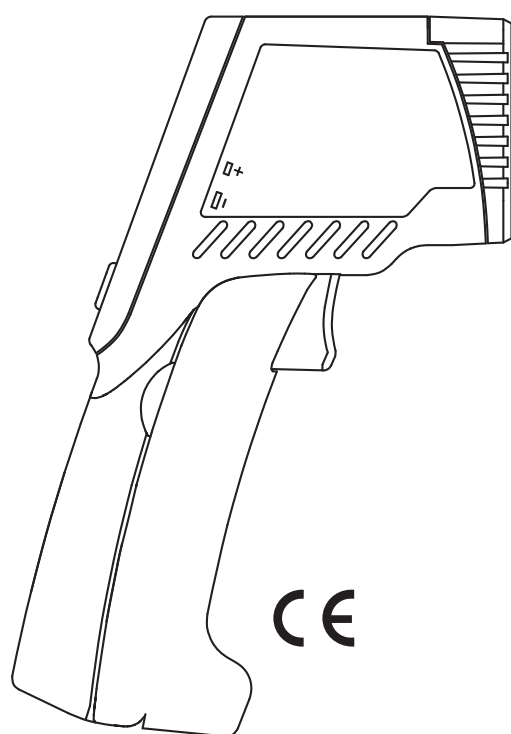


INSTRUCTION MANUAL MANUAL DE INSTRUCCIONES MANUEL D'INSTRUCTIONS



GREENLEE®

A Textron Company



TG-2000

Infrared and Contact Thermometer

Termómetro infrarrojo y de contacto

Thermomètre infrarouge et à contact



Read and understand all of the instructions and safety information in this manual before operating or servicing this tool.

Lea y entienda todas las instrucciones y la información sobre seguridad que aparecen en este manual, antes de manejar estas herramientas o darles mantenimiento.

Lire attentivement et bien comprendre toutes les instructions et les informations sur la sécurité de ce manuel avant d'utiliser ou de procéder à l'entretien de cet outil.



Description

The Greenlee TG-2000 Infrared and Contact Thermometer is a hand-held surface temperature sensing device. The non-intrusive measuring capability of this unit is safer and quicker than other methods, and is well suited to checking the surface temperature of circuit breakers, motors, HVAC/R equipment, engines, etc.

This device measures surface temperature by gathering three forms of infrared energy — emitted, transmitted, and reflected — from an object and translating that energy into a temperature.

This temperature instrument includes the following features:

- Dual laser sighting. The two lasers indicate the approximate diameter of the measurement area.
- User-adjustable high and low temperature alarms.
- Automatic recording of maximum, minimum, difference, and average temperatures while making measurements.
- Probe jack. Allows the thermometer to measure contact temperature using any K-type thermocouple with a standard mini connector.
- Lock mode. Allows long-term measurements without holding the trigger. The lasers are turned off in Lock mode unless the trigger is held down.

Safety

Safety is essential in the use and maintenance of Greenlee tools and equipment. This instruction manual and any markings on the tool provide information for avoiding hazards and unsafe practices related to the use of this tool. Observe all of the safety information provided.

Purpose of this Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Greenlee TG-2000 Infrared and Contact Thermometer.

Keep this manual available to all personnel.



Do not discard this product or throw away!

All specifications are nominal and may change as design improvements occur. Greenlee Textron Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

KEEP THIS MANUAL

Important Safety Information



SAFETY ALERT SYMBOL

This symbol is used to call your attention to hazards or unsafe practices which could result in an injury or property damage. The signal word, defined below, indicates the severity of the hazard. The message after the signal word provides information for preventing or avoiding the hazard.

DANGER

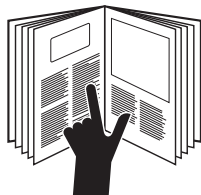
Immediate hazards which, if not avoided, **WILL** result in severe injury or death.

WARNING

Hazards which, if not avoided, **COULD** result in severe injury or death.

CAUTION

Hazards or unsafe practices which, if not avoided, **MAY** result in injury or property damage.



WARNING

Read and understand this material before operating or servicing this equipment. Failure to understand how to safely operate this tool could result in an accident causing serious injury or death.



WARNING

Electric shock hazard:

Do not use a thermocouple probe to measure the temperature of electrically energized objects such as terminals, fuses, or bare wires.

Contact with live circuits could result in severe injury or death.

Important Safety Information

WARNING

Electric shock and fire hazard:

- Do not expose this unit to rain or moisture.
- Do not use the unit if it is wet or damaged.
- Use this unit for the manufacturer's intended purpose only, as described in this manual. Any other use can impair the protection provided by the unit.

Failure to observe these warnings could result in severe injury or death.

WARNING

Electric shock hazard:

- Do not open the case, except for the battery compartment.
- Before opening the case, release the trigger, unplug the thermocouple probe from the unit, and shut off the unit.

Failure to observe these warnings could result in severe injury or death.

WARNING

This unit is not intended for medical applications.

Failure to observe this warning could result in severe injury or death.

CAUTION	LASER RADIATION DO NOT STARE INTO BEAM CLASS 2 LASER PRODUCT
 LASER RADIATION-DO NOT STARE INTO BEAM Max. Output <1 mW, Wavelength: 635-660 nm Complies with 21 CFR, Chapter 1, subchapter J	CLASS II LASER PRODUCT CAUTION-CLASS 2 LASER RADIATION WHEN OPEN 

	 CAUTION Laser hazard: • Avoid laser exposure. • Do not point laser directly at eye or at reflective objects. Failure to observe these precautions may result in injury.
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Important Safety Information

	⚠ CAUTION
	Burn hazard: • Avoid contact with the probe until it has cooled. The thermocouple probe may remain hot for several minutes after making a temperature measurement. • Do not exceed the temperature rating of the thermocouple probe. Consult the manufacturer's specifications for the selected probe. Failure to observe these precautions may result in injury and can damage the unit.

⚠ CAUTION
Electric shock hazard: • Do not attempt to repair this unit. It contains no user-serviceable parts. • Do not expose the unit to extremes in temperature or high humidity. Refer to "Specifications." Failure to observe these precautions may result in injury and can damage the unit.

⚠ CAUTION
• Temperature readings will be inaccurate on highly reflective objects. • Temperature readings will be inaccurate on objects if emissivity is not adjusted properly. Follow masking and emissivity adjustment procedures. • Allow 30 minutes for the unit to adjust to large changes in ambient temperature; inaccurate readings can result. • Clean lens periodically; inaccurate readings can result. Refer to the "Maintenance" section. Failure to observe these precautions may result in injury and can damage the unit.

IMPORTANT
• Using this unit near equipment that generates electromagnetic interference can result in unstable or inaccurate readings. • Protect the unit against static electricity.

Important Safety Information

CE Certification

This instrument conforms to the following standards:

- EN50081-1:1992, Electromagnetic Emissions
- EN50082-1:1992, Electromagnetic Susceptibility

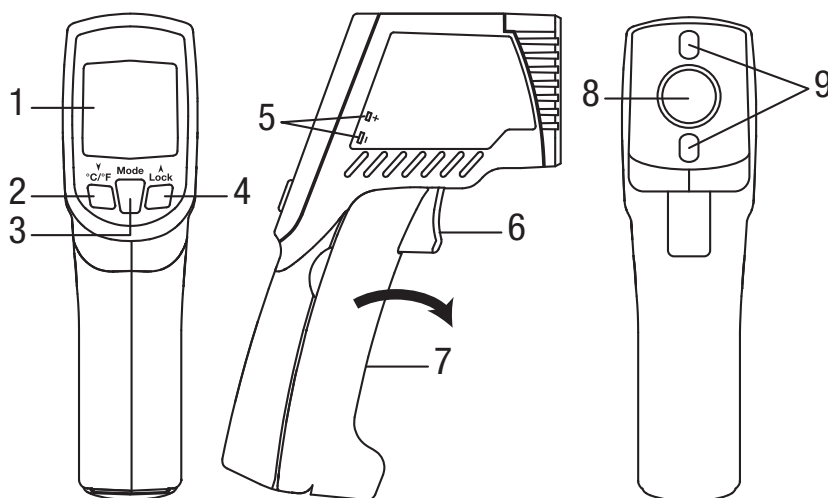
Readings may be affected if the unit is operated with a radio frequency electromagnetic field of approximately 3 volts per meter, but the performance of the instrument will not be permanently affected. From 200 to 600 MHz, the maximum error is 10 °C (18 °F).

CFR 21 1040.10 and 1040.11

Performance Standards for Light-Emitting Products

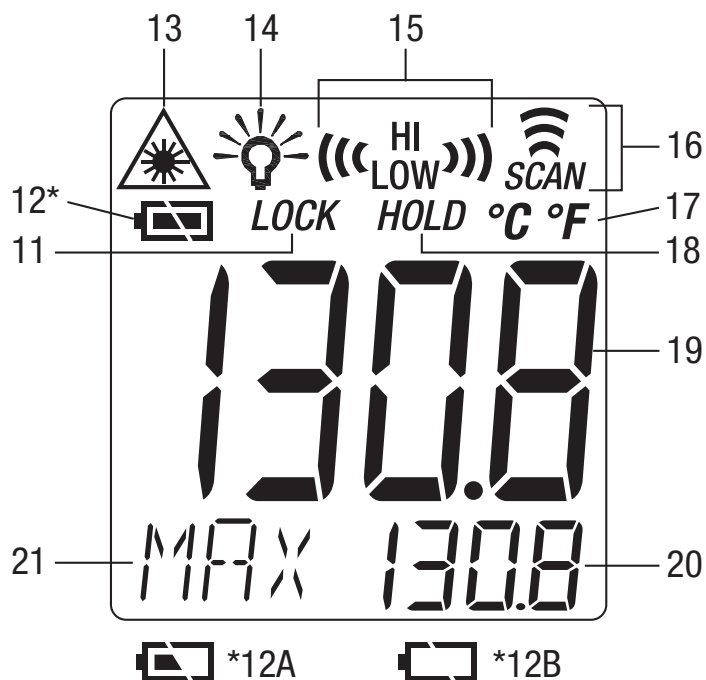
Identification

1. Display
2. Decrease button and °C/°F selector
3. Mode selector
4. Increase button and Lock button
5. Probe jack
6. Trigger
7. Battery compartment door
8. Lens
9. Lasers



Display Icons

11. Lock mode indicator
12. Full battery indicator
 - 12A. Low battery indicator
 - 12B. Dead battery indicator
13. Laser ON indicator
14. Backlight ON indicator
15. High/low alarm ON indicator
16. Scan mode indicator; blinks when reading is updated
17. Celsius or Fahrenheit indicator
18. Hold mode indicator
19. Temperature indicator
20. Mode value indicator
21. Mode indicator



Symbols on the Unit

- Warning—Read the instruction manual.
- Recycle product in accordance with manufacturer's directions.
- Laser radiation is emitted from this unit.

Using the Features

Basic Features

- To turn the laser on or off: Press and hold the trigger, and then momentarily press the ▼ button.
- To turn the backlight on or off: Press and hold the trigger, and then momentarily press the ▲ button.
- To change between Celsius and Fahrenheit: If the LCD is blank, press and release the trigger. Momentarily press the °C/°F button.
- To lock the trigger for continuous measurement: If the LCD is blank, press and release the trigger. Momentarily press the **Lock** button. Momentarily press the **Lock** button again to return to normal measurement. The unit will automatically exit Lock mode after 60 minutes.

Advanced Features

Press the **Mode** button to access the advanced features. They appear in this order: Emissivity Display (E), Emissivity Setting (↓E↑), Maximum (MAX), Minimum (MIN), Difference (dIF), Average (AVG), High Alarm Limit (HAL), Low Alarm Limit (LAL), and Probe (PRB).

Setting Alarm Points

After selecting the HAL or LAL mode, use the ▼ or ▲ button to set the alarm point. A tone will sound and the alarm indicator will flash if the temperature is higher than or lower than the corresponding set point. “HI” or “LOW” will appear with the alarm indicator.

Temperature Probe

To use a K-type thermocouple temperature probe (purchased separately), connect the probe to the probe jack on the side of the thermometer. Select PRB mode. The probe temperature will appear in the lower right corner of the display. The temperature detected by the infrared sensor will continue to appear in the center of the display. You may still use the **Mode** button to access the other advanced features, but the probe temperature is displayed only when PRB mode is selected.

Note: The probe will not trip the high alarm and low alarm.

Measurement Review

After the unit shuts off, press **Mode** to review the measurement:

- MAX — the highest recorded temperature among all of the readings.
- MIN — the lowest recorded temperature among all of the readings.
- dIF — the difference between the maximum and minimum readings.
- AVG — a weighted rolling average of all of the readings.

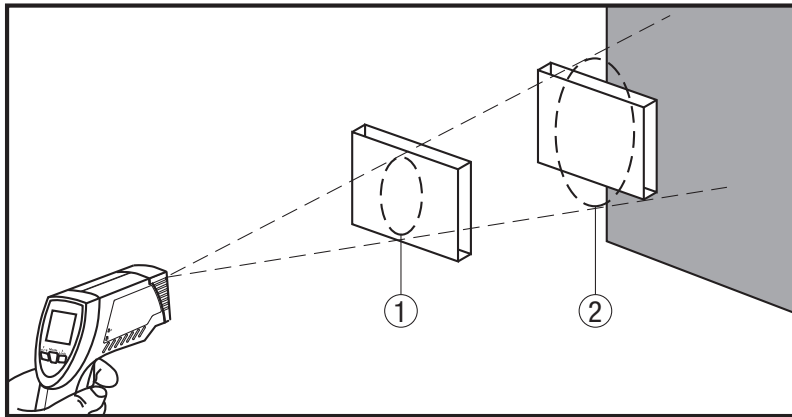
Note: Values for MAX, MIN, dIF and AVG are reset each time the trigger is pressed.

Note: The AVG feature acts as a filter to eliminate fluctuations from the temperature readings. It is not an arithmetic mean, but rather a rolling weighted average of the readings that smoothes the data and excludes sudden spikes.

Distance from Target

Thermometers measure the surface temperature of an object by sensing its emitted, reflected, and transmitted energy. The sensor collects this energy from the area being measured (spot size). The spot size varies as the distance to the target changes. The farther the distance from the area being targeted, the larger the spot size.

When determining the appropriate distance from the object, the spot size must be somewhat smaller than the target area. When accuracy is critical, the spot size should be half as large as the target. If the spot size is larger than the target size, the thermometer will pick up the temperature of the background, resulting in inaccurate readings.



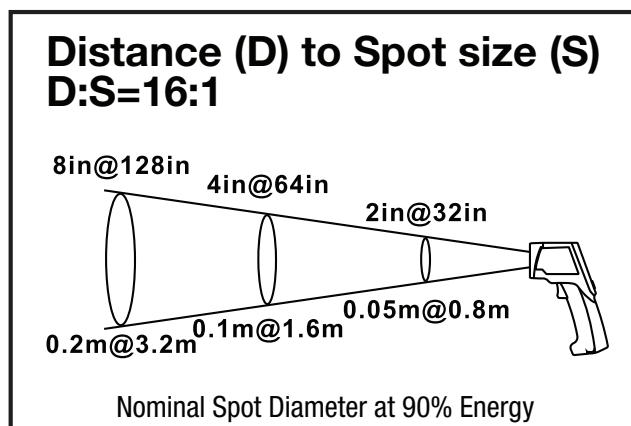
Object 1 is the correct distance from the unit. Note the target is slightly larger than the spot size being measured.

Object 2 is too far away. The thermometer also measures the background because the target is smaller than the instrument's spot size. This can result in an inaccurate reading.

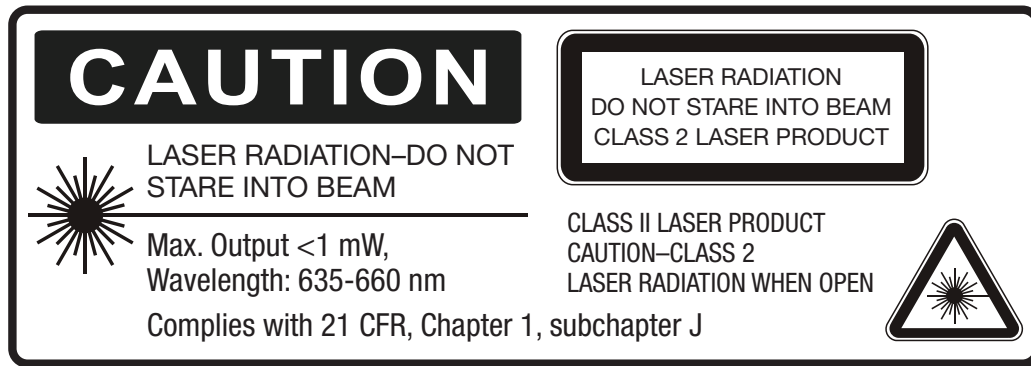
Distance to Spot Size

The distance to spot size is a ratio that provides the appropriate distance to the target.

The nominal distance-to-spot-size (D:S) ratio for TG-2000 is 16:1.



Operation



1. Refer to “Typical Measurements” for specific measuring instructions.
2. Test the unit on an object with a known temperature.
 - If the unit does not function as expected on an object of known temperature, replace the batteries.
3. To measure the temperature of a selected area: Press and hold the trigger and point the thermometer at the object to be measured. The dual lasers indicate the approximate diameter of the measured area. “SCAN,” the measured temperature, and advanced feature data will appear on the display. The scan icon will blink. Release the trigger after completing the measurement. “HOLD,” the final temperature measurement, and advanced feature data will remain on the display for 1 minute.
4. To take more than one temperature measurement, or to locate a hot spot: Press and hold the trigger, and scan the objects to be measured. The unit will record the maximum, minimum, difference, and average temperatures.

To perform other functions, refer to “Advanced Features” in the “Using the Features” section.

Limitations

- The thermometer cannot measure through transparent objects, such as glass or plastic. It will measure the surface temperature of the glass or plastic.
- Steam, dust, smoke, or other particles can prevent accurate measurement by obstructing the unit’s infrared sensor.

Locating a Hot Spot

To find a hot spot, aim the thermometer outside the area of interest, and then scan across with an up and down motion.

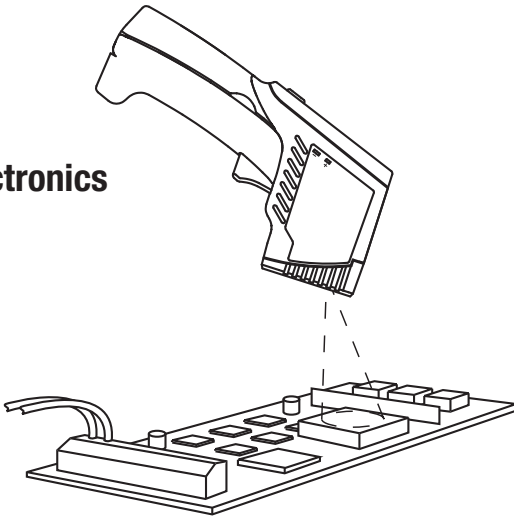
Operation (cont'd)

Troubleshooting

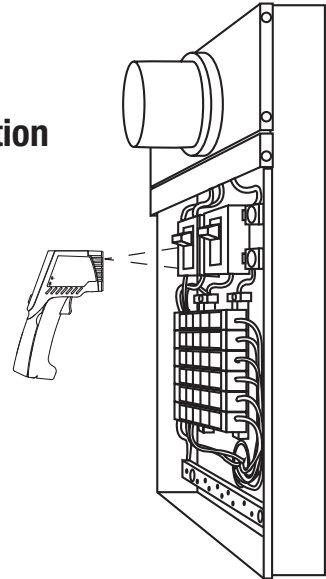
Code	Problem	Action
Er2	Thermometer has been exposed to rapid temperature change.	Allow at least 30 minutes for thermometer to stabilize at new ambient temperature.
Er3	Ambient temperature is outside operating limits (refer to "Specifications").	Operate thermometer within limits in the "Specifications" section.
Er5 ~ 9	Other errors.	Reset thermometer by removing batteries for at least 1 minute. Reinstall batteries and check operation.
HI	Measured temperature is above range of thermometer.	Use thermometer within its specified range.
LO	Measured temperature is below range of the thermometer.	Use thermometer within its specified range.

Typical Measurements

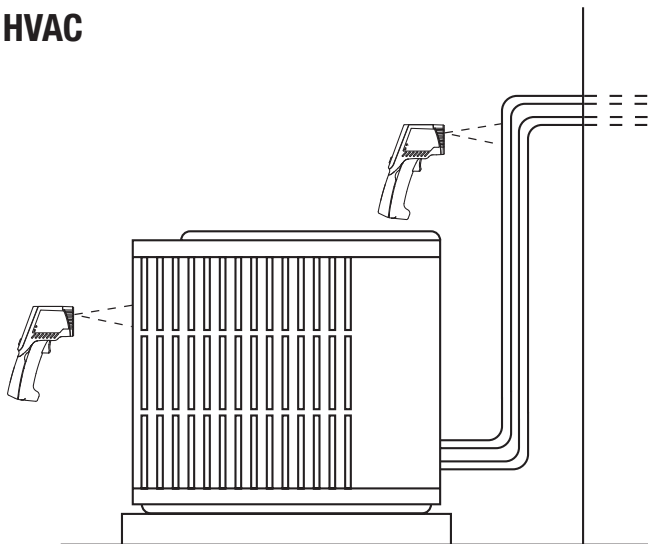
Electronics



Power Distribution



HVAC



- Minimum width of line is 25 mm (1") for accurate reading
- Non-insulated line

Emissivity

Emissivity is the ability of an object to emit infrared energy. Most objects or surfaces have an emissivity value of about 0.95. Some objects, such as polished or shiny metallic surfaces, may have much lower emissivity. Using an infrared thermometer to measure the temperature of such objects will produce inaccurate results.

CAUTION

- Temperature readings will be inaccurate on highly reflective objects.
- Temperature readings will be inaccurate on objects if emissivity is not adjusted properly. Follow masking and emissivity adjustment procedures.

Failure to observe these precautions may result in injury and can damage the unit.

Masking a Surface to Determine Emissivity

To determine the effect of emissivity on the measurement, cover the surface with masking tape or flat black paint. (Be sure to use tape or paint that can withstand the anticipated temperature.) The emissivity of both these materials is about 0.95. Allow time for the tape or paint to reach the temperature of the material underneath. Measure the covered area and a nearby area. The readings should be about the same. If they are not, the emissivity may affect your measurements.

Compensating for Emissivity

- If the temperature of the surface is known, adjust the emissivity until the unit agrees with the known temperature.
- If the material of the surface is known, adjust the emissivity according to the Common Emissivities table on the following page.
- Otherwise, mask the surface as described above. Measure temperature of the masked area with emissivity set at 0.95. Measure temperature of unmasked surface and adjust emissivity until temperatures agree. Write down emissivity value for future readings on this surface.

Emissivity (cont'd)

Common Emissivities

Material	Emissivity
Aluminum	0.30
Asbestos	0.95
Asphalt	0.95
Basalt	0.70
Brass*	0.50
Brick	0.90
Carbon	0.85
Ceramic	0.95
Concrete	0.95
Copper*	0.95
Dirt	0.94
Food (frozen)	0.90
Food (hot)	0.93
Glass (plate)	0.85
Ice	0.98

Material	Emissivity
Iron*	0.70
Lead*	0.50
Limestone	0.98
Oil	0.94
Paint	0.93
Paper	0.95
Plastic**	0.95
Rubber	0.95
Sand	0.90
Snow	0.90
Steel*	0.80
Textiles	0.94
Water	0.93
Wood***	0.94

*oxidized

**opaque, over 0.51 mm (0.0020") thick

***natural

Accuracy

Accuracy Table for Infrared Sensor

Target Temperature	Ambient Temperature	Accuracy
15 °C to 35 °C	25 °C	± 1.0 °C
-60 °C to 0 °C	20 °C to 26 °C	± (2.0–0.05 x reading) °C
0 °C to 625 °C		± 2.0% of reading or 2 °C, whichever is greater
59 °F to 95 °F	77 °F	± 1.8 °F
-76 °F to 32 °F	73 °F to 79 °F	± (5.2–0.05 x reading) °F
32 °F to 1157 °F		± 2.0% of reading or 4 °F, whichever is greater

Accuracy (cont'd)

Accuracy for K-Type Thermocouple Measurements

Instrument error is $\pm 1.0\%$ of reading or $1\text{ }^{\circ}\text{C}$ ($1.8\text{ }^{\circ}\text{F}$), whichever is greater. Specification applies at ambient temperature of $17\text{ }^{\circ}\text{C}$ to $29\text{ }^{\circ}\text{C}$ ($63\text{ }^{\circ}\text{F}$ to $84\text{ }^{\circ}\text{F}$). Thermocouple range or accuracy not included. Consult thermocouple probe data sheet for usable temperature range and accuracy specification.

Specifications

Display: 4-digit LCD (999.9 or 9999 maximum display)

Response Time: 1 second, 90% response

Temperature Range:

Infrared Sensor: $-60\text{ }^{\circ}\text{C}$ to $625\text{ }^{\circ}\text{C}$ ($-76\text{ }^{\circ}\text{F}$ to $1157\text{ }^{\circ}\text{F}$)

K-Type Thermocouple Probe: $-64\text{ }^{\circ}\text{C}$ to $1400\text{ }^{\circ}\text{C}$ ($-83.2\text{ }^{\circ}\text{F}$ to $2552\text{ }^{\circ}\text{F}$)

Spectral Response: 8 to $14\text{ }\mu\text{m}$

Repeatability: $\pm 0.5\%$ of reading or $\pm 1\text{ }^{\circ}\text{C}$ ($\pm 2\text{ }^{\circ}\text{F}$), whichever is greater

Emissivity: 0.10 to 1.0, digitally adjustable

Ambient Operating Temperature Range: $0\text{ }^{\circ}\text{C}$ to $50\text{ }^{\circ}\text{C}$ ($32\text{ }^{\circ}\text{F}$ to $122\text{ }^{\circ}\text{F}$)*

Relative Humidity: 10% to 90% (non-condensing) at $< 30\text{ }^{\circ}\text{C}$ ($86\text{ }^{\circ}\text{F}$) ambient temperature

Altitude: 2000 m (6500') maximum

Storage Conditions: $-10\text{ }^{\circ}\text{C}$ to $60\text{ }^{\circ}\text{C}$ ($14\text{ }^{\circ}\text{F}$ to $140\text{ }^{\circ}\text{F}$)*.

Remove batteries.

Battery: Two 1.5 volt batteries (AAA, NEDA 24A or IEC LR03)

* For improved accuracy, allow unit 30 minutes to adjust to large change in temperature.

Statement of Conformity

Greenlee Textron Inc. is certified in accordance with ISO 9001 (2000) for our Quality Management Systems.

The instrument enclosed has been checked and/or calibrated using equipment that is traceable to the National Institute for Standards and Technology (NIST).

Maintenance

CAUTION

Electric shock hazard:

Do not attempt to repair this unit. It contains no user-serviceable parts.

Failure to observe this precaution may result in injury and can damage the unit.

Battery Replacement

1. Pivot the top of the door down and away from the handle.
2. Replace the batteries (observe polarity).
3. Close the battery compartment door.

Cleaning

Lens

1. Blow off loose particles using clean compressed air.
2. Gently brush any remaining debris away with a camel hair brush or soft cloth.
3. Carefully wipe the surface with a water-moistened cotton swab.

Note: Do not use solvents!

Housing

Periodically wipe the housing with a damp cloth and mild detergent; do not use abrasives or solvents.