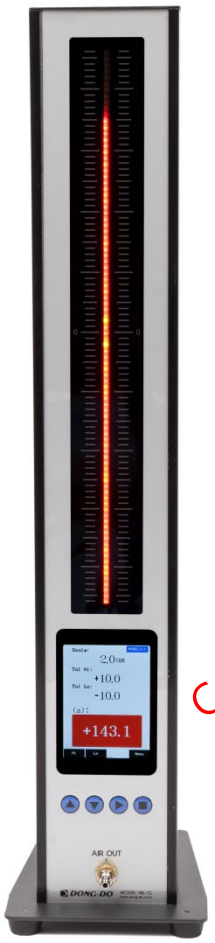
DONG-DO



Color TFT LCD & Column LED bar Display

High Precision Air type Electronic micrometer

ML-1CT-A1

User's Guide (Ver. 8.0R8)

The contents of this manual could be different according to the software version and it can be changed without notice.
Please use this good after reading the manual thoroughly.

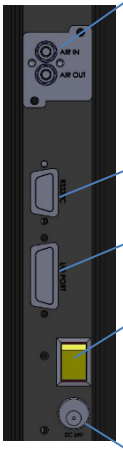
Table of Contents

Product features & composition

1. Features(features could be different from pictures without notice.)

LED Column Bar:
It is displayed 'OK(Green color) / NG(Red color) / High & Low tolerance marking'

Air sensor unit
-Air In : 2bar air input
-Air out: Plug gauge



RS232C communication port

I/O port

Power switch

DC 24V power input

Color TFT LCD

Setup buttons
(up▲, down▼, select▶, mode■
buttons in a row)

'Air out' front side nipple(Option)

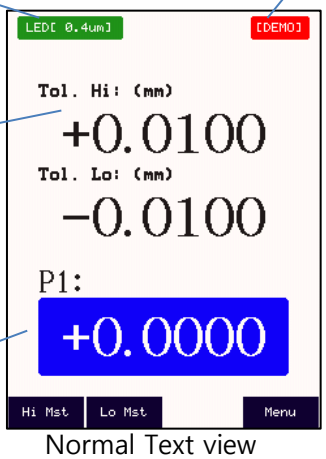
2. Measuring screen

Scale for LED column bar

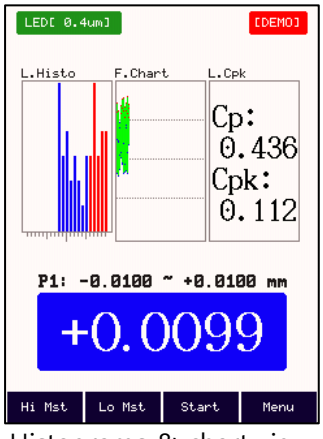
Model number

Hi/Low tolerances

Measured data



Normal Text view



Histograms & chart view

**Simple setting orders.

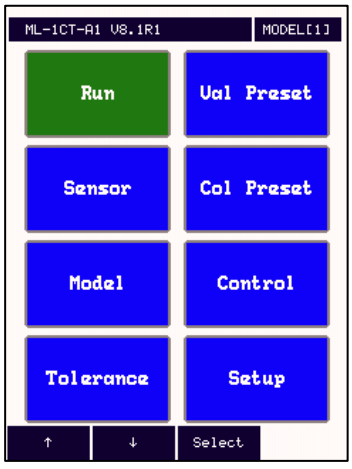
***Air input(2bar)→ Direction→ Dimension→ Sensitivity→ Calibration→ Tolerance→ Other options**

a. Measuring direction setting(at **Sensor → Direction** menu).
b. Hi/Lo Master Size input(at **Sensor → Dimension** menu).
c. Sensor sensitivity setting(Optional if it's shown, at **Sensor → Sensitivity** menu).
d. Hi/Lo Master Calibration(at **Sensor → Calibration** menu).
e. Zero Master offset setting(Optional, at **Sensor → Offset** menu)
f. **Tolerance** setting to make the decision of OK or NG.
g. Other settings as like Preset, Display, etc.

Master Size	10.000 [mm] +0.010 [mm] -0.010 [mm]	20.500 [mm] +0.050 [mm] +0.030 [mm]
Inputting Dimension Value	Preset: +10.000 **HI : +10.0(um)** **LO : -10.0(um)**	Preset: +20.500 **HI : +50.0(um)** **LO : +30.0(um)** = Preset: +20.530 **HI : +20.0(um)** **LO : +0.0(um)**
Note	-	Both of the settings are possible.(HI/LO deviation is the same. 'Preset' is a nominal value but just for display on measuring screen.)

1. Main menu

- Main menu is entered by hitting ■ button(4th button from left) on the measuring screen.



-The main menu is composed as like the picture at the left.
-Each functions can be chosen by ▶(select) button after cursor is moved by ▲▼buttons.

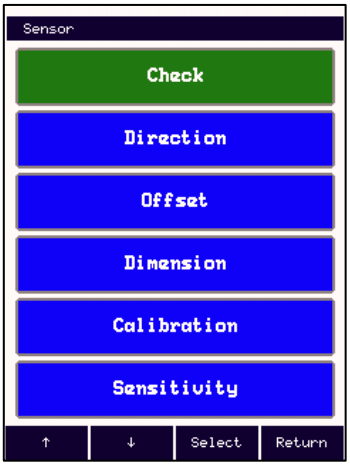
1. Run: To go to the measuring screen.
2. Sensor: Calibration sensors by Hi/Low masters.
3. Model :Memory space to save the current settings.
   There are 16 spaces, 1 to 16, and external memory selection by input signal is possible if the model is set to 'Ext. Model'.
4. Tolerance: To input the tolerance of the measuring part.
5. Val Preset: Preset(Nominal) value for the measuring data on the LCD display.
6. Col Preset: Preset(Nominal) value for the measuring data on the LED bar display.
7. Control: To set up the input/output methods, serial communication, etc.
8. Setup : To setup the brightness, unit, passwords, etc.

2. Run

-To enter the measuring screen.

3. Sensor

-If ▶(SELECT) button is pushed at the "Sensor" on the main menu, the items below are shown.

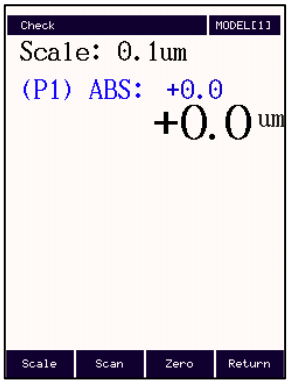


1. Check: Checking sensor data.
2. Direction :Sensor direction setting(IN-DIA ←→ OUT-DIA)
3. Offset: An offset value for the measured data.
4. Dimension: Hi/Low masters' dimension setting.
5. Calibration: Calibration sensors by Hi/Low masters.
6. Sensitivity: Sensitivity of the air sensor.(x1, **x2**, x4, x8)

****If the settings of Direction/Offset/Dimension/Sensitivity are changed, the calibration should be done again!!**

1) Check

-If ▶(SELECT) button is pushed at the "Check" on the menu, sensor data checking screen is come out. A row data of the sensor is on the screen in this menu.
The value would be moved around from +0 ~ +2000.0.
(at Direction: In-dia, Sensitivity: x2). If the value is not moving among gauge air output amount is changed, the sensor or amp unit might have a matter.



-If ▲(SCALE) button is pushed, the scale of LED bar would be changed as the scale.
-If ▼ (SCAN) button is pushed, a row data is displayed same on ABS and next line.
-If ▶(ZERO) button is pushed, a relative value from the value of the moment is displayed. The current value of the ABS is set to zero. But the value is not saved at all, it's just a temporary data.
-■ (RETURN): to go upper menu.

2) Direction:

- Sensor direction setting menu. IN-DIA ←→ OUT-DIA
- IN-DIA : to measure inner diameter. So, the value is increased as the hole size is bigger.
- OUT-DIA : to measure outer diameter. So, the value is increased as the part size is bigger.

3) Offset:

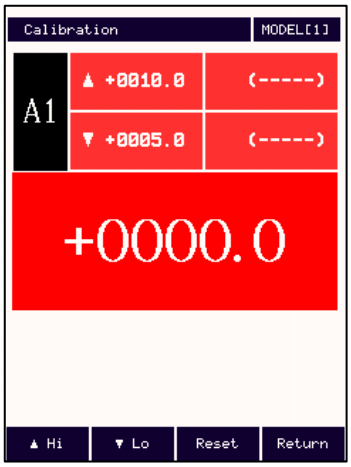
- An offset value is set on this menu. The offset value would be added on the real measured data and displayed on the measuring screen.
- Default value is 0.
• Measured(displayed) data = Real measured data + Offset value.

4) Dimension:

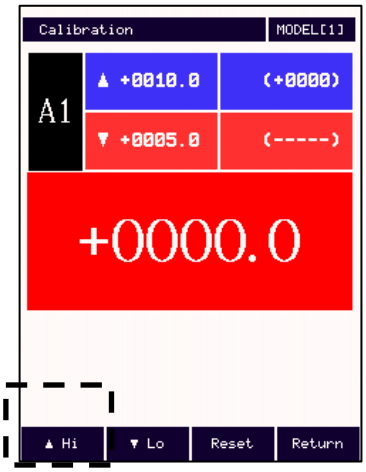
- Hi/Low masters' dimension setting before doing master calibration. (Please check page 4.)

5) Calibration:

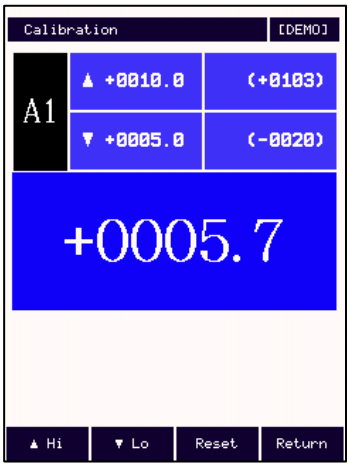
- Hi/Low masters setting menu.



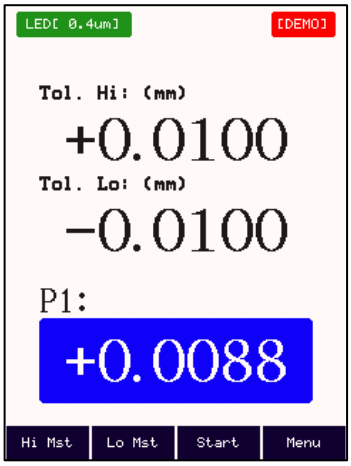
①Red color is shown without Master setting



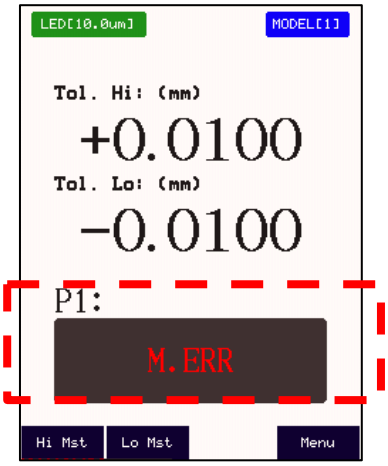
②Blue color is shown at the High value with Hi master setting.



③All blue color is shown if the master setting is done well.



Measuring screen view on a good mastering



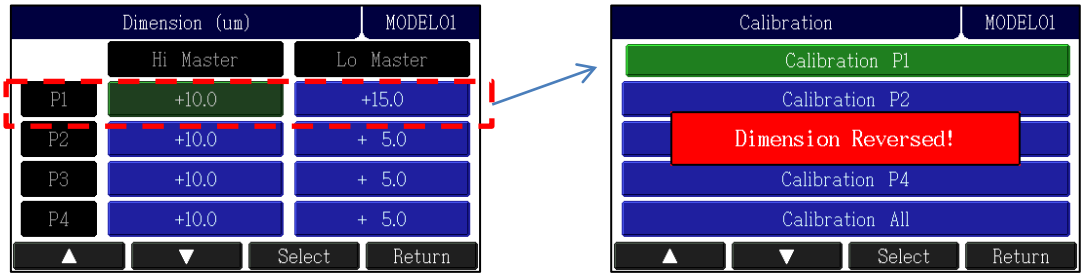
A grey box is shown for the wrong master setting.

6) Sensitivity:

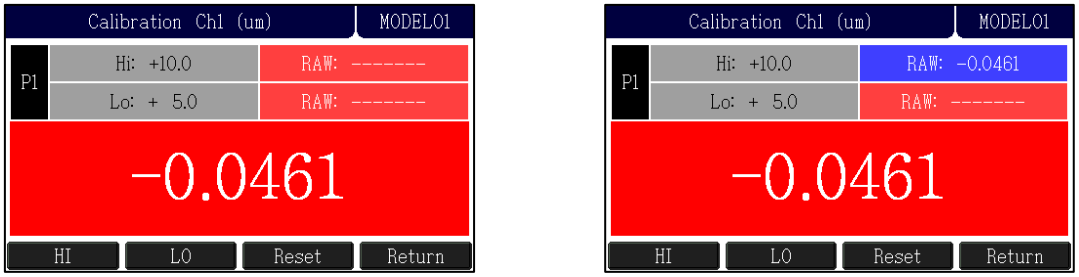
- Air sensor's sensitivity can be changed here. x1, x2, x4, x8. If measuring value is stable, high sensitivity should be better. Default setting is x2.

7) Master setting(Calibration) error view:
- There're Master setting error view to prevent user's mistakes.

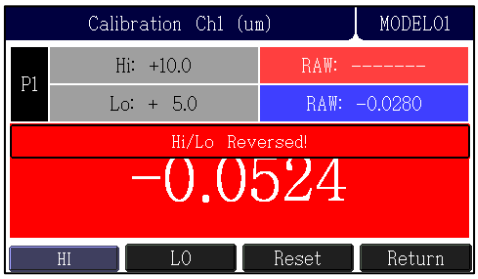
A. Dimension setting error:
- If user put in the dimension opposite size, it shows 'Dimension Reversed' on the calibration menu.



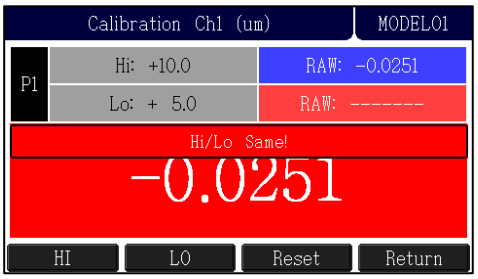
B. No high or low master setting:
- If user doesn't set the masters. It shows a red cautions for it.



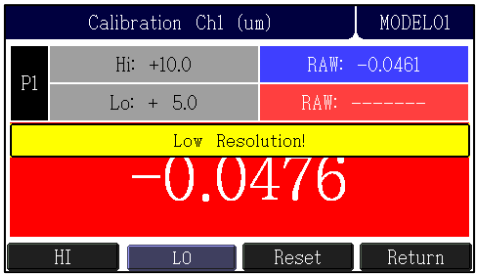
C. high and low master reverse setting:
-If user set the masters reversed.
-It shows a red cautions for it.

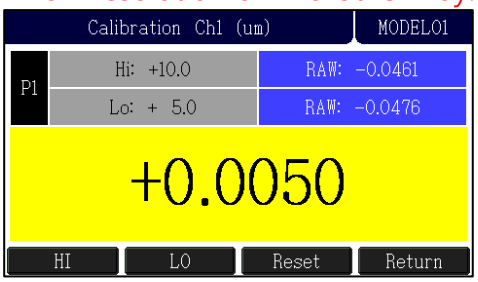


D. high and low master value is the same:
- If the value is the same,



E. high and low master value is similar(low resolution):
-If the resolution is low(Over 0.1um), it shows a yellow caution for it. But it is working in low resolution. So, user should decide if it is used in low resolution or find other way.





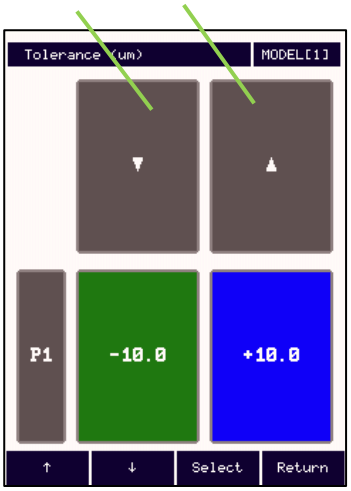
4. Model

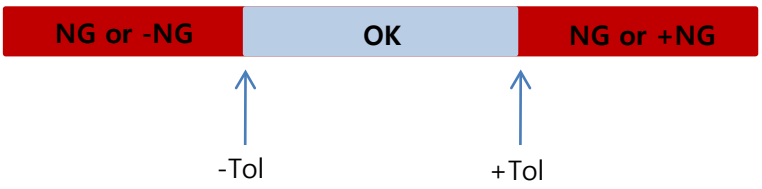
- Memory space to save the current settings. And the setting can be recalled. There're 16 memory spaces. If the model is set by 99 or External, the model can be changed by external I/O input.

5. Tolerance

- Tolerance to make the decision of OK/NG is put in this menu.

Low limit High limit





+NG / -NG can be used on Group OK/NG output signal.
Please check Input/Output setting on page 12.

6. Val preset

- Preset(nominal) value for the measuring data on the LCD display. Preset is useful to display the real dimension number.

※ The value on the Preset does not effect to the result of the decision. It is just added when the meas uring data is displayed.

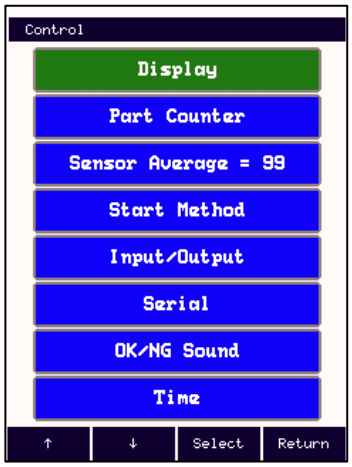
7. Col preset

- Preset(nominal) value for the measuring data on the LED column bar display. Preset is useful to disp lay whole of the measuring area of a part.

※ The value on the Preset does not effect to the result of the decision. It is just added when the meas uring data is displayed on the LED column bar.

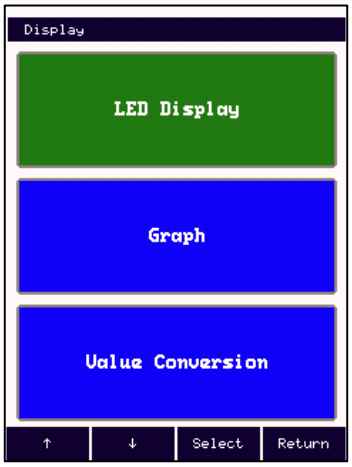
8. Control

- To set up the input/output methods, serial communication, etc.



1) Display:

- To set up display items on the measuring screen.



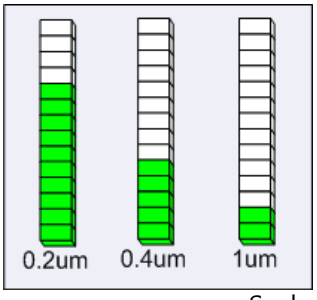
a. LED Display:

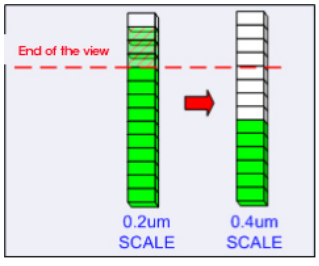
- To set the scale, and display modes for the LED bar.

- Scale

It is for the setting how length is shown as the length of the LED display increased.
For example, if 0.2um/LED is set, the each LED shows 0.2um.
The picture on the bottom is shown the LED display as the scales ar e changed at the 0.2um.
If 'Auto' is set in this menu, the scale is changed automatically as the area of measuring is changed.

* Auto → 0.1 → 0.2 → 0.4 → 0.5 → 1.0 → 2.0 → 4.0 → 5.0 → 10.0 u m as the ▶ button is hit.





<Scale change>

- Mode for LED bar display

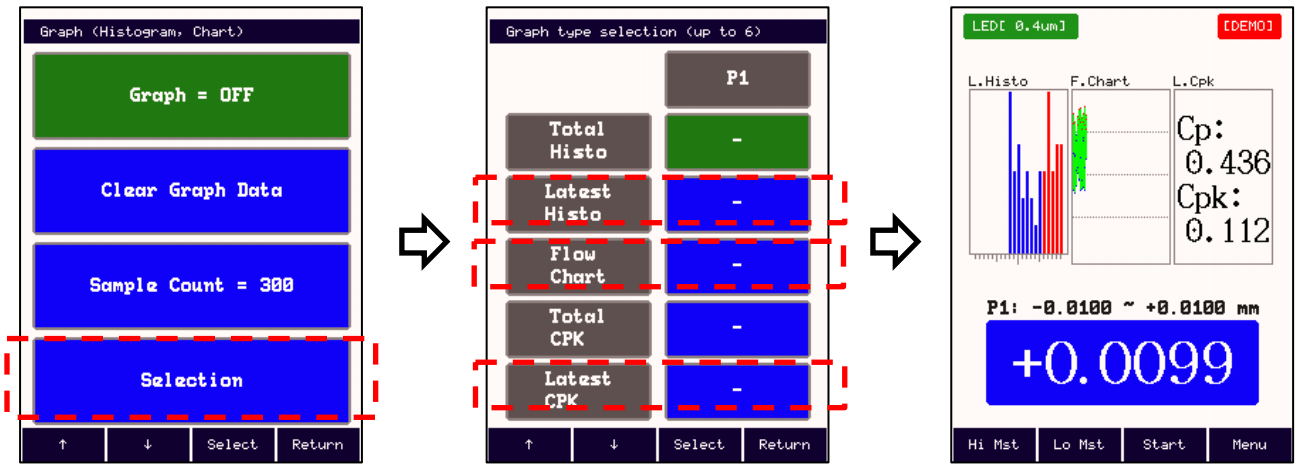
The LED display start position is set on this screen
CENTER : LED display is started from middle of the bar.
BOTTOM : LED display is started from bottom of the bar.

b. Graph:
To set which the histograms & charts are on the measuring screen.

- Graph On/Off : To select if the graph function is used or not.
- Clear Graph Data : To clear the graphs on the measuring screen.
- Sample Count : This is for 'Latest histogram' & 'Flow chart' & 'Latest CP/CPK'.
  It's about how many latest data is used for them.
- Selection : To choose which graphs are displayed on the measuring screen.

* There're number limitations of displaying histograms and flow charts(it's about 2ch~4ch column)
• By 4 groups : Max. 9 histograms & charts.
• From 5 to 8 groups: Max. 3 histograms & charts.

**There're 5 kinds of display output in the 'Graph' selection menu.
• Total histogram(T.Histo) : Histogram by total data but they're not saved in the memory, but only updated from last histogram.
• Latest histogram(L.Histo) : Histogram by a number of latest data, 1 to 300, and they're saved in the memory.
• Flow chart(F.Chart) : Flow chart by a number of latest data, 1 to 300.
• Total CP/CPK(T.Cpk) : CP/CPK by 'Total histogram'.
  Caution: the total histogram data is saved on 23 sections between (-tolerance value x 2) to (+tolerance value x 2). And if the data is out of the area, +/- tolerance x 2, the data is saved at the last value, at -tolerance x 2 or +tolerance x 2. So, if there're a lot of measuring data that is out of the area, the CP/CPK value could be different. **So, it is a reference value, but not exact value.**
• Latest CP/CPK(L.Cpk) : CP/CPK with latest data based.
  It is the CP/CPK value based on real latest data. So, the value is exact. But there's a data number limits, normally latest 300 data.



<Graph menu> <Graph selection menu> <Measuring screen>

c. Value conversion:
- Conversion Method: To setup the end figure of the measured value. There are the options of 'round', 'raise', and 'cut'.
- Digits : 0.000 ← → 0.0000 mm

2) Part Counter
- Part number counting On/Off. Max count is 9999 and after that it goes to 0001.

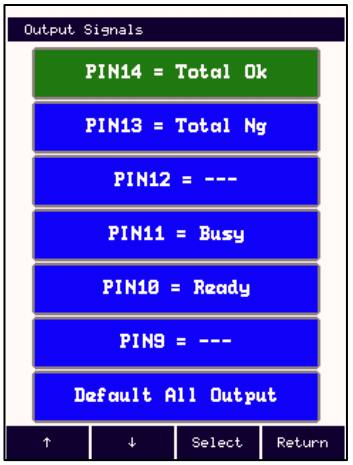
3) Sensor Average:
-To set how many raw data is used to average them for one measuring sequence.
- The one measuring sequence time could be different by this setting.

4) Start Method:
a. Start:
- Auto : Start the measuring continuously.
- Semi-Auto : Data is updated continuously on the screen.
  But the measured data is gotten when 'start' signal is inputted.
- Manual : give the start signal from outside(▶button or from I/O port).

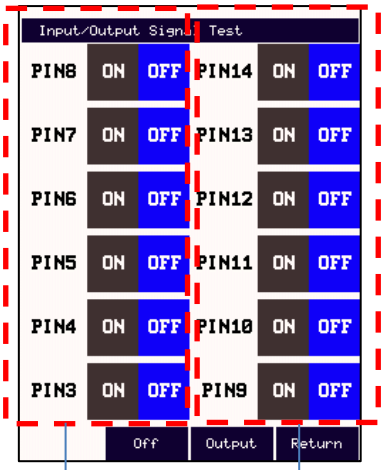
b. Wait Start Off :
If this is 'ON', starting the measuring sequence is waited until the 'Start' signal is off.
If this is 'Off', the measuring sequence is continued until the 'Start' signal is on.
Work with the 'Start Method' is 'Manual' or 'Semi-auto'.

5) Input/output:
- To set input / output pins' purpose and test them. (Check page 17 for wiring).
- 6 input(PIN #3~8) and 6 output(PIN #9~14) can be set as customer wants. **(From Firmware ver. 8.0R8)**

<Input menu>
-Start: Start signal
-K. Up: External Up key(▲)
-K. Dn: External Down key(▼)
-K. Sel: External Select key(▶)
-K. Mod: External Mode key(■)
-MDL0~3: External Model change.
e.g.) MDL3, 2, 1, 0 order.
1000 : Model #8.
0100 : Model #4.
0011 : Model #3.



<Output menu>
-Total Ok
-Total Ng
-Busy
-Ready
-Group OK/NG
(Can set +/-NG)



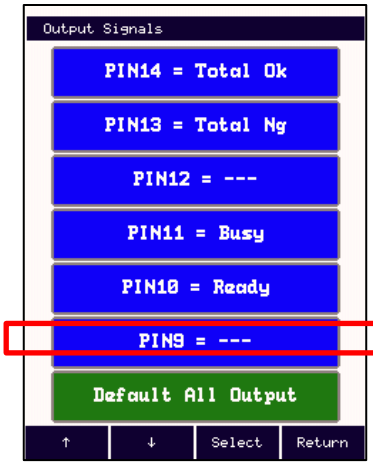
<IO test>

-Input test
ON←→OFF
as signal inputs

-Output test
ON←→OFF
ON: signal on
OFF: signal off

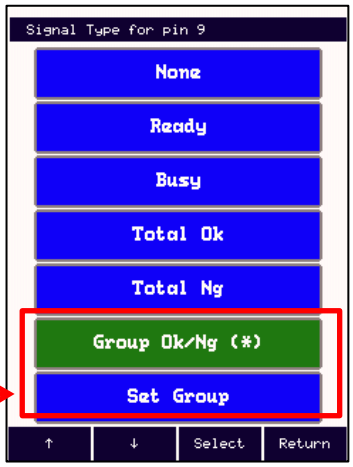
Functions

Output setting e.g.

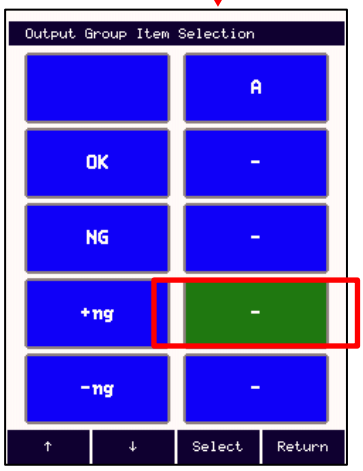


To setup a pin a function

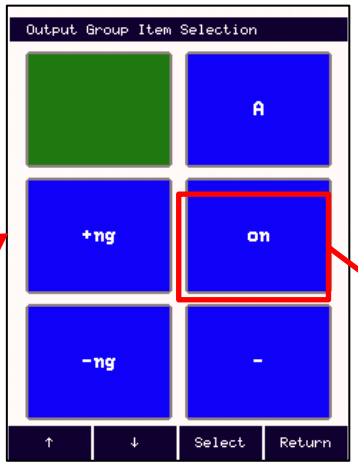
Select one function. → DONE.
*For –NG/+NG, select 'Group OK/NG'



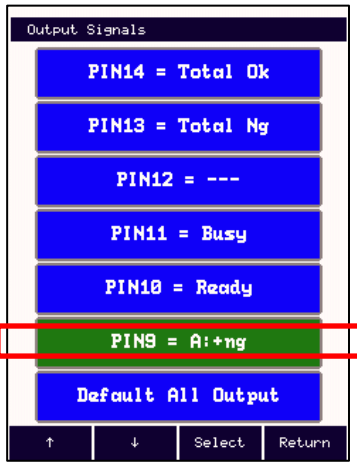
Then press 'Set Group'



Choose one from
'-NG/OK/NG/+NG'



If press '+NG' tap.
→ Press 'Return'

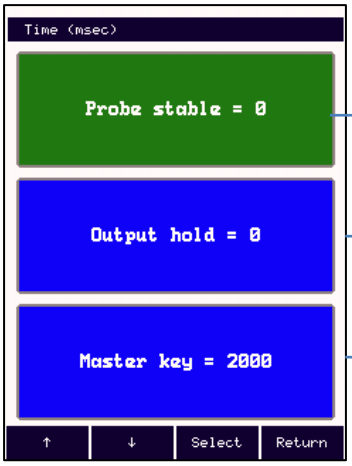


The pin9 is set to +NG(for A group)

6) Serial:
-To set the RS232C data format, Speed (Check page 15, 16).

7) OK/NG sound:
-To set if a beep is used at the decision of the OK or NG.

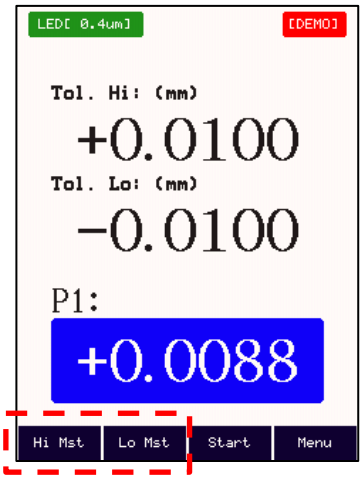
8) Time:
- To set the probe stable time and output signal hold time.



Default : 0 for air sensor.
If user uses automation system with air cylinders, etc.,
probe stable time should be put in among the system stable time.

Default : 0 for air sensor.
Add it if necessary

Mastering key active time(ms) at the measuring screen.
User can do the mastering(Hi/Low calibration) with Up/Down keys
at the measuring screen.
If Up or Down key is pressed, the time would be shown with discounting.
Then the key is pressed by 0, the calibration will be saved.

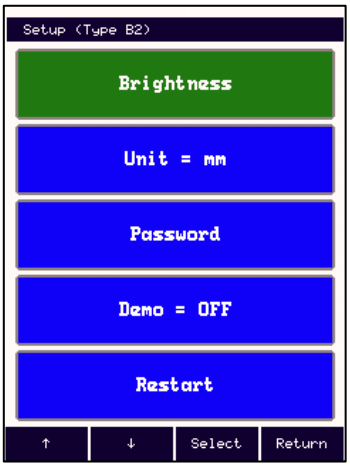


Caution:
If the 'Master key' time is too short as like 100ms,
wrong calibration could be done by a mistake.

Up button: for Hi mastering.
Down button: for Low mastering.

9. Setup

- To set up the brightness, unit, password, etc.



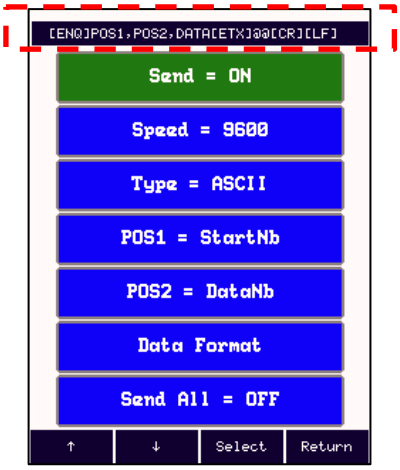
1) Brightness: Brightness of LCD control by %.
2) Unit: unit is changed mm → mil(1/1000 inch) → inch.
3) Password : To set the password to enter main menu.
   At the first, password is null, no set.
4) Demo : To make a random data for a show.
5) Restart : To restart the system(Same as turning off the power and on again).

10. Initializing

- To initialize all of the setting to the factory set.
- Power on with pressing the mode(■) button. Then a warning message about initializing should be shown. The user setting values are initialized if the select(▶) button is pushed.

※ Every values are initialized to the factory setting. So, write down the values before initializing.

Serial communications



Serial format viewer :
Whenever the settings are changed, the serial format is shown on this viewer.

① Items (At the Main menu → Control → Serial)
- **Send** : To set the use of the RS232C serial output or not.
- **Speed** : Communication speed from 9600 bps to 115200 bps.
- **Type** : ASCII or HEX
- **POS1, POS2** : User can choose one.
  a start number(StartNb), result(OK/NG), a number of data(DataNb), or model number(Mdl.Nb).
- **Data Format** :
  1)Point On/Off : To put the decimal point on the data or not.
  2)Preset On/Off : To add the 'Val preset' values for the serial data or not.
  3)Int.Length : To set how many digits are at the front of the decimal point.
  (Only used if 'Point' = ON) ex) In.Length = 4 & Point On/Off = On → +0000.0000
  4)Group OK/NG : To send individual 'Group' OK/NG result on each data.

-**Send All** : To send all groups' data even if user doesn't set some groups. i.e. max data output.

② Cable setting

Elec' micrometer		Direction of signal	Computer	
Signal	Pin No.		Pin No.	Signal
N.C	1		1	DC
RD	2	←	2	RD
TD	3	→	3	TD
N.C	4		4	DTR
SG	5	—	5	SG
N.C	6		6	DSR
N.C	7		7	RTS
N.C	8		8	CTS
N.C	9		9	RI

- Cable of computer serial working terminal - Connect 4Pin and 6Pin / Connect 7Pin and 8Pin

Serial communications

③ Examples of the serial communication

- Hex Format

STX (1 Byte)	STATUS (1 Byte)	MEASURING DATA (n Byte)	ETX (1 Byte)

(n = Transmit Data Q'ty x 2)

- ASCII Format

Byte	1	2	1	2	1	-	1	1	2	1	1
Char	ENQ (0x05)	Start Point	,	End Point	,	Data	,	ETX (0x03)	@@	CR	LF

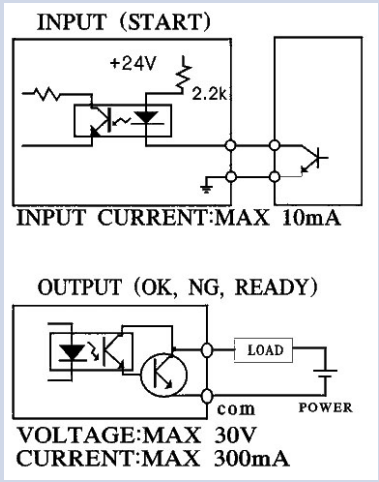
Ex) In case of ASCII Formant, No. of Data is 2. (for 1ch unit the No. of data should be 1)

1	2	1	2	1	5	1	5	1	1	2	1	1
ENQ	01	,	02	,	+0043	,	-0025	,	ETX	@@	CR	LF

I/O port & operating sequence

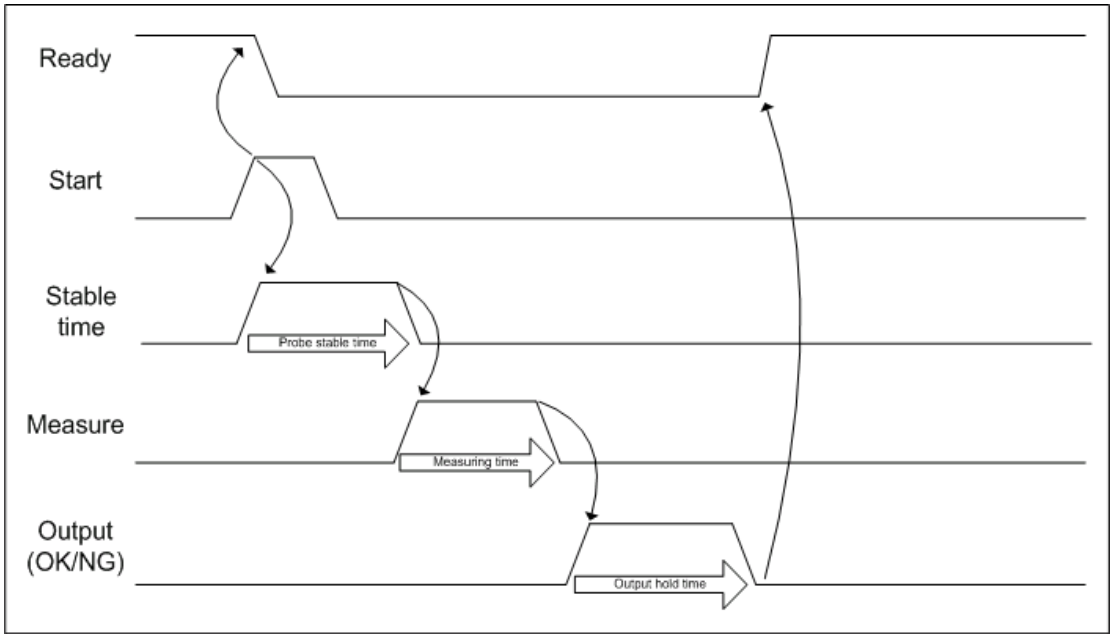
1) I/O pin description

Pin	Name	In/Out		Description	Circuit
1	NCOMMON		0 V	GROUND	
2	None				
3	IN6	in	H/L		
4	IN5	in	H/L		
5	IN4	in	H/L		
6	IN3	in	H/L		
7	IN2	in	H/L		
8	IN1	in	H/L		
9	OUT6	out	H/L		
10	OUT5	out	H/L		
11	OUT4	out	H/L		
12	OUT3	out	H/L		
13	OUT2	out	H/L		
14	OUT1	out	H/L		



* User should set how to use the IN/OUT pins at the 'Control' → 'Input/output'.

2) Timing diagram



Specifications

1. General Specifications

DIVISION	GENERAL
MAIN SUPPLY	DC24V
OPERATING TEMPERATURE	5 ~ 40℃
RELATIVE HUMIDITY	Up To 70%
INPUT AIR PRESSURE	2 BAR
OPERATING CONDITION	NO CORROSIVE GAS AND DUST, CLEAN & DRY AIR
SUPPORTING OUTAGE	None

2. Specifications

DIVISION		SPECIFICATION
AIR SENSOR	CHANNELS	1ch
	RESOLUTION	0.1um
DISPLAY	LCD	2.8" TFT COLOR GRAPHIC LCD
DIMENSION		W153×D107.5×H440(㎜)
WEIGHT		1.7kg
OUTER INTERFACE		RS232C, 9600N81
		I/O port (IN:6, OUT:6)

High Precision Air Type Micrometer

DONG-DO