



# Valve Solutions

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## Downstream Pressure Controllers and Valves

### PRODUCT SELECTION GUIDE

#### 651, 1651, 153, 253, 653, AND HEATED VALVES

Isolating and close-loop controlling each variable that affects a vacuum process is the best method for achieving process consistency. At MKS, we can isolate and close-loop control process pressure using a throttling control valve and a digital PID or self-tuning pressure controller. A typical pressure control system works as follows: (1) a Baratron® capacitance manometer senses pressure in a vacuum chamber; (2) this pressure is then compared to the desired set point pressure in the pressure controller; and (3) the pressure controller commands the control valve to open or close, changing the chamber pressure and bringing it to the desired process pressure set point.

No one pressure control technique is best for all applications, though the downstream control technique is chosen most often for today's more critical vacuum processes (see chart below). With the downstream control technique, an exhaust throttle valve is opened or closed, changing the conductance to the vacuum pump in order to achieve and maintain the desired process pressure— independent of gas inlet. The downstream pressure control technique provides high dynamic range, works well with all types of vacuum pumps, provides fast response, is tolerant to most effluent gases, and has moderate initial costs.

### Pressure Control Techniques

	Blower Speed Control	Gas (Ballast) Bypass	Downstream Control
Dynamic Range	low (10 to 1 typical)	moderate (500 to 1 typical - 1000 to 1 max.)	high (1000 to 1 typical - up to 10,000 to 1)
Types of Pumps	will not work on all pumps	will work with any pump which can operate at process pressure	all
Speed of Response	moderate	fast	fast
Initial Capital Cost	AC or SCR motor controller	bypass valve and optional controller	exhaust valve and controller
Extra Operating Costs	none	nitrogen	none
Susceptibility to Effluent Gases	none	none	slight
Special Requirements	pump controller and flow rates must be properly sized	bypass valve and pump must be properly sized	none

## Self-Tuning/Digital PID Pressure Controllers



### 651

The 651 Self-tuning/Digital PID Valve Controller drives 653 or 253 Exhaust Throttle Valves with speed and precision. Its self-tuning algorithm brings the system to set point faster than conventional controllers, and ensures repeatable process recipes without operator involvement. The self-tuning function determines optimal control parameters for any set point in the range of the valve by learning time constants, transfer functions of the valve and plumbing, valve gain, and other important parameters.

The 651 includes adjustable soft-start functions for each set point, as well as open and close functions to minimize turbulence in the chamber; local/remote transducer zeroing capability; and two relays to activate other system functions, or to indicate if the pressure deviates from the desired set point. All controls are easily accessed via a simple-to-use front panel, or remotely through RS-232, TTL, or analog voltage. An LCD readout shows valve position and displays pressure in a wide range of engineering units. Five reprogrammable set points are provided for pressure or position control.



### 1651

The 1651 is a display-less version of the 651 for OEM design engineers who wish to completely control their process via a host computer. Offered as an economical alternative to the 651, this "black box" version allows for remote setup or control entirely through rear panel interface—RS-232, TTL, or analog. Its compact size allows for installation anywhere on the process system, saving valuable rack space.



## Pressure Controllers and Exhaust Throttle Valves

### Exhaust Throttle Valve



#### 253

The 253 Exhaust Throttle Valve regulates the removal of gas from a processing system. Its flapper is positioned to modulate gas flow, thereby controlling process pressure. The 253 has a non-linear actuator placed between the flapper shaft and the motor drive shaft in order to generate a linear valve transfer characteristic and provide smooth linear pressure control. The 253 is available in standard sizes and flange styles, and is compatible with all MKS throttle valve controllers.

### “Smart” Exhaust Throttle Valve



#### 153

Specifically designed for computer-controlled applications where a simple pressure control system is desired, the 153 Valve integrates all control, communication, and driver circuits via a compact “add-on” electronics module within a 253 Throttle Valve assembly, eliminating the need for a separate pressure control electronics module. The 153 is operable in two modes, flapper positioning or pressure control.

For DeviceNet™ communications consult Applications Engineering on the 683.



## Exhaust Throttle Valve with High-speed Motor/Gear Assembly



### 653

The 653 high-speed motor and gear/driver assembly provides fast response to a given set point to quickly achieve desired pressure and increase system throughput. High accuracy is attained by micro-stepping the flapper to give more precise control, and no drift, of pressure at the desired set point. The 653 has sufficient torque to operate sealing valves up to four inches and non-sealing valves to 12 inches to prevent clogging from contamination buildup. The valve body can be heated up to 150°C (using optional sealing materials) for operation in high temperature applications and processes. The 653 has a flapper position indicator to identify valve angle during system troubleshooting, is available in a variety of sizes and flange styles, and is compatible with 651 and 1651 Controllers.

## Heaters



### IPS Subsystem

Current trends in semiconductor processing are towards less maintenance, more uptime, and increased product yield. Reduction of the solid buildup resulting from the cooling of effluent gases can be a factor in achieving those goals. Heating the valve and other components of the system is part of a method to manage these byproducts, increasing uptime, and improving wafer yields, with a quick payback.

IPS offers subsystems to improve heat distribution on downstream lines while complying with strict agency and corporate personnel safety standards.



# Pressure Controller Specifications

	651C	1651C
<b>Valves Operated</b>	653 and 253 Exhaust Throttle Valves	653 and 253 Exhaust Throttle Valves
<b>Pressure Input Signal</b>	0-10 VDC, 0-5 VDC, or 0-1 VDC, selectable	0-5 VDC, 0-10 VDC, 0-1 VDC, selectable
<b>Input Power Required</b>	90-132 or 180-264 VAC, 50/60 Hz	±15 VDC ±5%
<b>Minimum Input Current</b>		For 653 Valve: 1 Amp + transducer current For 253 Valve: 0.5 Amp + transducer current
<b>Maximum Input Current</b>		Not to exceed 7 Amps
<b>Set Points</b>		
<b>Programmable</b>	5 total, programmable in any combination for pressure or position (adjustable from the front panel or RS-232; selectable from the front panel, TTL, or RS-232)	5 total, programmable in any combination for pressure or position (adjustable via RS-232; selectable via TTL or RS-232)
<b>External Analog</b>	1; pressure or position, 0-5 or 0-10 VDC	1; pressure or position, 0-5 or 0-10 VDC
<b>Controller Repeatability</b>	±0.1% of F.S.	±0.1% of F.S.
<b>Ambient Operating Temperature</b>	15°-40°C (60°-104°F)	15°-50°C (60°-122°F)
<b>Output Power</b>	Standard: ±15 VDC ±5 @ 0.5 Amp (Derated to 0.4 Amp with 90-99 or 180-198 VAC input) when powered Optional: ±15 VDC ±5% @ 1.5 Amps max.	Available to external transducers: ±15 Volts @ 3 Amps max. (90 Watts) from an external power supply with a capacity of ±15 Volts @ 5 Amps (150 Watts)
<b>Analog Output Signal</b>	0-5 or 0-10 VDC for 0-100% valve position and 0-10 VDC for 0-100% F.S. pressure	0-5 or 0-10 VDC for 0-100% valve position and 0-10 VDC for 0-100% F.S. pressure
<b>Size</b>	1/2-rack packaging: 3-1/2"H x 9-1/2"W x 9"D	3 1/2" H x 6.7"W x 9.15"D
<b>Display</b>	2-line LCD with 4-1/2 place readout (pressure and valve position)	N/A
<b>Display Units</b>	Torr, mTorr, mbar, Pascal, cmH <sub>2</sub> O, inH <sub>2</sub> O, μbar, kPa	N/A
<b>Soft Start</b>	Standard	Standard
<b>Self-tuning Unit</b>	Standard	Standard
<b>PID Control</b>	Standard	Standard
<b>Remote Zero</b>	Standard	Standard
<b>Interface</b>	Front panel, Analog, TTL (16 inputs, 6 outputs) and RS-232	Analog, TTL (16 inputs, 6 outputs) and RS-232
<b>Relay Outputs</b>	2, process limits: 24 Volts AC/DC @ 1 Amp resistive	2, process limits: 24 Volts VDC @ 1 Amp resistive
<b>Remote Control Override (Open, Close, Hold)</b>	Standard	Standard
<b>Position Control Capability</b>	Standard	Standard
<b>Connectors</b>	Valve: 9-pin Type "D" female I/O: 37-pin Type "D" female Transducer: 15-pin Type "D" female RS-232: 9-pin Type "D" male	Power Connector: 9-pin Type "D" male Valve: 9-pin Type "D" female I/O: 37-pin Type "D" female Transducer: 15-pin Type "D" female RS-232: 9-pin Type "D" male
<b>Compliance</b>	CE	CE



## Throttle Valve Specifications (Common to All Sizes & Flanges)

	653B	253B
<b>Speed (open to close)</b>	1.7 sec	Standard: 7.5 sec. Optional: <2 sec. (Note 1)
<b>Resolution</b>	1/12,000	Standard: 1/10,000 Fast Motor Option: 1/2800
<b>Drive Method</b>	Direct gear drive	Mechanical (non belt) drive with integral cosine generator to linearize valve transfer characteristic
<b>Maximum Valve Body Operating Temperature</b>	Standard: 0°C-100°C Optional: 0°C-150°C (Note 1)	0°-90°C
<b>Valve Motor Ambient Operating Temperature</b>	-20°C to +40°C	0°C-70°C max.
<b>Differential Pressure Across Valve</b>	1 atm. (15 psig) max.	1 atm. (15 psig)
<b>External Leakage at Shaft Seal</b>	1x10 <sup>-6</sup> scc/sec He	1x10 <sup>-7</sup> scc/sec He
<b>Materials Exposed to Process</b>	Standard: 316L S.S., Viton® (Note 2)	316 S.S., Viton (Note 2)
<b>Compatible Controller</b>	651, 1651	651, 1651, 153
<b>Visual Position Indicator</b>	Standard	N/A
<b>Drive Output Torque (with 651 Controller)</b>	800 in-oz	Standard speed: 600 in-oz High-speed: 170 in-oz
<b>Closed Leakage (valves with a flapper o-ring)</b>	<10 <sup>-7</sup> (Torr l/s)	<10 <sup>-7</sup> (Torr l/s)
	Notes: 1) Consistent with shaft seal and flapper seal o-ring material. 2) Where Viton is used, other materials are available. Contact Applications Engineering.	Notes: 1) Fast Motor Option only available on non-sealing valves. 2) Where Viton is used, other materials are available. Contact Applications Engineering.



# Exhaust Throttle Valve Sizes and Flange Styles

## ASA Flanges

### 253B

Part Number	Mounting Flange	(A) Nominal Inside Diameter	(B) Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height*	Bolt Circle Diameter	Flange O-ring Groove ID	Flapper O-ring	Flange O-ring Parker No.	(**) Controllable Conductance l/s min	(max)
253B-2-2-1	2" ASA	1.88 (48)	5.95 (151)	0.75 (19)	0.75 (19)	4	10.79 (274)	4.750 (121)	3.365 (85)	Yes	2-237	0.35	300
253B-2-2-2	2" ASA	1.95 (50)	5.95 (151)	0.75 (19)	0.75 (19)	4	10.79 (274)	4.750 (121)	3.365 (85)	No	2-237	0.7	300
253B-60-2-2	2" ASA	2.362 (60)	5.95 (151)	0.75 (19)	0.75 (19)	4	10.79 (274)	4.750 (121)	3.365 (85)	No	2-237	0.8	375
253B-3-2-2	2" ASA	3.025 (77)	5.95 (151)	0.75 (19)	0.75 (19)	4	10.79 (274)	4.750 (121)	3.365 (85)	No	2-237	1	500
253B-3-3-2	3" ASA	3.025 (77)	7.40 (188)	0.88 (22)	0.75 (19)	4	12.24 (311)	6.000 (152)	4.475 (114)	No	2-349	1	500
253B-3-3-2	3" ASA	3.965 (101)	7.40 (188)	0.88 (22)	0.75 (19)	4	12.24 (311)	6.000 (152)	4.475 (114)	No	2-349	1.5	950
253B-4-4-2	4" ASA	3.965 (101)	8.90 (226)	0.88 (22)	0.75 (19)	8	13.74 (349)	7.500 (191)	5.995 (152)	No	2-258	1.5	950

\*For 153 Valves, add 1.93" (49mm) to the 253 Dimension

\*\* Molecular flow regime

### 653B

Part Number	Mounting Flange	(A) Nominal Inside Diameter	(B) Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height	Bolt Circle Diameter	Flange O-ring Groove ID	Flapper O-ring	Flange O-ring Parker No.	(**) Controllable Conductance l/s min	(max)
653B-2-2-1	2" ASA	1.886 (48)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	Yes	2-237	0.35	300
653B-2-2-2	2" ASA	1.886 (48)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	No	2-237	0.7	300
653B-60-2-1	2" ASA	2.360 (60)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	Yes	2-237	0.4	375
653B-60-2-1	2" ASA	2.360 (60)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	Nos	2-237	0.8	375
653B-3-2-1	2" ASA	2.886 (73)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	Yes	2-237	0.5	500
653B-3-2-2	2" ASA	2.886 (73)	5.95 (151)	1.00 (25)	0.75 (19)	4	12.53 (318)	4.750 (121)	3.365 (85)	No	2-237	1	500
653B-3-3-1	3" ASA	2.886 (73)	7.40 (188)	1.00 (25)	0.75 (19)	4	14.02 (356)	6.000 (152)	4.475 (114)	Yes	2-349	0.75	500
653B-3-3-2	3" ASA	2.886 (73)	7.40 (188)	1.00 (25)	0.75 (19)	4	14.02 (356)	6.000 (152)	4.475 (114)	No	2-349	1	500
653B-4-3-1	3" ASA	3.885 (99)	7.40 (188)	1.00 (25)	0.75 (19)	4	14.02 (356)	6.000 (152)	4.475 (114)	Yes	2-349	0.75	950
653B-4-3-2	3" ASA	3.885 (99)	7.40 (188)	1.00 (25)	0.75 (19)	4	14.02 (356)	6.000 (152)	4.475 (114)	No	2-349	1.5	950
653B-4-4-1	4" ASA	3.885 (99)	8.90 (226)	1.00 (25)	0.75 (19)	8	15.54 (395)	7.500 (191)	5.995 (152)	Yes	2-258	0.75	950
653B-4-4-2	4" ASA	3.885 (99)	8.90 (226)	1.00 (25)	0.75 (19)	8	15.54 (395)	7.500 (191)	5.995 (152)	No	2-258	1.5	950
653B-6-4-1	4" ASA	5.503 (140)	8.90 (226)	1.62 (41)	0.75 (19)	8	16.16 (410)	7.500 (191)	5.995 (152)	No	2-258	4	2150
653B-6-6-2	6" ASA	5.869 (149)	10.90 (277)	1.62 (41)	0.88 (22)	8	18.18 (462)	9.500 (241)	8.000 (203)	No	2-266	4	2150
653B-8-6-2	6" ASA	7.636 (194)	10.90 (277)	1.62 (41)	0.88 (22)	8	18.18 (462)	9.500 (241)	8.000 (203)	No	2-266	6	3600
653B-8-8-2	8" ASA	7.636 (194)	13.19 (335)	1.62 (41)	0.88 (22)	8	20.48 (520)	11.750 (298)	9.750 (248)	No	2-273	8	3600
653B-10-10-2	10" ASA	10.118 (257)	16.00 (406)	1.62 (41)	1.00 (25)	12	23.31 (592)	14.250 (362)	11.938 (362)	No	2-278	10	6400

Dimensions in inches (mm)

\*\* Molecular flow regime





# CF Flanges

## 253B

Part Number	Mounting Flange	(A) Nominal Inside Diameter	(B) Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height*	Bolt Circle Diameter	Flapper O-ring	(**) Controllable Conductance l/s min	(max)
253B-20-2CF-1	2 3/4" CF	0.779 (20)	2.75 (70)	1.25 (32)	0.26 (6.6)	6	8.64 (220)	2.312 (59)	Yes	0.07	24
253B-20-2CF-2	2 3/4" CF	0.779 (20)	2.75 (70)	1.25 (32)	0.26 (6.6)	6	8.64 (220)	2.312 (59)	No	0.25	31
253B-1-2CF-1	2 3/4" CF	1.270 (32)	2.75 (70)	1.25 (32)	0.26 (6.6)	6	8.64 (220)	2.312 (59)	Yes	0.2	50
253B-1-2CF-2	2 3/4" CF	1.270 (32)	2.75 (70)	1.25 (32)	0.26 (6.6)	6	8.64 (220)	2.312 (59)	No	0.4	55
253B-2-3CF-1	3 3/8" CF	1.889 (48)	3.25 (83)	1.06 (27)	0.33 (8.3)	8	9.14 (232)	2.850 (72)	Yes	0.35	300
253B-2-3CF-2	3 3/8" CF	2.000 (51)	3.25 (83)	1.06 (27)	0.33 (8.3)	8	9.14 (232)	2.850 (72)	No	0.7	300
253B-2-4CF-2	4 1/2" CF	2.000 (51)	4.47 (114)	1.00 (25)	0.33 (8.3)	8	10.36 (263)	3.628 (92)	No	0.7	300
253B-3-6CF-2	6" CF	3.000 (76)	7.40 (188)	0.81 (21)	0.33 (8.3)	16	12.24 (311)	5.128 (130)	No	1	500
253B-4-6CF-2	6" CF	3.875 (98)	7.40 (188)	0.94 (24)	0.33 (8.3)	16	12.24 (311)	5.128 (130)	No	1.5	900

\*For 153 Valves, add 1.93" (49mm) to the 253 Dimension

\*\* Molecular flow regime

## 653B

Part Number	Mounting Flange	(A) Nominal Inside Diameter	(B) Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height	Bolt Circle Diameter	Flapper O-ring	(**) Controllable Conductance l/s min	(max)
653B-20-2CF-1	2 3/4" CF	0.779 (20)	2.75 (70)	1.00 (25)	0.27 (6.8)	6	10.55 (268)	2.312 (59)	Yes	0.07	24
653B-20-2CF-2	2 3/4" CF	0.779 (20)	2.75 (70)	1.00 (25)	0.27 (6.8)	6	10.55 (268)	2.312 (59)	No	0.25	31
653B-1-2CF-1	2 3/4" CF	1.270 (32)	2.75 (70)	1.00 (25)	0.27 (6.8)	6	10.55 (268)	2.312 (59)	Yes	0.2	50
653B-1-2CF-2	2 3/4" CF	1.270 (32)	2.75 (70)	1.00 (25)	0.27 (6.8)	6	10.55 (268)	2.312 (59)	No	0.4	55
653B-2-3CF-1	3 3/8" CF	1.886 (48)	3.25 (83)	1.00 (25)	0.34 (8.6)	8	11.05 (281)	2.850 (72)	Yes	0.35	300
653B-2-3CF-2	3 3/8" CF	1.886 (48)	3.25 (83)	1.00 (25)	0.34 (8.6)	8	11.05 (281)	2.850 (72)	No	0.7	300
653B-2-4CF-1	4 1/2" CF	1.886 (48)	4.47 (114)	1.00 (25)	0.34 (8.6)	8	12.28 (312)	3.628 (92)	Yes	0.35	300
653B-2-4CF-2	4 1/2" CF	1.886 (48)	4.47 (114)	1.00 (25)	0.34 (8.6)	8	12.28 (312)	3.628 (92)	No	0.7	300
653B-3-6CF-1	6" CF	2.886 (73)	7.40 (188)	1.00 (25)	0.33 (8.4)	16	14.07 (357)	5.128 (130)	Yes	0.5	500
653B-3-6CF-2	6" CF	2.886 (73)	7.40 (188)	1.00 (25)	0.33 (8.4)	16	14.07 (357)	5.128 (130)	No	1	500
653B-4-6CF-1	6" CF	3.885 (99)	7.40 (188)	1.00 (25)	0.33 (8.4)	16	14.07 (357)	5.128 (130)	Yes	0.75	900
653B-4-6CF-2	6" CF	3.885 (99)	7.40 (188)	1.00 (25)	0.33 (8.4)	16	14.07 (357)	5.128 (130)	No	1.5	900
653B-6-8CF-2	8" CF	5.869 (149)	8.90 (226)	1.62 (41)	0.33 (8.4)	20	17.13 (435)	7.128 (181)	No	2	2100
653B-8-10CF-2	10" CF	7.650 (194)	11.22 (285)	1.62 (41)	0.33 (8.4)	24	18.90 (480)	9.128 (232)	No	3	3750

Dimensions in inches (mm)

\*\* Molecular flow regime





# Exhaust Throttle Valve Sizes and Flange Styles

## ISO Flanges

### 253B

Part Number	Mounting Flange	(A) Inside Diameter	(B) Nominal Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height*	Bolt Circle Diameter	Flapper O-ring	(**) Controllable Conductance l/s min	(max)
253B-20-40-1	ISO KF-40	0.779 (20)	2.75 (70)	2.25 (57)	N/A	N/A	8.64 (219)	N/A	Yes	0.07	24
253B-20-40-2	ISO KF-40	0.779 (20)	2.75 (70)	2.25 (57)	N/A	N/A	8.64 (219)	N/A	No	0.25	31
253B-1-40-1	ISO KF-40	1.270 (32)	2.75 (70)	2.25 (57)	N/A	N/A	8.64 (219)	N/A	Yes	0.2	50
253B-1-40-2	ISO KF-40	1.770 (32)	2.75 (70)	2.25 (57)	N/A	N/A	8.64 (219)	N/A	No	0.4	55
235B-2-50-1	ISO KF-50	1.888 (48)	3.25 (83)	2.00 (51)	N/A	N/A	9.14 (232)	N/A	Yes	0.35	300
235B-2-50-2	ISO KF-50	2.000 (51)	3.25 (83)	2.00 (51)	N/A	N/A	9.14 (232)	N/A	No	0.7	300
253B-60-63-2	ISO NW-63	2.362 (60)	5.95 (151)	0.81 (21)	0.35 (9)	4	10.79 (274)	4.330 (110)	No	0.8	375
253B-3-80-2	ISO NW-80	3.000 (76)	5.95 (151)	0.81 (21)	0.35 (9)	8	10.79 (274)	4.920 (125)	No	1	500
253B-4-100-2	ISO NW-100	3.875 (98)	7.40 (188)	0.94 (24)	0.35 (9)	8	12.24 (311)	5.710 (145)	No	1.5	900

\*For 153 Valves, add 1.93" (49mm) to the 253 Dimension

\*\* Molecular flow regime

### 653B

Part Number	Mounting Flange	(A) Nominal Inside Diameter	(B) Outside Diameter	(C) Thickness	(D) Bolt Hole Diameter	(E) Number of Bolt Holes	Overall Height	Bolt Circle Diameter	Flapper O-ring	(**) Controllable Conductance l/s min	(max)
653B-20-40-1	ISO KF-40	0.779 (20)	2.75 (70)	2.25 (57)	N/A	N/A	10.58 (268)	N/A	Yes	0.07	24
653B-20-40-2	ISO KF-40	0.779 (20)	2.75 (70)	2.25 (57)	N/A	N/A	10.58 (268)	N/A	No	0.25	31
653B-1-40-1	ISO KF-40	1.270 (32)	2.75 (70)	2.25 (57)	N/A	N/A	10.58 (268)	N/A	Yes	0.2	50
653B-1-40-2	ISO KF-40	1.270 (32)	2.75 (70)	2.25 (57)	N/A	N/A	10.58 (268)	N/A	No	0.4	55
653B-2-50-1	ISO KF-50	1.886 (48)	3.25 (83)	2.00 (51)	N/A	N/A	11.06 (281)	N/A	Yes	0.35	300
653B-2-50-2	ISO KF-50	1.886 (48)	3.25 (83)	2.00 (51)	N/A	N/A	11.06 (281)	N/A	No	0.7	300
653B-60-63-1	ISO NW-63	2.360 (60)	5.95 (151)	1.00 (25)	0.35 (9)	4	12.53 (318)	4.330 (110)	Yes	0.4	375
653B-60-63-2	ISO NW-63	2.360 (60)	5.95 (151)	1.00 (25)	0.35 (9)	4	12.53 (318)	4.330 (110)	No	0.8	375
653B-3-80-1	ISO NW-80	2.886 (74)	5.95 (151)	1.00 (25)	0.35 (9)	8	12.53 (318)	4.920 (125)	Yes	0.5	500
653B-3-80-2	ISO NW-80	2.886 (74)	5.95 (151)	1.00 (25)	0.35 (9)	8	12.53 (318)	4.920 (125)	No	1	500
653B-4-100-1	ISO NW-100	3.885 (99)	7.40 (1.88)	1.00 (25)	0.35 (9)	8	14.02 (356)	5.710 (145)	Yes	0.75	950
653B-4-100-2	ISO NW-100	3.885 (99)	7.40 (1.88)	1.00 (25)	0.35 (9)	8	14.02 (356)	5.710 (145)	No	1.5	900
653B-6-160-2	ISO NW-160	5.869 (149)	8.90 (226)	1.62 (41)	0.43 (11)	8	16.16 (410)	7.870 (200)	No	4	2100
653B-8-200-2	ISO NW-200	7.650 (194)	11.22 (285)	1.62 (41)	0.43 (11)	12	18.50 (470)	10.240 (260)	No	6	3750
653B-10-250-2	ISO NW-250	9.700 (246)	13.19 (335)	1.62 (41)	0.43 (11)	12	20.48 (520)	12.200 (310)	No	8	6000
653B-12-320-2	ISO NW-320	12.370 (314)	16.73 (425)	1.62 (41)	0.55 (14)	12	24.02 (610)	15.55 (395)	No	10	9300

Dimensions in inches (mm)

\*\* Molecular flow regime



# JIS Flanges

## 253B

Part Number	Mounting Flange	Nominal Inside Diameter	Outside Diameter	Thickness	Bolt Hole Diameter	Number of Bolt Holes	Overall Height*	Bolt Circle Diameter	Flange O-ring Groove ID	Flange O-ring Size (JIS)	Flapper O-ring	Controllable (**) Conductance l/s min	(max)
253B-2-50J-1	JIS 50mm	1.888 (48)	4.47 (114)	1.00 (25)	0.39 (10)	4	10.36 (263)	3.937 (100)	2.766 (70)	2.765 x 0.157 (70) x (4)	Yes	0.35	300
253B-2-50J-2	JIS 50mm	2.000 (51)	4.47 (114)	1.00 (25)	0.39 (10)	4	10.36 (263)	3.937 (100)	2.766 (70)	2.765 x 0.157 (70) x (4)	No	0.35	300
253B-4-100J-2	JIS 50mm	3.875 (98)	7.40 (188)	0.94 (24)	0.47 (12)	8	13.29 (338)	6.299 (160)	4.724 (120)	4.724 x 0.157 (120) x (4)	No	0.35	300

\*For 153 Valves, add 1.93" (49mm) to the 253 Dimension

\*\* Molecular flow regime

## 653B

Part Number	Mounting Flange	Nominal Inside Diameter	Outside Diameter	Thickness	Bolt Hole Diameter	Number of Bolt Holes	Overall Height	Bolt Circle Diameter	Flange O-ring Groove ID	Flange O-ring Size (JIS)	Flapper O-ring	Controllable (**) Conductance l/s min	(max)
653B-2-50J-1	JIS 50mm	1.886 (48)	4.47 (114)	1.00 (25)	0.39 (10)	4	12.27 (312)	3.937 (100)	2.766 (70)	2.756 x 0.157 (70) x (4)	Yes	0.35	300
653B-2-50J-2	JIS 50mm	1.886 (48)	4.47 (114)	1.00 (25)	0.39 (10)	4	12.27 (312)	3.937 (100)	2.766 (70)	2.756 x 0.157 (70) x (4)	No	0.7	300
653B-4-100J-1	JIS 100mm	3.8865 (99)	7.28 (185)	1.00 (25)	0.47 (12)	8	13.90 (353)	6.299 (160)	4.724 (120)	4.724 x 0.157 (120) x (4)	Yes	0.75	950
653B-4-100J-2	JIS 100mm	3.8865 (99)	7.28 (185)	1.00 (25)	0.47 (12)	8	13.90 (353)	6.299 (160)	4.724 (120)	4.724 x 0.157 (120) x (4)	No	1.5	900
653B-6-150J-2	JIS 150mm	5.709 (145)	9.25 (235)	1.62 (41)	0.47 (12)	8	16.51 (419)	8.268 (210)	6.890 (175)	6.890 x 0.157 (173) x (4)	No	2	2100
653B-8-200J-2	JIS 200mm	7.677 (195)	11.81 (300)	1.62 (41)	0.59 (15)	8	19.09 (485)	10.630 (270)	8.858 (225)	8.761 x 0.236 (223) x (6)	No	3	3600
653B-10-250J-2	JIS 250mm	9.645 (245)	13.78 (350)	1.62 (41)	0.59 (15)	12	21.08 (535)	12.598 (320)	10.827 (275)	10.709 x 0.236 (272) x (6)	No	4	6000
653B-12-300J-2	JIS 300mm	11.597 (295)	15.75 (400)	1.62 (41)	0.59 (15)	12	23.02 (585)	14.566 (370)	12.795 (325)	12.795 x 0.236 (322) x (6)	No	5	8600

Dimensions in inches (mm)

\*\* Molecular flow regime



# Throttle Valve Heater Kits

## NW40

Voltage	Temp.	LTA	Watts	Amps	Kit# (253 & 653)
120 VAC	150°C	No	59	0.49	55-0361
120 VAC	150°C	Yes	59	0.49	55-0362
120 VAC	105°C	No	59	0.49	55-0363
120 VAC	105°C	Yes	59	0.49	55-0364
240 VAC	150°C	No	59	0.25	55-0367
240 VAC	150°C	Yes	59	0.25	55-0368
240 VAC	105°C	No	59	0.25	55-0369
240 VAC	105°C	Yes	59	0.25	55-0370

## NW50

Voltage	Temp.	LTA	Watts	Amps	Kit# (253 & 653)
120 VAC	150°C	No	68	0.57	55-0371
120 VAC	150°C	Yes	68	0.57	55-0372
120 VAC	105°C	No	68	0.57	55-0373
120 VAC	105°C	Yes	68	0.57	55-0374
240 VAC	150°C	No	68	0.28	55-0377
240 VAC	150°C	Yes	68	0.28	55-0378
240 VAC	105°C	No	68	0.28	55-0379
240 VAC	105°C	Yes	68	0.28	55-0380

## NW63

Voltage	Temp.	LTA	Watts	Amps	Kit# 253	Kit# 653
120 VAC	150°C	No	104	0.87	55-0721	55-0731
120 VAC	150°C	Yes	104	0.87	55-0722	55-0732
120 VAC	105°C	No	104	0.87	55-0723	55-0733
120 VAC	105°C	Yes	104	0.87	55-0724	55-0734
240 VAC	150°C	No	104	0.43	55-0727	55-0737
240 VAC	150°C	Yes	104	0.43	55-0728	55-0738
240 VAC	105°C	No	104	0.43	55-0729	55-0739
240 VAC	105°C	Yes	104	0.43	55-0730	55-0740

## Heater Specifications

<b>Temperature</b>			
Nominal Set Point	150°C	105°C	
Exterior Range	60-70°C	45-55°C	
Interior Range	130-170°C	90-120°C	
<b>Electrical Duty Cycle</b>		100 volts	72%
		120 volts	50%
<b>Foam Thickness</b>		0.5 in. (12.7mm)	
<b>Materials</b>		Molded silicone foam, fiberglass reinforced silicone, Teflon insulated wire	
<b>Relative Humidity</b>		90% Maximum	
<b>Connectors</b>		Midget Twist-Lock, nylon NEMA ML-1	
<b>Weight Range</b>		0.5 to 3.3 lb (0.73 to 1.5 kg)	
<b>Compliance</b>		CE, UL E52951	

## NW80\*

Voltage	Temp.	LTA	Watts	Amps	Kit# 253	Kit# 653
120 VAC	150°C	No	104	0.87	55-0172	55-0176
120 VAC	150°C	Yes	104	0.87	55-0173	55-0177
120 VAC	105°C	No	104	0.87	55-0170	55-0174
120 VAC	105°C	Yes	104	0.87	55-0171	55-0175
240 VAC	150°C	No	104	0.43	55-0221	55-0225
240 VAC	150°C	Yes	104	0.43	55-0222	55-0226
240 VAC	105°C	No	104	0.43	55-0223	55-0227
240 VAC	105°C	Yes	104	0.43	55-0224	55-0228

## NW100\*\*

Voltage	Temp.	LTA	Watts	Amps	Kit# 253	Kit# 653
120 VAC	150°C	No	123	1.02	55-0251	55-0255
120 VAC	150°C	Yes	123	1.02	55-0252	55-0256
120 VAC	105°C	No	123	1.02	55-0253	55-0257
120 VAC	105°C	Yes	123	1.02	55-0254	55-0258
240 VAC	150°C	No	123	0.51	55-0261	55-0265
240 VAC	150°C	Yes	123	0.51	55-0262	55-0266
240 VAC	105°C	No	123	0.51	55-0263	55-0267
240 VAC	105°C	Yes	123	0.51	55-0264	55-0268

Kits include any special hardware required, such as clamps.

LTA- Low Temperature Alarm

\*Valve Heater designed to mate with heater on 3" tubing (consult for other size tubing)

\*\*Valve Heater designed to mate with heater on 4" tubing (consult for other size tubing)

Note: Heaters can only be used with valves that are configured for use at higher temperatures. To obtain the order code for a heat-able throttle valve, place the letter "A" in place of the last "-" in the part number.

Example: 253B-20-40-1  
Becomes  
253B-20-40A1

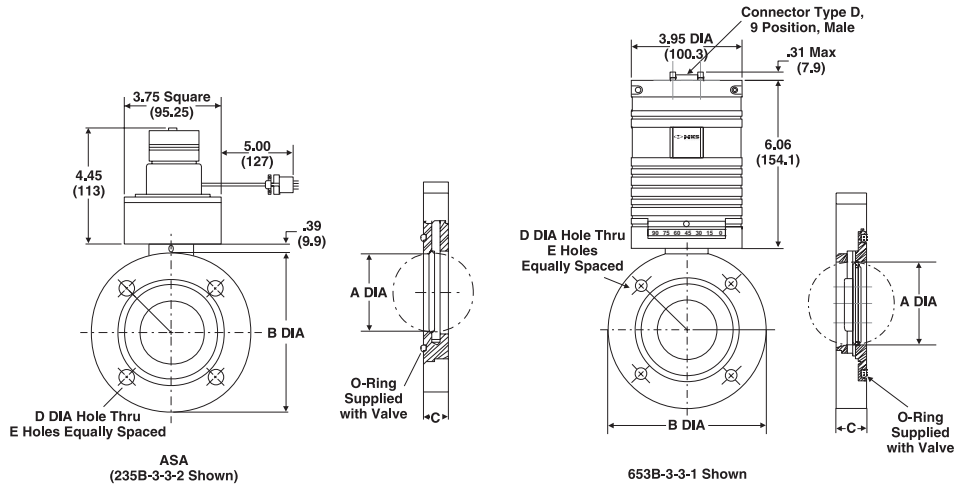


## LTA Monitor Specifications

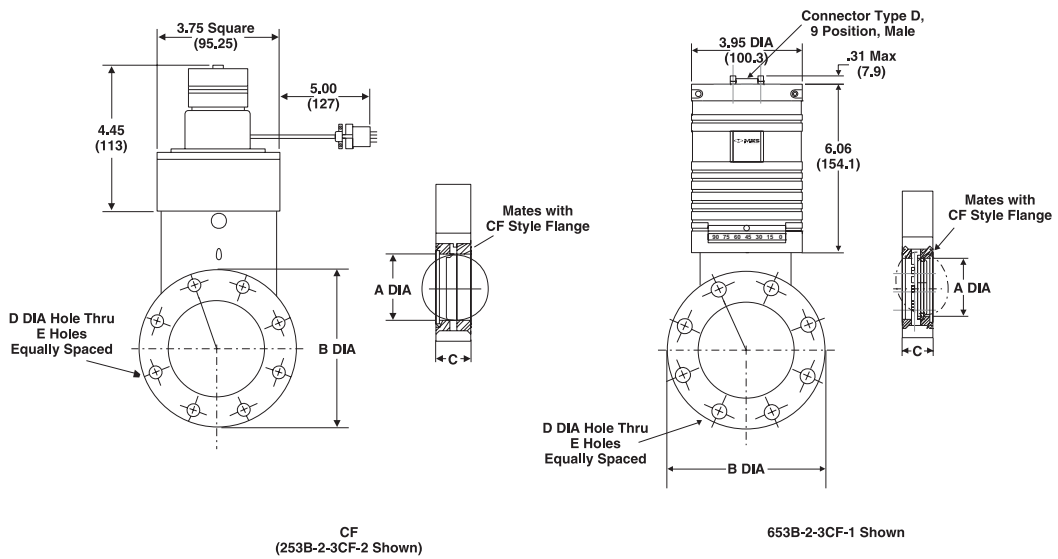
<b>Enclosure</b>	Black Plastic
<b>Power Requirements</b>	90-130 VAC input, 12 VDC ±3 VDC output
<b>Power Consumption</b>	0.3 W
<b>Relay Contact Rating</b>	SPDT, 2A @ 50 VAC resistive 1@30 VDC
<b>Input/Output Wiring</b>	1 Thermal switch line IN 2 Thermal switch line OUT 3 Normally closed 4 Common 5 Normally open
<b>Dimensions</b>	2.58" x 4.76" x 1.46" (inches) (L x H x D)
<b>Compliance</b>	CE



**ASA Flange**  
253, 653

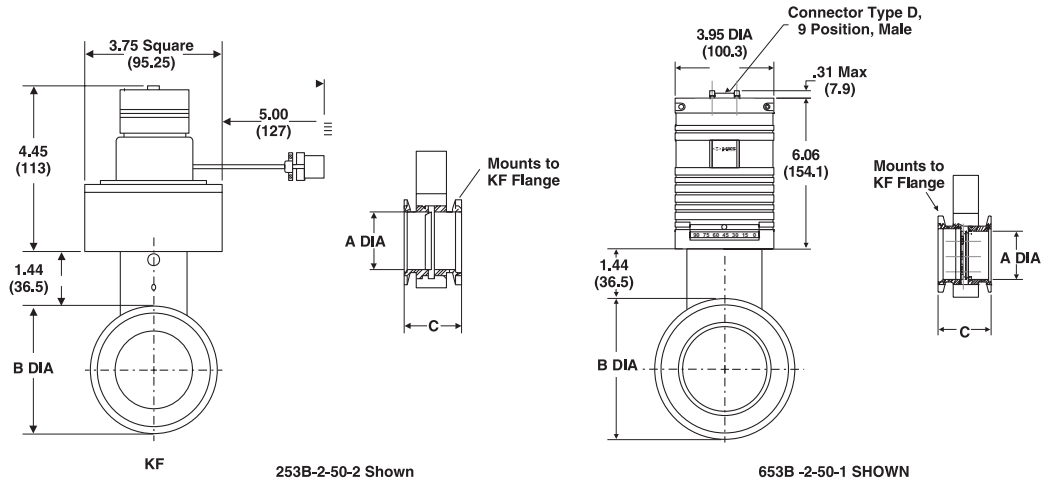


**CF Flange**  
253, 653

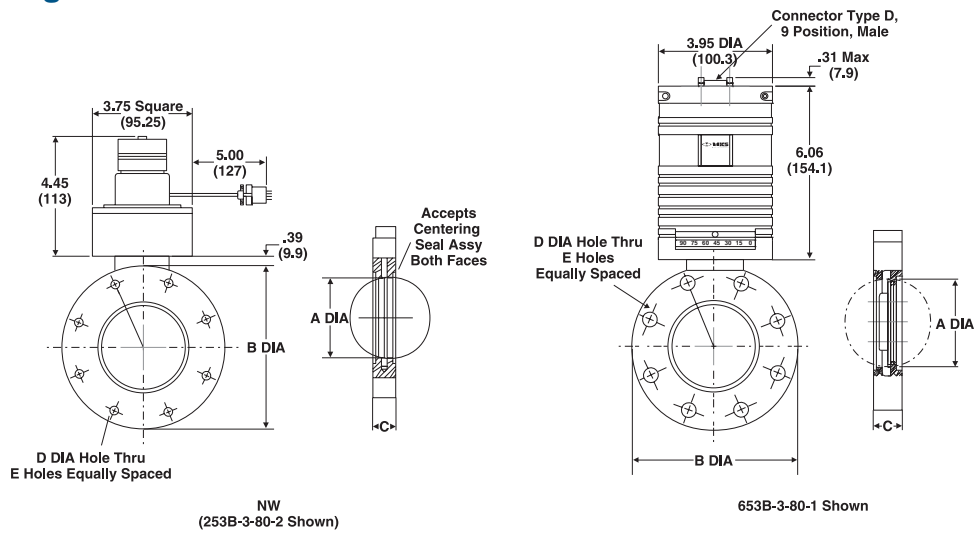


# Dimensional Drawings

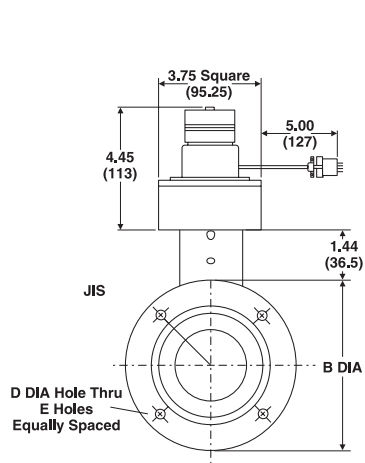
## ISO KF Flange 253, 653



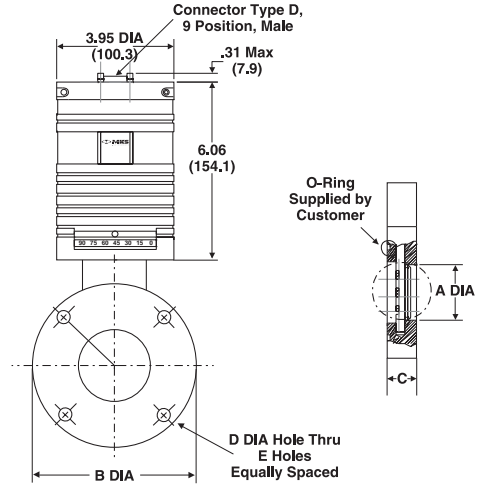
## ISO NW Flange 253, 653



## JIS Flange 253, 653

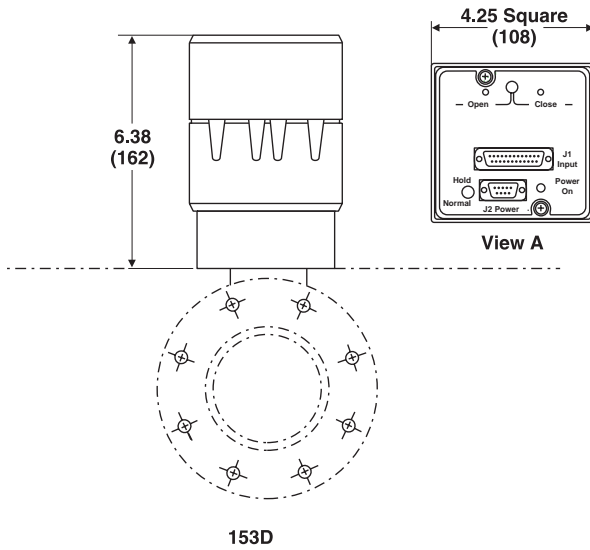


253B-2-50J-2 Shown

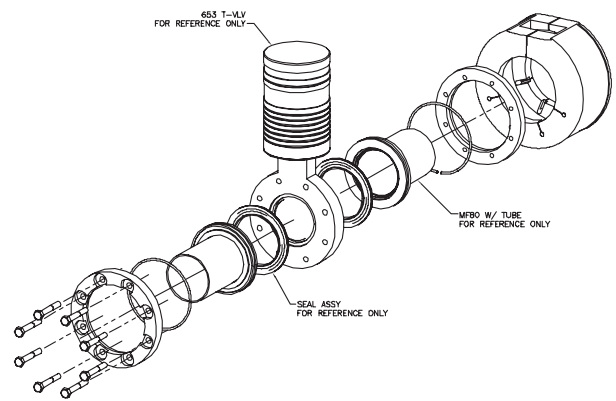


653A-2-50J-1 Shown

## 153

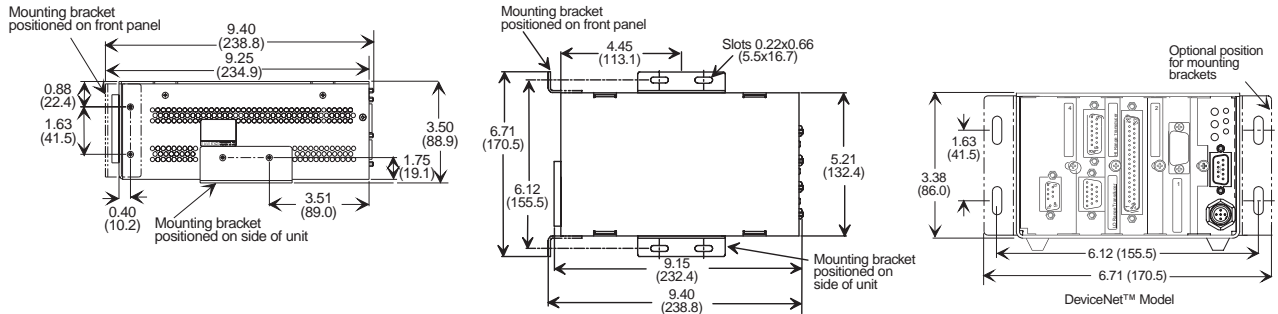


## Heater Kit for 653 Throttle Valve

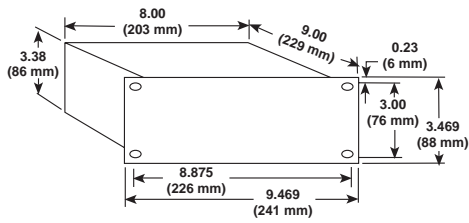


# Dimensional Drawings

## Pressure Controller 1651

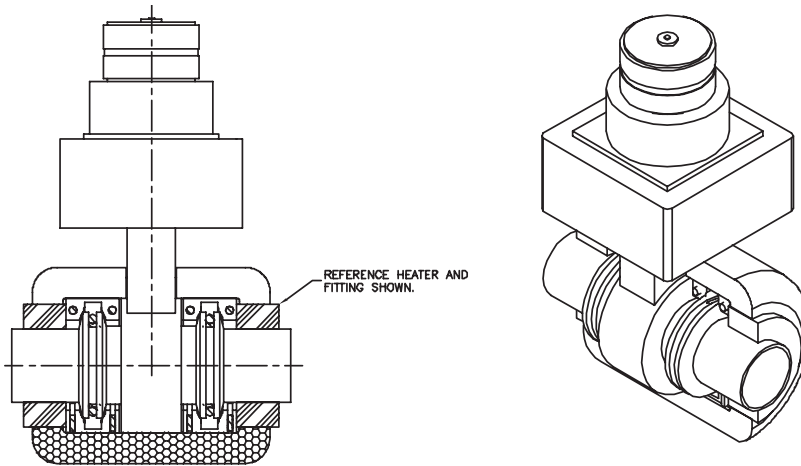


## 651



Note: Allow 2.5" (63 mm) clearance behind rear panel for connectors/cables.

## Heater Kit For 253 and 653 Throttle Valves



NOTES:  
KIT SHOWN WITH 253 THROTTLE VALVE (REFERENCE ONLY).  
THIS KIT WILL IS DESIGNED FOR BOTH THE 253 AND 653 THROTTLE VALVES.





# Ordering Information

Ordering Code Example: 651CDYZCD	Code	Configuration
651C Self-Tuning/Digital PID Pressure Controller (for use with 653 or 253 Throttle Valves)	651CD	651CD
<b>Interface (Y)</b>		
RS-232	2	2
<b>Valve Driver (Z)</b>		
Stepper Motor	S	S
<b>Power Supply (C)</b>		
0.5 Amp	1	1
1.5 Amp	2	
<b>Options (D)</b>		
None	N	N

### Cabling for 651CD:

#### Input Cables:

CB112-2-10 to connect 651 to 223, 225, 622, 623, 722 (terminal strip)  
 CB259-5-10 to connect 651 to 624, 625, 626, 627, 628, 722 (15-pin)  
 CB120-6-10 to connect 651 to 120  
 CB112-10-10 to connect 651 to 220  
 CB112-14-10 to connect 651 to 121, 221

#### Valve Cables:

CB652-1-10 to connect 651 to 653B  
 CB651-30-10 to connect 651 to 253B

Ordering Code Example: 1651CYZ	Code	Configuration
1651C Displayless Self-Tuning/Digital PID Pressure Controller (for use with 653 or 253 Throttle Valves)	1651C	1651C
<b>Interface (Y)</b>		
RS-232	2	2
<b>Valve Driver (Z)</b>		
Stepper Motor	S	S

### Cabling for 1651C

#### Input Cables:

CB112-2-10 to connect 1651 to 223, 225, 622, 623, 722 (terminal strip)  
 CB147-1-10 to connect 1651 to 624, 625, 626, 627, 628, 722 (15-pin)  
 CB120-1-10 to connect 1651 to 120  
 CB112-10-10 to connect 1651 to 220  
 CB112-14-10 to connect 1651 to 121, 221

#### Valve Cables:

CB652-1-10 to connect 1651 to 653B  
 CB651-30-10 to connect 1651 to 253B



### MKS Instruments, Inc. Global Headquarters

2 Tech Drive, Suite 201  
 Andover, MA 01810  
 Tel: 978.645.5500  
 Tel: 800.227.8766 (in U.S.A.)  
 Web: www.mksinst.com

### MKS Instruments, Inc. Valve Solutions

Six Shattuck Road  
 Andover, MA 01810  
 Tel: 978.975.2350