



# DVC700 Series Controllers

## DVC745 User Manual – Rev. B1



[www.hctcontrols.com](http://www.hctcontrols.com)

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## Product Overview

The DVC745 is a robust digital output expansion controller for solenoid-operated ON/OFF valves, lights, alarms and more. It is designed to be used as an output expansion module for the DVC700 series controllers or as a stand-alone output module using direct CAN bus communication.

Each output may be individually configured to operate 12 or 24  $V_{DC}$  coils or LED's.

The DVC745 must be initially configured using the Intella Program Loader Monitor (PLM) for Mac ID, Module Number, Baud Rate and CAN type.

The outputs can be configured using the PLM or any J1939 CAN capable Electronic Control Unit (ECU).

- 12 ON / OFF output expansion module
- Can be used with any J1939 CAN capable control device
- Can be combined with DVC700 series controllers as an output expansion module for large system solutions
- Utilize as a stand-alone output module via J1939
- SAE J1939 or DVC DeviceNet CAN bus communication
- Open/short detection for diagnostics
- Rugged and fully encapsulated
- SAE J1455 environment and load dump compliant
- IP67, 69K
- CE Certified

For the Mobile and Industrial hydraulic markets.



## Hints & Tips

### Hints & tips for successful application of High Country Tek's electro-hydraulic control products

#### ALWAYS do the following:

- Read this entire 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 PLM and hardware combination.
- Cycle the power to ensure changes are accepted by the controller.
- When the PLM is first connected to a powered controller, a 'Handshake' takes place to confirm the internal software (BIOS) is compatible with the PLM. This allows the PC and the module to communicate. If an error is detected, the PLM will indicate "OFF LINE" and NOT allow communications.

#### Never do the following:

- Attempt to use this unit if you are unsure of electrical or hydraulic connections or expected operation.
- Operate this unit without the recommended power supply in put fuse installed as recommended power supply input fuse installed as recommended.
- Arc weld or charge batteries with this controller unit connected as damage can occur.
- Attempt to use this unit in areas where other AC or DC coils have not been fully suppressed.
- Install Amplifiers in vicinity of AC products – e.g. VFD Amplifiers, motor starters, HV fuses, etc.
- Use a power supply that is not rated for the correct required output current under full load.
- Allow wires to or from the unit to short circuit (to each other or chassis/cabinet)/.
- Attempt to use this unit in areas of intense radio Frequency (RF) without adequate screening measures.
- Disconnect or connect wires to or from this unit unless it is isolated form the power supply.
- Use this unit in temperatures that exceed specifications as operation may be affected.
- Start this unit without ensuring ALL work areas are clear from personnel.

## Connections

### Pin-Out

| Pin | Function |
|-----|----------|
|-----|----------|

|    |          |
|----|----------|
| A1 | Output 1 |
| A2 | CAN H    |
| A3 | RXD      |

| Pin | Function |
|-----|----------|
|-----|----------|

|    |          |
|----|----------|
| B1 | Output 2 |
| B2 | CAN L    |
| B3 | TXD      |

| Pin | Function |
|-----|----------|
|-----|----------|

|    |           |
|----|-----------|
| C1 | Output 3  |
| C2 | POWER COM |
| C3 | POWER COM |

|    |           |
|----|-----------|
| D1 | Output 4  |
| D2 | POWER COM |
| D3 | POWER COM |

|    |          |
|----|----------|
| E1 | Output 5 |
| E2 | Output 6 |
| E3 | Output 7 |

|    |           |
|----|-----------|
| F1 | Output 8  |
| F2 | Output 9  |
| F3 | Output 10 |

|    |           |
|----|-----------|
| G1 | Output 11 |
| G2 | POWER COM |
| G3 | POWER COM |

|    |           |
|----|-----------|
| H1 | Output 12 |
| H2 | POWER COM |
| H3 | POWER COM |

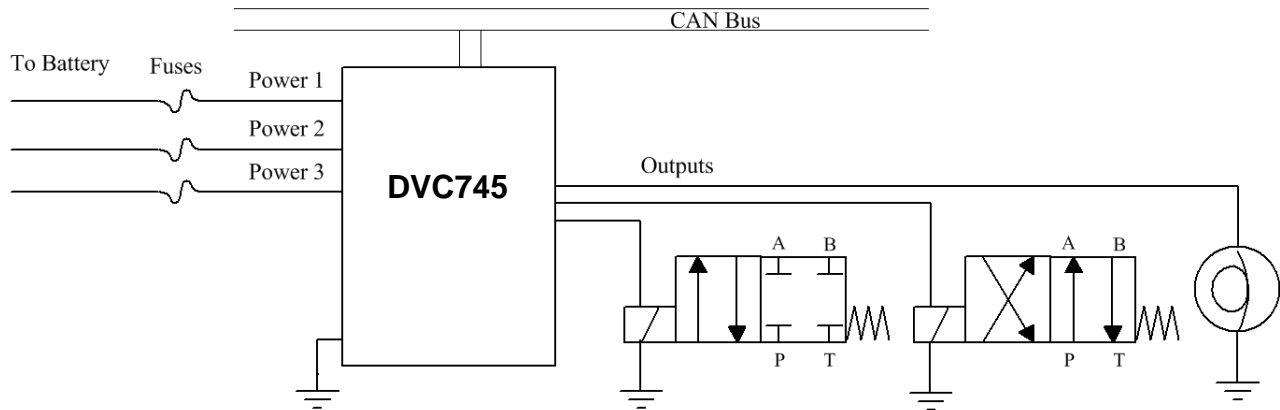
|    |              |
|----|--------------|
| J1 | + POWER IN 1 |
| J2 | + POWER IN 2 |
| J3 | + POWER IN 3 |

Notes:

|    |              |
|----|--------------|
| K1 | + POWER IN 1 |
| K2 | + POWER IN 2 |
| K3 | + POWER IN 3 |

1. Each Power pin used must be individually fused with an ATO 5, AGC 5 or smaller fuse
2. High voltage transient protection is monitored on Power In 1 (Load Dump)
3. Power In 1, Power In 2 and Power In 3 are electrically separate Power Planes
4. Outputs 1 – 4 and the controllers on board logic is supplied from Power In 1
5. Outputs 5 – 8 are supplied from Power In 2
6. Outputs 9 – 12 are supplied from Power In 3

### Example Configuration



### Mating Connector Information

| DELPHI PACKARD MATING CONNECTOR PARTS |            |
|---------------------------------------|------------|
| Connector 30 Pin Female:              | 12048455   |
| Terminals, Female:                    | 12103881   |
| Cavity Plug:                          | 12034413-B |
| Terminal Crimp Tool:                  | 12039500   |
| Extraction Tool:                      | 12094429   |

## Product Specifications

### User Interface

The DVC745 is configured using HCT's free Intella® Program Loader Monitor (PLM). The PLM is used as the primary interface to specify the communication speed, type, module and MAC ID. The PLM can also be used to configure the outputs and for J1939 communication when used with other J1939 CAN capable Electronic Control Units (ECU). The PLM also contains a dashboard providing real time feedback for diagnostics and troubleshooting. The communication cable 999-10075 and adapter 108-00119 are required in order to communicate between a PC and the DVC745.

- Save and load data files
- Enable or disable open circuit detection
- Configure output errors to reset with unit power cycle or command output cycle
- Configure MAC ID, Module ID, communication rate and CAN communication types

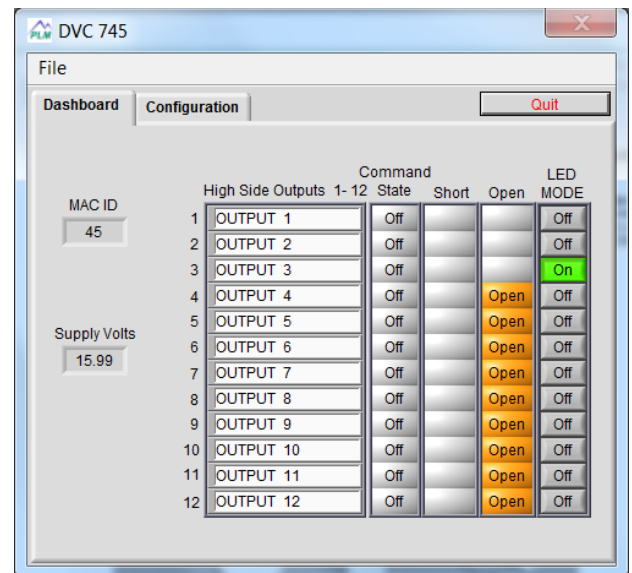


Figure 1 DVC745 PLM Dashboard Window

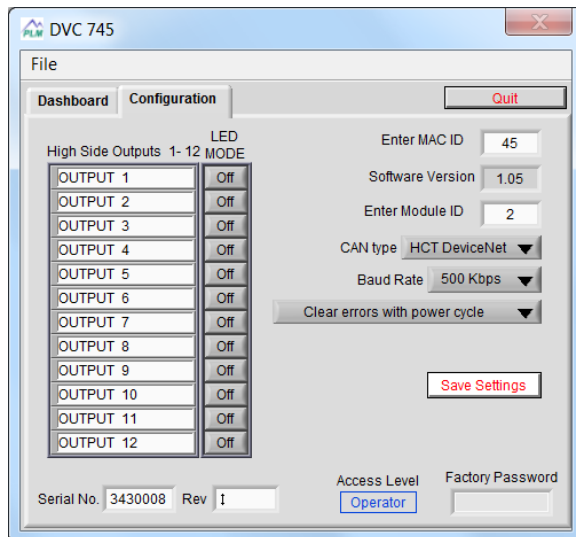


Figure 2 DVC745 PLM Configuration Window

- Command ON / OFF outputs directly from the DVC745 controller without needing a DVC710 or DVC707 master controller
- Configure the outputs directly from a CAN capable display including: command state, open circuit detection and error reset mode
- Monitor output status directly from a CAN capable display for safety messages and diagnostics
- Compatible with High Country Tek's rugged displays (PV780 and PV450)

## Operational Specifications

|                              |  |
|------------------------------|--|
| <b>Supply Voltage</b>        | 9-30 V <sub>DC</sub> (recommended operating voltage +12 to +28 V <sub>DC</sub> , absolute maximum +/- 32 V <sub>DC</sub> ) |
| <b>Supply Current</b>        | 30 Amps (recommended supply current per power pin 5 Amps, absolute maximum 8 Amps)   |
| <b>Operating Temperature</b> | -40 to +85°C   |
| <b>Storage Temperature</b>   | -40 to +100°C  |
| <b>Weight</b>                | 1.29 lbs (0.58 kg)   |
| <b>Dimensions</b>            | L: 5.50 in (140 mm) x W: 4.70 in (119 mm) x H: 1.65in (42 mm)  |
| <b>Enclosure</b>             | Solid potted, industry standard Deutsch enclosure with automotive connectors   |
| <b>NEMA / IP Rating</b>      | NEMA 6P / IP67, 69K  |

## Communication

|                         |  |
|-------------------------|--|
| <b>CAN</b>              | 2.0B (maximum voltage +/-14V <sub>DC</sub> )                                       |
| Baud rates              | 125 kb/s, 250kb/s, 500kb/s, 1Mb/s, software configurable                           |
| Protocol                | SAE J1939, HCT DeviceNet   |
| Default baud rate       | 250kb/s  |
| <b>Serial Interface</b> | RS232 (maximum voltage Rxd,RTS = +/-15V <sub>DC</sub> Txd = +/-8 V <sub>DC</sub> ) |

## Outputs

|                         |  |
|-------------------------|--|
| <b>Digital (Qty 12)</b> | 3,000 mA sourcing, software configurable   |
| Current Leakage         | Off = 370µA, Supply = +28 V <sub>DC</sub><br>Off = 180µA, Supply = +13.6 V <sub>DC</sub> |
| Diagnostics             | Open/short circuit detection   |
| Fly back protection     | Integrated   |

NOTE: 1) Maximum voltage on any input pin +/-32 V<sub>DC</sub>



## Standards

|                                   |                      |                  |                          |
|-----------------------------------|----------------------|------------------|--------------------------|
| <b>Environmental</b>              | SAE J1455            | <b>Immunity</b>  | 89/336/EEC, EN 61000-6-2 |
| Temperature                       | Section 4.1.3.2      | ESD              | EN 61000-4-2             |
| Salt Spray                        | Section 4.3.3.1      | EMC              | EN 61000-4-3             |
| Steam Cleaning & Pressure Washing | Section 4.5.3.2      | EMC              | EN 61000-4-4             |
| Vibration                         | Section 4.10.4.2     | RF               | EN 61000-4-6             |
| Shock                             | Section 4.11.3.4     | <b>Emissions</b> | 89/336/EEC, EN 61000-6-4 |
| Load Dump                         | Section 4.13.2.2.1.a |                  | EN 55011                 |

## Certifications

CE Mark

## Mounting

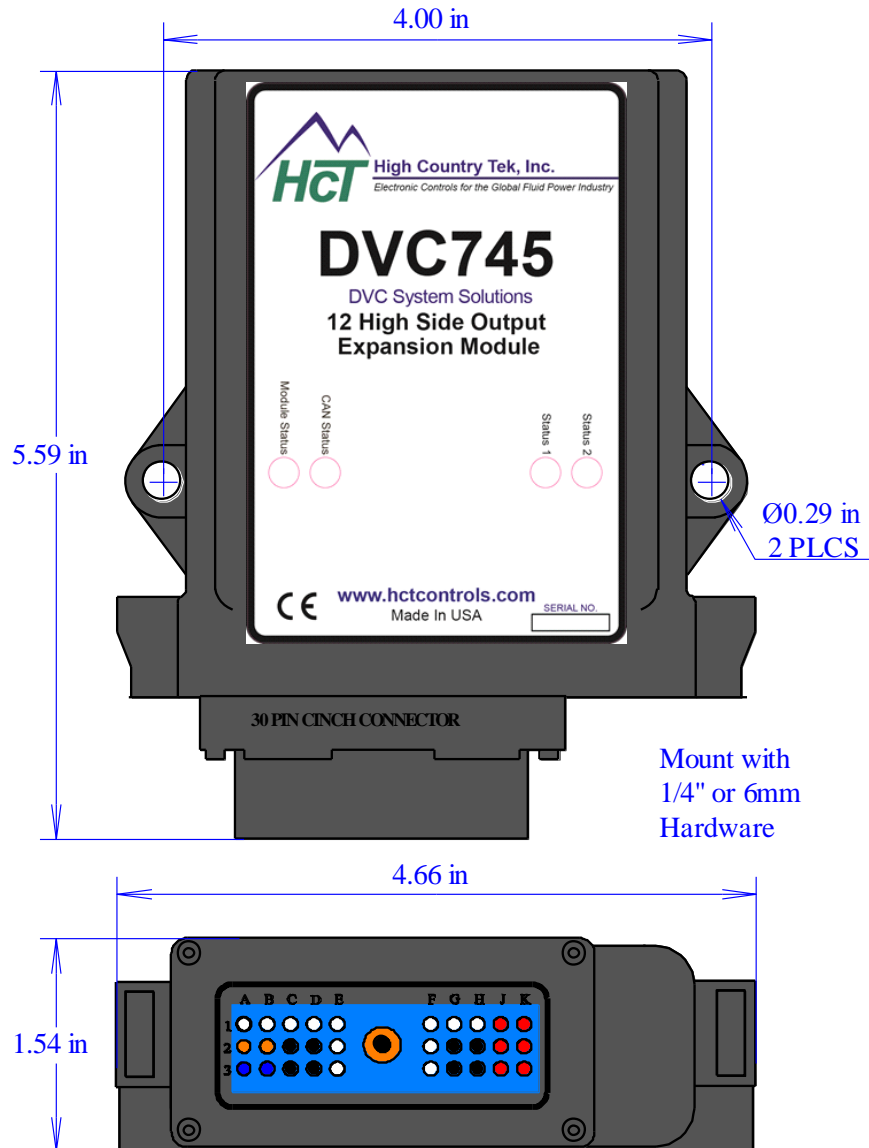


Figure 3 DVC745 dimensions

### Notes:

- 1) All dimensions are in Inches (Millimeters).
- 2) Use 1/4 x 20 SAE Grade 2 bolts (M6 x 1 ISO Grade 8)
  - \* Torque to 4 ft-lbs (5.4 N-m) Dry
  - \* Torque to 3 ft-lbs (4.1 N-m) Oiled
- 2) Mount to a flat hard surface protected from excess heat and moving parts.
- 3) Factory recommended 18-22 AWG (1.02mm to 0.64mm) TXL, XSL, and GXL automotive grade wire
- 4) Each Power pin used must be individually fused with an ATO 5, AGC 5 or smaller fuse

## Recommended Operating Parameters / Pin Functions

| Pin  | Name                         | Function/Features                                      | Range  |
|--|------------------------------|--|--|
| J1, K1   | Power In 1<br>(Note: 1)      | Positive Power Supply Input<br>Outputs 1 – 4 and Logic | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| J2, K2   | Power In 2<br>(Note: 1)      | Positive Power Supply Input<br>Outputs 5 - 8           | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| J3, K3   | Power In 3<br>(Note: 1)      | Positive Power Supply Input<br>Outputs 9 - 12          | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| C2, C3, D2, D3<br>G2, G3, H2, H3                     | Power<br>Common<br>(Note: 1) | Return for Power Supply or<br>Signal Com               | 0 Volts (GND)  |
| A1, B1, C1, D1,<br>E1, E2, E3, F1,<br>F2, F3, G1, H1 | Outputs                      | Sourcing Discreet Output                               | <p><b>Default Mode</b></p> <p>On = +Supply 3,000mA</p> <p>Off = +Supply 370μA, Supply = 28V<sub>DC</sub></p> <p>Off = +Supply 180μA, Supply = 13.6V<sub>DC</sub></p> <p><b>LED Mode</b></p> <p>On = +Supply 3,000mA</p> <p>Off = 2.3V<sub>DC</sub> 342μA, Supply = 28V<sub>DC</sub></p> <p>Off = 1.13V<sub>DC</sub> 166μA, Supply = 13.6V<sub>DC</sub></p> |

**Notes:**

1. Maximum continuous current allowed on any single connector Pin = 8 Amps
2. All limits are guaranteed by testing or statistical analysis
3. Each Power pin used must be individually fused with an ATO 5, AGC 5 or smaller fuse
4. High voltage transient protection is monitored on Power In 1 (Load Dump)
5. Power In 1, Power In 2 and Power In 3 are electrically separate Power Planes
6. Outputs 1 – 4 and the controllers on board logic is supplied from Power In 1
7. Outputs 5 – 8 are supplied from Power In 2
8. Outputs 9 – 12 are supplied from Power In 3

## Diagnostic Indicators

| 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>    | Low Supply Voltage.   |
| <b>CAN Status</b>      |   |
| On <b>GREEN</b>        | Communication established with another Master Controller      |
| Flashing <b>GREEN</b>  | Waiting to establish communication with the Master Controller |
| On <b>RED</b>          | J1939 Communications are in a timed out state                 |
| Flashing <b>RED</b>    | The HCT DeviceNet communication is in a timed-out state       |
| <b>Status 1</b>        |   |
| One <b>GREEN</b> Flash | An output has changed its state                               |
| On <b>GREEN</b>        | Normal operation  |
| <b>Status 2</b>        |   |
| On <b>GREEN</b>        | Normal operation  |

## Configuration

### Getting Started

For programming the DVC745 for use with the DVC707 or DVC710 master controllers, please refer to document number, 021-00163 DVC710 Family System and Programming Guide. Programmable features of the DVC745 for use as a standalone module on a J1939 CAN bus is explained below. Regardless of the type of system that the DVC745 is installed on, the following parameters are set using the Intella® Programming Loader Monitor (PLM) communicating through the modules serial port using communication cable 999-10075 and adapter 108-00119.

- Module Number
- MAC ID
- Module Baud Rate
- CAN bus Type

When used as a standalone module on a J1939 CAN bus the following parameters may be configured by using either the PLM or J1939 communication protocols:

- Output Mode (normal / LED)
- Reset Output Errors with Power Cycle or Command Cycle

Module Status and Serial Number may all be viewed through the Intella® Programming Loader Monitor.

The DVC745 must be powered up, indicated by the Module Status LED, to communicate with the module. Download the PLM software from HCT's website here:

<http://www.hctcontrols.com/software/index.htm>

### DVC745 PLM Dashboard Window

The main Dashboard tab on the DVC745's PLM screen displays the current status of all 12 outputs at the same time. The modules MAC ID and supply voltage is also displayed here. The drop down menu for file operations allows the user to read and save data files containing the modules profile information.

#### Output State

High Side Outputs are Voltage Sourcing outputs; they provide positive voltage to the load. High Side Outputs may be considered to be like a switch, the state of the output may be either true (on/set) or false (off/reset). The resistance of the load along with the system voltage determines the amount of current through the load. Each load must be individually wired from its output connector pin to the load, however a return "Ground" wire back to the DVC745 is not necessary and a local / frame Ground is sufficient.

#### Output Short

This is an indicator only, it is true when the hardware has detected that the output is shorted to ground. Shorts are detected when the output is in the ON state. Output Errors may be reset with respect to the Reset Outputs Mode.

#### Output Open

This is an indicator only, it is true when the hardware has detected that the output is Open and there is no path to ground through a load. Open circuits are detected when the output is in the OFF state. When in LED Mode, Open output detection is automatically disabled. Output Errors may be reset with respect to the Reset Outputs Mode.

#### File Menu

Available in the Intella® Programming Loader Monitor, the File Menu is used to Save / Load configuration files between DVC745 Modules.

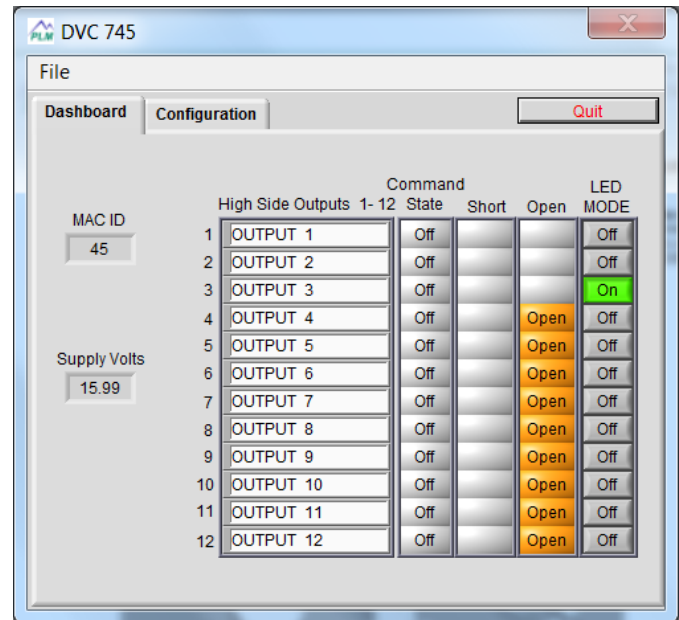


Figure 4 DVC745 PLM Dashboard Window

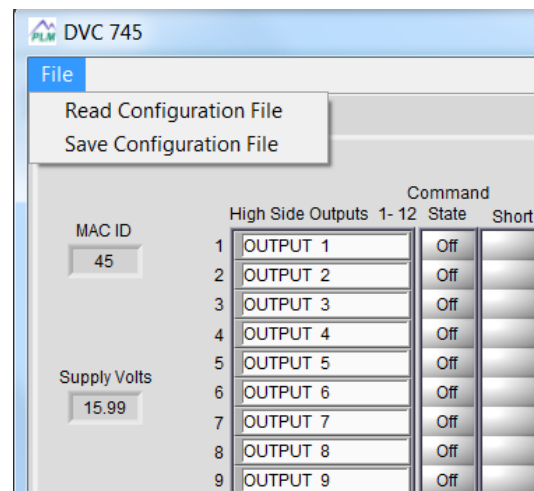


Figure 5 DVC745 PLM File Menu

## DVC745 PLM Configuration Window

The Configuration tab is where the user can setup each individual output mode and module settings. Simply select or enter the desired values and select the Save Settings button to send the new settings to the module. Profile changes made here are automatically saved in the modules permanent memory. Password operation beyond Operator is reserved for factory use only.

### LED Output / Mode

Configured with the Intella® Programming Loader Monitor or over the CAN Bus. When in LED Mode, the DVC745 will configure its internal circuits to add a pull down resistor on the output pin and prevent the output from dimly driving the LED when off. Open Circuit detection is also disabled in this mode.

### MAC ID Number

Configured with the Intella® Programming Loader Monitor, the MAC ID Number is used to Identify the Module on the CAN Bus when connected to a system with a DVC707 / DVC710 Master Module.

**Range:** 1 to 63

### Module ID Number

Configured with the Intella® Programming Loader Monitor, the Module ID Number is used to determine the PGN address scheme used when in J1939 mode.

**Range:** 1 to 127

### CAN Type

Configured with the Intella® Programming Loader Monitor, the CAN Type is used to determine whether the DVC745 will be used as an expansion module with a DVC Master Module or as a standalone module operating on a J1939 CAN Bus.

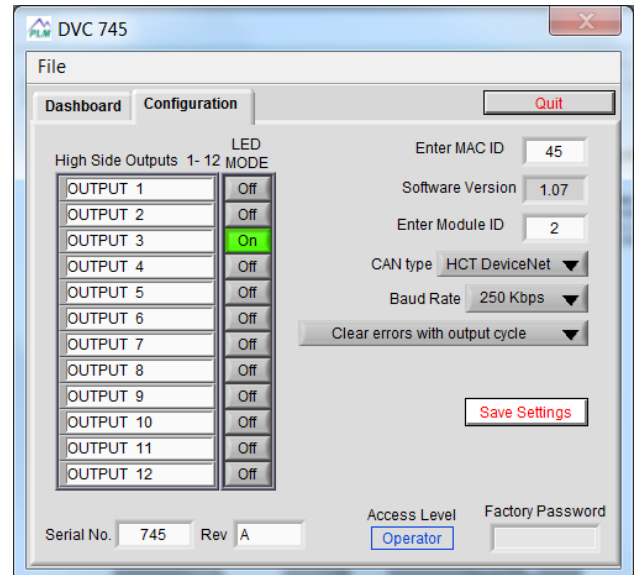


Figure 6 DVC745 PLM Configuration Window

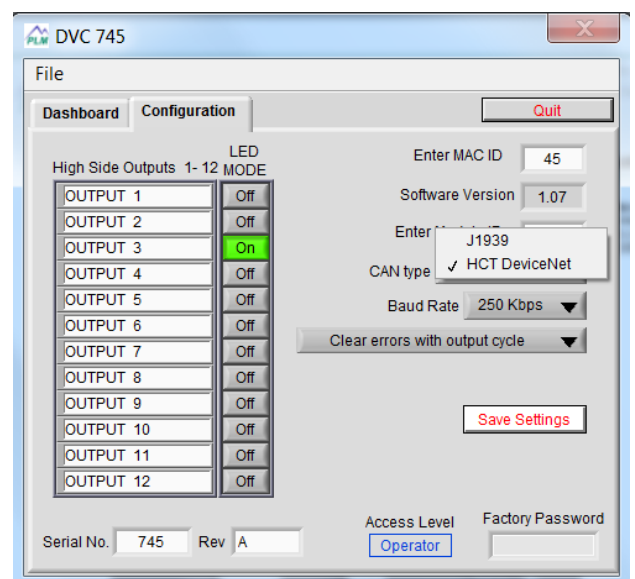


Figure 7 DVC745 CAN Types

**Baud Rate**

Configured with the Intella® Programming Loader Monitor, the Baud Rate determines CAN bus message rate.

**Range:** Selectable, 125kB, 250kB, 500kB and 1MB

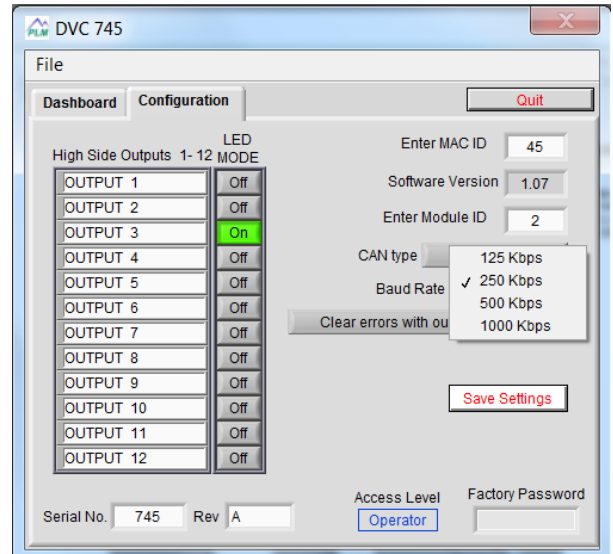


Figure 8 DVC745 CAN Types

**Reset Outputs Mode**

Configured with the Intella® Programming Loader Monitor or over the CAN Bus, the Reset Outputs Mode is used to determine the behavior of the DVC745 with respect to resetting output errors. When in Reset Open/Shorts with Power Cycle, any output error must be reset by cycling power to the module. When in Reset Open/Shorts with Output Cycle, errors are automatically reset when the command to the output is off.

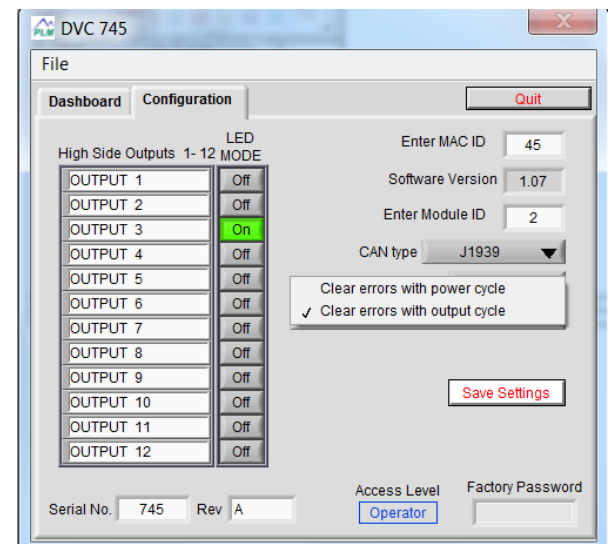


Figure 9 DVC745 Reset Outputs Mode



**Save Settings**

When making changes to the modules configuration through the Intella® Programming Loader Monitor, Select “Save Settings” to write the changes to the module.

To access previously saved settings, use the file drop down menu and select “Read Configuration File”.

**Access Level**

Displays the modules current authorized password level (display only).

**Factory Password**

For factory use only.

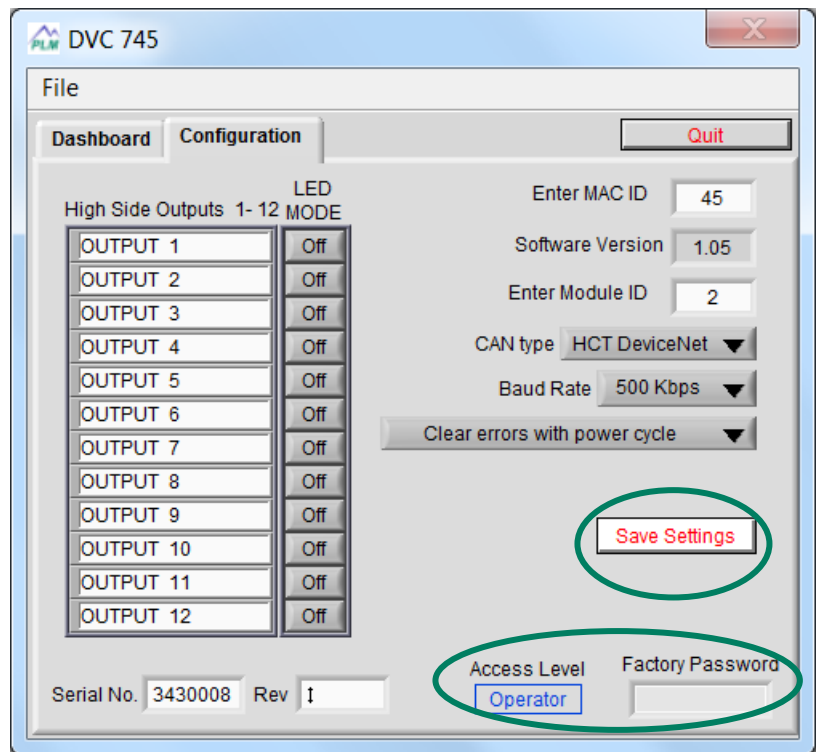


Figure 10 DVC745 PLM Save Settings

## J1939 CAN Bus Communication

The DVC745 may be installed directly on a J1939 CAN Bus and operate without the need for a DVC710/707 Master module using the following message format. When in J1939 Mode, the DVC745 will automatically broadcast its status on the CAN Bus using a predefined PGN determined by the Module number assigned to the input module.

The DVC745 transmits and receives all J1939 messages using Source Address 0x22 (Aux Valve Controller) only. The Modules ID number determines which PGN Numbers the module will transmit and receive on the J1939 Bus. It sets the PDU Specific (PS) part of the message header for the Configuration Message that the unit will accept when being configured over the J1939 Bus. For example, a unit with the Module ID of 1 would accept PGN: 0xFF01 SA: 0x22 as a command input. Using this format, the user may command up to 127 separate expansion modules on a single Bus using any number of master controllers. Valid module ID numbers are 1 through 127.

The PGN numbers 0xFF01 through 0xFF7F are used as the Command and Configuration Messages for the DVC745. PGN numbers 0xFF00 and 0xFF80 are reserved for special functions. PGN numbers 0xFF81 through 0xFFFF are used as the complementary Status Messages transmitted by the DVC745. The user can calculate the PGN that the Module will transmit as its Status Message by adding 0x80 to the Module ID. For example, a unit with a module ID of 61 would accept PGN 0xFF3D as a command message and would transmit PGN 0xFFBD as its Status Message,  $0xFF3D + 0x80 = 0xFFBD$ . A list of Module IDs, Command Message PGNs and Status Message PGNs is listed below.

The DVC745 will transmit its state message whenever there is a state change on one of the outputs or at least once every 1000mS. The DVC745 will transmit a Profile Acknowledgment message each time that it receives and processes a valid profile message. The Profile Acknowledgment message will contain the exact same data field that was received in the profile message and may be used by the controlling ECU to verify that the output was profiled correctly.

The DVC745 expects to receive a command message at least once every 1000mS. If the DVC745 detects a timeout on the command message, it will shut down all outputs and turn the CAN Status LED to RED.

### Status Message Format

Transmission Cycle Time: 1000mS or on change.  
 Data Length: 8  
 Data Page: 1  
 PDU Format: 255  
 PDU Specific: Module ID + 128 (0x80)  
 Priority: 6  
 Parameter Group Number: 65409 Through 65535 (FF81 Through FFFF)

| <u>Start Position</u> | <u>Length</u> | <u>Parameter Name</u> |
|-----------------------|---------------|-----------------------|
| 1.1                   | 1 Byte        | Multiplexer           |
| 2.1                   | 1 Byte        | Module Type           |
| 3.1                   | 2 bits        | Output 1 State        |
| 3.3                   | 2 bits        | Output 2 State        |
| 3.5                   | 2 bits        | Output 3 State        |
| 3.7                   | 2 bits        | Output 4 State        |
| 4.1                   | 2 bits        | Output 5 State        |
| 4.3                   | 2 bits        | Output 6 State        |
| 4.5                   | 2 bits        | Output 7 State        |
| 4.7                   | 2 bits        | Output 8 State        |
| 5.1                   | 2 bits        | Output 9 State        |
| 5.3                   | 2 bits        | Output 10 State       |
| 5.5                   | 2 bits        | Output 11 State       |
| 5.7                   | 2 bits        | Output 12 State       |
| 6.1                   | 1 bit         | Output 1 Mode         |
| 6.2                   | 1 bit         | Output 2 Mode         |
| 6.3                   | 1 bit         | Output 3 Mode         |
| 6.4                   | 1 bit         | Output 4 Mode         |
| 6.5                   | 1 bit         | Output 5 Mode         |
| 6.6                   | 1 bit         | Output 6 Mode         |
| 6.7                   | 1 bit         | Output 7 Mode         |
| 6.8                   | 1 bit         | Output 9 Mode         |
| 7.1                   | 1 bit         | Output 9 Mode         |
| 7.2                   | 1 bit         | Output 10 Mode        |
| 7.3                   | 1 bit         | Output 11 Mode        |
| 7.4                   | 1 bit         | Output 12 Mode        |
| 7.5 – 8.8             | 10 bits       | Reserved              |

## Message Definitions

### Multiplexer

|                    |  |
|--------------------|--|
| Data Length:       | 1 Bytes  |
| Resolution:        | 1 bit, 0 offset  |
| Data Range:        | 0 to 255   |
| Operational Range: | 1 to 5   |
| Definitions:       | 0 – Invalid<br>1 – Profile Mode<br>2 – Profile Acknowledgement<br>3 – Reserved<br>4 – Command Outputs (DVC745)<br>5 – Save Profile to Permanent Memory<br>6...255 – Reserved |

### Module Type

|                    |                          |
|--------------------|--------------------------|
| Data Length:       | 1 Byte                   |
| Resolution:        | 1 bit, 0 offset          |
| Data Range:        | 0 to 255                 |
| Operational Range: | 1 to 2                   |
| Definitions:       | 1 – DVC725<br>2 – DVC745 |

### Output State

|                    |  |
|--------------------|--|
| Data Length:       | 2 bits   |
| Resolution:        | 1 bit, 0 offset  |
| Data Range:        | 0 to 3   |
| Operational Range: | 0 to 3   |
| Definitions:       | 0 – Output Off<br>1 – Output On<br>2 – Output Open<br>3 – Output Short |

### Output Mode

|                    |                                 |
|--------------------|---------------------------------|
| Data Length:       | 1 bit                           |
| Resolution:        | 1 bit, 0 offset                 |
| Data Range:        | 0 to 1                          |
| Operational Range: | 0 to 1                          |
| Definitions:       | 0 – Normal Mode<br>1 – LED Mode |

## Command / Profile Message Format

|                         |                     |                     |
|-------------------------|---------------------|---------------------|
| Transmission Repletion: | 1000mS minimum      |                     |
| Data Length:            | 8                   |                     |
| Data Page:              | 1                   |                     |
| PDU Format:             | 255                 |                     |
| PDU Specific:           | Module ID # 1 – 127 | (0x01 – 0x7F)       |
| Priority:               | N/A                 |                     |
| Parameter Group Number: | 65281 Through 65407 | (FF01 Through FF7F) |

| <u>Start Position</u> | <u>Length</u> | <u>Parameter Name</u>           |
|-----------------------|---------------|---------------------------------|
| 1.1                   | 1 Byte        | Multiplexer                     |
| 2.1                   | 1 Byte        | Module Type                     |
| 3.1                   | 1 bit         | Output 1 Command / Profile      |
| 3.2                   | 1 bit         | Output 2 Command / Profile      |
| 3.3                   | 1 bit         | Output 3 Command / Profile      |
| 3.4                   | 1 bit         | Output 4 Command / Profile      |
| 3.5                   | 1 bit         | Output 5 Command / Profile      |
| 3.6                   | 1 bit         | Output 6 Command / Profile      |
| 3.7                   | 1 bit         | Output 7 Command / Profile      |
| 3.8                   | 1 bit         | Output 8 Command / Profile      |
| 4.1                   | 1 bit         | Output 9 Command / Profile      |
| 4.2                   | 1 bit         | Output 10 Command / Profile     |
| 4.3                   | 1 bit         | Output 11 Command / Profile     |
| 4.4                   | 1 bit         | Output 12 Command / Profile     |
| 4.5                   | 3 bits        | Not Used                        |
| 4.8                   | 1 bit         | Reset Faults With Command Cycle |
| 5.1                   | 4 Bytes       | Reserved                        |

## Message Definitions

### Multiplexer

|                    |                             |
|--------------------|-----------------------------|
| Data Length:       | 1 Byte                      |
| Resolution:        | 1 bit, 0 offset             |
| Data Range:        | 0 to 255                    |
| Operational Range: | 1 to 5                      |
| Definitions:       | 0 – Invalid                 |
|                    | 1 – Profile Mode            |
|                    | 2 – Profile Acknowledgement |
|                    | 3 – Reserved                |

4 – Command Outputs (DVC745)  
 5 – Save to Permanent Memory  
 6...255 – Reserved

**Module Type**

Data Length: 1 Byte  
 Resolution: 1 bit, 0 offset  
 Data Range: 0 to 255  
 Operational Range: 1 to 2  
 Definitions: 1 – DVC745  
 2 – DVC745

**Output Command**

Data Length: 1 bit  
 Resolution: 1 bit, 0 offset  
 Data Range: 0 to 1  
 Operational Range: 0 to 1  
 Definitions: 0 – Output Off  
 1 – Output On

**Output Profile**

Data Length: 1 bit  
 Resolution: 1 bit, 0 offset  
 Data Range: 0 to 1  
 Operational Range: 0 to 1  
 Definitions: 0 – LED Mode Off  
 1 – LED Mode On

**Reset Faults With Command Cycle**

Data Length: 1 bit  
 Resolution: 1 bit, 0 offset  
 Data Range: 0 to 1  
 Operational Range: 0 to 1  
 Definitions: 0 – False, Output errors may only be reset by cycling power to the module.  
 1 – True, Output errors may be reset by cycling the outputs command.

### Module ID & PGN Map

| 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       |
|           |             |            |
|           |             |            |

## Accessories

### Order Guide

| Part Number | Description  |
|-------------|--|
| DVC745      | 12 high side ON / OFF output expansion module, 1x CAN port   |
| 999-10075   | Communications Cable, multi-controller, 4-way to PC (RS232), 2m length, auto-grade   |
| 108-00119   | Adapter, USB to RS232, use with 999-10075 assembly, only required if PC has no RS3232 'D' ports                                    |
| 999-10076   | Serial port adapter for program updates, 4 wires   |
| 999-10318   | DVC745, 30 pin connector kit with 1x CANbus (Deutsch) connector shell + pins, and serial port adapter 999-10076, assembly required |
| 999-10313   | DVC745, 30 pin prototype harness with 1x CANbus (Deutsch), 3m length, auto grade with serial port adapter 999-10076                |



Programmable System Controller

**Configured Using HCT's Program Loader Monitor (PLM)**

12 high side output expansion module, 1 CAN interface  
Supply voltage 9-30Vdc

The DVC745 is a robust digital output expansion controller for solenoid-operated ON/OFF valves, lights, alarms, etc. It is designed to be used as an output expansion module for the DVC700 series controllers or as a stand-alone output module using direct CAN bus communication.

- 12 ON / OFF output expansion module
- Can be used with any J1939 CAN capable control device
- Can be combined with DVC700 series controllers as an output expansion module for large system solutions
- Utilize as a stand-alone output module via J1939
- SAE J1939 or DVC DeviceNet CAN bus communication
- Open/short detection for diagnostics
- Rugged and fully encapsulated
- SAE J1455 environment and load dump compliant
- IP67, 69K
- CE Certified



**Operational Specifications**

|                              |   |
|------------------------------|---|
| <b>Supply Voltage</b>        | 9-30 V <sub>DC</sub> (recommended operating voltage +12 to +28 V <sub>DC</sub> , absolute maximum +/-32 V <sub>DC</sub> ) |
| <b>Supply Current</b>        | Total Load = 100mA (recommended supply current per power pin 5 Amps, absolute maximum 8 Amps)                             |
| <b>Operating Temperature</b> | -40 to +85°C  |
| <b>Storage Temperature</b>   | -40 to +100°C   |
| <b>Weight</b>                | 1.29 lbs (0.58 kg)  |
| <b>Dimensions</b>            | L: 5.50 in (140 mm) x W: 4.70 in (119 mm) x H: 1.65in (42 mm)   |
| <b>Enclosure</b>             | Solid potted, industry standard Deutsch enclosure with automotive connectors  |
| <b>NEMA / IP Rating</b>      | NEMA 6P / IP67, 69K   |

**Communication**

|                         |  |
|-------------------------|--|
| <b>CAN</b>              | 2.0B (maximum voltage +/-14V <sub>DC</sub> )                                       |
| Baud rates              | 125 kb/s, 250kb/s, 500kb/s, 1Mb/s, software configurable                           |
| Protocol                | SAE J1939, HCT DeviceNet   |
| Default baud rate       | 250kb/s  |
| <b>Serial Interface</b> | RS232 (maximum voltage Rxd,RTS = +/-15V <sub>DC</sub> Txd = +/-8 V <sub>DC</sub> ) |

Programmable System Controller

**Outputs**

|                         |  |
|-------------------------|--|
| <b>Digital (Qty 12)</b> | 3,000 mA sourcing, software configurable   |
| Current Leakage         | Off = 370µA, Supply = +28 V <sub>DC</sub><br>Off = 180µA, Supply = +13.6 V <sub>DC</sub> |
| Diagnostics             | Open/short circuit detection   |
| Fly back protection     | Integrated   |

NOTE: 1) Maximum voltage on any input pin +/-32 V<sub>DC</sub>

**Standards**

| Environmental                     | SAE J1455            | Immunity  | 89/336/EEC, EN 61000-6-2 |
|-----------------------------------|----------------------|-----------|--------------------------|
| Temperature                       | Section 4.1.3.2      | ESD       | EN 61000-4-2             |
| Salt Spray                        | Section 4.3.3.1      | EMC       | EN 61000-4-3             |
| Steam Cleaning & Pressure Washing | Section 4.5.3.2      | EMC       | EN 61000-4-4             |
| Vibration                         | Section 4.10.4.2     | RF        | EN 61000-4-6             |
| Shock                             | Section 4.11.3.4     | Emissions | 89/336/EEC, EN 61000-6-4 |
| Load Dump                         | Section 4.13.2.2.1.a |           | EN 55011                 |

**Certifications**

CE

Programmable System Controller

Pin Out

| Pin | Function |
|-----|----------|
|-----|----------|

|    |          |
|----|----------|
| A1 | Output 1 |
| A2 | CAN H    |
| A3 | RXD      |

| Pin | Function |
|-----|----------|
|-----|----------|

|    |          |
|----|----------|
| B1 | Output 2 |
| B2 | CAN L    |
| B3 | TXD      |

| Pin | Function |
|-----|----------|
|-----|----------|

|    |           |
|----|-----------|
| C1 | Output 3  |
| C2 | POWER COM |
| C3 | POWER COM |

|    |           |
|----|-----------|
| D1 | Output 4  |
| D2 | POWER COM |
| D3 | POWER COM |

|    |          |
|----|----------|
| E1 | Output 5 |
| E2 | Output 6 |
| E3 | Output 7 |

|    |           |
|----|-----------|
| F1 | Output 8  |
| F2 | Output 9  |
| F3 | Output 10 |

|    |           |
|----|-----------|
| G1 | Output 11 |
| G2 | POWER COM |
| G3 | POWER COM |

|    |           |
|----|-----------|
| H1 | Output 12 |
| H2 | POWER COM |
| H3 | POWER COM |

|    |              |
|----|--------------|
| J1 | + POWER IN 1 |
| J2 | + POWER IN 2 |
| J3 | + POWER IN 3 |

|    |              |
|----|--------------|
| K1 | + POWER IN 1 |
| K2 | + POWER IN 2 |
| K3 | + POWER IN 3 |

Programmable System Controller

Recommended Operating Parameters / Pin Functions

| Pin  | Name                      | Function/Features                                      | Range  |
|--|---------------------------|--|--|
| J1, K1   | Power In 1<br>(Note: 1)   | Positive Power Supply Input<br>Outputs 1 – 4 and Logic | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| J2, K2   | Power In 2<br>(Note: 1)   | Positive Power Supply Input<br>Outputs 5 - 8           | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| J3, K3   | Power In 3<br>(Note: 1)   | Positive Power Supply Input<br>Outputs 9 - 12          | +12V <sub>DC</sub> to +28V <sub>DC</sub>   |
| C2, C3, D2, D3<br>G2, G3, H2, H3                     | Power Common<br>(Note: 1) | Return for Power Supply or Signal<br>Com               | 0 Volts (GND)  |
| A1, B1, C1, D1,<br>E1, E2, E3, F1,<br>F2, F3, G1, H1 | Outputs                   | Sourcing Discreet Output                               | <p><b>Default Mode</b></p> <p>On = +Supply 3,000mA<br/>           Off = +Supply 370µA, Supply = 28V<sub>DC</sub><br/>           Off = +Supply 180µA, Supply = 13.6V<sub>DC</sub></p> <p><b>LED Mode</b></p> <p>On = +Supply 3,000mA<br/>           Off = 2.3V<sub>DC</sub> 342µA, Supply = 28V<sub>DC</sub><br/>           Off = 1.13V<sub>DC</sub> 166µA, Supply = 13.6V<sub>DC</sub></p> |

Notes:

1. Maximum continuous current allowed on any single connector Pin = 8 Amps
2. All limits are guaranteed by testing or statistical analysis
3. Each Power pin used must be individually fused with an ATO 5, AGC 5 or smaller fuse
4. High voltage transient protection is monitored on Power In 1 (Load Dump)
5. Power In 1, Power In 2 and Power In 3 are electrically separate Power Planes
6. Outputs 1 – 4 and the controllers on board logic is supplied from Power In 1
7. Outputs 5 – 8 are supplied from Power In 2
8. Outputs 9 – 12 are supplied from Power In 3

Programmable System Controller

LED Diagnostic Indicators

| 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>   | Low Supply Voltage.                             |

| CAN Status            |   |
|-----------------------|---|
| On <b>GREEN</b>       | Communication established with another Master Controller      |
| Flashing <b>GREEN</b> | Waiting to establish communication with the Master Controller |
| On <b>RED</b>         | J1939 Communications are in a timed out state                 |
| Flashing <b>RED</b>   | The HCT DeviceNet communication is in a timed-out state       |

| Status 1               |                                 |
|------------------------|---------------------------------|
| One <b>GREEN</b> Flash | An output has changed its state |
| On <b>GREEN</b>        | Normal operation                |

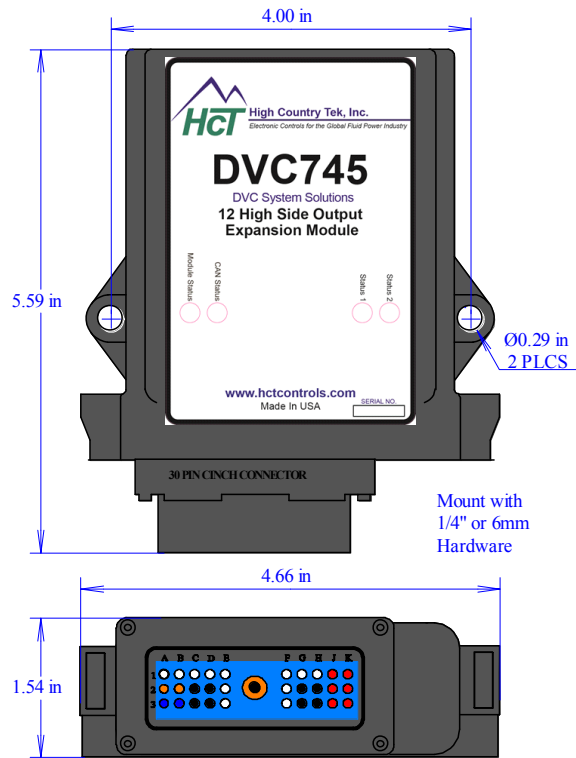
| Status 2        |                  |
|-----------------|------------------|
| On <b>GREEN</b> | Normal operation |

Programmable System Controller

**Physical Description**

Notes:

- 1) All dimensions are in Inches (Millimeters).
- 2) Use 1/4 x 20 SAE Grade 2 bolts (M6 x 1 ISO Grade 8)
  - \* Torque to 4 ft-lbs (5.4 N-m) Dry
  - \* Torque to 3 ft-lbs (4.1 N-m) Oiled
- 2) Mount to a flat hard surface protected from excess heat and moving parts.
- 3) Factory recommended minimum 18-22 AWG (1.02mm to 0.64mm) TXL, XSL, and GXL automotive grade wire
- 4) Each Power pin used must be individually fused with an ATO 5, AGC 5 or smaller fuse



**Connections**

|                                  |                         |
|----------------------------------|-------------------------|
| <b>Module Connector - 30 Pin</b> | Cinch 581-01-30-001     |
| <b>Mating Connector - 30 Pin</b> | Delphi Packard 12048455 |
| <b>Mating Connector Pins</b>     | Delphi Packard 12103881 |

**Order Guide**

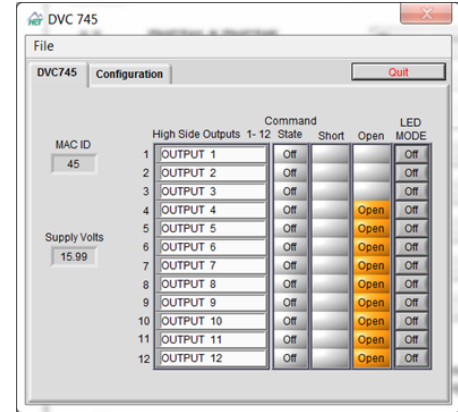
| Part Number      | Description  |
|------------------|--|
| <b>DVC745</b>    | 12 high side ON / OFF output expansion module, 1x CAN port   |
| <b>999-10075</b> | Communications Cable, multi-controller, 4-way to PC (RS232), 2m length, auto-grade   |
| <b>108-00119</b> | Adapter, USB to RS232, use with 999-10075 assembly, only required if PC has no RS232 'D' ports                                     |
| <b>999-10076</b> | Serial port adapter for program updates, 4 wires   |
| <b>999-10318</b> | DVC745, 30 pin connector kit with 1x CANbus (Deutsch) connector shell + pins, and serial port adapter 999-10076, assembly required |
| <b>999-10313</b> | DVC745, 30 pin prototype harness with 1x CANbus (Deutsch), 3m length, auto grade with serial port adapter 999-10076                |

**Programmable System Controller**

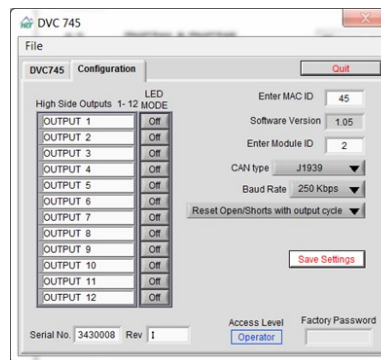
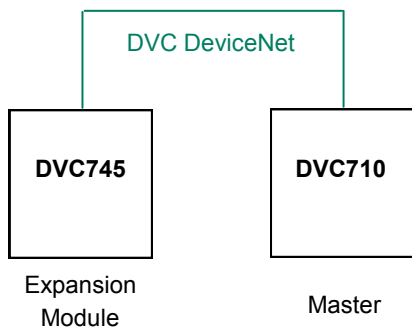
**Program Loader Monitor Configuration**

The DVC745 is configured using HCT's free Program Loader Monitor (PLM). The PLM is the separate graphical user interface component to the Intella Software Suite™ and can be downloaded from HCT's website. Configuration through the PLM allows the user to;

- Enable or disable open circuit detection
- Configure output errors to reset with unit power cycle or command output cycle
- Configure MAC ID, Module ID, communication rate and CAN communication types



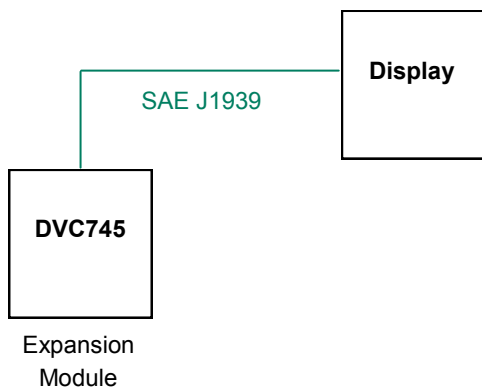
DVC745 PLM Dashboard Window



DVC745 PLM Configuration Window

Note: For more details on how to configure the DVC745, refer to the DVC745 User Manual.

**Direct CAN bus Control Configuration**



The DVC745 can be used with any J1939 capable control unit.

- Command Outputs directly for the DVC745 controller without needing a DVC710 or DVC707 master controller
- Configure the outputs directly from a CAN capable display or controller including: command state, open circuit detection and error reset mode
- Monitor output status directly from a CAN capable display or controller for safety messages and diagnostics
- Compatible with High Country Tek's rugged displays (PV780 and PV450)

Note: For more details on how to configure the DVC745, refer to the DVC745 User Manual.

Programmable System Controller

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