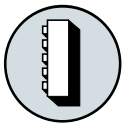
Reference Gages

Length Standards Brought to You by Mitutoyo

Height Master SERIES 515

- Height Master is a best-selling product with a name that has become the industry standard for height reference instruments.

Staggered 20 mm blocks (movable)



Vertical orientation

Riser block

515-322

SPECIFICATIONS

Metric

Order No.	515-322
Range (H)	5 < H ≤ 310 mm
Graduation (analog scale)	0.001 mm
Block step	20 mm (staggered)
Micrometer adjustment	20 mm
Micrometer feed	0.5 mm/rev
Block pitch accuracy	±1.5 µm
Parallelism of blocks	1.0 µm
Feed error	±1.0 µm
Retrace error	1.0 µm
Mass	23 kg

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

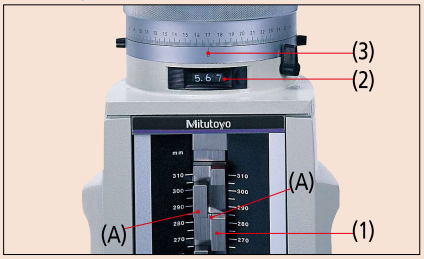
Inch

Order No.	515-310	515-311
Range (H)	0.2 in < H ≤ 12.2 in	0.2 in < H ≤ 12.2 in
Graduation (analog scale)	0.00001 in	
Block step	0.5 in (straight)	1 in (staggered)
Micrometer adjustment	1 in	
Micrometer feed	0.025 in/rev	
Block pitch accuracy	±50 µin	
Parallelism of blocks	40 µin	
Feed error	±40 µin	
Retrace error	40 µin	
Mass	23 kg	

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

Typical application

Reading



(A) Height A

(1) Scale	280.	mm
(2) Counter	5.67	mm
(3) Thimble	0.000	mm
	285.670	mm

An inspection certificate is supplied as standard. Refer to page U-11 for details.

Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Technical Data

- Display: LCD 6 digits
- Battery: SR44 (2 pcs.)
- Battery life: Approx. 1.8 years under normal use

Function

Zero setting, Origin-setting, Origin restoration, Data hold, Auto power off, Data output

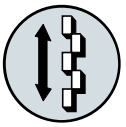
Optional Accessories

515-111: Auxiliary block kit for bore gage (mm)
515-120: Auxiliary block kit for bore gage (inch)
———: Riser block (see page E-36.)
959149: SPC cable (1 m)
959150: SPC cable (2 m)

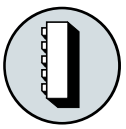
Digital Height Master SERIES 515

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Best-selling height reference standard.
- Equipped with a data output port that enables incorporation into measurement networking and statistical process control systems. (Refer to Page A-3 for details)



Staggered 20 mm blocks (movable)



Vertical orientation

Riser block

515-374

SPECIFICATIONS

Metric

Order No.	515-374	515-376	515-378
Range (H)	10 < H ≤ 310 mm	10 < H ≤ 460 mm	10 < H ≤ 610 mm
Resolution (digital display)	0.001 mm		
Block step	20 mm (staggered)		
Micrometer adjustment	20 mm		
Micrometer feed	0.5 mm/rev		
Block pitch accuracy 0 < H ≤ 310 mm	±1.5 µm		
Block pitch accuracy 310 < H ≤ 460 mm	—	±2.5 µm	
Block pitch accuracy 460 < H ≤ 610 mm	—	—	±3.5 µm
Parallelism of blocks 0 < H ≤ 310 mm	2.0 µm		
Parallelism of blocks 310 < H ≤ 610 mm	—	2.5 µm	
Feed error	±2.0 µm		±2.5 µm
Retrace error	2.0 µm		2.5 µm
Mass	9.5 kg	13.6 kg	16 kg

Note: The block accuracy and the parallelism of blocks are based on main unit installation surface, which does not include the retrace error.

Inch

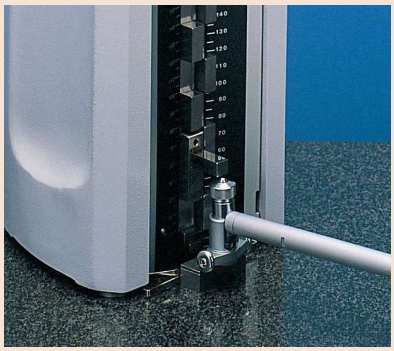
Order No.	515-375	515-377	515-379
Range (H)	0.5 in < H ≤ 12 in	0.5 in < H ≤ 18 in	0.5 in < H ≤ 24 in
Resolution (digital display)	0.0001 in		
Block step	1 in (staggered)		
Micrometer adjustment	1 in		
Micrometer feed	0.025 in/rev		
Block pitch accuracy 0 < H ≤ 12 in	±100 µin		
Block pitch accuracy 12 in < H ≤ 18 in	—	±100 µin	
Block pitch accuracy 18 in < H ≤ 24 in	—	—	±150 µin
Parallelism of blocks 0<H≤12 in	50 µin		
Parallelism of blocks 12 in < H ≤ 18 in	—	100 µin	
Feed error	±100 µin		±100 µin
Retrace error	100 µin		100 µin
Mass	9.5 kg	13.6 kg	16 kg

Note: The block accuracy and the parallelism of blocks are based on main unit installation surface, which does not include the retrace error.

An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Height Master
SERIES 515 — Optional accessories

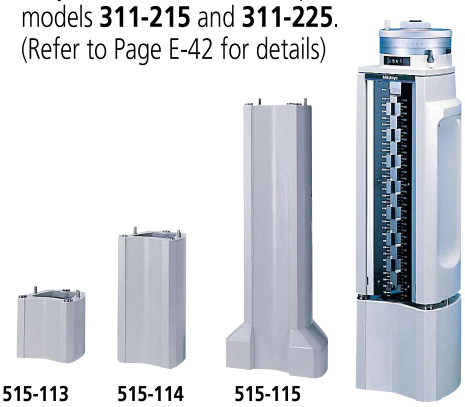
Typical application



Bore gage zero-setting

Riser Blocks
SERIES 515

- These riser blocks are designed to increase the measurable height.
- They can also be used on Square Master models **311-215** and **311-225**. (Refer to Page E-42 for details)



515-113 **515-114** **515-115**

SPECIFICATIONS

Metric

Order No.	Height (mm)	Accuracy (µm)	Variation in length (µm)	Mass (kg)
515-113	150	±0.6	0.6	5.7
515-114	300	±1.0	0.8	9.8
515-115	600	±2.0	1.0	26.8

Inch

Order No.	Height (in)	Accuracy (µin)	Variation in length (µin)	Mass (kg)
515-116	6	±20	20	4.8
515-117	12	±40	30	11.3
515-118	24	±80	40	31

Auxiliary Block Kit
SERIES 515 – for Bore Gage

- Enables efficient zero point adjustment of cylinder gages using the Height Master.
- Zero point adjustment range: 18 to 150 mm.

515-112

SPECIFICATIONS

Metric

Order No.	Model
515-110	Universal Height Master
515-111	Digital Height Master (**515-374**/**376**/**378**)
515-112	Height Master (**515-322**)

Inch

Order No.	Model
515-119	Universal Height Master, Height Master (**515-310**)
515-120	Digital Height Master (**515-375**/**377**/**379**)
515-121	Height Master (**515-311**)

E

Reference Gages

Length Standards Brought to You by Mitutoyo

Universal Height Master
SERIES 515 — Usable in Vertical and Horizontal Orientations

- The Universal Height Master is designed for both vertical and horizontal orientation, providing a wide range of applications such as accuracy checking of machine tool table movements.

515-520

- Analog display by the built-in counter – the appearance and specifications are the same as model **515-322**.
(Refer to Page E-35 for details)

SPECIFICATIONS

Metric

Order No.		515-520	515-523
Range (H)		5 < H ≤ 610 mm	5 < H ≤ 1010 mm
Graduation (analog scale)		0.001 mm	
Block step		10 mm (straight)	
Micrometer adjustment		20 mm	
Micrometer feed		0.5 mm/rev	
Block pitch accuracy	H ≤ 310 mm	±1.5 µm	
	310 < H ≤ 610 mm	±2.5 µm	
	610 < H ≤ 1010 mm	—	±3.5 µm
Parallelism of blocks	H ≤ 610 mm	1.5 µm	
	610 < H ≤ 1010 mm	—	2.0 µm
Feed error		±1.2 µm	±1.5 µm
Retrace error		1.2 µm	1.5 µm
Mass		42 kg	63.5 kg

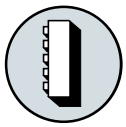
Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

Inch

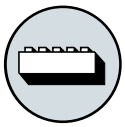
Order No.		515-512	515-510	515-513
Range (H)		0.2 in < H ≤ 18.2 in	0.2 in < H ≤ 24.2 in	0.2 in < H ≤ 40.2 in
Graduation (analog scale)		0.00001 in		
Block step		0.5 in (straight)		
Micrometer adjustment		1 in		
Micrometer feed		0.025 in/rev		
Block pitch accuracy	H ≤ 12 in	±50 µin		
	12 in < H ≤ 24 in	—	±100 µin	
	24 in < H ≤ 40 in	—	—	±150 µin
Parallelism of blocks	H ≤ 24 in	60 µin		
	24 in < H ≤ 40 in	—	80 µin	
Feed error		±40 µin		±60 µin
Retrace error		40 µin		60 µin
Mass		42 kg		63.5 kg

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

Single-row 10 mm blocks (movable)



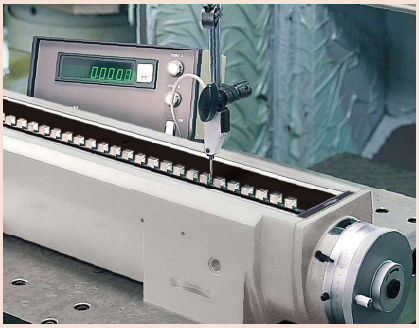
Vertical orientation



Horizontal orientation

Riser block

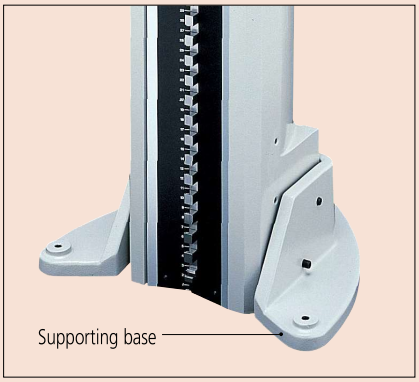
An inspection certificate is supplied as standard.
Refer to page U-11 for details.



Typical application using in horizontal orientation

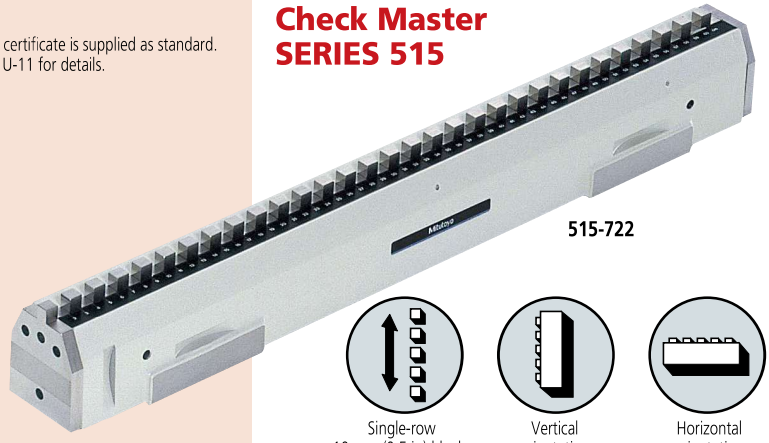
Optional Accessories

Supporting base
900574 (Dedicated for the Universal Height Master. Provided for **515-523** and **515-513** as standard.)
- Stable vertical orientation is available.



An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Check Master SERIES 515



515-722

- Designed to check the accuracy of table movements of machine tools and calibrate CMMs.
- Can be used in either vertical or horizontal orientation.

515-724 515-723 515-722

Single-row
10 mm (0.5 in) blocks

Vertical orientation

Horizontal orientation

SPECIFICATIONS

Metric

Order No.		515-720	515-721	515-722	515-723	515-724
Range (H)		310 mm	450 mm	610 mm	1010 mm	1510 mm
Block step		10 mm				
Block pitch accuracy	H ≤ 310 mm	±2.5 µm				
	310 < H ≤ 610 mm	—	±3.5 µm			
	610 < H ≤ 1010 mm	—	—	—	±5.0 µm	
	1010 < H ≤ 1510 mm	—	—	—	—	±8.0 µm
Parallelism of blocks	H ≤ 310 mm	1.2 µm				
	310 < H ≤ 610 mm	—	1.5 µm			
	610 < H ≤ 1010 mm	—	—	—	2.0 µm	
	1010 < H ≤ 1510 mm	—	—	—	—	2.5 µm
Mass		7 kg	10 kg	13 kg	22 kg	30 kg

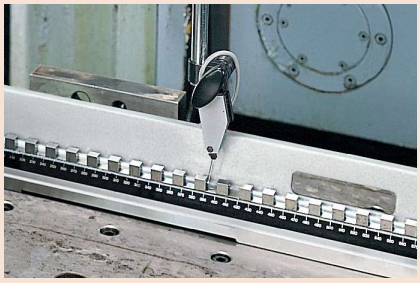
Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

Inch

Order No.		515-710	515-711	515-712	515-713
Range (H)		12.5 in	18.5 in	24.5 in	40.5 in
Block step		0.5 in			
Block pitch accuracy	H ≤ 12.5 in	±100 µin			
	12.5 in < H ≤ 24.5 in	—	±150 µin		
	24.5 in < H ≤ 40.5 in	—	—	—	±200 µin
Parallelism of blocks	H ≤ 12.5 in	50 µin			
	12.5 in < H ≤ 24.5 in	—	60 µin		
	24.5 in < H ≤ 40.5 in	—	—	—	80 µin
Mass		7 kg	10 kg	13 kg	22 kg

Note 1: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.
Note 2: Supplied with a wooden storage case as standard.

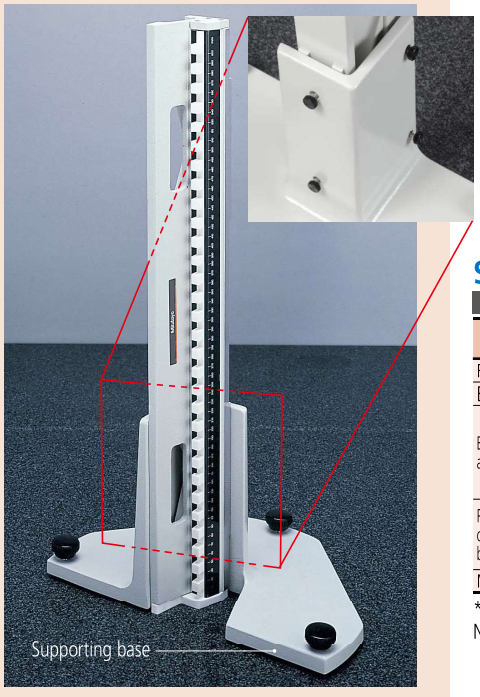
An inspection certificate is supplied as standard.
Refer to page U-11 for details.



Typical application using in horizontal orientation

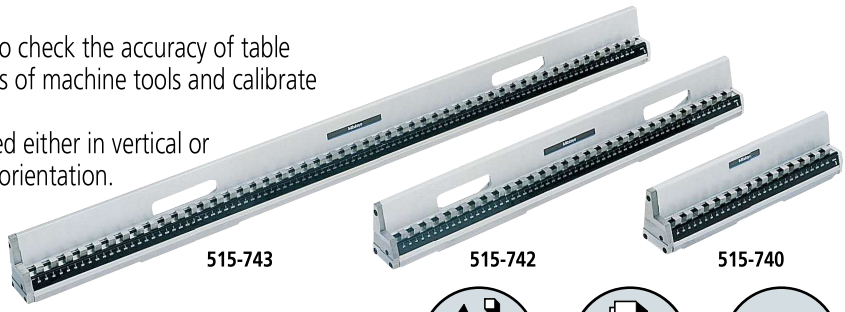
Optional Accessories

Supporting base
601167: Supporting base for vertical operation
• Enables stable operation in the vertical orientation.

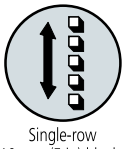


High Accuracy Check Master SERIES 515

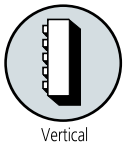
- Designed to check the accuracy of table movements of machine tools and calibrate CMMs.
- Can be used either in vertical or horizontal orientation.



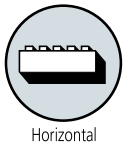
515-743 515-742 515-740



Single-row
10 mm (5 in) blocks



Vertical orientation



Horizontal orientation

SPECIFICATIONS

Metric

Order No.		515-740*/ 515-760*	515-741*/ 515-761*	515-742*/ 515-762*	515-743*/ 515-763*	515-744*/ 515-764*
Range (H)		310 mm	450 mm	610 mm	1010 mm	1510 mm
Block step		10 mm				
Block pitch accuracy	H ≤ 310 mm	±1.2 µm				
	310 < H ≤ 610 mm	—	±1.8 µm			
	610 < H ≤ 1010 mm	—	—	—	±2.5 µm	
	1010 < H ≤ 1510 mm	—	—	—	—	±4.0 µm
Parallelism of blocks	H ≤ 450 mm	1.0 µm				
	450 < H ≤ 1010 mm	—	—	1.5 µm		
	1010 < H ≤ 1510 mm	—	—	—	—	2.0 µm
Mass		3.6 kg	5.4 kg	7.2 kg	12 kg	18 kg

* Ceramic Check Master
Note: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

Inch

Order No.		515-730*/ 515-750*	515-731*/ 515-751*	515-732*/ 515-752*	515-733*/ 515-753*	515-734*/ 515-754*
Range (H)		12.5 in	18.5 in	24.5 in	40.5 in	60.5 in
Block step		0.5 in				
Block pitch accuracy	H ≤ 12.5 in	±50 µin				
	12.5 in < H ≤ 24.5 in	—	±70 µin			
	24.5 in < H ≤ 40.5 in	—	—	—	±100 µin	
	40.5 in < H ≤ 60.5 in	—	—	—	—	±158 µin
Parallelism of blocks	H ≤ 18.5 in	40 µin				
	18.5 in < H ≤ 40.5 in	—	60 µin			
	40.5 in < H ≤ 60.5 in	—	—	—	—	80 µin
Mass		3.6 kg	5.4 kg	7.2 kg	12 kg	18 kg

* Ceramic Check Master
Note: The block accuracy and the parallelism of blocks are relative to the main unit installation surface.

E

Mitutoyo

Reference Gages

Length Standards Brought to You by Mitutoyo

Standard Scales
SERIES 182 — Made of Low Expansion Glass

- Standard scales can be used as a traceable standard of length for calibrating measuring instruments.
- These scales are manufactured using Mitutoyo's high-definition lithography technology in an underground scale manufacturing facility dedicated to the production of high-accuracy, high-quality line standards. They are considered top-grade length standards.

182-501

182-502

Technical Data

- Material: Low expansion glass
- Thermal expansion coefficient: (0.00±0.02)×10^{-6}/K
- Graduation line thickness: 4 µm
- Graduation: 1 mm
- Accuracy (at 20 °C): (0.5 + L/1000) µm,
  L=Measured length (mm)

SPECIFICATIONS

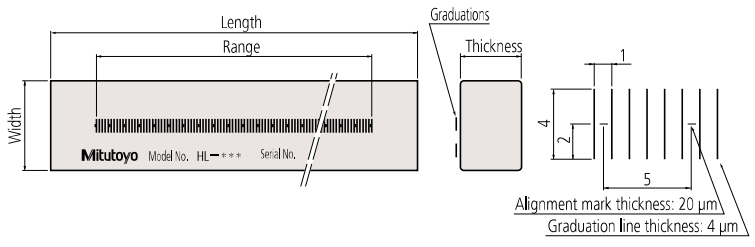
Metric

Order No.	Range (mm)	Length (mm)	Width (mm)	Thickness (mm)
182-501-50	250	280	20	10
182-501-60*				
182-502-50	500	530	30	20
182-502-60*				

* With English JCSS certificate.

DIMENSIONS

Unit: mm



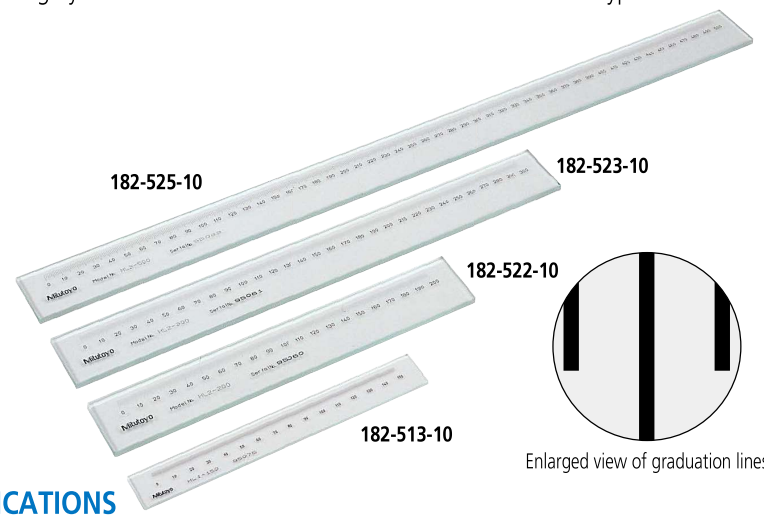
E

Technical Data

- Glass material: Soda-lime glass
- Thermal expansion coefficient: 8.5×10^{-6}/K
- Accuracy (at 20 °C): (1.5 + 2L/1000) µm,
  L=Measured length (mm)

Working Standard Scales
SERIES 182

- These standard scales can be used to calibrate various measuring instruments and to confirm traceability to upper-level calibration devices and reference instruments. For example, they can be used in daily and periodic inspections of profile projector/microscope stages and of optical length measurement systems.
- These scales are manufactured using high-accuracy lithographic technologies. Mitutoyo has developed these technologies at the dedicated underground facility which was custom-built to produce highly accurate scales. Various sizes are available for each type to suit the application.



Enlarged view of graduation lines

SPECIFICATIONS

Metric

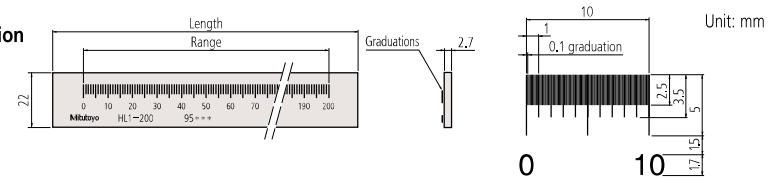
Order No.	Range (mm)	Graduation (mm)	Length (mm)	Inspection pitch (mm)	Graduation line thickness (µm)	Mass (kg)
182-511-10	50	0.1	75	5	20	0.23
182-512-10	100		125	10		0.24
182-513-10	150		175			0.25
182-514-10	200		225			0.26
182-521-10	100	0.5	130	20	50	0.27
182-522-10	200		230			0.32
182-523-10	300		330			0.57
182-524-10	400		430			0.71
182-525-10	500		530			0.86
182-531-10	250	1	280	25	100	0.55
182-532-10	500		530			1.22
182-533-10	750		780			0.23
182-534-10	1000		1030			1.54

Note: An inspection certificate produced by a standard scale automatic calibration system is supplied as standard.

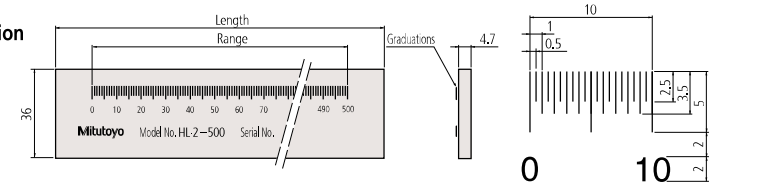
DIMENSIONS

Unit: mm

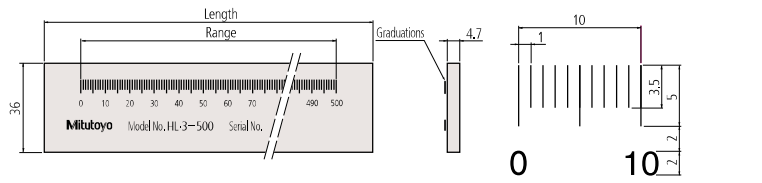
- **0.1 mm graduation**



- **0.5 mm graduation**



- **1 mm graduation**



E

Mitutoyo

Reference Gages

Length Standards Brought to You by Mitutoyo

High Precision Square SERIES 311

- The High Precision Square is a gage used for inspecting the travel straightness and axial perpendicularity of moving elements on equipment such as machine tools, CMMs, form measuring machines and semiconductor-related equipment.
- All four surfaces, finished using ultra-precision technology built on our experience in gauge blocks and other products, can be used as reference surfaces.
- Better than 1 µm/300 mm straightness and perpendicularity of each (four) reference surface. In addition, front and back faces are accurate to better than 5 µm/300 mm.
- Three nominal sizes are available (90×110, 160×210 and 260×310 mm) so that you can select the size that best suits the application.

311-111

311-112

311-113

SPECIFICATIONS

Metric

Order No.	Dimension (W×L×T) (mm)	Mass (kg)
311-111	90×110×25	1.5
311-112	160×210×25	5.0
311-113*	260×310×30	14.0

* Supplied with a removable handle.

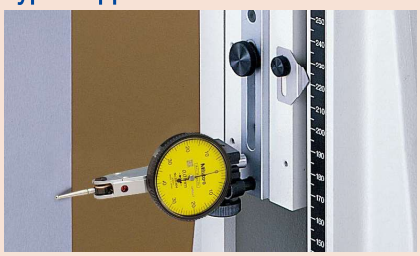
PROPRIETARY INSPECTION CERTIFICATE

An inspection certificate is supplied as standard.
Refer to page U-11 for details.

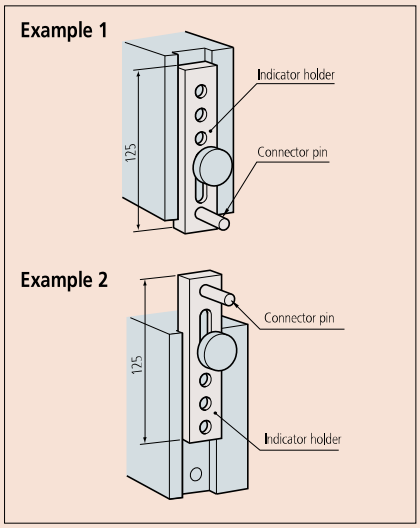
Technical Data

- Reference surface
  Perpendicularity tolerance: 1 µm
  Straightness tolerance: 1 µm
- Front/back faces
  Perpendicularity tolerance: 5 µm
  Straightness tolerance: 5 µm
- Dedicated wooden case is provided.

Typical application



Mounting the Indicator Holder



Standard Accessories

- **513-401-10H** (Metric)
- **902053**: Clamp
- **601471**: Indicator holder
- **538616**: Hexagonal-head wrench (3 mm)

Note: Inspection certificate is not attached. Contact your local Mitutoyo sales office.

Optional Accessories

- **900565**: Feeler
- **900571**: Adjustable holder
- **900551**: Extension holder

Square Master
SERIES 311 — Squareness/Straightness Measuring

- Squareness (perpendicularity) and straightness measurements can be performed accurately and efficiently by just moving a lever. Use the vertical motion handle on the rear of the main unit for operation.
- Highly accurate measurement of squareness and straightness is available by calibrating a square as a master using the built-in perpendicularity adjustment mechanism. Prepare a square to be used for accuracy check/adjustment separately.
- Sliding force: Approx. 2 to 5 N

311-215

311-225

311-245

SPECIFICATIONS

Metric

Order No.	Vertical travel (mm)	Squareness (µm)	Straightness (µm)	Dimension (mm)			Mass (kg)
				Width	Depth	Height	
311-215*	150	3	2	180	200	420	13.7
311-225*	250	6	2.5	180	200	520	16.2
311-245	450	9	3.5	220	220	720	24

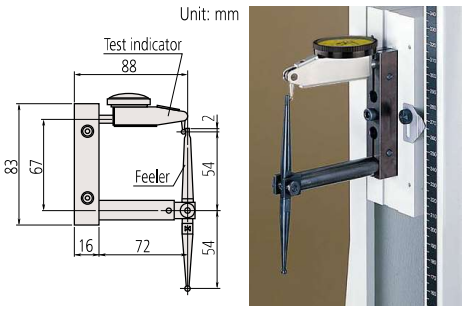
* Riser blocks to extend the height of Square Masters can be used. (Refer to Page E-36 for details)

Optional accessory

900565: Feeler

For probing surfaces that the contact point of a detector cannot reach.

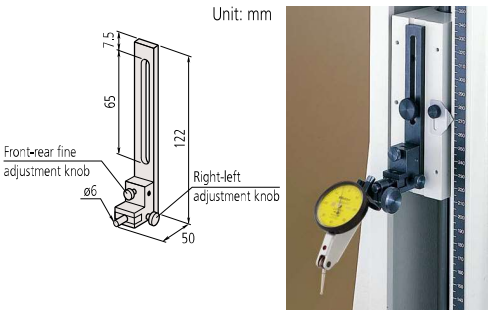
Unit: mm



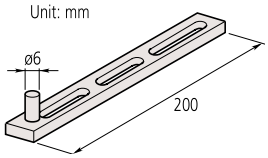
900571: Adjustable holder

Enables easy adjustment of indicator position.

Unit: mm



Unit: mm



900551: Extension holder

Measurement position can be extended by using this 200 mm length holder instead of the indicator holder.

E

Reference Gages

Length Standards Brought to You by Mitutoyo

Precision Levels
SERIES 960

- High-precision longitudinal and transverse vials make it possible to check or level surfaces.

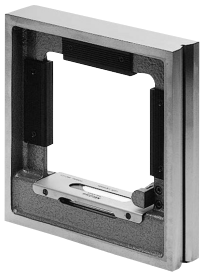
SPECIFICATIONS

Order No.	Sensitivity (mm/m)	Dimensions (W×D×H) (mm)
960-603	0.02	200×44×38.2
960-703	0.02	200×44×200

Technical Data

- Accuracy of graduations: ±0.7 DIV (**960-603**), ±0.3 DIV (**960-703**)

960-603



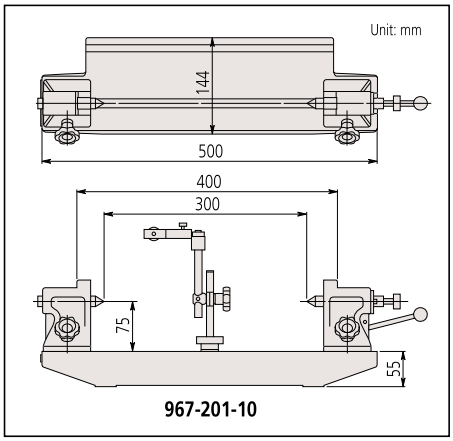
960-703

Bench Centers
SERIES 967

FEATURES

- Used with a dial test indicator (optional), these Bench Centers provide precision measurement of concentricity on cylindrical workpieces.
- With an indicator clamp. (Holding stem diameter: 8 mm)

Dimensions



967-201-10

Technical Data

- Maximum workpiece length: 300 mm
- Maximum workpiece dia.: 150 mm
- Mass: 13 kg

967-201-10

Steel Rules
SERIES 182

- Clear graduations on satin-chrome finish.
- Stainless tempered.

182-101

182-102

182-103

182-105

182-201

182-202

182-205

182-302

SPECIFICATIONS

Metric Wide Rigid Rules

Order No.	Graduations (mm)	Range (mm)	Width (mm)
182-111	1, 0.5 (on both faces)	150	19
182-131		300	25
182-151		450	30
182-171		600	30

Metric Fully-Flexible Rules

Order No.	Graduations (mm)	Range (mm)	Width (mm)
182-211	1, 0.5 (on both faces)	150	12
182-231		300	12
182-251		450	19
182-271		600	19

Inch/Metric Semi-Flexible Rules

Order No.	Graduations*	Range	Width (in)
182-302	1/16 in, 1/32 in, 1/64 in, 1 mm, 0.5 mm	6 in/150 mm	0.51
182-303		8 in/200 mm	0.51
182-305		12 in/300 mm	0.59
182-307		20 in/500 mm	0.59
182-309		40 in/1000 mm	0.59

* Engraved on the front side only.

Inch/Metric Wide Rigid Rules

Order No.	Graduations	Range	Width (in)
182-105	1/32 in, 1/64 in, 1 mm, 0.5 mm	6 in/150 mm	0.75
182-125		12 in/300 mm	0.98
182-145		18 in/450 mm	1.18
182-165		24 in/600 mm	1.18
182-106	1/50 in, 1/100 in, 1 mm, 0.5 mm	6 in/150 mm	0.75
182-126		12 in/300 mm	0.98
182-107	1/10 in, 1/100 in, 1 mm, 0.5 mm	6 in/150 mm	0.75
182-108	1/10 in, 1/50 in, 1 mm, 0.5 mm	6 in/150 mm	0.75

Inch/Metric Fully-Flexible Rules

Order No.	Graduations	Range	Width (in)
182-205	1/32 in, 1/64 in, 1 mm, 0.5 mm	6 in/150 mm	0.47
182-225		12 in/300 mm	0.47
182-245		18 in/450 mm	0.75
182-265		24 in/600 mm	0.75
182-206	1/50 in, 1/100 in, 1 mm, 0.5 mm	6 in/150 mm	0.47
182-226		12 in/300 mm	0.47
182-207	1/10 in, 1/100 in, 1 mm, 0.5 mm	6 in/150 mm	0.47
182-208	1/10 in, 1/50 in, 1 mm, 0.5 mm	6 in/150 mm	0.47

Inch Wide Rigid Rules

Order No.	Graduations (in)	Range (in)	Width (in)
182-101	1/8, 1/16, 1/32, 1/64	6	0.75
182-121		12	0.98
182-141		18	0.71
182-161		24	1.18
182-102	1/50, 1/100, 1/32, 1/64	6	0.75
182-122		12	0.98
182-142		18	1.18
182-162		24	1.18
182-103	1/10, 1/100, 1/32, 1/64	6	0.75
182-123		12	0.98
182-143		18	1.18
182-163		24	1.18
182-104	1/10, 1/50, 1/32, 1/64	6	0.75
182-124		12	0.98

Inch Fully-Flexible Rules

Order No.	Graduations (in)	Range (in)	Width (in)
182-201	1/8, 1/16, 1/32, 1/64	6	0.47
182-221		12	0.47
182-241		18	1.18
182-261		24	0.75
182-202	1/50, 1/100, 1/32, 1/64	6	0.47
182-222		12	0.47
182-242		18	0.75
182-262		24	0.75
182-203	1/10, 1/100, 1/32, 1/64	6	0.47
182-223		12	0.47
182-243		18	0.75
182-263		24	0.75
182-204	1/10, 1/50, 1/32, 1/64	6	0.47
182-224		12	0.47

E

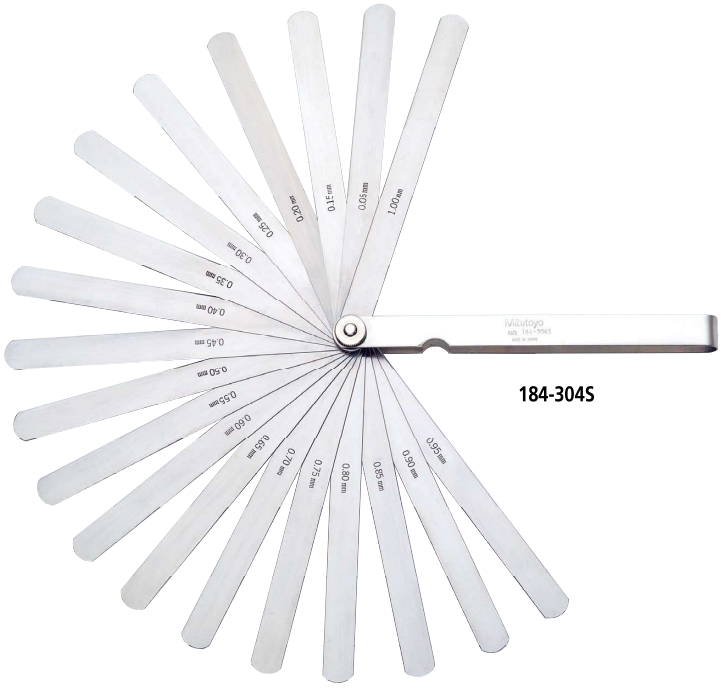
Mitutoyo

Reference Gages

Length Standards Brought to You by Mitutoyo

Thickness Gages
SERIES 184

- Metric thickness gages are available with tapered leaves.
- Each leaf is marked with its thickness.
- Each leaf is detachable if necessary.



184-304S

SPECIFICATIONS

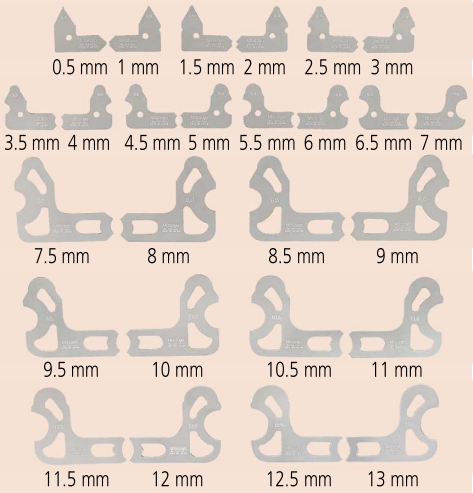
Metric

Order No.	Range (mm)	Composition of leaves	Remarks
184-313S	0.05 - 1	28 leaves: 0.05 - 0.15 mm by 0.01 mm, 0.2 - 1 mm by 0.05 mm	—
184-303S		28 leaves: 0.05 - 0.15 mm by 0.01 mm, 0.2 - 1 mm by 0.05 mm	Long leaf
184-304S	0.05 - 1	20 leaves: 0.05 - 1 mm by 0.05 mm	Long leaf
184-305S	0.05 - 1	13 leaves: 0.05 - 0.3 mm by 0.05 mm, 0.4 - 1 mm by 0.1 mm	—
184-301S		13 leaves: 0.05 - 0.3 mm by 0.05 mm, 0.4 - 1 mm by 0.1 mm	Long leaf
184-306S	0.05 - 0.8	10 leaves: 0.05 - 0.2 mm by 0.05 mm, 0.3 - 0.8 mm by 0.1 mm	—
184-308S		10 leaves: 0.05 - 0.2 mm by 0.05 mm, 0.3 - 0.8 mm by 0.1 mm	Long leaf
184-307S	0.03 - 0.5	13 leaves: 0.03 - 0.1 mm by 0.01 mm, 0.2 - 0.5 mm by 0.1 mm, 0.15 mm	—
184-302S		13 leaves: 0.03 - 0.1 mm by 0.01 mm, 0.2 - 0.5 mm by 0.1 mm, 0.15 mm	Long leaf

DIMENSIONS

Unit: mm

Order No.	L1	L2
184-313S	100	106
184-303S	150	156
184-304S	150	156
184-305S	100	106
184-301S	150	156
184-306S	100	106
184-308S	150	156
184-307S	100	106
184-302S	150	156

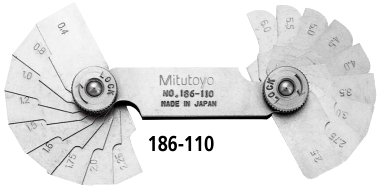


Composition of leaves for **186-902**

Radius Gages SERIES 186

- Radius size is stamped on each gage leaf.
- Each leaf comprises an internal and an external radius gage of the same size.
- With locking clamp.

186-105



186-110

SPECIFICATIONS

Metric

Order No.	Range (mm)	Accuracy	Composition of leaves	Remarks
186-110	0.4 - 6	±0.04 mm	18 leaves: 0.4, 0.8, 1, 1.2, 1.5, 1.6 mm, 1.75 - 3 mm by 0.25 mm, 3.5 - 6 mm by 0.5 mm	90° arc
186-902	0.5 - 13		26 leaves: 0.5 - 13 mm by 0.5 mm	90° arc, separate part type
186-105	1 - 7		34 leaves: 1 - 3 mm by 0.25 mm, 3.5 - 7 mm by 0.5 mm	180° arc
186-106	7.5 - 15		32 leaves: 7.5 - 15 mm by 0.5 mm	180° arc
186-107	15.5 - 25		30 leaves: 15.5 - 20 mm by 0.5 mm, 21 - 25 mm by 1 mm	180° arc

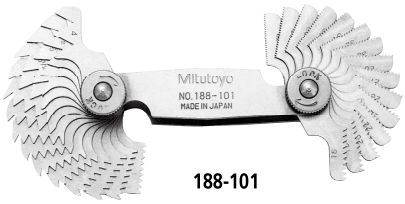
Inch

Order No.	Range (in)	Accuracy	Composition of leaves	Remarks
186-103	1/32 - 17/64	±0.002 in	16 leaves: 1/32 in - 17/64 in by 64ths	90° arc
186-101	1/32 - 1/4		30 leaves: 1/32 in - 1/4 in by 64ths	180° arc
186-102	17/64 - 1/2		16 leaves: 17/64 in - 1/2 in by 64ths	180° arc
186-104	9/32 - 33/64		16 leaves: 9/32 in - 33/64 in by 64ths	90° arc
186-901*	1/64 - 1/2		25 leaves: 1/64 in - 17/64 in by 64ths, 9/32 in - 1/2 in by 32nds	—

* Each gage has five measuring locations.

Thread Pitch Gages SERIES 188

- Thread pitch is stamped on each gage.
- Metric, Unified, and Whitworth screw pitch gages.



188-101

SPECIFICATIONS

Metric Screw Pitch Gages

Order No.	Range (mm)	Integration pitch error	Composition of leaves
188-130	0.35 - 6	±0.05 mm	22 leaves: 0.35, 0.4, 0.45, 0.5, 0.6, 0.7, 0.75, 0.8, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6 mm and 60° angle gage
188-122	0.4 - 7		21 leaves: 0.4, 0.5, 0.7, 0.75, 0.8, 0.9, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 mm
188-121	0.4 - 7		18 leaves: 0.4, 0.5, 0.75, 1, 1.25, 1.5, 1.75, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5, 7 mm

Unified Screw Pitch Gages

Order No.	Range	Integration pitch error	Composition of leaves
188-111	4 - 42 TPI	±0.002 in	30 leaves: 4, $4^{1/2}$, 5, $5^{1/2}$, 6, 7, 8, 9, 10, 11, $11^{1/2}$, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI

Note: Metric and Unified Pitch Gage Set (**188-151**) is available.

Metric and Unified Screw Pitch Gage Set

Order No.	Range	Integration pitch error	Composition of leaves
188-151	0.4 - 7 mm/4 - 42 TPI	±0.05 mm/ ±0.002 in	51 leaves: Set of **188-122** and **188-111**

Whitworth Screw Pitch Gages

Order No.	Range	Integration pitch error	Composition of leaves
188-101	4 - 42 TPI	±0.002 in	30 leaves: 4, $4^{1/2}$, 5, $5^{1/2}$, 6, 7, 8, 9, 10, 11, $11^{1/2}$, 12, 13, 14, 15, 16, 18, 20, 22, 24, 26, 27, 28, 30, 32, 34, 36, 38, 40, 42 TPI
188-102	4 - 60 TPI		28 leaves: 4, $4^{1/2}$, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 40, 48, 60 TPI

E

Mitutoyo

Reference Gages

Length Standards Brought to You by Mitutoyo

Digimatic Universal Protractor SERIES 187

- Data output function makes it easy to gather statistical data.
- Can be attached to height gages using a gage holder (**950750**, metric)
- Setting preset value.
- Removable blade.

187-501

Technical Data

- Battery: Lithium Battery
- Battery life: 2,000 hours

Function

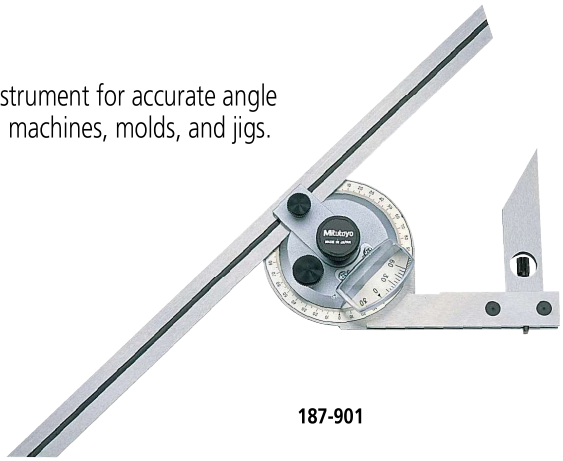
- Presetting

SPECIFICATIONS

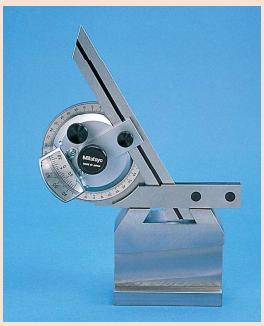
Order No.	Blade length	Range	Resolution	Accuracy	Repeatability	Remarks (standard accessory)
187-501	150 mm	-360 ° to +360 °	1' (0.01 °)	±2' (±0.03 °)	1'	Height gage holder (**950750**)
187-502	300 mm					Height gage holder (**950750**)
187-551	6 in					Height gage holder (**950749**)
187-552	12 in					Height gage holder (**950749**)

Universal Bevel Protractor SERIES 187

- High-precision instrument for accurate angle measurement on machines, molds, and jigs.
- Graduation: 5'



187-901



SPECIFICATIONS

Metric

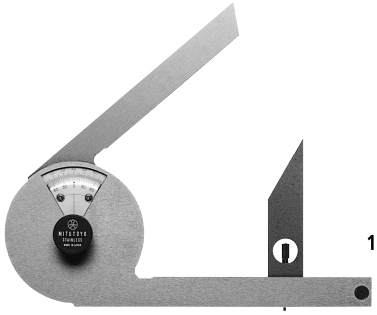
Order No.	Blade length (mm)	Remarks
187-901	150, 300	w/60°, 45°, 30° edges
187-907	150	w/60°, 45° edges
187-908	300	w/60°, 45° edges

Inch

Order No.	Blade length (in)	Remarks
187-902	6, 12	w/60°, 45°, 30° edges
187-904	6	w/60°, 45° edges
187-906	12	w/60°, 45° edges

Bevel Protractor
SERIES 187

- Consists of three sheets of stainless steel, the middle one of which is made for angle measurements.



187-201

SPECIFICATIONS

Order No.	Blade length (mm)	Range	Graduation	Blade edge angle	Mass (g)	Remarks
187-201	137	90°×4 (360°)	5' (0° to 90° to 0°)	30° and 60°	260	w/60°, 30° edges

E

Reference Gages

Length Standards Brought to You by Mitutoyo

An inspection certificate is supplied as standard.
Refer to page U-11 for details.

Black Granite Surface Plates SERIES 517

- Natural granite is free from deterioration or dimensional change over time.
- Black Granite Plate's most distinctive feature is its hardness, twice that of cast iron.
- Free from wringing effects, so there is no interruption of work.
- Since granite is harder, finer grained, and more brittle than cast iron it does not throw up burrs or protrusions if scratched. (See Figure 1.) This ensures a high degree of flatness with no risk of damaging instruments or workpieces.
- Use these plates in a stable temperature environment. Since flatness error occurs when there is a temperature difference between the working surface and the underside, avoid working in direct sunlight. Also, do not place a plate in the vicinity of an air conditioner or heater. (Recommended environment: Temperature 20±1 °C, Humidity 58±2 %)

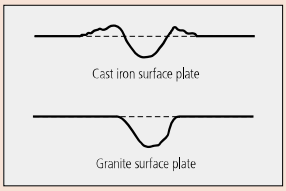


Figure 1

1000×750 mm

600×600 mm

Custom-made Granite Products

Mitutoyo can manufacture granite products to your design (such as main structural components of semiconductor instruments and process machinery). For detailed information, contact the nearest Mitutoyo sales office.

E

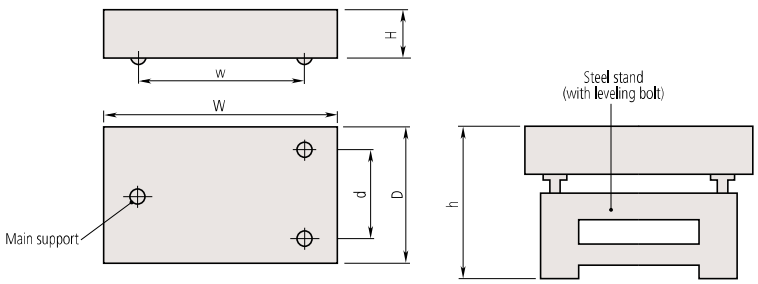
SPECIFICATIONS

Order No.	Size (mm)			Flatness (μm)	Mass (kg)	Optional stands for black granite surface plates			h (mm)
	W×D×H	d	w			Standard type	with safety frame	with casters (with safety frame)	
517-401-4	300×300×100	240	240	2	27	—	—	—	—
517-301				3					
517-101				5					
517-411-4	450×300×100	240	390	2	40	—	—	—	—
517-311				3					
517-111				6					
517-414-4	600×450×100	370	500	2.5	80	**517-203-2**	**517-203R**	**517-203CR**	755 to 775
517-314				4					
517-114				8					
517-403-4	600×600×130	500	500	2.5	140	**517-204-2**	**517-204R**	**517-204CR**	755 to 775
517-303				5					
517-103				8					
517-405-4	750×500×130	420	630	3	146	**517-205-2**	**517-205R**	**517-205CR**	755 to 775
517-305				5					
517-105				9					
517-407-4	1000×750×150	630	700	3	337	**517-206-2**	**517-206R**	**517-206CR**	755 to 775
517-307				6					
517-107				12					
517-409-4	1000×1000×150	700	700	3.5	450	**517-207-2**	**517-207R**	**517-207CR**	735 to 775
517-309				7					
517-109				13					
517-413-4	1500×1000×200	700	1100	4	900	**517-208-4**	**517-208R**	**517-208CR**	735 to 775
517-313-4				8					
517-113-4				16					
517-410-4	2000×1000×250	700	1500	4.5	1500	**517-209-4**	**517-209R**	**517-209CR**	735 to 775
517-310-4				9.5					
517-110-4				19					
517-416-4	2000×1500×300	1100	1500	5	2700	**517-210-4**	**517-210R**	**517-210CR**	735 to 775
517-316-4				10					
517-116-4				20					
517-317-4	2000×2000×350	1500	1500	11	4200	—	—	—	700 to 706*
517-117-4				22					
517-318-4	3000×1500×400	1100	2000	12.5	5400	—	—	—	700 to 706*
517-118-4				25					
517-319-4	3000×2000×500	1500	2000	13.5	9000	—	—	—	700 to 706*
517-119-4				27					

* Distance from the bottom of the large granite plate block mount to the granite plate top surface.

DIMENSIONS

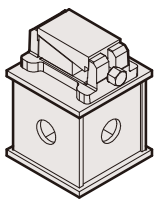
Unit: mm



SPECIFICATIONS: Main and auxiliary supports for large surface plates

Support sets			Applicable surface plates	
Order No.	Main support	Auxiliary support	**Order No.**	Size (W×D×H) (mm)
06AAY174	3 pcs.	2 pcs.	**517-317**	2000×2000×350
			517-117	
06AAY175	3 pcs.	3 pcs.	**517-318**	3000×1500×400
			517-118	
06AAY176			**517-319**	3000×2000×500
			517-119	

Main support (3 required)



Auxiliary support (2 or 3 required)