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CE 0539

DVC-DN Discrete Valve Controller
DVM-DN Discrete Valve Monitor

TopWorx discrete valve controllers integrate sensors, bus communications, pilot valve, and termination points into a variety of enclosures, delivering the ultimate in modularity.

- Direct Mount with no brackets
- Zone 2 (Cl I, Div 2)
- 3 DI and 2 DO (1 AI optional)
- Seamless integration with Networx products

Table of Contents

3300 Fern Valley Road, Louisville, Kentucky 40213 USA **www.topworx.com**
502.969.8000 phone 502.969.5911 fax info@topworx.com

TOPWORX

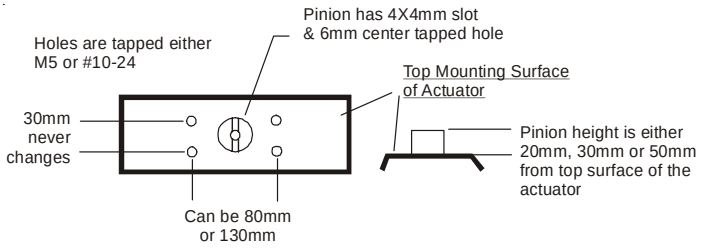
Lumitech DVC-DN & DVM-DN

ISO 5211/NAMUR Actuator Accessory Mounting

The TopWorx Lumitech DVC and DVM product line is a DeviceNet (DN) compatible direct mount valve control and/or monitoring package for any ISO5211/NAMUR actuator.

Though specifically designed for direct interface with ISO 5211/NAMUR accessory mounting dimensions, the unit can be used on nearly any non-NAMUR actuator utilizing one of TopWorx's VIP Bracket Kits. Our bracket kits are manufactured in-house from stainless steel flat and bar stock, providing superior stability and corrosion resistance for the life of the product. These mounting kits may be found in the VIP Mounting Kits section of the TopWorx Process Automation Solutions Pricing Guide (publication L-L106), attainable through our distribution network, or on-line at **www.topworx.com**. See Figure 1 for the ISO 5211/NAMUR accessory mounting standard.

Figure 1
ISO 5211/NAMUR standard



Since the Lumitech unit is designed for direct mounting to ISO 5211/NAMUR actuators, you will realize a cost and labor savings on projects since there are no mounting brackets to purchase or install.

Mechanical Installation Procedures

Your Lumitech package comes complete with all necessary fasteners for mounting to any ISO/NAMUR actuator. The holes on the top accessory mounting pad are tapped either M5 or #10-24 (see Figure 1 above), both of which are included in the hardware package.

Reference Figure 2 for all steps below.

Step 1
Thread the M5 or #10 stud into the holes on the top surface of the actuator on the same side as the air ports of the actuator. Tighten the studs using good mechanical practices. The enclosure is designed to be transversely mounted to the length of the actuator.

When mounting the unit using the 80mm spaced holes, the crescent shaped spacer must be used under the enclosure.

Step 2
Slide the enclosure mounting feet over the installed studs and secure with the washers and nuts provided.

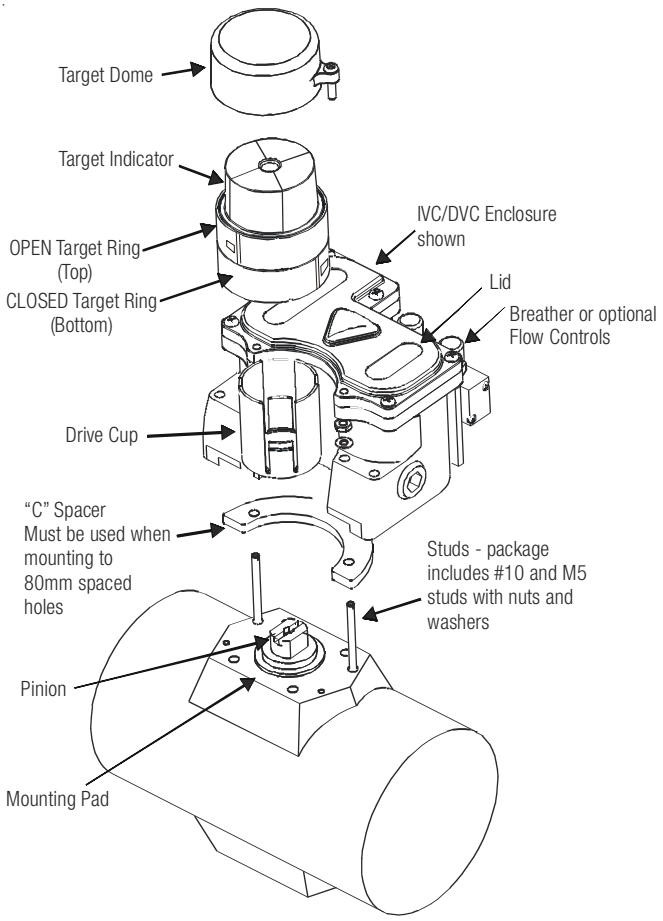
Step 3
Attach the Drive Cup to the actuator pinion. Align the tang on the bottom with the slot in the actuator pinion.

Step 4
To install the target assembly, look in the bottom of the target assembly (Core Indicator and Target Rings). You will see ribs and slots on the inside diameter of the Target Core. Align the slots with the tangs on the Drive Cup, and push the assembly down until it bottoms out.

Typically, the valve is in the Closed state when received. It is best to have one of the Red "Closed" quadrants facing the triangular LED lens in the enclosure lid.

Step 5
Install the Dome with the captured screws through the enclosure lid.

Figure 2
Mechanical Installation Exploded View



Enclosure / Target Materials of Construction	
Enclosure Body and Lid	Polybutylene Teraphthalate (PBT) / Polycarbonate Blend
LED Lens	Polycarbonate
Enclosure O-ring	Silicone
All Enclosure Inserts	Stainless Steel
Spool Valve Manifold Gasket	Silicone
Target Core and Target Rings	Polybutylene Teraphthalate (PBT) / Polycarbonate Blend
Dome	Polycarbonate

This product comes shipped with plastic plugs in the conduit entries in an effort to protect the internal components from debris during shipment and handling. **It is the responsibility of the receiving and/ or installing personnel to provide appropriate permanent sealing devices to prevent the intrusion of debris, or moisture, when stored outdoors or when installed.**

It is the responsibility of the installer, or end user, to install this product in accordance with the National Electrical Code (NFPA 70), or any other national or regional code defining proper practices.

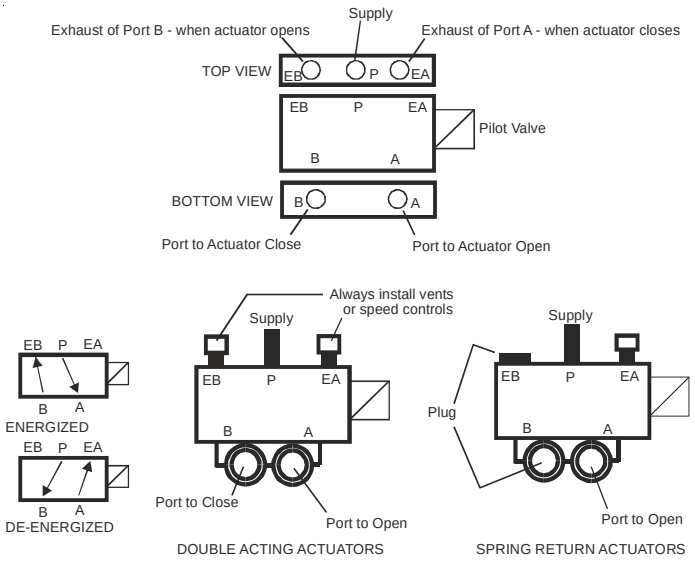
Pneumatic Hookup Procedures

Prior to connecting the supply air to the spool valve, flush the system to remove any debris or contaminates. Galvanized pipe can easily flake and contaminate the system and therefore is not recommended.

4-Way Spool Valves

The TopWorx spool valve is a 5 port, 4-way valve driven by an internally mounted pilot valve. The electrical hookup of the pilot is covered in the DeviceNet Specification section. The spool valve supply port and work ports are 1/4 FNPT. The exhaust ports are 1/8 FNPT, marked as follows for the DVC:

Figure 3 - TopWorx Spool Valve



Highly Recommended

TopWorx highly recommends Locktite 567 brand thread sealant. Do not use a hard setting pipe compound. If Teflon thread seal tape is used, start the wrap on the second thread from the leading thread of the fitting. This will prevent tape shreds from contaminating the spool valve seals.

Flow controls (AL-M21) or Breathers (AL-M31) should be installed in the exhaust posts to keep debris from falling into the spool valve and damaging the seals. This must be addressed prior to installation, or storage.

Spool Valve Specifications for DVC-DN

Spool Valve Specifications	
Medium	Dried/filtered air (5 micron)
Max Operating Pressure	100psi (0.7 MPa)(6.89 Bar)
Min Operating Pressure	30psi (0.21 MPa)(2.07 Bar)
Ambient Temperature Range	22^0 to 122^0F (-5^0 to 50^0C)
Flow Coefficient	1.2 Cv
Environment Rating	Type 4, 4X, IP56
Port Size	1/4" NPT(Supply & Work), 1/8" NPT(Exhaust)
Pilot Operator Manual Override	Non-Locking Push Type
Valve Body	Diecast aluminum, dichromate and / or epoxy coating. Stainless steel option.
Valve Seals	Buna-N

Don't forget!

TopWorx has a complete line of breathers, flow controls, regulators and filters.

Check out **www.topworx.com** or call us at **502.969.8000** for more details

Basic DeviceNet I/O Operation

The DeviceNet Sensor-Communications Module (known hereafter as SCM-DN) operates as a combined discrete input and output device on the DeviceNet network. It is a slave (server) device that can be allocated by the system implementer to one specific master (client). There are several parameters that may be modified by the user. These are collected in a block of data called the Parameter Object (see Table 17, pg. 9). They may be left as defaulted, depending upon your application.

The Polled I/O feature follows the conventional method of a client requesting data from and/or sending data to one server at a time. This requires both a command message from the client and a response message from each server for every set of I/O. To improve throughput on the network Change-of-State and Cyclic I/O functions have been defined by the DeviceNet protocol. These functions are supported by the SCM-DN. The discrete data returned in the poll response to the client will contain both valve contact input and valve command output status data.

Polled I/O

The client can poll (read) the input and command the output status from the SCM-DN and can energize or de-energize the discrete outputs on the SCM-DN. The status LEDs report the actual state of the valve; i.e. the red led is lit when the valve is closed, and the green led is lit when the valve is open.

The client controls the valve outputs by sending a poll command to the SCM-DN. If no data is sent to the SCM-DN during a poll, then the outputs are put into the "idle" state and their actions are then governed by the Idle Action and Idle Value attributes of the Parameter Object (See Table 17, pg. 9).

Both idle and fault operations are implemented for the valve output points. The outputs can be set individually to hold last state or to implement user-defined states upon receipt of an "idle" command or upon a "fault" condition. You can implement these actions via the Parameter Object (See Table 17, pg. 9).

Cyclic and Change-of-State I/O

Both the Cyclic and Change-Of-State (COS) are activated by allocating a connection for one or the other using the allocate service of the DeviceNet Object (class 3), and setting the EPR (Expected Packet Rate) for that connection. The value for the EPR is used to set the various communication timers.

The Cyclic connection initiates a transmission every time the connection timer expires. The cyclic connection can only send data from the SCM-DN to it's assigned client. The polled and cyclic connections are not exclusive, so both can exist at the same time. The manner in which cyclic connection reports its data is the same as the polled connection.

The Change of State (COS) connection is the same as the cyclic connection except that as well as triggering communications on the expiration of the timer, the COS connection also initiates a transfer on a change of the valve's status. The COS connection is mutually exclusive with the cyclic connection, but can coexist with the polled connection. The COS connection operation is very useful in conserving bandwidth, and provides the client with the most current data as fast or faster than a poll connection. The COS connection automatically turns on the COS mechanism when the connection is created.

Quick Start for DeviceNet

Limit Switch Calibration

Step 1
Once pneumatic hookup and wiring has been completed close the valve using the SCM-DN on-board calibration switch, as seen in Figure 4. If no DeviceNet network connection is available, you may connect to a 24VDC power supply.

Step 2
With a flat blade screwdriver, place blade in slot on lower Target Ring and twist. This disengages the snap lock. Rotate the lower Target Ring clockwise until the Red LED lights. Squeeze the Target Ring until the snap lock is engaged.

Step 3
Open the valve by sliding the calibration switch to the OPEN position.

Step 4
With a flat blade screwdriver, place blade in slot on upper Target Ring and twist. This disengages the snap lock. Rotate the upper Target Ring counter-clockwise until the Green LED lights. Squeeze the Target Ring until the snap lock is engaged.

Step 5
Cycle the valve CLOSED and OPEN a few times using the calibration switch to verify both limit switches are maintaining their set points.

Step 6
Finally, slide the calibration switch to the DeviceNet position. The DeviceNet network will now have full control of the valve once the SCM-DN has been addressed.

How to Install and Establish DeviceNet Communications

Step 1
Connect the DeviceNet cable to the round 5-pin round mini or micro connector according to DeviceNet cable wiring specifications, or wire directly to the terminals on the SCM-DN.

Step 2
Make sure that the DeviceNet network is terminated properly.

Step 3
Set the baud rate and address of the SCM-DN if different from default (see Table 2).

Step 4
Make sure that there is power on the DeviceNet network and that it is plugged into a Master device.

Step 5
Plug the DeviceNet cable into the SCM-DN.

Step 6
In fixed baud rate mode, the SCM-DN will undergo its initialization sequence, flashing both LEDs. After approximately 4 seconds, the Module Status LED (labeled "MS") will go on solid green and the Network LED will flash green.

Step 7
In autobaud mode, the SCM-DN the Module Status LED will continue to blink until the SCM-DN recognizes valid traffic on the DeviceNet link and syncs to a specific baud rate.

Step 8
The green Network Status LED (labeled "NS") will go on solid once the Master recognizes the unit on the link and allocates the connection (commissions it).

Step 9
The SCM-DN is now operating on the network.

How to Configure the DeviceNet Node Address and Baud Rate

Step 1
The address and baud rate can be set using the 6-position DIP switch blocks, SW1 and SW2 (as seen in Figure 4).

Step 2
Switches 1 and 2 on SW2 define the baud rate selection as shown in Table 2.

Step 3
Switches 1 through 6 on SW1 define the address selection as shown in Table 1.

Step 4
Switch setting changes will NOT take effect until the device is reset with either a RESET command or a power cycle.

How to Configure the Network Communications Protocol

Step 1
Switches 3, 4 and 5 on SW2 define which link is selected –DeviceNet or Modbus – as shown in Table 3.

Step 2
For DeviceNet set all 3 switches OFF or 0.

Step 3
If you change the switches, the new selection will not become effective until the unit is power cycled or a Reset command is received by the SCM-DN.

Step 4
Switch 6 of SW2 selects the Modbus protocol for ASCII or RTU as shown in Table 4.

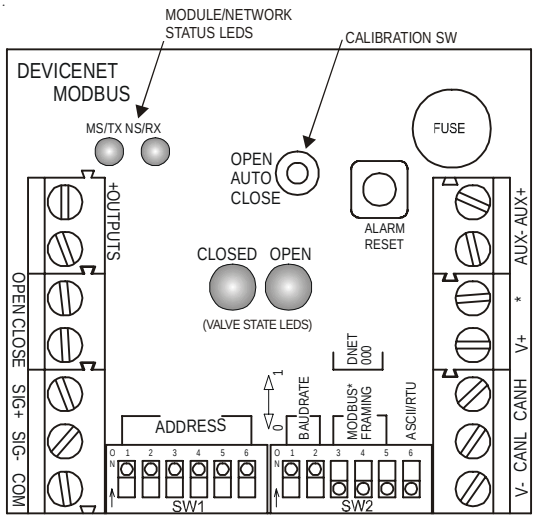


Figure 4 - DeviceNet Sensor-Communication Module (SCM-DN) Top View

The SCM-DN can be connected to the main DeviceNet trunk line or to a drop line via cable connection to the 5-pin Mini or Euro type quick disconnect plug. The network shield is not terminated. Connections to the pilot valve and relay contacts are all made internal to the enclosure.

Note: Switches are read from left to right as viewed in Figure 4.

Table 1 - Address Selection

Node Address	ADDRESS Switch Position					
	SW 1,1	SW 1,2	SW 1,3	SW 1,4	SW 1,5	SW 1,6
	Switch Position Values					
	32	16	8	4	2	1
0	OFF	OFF	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	OFF	OFF	ON
2	OFF	OFF	OFF	OFF	**ON**	OFF
3	OFF	OFF	OFF	OFF	**ON**	ON
4	OFF	OFF	OFF	**ON**	OFF	OFF
5	OFF	OFF	OFF	**ON**	OFF	**ON**
. . .						
62	**ON**	**ON**	**ON**	**ON**	**ON**	OFF
63	**ON**	**ON**	**ON**	**ON**	**ON**	**ON**

Table 2 - Baud Rate Selection

DeviceNet Baud Rate	DIP Switch Position	
	SW 2,1	*SW 2,2*
125k	OFF	OFF
250k	OFF	ON
500k	ON	OFF
Autobaud	ON	ON

Table 3 - Communications Protocol Selection

DeviceNet	Modbus	DIP Switch Position		
		SW 2,3	*SW 2,4*	*SW 2,5*
DeviceNet	N/A	OFF	OFF	OFF
N/A	7,N,2	OFF	OFF	**ON**
N/A	7,E,1	OFF	**ON**	OFF
N/A	7,O,1	OFF	**ON**	**ON**
N/A	8,N,1	**ON**	OFF	OFF
N/A	8,N,2	**ON**	OFF	**ON**
N/A	8,E,1	**ON**	**ON**	OFF
N/A	8,O,1	**ON**	**ON**	**ON**

Table 4 - Modbus Protocol

Modbus Protocol	DIP Sw Position
	SW 2,6
ASCII	OFF
RTU	ON

Contact TopWorx to see our selection of diagnostic tools designed to reduce the total cost of ownership of DeviceNet networks and devices.

Our handheld diagnostic and troubleshooting device with a simple user interface is a powerful startup, verification and troubleshooting tool for any DeviceNet network.

How to Read Discrete Input Data – DeviceNet

Step 1
Plug the DeviceNet connector into the SCM-DN. This powers up the unit electronics.

Step 2
Allocate a Poll Connection to the SCM-DN from the client.

Step 3
Perform a poll command to the SCM-DN from the client. The SCM-DN returns 2 bytes of data using Assembly Instance 1 (default).

Step 4
The discrete input channel values will be available in the first 2 bits of data in the 1st **byte returned.**

Table 5 - Poll Response (Input Data) Assembly Instance 1

	Bit Positions							
BYTE	7	6	5	4	3	2	1	0
1	Reset Sw Sate	Aux Input State	Calibrate Close Sw State	Calibrate Open Sw State	Close Output State	Open Output State	Close Limit Sw State	Open Limit Sw State
2	0	0	0	0	Analog Input Alarm	Cycle Count Alarm	Close Timeout Alarm	Open Timeout Alarm

Using Assembly Instance 2 (see Table 17, Parameter 10), the Cycle Open and Close Times are added to the poll bytes in Table 5, as shown above.

Table 6 - Poll Response Assembly Instance 2

BYTE	Description
1	Input Status Bits
2	Alarm Bits
3	LS Byte of Last Open Time
4	MS Byte of Last Open Time
5	LS Byte of Last Close Time
6	MS Byte of Last Close Time

Using Assembly Instance 3, the Cycle Count is added to the poll bytes in Table 5, as shown here.

Table 7 - Poll Response Assembly Instance 3

BYTE	Description
1	Input Status Bits
2	Alarm Bits
3	LS Byte of Cycle Count
4	MLS Byte of Cycle Count
5	MMS Byte of Cycle Count
6	MS Byte of Cycle Count

Assembly Instance 4 incorporates all data.

Table 8 - Poll Response Assembly Instance 4

BYTE	Description
1	Input Status Bits
2	Alarm Bits
3	LS Byte of Last Open Time
4	MS Byte of Last Open Time
5	LS Byte of Last Close Time
6	MS Byte of Last Close Time
7	LS Byte of Cycle Count
8	MLS Byte of Cycle Count
9	MMS Byte of Cycle Count
10	MS Byte of Cycle Count

How to Energize and De-energize Valve Solenoids

1. Reconnect the SCM-DN and allocate a Poll Connection to the SCM-DN from the client.
2. Issue a Poll Command from the client with a data value of 00, 01 or 02. Each of the two possible outputs will be turned ON or OFF, as defined by a corresponding bit value of 1 or 0. Note that having both the Open and Close bit set is an illegal state and will be ignored by the SCM-DN.

Table 9 - Poll Request (Output Data)

Bit Positions								
BYTE	7	6	5	4	3	2	1	0
1	0	0	0	Reset Cycle Count	Enable Cal Switch	Reset Alarms	Close	Open

The operation of the Open and Close control bits is as follows:

Table 10 - Solenoid Action Commands

Open Bit	Close Bit	SCM Action
OFF	OFF	De-energize both solenoid outputs
ON	OFF	Energize Open solenoid output, de-energize Close solenoid output
OFF	ON	Energize Close solenoid output, de-energize Open solenoid output
ON	ON	Holds Last State

To open the valve, set the Open bit to 1 for at least one poll message. A value of 0 will deactivate the output to the solenoid. The Close bit operates in the same fashion.

Setting the Reset Alarms bit to 1 clears the Open and Closed Time counters and resets all active alarm notification bits. As long as this bit is set, the alarms will be inactive.

The Enable Cal Switch bit is set to 1 to allow the Open/Close Calibration Switch on the module to be used manually to calibrate the limit switches. The calibration switch is also enabled if the device gets an empty poll message, which puts the device into Idle Mode.

The Reset Cycle Count bit is set to 1 to clear the Cycle Counter.

LED Indication Status Feedback

The DeviceNet module has two LEDs that provide visual status feedback to the user about the product and the DeviceNet network. These LED obviously are not visible with the enclosure lid attached, but are most beneficial when commissioning and testing the device and network.

Table 11 - Module Status, LED Indications

LED State	Module Status	Meaning
OFF	No Power	No power through DeviceNet
Green	Device Operational	SCM-DN operating normally
Flashing Green	Device in Standby	SCM-DN needs commissioning
Flashing Red	Minor Fault	Recoverable Fault
Red	Unrecoverable Fault	SCM-DN may need replacing
Flashing Red/Green	Device Self-testing	SCM-DN in self-test mode

Table 12 - Network Status, LED Indications

LED State	Module Status	Meaning
OFF	No power not online	SCM-DN has no power, or not completed the Dup_MAC_ID test
Flashing Green	Online, not connected	SCM-DN is Online but not allocated to a Master
Green	Online	SCM-DN operating normally
Flashing Red	Connection Timeout	One or more I/O connections have timed out
Red	Critical Link Failure	SCM-DN detected an error that makes it incapable of communicating on the link (Bus off or dup MAC_ID)

Valve State Indicator LEDs

There are two Valve State Indicating LEDs on the DeviceNet module. Again, these LEDs are not visible through the enclosure lid, but are used in set up and calibration of the device.

Table 13 - Valve Position Indication LEDs

LED State	Red	Green
OFF	Valve not Closed	Valve not Open
ON	Valve Closed	Valve Open
Flashing	Valve has timed out on stroke	Valve has timed out on stroke

DeviceNet Network Topology and Distances

DeviceNet specifications provide for the maximum distances allowable for the main trunk line and drops based on the baud rate selected.

Table 14 - Maximum Network Lengths

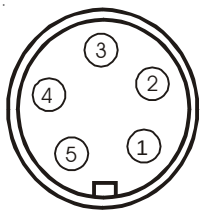
Baud Rate	Trunk Line Length		Drop Length			
	Max Distance		Maximum		Cumulative	
	Meters	*Feet*	*Meters*	*Feet*	*Meters*	*Feet*
125k	500	1640	6	20	156	512
250k	250	820	6	20	78	256
500k	100	328	6	20	39	128

Table 15 - DeviceNet Conductor sizes

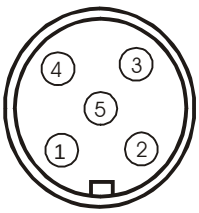
Function	Thick wire	Thin wire
Power	15 AWG	22 AWG
Signal	18 AWG	24 AWG

DeviceNet Quick Disconnect Wiring

The DVC-DN can be connected to the network via hardwire to the terminal strip provided on the DeviceNet module, or the device can be fitted with 5-pin Mini or Euro type quick disconnect plugs.



MINI Style
Male View



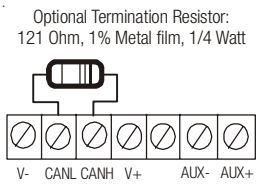
EURO Style
Male View

Pin Connections:
Pin 1 = Not Connected
Pin 2 = V+
Pin 3 = V-
Pin 4 = CANH
Pin 5 = CANL

Network Terminating Resistor

A DeviceNet system ***must be terminated at each end of the trunk line.*** The host controller and the last device on the network must always have a terminating resistor installed to prevent reflections, even if only two nodes are present.

Figure 5 - Terminating Resistor Specs and Connection



Caution: Per DeviceNet specifications, do not use a terminating resistor on any drop line devices.

I/O Connections (Solenoids)

The single pilot wires are factory terminated for the integral mounted spool valve. Use the table below if making your own pilot valve terminations.

Table 16 - Pilot Valve Terminations

Solenoid No.	Positive Terminal +24VDC	Negative Terminal Signal to Solenoid
1	+Output	Open
2	+Output	Close

Important: All DC output and DC input circuits are polarity sensitive. Proper operation requires they be wired as shown above. The outputs will not work and the device can be damaged if terminations do not conform to the table.

All terminals on the module accept 22 to 12AWG conductors.

Power Requirements

Device Power

The SCM-DN can be powered via the network connection or an external power supply. Typically the device is powered from the 11-25VDC network power. In Modbus mode, the DVC/DVM-DN is powered from a factory-supplied 24VDC source connected to the V+/V- terminals. The DVC/DVM-DN module consumes 45mA of current at 24VDC, or 1.1 Watts (Typical).

Utilizing an external power supply reduces the load on the DeviceNet power supply and provides a degree of electrical isolation between the device and the network.
Power to and from the limit switch relays and the pilot valves are fed through the DeviceNet module via the device power connection.

Power Fuse

The DVC/DVM-DN module has an on-board 1 Amp fuse.

Note: Should the pilot device outputs exceed 1/2 Amp, this fuse may require replacing. Contact the factory.

Software Configuration

Parameters

The SCM-DN is software configurable for several parameters. The following table defines the legal and default values for the I/O configuration selections.

Table 17 - Configuration Parameters (Class 15)

Instance	Parameter Name	Values	Default Setting	Default Value	Description
1	Max Open Time	0 to 65535	Disabled	0	Max time allowed for valve to Open before triggering an alarm
2	Max Close Time	0 to 65535	Disabled	0	Max time allowed for valve to Close before triggering an alarm
3	Cycle Count Limit	0 to 4294967295	Disabled	0	Max number of cycles allowed before triggering an alarm
4	Analog High Limit	0 to 255	Disabled	255	Highest analog value before triggering an alarm
5	Analog Low Limit	0 to 255	Disabled	0	Lowest analog value before triggering an alarm
6	DNet Fault Action	0 or 1	Use Fault Value	0	0 = Use fault value 1 = Hold last state
7	DNet Fault Value	0 thru 3	OFF	0	0 = OFF 1 = Open 2 = Close 3 = No change
8	DNet Idle Action	0 or 1	Use Fault Value	0	0 = Use fault value 1 = Hold last state
9	DNet Idle Value	0 thru 3	OFF	0	0 = OFF 1 = Open 2 = Close 3 = No change
10	Ass'y Config	1 to 4	Standard Ass'y	1	1 = Status & Alarm bytes 2 = Status & Alarm bytes = last Open & Close Times 3 = Status & Alarm bytes + Cycle Count 4 = Status & Alarm bytes + last Open/Close Times + Cycle Count

Definitions of these parameters are as follows:

Max Open Time-Maximum allowed time for the valve to open before triggering an alarm.

Max Close Time-Maximum allowed time for the valve to close before triggering an alarm.

Cycle Count Limit-Maximum number of valve cycles allowed before triggering an alarm.

***Analog High Limit-**Highest analog value allowed before triggering an alarm.

***Analog Low Limit-**Lowest analog value allowed before triggering an alarm.

Output Fault Action-Selection to determine whether each output will hold its last state or assume the value identified in the next parameter upon a device fault.

Output Fault Value-The value each output will assume after a fault if fault value is selected above (hold last state is not selected).

Output Idle Action-Selection to determine whether each output will hold its last state or assume the value identified in the next parameter if an Idle Command is issued by the Master.

Output Idle Value-The value each output will assume upon an Idle Command if Idle Value is selected above (hold last state is not selected).

Assembly Configuration-This determines what data is returned in the poll response. See Tables 5 through 8 for values and data formats.

*Contact factory for information concerning Analog Input options.

Calibration of Limit Switches

A calibration switch is provided on the DeviceNet SCM-DN to allow for manual stroking of the actuator to set the limit switch trip points. A three position toggle on the device module (see Figure 4) is labeled:

OPEN-AUTO-CLOSE

The calibration switch is active ONLY while the device is in Idle Mode, or if the ENABLE_CAL_SWITCH bit is set in the poll output command byte. This allows the pilot valve outputs to be manually energized through the device module or the remote controller via network commands. The following tables describe the calibration switch and ENABLE_CAL_SWITCH features.

Table 18 - Enable Cal Switch Bit

ENABLE CAL SWITCH Bit Value	Manual Calibration Status
0 = OFF	Disabled. Calibration switch has no effect.
1 = ON	Enabled. Valve may be stroked using the calibration switch.

Table 19 - Calibration Switch Operation

Switch Position	Action
OPEN	Energizes the Open solenoid terminals, de-energizes the Close solenoid terminals
AUTO	Places control of solenoid terminals into DeviceNet network commands
CLOSE	Energizes the Close solenoid terminals, de-energizes the Open solenoid terminals

Open/Close Timers and Alarms

The SCM-DN tracks the time it takes the valve to open or close by recording the interval between when an Open, or Closed, command is received and the corresponding limit switch relays feedback. These times may be read in the poll response if Assembly Instance 2 or 4 is selected. Additionally, you may set corresponding alarm limits on these times by setting the appropriate parameters in the Parameter Object (see Table 17). When the configured time is exceeded during an Open or Closed operation, the corresponding alarm bit will be set and returned in the Alarm Byte (byte 2) of each input response to a poll command.

These Open/Close Time Alarms are set in 10 msec increments with a minimum of 10 msec, and a maximum of 109 min 13.5 sec.

When an alarm is active the corresponding Position Indicating LED flashes, as defined in Table 13.

Cycle Counter and Alarm

The Cycle Counter is a means to track the total number of cycles an actuator will see during its life for diagnostic and maintenance information feedback.

The Cycle Counter counts the number of times an actuator performs one Open, one Closed cycle. The counter will register up to 4, 294, 967, 295 cycles before clearing and starting back at 0.

A Cycle Count Alarm may be set that when exceeded will activate an alarm condition. The actual count is written to the non-volatile (NV) memory. This is done only every 256 counts to avoid excessive writes to the NV register.

The Cycle Counter can be reset to 0 as appropriate, such as changing out an actuator, by setting Bit 4 in the Poll Command byte (see Table 9).

If the number of cycles exceeds the limit value you set in Parameter 3, the Cycle Alarm bit will be set, and returned, in the Alarm Byte (byte 2) of each Input Response to a Poll Command.

Configuring the Alarms

The alarms are not active if the limit values are zero. To activate an alarm, set a Limit Parameter to a non-zero value (see Table 17, Parameters 1, 2 and 3).

Clearing the Alarms

There are two ways to clear the alarms.

The Reset Alarms bit (bit 2 in Table 9) may be set to clear ALL alarms. If this bit is left active, the alarm counters and notifications will be cleared.

The other way is to push the Reset Alarms button on the DeviceNet module in the DVC/DVM-DN (see Figure 4).

Note: If the cause of the alarm remains, resetting the alarms with the Reset Button, or the Output Command bit, only restarts the counters/timers on the next operation. To clear the alarm entirely, remove the alarm trip condition and then reset the alarm(s).

DeviceNet Technical Details

The following describes the DeviceNet Objects present in the SCM-DN. The SCM-DN conforms to a Type 7, Generic I/O device.

Table 20 - DeviceNet Objects

Object	DeviceNet Object Class	No. of Instances
Identity	1	1
Message Router	2	1
DeviceNet	3	1
Assembly	4	3
Connection	5	2 (Explicit msg, polled I/O)
Parameter	15 (F_{hex})	6
Serial ASCII Input/Output	100 (64_{hex})	1
Valve Controller	110 ($6E_{hex}$)	1
Alarm	111 ($6F_{hex}$)	5
Alarm Group	112 (70_{hex})	2

Identity Object Class 1. Instances 0 and 1 exist in the SCM-DN.

Table 21 - Identity Object Class Attributes (Instance 0)

Attribute ID	Access Rule	Name	DNet Data Type	Description of Attribute	Value
1	Get	Rev	UINT	Rev of this object	1
2	Get	Max. Obj Instance	UINT	Max Instance no. of current object	1
6	Get	Max. Class Attribute ID	UINT	Attr ID no. of last Class Attr of the Class Definition implemented in the device	7
7	Get	Max. Instance Attribute ID	UINT	Attr ID no. of last Instance Attr of the Class Definition implemented in the device	1

Table 22 - Identity Object Instance Attributes (Instance 1)

Attribute ID	Access Rule	Name	DNet Data Type	Description of Attribute	Value
1	Get	Vendor	UINT	ODVA Vendor No. for this product	9
2	Get	Device Type	UINT	ODVA General I/O Device Type	0
3	Set	Product Code	UINT	TopWorx Unique Product Code No.	110
4	Get	Revision	STRUCT of:	Revision of this device	2.050
		Major Rev	USINT		
		Minor Rev	USINT		
5	Get	Status	WORD	Summary Status of device	0
6	Get	Serial No.	UDINT	TopWorx Unique Device Serial No.	XXXX
7	Get	Product Name	SHORT STRING	ASCII Name of product	DNP
10	Get/Set	Heartbeat Intervall	USINT	The interval, in seconds, that the device generates a heartbeat message. A value of 0 disables heartbeat generation.	0

Table 23 - Identity Object Common Services

Service Code	Class	Instance	Service Name	Description of Service
05hex	YES	YES	Reset	Invokes the Reset Service for the device
0Ehex	YES	YES	Get_Attribute_Single	Returns contents of specified attribute
10hex	NO	YES	Set_Attribute_Single	Modifies an attribute value

Parameter Object - Class 15 ($0F_{hex}$)

There are many configurable data parameters associated with the SCM-DN. The SCM-DN uses a Parameter Object (a collection of user configurable parameters) to assist you in reading and changing the configurable data. These parameters are retained in the NV memory. Following are the Class Attributes, Instance Attributes and Services supported by the DVC/DVM-DN for the Parameter Object.

Table 24 - Parameter Class Attributes (Instance 0)

Attribute ID	Access Rule	Name	DNet Data Type	Description of Attribute	Value
1	Get	Revision	UINT	Rev of this object	1
2	Get	Max Instance	UINT	Max Instance no. of the Parameter Object	10
8	Get	Parameter Class Descriptor	WORD	Bits describing parameters	9

Table 25 - Parameter Instance Attributes

Attribute ID	Access Rule	Name	DNet Data Type	Description of Attribute	Value
1	Set	Parameter value	*Data type* specified in Descriptor Data Type and Size	Actual value of paramter. Can be read from or written to. This Attribute is read only if bit 4 of Attribute is TRUE.	0
2	Set	Link path size	USINT	Size of link path. If "0", no link is specified.	6
3	Set	Link path	ARRAY of DNet path:	Dnet path to the object from where this parameter's value is retrieved.	0
4	Get	Descriptor	UINT	Description of parameter.	X
5	Get	Data type	USINT	Data type code.	X
6	Get	Data size	USINT	No. of bytes in parameter value.	X

Table 26 - Parameter Object Common Services

Service Code	Class	Instance	Service Name	Description of Service
05_{hex}	Yes	No	Reset	Resets all parameters to factory defaults
$0E_{hex}$	Yes	Yes	Get_Attribute_Single	Returns the contents of the specified attribute
10_{hex}	Yes	Yes	Set_Attribute_Single	Modifies an attribute value

General Specifications

General Specifications		
Description	Remote multiplexer, compatiable with ODVA's DeviceNet protocol for discrete I/O. Supports (3) discrete inputs, (2)discrete outputs and (1) analog 8 bit input	
Device Profile	General Purpose discrete I/O, Class 7 with objects	
	Identity	(Class 1)
	Message Router	(Class 2)
	DeviceNet	(Class 3)
	Assembly	(Class 4, 4 Instances)
	Connection	(Class 5)
	Parameter	(Class F_{hex}, 10 Instances)
	Valve	(Class $6E_{hex}$)
	Alarm	(Class $6F_{hex}$, 5 Instances)
	Alarm Group	(Class 70_{hex}, 2 Instances)
Device Conformance	Designed to conform to ODVA DeviceNet Spec Vol.I Version 2.0 & Vol. II Version 2.0	
Communications	Predefined Master/Slave Connection Set, Group 2 Only Server	
I/O Protocols	Polled I/O or Change of State (COS), Cyclic	
DeviceNet Connection	5-pin quick disconnect (See Fig. 2) or via terminal blcoks on device module	
Network Termination	None Required	
Status Indicators	Module Status	Green/Red Bicolor LED
	Network Status	Green/Red Bicolor LED
	Valve Open	Green High Intensity LED
	Valve Closed	Red High Intensity LED
Voltage Isolation	None	
Maximum Power	100mA @ 11VDC, 45mA @ 25VDC (1.1 watts) unregulated power supply excluding output load(s)	
I/O Refresh Rate	400 micro seconds (2.5kHz) minimum	
I/O Fuse	1 Amp	
Operating Temperature	0-60^{0}C	
Humidity	0-95% RH, non-condensing	

I/O Electrical Specifications

Ratings	Min.	Typical	Max	Units	Comments
Input Power					
Device Power	11	24	25	VDC	per DeviceNet Spec
Discrete Inputs					
Aux Input	11	24	25	VDC	
Open/Close Outputs					
Max Voltage			25	VDC	
Output Current	0	0.5	0.5	Amp	
Surge Current			5	Amps - peak	
Turn On Time		10	40	msec	Resistive load
Turn Off Time		10	40	msec	Function of solenoid

Troubleshooting	
Problem	**Solution**
The Module Status LED is solid green The Network Status LED is flashing green The device will not communicate over the network	The network does not have a terminating resistor. Add 121 Ohm resistor as shown in Figure 3 at the first and last nodes.
The Module Status LED is solid red The device will not initialize	The EEprom chip has malfunctioned. Device may be damaged. Return to factory for evaluation.
The Module Status LED is solid green Network Status LED is flashing red	Another device has the same MacID (address). Remove power from the offending device and assign a unique MacID to it.
The Module Status LED is solid green The Network Status LED is solid green The valve does not operate with network command	There is a loose connection in the field wiring; the wiring has incorrect polarity on terminals; or the device is damaged.

Telemetering Equipment for use in Hazardous Locations

CE 0539 Ex II 3 G D c UL us LISTED

EEx nC IIC T4 -40°C≤Tamb≤60°C
DEMKO 02 ATEX 130957X IP56
Max current 500mA @ Max voltage 25V
Class I Div.2, Grps A, B, C, D; Class II, Div.2, Grps F&G; T4
Type 4, 4X

Zone 2

Special Conditions of Safe Use (All installations)

Clean only with a damp cloth to prevent possibility of electrostatic discharge.

Warranty

TopWorx, Inc., warrants that each item of new equipment manufactured by it will be free from defects in material and workmanship under normal use and service; its obligation under this Warranty, being limited to making good, at its factory, and part of parts thereof, which shall be returned to it with transportation charges prepaid, within one year after the date of the purchase of such equipment by the original purchaser, and which its examination shall disclose to its satisfaction to have been thus defective. TopWorx, Inc., however, assumes no risk or liability for results of the use of the products purchased from it.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER OF MERCHANTABILITY FITNESS, OR OTHERWISE EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES AND TOPWORX NEITHER ASSUMES , NOR AUTHORIZES ANY PERSON TO ASSUME FOR IT ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS EQUIPMENT.

No claims for labor in replacing defective parts and equipment and consequential damages will be allowed by the Company.

This Warranty shall not apply to equipment which has been subjected to misuse, negligence or accident.

This Warranty shall not apply to any equipment which shall have been repaired or altered, outside the Company's factory so as to affect such equipment's stability or reliability in the judgement of the Company.

Customer Feedback Form

For us to better serve you, we need your comments. Please take the time to fill out this questionnaire. We value your feedback!

Contact_____

Company_____

Address_____

City_____ State_____ Zip_____ Country_____

Telephone_____ Fax_____

Email_____

What type of company do you work for? ☐ Distributor ☐ Valve Automator ☐ Systems Integrator ☐ End User ☐ Other

In what industry are the TopWorx devices being used? ☐ Chemical ☐ Food & Beverage ☐ Pharmaceutical ☐ Power

☐ Oil & Gas ☐ Pulp & Paper ☐ Wastewater ☐ Other

Briefly describe the process where the devices are being used?_____

_____

Which TopWorx products are being installed: _____

Date TopWorx products are being installed:_____

Was the product easy to mount?_____

Was the product easy to calibrate and address (if applicable)?_____

Was the product easy to commission (if applicable)?_____

Was the Instruction Manual thorough and easy to read and understand?_____

What improvements, if any, would you make to this product or the Instruction Manual?_____

_____

Please fax your replies to TopWorx at **502.969.5911**. If you prefer, email your comments and suggestions to **info@topworx.com**. For an overview of the additional TopWorx products available, please visit our website at **www.topworx.com**.

We look forward to serving you with Speed & Excellence. Thanks for your feedback!

About Valvetop™

Valvetop valve networking and control devices link on/off valves to process control systems via a variety of fieldbus protocols. Valvetop valve controllers and monitors support multiple bus protocols, operate in the most demanding plant conditions, and carry a variety of global approvals. Whether your application is rotary or linear, fieldbus or conventional, hazardous or general purpose, we have a suitable solution for you.

For inquiries, contact TopWorx at: 502.969.8000
www.topworx.com
info@topworx.com

About TopWorx

TopWorx is the leader in field networking, valve control, and position sensing solutions for the process industries. Our products and services help plants, mills, and pipelines improve their performance by making it easy to implement modern automation technologies.

Field Networking Solutions

Networx™ field networking products and services make it easy for plant personnel to understand, implement, and enjoy the benefits of modern bus networking technologies.

Valve Control Solutions

Valvetop™ valve networking and control solutions support multiple bus protocols, operate in the most demanding plant conditions, and carry a variety of global approvals.

Position Sensing Solutions

GO® Switch leverless limit switches provide reliable position sensing in extremely hot, cold, wet, dirty, corrosive, abusive, and explosive plant conditions.

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