

# **DeZURIK PRECISION ELECTRIC CONTROL VALVES**



# Control Systems

## Time-Duration Control System

Precision electric valves set up for time duration operation are built to provide a choice of running times for full scale plug travel – nominally 2.5 and 6 minutes. As an open-loop system, the valve moves at synchronous speed in either direction for as long as power is applied. The degree of precision is determined by the length of on-time signal (duration) and the designed full-stroke run time. The minimum on-time duration recommended is 50 milliseconds. For example, a DeZURIK 60 hz motor with a run time of 388 seconds may provide 7760 positions from fully closed to fully open. The advantage of the time-duration system is it can be programmed to accept signals from 50 milliseconds to total run time of the valve, according to the needs of the process loop.

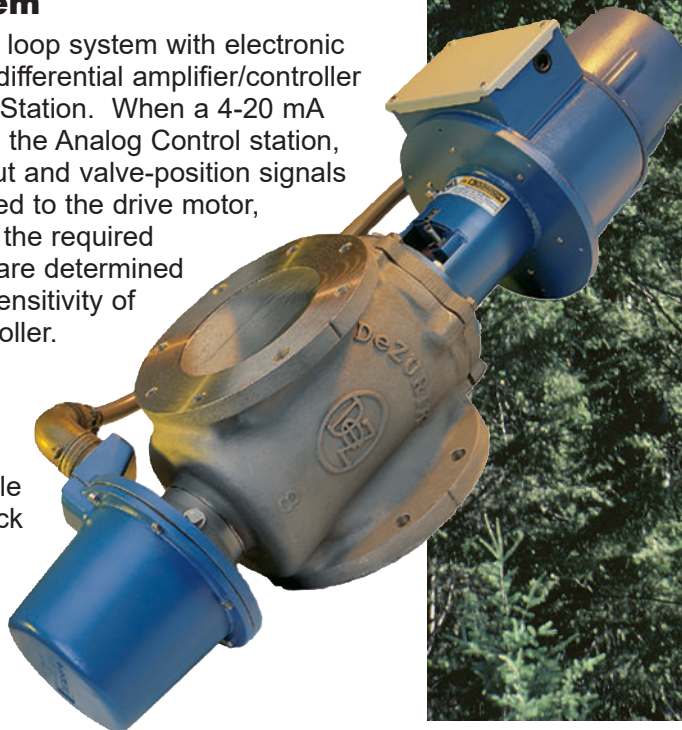
## 12-bit Position-Feedback Control System

The optional resolver provides a very high resolution 4-20 mA signal to a process control computer. Using this as a means of control, 4,000 repeatable valve positions can be achieved. As an open loop system, the valve moves at synchronous speed as long as power is applied. A process computer control algorithm can manage run time power signals as short as 50 milliseconds to move the control valve to a specific position – based on a resolver position feedback signal. Such a control system works in conjunction with a standard Time Duration Control Station. It requires that the valve's time duration run-time be set for a nominal value of 6 minutes. This resolver provides a clean, high signal-to-noise ratio allowing process control systems to scale up the position signal without concern for error.

## Analog Control System

Analog control uses a closed loop system with electronic valve position feedback to a differential amplifier/controller located in an Analog Control Station. When a 4-20 mA valve-control signal is sent to the Analog Control station, a difference between the input and valve-position signals will cause power to be directed to the drive motor, causing the valve to move in the required direction. System limitations are determined by control-signal noise and sensitivity of the differential amplifier/controller.

Valve positioning accuracy is typically within 0.1%, providing 1000 repeatable valve positions within full-scale valve signal. Position feedback is with a potentiometer.







## **Motors and Accessories**

### **Drive Motors**

All Precision Electric Valves employ AC synchronous motors which run at constant speed when powered. The motor starts within 1.5 cycles of applied frequency and stops within 5 degrees of motor rotation, ensuring instant response and positioning accuracy.

These can be permanently stalled without overheating or harmful effects on the components. Permanent magnets in the rotor provide brushless operation and provide residual torque for holding the valve plug in position when the power to the motor is off.

The key to this high degree of precision is the harmonic drive. It provides positive, undetectable backlash between the drive module and the valve plug. The elliptical tooth path and slight deflection of the teeth produce a preload between driving and driven components resulting in no relative motion between teeth at the points where torque is being transferred. With 10% of teeth engaged at all times, the effect of tooth-to-tooth error is reduced to the point that backlash cannot be detected at the mesh.

### **Switches and Potentiometers**

As standard, all Precision Electric Valves are furnished with one set of open and closed position limit switches and dual 1000 ohm potentiometers. Two additional switches are available for remote indication of travel. Two additional 1000 ohm potentiometers are also available.

### **Control Stations**

DeZURIK offers two styles of control stations; a vertical totally enclosed and a horizontal rack-mounted model. These stations provide a 3 digit valve position display, an on-off switch to immobilize the valve, a manual-automatic operation selector switch and push-button switches for manual operation. They are offered in Time Duration or Analog mode. The Analog Station incorporates an integral servo-amplifier (differential error amplifier) to operate the valve in response to input signals and valve position signals. The vertical model is fully weather proof and can be installed in a wet environment. The rack-mounted model is designed to be incorporated into standard control room systems mountings.

## Two Valve Plug Styles

The Precision Electric Valve is available with two trim packages, a V-Port and a Straight Concentric configuration. The V-Port plug provides an equal percentage characteristic and is designed for operation in paper/pulp stock and/or other fiber suspensions. The Straight Concentric plug offers higher flow capacity, a more linear flow characteristic and is designed for use in very low consistency fiber suspensions or clean liquid/gas fluids.

## Stainless Steel Construction

The valve body, plug, bonnet and packing gland, as standard, are 316 stainless steel, ASTM A743, CF-8M.

## NEMA IV Control Module

The control module cover provides NEMA IV protection and is easily removed for service and/or inspection. The components ride in precision bronze bushings. The entire control module can be stocked as a factory-calibrated unit. A spring-loaded v-ring PTFE seal protects control module components from flowing media.

## Continuous, Smooth Operation

The plug does not contact the seat or valve body, providing continuous, smooth operation. High compression pure-carbon bearings are chemically inert and support the valve plug and drive train in three locations. They are designed to provide decades of smooth trouble free operation.

## Manual Operation

A fail-safe interlock switch interrupts the motor circuit when the end cover is removed for manual operation. A manual thumb-wheel incorporating a slip-clutch allows adjustment of the motor back shaft for accurate valve positioning, should there be power or signal failure. The integral slip-clutch protects the integrity of drive components by preventing excessive torque being applied.



## External Valve Position Indicator

An external mechanical dial and pointer provide visual indication of valve plug position.

## Unmatched Control Accuracy

The DeZURIK Precision Electric Control Valve is designed specifically for critical basis weight and head box control applications, as well as other critical control applications where high resolution is required. Control system options provide positioning accuracy from 1000 to over 7000 positions. DeZURIK can provide one analog and two time duration control systems.

# Design and Construction

The DeZURIK Precision Electric Control Valve is designed for critical flow control requirements. The design is simple. Construction is rugged. Operation is all electric. Positioning the valve plug is accomplished with a small, slow speed motor, a high reduction drive, and rigid connections. Direct drive to the control module provides accurate feedback of plug position. A wide range of sizes and three control modes make this precision valve suitable for a broad range of critical control applications.

## 1. Electric Motors

Precision Electric Control Valves are actuated by AC synchronous motors which run at a speed determined by the frequency (50/60 hertz) of applied electrical power. These motors will start with 1½ cycles of applied power and stop within 5° of rotor rotation ensuring instant response and positioning accuracy. Motors can be permanently stalled without overheating or harmful effects to components. Permanent magnets in the rotor provide brushless operation and provide residual torque for holding the valve plug in position when power to the motor is off.

## 2. Control Modes

### Duration Pulse Control

Valve plug position is controlled by driving the constant speed motor in either direction with AC power for a predetermined period of time.

### Analog Control

Valve plug position is controlled by output from a differential error amplifier which compares an input signal (4-20 mA range), representing desired valve position, with an electronic valve position signal representing actual valve position. It provides power to the motor, in the appropriate direction until the desired valve position is achieved.

### 12-bit Position-Feedback Control

Valve plug position is controlled by driving the constant speed motor in either direction with AC power until the desired valve position is achieved. This is determined by comparing desired valve position, expressed as a 4-20 mA signal, to actual valve position, expressed by a 4-20 mA (12-bit precision) resolver and providing motor power in the appropriate direction until the desired valve position is achieved.

## 3. Drive

A compact high reduction drive amplifies motor torque to the valve plug and reduces the speed of operation. This unique drive provides power transmission efficiency exceeding 90% and reduces mechanical backlash to the point where it cannot be detected.

## 4. Valve Body

Valve body, plug, bonnet, and gland are type 316 stainless steel, conforming to ASTM A743, CF-8M specifications. Pressure rating is ASME 150 for pressures to 275 psi. Straight through large port opening minimizes turbulence and provides high flow capacity. All valves are furnished as standard with flange end connections. Flange drilling options include ASME 150, DIN 10 or 16, BS 10-D or E, and JIS-10.

## 5. Two Valve Plug Styles

The Precision Electric Valve is available with two trim packages, a V-Port and a Straight Concentric configuration. The V-Port plug provides an equal percentage characteristic and is designed for operation in paper/pulp stock and/or other fiber suspensions. The Straight Concentric plug offers higher flow capacity, a more linear flow characteristic and is designed for use in very low consistency fiber suspensions or clean liquid/gas fluids.

## 6. Control Module

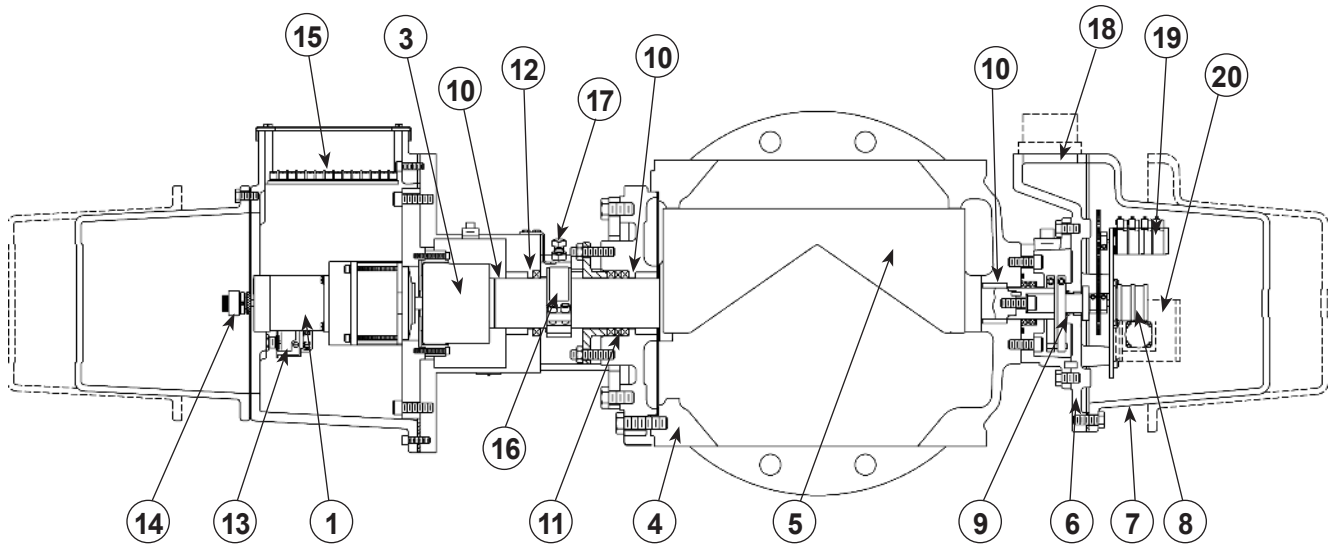
The foundation of a control module is a rugged aluminum casting to which a precision machined base plate is mounted to hold the control mode components. Drive components ride in precision bronze bushings and are coupled directly to the lower journal of the valve plug. Drive gears are precision anti-backlash gears conforming to AGMA #12 specifications.

The entire control module can be stocked as a factory calibrated unit ready for emergency repairs. It is designed to facilitate rapid, easy control module exchange without system shutdown.

## 7. Control Module Cover

A rugged cast aluminum cover protects control module components. This cover provides weatherproof, NEMA IV protection and is easily removed for service or inspection of the control module.





### 8. Potentiometer

Infinite resolution ball bearing potentiometer transmits valve position for system feedback to valve position display or analog control input. Standard construction includes dual-ganged potentiometers with 1K ohm rating. Linearity is 0.5%. Power rating equals 1 watt. A four-gang potentiometer set is available as an option.

### 9. Control Module Seal

Spring loaded V-ring PTFE seal provides reliable long-life protection from flowing media for control module components.

### 10. Bearings

High compression pure carbon bearings, top and bottom, are chemically inert and ensure continuous smooth operation even under high pressure drop loads. The motor housing bearing provides the same service, plus supports extended end of shaft.

### 11. Packing

Multiple V-rings of PTFE packing with adjustable gland ensure reliable long-life shaft seal.

### 12. Motor Housing Seal

Spring loaded cartridge seal protects bearings, motor and drive train from atmosphere.

### 13. Manual Safety Interlock Switch

A fail-safe interlock switch interrupts the motor circuit when the end cover is removed for manual actuation.

### 14. Manual Override

A manual thumb-wheel incorporating a slip-clutch allows adjustment of the motor back shaft for accurate valve positioning, should there be power or signal failure. The integral slip-clutch protects the integrity of drive components by preventing excessive torque being applied.

### 15. Junction Box

Junction box is designed to meet NEMA IV rating. All terminals for power and position signaling are available in this one location. A wiring instruction sheet is attached to the inside of the cover.

### 16. Position Indicator

External mechanical dial and pointer provides visual position indication at the valve location.

### 17. Mechanical Stop

Adjustable closed position stop prevents over-travel.

### 18. Connector

All feedback and control module functions are pre-wired by means of a cable and multi-pin connector.

### 19. Switches

Precision miniature adjustable rotary cam action gang switches are furnished as travel action stops, with an extra set of switches available for external control panel indicator lights if specified. Each switch has individual screwdriver adjustment and locks. Electrical rating is 7 amps.

### 20. Resolver

Optional precision resolver can be added to provide a 4000 position, 4-20 mA valve plug position feedback signal.

# Remote Control Stations

The DeZURIK Precision Electric Valve normally operates in response to a control signal supplied by an electronic controller or process computer. Within the control loop it is common practice to install a manual control station allowing the operator to choose between manual and automatic control and to drive the valve manually when the system is not on automatic control. For this purpose, DeZURIK offers a complete line of electronic control stations. Each of these control stations is designed to ensure compatibility with the DeZURIK Precision Electric Valve. All stations are furnished complete with detailed wiring diagrams for each installation. Two basic styles are available: a standard vertical style totally enclosed, or a horizontal rack mounted chassis for installation in the control room.

## Time Duration Station

The input signal for time duration control is a time measured pulse of 115 volt 50 Hz or 115 volt 60 Hz electrical power. This station is furnished with a manual/automatic selector switch. On automatic, the process computer is controlling the system and the only purpose served by the control station is to indicate valve movement by means of indicating displays located on the front panel, which includes a light, indicating power supply to the motor. When switched to the manual position, the control station overrides the process computer or controller and the operator may push appropriate switches to drive the valve open or shut. While the valve is moving in the open or shut direction, a "run" light is energized. When the valve reaches the end of its stroke, an "open limit" or "closed limit" light is energized. Furnished as standard with the control station (CPE 102) is an extra relay to alert the process computer when the valve is in manual operation.

A dual 1K ohm potentiometer is provided as standard equipment in the valve control module. One of these potentiometers is required for use with the valve position display in the control station leaving the other for customer use. If additional potentiometers are required, specify R2 and a total of four 1K ohm, 1 watt potentiometers are provided. (See Accessories, page 8)

This control station is furnished with a three digit valve position display, complete with integral power supply. The digital display is wired by a shielded cable not to exceed 1,000 feet in length. This cable is not supplied, but you can contact DeZURIK for cable specifications. Time duration stations are available with the horizontal (CPE 101) style rack mounted chassis and vertical (CPE 102) style. Time duration stations may be ordered as part of the valve or as a separate item.

## Analog Control Stations

Analog control stations provide the same manual/automatic control functions found in the time duration control station. Analog control stations incorporate a differential error amplifier which compares the analog input signal to valve position feedback signal, and generates a 115 VAC power signal which is sent to the valve motor. Selector (DIP) switches permit control signal selection of either 1-5 mA, 4-20 mA, 10-50 mA or 1-5 volts.

A dual 1K ohm potentiometer is provided as standard in the valve control module, with both potentiometers required for use with analog control stations. If additional potentiometers are required, specify R2 and a total of four 1K ohm, 1 watt potentiometers are provided. (See Accessories, page 8)

Analog control stations are available with the horizontal (CPE 103) style rack mounted chassis and vertical (CPE 104) style. Control station is supplied with three digit display as described for the time duration control station.

# Specifications

## Size Range

VP – V-Port Concentric Plug, 4–20" (100–500 mm)  
SC – Straight Concentric Plug, 4–20" (100–500mm)

## Materials of Construction

Body, Plug, Cover and Gland—Cast Type 316 Stainless Steel ASTM A743, CF-8M  
Packing—Multiple PTFE V-Flex  
Bearings—Pure Carbon

## Pressure Rating

Maximum Non-Shock CWP Pressure Rating is 275 psi.

## End Connections

ASME 150, DIN 10 or 16 B.S. 10-D or E, and JIS-10

## Temperature Range

32°F to + 180°F (0°C to 82°C)

## Enclosure

NEMA IV, Weatherproof (for CPE 102 & CPE 104 control station only.)

## Electrical Characteristics

Motor: 115V - 50/60 single phase. Current consumption is less than 1 amp for most valve sizes.  
230V - 50 single phase operation available by request.

## Positioning Accuracy

0.1% positioning resolution when using 4-20 mA analog signals for control. Over 7,000 positioning steps when using a 50 millisecond duration signal and a (nominal) 6-minute speed of operation. 0.025% resolution providing 4000 repeatable positions (12-bit resolution) when using a resolver and 6-minute speed of operation.

## Linearity

Analog control: Up to 0.5%, full scale  
Time Duration control: Up to 0.05%, full scale  
Position feedback control: Up to 0.025%, full scale

## Input Signals

1. Analog: Valves furnished complete with DeZURIK Control Station are provided with a selector switch which permits selection of one of the following analog signal ranges: 1-5 mA, 4-20 mA, 10-50 mA or 1-5 volts.
2. Time Duration: 115 Volt 60 or 50 Hz signal duration time as generated by the process computer control system.

## Failure Position

Power Failure: Permanent magnet motor construction provides residual holding torque whenever power to the motor is off. Valve will remain in last position when power fails.

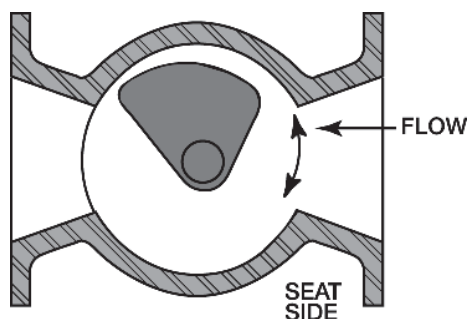
Signal Failure: In analog systems the valve will fail in the direction of signal failure. In time duration systems the valve will fail in the last position in the event of power signal failure.

## Mounting Position

The valve and valve actuator may be mounted in any vertical, horizontal or canted pipeline position. In slurry or fibrous fluid applications the valve should always be installed with flow against the face of the plug. Wherever possible, in slurry and fiber applications, the valve should be installed with the axis of the plug horizontal and with plug rotation into the upper part of the body cavity while open.

## Vibration Resistance

The DeZURIK Precision Electric Valve has been designed to withstand typical pipeline vibrating conditions. Laboratory vibration testing has been conducted on this valve at various rates of acceleration, amplitude, and frequency on all three of the dimensional axis. A complete copy of the laboratory vibration test report is available on request.

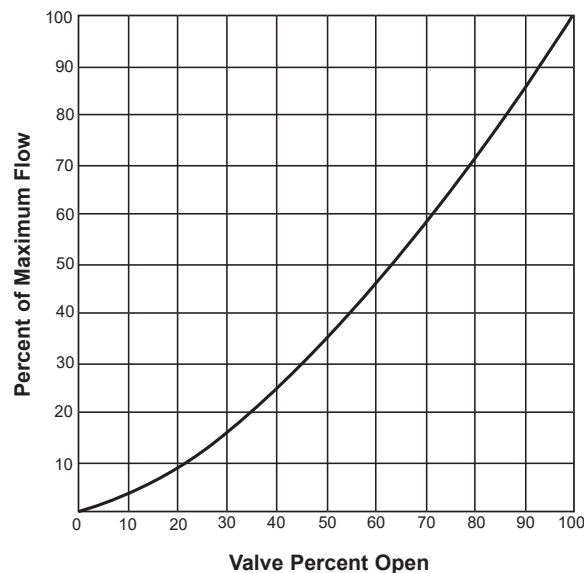




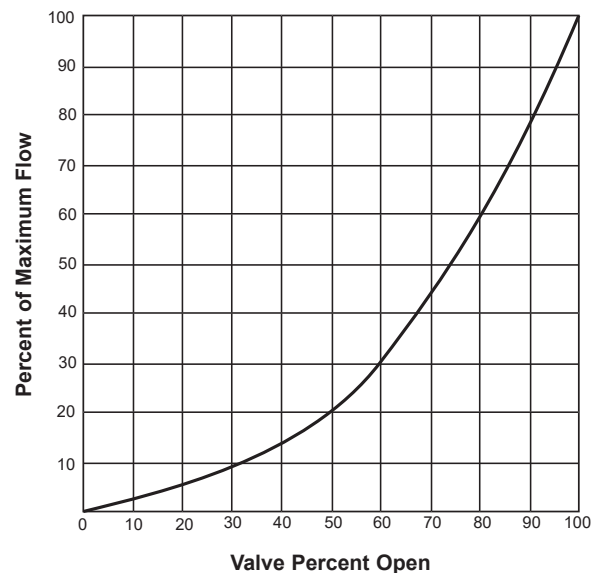
# Valve Selection

## Flow Characteristic

Straight Concentric Plug



V-Port Concentric Plug



## Flow Parameters

Valve Size	Cv*/Kv* 100% Open	
	Straight	V-Port
4"	560	425
100mm	484	368
6"	1180	925
150mm	1021	800
8"	2030	1350
200mm	1756	1168
10"	3130	2050
250mm	2707	1773
12"	4140	2780
300mm	3581	2405
14"	5500	3780
350mm	4758	3270
16"	7300	4460
400mm	6315	3858
18"	9600	6340
450mm	8304	5484
20"	13000	8470
500mm	11245	7327

\*Cv = Flow in GPM of water at 1 psi pressure drop.  
\*Kv = Flow in m3/hr. of water at 100 kPa pressure drop.

# Ordering

To order, simply complete the valve order code from the information shown.  
An ordering example is shown for your reference.

**Valve Style**  
Give valve style code as follows:

PPE = Precision Electric

**Valve Size**  
Give size code as follows:

4 = 4" (100mm)

6 = 6" (150mm)

8 = 8" (200mm)

10 = 10" (250mm)

12 = 12" (300mm)

14 = 14" (350mm)

16 = 16" (400mm)

18 = 18" (450mm)

20 = 20" (500mm)

**End Connection**  
Give end connection code as follows:

F1 = Flanged, ASME Class 150

F110 = Flanged, Class 150 DIN 10 or BS4504/10

F116 = Flanged, Class 150 DIN 16 or BS4504/16

F1D = Flanged, Class 150 B.S. Table D Drilling

F1E = Flanged, Class 150 B.S. Table E Drilling

F1J1 = Flanged, Class 150 JIS 10 Drilling

**Body Material**  
Give body material code as follows:

S2 = 316 stainless steel

**Packing Material**  
Give packing material code as follows:

TC = PTFE V-Flex

**Plug Type**  
Give plug type code as follows:

SC = Straight Concentric

VP = V-Port Concentric

**Options**  
Give option code as follows:

DTR = DeZURIK Standard Certified Production Hydrostatic Shell & Seat Test Report

**Motor Style**  
Give motor style code as follows:

AC = Synchronous Motors

**Motor Cycle**  
Give motor cycle code as follows:

50A = 50 Cycle, 186 Seconds

50B = 50 Cycle, 466 Seconds

60A = 60 Cycle, 155 Seconds

60B = 60 Cycle, 388 Seconds

**Ordering Example:**  
PPE, 4, F1, S2, VP, TC\*AC-50B

# Accessories

**Time Duration Control Stations**  
**Stations**

CPE101-1V = Rack Mounted, 110 Volts

CPE102-1V = Vertical Panel, 110 Volts

CPE101-2V = Rack Mounted, 220 Volts

CPE102-2V = Vertical Panel, 220 Volts

**Analog Control Stations**

CPE103-1V = Rack Mounted, 110 Volts

CPE104-1V = Vertical Panel, 110 Volts

CPE103-2V = Rack Mounted, 220 Volts

CPE104-2V = Vertical Panel, 220 Volts

**Additional Switches/Potentiometer**

X2 = 2 additional switches

R2 = 2 additional potentiometers

**Resolver/Control Module**

RES12M = 12 bit resolver, 4-20 mA signal

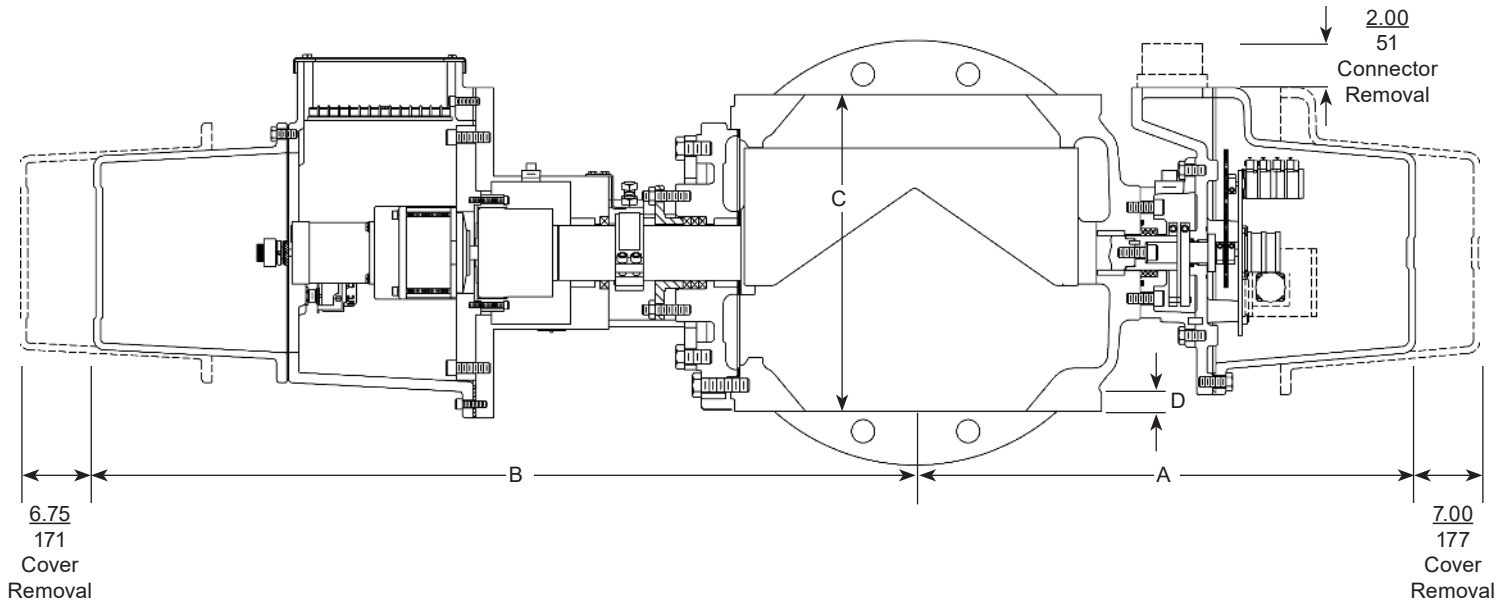
ACC\*CM12M = Control Module with 12 bit resolver, 4-20 mA Signal

NOTE: AC motors are furnished with a dual 1,000 ohm, 1 watt potentiometer as standard. One potentiometer is used with time duration control stations. Both will be used with analog control stations. If additional potentiometers are required, they can be ordered as accessory "R2". Ordering R2 will result in a total of 4 potentiometers on AC actuator units.

10

[DeZURIK.com](http://DeZURIK.com)

# Dimensions



## Dimensions

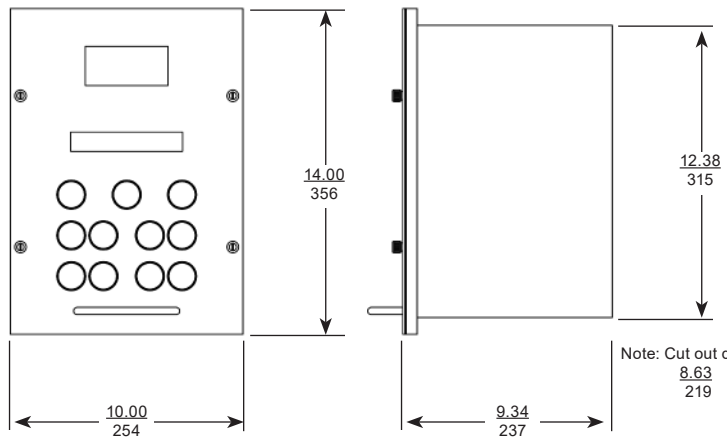
Valve Size	A	B	C	D
4	15.44	25.19	9.00	0.75
100	392	640	229	19
6	16.5	27.88	10.50	0.88
150	419	708	267	22
8	18.12	29.69	11.50	1.00
200	460	754	292	25
10	20.12	32.25	13.00	1.06
250	511	819	330	27
12	21.81	35.00	14.00	1.12
300	554	889	356	29
14	23.00	37.25	17.00	1.25
350	584	946	432	32
16	24.69	39.38	17.75	1.31
400	627	975	451	33
18	25.50	39.75	21.50	1.44
450	648	1010	546	37
20	27.44	41.62	23.50	1.75
500	697	1057	597	44

Inches

Millimeter

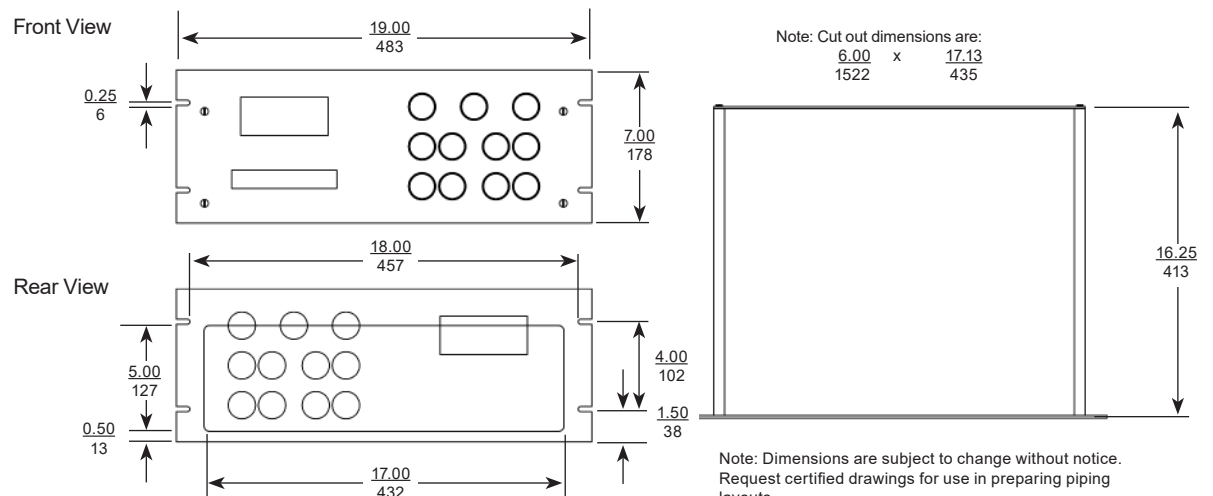
(D) is flange thickness

## Vertical Control Panel



Note: Cut out dimensions are:  
8.63 x 12.50  
219 317

## Horizontal Control Panel



Note: Cut out dimensions are:  
6.00 x 17.13  
1522 435

Note: Dimensions are subject to change without notice.  
Request certified drawings for use in preparing piping layouts.



### **Sales and Service**

For information about our worldwide locations, approvals, certifications and local representative:

**Web Site:** [DeZURIK.com](http://DeZURIK.com)    **E-Mail:** [info@dezurik.com](mailto:info@dezurik.com)



250 Riverside Ave. N. Sartell, Minnesota 56377 • Phone: 320-259-2000 • Fax: 320-259-2227

*DeZURIK, Inc. reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing by DeZURIK, Inc. Certified drawings are available upon request.*