



MECHANO TRANSFORMER

Specialist of Precision Piezo-Actuators



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COMPANY

Mechano Transformer Corporation expertise in core Actuator technology, aiming to explore opportunities globally by providing new developments to industries such as medical, energy, agricultural etc.

ABOUT US 会社案内

COMPANY

Company Name	Mechano Transformer Corporation
President	Chee Sze Keat
Paid-in capital	10 Million Japanese Yen
Location	Head Office: 4F BUILDX No3, 2-7-12, Iwamoto Cho Chiyoda-ku Tokyo 101-0032 Japan Aoto Factory: 7-23-23, Aoto, Katsushika-ku, Tokyo 125-0062 Japan Malaysia Office: Kuala Lumpur SK PRECISION ENTERPRISE
History	MAY 2002: The establishment Denshi Seiki Co. Ltd Shinagawa Ward, Tokyo MAY 2005: The relocation to our current address at KBIC, the replacement of the company name to Mechano Transformer Corp. and the acceptance of the Kawasaki Entrepreneur Award for Excellence MAY 2006: The approval to obtain the SME Support Growth Grant by the Organization for SME and Regional Innovation, Japan



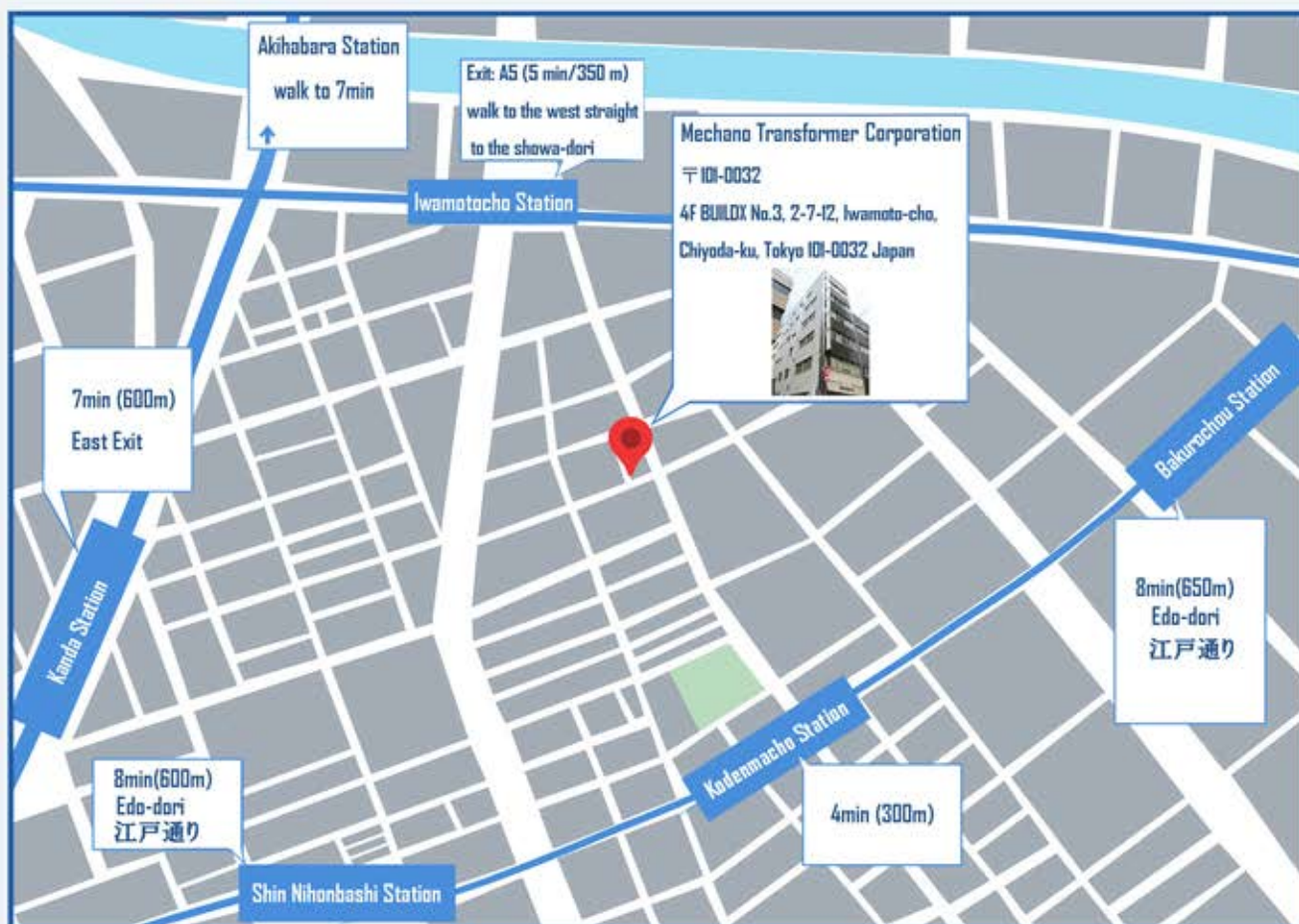
ACCESS

Mechano Transformer Corporation (Head Office)

Address: 〒101-0032

4F BUILDX No3, 2-7-12, Iwamoto-cho,
Chiyoda-ku, Tokyo 101-0032 Japan

TEL: 03-5835-0108 FAX: 03-5835-0109



Station near by us

Kanda Station     7min by walking

Iwamotocho Station  5min by walking

Bakurochou Station   8min by walking

Shin Nihonbashi Station  8min by walking

Kodenmacho Station  5min by walking

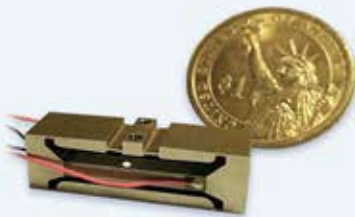
Akihabara Station    8min by walking

PRODUCTS

製品情報

Years of experience in handling a type of smart actuator - piezo actuator we have a complete range of product line-up from stacked piezo actuator to mechanical transformer (MechaTrans™, this is a mechanical structure to overcome the limitation of stacked piezo actuator developed by our company) to applications such as Piezo Assist precision stage, Piezo Assist precision motor, Piezo valves, Mirror Holder. We offer both standardized and customized products with output stroke from several μm to several mm for piezo actuator.

Besides the standardized products stated in this homepage we provide customized products based on customer needs. Besides that, we also offer a range of drivers to drive and controllers these actuators (including small size drivers as tiny as fingertip).



Piezo Actuator: MechaTrans®



Drivers



Piezo Assist Motor



1-3 Dice & Fill Composites



Thin Piezo Actuator/ Piezo Sensor;
Macro Fiber Composite



Piezo Assist Stage



1-3 Random Fiber
Composites

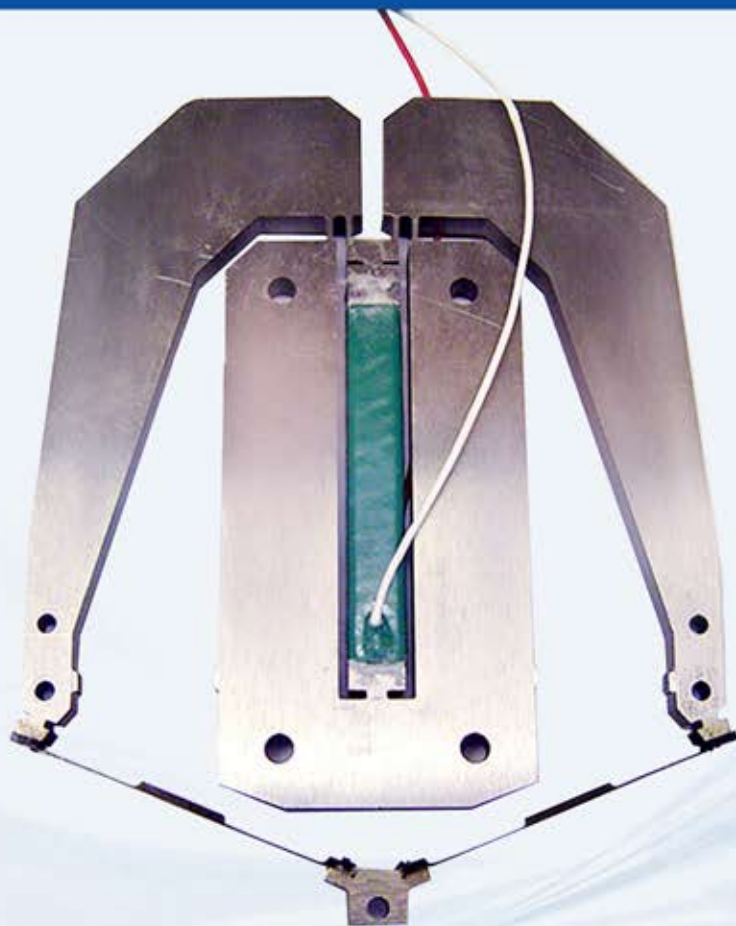


1-3 Regular Fiber
Composites

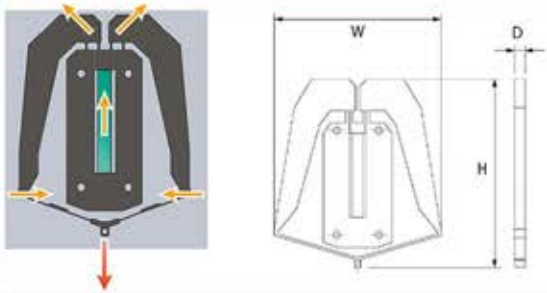


Customized Products

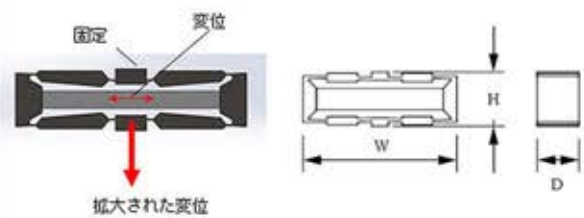
Piezo Actuator : MechaTrans®



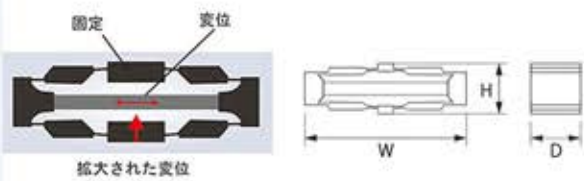
Piezo Actuator: MechaTrans[®]

MTA Series	Movement direction : Elongation	MIN	MAX
	W (mm)	25	89
	D (mm)	1	10
	H (mm)	28	97
	Displacement (μm)	75	3,000
	Blocked force (N)	0	64

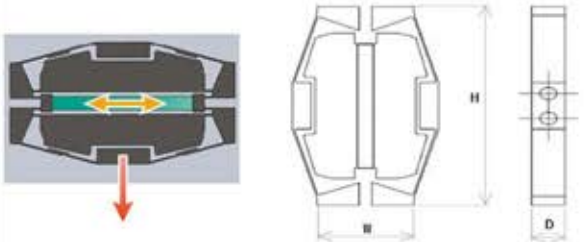
(p5~7)

MTDD Series	Movement direction : Shrink	MIN	MAX
	W (mm)	15	52
	D (mm)	3	16
	H (mm)	5	14
	Displacement (μm)	50	750
	Blocked force (N)	3	90

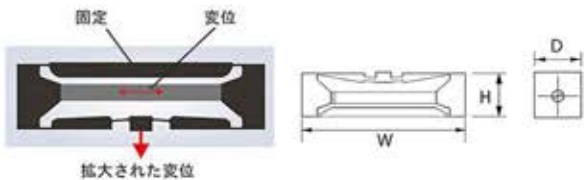
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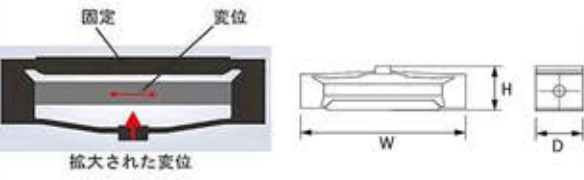
MTD Series	Movement direction : Shrink	MIN	MAX
	W (mm)	15	52
	D (mm)	3	37
	H (mm)	5	90
	Displacement (μm)	50	830
	Blocked force (N)	3	920

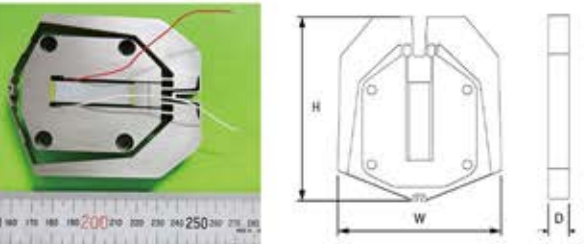
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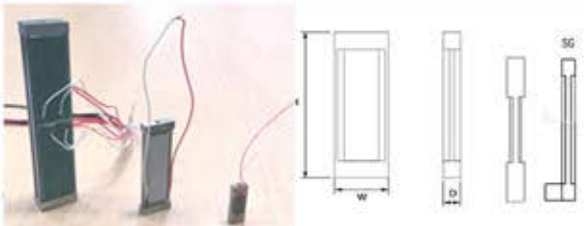
MTN Series	Movement direction : Elongation	MIN	MAX
	W (mm)	2	10
	D (mm)	3	10
	H (mm)	10	80
	Displacement (μm)	50	200
	Blocked force (N)	4	113

(p12)

MTA Series	Movement direction : Elongation	MIN	MAX
	W (mm)	15	84
	D (mm)	3	21
	H (mm)	5	37
	Displacement (μm)	45	500
	Blocked force (N)	4	170

MTDD Series	Movement direction : Elongation	MIN	MAX
	W (mm)	12	28
	D (mm)	5	12
	H (mm)	8	12
	Displacement (μm)	18	130
	Blocked force (N)	13	65

MTD Series	Movement direction : Shrink	MIN	MAX
	W (mm)	-	79
	D (mm)	-	94
	H (mm)	-	10
	Displacement (μm)	-	1,450
	Blocked force (N)	-	70

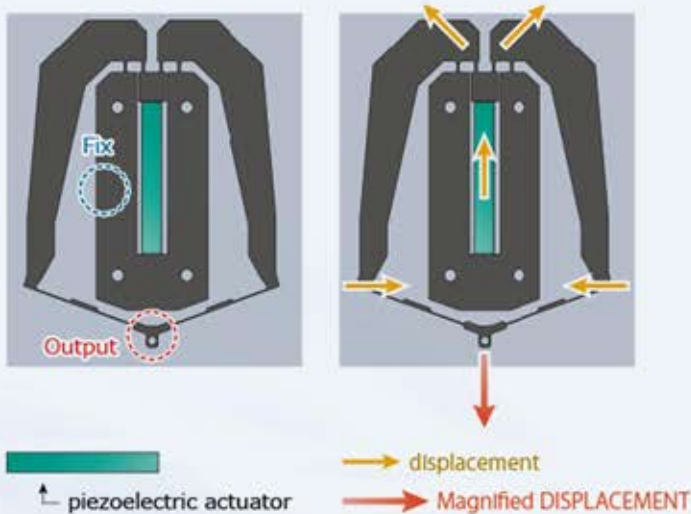
MTN Series	Movement direction : Elongation	MIN	MAX
	W (mm)	3	10
	D (mm)	9	16
	H (mm)	22	52
	Displacement (μm)	5	50
	Blocked force (N)	50	3,000

MTA Series

The displacement, force, rigidity and capacitance of the existing MechaTrans® are shown in the following table. These specification data is measured at DC 100 volts as recommended by Mechano Transformer. Fig.4 is MechaTrans® map which shows the relation between the displacement and the force. It may be useful to select an optimum MechaTrans®.



The operating principles



Outline important parameters

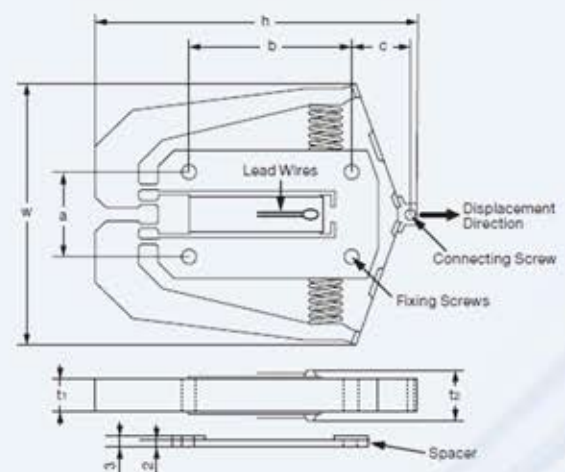
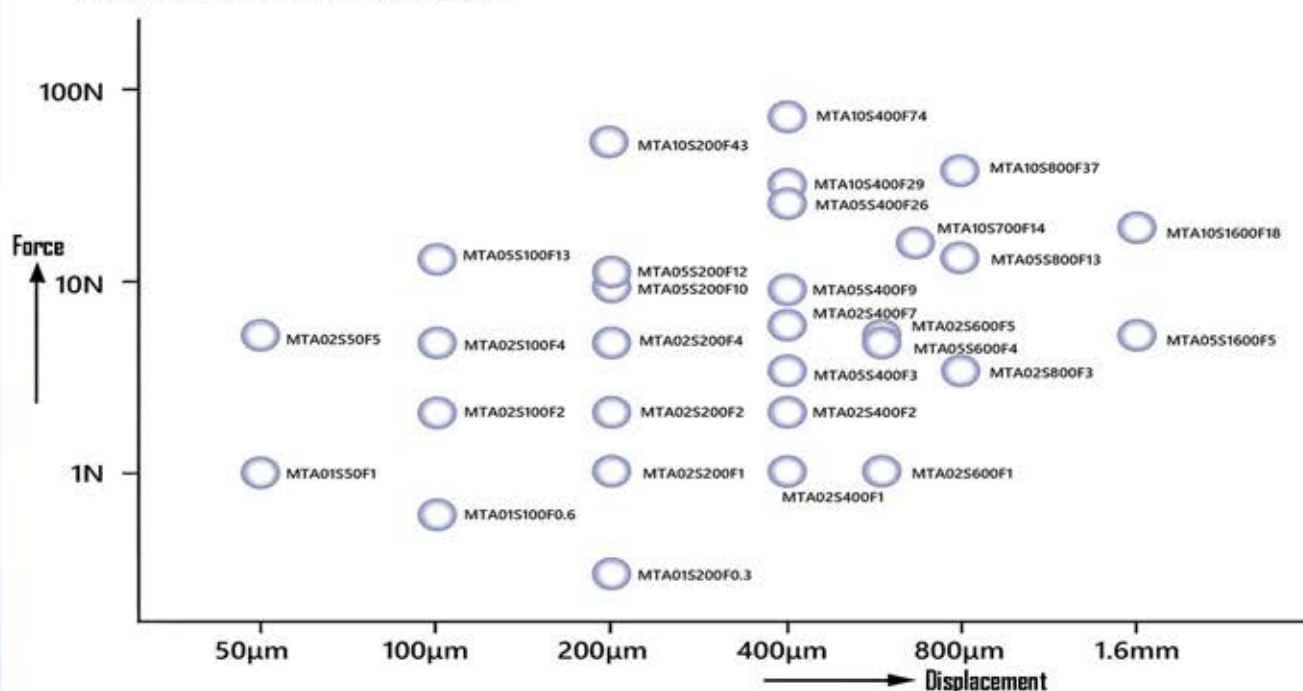


Fig. 3

The dimensions of each part are as follows

(mm)										
Type	Item	t 1	t 2	h	w	a	b	c	Fixed Screw	Drive Strew
	MTA01S50F1	1	1.9	32	26	10.4	7	9.8	φ2	φ2
	MTA01S100F0.6	1	1.9	32	26	10.4	7	9.8	φ2	φ2
	MTA01S200F0.3	1	1.9	32	26	10.4	7	11.3	φ2	φ2
	MTA02S50F5	2	3.5	28	25	10.4	7	9.7	φ2	φ2
	MTA02S100F2	2	3.5	31	30	10.4	7	9.7	φ2	φ2
	MTA02S200F1	2	3.5	33	35	10.4	7	9.7	φ2	φ2
	MTA02S100F4	2	3.5	46	43	13	14	13	φ3	φ2
	MTA02S200F2	2	3.5	42	43	13	14	13	φ3	φ2
	MTA02S400F1	2	3.5	46	48	13	14	13	φ3	φ2
	MTA02S200F4	2	3.5	63	58	15	24	18	φ3	φ2
	MTA02S400F2	2	3.5	55	58	15	24	13	φ3	φ2
	MTA02S600F1	2	3.5	62	58	15	24	18	φ3	φ2
	MTA02S400F7	2	3.5	81	58	15	44	13	φ3	φ2
	MTA02S600F5	2	3.5	83	58	15	44	13	φ3	φ2
	MTA02S800F3	2	3.5	79	58	15	44	13	φ3	φ2
	MTA05S100F13	4.8	8	53	52	16	19	13.5	φ3	φ2
	MTA05S200F10	4.8	8	51	50	16	19	13.5	φ3	φ2
	MTA05S400F3	4.8	8	55	50	16	19	14	φ3	φ2
	MTA05S200F12	4.8	8.6	65	58	16	26	15	φ3	φ2
	MTA05S400F9	4.8	8.6	61	58	16	24	15	φ3	φ2
	MTA05S600F4	4.8	8.6	65	58	16	24	15	φ3	φ2
	MTA05S400F26	4.8	8.6	86	67	18	44	17	φ3	φ2
	MTA05S800F13	4.8	8.6	86	67	18	44	17	φ3	φ2
	MTA05S1600F5	4.8	8.6	91	77	20	50	15	φ3	φ2
	MTA10S200F43	9.4	14.2	75	75	26	29	17.8	φ4	φ2
	MTA10S400F29	9.4	14.2	75	75	26	29	17.8	φ4	φ2
	MTA10S700F14	9.4	14.2	75	83	26	29	17.8	φ4	φ2
	MTA10S400F74	9.4	14.2	96	77	26	49	17.8	φ4	φ2
	MTA10S800F37	9.4	14.2	96	77	26	49	17.8	φ4	φ2
	MTA10S1600F18	9.4	14.2	97	89	26	49	17.8	φ4	φ2

Fig.4 Map of MechaTrans displacement and force



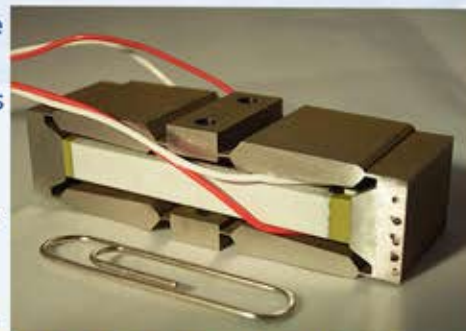
Price

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTA01S50F1	26×1×32	75	1.4	0.028		0.026				
MTA01S100F0.6	26×1×32	150	0.6	0.006		0.026				
MTA01S200F0.3	26×1×32	300	0.3	0.002		0.026				
MTA02S50F5	25×2×28	75	5	0.074		0.090				
MTA02S100F2	30×2×31	150	2	0.017		0.090				
MTA02S200F1	35×2×33	300	1	0.004		0.090				
MTA02S100F4	43×2×46	150	4	0.043		0.180				
MTA02S200F2	43×2×42	300	2	0.011		0.180				
MTA02S600F2	44×2×40	600	2	0.003	600	0.420				
MTA02S200F4	58×2×63	300	4	0.017		0.350				
MTA02S400F2	58×2×55	600	2	0.005		0.350	Please check our homepage for the price			
MTA02S600F1	58×2×62	900	1	0.002		0.350				
MTA02S400F7	58×2×81	600	7	0.017		0.820				
MTA02S600F5	58×2×83	900	5	0.008		0.820				
MTA02S800F3	58×2×79	1200	3	0.004		0.820				
MTA05S100F13	52×5×53	150	13	0.132		0.750				
MTA05S200F10	50×5×51	300	8	0.037		0.750				
MTA05S400F3	50×5×55	600	3	0.007		0.750				
MTA05S200F12	58×5×65	300	12	0.049		1.40				
MTA05S400F9	58×5×61	600	8	0.021	450	1.40				
MTA05S600F4	58×5×65	900	4	0.007	288	1.40				
MTA05S400F26	67×5×86	600	27	0.057	800	3.40				
MTA05S1200F22	67×5×86	1200	22	0.018	400	4.40				
MTA05S2400F11	77×5×91	2400	11	0.005	190	4.70				
MTA05S3000F3	79×5×90.5	3000		0.001	160	6.90				
MTA10S200F43	75×10×75	300	43	0.228		5.40				
MTA10S400F29	75×10×75	600	28	0.071		5.40				
MTA10S700F14	83×10×75	1050	14	0.019		5.40				
MTA10S400F74	77×10×96	600	64	0.148		25				
MTA10S1200F70	77×10×96	1200	70	0.0583	462	25				
MTA10S1600F18	89×10×97	2400	18	0.011	190	25				

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MTDD Series

MTDD Series is a compact piezoelectric actuators that can generate output strokes, which is 10 times and above larger than the stroke of a multilayer stacked piezoelectric actuator. MTDD Series consists of a stroke magnification or amplification structure and multilayer stacked piezoelectric actuators. With the stroke magnification structure, the stroke is magnified to overcome the limitation of the multilayer stacked piezoelectric actuator. MTDD Series is designed flat and compact in size, therefore the efficiency of the space utilization is high. The output stroke is converted to 90 degree in direction compare to the original output stroke of the multilayer stacked piezoelectric actuator. When a voltage is applied to the MechaTrans®DD-Series, it elongates as shown in Fig. 2.



Features of the MTDD Series

- Large output stroke
- Flat and compact
- Output stroke of the piezoelectric actuators is converted to 90 degrees in direction.
- The MechaTrans®DD-Series elongates as Fig. 2 when a voltage applied.
- Output stroke direction is opposite to the MTD-Series

The operating principle

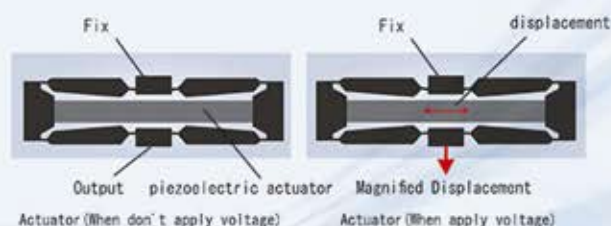
Mechanical tapped holes are fabricated at both sides of the MechaTrans®DD-Series. Lead wires of red and black(white) are attached at the piezoelectric actuators. Fig. 1 shows an example of the connection between the driver and the piezoelectric actuators. A resistance may be needed in between depend on the driving conditions. When a voltage is applied to the piezoelectric actuators, the MechaTrans®DD-Series elongate as shown in Fig. 2.



(1) A piezoelectric actuator system



(2) Enlarged picture of the MechaTrans®DD-Series



Prices

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD08S250F12	26×8×7	250	12	0.048	450	1.4				
MTDD03S50F3	15×3×5	50	3	0.06	1500	0.03				
MTDD06S100F10	20×6×7	100	10	0.10	700	0.2				
MTDD06S100F11	20×6×7	100	11	0.11	900	0.36				
MTDD06S330F7	22×6×7.8	330	7	0.02	400	0.86				
MTDD08S180F32	28×8×8	180	32	0.18	900	0.9	Please check our homepage for the price			
MTDD08S300F16	26×8×7	300	16	0.053	460	0.7				
MTDD08S300F18	26×8×7	350	18	0.051	500	0.8				
MTDD12S90F5	22×12×5.12	90	5	0.06	700	0.36				
MTDD12S600F80	46.8×12×12.6	600	80	0.13	300	6.75				
MTDD16S750F90	52×16×14	750	90	0.12	230	8.0				
MTDD16S830F80	52×16×14	830	80	0.10	230	11.8				
MTDD16S860F64	52×16×14	860	64	0.07	195	11.7				

MTDD Series - Non Magnetic

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD16S860F64NM	52×16×14	860	64	0.07	195	11.7	Please check our homepage for the price			

MTDD Series - Non Magnetic & Vacuum Compatible

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD12S600F80-VC	46.8×12×12.6	600	80	0.13	300	2.6	Please check our homepage for the price			

MTDD Series - Non Magnetic & Vacuum Compatible

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD10S580F80NM-PS	64×10×21.4	580	80	0.14	282	11.6	Please check our homepage for the price			

MTDD Series - With Linear Bush

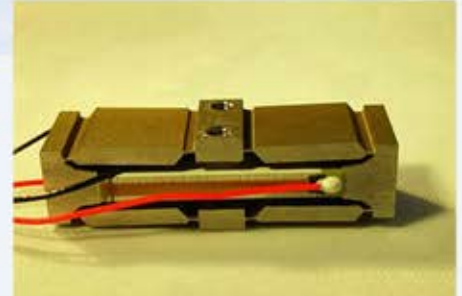
商品名	外形寸法[mm] W×D×H	変位 [μm]	力 [N]	剛性 [N/μm]	自己共振 周波数 [Hz]	静電容量 [μF]	価格 [¥] (税込)			
							1個	5個以上	25個以上	100個以上
MTDD23S150F800LB	90×54×27	1500	800	5.33	1600	23.1	Please check our homepage for the price			

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MTD Series

The MechaTrans®D-Series is a compact piezoelectric actuators that can generate large output strokes, which is 10 times and above larger than the stroke of a multilayer stacked piezoelectric actuator. The MechaTrans®D-Series consists of a stroke magnification / amplification structure and multilayer stacked piezoelectric actuators. With the stroke magnification structure, the stroke is magnified to overcome the limitation of the multilayer stacked piezoelectric actuator. The MechaTrans®D-Series is designed flat and compact in size, therefore the efficiency of the space utilization is high. The output stroke is converted to 90degree in direction compare to the original output stroke of the multilayer stacked piezoelectric actuator. When a voltage is applied to the MechaTrans®D-Series, it shrinks as shown in Fig. 2.



Features of the MTD Series

- Large output stroke
- Flat and compact
- Output stroke of the piezoelectric actuators is converted to 90 degrees in direction.
- The MechaTrans®D-Series shrinks as Fig. 2 when a voltage applied.
- Output stroke direction is opposite to the MechaTrans®DD-Series

The operating principle of the MTD Series

Mechanical tapped holes are fabricated at both sides of the MechaTrans®D-Series. Lead wires of red and black(white) are attached at the piezoelectric actuators. Fig. 1 shows an example of the connection between the driver and the piezoelectric actuators. A resistance may be needed in between depend on the driving conditions.

When a voltage is applied to the piezoelectric actuators, the MechaTrans®D-Series shrink as shown in Fig. 2.

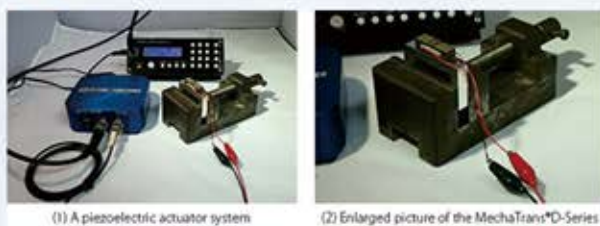


Fig.1 The piezoelectric actuator system

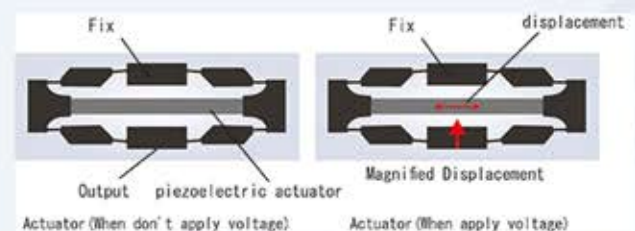


Fig.2 Operating principles

Prices

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTD03S50F3	15×3×5	50	3	0.06	2000	0.03				
MTD08S250F27	22×8×8	250	27	0.11	790	0.85				
MTD08S270F25	22×8×8	270	25	0.09	650	0.85				
MTD08S300F25	26×8×8	300	25	0.08	500	0.85				
MTD16S750F90	52×16×16	750	90	0.12	290	8.5	Please check our homepage for the prices			
MTD16S750F120	52×16×16	750	120	0.16	320	11.5				
MTD16S800F90	52×16×16	800	90	0.11	280	3.2				
MTD16S830F100	52×16×16	830	100	0.12	290	8.5				
MTD20S160F920	21.1×37×90	160	920	5.75	850	25				

MTDD Series - Non Magnetic

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD16S860F64NM	52×16×14	860	64	0.07	195	11.7	Please check our homepage for the prices			

MTDD Series - Non Magnetic

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTDD16S860F64NM	52×16×14	860	64	0.07	195	11.7	Please check our homepage for the prices			

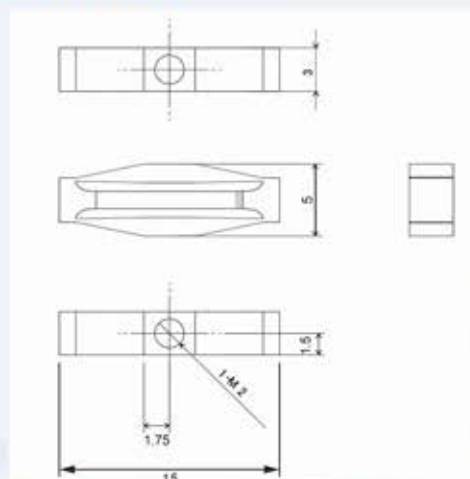
*1 : Nominal value *2 : Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Applications

These are some examples of the application of the MTD Series.

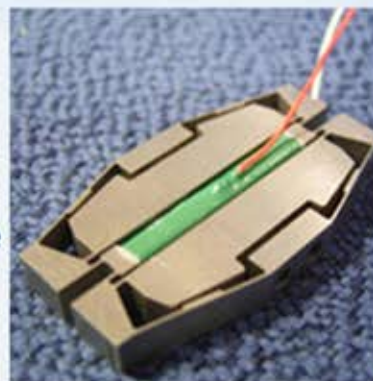
- Positioning stage for lithography process
- Auto focus module for a camera
- Precision pump



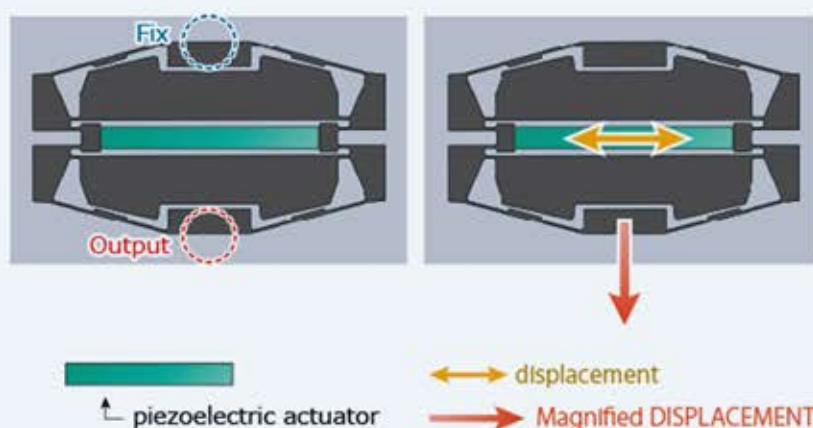
MTN Series

Features

- Compact and thin
- Output stroke perpendicular to the output stroke the piezoelectric actuator



The operating principles



Price

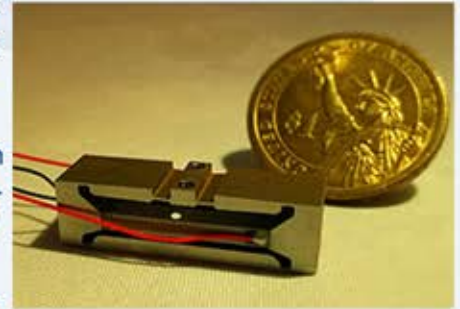
Product Name	Outline dimension(mm) W×D×H	Displacement (μm)		Blocked force F _s (N)	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
		≒ 100 V	≒ 150 V					1pc	5pc above	25pc above	100pc above
MTN03S100F6	2×3×10	70	100	6	60	950	Please check our homepage for the prices				
MTN04S270F8	2x3x20	190	270	8	30	380					
MTN10S1150F113	10×10×80	750	1150	113	110.7	106					

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MTKK Series

The MechaTrans®KK-Series is a High Speed piezo actuator that has a higher rigidity/stiffness and higher resonance frequency compare to the MechaTrans®DD-Series or the MechaTrans®D-Series. Therefore the High Speed MechaTrans®KK-Series has a shorter rise time. The High Speed MechaTrans®KK-Series consists of a stroke magnification / amplification structure and multilayer stacked piezoelectric actuators. With the stroke magnification structure, the stroke is magnified to overcome the limitation of the multilayer stacked piezoelectric actuator (piezo actuator). However, the magnification / amplification ratio is smaller than the MechaTrans®DD-Series or the MechaTrans®D-Series. Like the MechaTrans®DD-Series or the MechaTrans®D-Series, the High Speed MechaTrans®KK-Series is designed flat and compact in size, therefore the efficiency of the space utilization is high. The output stroke is converted to 90 degree in direction compare to the original output stroke of the multilayer stacked piezoelectric actuator. When a voltage is applied to the High Speed MechaTrans®KK-Series, it elongates as shown in Fig. 2.



Features of the MTKK-Series

- High resonance frequency
- High speed linear actuation & High blocked force
- Fast response/ Short rise time/ Flat and compact
- Output stroke direction is opposite to the MTK Series
- Output stroke of the piezoelectric actuators is converted to 90 degrees in direction
- MTKK Series elongates as Fig.2 when a voltage applied

The operating principle of the MTKK-Series

Mechanical tapped holes are fabricated at both sides of the MechaTrans®KK-Series. Lead wires of red and black(white) are attached at the piezoelectric actuators. Fig. 1 shows an example of the connection between the driver and the piezoelectric actuators. A resistance may be needed in between depend on the driving conditions.

When a voltage is applied to the piezoelectric actuators, the MechaTrans®KK-Series elongate as shown in Fig. 2.



(1) A piezoelectric actuator system



(2) Enlarged picture of the MechaTrans®KK-Series

Fig.1 The piezoelectric actuator system

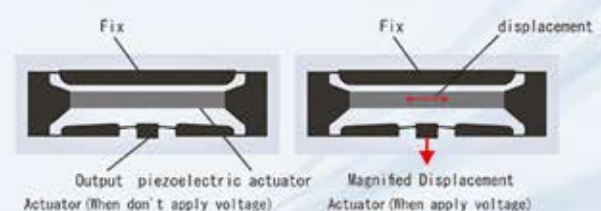


Fig.2 Operating principles of the MTKK Series

Price

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTKK03S45F4	15×3×4.8	45	4	0.09	5100	0.03				
MTKK08S70F20	14.7×8×4.5	70	20	0.29	6500	0.40				
MTKK08S180F30	28×8×8	180	30	0.17	3000	0.87	Please check our homepage for the prices			
MTKK12S100F40	24×12×7.13	100	40	0.40	6600	1.40				
MTKK16S250F180	40×16×11.8	250	180	0.72	2200	5.20				
MTKK12S400F140	56×12×16	400	140	0.35	1600	8.40				

Non Magnetic

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTKK08S180F30NM	28x8x8	180	30	0.17	3000	0.87	Please check our homepage for the prices			
MTKK16S250F180NM	36x16x11.8	250	180	0.72	1900	5.20	Please check our homepage for the prices			

Non Magnetic & Vacuum Compatible

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTKK08S60F17NM-VC	14.7×8×4.5	60	17	0.28	7400	0.15	Please check our homepage for the prices			
MTKK12S200F55NMVC	56×12×16	200	55	0.28	1500	1.28	Please check our homepage for the prices			

Element exchange type

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTKK16S400F170R	72×21×15	400	170	0.43	1200	12.5	Please check our homepage for the prices			
MTKK16S550F140R	72×21×15	550	140	0.25	970	12.5	Please check our homepage for the prices			

With Parallel Spring

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTKK05S300F80PS	58×5×25	300	80	0.27	1500	3.22	Please check our homepage for the prices			
MTKK10S300F120PS	84×10×36.8	300	138	0.46	1170	12	Please check our homepage for the prices			

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

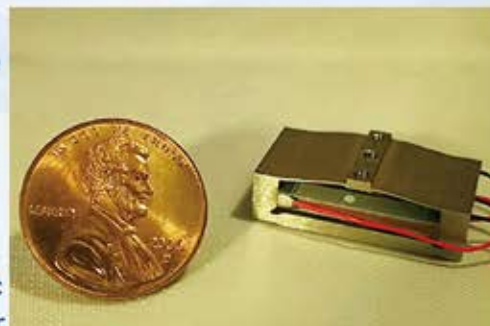
MTK Series

The MechaTrans®K-Series is a piezoelectric actuator that has a higher rigidity/stiffness and higher resonance frequency compare to the MechaTrans®DD-Series or the MechaTrans®D-Series.

Therefore the MechaTrans®K-Series has a shorter rise time. The MechaTrans®K-Series consists of a stroke magnification / amplification structure and multilayer stacked piezoelectric actuators.

With the stroke magnification structure, the stroke is magnified to overcome the limitation of the multilayer stacked piezoelectric actuator. However, the magnification/amplification ratio is smaller

than the MechaTrans®DD-Series or the MechaTrans®D-Series. Like the MechaTrans®DD-Series or the MechaTrans®D-Series, the MechaTrans®K-Series is designed flat and compact in size, therefore the efficiency of the space utilization is high. The output stroke is converted to 90 degree in direction compare to the original output stroke of the multilayer stacked piezoelectric actuator. When a voltage is applied to the MechaTrans®K-Series, it shrinks as shown in Fig. 2.



Features

- High resonance frequency & High blocked force
- Fast response/ Short rise time
- Flat and compact
- Output stroke of the piezoelectric actuators is converted to 90 degrees in direction
- Output stroke direction is opposite the MTKK-Series
- The MTK Series shrinks as Fig.2 when a voltage applied.

The operating principle of the MTK-Series

Mechanical tapped holes are fabricated at both sides of the MechaTrans®K-Series. Lead wires of red and black(white) are attached at the piezoelectric actuators. Fig. 1 shows an example of the connection between the driver and the piezoelectric actuators. A resistance may be needed in between depend on the driving conditions.

When a voltage is applied to the piezoelectric actuators, the MechaTrans®K-Series shrinks as shown in Fig. 2.



(1) A piezoelectric actuator system



(2) Enlarged picture of the MechaTrans®K-Series

Fig.1 The piezoelectric actuator system

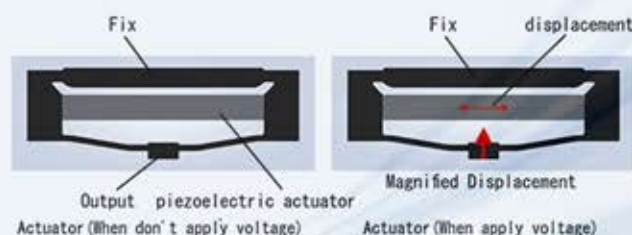


Fig.2 Operating principles of the MTK-Series

Price

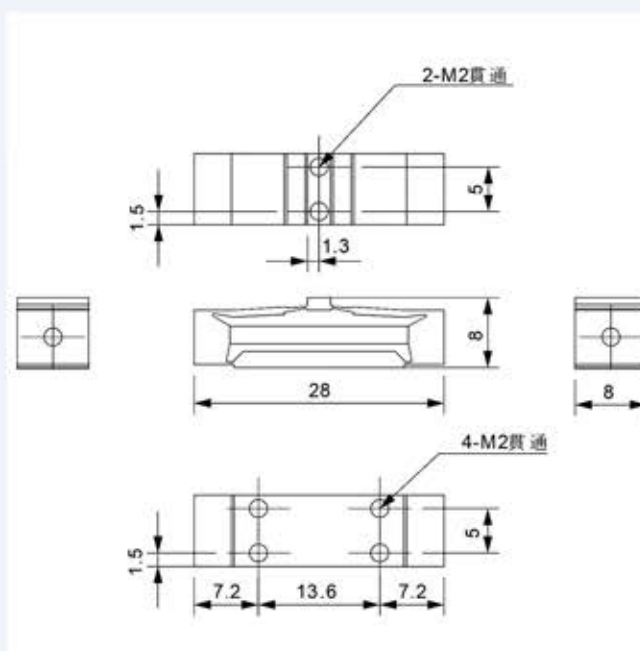
Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked force [N]	Stiffness [N/μm]	Resonance frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTK08S130F13	28×8×8	130	13	0.10	1750	0.73	Please check our homepage for the prices			
MTK08S160F30	28×8×8	160	30	0.19	3000	0.87	Please check our homepage for the prices			
MTK12S100F55	24×12×7.96	100	55	0.65	8000	1.31	Please check our homepage for the prices			
MTK12S18f25000	12×4.6×12	18	14	0.80	25000	0.60	Please check our homepage for the prices			

*1 : Nominal value *2 : Blocked-Free

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Applications

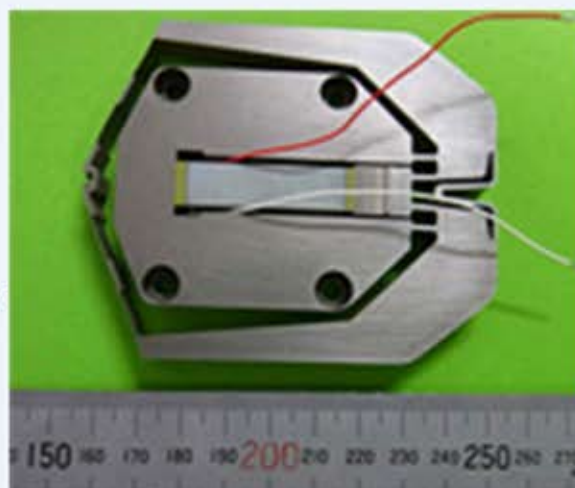
- Haptics actuator
- Precision stage for lithography process
- Auto focus module for camera
- Mass flow



MTAU Series

Features

- 1450 μ m Large displacement (@150V)
- Blocked force larger than 70N@150V)
- Rise time with Responsive high speed 1.3ms



Price

Product Name	Outline dimension(mm) W×D×H	Displacement [μ m]	Blocked Force [N]	Stiffness [N/ μ m]	Resonance Frequency [Hz]	Capacitance [μ F]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTAU10S1450F70	79×94×10	1450	70	0.048	425	25	Please check our homepage for the prices			

*1 : Nominal value *2 : Blocked-Free

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Non-Magnetic

Product Name	Outline dimension(mm) W×D×H	Displacement [μ m]	Blocked Force [N]	Stiffness [N/ μ m]	Resonance Frequency [Hz]	Capacitance [μ F]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTAU10S1450F70NM	79×94×10	1450	70	0.048	425	25	Please check our homepage for the prices			

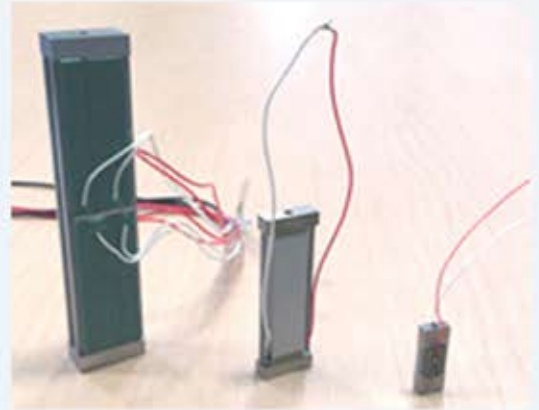
*1 : Nominal value *2 : Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MTPTK Series

MTPTK Series Nano Positioning Piezo Actuator

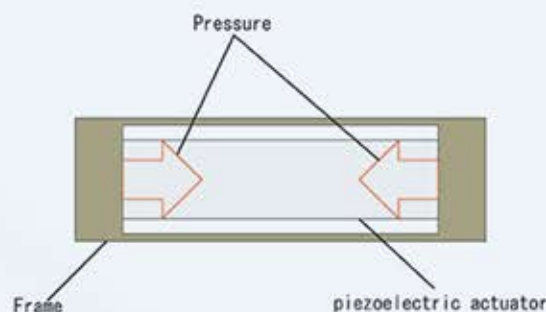
- Outstanding life time
- Nanometer resolution
- Microsecond response
- Capable to be used in closed loop
- Travel range 5~50 μ m
- Blocked force 50N~3000N



The preload structured piezoelectric actuator is a piezoelectric actuator where the multilayer stacked piezoelectric actuator is incorporated into a preload frame. The preload frame allows us to create a different output stroke and block force based on our needs by incorporating several multilayer stacked piezoelectric actuators into a preload frame.

Features

—Enhancing reliability of the multilayer stacked piezoelectric actuator



The multilayer stacked piezoelectric actuator can be so lasting when is well designed, but can be so fragile when the design work is insufficient. One the reason is the multilayer stacked piezoelectric actuator must be used under a preload conditions due its tension failure is so low which is 1/10 of its blocked (output) force. If a multilayer stacked piezoelectric actuator is well designed with preload, its life cycles can be more than 5 billions cycles.

—Easy to handle

It is quite tricky sometimes to utilize a multilayer stacked piezoelectric actuator. When the design works is not sufficient, then the output stroke become less. You need some know how to fully utilize it. Here, with the preload structured piezoelectric actuator, we guarantee you the performance of the multilayer stacked piezoelectric actuator. Besides, there are tapped hole machined in the preload mechanical structure, you can easily connect it to your experiment setup easily with screws. As the preload structured piezoelectric actuator is only connected to your experiments setup with screws, you can change it easily if there is a necessity. The multilayer stacked piezoelectric actuator will be more robust in your experiments setup when it is case in the preload mechanical structure.

—Reuse of the multilayer stacked piezoelectric actuator

The preload structured piezoelectric actuator can be reuse because it can be easily installed or removed from your experiments setup by removing the screws. Moreover, the multilayer stacked piezoelectric actuator will be more robust in your experiments setup when it is incorporated into a preload frame. Therefore, the chances to reuse the multilayer stacked piezoelectric actuator is high.

—Tailor made your own piezoelectric actuator

The are only several standard sizes of the multilayer stacked piezoelectric actuator in the market. When one need to use a different output performance of the multilayer stacked piezoelectric such as output stroke more that $100\mu\text{m}$, one have to order made from the manufacturer. However, it may be highly cost and time consuming to the process. Sometimes the manufacturers do not even supply such long stroke piezoelectric actuator. Therefore, we propose a preload structured piezoelectric actuator that can be tailor based on your needs. We can combine the multilayer piezoelectric actuator in series or in parallel in order to achieve performance you need. Figure of PTK10S90 shows an example of a long strokes preload structured piezoelectric actuator

Long stroke preload structured piezoelectric actuator (PTK10S90)

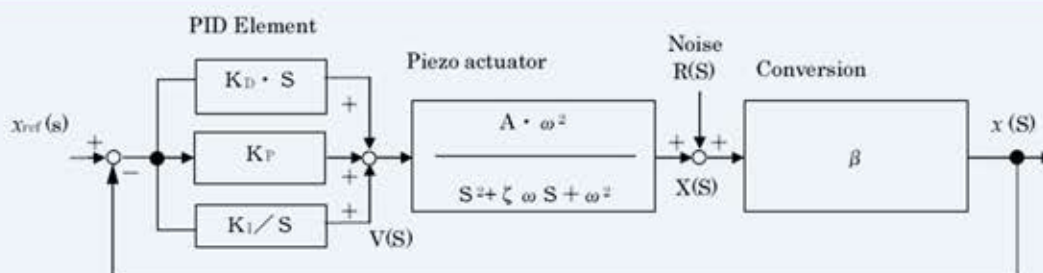


Outline

Dimension: 14 x 19 x 91mm

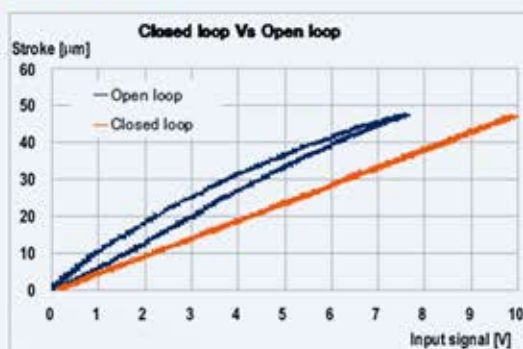
Output stroke: 100 μ m (-20V~150V)

Strain gages attached preload piezo actuator (MTPTK)

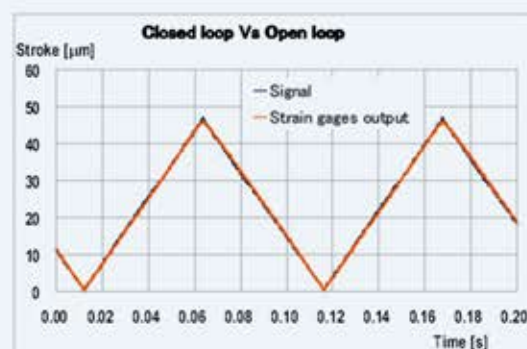


Structure of the closed loop system utilizing the PID control

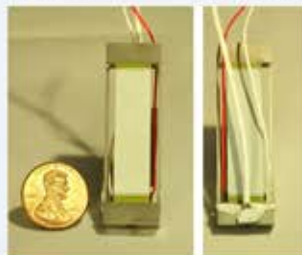
The piezo actuator (piezoelectric stack actuator) is known to have hysteresis, which effect the positioning accuracy. However, with a closed loop control, the linearity of the positioning accuracy can be guaranteed to a certain level depends on the positioning sensor used. Here is an example result of using the strain gages as a positioning sensor to form a closed loop to do a precise positioning with the piezo actuator. The structure of the closed loop system is illustrated below. The PID control method is utilized in the closed loop system.



Input signal Vs output stroke (displacement)



The tracking performance with strain gages (10Hz)



Picture of the strain gages attached preload piezo actuator

Price

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTPTK03S5F50	3×8.6×22	5	50	10.0	30000	0.20	Please check our homepage for the prices			
MTPTK03S28F150	14×3×52	28	150	5.3	3500@ 負荷30g付	1.1	Please check our homepage for the prices			
MTPTK05S45F1600	5×15.6×52	45	1600	35.6	2400@ 負荷130g付	9.0	Please check our homepage for the prices			
MTPTK05S50F2000	5×15.6×52	50	2000	40.0	2100@ 負荷130g付	11.0	Please check our homepage for the prices			
MTPTK10S50F3000	10×15.6×52	50	3000	60.0	2600@ 負荷130g付	25.6	Please check our homepage for the prices			

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Strain gages attached preload piezo actuator MTPTK-SG Series

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTPTK05S50F2000SG	5x16x52	50	2000	40.0	2100 @負荷 130g付		Please check our homepage for the prices			

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Silicon coating type MTPTK-SI Series

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTPTK10S50F2000-SI	10x12x52	50	2000	40.0	2800 @負荷 130g付	11.0	Please check our homepage for the prices			

*1: Nominal value *2: Blocked-Free

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

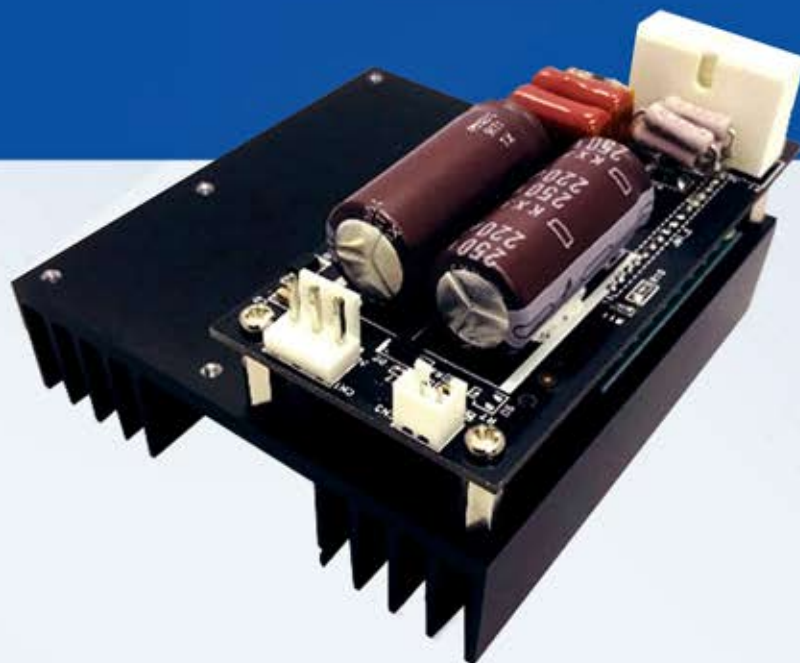
Vacuum environment compatible type MTPTK-VC Series

Product Name	Outline dimension(mm) W×D×H	Displacement [μm]	Blocked Force [N]	Stiffness [N/μm]	Resonance Frequency [Hz]	Capacitance [μF]	Price [¥] (Including Tax)			
							1pc	5pc above	25pc above	100pc above
MTPTK10S75F2000-VC	10x12x92	75	2000	26.7	2800 @負荷 130g付	11.0	Please check our homepage for the prices			

*1: Nominal value *2: Blocked-Free

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Drivers



Drivers

Mechano Transformer Corporation supply various drivers and controllers to drive piezo actuators (or piezoelectric elements) at a high-speed drive with low noise. Low noise is very important for positioning applications. Besides that, digital operation such as ON / OFF drive, the factor of supplying high instantaneous current is an extremely important selection criterion in high-speed drive applications. From board type, module type to case type etc, we supply and handle a wide range of applications as well as different capacity loads. Please feel free to contact us for customization needs.



Voltage Base



MTAD38

Please check our homepage for the price

Gain: 15X
Heat sink Dimension: 100x98x125.1mm
Max Peak Current setting: 8.5A
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Voltage output range: +150V, +15V(Monitor)
Module Dimension: 100x48x43mm
Power Supply: +160V, -12V



MTAD1030

Please check our homepage for the price

Gain: 30X
Voltage output range: 0V~+150
Average current: 100mA
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Dimension: 120 x 50 x 210mm
Power supply: AC100V



MTAD3001

Please check our homepage for the price

Gain: 50X
Voltage output range: 0V~+150V
Average current: 1A
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Dimension: 104.5x132.5x125mm
Power supply: AC 100V 50/60Hz or AC 230V 50/60Hz



MTAD3002

Please check our homepage for the price

Gain : 50X
Average : 2A
Dimension : W360xD300xH85mm
Power supply : AC100V
Output range : -20V~+150V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator



MTAD3002A

Please check our homepage for the price

Gain : 50X
Average : 2A
Dimension : W360xD300xH85mm
Power supply : AC100V
Output range : 0V~+150V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator



MTAD3003

Please check our homepage for the price

Gain : 50X
Average : 3A
Dimension : W440xD350xH85mm
Power supply : AC100V
Output range : -20V~+150V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator



MTAD2012

Please check our homepage for the price

Gain : 15X
Average : 0.7A
Dimension : W440xD350xH200mm
Power supply : AC100V
Output range : 0V~+150V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator



MTAD4002

Please check our homepage for the price

Gain : 50X
Average : 2A
Mass : 0.5g
Dimension : 12x13mm
Power supply : AC100V
Output range : -20V~+150V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator



PDu100 (Produced by Piezo Drive)

Please check our homepage for the price

Gain : 27.5X, 55X (Based on setting condition)
Mass : 0.5g
Dimension : 12x13mm
Power supply : 3V to 5.5V
Output range : 100V, +100V
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus



PDu100B

Please check our homepage for the price

Power supply : 3V~5.5V
Output range : +60V, +90V, +100V, +60V, +90V, +100V
Gain : 13.75X, 27.5X, 55X (Based on setting condition)
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator
Dimension : 39x25mm
Mass : 3g



PDu150

Please check our homepage for the price

Power supply : +24V
Output range : -30V~+150V
Gain : 20X
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator
Dimension : 76x40x37mm
Mass : 80g



PDu150CL

Please check our homepage for the price

Power supply : +24V
Output range : -30V~+150V
Gain : 20X
Drive target : Stacked Piezoelectric, Bimorph, unimorph
Example application : Precision stage, pump, air valve, Autofocus Actuator
Dimension : 40x89x37mm
Mass : 80g



PDM200 (Produced by Piezo Drive)

Gain: 20X
Mass: 50g
Dimension: 7x38mm
Power supply: $\pm 12V \sim \pm 34V$
Output range: $-30V \sim 200V, \pm 200V, \pm 400V^*$
(*Based on bridge connection)
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Example application: Precision stage, pump, air valve, AutoFocus Actuator

Please check our homepage for the price



MX200 (Produced by Piezo Drive)

Gain: 24V
Mass: 80g
Power supply: 24V
Dimension: 80x46x40mm
Output range: $+100V, +150V, +200V$
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Example application: Precision stage, pump, air valve, AutoFocus Actuator

Please check our homepage for the price



PD200 (Produced by Piezo Drive)

Gain: 20X
Power supply: AC90V or AC250V
Output range: $+200V, +150V, -50 \sim -150V, \pm 100V$
Dimension: 275x14x64mm
RMS current: $\pm 570mA$
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Example application: Precision stage, pump, air valve, AutoFocus Actuator

Please check our homepage for the price



PX200 (Produced by Piezo Drive)

Please check our homepage for the price

Gain: 20X
Power supply: AC90V or AC250V
Dimension: 212x304.8x88mm
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Example application: Precision stage, pump, air valve, AutoFocus Actuator
RMS current: 1.5 Amps (3 Amps in 100V range)
Output range: $+50V \sim +200V, \pm 100V, -50V \sim +150V$



TD250 (Produced by Piezo Drive)

Please check our homepage for the price

Gain: 20X
50mA Peak current
Up to $\pm 500V$ in bridge mode
Power supply: 90Vac $\sim$ 250Vac
Output voltage range: $\pm 250V$
High signal bandwidth, 100 kHz
Power bandwidth up to 20 kHz
Less than 70uV RMS noise with a 100nF load
Dimension: 275x141x64 mm
Drive target: Piezoelectric tubes, stack actuators, standard piezoelectric actuators, and bender actuators
Example application: Nanopositioning, microscopy, electro-optics, vibration control, and piezoelectric motors



PD32 (Produced by Piezo Drive)

Please check our homepage for the price

Gain: 15X, 30X (Based on setting condition)
Dimension: 212x304.8x88mm
Power supply: AC90V or AC250V
Drive target: Stacked Piezoelectric, Bimorph, unimorph
Output range: $+50V$ to $+140V$ $\pm 50V$ to $\pm 140V$
(Based on setting condition)
Example application: Precision stage, pump, air valve, AutoFocus Actuator
RMS current: 106mA per channel 53mA per channel (Based on setting condition)

Piezo Assist Stage



Piezo Assist Stage

What is Piezo Assist Stage?

Piezo Assist Stage is a manual stage where its fine positioning resolution is 20 nanometer while the coarse positioning range can be several millimeters to 13 millimeters. The Piezo Assist Stage is mainly used for positioning table or jig or for controlling very precise and very small load in application like nano indentation. The Piezo Assist Stage is compact in size and user friendly.

The operating principles

<Configuration of equipment>

In each of the X-axis and the Y-axis, Piezo Assist Stage has the micrometer as coarse adjustment mechanism, and the Piezo Assist mechanism as the fine adjustment mechanism. The Piezo Assist Stage, a fine adjustment mechanism equipment, is for precise positioning or precise force control. The precise positioning and precise force control can be obtained by elongation and shrinkage of the piezoelectric actuator. At coarse adjustment mechanism, the adjustable linear motion range is 13mm, with a resolution of 10 micrometer. At fine adjustment mechanism, the adjustable linear motion range is 35 micrometers, with a resolution of 20 nanometer. Precise positioning that needs resolution of nanometer is possible.

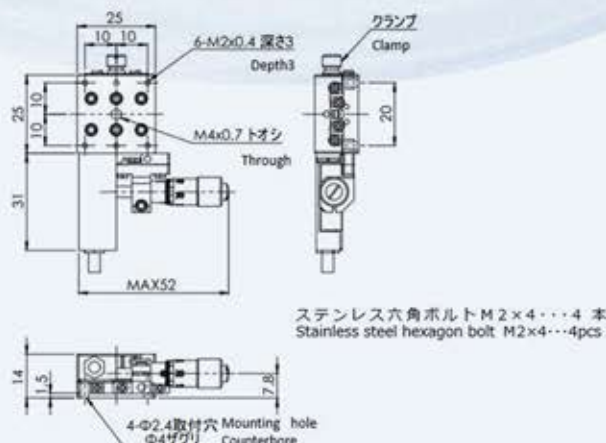
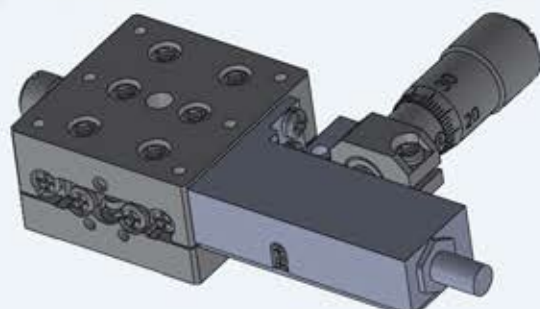
<Precise positioning with coarse adjustment mechanism>

Precise positioning with coarse adjustment mechanism can be realized by turning the micrometer knob.

<Precise positioning a fine adjustment mechanism>

Precise positioning at fine adjustment mechanism adjust by elongation and shrinkage of the piezo actuator. While the voltage is applied to the piezo actuator, in proportion to the voltage, the piezo actuator elongates or shrinks. Precise positioning at nanometer level is realize by controlling the voltage applied to the piezo actuator.

MTPA-2251SPA



Specifications

Table size	25×25mm
Coarse Drive Travel	±3mm
Fine Drive Travel	> 25μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	39.2N (4.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.0N・m
Max. Moment Capacity / Roll	1.9N・m
Max. Moment Capacity / Yaw	1.9N・m
Moment Stiffness / Pitch	2.5" /N・cm
Moment Stiffness / Roll	2.0" /N・cm
Parallelism	30μm
Running Parallelism	10μm
Mass weight	0.07kg
Price	Please check our homepage for the price

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Caution

- 1 Please handle the micrometer bracket with caution during the setup of the stage. If any shock occurred, the Piezo Assist mechanism may be damaged.
- 2 When the power of the Piezo Assist controller is being switched OFF, there will be changes on the position adjustment of Piezo Assist, causing fine adjustment position alignment changes.
- 3 Please make sure to lock the stage when moving/carrying the Piezo Assist Stage. Moving/Carrying the Piezo Assist stage may cause damage to the Piezo Assist mechanism.

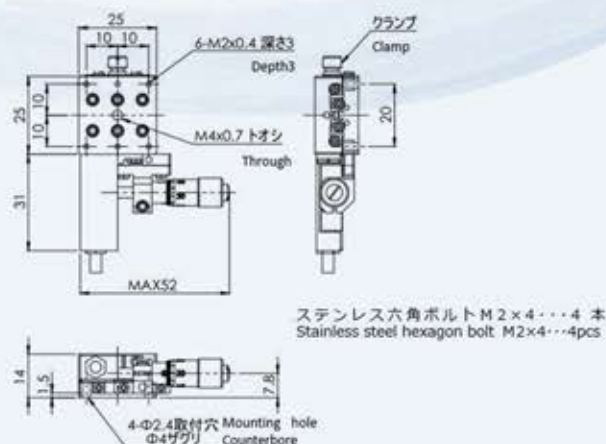
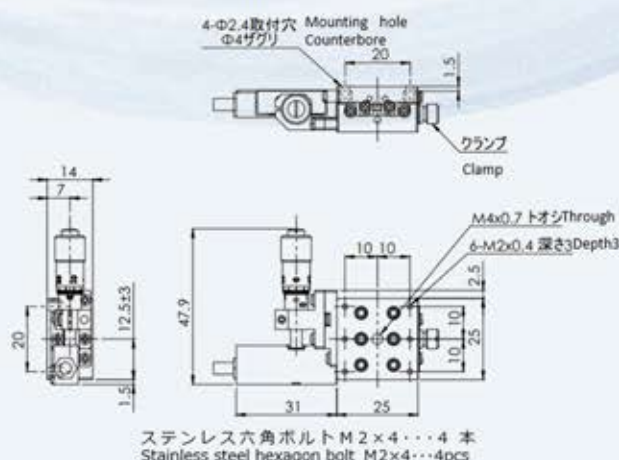
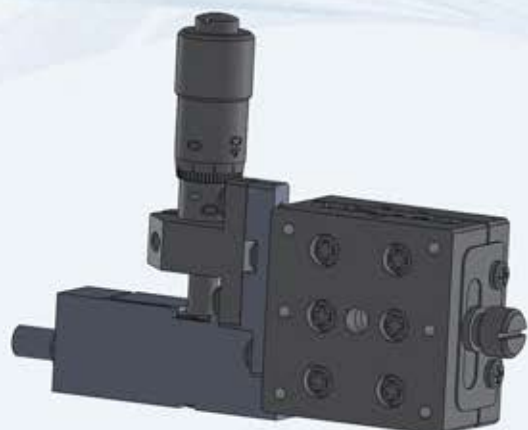


Table size	25×25mm
Coarse Drive Travel	±3mm
Fine Drive Travel	> 25μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	39.2N (4.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.0N・m
Max. Moment Capacity / Roll	1.9N・m
Max. Moment Capacity / Yaw	1.9N・m
Moment Stiffness / Pitch	2.5″ /N・cm
Moment Stiffness / Roll	2.0″ /N・cm
Parallelism	30μm
Running Parallelism	10μm
Mass weight	0.07kg
Price	Please check our homepage for the price

Caution

- 32

MTPA-2251SRZPA



Specifications

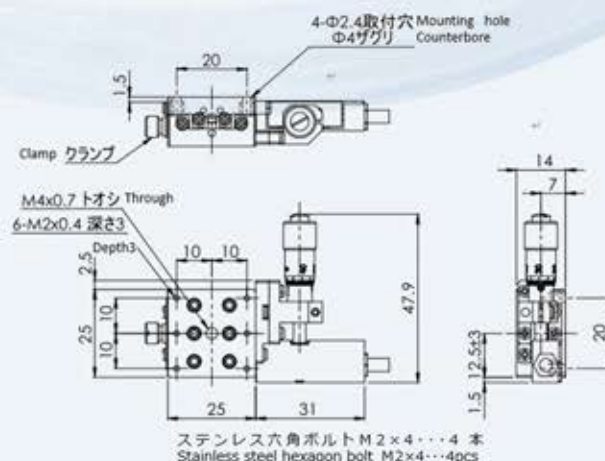
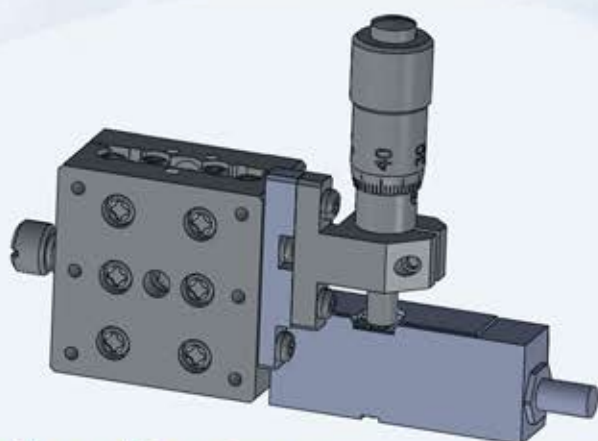
Table size	25×25mm
Coarse Drive Travel	±3mm
Fine Drive Travel	> 25μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	1.47N・m
Max. Moment Capacity / Roll	1.47N・m
Moment Stiffness / Pitch	6.0" /N・cm
Running Parallelism	20μm
Mass weight	0.07kg
Price	Please check our homepage for the price

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Caution

- 1 Please handle the micrometer bracket with caution during the setup of the stage. If any shock occurred, the Piezo Assist mechanism may be damaged.
- 2 When the power of the Piezo Assist controller is being switched OFF, there will be changes on the position adjustment of Piezo Assist, causing fine adjustment position alignment changes.
- 3 Please make sure to lock the stage when moving/carrying the Piezo Assist Stage. Moving/Carrying the Piezo Assist stage may cause damage to the Piezo Assist mechanism.

MTPA-2251SZPA



Specifications

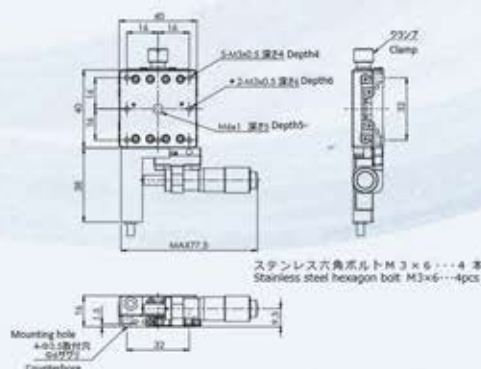
Table size	25×25mm
Coarse Drive Travel	±3mm
Fine Drive Travel	>25μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	1.47N・m
Max. Moment Capacity / Roll	1.47N・m
Moment Stiffness / Pitch	6.0" /N・cm
Running Parallelism	20μm
Mass weight	0.07kg
Price	Please check our homepage for the price

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- 3 Please make sure to lock the stage when moving/carrying the Piezo Assist Stage. Moving/Carrying the Piezo Assist stage may cause damage to the Piezo Assist mechanism.

MTPA-2401SPA



Specifications

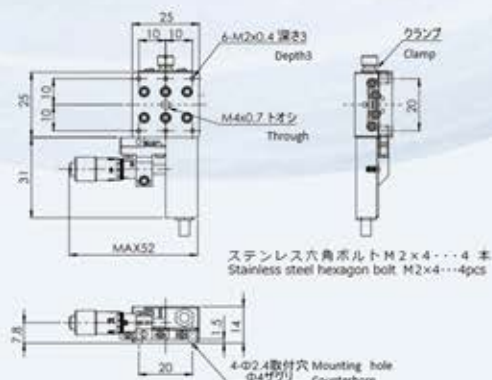
Table size	40×40mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	49N (5.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	3N・m
Max. Moment Capacity / Yaw	2.5N・m
Moment Stiffness / Pitch	0.66″ /N・cm
Moment Stiffness / Roll	0.36″ /N・cm
Parallelism	30μm
Running Parallelism	10μm
Mass weight	0.16kg
Price	Please check our homepage for the price

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Caution

- 1 Please handle the micrometer bracket with caution during the setup of the stage. If any shock occurred, the Piezo Assist mechanism may be damaged.
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- 3 Please make sure to lock the stage when moving/carrying the Piezo Assist Stage. Moving/Carrying the Piezo Assist stage may cause damage to the Piezo Assist mechanism.

MTPA-2401SRPA



Specifications

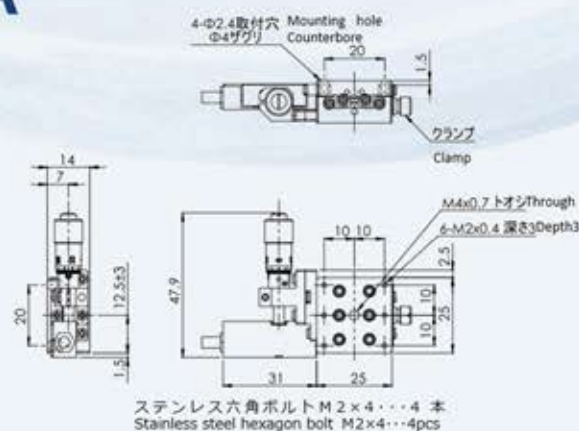
Table size	40×40mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	49N (5.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	3N・m
Max. Moment Capacity / Yaw	2.5N・m
Moment Stiffness / Pitch	0.66" /N・cm
Moment Stiffness / Roll	0.36" /N・cm
Parallelism	30μm
Running Parallelism	10μm
Mass weight	0.16kg
Price	Please check our homepage for the price

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MTPA-2401SRZPA



ステンレス六角ボルト M2×4・・・4 本
Stainless steel hexagon bolt M2×4・・・4pcs



Specifications

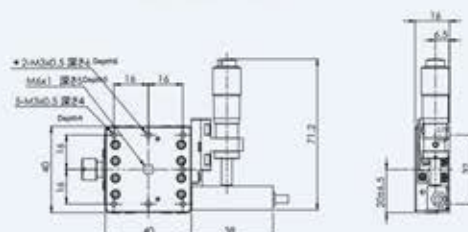
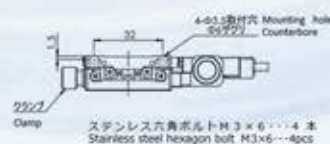
Table size	40×40mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	2.5N・m
Moment Stiffness / Pitch	0.66" /N・cm
Running Parallelism	10μm
Mass weight	0.16kg
Price	Please check our homepage for the price

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Caution

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MTPA-2401SZPA



Specifications

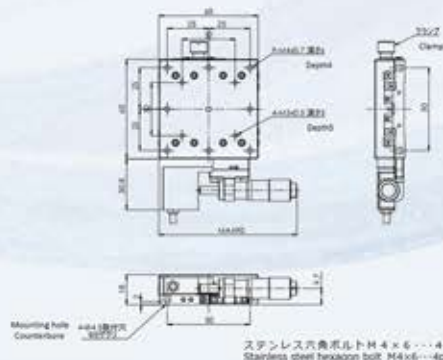
Table size	40×40mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	2.5N・m
Moment Stiffness / Pitch	0.66" /N・cm
Running Parallelism	10μm
Mass weight	0.16kg
Price	Please check our homepage for the price

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MTPA-2601SPA



Specifications

Table size	60×60mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	49N (5.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	4.9N・m
Max. Moment Capacity / Roll	4.9N・m
Max. Moment Capacity / Yaw	4.9N・m
Moment Stiffness / Pitch	0.3" /N・cm
Moment Stiffness / Roll	0.25" /N・cm
Parallelism	30μm
Running Parallelism	10μm
Mass weight	0.25kg
Price	Please check our homepage for the price

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Caution

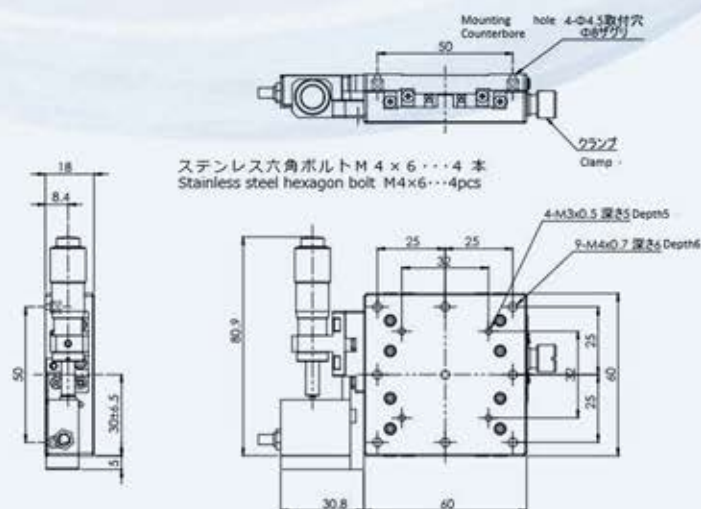
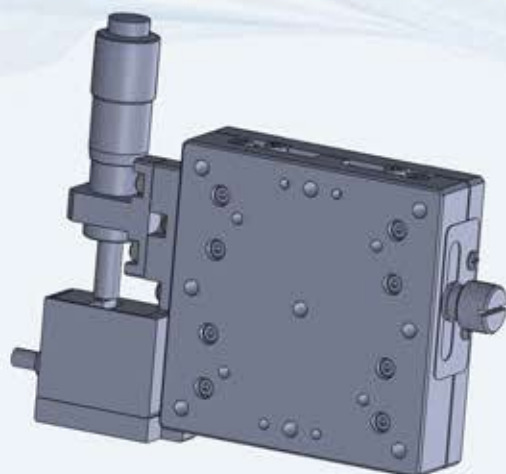
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MTPA-2601SRZPA



Specifications

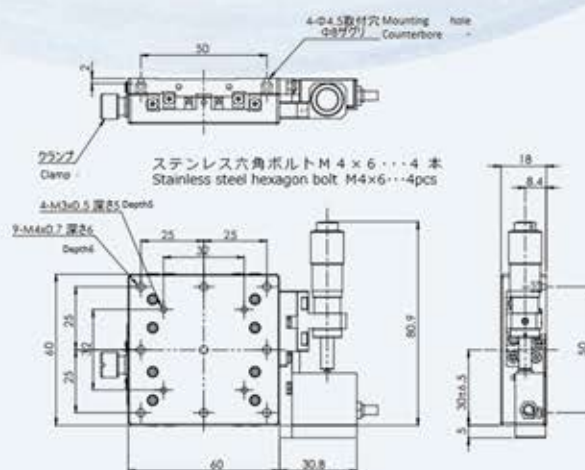
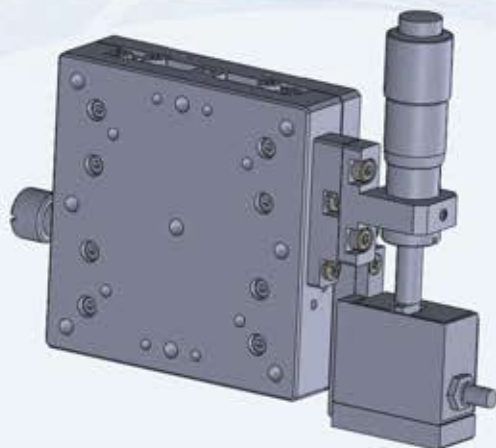
Table size	60×60mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	2.5N・m
Moment Stiffness / Pitch	0.66" /N・cm
Running Parallelism	10μm
Mass weight	0.25kg
Price	Please check our homepage for the price

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Caution

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MTPA-2601SZPA



Specifications

Table size	60×60mm
Coarse Drive Travel	±6.5mm
Fine Drive Travel	> 30μm
Micrometer Position	サイド Side
Movement per rotation	0.5mm
Micrometer Readable Resolution	0.01mm
Fine movement minimum resolution	<20nm
Guide	Ball Bearing guide
Primary material	Aluminum
Finish	Black anodized
Load capacity	9.8N (1.0kgf)
Travel accuracy / Straightness	3μm
Max. Moment Capacity / Pitch	2.5N・m
Max. Moment Capacity / Roll	2.5N・m
Moment Stiffness / Pitch	0.66" /N・cm
Running Parallelism	10μm
Mass weight	0.25kg
Price	Please check our homepage for the price

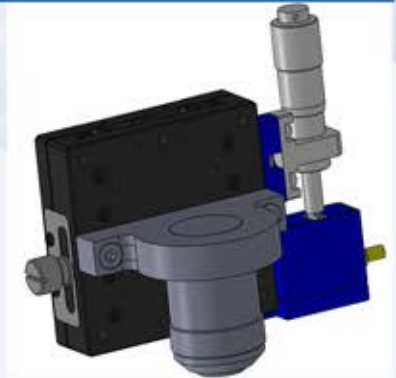
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Piezo Assist Stage application examples

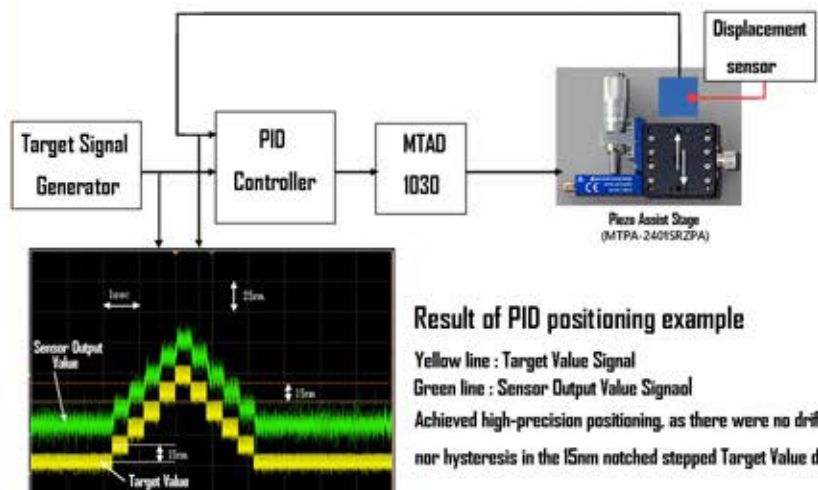
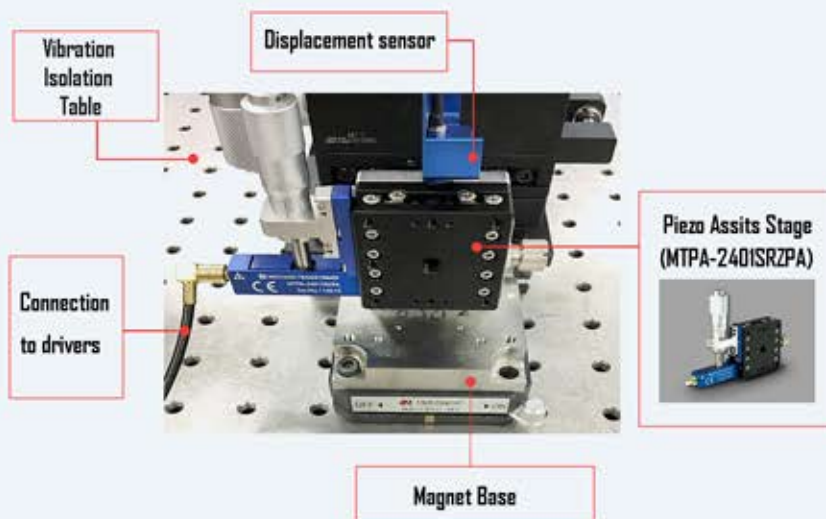
- ◆ Auto focusing
- ◆ Laser processing
- ◆ Interferometer shape measurement
- ◆ Image processors
- ◆ Semiconductor and FPD inspection devices
- ◆ Confocal microscopes



Above is an example of attaching lens on MTPA-2601SZPA

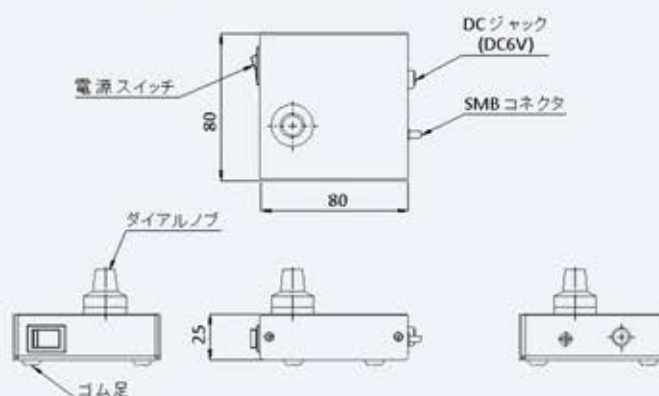
PID Control and Positioning system

By using displacement sensor on Piezo Assist Stage, achieving stabilized high-precision positioning control without drift or hysteresis

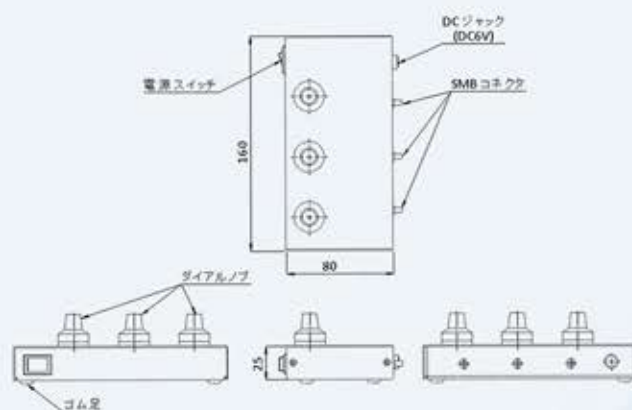


Piezo Assist Stage Controller (MTSD2001&MTSD2003)

- ◆ Piezo Assist Stage Controller is used for fine adjustment of Piezo stage
- ◆ 2 product types- 1Axis(MTSD2001) and 3Axis (MTSD2003) are available
- ◆ When the dial knob on the controller is being rotated, voltage applied to the actuator inside the Piezo Assist Stage will change and achieve position adjustment
- ◆ A cable dedicated to connect between the Piezo Assist Stage and Piezo Assist Stage Controller is attached with this product



Product	Control axis	Power supply & voltage	Compatible AC adapter	Operating temperature	Storage temperature	Room Humidity	Dimension (Excluding the protrusion)	CEC Level	Weight	Price
MTSD2001	1Axis	DC6V 0.8A	US300618	5~40°C	-20~60°C	20~80%RH (No condensation)	80x80x25mm	—	0.12kg	Please check our homepage for the price



Product	Control axis	Power supply & voltage	Compatible AC adapter	Operating temperature	Storage temperature	Room Humidity	Dimension (Excluding the protrusion)	CEC Level	Weight	Price
MTSD2003	3Axis	DC6V 1.8A	US300618	5~40°C	-20~60°C	20~80%RH (No condensation)	160x80x25mm	—	0.28kg	Please check our homepage for the price



Cable attached (2m)

Product	Power supply & voltage	Operating temperatation	Storage temperature	Room Humidity	Dimension (Excluding the protrusion)	CEC Level	Weight	Price
Adapter (US300618)	DC6V 1.8A	5~40°C	-20~60°C	20~80%RH (結露なきこと)	60x44x26.5mm	V	0.10kg	Please check our homepage for the price

Operating Precautions

- ◆ The compatible size for DC Jack is $\phi 4\text{mm}$. Please be careful of the plug diameter during the preparation of the power supply.
- ◆ When turning OFF the power supply of the Piezo Assist Stage Controller (MTSD2001 or MTSD2003), position adjustment may occur resulting in misalignment of the fine adjustment.

Thin Piezo Actuator/ Piezo Sensor: Macro Fiber Composite



Thin Piezo Actuator/ Piezo Sensor: Macro Fiber Composite

- ◆ Flexible, durable, reliable and Demonstrated performance
- ◆ Increased strain actuator efficiency and Damage-tolerant
- ◆ Directional actuation, Readily embeddable and sensing
- ◆ Conforms to surfaces and Environmentally sealed package
- ◆ Available as elongator (d33 mode) and contractor (d31mode)
- ◆ Available also in single crystal PMN-PT, PZN-PT
- ◆ Different piezo ceramic materials available

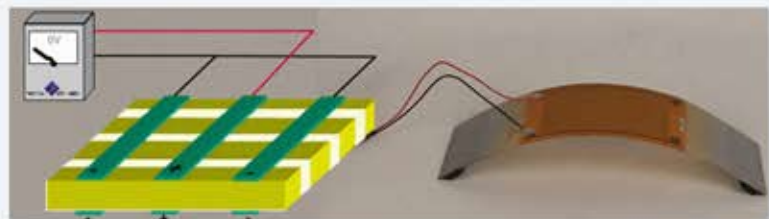
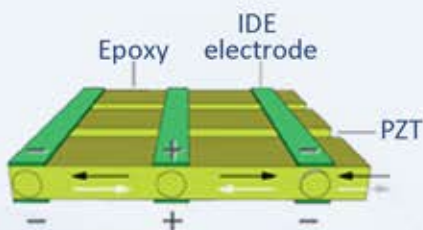


The Macro Fiber Composite (MFC) is the leading low-profile actuator and sensor offering high performance, flexibility and reliability in a cost- competitive device. The MFC was invented by NASA in 1999. In 2002, Smart Material started commercializing this patented invention worldwide as its licensed manufacturer and distributor. Since then, the MFC has been continuously improved and customized to fit customers' specific needs and to meet the requirements for new applications.

The MFC consists of rectangular piezo ceramic rods sandwiched between layers of adhesive, electrodes, and polyimide film. The electrodes are attached to the film in an interdigitated pattern which transfers the applied voltage directly to and from the ribbon-shaped rods. This assembly enables in-plane poling, actuation, and sensing in a sealed and durable, ready-to-use package.

The MFC can also be applied (normally bonded) as a thin, surface-conformable sheet to various types of structures, or embedded in a composite structure. If voltage is applied, it will bend or distort materials, counteract vibrations, or generate vibrations. If no voltage is applied it can work as a very sensitive strain gauge, sensing deformations, noise, and vibrations. The MFC is also an excellent device to harvest energy from vibrations.

MFC P1 type (d33 effect), Elongator



The P1 type MFCs, including the F1 and S1 types, utilize the d33 effect for actuation and will elongate up to 1800ppm if operated at the maximum voltage rate of -500V to +1500V. The P1 type MFCs are also very sensitive strain sensors.

MFC P1, F1 and S1 types (d33 effect), Elongator

Model	active length in mm	active width in mm	overall length in mm	overall width in mm	Capacitance in nF $\pm 20\%$	free strain in ppm $\pm 10\%$	blocking force in N $\pm 10\%$	Price (JPY) excluding tax	Price (JPY) including tax
M2503-P1	25	3	35	9	0.34	788	21		
M2807-P1	28	7	38	13	0.93	1035	62		
M2814-P1	28	14	38	20	1.40	1160	146		
M4005-P1	40	5	50	11	0.70	885	38		
M4010-P1	40	10	50	16	1.87	1050	90	Please check our homepage for the price	
M4312-P1	43	12	53	18	3.49	1050	94		
M5628-P1	56	28	67	35	8.71	1350	340		
M8503-P1	85	3	116	14	1.10	788	21		
M8507-P1	85	7	101	13	1.76	1035	65		
M8514-P1	85	14	101	20	5.81	1200	152		
M8528-P1	85	28	103	35	11.31	1350	454		
M8557-P1	85	57	103	64	16.00	1350	693		
M14003-P1	140	3	160	10	2.51	1050	28		

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MFC Special types, S1

Model	active length in mm	active width in mm	overall length in mm	overall width in mm	Capacitance in nF $\pm 20\%$	free strain in ppm $\pm 10\%$	blocking force in N $\pm 10\%$	Price (JPY) excluding tax	Price (JPY) including tax
M8557-S1 Actuator	85	47	112	75	13.00	1350	570calc.	Please check our homepage for the price	
with co-located Sensor M8557-S1 Actuator	85	5	112	75	1.45	1350	570calc.		

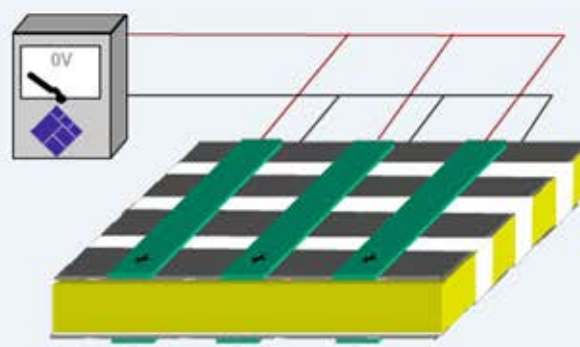
※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MFC F1 types, 45°fiber orientation

Model	active length in mm	active width in mm	overall length in mm	overall width in mm	Capacitance in nF $\pm 20\%$	free strain in ppm $\pm 10\%$	blocking force in N $\pm 10\%$	Price (JPY) excluding tax	Price (JPY) including tax
M8528-F1	85	28	105	35	11.00	1350	364calc.	Please check our homepage for the price	
M8557-F1	85	57	105	64	16.00	1350	710 calc.		

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

MFC P2 type and P3 type (d31 effect), Contractor



P2 and P3 type standard inventory sizes

Model	active length in mm	active width in mm	overall length in mm	overall width in mm	Capacitance in nF $\pm 20\%$	free strain in ppm $\pm 10\%$	blocking force in N $\pm 10\%$	Price (JPY) excluding tax	Price (JPY) including tax
M0714-P2	7	14	16	16	11	-540	-57		
M2807-P2	28	7	37	10	21.5	-600	-35		
M2814-P2	28	14	37	18	43	-630	-76		
M5628-P2	56	28	67	31	175	-740	-175	Please check our homepage for the price	
M8503-P2	85	3	94	7	15.5	-430	-11		
M8507-P2	85	7	100	10	63	-605	-38		
M8514-P2	85	14	100	18	127	-630	-76		
M8528-P2	85	28	103	31	258	-740	-180		
M8557-P2	85	57	103	60	548	-750	-385		
M8585-P2	85	85	103	88	662	-750	-585		
M17007-P2	170	7	185	11	126	-600	-37		

Model	active length in mm	active width in mm	overall length in mm	overall width in mm	Capacitance in nF $\pm 20\%$	free strain in ppm $\pm 10\%$	blocking force in N $\pm 10\%$	Price (JPY) excluding tax	Price (JPY) including tax
M2814-P3	28	14	37	18	52	-620	-95	Please check our homepage for the price	
M5628-P3	56	28	66	31	130	-800	-240		
M8528-P3	85	28	103	31	277	-800	-240		

Piezo Assist Motor



Piezo Assist Motor (PAM3-6.5 and PAM6-13)



- (1) Assist Motor is compact in size, and designed to have a high output force up to around 13N for PAM 3-6.5 and around 29N for PAM6-13.
- (2) The output displacement is 6.5mm for PAM3-6.5 and 13mm for PAM6-13. The high displacement resolution is below 25nm~30nm while the travel velocity is above 1.5m/s.
- (3) The Piezo Assist Motor is designed user friendly for industrial, scientific research applications.
- (4) Applications include Microscope scanning, High resolution microscope, Biotechnology, Measurement technology, High speed throughput microscope, Mask/ Wafer positioning, Interferometer shape measurement and Micromanipulation.
- (5) Please use the designated Piezo Assist Motor Controller (PAMC-104) to drive the Piezo Assist Motor. A software and cable (2m) is attached to Piezo Assist Motor.

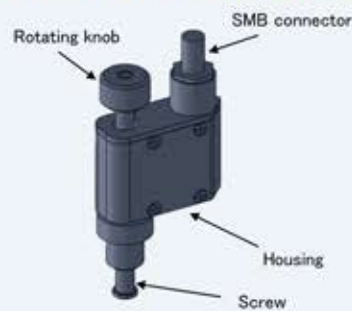


Fig. 1. Piezo Assist Motor outer view

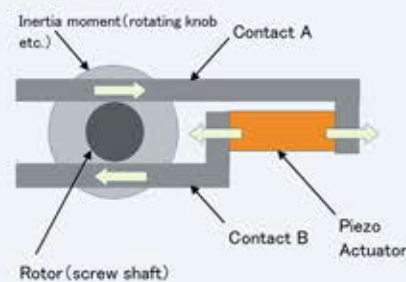


Fig. 2. Piezo assist motor rotation mechanism & principal diagram

Piezo Assist motor rotates based on the inertial rotation mechanism inside the housing. This generates thrust and displacement in the direction of the screw shaft. As shown in Fig 2, the inertial rotation mechanism principal diagram, the screw shaft work as a rotor. The screw shaft is connected to the moment of inertia (rotary knob, etc). The screw shaft is hold by the contactor with static friction force. Therefore, no power consumption is needed to maintain the position. When the piezoelectric actuator extends as shown in Fig.2, contacts A and B move at an opposite direction to each other. An acceleration at contract A and B is created intentionally. The acceleration will take over the static friction and generate a slippage between rotor and contract. The slippage resulted a rotational motion of the screw shaft. As a result, the screw shaft is moved in a thrust direction.

Specifications



Product Name	PAM3-6.5	PAM6-13
Minimum Movement (nm)	Below 30	Below 25
Maximum Load Capacity (N)	Above 13	Above 29.4
Maximum Drive Frequency (Hz)	2000	2000
Moving Speed (mm/min)	1.5	1.5
Mounting Part (mm)	Above 6.5(Maximum 9)	Above 13(Maximum18)
Dimension (mm)	φ6 shank	M9x0.5screw
Operating Temperature	41x21.6x8.2	61x31x15.1
Storage Temperature	0~40°C	0~40°C
Ambient Humidity	0~40°C	0~40°C
Connector	10~80% RH (No condensation)	10~80% RH (No condensation)
Product Name	SMB connector	SMB connector
Lifespan	Above 1x10 ⁹ pulse	Above 1x10 ⁹ pulse
Weight (kg)	0.02	0.05
Price	Please check our homepage for the price	Please check our homepage for the price

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.

Application

(Application example of PAM6-13) To be attached to Piezo Assist Stage (Table Size 40x40mm, Table Size 60x60mm).

- ◆ Microscope scanning
- ◆ Measurement technology
- ◆ Interferometer shape measurement
- ◆ High resolution microscope
- ◆ High speed throughput microscope
- ◆ Micromanipulation
- ◆ Biotechnology
- ◆ Mask/Wafer positioning

Piezo Assist Motor Operation Example

Fig.1 and Fig.2 show the displacement vs characteristics of the Piezo Assist Motor driven at 40 pulses with drive frequencies of 1Hz and 5Hz. Fig.1 shows the data during forward rotation, and Fig.2 shows data during reverse rotation.

- ◆ At 1Hz, the displacement is stepped at 10 - 16nm/pulse, and the displacement is smooth at 5Hz.
- ◆ The displacement for 40pulses is 480nm (average 12nm/pulse) in forward rotation for both 1Hz and 5Hz. They are 520nm (average 13nm/pulse) in reverse rotation.

The operation example of PAM6-13 is shown below

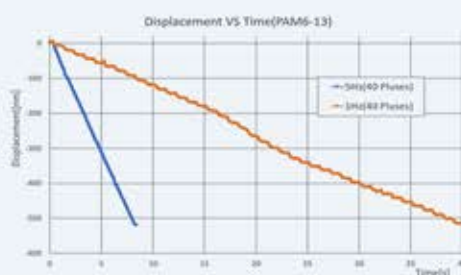
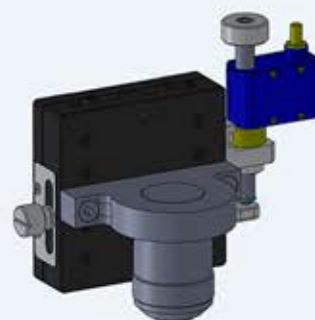


Fig1. Displacement vs time characteristics during forward rotation drive(PAM-13)



Fig 5. Displacement vs time characteristics during reverse rotation drive (PAM-13)



Application example of Piezo Assist Mirror (Angle Adjustment of Mirror Holder)



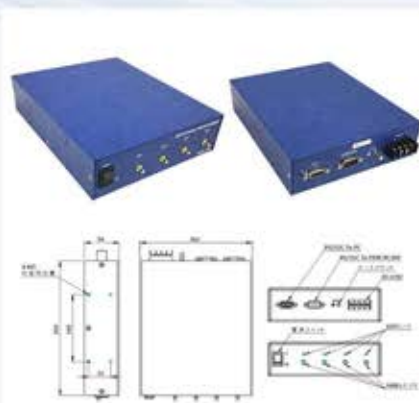
- ◆ Ultra-fine resolution in Nanometer
- ◆ Holds position even when power is not supplied
- ◆ Movable angle range is $\pm 3.5^\circ$ ($\approx \pm 61\text{mrad}$)
- ◆ $1.6 \mu\text{rad}$ Ultra-precise adjustment by (Over 70,000 steps)

Precautions

- ◆ Set an appropriate load (more than 3N is recommended) to improve the follow ability of the actuator body.
- ◆ Please note that the speed and minimum movement varies depending on individual differences and the feed direction of the actuator.
- ◆ It is possible to attach this product to your specified manual stage. Please contact us and let us know accordingly. We will try our best to meet your needs. However please be noted that depending on the specifications, additional machining or modification may be required.
- ◆ Please use specified Piezo Assist Motor Controller (PAMC-104) for this product.

Piezo Assist Motor Controller

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.



Product Name	PAMC-104	PAM-RC100
Driving Frequency (Hz)	-	0~2000
Switchable channel number	2	
Interface	RS232C	RS232C
Number of Driving Axis	4	-
Current consumption (A)	-	4
Dimension (mm) (excluding protrusions)	200x162x50	102x78x30
Power Supply Voltage (V)	DC24	-
Operating Temperature	0~40°C	0~40°C
Storage Temperature	0~40°C	0~40°C
Ambient Humidity	10~80% RH(No condensation)	10~80% RH(No condensation)
Weight (kg)	1.2	0.32
Price	Please check our homepage for the price	Please check our homepage for the price

Piezo Assist Motor Controller (PAMC-104)

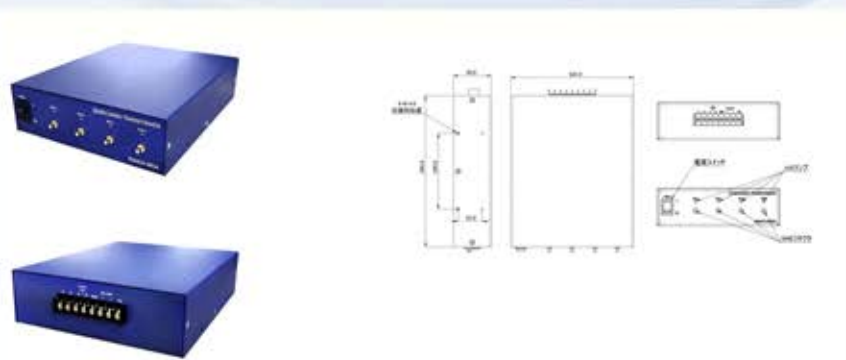
- ◆ Piezo Assist Motor Controller is a designated controller to drive Piezo Assist Motor.
- ◆ This product can operate the Piezo Assist Motor remotely with PC through RS-232C.
- ◆ By connecting the controller to PAM-RC100, the Piezo Assist Motor can be operated manually.
- ◆ Please only use the attached cable for driving the Piezo Assist Motor.

Precautions

- ◆ The power supply specification for this product is DC+24V2A.
- ◆ Please do not connect to other products besides Piezo Assist Motor.

PAMC 4-485

※prices in the table are tax included for Japan domestic customers. For overseas (non-Japan) customers, 10% sales tax will be deducted from the price stated.



Product Name	PAMC 4-485
Driving Frequency (Hz)	4
Switchable channel number	1500
Interface	RS485
Number of Driving Axis	4
Current consumption (A)	DC24
Dimension (mm) (excluding protrusions)	□
Power Supply Voltage (V)	200x162x50
Operating Temperature	0~40℃
Storage Temperature	0~40℃
Ambient Humidity	10~80%RH(No condensation)
Weight (kg)	1.2
Price	Please check our homepage for the price

Piezo Assist Motor Controller (PAMC4-485)

- ◆ Piezo Assist Motor Controller is a designated controller to drive Piezo Assist Motor.
- ◆ PAMC-4-485 operate the Piezo Assist Motor remotely with PC through RS-232C. By connecting the controller to PAM-RC100, the Piezo Assist Motor can be operated manually.
- ◆ Please only use the attached cable for driving the Piezo Assist Motor.

Precautions

- ◆ The power supply specification for this product is DC+24V2A.
- ◆ Please do not connect to other products besides Piezo Assist Motor.

1-3 Dice & Fill Composites



1-3 Dice & Fill Composites

Smart Material manufactures 1-3 composites using the commonly used Dice & Fill method.

1-3 Dice & Fill Composites specifications:

- ◆ Frequencies 500kHz to 12 MHz
- ◆ PZT Navy type I, II, III and IV
- ◆ Fill Factors 25% to 75%
- ◆ Single Crystal PMN-PT
- ◆ Maximum dimensions 8cm by 8cm, larger and curved on request
- ◆ Various epoxy and polyurethane interstitial materials available.
- ◆ Operational temperatures up to 135°C
- ◆ Available with Gold, Copper-Tin electrodes



Smart Material manufactures 1-3 composites using the standard Dice & Fill method, which is the current industry standard for frequencies greater than 500kHz. 1-3 Dice & Fill piezo composites are prepared by dicing a piezoceramic plate into an orthogonal array and cutting 80% - 90% of the plate thickness.

The pitch (distance between rods) must be very small, typically near 100µm at 5 MHz resonance frequency to avoid lateral modes and grating lobes.

The kerfs or trenches are filled with epoxy or other polymer material. After the interstitial material has cured the uncut side of the ceramic is grinded down to the rod structure and the thickness is adjusted to the desired resonance frequency.

This yields a regular pixel or rod distribution required for phased array ultrasound transducers.



1-3 D&F Composite product specifications and selections

Resonance Frequencies	500kHz up to 15MHz	Frequency	Pixel Size	Fill Factor	Dimensions mm ²
		500kHz-1MHz	400-800µm	25% - 75%	Max. 75 x 75
		1MHz-2MHz	150-350µm	25% - 75%	Max. 75 x 75
		2MHz-6MHz	55-200µm	25% - 75%	Max. 75 x 75
		6MHz-8MHz	75-100µm	35% - 65%	Max. 35 x 35
		8MHz-10MHz	40-75µm	50% - 60%	Max. 35 x 35
		10MHz-15MHz	15-35µm	50% - 60%	Max. 35 x 35
Frequency Tolerances : ± 10% typical ± 5% on request					

Fill Factors	25% up to 75%	Fill Factor	Frequency	
		25% to 75%	500kHz to 6Mk	
		35% to 65%	6kHz to 8Mk	
		40% to 65%	8MHz to 10Mk	
PZT Materials	PZT Navy Type I,II,III,IV Single Crystal PMN-PT	PZT Material	Di-electric constant	Frequency
		PZT Navy Type I, SP4	1200 - 1300	500kHz to 8MHz
		PZT Navy Type II, 5A	1850 - 2000	500kHz to 10MHz
		PZT Navy Type III, PTZB	~ 1050	500kHz to 8MHz
		PZT Navy Type VI, 5H	3200 - 6200	500kHz to 10MHz
		Single Crystal PMN-PT	4000 - 7500	2MHz to 10MHz
Acoustic Impedance	8.5 MRayl to 26 MRayl	Typical Fill Factors	Acoustic Impedance MRayl	
		25%	8.5 MRayl	
		35%	12 MRayl	
		50%	17 MRayl	
		65%	22 MRayl	
		75%	25-26 MRayl	
Available Electrodes	CuSn (Copper with Tin flash layer) Au (Gold)	Typical Fill Factors	Acoustic Impedance MRayl	Electrode thickness
		CuSn	500kHz to 8MHz	~1.5µm
		Au	4MHz to 10MHz	~0.8µm

Dimensions	Max. 75mm by 75mm, various round diameters	Fill Factor		Frequency	
		25% to 75%		500kHz to 6Mk	
		35% to 65%		6kHz to 8Mk	
		40% to 65%		8MHz to 10Mk	
		Mechanical Tolerances: <6mm ± 0.1mm <30mm± 0.2mm >30mm± 0.3mm			
		Available Diameters			
		Ø in mm	Ø in inch	Ø in mm	Ø in inch
		3.18mm	0.125"	12.70mm	0.500"
		5.12mm	0.202"	14.20mm	0.559"
		5.18mm	0.204"	15.90mm	0.626"
		5.68mm	0.224"	17.50mm	0.689"
		6.00mm	0.236"	18.00mm	0.709"
		6.50mm	0.256"	19.05mm	0.750"
		8.20mm	0.323"	20.00mm	0.787"
		9.00mm	0.354"	24.00mm	0.945"
		9.50mm	0.374"	25.40mm	1"
10.00mm	0.394"	30.00mm	1.181"		
10.20mm	0.402"	35.00mm	1.378"		
12.00mm	0.472"	37.7mm	1.48"		
Coupling Coefficient kt		0.61 to 0.68 for standard PZT materials, > 0.75 for single Crystal			
Operational Temperatures		Typical 95°C, 135°C on request			
Interstitial Materials		Various Epoxy systems			

Typical Ultrasound Applications for 1-3 D&F Composites

- NDT, Non-Destructive Testing
- Medical Ultrasound
- Flow Control and Measurement
- Flow Control and Measurement

Compared with the Arrange & Fill production method for our 1-3 random and regular fiber composites, the Dice & Fill method is generally more expensive than similar 1-3 fiber composites due to additional production steps and scalability for volume quantities.

Smart Material typically manufactures Dice & Fill standard composites for frequencies between 500kHz and 15MHz with maximum sizes of 75mm by 75mm.

Available fill factors range from 25% up to 75% and available PZT materials, for example Navy Type I, Type II (standard), Type III and Type VI (standard). Single crystal materials, i.e. PMN-PT are also available on request.

Smart Material offers various standard epoxy and polyurethane systems as the interstitial material, often called filler.

The available filler materials allow for operational temperatures between 95°C and 135°C.

Smart Material's machining equipment and capacities also allow the manufacturing of curved 1-3 Dice & Fill piezo composites as well as complex array structures and interconnects.

1-3 Random Fiber Composites



1-3 Random Fiber Composites

Smart Material manufactures 1-3 composites using piezo ceramic fibres as active rods, randomly distributed over the composite active area. 1-3 fiber composites are prepared by epoxy infiltration of fiber bundles and bundles and dicing of the cube-shaped blocks perpendicular to the direction of the fibers. This patented method is also called Arrange & Fill. A random distribution of the fibers allows for excellent suppression of lateral frequency modes.

1-3 Random Fiber Composites specifications:

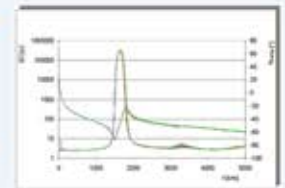
- ◆ Frequencies 500kHz to 12 MHz
- ◆ PZT Navy type I, II, III and IV
- ◆ Fill Factors 25% to 75%
- ◆ Single Crystal PMN-PT
- ◆ Maximum dimensions 8cm by 8cm, larger and curved on request
- ◆ Various epoxy and polyurethane interstitial materials available.
- ◆ Operational temperatures up to 135°C
- ◆ Available with Gold, Copper-Tin electrodes



1-3 Random Fiber A & F Composites specifications

Smart Material manufactures 1-3 composites using piezo ceramic fibers as active rods. PZT fiber composites are a cost-effective alternative compared to the Dice & Fill method. 1-3 fiber piezo composites are prepared by epoxy infiltration of fiber bundles and dicing of the cube-shaped blocks perpendicular to the direction of the fibers. This patented method is also called Arrange & Fill.

Smart Material manufactures 1-3 composites using piezo ceramic fibers as active rods. PZT fiber composites are a cost-effective alternative compared to the Dice & Fill method. 1-3 fiber piezo composites are prepared by epoxy infiltration of fiber bundles and dicing of the cube-shaped blocks perpendicular to the direction of the fibers. This patented method is also called Arrange & Fill. Using piezo ceramic fibers with 105µm, 250µm and 800µm diameters will yield fill factors of approx. 35%, 65% and 80% in a random distributed cross-section.



The random fiber composite material shows superior properties for ultrasound transduction, which is due to reduced acoustic impedance and high coupling factor. Additionally, 1-3 fiber composites with random element distribution yield an increased spurious mode suppression due to the random spacing.

1-3 Random Fiber Composite product specifications and selections

Resonance Frequencies	80kHz up to 8MHz	Frequency	Pixel Size	Fill Factor	Dimensions mm ²
		80kHz - 1MHz	105µm, 250µm, 800µm	35%, 65%, 80%	Max. 100 x 100
		1MHz - 5MHz	105µm, 250µm	35% - 65%	Max. 100 x 100
		5MHz - 8MHz	105µm	35%	Max. 100 x 100
		Frequency Tolerances : ± 10% typical ± 5% on request			

Fill Factors	35%, 65%, 80%	Fill Factor	Fiber Diameter (Pixel)	Frequency
		35%	105µm	80kHz to 8MHz
		65%	250µm	80kHz to 5MHz
		80%	800µm	80kHz to 1MHz
PZT Materials	PZT Navy Type II	PZT Material	Di-electric constant	Frequency
		PZT Navy Type II, 5A	1850	800kHz to 100MHz
Fill Factors	12 MRayl to 27 MRayl	Typical Fill Factors		Acoustic Impedance MRayl
		35%		12 MRayl
		65%		22 MRayl
		80%		27 MRayl
Available Electrodes	CuSn (Copper with Tin flash layer) Au (Gold)	Electrode Material		Frequency
		CuSn		80kHz to 1MHz
		CuSn, Au		1MHz to 8MHz
Coupling Coefficient kt	0.61 to 0.68, fiber diameter - max. frequency aspect ratio rules apply	Fiber Diameter		Max. Frequency for the best kt
		105µm		8MHz
		250µm		4MHz
		800µm		1MHz

Dimensions	Max. 75mm by 75mm, various round diameters	Maximum Dimensions		Frequency	
		100mm by 100mm		80kHz to 5MHz	
		65mm by 65mm		5MHz to 8MHz	
		Mechanical Tolerances:			
		<6mm ± 0.1mm			
		<6mm ± 0.2mm			
		>30mm ± 0.3mm			
		Available Diameters mm		Available Diameters inch	Available Diameters mm
		3.18mm		0.125"	12.70mm
		5.12mm		0.202"	14.20mm
		5.18mm		0.204"	15.90mm
		5.68mm		0.224"	17.50mm
		6.00mm		0.236"	18.00mm
		6.50mm		0.256"	19.05mm
		8.20mm		0.323"	20.00mm
9.00mm		0.354"	24.00mm		
9.50mm		0.374"	25.40mm		
10.00mm		0.394"	30.00mm		
10.20mm		0.402"	35.00mm		
12.00mm		0.472"	37.7mm		
Operational Temperatures		Typical 95°C, 135°C on request			
Interstitial Materials		Various Epoxy systems			

Typical Ultrasound Applications for 1-3 Random Fiber Composites

- NDT, Non- Destructive Testing
- SONAR, single element transducer
- Air Ultrasound Transducer
- Flow Control and Measurement



Due to the Arrange & Fill production method the raw 1-3 fiber composite material are typically blocks of up to 10cm length and the lateral dimensions of the targeted element.

The A&F method also allows to machine 1-3 composites into various shapes and forms, in addition to slicing elements with the desired resonance frequency of the raw fiber block.



Plano-Concave This includes precise concave or convex contours for superior broadband ultrasound receiver applications. The Arrange & Fill production method is easily scalable for volume quantities which also allows for short lead time, a major advantage over the commonly used Dice & Fill method.

Smart Material offers various standard Epoxy and Polyurethane systems as the interstitial material for its random fiber composites, often called filler.

The different, available filler materials allow for operational temperatures between 95°C and 135°C.

1-3 Regular Fiber Composites



1-3 Regular Fiber Composites

Smart Material manufactures 1-3 composites using piezo ceramic fibers as active rods. 1-3 fiber piezo composites are prepared by epoxy infiltration of fibers. This patented method is also called Arrange & Fill. Regular fiber distribution is achieved by arranging the fibers with fixed spacing.

1-3 Regular Fiber A & F Composites specifications:

- ◆ Frequencies 80kHz to 1MHz
- ◆ PZT Navy type II
- ◆ Fill Factors 15% to 48%
- ◆ Available with Gold, Copper-Tin and Silver electrodes
- ◆ Maximum dimensions 10cm by 10cm, larger on request
- ◆ Various epoxy and polyurethane interstitial materials available.
- ◆ Operational temperatures up to 135°C



1-3 Regular Fiber Composites specifications

Smart Material manufactures 1-3 composites using piezo ceramic fibers as active rods. PZT fiber composites are a cost-effective alternative compared to the Dice & Fill method. 1-3 fiber piezo composites are prepared by epoxy infiltration of fiber bundles and dicing of the cube-shaped blocks perpendicular to the direction of the fibers. This method is also called Arrange & Fill.

Regular pixel distribution is achieved by arranging ceramic fibers with 800µm diameter with a constant pitch. This yields fill factors of approx. 15% to a maximum of 48%.

The 1-3 fiber regular composite material was especially designed for SONAR and other underwater ultrasound applications. A modified vacuum deposition method allows for a low impedance copper-flash tin layer with a typical thickness of 2.5µm for high durability and improved solderability.

1-3 Regular Fiber Composite product specifications and selections

Resonance Frequencies	80kHz up to 1MHz	Frequency	Pixel Size	Fill Factor	Dimensions mm ²
		80kHz - 1MHz	800µm	15%	Max. 100 x 100
		80kHz-1MHz	800µm	25%	Max. 100 x 100
		80kHz - 1MHz	800µm	35%	Max. 100 x 100
		Frequency Tolerances : ± 10% typical ± 5% on request			
Fill Factors	15% up to 48%	Frequency		Fill Factor	
		15%		80kHz - 1MHz	
		25%		80kHz-1MHz	
		35%		80kHz - 1MHz	
		other		80kHz - 1MHz	

PZT Material	PZT Navy Type II	PZT Material	Di-electric Constant	Frequency
		PZT Navy Type II, 5A	1850	80kHz to 10MHz
Acoustic Impedance	5 MRayl to 16 MRayl	Typical Fill Factors		Acoustic Impedance MRayl
		15%		5.1 MRayl
		25%		8.5 MRayl
		48%		16 MRayl
Dimensions	Max. 100mm by 100mm, various round diameters	Maximum Dimension		Frequency
		100mm by 100mm		80kHz to 1MHz
		Mechanical Tolerances: < 6mm ± 0.1mm < 30mm ± 0.2mm > 30mm ± 0.3mm		
		Available Diameters mm	Available Diameters inch	Diameters inch Available Diameters mm
		3.18mm	0.125"	12.70mm
		5.12mm	0.202"	14.20mm
		5.18mm	0.204"	15.90mm
		5.68mm	0.224"	17.50mm
		6.00mm	0.236"	18.00mm
		6.50mm	0.256"	19.05mm
		8.20mm	0.323"	20.00mm
		9.00mm	0.354"	24.00mm
		9.50mm	0.374"	25.40mm
		10.00mm	0.394"	30.00mm
		10.20mm	0.402"	35.00mm
		12.00mm	0.472"	37.7mm
				1.48"

Coupling Coefficient kt	0.61 to 0.68
Operational Temperatures	Typical 95°C, 135°C on request
Interstitial Materials	Various Epoxy systems

Typical Ultrasound Applications for 1-3 Regular Fiber Composites

- SONAR, array transducer
- SONAR, single element transducer
- General Underwater Ultrasound Applications
- Air Ultrasound Transducers

Due to the Arrange & Fill production method the raw 1-3 fiber composite material are typical blocks of up to 10cm length and the lateral dimensions of the targeted element. It also allows to machine 1-3 composites into various shapes and forms, in addition to slicing elements with the desired esonance frequency of the raw fiber block.



This includes precise concave or convex contours for superior broadband ultrasound receiver applications. The Arrange & Fill production method is easily scalable for volume quantities which also allows for short lead time - a major advantage over the commonly used Dice & Fill methods, especially for low frequency applications.

Smart Material offers various standard Epoxy and Polyurethane systems as the interstitial material for its random fiber composites, often called filler.

The different, available filler materials allow for operational temperatures between 95°C and 135°C.

Partnerships with Mechano Transformer Corporation

Mechano Transformer Corporation (MTC) always explore new directions in collaboration with our partners in various fields. MTC provides a wide range of knowledge and knowhow from actuators, positioning stage designs and prototyping to mass production. Hundreds of MTC's ecosystem partners come together to help our customers to get their products to go to market faster.

OEM • ODM

MTC provides OEM and ODM services. Depending on the conditions, it is also possible to directly license MTC patents.

System Integration

MTC performs system integration of products that meets customer specifications and realize faster market introduction.

Mass Production Service

MTC provides a consistent one-stop service from concept and development to supply of mass-produced products.

Software • Hardware

MTC is also experienced in software and hardware and can reduce the time and effort to bring you to market.

TECHNOLOGY



What is MechaTrans®?

Piezoelectric device generates a required displacement with low voltage. The electrical energy can be converted to mechanical energy at 60% of the conversion efficiency rate. For example, a piezoelectric device of 10mm × 10mm cross section size produces 3,500N(357kgf). However, as the displacement to be generated ranges from a few μm up to 40 μm , the application fields should be limited due to the very small displacement. In order to overcome the disadvantage, Mechano Transformer Corporation has developed the displacement enlargement mechanism by using an unique lever principle.

The enlarged displacement achieves one hundred times of the piezoelectric device itself. The displacement enlargement mechanism is a kind of a passive structure and no additional energy is required. As the mechanism is similar principle to a transformer which is used in electric circuits, it was called mechanical transformer but has been abbreviated to MechaTrans® later on and registered as a trademark in Japan.

MechaTrans® was originally named only for the displacement enlargement mechanism but currently it is used as the actuator with a piezoelectric device.

Features of MechaTrans®

High energy efficiency

The conversion efficiency rate of MechaTrans® from the electrical energy to the mechanical energy should be 25%, including the displacement enlargement mechanism. Moreover, the current to retain a certain displacement is very small.



High-speed operation

MechaTrans® is capable of high-speed operation compared to the usual actuators such as electromagnetic type. The resonance frequency which means the drive limitation is explained at the paragraph 3 of the technical notes.



Effective space utility

MechaTrans® is compact, especially in the thickness dimensions, compared to electromagnetic types of actuators with the same displacement and/or force.



Easy to use

MechaTrans® is easy to use because the displacement is proportional to the supply voltage. If it is required to control the displacement more precisely, aside from the hysteresis to be appeared by the input direction of the supply voltage, it is recommended to add a displacement sensor to the system. More details about this are explained at "Operating precautions for MechaTrans®".



Application fields of MechaTrans®

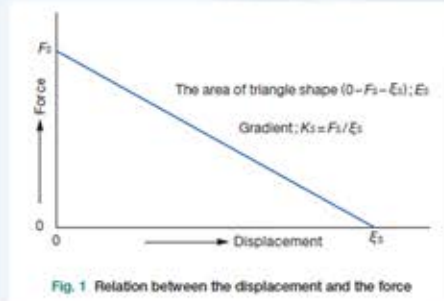
It is said that "actuator" is a general term for a motion mechanism. Our MechaTrans® is also a kind of an actuator which is applicable to industrial fields, medical, automotive, consumer products, aircraft, aerospace, agriculture and so on.

MechaTrans® is available for not only straight motion, but also rotary motion.



MechaTrans®

1. Displacement and force to be generated

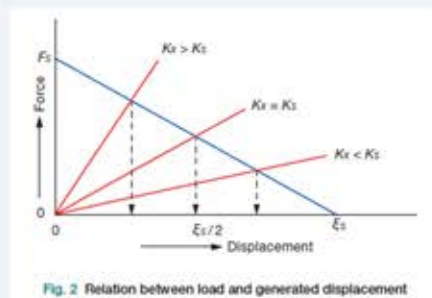


The relation between the displacement and the force to be generated is shown in Fig.1.

The displacement ξ_s at the mechanical output point of MechaTrans® is obtained when 100 [V] of the recommended voltage is supplied onto MechaTrans® without any external load, namely free condition. The force F_s is generated when 100 [V] is supplied and the output point is fixed.

The gradient of the line $K_s = F_s / \xi_s$ is represented as the rigidity of MechaTrans® whereas the area of the triangle $0-E_s-\xi_s$ indicates the energy E_s to be produced by MechaTrans® itself.

2. Characteristics under static conditions



The displacement of MechaTrans® to be generated is shown in Fig.2 when it is used under a static loading condition such as spring constant. If the load rigidity K_x to MechaTrans® is equal to the rigidity of MechaTrans® K_s , the displacement of MechaTrans® should be half of the free condition.

If K_x is larger than K_s , the displacement should be less than half of the free condition, and if K_x is smaller than K_s , the displacement should be more than the half. The energy of the loading side given by MechaTrans® should be maximized when K_x is equal to K_s and it is a quarter of the total energy of MechaTrans® itself shown as Fig.1.

3. Performance under a dynamic loading force

$$f = \frac{1}{2\pi} \sqrt{\frac{K_s}{M}} \quad (1)$$

Here the units are, f : Hz, K_s : N/m, M : kg.

A mechanical resonance system is made up of both a loading mass M and rigidity of MechaTrans®. The resonance frequency can be calculated from the following equation.

In this case, the M is very important to the resonance frequency of MechaTrans® itself and the M consists of both the mass at the output point of MechaTrans® and the mass of the loading side. When a step voltage is supplied to MechaTrans®, the maximum kinetic energy to be given to M

On the transient phenomenon should be equal to the own energy of the piezoelectric device. That means the energy difference between dynamic conditions and static conditions is not so small. When MechaTrans® is used under dynamic conditions, it is required to receive our technical consultation because MechaTrans® may be damaged in the worst case unless appropriate treatments are given to MechaTrans®. Please refer to "Operating precautions for MechaTrans®>4) Do not superimpose DC voltage instantaneously".

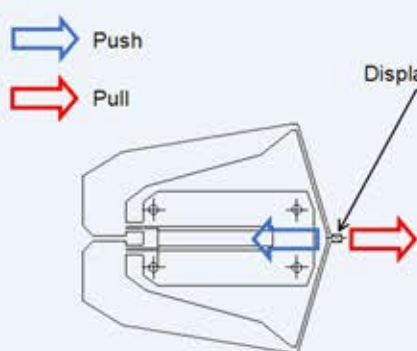
Operating precautions for MechaTrans®

Recommended product storage temperature and humidity

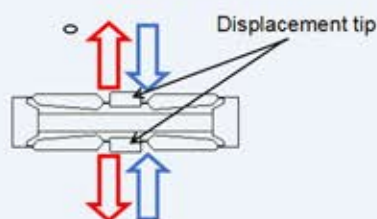
1. Please store MechaTrans® in the following environment:
Temperature: $-5^{\circ}\text{C} \sim +40^{\circ}\text{C}$ Humidity: below 40%RH
2. Using MechaTrans® in a high humidity environment (relative humidity of above 70%) with constant voltage applied will cause migration in the internal electrode of the piezoelectric actuator and may deteriorate the insulation resistance.
3. The operating temperature range is $-20^{\circ}\text{C} \sim 85^{\circ}\text{C}$. For any application, please consider the temperature increase of the piezoelectric actuator itself.

Regarding the handling of MechaTrans®

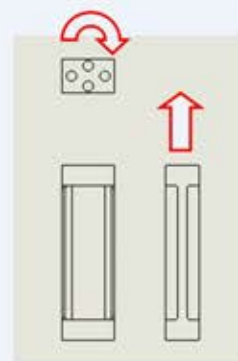
4. Be careful of the following points to avoid the happening of pulling force on the piezoelectric actuator of MechaTrans®
[1] When connecting MechaTrans® to other mechanisms, do not mount the MechaTrans® in the same direction as the displacement direction.
[2] Do not apply excessive force, such as pushing, pulling or twisting the tip of the displacement part of the MechaTrans®.



Example 1: MechaTrans® MTA series



Example 2: MechaTrans® MTDD series



Example 3: MechaTrans® MTPTK series

For MechaTrans® MTPTK series, in order to prevent twisting of the MechaTrans® caused by the screw tightening force, please be sure to fix the actuator upper part as shown in the photo below.

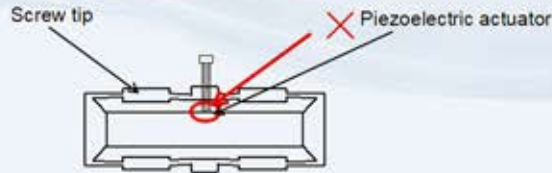


* The built-in piezoelectric actuator in MechaTrans® is made of ceramic material. Ceramic materials are weak in the pulling direction and may break if pulled with a strong force.

MechaTrans® converts the displacement and force generated by the piezoelectric actuator into a large displacement and force using an enlargement mechanism. Conversely, the force applied to the displacement tip is transmitted as a large force to the piezoelectric actuator, and if that force pulls the piezoelectric actuator, the same will be destroyed. The direction of the force pulling the piezoelectric actuator is opposite to the direction of displacement of the MechaTrans®. Please beware not to apply same direction force.

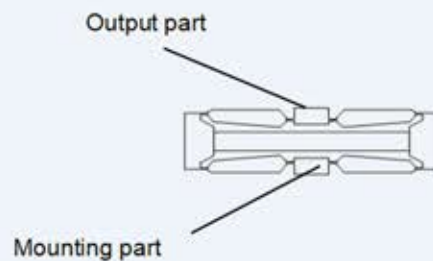
5. The length of the screws used when installing the MechaTrans® should be as shown in the picture below.
If the screw is too long, the tip of the screw and the piezoelectric actuator may contact each other and damage the piezoelectric actuator. The piezoelectric actuator may be destroyed due to the scratch.

• MTDD series • MTD series • MTKK series • MTK series



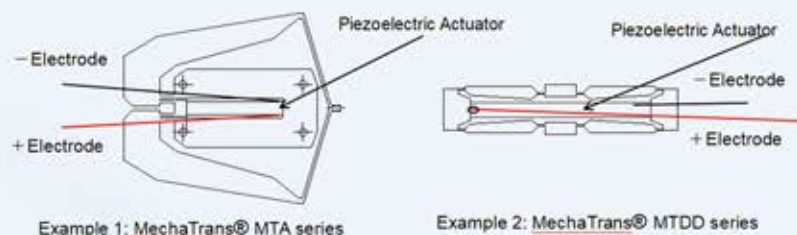
6. When attaching the mounting part of the MechaTrans® as shown below to any mounting base, fasten it with a jig or tool so that the mounting part does not rotate. Similarly, when mounting a part to be loaded or moved to the output part of the MechaTrans®, fasten it with a jig or tool so that the output part does not rotate. Otherwise, the rotating moment while tightening the screw may damage the MechaTrans®.

• MTDD series • MTD series • MTKK series • MTK series



Voltage application

7. Use the mechanical transformer within the rated voltage described below. If a voltage exceeding the rated voltage is applied to the MechaTrans®, the piezoelectric actuator in the MechaTrans® may be damaged and is not covered by our warranty. Rated Voltage : -20V~150V
8. When driving the MechaTrans®, a high voltage is applied between the electrodes of the piezoelectric actuator. Be careful not to create electrical shorts between the electrodes due to contact of electric wires, liquid, or conductive substances contacting with the piezoelectric actuator electrodes.



9. When applying a large voltage momentarily to the MechaTrans® (e.g. applying a DC voltage directly to the MechaTrans® using a switch, etc.), please take note of the following points.
- [1] Connect a resistor between the voltage supply side and the MechaTrans®
 - [2] To prevent mechanical damage to the piezoelectric actuator, limit the inrush current, especially when driven by a rectangular wave.
 - [3] If DC voltage is directly supplied to MechaTrans® by using a switch and unless any resistor is added onto MechaTrans® in series, the maximum displacement may be twice, compared to the displacement under static conditions, and then MechaTrans® may be damaged. In that case, it is recommended to add a suitable resistor onto MechaTrans®, to increase DC voltage gradually, or to control the voltage less than 80V.

10. Avoid reversed polarity usage of the MechaTrans® lead wire. The polarity of the lead wire of the MechaTrans® is Red for + polarity White (or Black) for - polarity.

* Depending on the model, if the polarity cannot be distinguished by lead wire color, the longer lead wire is the positive pole. (Example: MTDD03S50F3, MTD03S50F3 etc.)

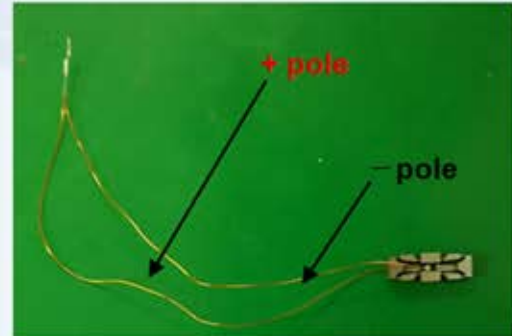
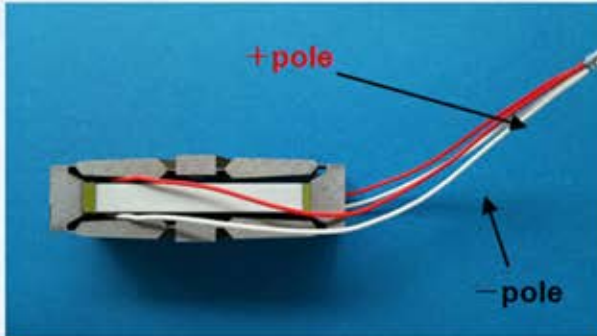
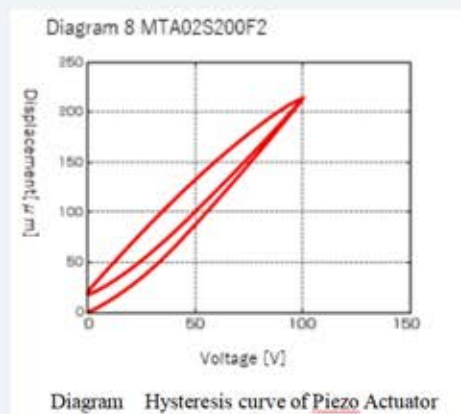


Diagram MechaTrans® Lead wire polarity

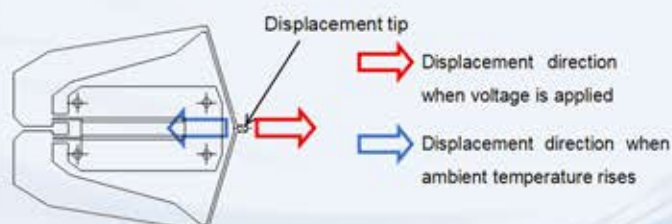
※ When the lead wire polarity is reversed and voltage is applied, the generated displacement will be negative up to about -20V, but any higher voltage will return the displacement to the positive side. This is caused by the polarization inversion that occurred inside the piezoelectric actuator, and the MechaTrans® may break if continuously being applied with inverted polarization. Please use single voltage polarity.

Characteristics of MechaTrans®

11. Please refer to Diagram 8 below regarding the hysteresis between applied voltage and generated displacement of MechaTrans®. With the same applied voltage, there is a slight difference between the generated displacement of the MechaTrans® when the voltage rises and when the voltage drops. This is the general characteristic of the piezoelectric actuator in MechaTrans® and is unavoidable. If it is necessary to control the absolute value of the displacement, the usage of displacement sensor together with MechaTrans® is compulsory.

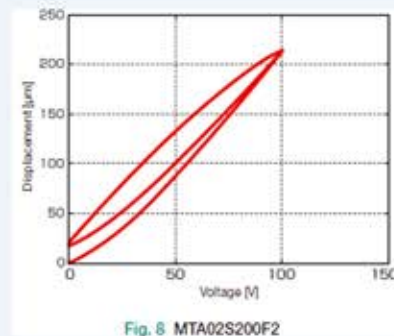


12. The initial position of the MechaTrans® displacement tip changes as the ambient temperature changes. For example, in the following model, when the ambient temperature rises, the initial position direction change is as shown below. Measurements may be carried out to overcome this phenomenon. Please feel free to contact us if there are any doubts concerning this.



Others

13. Please do not disassemble the MechaTrans®. We are not responsible of repairing any disassembled MechaTrans®.
14. When the MechaTrans® is not used, keep it in a storage environment (eg desiccator) with a humidity of 40% or less. If a voltage is applied to a piezoelectric actuator that contains moisture, migration may occur, and the actuator may be damaged. Besides that, please make sure to short-circuit the electrodes of the piezoelectric actuator in MechaTrans® during storage in order to avoid accumulation of electric charge in the piezoelectric actuator when it is not in use.
15. With the prerequisite of proper storage and regular usage, we guarantee the performance of MechaTrans® for 1 year or 10 million times from the date of purchase. Please contact us if you need further guarantee. Our record for certain models cleared 15 billion times of usage.



Fast tip/ tilt steering stage MTS2A23H6mf6000



Fast tip/ tilt steering stage MTS2A23H6mf6000

We build Compact fast tip/tilt steering stage for laser satellite communication.

Speaking of satellite communication, it used to be an era of radio wave communication, but in recent years, laser communication methods have been proposed and verified in various places.

Conventional radio communication (microwaves) has a conspicuous problem of frequency band depletion. With optical communication in satellite, the communication speed increases by a great difference. In addition, there are no concerns about interference or eavesdropping as communication is performed with a focused laser.

We will do our best to realize and popularize this dream technology, optical communication. We have over 20 years of experience in driving piezoelectric actuators and can consistently design, manufacture and sell piezoelectric actuators in house.

This time, we are launching a compact steering mirror that can accurately control the angle of the mirror at high speed, contributing to the spread of satellite communications.



Specifications for MTS2A23H6mf6000

Detailed specifications are as follows.

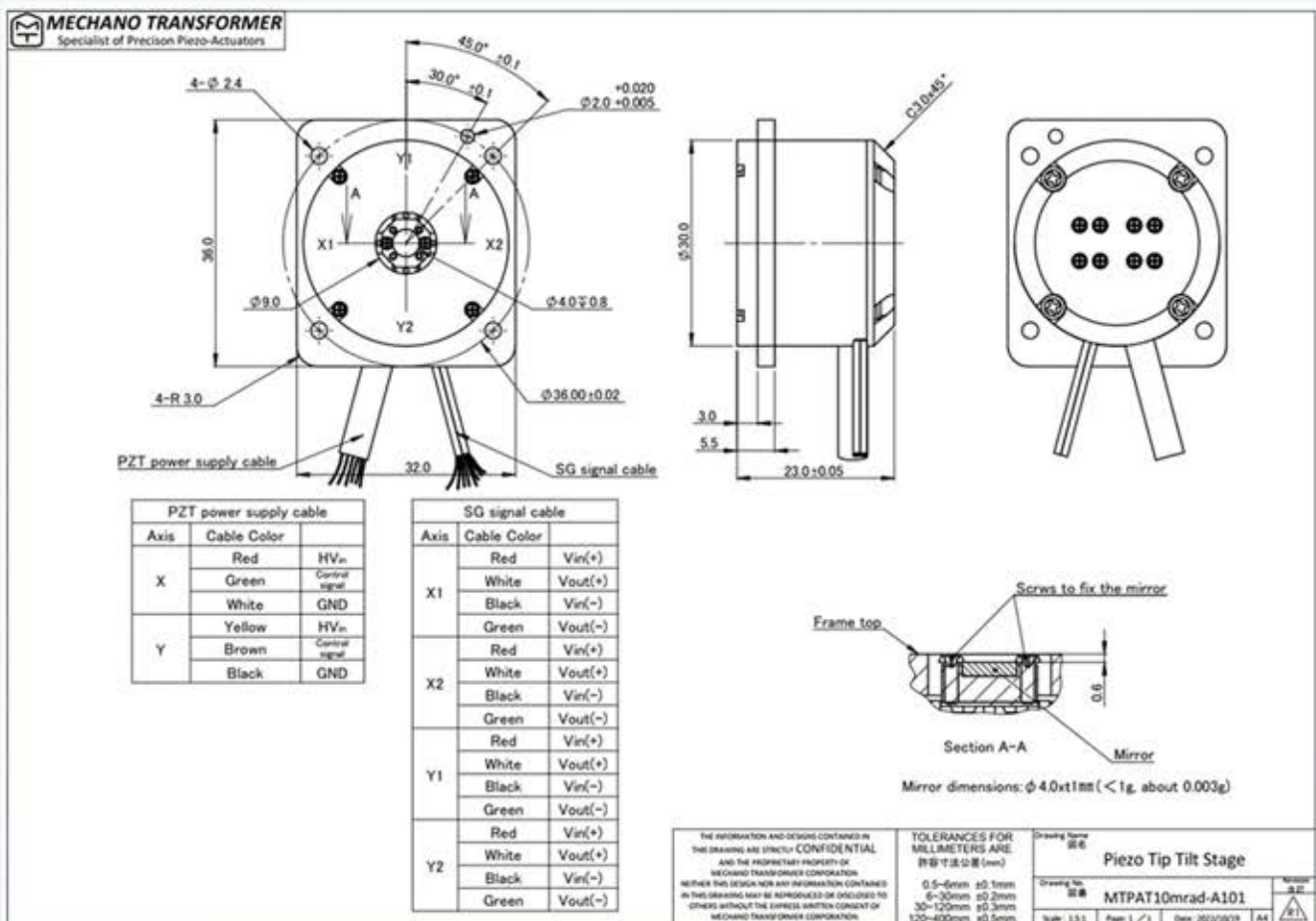
Active axes		Unit	Tolerance
Motion and positioning	θ_x, θ_y		
Integrated sensor			
Tip/Tilt angle, closed loop(Static motion at 0~150V)	SGS		
Resolution	± 6.5	mrad	
Mechanical properties	Below 1.0	μrad	
Resonant frequency @ without load			
Resonant frequency @ Max load	5 & above	kHz	
Drive properties	4 & above	kHz	

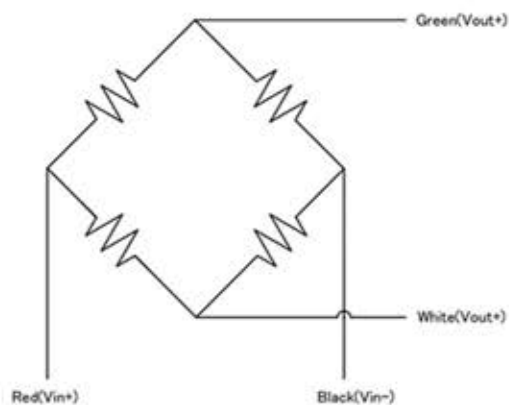
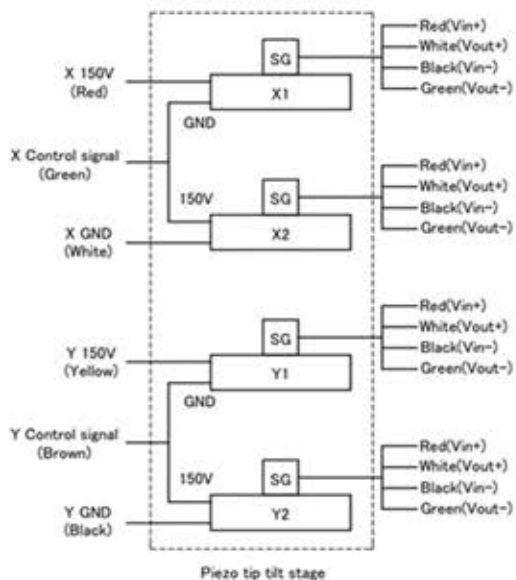
Max driving voltage	150	V	Typ.
Max load	0.2	g	Typ.
Miscellaneous			
Operating temperature	-40 ~ 80	°C	
Material platform	Aluminum		
Height	23.0	mm	Typ.
Mass	50	g	Typ.
Diameter	30.0	mm	Typ.

>Mechanical interfaces Tolence

>Optical interfaces

>Electrical interfaces





SGS: X1, X2, Y1, Y2
The SGS voltage is 2V.

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4F BUILDX No.3, 2-7-12, Iwamoto-cho, Chiyoda-ku,
Tokyo 101-0032 Japan



info@mechano-transformer.com



+81 03-5835-0108



+81 03-5835-0109