The Williamson Advantage

Williamson

Innovators in Noncontact Temperature Measurement

ARE ALL SINGLE-WAVELENGTH INFRARED THERMOMETERS ALIKE?

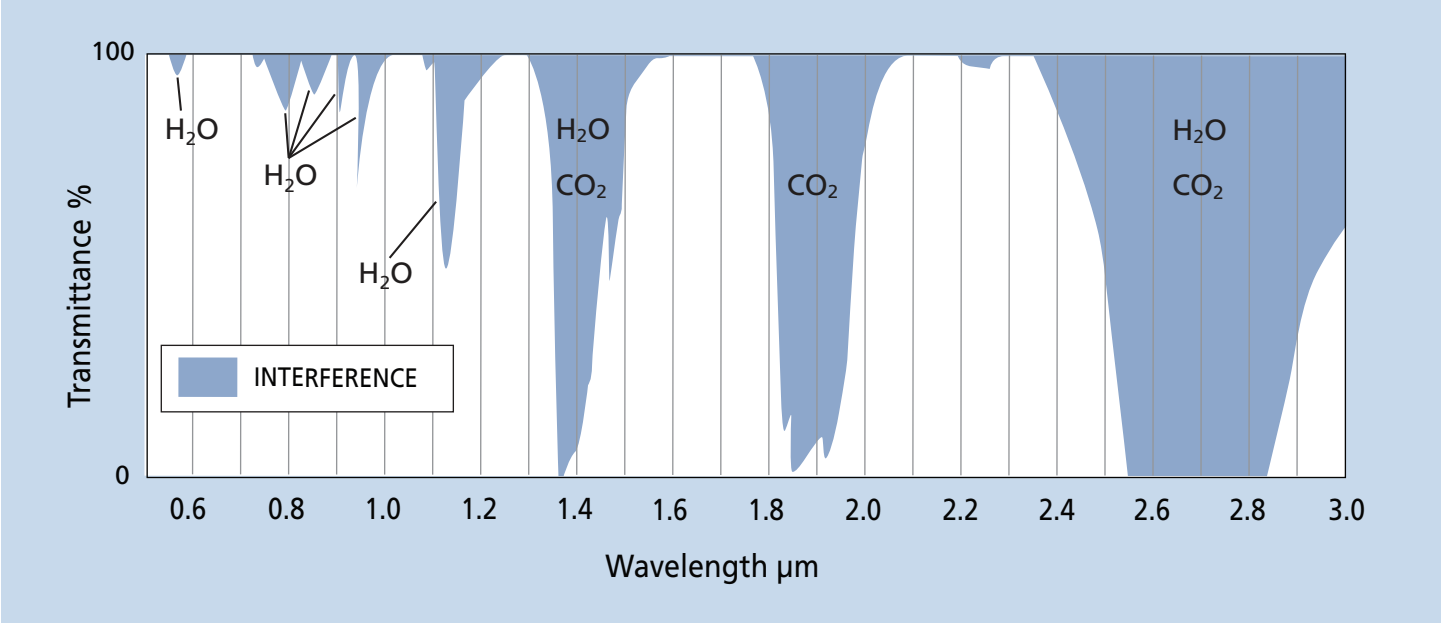
Most single-wavelength infrared thermometers are virtually identical; however, a close look reveals that Williamson sensors are different from all other brands in one critically important way – the wavelength. Because of their unique wavelength selection, Williamson sensors offer a significant advantage for applications involving steam, flames, combustion gasses and other types of wavelength-selective optical interference like plasma, laser energy, water and oil.

Wavelength is an important parameter when selecting an infrared thermometer because some optical interferences are highly transparent only in specific wavebands. Infrared energy is an electromagnetic energy just like visible light and x-rays. Visible light, different from x-rays only in wavelength, does not pass through the human chest, while x-rays go right through. In a similar way, the correct wavelength selection allows an infrared thermometer to view clearly through some types of intervening media without introducing an error.

Where the following graph is white (black), steam, flames and combustion gasses are highly transparent (opaque). Of all the major manufacturers, only Williamson offers short-wavelength sensors able to view clearly through steam, flames or combustion gasses (or long paths of air, for that matter). Therefore, Williamson single-wavelength sensors provide a significant technical advantage whenever these interferences are found. Wavelength selection is equally critical for other types of optical obstruction.

Williamson single-wavelength sensors are the best when oil, water, steam, flames or combustion gasses are encountered.

Single-Wavelength Brand	Nominal Wavelength	Actual Wavelength	Views Through Combustion Gas, Steam, and Flames
Raytek, Ircon, Land, Mikron, Impac*, Chino, Keller, and Others	1.6 um	1.0-1.75 um *1.0-1.45 um	No
Williamson	1.6 um	1.55-1.65 um	Yes
Raytek, Ircon, Land, Mikron, Impac*, Chino, Keller, and Others	2.2 um	*2.0-2.8 um **2.0-2.6 um 2.0-2.5 um	No
Williamson	2.2 um	2.05-2.4 um	Yes



As an example of the importance of wavelength selection, consider a continuous heat treat furnace with a heating zone, a soaking zone and a cooling zone. When aiming a Williamson sensor and another brand about 2 meters into the soaking zone (where the combustion gas and the product temperature are about the same) both sensors will read the same temperature value. However, when the two sensors are moved to the heating zone (where the combustion gasses are hotter than the product) the Williamson sensor will measure the true product temperature while the other brand will measure about 60 F / 35 C too high. Likewise, when the two sensors are moved to the cooling zone, the Williamson sensor will again produce a true reading while the other brand will read about 50 F / 30 C too low (because of the cool furnace gasses). Through thoughtful wavelength selection, Williamson short-wavelength sensors can view clearly through even the strongest flames, combustion gasses and clouds of steam without interference.

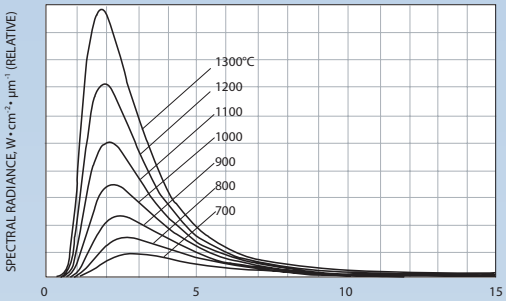
THE ADVANTAGES OF WILLIAMSON SHORT-WAVELENGTH SINGLE-WAVELENGTH SENSORS

Williamson short-wavelength infrared thermometers offer several advantages compared to other brands and to long-wavelength sensors.

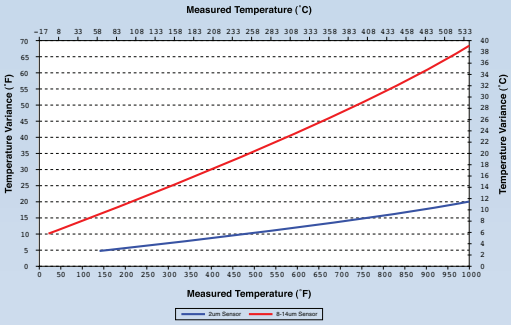
Williamson Short-Wavelength Sensors –

- Are available in Traditional and Fiber-Optic Configurations
- View Through Common Window Materials
- Uniquely view clearly through Steam, Flames and Combustion Gasses
- Select Models view through water, oil, wax, glass, plastic, plasma, laser energy, and other interferences
- Measure Low Temperature Values Rivaling Competitive Long-Wavelength Sensors
- Measure Broad Temperature Spans Rivaling Competitive Long-Wavelength Sensors
- Are 4 to 20 times less sensitive to Emissivity Variation compared to Long Wavelength Sensors
- Are 4 to 10 times less sensitive to Optical Obstruction compared to Long Wavelength Sensors
- Are 4 to 10 times less sensitive to Surface Scale & Cold Spots compared to Long Wavelength Sensors
- Are 4 to 10 times less sensitive to Misalignment compared to Long Wavelength Sensors
- Wmsn Hot Spot Detectors are 4 to 10 times more sensitive compared to Long Wavelength Sensors
- All Williamson Short-Wavelength Sensors are exceptionally stable and don't require periodic calibration
- Williamson's Patented Auto-Null Sensors Self-Calibrate 20X/second for long-term calibration stability
- Williamson Short-Wavelength Sensors make "impossible" measurements of Low-Temperature, Low-Emissivity Targets (Aluminum, Zinc, Chromate, Stainless Steel, Chrome, Copper, etc…)
- Short-Wavelength Sensors better tolerate emissivity variation,
- misalignment and optical obstruction

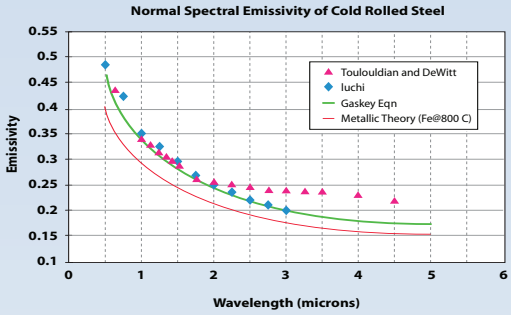
Williamson places a strong emphasis on short-wavelength single-wavelength sensors because of their better ability to tolerate emissivity variation and optical obstruction. As a result, Williamson is able to use these short wavelength sensors under a wider range of operating conditions than can other manufacturers. The result is superior sensor performance under real-world operating conditions. Every day, Williamson short-wavelength single-wavelength sensors are used to make measurements that are traditionally considered impossible to make.



Infrared energy change is more dynamic at shorter wavelengths



Short wavelength produce smaller errors



Emissivity is higher and more stable at shorter wavelengths

ARE ALL RATIO INFRARED THERMOMETERS ALIKE?

(a.k.a. Two-Color and Dual-Wavelength)

Most ratio infrared thermometers are virtually identical; however, a close look reveals that Williamson's unique single-detector dual-wavelength design is significantly different from and far superior to the two-color technology used by all other major manufacturers. The Williamson dual-wavelength technology effectively addresses each of the four important limitations associated with the two-color design.

Williamson dualwavelength sensors are best when water, steam, scale, severe temperature gradients, severe or intermittent optical obstruction, flames, combustion gasses, laser energy, plasma, small target, low temperatures, real-time emissivity measurements, or calibration stability are important application issues.

Two-Color Limitation #1: Wavelength Selection

Two-color detector technology dictates a specific wavelength set, while dual-wavelength technology allows free wavelength selection. Thoughtful wavelength selection permits Williamson sensors to better tolerate interference from water, steam, flames, combustion gasses, plasma and laser energy. Thoughtful wavelength selection also permits Williamson dual-wavelength sensors to provide broader temperature spans and to measure lower temperature values – as low as 200 F / 95 C and above.

Two-Color Limitation #2: Signal Dilution Capability

The two-color detector set includes two separate detectors – one on top of the other, with the bottom detector "blindfolded" by the one above it. Therefore, most of the energy collected by the sensor never reaches the bottom detector. Without this limitation, Williamson sensors can tolerate 20 to 100 times more optical obstruction compared to two-color sensors (varies by brand), allowing Williamson sensors to better view through dirty windows and severe dust storms and to better measure small or wandering targets that do not fill the sensor's field-of-view.

Two-Color Limitation #3: Wavelength Separation

A bump on the floor causes a table to wobble, but the wobble will be less when there is a greater separation between the legs. Similarly, the stability of a ratio sensor is related to the separation between the wavelengths. Because the Williamson wavelength sets have a greater separation, Williamson sensors are as much as 20 times less sensitive to interference compared to two-color sensors. For example, surface scale on a steel target that causes a 60 degree error for a two-color sensor produces an error of only 3 degrees for a Williamson sensor. Likewise, Williamson sensors are 20 times better able to measure only the hottest temperature viewed. This is important for applications with a small heated area or a temperature gradient, such as welding or induction heating.

Two-Color Limitation #4: Calibration Drift

With two detectors, two-color sensors are prone to calibration drift. With only one detector, any detector drift affects both wavelength equally, and therefore, does not impact the ratio measurement. Williamson dual-wavelength sensors therefore hold their calibration much better than do two-color sensors.

Single-Wavelength Brand	
Single-Detector Dual-Wavelength Ratio Sensors	Two-Color Ratio Sensors
Williamson Sensors stand alone	Raytek, Ircon, Land, Mikron, Impac, Keller, Chino, and Others are all alike

THE ADVANTAGES OF WILLIAMSON SINGLE-DETECTOR DUAL-WAVELENGTH SENSORS

Williamson single-detector dual-wavelength sensors offer several advantages compared to two-color sensors offered by others.

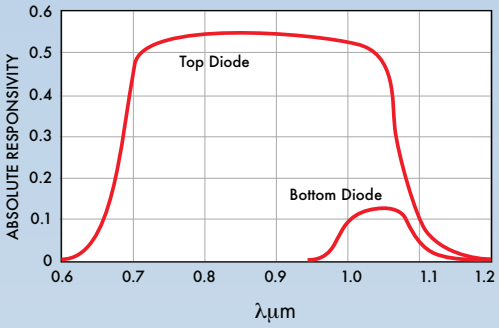
Williamson Dual-Wavelength Sensors –

- Are available in Traditional and Fiber-Optic Configurations
- Measure Low Temperatures – as low as 200 F / 95 C and above Fiber-Optic 400 F / 200 C and above
- Provide a Real-Time Measure of Temperature, Ambient Temperature, Emissivity and Signal Dilution
- Can Measure Single-Wavelength and Dual-Wavelength Temperature Values Simultaneously
- Include ESP Filtering to measure intermittent targets or to eliminate intermittent interferences
- Measure Broad Temperature Spans ideal for most Heating Applications
- Select models uniquely view clearly through Water, Steam, Flames and Combustion Gasses
- Select models uniquely view through Plasma and Laser Energy
- Are 20 times less sensitive to Scale and temperature gradients compared to two-color sensors
- Are 20 to 100 times less sensitive to optical obstruction and misalignment compared to two-color sensors
- All Williamson Dual-Wavelength Sensors are exceptionally stable and do not require periodic calibration
- Williamson sensors produce a better quality reading while requiring less maintenance and attention compared to all competitive brands

Williamson places a strong emphasis on dual-wavelength sensors because of their better ability to tolerate a wide range of common application issues with little or no maintenance. Williamson dual-wavelength sensors are used every day to make measurements that are traditionally considered impossible to make

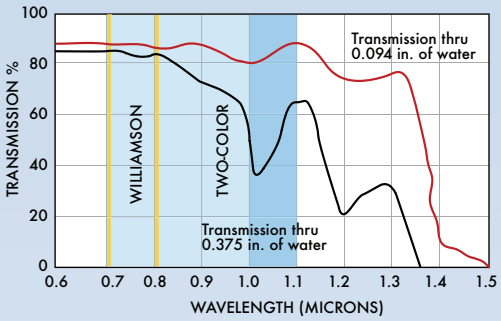
- Molten Metal Stream (Al, Cu, Fe, Ag, Au, etc…)
- Sinter Furnace
- Coke Guide
- Continuous Caster
- Reheat / Heat Treat Furnace
- Rolling Mill Descaler
- Rolling Mill Stands
- Rolling Mill Cooling
- Rolling Mill Coiler
- Annealing Line Wedge
- Forging Die
- Ultra-Fine Wire
- Oilfield Tubular Products
- Induction Heating
- Severe Optical Obstruction
- Aluminum Brazing
- Plasma Diamond Growth
- Plasma Ion Nitriding
- Carbon Densification
- Engineered Ceramics

Dual-Wavelength Sensors better tolerate emissivity variation, misalignment and optical obstruction.

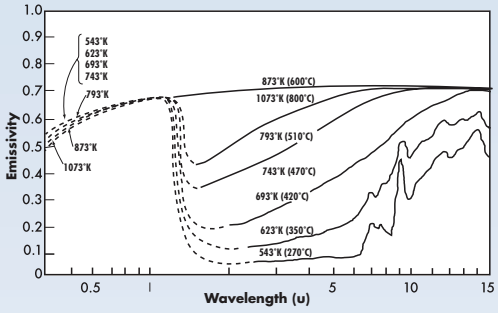


The Two-Color Detector Design Dictates the Wavelength Set.

Note that the two wavelengths overlap without separation, 1.0-1.1 um is the wrong wavelength for water, steam, flames, combustion gasses, and silicon, and the long wavelength (bottom detector) is weak.



Williamson Dual-Wavelength Sensors View Clearly Through Water and Steam without interference (Select Models). Two-color sensors do not.



Select Williamson Dual-Wavelength Sensors are filtered in a waveband where silicon has highly stable optical properties. Two-Color sensors are not.

WILLIAMSON'S UNIQUE MULTI-WAVELENGTH TECHNOLOGY

The most significant challenge for many infrared thermometer applications is contending with the complex emissive character associated with the measured material or with challenging measurement conditions. Single-wavelength sensors measure a significant error whenever the emissivity value is highly variable and they can not tolerate a significant optical obstruction. Dual-wavelength sensors measure a significant error whenever the change in emissivity is inconsistent at the two measured wavelengths and they assume that any optical obstruction impacts both measured wavelengths equally. When the emissive character of the measured material or when the transmission characteristic of any intervening media does not allow a single- or dual-wavelength sensor to produce an accurate reading, then the Williamson multi-wavelength technology is recommended.

Williamson multi-wavelength sensors are used for a variety of applications where traditional infrared thermometer technologies prove inadequate. The Williamson multi-wavelength sensors use ESP Algorithms to adjust for the unique emissive character associated with the specific measured material or measurement condition and to produce an accurate measure of temperature and emissivity. There are different algorithms for different materials and for different measurement conditions. The iterative ESP Algorithm is used to first measure the emissive character of the measured material across the entire wavelength set, and then to calculate a measure of both temperature and emissivity. Each Williamson multi-wavelength sensor can hold as many as eight ESP Algorithms. The ability to hold multiple algorithms means that each Williamson sensor can be used for multiple measurement applications.

The Williamson multi-wavelength infrared thermometers represent the culmination of nearly four decades of refinement and perfection to the world's first and most robust commercial multi-wavelength product line. Originally introduced in the 1970s, no other multi-wavelength sensor is as precise, as accurate, as robust, as reliable, as versatile, as innovative, or as easy to use. No other infrared thermometers equal the features or performance of the Williamson multi-wavelength products. No other product can measure such a wide range of materials under such a wide range of conditions over such a wide temperature span and in such a wide range of environments. Williamson multi-wavelength sensors are truly without peers. There are a number of temperature measurement applications for which the Williamson multi-wavelength sensor represents the only viable and accurate solution.

Some of the more popular multi-wavelength applications include the following.

Applications and Materials:

Aluminum & Copper

- Extruded Surface
- Rolled Surface
- Cast Surface
- Sheared Surface
- Forged Surface
- Brazing Operations
- Coating Preheat

Steel

- Cold Rolled Steel
- High Alloy Steels
- Electrical Steel
- Zinc-Coated Steel
- Shot-Blasted Pipe
- Hot Mill Coilers
- Bearings
- Motor Rotors

Glass & Plastic

- Molds
- Plungers
- Streams & Gobs

Engineered Materials

- CVD

WILLIAMSON MULTI-WAVELENGTH SENSORS

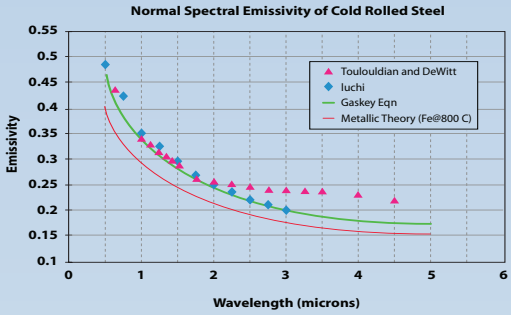
Williamson multi-wavelength infrared thermometers offer several advantages compared to other brands and to other sensor technologies.

Williamson Multi-Wavelength Sensors –

- Are available in Traditional and Fiber-Optic Configurations
- View Through Common Window Materials
- Measure Low Temperatures – as low as 300 F / 150 C and above Fiber-Optic 400 F / 200 C and above
- Provide a Real-Time Measure of Temperature, Ambient Temperature, Emissivity and Signal Dilution
- Can Measure Single-Wavelength and Dual- or Multi-Wavelength Temperature Values Simultaneously
- Include ESP Filtering to measure intermittent targets or to eliminate intermittent interferences
- Measure Broad Temperature Spans ideal for most Heating Applications
- Select models uniquely view clearly through Water, Steam, Flames and Combustion Gasses
- Select models uniquely view through Plasma and Laser Energy
- Tolerate Misalignment and Dirty Optics (select algorithms)
- Tolerate non-grey emissivity variation.
- Tolerate non-grey optical interferences.
- Store as many as Eight ESP Algorithms for use in as many as eight applications for extreme versatility..
- All Williamson Multi-Wavelength Sensors are exceptionally stable and do not require periodic calibration!!
- Williamson sensors produce a better quality reading while requiring less maintenance and attention compared to all competitive brands
- Williamson Multi-Wavelength Sensors make “impossible” measurements of challenging materials (Aluminum, Zinc, Stainless Steel, Copper, High Alloy Steel, Electrical Steel, Cold Rolled Steel, Molds and Plungers, etc…)

Williamson specializes in advanced technologies to compensate for the low and variable emissivity character associated with many industrial applications.

Multi-Wavelength Sensors tolerate non-grey emissivity variation and optical obstruction.



Non-Grey: Emissivity is different and changes differently at different wavelengths.

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