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NT™ Proportional Control Valve, Model 6300

User Guide

Entegris

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Introduction

This manual is for use with a standard NT™ Proportional Control Valve, Model 6300. These instruments have been designed for use in high-purity fluid applications within industries that need tightly controlled chemical processes such as the semiconductor, biomedical and solar cell industries. The wetted parts are constructed with PTFE, PFA or other similar high-purity inert materials.

WARNING! Attempting to install or operate standard NT Proportional Control Valves without reviewing the instructions contained in this manual could result in personal injury or equipment damage.

PRINCIPLE OF OPERATION

The user provides a setpoint signal that corresponds to the desired valve position. The range code of the product specifies the maximum C_V of the unit. The setpoint signal will proportionally control the unit's C_V from 0 to maximum C_V. The C_V curve is linear.

For example, 6300-CV3-F04-B06-M has a C_V of 1.0 and has a setpoint of 0–5 VDC. A 2.5 VDC setpoint signal will adjust the valve to a 0.5 C_V. A 3.75 VDC setpoint signal will adjust the valve to a 0.75 C_V.

FACTORY CONFIGURED

The standard NT Proportional Control Valve is pre-configured from the factory for the C_V range chosen by the user. The specified C_V range is found on the label of the unit.

NOTE: The NT Proportional Control Valve has been factory sealed. DO NOT attempt to remove the cover of the unit. Any attempt at removal of the unit cover will void the warranty.

General Considerations

LINE PRESSURE

The system line pressure (measured at the inlet of the unit) can be -100 to 415 kPa (-14.5 to 60 psig) for C_V1 – C_V4 range. For C_V7 – C_V8, the system line pressure can be -100 to 550 kPa (-14.5 to 80 psig).

DIMENSIONS

The following fitting size and flow range combinations are available:

Please consult the factory for custom fitting size and flow range combinations.

$C_V1 – C_V4$ Ranges

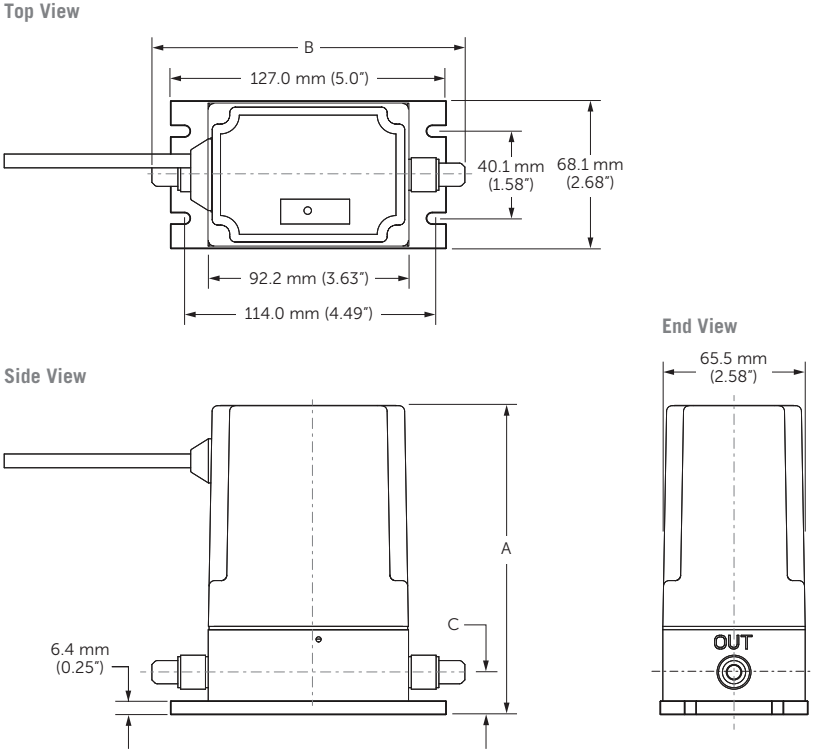
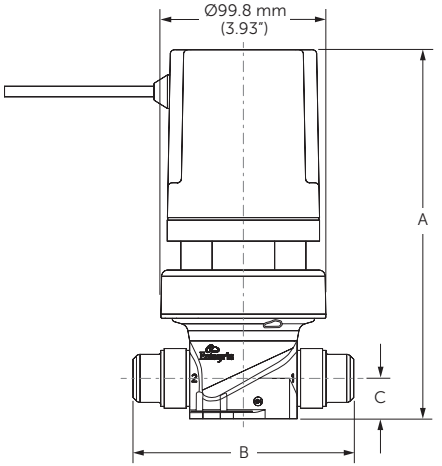


Figure 1. $C_v1 – C_v4$ ranges

Inlet/outlet port connection $C_V1 – C_V4$ ranges	Dimensions		
	A	B	C
¼" Flaretek	142.2 mm (5.60")	144.0 mm (5.67")	19.5 mm (0.77")
⅜" Flaretek	142.2 mm (5.60")	144.0 mm (5.67")	19.5 mm (0.77")
½" Flaretek	144.5 mm (5.69")	150.0 mm (5.91")	21.6 mm (0.85")
¾" Flaretek	153.6 mm (6.05")	153.7 mm (6.05")	27.4 mm (1.07")

$C_V7 – C_V8$ Ranges
(¾" and 1" Flaretek Inlet/Outlet Type)

Side View



Bottom View

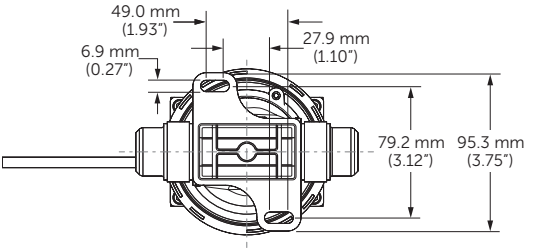


Figure 3. $C_V7 – C_V8$ ranges

Inlet/outlet port connection $C_V7 – C_V8$ ranges	Dimensions		
	A	B	C
¾" Flaretek	223.4 mm (8.79")	129.0 mm (5.08")	24.4 mm (0.96")
1" Flaretek	223.4 mm (8.79")	133.6 mm (5.26")	24.4 mm (0.96")

Installation

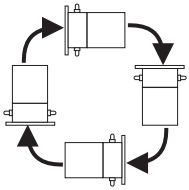
PROVIDED EQUIPMENT

The product box contains the proportional control valve. For units with Flaretek connections, two nuts are included. For units with Pillar connections, two nuts, two sleeves and two gauge rings are included.

NOTE: This unit has been assembled and double-bagged under cleanroom conditions. To maintain purity, only open in cleanroom environment.

MOUNTING REQUIREMENTS

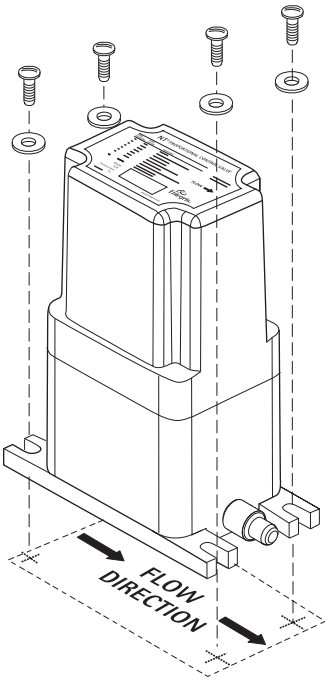
The proportional control valve may be mounted in any orientation.



Care should be taken when installing the proportional control valve to avoid fluid leaks. Do not use excessive torque or subject the unit to high heat during installation. The unit and base bracket assembly must be mounted to a solid surface to ensure stability.

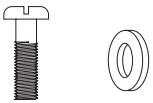
Verify the body and the electrical cable are free from mechanical stress from the surrounding equipment.

NOTE: The proportional control valve requires mounting in the direction of the fluid flow.



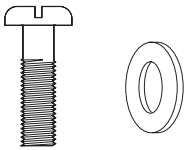
Recommended Hardware:

$C_V1 – 4$
SAE #10 (metric M4)



#10 (M4) Pan head *#10 (M4) Flat washer*

$C_V7 – 8$
SAE ¼" (metric M6)



¼" (M6) Pan head *¼" (M6) Flat washer*

Mechanical Installation

Prepare and Connect Fluid Lines

The standard NT proportional control valve must be used with the proper tubing size and fittings.

⚠ **CAUTION: Do not tighten the nuts on the fitting connection without tubing in place. Tightening the nuts without the tubing installed may damage the unit's connections.**

Flaretek Tube Fitting:

Flare each tube end prior to installation onto the valve fitting. For detailed tube flaring instructions, see "Flaretek tube fitting flare and assembly procedures" at www.entegris.com

⚠ **CAUTION: Over-tightening the nuts with tubing in place will result in damage to the fitting.**

POWER SUPPLY REQUIREMENTS

The power supply range for the proportional control valve is 24 VDC ±10%. The power supply must be regulated and provide minimum 1.2 ampere (nominal) continuous service for each proportional control valve installed. The power supply requirements must be met at the wire connections or connector of the proportional control valve, not only at the power supply itself.

The power supply to the unit must provide clean power and must be used only to power similar measurement-type devices. The power supply must not be used to power other inductive loads, such as motors, relays, or solenoids. These devices may produce electrical transients that may affect unit performance.

An induced power spike, creating an interruption in power greater than 10 milliseconds in duration, may cause the unit to reset. Loss of power will not cause the loss of any system parameters. Loss of power may allow the valve to open due to applied fluid pressure.

In addition to providing clean power, the instrumentation signals and power return lines must not be run within the same conduit or cable along with heavy current demands from motors, charging capacitors or other inductive loads. This may cause a voltage change within the instrumentation signal line, causing erroneous valve operation.

Input Impedance of the Voltage Setpoint

The input impedance of the voltage setpoint is 37 kOhm.

Voltage Drop at the 4 – 20 mA Setpoint Input

The 4 – 20 mA input will drop 4.6 V at 20 mA. Input impedance is 230 ohms.

Reverse Polarity Protection

The proportional control valve is reverse polarity protected; connecting 24 VDC power to any wire will not harm the unit. To operate properly, the polarity must be correct.

Over-voltage on any Wire (DC)

In the event of accidental application of voltage greater than 24 VDC ±10%, the proportional control valve will withstand continuous 30 VDC on any wire without compromising the unit.

Over-voltage on any Wire (AC)

The proportional control valve is not designed to withstand the accidental application of 110⁄220 VAC to any wire. Application of AC voltage will damage the unit.

Short Protection

The proportional control valve will not be damaged or compromised in any way if any combinations of wires are shorted together.

Circuit Protection

Entegris recommends fusing the input power line to the NT Proportional Control Valve, Model 6300. Use a 2 Amp rated, time-lag fuse for the proportional control valve. Place the fusing on the input power line to the unit at the equipment electrical enclosure to ensure that both the wiring to the unit and the unit itself are protected from any over-current condition. Best practice is to locate the fuse away from the typical liquid exposure or harmful vapor areas. Locating the fuse within the electrical enclosure shared by the power supply enables accessibility for troubleshooting or replacement.

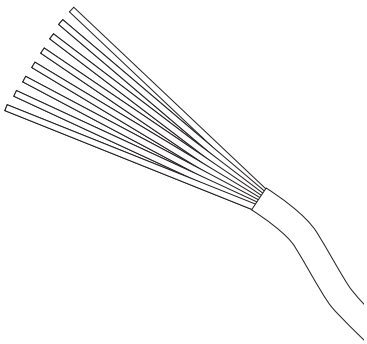
ELECTRICAL CONNECTIONS

Pigtail Electrical Cable

Units specified with a pigtail electrical connection are manufactured with a permanently attached cable. Table 1 details the wire connections for the proportional control valve with a pigtail electrical cable.

Table 1. Wire connections – pigtail cable

WIRE COLOR	MARKER NO.	FUNCTION
Red	2	+24 VDC
Black	8	Ground (+24 VDC common)
Violet	6	Factory use only – do not connect
White	7	Factory use only – do not connect
Tan	10	Setpoint, current, 4–20 mA
Gray	12	Setpoint, common
Pink	11	Setpoint, voltage, 0–10 or 0–5 VDC
Green	9	Valve home input



Pigtail Cable

G-Series Electrical Connector

Units specified with a G-Series connector use a Turck® brand, versafast style, BSMK type, constructed of polyurethane with a nylon coupling nut. The connector is over-molded onto an electrically shielded, PVC jacketed cable. The pin contacts for the electrical connection are gold-plated for performance and corrosion resistance. The connector is physically "keyed," making it easy to connect to a receptacle. Press it into a receptacle and turn the threaded coupling nut to draw the connector and receptacle together until finger tight. G-series connectors to pigtail mating cables are available. See the Ordering Information section of this user guide.

Table 2 and the following pin diagram detail the wire connections for the proportional control valve type with G-series electrical connector.

Table 2. Wire connections – g-series connector

PIN	FUNCTION
R	+24 VDC
E	Ground (+24 VDC common)
J	Valve home input
U	Setpoint, current, 4–20 mA
G	Setpoint, voltage, 0–10 or 0–5 VDC
S	Setpoint, common
O	Factory use only – do not connect
P	Factory use only – do not connect
M	No connect (NC)
L	No connect (NC)
A	No connect (NC)
N	No connect (NC)
C	No connect (NC)
T	No connect (NC)

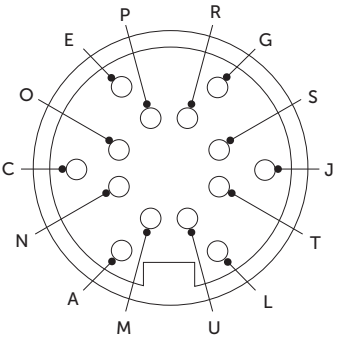
Mandatory Connections

Refer to the wire connections in Table 1, Table 2 and the appropriate Wiring Diagram on page 9.

NOTE: The Valve home input +24 VDC must be referenced to the same ground as the main power source ground 2-Black/Pin E connection. See the Maintenance section of this user guide for valve homing instructions. Consult factory with any questions about electrical installation.

Unused Connections

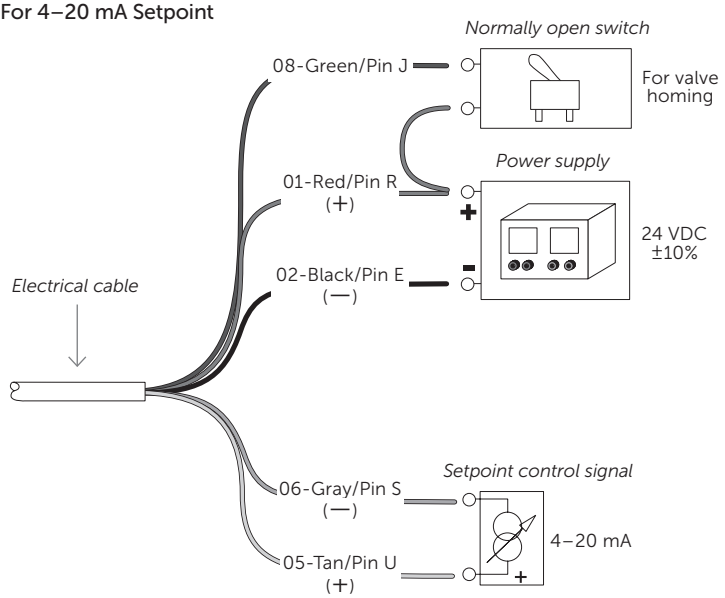
The 3-Violet/Pin O and 4-White/Pin P wires are for factory use only. Do not connect to power supply or ground. These wires must remain disconnected.



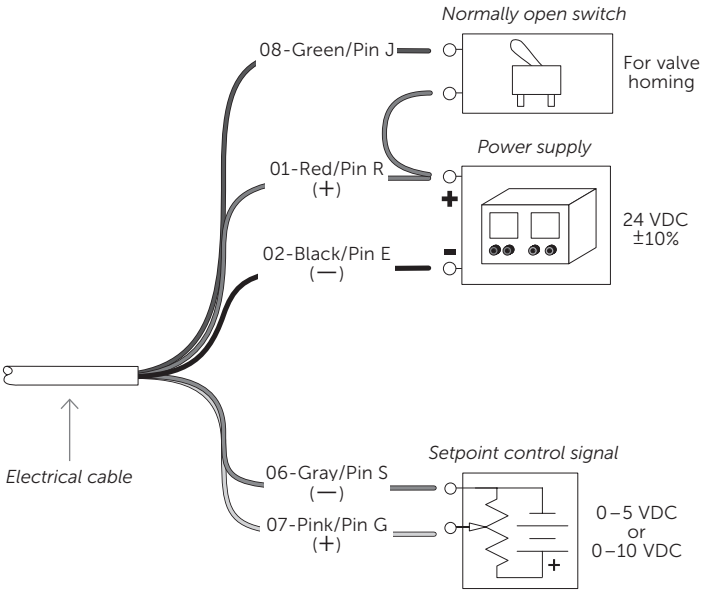
Plug Orientation, Face View

WIRING DIAGRAM

For 4–20 mA Setpoint



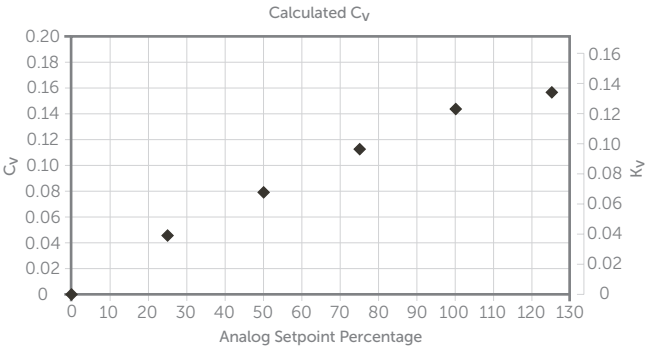
For Voltage Setpoints



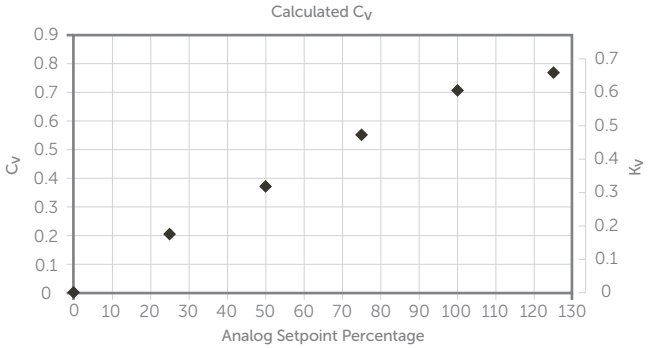
Unit Operation

PERFORMANCE*

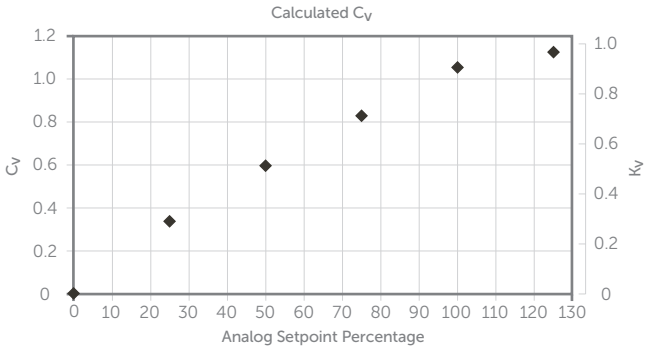
C_V1 F02: Max C_V = 0.16



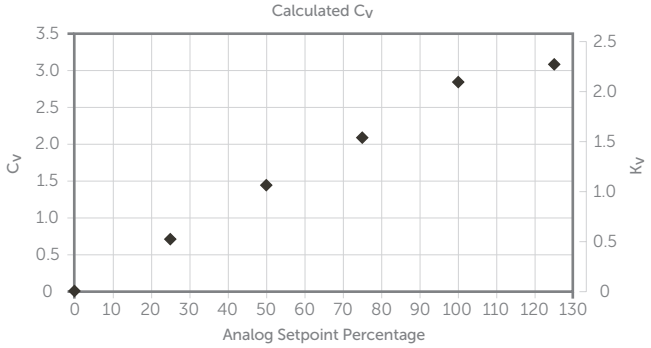
C_V2 F03: Max C_V = 0.68



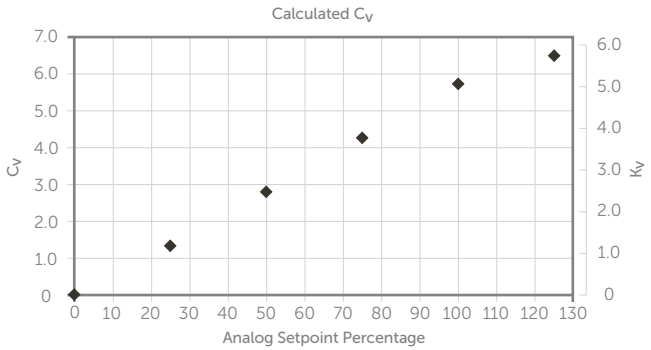
C_V3 F04: Max C_V = 1.0



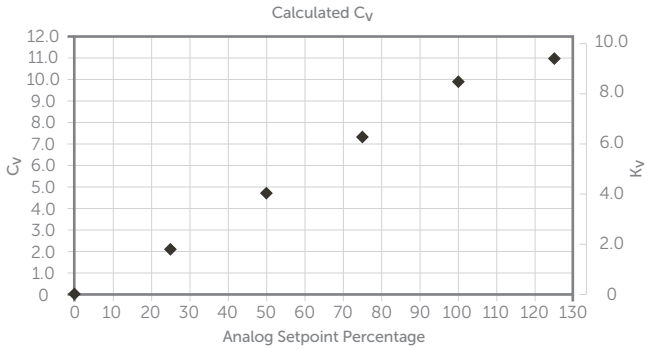
C_V4 F06: Max C_V = 2.8



C_V7 F06: Max C_V = 5.6



C_V8 F08: Max C_V = 10.0



**Graph data is representative and each valve needs to be characterized with the application to optimize performance.*

OPERATING ENVIRONMENT

Storage Temperature Range

The proportional control valve can withstand storage temperatures between -40° to 65°C (-40° to 149°F) with no permanent effect on the performance of the device.

Operating Ambient Temperature Range

The proportional control valve is designed to operate in ambient temperature, cleanroom environments. Units are specified to operate at temperatures of 10° to 65°C (50° to 149°F). For operation above 65°C (149°F), contact the factory.

Operating Process Temperature Range

Units indicated have a range of acceptable process temperatures of 10° to 65°C (50° to 149°F). For operation above 65°C (149°F), contact the factory.

Line Pressure

The system line pressure (measured at the inlet of the unit) can be -100 to 415 kPa (-14.5 to 60 psig) for C_v1 – C_v4 range. For C_v7 – C_v8 range, the system line pressure can be -100 to 550 kPa (-14.5 to 80 psig).

Unit Enclosure

The standard NT Proportional Control Valve cover is factory sealed and should not be tampered with or opened. Spray-down or temporary immersion will not compromise the performance of the unit.

NOTE: Any attempt to remove, tamper with or open the proportional control valve cover will void the warranty.

OPERATION AND USE RECOMMENDATIONS

NOTE: Unit is shipped in an open state.

System Valving Considerations

The NT Proportional Control Valve, Model 6300 can be installed with upstream and/or downstream on/off valves. However, some precautions should be taken to ensure longevity and proper operation of the proportional control valve.

The proportional control valve will close under two conditions:

1. Zero value setpoint
2. Valve Homing signal command activated

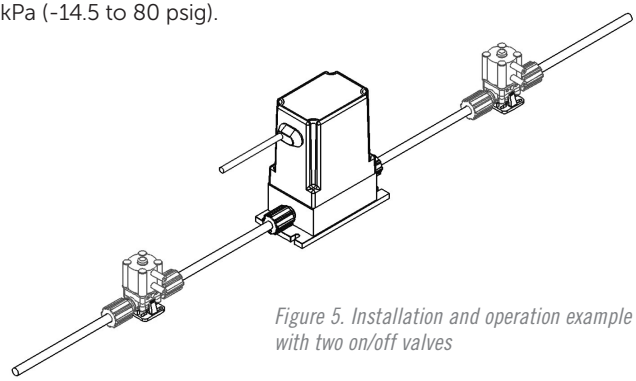


Figure 5. Installation and operation example with two on/off valves

If the proportional control valve closes while upstream or downstream valves are closed, this may create a high level pressure condition in the fluid tubing due to compressed liquid. This high pressure condition may lead to inaccurate homing of the device (indicated by temporary port-to-port leaking), a small amount of media escaping via the weephole, and/or damage to the device.

To address this issue, one possible solution is to keep the on/off valves upstream and downstream of the proportional control valve open at all times. If this is not possible, the proportional control valve should be closed first, allowing adequate time before either the upstream or downstream valves are closed.

Valve Under No-power Condition

The proportional control valve does not rely on a spring to close. The motor movement is electrical. Loss of electrical power will suspend the valve movement. For example, if the valve was partially open during loss of power, the valve will remain partially open. Normal operation will resume when power is reapplied. In an unpowered state, the valve could be forced open with excessive line pressure.

PERFORMANCE

Response Time

Response time is defined as the length of time required for the proportional control valve to complete valve movement to match a new setpoint signal.

The maximum response time for $C_V1 – 4$ is <2 seconds from 5 – 95% full scale. The maximum response time for $C_V7 – 8$, is <4 seconds from 5 – 95% full scale.

The proportional control valve will accept setpoint changes within 50 milliseconds of receiving the new setpoint value.

When power is first applied to the unit (for example, during a startup sequence), the unit will reach the correct valve position within ten seconds.

Temperature Increase at Unit Enclosure

You may notice a slight temperature increase of the unit cover while in an ambient environment after warm-up, when idling or while controlling flow. This is normal.

OPERATIONAL RELIABILITY

Redundant Process Seals

All internal process wetted seals are redundant, i.e., there is a secondary seal that prevents process fluid from reaching the interior of the device in the case of a primary seal failure. Weep holes are provided from the secondary containment regions.

Drop and Topple

If the unit topples over from a 45-degree angle onto a bench top, the performance will not be compromised and the unit will not be externally damaged.

Cable Pull

The cable will withstand a static pull test of 9.1 kg (20 lbs.) straight and 4.5 kg (10 lbs.) at 90 degrees without being damaged.

Diagnostic Guide

SYMPTOM	POSSIBLE CAUSES	SUGGESTIONS
1. Unit is unresponsive	No power	Check power connections or fusing.
	No setpoint signal	Check setpoint wiring for correct setup. Verify setpoint code of the proportional control valve matches your wiring setup and applied setpoint.
	Rezero line active	Clear rezero line.
2. Unit is unable to meter flow	Unit is undersized	Use a larger C_V unit.
	Unit is oversized	Use a smaller C_V unit.
	Unstable setpoint signal	Check wiring and setpoint electrical stability.
3. Unit operation is unstable	Unit installed backwards	Verify inlet/outlet connection.
	Unstable pressure	Check applied pressure stability and/or stability of downstream backpressure.
	Unstable setpoint signal	Check wiring and setpoint electrical stability.
4. Unit causes high pressure when closing	External valving	Verify the unit does not close against a fixed volume, trapped between valves (the proportional control valve can be one of the two valves). Stepper motor valve closes and creates entrapped fluid.
5. Unit does not close	External valving — entrapping a fixed volume	Close unit before closing external valve. See page 12 for more information.
	Foreign object in valve	Clear obstruction with back flush/ forward flush procedure.
6. Unit leaks fluid out of weep hole	Overpressure on unit	Intermittent — single overpressure event. Monitor for future instances. Continuous — diaphragm rupture. Call factory for more information.

Maintenance

NORMAL OPERATION

During normal operation, the standard NT Proportional Control Valve, Model 6300 requires no maintenance, other than a periodic valve homing of the unit. In applications with greater movement duty cycle, more frequent valve homing is recommended.

At the time of unit power-up, and any subsequent power cycle, the proportional control valve will perform a valve homing procedure before becoming active.

VALVE HOMING FUNCTION

NOTE: The following procedure must be followed precisely to ensure proportional control valve homing.

1. The proportional control valve homing function requires the use of the same 24 VDC ±10% power source that is used to power the unit.
2. Apply 24 VDC ±10% to the 8-Green/-Pin J wire to initiate valve homing routine, for a mini-mum of 1 second. The 24 VDC for valve homing must use the same ground as the ground 2-Black/Pin E wire. Only apply 24 VDC to this 8-Green/-Pin J wire, long enough to re-home the valve. The valve homing will be complete within 5 seconds.

NOTE: The valve homing function will remain active and at home position as long as 24 VDC is applied to the valve home input wire.

In most applications, the valve homing procedure may be automated using switches, a PLC or other logic proportional control valve devices.

Reference

PHYSICAL SPECIFICATIONS

Materials of construction	Wetted parts	Body and diaphragms PTFE or PFA
	Nonwetted parts	Polypropylene, Viton® , PVDF
Response time	$C_V1 – C_V4$	<2 seconds from 5 – 95% full scale
	$C_V7 – C_V8$	<4 seconds from 5 – 95% full scale
Pressure range*	-14.5 to 60 psig ($C_V1 – C_V4$)	-14.5 to 80 psig ($C_V7 – C_V8$)
Over pressure limit	100 psig	
Process temperature**	10° to 65°C (50° to 149°F)	
Setpoint input signal	4–20 mA, 0–10 VDC, 0–5 VDC; separate homing line also included	
Enclosure	NEMA 5/IP54	
Connection type***	Flaretek tube fitting and Pillar Super 300 tube fitting	
Approvals	CE	

Note: Preliminary specifications and features subject to change.

** Please consult the factory for pressure ranges from 60 to 80 psig.*

*** Please consult the factory for temperatures from 65° to 80°C (149° to 176°F).*

**** For PrimeLock® connections and other options not listed, please contact Entegris.*

ELECTRICAL SPECIFICATIONS

Input voltage	24 VDC ±10%, regulated
Input current	1.0 A nominal, 1.2 A peak
Impedance of setpoint input (voltage)	37 kOhm
Voltage drop, current setpoint input	<4.6 volts @ 20 mA @ 230 ohm
Electrical connection	FEP or PVC-jacketed cable

Ordering Information

The model number can be established using the following chart.

NT Proportional Control Valve

6300	Base model
C_V	
C_V1	0.16 maximum C_V (only F02)
C_V2	0.68 maximum C_V (only F03)
C_V3	1.00 maximum C_V (only F04)
C_V4	2.80 maximum C_V (only F06)
C_V7	5.6 maximum C_V (available in F06)
C_V8	10.0 maximum C_V (available in F08)
Inlet/Outlet Type	
F02	¼" Flaretek tube fitting
F03	⅜" Flaretek tube fitting
F04	½" Flaretek tube fitting
F06	¾" Flaretek tube fitting
F08	1" Flaretek tube fitting
Electrical Connector Type	
B12	FEP-jacketed 12' pigtail electrical cable
G01	PVC-jacketed 1' electrical cable terminated with 14-pin Turck connector*
Setpoint Input Signal	
K	4–20 mA
L	0–10 VDC
M	0–5 VDC

**14-pin mating cable required for installation*

Example model number: 6300-CV1-F02-B12-K

Ordering Information (continued)

Accessories

Part number	Description
14G05	5 meter mating cable, 14-pin Turck to pigtail, PVC-jacketed
14G10	10 meter mating cable, 14-pin Turck to pigtail, PVC-jacketed

Certifications

CE CERTIFICATION

Please visit www.entegris.com for the most current information.

Repair and Warranty Service

Repair and warranty service is available at the Entegris factory. To expedite the return and repair of the product, contact Entegris at +1 800 394 4084. A Return Materials Authorization (RMA) number, MSDS requirements and a product packaging and return procedure will be provided at that time.

If the product being returned was exposed to a hazardous substance, a copy of the Material Safety Data Sheet (MSDS) for each hazardous substance identified must be included with the returned product.

WARNING! Mishandling products exposed to a hazardous substance may result in death or serious injury.

Technical Support

For technical support, contact the factory at +1 800 394 4084. Please have the complete model number, chemical and application information ready when calling.

FOR MORE INFORMATION

Please call your Regional Customer Service Center today to learn what Entegris can do for you. Visit entegris.com and select the Contact Us link to find the customer service center nearest you.

TERMS AND CONDITIONS OF SALE

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