## **Dial Test Indicators**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### SERIES 513 — Dial Test Indicator Features

- Designed to probe surfaces that cannot be reached with a normal dial gage. Useful both for alignment and for measurement purposes.
- Mitutoyo's proprietary new design permits smooth pointer operation.
- Strong frame provides excellent rigidity and durability.
- The pointer and carbide contact point are only slightly magnetizable\*, and so they are hardly affected by a magnetic environment. In addition, models with a ruby contact point are available. The ruby contact point also has several times the abrasion resistance of carbide contact point and is safely usable with an electric discharge machine thanks its being a non-conductor.
- Clear and concise wide dial face allows excellent visibility.
- The surface of the crystal is hard-coated for excellent scratch resistance.
- \* Magnetic material is used for some internal parts.

- Flat crystal makes graduations easy to read. Moreover, the O-ring sealing method used for the bezel prevents water or oil penetration. (Note that this type is NOT waterproof.)
- The main unit is equipped with three dovetails to which the stem with dovetail groove Ø6 (standard accessory) can be attached. This greatly improves convenience as the attachment location can be adjusted as needed.
- Five types are available: horizontal, horizontal (20° tilted face), vertical, parallel, and universal, allowing users to select according to their needs.
- Completed products are inspected according to JIS B 7533:2015. Horizontal, horizontal (20° tilted face), and vertical types are inspected with the dial face in the upward orientation, while the parallel type is inspected with the dial face in the vertical orientation to guarantee their accuracy.



#### **Feature icons**

lcon	Feature description
H	High accuracy
	With revolution counter
1	Long contact point
5	Standard
	Double scale spacing
$\Diamond$	Compact
	Carbide contact point (Slightly magnetic)
:1:	Ruby contact point (Non-conductive and abrasion resistant)



Multi-layer coatings on the crystal

Improved contact point bearing gives smoother tracking

No deterioration in contact point sensitivity and trackability





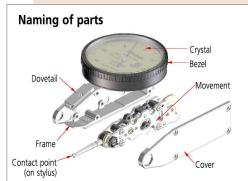


Horizontal (20° Tilted face)







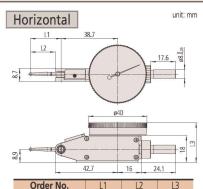




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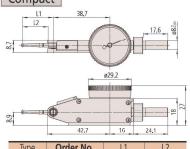


#### **DIMENSIONS**



Order No.	L1	L2	L3
513-401-10E	14.7	11.2	
513-471-10E	14.7	11.2	27
513-405-10E/A/T			21
513-475-10E	18.7	15.2	
513-425-10E/A			28
513-404-10E/A/T	20.9	17.4	
513-474-10E	20.5	17.4	27
513-424-10E/A/T			
513-426-10E/A	22.2	18.7	28
513-478-10E			
513-414-10E/A/T	37.4	33.9	27
513-415-10E/A/T	44.5	41.0	21
513-477-10E	74.5	71.0	

#### Compact



Type	Order No.	L1	L2
	513-465-10E	18.7	15.2
Compact	513-464-10E	20.9	17.4
	513-466-10E	22.2	18.7

Note: A slight difference may occur depending on the center of the contact point, graduation plate, and stem fixing position, etc.

#### Special Set: 513-908-10E (Metric)

**513-404-10E**: Dial test indicator **7014-10**: Mini magnetic stand

#### 513-907-10E (inch)

513-402-10E: Dial test indicator 7014E-10: Mini magnetic stand



# **Dial Test Indicator SERIES 513 — Horizontal Type**









Note: **513-4XX-10** is indicated on the dial face. But the Order No. for the Special Set provided with the stem etc. has a suffix (E or T) at the end.



Graduation: 0.01 mm Range: 0.8 mm

513-404-10E / 10A / 10T

Standard

Carbide contact point (Slightly magnetic)



Graduation: 0.01 mm Range: 0.5 mm

513-414-10E/10A/10T

Long stylus

Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm Range: 0.2 mm

513-405-10E / 10A / 10T

Standard

Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm Range: 0.2 mm

513-465-10E

Carbide contact point
(Slightly magnetic)



Graduation: 0.0005 in Range: 0.03 in

513-402-10E/10T

**S** Standard

(Slightly magnetic)



Graduation: 0.01 mm Range: 0.5 mm

513-424-10E/10A/10T

**S** Standard

Double scale spacing

Carbide contact point (Slightly magnetic)



Graduation: 0.01 mm Range: 1.0 mm

513-415-10E/10A/10T

Long stylus

Carbide contact point (Slightly magnetic)



Graduation: 0.002 mm Range: 0.6 mm

513-425-10E/10A

With revolution counter

Carbide contact point (Slightly magnetic)



Graduation: 0.001 mm Range: 0.14 mm

513-401-10E

High accuracy

Carbide contact point (Slightly magnetic)



Graduation: 0.0001 in Range: 0.008 in

513-403-10E/10T

**S** Standard

Carbide contact point (Slightly magnetic)



#### **SPECIFICATIONS**

Metric																				
	Order No.					Maxim	um perm	issible e	error (MP	E)* (µm)				ter					Į.	
Basic set	Plus set	Full set	Graduation (mm)	Range (mm)	Dial reading	Measuring range	One rev.	10 scale divisions	Hysteresis	Repeatability	Mass (g)	Measuring force (N)	High accuracy	With revolution counter	[1] Long contact point	Standard	Double scale spacing	Compact	(Slightly magnetic)	Ruby contact point
	513-424-10A	513-424-10T									45					1			1	
513-478-10E	-	-		0.5	0.25.0	6	_		4		44	0.3 or less				1				1
513-466-10E	-	-			0-25-0						41	0.0					1	1	1	
		513-414-10T					-	5			0.2 or less			1		1		/		
513-426-10E	200.000 - 0.000 - 0.000		0.01	1.5		16	10	5		3	45	0.4 or less		1					1	
513-404-10E	513-404-10A	513-404-10T														/			/	
513-474-10E	-	-		0.8	0-40-0	9			4		_	0.3 or less				/				1
513-464-10E	-	-									41							1	1	
	513-415-10A	513-415-10T		1.0	0-50-0	10	_		5			0.2 or less			1				/	
513-477-10E	-	-		1.0.00		7.081					45				1					1
513-405-10E	513-405-10A	513-405-10T													_	/			/	
513-475-10E	-	-	0.002	0.2	0-100-0	100-0 4		3			0.3 or less				1				1	
513-455-10E								2		1	41							1	1	
513-425-10E	513-425-10A	_		0.6		7	5	_	4	·		0.4 or less		1					1	
513-401-10E	-	-	0.001	0.14	0-70-0	4	_		3		45	0.3 or less	1						1	
513-471-10E	-	-	5.501	0.11	0,00				,			5.5 51 less	1							1

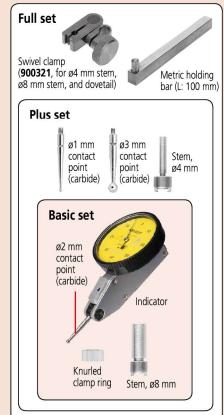
Inch																		
C	rder N	0.				Maximum pe	rmissible erro	r (MPE)* (in)				ter					=	
Basic set	Plus set	Full set	Graduation (in)	Range (in)	Dial reading	One rev.	Hysteresis		Mass (g)	Measuring force (N)	H High accuracy	With revolution counter	Long contact point	Standard	Double scale spacing	Compa	Carbide contact point (Slightly magnetic)	Ruby contact point
513-402-10E	_	513-402-10T								0.3 or less				1			1	
513-472-10E	-	_							45	U.3 OF 1655				1				1
513-412-10E	-	513-412-10T	0.0005	0.03	0-15-0	±0.0005	0.0002	±0.0002	45	0.2 or less			1				1	
513-479-10E	-	-								U.Z UI IESS			1					1
513-462-10E	-	-							41							1	1	
513-407-10E	_	513-407-10T	0.00005														1	
513-403-10E	_	513-403-10T		0.008	0-4-0	±0.0001	0.0001	±0.00004	45	0.3 or less				1			1	
513-473-10E	-	-	0.0001	0.006	0-4-0	±0.0001	0.0001	±0.00004						1				1
513-463-10E	_	_							41							1	1	

Metric/Inch	-														
Order No.				Maximum	permissi	ble error (N	/IPE)* (μm)				counter		g	int	
Basic set Plus set Full set	Graduation	Range	Dial reading	Measuring range	10 scale divisions		Repeatability	INIG22	Measuring force (N)	High accura	With revolution	Standard Standard	Double scale spacing	Carbide contact point (Slightly magnetic)	Ruby contact point
513-409-10E - 513-409-10	0.002 mm /0.0001 in	0.2 mm /0.0076 in	0-10-0 /0-38-0	4	2	3	1	45	0.3 or less					1	

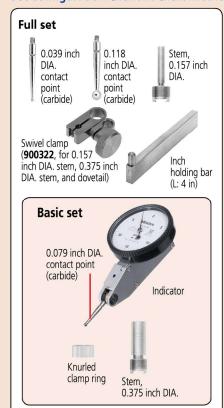
Į	Inch/Me	tric		C													
	0	rder No	o.				Maximum p	ermissible err	ror (MPE)* (in)				counter	0		nt	
	Basic set	Plus set	Full set	Graduation	Range	Dial reading	One rev.	Hysteresis	Repeatability	Mass (g)	Measuring force (N)	High accuracy	5	Stancard  Double scale spacing	Compact	Carbide contact point (Slightly magnetic)	Ruby contact point
	513-406-10E	-	513-406-10T	0.0005 in /0.01 mm	0.03 in /0.7 mm	0-15-0 /0-35-0	±0.0005	0.0002	±0.0002	45	0.3 or less					1	

\* We guarantee the accuracy of completed products by inspecting them with the dial face facing upward. Note: Stem with dovetail groove is not included in the mass.

#### Set Configuration: Metric and Metric/Inch



#### Set Configuration: Inch and Inch/Metric

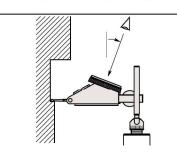




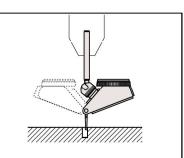


#### **Dial Test Indicator** SERIES 513 — Horizontal (20° Tilted Face), Vertical, and Parallel Types

• Specially designed for easy viewing of dial.



• The dial face obliquely faces upward, allowing users to read the graduations from the user's side. It is convenient when probing on the side of a large workpiece and the workbench is high.



• Using the universal holder allows easy hole centering. The dial face always faces upward when the indicator is rotated, which makes reading easy.





Graduation: 0.01 mm Range: 0.8 mm

 Carbide contact point (Slightly magnetic)



Contact point No. 133195



Graduation: 0.0005 in Range: 0.03 in

Carbide contact point (Slightly magnetic)





Graduation: 0.01 mm Range: 1.6 mm

With revolution counter

Carbide contact point (Slightly magnetic)



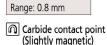


Graduation: 0.002 mm Range: 0.4 mm

With revolution counter

Carbide contact point (Slightly magnetic)









Graduation: 0.002 mm Range: 0.2 mm

 Carbide contact point (Slightly magnetic)



(Slightly magnetic)

Note: **513-4XX-10** is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.



Comparison measuring instruments which ensure high quality, high accuracy and reliability.

With revolution counter

Long stylus

Carbide contact point (Slightly magnetic)

#### **SPECIFICATIONS**

Metric			Horizont	al (20°	tilted fa											
Basic set	Order No Plus set	Full set	Graduation (mm)	Range (mm)	Dial reading	Maximu Measuring range	m perm One rev.	issible e 10 scale divisions	error (N Hysteresis	IPE)* (μm) Repeatability	Mass (g)	Measuring force (N)	Y	ı-İ	U	Remarks
	DE 513-444-10 <i>F</i> DE 513-445-10 <i>F</i>		0.01	1.6 0.4	0-40-0 0-100-0	16	10 5	5	5 4	3	48	0.3 or less	V /		V /	
Inch			Horizont	al (20°	tilted fa	ace) type	e									
Basic set	Order No Plus set	Full set	Graduation (in)		Dial reading	Maximu One rev.	m perm First 2 rev.	issible e .5 Hyst	error (M eresis F	IPE)* (in) Repeatability	Mass (g)	Measuring force (N)	Y	1	n	Remarks
	513-442-10A 513-442-16A 513-446-10A 513-446-16A	513-442-16T 513-446-10T	0.0005	0.06	0-15-0					±0.0002	48	0.3 or less 0.3 or less 0.2 or less 0.2 or less	ソソソソ	77	ンソソソ	Black dial
=	513-443-10A 513-443-16A		0.0001	0.016	0-4-0	±0.0002	±0.000	0.0	001	±0.00004		0.3 or less 0.3 or less	1		ソソ	Black dial
Metric			Vertical	type												
Basic set	Order No Plus set	Full set	Graduation (mm)	Range (mm)	Dial reading	Maximu Measuring range	One 1	issible e 10 scale divisions	error (M Hysteresis	IPE)* (µm) Repeatability	Mass (g)	Measuring force (N)	Y	1-1	U	Remarks
	DE —— DE 513-454-10/ DE 513-455-10/		0.01	0.5 0.8 0.2	0-25-0 0-40-0 0-100-0	6		5	4	3		0.3 or less			V V V	
J13-433-10	IL   J 1J-4JJ-10/	101-625-616	\/a-ti-a-l-		0-100-0	+			)							

Inch			Vertical	type											
Basic set	Order No. Plus set	Full set	Graduation (in)			Maximum One rev.	permissible First 2.5 rev.	e error (N Hysteresis	IPE)* (in) Repeatability	Mass (g)	Measuring force (N)	Y	1-1	N	Remarks
513-452-10E	_	513-452-10T	0.0005	0.03	0-15-0	±0.0005	_	0.0002	±0.0002	16	0.3 or less			V	
513-453-10E	_	513-453-10T	0.0001	0.008	0-4-0	±0.0001	_	0.0001	±0.00004	46	0.3 or less			1	

Į	Metric			, Parallel 1	Гуре											
		Order No.		Graduation	Range	Dial	Maximu	m perr	nissible e	error (M	PE)* (μm)	Macc	Measuring			
	Basic set	Plus set	Full set	(mm)	(mm)	reading	Measuring range	One rev.	10 scale divisions	Hysteresis	Repeatability	(g)	force (N)	 •-[	M	Remarks
j	513-486-10E	_	_	0.01	0.5	0-25-0	6	.—	Г	1	2				~	
	513-484-10E	513-484-10A	513-484-10T	0.01	0.8	0-40-0	9	-	כ	4	3	53	0.3 or less		~	
	513-485-10E	_		0.002	0.2	0-100-0	4	_	2	3	1				V	

Inch			, Parallel I	ype										
	Order No.		Graduation	Range	Dial				MPE)* (in)		Measuring			
Basic set	Plus set	Full set	(in)	3		One rev.	First 2.5 rev.	Hysteresis	Repeatability	(g)	Measuring force (N)	; <u> </u>		Remarks
_	513-482-10A	513-482-10T	0.0005	0.03	0-15-0	±0.0005	_	0.0002	±0.0002	53	0.3 or less		~	

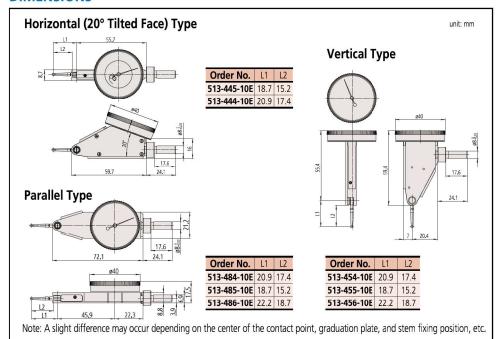
\* Horizontal (20° Tilted Face) Type, Vertical Type:

We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

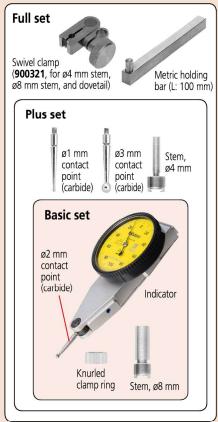
Parallel Type: We guarantee the accuracy of completed products by inspecting them with the dial face vertical.

Note: 513-4XX-10 is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.

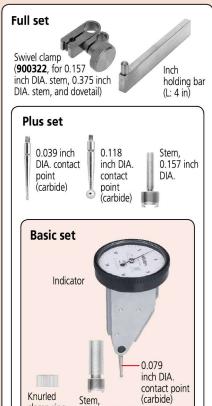
#### **DIMENSIONS**



#### **Set Configuration: Metric**



#### **Set Configuration: Inch**



0.375 inch DIA

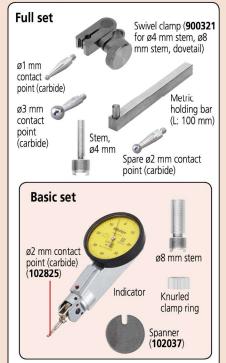
**M**itutoyo

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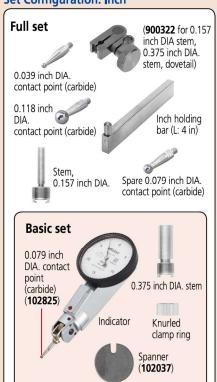
clamp ring



#### **Set Configuration: Metric**



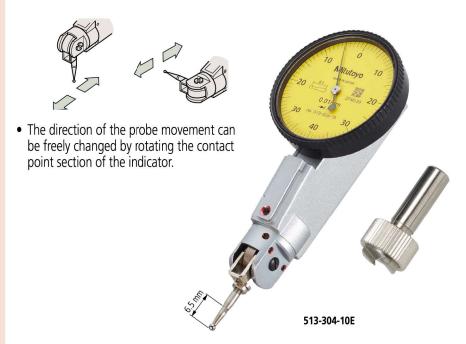
#### **Set Configuration: Inch**



#### **Optional Accessories**

 Swivel clamps (See page F-75)
 Holding bars (See page F-75)
 Sterns (See page F-75)
 102824: ø1 mm contact point (carbide)
 102824: ø3 mm contact point (carbide) 102825: ø2 mm contact point (carbide) 102826: ø3 mm contact point (carbide)

#### **Dial Test Indicator SERIES 513** — Universal Type



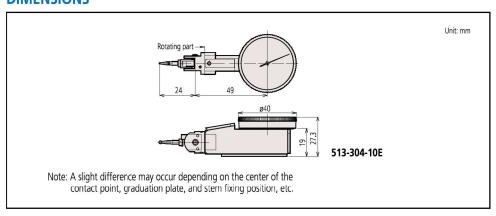
#### **SPECIFICATIONS**

Metric																			
Orde	r No.				Maximu	ım perm	issible e	error (MP	E)* (µm)			.y	on counter	t point		spacing		contact point	t point
Basic set	Full set	Graduation (mm)		Dial reading	Measuring range	One rev.	10 scale divisions	Hysteresis	Repeatability	Mass (g)	Measuring force (N)	H High accuracy	With revolution	[1] Long contact	Standard Standard	Double scale	Compact	Carbide cont	Ruby contact
513-304 -10E	513-304-10T	0.01	0.8	0-40-0	9	_	5	4	3	71	0.3 or less							V	

0	Inch																	
	Orde	Order No.					m permissi (MPE)* (in)			Managina	y.	on counter	t point	spacing			contact point magnetic)	t point
	Basic set	Full set	Graduation (in)	Range (in)	Dial reading	One rev.	Hysteresis	Repeatability	Mass (g)	Measuring force (N)	H High accuracy	With revolution	Long contact	Double scale	Compact	Dustpro	(Slightly	Ruby contact
	513-302-10E	513-302-10T	0.0005	0.03	0-15-0	±0.0005	0.0003	±0.0003	71	0.3 or less							<b>/</b>	

\* We guarantee the accuracy of completed products by inspecting them with the dial face facing upward. Note: 513-3XX-10 is indicated on the dial face. But the Order No. for the set provided with the stem etc. has a suffix (E or T) at the end.

#### **DIMENSIONS**





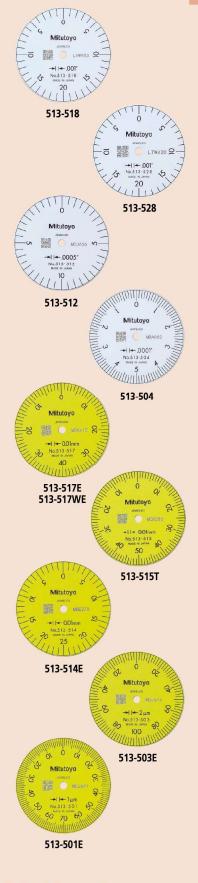
## **Dial Test Indicators**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **Pocket Type Dial Test Indicator SERIES 513**

- Slim design is suited for measurement in deep holes.
- Jeweled bearings assure higher sensitivity and accuracy.
  - Indicator can be mounted by clamping the stem or the body (except for 513-517WE and 513-517WT).
- Bezel is sealed with an O-ring to keep out water and oil. (Note that this type is NOT waterproof.)
- Clutch type (with a clutch lever)
- With ø2 mm Carbide contact point
- Jeweled bearing
- Completed products are inspected according to JIS B 7533:1990.





#### **Optional Accessories**

- Swivel clamps (See page F-75)
- Holding bars (See page F-75)
- Stems (See page F-75)
- Contact point (See page F-75)

#### **Set Configuration: Metric**





#### **Set Configuration: Inch**







Jeweled bearing



Dustproof



#### **SPECIFICATIONS**

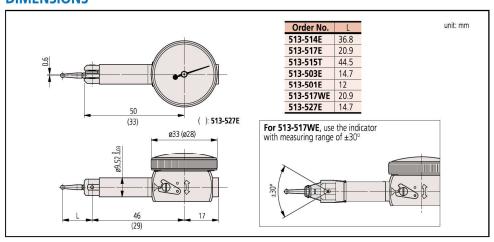
Metric		Ű.									
Orde	r No.	Graduation	Range	Accuracy	Dial	Measuring	1-1	<b>₩</b>	<b>\$</b>	$\Box$	
Basic set	Full set	(mm)	(mm)	(µm)	reading	force (N)	٠				
513-514E	513-514T	0.01	0.5	10	0-25-0	0.3 or less	~	~			
513-517E	513-517T	0.01	0.8	8	0-40-0	0.3 or less		~			
513-517WE	513-517WT	0.01	0.8	8	0-40-0	0.3 or less		V		~	
513-527E	513-527T	0.01	0.8	8	0-40-0	0.3 or less		~	~		
<del>-</del>	513-515T	0.01	1	10	0-50-0	0.3 or less	~	~			
513-503E	513-503T	0.002	0.2	3	0-100-0	0.3 or less		~			
513-501E	513-501T	0.001	0.14	3	0-70-0	0.4 or less		~			

Note: We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

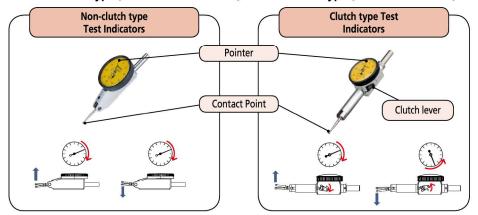
Inch		ľ									
Orde	er No.	Graduation	Range	Accuracy	Dial	Measuring	1-1	<b>₩</b>	0		
Basic set	Full set	(in)	(in)	(in)	reading	force (N)			Y		
513-518	513-518T	0.001	0.04	±0.001	0-20-0	0.3 or less		~			
513-528	513-528T	0.001	0.04	±0.001	0-20-0	0.3 or less		~	~		
513-512	513-512T	0.0005	0.02	±0.0005	0-10-0	0.3 or less	1	~			
513-504	513-504T	0.0001	0.01	±0.0002	0-5-0	0.3 or less		1			

Note: We guarantee the accuracy of completed products by inspecting them with the dial face facing upward.

#### **DIMENSIONS**



#### There are two types of Mitutoyo Dial Test Indicator: The non-clutch type (without a clutch lever) and the clutch type (with a clutch lever)



In the non-clutch type, although the contact point may move either in the upward or downward direction, the pointer always rotates clockwise.

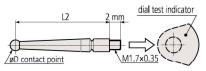
In the clutch type, if the clutch lever is set in one position the contact point moves in the upward direction and the pointer rotates clockwise. Conversely, if the lever is set in the other position the contact point moves in the downward direction and the pointer rotates counterclockwise.



#### **Contact points, Stems and Holders Optional Accessories for Dial Test Indicators**

#### **Contact point** (for Metric Models Only\*)

\* Except for universal type dial test indicator (513-304-10).



#### ø0.5 mm contact point ø0.7 mm contact point



ø1 mm contact point (Carbide)

190654 (L2=18.7 mm)

**190656** (L2=41.0 mm)

21CAB111 (L2=33.9 mm)

ø2 mm contact point (Carbide)

190653 (L2=18.7 mm)

190655 (L2=41.0 mm)

21CAB112 (L2=33.9 mm)

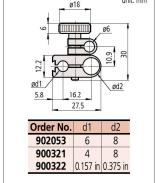


ø2 mm contact point (Ruby)

(Carbide)



## ø3 mm contact point



## **Spanner**



## **Holding Bars**





0.25 inx0.5 in 953639 (Lenath: 2 in) 900306 (Length: 4 in)

#### **Swivel Clamps**

For ø6 mm stem, ø8 mm stem, and dovetail

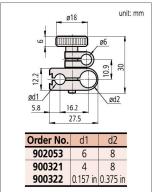


For ø4 mm stem, ø8 mm stem, and dovetail



For 0.157 inch DIA. stem, 0.375 inch DIA. stem, and dovetail





#### **Stems with Knurled Clamp Ring**





21CZB129

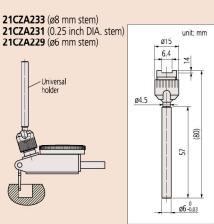
21CZB130

Stem DIA. ød	Stem with dovetail (Individual item)	Nut (Individual item)	Full set (Stem with dovetail+Nut)
øu		Order No.	
ø4	21CAB106	190322	21CZB131
ø6	21CAB103	190322	21CZB128
ø8	21CAB104	190322	21CZB129
ø0.375 in	21CAB105	190322	21CZB130

#### **Universal Holder (dovetail clamp)**

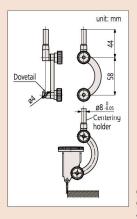
• A universal holder is an attachment used to mount a dial test indicator in a machine tool spindle so that it can be used to align the spindle axis with a workpiece feature such as a hole center, or a machine axis with an edge. (See diagram below.) It also gives some protection against accidental impacts on the indicator.





#### **Centering Holder**

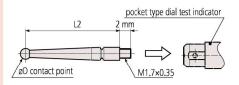
 Allows large diameter cylinders or holes to be centered on a machine tool.





901959 (ø8 mm stem) 901997 (0.25 inch DIA. stem)

#### **Contact point** (for Metric Models Only)



#### ø0.5 mm contact point ø0.7 mm contact point



#### ø1 mm contact point (Carbide)



#### ø2 mm contact point (Ruby)



#### ø2 mm contact point (Carbide)



#### ø3 mm contact point (Carbide)



103018 (L2=11.2 mm) 103014 (L2=17.4 mm) 137747 (L2=33.3 mm) 136236 (L2=41.0 mm)

#### **Swivel Clamps**



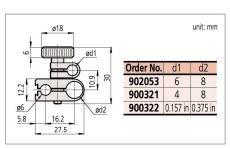


For ø4 mm stem and ø8 mm stem, and dovetail



For 0.157 inch DIA. stem and 0.375 inch DIA. stem, and dovetail



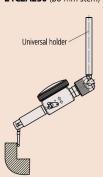


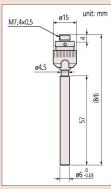
#### **Universal Holder (screw clamp)**

• A universal holder is an attachment used to mount a dial test indicator in a machine tool spindle so that it can be used to align the spindle axis with a workpiece feature such as a hole center, or a machine axis with an edge. (See diagram below.) It also gives some protection against accidental impacts on the indicator.



21CZA234 (ø8 mm stem) 21CZA232 (0.25 inch DIA. stem) **21CZA230** (ø6 mm stem)





#### **Stems**

ø4 mm ø8 mm (0.157 inch DIA.) (0.315 inch DIA.) 0.375 inch DIA.









#### **Holding Bars**



Note: Suitable for height gages with a scriber section of 12.7×6.35 mm.





#### i-Checker IC2000 SERIES 170

- Indication accuracy of (0.1 + 0.4L/100) μm, the highest level in the world, is achieved. (When inspected in the vertical orientation.)
- Can directly inspect indicators with a stroke of up to 100 mm. Moreover, a wide variety of optional accessories enable the inspection and calibration of many types of gage including dial indicators, lever-type dial indicators, dial test indicators, cylinder gages, Digimatic indicators, linear gages and electronic micrometers that use various stem diameters and
- The pointer of the analog indicator is positioned just before the measuring point automatically in the semi-automatic mode.
- Digital indicators equipped with a data output function are checked very efficiently due to spindle positioning at the inspection points and recording of measurement results being under fully automatic control.





Typical application for Dial Test Indicator Accessory Set



Typical application using dial test indicator attachment set (**02ASK000**)

#### **SPECIFICATIONS**

support systems.

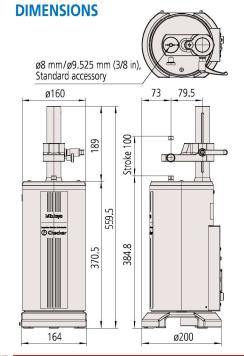
Order No.		170-402	170-403					
Remarks		with 8 mm bush	with 3/8 in bush					
Measuring	Range	100 mm						
Resolution		0.01 µm						
Accuracy	vertical orientation	(0.1 + 0.4L/100) μm L	_=Arbitrary length (mm)					
(20 °C)	lateral orientation	(0.15 + 0.6L/100) μm	L=Arbitrary length (mm)					
Feed speed		Maximum	10 mm/s					
Drive method	od	Motor drive (semi-automatic/fully-automatic)						
Measuring	Unit	Separate type	Linear Encoder					
Moscuromo	ant mathod	Semi-automation	c measurement					
Measurement method		Fully automatic measurement (only when using an	indicator equipped with data output function)*1*2					
Mass			kg					
Operating ten	nperature range	20 °C±0.5 °C						

IC2000

\*1 Automatic measurement requires the indicator's connecting cable. Additionally some form of indicator, along with the normally connected accessory (the optional accessory for the indicator such as a Digimatic power-supply unit in an EF counter) will be required.

\*2 The indicator measured via RS-232C has the capability to receive data from the main unit and output the counter value.







(**E12015**) for more details.



#### **Optional accessory**

Stand for bore gage inspection (12AAK824)

Note: Can be used for the inspection of bore gages 511

SERIES standard type and with micrometer head up to
400 mm. (Refer to pages C-33 and C-39 for details.)



#### **SERIES 170 — UDT-2 Dial Indicator Tester**

 UDT-2 is the accuracy tester for 0.01 mm resolution/graduation dial indicators, dial test indicators and bore gages. • Stem mounting hole: ø6, ø8 mm (Metric) ø1/4 in, ø3/8 in (Inch)



#### **SPECIFICATIONS**

Metric	Í			
	Micromet		Accuracy	
Order No.	Graduation (mm)	Range (mm)	Feed accuracy (25 mm stroke)	Hysteresis
170-102-12	0.001	0 - 25	±2	0.5

Inch	í.						
	Micromet	ter head	Accuracy (in)				
Order No.	Graduation (in)	Range (in)	Feed accuracy (25 mm stroke)	Hysteresis			
170-101-10	0.0001	0 - 1	±0.0001	0.00002			

#### **SERIES 521 — Calibration Tester**

 Can also be used to inspect dial indicators and dial test indicators with 0.001 mm graduations, or to adjust the sensitivity of electronic micrometers.  The mounting bracket, which can move in any direction, accepts a wide range of indicator stem sizes (ø4 mm to ø10 mm).





#### **SPECIFICATIONS**

ead Accuracy	(µm)
	Hysteresi
- 1 ±0.2	0.2
- 5 ±0.8	0.8
	nge Indication accuracy + 1 ±0.2

Inch	C.						
	Microme	ter head	Accuracy (in)				
Order No.	Graduation	Range	Indication	Hysteresi			
	(in)	(in)	accuracy	riyoteresi			
521-104	0.00001	0 - 0.05	±0.00001	0.0000			
521-106	0.00001	0 - 0.2	±0.00003	0.00003			

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

# Thickness Gages SERIES 547, 7



Standard Type (Resolution: 0.01 mm)





High Accuracy Type (Resolution: 0.001 mm)



Standard Type (Graduation: 0.01 mm)



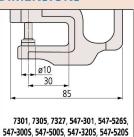


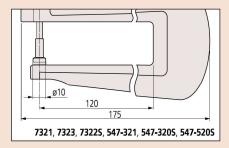
MeasurLink' ENABLED

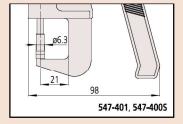
Products equipped with the measurement data output function can be connected to the measurement data network system MeasurLink (refer to page A-5 for details).

Unit: mm

#### **DIMENSIONS**







**M**itutoyo

#### **Technical Data**

- Display: 6-digit LCD, sign
  Battery: SR44 (1 pc.), 938882 for initial operational checks (standard accessory)
  Battery life: Approx. 7,000 hours of continuous use Approx. 1.2 years under normal use
  Maximum response speed: Not restricted (except for
- scanning measurement)

#### **Functions**

- Zero-setting (INC system)
- Presetting (ABS system)
- Direction switching
- Tolerance judgment
- Resolution switching (For 0.001 mm or 0.00005 inch resolution models)
- Calculation: f(x) =Ax
- Function Lock
- Data output
- Display value holding (when no external device is connected)
- 330° rotary display
- Low battery voltage alarm display
- Error alarm display

#### **Optional Accessories**

• SPC Cable:

905338 (1 m) 905409 (2 m)

- (Refer to pages A-27 to A-29 for details.)
   USB Input Tool Direct (2 m): **06AFM380F** (Refer to page A-13 for details.)
   Connecting Cables for **U-WAVE-T** (160 mm):

#### 02AZD790F

For foot switch: 02AZE140F

(Refer to pages A-19 to A-21 for details.)

• Digimatic Mini-Processor **DP-1VA LOGGER**: **264-505** 

#### Lens thickness measurement

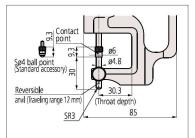
- Thickness of concave-convex lenses and surfaces can be measured. (Contact point, Anvil: hardened steel)
- Anvils and contact points are interchangeable to enable concave surfaces to be measured.



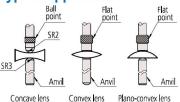
• Provided with a ball point as standard.

#### **DIMENSIONS**

Unit: mm



#### **Typical applications**

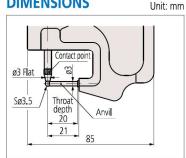


#### Tube thickness measurement

 Pipe wall thickness, thickness of curved boards can be measured. (Contact point, Anvil: hardened steel)



#### **DIMENSIONS**

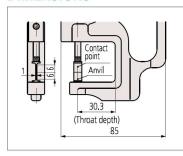


#### Groove thickness measurement





Unit: mm





# **Dial Indicator Applications**Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **Thickness Gages SERIES 547, 7**

#### **SPECIFICATIONS**

Metric									
Order No.	Resolution (mm)	Range (mm)	Measuring depth (mm)	Contact point, Anvil (mm)	Parallelism of Contact point, Anvil (µm)	Accuracy (µm)	Measuring force (N)	Mass (g)	Remarks
547-401	0.001/0.01 (selectable)	0 - 12	21	ø6.3 Flat (Carbide)	3	±3	3.5 or less	280	High accuracy, carbide point anvil
547-301	0.01	0 - 10	30	ø10 Flat	10	±20	1.5 or less	255	Standard, ceramic point/anvil
547-321	0.01	0 - 10	120	ø10 Flat	10	±20	1.5 or less	425	Deep throat, ceramic point/anvil
547-313	0.01	0 - 10	30	ø6 Flat (Contact point) ø4.8 Flat (Anvil)	10	±20	1.5 or less	275	Lens thickness
547-315	0.01	0 - 10	30	t=1 Blade	10	±20	1.5 or less	270	Groove thickness
547-360	0.01	0 - 10	20	ø3 Flat (Contact point) ø3 5 Ball (Apvil)	_	±20	1.5 or less	250	Tube thickness

	Inch/Metric	ī								
	Order No.	Resolution	Range (in)	Measuring depth	Contact point, Anvil	Parallelism of Contact point, Anvil	Accuracy	Measuring force (N)	Mass (g)	Remarks
	547-400S	0.00005 in/0.001 mm	0 - 0.47	21 mm (0.83 in)	ø6.3 mm (ø0.25 in) Flat	0.0001 in/0.003 mm	±0.0001 in/±3 µm	3.5 or less	290	High accuracy, carbide point anvil
	547-526S*	0.0001 in/0.001 mm	0 - 0.47*	30 mm (1.18 in)	ø10 mm (ø0.39 in) Flat	0.0002 in/0.005 mm	±0.0002 in/±5 µm	1.5 or less	225	Standard, ceramic point/anvil
	547-300S	0.0005 in/0.01 mm	0 - 0.4	30 mm (1.18 in)	ø10 mm (ø0.39 in) Flat	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	255	Standard, ceramic point/anvil
	547-500S*	0.0005 in/0.01 mm	0 - 0.47*	30 mm (1.18 in)	ø10 mm (ø0.39 in) Flat	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	225	Standard, ceramic point/anvil
Ī	547-320S	0.0005 in/0.01 mm	0 - 0.4	120 mm (4.72 in)	ø10 mm (ø0.39 in) Flat	0.005 in/0.01 mm	±0.001 in/±20 μm	1.5 or less	400	Deep throat, ceramic point/anvil
	547-520S*	0.0005 in/0.01 mm	0 - 0.47*	120 mm (4.72 in)	ø10 mm (ø0.39 in) Flat	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	380	Deep throat, ceramic point/anvil
	547-312S	0.0005 in/0.01 mm	0 - 0.4	30 mm (1.18 in)	ø6 mm (ø0.24 in) Flat (Contact point) ø4.8 mm (ø0.19 in) Flat (Anvil)	0.005 in/0.01 mm	±0.001 in/±20 μm	1.5 or less	275	Lens thickness
	547-5125*	0.0005 in/0.01 mm	0 - 0.47*	30 mm (1.18 in)	ø6 mm (ø0.24 in) Flat (Contact point) ø4.8 mm (ø0.19 in) Flat (Anvil)	0.005 in/0.01 mm	±0.001 in/±20 μm	1.5 or less	240	Lens thickness
	547-316S	0.0005 in/0.01 mm	0 - 0.4	30 mm (1.18 in)	t=1 mm (0.04 in) Blade	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	270	Groove thickness
	547-516S*	0.0005 in/0.01 mm	0 - 0.47*	30 mm (1.18 in)	t=1 mm (0.04 in) Blade	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	260	Groove thickness
	547-3615	0.0005 in/0.01 mm	0 - 0.4	20 mm (0.79 in)	ø3 mm (ø0.12 in) Flat (Contact point) ø3.5 mm (ø0.14 in) Ball (Anvil)	0.005 in/0.01 mm	±0.001 in/±20 μm	1.5 or less	240	Tube thickness
	547-5615*	0.0005 in/0.01 mm	0 - 0.47*	20 mm (0.79 in)	ø3 mm (ø0.12 in) Flat (Contact point) ø3.5 mm (ø0.14 in) Ball (Anvil)	0.005 in/0.01 mm	±0.001 in/±20 µm	1.5 or less	215	Tube thickness

<sup>\*</sup> Using ID-SX Digimatic indicator.

Metric									
Order No.	Graduation (mm)	Range (mm)	Measuring depth (mm)	Contact point, Anvil (mm)	Parallelism of Contact point, Anvil (µm)	Accuracy (µm)	Measuring force (N)	Mass (g)	Remarks
7327	0.001	0 - 1	30	ø10 Flat	5	±5	1.5 or less	230	Fine dial reading, ceramic point/anvil
7301	0.01	0 - 10	30	ø10 Flat	5	±15	1.4 or less	218	Standard, ceramic point/anvil
7305	0.01	0 - 20	30	ø10 Flat	5	±20	2.0 or less	236	Standard, ceramic point/anvil
7321	0.01	0 - 10	120	ø10 Flat	5	±15	1.4 or less	377	Deep throat, ceramic point/anvil
7323	0.01	0 - 20	120	ø10 Flat	5	±22	2.0 or less	371	Deep throat, ceramic point/anvil
7313	0.01	0 - 10	30	ø6 Flat (Contact point) ø4.8 Flat (Anvil)	5	±15	1.4 or less	220	Lens thickness
7315	0.01	0 - 10	30	t=1 Blade	5	±15	1.4 or less	220	Groove thickness
7360	0.01	0 - 10	20	ø3 Flat (Contact point) ø3.5 Ball (Anvil)	/—	±15	1.4 or less	220	Tube thickness

Inch									
Order No.	Graduation (in)	Range (in)	Measuring depth (in)	Contact point, Anvil (in)	Parallelism of Contact point, Anvil (in)	Accuracy (in)	Measuring force (N)	Mass (g)	Remarks
7326S	0.0001	0 - 0.05	1.18	ø0.39 Flat	0.0002	±0.0002	2.0 or less	205	Fine dial reading, ceramic point/anvil
7300S	0.001	0 - 0.5	1.18	ø0.39 Flat	0.0005	±0.001	1.8 or less	205	Standard, ceramic point/anvil
7304S	0.001	0 - 1	1.18	ø0.39 Flat	0.0005	±0.002	2.0 or less	220	Standard, ceramic point/anvil
7322S	0.001	0 - 1	1.18	ø0.39 Flat	0.0005	±0.002	2.0 or less	370	Deep throat, ceramic point/anvil
73125	0.001	0 - 0.5	1.18	ø0.24 Flat (Contact point) ø0.19 Flat (Anvil)	0.0005	±0.001	1.8 or less	215	Lens thickness
7316S	0.001	0 - 0.5	1.18	t=0.04 Blade	0.0005	±0.001	1.8 or less	220	Groove thickness
7361S	0.001	0 - 0.5	0.8	ø0.12 Flat (Contact point) ø0.14 Ball (Anvil)	_	±0.001	1.8 or less	200	Tube thickness

Note 1: The dial indicator needs to be reset when a contact point is replaced.

Note 2: The stated accuracy of Digimatic indicators does not include an allowance for quantizing error (±1 count).



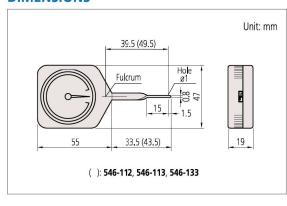
#### Measuring contact force on a relay



## **Contact Force Gage SERIES 546**

- Contact Force Gages are widely used to determine the measuring force applied by an instrument to a workpiece, as well as contact forces of electrical relays, micro-switches, valves and precision springs.
- Thanks to the miniature anti-friction bearing in the fulcrum, stable measurement is guaranteed.
- 2 types are available: Standard and peak hold.

#### **DIMENSIONS**









#### **SPECIFICATIONS**

#### mN-scale models

Į	Standard	ı		
	Order No.	Graduation (mN)	Range (mN)	Accuracy (division)
	546-112	2	6 - 50	
	546-113	5	10 - 100	±0.5
	546-114	10	30 - 300	

Peak hold			
Order No.	Graduation (mN)	Range (mN)	Accuracy (division)
_	_	-	_
546-133	5	10 - 100	±0.5
546-134	10	30 - 300	±0.5

Note: Please note that these products are only available in their standard forms; they cannot be customized for special sizes or specifications.

#### N-scale models

Standard _	ř.		
Order No.	Graduation (N)	Range (N)	Accuracy (division)
546-115	0.02	0.06 - 0.5	
546-116	0.05	0.1 - 1	
546-117	0.05	0.15 - 1.5	±0.5
546-118	0.1	0.3 - 3	
546-119	0.2	0.6 - 5	

Peak hold			
Order No.	Graduation (N)	Range (N)	Accuracy (division)
546-135	0.02	0.06 - 0.5	
546-136	0.05	0.1 - 1	
546-137	0.05	0.15 - 1.5	±0.5
546-138	0.1	0.3 - 3	
546-139	0.2	0.6 - 5	

Note: Please note that these products are only available in their standard forms; they cannot be customized for special sizes or specifications.

# **Dial Indicator Applications**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **Dial Snap Gage SERIES 201**

• Designed for quick GO/NG judgment of diameters of cylinders and shafts in machining processes.

• Wide (13.5×12 mm/1.53×47 in), flat carbide anvils.

• Anvil retracting stroke: 2 mm/0.08 in Anvil positioning range: 25 mm/1 in

• Adjustment nut: adjusts the measuring range.

• Clamp: adjustment nut

• Flatness of measuring face: 1 µm

• Repeatability of indication: 2 µm or better (repeatability of indicators is not included)

• The dial indicator and protection cover are optional. Also, some dial indicators and protection covers cannot be used with the dial snap gage. Consult Mitutoyo if intending to use dial indicators which are not recommended.



Note: The dial indicator and protection cover are optional.

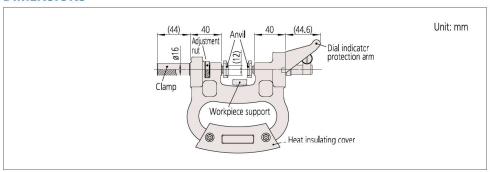
#### **SPECIFICATIONS**

Metric			
Order No.	Range (mm)	Parallelism (µm)	Measuring force* (N)
201-101	0 - 25		
201-102	25 - 50		
201-103	50 - 75		
201-104	75 - 100		
201-105	100 - 125		
201-106	125 - 150	5	15±3
201-107	150 - 175	5	10±3
201-108	175 - 200		
201-109	200 - 225		
201-110	225 - 250		
201-111	250 - 275		
201-112	275 - 300		

Inch	ı		
Order No.	Range (in)	Parallelism (in)	Measuring force* (N)
201-151	0 - 1		
201-152	1 - 2		
201-153	2 - 3		
201-154	3 - 4		
201-155	4 - 5		
201-156	5 - 6	0.00025	15±3
201-157	6 - 7	0.00025	13±3
201-158	7 - 8		
201-159	8 - 9		
201-160	9 - 10		
201-161	10 - 11		
201-162	11 - 12		

<sup>\*</sup> Measuring force is that force present before an indicator is installed and is determined at the point where the spindle is retracted 1 mm from the rest position.

#### **DIMENSIONS**





**Optional accessories** 

Dial protection cover: 21DZA000

**Recommended dial indicators (optional)** 

• Metric models:

Metric models:
2046SB: Dial indicator (Graduation: 0.01 mm)
2109SB-10: Dial indicator (Graduation: 0.001 mm)
Inch models: 2803SB-10 (Graduation: 0.0001 in)

## **Stands**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **SERIES 7 — Magnetic Stands**

- Mitutoyo's Magnetic Stands clamp to iron or steel surfaces with a strong magnetic force that is switchable ON or OFF to allow easy mounting and dismounting.
- Vertical/horizontal mounting holes and bushes are available for attaching dial test indicators and dial indicators\*.
- In addition, models **7014-10**, **7014E-10**, **7031-10**, **7032-10** and **7033-10** have a dovetail groove in the swivel holder for attaching dial test indicators that are equipped with a dovetail.
- \* Recommended dial indicators: compact and lightweight

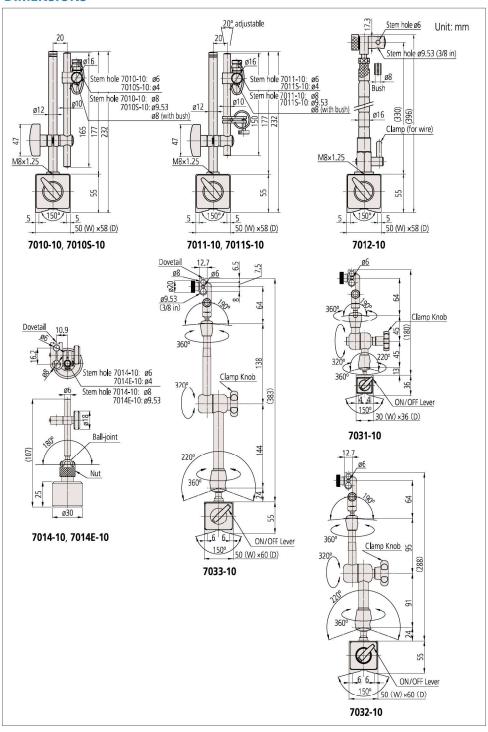




## **Stands**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **DIMENSIONS**



#### **SPECIFICATIONS**

DI LCIII	CATHOLIS			
Order No.	Description	Applicable holding stem sizes	Magnetic force*1	Remarks
7010-10*2*3	Magnetic stand	ø6 mm, ø8 mm	Approx. 600 N	_
7010S-10*2*3	Magnetic stand	ø4 mm, ø8 mm, ø9.53 mm (3/8 in)	Approx. 600 N	_
7011-10*2*3	Magnetic stand	ø6 mm, ø8 mm	Approx. 600 N	With fine adjustment
7011S-10*2*3	Magnetic stand	ø4 mm, ø8 mm, ø9.53 mm (3/8 in)	Approx. 600 N	With fine adjustment
7012-10* <sup>4</sup>	Magnetic stand	ø6 mm, ø8 mm, ø9.53 mm (3/8 in)	Approx. 600 N	_
7014-10* <sup>4</sup>	Mini magnetic stand	ø6 mm, ø8 mm, with dovetail	Approx. 150 N	Without magnet ON/OFF
7014E-10*2*3	Mini magnetic stand	ø4 mm, ø9.53 mm (3/8 in)	Approx. 150 N	Without magnet ON/OFF
7031-10	Universal magnetic stand	ø6 mm, ø8 mm, ø9.53 mm (3/8 in), with dovetail	Approx. 300 N	With mechanical locking system
7032-10	Universal magnetic stand	ø6 mm, ø8 mm, ø9.53 mm (3/8 in), with dovetail	Approx. 600 N	With mechanical locking system
7033-10	Universal magnetic stand	ø6 mm, ø8 mm, ø9.53 mm (3/8 in), with dovetail	Approx. 600 N	With mechanical locking system



<sup>\*1</sup> The magnetic holding force applies to that needed for vertical separation from a thick and flat steel object,
\*2 Back plunger type (**1160T**, etc.) cannot be attached.
\*3 When attaching a compact dial indicator (outer frame diameter 31, 36 or 40 mm), select a back cover type with a lug.
\*4 Use with a dial test indicator or SERIES 1 dial indicator (compact or lightweight type) is recommended.

## F

## Dial Gage Stands SERIES 7

- A convenient supporting stand for enabling a dial indicator to be used for comparative height or thickness measurements.
- Anvil: ø58 mm for **7001-10**, **7002-10** 90×90 mm for **7007-10**.
- Vertical fine adjustment is available with onetouch control thanks to the parallel spring suspension.



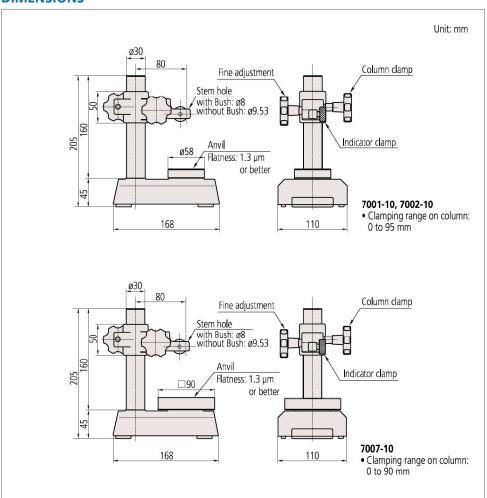


**7007-10** (with 90 mm square semi-serrated anvil)

## **Stands**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **DIMENSIONS**



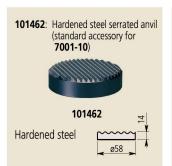
#### **SPECIFICATIONS**

Metric	_	
Order No.	Stem hole (mm)	Remarks
7001-10	ø8, ø9.53	With serrated anvil
7002-10	ø8, ø9.53	With flat anvil
7007-10	ø8, ø9.53	With square anvil

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect). Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

#### Accessories (for 7001-10, 7002-10)









#### Accessories for 215-156-10

- 21JAA329: Ø8 mm bush (standard accessory)
   21JAA330: Ø9.53 mm (3/8 in) bush (standard accessory)
   21JAA331: Ø15 mm bush (optional accessory)

#### **SERIES 215 — Granite Base Comparator Stands**

- The base is made of black granite that stays free of burrs and build-ups due to its finegrain composition.
- Easy maintenance due to the non-rusting base.
- The stability of the granite base assures long-lasting flatness accuracy.









#### **SPECIFICATIONS**

Order No.	Granite base size (W×D×H) (mm)	Clamping range (mm)	Stem hole (mm)	Remarks
215-150-10	120×180×50	110	ø8, ø9.53	With fine adjustment of 1 mm range
215-151-10	150×200×50	250	ø8, ø9.53	With fine adjustment of 1 mm range
215-153-10	200×250×80	260	ø8, ø9.53	With fine adjustment of 1 mm range
215-156-10	300×250×80	275	ø8, ø9.53, ø20	With fine adjustment over entire travel

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.2 mm/100 mm.

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

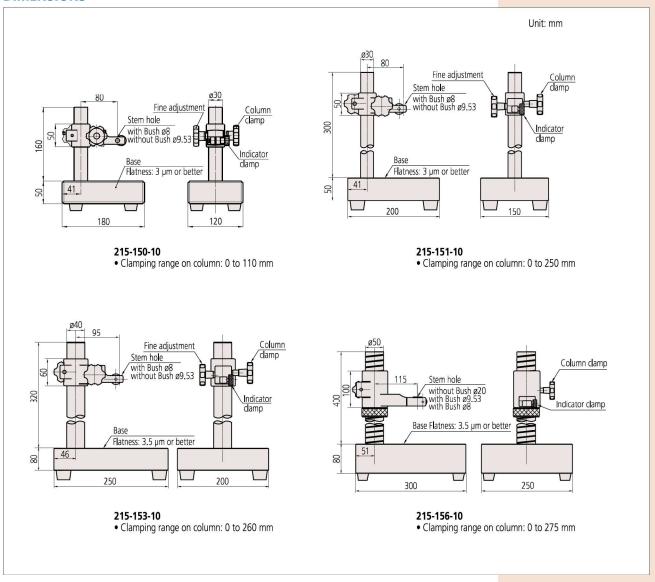
Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.



## **Stands**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **DIMENSIONS**



Typical application using Digimatic Indicator

#### Accessories for 215-505-10

- 21JAA329: ø8 mm bush (standard accessory)
- 21JAA330: ø9.53 mm (3/8 in) bush (standard accessory)
- 21JAA331: ø15 mm bush (optional accessory)

#### **SERIES 215 — Cast Iron Base Comparator Stands**

• These stands have a very stable cast-iron base • With an integrated indicator mounting that enables precise measurement.

• The semi-serrated anvil prevents very flat workpieces from wringing to it and the 2.3 µm flatness (or better) promotes accurate measurement.

section and arm, the bracket for BSC-30HX provides further improved rigidity, making it easy to adjust parallelism.

• BSB-20X uses a square 110 mm×110 mm serrated anvil while **BSC-30HX** uses a square 150 mm×150 mm serrated anvil.



#### **SPECIFICATIONS**

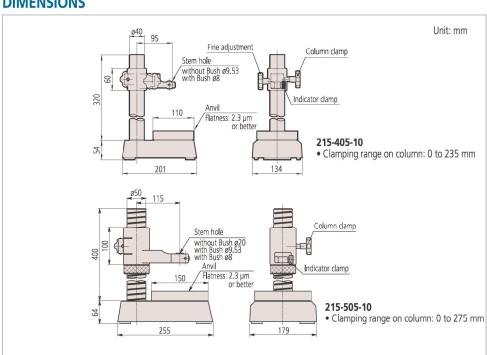
Order No.	Anvil	Micromotion mechanism (Adjustment range)	Stem hole (mm)	
215-405-10	Square semi-serrated anvil (110×110 mm)	Vertical fine adjustment (1 mm)	ø9.53, ø8 with Bush	
215-505-10	Square semi-serrated anvil (150×150 mm)	Micromotion screw	ø20, ø9.53 with Bush, ø8 with Bush	

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm.

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

#### **DIMENSIONS**





## **Stands**

Comparison measuring instruments which ensure high quality, high accuracy and reliability.

#### **SERIES 519 — Transfer Stands**

• Transfer Stands are designed for comparison measurements of size using a dial indicator or Digimatic Indicator.



#### **SPECIFICATIONS**

 11211	II C	

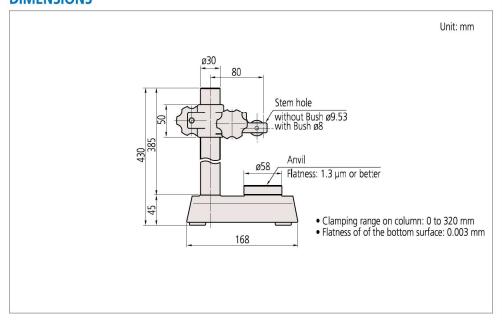
Order No.	Clamping range on column (mm)	Micromotion adjustment range (mm)	Stem hole (mm)
519-109-10	0 to 320	1	ø9.53. ø8 with Bush

Note 1: Perpendicularity of the stem hole to the anvil is better than 0.4 mm/100 mm.

Note 2: Take note that when mounting high-accuracy Linear Gages (with resolution of 0.1 µm or better) to these stands, accuracy may be affected depending on the perpendicularity of the mounting hole to the top surface of the anvil (cosine effect).

Note 3: Compact dial indicators (bezel ø31, ø36) are not suitable for use with these stands.

#### **DIMENSIONS**



#### **Accessories**

101462: Hardened steel serrated anvil (standard accessory)



101461: Hardened steel non-serrated anvil



101463: Hardened steel domed anvil (optional)



Accuracy		
	Mitutoyo	Reference JIS B 7540 Grade 1,100 mm or shorter
Bottom-surface flatness	2 µm or better	10 µm or better
V-surface flatness	2 µm or better	10 µm or better
Parallelism between the bottom-surface and a cylinder on the V-surface	7.5 µm or better	10 µm or better
Inclination of the V-anvil against the bottom-surface	10 µm or better	10 µm or better
Parallelism between the side surface and a cylinder on the V-surface	7.5 µm or better	20 µm or better
Difference in the height of a pair of V-Blocks	9 µm or better	10 µm or better

Optional Accessory 101462 Serrated anvil (standard accessory)

# V-Block Set SERIES 181

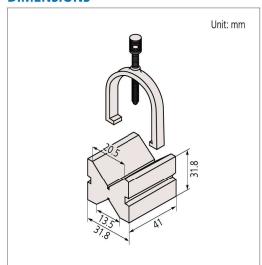


# SPECIFICATIONS Metric

-			m	
М		7	T	r
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Order No.	Max. workpiece dia. (mm)	Remarks
181-902-10	25	A set of two blocks and clamps

### **DIMENSIONS**



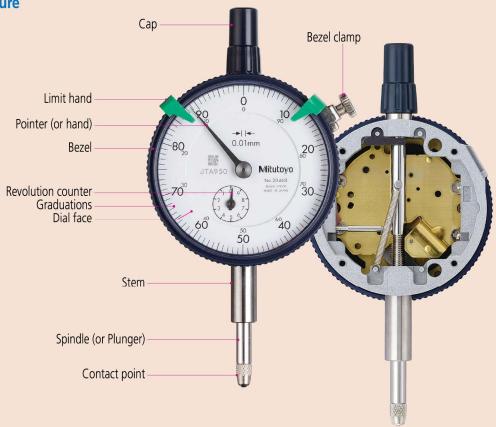


# Quick Guide to Precision Measuring Instruments



## **Dial Gages and Digital Indicators**

#### **Nomenclature**

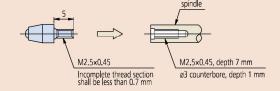


## **Mounting a Dial gage**

Stem mounting	Method	Clamping the stem directly with a screw	Clamping the stem by split-clamp fastening					
	Note	<ul> <li>Mounting hole tolerance: ø8 G7 (+0.005 to 0.02)</li> <li>Clamping screw: M4 to M6</li> <li>Clamping position: 8 mm or more from the lower edge of the stem</li> <li>Maximum clamping torque: 150 N·cm when clamping with a single M5 screw</li> <li>Note that excessive clamping torque may adversely affect spindle movement.</li> </ul>	• Mounting hole tolerance: ø8 G7 (+0.005 to 0.02)					
Lug mounting	Method	M6 screw Plain washer						
	Note	<ul> <li>Lugs can be changed 90° in orientation according to the application. (The lug i</li> <li>Lugs of some SERIES 1 models (1911T-10, 1913T-10 and 1003T), however, ca</li> <li>To avoid cosine-effect error, ensure that any type of gage or indicator is mount</li> </ul>	s set horizontally when shipped.) annot be altered to horizontal. ed with its spindle in line with the intended measurement direction.					

#### **Contact point**

- Screw thread is standardized on M2.5x0.45 (Length: 5 mm).
  Incomplete thread section at the root of the screw shall be less than 0.7 mm when fabricating a contact point.





#### Measuring orientation

ivieasuring orientation		
	Orientation	Remarks
Vertical (contact point downward)	Ground ///	_
Lateral (spindle horizontal)	Ground /////	If measurement is performed in the lateral orientation, or upside-down
Upside-down (contact point upward)	Ground	If measurement is performed in the lateral orientation, or upside-down orientation, the measuring force is less than in the vertical orientation. In this case be sure to check the operation and repeatability of the indicator. For guaranteed-operation specifications according to the operating orientation refer to the specific product descriptions in the catalog.

### **Setting the origin of a Digimatic indicator**



The accuracy specification in the range of 0.2 mm from the end of the stroke is not guaranteed for Digimatic indicators. When setting the zero point or presetting a specific value, be sure to lift the spindle at least 0.2 mm from the end of the stroke.

### Notes on using a dial indicator or Digimatic indicator

- Do not lubricate the spindle. Doing so might cause dust to accumulate, resulting in a malfunction.
- If the spindle movement is poor, wipe the upper and lower spindle surfaces with a dry or alcohol-soaked cloth. If the movement is not improved by cleaning, contact Mitutoyo for repair.
- Before making a measurement or calibration, confirm if the spindle moves upward and downward smoothly, and stability of the zero point.

Dial Indicator Standard P7E02, 2017 (Extract fro

Dial II	ndicator s	tandard i	3/503: 201/ (Extract from	i JIS/Japanese Industrial Standard	15)
	Item Model		Measuring method (zero-point fixed)	Evaluation method (performance evaluation by moving the zero point)	Measurement examples
Indication	Indication error over the entire measuring range 1/10 revolution indication error	One-revolution dial indicator and multi-revolution dial indicator	Set the dial indicator on the supporting stand, and read the indication error*1 of the next point while gradually retracting the spindle.  - Every 1/10 revolution for the first two revolutions*2  - Every half revolution from two to five	Obtain the difference between the maximum and the minimum values of indication error of all measurement points in both retract and extend directions.  During the first two revolutions in both retract and extend directions, obtain the maximum difference of the indication error among the adjacent measurement points per 1/10 revolutions*3.	Dial indicator
error	1/2 revolution indication error	Multi-revolution	revolutions - Every revolution from five to ten revolutions - Every five revolutions from 10 to 50	During the first five revolutions in both retract and extend directions, obtain the maximum difference of the maximum and the minimum indication errors over the measuring range per 1/2 revolutions.	Supporting stand Micrometer head or other
	1 revolution indication error	dial indicator	Next after retracting the spindle for more	During the first ten revolutions in both retract and extend directions, obtain the maximum difference of the maximum and the minimum indication errors over the measuring range per one revolution.	length measuring unit
Retrace e	error	One-revolution dial indicator and multi-revolution dial indicator	extend the spindle gradually and read the indication error at the same measurement point in the retract direction.	Obtain the maximum difference of all the measuring points in reference to the indication error at the same measuring point in both forward and backward directions.	
Repeatab	epeatability		Set the dial indicator on the supporting stand, retract the spindle at a desired position within the measuring range. Then, extend the spindle quickly and slowly three times and read each value.	Obtain the maximum difference among five indication values.	Supporting stand (Gauge block) Measuring stage
Measurin	g force	One-revolution dial indicator and multi-revolution dial indicator	Set the dial indicator on the supporting stand, retract and extend the spindle continuously and gradually, and read the measuring force at the zero and end points.	Obtain the maximum measuring force, the minimum measuring force, and the difference of the measuring force in both retract and extend directions at the same measurement point.	Dial indicator  Supporting stand  Top pan type spring scale or force gage

<sup>\*1</sup> For how to read the indication error, either read the input quantity of the measuring instrument aligning the long hand to the graduation, or read the indication value of the dial indicator according to the moving amount of the measuring instrument.

<sup>\*2</sup> With the one-revolution dial indicator, read the indication error per 10 graduations.
\*3 With the one-revolution dial indicator, read the indication error per 10 graduations.



			Maximum permissible error (MPE) by measurement characteristics dial indicators with bezel dia. 50 mm or larger											M. characte	ristics - d	oermissibl ial indicat Back Plur	ors with I	oezel dia.	50 mm c	ent er smaller
Gra	duation (mm)				0.	01				0.005		0.001		0.01				0.005	0.002	0.001
Me	asuring range (mm)	1 or less	Over 1 and up to 3			Over 10 and up to 20		and up		5 or less	1 or less	Over 1 and up to 2	Over 2 and up to 5	1 or less	Over 1 and up to 3	Over 3 and up to 5	Over 5 and up to 10	5 or less	1 or less	1 or less
R	etrace error	3	3	3	3	5	7	8	9	3	2	2	3	4	4	4	5	3.5	2.5	2
R	epeatability	3	3	3	3	4	5	5	5	3	0.5	0.5	1	3	3	3	3	3	1	1
	Arbitrary 1/10 revolution	5	5	5	5	8	10	10	12	5	2	2	3.5	8	8	8	9	6	2.5	2.5
error	Arbitrary 1/2 revolution	8	8	9	9	10	12	12	17	9	3.5	4	5	11	11	12	12	9	4.5	4
Indication	Arbitrary One revolution	8	9	10	10	15	15	15	20	10	4	5	6	12	12	14	14	10	5	4.5
Indi	Entire measuring range	8	10	12	15	25	30	40	50	12	5	7	10	15	16	18	20	12	6	5

Note 1: The maximum permissible error (MPE) for one-revolution dial indicators does not specify the indication error of an arbitrary 1/2 and 1 revolution.

Note 2: The MPE represents the value at 20 °C, which JIS B 0680 defines as the standard temperature.

#### Mitutoyo's Response to Dial Indicator Standard B 7503: 2017

- We guarantee the accuracy of completed products by inspecting them in the vertical posture. Standard-attached inspection certificate includes inspection data.
  We issue paid-for inspection certificates for horizontal or opposite posture if required.
- It is said that, for evaluation of the compatibility to the specifications, JIS B 0641-1 or the criteria where the internationally-recognized specification range and the OK range are equal shall be applied. Also, it is said that the uncertainty is preferred to be evaluated based on ISO 14253-2 and ISO/IEC Guide 98-3. Therefore, we perform shipping inspection of dial indicators inclusive of the uncertainty of calibration as in the past.

#### Dial test indicator (lever type) Standard B7533: 2015 (Extract from JIS / Japanese Industrial Standards)

No		Measuring method	Measuring point	Evaluation method	Diagram
1	Error of indication over a range of Measuring range	Holding the dial test indicator (lever type), define the reference point at near the contact point resting point where the indication and error of indication is set zero.		Obtain the difference between the maximum and the minimum values of indication error of all measurement points in the forward direction.	Dial test indicator (lever type)
2	over a range of	Then, move the contact point in the forward direction and read the error of indication at each measuring point.  Next, after moving the contact point for more than three graduations from the end of the	Per 10 graduations in the forward and backward	In the forward direction from the reference point to the end point, obtain the maximum difference of the indication error among the adjacent measurement points per 10 graduations.	Supporting
3	Error of indication over a range of One revolution	measuring range, move the contact point in the backward direction and read the error of indication at the same measurement point in the forward direction.  (The forward direction is the direction against	direction from the reference point to the end point.	In the forward direction from the reference point to the end point, obtain the maximum difference of the maximum and the minimum indication errors to be read by the zero-point fixed method over the measuring range per 1 revolution.	
4	Hysteresis	the measuring force to the contact point of the lever-operated dial indicator; the backward direction is the measuring force applied direction.)		Obtain the maximum difference in reference to the indication error at the same measuring point in both forward and backward directions among all the measurement points.	Micrometer head or length measuring unit
5	Repeatability	Holding the dial test indicator (lever type) with its contact point parallel with the top face of the measuring stage, move the contact point quickly and slowly five times at a desired position within the measuring range and read the indication at each point.	At arbitrary points within the measuring range	Obtain the maximum difference of the five measured values.	Dial test indicator (lever type)  Supporting stand
6	Measuring force	Holding the dial test indicator (lever type), move the contact point in the forward and backward directions continuously and gradually, and read the measuring force in the measuring range.	Reference point and end point within the measuring range	Obtain the maximum and the minimum values in reference to the measuring force.	Dial test indicator (lever type)  Top pan type spring scale



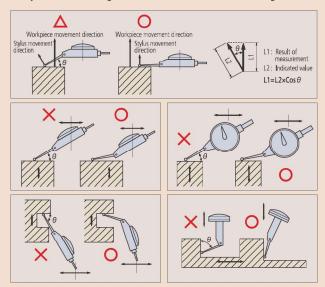
Note 3: The measurement characteristics of a dial indicator have to meet both maximum permissible error (MPE) and measurement force permissible limits (MPL) at any position within the measuring range in any posture when the measurement characteristics are not specified by the manufacturer.

#### • Maximum permissible error and permissible limits

Graduation (mm)			0.001/0.002		0.01					
Revolution		1 revolution	Multi-re	volution		Multi-revolution				
Measuring range (mi	m)	0.3 or less	Over 0.3, up to 0.5	Over 0.5, up to 0.6	0.5 or less	Over 0.5, L1 ≥ 35	up to 0.6 35 < L1	Over 1.0, up to 1.6		
Error of indication	Measuring range (μm)	4	6	7	6	9	10	16		
over a range of	One revolution (µm)	_	5	5	_	_	_	10		
	10 scale divisions (µm)	2	2	2	5	5	5	5		
Hysteresis (µm)		3	4	4	4	4	5	5		
Repeatability (µm)		1	1	1	3	3	3	3		
Massuring force (NI)	Max.	0.5	0.5	0.5	0.5	0.5	0.5	0.5		
Measuring force (N)	Min.	0.01	0.01	0.01	0.01	0.01	0.01	0.01		

#### **Dial Test Indicators and the Cosine Effect**

Always minimize the angle between movement directions during use.



The reading of any indicator will not represent an accurate measurement if its measuring direction is misaligned with the intended direction of measurement (cosine effect). Because the measuring direction of a dial test indicator is at right angles to a line drawn through the contact point and the stylus pivot, this effect can be minimized by setting the stylus to minimize angle  $\theta$  (as shown in the figures). If necessary, the dial reading can be compensated for the actual  $\theta$  value by using the table below to give the result of measurement. Result of measurement = indicated value × compensation value

#### Compensating for a non-zero angle **Examples**

Angle	Compensation value
10°	0.98
20°	0.94
30°	0.87
40°	0.77
50°	0.64
60°	0.50

If a 0.002 mm measurement is indicated on the dial at various values of  $\theta$ , the result of measurements are: For  $\theta$ =10°, 0.002 mm×0.98=0.00196 mm For  $\theta$ =20°, 0.002 mm×0.94=0.00188 mm For  $\theta$ =30°, 0.002 mm×0.87=0.00174 mm

#### Mitutoyo's Response to Lever-operated Dial Indicator B 7533: 2015

- In the finished product inspection, the accuracy is guaranteed using the horizontal, tilted, vertical type dial indicator with its dial face facing upward; the parallel type with its dial face set in the vertical orientation.
- Standard-attached inspection certificate includes inspection data.
- The inspection certificate for other than the above postures is available for a fee.
- It is said that, for evaluation of the compatibility to the specifications, the criteria based on JIS B 0641-1 or ISO/TR14253-6 shall be applied. Also, it is said that the uncertainty is preferred to be evaluated based on ISO 14253-2 and ISO/IEC Guide 98-3. Therefore, we perform shipping inspection of dial indicators inclusive of the uncertainty of calibration as in the past.
- For pocket types, we perform the finished product inspection based on JIS B 7533-1990.

