UNI-T

UT305A/B/C
UT306A/B/C
Operating Manual

Infrared Thermometer

Introduction

The Model UT305A/B/C and UT306A/B/C Infrared Thermometers (hereafter, the "Thermometer") can determine the surface temperature by measuring the amount of infrared energy radiated by the target's surface. They have different Distance to Spot(D:S) ratios and different temperature ranges, read the manual for details.

The Thermometer is a non-contact infrared instrument designed with low power consumption, which can make the measurements much faster and easier and meanwhile save you amount of time from frequent battery replacement. It can be powered by the battery or the source with USB connected to.

This Manual uses UT305A as illustration.

Contacting Uni-Trend

To contact Uni-Trend. call (852) 2950 9168 or visit Uni-Trend web site at

Safety Information

⚠ **Warning**
A warning identifies conditions and actions that pose hazards to the user. To avoid electrical shock or personal injury, follow these guidelines:
- Do not point the laser toward anyone's eye or allow the laser to strike the eye from a reflective surface.
- Before using the Thermometer inspect the case. Do not use the Thermometer if it appears damaged. Look for cracks or missing plastic.
- Replace the battery as soon as the battery indicator ▱ appears.
- Do not use the Thermometer if it operates abnormally. Protection may be impaired. When in doubt, have the Thermometer serviced.
- Do not operate the Thermometer around explosive gas, vapor, or dust.
- To avoid a burn hazard, remember that highly reflective objects will often result in lower than actual temperature measurements.
- Do not use in a manner not specified by this manual or the protection supplied by the equipment may be impaired.
- To avoid damaging the thermometer or the equipment under test protect them from EMF (electro-magnetic fields) from arc welders, induction heaters, etc; static electricity; thermal shock (caused by large or abrupt ambient temperature changes – all 30 minutes from the Thermometer to stabilize before use); placed on or near objects of high temperature.

Table 1 and Figure 1 show various symbols and safety markings that are on the Thermometer and in this manual.

Table 1. Symbols

Symbol	Explanation
⚠	Risk of danger. Important information. See Manual.
☀	Warning. Laser
CE	Conforms to Standards of European Union
▱	Battery

Figure 1. Symbols and Safety Markings

Features

The Thermometer includes:
- Single Laser Pointer
- USB-Powered
- Level 2 White Backlight (With USB connected, this feature will be on automatically).
- Current Temperature Plus MIN, MAX, DIF, AVG Display Functions
- Adjustable Emissivity
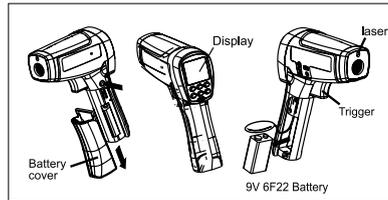- Trigger Locked
- ℃/℉ Selectable
- Tripod mount
- One 9V Battery

Figure 2. Infrared Thermometer

Display

The primary temperature display reports the current or last IR temperature reading until the 8-second hold time elapses.

The secondary temperature display reports a choice of maximum, minimum, difference between maximum and minimum temperature or average value.

You can toggle through the maximum, minimum, difference and average IR temperatures anytime the display is on by pressing the yellow button. The MAX, MIN, DIF and AV temperatures are constantly calculated and updated when the trigger is pressed. After the trigger is released, the MAX, MIN, DIF and AV temperatures are held until the Thermometer is auto power off.

Notes
When the battery is low ▱, appears on the display. The last selection (MAX/MIN/DIF/AVG) is maintained on the secondary display even after the Thermometer has been turned off, providing the batteries have not failed.
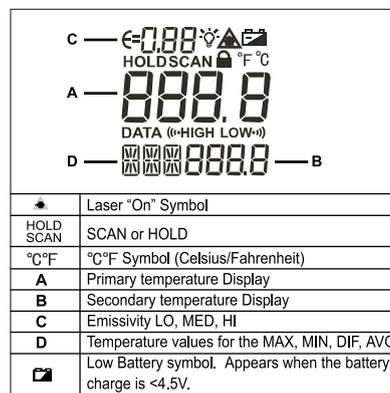

Figure 3. Thermometer Display

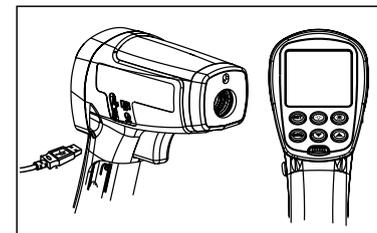|	
☀	Laser "On" Symbol
HOLD SCAN	SCAN or HOLD
℃℉	℃℉ Symbol (Celsius/Fahrenheit)
A	Primary temperature Display
B	Secondary temperature Display
C	Emissivity LO, MED, HI
D	Temperature values for the MAX, MIN, DIF, AVG
▱	Low Battery symbol. Appears when the battery charge is <4.5V.

Buttons and Connector

Figure 4. Buttons and Connector

Button / Connector	Description
YELLOW Button	Press YELLOW button to toggle between MAX, MIN, DIF, AVG, HAL, LAL, DATA and T-C options. Press YELLOW to turn the Thermometer on again and displays the last measurement result.
SET	Press to enter set up mode. Refer refer to the below User Setup topics for details.
☼	Backlight button. To step through Backlight Level one, Level Two and Backlight Off status, accompanied by on/off ☼ icon.
☀	Press ☀ to turn the laser on and off. After laser is on, ⚠ will be shown.
DATA	Data transfer button to be used with ▼▲, refer to User Setup topics for details.
▼	When the Thermometer enters the setup up mode, press ▼ to select an option, refer to the below User Setup topics for details.
▲	When the Thermometer enters the user setup mode, press ▲ to select an option, refer to the below User Setup topics for details.
TC-K jack	Insert the K type thermocouple into this jack to carry out contact temperature measurement.
POWER jack	Insert the power adaptor into this jack.
USB port	Connect USB cable for supply power to the unit or data transmission with the software; Backlight will automatically turn on;

How the Thermometer Works

Infrared thermometers measure the surface temperature of an opaque object. The Thermometer's optics sense infrared energy, which is collected and focused onto a detector. The Thermometer's electronics then translate the information into a displayed temperature reading which appears on the display. The laser is used for aiming purposes only.

Operating the Thermometer

The Thermometer turns on when you press the trigger. The Thermometer turns off when no activity is detected for 8 seconds.

To measure temperature, aim the Thermometer at the target, pull and hold the trigger. Release the trigger to hold a temperature reading.

Be sure to consider distance-to-spot size ratio and filed of view. The laser is used for aiming only.

Locating a Hot or Cold Spot

To find a hot or cold spot, aim the Thermometer outside the target area. Then, slowly scan across the area with an up and down motion until you located the hot or cold spot. See Figure 5.
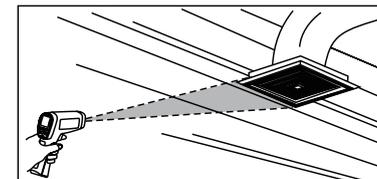

Figure 5. Locating Hot or Cold Spot

Distance and Spot Size

As the distance (D) from the target being measured increases, the spot size (S) of the area measured by the unit becomes larger. The spot size indicates 90% encircled energy. The maximum D:S is obtained when the Thermometer is 1000mm (100in) from the target resulting in a spot size of 20mm (2 in). See Figure 6.
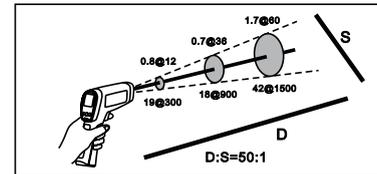

Figure 6. Distance and Spot Size

Field of View

Make sure that the target is larger than the spot size. The smaller the target, the closer you should be to it. See Figure 7.
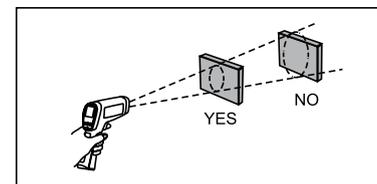

Figure 7. Field of View

Emissivity

Emissivity describes the energy-emitting characteristics of materials. Most organic materials and painted or oxidized surfaces have an emissivity of about 0.95.

If possible, to compensate for inaccurate readings that may result from measuring shiny metal surfaces, cover the surface to be measured with masking tape or flat black paint (<150℃ / 302℉) and use the high emissivity setting. Allow time for the tape or paint to reach the same temperatures as the surface beneath it. Measure the temperature of the tape or painted surface. If you cannot use paint or use tape, then you could improve the accuracy of your measurements with the emissivity selector. Even with emissivity selector, it can be difficult to get a completely accurate infrared measurement of a target with a shiny or metallic surface.

User Setup

Press **SET** button to step through Emissivity Setup→ Trigger Lock→Switching℃/℉→ Normal Measurement. Press **YELLOW** button to save and exit Setup.

Emissivity Setup

This feature is to change the value of emissivity. To adjust values for emissivity, follow the below procedure:
1. Press **SET** to select emissivity set up, icon **E=0** on the display is blinking.
2. Press ▲ to increase the value by 0.01 or press and hold ▲ to access quick setting. The maximum value is 1.00.
3. Press ▼ to decrease the value by 0.01 or press and hold ▼ to access quick setting. The minimum value is 0.10.

The Thermometer allows you to adjust the unit's emissivity for the type of surface before measured. Refer to Table 2. But it is only a typical case. You could base on your own case and materials to have different setting.

Table 3. Surface Emissivity

Measure Surface	Switch Setting	Measure Surface	Switch Setting
METALS			
Aluminum		**Iron Cast**	
Oxidized	0.2-0.4	Oxidized	0.6-0.95
Alloy A3003		Unoxidized	0.2
Oxidized	0.3	Molten	0.2-0.3
Roughened	0.1-0.3	**Iron Wrought**	
Brass		Dull	0.9
Burnished	0.3	**Lead**	
Oxidized	0.5	Rough	0.4
Copper		Oxidized	0.2-0.6
Oxidized	0.4-0.8	**Molybdenum**	
Electrical Terminal Blocks	0.6	Oxidized	0.2-0.6
Haynes		**Nickel**	
Alloy	0.3-0.8	Oxidized	0.2-0.5
Inconel		**Platinum**	
Oxidized	0.7-0.95	Black	0.9
Sandblasted	0.3-0.6	**Steel**	
Electoropolished	0.15	Cold-Rolled	0.7-0.9
Iron		Ground Sheet	0.4-0.6
Oxidized	0.5-0.9	Polished Sheet	0.1
Rusted	0.5-0.7	**Zinc**	
		Oxidized	0.1
NON-METALS			
Asbestos	0.95	**Glass**	
Asphalt	0.95	Plate	0.85
Basalt	0.7	**Gravel**	0.95
Carbon		**Gypsum**	0.8-0.95
Unoxidized	0.8-0.9	**Ice**	0.98
Graphite	0.7-0.8	**Limestone**	0.98
Carborundum	0.9	**Paper(any colour)**	0.95
Ceramic	0.95	**Plastic**	
Clay	0.95	Opaque	0.95
Concrete	0.95	**Soil**	0.9-0.98
Cloth	0.95	**Water**	0.93
		Wood, (natural)	0.9-0.95

Trigger Lock Setup.

This feature is to set trigger lock or unlock
To lock or unlock the trigger, follow the below procedures:
1. Press **SET** to select trigger lock setting, the 🔒 is blinking.
2. Press ▼or▲ to select ON or OFF.

When the trigger is locked, the Thermometer is on for continuous measurement, there is no need to pull the trigger.

When the trigger is unlocked, user needs to pull the trigger for measurement. When you release the trigger, the Thermometer will keep hold the measurement result automatically.

Switching ℃/℉

This feature is to select ℃ or ℉ .
1. Press **SET** to choose ℃ / ℉ selection mode,
2. Press ▼or▲ to select ℃ or℉ .

HAL Setup

This feature is to set up the high limit. When carrying out measuring, the Thermometer beeps continuous if the temperature is over this limit.
1. Press **YELLOW** button to toggle to HAL mode.
2. Press ▲ to increase the value by 0.1 or press and hold ▲ to access quick setting until the maximum value is reached. The thermometer stops and beeps.
3. Press ▼ to decrease the value by 0.1 or press and hold ▼ to access quick setting until the minimum value is reached or it lower than LAL value. The thermometer stops and beeps.
4. Press **SET** to confirm this setting, the LCD displays **HIGH**
5. This feature is not valid when carrying out measurement with TC-K type thermocouple
6. HAL value cannot set below the LAL value.

LAL Setup

This feature is to set up the low limit. When carrying out measuring, the Thermometer beeps continuous if the temperature is below this limit.
1. Press **YELLOW** button to toggle to LAL mode.
2. Press ▲ to increase the value by 0.1 or press and hold ▲ to access quick setting until the maximum value is reached or higher than HAL value. The thermometer stops and beeps.
3. Press ▼ to decrease the value by 0.1 or press and hold ▼ to access quick setting until the minimum value is reached. The thermometer stops and beeps.

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4. Press **SET** to confirm this setting, the LCD displays **LOW**
5. This feature is not valid when carrying out measurement with TC-K type thermocouple
6. HAL value cannot set higher than the LAL value.

DATA
This feature is to store the data measuring under infrared mode.
1. The maximum number of data to be stored is 99.
2. When the storage is empty, it displays "--- . ---"
3. Under non-measurement mode, press and hold DATA and ▼ for 8 seconds to clear the stored data, the Thermometer beeps.
4. Under measurement mode, press **YELLOW** button to toggle to DATA mode.
5. Press ▲ or ▼ to select the location of storing the data.
6. Press **DATA** to store the value.

TC-K Thermocouple Measurement
This feature is to measure temperature with K type thermocouple.
1. Press **YELLOW** button to toggle to T-C mode. The LCD display shows OL before the thermocouple is connected.
2. Connect the K type thermocouple, press the trigger to start measuring. The LCD display shows the reading.
3. Release the trigger, the reading is kept, LCD shows T-C. The temperature reading is shown on the bottom of right hand side.

HOLD
The display will remain activated 8 seconds after the trigger is released. HOLD appears in the upper middle of the display. When the trigger is pulled again, the Thermometer will begin measuring in the last function selected.

Typical Measurements
This section describes a variety of measurements often performed by technicians.

Operation Tips:
● User could select to turn on or off the backlight and laser whenever you are making readings with the Thermometer. But if you are using USB to power up the Thermometer, the two levels white colour backlight will be on automatically.
● Relatively high emissivity normally means emissivity setting of about 0.95.
● Relatively low emissivity normally means emissivity setting of about 0.30.
● When user cannot identify the emissivity of the object to be measured, user could cover the surface to be measured (temperature >150℃) with black electric tape (emissivity of about 0.95). Allow time for the tape to reach the same temperature as the object to be measured. Measure and record the temperature of the tape. Target the Thermometer to the object to be measured, adjust the emissivity setting to make it as the same temperature as the tape. At this time, the Thermometer emissivity setting is close to the emissivity of the object to be measured, measurement could be started.

Testing Contactors (Starters)
1. Press **SET** to select emissivity. Press ▼/▲ to select relatively low emissivity for bright contacts, or 0.7 mid level for darkened contacts.
2. Press **YELLOW** button to select MAX.
3. Measure line and load side of one pole without releasing trigger
4. A temperature difference between the line and load sides of a pole indicate increased resistance of one point and a contactor may be failing.

Testing Enclosed Relays
1. Press **SET** and then press ▼/▲ to set emissivity to relatively low for uninsulated connectors or relatively high for plastic encased relays or for bakelite enclosed relays or insulated connectors.
2. Press **YELLOW** button to select MAX.
3. Start to scan.
4. Measure the relay casing, looking for hot spots.
5. Measure electrical connections on relay terminals looking for hot spots.

Testing Fuses and Buss Connections
1. Press **SET** and then press ▼/▲ to set emissivity to relatively high for paper covered fuse body or insulated connections.
2. Press **YELLOW** button to select MAX.
3. Scan the paper covered length of fuse.
4. Without releasing the trigger, scan each fuse. Unequal temperatures between fuses may indicate voltage or amperage imbalance.
5. Press **SET** and then press▼/▲ to set emissivity to relatively low, for metal fuses and caps and insulated buss connections.
6. Press **YELLOW** button to select MAX.
7. Scan each end cap on each fuse/

Note
Unequal temperatures or a high temperature indicates loose or corroded connection through the fuse buss spring clip.

Testing Electrical Connections
1. Press **SET** and then press ▼/▲ to set emissivity to relatively low for uninsulated connectors or buss connections or relatively high for insulated connections.

Note
Conductors are typically smaller than the Thermometer's spot size. If the spot size is bigger than the connector, the temperature reading is the average within the spot.
2. Scan the conductor, moving toward direction of electrical connector (quick connect, wire nut, buss connection, or lug).

Scanning Walls for Air Leaks or Insulation Deficiencies
1. Turn off heating, cooling, and blower.
2. Press **SET** to select emissivity. Press ▼/▲ to select emissivity relatively high for painted surfaces or window surfaces.
3. Press **YELLOW** button to select MIN when opposite side of wall is at lower temperature and or select MAX when opposite side of wall is at higher temperature.
4. Measure an interior partition wall surface temperature. Do not release the trigger. Record this temperature as your baseline (or benchmark) for a "perfectly" insulated wall.
5. Face the wall to be scanned. Stand 1.2m away to scan a 10cm spot on the wall.
6. Scan horizontal rows of wall from top to bottom, or horizontal rows of ceiling from wall to wall. Look for greatest deviations from baseline temperature to identify problems.This completes the insulation test scan.

Turn on the blower (no heat, no cooling) and retest. If test results with the blower on are different than results with the blower off, this may indicate air leaks in conditioned envelope walls. The air leaks are caused by duct leaks that create a pressure differential across the conditioned space envelope.

Testing Bearings

⚠️ **Warning**
To avoid injury when testing bearings:
● **Do not wear loose clothing, jewelry, or anything around neck when working around moving parts such as motors, belts, blower, and fans.**
● **Make sure an electrical disconnect is within reach and operating correctly and freely.**
● **Do not work alone.**

Note
It works best to compare two similar motors operating similar loads.
1. Press **SET** and then press ▼/▲ to select relatively high emissivity.
2. Press **YELLOW** button to select MAX.
3. Enable motor and allow it to reach steady state operating temperatures.
4. Disable the motor if possible.
5. Measure the two motor bearing temperatures
6. Compare the two motor bearing temperatures. Unequal temperatures or a high temperature can indicate a lubrication or other bearing problem that is resulting from excess friction.
7. Repeat the sequence for the blower bearings.

Testing Belts and Sheaves
1. Press **SET** and then press ▼/▲ to select relatively high emissivity.
2. Press **YELLOW** button to select MAX.
3. Enable the motor and allow it to reach a steady state operating temperatures.
4. Aim the Thermometer at the surface to be measured.
5. Start recording temperature
6. Slowly move the Thermometer up the belt toward second sheave.
● If belt is slipping, sheave temperature will be high from friction.
● If belt is slipping, belt temperature will remain high between sheaves.
● If belt is not slipping, belt temperature will reduce between sheaves.
● If inner surfaces of sheaves are not a true "V" shape, this indicates belt slippage and will continue to operate at elevated temperatures until sheave is replaced.
● Sheaves must be properly aligned (include "pitch & yaw") for belt and sheaves to operate at appropriate temperatures. A straight edge or taut string, can be used to check alignments.
● Motor sheave should operate at a temperature consistent with blower sheaves.
● If motor sheave is at a higher temperature at motor shaft than at outer circumference, belt is probably not slipping.
● If outer circumference of sheave is at higher temperature than sheave at motor shaft, then belt is probably slipping and sheaves may be misaligned.

Checking Hydronic Radiant Heat Applications
Radiant heat tubes in the floor will normally run parallel to the outside walls. Starting at the floor wall juncture, scan parallel to the wall while moving into the room away from the wall. Parallel to the outside wall you should find parallel isothermal rows indicating the location of heat tubes below the surface. Perpendicular to the outside wall, you should find rising and falling temperatures at equal distances. High temperatures indicate you are scanning a heat tube beneath the floor surface, low falling temperatures indicate a space between the heat tubes.
1. Press **SET** and then press ▼/▲ to select relatively high emissivity.

2. Press **YELLOW** button to select MAX.
3. To locate radiant heat tubes in floor, temporarily elevate the loop temperature to create hotter spots for identifying tubing runs.
4. Before releasing trigger, press **YELLOW** button to toggle between MIN, MAX, DIF floor temperatures and record the temperature for future comparison and trending under similar conditions.

Measuring Grille, Register, or Diffuser Discharge Temperature
1. Press **SET** and then press ▼/▲ to select relatively high emissivity.
2. Aim the Thermometer at the discharge air grille, register, or diffuser.
3. Measure discharge temperature.
4. Release trigger to freeze the temperature reading for 8 seconds and record this temperature.
5. Grille, register, or diffuser temperature should be equivalent to discharge temperature at the air handler.

Checking for Blockage in Air-To-Air Evaporators or Condensers
1. Remove panels to gain access to coil return bends or hairpins.
2. Press **SET** and then press ▼/▲ to select relatively high emissivity for copper tube.

3. Start the refrigeration system.
4. Aim the Thermometer at coil turn bends/hairpins.
5. Start recording temperature.
6. Take temperature of each return bend/hairpin.
● All evaporator return bends/hairpins should be at or slightly above evaporator saturation temperature from the pressure/temperature chart.
● All condenser return bend/hairpins should be at or slightly less than condenser saturation temperature.
● If a group of return bends/hairpins do not conform to expected temperatures, that indicates a blocked or restricted distributor or distributor tube.

Maintenance
Changing the Battery
To install or change the 9V battery, open the battery compartment the battery as shown in Figure 2.

Cleaning the Lens
Blow off loose particles using clean compressed air. Carefully wipe the surface with a moist cotton swab. The swab may be moistened with water.

Cleaning the Housing
Use soap and water on a damp sponge or soft cloth. To avoid damage to the Thermometer, do not soak the unit into water.

⚠️ **Caution**
To avoid damaging the Thermometer, do NOT submerge it in water.

Troubleshooting

Symptom	Problem	Action
OL (on display)	Target temperature is over range	Select target with specifications
-OL (on display)	Target temperature is under range	Select target with specifications
🔋	Low Battery	Replace Battery
Blank Display	Possible dead battery	Check and / or replace battery
Laser does not work	1. Low or dead battery 2. Ambient temperature above 40℃ (104℉)	1. Replace battery 2. Use in area with lower ambient temperature.
Beeper beeps continuously	1. Has the High/Low feature been set? And 2. Measurement value has over the limit	3. Reset the setting or 4. Cancel the limit setting

Table 4. Troubleshooting

CE Certification
The Thermometer conforms to the following standards:
● EN61326: 2006
● EN60825-1: 1994+A2: 2001+A1: 2002 Laser Safety Standard
Certification testing was conducted using a frequency range of 80 to 100MHz with instrument in three orientations.

Specifications
Infrared and T-C Thermocouple
Measurement Range (UT305A)——————————— -50℃ to 1050℃ (-58℉ to 1992℉)
Measuremnet Range (UT305B)——————————— -50℃ to 1250℃ (-58℉ to 2282℉)
Measuremnet Range (UT305C)——————————— -50℃ to 1550℃ (-58℉ to 2822℉)
Measuremnet Range (UT306A)——————————— -50℃ to 1250℃ (-58℉ to 2282℉)
Measuremnet Range (UT306B)——————————— -50℃ to 1550℃ (-58℉ to 2822℉)
Measuremnet Range (UT306C)——————————— -50℃ to 1850℃ (-58℉ to 3362℉)
Spectral Range ————————————————— 8 to 14 um
IR Accuracy ——————————————————— 1.8% or 1.8℃ (4℉) ; >600 ℃:±3%
T-C Accuracy ——————————————————— 1% or 1℃ (2℉)
(Assumes ambient operating temperature of 23 to 25℃ (73 to 77℉).
When below 0℃ : add 1℃ to stated accuracy.
When below -35℃: for reference only)
Repeatability ————————————————————— 0.5℃ or 0.5% of reading
Response Time (95%) —————————————————— 250ms
Distance to Spot (D:S) (UT305A/B/C)————————————50:1
Distance to Spot (D:S) (UT306A/B/C)————————————60:1
Emissivty Adjustment ———————————————— 0.10~1.00
Display Resolution ————————————————— 0.1℃ (0.1℉) ; (<10℃: 0.2℃; >999.9 ℃:1℃/1 ℉)
Secondary Display Information —————————— Maximum, Minimum, Differential, Average

Laser
Pointer ————————————————————— Single laser pointer
Power ————————————————————— Class 2 (II) operation; Output <1mV, wavelength: 630 to 670mm

Electrical
Power Supply ——————————————— 6F22 9V Battery
Battery Life ————————————————— Alkaline: around 30 hours; Dry Zinc-Manganese:around 10hours

Physical
Weight ——————————————————————— 270g
Size ———————————————————————— 168.5mm (H) x 137.8mm (L) x 53mm (W)

Environmental
Operating Temperature Range ————————————— 0℃ to 50℃ (32℉ to 120℉)
Relative Humidity ——————————————————— 0 to 75% noncondensing
Storage Temperature ————————————————— -20℃ to 65℃ (-4℉ to 150℉)

Accessories ————————————————————— K type thermocouple, tool box, CD software, USB cable, battery and English manual

~ END ~
This operating manual is subject to change without notice.