

Column Type Air Micrometer

CAG2000 Instruction Manual



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1. Introduction

The column type air micrometer is a measuring instrument with an easy-to-see three-color bargraph display. Combination with an air/electric (A/E) converter provides this compact instrument with an automatic mastering function. It can also be easily connected with another or more identical units to allow the trend of works to be read from the bargraph displays arranged side by side.

2. Main Features

- (1) A three-color bargraph display allows the measurement result to be more easily seen.
- (2) An eight-digit alphanumeric display indicates the measured value, set item, and other types of information.
- (3) Control keys are used to automatically calibrate the instrument with the maximum and minimum masters.
- (4) The instrument is only 50 mm wide, so that it is suited for measuring with another or more identical units operating together.
- (5) The standard serial communication function allows the output of data to the personal computer and printer. The data can be stored, statistically processed, and input to a spreadsheet program like Excel.
- (6) In the set mode, the ENT key can be pressed to sequentially select all items.
- (7) Programs can be selected to store ten types of set values and mastering data and change from one type to another.

3. Main Modes

The instrument operates in the following four main modes:

(1) Measure mode

Measure (in free run condition): Measures a work.

Hold measured value: Holds the measured value, except when the mastering result is NG.

(2) Set mode

Enters and changes the set value.

(3) Master mode

Master: Calibrates the instrument with the masters. This instrument is a comparative measuring instrument. Be sure to use it upon completion of the mastering operation.

Adjust detector: Adjusts the detector.

Clear mastering data: Clears the mastering data.

(4) Change program mode

Changes from one program to another. When the instrument is started, the program used last is launched.

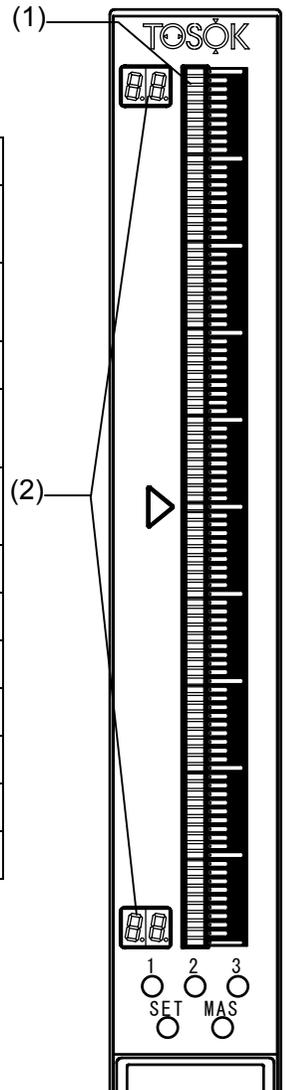
4. Names and Functions of Controls and Parts

(1) Bargraph display

Indicates the measured value, judgment result, or other types of information by a 101-dot, 3-color bar.

Table 4-1. Relationship between bar color and display description in each mode.

Mode	Bar color	Display description
Measure	Green (light)	Measured value (judgment result OK)
	Red (light)	Measured value (judgment result NG)
	Orange (dot)	Upper or lower limit value
Hold measured value	Green (dark)	Measured value (judgment result OK)
	Red (dark)	Measured value (judgment result NG)
Set	Orange (light)	Current set value
	Green (dot)	Previous set value
Master	Green (light)	Mastering enabled condition
	Red (light)	Mastering disabled condition
	Orange (dot)	Mastering data
Adjust detector	Orange (light)	Measured value
	Green (dot)	Mastering data



(2) Range displays

Indicate the bar top and bottom dimensions in two digits.

Table 4-2. Range displays.

Measuring range (μm)	Digital display
20	10.
50	25.
100	50.
200	10

(3) Alphanumeric display

Indicates the measured value, set value, set item, or other types of information by 8-digit 7 × 5 dot characters.

(4) Sensitivity adjustment knob

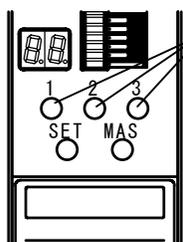
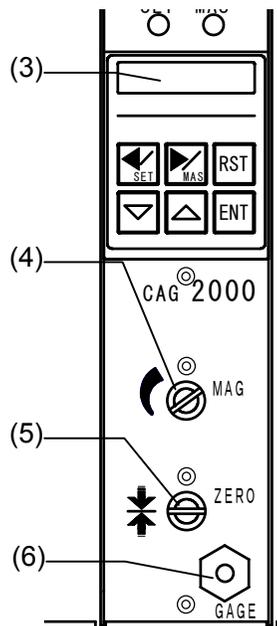
Adjusts the sensitivity of the air circuit. This adjustment is necessary only for changing the measuring nozzle and correcting a mastering error.

(5) Zero adjustment knob

Adjusts the zero position of the air circuit. This adjustment is necessary only for changing the measuring nozzle and correcting a mastering error.

(6) Measuring nozzle port

Accepts the vinyl hose of the measuring nozzle.

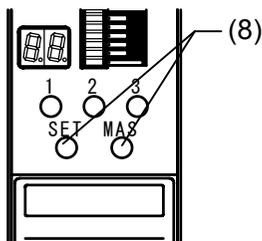


(7) Item and judgment LEDs

Indicate the judgment result. LED 1 comes on red when the measured value is -NG, LED 2 comes on green when the measured value is OK, and LED 3 comes on red when the measured value is +NG.

Table 4-3. LED colors and conditions indicated.

Color	Condition	Mode
LED 1: Red (light)	Judgment result -NG	Measure
LED 2: Green (light)	Judgment result OK	Measure
LED 3: Red (light)	Judgment result +NG	Measure
LED 1: Red (dark)	Judgment result -NG	Hold measured value
LED 2: Green (dark)	Judgment result OK	Hold measured value
LED 3: Red (dark)	Judgment result +NG	Hold measured value
LED 1: Orange (light)	Mastering	Master



(8) Mode LEDs

Indicate the current mode and the mastering result. The relationship between the LED color and the mode or mastering result is as shown in Table 4-4.

Table 4-4. LED colors and conditions indicated.

LED name	LED color	Mode or condition
SET	Orange	Set mode
	Green	Change program mode
MAS	Orange	Master mode
	Flashing red	Mastering result NG
	Alternately red and orange	Master mode, Mastering result NG

(9) Control keys

① Left arrow key 

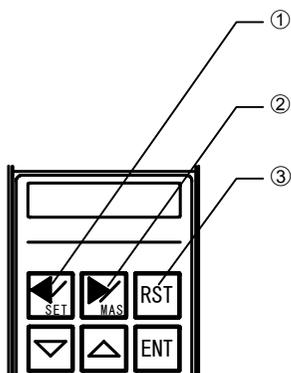
Mode	Keying	Condition
Measure	Press 2 sec.	Mode is changed to set mode.
Set	Press once.	Set item can be selected.

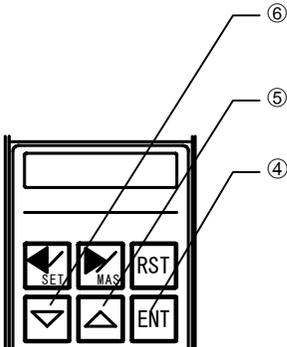
② Right arrow key 

Mode	Keying	Condition
Measure	Press 2 sec.	Mode is changed to master mode.
Set	Press once.	Set item can be selected.
Master	Press once.	Display description is changed.

③ RST (reset) key 

Mode	Keying	Condition
Hold measured value	Press once.	Measured value hold is cleared.
Set (set value being entered)	Press once.	Set value is returned to previous condition.
Set (set item being selected)	Press once.	Setting can be finished (WRITE or CANCEL).
Master	Press once.	Display description is returned to previous condition.
Adjust detector	Press once.	Display description is returned to previous condition.





④ ENT (enter) key 

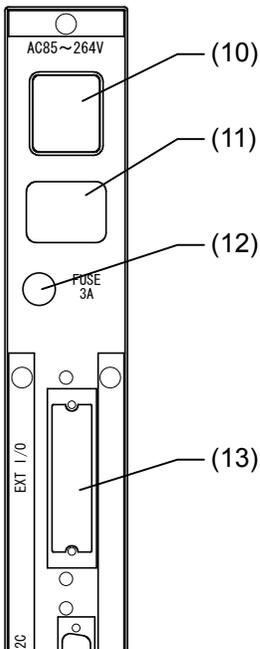
Mode	Keying	Condition
Measure	Press once.	Measured value is held (when mastering result is OK).
Set	Press once.	Set item and value are determined.
Master	Press once.	Master measured value is read.
Adjust detector	Press once.	Detector adjustment is finished.

⑤ Up arrow key 

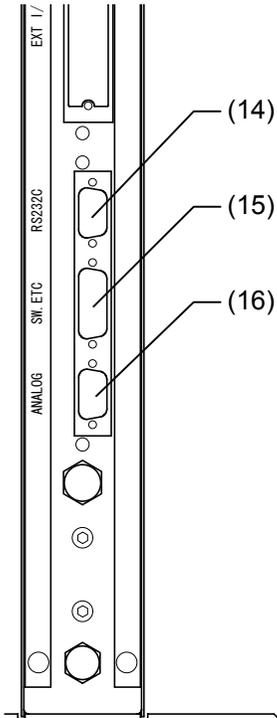
Mode	Keying	Condition
Set	Press once.	Set value is entered.

⑥ Down arrow key 

Mode	Keying	Condition
Measure	Press 2 sec.	Mode is changed to change program mode.
Set	Press once.	Set value is entered.



- (10) Power connector (input) and power switch
Input AC power. Usable in the range of 85 to 264 VAC. Use the accessory power cable in the range of 85 to 125 VAC.
- (11) Power connector (output)
Accepts the power connector (input) of an adjacent instrument to be used in combination, and is internally connected to the power connector (input).
- (12) Fuse holder
A glass tube fuse ($\phi 5.2 \times 20$, 3 A) is used.
- (13) DC input/output connector (option)
Connector to be connected to an LED or sequencer, and used for input of measure, mastering and other commands and for output of judgment result and BCD.



(14) RS232C connector

A serial communication connector for connecting a personal computer or printer.

(15) Switch input connector

A connector for input of a measure or mastering command with an external button. It is also used for RS422 communication and Digimatic output (options).

(16) Analog input/output connector

A connector for external analog signal input and amplifier signal output.

5. Specifications

Item	Specification		Remarks
Input	1 air channel		
Air supply pressure	0.196 MPa		Source pressure: 0.3 MPa or more
Measurement item	1		
Measuring range (mm)	CAG2000	0.0200, 0.0500, 0.100, 0.200	
	CAG2000E	0.0250, 0.0500, 0.100, 0.200	
	CAG2000H	0.0100, 0.0200, 0.0500, 0.1000	
Resolution (mm)	CAG2000	0.0002, 0.0005, 0.001, 0.002	
	CAG2000E	0.00025, 0.0005, 0.001, 0.002	
	CAG2000H	0.0001, 0.0002, 0.0005, 0.0010	
Bargraph display	101 dots (red, green, orange, light/dark)		
Bargraph display method	Bar (OK: Green, NG: Red), Dots (Max/Min)		
Range display	2 digits (numbers), 2 places		
Multifunctional display	8 digits (numbers/alphabet) Measured value, set item, set value, and error display		
Shift range	±1000% (full scale)		From Version 2.60
Actual dimension display	000.0000 mm (7 digits + decimal point)		
Judgment result	±NG and OK		
Judgment result display	Bargraph display (color), judgment LEDs Multifunctional display		
Automatic mastering	Minimum and maximum masters		
Automatic mastering range	Zero position: ±50% (full scale) Sensitivity: ±20% (full scale)		
Number of setting programs	10		
Power supply voltage and frequency	85 to 264 VAC, 50/60 Hz		100-VAC power cable supplied as accessory
Power supply capacity	30 VA		
Dimensions and mass	50 mm wide × 480 mm high × 200 mm deep, 4 kg		
Operating temperature	0 to 45°C		

Item	Specification	Remarks
Standard		
External input	4 (measure, reset, maximum master, and minimum master)	External buttons or foot switch
Serial output	1 (printer or personal computer)	RS232C
Optional		
Printer output	1 (DP1)	Digimatic
Judgment result output	-NG, OK, +NG (12/24 VDC)	
Rank output	-NG,OK1 to OK14, +NG (12/24 VDC)	Rank function combined use
BCD output	1 (12/24 VDC)	
Peak measurement function	+PEAK, -PEAK, TIR (= +PEAK - (-PEAK)), TIR (= +PEAK - (-PEAK) /2)	Based on measurement value change with auto measurement start function
Rank function	99 ranks maximum	OK range

6. Measurement

6.1 Preparation

- ① Attach the regulator to the rear of the instrument, and connect it with the air filter.
- ② Connect the measuring nozzle hose to the front of the instrument, and connect the accessory power cable to the rear of the instrument.
- ③ Turn on the power switch (or press the position marked I of the switch) at the rear of the instrument, so that the power of 85 to 264 VAC (50/60 Hz) will be supplied to the instrument. Supply air at 0.3 to 0.7 MPa to the air filter.
- ④ When the instrument is started, it is in the measure mode. Press  for 2 sec to change to the master mode,  for 2 sec to change to the set mode, and  for 2 sec to change to the change program mode.

6.2 Measuring

- ① Bargraph display, and item and judgment LEDs
 - (1) The judgment upper and lower limit values are indicated by orange (dark) on the bargraph display.
 - (2) The bargraph display is illuminated green (light) and red (light) when the judgment result is OK and NG, respectively.
 - (3) The item and judgment LEDs 1, 2 and 3 come on red, green and red when the measured value is -NG, OK and +NG, respectively.

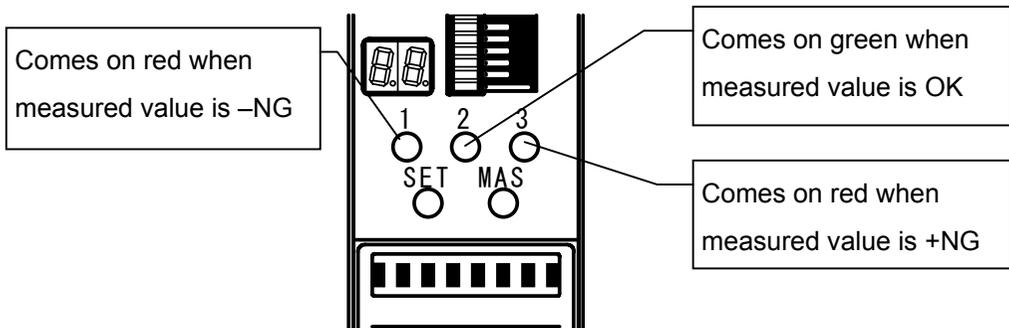


Fig. 6-1. Item and judgment LEDs during measurement.

② Hold measured value mode

The measured value is held, except when the mastering result is NG.

- (1) The bargraph display is usually in the measure mode and shows the value being measured (this is called the free run condition). In the free run condition, the measured value is indicated by green (light) on the bargraph display when it is OK and by red (light) on the bargraph display when it is NG.
- (2) Press **ENT** in the free run condition to hold the measured value (this is called the hold condition). In the hold condition, the measured value is indicated by green (dark) on the bargraph display when it is OK and by red (dark) on the bargraph display when it is NG.
- (3) Press **RST** to clear the measured value hold.

7. Mastering

7.1 Automatic mastering

- ① In the measure mode, press  for 2 sec or more.
- ② The MAS LED below the bargraph display comes on orange, “MIN M.” appears on the alphanumeric display, and the instrument changes to the master mode.

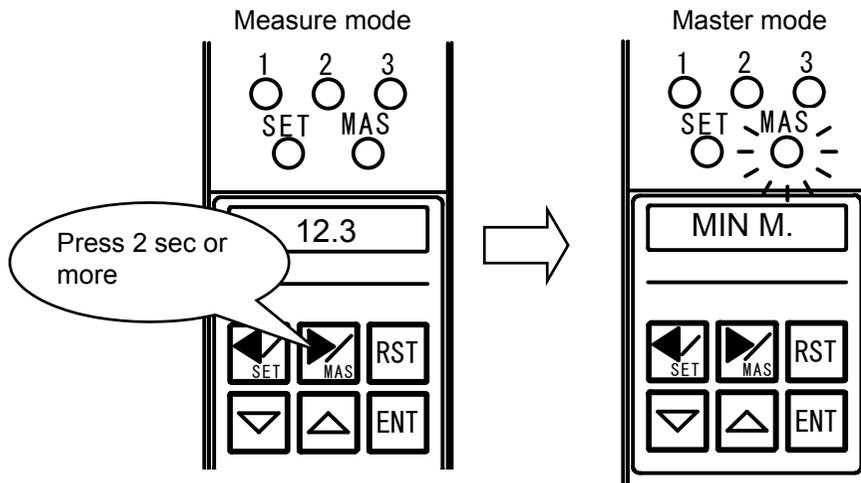


Fig. 7-1. Changing to master mode.

- ③ Set the minimum master in the measuring nozzle, and press . The instrument is calibrated with the minimum master, and “MAX M.” is shown on the alphanumeric display.

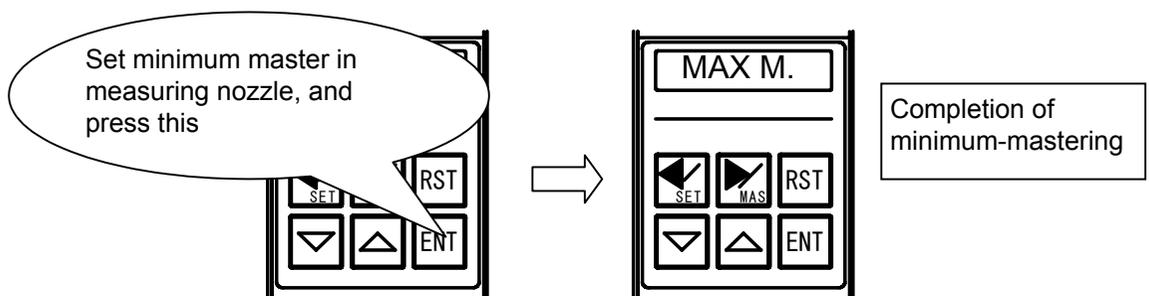


Fig. 7-2. Calibrating with minimum master.

- ④ Set the maximum master in the measuring nozzle, and press **ENT**. The instrument is calibrated with the maximum master. If there is no mastering error, “MAS OK” is shown for 2 sec on the alphanumeric display, and the instrument ends the master mode and returns to the measure mode.

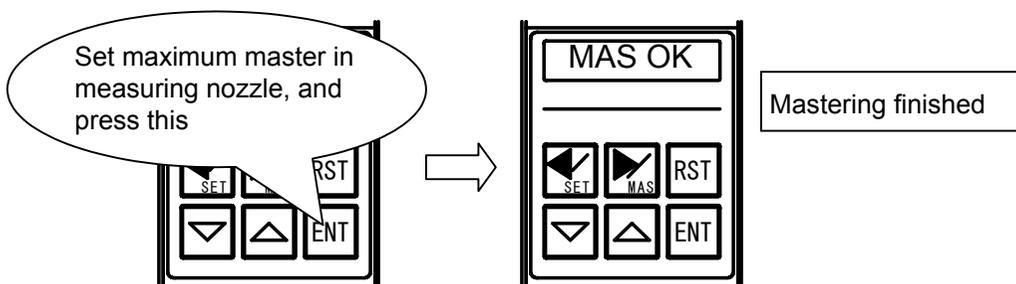


Fig. 7-3. Ending mastering.

- ⑤ If there is a mastering error, its description is shown on the alphanumeric display as follows:

ERR ZERO: Zero position error (outside of automatic mastering range)

ERR MAG: Sensitivity error (outside of automatic mastering range)

ERR REV: Maximum and minimum master values reversed

ERR OFFR: Outside of measuring range

Press **ENT** to return to step ② above. If it is necessary to adjust the zero position and sensitivity of the air circuit with the zero and sensitivity adjustment knobs, respectively, refer to “10. Adjusting Zero Position and Sensitivity with Zero and Sensitivity Adjustment Knobs”.

- ⑥ In the middle of the master mode, press **RST** to return to the previous condition. When “MIN M.” is displayed, press **RST** to return to the measure mode.

Mastering data storing function

The instrument is designed to read the last mastering data and fall in the master request condition.

(1) Master request condition

When the power of the instrument is turned on or when a program change is made, the instrument operates as follows:

① Flashing of MAS LED

The MAS LED flashes orange to indicate that the last mastering data is effective for the currently selected program and flashes red to indicate that the last mastering data is not effective for the currently selected program (or the mastering data is cleared).

② Indication on alphanumeric display

“MAS REQ” is shown on the alphanumeric display.

③ Judgment result output signal (when judgment result output option is added)

The judgment result output signal “MAS OK” is turned off.

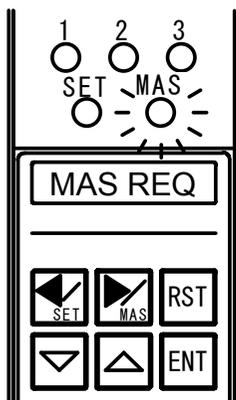


Fig. 7-4. Master request condition.

(2) Procedure for coping with master request condition

① Calibrate the instrument with the masters.

When the MAS LED is flashing orange, the mastering operation can be omitted by any of steps ② to ④ below.

② Press one of the control keys.

③ Input a reset command from an external signal or with an external button.

④ Input a clear master request command through the serial communication (RS232C). (Refer to “11.1 Serial output”.)

These steps ② to ④ clear the condition described in ② in (1) above when the MAS LED is flashing red, and clear the conditions described in ① to ③ in (1) above when the MAS LED is flashing orange.

7.2 Clearing mastering data

- ① In the measure mode, press  for 2 sec or more.
- ② When the MAS LED below the bargraph display is turned on and “MAX M.” or “MIN M.” is shown on the alphanumeric display (refer to Fig. 7-1), press  to change to the adjust detector mode and show “ADJ.” on the alphanumeric display.
- ③ Press  to change to the clear mastering data mode and show “MAST CLS” on the alphanumeric display.
- ④ Press  to clear the mastering data, show “M .CLS OK” on the alphanumeric display, and return to the master mode.

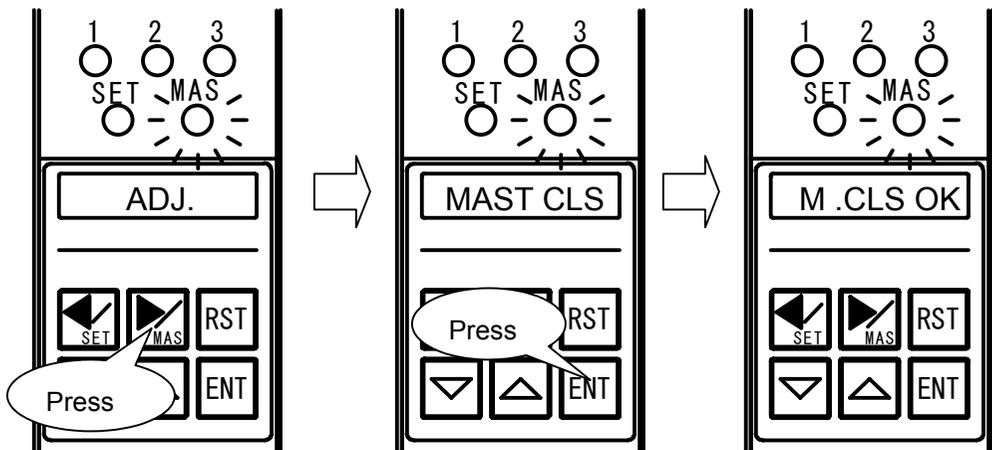


Fig. 7-5. Clearing mastering data.

8. Changing Programs

- ① In the measure mode, press  for 2 sec or more.
- ② The SET LED below the bargraph display comes on green, “PROG” appears on the alphanumeric display, and the instrument changes to the change program mode.

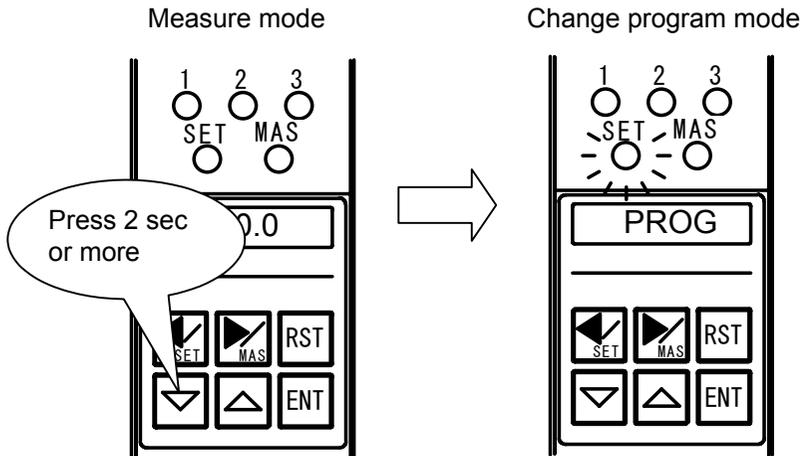


Fig. 8-1. Changing to change program mode.

- ③ With “PROG” shown on the alphanumeric display, press . The current program number is shown on the alphanumeric display.

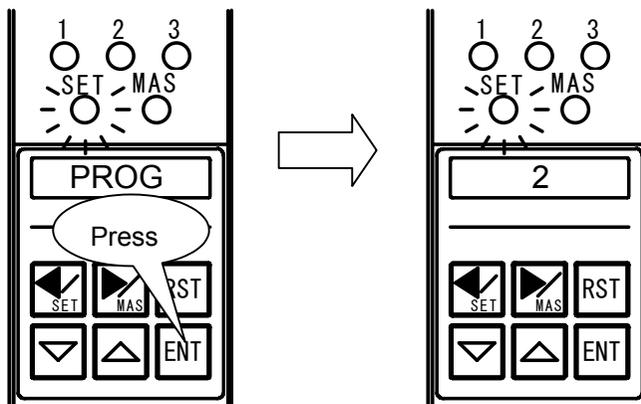


Fig. 8-2. Display of current program number.

- ④ Press  or  to select the number of the program to be used, and press  to determine the selection. The instrument ends the change program mode and returns to the measure mode.

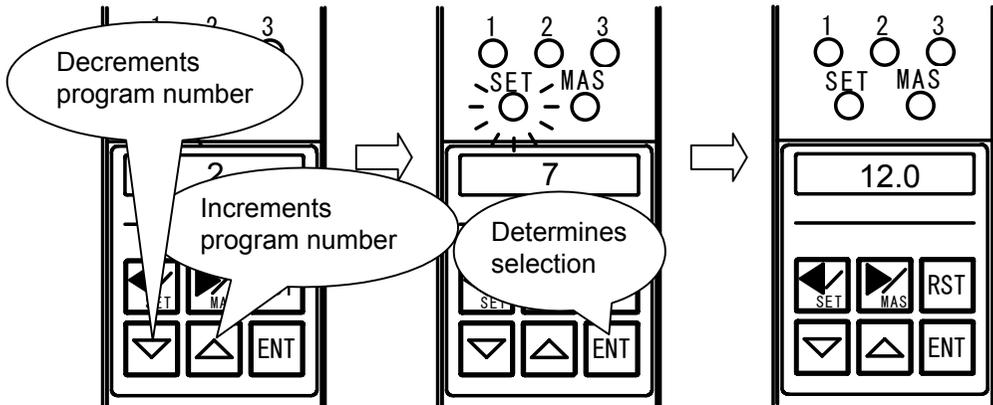


Fig. 8-3. Selecting and determining program number.

- ◆ A program number change calls for mastering. A measuring nozzle change may call for the zero position and sensitivity of the air circuit to be adjusted with the zero and sensitivity adjustment knobs, respectively.
- ◆ When setting any item, select the number of the program to be used before changing to the set mode.
- ◆ When its power is turned on, the instrument starts at the program number selected last.

9. Setting

Setting relevant items is required for each program to be used. After a program change, set necessary items. (Refer to “8. Changing Programs”.)

(1) Setting polarity

- ① In the measure mode, press  for 2 sec or more. The SET LED below the bargraph display comes on orange, “POL” appears on the alphanumeric display, and the instrument changes to the set mode.

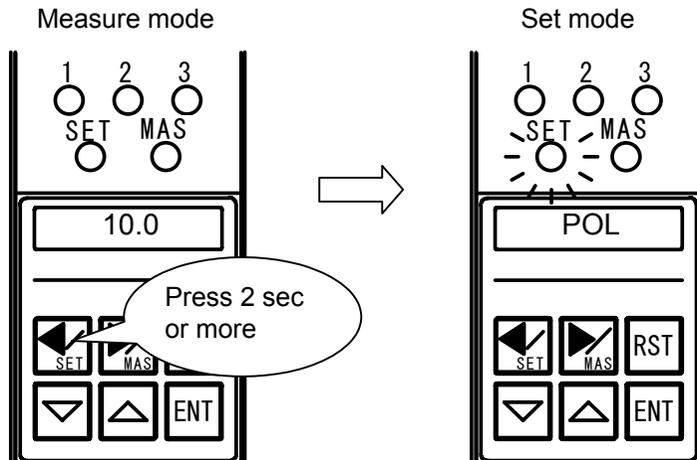


Fig. 9-1. Changing to set mode.

- ② Press  to show the current polarity on the alphanumeric display, and press  or  to change between “+ (ID measurement)” and “- (OD measurement)”.

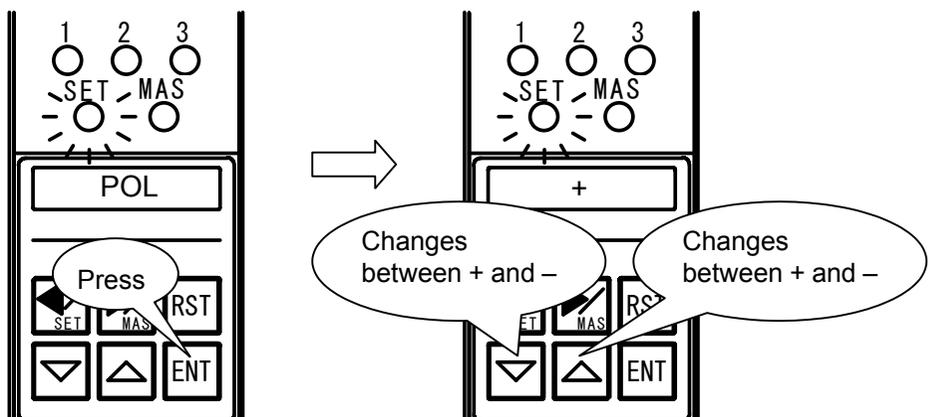


Fig. 9-2. Changing polarity.

- ③ Press **ENT** to determine the selected polarity. The next step is setting the measuring range, and “RANGE” is shown on the alphanumeric display.

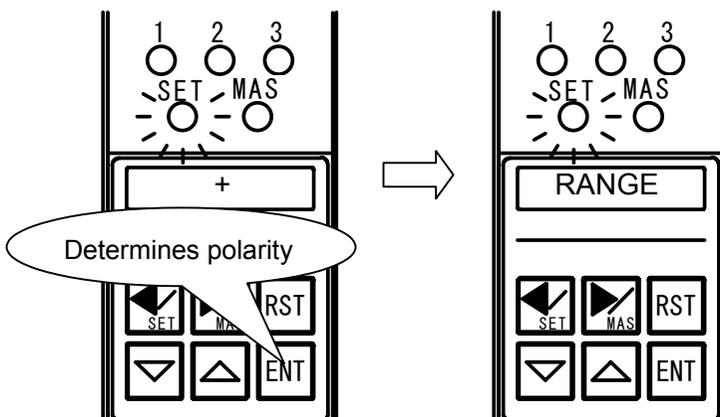


Fig. 9-3. Determining polarity.

(2) Setting measuring range

Changing the measuring range may call for the A/E converter to be switched over. When changing the measuring range between 50 and 100 μm , the A/E converter need not be switched over, but the instrument must be adjusted as described in “10. Adjusting Zero Position and Sensitivity with Zero and Sensitivity Adjustment Knobs”. In other cases, contact NIDEC TOSOK.

- ① With “RANGE” shown on the alphanumeric display, press **ENT**. The current measuring range is shown. Press **▲** or **▼** to change the measuring range to 20, 50, 100, or 200 μm .

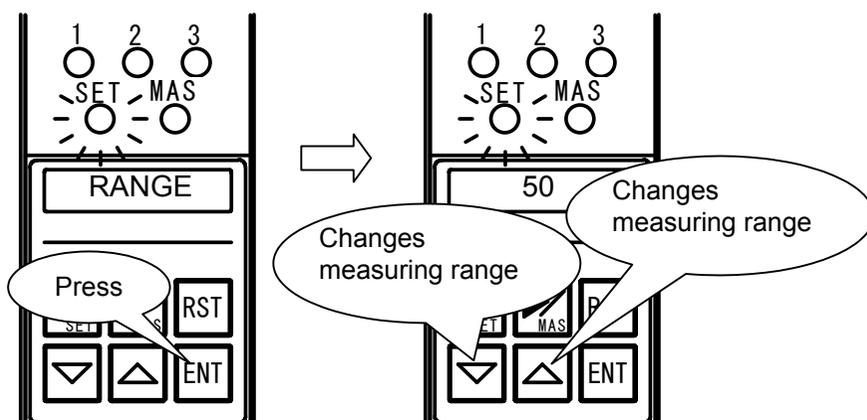


Fig. 9-4. Changing measuring range.

- ② Press **ENT** to determine the selected measuring range. The next step is setting the shift value, and “SHIFT” is shown on the alphanumeric display.

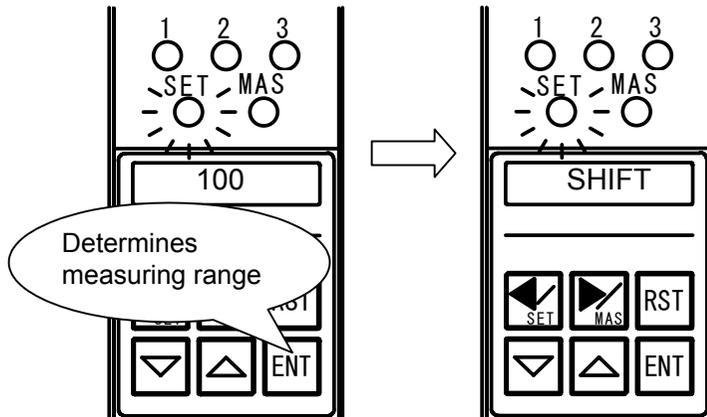


Fig. 9-5. Determining measuring range.

(3) Setting shift value

In the case of a one-side tolerance, for example, the measured value is shown at the center of the bargraph display. When not using this function, set the shift value at 0.

- ① With “SHIFT” shown on the alphanumeric display, press **ENT**. The current notation unit is shown. Press **▲** or **▼** to change to the tolerance notation in μm or the nominal notation in mm. Press **ENT** to determine the selected notation.

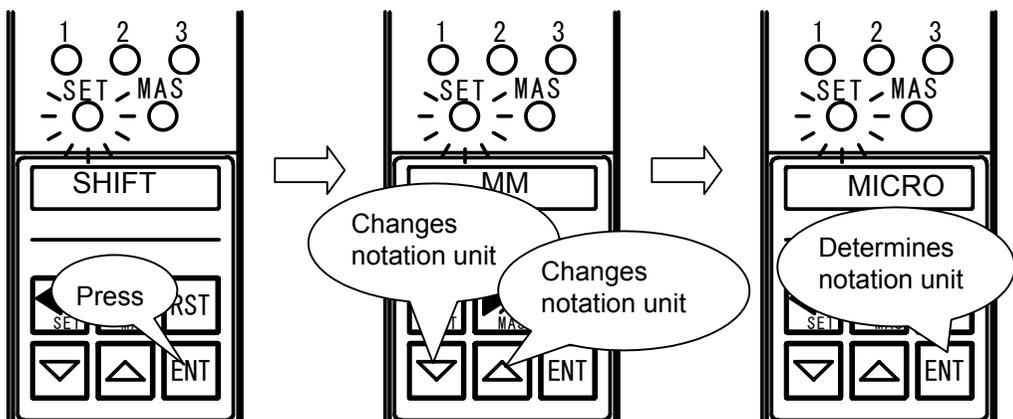


Fig. 9-6. Changing notation unit.

- ② When the tolerance notation is selected, press  or  to enter the shift value. When the nominal notation is selected, press  or  to change the digit to be set, and press  or  to enter the shift value. Usually, enter the median value of the tolerances as the shift value.

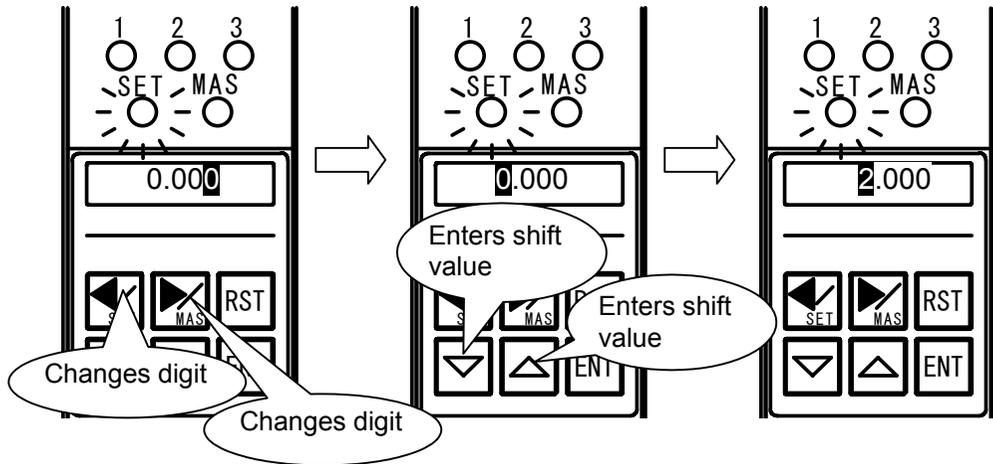


Fig. 9-7. Entering shift value (for nominal notation).

- ③ Press  to determine the entered shift value. The next step is setting the judgment upper limit value, and “MAX” is shown on the alphanumeric display.

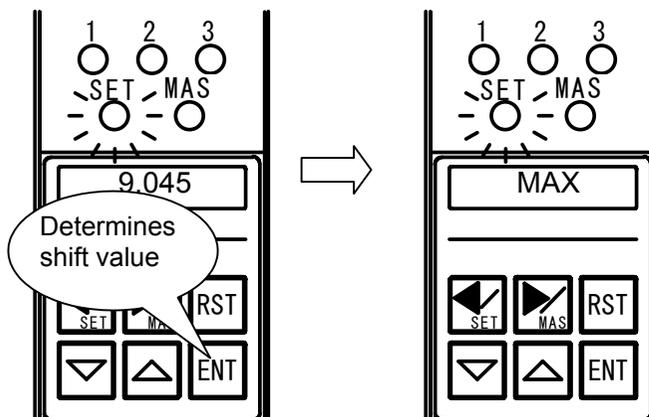


Fig. 9-8. Determining shift value.

(4) Setting judgment upper limit value

- ① With “MAX” shown on the alphanumeric display, press **ENT**. The current judgment upper limit value is shown. Press  or  to enter the new judgment upper limit value.

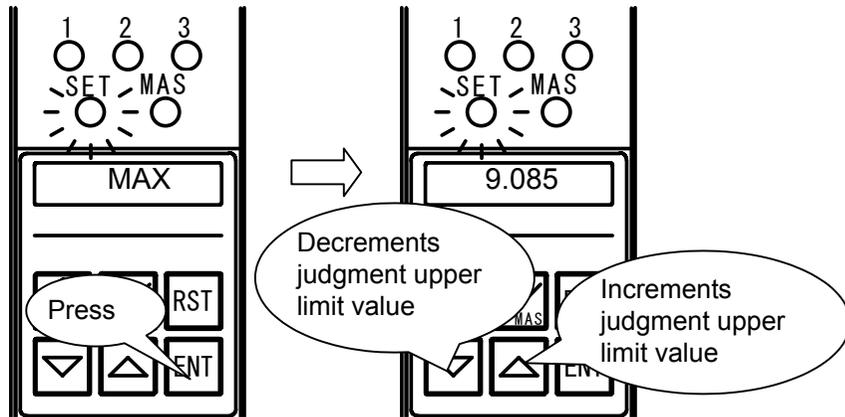


Fig. 9-9. Entering judgment upper limit value.

- ② Press **ENT** to determine the new judgment upper limit value. The next step is setting the judgment lower limit value, and “MIN” is shown on the alphanumeric display.

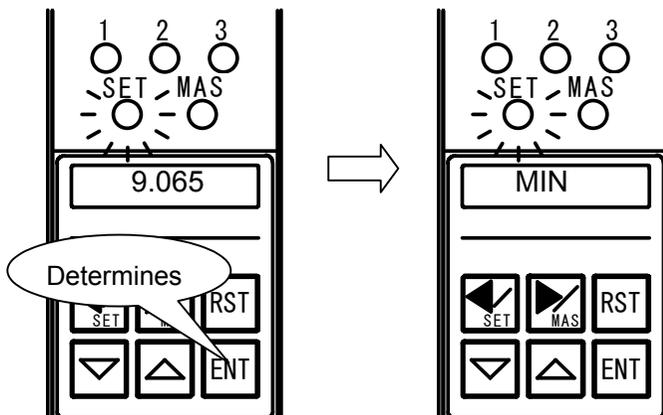


Fig. 9-10. Determining judgment upper limit value.

(5) Setting judgment lower limit value

- ① With "MIN" shown on the alphanumeric display, press **ENT**. The current judgment lower limit value is shown. Press  or  to enter the new judgment lower limit value.

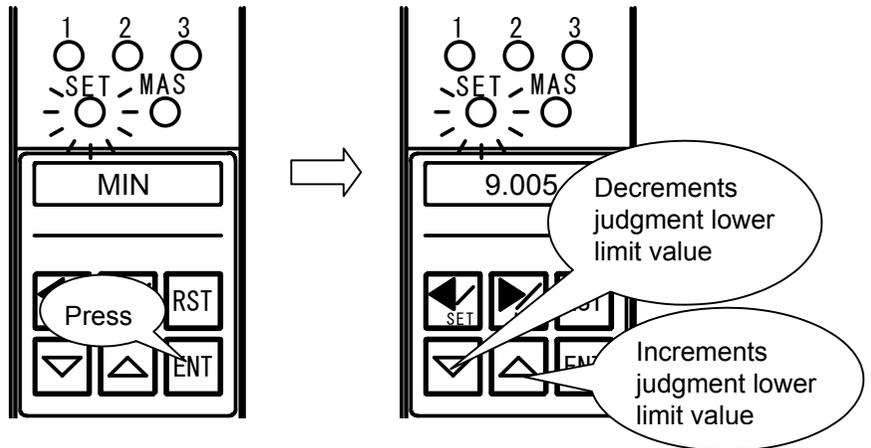


Fig. 9-11. Entering judgment lower limit value.

- ② Press **ENT** to determine the new judgment lower limit value. The next step is setting the maximum master value, and "MAX M." is shown on the alphanumeric display.

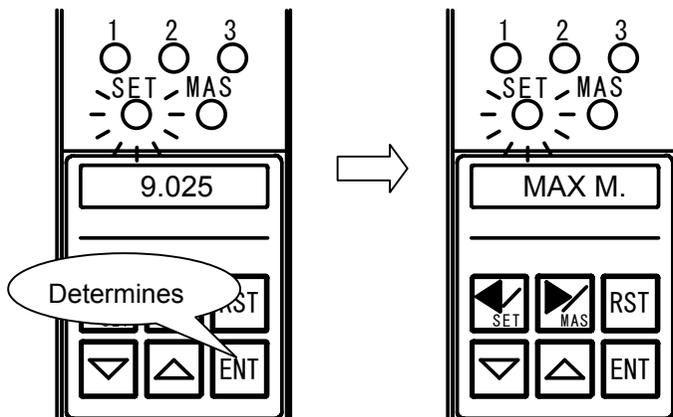


Fig. 9-12. Determining judgment lower limit value.

(6) Setting maximum master value

- ① With “MAX M.” shown on the alphanumeric display, press **ENT**. The current maximum master value is shown. Press  or  to enter the new maximum master value.

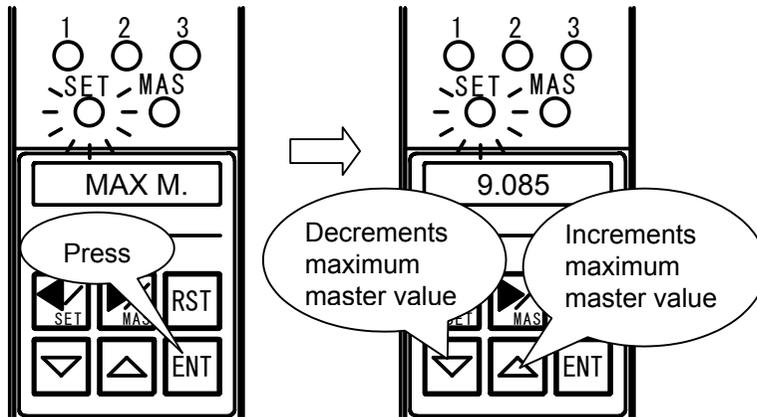


Fig. 9-13. Entering maximum master value.

- ② Press **ENT** to determine the new maximum master value. The next step is setting the minimum master value, and “MIN M.” is shown on the alphanumeric display.

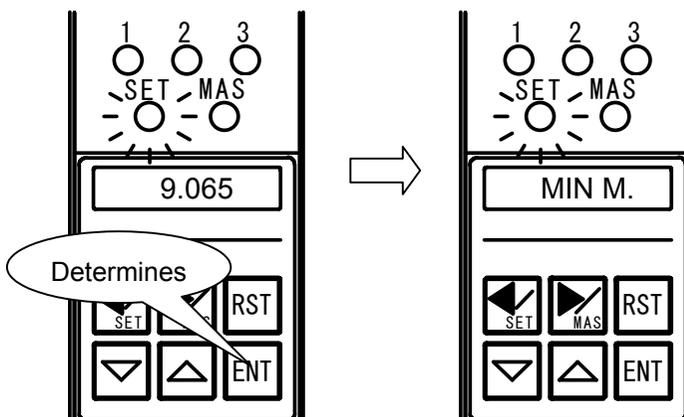


Fig. 9-14. Determining maximum master value.

- ③ When the maximum master value is equal to or smaller than the minimum master value, “ERR MAS” is shown on the alphanumeric display, the set value returns to the previous value, and the instrument returns to the condition in step ① above. Again enter the new maximum master value.

(7) Setting minimum master value

- ① With “MIN M.” shown on the alphanumeric display, press **ENT**. The current minimum master value is shown. Press  or  to enter the new minimum master value.

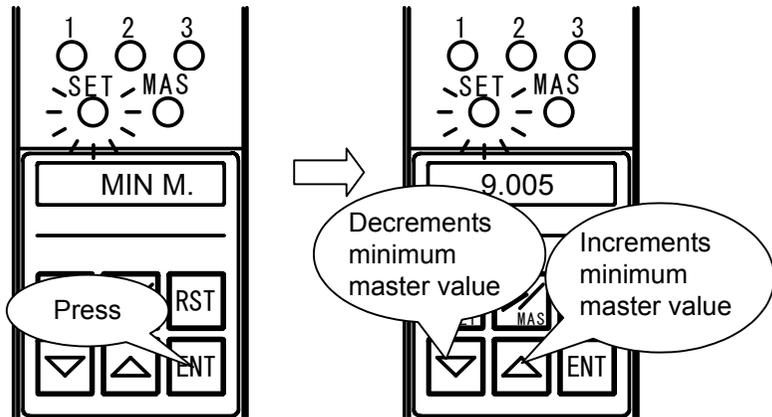


Fig. 9-15. Entering minimum master value.

- ② Press **ENT** to determine the new minimum master value. The next step is storing the set values, and “END” is shown on the alphanumeric display.

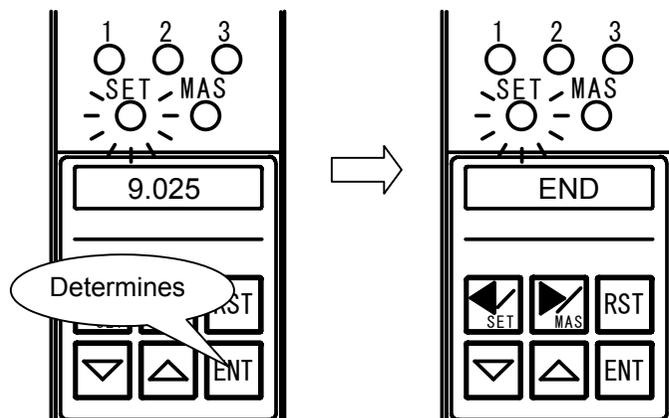


Fig. 9-16. Determining minimum master value.

- ③ When the minimum master value is equal to or greater than the maximum master value, “ERR MAS” is shown on the alphanumeric display, the set value returns to the previous value, and the instrument returns to the condition in step ① above. Again enter the new minimum master value.

(8) Storing set values (described in Items (1) to (7) above)

- ① When the setting of the minimum master value is finished as the last step of the setting procedure, “END” is shown on the alphanumeric display. When **RST** is pressed in the middle of the set mode, “END” is also shown. Press **ENT** to show “WRITE” on the alphanumeric display.

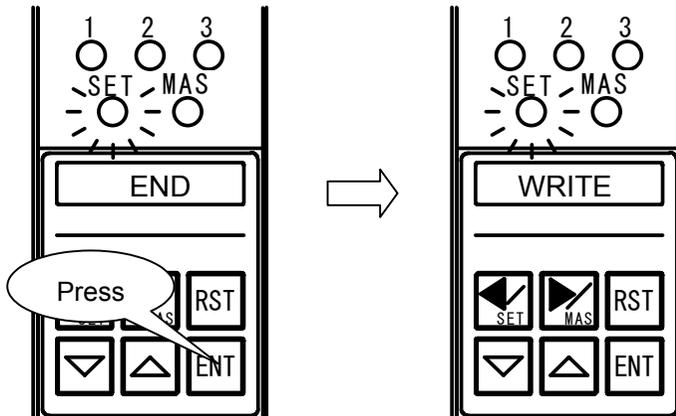


Fig. 9-17. Ending setting.

- ② Press **▲** or **▼** to select “WRITE” or “CANCEL”, and press **ENT** to determine the selection. When “WRITE” is selected, the current set values are stored. When “CANCEL” is selected, the current set values are canceled, and the previous set values are made effective. After this determination, the instrument ends the set mode and returns to the measure mode.

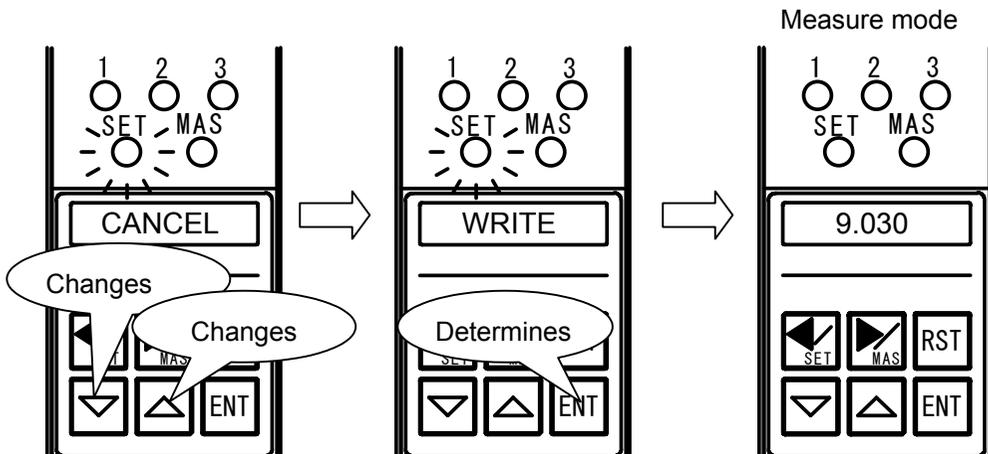


Fig. 9-18. Storing set values.

10. Adjusting Zero Position and Sensitivity with Zero and Sensitivity Adjustment Knobs

The zero position and sensitivity of the air circuit need not be adjusted, except after a measuring head change or after the output of the mastering result NG due to wear.

10.1 Adjusting

- ① In the measure mode, press  for 2 sec or more.
- ② The MAS LED below the bargraph display comes on, and “MAX M.” or “MIN M.” appears on the alphanumeric display. Press  to change to the adjust detector mode. The alphanumeric display shows “ADJ.” for 2 sec and then the measured value.

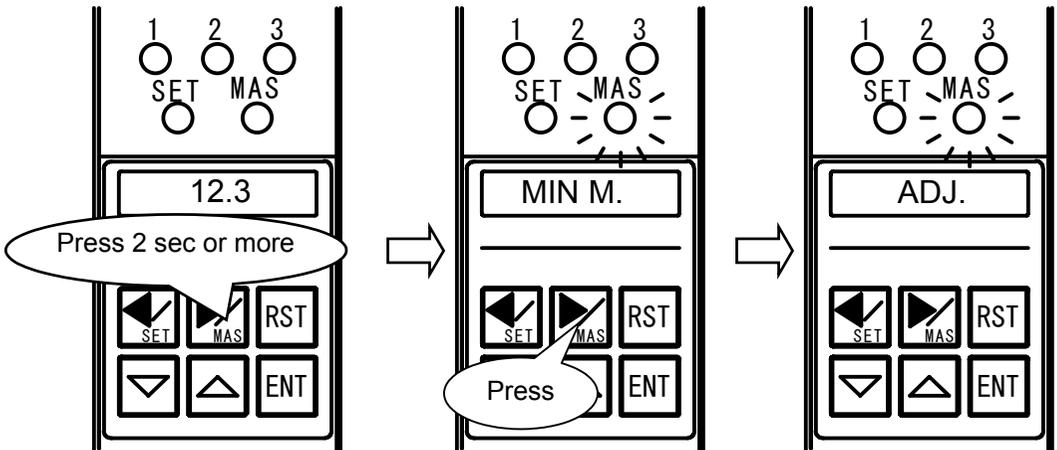


Fig. 10-1. Changing to adjust detector mode.

- ③ Press **ENT** to double the indicating range of the bargraph display and show the measured value on the bargraph and alphanumeric displays.

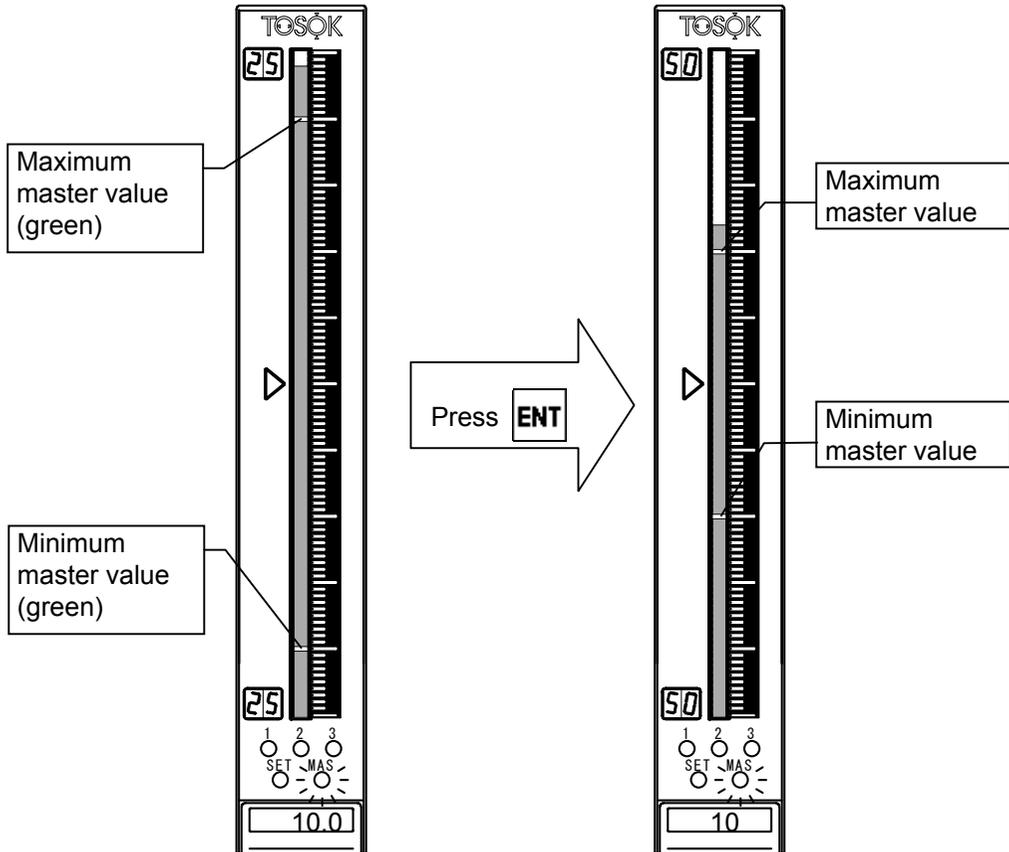


Fig. 10-2. Doubling indicating range.

- ④ Set the minimum master in the measuring head, and turn the zero adjustment knob to set the indication at the minimum master value.

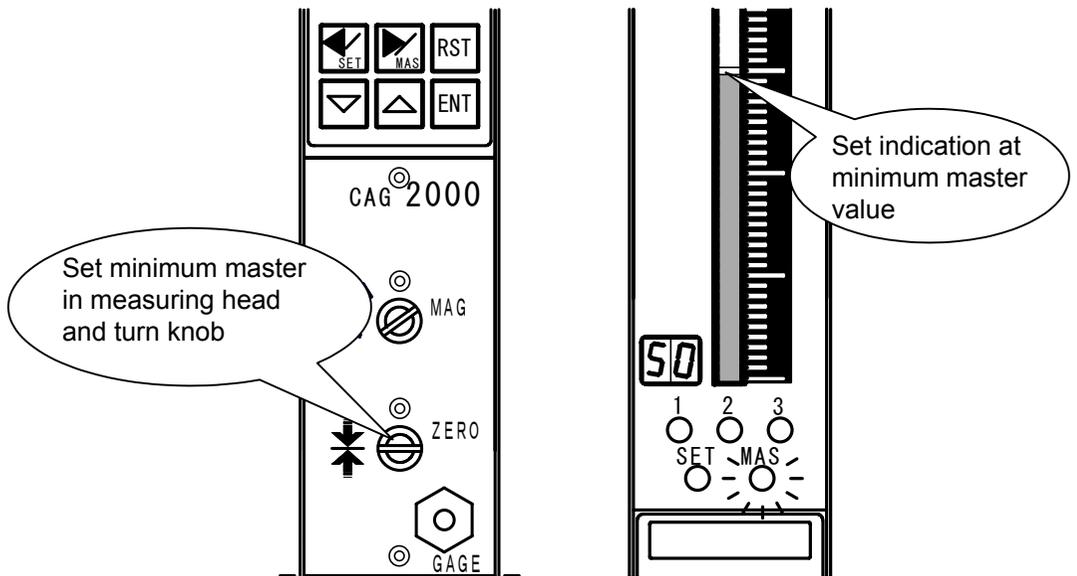


Fig. 10-3. Adjusting zero position.

- ⑤ Set the maximum master in the measuring head. If the indication is about the maximum master value, the adjustment is finished.

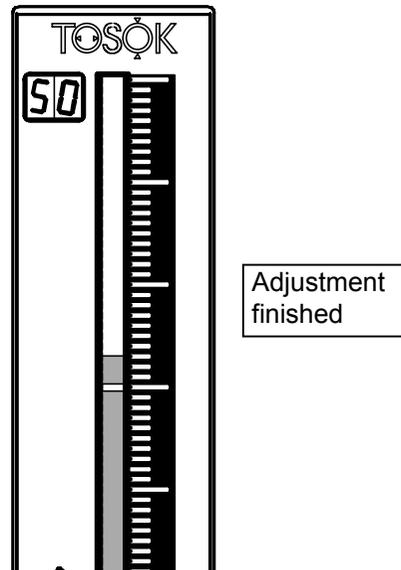


Fig. 10-4. Finishing adjustment with zero and sensitivity adjustment knobs.

When the indication is not in the automatic mastering range (or the bargraph display is illuminated red), refer to “10.2 Indication below mastering range” on page 31 or “10.3 Indication above mastering range” on page 32.

- ⑥ After the adjustment is finished, press **ENT** to change to the master mode and show “MIN M.” on the alphanumeric display. For automatic mastering, refer to “7. Mastering”.

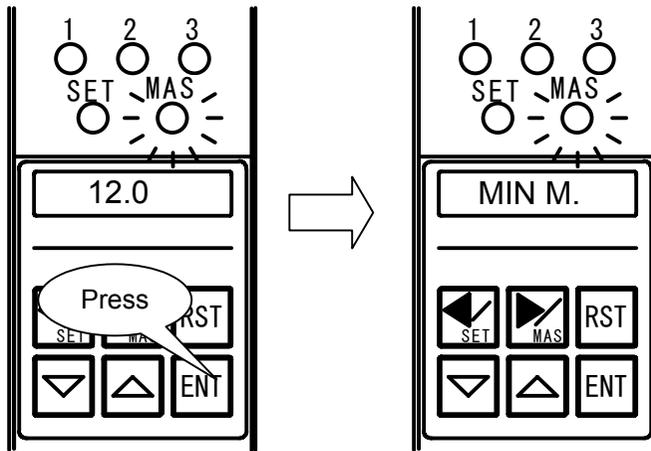


Fig. 10-5. Changing to master mode.

- ⑦ When returning to the measure mode without automatic mastering, press **RST**.

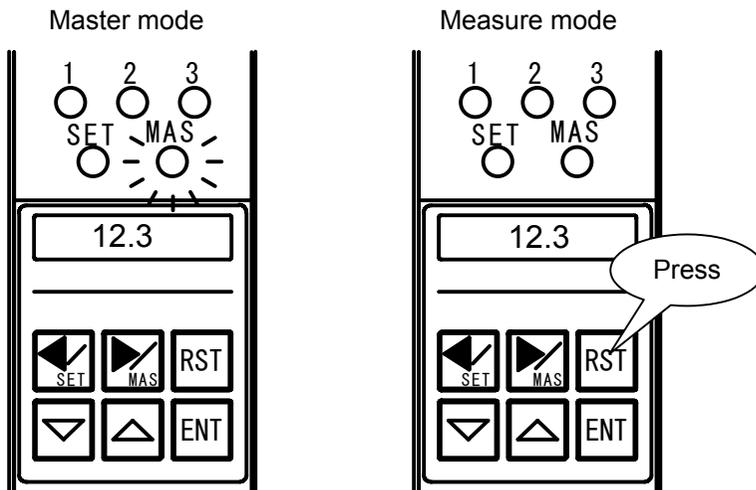


Fig. 10-6. Returning to measure mode.

10.2 Indication below mastering range

- (1) When the indication does not reach the mastering range, the instrument is insufficient in sensitivity. With the maximum master set in the measuring head, turn the sensitivity adjustment knob clockwise so that the indication exceeds the maximum master value by about 5 times the insufficiency from the maximum master value.
- (2) Turn the zero adjustment knob clockwise to set the zero position at the maximum master value.

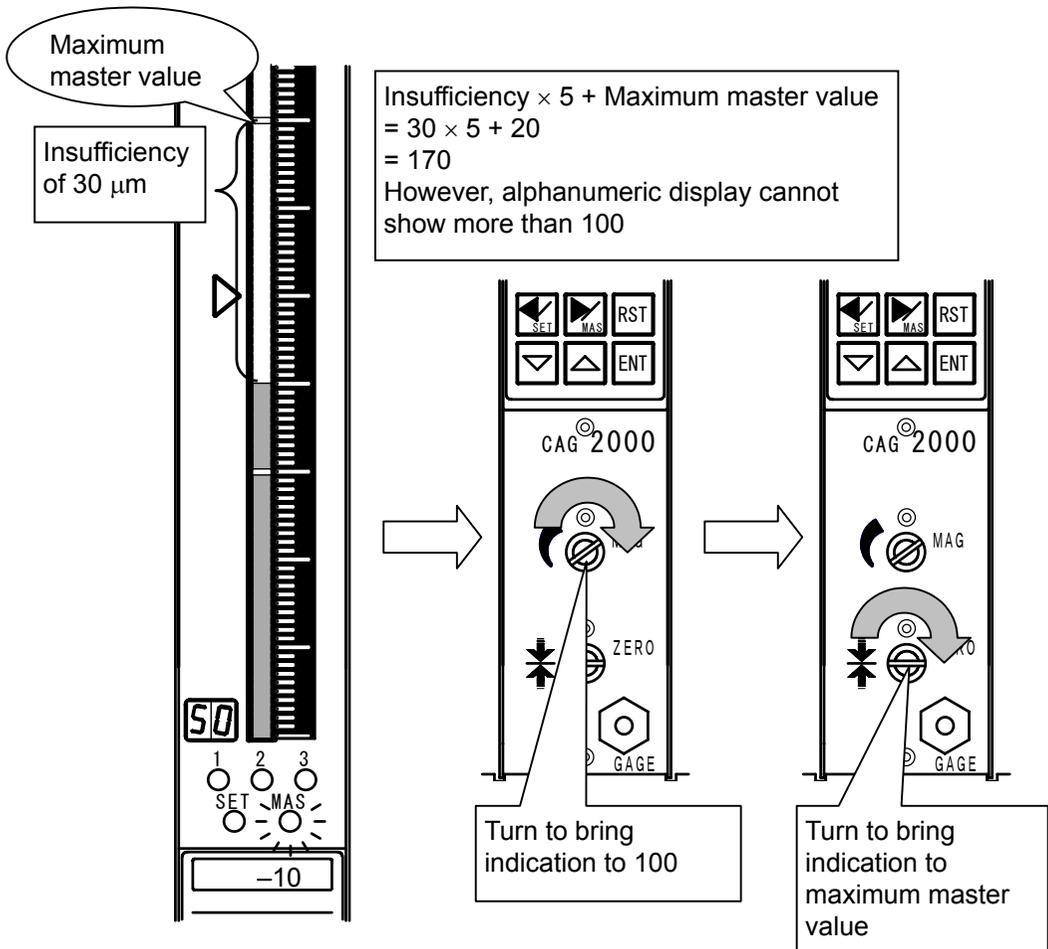


Fig. 10-7. Adjusting for indication below mastering range.

- (3) Set the minimum master in the measuring head. When the indication is about the minimum master value, the adjustment is finished.
- When the indication is not about the minimum master value, turn the zero adjustment knob to bring the indication to the minimum master value. Set the maximum master in the measuring head. If the indication does not come to about the maximum master value, repeat steps (1) and (2) in 10.2 or 10.3.

10.3 Indication above mastering range

- (1) When the indication is above the mastering range, the instrument is excessive in sensitivity. With the maximum master set in the measuring head, turn the sensitivity adjustment knob counterclockwise so that the indication is returned from the maximum master value by about 5 times the excess from the maximum master value.
- (2) Turn the zero adjustment knob counterclockwise to set the zero position at the maximum master value.

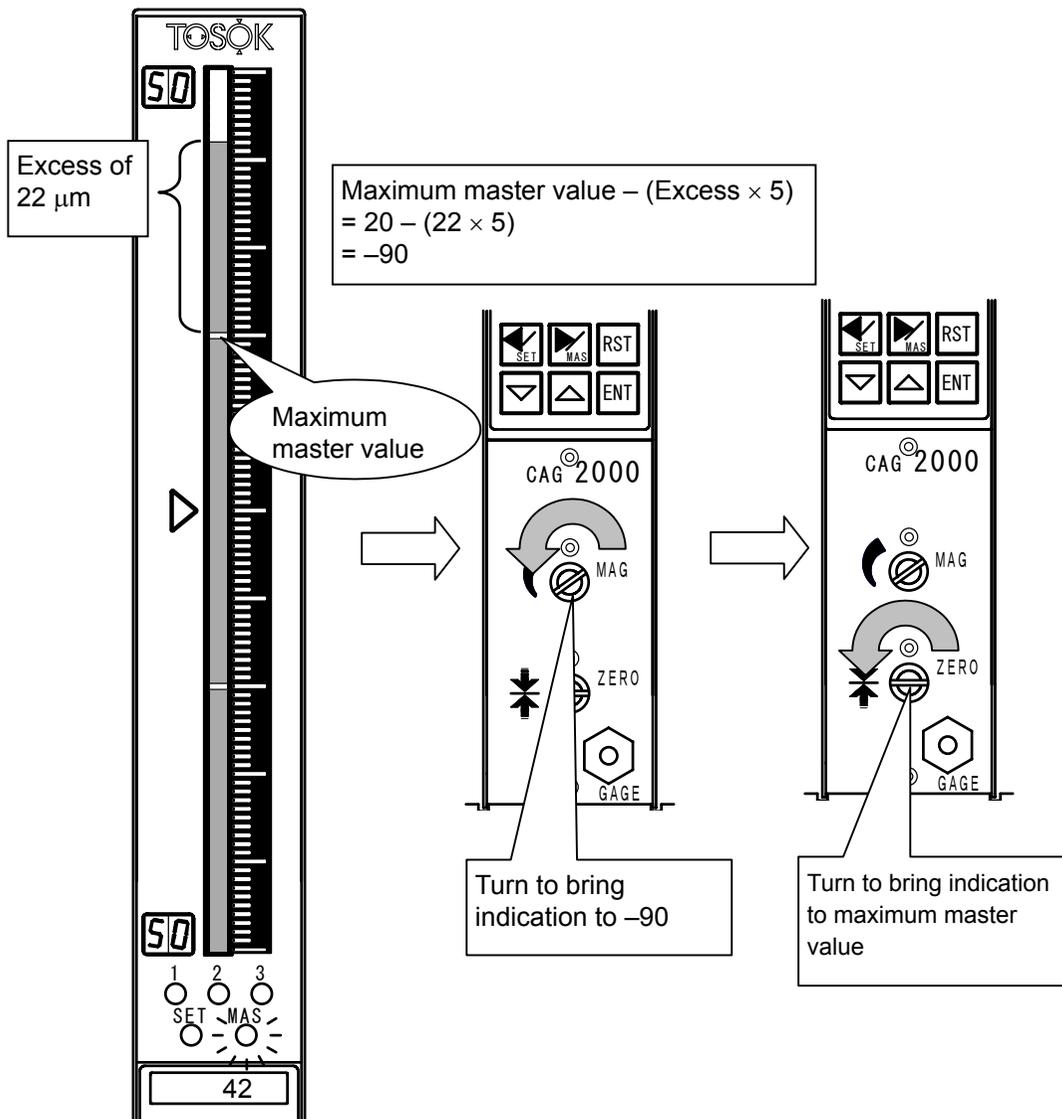


Fig. 10-8. Adjusting for indication above mastering range.

(3) Set the minimum master in the measuring head. When the indication is about the minimum master value, the adjustment is finished.

When the indication is not about the minimum master value, turn the zero adjustment knob to bring the indication to the minimum master value. Set the maximum master in the measuring head. If the indication does not come to about the maximum master value, repeat steps (1) and (2) in 10.2 or 10.3.

11. I/O Description

11.1 Serial output (RS232C)

(1) Description

This instrument can output the measured values to a printer and communicate with a personal computer through RS232C.

Command	Symbol
Hold measured value	E
Clear measured value hold	R
Clear master request	
Request measured value	D
Minimum-mastering	N
Maximum-mastering	X
Change to Program 1	P01
Change to Program 4	P04

(2) Preparation

The RS232C connector at the rear of the instrument is provided for the personal computer or printer. Connect the D-sub 9-pin (male) plug of an optional communication cable to the RS232C connector. Three types of optional communication cables are available for specific applications. For details, refer to "13. Options".

(3) Setting serial port

Baud rate: 9600

Bits/character: 8

Stop bit: 1

Start bit: 1

Parity bit: None

(4) Transmitting measured values

① Commands to instrument

Command	Data type	Symbol
Hold measured value	Character string	E
	ASCII	45H
Clear measured value hold	Character string	R
	ASCII	52H
Request measured value	Character string	D
	ASCII	44H

② Data transmitted to personal computer

Measured value								SP	Judgment result	CR	LF	
								20	:	:	0D	0A

*SP represents a space character.

◎ In the measure mode, press **ENT**. The measured value is held and transmitted to the personal computer. The data transmission is disabled when the mastering result is NG.

(5) Automatic mastering

The master request condition can be cleared, and the instrument can be calibrated with the minimum and maximum masters.

① Commands to instrument

Command	Data type	Symbol
Clear master request	Character string	R
	ASCII	52H
Minimum-mastering	Character string	N
	ASCII	4EH
Maximum-mastering	Character string	X
	ASCII	58H

Calibrate the instrument with the minimum and maximum masters in that order.

② Data transmitted to personal computer

When automatic mastering is performed through the serial communication, one of the data shown in the table below is returned back.

Instrument condition		Data type	Externally returned data														
Mastering result OK	Character string	@	0	O	K	SP	SP	SP	M	A	S	SP	SP	SP	CR	LF	
	ASCII (hex)	40	30	4F	4B	20	20	20	4D	41	53	20	20	20	0D	0A	
Mastering error	Zero position	Character string	@	0	E	R	R	0	1	Z	E	R	O	M	1	CR	LF
		ASCII (hex)	40	30	45	52	52	30	31	5A	45	52	4F	4D	31	0D	0A
	Sensitivity	Character string	@	0	E	R	R	0	4	G	A	I	N	M	1	CR	LF
		ASCII (hex)	40	30	45	52	52	30	34	47	41	49	4E	4D	31	0D	0A
	Masters reversed	Character string	@	0	E	R	R	0	7	R	E	V	SP	M	1	CR	LF
		ASCII (hex)	40	30	45	52	52	30	37	52	45	56	20	4D	31	0D	0A
Other than above	Character string	@	0	E	R	R	1	0	O	F	F	R	M	1	CR	LF	
	ASCII (hex)	40	30	45	52	52	31	30	4F	46	46	52	4D	31	0D	0A	

*SP represents a space character.

(6) Changing programs

A change can be made to programs 0 to 9.

① Commands to instrument

Command	Data type	Symbol		
Change to program 1	Character string	P	0	1
	ASCII	50H	30H	31H
Change to program 4	Character string	P	0	4
	ASCII	50H	30H	34H

② Data transmitted to personal computer

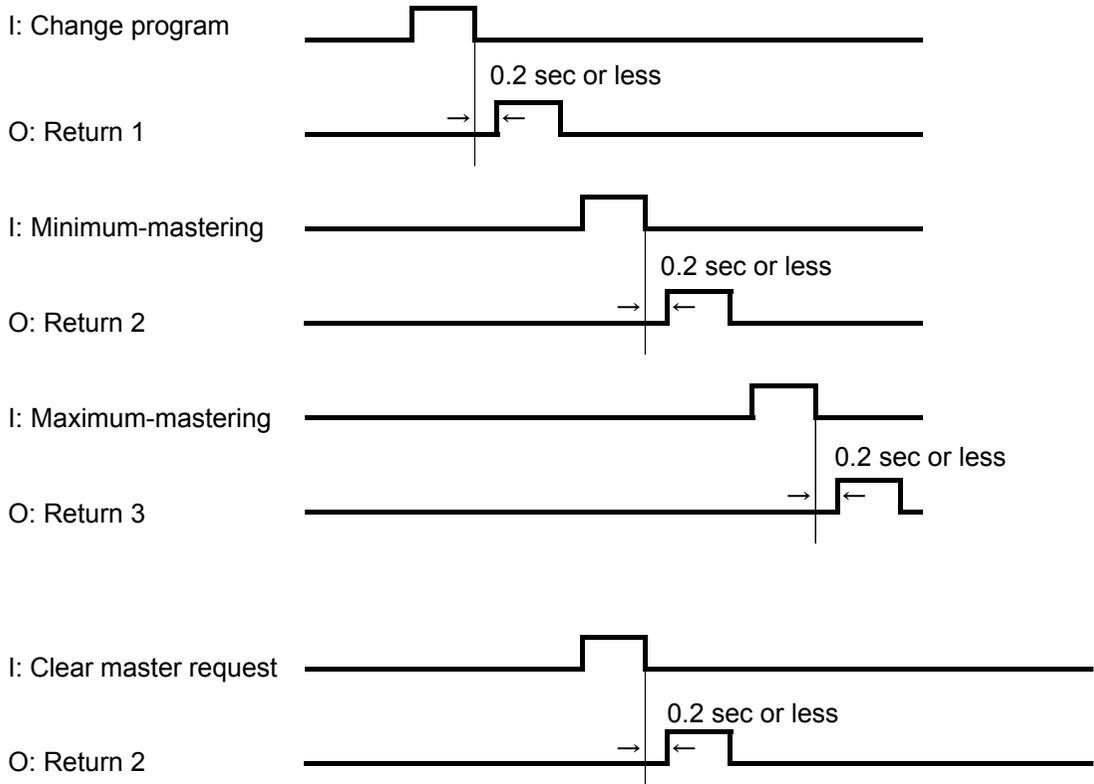
When a program change is made through the serial communication, one of the data shown in the table below is returned back.

Instrument condition	Data type	Externally returned data														
Change to program 1 finished	Character string	@	0	P	R	O	G	1							CR	LF
	ASCII	40H	30H	50H	52H	4FH	47H	31H	20H	20H	20H	20H	20H	20H	0DH	0AH
Change to program 4 finished	Character string	@	0	P	R	O	G	2							CR	LF
	ASCII	40H	30H	50H	52H	4FH	47H	32H	20H	20H	20H	20H	20H	20H	0DH	0AH

(7) Changing program and mastering timing charts

The commands cannot be executed in combination, but must be executed individually.

(I: Transmission to CAG/CEG2000, O: Reception from CAG/CEG2000)



11.2 External input

(1) Description

Using external buttons and a foot switch, the instrument can:

- ① Measure a work.
- ② Reset itself.
- ③ Be calibrated with the minimum master.
- ④ Be calibrated with the maximum master.

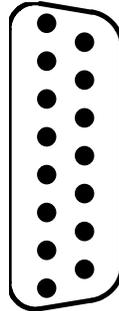
Note: Do not use the instrument through relay contact input.

(2) Preparation

The SW. ETC connector at the rear of the instrument is provided for external buttons. It accepts a D-sub 15-pin (male) plug.

(3) Connector pin arrangement

Description	No.
	1
	2
	3
	4
	5
GND	6
Measure button	7
RESET button	8



No.	Description
9	Maximum master button
10	Minimum master button
11	
12	
13	
14	
15	

Fig. 11-1. Pin arrangement diagram of SW. ETC connector at rear of instrument.

(4) Operation with external buttons

① Measure button

- (a) In the measure mode, press the measure button.
- (b) The measured value is held. (This is called the hold measured value condition.)

Note: The measured value cannot be held when the mastering result is NG.

② RESET button

Clears the measured value hold.

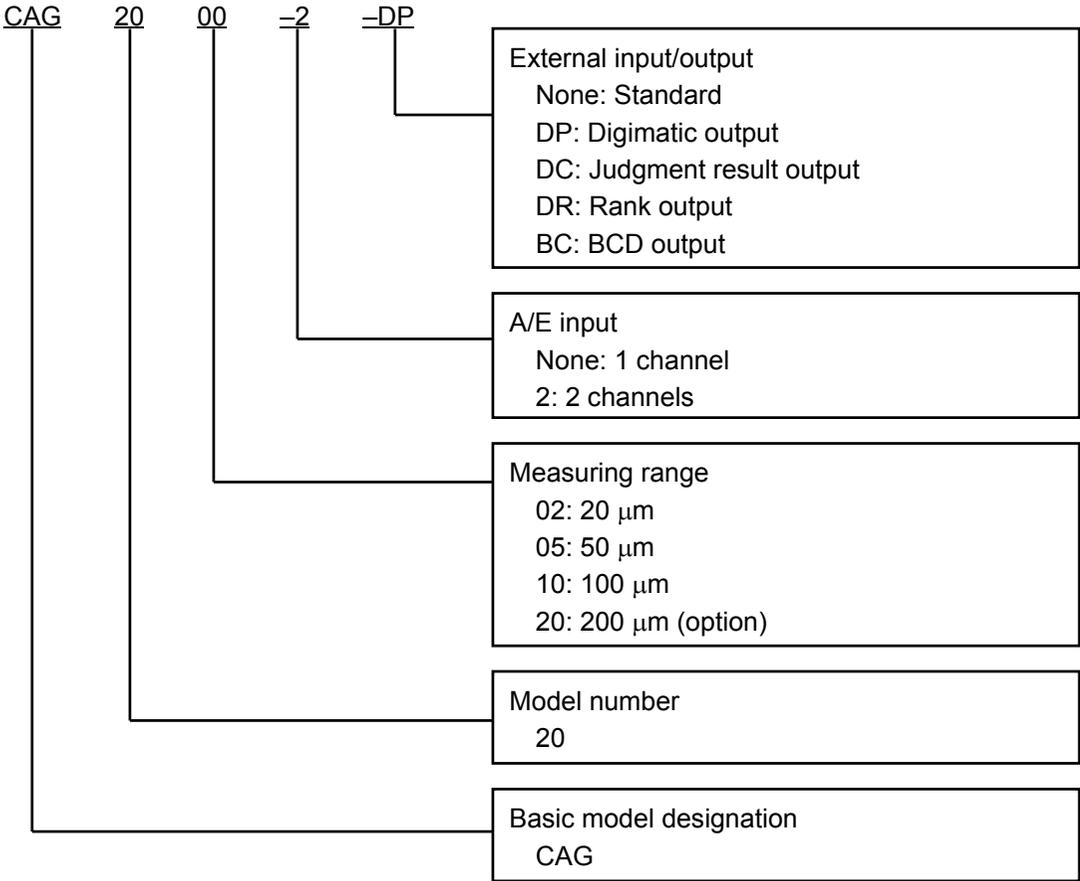
③ Minimum master button

- (a) In the measure mode, set the minimum master in the measuring nozzle.
- (b) When the bargraph display is stabilized, press the minimum master button.
- (c) The instrument is calibrated with the minimum master and readied for calibrating itself with the maximum master (this is called the maximum-mastering ready condition).

④ Maximum master button

- (a) In the maximum-mastering ready condition, set the maximum master in the measuring nozzle.
- (b) When the bargraph display is stabilized, press the maximum master button.
- (c) The instrument is calibrated with the maximum master and returns to the measure mode.
- (d) When a mastering error occurs (refer to step ⑤ in “7.1 Automatic mastering”), use the control keys on the instrument to clear the mastering error.

12. Model Identification



13. Options

(1) Instrument

- ① Measuring range : 200 μm
— Effective measuring range : 160 μm (with linear compensation)
- ② Digimatic output: Output to printer (DP1), for example
- ③ Judgment result output : 12/24 VDC
- ④ Rank output : 12/24 VDC
- ⑤ BCD output : 12/24 VDC

(2) Separately sold parts

- ① Filter (CAG2000-OP-AF): Air filter + Mist separator
- ② Filter (CAG2000-OP-AFA): Air filter + Mist separator (with automatic drain)
- ③ Regulator (CAG2000-OP-AR): Precision regulator
- ④ Communication cable (CAG2000-OP-CB-1): D-sub 9-pin connector (EIA-232) for
personal computer
- Communication cable (CAG2000-OP-CB-2): D-sub 25-pin connector (EIA-574) for
personal computer
- Communication cable (CAG2000-OP-CB-3): D-sub 25-pin connector (EIA-574) for
printer

14. Maintenance

(1) The air filter is clogged as it is used for a long period of time. Change the air filter element after two years of use or when the pressure drop reaches 0.1 MPa.

(2) Cleaning A/E converter

When the A/E converter is used for a long period of time, oil and dust may accumulate in the air circuit. Clean the A/E converter as described below.

- ① Record the approximate installation position of the zero and sensitivity adjustment knobs at the front of the instrument (or the distance of each knob from the edge). This record facilitates mastering after cleaning.
- ② Turn the zero and sensitivity adjustment knobs counterclockwise, and remove them from the instrument.
- ③ Check the O-ring of each needle. If the O-ring is damaged, change it.
- ④ If the needle is dirty, clean it. Dampen a cotton swab with alcohol, and use it to clean the $\phi 3$ mm hole into which the needle enters.
- ⑤ Replace the needle in each knob. If the split screw is loose, expand it with the tip of a flat-end screwdriver. Take care not to overbend the split screw.
- ⑥ Turn the needle of each knob clockwise, and install the knobs in the original position recorded at first. Adjust the zero position and sensitivity of the air circuit with the zero and sensitivity adjustment knobs, respectively, and calibrate the instrument with the minimum and maximum masters.

15. Troubleshooting

Phenomenon	Cause	Remedy
Repeatability is not stable.	<ul style="list-style-type: none"> ① Air supply pressure is not stable. ② Regulator is malfunctioning. ③ Measuring nozzle is worn. ④ Piping and joints are leaking. ⑤ Entry of moisture or oil causes trouble to instrument. 	<ul style="list-style-type: none"> ① Set regulator source pressure at 300 kPa or more. ② Overhaul or change it. ③ Change it. ④ Check for leakage, and retighten. ⑤ Clean instrument.
Zero adjustment knob is ineffective.	<ul style="list-style-type: none"> ① Air supply pressure is too low or high. ② Piping and joints are leaking. ③ Gap of measuring nozzle is too small. ④ Gap of measuring nozzle is too large. 	<ul style="list-style-type: none"> ① Set regulator at 196 kPa. ② Check for leakage, and retighten. ③ Adjust to proper gap. ④ Adjust to proper gap.
Bargraph display does not operate.	<ul style="list-style-type: none"> ① Specified power is not supplied. ② Zero position of air circuit is improperly adjusted. ③ Instrument is in hold measured value mode. Bargraph display is illuminated green or red (dark). ④ Instrument is in set mode. 	<ul style="list-style-type: none"> ① Supply power of 85 to 264 VAC. ② Calibrate instrument with masters. ③ Press RST to clear this condition. ④ End set mode.
Bargraph and alphanumeric displays are not illuminated.	<ul style="list-style-type: none"> ① Power is not supplied. ② Fuse is blown. ③ Power supply or internal circuit is faulty. 	<ul style="list-style-type: none"> ① Supply power of 85 to 264 VAC. ② Change it. ③ Ask NIDEC TOSOK for repair.

16. Cautions

(1) Air supply

Supply clean air free from dust, moisture, and oil. Drain the air filter once per day or more frequently.

(2) Power cable

The power cable supplied as standard accessory is for 100 V. If you use supply voltage in excess of 125 V, separately prepare a 250-V power cable.

(3) Control keys

Never operate the control keys with a sharp-pointed tool or the like.

(4) Export

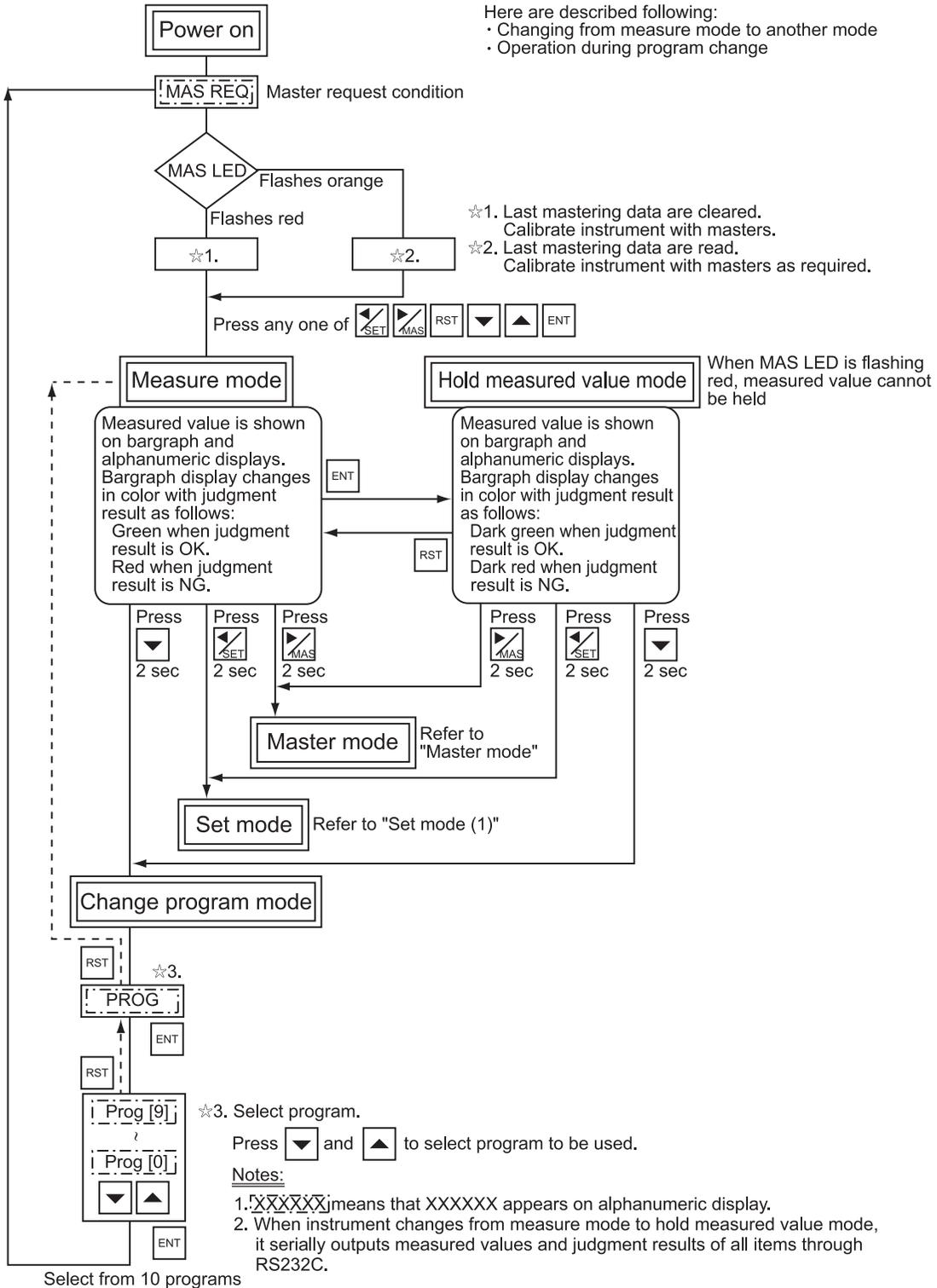
When you try to export this instrument overseas, you may have to have the export approved by the Ministry of Economy, Trade and Industry under the Export Trade Control Ordinance. In such a case, contact your nearest NIDEC TOSOK sales office.

(5) Specifications

The specifications are subject to change without notice.

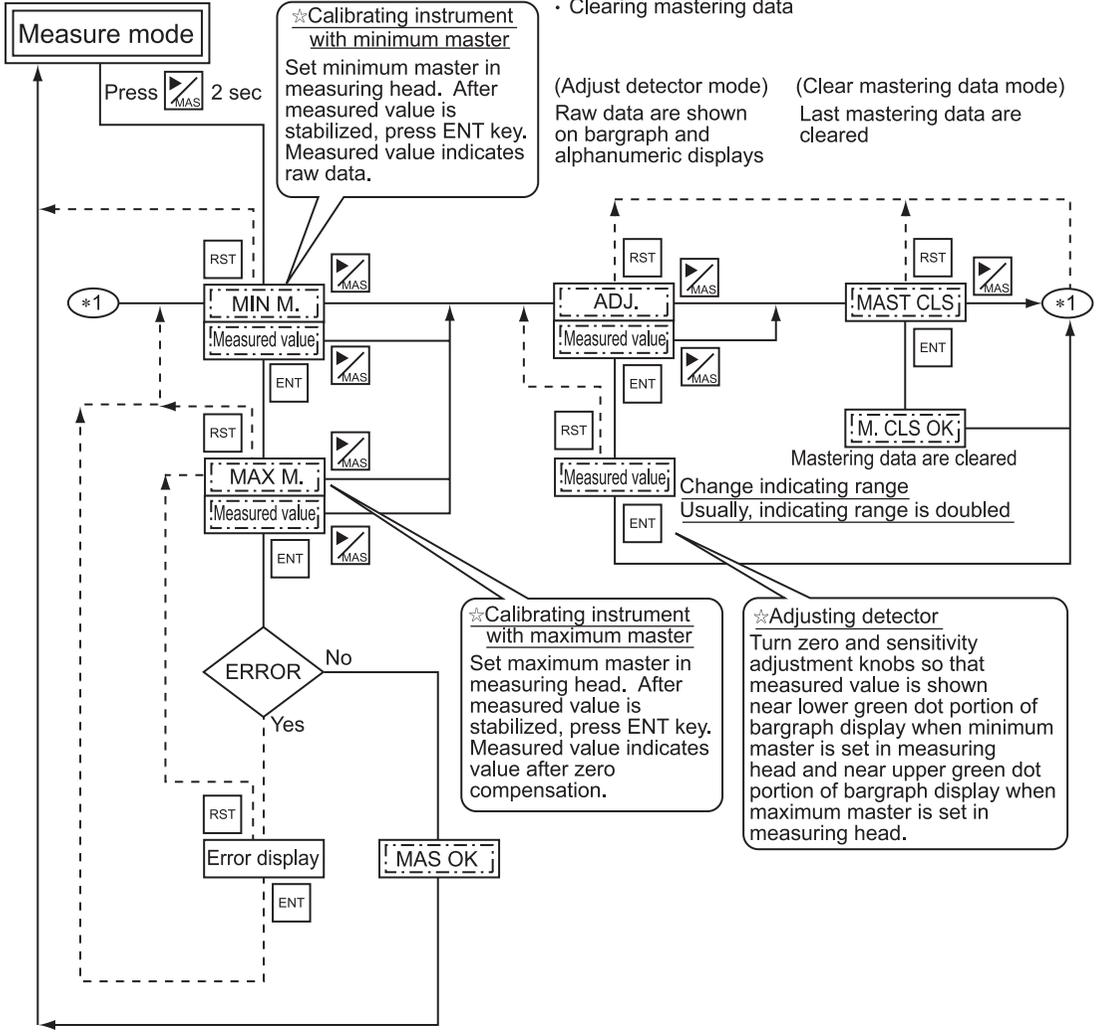
17. Operation Flow

Measure mode and change program mode



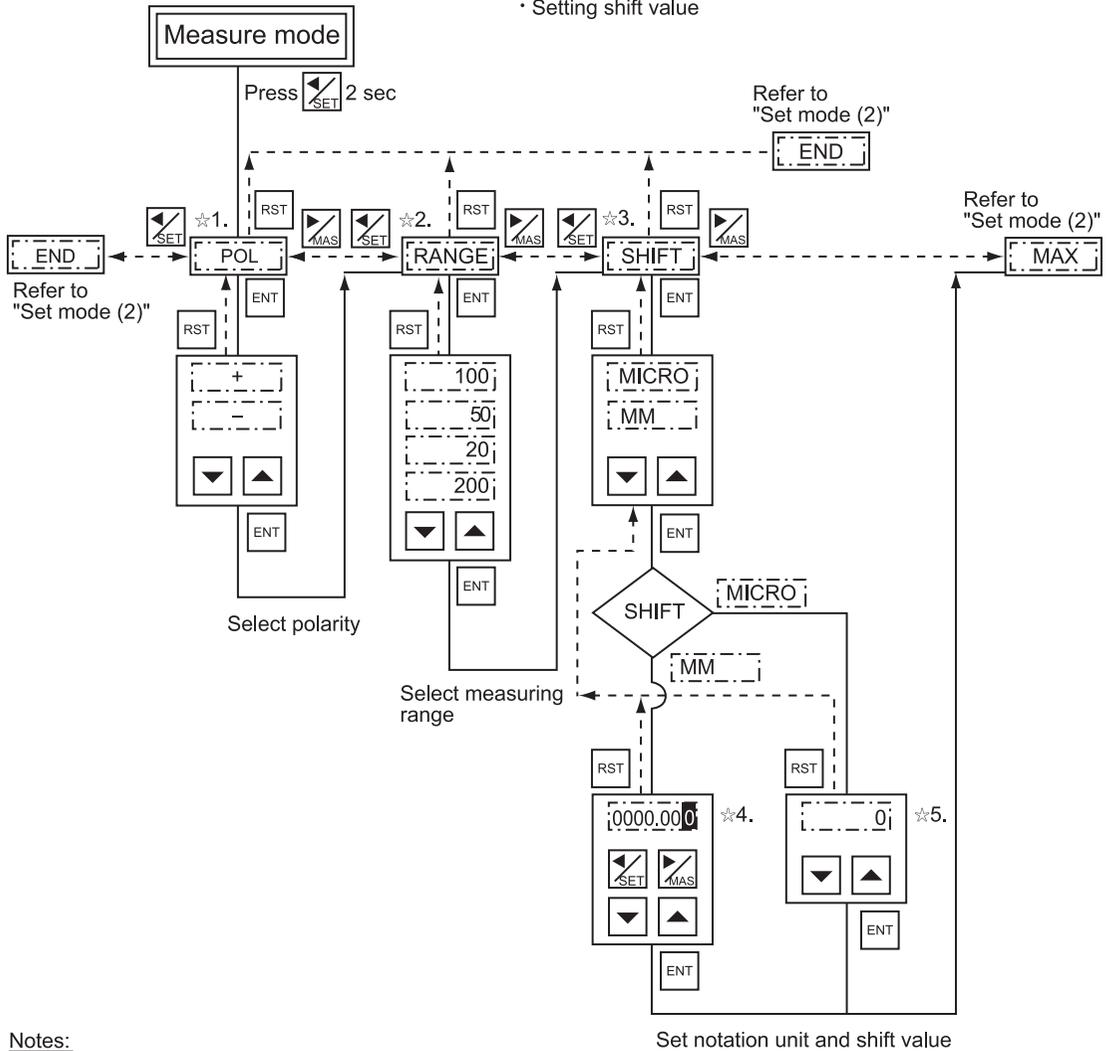
Master mode

Here are described following:
 • Mastering
 • Adjusting detector
 • Clearing mastering data



Set mode (1)

Here are described following:
 • Selecting polarity
 • Selecting measuring range
 • Setting shift value



Notes:

- ☆1. Select polarity.
 Select [+] for ID measurement and [-] for OD measurement.
- ☆2. Select measuring range (bargraph display range).
- ☆3. Set shift value.
 Enter median value of work tolerances.
 Select [MICRO] for micrometer notation and [MM] for millimeter notation.
- ☆4. Press **SET** and **MAS** to select digit, and press **▼** and **▲** to change value of that digit.
- ☆5. Press **▼** and **▲** to decrement and increment shift value by 1/100 each.

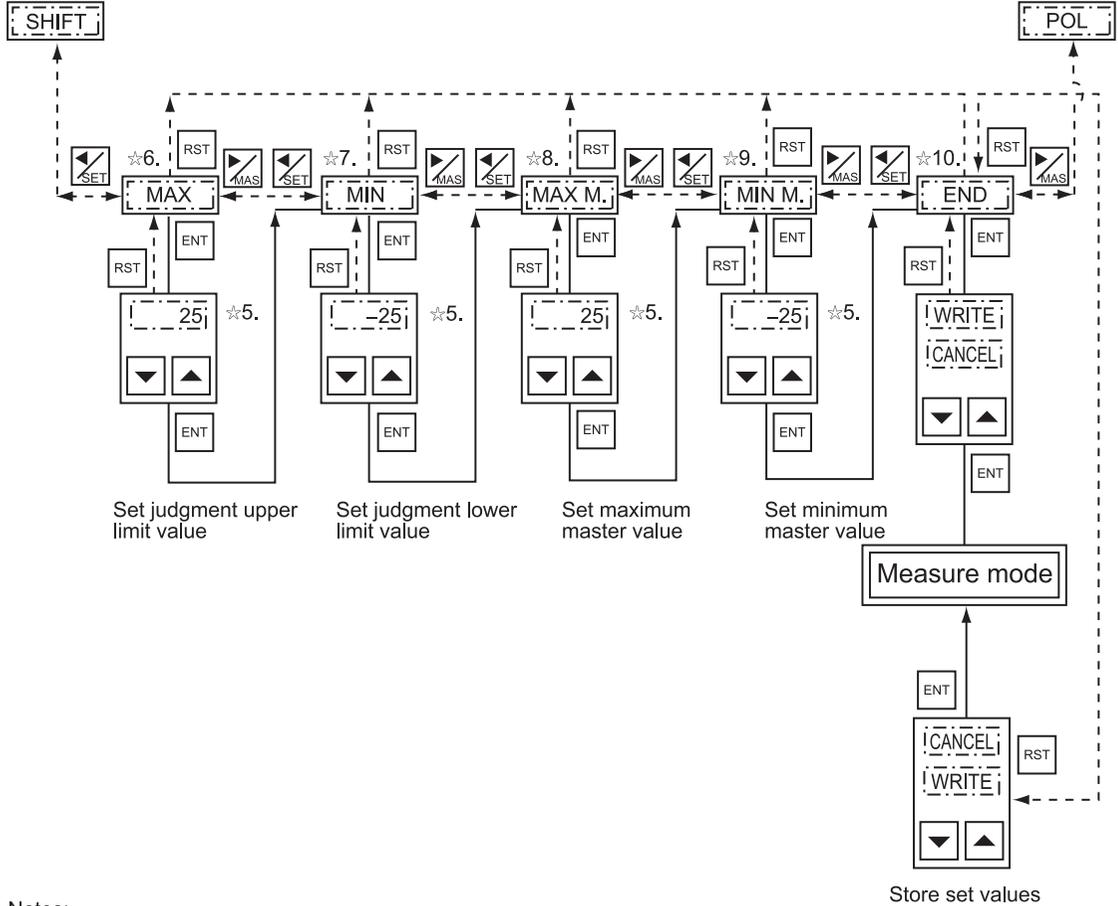
Set mode (2)

Here are described following:

- Setting judgment upper and lower limit values,
- and maximum and minimum master values
- Storing set values

Refer to
"Set mode (1)"

Refer to
"Set mode (1)"



Notes:

- ☆ 5. Press and to decrement and increment set value by 1/100 each.
- ☆ 6. Set judgment upper limit value.
Enter upper limit value of work tolerances.
- ☆ 7. Set judgment lower limit value.
Enter lower limit value of work tolerances.
- ☆ 8. Set maximum master value.
Enter measured value of larger master.
- ☆ 9. Set minimum master value.
Enter measured value of smaller master.
- ☆ 10. Store set values.
Select WRITE to store new set values. Set values are updated.

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