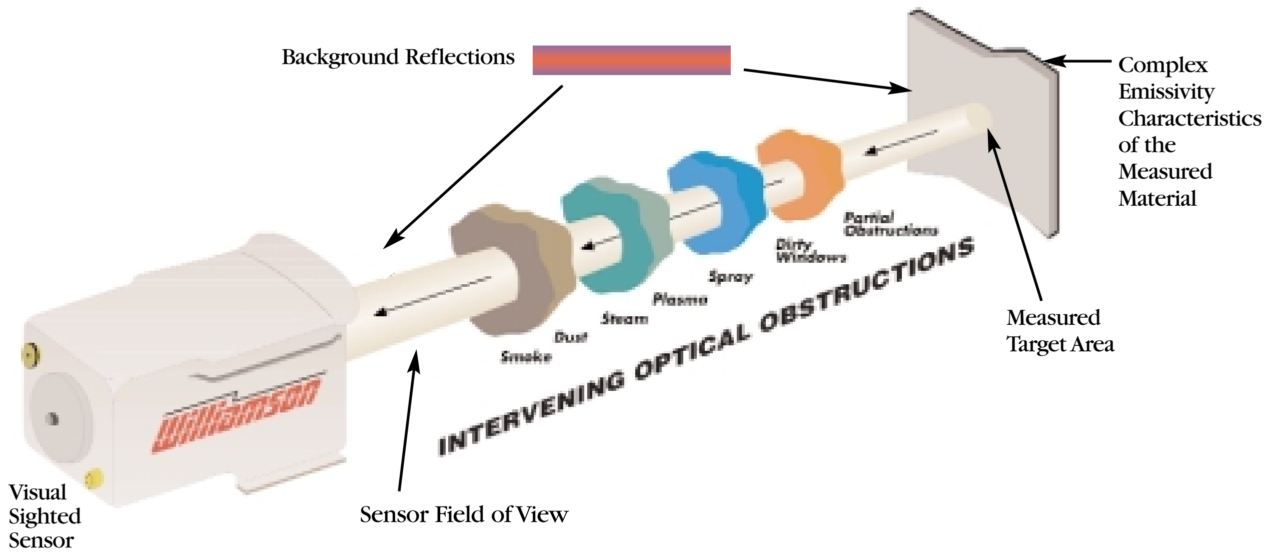
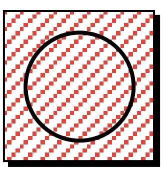
Pro Series Pyrometers with ESP Provide Greater Accuracy, Reliability, and Ease of Use

ExtraSensory Perception (ESP)

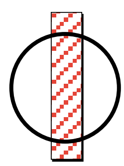
"The ability to obtain understanding by going beyond the recognized senses"





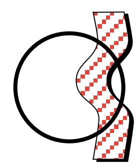
Full Field of View

Target fills the measured area



Partially Filled Field of View

Target does not fill the measured area, but it is centered in the area



Wandering Field of View

Target does not fill the measured area, and it moves within the area

A rule of thumb for applying infrared temperature sensors suggests that 20% of the problem is picking the right sensor; and 80% is installing it correctly. Despite tremendous advances in sensor technologies, installing temperature sensors correctly can still be challenging.

As the figure above illustrates, emissivity, intervening optical obstructions (smoke, steam, dust, mist, dirty window, etc.), misalignment, and reflections are enough to threaten the results of any installation. Successful installation requires minimizing or eliminating the impact of these interference sources. But even the best-planned installations might not eliminate the issues that affect a sensor's readings.

The PRO Series dual- and multi-wavelength sensors feature a unique ESP technology that is used to simplify and improve the management of these troublesome applications issues. With ESP Technology the sensor continuously monitors process conditions and automatically responds appropriately to provide more accurate and reliable temperature measurements than traditional temperature sensors. ESP is used to:

- Simplify Installation
- Verify Sensor Performance
- Identify Error Sources
- Correct for Emissivity Irregularities

With ESP Technology, the PRO Series sensors provide a valid reading - or none at all!

Overview of PRO Series Models

Model	Type of Sighting	Type of Sensor	ESP Functions
PRO 80	Visual	Dual-Wavelength	**ESP Filters**[1]
PRO 90	Fiber Optic		
PRO 100	Visual	Multi-Wavelength	**ESP Filters**[1] and **ESP Algorithms**
PRO 200	Fiber Optic		

[1] Patent Pending

Advanced ESP functions enable 'aim-and-read' capability on many applications that were previously considered difficult to measure. Some examples of applications that benefit from ESP include measurement of:

- Aluminum and other nonferrous metals
- Galvannealed Steel
- Glass Molds
- Molten Metal
- Small Wires
- Stainless Steel
- Welded Tubes

Williamson

Innovators in Noncontact Temperature Measurement

Innovative Design for Traditional and Difficult Applications

Infrared sensors use an optical system to collect infrared energy from a measured target area. This energy is used to calculate the target surface temperature. In many industrial and laboratory settings, there are often application issues that interfere with the amount of infrared energy collected by the sensor, including: emissivity variation, misalignment, intervening optical obstructions and stray reflected infrared energy.

The PRO Series dual- and multi-wavelength sensors offer ESP to improve and simplify the management of these application issues. The goal of ESP is to enable out-of-the-box 'aim-and-read' capabilities for even the most demanding applications. Unique ESP features include:

- **System status messages** provide useful information for operation verification.
- **Five measured parameters** enable the sensor to effectively characterize a wide range of application conditions (See Table below). Each measured parameter may be viewed on the sensor's displays or sent elsewhere via programmable outputs and alarms.
- Pre-programmed, application-specific **ESP Models** automatically recognize and compensate for a wide range of application conditions. ESP parameters can be easily adjusted for custom application requirements or for fine-tuning of an existing ESP Model.
- A **text-based menu** makes it easy to view and adjust parameters in the system. If adjustments are required, no manual or special training is required to translate obscure programming codes.

All combined, these innovative features enable the PRO Series dual- and multi-wavelength sensors to outperform traditional noncontact temperature sensors for all but the simplest applications.

PRO Series Measured Parameters

Parameter	Description	Troubleshooting Procedure
Ambient Temperature	The ambient temperature inside the sensor is measured to verify that the sensor is within its specified ambient operating limits. A status message is displayed when ambient limits are exceeded.	• Move the sensor to a cooler location • Shield the sensor from the heat source(s) • Add a water- or air-cooling accessory • Convert to a fiber optic style sensor
Signal Strength / Emissivity	The signal strength value is a measure of effective emissivity. When the sensor field of view is filled, with no obstructions or background influences, this value represents the emissivity of the measured surface.	**Low Signal Strength & Signal Dilution Readings** • Clean the sensor lens / window • Verify sensor alignment • Eliminate optical obstructions **High Signal Strength & Signal Dilution Readings** • Eliminate reflections from background sources • Eliminate a high temperature interference
Signal Dilution	Signal dilution is a relative measure of the infrared energy emitted by a target. A signal dilution factor of 500:1 indicates that the sensor is measuring 500 times more infrared signal than is required to make a reading.	
Unfiltered Temperature	The measured target temperature with no signal conditioning filters applied. It can be viewed simultaneously with the filtered temperature to better understand the measurement conditions.	• If this value is particularly unstable, it many indicate that some abnormal conditions exist.
Filtered Temperature	The measured target temperature with the signal conditioning filters applied.	• If this value is unstable then identify the interference via an association, or adjust signal conditioning (time averaging, peak hold, or ESP filtering) to obtain an acceptable reading.

ESP Filtering Assures the Validity of Measurements When Severe Interference Exists

It is not always possible to eliminate interference sources. But with Williamson's unique ESP filters for signal strength and signal dilution, it is possible to overcome persistent application interference.

The PRO Series dual- and multi-wavelength sensors continuously measure **signal strength** and **signal dilution**. Because each application has a characteristic range of acceptable values for these parameters, these measurements provide the sensor with valuable information about application conditions.

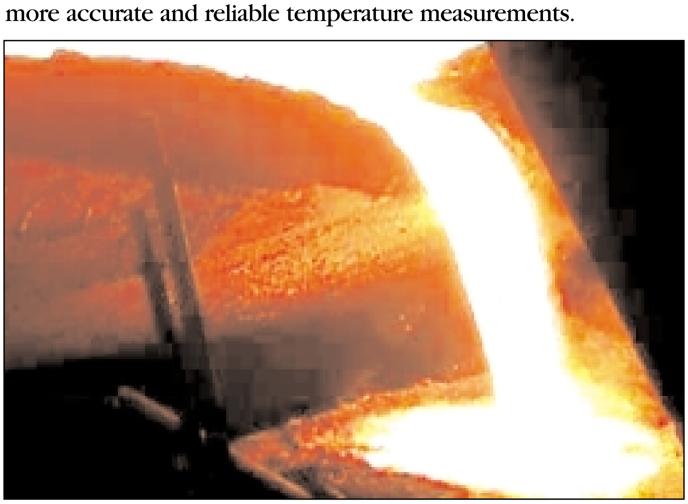
By setting the **ESP filters** for signal strength and signal dilution to the characteristic range of an application, the sensor can automatically recognize valid and invalid application conditions and respond appropriately. ESP filters can be pre-programmed for specific applications, and easily adjusted in the field from the text based menu system for unique applications and ad hoc troubleshooting procedures.

There are two possible responses that the sensor can provide to an invalid operating condition:

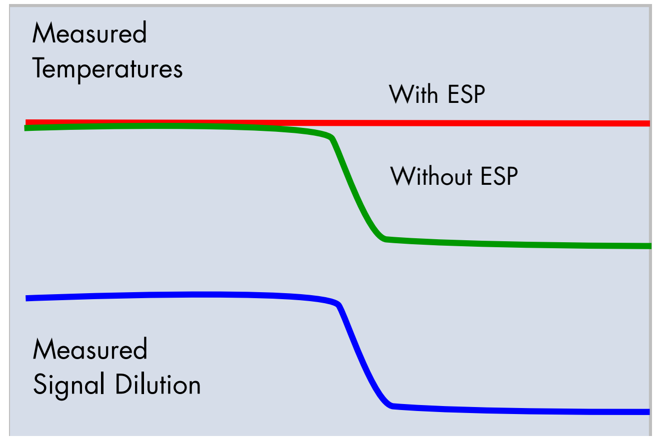
- The sensor can "turn off" and display a status message that indicates which ESP Filter is out of range.
- An advanced peak hold feature can display and hold the last valid temperature measurement before the invalid condition occurred.

The end result of the ESP filters is that the sensor will only display temperature values that are accurate and reliable. Thus, ESP filters enable more reliable temperature monitoring to help improve process quality, control, and productivity.

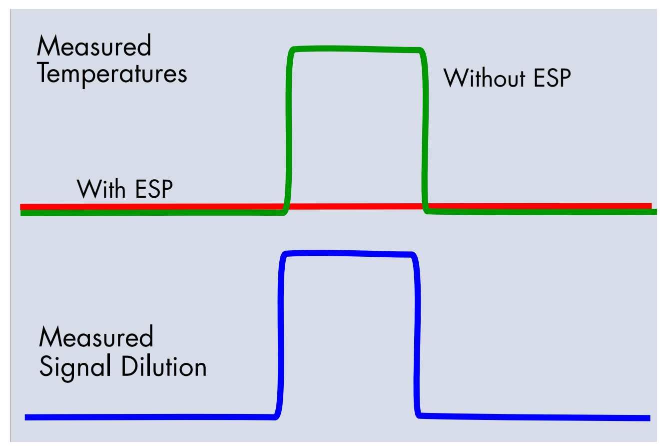
One example where ESP Filtering is used to assure valid readings is the temperature measurement of a molten iron stream. In this application, heavy smoke, sparklers, and reflections often make measurement extremely difficult. The three graphs illustrate how advanced ESP Filters are used to recognize changes in application conditions and enable the sensor to respond appropriately for more accurate and reliable temperature measurements.



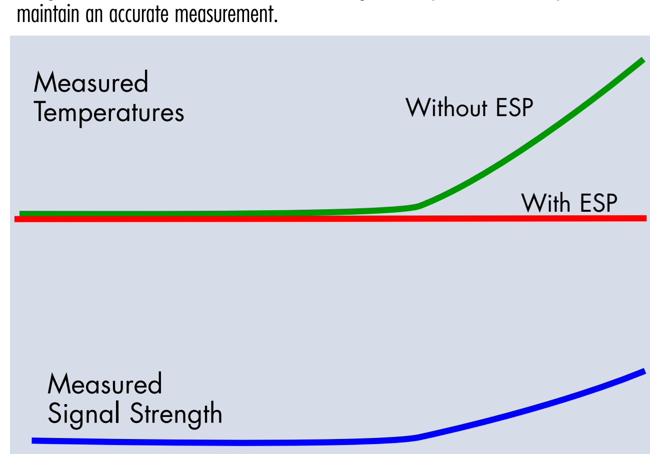
Even with demanding application conditions ESP Filtering assures that the sensor will provide a valid reading … or none at all.



Heavy Smoke: Heavy smoke can obstruct the sensor's view of the measured target and cause a sensor without ESP to read in error. By monitoring the decrease in signal dilution, the sensor with ESP can recognize the presence of smoke and maintain an accurate measurement.



Sparklers: As molten iron cools, carbon comes out of suspension and ignites to create sparklers that cause a sensor without ESP to read too high. By monitoring the increase in signal dilution, the sensor with ESP can recognize the presence of the sparklers and maintain an accurate measurement.



Ladle Reflections: As a ladle is tipped, hot refractory walls are exposed, and a reflected image of these walls can cause a sensor without ESP to read in error. By monitoring the increase in signal strength, the sensor with ESP can recognize the presence of reflections and maintain an accurate measurement.

ESP Algorithms Correct for Emissivity Irregularities

Successful temperature measurement of non-greybody materials is difficult because complex emissivity variations occur with changes in surface oxidation, alloy composition, surface texture, temperature, or crystal structure. Except under highly controlled conditions, traditional single- and dual-wavelength temperature sensors are unable to compensate for these variations.

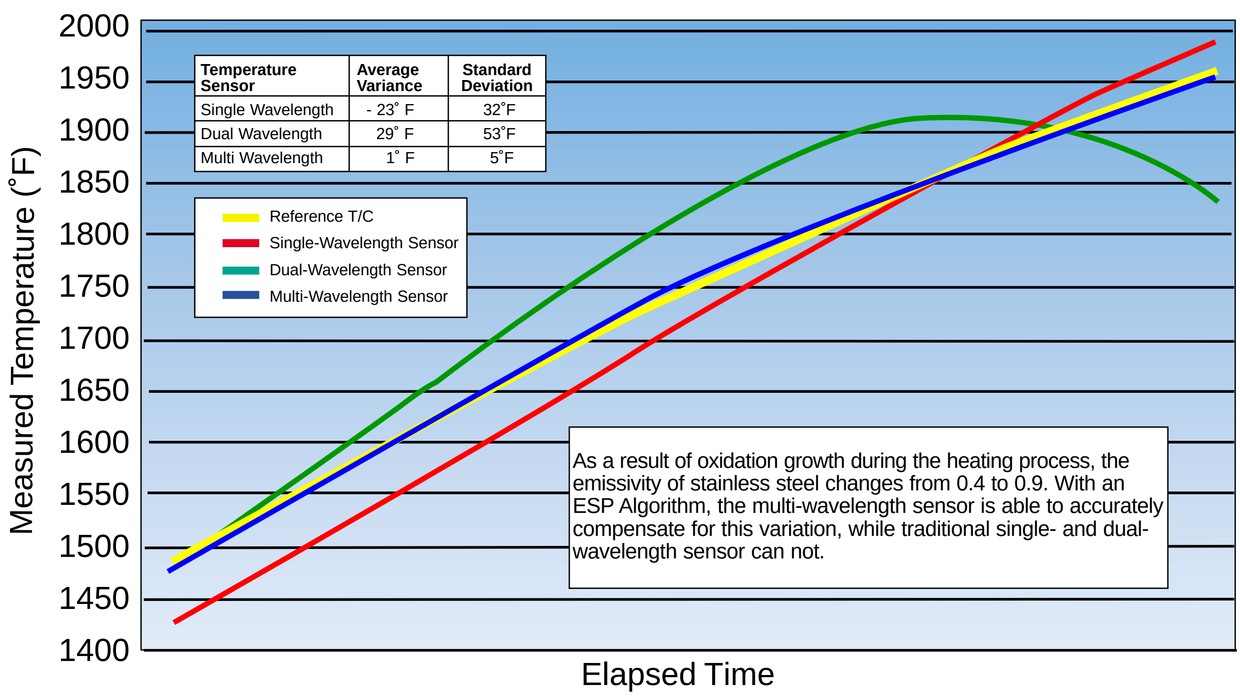
Williamson's unique multi-wavelength infrared thermometers use advanced ESP algorithms to solve this complex problem. **ESP algorithms** are computer-based empirical models that consider infrared energy, emissivity, and the measured wavelengths to properly compensate for the irregularities of non-greybody materials.

The graph below illustrates the accuracy of the multi-wavelength sensor on a typical non-greybody material, stainless steel. By using a stainless steel algorithm to compensate for the changes in emissivity, the multi-wavelength sensor provides superior results with an out-of-the-box 'aim-and-read' capability. Several application specific ESPs have been developed to produce comparable results with applications previously considered difficult to measure.

Examples of non-greybody materials:

- **Aluminum**
- **Brass**
- **Chromium**
- **Copper**
- **Molybdenum**
- **Stainless Steel**
- **Tin**
- **Titanium**
- **Tungsten**
- **Zinc**

Each multi-wavelength sensor can include up to four menu-selectable, factory-programmed **ESP algorithms** as well as a dual/ratio mode for dual-wavelength measurement. It is also easy to create advanced ESP models that combine the **ESP algorithms** with the **ESP filters** to enable measurement of non-greybody materials under adverse operating conditions.



WILLIAMSON CORPORATION
70 Domino Drive, Concord, Massachusetts 01742
TEL: (978) 369-9607 • FAX: (978) 369-5485 • (800) 300-8367 (USA)
www.Williamsonir.com • Sales@Williamsonir.com

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