

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — for Small Holes

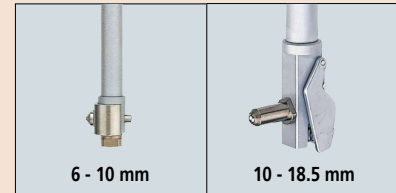
- These gages are designed to measure the diameters of very small holes.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to page C-47)



511-201

Note: The dial indicator and protection cover are optional.

Contact Points



Technical Data

- Accuracy: Metric models: 5 μ m
Inch models: 0.0002 in
- Repeatability: Metric models: 2 μ m
Inch models: 0.00008 in
- Adjacent error: Metric models: 2 μ m
Inch models: 0.00008 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000**
(See page C-45)

Recommended Digimatic Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
 - Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

SPECIFICATIONS

Metric

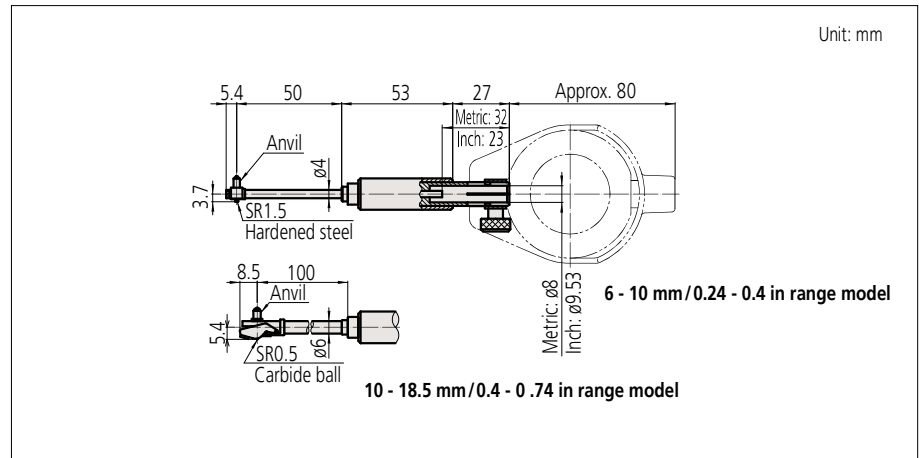
Order No.	Range (mm)	Stroke of contact point (mm)	Measuring force (N)	Guide force (N)	Content of set					Probing depth (mm)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	
511-209	6 - 10	0.5	2 or less	—	511-209	Not supplied	Not supplied	9 pcs.	Not supplied	50
511-201	10 - 18.5	0.6		6 or less	511-201					100
511-210	6 - 10	0.5	2 or less	—	511-209	2109SB-10 (Graduation: 0.001 mm)	21DZA000	9 pcs.	Not supplied	50
511-203	10 - 18.5	0.6		6 or less	511-201					100
511-211	6 - 10	0.5	2 or less	—	511-209	2046SB (Graduation: 0.01 mm)	21DZA000	9 pcs.	Not supplied	50
511-204	10 - 18.5	0.6		6 or less	511-201					100

Inch

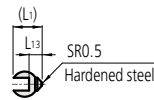
Order No.	Range (in)	Stroke of contact point (in)	Measuring force (N)	Guide force (N)	Content of set					Probing depth (in)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	
511-214	0.24 - 0.4	0.020	2 or less	—	511-214	Not supplied	Not supplied	9 pcs.	Not supplied	2
511-205	0.4 - 0.74	0.024		6 or less	511-205					4
511-212	0.24 - 0.4	0.020	2 or less	—	511-214	2923SB-10 (Graduation: 0.0001 in)	21DZA000	9 pcs.	Not supplied	2
511-206	0.4 - 0.74	0.024		6 or less	511-205					4
511-213	0.24 - 0.4	0.020	2 or less	—	511-214	2922SB (Graduation: 0.0005 in)	21DZA000	9 pcs.	Not supplied	2
511-207	0.4 - 0.74	0.024		6 or less	511-205					4



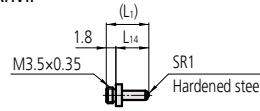
DIMENSIONS



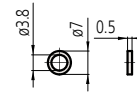
511-209/511-214
Anvil



511-201/511-205
Anvil



Interchangeable washer
(Supplied only with 511-201/511-205)



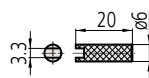
204355

STANDARD ACCESSORIES

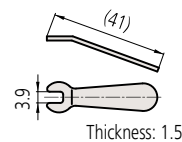
Bore gage (Main body)	Anvil					Interchangeable Washer	Spanner
	Marked No.	Order No.	Indication of measuring size	L ₁	L ₁₃	Order No.	Order No.
511-209 511-214	1	952168	6.0 mm/0.24 in	4.7	1.2	Not supplied	206709
	2	952169	6.5 mm/0.26 in	5.3	1.7		
	3	952170	7.0 mm/0.28 in	5.8	2.2		
	4	952414	7.5 mm/0.30 in	6.3	2.7		
	5	952415	8.0 mm/0.32 in	6.8	3.2		
	6	952416	8.5 mm/0.34 in	7.3	3.7		
	7	952417	9.0 mm/0.36 in	7.8	4.2		
	8	952418	9.5 mm/0.38 in	8.3	4.7		
	9	952419	10.0 mm/0.40 in	8.8	5.2		

Bore gage (Main body)	Anvil					Interchangeable Washer	Spanner
	Marked No.	Order No.	Indication of measuring size	L ₁	L ₁₄	Order No.	Order No.
511-201 511-205	1	204356	10 mm/0.40 in	3.8	2	204355	204354
	2	204357	11 mm/0.44 in	4.8	3		
	3	204358	12 mm/0.48 in	5.8	4		
	4	204359	13 mm/0.52 in	6.8	5		
	5	204360	14 mm/0.56 in	7.8	6		
	6	204361	15 mm/0.60 in	8.8	7		
	7	204362	16 mm/0.64 in	9.8	8		
	8	204363	17 mm/0.68 in	10.8	9		
	9	204364	18 mm/0.72 in	11.8	10		

Spanner
206709



204354



Unit: mm

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511

- Longer plunger stroke with no effect on accuracy.
- Carbide is used for the contact point ensuring high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-702



511-703

Note: The dial indicator and the protection cover are optional.

SPECIFICATIONS

Metric

Order No.	Range (mm)	Stroke of contact point (mm)	Measuring force (N)	Guide force (N)	Content of set							Probing depth (mm)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-701	18 - 35	1.2	4 or less	6 or less	511-701	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-702	35 - 60				511-702			6 pcs.				
511-703	50 - 150	1.6	5 or less	10 or less	511-703	Not supplied	Not supplied	11 pcs.	4 pcs.	1 pc.	Not supplied	150
511-704	100 - 160				511-704			13 pcs.				
511-705	160 - 250		6 or less	15 or less	511-705			6 pcs.	7 pcs.	1 pc.		250
511-706	250 - 400				511-706			5 pcs.				
511-721	18 - 35	1.2	4 or less	6 or less	511-701	2109SB-10 (Graduation: 0.001 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-722	35 - 60				511-702			6 pcs.				
511-723	50 - 150	1.6	5 or less	10 or less	511-703	2046SB (Graduation: 0.01 mm)	21DZA000	11 pcs.	4 pcs.	1 pc.	Not supplied	150
511-724	100 - 160				511-704			13 pcs.				
511-725	160 - 250		6 or less	15 or less	511-705			6 pcs.	7 pcs.	1 pc.		250
511-726	250 - 400				511-706			5 pcs.				
511-711	18 - 35	1.2	4 or less	6 or less	511-701	2046SB (Graduation: 0.01 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-712	35 - 60				511-702			6 pcs.				
511-713	50 - 150	1.6	5 or less	10 or less	511-703	2046SB (Graduation: 0.01 mm)	21DZA000	11 pcs.	4 pcs.	1 pc.	Not supplied	150
511-714	100 - 160				511-704			13 pcs.				
511-715	160 - 250		6 or less	15 or less	511-705			6 pcs.	7 pcs.	1 pc.		250
511-716	250 - 400				511-706			5 pcs.				
511-921	18 - 150	—	—	—	511-701	2046SB	21DZA000	—	—	—	—	—
511-922					511-702	2109SB-10						
511-925-10					511-703	543-310B						

Inch

Order No.	Range (in)	Stroke of contact point (in)	Measuring force (N)	Guide force (N)	Content of set							Probing depth (in)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-731	0.7 - 1.4	0.047	4 or less	6 or less	511-731	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-732	1.4 - 2.5				511-732			6 pcs.				
511-733	2.0 - 6.0	0.063	5 or less	10 or less	511-733	Not supplied	Not supplied	11 pcs.	4 pcs.	1 pc.	Not supplied	6
511-734	4.0 - 6.5				511-734			13 pcs.				
511-735	6.5 - 10.0		6 or less	15 or less	511-735			6 pcs.	7 pcs.	1 pc.		10
511-736	10.0 - 16.0				511-736			5 pcs.				
511-751	0.7 - 1.4	0.047	4 or less	6 or less	511-731	2923SB-10 (Graduation: 0.0001 in)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-752	1.4 - 2.5				511-732			6 pcs.				
511-753	2.0 - 6.0	0.063	5 or less	10 or less	511-733	2923SB-10 (Graduation: 0.0001 in)	21DZA000	11 pcs.	4 pcs.	1 pc.	Not supplied	6
511-754	4.0 - 6.5				511-734			13 pcs.				
511-755	6.5 - 10.0		6 or less	15 or less	511-735			6 pcs.	7 pcs.	1 pc.		10
511-756	10.0 - 16.0				511-736			5 pcs.				
511-741	0.7 - 1.4	0.047	4 or less	6 or less	511-731	2922SB (Graduation: 0.0005 in)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-742	1.4 - 2.5				511-732			6 pcs.				
511-743	2.0 - 6.0	0.063	5 or less	10 or less	511-733	2922SB (Graduation: 0.0005 in)	21DZA000	11 pcs.	4 pcs.	1 pc.	Not supplied	6
511-744	4.0 - 6.5				511-734			13 pcs.				
511-745	6.5 - 10.0		6 or less	15 or less	511-735			6 pcs.	7 pcs.	1 pc.		10
511-746	10.0 - 16.0				511-736			5 pcs.				
511-931	0.7 - 6.0	—	—	—	511-731	2922SB	21DZA000	—	—	—	—	—
511-932					511-732	2923SB-10						
511-935-10					511-733	543-312B						

Note 1: A 50 mm sub-anvil is supplied with 511-703, and a 75 mm sub-anvil is supplied with 511-706.

Note 2: A 2 in sub-anvil is supplied with 511-733, and a 3 in sub-anvil is supplied with 511-736.

Note 3: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Anvil

A carbide ball is used for the contact point. It is more abrasion resistant than a hardened steel ball and, as its surface is smoother than that of a carbide tip, the workpiece is less liable to be marked.

Comparison of abrasion resistance

Hardened steel ball (conventional model)

Carbide ball (current model)



Abrasion depth: 0.1 mm
750 HV or more

Abrasion depth: 0.001 mm
1350 HV or more

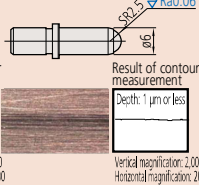
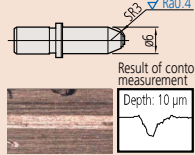
Inspection method

- Load a 0.5 N weight on the anvil, and slide for 1,000 m on abrasive paper of 9 μm (#2000) particle size.

Comparison of marks on the workpiece

Carbide tip (conventional model)

Carbide ball (current model)



Inspection method

- Load a 4 N weight on the anvil, and slide on the aluminum plate back and forth for 20 times.



The grip is highly resistant to heat transfer from the operator's hand.

Technical Data

- Accuracy: Metric models 2 μm
Inch models 0.00008 in
- Repeatability: Metric models 0.5 μm
Inch models 0.00002 in
- Adjacent error: Metric models 1 μm
Inch models 0.00004 in

Optional Accessories

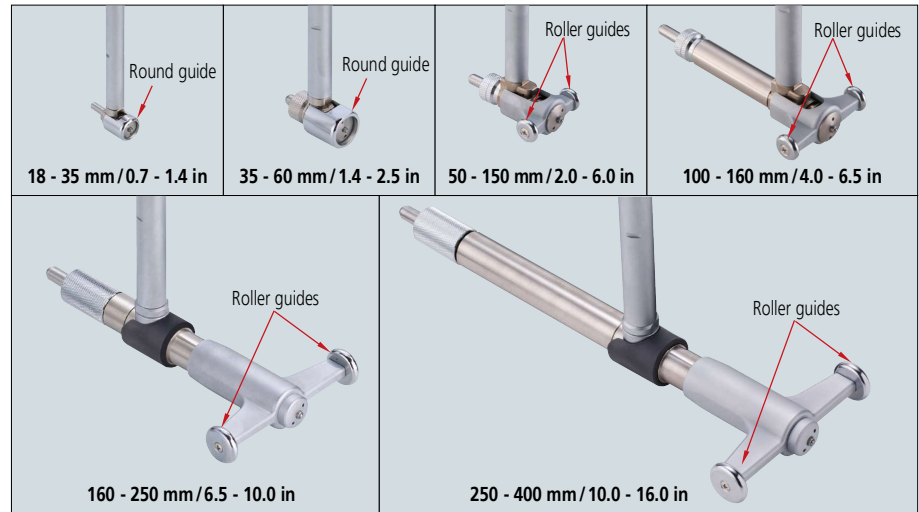
- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

Recommended Dial Indicators (see Chapter F)

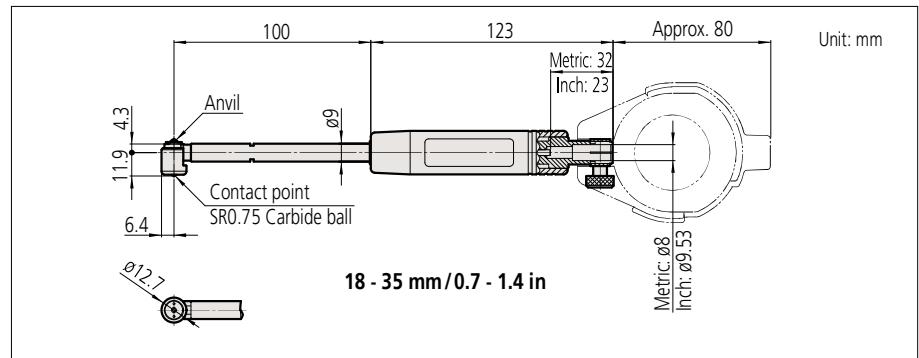
- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Note: Indicators equipped with rubber bellows, such as waterproof types, cannot be used.

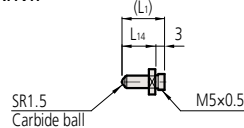
Contact Points



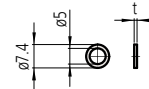
DIMENSIONS



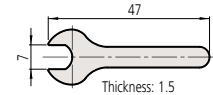
Anvil



Interchangeable washer



Spanner 102148



STANDARD ACCESSORIES

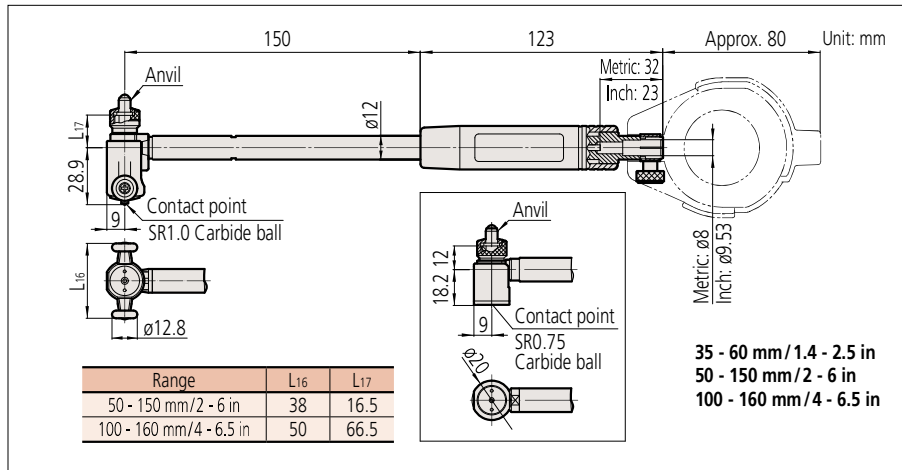
Bore gage (Main body)	Anvil					Interchangeable washer		Spanner
	Marked No.	Order No.	Indication of measuring size	L1	L14	Order No.	t	Order No.
511-701 511-731	1	21DZA213A	18 mm/0.71 in	5.5	2.5	205623 205624	0.5 mm/0.02 in 1.0 mm/0.04 in	102148
	2	21DZA213B	20 mm/0.79 in	7.5	4.5			
	3	21DZA213C	22 mm/0.87 in	9.5	6.5			
	4	21DZA213D	24 mm/0.94 in	11.5	8.5			
	5	21DZA213E	26 mm/1.02 in	13.5	10.5			
	6	21DZA213F	28 mm/1.10 in	15.5	12.5			
	7	21DZA213G	30 mm/1.18 in	17.5	14.5			
	8	21DZA213H	32 mm/1.26 in	19.5	16.5			
	9	21DZA213J	34 mm/1.34 in	21.5	18.5			

Bore Gages

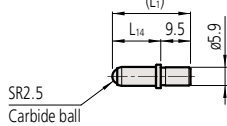
For easy and accurate measurement of inside diameters

Bore Gages SERIES 511

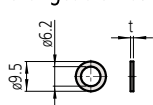
DIMENSIONS



Anvil

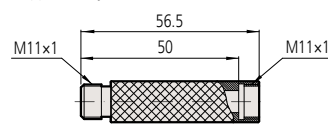


Interchangeable washer



Sub-anvil

(Supplied only for 511-703 / 733)



102178

Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

Bore gage (Main body)	Anvil					Interchangeable washer		Sub-Anvil
	Marked No.	Order No.	Indication of measuring size	L1	L14	Order No.	t	Order No.
511-702 511-732	1	21DZA232A	35 mm / 1.38 in	15	5.5	205457 205458 205459 205460	0.5 mm / 0.02 in 1.0 mm / 0.04 in 2.0 mm / 0.08 in 3.0 mm / 0.12 in	102178 (50 mm / 2 in)
	2	21DZA232B	40 mm / 1.57 in	20	10.5			
	3	21DZA232C	45 mm / 1.77 in	25	15.5			
	4	21DZA232D	50 mm / 1.97 in	30	20.5			
	5	21DZA232E	55 mm / 2.17 in	35	25.5			
	6	21DZA232F	60 mm / 2.36 in	40	30.5			
511-703 511-733 () Using 50 mm / 2 in Sub-Anvil	1	21DZA232A	50 mm (100 mm) / 1.97 in (3.94 in)	15	5.5			
	2	21DZA232B	55 mm (105 mm) / 2.17 in (4.13 in)	20	10.5			
	3	21DZA232C	60 mm (110 mm) / 2.36 in (4.33 in)	25	15.5			
	4	21DZA232D	65 mm (115 mm) / 2.55 in (4.53 in)	30	20.5			
	5	21DZA232E	70 mm (120 mm) / 2.74 in (4.72 in)	35	25.5			
	6	21DZA232F	75 mm (125 mm) / 2.93 in (4.92 in)	40	30.5			
	7	21DZA232G	80 mm (130 mm) / 3.12 in (5.12 in)	45	35.5			
	8	21DZA232H	85 mm (135 mm) / 3.31 in (5.31 in)	50	40.5			
	9	21DZA232J	90 mm (140 mm) / 3.50 in (5.51 in)	55	45.5			
	10	21DZA232L	95 mm (145 mm) / 3.69 in (5.71 in)	60	50.5			
	11	21DZA232M	100 mm (150 mm) / 3.88 in (5.91 in)	65	55.5			
511-704 511-734	1	21DZA232A	100 mm / 3.94 in	15	5.5			
	2	21DZA232B	105 mm / 4.13 in	20	10.5			
	3	21DZA232C	110 mm / 4.33 in	25	15.5			
	4	21DZA232D	115 mm / 4.53 in	30	20.5			
	5	21DZA232E	120 mm / 4.72 in	35	25.5			
	6	21DZA232F	125 mm / 4.92 in	40	30.5			
	7	21DZA232G	130 mm / 5.12 in	45	35.5			
	8	21DZA232H	135 mm / 5.31 in	50	40.5			
	9	21DZA232J	140 mm / 5.51 in	55	45.5			
	10	21DZA232L	145 mm / 5.71 in	60	50.5			
	11	21DZA232M	150 mm / 5.91 in	65	55.5			
	12	21DZA232N	155 mm / 6.10 in	70	60.5			
	13	21DZA232P	160 mm / 6.30 in	75	65.5			

Recommended Digimatic Indicators (see Chapter F)

- Metric models: 543-310B (ID-C112GXB: 0.001 mm)
- Inch models: 543-312B (ID-C112GEXB: 0.001 mm / 0.00005 in)



- The ID measurement can be performed easily since the minimum value is detected automatically.
 - Up to three combinations of master value and tolerance value can be set.
 - Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected).
- Refer to page F-14 for details.

Bore Gage Checker

515-590

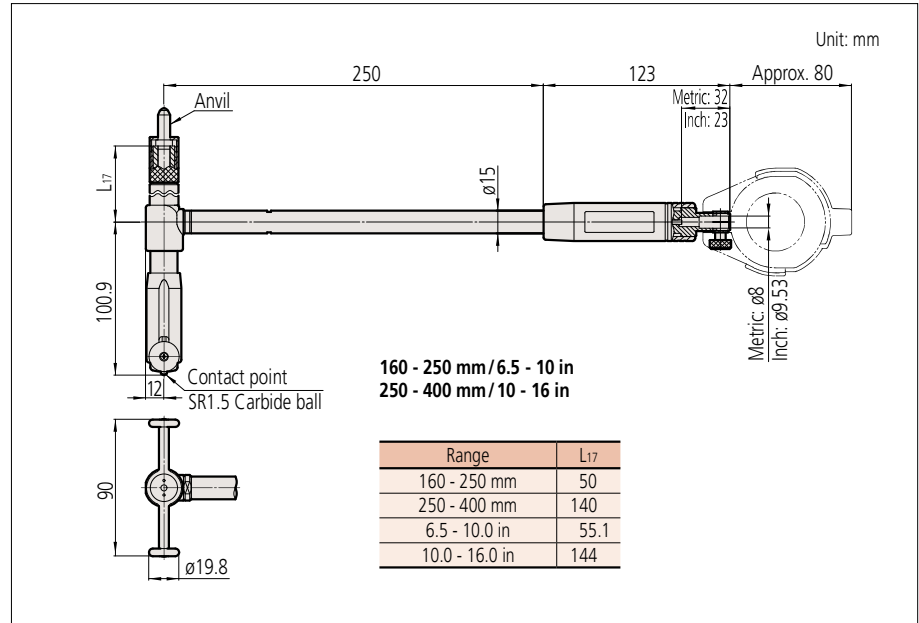
- The Bore Gage Checker allows easy setting of dial bore gages with ranges of 18 mm (0.7 in) through 400 mm (16 in) using gauge blocks.
- Refer to page C-46 for details.



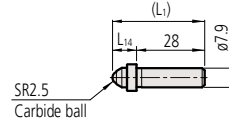
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Standard configuration: Stand, Attachment A, B, C 1 pc. for each, Parallel Jaw (2 pcs.)

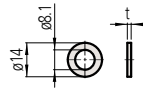
DIMENSIONS



Anvil

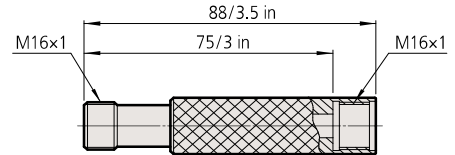


Interchangeable washer



Sub-anvil

Supplied only for **511-706 (202974)** and **511-736 (202975)**



202974 (511-706)
202975 (511-736)

Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

Bore gage (Main body)	Anvil					Interchangeable washer		Sub-Anvil
	Marked No.	Order No.	Indication of measuring size	L ₁	L ₁₄	Order No.	t	Order No.
511-705 511-735	1	21DZA241A	160 mm/6.50 in	38	10	205467 205461 205462 205463 205464 205465 205466	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in 4.0 mm/0.16 in 5.0 mm/0.20 in 6.0 mm/0.24 in	Metric: 202974 (75 mm) Inch: 202975 (3.0 in)
	2	21DZA241B	175 mm/7.09 in	53	25			
	3	21DZA241C	190 mm/7.68 in	68	40			
	4	21DZA241D	205 mm/8.27 in	83	55			
	5	21DZA241E	220 mm/8.86 in	98	70			
	6	21DZA241F	235 mm/9.45 in	113	85			
511-706 511-736 () Using 75 mm/3 in Sub-Anvil	1	21DZA241A	250 mm (325 mm)/10.00 in (13.00 in)	38	10	205467 205461 205462 205463 205464 205465 205466	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in 4.0 mm/0.16 in 5.0 mm/0.20 in 6.0 mm/0.24 in	Metric: 202974 (75 mm) Inch: 202975 (3.0 in)
	2	21DZA241B	265 mm (340 mm)/10.59 in (13.59 in)	53	25			
	3	21DZA241C	280 mm (355 mm)/11.18 in (14.18 in)	68	40			
	4	21DZA241D	295 mm (370 mm)/11.77 in (14.77 in)	83	55			
	5	21DZA241E	310 mm (385 mm)/12.36 in (15.36 in)	98	70			

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages

SERIES 511 — Short Leg Type

- Compact and lightweight due to the short length below the grip.
- Longer plunger stroke with no effect on accuracy.
- Carbide contact point ensures high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by approx. 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-761



511-762



511-763



511-761

Note: The dial indicator and the protection cover are optional.



511-763

Note: The dial indicator and the protection cover are optional.



Technical Data

- Accuracy: Metric models 2 μ m
Inch models 0.00008 in
- Repeatability: Metric models 0.5 μ m
Inch models 0.00002 in
- Adjacent error: Metric models 1 μ m
Inch models 0.00004 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

SPECIFICATIONS

Order No.	Range (mm)	Stroke of contact point (mm)	Measuring force (N)	Guide force (N)	Content of set							Probing depth (mm)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-761	18 - 35	1.2	4 or less	6 or less	511-761	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	50
511-762	35 - 60				511-762			6 pcs.			4 pcs.	
511-763	50 - 150	1.6	5 or less	10 or less	511-763	2109SB-10 (Graduation: 0.001 mm)	21DZA000	11 pcs.	4 pcs.	1 pc.		Not supplied
511-764	100 - 160				511-764			13 pcs.			2 pcs.	
511-771	18 - 35	1.2	4 or less	6 or less	511-761	2109SB-10 (Graduation: 0.001 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied		1 pc.
511-772	35 - 60				511-762			6 pcs.			4 pcs.	1 pc.
511-773	50 - 150	1.6	5 or less	10 or less	511-763	2046SB (Graduation: 0.01 mm)	21DZA000	11 pcs.	4 pcs.	1 pc.		
511-774	100 - 160				511-764			13 pcs.			2 pcs.	Not supplied
511-766	18 - 35	1.2	4 or less	6 or less	511-761	2109SB-10 (Graduation: 0.001 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied		
511-767	35 - 60				511-762			6 pcs.			4 pcs.	1 pc.
511-768	50 - 150	1.6	5 or less	10 or less	511-763	2046SB (Graduation: 0.01 mm)	21DZA000	11 pcs.	4 pcs.	1 pc.		
511-769	100 - 160				511-764			13 pcs.			2 pcs.	Not supplied

Order No.	Range (in)	Stroke of contact point (in)	Measuring force (N)	Guide force (N)	Content of set							Probing depth (in)
					Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-781	0.7 - 1.4	0.047	4 or less	6 or less	511-781	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	2
511-782	1.4 - 2.5				511-782			6 pcs.			4 pcs.	
511-783	2.0 - 6.0	0.063	5 or less	10 or less	511-783	2923SB-10 (Graduation: 0.0001 in)	21DZA000	11 pcs.	4 pcs.	1 pc.		Not supplied
511-784	4.0 - 6.5				511-784			13 pcs.			2 pcs.	
511-791	0.7 - 1.4	0.047	4 or less	6 or less	511-781	2923SB-10 (Graduation: 0.0001 in)	21DZA000	9 pcs.	2 pcs.	Not supplied		1 pc.
511-792	1.4 - 2.5				511-782			6 pcs.			4 pcs.	1 pc.
511-793	2.0 - 6.0	0.063	5 or less	10 or less	511-783	2922SB (Graduation: 0.0005 in)	21DZA000	11 pcs.	4 pcs.	1 pc.		
511-794	4.0 - 6.5				511-784			13 pcs.			2 pcs.	Not supplied
511-786	0.7 - 1.4	0.047	4 or less	6 or less	511-781	2922SB (Graduation: 0.0005 in)	21DZA000	9 pcs.	2 pcs.	Not supplied		
511-787	1.4 - 2.5				511-782			6 pcs.			4 pcs.	1 pc.
511-788	2.0 - 6.0	0.063	5 or less	10 or less	511-783	2922SB (Graduation: 0.0005 in)	21DZA000	11 pcs.	4 pcs.	1 pc.		
511-789	4.0 - 6.5				511-784			13 pcs.			2 pcs.	Not supplied

Note 1: A 50 mm sub-anvil is supplied with 511-763.

Note 2: A 2 in sub-anvil is supplied with 511-783.

Note 3: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

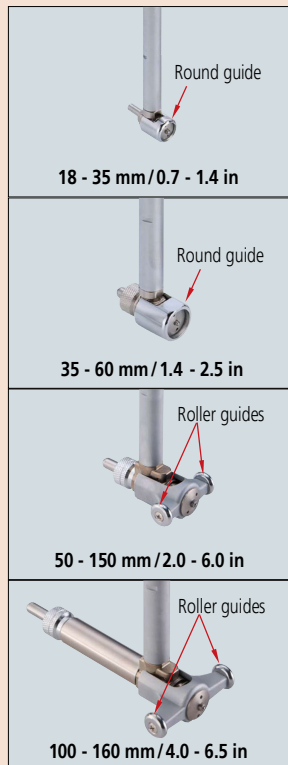
Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B** (ID-C112GXB: 0.001 mm)
- Inch models: **543-312B** (ID-C112GEXB: 0.001 mm/0.00005 in)

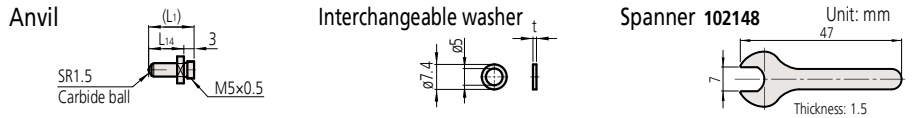
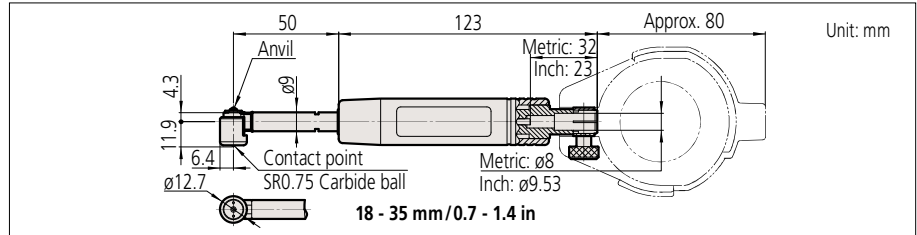


- The ID measurement can be performed easily since the minimum value is detected automatically.
- Up to three combinations of master value and tolerance value can be set.
- Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected). Refer to page F-14 for details.

Contact Points



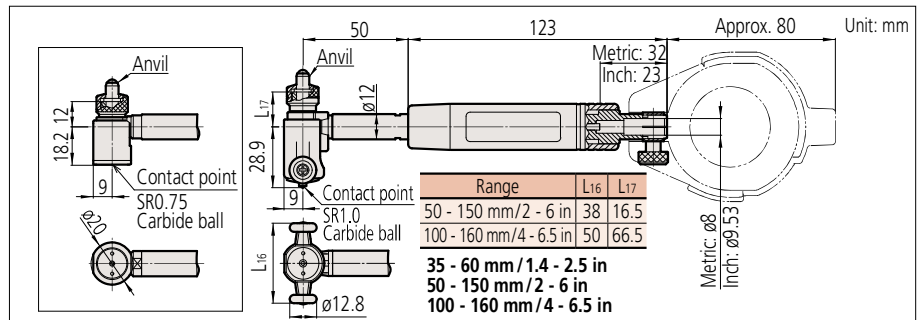
DIMENSIONS



STANDARD ACCESSORIES

Bore gage (Main body)	Anvil					Interchangeable washer		Spanner 102148
	Marked No.	Order No.	Indication of measuring size	L ₁	L ₁₄	Order No.	t	
511-761 511-781	1	21DZA213A	18 mm/0.71 in	5.5 mm/0.22 in	2.5 mm/0.10 in	205623 205624	0.5 mm/0.02 in 1.0 mm/0.04 in	102148
	2	21DZA213B	20 mm/0.79 in	7.5 mm/0.30 in	4.5 mm/0.18 in			
	3	21DZA213C	22 mm/0.87 in	9.5 mm/0.37 in	6.5 mm/0.26 in			
	4	21DZA213D	24 mm/0.94 in	11.5 mm/0.45 in	8.5 mm/0.33 in			
	5	21DZA213E	26 mm/1.02 in	13.5 mm/0.53 in	10.5 mm/0.41 in			
	6	21DZA213F	28 mm/1.10 in	15.5 mm/0.61 in	12.5 mm/0.49 in			
	7	21DZA213G	30 mm/1.18 in	17.5 mm/0.69 in	14.5 mm/0.57 in			
	8	21DZA213H	32 mm/1.26 in	19.5 mm/0.77 in	16.5 mm/0.65 in			
	9	21DZA213J	34 mm/1.34 in	21.5 mm/0.85 in	18.5 mm/0.73 in			

DIMENSIONS



Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

STANDARD ACCESSORIES

Bore gage (Main body)	Anvil					Interchangeable washer		Sub-Anvil
	Marked No.	Order No.	Indication of measuring size	L ₁	L ₁₄	Order No.	t	
511-762 511-782	1	21DZA232A	35 mm/1.38 in	15	5.5	205457 205458 205459 205460	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in	102178 (50 mm/2 in)
	2	21DZA232B	40 mm/1.57 in	20	10.5			
	3	21DZA232C	45 mm/1.77 in	25	15.5			
	4	21DZA232D	50 mm/1.97 in	30	20.5			
	5	21DZA232E	55 mm/2.17 in	35	25.5			
	6	21DZA232F	60 mm/2.36 in	40	30.5			
511-763 511-783 () Using 50 mm/2 in Sub-Anvil	1	21DZA232A	50 mm (100 mm)/1.97 in (3.94 in)	15	5.5			
	2	21DZA232B	55 mm (105 mm)/2.17 in (4.13 in)	20	10.5			
	3	21DZA232C	60 mm (110 mm)/2.36 in (4.33 in)	25	15.5			
	4	21DZA232D	65 mm (115 mm)/2.55 in (4.53 in)	30	20.5			
	5	21DZA232E	70 mm (120 mm)/2.74 in (4.72 in)	35	25.5			
	6	21DZA232F	75 mm (125 mm)/2.93 in (4.92 in)	40	30.5			
	7	21DZA232G	80 mm (130 mm)/3.12 in (5.12 in)	45	35.5			
	8	21DZA232H	85 mm (135 mm)/3.31 in (5.31 in)	50	40.5			
	9	21DZA232J	90 mm (140 mm)/3.50 in (5.51 in)	55	45.5			
	10	21DZA232L	95 mm (145 mm)/3.69 in (5.71 in)	60	50.5			
	11	21DZA232M	100 mm (150 mm)/3.88 in (5.91 in)	65	55.5			
511-764 511-784	1	21DZA232A	100 mm/3.94 in	15	5.5			
	2	21DZA232B	105 mm/4.13 in	20	10.5			
	3	21DZA232C	110 mm/4.33 in	25	15.5			
	4	21DZA232D	115 mm/4.53 in	30	20.5			
	5	21DZA232E	120 mm/4.72 in	35	25.5			
	6	21DZA232F	125 mm/4.92 in	40	30.5			
	7	21DZA232G	130 mm/5.12 in	45	35.5			
	8	21DZA232H	135 mm/5.31 in	50	40.5			
	9	21DZA232J	140 mm/5.51 in	55	45.5			
	10	21DZA232L	145 mm/5.71 in	60	50.5			
	11	21DZA232M	150 mm/5.91 in	65	55.5			
	12	21DZA232N	155 mm/6.10 in	70	60.5			
	13	21DZA232P	160 mm/6.30 in	75	65.5			

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages

SERIES 511 — with Micrometer Head

- Micrometer head is attached to the anvil for accurate dimensional setting.
- Longer plunger stroke with no effect on accuracy.
- Carbide is used for the contact point ensuring high durability and wear resistance.
- This model reduces the influence of heat from the operator's hand by approx. 50 % by increasing the grip size and making the grip hollow-structured, thereby retaining high-accuracy measurement.
- Wide measuring range with sub-anvils.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



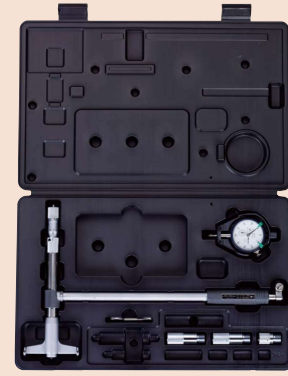
511-803

511-804



511-804

Note: The dial indicator and the protection cover are optional.



511-806

Note: The dial indicator and the protection cover are optional.

SPECIFICATIONS

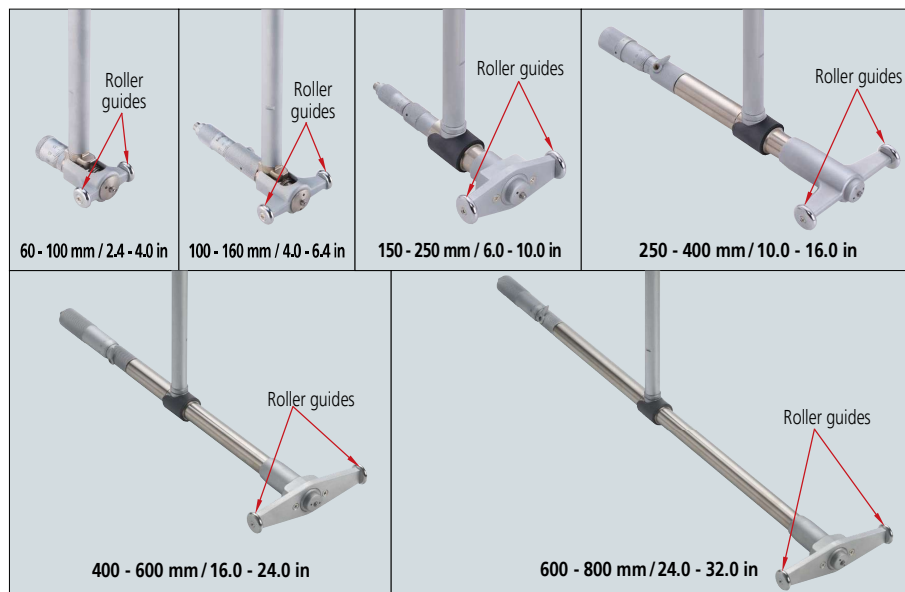
Metric																		
Order No.	Range (mm)	Stroke of contact point (mm)	Measuring force (N)	Guide force (N)	Content of set						Probing depth (mm)							
					Bore gage	Dial indicator	Dial protection cover	Micrometer head	Sub-Anvil	Spanner								
511-803	60 - 100	1.6	5 or less	10 or less	511-803	Not supplied	Not supplied	1 pc.	2 pcs.	3 pcs.	150							
511-804	100 - 160				511-804													
511-805	150 - 250		6 or less	15 or less	511-805							2 pcs.	250					
511-806	250 - 400				511-806													
511-807	400 - 600			20 or less	511-807									2 pcs.	250			
511-808	600 - 800				511-808													
511-823	60 - 100		1.6	5 or less	10 or less							511-803	2109SB-10 (Graduation: 0.001 mm)	21DZA000	1 pc.	2 pcs.	3 pcs.	150
511-824	100 - 160											511-804						
511-825	150 - 250	6 or less		15 or less	511-805	2 pcs.	250											
511-826	250 - 400				511-806													
511-827	400 - 600			20 or less	511-807			2 pcs.	250									
511-828	600 - 800				511-808													
511-813	60 - 100	1.6		5 or less	10 or less	511-803	2046SB (Graduation: 0.01 mm)	21DZA000	1 pc.	2 pcs.	3 pcs.	150						
511-814	100 - 160					511-804												
511-815	150 - 250		6 or less	15 or less	511-805	2 pcs.							250					
511-816	250 - 400				511-806													
511-817	400 - 600			20 or less	511-807									2 pcs.	250			
511-818	600 - 800				511-808													

Inch																		
Order No.	Range (in)	Stroke of contact point (in)	Measuring force (N)	Guide force (N)	Content of set						Probing depth (in)							
					Bore gage	Dial indicator	Dial protection cover	Micrometer head	Sub-Anvil	Spanner								
511-833	2.4 - 4.0	0.063	5 or less	10 or less	511-833	Not supplied	Not supplied	1 pc.	2 pcs.	3 pcs.	6							
511-834	4.0 - 6.4				511-834													
511-835	6.0 - 10.0		6 or less	15 or less	511-835							2 pcs.	10					
511-836	10.0 - 16.0				511-836													
511-837	16.0 - 24.0			20 or less	511-837									2 pcs.	10			
511-838	24.0 - 32.0				511-838													
511-853	2.4 - 4.0		0.063	5 or less	10 or less							511-833	2923SB-10 (Graduation: 0.0001 in)	21DZA000	1 pc.	2 pcs.	3 pcs.	4
511-854	4.0 - 6.4											511-834						
511-855	6.0 - 10.0	6 or less		15 or less	511-835	2 pcs.	6											
511-856	10.0 - 16.0				511-836													
511-857	16.0 - 24.0			20 or less	511-837			2 pcs.	10									
511-858	24.0 - 32.0				511-838													
511-843	2.4 - 4.0	0.063		5 or less	10 or less	511-833	2922SB (Graduation: 0.0005 in)	21DZA000	1 pc.	2 pcs.	3 pcs.	4						
511-844	4.0 - 6.4					511-834												
511-845	6.0 - 10.0		6 or less	15 or less	511-835	2 pcs.							6					
511-846	10.0 - 16.0				511-836													
511-847	16.0 - 24.0			20 or less	511-837									2 pcs.	10			
511-848	24.0 - 32.0				511-838													

Note 1: Storage boxes for 511-807/808/837/838 models are made of wood. The boxes of other models are made of plastic.

Note 2: It is not permissible to expand measuring range using sub-anvils other than as supplied as standard accessories. (The measurement accuracy in such cases is not guaranteed.)

Contact Points



Technical Data

- Accuracy: Metric models 2 μm
Inch models 0.00008 in
- Repeatability: Metric models 0.5 μm
Inch models 0.00002 in
- Adjacent error: Metric models 1 μm
Inch models 0.00004 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

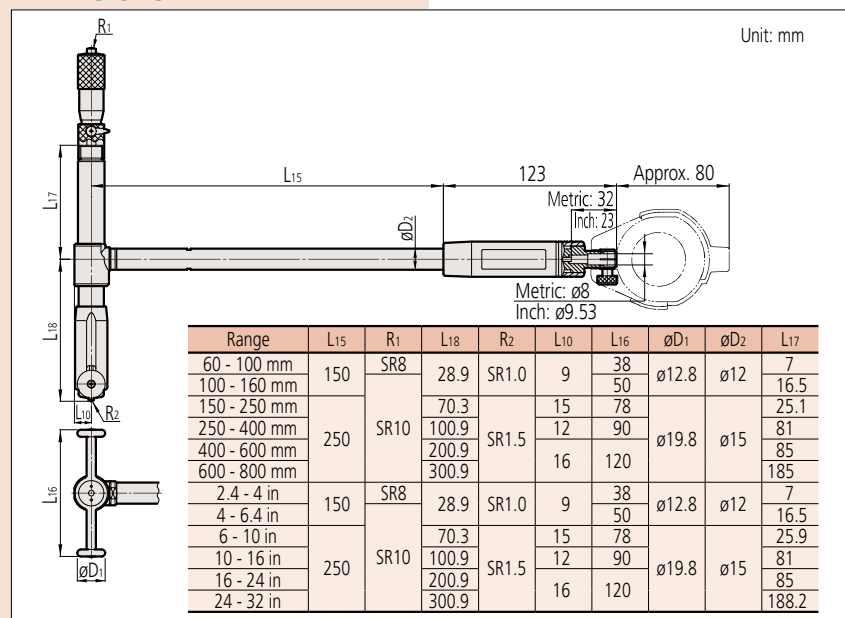
Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

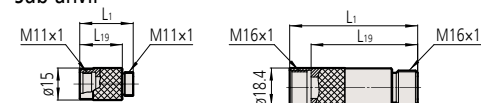
Recommended Digimatic Indicators (see Chapter F)

- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
 - Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.

DIMENSIONS



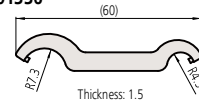
Sub-anvil



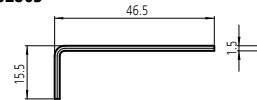
Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Spanner

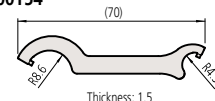
301336



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200154



STANDARD ACCESSORIES

Metric		Micrometer head		Sub-Anvil				Spanner
Bore gage (Main body)	Order No.	Stroke (mm)	Screw size	Marked No. (mm)	Order No.	L1 (mm)	L19 (mm)	Order No.
511-803	21DZA267	10	M11x1	10	208892	15	10	301336 (2 pcs.)
				20	208894	25	20	202863 (1 pc.)
511-804	21DZA268	13	M11x1	10	208892	15	10	301336 (2 pcs.)
				20	208894 (2 pcs.)	25	20	
511-805	21DZA268	13	M11x1	10	208892	15	10	301336 (2 pcs.)
				20	208894 (2 pcs.)	25	20	
				50	21DAA492	55	50	
511-806	953118	25	M16x1	25	208926	35	25	200154 (2 pcs.)
				50	208928 (2 pcs.)	60	50	
511-807	953120	50	M16x1	50	208928	60	50	200154 (2 pcs.)
				100	208932	110	100	
511-808	953120	50	M16x1	50	208928	60	50	200154 (2 pcs.)
				100	208932	110	100	

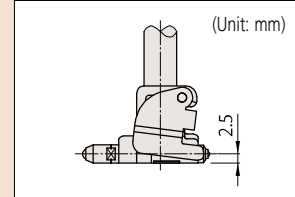
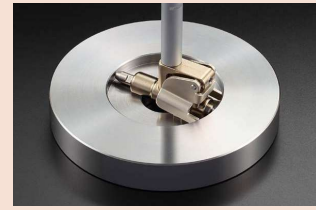
Inch		Micrometer head		Sub-Anvil				Spanner
Bore gage (Main body)	Order No.	Stroke (in)	Screw size	Marked No. (in)	Order No.	L1 (in)	L19 (in)	Order No.
511-833	21DZA272	0.4	M11x1	0.4	208893	0.6	0.4	301336 (2 pcs.)
				0.8	208895	1.0	0.8	202863 (1 pc.)
511-834	21DZA273	0.5	M11x1	0.4	208893	0.6	0.4	301336 (2 pcs.)
				0.8	208895 (2 pcs.)	1.0	0.8	
511-835	21DZA273	0.5	M11x1	0.4	208893	0.6	0.4	301336 (2 pcs.)
				0.8	208895 (2 pcs.)	1.0	0.8	
				2	21DAA493	2.2	2	
511-836	21DZA275	1.0	M16x1	1	208927	1.4	1	200154 (2 pcs.)
				2	208929 (2 pcs.)	2.4	2	
511-837	902313	2.0	M16x1	2	208929	2.4	2	200154 (2 pcs.)
				4	208933	4.4	4	
511-838	902313	2.0	M16x1	2	208929	2.4	2	200154 (2 pcs.)
				4	208933	4.4	4	

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — for Blind Holes

- Capable of ID (inside diameter) measurement close to the bottom of a hole.
- Carbide contact point ensuring high durability and wear resistance.
- Grip is large and hollow to reduce effect of body heat on high-accuracy measurements.
- The indicator (dial indicator, Digimatic indicator) and dial protection cover are optional. Select an indicator from the recommended dial indicators and Digimatic indicators. Please contact us for advice when using an indicator other than the recommended indicators.
- Optional Extension Rods can be attached for measuring deep holes. (For details, refer to page C-45)
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



Technical Data

- Accuracy: Metric models 4 μm
Inch models 0.00016 in
- Repeatability: Metric models 1 μm
Inch models 0.00004 in
- Adjacent error: Metric models 1 μm
Inch models 0.00004 in

Optional Accessories

- Dial indicator (See Chapter F)
- Dial protection cover: **21DZA000** (See page C-45)

Recommended Dial Indicators (see Chapter F)

- Metric models: **2046SB** (0.01 mm)
2972TB (0.01 mm - One-revolution type)
2109SB-10 (0.001 mm)
2900SB-10 (0.001 mm - One-revolution type)
- Inch models: **2922SB** (0.0005 in)
2977TB (0.0005 in - One-revolution type)
2923SB-10 (0.0001 in)
2910SB-10 (0.0001 in - One-revolution type)

Recommended Digimatic Indicators (see Chapter F-14)

- Metric models: **543-310B** (0.001 mm)
- Inch models: **543-312B** (0.001 mm/0.00005 in)

Note: Indicators equipped with rubber bellows, such as water-proof types, cannot be used.



Note: The dial indicator and protection cover are optional.



Note: The dial indicator and protection cover are optional.

SPECIFICATIONS

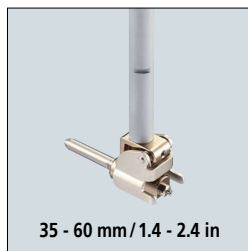
Metric										
Order No.	Range (mm)	Stroke of contact point (mm)	Measuring force (N)	Guide force (N)	Content of set				Probing depth (mm)	
					Bore gage	Dial indicator	Dial protection cover	Anvil		Washer
511-415	15 - 35	1.2	4 or less	6 or less	511-415	Not supplied	Not supplied	11 pcs.	1 pc.	150
511-416	35 - 60		5 or less	10 or less	511-416			6 pcs.	4 pcs.	
511-417	50 - 150		5 or less	10 or less	511-417			11 pcs.	4 pcs.	
511-425	15 - 35	1.2	4 or less	6 or less	511-415	2046SB (Graduation: 0.01 mm)	21DZA000	11 pcs.	1 pc.	150
511-426	35 - 60		4 or less	6 or less	511-416			6 pcs.	4 pcs.	
511-427	50 - 150		5 or less	10 or less	511-417			11 pcs.	4 pcs.	
511-435	15 - 35	1.2	4 or less	6 or less	511-415	2109SB-10 (Graduation: 0.001 mm)	21DZA000	11 pcs.	1 pc.	150
511-436	35 - 60		4 or less	6 or less	511-416			6 pcs.	4 pcs.	
511-437	50 - 150		5 or less	10 or less	511-417			11 pcs.	4 pcs.	

Inch										
Order No.	Range (in)	Stroke of contact point (in)	Measuring force (N)	Guide force (N)	Content of set				Probing depth (in)	
					Bore gage	Dial indicator	Dial protection cover	Anvil		Washer
511-418	0.6 - 1.4	0.047	4 or less	6 or less	511-418	Not supplied	Not supplied	11 pcs.	1 pc.	6
511-419	1.4 - 2.4		5 or less	10 or less	511-419			6 pcs.	4 pcs.	
511-420	2.0 - 6.0		5 or less	10 or less	511-420			11 pcs.	4 pcs.	
511-428	0.6 - 1.4	0.047	4 or less	6 or less	511-418	2922SB (Graduation: 0.0005 in)	21DZA000	11 pcs.	1 pc.	6
511-429	1.4 - 2.4		4 or less	6 or less	511-419			6 pcs.	4 pcs.	
511-430	2.0 - 6.0		5 or less	10 or less	511-420			11 pcs.	4 pcs.	
511-438	0.6 - 1.4	0.047	4 or less	6 or less	511-418	2923SB-10 (Graduation: 0.0001 in)	21DZA000	11 pcs.	1 pc.	6
511-439	1.4 - 2.4		4 or less	6 or less	511-419			6 pcs.	4 pcs.	
511-440	2.0 - 6.0		5 or less	10 or less	511-420			11 pcs.	4 pcs.	

Note 1: A 10 mm (0.4 in) sub-anvil is supplied with 511-415/425/435/418/428/438 and a 50 mm (2 in) sub-anvil is supplied with 511-417/427/437/420/430/440.

Note 2: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

Contact Points

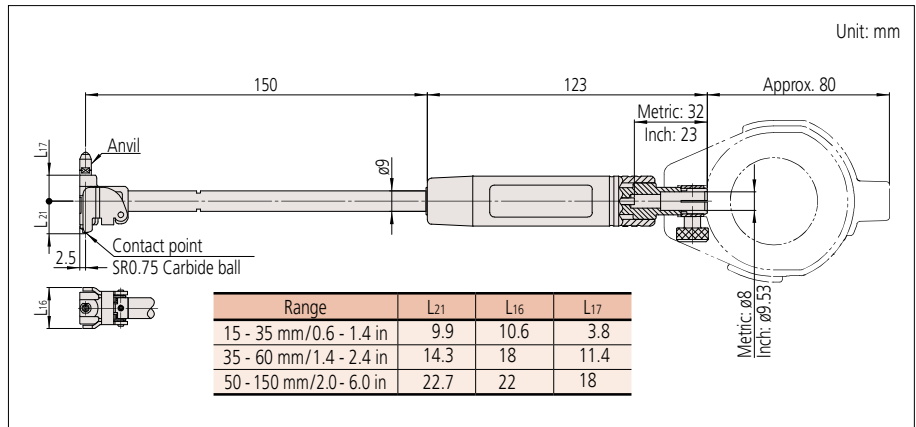


Recommended Digimatic Indicators (see Chapter F)

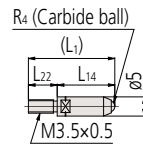
- Metric models: **543-310B (ID-C112GXB)**: 0.001 mm
- Inch models: **543-312B (ID-C112GEXB)**: 0.001 mm/0.00005 in
- The ID measurement can be performed easily since the minimum value is detected automatically.
- Up to three combinations of master value and the tolerance value can be set.
- Nine measurement results (maximum) can be saved and recalled from memory (when no external device is connected).
- Refer to page F-14 for details.



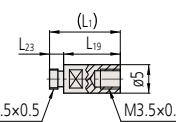
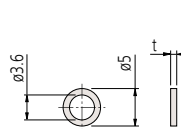
DIMENSIONS



Anvil

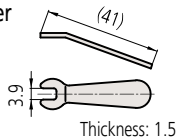


Interchangeable washer Sub-anvil

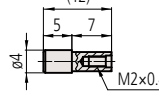


Note: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

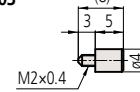
Spanner 204354



Washer holder 212202



Locking screw 212203



STANDARD ACCESSORIES

Bore gage (Main body)	Anvil							Interchangeable washer		Sub-Anvil		
	Marked No.	Order No.	Indication of measuring size	L1	L22	R4	L14	Order No.	t	Order No.	L23	L19
511-415 511-418 () Using 10 mm/0.4 in Sub-Anvil	1	21DZA376A	15 mm (25 mm)/0.59 in (0.98 in)	4.5	2.5	SR1	2	212127	0.5 mm/0.02 in	21DAA563	2.5	10 mm/0.4 in
	2	21DZA376B	16 mm (26 mm)/0.63 in (1.02 in)	5.5			3					
	3	21DZA376C	17 mm (27 mm)/0.67 in (1.06 in)	6.5			4					
	4	21DZA376D	18 mm (28 mm)/0.71 in (1.10 in)	7.5			5					
	5	21DZA376E	19 mm (29 mm)/0.75 in (1.14 in)	8.5			6					
	6	21DZA376F	20 mm (30 mm)/0.79 in (1.18 in)	9.5			7					
	7	21DZA376G	21 mm (31 mm)/0.83 in (1.22 in)	10.5		SR1.5	8					
	8	21DZA376H	22 mm (32 mm)/0.87 in (1.26 in)	11.5			9					
	9	21DZA376J	23 mm (33 mm)/0.91 in (1.30 in)	12.5			10					
	10	21DZA376L	24 mm (34 mm)/0.94 in (1.34 in)	13.5			11					
	11	21DZA376M	25 mm (35 mm)/0.98 in (1.38 in)	14.5			12					
511-416 511-419	1	21DZA404A	35 mm/1.38 in	17.5	7.5	SR1.5	10	212127 212128 212129 212130	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in			
	2	21DZA404B	40 mm/1.57 in	22.5			15					
	3	21DZA404C	45 mm/1.77 in	27.5			20					
	4	21DZA404D	50 mm/1.97 in	32.5			25					
	5	21DZA404E	55 mm/2.17 in	37.5			30					
	6	21DZA404F	60 mm/2.36 in	42.5			35					
511-417 511-420 () Using 50 mm/2 in Sub-Anvil	1	21DZA404A	50 mm (100 mm)/1.97 in (3.94 in)	17.5	7.5	SR1.5	10	212127 212128 212129 212130	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in	21DAA596	7.5	50 mm/2 in
	2	21DZA404B	55 mm (105 mm)/2.17 in (4.13 in)	22.5			15					
	3	21DZA404C	60 mm (110 mm)/2.36 in (4.33 in)	27.5			20					
	4	21DZA404D	65 mm (115 mm)/2.56 in (4.53 in)	32.5			25					
	5	21DZA404E	70 mm (120 mm)/2.76 in (4.72 in)	37.5			30					
	6	21DZA404F	75 mm (125 mm)/2.95 in (4.92 in)	42.5			35					
	7	21DZA404G	80 mm (130 mm)/3.15 in (5.12 in)	47.5			40					
	8	21DZA404H	85 mm (135 mm)/3.35 in (5.31 in)	52.5			45					
	9	21DZA404J	90 mm (140 mm)/3.54 in (5.51 in)	57.5			50					
	10	21DZA404L	95 mm (145 mm)/3.74 in (5.71 in)	62.5			55					
	11	21DZA404M	100 mm (150 mm)/3.94 in (5.91 in)	67.5			60					

Bore Gages

For easy and accurate measurement of inside diameters

Bore Gages SERIES 511 — ABSOLUTE Digimatic Bore Gages

- These ABSOLUTE Digimatic bore gages are exclusively designed for inside diameter measurement.
- ABS (ABSOLUTE) type bore gages are not subject to overspeed error.
- Up to four Extension Rods (optional) can be connected for measuring at the bottom of a hole 2 m deep.
- The display and grip can be rotated up to 320° and the display can be inclined up to 90°, so that it is easily readable from any direction.
- The minimum value holding function provides easy measurement of hole diameter.
- The gauge block set for master setting allows quick and accurate zero-point setting.
- A Bore Gage Checker and a range of Setting Rings are available to aid in accurately setting a gage before making a measurement. (For details, refer to pages C-46 and C-47)



511-501



SPECIFICATIONS

Metric		
Order No.	511-501	511-502
Range	45 - 100 mm	100 - 160 mm
Stroke of contact point	1.2 mm	
Resolution	0.001 mm	
Accuracy	Overall*1	0.003 mm or less
	Adjacent error	0.002 mm or less
	Repeatability	0.002 mm or less
Measuring force	5 N or less	
Guide force	10 N or less	
Battery	SR44 (2 pcs.), 938882 For initial operational checks (standard accessory)	
Battery life*2	Approx. 2,000 hours under normal use.	
Scale type	ABSOLUTE electrostatic linear encoder	
Sampling frequency*3	50 times/s	
Dust / Water protection level*4	IP53 (IEC60529/JIS D0207, C0920)	
Display	<ul style="list-style-type: none"> • 7 segments 6 digits decimal numeric with minus sign, in/mm • Tolerance judge indication • Analog indication 	
Net weight	500 g	570 g

Inch		
Order No.	511-521	511-522
Range	1.8 - 4.0 in	4.0 - 6.5 in
Stroke of contact point	0.048 in/1.2 mm	
Resolution	0.00005 in/0.001 mm	
Accuracy	Overall*1	0.0001 in/0.003 mm or less
	Adjacent error	0.00008 in/0.002 mm or less
	Repeatability	0.0001 in/0.002 mm or less
Measuring force	5 N or less	
Guide force	10 N or less	
Battery	SR44 (2 pcs.), 938882 For initial operational checks (standard accessory)	
Battery life*2	Approx. 2,000 hours under normal use.	
Scale type	ABSOLUTE electrostatic linear encoder	
Sampling frequency*3	50 times/s	
Dust / Water protection level*4	IP53 (IEC60529/JIS D0207, C0920)	
Display	<ul style="list-style-type: none"> • 7 segments 6 digits decimal numeric with minus sign, in/mm • Tolerance judge indication • Analog indication 	
Net weight	500 g	570 g

*1 A quantizing error is excluded.

*2 When the usage time per day is eight hours.

*3 If the contact point detecting speed is over 50 μm/s, the peak value may not be displayed correctly.

*4 The level indicated is valid only if the output connector cap is installed.

MeasurLink¹ 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).

ABSOLUTE™



Function

- Preset function
- Master value registration (3 values maximum)
- Tolerance judgment
- Upper/lower limit registration (3 values maximum)
- Minimum value holding
- Data output
- Display rotation (320°)
- Display inclination (90°, 7 steps)
- Low battery alarm display
- Error display

Optional Accessories

- Extension rod
250 mm (10 in): **21DZA089**
500 mm (20 in): **21DZA081**
Up to four extension rods can be jointed, and a maximum length of 2 m is allowed.
- Example of Connection
Using four 500 mm extension rods
- SPC Cable:
1 m: **905338**
2 m: **905409**
Refer to pages A-27 to A-29
- **USB** Input Tool Direct (2 m): **06AFM380F**
Refer to page A-28
- **USB** Keyboard Signal Conversion Type Communication Conversion Type: **264-016**
- **RS-232C** Communication Conversion Type: **264-007**
Refer to page A-14
- Connecting Cables for **U-WAVE-T** (160 mm): **02AZD790F**
For foot switch: **02AZE140F**
Refer to page A-20
- Digimatic Mini-Processor **DP-1VA** **LOGGER: 264-505**

Gauge Blocks and Block Sets for Setting the Origin or Master Blue (optional)

- Typical application



- Rectangular gauge blocks
- Note: Available only for **511-501/521**

516-118-10
516-118-60 with calibration certificate

Description*	Order No.	Qty	
Nominal length (mm)	1	611611-021	1
	2	611612-021	1
	3	611613-021	1
	5	611615-021	1
	10	611671-021	1
	20	611672-021	1
	30	611673-021	1
	40	611674-021	1
Flat jaw	630030	1 pair (2 pcs.)	
Holder 160 mm	619004	1	
Certificate of inspection		1	

* Equivalent to JIS B 7506 Grade 0

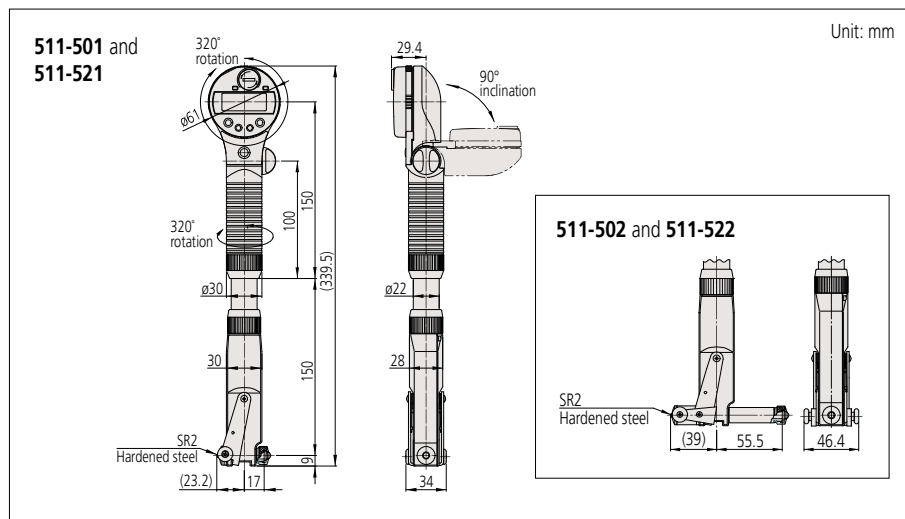
- Square gauge blocks
- Note: Available only for **511-501/521**

516-119-10
516-119-60 with calibration certificate

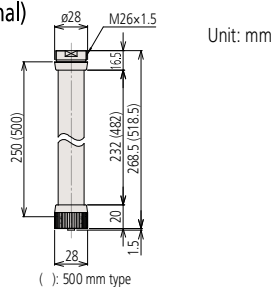
Description*	Order No.	Qty	
Nominal length (mm)	1	614611-021	1
	2	614612-021	1
	3	614613-021	1
	5	614615-021	1
	10	614671-021	1
	20	614672-021	1
	30	614673-021	1
	40	614674-021	1
Flat jaw	619072	1 pair (2 pcs.)	
Tie rod 3 in	619062	1	
Tie rod 2 1/4 in	619063	1	
Tie rod 1 1/2 in	619064	1	
Flat head screw 1 1/4 in	619057	2	
Flat head screw 5/8 in	619058	2	
Certificate of inspection		1	

* Equivalent to JIS B 7506 Grade 0

DIMENSIONS



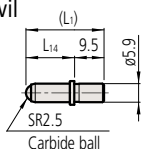
Extension rod (optional)



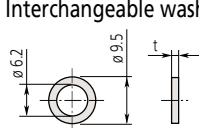
STANDARD ACCESSORIES

Bore gage	Anvil					Interchangeable washer	
(Main body)	Marked No.	Order No.	Indication of measuring size	L ₁ (mm)	L ₁₄ (mm)	Order No.	t
511-501 511-521	1	21DZA232A	45 mm/1.8 in	15	5.5	205457 205458 205459 205460	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in
	2	21DZA232B	50 mm/2.0 in	20	10.5		
	3	21DZA232C	55 mm/2.2 in	25	15.5		
	4	21DZA232D	60 mm/2.4 in	30	20.5		
	5	21DZA232E	65 mm/2.6 in	35	25.5		
	6	21DZA232F	70 mm/2.8 in	40	30.5		
	7	21DZA232G	75 mm/3.0 in	45	35.5		
	8	21DZA232H	80 mm/3.2 in	50	40.5		
	9	21DZA232J	85 mm/3.4 in	55	45.5		
	10	21DZA232L	90 mm/3.6 in	60	50.5		
	11	21DZA232M	95 mm/3.8 in	65	55.5		
	12	21DZA232N	100 mm/4.0 in	70	60.5		
511-502 511-522	1	21DZA232A	100 mm/4.0 in	15	5.5	205457 205458 205459 205460	0.5 mm/0.02 in 1.0 mm/0.04 in 2.0 mm/0.08 in 3.0 mm/0.12 in
	2	21DZA232B	105 mm/4.2 in	20	10.5		
	3	21DZA232C	110 mm/4.4 in	25	15.5		
	4	21DZA232D	115 mm/4.6 in	30	20.5		
	5	21DZA232E	120 mm/4.8 in	35	25.5		
	6	21DZA232F	125 mm/5.0 in	40	30.5		
	7	21DZA232G	130 mm/5.2 in	45	35.5		
	8	21DZA232H	135 mm/5.4 in	50	40.5		
	9	21DZA232J	140 mm/5.6 in	55	45.5		
	10	21DZA232L	145 mm/5.8 in	60	50.5		
	11	21DZA232M	150 mm/6.0 in	65	55.5		
	12	21DZA232N	155 mm/6.2 in	70	60.5		
	13	21DZA232P	160 mm/6.4 in	75	65.5		

Anvil



Interchangeable washer



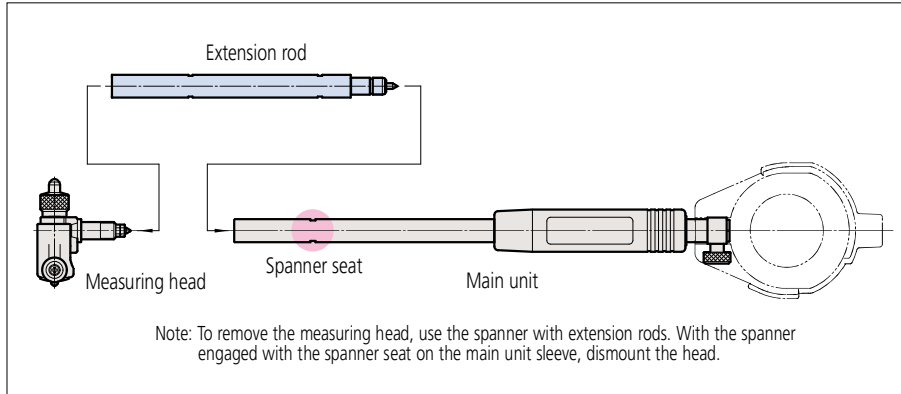
Unit: mm

Bore Gages

For easy and accurate measurement of inside diameters

Extension Rod SERIES 511 — Accessories for Bore Gages

- Extension Rods (optional) are available to assist in deep-hole measurement.
- If two or more Extension Rods are connected together, measurement errors may occur due to flexure of the rod assembly. Therefore it is best to use no more than a single Extension Rod.
- Extension Rods are available up to 1,000 mm in length.
- Cannot be connected to products with special sizes or special specifications.
- When using a 500 mm (or longer) Extension Rod, use the bore gage in an upright position.
- The accuracy and security of the assembly should be confirmed after connecting an Extension Rod.



SPECIFICATIONS

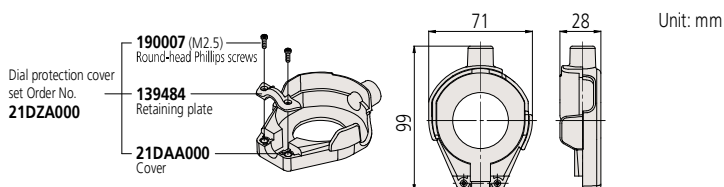
Applicable model Order No.	Extension rod length (mm)					Extension rod diameter (mm)	Spanner Order No.
	125	250	500	750	1000		
511-701/511-731 511-415/511-418 511-416/511-419 511-417/511-420	953549	953550	953551	—	—	ø9	102148 (2 pcs.)
511-702/511-732 511-703/511-733 511-704/511-734 511-803/511-833 511-804/511-834	953552	953553	953554	953555	953556	ø12	212556 (2 pcs.)
511-705/511-735 511-706/511-736 511-805/511-835 511-806/511-836 511-807/511-837 511-808/511-838	953557	952361	953558	953559	953560	ø15	212556 (2 pcs.)

Note 1: If an extension rod is attached, the measuring accuracy may degrade due to factors such as rod deflection.

Note 2: Spanner is supplied as standard.

Protection cover

- Both the flat backplate of a dial indicator and backplate with a lug can be attached to a protection cover. It can also be attached to Digimatic Indicators (543-310B, 543-312B).



Typical application



Technical Data

- Flatness of parallel jaw
0.5 μm (Parallelism 1 μm)

Standard Accessories

Parallel jaw 2 pcs.	630030
Attachment A	940088
Attachment B	940089
Attachment C	940090

Bore Gage Checker SERIES 515

- The Bore Gage Checker allows easy setting of dial bore gages with ranges of 18 mm (0.7 in) through 400 mm (16 in) using gauge blocks.
- Can be used in both vertical and horizontal positions.



515-590

Standard configuration: Stand
Attachment A, B, C 1 pc. for each
Parallel jaw (2 pcs.)

SPECIFICATIONS

Order No.	Applicable range
515-590	18 - 400 mm (0.7 - 16 in)

Bore Gages

For easy and accurate measurement of inside diameters

Setting Rings

SERIES 177 — Accessories for Inside Micrometers, Holtest and Dial Bore Gages

- Used for quick and accurate setting of dial bore gages, Holtest, and inside micrometers.
- Actual diameter is marked in 0.001 mm increments. (Dimension measuring position is the center of the height T.)

Steel Setting Rings



177-146



177-300

CERA Setting Rings

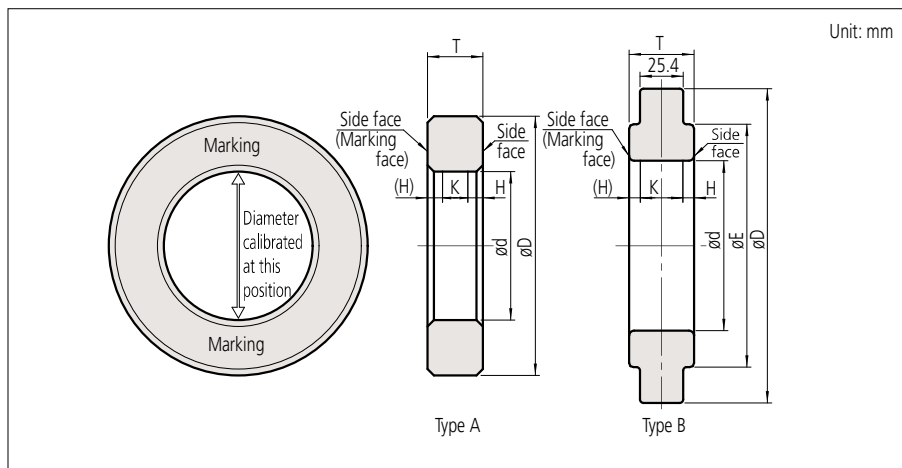


177-429



177-432

DIMENSIONS



Suffix

177-*-62:** With Inspection Certificate (provides a record of the calibrated diameter) and Calibration Certificate

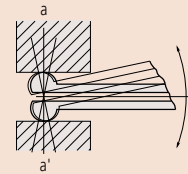
177-*-82:** With Inspection Certificate (provides a record of the calibrated diameter), Calibration Certificate, and Traceability System Chart

Note 1: The Inspection Certificate is not a substitute for a calibration certificate as it is undated.

Note 2: A more detailed inspection certificate describing roundness and cylindricity is available on request.

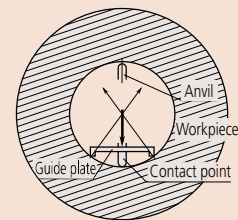
How to Read the Indicated Value

• SERIES 526



The 526 Series contact points have high curvature. Alignment with the diameter (a-a') is achieved by rotating the gage head in the direction indicated by the arrow, and the reading is the maximum value read from the dial indicator.

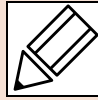
• SERIES 511



The 511 Series provides a guide plate to align the setting ring diameter with the measurement axis of the bore gage.

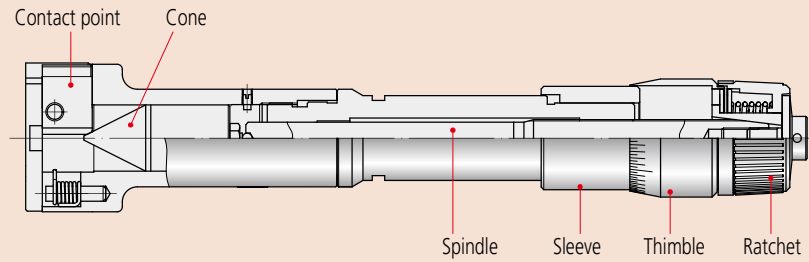


Quick Guide to Precision Measuring Instruments



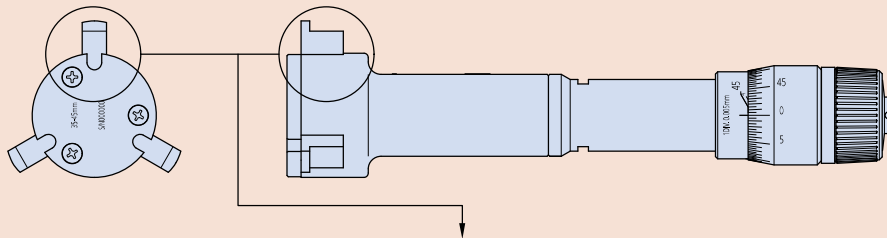
Inside Micrometers

Nomenclature (Holtest)



Custom-ordered Products (Holtest / Borematic)

Mitutoyo can custom-build an inside micrometer best suited to your special application. Please feel free to contact Mitutoyo about the possibilities - even if only one custom-manufactured piece is required. Please note that, depending on circumstances, such a micrometer will usually need to be used with a master setting ring for accuracy assurance. (A custom-ordered micrometer can be made compatible with a master ring supplied by the customer. Please consult Mitutoyo.)

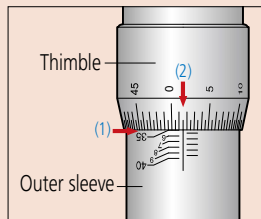


Type of feature	Workpiece profile (example)	Contact point tip profile (example)	Remarks
Square groove			<ul style="list-style-type: none"> Allows measurement of the diameter of variously shaped inside grooves and splines. Minimum measurable groove diameter is approximately 16 mm (differs depending on the workpiece profile.) Dimension ℓ should be as follows: For W=less than 2 mm: ℓ=less than 2 mm For W=2 mm or more: ℓ=2 mm as the standard value which can be modified according to circumstances. The number of splines or serrations is limited to a multiple of 3. Details of the workpiece profile should be provided at the time of placing a custom-order. If your application needs a measuring range different from that of the standard inside micrometer an additional initial cost for the master ring gage will be required.
Round groove			
Spline			
Serration			
Threaded hole			

How to Read the Scale

Graduation 0.005 mm

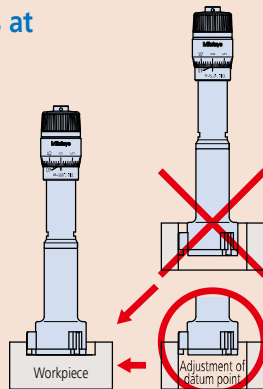
(1) Outer sleeve	35 mm
(2) Thimble	0.015 mm
Reading	35.015 mm



Changes in measured values at different measuring points

The accuracy of a Holtest is maximized if the same part of the anvils is used for measurement as was used for standardizing the instrument with a setting ring.

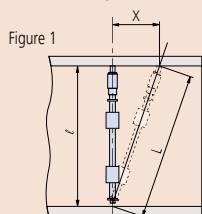
When you use the tip of the anvil for measurement, adjust the datum point using the tip of the anvil.



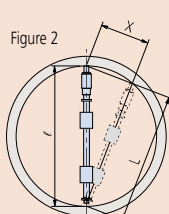
Measurement error due to temperature effects on an inside micrometer

The accuracy of an inside micrometer is degraded if its temperature is significantly different from. To help prevent this situation occurring wear gloves and only hold the micrometer by the heat insulators to reduce the transfer of heat from the operator's hands.

Effect of misalignment on accuracy (Inside Micrometer)

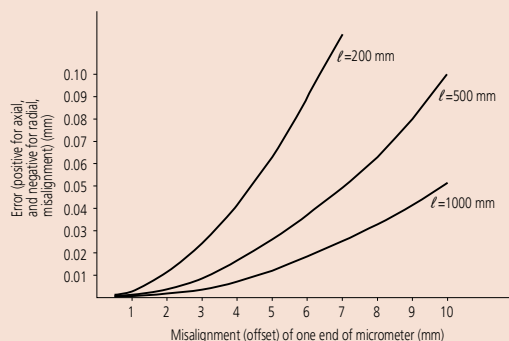


r : Inside diameter to be measured
 L : Length measured with axial offset X
 X : Offset in axial direction
 Δr : Error in measurement
 $\Delta r: L - l = \sqrt{r^2 + X^2} - l$



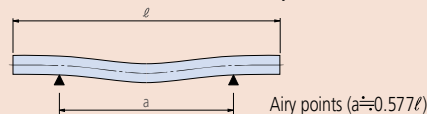
r : Inside diameter to be measured
 L : Length measured with radial offset X
 X : Offset in radial direction
 Δr : Error in measurement
 $\Delta r: L - l = \sqrt{r^2 - X^2} - l$

If the Inside Micrometer is misaligned in the axial or radial direction by an offset distance X when a measurement is taken, as in Figures 1 and 2, then that measurement will be in error as shown in the graph below (constructed from the formulae given above). The error is positive for axial misalignment and negative for radial misalignment.

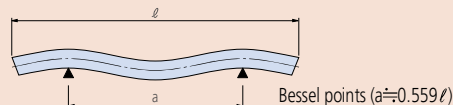


Airy and Bessel Points

When a length standard bar or inside micrometer lies horizontally, supported as simply as possible at two points, it bends under its own weight into a shape that depends on the spacing of those points. There are two distances between the points that control this deformation in useful ways, as shown below.



The ends of a bar (or micrometer) can be made exactly horizontal by spacing the two supports symmetrically as shown above. These points are known as the 'Airy Points' and are commonly used to ensure that the ends of a length bar are parallel to one another, so that the length is well defined.



The change in length of a bar (or micrometer) due to bending can be minimized by spacing the two supports symmetrically as shown above. These points are known as the 'Bessel Points' and may be useful when using a long inside micrometer.

Reference point setting (2-point gages)

- Reference point setting with a ring gage or cylinder master gage
 Insert the bore gage into the ring gage, vertically or horizontally swing the bore gage, and set the zero point to the point where the indicator reads the maximum value. (Rotate the dial face for a dial gage and perform presetting or zero setting for a Digimatic indicator.)
- Reference point setting with outside micrometer and gauge block
 Hold a gauge block (of the reference dimension) between a micrometer's measuring faces as if measuring the block. Clamp the micrometer's spindle and then pull out the gauge block. Insert the bore gage between the micrometer's measuring faces. Maneuver the bore gage to the position where the indicator reads a minimum and then set the pointer to read zero (or a preset value required) by rotating the bezel.
- Reference point setting with outside micrometer only
 Fix the micrometer in a vertical attitude with its head side (spindle side) downward (see illustration below), and then adjust the distance between the measuring faces to the reference dimension. At this time, do not clamp the micrometer spindle. Insert the bore gage between the micrometer's measuring faces. Maneuver the bore gage to the position where the indicator reads a minimum and then set the pointer to read zero (or a preset value required) by rotating the bezel. Zero-setting with a micrometer requires a certain degree of dexterity because no self-centering action is available, as is the case when using a setting gage. Zero-setting is also possible by performing the same procedure using the gauge block, height master, or bore gage zero checker in addition to the outside micrometer.

