evc/epc

Electronic Valve Controller

User Manual

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A Sun Hydraulics Company

Contents

Welcome

Welcome to the **High Country Tek** Inc. HCT is North America's foremost independent designer and producer of modular, ruggedized digital and analog electronic controllers for the fluid power industry.

From our factory in California, we build, test and produce 'specialty' controllers for specific functions and user programmable 'DVC family' to enable large area networked system solutions.

The modules are used in mobile, industrial and marine applications. They are also applied successfully in other industry segments.

HCT's every module is encapsulated in solid flame resistant material for maximum durability, electrical integrity and complete environmental security.

HCT is a market leader in many application arenas, including hydraulic generator, *e-Fan* and hydraulic fan system controls. These controllers realize significant fuel, emission and operational savings.

HCT's market neutrality offers integration with any hydraulic OEM valves, pumps, sub-systems or systems.

For more information, please visit us at: **www.hctcontrols.com**.

Cautions

Changing setup values or operating modes while the machine is running may cause unintended machine movement. It may lead to possible **injury** or **death**. Any moving parts should be disabled prior to changing setup values or operating modes. In any case, exercise caution and work should be completed only by qualified personnel.

Warranty Information

High Country Tek guarantees this product to be free of defects in materials and workmanship for one year from the date shipped from the factory. Within this time frame, High Country Tek will provide evaluation of warranted items free of charge. Warranty repair or replacement will be at the factory's discretion.

Please have the units full Model / Part Number and Serial Number available when contacting the factory. Do not return products to the factory without a RMA (Return Material Authorization) number.

Product Application Guidelines

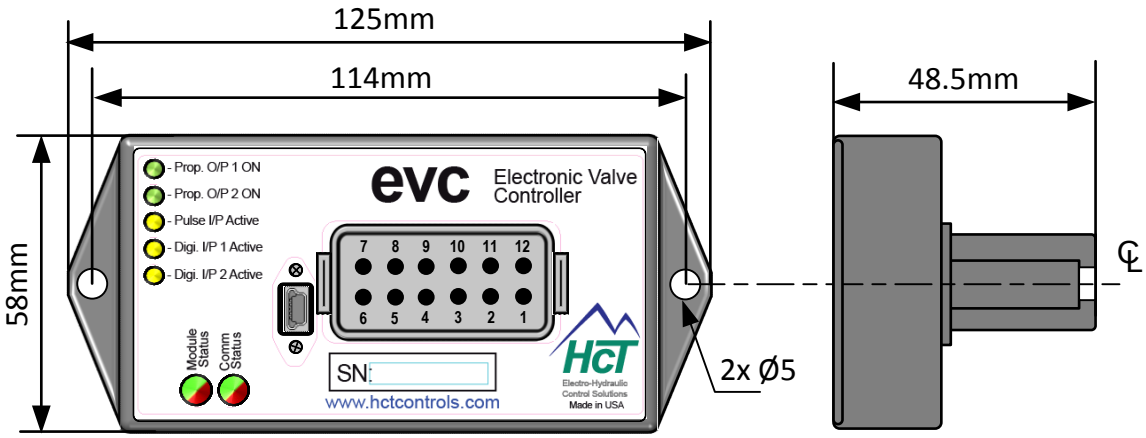
ALWAYS do the following

- FULLY read this manual and product data sheets BEFORE starting.
- Isolate the controller from all other equipment BEFORE any form of welding.
- Isolate the controller from ANY form of battery charging or battery boosting.
- Be aware of the electrical & mechanical connections, and the expected reactions of the equipment.
- Operate the controller within the temperature range.
- Use the correct tools (i.e. P.C., software) etc.
- Separate High Voltage AC cables from Low Voltage DC signal and supply cables.
- Make sure power supply is CORRECT, ELECTRICALLY CLEAN, STABLE and rated for the full load.
- Make sure the controller voltage & current are compatible with the equipment!
- All unused wires / terminals should be terminated safely.
- Ensure ALL connectors have no unintended SHORT or OPEN circuits.
- Ensure ALL connectors are wired correctly, secure, locked in place and fully connected.
- Disconnect or connect wires to or from the controller only when the power supply is disconnected.
- Use adequate screening in areas of intense Radio Frequency fields.
- Ensure ALL work areas are clear of personnel before operating the controller.
- Follow and abide by local and country health & safety standards!

Software Safety

- Use the correct GUI and hardware combination.
- Cycle the power to ensure changes are accepted by the controller.
- When the GUI is first connected to a powered controller, a ‘Handshake’ takes place to confirm the internal software (BIOS) is compatible with the GUI. This allows the PC and the module to communicate.
- If an error is detected, the GUI will indicate “OFF LINE” and NOT allow communications.

Controller Specification

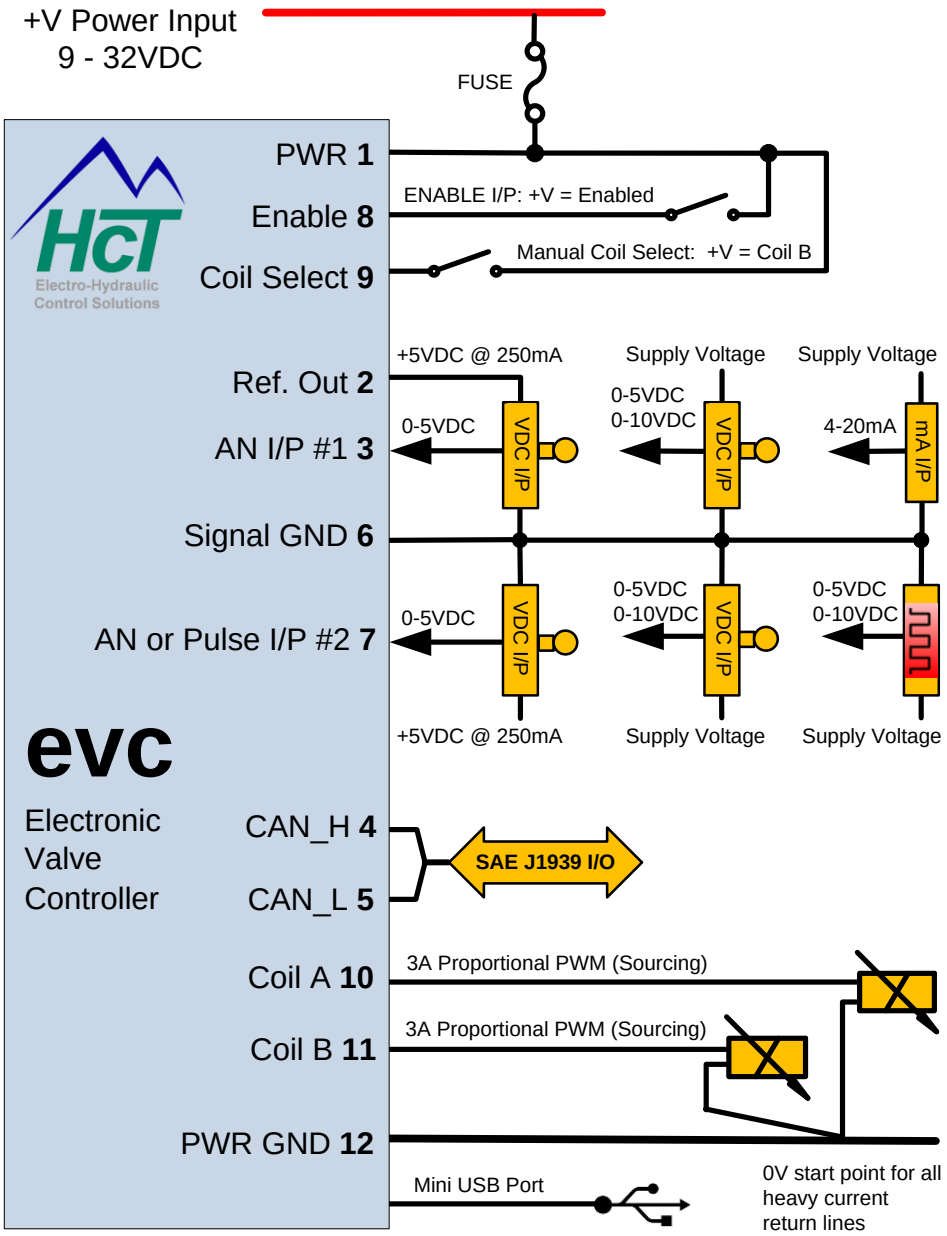


Controller Mounting Information

- Mount controller in an easily accessible location.
- Mount controller to a flat, cool surface.
- If mounting to a hydraulic product, allow at least a 2mm air gap underneath the unit.
- Use BOTH mounting holes with correct hardware.
- DO NOT mount controller with connector facing UP if possible.

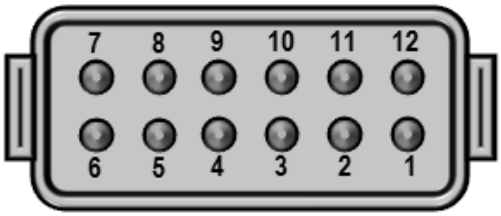
Housing Type	HCT encapsulated block
Power Supply Voltage	9 to 32VDC *(Absolute maximum)*
Current Consumption	Valve current + 50mA Quiescent *(Max)*
Command Inputs	**SAE J1939**
	2x switched inputs *(ON/Off)*
	2x analog inputs: One with *(0-5V, 0-10V, 4-20mA)* One with *(0-5V, 0-10V, Pulse or Freq. - 3 to 30KHz)*
Input Impedance	Voltage & Freq. inputs = 100kΩ
	4-20mA input = 100Ω
Outputs	2x 3A proportional PWM *(Sourcing)*
	(*Short circuit protection and open circuit alert*)
	1x 5VDC ±10% *(Regulated voltage @ 250mA)*
PWM Dither Freq.	Software adjustable - 33 to 500Hz
Module Connector	DTF15-12PB, 12-way Male
Communication	Mini-B USB standard
Housing Material	Black, Polycarbonate
Encapsulation	Flameproof epoxy resin
Mounting	2x No.8 *(5mm)* screws
Temperature Range	-40 to +85ºC *(Operational)*
	-60 to +90ºC *(Storage)*
NEMA/IP Rating	NEMA 6P/IP67, 69K

Electrical Diagram



PINOUT

evc/epc controller has a 12-Pin Deutsch connector and a mini-USB port for communication.



evc/epc Connector Designation Table	
12-way Deutsch Connector (Male, Plug)	
PIN	Name
Pin 1	+9 to 32VDC power supply input
Pin 2	+5VDC @ 250mA regulated O/P
Pin 3	Command input *(0-5V, 0-10V, 4-20mA)*
Pin 4	CAN_HI (SAE J1939)
Pin 5	CAN_LO (SAE J1939)
Pin 6	0V - Signal GND
Pin 7	Pulse input or analog input 2
Pin 8	Controller enable input (high = enable)
Pin 9	Manual selection of coil A or B
Pin 10	Coil A proportional output + (3A, sourcing)
Pin 11	Coil B proportional output + (3A, sourcing)
Pin 12	0V - Power GND

LED Diagnostic Codes (common to both modules)

Module Status LED

GREEN steady	Normal operation
RED 1 pulse	Output A short detected
RED 2 pulses	Output B short detected
GREEN 1 pulse	Output A open detected
GREEN 2 pulses	Output B open detected
RED 3 pulses	Input error detected, reference voltage error
GREEN 3 pulses	Power supply error
GREEN 4 pulses	Reverse retry fail error
RED 4 pulses	Pot not centered at reset error
ORANGE 1 pulse	State error

Communication Status LED

GREEN steady	Normal operation
GREEN with ORANGE pulses	Serial port (GUI) traffic
ORANGE/ RED pulsing	Receiving SAE J1939 traffic
RED 1 pulse	SAE J1939 set point message timeout
RED 2 pulses	SAE J1939 engine rpm message timeout
RED 3 pulses	Pot not centered at reset error
ORANGE 1 pulse	State error

Using the evc/epc with your PC

Install the **G**raphical **U**ser **I**nterface (GUI) on a host PC. Use the default file locations for easy future update. The user has the option to choose file location.

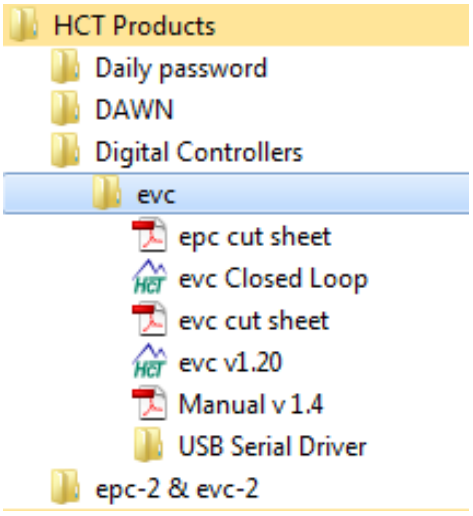
Don't run the GUI from a network as it needs access to certain files only in the Windows directories.

System Requirements

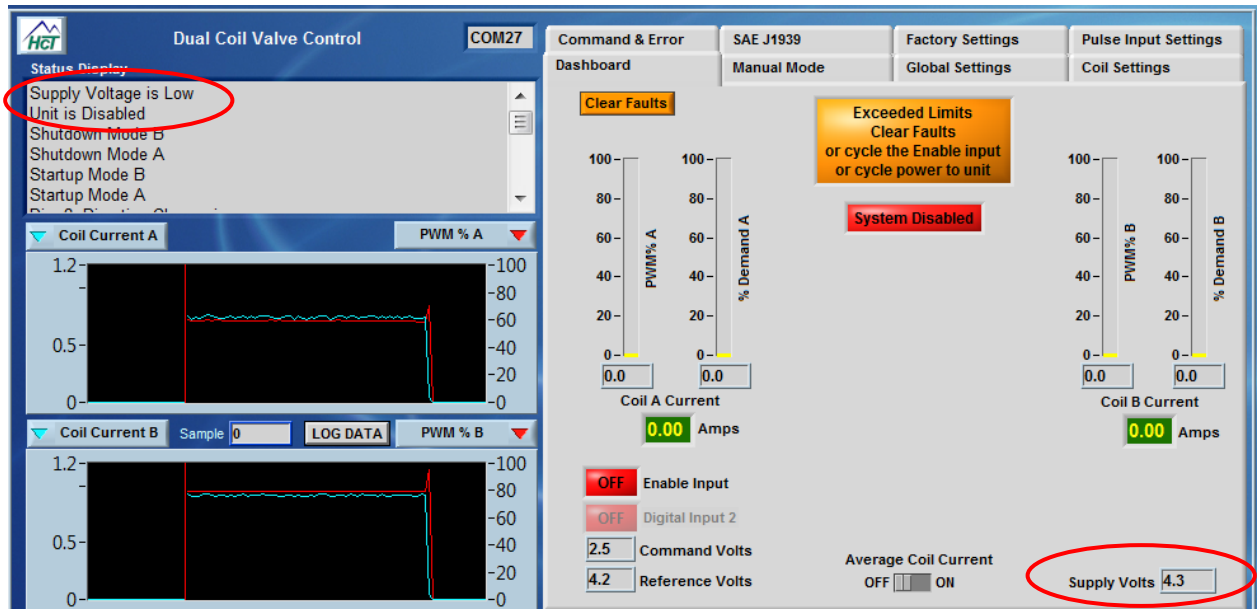
- Windows XP, Vista or Windows7, 100MB or greater free disk space.
- Insert the CD and follow the instructions. This will install the evc/epc GUI, manual and help files.
- Install the Com Port driver. Locate the installation file by the following route:

  Start ⇒ HCT Products ⇒ Digital Controllers ⇒ evc/epc ⇒ USB Serial Driver, CDM*xxxxx*_setup.exe
- To insure a complete install, run the CDM*xxxxx* twice.

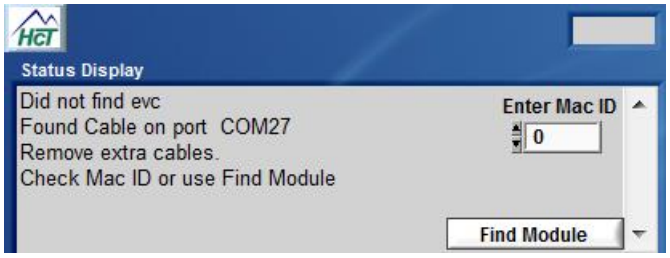
To launch evc Graphic User Interface, click Start ⇒ HCT Products ⇒ Digital Controllers ⇒ evc/epc. Choose "evc Closed Loop" for closed loop applications, choose "evc v1.20" for open loop applications.



The evc/epc can be powered by a +5V USB to allow configuration without connecting to a 12/24VDC system. A message “Supply Voltage is Low” appears on the screen. ***The user may communicate, change, and save settings to the unit without driving the coil(s).***



At start up the GUI searches the PC communication ports for the evc/epc controller.



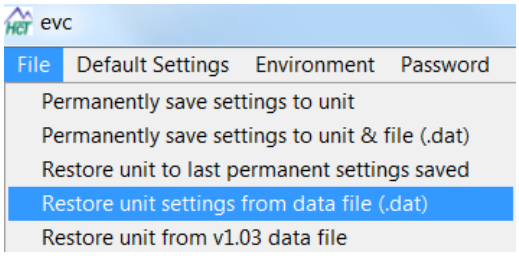
The **MAC ID** determines the module’s Command and Status PGN addresses on the SAE J1939 bus. The user may command multiple evc/epc modules on a single SAE J1939 bus. Please see SAE J1939 section.

The **default MAC ID is 1**.

“Find Module” or enter the **“Mac ID”** will locate the controller. It will restart the operation with the controller’s information and **“Mac ID”**.

evc/epc GUI Overview

File



All changes made through the GUI are temporary until saved permanently.

Permanently save settings to unit: Save the settings to the unit's EEPROM (permanent memory).

Permanently save settings to unit & file (.dat): Permanently save the settings to the unit's EEPROM and to a data file that may be uploaded into any evc/epc controllers later.

Settings will be lost if not permanently saved before power cycle.

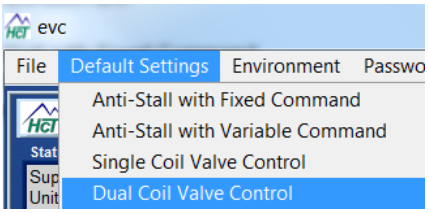
To reset the unit with a power cycle, you must remove both the USB cable and DC power from the unit.

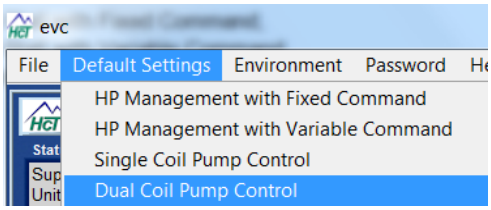
Restore unit to last permanent settings saved: Reload settings stored in the EEPROM. This will undo all changes made since the last Permanent Save.

Restore unit settings from data file (.dat): Load the data file from the PC to the evc/epc.

Restore unit from v1.03 data file: Load the previous version data file from the PC to the evc/epc.

Default Settings

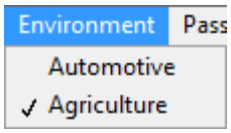




There are four default modes of operation. Other modes of operations can be created using data files.

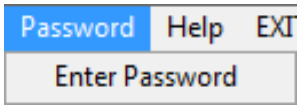
1. HP Limiting or Anti-Stall with Fixed Command
2. HP Limiting or Anti-Stall with Variable Command
3. Single Coil Pump or Valve Control
4. Dual Coil Pump or Valve Control

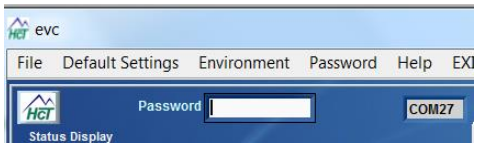
Environment



The Environment Menu selects the terminology for various markets.
In the Automotive Environment, load control is called “Anti-Stall” and in the Agriculture environment the same function is called “HP Limiting”.

Password



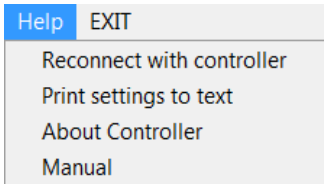


“Enter Password” unlocks certain features of the GUI.

Please contact your point of sales to obtain a password if required.

*Passwords are ‘**cAsE SeNsitivE**’.*

Help



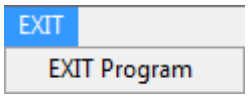
Reconnect with controller: The GUI will reset communication with the module, and re-read and update all variables.

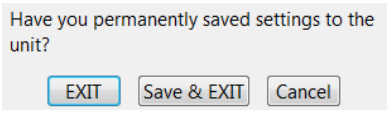
Print Settings to text: Will print all settings to your PC default printer, or print to a text file, tab delimited. The text file may be viewed with Notepad, Word, or Excel.

About Controller: Will display information about the evc/epc, the GUI revision, serial number, contact information etc.

Manual: Will open the folder in C:\\HCT products/Digital Controllers, or browse to other locations.

Exit

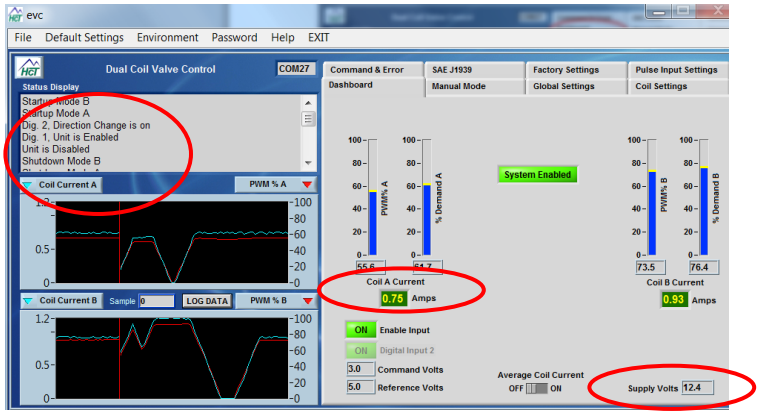




Exits the evc/epc GUI and frees up the com port and memory used by the application.

You can exit the GUI with or without saving the changes.

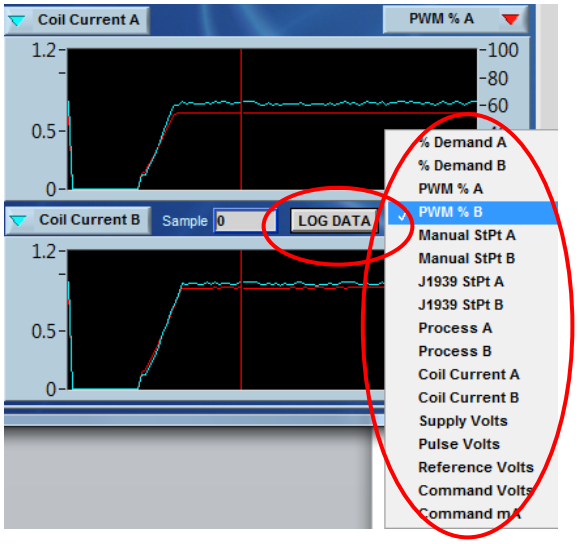
Dashboard, Status and Graphing Windows

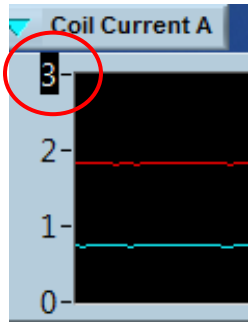


They give real time overview of the controller health, operation of the system and condition of inputs, outputs and any alarms.

Each graph tracks two variables that are individually scaled. Select the variable from the **Pull Down Menus**. "Y" axis is automatically scaled to the respective minimum and maximum values.

To customize the scaling, simply select a value on the graph and enter the desired value.



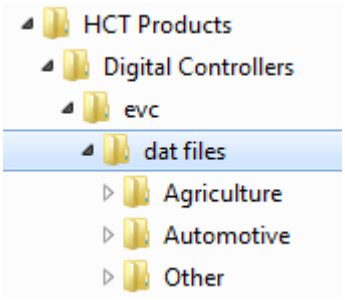


Data Logging

"Log Data" and save it in ".xls" format. The data file size is only limited by the PC hard-drive capacity.

Each log begins with a list of unit settings and followed by real time operational information. The sample rate depends on the workload of the PC and the evc/epc at recording. A timestamp scales the logs appropriately. Subsequent logs may be stored in a new file or appended to the original log file by selecting the original file.

The log file may not have all of the Excel formatting. Excel may declare an unknown file format. If it does, select '**Open'** and the information will display normally.



Example data files are saved to your PC during the installation.

When loading factory default data files, select "**Environment**", then select the desired default file.

Default Data files will overwrite any settings in the unit.

Adjust the Coil Settings first, then other settings as needed.

In Agriculture or Automotive you will have **Four** files:

1. HP Limiting with Variable Command /Anti-stall with Variable Command.

   Monitors RPM, the command input, and adjusts the output accordingly.

2. HP Limiting with fixed command/Anti-stall with fixed command.

   Monitors RPM and adjusts the output accordingly.

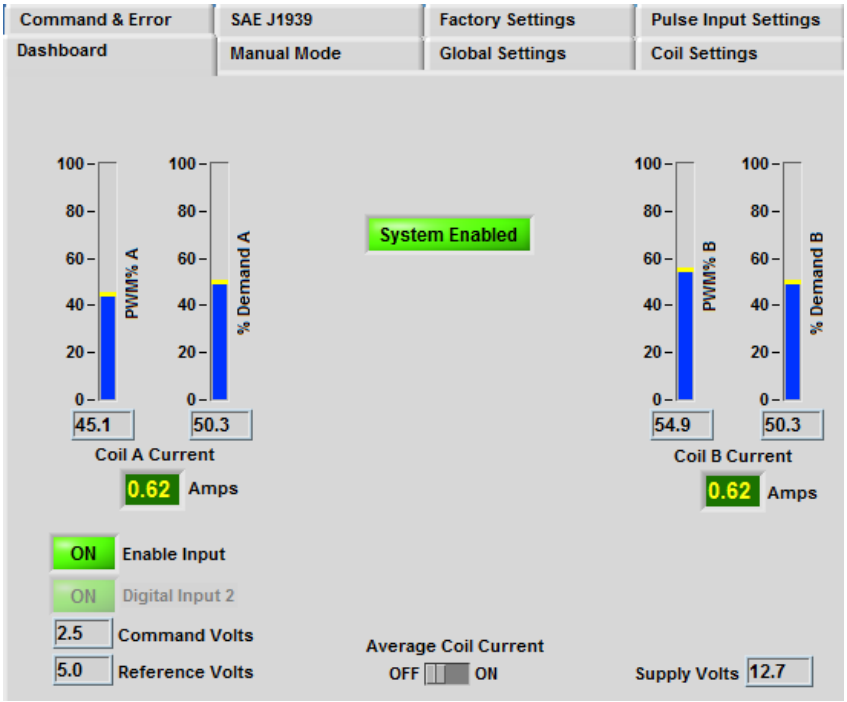
3. Single Coil Pump Control / Valve Control

   Controls the single-coil pump/valve in open loop mode.

4. Dual Coil Pump Control / Valve Control

   Controls the dual-coil pump(s)/valve(s) in open loop mode.

Dashboard



PWM% A/B – displays the PWM duty cycle output for coil A and B. The PWM% B will be “Grayed Out” when Coil B is disabled.

% Demand A/B – displays the percent of demand for the output with respect to the Maximum and Minimum Current settings. The % Demand B will be “Grayed Out” when Coil B is disabled.

Coil Current A/B – displays the output current. The Coil B Current will be “Grayed Out” when Coil B is disabled.

Enabled/Disabled – displays the current state of the enable input.

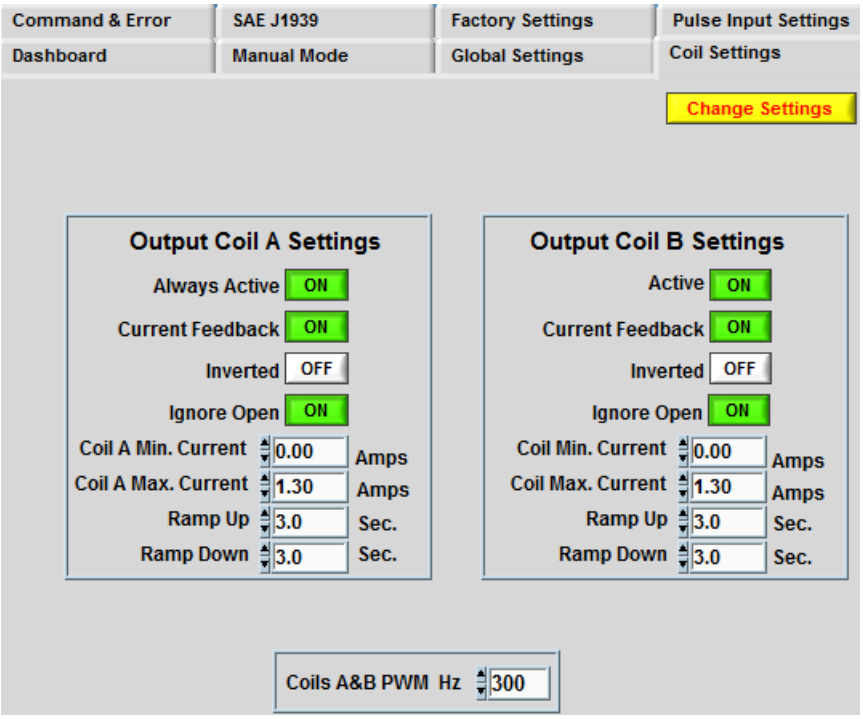
Command Volts/mAmps – Displays the voltage or current at the Command input.

Reference Volts – Displays the voltage at the User Reference output.

Supply Volts – Displays the voltage at the main Power Supply Input.

Average Coil Current – Applies averaging function to the displayed coil current. It does not affect coil current.

Output A or B Coil Settings



- Select Coil B Active for a Dual Coil Valve Control.
- Enter minimum, maximum current and dither frequency according to the valve specification.
- Enter UP or DOWN ramp times.
- "Change Settings" to apply the changes to the unit's temporary memory.
- Once the system is running, fine tune these settings.

Always Active (ON) – Output A is always active and cannot be set "OFF".

Coil B – active (ON/OFF) – Enables/Disables Output B.

Current feedback (ON/OFF)

- When Current Feedback is "**ON**", coil current output is monitored and adjusted proportionally to the demand within the coil max and min settings.
- Current Feedback compensates for supply voltage and coil temperature changes. When disabled, the output's waveform is adjusted proportionally to the demand between 0% and 100% PWM Duty Cycle.

Inverted (ON/OFF)

- When Inverted is "**ON**", the output is inversely proportional to the input. This is used with normally closed valves.
- When Inverted is "**OFF**", the output is proportional to the input.

Coil A/B Min Current (0 to 2.5Amps)

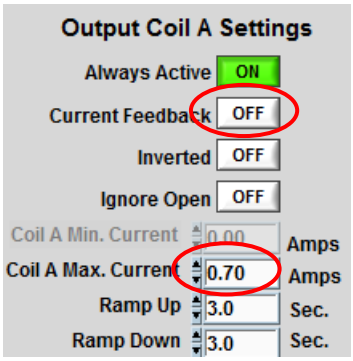
- Determines the min current or duty cycle. Fine tune this value to balance machine safety and valve responsiveness. Typical values for this can be found in the manufacturer's information.

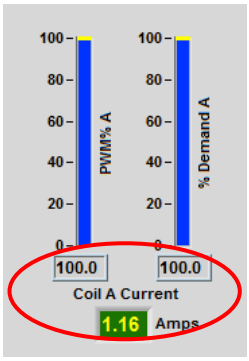
Coil A/B Max Current (0 to 3Amps)

- When Current Feedback is "**ON**", it determines the max output current. Typical values can be found in the valve manufacturer's information.

When Current Feedback is "**OFF**", the Coil A/B Min Current setting does not apply and is grayed out. The Max Current is used as an internal reference to declare a coil short condition when the output current is **0.5A higher** than the max current setting.

When Current Feedback is "**OFF**", the output PWM duty cycle (0-100%) matches the percent of demand. The current will change when supply voltage and/or coil temperature changes.

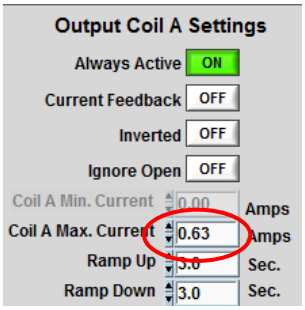


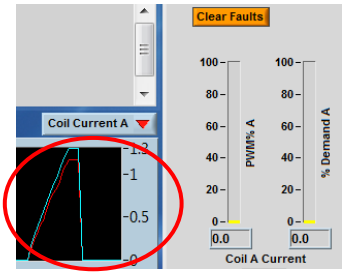


In this example, the output PWM duty cycle (0-100%) matches the percent of demand.

The output current will change when supply voltage and/or coil temperature changes.

The evc/epc does not declare an error because the output current 1.16A is **not 0.5A higher** than the max setting 0.7A.





In this example, the evc/epc declared an error because the output current 1.16A is **0.5A higher** than the max setting 0.63A.

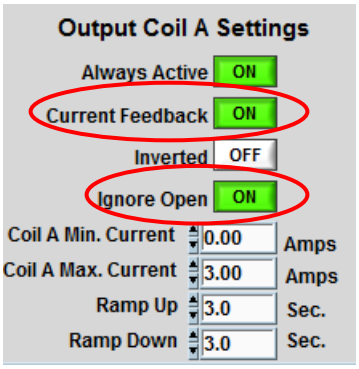
Ramp Up (1 to 65,000 Mini Seconds) – Determines the time for Output A or B to ramp **UP** from minimum to maximum current.

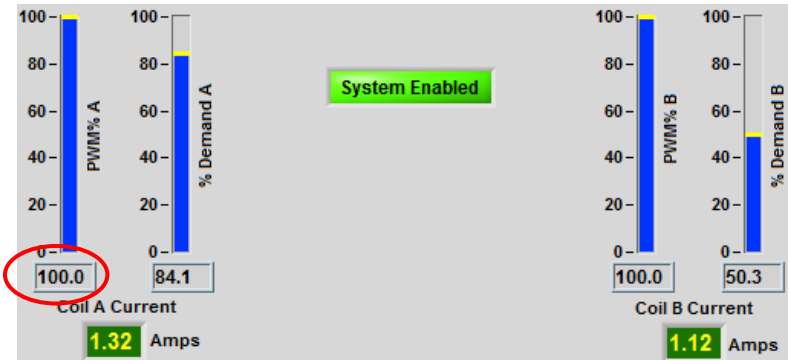
Ramp Down (1 to 65,000 Mini Seconds) – Determines the time for Output A or B to ramp **Down** from maximum to minimum current.

Coil A&B PWM Hz (33 to 500Hz) – This is the PWM or Dither frequency according to the valve spec. (Sun cartridges are 140Hz).

Ignore Open (ON/OFF)

- When Ignore Open is "**ON**" and Current Feedback is "**ON**", the evc/epc will **not** declare an error when the output duty cycle reaches 100%.
- When Ignore Open is "**OFF**" and Current Feedback is "**ON**", the evc/epc will declare an error when the output duty cycle reaches 100%.
- When Current Feedback is "**OFF**", Ignore Open does not have any effect.

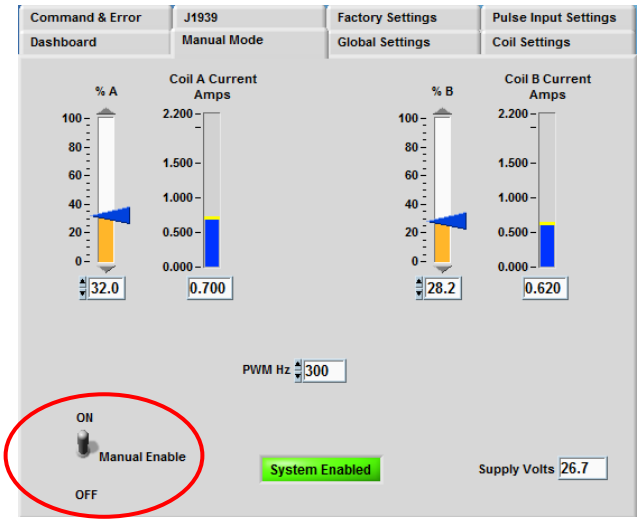


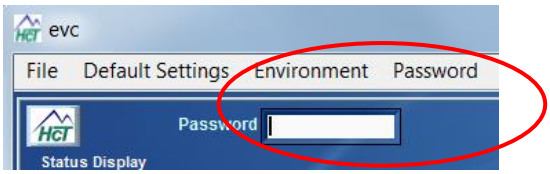


Manual Mode

Caution

- *All settings on this tab are temporary and will immediately affect the outputs.*
- *In manual mode all limits and controls are bypassed.*
- *The evc/epc goes back to normal operation when exiting the GUI in manual mode.*
- *Cycling power on the unit will reset the controller and remove manual override.*





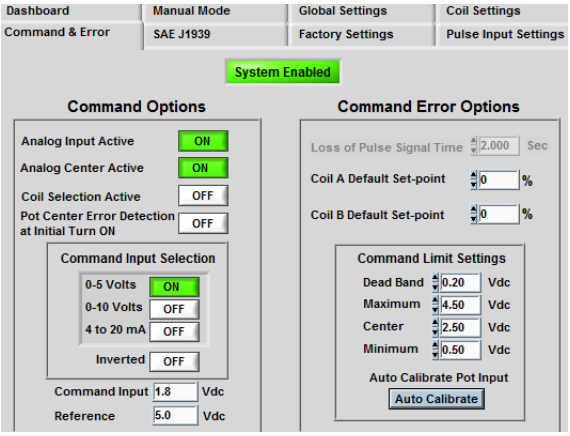
"Manual Mode" provides a quick method of testing the outputs. Manually verify that the system is working properly and determine the max coil current for the present operating conditions.

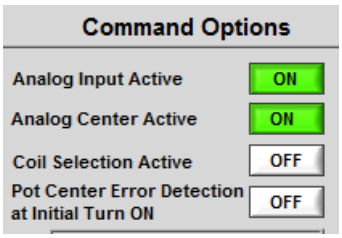
To unlock manual control, you must enter the OEM password.

When the GUI is initially purchased, the OEM password is included.

The authorized user can then change the factory password if required for security.

Command & Error Settings





Analog Input Active (On/Off) – Enables/Disables the command analog input.

Analog Center Active (On/Off)

- When enabled, the “Pot Center Voltage” becomes the zero demand point.
- Coil A is driven from the center voltage to the max voltage and coil B is driven from the center voltage to the min voltage
- This setting is used in Dual Coil Valve Control only. The **“**Coil Selection Active” switch is automatically **turned OFF** when the Center Active is “**ON**”.

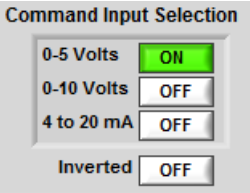
Coil Selection Active (On/Off)

- When the input is High, (+5V to Supply Volts) coil B is active and when Low (0V to 2.5V) coil A is active.
- This feature allows the full command resolution on coil A and B.
- As an example, it is used in the applications where a reciprocating action is triggered by a single high-low input.

Pot Center Error Detection at Initial Turn On

- When **ON**, the module verifies the analog input is in the center deadband range before enabling the output(s) after the initial power up.
- Once the command is centered, the outputs will be enabled.
- This safety feature ensures that the system will NOT immediately go to the previous settings after cycling the power.

Command Input Selection



- 0-5VDC
- 0-10VDC
- 4-20mA

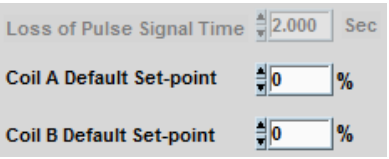
Inverted – reverses the response of the command input to output current.

i.e., Minimum command input will give 100% output current and the Maximum command input gives 0% output current.

For industrial applications that use ±5VDC or ±10VDC, please use a HCT Command Signal Conditioner with the evc/epc controller.

CSC-0505 – accepts ±5VDC and converts to 0-5V.

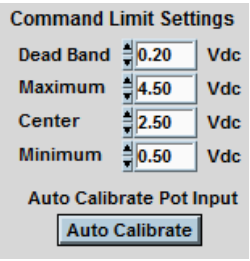
CSC-1005 – accepts ±10VDC and converts to 0-5V.

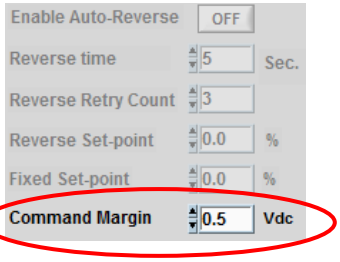


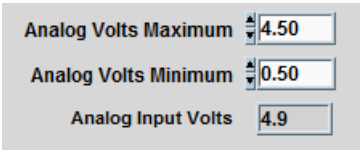
Loss of Pulse Signal Time – (1mS to 65Sec) Sets the time delay before an error of loss of any "Pulse signal" causes to be declared.

Coil A or B default set-point – (0-100%) Output A or B will ramp to this value when the input limits are exceeded or J1939 message times out, or reference voltage drops to below 4VDC, or the supply voltage drops to below 9VDC, or the pulse signal is lost.

Command Limit Settings







Dead band

- The Dead band can only be used when the Analog Center Active is "**ON**".
- Dead band is split one half above, one half below the center point.
- 0.2VDC means coil A output current starts at 2.6VDC, coil B output current starts at 2.4VDC.

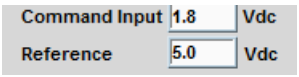
Pot Maximum

- It sets the max command input to have the maximum current.
- If the command input is > POT Maximum + the Command Margin, the evc/epc will declare an error and the outputs go to the default settings.

Pot Center – Sets the value of the center of the dead band.

Pot Minimum

- It sets the min command input to have the minimum current.
- If the command input is < Minimum - the Command Margin, the evc/epc will declare an error and the outputs go to the default settings.



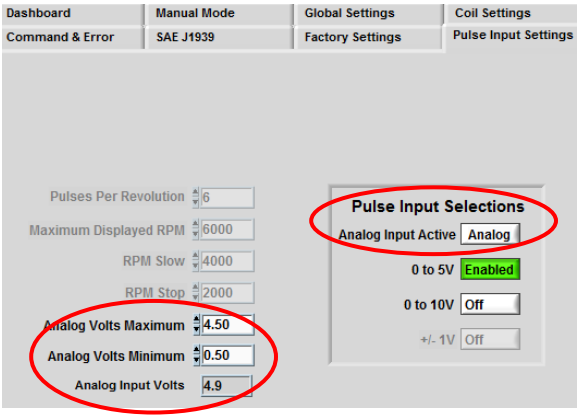
Reference voltage is 5V ±10% @ 250mA.

HCT has a manual command potentiometer – part number 999-10205 that outputs 0.5-4.5VDC when connected to a +5VDC user voltage.

Auto Calibrate Pot Input

- Calibrate the command limits – i.e. joystick or foot pedal etc.
- When the button is clicked, a box will appear with instructions.
- Adjust the input from full High to full Low, and then adjust to the neutral or crossover point.
- "OK" to save the values.

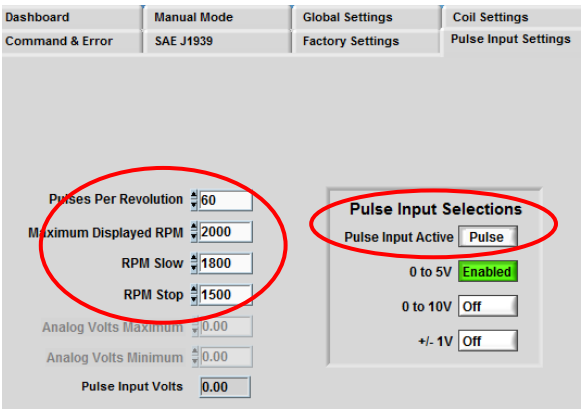
Pulse/AIN 2 Settings



Pulse Input Selections (Analog or Pulse) – Select analog to use this input as **analog input 2** for dual valve control or select pulse to use this input as the pulse input for anti-stall function.

0-5V, 0-10V & ±1V (Enabled/OFF) – Select the voltage range that matches the analog input signal.

The ±1V only applied to Pulse input.



For anti-stall function, match the voltage range to the Pulse Pick UP. The signal can be 0-5VDC, or 0-10VDC, or ±1VDC.

Pulses per revolution *PPR* - (1 to 65535) – Enter the pulse per revolution of the speed sensor.

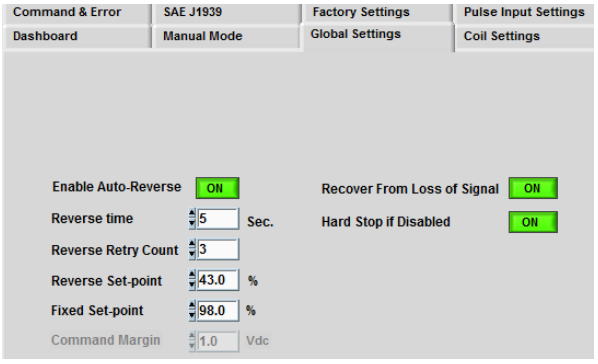
Maximum displayed RPM (1 to 65535) – Visual only - scales the RPM gauge on the Dashboard.

Keep this value near the maximum RPM to assure the resolution and accuracy.

RPM slow Set-Point or Max Load RPM (1 to 65535) – The set-point where coil A current starts to reduce in Anti-Stall or HP limit modes.

RPM stop Set-Point or No Load RPM (1 to 65535) – The set-point where coil A current reaches 0 in Anti-Stall or HP limit modes. If auto-reverse is ON, reverse cycle will start at this rpm.

Global Settings



Enable Auto-Reverse (On/Off)

- When in HP Management or Anti-Stall mode, if the measured RPM is ≤ RPM **Stop or No Load RPM**, coil A current ramps down to 0, and then coil B current ramps up to the Reverse Set- point.
- The module will try to restart normal operation after the reverse cycle completes.

Reverse Time (0 to 65 Sec) – It sets the time that coil B will remain in reverse during an Auto-Reverse cycle.

Reverse Retry Count (0 to 65535) –The number of times the Auto-Reverse cycle will try to restore normal RPM before declaring a fault and disabling the unit.

Reverse set-point (0 to 100%) – The percentage of Imax output current for coil B during the reverse cycle.

Fixed set-point (0 to 100%)

- The percentage of Imax output current for coil A when the measured RPM is above the RPM slow or Max Load RPM in “anti-stall with fixed command” or “HP management with fixed command”.

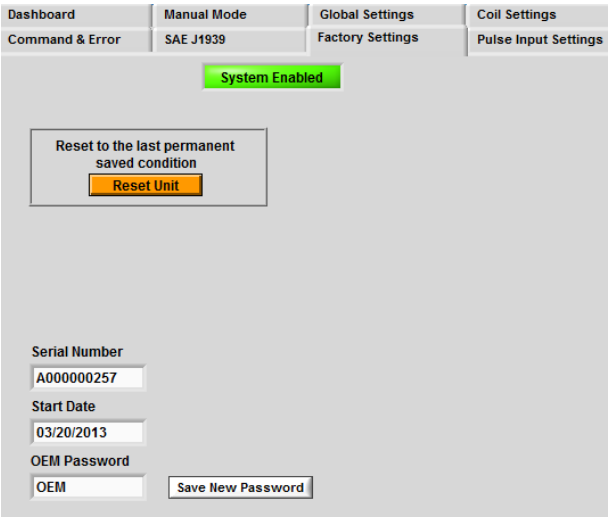
Recover from loss of signal

- When “**ON**”, the evc/epc automatically recovers and returns to normal operation after the pulse input and the analog input(s) are back in range.
- The evc/epc automatically recovers from a SAE J1939 message timeout error.
- The evc/epc automatically recovers when the reference voltages or the supply voltages are outside the acceptable limits and recover.
- The evc/epc will not automatically recover from a coil open or short error.

Hard stop if disabled

- When “**ON**”, coil A or B outputs are immediately set to zero without ramps whenever the enable input is set to “**OFF**”.
- When “**OFF**”, the coil A or B outputs ramp down to zero when the enable input is set to “**OFF**”.

Factory Settings (Only available with the OEM password)



Reset Unit

It restores the controller to the last permanently saved configuration.

Serial Number

Specific for this unit, reference to the factory record.

Start Date

The date when the evc/epc is connected to the GUI for the first time.

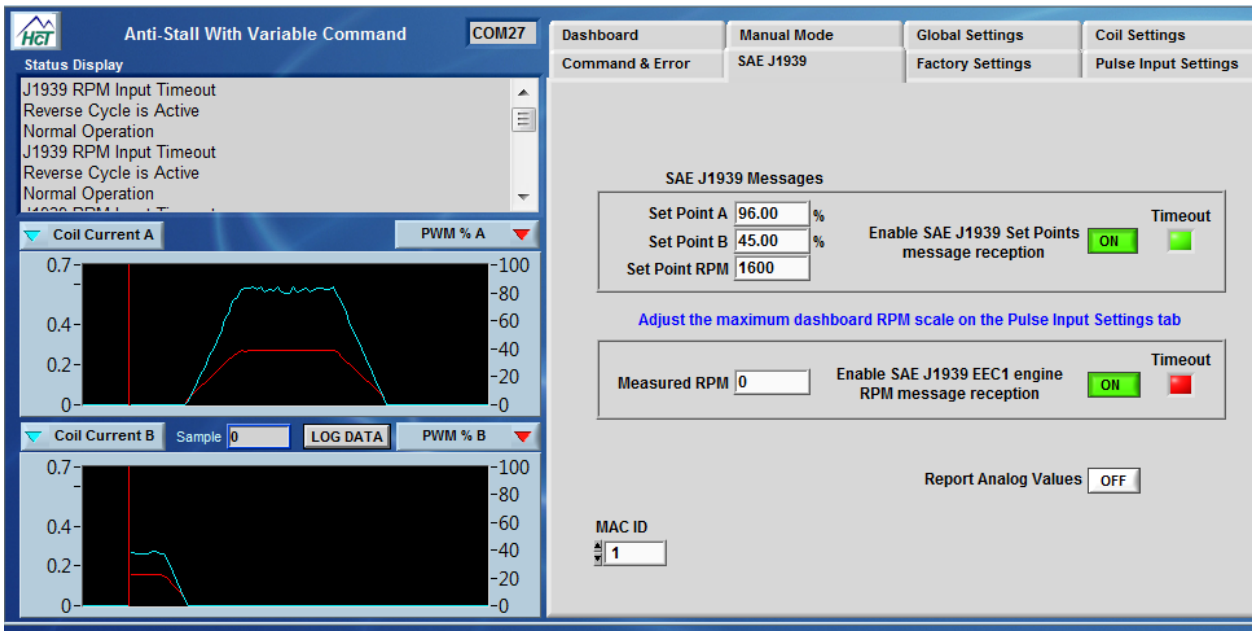
OEM Password

When the GUI is purchased, the initial password is included. If lost, please contact HCT.

Users may change the OEM password.

The authorized user can change the factory password if required for security

SAE J1939



Set Point A or B % and Set Point RPM

- A SAE J1939 message can set the demand for coil A and B.

Measured RPM

The evc/epc controller can accept an SAE J1939 message containing the measured engine RPM on PGN: 0xF004 (61444) Source Address (SA): 0x00.

Timeout

- The box is **red** when the SAE J1939 message has timed out indicating a bus, connection or data error.
- Outputs for coil A and B will ramp to the default settings according to the "**Command & Error**" page.
- If "Recover from loss of signal" is "**ON**", the outputs will resume normal operation when a valid SAE J1939 message is received. The box becomes **green**.

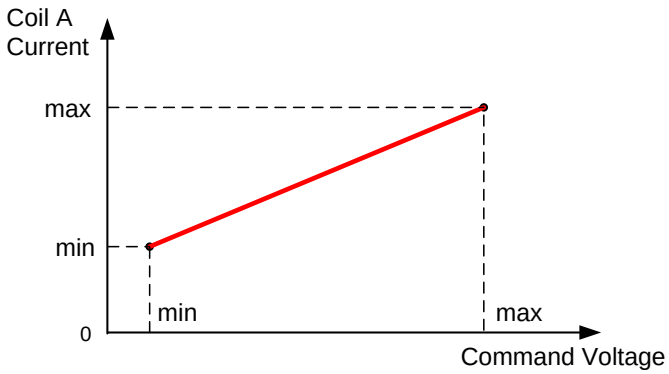
MAC ID – Displays and allows changing the MAC ID. It is the network address for this specific evc/epc.

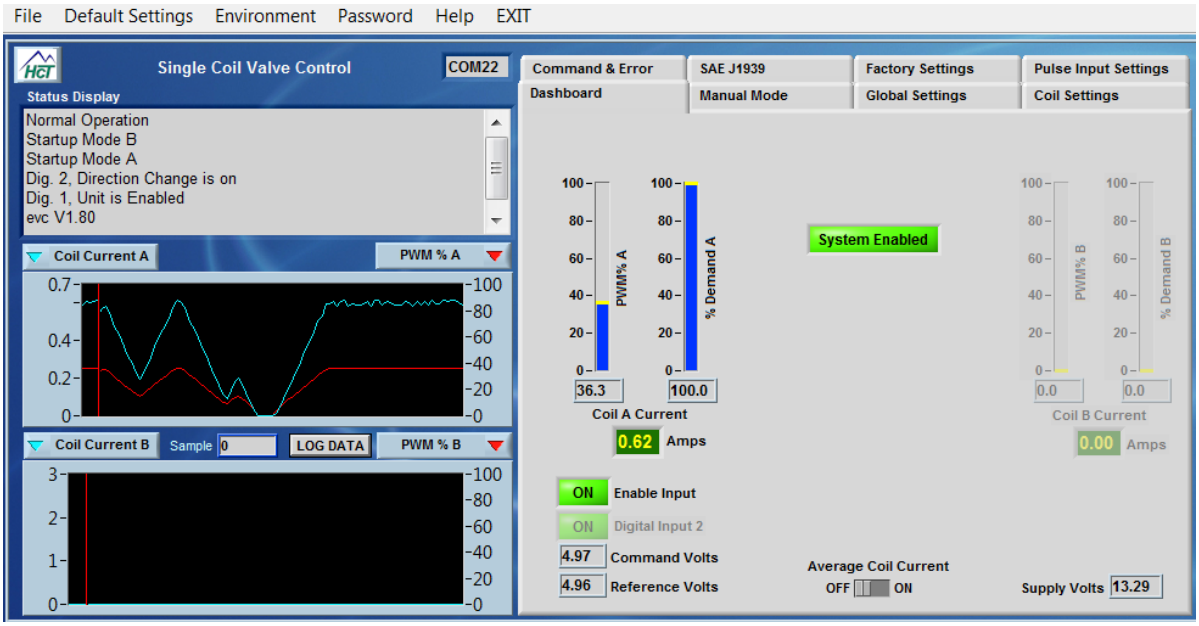
Report Analog Values – When "**ON**", it will transmit the values of the analog inputs on SAE J1939 Bus. It does not force to change the settings.

Operational Modes

Single Coil Valve or Pump Control

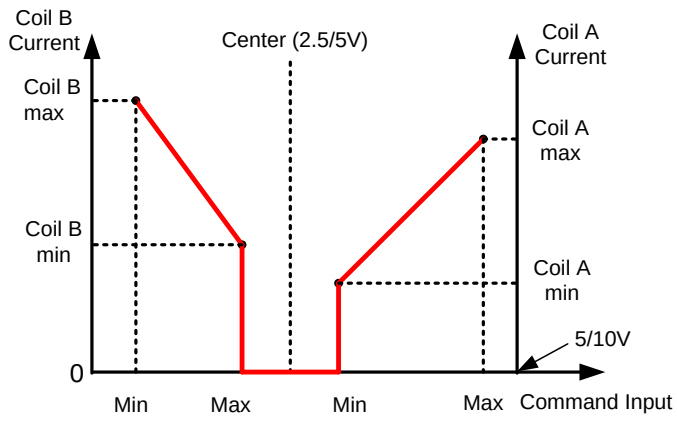
Only Coil A is used in this function. 0-5VDC gives coil A 0-100% current output.





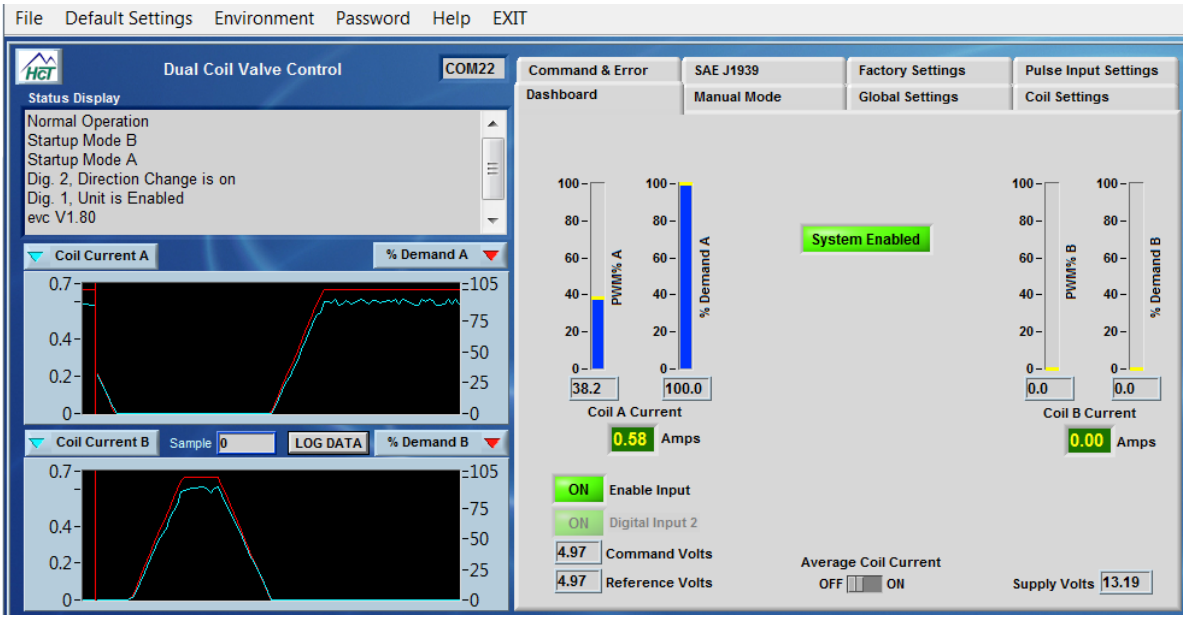
Dual Coil Valve or Pump Control

One Valve with coil A and B when Center Active is ON

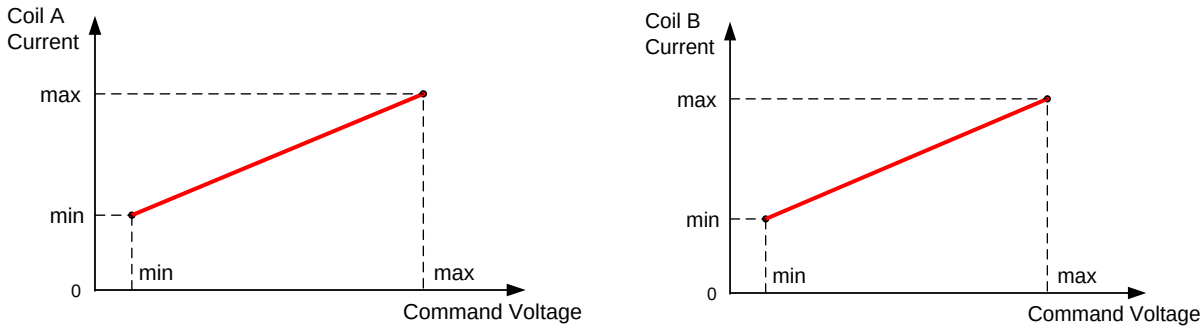


Analog **Center Active** (Enabled/OFF) – when **enabled**, 0-2.5VDC drives coil B, 2.5-5VDC drives coil A.

POT Center Error Detection at Initial Turn On (Enabled/OFF) – when **enabled**, we have a neutral start position for machine safety.

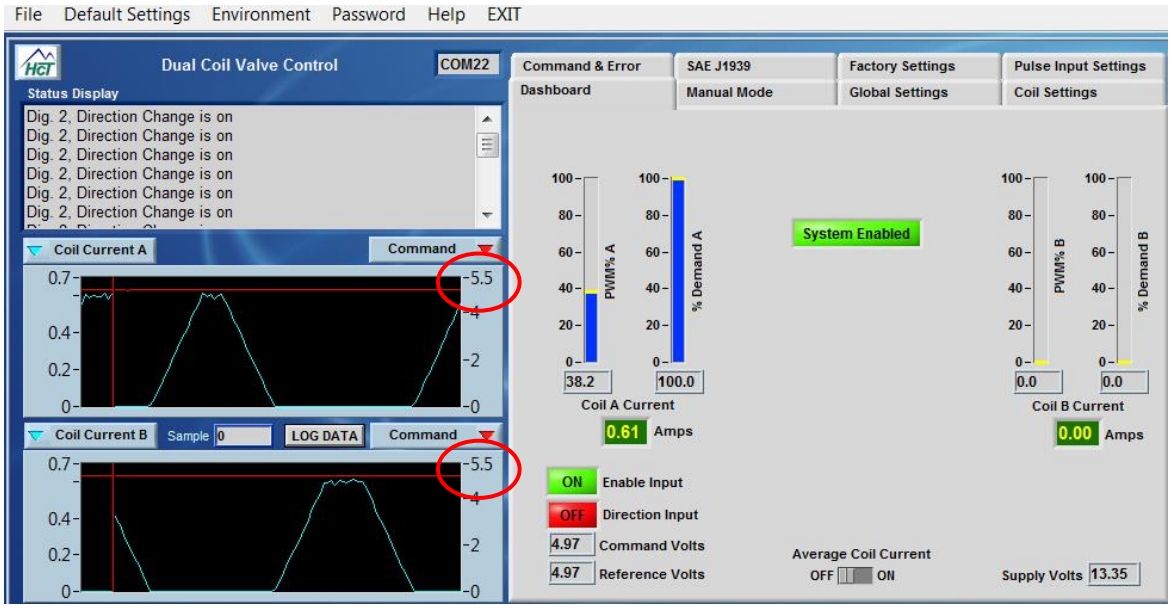


One Valve with coil A and B when Coil Selection is ON

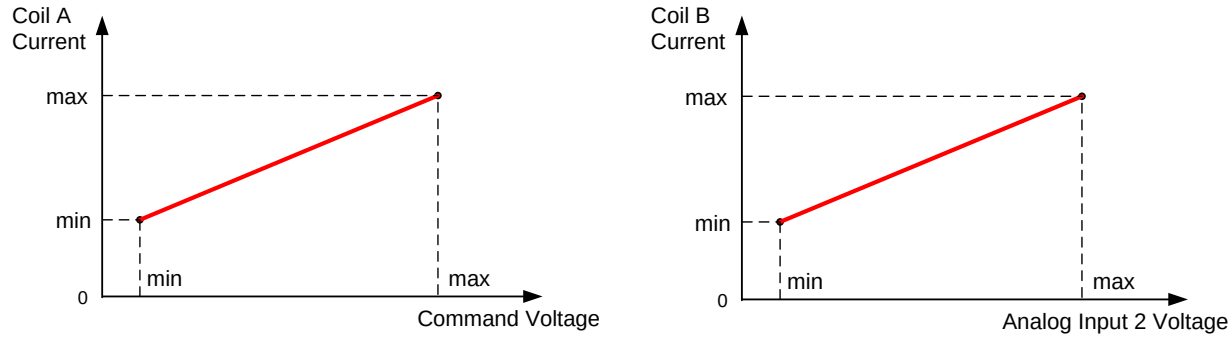


Coil Selection Active (Enabled/OFF) – when **enabled**, Analog Center Active is automatically turned **OFF**. 0-5V gives both coils 0-100% PWM current output. But there is only one output at one time.

When the digital input 2 is OFF, coil A is working.
When the digital input 2 is ON, coil B is working.

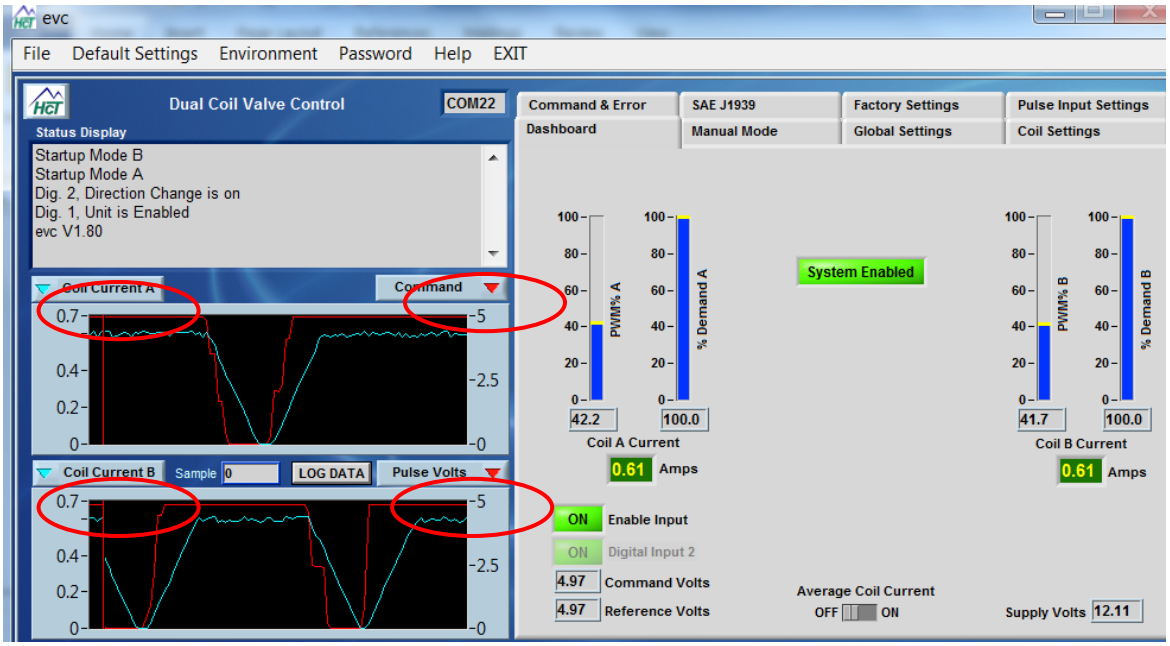


Two Valves, Coil A for Valve 1, Coil B for Valve 2



Coil A and B are independently controlled by 2 Potentiometers or Joysticks. Coil A follows the Command Volts. Coil B follows the Pulse Volts because the pulse input Pin is used as the Analog input 2.

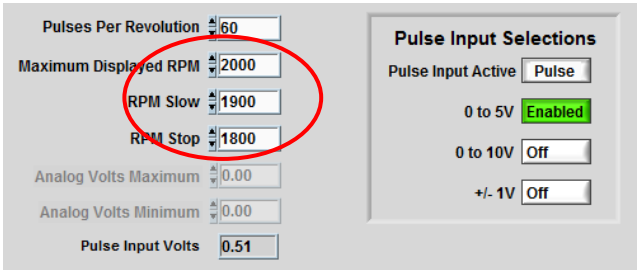
0-5V gives both coils 0-100% PWM current output. But there are **two** outputs at the same time.

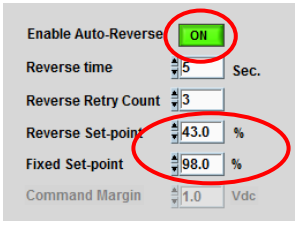


Anti-Stall or Horsepower Management With Fixed Command

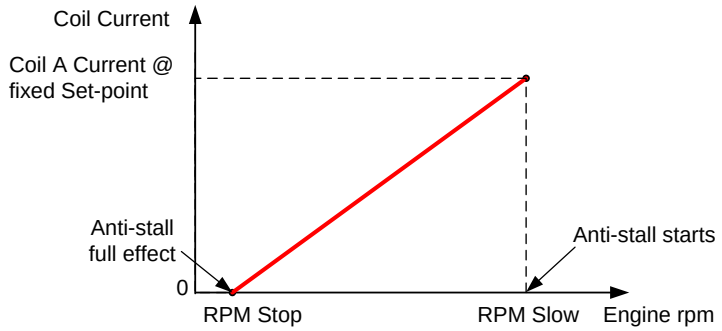
The Anti-Stall function reduces the current to prevent the engine from stalling during a sudden external load increase. The fixed set-point determines the max forward speed of the work function. The reverse set-point determines the max reverse speed of the work function.

- At start-up the measured RPM must initially reach the “RPM Slow” set-point to allow the evc/epc to ramp up Coil A. This ensures that the prime mover has started and is at a stable speed**.**

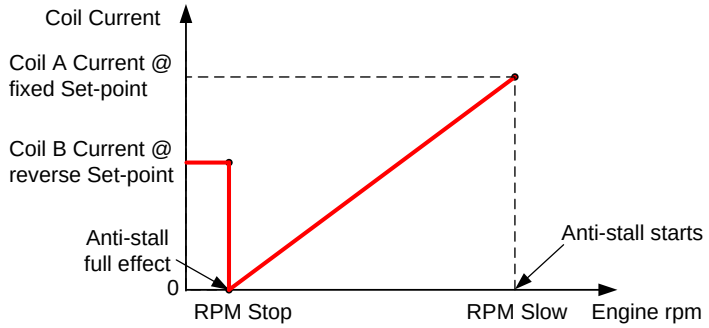




- When the measured RPM is above the “RPM Slow” (1900RPM), Coil A current is determined by the Fixed Set-point.
- When the measured RPM starts to drop below the “RPM Slow”, Coil A current is reduced proportionally to the measured RPM.
- Coil A current becomes zero when the measured RPM reaches “RPM Stop” (1800RPM) or below.
  - When “Auto-Reverse” is “**OFF**”, Coil A current stays at 0 until the RPM increases to above “RPM Stop”, it will increase proportionally to the measured RPM.



  - When “Auto-Reverse” is “**ON**”, Coil A current stays at 0 and Coil B current will ramp up to the Reverse Set-point.
  - After the reverse cycle is over, if the measured RPM increases to above RPM Stop, Coil A current increases proportionally until reaching the fixed set-point. If not, the evc/epc will re-enter reverse for “Reverse Retry Count” times, each time remaining in reverse for “Reverse Time” duration.
  - If the Reverse Retry Count is depleted and the measured RPM remains below RPM Stop, the evc/epc will declare an error and output the default settings to coil A.



Anti-Stall or Horsepower Management With Variable Command

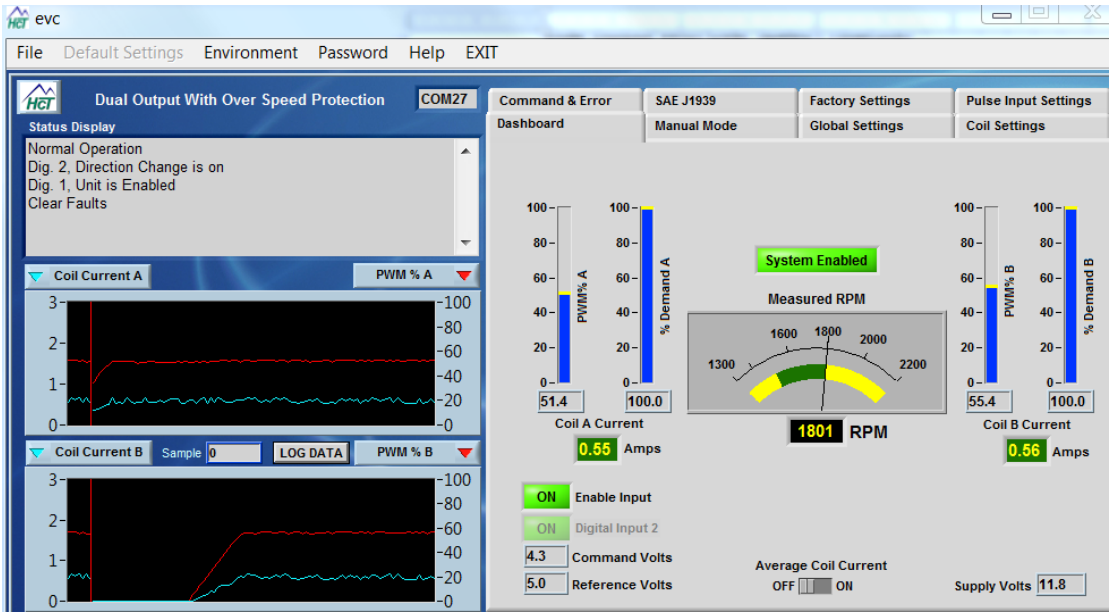
This mode is similar to the “Anti-stall with Fixed Command” or “Horsepower Management with Fixed Command”.

The only difference is that this function allows a variable command input to control the forward speed of the work function. The max reverse speed of the work function is set by the GUI.

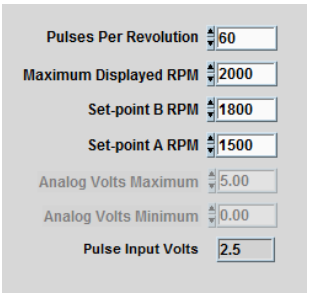
The input can be from an external POT, a joystick or a SAE J1939 message.

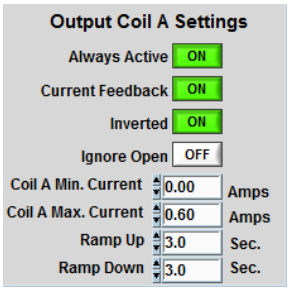
At any given forward speed of the work function, the Anti-Stall function reduces the current to prevent the engine from stalling during a sudden external load increase.

Dual Output With Over Speed Protection



It works with dual fixed displacement pumps and switches valves ON or OFF according to the measured RPM.

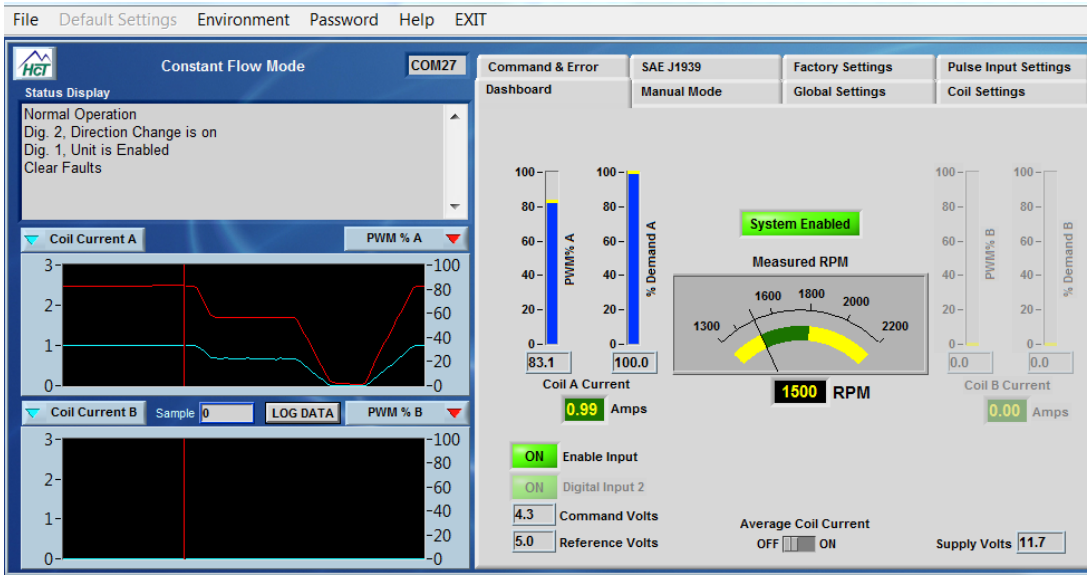




- The measured engine RPM can be from the alternator 'R' terminal, PPU, or SAE J1939.
- BOTH outputs are ON when below 'A' setting.
- When the measured RPM ≥ Set-point A RPM, coil A ramps down to minimum current.
- When the measured RPM ≥ Set-point B RPM, coil B ramps down to minimum current

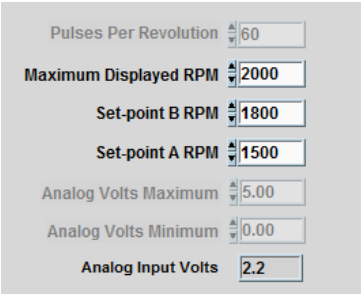
NOTE: with Ramps set to minimum times, the outputs will drive ON/OFF valves

Constant Flow Mode



Constant Flow Mode operates with a variable displacement pump.

It reduces the output of coil A to reduce the pump displacement when the engine rpm increases, maintaining constant flow output of the pump.

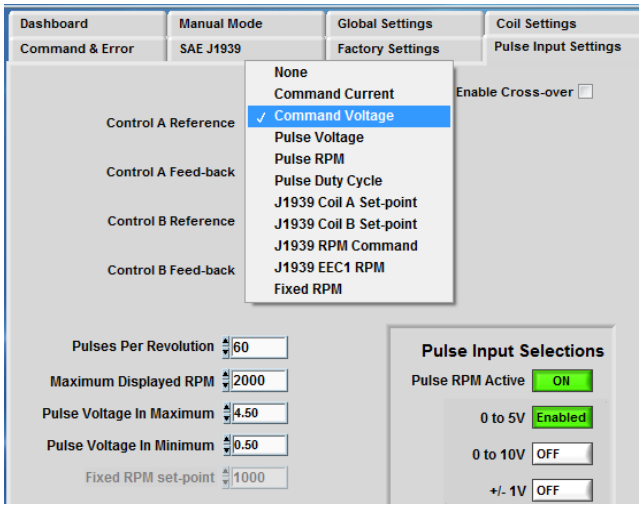


- When the measured RPM is 1500rpm, output A provides max current.
- When the measured RPM is 1800rpm, output A provides 0 current.

Closed Loop Speed Control

The “evc Closed Loop” Graphical User Interface must be selected.

Set the coil min, max current and the PWM frequency according to the valve specification.



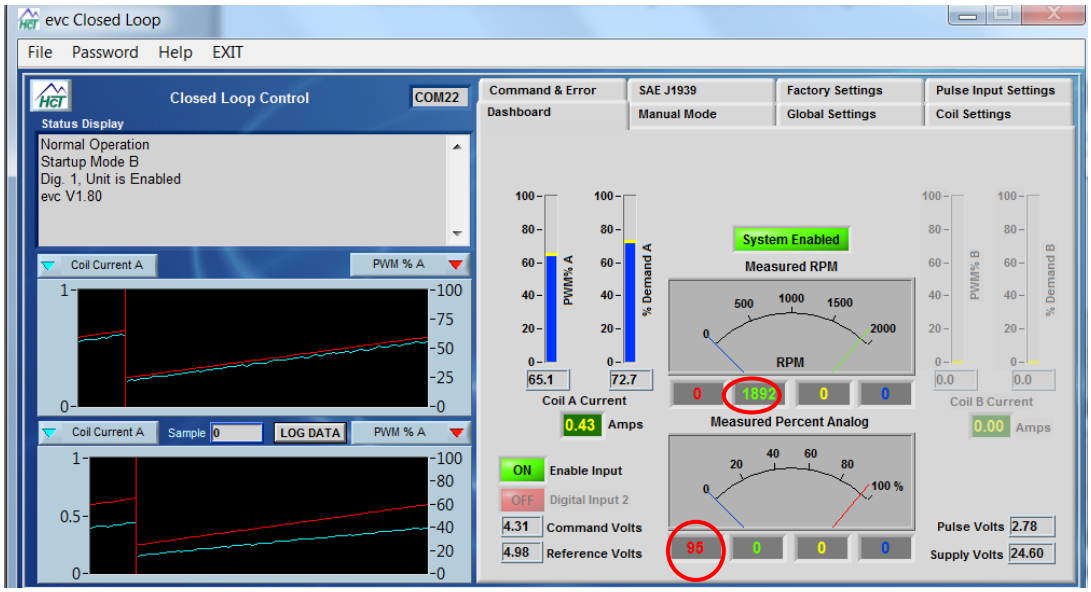
The reference and the feedback can be set by either of the command voltage, pulse voltage, pulse rpm, J1939, etc.

In this example, the reference A is set by the command voltage.

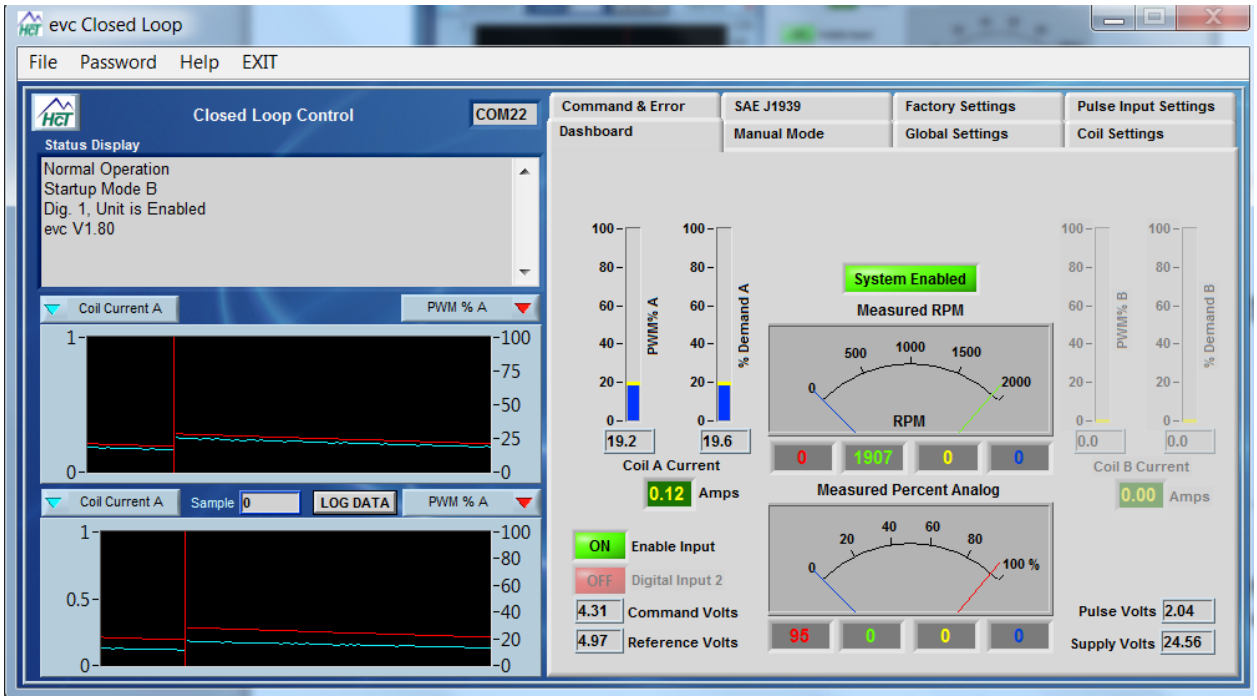
The feedback is set by the pulse rpm.

The maximum displayed RPM is for the display only.

In this example, the analog input demands 95% of the maximum displayed rpm which is 1900rpm. The measured rpm is 1892rpm. The evc/epc controller will increase the current to maintain 1900rpm until the current reaches the max setting.



When the measured rpm increases to above 1900rpm, the evc/epc will reduce the current to maintain 1900rpm until it reaches 0.



The closed loop control is a dynamic process. The evc/epc constantly changes the current to maintain the reference rpm.

If the overshoot of the speed is big, the changing rate of the current is fast.

If the overshoot of the speed is small, the changing rate of the current is slow.

The same working principle applies when different signals are used as the reference and the feedback.

SAE J1939 CAN Bus

The evc/epc can be controlled by messages received over the SAE J1939 Bus.

The EEC1 (PGN: 61444 SA: 0) engine RPM (SPN: 190) can be monitored for use in anti-stall and closed loop operations.

The proprietary SAE J1939 Command Message (PGN: 65281 through 65407 SA: 34) can be monitored for Coil A, Coil B and RPM Set points for various operation modes. This address is adjusted based on the Module ID. The relationship of the Module ID and the Command Message address is defined in a chart at the end of this section.

The evc/epc can transmit its status over the SAE J1939 Bus.

The proprietary SAE J1939 Status Message (PGN: 65409 through 65535 SA: 34) is a multiplexed message with the first data byte indicating message 1 Status or message 2 Analog Values. This address is adjusted based on the Module ID. The relationship of the Module ID and the Status Message address is defined in a chart at the end of this section. When the SAE J1939 Command Message is enabled, the Status Message will be transmitted. If Report Analog Values is enabled on the SAE J1939 tab, the Analog Values will be transmitted. The content of the Status and Analog Values messages are detailed below.

Command Message Format

Transmission Repetition	40mS	
Data Length	8	
Data Page	0	
PDU Format	255	
PDU Specific	Module ID #	
Priority	N/A	
Parameter Group Number	65281 Through 65407	(FF01 Through FF7F)

Start Position	Length	Parameter Name
1	1 Byte	Always = 1
2-3	2 Bytes	Coil A Set point
4-5	2 Bytes	Coil B Set point
6-7	2 Bytes	RPM Set point

Status Message Format

Transmission Cycle Time	100mS	
Data Length	8	
Data Page	0	
PDU Format	255	
PDU Specific	Module ID + 128	
Priority	3	
Parameter Group Number	65409 Through 65535	(FF81 Through FFFF)

Status Message

Start Position	Length	Parameter Name
1	1 Byte	Always = 1 (Status)
2.1	1 bit	Command Input Error
2.2	1 bit	Reference Voltage Error
2.3	1 bit	Pulse Input LOS
2.4	1 bit	Power Supply High
2.5	1 bit	Power Supply Low
2.6	1 bit	Coil A Msg Timeout
2.7	1 bit	Coil B Msg Timeout
2.8	1 bit	RPM Msg Timeout
3.1	1 bit	not used
3.2	1 bit	Reverse Cycle Active
3.3	1 bit	Digital Input 1 State
3.4	1 bit	Digital Input 2 State
3.5	1 bit	Coil A Short
3.6	1 bit	Coil A Open
3.7	1 bit	Coil B Short
3.8	1 bit	Coil B Open
4.1	1 bit	Process A Ramping
4.2	1 bit	Process B Ramping
4.3	1 bit	Command Input Not Centered
4.4	1 bit	Reverse Cycle Retry Timeout
4.5	1 bit	System in Startup Mode
4.6	1 bit	System in Shutdown Mode
4.7	1 bit	not used
4.8	1 bit	not used
5-6	2 Bytes	Coil A Current (mA)
7-8	2 Bytes	Coil B Current (mA)

Analog Values Message

Start Position	Length	Parameter Name
1	1 Byte	Always = 2 (Analog Value)
2-3	2 Bytes	Command Input Value (volts x100 or mA x100)
4	1 Byte	0 = Command Volts, 1 = Command mA
5-6	2 Bytes	Pulse Input volts x100
7	1 Byte	Always = 0
8	1 Byte	Always = 0

Parameter Values

Coil n Set point

Data Length	2 Bytes
Resolution	0.00152903 %/bit, 0 offset
Data Range	0% to 100%
Operational Range	0 to 100%

Coil n Current

Data Length	2 Bytes
Resolution	1mA/bit, 0 offset
Data Range	0 to 65535mA
Operational Range	0 to 3000mA

RPM

Data Length	2 Bytes
Resolution	0.125 rpm/bit, 0 offset
Data Range	0 to 8,031.875 rpm
Operational Range	0 to 8,031.75 rpm

Module Id	Command PGN	Status PGN
1	FF01	FF81
2	FF02	FF82
3	FF03	FF83
4	FF04	FF84
5	FF05	FF85
6	FF06	FF86
7	FF07	FF87
8	FF08	FF88
9	FF09	FF89
10	FF0A	FF8A
11	FF0B	FF8B
12	FF0C	FF8C
13	FF0D	FF8D
14	FF0E	FF8E
15	FF0F	FF8F
16	FF10	FF90
17	FF11	FF91
18	FF12	FF92
19	FF13	FF93
20	FF14	FF94
21	FF15	FF95
22	FF16	FF96
23	FF17	FF97
24	FF18	FF98
25	FF19	FF99
26	FF1A	FF9A
27	FF1B	FF9B
28	FF1C	FF9C
29	FF1D	FF9D
30	FF1E	FF9E
31	FF1F	FF9F
32	FF20	FFA0
33	FF21	FFA1
34	FF22	FFA2
35	FF23	FFA3
36	FF24	FFA4
37	FF25	FFA5
38	FF26	FFA6
39	FF27	FFA7
40	FF28	FFA8
41	FF29	FFA9
42	FF2A	FFAA
43	FF2B	FFAB

Module Id	Command PGN	Status PGN
44	FF2C	FFAC
45	FF2D	FFAD
46	FF2E	FFAE
47	FF2F	FFAF
48	FF30	FFB0
49	FF31	FFB1
50	FF32	FFB2
51	FF33	FFB3
52	FF34	FFB4
53	FF35	FFB5
54	FF36	FFB6
55	FF37	FFB7
56	FF38	FFB8
57	FF39	FFB9
58	FF3A	FFBA
59	FF3B	FFBB
60	FF3C	FFBC
61	FF3D	FFBD
62	FF3E	FFBE
63	FF3F	FFBF
64	FF40	FFC0
65	FF41	FFC1
66	FF42	FFC2
67	FF43	FFC3
68	FF44	FFC4
69	FF45	FFC5
70	FF46	FFC6
71	FF47	FFC7
72	FF48	FFC8
73	FF49	FFC9
74	FF4A	FFCA
75	FF4B	FFCB
76	FF4C	FFCC
77	FF4D	FFCD
78	FF4E	FFCE
79	FF4F	FFCF
80	FF50	FFD0
81	FF51	FFD1
82	FF52	FFD2
83	FF53	FFD3
84	FF54	FFD4
85	FF55	FFD5
86	FF56	FFD6

Module Id	Command PGN	Status PGN
87	FF57	FFD7
88	FF58	FFD8
89	FF59	FFD9
90	FF5A	FFDA
91	FF5B	FFDB
92	FF5C	FFDC
93	FF5D	FFDD
94	FF5E	FFDE
95	FF5F	FFDF
96	FF60	FFE0
97	FF61	FFE1
98	FF62	FFE2
99	FF63	FFE3
100	FF64	FFE4
101	FF65	FFE5
102	FF66	FFE6
103	FF67	FFE7
104	FF68	FFE8
105	FF69	FFE9
106	FF6A	FFEA
107	FF6B	FFEB
108	FF6C	FFEC
109	FF6D	FFED
110	FF6E	FFEE
111	FF6F	FFEF
112	FF70	FFF0
113	FF71	FFF1
114	FF72	FFF2
115	FF73	FFF3
116	FF74	FFF4
117	FF75	FFF5
118	FF76	FFF6
119	FF77	FFF7
120	FF78	FFF8
121	FF79	FFF9
122	FF7A	FFFA
123	FF7B	FFFB
124	FF7C	FFFC
125	FF7D	FFFD
126	FF7E	FFFE
127	FF7F	FFFF

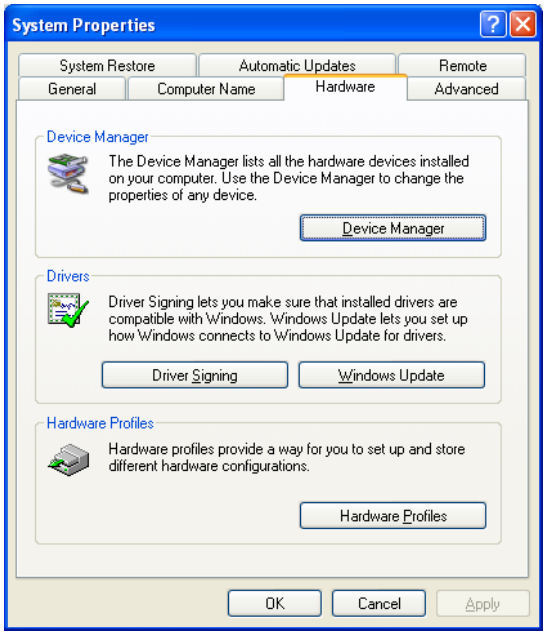
Problems installing the Communication Port Adapters

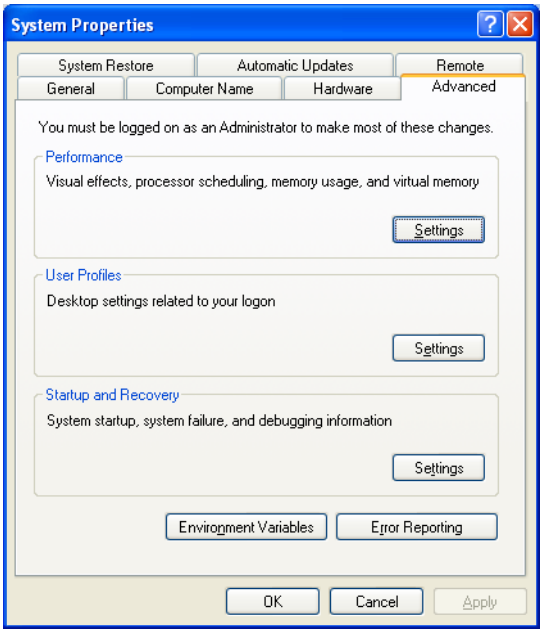
Windows does not like Com ports with the same name, and some devices might hang onto a com port when not in use. Here is how to clean and remove problem ports.

Option 1

Devices that have been installed but are not currently available are "phantom devices". These devices are not usually displayed in the device manager, but can be made to be displayed.

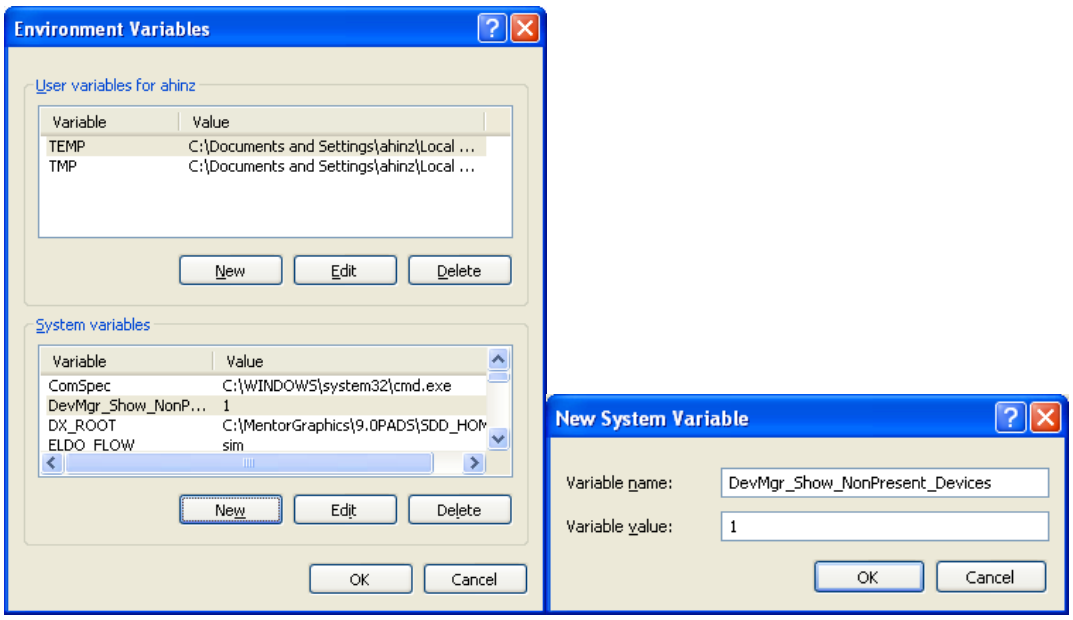
This allows device properties to be changed or devices to be uninstalled even though the device is not physically connected to the PC.





Control Panel ⇒ System Properties

⇒ "Advanced" option and click "Environment Variables"
⇒ In the System Variables sections, click "New"



⇒ "DevMgr_Show_NonPresent_Devices" and set the value to 1, then click OK.
⇒ Close the System Properties panel.
⇒ Open the Device Manager
⇒ "View" ⇒ Show Hidden Devices".

Device Manager will show all hidden and phantom devices.

⇒ Uninstall the phantom devices by right clicking on them, and 'delete'.
⇒ Reboot the PC.

When you connect PC to the unit, give the computer time to find and install the driver.

Option 2

In control panel, "Add or Remove Programs"
Remove old versions of FTDI software.
Remove Windows Driver Package - FTDI CDM Driver Package.

evc/epc Controller

With SAE J1939 Interface

- Mining & Exploration
- Agriculture
- Cranes & lifts
- Refuse & Re-cycling
- Construction
- Off-Road vehicles
- Forestry, Wood & Pulp
- Reclamation & Salvage
- Oil Field & Sands
- Demolition Equipment
- Cooling Solutions
- Military Apparatus
- Specialty Use
- Remote Control
- Power Generation
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