

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Sheet Metal Micrometers SERIES 389, 118

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Measures thickness of sheet metal.
- IP65 water/dust protection (series 389).
- Measuring faces: Carbide.

- Profile of measuring faces: Flat-Flat, Spherical-Flat and Spherical-Spherical.
- Equipped with Ratchet Stop for constant measuring force.



389-251-30



118-102

SPECIFICATIONS

Metric					
Order No.	Range	Resolution	Accuracy*	Throat depth	Measuring surfaces
Digimatic (LCD)	0 - 25 mm	0.001 mm	±4 μm	150 mm	F-F
389-251-30					S-F
389-261-30					S-S
389-271-30					S-S
389-514	25 - 50 mm	0.001 mm	±5 μm	300 mm*1	F-F
389-252-30					S-F
389-262-30					S-S
389-272-30					S-S

* Excluding quantizing error of ±1 count

Metric					
Order No.	Range	Graduation	Accuracy	Throat depth	Measuring surfaces
Analog					
118-101	0 - 25 mm	0.01 mm	±4 μm	100 mm	F-F
118-102				150 mm	S-F
118-114				150 mm	S-S
118-118				300 mm*1	S-S
118-103	25 - 50 mm	0.01 mm	±5 μm	300 mm*1	F-F
118-110				150 mm	S-F
118-111				150 mm	S-S
118-126				150 mm	S-S

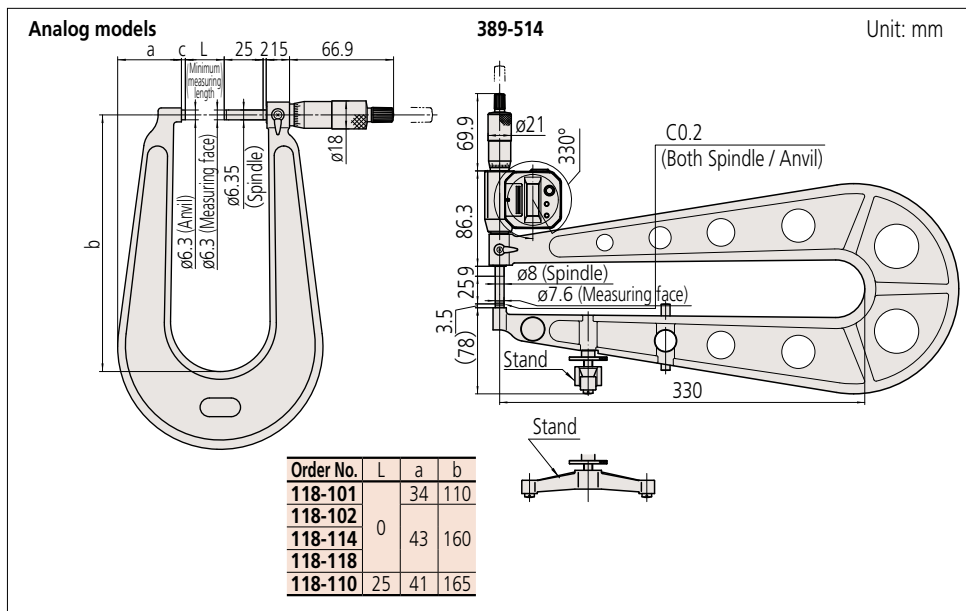
*1 Models with a 300 mm (12 in) throat are equipped with a stand for convenience of measurement in the horizontal orientation as standard.

Inch/Metric					
Order No.	Range	Resolution	Accuracy*	Throat depth	Measuring surfaces
Digimatic (LCD)					
389-351-30	0 - 1 in	0.00005 in/ 0.001 mm	±0.0002 in	6 in	F-F
389-361-30					S-F
389-371-30					S-S
389-714					S-S
389-352-30	1 - 2 in	0.00005 in/ 0.001 mm	±0.0002 in	12 in*1	F-F
389-362-30					S-F
389-372-30					S-S
389-372-30					S-S

* Excluding quantizing error of ±1 count

Inch					
Order No.	Range	Graduation	Accuracy	Throat depth	Measuring surfaces
Analog					
118-129	0 - 1 in	0.0001 in	±0.0002 in	6 in	F-F
118-116					S-F
118-120					S-S
118-107					S-S
118-112	1 - 2 in	0.001 in	±0.00025 in ±0.0002 in	12 in*1 6 in	F-F

DIMENSIONS



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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).



These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.



(Refer to page X for details.)

IP Codes (series 389)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

Flatness: 0.6 μm/0.000024 in for models with 150 mm/6 in throat
1 μm/0.00004 in for models with 300 mm/12 in throat
Parallelism: 3 μm/0.00012 in
Quantizing error (**series 389**): excluding ±1 count

Standard, Flat-Flat (F-F)



Spherical-Flat (S-F)



Spherical-Spherical (S-S)



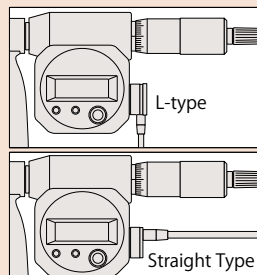
Battery for Series 389

SR44 (1 pc), **938882**, **2 pcs:389-514, 389-714** for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 389-2XX, 3XX)
Approx. 1.8 years under normal use (for series 389-514, 714)

Length standard: Electromagnetic rotary sensor (for series 389)
Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models)
Spanner (200877), 1 pc (for series 118-1XX)
Spanner (301336), 1 pc (for series 389-2XX, 3XX)
Spanner (200154), 1 pc (for series 118-103/107, 389-514/714)

Optional Accessories for Series 389

- Connecting cables for **Series 389** (excluding **389-514** and **389-714**)
1 m: **05CZA662**
2 m: **05CZA663**
 - **USB Input Tool Direct**
USB-ITN-B (2 m): **06AFM380B**
 - SPC cables for **U-WAVE**, series 389 (excluding **389-514** and **389-714**)
Wireless data output **U-WAVE/fit**
U-WAVE-TM 264-622 (IP67 type)
264-623 (Buzzer type)
Connecting unit for U-WAVE-TM
02AZF310 (IP67 type)
- Refer to page A-15 for details
- Connecting cables for **389-514, 389-714**
 - Recommended cables: L-Type (does not interfere with operating the thimble.)
1 m: **04AZB512**
2 m: **04AZB513**
 - Straight type (may interfere with operating the thimble.)
1 m: **959149**
2 m: **959150**



Refer to page B-68 for detailed information about recommended cables.

Sheet Metal Micrometer SERIES 119

- Large diameter dial model enables easy and quick measurement of sheet metal thickness.
- Equipped with Ratchet Stop for constant measuring force.
- Adjustable anvil.
- Measuring faces: Carbide.



Technical Data

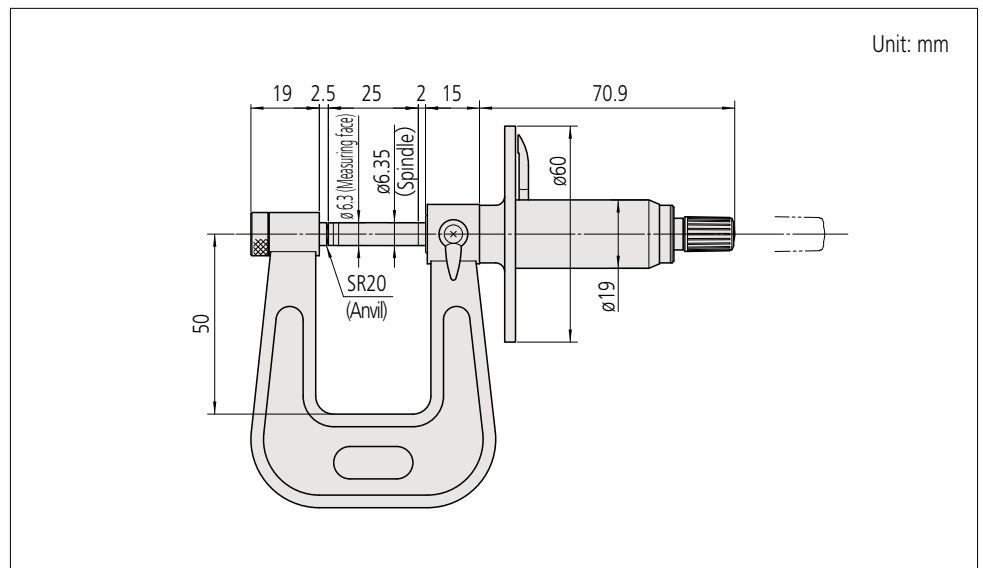
Standard accessories: Spanner (200168), 1 pc



SPECIFICATIONS

Metric				
Order No.	Range	Graduation	Accuracy	Throat depth
119-202	0 - 25 mm	0.01 mm	±4 μm	50 mm

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Tube Micrometers SERIES 395, 115, 295

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- Measuring faces: Carbide.
(**115-101**: only the spindle is carbide tipped.)
- series 395: IP65 digital spherical-flat anvil type micrometer.
- Equipped with Ratchet Stop for constant measuring force.



SPECIFICATIONS

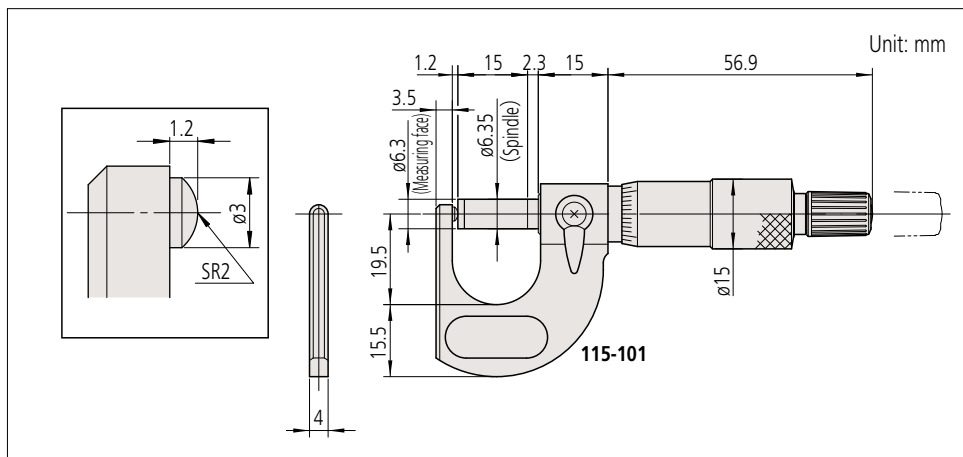
Metric				
Order No.	Range	Resolution	Accuracy*	øD
Digimatic (LCD)				
395-251-30	0 - 25 mm	0.001 mm	±2 μm	ø15
395-252-30	25 - 50 mm			
395-253-30	50 - 75 mm			ø19
395-254-30	75 - 100 mm			
			±3 μm	ø20

* Excluding quantizing error of ±1 count

Metric				
Order No.	Range	Graduation	Accuracy	øD
Analog				
115-101	0 - 15 mm	0.01 mm	±3 μm	ø5.5
115-115	0 - 25 mm			ø10
115-116	25 - 50 mm			ø11
115-117	50 - 75 mm			ø17
115-118	75 - 100 mm			ø18
Mechanical counter model				
295-115	0 - 25 mm		±3 μm	ø10

Note: For the function of **series 395**, refer to page B-8.
Also, other than the waterproof type only the connection cable (option) cannot be used.

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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).

IP 65

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(Refer to page X for details.)

IP Codes (Series 395)

Level 6: Dust-proof.

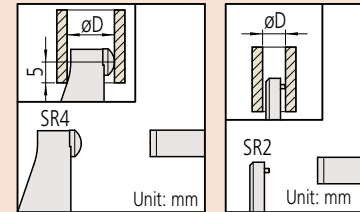
No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

Flatness: 0.6 μm / 0.000024 in (**series 115 & 295**)
0.3 μm / 0.000012 in (**series 395**)



Other than **115-101**

115-101

Battery for Series 395

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Battery life: Approx. 2.4 years under normal use (for series 395)

Length standard: Electromagnetic rotary sensor (for series 395)

Standard accessories: Reference bar, 1 pc

(except for measuring range 0-15 mm / 0-25 mm (0-1 in) models)

Spanner (200168), 1 pc (for series 115-101)

Spanner (301336), 1 pc (for models other than series 115-101)

Optional Accessories

Connecting cables for **series 395**

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE^{fit}**

U-WAVE-TM **264-622** (IP67 type)

264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

Refer to page A-15 for details

Micrometer

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Tube Micrometers SERIES 395, 115, 295 — Spherical and Cylindrical Anvil Type

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- Spindle face: Carbide.
- series 395: IP65 spherical and cylindrical anvil type digital micrometers.
- Equipped with Ratchet Stop for constant measuring force.



395-261-30



SPECIFICATIONS

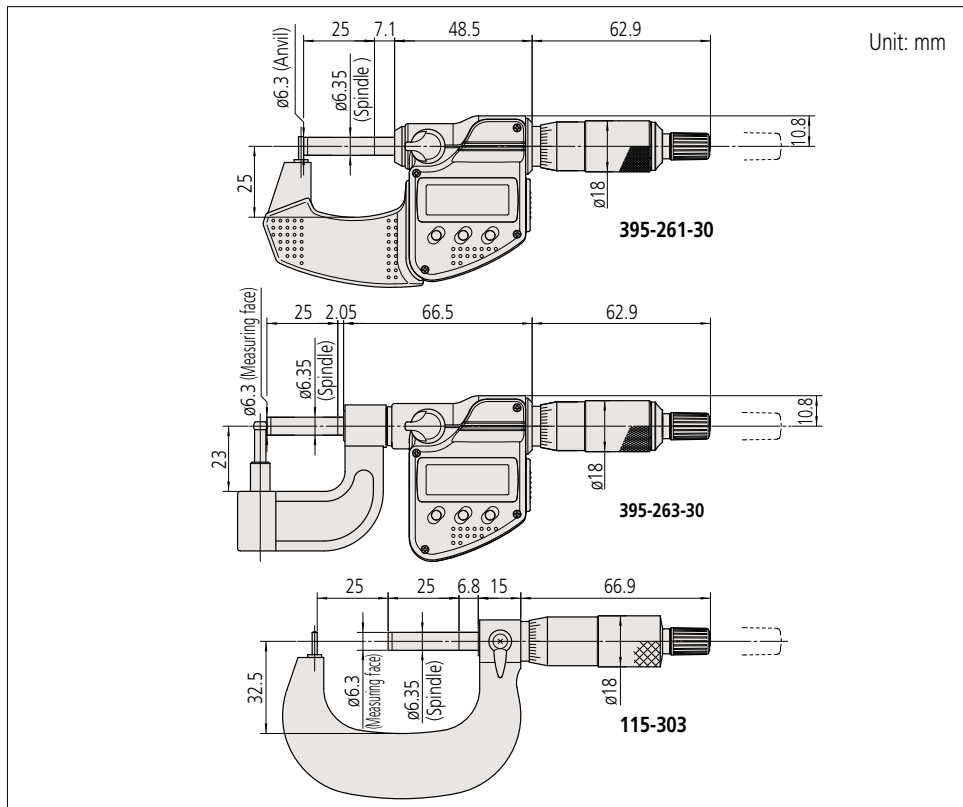
Metric				
Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
395-261-30	0 - 25 mm	0.001 mm	±3 μm	Type A
395-262-30				Type B
395-263-30				Type C
395-264-30				Type D

* Excluding quantizing error of ±1 count

Metric				
Order No.	Range	Graduation	Accuracy	Remarks
Analog				
115-302	0 - 25 mm	0.01 mm	±3 μm	Type A
115-308				Type B
115-303	25 - 50 mm			Type A
115-309	Type B			
115-315	0 - 25 mm	Type C		
115-316		Type D		

Note: For the function of series 395, refer to page B-8.
Also, other than the waterproof type only the connection cable (option) cannot be used.

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(Refer to page X for details.)

IP Codes (series 395)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

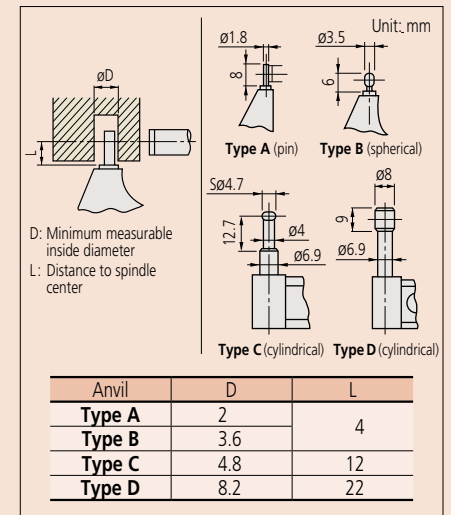
Type A (pin)

Type B (spherical)



Type C (cylindrical)

Type D (cylindrical)



Battery for Series 395

SR44 (1 pc, 938882, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 395)
Length standard: Electromagnetic rotary sensor (for series 395)
Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models)
Spanner (301336), 1 pc

Optional Accessories

Connecting cables for series 395
1 m: 05CZA662
2 m: 05CZA663
USB Input Tool Direct
USB-ITN-B (2 m): 06AFM380B
Wireless data output U-WAVE fit
U-WAVE-TM 264-622 (IP67 type)
264-623 (Buzzer type)
Connecting unit for U-WAVE-TM
02AZF310 (IP67 type)
Refer to page A-15 for details



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(Refer to page X for details.)

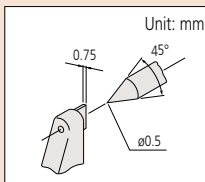
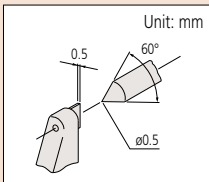
IP Codes (series 342-271-30, 342-371-30, 342-451-20)

Level 6: Dust-proof.

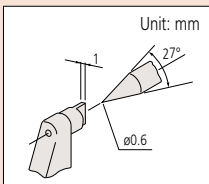
No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.



342-271-30, 342-371-30, 112-401 342-451-20



142-402, 142-403

Battery for Series 342

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Battery life: Approx. 2.4 years under normal use (for series 342-271-30/342-371-30)

Approx. 5 years under normal use

Approx. 18,000 hours in continuous use (for series 342-451-20)

Length standard: Electromagnetic rotary sensor (for series 342-271-30/342-371-30)

Electrostatic capacity absolute sensor (for series 342-451-20)

Standard accessories:

Spanner (301336), 1 pc (except for series 342-451)

Optional Accessories

Connecting cables (digital model)

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE** *fit*

U-WAVE-TM **264-622** (IP67 type)

264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

Note: cannot be used with 342-451-20

Refer to page A-15 for details

Crimp Height Micrometers Series 342,112,142

- Measures the height of crimp contacts.
- Equipped with Ratchet Stop for constant measuring force.
- IP65 water/dust protection (digital model).

- Model **342-451-20** is the Quickmike type which provides a speedy spindle feed of 10 mm per thimble rotation, which enables widely differently sized features to be measured quickly.



Digimatic (LCD)
342-271-30



Quickmike type (LCD)
342-451-20



ABSOLUTE™



112-401

SPECIFICATIONS

Metric			
Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
342-271-30	0 - 20 mm	0.001 mm	±3 μm
Quickmike (LCD)			
342-451-20	0 - 15 mm	0.001 mm	±3 μm

* Excluding quantizing error of ±1 count

Metric			
Order No.	Range	Graduation	Accuracy
Mechanical counter model			
142-402	0 - 25 mm	0.01 mm	±3 μm
142-403	0 - 25 mm	0.001 mm	

Metric			
Order No.	Range	Graduation	Accuracy
Analog			
112-401	0 - 25 mm	0.01 mm	±3 μm

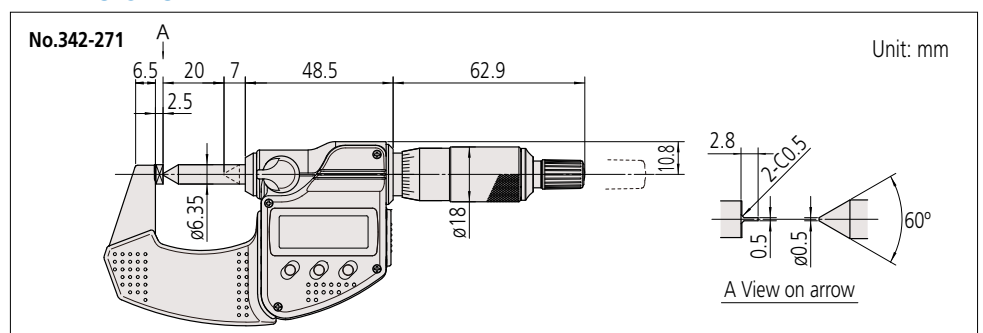
Inch/Metric			
Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
342-371-30	0 - 0.8 in	0.00005 in/ 0.001 mm	±0.00015 in

* Excluding quantizing error of ±1 count

Note: For the **series 342** functions, refer to page B-8.

Also, other than the waterproof type only the connection cable (option) cannot be used.

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Spline Micrometers SERIES 331, 111, 131

- The anvil and spindle are of small diameter for measuring splined shafts, slots and keyways.
- IP65 water/dust protection (series 331).
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.

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331-251-30



111-115

SPECIFICATIONS

Metric				
Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
331-251-30	0 - 25 mm	0.001 mm	±2 μm	Type A
331-252-30	25 - 50 mm			
331-253-30	50 - 75 mm			
331-254-30	75 - 100 mm		±3 μm	Type B
331-261-30	0 - 25 mm			
331-262-30	25 - 50 mm			
331-263-30	50 - 75 mm	±2 μm	Type B	
331-264-30	75 - 100 mm	±3 μm		

* Excluding quantizing error of ±1 count

Inch/Metric				
Order No.	Range	Resolution	Accuracy*	Remarks
Digimatic (LCD)				
331-351-30	0 - 1 in	0.00005 in/ 0.001 mm	±0.0001 in	Type A
331-352-30	1 - 2 in			
331-353-30	2 - 3 in			
331-354-30	3 - 4 in		±0.00015 in	Type B
331-361-30	0 - 1 in			
331-362-30	1 - 2 in			
331-363-30	2 - 3 in	±0.0001 in	Type B	
331-364-30	3 - 4 in	±0.00015 in		

* Excluding quantizing error of ±1 count

Metric				
Order No.	Range	Graduation	Accuracy	Remarks
Analog				
111-215	0 - 25 mm	0.01 mm	±3 μm	Type B
111-115	0 - 25 mm			
111-116	25 - 50 mm			
111-117	50 - 75 mm			
111-118	75 - 100 mm			
111-119	100 - 125 mm			
111-120	125 - 150 mm		±4 μm	Type A
111-121	150 - 175 mm			
111-122	175 - 200 mm			
111-123	200 - 225 mm			
111-124	225 - 250 mm			
111-125	250 - 275 mm			
111-126	270 - 300 mm	±5 μm	Type A	
111-126	270 - 300 mm	±6 μm		
Mechanical counter model				
131-115	0 - 25 mm		±3 μm	Type A

Note: For the function of series 331, refer to page B-8.

Also, other than the waterproof type only the connection cable (option) cannot be used.

IP Codes (series 331)

Level 6: Dust-proof.

No ingress of dust allowed.

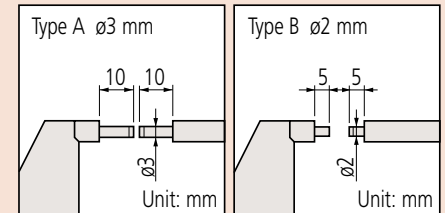
Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

Flatness: 0.3 μm / 0.000012 in

Parallelism: (2+R/100) μm, R = max. range (mm)
[0.00008 in + 0.00004(R/4)] in R = max range (inch)
fraction rounded down



Battery for Series 331

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Battery life: Approx. 2.4 years under normal use (for series 331)

Length standard: Electromagnetic rotary sensor (for series 331)

Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models)
Spanner (301336), 1 pc

Optional Accessories

Connecting cables for **series 331**

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE^{fit}**

U-WAVE-TM **264-622** (IP67 type)

264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

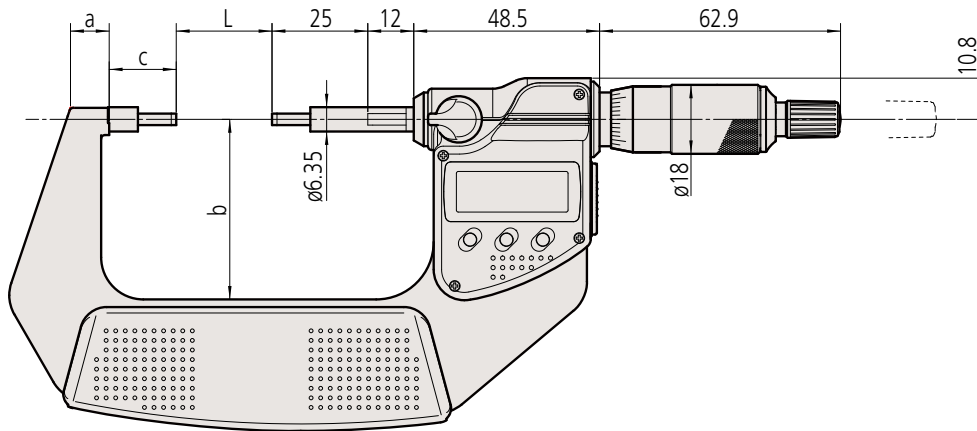
Refer to page A-15 for details

DIMENSIONS

Unit: mm

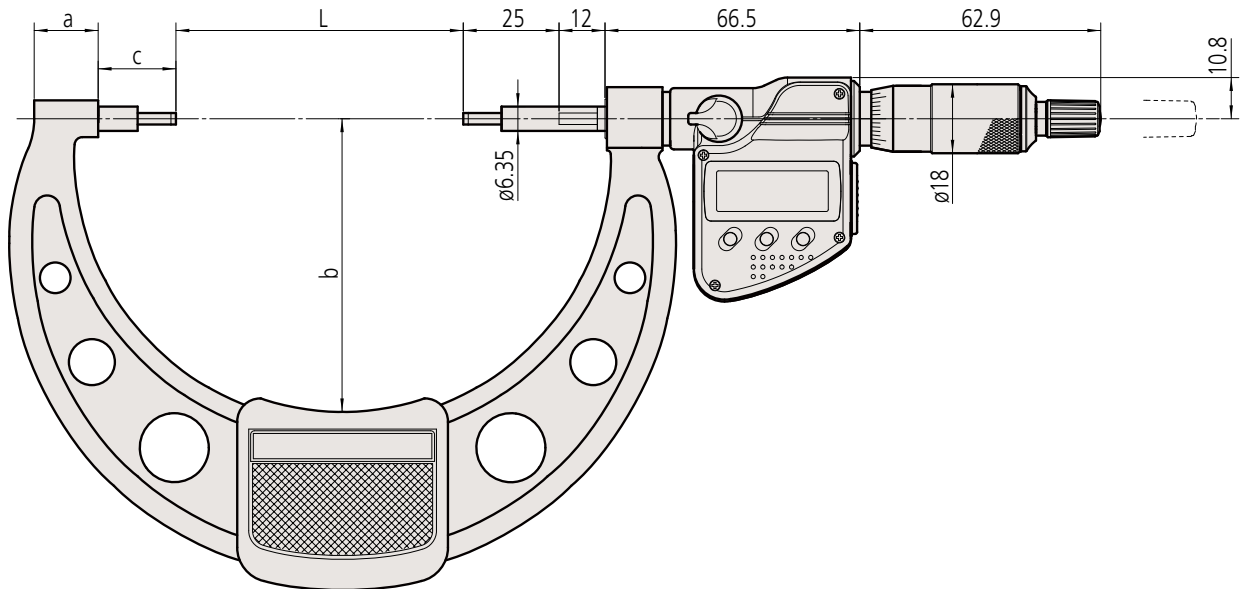
Digital Models

Models up to 75 mm measuring range



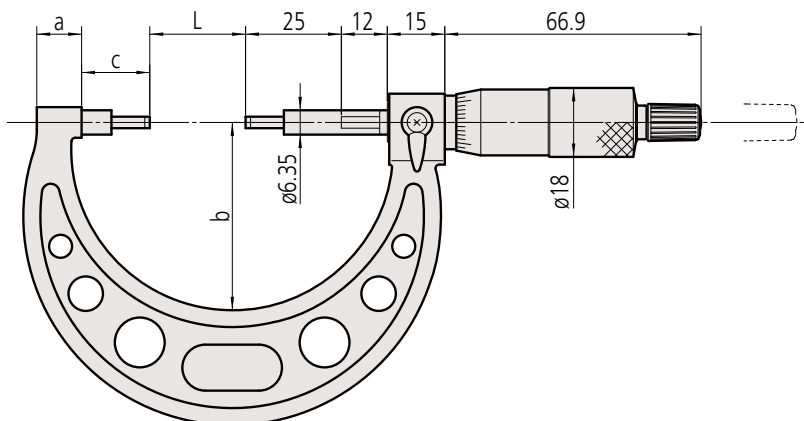
Digital Models

Models over 75 mm measuring range



Analog Models

Models up to 300 mm measuring range



Order No.	L	a	b	c
331-251-30	0	7.3	32.5	17.5
331-261-30				
331-252-30	25	10.1	47	
331-262-30				
331-253-30	50	11.5	60	20.3
331-263-30				
331-254-30	75	16.7	76	
331-264-30				
111-215	0	10	38	17.5
111-115				
111-116	25	12	49	
111-117	50	14	60	
111-118	75	16.7	79	20.3
111-119	100	18.8	94	20.7
111-120	125	19.1	106	21.1
111-121	150	18.2	118	21.3
111-122	175	16.8	130	21.7
111-123	200	18	143	20.5
111-124	225		156	21.5
111-125	250		169	
111-126	275		181	

Micrometer

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Point Micrometers SERIES 342, 142, 112

- Pointed spindle and anvil for measuring the web thickness of drills, small grooves, keyways and other hard-to-reach features.
- The measuring points (carbide tipped) have approximately 0.3 mm radius.
- Series 342: IP65 Digimatic micrometers.
- Equipped with Ratchet Stop for constant measuring force.

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(Refer to page X for details.)



342-251-30



112-201

SPECIFICATIONS

Metric				
Order No.	Range	Resolution	Accuracy*	Point
Digimatic (LCD) (With carbide tip)				
342-251-30	0 - 25 mm	0.001 mm	±2 μm	15°
342-252-30	25 - 50 mm			
342-253-30	50 - 75 mm			
342-254-30	75 - 100 mm			
342-261-30	0 - 25 mm	0.001 mm	±3 μm	30°
342-262-30	25 - 50 mm			
342-263-30	50 - 75 mm			
342-264-30	75 - 100 mm			

* Excluding quantizing error of ±1 count

Metric				
Order No.	Range	Graduation	Accuracy	Point
Analog				
112-153	0 - 25 mm	0.01 mm	±3 μm	15°
112-154	25 - 50 mm			
112-155	50 - 75 mm			
112-156	75 - 100 mm			
112-201	0 - 25 mm	0.01 mm	±4 μm	30°
112-202	25 - 50 mm			
112-203	50 - 75 mm			
112-204	75 - 100 mm			
Analog (With carbide tip)				
112-165	0 - 25 mm	0.01 mm	±3 μm	15°
112-166	25 - 50 mm			
112-167	50 - 75 mm			
112-168	75 - 100 mm			
112-213	0 - 25 mm	0.01 mm	±4 μm	30°
112-214	25 - 50 mm			
112-215	50 - 75 mm			
112-216	75 - 100 mm			
Mechanical counter model				
142-153	0 - 25 mm		±3 μm	15°
142-201				30°

Inch/Metric				
Order No.	Range	Resolution	Accuracy*	Point
Digimatic (LCD) (With carbide tip)				
342-351-30	0 - 1 in	0.00005 in/ 0.001 mm	±0.0001 in	15°
342-352-30	1 - 2 in			
342-353-30	2 - 3 in			
342-354-30	3 - 4 in			
342-361-30	0 - 1 in	0.00005 in/ 0.001 mm	±0.00015 in	30°
342-362-30	1 - 2 in			
342-363-30	2 - 3 in			
342-364-30	3 - 4 in			

* Excluding quantizing error of ±1 count

Inch				
Order No.	Range	Graduation	Accuracy	Point
Analog				
112-177	0 - 1 in	0.001 in	±0.00015 in	15°
112-178	1 - 2 in			
112-225	0 - 1 in			
112-226	1 - 2 in			
Analog (With carbide tip)				
112-189	0 - 1 in	0.001 in	±0.00015 in	15°
112-190	1 - 2 in			
112-191	2 - 3 in			
112-237	0 - 1 in			
112-238	1 - 2 in	0.001 in	±0.00015 in	30°
112-237	0 - 1 in			
Mechanical counter model				
142-177	0 - 1 in		±0.00015 in	15°
142-225				30°

IP Codes (series 342)

Level 6: Dust-proof.

No ingress of dust allowed.

Level 5: Protected against water jets.

Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data



Tip angle: 15°



Tip angle: 30°



Battery for Series 342

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Battery life: Approx. 2.4 years under normal use (for series 342)

Length standard: Electromagnetic rotary sensor (for series 342)

Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models) Spanner (301336), 1 pc

Optional Accessories

Connecting cables for **series 342**

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE**

U-WAVE-TM 264-622 (IP67 type)

264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

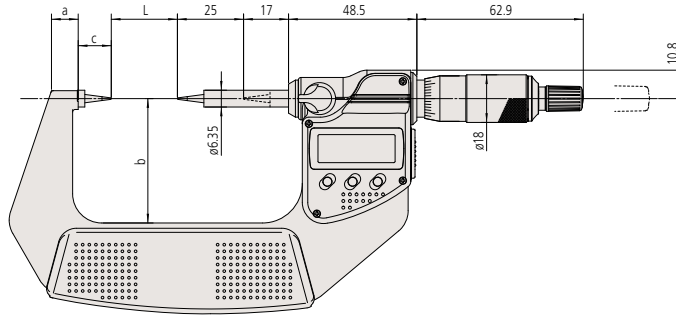
02AZF310 (IP67 type)

Refer to page A-15 for details

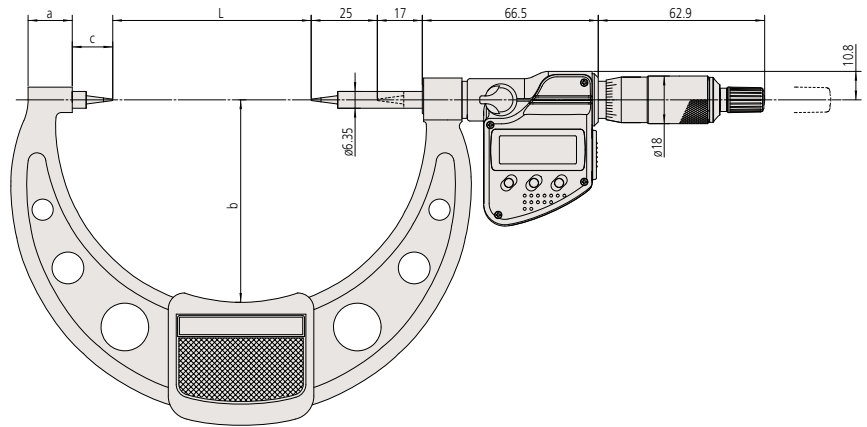
DIMENSIONS

Unit: mm

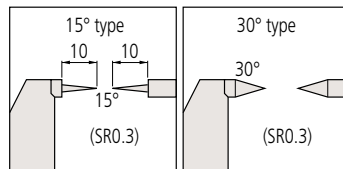
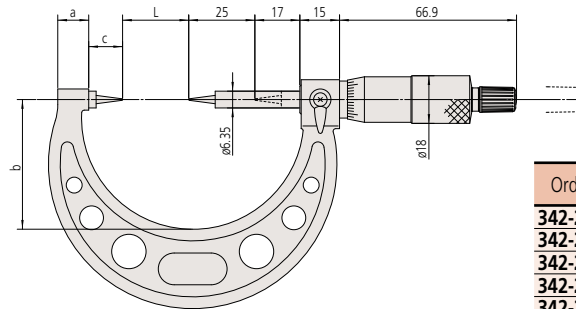
Digital models up to 75 mm measuring range



Digital models over 75 mm measuring range



Analog models measuring range



Order No.	L	a	b	c	Frame thickness*1
342-251-30	0	7.3	32.5		(11.2)
342-261-30					(12.8)
342-252-30	25	10.1	47	12.5	(12.8)
342-262-30					(12.8)
342-253-30	50	11.5	60		(20.8)
342-263-30					(20.8)
342-254-30	75	16.7	76	15.3	(9)
342-264-30					(10)
112-153	0	10	38		(11)
112-154	25	12	49	12.5	(11)
112-155	50	14	60		(13)
112-156	75	16.7	79	15.3	

*1 Digimatic type: thickness over heat shield

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

V-Anvil Micrometers SERIES 314, 114 — 3 Flutes and 5 Flutes

MeasurLink® ENABLED
Data Management Software by Mitutoyo

- Measures the outside diameter of cutting tools (such as taps, reamers, end mills) which have three or five flutes.
- Measures pitch diameter: refer to "Quick Guide to Precision Measuring Instruments" on page B-72.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



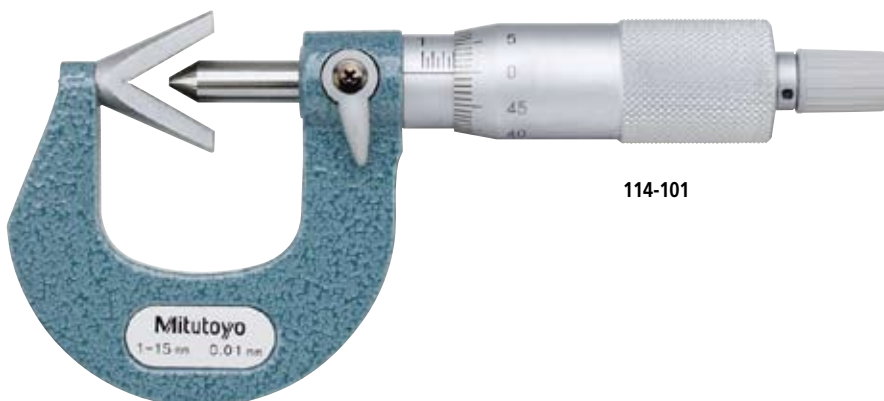
314-251-30



114-121



114-102



114-101

MeasurLink® ENABLED
Data Management Software by Mitutoyo

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

Flatness: (Series 114) 0.6 μ m / 0.000024 in (Spindle)
1.3 μ m / 0.000052 in (Anvil)
(Series 314) 0.3 μ m / 0.000012 in (Spindle)
1.0 μ m / 0.00004 in (Anvil)

Battery for Series 314

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 314)
Length standard: Electromagnetic rotary sensor (for series 314)
Standard accessories:
Reference bar, 1 pc
Spanner (301336), 1 pc
(Maximum measuring range up to 55 mm/2.2 in 114-114)*¹
(Maximum measuring range up to 45 mm/1 in)*²
Spanner (200877), 1 pc
(for maximum measuring range 70 mm or over)*¹
(for maximum measuring range 65 mm or over)*²
*¹ For analog type with 3-flute cutting tools.
*² For analog type with 5-flute cutting tools.

Optional Accessories

Connecting cables for **series 314**

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE™**

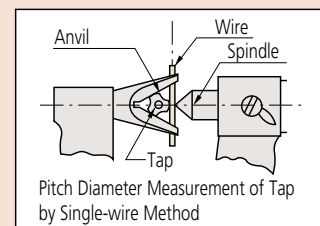
U-WAVE-TM 264-622 (IP67 type)

264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

Refer to page A-15 for details



SPECIFICATIONS

Metric For 3-flute cutting tools					
Order No.	Range	Resolution	Accuracy*	Remarks	Anvil
Digimatic (LCD)					
314-251-30	1 - 15 mm	0.001 mm	±4 μm	w/groove	60°
314-252-30	10 - 25 mm				
314-253-30	25 - 40 mm				
314-261-30	1 - 15 mm				
314-262-30	10 - 25 mm				

*Excluding quantizing error of ±1 count

Metric For 3-flute cutting tools									
Order No.	Range	Graduation	Accuracy	Remarks	Anvil				
Analog Anvil, Spindle (With carbide tip)									
114-204	2.3 - 25 mm	0.01 mm	±4 μm	w/groove	60°				
Analog Spindle (With carbide tip)									
114-101	1 - 15 mm								
114-102	10 - 25 mm								
114-103	25 - 40 mm								
114-104	40 - 55 mm								
114-105	55 - 70 mm								
114-106	70 - 85 mm								
114-161	1 - 15 mm								
114-162	10 - 25 mm								

Metric For 5-flute cutting tools									
Order No.	Range	Graduation	Accuracy	Remarks	Anvil				
Analog Anvil, Spindle (With carbide tip)									
114-137	2.3 - 25 mm	0.01 mm	±4 μm	w/groove	108°				
Analog Spindle (With carbide tip)									
114-121	5 - 25 mm								
114-122	25 - 45 mm								
114-123	45 - 65 mm								
114-124	65 - 85 mm								
114-165	5 - 25 mm								

Inch/Metric For 3-flute cutting tools					
Order No.	Range	Resolution	Accuracy*	Remarks	Anvil
Digimatic (LCD)					
314-351-30	0.05 - .6 in	0.00005 in/ 0.001 mm	±0.0002 in	w/groove	60°
314-352-30	0.4 - 1 in				
314-353-30	1 - 1.6 in				
314-361-30	0.05 - .6 in				
314-362-30	0.4 - 1 in				

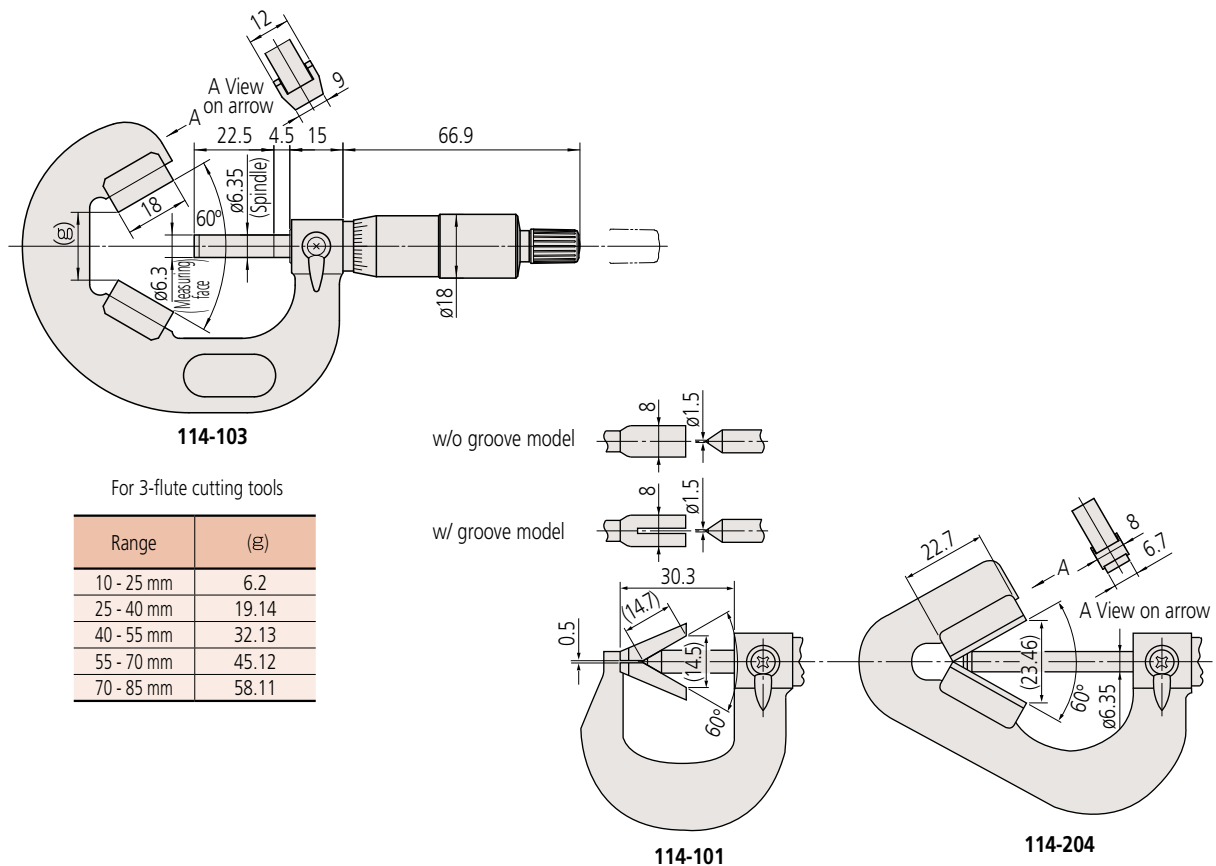
*Excluding quantizing error of ±1 count

Inch For 3-flute cutting tools					
Order No.	Range	Graduation	Accuracy	Remarks	Anvil
Analog Anvil, Spindle (With carbide tip)					
114-202	0.09 - 1 in	0.0001 in	±0.0002 in	—	—
Analog Spindle (With carbide tip)					
114-163	0.05 - 0.6 in	0.0001 in	±0.0002 in	—	60°
114-113	1 - 1.6 in				
114-114	1.6 - 2.2 in				

Inch For 5-flute cutting tools					
Order No.	Range	Graduation	Accuracy	Remarks	Anvil
Analog Anvil, Spindle (With carbide tip)					
114-135	0.09 - 1 in	0.0001 in	±0.0002 in	—	108°

DIMENSIONS

Unit: mm



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Blade Micrometers SERIES 422, 122 — Non-Rotating Spindle Type

- The anvil and spindle are blade-shaped for measuring the groove diameter of shafts, keyways, and other hard-to-reach features.
- Carbide-tipped measuring faces are available.
- Non-rotating spindle type.
- Equipped with Ratchet Stop for constant measuring force.

MeasurLink ENABLED
Data Management Software by Mitutoyo



SPECIFICATIONS

Metric					
Order No.	Range	Resolution	Accuracy*	Remark	
Digimatic (LCD)					
422-230-30	0 - 25 mm	0.001 mm	±3 μm	Type A	
422-231-30	25 - 50 mm				
422-232-30	50 - 75 mm				
422-233-30	75 - 100 mm				
422-260-30	0 - 25 mm		±4 μm		
422-261-30	25 - 50 mm				
422-270-30	0 - 25 mm	±3 μm	Type B	Type C	Type D
422-271-30					

* Excluding quantizing error of ±1 count

Metric Quickmike type					
Order No.	Range	Resolution	Accuracy*	Remark	
Digimatic (LCD)					
422-411-20	0 - 30 mm	0.001 mm	±3 μm	Type A	
422-412-20	25 - 55 mm				

* Excluding quantizing error of ±1 count

Metric					
Order No.	Range	Graduation	Accuracy	Remark	
Analog					
122-101	0 - 25 mm	0.01 mm	±3 μm	Type A	
122-102	25 - 50 mm				
122-103	50 - 75 mm				
122-104	75 - 100 mm		±4 μm		
122-105	100 - 125 mm				
122-106	125 - 150 mm		±5 μm		
122-107	150 - 175 mm				
122-108	175 - 200 mm		±6 μm		
122-109	200 - 225 mm				
122-110	225 - 250 mm		±3 μm		
122-111	250 - 275 mm				
122-112	275 - 300 mm	Type B			
122-111	0 - 25 mm				
122-112	25 - 50 mm				
122-112	25 - 50 mm				
Analog (With carbide tip)					
122-161	0 - 25 mm	0.01 mm	±3 μm	Type C	
122-162	25 - 50 mm				
122-141	0 - 25 mm				
122-142	25 - 50 mm				

Notes: 1) A heat shield is provided with Digimatic models and 122-101, 122-161, 122-141 as standard.

Inch/Metric					
Order No.	Range	Resolution	Accuracy*	Remark	
Digimatic (LCD)					
422-330-30	0-1 in	0.0005 in/ 0.001 mm	±0.00015 in	Type A	
422-331-30	1-2 in				
422-332-30	2-3 in				
422-333-30	3-4 in				
422-360-30	0-1 in		±0.0002 in		
422-361-30	1-2 in				
422-370-30	0-1 in	±0.00015 in	Type B	Type C	Type D
422-371-30					

* Excluding quantizing error of ±1 count

Inch/Metric Quickmike type					
Order No.	Range	Resolution	Accuracy*	Remark	
Digimatic (LCD)					
422-421-20	0-1.2 in	0.00005 in/ 0.001 mm	±0.00015 in	Type A	

* Excluding quantizing error of ±1 count

Inch					
Order No.	Range	Graduation	Accuracy	Remark	
Analog					
122-125	0 - 1 in	0.0001 in	±0.00015 in	Type A	
122-126	1 - 2 in				
122-127	2 - 3 in				
122-128	3 - 4 in		±0.0002 in		
122-135	0 - 1 in				
122-151			±0.00015 in		

Notes: 1) A heat shield is provided with Digimatic models and 122-125, 122-135, 122-151 as standard.

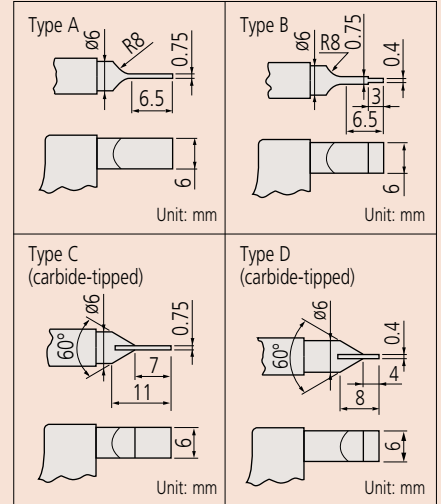
MeasurLink ENABLED
Data Management Software by Mitutoyo

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

Parallelism
3 μm for models up to 75 mm
0.00015 in for models up to 3 in
(3+R/100) μm for models over 75 mm
0.0002 in for models over 3 in
R = max. range (mm)
fraction rounded up

Type and Dimensions



Battery for Series 422

SR44 (1 pc, **938882**, for initial operational checks (standard accessory)
Battery life: Approx. 2.4 years under normal use (for series 422-2XX, 3XX)
Approx. 5 year under normal use (for series 422-4XX)
Approx. 18,000 hours in continuous use

Length standard: Electromagnetic rotary sensor (for series 422-2XX, 3XX)

Electrostatic capacity absolute sensor (for series 422-4XX)

Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm / 0-30 mm (0-1 in/0-1.2 in) models)

Spanner (301336), 1 pc (for series 122-1XX, 422-2XX, 3XX)

Optional Accessories

Connecting cables for digital models

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Connecting for **422-230-30** to **422-371-30**

422-271-30, 422-330-30 to **422-371-30**

Wireless data output **U-WAVE** fit

U-WAVE-TM 264-622 IP67 type

264-623 Buzzer type

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

Note: cannot be used with Quickmike type

Refer to page A-15 for details

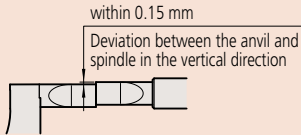


DIMENSIONS

Quickmike

Provides a speedy spindle feed of 10mm per thimble rotation which enables widely differently sized features to be measured quickly.

Deviation Between the Anvil and Spindle in the Vertical Direction

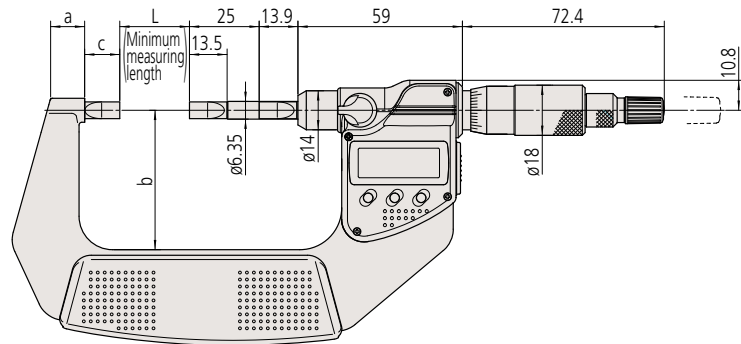


Deviation of 0.15 mm or less* is guaranteed between the anvil and spindle in the vertical direction.

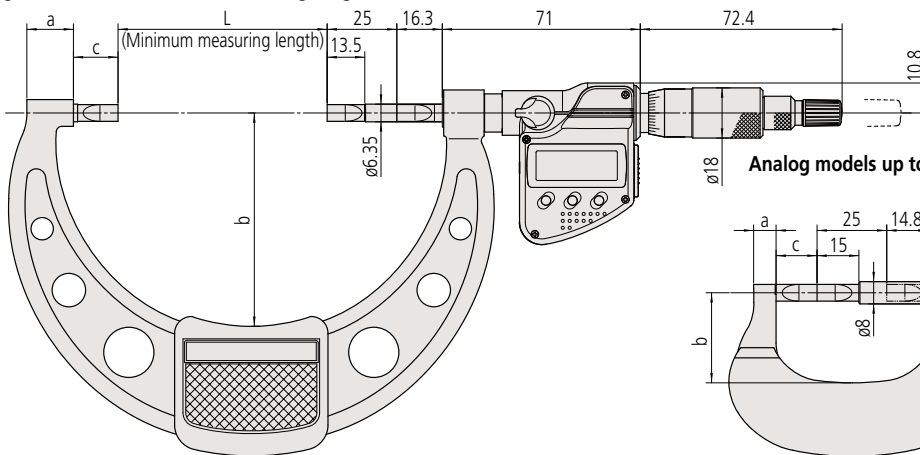
* When the measuring range is 0 - 25 mm

Digital models up to 50 mm measuring range

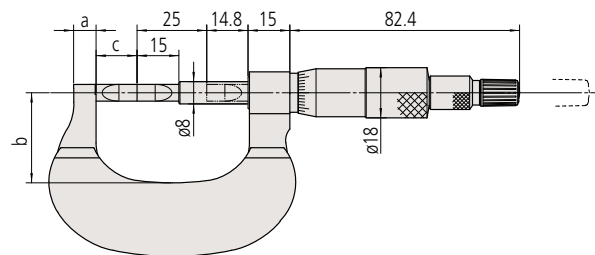
Unit: mm



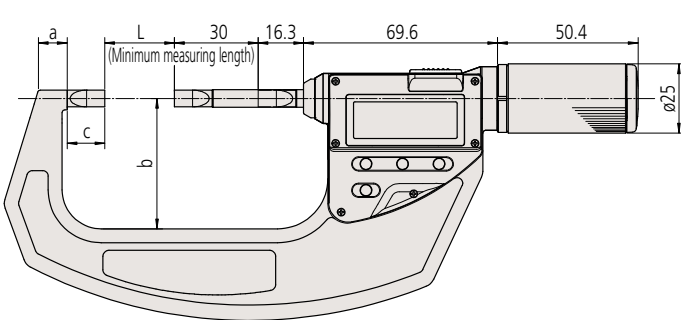
Digital models over 75 mm measuring range



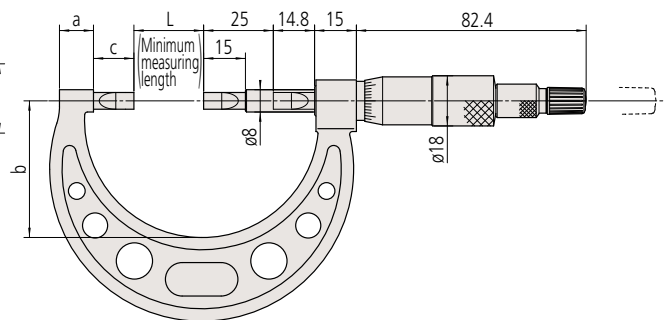
Analog models up to 25 mm measuring range



Quickmike type



Analog models over 50 mm measuring range



Order No.	L	a	b	C
422-230-30	0	11	31	12.5
422-231-30	25	12.2	50	12.6
422-232-30	50	14.6	57	13
422-233-30	75	16.7	76	16
422-260-30	0	11	31	12.5
422-261-30	25	12.2	50	12.6
422-270-30	0	11	31	12.5
422-271-30				
122-101	25	7.8	32	15
122-102		12.2	49	14.5
122-103		14.6	60	
122-104		16.7	79	
122-105	100	18.8	94	17.9
122-106	125	19.1	106	18.3
122-107	150	18.2	118	18.5
122-108	175	16.8	130	18.9
122-109	200	18	143	17.7
122-110	225		156	18.7
122-115	250		169	
112-116	275		181	
422-411	0	8.5	36	13.5
422-412	25	10.3	47	

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Can Seam Micrometers SERIES 147

- Measures the width, height, and depth of can seams.



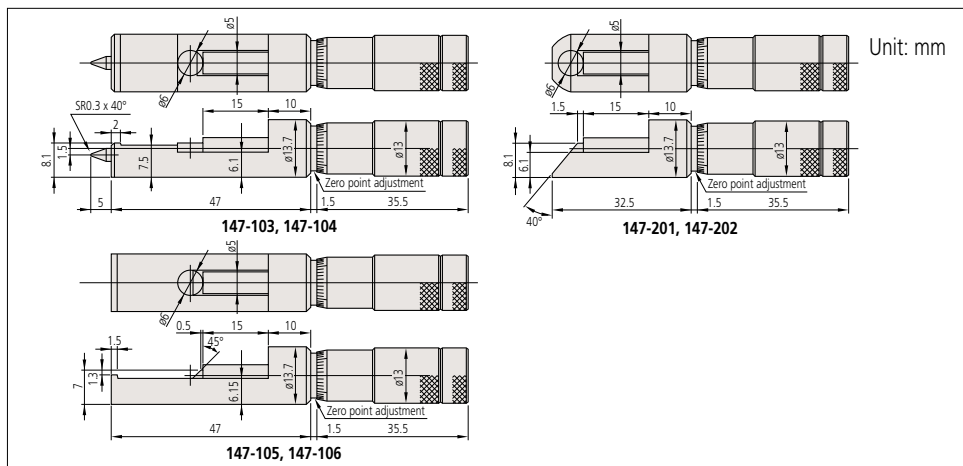
147-103

SPECIFICATIONS

Metric				
Order No.	Range	Graduation	Accuracy	Remarks
147-103	0 - 13 mm	0.01 mm	±3 μm	for steel cans
147-105				for aluminum cans
147-202				for spray cans

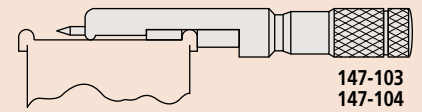
Inch				
Order No.	Range	Graduation	Accuracy	Remarks
147-104	0 - 0.5 in	0.001 in	±0.00015 in	for steel cans
147-106				for aluminum cans
147-201				for spray cans

DIMENSIONS

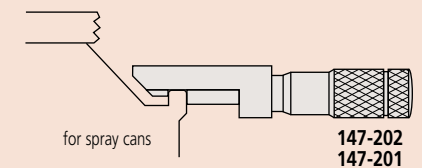
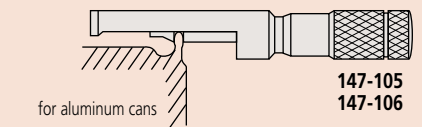


Technical Data

Standard accessories: Spanner (200168), 1 pc
Spanner (202863), 1 pc



for steel cans
(for depth measurements up to 5 mm)



Hub Micrometers SERIES 147

- Measures hub thickness and shoulders inside a bore.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



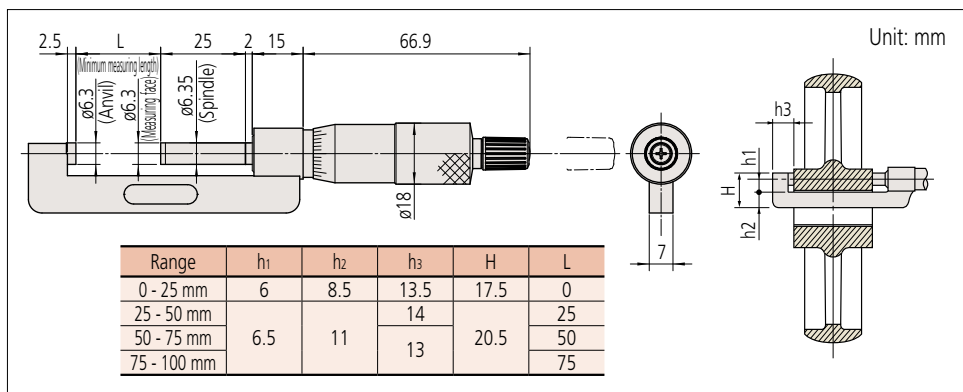
147-301

SPECIFICATIONS

Metric			
Order No.	Range	Graduation	Accuracy
147-301	0 - 25 mm	0.01 mm	±2 μm
147-302	25 - 50 mm		
147-303	50 - 75 mm		
147-304	75 - 100 mm		

Inch			
Order No.	Range	Graduation	Accuracy
147-351	0 - 1 in	0.001 in	±0.0001 in
147-352	1 - 2 in		
147-353	2 - 3 in		
147-354	3 - 4 in		

DIMENSIONS



Technical Data

Flatness: 0.6 μm/0.000024 in
Parallelism: 3 μm / 0.00012 in
Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25 mm (0-1 in) models)
Spanner (301336), 1 pc



Technical Data

Flatness: 0.6 μm /0.000024 in
 Parallelism: 1.3 μm /0.00005 in



Standard accessories: Spanner (200168), 1 pc

Wire Micrometers Series 147

- Designed for measuring wire thickness.
- Measurable wire dia.: 10 mm or less.
- Measuring faces: Carbide.
- Equipped with Ratchet Stop for constant measuring force.



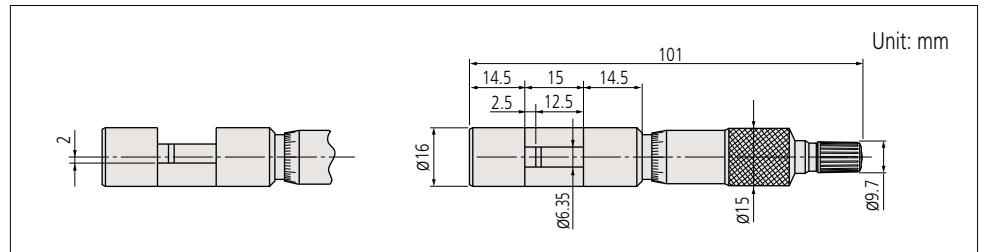
147-401

SPECIFICATIONS

Metric			
Order No.	Range	Graduation	Accuracy
147-401	0 - 10 mm	0.01 mm	$\pm 3 \mu\text{m}$

Inch			
Order No.	Range	Graduation	Accuracy
147-402	0 - 0.4 in	0.0001 in	± 0.00015 in

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

"Uni-Mike" Series 317, 117 — Interchangeable Anvil Type

MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

- Measures tubing thickness, shoulder-edge distance, rivet head height, etc., with interchangeable anvils (flat anvil, rod anvil, V-anvil).
- IP65 water/dust protection (series 317).
- Equipped with Ratchet Stop for constant measuring force.



317-251-30



117-101

SPECIFICATIONS

Metric			
Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
317-251-30	0 - 25 mm	0.001 mm	±4 μm
317-252-30	25 - 50 mm		

* Excluding quantizing error of ±1 count

Metric			
Order No.	Range	Graduation	Accuracy
Analog			
117-101	0 - 25 mm	0.01 mm	±4 μm
117-102	25 - 50 mm		

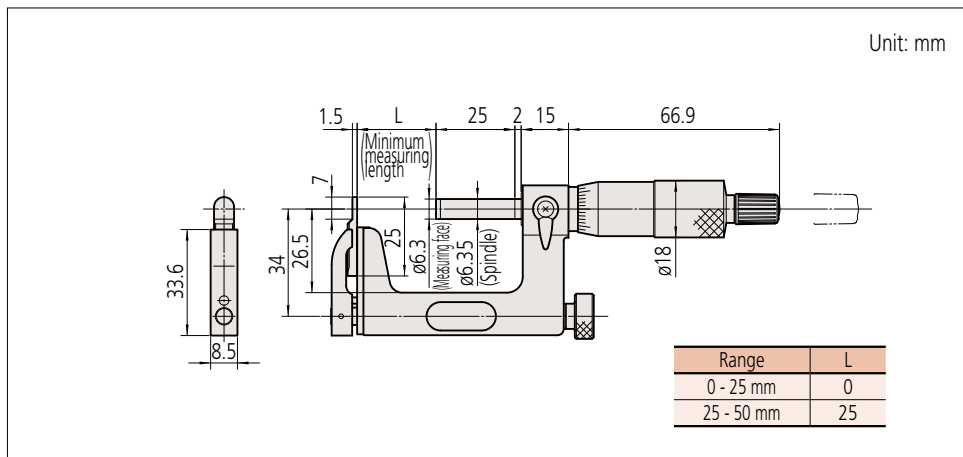
Inch/Metric			
Order No.	Range	Resolution	Accuracy*
Digimatic (LCD)			
317-351-30	0 - 1 in	0.00005 in/ 0.001 mm	±0.0002 in
317-352-30	1 - 2 in		

* Excluding quantizing error of ±1 count

Inch			
Order No.	Range	Graduation	Accuracy
Analog			
117-107	0 - 1 in	0.0001 in	±0.0002 in
117-108	1 - 2 in		

Note: For the **series 317** functions, refer to page B-8.
Also, other than the waterproof type only the connection cable (option) cannot be used.

DIMENSIONS



MeasurLink[®] ENABLED
Data Management Software by Mitutoyo

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).

IP 65

These marks indicate that a product has successfully passed IP65-level testing, which is carried out by the independent German certification organization TÜV Rheinland.

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ID: 000049131

(Refer to page X for details.)

IP Codes (series 317)

- Level 6: Dust-proof.
No ingress of dust allowed.
- Level 5: Protected against water jets.
Water projected in jets against the enclosure from any direction shall have no harmful effects.

Technical Data

Flatness: Spindle face 0.6 μm / 0.000024 in
Anvil face 2 μm / 0.00008 in
Parallelism: 3 μm / 0.00012 in



Battery for Series 317

SR44 (1 pc), **938882**, for initial operational checks (standard accessory)

Battery life: Approx. 2.4 years under normal use (for series 317)

Length standard: Electromagnetic rotary sensor (for series 317)

Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models)

Spanner (200877), 1 pc (for series 117-XXX)
Spanner (301336), 1 pc (for series 317-XXX)

Optional Accessories

Connecting cables (**series 317**)

1 m: **05CZA662**

2 m: **05CZA663**

USB Input Tool Direct

USB-ITN-B (2 m): **06AFM380B**

Wireless data output **U-WAVE** **WiFi**

U-WAVE-TM 264-622 (IP67 type)

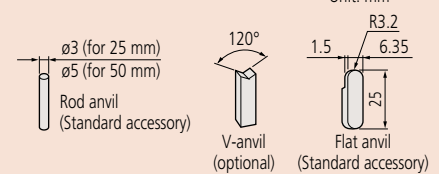
264-623 (Buzzer type)

Connecting unit for U-WAVE-TM

02AZF310 (IP67 type)

Refer to page A-15 for details

Accessories



Order No.	Item
201216	Flat anvil (standard accessory)
201217	Rod anvil (standard accessory for 117-101/117-107/317-251-30/317-351-30)
201379	Rod anvil (standard accessory for 117-102/117-108/317-252-30/317-352-30)
201218	V-anvil (optional)
950758	Base for 25 mm (optional)

Limit Micrometers SERIES 113



Technical Data

Standard accessories: Reference bar, 1 pc
(except for measuring range 0-25 mm models)
Spanner (200877), 1 pc

- Dual-spindle design enables use as a GO/±NG gage by setting upper and lower limits.
- Measuring faces: Carbide.

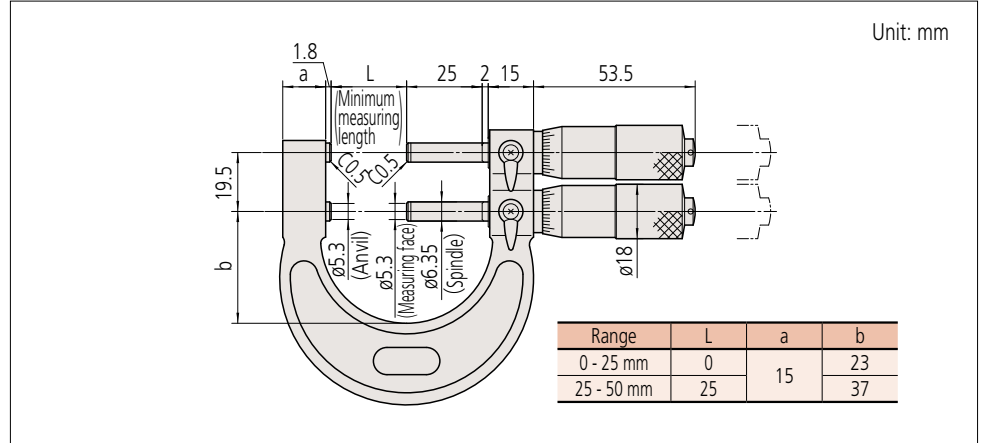


113-102

SPECIFICATIONS

Metric					
Order No.	Range	Graduation	Accuracy	Flatness	Parallelism
113-102	0 - 25 mm	0.01 mm	±3 μm	0.6 μm	3 μm
113-103	25 - 50 mm				

DIMENSIONS

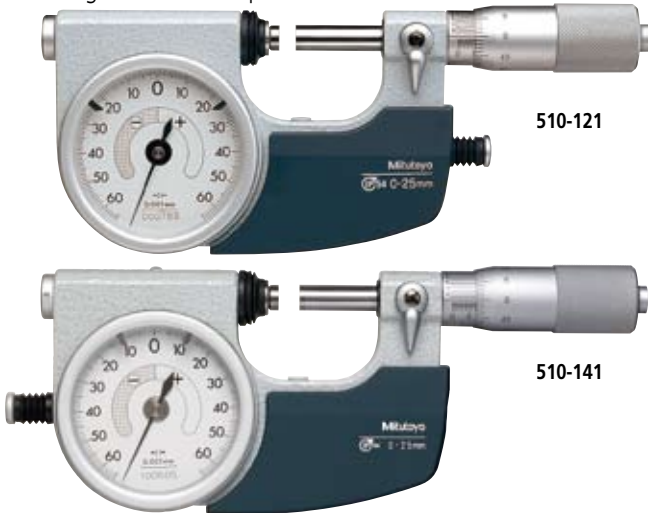


Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Indicating Micrometers SERIES 510

- Suited to the measurement of low-volume manufactured parts.
- Easy to use when operating one-handed due to retractable anvil.
- In the 25 mm measuring range, the model lineup offers a choice of left or right positioning of the anvil-retraction button.
- Greatly improved accuracy: indication error and graduation of 1 μm .
- Water-proof to protection level IP54.
- Hard-coated crystal: enhanced oil and scratch resistance.
- Indicator scale is large and easy to read.
- The zero position and adjustable limit markers, for GO/ \pm NG testing, are easily set.
- Measuring faces: Carbide.

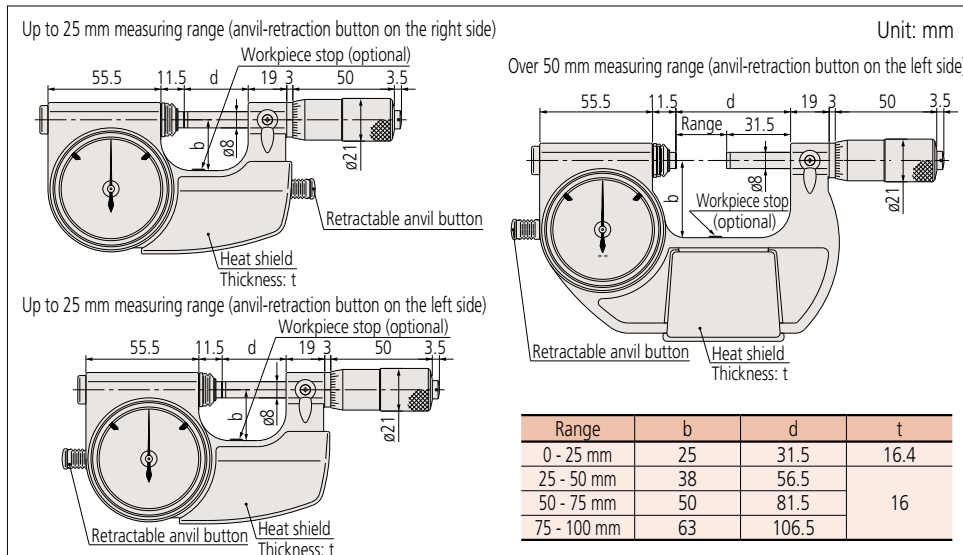


SPECIFICATIONS

Metric							
Order No.	Range	Indicating range	Graduation	Dial graduation	Measuring force	Anvil retraction button	Mass
510-121	0 - 25 mm	± 0.06 mm	0.001 mm	0.001 mm	5 - 10 N	Right side	520 g
510-141						Left side	530 g
510-122	25 - 50 mm					670 g	
510-123	50 - 75 mm					820 g	
510-124	75 - 100 mm	970 g					

Inch							
Order No.	Range	Indicating range	Graduation	Dial graduation	Measuring force	Anvil retraction button	Mass
510-131	0 - 1 in	± 0.0023 in	0.0001 in	0.00005 in	5 - 10 N	Right side	520 g
510-151						Left side	530 g
510-132	1 - 2 in					670 g	
510-133	2 - 3 in					820 g	
510-134	3 - 4 in	970 g					

DIMENSIONS



(Refer to page X for details.)

Technical Data

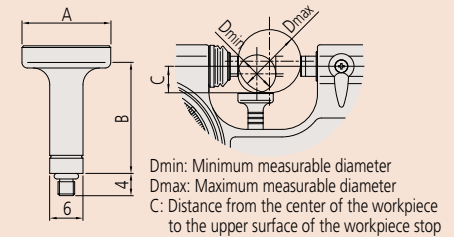
Flatness: 0.3 μm / 0.000012 in
 Parallelism: 0.6 μm / 0.000024 in for models up to 50 mm / 2 in
 1 μm / 0.00004 in for models over 50 mm / 2 in
 Accuracy: ± 2 μm / ± 0.0001 in
 Spindle feed error: 3 μm / 0.00015 in
 Dispersion of indication: 0.4 μm / 0.00002 in
 Dial indication accuracy: 1 μm / 0.00005 in
 Standard accessories: Reference bar, 1 pc (except for measuring range 0-25 mm (0-1 in) models)
 Spanner (200154), 1 pc

Workpiece Stop (optional)

Produces more stable measurement.

Three types are available to suit workpieces of different sizes.

Range	Unit: mm	
	A	B
Workpiece stop A 04AZA124	$\phi 16$	23
Workpiece stop B 04AZA125	$\phi 14$	20.5
Workpiece stop C 04AZA126	$\phi 14$	15



Order No 510-121, 510-141, 510-131, 510-151 Unit: mm

	Dmin	Dmax	C
Workpiece stop A	N/A	N/A	N/A
Workpiece stop B	4	16	5.0
Workpiece stop C	15	25	10.5

510-122 and 510-132

	Dmin	Dmax	C
Workpiece stop A	25	37	15.5
Workpiece stop B	30	42	18.0
Workpiece stop C	41	50	23.5

510-123 and 510-133

	Dmin	Dmax	C
Workpiece stop A	50	61	27.5
Workpiece stop B	54	66	30.0
Workpiece stop C	65	75	35.5

510-124 and 510-134

	Dmin	Dmax	C
Workpiece stop A	75	87	40.5
Workpiece stop B	80	92	43.0
Workpiece stop C	91	100	48.2

Technical Data

Indicator
 Indicating range: ± 0.06 mm/ ± 0.0023 in
 Repeatability of indication: $0.4 \mu\text{m}/0.00002$ in
 Dial indication accuracy: $1 \mu\text{m}/0.00005$ in
 Flatness: $0.3 \mu\text{m}/0.000012$ in
 Parallelism: $0.6 \mu\text{m}/0.000024$ in for models up to 50 mm/2 in measuring range
 $1 \mu\text{m}/0.00004$ in for models over 50 mm/2 in measuring range



**Dial Snap Meters
 SERIES 523**

- Suited for the measurement of mass-produced parts.
- Designed for measurement using a stand: produces stable measurement.
- Greatly improved accuracy: indication error and graduation of $1 \mu\text{m}$.
- Water-proof to protection level IP54.
- Hard-coated crystal: enhanced oil and scratch resistance.
- Indicator scale is large and easy to read.
- Easily settable adjustable limit markers for GO/ \pm NG testing.
- Equipped with an elevating workpiece stop as standard.
- Measuring faces: Carbide.



523-121

SPECIFICATIONS

Metric				
Order No.	Range	Dial graduation	Measuring force	Mass
523-121	0 - 25 mm	0.001 mm	5 - 10 N	740 g
523-122	25 - 50 mm			840 g
523-123	50 - 75 mm			950 g
523-124	75 - 100 mm			1080 g
Inch				
Order No.	Range	Dial graduation	Measuring force	Mass
523-131	0 - 1 in	0.00005 in	5 - 10 N	740 g
523-132	1 - 2 in			840 g
523-133	2 - 3 in			950 g
523-134	3 - 4 in			1080 g

DIMENSIONS

Unit: mm

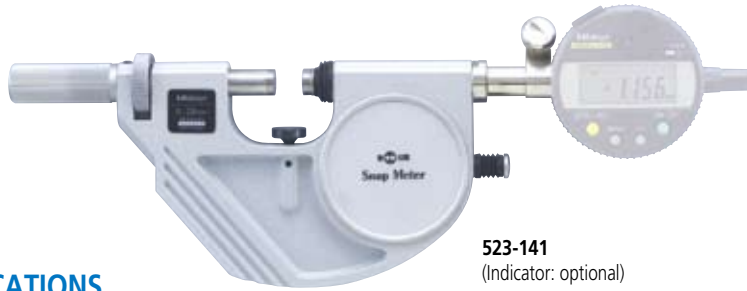
Range	b	d
0 - 25 mm	25	31
25 - 50 mm	35	56
50 - 75 mm	47	81
75 - 100 mm	60	106

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Snap Meters SERIES 523

- Suited for the measurement of mass-produced parts.
- Various types of indicator can be selected according to the measurement application.
- Measuring faces: Carbide.



523-141
(Indicator: optional)

SPECIFICATIONS

Metric

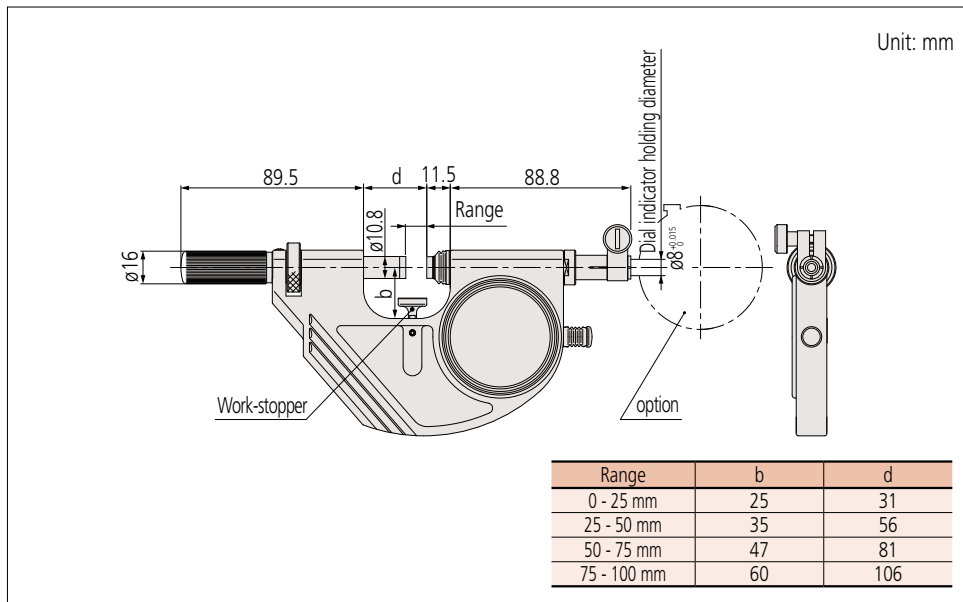
Order No.	Range	Anvil movement	Measuring force*	Mass
523-141	0 - 25 mm	2 mm	5 - 10 N	710 g
523-142	25 - 50 mm			810 g
523-143	50 - 75 mm			920 g
523-144	75 - 100 mm			1050 g

Inch

Order No.	Range	Anvil movement	Measuring force*	Mass
523-151	0 - 1 in	0.078 in	5 - 10 N	710 g
523-152	1 - 2 in			810 g
523-153	2 - 3 in			920 g
523-154	3 - 4 in			1050 g

* Measured at the position where the anvil is retracted by 1mm from the free position without installing the indicator.

DIMENSIONS



Accuracy

Flatness: 0.3 μm /0.000012 in
 Parallelism: 0.6 μm /0.000024 in for models up to 50 mm/2 in
 1 μm /0.00004 in for models over 50 mm/2 in
 Repeatability of indication: 0.4 μm /0.00002 in

Typical Indicators Used with Gage

ID-C (0.001 mm)/ **543-390B**
 LGF-L (0.001 mm)/ **542-181** & Counter **542-015**



ABS Digimatic Indicator



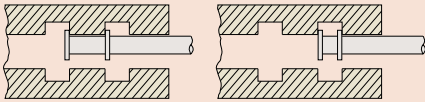
Linear Gage and counter

Technical Data

Parallelism: 10 µm/0.0004 in

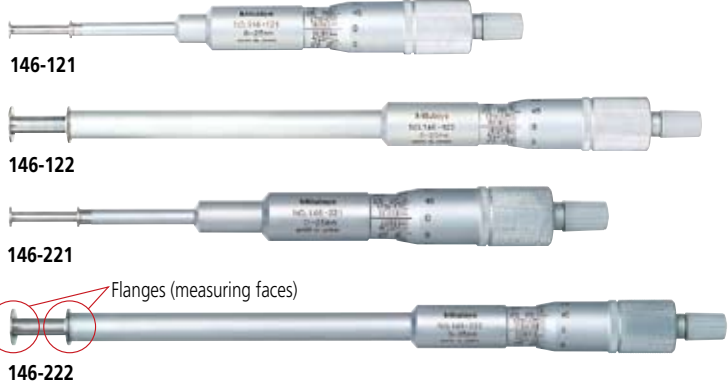


Standard accessories: Spanner (301336), 1 pc



Groove Micrometers SERIES 146

- Flanged spindle and anvil for measuring width and location of grooves inside bores and tubes.
- Two-directional ratchet stop.
- For ID and OD (except for 0 - 25 mm) measurement, a master gage is required for adjusting the reference point.



SPECIFICATIONS

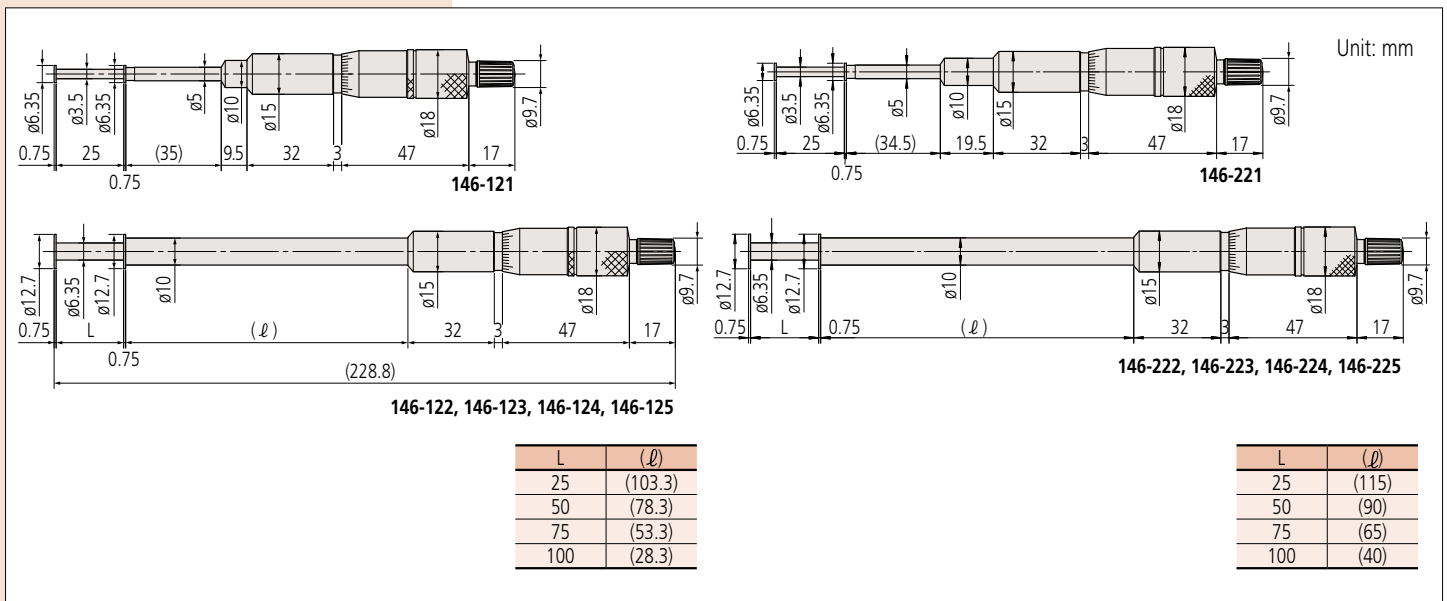
Metric					
Order No.	Range Outside	Range Inside	Graduation	Accuracy	Flange
Rotating spindle					
146-121	0 - 25 mm	1.6 - 26.5 mm	0.01 mm	±10 µm	ø6.35 mm
146-122					ø12.7 mm
146-123	25 - 50 mm	26.5 - 51.5 mm			ø12.7 mm
146-124	50 - 75 mm	51.5 - 76.5 mm			ø12.7 mm
146-125	75 - 100 mm	76.5 - 101.5 mm			

Metric					
Order No.	Range Outside	Range Inside	Graduation	Accuracy	Flange
Non-rotating spindle					
146-221	0 - 25 mm	1.6 - 26.5 mm	0.01 mm	±10 µm	ø6.35 mm
146-222					ø12.7 mm
146-223	25 - 50 mm	26.5 - 51.5 mm			ø12.7 mm
146-224	50 - 75 mm	51.5 - 76.5 mm			ø12.7 mm
146-225	75 - 100 mm	76.5 - 101.5 mm			

Inch					
Order No.	Range Outside	Range Inside	Graduation	Accuracy	Flange
Rotating spindle					
146-131	0 - 1 in	0.055 - 1.05 in	0.001 in	±0.0004 in	ø0.25 in
146-132					ø0.5 in
146-133	1 - 2 in	1.05 - 2.05 in			ø0.5 in
146-134	2 - 3 in	2.05 - 3.05 in			ø0.5 in
146-135	3 - 4 in	3.05 - 4.05 in			

Inch					
Order No.	Range Outside	Range Inside	Graduation	Accuracy	Flange
Non-rotating spindle					
146-231	0 - 1 in	0.055 - 1.05 in	0.001 in	±0.0004 in	ø0.25 in
146-232					ø0.5 in
146-233	1 - 2 in	1.05 - 2.05 in			ø0.5 in
146-234	2 - 3 in	2.05 - 3.05 in			ø0.5 in
146-235	3 - 4 in	3.05 - 4.05 in			

DIMENSIONS



Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

QUICKmini SERIES 700

- Lightweight, compact, palm-sized device.
 - Measurement of small, thin workpieces is possible by only a single operation.
 - Electromagnetic induction type ABSOLUTE encoder is adopted.
 - Built-in ABS (absolute) scale requires no zero-set every time the power is turned on. In addition, reliability has improved by eliminating overspeed errors.
 - 18,000 hours of continuous operation is achieved thanks to adoption of the absolute scale.
- Applications:**
- Measurement of small workpieces: Pearl, jewel, engine tappet shim, screws.
 - Measurement of thin workpieces: Printing paper, polyethylene bags, sheet material, noodles and other food products, medium substrate, foil, thin plate, filter cloth and other medical supplies.
 - Measurement of thin lines and bars: Fishing line, dental reamers, spaghetti, drill for PCBs, wiring.



700-119-30

SPECIFICATIONS

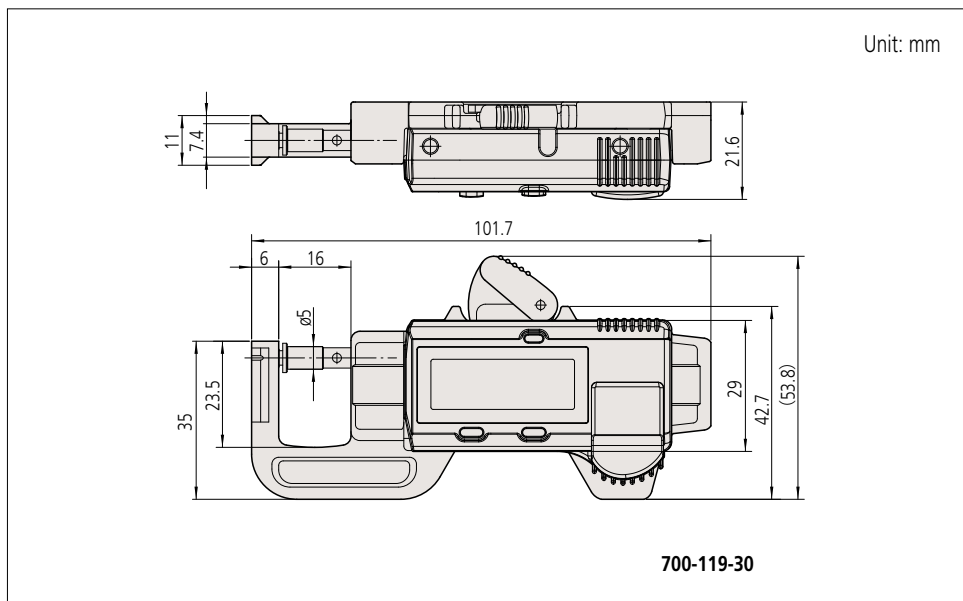
Metric				
Order No.	Range	Resolution	Accuracy*	Mass
700-119-30	0 - 12 mm	0.01 mm	±0.02	100 g

* Excluding quantizing error of ±1 count

Inch/Metric				
Order No.	Range	Resolution	Accuracy*	Mass
700-118-30	0 - 5 in/ 0 - 12 mm	0.0005 in/0.01 mm	±0.001 in	100 g

* Excluding quantizing error of ±1 count

DIMENSIONS



Technical Data

SR44 (1 pc), 938882, for initial operational checks (standard accessory)

Silver oxide button cell battery SR44 (938882), 1 pc. for monitor (standard accessory)

Functions

ABS measurement function: after a data is displayed, next measurement can be performed without zero-setting. Also, the ABS origin point can be changed with ORIGIN switch.

INC measurement function: clears the displayed data at any point. The comparative measurement can be easily performed.

Low battery alarm: notifies that the battery is worn with "B" mark before becoming immeasurable. Thus, the timing for battery replacement can be confirmed in advance.

Small Hole Gage Set SERIES 154



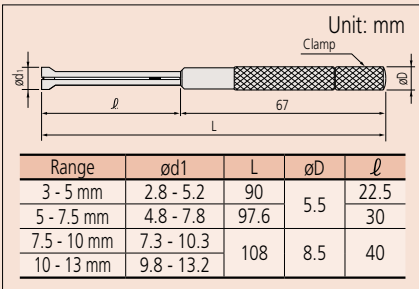
- Extra long for gaging deep and shallow holes, slots, and similar workpiece features.

- Two sprung leaves are fully expanded inside a feature so that its size can be measured with an outside micrometer after extraction.



154-902

DIMENSIONS



SPECIFICATIONS

Metric	Order No.	Range
4-gage Set	154-902	3 - 13 mm
Gages included	154-101	3 - 5 mm
	154-102	5 - 7.5 mm
	154-103	7.5 - 10 mm
	154-104	10 - 13 mm

Inch	Order No.	Range
4-gage Set	154-901	0.125 - 0.5 in
Gages included	154-105	0.125 - 0.2 in
	154-106	0.2 - 0.3 in
	154-107	0.3 - 0.4 in
	154-108	0.4 - 0.5 in

Telescoping Gage Set SERIES 155

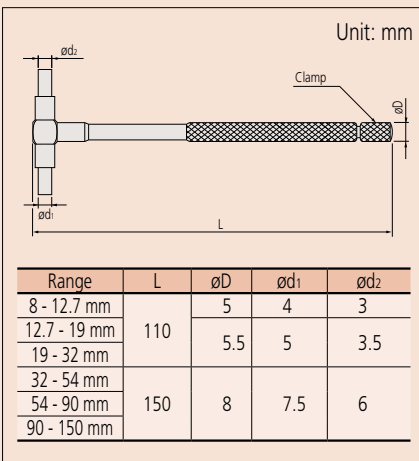


- A spring-loaded plunger expands within a bore (or groove) and is locked in place allowing measurement of diameter (or width) with an outside micrometer after extraction.

SPECIFICATIONS

Metric	Order No.	Range
6-gage Set	155-905	8 - 150 mm
Gages included	155-127	8 - 12.7 mm
	155-128	12.7 - 19 mm
	155-129	19 - 32 mm
	155-130	32 - 54 mm
	155-131	54 - 90 mm
	155-132	90 - 150 mm

DIMENSIONS



155-905

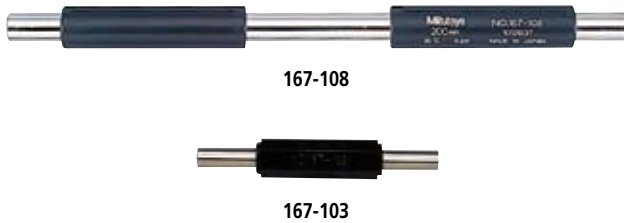
Inch	Order No.	Range
6-gage Set	155-903	0.313 - 6 in
Gages included	155-121	0.313 - 0.5 in
	155-122	0.5 - 0.75 in
	155-123	0.75 - 1.25 in
	155-124	1.25 - 2.125 in
	155-125	2.125 - 3.5 in
	155-126	3.5 - 6 in

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

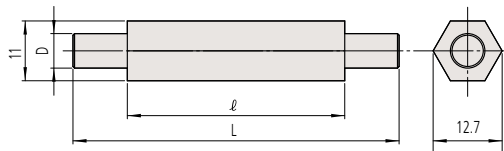
Setting Standards for Outside Micrometers SERIES 167

- Used for adjusting the reference point of outside micrometers.



SPECIFICATIONS and DIMENSIONS

167-101 – 167-103
167-141 – 167-143

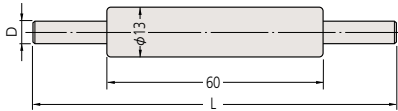


Unit: mm

Metric				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-101	25 mm	$\pm 1.5 \mu\text{m}$	18	6.35 mm
167-102	50 mm	$\pm 2.0 \mu\text{m}$	40	
167-103	75 mm	$\pm 2.5 \mu\text{m}$		

Inch				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-141	1 in	$\pm 0.00005 \text{ in}$	18	0.25 in
167-142	2 in	$\pm 0.0001 \text{ in}$	40	
167-143	3 in	$\pm 0.0001 \text{ in}$		

167-104 – 167-107
167-144 – 167-147

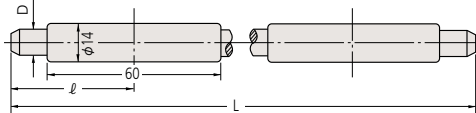


Unit: mm

Metric			
Order No.	Length (L)	Tolerance	Diameter (D)
167-104	100 mm	$\pm 3 \mu\text{m}$	7.9 mm
167-105	125 mm	$\pm 3.5 \mu\text{m}$	
167-106	150 mm	$\pm 4 \mu\text{m}$	
167-107	175 mm	$\pm 4.5 \mu\text{m}$	

Inch			
Order No.	Length (L)	Tolerance	Diameter (D)
167-144	4 in	$\pm 0.0001 \text{ in}$	0.31 in
167-145	5 in	$\pm 0.00015 \text{ in}$	
167-146	6 in		
167-147	7 in		

167-108 – 167-119
167-148 – 167-159



Unit: mm

Metric				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-108	200 mm	$\pm 5.0 \mu\text{m}$	47	9.4 mm
167-109	225 mm	$\pm 5.5 \mu\text{m}$	47	
167-110	250 mm	$\pm 6.0 \mu\text{m}$	52	
167-111	275 mm	$\pm 6.5 \mu\text{m}$	57	
167-112	300 mm	$\pm 7 \mu\text{m}$	64	
167-113	325 mm	$\pm 7.5 \mu\text{m}$	69	
167-114	350 mm	$\pm 8 \mu\text{m}$	74	
167-115	375 mm	$\pm 8.5 \mu\text{m}$	80	
167-116	400 mm	$\pm 9 \mu\text{m}$	85	
167-117	425 mm	$\pm 9.5 \mu\text{m}$	90	
167-118	450 mm	$\pm 10 \mu\text{m}$	95	
167-119	475 mm	$\pm 10.5 \mu\text{m}$	101	

Inch				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-148	8 in	$\pm 0.00015 \text{ in}$	47	0.37 in
167-149	9 in	$\pm 0.0002 \text{ in}$	47	
167-150	10 in	$\pm 0.0002 \text{ in}$	52	
167-151	11 in	$\pm 0.0002 \text{ in}$	57	
167-152	12 in	$\pm 0.00025 \text{ in}$	64	
167-153	13 in	$\pm 0.00025 \text{ in}$	69	
167-154	14 in	$\pm 0.00025 \text{ in}$	74	
167-155	15 in	$\pm 0.00025 \text{ in}$	80	
167-156	16 in	$\pm 0.00025 \text{ in}$	85	
167-157	17 in	$\pm 0.00025 \text{ in}$	90	
167-158	18 in	$\pm 0.00025 \text{ in}$	95	
167-159	19 in	$\pm 0.0003 \text{ in}$	101	

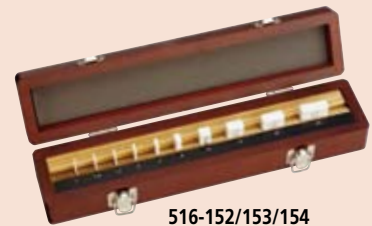
Technical Data

Flatness: $0.3 \mu\text{m}$
Parallelism: $2 \mu\text{m}$



Micrometer Inspection Gauge Block Set

Refer to page E-11 for details.

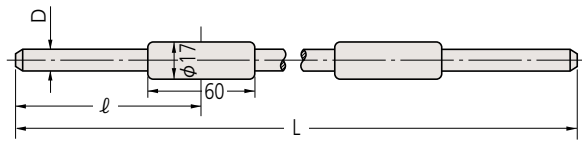


516-152/153/154



Micro Checker (holder only)
516-607

167-120 – 167-404
167-160 – 167-180



Unit: mm

Metric				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-120	500 mm	±11 μm	106	0.47 in
167-121	525 mm	±11.5 μm	112	
167-122	550 mm	±12.0 μm	117	
167-123	575 mm	±12.5 μm	122	
167-124	600 mm	±13 μm	128	
167-125	625 mm	±13.5 μm	133	
167-126	650 mm	±14 μm	138	
167-127	675 mm	±14.5 μm	142	
167-128	700 mm	±15 μm	147	
167-129	725 mm	±15.5 μm	153	
167-130	750 mm	±16 μm	158	
167-131	775 mm	±16.5 μm	164	
167-132	800 mm	±17 μm	170	
167-133	825 mm	±17.5 μm	175	
167-134	850 mm	±18 μm	180	
167-135	875 mm	±18.5 μm	185	
167-136	900 mm	±19 μm	191	
167-137	925 mm	±19.5 μm	196	
167-138	950 mm	±20 μm	201	
167-139	975 mm	±20.5 μm	207	
167-140	100 mm	±21 μm	211	11.9 mm
167-365	1025 mm	±21.5 μm	217	
167-366	1050 mm	±22 μm	222	
167-367	1075 mm	±22.5 μm	227	
167-368	1100 mm	±23 μm	232	
167-369	1125 mm	±23.5 μm	238	
167-370	1150 mm	±24 μm	243	
167-371	1175 mm	±24.5 μm	248	
167-372	1200 mm	±25 μm	254	
167-373	1225 mm	±25.5 μm	259	
167-374	1250 mm	±26 μm	264	
167-375	1275 mm	±26.5 μm	269	
167-376	1300 mm	±27 μm	275	
167-377	1325 mm	±27.5 μm	280	
167-378	1350 mm	±28 μm	285	
167-379	1375 mm	±28.5 μm	291	
167-380	1400 mm	±29 μm	296	
167-381	1425 mm	±29.5 μm	301	
167-382	1450 mm	±30 μm	306	
167-383	1475 mm	±30.5 μm	312	
167-384	1500 mm	±31 μm	317	
167-385	1525 mm	±31.5 μm	322	
167-386	1550 mm	±32 μm	328	
167-387	1575 mm	±32.5 μm	333	
167-388	1600 mm	±33 μm	338	
167-389	1625 mm	±33.5 μm	343	
167-390	1650 mm	±34 μm	349	
167-391	1675 mm	±34.5 μm	354	
167-392	1700 mm	±35 μm	359	
167-393	1725 mm	±35.5 μm	364	
167-394	1750 mm	±36 μm	370	
167-395	1775 mm	±36.5 μm	375	
167-396	1800 mm	±37 μm	380	
167-397	1825 mm	±37.5 μm	386	
167-398	1850 mm	±38 μm	391	
167-399	1875 mm	±38.5 μm	396	
167-400	1900 mm	±39 μm	401	
167-401	1925 mm	±39.5 μm	407	
167-402	1950 mm	±40 μm	412	
167-403	1975 mm	±40.5 μm	417	
167-404	2000 mm	±41 μm	423	

Inch				
Order No.	Length (L)	Tolerance	ℓ	Diameter (D)
167-160	20 in	±0.0003 in	106	0.47 in
167-161	21 in	±0.0003 in	112	
167-162	22 in	±0.0003 in	117	
167-163	23 in	±0.0003 in	122	
167-164	24 in	±0.0003 in	128	
167-165	25 in	±0.00035 in	133	
167-166	26 in	±0.00035 in	138	
167-167	27 in	±0.00035 in	142	
167-168	28 in	±0.00035 in	147	
167-169	29 in	±0.00035 in	153	
167-170	30 in	±0.00035 in	158	
167-171	31 in	±0.00035 in	164	
167-172	32 in	±0.00035 in	170	
167-173	33 in	±0.00035 in	175	
167-174	34 in	±0.00035 in	180	
167-175	35 in	±0.00035 in	185	
167-176	36 in	±0.00035 in	191	
167-177	37 in	±0.0004 in	196	
167-178	38 in	±0.0004 in	201	
167-179	39 in	±0.0004 in	207	
167-180	40 in	±0.0004 in	211	

Available up to 79 in

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Setting Standards for Screw Thread Micrometers SERIES 167

- Used for accurately setting screw thread micrometers at the start or end of the measuring range.



167-264
(60° screw)



167-262
(60° screw)



Metric		
Order No.	Length	Accuracy
Metric (unified) $\theta = 60^\circ$		
167-261	25 mm	$\pm 4 \mu\text{m}$
167-262	50 mm	$\pm 5 \mu\text{m}$
167-263	75 mm	$\pm 6 \mu\text{m}$
167-264	100 mm	$\pm 7 \mu\text{m}$
167-265	125 mm	$\pm 8 \mu\text{m}$
167-266	150 mm	$\pm 9 \mu\text{m}$
167-267	175 mm	$\pm 10 \mu\text{m}$
167-268	200 mm	$\pm 11 \mu\text{m}$
167-269	225 mm	$\pm 12 \mu\text{m}$
167-270	250 mm	$\pm 13 \mu\text{m}$
167-271	275 mm	$\pm 14 \mu\text{m}$
Whitworth $\theta = 55^\circ$		
167-272	25 mm	$\pm 4 \mu\text{m}$
167-273	50 mm	$\pm 5 \mu\text{m}$
167-274	75 mm	$\pm 6 \mu\text{m}$
167-275	100 mm	$\pm 7 \mu\text{m}$
167-276	125 mm	$\pm 8 \mu\text{m}$
167-277	150 mm	$\pm 9 \mu\text{m}$
167-278	175 mm	$\pm 10 \mu\text{m}$
167-279	200 mm	$\pm 11 \mu\text{m}$
167-280	225 mm	$\pm 12 \mu\text{m}$
167-281	250 mm	$\pm 13 \mu\text{m}$
167-282	275 mm	$\pm 14 \mu\text{m}$

Inch		
Order No.	Length (L)	Accuracy
Metric (unified) $\theta = 60^\circ$		
167-294	1 in	± 0.00015 in
167-295	2 in	± 0.0002 in
167-296	3 in	± 0.00025 in
167-297	4 in	± 0.0003 in
167-298	5 in	± 0.00035 in
167-299	6 in	± 0.0004 in
Whitworth $\theta = 55^\circ$		
167-283	1 in	± 0.00015 in
167-284	2 in	± 0.0002 in
167-285	3 in	± 0.00025 in
167-286	4 in	± 0.0003 in
167-287	5 in	± 0.00035 in
167-288	6 in	± 0.0004 in

Setting Standards for V-Anvil Micrometers SERIES 167

- Specially designed for accurately setting V-anvil micrometers.



Metric			
Order No.	Length	Accuracy	Type
167-327	5 mm	$\pm 2 \mu\text{m}$	Plug
167-328	10 mm		
167-329	25 mm		
167-330	40 mm	$\pm 3 \mu\text{m}$	Ring
167-331	55 mm		
167-332	70 mm		
167-333	85 mm		

Inch			
Order No.	Length (L)	Accuracy	Type
167-337	0.2 in	± 0.0001 in	Plug
167-338	0.4 in		
167-339	1 in		
167-340	1.6 in	± 0.00015 in	Ring
167-341	2.2 in		
167-342	2.8 in		
167-343	3.4 in		



Optical Parallels SERIES 157

- Designed to inspect parallelism and flatness of measuring faces of micrometers. For details, refer to "Quick Guide to Precision Measuring Instruments".
- Each set consists of 4 sizes to aid in testing parallelism at various angular positions of the micrometer spindle.



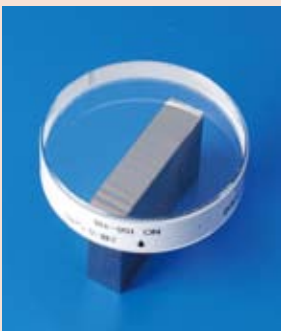
157-903

SPECIFICATIONS

Metric						
Order No.	Range of micrometer to be checked	Sizes of parallels included in set	Diameter	Flatness	Parallelism	Remarks
157-903	0 - 25 mm	12.00, 12.12, 12.25, 12.37 mm	ø30	0.1 μm	0.2 μm	For 25 mm
157-904	25 - 50 mm	25.00, 25.12, 25.25, 13.37 mm				For 50 mm
Inch						
Order No.	Range of micrometer to be checked	Sizes of parallels included in set	Diameter	Flatness	Parallelism	Remarks
157-901	0 - 1 in	0.5000 in, 0.5062 in, 0.5125 in, 0.5187 in	ø30	0.1 μm	0.2 μm	For 25 mm
157-902	1 - 2 in	1.0000 in, 1.0062 in, 1.0125 in, 1.0187 in				For 50 mm

Optical Flats SERIES 158

- Used for inspecting the flatness of very flat surfaces. For details, refer to "Quick Guide to Precision Measuring Instruments".



158-118

SPECIFICATIONS

Metric				Inch			
Order No.	Thickness	Diameter	Flatness grade	Order No.	Thickness	Diameter	Flatness grade
158-117	12 mm	45 mm	0.2 μm	158-122	0.5 in	1.8 in	0.00004 in
158-118			0.1 μm				
158-119	15 mm	60 mm	0.2 μm	158-124	0.6 in	2.4 in	
158-120			0.1 μm				

Micrometer

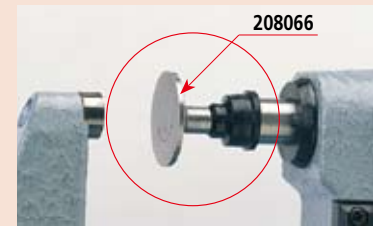
The origin of Mitutoyo's trustworthy brand of small tool instruments

Spindle Attachment Tips

- Simple interchangeable tips attached to standard micrometer spindles enable measurement of contours otherwise unmeasurable (for $\varnothing 6.35$ spindles only).
- Measuring range changes when a spindle attachment tip is mounted: the maximum measuring range is 10 mm or less (accuracy is not guaranteed).

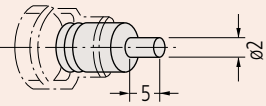
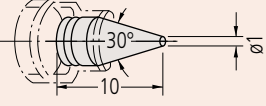
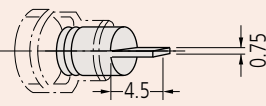
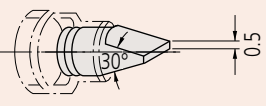
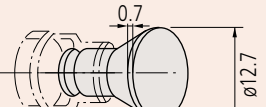
Technical Data

Tip length: 10 mm $\pm 5 \mu\text{m}$



Specifications and Dimensions

Unit: mm

Order No.	Tip type	Dimensions
208062	Spline	
208063	Comparator	
208064	Blade	
208065	Knife-edge	
208066	Disk-plate	

Micrometer Oil

- Special lubricant for micrometers.



207000
(Content: 30 ml)

SPECIFICATIONS

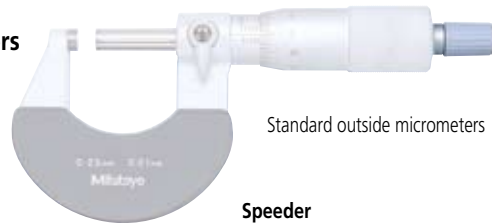
Order No.	Product name	Remarks
207000	Micrometer oil	Grease (30 ml)

Color-Coded Ratchet and Speeder Covers

- Ratchet and speeder covers in a choice of seven colors for use in instrument identification control schemes: red, blue, yellow, green, brown, black and gray.

SPECIFICATIONS

Ratchet and speeder covers



Ratchet



Speeder



Analog type: 0 - 300 mm

Order No.		Color	Material
Ratchet	Speeder		
04GZA239	04GAA260	Gray	Plastic
985056	301708	Black	
985061	301709	Red	
985081	301713	Blue	
985071	301711	Yellow	
985076	301712	Green	
985066	301710	Brown	
950700	—	Gray	Steel

Analog type: 300 - 1000 mm

Order No.		Color	Material
Ratchet	Speeder		
04GZA243	04GAA260	Gray	Plastic
—	301708	Black	
—	301709	Red	
—	301713	Blue	
—	301711	Yellow	
—	301712	Green	
—	301710	Brown	
950701	—	Gray	Steel

Digimatic type 0 - 300 mm*

Order No.*		Color	Material
Ratchet	Speeder		
04AZB661	04GAA260	Gray	Plastic
04GZA241	04GAA260	Gray	
—	301708	Black	
—	301709	Red	
—	301713	Blue	
—	301711	Yellow	
—	301712	Green	
—	301710	Brown	
951588	—	Gray	Steel

*Cannot be used for analog types.

Color-coded speeder covers



Color-coded speeder covers



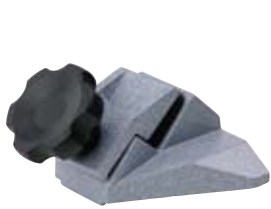
Order No.	Color
04GAA899	Black
04GAA900	Red
04GAA901	Yellow
04GAA902	Green
04GAA903	Blue
04AAB208	Gray

Micrometer

The origin of Mitutoyo's trustworthy brand of small tool instruments

Micrometer Stands SERIES 156

- Designed to allow benchtop use of hand micrometers or other gages which have frames suitable for gripping by the clamp.



156-105-10



156-101-10



156-102



156-105-10



156-101-10

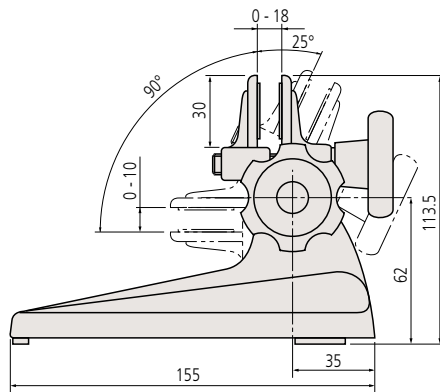
SPECIFICATIONS

Order No.	Micrometer ranges	Remarks
156-101-10	Up to 100 mm (4 in)*	Adjustable angle type
156-105-10	0-25 mm (0-1 in), 25-50 mm (1-2 in)	Fixed angle type
156-102	125-300 mm (5-12 in)	Vertical type
156-103	300-1000 mm (12-40 in)	Vertical type

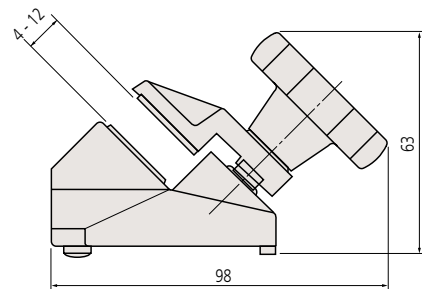
* Items that cannot be mounted on these stands
(Order No. 406-253-30, 323-253-30, 331-254-30, 342-254-30, 342-264-30, 369-253-30, 422-232-30, 422-233-30, etc.)

DIMENSIONS

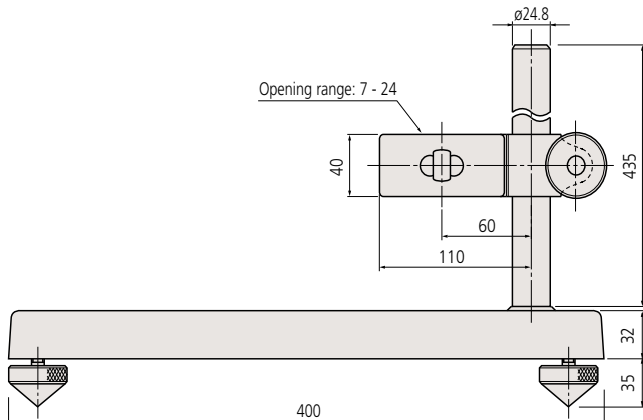
Unit: mm



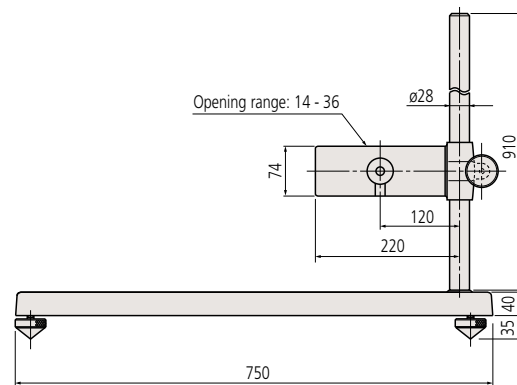
156-101-10



156-105-10



156-102



156-103

Connecting Optional Measurement Data Recording Tools to Micrometers and Micrometer Heads

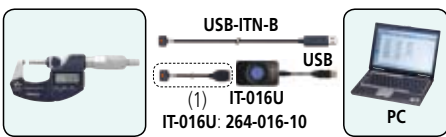
For Digimatic Micrometers other than Quickmike type, and Digimatic Micrometer Heads series 350 (Connector type B)

■ Dedicated connecting cables (optional)

Interface for connecting to PC or PLC, and dedicated printer and its connecting cable.

- **PC connection (wired system) ... USB Input Tool**
(refer to page A-13)

USB-ITN-B (2 m): 06AFM380B

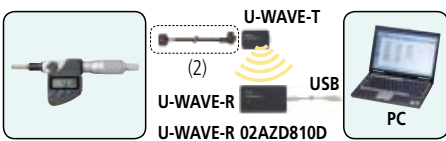


Dedicated cable for models with SPC data output

- (1) 1 m: **05CZA662**
- 2 m: **05CZA663**

- **PC connection (wireless system) ... U-WAVE**
(refer to page A-17)

U-WAVE-T (IP67): 02AZD730G
U-WAVE-T (buzzer): 02AZD880G



Dedicated cable for models with SPC data output

- (2) For standard 160 mm: **02AZD790B**
- For footswitch: **02AZE140B**

- **Dedicated printer connection (only for wired system)**
... **DP-1VA LOGGER** (refer to page A-23)

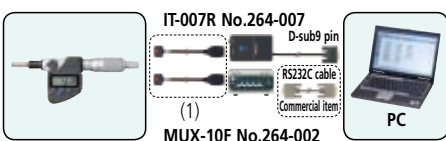


Dedicated cable for models with SPC data output

- (1) 1 m: **05CZA662**
- 2 m: **05CZA663**

- **Connecting to PC, PLC, etc. by RS-232C communication (only for wired system)**

... **IT-007R** (refer to page A-14), **MUX-10F** (refer to page A-24)



Dedicated cable for models with SPC data output

- (1) 1 m: **05CZA662**
- 2 m: **05CZA663**

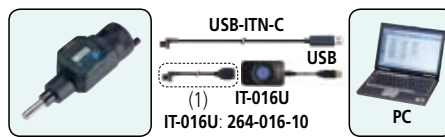
For Digimatic Micrometer Heads series 164 (Connector type C)

■ Dedicated connecting cables (optional)

Interface for connecting to PC or PLC, and dedicated printer and its connecting cable.

- **PC connection (wired system) ... USB Input Tool**
(refer to page A-13)

USB-ITN-C (2 m): 06AFM380C

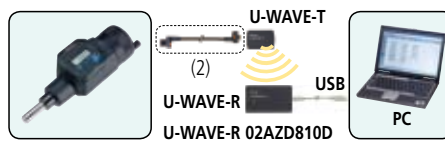


Dedicated cable for models with SPC data output

- (1) 1 m: **959149**
- 2 m: **959150**

- **PC connection (wireless system) ... U-WAVE**
(refer to page A-17)

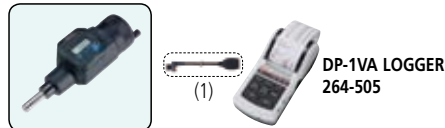
U-WAVE-T (IP67): 02AZD730G
U-WAVE-T (buzzer): 02AZD880G



Dedicated cable for models with SPC data output

- (2) For standard 160 mm: **02AZD790C**
- For footswitch: **02AZE140C**

- **Dedicated printer connection (only for wired system)**
... **DP-1VA LOGGER** (refer to page A-23)

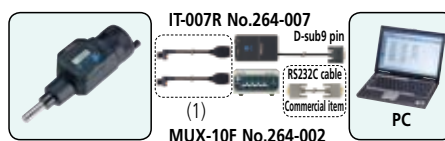


Dedicated cable for models with SPC data output

- (1) 1 m: **959149**
- 2 m: **959150**

- **Connecting to PC, PLC, etc. by RS-232C communication (only for wired system)**

... **IT-007R** (refer to page A-14), **MUX-10F** (refer to page A-24)



Dedicated cable for models with SPC data output

- (1) 1 m: **959149**
- 2 m: **959150**

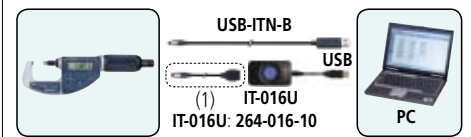
For Quickmike type (Connector type B)

■ Dedicated connecting cables (optional)

Interface for connecting to PC or PLC, and dedicated printer and its connecting cable.

- **PC connection (wired system) ... USB Input Tool**
(refer to page A-13)

USB-ITN-E (2 m): 06AFM380B

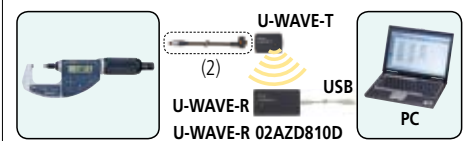


Dedicated cable for models with SPC data output

- (1) 1 m: **937387**
- 2 m: **965013**

- **PC connection (wireless system) ... U-WAVE**
(refer to page A-17)

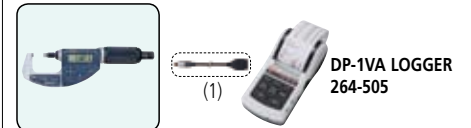
U-WAVE-T (IP67): 02AZD730G
U-WAVE-T (buzzer): 02AZD880G



Dedicated cable for models with SPC data output

- (2) For standard 160 mm: **02AZD790E**
- For footswitch: **02AZE140E**

- **Dedicated printer connection (only for wired system)**
... **DP-1VA LOGGER** (refer to page A-23)



Dedicated cable for models with SPC data output

- (1) 1 m: **937387**
- 2 m: **965013**

- **Connecting to PC, PLC, etc. by RS-232C communication (only for wired system)**

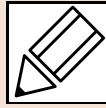
... **IT-007R** (refer to page A-14), **MUX-10F** (refer to page A-24)



Dedicated cable for models with SPC data output

- (1) 1 m: **937387**
- 2 m: **965013**

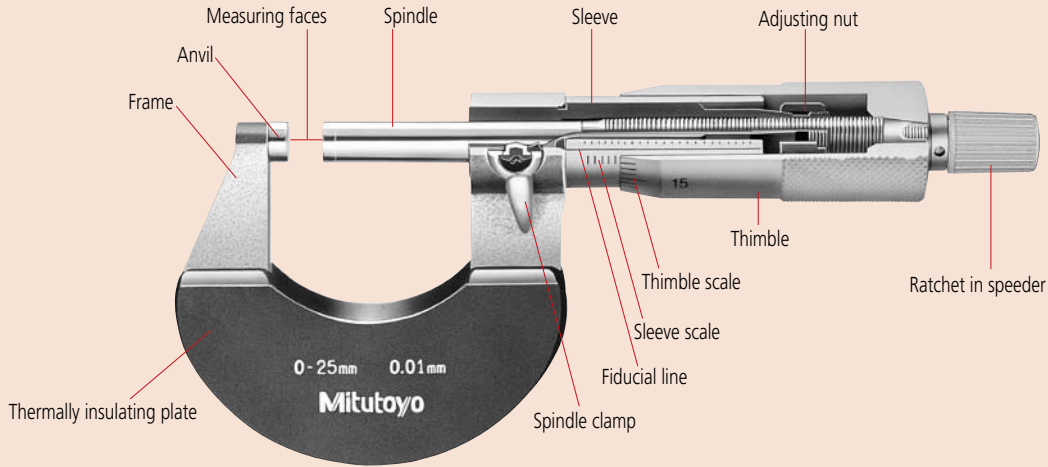
Quick Guide to Precision Measuring Instruments



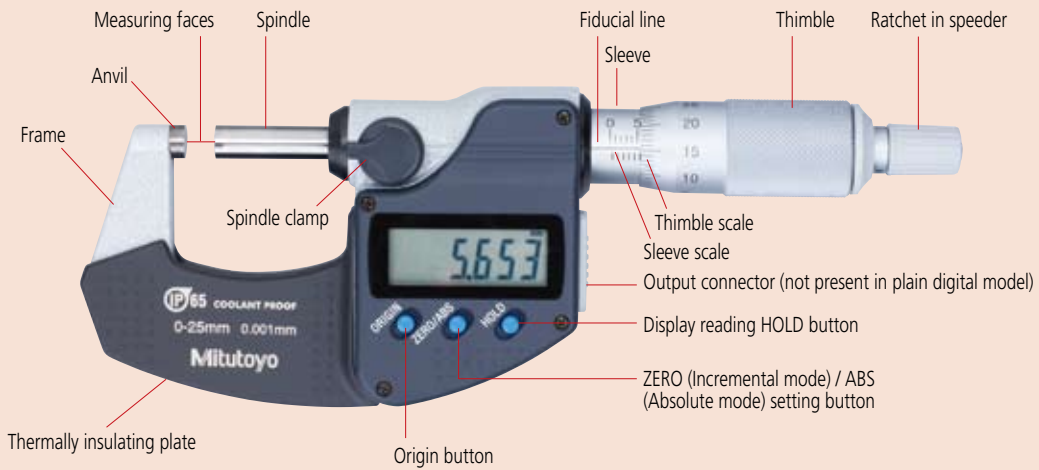
Micrometers

Nomenclature

Standard Analog Outside Micrometer

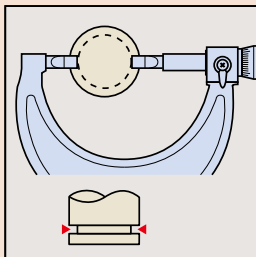


Digital Outside Micrometer



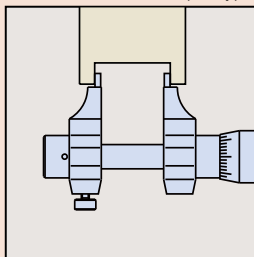
Special Purpose Micrometer Applications

Blade micrometer



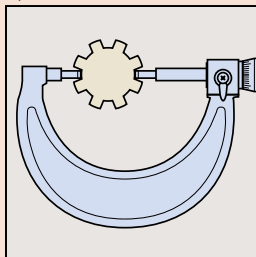
For inside diameter, and narrow groove measurement

Inside micrometer, caliper type



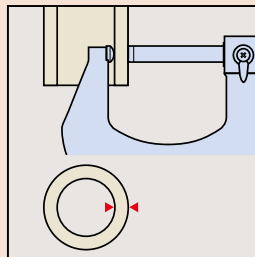
For small internal diameter, and groove width measurement

Spline micrometer



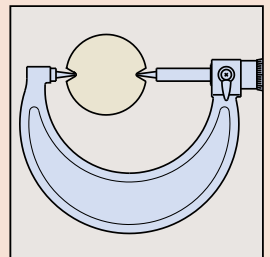
For splined shaft diameter measurement

Tube micrometer



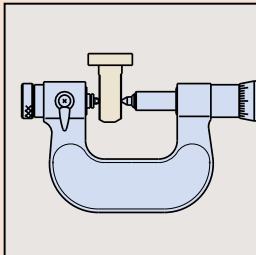
For pipe thickness measurement

Point micrometer



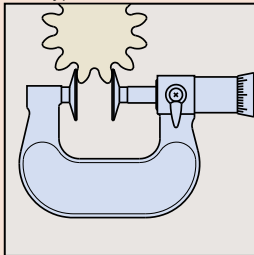
For root diameter measurement

Screw thread micrometer



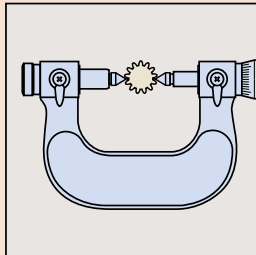
For effective thread diameter measurement

Disc type outside micrometer



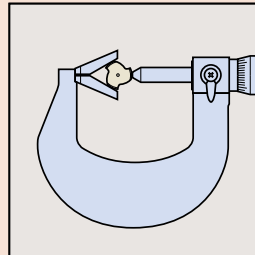
For root tangent measurement on spur gears and helical gears.

Ball tooth thickness micrometer



Measurement of gear over-pin diameter

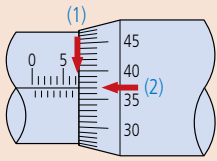
V-anvil micrometer



For measurement of 3- or 5-flute cutting tools

How to Read the Scale

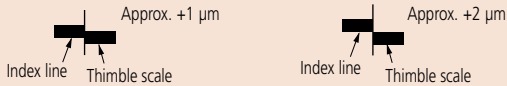
Micrometer with standard scale (graduation: 0.01 mm)



(1) Sleeve scale reading 7. mm
 (2) Thimble scale reading + .37 mm
 Micrometer reading 7.37 mm

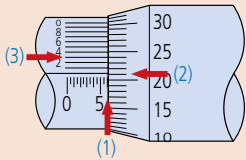
Note) 0.37 mm (2) is read at the position where the sleeve fiducial line is aligned to the thimble graduations.

The thimble scale can be read directly to 0.01 mm, as shown above, but may also be estimated to 0.001 mm when the lines are nearly coincident because the line thickness is 1/5 of the spacing between them.



Micrometer with vernier scale (graduation: 0.001 mm)

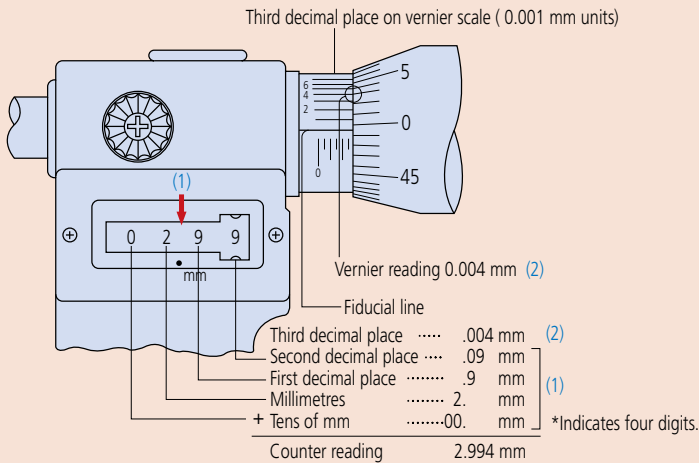
The vernier scale provided above the sleeve index line enables direct readings to be made to within 0.001 mm.



(1) Sleeve scale reading 6. mm
 (2) Thimble scale reading .21 mm
 (3) Reading from the vernier scale marking and thimble graduation line + .003 mm
 Micrometer reading 6.213 mm

Note) 0.21 mm (2) is read at the position where the index line is between two graduations (21 and 22 in this case). 0.003 mm (3) is read at the position where one of the vernier graduations aligns with one of the thimble graduations.

Micrometer with mechanical-digit display (digital step: 0.001 mm)

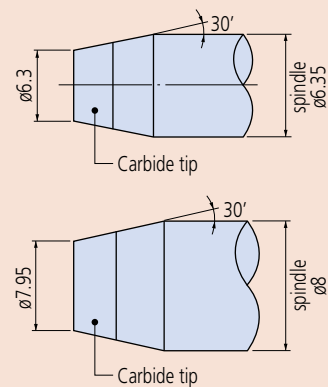


Note) 0.004 mm (2) is read at the position where a vernier graduation line corresponds with one of the thimble graduation lines.

Measuring Force Limiting Device

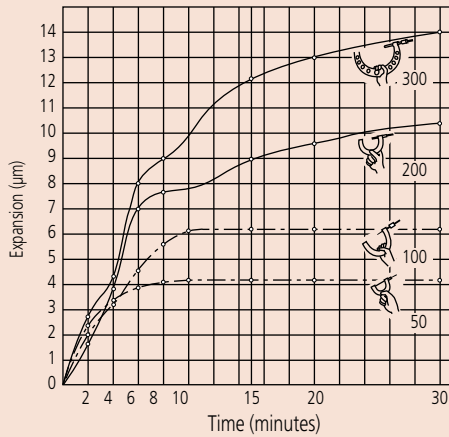
	Audible in operation	One-handed operation	Remarks
Ratchet stop	Yes	Unsuitable	Audible clicking operation causes micro-shocks
Friction thimble (F type)	No	Suitable	Smooth operation without shock or sound
Ratchet thimble	Yes	Suitable	Audible operation provides confirmation of constant measuring force

Measuring Face Detail



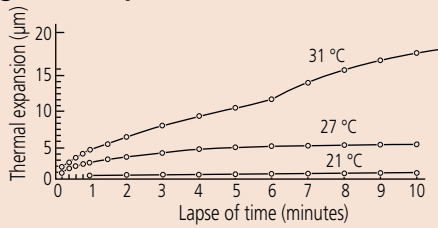
The drawings above are for illustration only and are not to scale

■ Micrometer Expansion due to Holding Frame with the Bare Hand



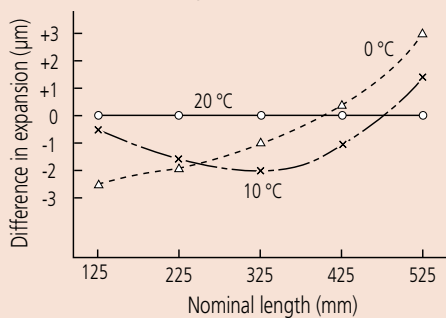
The above graph shows micrometer frame expansion due to heat transfer from hand to frame when the frame is held in the bare hand which, as can be seen, may result in a significant measurement error due to temperature-induced expansion. If the micrometer must be held by hand during measurement then try to minimize contact time. A heat insulator will reduce this effect considerably if fitted, or gloves may be worn. (Note that the above graph shows typical effects and is not guaranteed.)

■ Length Standard Expansion with Change of Temperature (for 200 mm bar initially at 20 °C)



The above experimental graph shows how a particular micrometer standard expanded with time as people whose hand temperatures were different (as shown) held the end of it at a room temperature of 20 °C. This graph shows that it is important not to set a micrometer while directly holding the micrometer standard but to make adjustments only while wearing gloves or lightly supporting the length standard by its heat insulators. When performing a measurement, note also that it takes time until the expanded micrometer standard returns to the original length. (Note that the graph values are not guaranteed values but experimental values.)

■ Difference in Thermal Expansion between Micrometer and Length Standard



In the above experiment, after the micrometer and its standard were left at a room temperature of 20 °C for about 24 hours for temperature stabilization, the start point was adjusted using the micrometer standard. Then, the micrometer with its standard were left at the temperatures of 0 °C and 10 °C for about the same period of time, and the start point was tested for shift. The above graph shows the results for each of the sizes from 125 through 525 mm at each temperature. This graph shows that both the micrometer and its standard must be left at the same location for at least several hours before adjusting the start point. (Note that the graph values are not guaranteed values but experimental values.)

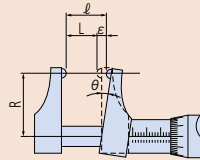
■ Effect of Changing Support Method and Orientation (Unit: µm)

Changing the support method and/or orientation of a micrometer after zero setting affects subsequent measuring results. The tables below highlight the measurement errors to be expected in three other cases after micrometers are zero-set in the 'Supported at the bottom and center' case. These actual results show that it is best to set and measure using the same orientation and support method.

Supporting method	Supported at the bottom and center	Supported only at the center
Attitude		
Maximum measuring length (mm)		
325	0	-5.5
425	0	-2.5
525	0	-5.5
625	0	-11.0
725	0	-9.5
825	0	-18.0
925	0	-22.5
1025	0	-26.0

Supporting method	Supported at the center in a lateral orientation.	Supported by hand downward.
Attitude		
Maximum measuring length (mm)		
325	+1.5	-4.5
425	+2.0	-10.5
525	-4.5	-10.0
625	0	-5.5
725	-9.5	-19.0
825	-5.0	-35.0
925	-14.0	-27.0
1025	-5.0	-40.0

■ Abbe's Principle



Abbe's principle states that "maximum accuracy is obtained when the scale and the measurement axes are common".

This is because any variation in the relative angle (θ) of the moving measuring jaw on an instrument, such as a caliper jaw micrometer, causes displacement that is not measured

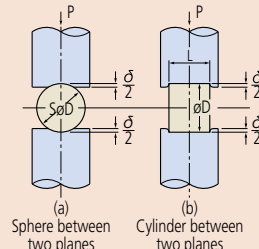
on the instrument's scale and this is an Abbe error ($\epsilon = l - L$ in the diagram). Spindle straightness error, play in the spindle guide or variation of measuring force can all cause (θ) to vary, and the error increases with R.

■ Hooke's Law

Hooke's law states that strain in an elastic material is proportional to the stress causing that strain, providing the strain remains within the elastic limit for that material.

■ Hertz's Formula

Hertz's formula give the apparent reduction in diameter of spheres and cylinders due to elastic compression when measured between plane surfaces. These formula are useful for determining the deformation of a workpiece caused by the measuring force in point and line contact situations.



Assuming that the material is steel and units are as follows:
 Modulus of elasticity: $E = 205 \text{ GPa}$
 Amount of deformation: δ (μm)
 Diameter of sphere or cylinder: D (mm)
 Length of cylinder: L (mm)
 Measuring force: P (N)
 a) Apparent reduction in diameter of sphere
 $\delta 1 = 0.82 \sqrt[3]{P^2/D}$
 b) Apparent reduction in diameter of cylinder
 $\delta 2 = 0.094 \cdot P/L \sqrt[3]{1/D}$

Major Measurement Errors of the Screw Micrometer

Error cause	Maximum possible error	Precautions for eliminating errors	Error that might not be eliminated even with precautions
Micrometer feed error	3 μm	1. Correct the micrometer before use.	±1 μm
Anvil angle error	±5 μm assuming the error of a half angle is 15 minutes	1. Measure the angle error and correct the micrometer. 2. Adjust the micrometer using the same thread gage as the workpiece.	±3 μm expected measurement error of half angle
Misaligned contact points	+10 μm		+3 μm
Influence of measuring force	±10 μm	1. Use a micrometer with a low measuring force if possible. 2. Always use the ratchet stop. 3. Adjust the micrometer using a thread gage with the same pitch.	+3 μm
Angle error of thread gage	±10 μm	1. Perform correction calculation (angle). 2. Correct the length error. 3. Adjust the micrometer using the same thread gage as the workpiece.	+3 μm
Length error of thread gage	$\pm\left(3+\frac{1}{25}\right)\mu\text{m}$	1. Perform correction calculation. 2. Adjust the micrometer using the same thread gage as the workpiece.	±1 μm
Workpiece thread angle error	JIS 2 grade error of half angle ±229 minutes -91 μm +71 μm	1. Minimize the angle error as much as possible. 2. Measure the angle error and perform correction calculation. 3. Use the three-wire method for a large angle error.	±8 μm assuming the error of half angle is ±23 minutes
Cumulative error	(±117+40) μm		+26 μm -12 μm

Screw Pitch Diameter Measurement

Three-wire method

The screw pitch diameter can be measured with the three-wire method as shown in the figure.

Calculate the pitch diameter (E) with equations (1) and (2).

Metric thread or unified screw (60°)

$$E = M - 3d + 0.866025P \quad \dots\dots(1)$$

Whitworth thread (55°)

$$E = M - 3.16568d + 0.960491P \quad \dots\dots(2)$$

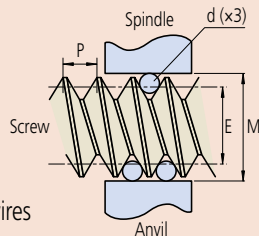
d = Wire diameter

E = Screw pitch diameter

M = Micrometer reading including three wires

P = Screw pitch

(Convert inches to millimeters for unified screws.)



Thread type	Optimal wire size at D
Metric thread or unified screw (60°)	0.577P
Whitworth thread (55°)	0.564P

Major Measurement Errors of the Three-wire Method

Error cause	Precautions for eliminating errors	Possible error	Error that might not be eliminated even with precautions
Pitch error (workpiece)	1. Correct the pitch error ($\delta p = \delta E$) 2. Measure several points and adopt their average. 3. Reduce single pitch errors.	±18 μm assuming that the pitch error is 0.02 mm.	±3 μm
Error of half angle (workpiece)	1. Use the optimal wire diameter. 2. No correction is needed.	±0.3 μm	±0.3 μm
Due to anvil difference	1. Use the optimal wire diameter. 2. Use the wire which has a diameter close to the average at the one wire side.	±8 μm	±1 μm
Wire diameter error	1. Use the predetermined measuring force appropriate for the pitch. 2. Use the predetermined width of measurement edge. 3. Use a stable measuring force.	-3 μm	-1 μm
Cumulative error		In the worst case +20 μm -35 μm	When measured carefully +3 μm -5 μm

One-wire method

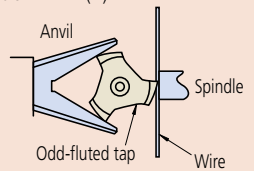
The pitch diameter of odd-fluted tap can be measured using the V-anvil micrometer with the one-wire method. Obtain the measured value (M₁) and calculate M with equation (3) or (4).

M₁ = Micrometer reading during one-wire measurement
D = Odd-fluted tap diameter

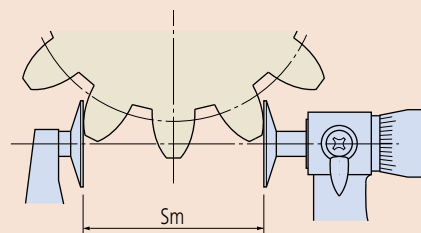
$$\text{Tap with three flutes : } M = 3M_1 - 2D \quad \dots\dots(3)$$

$$\text{Tap with five flutes : } M = 2.2360M_1 - 1.23606D \quad \dots\dots(4)$$

Then, assign the calculated M to equation (1) or (2) to calculate the pitch diameter (E).



Root Tangent Length



Formula for calculating a root tangent length (Sm):

$$S_m = m \cos \alpha_0 \{ \pi (Z_m - 0.5) + Z \text{ inv } \alpha_0 \} + 2Xm \sin \alpha_0$$

Formula for calculating the number of teeth within the root tangent length (Z_m):

$$Z_m' = Z \cdot K(f) + 0.5 \quad (Z_m \text{ is the integer closest to } Z_m')$$

$$\text{where, } K(f) = \frac{1}{\pi} \{ \sec \alpha_0 \sqrt{(1+2f)^2 - \cos^2 \alpha_0} - \cos^2 \alpha_0 - \text{inv } \alpha_0 - 2f \tan \alpha_0 \}$$

$$\text{and, } f = \frac{X}{Z}$$

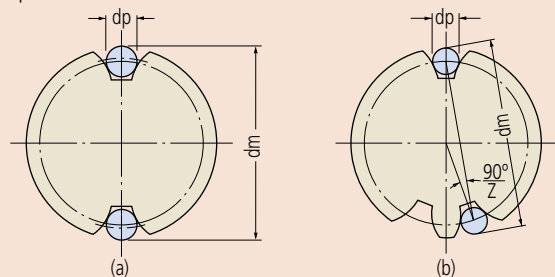
- m: Module
- α₀: Pressure angle
- Z: Number of teeth
- X: Addendum modification coefficient
- S_m: Root tangent length
- Z_m: Number of teeth within the root tangent length

$$\text{inv } 20^\circ \cong 0.014904$$

$$\text{inv } 14.5^\circ \cong 0.0055448$$

Gear Measurement

Over-pin method



For a gear with an even number of teeth:

$$d_m = dp + \frac{dg}{\cos \theta} = dp + \frac{Z \cdot m \cdot \cos \alpha_0}{\cos \theta}$$

For a gear with an odd number of teeth:

$$d_m = dp + \frac{dg}{\cos \theta} \cdot \cos \left(\frac{90^\circ}{Z} \right) = dp + \frac{Z \cdot m \cdot \cos \alpha_0}{\cos \theta} \cdot \cos \left(\frac{90^\circ}{Z} \right)$$

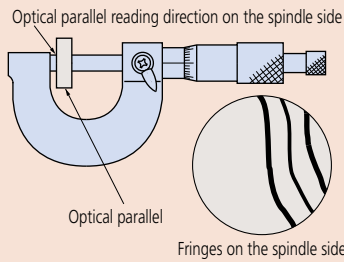
however,

$$\text{inv } \theta = \frac{dp}{dg} - \frac{X}{Z} = \frac{dp}{Z \cdot m \cdot \cos \alpha_0} - \left(\frac{\pi}{2Z} - \text{inv } \alpha_0 \right) + \frac{2 \tan \alpha_0}{Z} \cdot X$$

Obtain θ (invθ) from the involute function table.

- Z: Number of teeth
- α₀: Pressure angle teeth
- m: Module
- X: Addendum modification coefficient

■ Testing Parallelism of Micrometer Measuring Faces

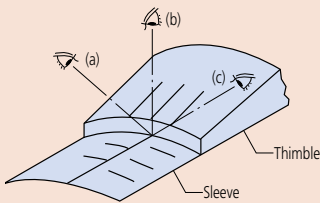


Parallelism can be estimated using an optical parallel held between the faces. First, wring the parallel to the anvil measuring face. Then close the spindle on the parallel using normal measuring force and count the number of red interference fringes seen on the measuring face of the spindle in white light. Each fringe represents a half wavelength difference in height ($0.32\ \mu\text{m}$ for red fringes).

In the above figure a parallelism of approximately $1\ \mu\text{m}$ is obtained from $0.32\ \mu\text{m} \times 3 = 0.96\ \mu\text{m}$.

■ General Notes on Using the Micrometer

- Carefully check the type, measuring range, accuracy, and other specifications to select the appropriate model for your application.
- Leave the micrometer and workpiece at room temperature long enough for their temperatures to equalize before making a measurement.
- Look directly at the fiducial line when taking a reading against the thimble graduations. If the graduation lines are viewed from an angle, the correct alignment position of the lines cannot be read due to parallax error.



(a) From above the index line



(b) Looking directly at the index line



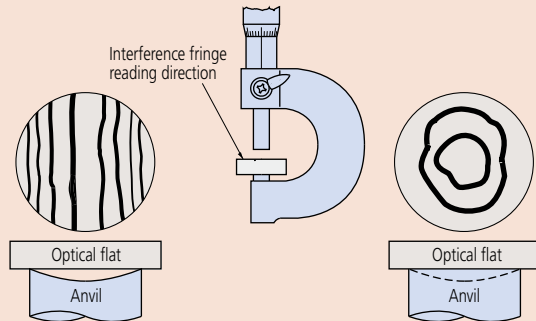
(c) From below the index line

- Wipe off the measuring faces of both the anvil and spindle with lint-free paper set the start (zero) point before measuring.



■ Testing Flatness of Micrometer Measuring Faces

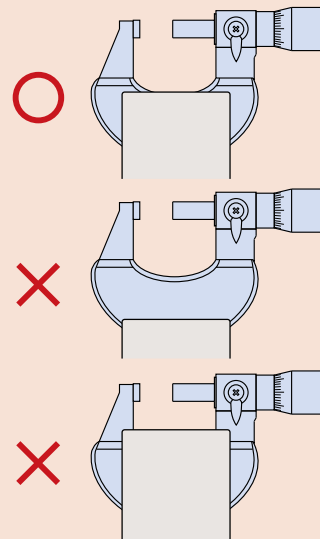
Flatness can be estimated using an optical flat (or parallel) held against a face. Count the number of red interference fringes seen on the measuring face in white light. Each fringe represents a half wavelength difference in height ($0.32\ \mu\text{m}$ for red).



Measuring face is curved by approximately $1.3\ \mu\text{m}$. ($0.32\ \mu\text{m} \times 4$ paired red fringes.)

Measuring face is concave (or convex) approximately $0.6\ \mu\text{m}$ deep. ($0.32\ \mu\text{m} \times 2$ continuous fringes)

- Wipe away any dust, chips and other debris from the circumference and measuring face of the spindle as part of daily maintenance. In addition, sufficiently wipe off any stains and fingerprints on each part with dry cloth.
- Use the constant-force device correctly so that measurements are performed with the correct measuring force.
- When attaching the micrometer onto a micrometer stand, the stand should clamp the center of the micrometer frame. Do not clamp it too tightly.



- Be careful not to drop or bump the micrometer on anything. Do not rotate the micrometer thimble using excessive force. If you believe a micrometer may have been damaged due to accidental mishandling, ensure that it is inspected for accuracy before further use.
- After a long storage period, or when there is no protective oil film visible, lightly apply anti-corrosion oil to the micrometer by wiping with a cloth soaked in it.
- Notes on storage:
 - Avoid storing the micrometer in direct sunlight.
 - Store the micrometer in a ventilated place with low humidity.
 - Store the micrometer in a place with little dust.
 - Store the micrometer in a case or other container, which should not be kept on the floor.
 - When storing the micrometer, always leave a gap of 0.1 to $1\ \text{mm}$ between the measuring faces.
 - Do not store the micrometer in a clamped state.

■ Micrometer Performance Evaluation Method

JIS B 7502 was revised and issued in 2016 as the Japanese Industrial Standards of the micrometer, and the "Instrumental error" indicating the indication error of the micrometer has been changed to "Maximum Permissible Error (MPE) of indication".

The "Instrumental error" of the old JIS adopts acceptance criteria that the specification range (precision specification) equals acceptance range, and the OK/NG judgment does not include measurement uncertainty (Fig.1).

The "Maximum Permissible Error (MPE) of indication" of the new JIS employs the basic concept of the OK/NG judgment taking into account the uncertainty adopted in the ISO standard (ISO 14253-1).

The verification of conformity and nonconformity to the specifications is clearly stipulated to use the internationally recognized acceptance criteria (simple acceptance) when the specification range equals the acceptance range, and it is accepted that the specification range equals the acceptance range if a given condition considering uncertainty is met.

The above said internationally recognized acceptance criterion is ISO/TR14253-6:2012 (fig.2).

The following describes the standard inspection method including the revised content of JIS 2016.

Fig. 1 Conventional JIS Instrumental error
JIS B 7502-1994

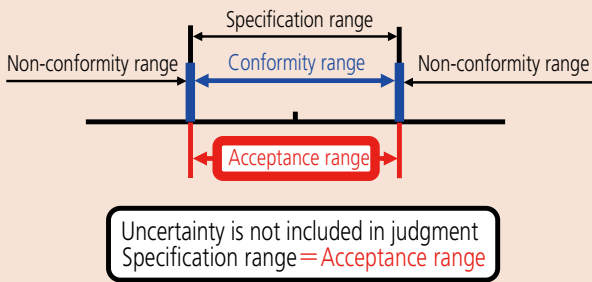
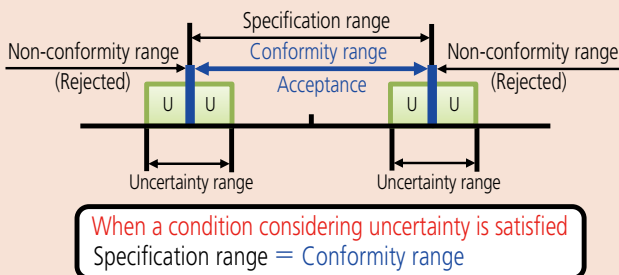


Fig. 2 New JIS Maximum Permissible Error (MPE)
JIS B 7502: 2016 (ISO/TR 14253- 6:2012)



■ Maximum Permissible Error of total measuring surface contact error J_{MPE} [JIS B 7502:2016]

The total measuring surface contact error of the outside micrometer is an indication error measured by contacting the entire measuring surface with the object to be measured at an arbitrary point in the measuring range.

Table 1 shows the Maximum Permissible Error of total measuring surface contact error J_{MPE} .

The value can be obtained by adjusting the reference point using a constant pressure device with the minimum measuring length of the micrometer, inserting a grade 0 or 1 gage block prescribed in JIS B 7506 or an equivalent or higher gage between the measuring surfaces (Fig. 3), and then subtracting the dimensions of the gage block from the indication value of the micrometer using a constant pressure device.

Unit: μm	
Measuring range (mm)	Outside micrometer
0 to 25	± 2
25 to 50	

Table 1: Maximum Permissible Error of total measuring surface contact error J_{MPE}

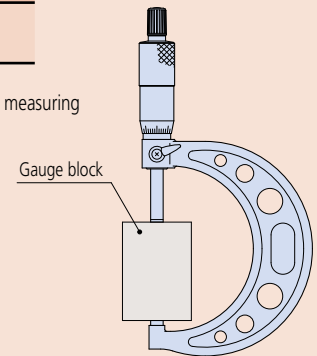


Fig. 3: Measurement of total measuring surface contact error

"Instrumental error" of JIS expressing the indication error was changed to "Maximum Permissible Error (MPE) of indication" in the following four models.

- Series 102 Standard Outside Micrometer refer to B-13 (102-301, 102-302)
- Series 103 Standard Outside Micrometer refer to B-15 (103-137, 103-138)