OMEGA

HH508/HH509/HH509R
Digital Thermometer

INTRODUCTION

This instrument is a 3½ digit, compact-sized portable digital thermometer designed to use external K/J/T/E/S type thermocouples as temperature sensor. Temperature indication follows Reference Temperature/Voltage Tables (N.I.S.T. Monograph 175 Revised to ITS-90) for K/J/T/E/S type thermocouples.

SAFETY INFORMATION

It is recommended that you read the safety and operation instructions before using the thermometer.

WARNING
To avoid electrical shock, do not use this instrument when working voltages at the measurement surface over 24V AC or DC.

WARNING
To avoid damage or burns, do not make temperature measurement in microwave ovens.

CAUTION
Repeated sharp flexing can break the thermocouple leads. To prolong lead life, avoid sharp bends in the leads, especially near the connector.

The ⚠ symbol on the instrument indicates that the operator must refer to an explanation in this manual.

SPECIFICATIONS

ENVIRONMENTAL
Ambient Operating Ranges: 0°C to 50°C (32°F to 122°F) <80% R.H.
Storage Temperature: -20°C to 60°C (-4°F to 140°F) <70% R.H.

GENERAL
Display: 3½ digit liquid crystal display (LCD) with a maximum reading of 1999.
Polarity: Automatic, positive implied, negative polarity indication.
Overrange: -OL is displayed.
Zero: Automatic.
Reading Rate: one time per second.
Low battery indication: the " 🔋 " is displayed when the battery voltage drops below the operating level.
Measurement rate: 1 times/second.
Accuracy: Stated accuracy at 23°C±5°C, <75% relative humidity.
Dimensions: 195mm(H) x 92mm(W) x 53mm(D).
Weight: 365g.
Input Connector: Accepts standard miniature thermocouple connectors (flat blades spaced 7.9mm, center to center).
Battery Life: 100 hours typical battery.
Auto power off: The meter key switch inactive for more than 30 minutes, press power key to resume operation.
Temperature Coefficient: 0.1 times the applicable accuracy specification per °C from 0°C to 18°C and 28°C to 50°C (32°F to 64°F and 82°F to 122°F).
Input Protection: 24V dc or 24V ac rms maximum input voltage on any combination of input pins.
Maximum Differential Common Mode Voltage (Maximum Voltage between T1 and T2 during measurement): 1 volt.

ELECTRICAL

Temperature Scale: Celsius or Fahrenheit user-selectable.

Measurement Range:

Thermocouple	Range
K-TYPE(0.1°C)	-200°C to 1372°C, -328°F to 1999°F
J-TYPE(0.1°C)	-210°C to 1200°C, -346°F to 1999°F
T-TYPE(0.1°C)	-200°C to 400°C, -328°F to 752°F
E-TYPE(0.1°C)	-220°C to 1000°C, -364°F to 1832°F
S-TYPE(1°C)	0°C to 1767°C, 32°F to 1999°F

Auto range: 0.1°C/1°C, 0.1°F/1°F.

Accuracy: Accuracy is specified for operating temperatures over the range of 18°C to 28°C (64°F to 82°F), for 1 year, not including thermocouple error.

$\pm$(0.1% rdg + 1°C) range -60°C to 1372°C
$\pm$(0.1% rdg + 2°C) range -60°C to -220°C
$\pm$(0.1% rdg + 2°F) range -76°F to 1999°F
$\pm$(0.1% rdg + 4°F) range -76°F to -364°F

S-TYPE $\pm$(0.0% rdg + 2°C) on 0°C to 50°C
$\pm$(0.1% rdg + 1°C) on 50°C to 1767°C
$\pm$(0.0% rdg + 4°F) on 32°F to 122°F
$\pm$(0.1% rdg + 2°F) on 122°F to 1999°F

OPERATING INSTRUCTIONS

① ⓘ **Power Switch**
The ⓘ key turns the thermometer on or off. In the MIN MAX record mode can not power off, must leave MIN MAX record mode then power off.

② ⑤ **°C °F Selecting the Temperature Scale**
Readings is displayed in either degrees Celsius(°C) or degrees Fahrenheit(°F). When the thermometer is turned on, it is set to the temperature scale that was in use when the thermometer was last turned off. To change the temperature scale, press the °C or °F key.

③ **"✱" Button**
Press "✱" button to toggle on and off of backlight. The backlight will switch-off automatically after 30 seconds.

④ **HOLD Mode**
Pressing the HOLD key to enter the Data Hold mode, the "HOLD" annunciator is displayed. When HOLD mode is selected, the thermometer held the present readings and stops all further measurements.
Pressing the HOLD key again to cancel HOLD mode causing thermometer to resume taking measurements.
In the MIN/MAX recording mode, press HOLD key to stop the recording. Press HOLD key again to resume recording. (Previously recorded reading are not erased).

⑥ **MIN MAX record Mode**

Press MIN MAX key to enter the MIN MAX Recording mode, (displays the Maximum reading, Minimum reading, "MAX-MIN" reading and Average reading stored in record mode). In the this mode the automatic power-off feature is disabled and ⏻key and all function key are disabled. The beeper emits a tone when a new minimum or maximum value is recorded.

Push MIN MAX key to cycle through the MAX, MIN, MAX-MIN and AVG readings.

If an overload is recorded, the averaging function is stopped and average value display"-OL".

In the this mode, press HOLD key to stop the recording of readings, all values are frozen, press again to restart recording.

To prevent accidental loss of MIN, MAX, "MAX-MIN" and AVG data, in this mode can only be cancelled by pressing and hold down the MIN MAX key for 2 seconds to exit and erased recorded readings.

WARNING

MIN, MAX and AVG readings can be recorded for a period of up to 50 hours maximum. If this 50 hours period is exceeded the unit readings will not be accurate.

⑦⑧⑨ **T1 T2/T1-T2 (for HH501BR/HH501BS)**

The input selection indicates which input is selected for display; T1 thermocouple, T2 thermocouple or the difference between the two thermocouples (T1-T2), when the thermometer is turned on, when the thermometer is turned on, it is set to the input selected that was in use when the thermometer was last turned off.

⑦⑧⑨ **TIMER STOP-WATCH Mode (for HH501AR / HH501AS)**
Press TIMER STOP-W key to enter stop-watch mode stop-watch is displayed. Press START/STOP key to toggle stop-watch starts and stops (Time goes up to 19 minutes & 59.9 seconds). Press CLEAR key to display 0.1 second, then press again to zero the stop-watch.
Press TIMER STOP-W key again to exit the stop-watch mode.

⑩ **REL Relative mode**
Pressing REL key to enter the Relative mode, zero the display, and store the displayed Reading as a reference value and annunciator REL is displayed. Press REL key again to exit the relative mode.
The relative value can also be entered by the user. (See "SET mode" later in this manual.)
When the desired Relative value has been entered, press REL key to enter the Relative mode, press SET key use set Relative value as a reference value. Press REL key again to exit the relative mode.
In the Relative mode, the value (can not >±2000.0 counts) shown on the LCD is always the difference between the stored reference and the present reading.

ⅠⅠ **SET mode (Relative value set and Hi/Lo Limits value set)**

1. Press SET key to enter Relative valuse SET mode (Press ENTER key can escape relative valuse set mode), REL set mode. _ = = =.= is displayed (the ".=" is displayed when you set up the fourth umber). Relative value is entered via overlay numbers, when you want to get negative values push (- 0) key for end of numbers, then press overlay ENTER key, stored the relative value, enter Hi/Lo Limits value set mode.

2. Hi Limit value set mode, (Press ENTER key can escape Hi Limit value set mode), _ ===.= is displayed (the ".=" is displayed when you set up the fourth number), Hi Limit value is entered via overlay numbers, when you want to get negative values push (- 0) key for end of numbers, then press overlay ENTER key, stored the Hi Limit value, enter Lo Limit value set mode (Press ENTER key can escape Lo Limit value set mode), _ ===.= is displayed (the ".=" is displayed when you set up the fourth number), Lo Limit value is entered via overlay numbers, when you want to get negative values push (- 0) key for end of numbers, then press overlay ENTER key, stored the Lo Limit value and exit set mode.

3. In the SET mode, the value can not >±2000.0 counts.all value will be memorized until yor reset it.

⑫ Hi/Lo LIMITS mode

Press Hi/Lo LIMITS key to enter the Hi/Lo Limits comparative mode, "LIMIT" is displayed. In the this mode the automatic power-off feature is disabled and other funtion key are disabled, when input temperature value exceed Hi. The beeper emits a continuity pulse tone and "Hi" is displayed, and when input temperature value exceed Lo value. The beeper emits a discontinuous pulse tone and "Lo" is displayed. Press Hi/Lo LIMIT key again to exit the Hi/Lo LIMIT mode.

OPERATOR MAINTENANCE

> **WARNING**
>
> To avoid possible electrical shock, disconnect the thermocouple
> connectors from the thermometer before removing the cover.

Battery Replacement

Power is supplied by a 9 volt "transistor" battery. (NEDA 1604, IEC 6F22). The "🔋" appears on the LCD display when replacement is needed. To replace the battery, remove the two screws from the back of the meter and lift off the battery cover. Remove the battery from battery contacts.

RS-232 Operation Using Quick BASIC

The following example shows how to send command instruction and receive data responses over the RS-232 interface using Quick BASIC.
The program example is set up on "COM1".

```
CLS
E$ = "A"
ST1:
CLOSE #1
OPEN "COM1:1200,E,7,1,DS,RS" FOR OUTPUT AS #1
PRINT #1, E$;
CLOSE #1
OPEN "COM1:1200,E,7,1,DS,RS" FOR RANDOM AS #1
ST2:
INPUT #1, A$
B$ = MID$(A$, 2, 6)
DEC = 0
F$ = "0123456789ABCDEF"
N = 6
FOR I = 0 TO 5
   C$ = MID$(B$, N, 1)
   N = N - 1
   D = INSTR(F$, C$) - 1
   DEC = DEC + (16 ^ I) * D
NEXT
DEC = DEC / 1000
C$ = MID$(A$, 1, 1)
```

```
IF C$ = "-" THEN
  DEC = DEC * -1
END IF
B$ = MID$(A$, 10, 6)
DEC1 = 0
N = 6
FOR I = 0 TO 5
  C$ = MID$(B$, N, 1)
  N = N - 1
  D = INSTR(F$, C$) - 1
  DEC1 = DEC1 + (16 ^ I) * D
NEXT
DEC1 = DEC1 / 1000
C$ = MID$(A$, 9, 1)
IF C$ = "-" THEN
  DEC1 = DEC1 * -1
END IF
CLS
LOCATE 12, 33
PRINT "  T1      T2"
LOCATE 13, 30
PRINT USING "######.#   ######.#"; DEC; DEC1
E$ = INKEY$
IF E$ = "" THEN
  GOTO ST2
END IF
GOTO ST1
```

RS-232 Transmit and Receive Comammand Summary

1. Control letter should use Capital Letter.

   Baud rate: 1200

   Parity check: EVEN

   Data bits: 7

   Stop bits: 1

   "A"   Activate data transmission

   "B"   Stop data transmission

   "C"   °C/°F Key

   "D"   " � " Key

   "E"   HOLD Key

   "F"   TYPE Key

   "G"   MIN/MAX Key

   "H"   Exit record mode

   " I "   T1 Key

   "J"   T2 Key

   "K"   T1-T2 Key

   "L"   REL Key

   "M"   Hi/Lo LIMITS Key

   "P"   Turn off power of meter

2. If you write you own program, the host computer must send the "A" letter to activate data transmission.

3. If you should stop data transmission the host computer must send the "B" letter to extend battery life.

4. Communication Parameters

OUTPUT DATA FORMATS

The data format consists of 32 bytes.

byte

0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		1	1	1	2	2	2	2	2	2	2	2	2	3	3	3
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6		7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
S	H	H	H	H	H	H	A	S	H	H	H	H	H	H	A		D	D	D	D	D	D	A	A	A	A	A	A	A	A	CR	nl

— T1 present status — — T2 present status —   — Timer — — Meter status —

S: Negative sign or positive sign
H: Hexadecimal digits
D: Numeric digits
A: Capital Letter or "–" sign
CR: Carriage return character
nl: newline character

01 ⎤⎡ T1 polarity ⎤⎡ "+" Positive
09 ⎦⎣ T2 polarity ⎦⎣ "–" Negative

02 — MSD ⎤⎡ T_1 Values=$[H_{07} \times 16^0 + H_{06} \times 16^1 + H_{05} \times 16^2$
07 — LSD ⎦⎣ $+ H_{04} \times 16^3 + H_{03} \times 16^4 + H_{02} \times 16^5] / 1000$

10 — MSD ⎤⎡ T_2 Values=$[H_{15} \times 16^0 + H_{14} \times 16^1 + H_{13} \times 16^2$
15 — LSD ⎦⎣ $+ H_{12} \times 16^3 + H_{11} \times 16^4 + H_{10} \times 16^5] / 1000$

08 — Thermocouple Type ——— "K" ® K type
                         — "J" ® J type
                         — "T" ® T type
                         — "E" ® E type
                         — "S" ® S type

```
16 — none        — "-"
17 — MSD  ┐
18 — LSD  ┘─ (H)ours ──┐
19 — MSD  ┐            │
20 — LSD  ┘─ (M)inutes ─┼── Time=INT[(Hx3600+Mx60+S)/2]
21 — MSD  ┐            │
22 — LSD  ┘─ (S)econds ─┘

23 — Record mode ─┬─ "R"  ®  Record mode
                  ├─ "M"  ®  MAX mode
                  ├─ " I "  ®  MIN mode
                  ├─ "A"  ®  AVG mode
                  ├─ "-"  ®  MAX-MIN mode
                  └─ "-"  ®  normal mode

24 — REL & HOLD ─┬─ "R"  ®  Relative mode
     mode        ├─ "H"  ®  HOLD mode
                 └─ "-"  ®  normal mode

25 — none        — "-"

26 — LIMITS mode ─┬─ "L"  ®  Limits mode
                  └─ "-"  ®  normal mode

27 — Hi LIMITS ─┬─ "H"  ®  Hi Limits
                └─ "-"  ®  normal mode

28 — Lo LIMITS ─┬─ "L"  ®  Lo Limits
                └─ "-"  ®  normal mode

29 — none        — "-"

30 — Battery status ─┬─ "B"  ®  Low battery
                     └─ "-"  ®  normal mode
```

COMMUNICATION

4612-IR232
RS232C CABLE

508BR

COMPUTER

RS-232C "COM1" PORT
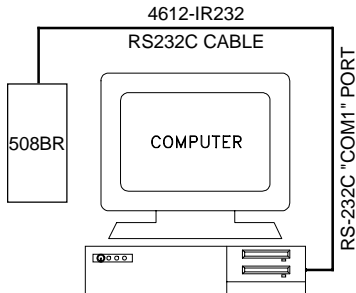
1. Install the RSR232C cable between computer "COM1" and Thermometer RS232C port.
2. Turn on Thermometer.
3. Utilize the Quick BASIC for inputting programs.
4. Use the capital control letter and input "A" letter from the keyboard to start sending messages to computer.
5. Input "C" letter from the keyboard and then you can change the temperature scale.
6. Input "F" letter from the keyboards and then you can circulating select the T1 input type.
7. Input "G" letter from the keyboard and then the meter enter record mode, and then you can push "G" again to circulate through Maximum/Minimum/Average/ Record mode.
8. When you want to stop transmission mode you should push "B" letter from the keyboard in order to conserve battery life.

HH501(A,B)K / HH501(A,B)J / HH501(A,B)T / HH501(A,B)E

HH508BR/HH508/HH509/HH509R
CALIBRATION PROCEDURE

Note: The following calibration procedure should perform only by qualified technicians
who have access to the items as following.

Equipment: The class of calibrator had better 10 times greater than the measured meter.

1. Set the jumper position on J1 position.
2. Input DCV 25.6mV to the T1 after the display is stabilized (forward 4 digits), then press " ENTER " key and "01" is displayed.
3. Input DCV 74mV after the display is stabilized, then press "ENTER " key and "OL" is displayed.
4. Input 0°C (K-type) after the display is stabilized, then press "ENTER " key.
5. Don't push any key and the meter will turn off automatically after 10 seconds.
6. After adjustment set the jumper back to J3 position.
7. Turn on the meter then input 0°C (K-type). The display reading reads 0°C if the calibration procedure is right.

1

WARRANTY / DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 13 **months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

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2. Model and serial number of the product under warranty, and	2. Model and serial number of product , and
3. Repair instructions and/or specific problems relative to the product.	3. Repair instructions and/or specific problems relative to the product.

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