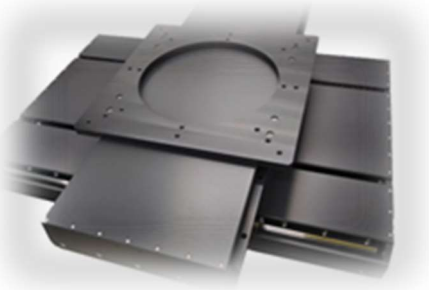
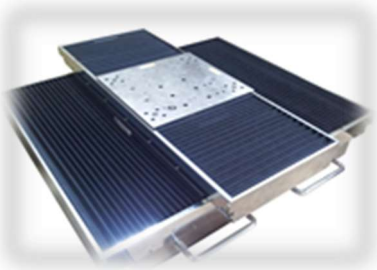
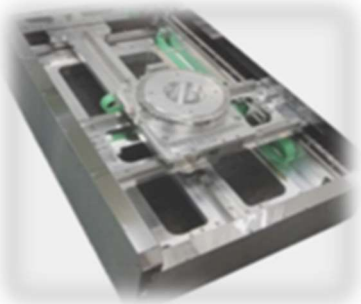
Ultra precision positioning stage







Version: 3.0

Date: 2023. 01. 01

● Introduction

Ultra precision positioning stage has been our core technology for 17 years. The technology was first transferred from NSK. Then the cooperation with Taiwan semiconductor industry further enhances our company's capability to be the world-wide solution provider. This series mainly compose three models.

- Positioning stage for general purpose
- Positioning stage for line scan application
- Positioning stage for ultra vacuum application

There are various sizes of each model for selection. The tailor-made request is also acceptable.

● Applications

Isolation layer hole drilling for wafer probe card
E-beam inspector for semiconductor
Wafer boding equipment
Line scan AOI wafer inspection machine
LCD/LED die bonder、wire bonder、and sorter
etc…

● Positioning stage for general purpose

- Extremely low cogging linear motor is employed to reduce settling time and enhance trajectory tracking.
- NSK precision linear guide is adopted for best performance.
- 50 nm stepping and repeatability of ±0.3umcan be realized.
- Miniature optical encoder and programable resolution interpolator is used to ease application.
- Bellow cover is used to achieve dust proof.

1. Model designation：

MTXY — **Mode**

06 — **Frame**

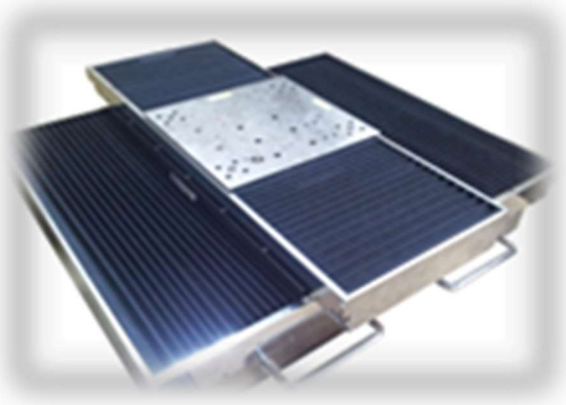
06 (6 inch)
08 (8 inch)
12(12 inch)

001 — **Resolution**

001: 0.01 um
002: 0.02 um
005: 0.05 um
010: 0.1 um
050: 0.5 um
100: 1 um

10 — **Cable length**

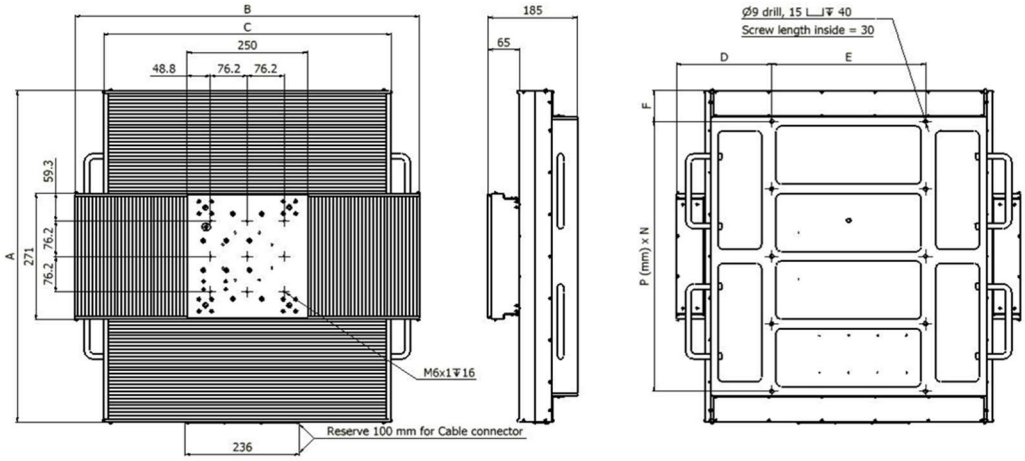
10: 1000 mm
30: 3000 mm
50: 5000 mm
80: 8000 mm



2. Specification：

Mechanical parameters	Unit	MTXY06	MTXY08	MTXY12
Total stroke	mm	170	220	320
Effective stroke	mm	160	210	310
Straightness	um	＜2	＜2.5	＜3
Flatness	um	＜8	＜12	＜15
Repeatability	um	±0.3	±0.3	±0.3
Accuracy	um	＜0.6	<0.6	<0.6
Moving mass of upper axis	kg	7	7	7
Moving mass of lower axis	kg	19	21	24
Maximal payload	kg	20	20	20
Electrical parameters	Unit			
Peak force of upper axis	Nt	720	720	720
Peak force of lower axis	Nt	1200	1200	1200
Conti. Force of upper axis	Nt	240	240	240
Conti. Force of lower axis	Nt	400	400	400
Peak current of upper axis	Arms	16.8	16.8	16.8
Peak current of lower axis	Arms	19.2	19.2	19.2
Conti. current of upper axis	Arms	5.6	5.6	5.6
Conti. current of lower axis	Arms	6.4	6.4	6.4
Force constant of upper axis	Nt/Arms	42.5	42.5	42.5
Force constant of lower axis	Nt/Arms	63.4	63.4	63.4
Pole pair pitch	mm	27	27	27
Motor voltage	VAC	220	220	220

3. Dimensions：



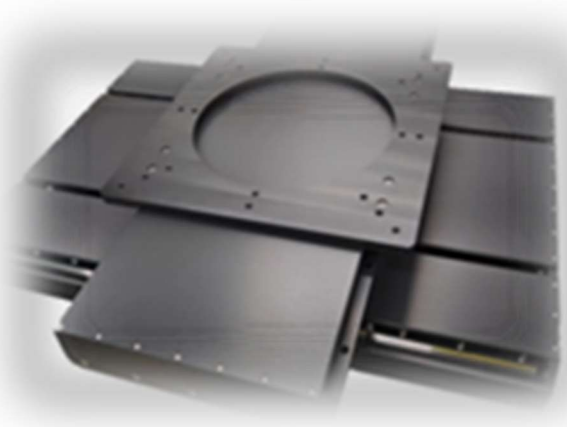
Stroke (mm)		Dimensions- mm						
Upper axis	Lower axis	A	B	C	D	E	F	P(mm)xN
160	160	552	552	480	174	204	58	145 x 3
210	210	602	602	510	184	234	83	145 x 3
310	310	712	712	594	197	318	66	145 x 4

● Positioning stage for line scan application

- Zero cogging linear motor is employed to achieve the best velocity stability.
- NSK precision linear guide is adopted for best performance
- Repeatability of ±0.2um and velocity stability of 0.2% @ 250mm/s can be realized
- Black anodized surface treatment is adopted to eliminate light interference.
- 48VDC is adopted for motor drive to prevent velocity stability and image acquisition from AC power noise.
- Miniature optical encoder and programable resolution interpolator is used to ease application.

1. Model designation：

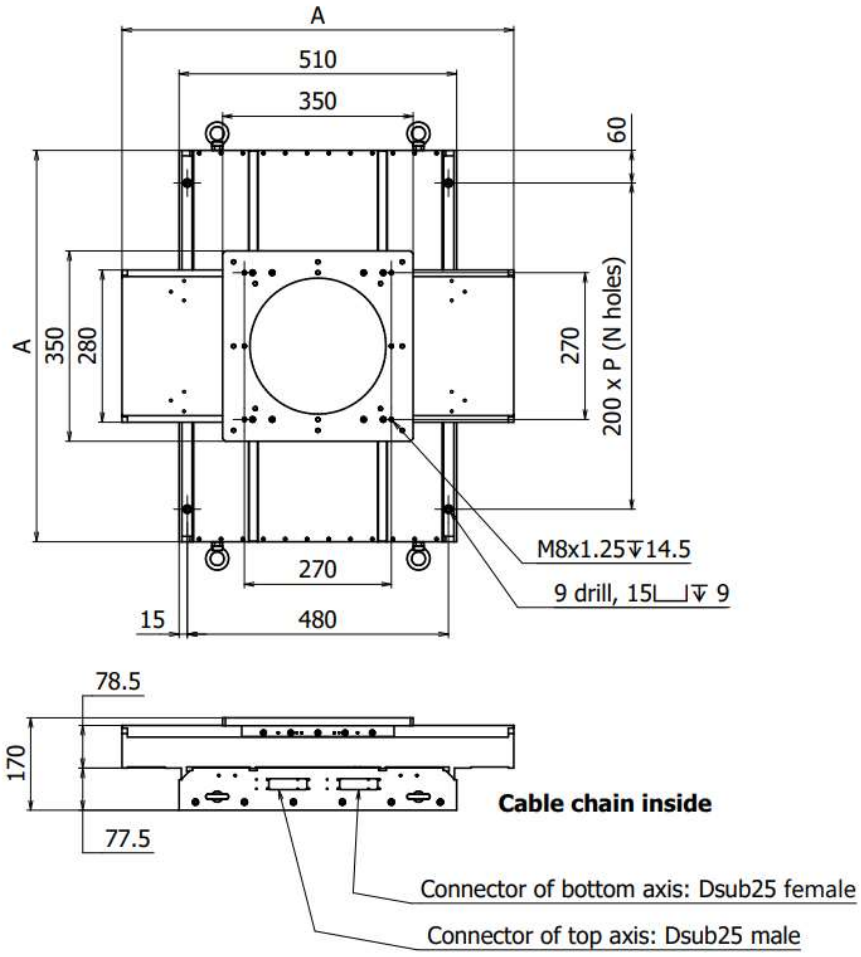
MTLS	06	001	10
Model	**Frame**	**Resolution**	**Cable length**
	06(6 inch) 08(8 inch) 12(12 inch) 15(15 inch)	001: 0.01 um 002: 0.02 um 005: 0.05 um 010: 0.1 um 050: 0.5 um 100: 1 um	10: 1000 mm 30: 3000 mm 50: 5000 mm 80: 8000 mm



2. Specification：

Mechanical parameters	Unit	MTXY06	MTXY08	MTXY12	MTXY15
Total stroke	mm	170	220	320	400
Effective stroke	mm	160	210	310	380
Straightness	um	＜1	＜1.5	＜2	<2.5
Flatness	um	＜4	＜6	＜8	<10
Repeatability	um	±0.2	±0.2	±0.2	±0.2
Accuracy	um	＜0.5	<0.5	<0.5	<0.5
Moving mass of upper axis	kg	8	8	8	8
Moving mass of lower axis	kg	20	23	28	34
Maximal payload	kg	10	10	10	10
Electrical parameters	Unit				
Peak force of upper axis	Nt	246	246	246	246
Peak force of lower axis	Nt	492	492	492	492
Conti. Force of upper axis	Nt	52	52	52	52
Conti. Force of lower axis	Nt	104	104	104	104
Peak current of upper axis	Arms	19	19	19	19
Peak current of lower axis	Arms	38	38	38	38
Conti. current of upper axis	Arms	4	4	4	4
Conti. current of lower axis	Arms	8	8	8	8
Force constant of upper axis	Nt/Arms	13	13	13	13
Force constant of lower axis	Nt/Arms	13	13	13	13
Pole pair pitch	mm	45	45	45	45
Motor voltage	VDC	48	48	48	48

3. Dimensions：



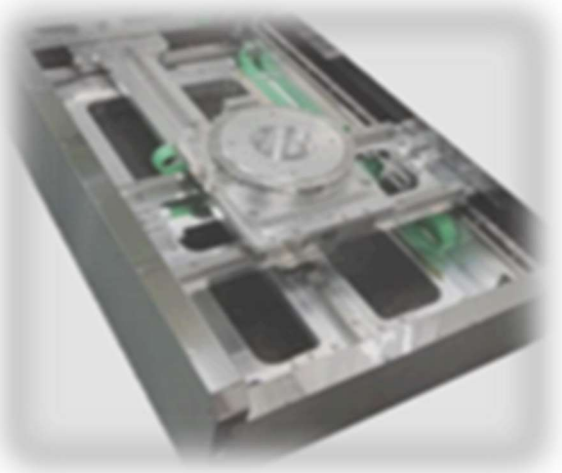
Stroke (mm)		Dimensions- mm	
Upper axis	Lower axis	A	PxN
160	160	510	2 x 3
210	210	550	2 x 3
310	310	650	3 x 4
380	380	720	3 x 4

● Positiong stage for ultra vacuum application

- Zero cogging linear motor is employed to achieve the best velocity stability.
- NSK precision linear guide is adopted for best performance.
- 50 nm stepping and repeatability of ±0.3umcan be realized.
- All windings are stationary to solve heat dissipation problem in the vacuum.
- A novel decoupling mechanism is adopted so that the band width and motor parameters are the same for both axes.
- Miniature optical encoder and programable resolution interpolator is used to ease application.
- Vacuum compatibility to 10e-7 Torr.

1. Model designation：

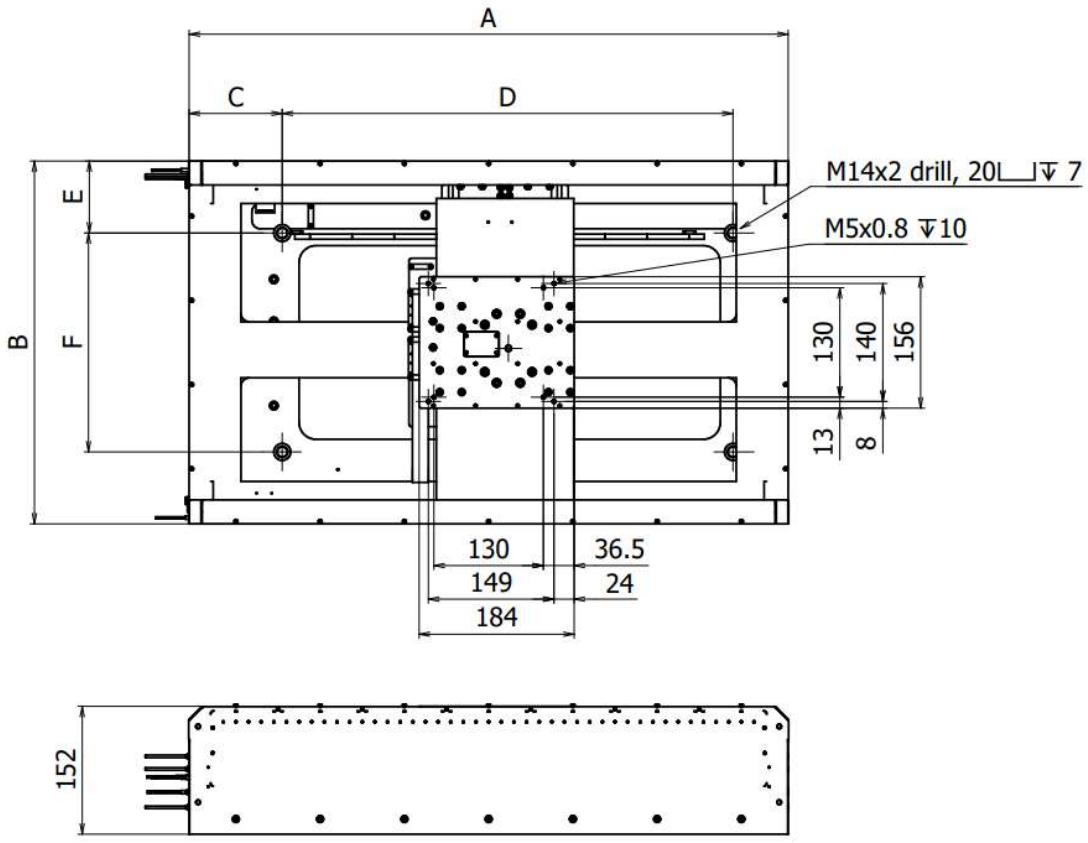
MTVC	450-310	03	10
Model	**Frame**	**Cable length inside vacuum chamber**	**Cable length outside vacuum chamber**
	250-150 450-200 450-310 R160	01: 100 mm 02: 200 mm 05: 500 mm	10: 1000 mm 30: 3000 mm 50: 5000 mm



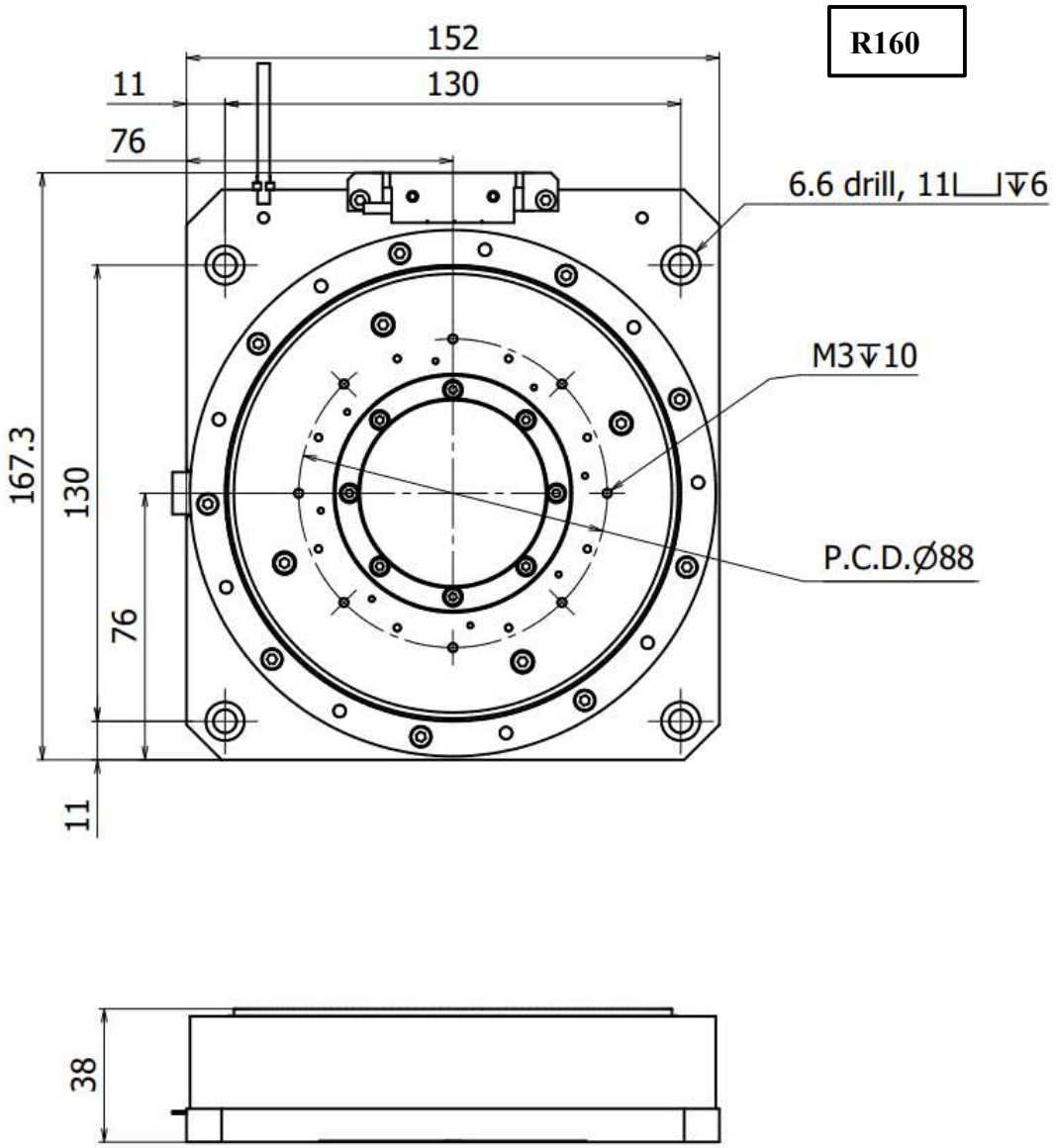
2. Specification：

Mechanical parameters	Unit	250-150	450-200	450-310	R160 Rotary DD
Total stroke	mm	260/160	460/210	460/320	360
Effective stroke	mm	250-150	450/200	450/310	360
Straightness	um	＜2	＜2	＜2	<2.5
Flatness	um	＜5	＜5	＜5	<5
Repeatability	um	±0.3	±0.3	±0.3	±1 arcsec
Accuracy	um	＜0.8	<0.8	<0.8	<3 arcsec
Moving mass of upper axis	kg	7	7	7	4618
Moving mass of lower axis	kg	7	7	7	Kg-mm^2
Maximal payload	kg	20	20	20	20
Electrical parameters	Unit				
Peak force of upper axis	Nt	190	190	190	2.7
Peak force of lower axis	Nt	190	190	190	Nt-m
Conti. Force of upper axis	Nt	63	63	63	0.9
Conti. Force of lower axis	Nt	63	63	63	Nt-m
Peak current of upper axis	Arms	15	15	15	4.8
Peak current of lower axis	Arms	15	15	15	
Conti. current of upper axis	Arms	5	5	5	1.6
Conti. current of lower axis	Arms	5	5	5	
Force constant of upper axis	Nt/Arms	13	13	13	0.56 Nt-m/Apeak
Force constant of lower axis	Nt/Arms	13	13	13	
Pole pair pitch	mm	45	45	45	12 poles
Motor voltage	VDC	48	48	48	48

3. Dimensions：

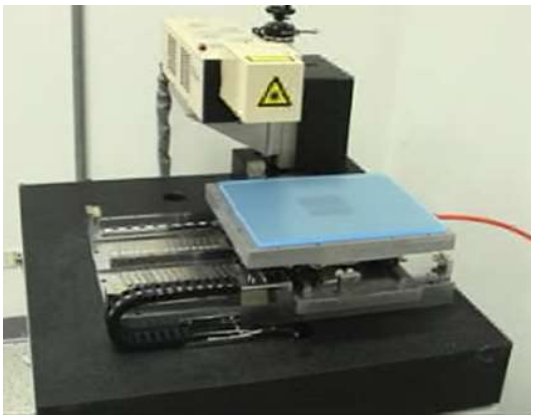


Stroke (mm)		Dimensions- mm					
Frame	Upper/lower	A	B	C	D	E	F
XY250-150	250/156	481	381	65.5	350	85.5	210
XY450-200	450/206	711	431	110.5	535	85.5	260
XY450-310	450/316	711	541	100	545	85.5	370


R160
152
11
130
76
6.6 drill, 11⌴↧6
M3↧10
P.C.D.Ø88
167.3
130
76
11
38

●Reference of applications

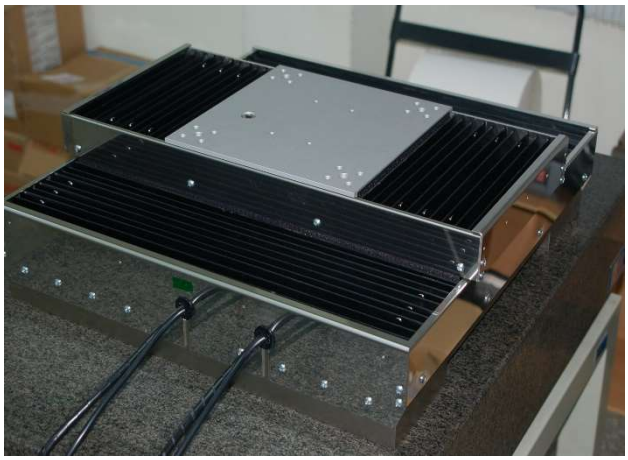
1.Laser drill stage for back light module



ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	310	310	
	Maximal (mm)	320	320	
Resolution (um)		0.1	0.1	
Straightness (um)		<1	<1	
Flatness (um)		<5	<5	
XYZ squareness (um)		<3		
Repeatability (um)		+/- 0.2	+/- 0.2	
Accuracy (um) (after laser calibration)		< 1	< 1	
Maximal speed (m/sec)		1.8	1.8	
Maximal Acc. (G)		2	2	

- The up axis and down axis are stacked with a very low profile design. The distance between working surface of up axis and linear guide mounting surface of down axis is only 100 mm.
- Wide span design of down axis together with driven by dual linear motors eliminates resonance in yaw direction due to gravity center change of up axis.
- The stage employees a bottom base made of cast iron to absorb vibration.
- Ultra-low cogging force linear motors are employed.

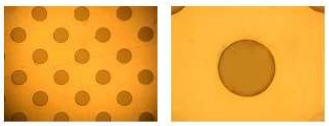
2. Ultra-precision Laser drill stage for Wafer Probe Card



高分子材料雷射鑽孔 Polymer Laser Drilling

雷射加工於Probe Card的另一項運用，係在高分子材料上以紫外光雷射鑽孔，利用紫外光雷射剝離(laser ablation)的特性，具備高解析度及低熱效應的加工製程，製作更細微的孔徑、更小的孔徑間距，目前也已屬穩定量產。

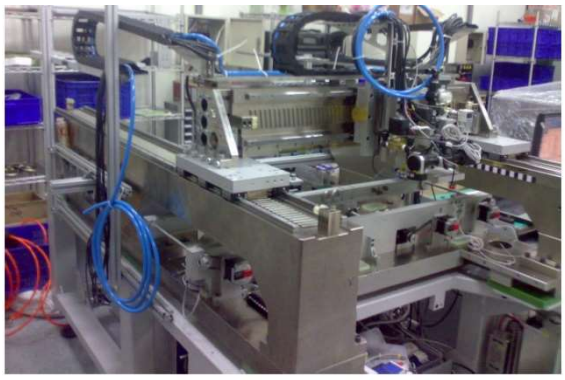
適用材料：PI、Mylar、Kapton、Polyimide等材料
鑽切厚度：0.15mm以下
加工孔徑：10μm以上
錐度：5度
加工精度：孔徑 ±1μm
位置精度：5μm以內
加工面積：150mm*150mm



ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	150	150	
	Maximal (mm)	160	160	
Resolution (um)		0.05	0.05	
Straightness (um)		<1	<1	
Flatness (um)		<5	<5	
XYZ squareness (um)		<2		
Repeatability (um)		+/- 0.1	+/- 0.1	
Accuracy (um) (with laser calibration)		< 1	< 1	
Maximal speed (m/sec)		0.8	0.8	
Maximal Acc. (G)		2	2	

- The up axis and down axis are stacked with a very low profile design. The distance between working surface of up axis and linear guide mounting surface of down axis is only 100 mm.
- Wide span design of down axis together with driven by dual linear motors eliminates resonance in yaw direction due to gravity center change of up axis.
- The stage employees a bottom base made of cast iron to absorb vibration.
- Built-in cable chain and fully covered bellow to improve protection grade.
- Ultra-low cogging force linear motors are employed.

3. Gantry stage for cell phone PCB remounting



ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	700	1500	
	Maximal (mm)	750	1550	
Resolution (um)		0.5	0.5	
Straightness (um)		<3	<3	
Flatness (um)		<9	<9	
XYZ squareness (um)		<5		
Repeatability (um)		+/- 1	+/- 1	
Accuracy (um) (with laser calibration)		< 5	< 5	
Maximal speed (m/sec)		2.5	2.5	
Maximal Acc. (G)		2.5	2.5	

- Dual linear motors, dual linear scales and dual drivers are employed to realize high speed/acceleration gantry system.
- X axis uses composite material to reduce weight and increase rigidity.
- M-shape bottom base made of cast iron is used to absorb vibration.
- Ultra-low cogging force linear motors are employed.

4. XY high-speed stage for SMD steel plate laser cutting machine

ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	600	600	
	Maximal (mm)	620	620	
Resolution (um)		0.5	0.5	
Straightness (um)		<2	<2	
Flatness (um)		<9	<9	
XYZ squareness (um)		<5		
Repeatability (um)		+/- 1.5	+/- 1.5	
Accuracy (um) (with laser calibration)		< 5	< 5	
Maximal speed (m/sec)		2	2	
Maximal Acc. (G)		2	2	

- The linear guides of X and Y axes are arranged on the same plane to enhance fast settling and trajectory tracking.
- The up axis and down axis are stacked with a very low profile design.

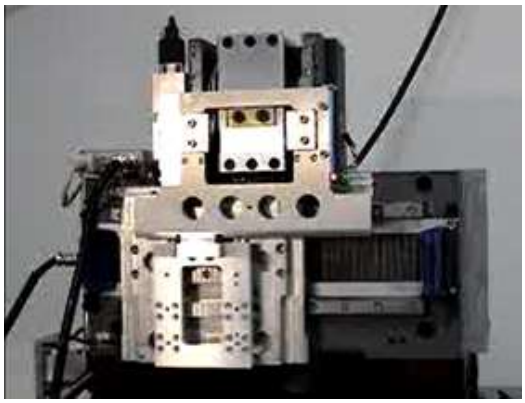
  The distance between working surface of up axis and linear guide mounting surface of down axis is only 60 mm.
- The stage employees a bottom base made of cast iron to absorb vibration.
- Built-in cable chain and fully covered bellow to improve protection grade.
- Ultra-low cogging force linear motors are employed.

5. XYZ precision stage for optical lens dispenser on LED wafer

ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	150	150	50
	Maximal (mm)	158	158	58
Resolution (um)		0.05	0.05	0.05
Straightness (um)		<2	<1	<1
Flatness (um)		<1	<2	<2
XYZ squareness (um)		<2	<2	
Repeatability (um)		+/- 0.1	+/- 0.1	+/- 0.1
Accuracy (um) (with laser calibration)		< 1	< 1	< 1
Maximal speed (m/sec)		0.8	0.8	0.8
Maximal Acc. (G)		2	2	2

- X and Y axes are arranged to move separately, while the Z axis is stacked on the top X axis.
- Moving magnet is employed so that there is no moving cable for this system.
- Built-in cable chain and fully covered bellow to improve protection grade.
- Ultra-low cogging force linear motors are employed.

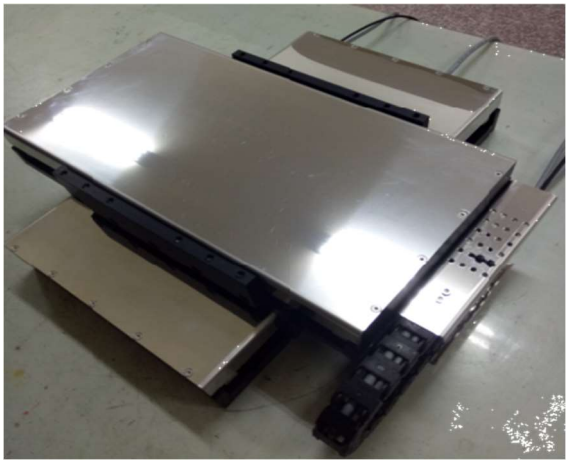
6. YZ high-speed stage for die bonder



ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)		150	50
	Maximal (mm)		160	58
Resolution (um)			1	1
Straightness (um)			<2	<2
Flatness (um)			<5	<5
XYZ squareness (um)			<5	
Repeatability (um)			+/- 2	+/- 2
Accuracy (um) (with laser calibration)			< 1	< 1
Maximal speed (m/sec)			4	4
Maximal Acc. (G)			7	7

- Y and Z axes are decoupled to move so that the payload for both axes are the same to achieve the same bandwidth.
- Moving magnet is employed so that there is no moving cable for this system.
- The stage employees a bottom base made of cast iron to absorb vibration.
- Ultra-low cogging force linear motors are employed.

7. Precision stage for submicron EDM



ITEM		X axis (up)	Yaxis(down)	Z axis
Stroke	Effective (mm)	150	150	
	Maximal (mm)	160	160	
Resolution (um)		0.02	0.02	
Straightness (um)		<1	<1	
Flatness (um)		<5	<5	
XYZ squareness (um)		<3		
Repeatability (um)		+/- 0.05	+/- 0.05	
Accuracy (um) (with laser calibration)		< 0.5	< 0.5	
Maximal speed (m/sec)		1	1	
Maximal Acc. (G)		3	3	

- The up axis and down axis are stacked with a very low profile design. The distance between working surface of up axis and linear guide mounting surface of down axis is only 100 mm.
- Wide span design of down axis together with driven by dual linear motors eliminates resonance in yaw direction due to gravity center change of up axis.
- Built-in cable chain and blind path cover to improve protection grade.
- Ultra-low cogging force linear motors are employed.

8. Long stroke positioning module for LCD panel handler

ITEM		X axis
Stroke	Effective (mm)	6000
	Maximal (mm)	6100
Resolution (um)		1
Straightness (um)		<15
Flatness (um)		<30
Repeatability (um)		+/- 3
Accuracy (um) (with laser calibration)		< 5
Maximal speed (m/sec)		5
Maximal Acc. (G)		2

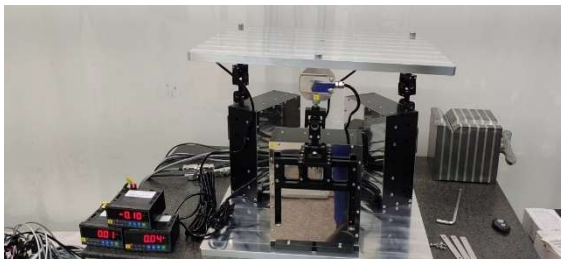
- Scaleless position encoder is employed to ease installation.
- Extremely low cogging linear motor is used to minimize speed ripple.

9. Long stroke positioning module for outdoor banner printer

ITEM		X axis
Stroke	Effective (mm)	5000
	Maximal (mm)	5100
Resolution (um)		1
Straightness (um)		<15
Flatness (um)		<30
Repeatability (um)		+/- 3
Accuracy (um) (with laser calibration)		< 5
Maximal speed (m/sec)		5
Maximal Acc. (G)		2

- Scaleless position encoder is employed to ease installation.
- Extremely low cogging linear motor is used to minimize speed ripple.

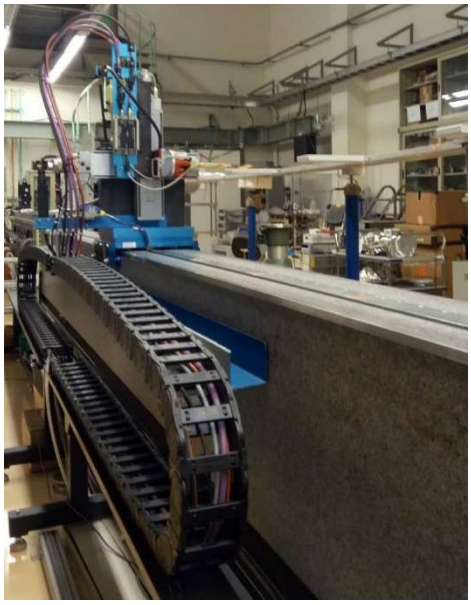
10. Z-Pitch-Roll positioning module with force feedback for wafer bonding



ITEM		Z axis
Stroke	Effective (mm)	25
	Maximal (mm)	20
Resolution (um)		0.02
Straightness (um)		<1
Flatness (um)		<2
Repeatability (um)		+/- 0.2
Accuracy (um) (with laser calibration)		< 2
Maximal speed (m/sec)		0.3
Maximal Acc. (G)		2

- Z-pitch-roll 3DOF motion is realized with 3 Z axis together with 3 universal bearing.
- Each axis equipped with load cell for real-time force feedback to equalize the pressure of the whole surface.
- Extremely low cogging linear motor is used to minimize speed ripple.

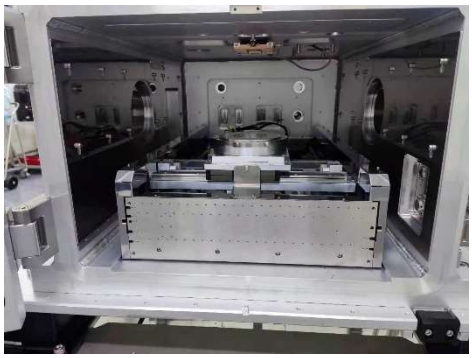
11. Air-bearing positioning stage for magnetic field measurement system of NSRRC



ITEM		Z axis
Stroke	Effective (mm)	5000
	Maximal (mm)	5200
Resolution (um)		0.02
Straightness (um)		<1
Flatness (um)		<1
Repeatability (um)		+/- 0.1
Accuracy (um) (with laser calibration)		<0.5
Maximal speed (m/sec)		0.5
Maximal Acc. (G)		1

- Air bearing is used to achieve long stroke precision motion.
- Extremely low cogging linear motor is used to minimize speed ripple.
- Symmetrical cable chains is designed to cancel out the bending force from cables.

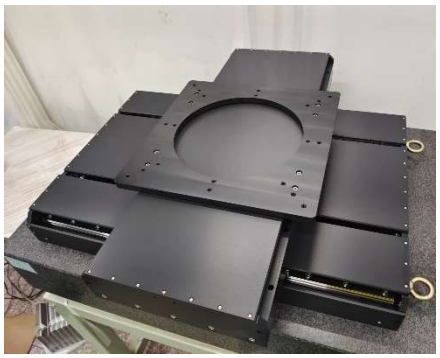
12. Ultra precision positioning stage for E-beam inspector



ITEM		X axis	Y axis	R axis
Stroke	Effective (mm)	310	450	360 degree
	Maximal (mm)	320	460	360 degree
Resolution (um)		0.02	0.02	0.1 arcsec
Straightness (um)		<1	<1	<1 (同心度)
Flatness (um)		<3	<3	<1
Repeatability (um)		+/- 0.3	+/- 0.3	+/- 0.5 arcsec
Accuracy (um) (with laser calibration)		<0.5	<0.5	<2 arcsec
Maximal speed (m/sec)		0.4	0.4	15 rpm
Maximal Acc. (G)		1.5	1.5	1

- All motor windings are stationary so that the heat can be dissipated to the frame of vacuum chamber.
- Extremely low cogging linear motor is used to minimize speed ripple.
- High vacuum compatible to 10 e-7 Torr.

13. Ultra precision positioning stage for line-scan wafer inspector



ITEM		X axis	Y axis
Stroke	Effective (mm)	390	390
	Maximal (mm)	400	400
Resolution (um)		0.02	0.02
Straightness (um)		<1	<1
Flatness (um)		<3	<3
Repeatability (um)		+/- 0.1	+/- 0.1
Accuracy (um) (with laser calibration)		<0.5	<0.5
Maximal speed (m/sec)		0.4	0.4
Maximal Acc. (G)		1.5	1.5

- Special linear guide arrangement leads to excellent speed stability <0.2mm/s @ 250 mm/s (0.08%)
- Extremely low cogging linear motor is used to minimize speed ripple.
- Black anodizing surface treatment to reduce reflection light interference.

14. Gantry stage with carbon fiber moving beam for laser cutting machine

ITEM		X axis	Y axis
Stroke	Effective (mm)	850	1600
	Maximal (mm)	900	1650
Resolution (um)		1	1
Straightness (um)		<3	<3
Flatness (um)		<10	<10
Repeatability (um)		+/- 3	+/- 3
Accuracy (um) (with laser calibration)		<5	<5
Maximal speed (m/sec)		5	5
Maximal Acc. (G)		6	6

- Carbon fiber low weight moving beam (1.2m / 42kg) is employed to achieve 6G acceleration gantry system.
- Extremely low cogging linear motor is used to minimize speed ripple.

Black anodizing surface treatment to reduce reflection light interference.