

# The BD-E Series

## EMC-Compliant Brushless Servo Systems

### Direct-On-Line Operation with EMC Compliance

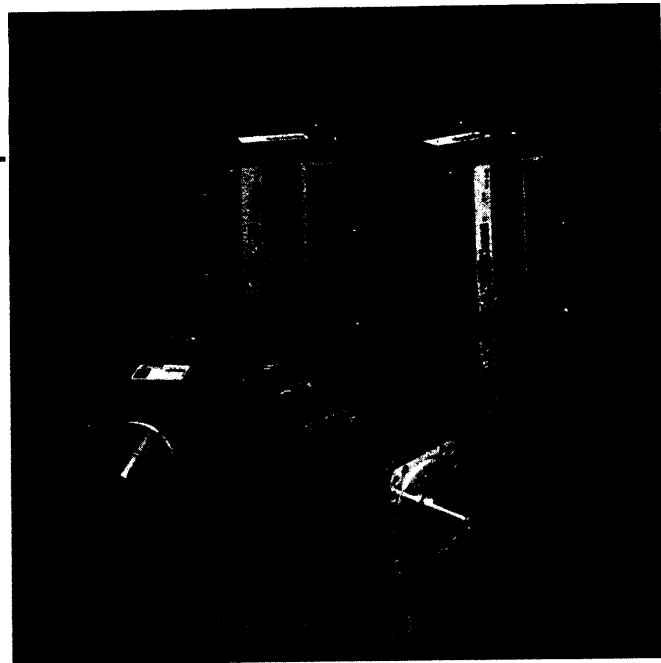
With the introduction of the BD-E Series, Parker makes available a high-performance brushless servo system which is CE marked and complies with the European EMC and Low-voltage Directives.

Building on experience gained with the highly-successful BLH Series, Parker has incorporated a large number of improvements to produce a servo system with outstanding flexibility. A major advance is the introduction of direct-on-line operation at 230V AC without the additional size, weight and cost of a separate transformer. All line filter components necessary for EMC compliance are built into the drive—this eliminates all potential problems associated with the mounting and wiring of external filter units.

High-resolution sinusoidal commutation guarantees smooth rotation over the full speed range. The redesigned MD Series motors now have larger shafts with improved dimensional tolerances to aid the fitting of components such as precision gearboxes. All drive configuration is performed using dip switches located on the front panel.

BD-E Series drives have comprehensive built-in monitoring systems to protect both the drive and the motor. An I-t circuit limits the time for which any given motor current can flow before being clamped at the continuous rating of the drive. An additional monitor circuit guards against full drive current being delivered for an extended period at very low speeds. As well as protecting against supply overvoltage or undervoltage, partial supply failure, excess output current and overheating of the drive or motor, the BD-E also checks for overspeed conditions and loss of commutation or position feedback signals. With commutation data being derived from the incremental encoder, there is automatic tach fault protection since loss of the encoder signal will prevent commutation and therefore stop the motor.

The BD-E Series is available with a choice of current ratings and in three versions—an analog-input velocity or torque servo, a step and direction input version, and a complete positioning system incorporating the new X150E controller. As well as being fully EMC-compliant, this controller offers the convenience of configuring entirely by software, without the use of jumper links. The X150E is compatible with almost any type of PLC—both NPN and PNP output drivers are incorporated as standard, selectable by software. Inputs and outputs may be configured to operate at 5V or 24V. The command language is based on Compumotor's popular X-Code, which is user-friendly and extremely versatile. The controller can store up to 64 complete motion programs in its non-volatile memory and offers advanced programming features such as conditional branching and math functions.



### BD-E Series Common Features

- Direct operation from 230V AC single-phase supply
- Fully EMC and LVD compliant with all line filter components built in
- Two current levels —3A and 6A continuous
- Peak torques up to 14Nm
- Speeds up to 5,000 rpm
- Commutation, velocity, and position by integral incremental encoder, with separate initialization encoder
- High-efficiency recirculating PWM current control system
- Integral regenerative power dump
- Rugged industrial housing
- All configuration either by switches or software
- Drives fully protected against overheating, short circuits and supply faults

### BD-E Features

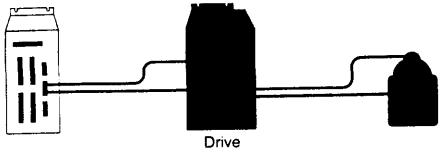
- Velocity or torque mode operation
- Industry-standard differential analog inputs
- Velocity and torque monitor outputs
- Compatible with Parker 6000 Series controllers

### BDS-E Features

- TTL-compatible step and direction inputs
- Compatible with Parker 6000 Series indexers
- Velocity and torque monitor outputs

### BDHX-E Drive/Controller Features

- Up to 32 drives can be daisy chained or multi-dropped via RS-232C
- Non-volatile memory stores up to 64 motion programs
- 7-segment diagnostic display
- Dedicated inputs for end-of-travel and home position switches
- 10 user-definable inputs, 6 outputs
- Sinking or sourcing outputs; software selectable
- Optional remote panel or thumbwheel input
- High-speed (15  $\mu$ S) registration input



**Specifications – BD-E and BDS-E Servos**

Parameter	Value	
<b>Performance</b>	<b>BD75E</b>	<b>BD150E</b>
Continuous current, A rms	3	6
Peak current, A rms	6	12
DC bus voltage at nominal input, V	325	325
Power dump current, A (@ 400V DC)	12	12
Max continuous dump power, W	96	96
Peak dump power, kW	4.5	4.5
Current control	10 kHz recirculating PWM	
Current limit	Switch-selectable to 40% of peak	
Bandwidth	Torque amplifier > 2.5 kHz	
Speed/torque	Curves located on page B52	
Encoder	Maximum frequency pre-quadrature 100KHz (from motor encoder)	
Current control	Re-circulating PWM, at 20KHz	
<b>AC Power Input</b>		
Voltage	230VAC, single phase ±10%	
Frequency	50-60Hz	
Voltage Ranges		
Absolute Min	207VAC	
Absolute Max	264VAC	
Nominal	230VAC	
<b>Inputs</b>		
Connector	15 pin D-type socket (user I/O)	
Analog command (BD-E)	±10V differential analog input. Input impedance 30K	
Step and Direction (BDS-E)	Differential TTL levels, min. pulse width = 1µs, max frequency = 350 kHz	
Reset/disable	Jumper configurable for normally closed contact to +15V, or normally open contact to GND	
	High >10V, Low ≤0.9V, drive is disabled by low input	
<b>Outputs</b>		
Connector	15 pin D-type socket (user I/O)	
Drive fault	Active low. NPN open collector. Emitter coupled to GND. Maximum off-state voltage 40V. Maximum current sink 80mA. On state voltage of 0.2V at 80mA.	
Encoder	See encoder output specifications	
±15V	±15V auxiliary power supply at 5mA max	
<b>Encoder Outputs</b>		
Type	Buffered from motor encoder, available for use with servo controller	
Connector	15 pin D-type socket (user I/O)	
Electrical	Pre-quadrature A, B with Z channel. Differential TTL line driver. 100KHz maximum frequency.	
<b>Diagnostics</b>		
LED	Over-temperature, drive fault and current limit	
Output	See drive fault specifications	
<b>Environmental</b>		
Drive		
Storage	-40°F to 185°F (-40°C to 85°C)	
Operation	32°F to 122°F (0°C to 50°C)	
Humidity	0-95% non-condensing	
Weight	14.3 lbs (6.5 kb)	

**Specifications – BDHX-E Positioning Servo**

Parameter	Value
<b>Communications</b>	
Type	RS232C serial link, 3-wire implementation (Tx, Rx, GND). Minimum voltage swing on Rx line is $\pm 3V$
Parameters	9600 baud, 8 data bits, 1 stop bit, no parity
Configuration	Up to 32 BDHXs may be controlled from a single host RS232C port
Language	X-code commands, with preceding device address
Operator Interface Function	RP240 allows entry of user variables, LCD displays operator messages, LEDs display machine status
Power	Supplied by the BDHX drive
<b>Performance</b>	
	<b>BDHX75E</b> <b>BDHX150E</b>
Continuous current, A rms	3                                      6
Peak current, A rms	6                                      12
DC bus voltage at nominal input, V	325                                    325
Power dump current, A (@ 400V DC)	12                                    12
Max continuous dump power, W	96                                    96
Peak dump power, kW	4.5                                    4.5
Current control	10 kHz recirculating PWM
Current limit	Switch-selectable to 40% of peak
Position range	$\pm 1$ to $\pm 268,435,455$ steps
Velocity range	0.0001 to 200 rev/sec (motor limited)
Acceleration range	0.06 to 999,999 rev/sec/sec
Speed/torque	See curves located on page B52
Encoder	Maximum frequency pre-quadrature 100KHz (from motor encoder)
Indexer update	2 milliseconds
<b>Servo Loop</b>	
Tuning	Fully digital PIVF or PID options, configured through serial port
Update time	500 microseconds
Servo tuning	Values stored in battery backed RAM
<b>AC Power Input</b>	
Voltage	230VAC, single phase $\pm 10\%$
Frequency	50-60Hz
Voltage Ranges	
Absolute Min	207VAC
Absolute Max	264VAC
Nominal	230VAC
<b>Inputs</b>	
Number	10 user-definable inputs and five dedicated inputs. User-definable inputs can be assigned special functions such as trigger, motion kill, pause/continue, go direction, jog, data strobe, reset and motor shutdown. The dedicated input functions are home, end-of-travel limits, stop and auxiliary-in.
Electrical	Optically isolated, Inputs can be configured for 5V or 24V operation. Groups of inputs can be configured for either sinking or sourcing. In 5V mode, the input levels are low $< 2.5V$ , high $> 3.0V$ . In 24V mode, the input levels are low $< 5.7V$ , High $> 9.0V$ . Hysteresis on each input improves noise immunity.

**B Servo Systems**

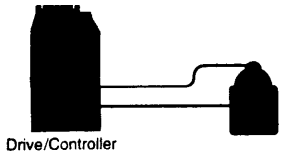
**Specifications – BDHX-E Positioning Servo**

Parameter	Value
<b>Outputs</b>	
Number	6 user-definable outputs. Outputs can be assigned special functions such as in-position, moving/not moving, program running, data strobe and fault.
Electrical	Opto-isolated. Sinking (NPN) or sourcing (PNP) operation (software selectable). NPN: Max. OFF state voltage 30V, Max. current sink 300mA, ON state voltage of 2.5V at 300mA. PNP: Max. OFF state voltage 30V. Max. current source 300mA. ON state voltage of 2.5V at 300mA. [Note: BDHX supplies 160 mA (max). External 24VDC supply required to source more than 160 mA, up to 1.0A max]
<b>Encoder Outputs</b>	
Type	Buffered from motor encoder
Electrical	Quadrature A, B with Z channel. Differential TTL line driver. 100KHz maximum frequency.
<b>Encoder Feedback Input</b>	
Configuration	Factory default uses motor encoder. Jumper configurable for load-mounted encoder
Electrical	Opto-isolated differential input. TTL signals high >3.5VDC, low <0.8VDC. Current sink minimum 15mA, maximum 20mA.
<b>Diagnostics</b>	
RS232C	X-Code commands offer detailed status reports
LED	Over-temperature, drive fault, current limit and power
Status	Seven-segment LED indicates positioner status
Outputs	Drive fault and positioner fault
<b>Motion Programs</b>	
Storage	8000 characters of battery backed RAM
Program length	Variable up to memory limit
Number	64 programs
Execution	a) Command from serial port, b) Sequence selection inputs, c) Automatic execution at power-up, selected by XP command, d) RP240, e) TM8 Thumbwheel
<b>Environmental</b>	
Drive	
Storage	-40°F to 185°F (-40°C to 85°C)
Operation	32°F to 122°F (0°C to 50°C)
Humidity	0-95% non-condensing
Weight	15.4 lbs (7 kg)

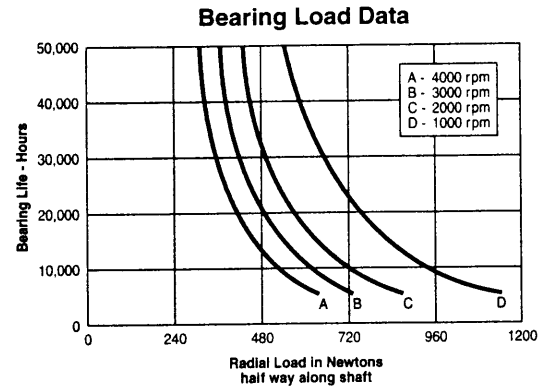
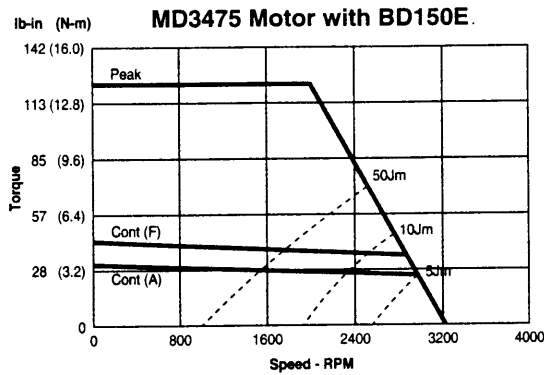
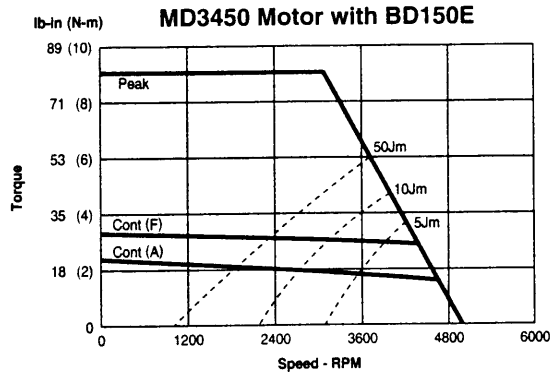
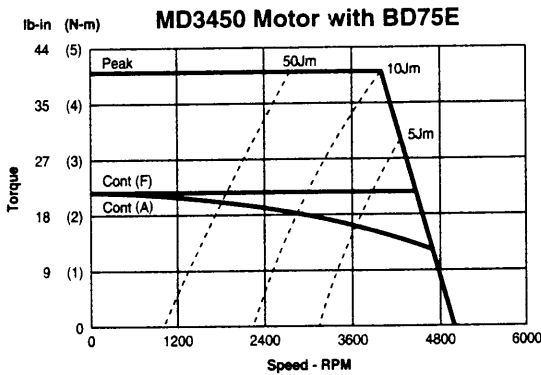
## BDHX-E Alphabetical Command Listing

#	Step sequence	<b>DVA</b>	Display Velocity	<b>OSM</b>	Integral Action	<b>TRMP</b>	Trigger on positive motor distance
;	Comment		Actual		Sensitivity		Trigger On Input
<b>A</b>	Acceleration Rate	<b>DVO</b>	Display variable data on RP240 display	<b>OSO</b>	Suppress Units	<b>TRN</b>	Not Equal
<b>B</b>	Buffer Status Request			<b>OUT</b>	Define output functions	<b>TRR</b>	Registration Mode
<b>BS</b>	Buffer Size Request	<b>DVS</b>	Display Velocity Setpoint	<b>P</b>	Position	<b>TUNE</b>	Show Tuning Settings
<b>C</b>	Continue	<b>E</b>	Enable	<b>PIC</b>	Picture	<b>TUNET</b>	Self-Tune Servo (Torque Amplifier)
<b>CAG</b>	Configure Acceleration Gain	<b>ELSE</b>	Communications Else	<b>PR</b>	Position Report Pause	<b>TUNEV</b>	Self-Tune Servo (Velocity Amplifier)
<b>CCP</b>	Configure Current Clamp	<b>EX</b>	Set Communication Style	<b>PS</b>	Position Zero		Pause
<b>CCS</b>	Configure Command Source		Disable	<b>PZ</b>	Transmit An Identifier	<b>U</b>	Until
<b>CDG</b>	Configure Derivative Gain	<b>F</b>	Communications Following Percent	<b>QS</b>	Report Control	<b>UNTIL</b>	Velocity
<b>CEW</b>	Configure In-Position Window	<b>FOL</b>	Read following ratio from parallel I/O	<b>R</b>	Module Status	<b>V</b>	Variables
<b>CFG</b>	Configure Feedforward Gain	<b>FRD</b>	Go	<b>RA</b>	Report A - Limit Status Request	<b>VAR</b>	Read variable from parallel I/O
<b>CIG</b>	Configure Integral Gain	<b>G</b>	Go Home Acceleration	<b>RAT</b>	Set Rate Multiplier Value	<b>VARD</b>	Enable and read function keys (RP240)
<b>CIT</b>	Configure In-Position Time	<b>GA</b>	Go Home	<b>RB</b>	Report B - Miscellaneous Status Request	<b>VARn=FUN</b>	Enable and read numeric keys (RP240)
<b>CIW</b>	Configure Integral Action Window	<b>GH</b>	Go Home	<b>RE</b>	Drive Status Request	<b>VARn=NUM</b>	Enable and read numeric keys (RP240)
<b>CIX</b>	Configure Index Resolution	<b>GHF</b>	Go Home Final	<b>REPEAT</b>	Repeat	<b>VRD</b>	Read velocity value from parallel I/O
<b>CJL</b>	Enter Motor + Load Inertia	<b>GOSUB</b>	GOSUB sequence	<b>RFS</b>	Return Servo to Factory Settings	<b>WHEN</b>	Set WHEN condition
<b>CMR</b>	Configure Motor Resolution	<b>GOTO</b>	GOTO sequence	<b>RG</b>	Report Go Home Status	<b>WHILE</b>	Set WHILE condition
<b>COFF</b>	Configure Amplifier Offset	<b>H</b>	Change Direction	<b>RIFS</b>	Return Indexer to Factory Settings	<b>XBS</b>	Sequence memory available
<b>CPE</b>	Configure Position Error	<b>^H</b>	Backspace	<b>RPO</b>	Report Power-On Time	<b>XC</b>	Checksum
<b>CPG</b>	Configure Proportional Gain	<b>H+</b>	Set Direction	<b>RS</b>	Report Sequence Status	<b>XD</b>	Sequence Download
<b>CTG</b>	Configure Filter Time Constant	<b>H-</b>	Set Direction	<b>RSE</b>	Report Servo Errors	<b>XE</b>	Sequence Delete
<b>CTQ</b>	Enter Motor Torque	<b>HALT</b>	Halt	<b>RST</b>	Freeze Torque Demand	<b>XG</b>	GOTO sequence
<b>CUR</b>	Configure User Resolution	<b>HELP</b>	Produce Help Screens	<b>RV</b>	Revision	<b>XP</b>	Power-On Sequence Number
<b>CVG</b>	Configure Velocity Gain	<b>ID</b>	Immediate Distance	<b>S</b>	Stop	<b>XR</b>	Run Sequence
<b>CVT</b>	Configure Velocity Trip	<b>IF</b>	If	<b>SAVE</b>	SAVE Parameters	<b>XRD</b>	read sequence from parallel I/O
<b>D</b>	Distance	<b>IN</b>	Define input functions	<b>SB</b>	Stop Buffered	<b>XRP</b>	Run/Pause Sequence
<b>DCLR</b>	Clear RP240 display	<b>IO</b>	Immediate Output	<b>SIM</b>	Set Indexer/ Following Mode	<b>XRT</b>	Return From Sequence
<b>DCNT</b>	Enable/Disable the RP240 Pause/Continue keys	<b>IS</b>	Input Status	<b>SKE</b>	Skip On 'Equals'	<b>XSD</b>	Sequence Download Status Report
<b>DFX</b>	Display Flags Indexer	<b>IV</b>	Immediate Velocity	<b>SKN</b>	Skip On 'Not Equal'	<b>XSR</b>	Sequence Run Status Report
<b>DIC</b>	Display Indexer Counter	<b>JA</b>	Jog Acceleration	<b>SS</b>	Set current position to value	<b>XSS</b>	X Sequence Status
<b>DLED</b>	Turn RP240 LEDs on/off	<b>JV</b>	Jog Velocity	<b>SSA</b>	Set Switches	<b>XT</b>	Sequence Terminator
<b>DPA</b>	Display Position Actual	<b>K</b>	Kill	<b>SSD</b>	RS232C Echo Control	<b>XTR</b>	Set trace mode
<b>DPC</b>	Position cursor on RP240 display	<b>KILL</b>	Kill Motion	<b>SSG</b>	Set Output 1 as Composite Fault Signal	<b>XU</b>	Sequence Upload
<b>DPE</b>	Display Position Error	<b>L</b>	Loop	<b>SSH</b>	Save Command Buffer	<b>XWHEN</b>	Set WHEN sequence
<b>DPS</b>	Display Position Setpoint	<b>LA</b>	Limit Deceleration	<b>SSI</b>	On Limit	<b>XZ</b>	Reset Power-Up Sequence Mode
<b>DR</b>	Display Report	<b>LD</b>	Limit D sable		Save Command Buffer	<b>Y</b>	Terminate Loop
<b>DRD</b>	Read distance from parallel I/O	<b>LS</b>	Limit Switch Fast Stop		On Stop	<b>Z</b>	Reset
<b>DS</b>	Display Signal		Limit Switch Fast Stop		Sequence Select Inputs		
<b>DSTP</b>	Enable/Disable the RP240 Stop key	<b>MC</b>	Mode Continuous	<b>ST</b>	Energize/De-Energize Drive		
<b>DTA</b>	Set Dither Amplitude	<b>MN</b>	Mode Normal	<b>STOP</b>	Stop Motion		
<b>DTF</b>	Set Dither Frequency	<b>MPA</b>	Mode Position Absolute	<b>SV</b>	Save		
<b>DTXT</b>	Display text data on RP240 display	<b>MPI</b>	Mode Position Incremental	<b>T</b>	Time Delay		
		<b>MQ</b>	Speed Change Mode	<b>TMRD</b>	Read timer value from parallel I/O		
		<b>N</b>	End Loop	<b>TRD</b>	Trigger On Input Distance		
		<b>NIF</b>	End of IF	<b>TRE</b>	Trigger On Input Equal		
		<b>NWHILE</b>	End of WHILE	<b>TRIP</b>	Trigger On In Position		
		<b>O</b>	End of WHILE Programmable Output	<b>TRMN</b>	Trigger on negative motor distance		
		<b>OFF</b>	De-Energize Drive				
		<b>ON</b>	Energize Drive				
		<b>OS</b>	Other Switches				
		<b>OSA</b>	Home @ Index Pulse				
		<b>OSB</b>	Integral Action Selection				
		<b>OSC</b>	Monitor Command Reporting				
		<b>OSE</b>	Jog Enable				
		<b>OSF</b>	Initialization on Limit				
		<b>OSJ</b>	RAT 16/24 Bit select				
		<b>OSK</b>	Encoder Integrity Check				

Note: The positioner card used in BDHX-E Series Drives is a general-purpose controller used in a range of products. The HELP screens displayed by the positioner include additional commands which are not relevant to the BDHX-E Drive. These are identified in the product user guide.



### Speed/Torque Curves



### Power Dump Dissipation Curves

In addition to torque/speed data, the performance graphs also give an indication of the safe operating area of the power dump circuit in repetitive start-stop operation. The data are based on a "worst case" system performing repeated trapezoidal moves with no dwell in between. The time at maximum speed is as short as the thermal rating of the motor will allow. Under these conditions, for any given load inertia, the power in the ballast resistor depends on the peak torque during deceleration and the maximum speed.

The broken lines represent different load inertias as a ratio of the rotor inertia (Jm). When the application requirements have

been calculated, plot the point representing peak torque and maximum speed on the performance graph. If this point lies to the left of the corresponding inertia line, the resistor rating will not be exceeded. If it lies to the right, there is not necessarily a problem but further calculation is required to establish the dump power more accurately—please consult your supplier. For example, a peak torque of 3 Nm and a maximum speed of 3,000 rpm are acceptable with the MD3450 motor and BD75E drive.

Note that this information is for general guidance purposes only and will not apply to light-duty cycles.

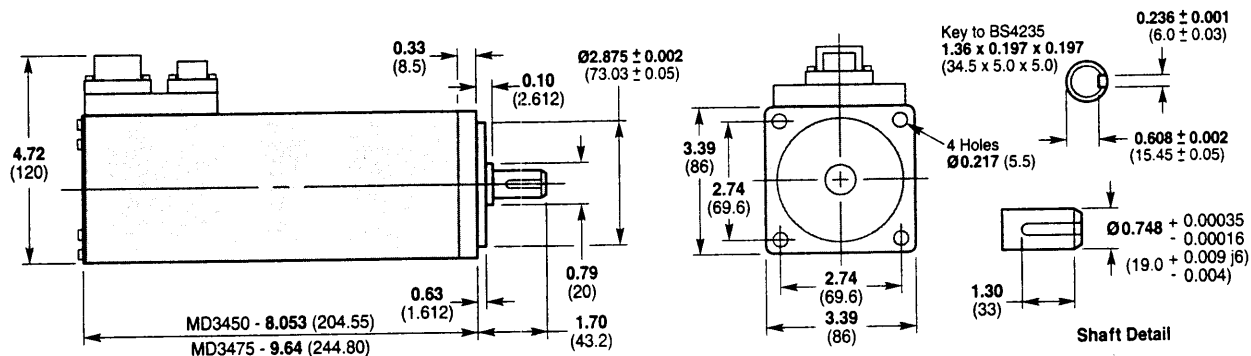
**Motor Specifications**

	Units	MD3450	MD3475
Stall torque in air	oz-in (N-m)	312 (2.2)	496 (3.5)
Stall torque, flange mounted	oz-in (N-m)	439 (3.1)	609 (4.3)
Rated speed	rpm	5,000	3,250
Rotor inertia	oz-in <sup>2</sup>	8.75	13.1
	kg-cm <sup>2</sup>	1.6	2.4
Mechanical time constant	mS	1.5	1.13
Thermal time constant	min	30	40
Torque constant	oz-in/A rms	107.6	164.3
Voltage constant	V/1,000 rpm	65	99.4
Encoder resolution	lines/rev	1,024	1,024
	counts/rev	4,096	4,096
Weight	lbs	10.1	13.2
	kg	4.6	6.0
Operating ambient temperature range		0-40°C	
Sealing		IP54	
Terminations		MS Connectors	

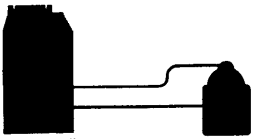
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**Motor Dimensions**

(—) denotes millimeters



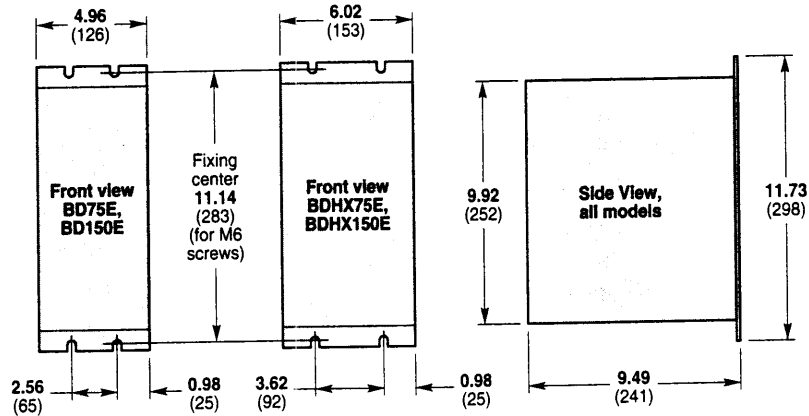
14 mm shaft is available for use with Parker actuators. Call factory for information.



Drive/Controller

**Motor Dimensions**

(—) denotes millimeters



**Ordering Information**

Model No. Description

**CE (EMC and LVD)**

**Drive:**

- BD75E/230V Analog input drive, 3A continuous, 6A peak
- BD150E/230V Analog input drive, 6A continuous, 12A peak
- BDS75E/230V Step and Direction Input Servo Drive, 3A continuous, 6A peak
- BDS150E/230V Step and Direction Input Servo Drive, 6A continuous, 12A peak
- BDHX75E/230V Servo Drive/Controller, 3A continuous/6A peak
- BDHX150E/230V Servo Drive/Controller, 6A continuous/12A peak

**Motors:**

- MD3450/230V 3450 motor with encoder (cables not included)
- MD3475/230V 3475 motor with encoder (cables not included)

**Cables:**

- BDC-10 10-foot cable set for MD motor
- BDC-25 25-foot cable set for MD motor
- BDC-50 50-foot cable set for MD motor
- BDC-100 100-foot cable set for MD motor