

Valve

Solutions

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Downstream Pressure Controllers and Valves

PRODUCT SELECTION GUIDE

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



Downstream Pressure Controllers and 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



Type 651

The MKS Type 651 Self-tuning/Digital PID Valve Controller drives MKS Type 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.



Type 1651

The 1651 is a display-less version of the Type 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.



Type 655

The Type 655 Controller can be operated by its easy-to-use front panel, or remotely via analog I/O, TTL, or the RS-232 interface. A front panel key lock switch selects either local or remote control. The 655 provides power for the Baratron® Capacitance Manometer, including most heated models. A remote zero feature on the 655 allows for convenient rezeroing. A two-line, lighted LCD display provides readout of pressure from the Baratron in several selectable engineering units, as well as valve position and other setup and operating parameters. The controller can be preset for up to five pressure or position set points.



Exhaust Throttle Valve



Type 253

The MKS Type 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 MKS Type 253 is available in standard sizes and flange styles, and is compatible with all MKS throttle valve controllers.

“Smart” Exhaust Throttle Valve



Type 153

Specifically designed for computer-controlled applications where a simple pressure control system is desired, the Type 153 Valve integrates all control, communication, and driver circuits via a compact “add-on” electronics module within a Type 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 Type 683.



Downstream Exhaust Throttle and Poppet Valves

Exhaust Throttle Valve with High-speed Motor/Gear Assembly



Type 653

The Type 653's 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 Type 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 MKS Type 651 and 1651 Controllers.

Poppet Valve



Type 656

The MKS Type 656 Throttling Isolation Valves are designed on the platform of the industry standard bellows-sealed angle and in-line valves. The Type 656 provides: 1) fast, accurate closed-loop control of process pressures; 2) positive leak-tight shutoff when closed; and 3) soft pumpdown from atmosphere. These valves are a simpler and less costly alternative to the combination of shutoff gate, butterfly control, and soft start valves. The valves are available in angle or in-line configurations in 40 mm, 50 mm, 80 mm, and 100 mm sizes (1.5", 2", 3", 4" respectively).

Type 656 Valves feature a patented¹, unique constant force closure that compensates for thermal expansion/contraction and seals leak-tight even under changing sealing conditions as encountered in many contaminant-prone processes.

¹U.S. Patent #5318272. Foreign Patents pending.



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.

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



Pressure Controller Specifications

	Type 651C	Type 1651C	Type 655
Valves Operated	Type 653 and 253 Exhaust Throttle Valves	Type 653 and 253 Exhaust Throttle Valves	Type 656 Exhaust Throttle Valves
Pressure Input Signal	0-10 VDC, 0-5 VDC, or 0-1 VDC, selectable	0-5 VDC, 0-10 VDC, 0-1 VDC, selectable	0-10, 0-5, or 0-1 VDC, selectable
Input Power Required	90-132 or 180-264 VAC, 50/60 Hz	±15 VDC ±5%	90-132 or 180-264 VAC 48/62 Hz
Minimum Input Current		For Type 653 Valve: 1 Amp + transducer current For Type 253 Valve: 0.5 Amp + transducer current	
Maximum Input Current Set Points		Not to exceed 7 Amps	
Programmable	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)	5 total, programmable in combinations for pressure or position (adjustable from front panel or RS-232; selectable from front panel, TTL or RS-232)
External Analog	1; pressure or position, 0-5 or 0-10 VDC	1; pressure or position, 0-5 or 0-10 VDC	1; pressure or position, 0-5 or 0-10 VDC
Controller Repeatability	±0.1% of F.S.	±0.1% of F.S.	±0.1% F.S.
Ambient Operating Temperature	15°-40°C (60°-104°F); 15°-35°C with battery backup option	15°-50°C (60°-122°F)	15° to 40°C (59° to 104°F)
Output Power	Standard: ±15 VDC ±5 @ 0.5 Amp (Derated to 0.4 Amp with 90-99 or 180-198 VAC input) Optional: ±15 VDC ±5% @ 1.5 Amps max.	Available to external transducers: ±15 Volts @ 3 Amps max. (90 Watts) when powered from an external power supply with a capacity of ±15 Volts @ 5 Amps (150 Watts)	±15 VDC ±5% @ 1.0 Amp max.
Analog Output Signal	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	0-5 or 0-10 VDC for 0-100% valve position and 0-10 VDC for 0-100% F.S. pressure
Size	1/2-rack packaging: 3-1/2"H x 9-1/2"W x 9"D 12"D with battery backup option	3 1/2" H x 6.7"W x 9.15"D	Std. 1/2 rack packaging: 3-1/2"H x 9-1/2"W x 9"D
Display	2-line LCD with 4-1/2 place readout (pressure and valve position)	N/A	2 line LCD with 4-1/2 place readout
Display Units	Torr, mTorr, mbar, Pascal, cmH ₂ O, inH ₂ O, μbar, kPa	N/A	Torr, mTorr, mbar, Pascal, cmH ₂ O, inH ₂ O, μbar, kPa
Soft Start	Standard	Standard	Standard
Self-tuning Unit	Standard	Standard	Standard
PID Control	Standard	Standard	Standard
Remote Zero	Standard	Standard	Standard
Interface	Front panel, Analog, TTL (16 inputs, 6 outputs) and RS-232	Analog, TTL (16 inputs, 6 outputs) and RS-232	Analog , TTL (16 inputs, 6 outputs), and RS-232
Relay Outputs	2, process limits: 24 Volts AC/DC @ 1 Amp resistive	2, process limits: 24 Volts VDC @ 1 Amp resistive	2, process limits: 24 Volts AC/DC @1 Amp, resistive
Remote Control Override (Open, Close, Hold)	Standard	Standard	Standard
Position Control Capability	Standard	Standard	Standard
Battery Backup	Optional	N/A	Optional
Connectors	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	Valve: 15-pin Type "D" female I/O: 37-pin Type "D" female Sensor: 15-pin Type "D" female RS-232: 9-pin Type "D" male
CE Mark Compliance			
Electromagnetic Compatibility	Fully compliant to EMC Directive 2004/108/EEC when used with an overall metal braided shielded cable, properly grounded at both ends	Fully compliant to EMC Directive 2004/108/EEC when used with an overall metal braided shielded cable, properly grounded at both ends	Fully compliant to EMC Directive 2004/108/EEC when used with an overall metal braided shielded cable, properly grounded at both ends
Product Safety	Fully compliant to Low Voltage Directive 72/23/EEC	N/A	Fully compliant to Low Voltage Directive 72/23/EEC



Throttle Valve Specifications (Common to All Sizes & Flanges)

	Type 653B	Type 253B
Speed (open to close)	1.7 sec	Standard: 7.5 sec. Optional: <2 sec. (Note 1)
Resolution	1/12,000	Standard: 1/10,000 Fast Motor Option: 1/2800
Drive Method	Direct gear drive	Mechanical (non belt) drive with integral cosine generator to linearize valve transfer characteristic
Maximum Valve Body Operating Temperature	Standard 0°C-100°C Optional: 0°C-150°C (Note 1)	0°-90°C
Valve Motor Ambient Operating Temperature	-20°C to +40°C	0°C-70°C max.
Differential Pressure Across Valve	1 atm. (15 psig) max.	1 atm. (15 psig)
External Leakage at Shaft Seal	1x10 ⁻⁸ scc/sec He	1x10 ⁻⁷ scc/sec He
Materials Exposed to Process	Standard: 316L S.S., Viton (Note 2)	316 S.S., Viton (Note 2)
Compatible Controller	Types 651, 1651	Types 651, 1651, 153
Visual Position Indicator	Standard	N/A
Drive Output Torque (with Type 651 Controller)	800 in-oz	Standard: speed: 600 in-oz High Speed: 170 in-oz
Closed Leakage (valves with a flapper o-ring)	<10 ⁻⁷ (Torr l/s)	<10 ⁻⁷ (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

Type 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 Type 153 Valves, add 1.93" (49mm) to the Type 253 Dimension

** Molecular flow regime

Type 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

Type 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 Type 153 Valves, add 1.93" (49mm) to the Type 253 Dimension

** Molecular flow regime

Type 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

Type 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	(**) Controllable Conductance l/s (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	1.270 (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 Type 153 Valves, add 1.93" (49mm) to the Type 253 Dimension

** Molecular flow regime

Type 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	(**) Controllable Conductance l/s (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

Type 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 Type 153 Valves, add 1.93" (49mm) to the Type 253 Dimension

** Molecular flow regime

Type 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

Type 656

Consult Applications Engineering for availability.



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

Temperature			
Nominal Set Point	150°C	105°C	
Exterior Range	60-70°C	45-55°C	
Interior Range	130-170°C	90-120°C	
Electrical Duty Cycle		100 volts	72%
		120 volts	50%
Foam Thickness		0.5 in. (12.7mm)	
Materials		Molded silicone foam, fiberglass reinforced silicone, Teflon insulated wire	
Relative Humidity		90% Maximum	
Connectors		Midget Twist-Lock, nylon NEMA ML-1	
Weight Range		0.5 to 3.3 lb (0.73 to 1.5 kg)	
Product Safety		CE Mark: 89/336/EEC EMC Directive, 73/23/EEC LV Directive UL Listed: File E52951 2JR	

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

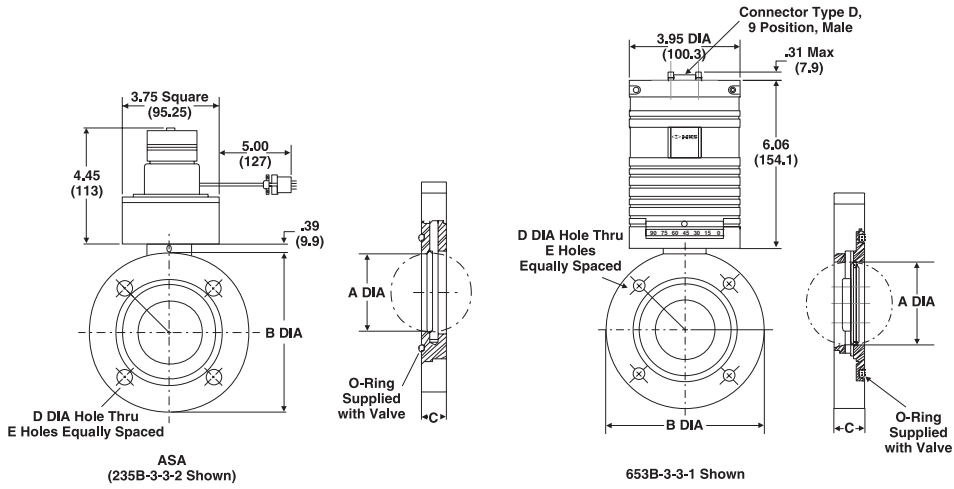


LTA Monitor Specifications

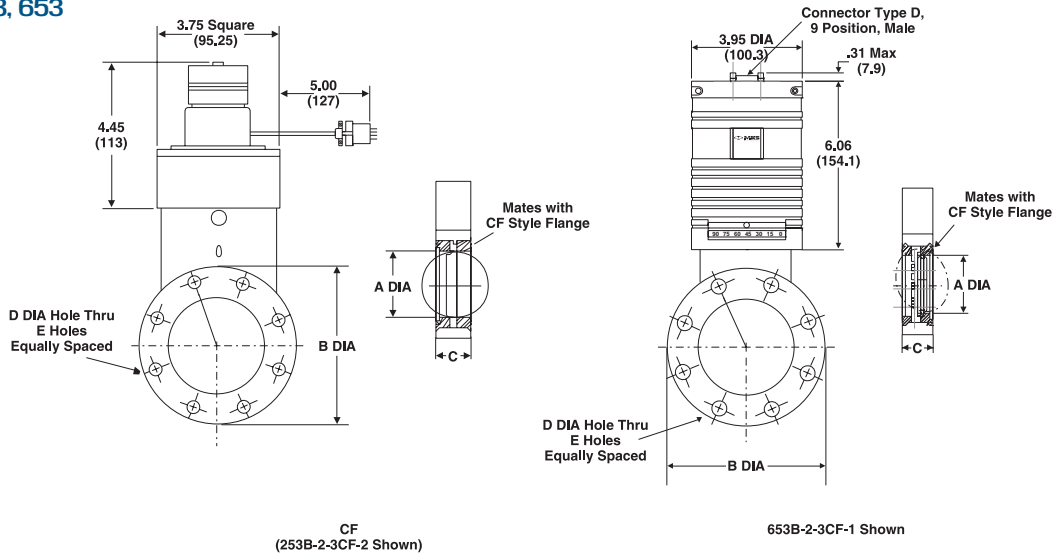
Enclosure	Black Plastic
Power Requirements	90-130 VAC input, 12 VDC ±3 VDC output
Power Consumption	0.3 W
Relay Contact Rating	SPDT, 2A @ 50 VAC resistive 1@30 VDC
Input/Output Wiring	1 Thermal switch line IN 2 Thermal switch line OUT 3 Normally closed 4 Common 5 Normally open
Dimensions	2.58" x 4.76" x 1.46" (inches) 66 x 121 x 37 (mm)
Product Safety	CE Mark: 89/336/EEC EMC Directive 92/59/EEC General Product Safety Directive



ASA Flange
Types 253, 653

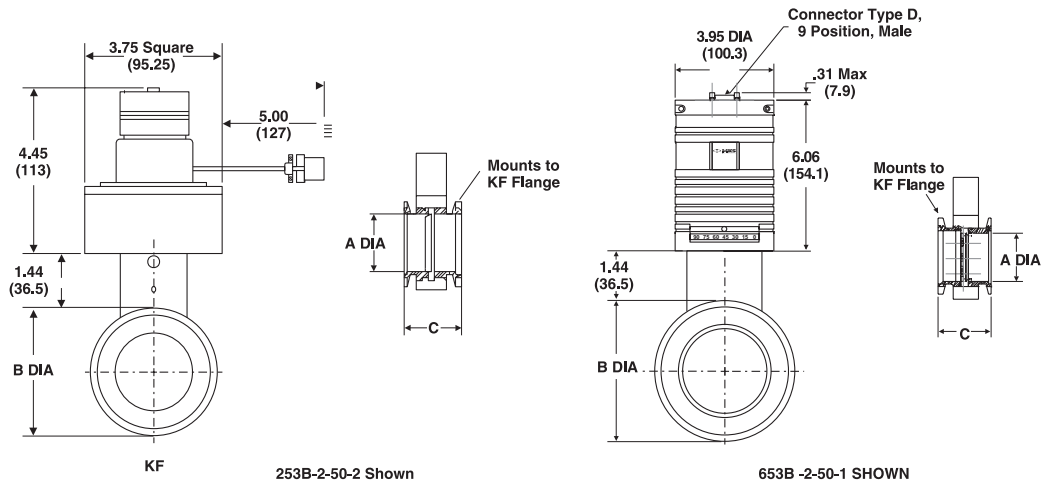


CF Flange
Types 253, 653

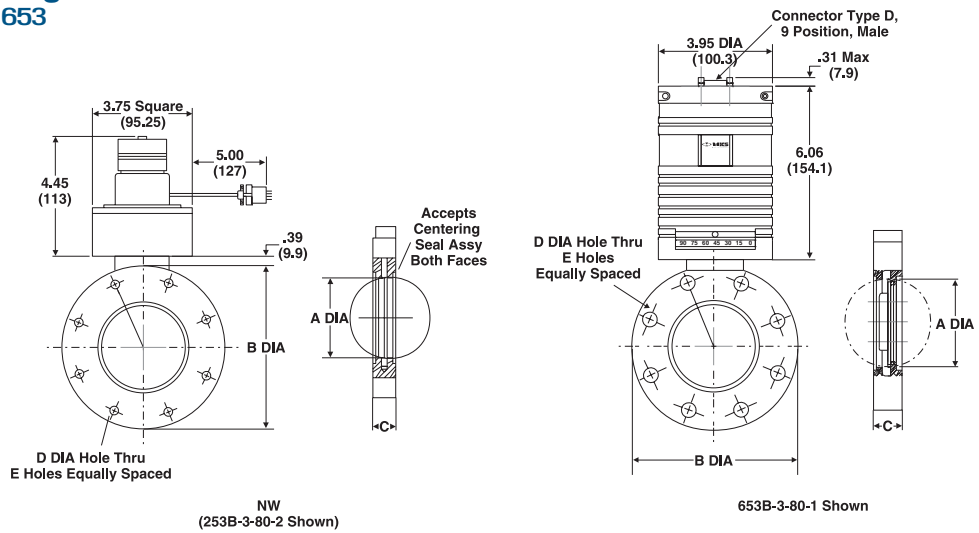


Dimensional Drawings

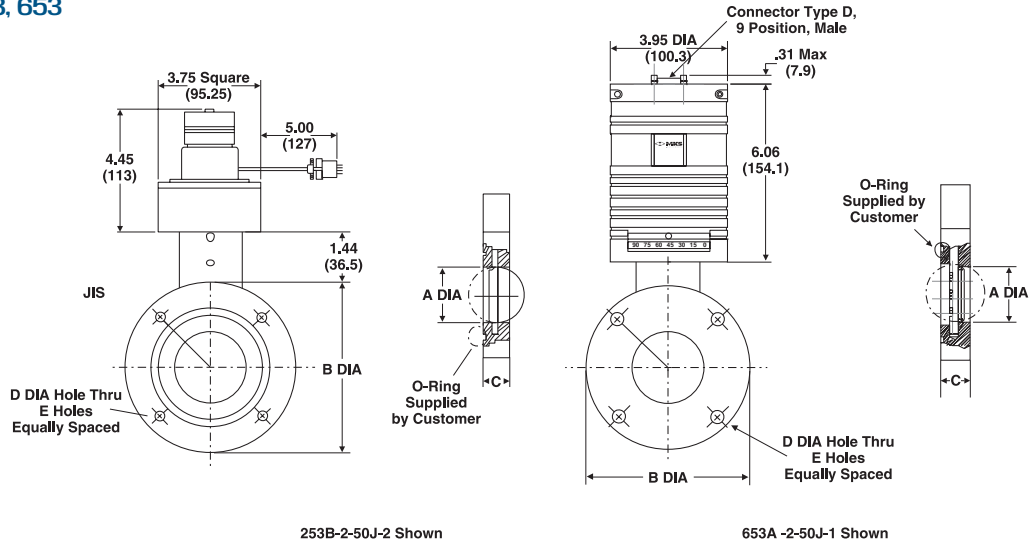
ISO KF Flange Types 253, 653



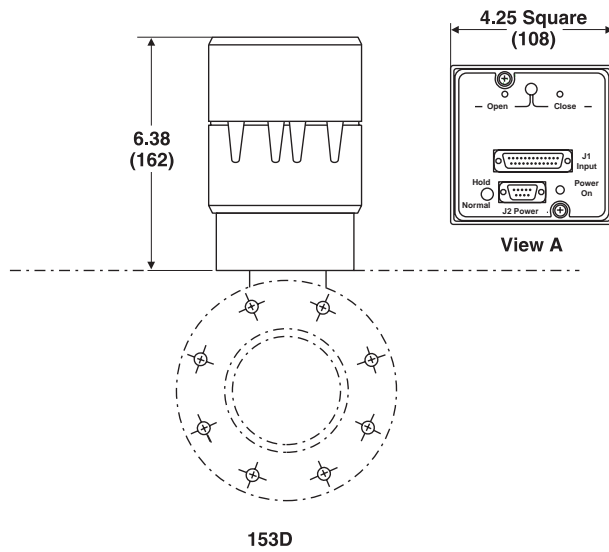
ISO NW Flange Types 253, 653



JIS Flange
Types 253, 653

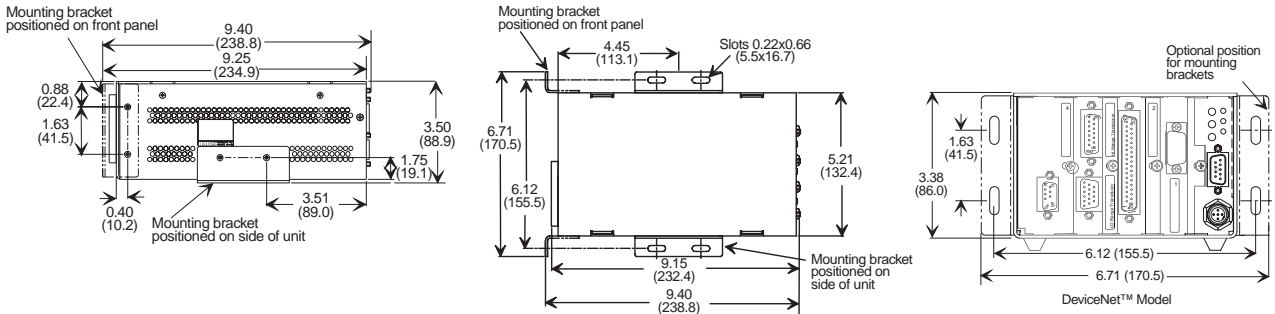


Type 153

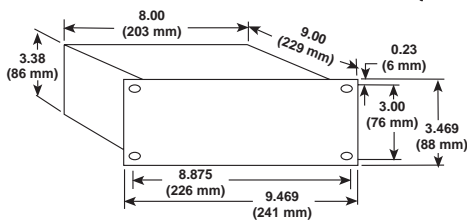


Dimensional Drawings

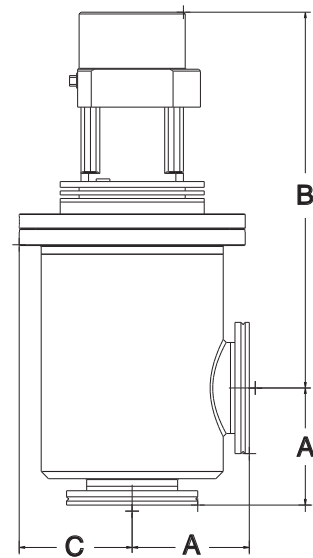
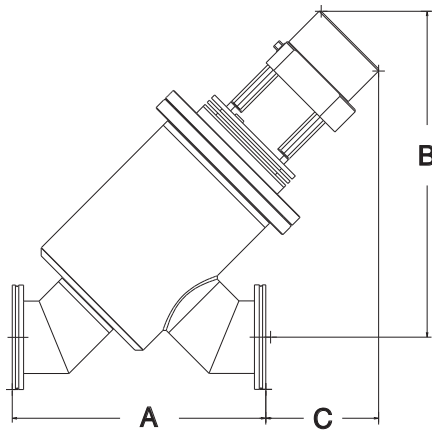
Pressure Controller Type 1651



Type 651



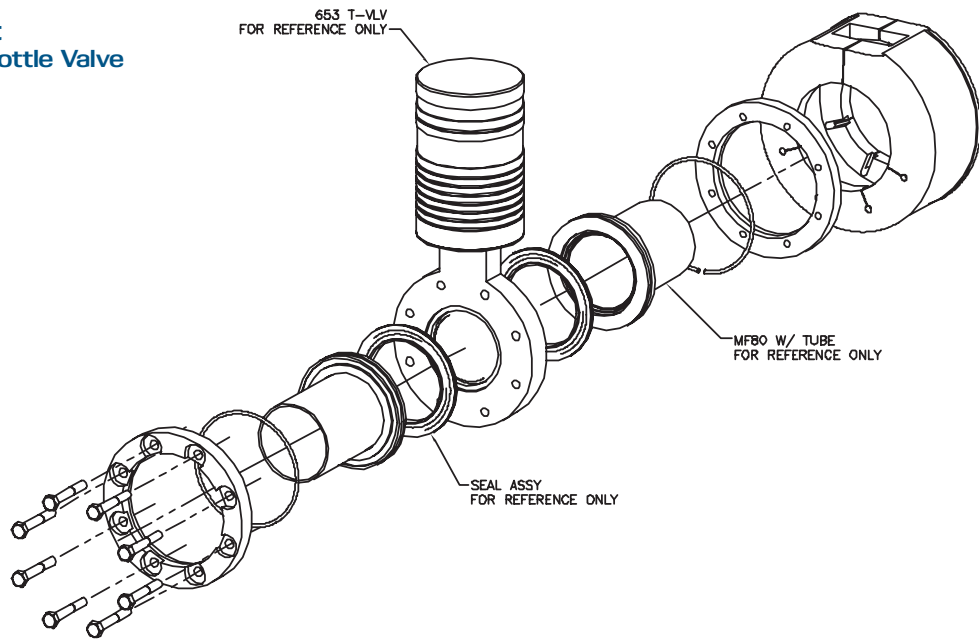
Poppet Valve Type 655/656 In-line & Angle



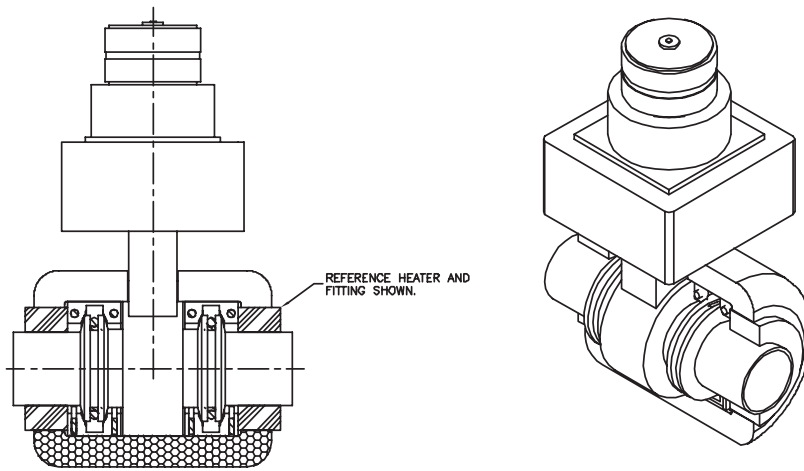
In-Line Valve Size	A	B	C	Angle Valve Size	A	B	C
40 mm	5.12 (130.1 mm)	10.64 (270.3 mm)	6.28 (159.5 mm)	40 mm	2.57 (65.3 mm)	10.82 (274.8 mm)	2.38 (60.5 mm)
50 mm	7.00 (177.8 mm)	10.88 (276.4 mm)	5.35 (135.9 mm)	50 mm	2.77 (70.4 mm)	10.82 (274.8 mm)	2.38 (60.5 mm)
80 mm	10.55 (268 mm)	13.50 (342.9 mm)	4.69 (119.1 mm)	80 mm	3.86 (98 mm)	12.39 (314.7 mm)	3.73 (94.7 mm)
100 mm	13.58 (344.9 mm)	14.02 (356.1 mm)	3.18 (80.8 mm)	100 mm	4.25 (108 mm)	12.39 (314.7 mm)	3.73 (94.7 mm)
Tolerance	A: ±0.03	B: reference only	C: reference only	Tolerance	A: ±0.03	B: reference only	C: reference only



**Heater Kit
for 653 Throttle Valve**



**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.



Pressure Controller Ordering Information

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

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: 1651CZY	Code	Configuration
Type 1651C Displayless Self-Tuning/Digital PID Pressure Controller (for use with 653 or 253 Throttle Valves)	1651C	1651C
Interface (Y)		
RS-232	2	2
Valve Driver (Z)		
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





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