



## DVC7 (Programmable Valve Controller)



### DESCRIPTION

The DVC7 Programmable Valve Controller is the latest addition to the DVC family of modules. The DVC7 is designed to be a low cost subsystem controller. The low cost DVC7 has enough processing power and input output functionality to support a wide range of hydraulic applications. From 4 to 8 valves can be controlled based on their types. Direct connection to the J1939 CAN Bus is supported and should more capability be needed than is provided by a single DVC7 module, multiple CAN Bus interconnected DVC7s or DVC5 / DVC10 controllers and the DVC expansion modules can be used.

With its enhanced pulse input capability the DVC7 is ideal for vehicle steering and propulsion applications. For high volume applications the DVC7's hardware can also be customized to eliminate unused components for cost reduction and also outfitted with a style of connector more suitable for your equipment.

The standard DVC7 comes in one version. It supports the RS232 connected D206 or D210 Graphical Displays or DVC61 text display or a handheld DP04 Pendant. The RS232 port on the DVC7 is used for loading and monitoring your application program. Four light emitting diodes (LEDs) mounted around the connector on the DVC7 module also are useful for monitoring your system's execution.

The DVC7 has 3 Universal/Pulse inputs (programmable to accept the most common sensor inputs), 2 analog inputs (programmable for joysticks and potentiometers) and 3



digital/pulse inputs with digital input 1 able to be configured as an ESTOP input. The analog and universal inputs can be configured as digital inputs when needed.

New with the DVC7 and unlike the DVC5 and DVC10 the DVC7 has a single +5 volt regulated reference output and ground. This reference can supply up to a total of 500ma of current. Multiple devices with varying current requirements can be connected to this reference. Only the total load current of 500ma needs to be adhered to.

In addition the DVC7 has 6 High-Side (sourcing) and 2 PWM (sinking) outputs. The High-Side outputs provide +POWER IN when turned on. The PWM outputs can provide a current controlled valve output, which is unaffected by coil resistance or power supply fluctuations. The High-Side and PWM outputs can be used individually or in combination with one another in a variety of configurations allowing users to maximize the controller's flexibility within different systems.

The DVC7 software provides users the ability to program this module to work in a variety of applications without large outside development costs (knowledge of Windows XP, basic programming, and electro-hydraulics is recommended).

## HARDWARE FEATURES

- **Powerful 16-bit Processor.**
- **J1939 compatible, Controller Area Network (CAN 2.0B) Optional - provides high-speed serial communications with up to 16 other CAN compatible devices**
- **Rugged encapsulated enclosure withstands harsh environments commonly found in mobile applications. (IP67)**
- **Field Programmable**
- **Multifunctional, Programmable Inputs and Outputs**
- **Multiple closed loop capabilities.**
- **Closed loop current regulation independent of application.**
- **Rugged power supply operates over the full range 8.5Vdc to 32Vdc with reverse polarity protection and transient protection up to 600 Watts Peak Pulse Power Dissipation.**
- **5 Volt 500mA Reference Output.**
- **All inputs and outputs are protected from shorting to ground or the power supply.**
- **Large amount of on board memory for complex programming.**
- **Compact packaging.**
- **Control valves from multiple manufacturers.**
- **Conforms to CE Standards.**



## SOFTWARE FEATURES

### **FIRMWARE FEATURES**

All Inputs and Outputs on the DVC7 are fully programmable. The application may be programmed to provide function curves between inputs and outputs as well as for open or closed loop applications that range from simple operations to complex applications.

### **NON-PROGRAMMED CONTROLLERS**

The Intella™ Software Suite is used for programming the DVC7.

This software suite includes:

- DVC Programming Tool
- DVC Program Loader Monitor
- DVC Programming User Guide

### **PRE-PROGRAMMED CONTROLLERS**

The DVC7 may be supplied with pre-loaded customer-specific application software created by either product users or High Country Tek.

## TECHNICAL DATA

### **UNIVERSAL INPUTS – Qty 3<sup>1</sup>**

All Universal inputs may be configured as analog, current, or pulse inputs (see the DVC Programming User Guide for programming examples). All Universal inputs have 10-bit resolution.

### **PROGRAMMABLE MODES**

- 1) Inputs Modes
  - a) Analog – 0 to +5Vdc.
  - b) Pulse – 0 to +5Vdc, 0-8KHz. (The maximum Frequency of all Pulse Inputs combined including Digital Inputs configured as Pulse Inputs is 21KHz)
    - a. RPM
    - b. Counter
    - c. Quadrature, (Universal input 2 and 3)
  - c) Current - 0 to 20ma. (This output will shut off and stay at the maximum current for 5 seconds if the input exceeds 22.8ma. This is to avoid internal circuitry failure do to miss-wires)
  - d) Digital Input – Causes the input to behave like a Digital Input either Active High or Active Low.
- 2) Joystick Configuration
  - a) Enable Center – sets up upper and lower configuration for single axis joystick.

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<sup>1</sup> The three Digital Inputs may be configured as Pulse inputs for a total of 6 Pulse inputs.



- b) Deadband – Sets the % of deadband at center.
- 3) Voltage Calibration
  - a) Setting for the actual voltage/current received at the input (Min, Center and Max).
- 4) Voltage/Current Limits
  - a) Sets the Min a Max limits of the input. A flag is set when these limits are met. This feature detects unwanted conditions so that the controller can be safely programmed to a default condition. (The input will go high if the input is open i.e. no connection).
- 5) Invert Output
  - a) Simply inverts the output control with respect to the input command.
- 6) Pot Reference Flag
  - a) Detects an open circuit to the Pot Ref output (mainly used with potentiometers).
- 7) Pulse Configuration
  - a) Pulse Time Out sets a flag if no pulses are received in the specified amount of time.
  - b) Pulses Per Rev is used to calibrate RPM

## **ANALOG INPUTS – Qty 2**

The Analog inputs have a range of 0 to +5Vdc. All Analog inputs have 10-bit resolution.

### **PROGRAMMABLE MODES**

- 1) Inputs Modes
  - a. Analog – 0 to +5Vdc.
  - b. Digital Input – Causes the input to behave like a Digital Input either Active High or Active Low.
- 2) Joystick Configuration
  - a. Enable Center – sets up upper and lower configuration for single axis joystick.
  - b. Deadband – Sets the % of deadband at center.
- 3) Voltage Calibration
  - a. Setting for the actual voltage/current received at the input (Min, Center and Max).
- 4) Voltage Limits
  - a. Sets the Min a Max limits of the input. A flag is set when these limits are met. This feature detects unwanted conditions so that the controller can be safely programmed to a default condition. (The input will go high if the input is open i.e. no connection).
- 5) Invert Output
  - a. Simply inverts the output control with respect to the input command.
- 6) Pot Reference Flag
  - a. Detects an open circuit to the Pot Ref output (mainly used with potentiometers).

## **DIGITAL INPUTS – Qty 8, (3 Dedicated, 5 programmable through Analog and Universal Inputs)**

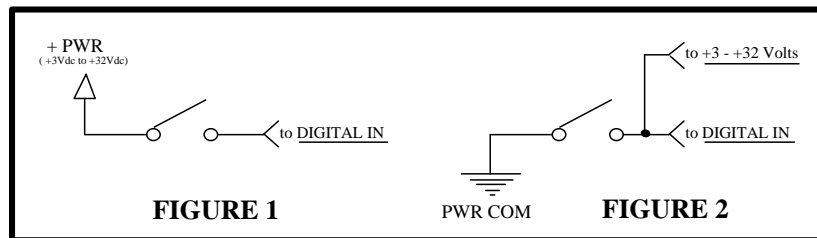
All digital inputs are sinking inputs (connect to voltage to turn on). The voltage required to turn on this input is between 3.0Vdc and 32Vdc (see Figure 1). All 3 dedicated Digital inputs are connected internally to PWR COM through a series resistor (> 10K ohm). Use a



Voltage Source in conjunction with Digital Input if you are switching the Digital Input to PWR COM instead of switching to a voltage (see Figure 2).

### PROGRAMMABLE MODES

- 1) Digital Input – Causes the input to behave like a Digital Input either Active High or Active Low.
- 2) Pulse – 0 to +5Vdc, 0-8KHz. (The maximum Frequency of all Pulse Inputs combined including Digital Inputs configured as Pulse Inputs is 21KHz)
  - d. RPM
  - e. Counter



### OUTPUTS – Qty 9

The outputs are designed to give the user a great deal of flexibility. The software gives the user the ability to control the sourcing voltage (HS OUT) to the positive side of the coil and control the PWM sinking capability (PWM OUT) to the negative side of the coil.

### REFERENCE OUTPUT – Qty 1

The 5 Volt Reference Output is provided to drive sensors such as Joysticks, Potentiometers and Hall Effect Sensors. It will supply 5 Volts up to 500mA. It is protected against constant shorts to GND and brief shorts to +Power.

### HIGH-SIDE OUTPUTS (HS OUT) – Qty 6

These outputs are designed to source (supply) power supply voltage when activated. Each output is short protected and has open detection. The maximum current capability is 3 Amps. High Side Outputs may be used in parallel in order to increase the current capability to a single load by using the Open Detect Disable feature in software.

### PWM OUTPUTS (PWM OUT) – Qty 2

These outputs are designed to sink current to ground at a PWM frequency. Each output can be configured for a specified current range for maximum current sensing resolution (10 bit).



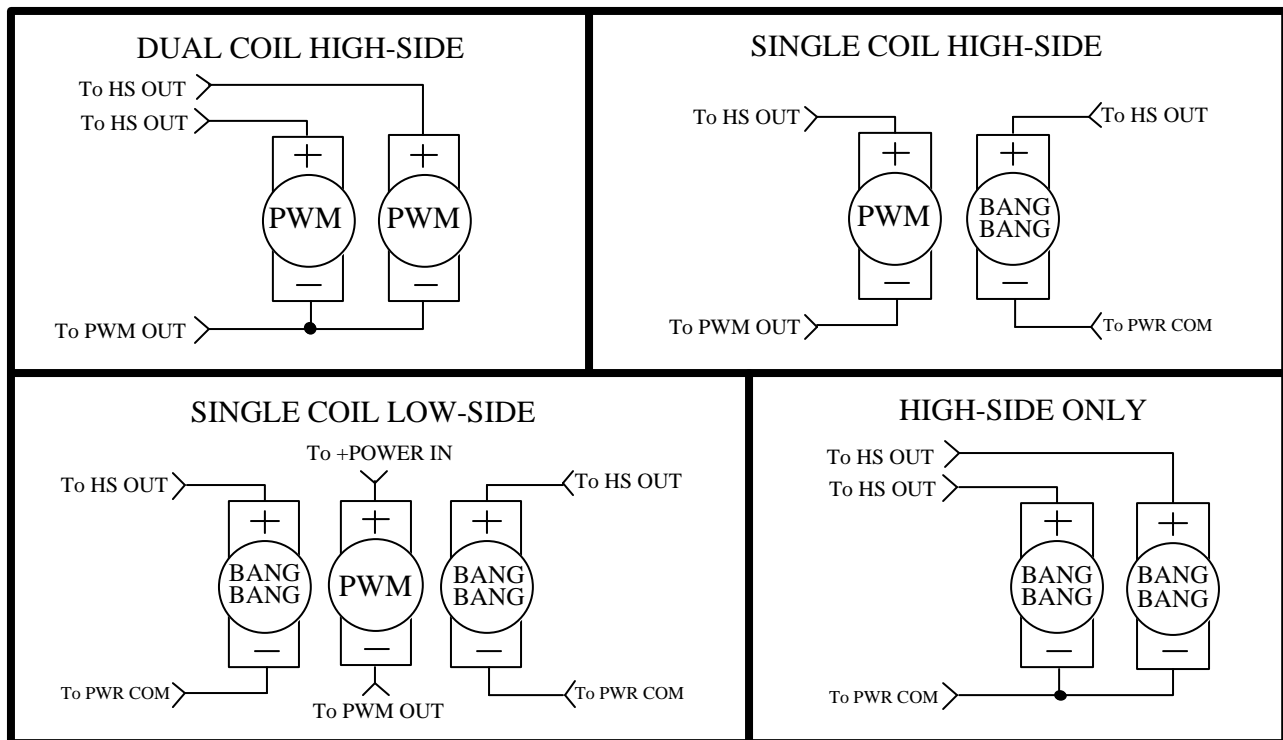
The PWM Outputs will accurately regulate current to the coil with minimum and maximum current settings between 0 – 90mA and 0 – 500mA to 3000mA.

### OUTPUT GROUPS 3

The outputs are divided up into 3 output groups. Two output groups have 2 High-Side outputs and 1 PWM output while the third output group has 2 High Side Outputs without the PWM output.

- 1) Programmable Features Include<sup>2</sup>:
  - a) Dither
  - b) Ramping
  - c) PID setting for current regulation and I/O functions.
  - d) Min and Max current
  - e) Output Configuration Selection
  - f) Process selection including: Current regulation, Enable process PI, Enable current ramps, and PWM Duty cycle mode.

### OUTPUT GROUP CONFIGURATIONS



<sup>2</sup> See the DVC Programming User Guide for more information.



## **COMMUNICATIONS**

The DVC7 has two communication ports:

1. Can Bus 2.0B – This port is used to communicate with either other DVC modules or on the J1939 Bus.
2. RS-232 serial port is used for:
  - a. Downloading and uploading software.
  - b. Monitoring the functions of the DVC10.
  - c. Setting parameters on the fly (fine-tuning).
  - d. Driving an external display.

## **POWER SUPPLY**

A. The DVC7 Power Input has the following features:

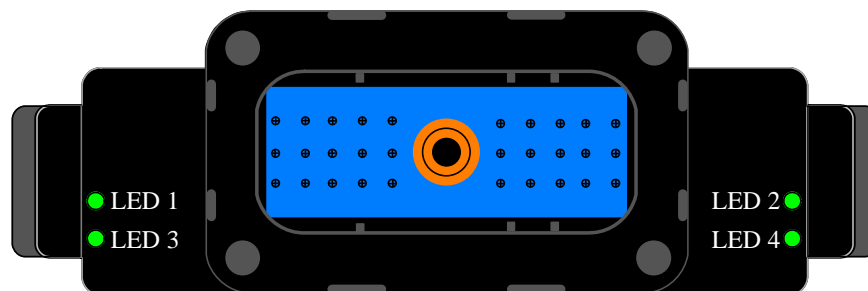
1. Voltage Input Range +8.5Vdc to 32Vdc
2. Reverse polarity protection and transient protection up to 600 Watts Peak Pulse Power Dissipation
3. More than one power and ground pin must be used if driving over 8 amps (at one time).

## **MEMORY SIZE**

1. 1MByte Flash Memory (up to 100,000 erase/write cycles)
2. 128 Kbytes RAM
3. 2 Kbytes EEPROM (non-volatile memory)

## **INDICATORS**

The DCV7 has 4 two color (Red/Green) LEDs. There are 2 LEDs on either side of the connector face of the unit. The application can switch the sequencing of the LEDs from side to side at the user's preference.



## **LED Sequences**

### **Programming (Application or BIOS loading)**

All LEDs are OFF



### Power Initialization

Length: 30 seconds

Summary: LED1 and LED2 display the Network Status (NS). LED3 and LED4 display the Module Status (MS).

NOTE: The application can change the length of the “Power ON” sequence. The default is 30 seconds. The programmer may wish to give more or less time for this sequence.

LED1 and LED2: Network Status – DVC7	
LED STATE	MEANING
Off	There is no J1939 device (or other DVCs) in the project.
On <b>GREEN</b>	J1939 communication has been established.
Flashing <b>GREEN</b>	J1939 device in project but communication has not been established. Flash 2 times in 2 seconds.
On <b>RED</b>	The device has detected an error that has rendered it incapable of communicating on the network.
Flashing <b>RED</b>	The J1939 communication is in a timed-out state. Flash 2 times in 2 seconds.

LED3 and LED4: Module Status	
LED STATE	MEANING
Off	There is no power applied to the module.
On <b>GREEN</b>	The module is operating in a normal condition.
Flashing <b>GREEN</b>	Device is in standby state. May need servicing.
On <b>RED</b>	Module has an unrecoverable fault.
Flashing <b>RED</b>	Recoverable fault.
Flashing <b>RED/Green</b>	This DVC7 was loaded with an application meant for a DCV10 or DVC5. The DVC7 is not operational in this condition. A correct application needs to be loaded.

### Normal Operation

Length: Until the next power cycle.

Summary: LED1 displays Network Status (NS). LED2 displays max PWM. LED3 displays Module Status (MS). LED4 displays the error code if any.

LED1 – Network Status	
LED STATE	MEANING
Off	There is no J1939 device (or other DVCs) in the project.



On <b>GREEN</b>	J1939 communication has been established.
Flashing <b>GREEN</b>	J1939 device in project but communication has not been established. Flash 2 times in 2 seconds.
On <b>RED</b>	The device has detected an error that has rendered it incapable of communicating on the network.
Flashing <b>RED</b>	The J1939 communication is in a timed-out state. Flash 2 times in 2 seconds.

<b>LED2: PWM Status</b>	
<b>LED STATE</b>	<b>MEANING</b>
Off	No PWM Output is active.
<b>RED &gt;&gt; GREEN</b>	The greatest PWM %
Flashing <b>GREEN</b>	PWM or High Side output Open circuit detected
Flashing <b>RED</b>	PWM or High Side output Short circuit detected

<b>LED3: Error/E-Stop/Module Ready</b>	
<b>LED STATE</b>	<b>MEANING</b>
Off	No errors.
On <b>Red</b>	Unrecoverable error
On <b>Yellow</b>	E-Stop active
On <b>Green</b>	Module Ready
Flashing <b>RED</b>	Low voltage (<8.5vdc) into DVC7

<b>LED4: Error Code</b>	
<b>LED STATE</b>	<b>MEANING</b>
Off	No errors
On <b>Red</b>	PWM1 Open or Short Detected
On <b>Green</b>	PWM2 Open or Short Detected
Flashing <b>Yellow</b>	High Side Open or Short Detected
Blink codes	Application defined blink codes.

## **PACKAGING**

1. Physical Size - 6.2L” x 4.75W” x 1.65H” encapsulated module.
2. Each module has two mounting holes 4.0” a part. Each mounting hole has an I.D. of 0.325”.
3. Weight – 1 lb. 7 oz.

## **CONNECTORS**

The DVC7 uses the Cinch 581 01 30 002 (or compatible) connector header.



## **MATING CONNECTOR**

The Cinch 581-01-30-028 Harness Connector (or compatible) is the mating connector for the DVC7. Contact High Country Tek or log onto <http://www.highcountrytek.com> for information about available Connector Kits.

The RS-232 port is accessed through the 30-pin connector. A DVC Serial Port Adapter (HCT PN. 999-10076) is available to connect to the 30-pin Female mating connector. A DVC RS-232 Cable (HCT PN. 999-10075) can be used to interface from the DVC Serial Port Adapter to a PC. Drawings for these cables are available at: <http://www.highcountrytek.com>

## **ENVIRONMENTAL**

- Operating Temperature -40° C to 85° C
- Storage Temperature -40° C to 85° C
- Designed to meet IP67