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INTRODUCTION

This instrument is a digital thermometer for use with any K-type thermocouple as temperature sensor. Temperature indication follows National Bureau of Standards and IEC 584 temperature/voltage table for K-type thermocouples.

SPECIFICATIONS

NUMERICAL DISPLAY:
4 digital liquid crystal display

MEASUREMENT RANGE:
-200°C ~ 1370°C  -328°F ~ 2498°F

RESOLUTION:
-200°C ~ 200°C  0.1°C; 800°C ~ 1370°C  1°C
-200°F ~ 200°F  0.1°F; else 1°F

MAXIMUM VOLTAGE AT THERMOCOUPLE INPUT:
60V DC, or 24Vrms AC

ENVIRONMENTAL:
- Operating Temperature and Humidity: 0°C ~ 50°C (32°F ~ 122°F); 0 ~ 80% RH
- Storage Temperature and Humidity: -10°C to 60°C (14°F ~ 140°F); 0 ~ 80% RH
- Altitude up to 2000 meters.
2. SPECIFICATIONS

**ACCURACY: AT (23 ± 5°C)**

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200°C ~ 200°C</td>
<td>±(0.3% reading + 1°C)</td>
</tr>
<tr>
<td>200°C ~ 400°C</td>
<td>±(0.5% reading + 1°C)</td>
</tr>
<tr>
<td>400°C~1370°C</td>
<td>±(0.3% reading + 1°C)</td>
</tr>
<tr>
<td>-328°F ~ -400°F</td>
<td>±(0.5% reading + 2°F)</td>
</tr>
<tr>
<td>-200°F ~ 200°F</td>
<td>±(0.3% reading + 2°F)</td>
</tr>
<tr>
<td>200°F ~ 400°F</td>
<td>±(0.5% reading + 2°F)</td>
</tr>
<tr>
<td>400°F ~ 2498°F</td>
<td>±(0.3% reading + 2°F)</td>
</tr>
</tbody>
</table>

For T1-T2 Measurement, the accuracy is
±(0.5% T1-T2 reading + 2°C) or ±(0.5% T1-T2 reading + 2°F)

**TEMPERATURE COEFFICIENT:**
For ambient temperatures from 0°C ~ 18°C and 28°C ~ 50°C, for each °C ambient below 18°C or above 28°C add the following tolerance into the accuracy spec.
0.01% of reading + 0.03°C (0.01% of reading + 0.06°F)

**NOTE:**
The basic accuracy Specification does not include the error of the probe please refer to the probe accuracy specification for additional details.

**SAMPLE RATE:**
0.6 times per second
2. SPECIFICATIONS

DIMENSION:
184×64×30mm

WEIGHT:
210g Approx.(7.4oz)

ACCESSORY:
K Type Bead Probe, Battery, Carrying Case, Instruction Menu.

OPTION:
Soft Ware Package ( Program, RS232 Connection Cable) , AC Adapter.

POWER REQUIREMENT:
9 Volt Battery, NEDA 1604 or JIS 006P or IEC6F22

BATTERY LIFE:
Approx. 100hrs with alkaline battery

AC ADAPTER:
9VDC ±15% 100mA ; Plug Diameter: 3.5×1.35mm
3. SYMBOL DEFINITION AND BUTTON LOCATION

- This indicates that the minus temperature is sensed.

°C °F : Centigrade and Fahrenheit indication.

K : Thermocouple Type Indication

HOLD : This indicates that the display data is being hold.

MAX : The Maximum value is now being displayed.

MIN : The Minimum value is now being displayed.

AVG : The Average value is now being displayed.

△REL : The reading is now under Relative Mode.

: The Battery is not sufficient for proper operation.
3. SYMBOL DEFINITION AND BUTTON LOCATION

1. T1 K type temperature sensor connector
2. T2 K type temperature sensor connector
3. LCD display
4. ON/OFF button
5. HOLD button
6. T1, T2, T1-T2 control button
7. Relative readout button
8. MAX MIN Average control button
9. °C, °F control button
10. Offset calibration screw
11. 11 Digital output connector
12. AC power adapter connector
13. Tripod connector
14. Battery cabinet cover
4. OPERATION INSTRUCTIONS

4.1 POWER-UP
Press the key to turn the thermometer On or OFF.

4.2 CONNECTING THE THERMOCOUPLES
For measurement, plug the thermocouple into the input connectors.

4.3 SELECTING THE TEMPERATURE SCALE
When the meter was first powered on, the default scale setting is set at Celsius (°C) scale. The user may change it to Fahrenheit (°F) by pressing “°C/°F” button and vice versa to Celsius.

4.4 DATA-HOLD OPERATION
The user may hold the present reading and keep it on the display by pressing the “HOLD” button. When the held data is no longer needed, one may release the data-hold operation by pressing “HOLD” button again. When the meter is under Data Hold operation, the “▲ REL”, “MAX”, “MIN”, and “°C/°F” button are disabled.

4.5 T1,T2,T1-T2 DISPLAY CONTROL
One may select T1,T2 or T1-T2 to show on the main display by pressing button. When T1 or T2 is select to show on the main display, the other temperature will be shown on the second display. When one select T1-T2 to show on the main display, T1 and T2 will be shown on the second display alternately.

4.6 RELATIVE OPERATION FOR MAIN DISPLAY
When one press the “▲ REL” button, the meter will memorize the present reading and the difference between the new reading and the memorized data will be shown on the display. Press the “▲ REL” button again to exit the Relative operation.
4.7 MAX/MIN/AVG OPERATION FOR MAIN DISPLAY

When one presses the button the meter will enter the MAX/MIN mode. Under this mode the maximum value, minimum value and average value of latest 8 data is kept in the memory simultaneously and updated with every new data.

When the MAX symbol is display, the Maximum is shown on the display.

Press again, then the MIN symbol is on the display and also the minimum reading.

Press again, the AVG symbol is on the display and also the average reading.

Press again, MAX, MIN and AVG will blink together. This means that all these data is updated in the memory and the reading is the present temperature.

One may press to circulate the display mode among these options.

When the meter is under operation, “▲ REL” and “°C/°F” are disabled.

To exit the MAX/MIN mode, one may press and hold for two seconds.

4.8 AUTO POWER OFF

By default, when the meter is powered on, it is under auto power off mode. The meter will power itself off after 30 minutes if no key operation or RS232 communication. Key combination at power on or RS232 communication can disable auto power off. One may press and hold “HOLD” button and then power on the meter and there will be two successive beeps to indicate that auto power off is disabled.
4.9 LOW BATTERY CONDITION
When the battery voltage is under proper operation requirement, the symbol will show on the LCD and the battery need to be replaced with new one.

4.10 CALIBRATION POINT
Room Temperature 23 ± 3°C

<table>
<thead>
<tr>
<th>input</th>
<th>Adjust VR</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 °C</td>
<td>VR1</td>
<td>± 0.1 °C</td>
</tr>
<tr>
<td>190 °C</td>
<td>VR2</td>
<td>± 0.1 °C</td>
</tr>
<tr>
<td>1000 °C</td>
<td>VR3</td>
<td>± 1 °C</td>
</tr>
<tr>
<td>1900 °F</td>
<td>VR4</td>
<td>± 1 °F</td>
</tr>
</tbody>
</table>

Normally, performing offset Calibration with thermal stabled ice water through VR1 will give a very good calibration result.

4.11 DIGITAL OUTPUT
The Digital Output is a 9600bps N 81 serial interface. The RX is a 5V normal high input port. The TX is a 5V normal high output port. The command of Digital Output is list below.
4. OPERATION INSTRUCTIONS

<table>
<thead>
<tr>
<th>RS232 command</th>
<th>Function</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>K(ASC 4BH)</td>
<td>Ask for model No.</td>
<td>Send 4 bytes</td>
</tr>
<tr>
<td>D(ASC 44H)</td>
<td>Ask for main display Range, Data, Unit</td>
<td>Send 22 bytes</td>
</tr>
<tr>
<td>B(ASC 42H)</td>
<td>Ask for secondary display Range, Data, Unit</td>
<td>Send 22 bytes</td>
</tr>
<tr>
<td>S(ASH 53H)</td>
<td>Ask Status</td>
<td>Send 13 bytes</td>
</tr>
<tr>
<td>H(ASC 48H)</td>
<td>Hold button</td>
<td></td>
</tr>
<tr>
<td>T(ASC 54H)</td>
<td>TIMER button</td>
<td></td>
</tr>
<tr>
<td>M(ASC 4DH)</td>
<td>AVG/MAX/MIN button</td>
<td></td>
</tr>
<tr>
<td>N(ASC 4EH)</td>
<td>Exit AVG/MAX/MIN mode</td>
<td></td>
</tr>
<tr>
<td>R(ASC 52H)</td>
<td>REL button</td>
<td></td>
</tr>
<tr>
<td>C(ASC 43H)</td>
<td>C/F button</td>
<td></td>
</tr>
<tr>
<td>A(ASC 41H)</td>
<td>Inquire all encoded data</td>
<td>Send encoded 8 byte</td>
</tr>
</tbody>
</table>

- **COMMAND K**
  Return 4 bytes. For example, when sends command "K" to meter, it will return "3","0","1", ASCII(13) .

- **COMMAND D**
  Return data of main window.
  Range: T1, T2, T1-T2 (7bytes), the unused characters is left as space ASC(13).
4. OPERATION INSTRUCTIONS

Data: ±9999.9,-OL,OL (7 bytes include polarity and decimal point),
Unit: C,F (5 bytes)
When the meter receive the D command, it will send:
Range □ Data □ Unit.
( where □ represent space (ASC(20H) )
For example:
T1□□□□□□-199.9□□□□□
(0x13) represent T1, -199.9°C, The total byte number should be
7+1+7+1+5+chr(13)=22Bytes

- COMMAND B
  Return the operation mode HOLD □ MAX □ REL, if the mode is not entered, the related characters will be left as space.
  For example:
  when the meter is under MAX display, the meter will return: □□□□□
  MAX□□□□

- COMMAND T
  Equivalent to one pushing on the HOLD button.

- COMMAND M
  Equivalent to one pushing on the HOLD AVG/MAX/MIN button and no message is returned.

- COMMAND R
  Equivalent to one pushing on the REL button and no message is returned.

- COMMAND C
  Equivalent to one pushing on the C/F button and no message is returned.
4. OPERATION INSTRUCTIONS

• **COMMAND A**

1nd BYTE:
The first byte is the start byte, its value is 2.

2nd BYTE:

<table>
<thead>
<tr>
<th>bit7</th>
<th>bit6</th>
<th>bit5</th>
<th>bit4</th>
<th>bit3</th>
<th>bit2</th>
<th>bit1</th>
<th>bit0</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/F</td>
<td>Low Bat</td>
<td>Hold</td>
<td>REL</td>
<td>K/J</td>
<td>MAX/AVG/MIN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

bit 2 bit 1 bit 0
0 0 0 → normal mode
0 0 1 → MAXIMUM mode
0 1 0 → MINIMUM mode
1 0 0 → AVG mode
1 1 1 → calculate MAX/MIN/AVG in back-ground and LCD
"MAX""AVG""MIN" will flash

bit3:1→0→K TYPE 1→J TYPE
bit4:1→REL
bit5:1→HOLD 0→not HOLD
bit6:1→LOW BATTERY 0→BATTERY NORMAL
bit7:1→C 0→F

3nd BYTE:

<table>
<thead>
<tr>
<th>bit7</th>
<th>bit6</th>
<th>bit5</th>
<th>bit4</th>
<th>bit3</th>
<th>bit2</th>
<th>bit1</th>
<th>bit0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>Minus</td>
<td>OL</td>
<td>Point</td>
<td>Minus</td>
<td>OL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

bit0:1→main window value is OL 0→not OL
bit1:1→main window value is minus, 0→main window value is plus.
bit2:1→4th byte and 5th byte represent #### 0→4th byte and 5th byte represent ###.#
bit3:1→sub window value is OL 0→not OL
bit4:1→sub window value is minus, 0→sub window value is plus.
bit5:1→6th byte and 7th byte represent #### 0→6th byte and 7th byte represent ###.#
4. OPERATION INSTRUCTIONS

bit7 bit6:
00 → Main window is T1-T2, sub window is T1
01 → Main window is T1-T2, sub window is T2
10 → Main window is T1, sub window is T2
11 → Main window is T2, sub window is T1

4th BYTE:
first two BCD code of main window value.

5th BYTE:
last two BCD code of main window value

6th BYTE:
first two BCD code of sub window value.

7th BYTE:
last two BCD code of sub window value.

8th BYTE:
The last byte is the end byte, it value is 3, first and last byte are used to check frame error.
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