

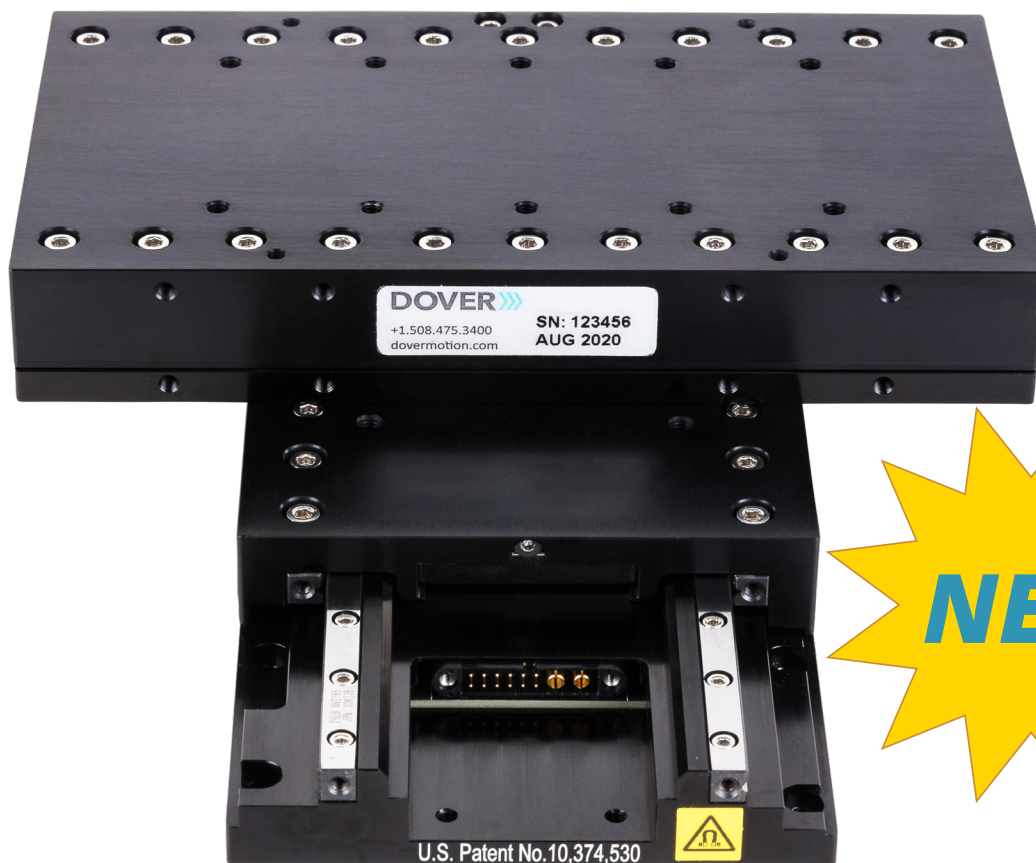


SmartStage™ XY Linear Positioner

Simple - Clean - Smart

Precision linear stage with *all* control electronics built-in.

Save space, save time, save money, and
minimize risk in your next instrument design.



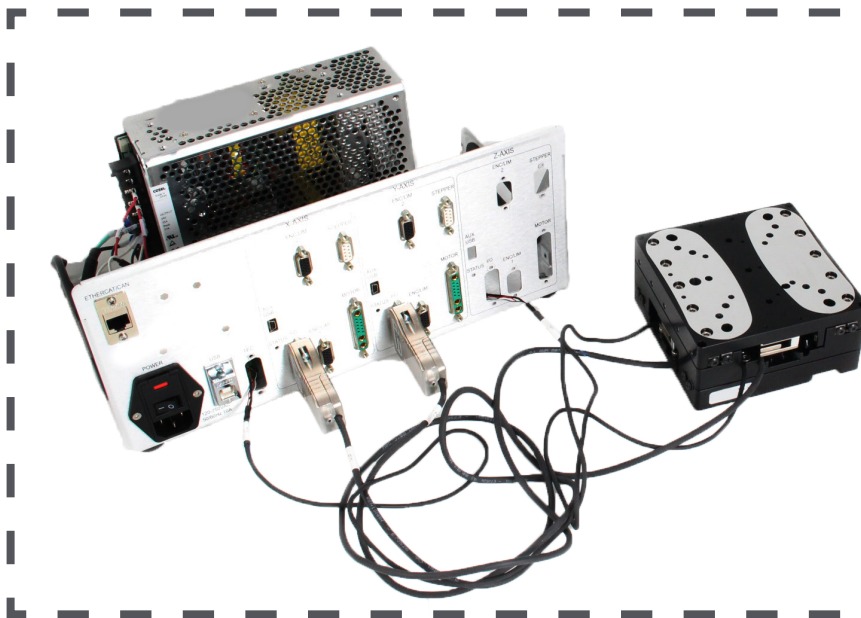
DOVER
MOTION 
A division of Invetech

US Patent 10,374,530
US Patent 10,367,436

What makes a SmartStage Linear Positioner unique?

A typical linear stage requires a bulky expensive external controller, motor drive circuit, feedback interpolation, limit and home input circuits, as well as multiple cables per axis. With a SmartStage positioner, the high performance controller and all hardware to position the stage are built-in. A SmartStage Linear Positioner delivers all this capability in an ultra-compact package.

Typical XY Setup



Dover Motion SmartStage XY



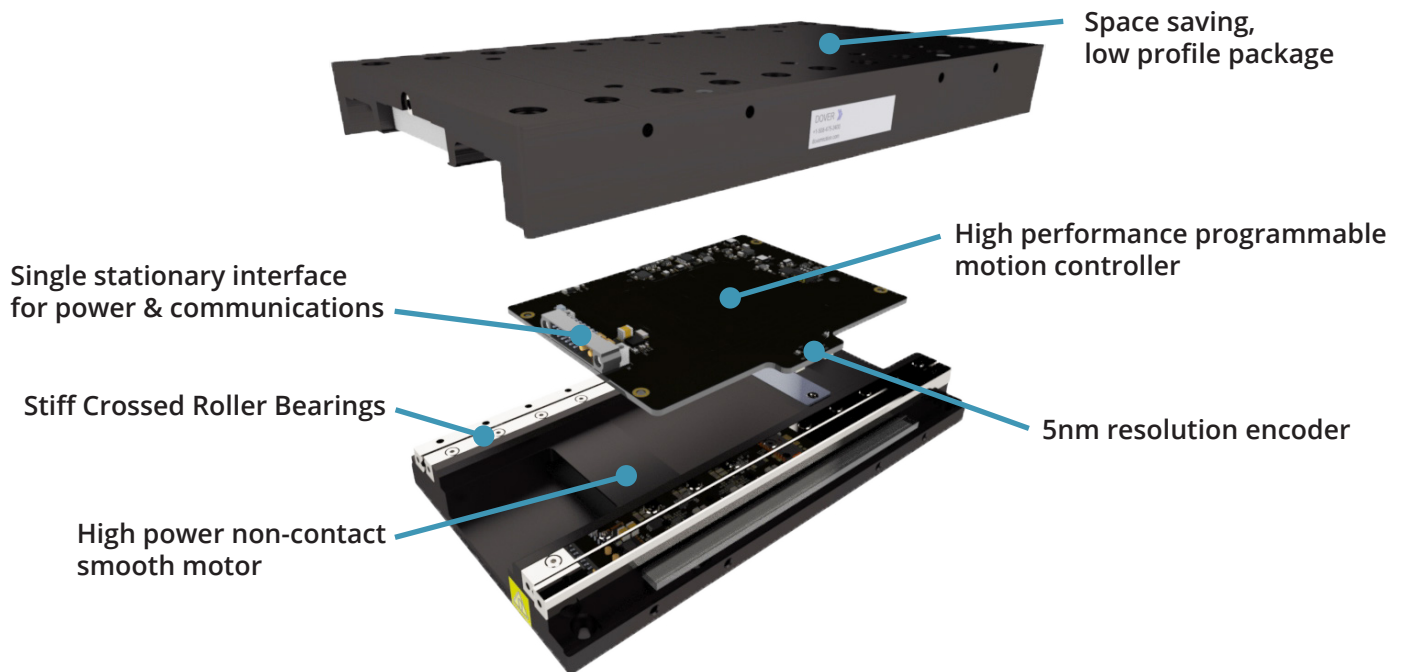
What about the performance?

Dover Motion's unique, patented stage architecture embeds the encoder feedback circuit, limit and home sensors, digital I/O, 3 phase PWM drive, and high-performance controller inside the stage. By embedding what used to be multiple cables and external electronics, the control is seamless, and performance-optimized for low noise. The result is ultra-high stage performance with 5nm resolution and no backlash.

What else do I need to get started?

Just a power supply and computer! Dover Motion provides a user interface, software libraries, manuals, and code examples. Each stage is factory configured and tested to ensure the highest quality out-of-box performance.

Features



In addition to the above features, the SmartStage XY Linear Positioner also includes:

High Resolution Trigger On Position for Image Capture or Laser Synchronization

High speed hardware output with < 1 nm resolution for synchronizing stage position with a camera or laser. Ideal for triggering during motion commonly required for TDI Imaging or laser processing

Smooth and Stable Motion

The unique motor design combined with ultra-precision Dover Encoder™ provides consistent force over the entire travel of the stage resulting in extremely low velocity ripple while scanning and < 30 nm stability at rest

Single Stationary Cable Connection for 2 axes

Communicates directly to your host computer, and includes 3 I/O per axis

Overview

The Dover Motion SmartStage linear positioner is a simple to integrate high resolution stage. Unlike a traditional direct-drive linear motor stage, it includes a built-in controller, drive, communications interface, and I/O. The on-board Dover Encoder and precision chrome on glass scale provide accurate, repeatable, and stable positioning with 5nm resolution. By including the Dover Encoder, interpolator, and motion controller electronics all within the stage, the SmartStage positioner is able to achieve high in-position stability and avoid noise errors introduced by external cabling, poor grounding, and other detrimental influences on the feedback signal. Stiff, crossed roller bearings allow for a wide range of payloads. These bearings also offer exceptional trajectory performance and excel for applications such as constant velocity scanning that requires smooth motion. The novel magnetic topology of Dover Motion's ironless linear motor technology is optimized for high servo bandwidth and uniform force over the entire stroke, and it has no backlash as commonly experienced with screw-based positioners. This allows SmartStage axes to perform equally well for applications requiring high-throughput step and settle or constant velocity scanning. This potent combination of crossed roller bearing ways and Dover Motion's linear motor drive system results in superior instrument performance.

Due to the novel and patented architecture of the SmartStage XY positioner, both lower and upper axes are powered and controlled through a single stationary cable.

A high-speed Trigger On Position output allows precise synchronization of a camera, laser, or other peripheral device with the exact position of the stage. Triggering is configurable at either fixed incremental intervals, or at arbitrary intervals using a user-defined look up table.

The stage provides a digital quadrature output of the interpolated encoder position signal. To coordinate motion between multiple axes, this is used as the master signal for controlling a secondary axis.

Additional SmartStage Positioner Features:

- Multiple communication options: RS-232, RS-485, and CAN
- Positive and negative end of travel limits, and a home switch
- 2 digital inputs and 1 digital output which are configurable for:
 - High speed Trigger On Position
 - Encoder position output
 - XY Co-ordinated motion
 - Step & direction output to command motion
- Low voltage 24 – 48V power input range



Dover Motion has implemented a Quality Management System in accordance with ISO 9001:2008 for the Design and Manufacture of Precision Positioning Products and Motion Systems

SmartStage XY Specifications

Travel (mm)	50	100	150	200
Position Feedback - Encoder Resolution*	5 nm			
Accuracy (2σ , μm) ¹	10	12	14	16
Bi-directional repeatability. (2σ , μm)	0.8	0.8	0.8	0.8
Homing repeatability (μm)	1	1	1	1
Minimum Move (nm)	100	100	100	100
Holding Stability (\pm nm)	30	30	30	30
Load Capacity (kg) ²	10	10	10	10
Maximum Acceleration (m/s^2) ³	10	10	10	10
Maximum Velocity (m/s) ³	0.6	1.0	1.0	1.0
Flatness & Straightness (μm TIR) ⁴	3	4	5	6
Total Mass (kg)	0.8	1.1	1.4	1.7
Moving Mass (kg)	0.4	0.7	0.8	1.0

* Other resolutions available, for options contact an applications engineer

¹ Accuracy has 2 point slope correction applied

² Please contact our Applications Engineers for loads exceeding 10kg.

³ The maximum acceleration and velocity is encoder and load dependent. For TOP mode contact an apps. engineer.

⁴ Stage must be mounted to a plate with flatness according to dimension details for each travel listed below.

⁵ Travel Life > 1,000,000 km

Motor Specifications			
Main Supply Voltage		V	48
Rated Performance	Symbol	Units	Value
Peak Force ¹	F_p	N	36 *
Continuous Force	F_c	N	12
Motor constant	K_m	N / W ^{0.5}	3.1
Electrical Specifications	Symbol	Units	Value
Motor Type			3 Phase
Peak Current	I_p	A	6 **
Continuous Current ¹	I_c	A	2
Electrical Resistance ³	R	Ω	5.4
Inductance ⁴	L	mH	1.8
Back EMF (Sine RMS) ²	K_e	V / m / s	6.9
Force Constant ³	K_f	N / A _{Peak}	6.0
Max Allowable coil temp	T_{max}	$^{\circ}\text{C}$	80
Max Voltage	V_{max}	V	48
Magnetic Pole Pitch	P	mm	25.4

* Motor Peak Force assumes 48V main supply, for 24V main supply Peak Force is 24N

** Motor Peak Current assumes 48V main supply, for 24V main supply continuous Current is 2A

¹ Motor winding temperature rise, $\Delta T = 75^{\circ}\text{C}$, @ 25°C ambient; Stage mounted to a 200x200x10 mm or larger aluminum plate

² Measured @ 25°C

³ Measured line-to-line $\pm 10\%$

⁴ Measured line-to-line $\pm 10\%$ measured @1Khz



SmartStage XY 100mm x 100mm travel
with DOF-5 Z axis and 4 slides

SmartStage XY Electrical Specifications

Description	Units	Value
Input Voltage	VDC	24 – 48 ± 10%
Idle Power	W	< 2
Digital Input Voltage	VDC	5V
Digital Input Current Range	µA	5 - 20
Digital Output Voltage	VDC	5
Digital Output Max Current	mA	10

Absolute Maximum Ratings

Power

Description	Units	Value
Maximum Voltage Rating	VDC	50
Maximum Input Current Rating	A	5
Maximum Power Input	W	250

Inputs

Description	Units	Value
Digital In 1 / Step Voltage	VDC	5
Digital In 2 / Direction Voltage	VDC	5

Outputs

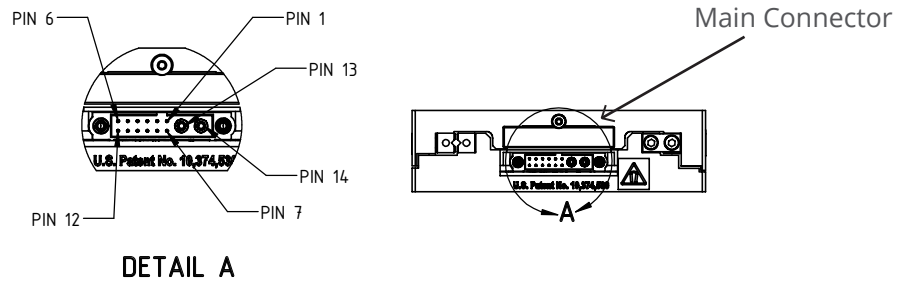
Description	Units	Value
General Purpose Outputs (GPO)	VDC	5
Encoder Signal Output (single ended digital quadrature)	VDC	5
Trigger On Position Signals	VDC	5
Digital Output (Dig Out 1)	VDC	5

Environmental Requirements

- Operating Temperature Range 0 °C – 40 °C
- Storage Temperature Range -20 °C – 85 °C
- Maximum Humidity 90% Non-Condensing
- Maximum Operating Altitude 2,000 m

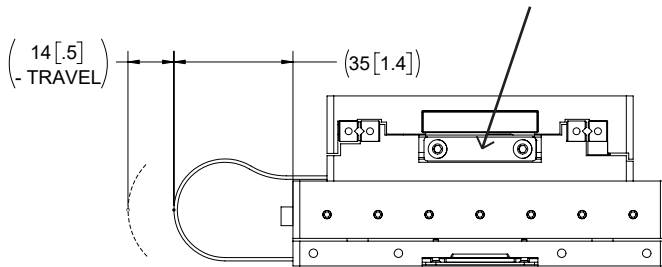
SmartStage XY Dimensional Drawings

Front View - All Travels



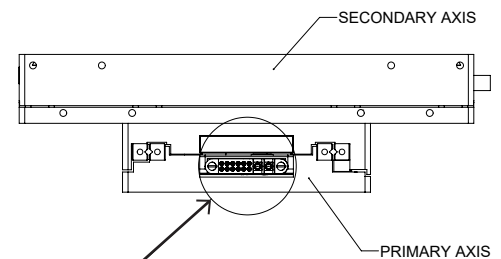
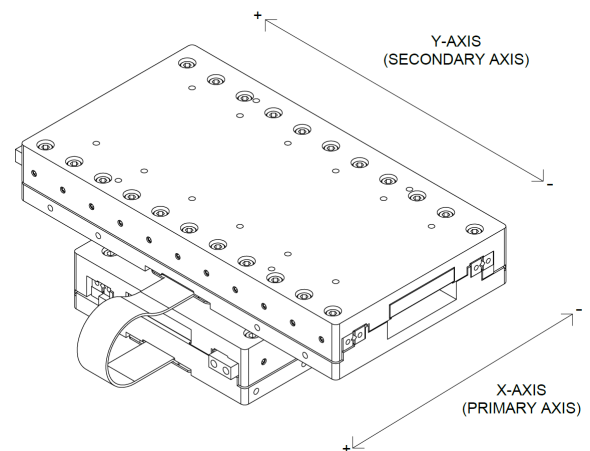
XY Ribbon Cable Dimensions

Note: For XY setup, there is only 1 main cable required, a blank plate covers the upper axis main connector



ALL DIMENSIONS ARE IN MILLIMETERS [INCHES]

XY Naming Conventions

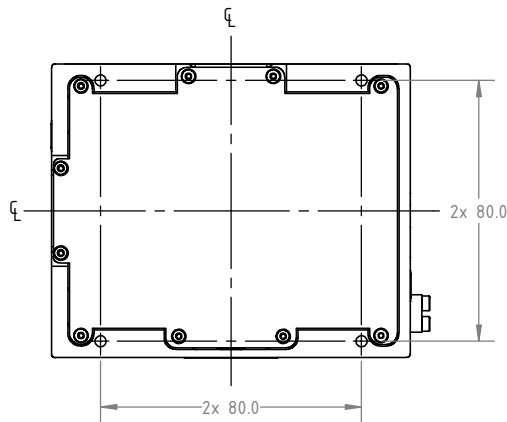


For XY: 1 main connector has all signals for both axes

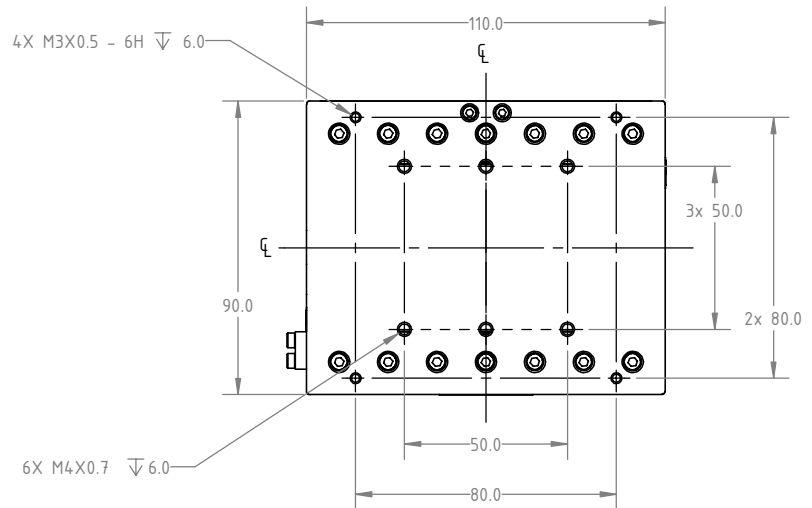
SmartStage XY Dimensional Drawings

50mm Travel Individual Stage

Bottom View

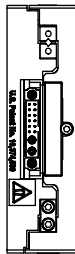


Top View

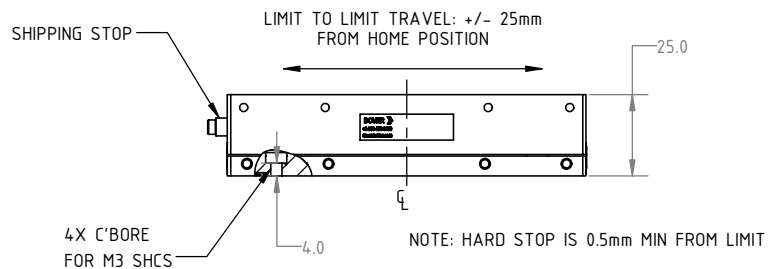


80 mm hole pattern in base and table is used for XY stacking

Front View



Side View



Specifications based on mounting base of stage to a surface with flatness of 0.005 mm

All dimensions are in millimeters [inches]

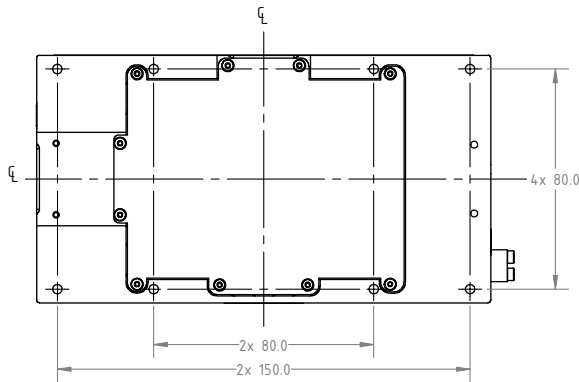


50mm Travel Stage

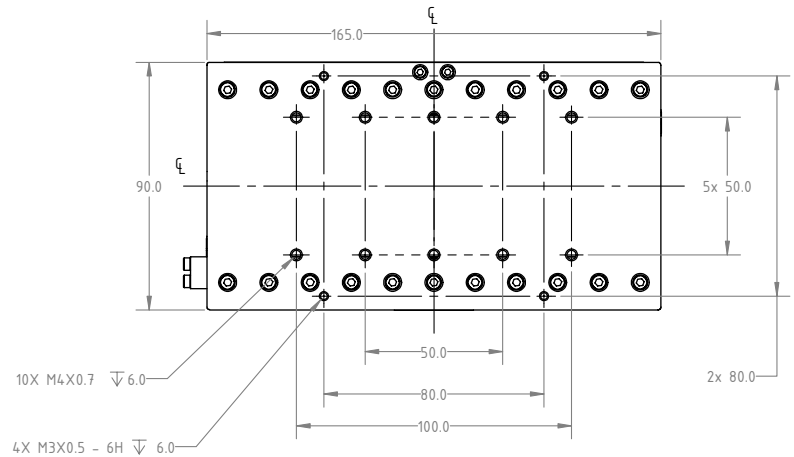
SmartStage XY Dimensional Drawings

100mm Travel Individual Stage

Bottom View

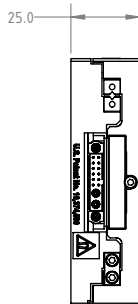


Top View

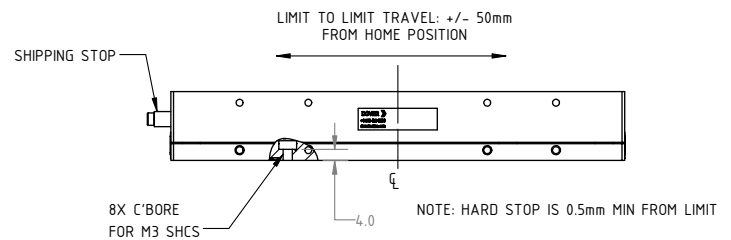


80 mm hole pattern in base and table is used for XY stacking

Front View

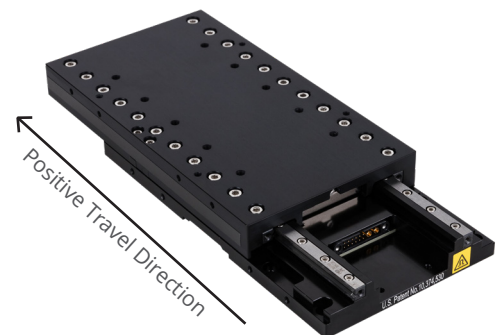


Side View



Specifications based on mounting base of stage to a surface with flatness of 0.005 mm

All dimensions are in millimeters [inches]

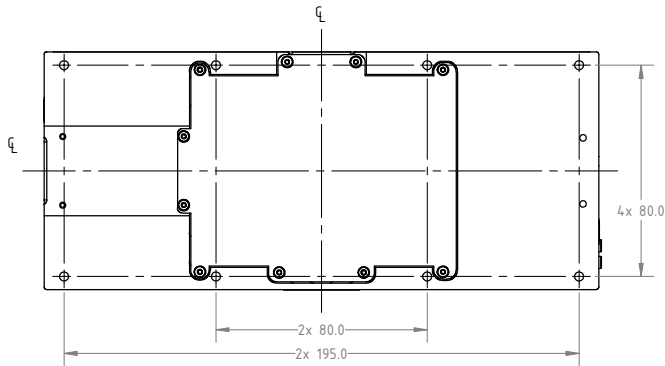


100mm Travel Stage

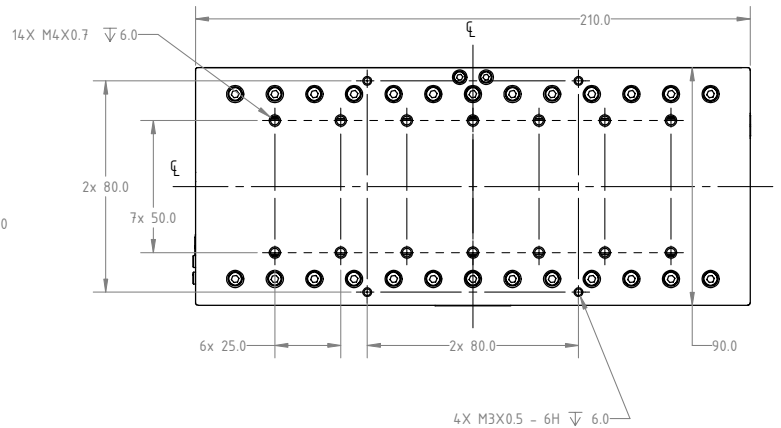
SmartStage XY Dimensional Drawings

150mm Travel Individual Stage

Bottom View

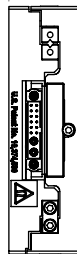


Top View

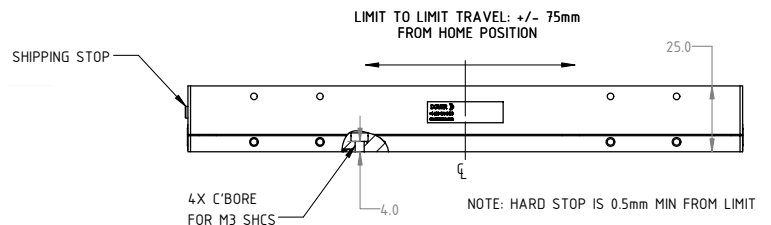


80 mm hole pattern in base and table is used for XY stacking

Front View



Side View



Specifications based on mounting base of stage to a surface with flatness of 0.008 mm

All dimensions are in millimeters [inches]

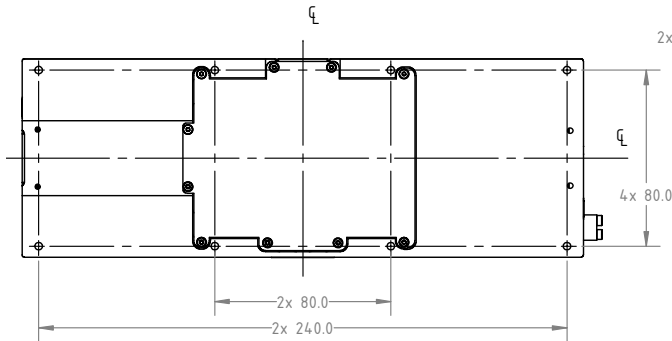


150mm Travel Stage

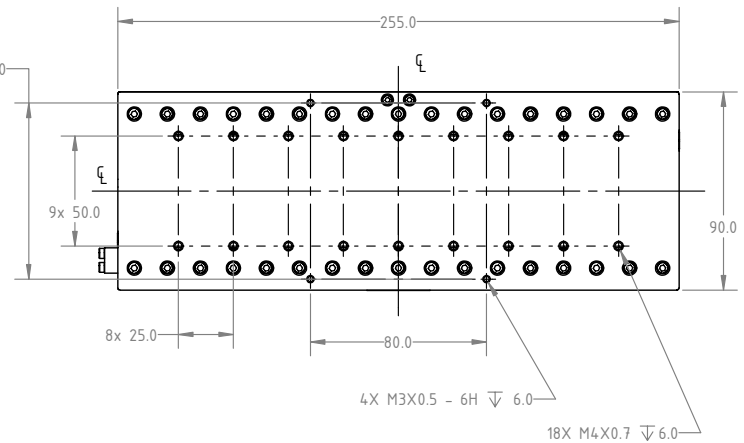
SmartStage XY Dimensional Drawings

200mm Travel Individual Stage

Bottom View

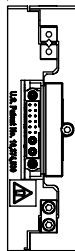


Top View

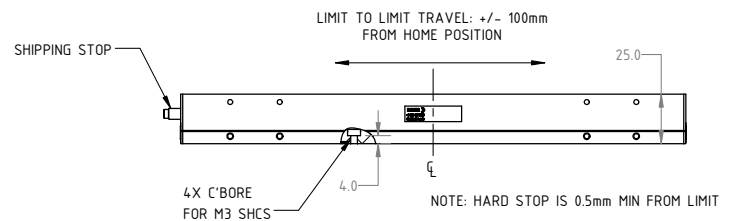


80 mm hole pattern in base and table is used for XY stacking

Front View



Side View



Specifications based on mounting base of stage to a surface with flatness of 0.010 mm

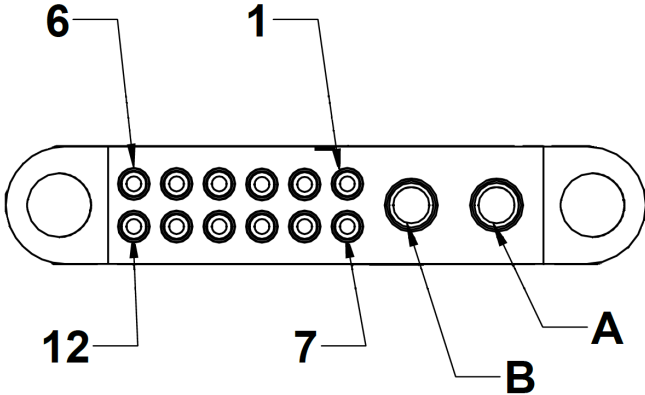
All dimensions are in millimeters [inches]



200mm Travel Stage

Pinout

J1 - Main Connector

Pin	RS-232	RS-485	CAN	14 Pin Male
1	Secondary Axis I/O 3			
2	Secondary Axis I/O 1			
3	Primary Axis I/O 3			
4	Primary Axis I/O 1			
5	Digital I/O Return			
6	Primary Axis TX	Y		
7	Secondary Axis I/O 2			
8	Digital I/O Return			
9	Primary Axis I/O 2			
10	Secondary Axis RX	B	CANH	
11	Primary Axis RX	A	CANL	
12	Secondary Axis TX	Z		
B	Main Logic and Bus Supply			
A	Main Supply Return			

Notes:

For Half Duplex (2 wire) RS-485 slave use signals: Y for Data+ and Z for Data-

Half Duplex RS-485 has the master and slave(s) Data + connected together and Data- connected together

For Full Duplex (4 wire) RS-485 slave use signals: A for Rx(D+), B for Rx(D-), Y for Tx(D+), Z for Tx(D-)

Full Duplex RS-485 has the master Tx connected to slave(s) Rx and master Rx connected to slave(s) Tx

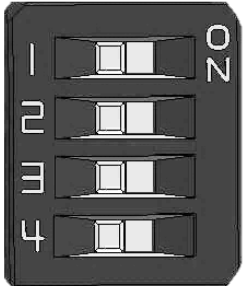


50mm x 50mm SmartStage XY;
only one connector for both axes

Configuration Switches

Accessing some of the features on the Dover Motion Control Module must be done by manually changing selection switches on the board. These switches may be accessed directly on the controller board which is accessible after removing the enclosure cover. The switches are factory set according to the ordered configuration

SW1 - Communications Method Selection

Description	Switch Setting				Switch
Position	1	2	3	4	
Name	CAN/SRL	485/232	LOZ/HIZ	HD/FD	
RS-232 Primary Axis	ON	ON	OFF	OFF	
RS-232 Secondary Axis	ON	ON	ON	ON	
RS-485 Low Z Full Duplex	ON	OFF	OFF	ON	
RS-485 Low Z Half Duplex	ON	OFF	OFF	OFF	
RS-485 High Z Full Duplex	ON	OFF	ON	ON	
RS-485 High Z Half Duplex	ON	OFF	ON	OFF	
CAN 2.0B Low Z	OFF	X	OFF	X	
CAN 2.0B High Z	OFF	X	ON	X	

Factory Configured I/O Options

Signal Information / Pinout			
I/O State	I/O 1	I/O 2	I/O 3
S1	Step Input	Direction Input	GPO, TOP LUT
S2	TOP Incremental	TOP Gate	GPO
S3	GPI	GPI	GPO
S4	GPI	Encoder A Out	Encoder B Out
S5	Coordinated motion mode, lower axis Master		GPO
S6	Coordinated motion mode, upper axis Master		GPO
S7	GPO	Encoder A Out	Encoder B Out

* For I/O State S3 (Trigger On Position Mode) the stage velocity is limited to 125 mm/s with standard resolution of 5nm. For faster speed, the factory set resolution can be changed, ask an applications engineer for more information.

Recommended Dual Axis Configuration: SS-XY-##-5nm-G07-S3-A1-##-5nm-G06-S3-A2

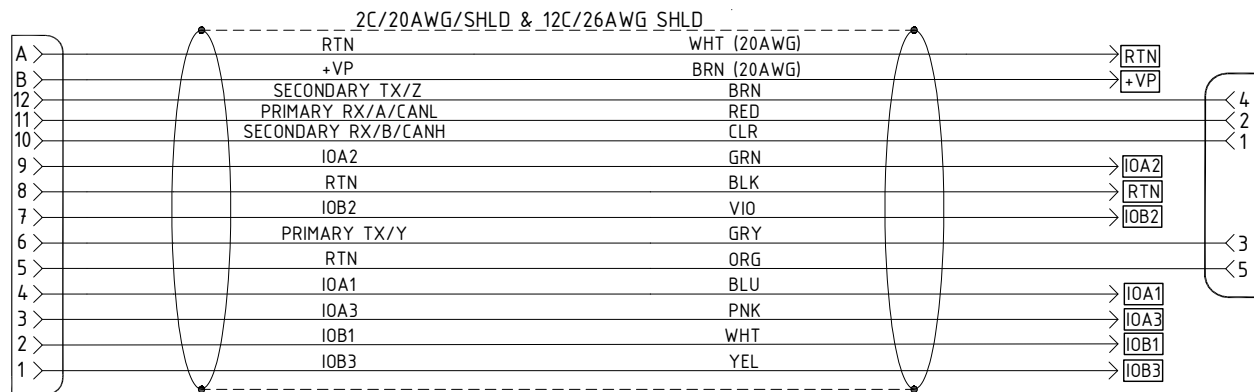
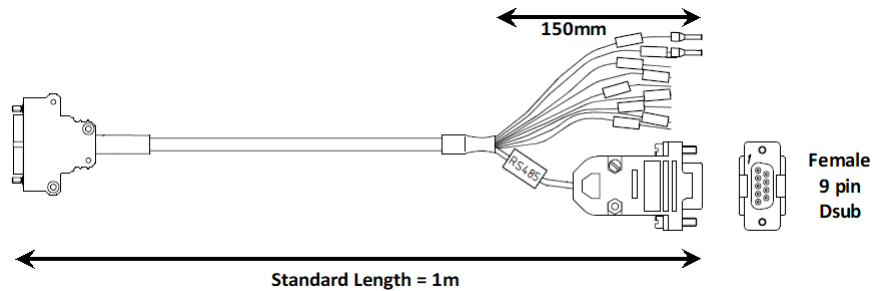


Accessories

Main Cable

Optional Accessory: Main Cable Details

Orderable Part Number: 36308-040



Cable Kits

Standard cable kits are available for communications, power, and I/O connections.

RS-485 & RS-232 Cable Kit (P/N: 31-1045)

- 1m, Main Cable (see above 36308-040)
- RS-485 / RS-232 to USB Converter
- RS-485 to RS-232 Converter

CAN Cable Kit (P/N: 31-1046)

- 1m, Main Cable (see above 36308-040)
- CAN to USB Converter



3 Node Communications Cable (P/N: 36185-00)

- Ribbon Cable with Dsub connectors to connect up to 3 nodes to the same communications host

5 Node Communications Cable (P/N: 36186-00)

- Ribbon Cable with Dsub connectors to connect up to 5 nodes to the same communications host

For customization, contact Dover Motion Applications Support at:
sales@dovermotion.com for more information.