No.99MAJ004B2
SERIES No.511

Operation Manual

511 series

Digimatic bore gage

Mitutoyo

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Introduction

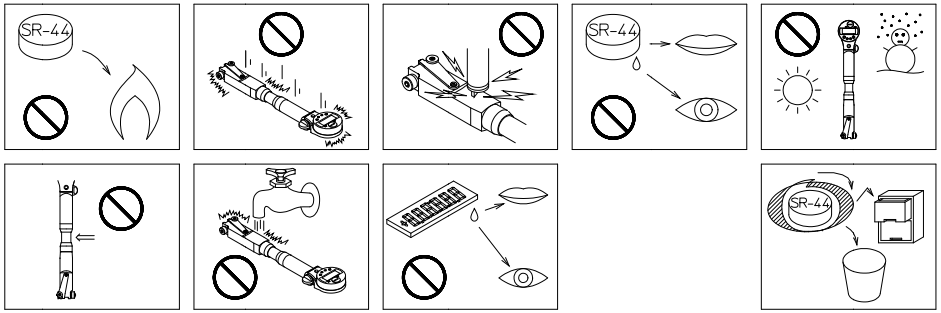
Digimatic Bore gage is the dedicated ID measuring instrument. To take full advantage of this gage, read this manual thoroughly before using it. After reading , retain this manual for future reference. Specifications of the Digimatic Bore gage and the information in this manual are subject to change without notice.

Warranty : In the event that the Mitutoyo Digimatic Bore gage should prove defective in workmanship or material, within one year from the date of original purchase for use, it will be repaired, at our option, free of change upon its prepaid return to us. Please contact your Mitutoyo office.

Features

- Capable of holding the minimum value. This provides simple, accurate and stable ID measurement easily.
- Capable of tolerance judgment for the minimum value.
- The analog bar shows the minimum value, upper/lower limit values (in the tolerance judgment) and the current value.
- Capable of presetting 3 reference values (master values), and setting a corresponding tolerance value for each.
- By connecting a data processor, measurement value can be recorded.

Precautions on use



Observe the following precautions to avoid instrument failure and malfunction

IMPORTANT

- Do not disassemble and modify this indicator.
- Do not bump any part of the instrument.
- Although separating for extension combination is possible, please use a display part and measurement part of this instrument combining the surely same serial number comrade. A guarantee of accuracy becomes impossible.
- Use only the supplied interchangeable washer, anvil and other accessories. Do not use them with other instruments.
- To clean the indicator, use a soft cloth soaked in a diluted neutral detergent. Do not use any organic solvent (thinner or benzene). It may deform or damage the indicator.
- If the indicator is not used for more than three months, remove the batteries from the indicator to store them separately. Otherwise, the liquid leaked from the battery may damage the indicator

NOTE

Use the instrument in a temperature-controlled room that has minimum temperature fluctuation. Allow a sufficient time for the instrument and workpiece to thermally stabilize if it is moved to an environment with a different temperature.

Warning on battery

- Do not disassemble, short-circuit, charge, heat the battery to 100℃ and over, or throw the battery into fore; otherwise the content may leak to come in contact with the eye, or cause heating or explosion.
- Should the contact accidentally come into contact with the eye or skin, or get into the mouth, rinse with water immediately and consult a physician. Should it attach to the clothes, wash it with water.
- For disposing or storing battery, cover the positive(+) and negative(−) terminals with a piece of insulating tape to prevent contact with other metals.
- To store, avoid direct sunlight, high temperature and high humidity.

Warning on disposal

- For this instrument the LCD and a silver oxide battery are used. When disposing them, follow the local ordinances or regulations of respective local governments.。
- The LCD part contains irritating substance. Should the liquid content accidentally come into contact with the eye or skin, rinse with water immediately and consult a physician. Should it get into the mouth, immediately rinse inside the mouth, swallow plenty of water, vomit, then consult a physician.

Electromagnetic compatibility

This product complies with the EMC Directive below. Note that in environments where electromagnetic interference exceeds EMC requirements defined in this directive, appropriate countermeasures are required to assure the product performance.

- A display value on this product may flicker or disappear temporarily due to electromagnetic interference caused by electrostatic discharge. However, this product will return to normal after removing the interference.

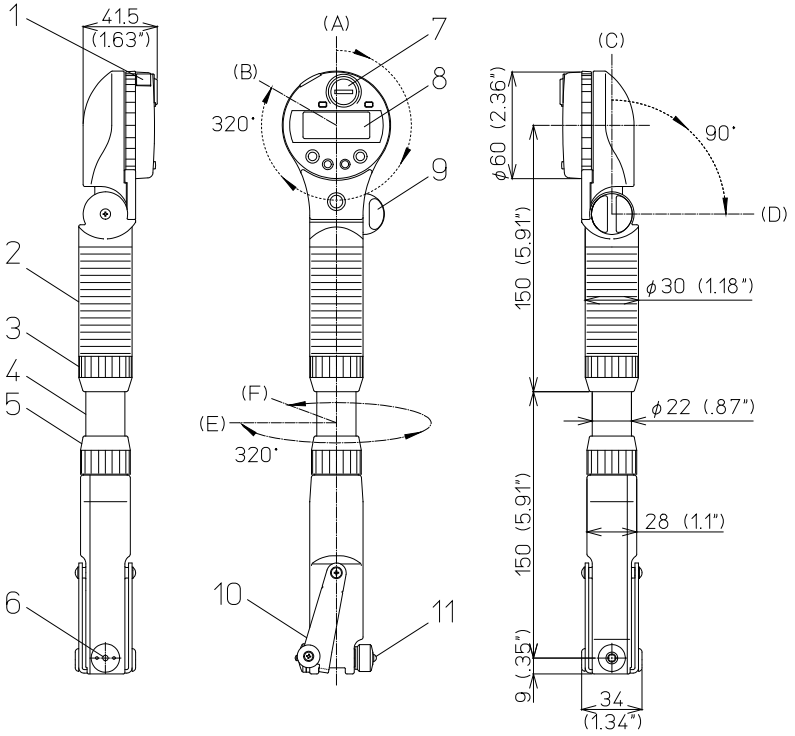
CE marking
EMC Directive EN61326-1
Immunity test requirement : Clause 6.2 Table 2
Emission limit : Class B
RoHS Directive EN50581

Disposal of Old Electrical & Electronic Equipment (Applicable in the European Union and other European countries with separate collection systems)

- This symbol on the product or on its packaging indicates that this product shall not be treated as household waste. To reduce the environmental impact of WEEE (Waste Electrical and Electronic Equipment) and minimize the volume of WEEE entering landfills, please reuse and recycle.
- For further information, please contact your local dealer or distributors.

1. Nomenclature, Dimensions and adjustment of angle

Unit : mm



1.

1 Nomenclature

1 Output connector (with a rubber cap) 2 Holder (grip) 3 Holder nut 4 Pipe 5 Pipe nut
6 Contact nut 7 Battery cap 8 LCD 9 Clamp knob 10 Guide 11 Anvil

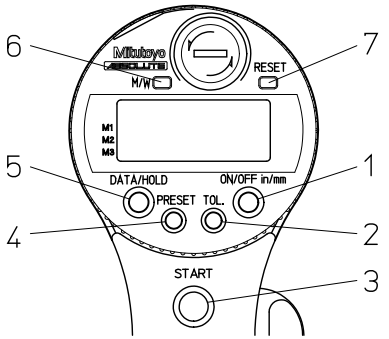
1. 2 Adjustment of angle

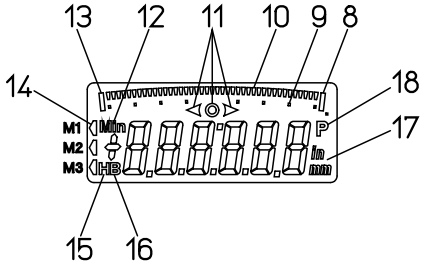
- The display unit rotates 330° (B) clockwise from the position (A).
- 90-degree adjustment (seven positions) of the display unit can be carried out from (C) to (D). Please loosen a clamp knob and adjust to a legible angle. Please fasten a clamp knob, if adjustment finishes.
- The 320 degrees of the directions of a contact point can be rotated from (E) to (F).
  Please loosen a holder nut and adjust in the direction which is easy to measure. Please fasten a holder nut, if adjustment finishes.

Important

- It will become the cause of failure if it turns by force exceeding the stopper in each position.
- It will become the cause of failure if a display unit is drawn out or pushed in. when combination ex.- rod.

2. Nomenclatures and Functions of the display





2.1 Function of switch

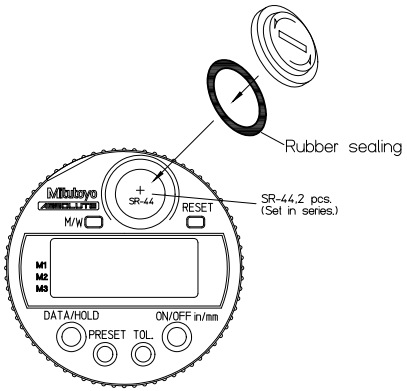
Switch	Valid mode/Condition(pressing time)	Function
1in/mm ON/OFF	always valid(＜2sec)	Turns the power ON/OFF
	Measurement mode and initial state (≧2sec)	Switches inch/mm display. (unique to inch/mm model)
2TOL.	Tolerance judgment ON	To the initial state.(tolerance judgment OFF)
	Tolerance judgment OFF	To tolerance setting mode
	Tolerance setting mode(2sec)	Set the Upper/lower limit value
	Tolerance setting mode(2sec)	Changes the active digit.(in the upper/lower limit value setting)
3START	Measurement mode and initial state	Starts workpiece measurement.
	Master setting mode	Starts setting with a master ring.
4PRESET	Master setting mode(＜2sec)	Set the master value.
	Master setting mode(≧2sec)	Change the active digit. (in the master setting)
	When installing battery	To the initial state.
5DATA/HOLD	Measurement mode and initial state	Output the date.(if a data processor is connected)
		Hold/release the display.(if no data processor is connected)
	Master setting mode	Hold/release the display.
6M/W	Master setting mode(＜2sec)	To the initial state.
	Master setting mode(≧2sec)	Switching the master (M1→M2→M3→M4)
	Measurement mode and initial state	To the Master setting mode.
7 RESET	When combination extension mode	To the initial state.

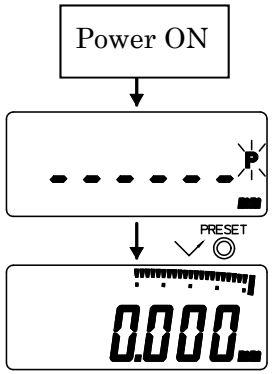
2. 2 Nomenclatures

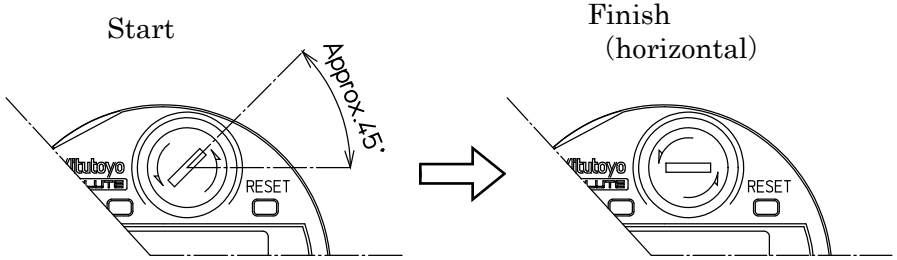
8 Upper over range 9 Graduation 10 Analog bar 11 Tolerance judgment result
12 Minimum value (Min) measurement 13 Lower over range 14 Master No.
15 Hold 16 Battery warning 17 Unit 18 During the master setting

3. Setup

3. 1Battery replacement







Set two silver oxide batteries (SR-44) in series with the positive (+) side facing up.

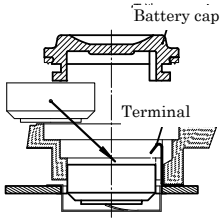
Step1Remove the battery cap by turning it counterclockwise (arrow direction) with a coin set in the groove. Then replace the batteries by new ones.

Step2 Put back the battery cap and turn it clockwise to secure (upper right 45° to horizontal). Be careful not to allow the seal to protrude.[------]appears, and the sign "P" blinks.

Step3 Press the [PRESET] switch shortly, then the display will change to "0.000mm" in initial state. The inch/mm displays "0.00000inch" or "0.0000inch".
Move to the master setting.(Refer to the section 4.2.1 Master setting mode.)

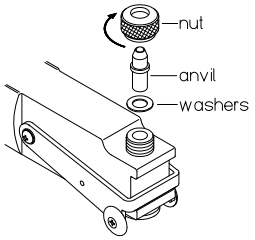
Important

- Install the batteries in the direction described on the right, so as not to damage the battery terminal.
- Replace the 2 batteries together. Do not install the used and fresh batteries mixed.
- If an abnormal display appears, remove the batteries, then install them again.



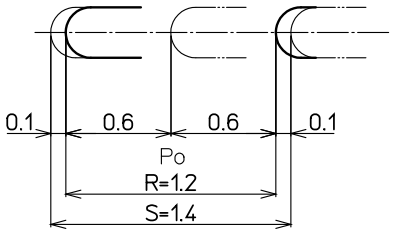
- All of the setting values (master value and upper/lower limit values) are already set to "0.000mm"("0.00000inch"or"0.0000inch"for inch/mm model).

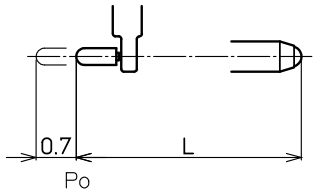
3. 2Setting the measuring dimension



For the required measuring dimension select the appropriate interchangeable washers and the anvil and set them on the main unit. If performing measurement with the interchangeable washers, and the anvil assembled, use a minimum number for each.

Although there is 1.4mm of all a contact point strokes, effective measurement length is ±0.6mm (a total of 1.2mm) on the basis of P0(neutral point), as shown below. Before and after all strokes, every 0.1mm, since accuracy is not guaranteed in a free stroke, please be careful. In measurement, we recommend you to set the

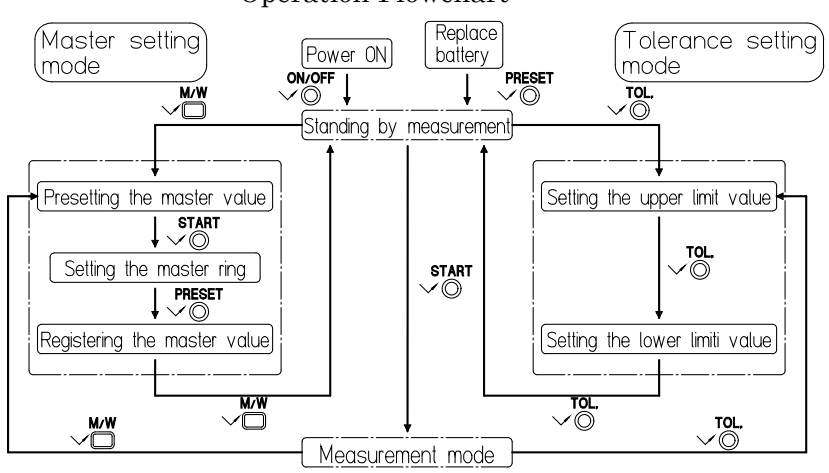




center of all tolerance ranges as a zero point(neutral point) as much as possible.

4. Measurement

4. 1Outline



・Turn the power on(or replace the batteries), then it stands by measurement(initial state). If the master setting is completed. Press the[START]button shortly to measure workpieces. (See the Operation Flowchart right.) In the initial state, the current position of the contact point is shown on the digital display and the analog bar, but the minimum value cannot be held.

・this instrument has 3 modes, Master setting mode. Tolerance setting mode, and Measurement mode. (Refer to the Operation Flowchart)

・Master setting mode：Calibrate this instrument using the master ring. The calibration procedures are as follows.

Presetting the master value：Preset the value of the master ring.

Setting the master ring：Put this instrument into the master ring, then probe the minimum value. On the digital display the minimum value is held.

Registering the master value：Register the master value where the minimum value is detected by probing the master ring.

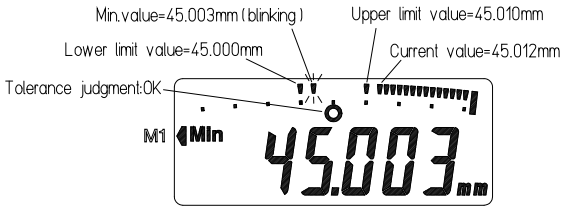
・Tolerance setting mode：Set the tolerance limit(upper/lower limits). They are shown on the analog bar, and the tolerance judgment result(“◀”、“O”、“▶”)is displayed.

・Measurement mode：Measure the inside diameter (minimum value) of the workpiece. The minimum value is held on the digital display.

・If extension rod attachment or removal, or if changing the anvil or washer, calibrate this instrument with a reference such as a master ring.

・Set the upper/lower limits in the tolerance setting mode to perform the tolerance judgment.

・The display has the following features while measuring a workpiece or setting the master ring.
The digital display holds the minimum value, which makes it easy to confirm the minimum value. The analog bar shows the current as well as the minimum value (linked).



If the tolerance limits are set, the analog bar also shows the upper/lower values. Therefore the state of the diameter to the tolerance limit can be checked easily. The example on the left shows a measurement result of a workpiece, the minimum value = 45.003mm(current value=45.012mm), with the setting of the upper limit=45.010mm and the lower limit=30.000mm

4. 2 Operation

Following the flowchart on the left, here explains the procedures in order of the Master ring measurement mode, Tolerance setting mode and Measurement mode.

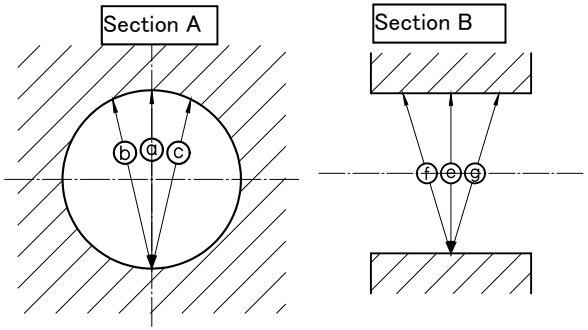
Note

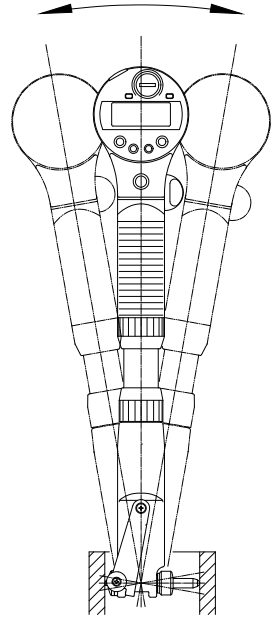
Two ways of key operation are represented by the following illustrations.

Press shortly(less than 2sec.). Press and hold(2sec. or more)

4. 2. 1The method of master setting

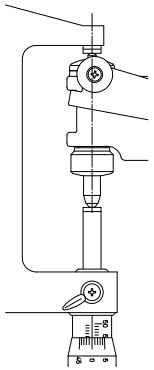
・This instrument is a comparison measurement machine. Please be sure to perform master adjustment by the following methods in measurement. When the time of extension rod attachment or removal or anvil, and a substitute washer are changed, master adjustment is surely required. Please refer to 4.2.2 Terrence setting mode.





a) Master setting with the ring gauge ormastering.

For periodically taking measurements over the long term, of mass produced parts for example from workpieces with identical specifications, it is recommended that a master ring is prepared. The setup procedure for the Bore Gage is the same as that for actual measurement.
Diameter(e) is maximized when intersection(A) is perpendicular to the axis to the objective cylinder, thus the Bore Gage will take the minimum reading. In contrast, diameter(e) is minimized at intersection(B), which includes the cylinder axis, so that the Bore Gage will take the maximum reading. Therefore, when using the bore gage, adjust the moving direction of the contact point along(a) on intersection (A), and along(e) on intersection(B).
In this instrument, diameter (a) is automatically calculated by the guide. In order to make diameter (e) agree, the point which this instrument is shaken as shown in the right figure, and shows the minimum value is looked for.



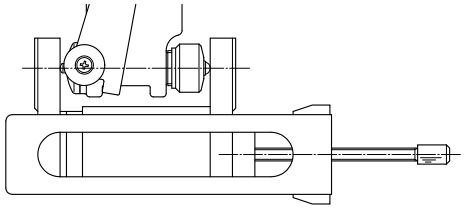
b) Master setting with outside micrometer

Micrometer is fixed to a stand and it opens to required length. As shown in the right figure, this instrument is inserted between two measurement sides of micrometer, and the point which shows the minimum value is looked for. Master adjustment by micrometer needs skill to some extent, in order that the automatic centripetalism by the guide may not work.

NOTE

・Hold the micrometer vertically so that the micrometer head facing downward.
・Do not clamp the micrometer while performing this adjustment.

c) Master setting with gauge blocks

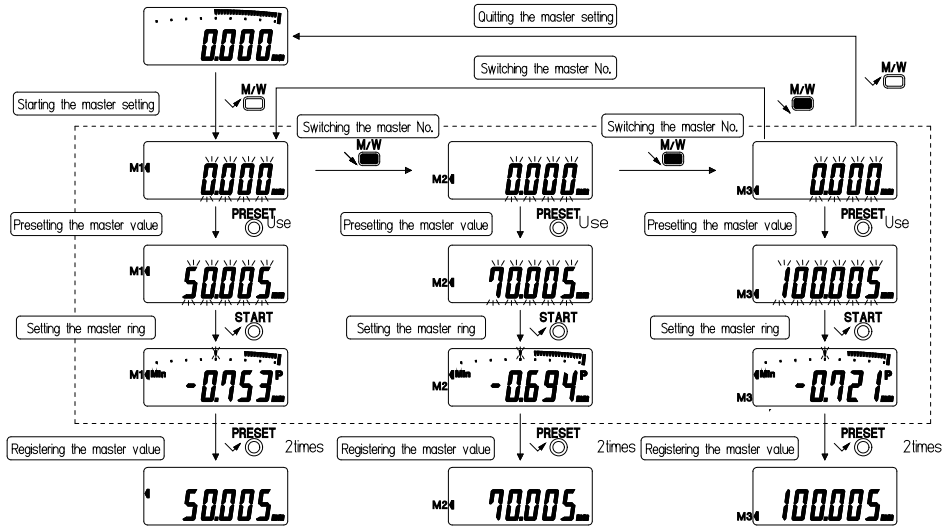


Master setting can be carried out combining gauge blocks and accessories .
Experience is needed for this method as is so for the outside micrometer.

Please ask nearby a Mitutoyo sales office about the combination of gauge blocks and accessories.

4. 2. 2Master setting mode

Using the master ring of 50.005mm, preset the master value to the master No. M1.



a) Presetting the master value

Select the master No., then preset the value of the master ring (master value).

Step 1 Press the [ON/OFF] button shortly to turn the power on.(Initial state)
If it is in the measuring mode, skip this step.

Step 2 Press the [M/W] button shortly. The analog bar disappears, then the previous master value registered at the M1 blinks. When presetting the master value at M2 or M3, hold the [M/W] button to switch the master No.. The master No. will switches M1 – M2 – M3 – M1.

Step 3 Press the [PRESET] button ("P" blinks.), then preset the master value. If no need to change the value, move to **the step 6**.

Step 4 Press the [PRESET] button to preset the master value into each digit.
Holding the [PRESET] button : The blinking digit moves on. Hold the [PRESET] button until a desired digit starts blinking.
Pressing the [PRESET] button shortly : Every press of the button switches display value. The sign switches between + and – and the figure changes from 0 – 1 – 2 … 9. Repeat this procedure to preset the master value correctly to each digits.

Step 5 Hold the [PRESET] button until the sign "P" starts blinking again.

Step 6 Press the [PRESET] button shortly. The new preset value starts blinking.

To register this value as the master value , move to the b) Setting the master ring and c) Registering the master value.

IMPORTANT

- If the master No. is changed, execute the master setting to register the master value again.
- The unit (inch/mm) cannot be changed in the middle of the master setting. If the master setting is started in the inch state, the master value registered in metric is converted and displayed in inch.

b) Setting the master ring

Put this instrument into the master ring, and probe a minimum value. This can be performed after **the step 6 of a) Presetting the master value**.

Step 1 Put this instrument is mounted into the master ring.

Step 2 Press the[START] button shortly to be on the waiting for detecting a minimum value. The sign "Min"and "P" are turned on, the digital display shows "0.000mm", and the center analog bar ("0.000mm") blinks.

INPORTANT

Before pressing the [START] button, put this instrument into the master ring.

Step 3 Probe the minimum value of the master ring. When a minimum value is detected/updated, the digital display holds its value and the analog bar leaves a blinking cell at the position.

Step 4 Finish detecting the minimum value. The digital display holds minimum value, and the analog bar shows the minimum value (blinks) and the current value (light).

Step 5 To confirm the minimum value detected in the step 4, press the [START] button again. The minimum value position will be "0.000mm" (at the center of analog bar), then a minimum value can be detected again.

Step 6 Probe this instrument to detect a minimum value again. The difference to the minimum value detected in **the step 4** is displayed. Check whether the calibration is correctly performed or not.

Step 7 If there is a possibility of an accidental change of the minimum value detected , press the [DATA/HOLD] button shortly to hold the display value, **then move to the c) Registering master value**. (The sign "H" is turned on.) To release the display value press again the [DATA/HOLD] button shortly.

INPORTANT

- Until the master value is registered, checking the master value (**step 5**) can be repeated.
- If the value exceeds the display range during the detection, the analog bar indication will be changed so that the minimum value comes at the center of the bar.

c) Registering the master value

This can be performed after **the step 7 of b) Setting the master ring**. If this is not performed, the preset value set in the a) Presetting the master value is not registered as the master value.

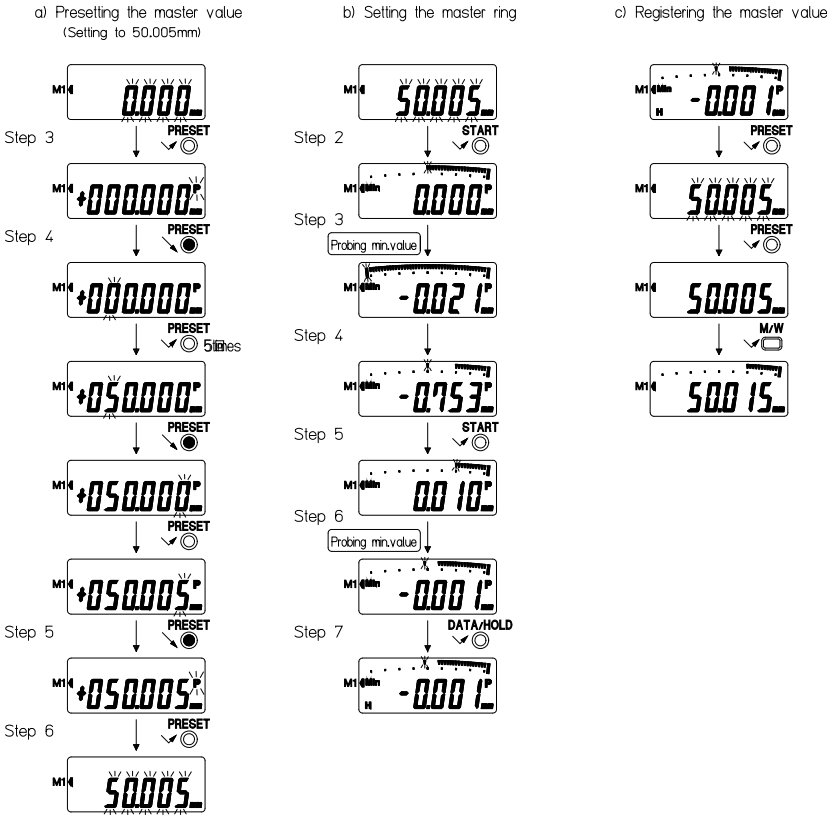
Step 1 Press the [PRESET] button shortly to call the preset value (blink) set in the **a) Presetting the master value**. Then sign "P" and "Min" disappear.

Step 2 Press the [PRESET] button again shortly to register the master value. The figure stops blinking (light).

IMPORTANT

To check the calibration, press the [START] button shortly after registering the master value. Then prove a minimum value of the master ring. If the minimum value equals the master value, moves to **the step 3**, for other cases repeat from **the step 1** again.

Step 3 Press the [M/W]button shortly to quit the master setting mode. If becomes on the initial state, the new master value comes at the center of the analog bar.



4. 2. 3Tolerance setting mode

In this mode the upper/lower limit values can be set for the master values of M1, M2 and M3 registered in the section 4.2.1 Master setting mode. After setting the tolerance value, the analog bar shows the upper and lower limits. Here explains how to set the upper limit (30.010mm) and the lower limit (30.000mm) to the master No. M1 (30.005mm).

Step 1 Be sure that it is on the initial state or in the measurement mode.

Step 2 Press the [TOL.] button shortly. The analog bar disappears and the previous upper limit value of M1 is displayed. (" ▶ " blinks.)

Step 3 Press the [TOL.] button to set the upper limit value into each digit. (" ▶ " lights.)

Holding the [TOL.] button: The blinking digit moves on. Hold the button until a desired digit starts blinking.

Pressing the [TOL.] button shortly: Every press of the button switches display value. The sign switches between + and − and the figure from 0 − 1 − 2 ... 9.

Repeat this procedure to set the upper limit value correctly to each digit.

Step 4 Hold the [TOL.] button until the sign " ▶ " starts blinking.

Step 5 Press the [TOL.] button shortly. The previous lower limit value set to M1 is displayed. (" ◀ " blinks.)

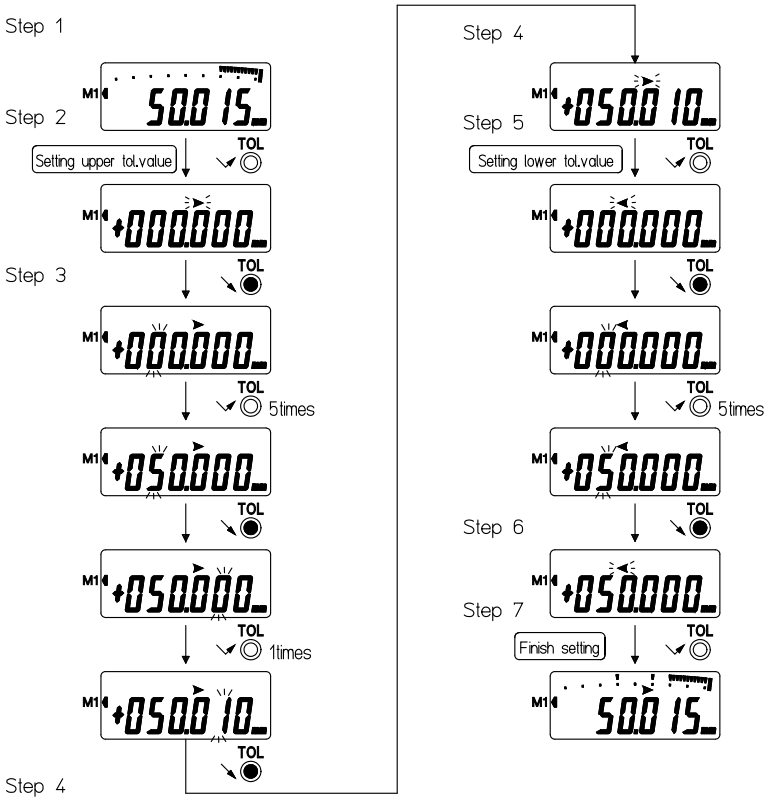
Operate the [TOL.] button to set the lower limit value to each digit, following the step 3.

Step 6 Hold the [TOL.] button until the sign " ◀ " starts blinking.

Step 7 Press the [TOL.] button shortly to quit the tolerance setting mode. The tolerance judgment is started on the initial state.

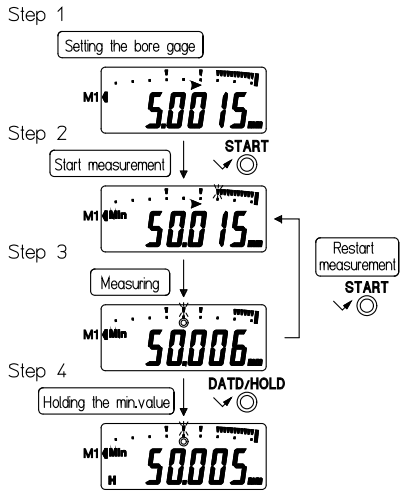
IMPORTANT

- If the upper limit is smaller than the lower limit, "E−−SE" (tolerance setting error) is displayed. Set the tolerance limit again returning to **the step 2**. The value set can be confirmed by pressing the [TOL.] button shortly.
- The weight of the analog bar is automatically determined (display range is fixed), according to the difference between the upper and the lower limits, so that the both limit values can fit in the display range. (Refer to **the section 5.2 Weight of the analog bar**.)
- The upper/lower limits set are maintained together with the master value until next setting.
- When setting the tolerance value to M2 or M3, first perform the master setting. (Refer to **the section 4.2.1 Master setting, a) Presetting the master value**.)

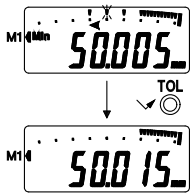


4. 2. 4 Measurement mode

Measure the workpiece inside diameter (minimum value). The analog bar shows a different display, depending on whether the tolerance judgment is performed or not.



▪Tolerance judgment ON/OFF



a) If tolerance judgment is performed

Ex. If the upper limit (30.010mm) and the lower limit (30.000mm) are set to the master No. M1 (30.005mm)

Step 1 Put this instrument into a workpiece

The digital display shows the current position of the contact point, and the analog bar displays the upper/lower limits and the current position. The midpoint of the upper/lower limits (30.005mm) is on the center of the analog bar.

IMPOTANT

The analog bar weight is determined, according to the difference between the upper and the lower limits. (Refer to **the section 5.2 Weight of the analog bar**.)

Step 2 Press the [START] button shortly to start measurement. The sign "Min" lights, and the analog bar for the current position blinks.

IMPOTANT

Press the [START] button shortly after this instrument is put into the workpiece.

Step 3 Probe the workpiece to measure the minimum value.

If a new minimum value is detected during the measurement, it is held on the digital display, and its Position on the analog bar blinks. Therefore, it is easy to confirm the state of the inside diameter (Minimum value) to the tolerance limits.

The tolerance judgment result ("◀", "○", "▶") will be displayed.

To measure the next workpiece or the same workpiece again, press the [START] button shortly.

Step 4 If there is a possibility of an accidental change of the minimum value detected, press the [DATA/HOLD] button shortly to hold the display value. (The sign "H" is turned on.) To release the display value press again the [DATA/HOLD] button shortly.

If a data processor is connected, it works differently. Pressing the [DATA/HOLD] button shortly outputs the display value to the external device.

b) If tolerance judgment is not performed

The analog bar shows the minimum value (blinks) and current value. The analog bar weight (reading per bar) is 0.001mm, .00005" or .0001". (Refer to **the section 5.2 Weight of the analog bar**.)

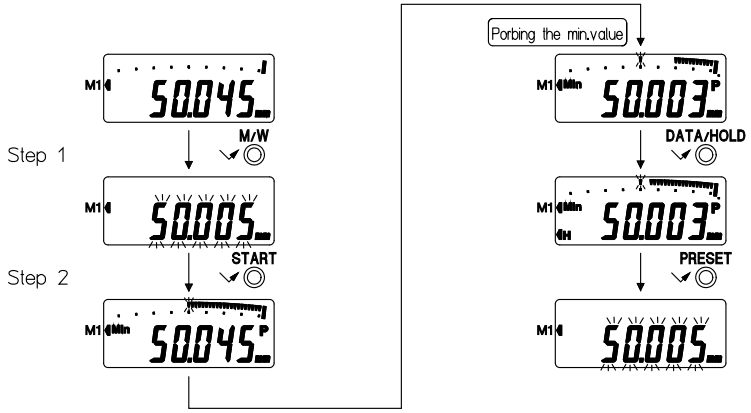
For the operating procedures, follow the procedures above.

IMPORTANT

- During the measurement if the minimum value is over the analog bar range (lower over range bar light), it is automatically repositioned in the center of the analog bar. Therefore the minimum value would be always displayed in the display range of the analog bar.
- If the [TOL.] button is pressed shortly in the tolerance judgment state, it is restored to the initial state (tolerance judgment OFF).

4. 3Re-calibrating this instrument

Here explains how to re-calibrate this instrument for which the master setting has been finished. However, if the master No. is changed, execute the master setting to register the master value again by referring to **the section 4.2.1 Master setting mode**.



If the master No. is changed, it requires re-calibration of this instrument using the master ring.

Step 1 Confirm that it is in the initial state or measurement mode, then press the [M/W] button shortly. The analog bar disappears and the master value registered previously blinks.

Put this instrument into the setting ring.

Step 2 Press the [START] button shortly to stand by for probing the minimum value. The signs "Min" and "P" will light, the digital display shows the current position of the contact point, and the analog bar of the current position blinks.

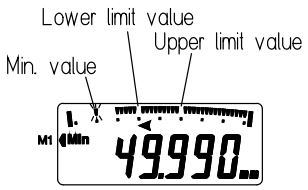
For further procedures, follow **the section 4.2.1 Master setting mode, b) Setting the master ring, and c) Registering the master value**.

5. Analog bar

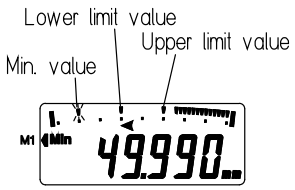
5. 1Analog bar display

- The analog bar shows the current position of the contact point with the bar indication. When measuring a minimum value, if the minimum value is detected, the bar for that position blinks.
- If tolerance values are set, the upper/lower limits are displayed on the analog bar. Therefore the state of the minimum value to the upper/lower limits can be easily checked. If the upper or lower limit is the same as the current value, the bar overlapped disappears.

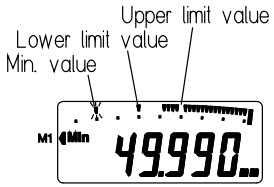
1)



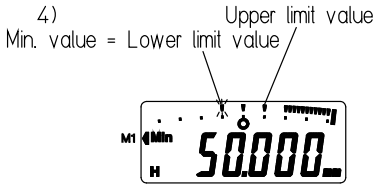
3)



2)



4)



The example as stated above shows a measurement result, the minimum value=49.990mm (No.4) =50.000mm), setting the upper limit=50.010mm, lower limit=50.000mm.

1) If the current value (=49.995mm) <lower limit value (=50.000mm), the both upper and lower limits disappears.
2) If the lower limit (=50.000mm) <current value (=50.006mm) <upper limit value (=50.010mm), the lower limit will light, but the upper limit disappears.
3) If the upper limit (=50.010mm) <current value (=50.013mm), the both upper and lower limits will light.
4) If the upper or lower limits is the same as the current value (=50.000mm), the bar overlapped disappears.

5. 2Weight of the analog bar(reading per bar)

The weight of the analog bar means the reading per bar. The weight differs, depending on the cases whether the tolerance judgment is performed or not.

・If tolerance judgment is not performed:
The weight of the analog bar is the resolution of the digital display.
・If the tolerance judgment is performed:
The upper/lower limits are displayed within the range of ±10 reading form the center of the analog bar. The weight differs, according to the differences of the upper/lower limits.(Refer to **the table on the top**)

IMPORTANT

The weight of the analog bar differs, according to the differences of the upper/lower limits. Therefore if there is a great difference (big reading per bar), the movement of the analog bar is very slow.

Difference of the upper/lower limit	Weight of the analog bar	Analog bar range
Less than 0.019mm	0.001mm/bar	-0.020mm -0.010mm 0.000mm 0.010mm 0.020mm
0.020mm - 0.039mm	0.002mm/bar	-0.040mm -0.020mm 0.000mm 0.020mm 0.040mm
0.040mm - 0.059mm	0.003mm/bar	-0.060mm -0.030mm 0.000mm 0.030mm 0.060mm
Less than .00095"	.00005"/bar	-.00100" -.00050" .00000" .00050" .00100"
.00100" - .00195"	.00010"/bar	-.00200" -.00100" .00000" .00100" (.0020")
.00200" - .00295"	.00015"/bar	-.00300" -.00150" .00000" .00150" .00300"

5. 3Resetting the analog bar

When not performing the tolerance judgment in the measurement mode or setting the master ring, the weight of the analog bar is equal to the resolution of the digital display. The detected minimum value might be over the analog bar range, and the position could be lost. To avoid this problem, if a minimum value is over the analog bar range, the analog bar is reset automatically, so that the minimum value is repositioned in the center.

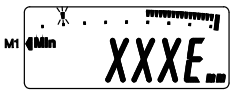
IMPORTANT

- When not performing the tolerance judgment in the measurement mode or recalculating the bore gage, if the current value is over the analog bar range, it is automatically repositioned in the center.
- When performing the tolerance judgment, the analog bar cannot be reset.

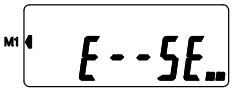
6. Error message and Corrective measures

1)

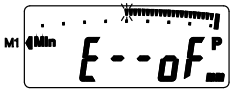
3)



2)



4)



1)Sign “B”: Voltage of the battery has dropped. Replace the batteries.

2)Tolerance setting error: Tolerance limits are set with the upper limit being smaller than the lower limit. Set them so that the upper limit is bigger than the lower limit.

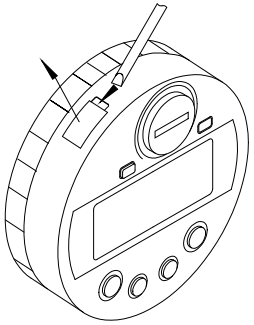
3) ABS data composition error: If it occurs temporarily when the spindle is moved too fast, you can continue the measurement since this does not imply measurement error.(“E” is displayed on the last digit until the data counting catches up with the spindle movement. The display will be restored, if the moving speed returns to normal.)

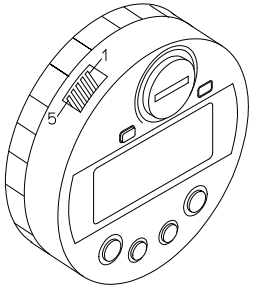
IMPORTANT

If this error occurs while the spindle is stopped, or if the count jump occurs, it could be due to a sensor failure. Contact a Mitutoyo sales office or representative.

4)Overflow : Preset value is improper. Check the set value and set it again.

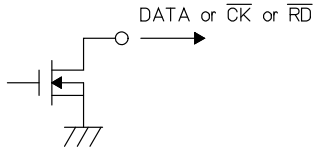
7. Data output



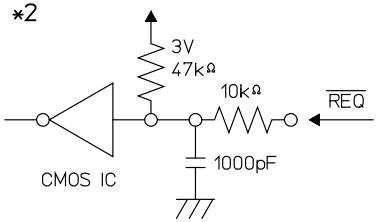


Pin No.	Signal	I/O
1	GND	———
2 *1	DATA	O
3 *1	$\overline{CK}$	O
4 *1	$\overline{RD}$	O
5 *2	$\overline{REQ}$	I

*1



*2



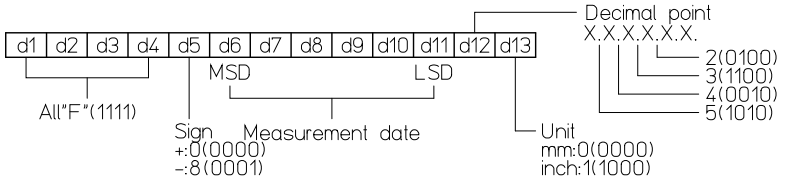
Vital SPC data is available by connecting the instrument to a data processor (e. g. Digimatic Miniprocessor DP-1VR) with an optional SPC cable.

Remove the cap of the output connector using a slotted screwdriver and insert the SPC cable fully to the end. Put the removed cap in a small bag and store in safe place. (Refer to the figures below)

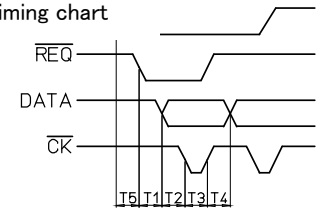
IMPORTANT

- Read the manual of the data processor thoroughly for proper operation.
- Data output may be disabled if an output request (REQ) is received while the spindle is in motion or if REQ are made at short intervals during a continuous data output.

Data output format



Timing chart



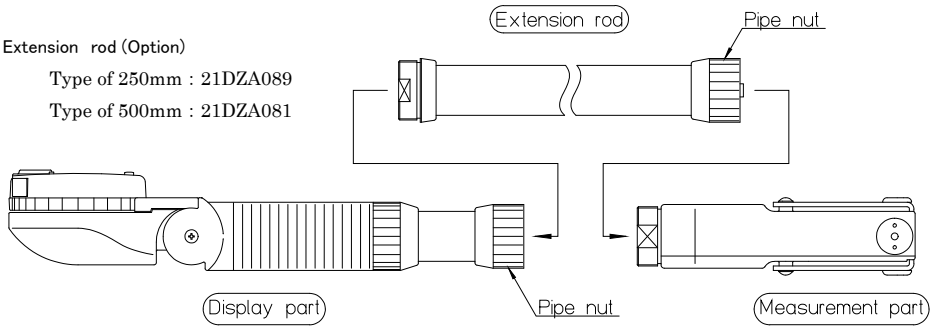
$500\,\mu s \leqq T1 < 70ms$
$200\,\mu s \leqq T2 \leqq 280\,\mu s$
$200\,\mu s \leqq T3 \leqq 280\,\mu s$
$200\,\mu s \leqq T4 \leqq 280\,\mu s$
T5 : It depends on the capacity of the data processing device connected.

8. Connection to Extension rod

Extension rod (Option)

Type of 250mm : 21DZA089

Type of 500mm : 21DZA081



When a deep bore is to be measured, the Digimatic Bore Gage can be extended by the use of the Ex.-rod. Set the Ex.-rod in the following steps.

(1) Press the [ON/OFF] button shortly to turn the power off.

(2) The pipe nut of a main part is loosened, and it separates into a display part and a measurement part.

(3) Insert the convex of an Extension rod in the connector (the shape of a concave) of a measurement part. and fasten a pipe nut.

(4) Insert the convex from of a display part in the connector (the shape of a concave) of an Extension rod, and fasten a pipe nut.

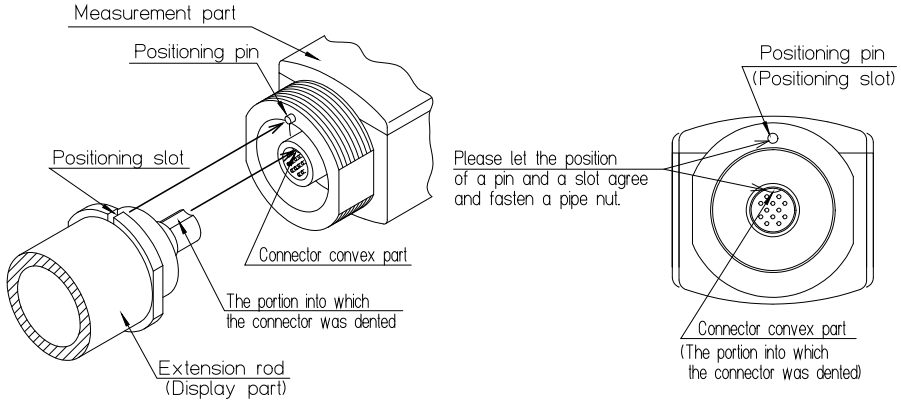
(5) Press the [ON/OFF] button to turn the power on.

(6) Press the [RESET] button .The digital display [- - - - - -] appears, and the signs “P” blinks.

(7) Press the [PRESET] button shortly, then the display will change to “ 0.000mm” in the initial state. Move to the master setting. (Refer to the section **4.2.1 Master setting mode**)

IMPORTANT

- Make sure positioning pin if when it connection. Don’t connect it too hard.
- When connection finished, don’t forget to press the [PRESET] button, and move to the master setting, or display latch the data, run away.
- Display part and measurement part are possible to divide for connection to Extension rod, be sure to combine same serial number, or it is not guaranteed.
- Connection of up to 2,000 mm maximum extension rod, consolidation will be up to 4pcs.



9. Specifications

9. 1 Specifications of the main unit

	Metric model	Inch / metric model
Effective stroke of contact point	1.2mm	.048”/1.2mm
Resolution	0.001mm	.00005”/0.001mm
Wide-range accuracy *1	0.003mm or less	.00012”(=0.003mm) or less
Adjacent error	0.002mm or less	.00008”(=0.002mm) or less
Repeatability	±1 count or less	±1 count or less
Quantizing error	±1 count or less	±1 count or less
Battery	Silver oxide cell(SR-44), 2 pcs.	
Battery life	9 months under normal use(contact point Pause:Move=4:1)	
Detection method	Capacitance-Type Absolute-linear-encoder	
Sampling frequency *2	50 times/sec	
Dust/Water protection level *3	Protection from foreign substance, waterproof type conforming to IP-53	
Anvil(standard accessories)	13 pcs.	13 pcs.
Washers(standard accessories)	4 pcs.	4 pcs.
Wrench(standard accessories)	1 pc.	1 pc.
Standard accessories	Silver oxide cell(SR-44), 2 pcs.(No.938882)	
L.C.D	・7segments 6digits decimal numeric with minus sign. in/mm ・Tolerance judge indication ・Analog indication	
Operation keys	・ON/OFF(common with in/mm) ・DATA/HOLD ・PRESET ・TOL ・M/W(master setting/ work measuring) ・START ・RESET	
Alarms	"B"：Voltage down "E--oF"：Over flow "E--SE"：Limit set error	
Data interface	Dijimatic data out	
Operating temperature	0℃ to 40℃	
Storage temperature	-10℃ to 60℃	

*1: A quantizing error is excluded.
*2: If the contact point detecting speed is over 50㎜/s, the peak value may not be displayed correctly.
*3: Protection level(IP:International Protection) according to IEC 529/ JIS D0207,C0920.
The level indicated is valid only if the output connector cap is installed.

9. 2 Standard accessory

1） Anvil 12pcs.(511-502、511-522 : 13pcs.)
2） Washers 4pcs.
3） Wrench 1pc.
4） Silver oxide cell 2pcs.

9. 3 Optional accessory

21DZA089 extention rod (250mm/10”)
21DZA081 extention rod (500mm/20”)
905338 SPC cable (1m)
905409 SPC cable (2m)

Mitutoyo Corporation
20-1, Sakado 1-Chome, Takatsu-ku, Kawasaki-shi,
Kanagawa 213-8533, Japan
http://www.mitutoyo.co.jp

For the EU Directive
Authorized representative and importer in the EU :
Mitutoyo Europe GmbH
Borsigstrasse 8-10, 41469 Neuss, Germany