

Bore Gages

Bore Gages SERIES 511

- This series includes models for highly accurate measurement of $\varnothing 18$ to 400 mm inside diameters.
- The contact point and anvil have a carbide ball tip that is highly durable and abrasion-resistant.
- The grip minimizes the variation of indicator values by reducing heat transfer from the operator's hand.
- Optional extension rods are available for measuring deep holes. Customized products with a longer rod below the grip are also available upon request.



511-702

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

SPECIFICATIONS

Metric							
Order No.	Range (mm)	Stroke of contact point (mm)	Accuracy* (μm)	Repeatability* (μm)	Adjacent error* (μm)	Measuring force (N)	Guide force (N)
511-701	18 - 35	1.2	2	0.5	1	4 or less	6 or less
511-702	35 - 60					5 or less	10 or less
511-703	50 - 150	1.6				6 or less	15 or less
511-704	100 - 160						
511-705	160 - 250						
511-706	250 - 400						
511-721-20	18 - 35	1.2	2	0.5	1	4 or less	6 or less
511-722-20	35 - 60					5 or less	10 or less
511-723-20	50 - 150	1.6				6 or less	15 or less
511-724-20	100 - 160						
511-725-20	160 - 250						
511-726-20	250 - 400						
511-711-20	18 - 35	1.2	2	0.5	1	4 or less	6 or less
511-712-20	35 - 60					5 or less	10 or less
511-713-20	50 - 150	1.6				6 or less	15 or less
511-714-20	100 - 160						
511-715-20	160 - 250						
511-716-20	250 - 400						
511-921-20	18 - 150	See SPECIFICATIONS of 511-701/702/703					
511-922-20							
511-925-10							

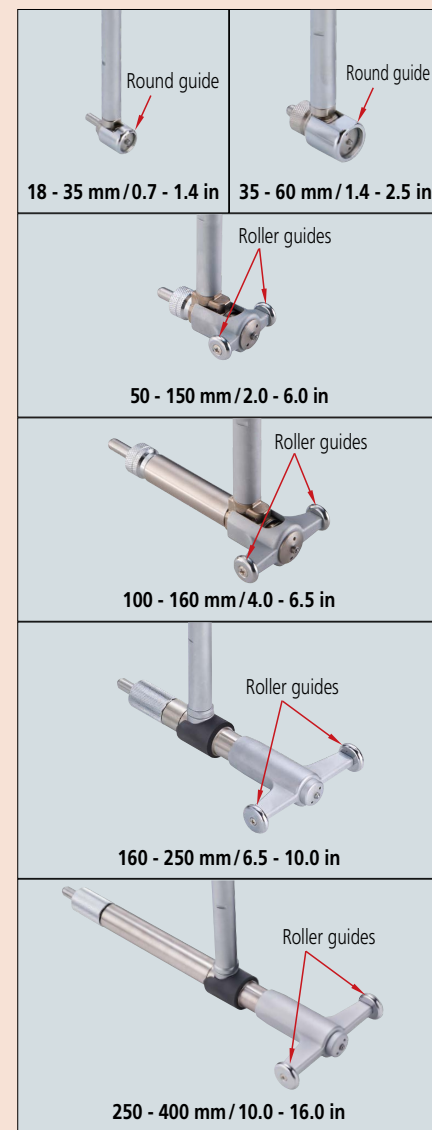
Order No.	Content of set							Probing depth (mm)
	Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-701	511-701	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-702	511-702			6 pcs.	4 pcs.		Not supplied	Not supplied
511-703	511-703			11 pcs.		1 pc.		
511-704	511-704			13 pcs.	7 pcs.	Not supplied	Not supplied	250
511-705	511-705			6 pcs.				
511-706	511-706			5 pcs.	1 pc.			
511-721-20	511-701	2109AB-10 (Graduation: 0.001 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-722-20	511-702			6 pcs.	4 pcs.	1 pc.	Not supplied	150
511-723-20	511-703			11 pcs.				
511-724-20	511-704			13 pcs.	7 pcs.	Not supplied	Not supplied	250
511-725-20	511-705			6 pcs.				
511-726-20	511-706			5 pcs.	1 pc.			
511-711-20	511-701	2046AB (Graduation: 0.01 mm)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	100
511-712-20	511-702			6 pcs.	4 pcs.	1 pc.	Not supplied	150
511-713-20	511-703			11 pcs.				
511-714-20	511-704			13 pcs.	7 pcs.	Not supplied	Not supplied	250
511-715-20	511-705			6 pcs.				
511-716-20	511-706			5 pcs.	1 pc.			
511-921-20	Set of	2046AB	21DZA000	See SPECIFICATIONS of 511-701/702/703				
511-922-20	511-701/	2109AB-10						
511-925-10	702/703	543-310B						

* Accuracy of the bore gage alone.

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: 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



Extension Rod

Refer to page C-49.

The dial protection cover, recommended indicators

Refer to page C-50.

Setting rings

Refer to pages C-52 to C-55.

Recommended Digimatic Indicators (see Chapter F)

- Metric type:
543-310B-10 (ID-C112GXB2: 0.001 mm)
- Inch type:
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-12 for details.

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

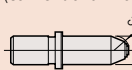
Inspection method

- 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)

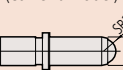
Carbide ball
(current model)



Result of contour measurement

Depth: 10 µm

Vertical magnification: 2,000
Horizontal magnification: 200



Result of contour measurement

Depth: 1 µm or less

Vertical magnification: 2,000
Horizontal magnification: 200

Inspection method

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

SPECIFICATIONS

Inch										
Order No.	Range (in)	Stroke of contact point (in)	Accuracy* (in)	Repeatability* (in)	Adjacent error* (in)	Measuring force (N)	Guide force (N)			
511-731	0.7 - 1.4	0.047	0.00008	0.00002	0.00004	4 or less	6 or less			
511-732	1.4 - 2.5					5 or less	10 or less			
511-733	2.0 - 6.0	0.063								
511-734	4.0 - 6.5	6 or less				15 or less				
511-735	6.5 - 10.0									
511-736	10.0 - 16.0	0.047	0.00008	0.00002	0.00004	4 or less	6 or less			
511-751-20	0.7 - 1.4					5 or less	10 or less			
511-752-20	1.4 - 2.5	0.063								
511-753-20	2.0 - 6.0	6 or less				15 or less				
511-754-20	4.0 - 6.5									
511-755-20	6.5 - 10.0	0.047	0.00008	0.00002	0.00004	4 or less	6 or less			
511-756-20	10.0 - 16.0					5 or less	10 or less			
511-741-20	0.7 - 1.4	0.063								
511-742-20	1.4 - 2.5	6 or less				15 or less				
511-743-20	2.0 - 6.0									
511-744-20	4.0 - 6.5	0.047				0.00008	0.00002	0.00004	4 or less	6 or less
511-745-20	6.5 - 10.0		5 or less	10 or less						
511-746-20	10.0 - 16.0	0.063								
511-931-20	0.7 - 6.0	See SPECIFICATIONS of 511-731/732/733								
511-932-20										
511-935-10										

See SPECIFICATIONS of **511-731/732/733**

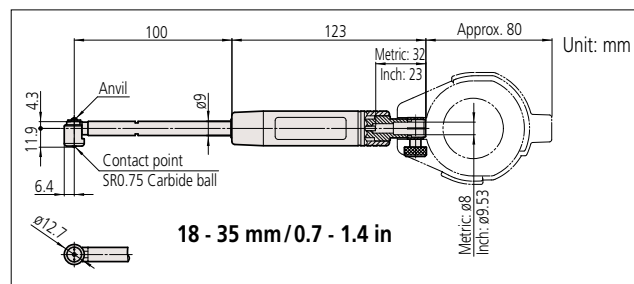
Order No.	Content of set							Probing depth (in)
	Bore gage	Dial indicator	Dial protection cover	Anvil	Interchangeable Washer	Sub-Anvil	Spanner	
511-731	511-731	Not supplied	Not supplied	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-732	511-732			6 pcs.	4 pcs.	1 pc.	Not supplied	6
511-733	511-733			11 pcs.				
511-734	511-734			13 pcs.				
511-735	511-735			6 pcs.	7 pcs.	Not supplied	10	
511-736	511-736			5 pcs.				1 pc.
511-751-20	511-731	2923AB-10 (Graduation: 0.0001 in)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-752-20	511-732			6 pcs.	4 pcs.	1 pc.	Not supplied	6
511-753-20	511-733			11 pcs.				
511-754-20	511-734			13 pcs.				
511-755-20	511-735			6 pcs.	7 pcs.	Not supplied	10	
511-756-20	511-736			5 pcs.				1 pc.
511-741-20	511-731	2922AB (Graduation: 0.0005 in)	21DZA000	9 pcs.	2 pcs.	Not supplied	1 pc.	4
511-742-20	511-732			6 pcs.	4 pcs.	1 pc.	Not supplied	6
511-743-20	511-733			11 pcs.				
511-744-20	511-734			13 pcs.				
511-745-20	511-735			6 pcs.	7 pcs.	Not supplied	10	
511-746-20	511-736			5 pcs.				1 pc.
511-931-20	Set of	2922AB	21DZA000	See SPECIFICATIONS of 511-731/732/733				
511-932-20	511-731/	2923AB-10						
511-935-10	732/733	543-312B						

* Accuracy of the bore gage alone.

Note 1: A 2 in sub-anvil is supplied with **511-733**, and a 3 in sub-anvil is supplied with **511-736**.

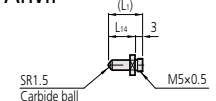
Note 2: It is not permissible to use a sub-anvil other than as supplied as a standard accessory, or widen a measuring range by using multiple sub-anvils. (The measurement accuracy in such cases is not guaranteed.)

DIMENSIONS

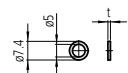


Unit: mm

Anvil

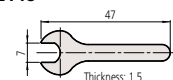


Interchangeable washer



t (mm)	Order No.
0.5	205623
1	205624

Spanner 102148



STANDARD ACCESSORIES

Bore gage (Main body)	Anvil				
	Marked No.	Order No.	Indication of measuring size	L1	L14
511-701 511-731	1	21DZA213A	18 mm/0.71 in	5.5	2.5
	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