DONG-DO

Color Display & Touch pad

Max 16 Channels Input

Multi channel electronic micrometer

ML-LP

User's Guide (Ver. 4.7R1)

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.

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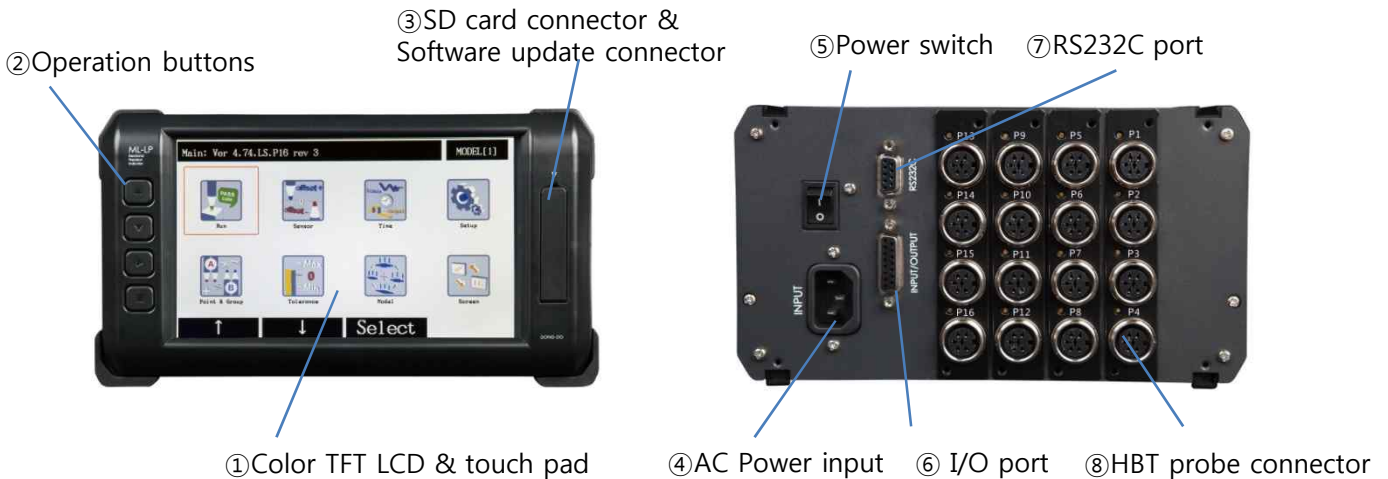
Introduction

Thanks for buying our product.
ML-LP is a high precision multi-channels electronic micrometer with a wide color TFT LCD and touch pad. ML-LP must be your various solutions for your inspection systems.

Specialty of ML-LP
1. Maximum 16 channels HBT probe inputs are supported.
2. Maximum 6 channels of air gauge inputs are supported.
3. Various calculation modes(+, -, x, /, avg, max, min, Max-min, sin, cos, and even user's unique functions).
4. Intuitively confirm production status by various histograms and flow chart.
5. High resolution & reliability.
6. Easy operation with 7″ color TFT LCD and touch pad.
7. RS232C communication.
8. I/O interface.
9. Micro SD card data backup.(*.CSV or *.TXT).
10. PC screen editor is supported.
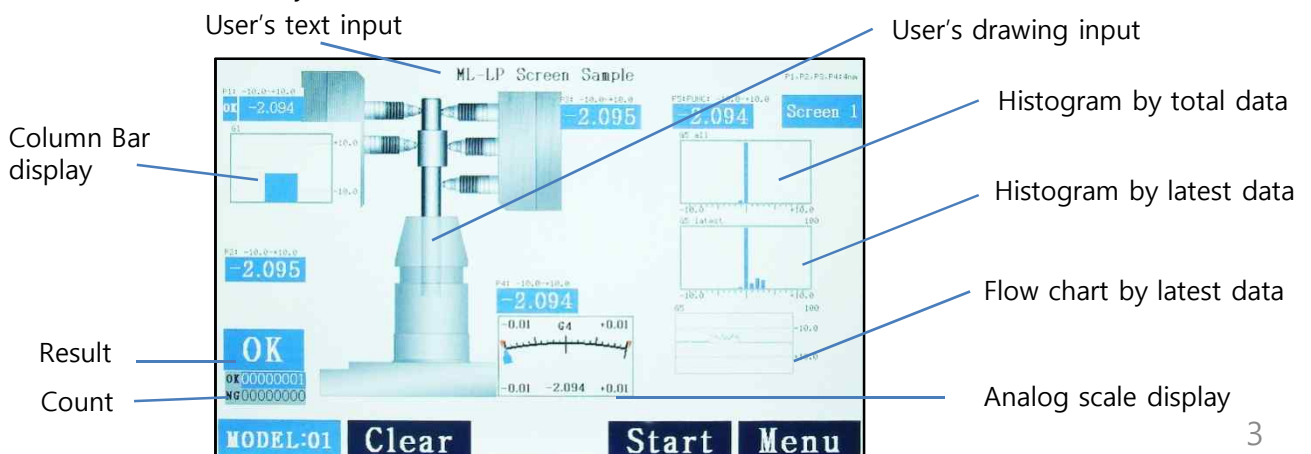
Product features & composition

1. Features

③SD card connector &
Software update connector

②Operation buttons

⑤Power switch   ⑦RS232C port

①Color TFT LCD & touch pad

④AC Power input   ⑥ I/O port   ⑧HBT probe connector

① LCD & Touch pad : To display the measuring data and show variable menu for data setting.
Operating by touch pad is possible.
② Operation buttons : To select menu & change values instead of touch pad.
UP▲ : Move up the cursor or increase values.
DOWN ▼: Move down the cursor or decrease values. / Runout measuring start.
SELECT ▶: Make a choice of the cursor position. / Static measuring start.
MODE ■ : Escape the menu. / Enter the main menu from measuring screen.
③ SD card connector & Software update connector : To save the measuring data by micro SD
card or to upload a software for ML-LP.
④ AC power input socket : AC110~220V, 50Hz/60Hz power input.
⑤ Power switch : power ON/OFF switch.
⑥ I/O port : To communicate with external PLC or controller.
⑦ RS232C port : To do serial communication with PC or PLC.
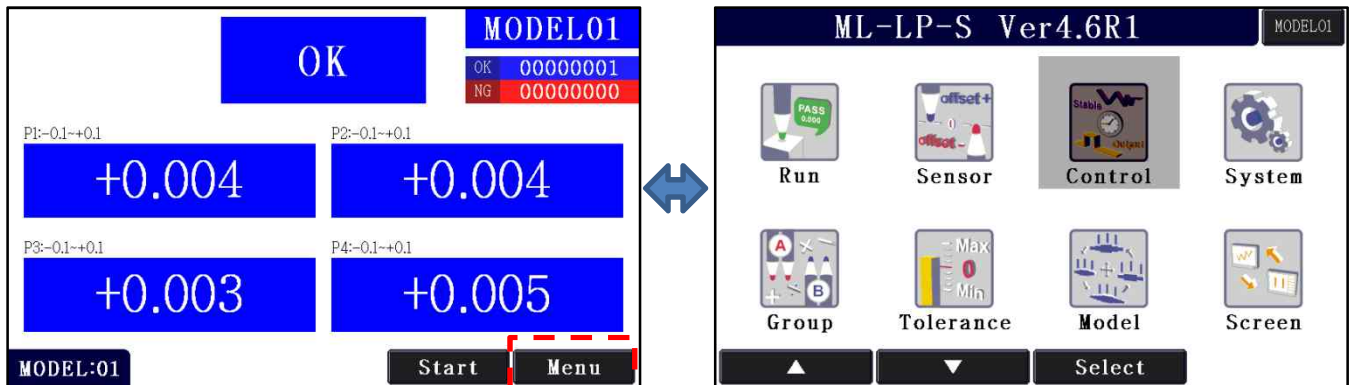⑧ HBT probe connector : Maximum 16 probes can be connected.

2. Measuring screen

ML-LP is supported user friendly various functions and display as like below picture.
The screen is edited by 'ML-LP Screen Editor' on PC.

User's text input

User's drawing input

Column Bar display

Histogram by total data

Histogram by latest data

Flow chart by latest data

Result

Count

Analog scale display

3

Functions

1. Main Menu

If the 'Menu' on the screen or the mode button(■) is pressed, the main menu is appeared. The main menu is reached in the any other menu by pressing the Mode button(■) several times. The menus shown on the screen can be entered by touching the screen or moving the cursor by Up(▲) /Down(▼) buttons and pressing Select(▶) button on it.

1) RUN : To go to the measuring screen
2) Group : To set the items to display on the measuring screen.
       Various functions can be set in this menu.
3) Sensor : To check the raw sensor values. Setting master zero, offset, direction, etc.
4) Tolerance : To set the tolerances for each points and groups. And setting nominal values, too.
5) Control: To change the settings about runout, start method, I/O, RS232, etc.
6) Model : Memory space to save the current settings. And the setting can be recalled.
7) System : To change the settings about system as like sensor type, unit, language, etc.
8) Screen : To change the measuring screen settings by micro SD card.

2. Run
- To go to the measuring screen.

Functions

3. Group

- To set the items to display on the measuring screen. Various functions can be set in this menu.
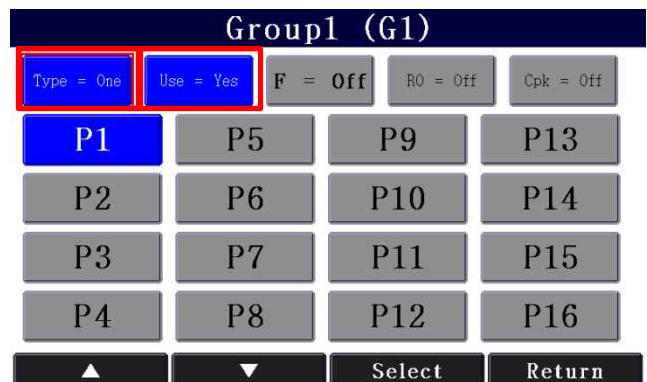- Maximum 20 groups are possible to display on the screen.

***Please use PC screen editor to add the groups, if not, there should be a display errors.
  The calculation of the existed group is possible.**
***If 'text mode' = on, it's possible to add the groups without PC screen editor. Please see page
Please see the 9.Screen at 11th page.**
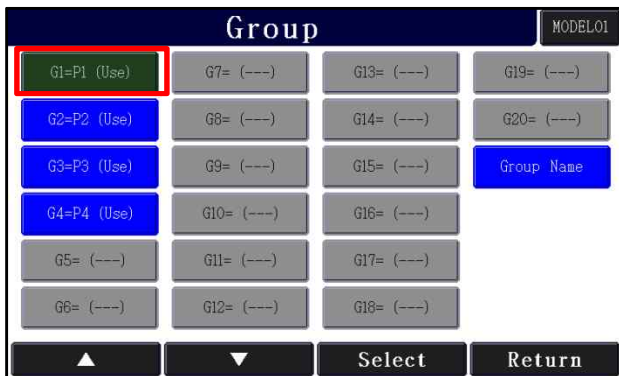
① Choose the group to set
(Touch screen)

② Setting the type of the group, points or groups to use in this group function, and the decision of use this group or not.

- There are the types of the group, None, One, Max, Min, Avg, Sum, M-m, Plus, Minus, and Func. If the type is selected, the display is changed along the type.
①None: No used
②One: 1 point
③Max: Maximum value in the selected points or groups.
④Min: Minimum value in the selected points or groups.
⑤Avg: Average value in the selected points or groups.
⑥Sum: Addition value of the selected points or groups.
⑦M-m: (Maximum value – minimum value) in the selected points or groups.
⑧Plus: Addition between two values.
⑨Minus: Subtraction between two values.
⑩Func: User's functions as like =(G1+G2)x3.14+10. So, user can calculate anything with it.

-If USE = Yes, the group is displayed on the measuring screen(except type is set by 'None').

-If F is not 'Off' as like F = sin(or cost...etc.), the group is calculated as like
 sin(the group value). So, you can use the trigonometric functions with the group.
 Ex) F = sin, Type = Avg(P1, P2, P3) → Result = sin(avg(P1,P2,P3))

-If R0 is not 'Off' as like R0 = rM-m, etc., the group becomes a runout group.
 Runout group measuring setting is on the 'Control'->'Runout' menu. Look at the page 8.

-If Cpk button is pushed, a menu comes out to select 'Cp' or 'Cpk'. To display and serial out the Cp or Cpk, please on this tap.
Ex) Type = one, Use = Yes, Cp = On(or Cpk = On), choose P1(any point or group for it)
     Set the UL & LL at the 'Tolerance' menu.
       → Then Cp or Cpk value for P1 will be on the screen & value goes out to RS232C port.

Functions

4. Sensor

- To check the raw sensor values. Setting master zero, offset, direction, etc. All of the values about the current sensors are shown in this menu.

①Probe type(4mm/10mm/15mm..etc)　②Value status(ABS/REL/Master)

⑩Sensor value

⑨Return button

③Master value view　⑤Zero set　⑦Digital gain　⑧Master Offset

④ABS view　⑥Sensor direction(POS ←→NEG)

①Probe type: Current probe type. Probe type could be set at 'Setup'→'Sensor&Unit'→ 'Select Probe' (4mm→10mm→15mm →25mm →40mm→(AIR))
　**Cautions: if the probe type is not correct, the measuring data should be not correct!!
②Value status: Current value's status. M: master view(Current master's setting values view), A: absolute value view(Raw probe's value), R: relative value from master zero value.
③Master: To see master set values.
④Scan: To see the absolute value of the probe(raw value of it).
⑤Zero: To set the current value to master zero.
⑥Dir: Direction of the sensor, normally POS. Sensor value is increase if probe is pressed
　　　when the 'Dir' is set by POS. Touch the screen to change it, POS ←→ NEG.
⑦Factor: Digital gain. Normally set by 1.000. Final value = raw value * Factor.
⑧Master Offset: The offset value would be added on the real measured data.
　Normally set by 0.000

$$\text{Measured result} - \text{Target(Drawing)} = \text{Input data in offset}$$
$$9.900 \quad - \quad 10.000 \quad = -0.100$$

⑨Return: To return to the main menu with saving the setting.
⑩Sensor value: The sensor's value depends on the value status.

Functions

5. Tolerance

- To set the tolerances for each points and groups. And setting nominal values, too.
- Each items can be selected by touching the item.

①Group name　　　　②Hi/Low tolerance　　　③Preset(Nominal value)

④Offset for group

Tolerance					MODEL01
	Lo	Hi	Preset	Offset	Factor
P1	-0.100	+0.100	0.000	+0.000	1.000
P2	-0.100	+0.100	0.000	+0.000	1.000
P3	-0.100	+0.100	0.000	+0.000	1.000
P4	-0.100	+0.100	0.000	+0.000	1.000
F5:FUNC	-0.100	+0.100	0.000	+0.000	1.000
▲	▼		Select	Return	

⑤Digital gain for group

⑥Return button

①Group name: User can change the name of the 'points and groups' here for the measuring screen.
②Hi/Low tolerance: Hi and Low tolerance to make the OK/NG decision. If the tolerance to change is selected, the number entering menu is come out.
③Preset: A nominal value for measuring screen. The real value is added on this value but not affected on the result.
④Offset: Offset values for groups. Normally set by 0.000.
⑤Factor: Digital gain for groups. Normally set by 1.000.
　　Final value = raw value * Factor(at 'Sensor' menu) * Factor(at 'Tolerance' menu).
⑤Return: To return to the main menu with saving the setting.

6. Control
- To change the settings about runout, start method, I/O, RS232, etc.

```
                        Control
     ┌─────────────────────┐   ┌─────────────────────┐
     │      Runout         │   │    Memory Card      │
     ├─────────────────────┤   ├─────────────────────┤
     │      Display        │   │      Serial         │
     ├─────────────────────┤   ├─────────────────────┤
     │   Zero Key = OFF    │   │    OK/NG Sound      │
     ├─────────────────────┤   ├─────────────────────┤
     │   Sensor Average    │   │       Time          │
     ├─────────────────────┤   ├─────────────────────┤
     │    Start Method     │   │    Part Counter     │
     ├─────────────────────┤   └─────────────────────┘
     │    Input/Output     │
     └─────────────────────┘
     ┌────────┬────────┬──────────┬──────────┐
     │   ▲    │   ▼    │  Select  │  Return  │
     └────────┴────────┴──────────┴──────────┘
```
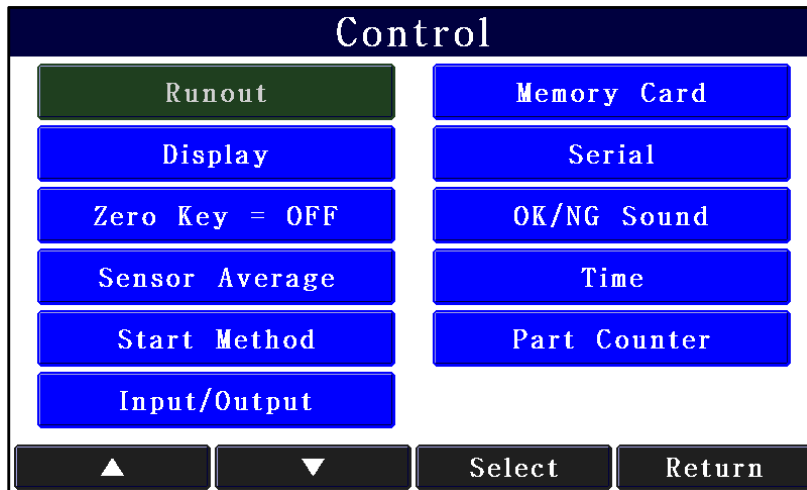
①Runout: Simple runout is supported with ML-LP-S or ML-LP-A models.
　　　　　Under 40Hz to 100Hz data gathering is possible to gather the data for runout mode.
　　　　　For higher speed runout, there're special model(ML-LP-R).

1) Stopping method : There're 3 kinds of method of stopping 1 cycle of runout.
　- Stop by stop: stop the cycle by the stop signal on input port.
　- Stop by start off : stop the cycle when start signal is off.
　- Stop by time out: stop the cycle by time out.
　** Starting the runout cycle is always by the start signal on the input port.
2) Time : The time to gather the data. Only available when 'Stop by timeout' is set.
3) RO with Flatness: If NO is set, only runout set groups are measured.
　　If Yes is set, static set groups are also measured with RO start signal.
4) Flatness data: When RO with Flatness = YES, user should choose if the static measuring is first or last. Ex) If 'First' is set, static groups are measured first and then runout groups are measured.

② Display :
1) LCD: LCD on/off is possible to increase RS232C data output speed.
2) Clear Graph Data: Histogram data is cleared by this menu.
3) Value conversion: Value conversion setting.
　　Method to choose round/raise/cut for last digit.
　　Digit to choose the numbers below decimal point. 0.00 or 0.000.
4) OK/NG counter: on/off the OK or NG counter.

③Zero Key: To allow to set master zero on the measuring screen. If the UP▲ button is pressed for over 2 sec., the master zero is set.

④Sensor 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.
- Measure average: average count for measuring / Zero average: for master zeroing.　8

Functions

⑤Start Method: To choose the start method of measurement.
  1) Auto: measurement is doing continuously.
  2) Manual: measurement is done just when start signal is input.
  3) Semi-Auto: data changes are shown continuously, but measurement is done
    with only start signal.
  4) Wait start off: If On is set, the measurement is waited until the start signal is off.

⑥ Input/Output: To set input / output pins' purpose.

⑦Memory card: To set if the SD memory card is used to save data. The data format is the same as serial output. And the file formats are .txt or .csv.
The data is saved in the date folder in SD card automatically.

⑧Serial: To set the serial format. Please check serial communication section for details.

⑨OK/NG sound: Beep sound setting for OK/NG.

⑩Time: To set the stable time for probe and data output signal holding time on the I/O port.

⑪ Part Counter: Part number counting On/Off. Max count is 9999 and after that it goes to 0000.
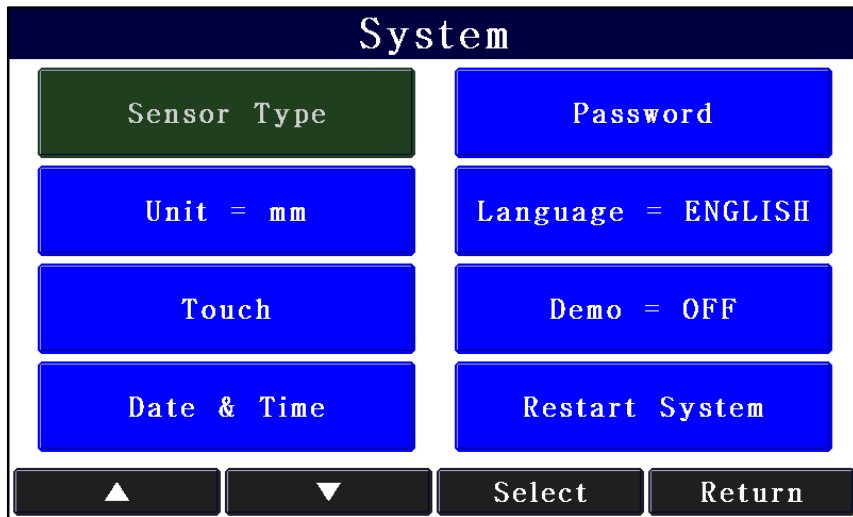
7. Model

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

Functions

8. System

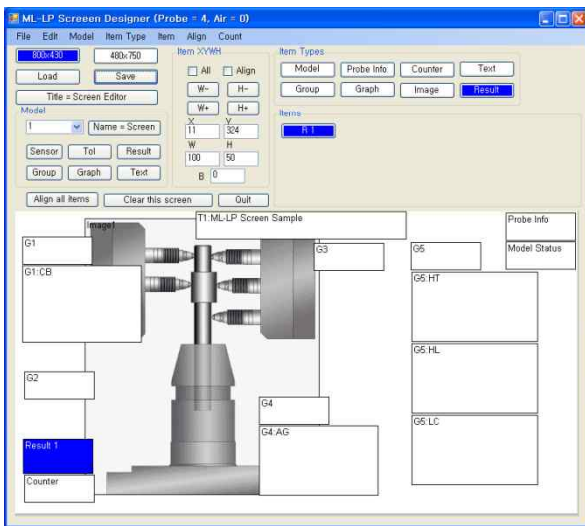To change the settings about system as like sensor type, unit, language, etc.

①Select probe : probe type is changeable as like
4mm→10mm→15mm →25mm →40mm→(AIR).

②Unit: unit is changed mm ←→ mil(1/1000 inch).

③ Touch : To check or calibrate the touch pad. To calibrate it, just follow the 5 cross in order.
You should press it until a beep is on.

④ Date & time : To set current date and time.

⑤ Password : User can set the password to enter the 'Main' menu from measuring screen.
Password ON -> Password Change -> enter Password.

⑥ Lang : Menu language selection. English / Korean / Chinese.

⑦ Demo : To make a random data for a show.

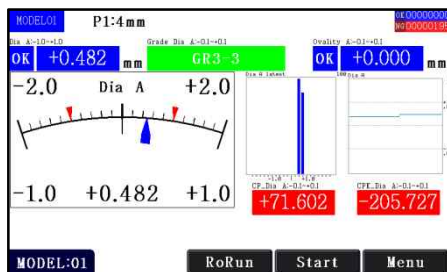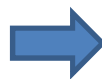⑧ Restart system : To restart the system(Turn off the power and on again).

Functions

9. Screen

- To change the edited settings for measuring screen. It is edited by 'PC Screen Editor for ML-LP' on PC. The software is loaded by micro SD card.
- To use 'PC Screen Editor' for ML-LP, please see the manual, 'PC screen editor for ML-LP'.

① Load from Card: To install the edited files on PC. And it becomes a default setting.
　*Caution: if the probe type and channel number is not correct, ML-LP shouldn't work right.

② Save to Card: To save the settings to SD card. It can be loaded on PC.

③ Load Default : To load the configuration settings from default memory on ML-LP.

④ Save Default : To save the configuration settings to default memory on ML-LP.

⑤ Screen Direction : The screen direction is turning by 90°.

⑥ Text Mode : To display only text on the measuring screen. No pictures, no graphs.
　　On the text mode, user doesn't have to use PC editor to add groups.

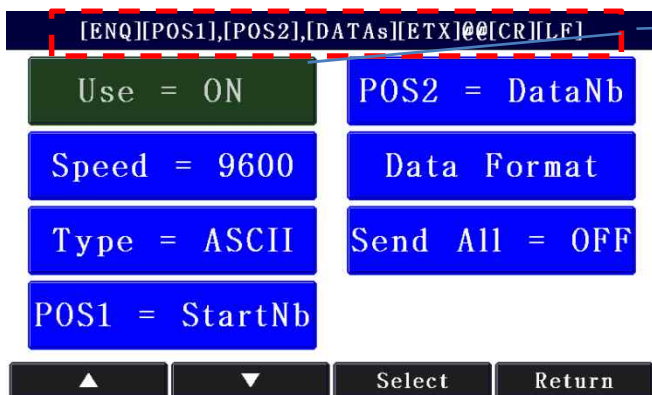<Text Mode : Off>　　　　　　　<Text Mode : On>

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Serial communications

`[ENQ][POS1],[POS2],[DATAs][ETX]@@[CR][LF]`

Use = ON	POS2 = DataNb
Speed = 9600	Data Format
Type = ASCII	Send All = OFF
POS1 = StartNb	

▲	▼	Select	Return

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

① Items (At the Main menu → Setup → Input/Output → Serial)
- Use : 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),
        model number(Mdl.Nb), or model name(Mdl.name).
- Data Format :
    1)Point On/Off : To put the decimal point on the data or not.
    2)Preset On/Off : To add the '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 → +0000.000
    4)OK/NG : To send individual 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	5*n+(n-1)	1	1	2	1	1
Char	ENQ (0x05)	Start Point	,	End Point	,	Data	,	ETX (0x03)	@@	CR	LF

Ex) In case of No. of Data is 2.

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

- ASCII Format with Part counter.(A special request is required at the Purchased Order.)

Byte	1	2	1	2	1	2	1	5*n+(n-1)	1	1	2	1	1
Char	ENQ (0x05)	Part No.	,	Start Point	,	End Point	,	Data	,	ETX (0x03)	@@	CR	LF

I/O port & operating sequence

1) I/O pin description

Pin	Name	In/Out		Description	Circuit
1	NCOMMON		0 V	GROUND	
2	PCOMMON		+24V		INPUT (START)
3	IN6	in	H/L		+24V
4	IN5	in	H/L		
5	IN4	in	H/L		
6	IN3	in	H/L		INPUT CURRENT:MAX 10mA
7	IN2	in	H/L		OUTPUT (OK, NG, READY)
8	IN1	in	H/L		LOAD
9	OUT6	out	H/L		
10	OUT5	out	H/L		com POWER
11	OUT4	out	H/L		VOLTAGE:MAX 30V
12	OUT3	out	H/L		CURRENT:MAX 300mA
13	OUT2	out	H/L		
14	OUT1	out	H/L		

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

2) Timing diagram
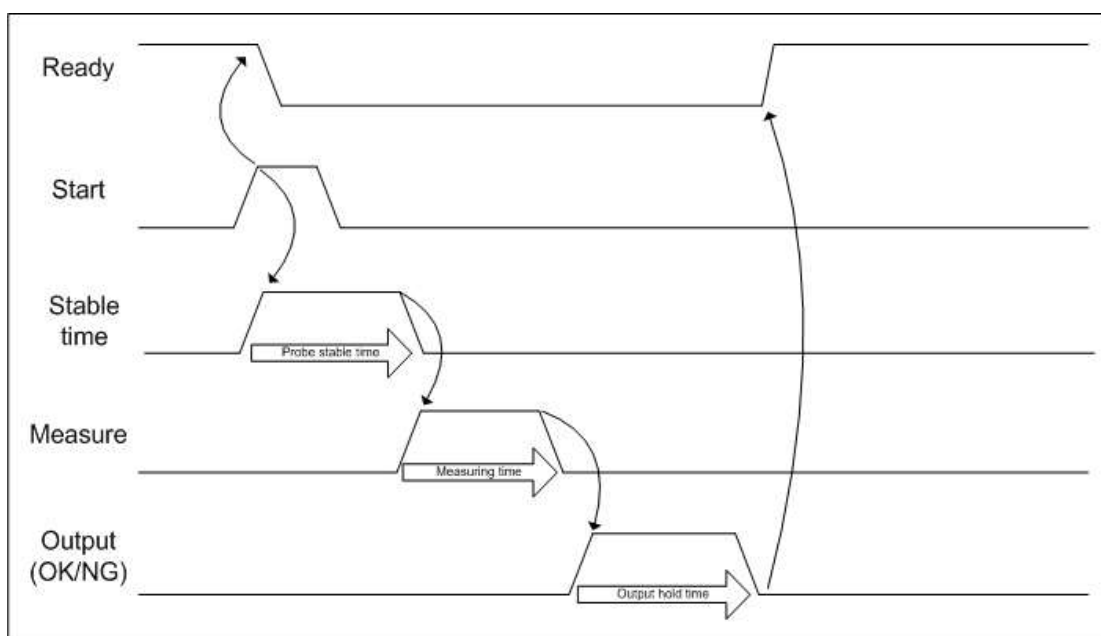
Specifications

1. Operation condition

| DIVISION	GENERAL
MAIN SUPPLY	AC100-220V, 50/60Hz
OPERATING TEMPERATURE	5 ~ 40℃
RELATIVE HUMIDITY	Up To 70%
SUPPORTING OUTAGE	DATA BACK UP BY INNER FLASH MEMORY

2. Specifications

DIVISION		SPECIFICATION
HBT/LVDT Sensor	CHANNELS	1ch ~16ch (HBT Probes) / 1ch~6ch(Air sensors)
	RESOLUTION	- 1um(0.1um option) for HBT probe - 0.1um for air sensor
DISPLAY	Color TFT LCD	7″ TFT COLOR LCD
DIMENSION		W220×D184×H120 (㎜)
WEIGHT		Approx. 2.2kg
OUTER INTERFACE		RS232C, 9600 ~ 115200bps
		I/O port (IN:6, OUT:6)

SPC functions

1. Histogram
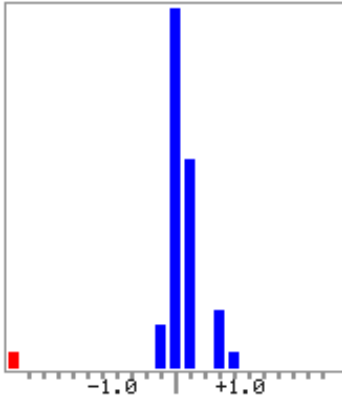
Histogram shows the representation of the distribution of numerical data.
It is very intuitive and powerful to know the production flow.

ML-LP histogram spec:
1. 23 bars are shown.
2. Blue color bars are between Hi/Low tolerance,
   Red color bars are outside of the tolerance.
3. If too high or low measurement is occurred, the first or last bar
   is increased.
4. Two type histograms are on ML-LP
1) Total histogram: update the histogram from first to last
   until power is off.
2) Latest histogram: draw the histogram with latest 100 data.

2. Control chart(Flow chart)

Control chart shows the process is currently under control.

ML-LP control chart spec:
1. Mark a spot with current measurement.
2. Blue spots are between UCL and LCL,
   Red spots are outside of the control limits.
3. Draw the control chart with latest 100 data.

3. CP/CPK (Process capability Index)

To report process capability and process performance with Cp, Cpk.
Cp= Process Capability. A simple and straightforward indicator of process capability.
Cpk= Process Capability Index. Adjustment of Cp for the effect of non-centered distribution.

$Cp = (USL - LSL) / (6 \times \sigma)$
$Cpk = (1-K) * Cp$

ML-LP cp/cpk spec:
-Maximum number of data is 100, after that it is updated with latest 100 data.

*Make groups for Cp or Cpk to display or send it out to RS232C port.
Please see page 5 for it.

High Precision Electronic Micrometer

DONG-DO