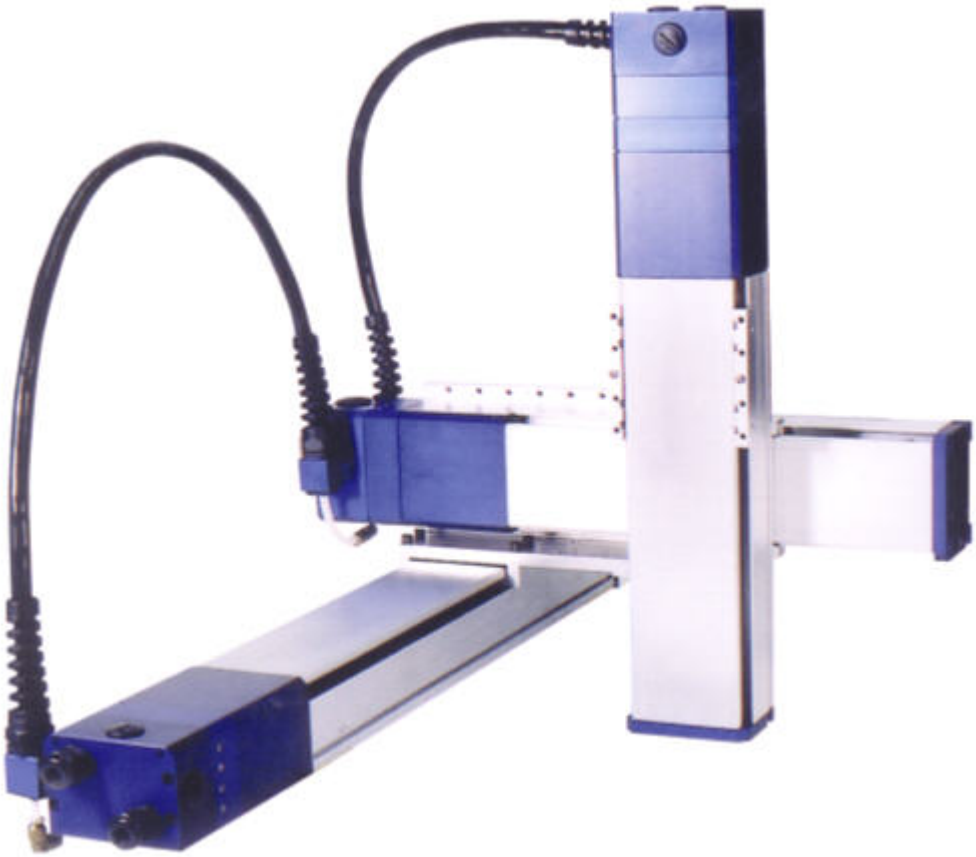
Smart Linear Actuator

Quick Start Reference Guide



Robohand, Inc. 3305 Wiley Post Rd. Carrollton, TX 75006 972-726-7300 www.robohandsla.com

ROBOHAND SLA DOCUMENTATION

Please use the SLA CD for the following installation.

_____MAIN PROGRAM_____

Install operations software by clicking setup.exe.
You can run sla software without having actual hardware in virtual mode.
Once loaded, the user name and password are both sla

_____FOLDERS ON CD_____

APPLICATION_MOVIES	SLA software demo movies
eCylinder MECHANICAL	eCylinder Mechanical drawings & repair manuals
eCylinder_WIRING	WIRING DIAGRAMS
EXAMPLE_PROGRAMS	EXAMPLE SLA PROGRAM
SLA MECHANICAL	SLA Mechanical drawings & repair manuals
SLA WIRING	SLA WIRING CONFIGURATIONS
SoftwareDemoMovies	SOFTWARE DEMONSTRATIONS
WebHelp	BROWSER BASED HELP FILE. SEE BELOW.
CE_TEST_SLA_eCylinder.pdf	CE certification of SLA & eCylinder
setup.exe	MAIN SLA PROGRAMMING PACKAGE
SLA_software_manual.pdf	SOFTWARE PROGRAMMING MANUAL
SLA_Sales_Catalog.pdf	SALES CATALOG
SLA_QUICK_START.pdf	SLA QUICK START GUIDE

_____HELP FILE HINTS_____

Create a folder on your computer called C:\SLA or similar.
Drag the entire contents of this CD to this folder.
Locate the following files. Right click and create shortcut.

SOFTWARE DOCUMENTATION---WEBHELP\INDEX.HTM
SOFTWARE MOVIE DEMO------\SoftwareDemoMovies\slaMovies.html

PLC PROGRAMMING---
WebHelp\Programming\Binary_Coded_Decimal_Programs_(BCD).htm

PC PROGRAMMING
WebHelp\Programming\Multi_Motor_Programs_(MMP).htm

SLIDE STAND ALONE PROGRAM---
WebHelp\Programming\Smart_Motor_Programs_(SMP).htm
Run these shortcuts for movies and documetation.

Log onto www.robohandsla.com for even more extensive documentation.
You should register to gain extended access.

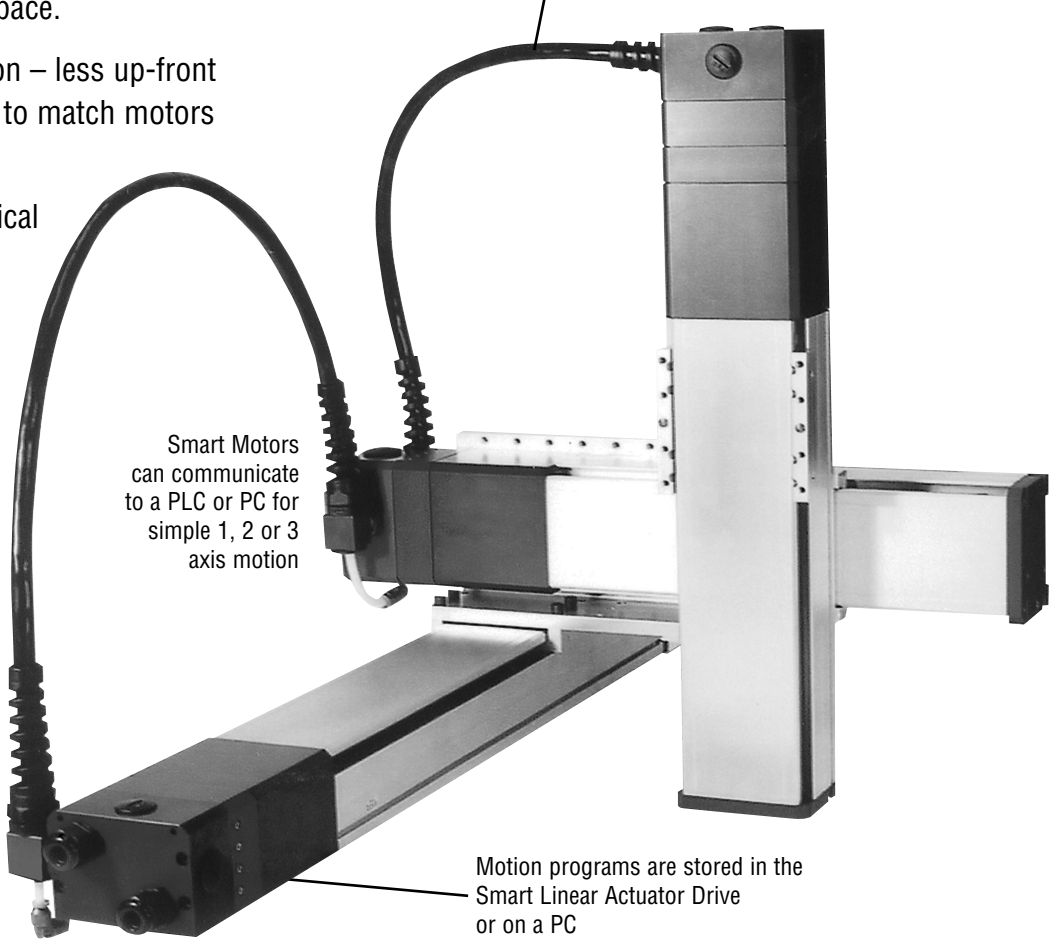
Please Call Minh Truong 972-726-7300 x125 or Peter McCormick x101 if you have questions.

Overview

Handle many typical point-to-point applications without an external control unit

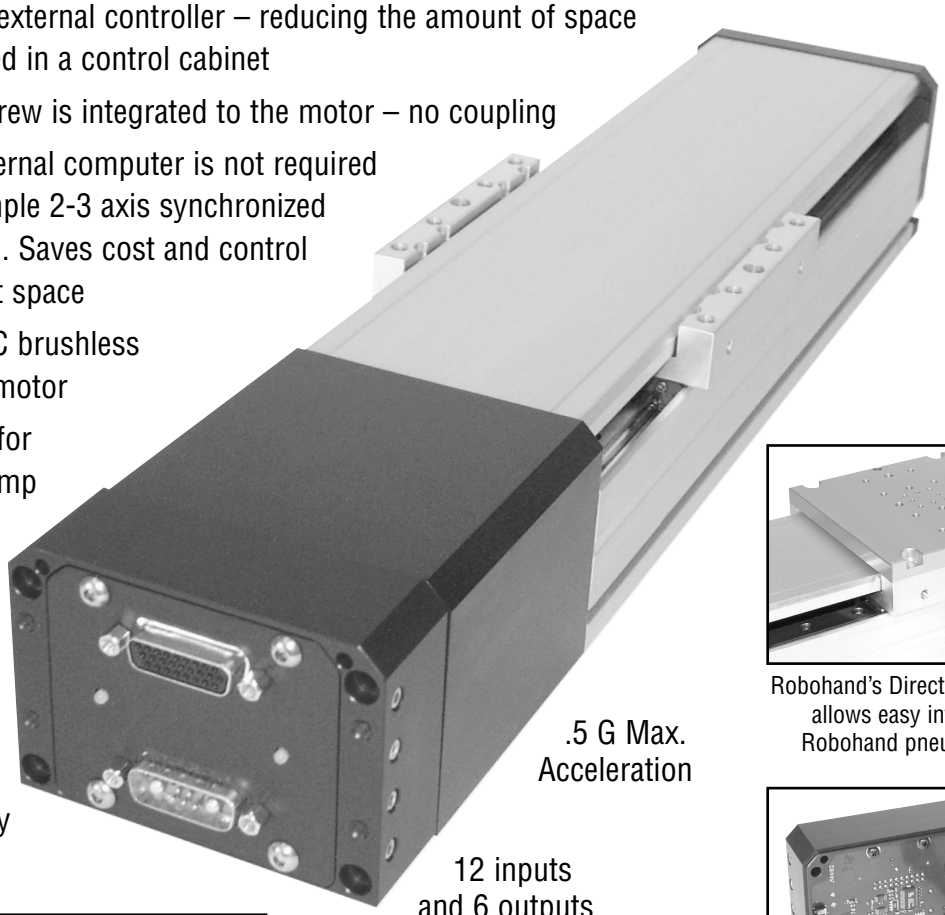
- NEW ■ Position data import for DXF, XLS and CSV files
- NEW ■ Vision commands
- NEW ■ HMI commands
- NEW ■ Unit conversion calculator

- Smart linear actuators are controlled by only 6 conductors – resulting in a lighter cable bundle for improved life cycle.
- Motor drive is built into the motor – reducing the amount of space required in a control cabinet.
- An external computer is not required for simple 2-3 axis synchronized motion. Saves cost and control cabinet space.
- Integrated solution – less up-front engineering time to match motors with drives
- Optional mechanical brake
- Networking capability via Ethernet



The SLA Series of programmable servo slides is one of the first in the industry to utilize Smart Motor Technology

- Drive is located on the actuator – no external controller required in most cases
- Smart linear actuators are controlled by only 6 conductors – resulting in a lighter cable bundle for improved life cycle
- Motor drive is built onto the motor which, in many cases, eliminates the need for an external controller – reducing the amount of space required in a control cabinet
- Ball screw is integrated to the motor – no coupling
- An external computer is not required for simple 2-3 axis synchronized motion. Saves cost and control cabinet space
- 48V DC brushless servo motor
- T-Slot for toe clamp



± .02mm (.0008") repeatability

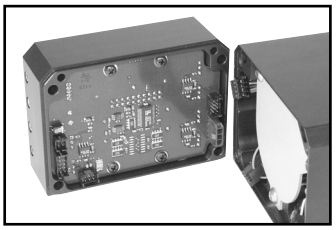
.5 G Max. Acceleration

12 inputs and 6 outputs

Model	Rated Thrust (N[lbf])
SLA-90	150 [33.72]
SLA-120	165 [37.09]
SLA-150	330 [74.19]

Weld field immune electronics and weld spark resistant cover available on all sizes.

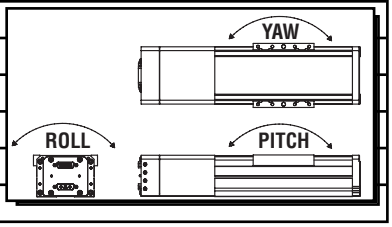
Robohand's DirectConnect pattern allows easy integration of Robohand pneumatic slides



Smart Motor – Integral drive and motor built-in for space savings and, in many cases, the elimination of an external controller

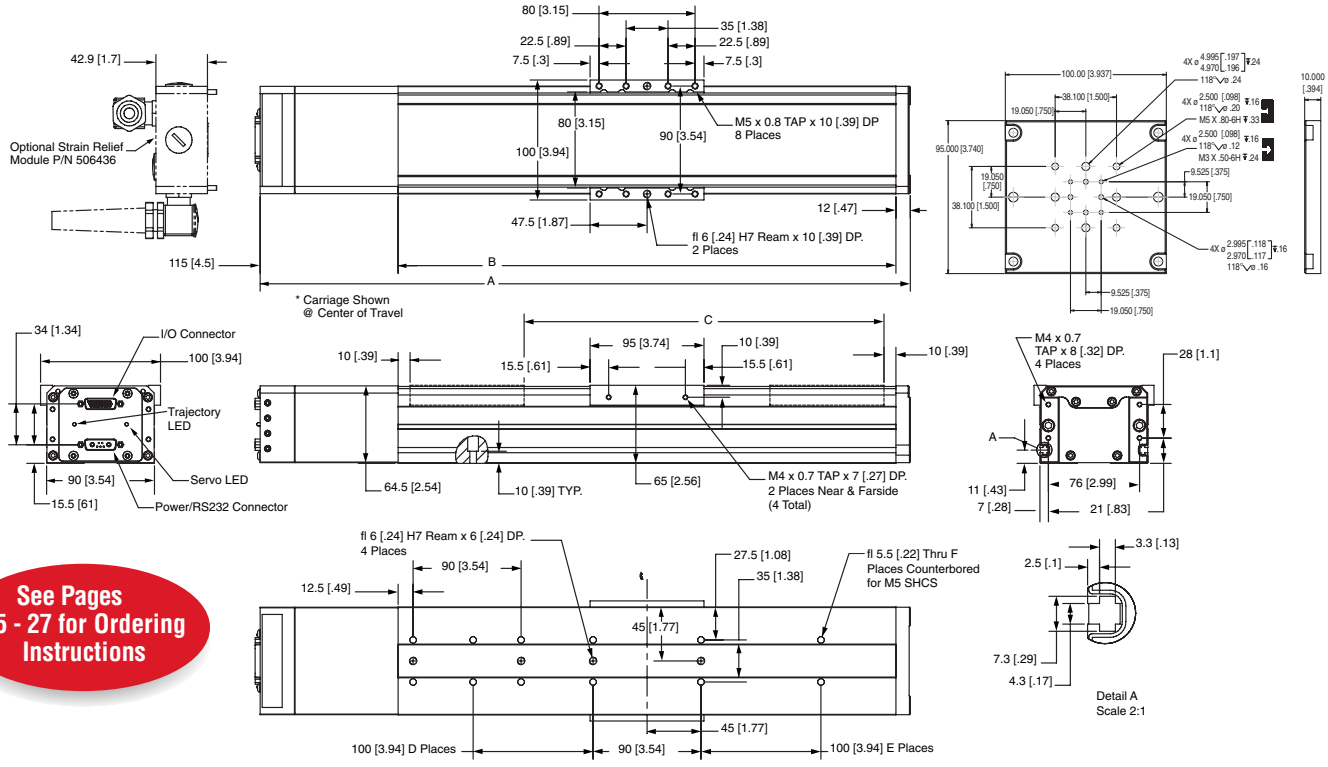
Model SLA90

Stroke	mm [in]	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	500 [19.68]	600 [23.62]
Rated Power[1]	W [hp]	175 [0.235]					
Max. Speed[2,4]	mm/sec [in/sec]	700 [27.56]	800 [31.50]	800 [31.50]	800 [31.50]	700 [27.56]	600 [23.62]
Max. Acceleration	G	0.5					
Rated Thrust	N [lbf]	150 [33.72]					
Repeatability (bi-directional)	mm [in]	±.02 [0.0008]					
Unit Weight	kg [lbs]	3.1 [6.83]	3.6 [7.94]	5.4 [11.90]	5.9 [13.01]	7.3 [16.09]	8.3 [18.30]
Ball screw Inertia	kg-m^2 in-lbf sec^2	1.74E-05 [1.54E-04]	1.91E-05 1.69E-04]	2.08E-05 [1.84E-04]	2.25E-05 [1.99E-04]	2.42E-05 [2.14E-04]	2.59E-05 [2.29E-04]
Carriage Weight	kg [lbs]	.8 [1.76]					
Motor		DC Servo					
Table Top	kg [lbs]	0.24 [0.52]					
Encoder		Incremental, Attached to ball screw, 1000 lines/rev (0.0025 mm [0.84 E-04 in] resolution @ 10mm [0.39 in] lead)					
Limit Sensors		Forward & Reverse					
Ball screw		10 mm [0.39 in] lead					
Max. Thrust[3]	N [lbf]	300 [67.44]					
Payload Capacity[2,4]	Kg [lbs]	23 [50.70]					
Moment Capacity[5,6]	Nm [lbf-ft]	M_{pitch} 40 [29.50], M_{yaw} 28 [20.65], M_{roll} 40 [29.50]					
Motor Torque Constant	Nm/amp [lbf-ft/amp]	0.061 [0.045]					
Motor Back EMF Constant	V/Krpm	7.1					
Motor Resistance	Ohms	0.64					
Motor Inductance	mH	0.71					
Brake Holding Force	N [lbf]	80 [17.98]					



Notes:
1 - At 48 volts & 5.6 amps.
2 - At max payload rating & acceleration of 0.5G over full travel of a single axis in a horizontal orientation. Actual maximum speed governed by maximum acceleration, travel distance, and ball screw critical speed.
3 - At speed of 50mm/sec for 1 second.
4 - For uniformly distributed load on carriage with CG no more than 220mm above carriage & base affixed to a flat, rigid frame.
5 - Payload capacity not to be exceeded. Combined moment loads due to acceleration/deceleration of offset loads & static moment loads must be less than the rated moment capacity. Moment directions (Diagram)
6 - Refer to Loading Specification on Page 12

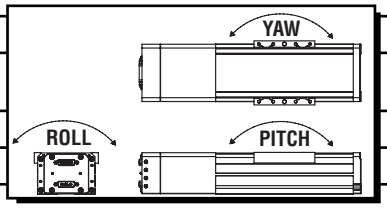
Stroke	100mm	200mm	300mm	400mm	500mm	600mm
A	342 [13.46]	442 [17.40]	542 [21.34]	642 [25.28]	742 [29.21]	842 [33.15]
B	215 [8.46]	315 [12.40]	415 [16.34]	515 [20.28]	615 [24.21]	715 [28.15]
C	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	500 [19.69]	600 [23.62]
D	0	0	1	1	2	2
E	0	1	1	2	2	3
F	8	10	2	14	16	18



See Pages 25 - 27 for Ordering Instructions

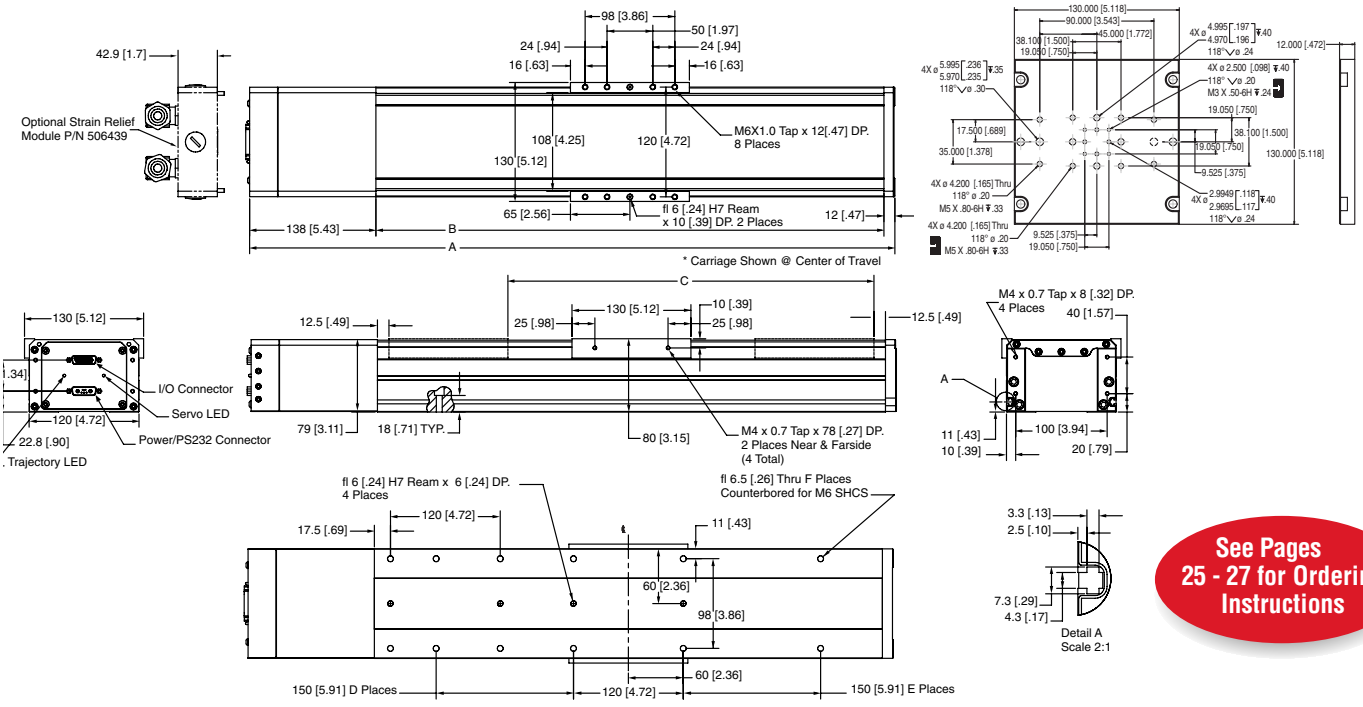
For more information call us at: 800-259-9890 or 972-726-7300 Fax: 972-726-9034 Email: tech-sla@robohand.com www.robohandsla.com

Stroke	mm [in]	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	600 [23.62]	800 [31.49]	1000 [39.37]
Rated Power[1]	W [hp]	225 [0.30]						
Max. Speed[2,4]	mm/sec [in/sec]	700 [27.56]	950 [37.40]	1000 [39.37]	1000 [39.37]	800 [31.50]	600 [23.62]	500 [19.68]
Max. Acceleration	G	0.5						
Rated Thrust	N [lbf]	165 [37.09]						
Repeatability (bi-directional)	mm [in]	±.02 [0.0008]						
Unit Weight	kg [lbs]	8.3 [18.30]	9.7 [21.38]	11.2 [24.52]	12.7 [28.00]	15.6 [34.39]	18.5 [40.78]	21.4 [47.18]
Ball screw Inertia	kg-m² in-lbf sec²	3.63E-05 [3.21E-04]	4.17E-05 [3.69E-04]	4.71E-05 [4.17E-04]	5.24E-05 [4.64E-04]	6.33E-05 [5.60E-04]	7.41E-05 [6.56E-04]	8.49E-05 [7.51E-04]
Carriage Weight	kg [lbs]	1.7 [3.75]						
Motor		DC Servo						
Table Top	kg [lbs]	0.51 [1.13]						
Encoder		Incremental, Attached to ball screw, 1000 lines/rev (0.004mm [1.57E-04 in] resolution @ 16mm [0.63 in] lead)						
Limit Sensors		Forward & Reverse						
Ball screw		16 mm [0.63 in] lead						
Max. Thrust[3]	N [lbf]	330 [74.19]						
Payload Capacity[2,4]	Kg [lbs]	40 [88.18]						
Moment Capacity[5,6]	Nm [lbf-ft]	M_{pitch} 128 [94.41], M_{yaw} 80 [59.00], M_{roll} 128 [94.41]						
Motor Torque Constant	Nm/amp [lbf-ft/amp]	0.081 [0.060]						
Motor Back EMF Constant	V/Krpm	9.5						
Motor Resistance	Ohms	0.47						
Motor Inductance	mH	0.61						



Notes:
1 - At 48 volts & 6.9 amps.
2 - At max payload rating & acceleration of 0.5G over full travel of a single axis in a horizontal orientation. Actual maximum speed governed by maximum acceleration, travel distance, and ball screw critical speed.
3 - At speed of 50mm/sec for 1 second.
4 - For uniformly distributed load on carriage with CG no more than 220mm above carriage & base affixed to a flat, rigid frame.
5 - Payload capacity not to be exceeded. Combined moment loads due to acceleration/deceleration of offset loads & static moment loads must be less than the rated moment capacity. Moment directions (Diagram)
6 - Refer to Loading Specification on Page 12

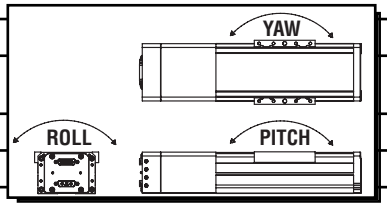
Stroke	100mm	200mm	300mm	400mm	600mm	800mm	1000mm
A	405 [15.94]	505 [19.80]	605 [23.82]	705 [27.76]	905 [35.63]	1105 [43.50]	1305 [51.38]
B	255 [10.04]	355 [13.98]	455 [17.91]	555 [21.85]	755 [29.72]	955 [37.60]	1155 [45.47]
C	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	600 [23.62]	800 [31.50]	1000 [39.37]
D	0	0	0	1	1	2	3
E	0	0	1	1	2	2	3
F	8	8	10	12	14	16	20



See Pages 25 - 27 for Ordering Instructions

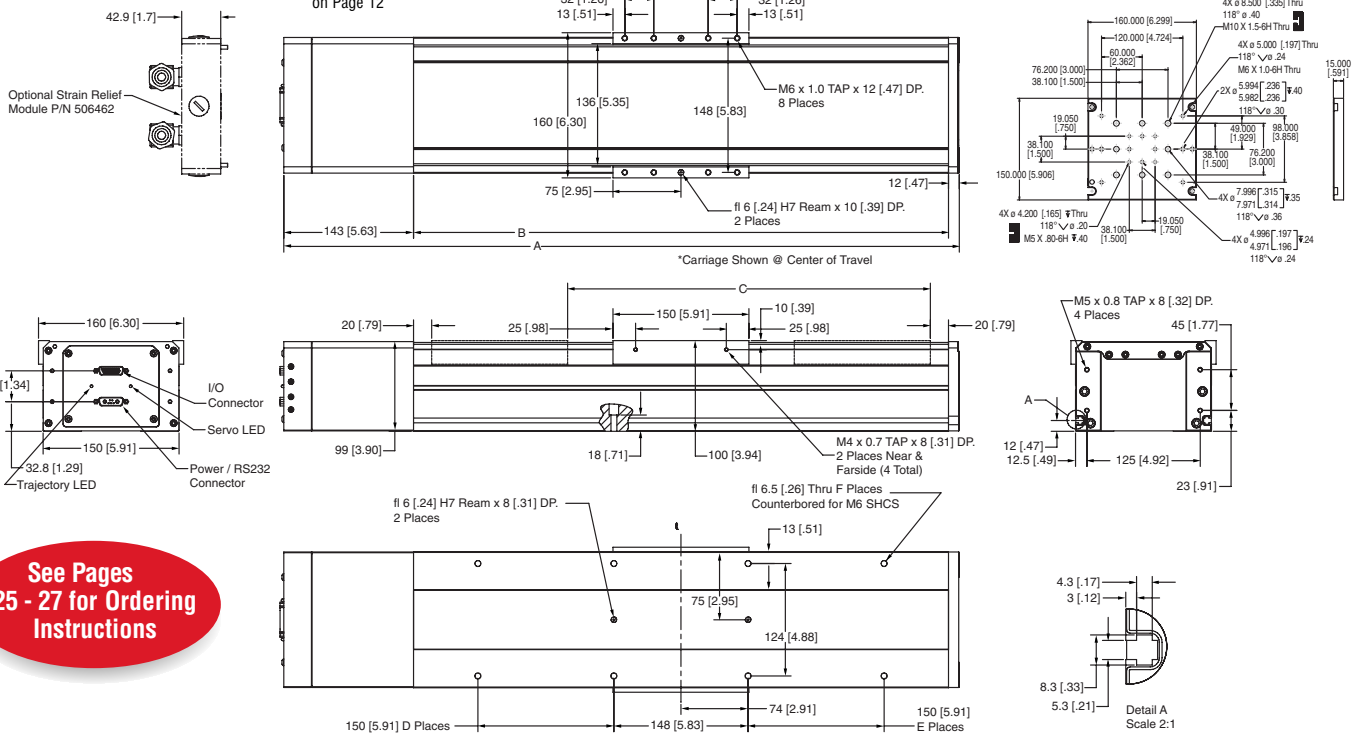
Model SLA150

Stroke	mm [in]	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	600 [23.62]	800 [31.49]	1000 [39.37]	1200 [47.24]	1400 [55.12]
Rated Power[1]	W [hp]	420 [0.56]								
Max. Speed[2,4]	mm/sec [in/sec]	700 [27.56]	950 [37.40]	1100 [43.31]	1100 [43.31]	1100 [43.31]	800 [31.50]	600 [23.62]	450 [17.72]	320 [12.60]
Max. Acceleration	G	0.5								
Rated Thrust	N [lbf]	330 [74.19]								
Repeatability	mm [in]	±.02 [0.0008]								
Unit Weight	kg [lbs]	13.2 [29.10]	16.3 [35.94]	18.5 [40.78]	20.8 [45.86]	25.2 [55.56]	27.3 [60.19]	34.2 [75.40]	38.7 [85.32]	43.1 [95.02]
Ball screw Inertia	kg-m² [in-lbf-sec²]	1.79E-04 [1.58E-03]	1.92E-04 [1.70E-03]	2.06E-04 [1.82E-03]	2.19E-04 [1.94E-03]	2.45E-04 [2.17E-03]	2.72E-04 [2.41E-03]	2.98E-04 [2.64E-03]	3.24E-04 [2.87E-03]	3.51E-04 [3.11E-03]
Carriage Weight	kg [lbs]	2.9 [6.39]								
Table Top	kg [lbs]	0.91 [2.01]								
Motor		DC Servo								
Encoder		Incremental, Attached to ball screw, 1000 lines/rev (0.005mm [1.97E-04 in] resolution @ 20mm [0.79 in] lead)								
Limit Sensors		Forward & Reverse								
Ball screw		20 mm [0.79 in] lead								
Max. Thrust[3]	N [lbf]	500 [112.40]								
Payload Capacity[4]	Kg [lbs]	70 [154.32]								
Moment Capacity[5,6]	Nm [lbf-ft]	M_{pitch} 280 [206.52], M_{yaw} 189 [139.40], M_{roll} 280 [206.52]								
Motor Torque Constant	Nm/amp [lb-ft/amp]	0.10 [0.074]								
Motor Back EMF Constant	V/Krpm	11.6								
Motor Resistance	Ohms	0.15								
Motor Inductance	mH	0.50								



Notes:
1 - At 48 volts & 6.9 amps.
2 - At max payload rating & acceleration of 0.5G over full travel of a single axis in a horizontal orientation. Actual maximum speed governed by maximum acceleration, travel distance, and ball screw critical speed.
3 - At speed of 50mm/sec for 1 second.
4 - For uniformly distributed load on carriage with CG no more than 220mm above carriage & base affixed to a flat, rigid frame.
5 - Payload capacity not to be exceeded. Combined moment loads due to acceleration/ deceleration of offset loads & static moment loads must be less than the rated moment capacity. Moment directions (Diagram)
6 - Refer to Loading Specification on Page 12

Stroke	100mm	200mm	300mm	400mm	600mm	800mm	1000mm	1200mm	1400mm
A	445 [17.52]	545 [21.46]	645 [25.39]	745 [29.33]	945 [37.20]	1145 [45.08]	1345 [52.95]	1545 [60.83]	1745 [68.70]
B	290 [11.42]	390 [15.35]	490 [19.29]	590 [23.23]	790 [31.10]	990 [38.98]	1190 [46.85]	1390 [54.72]	1590 [62.60]
C	100 [3.94]	200 [7.87]	300 [11.81]	400 [15.75]	600 [23.62]	800 [31.50]	1000 [39.37]	1200 [47.24]	1400 [55.12]
D	0	0	1	1	2	2	3	4	4
E	0	0	1	1	2	2	3	4	4
F	4	4	8	8	12	12	16	20	20



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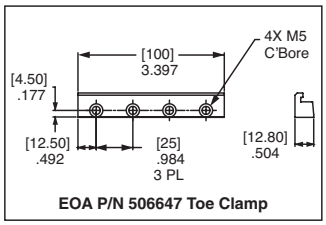
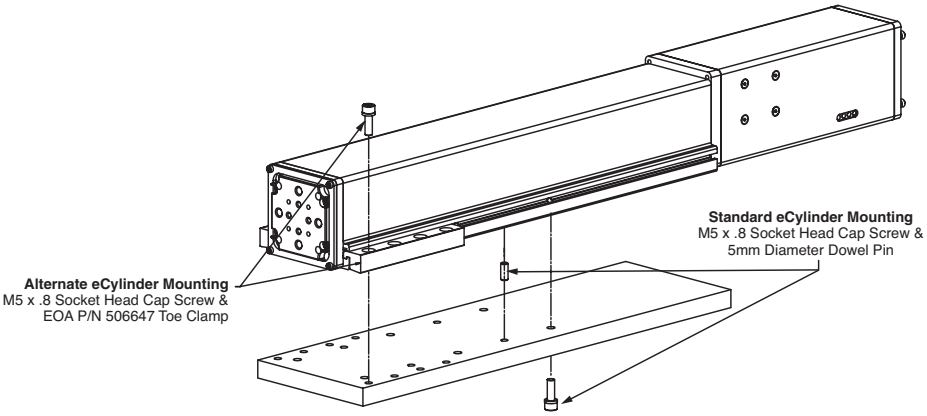
eCYLINDER™

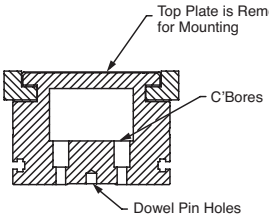


EOA P/N 506647 Toe Clamp

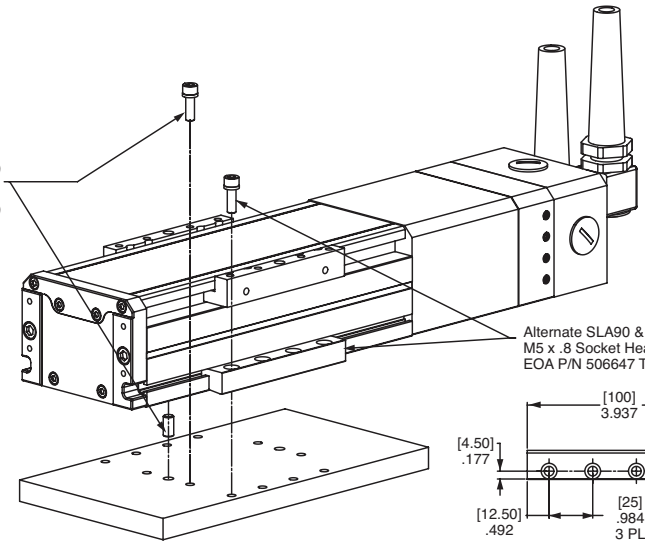


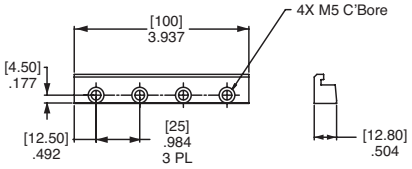
SLA

Standard SLA Mounting
- M5 x .8 Socket Head Cap Screws for SLA90 & SLA120
- M6 x 1.0 & Socket Head Cap Screws for SLA150
- 6mm Dowel Pins for SLA90, SLA120 & SLA150



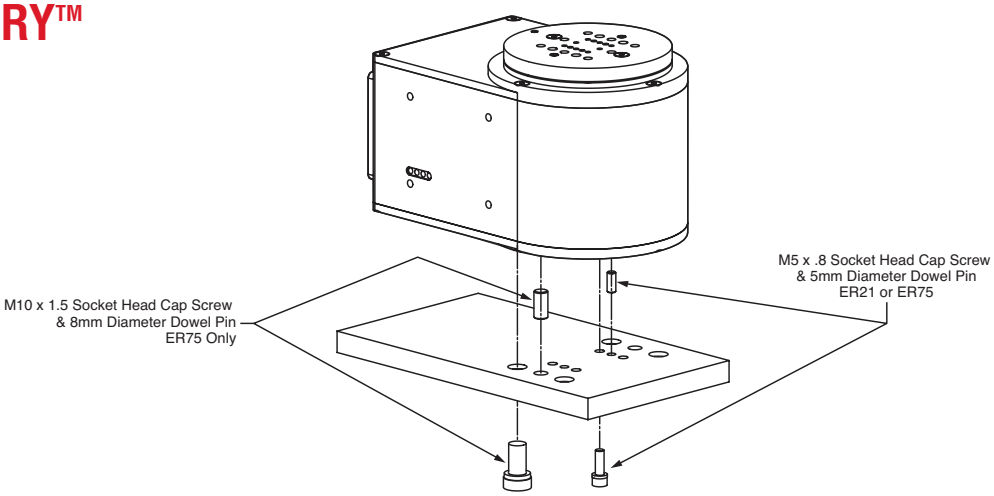
SLA Standard Mounting
Cross Section





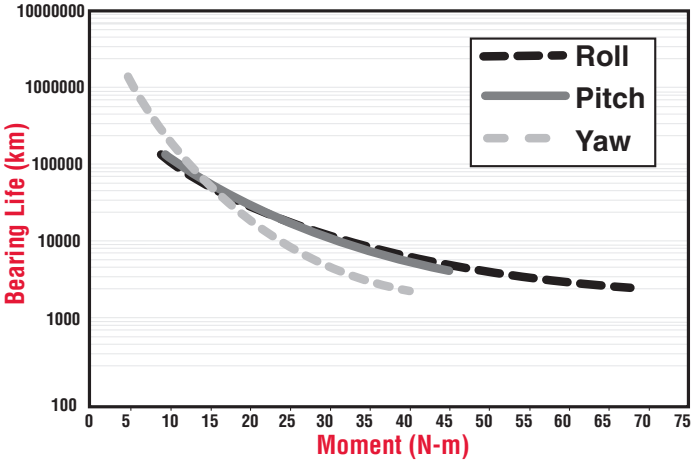
EOA P/N 506647 Toe Clamp

eROTARY™

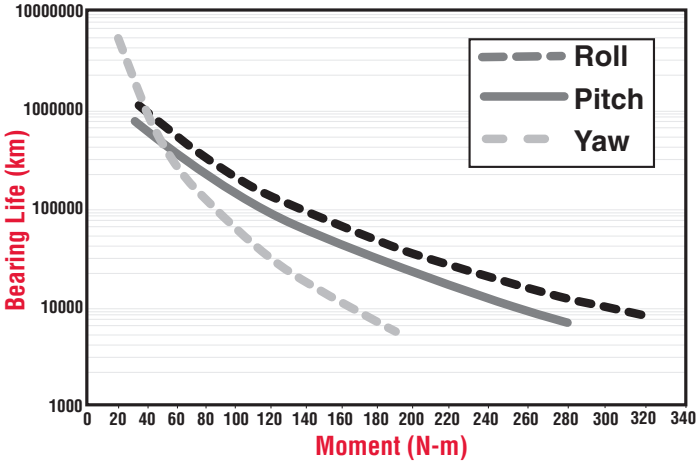


Loading Specifications

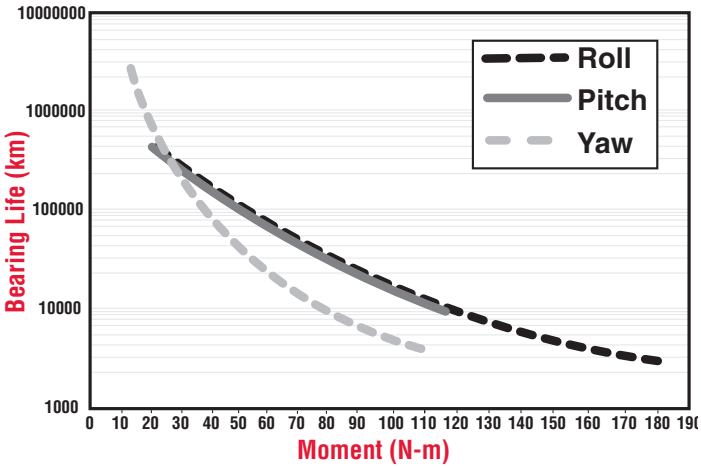
SLA90 Moment vs. Bearing Life

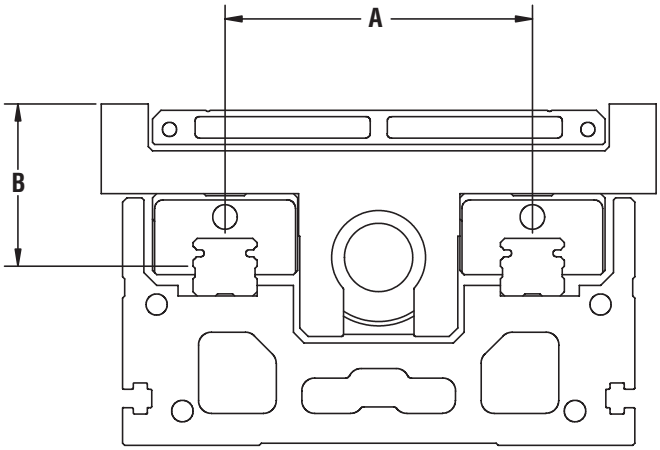


SLA150 Moment vs. Bearing Life



SLA120 Moment vs. Bearing Life





	SLA90 (mm[in])	SLA120 (mm[in])	SLA150 (mm[in])
A = Bearing rail center lateral spacing	58 [2.28]	72 [2.83]	92 [3.62]
B = Rail center-to-carriage mounting surface	25 [0.98]	38 [1.50]	43 [1.69]
Bearing block center-to-center longitudinal spacing (not shown)	50 [1.97]	70 [2.76]	78 [3.07]

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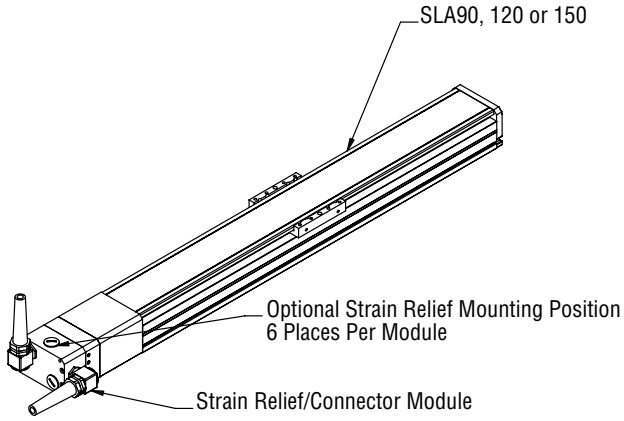
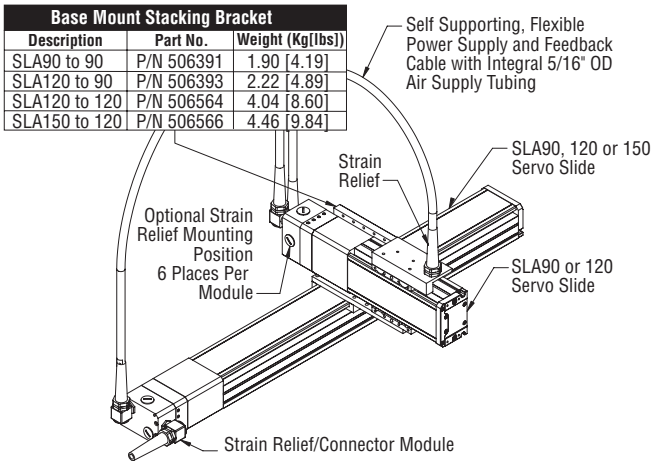
SLA Modular Automation System Configurations

Stand-Alone SLA Servo Slide



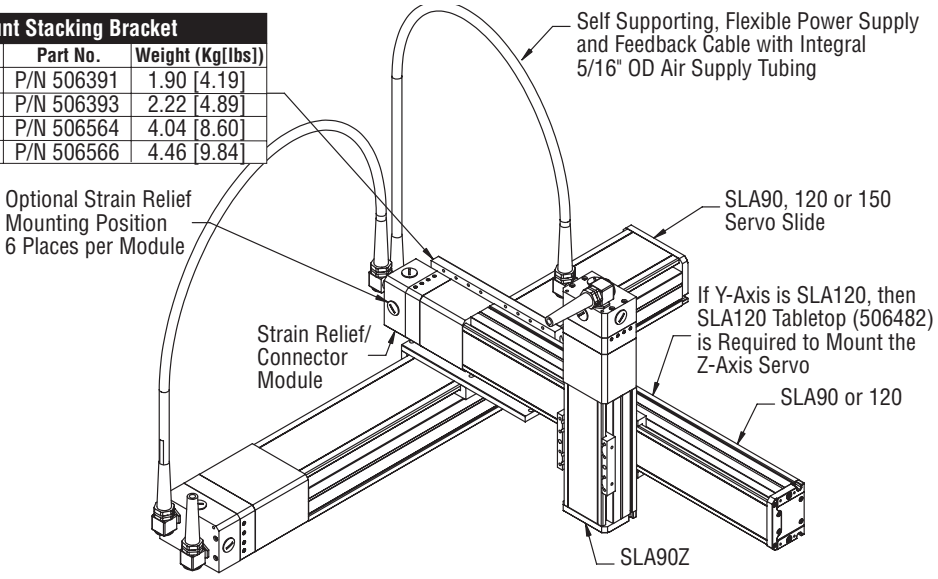
XY Servo, Y Base Affixed No End Effector

Base Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]



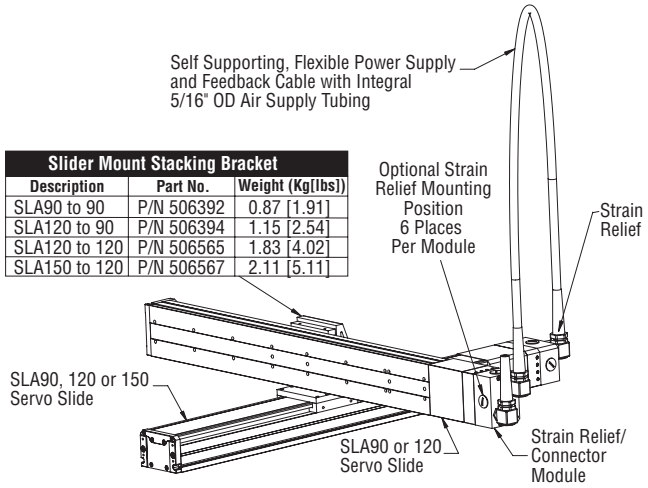
XYZ Servo, Y and Z Base Affixed No End Effector

Base Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]



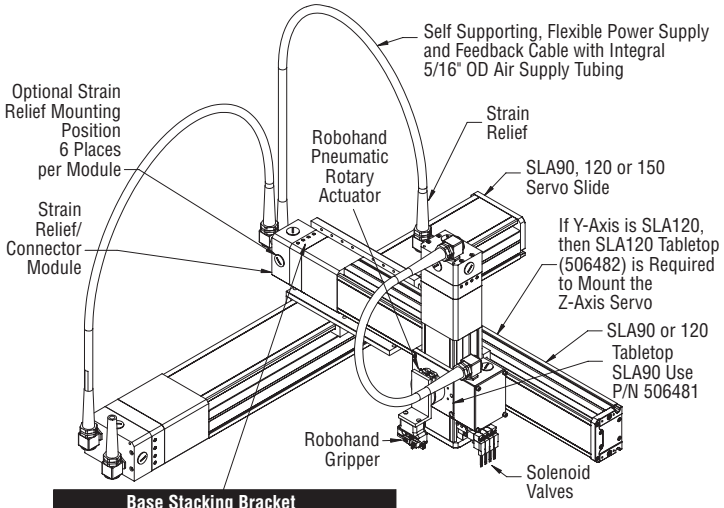
System Configurations

XY Servo, Slider Affixed No End Effector



Slider Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506392	0.87 [1.91]
SLA120 to 90	P/N 506394	1.15 [2.54]
SLA120 to 120	P/N 506565	1.83 [4.02]
SLA150 to 120	P/N 506567	2.11 [5.11]

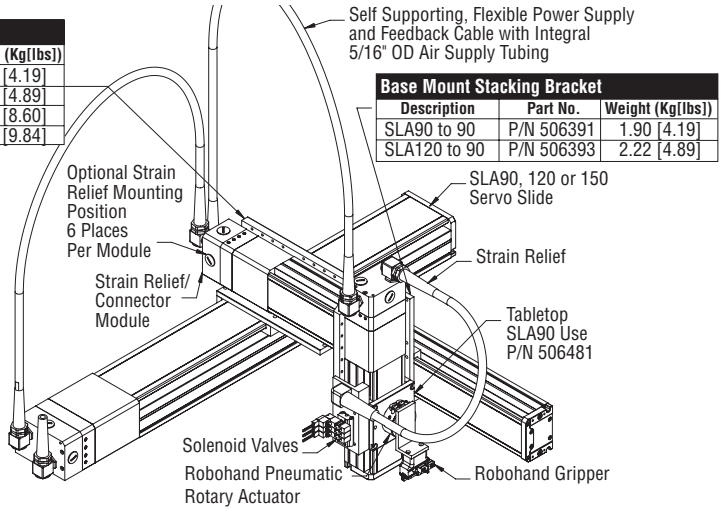
XYZ Servo, Y and Z Base Affixed With End Effector and Rotary



Base Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]

XYZ Servo, Y and Z Base Affixed With End Effector and Rotary

Base Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]



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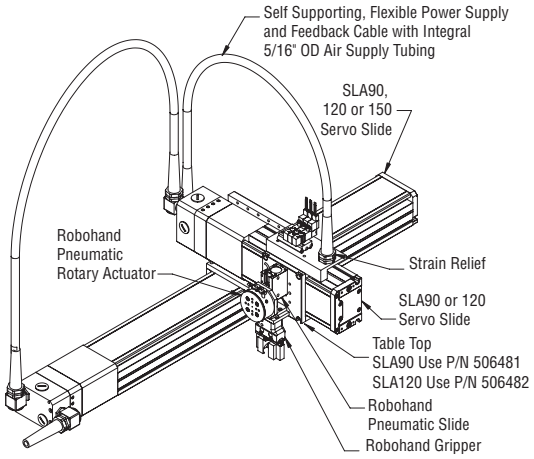
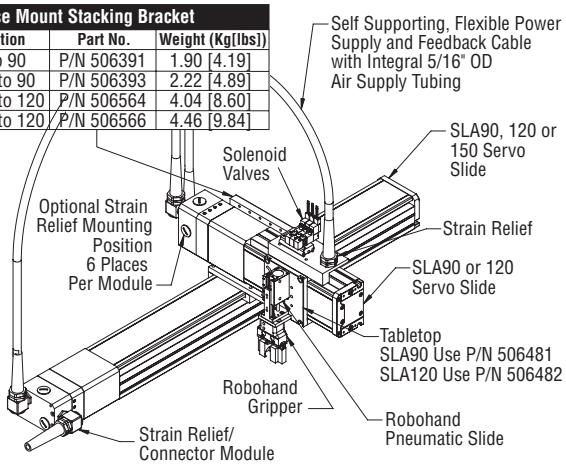
XY Servo, Z Pneumatic, Y Base Affixed With End Effector and Rotary



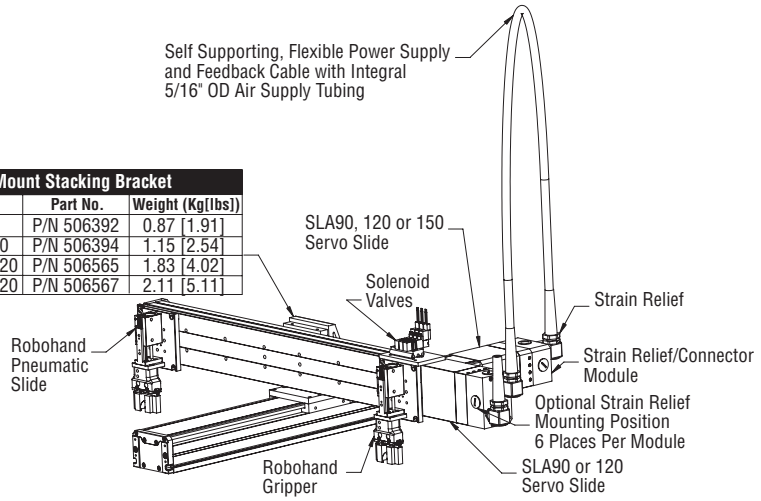
XY Servo, Z Pneumatic Y Base Affixed With End Effector

Base Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]



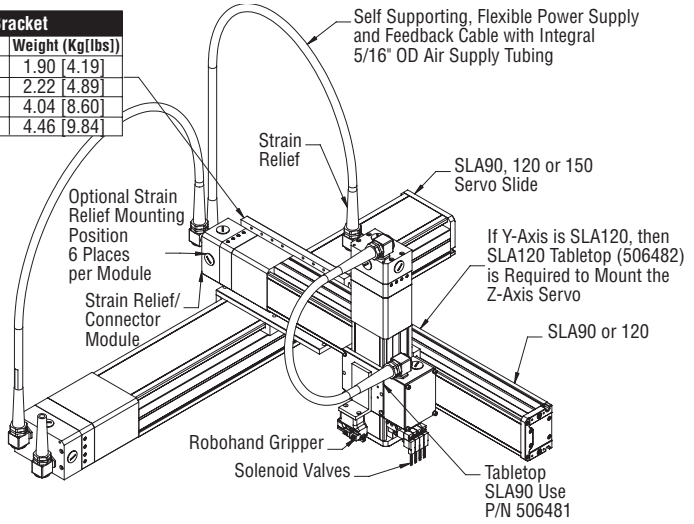
XY Servo, Z Pneumatic, Slider Affixed With End Effector

Slider Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506392	0.87 [1.91]
SLA120 to 90	P/N 506394	1.15 [2.54]
SLA120 to 120	P/N 506565	1.83 [4.02]
SLA150 to 120	P/N 506567	2.11 [5.11]

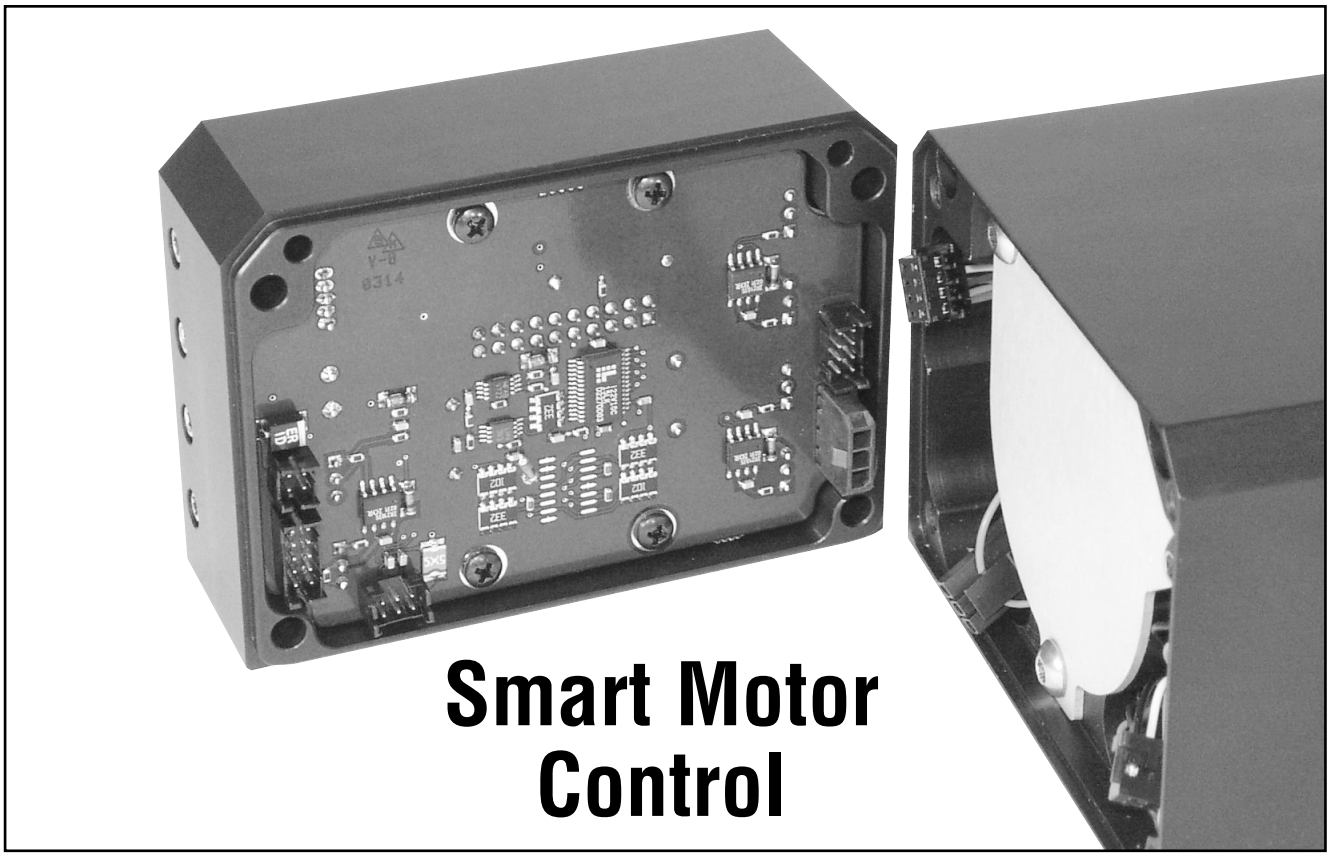


XYZ Servo, Base Affixed With End Effector

Base Mount Stacking Bracket		
Description	Part No.	Weight (Kg[lbs])
SLA90 to 90	P/N 506391	1.90 [4.19]
SLA120 to 90	P/N 506393	2.22 [4.89]
SLA120 to 120	P/N 506564	4.04 [8.60]
SLA150 to 120	P/N 506566	4.46 [9.84]



Control Overview



Smart Motor Control

Outputs: 6 24V @ .3 A sourcing

Inputs: 12 24V sourcing

Brushless DC Motor Control

- SLA-90: 48VDC, 10A peak, 5A cont
- SLA-120: 48VDC, 20A peak, 10A cont
- SLA-150: 48VDC, 20A peak, 10A cont

Minimum System Requirements
(If supplying your own PC controller)

- Windows 2000 or XP
- 500 mhz
- One (1) RS-232 Port
  (USB to Serial Adapter Recommended)

Control is integral to the slides

- Full Servo Control: Position, velocity and torque modes
- Program Flow: Run, goto, while, if then else switch, wait
- System State: Motor off, temperature, position error, index, communication, limits, math error
- Variables: Arrays, EEPROM, integers, characters (25 variables total)
- PID Filter Control: KP, KI, KD, KL, F, E, KG, KV, KA, KS, KGON, KGOFF, AMPS
- Monitor Motor Status: Position, velocity, acceleration, index, position error, overhead, error, limit switches
- Report Status: All variables, all buffered values, position, acceleration, program, counters, limit switch, trajectory, errors, overheat, history, index, overflow, amps
- Download programs to the motors from Robohand software
- Tune motors using a tuning utility. Run the tuner. Upload/download values

SLA Servo Slide "Smart Motor" Technology eliminates the need for an external controller in many applications

Application	External PC Control Unit Required?
One-axis motion	No
2- or 3-axis "Point-to-Point" synchronized motion	No
2- or 3-axis "Precision" synchronized motion	Yes

SLA PC Control Unit

For Coordinated Motion Applications

Features

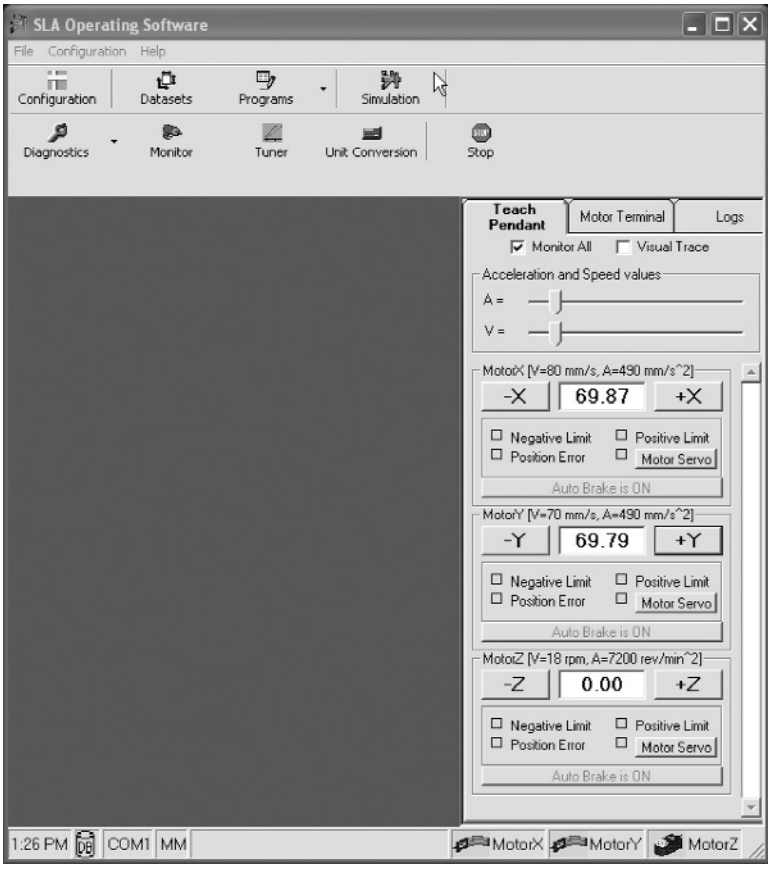
- PC on a card controller
- Multi-tasking programming capability
- Networking capability via ethernet
- Arcs, tangents, circular interpolated motion, and position are unaffected by changes in velocity
- Industrial PC designed for use in a panel
- Rack mount enclosure

Specifications

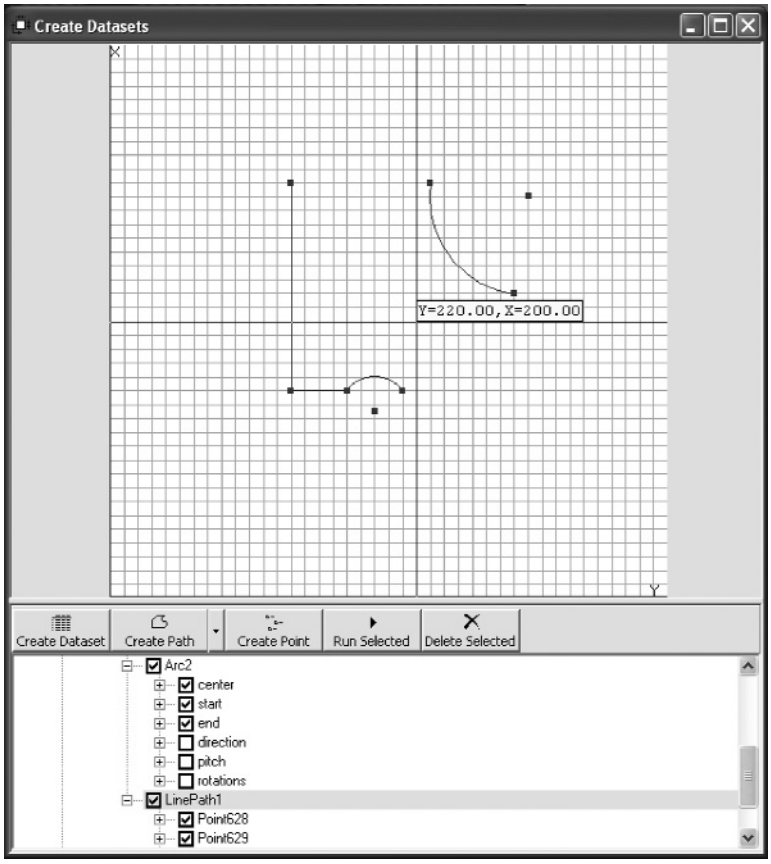
- Runs on Windows 98, NT, 2000 or XP
- 800 Mhz CPU, 128k cache memory
- 40 GB hard drive
- 128 MB RAM
- Mouse and keyboard jacks
- Floppy connector
- 10/100 Mbs Ethernet
- Two RS-232 ports
- Parallel printer port
- 2 USB ports
- Power Requirements: 2.3 A @ +5V; 0.8 A @ 12V
- Temperature: 0 - 60°C (32 - 140°F)
- Dimensions: 7.5" W x 4.5" D x 3.875" H

How to Program

SLA is easy to program through a wide range of popular methods. PC-based programming software is included with each purchase.



Teach Pendant Programming



Program by Graphically Drawing the Path or Points

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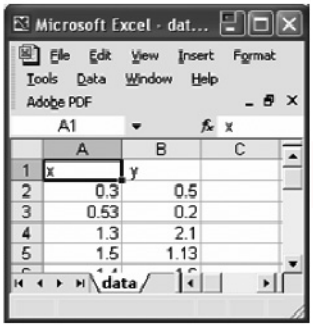
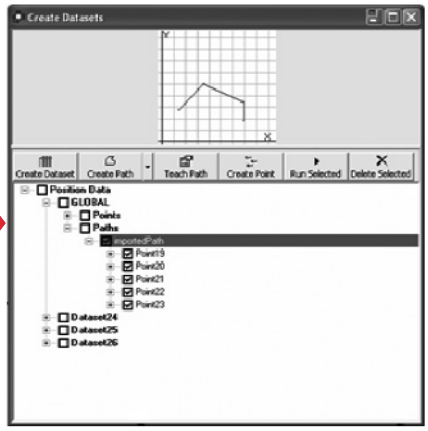
Import Data Files

Spreadsheet Programming

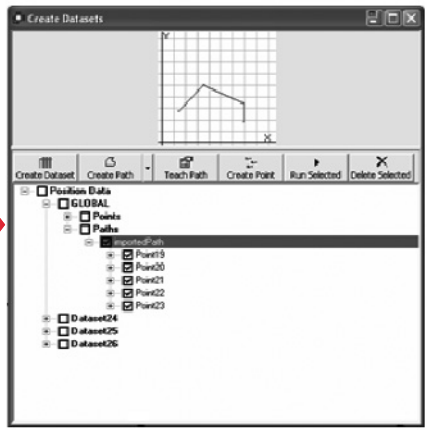
XLS





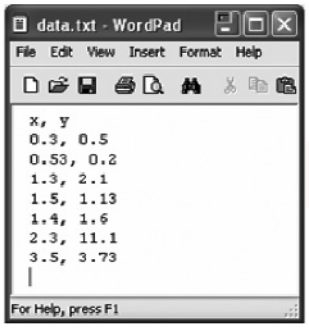
Program by Importing a DXF File

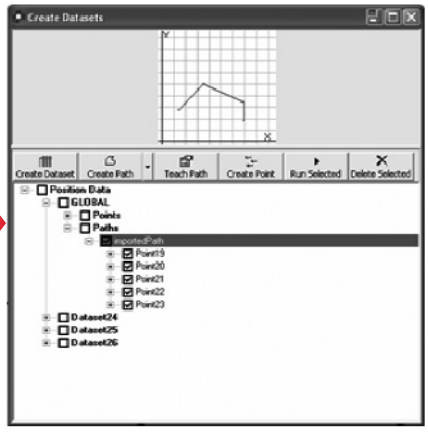
DXF



Program in CSV Format

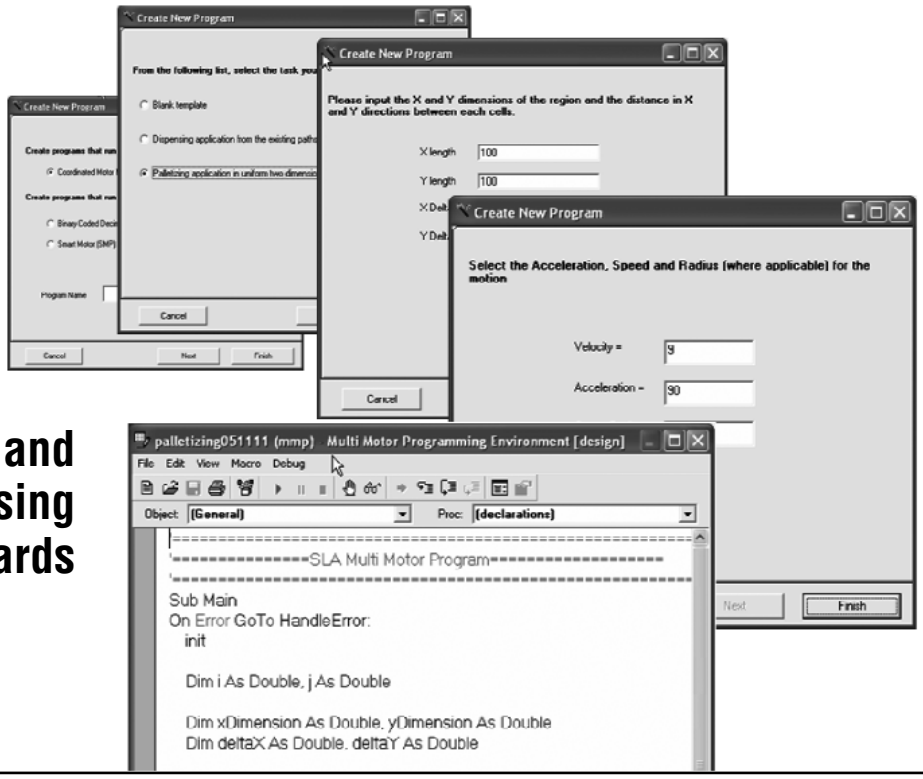
CSV



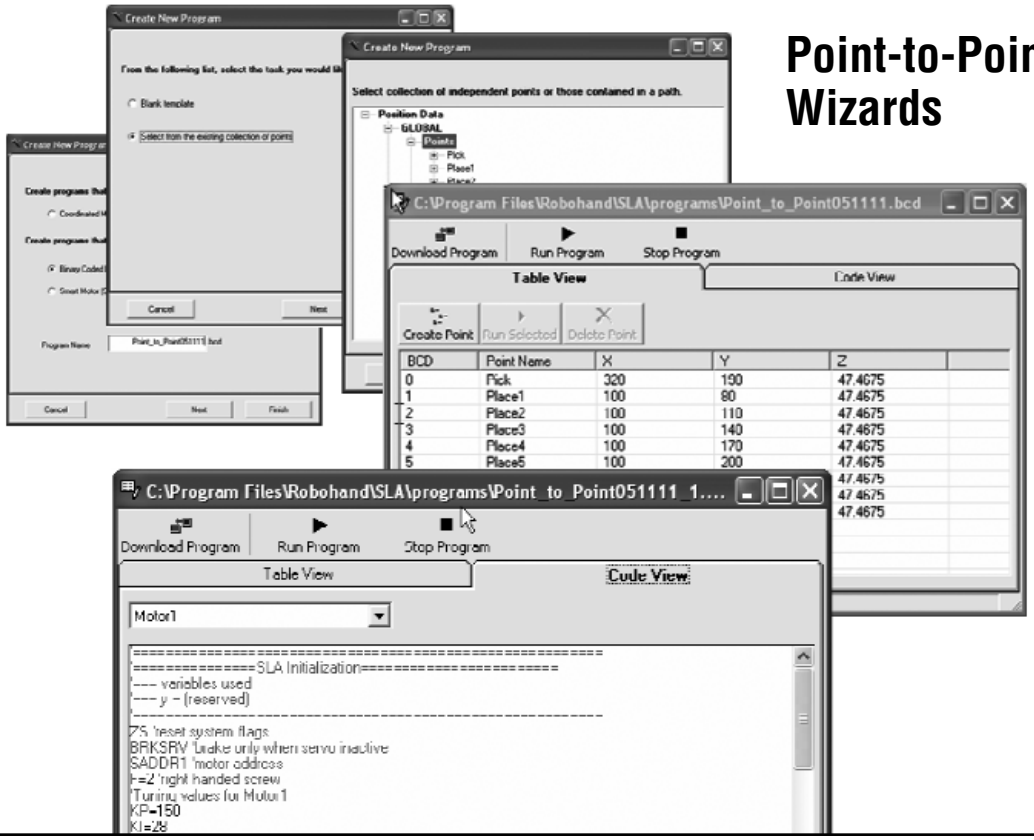


Note: *SLA's modular architecture supports adding other formats in the future*

Wizards to Automate Programming



Palletizing and Dispensing Wizards



Point-to-Point Wizards

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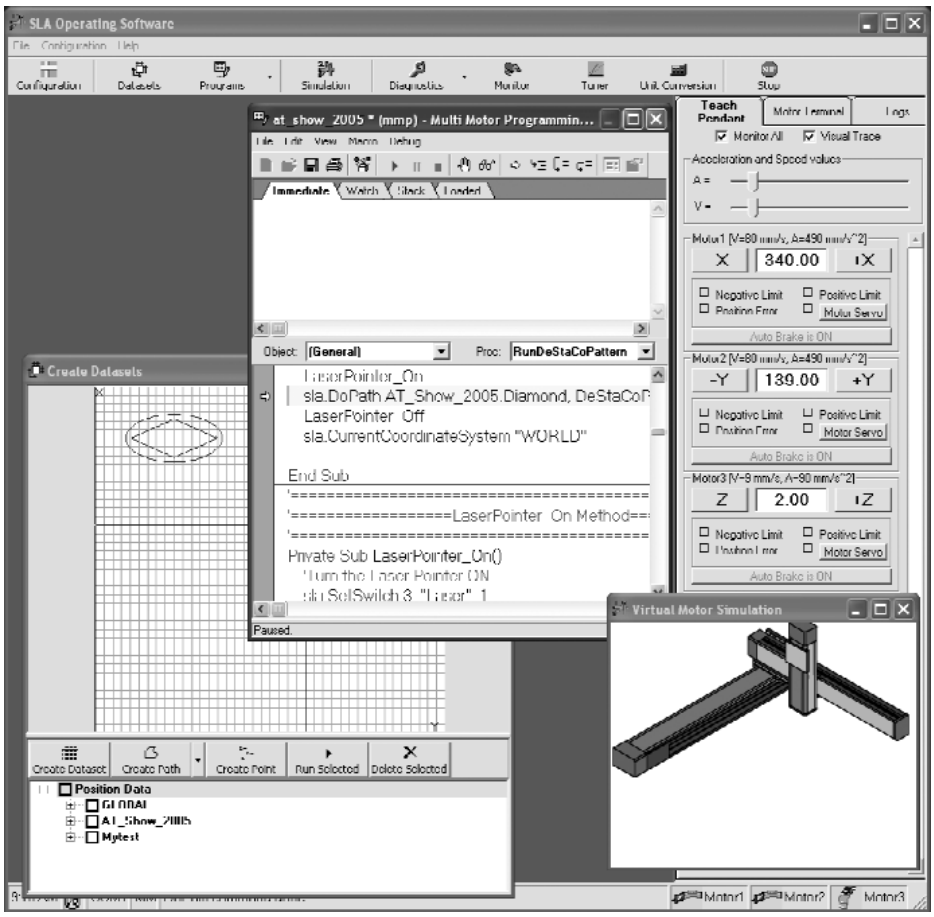
SLA Simulation Feature

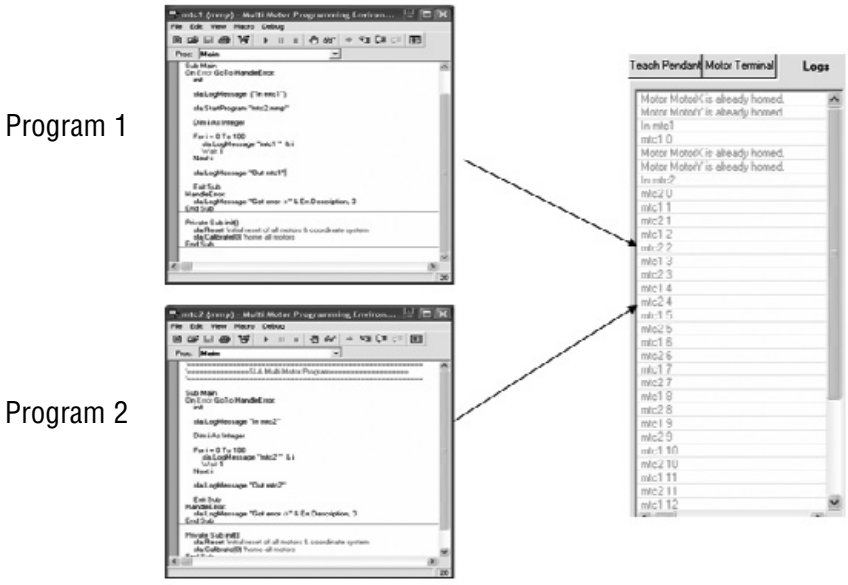
Virtual Motor Simulation

- Write, test and simulate an SLA program without the SLA slide
- Allows faster integration of the SLA System because programs can be written and tested prior to arrival of the SLA System

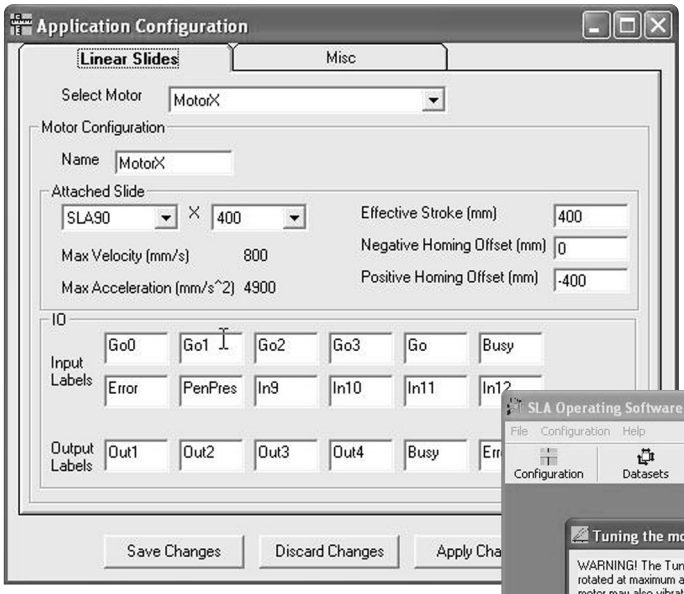


Multi-Task to Communicate with Peripheral Devices

- Allows multiple programs to run concurrently
- Allows synchronizing other devices to work simultaneously with SLA
- Allows efficient usage of resources with parallel processing

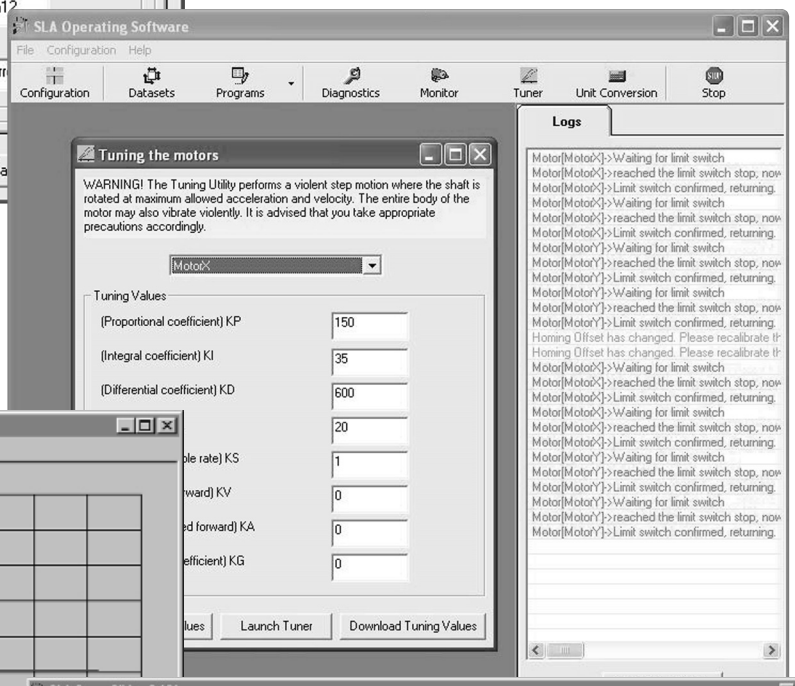


Monitoring, I/O Status and Error Reporting



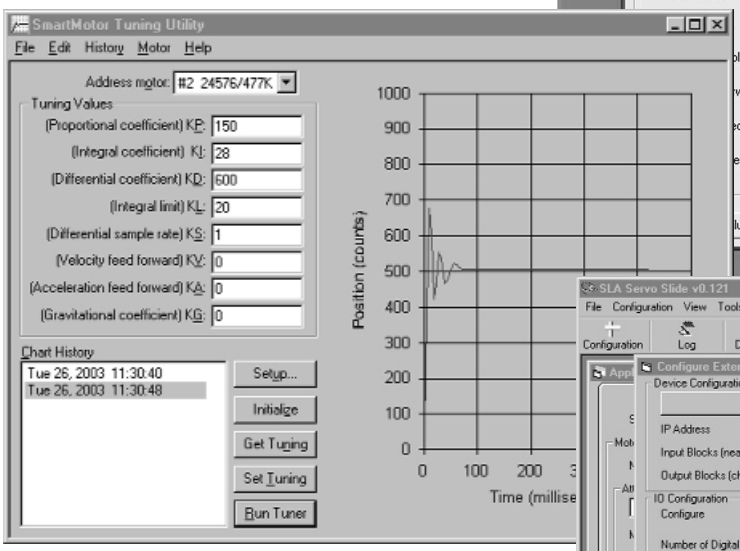
Each motor can be configured for:

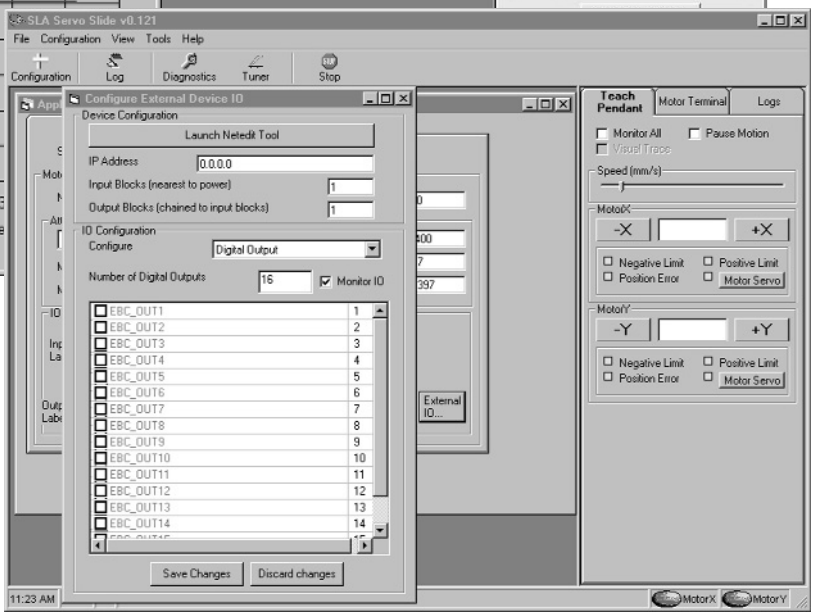
- Model and stroke length
- Default acceleration
- Positive and negative homing offsets
- Assign names to inputs and outputs
- Up to 12 inputs and 6 outputs available for each motor
- I/O names are editable



Tune Motor

Motor control parameters for each motor can be viewed, modified and tested





Optional External I/O Module:

- Ethernet connection
- I/O controlled directly from SLA PC control unit
- Available in both NPN and PNP types
- I/O blocks are expandable
- Comes in groups of 16 I/O

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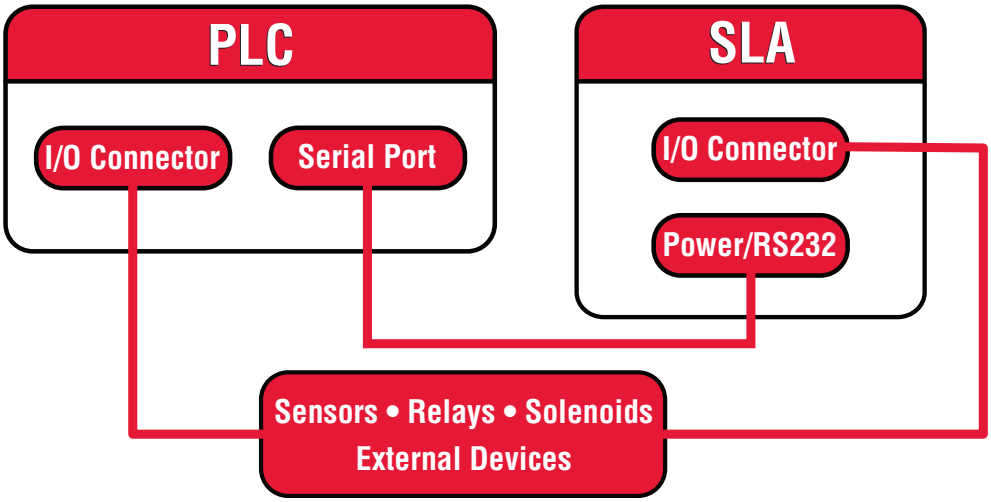
Applications Running Under PLC Control

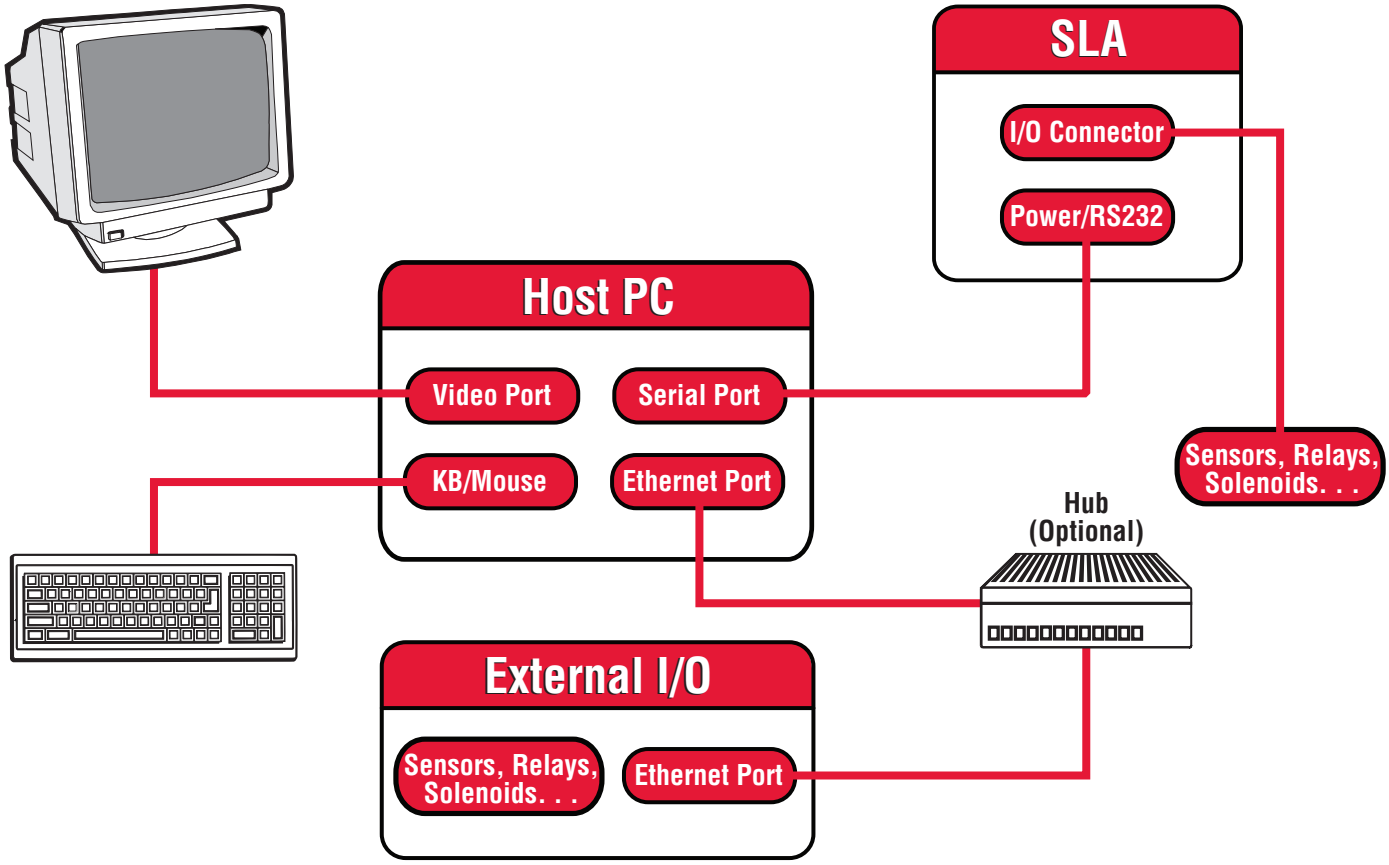
(BCD/SMP Mode)



- Programs are developed with SLA Servo Slide software and downloaded to smart motors
- Program resides only in smart motors. Up to 32k of memory is available for user programs (approximately 2,000 lines of code)
- Synchronized lines, synchronized paths. Smart motors monitor discrete signals from a PLC and act when discrete I/O changes occur
- Run user-written programs using on-board smart motor programs and I/O
- PLC Control: Point-to-Point, use PLC I/O to control slides and grippers
- Move to a position taught by leading the slide to the point by hand
- Move to one of 100 user-defined positions available for point-to-point applications

Software upgrades
are available for downloading at
www.Robohandsla.com

Applications Running Under Host PC



- Uses Basic Language for full programmability of program flow and slide motion
- Coordinated Motion: lines, arcs, circles, path following
- Path following via lead-through points
- Move to positions taught by entering numbers or lead-through
- Lead-through teaching of paths and points
- Manually drag robot through paths. Recall these paths or points by name in the Basic program
- Communicate to HMI, Vision System or other user-control devices

Installing SLA OS Software

To install the software:

1. Close all programs including any copy of SLA OS Software.
2. If you have a previous copy of the software installed, uninstall it before installing the new version. (note: Older versions (before v1.2) require backing up of database located in "C:\Program Files\Robohand\SLA\data\data.mdb" in a safe location.) To uninstall the previous version, open Control Panel, click on 'Add or Remove Programs', click on 'SLA Operating Software' and follow the instructions for removing the software.
3. Double click on the installation setup.exe file. The installation wizard will lead through the steps for installation.
4. If you had to backup the database in earlier step, copy the database back in the original location.
5. Once the software is installed, it will create shortcuts on the Desktop as well as create additional menu items in the program menu accessible from standard Windows Start menu.

Quick Start

Quick Introduction to Configuration of SLA OS

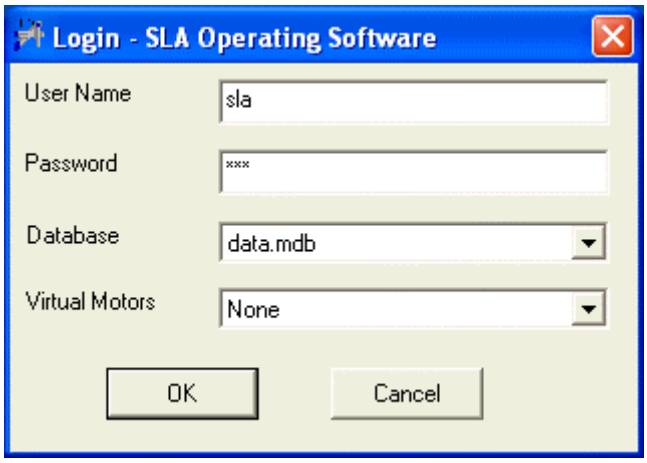
This section is designed for a quick introduction to the SLA OS by showing how easy it is to write useful programs to get the results you want. It shows examples of three different types of programs:

1. **Multi Motor Program (MMP)** - can handle most applications with its inbuilt library of highly sophisticated commands. It runs from the (optional) SLA Control Unit.
2. **Smart Motor Program (SMP)** - runs in the motors (doesn't require SLA Control Unit) and can handle many of the less complex tasks.
3. **Binary Coded Decimal Program (BCD)** - type of simplified SMP program where PLC based controls can be used to send BCD numbers to the motors to go to pre programmed locations.

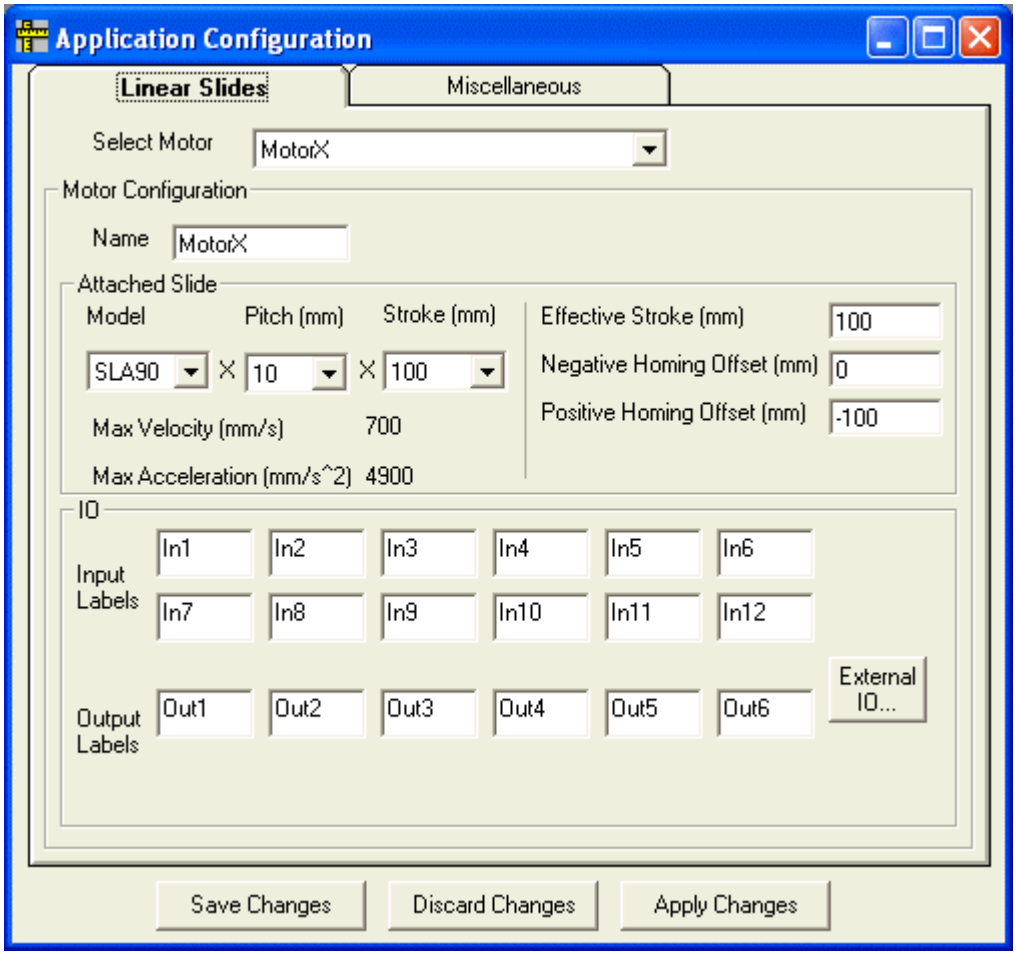
Before a program can be written the SLA OS software must be configured to match the settings of the slides configuration.

Quick Configuration

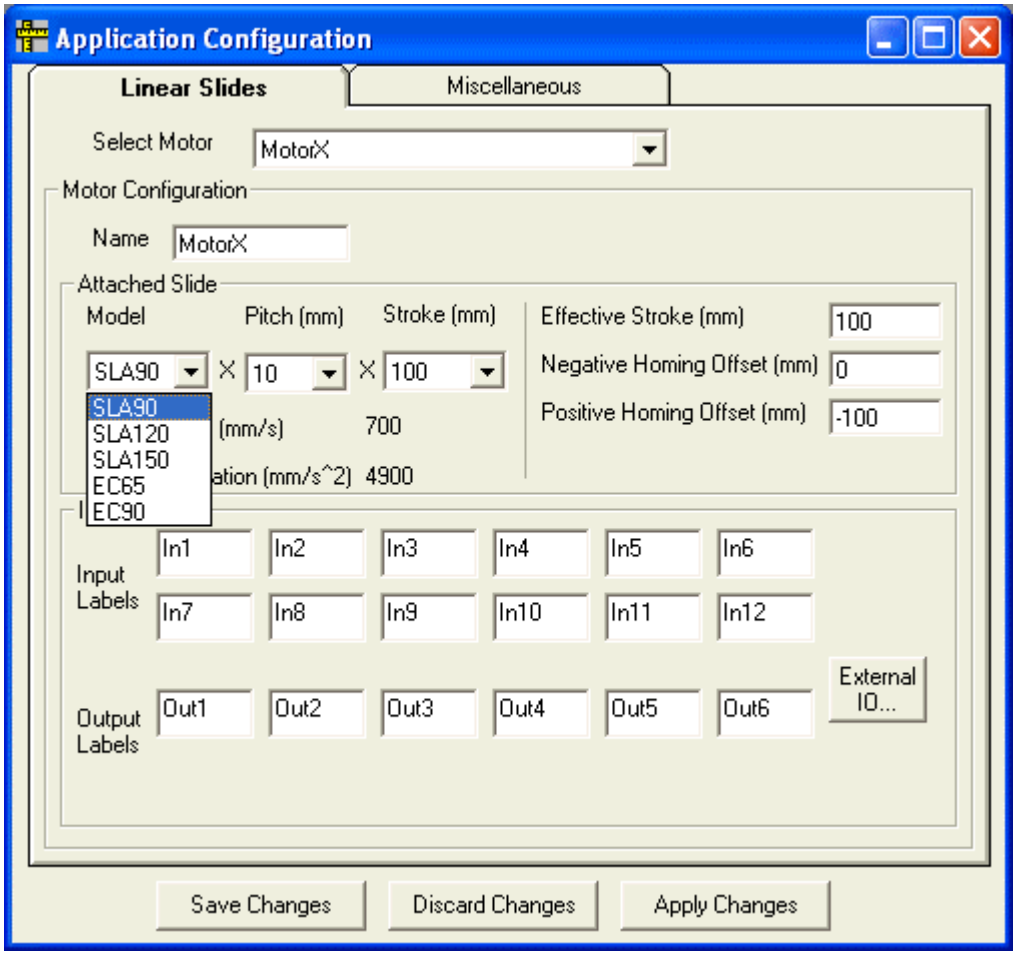
Once the SLA OS software is installed (it already comes pre-installed if you also ordered the SLA Control Unit), login with the user and password both as "sla" (in lowercase).



Click on the Configuration icon in the toolbar to open the following configuration screen.



Select the correct slide models and stroke lengths for each of the motors by clicking on the appropriate drop down combobox and saving the settings.



Once the system is configured, the following three sections show how to quickly write programs using the three mentioned program types.

1. **Multi Motor Program (MMP) Quick Start**
2. **Smart Motor Program (SMP) Quick Start**
3. **Binary Coded Decimal Program (BCD) Quick Start**

Later in the manual many of the advanced features will be discussed in more details to fully harness the power of SLA OS.

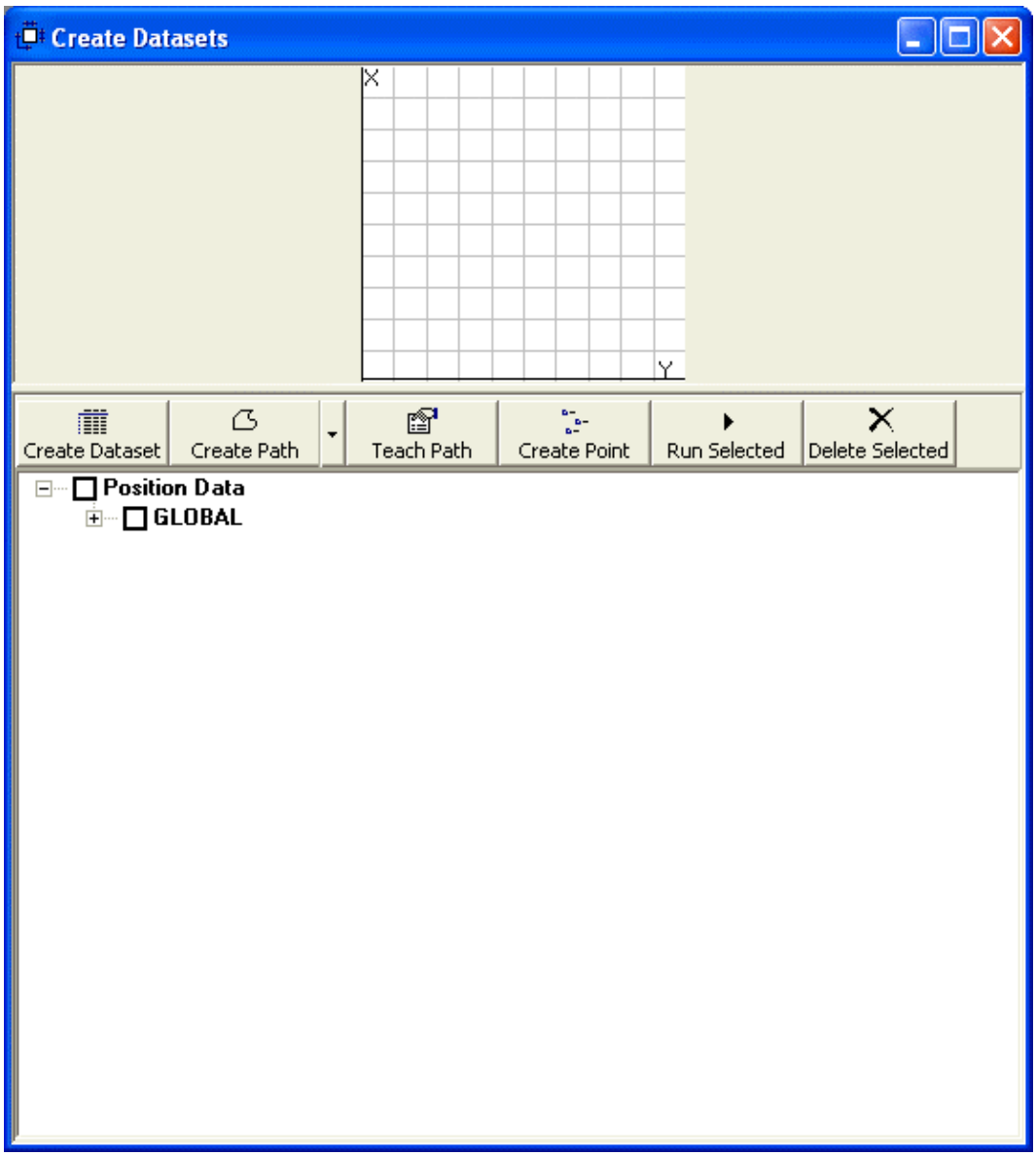
Quick Introduction to Multi Motor Programming with SLA OS

This section is designed for a quick introduction to Multi Motor Programming with SLA OS by writing a simple Multi Motor Program (MMP) for dispensing along a square shape of 60 mm side with rounded corners of radius 5 mm. The three main steps are

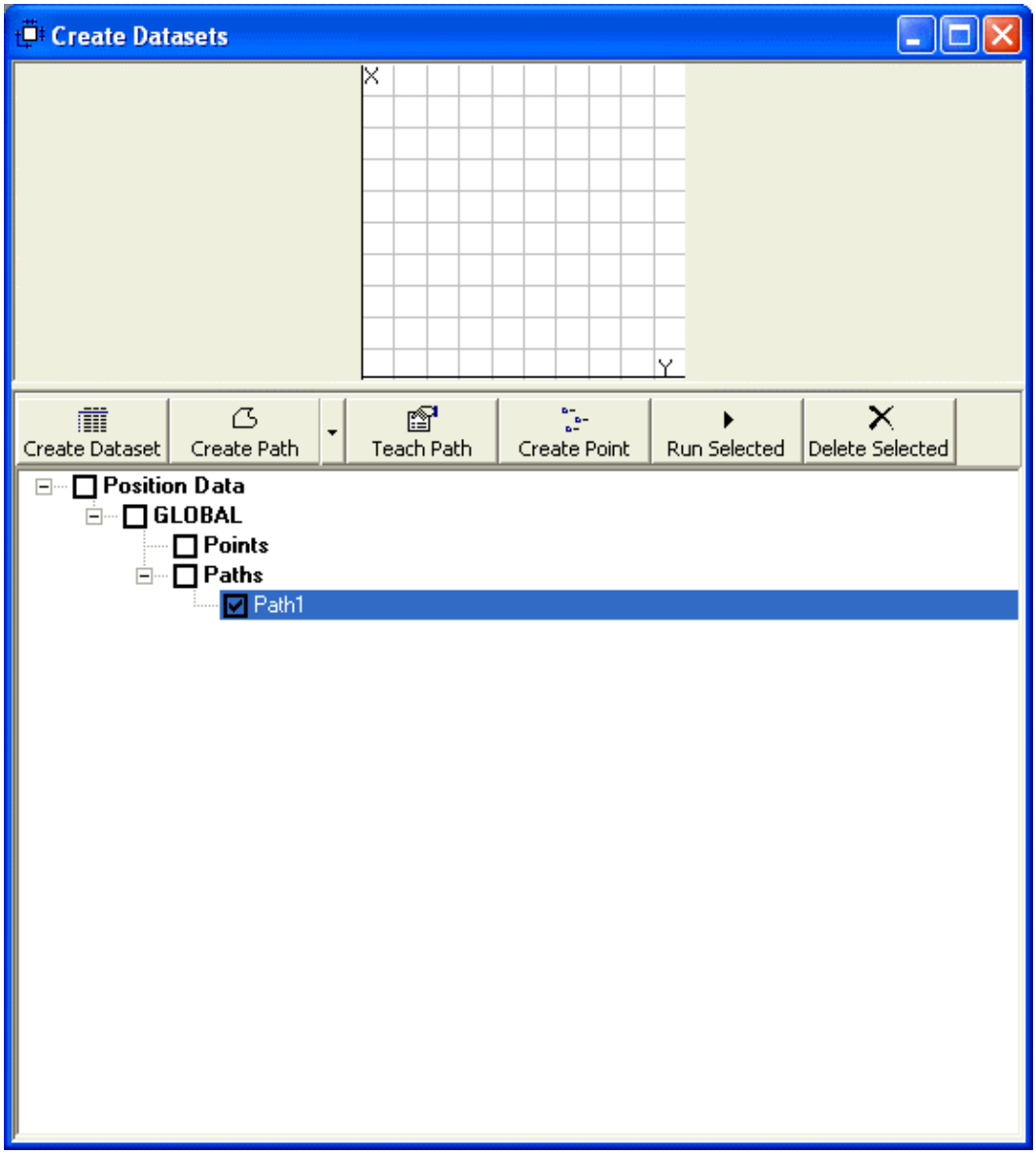
1. Position Data Creation
2. Programming
3. Results

Quick Position Data Creation

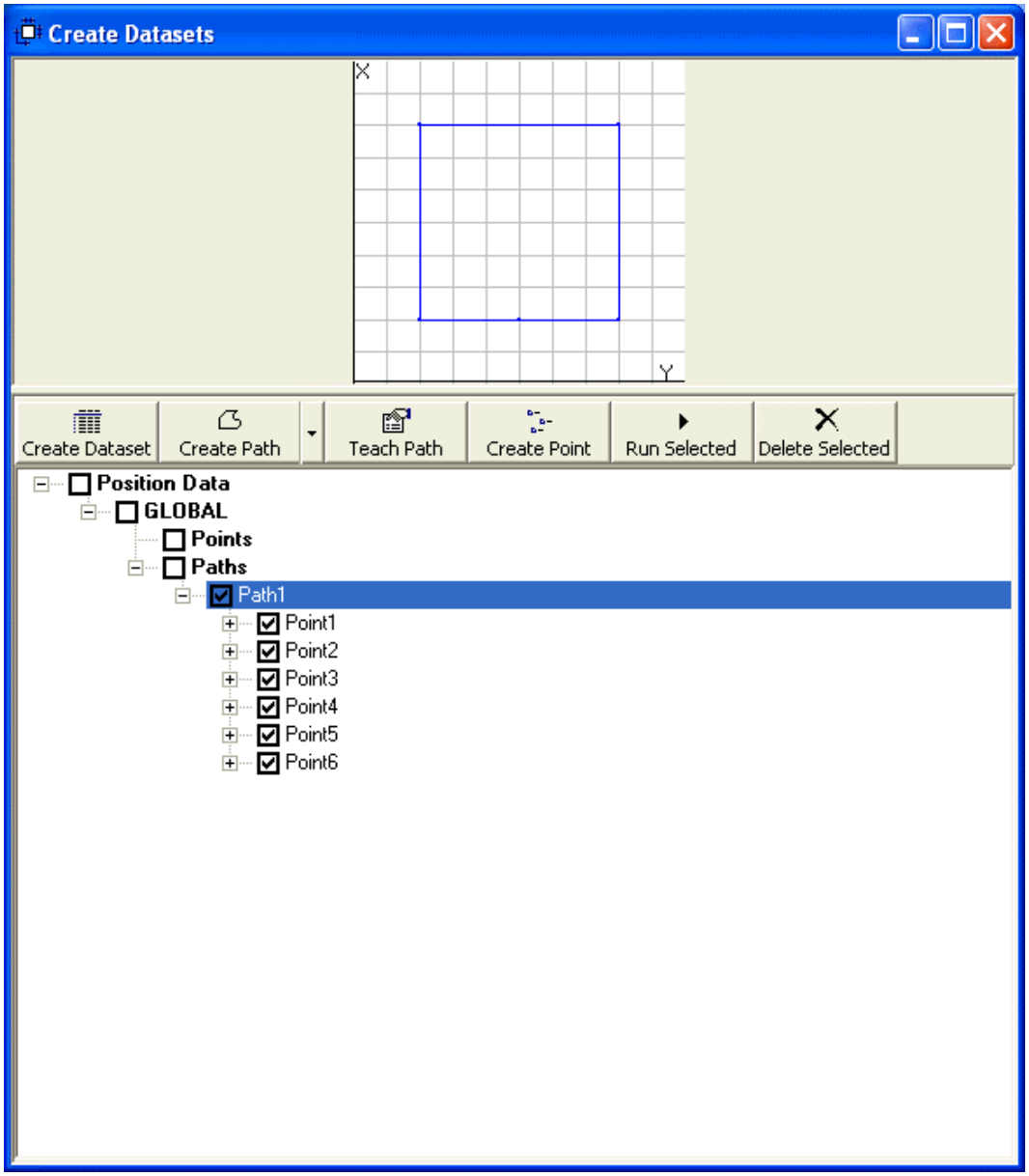
Click on the Datasets icon in the toolbar to open 'Create Datasets' screen.



Click on the 'Create Path' icon in the screen to create a new path for dispensing.

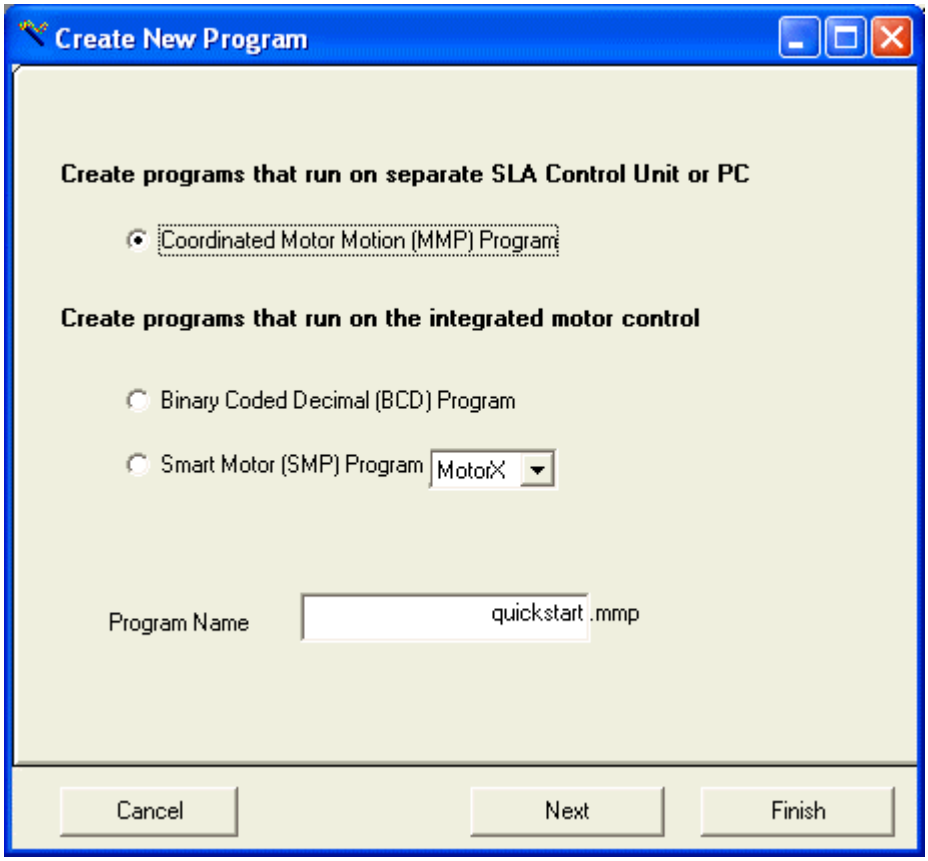


With the mouse, create the desired path as shown below. The six point square includes starting from the center of a side and selecting all four corners and back to the original center point to create six points as shown below.

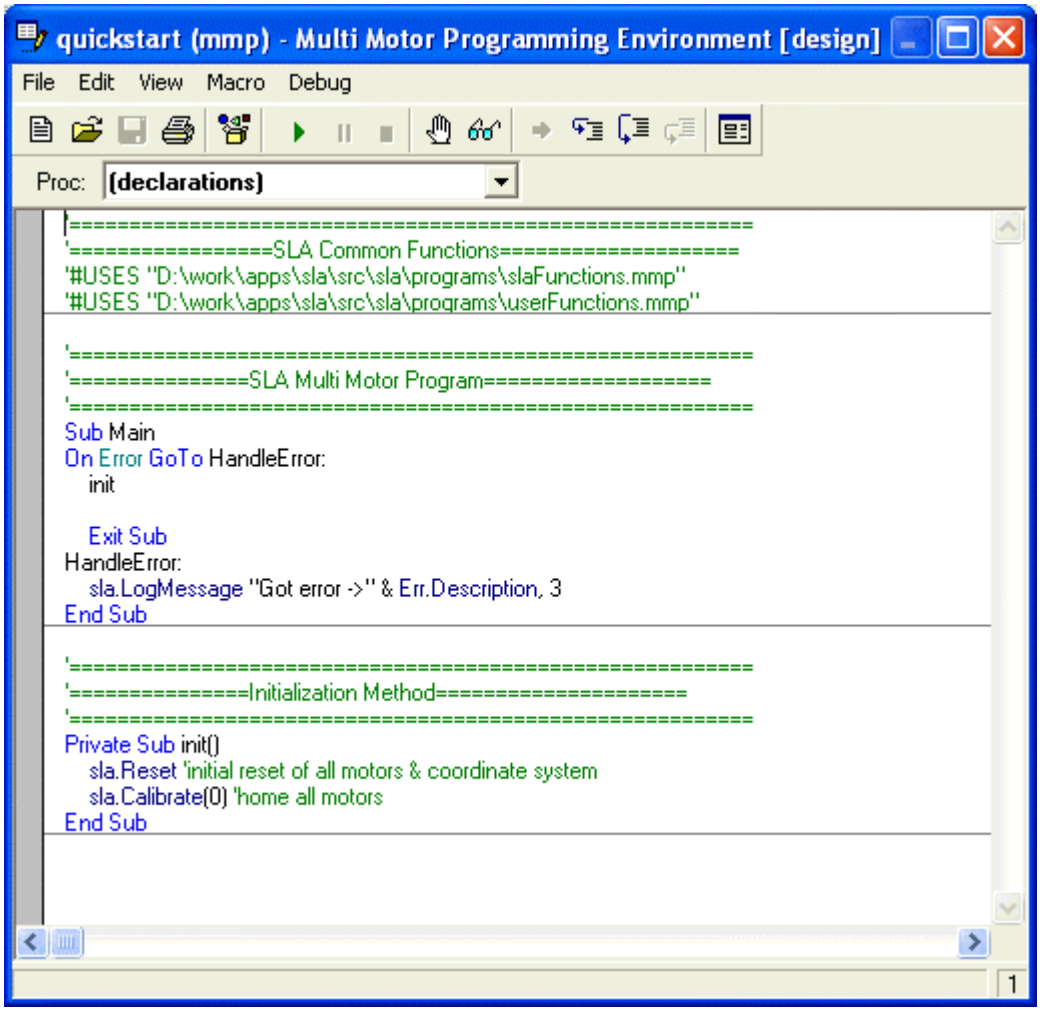


Quick Programming

Open a 'New Program...' dialog by clicking on File menu or pressing Ctrl+N (Control and N together). By default, the MMP program is selected. Type the name of the new program in 'Program Name' textbox and click 'Create Program' button.

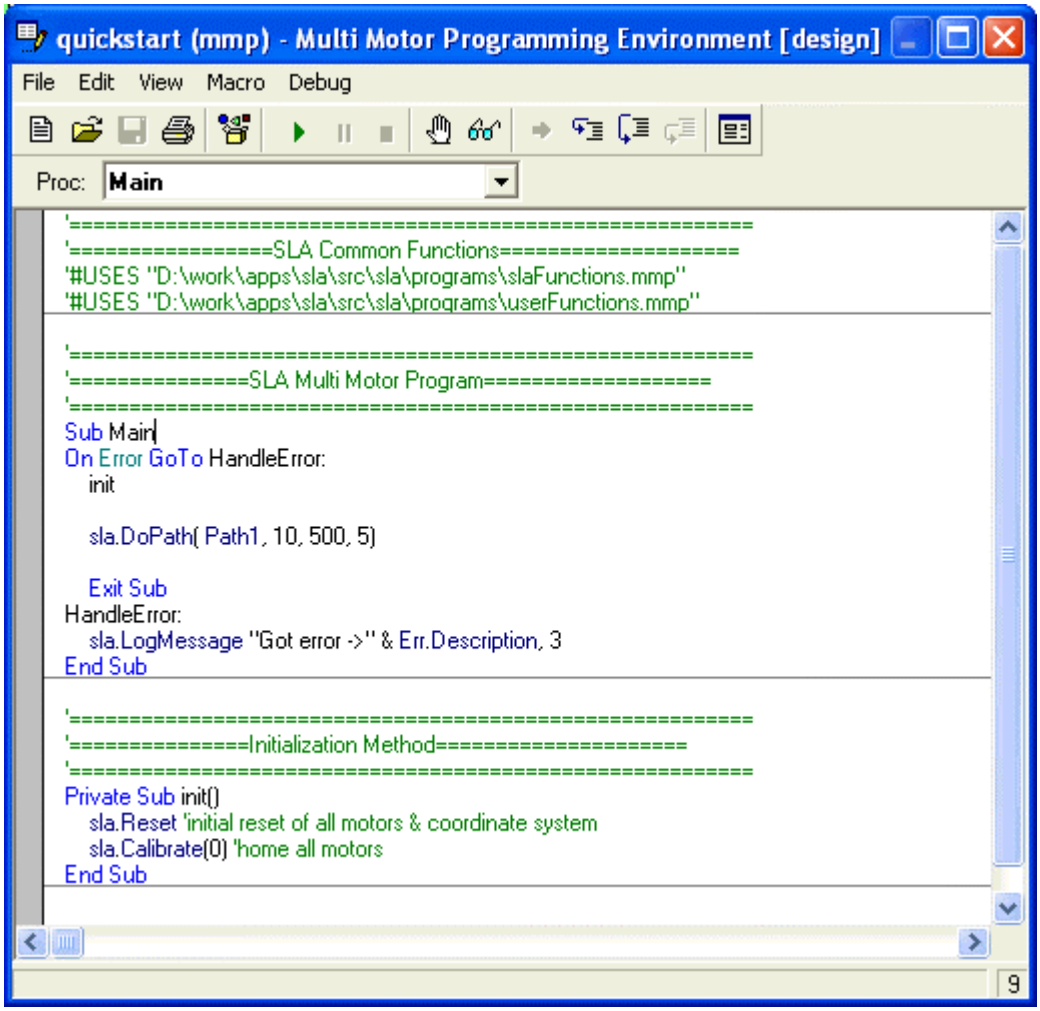


This will bring up the MMP Programming Environment with the template of the program already created as shown below.



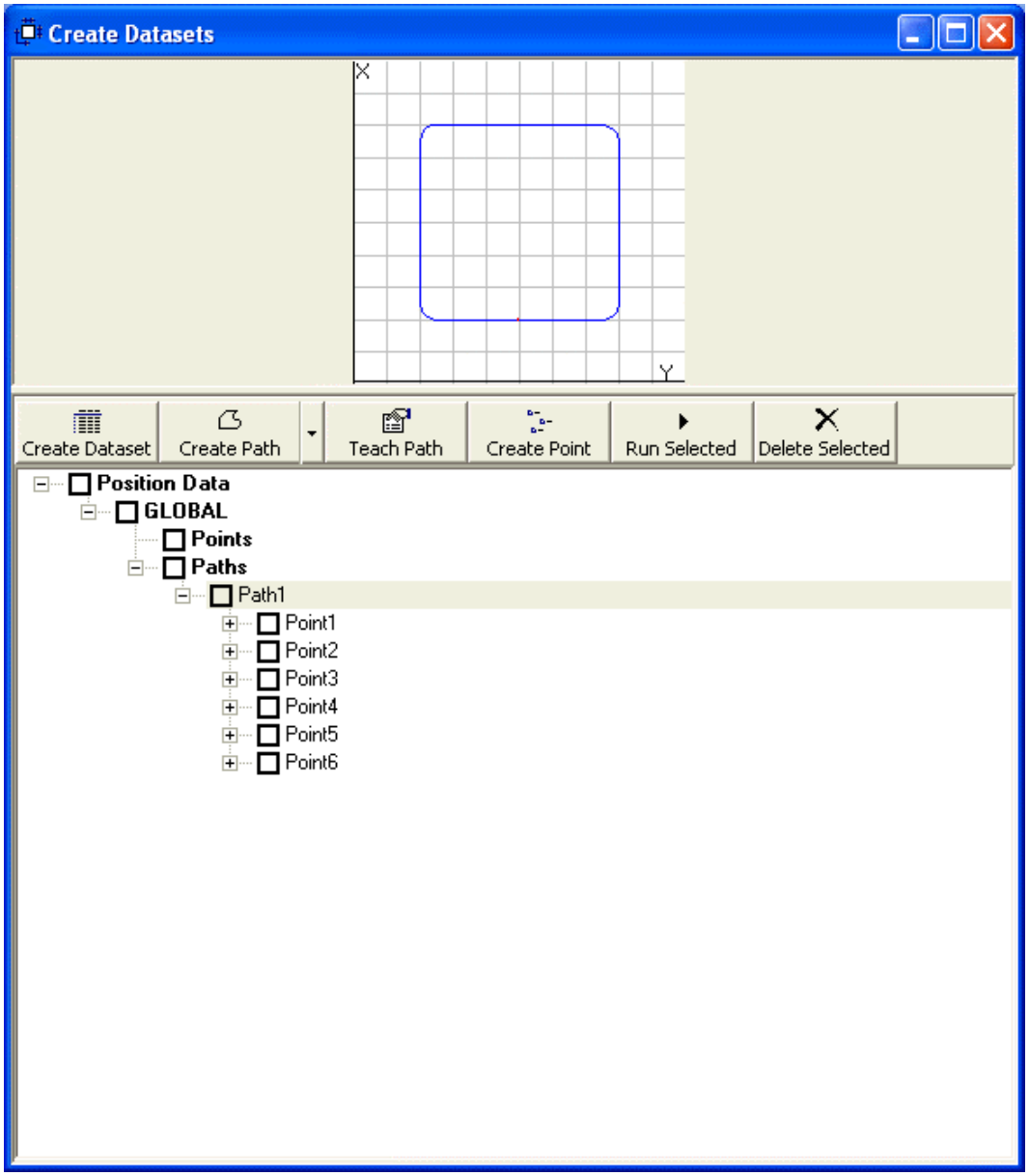
Just after the 'init' call to calibrate the system, add the following line to make the slide follow the square path (Path1) just created. Note that as soon as you start typing 'sla.' the autocomplete feature of the environment displays all the possible completion. At this point it is a matter of selecting from the options and filling in the arguments. The following command will make slide follow the Path1 with 10 mm/sec. speed and acceleration of 500 mm/sec.^2. Note, how easy it is to add the rounding of 5 mm for the corners.

```
sla.DoPath( Path1, 10, 500, 5)
```



Quick Results

Select the 'Monitor All' and 'Visual Trace' checkboxes on the main window to follow the movement of the slides on the Dataset screen. Click the Start button on the MMP Programming Environment to run the program to see the following successful result.


Create Datasets
X
Y
Create Dataset
Create Path
Teach Path
Create Point
Run Selected
Delete Selected
Position Data
GLOBAL
Points
Paths
Path1
Point1
Point2
Point3
Point4
Point5
Point6

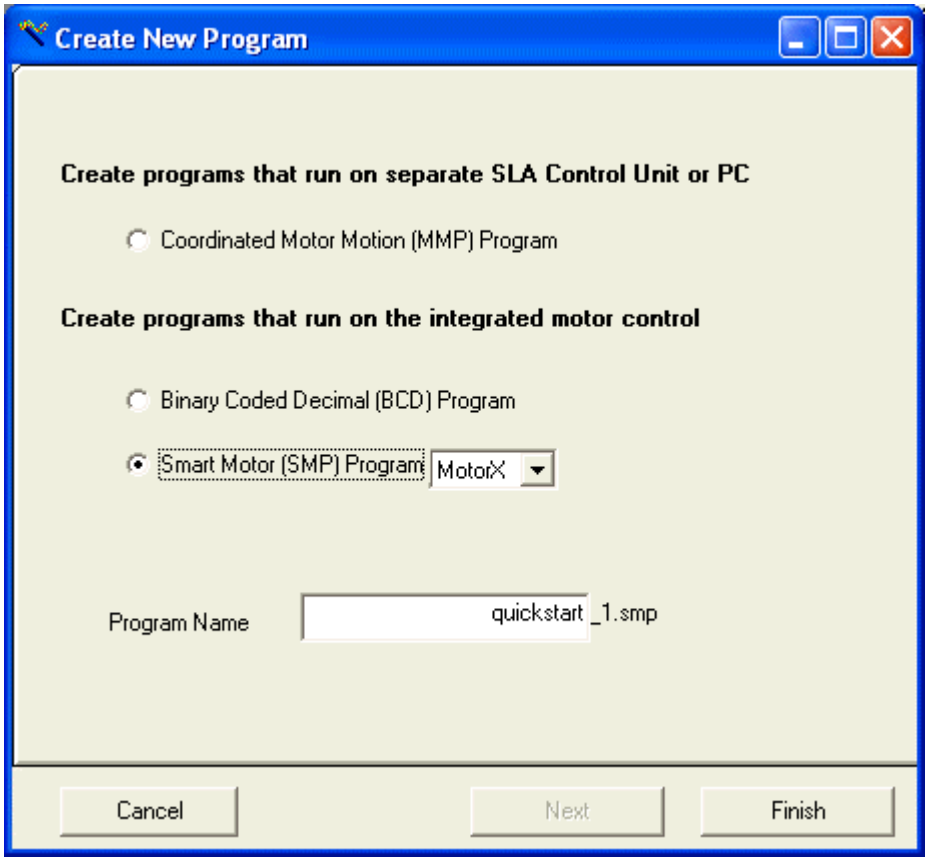
Quick Introduction to Smart Motor Programming with SLA OS

This section is designed for a quick introduction to Smart Motor Programming with SLA OS by writing a simple Smart Motor Program (SMP) for creating a constant velocity motion of for MotorX in positive direction. The two main steps are

1. Programming
2. Results

Quick Programming

Open a 'New Program...' dialog by clicking on File menu or pressing Ctrl+N (Control and N together). Select the SMP program type and enter the name of the new program in 'Program Name' textbox. Note that by default, MotorX is selected. Click 'Create Program' button.



This will bring up the SMP Programming Environment with the template of the program already created as shown below which includes the instructions for downloading tuning parameters and homing the motor at the start of the program.

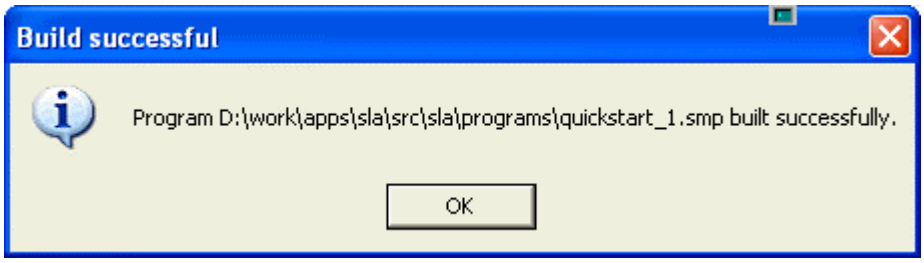
Between the section indicated for user code, add the following lines to make the slide move in the positive X direction with 1000000 Smart Motor Unit speed and 100 Smart Motor Unit acceleration. The command MV defines the velocity mode for motion and the command G starts the motion.

```
MV
A = 100
V = 1000000
G
```

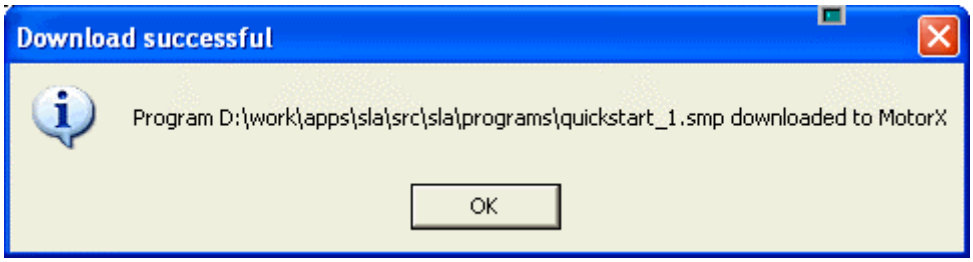

D:\work\apps\sla\src\sla\programs\quickstart_1.smp*
Motor:
MotorX
'==
'===============SLA Initialization=========================
'=== variables used
'=== d = directionHoming
'=== y = (reserved)
'==
F=2 'right handed screw
'Tuning values for MotorX
KP=150
KI=28
KD=600
KL=20
KS=1
KV=0
KA=0
KG=0
F 'load the Tuning values
'home the motor first
d = -1 'direction of homing
GOSUB0 'call homing subroutine
'==
'===============SLA Main Program============================
'==
'vvvvvv---user code starts below this line---vvvvv
MV
A = 100
V = 1000000
G
'^^^^^^---user code ends above this line---^^^^^^
END
'==
'===============SLA Homing Subroutine======================
'=== variables used
'=== o = origin
'=== p = position
'=== i = index
'=== z = homeFlag
'==
CO   'home current motor
  z=0 'motor is not homed yet

Quick Results

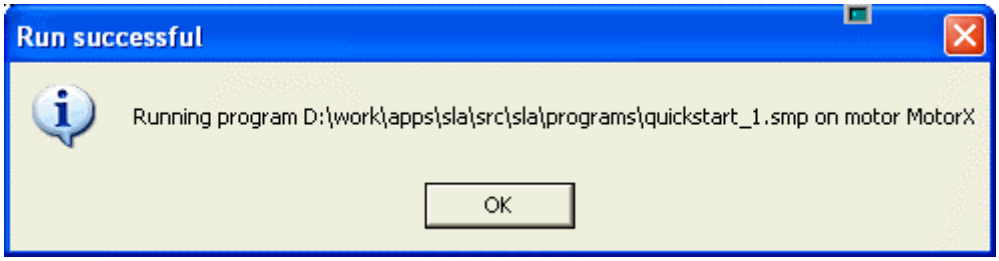
Before you can run the program, first build the program by clicking on the 'Build the Smart Motor Program' button in the toolbar. You should see the following confirmation to make sure that the program compiles successfully.



Next step is to download the compiled program to motor. Click on the 'Transfer Program from PC to Motor' button in the toolbar. You should see the following confirmation dialog box.



Now, to run the program, click on the 'Run' button. This will result in the downloaded programs running in the destination MotorX. By default, the generated programs run the homing routine initially. This behavior can be changed by modifying the program and rebuilding and downloading again.



The slide will move in the positive X direction and come to stop at the limit switch at the end of the slide.

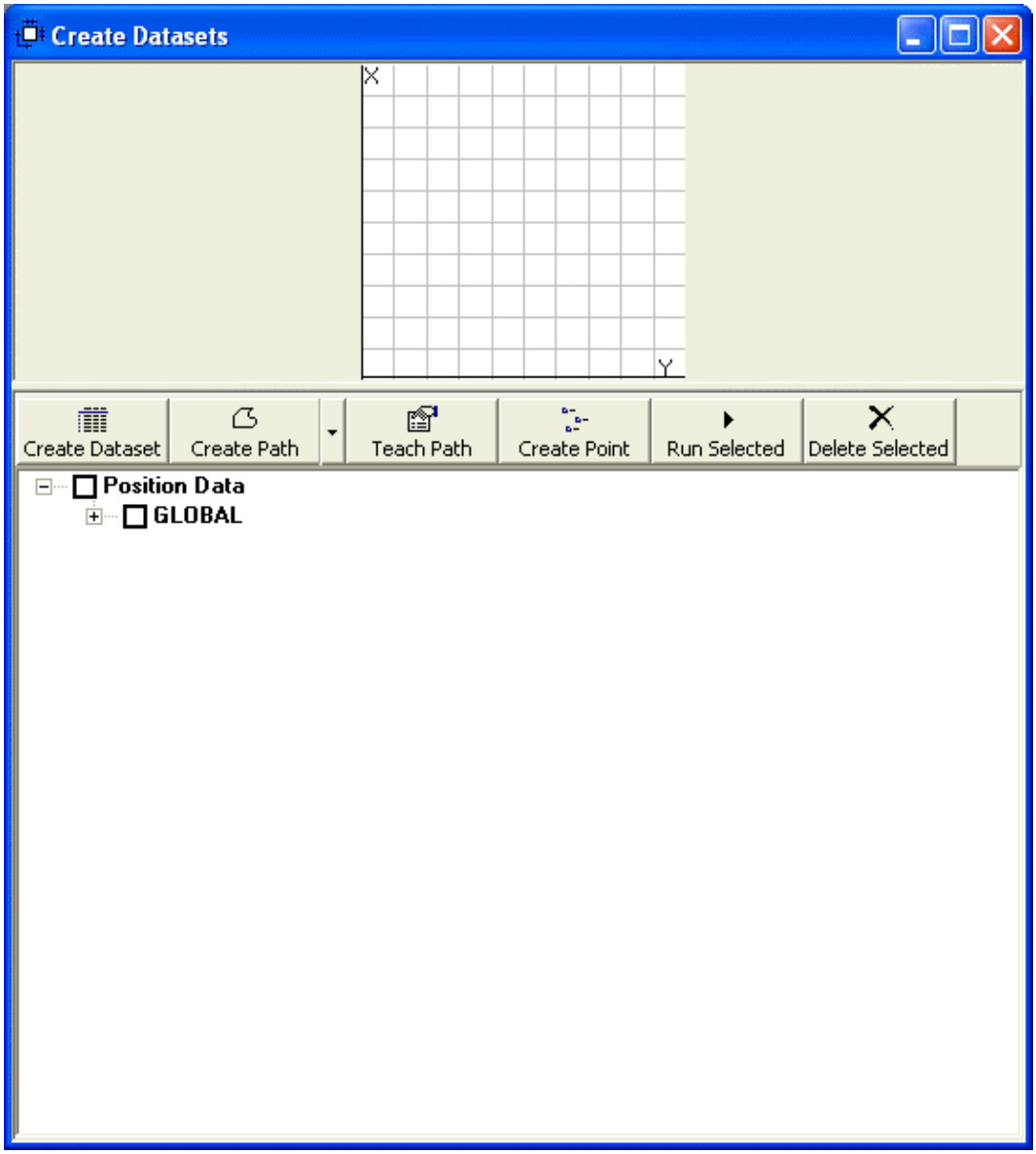
Quick Introduction to Binary Coded Decimal Programming with SLA OS

This section is designed for a quick introduction to Binary Coded Decimal Programming with SLA OS by writing a simple Binary Coded Decimal Program (BCD) for generating series of positions to move The three main steps are

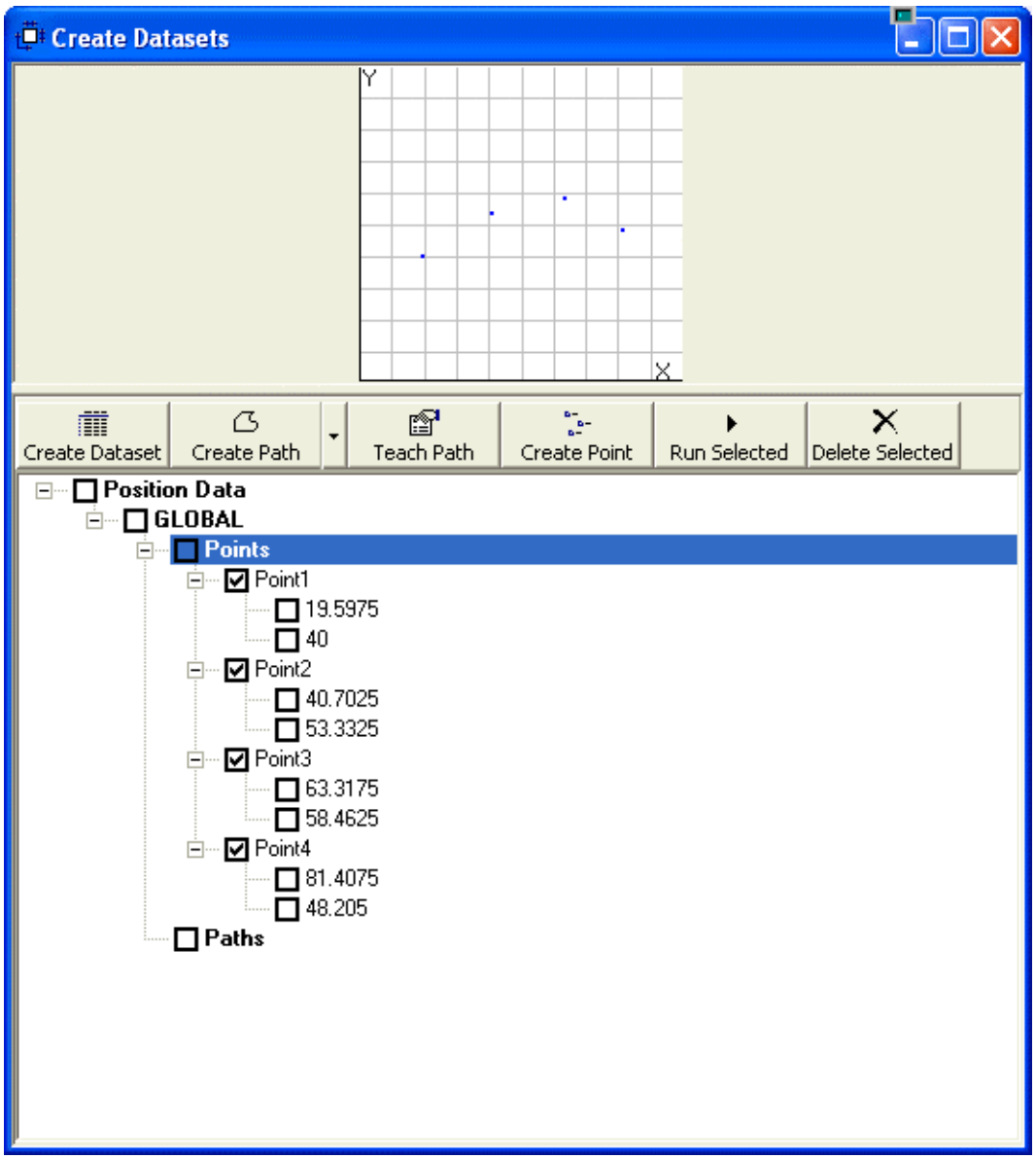
1. Position Data Creation
2. Programming
3. Results

Quick Position Data Creation

Click on the Datasets icon in the toolbar to open 'Create Datasets' screen.

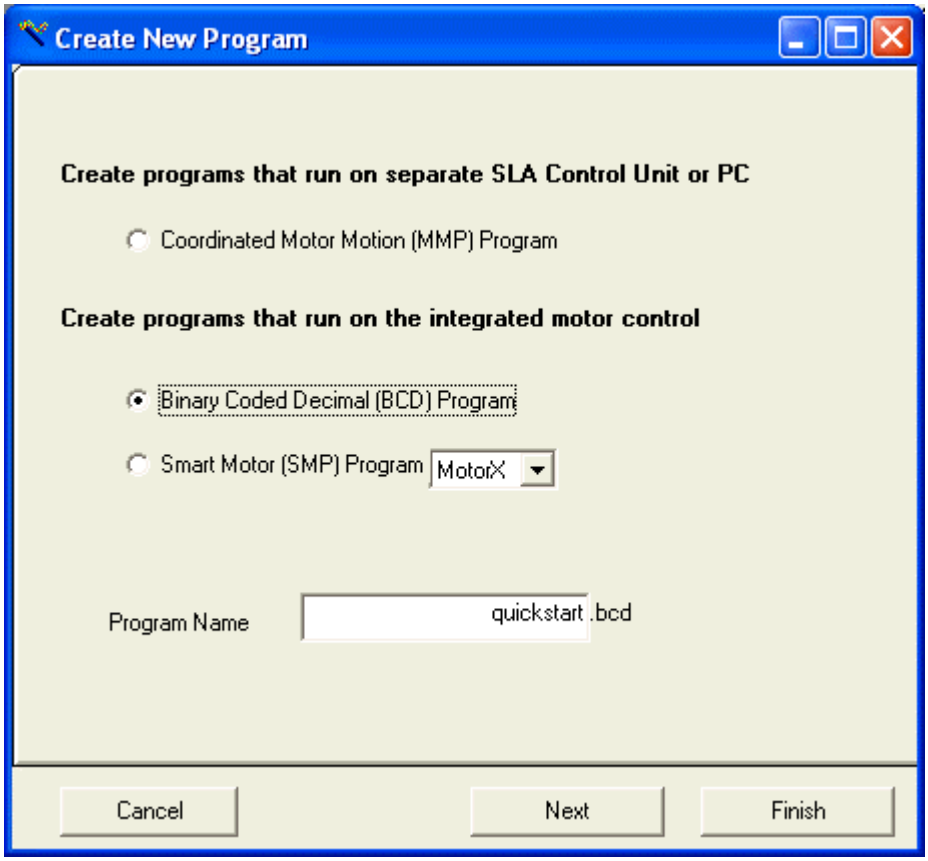


With the mouse, click on the screen to create the positions corresponding to the BCD input. With each click, a new point is added to the Points node as shown below. Since this is just for the test purpose, the exact locations of the points don't matter.

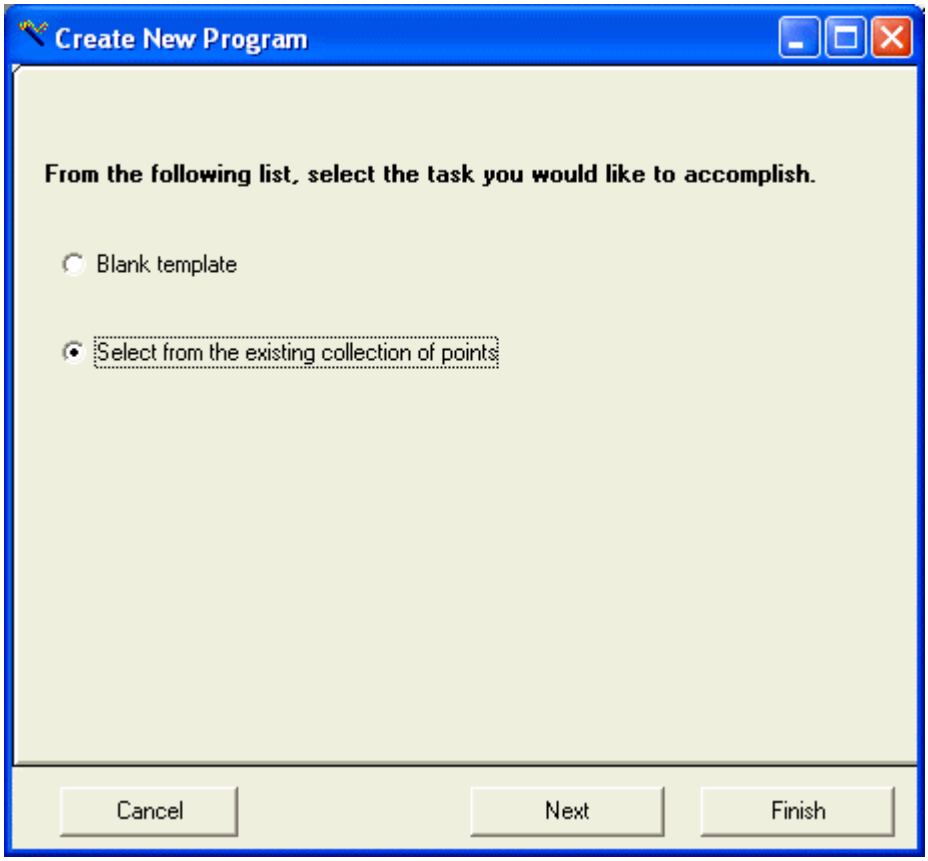


Quick Programming

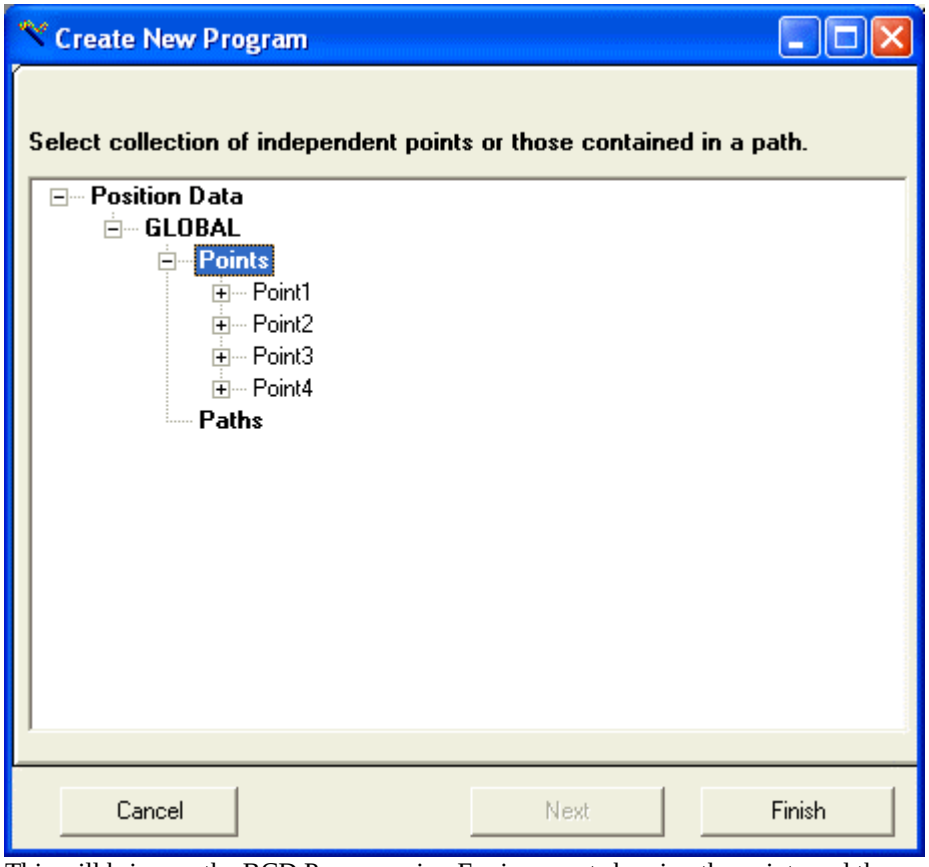
Open a 'New Program...' dialog by clicking on File menu or pressing Ctrl+N (Control and N together). Select the BCD program type and enter the name of the new program in 'Program Name' textbox. Click 'Next' button.



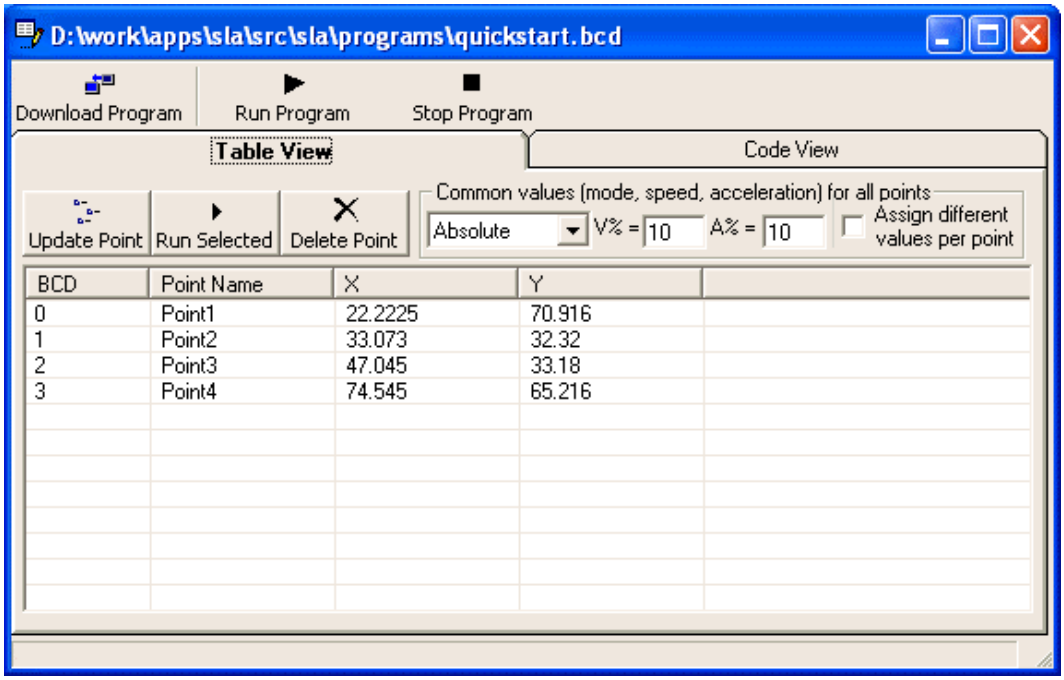
In the task selection window, you can select different ways to create a BCD program. Select the second option for creating a BCD program from existing data.



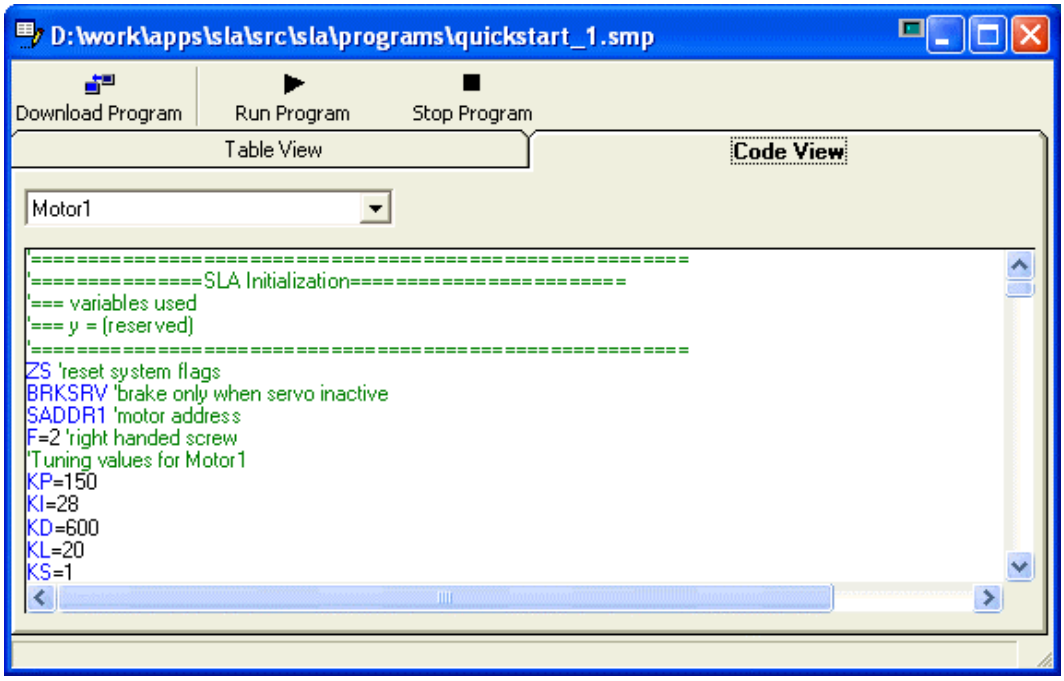
This will bring up a window with the position data tree that was earlier created in the Datasets window. Select the collection of points (either a path or points) to create BCD program from as shown below.



This will bring up the BCD Programming Environment showing the points and the corresponding BCD values.

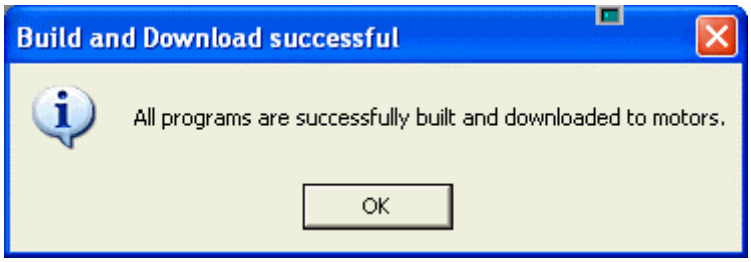


Click on the 'Code View' tab to see the SLA OS generated code which also includes code for homing to match the existing configuration information. Note that the displayed code depends on the type of slide connected to the axis. The following display corresponds to SLA.

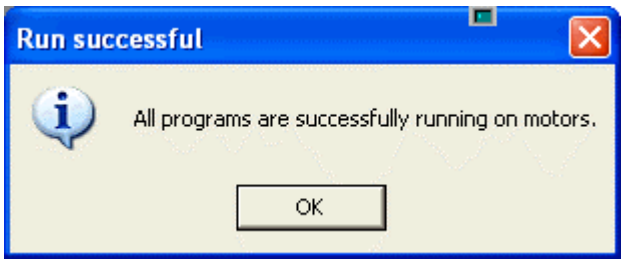


Quick Results

Since all the code is already generated by the SLA OS software, there is no additional programming involved. Before you can run the program, compile and download the programs to all the motors by clicking on the 'Build and Download' button on the top. You should see the following confirmation to make sure that everything is successful.



Now, to run the program, click on the 'Run' button. This will result in the downloaded programs running in all the motors. By default, the generated programs run the homing routine initially. This behavior can be changed using the SMP Programming Environment since BCD programs are basically SLA OS generated SMP programs.



Once the programs are running, the motion can be achieved by feeding the correct input values using either a test BCD input box or PLC.