signal is removed. (Used when shutting down the generator.)

DITHER FREQ. – The Dither Frequency parameter has 11 options for setting the dither frequency between, 50 and 1000 Hz. Dither provides low frequency modulation which is required to reduce stiction and hysteresis in many hydraulic proportional valves.

MINIMUM OUTPUT – The Minimum Output parameter represents the minimum (starting) current of the output. This may be used to induce, reduce or eliminate dead band at the bottom of the valve. The value displayed represents the current in milliamps (amps for -12A, -25A).

HGC-2 Controller Settings and GUI Descriptions:

MAXIMUM OUTPUT – Represents the maximum current output to the coil. The value displayed represents the current in milliamps (amps for -12A, -25A).

MINIMUM FREQ – Establishes the minimum frequency for the desired range of operation. During operation, a feedback frequency below this value would be handled according to the Below Min Freq. parameter.

BELOW MIN FREQ – Selects which function to use when the frequency falls below the Minimum Frequency; NO FAULT will ignore the condition
TIMED FAULT will shut down the generator after the set time has expired assuming the fault remains valid.

MAXIMUM FREQ – Establishes the maximum frequency for the desired range of operation. During operation, a feedback frequency above this value would be handled as determined by the Above Max Freq. parameter.

ABOVE MAX FREQ – Selects which function to use when the frequency rises above the Maximum Frequency; NO FAULT will ignore the condition
TIMED FAULT will shut down the generator after the set time has expired assuming the fault remains valid.

FAULT TIME – Sets the amount of time that a frequency fault condition exists before the controller shuts down and indicates the fault.

CC MODE CURRENT (Constant Current) – Sets the output current to a fixed value. Applied when the constant current mode is enabled. – **see page 17 for details**.

CUT OFF FREQUENCY – This variable acts as a digital noise filter on the AC input to the controller. The frequency entered will be the point where the controller will stop regulating and slow down the generator by lowering its output to the valve. If set too low, the module could misinterpret the incoming frequency and run away. It should be kept as high as practical to prevent the generator from running away. During initial setup, set the Cutoff Frequency well above the target frequency, then lower it to a practical set point after the PID alignment is complete.

Initial Set-up Procedure:

The following steps are recommended when commissioning a HGC-2 controller:

1. Select the desired operating frequency of the generator – 50 or 60 Hz.

2. Set the Minimum and Maximum Output currents according to the valve coil data sheet.

3. Set the Dither (PWM) Frequency as recommended by the valve manufacturer.

(NOTE: Higher dither frequencies can sometimes be used in closed loop systems to improve response).

4. Set the Ramp Up Rate and Ramp Down Rate to a nominal 3 seconds (trim this to suit performance).

5. Adjust the PID parameters as needed to optimize the system response;

   ❖ Start with Proportional (**P**) setting and increase to achieve a stable system.

   ❖ Once stability is achieved, gradually increase the add Integral (**I**) setting and finally,

   ❖ Increase the Derivative (**D**) setting as needed to improve system response and/or stability.

Troubleshooting - Constant Current Mode (CC Mode):

The Constant Current Mode, or CC Mode, is useful for setup and troubleshooting. In this mode, the HGC-2 controller will maintain a constant output current to the proportional valve coil and ignoring the AC line feedback if connected.

To initiate CC Mode:

1. Adjustment of the output current value (mA) to the proportional coil is made through the HGC-2 GUI. If needed, make sure your test PC has the HGC-2 GUI installed, running, and is connected to the HGC-2 with communications open and an OEM password entered.

2. Apply a +V signal to both the 'CC Mode Enable' (pin 7) and the main 'Enable IN' (pin 8) simultaneously.

3. Once the genset has started, the +V 'CC Mode Enable' signal can be removed and the controller will continue in this mode until the main 'Enable IN' is removed.

4. CC Mode cannot be initiated after the controller is started in normal mode.

Operational Guide:

The following section gives the user a generic overview of expected control results once the controllers PID settings have been optimized for the individual generator system. These results are for reference only and may vary depending on individual circumstances and/or product technologies.

Hydraulic Circuit configuration:

• Generator Info. – 50KW @ 1800 RPM on Variable Frequency Drive
• Pump – 45 cc/rev load-sense pump
• Valve – 2 position, 2 way, non compensated proportional size 12 cartridge with 12 VDC coil
• Oil temperature – forced air cooled with ambient air
• Oil type – Standard Hydraulic Mineral oil

Generator Configuration:

• Armature – Mec Alte' 2 pole, S16F-180/B rated at 8KW @ 3600 RPM (de-rated to 6KW for severe duty service)
• Hydraulic Motor – Sauer Danfoss SNM2-FL/08-SSC06-RZZ1
• Voltage regulator – dual capacitor, passive

Electrical specification:

• Regulated power supply 13 VDC (from integrated PSU on test application).
• HV electrical loading by combined resistive and inductive loads

Test Specifications – Stability With Load Changes

**No load – Full load – No load test**
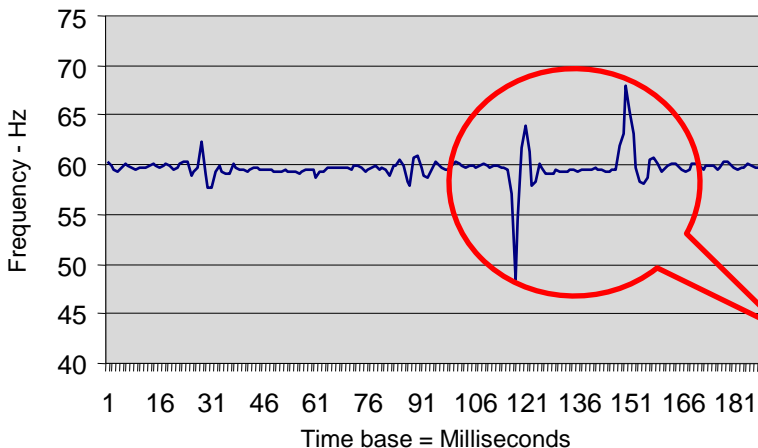
This result shows what can be achieved with the correct settings on the controller. The graph left demonstrates the recovery time of the output frequency when the generators load is fully applied, then fully removed, then fully applied once more.
This sequence of instantaneous events is probably the worst that the generator will see, yet undershoot, overshoot and steady state are well controlled and acceptable for the majority of today's applications.

Operational Guide – DC Supply Voltage Fluctuation:

DC Supply Voltage Fluctuation
13V – 10V – 13V within 1 second
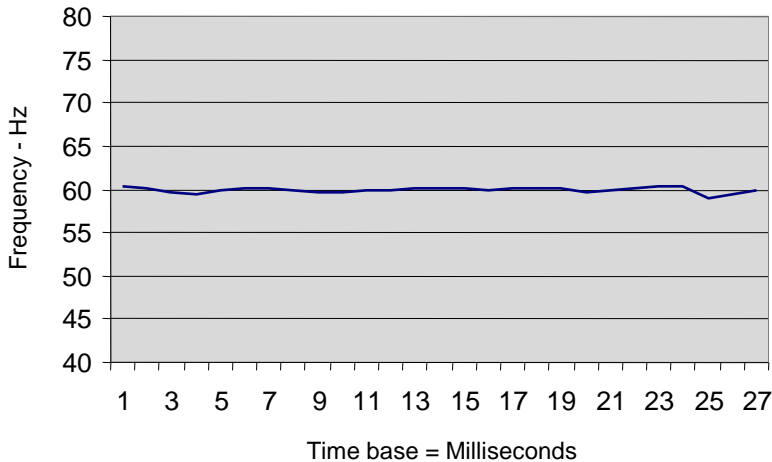
The HGC-2 has been designed to work under extreme conditions seen in mobile equipment. One variable that can effect operation is the vehicle battery voltage, but as can be seen in the graph, right, the fluctuations that can occur have very little effect on the controlled frequency of the generator output, with good control being shown at all times.

Test Specifications – Prime Mover Speed Change

Prime Mover Speed changes
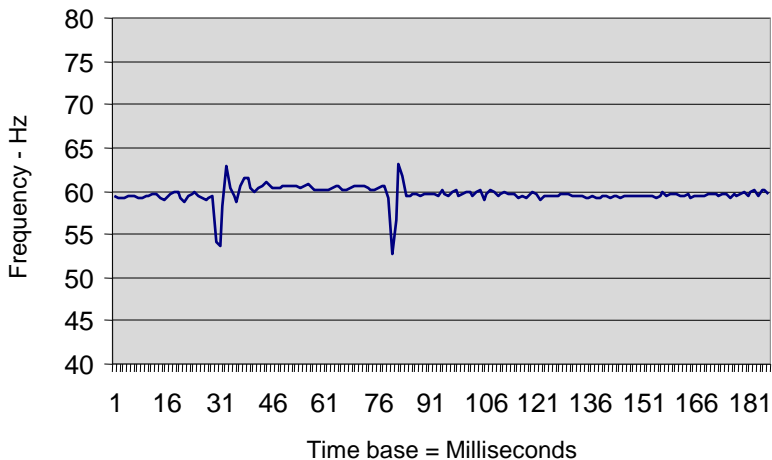
In the event that the prime mover has variations in speed (i.e. engine momentary loading), the controller must be able to react quickly and smoothly, avoiding major over and undershoots and recovering to steady state as soon as possible.
This test demonstrates the generator output with prime mover speed changes from mid range (normal = 3600RPM) to minimum (3400 RPM) and then to maximum (3800 RPM).
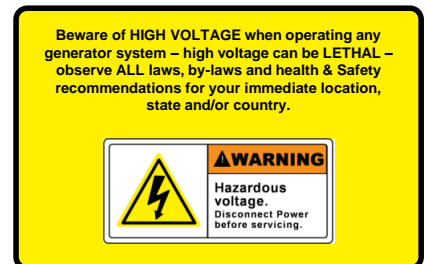
Test Specifications - General:

There are few hydraulic generator specifications that have been written. The most common is the NFPA specification for generators applied to fire protection equipment.
It is based on a non-electronically controlled hydraulic generator (load sense pump with fixed orifice) and thus addresses dynamics specific to that design, such as frequency droop over time under full load (to assess volumetric efficiency losses).   This specification is attached. A generator using either test specimen will meet this specification.

HGC-2 Electrical Specification:

1.	**Housing Type:**	HCT unique 'encapsulated' block.
2.	**Input Supply Voltage:**	+9 to +28VDC (Absolute Maximum)
3.	**Input Supply Current:**	Valve Current Setting + 50mA Quiescent (Max)
4.	**Feedback Voltage:**	100 to 250VRMS
5.	**O/P Current Ranges:**	600mA, 1.2A or 2.5A (specified at time of order)
6.	**Solenoid Min Ohms:**	2Ω minimum resistance
7.	**Dither (PWM) Frequency :**	Software adjustable, ~50Hz to ~1KHz
8.	**Housing Material:**	ABS, black
9.	**Encapsulation:**	Flameproof epoxy resin
10.	**I/O Connections:**	8 pin Deutsch - DT06
11.	**Mounting:**	2x No. 6 (4mm) screws .
12.	**Working Temp.:**	-40⁰C (-40⁰F) to +80⁰C (+176⁰F) (operational)
13.	**Storage Temp.:**	-50 (-46⁰F) to +85 ⁰C (+185⁰F)
14.	**Humidity:**	95 to 100% NON condensing
15.	**NEMA/IP Rating:**	NEMA 6P / IP68

> **Beware of HIGH VOLTAGE when operating any generator system – high voltage can be LETHAL – observe ALL laws, by-laws and health & Safety recommendations for your immediate location, state and/or country.**
>
> **⚠WARNING**
> **Hazardous voltage. Disconnect Power before servicing.**

HGC-2 Module overview:

1. Main Input /Output connector for HGC-2

2. STATUS led with blink code for local diagnostics

3. Infra-red transmitter lens (flush with module)

4. Infra-red receiver lens (flush with module)

HGC-2 Error code Description (STATUS):

| Blink	Definition
OFF	System is OK and operating normally
2	Open Circuit On Controller Output – wires to solenoid disconnected while under power
3	Short Circuit On Controller Output - wires or solenoid have become short circuited
5	Frequency Fault – output frequency has been below min. or above max. for greater than fault time

HGC-2 Dimensions:
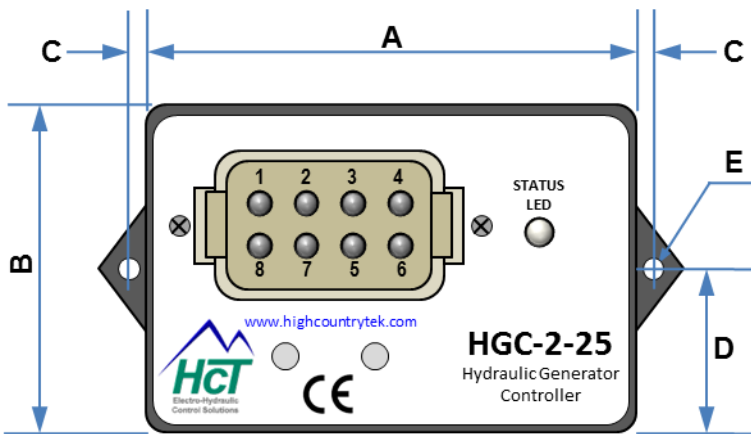
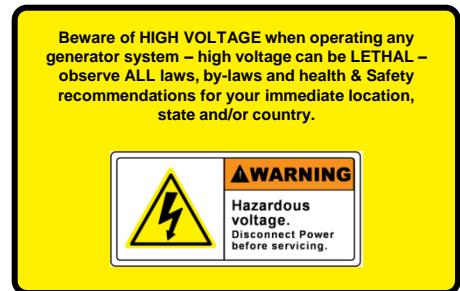| Label	Inches	Millimeters
A	3.0	76.2
B	2.0	50.8
C	0.25	6.4
D	1.0	25.4
E	0.188	4.80

IMPORTANT NOTES:

• **ALWAYS Mount HGC-2 controller with I/O connector facing downwards to avoid debris collection.**

• **Recommended tightening torques for securing bolts on the HGC-2 module are as follows:**

For 2 x #6 (4mm) bolts - Dry Torque = 6 Ft-Lbs - Lubricated Torque = 4 Ft-Lbs

Electrical System Connections:
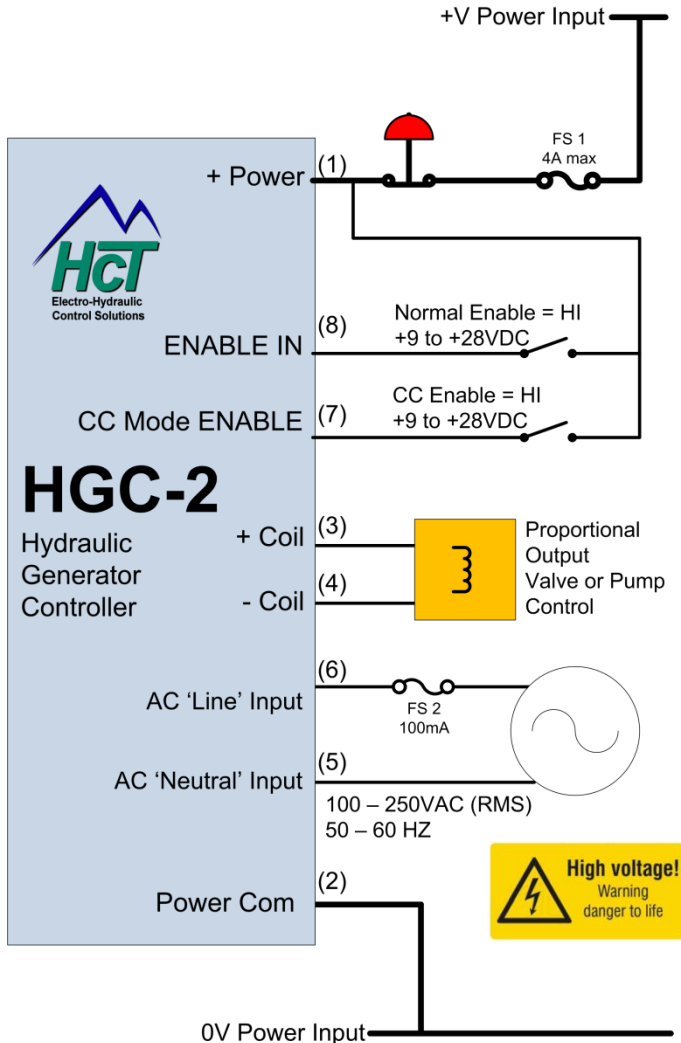
Pin	Function
1	+Power Input Supply
2	- Power Input Supply (GND)
3	+Solenoid Connection
4	-Solenoid Connection (GND)
5	AC feedback Neutral
6	AC feedback Line
7	Constant Current Mode Enable In
8	Controller ENABLE In

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**⚠ WARNING** Hazardous voltage. Disconnect Power before servicing.

HGC-2 Module Connection notes:

1. Ensure that the recommended fuses (FS1 & FS2) are installed in the system for full protection and warranty.
2. Use separate cables for each connection as shown above.
3. Connect proportional valve coil cables and run separate from all/any high voltage wires.
4. Ensure that high voltage feedback cable is protected to prevent insulation wear during usage through vibration

HGC-2 Ordering Information:

H	G	C	2	-	1	2
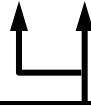
Output Current Range:

06 - 600mA current range
12 - 1200mA current range
25 - 2500mA current range

Notes:

• The current range chosen represents the maximum current available at the controller output.
• Please choose the lowest current range that will work for your application.

HGC-2 Connector Kit:

Deutsch, DT06-08 Connector

Note:

Mating Connector Kit, PN: 999-10073, contact HCT sales and service for more information

HGC-2 Programming Cable:

The programming cable Requires a USB connection.

Order, 999-10166, contact HCT sales and service for more information

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