

Micro Autograph MST-I

Shimadzu Micro Strain Tester



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Supports Strength Evaluation at the um/mN Level

Recently, with miniaturization of electronic equipment, increasingly small components are mounted at increasingly high densities. Accordingly, demands are increasing for strengthevaluation testing on micro areas (particularly micro displacements) and on micro-specimens. The Micro Autograph MST-I generates accurate micro testing loads by converting a servomotor output to linear motion with a precision ballscrew. To achieve more accurate positioning and displacement measurements, a linear sensor fixed to the linear-moving unit conducts displacement control in the load direction. The optional XY stage and stereomicroscope simplify positioning.

Applications

1.Soldered joint strength evaluation for chip components (shear, peeling) 2.Solder ball joint strength evaluation (tension, compression, shear) 3.Bonding wire joint strength evaluation 4.Bonding wire tensile strength evaluation

5.Metal foil physical strength evaluation (tensile strength, flexural rigidity) 6.Connector pin insertion-force measurement (insertion, withdrawal) 7.Monofilament tensile strength evaluation (tensile strength)

Highly accurate displacement measurement

- A high-accuracy (±0.2 μm) linear sensor is employed for the measurement of displacements in the load direction. The backlash-free construction ensures excellent test accuracy.
- Displacements in the load direction with respect to the specimen can be accurately set to 0.02 µm displacementdisplay resolution and 0.005 µm (Type HR) or 0.02 μ m (Type HS) control resolution.

Micro test-force measurements



Highly rigid frame



P 5 - Accessories

TRAPEZIUM 2 dataprocessing software

micro-specimens

simplifies the positioning of

allows observation of the

specimen positioning.

The optional stereomicroscope

The optional XY stage

micro-specimens.

- Latest user interface with Windows XP compatibility
- Set all test conditions using TRAPEZIUM 2. • View sampling data and graphs in realtime
- during testing. Comprehensive data processing functions
- simplify data analysis.

P 6 - Software

Position

Contents

P 4 - Features

Features

Test Examples

MST-I permits the strength testing of micro-components and monofilaments that were previously hard to test.

Tensile Testing of Bonding Wire

Micro-chuck

Specimen



Bonding Wire Tensile Testing

Fig. 1 shows an overview of the bonding wire tensile test. Fig. 2 and Fig. 3 show the stroke (displacement) – test force curves for the leads and chip, respectively. The optional stereoscopic microscope and XY stage were used to visually position the test specimen. The 30 μ m-diameter bonding wire was grasped in the optional microchuck. It is apparent that the fine test specimen was firmly gripped and that data was collected up to break.

As the wire broken in the lead test in Fig. 2, a plastic deformation region (region of large extension with respect to the test force) appears immediately before the point of break. The test force at break was read as 55 mN. In the chip test in Fig. 3, the bond separated from the chip, and no plastic deformation region is apparent. The test force at break was read as 57 mN.

The tensile strength of bonding wire was conventionally tested by applying the test force through a hook that is hooked onto the wire. However, the Micro Autograph can measure the wire joint strength separately on both the chip and leads.

Compression Testing of Thin Speakers



Fig. 4 shows an overview of the compression testing of a thin speaker, and Fig. 5 shows the stroke (displacement) – test force curve for the test. The indenter was pressed into the center of the speaker diaphragm. Fig. 5 shows that the distance before contact between the indenter and speaker surface was approximately 0.05 mm, and that a region of high linearity exists for about 0.2 mm after the point of contact.



Other Applications



Tensile Testing of Monofilaments



Fig. 6 shows an overview of the tensile test on a monofilament (7 mm long x 0.05 mm dia.) and Fig. 7 shows the stroke (displacement) – test force curve for the test. The optional stereoscopic microscope and XY stage were used to visually position the test specimen. One end of the monofilament was attached in advance with adhesive, while the other end was grasped in a micro-chuck. It is apparent that the data was collected up to failure. The test force at failure

was read as 94 mN. The wave-like disturbance immediately after the test was started is thought to result from peeling of the edge of the adhesive as the test force is applied to the monofilament. The micro-chuck can grasp specimens of about 0.5 mm. In cases where only specimens of a restricted size are available, this system can test them effectively. Fig. 7

Tensile Testing of a Natural Monofilament



• Use for diverse applications, such as the strength evaluation of micromachines or biospecimens.

Optional Accessories

For Tensile Testing

Grips				
P/N	Product name	Specification	Comments	
346-51690-03	500 N small flat grips (Upper and lower grips: 1 set)	Max. test force: 500 N Clearance: 0 to 5 mm Face width: 25 mm Face length: 20 mm	Film, plastic, etc.	
346-53492	10 N micro-chuck (used in test examples)	Max. test force: 10 N Clearance: 0 to 0.3 mm Face width: 1.5 mm Face length: 1.5 mm	Bonding wire, monofilaments, biospecimens (20 to 200 m dia.; grip length 0.5 mm mir	
346-53492-01	10 N micro-chuck (with tweezers)	Max. test force: 10 N Clearance: 0 to 0.5 mm	For solder ball tensile testing	

* The micro-chucks provide the upper grip only. The lower grip suitable for each specimen is separately required.



Wire-pull Jig – for tensile testing of bonding wires, etc.

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P/N	Product name	Specification	Comments
347-57500	20 N wire-pull jig	Max. test force: 20 N	Jig that hooks onto the center of the bonding wire



For Compression Testing Cone type Indenter and Indenter Mounting Adapter – for compression testing of solder bumps

P/N	Product name	Specification	Comments	
340-47026-01	50 µm dia. cone type indenter	50 μ m tip diameter		
340-47026-02	500 μm dia. cone type indenter (used in test examples)	500 μm tip diameter	Solder balls, micromachines, etc.	
347-57266	Indenter adapter (mounted to 5 N, or above, load cell)		Used to mount load cell	
347-57266-01	Indenter adapter (mounted to 0.5 to 2 N load cell)		to the top	
347-57073	Indenter adapter		Used to mount load cell to the bottom	



Truncated-cone Indenter

For Shear Testing Shear jig – for shear testing of IC chips

P/N	Product name	Specification	Comments
346-54383	50 N shear jig for IC chips	Max. test force: 50 N	Applicable board size: 30 x 30 mm max.
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Jigs Common to Tensile, Compression and Shear Testing Fixing jig – for fixing the bottom end of the specimen

P/N	Product name	Specification	Comments
341-64251	Specimen fixing vise		Can be directly mounted on the XY stage
346-53301	5 N specimen fixing jig	Fixes approx. 10 x 10 mm specimens	Mount on top of a bottom-mounted 0.5 N cell

Heating plate – for heating test specimens

P/N	Product name	Specification	Comments
346-54511-02	26 x 40 heating plate	Set temp.: room temperature +30°C to +250°C Accuracy: set temp. ± 2°C max. Method: PID control	Permits fixing of a Si board (approx. 20 mm x 20 mm)
346-54540-01	80 x 80 heating plate	Set temp.: room temperature +30°C to +250°C Accuracy: set temp. ± 5°C max.	

XY stage – for specimen positioning

P/N Product name Specificat		Specification	Comments
344-82861	XY stage	Max. load: ±200 N Movement range: ±12.5 mm (X and Y directions)	Manually positioned with a micrometer

Stereomicroscope - for observations during testing and sample positioning

P/N	Product name	Specification	Comments
346-53303	Stereomicroscope (binocular type)	Magnification: x16 to x100 Illumination: LED (low-heat type)	With zoom function

Anti-vibration base - for micro test-force measurements (0.05 N max.)

P/N	Product name	Specification	Comments
339-81528	Anti-vibration base (passive type)	900(W) x 700(D) x 700(H) Weight: 100 kg	Integral with table
339-81524	Anti-vibration base (active type)	700(W) x 600(D) x 165(H) Weight: 70 kg	Tabletop type

Table

P/N	Product name	Specification	Comments
088-20092-01	Table	1500(W) x 600(D) x 740(H) Weight: 20 kg	
339-81524-03	Table (for use with active anti- vibration base)	800(W) x 700(D) x 535(H) Weight: 215 kg	Total weight with active anti-vibration ba- se : 285 kg

Windbreak

P/N	Product name	Specification	Comments
346-53387-01	Windbreak	700(W) x 750(D) x 1200(H) Anti-static construction	Accommodates up to 30 mm clearance between table and load rod
346-54542	Windbreak (for use with active anti-vibration base)	700(W) x 750(D) x 1450(H) Anti-static construction	Accommodates up to 30 mm clearance between table and load rod (or max. clearance if no active anti- vibration base used)

MST-I Model Line-up by Capacity and Kit Number

346-5450 <u>></u>	<u> </u>		
Model		Capacity	
	Top-mounted load cell	Bottom-mounted load cell	Capacity
0.111	01	51	0.5N
2:H5	02	52	1N
	03	53	2N
	04	54	5N
	05	55	10N
	06	56	25N
	07	57	50N
	08	58	100N
	09	59	200N
	10	60	500N
	11	61	1kN
	12	62	2kN

Software linked with the test machine on many dimensions

The Windows XP compatible TRAPEZIUM 2 software allows various testing operations from simple test control to complicated control patterns created by the user, with its visual wizard settings and the industry's first operation navigation system. Also, data obtained from the test can be processed based on various standards.

Flexible operations such as re-testing and re-analysis, as well as many advanced functions such as network transmission of measurement data and screen customization intelligently navigate various strength tests.

Testing

Powerful sampling functions

- 6-channel input and display
- · Sampling intervals can be set by time, test force, or displacement.
- Test force automatic calibration function
- Test force calibration can be conducted in one touch.

The highly functional built-in controller allows various control patterns.

Automatic test force control
Control of the test force, such

Control of the test force, such as keeping a constant test speed or test force, is possible.

Break point detection

The specimen break point is automatically detected, upon which the testing machine is automatically stopped or the crosshead is restored to its original position.

• Auto/full-auto test force range switching function The test force range is automatically switched to always keep the optimal range.

Specimen protection function

The load applied to the specimen is automatically cancelled to prevent specimen damage before testing.

Analyzing

Free data analysis thanks to a wide range of useful functions

- "Re-tests" and "Extra Lot Tests" can be conducted in one touch to automatically replace results of mis-operations with correct data.
- The "Recalculation" function allows re-analyzing, analyzing of different items and changing names.
- The "Multiple Test Result Files Reading" function allows easy comparison of old and new data.









• The "Point Picking" function allows easy confirmation of values on the graph. Also, the data processing results can be changed on the graph.



Reports can be output as PDF files. By sending the PDF files via e-mail, it is possible to print out reports anywhere, even without the testing machine.

Compatibility with commercial software

Test results and graphs can be output to spreadsheets and word-processing software.

Part number	TRAPEZIUM2	(RS232C cable included)
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Software	Part number		
Single software	345-47308-01		
Cycle software	345-47308-02		
Control software	345-47308-03		
Set	345-47308		



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