

# T2BA Exhaust Throttle Valve

EtherCAT®, RS232, RS485 and DeviceNet® I/O



The T2BA Exhaust Throttle Valve is specifically designed for applications where a simple, yet advanced, pressure control system is desired. The T2BA integrates all control, communication, and driver circuits within a throttle valve assembly, thereby eliminating the need

for mounting a separate pressure control electronics module. The unique model-based control algorithm and high-speed operation drives the system to set point quickly with minimum overshoot, and ensures repeatable process recipes without operator involvement.

## Product Features

- Compact pressure control system - valve with integrated on-board controller electronics
  - Easy integration, no need for additional cables or rack space
- High-speed configurations available (<250 msec. open to close)
  - Faster set point and recovery from flow and pressure perturbations
  - Enables high tool throughput
- Selectable high torque drives
  - Extends uptime in harsh process conditions
- Dual channel Baratron® sensor input with range auto switching
  - Supports wide dynamic pressure control range
  - Allows for high pressure control accuracy
- Advanced model-based pressure control algorithm
  - Minimizes time to set point
  - Ensures repeatable process recipes without operator involvement
- Available in low conductance soft-sealing versions
  - Supports high-pressure processes even at low flows (Epi, RTP, SACVD and more)
  - Suitable for "house exhaust" or atmospheric applications
- Provides power for connected Baratron capacitance manometers (optional, some models)



## Key Benefits

- On-board LCD touchscreen display of pressure and position
- Programmable for pressure or position control
- Encoder-based actual position verification
- Heatable valve body (105°C standard, 150°C and 200°C optional)

The T2BA Exhaust Throttle Valve can operate in two primary modes: flapper positioning or pressure control, either of which can be user-activated through the I/O interface. All of the adjustable setup parameters, run time operation, and diagnostics information is available through the communications interface. EtherCAT T2BA is fully compatible with EtherCAT manometers. Analog manometers require a gateway.

The downstream pressure control technique provides wide dynamic range, works with all types of pumps, provides fast response, and is tolerant to most effluent gases.

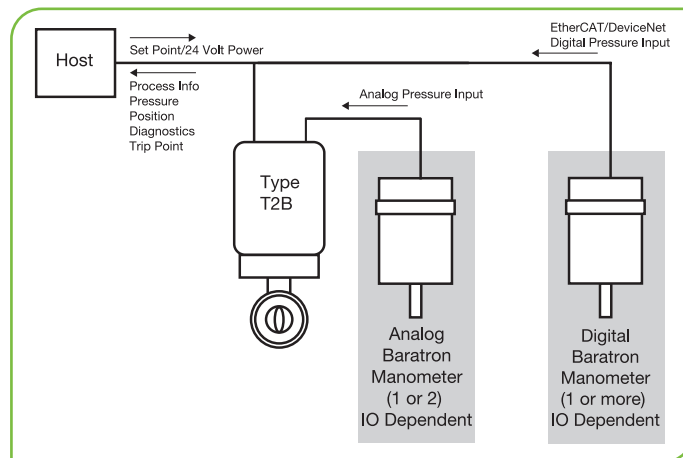
The "intelligent instrument" concept results in valuable system space savings, improved noise immunity, and easy access to time-critical process and calibration information as well as on-board diagnostic functions.

The T2BA utilizes a direct drive high-speed stepper motor. The valve driver provides high resolution pressure control. The optional, high torque direct drive motor provides extended uptime and extends preventative maintenance cycles — a great advantage in demanding processes where just one hour of downtime can cost thousands of dollars. The T2BA is also available in geared versions, providing maximum torque and enabling long-term operation in harsh environments.

The T2BA valves are optionally heatable up to 200°C with available MKS external heaters (proper selection of seal materials is required).

The T2BA is available in unique MKS low-conductance versions, enabling high-speed pressure control in atmospheric applications, including exhaust pressure control, CVD and RTP without a need for relying on O-Ring-based designs to minimize valve conductance. An encoder-based position feedback system is provided for diagnostic purposes. The valve is constructed of corrosion-resistant 316 stainless steel compatible with most process gases and is available in standard ISO flange styles with bore sizes from 1" to 4" (alternate

sizes available on a custom basis). Standard seals offered are Viton®, alternate materials can be specified for compatibility with various process chemistries and/or heated applications.



Pressure Control System Schematic

### Software Functions

- Pressure control or position control mode
- Set points for pressure and position control
- Manual override to open or close valve
- Report pressure from external transducer
- Report HW/SW revision, serial and model numbers
- Report valve cycles and run hours

Specifications	
<b>Pressure Control Performance</b> <b>Accuracy Control Range</b>	<ul style="list-style-type: none"> <li>• 0.25% of set point, or 5mV (whichever is greater)</li> <li>• 0.0001%-100% FS (with Dual Transducer Input)</li> </ul>
<b>Operating Temperature</b> <b>Motor and Electronics</b> <b>Valve Body</b> <b>Storage Temperature</b>	<ul style="list-style-type: none"> <li>• 15° to 50°C</li> <li>• 105°C standard, 150°C and 200°C optional</li> <li>• -20° to 80°C</li> </ul>
<b>Wetted Materials</b> <b>Low closed-conductance</b> <b>Non-sealing Types</b> <b>soft-sealing Types</b> <b>Shaft Seal Material</b>	<ul style="list-style-type: none"> <li>• 316 SST, Tefzel</li> <li>• 316 SST, Tefzel, PTFE</li> <li>• Viton, Kalrez®, Chemraz®, and others - see ordering code</li> </ul>
<b>External Leak Rate</b>	1 e-9 atm*cc/sec
<b>Valve Power</b>	24 VDC @ < 100 W max. 4A supply capacity recommended.
<b>Valve Sizes</b>	KF40, KF50, NW63, NW80 and NW100 (Additional sizes available, contact MKS Applications Engineering)
<b>Flapper Types</b>	Non-sealing and low-conductance soft-sealing
<b>Drives</b> <b>8 in-lb Direct Drive</b> <b>25 in-lb Direct Drive</b> <b>40 in-lb High Torque Geared Drive</b>	<ul style="list-style-type: none"> <li>• Direct drive is the lowest cost and highest speed solution</li> <li>• Ideal for clean processes where the valve is not subject to deposits inside the valve.</li> <li>• Suited for slightly depositing processes where the valve may be subject to deposits side the valve.</li> <li>• Increase available drive torque for the most harsh processes. Utilizes a 10:1 planetary gear box to deliver reliable torque to combat harsh deposits in tough processes like Epi, CVD, MOCVD and others.</li> </ul>
<b>Flapper Gap (Radial Clearance)</b>	<ul style="list-style-type: none"> <li>• Standard clearances are appropriate for most applications.</li> <li>• Consult MKS for applications with high internal heating.</li> </ul>
<b>Heatability</b>	<ul style="list-style-type: none"> <li>• All T2BA valves allow the valve body to be heated to 105°C standard or optionally 150°C or 200°C.</li> <li>• T2BA valve bodies may be heated up to 200°C with the heatability option and appropriate selection of shaft seal compound.</li> </ul>
<b>Shaft Seal Material</b>	<ul style="list-style-type: none"> <li>• Viton shaft seals are available for valve body temperatures that will not exceed 105°C and process gases compatible with Viton.</li> <li>• For valve body heating as high as 200°C and/or process gas compatibility, various Kalrez and Chemraz compounds are also offered.</li> </ul>
<b>Communications I/O</b>	<ul style="list-style-type: none"> <li>• EtherCAT ETG. 5003.1 Common Device Profile; ETG.5003.2030 Process Control Valve<sup>1</sup>.</li> <li>• RS232 full duplex; RS485 half duplex</li> <li>• DeviceNet</li> </ul>
<b>Pressure Sensor Input and Power</b>	<ul style="list-style-type: none"> <li>• T2BA with an EtherCAT interface do not include nor need analog connections to the process tool pressure sensors.</li> <li>• EtherCAT pressure sensors exchange data to the master and the data is available (typically ~ 1 ms refresh) as standard PDO data to the T2BA enabling fast, noise-free, and precise closed-loop pressure control.</li> <li>• Communication interfaces other than EtherCAT support up to two analog capacitance manometers.</li> <li>• An optional integrated power supply can supply up to 650mA of ±15 VDC of power for one or two manometers. Not available with EtherCAT</li> </ul>
<b>Firmware</b>	<ul style="list-style-type: none"> <li>• To support copy-exact methodologies, the firmware revision shipped is defined by this code.</li> <li>• Re-ordering by the same code assures an identical product when desired.</li> <li>• First-time orders where no specific version is noted or required can be identified with a "VV".</li> <li>• The T2BA unit will be configured and shipped with the most up-to-date firmware available.</li> </ul>

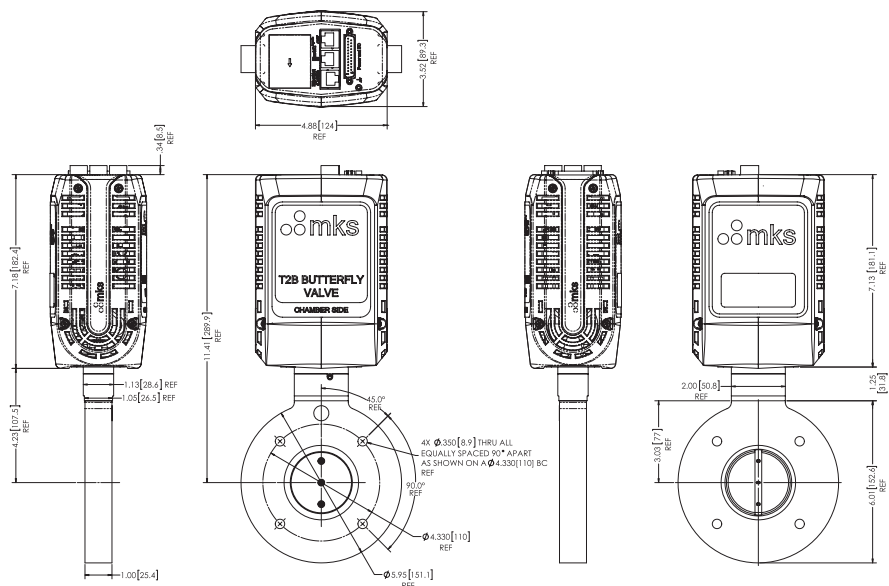
<sup>1</sup> The T2BA Butterfly Valve utilizes EtherCAT communications. For RS485, Analog, or DeviceNet communications, contact MKS Applications Engineering.

Communications	DeviceNet™	RS232	RS485	EtherCAT®
<b>Input Power Required</b>	+24 VDC, 100W Max.	+24 VDC, 100W Max.	+24 VDC, 100W Max.	+24 VDC, 100W Max.
<b>Connectors</b>	<ul style="list-style-type: none"> <li>• 5 pin micro connector (comms)</li> <li>• 25 pin Type D male (power, DIO)</li> <li>• 15 pin Type D female (sensor power and signal)</li> <li>• RJ-45 (Diagnostics)</li> </ul>	<ul style="list-style-type: none"> <li>• 25 pin Type D male (power, DIO and comm.)</li> <li>• 15 pin Type D female (sensor power and signal)</li> <li>• RJ-45 (Diagnostics)</li> </ul>	<ul style="list-style-type: none"> <li>• 25 pin Type D male (power, DIO and comm.)</li> <li>• 15 pin Type D female (sensor power and signal)</li> <li>• RJ-45 (Diagnostics)</li> </ul>	<ul style="list-style-type: none"> <li>• 25 pin Type D male (power and DIO)</li> <li>• 2 x RJ-45 (Ethercat comm. In/ Out)</li> <li>• 1 x RJ-45 (Diagnostics)</li> </ul>
<b>Data Rate Selection</b>	<ul style="list-style-type: none"> <li>• 4 positions: 125, 250, 500K (Default), (programmable over network)</li> </ul>	<ul style="list-style-type: none"> <li>• No switch</li> <li>• Set data rate via RS232</li> </ul>	<ul style="list-style-type: none"> <li>• No switch</li> <li>• Set data rate via RS485</li> </ul>	<ul style="list-style-type: none"> <li>• No switch</li> <li>• Managed via Host</li> </ul>
<b>Comm. Rate(s)</b>	<ul style="list-style-type: none"> <li>• 125 Kbps</li> <li>• 250 Kbps</li> <li>• 500 Kbps</li> </ul>	<ul style="list-style-type: none"> <li>• 9.6 Kbps</li> <li>• 19.2 Kbps</li> <li>• 38.4 Kbps</li> <li>• 57.6 Kbps</li> <li>• 115.2 Kbps</li> </ul>	<ul style="list-style-type: none"> <li>• 9.6 Kbps</li> <li>• 19.2 Kbps</li> <li>• 38.4 Kbps</li> <li>• 57.6 Kbps</li> <li>• 115.2 Kbps</li> </ul>	Managed via Host
<b>MAC ID Switches/ Addresses</b>	2 switches, 10 positions; 0,0 to 6,3	N/A	<ul style="list-style-type: none"> <li>• Set address over RS485</li> <li>• Addresses 0 to 999</li> </ul>	<ul style="list-style-type: none"> <li>• Set on LCD- 3 characters</li> <li>• 16 values each</li> </ul>
<b>Network Size</b>	Up to 64 nodes	N/A	Up to 32 nodes	Up to 4095 nodes
<b>Visual Indicators</b>	<ul style="list-style-type: none"> <li>• LED Network (green/red)</li> <li>• LED Module (green/red)</li> </ul>	<ul style="list-style-type: none"> <li>• LED Comm (green)</li> <li>• LED Error (red)</li> </ul>	<ul style="list-style-type: none"> <li>• LED Comm (green)</li> <li>• LED Error (red)</li> </ul>	<ul style="list-style-type: none"> <li>• LED Power (green)</li> <li>• LED Run (green)</li> <li>• LED Error (red)</li> <li>• LED Comm (green)</li> </ul>
<b>Compliance</b>	CE	CE	CE	CE

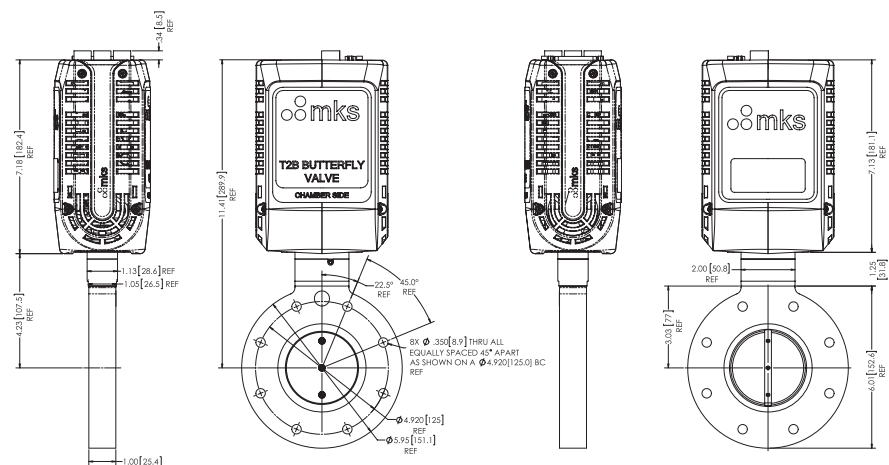


Heater, hardware and full integrated foreline solutions are available.

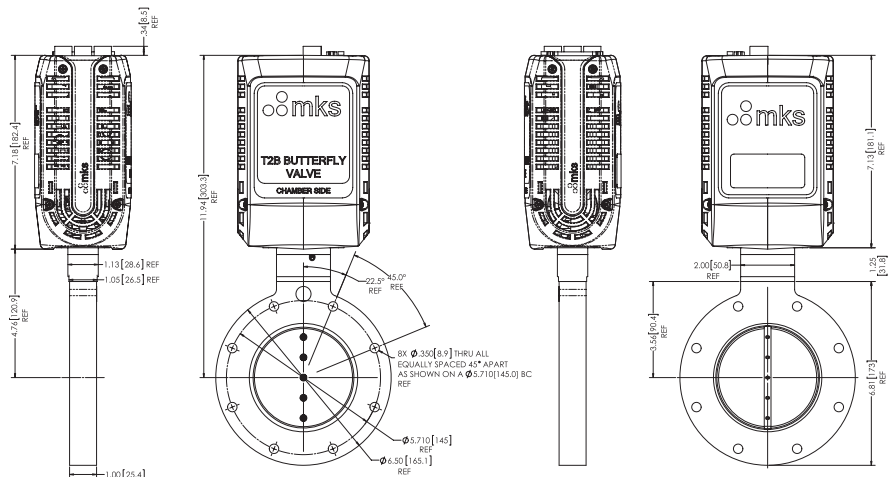
### NW63 (60mm)



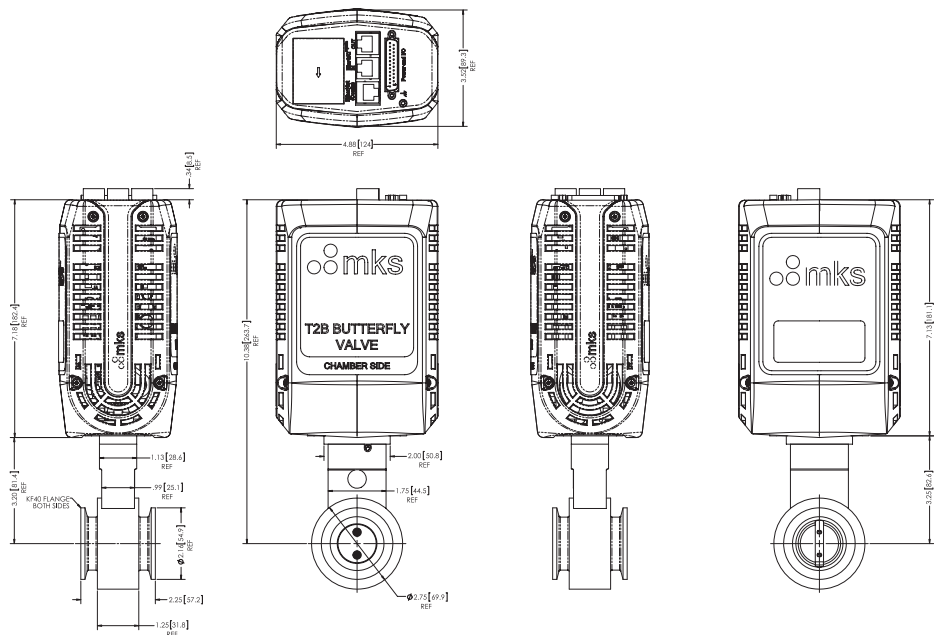
### NW80 (3 inch)



### NW100 (4 inch)



## KF40 (1 inch)

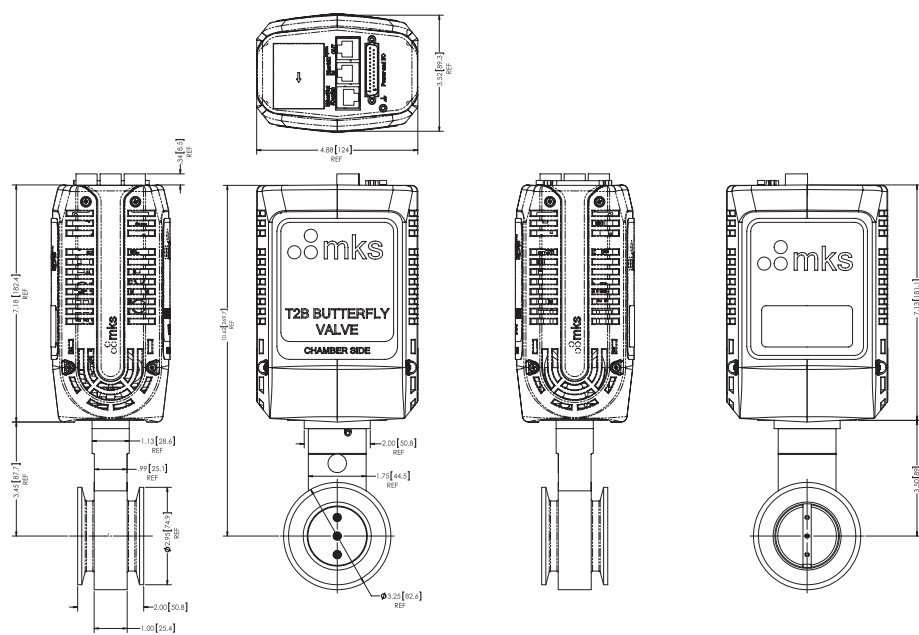


KF40 Flange (EtherCAT®) Dimensional Drawing

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).

Model Code Prefix	Flange/Bore	Flapper	Flapper/Body Nominal Radial Gap inches (mm)	Drive
<b>KF40 Non-Sealing Valves</b>				
T2BA20K22020 T2BA20K24020 T2BA20K23020 T2BA01K22020 T2BA01K24020 T2BA01K23020	KF40 / 20 mm KF40 / 20 mm KF40 / 20 mm KF40 / 32 mm KF40 / 32 mm KF40 / 32 mm	non-sealing	0.002 / (0.051)	8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive 8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive
<b>KF50 Non-Sealing Valves</b>				
T2BA02K22020 T2BA02K24020 T2BA02K23020	KF50 / 48 mm	non-sealing	0.002 / (0.051)	8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive
<b>NW63 Non-Sealing Valves</b>				
T2BA60N22020 T2BA60N24020 T2BA60N23020	NW63 / 60 mm	non-sealing	0.002 / (0.051)	8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive
<b>NW80 Non-Sealing Valves</b>				
T2BA03N22030 T2BA03N24030 T2BA03N23030	NW80 / 80 mm	non-sealing	0.003 / (0.076)	8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive
<b>NW100 Non-Sealing Valves</b>				
T2BA04N22030 T2BA04N24030 T2BA04N23030	NW100 / 100 mm	non-sealing	0.003 / (0.076)	8 in-lbs direct drive 25 in-lbs direct drive 40 in-lbs geared drive

## KF50 (2 inch)



KF50 Flange (EtherCAT®) Dimensional Drawing

Note: Unless otherwise specified, dimensions are nominal values in inches (mm referenced).

Model Code Prefix	Approximate Bore Inches (mm)	Flapper Seal Material	Open to Close Speed	Min/Max Controllable Conductance	Maximum Closed Leakage (sccm)	Body Thick-ness Inches (mm)
KF40 Non-Sealing Valves						
T2BA20K22020 T2BA20K24020 T2BA20K23020 T2BA01K22020 T2BA01K24020 T2BA01K23020	0.779 (20) 0.779 (20) 0.779 (20) 1.270 (32) 1.270 (32) 1.270 (32)	none	<250 msec <480 msec <950 msec <250 msec <480 msec <950 msec	0.25 / 31 0.25 / 31 0.25 / 31 0.4 / 55 0.4 / 55 0.4 / 55	n/a	2.25 (57)
KF50 Non-Sealing Valves						
T2BA02K22020 T2BA02K24020 T2BA02K23020	1.886 (48)	none	<250 msec <480 msec <950 msec	0.7 / 150	n/a	2.00 (51)
NW63 Non-Sealing Valves						
T2BA60N22020 T2BA60N24020 T2BA60N23020	2.360 (60)	none	<250 msec <480 msec <950 msec	0.8 / 375	n/a	1.00 (25)
NW80 Non-Sealing Valves						
T2BA03N22030 T2BA03N24030 T2BA03N23030	2.886	none	<250 msec <480 msec <950 msec	1 / 500	n/a	1.00 (25)
NW100 Non-Sealing Valves						
T2BA04N22030 T2BA04N24030 T2BA04N23030	3.885 (99)	none	<250 msec <480 msec <950 msec	2.2 / 900	n/a	1.00 (25)



Ordering Code Example: T2BA01K220203V4000VV		
Model	Code	Configuration
T2BA Exhaust Throttle Valve	T2BA	T2BA
Valve Bore/Flange Size*		
1"/KF40 2"/KF50 60mm/NW63 3"/NW80 4"/NW100	01K 02K 60N 03N 04N	01K
Flapper Type		
Non-sealing Low-Conductance F-seal Low-Conductance Q-seal	2 3 4	2
Drive Type**		
Direct Drive, NEMA 23-2, 8 in-lb Direct Drive, NEMA 24-2, 25 in-lb Geared Drive, NEMA 17-2 10:1, 40 in-lb	2 4 3	2
Nominal Radial Gap (NRG), Flapper/Body		
0.000" NRG (F-seal or Q-seal) 0.002" NRG (std for 1", 2", 60mm) 0.003" NRG (std for 3", 4")	000 020 030	020
Heatability		
Up to 105°C, without fan (for drive type selection 2 only) Up to 105°C, with fan (for drive type selections 4 and 3) Up to 150°C (all drive types) Up to 200°C (all drive types)	3 1 2 4	3
Seal Materials (Valve Shaft)		
Viton Chemraz E38 Chemraz 592 Chemraz 515 Kalrez 4079 Kalrez 8085 Kalrez 9100 Kalrez 9500	V C D W L K M N	V
Communications		
RS232, analog pressure input, w/LCD EtherCAT, no analog w/LCD RS485, analog pressure input, w/LCD DeviceNet, w/out analog outputs	2 4 5 D	4
Pressure Sensor Power Supply		
No Power ±15 VDC @ 650 mA total (available RS232, RS485 and DeviceNet only)	0 1	0
Reserved		
Default	00	00
Firmware		
Unless otherwise specified, MKS will ship the current firmware revision	VV	VV

\* Additional sizes available, contact MKS Applications Engineering.

\*\*Consult applications for optimal drive torque selection based on flapper size and type as well as process needs.