



# TECHNICAL BULLETIN

## *Logix 520MD Series*

Digital Positioner

FCD LGENTB0520-01 11/09



*Experience In Motion*

## ***Introduction***

The Logix 520MD Series combines superior positioning and tuning functions with convenient setup and powerful, easy to use diagnostic tools unlike other positioners that have only one gain. The Logix 520MD positioner uses a multi-variable variable gain tuning algorithm. This allows the positioner to make large step changes with minimal overshoot, while achieving the resolution to respond to very small step changes. The Auto-tune procedure cycles the actuator to produce a measured response and selects gain values that provide appropriate actuator performance. The Auto-tune function includes a gain modifier selector that can be used to increase or decrease the calculated gain in order to achieve optimal performance. By setting the Auto-tune on/off DIP switch, the tuning mode can be changed from auto to manual. The Logix 520MD Series positioners provide several preset gain settings with a locally adjustable gain set selector directly from the user interface on the positioner. If custom settings are desired, tuning sets can be modified with a handheld or with *ValveSight™ software*, to accommodate a wide range of actuator sizes and types.

## ***The 520MD, 521MD and 522MD models***

- Three versions:
  - Basic
  - Advanced (Advanced includes pressure sensors)
  - Pro (Pro includes pressure sensors and full featured valve diagnostics)
- HART Command 1, 3, 9, 33 & 48
- Burst Mode available for continuous data transmission
- Position command with analog 4-20 mA loop current
- Final value of command after characterization
- Supply pressure (Advanced +Pro)
- Stem position in percent
- Onboard temperature sensor to measure local positioner ambient temperature
- Stroke speed limiter (configurable through HART or *ValveSight™*)
- Step test, friction test, HRL, data logger
- DTM Available

## Features and Benefits

Feature	Benefits	Logix		
		520MD	521MD	522MD
Easy commissioning	Commissioning is performed by simply setting a few switches and pressing the Quick-Cal button. The direct User Interface allows local access to positioner control without requiring multi-level menus, a handheld communicator or a laptop computer.	X	X	X
Local status LED	LEDs visible from a distance, indicate positioner's current status without removing the cover.	X	X	X
Internal diagnostic codes	LEDs providing instant information relating to internal diagnostic codes. These codes indicate to the user positioner status and alarms without the need for a handheld communicator or a laptop computer.	X	X	X
Fast and simple configuration	With its unique Direct User Interface, Logix 500 positioners provide fast and easy configuration. Local configuration switches allow the user to set all basic parameters for positioner operation.	X	X	X
Jog calibration	The Jog calibrate function allows the user to easily and quickly calibrate the positioner on all actuators without physical stroke stops.	X	X	X
Auto-tune	A simple press of a button starts the self-calibration and auto-tune process, speeding up commissioning procedure and ensuring consistency between one valve and the next (regardless of who performs the procedure). Additionally, a gain selector allows the user to modify the calculated auto-tune result.	X	X	X
HART communication	Using industry standard HART protocol and FDT/DTM technology the Logix 500 can use existing handheld communicators and supplies extensive information to maintenance database software packages. With <i>ValveSight™</i> DTM Software, the Logix 500 can be monitored through any connected computer.	X	X	X
Low air consumption	State-of-the art piezo technology combined with inner-loop feedback procedures provides high-performance control with minimal air consumption.	X	X	X
21-point characterization	With <i>ValveSight™</i> software or a handheld communicator, a custom 21-point characterization curve can be generated which can be used to change the response of the positioner to meet the process requirements.	X	X	X
Standard diagnostic	Standard diagnostic functionality through <i>ValveSight™</i> software such as cycle limit alarms, health dashboard, signatures and many more.	X	X	X
Advanced diagnostic	All of the functionality of the standard diagnostic version plus additional build-in pressure sensors to be able to determine what and when a problem occurred and how to fix it.		X	X
Pro diagnostic	All of the advanced diagnostic functionality including pressure sensors and full <i>ValveSight™</i> connectivity and On-Line diagnostic including friction and health indication. All options from <i>ValveSight™</i> can be used with the Logix 522MD.			X
Two stage control design	Logix 500 positioners use two-stage control to provide faster response and tighter control.	X	X	X
Configuration lockout	Local configuration lockout switch permits users to perform automatic quick-calibration procedures without modifying existing configuration and tuning settings.	X	X	X
Mounting	IEC534 (NAMUR) mounting as well as VDI/VDE 3845 and 3847 mounting options allows the Logix 500 to be mounted on almost all actuators available on the market. With its unique Flowserve direct mounting option the Logix 500 can be mounted directly without tubing to Flowserve's single acting diaphragm actuators.	X	X	X
Limit switch options	Modular design allows reliable, inexpensive, non-contact, high resolution, build-in limit switches	X	X	X

## Principle of Operation

The Logix 520MD positioner is a digital positioner with various options. The positioner consists of three main modules:

1. The microprocessor based electronic control module includes direct local user interface switches
2. The piezo valve based electro-pneumatic converter module
3. The infinite resolution valve position sensor.

The basic positioner operation is best understood by referring to Figure 1. The complete control circuit is powered by the two-wire, 4-20 mA command signal. The analog 4-20 mA command is passed to the microprocessor, where it is compared to the measured valve stem position. The control algorithm in the processor performs control calculations and produces an output command to the piezo valve, which drives the pneumatic amplifier. The position of the pilot valve in the pneumatic amplifier is measured and relayed to the inner loop control circuit. This two-stage control provides for more responsive and tighter control than is possible with a single stage control algorithm.

The pneumatic amplifier controls the airflow to the actuator. The change of pressure and volume of the air in the actuator causes the valve to stroke. As the valve approaches the desired position, the difference between the commanded position and the measured position becomes smaller and the output to the piezo is decreased. This, in turn, causes the pilot valve to close and the resulting flow to decrease, which slows the actuator movement as it approaches the new commanded position. When the valve actuator is at the desired position, the pneumatic amplifier output is held at zero, which holds the valve in a constant position.

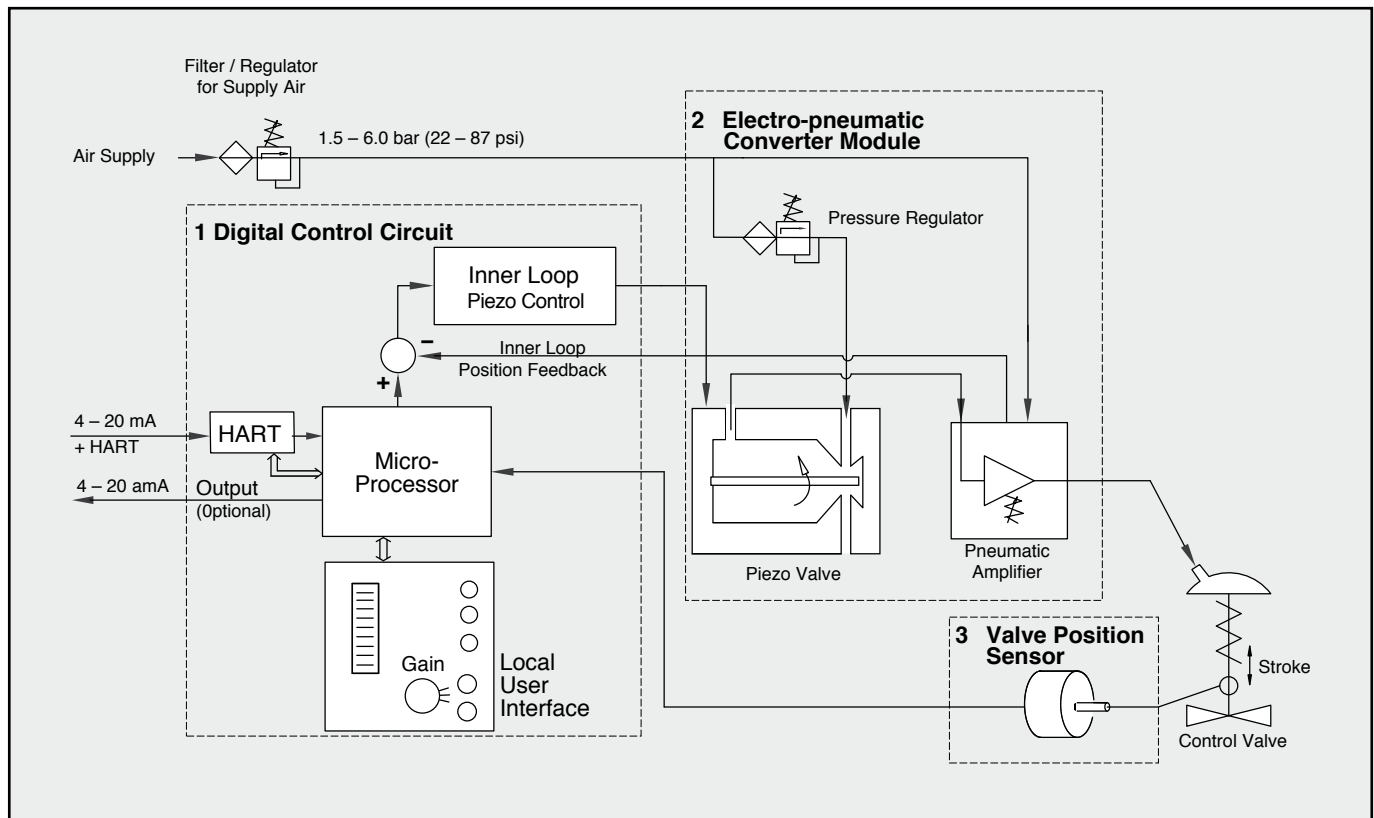


Figure 1: Logix 520MD Principle of Operation

## The Logix 520MD for HART Applications

Complete local configuration

- Local status and alert messages
- Tuning (Auto-tune function and manual adjustment)
- Jog buttons to manually adjust 100% position
- Easy-to-install 4-20 mA analog feedback card option

Logix 520MD Features	
RFI/EMI Immunity	✓
Auto-tune (Positioner Performance)	✓
High Friction Stability Tuning	✓
Integral 4-20 mA Feedback Option	✓
Flash RAM (Local Positioner Embedded Code Upgrade)	✓
Local Valve Signature Storage	✓
Local Calibration and Setup	✓
24/7 Local Fault Monitoring	✓
Local Adjustable Gain	✓
Three Response Curves (Linear, =% and custom)	✓
Local Jog Buttons to Adjust 100% Command Position	✓
DTM Available	✓
Yokogawa VIP Partner	✓
Honeywell PKS Partner with Honeywell HART FDM	✓

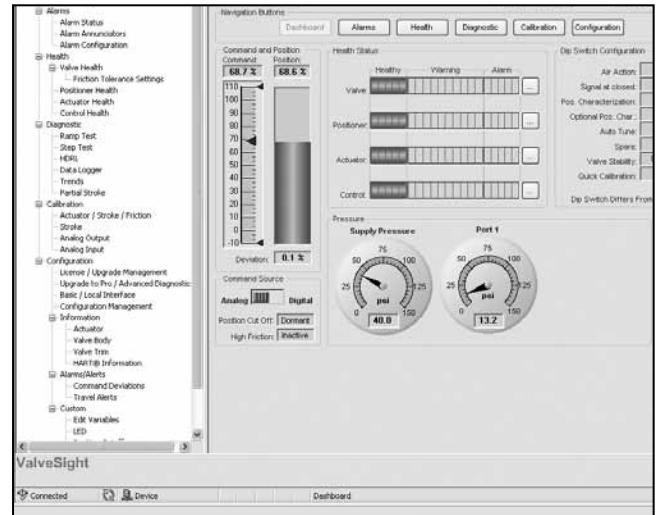


Figure 2: ValveSight™ Dashboard for Logix 520MD Advanced DTM and Pro diagnostics

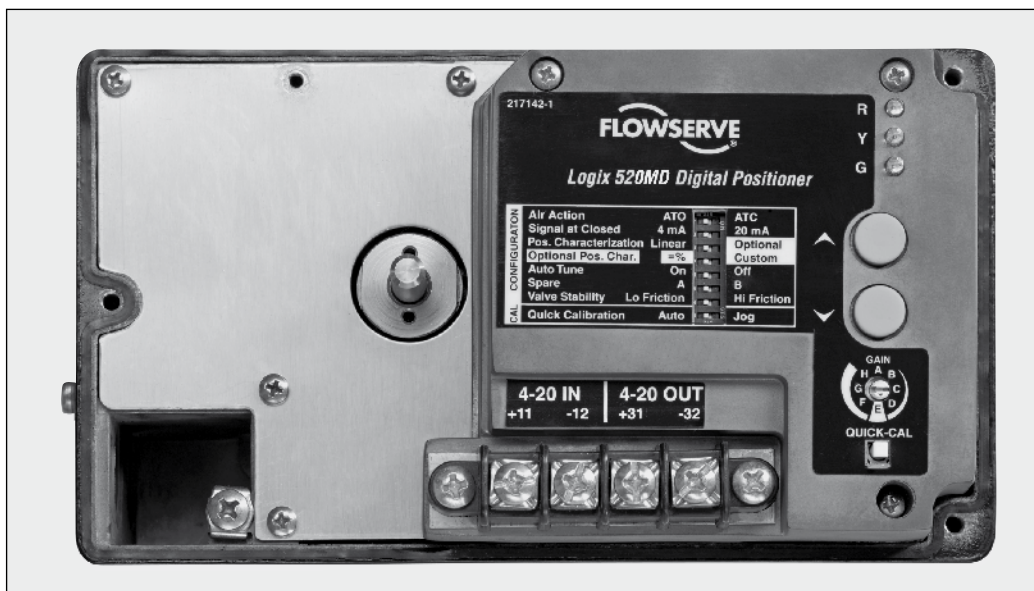
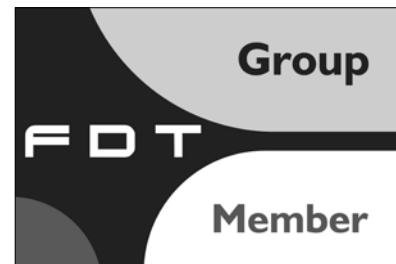


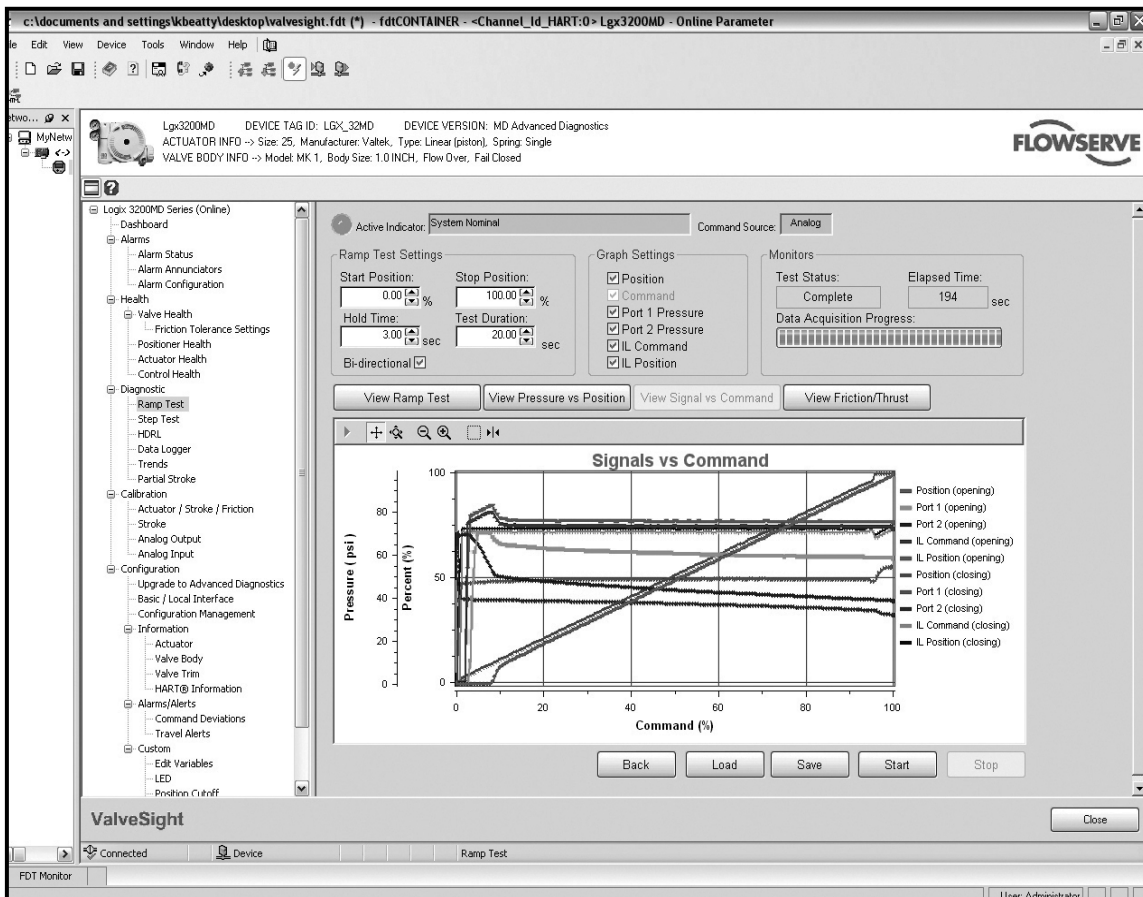
Figure 3: Logix 520MD Series

## ValveSight™ FDT/DTM Technology

Flowserve’s ValveSight™ DTM software helps manage field devices by combining the features of field network hardware and the Hart 500MD communication protocols using FDT/DTM technology with the Logix 500MD series positioners. ValveSight™ is a complete software package, featuring a unique and easy to understand health status of the device that shows not only problems, but also the magnitude of developing problems.

ValveSight™ also has configuration and calibration screens to fully support the Logix 500MD positioner family. Additionally, the user can access customized reports for all configuration, calibration and event data. Flowserve’s ValveSight™ DTM opens a ‘window’ to the device and allows immediate views with live feedback on all active device sensors including valve stem position, control signal, friction, response time and other important system metrics.

ValveSight™ DTM software enables communication between the software and field device networks using the HART or FF protocol and provides access to the 24/7 diagnostic information from field devices. Using FDT/DTM technology maintenance personnel can access any Logix 500MD series positioner on the network from a single workstation. Additionally, the software has the capability to store configuration and calibration history and view event logs for each digital positioner accessible through the network.



## Logix 520MD Series Features List for ValveSight™ DTM

		ValveSight™ DTM		Logix 520MD Positioners		
		ValveSight™ Basic	ValveSight™ Advanced	Logix 520MD*	Logix 521MD	Logix 522MD
Overview	Dashboard	✓ <sup>1</sup>	✓	✓ <sup>1</sup>	✓ <sup>1</sup>	✓
	All-Alarm Annunciator	✓	✓	✓ <sup>2</sup>	✓	✓
Configuration	Configuration Management	✓	✓	✓	✓	✓
	Local Interface Control	✓	✓	✓	✓	✓
	Position Cutoff	✓	✓	✓	✓	✓
	Soft Limits	✓	✓	✓	✓	✓
	Custom Stroke Characterization	✓	✓	✓	✓	✓
	Counters and Travel Settings	✓	✓	✓	✓	✓
	Command Deviation Settings	✓	✓	✓	✓	✓
	Custom Units of Measure	✓	✓	✓ <sup>2</sup>	✓	✓
	All-Variable Editor	✓	✓	✓	✓	✓
	Upgrade Devices to Advanced Diagnostics	✓	✓	✓	✓	
Calibration	Analog Output Calibration	✓	✓	✓	✓	✓
	Analog Input Calibration	✓	✓	✓	✓	✓
	Stroke Calibration	✓	✓	✓	✓	✓
	Pressure and Friction Calibration	✓	✓		✓	✓
Off-Line Diagnostics	Ramp Test	✓	✓	✓ <sup>2</sup>	✓	✓
	Step Test	✓	✓	✓ <sup>2</sup>	✓	✓
	HDRL Test		✓	✓	✓	✓
	Data Logger		✓	✓ <sup>2</sup>	✓	✓
On-Line Diagnostics	Supply Pressure	✓	✓		✓	✓
	Port 1 Pressure	✓	✓		✓	✓
	Friction		✓			✓
	Actuation Ratio		✓			✓
	Pneumatic Leak		✓			✓
	Long-Term Trends		✓			✓
	Partial Stroke Test		✓			✓
	Valve Health View		✓			✓
	Positioner Health View		✓			✓
	Actuator Health View		✓			✓
Control Health View		✓			✓	

\*Note: With double acting configuration, the 522MD functionality is not available at this time.

<sup>1</sup> Limited function. No health information - <sup>2</sup> Limited function. No pressure monitoring information

## Specifications

**Table 1: Input Signal**

Input Signal Range	4 - 20 mA HART
Compliance Voltage	10 VDC
Voltage Supply (maximum)	30 VDC
Minimum Required Operating Current	3,6 mA

**Table 2: Stroke Output**

Feedback Shaft Rotation	min. 15°, max 90° 40° recommended for linear applications
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**Table 3: Air Supply**

Air Supply Quality	free from moisture, oil and dust per IEC 770 and ISA-7.0.01
Input Pressure range	1,5 to 6,0 bar (22 to 87 psi)
Air Consumption (steady state)	0,08 Nm <sup>3</sup> /h @ 1,5 bar (0,047 SCFM @ 22 psi) 0,12 Nm <sup>3</sup> /h @ 6,0 bar (0,071 SCFM @ 87 psi)

**Table 4: Output Signal**

Output Pressure Range	0 to 100% of air supply pressure
Output Flow Capacity	2,4 Nm <sup>3</sup> /h @ 1,5 bar (1,41 SCFM @ 22 psi) 7,0 Nm <sup>3</sup> /h @ 6,0 bar (4,12 SCFM @ 87 psi)

**Table 5: Shipping Weights**

Base Positioner without Accessories	1,2 kg (2,65 lbs)
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**Table 6: Performance Characteristics (typical)**

Linearity	< +/- 1,0%
Resolution	< 0,1%
Repeatability	< 0,2%
Deadband	< 0,2%

**Table 7: Environmental Conditions**

Operating Temperature	-40°C to +80°C (-40°F to +178°F)
Transport and Storage Temperature	-40°C to +80°C (-40°F to +178°F)
Operating Humidity	0 to 100% non-condensing

**Table 8: Limit Switches (optional)**

Type	P&F SJ2-S1N
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-25 °C to 100 °C (-13 °F to 212 °F)
Type	P&F SJ2-SN
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-40 °C to 100 °C (-40 °F to 212 °F)
Type	P&F SJ2-N
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-25 °C to 100 °C (-13 °F to 212 °F)



# Ordering Information

Family	Series	Communication / Diagnostic	Software	Certifications	Housing	Threaded Conn.	Feedback Shaft	Temperature	Language	Position Indicator	Options	Add-in Electronics	Limit Switches
Logix	5	XX	XX	XX	X	X	X	X	X	X	X	X	X
		AA	BB	CC	D	E	F	G	H	I	J	K	L
<b>Positioner Model</b>													
Standard													
<b>Communication and Diagnostic</b>													
520 HART - Standard		20	MD										
521 HART - Advanced		21	MD										
522 HART - Pro Diagnostic		22	MD										
<b>Certifications</b>													
Intrinsically Safe Class I, Div 1, Groups A,B,C,D (Factory Mutual / CSA)				-02-									
Nonincendive Class I, Div.2 (FM), Class I, Div.2 (CSA)				-08-									
General Purpose				-14-									
Ex ia IIC, ATEX II 1G				-15-									
Ex ic IIC, ATEX II 3G				-32-									
<b>Housing</b>													
Flowserve: Aluminum, Black with white cover					W								
Flowserve: Aluminum, Black with yellow cover					Y								
Flowserve: Aluminum, Black					B								
<b>Threaded Connections</b>													
1/2 NPT conduit, 1/4 NPT pneumatic						1							
M20 conduit, 1/4 NPT pneumatic						2							
1/2 NPT conduit, 1/4 NPT pneumatic, 1/8 NPT aux. vent						3							
M20 conduit, 1/4 NPT pneumatic, 1/8 NPT aux. vent						4							
<b>Feedback Shaft</b>													
D Shaft - 316SS (Valtek Standard)							D						
VDI/VDE 3845 (NAMUR)							R						
<b>Temperature</b>													
-40 °C to 85 °C (-40 °F to 185 °F)								E					
<b>Language</b>													
English									E-				
French									F-				
German									G-				
<b>Position Indicator</b>													
No indicator										0			
Flat										F			
Domed										D			
<b>Special Options</b>													
Standard											0		
<b>Add-in Electronic Circuits</b>													
None												0	
4-20 mA Feedback												F	
<b>Limit Switches</b>													
No switches													0
Slot type Namur sensor, P+F SJ2 S1N													4
Slot type Namur sensor, P+F SJ2 SN													5
Slot type Namur sensor, P+F SJ2N													6

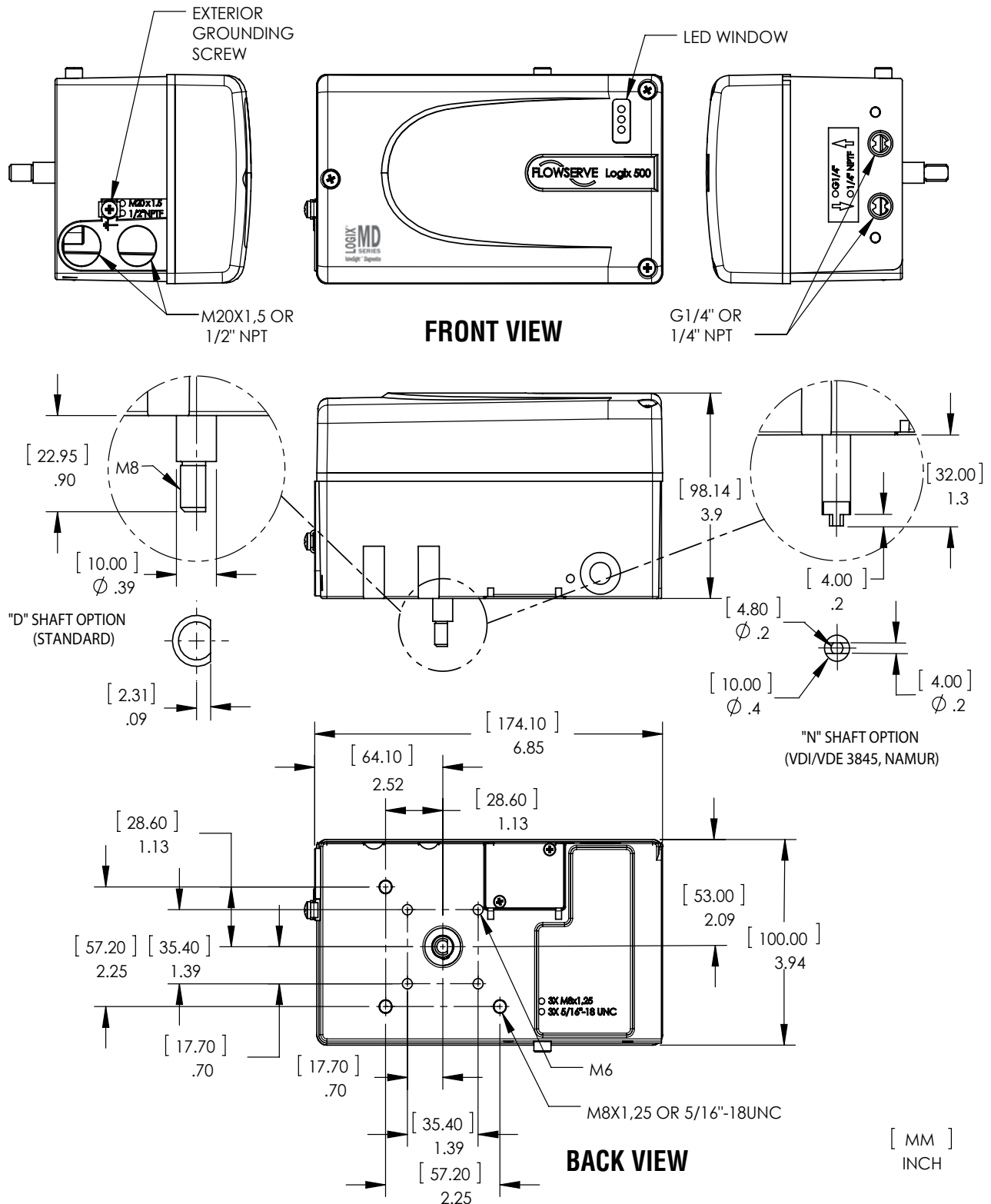
## Manifold and Gauge Options Ordering Information

	Manifold Options	Gauge Options	
	XX	X	
	MM	N	
<b>Manifold Options (MM)</b>			
No manifold	00		
Double acting	DA		
Gauge adapter	GA		
Gauge manifold - NPT Threads	GM		
Gauge manifold - G Threads	GC		
VDI/VDE 3847 semi-integrated manifold	VE		
<b>Gauge Options (N)</b>			
No gauges			0
Output, PSI/BAR/KPA Stainless steel with brass internals (qty. 1)		x	1
Output + Supply, PSI/BAR/KPA Stainless steel with brass internals (qty. 2)			2
Output + Output PSI/BAR/KPA Stainless steel with brass internals (qty. 2)	x		3
Output, PSI/BAR/KPA Stainless steel with stainless steel internals (qty. 1)		x	4
Output + Supply, PSI/BAR/KPA Stainless steel with stainless steel internals (qty. 2)			5
Output + Output, PSI/BAR/KPA Stainless steel with stainless steel internals (qty. 2)	x		6
Output, Kg/Cm <sup>2</sup> /PSI Stainless steel with brass internals (qty. 1)		x	7
Output + Supply, Kg/Cm <sup>2</sup> /PSI Stainless steel with brass internals (qty. 2)			8
Output + Output, Kg/Cm <sup>2</sup> /PSI Stainless steel with brass internals (qty. 2)	x		9
Output, Kg/Cm <sup>2</sup> /PSI Stainless steel with stainless steel internals (qty. 1)		x	A
Output + Supply, Kg/Cm <sup>2</sup> /PSI Stainless steel with stainless steel internals (qty. 2)			B
Output + Output, Kg/Cm <sup>2</sup> /PSI Stainless steel with stainless steel internals (qty. 2)	x		C
Any KPA gauges	x	x	D
Output + Output + Supply, PSI/BAR/KPA Stainless steel with brass internals (qty. 3)	x		E
Output + Output + Supply, PSI/BAR/KPA Stainless with stainless steel internals (qty. 3)	x		F
Output + Output + Supply, Kg/Cm <sup>2</sup> /PSI Stainless steel with brass internals (qty. 3)	x		G
Output + Output + Supply, Kg/Cm <sup>2</sup> /PSI Stainless with stainless steel internals (qty. 3)			H
VE Gauge Options - Consult Factory			

## Certifications

Noified Body	Certification Option	Approval	Entity Parameters	Temperature Codes	Enclosure Rating
	-02	Intrinsically Safe Class I Division 1 Groups A,B,C,D	Ui = 30V Ii = 100mA Pi = 800mW Ci = 0 Li = 0	T4 T <sub>amb</sub> <85 °C (185 °F)	NEMA 4 X
	-08	Nonincendive Class I Division 2 Goups A,B,C,D	Install per NEC Article 501-4 when barriers are not used.	T4 T <sub>amb</sub> <85 °C (185 °F)	NEMA 4 X
	-02	Intrinsically Safe Class I Division 1 Groups A,B,C,D	Ui = 30V Ii = 100mA Pi = 800mW Ci = 0 Li = 0	T4 T <sub>amb</sub> <85 °C (185 °F)	NEMA 4 X
	-08	Nonincendive Class I Division 2 Goups A,B,C,D	Install per NEC Article 501-4 when barriers are not used.	T4 T <sub>amb</sub> <85 °C (185 °F)	NEMA 4 X
	-15	II1G Ex ia IIC T5 - T6	Ui = 30V Ii = 100mA Pi = 800mW Ci = 0 Li = 0	T5 T <sub>amb</sub> < 85 °C (185 °F) T6 T <sub>amb</sub> < 40 °C (104 °F)	IP65
	-32	II3G Ex ic IIC T5 - T6	Ui = 30V Ii = 100mA Pi = 800mW Ci = 40nF Li = 0	T5 T <sub>amb</sub> < 85 °C (185 °F) T6 T <sub>amb</sub> < 40 °C (104 °F)	IP65

**Dimensions**



**Figure 4: Dimensional Drawing of the Logix 520MD Series Digital Positioner**