1~4 CHANNEL
User's manual

(STANDARD)

! Safety cautions !

1) The apparatus should not be exposed to water(dripping or splashing) and no objects filled with liquids, such as vases, should be placed on the apparatus.
2) The mains plug is used as the disconnect device. The disconnect device shall remain readily operable.
3) This equipment shall be connected to mains socket outlet with a protective earthing connection.

1. Beginning

Thanks so much for purchasing one of our products.

1.1 Description

There are some merits when you use the type of touching displacement sensor(LVDT/HBT) for a high accuracy
- The sensor is hypersensitive itself and precise.
- It has high resistance to the influence of environment(temperature changes, humidity, etc...)
- Heavy duty, small size and light weight

For that reason this sensor can be used for several measuring field.
To operate the type of touching displacement sensor(LVDT/HBT) needs Amplifier or Indicator. we developed this product("Electrical micrometer") user centered who has Amplifier or Indicator. A feature of this product is we sell and develop it based on user's purpose. One thing we have model could measure manufacture's thickness, difference of height, flatness, perpendicularity rate, etc...

These are our advantages for the new product.
- It has many functions that can be provide you easy directions for your needs.
- It will print formatted data and results for the quality control directly using the built in serial port(RS232C/PLC Interface)

1.2 Structure and Fundamental

1) Structure of the type of touching displacement sensor(LVDT/HBT PROBE)
Displacement sensor include differential transformer that can convert with the change of Core & Coil's position into electrical signals. The Bobbin twisted with coil is insulated material, so that might be used by lower temperature modulus and core might be used by
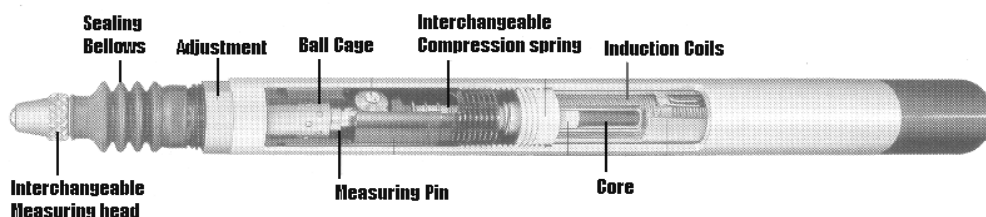

[Figure.1] Structure of sensor.(LVDT/HBT)

high saturation magnetic flux density or resistivity.

2) Fundamental of measurement

 [Figure.2]is differential transformer electric circuit. Magnetize primary coil into an A.C on the differential transformer. According to core's displacement it will show D.C signal after check the secondary sign of proportional change.

 When the Core is on the center of Coil[Figure.2] out voltage is 0(Zero) and it will change directly according to the Core's displacement.

 After Being taken out voltage passes through the Amplifier and Filter circuit, the user will get the final rectified voltage which is based on Core's position.
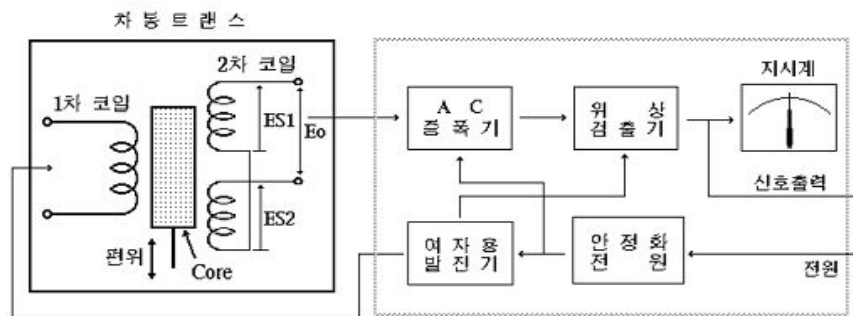
[Figure.2] Signal processor circuit

1.3 System specifications

1) General

DIVISION	GENERAL
MAIN SUPPLY	AC100-220V~ 50/60Hz
MAX.POWER CONSUMTION	30W
INNER FUSE	Fuse T2AL 250V
OPERATING TEMPERATURE	5 ~ 40℃
RELATIVE HUMIDITY	Up To 70%
OPERATING CONDITION	NO CORROSIVE GAS AND DUST
SUPPORTING OUTAGE	DATA BACK UP BY INNER FLASH MEMORY

2) Specifications

Division		General
LVDT/HBT (AMP.)	INNER POWER	±12V, +5V, +24V
	PROBE INPUT	MAX 4CH.
	MEASUREMET RANGE	ON MODELS
DISPLAY	LCD	Graphic B/W LCD
	BACKLIGHT	Led backlight
	SIZE	128 pixel × 64 pixel
DIMENSION		W 215 × H 105 × D 268(mm)
WEIGHT		3.3kg
OUTER INTERFACE		RS232C, 9600N81
		PLC I/F(IN:6, OUT:6)

3) Dimension drawing

ML－4P2

215

105

16

268
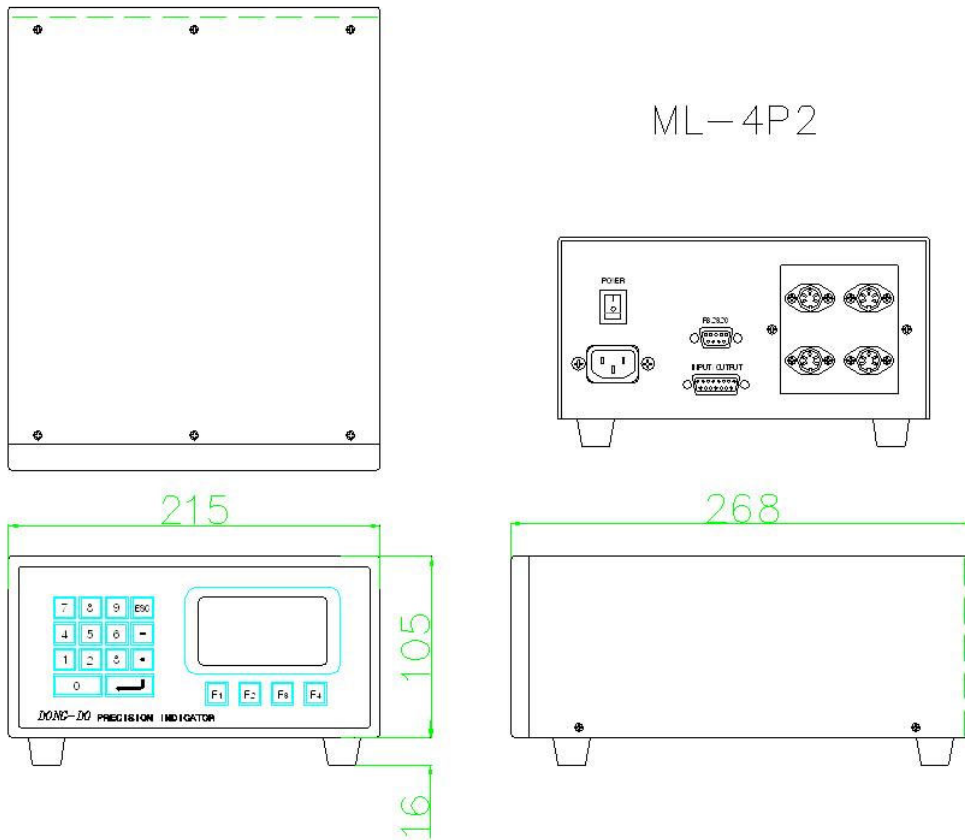
1.4 Physical Description and functions
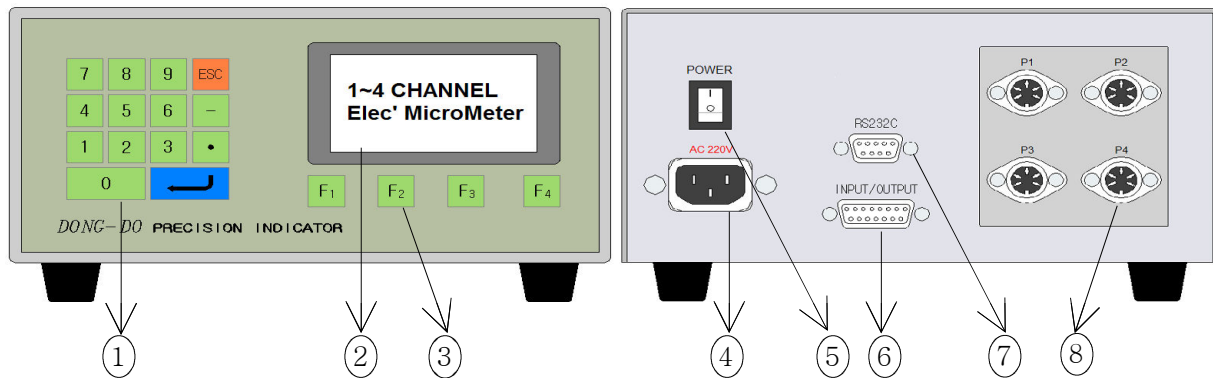
1) General features

(1) Function and Numeric keys : calibrate master value and set the limit.

(2) Liquid Crystal Dispaly(LCD) : displays power readings, menus, and information
necessary for operation of the micrometer.

(3) Function Keys : Choose the menu.

(4) Power Plug : connects power cord(include Noise Filter supply for AC220V)

(5) On/Off key : turns the micrometer ON or OFF

(6) Outer interface : connects outer PLC or controller

(7) RS232C connector : serial port for communicating computer or PLC

(8) Displacement sensor(LVDT/HBT PROBE) connector : connect with displacement sensor
(Maximum amount:4)

1.5 Directions for use

- Master setting require Probe's value up to ± 100um.
- Before use meter please set the master value for avoiding error.
- Before use meter please inspect the sensor for its useful life.
- If you keep the old meter model without use, inner battery might be discharge also the
initial value can be change. It is not a faulty product. Please follow instructions and
reset the meter.

1.6 Directions for installation

 When you install the product must be careful of your micrometer and sensor. It is very sensitive and accuracy. Follow the instructions below to install easily not only our product but also inspection and measurement equipment.

1) The cable of signal of the displacement sensor is treated by shield but it might be influenced by organic voltage, therefore please keep the distance(more than 30mm) all the PLC input/output, motor related, power cabels.

2)Please connect spark killer or varistor(ZNR/TNR) with the induction load power(or signal cable and RELAY, MAGNETIC CONTACTOR, MOTOR, PARTS FEEDER, etc)
  when the induction load power on have no problem but off make strong counter electromotive force(20times of power voltage) and it will have affect on results.
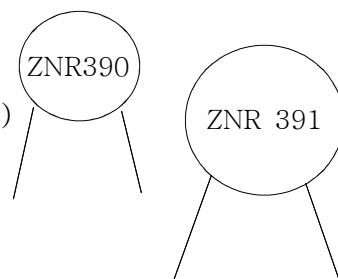 Please reduce counter electromotive force for the reliable results.
       e.g. 1) USING 24V RELAY : USE ZNR 390($39 \times 10^{\circ}$)
              (or, CUTTING OVER 39V SURGE VOLTAGE)
       e.g. 2) USING 220V MAGNETIC CONTACTOR : USE ZNR 391(39×10^{1})
              (or, CUTTING OVER 390V SURGE VOLTAGE)

ZNR390

ZNR 391

3) In case of using the motor for equipment's operation. This electric force might affect the results. In this case please make mounting bracket to be insulated materials(MC NYLON, BAKELITE)
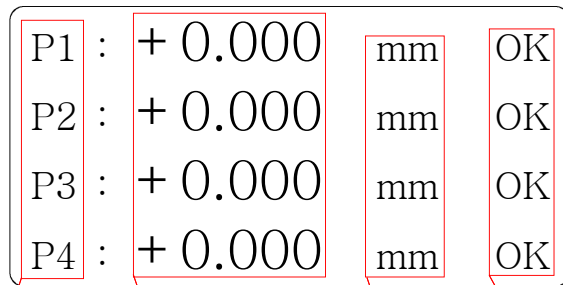
2. OPERATION

1. Introduction

Elec" MicroMeter can process several(MAX:4CH) displacement sensor's value in real-time and analyze data with printing text or graph.

2. DISPLAY

After press ON button a screen will appear like the one below, which is showed text or graph.

```
P1 : + 0.000    mm    OK
P2 : + 0.000    mm    OK
P3 : + 0.000    mm    OK
P4 : + 0.000    mm    OK
```

①   ②   [Figure. 1] ③   ④

" ① " Display Channels.

" ② " Display the results of measurements.

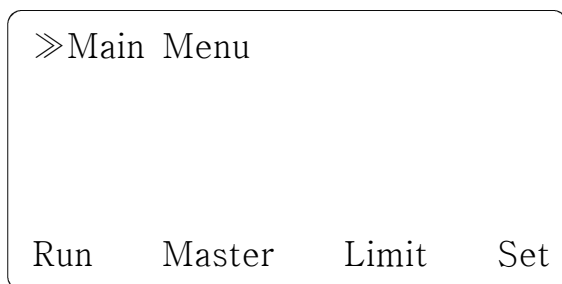" ③ " Display current unit.

" ④ " Display the results of decisions pass or not.

2-1. Main Menu

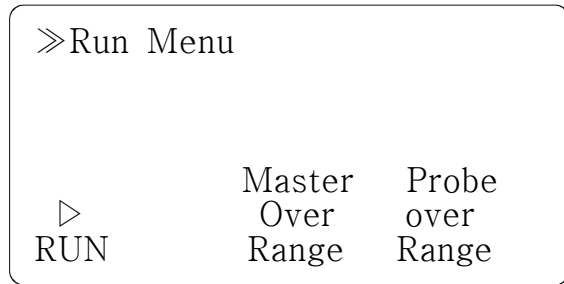1. When the press ESC key. It will show the initial screen.

   Any screens can be showed it by pressing ESC key several times.

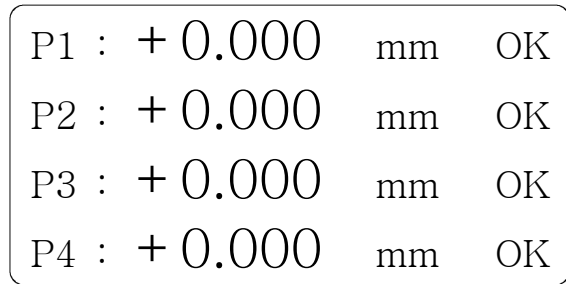2. Press F1(RUN)to load submenu and once again to return back.

```
≫Main Menu



Run     Master     Limit     Set
```

[Figure. 2]

2-2. Run (Over Range)

```
≫Run Menu



         Master    Probe
  ▷      Over      over
RUN      Range     Range
```
[Figure. 3]

```
P1 : +0.000   mm   OK
P2 : +0.000   mm   OK
P3 : +0.000   mm   OK
P4 : +0.000   mm   OK
```
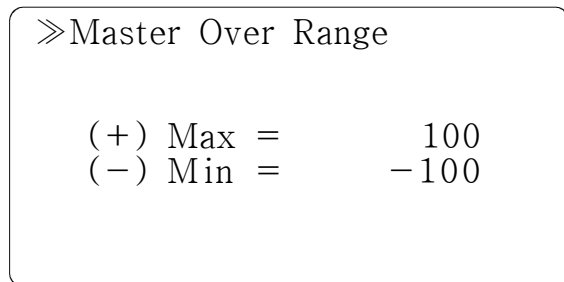[Figure. 3-1]

F1

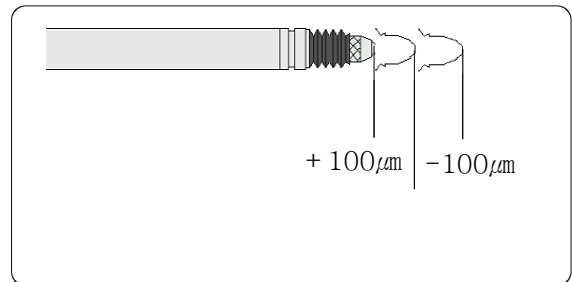- Press "F1" to skip from [Figure. 2] to [Figure. 3]

1. Meaning of each steps

-RUN : Press "F1" to skip from [Figure. 3] to [Figure. 3-1]

-Master Over Range : The user will set the over range to be based on absolute value(LVDT sensor) within range of master setting value.

```
≫Master Over Range


  (+) Max =        100
  (-) Min =       -100


```
[Figure. 3-2]

$+100\mu m$ $-100\mu m$

[Figure. 3-3]

-Error message shown down below[Figure. 3-4] will appear if you set the over range ±100μm [Figure. 3-2] and it will not be allow the value of you set.

```
≫Master
  !  MASTER  !
  ! Over Range !

            SCAN    ZERO
```
[Figure. 3-4]
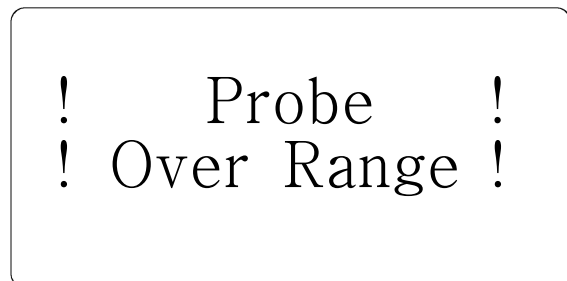
```
  !    Probe    !
  ! Over Range !


```
[Figure. 3-5]

-Probe Over Range : Same as Master Over Range, when the value of LVDT sensor goes beyond setting range the Error message will be showed[Figure. 3-5]

2-3. Master (Set zero, reference, offset)

```
≫Master Menu                          ≫Master

                          F1          a)  + 0.008
                          →

   SET        BASE  OFFS                      SCAN    ZERO
```
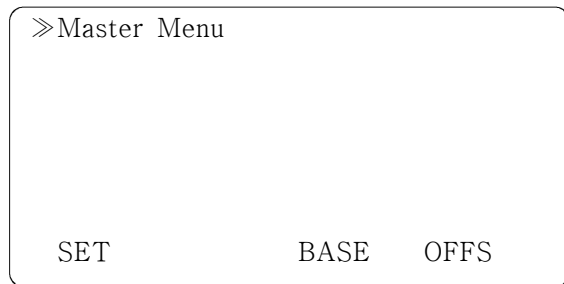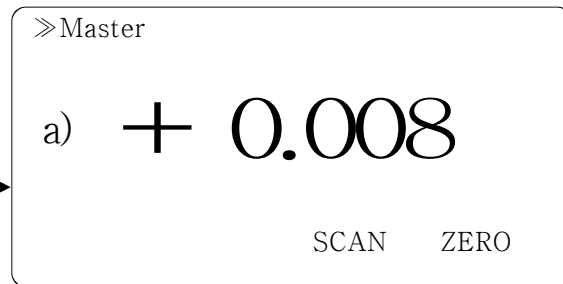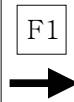
[Figure. 4]   [Figure. 4-1]

- Press "F2" to skip from [Figure. 2] to [Figure. 4] Master menu.

- The mode shown overhead is showed setting zero/reference/offset.

1. MASTER(Zeroing)

- Press "F1"(SET) to skip from [Figure. 4] to [Figure. 4-1] Master menu.

- Method

  Move to the position of measurement after taking MASTER and the meter.

  Press " F3 " (SCAN) : Displays sensor's real-time value.

  Press " F4 " (ZERO) : Set the zero current position.

 ※After zeroing if you load the zeroing mode again the screen will appear previous probe's absolute value.

1-1. Initial installation of PROBE

Please set the initial position correctly for standing long use and avoiding damage.

 Ex) Installation of DP-S4
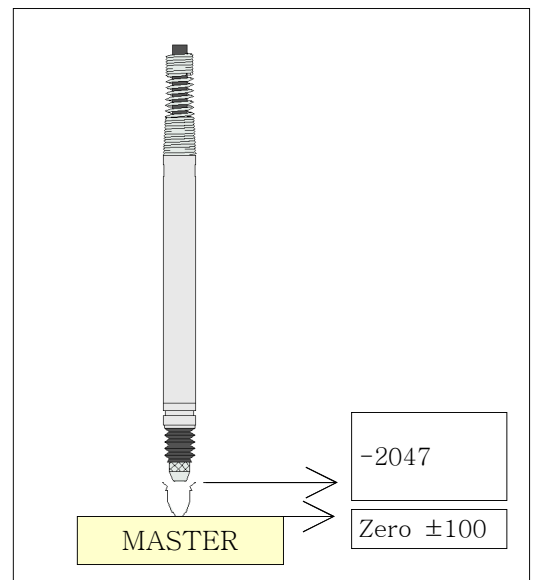
 1) Press "F3(SCAN) in Master Menu

(You will see the message "-2047" and while moving sensor tip you can check changes.

 2) Put the standard(MASTER) and move to sensor Zero position.

 3) Adjust measurement value shown LCD within ± 100㎛ after the sensor install to BUSH.

 4) Press "F4"(ZERO) and "ESC" to return and store at once.


```
  -2047
MASTER    Zero ±100
```
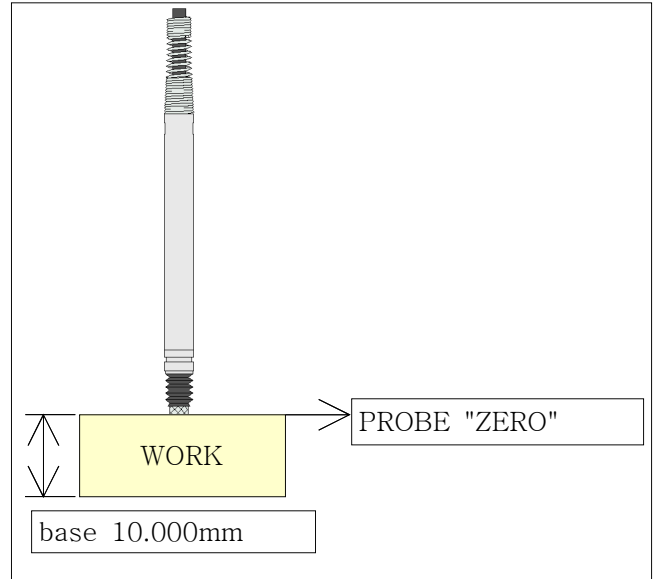
[Figure. 5-1]

2. BASE(set a reference)

Input product's real value. The screen will appear that measured sensor value adds each input data.

Such as [Figure. 4-3] set the base in that "ZERO" position. Meter will recognize the position "0" and if measures over again it would print out "0.000"

The screen will show the value that the thickness of product is set by setting base value.

[Figure. 4-3]

예) Display = Base value+
Measurement value
10.500 = 10.000 + 0.500

Notice) Base value does not have influence on
result of measurement(OK/NG)

3. OFFSET

- After making Master product if there is the difference between target and measured result, in the case of this it will compensate the difference.

- Method

Ex)

Measured result - Target(Drawing) = Input data
9.900   -   10.000   =   -0.100

2-4. Limit

- Press "F3" in the [Figure. 2] screen and the LIMIT menu screen will appear that looks like on the right.
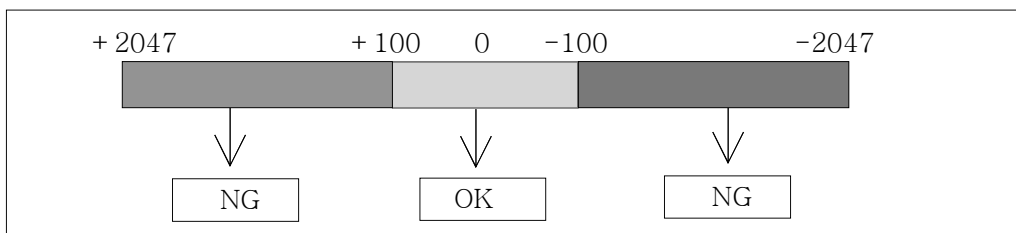- [Figure.5] : "set limit/rounding/low/cut"
"Direnctions"

≫Limit Menu

LIMIT   SHOW   DIR
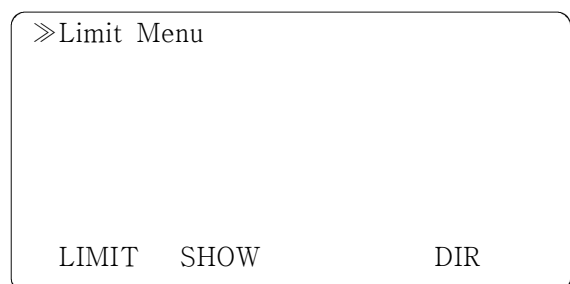
[Figure. 5]

1. LIMIT (Tolerance)

- Press "F1" in the [Figure. 5] screen and the LIMIT menu screen will appear.
- Set Limit : Max. and Min. base value on Master's Zero position.

  and it will be able to print "OK"(within Max. & Min.) and "NG"(Out of range)

- If you set the Limit range ±100㎛ that looks like one[Figure. 5-1] below it will print "OK"(within Max. and Min.) and "NG"(Out of range).

```
   +2047          +100   0   -100           -2047

         [          ][          ][          ]

             ↓            ↓            ↓
          [  NG  ]     [  OK  ]     [  NG  ]
```
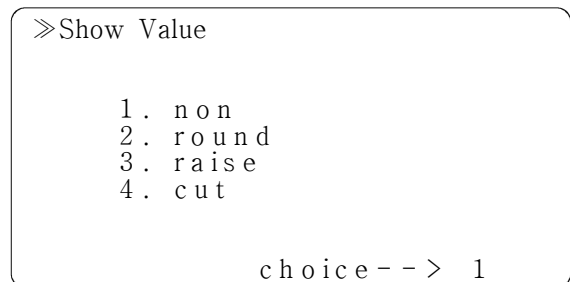
[Figure. 5-1]

2. SHOW (Round/Raise/Cut)

- Press "F2" in the [Figure. 5] the LIMIT
  screen will appear that looks like on the right.
- The menu beside will set measured data
  "round/raise/cut".

```
≫Show Value

    1. n o n
    2. r o u n d
    3. r a i s e
    4. c u t


            c h o i c e - - >  1
```

[Figure. 5-2]

1)Meaning

non : leave the result.

round : Rounding off the last unit's result.

raise : Raise the last unit's result.

cut : Cut the last unit's result.

3. DIR (Direction)

- This menu [Figure. 5-2] can change
  sensor's direction to software.
  while measuring generally it will set to
  "-" without setting of sensor's
  measurement value. if setting starts
  it will change to "+". In other way please set to "NEG"

```
≫Direction


   (a)DIRECTION = POS


            POS     NEG
```
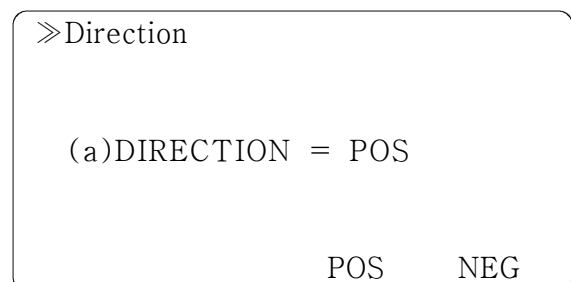
[Figure. 5-2]

Ex) Set the "POS" to make "+" like on the right[Figure. 5-3] and the "NEG" to make "-"

like on the left[Figure. 5-3].
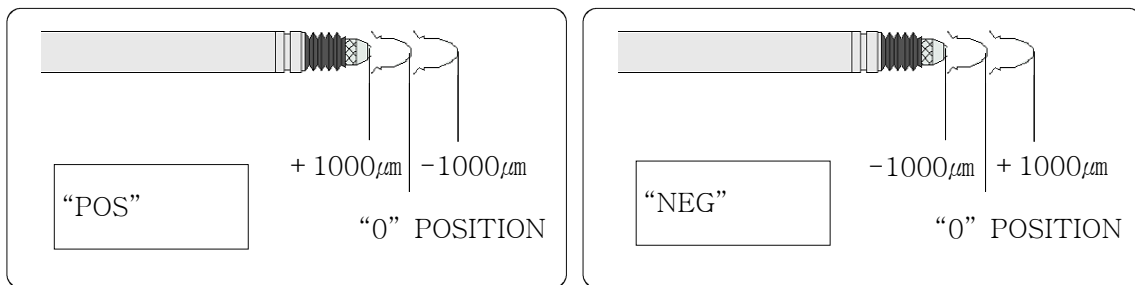
[Figure. 5-3]

2-5. SET (Sound, Time, Appendix)

- Press "F4" in the [Figure.2] the LIMIT

  menu like [Figure. 5] will appear.
- The menu on the right is setting

  sound/time/appendix/model.
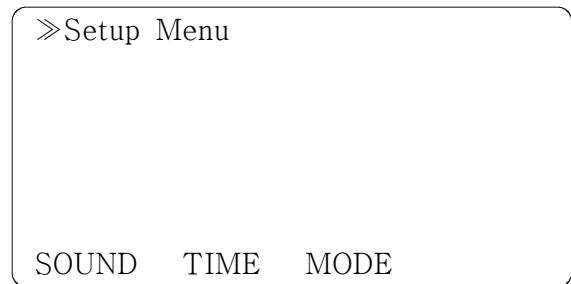
[Figure. 6]

1. SOUND

- Press "F1" in the [Figure. 6]

- It sets sound of OK/NG

  1) OK SOUND : when the result of product is ok.

  2) NG SOUND : when the result of product is not ok(defective).

2. TIME

- Press "F2" in the [Figure. 6]

- It sets Meter's running time.

[Figure. 6-1]

1)Meaning

-Probe stable time : After receiving sign of
  start measurement it delays for a moment
  as you set and it will start to measure.

-Output hold time : After measured by sign of start measurement. it will set the output
  range of OK/NG.

Set "0" : Continue to print until set the next sign of start.

3. MODE (Appendices)

-Press "F3" in the [Figure. 6]

The screen will appear that looks
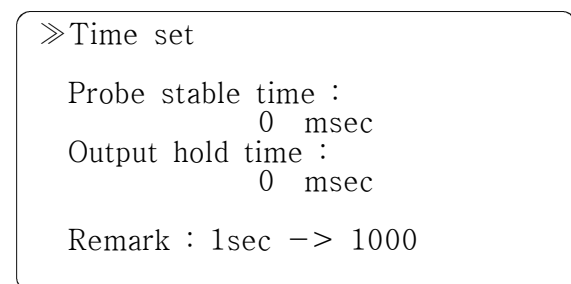
like on the light.

-It sets method of measurement/

bar graph/set output.

```
≫Mode Menu




Meas                HISTO   I/O
```

[Figure. 6-2]

```
≫Measure method
1. a
2. a-b    3. a+b
4. a (IN2:GAP)
5. a,b    6. a,b (IN2)
7. a, b, a-b
8. a, b, a+b
              choice  -->    1
```

[Figure. 6-3]

```
≫Measure method
1. a, b, c    2. a, b, c, d
3. a+b , c+d
4. a, b, c, Avg
5. a, b, c, M-m
6. a, a-b, a-c, a-d, M-m
7. a, a-b, a-c,
              choice  -->    1
```
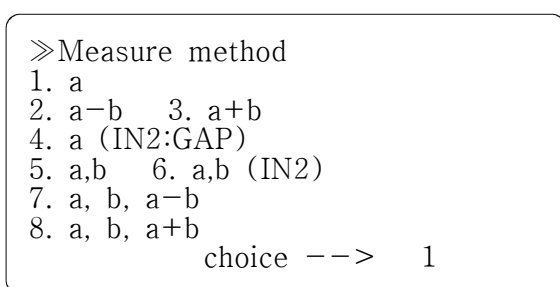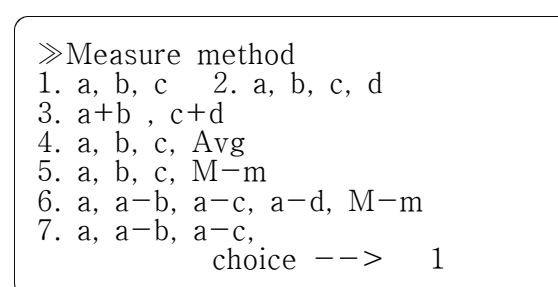
[Figure. 6-4]

(1)Meanings of each items.

a , b , c , d	Number of sensor.
+	Addition
-	Subtraction
Avg	Average
M-m	The difference between the Max. and Min.
(IN2 : GAP)	Measure the difference

Ex) (a, a-b, a-c, a-d, M-m) : Calculate the difference between the Max.
and Min. that subtract a through d.

2). HISTO(Histogram)

-Press "F3" in the [Figure. 6-2]
  A will appear that looks like
  on the right.
-It displays histogram.
1) Meaning
  DISPLAY : Turns the display ON of OFF.
  AUTO RESET : Sets how many cumulative histogram display.
※ This is only for 2 channel.

```
≫Histogram
   DISPLAY       =  OFF
   AUTO RESET   =  50EA

                    ON     OFF
```

[Figure. 6-5]

3). I/O (Input/Output)

-Press "F4" in the [Figure. 6-2]
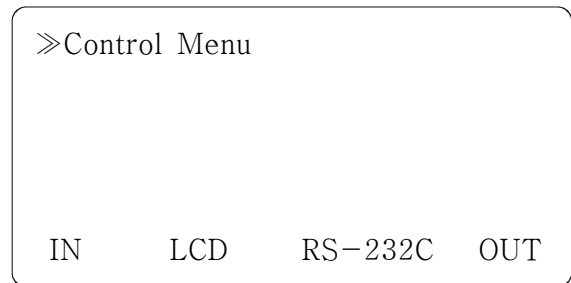 A screen will appear that looks
  like on the right.
-Sets "measure method/display off/
   communication/output".

```
≫Control Menu




   IN      LCD     RS-232C   OUT
```

[Figure. 6-6]

(1). IN(Measure method)

-Press "F1" in the [Figure. 6-6]
  A screen will appear that looks
  like on the right.
-Sets measure method
   from outer signal or without signal.

```
≫Start Mode
    1. SCAN
    2. HOLD

                 choice --> 2
```
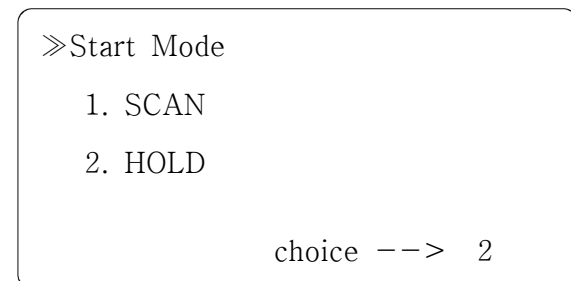
[Figure. 6-7]

①Meaning
  - SCAN : Measure in real-time without outer signal.
    If you set "SCAN" I/O and RS232C will keep printing.
    Because of its real-time measurement
  - HOLD : Measure from outer signal.
    If you set "HOLD" it will only measure from getting outer signal. After measuring I/O(during
input) and RS232C will print one time.

(2). LCD (Display ON/OFF)

-Press "F3" in the [Figure. 6-6]

　A screen will appear that looks

　like on the right.

-Turns data display ON or OFF.

　② Meaning

　- "DISPLAY = ON" :
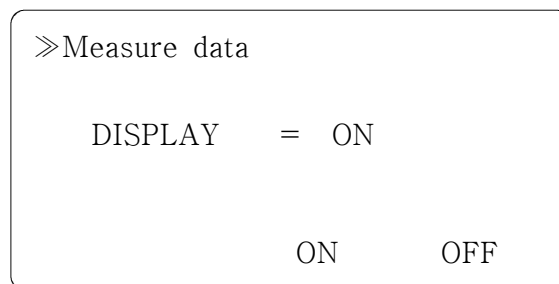
　　Display measure data.(in general use)

　- "DISPLAY = OFF" :

　　Hide measure data. (not in general use)

　It could be used for quick RS232C communication.(on "SCAN" [Figure. 6-7])

```
≫Measure data

    DISPLAY    =   ON


                 ON       OFF
```

[Figure. 6-8]

(3). RS232C (Communication)

-Press "F3" in the [Figure. 6-6]

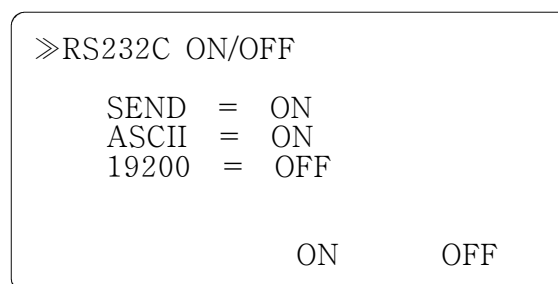　A screen will appear that looks

　on the right.

-Print out measurement results through

　the RS232C PORT.

　① Meaning

　- SEND : Turns communication ON or OFF

　- ASCII : Sets Control units.(Off : HEX format.)

　- 19200 : Sets communication speed. Use(19200bps)/No use(9600bps)

　②Transmit setting

```
≫RS232C ON/OFF

    SEND  =  ON
    ASCII =  ON
    19200 =  OFF


                 ON       OFF
```

[Figure. 6-9]

Division	Setting
• Interface • Port	- RS232C - RS232C PORT ⇨ 1 Channel - Asynchronous
• Character 　 organization • Control units • Communication 　 spped • Connection	- DATA BIT ⇨ 8 Bit - PARITY BIT ⇨ None - STOP BIT ⇨ 1 Bit - ASCII Code - 9600 Baud (Fixed) - One

③ 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 4P, 6P

Connect 7P, 8P

④ Output types for communication

- HEX Format

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

(n = Transmit Data Q'ty x 2)

- ASCII Format

EX)In case of measuring 4 probe data.

Data value = +120 , −50 , −100 , −1000

1	2	1	2	1	5	1	5	1	5	1	5	1	1	1	1	1
ENQ	01	,	04	,	+0120	,	−0050	,	−0100	,	−1000	ETX	@	@	CR	LF

※ Start position through end position mean measuring 1~4 channel.

(4) OUT (Output)

-Press "F4" in [Figure. 6-6]

A screen will appear that looks like the one below.

-Sets output types.

For 1~2 Channel

```
≫Output mode
  1. non
  2. ok , ng
  3. +ng , ok , -ng
  4. total ok , ng
  5. Binary (Opt .)


             choice --> 2
```

For 1~4 Channel

```
≫Output mode
  1. non
  2. total ok , ng
  3. NGs , ok
  4. OK , NG
  5. P1 , 2 , P3 , 4
  6. Binary (Opt .)

             choice --> 2
```

※ It might be different cs version. [Figure. 6-10]

[Figure. 6-11]

①Meaning

- The numbers below are I/O connetor number.

- Print it from 1 channel in order of OK, NG that is based on no.14

Ex) Set 1~2 channel meter "OK, NG"

No.14	No.13	No.12	No.11
1Channel	1Channel	2Channel	2channel
"OK"	"NG"	"OK"	"NG"

-1~2Channel meter output meaning.

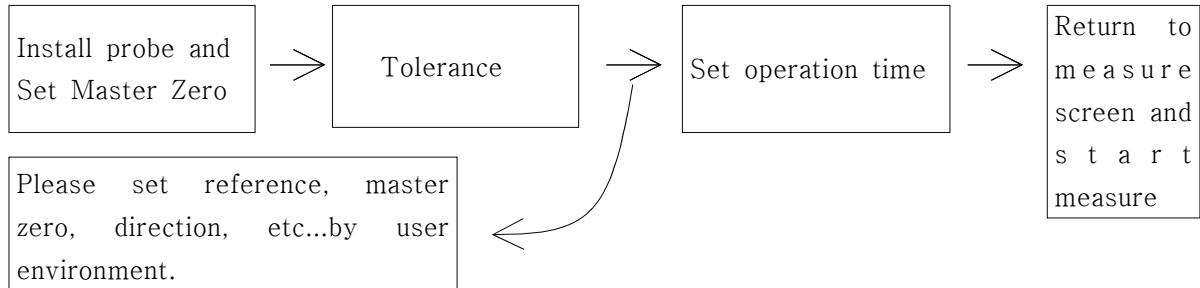| 1. non	No output data.
2. ok , ng	Print all "OK/NG" from no.14 about 2channel.
3. +ng , ok , -ng	If set for 2 channel, print from no.14(+ng,ok,-ng) without READY.
4. total ok , ng	All status "OK" : Enen if no.14 is "NG", print no.1
5. Binary (Opt .)	Print all "OK/NG" from no.14 about 2channel.

-1~4Channel meter output meaning.

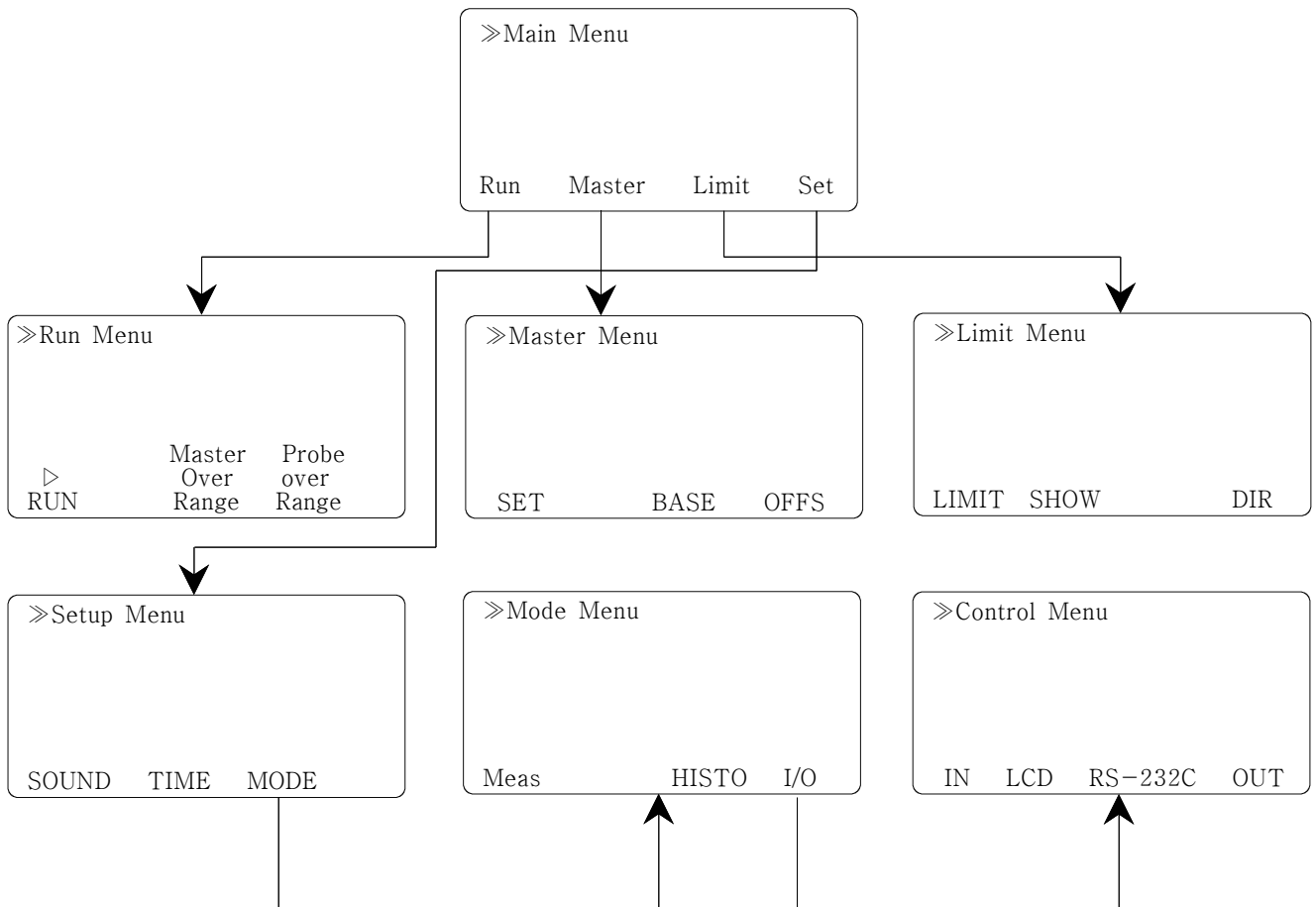| 1. non	No output data.
2. total ok , ng	All status "ok" : even if no.14 is "NG" it will print no.13
3. NGs , ok	If set for 4 channel, not print READY. In case of "NG", print "NG" from no.14. All status "OK" : print "OK" from no.10
4. OK , NG	Only for 3 channel. From no.14, print out in order of "OK"
5. P1 , 2 , P3 , 4	In case of 4 channel : print it from no.14 with no.1, no.2, no.3, no.4 separately.

3. Setup and appendices

1. Operation setting

- Oder from installation to measurement.

| Install probe and Set Master Zero | → | Tolerance | → | Set operation time | → | Return to measure screen and start measure |

| Please set reference, master zero, direction, etc...by user environment. | ← |

1) Menu display.

≫Main Menu

Run   Master   Limit   Set

≫Run Menu

        Master   Probe
▷   Over   over
RUN   Range   Range

≫Master Menu

SET   BASE   OFFS

≫Limit Menu

LIMIT   SHOW   DIR

≫Setup Menu

SOUND   TIME   MODE

≫Mode Menu

Meas   HISTO   I/O

≫Control Menu
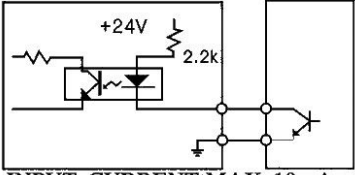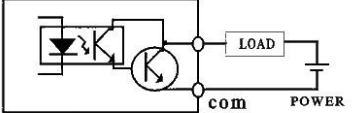
IN   LCD   RS-232C   OUT

2. Appendices

- Reset : Turn off the meter first. Press "F4" and "Power on" at the same time.
         Enter to reset after massage.

※ Please note your settings before reset. (set as default status.)

4. I/O pin description

▶ I/O Pin Description

Pin	Name	In/Out	H/L	Description	Circuit
1	NCOMMON		0 V	GND	**INPUT (START)**
3	RECALL	in	H/L	Request RS232C Data	
4	MODEL BIT2	in	H/L	Model control bit 2	
5	MODEL BIT1	in	H/L	Model control bit 1	
6	MODEL BIT0	in	H/L	Model control bit 0	**INPUT CURRENT:MAX 10mA**
7	ZERO	in	H/L	Zero signal	**OUTPUT (OK, NG, READY)**
8	START	in	H/L	Meas. start signal	
9	BUSY	out	H/L	When Ext. zero	
10	READY	out	H/L	READY signal	**VOLTAGE:MAX 30V** **CURRENT:MAX 300mA**
11	N.C				
12	N.C				
13	NG	out	H/L	NG signal	
14	OK	out	H/L	OK signal	

Model	4	5	6
MODEL0	OFF	OFF	OFF
MODEL1	OFF	OFF	ON
...			
MODEL7	ON	ON	ON

▶ Timing diagram