



OUR PRODUCTS DEVELOP TOMORROW'S TECHNOLOGIES™

SMART BUTTERFLY COMMANDVALVE™

USER MANUAL



All KF and CF Flanged Generation II Models

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SAFETY

IMPORTANT SAFETY INFORMATION

Thank you for purchasing this equipment from Ideal Vacuum Products. We want you to operate it safely.

- Read this manual before installing or operating this equipment. Failure to follow the warnings and instructions may result in serious injury or equipment damage.
- Keep this manual in a safe location for future reference.
- This equipment should only be installed and operated by trained, qualified personnel, wearing appropriate protective equipment.
- Follow all codes that regulate the installation and operation of this equipment.

DANGER



CommandValves are not hermetically sealed. They include O-rings on the valve stem. **DO NOT** use CommandValves in applications where acutely toxic chemicals are present.

CommandValves have been tested at many times higher than the positive pressure specifications described here without leaking. However, the butterfly stem O-ring seals could start to leak when process contaminants deposit on the shaft stem.

CAUTION



Always wear protective equipment, including safety glasses and gloves. Exercise care when working with vacuum equipment.

NOTICE



CommandValves are not suitable for:

- Ambient temperatures above 50°C
- Differential pressure >15 psi

NOTE

To eliminate installation delays, test all automation and control operations of the CommandValve before installing it into the vacuum system.

1. GENERAL INFORMATION

1.1 INTRODUCTION

The Ideal Vacuum Products (IVP) series of CommandValves™ are smart electronic butterfly valves. They are a reliable, low-cost alternative to manual or pneumatic gate valves. CommandValves are available in ISO KF sizes from KF-16 to KF-50, and in Conflat sizes from CF 1.33" to CF 3.375".

These smart valves are operated either manually, using onboard pushbutton controls, or by computer control via an integrated USB virtual serial port. This makes CommandValves an excellent solution for vacuum system integration, automation, and control. These IVP exclusive high flow butterfly valves feature a small footprint, the shortest possible gas path, high accuracy, and fast closure time (~500ms). CommandValves are rated for high vacuum applications to 3×10^{-8} Torr, and for positive pressures to 15 psig. They have an operating temperature range of 0° C to 50° C and a MTTR (mean time until repair) of 30,000 cycles. CommandValves employ O-ring stem seals which does not allow them to be used for ultra-high vacuum. CommandValve bodies and butterflies are made exclusively of 304L stainless steel, and have Viton® FKM O-ring seals¹.

CommandValves can be used as roughing, backing, and high vacuum valves. Because they can be opened and closed incrementally in 0.1 degree increments, from 90 degrees (fully open) to 0 degrees (closed), these valves can be used for precision throttling of the exhaust or purge line where it is desirable to maintain a steady vacuum chamber pressure (i.e., for altitude simulation).

Documentation, firmware updates (if available), and DirectVac™ II software for CommandValve control is freely downloadable from any CommandValve product listing page at idealtvac.com, or from the links in this manual.

CommandValves are powered by low voltage (12 VDC). A universal power supply adapter (input 100-240VAC 50/60Hz, output 12 VDC@3A) and a USB-A to USB-B mini cable are included with each CommandValve package.

A signal converter ([P1012593](#)) is available which extends the capability of the CommandValve by providing valve management via analog and Modbus (RS-485) communications. Without the Signal Converter, the CommandValve is limited to serial commands only via a USB host. The signal converter is compatible with all CommandValves with firmware versions 1.7.2 or higher.



Figure 1 - CommandValve package contents Figure 2 - CommandValve signal converter

1 - Viton is used because of its low permeability, resistance to heat, compression set, and degradation by a great variety of fluids and chemicals, including oils, fuels, lubricants, most mineral acids, and aliphatic and aromatic hydrocarbons.

1.2 SPECIFICATIONS

PARAMETER	MEASURE/TYPE
KF Flange Sizes	KF-16, KF-25, KF-40, KF-50
CF Flange Sizes	CF 1.33", CF 2.125", CF 2.75", CF 3.375"
Minimum Recommended Vacuum	3x10 ⁻⁸ Torr (high vacuum)
Maximum Pressure	15 psig
Conductance	KF-16 / CF 1.33": 3 liters/sec KF-25 / CF 2.12": 10 liters/sec KF-40 / CF 2.75": 30 liters/sec KF-50 / CF 3.38": 85 liters/sec
Operating Temperature Range	-20° to 50° C
Operation	Manual: Via two onboard control buttons Remote: Serial via USB-B mini port (3 ft. USB cable included)
Leak Rate	1 x 10 ⁻⁹ std cc/sec. Helium
Position Range	0° to 90°
Position Accuracy	< 0.5°
Open-to-Close time	500 ms
MTTR (mean time until repair)	30,000 cycles
Materials Exposed to Vacuum	Valve body & butterfly: 304L stainless steel Seals: Viton
Input Voltage	12 VDC
Maximum Current	700 mA
Power Consumption at Idle	70 mA, 0.84 W
Power Consumption in Motion	500 mA, 6 W (avg.), 700 mA, 8.4 W (peak)
AC Power Adapter	Universal 100-240 VAC, 50/60 Hz to 12 VDC@3A power supply included
Input Power	100-240 VAC, 50/60 Hz

Table 1 - Technical specifications

1.3 DIMENSIONS

Please see [Sec. 3.2, p. 15](#) for making vacuum flange connections.

KF Flanged CommandValves					
Flange	Part #	A	B	C	D
KF-16	P108390	5.73 in. (145.6 mm)	0.59 in. (15.0 mm)	1.50 in. (38.1 mm)	2.00 in. (50.1mm)
KF-25	P108389	6.41 in. (162.9 mm)	0.94 in. (23.9 mm)	2.125 in. (54.0 mm)	2.00 in. (50.1 mm)
KF-40	P108388	7.07 in. (179.4 mm)	1.48 in. (37.6 mm)	2.74 in. (69.6 mm)	2.25 in. (57.2 mm)
KF-50	P108185	7.27 in. (184.8 mm)	1.96 in. (49.8 mm)	2.95 in. (75.0 mm)	2.24 in. (56.9 mm)

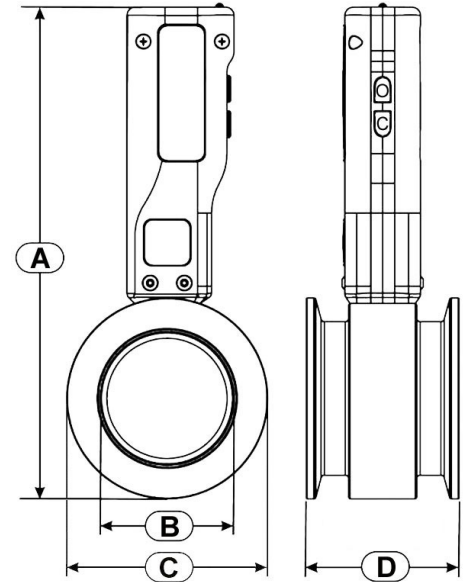
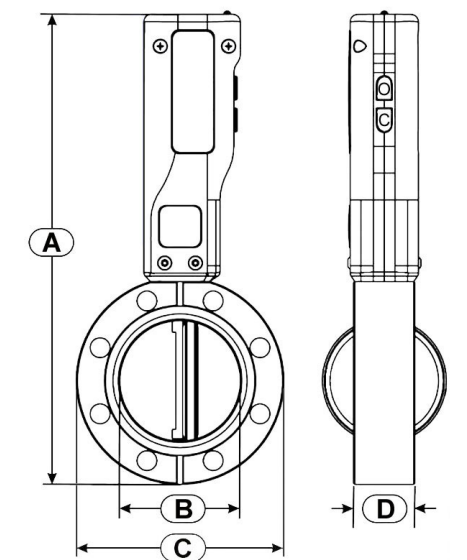


Table 2 - KF flanged CommandValve dimensions

CF Flanged CommandValves					
Flange	Part #	A	B	C	D
CF 1.33"	P108517	5.84 in. (148.3 mm)	0.72 in. (18.3 mm)	1.33 in. (33.8 mm)	1.00 in. (25.4mm)
CF 2.125"	P108436	6.41 in. (162.9 mm)	0.94 in. (23.9 mm)	2.125 in. (54.0 mm)	1.00 in. (25.4mm)
CF 2.75"	P108437	7.07 in. (179.5 mm)	1.48 in. (37.6 mm)	2.75 in. (69.9 mm)	1.00 in. ¹ (25.4mm)
CF 3.375"	P108438	7.71 in. (195.8 mm)	1.96 in. (49.8 mm)	3.375 in. (85.7 mm)	1.00 in. ² (25.4mm)



1 - Total width is 1.53 in. (38.9 mm) when valve is fully open (butterfly extends beyond valve body).

2 - Total width is 2.02 in. (51.3 mm) when valve is fully open (butterfly extends beyond valve body).

Table 3 - CF flanged CommandValve dimensions

1.4 KEY COMPONENTS

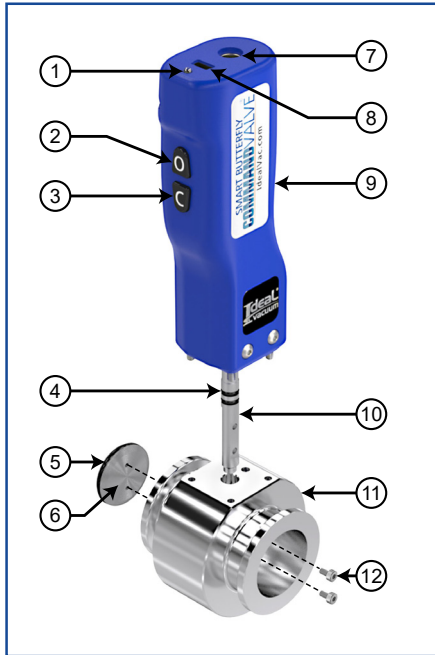


Figure 3 - Key components

Item	Description
1	LED power and position indicator
2	Open push button
3	Close push button
4	Valve stem (shaft) O-ring seals
5	Butterfly o-ring seal
6	Butterfly
7	DC input connector 2.1x5.5 mm, center positive
8	Mini USB-B serial port
9	Valve handle
10	Valve stem
11	Valve body
12	Vented butterfly retaining screws

Table 4 - CommandValve parts

1.5 VALVE REPAIR AND O-RING REPLACEMENT

CommandValve shaft O-rings cannot easily be replaced since the handle must be disassembled in order to replace them. It is recommended to return the valve to Ideal Vacuum where trained technicians can replace the butterfly and shaft O-rings and helium leak check the valve. Please contact customer support for CommandValve service.

1.6 DOWNLOADS AND FIRMWARE UPDATES

The most recent CommandValve information is provided on idealtvac.com and is found on any CommandValve listing page. Free downloads include:

- [The most recent version of this manual.](#)
- [The IVP Firmware Update Tool and Patch Notes User Manual](#) where a link to the Firmware Update Tool software is provided. See also this manual [page 16](#) where a link is provided.
- [DirectVac II software](#) (standalone control software for the CommandValve).

Firmware:

CommandValve firmware may occasionally be updated to fix minor issues or to add new features. Firmware updates can be downloaded and installed through the USB port **ONLY IF THE COMMANDVALVE HAS VERSION 1.7.1 FIRMWARE OR NEWER**. The valve's firmware version can be verified through the DirectVac II software ([Sec. 4.2, p. 18](#)) or by querying the valve through terminal software using the **version** serial command ([Sec. 4.3.1, p. 22](#)). Please contact customer support for updating older valves or for technical support.

1.7 PARTS AND ACCESSORIES

We have a large offering of connection hardware and sealing gaskets in all sizes and types. Refer to [Sec. 3.2, p. 14](#) for making CommandValve to vacuum flange connections.

To prevent galling or seizing and to eliminate the need for thread lubricants, silver-plated bolts are recommended for CF connections larger than 1.33”.

KF Flanged CommandValve Replacements and Accessories				
Description	KF-16	KF-25	KF-40	KF-40
Centering Ring w/ Viton O-Ring	P101242	P101243	P101244	P101245
Hinge Clamp w/ Wing Nut	P101198	P101199	P101200	P101201
Bulkhead Clamp	P104598	P104599	P104600	P104601

Table 5 - Parts and accessories for KF CommandValves

CF Flanged CommandValve Replacements and Accessories				
Description	CF 1.33”	CF 2.125”	CF 2.75”	CF 3.375”
Viton Conflat Gasket	P104339	P104340	P104341	P104342
Copper Conflat Gasket	P102277	P104337	P102278	P102279
Connection Bolt Kit	P108981	P108970	P108980	P108979
Full Extension Nipple	P102206	P104826	P102207	P108986

Table 6 - Parts and accessories for CF CommandValves

NOTICE

The butterfly in CF 2.75” and 3.375” Conflat flanged CommandValves extends slightly past the valve flange when the valve is fully open. For these larger CommandValves use a short nipple to ensure the butterfly does not contact the pump rotator or inlet when the valve is opened fully. Pump or valve damage could result. The butterfly does not protrude on CF 1.33” or CF 2.125” valves and a nipple is not required for smaller CommandValves.

2. APPLICATIONS

CommandValves can be used in roughing and high vacuum backing lines to direct gas flow from the vacuum chamber to the roughing pump, or between the high vacuum and backing pumps. Although not recommended, they can also be used as replacements for manual or pneumatic gate valves between a small high vacuum pump and chamber.

Because the opening angle of the CommandValve butterfly can be controlled, they are ideally suited for use as throttling valves for pressure and flow control when plumbed into the roughing line or when used as vent or purge valves.

NOTICE

CommandValves do not close automatically when powered off and are not intended as a failsafe valve. If a power failure occurs, high vacuum pump damage could result.

2.1 ROUGHING, BACKING, AND HIGH VACUUM

The figure below illustrates a typical example of a high-vacuum system that includes three CommandValves. One valve controls roughing of the vacuum chamber. Another is used to open and close the backing line between the high vacuum turbo pump exhaust port and the backing (roughing) pump. The third is used between the high vacuum pump and the chamber.

Starting at ambient atmosphere, the roughing valve is opened and the backing and high vacuum valves are closed. The roughing pump is then powered on. When the high vacuum crossover threshold pressure is reached, the roughing valve is closed and the backing and high vacuum valves are opened. When the process is completed, the high vacuum and backing valves are closed and the chamber is vented to atmosphere. Automating and synchronizing these valves may be accomplished using the CommandValve's computerized control capabilities. ([Sec.4.2, p.17](#)).

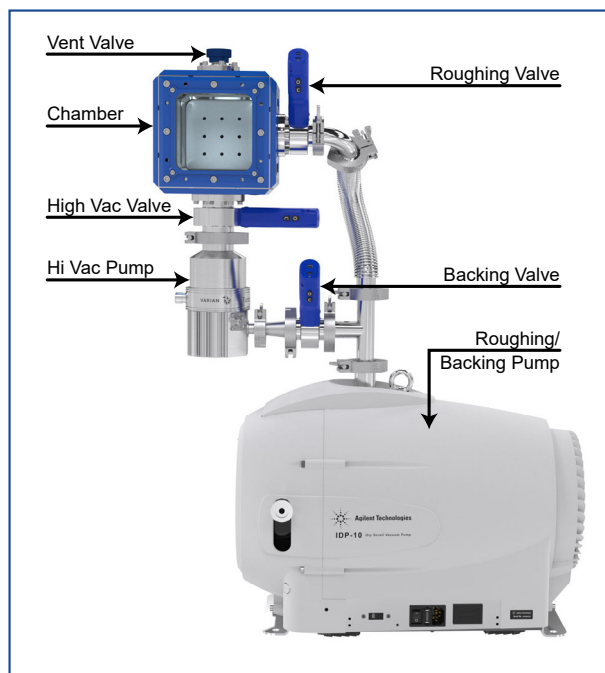


Figure 4 - CommandValves used as roughing, backing and high vacuum valves

2.2 THROTTLING

CommandValves are commonly used for pressure and flow control (throttling) in the medium vacuum range, where a desired pressure is maintained inside the vacuum chamber. Because the CommandValve can be set to any angle between fully open and closed, the CommandValve provides a means to regulate the removal rate of chamber gases.

In throttling applications, a vent or purge leak valve is installed on the chamber to supply a constant low flow rate of gas into the chamber. A pressure gauge and controller is used to monitor the pressure in real-time, and a CommandValve is plumbed between the chamber and vacuum pump. With the CommandValve under computer control, the software program monitors chamber pressure and constantly adjusts the CommandValve's butterfly angle to throttle the evacuated gas flow rate so that the desired chamber pressure is maintained. For the most precise pressure and flow control, the vent or purge leak valve is replaced with a second CommandValve. With computer control, the two CommandValves are synchronized to work together to maintain the target pressure more precisely than with just one valve. The figure below shows an example of the use of CommandValves in a throttling application (An MKS Baratron® 626D capacitance manometer gauge and an IVP Dual Capacitance Manometer Gauge Controller ([P1010127](#)) are illustrated).

It is important to know the pump's maximum continuous operational limits when planning for a process which requires flow control. The system designer must ensure that the pump, whether a roughing or high vacuum pump, is sized to have sufficient continuous pumping speed to overcome the vent or purge valve flow rate, at least enough to drop the chamber's pressure to the desired target pressure range. A well-designed throttling system should also consider the conductance of the vacuum tubing.

When operating a turbo pump under throttling conditions (above its ultimate vacuum pressure), where it is operating at its maximum flow rate for extended periods, the pump will run hot from the high current load. This can cause premature bearing failure. To extend turbo bearing life, use water cooling when a turbo pump is used for throttling applications.

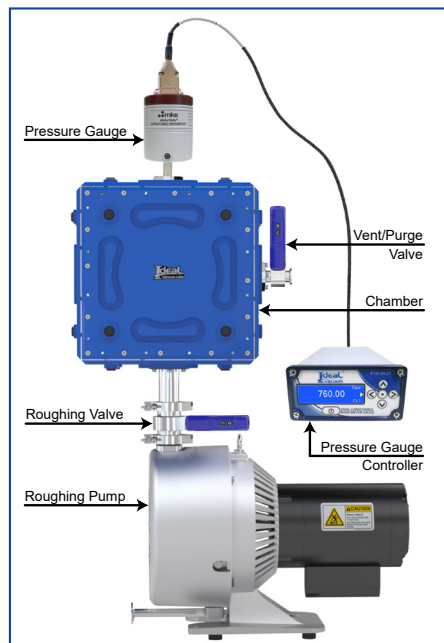


Figure 5 - CommandValves used for throttling applications

3. INSTALLATION

3.1 POWER AND COMMUNICATION CONNECTIONS

The CommandValve needs just two connections: power and communications. If the valve is operated manually, only power is needed ([Chap. 4.1, p. 17](#)).

The CommandValve does not have an on/off switch. When the supplied AC/DC power adapter is plugged into an outlet and its power cable is plugged into the CommandValve, the valve immediately powers on. It goes through a “homing cycle” and the LED illuminates. Disconnect the power cable to turn off the valve.

Communication with a remote computer is via USB. A USB-B mini to USB-A cable is supplied with the valve package. The USB-B mini connector plugs into the valve. The USB-A connector plugs into the computer ([Sec. 4.3, p. 22](#)).

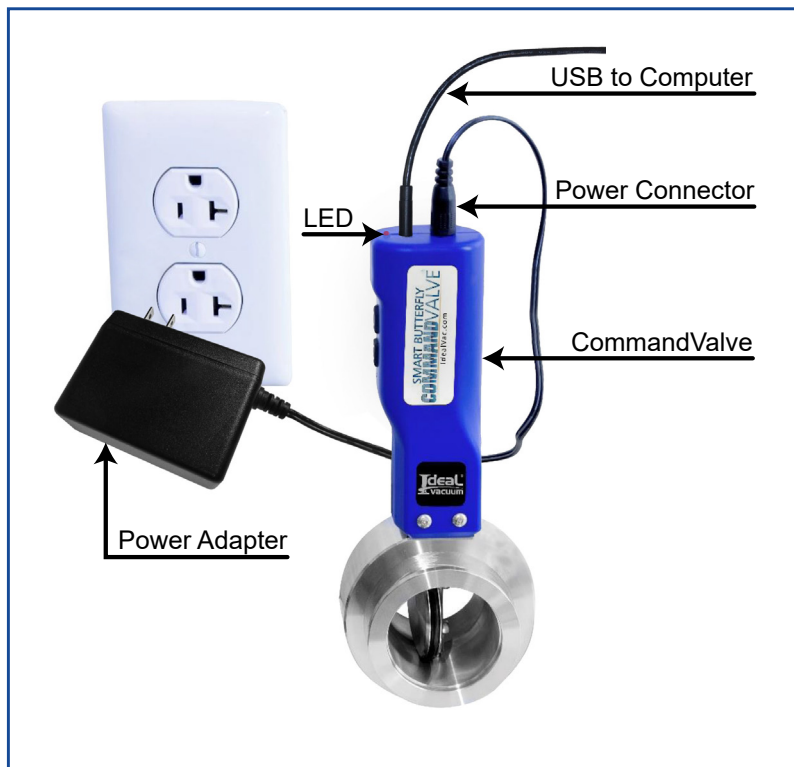


Figure 6 - Wiring connections

3.2 VACUUM FLANGE CONNECTIONS

CommandValves are available with either KF or CF flanges. Installation of the valve depends on the flange type and its location in the vacuum system.

However the CommandValve is used, whether as a roughing, backing, high vacuum, vent, or purge valve, it is recommended that the valve stem should face away from the chamber.

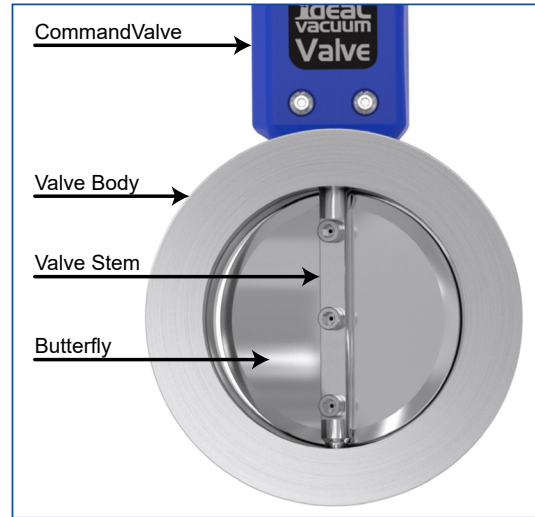


Figure 7 - Valve stem orientation

3.2.1 KF FLANGES

To install a CommandValve in-line with KF type flanges, refer to the figure below. Mate the KF flange faces of the CommandValve to the KF flange faces of the vacuum line on either side of the valve. Use KF centering rings with O-ring seals between the flanges. Wrap a KF hinge clamp around the mated flanges and tighten the wing nuts until the seals are tight. The KF connection is appropriate for applications down to 3×10^{-8} Torr. Download and read the [IVP Common Vacuum Fittings Selection and Assembly Guide](#) for more information about making leak-proof vacuum seals.

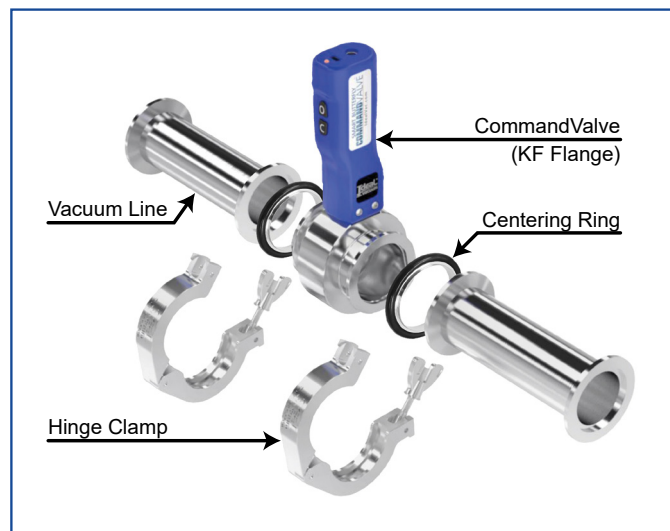


Figure 8 - KF type CommandValve connection

3.2.2 CF FLANGES

CommandValves with CF flanges have through bolt holes. To install a CommandValve in-line with CF type flanges, the two mating CF flanged line fittings must also have through bolt holes. Viton or copper gaskets are used to seal the flanges on either side of the valve. Long bolts go through both the vacuum line fittings and the CommandValve, and are secured with platenuts. It is strongly recommended to use silver-plated bolts on CommandValves larger than 1.33" to prevent galling or seizing and to eliminate the need for thread lubricants. In order to ensure the gaskets remain properly aligned over the flange's knife edge, stack the fittings vertically (if possible) when connecting the joints. Use care not to bang parts together which could damage the Conflat knife edges. If flanges are fitted with leak-test grooves, the grooves should be aligned.

Tighten the bolts gradually in 1/8 to 1/4 turn increments in a star pattern. Continue tightening incrementally until the proper torque ratings have been achieved (below). Download and read the [IVP Common Vacuum Fittings Selection and Assembly Guide](#) for more information about making leak-proof vacuum seals.

CF flanged CommandValves contain O-ring seals on their valve stems. This limits ultimate chamber pressure to that of an O-ring sealed system, typically 3×10^{-8} Torr.

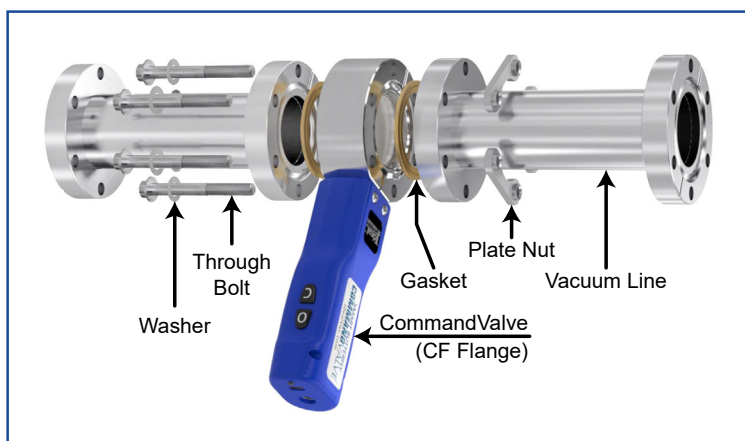


Figure 9 - CF type CommandValve Connection



Figure 10 - Finished CF connection

Torque Limits and Bolt Kits for CF Flanged CommandValves				
CF Flange Size	# of Bolts	Bolt Size	Torque (in-lbs.)	Bolt Kit
1.33"	6	8-32 x 1.25"	28	P108981
2.12"	4	1/4-28 x 2.25"	110	P108980
2.75"	6	1/4-28 x 2.25"	110	P108980
3.38"	8	5/16-24 x 2.5"	190	P108979

Table 7 - CF flange bolt torques and kits

NOTICE

The butterfly in Conflat flanged CommandValves (CF 2.75" and CF 3.375") extends slightly past the valve flange when the valve is fully open. Use a short nipple to move the valve away from the high vacuum pump to ensure the butterfly does not contact the rotator or inlet when the valve is opened fully.

4. OPERATION

The CommandValve can be operated either manually using onboard pushbuttons ([Sec. 4.1, p. 17](#)), or remotely via USB using serial commands. Serial commands can be sent directly to the valve with IVP DirectVac II software ([Sec. 4.2, p. 18](#)), or with terminal software ([Sec. 4.3, p. 22](#)).

The LED on the end of the valve handle indicates the butterfly position: red is closed (0°), orange is partially open, and green is fully open (90°). A blinking LED indicates an error.

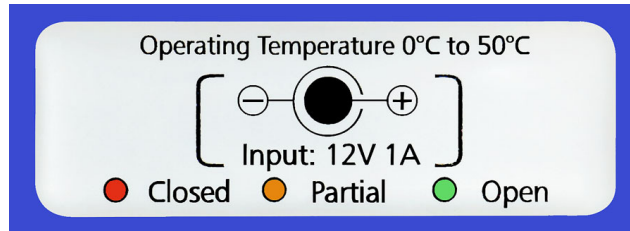


Figure 11 - Handle sticker with LED color key

When initially powered, the CommandValve goes through a “homing” cycle. The homing cycle calibrates motor power, mechanical backlash, and sets the 0° (closed) position of the valve’s butterfly. Whenever the valve is re-energized, or a ***RST**, **reset** or **home** serial command is sent to the valve, it automatically performs a homing cycle. During the homing cycle, serial commands are inactive. ([Sec. 4.2.3, p. 19](#)).

NOTICE

CommandValves do not close automatically and are not intended as a failsafe valve. If power is disconnected or a power failure occurs, the valve remains in its present position.

NOTE

It is best to use the CommandValve with the latest firmware. To check the valve’s firmware version, use DirectVac II software, or terminal software. Use serial command “*version*”.

If a newer firmware version is available, click the link below to download the IVP Firmware Update Tool.



4.1 MANUAL VALVE CONTROL

The CommandValve can be controlled locally by the Open and Close push buttons on the valve's controller handle. There are two operational modes: Full Open/Close and Incremental. There are also two speed modes: Maximum and Slow ([Slow command, p. 26](#)). The last operational and speed mode settings are saved and persist when valve power is cycled, unless subsequently changed.

Full Open/Close Mode:

In Full Open/Close Mode, the valve goes to the fully open position when the Open button is pressed (butterfly at 90°), and goes from its current position to the closed position (0°) when the Close button is pressed.

Incremental Mode:

In Incremental Mode (the factory default) the valve goes to a position between open and closed when the Open or Close button is momentarily pressed.

Switching Operational Modes:

To switch between Full Open/Close and Incremental modes, press and hold both the Open and Close buttons simultaneously for a few seconds. The LED will flash several times indicating the mode is changed.

Switching Speed Modes:

To switch between the maximum butterfly speed (the factory default) and "slow" mode, where the butterfly opens and closes at just over its minimum speed, press and hold down the Close button for 4 seconds. The LED will flash once indicating the mode is changed. To switch back to maximum speed, press and hold the Open button for 4 seconds. The LED will flash once again.

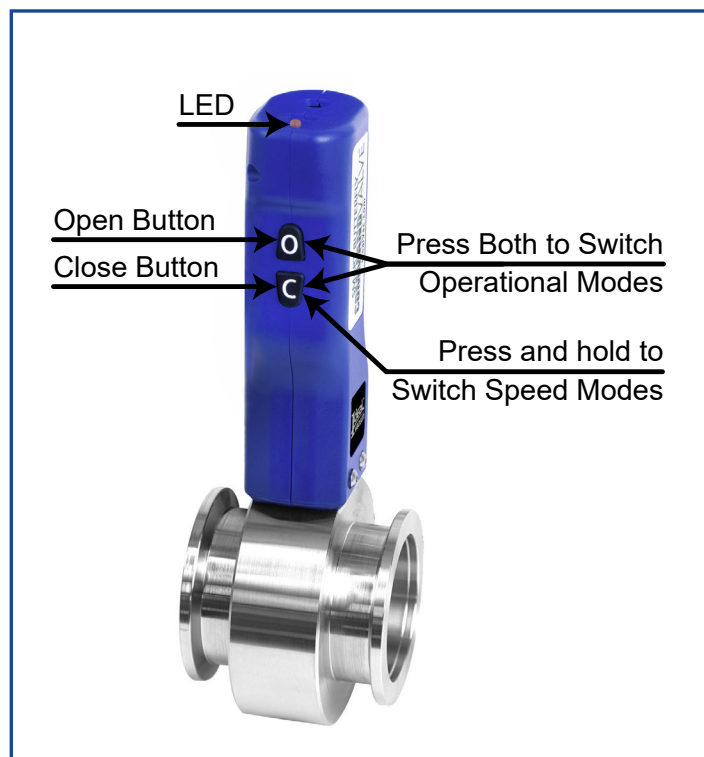


Figure 12 - Switching modes

4.2 DIRECTVAC II SOFTWARE

IVP's DirectVac II control software is a Windows 10 and newer program that can directly control a CommandValve. This software works with all CommandValves with firmware versions 1.7.2 and newer ([Sec. 1.6, p. 9](#)).

DirectVac II provides an animated representation of the valve's operation in real-time and allows the user to easily and precisely operate the valve with quick command buttons or to directly input serial commands ([Sec. 4.3, p. 22](#)).

The latest version of DirectVac II software can be downloaded from any CommandValve product listing on the idealvac.com website, or by clicking this graphic:



Once the software is downloaded, follow these steps:

1. The file will typically be saved in the Windows Downloads folder.
2. Double-Click the DirectVac_II_Setup.exe file.
3. Follow the on-screen prompts to install the software
4. During installation you can choose to add a shortcut and this manual to the Desktop.
5. After the installation is finished, connect the CommandValve to the computer with the USB cable and connect power.
6. If you selected to have a shortcut placed on the desktop during installation, double-click it.
7. Alternatively, go to the Windows Start Menu and select DirectVac II from the IdealVac folder.
8. Apply power and connect the CommandValve to the computer. Then, press Connect.

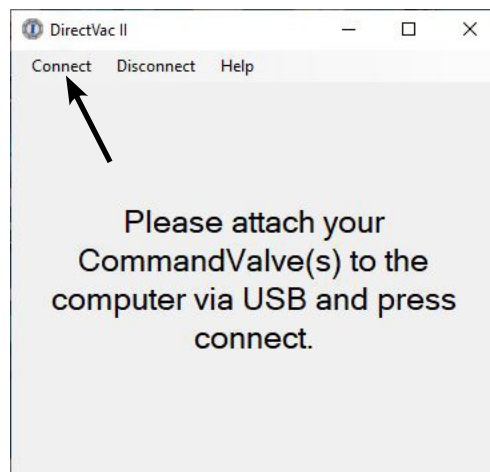


Figure 13 - Connect CommandValve to computer and press connect

4.2.1 INTERFACE DETAILS

Once the Connect button is pressed, the software automatically finds all connected CommandValves and presents a separate DirectVac II window for each valve (if more than one is present). A representation of the valve and its butterfly position is displayed. This interface window allows the user to easily and precisely operate the valve by entering a numerical butterfly angle, by using the Quick Command buttons, or by directly entering serial commands. See [page 23](#) for a list of CommandValve serial commands.

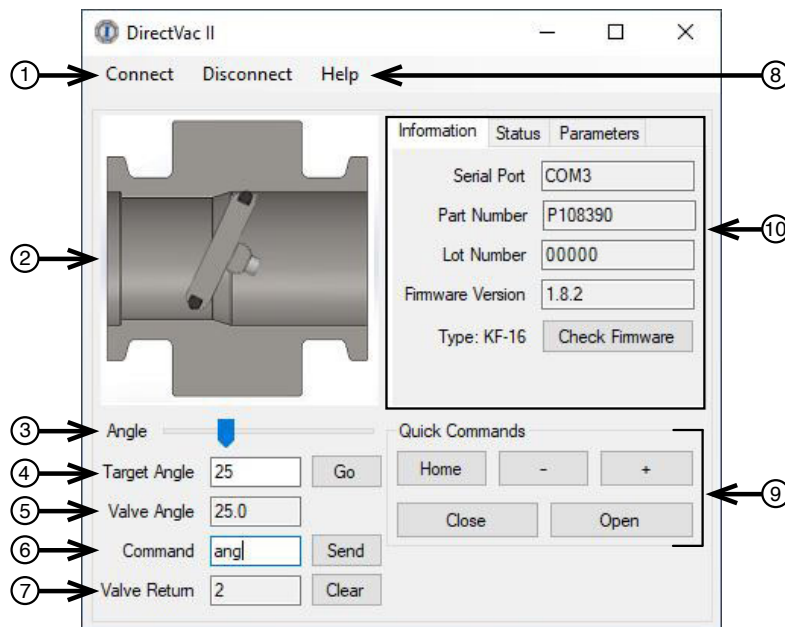


Figure 14 - DirectVac II interface window

① Connect and Disconnect Buttons

These buttons are used to start and stop communication between the valve and computer. If the **reset** command is entered in the Command Field (6), the Connect button is used to reconnect the valve.

② Animated Valve Image

This dynamic picture shows the valve position relative to the valve body. While the valve is moving, the image is animated.

③ Angle Slider

This horizontal slider changes the angle of the butterfly from closed (90°) to fully open (0°). The speed with which the butterfly angle changes depends on the Slow Mode setting in the Parameters tab (10). See Parameters Group, Slow Mode, [page 21](#).

④ Target Angle Field

A desired butterfly angle is entered in this field in the form <##.>. Values from 0.0 to 90.0 are allowed. When the Go button is pressed, the butterfly rotates to the specified angle at the speed determined by the Slow Mode selection (On or Off) in the Parameters tab (10).

When any command is entered, whether it be from the Target Angle Field (4), the Command Line Field (6) or by a Quick Command button (9), the animated image (2), the Target Angle Field (4), and the Valve Angle (5) are all automatically updated.

⑤ Valve Angle

This value is the current actual butterfly angle. The difference between the Target Angle (4) and the Valve Angle (5) should not be more than 0.5° when the valve is static. When in motion, the difference between the target and actual butterfly angle may be significantly higher.

⑥ Command Line Field

CommandValve serial commands can be typed into this field. Commands are case-sensitive. See [page 23](#) for a list of acceptable CommandValve serial commands.

⑦ Valve Return Field

Any valve reply information is shown in this field. The reply is dependent on the command sent. When the Echo Mode is On in the Parameters tab (10), the valve may reply with a 0 (command was successful), or a 1, 2, or 3, indicating that the command was not executed because of a syntax or typographical error. Returns of 4, 5, or 6 may indicate a problem with the valve. See **echo** command details ([Sec. 4.2.4, p. 24](#)).

⑧ Help Button

This button has links to the latest copies of this manual and the firmware updater tool manual.

⑨ Quick Commands Group

This area contains shortcut buttons for five commonly used commands. These buttons behave as if the same command was entered in the Command Line Field (6).

The (+) and (-) buttons open or close the butterfly valve position by 1° each time they are pressed. When held, the buttons continuously open or close the butterfly.

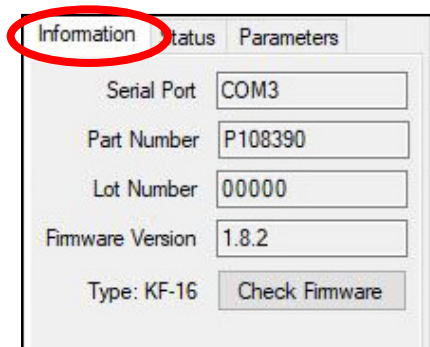
⑩ Tab Section

This section has three tabs: **Information**, **Status**, and **Parameters**. Click on a tab to go to a different page. The startup default is the Information tab (home page). See the figures and descriptions below and on the following page for details.

Information Tab

When the Information tab is selected, the valve's COM port and other identifying information is displayed. This information is useful to identify a single valve in a multi-valve system and is needed when contacting Ideal Vacuum about the valve.

This section also shows the valve's firmware version. By pressing the Check Firmware button, the user can determine if the valve's firmware is the latest version (internet access is required). If a newer firmware version is available, it can be updated by pressing the IVP Firmware Update Tool graphic on [page 16](#).



Information	Status	Parameters
Serial Port	COM3	
Part Number	P108390	
Lot Number	00000	
Firmware Version	1.8.2	
Type: KF-16	Check Firmware	

Figure 15 - Information tab

Status Tab

When the Status tab is selected, any warnings and/or errors are indicated. See **warning** and **error** serial commands and returns, [page 27](#). A description of the warning or error is displayed in the bottom of this section.

Note that warning and error serial returns are always displayed in DirectVac II's Status tab whether or not the **echo** mode is on. See Parameters Tab, below.

The valve's momentary current draw, maximum current since powered on, and valve temperature are also displayed. This data can be useful for valve diagnosis.

Figure 16 - Status tab

Parameters Tab

After Home: The desired angle that the butterfly returns to each time the valve is reset, homed, or valve power is cycled is entered in the After-Home field in the form <##.#>. Values from 0 to 90 are allowed. See **after-home** command, [page 25](#).

Home Offset: This parameter allows the home butterfly position to be finely tuned to produce the best valve closure. It is set at the factory and should not be changed unless an IVP representative instructs you to do so. *Changing this parameter can result in crashing the valve!*

Echo Mode: When Echo Mode is On, the valve returns a code (feedback) about an echo-enabled command's success. When echo-mode is Off (default), success codes are not generated. See **echo** command [page 24](#).

Echo Mode On is equivalent to the **echo 1** command.

Echo Mode Off is equivalent to the **echo 0** command.

Slow Mode: When Slow Mode is On, the butterfly moves at just above the minimum butterfly speed as determined during the homing cycle. When slow mode is Off (default) the valve moves at its maximum speed. See **slow** command, [page 26](#).

Slow Mode On is equivalent to the **slow 1** command.

Slow Mode Off is equivalent to the **slow 0** command.

Home on Start: Enables or disables homing upon startup when the valve is in the 0° position. When Home on Start is On (default), the valve homes whenever the valve is **reset** or power cycled. When Home on Start is Off (disabled) and the valve is already closed (in the 0° position), the valve will not home. When the valve is restarted, it normally opens a few degrees, then homes (goes to 0°). Disabling Home on Start keeps the valve zeroed even when restarted.

If the valve is open and Home on Start is disabled, the valve is forced to home upon **reset** or powering on but will then return to its previous position. In this scenario, if after-home is set to an angle greater than 0°, it is overridden and the valve will still return to its previous position. But, the **after-home** value does not change.

Figure 17 - Parameters tab

4.3 REMOTE OPERATION

Any device capable of running a USB host and that can communicate serial commands can precisely operate the CommandValve. The CommandValve can be remotely operated with terminal software, such as Terminate[®], by writing a CommandValve control program, or by integration into an existing system automation program.

4.3.1 TERMINAL SOFTWARE

There are many CommandValve automation and control features available through serial communication. One method used to control the valve is by using terminal software such as [Termite \(compuphase.com/software/termite.htm\)](http://compuphase.com/software/termite.htm). The computer communicates with the valve through the supplied USB-B mini to USB-A cable. The distance between the valve and computer may be increased by a USB extension cable (part number [P1012818](#)). Before operating the valve, the CommandValve's COM port must be selected. The figures below show the set up and operation using Terminate.

1. Download and install Terminate (if necessary). Start the software.
2. Click Clear.
3. Click Settings.
4. Choose the valve's COM port. Press OK.

The correct COM port must be selected before the valve will accept commands. Choose the COM port below COM1 (COM1 is never the correct port). In the example below, it is COM4.

If there is not a second COM port available in the pull down menu, disconnect and reconnect the valve's USB cable, then restart Terminate.

5. Make sure Append LF (line feed) is selected. In Terminate, this adds a (hidden) terminating line feed character (\n) to all serial commands. The valve requires that all serial commands be terminated with a line feed in order to operate correctly.
6. Finish by selecting Data bits (8), Stop bits (1), Parity (none), and Flow control (none).

The table on the following page shows the complete list of available serial commands.

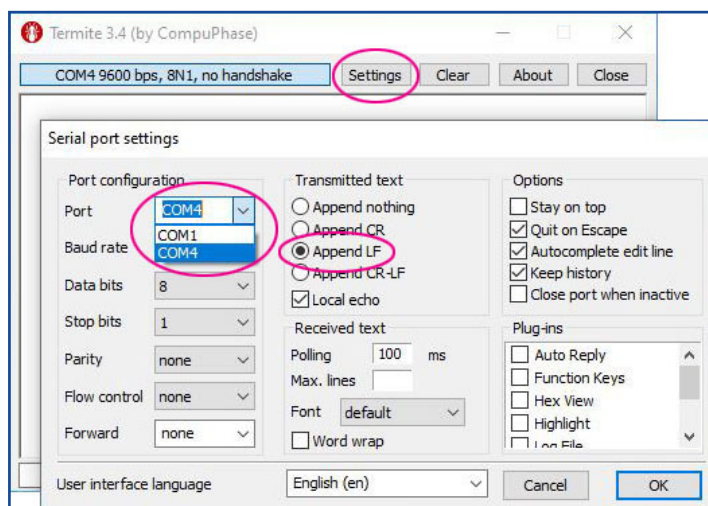


Figure 18 - Select the COM port

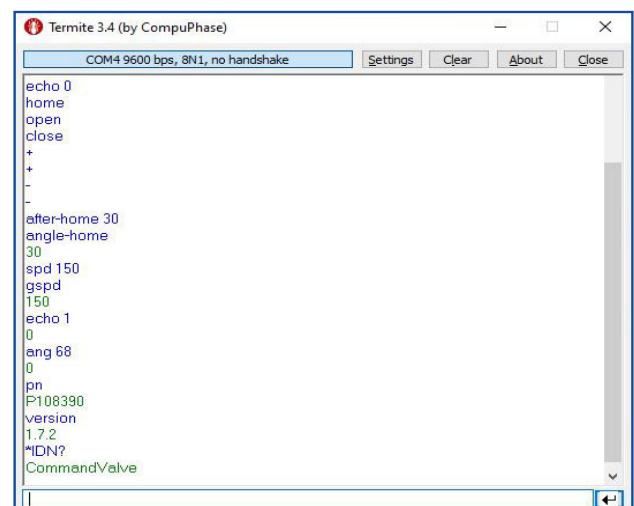


Figure 19 - Serial commands in Terminate

4.2.3 SERIAL COMMANDS SUMMARY

The table below summarizes the available serial commands. The pages that follow describe in detail the use of and proper syntax for each command. Commands are case sensitive. When using terminal software or if writing a custom program, all serial commands must be terminated with a line feed (\n).

Command	Function
echo¹	Enables or disables command feedback (replies) for select commands.
echo?	Returns the current status of the echo mode.
ang	Sends the butterfly to a user specified angle.
open	Sends the butterfly to the fully open position (90°).
close	Sends the butterfly to the closed position (0°).
+	Opens the butterfly by 1°.
-	Closes the butterfly by 1°.
stop	Immediately stops the butterfly at its current position.
pos	Gets the current angular position of the butterfly in degrees.
err	Gets the butterfly's current deviation from the target position in degrees.
temp	Returns the controller's current temperature (°C)
home	Performs the valve's homing cycle and sets the 0° closed position.
after-home¹	Defines the angle the butterfly will return to after each home cycle.
angle-home	Returns the currently set after-home angle.
homeoffset¹	Defines the offset value (in encoder steps) used to tune the valve's 0° position
homeoffset?	Returns the current homeoffset value
homeonstart¹	Enables and disables homing upon startup when the valve is in the 0° position.
slow¹	Enables and disables reduced butterfly rotational speed.
version	Gets the firmware version of the valve.
pn	Gets Ideal Vacuum's valve part number.
sn	Gets the serial number (lot number) of the valve.
*IDN?	Gets the unique product identification/model number of the valve (VISA).
*RST	Reboots the valve and performs a homing cycle (VISA).
reset	Same as *RST .
warning	Returns the warning register. When only a warning is active (no errors), the valve will operate and move normally.
error	Returns the current error code. If error code is not "0" then the valve will not move.
defaults	Resets valve to factory defaults: (Echo mode = off, Home angle = 0, Slow mode = off, Push buttons = incremental)

¹ - This setting is saved in non-volatile memory and persists when valve power is cycled, unless subsequently changed.

Table 8 - Summary of serial commands

4.2.4 SERIAL COMMAND DETAILS

echo <#>

Description: Enables or disables feedback on commands that do not reply with a numerical or string value.

*This setting persists when the valve is **reset** or power is cycled.*

Argument: 0 or 1 (0 = off, 1 = on). *echo 0 is the default.*

Example: **echo 0** (turns off command feedback from the valve on select commands).
echo 1 (turns on command feedback from the valve on select commands).

Reply: When echo is enabled, an echo code is returned after the valve receives a serial command.

Echo Code	Description
0	Command received OK. Command Successful.
1	Command received. Invalid argument.
2	Command received. Missing argument.
3	Invalid command.
4	Cannot execute command. Valve is in an error state.
5	A warning was triggered. Check valve warning code.
6	An error was triggered. Check valve error code.

echo?

Description: Returns the current status of the **echo** mode.

Reply: 0 or 1 (0 = echo off, 1 = echo on)

ang <##.#>

Description: Opens the butterfly to a user specified angle.

Argument: Range is 0.0 to 90.0

Example: **ang 25** (opens the butterfly to 25° from closed position).

Reply: 0 - 6 (when echo is on). 0 = Success.

open

Description: Sends the butterfly to 90° (the fully open position).

Reply: 0 - 6 (when echo is on). 0 = Success.

close

Description: Sends the butterfly to 0° (the closed position).

*The close command returns the valve's butterfly to 0° as determined by the homing cycle. It is equivalent to entering a command of **ang 0**.*

Reply: 0 - 6 (when echo is on). 0 = Success.

+

Description: Opens the butterfly 1° from its current position.

Reply: 0 - 6 (when echo is on), 0 = Success, 1 = angle is already at 90°.

-

Description: Closes the butterfly 1° from its current position.

Reply: 0 - 6 (when echo is on), 0 = Success, 1 = angle is already at 0°.

stop

Description: Immediately stops the butterfly's motion at its current position.

Reply: 0 - 6 (when echo is on). 0 = Success.

pos

Description: Gets the angular position of the butterfly in degrees (from the closed position).

Reply: <##.#>

err

Description: Gets the valve's current deviation from the target position in degrees.

Reply: <##.#> (range -90.0 to 90.0)

*When the butterfly is static, **err** should not be more than ±0.5 degrees.*

*If **err** is requested while the butterfly is in motion, err could be significantly larger.*

temp

Description: Returns the controller's current temperature in (°C)

Reply: <##.#>

home

Description: Runs the valve's homing cycle.

*The homing cycle calibrates motor power, mechanical backlash, sets the 0° (closed) position of the valve's butterfly, sets the minimum butterfly rotational speed, and positions the butterfly to the **after-home** angle.*

During the homing cycle, serial commands are inactive.

Reply: 0 - 6 (when echo is on), 0 = Success. *Reply is delayed until homing cycle is completed.*

after-home <##>

Description: Defines the opening angle that the butterfly will return to after each home cycle.

*This setting persists when the valve is **reset** or power is cycled.*

Argument: Range is 0 to 90 (integer values only). *after-home 0 is the default.*

Example: **after-home 20** (butterfly opens to 20° after power is cycled or valve is reset).

Reply: 0 - 6 (when echo is on), 0 = Success

angle-home

Description: Gets the currently set **after-home** angle.

Reply: <##.#>

homeoffset <±##>

Description: Defines the offset value (in encoder steps) used to tune the valve's 0° position

*This value is set at the factory. It should not be changed unless an IVP representative instructs you to do so! **Changing this parameter can result in crashing the valve!** This setting persists when the valve is **reset** or power is cycled.*

homeoffset?

Description: Returns the homeoffset value

Reply: <±##>

homeonstart <#>

Description: Enables and disables homing upon startup when the valve is in the 0° position.

See Parameters Tab, [Sec. 4.2.1, p. 21](#), for detailed description.

*This setting persists when the valve is **reset** or power is cycled.*

Argument: 0 or 1 (0 = off, 1 = on). *homeonstart 1 is the default.*

slow <#>

Description: Enables or disables slower butterfly rotation.

*The **slow** speed is set just above the minimum butterfly speed, as determined during the **home** cycle.*

*This setting persists when the valve is **reset** or power is cycled.*

Argument: 0 or 1 (0 = off, 1 = on). *slow 0 is the default.*

Example: **slow 0** (butterfly rotates at maximum speed).

slow 1 (butterfly rotates at reduced rotational speed).

Reply: 0 - 6 (when echo is on), 0 = Success.

version

Description: Gets the valve's firmware version number.

See [Chap. 4, p. 16](#) to check for the latest CommandValve firmware revision.

Reply: <#.#.#>

pn

Description: Gets the valve's Ideal Vacuum product number.

This is the specific valve product number (SKU number) listed on idealvac.com.

Reply: P<#####>

sn

Description: Gets the valve's serial/lot number.

This number is needed when contacting Ideal Vacuum's customer support.

Reply: <#####>

*IDN?

Description: Gets the valve's unique product identification (VISA)

Reply: "CommandValve"

reset

Description: Behaves the same as *RST.

defaults

Description: Resets the valve to factory defaults:

Echo mode = off, Home angle = 0°, Slow mode = off, Push buttons = incremental

*RST

Description: Reboots the valve and the valve performs a homing cycle.

*The homing cycle calibrates motor power, mechanical backlash, sets the 0° (closed) position of the valve's butterfly, sets the minimum butterfly rotational speed, and positions the butterfly to the **after-home** angle.*

During the homing cycle, serial commands are inactive.

*Some user defined settings persist after ***RST** or **reset**.*

Reply: 0 - 6 (when echo is on), 0 = Success. *Reply is delayed until homing cycle is completed.*

warning

Description: Returns the warning register.

When a warning is active but there are no errors, the valve will operate normally.

Reply: These warning codes may be returned:

Warning Code	Description
0	Status OK. No warning stored.
1	Valve required excessive power to open during home cycle.
2	Valve required excessive power to close during home cycle.
4	Valve backlash value too high.
8	Valve has not been homed during this power cycle. Positional accuracy may be decreased.
16	Valve has detected and corrected a position deviation.

Warning codes are stored in an 8 bit register and returned via serial in integer format. Multiple warnings can be active on the valve. For example, a warning code of "6" would be returned if both warning 2 and warning 4 are active.

Warnings are automatically reset by the valve if the condition causing the warning is discontinued.

error

Description: Returns the current error code.

Reply: The error codes (below) may be returned.

Note: If the error code is not "0" then the valve will not move.

Any error code is resolved by homing the valve.

Error Code	Description
0	Status OK. No warning stored.
1	Valve has not yet been homed successfully.
2	Homing failure. Valve failed to open.
3	Homing failure. Valve failed to close.
4	Homing failure. Valve failed to calibrate position.
5	Homing failure. Failed to calibrate backlash.
6	Homing failure. Failed to calibrate valve speed.
7	Motor stalled when opening.
8	Motor stalled when closing.
9	Over temperature.

Only one error code is stored at any time.

If an error is encountered, the valve will not attempt to execute any moves except a homing cycle.

An error code is automatically reset by the valve if the condition causing the error is discontinued.



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