DVC10 (Master Module)   Rev. P5.2

DESCRIPTION

The DVC10 Master Module is the main control module for all DVC series modules. It has a large number of inputs and outputs to work as a stand-alone unit or it can be the main module for a large CAN Bus system with up to 16 DVC expansion modules (see the DVC Series Modular Configuration drawing for available DVC expansion modules). An RS-232 port is used for programming, monitoring and driving an external display.

The DVC10 has 3 Universal inputs (programmable to accept the most common sensor inputs), 3 analog inputs, and 8 digital inputs. All universal and analog inputs have a corresponding Pot Reference output. All digital inputs have an indicator to show input activity.

The DVC10 has 6 High-Side (sourcing) and 3 PWM outputs. The High-Side outputs provide +POWER IN when turned on. The PWM outputs are used to vary current to the valves (switch to ground at a high frequency). This regulated valve current provides a constant valve output, which is unchanged by coil resistance or power supply fluctuations. An indicator located on the module displays the status of each output. The High-Side and PWM outputs can be used stand-alone or in conjunction with one another (High-side attached to the + coil and PWM to the –coil).

The DVC10 software provides each individual user the ability to program this module to work in a variety of applications without large outside development costs (knowledge of Windows98, programming, and electro-hydraulic needed).

The controller 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.
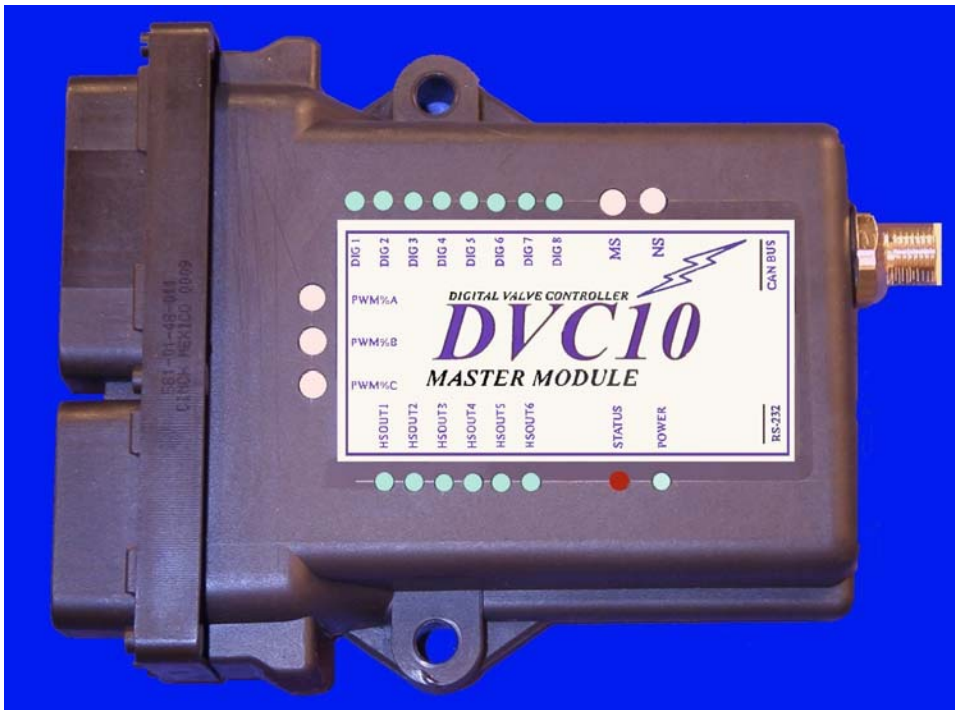
FEATURES

- **Multiple closed loop capabilities.**
- **Closed loop current regulation.**
- **Control valves from multiple manufacturers.**
- **Powerful 16-bit Processor.**
  - **fast**
  - **versatile**
  - **multi-function**
- **Controller Area Network (CAN 2.0B) provides high-speed serial communications with up to 16 other CAN compatible devices.**
- **Rugged encapsulated enclosure withstands harsh environments commonly found in mobile applications.**
- **User friendly display shows I/O status at a glance.**

- **Flash Memory accessible through the RS-232 port. This feature allows the customer to program the module in the field.**
- **Rugged power supply operates over the full range 8.0Vdc to 32Vdc with reverse polarity protection and transient protection up to 1.5 KWatts Peak Pulse Power Dissipation.**
- **All inputs and outputs are protected from shorting to ground or the power supply.**
- **Large amounts of on board memory for complex programming.**
- **Compact packaging.**

SOFTWARE FEATURES

PRE-PROGRAMMED CONTROLLERS
DVC10 Controllers can be supplied with customer-specific application software created by High Country Tek. Many application modules have been written to reduce development time, such as:

- Power management such as anti-stall, horsepower limit, and load limit.
- Speed control/idle control using PID control algorithms.
- Brake and clutch control algorithms utilizing adjustable valve transfer functions.
- steering control for mobile steering requirements
- hydrostatic transmission control
- pressure control
- multiple valve control

- controller networking

UN-PROGRAMMED CONTROLLERS
Software and programming kits are available for programming the DVC10 . The kits includes:

- User-friendly software generated by High Country Tek and designed for the mobile environment. This software will include:
  - DVC Programming Tool
  - DVC Program Loader Monitor
  - sample software
- DVC10 Programming User Guide

TECHNICAL DATA

UNIVERSAL INPUTS – Qty (3)

All Universal inputs can be configured for analog, current, or pulse inputs (see the DVC10 software manual for programming examples). A Pot Reference output (+5Vdc reference through a series 1K ohm resistor) is supplied with each Universal Input for a potentiometer (recommend 10K ohm) connection. All Universal inputs have 10-bit resolution.
*Note: Pulse inputs are rated up to 8 KHz.

PROGRAMMABLE MODES

A. Inputs Modes
  1. Analog – +/- 1Vdc, 0 to +5Vdc, or 0 to +10Vdc.
  2. Pulse - +/- 1Vdc, 0 to +5Vdc, or 0 to +10Vdc.
    a. Pulse Timeout – sets a flag if a pulse has not been detected for a certain amount of time.
    b. Pulses Per Rev – used for calculating RPM.
* Note - The maximum speed for all three universal inputs is 21khz (total of all three inputs added together).
*Note: Pulse inputs are rated up to 8 KHz.
  3. Current - 0 to 20ma
* Note – 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 miswires.
B. Joystick Configuration
  1. Enable Center - sets up upper and lower configuration for single axis joystick.
  2. Deadband – Sets the % of deadband at center.
C. Voltage Calibration – Setting for the actual voltage/current received at the input (Min, Center and Max).
D. Voltage/Current Limits – 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.
* Note – The input will go high if the input is open (no connection).
E. Invert Output – Simply inverts the output control with respect to the input command.
F. Pot Reference Flag – Detects an open circuit to the Pot Ref output (mainly used with potentiometers).
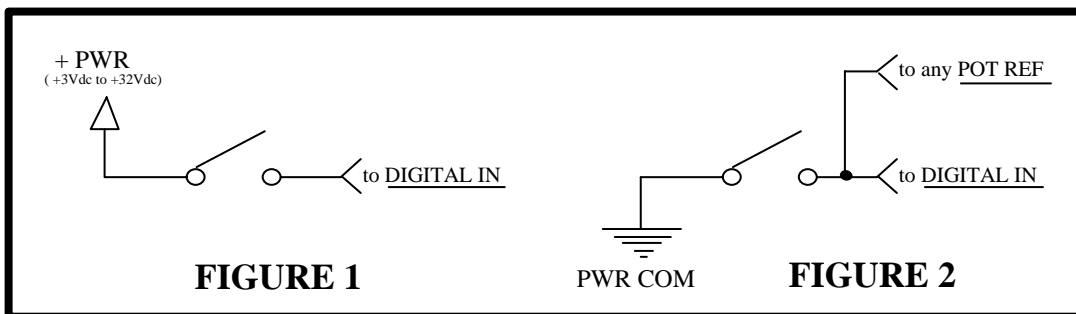
ANALOG INPUTS – Qty (3)

The Analog inputs have a range of 0 to +5Vdc. A Pot Reference output (+5Vdc reference through a series 1K ohm resistor) is supplied with each Analog Input for a potentiometer (recommend 10K ohm) connection. All Analog inputs have 10-bit resolution.

PROGRAMMABLE MODES

A. Joystick Configuration
  1. Enable Center - sets up upper and lower configuration for single axis joystick.
  2. Deadband – Sets the % of deadband at center.
B. Voltage Calibration – Setting for the actual voltage/current received at the input (Min, Center and Max).
C. Voltage Limits – 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.
D. Invert Output – Simply inverts the output control with respect to the input command.
E. Pot Reference Flag – Detects an open circuit to the Pot Ref output (mainly used with potentiometers).

DIGITAL INPUTS – Qty (8)

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 Digital inputs are connected internally to PWR COM through a series resistor (> 10K ohm). Use a Pot Ref output in conjunction with Digital Input if you are switching the Digital Input to PWR COM instead of switching to a voltage (see Figure 2). The Pot Ref inputs are connected internally to +5Vdc through a 1K ohm series resistor.

* The following are two common examples of Digital Input connections.

FIGURE 1   **FIGURE 2**

POT REFERENCE – Qty (6)

All Universal and Analog inputs have a Pot Reference output. These outputs are designed to supply a +5Vdc reference to a potentiometer. Each Pot Reference is connected to an internal +5Vdc power supply through a 1k ohm series resistor. All Pot Reference Outputs are protected against shorts to ground and voltages up to +32Vdc.
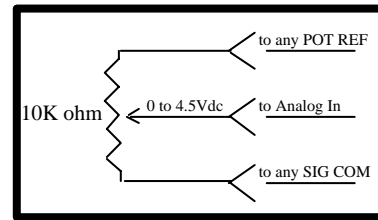
POTENTIOMETER HOOK-UP

to any POT REF

10K ohm   0 to 4.5Vdc   to Analog In

to any SIG COM

FIGURE 3

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.

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.

PWM OUTPUTS (PWM OUT) – Qty (3)

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). See the DVC10 Ordering Guide for typical current ranges. All outputs are short circuit protected and most current ranges have open circuit and short circuit detection (see Current Range Details for more information).
A. Current Ranges – Each PWM output can be configured to a current range, which will produce the maximum current sensing resolution (see ordering guide).
* Note - Current ranges "L", "H", and "D" are short circuit protected but do not have short circuit detection.

OUTPUT GROUPS (3)

The outputs are divided up into 3 output groups. Each output group has (2) High-Side outputs and (1) PWM output.

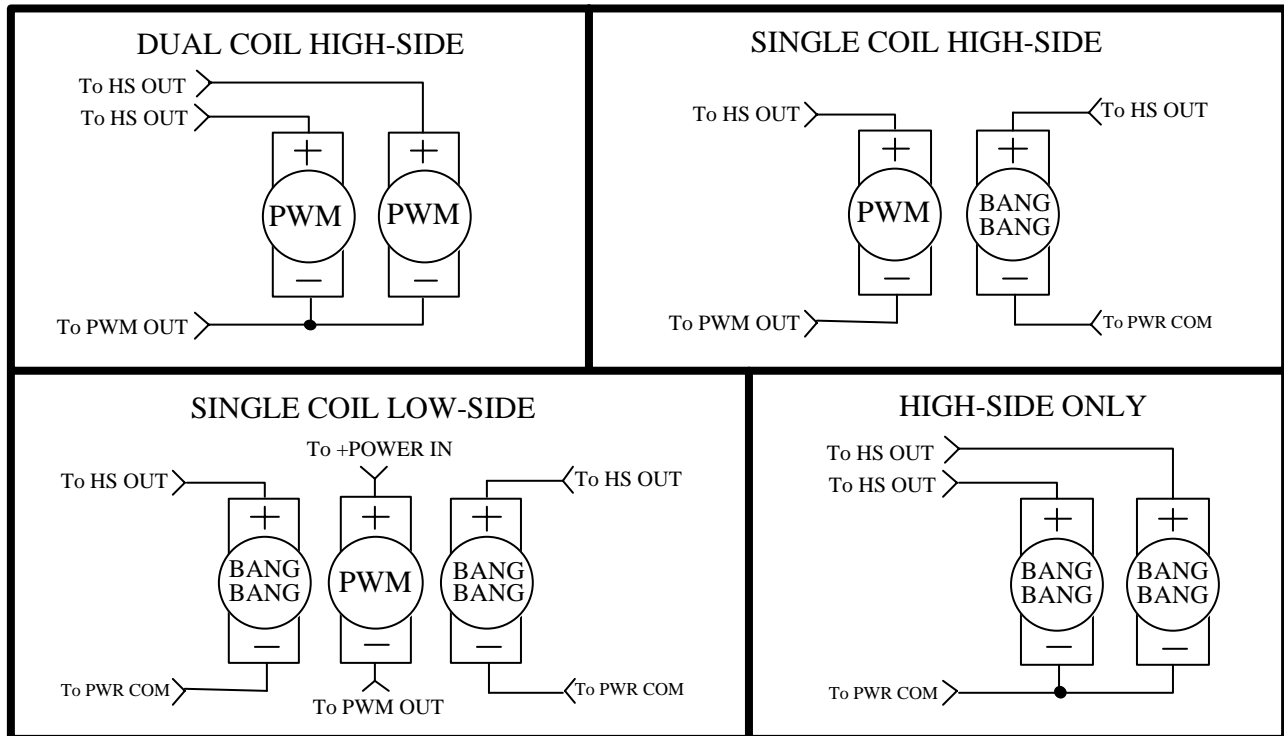## OUTPUT GROUP CONFIGURATIONS


FIGURE 4

A. Programmable Features
   1. Dither Amplitude
   2. Dither Frequency
   3. Ramp Up and Ramp Down
   4. PID setting for current regulation and I/O functions.
   5. Min and Max current
   6. Output Group Selection
   7. Process selection including: Current regulation, Enable process PI, Enable current ramps, and PWM Duty cycle mode.

* Note – See the **DVC10 Programming User Guide** for more details on programmable features.

INPUT/OUTPUT FUNCTIONS – Qty (8)

There are eight Input/Output Functions that can be programmed individually. The I/O Function gives the user the ability to change the response of the output with the change of the input (see sample screen below). The input and output are based on a percentage scale - 0 to 100% - (Min. to Max.). Different adjustable points on the response curve give the user full flexibility to control non-linear responses. These functions are adjustable while the controller is running in order to adjust unknown output characteristics.

* Note – See the **DVC10 Programming User Guide** for more details.
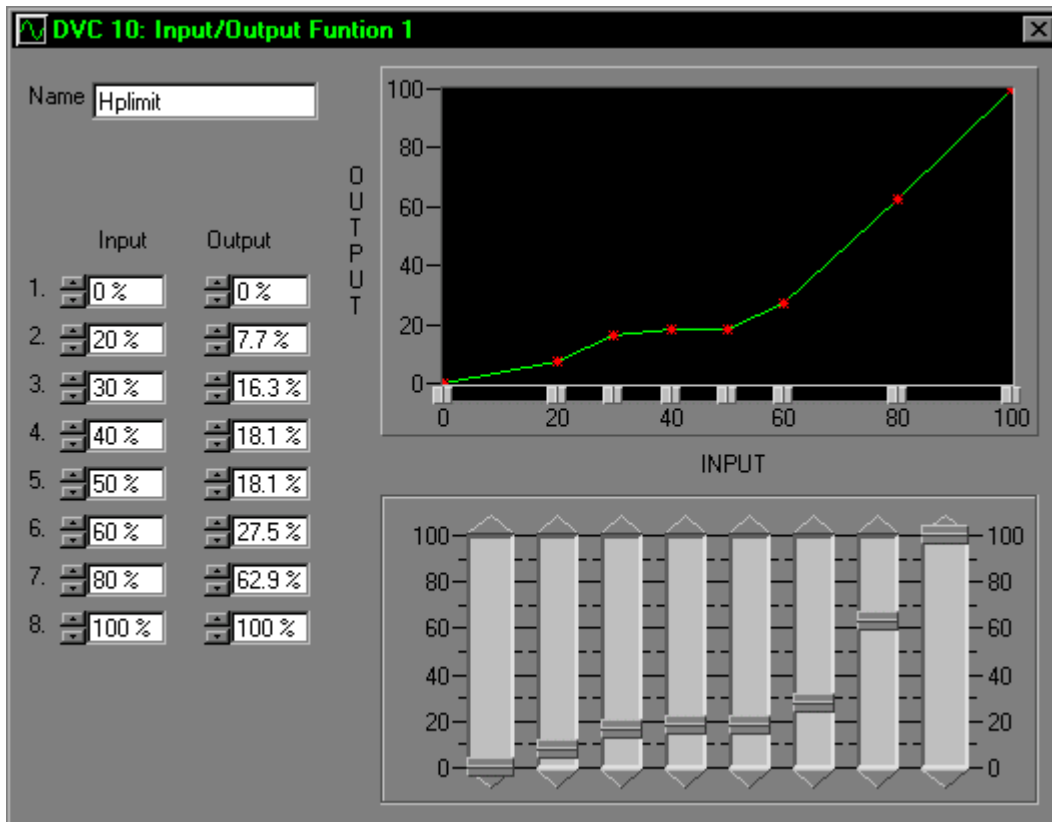
COMMUNICATIONS

A. The DVC10 has two communication ports:
   1. Can Bus 2.0B – This port is used to communicate to other DVC modules as well as an ECM (engine control module).
   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.

* Note – Consult factory for compatible displays.

POWER SUPPLY

A. The DVC10 Power Input has the following features:
1. Voltage Input Range - 8.5Vdc to 32Vdc
2. Reverse polarity protection and transient protection up to 1.5K Watts Peak Pulse Power Dissipation
3. More than one power and ground pin must be used if driving over 8 amps (at one time). Use P1-K1, P2-A1, or P2-A2 for the + POWER INPUT (typically +12Vdc or +24Vdc). Use P2-E1, P2-F1, P2-F2, or P2-F3 for the PWR COM (typically tied to chassis).

MEMORY SIZE

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

INDICATORS

A. Power LED (Qty 1) (Green) – Blinks if the power supply voltage is above +30Vdc. Turns off if the power supply voltage drops below +8.0Vdc.
B. Status LED (Qty 1) (Red) – This LED is programmable and is commonly used for error status or blink codes.
C. Digital Input Status (Qty 8) (Green) – Turns on when the corresponding input is activated. Inputs can be programmed as active high or low.
D. High-Side Output Driver Status (Qty 6)(Green) – Turns on when the corresponding High-side output is activated. Blinks once per second for an open circuit. Blinks four times per second for a short circuit.
E. PWM Output Driver Status (Qty 3) (R/G) – This LED displays duty-cycle status for the corresponding PWM output. The LED will display from red to green as the duty-cycle changes from 0% to 100% (50% displaying yellow).
F. Module Status (MS) (Qty 1) (R/G) –
1. Off – There is no power applied to the Module.
2. On green – The module is operating in a normal condition.
3. Flashing green – Device in standby state. May need commissioning.
4. Flashing red – Recoverable Fault.
5. On red – Module has an unrecoverable fault.
6. Flashing Red/Green – Device is in self-test.
G. Network Status (NS) (Qty 1) (R/G) –
1. Off - Device in not on-line.
2. Flashing green – Device in on-line but has not established connection to other nodes.
3. On green – Device in on-line and has established connection to other nodes.
4. Flashing red – One or more connections are in a timed-out state.

5. On red – The device has detected an error that has rendered it incapable of communicating on the network.

PACKAGING

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

CONNECTORS

A. The DVC10 uses the Metri-Pack 150 series (or compatible) sealed electronic header designed for severe underhood environments.
    1. 30-pin Header (P1) – Used for sensor signal inputs.
    2. 18-pin Header (P2) – Used for the power supply and output connections.
B. 5-pin CAN Bus (DeviceNet compliant) connector
    1. Pins are gold plated brass machined from solid stock.
    2. Protection rating – Nema 1,3,4,6P, and IEC IP 68.

MATING CONNECTORS

A. Mating for 30-pin Header (P1) and 18-pin Header (P2)
    1. Connector, 30-pin Female (P1)   Delphi Packard   P/N – 12034398
    2. Connector, 18-pin Female (P2)   Delphi Packard   P/N – 12040921
    3. Terminals, Female   Delphi Packard   P/N – 12103881
    4. Plugs   Delphi Packard   P/N – 12034413
    5. DVC Series 48-pin Connector Kit   HCT   P/N - 999-10077
                Includes the following:
                1 - Connector, 30-pin (P1) Delphi Packard
                1 - Connector, 18-pin (P2) Delphi Packard
                60 - Terminals, Delphi Packard
                25 – Plugs, Delphi Packard
B. Mating for CAN Bus connector (P4)
    1. 5-pin Female Mini-style DeviceNet compliant connector.
C. Mating to the RS-232 Port – The RS-232 port is accessed through the 30-pin connector at (P1). A DVC10 Serial Port Adapter is available to connect to the 30-pin Female (P1) mating connector. A DVC RS-232 Cable can be used to interface from the DVC10 Serial Port Adapter to a PC. Drawings for these two cables are supplied for user assembly; otherwise they are available from the HCT.
* Note – The DVC10 Serial Port Adapter comes with a plug. The plug is used to keep the cable weather-tight when not connected to peripherals.

1. DVC10 Serial Port Adapter   HCT   P/N - 999-10076
2. DVC RS-232 Cable Assembly   HCT   P/N - 999-10075

ENVIRONMENTAL

- Operating Temperature -40 Celsius to 85 Celsius
- Storage Temperature -40 Celsius to 85 Celsius