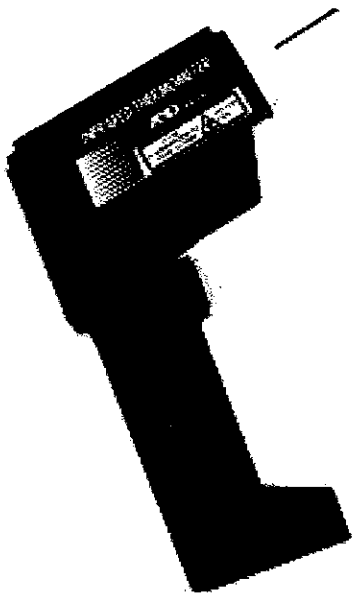
Non–Contact Infrared Thermometer

AD-5611



...Clearly a Better Value

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TABLE OF CONTENTS

INTRODUCTION

AD-5611 Features

- Switchable °F or °C readings
- Quick and simple operation
- Back-light
- Long battery life
- Temperature range of 0 to 788°F (-20 to 420°C)
- On-board nine measurement memory
- Barrel sight targeting

Package Contents

- Protective carrying case
- Operating instruction manual
- One battery

APPLICATION OVERVIEW

The practical applications for this instrument are far too numerous to list, however, this list represents some of the more common applications where you'll find non-contact thermometers used in industry.

Hazard Analysis Critical Control Point (HACCP)

Delivery
Cooking Surfaces
Heating surfaces

Electrical:

- Bus-bar contact maintenance
- Motor and bearing evaluation
- Inverter temperature monitoring
- Transformer temperature monitoring
- Circuit-breaker panel monitoring

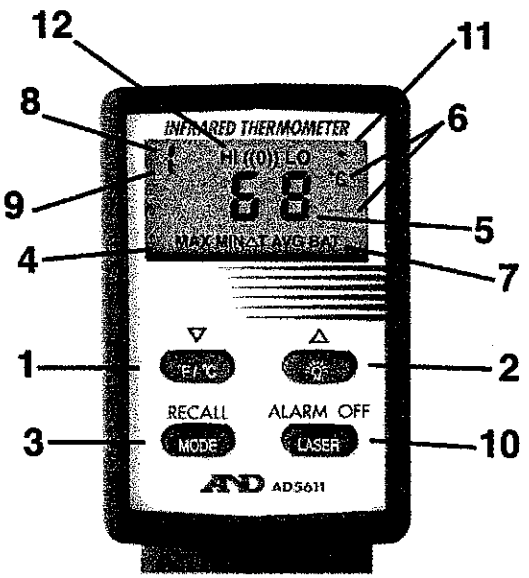
HVAC:

- AC region management
- Ambient temperature monitoring
- Net heating and cooling calculations
- Pump motor coupling temperature (alignment evaluation)
- Thermo-pane window efficiency
- Point sourcing heating and cooling losses

Combustion Engines:

- Find radiator blockages
- Check thermostat function
- Find cool (miss-firing) cylinders
- Check catalytic converter function

CONTROLS AND INDICATORS



AD-5611

1. Fahrenheit / Centigrade select push-button and mode down/decrease push-button.
2. Backlight push-button and up/increase selector.
3. Temperature display mode select, memory recall and programming select.
4. Temperature display mode indicator.
5. Temperature measurement.
6. Fahrenheit / Centigrade scale indicator.
7. Low battery annunciator.
8. Memory location annunciator.
9. Emissivity annunciator.
10. Laser targeting on/off push button.
11. Laser on annunciator.
12. Alarm mode indicator

SAFETY RULES

Caution

This equipment is intended for use by industry professionals who know their professional environments. Temperature measurements are often taken in potentially hazardous areas. Know and use the safety standards prescribed by your profession.

SYMBOLS

Laser Splash: 

Indicates the use of laser equipment and the category of laser used.

SAFETY TIPS

Validate Measurements

The accuracy and validity of measurements taken with this device depends on various criteria. One of the most critical criteria to consider is emissivity (a more detailed explanation is provided in the validation section of this manual). Before using this instrument to determine if an area is safe to touch, or enter, verify your readings are reasonably accurate by using comparisons with already known measurements.

AD-5611 OPERATING INSTRUCTIONS

This instrument's light weight, pistol grip design, raised push-buttons, and large LCD display make it convenient for most temperature measurement needs and accessible to processes not suited for conventional "contact' temperature measurements.

Taking Measurement Samples

To take temperature measurements, point the instrument at the surface to be measured and pull the trigger. A tube has been incorporated along the top of the barrel to aid the user in spotting the surface area to be measured (target).

Although this simple explanation works well in most cases, there are other factors that may impact the measurement accuracy. Consider these influences before using the data you obtain with your infrared thermometer:

- The target must completely fill the spot diameter seen by the infrared sensor; otherwise the temperature displayed will be influenced by the surface surrounding the target. The ratio of the distance from the end of the barrel to the size of the spot being measured is 8:1. For example, an object that is 6" in diameter can be accurately measured from 4' away. When using the gun to find hotspots, accuracy of the reading is not as important as keeping the gun at the same distance from the target for each sample measurement. If you are looking for hotspots on electrical panels, for instance, you could take the readings from 6' away each time, even though you may only be filling half the spot diameter. The critical information in this process would be any significantly higher temperature

- Emissivity of an object will also affect accuracy. See the "Validation" section for details.
- This instrument is sensitive to electromagnetic interference (EMI), such as that generated by spark plug wires, radio transmitters and welders. Do not use this instrument in close proximity to equipment that may produce such interference.
- The instrument must be used within the ambient temperature range specified in the specification table

Each time the trigger is pulled your AD-5611 monitors four different readings, regardless of the selected mode. They are:

- The highest temperature measured
- The lowest temperature measured
- The average temperature (time weighted)
- The Net difference between the high and low temperatures "ρT"

These four measurements go into the first memory location for future recall, when the trigger is released. See "Recalling memory points" for more details.

While the trigger is pulled, a temperature sample is taken at a minimum of once every 1/2 second (500 milliseconds). The four parameters mentioned above are updated at the same rate.

Selecting Fahrenheit or Centigrade Scales Select the scale you prefer to use (°F or °C) by pressing the ("°C/°F θ") push-button while the trigger is pulled.

Backlight Operation

To toggle the backlight on or off, press the push-button with the backlight (a light bulb) symbol while the trigger is pulled. Once the backlight has been turned on, it will come on each time the trigger is pulled until it is toggled off. Please note that this feature significantly reduces the battery's life.

Measurement Modes

This instrument allows you to select from one of five display modes. You can cycle through the modes in this order:

- Real-lime temperature measurements
- Maximum temperature measured (MAX mode)
- Minimum temperature measured (MIN mode)
- Temperature difference between MAX and MIN (AT mode)
- Calculated (time weighted) average temperature (AVG mode)

The last mode selected will remain selected the next time you pull the trigger.

Real-time Temperature Measurement Mode

This display mode shows the actual temperature of surfaces measured. This value is updated at least once every 1/2 second. When the instrument is powered up for the first time, this mode is pre-set.

Measurement Modes

Maximum Temperature (MAX) Mode
To enter the "MAX" display mode, pull the trigger, and press and release the MODE push-button repeatedly until you see the word "MAX" displayed on the LCD. In the "MAX" mode the highest temperature measurement taken, during the current trigger pull, is displayed on the LCD. The temperature reading will update each time a higher temperature is measured.

Minimum Temperature (MIN) Mode
To enter the "MIN" display mode, pull the trigger, and press and release the MODE push-button repeatedly until you see the word "MIN" displayed on the LCD. In the "MIN" mode, the lowest temperature measurement taken, during the current trigger pull, is displayed on the LCD. The temperature reading will update each time a new lowest temperature is measured.

Average (AVG) Mode
To select the "AVG" display mode, pull the trigger and press and release the MODE push-button repeatedly until "AVG" is displayed on the LCD. The term "time weighted" in reference to the averaging mode means all temperature measurements taken, from the time the trigger was first pulled, are averaged together. Actual surface temperature is not displayed while taking measurements in this mode. If you were to walk along a wall for one minute taking readings that were generally 72 degrees, then walk by a spot for 1/2 second that was 20 degrees, no significant change in average temperature would be displayed.

Temperature Differential (▲T) Mode
To select the temperature differential display mode (ρT), pull the trigger and press and release the mode push-button repeatedly until (ρT) is displayed on the LCD. This display mode is used to determine the net temperature difference between two surfaces. This is particularly valuable when calculating net heating or cooling, since ambient temperature is effectively removed from the equation.

Validation
Always validate your instrument's accuracy each time it is put into service.

The term validation, as we use it here, is the method used to verify the measurement you are taking is accurate. Emissivity is a value, referring to the surface you are targeting, that relates to that surface's ability to "emit" versus "reflect" heat energy. This value is a ratio of emitted heat energy to the total heat energy available (Example: .95 to 1). Because the ratio is always referenced to a total available value of "I", only the emitted heat value is referred to. This ratio is generally expressed as a decimal value, typically between .30 for surfaces that reflect most of the available heat energy, to a high of around .98 for surfaces that emit nearly all of their heat energy.

Some shiny, bright, polished or smooth surfaces reflect heat energy, and therefore, don't have high emissivity ratings. Generally these surfaces are not recommended.

Validation (Cont.)

As targets for non-contact thermometers. They can, however, be prepared for non-contact measurement. Compensating for emissivity of an object is part of the validating procedure. See the Emissivity table on page 18. For frequently repeated processes that warrant the use of a non-contact thermometer, take the time to perform one of the following preparatory procedures:

Pre-validate Accuracy

Most non-metallic surfaces have a natural emissivity value of about .95 (this instrument's factory default), and need no additional preparation for measurement. To ensure this is the case, take sample temperature readings from a surface in a controlled environment and compare them to the known temperature. For example, measure an empty cardboard box that has been sitting in a room for at least ten minutes, and compare those readings to the known room temperature.

For a quick validation, compare the reading of a prepared test area (see the next section) to an unprepared area. If there is no difference, there's no need for additional preparation.

Physically Prepare Surfaces For Consistent Readings

Some objects, such as lead and certain other alloys have low emissivity ratings. When temperature extremes and environmental conditions allow, the surface of such material can be modified to change the emissivity value to the conventional .95.

To prepare these surfaces to provide an accurate reading using a non-contact thermometer, pre-treat (to emit energy) the surface with flat colored paint, masking tape, or some similar rough, dark, dull or porous coating that has an inherently high emissivity value. Make sure these surfaces won't experience extreme environments that may burn, weather or otherwise degrade the surface preparation.

Be sure not to harm the surface of the object you are preparing for non-contact measurement. Often materials are designed to be reflective to control heat build-up. Emissive surfaces may cause excessive heat energy to be retained, even in a small area, which may eventually damage the equipment or impair operation.

Once the surface has been prepared, validate your readings as previously indicated.

Recalling Memory Points

With each pull of the trigger, four values are recorded in memory:

- The highest temperature measured
- The lowest temperature measured
- The time weighted average temperature
- The value last displayed before releasing the trigger

A total of nine sets of these four values, representing nine trigger pulls, are available for recall. To review recorded values, start with the instrument off, (trigger released and nothing visible on the LCD), then press and release the MODE push-button. The number "1" will appear on the display, indicating the latest of the nine sets of values recorded in memory. You may now either cycle through each of the four values recorded during the last trigger pull, or go to one of the four values, then select the number of the trigger pull you wish to review. Refer to example situation on next page.

For example, to select the high temperature measured three trigger pulls ago, you may either:

1. Press the MODE push-button once. The number "1" and a value appears.

2. Press the (light bulb/▲) push-button twice. The number "3" and a value appears.

3. Press the MODE push-button once again. The word "MAX" appears in the lower left of the LCD, along with the highest temperature recorded three trigger pulls prior.

Or:

1. Press the MODE push-button once. The number "1" and a value appears.

2. Press the MODE push-button once again. The word "MAX" appears in the lower left of the LCD, along with the highest temperature recorded during the last trigger pull.

3. Press the (light bulb/π) push-button twice. The number "1" and the value of the highest temperature recorded from three trigger pulls ago appears. To maneuver up and down through recorded values, press the appropriate (°F/°C/▼) or (light bulb/▲) pushbutton to view the different readings on the LCD.

Audible Alarms

The AD-5611 will sound an audible alarm at both an upper and a lower temperature limit, which you set.

To adjust the alarm, start with the instrument's power turned off. Press and hold the MODE push-button until you hear an audible beep. "HI" and "LO" will be displayed on the LCD. Do not pull the trigger.

Select the mode (HI or LO) you want the instrument to provide the alarm for by pressing either the (°F/°C/▼) push-button to select the high temperature alarm or the (light bulb/▲) push-button to select the low temperature alarm. Once the instrument indicates the alarm mode you want to set, press the (MODE) push-button again.

You're now ready to adjust the alarm's threshold value, displayed on the LCD. To decrease the value, press the (°F/°C/▼) push-button. To increase this value, press the (light bulb/▲) push-button. To lock this value in, pull the trigger.

The alarm settings (whatever is displayed at the time) are instantly saved if, at any time during the alarm setting process, the instrument either shuts off after five seconds of inactivity or the trigger is pulled.

Emissivity Adjustment

When a process calls for repeated measurements of like materials, such as evaluating a plastic's solidity at a processing plant, the best method of attaining quick, reliable temperature readings is to adjust the emissivity setting of your AD-5611. (See emissivity tables on page 18).

To set emissivity, you must pass through the alarm setting function. As described earlier, press and hold the MODE push-button until an audible tone is heard, and the LCD displays the alarm adjustment function. Do not pull the trigger, or let the instrument time-out and turn off. Press the MODE push-button once more to display the current emissivity value.

To decrease the value press the (°F/°C/▼) pushbutton. To increase this value, press the (light bulb/▲) push-button.

To exit and save the newly set value, press the MODE push-button again, let the instrument time-out in five seconds, or pull the trigger.

The value last entered for emissivity will become the instrument's default next time it is used. If the instrument will be used on various surfaces or by various people for different applications, it is a good practice to reset the emissivity value to .95 before returning it to storage.

Knowing the emissivity value your instrument is set at may prevent the collection of erroneous data that could result in unnecessary, time consuming and costly process step adjustments.

Laser Targeting

CAUTION

Do not point the laser at the eyes or face of any human or animal. Eye damage may result from direct exposure to laser light. Reflected laser light, from mirrors, glass, etc. can also cause eye damage. Laser is effective for hundreds of feet. Be aware of what or who is in your line of sight. Keep this device away from children, except under direct adult supervision.

To toggle the laser targeting feature on, or off depress the LASER push-button while pulling the trigger. You can engage the laser function from any of the five measurement modes. Once selected, the laser light is activated each time the trigger is pulled until it has been toggled off.

Note: The laser remains on for approximately 1/2 second after the trigger is released.

MAINTENANCE

Cleaning

Prevent contact with excessive dust dirt and liquid contamination as foreign substances can interfere with trigger operation and infrared lens performance.

When the housing becomes soiled, use a mild detergent and a damp cloth to clean the surface. Use caution to ensure no water or soap is allowed inside the unit, or on the infrared lens.

When the infrared lens becomes contaminated, try removing any debris with low pressure compressed air, such as that used on computer keyboards. If the contaminant can not be removed with air, use a residue free glass cleaning solution on the end of a soft cotton swab. The swab should be slightly damp, and very light pressure should be applied to the lens.

Troubleshooting

No display or erratic display: Check the battery for proper voltage and tight contact at the battery clip. Ensure the unit is at the specified operating temperature.

Constant or spurious over-load (OL) display: Check battery voltage. Check for electromagnetic interference (EMI). To check for EMI, move the unit to an open area, away from high voltage and radio or radar transmitting sources.

Erroneous Temperature Readings:
Inspect the infrared lens for blockage or contamination. Follow cleaning instructions. Check battery for proper voltage and tight fit in the battery clip.

Battery Replacement

To remove and replace the battery, turn the instrument upside down and slide the battery access panel (a plate at the bottom of the pistol grip) forward with your thumb.

Carefully remove the battery from the battery clip. A small flat-blade screw driver may be used to gently pry the clips away from the battery posts.

When placing a new battery in the clip, make sure the clip fits tightly around both posts of the battery. Some batteries are slightly larger or smaller than others; if necessary, compress the metal prongs on the clip to ensure the small red and black wires are not in a position to be pinched or cut as you replace the battery in its slot. When replacing the battery access cover, make sure to get a tight fit on the new battery.

AD-5611 SPECIFICATION TABLE

Specifications	**AD-5611**
Temperature range -20 to 420° (0 to 788°F)	
Accuracy	±2% of rdg. or ±2°C (±3°F). whichever is greater @ 23 ± 5° (73 ± 9°F) ambient operating temperature and a known blackbody emissivity
Repeatability	± 1% of rdg or ±1°(±2°F) whichever is great
Response time	500 m sec. (95% response)
Spectral response	7-18 microns nominal thermopile detector
FEATURES • MAX/MIN/ρT/AVG Temperatures • Recall Last Reading Laser • HI or LO audible/visible alarm • LCD Backlight • Laser (Class 2 Output)	
Emissivity	.30 – 1.00 digitally adjustable
Temperature display	°F or °C (selectable) 3 digit LCD
Display Resolution	1°F or 1°C in all modes
Ambient Operating Range	32 to 120°F (0 to 50°C)
Relative Humidity	10 – 95%RH noncondensing @ up to 85°F(30°)
Storage Temperature	-13 to 158° (-25 to 70°C) without battery
Power	9V Alkaline Battery
Battery Life (Alkaline)	All models 50 hrs. (backlight not used).* Enhance Laser Sighting Model 16 hrs. Laser used 50%, backlight used 50%.**
Dimensions	137mm x 41mm x 196mm (5.4" x 1.6" x 7.7")
Weight	9.5 oz. (270 grams)
Accessories	Hard case and manual
Distance Spot Ratio	8 to 1

*Laser is offset 1.4 cm (0.5") above center of target spot.
**Battery Life will vary depending on backlight and laser storage.

EMISSIVITY VALUES

SURFACE	EMISSIVITY
Iron and Steel	
Cast iron (polished)	0.2
Cast iron (turned at 100-C)	0.45
Cast iron (turned at 1000-C)	0.6 to 0.7
Steel (ground sheet)	0.6
Mild steel	0.3 to 0.5
Steel plate (oxidized)	0.9
Iron plate (rusted)	0.7 to 0.85
Cast iron (rough) rusted	0.95
Rough ingot iron	0.9
Mohan cast iron	0.3
Moll mild steel	0.3 to 0.4
Stainless steel (polished)	0.1
Stainless steel (various)	0.2 to 0.6
Aluminum	
Polished aluminum	0.1*
Aluminum (heavily oxidized)	0.25
Aluminum oxide at 260-C	0.6
Aluminum oxide at BOOT	0.3
Aluminum Alloys, various	0.1 to 0.25
Brass	
Brass (polished)	0.11
Brass (roughened surface)	0.2
Brass (oxidized)	0.6
Copper	
Copper (polished)	0.05*
Copper plate (oxidized)	0.8
Molten copper	0.15
Lead	
Lead (pure)	0.1*
Lead (oxidized at 25-C)	0.3
Lead (heated to 200°C)	0.6
Nickel and its Alloys	
Nickel (pure)	0.1*
Nickel plate oxidized)	0.4 to 0.5
Nichrome	0.7
Nichrome (oxidized)	0.95
Zinc (oxidized)	0.1*
Galvanized iron	0.3
Tin-plated steel	0.1*
Gold (polished)	0.1*
Silver (polished)	0.1*
Chromium (polished)	0.1*
Emissivity Values - Non-Metals	
Refractory & Building Materials	
Red brick (rough)	0.75 to 0.9
Fire clay	0.75
Asbestos	0.95
Concrete	0.7
Marble	0.9
Carborundum	0.85
Plaster	0.9
Alumina (fine grain)	0.25
Alumina (coarse grain)	0.45
Silica (fine grain)	0.4
Silica (coarse grain)	0.55
Zirconium silicate up to 500*C	0.85
Zirconium silicate at 850*C	0.6
Quartz (rough)	0.9
Carbon (graphite)	0.75
Carbon (soot)	0.95
Timber (various)	0.8 to 0.9
Miscellaneous	
Enamel (any color)	0.9
OH paint (any color)	0.95
Lacquer	0.9
Matte black paint	0.95 to 0.98
Aluminum lacquer	0.5
Water	0.98
Rubber (smooth)	0.9
Rubber (rough)	0.98
Plastics (various, solid)	0.8 to 0.95
Plastic films (.05 mm thick)	0.5 to 0.95
Polythene film (.03 mm thick)	0.2 to 0.3
Paper and cardboard	0.9
Silicone polish (.03 mm thick)	0.7

*Emissivity varies with purity