3 in 1
THERMOMETER
Infrared thermometer
+ Pt 100 ohm + Type K/J/R/E/T

TABLE OF CONTENTS

1. FEATURES

* 3 in 1, Infrared thermometer + Pt 100 ohm thermometer
  + Thermocouple (Type K/J/R/E/T) thermometer.
* The best professional thermometer in the world.
* Microcomputer circuit with high performance.
* Wide temperature measuring range.
* Build in 蚓 & 蚌 select button on the front panel.
* 0.1 degree resolution for Pt 100 ohm & type K/J/T/E.
* Data hold function for storing the desired value on display.
* Memory function to record the maximum & minimum reading.
* Build in a REL button, useful for relative measurement.
* LCD display with back light.
* Sensor select button on the front panel, easy to change different type probe.
* Infrared thermometer, non-contact temperature measurement, -20 蚓 to 400 蚓 (-4 蚌 to 752 蚌), precise non contact temperature measurement.
* Emissivity adjustment for IR thermometer.
* Laser guide for IR temperature measurement.
* 4 wires PT 100 probe input, cooperate with an 0.00385 alpha coefficient, meet DIN IEC 751, high precision.
* Thermocouple probe accept 5 different types : type K, type J, type R, type T, type E.
* RS 232 data output, easily cooperate with computer.
* Optional data acquisition software for data record.
* Auto power off saves battery life.
* Built-in low battery indicator.
* Heavy duty & compact housing case with stand.
* Operate from 006P DC 9V battery.
* Patent pending in TAIWAN, CHINA, USA, GERMANY......

2. SPECIFICATIONS

2-1 General Specifications

Display	51 mm x 32 mm supper large LCD display, 15 mm (0.6") digit size.
Sensor Type	*1. Infrared thermometer* (Non contact temperature measurement)
	2. Platinum Pt 100 ohm (0.00385 alpha coefficient, meet DIN IEC 751)
	3. Thermocouple probe @ Thermocouple type K @ Thermocouple type J @ Thermocouple type T @ Thermocouple type E @ Thermocouple type R
Functions	蚓, 蚌, Data hold, Memory (Max., Min.), Relative measurement, LCD back light, Emissivity adjustment (IR thermometer).
Resolution	0.1 degree or 1 degree.
Circuit	Exclusive microcomputer circuit, the software build in linearity correction function instead of the traditional hardware circuit.
Emissivity Adjustment	Range : 0.20 to 1.00. Adjustment by pushing button on front panel.
Laser Guide	Red laser light, less than 1 mW, *Meet EN60825*
Probe Input Socket	*Pt 100 ohm probe :* DIN 4 pin socket.
	Thermocouple couple probe : Standard 2 pin thermocouple socket.

Sampling Time	Approx. 1 second.
Hold Function	To freeze the display reading value.
Memory Recall	Memorize the Maximum, Minimum reading.
Offset Adjustment	Available for IR thermometer, Pt 100 ohm & Thermocouple thermometer Adjustment by pushing button on front panel.
Over Indication	Show " - - - - ".
Data Output	RS232 PC serial interface.
Power Supply	Alkaline or heavy duty type, DC 9V battery, 006P, MN1604 (PP3) or equivalent.
Power Consumption	Approx. DC 11 mA (w/o laser light on). Approx. DC 16 mA (with laser light on). * Above consumption value is caculated under the function of IR thermometer & without LCD back light.
Operating Temperature	0 to 50 蚓 (32 to 122 蚌).
Operating Humidity	Less than 80% RH.
Size	HWD 200 x 68 x 30 mm (7.9 x 2.7 x 1.2 inch).
Weight	220 g/0.48 LB.
Standard Accessory	Operational manual..... 1 PC.
Optional & accessories Temp. Probe (Refer page 18, page 19)	*Thermocouple couple (Type K) probe :* Model : TP-01, TP-02A, TP-03, TP-04.
	Pt 100 ohm probe : Model : TP-100
	RS232 cable Model : UPCB-02
	Application software, windows version. Model : SW-U101-WIN

2-2 Electrical Specifications

A. Infrared Thermometer

Resolution/	1蚓	- 20 蚓 to 400 蚓
ranges	1蚌	-4 蚌 to 752 蚌
Accuracy	? 3 % of reading or ? 3蚓 (5 蚌), which ever is greater. * Accuracy test under the measurement range less than 300 蚓 (572 蚌). * *Meter operating temp. within 23 ?5 蚓 & the emissivity value of measurement target set to 0.95.* * *Spec. tested under the 20 cm dia. black body, the measuring distance from the probe sensing Head is 30 cm.* * *Spec. tested under the environment RF Field Strength less than 3 V/M & frequency less than the 30 MHz only.*	
Temp. Sensor	Thermocouple pie.	
Emissivity Setting	* *By push button. Setting range : 0.20 to 1.00.* * *Factory preset emissivity value to 0.95, which will cover 90% of a typical application.*	
Measurement Wave length Region	6 to 12 micro meter.	
Distance Factor	D/S : Approx. 7:1. D - Distance, S - Spot.	

Sensor Type	Reso-lution	Range	Accuracy
Type K	0.1 蚓|	-50.0 to 1300.0 蚓|	?(0.2 % + 0.5 蚓|)
		-50.1 to -100.0 蚓|	?(0.2 % + 1 蚓|)
	0.1 蚌	-58.0 to 2372.0 蚌	?(0.2 % + 1 蚌)
		-58.1 to -148.0 蚌	?(0.2 % + 1.8 蚌)
Type J	0.1 蚓|	-100.0 to 1150.0 蚓|	?(0.2 % + 0.5 蚓|)
		-50.1 to -100.0 蚓|	?(0.2 % + 1 蚓|)
	0.1 蚌	-58.0 to 2102.0 蚌	?(0.2 % + 1 蚌)
		-58.1 to -148.0 蚌	?(0.2 % + 1.8 蚌)
Type T	0.1 蚓|	-50.0 to 400.0 蚓|	?(0.2 % + 0.5 蚓|)
		-50.1 to -100.0 蚓|	?(0.2 % + 1 蚓|)
	0.1 蚌	-58.0 to 752.0 蚌	?(0.2 % + 1 蚌)
		-58.1 to -148.0 蚌	?(0.2 % + 1.8 蚌)
Type E	0.1 蚓|	-50.0 to 900.0 蚓|	?(0.2 % + 0.8 蚓|)
		-50.1 to -100.0 蚓|	?(0.2 % + 1 蚓|)
	0.1 蚌	-58.0 to 1652.0 蚌	?(0.2 % + 1.5 蚌)
		-58.1 to -148.0 蚌	?(0.2 % + 1.8 蚌)
Type R	1 蚓|	0 to 600 蚓|	?(1 % + 5 蚓|)
		601 to 1700 蚓|	?(1.5 % + 5 蚓|)
	1 蚌	32 to 1112 蚌	?(1 % + 10 蚌)
		1113 to 3092 蚌	?(1.5 % + 10 蚌)

Remark :

   a. Accuracy value is specified for the meter only.
   b. Accuracy is tested under the meter's environment
      temperature within 23 ?5蚓|.
   c. Linearity Correction :
      Memorize the thermocouple's curve into the intelligent
      CPU circuit,

C. Platinum PT 100 ohm Thermometer

Resolution	Range	Accuracy
0.1 蚓	-200.0 to 850.0 蚓	?(0.2 % + 0.5 蚓)
0.1 蚌	-328.0 to 1562.0 蚌	?(0.2 % + 1.0 蚌)

Remark :

 a. Accuracy value is specified for the meter only.

 b. Accuracy is tested under the meter's ambient temperature within 23 ? 5蚓.

 c. Linearity Correction : Memorize the Pt 100 ohm's curve into the intelligent CPU circuit.

 d. Pt 100 probe input, cooperate with an 0.00385 alpha coefficient, meet DIN IEC 751.

 e. Input socket : DIN 4 pin socket.

 f. 4 wires Pt 100 ohm probe (model : PT-100) is optional, refer to page 18.

3. FRONT PANEL DESCRIPTION

3-1 Display
3-2 Power On/Off Button
3-3 Sensor Button
  (Left Button)
3-4 REL Button
  (Down Button)
3-5 Hold Button
  (Back light Button)
3-6 H(REC Button
3-7 蚓/蚌 Button
  (Up Button)

3-8 Emissivity Button
  (Laser Button)
3-9 RS232 Output Socket
3-10 Battery Compartment/Cover
3-11 Thermocouple
  (Type J/K/R/E/T) Input Socket
3-12 IR Sensing Head
3-13 Pt 100 ohm Input Socket
3-14 Laser Guide

4. IR MEASURING PROCEDURE

4-1 General IR Measurement

Measuring consideration of the " Emissivity "

All objects emit invisible energy. The amount of energy is emitted proportional to the object's temperature & its ability to emit energy. This ability is called emissvity based upon the material that object is made of and its surface roughness. Emissivity values range from 0.1 for a very reflective object to 1.00 for a black body.

> The probe of this IR THERMOMETER senses energy and calculates the temperature based on the amount of IR energy it receives and a factory set emissivity value is 0.95, which will cover 90% of the typical applications. However if the emissivity value of the measured material is not 0.95, then should adjust the " Emissivity Value ".
> The procedure of the emissivity adjustment, please refer to " 4-5 How to Calculate & Adjust the Emissivity, page 11 "

1) **Power On :**
   Power on the meter by pressing the " Power Off/On Button " (3-2, Fig. 1).

   The display will count down from " 99999 ", " " 88888 " .... to " " 00000 ", then show the IR temperature value (approx. room temperature value) & the emissivity value on the right bottom corner of the LCD.

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┌─────────────────────────────────────────────────┐
│                ┌──────┐                     蚓|    │
│            ┌───┘   │  │                            │
│   IR       └───────┘  │               0.95         │
└─────────────────────────────────────────────────┘
```
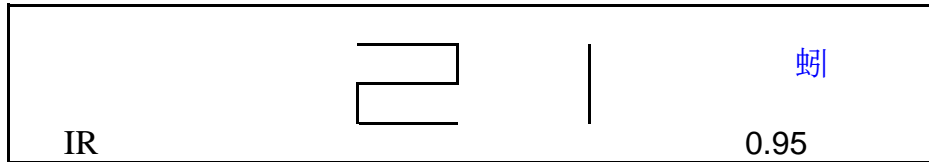
Remark : Suppose the approx.. room temperature
           is 21 蚓|

2) Select the " 蚓| " " 蚌 " display unit pressing " 蚓|/蚌 Button "
   (3- 7, Fig. 1).
3) Hold the meter, point the " IR Sensing Head " (3-12,
   Fig. 1) to the measured object. The meter will display
   the spot's temperature values.

   Consideration :
   a) The displayed value may fluctuate if the meter is
      shaken or suddenly stretched etc. during measurement.
   b) The devices automatically compensate for tempearture
      of the sensor influenced by the ambient temperature.
      When carry out the standard measurement, the device
      can be measured quickly for normal environment
      temp. changes with 23 ?5 蚓| For more accurate
      measure- ment, keep it approx. 30 min. in a new
      temperature.
   c) When low temperature objects are measured directly
      after high temperature objects, some time is required
      for the display to stabilize.

4-2 Laser Target Guide
Pressing the " Laser Button " (3-8, Fig. 1) once will
activate the laser light from the " Laser Guide " (3-14, Fig. 1).
The Laser Target Guide is a useful tool to approximately
locate the measured target of IR thermometer.

4-3 Measurement Field Distance/Spot (D/S) value

   The object must large than spot size calculated by the
measurement Distance/Spot ratio (Distance Factor, refer to
page 4). For accurate measurement, a 1.5 times distance/spot
size is recommended.

   Careful collimating is required when the object is not
large enough, if the temperature of the object or a part of
it is higher (or lower) than the ambient temperature.
After the direction of the probe (little move the probe),
the ideal collimating is obtained the display registers the
maximum (or minimum) reading. However the emissivity
of the object and its ambient must be roughly the same.

4-4 Disturbance

   Objects with low emissivity or objects with a low
temperature but high emissivity, emit little infrared energy.

Fig. 2

For this reason, measurement of these objects is effected by powerful infrared energy radiated from nearby objects with high emissivity or high temperature.

For example, when such objects are measured in sunlight, erratic measurement happened because of powerful radiated energy from the sun and reflected by the surface of the object and received by the sensor.

4-5 Emissivity Adjustment

A factory set emissivity value of 0.95, which will cover 90% of the typical applications. However to match the correct emissivity with the specific value of the object is important in order to obtain the true temperature. When the emissivity of the object is known & its value is not 0.95. It is necessary to adjust the emissivity value again. The adjustment procedures are listed as following :

a) Press the " Emissivity Button " (3-8, Fig. 1) continuously for at least 2 seconds. The emissivity value will flash, then release the button.
b) Use the " Down Button " (3-4, Fig. 1), " Up Button " (3-7, Fig. 1) or the " Left Button " (3-3, Fig. 1) to adjust the required emissivity value.
Press the " Emissivity Button " continuously for at least 2 seconds again. The emissivity value will stop flashing. Release the button, the adjustment procedures are completely finished.

4-6 Offset Value adjustment

   Caused by the environment temperature change or
other reasons.... Then the measuring value may drift few
degrees (1, 2 or 3 degrees).
   If found that the measuring values exist little deviation
especially when measuring the low temperature, then adjust
the offset value will make the compensation & let the
measured value precisely.

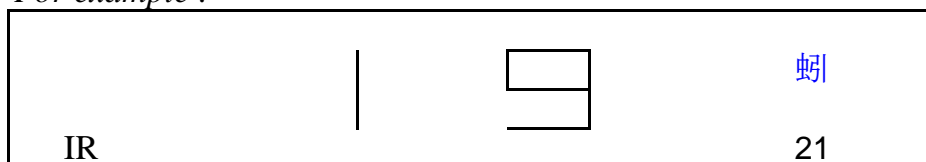*The offset value adjustment procedures are as following :*

a) Use two fingers to press the " Hold Button " (3-5, Fig. 1)
    & " REC Button " (3-6, Fig. 1) together & not release.
    The small digit (right bottom corner of LCD)
    will show the same value of main LCD (big digit).

> *For example :*
>
> | | |
> |---|---|
> | | 蚓 |
> | IR | 21 |
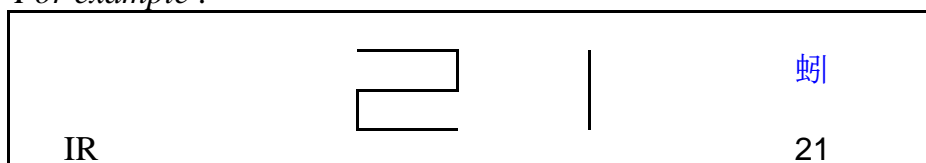
b) Still hold on the " Hold Button " & the " REC Button ",
    use the " Down Button " (3-4, Fig. 1), " Up Button "
    (3-7, Fig. 1) to adjust the big display until the required
    exact environment temp. value appeared.

> *For example :*
>
> | | |
> |---|---|
> | | 蚓 |
> | IR | 21 |

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Then release all buttons, the small digit display (right bottom corner of LCD) will disappear, the offset adjustment procedures are completely finished.

For example :

			蚓
IR			0.95
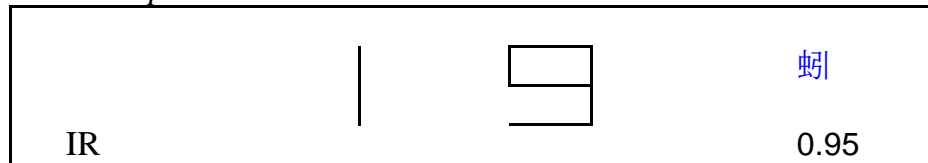
4-7 Others

 a) If the meter seems to be giving incorrect reading. Then the object may exist the not correct emissivity value (0.95), then it is necessary to make the right emissivity correction. procedures (refer 4-5).
 b) If the surface for measuring is covered by frost or other material, clean it expose the surface.
 c) If the surface for measuring is highly reflective, apply masking tape or apply the known " block body paint " (such as emissivity 0.95).

5. THERMOCOUPLE (Type K/J/T/E/R) MEASURING PROCEDURE

1) After power on the meter, select the sensor type (Type K/J/T/E/R) by pressing " Sensor Button " (3-3, Fig. 1). The display will show the symbol of K, J, R, E, T.
2) Insert the temp. probe plug into the " Thermocouple Input Socket " (3-11, Fig. 1).

3) Select the " ℃ " " ℉ " display unit by pressing " ℃/℉ Button " (3- 7, Fig. 1).
4) Display will show the temperature reading that measured from the probe.
5) **Offset Value adjustment :**
   Same as 4-6, refer to page 12.

Consideration :
* When insert the probe plug into the temp. input socket, please take care to observe the correct polarity.
* When the probe plug is first inserted into the thermometer socket, or if the probe is changed, the plug must be allowed to stabilize at temperature of the socket, which is in thermal contact with cold junction compensation device, for greatest accuracy is to be achieved. This will take a couple of minutes and only apply if the probe plug has previously been exposed to an ambient temperature different to that thermometer.

6. PT 100 ohm MEASURING PROCEDURE

1) After power on the meter, press the " Sensor Button " (3-3, Fig. 1) until the LCD show the mark of " Pt3850 "
2) During the power on, Plug the Pt 100 temp. probe (TP-100, optional) into the " Pt 100 ohm Input Socket " (3-13, Fig. 1)
3) Select the " ℃ " " ℉ " display unit by pressing " ℃/℉ Button " (3- 7, Fig. 1).
4) Display will show the temperature reading that measured from the probe.
5) **Offset Value adjustment :**
   Same as 4-6, refer to page 12.

7. DATA HOLD, RECORD, RELATIVE, LCD BACK LIGHT and AUTO POWER OFF DISABLE

7-1 Data Hold
1) During the measurement, pressing the " Hold Button " (3-5, Fig. 1) will freeze the measured value & the LCD will show " HOLD " symbol.
2) Press the " Hold Button " again to cancel the data hold function

7-2 Data Record (Maximum, Minimum reading)
1) The DATA RECORD function displays the maximum and minimum readings. To start the DATA RECORD function, press the " REC Button " (3-6, Fig. 1) once. " REC " symbol will appear on the LCD display.
2) With the " REC " symbol on the display :
   (a) Press the " REC Button " (3-6, Fig. 1) once, the " Max " symbol along with the maximum value will appear on the display.
   (b) Press the " REC Button " again, the " Min " symbol along with the minimum value will appear on the display.
   (c) To exit the memory record function, press the " REC Button " continuously for at least 2 seconds. The display will revert to the current reading.

7-3 Relative measurement
1) During the measurement, the circuit will memorize the last measured value if press the " REL Button " (3-4, Fig. 1) once, display will show zero value & a " REL " symbol appear on the LCD.

2) The new measured frequency values will deduct above memorized " Last measured values " automatically.
3) It will cancel the relative measurement function if press the " REL Button " once again, at same time the " REL " marker will disappear.

   Considering :
   When making the " Data Hold " & " Data Record " measurement, the Relative function is prohibited.

7-4 LCD Back-light
Press the " Back Light Button " (3-5, Fig. 1) continuously for at least 2 seconds. The " Back-light " of LCD will light 10 seconds approximately then off automatically.

7-5 Auto Power Off disable
The instrument build-in " Auto Power Shut-off " in order to prolong battery life. The meter will switch off automatically if none of the buttons are pressed within approx. 10 minutes.

To disable this feature, Select the memory record function during measurement, by pressing the " REC Button " (3-6, Fig. 1).
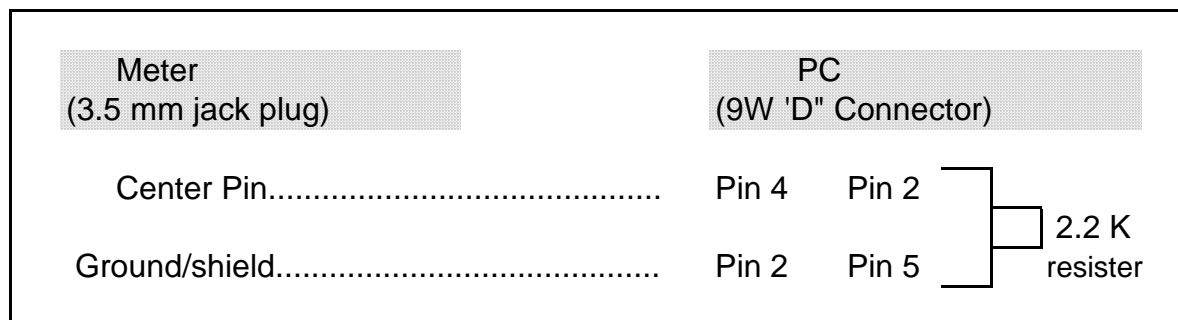
8. BATTERY REPLACEMENT

1) When the left top corner of LCD display show "   ",
   it is necessary to replace the battery.
   However within specification measurement may still be
   made for several hours after low battery indicator appears
   before the instrument become inaccurate.
2) Open the " Battery Cover " (3-10, Fig. 1) away from the
   instrument and remove the battery.
3) Install a 9 V battery (Alkaline or Heavy duty type) and
   replace the cover.

9. RS232 PC SERIAL INTERFACE

The instrument features an RS232 output via 3.5 mm
Terminal (3-9, Fig. 1).

The connector output is a 16 digit data stream which
can be utilized to the user's specific application.

**A RS232 lead with the following connection will
be required to link the instrument with the PC
serial input.**

Meter (3.5 mm jack plug)		PC (9W 'D" Connector)	
Center Pin..	Pin 4	Pin 2	
Ground/shield..	Pin 2	Pin 5	2.2 K resister

The 16 digit data stream will be displayed in the following format :

D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1 D0

Each digit indicate the following status :

D0	End Word
D1 & D8	Display reading, D1 = LSD, D8 = MSD For example : *If the display reading is 1234, then D8 to D1 is :* *00001234*
D9	Decimal Point(DP), position from right to the left 0 = No DP, 1= 1 DP, 2 = 2 DP, 3 = 3 DP
D10	Polarity 0 = Positive 1 = Negative
D11 & D12	Annunciator for Display
	蚓 = 01	蚌 = 02	
D13	1
D14	4
D15	Start Word

RS232 FORMAT : 9600, N, 8, 1

10. OPTIONAL ACCESSORIES & PROBES

PT-100 ohm
Probe
	Model : TP-100
	* -50 蚓 to 400 蚓 (-58 蚌 to 752 蚌), DIN
	    plug, 4 pins/4 wires, Class A, Cooperate
	    with an 0.00385 alpha coefficient,
	* Meet DIN IEC 751.
	* Accuracy : (0.15 + (0.002 x T))蚓
	* Dimension Sensing head - 152 mm tube
	    Probe length : 245 mm.

Thermocouple Probe (Type K)	Model : TP-01 * Measure Rage : -40 蚓 to 250 蚓, -40 蚌 to 482 蚌. * Ultra fast response naked-bead thermocouple, general purpose application.
Thermocouple Probe (Type K)	Model : TP-02A * Measure Range : -50 蚓 to 900 蚓, -50 蚌 to 1650 蚌. * Dimension: 10 cm tube, 3.2 mm Dia.
Thermocouple Probe (Type K) Surface Probe	Model : TP-04 * Measure Range : -50 蚓 to 400 蚓, -50 蚌 to 752 蚌. * Dimension: 10 cm tube, 8 mm Dia.
Thermocouple Probe (Type K)	Model : TP-03 * Measure Range : -50 蚓 to 1200 蚓, -50蚌 to 2200 蚌. * Size : Temp. sensing head - 15 mm Dia. Probe length : 120 mm.
RS232 cable	Model : UPCB-02 * RS232 cable for connecting between the meter & the computer.
Software	Model : SW-U101-WIN, Windows version. * Software apply as the performance of data logging system & data recorder...
Carrying Case	Model : CA-03, Vinyl soft carrying case.
Carrying Case	Model : CA-06, Hard carrying case.

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