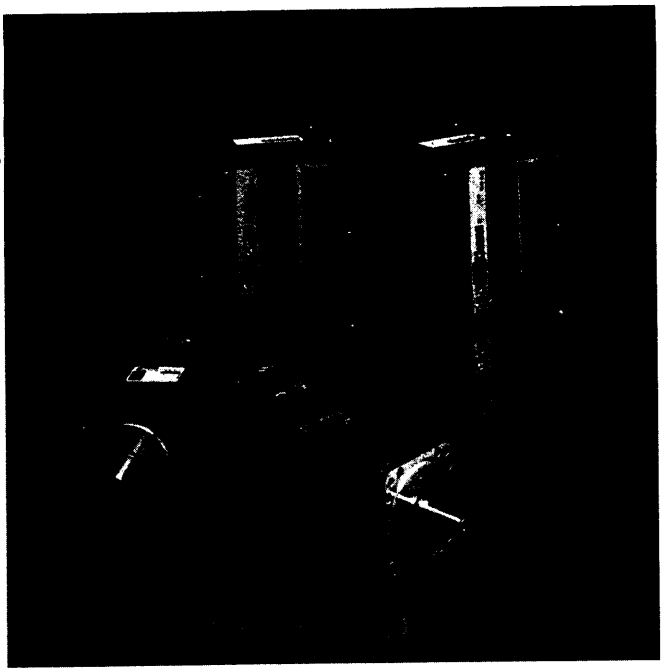

The BD-E Series

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 µS) registration input

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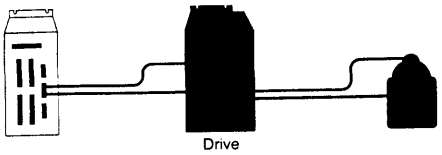
Drive

Specifications – BD-E and BDS-E Servos

Parameter	Value	
Performance	**BD75E**	**BD150E**
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	
AC Power Input		
Voltage	230VAC, single phase ±10%	
Frequency	50-60Hz	
Voltage Ranges		
Absolute Min	207VAC	
Absolute Max	264VAC	
Nominal	230VAC	
Inputs		
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 wideth = 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	
Outputs		
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	
Encoder Outputs		
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.	
Diagnostics		
LED	Over-temperature, drive fault and current limit	
Output	See drive fault specifications	
Environmental		
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)	

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Specifications – BDHX-E Positioning Servo

Parameter	Value	
Communications		
Type	RS232C serial link, 3-wire implementation (Tx, Rx, GND). Minimum voltage swing on Rx line is ±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	
Performance	**BDHX75E**	**BDHX150E**
Continuous current, A rms	3	6
Peak current, A rms	6	12
DC bus volage 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	±1 to ±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	
Servo Loop		
Tuning	Fully digital PIVF or PID options, configured through serial port	
Update time	500 microseconds	
Servo tuning	Values stored in battery backed RAM	
AC Power Input		
Voltage	230VAC, single phase ±10%	
Frequency	50-60Hz	
Voltage Ranges		
Absolute Min	207VAC	
Absolute Max	264VAC	
Nominal	230VAC	
Inputs		
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.	

Specifications – BDHX-E Positioning Servo

Parameter	Value
Outputs	
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]
Encoder Outputs	
Type	Buffered from motor encoder
Electrical	Quadrature A, B with Z channel. Differential TTL line driver. 100KHz maximum frequency.
Encoder Feedback Input	
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.
Diagnostics	
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
Motion Programs	
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
Environmental	
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
;	Comment
A	Acceleration Rate
B	Buffer Status Request
BS	Buffer Size Request
C	Continue
CAG	Configure Acceleration Gain
CCP	Configure Current Clamp
CCS	Configure Command Source
CDG	Configure Derivative Gain
CEW	Configure In-Position Window
CFG	Configure Feedforward Gain
CIG	Configure Integral Gain
CIT	Configure In-Position Time
CIW	Configure Integral Action Window
CIX	Configure Index Resolution
CJL	Enter Motor + Load Inertia
CMR	Configure Motor Resolution
COFF	Configure Amplifier Offset
CPE	Configure Position Error
CPG	Configure Proportional Gain
CTG	Configure Filter Time Constant
CTQ	Enter Motor Torque
CUR	Configure User Resolution
CVG	Configure Velocity Gain
CVT	Configure Velocity Trip
D	Distance
DCLR	Clear RP240 display
DCNT	Enable/Disable the RP240 Pause/ Continue keys
DFX	Display Flags Indexer
DIC	Display Indexer Counter
DLED	Turn RP240 LEDs on/off
DPA	Display Position Actual
DPC	Position cursor on RP240 display
DPE	Display Position Error
DPS	Display Position Setpoint
DR	Display Report
DRD	Read distance from parallel I/O
DS	Display Signal
DSTP	Enable/Disable the RP240 Stop key
DTA	Set Dither Amplitude
DTF	Set Dither Frequency
DTXT	Display text data on RP240 display
DVA	Display Velocity Actual
DVO	Display variable data on RP240 display
DVS	Display Velocity Setpoint
E	Enable Communications
ELSE	Else
EX	Set Communication Style
F	Disable Communications
FOL	Following Percent
FRD	Read following ratio from parallel I/O
G	Go
GA	Go Home Acceleration
GH	Go Home
GHF	Go Home Final
GOSUB	GOSUB sequence
GOTO	GOTO sequence
H	Change Direction
^H	Backspace
H+	Set Direction
H–	Set Direction
HALT	Halt
HELP	Produce Help Screens
ID	Immediate Distance
IF	If
IN	Define input functions
IO	Immediate Output
IS	Input Status
IV	Immediate Velocity
JA	Jog Acceleration
JV	Jog Velocity
K	Kill
KILL	Kill Motion
L	Loop
LA	Limit Deceleration
LD	Limit Disable
LS	Limit Switch Fast Stop
MC	Mode Continuous
MN	Mode Normal
MPA	Mode Position Absolute
MPI	Mode Position Incremental
MQ	Speed Change Mode
N	End Loop
NIF	End of IF
NWHILE	End of WHILE
O	Programmable Output
OFF	De-Energize Drive
ON	Energize Drive
OS	Other Switches
OSA	Home @ Index Pulse
OSB	Integral Action Selection
OSC	Monitor Command Reporting
OSE	Jog Enable
OSF	Initialization on Limit
OSJ	RAT 16/24 Bit select
OSK	Encoder Integrity Check
OSM	Integral Action Sensitivity
OSO	Suppress Units
OUT	Define output functions
P	Position
PIC	Picture
PR	Position Report
PS	Pause
PZ	Position Zero
QS	Transmit An Identifier
R	Report Control Module Status
RA	Report A – Limit Status Request
RAT	Set Rate Multiplier Value
RB	Report B – Miscellaneous Status Request
RE	Drive Status Request
REPEAT	Repeat
RFS	Return Servo to Factory Settings
RG	Report Go Home Status
RIFS	Return Indexer to Factory Settings
RPO	Report Power-On Time
RS	Report Sequence Status
RSE	Report Servo Errors
RST	Freeze Torque Demand
RV	Revision
S	Stop
SAVE	SAVE Parameters
SB	Stop Buffered
SIM	Set Indexer/ Following Mode
SKE	Skip On 'Equals'
SKN	Skip On 'Not Equal'
SP	Set current position to value
SS	Set Switches
SSA	RS232C Echo Control
SSD	Set Output 1 as Composite Fault Signal
SSG	Save Command Buffer On Limit
SSH	Save Command Buffer On Stop
SSI	Sequence Select Inputs
ST	Energize/De-Energize Drive
STOP	Stop Motion
SV	Save
T	Time Delay
TMRD	Read timer value from parallel I/O
TRD	Trigger On Input Distance
TRE	Trigger On Input Equal
TRIP	Trigger On In Poition
TRMN	Trigger on negative motor distance
TRMP	Trigger on positive motor distance
TRN	Trigger On Input Not Equal
TRR	Registration Mode
TUNE	Show Tuning Settings
TUNET	Self-Tune Servo (Torque Amplifier)
TUNEV	Self-Tune Servo (Velocity Amplifier)
U	Pause
UNTIL	Until
V	Velocity
VAR	Variables
VARD	Read variable from parallel I/O
VARn=FUN	Enable and read function keys (RP240)
VARn=NUM	Enable and read numeric keys (RP240)
VRD	Read velocity value from parallel I/O
WHEN	Set WHEN condition
WHILE	Set WHILE condition
XBS	Sequence memory available
XC	Checksum
XD	Sequence Download
XE	Sequence Delete
XG	GOTO sequence
XP	Power-On Sequence Number
XR	Run Sequence
XRD	read sequence from parallel I/O
XRP	Run/Pause Sequence
XRT	Return From Sequence
XSD	Sequence Download Status Report
XSR	Sequence Run Status Report
XSS	X Sequence Status
XT	Sequence Terminator
XTR	Set trace mode
XU	Sequence Upload
XWHEN	Set WHEN sequence
XZ	Reset Power-Up Sequence Mode
Y	Terminate Loop
Z	Reset

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.

B Servo Systems

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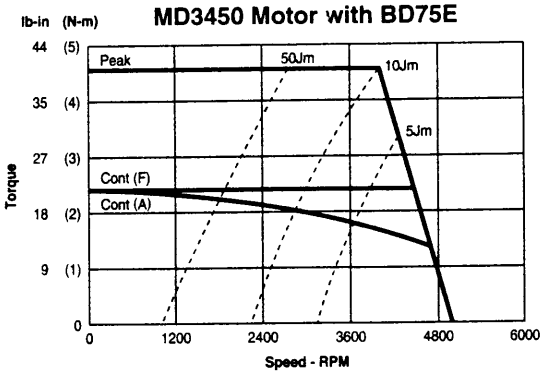
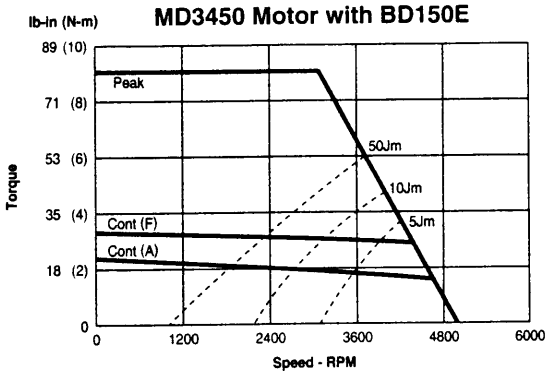
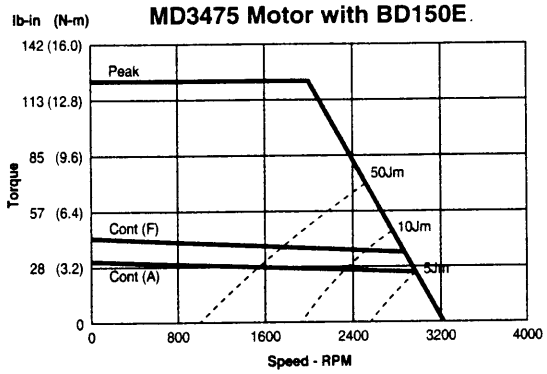
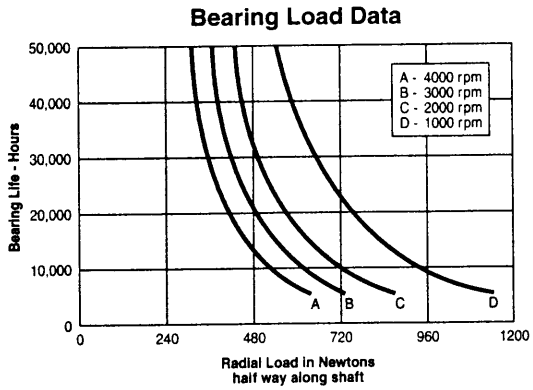
Speed/Torque Curves









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.

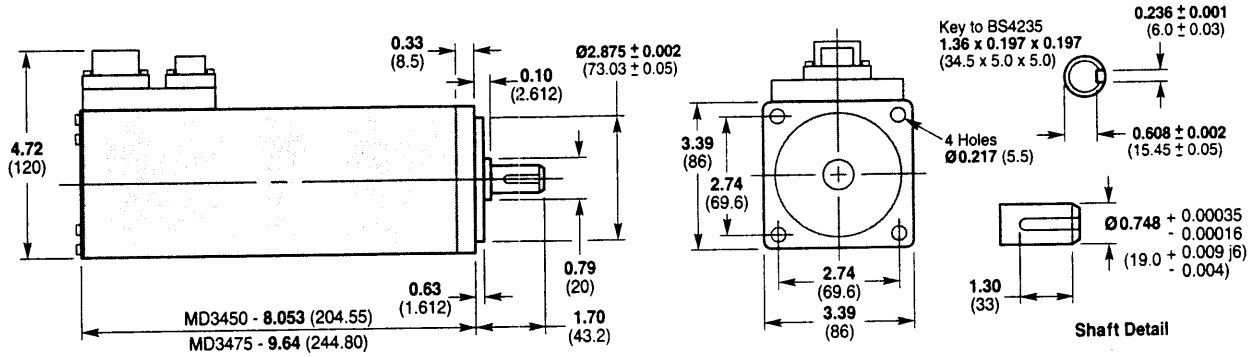
Note that this information is for general guidance purposes only and will not apply to light-duty cycles.

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^2 kg-cm^2	8.75 1.6	13.1 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 counts/rev	1,024 4,096	1,024 4,096
Weight	lbs kg	10.1 4.6	13.2 6.0
Operating ambient temperature range		0–40°C	
Sealing		IP54	
Terminations		MS Connectors	

Motor Dimensions

(—) denotes millimeters



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

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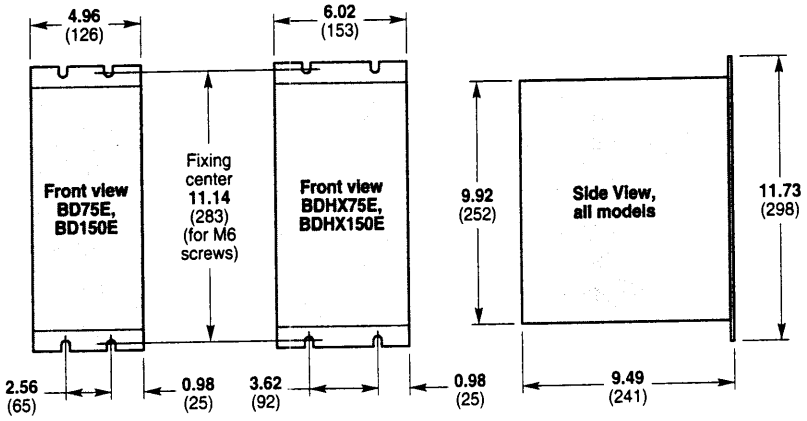
Motor Dimensions

(—) denotes millimeters



Ordering Information

CE (EMC and LVD)

Model No.	Description
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