

# twilight

INSTRUMENTOS DE MEDICIÓN INDUSTRIAL

**Termohigrometro  
condiciones térmicas  
abatidas USB, Tenmars  
TN-TM188D**

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# TENMARS

## HEAT STRESS WBGT

### METER

#### TM-188 / TM-188D



User's  
Manual



HB2TM18800000

TENMARS ELECTRONICS CO., LTD

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## 1. Preface


Thank you for purchasing our product. Please, read the operating instructions in details before you use this HEAT STRESS WBGT meter, so you will operate the meter correctly. This meter can be operated in industry and home.



### WARNING

Non-compliance warning and/or operating instructions may damage the instrument or its parts or injuring the operator.

## 2. General Description

- Quick-response capacitance sensor.  
Accurate measurement for wet bulb globe temperature(WBGT), black globe temperature(TG),humidity(%RH), air temperature(TA),wet bulb(WET)and dew point(DEW).
- Max/Min and data hold.
- Low battery indication “”.
- LCD display with LED backlight.
- Single data record (TM-188 is able to record 50 data).

- Viewing data records.
- Switch the temperature unit to °C or °F.
- Brass black ball in 50mm diameter.
- WBGT alarm setting.
- Auto power off with disable function.
- Interface: USB PC serial interface.(TM-188D)
- Data logging capacity :12000 records.(TM-188D)
- Sampling interval: Max 24 hours; Min 1 Second. (TM-188D)
- In order to measure the WBGT index, you should refer to the following regulations:  
ISO7243 : Hot environments. Estimation of the heat stress on working man.  
ISO7726 : Ergonomics of the thermal environment-instruments for measuring physical quantities.

**3. Specifications (23°C±5°C)**

**Wet bulb globe temperature (WBGT)**

Unit		Range	Resolution	Accuracy @15~40°C
indoor & Outdoor without sunlight	°C	0~59.0	0.1	±1.0
	°F	32.0~138.0	0.1	±1.8
Outdoor With sunlight	°C	0~56.0	0.1	±1.5
	°F	32.0~132.0	0.1	±2.7
※indoor & outdoor without sunlight: $WBGT = (0.7 \times WET) + (0.3 \times TG)$ Outdoor with sunlight: $WBGT = (0.7 \times WET) + (0.2 \times TG) + (0.1 \times TA)$				

**Air temperature (TA)**

Unit	Range	Resolution	Accuracy @15~40°C
°C	0~50.0	0.1	±0.8
°F	32.0~122.0	0.1	±1.5

**Black globe temperature (TG)**

Unit	Range	Resolution	Accuracy @15~40°C
°C	0~80.0	0.1	±0.6
°F	32.0~176.0	0.1	±1.1

**Relative Humidity (%RH)**

Measurement Range	1%~99%
Accuracy	±3.0%RH(20~80%) ±5.0%RH(<20%, >80%)
Resolution	0.1%


**Dew point temperature (DEW)**

Unit	Range	Resolution
°C	-35.3~48.9	0.1
°F	-31.5~120.1	0.1
The value is calculated from the RH and Air temperature.		

**Wet bulb temperature (WET)**

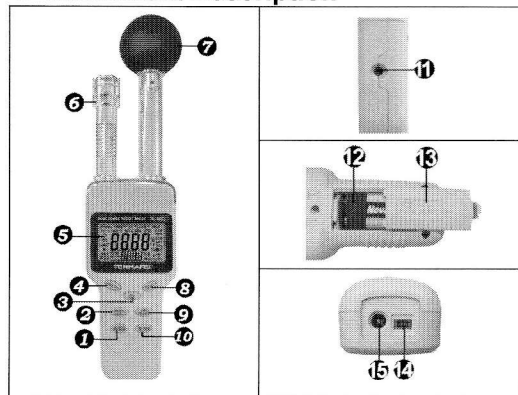
Unit	Range	Resolution
°C	-21.6~50.0	0.1
°F	-6.9~122.0	0.1
The value is calculated from the RH and air temperature.		

- Dimension : 243 x 70 x 50mm (L x W x H).
- Weight : 220g. (Without batteries).
- Sampling Rate : one times per second.
- Power supply : 006P 9V, or AC100~240V DC 9V/ 0.5A(9mm).
- Battery life : 200 hours.
- Operating Temperature & Humidity : 0°C to +50°C, <95%RH. (Non-condensing)
- Storage temperature & humidity : -10°C to +50°C, <70% RH. (Non-condensing)
- Data output : USB PC serial interface(TM-188D)
- LCD:  
52mm(W)x36mm(L) monochrome LCD and backlight.
- Standard accessories:  
006P 9V battery x1.  
User's manual x 1.  
Carrying x1.  
USB cable(TM-188D) x1.  
AC100~240V  
toDC9V/0.5A(9mm)x1(TM-188D) x1. Install  
CD disk(TM-188D) x1.

	<b>WARNING</b> Please place the meter in the environment of high temperature and low humidity for 24 hours after used the meter in the humid environment.
	<b>WARNING</b> In order to ensure the accuracy of this meter, we strongly recommend send the meter back to original factory for maintenance every year.

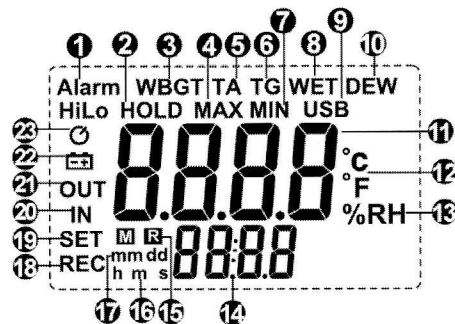
- EMC : This test was designed in accordance with EMC Standards in force and its compatibility has been tested in accordance with EN61326-1(2006).

4. Instrument Description





- |                           |                            |
|---------------------------|----------------------------|
| 1. UP/MAX/MIN             | 9. SEL/Alarm               |
| 2. MODE/SET               | 10. Down/REC               |
| 3. Power/Auto power off   | 11. Earphone jack          |
| 4. UNIT/HOLD              | 12. Battery holder         |
| 5. LCD                    | 13. Battery cover          |
| 6. Temp & humidity sensor | 14. 5 pin mini USB socket. |
| 7. Black globe sensor     | 15. DC power jack          |
| 8. Backlight/MEM          |                            |

5. LCD Description

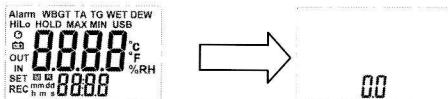


- |                      |                           |
|----------------------|---------------------------|
| 1. Alarm symbol      | 13. Relative Humidity     |
| 2. HOLD symbol       | 14. Secondary display     |
| 3. WBGT              | 15. Read & memory         |
| 4. MAX symbol        | 16. Date symbol           |
| 5. Air temperature   | 17. Time symbol           |
| 6. Black globe temp  | 18. Record symbol         |
| 7. Min symbol        | 19. Set symbol            |
| 8. Wet bulb temp     | 20. Indoor symbol         |
| 9. USB symbol        | 21. Outdoor symbol        |
| 10. Dew point temp   | 22. Low battery symbol    |
| 11. Primary display  | 23. Auto power off symbol |
| 12. Temperature unit |                           |

## 6. Power On/Off

- Press  button to turn on or turn off the meter.
- Display all the symbol: press  button more than 1 second to turn on the meter the firmware version will soon be displayed for one second.


Ex:



## 7. Auto Power Off



- Power off automatically after approx. 15 minutes without using the meter.

## 8. Alarm On/Off

- Press the  button for more than 2 second to turn on or turn off the alarm function.


※ The alarm function will be disable if the HOLD、SET、Viewing Data Records function is enabled.

## 9. Disable Auto Power Off


- When the power is on, press the  button for more than 2 second, to cancel or recovery automatically shutdown. Automatic shutdown feature is enabled If  shows on the screen.

※ The auto power off will be disable if the SET function, USB function, Alarm is enabled.

## 10. LED Backlight



-  : Press this button once to turn on the LCD backlight. The LCD backlight automatically turns off after 15 seconds.

## 11. Temperature Unit

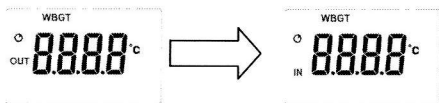
- Press  button to switch the temperature to °C/°F unit.



## 12. Mode


- Press  button for less than 1 second to change the mode. Units switch in order of  
WBGT=>TA=>%RH=>TG=>WET=>DEW.
- Press  button for less than 1 second to change the IN/OUT when the LCD displays WBGT mode.

EX:



- ※ The mode function will be unavailable if the HOLD function and SET function is enabled.

## 13. Data Hold


- Press  button for more than 2 seconds to enable hold function.

Ex:










- ※ The HOLD function will be unavailable if SET function is enabled.

## 14. Single Data Record

- Press  button for less than 1 second to record the current measured result and the "REC" and "R" symbol will also appear on the LCD.
- ※ The single data record function will be unavailable if the HOLD, SET, Viewing data records function is enabled.

## 15. Viewing Data Records

- Press  button for more than 2 seconds to turn on or off the viewing data records.
- Press  or  button to view the number of records.
- Press  button to change the mode. (IN/OUT WBGT、TA、%RH、TG、WET、DEW)
- Press  button to view the date of recorded data.  
(Select the year, month, date, hours, minutes, second)(TM-188D).
- Press  button to switch the temperature unit.
- Press  button for more than 2 seconds to exit the viewing data records mode.

Ex: TM-188





TM-188D






- ※ The viewing data records mode will be unavailable if the HOLD, SET function is enabled.

## 16. AUTO DATA LOGGER(TM-188D)

- Press  button for more than 2 seconds to turn on Auto Data logger mode, and the "REC", "R" symbol will also appear on the LCD. If you want to disable Auto Data logger mode, press  button again for more than 2 seconds, and the "REC", "R" symbol will also disappear on the LCD.
- It is well temporarily turn off if the single data record function and the HOLD function enabled.
- ※ The auto data logger mode will be unavailable if the HOLD, SET function is enabled.

## 17. Maximum/Minimum (MAX/MIN)


- Press  button for more than 2 seconds to enter MAX/MIN mode, and the LCD will display the maximum temperature data and the "MAX" symbol.
- Press  button for less than 1 second to change maximum or minimum.
- Press  button for more than 2 seconds to exit maximum/minimum mode.

※ **The maximum/minimum mode will be unavailable if the HOLD, SET, Viewing Data Records function is enabled.**









## 18. USB (TM-188D)

The LCD will be displayed the "USB" symbol if the USB cable is connected.

## 19. Setting and Calibration

- Press  button for more than 2 seconds to enter into setting mode Fig.A~L(see Table 1):







**Fig. A or B setting:** WBGT alarm High/Low setting:

- If you want to setup High, press  button to select Fig.A.
- If you want to setup Low, press  button to select Fig.B.
- Press  button to start setting, LCD displays will flashing.
- Press  button to change temperature unit.
- Press  button to change the digit you want to adjust.
- Press  ,  button to change the temperature value.
- Press  button to save the setting.







**Fig. C setting year (TM-188D):**

- z setting.







**Fig. D setting month, date (TM-188D):**

- Press  button to select the Fig. D.
- Press  button to start setting , LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press  and  button to increase or decrease the month and data.
- Press  button to save setting.






**Fig. E setting hour, minute (TM-188D):**

- Press  button to select the Fig. E.
- Press  button to start setting.
- Press  button to select the digit you want to adjust.
- Press ,  button to increase or decrease the hour and minute, the hour of the maximum value is 24 and the minimum is 00, the minute of the maximum value is 59 and the minimum is 00.
- Press  button to save setting.

**Fig. F setting second (TM-188D):**







- Press  button to select the Fig.F.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press ,  button to increase or decrease the second, the second of the maximum value is 59 and the minimum is 00.
- Press  button to save setting.

**Fig. G setting sampling interval in hours and minutes (TM-188D):**





- Press  button to select the Fig.G.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press ,  button to increase or decrease the hour and minute, the hour of the maximum value is 24 and the minimum is 00, the minute of the maximum value is 59 and the minimum is 00.

- Press  button to save setting.

**Fig. H setting** sampling interval in second (TM-188D):

- Press  button to select the **Fig.H**.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press  ,  button to increase or decrease the second, the second of the maximum value is 59 and the minimum is 00.
- Press  button to save setting.








**Fig. I setting** clear records:

- Press  button to select the **Fig.I**.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the NO or YES.
- If selected the YES and press  button, the records will be cleared.




Ex:



**Fig. J setting** air temperature offset calibration:








- Press  button to select the **fig.J**.
- Press  button to start setting LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press  ,  button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press  button to change temperature unit.
- Press  button to save setting.

**Fig. K setting** Humidity offset calibration:

- Press  button to select the **Fig.K**.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the digit you want to adjust.

- Press  ,  button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press  button to save setting.

### Fig. L setting black globe temperature offset calibration

- Press  button to select the Fig .L.
- Press  button to start setting, LCD displays will flashing.
- Press  button to select the digit you want to adjust.
- Press  ,  button to increase or decrease the digit, the digit of the maximum value is 9.9 and the minimum is -9.9.
- Press  button to change temperature unit.
- Press  button to save setting.






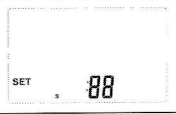






		
Fig.A	Fig.B	Fig.C
		
Fig.D	Fig.E	Fig.F
		
Fig.G	Fig.H	Fig.I
		
Fig.J	Fig.K	Fig.L

Table 1

**20. Thermal hazard prevention standards**

- Screening Criteria for Heat Stress Exposure (WBGT values in°C)

	Acclimatized				Not acclimatized			
	100%	75%	50%	25%	100%	75%	50%	25%
Work (%)	100%	75%	50%	25%	100%	75%	50%	25%
Rest (%)	0%	25%	50%	75%	0%	25%	50%	75%
Light	29.5	30.5	31.5	32.5	27.5	29.0	30.0	31.0
Moderate	27.5	28.0	29.5	31.0	25.0	26.5	28.0	29.0
Heavy	26.0	27.5	28.5	30.0	22.5	24.5	26.5	28.0
Very Heavy	-	-	27.5	29.5	-	-	25.0	26.5

- Example of activities within Metabolic Rate Categories

Categories	Examples Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work
Very heavy	Shoveling wet sand

According to the American Conference of Governmental Industrial Hygienists.[ACGIH](2005)

**21. Precautions**

- Keep the meter away from electromagnetic interference (EMI) which may cause erratic readings.
- The measured values will be inaccurate if you touch the black ball during the test.
- If the shape of black ball is being impacted to deformation, this will lead to inaccurate measured values.

**22. Software installation (TM-188D)**

Please refer to the TM-188D installation CD execution.

**23. Computer grade**

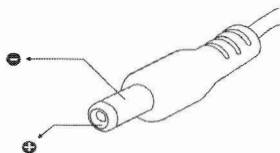
- CPU : Pentium III 1000MHZ.
- RAM : SDRAM 256MB.
- Hard disk : 200MB.
- OS : Windows 2000 · Windows XP.
- Display : 800×600 256 color.

**24. External DC power**

External AC to DC adapter : Voltage 9 V<sub>DC</sub>  
(8~14 V<sub>DC</sub> Max)/500mW.

Socket: Pin positive, Ground casing negative.

External diameter 5.5mm internal diameter  
2.1mm .

**25. Safety and maintenance standards**

- Do not put this device in direct sunlight or where it is hot and/or damp.
- Operating altitude: below 2,000m.

**26. Battery replacement**

	<b>WARNING</b>
	If the LCD displays “  ” symbol, please replace the battery immediately.

Turn off the power and unplug all cables, remove the battery and replace into the new battery.

Please use the correct specification of the battery and correctly installed in the battery holder.



**27. End of life****WARNING**

If not using the meter, please remove the battery to avoid possible damage.



**Caution:** This symbol indicates that equipment and its accessories shall be subject to a separate collection and correct disposal.

# twilight

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