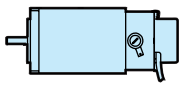
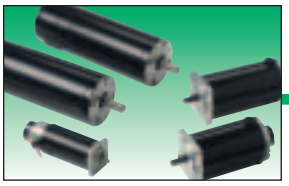
Products discontinued August 01, 2006:
SSC Multi-Axis Controller,
Stepper Motors & Control Products,
Brushed DC Motors & Control Products
Contact Tol-O-Matic for repair parts

- *MRB BRUSHED SERVO MOTORS*
- *AXIOM® DB BRUSHED SERVO DRIVE*
- *MSC CONTROLLER*
- *SSC CONTROLLER*
- *PIT PANEL MOUNT INTERFACE*
- *JS JOYSTICK INTERFACE*
- *SIT HAND-HELD INTERFACE*



BRUSHED DC



Axidyne® Brushed dc Sy

OVERVIEW

APPLICATION BENEFITS

- Low to medium cost
- Smooth and quiet operation
- Good for speeds generally less than 2500 rpm
- Good for torques up to 32 in-lbs. (3.62 N-m) continuous, 48 in-lbs. (5.42 N-m) peak
- Good for resolutions of 1,000 counts per revolution

MOTOR

MRB – Brushed DC Motors

- 1,000 line optical encoder available for servo operation
- NEMA 17, 23 and 34 mounting

DRIVE

AXIOM® DB – Brushed DC Servo Drive

- Peak current ratings of 20A
- Simple Windows®-based software
- Excellent performance and accuracy at high speeds
- Optically isolated inputs: dedicated CW/CCW travel limit; drive enable, step/direction and step CW/step CCW
- Optically isolated outputs

CONTROLLER

MSC Controller:

- Software icons for intuitive setup & programming
- Built-in power supplies: 24 Vdc, 100mA is provided for the user for sensors and I/O circuits.
- Optically isolated inputs: 4 dedicated, CW and CCW jog, 2 limits; 4 general purpose
- Optically isolated outputs: drive fault output; 3 general purpose; differential step and direction outputs
- Programmable resolution to match encoder

CONTROLLER

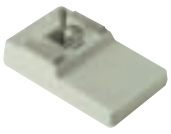
SSC Controller:

- Performs any motion task including jogging, point-to-point positioning, linear and circular interpolation, electronic gearing, camming and contouring
- Multitasking feature permits simultaneous execution of four independent applications programs
- Tol-O-Motion SSC Motion Control Software allows setup & programming with easy-to-use Windows® interface
- Up to 4 axes per unit - up to 4 units can be daisy-chained
- 4M non-volatile EEPROM memory for executing custom application programs - permits stand-alone operation
- Relative and absolute positioning with more than ± 2,000,000,000 counts per move
- Inputs: opto-isolated dedicated for home, abort, forward and reverse limits, 8 uncommitted; 7 analog inputs
- Outputs: 8 programmable

INTERFACES

PIT – Panel mount interface

- Keypad, LCD display for use with MSC Controller



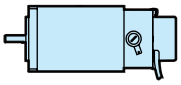
JS – Joystick

- Use with SSC joystick teach mode

SIT – Hand-held interface

- 45 key - keypad, LCD display
- for use with SSC

Host compatible PC



BRUSHED DC

Overview

Axidyne® MRB Brushed dc Motors

FEATURES & PERFORMANCE

MRB Brushed DC Motors

For cost sensitive applications requiring smooth and quiet operation, Tol-O-Matic provides the MRB series brushed DC motors. Available with a wide range of torque/speed characteristics, the MRB motors are ideal for operation in a servo system (AXIOM™ DB).

MRB FEATURES

- Rugged industrial enclosures
- 1000 line encoder for servo operation
- Ideal for operation with AXIOM™ DB brushed servo drives

CABLES

All MRB series motors include a 24-inch flying lead motor power cable.

Encoder cables are 18 inch flying leads.

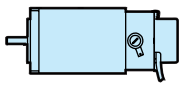
WIRE COLORS

1	2	3	4	5	6	7	8	
+VCC	GND	A+	A-	B+	B-	I+	I-	Shield
Red	Black	White	Yellow	Green	Blue	Orange	Brown	Drain

MRB MOTOR SPECIFICATIONS

	KE (1)	KT (2)		RESISTANCE (3)	ROTOR INERTIA		THERMAL RESISTANCE	CONT. STALL TORQUE		PEAK STALL TORQUE		MAXIMUM SPEED	INDUCTANCE (4)	WEIGHT	
	Volts/1000RPM	oz-in/Amp	N-m/Amp	Ohms	oz-in^2	gr-cm^2	°C/W	oz-in	N-m	oz-in	N-m	RPM	mH	lbs	kgs
MRB21	12.7	17.2	0.121	2.20	2.89	529	4	57	0.402	400	2.82	4000	6.40	3.5	1.6
MRB31	8.6	11.6	0.082	0.60	6.55	1200	2.7	100	0.706	480	3.39	4000	0.42	5.11	2.3
MRB32	13.4	18.1	0.128	0.46	13.1	2400	1.9	210	1.48	960	6.78	4000	0.64	8.6	3.9
MRB41	20	27.2	0.192	0.6	101	18500	1.09	376	2.65	2496	17.6	4000	2.2	17	7.7
MRB42	38	51.4	0.363	8.6	122	23000	0.90	496	3.50	3296	23.3	3500	4.4	20.0	9.1

(1) ±10 (2) ±10% (3) ±10% at 25° (4) ±15%



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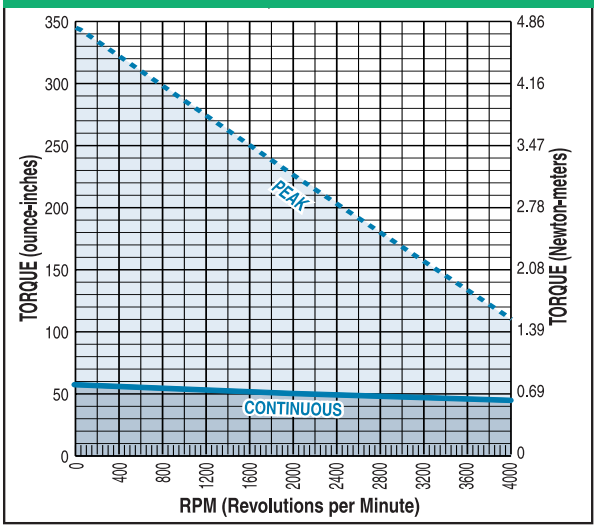
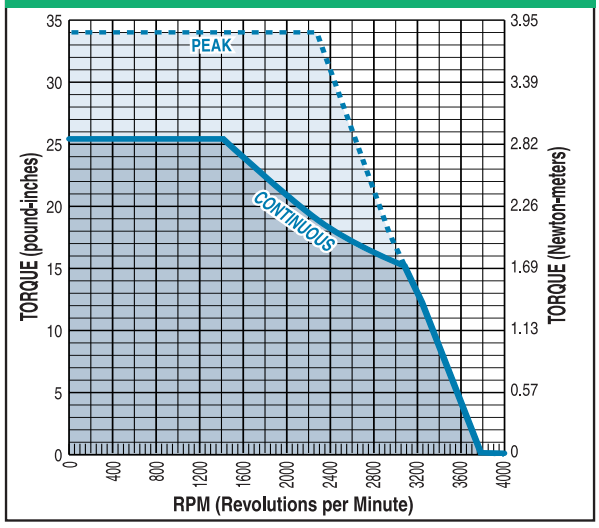
Axidyne® MRB Brushed dc Motors

PERFORMANCE DATA WITH AXIOM® DB DRIVES

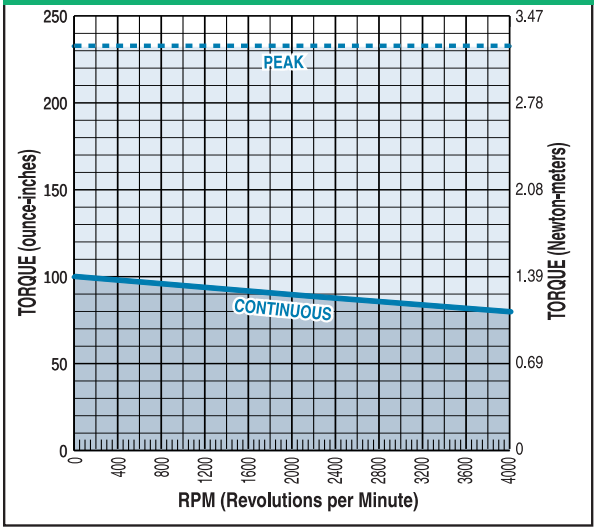
MRB21Y • DB20 DRIVE



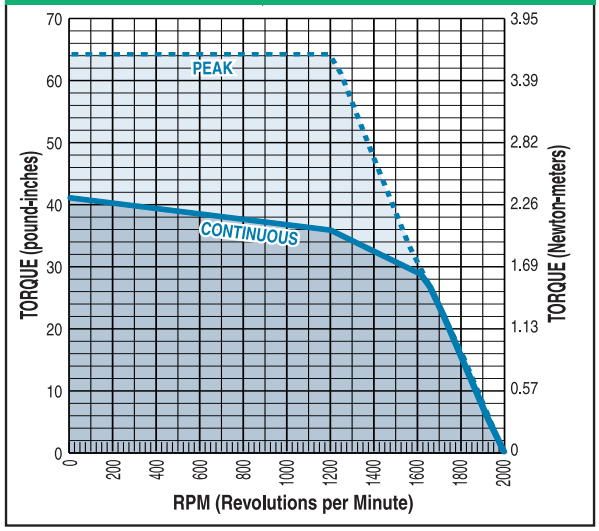
MRB41Y • DB20 DRIVE



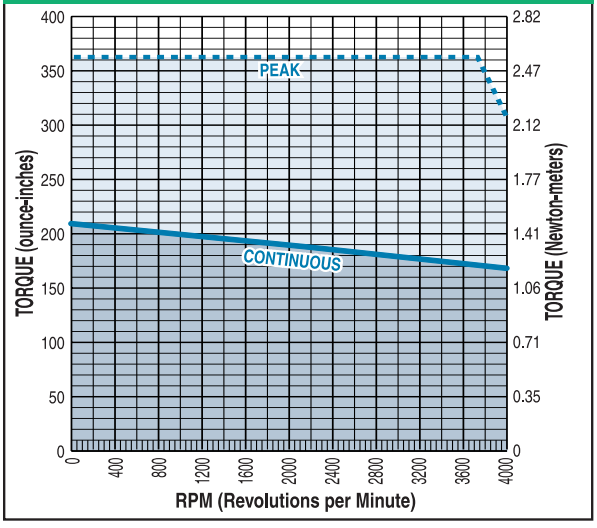
MRB31Y • DB20 DRIVE

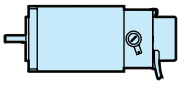


MRB42Y • DB20 DRIVE



MRB32Y • DB20 DRIVE





BRUSHED DC

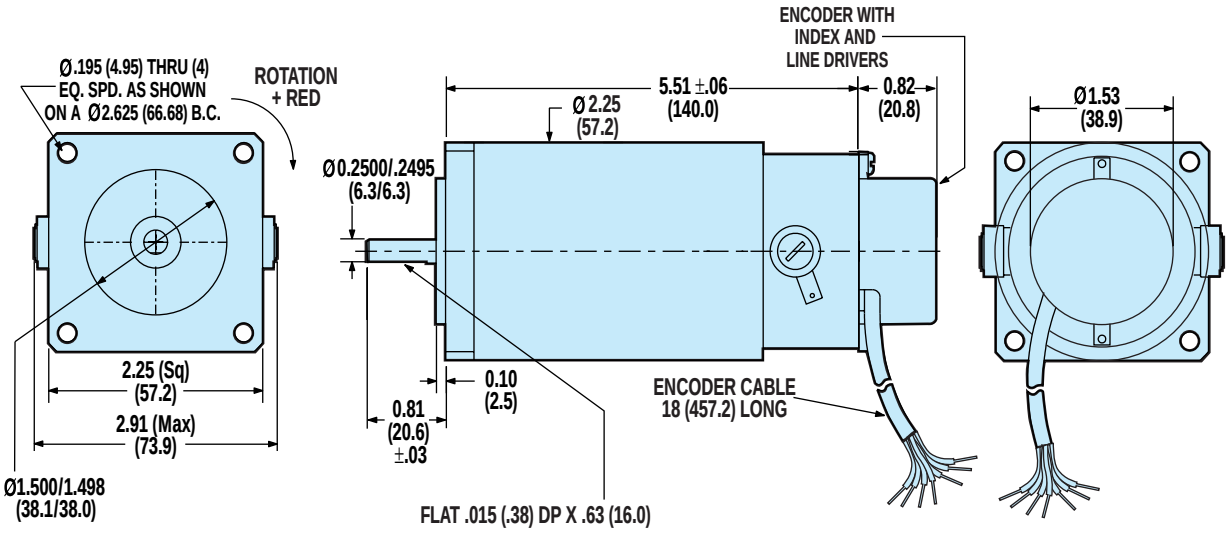
MRB Motors

- Performance with Axiom DB drives

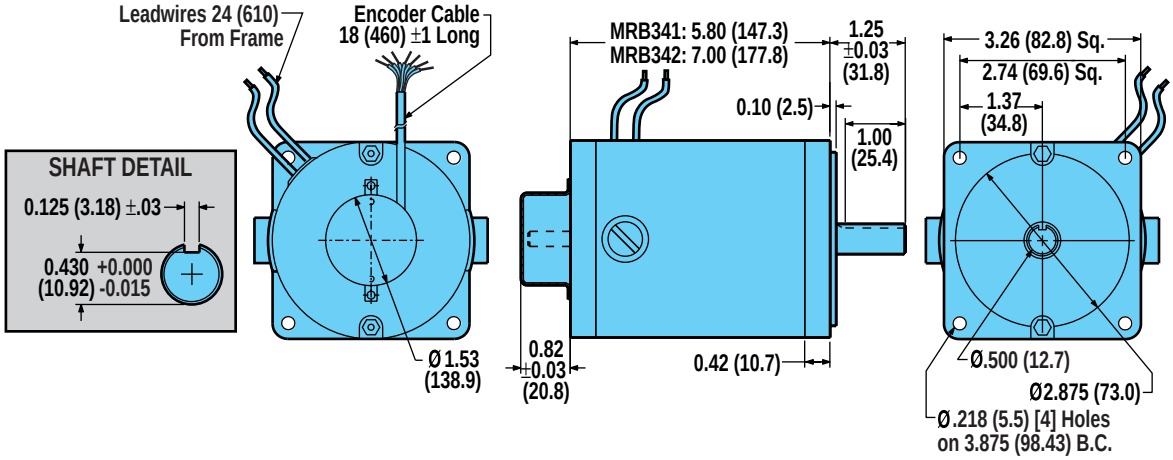
Axidyne® MRB Brushed dc MOTORS

DIMENSIONS

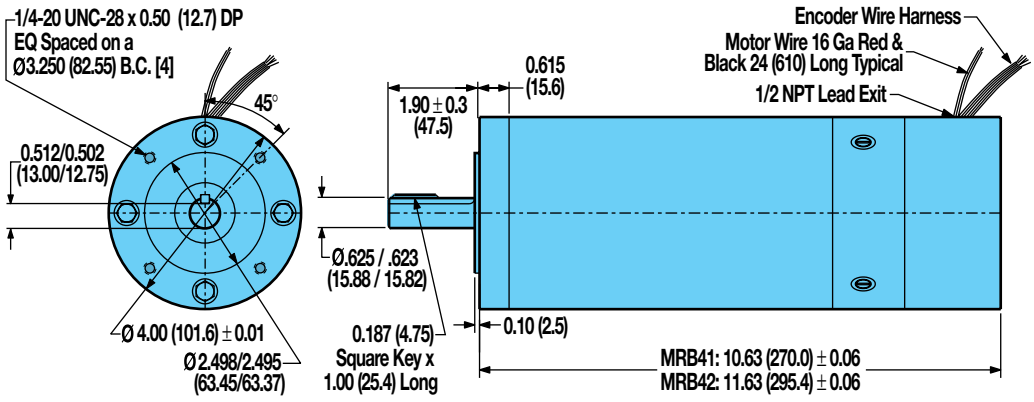
MRB21



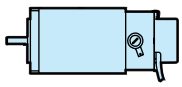
MRB31 / MRB32



MRB41 / MRB42



Unless otherwise noted, all dimensions shown are in inches (Dimensions in parenthesis are in millimeters)



Axidyne® Gearhead Reduction

SPECIFICATIONS AND DIMENSIONS

COMPATIBILITY:
SYSTEM: BRUSHLESS
MOTORS: MRV
ACTUATORS: ALL TOL-O-MATIC SCREW DRIVES

COMPATIBILITY:
SYSTEM: STEPPER
MOTORS: MRS
ACTUATORS: ALL TOL-O-MATIC SCREW DRIVES

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
ACTUATORS: ALL TOL-O-MATIC SCREW DRIVES

For a complete part listing of screw-drive motor and gearhead mounting kits referencing actuator/motor/coupler compatibilities, refer to document 3600-4631 available on the Literature/Axidyne/Part Sheet section of our web site at: www.tolomatic.com.

For those applications requiring reduction for inertia matching or higher torque at lower speeds, Tol-O-Matic offers high efficiency, single stage, true planetary gearheads. Gear ratios of 5.5:1 and 10:1 are available and are compatible with 23- and 34-frame MRV Brushless Servo, MRS Microstepping and Brushed DC motors.

SPECIFICATIONS

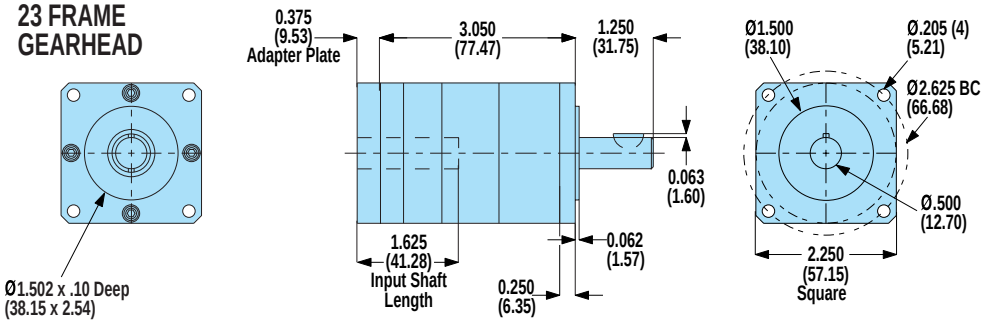
Efficiency:	85%
Backlash:	less than 10 arc minutes
Max. Input Speed:	5000 RPM

CONFIG NO.	PART NO.	FRAME SIZE	GEAR RATIO	REFLECTED INERTIA*		INPUT SHAFT DIA. (in)	WEIGHT	
				lb-in²	kg-m²		lbs	kgs
GHK20	3600-6150	23	5.5 : 1	0.0213	6.22	0.250	1.78	0.81
GHJ20	3600-6151	23	5.5 : 1	0.0213	6.22	0.500	2.00	0.91
GHJ21	3600-6152	23	10 : 1	0.0181	5.30	0.500	1.98	0.90
GHK30	3600-6153	34	5.5 : 1	0.1131	33.09	0.375	4.68	2.12
GHJ30	3600-6154	34	5.5 : 1	0.1131	33.09	0.500	4.60	2.09
GHJ31	3600-6155	34	10 : 1	0.0888	25.96	0.500	4.78	2.17
GHJ32§	3600-6156	34	10 : 1	0.0888	25.96	0.500	4.81	2.18

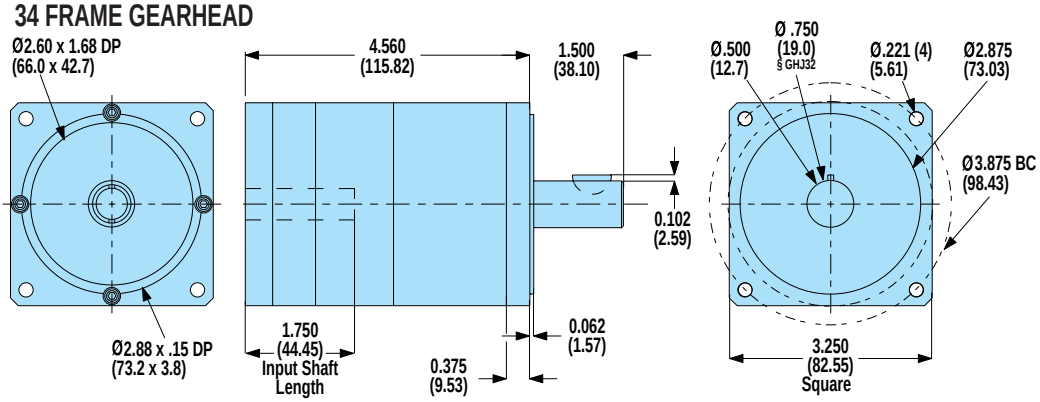
**** Reflected inertia is inertia at motor side of gearhead.***
§ Only available on RSA64 LMI

23- AND 34-FRAME GEARHEADS

23 FRAME GEARHEAD



34 FRAME GEARHEAD



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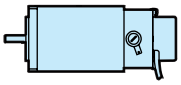


BRUSHED DC

Gearhead Reduction

- Specifications
- Dimensions

Axiom® DB Brushed dc Drive

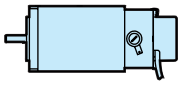
FEATURES

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: IS
SIT

The Axiom® series brushed servo drive combines high-speed accuracy with user friendly set-up and diagnostics. The Axiom® DB series is a state-of-the-art DSP controlled digital drive capable of driving a full range of brushed servo motors. Available in a 20 Amp peak rating (3 sec) and equipped with convenient pluggable screw terminal connectors, the Axiom DB series offers fast, easy set-up and installation for use in a wide variety of applications.

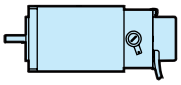
AXIOM DB DRIVE FEATURES

- Space vector commutation provides better bus voltage utilization than traditional sine drives for improved speed/torque curves
- Digital current control provides more accurate high bandwidth control of torque producing current
- Drives MRB series brushed dc motors
- Pluggable screw terminal connectors eliminate the need for special connectors and secondary breakout terminal strips
- 115Vac input, single phase
- Short circuit, over current and over voltage protection prevents drive damage
- 50W internal regeneration
- External regeneration connections
- Analog torque and velocity command (±) 10V
- Feedback from differential A+B and index channel optical encoder (5V)
- Maximum line count of 500,000/motor commutation cycle
- CW/CCW travel limit inputs
- Drive enable input
- Fault, enabled, and in-position outputs
- 3A brake relay
- 3 second peak ratings



AXIOM DB DRIVE SPECIFICATIONS

Power	
Continuous Current Rating:	15 Amps
Peak Current Rating (3 sec):	20 Amps
Max Input Current (single phase):	10 Amps (rms)
Input Voltage (single/3-phase):	95Vac -130Vac Single Phase
Input Frequency:	47Hz - 63Hz
Command Sources	
Analog Torque/Velocity Input:	± 10V, 16.4K ohm impedance
Step and Direction or	1 MHz maximum, 5V differential or single ended drivers Step CW/Step CCW
Serial Communication Port	
Type:	RS232
Baud Rate:	19,200 baud
Control Loops	
Type:	All digital
Loop Modes:	Torque, Velocity and Position Control
Torque Update Rate:	10KHz
Velocity Update Rate:	5Khz
Position Update Rate:	2.5Khz
Inputs and Outputs	
Dedicated Optically Isolated Inputs:	5Vdc - 25Vdc, 2.7ma - 15ma ENABLE, CW LIMIT and CCW LIMIT. Can be configured to source or sink current.
Dedicated Optically Isolated Outputs:	3 optically isolated, 25Vdc max., 50ma max. IN POSITION, ENABLED and FAULT. Can be configured to source or sink current.
1 Dedicated Brake Relay Output:	N.O. contact, 24Vdc, 115/230Vac, 3A max.
Motor Feedback:	Incremental encoder, 5Vdc, differential 4Mhz max., A/B/I channels 250 line min. with a 4 pole motor 125 line min. with a 2 pole motor
Encoder Output:	Differential, 5Vdc, A/B/I channels
Connectors	
Serial:	9 pin D-Sub.
Control and Feedback:	15 pin D-Sub.
Power, Motor, Brake Relay, Regen:	Screw terminal block
All Others:	Pluggable screw terminal blocks
Approvals:	UL, CUL, CE
Environmental	
Storage Temperature:	-40°C to 70°C
Operating Temperature:	0°C to 50°C
Humidity:	5% to 95%, non-condensing
Weight:	26 lbs. (12 kgs.)



AXIOM DB DRIVE CONNECTORS

TB1 - BRAKE

1 - Brake	
2 - Brake	

TB2 - MOTOR

1 - Motor +	
2 - Motor -	
3 - Motor Ground	

TB3 - AC POWER

1 - 120Vac	
2 - Neutral	
3 - Ground	

J3 - OUTPUTS

1 - In Position +	4 - Enabled Out -
2 - In Position -	5 - Fault Out +
3 - Enabled Out +	6 - Fault Out -

J4 - INPUTS

1 - CW Limit	6 - Step/Step CW +
2 - CCW Limit	7 - Step/Step CW -
3 - Limit Common	8 - Direction/Step CCW +
4 - Enable +	9 - Direction/Step CCW -
5 - Enable -	

ANALOG INPUT COMMAND

1 - Analog Common	3 - Analog -
2 - Analog +	4 - Shield

J7 - MOTOR ENCODER

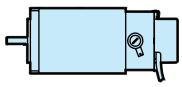
1 - Encoder +5V	6 - I+
2 - A+	7 - I-
3 - A-	8 - Common/Shield
4 - B+	9 - Motor Temp
5 - B-	

P1 - BUFFERED ENCODER OUTPUT

1 - Reserved	8 - Common
2 - Reserved	9 - Encoder Out A+
3 - Reserved	10 - Encoder Out A-
4 - Reserved	11 - Encoder Out B+
5 - Reserved	12 - Encoder Out B-
6 - Reserved	13 - Encoder Out I+
7 - Reserved	14 - Encoder Out I-

P2 - COMMUNICATIONS

1 - Reserved	6 - Reserved
2 - RS-232 TX	7 - Reserved
3 - RS-232 RX	8 - Reserved
4 - Reserved	9 - +5Vdc (30ma MAX.)
5 - Common	



Axiom® DB Brushed dc Dr

SET-UP / CONFIGURATION

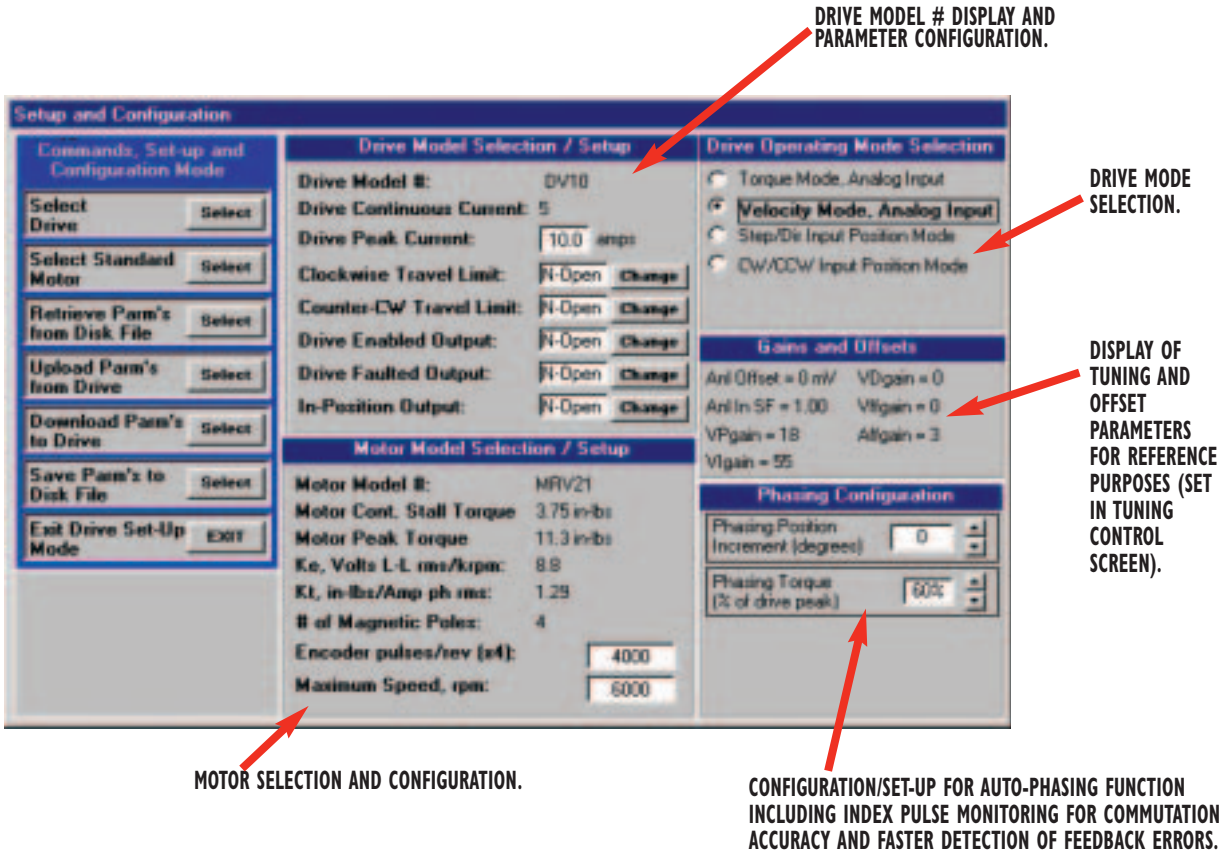
Axiom® Windows®-based PC setup software with a "control-panel" approach, makes it easy to get up and running fast. All set-up and configuration functions are performed using two main control-panel screens. Simple mouse-click commands automatically configure the control functions, eliminating layers of screens and menus. This approach also allows more relevant diagnostic information to be displayed simultaneously. All control screens include a command menu at the upper left to permit convenient selection of high-level functions and options.

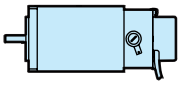
A main menu is provided which allows selection of the main control panel functions, active comm port, etc. Tutorial selections are provided which emulate the main control-panel functions in an off-line manner and provide "help" text and function definitions/ descriptions so that users can actively familiarize themselves with the software without actually connecting a drive.

The software communicates with the drive using a standard RS-232 connection operating at 19,200 baud, using either comm port 1 or 2 of the PC. It can be installed and executed from any PC running Windows 95, 98, NT, 2000 or XT.

SET-UP CONFIGURATION

Drive operating mode and other options can all be selected/enabled from this screen. All set-up parameters can be uploaded and downloaded with a single click of the mouse. The parameter set can be saved to or retrieved from a disk file. Once downloaded to the drive, all parameters are stored in non-volatile EEPROM memory.





BRUSHED DC

Axiom DB Drive

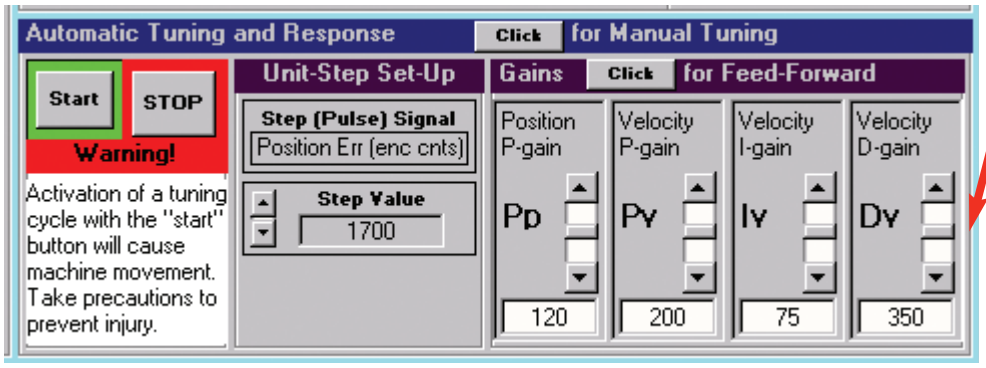
- Setup and configuration

TUNING AND DIAGNOSTICS

Use the 4-channel oscilloscope display for analysis of motion response when tuning and diagnosing. Scaling and format of the displayed traces can be easily modified. Values can be read directly off the traces at any point. Continuously updated bar graph displays allow important data to be viewed while motion is occurring. These displays are configured automatically based on drive operating mode they include peak detection functions and numeric displays. A status section of this control screen displays the current state of I/O and fault information.

Selecting "Drive-Tuning" from the command menu activates and displays the control functions for manual and automatic drive tuning. Use these controls to set-up and start actuation of an appropriate unit-step motion command and then enable automatic tuning parameter adjustment. Manual adjustments to tuning parameters can be easily accomplished.

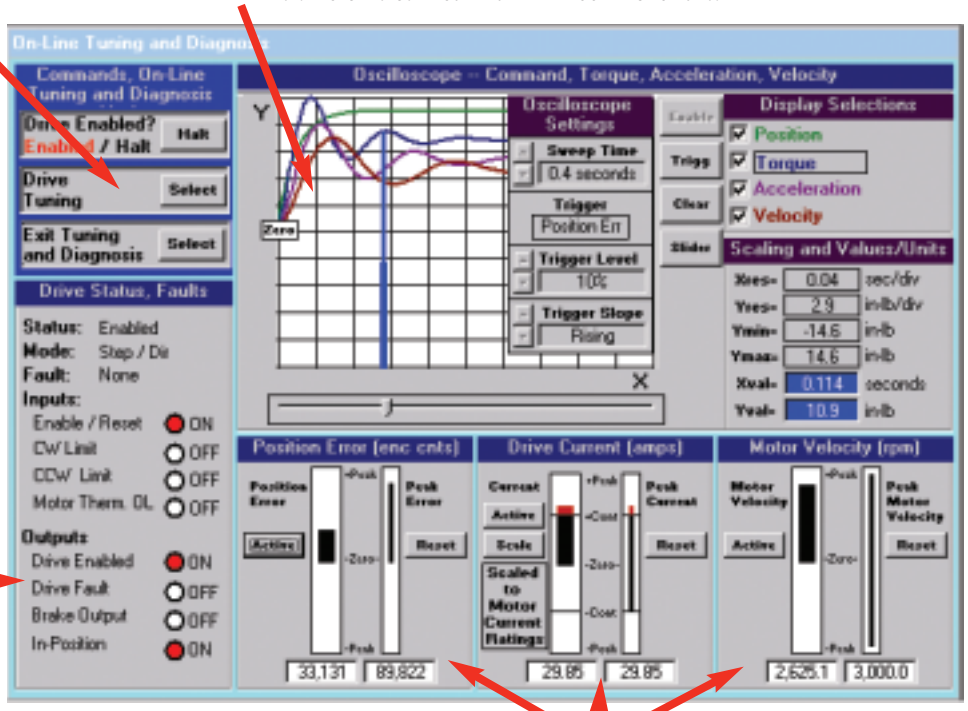
The oscilloscope functions are used in conjunction with tuning, ensuring desired response goals are achieved. All tuning parameters are updated and activated immediately in the drive when modified (and also stored in EEPROM memory).



TUNING CONTROLS ALLOW USER CONFIGURABLE UNIT-STEP ACTUATION. AUTOMATIC AND MANUAL TUNING FUNCTIONS ARE PROVIDED. OPTIONAL VALUES FOR FEED FORWARD GAINS AND ANALOG OFFSETS CAN ALSO BE ENTERED.

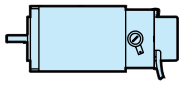
4-CHANNEL OSCILLOSCOPE DISPLAY FOR SET-UP/TUNING AND SUBSEQUENT DIAGNOSIS. FLEXIBLE DISPLAY CONFIGURATION AND SLIDING VALUE INDICATOR, MAKE ANALYSIS QUICK AND EASY. INCLUDES USER CONTROLLED TRIGGER FUNCTIONS.

ALL SOFTWARE SCREENS INCLUDE SEPARATE MENUS OF HIGH-LEVEL FUNCTIONS IN THE UPPER LEFT CORNER TO FACILITATE QUICK TRANSITIONS BETWEEN SCREENS AND FUNCTIONS.



CONTINUOUS DISPLAY OF CRITICAL DRIVE STATUS INFORMATION AS WELL AS PHYSICAL STATE OF I/O.

DIAGNOSTIC BAR GRAPH DISPLAYS OF CRITICAL SYSTEM VALUES, UPDATED CONTINUOUSLY. INCLUDES PEAK DETECTION AND NUMERIC DISPLAY.

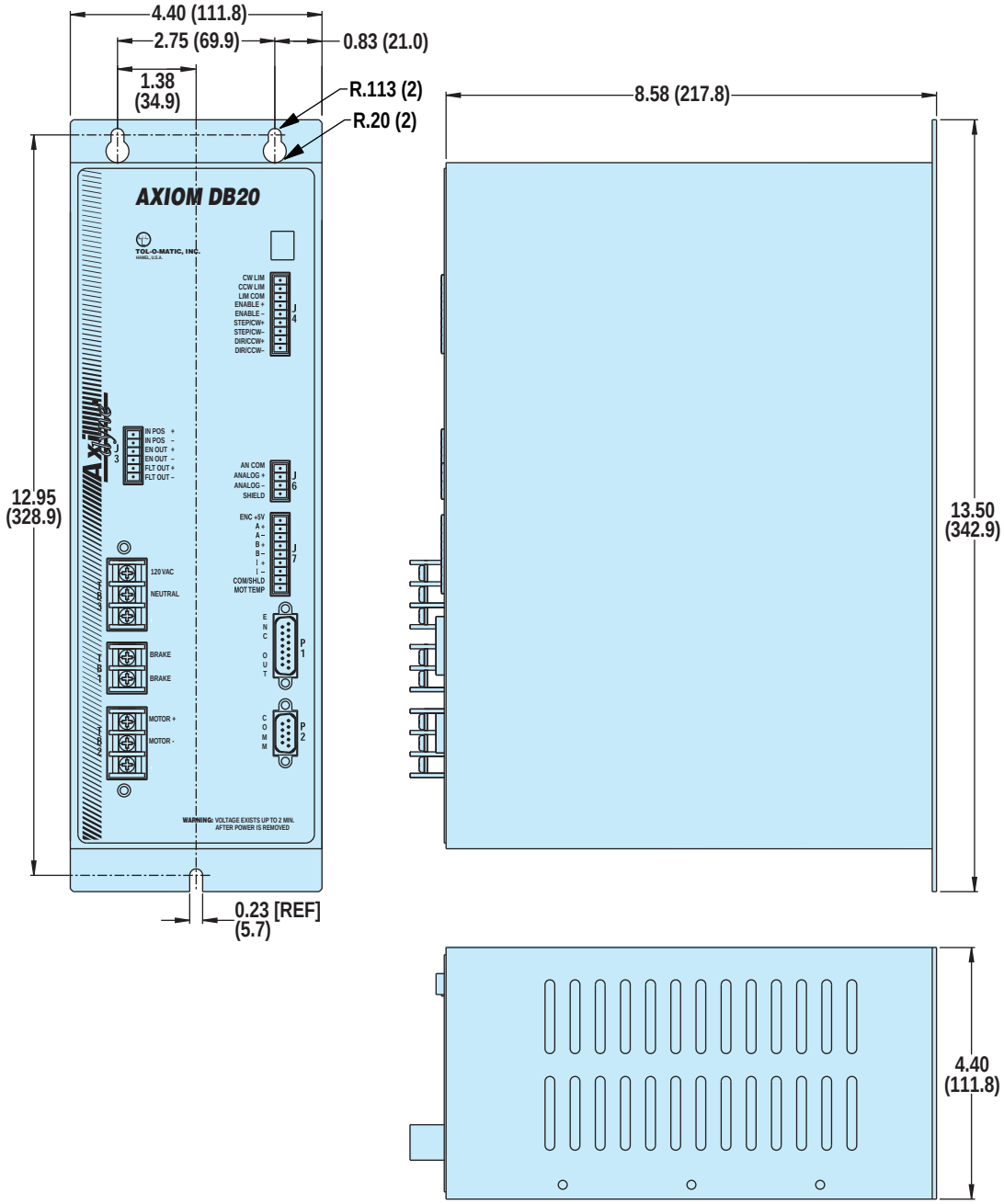


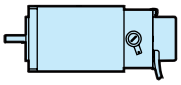
BRUSHED DC

Axiom DB
- Set-up / configuration

DIMENSIONS

AXIOM DB20 DRIVE





BRUSHED DC

Axiom DB Drive
- Dimensions

Unless otherwise noted, all dimensions shown are in inches (Dimensions in parenthesis are in millimeters)

Axidyne® MSC Controller

FEATURES AND SPECIFICATIONS

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: MSC
INTERFACE: PIT

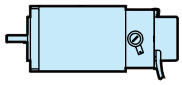
The MSC Microstepping Controller provides the simplest, quickest way to get up and running in a single-axis application. The Tol-O-Motion MS software allows sophisticated programming to be achieved by even the most novice user, through icons arranged in a simple, easy to follow format. Once programmed over the RS232 the PC may be removed and program interaction achieved through I/O, or by using the PIT panel mount interface. The MSC Microstepping controller comes as a stand-alone controller making it ideal for operation with the AXIOM™ DB brushed dc motor driver, or integral to the MSD microstepping drive.

MSC FEATURES

- Built-in power supplies: 24 Vdc, 100mA is provided for sensors and I/O circuits.
- Accepts 115 or 230 volt AC power
- 4 dedicated, optically isolated inputs: CW and CCW jog, 2 limits
- 4 general purpose, optically isolated inputs
- Drive fault output
- 3 general purpose, optically isolated outputs
- Pluggable screw terminal connectors for I/O, motor, AC power (all mating connectors included)
- Selectable linear scale simplifies linear motion programming
- Absolute positioning
- Single step program execution

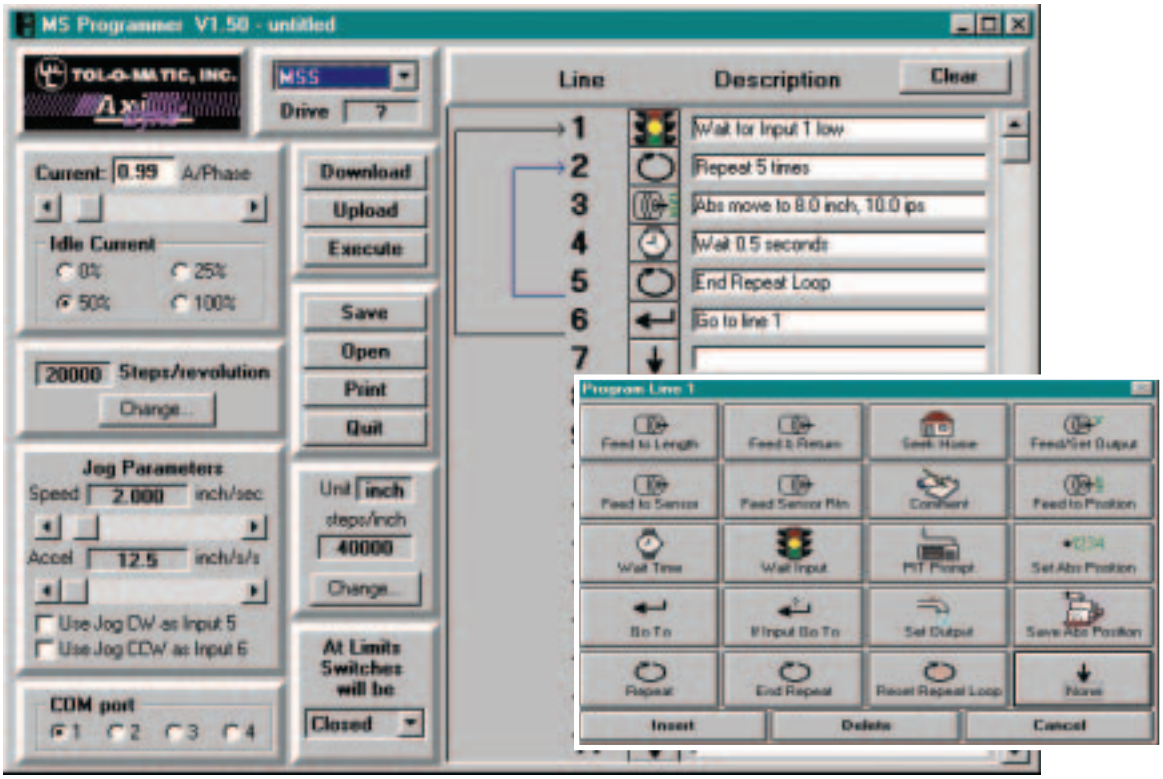
MSC SPECIFICATIONS

Power	
Input Voltages (AC line):	115 or 230 Vac, 50-60Hz (switch selected)
Input Current (AC line):	0.2A max. at 110 Vac
Input Fuses (AC line, L1 & L2/N):	0.25A fast acting TR5 style
Parameter Ranges	
Distance:	1 to 16,000,000 steps
Speed:	.025 to 100 revolutions per second (up to 25,400 steps/rev.)
Acceleration:	1 to 3000 rev/sec/sec (limited by accel torque)
Deceleration:	1 to 3000 rev/sec/sec (set independently from acceleration)
Time Delays:	0.1 to 25.5 seconds
Output Pulse Widths:	2 to 500 milliseconds
Iterations per loop:	1 to 255
Microstep Resolution:	200-50800 steps/rev
Outputs	
5V:	50 mA used by PIT (if connected) ±5%, 100 mA max, self resetting fuse,Not isolated from internal circuitry
24V:	±5%, 100 mA max, self resetting fuse, Not isolated from internal circuitry
STEP & Dir (logic high):	2.5V min, 3.4V typ, with 20mA load
STEP & Dir (logic low):	0.5V max, 0.3V typ, with 20mA load
STEP output frequency:	50 Hz to 2.54 MHz
STEP output duty cycle:	50%
I/O	
Inputs:	bidirectional, optically isolated, 5-24 Vdc
Input impedance - IN 1-4, CW Jog, CCW Jog, limits:	2200 Ohms
Outputs:	optically isolated, sourcing or sinking
output current (Out 1-3):	100mA max
output voltage (Out 1-3):	24Vdc max
Environment	
Ambient Temp. Range:	32° to 122° F (0 to 50° C)



Axidyne® MSC Controller
PROGRAMMING

MSC PROGRAMMING SOFTWARE



Main Programming Screen

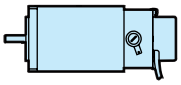
Programmable by RS232 connection to a PC running Windows 95, 98, NT, 2000 or XP. Programming software and cable included. Programming is very easy to learn and requires no previous programming experience.

Programs can be up to 100 lines long. Instructions are powerful, so 100 lines can provide the user with a sophisticated program. For example, in one program line the motor can be moved until a sensor changes state, then fed a precise distance to stop, delayed and returned to the starting point. Distances, delays, feed and return speeds, acceleration and deceleration parameters are all included in the single program instruction. The same move can take 10 program lines or more on other indexers. There are a total of 16 different instructions, including input/output, branches, loops and motion commands. These instructions can be combined to make a nearly infinite variety of programs, meeting the demands of a wide range of applications.

The main programming screen is shown above. On the right of the screen are the 100 program lines. In the center are command buttons and on the left are global parameters such as microstep resolution and jog. Clicking on a program step icon brings up a sequence of dialog boxes, making program selection and parameter setting easy.

Once programmed, the cable can be removed and the indexer-drive will run stand alone. Programs and parameters are stored internally in non-volatile memory. Upon power up, the drive automatically senses the connection to the Windows programming software. If no connection is detected, the program is automatically executed starting on line 1.

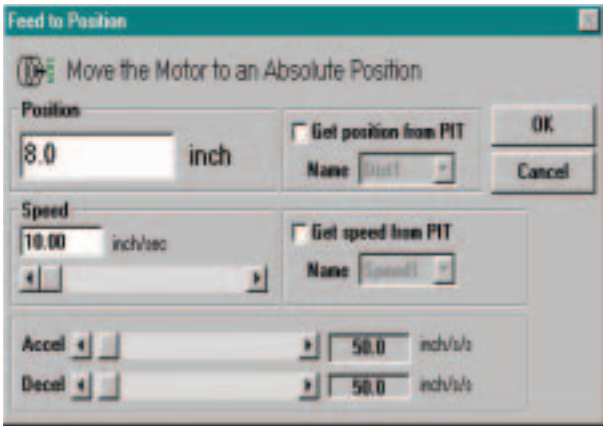
The MSS also allows program interaction to take place using the PIT user interface.



BRUSHED DC

MSC Controller

- Programming

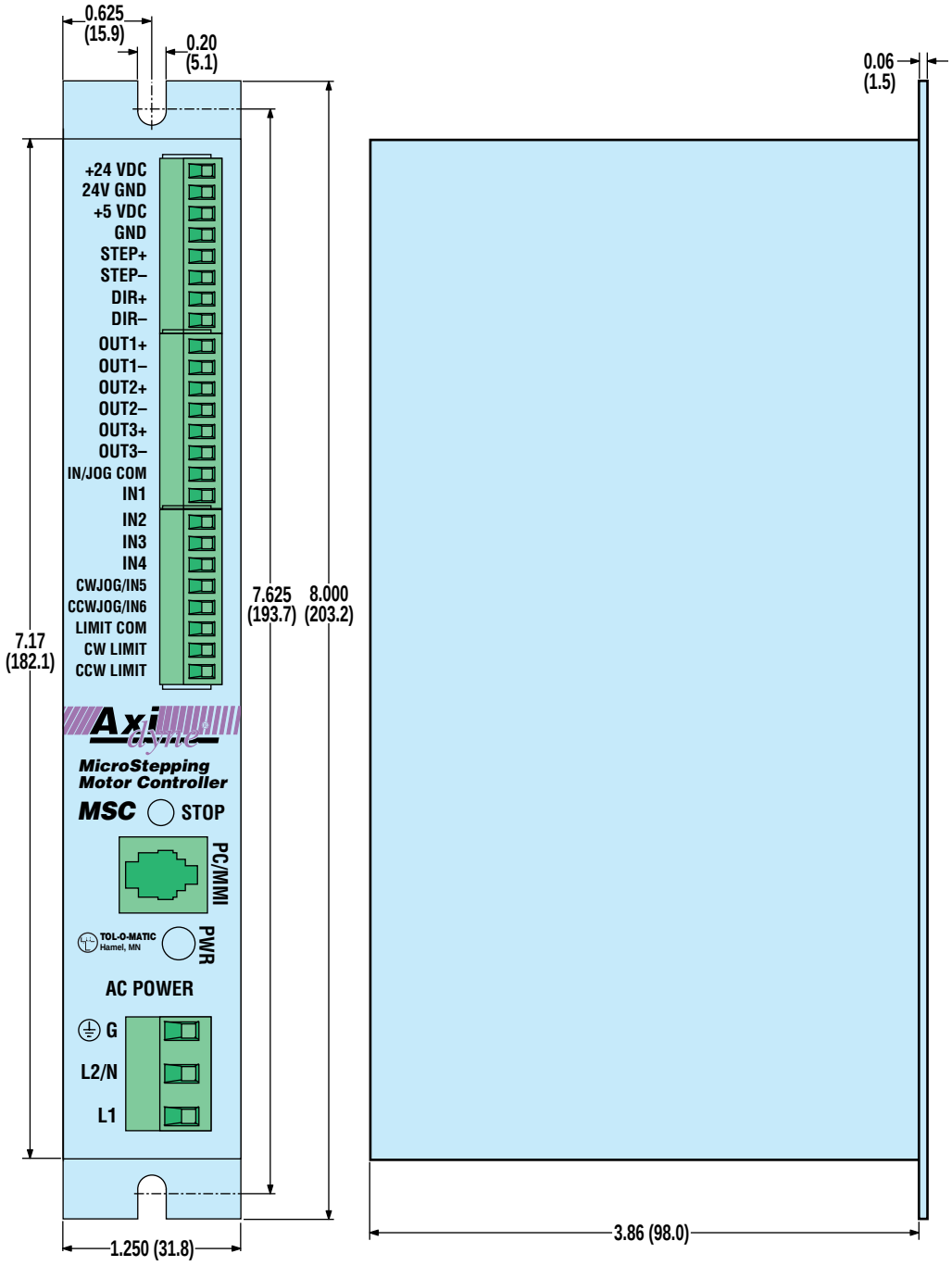


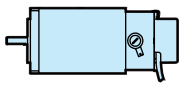
Dialog box for setting Feed to position

Axidyne® MSC Controller

DIMENSIONS

MSC CONTROLLER





BRUSHED DC

MSC Controller

- Dimensions

Unless otherwise noted, all dimensions shown are in inches (Dimensions in parenthesis are in millimeters)

Axidyne® SSC Multi-axis Servo/Stepper

FEATURES

COMPATIBILITY:
SYSTEM: BRUSHLESS
MOTORS: MRV
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS
SIT

COMPATIBILITY:
SYSTEM: STEPPER
MOTORS: MRS
DRIVE: MSD
CONTROLLER: SSC
INTERFACE: JS
SIT

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS
SIT

The SSC is a high-performance, state-of-the-art motion controller designed for stand-alone operation. This cost effective controller uses a 32-bit microprocessor, a sub-micron gate array, and Tol-O-Motion SSC software, to provide DSP performance without sacrificing ease of use.

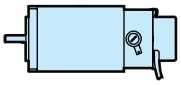
Available with up to 4 axes per unit, purchase only the number of axes required. It can simultaneously control stepper and /or servo systems.

Designed to solve complex motion problems with superior precision, the SSC can be used for applications requiring jogging, vector positioning of multi-axis, 2-dimensional linear or circular interpolation, contouring and electronic gearing.

With the Tol-O-Motion SSC software there is no need to learn programming language. Complex motion control is made easy with an interface that streamlines the entire programming process from setup to execution.

SCC FEATURES

- High performance motion control packaged in an industrial enclosure
- Uses a 32-bit specialized microcomputer and custom, submicron gate array for highest performance and speed
- Up to 4 axes per unit — up to 8 units can be daisy-chained
- 125 µsec per axis servo update rate for high bandwidth
- Controls servo motors and/or step motors
- Sophisticated PID filter with velocity and acceleration feed forward for optimum precision
- 16 bit DAC for fine resolution control
- 256K RAM memory for holding and running active program up to 1000 lines x 80 characters
- 4M EEPROM memory for non volatile storage of custom application programs, parameters and arrays (8000 array elements x 30 arrays) — permits stand-alone operation
- Multitasking feature permits simultaneous execution of four independent applications programs
- Programmable acceleration and deceleration with profile smoothing to eliminate jerk
- Continuous vector feed of infinite number of linear and arc segments for smooth motion
- Selectable linear scale simplifies linear motion programming
- Contour mode for profiling along computer generated paths such as parabolic or spherical profiles
- Performs any motion task including jogging, point-to-point positioning, linear and circular interpolation, electronic gearing, cam and contouring
- Dedicated opto-isolated inputs for home, abort, forward and reverse limits — noise immune
- Position feedback for each axis can be from analog signal or encoder
- Auxiliary encoder inputs and dual-loop damping — ideal for backlash compensation
- Programmable event triggers for monitoring elapsed time, position, speed, and motion complete
- I/O functions, timers, and logic functions for executing PLC tasks
- 254 symbolic variables and 8000 element array space for data storage
- Internal, universal switching power supply for direct connection to AC outlet (115V or 230V)
- IDC connectors on front panel connect to DIN rail mounted screw terminal breakouts included
- Additional I/O available on request



BRUSHED DC

SSC Servo/Stepper Controller
- Features

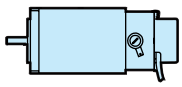
Axidyne® SSC Multi-axis Servo/Stepper Co

SPECIFICATIONS

SSC SPECIFICATIONS

Performance	
Servo Loop Cycle Time:	SSC 1: 250 µsec; SSC 2: 375 µsec SSC 3: 500 µsec; SSC 4: 500 µsec
Block Execution Time:	In contour mode, up to 1000 blocks (moves)/sec with full trajectory calculation
Position Accuracy:	±1 quadrature count
Velocity Accuracy:	Long-term: phase-locked, better than 0.003% Short-term: system dependent
Synchronization:	All axes in the same unit are perfectly synchronized and share the same servo cycle.
Position Capture Accuracy:	25 µsec with opto-isolation; 1 µsec if by-pass opto-isolation.
Parameter Ranges	
Position Range:	±2,147,483,647 counts/move; automatic rollover; no limit in jog or vector modes.
Velocity Range:	Up to 8,000,000 counts/sec
Acceleration/deceleration:	1,024 to 67,107,840 c/sec2
Error Limit:	±32,767 counts
Gear Ratio:	±127.9999
Filter Constants:	Kp: 0 to 1023.875 Kd: 0 to 4095.875 Ki: 0 to 2047.875
Motor Command Resolution:	16-bits or .0003 V
Step Motor Control Mode:	Full, half or microstep
Step Pulse Frequency:	2,000,000 pulse/sec
Number of Variables:	254
Array Memory Size:	8000 elements in up to 30 arrays
Program Memory Size:	1000 lines x 80 characters
Mechanical	
Dimensions:	13" high x 2.5" wide x 6.6" deep
Weight:	6 lbs.
Inputs/Outputs	
Feedback:	Two channels of A/B quadrature per axis with third channel for index. In servo mode, includes auxiliary encoder inputs for each axis. Single ended or differential. Can be configured for quadrature, pulse and direction, or from analog inputs.
General Purpose Inputs:	8 opto-isolated inputs
General Purpose Outputs:	8 TTL outputs
General Purpose Analog Inputs:	7, ±10 V; 12-bit resolution (16-bit optional)
Dedicated Inputs per Axis:	Forward and reverse limits, home.
Dedicated Outputs per Axis:	Analog motor command, pulse and direction, amplifier enable
Available Power to Drive External Devices	
+5 V 1.5 Amp	+12 V 750 mA -12 V 200 mA
Environment	
Operating Temperature:	32° to 158° F (0° to 70° C)
Communication Interface	
Selectable Baud Rate:	300, 1200, 4800, 9600, 19200, 38400. Handshake mode available.

I/O Description (Inputs)	
Encoder, A+, B+:	Position feedback from incremental encoder with two channels in quadrature. The encoder can be (±12V) or TTL. Note: Encoders that produce output in a pulse and direction format can also be used.
Encoder Index I+:	Once-per-revolution encoder pulse; used in Homing sequence or Find Index command. Minimum index pulse width is 120 nsec.
Encoder, A-, B-, I-:	Optional differential inputs from encoder; used for enhanced noise immunity.
Auxiliary Encoder:	Inputs for additional encoder; used when encoders on both the motor and the load are required.
Abort #:	Stops commanded motion instantly and also aborts application program.
Reset #:	System reset.
Forward and Reverse Limit Switch #:	When active, inhibits motion in forward or reverse direction and also causes the limit switch subroutine #LIMSWI to execute.
Home Switch #:	Input for Homing (HM) and Find Edge (FE) instructions.
Input 1 - Input 8#:	Uncommitted inputs; can be defined by the user to trigger events or interrupt program.
Latch#:	High-speed position latch to capture axis position within 25 µsec (bypass opto-isolation for .1 µsec capture). AL command arms latch. Input 1, 2, 3, 4 latches X, Y, Z, W respectively.
Analog 1 - Analog 7:	Analog inputs that can be connected to external analog signals such as force or pressure transducers. Can also be used for position feedback. 12-bit resolution ADC for ±10 V input.
I/O Description (Outputs)	
Analog Motor Command:	±10 V range signal for driving servo amplifiers; 16-bit resolution or .0003 V, 3 mA.
Amp enable:	Signal to disable and enable an amplifier. Amp enable goes low when a motor-off condition occurs. For step motors, this pin provides for reduced current when low.
Step Out:	Pulses for input to a step motor driver. The pulses can be either active low or high. Upon Reset, the output will be low if the SM jumper is on, Tristate if off. The STEP OUT pin also provides the PWM signal for servo motors.
Direction:	Used with the STEP OUT signal to give direction to step motors or servo motors in the sign magnitude mode.
Error:	The signal goes low when the position error on any axis exceeds the limit specified by the error command, ER.
Output 1 - Output 8:	These 8 TTL outputs are uncommitted and can be designated by the user to toggle relays and trigger external events. The output lines are toggled by Set Bit (SB), Clear Bit (CB), Define Bit (OB), and OP instructions. Upon reset these signals will be low.



SSC CONNECTORS

SSC J2 Main; 60-Pin IDC;

1	Ground	2	5 V				
3	Error	4	Reset				
5	Switch Common	6	Forward Limit - X				
7	Reverse Limit - X	8	Home - X				
9	Forward Limit - Y	10	Reverse Limit - Y				
11	Home - Y	12	Forward Limit - Z				
13	Reverse Limit - Z	14	Home - Z				
15	Forward Limit - W	16	Reverse Limit - W				
17	Home - W	18	Output 1				
19	Input Common	20	Latch X or Input 1				
21	Latch Y or Input 2	22	Latch Z or Input 3				
23	Latch W or Input 4	24	Abort Input				
25	Motor Command X	26	Amp Enable X				
27	Motor Command Y	28	Amp Enable Y				
29	Motor Command Z	30	Amp Enable Z				
31	Motor Command W	32	Amp Enable W				
33	A+ X	34	A- X	35	B+ X	36	B- X
37	I+ X	38	I- X	39	A+ Y	40	A- Y
41	B+ Y	42	B- Y	43	I+ Y	44	I- Y
45	A+ Z	46	A- Z	47	B+ Z	48	B- Z
49	I+ Z	50	I- Z	51	A+ W	52	A- W
53	B+ W	54	B- W	55	I+ W	56	I- W
57	+12 V	58	-12 V	59	5 V	60	Ground

SSC J5 General I/O; 26-Pin IDC;

1	Analog 1	2	Analog 2
3	Analog 3	4	Analog 4
5	Analog 5	6	Analog 6
7	Analog 7	8	Ground
9	5 V	10	Output 1
11	Output 2	12	Output 3
13	Output 4	14	Output 5
15	Output 6	16	Output 7
17	Output 8	18	Input 8
19	Input 7	20	Input 6
21	Input 5	22	Input 4 (Latch W)
23	Input 3 (Latch W)	24	Input 2 (Latch W)
25	Input 1 (Latch W)	26	Input Common (Isolated 5 V)

SSC J3 Auxiliary Encoder; 20-Pin IDC;

1	Sample Clock	2	Reserved
3	B- Aux W	4	B+ Aux W
5	A- Aux W	6	A+ Aux W
7	B- Aux Z	8	B+ Aux Z
9	A- Aux Z	10	A+ Aux Z
11	B- Aux Y	12	B+ Aux Y
13	A- Aux Y	14	A+ Aux Y
15	B- Aux X	16	B+ Aux X
17	A- Aux X	18	A+ Aux X
19	5 V	20	Ground

SSC J4 Driver; 20-Pin IDC;

1	Motor Command X	2	Amp Enable X
3	PWM X/Step X	4	Sign X/Dir X
5		6	Motor Command Y
7	Amp Enable Y	8	PWM Y/Step Y
9	Sign Y/Dir Y	10	
11	Motor Command Z	12	Amp Enable Z
13	PWM Z/Step Z	14	Sign Z/Dir Z
15	5 V	16	Motor Command W
17	Amp Enable W	18	PWM W/Step W
19	Sign W/Dir W	20	Ground

AC Power INputs; 4-PIN Detachable Screw Type:

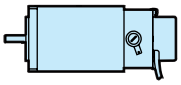
Hot	Connects to 110 or 220 AC
NC	No Connect
Neutral	Return for AC
Earth	Chassis input

RS232 - Main Port; 9-PIN:

1	CTS - output	2	Transmit data
3	Receive data	4	RTS - input
5	Ground	6	CTS - output
7	RTS - input	8	CTS - output
9	5 V		

RS232 - Auxiliary Port; 9-PIN:

1	CTS - input	2	Receive data -
3	Transmit data	4	RTS - output
5	Ground	6	CTS - input
7	RTS - output	8	CTS - input
9	5 V		

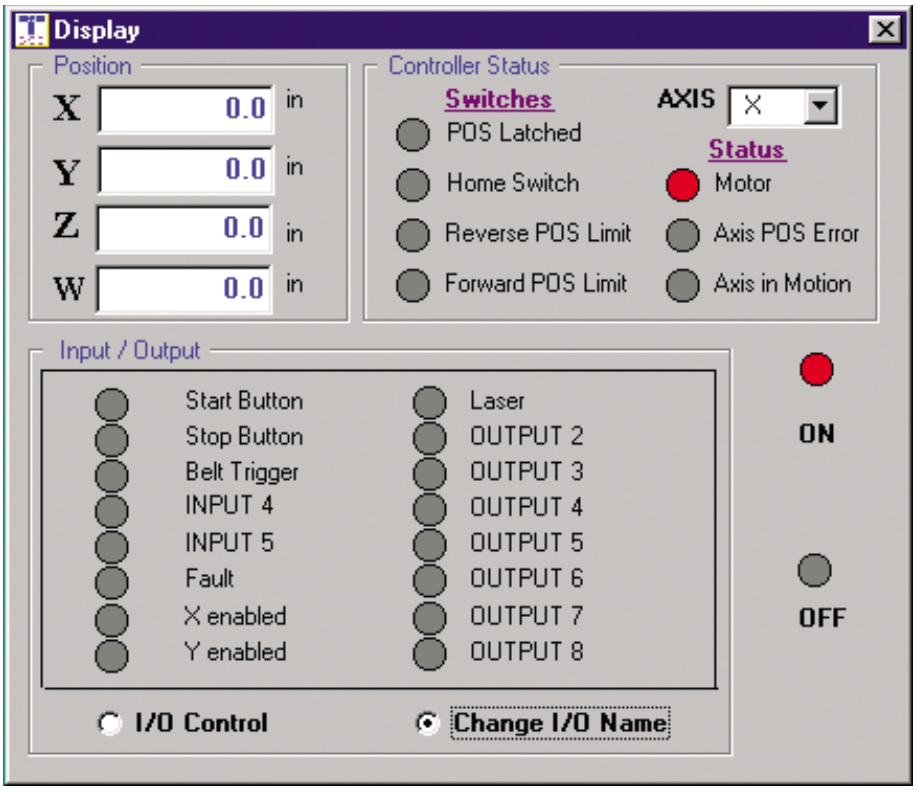


SSC PROGRAMMING SOFTWARE

Programming is accomplished through RS232 connection to a PC running Windows 95, 98, NT, 2000 or XP. Visual Basic panels guide the user through the complete setup process including communications and axis configuration. The user can then use other program options including Display, Jog, Teach, Programmer, Tune and Data Acquisition.

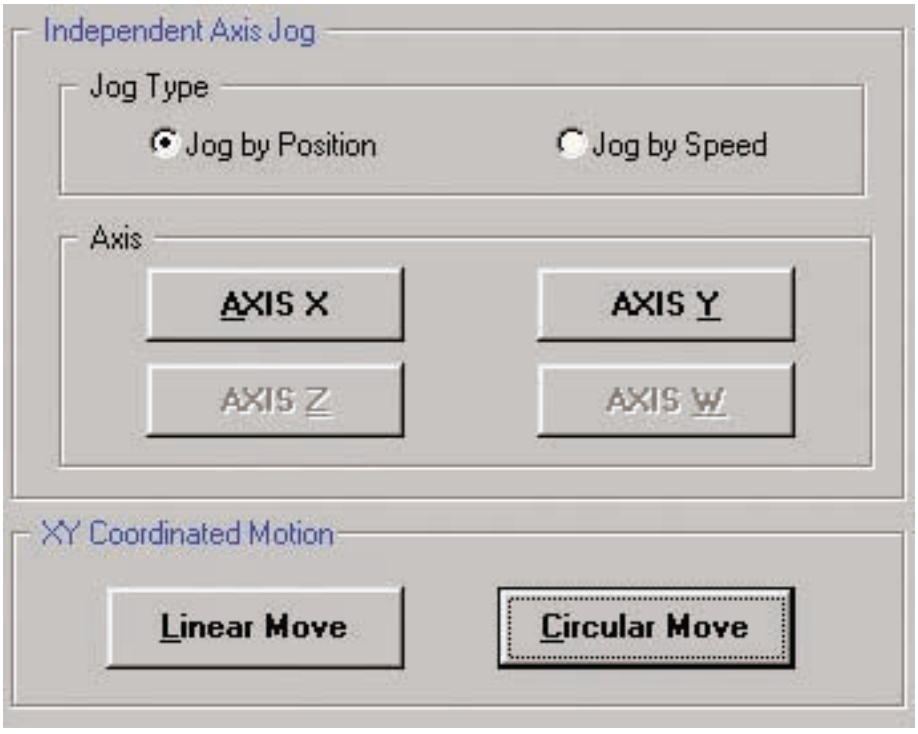
Display

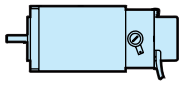
The Display panel (shown above) allows the user to identify axis locations and status faults, limits, and I/O.



Jog

The Jog panels allow the user to easily setup independent motion or coordinated motion.





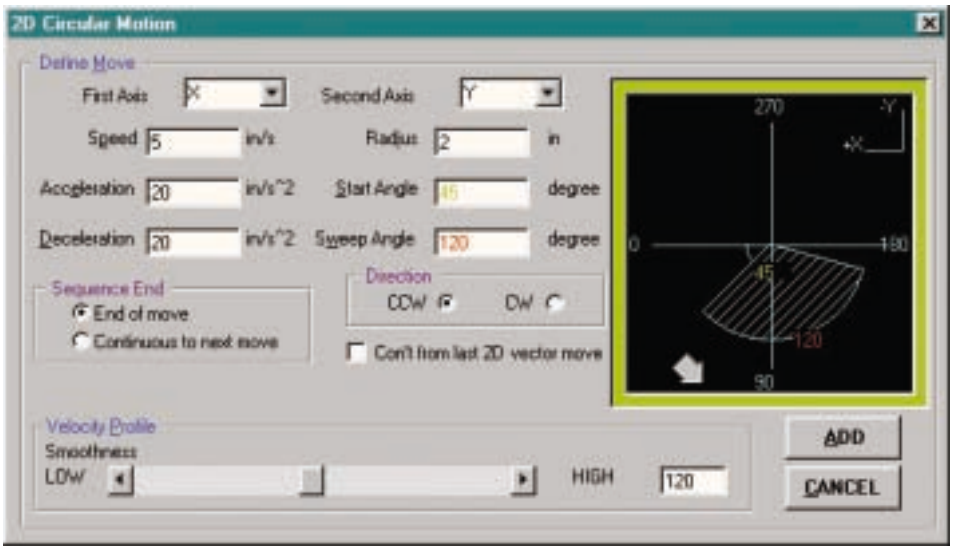
BRUSHED DC

SSC Servo/Stepper Controller

- Programming

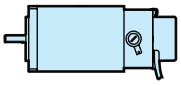
Axidyne® SSC Multi-axis Servo/Stepper

PROGRAMMING SOFTWARE



CIRCULAR MOTION

The added feature of 2-dimensional circular programming, assists you in selecting start and sweep angles.



BRUSHED DC

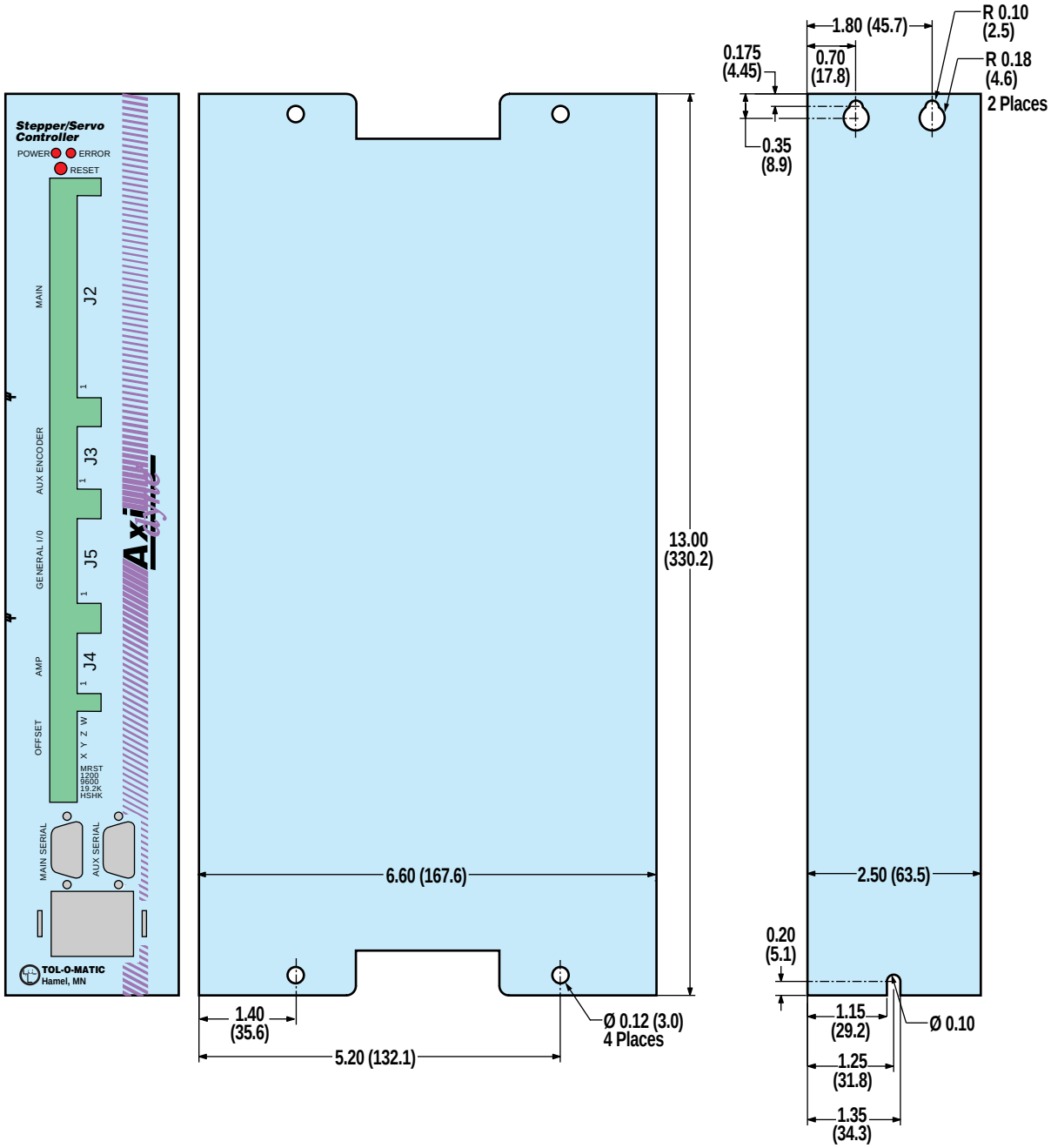
SSC Servo/Stepper Controller

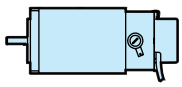
- Programming

Axidyne® SSC Multi-axis Servo/Stepper Co

DIMENSIONS

SSC (MULTI-AXIS SERVO/STEPPER CONTROLLER)





BRUSHED DC

SSC Servo/Stepper Controller

- Dimensions

Unless otherwise noted, all dimensions shown are in inches (Dimensions in parenthesis are in millimeters)

Axidyne® PIT – Panel Mount User In

FEATURES, SPECIFICATIONS AND DIMENSIONS

COMPATIBILITY:
SYSTEM: STEPPER
MOTORS: MRS
DRIVE: MSS
CONTROLLER: MSS
INTERFACE: PIT

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: MSC
INTERFACE: PIT

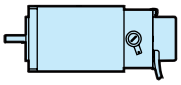
User interaction with the MSS is simple with the PIT panel mount user interface. The Tol-O-Motion MS software allows visual setup of the panel to status the user on a particular action taking place, or to prompt the user to make a decision or provide information such as move distance, move speed, repeat count.

FEATURES

- Flush or surface mounting
- Four line by 20 character LCD display
- RS232 communication to MSS controllers
- Uses RS232 cable supplied with MSS controllers

CABLES

Motor cable and encoder cable are included when ordering MSS controllers (see page H-25)

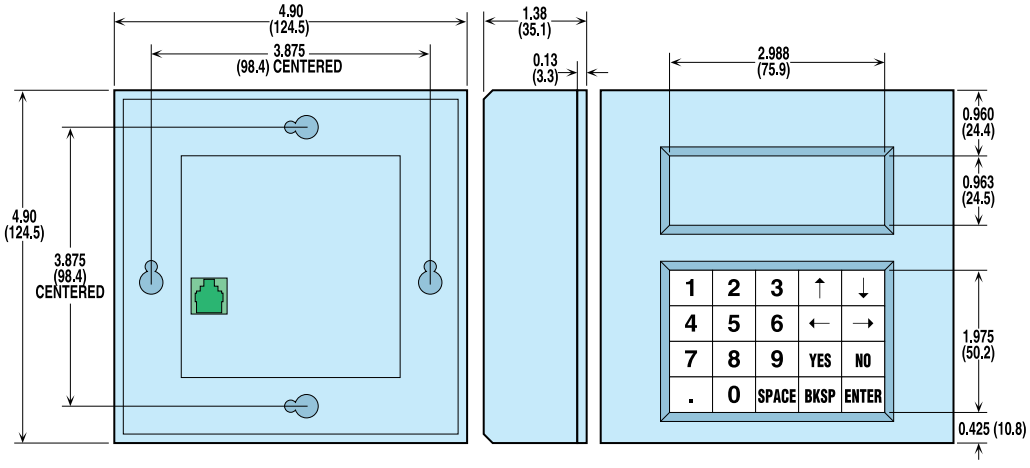


BRUSHED DC

PIT Panel Mount User Interface

- Features
- Specifications
- Dimensions

PIT (PANEL MOUNT USER INTERFACE) DIMENSIONS



Unless otherwise noted, all dimensions shown are in inches (Dimensions in parenthesis are in millimeters)

Axidyne® JS – Joystick User Interface

SPECIFICATIONS AND DIMENSIONS

COMPATIBILITY:
SYSTEM: BRUSHLESS
MOTORS: MRV
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS SIT

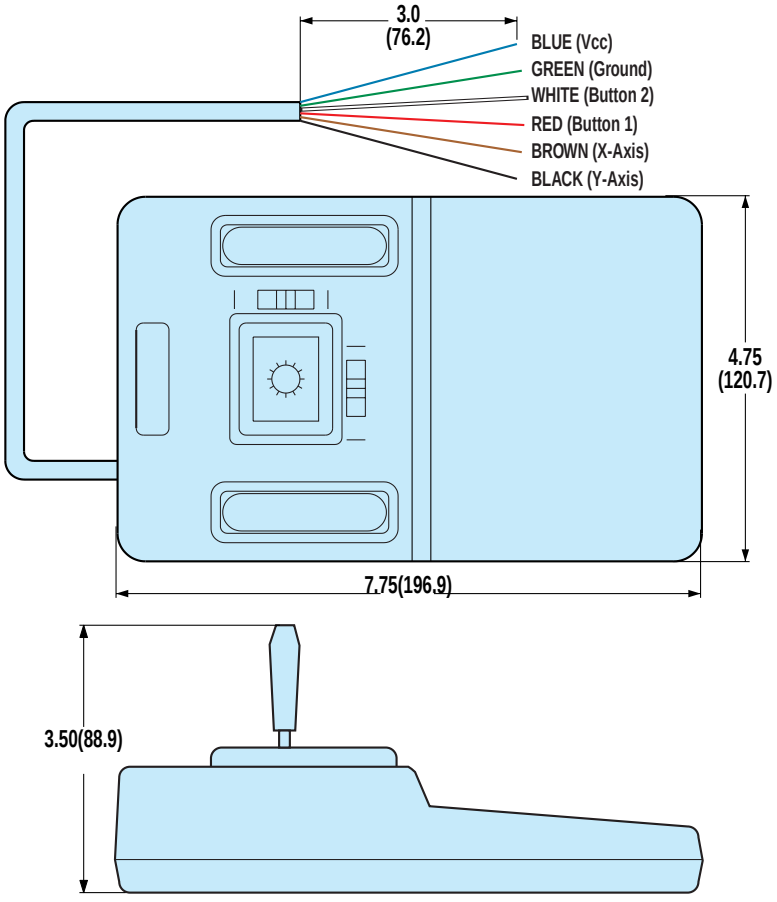
COMPATIBILITY:
SYSTEM: STEPPER
MOTORS: MRS
DRIVE: MSD
CONTROLLER: SSC
INTERFACE: JS SIT

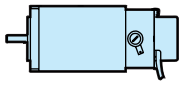
COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS SIT

For simple setup of the SSC controller the JS joystick provides 2-axis manipulation. Used with the Joystick Teach mode of the Tol-O-Motion SSC software, moves can be made with velocity control, and then stored using a separate button integrated into the joystick housing.

SPECIFICATIONS	JS Joystick
Joystick Travel	27° from design center in all directions
Mechanical Life Cycle	5 million (minimum)
Trim Movement (Optional)	±7° (total trim 14°) for each axis
Main Ball Pivot	Precision ground stainless steel
Stick Shaft	3/16" brass plated
Potentiometers	Set at center of resistance
Potentiometer Calibration	Thumb tab provides up to 114° of potentiometer calibration
Return to Center Repeatability	±1%
Deflection Force	0.14 lbs. at 27° at 2-7/8" from pivot point
Switches	2 elongated push-button switches
Cable	Integrated 7' (2.1m) cable with strain relief

JS (JOYSTICK) DIMENSIONS





BRUSHED DC

Js Joystick
User Interface
- Specifications
- Dimensions

Axidyne® SIT – Hand-held User interface

FEATURES, SPECIFICATIONS AND DIMENSIONS

COMPATIBILITY:
SYSTEM: BRUSHLESS
MOTORS: MRV
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS
SIT

COMPATIBILITY:
SYSTEM: STEPPER
MOTORS: MRS
DRIVE: MSD
CONTROLLER: SSC
INTERFACE: JS
SIT

COMPATIBILITY:
SYSTEM: BRUSHED DC
MOTORS: MRB
DRIVE: AXIOM DB
CONTROLLER: SSC
INTERFACE: JS
SIT

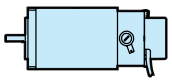
For user interaction with the SSC 1-4 axis multi-function controllers the SIT hand held user interface provides flexibility and setup simplicity. The Tol-O-Motion SS software (included with the SSC 1-4 controllers) has a setup page for use with the SIT to allow the controller to status the user, or to prompt the user for information, eliminating the need for a PC following setup.

FEATURES:

- 45 key, alpha-numeric tactile keypad
- 4 row by 20 character LCD display
- Rugged, high impact ABS housing
- 7 foot (2.1m) RS232 cable with 9-pin "D" connector for connection to the SSC 1-4
- 5 Vdc power supplied from SSC 1-4 controller over RS232

SPECIFICATIONS	JS Joystick
Weight	8.0 oz. (.23 Kg.)
Character Set	ASCII with upper case transmit, upper and lower case receive
Case	Molded, high impact ABS with retractable hanger
Keypad	15 user-programmable function keys
Display	Transreflective LCD with 5 by 7 character font
Power Requirements	30 mA maximum, regulated, 5 Vdc ±5% (Received through RS 232 cable)
Speaker	Audible key click, bell and alert
Storage Temperature	-4° F (-20° C) to 158° F (+70° C)
Operating Temperature	32°F (0° C) to 122° F (+50° C)
Relative Humidity	10% to 90% non-condensing

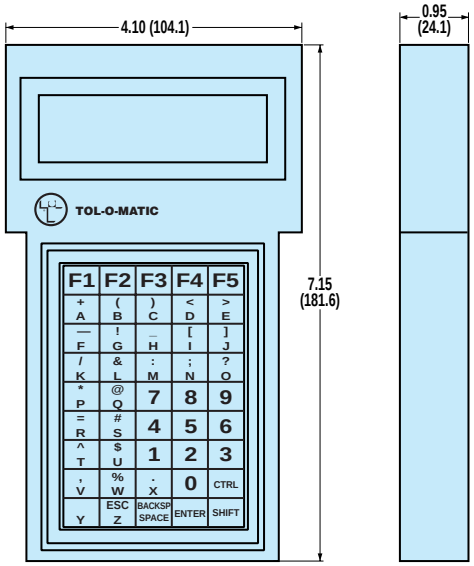
SIT (HAND-HELD INTERFACE)



BRUSHED DC

SIT Hand-held User Interface

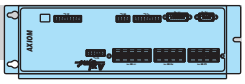
- Features
- Specifications
- Dimensions



Axidyne® Brushed dc Systems

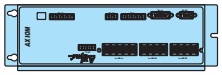
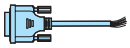
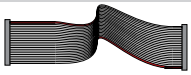
CABLES

MRB MOTORS TO AXIOM DB DRIVE

MRB21, MRB31, MRB32
MRB41, MRB42  TO: AXIOM DB 

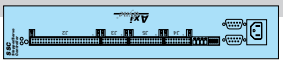
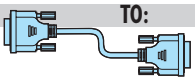
Config Code	Replacement Part Number	Included with Motor	Type	Description	Cable Length	Motor Sizes	CONNECTORS AT Motor	Drive	Drive Sizes
–	–	YES	Power		0.6m	All	Flying leads	Screw terminals	Axiom DB20
–	–	YES	Encoder		0.5m	All	Flying leads	Screw terminals	Axiom DB20

AXIOM DB DRIVE TO SSC CONTROLLER

AXIOM DB20    BREAKOUT BOX TO:  RIBBON CABLE SSC 

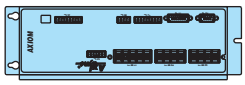
Config Code	Replacement Part Number	Included with SSC	Type	Description	Cable Length	Drive Sizes	CONNECTORS AT Drive	SSC	SSC Size
–	3600-1347 3600-1342	YES YES	Main/Driver Signals	Ribbon Breakout	1m	All	Screw terminals	IDC	All
–	3600-1346 3600-1341	YES YES	I/O	Ribbon Breakout	1m	All	Screw terminals	IDC	All
–	3604-1213	YES	Controller Encoder		3m	All	DB15	Screw terminals at breakout box	All

SSC CONTROLLER TO IBM COMPATIBLE PC

SSC  CRZ  TO: PC 

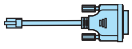
Config Code	Replacement Part Number	Included with SSC	Type	Description	Cable Length	SSC Size	CONNECTORS AT SSC	PC	PC Size
CRZ	3600-1172	Optional	Comm		1m	All	DB9	DB9	All

AXIOM DB DRIVE TO MSC CONTROLLER

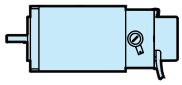
AXIOM DB20  TO: MSC 

Config Code	Replacement Part Number	Included	Type	Description	Cable Length	Drive Size	CONNECTORS AT Axiom DB	MSC	MSC Size
–	–	Cust. supplied		22-26 gauge		All	Screw terminal	Screw terminal	All

MSC CONTROLLER TO IBM COMPATIBLE PC

MSC  TO:  PC 

Config Code	Replacement Part Number	Included with MSC	Type	Description	Cable Length	MSC Size	CONNECTORS AT MSC	PC	PC Size
–	–	YES	Comm		2m	All	RJ11	DB9	All



BRUSHED DC

Cables

Products discontinued August 01, 2006:
SSC Multi-Axis Controller,
Stepper Motors & Control Products,
Brushed DC Motors & Control Products
Contact Tol-O-Matic for repair parts

Axidyne® Brushed dc System

ORDERING

MOTOR STYLE, SIZE AND GEARHEAD REDUCTION | CONTROLLER | CABLES, CONNECTIONS & INTERFACE

MRB 31Y_ GHJ31 | SSC34 | CRZ_ BOY | SIT

MOTOR TYPE

MRB	Brushless Servo Motor

MOTOR SIZE / DRIVE SIZE

MODEL	FRAME SIZE	STACK SIZE	DRIVE SIZE
21Y	23	1	Axiom DB20
31Y	34	1	Axiom DB20
32Y	34	2	Axiom DB20
41Y	40	1	Axiom DB20
42Y	40	2	Axiom DB20

Once motor type and frame size is selected, the appropriate adapter and couplers required are automatically chosen.

NO DRIVE OPTION

X	Replace Y with X if motor drive is NOT required (do not put 'Y' in string)

NO MOTOR OPTION

XY*	Motor(s) supplied by customer, Tol-O-Matic to mount using standard hardware and couplers
XJ*	Motor(s) supplied and mounted by customer, Tol-O-Matic to furnish standard hardware and couplers

* For XY and XJ options, a full endface and shaft dimensional drawing must accompany the order for the actuator. Customer motors must be directly interchangeable with Tol-O-Matic motors.

GEARHEAD REDUCTIONS

(For In-line or Direct-Drive mounting configurations only)

MODEL	INPUT DIA.	MOTOR SIZE	REDUCTION RATIO
GHK20	1/4-inch	23	5.5
GHJ20	1/2-inch	23	5.5
GHJ21	1/2-inch	23	10
GHJ30	1/2-inch	34	5.5
GHJ31	1/2-inch	34	10

CONTROLLER

SINGLE AXIS APPLICATIONS

MSC	Single Axis Controller
SSC10	**Stepper/Servo Controller, 1 axis application

MULTI AXIS APPLICATIONS

2 Axis Application

	1st Axis	2nd Axis
SSC21	Servo	Stepper
SSC22	Servo	Servo

3 Axis Application

	1st Axis	2nd Axis	3rd Axis
SSC31	Servo	Stepper	Stepper
SSC32	Servo	Stepper	Servo
SSC33	Servo	Servo	Stepper
SSC34	Servo	Servo	Servo

4 Axis Application

	1st Axis	2nd Axis	3rd Axis	4th Axis
SSC41	Servo	Stepper	Stepper	Stepper
SSC42	Servo	Stepper	Stepper	Servo
SSC43	Servo	Stepper	Servo	Stepper
SSC44	Servo	Stepper	Servo	Servo
SSC45	Servo	Servo	Stepper	Stepper
SSC46	Servo	Servo	Stepper	Servo
SSC47	Servo	Servo	Servo	Stepper
SSC48	Servo	Servo	Servo	Servo

CABLES

MRB motors have flying leads, special cables are not required.

For SSC Controllers

CRZ	If a 2-meter 9-pin RS232 cable is desired

If ordering with AXIOM drive, controller encoder cables are included for each axis.

⚠ ***Indicate if breakout terminal and ribbon cables are needed.***

BON	No breakout terminals
BOY***	With breakout terminals

***BOY option includes:

- 60 pin/18" (457mm) ribbon cable & 60 pin breakout
- 26 pin/18" (457mm) ribbon cable & 26 pin breakout
- If any axis configured w/ step & direction output — 20 pin/18" (457mm) ribbon cable & 20 pin breakout

USER INTERFACE

PIT	Panel mount interface (for use with MSC)
SIT	Hand-held user interface
JS	Joy Stick

⚠ ***Not all codes listed are compatible with all options.***

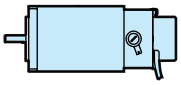
Use the Tol-O-Motion™ Sizing Software to determine available options and accessories based on your application requirements.

User manuals and software CD-ROM is included with any controller or drive ordered. Manuals and software are also available for download at www.tolomatic.com

Product discontinued February 01, 2006:
B3B/M3B Belt Drive Actuator
>> REPLACED WITH B3W/M3W <<
>> SEE BROCHURE 3600-4148 <<
Contact Tol-O-Matic for repair parts

TO ORDER ACTUATORS

B3S/M3S SERIES (SEE PAGE C-30)
B3B/M3B SERIES (SEE PAGE C-50)
BCS/MCS SERIES (SEE PAGE C-128)
SLS/MLS SERIES (SEE PAGE C-138)
RSA/RSM SERIES (SEE PAGE D-53)
GSA/GSM SERIES (SEE PAGE E-36)



Axidyne® Brushed dc System

FIELD RETROFIT ORDERING

*SSC 1-4 CONTROLLERS

Code	X-Axis	Y-Axis	Z-Axis	W-Axis	Part #
SSC10	Servo	-	-	-	3600-0210
SSC21	Servo	Stepper	-	-	3600-0221
SSC22	Servo	Servo	-	-	3600-0222
SSC31	Servo	Stepper	Stepper	-	3600-0231
SSC32	Servo	Stepper	Servo	-	3600-0232
SSC33	Servo	Servo	Stepper	-	3600-0233
SSC34	Servo	Servo	Servo	-	3600-0234
SSC41	Servo	Stepper	Stepper	Stepper	3600-0241
SSC42	Servo	Stepper	Stepper	Servo	3600-0242
SSC43	Servo	Stepper	Servo	Stepper	3600-0243
SSC44	Servo	Stepper	Servo	Servo	3600-0244
SSC45	Servo	Servo	Stepper	Stepper	3600-0245
SSC46	Servo	Servo	Stepper	Servo	3600-0246
SSC47	Servo	Servo	Servo	Stepper	3600-0247
SSC48	Servo	Servo	Servo	Servo	3600-0248

NOTE: Any axis of the SSC may be changed by the insertion or removal of a jumper, see SSC manual #3600-4608
*Includes user manual and software CD-ROM

*MSC CONTROLLER

Item	Part #
MSC Single Axis Controller	3600-0040

*Includes user manual and software CD-ROM

CABLES

Item	Part #
20 pin breakout	3600-1340
26 pin breakout	3600-1341
60 pin breakout	3600-1342
20 pin ribbon cable	3600-1345
26 pin ribbon cable	3600-1346
60 pin ribbon cable	3600-1347
SSC Encoder cable	3604-1213

*AXIOM DB DRIVE

Config. Code	Part #
DB20 cables are included as motor flying leads	3604-0003

*Includes user manual and software CD-ROM

CABLES

—	Controller Encoder Cable	3604-1213
CRZ	RS232 Cable	3600-1172

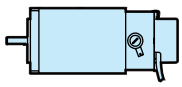
MRB BRUSHED DC MOTORS

Config. Code	Part #
MRB21	3600-6248
MRB31	3600-6249
MRB32	3600-6250
MRB41	3600-6251
MRB42	3600-6252

** For RSA Rod Screw Actuators only

USER INTERFACES

Config. Code	Part #
PIT	3600-9607
SIT	3600-9161
JS	3600-9162



BRUSHED DC

Field Retrofit Ordering

FIELD RETROFIT ORDERING
BRUSHLESS (SEE PAGE F-34)
STEPPER (SEE PAGE G-24)