METREL **MD 9880**
TRMS Thermal Multimeter

MD 9880
User manual

Ver. 1.0, code no. 20 752 955

METREL®

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Contents

1. Introduction

Professional True RMS Industrial Digital Multimeter with built-in thermal camera, with colour TFT LCD display, providing fast A/D conversion and high accuracy.
Let it be easy to find and solve the problems in equipment, mechanical devices, installation, buildings and more. Measurements can be done in nearly any environment due to double moulded plastic housing design.

Key features

- 4000 count 2.4" TFT Color LCD display,
- Built-in Thermal camera with Max, Min and Centre crosshair targeting,
- 50Hz frame rate for thermal images,
- DC, AC, AC+DC TRMS Voltage,
- DC, AC,AC+DC TRMS current,
- Resistance and continuity test,
- Diode test,
- Capacitance,
- Frequency,
- Duty Cycle

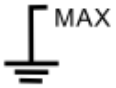
2. Safety

Symbols

This symbol adjacent to another symbol, terminal or operating device indicates that the operator must refer to an explanation in the User manual to avoid personal injury or damage to the meter.

This *WARNING* symbol indicates a potentially hazardous situation that could result in death or serious injury if not avoided.

This *CAUTION* symbol indicates a potentially hazardous situation that may result in damage to the product if not avoided.



Terminals with this marking must not be connected to voltage exceeding 600 V in DC or AC in respect to earth.

Terminals with this marking can be subjected to particularly high voltages during normal use. For maximum safety, the meter and the leads should not be handled while these terminals are energized.

Indicates electrical protections with double insulation.

Description of protection categories by standard IEC/EN 61010

1. **Overvoltage category I**

Equipment with CAT I protection is only to be connected to circuits where protection measures for limiting the transient over-voltages to acceptably low values are observed.
NOTE:
Examples include protected electronic circuits.

2. **Overvoltage category II**

Equipment with CAT II is can be connected to fixed installations with overvoltage protection in place.
NOTE:
Examples include household, office, and laboratory appliances.

3. **Overvoltage category III**

Equipment with CAT Ill can be used as part of fixed installations. It must contain its own overvoltage protection.
NOTE:
Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

4. Overvoltage category IV

Equipment with CAT IV is used at installation connection to the network.
NOTE:
Examples include electricity meters and primary over-current protection equipment.

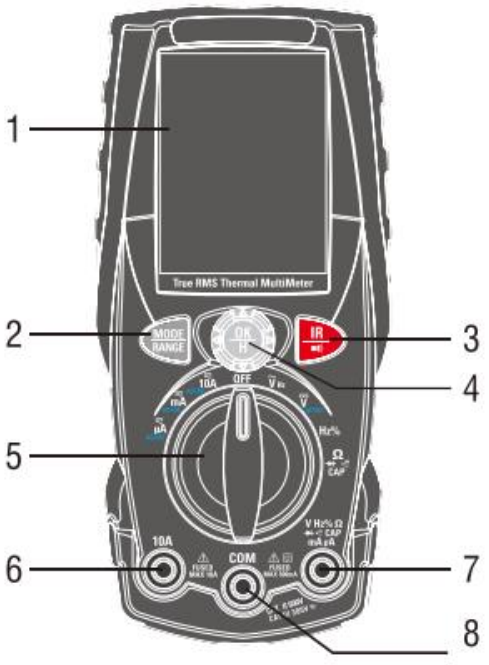
Safety instructions

The meter has been designed to be used safely, but must always be operated with caution. Rules for safe operation are the following.

- DO NOT use with voltage or current exceeding the specified maximum.

Input Protection Limits	
Function	**Maximum Input**
Voltage DC or AC	600 V_{DCRMS} / V_{ACRMS}
Frequency, Resistance, Capacitance Duty Cycle, Diode test, Continuity	
Current AC or DC	10 A
Surge Protection:6kV peak per IEC 61010	

- USE EXTREME CAUTION when working with high voltages.
- DO NOT measure voltage if voltage on the "COM" input jack exceeds 600V above earth.
- NEVER connect the meter leads across a voltage source while the function switch is in the current, resistance, or diode mode. Doing so can damage the meter.
- ALWAYS discharge filter capacitors in power supplies and disconnect the power when making resistance or diode tests.
- ALWAYS turn off the power and disconnect the test leads before opening the covers to replace the fuse or batteries.
- NEVER operate the meter unless the back cover, the battery, and fuse covers are in place and fastened securely.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



3. Product description

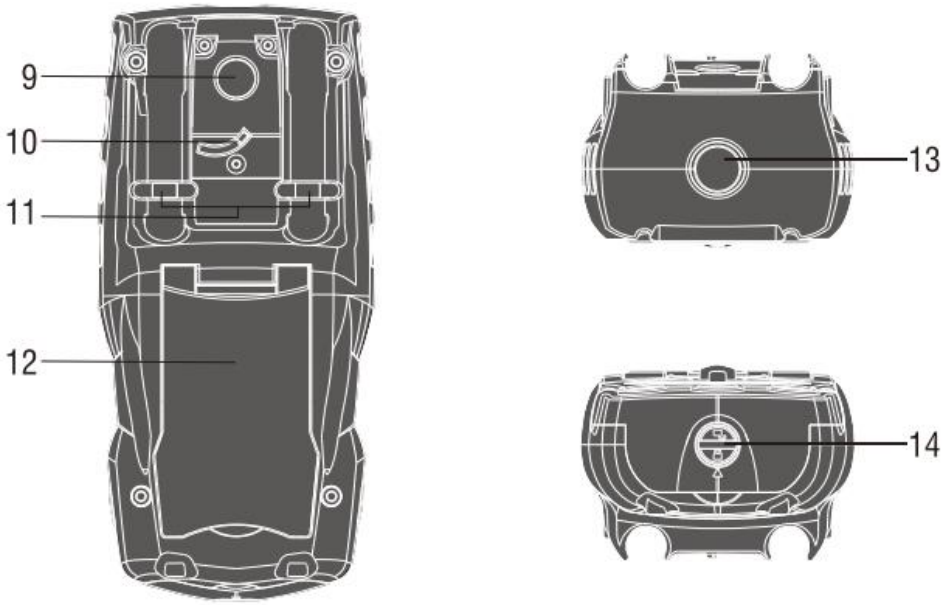
Front and back

1. LCD Display

2. MODE / RANGE button
3. Thermal mode / flashlight button
4. Navigation / menu buttons
5. Rotary switch
6. Positive (+) probe input jack for current.
7. Positive (+) probe input jack for all inputs except A and mA
8. COM(-) Probe input jack
9. Thermal camera lens
10. Lens cover
11. Probe slot
12. Support plate
13. Work light
14. USB interface cover lock

Understanding buttons

The 9 push buttons on the front of the Meter activate features that augment the function selected using the rotary switch, navigate menus or control power to Meter circuits.



1. Cursor soft buttons

Use navigational stick to select item in a menu, adjust display contrast, scroll through information, perform data entry, or enter one of the data modes:

REL ▲ Up navigational button enters Relative zero function; compare new result to the previous.

MAX ◄ Left navigational button enters Maximum function; only save when new result is higher than previous.

PEAK ► Right navigational button enters Peak mode; fast capture of the highest value.

2. Physical buttons

MODE RANGE Short press MODE key to change functions within the chosen on the rotary switch. Long press to switch range.

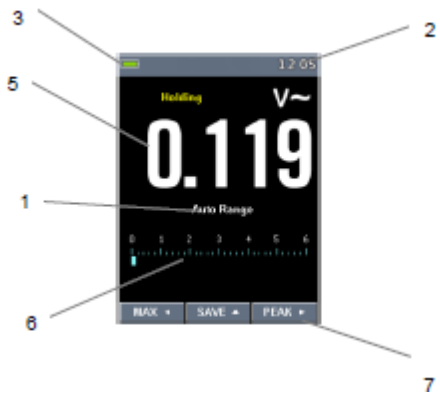
IR Short press the IT key to switch between IR+DMM or DMM modes. Long press to turn the LED flashlight on or off.

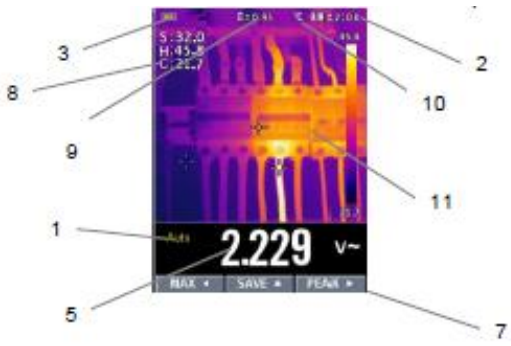
OK H Navigational stick. Short press centre for OK/Hold to freeze the present reading on display. Long press to enter main menu.

Understanding the display

DMM display:

1. Indication of Automatic / Manual mode
2. Indication of the system's time
3. Indication of battery charge level
4. Indication of measuring unit
5. Indication of measuring result
6. Analogue bar-graph
7. Indications associated with function keys
8. Measured temperatures
9. Emissivity
10. Temperature unit
11. IR image

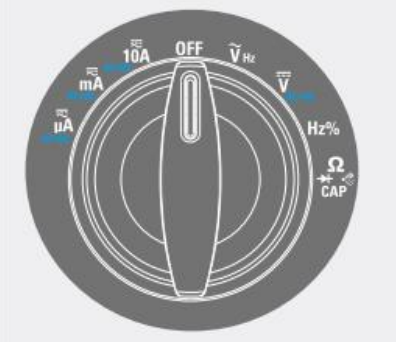




Icons on the display

⚡	Voltage over 30 V	~	AC voltage or current
⚠	Warning	⎓	DC voltage or current
	Flexible coil	≋	AC+DC voltage or
	Iron clamps	)))	current
Δ	Relative mode	→|←	Continuity beeper
⎍	Rising edge time	Ω	Diode function Resistance

Rotary switch



Select a primary measurement function by positioning the rotary switch to one of the icons around its edge. For each function, the Meter presents a standard display for that function (range, measurement units and modifiers). Button choices made in one function do not carry over into another function.

V~	AC voltage measurements
V≋	DC and AC+DC voltage measurements
HZ %	Frequency and Duty measurements
Ω, CAP, →|←)))	Resistance, diode test, capacitance and continuity measurements
A	AC, DC and AC+DC amperes measurements
mA	AC, DC and AC+DC milliamperes measurements
µA	AC, DC and AC+DC microamperes measurements up to 4,000 µA

4. DMM Setup and Measurements

DC Voltage Measurements

CAUTION:
Do not measure DC voltages on a motor while the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

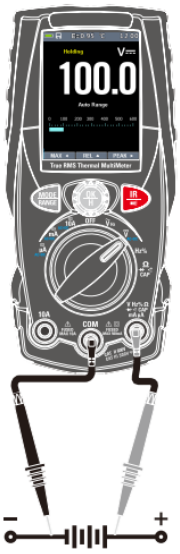


Figure 1: Measuring voltage, resistance, capacitance, frequency and diode

- Set the rotary function switch to the VDC position.
- Insert the black test lead banana plug into the negative COM jack.
- Insert the red test lead banana plug into the positive V jack.
- Read the voltage in the display.

AC+DC Voltage Measurements

CAUTION:
Do not measure DC voltages on a motor while the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the function switch to the VDC position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Press the MODE key to switch the V AC+DC Voltage function
- Read the AC+DC voltage in the display.

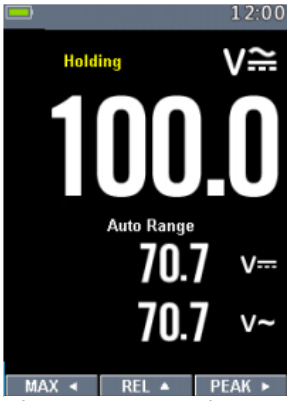


Figure 2: Screen when measuring AC and DC voltage

AC Voltage Measurements

WARNING: Risk of electrocution. The probe tips may not be long enough to contact the live parts inside some 240V outlets for appliances if the contacts are recessed deep. Therefore, the meter may read 0 on a live outlet. Make sure the contact is made before assuming no voltage is present.
CAUTION:
Do not measure DC voltages on a motor while the circuit is being switched ON or OFF. Large voltage surges may occur that can damage the meter.

- Set the rotary function switch to the VAC position.
- Insert the black test lead banana plug into the negative COM jack. Insert red test lead banana plug into the positive V jack.
- Read the voltage in the main display

Frequency Measurements

- Set the rotary function switch to the Hz% position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Read the Frequency in the display.
- Press the MODE key to switch the Duty cycle functions.
- Read the Duty cycle in the display.

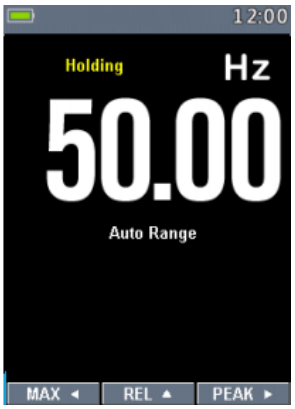


Figure 3: Measuring frequency

Resistance Measurements

WARNING:
To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

- Set the rotary function switch to the Ω CAP ⊣))) position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive Ω Jack.
- Read the resistance in the display

Continuity Check

WARNING:
To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any resistance measurements. Remove the batteries and unplug the line cords.

- Set the rotary function switch to the Ω CAP ⊣))) position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Press the MODE key to switch to the continuity function.
- If the resistance is less than approximately 50 Ω, the audible signal will sound. If the circuit is open, the display will indicate “O.L”.

Diode Test

- Set the rotary function switch to the Ω CAP ⊣))) position.
- Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into the positive V jack.
- Press the MODE key to switch to the Diode function.
- For ward voltage will typically indicate 0.400 to 3.000V

Reverse voltage will indicate "O.L”. Shorted devices will indicate near 0 V and an open device will indicate "OL” in both polarities.

Capacitance Measurements

WARNING:
To avoid electric shock, disconnect power to the unit under test and discharge all capacitors before taking any capacitance measurements. Remove the batteries and unplug the line cords.

- Set the rotary function switch to the Ω CAP position.
- Insert the black test lead banana plug into the negative COM jack. Insert the red test lead banana plug into the positive V jack.
- Press the MODE key to switch to the Capacitance function.
- Read the capacitance value on the display.

DC Current Measurements

- Insert the black test lead banana plug into the negative COM jack.
- For current measurements up to 4000µA DC, set the rotary function switch to the µA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 400mA DC, set the rotary function switch to the mA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 10 A DC, set the rotary function switch to the 10 A position and insert the red test lead banana plug into the 10A jack.
- Press the MODE button to indicate "⎓" on the display.
- Read the result on the display.

AC Current Measurements

- Insert the black test lead banana plug into the negative COM jack.
- For current measurements up to 4000µA AC, set the rotary function switch to the µA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 400mA AC, set the rotary function switch to the mA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 10 A AC, set the rotary function switch to the 10 A position and insert the red test lead banana plug into the 10A jack.
- Press the MODE button to indicate "~" on the display.
- Read the result on the display.

Figure 4: Leads positioning for current measurements

AC+DC Current Measurements

- Insert the black test lead banana plug into the negative COM jack.
- For current measurements up to 4000µA AC+DC, set the rotary function switch to the µA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 400mA AC+DC, set the rotary function switch to the mA position and insert the red test lead banana plug into the µAmA jack.
- For current measurements up to 10 A AC+DC, set the rotary function switch to

the 10 A position and insert the red test lead banana plug into the 10A jack.
- Press the MODE button to indicate "≅" on the display.
- Read the current in the display.

Using RANGE

In Autorange mode, the instrument selects the most appropriate measurement ratio automatically depending on the input magnitude.
- Press the RANGE key to activate the manual ranging mode and disable the Auto range function. The message "Manual Range" will appear in the middle of the display instead of "Auto Range".
- Press the RANGE key to change measuring range. The relevant decimal point will change its position.
- The RANGE key cannot be used in the function switch positions →+ ·)) % 10A≅.
- If a reading is higher than the maximum measurable value for selected range, the indication "O.L" appears on the display.
- Press and hold the RANGE key for more than 1 second to exit the manual mode and restore the Auto range mode.

Hold Mode

To freeze the display of any function, press key HOLD. Press again to release freeze.

Capturing Minimum and Maximum Values

The MAX MIN Record mode captures minimum and maximum input values. When the input falls below the recorded minimum value or rises above the recorded maximum value, the Meter beeps and records the new value. This mode is intended for capturing intermittent readings, recording minimum and maximum readings unattended or recording readings while equipment operation precludes watching the Meter. To activate the MAX MIN mode, push the navigation stick left toward soft button MAX. If the Meter is already in MAX MIN function, pushing navigational stick left causes the Meter to turn off MAX MIN function.

Relative Values

To activate the relative mode, press the navigational stick up to soft key labelled REL. If the Meter is already in the relative function, pressing the soft button the Meter to turn it off.

Capturing Peak Values

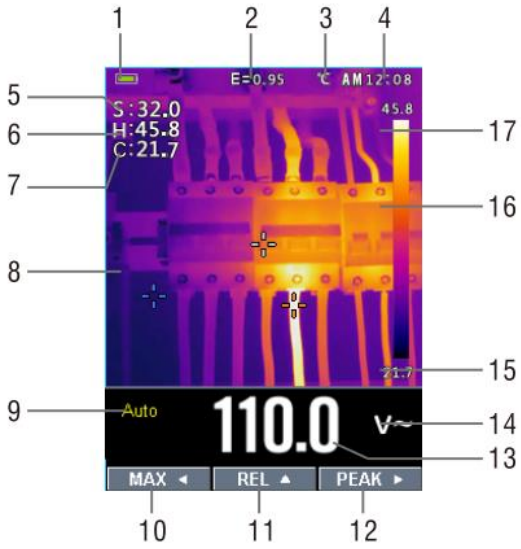
To activate the peak mode, press the navigational stick right to soft key labelled PEAK. If the Meter is already in the peak function, pressing the soft button causes the Meter to turn it off. Peak is the highest value in a single period of the waveform. Maximum is the highest value since the mode has been activated.

5. Thermal camera and DMM operation

Thermal camera basics

Meter allows using the thermal camera and multimeter at the same time. Multimeter result is displayed below the thermal image.

- Press the red 'IR" button to open the Thermal camera. The palette used in the thermal image in (figure) is set to IRON. More are available in the Settings.
- Open the protective lens cover on the back of the meter to use the thermal camera.



1. The battery charge indicator.
2. The currently selected emissivity value. Use the Settings Menu to change it.
3. The temperature unit icon. Use Settings Menu to select °C, °F, or K.
4. Current time of day display
5. Centre crosshair of the thermal camera temperature measurement where the centre spot temperature is taken.
6. Maximum temperature crosshairs, where the highest temperature in the scene is detected.
7. Minimum temperature crosshairs, where the lowest temperature in the scene is detected.
8. Thermal display.
9. Auto/manual range icon.
10. MAX soft button.
11. REL soft button.
12. PEAK soft button.
13. DMM measurement result.
14. DMM result unit.
15. Lowest temperature and darkest colour measured in the current frame.
16. The thermal scale shows the colour and associated temperature range for thermal images. The lighter the colour, the higher the temperature and vice versa.
17. Highest temperature and lightest colour measured in the current frame.

Using the thermal camera

Set the function switch to any position to turn the Meter ON.
Press the "IR" button to switch to the thermal camera mode.
Target the object by the thermal camera lens. The display will show the temperature measurement in the upper left hand corner for the targeted area along with the currently selected emissivity value.
In the Thermal imaging mode the display crosshairs can be used to assist in

targeting, the highest temperature will be auto marked by a red cross, and the lowest temperature will be auto marked by a blue cross. All markers can be turned ON or OFF in the Settings. Multimeter continues to operate normally while the camera is on. Press the HOLD button to freeze the thermal image frame.

Lens and camera field of view

This table lists the horizontal Filed of view (FOV), vertical FOV and IFOV for lens.

Focal Length	Horizontal FOV	Vertical FOV	IFOV
7.5mm	21°	21°	4.53mrad

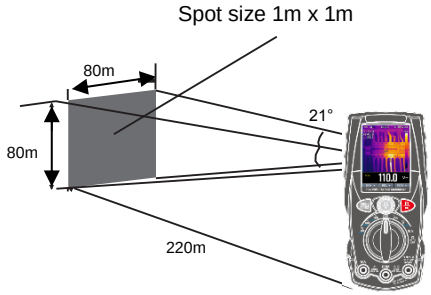
IFOV (Instantaneous Field of View) is the size of the object caught in the single pixel on the detector. It is given as spatial angle with unit mrad. It depends on the lens and detector size.
$DTS_{theoretical}$ is distance to spot. It is the distance at which the given size spot can be measured. At unity distance, the IFOV can be then directly translated to spot size. For accurate temperature measurement, the spot has to be about three times the size of $DTS_{theoretical}$.

$$IFOV = \frac{Pixel\ size}{Lens\ focal\ length}$$

$$DTS_{theoretical} = \frac{1}{IFOV}$$

$$DTS_{measured} = \frac{DTS}{3}$$

EXAMPLE:
The FOV of the camera is 21° x 21°, which is about 0.36x 0.36 rad. The detector resolution is 80x80 pixel. Each pixel then covers about 4.53 mrad, which is IFOV. This means that at 1m distance, each pixel is covering 4.53mm^2 actual space. Temperature can be accurately measured on about 13.6mm^2 at 1m distance. If turned the other way, DTS can be the calculated distance at which each pixel will



cover 1m^2 space, which is about 220m. Thermal camera uses 7,5mm lens, so knowing the IFOV gives the pixel size of the detector as 34um.

Using the Multimeter with the thermal camera

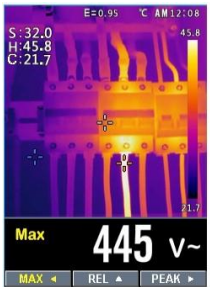


Figure 5: DMM and IR view in MAX mode

When using the IR+DMM mode, the following work the same as in DMM only mode:

- MODE key
- RANGE key
- HOLD key and
- REL Function.

1. Capturing MAX and MIN Values in the IR+DMM mode

To activate the max min mode, press the soft key labelled MAX to display max value.
If the Meter is already in the MAX/MIN function, then the soft button will cycle through MAX, MIN and current values. Press and hold the soft button to tun the mode off.

2. Capturing Peak Values on IR+DMM mode

To activate the peak mode, press the soft key labelled PEAK. It will display Peak max value. If the Meter is already in the peak function, then pressing the button will cycle through Peak min value and current measurement. Press and hold the soft key for more than one second to turn the mode off.

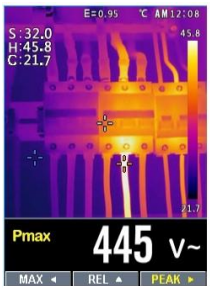


Figure 6: DMM and IR view in PEAK mode

6. Settings Menu

Using Settings Menu

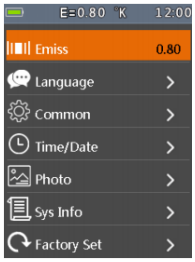


Figure 7: Settings main menu

- Press OK button to open the Setting s Menu, as show below.
- Press UP / DOWN on navigation stick to select menu item or change the value of currently focused item.
- Press OK/HOLD button to enter the submenu or set focus on the current selected item. Press left on navigation stick to return to the previous menu.
- To exit settings menu press IR or MODE buttons.

Settings details

1. Palette mode

Thermal camera has five palettes available:
Use navigation stick and OK button to select one of the display colour palettes.

2. Temp Unit

3. To change, press OK button with this option in focus. The colour of the set value will change to black: ℃.Use up and down on navigations stick to change to °F and K, and use OK button to exit focus state. The colour of set value will change back to white: K.
4. Measure

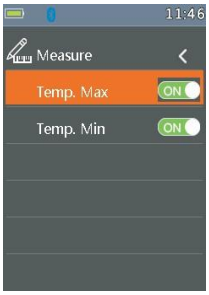


Figure 8: Measure menu

Press OK button to enter Measure menu. Two selections are available: Temp. Max and Temp. Min. Press OK button to set currently selected item on or off.

- Temp. Max: This option enables thermal camera to automatically detect the highest temperature point.
- Temp. Min: This option enables thermal camera to automatically detect the lowest temperature point.

5. Emissivity

Press OK button to set focus on this option. In focus state, use up or down on navigational stick to increase or decrease emissivity value, then use ESC or OK button to exit focus state. The available range is 0.01 to 0.99 in 0.01 steps.

6. Language

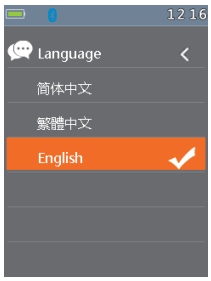


Figure 9: Language menu

Press OK button to enter language menu. Three options are available: Simplified Chinese, Traditional Chinese and English. use up or down on navigational stick to select language and use OK button to set.

7. Setup

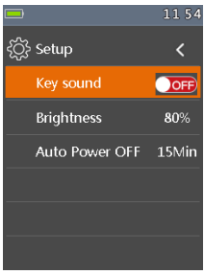


Figure 10: Setup menu

Press OK button to enter setup menu. Three options are available:

- Key sound: Use OK button to set sounds on keys on or off.
- Brightness: Press OK button to set focus on this option. In focus state, use UP/DOWN button to change LCD's brightness, use ESC orOK button to exit focus state. The available brightness's range is 100% to 10% in 10% steps.
- Auto Off: Press OK button to set focus on this option. In focus state, use UP/DOWN button to choose the time period after which the meter enters the sleep mode.

8. Time/Date

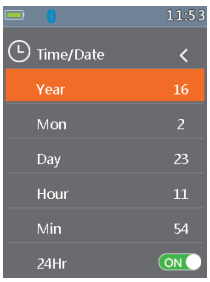


Figure 11: Date/time menu

Press OK button to enter Date/Time menu. In this menu, year, month, day, hour, minute and time format can be set by focusing them and using navigational stick. The changes take effect after exiting the settings menu.

9. Information

Figure 12: Information screen

Figure 13: Factory settings menu

Press OK button to enter system information menu. This menu contains software version, hardware version and thermal camera version.

- Factory Set

When Factory Set option is selected, the dialog box will be displayed as shown above. Select 'YES' button to reset system parameters.

7. Technical specifications

General

Display	TFT LCD screen, 4000 counts with bar graph
Display resolution	240x320 pixels resolution
Sampling speed	3/s typical
Battery	Rechargeable 3.7V 1400mA lithium ion battery (not user-replaceable)
Battery life	6 hours typical
Battery Charger	5VDC 1A USB charger
Drop test	2 m
Reference temperature	18 to 28°C
Operating Temperature	5 to 40°C
Storage Temperature	-30 to 55°C
Operating relative humidity	< 80%HR
Storage temperature	-20° ÷ 60°C
Storage humidity	< 80%HR
Size	175 X 85 X 55mm (7 X 3 X 2in)
Weight	540 g
Safety standard	IEC/EN61010-1
EMC standard	IEC/EN 61326-1
Insulation	double
Pollution level	2
Overvoltage category	CAT II 600V,CAT III 300V
Max operating altitude:	2000 m

Thermal camera

Field of view (FOV)	21° x 21°
Minimum focus distance	0.5m
IR resolution	80 x 80 pixels
Spatial resolution (IFOV)	4.53mrad
Thermal sensitivity/NETD	< 0.1°C @ +30°C (+86°F) / 100 mK
Image frequency	50Hz
Focus	Fixed focus
Focal length	7.5mm
Focal Plane Array / FPA Spectral range	Uncooled microbolometer / 8–14 µm
Object temperature range	–20°C to +260°C
Accuracy	±3°C (±5.4°F) or ±3% of reading (valid at environment temperature 10°C–35°C, object temperature >0°C)

Accuracy is calculated as [%reading + (num. digits*resolution)] at 18°C–28°C; <75% HR

DC voltage

Range	Resolution	Accuracy*	Input impedance	Overcharge protection
400.0 mV	0.1 mV	± (0.8 % reading + 8 d)	>10 MΩ	600 VDC / AC_{rms}
4.000 V	0.001 V	± (0.5 % reading + 5 d)		
40.00 V	0.01 V			
400.0 V	0.1 V	± (0.8 % reading + 5 d)		
600 V	1 V			

AC voltage

Range	Resolution	Accuracy		Overcharge protection
		50 – 60 Hz	**61 Hz – 1000 Hz**	
400.0 mV	0.1 mV	± (1.0 % reading + 5 d)	± (2.5 % reading + 5 d)	600 VDC / AC_{rms}
4.000 V	0.001 V			
40.00 V	0.01 V			
400.0 V	0.1 V			
600 V	1 V			

Accuracy is specified from 10% to 100% of the measuring range for a sine wave.
Input impedance >9MΩ.
Accuracy of PEAK function: 10% of reading; response time 1 ms.

AC+DC TRMS voltage

Range	Resolution	Accuracy*	Input impedance	Overcharge protection
400.0 mV	0.1 mV	± (2.5 % reading + 20 d)	>10 MΩ	600 VDC / AC_{rms}
4.000 V	0.001 V			
40.00 V	0.01 V			
400.0 V	0.1 V			
600 V	1 V			

DC current

Range	Resolution	Accuracy*	Overcharge protection
400.0 µA	0.01 µA	± (1.5 % reading + 5 d)	Fuse 500 mA / 600 V
4000 µA	1 µA		
40.00 mA	0.01 mA		
400.0 mA	0.1 mA	± (1.5 % reading + 8 d)	
10.0 A	0.01 A	± (2.0 % reading + 8 d)	Fuse 10A / 600 V

AC current

Range	Resolution	Accuracy*	Overcharge protection
400.0 µA	0.01 µA	± (2.0 % reading + 5 d)	Fuse 500 mA / 600 V
4000 µA	1 µA		
40.00 mA	0.01 mA		
400.0 mA	0.1 mA		
10.0 A	0.01 A	± (2.5 % reading + 5 d)	Fuse 10A / 600 V

* Accuracy is specified from 5% to 100% of the measuring range for a sine wave, frequency 50–60 Hz.
Accuracy of PEAK function: ±10 % of reading;
AC+DC TRMS Current accuracy for frequencies 50 Hz–1 kHz: ± (3.0%reading + 20dgt)

Diode test

Test current Max voltage for open circuit
<1.5mA 3.3VDC

Resistance and continuity test

Range	Resolution	Accuracy*	Buzzer	Overcharge protection
400.0 Ω	0.1 Ω	± (1.0 % reading + 10 d)	>50 Ω	600 VDC / AC_{rms}
4.000 kΩ	0.001 kΩ	± (1.0 % reading + 5 d)		
40.00 kΩ	0.01 kΩ			
400.0 kΩ	0.1 kΩ			
4.000 MΩ	0.001 MΩ			
40.00 MΩ	0.01 MΩ	± (2.5 % reading + 10 d)		

Frequency (electronic circuits)

Range	Resolution	Accuracy	Overcharge protection
40.00Hz–10kHz	0.01Hz–0.001kHz	±0.5%reading	600VDC / AC_{rms}

Sensitivity: 2 V_{rms}

Frequency (electronic circuits)

Range	Resolution	Accuracy	Overcharge protection
40.00Hz	0.01Hz	±(0.20%rdg +5digits)	600VDC/ACrms
400.0Hz	0.1Hz		
4.000kHz	0.001kHz		
40.00kHz	0.01kHz		
400.0kHz	0.1kHz		
4.000MHz	0.001MHz		
10.00MHz	0.01MHz		

Sensitivity:
> 2 Vrms (@ 20%–80% duty cycle) and f < 100 kHz;
> 5 Vrms (@ 20%–80% duty cycle) and f > 100 kHz.

Duty Cycle

Range	Resolution	Accuracy
10.0%+90.0%	0.1%	±(1.2%reading + 2digits)

Pulse frequency range: 40 Hz–10 kHz;
Pulse amplitude: ± 5 V at pulse width 100us–100ms.

Capacity

Range	Resolution	Accuracy	Overcharge protection
40.00 nF	0.01 nF	±(3.0 % reading + 20d)	600 VDC/AC_{rms}
400.0nF	0.1 nF	±(3.0 % reading + 5d)	
4.000 µF	0.001 µF	±(3.0 % reading + 5d)	
40.00 µF	0.01 µF	±(3.0 % reading + 5d)	
400.0 µF	0.1 µF	±(3.0 % reading + 5d)	
4000 µF	1 µF	±(3.5 % reading + 20d)	