

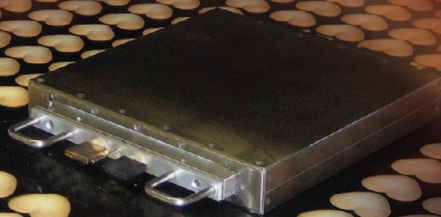


READING THERMAL



# SCORPION<sup>®</sup> 2

*Data Logging Measurement System  
with SMART SENSOR TECHNOLOGY™*



DATA COLLECTION ~ ANALYSIS ~ PROBLEM SOLVING

# Welcome

## Reading Thermal is proud to introduce you to the SCORPION® 2 Data Logging Measurement System with *SMART SENSOR TECHNOLOGY™*

The SCORPION® has become a standard in the baking industry, and SCORPION® 2 represents the next step in its evolution. SCORPION® 2, a major upgrade to the SCORPION® Data Logging Measurement System, embodies more than two years of R&D effort. The new design was customer driven with a primary focus on ease-of-use and technology advancements to increase the resolution of the baking profile and the speed in which profile data is collected. With these improvements, you receive enhanced productivity, product quality and increased profitability for a wide range of baking, drying and cooling processes. Like its predecessor, SCORPION® 2 is a complete data logging measurement system setting new standards in measuring and analyzing critical in-process conditions.

The SCORPION® 2 Data Logger is Faster, Easier to use and Smarter than its predecessor. It captures a better, more complete process picture in a shorter period of time. With its 32 input channels, a 0.1 sec scan rate and the ability to collect multiple profiles with no need to download between runs, you receive a highly defined process picture in a much shorter period of time. In fact, with the new SCORPION® 2, a complete set of profiles (Temperature, Airflow, Heat Flux and Humidity) can be collected on a typical biscuit or cracker line in 1/3 the time than with the original SCORPION® Data Logger.

Faster  
Easier  
Smarter





# SCORPION<sup>®</sup> 2

Data Logging Measurement System  
with SMART SENSOR TECHNOLOGY™

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# The solution is in the details

**f**or some, sameness is boring—but for bakers it's a thing of beauty. Being able to measure and control the many variables of the baking process – temperature, air velocity, heat flux and humidity, is the difference between inconsistent product and product that comes off the line the same – from line to line, from city to city, even from country to country.

The SCORPION® enables you to precisely measure and evaluate conditions throughout your baking process, allowing you to produce the same product on every line.

The SCORPION® is used around the world for many different applications in the food industry. It is also used by the manufacturers of oven lines and cooling tunnels to aid in their equipment design and testing. The most common application is profiling a product being conveyed through a heat transfer tunnel. Examples include baking and drying ovens, cooling tunnels and freezing tunnels. Products range

from cookies and crackers to chocolates and candies to chicken and sausage to aluminum cans. In these applications, the SCORPION® records measurements in line with the product flow, at product level, as it is being processed.

This allows the operator to collect data which directly reflects the conditions of the process under full load. In an organization the SCORPION® is used by various departments including R&D, Quality Assurance, Food Safety, Oven Operators and Maintenance.



# SCORPION® 2 Applications

## Quality Assurance

Record your processing conditions when your product quality is within specification. Save these profiles for future reference as “target” conditions. Use the SPC function included in the software to establish upper and lower control limits for your process temperature, air velocity, heat flux and humidity profiles.

## Line Start-up

Take a SCORPION® profile a few minutes before introducing product into a process. This is a good check that the process has reached the correct operating conditions before production is started.

## Product Consistency Line-to-Line

Compare SCORPION® profiles for two process ovens, perhaps in different factories, that are supposed to be making the same product.

## Commissioning and Maintenance

Heat process ovens usually include dampers and other controls that must be set by the installation engineer. Use SCORPION® to check that these have been set correctly. Repeat the profiles as part of your preventative maintenance program to detect drift in zone conditions and to pin-point the cause of problems when they do occur.

## Analyze Equipment Performance

Most oven manufacturers now use SCORPION® to design their heat processes. This is an invaluable tool for design engineers to balance heat and airflow across the width and along the length of the process oven.



## Optimize Food Safety and Throughput

Controlling internal food temperature is key to achieving food safety. Today's food processors must also document how they are meeting food safety requirements with data. The SCORPION® 2 Data Logging Measurement System makes both jobs easier.

The SCORPION® 2 Data Logger with R&D Smart Sensor and Product Probes simplifies the measurement of environment temperature, airflow, energy transfer and internal product core temperature. Plus the SCORPION® 2 Software (SV8) calculates and displays the % kill for a specified pathogen reduction level.

By combining this ease of measurement with robust data capture, the SCORPION® 2 System enables better process optimization. No other system makes achieving desired levels of food safety and throughput so simple.

## New Product Development

Use SCORPION® to record the processing conditions you develop in the lab or in a pilot plant. Then use SCORPION® again to establish the same conditions as the new product is transferred to a full-scale production line.

# SCORPION® 2 Data Logger

## with SMART SENSOR TECHNOLOGY™

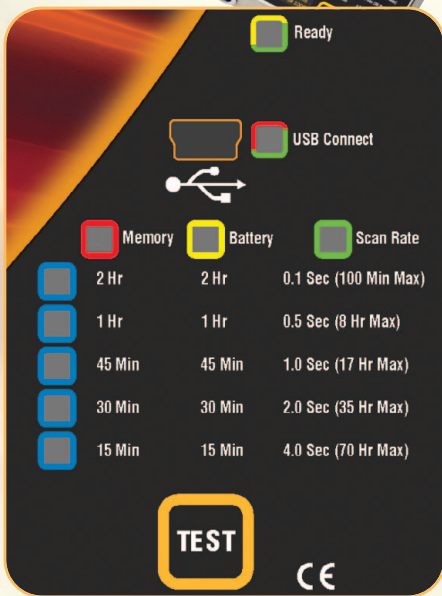
The SCORPION® 2 Data Logger is the 'brain' of the measurement system, capturing and storing profile data from the Smart Sensors for subsequent downloading to a computer for display and analysis. It can capture data from up to 32 sensor/input channels as fast as 10 times per second. The captured profiles are saved in non-volatile memory until the user chooses to delete them.

**SMART SENSOR TECHNOLOGY™** is employed on all SCORPION® 2 sensors and is the key to user friendly operation. Smart Sensors simplify the data collection process, enabling line workers without specialized training to handle test runs. Data from each run is stored in the data logger and can be downloaded for analysis, in a convenient office location, at a later time. Smart sensor technology allows the Data Logger to automatically recognize the attached

sensor and perform a self-test. Each **Smart Sensor™** contains embedded memory which is programmed during manufacturing. The embedded memory contains calibration data, date of calibration, sensor type, sensor serial number and date of manufacture.

Smart sensors are attached to the data logger via two 32-pin D-Sub connectors and an easily-aligned self-latching mechanism. Multiple profiles can be collected with the same or different sensor without returning to a computer and downloading data between runs. When ready to download and analyze data the user simply starts the SCORPION® Software (SV8) and connects the data logger to the computer via a USB cable.





The SCORPION® 2 Data Logger contains an onboard **User Interface** which enables data collection without the need of a computer on the factory floor. Immediately upon connecting a Smart Sensor, a communication link is established between the data logger and sensor and a self-test is initiated. The result of this test is indicated by a **Ready Light**, allowing the user to confidently proceed with data collection knowing that all data logger and sensor parameters are within operational limits. Pressing the **TEST** button displays the **Memory** and **Battery** capacity, cautioning the user as the minimum amount of time remaining drops below two hours. The **TEST** button is also used to select a **Scan Rate** of 0.1, 0.5, 1, 2, or 4 seconds.

## Technical Summary\*:

- Input Channels: 32
- Thermocouple Input Type: Type T
  - Type J & K optional for product probe inputs
  - Input Temperature Range: -260°C - 1378°C (-436°F - 2513°F)
- Output Channels:
  - (3) Constant Current sources for Air Velocity sensors
  - 7.2V unregulated output for Humidity Sensor heater
  - Regulated 5V output for Humidity Sensor
  - Regulated 3.3V output for SMART SENSOR Memory
- Sensor Interface: 32-pin D-Sub connectors
- Scan Interval: 0.1sec, 0.5sec, 1.0sec, 2.0sec, 4.0sec
- Memory Type: Non-volatile FLASH
- Memory Capacity (max):
  - Up to 100min @ 0.1sec scan rate
  - Up to 8hrs @ 0.5sec scan rate
  - Up to 17hrs @ 1sec scan rate
  - Up to 35hrs @ 2sec scan rate
  - Up to 70hrs @ 4sec scan rate
- Time Tracking: Onboard Real Time Clock – Time / Date
- Resolution: 0.025°C (0.045°F)
- Accuracy: ±1.0°C (±1.8°F)
- Battery Running Time: 50+ hrs. for Temperature Sensor Arrays, Interface Devices and Heat Flux Sensor  
Automatically adjusts for Air Velocity & Humidity Sensors
- Battery: 7.2V, 2200mAh
- PC Communication Link: USB 2.0
- Rugged Stainless-steel enclosure

*\*Not rated for condensing environments*

# SCORPION<sup>®</sup> 2 Smart Charger



The **SCORPION<sup>®</sup> 2 Smart Charger** is used to charge the SCORPION<sup>®</sup> 2 Data Logger Battery. It also acts as a user interface displaying vital information about Memory Available (hr:min), Battery Available (hr:min), Battery Internal Temperature, and Battery Health.

A microprocessor controlled smart circuit is used to analyze the battery capacity and temperature to determine the correct charging current required to bring the battery to full capacity as fast as possible. The smart circuit can bring a severely discharged battery to full capacity in 1.5 hours. It also provides over temperature protection by monitoring the internal battery temperature and suspending charging for 30 minutes if the maximum temperature exceeds 50°C (122°F).

## Technical Summary:

- Fast Charge: 1.5hrs
- Microprocessor Smart Circuit
- 3-State Charge:
  - Pre Charge – Initializes a severely discharged battery
  - Fast Charge – High current fast charge
  - Maintenance Charge – Keeps charged batteries fully charged
- Over Temp Protection
- LCD Display:
  - Logger Serial Number
  - Battery:
    - % Charged
    - Charging Status – Pre Charge/Fast Charge/ Fully Charged
    - (hr:min) Available – specific to attached SMART SENSOR
    - Internal Temperature
    - % Health – Indicates the maximum capacity of a fully charged battery so there is no question as to when a battery should be replaced
- Memory:
  - (hr:min) Available – Based on the selected Scan Rate and amount of memory already used
- Lightweight extruded aluminum case



# Data Logger Dwell Time

## (Time vs. Temperature)

A **Thermal Barrier** is used to protect the SCORPION® 2 Data Logger from extreme hot and cold conditions found in commercial ovens and freezers. By sliding the data logger inside the thermal barrier, thermal migration is delayed from damaging the sensitive electronic circuitry.



Several thermal barrier heights are available to cover a wide range of process temperatures and dwell times. The height is the thickness of the thermal barrier, which translates to the headroom required to pass the SCORPION® 2 through the process.

The Data Logger Dwell Time Graph is used to determine what size thermal barrier is required for safe operation. The thermal barrier performances for the 6 standard sizes are displayed.



THB40 THB50 THB60 THB80 THB100 THB125

### Thermal Barriers:

**THB40:** H = 40.0mm (1.6") x W = 25.0cm (9.8") x L = 29.1cm (11.5")

**THB50:** H = 50.0mm (2.0") x W = 25.0cm (9.8") x L = 29.1cm (11.5")

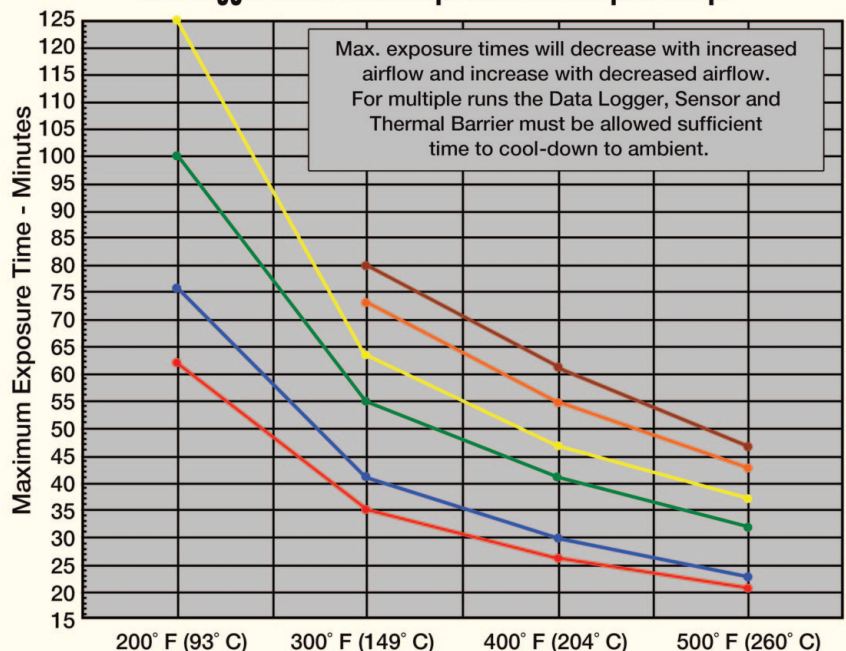
**THB60:** H = 60.0mm (2.4") x W = 26.0cm (10.2") x L = 29.1cm (11.5")

**THB80:** H = 80.0mm (3.2") x W = 28.0cm (11.0") x L = 32.1cm (12.6")

**THB100:** H = 100.0mm (3.9") x W = 32.5cm (12.8") x L = 39.1cm (15.4")

**THB125:** H = 125.0mm (4.9") x W = 32.5cm (12.8") x L = 39.1cm (15.4")

### Data Logger Dwell Time Graph in Air at 500fpm/2.5mps



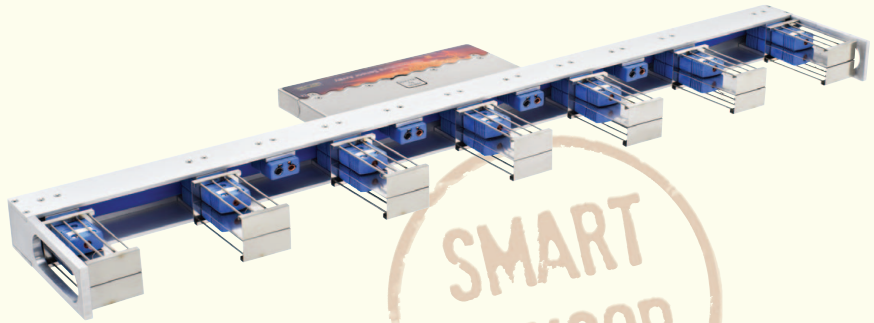
Max. exposure times will decrease with increased airflow and increase with decreased airflow. For multiple runs the Data Logger, Sensor and Thermal Barrier must be allowed sufficient time to cool-down to ambient.

Data Logger, Sensor & Thermal Barrier Starting temp = 75° F (24° C) Data Logger Ending temp = 158° F (70° C) Max internal temp

Thermal Barrier Height	40 mm (1.6")	50 mm (2.0")
	60 mm (2.4")	80 mm (3.2")
	100 mm (3.9")	125 mm (4.9")

# Temperature Sensor Array

**Product level temperature** throughout an oven can make the difference between optimum quality and throughput – and wasteful, under baked or burnt product. The right temperature applied at the right time causes chemical reactions to occur within a product. The process of fermentation, product swelling, moisture evaporation, flavor development, and surface coloring are all time and temperature dependent.



## The Process

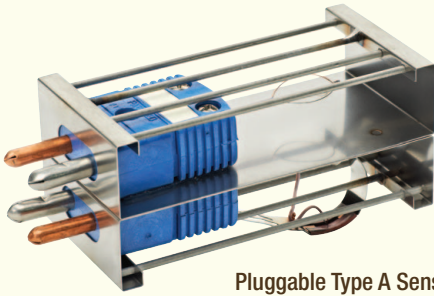
The SCORPION® 2 Temperature Sensor Array is designed to measure temperature at product level, in fixed positions across the conveyor, delivering a true representation of what the product experiences over time. The design contains pluggable thermocouple pairs equally spaced across the width of a bar, which is selected to match the width of the oven band. The number of sensor pairs varies with the width of the bar/conveyor. The sensor array travels through the process with the product, and the oven under full load,

yielding a precise picture of temperature from side-to-side and end-to-end. Simultaneous product-core-temperature measurements can be made via the product probe inputs on the sensor array. There are 2 or 4 product probe inputs on the temperature sensor array (see Standard Array Configurations Table).

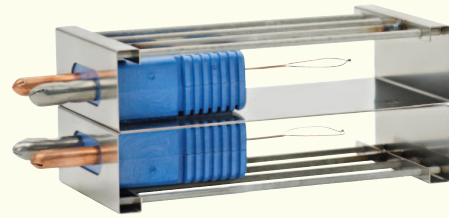
There are two types of Pluggable Temperature Sensors. **Type A** is an Air/Conveyor sensor designed to measure air temperature immediately above the conveyor, and surface temperature of the conveyor itself. Type A is used on solid or tight mesh conveyors. One thermocouple in each pair measures air temperature; the other is spring-loaded down onto the conveyor surface. Type A Temperature Sensors can only be used with the THB40 & THB50 Thermal Barriers.

## Standard Array Configurations

Conveyor Width mm (inch)	Array Width mm (inch)	Sensor Pairs (#)	Sensor Spacing mm (inch)	Product Probe Inputs (#)
300 (11.80)	250 (9.80)	3	99 (3.88)	2
500 (19.70)	450 (17.70)	5	100 (3.94)	4
800 (31.50)	750 (29.50)	7	116 (4.56)	4
1000 (39.38)	950 (37.38)	9	112 (4.44)	4
1200 (47.25)	1150 (45.25)	11	110 (4.31)	4
1500 (59.06)	1450 (57.06)	13	117 (4.56)	4
2000 (78.75)	1950 (76.75)	15	136 (5.31)	2



Pluggable Type A Sensor

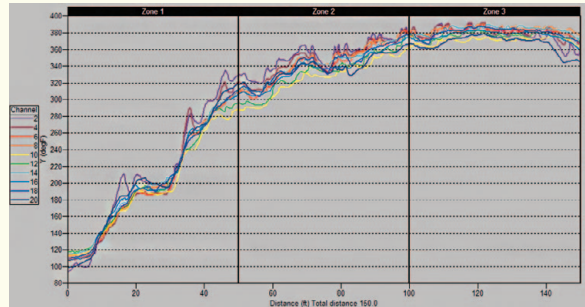


Pluggable Type B Sensor

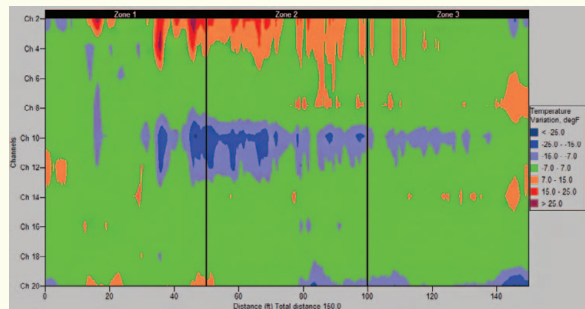
**Type B** is an Air/Air sensor designed to measure upper air temperature immediately above the conveyor, and lower air temperature of the air rising through the conveyor. The upper and lower thermocouples are separated by a thin shield. Type B is used on open mesh conveyors.

## Analyzing the Results

SCORPION® Software (SV8) is used to download the data from the SCORPION® 2 Data Logger and analyze the results. The stored data for each of the sensors can be displayed as a line (channel) in a **2D Line Graph**. Individual channels, combinations of channels, and channel averages can be displayed against time, distance, and % travel through the process. Side-to-side temperature variation is directly related to side-to-side variation in product bake, and represents a critical measurement displayed by the Temperature Sensor Array. The tighter the pattern of lines the more even the temperature is across the width of the band. Visually, side-to-side variation is better displayed in a **2D Contour Graph**, which in this example is showing greater than 28°C (50°F) band temperature variation; indicated by the hotter (red) left side and cooler (blue) center of the band.



2D Line Graph



2D Contour Graph

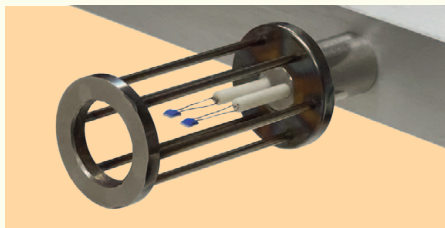
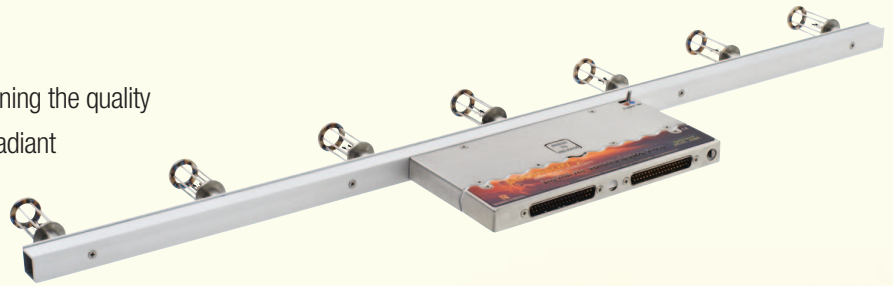
## Technical Summary\*:

- Number of Sensor Elements (channels): up to 32
- Sensor Type: Type T thermocouple
- Product Probe Inputs: 2 or 4 based on array length (custom options available)
- Product Probe Sensor Type: Type T thermocouple (Type J&K optional)
- Operating Temperature Range: -50°C (-58°F) to 350°C (662°F)
- Resolution: 0.025°C (0.045°F)
- Accuracy: ±1.0°C (±1.8°F)
- Response Time: t60 = 3.5sec in air at 1m/sec (200ft/min)
- Battery running time: 50+ hrs.

\*Not rated for condensing environments

# Digital Air Velocity Sensor Array

**Even distribution of airflow** is vital in maintaining the quality of product delivered by any oven system. In a radiant oven, (e.g. ribbon burners) the airflow comes from the moving conveyor, the exhaust system, and natural combustion air currents. In a convection oven, (e.g. air recirculation) the airflow comes primarily from the air distribution plenums. In this case, airflow is of particular importance because it directly controls the amount of heat delivered to the product.



Digital Air Velocity Sensor

## The Process

The SCORPION® 2 Digital Air Velocity Sensor Array delivers a precise picture of airflow patterns inside the thermal environment of an oven, dryer or cooling tunnel, from side-to-side and entrance-to-exit.

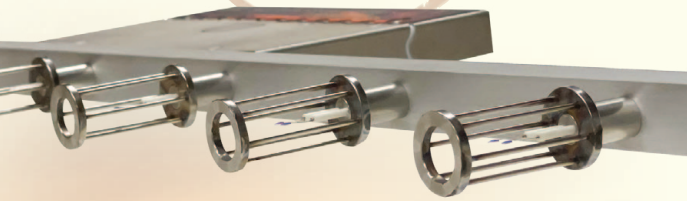
Physically, Air Velocity is measured from thin-film platinum RTD pairs operating as hot-wire anemometers. Proprietary Smart Temperature Compensation maintains sensor accuracy through varying process temperatures.

The Air Velocity Sensors are evenly spaced across the array width, which is selected to match the width of the conveyor. The fixed position sensors collect data, at product level, as the array passes through the process and displays the results in m/sec or ft/min. The number of sensors varies with the width of the array/conveyor.

## Standard Array Configurations

Conveyor Width mm (inch)	Array Width mm (inch)	Sensors (#)	Sensor Spacing mm (inch)
300 (11.80)	250 (9.80)	3	99 (3.88)
500 (19.70)	450 (17.70)	5	100 (3.94)
800 (31.50)	750 (29.50)	7	116 (4.56)
1000 (39.38)	950 (37.38)	9	112 (4.44)
1200 (47.25)	1150 (45.25)	11	110 (4.31)
1500 (59.06)	1450 (57.06)	13	117 (4.56)
2000 (78.75)	1950 (76.75)	15	136 (5.31)

SMART  
SENSOR

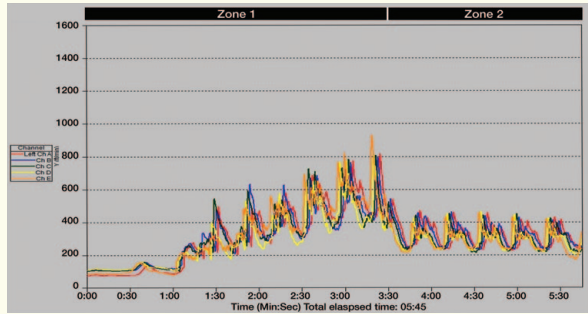


## Analyzing the Results

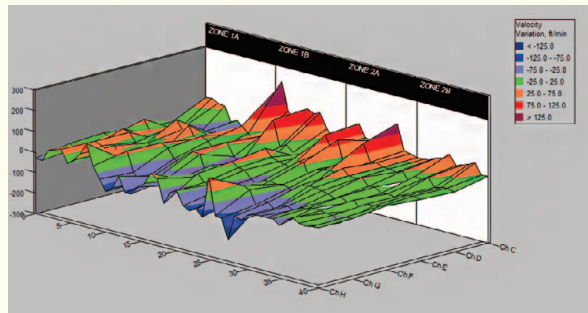
Each sensor output is the sum of air velocity components from all directions, and can be displayed as a line (channel) in a **2D Line Graph**. Side-to-side airflow variation is directly related to side-to-side variation in product bake, like color or texture, and represents a critical measurement displayed by this sensor array.

The tighter the pattern of lines, the more even the air distribution is across the width of the process. Visually, side-to-side variation is better displayed in a **3D Mesh Graph**, which in this example is showing greater than 1.2 m/sec (250 ft/min) airflow variation in several areas of the oven. Thin-film RTD technology minimizes sensor variation across channels, allowing more granular data collection.

The Digital Air Velocity Sensor Array can help you spot airflow differences between baking zones, concentrated air velocities on isolated parts of the conveyor, and unwanted air currents at the entrance or exit of the oven. Air Velocity Profiles are helpful in adjusting your process to maximize quality and reduce waste.



2D Line Graph



3D Mesh Graph

## Technical Summary\*:

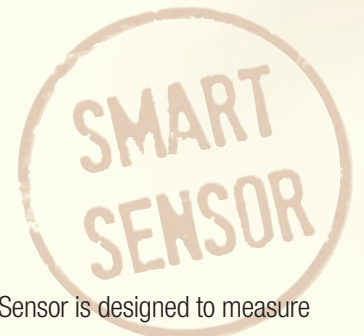
- Number of Sensor Elements (channels): up to 15
- Sensor Type: Miniature hot-wire anemometer using thin-film platinum RTD
- Direction of measurement: Omnidirectional
- Range: 0.6-10 m/sec (120-2000 ft/min)
- Operating Temperature Range: -50°C (-58°F) to 350°C (662°F)
- Resolution: < 0.01m/sec
- Accuracy: ±5% of full scale
- Response Time:  $t_{60} = 3.5$  sec in air at 5 m/sec (200ft/min)
- Battery running time:

Array Width	NEW Digital AV
300 mm	9:00 hrs.
500 mm	7:30 hrs.
800 mm	6:15 hrs
1.0 m	5:30 hrs.
1.2 m	4:45 hrs.
1.5 m	4:15 hrs
2 m	3:45 hrs.

\*Not rated for condensing environments

# Heat Flux Sensor

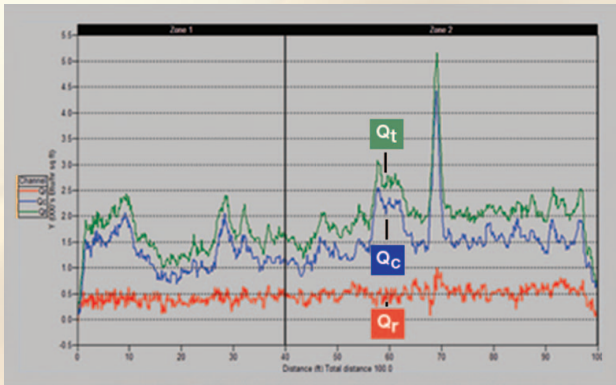
**Product specific characteristics** are defined by the amount of heat and the type of heat being applied to the product throughout a process. Heat is transferred to a product via three different mechanisms, each of which can be described by a Heat Flux component associated with radiation, convection, and conduction. Each of these modes of heat transfer is present in baking and other thermal applications. Every product has its own unique mix of heat flux components; there is not one optimal heat flux profile for all products. Heat flux profiles are often used when trying to produce the same product on two different lines, or when trying to transfer product from one line to another. When the heat flux component profiles are matched, the two lines will produce the same product.



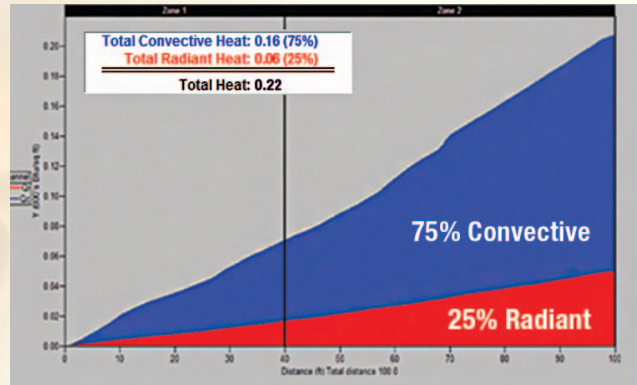
## The Process

The SCORPION<sup>®</sup> 2 Heat Flux Sensor is designed to measure convective and radiant heat fluxes at product level, and display the results in Btu/hr-ft<sup>2</sup> or W/m<sup>2</sup>. Convective and radiant heat is absorbed by the band, which serves as the conduction mechanism to the product. The sensor travels through the process with the product, and the oven under full load, yielding a precise profile of heat flux components experienced by the product. Mechanically the sensor is comprised of two copper spades and a bulk air temperature sensor. The black spade provides a measurement summation of convective and radiant heat fluxes, and the gold spade provides a measurement of only the convective heat flux component. The gold plated temperature sensor provides a measurement of the free stream air temperature associated with convection.





2D Line Graph



Total Heat Graph

## Analyzing the Results

The Heat Flux Sensor measures the flow of energy experienced by the product, from above the conveyor, and identifies which modes of heat transfer are predominant. Raw data from the heat flux sensor consists of several temperature measurements at precise locations in the sensor assembly. A mathematical model, representative of the physical measurement system, is applied to the measured values via the SCORPION® software. The resultant heat flux components  $Q_{\text{radiant}}$ ,  $Q_{\text{convective}}$  and  $Q_{\text{total}}$  are displayed in a **2D Line Graph** against time, distance, or % travel through the process. An interesting note is the large convective spike seen in zone 2 of this oven profile, which was traced to a separation in an air supply plenum.

Critical to understanding finished product characteristics is knowing the total heat experienced by the product, and the component quantities of radiant and convective heat fluxes. This is best viewed in the **Total Heat Graph** displaying the radiant and convective components as Joules/m<sup>2</sup> (Btu/ft<sup>2</sup>). The difference in proportions of heat types explains why one oven bakes differently than another – and analyzing and controlling these differences is fundamental to product quality.

## Technical Summary\*:

- Number of Sensor elements: 3
- Number of Channels displayed: 8
  - Radiation Heat Flux:  $Q_r$  (Btu/hr ft<sup>2</sup> or kW/m<sup>2</sup>)
  - Convection Heat Flux:  $Q_c$  (Btu/hr ft<sup>2</sup> or kW/m<sup>2</sup>)
  - Total Heat Flux:  $Q_t = Q_r + Q_c$  (Btu/hr ft<sup>2</sup> or kW/m<sup>2</sup>)
  - Convective Heat Transfer Coefficient:  $H_c$  (Btu/hr ft<sup>2</sup> °F or kW/m<sup>2</sup> °C)
  - Convective Air Temperature  $T_c$  (°F or °C)
  - Perceived Radiation Temperature:  $T_r$  (°F or °C)
  - Total Convective and Radiant Heat (Btu/ft<sup>2</sup> or kJ/m<sup>2</sup>)
- Sensor type: Type T thermocouples
- Operating Temperature Range: -50°C (-58°F) to 350°C (662°F)
- Accuracy: ±5% of full scale
- Response Time:  $t_{60} = 3\text{sec}$  in air at 1m/sec (200 ft/min)
- Battery running time: 50+ hrs.

\*Not rated for condensing environments

# Digital Humidity Sensor

**Humidity in a thermal process** interacts with the product. The moisture in the environment often comes from the product itself and represents a delicate balance affecting finished product quality in many ways. For example:

- The amount of moisture left in a product can determine its shelf life.
- Reduced evaporation can keep the surface of a product moist, allowing it to stretch, preventing cracks.
- Low humidity in a cracker oven can cause blisters leading to undesirable dark spots and excessive breakage.
- The lack of humidity in a cookie oven can cause case hardening preventing internal moisture from escaping leading to checking (the spontaneous cracking of the cookie after baking).
- High humidity in bread ovens produces the desirable glossy crust seen on many bread products. For this reason steam injection is often used.
- High humidity will assist with the killing of pathogens, like salmonella, potentially found in surface toppings.

Product throughput lb/hr (kg/hr) can also be affected by when and how much moisture builds in a process. Moisture laden environments reduce baking efficiency, thereby reducing product throughput.



## The Process

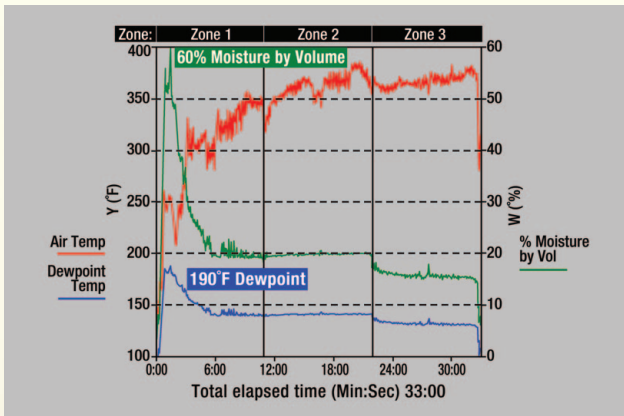
The SCORPION® 2 Digital Humidity Sensor is designed to measure the moisture content, of the thermal environment, in both heating and cooling processes. It is applicable to proofers, ovens, dryers and cooling tunnels.

Mechanically the Digital Humidity Sensor is comprised of an Air Temperature sensor, two inputs for Product Core Temperature Measurement and a proprietary humidity sampling system to measure Dew Point Temperature, Absolute Humidity and Relative Humidity. The sampling system contains patent pending Anti-Saturation Technology™ allowing measurements in very high dew point environments such as steam injection.

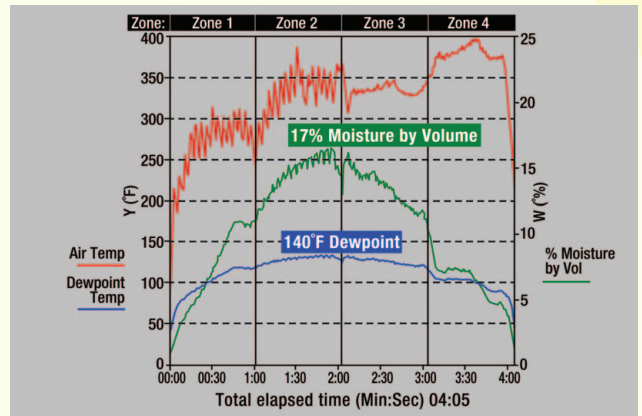
The Digital Humidity Sensor is engineered to be compatible with direct gas fired (DGF) ovens. Unlike oxygen sensor technology, which can be off by as much as 25% due to combustion gases in DGF ovens, the accuracy of the digital humidity sensor remains the same regardless of the oven platform.

The Humidity Sensor travels through the process with the product, yielding a precise profile of moisture experienced by the product.

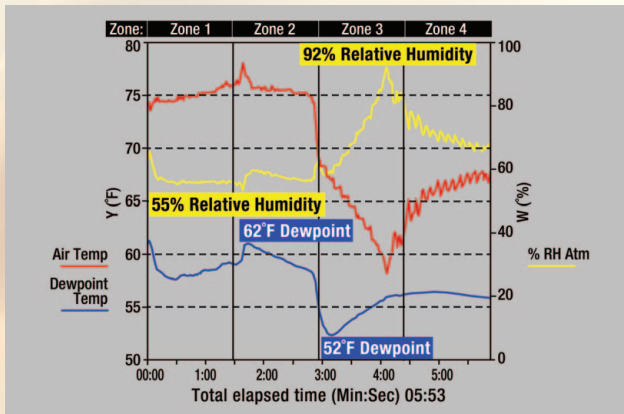




Bread Oven with Steam Injection



Cookie Oven



Cookie Cooling Tunnel

## Analyzing the Results

In high temperature applications above 212°F (100°C), absolute humidity is displayed. The user can choose between % Moisture by Volume or Humidity Mass Ratio (lb water/lb dry air or kg water/kg dry air).

In low temperature applications below 212°F (100°C), % Relative Humidity is displayed.

In both high and low temperature applications, the dew point temperature and dry bulb air temperature is displayed.

Humidity in *ovens* is generally controlled by extraction fans and dampers. Here the sensor is used to display the shape of the humidity profile as well as the peak moisture value obtained and where. In *proofers* it is used to document the temperature and relative humidity of the proof cycle. In *cooling tunnels* it is used to monitor dew point temperature, preventing condensation on the product surface which causes blooming.

## Technical Summary\*:

- Number of sensor elements: 2
- Product Probe Inputs: 2
- Data available for display
  - Air temperature (°F or °C)
  - Dew point temperature (°F or °C)
  - % Moisture by volume
  - Humidity mass ratio (lb water/lb dry air or kg water/kg dry air)
  - % Relative humidity atmosphere
- Sensor type: Digital Capacitive humidity chip and Type T thermocouples
- Operating Temperature Range: 32°F (0°C) to 662°F (350°C)
- Accuracy: ±5% of full scale for Humidity and Dew Point
- Response Time:  $t_{60} = 3\text{sec}$  in air at 200 ft/min (1m/sec)
- Dew Point range: 32°F (0°C) to 212°F (100°C)
- Relative Humidity Range: 0 to 100% RH Atm
- Absolute Humidity range: 0 to 100% Moisture by volume
- Dwell Time: See Digital Humidity Sensor Dwell Time Graph
- Battery running time: 4+ hrs.

\*Not rated for condensing environments

# Digital Humidity Sensor Dwell Time

## (Time vs. Temperature)

The length of time the Humidity sensor can be in a heated process is dependent on process temperature and airflow. Since the Digital Humidity Sensor contains electronics, it has a different **Time vs. Temperature** graph for the Thermal Barriers.



The dwell time for the Humidity sensor is less than the Data Logger. In other words, the Digital Humidity Sensor Dwell Time graph should always be the determining factor when using this sensor.

Several thermal barrier heights are available to cover a wide range of process temperatures and dwell times. The height is the thickness of the thermal barrier, which translates to the headroom required to pass the SCORPION® 2 through the process.

The Digital Humidity Sensor Dwell Time Graph is used to determine what size thermal barrier is required for safe operation. The thermal barrier performances for the 6 standard sizes are displayed.



THB40 THB50 THB60 THB80 THB100 THB125

### Thermal Barriers:

#### THB40:

H = 40.0mm (1.6") x W = 25.0cm (9.8") x L = 29.1cm (11.5")

#### THB50:

H = 50.0mm (2.0") x W = 25.0cm (9.8") x L = 29.1cm (11.5")

#### THB60:

H = 60.0mm (2.4") x W = 26.0cm (10.2") x L = 29.1cm (11.5")

#### THB80:

H = 80.0mm (3.2") x W = 28.0cm (11.0") x L = 32.1cm (12.6")

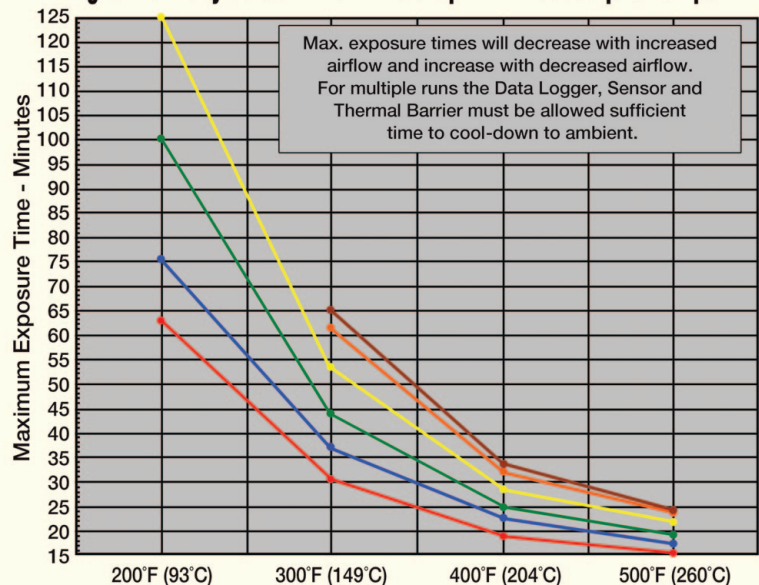
#### THB100:

H = 100.0mm (3.9") x W = 32.5cm (12.8") x L = 39.1cm (15.4")

#### THB125:

H = 125.0mm (4.9") x W = 32.5cm (12.8") x L = 39.1cm (15.4")

### Digital Humidity Sensor Dwell Time Graph in Air at 500fpm/2.5mps



Data Logger, Sensor & Thermal Barrier Starting temp = 75°F (24°C)

**Thermal Barrier Height**

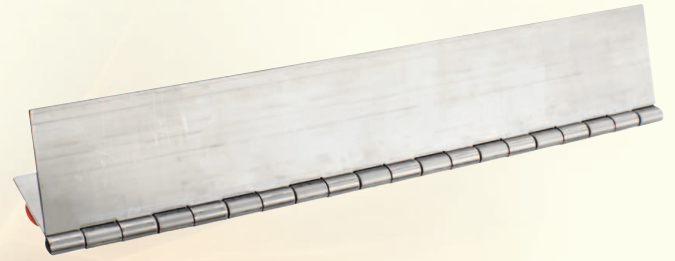
- 40 mm (1.6")
- 50 mm (2.0")
- 60 mm (2.4")
- 80 mm (3.2")
- 100 mm (3.9")
- 125 mm (4.9")

# Headroom Clearance Checkers

Two stainless steel panels connected via a continuous hinge and a multi-point magnetic base make up the hinged clearance checker. The height is built to match the Thermal Barrier height being used as this determines the maximum height required. The clearance checker is run through the process prior to the SCORPION® 2 to confirm that the required headroom clearance is available throughout the process.

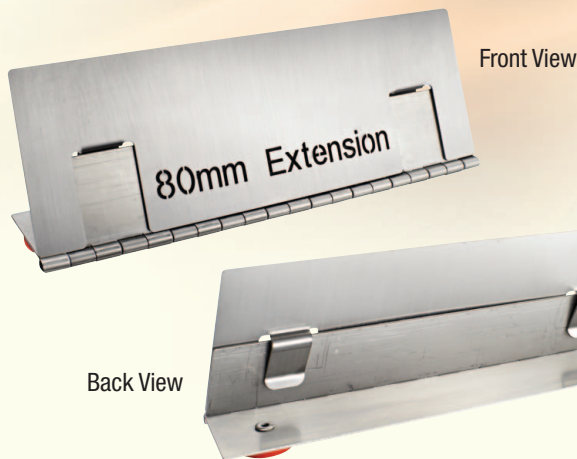
If the clearance checker comes in contact with any overhead obstruction it will fold flat and pass through the process.

*Failure to check headroom can result in the SCORPION® 2 getting caught in the process resulting in costly damages.*



## Hinged Headroom Clearance Checker

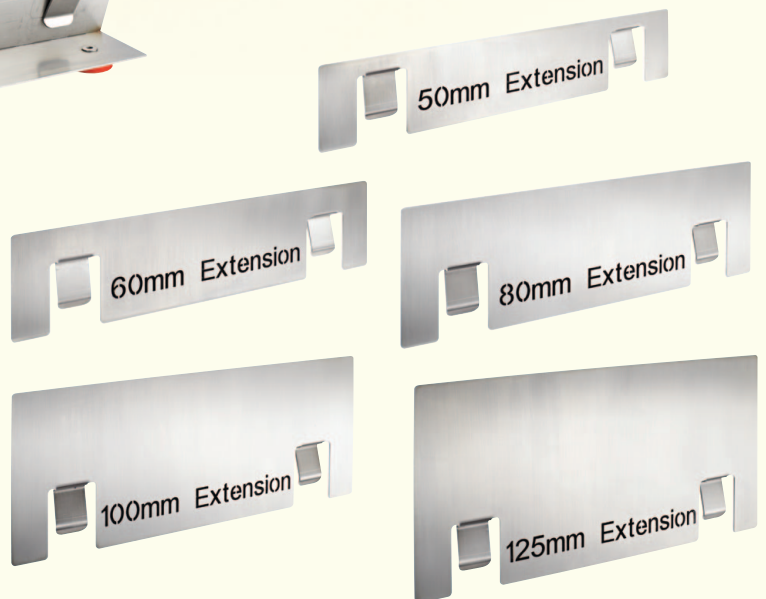
Used to check process headroom clearance when using a 40mm thick Thermal Barrier and small sensors. 51mm (2") tall x 254mm (10") long hinge with two point magnetic base. *Required to use Extensions.*



## Headroom Clearance Checker Extensions

Used to check process headroom clearance when using 50mm - 125mm thick Thermal Barriers and small sensors.

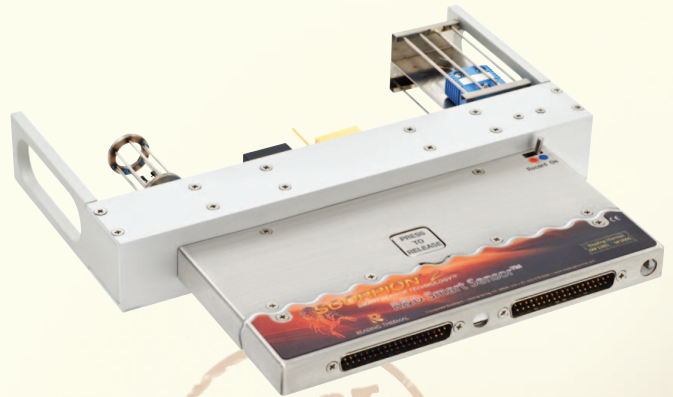
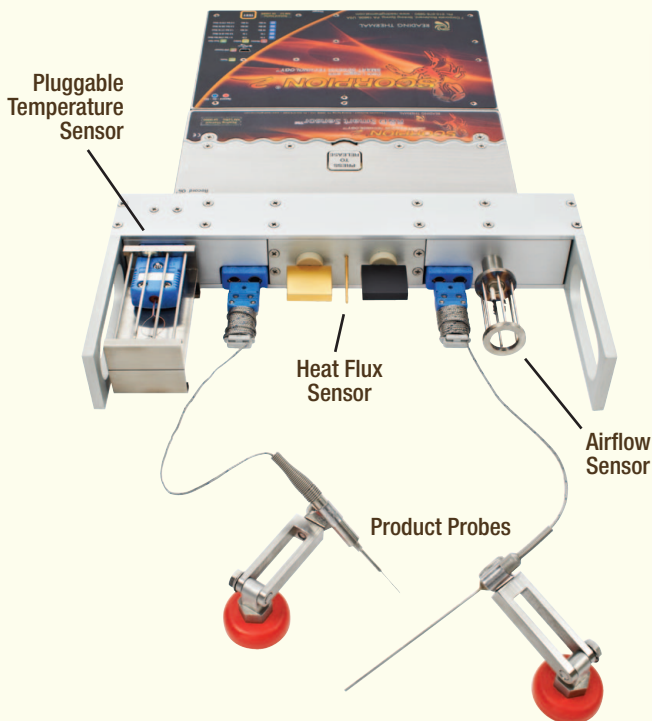
*Requires a Hinged Headroom Clearance Checker as base.*



*All items available in 952mm (37.5") Length to be used with large sensor arrays.*

# R&D Smart Sensor™

**Faster ~ Easier ~ Smarter** the R&D Smart Sensor™ is a multi-element sensor enabling the collection of 4 key baking parameters in a single pass through a process. The user quickly gathers a complete set of profiles characterizing Environment Temp, Product Core Temp, Airflow and Energy Transfer. To collect this data using individual sensors would typically require four passes through an oven. With its very small footprint, only 254mm (10") wide and only 40mm (2") of headroom required, the R&D Smart Sensor™ will pass through virtually any process.



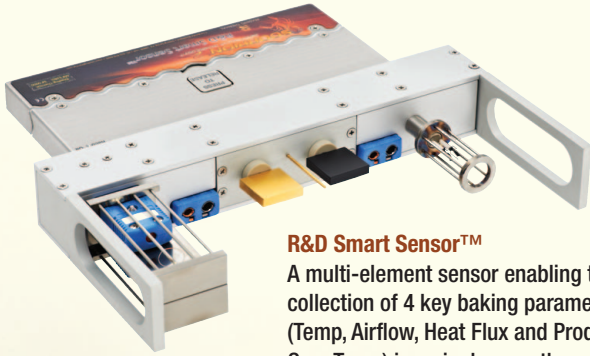
## The Process

The SCORPION® 2 R&D Smart Sensor is best used by the R&D/Corporate Engineer who needs the ability to quickly profile an oven. This person is **interested** in benchmarking an oven for R&D purposes, product development, product transfer and oven matching across the company's baking platforms. This person is **not interested** in studying side-to-side temperature or airflow variation which would require individual, much larger, temperature and air velocity sensor arrays to span the conveyor width.

## There are two types of Pluggable Temperature Sensors available:

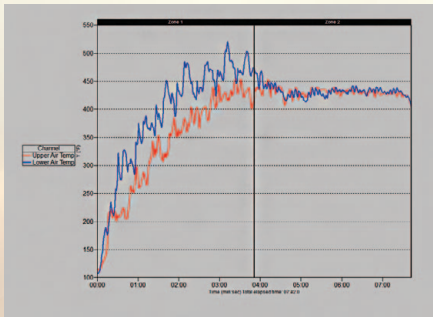
**Type A**, used on solid or tight mesh conveyors, is an Air/Band sensor designed to measure air temperature immediately above the conveyor, and surface temperature of the conveyor itself. *Type A can only be used with the THB40 & THB50 Thermal Barriers.*

**Type B**, used on open mesh conveyors, is an Air/Air sensor designed to measure upper air temperature immediately above the conveyor, and lower air temperature of the air rising through the conveyor. The upper and lower thermocouples are separated by a thin shield.

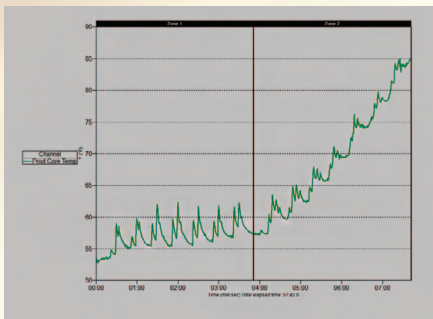


### R&D Smart Sensor™

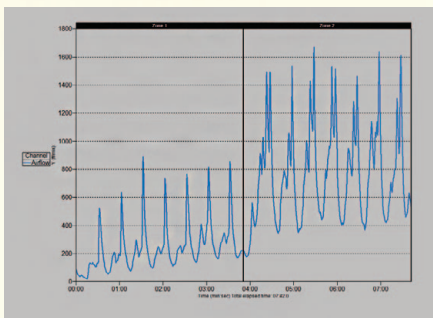
A multi-element sensor enabling the collection of 4 key baking parameters (Temp, Airflow, Heat Flux and Product Core Temp) in a single pass through an oven.



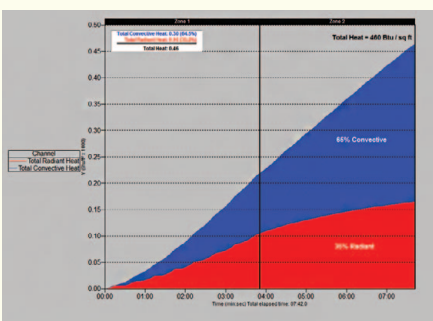
Upper & Lower Air Temperature



Product Core Temperature



Airflow



Energy Transfer

## Technical Summary\*:

### • Temperature Sensors

- Number of Temperature Sensor Elements (channels): 2
- Temperature Sensor Type: Type T thermocouple
- Response Time:  $t_{60} = 3.5\text{sec}$  in air at 1m/sec (200ft/min)
- Resolution:  $0.025^{\circ}\text{C}$  ( $0.045^{\circ}\text{F}$ )
- Accuracy:  $\pm 1.0^{\circ}\text{C}$  ( $\pm 1.8^{\circ}\text{F}$ )

### • Product Probe Interface

- Number of Product Probe Inputs (channels): 2
- Product Probe Sensor Type: Type T thermocouple (Type J&K optional)
- Resolution:  $0.025^{\circ}\text{C}$  ( $0.045^{\circ}\text{F}$ )
- Accuracy:  $\pm 1.0^{\circ}\text{C}$  ( $\pm 1.8^{\circ}\text{F}$ )



### • Air Velocity Sensor

- Number of Air Velocity Sensor Elements (channels): 1
- Sensor Type: Miniature hot-wire anemometer using Type T thermocouples
- Direction of measurement: Omnidirectional
- Range: 0-10 m/sec (0-1969 ft/min)
- Resolution:  $\sim 2\%$  of reading
- Accuracy:  $\pm 5\%$  of full scale
- Response Time:  $t_{60} = 3\text{sec}$  in air at 1m/sec (200ft/min)

### • Heat Flux Sensor

- Number of Sensor elements: 3
- Number of Channels displayed: 8
- Radiation Heat Flux:  $Q_r$  (Btu/hr  $\text{ft}^2$  or  $\text{kW}/\text{m}^2$ )
- Convection Heat Flux:  $Q_c$  (Btu/hr  $\text{ft}^2$  or  $\text{kW}/\text{m}^2$ )
- Total Heat Flux:  $Q_t = Q_r + Q_c$  (Btu/hr  $\text{ft}^2$  or  $\text{kW}/\text{m}^2$  °C)
- Convective Heat Transfer Coefficient:  $H_c$  (Btu/hr  $\text{ft}^2$  °F or  $\text{kW}/\text{m}^2$  °C)
- Convective Air Temperature  $T_c$  (°F or °C)
- Perceived Radiation Temperature:  $T_r$  (°F or °C)
- Total Convective and Radiant Heat (Btu/ $\text{ft}^2$  or  $\text{kJ}/\text{m}^2$ )
- Sensor type: Type T thermocouples
- Accuracy:  $\pm 5\%$  of full scale
- Response Time:  $t_{60} = 3\text{sec}$  in air at 1m/sec (200 ft/min)

### • System

- Operating Temperature Range:  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ ) to  $350^{\circ}\text{C}$  ( $662^{\circ}\text{F}$ )
- Battery running time: 7+ hrs.

\*Not rated for condensing environments

# SCORPION® 2 LITE Data Logger



The **SCORPION® 2 LITE Temperature Data Logger** is intended for the customer who wants to measure temperature only. Designed as a low-cost alternative to the full featured SCORPION® 2 Data Logger, it is compatible with all temperature measurement devices, i.e. Temperature Interface, Product Probe Interface, Temperature Sensor Arrays, Product Probes and Bare Wire Thermocouples. The SCORPION® 2 LITE Data Logger functions exactly like the SCORPION® 2 Data Logger when connected to these devices. All connections, charging, user interface and software are identical to the SCORPION® 2 Data Logger.

The SCORPION® 2 LITE Data Logger contains an onboard **User Interface** which enables data collection without the need of a computer on the factory floor. Immediately upon connecting a Smart Sensor, a communication link is established between the data logger and sensor and a self-test is initiated. The result of this test is indicated by a **Ready Light**, allowing the user to confidently proceed with data collection knowing that all data logger and sensor parameters are within operational limits. Pressing the **TEST** button displays the **Memory** and **Battery** capacity, cautioning the user as the minimum amount of time remaining drops below two hours. The **TEST** button is also used to select a **Scan Rate** of 0.1, 0.5, 1, 2, or 4 seconds.

## Technical Summary\*:

- Input Channels: 32
- Thermocouple Input Type: Type T
  - Type J & K optional for product probe inputs
  - Input Temperature Range: -260°C - 1378°C (-436°F - 2513°F)
- Output Channels:
  - Regulated 3.3V output for SMART SENSOR Memory
- Sensor Interface: 32-pin D-Sub connectors
- Scan Interval: 0.1sec, 0.5sec, 1.0sec, 2.0sec, 4.0sec
- Memory Type: Non-volatile FLASH
- Memory Capacity (max):
  - Up to 100min @ 0.1sec scan rate
  - Up to 8hrs @ 0.5sec scan rate
  - Up to 17hrs @ 1sec scan rate
  - Up to 35hrs @ 2sec scan rate
  - Up to 70hrs @ 4sec scan rate
- Time Tracking: Onboard Real Time Clock – Time / Date
- Resolution: 0.025°C (0.045°F)
- Accuracy: ±1.0°C (±1.8°F)
- Battery Running Time: 50+ hrs.
- Battery: 7.2V, 2200mAh
- PC Communication Link: USB 2.0
- Rugged Stainless-steel enclosure

*\*Not rated for condensing environments*

***The SCORPION® 2 LITE Data Logger is upgradable to the full featured SCORPION® 2 Data Logger***

# Interface Devices

## Product Probe Interface

The Product Probe Interface allows five external thermocouples to be connected to the SCORPION® 2 Data Logger. These thermocouples can be user supplied Type T with subminiature male connectors. Product Probes are commonly used to measure the core temperature of a product as it travels through a process.



### Technical Summary\*:

- Number of Product Probe Inputs (channels): 5
- Sensor Type: Type T thermocouple (Type J&K optional)
- Operating Temperature Range: -50°C (-58°F) to 350°C (662°F)
- Resolution: 0.025°C (0.045°F)
- Accuracy: ±1.0°C (±1.8°F)
- Battery running time: 50+ hrs.

*\*Not rated for condensing environments*

## Temperature Interface

The Temperature Interface allows ten external thermocouples to be connected to the SCORPION® 2 Data Logger. These thermocouples can be user supplied Type T with subminiature or standard male connectors. Product Probes are commonly used to measure the core temperature of a product as it travels through a process. The Temperature Interface also serves as the mounting point for a Magnetic Temperature Sensor Array.



### Technical Summary\*:

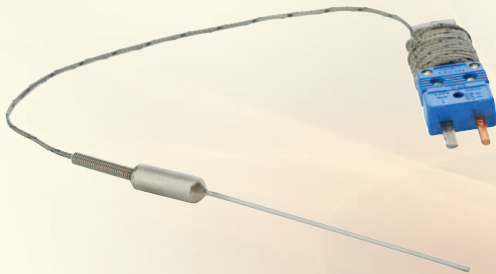
- Number of Product Probe Inputs (channels): 10
- Sensor Type: Type T thermocouple (Type J&K optional)
- Operating Temperature Range: -50°C (-58°F) to 350°C (662°F)
- Resolution: 0.025°C (0.045°F)
- Accuracy: ±1.0°C (±1.8°F)
- Battery running time: 50+ hrs.

*\*Not rated for condensing environments*

# Product Probes & Fixture

## Standard Color Coded Product Insertion Probe

A 76mm (3") long x 1.3mm (0.05") diameter high temperature probe with a 1.2m (47") stainless steel sheathed lead on an integrated wire spool (custom lengths available). This probe is recommended for measuring product core temperature of biscuit, cookie, and bread products. It can be used with the Temp Sensor Array, Product Probe Interface and Temperature Interface. The maximum tip temperature is 260°C (500°F).



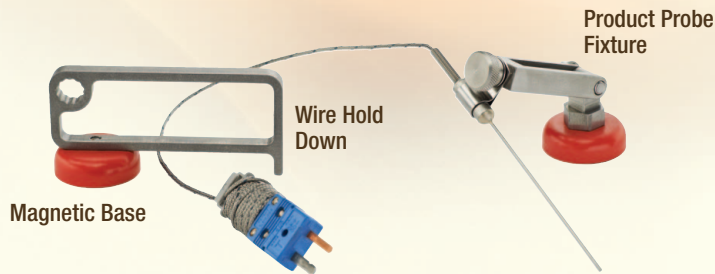
- A. Ruggedized 1.3mm (0.05") diameter thermocouple wire with braided sheathing and welded end point.
- B. Miniature 0.5mm (0.02") diameter thermocouple wire with a low-mass, fast-response loop end.
- C. Miniature 0.5mm (0.02") diameter thermocouple wire with welded end point.

## Specialty Type-T Thermocouples

3 kinds of prepared flexible thermocouples are available for directly sensing the temperatures of different products or surfaces (A,B,C above). They can be directly inserted, laminated between 2 pieces of product, or affixed to surfaces with heat-resistant tapes. Each comes with 1.2m (47") lead on an integrated spool. Custom lengths available. Each can be used with the Temp Sensor Array, Product Probe Interface, and Temperature Interface. Maximum tip temperatures of 260°C (500°F).

## Product Probe Fixture and Wire Hold Down

Magnetic base Fixture positively locates product probe in product and is fully adjustable for height and angle. Magnetic base Wire Hold Down is used to manage excess wire and also serves as an Adjustment Tool.



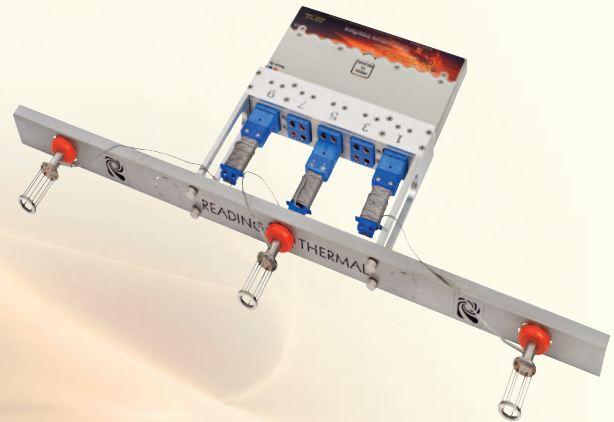


# Magnetic Temperature Sensor Arrays

The **Magnetic Temperature Sensor Arrays** are intended for the customer who wants fixed sensor repeatability for bulk air temperature measurements. Designed as a low-cost alternative to the conventional Temperature Sensor Array, it mounts to the Temperature Interface device. Up to 10 Magnetic Base Air Temperature Sensors are placed along the U channel at user controlled locations.

## Magnetic Temperature Sensor Array

Designed as a fixed-length array to match conveyor widths from 300mm (11.8") to 3000mm (118"). The Magnetic Stainless Steel U Channel provides the mounting point for 1 - 10 Magnetic Base Air Temperature Sensors. This allows the user to study side-to-side temperature variation across the width of a conveyor. *Requires a Temperature Interface (device pictured).*



## Technical Summary\*:

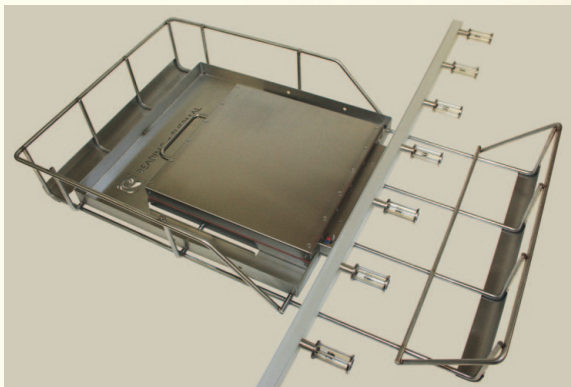
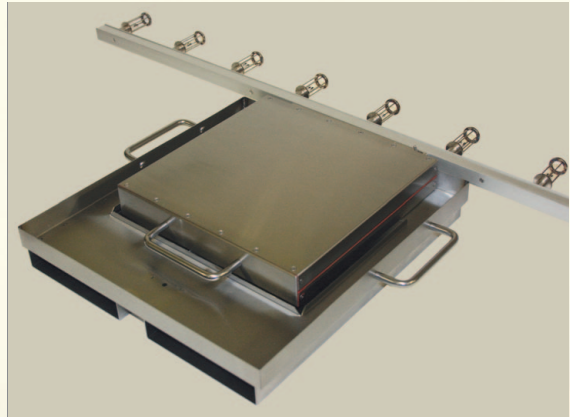
- Mounting Hardware compatible with Temperature Interface
- Number of Magnetic Base Air Temperature Sensors: 1 - 10
  - Sensor Type: Type T thermocouple
  - Resolution: 0.025°C (0.045°F)
  - Accuracy:  $\pm 1.0^{\circ}\text{C}$  ( $\pm 1.8^{\circ}\text{F}$ )
  - Response Time:  $t_{60} = 3.5\text{sec}$  in air at 1m/sec (200ft/min)
- Operating Temperature Range:  $-50^{\circ}\text{C}$  ( $-58^{\circ}\text{F}$ ) to  $350^{\circ}\text{C}$  ( $662^{\circ}\text{F}$ )
- Battery Running Time: 50+ hrs.

*\*Not rated for condensing environments*

# Bread & Bun Profiling Solutions

## Specialized Carrier for Endless Conveyor Ovens (e.g. BakeTech)

Tray Style Carrier for SCORPION® 2 Equipment provides easy loading and unloading on endless conveyors. The carrier, with SCORPION® 2, is inserted into the product flow replacing a bread or bun pan. Stainless Steel Magnetic Base Tray 406mm (16") wide x 356mm (14") long x 51mm (2") high accommodates all SCORPION® 2 Equipment.

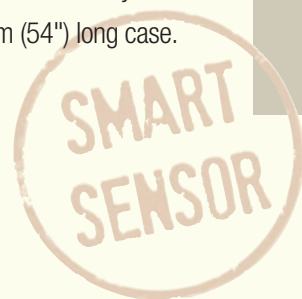
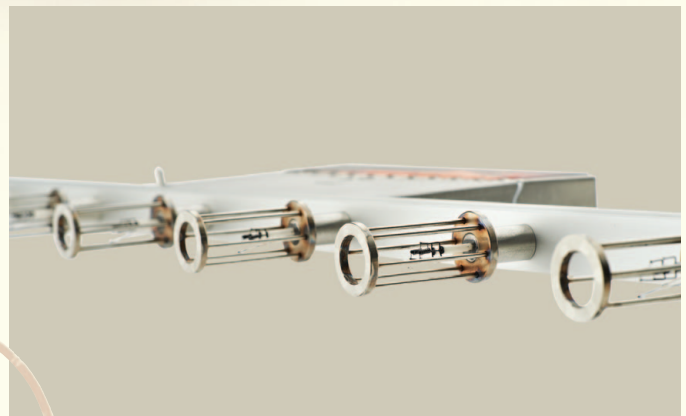


## Specialized Carrier for Tray and Grid Conveyor Ovens (e.g. AMF, Turkington)

Basket Style Carrier for SCORPION® 2 Equipment provides easy loading and unloading on tray and grid conveyors. The carrier, with SCORPION® 2, is inserted into the product flow replacing a bread or bun pan. Stainless Steel Wire Frame Basket 381mm (15") wide x 635mm (25") long x 90mm (3.5") high accommodates all SCORPION® 2 Equipment.

## Temp+Airflow Sensor Array

Designed to simultaneously profile temperature and airflow across the width of large tray and grid conveyor ovens. Array contains 9 Temp+Airflow sensors spaced evenly across the length of an aluminum bar. The array comes in 3 sizes to match the most popular bread oven widths. For easy transportation, the array folds to fit in a 1.4m (54") long case.



## Pan+Dough Probe

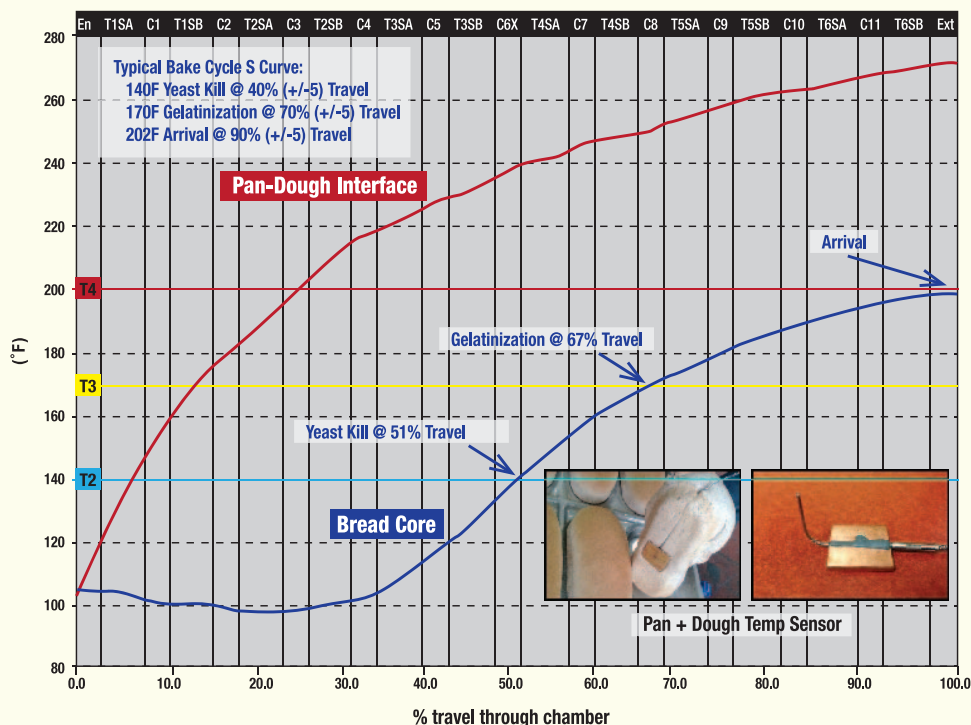
This dual probe unit is placed under the bread or bun dough simultaneously capturing the pan/dough interface temperature and the dough core temperature. The copper spade is pressed against the pan by the weight of the dough, measuring the critical pan/dough interface temperature. The vertical stainless steel probe penetrates the dough to a fixed distance from the pan (1" to 3" in 0.25" increments), measuring the dough core temperature used to produce the Bake Cycle S-Curve. The Pan+Dough Probe provides accurate repeatable results unattainable with hand-placed thermocouples. It connects to the Temperature Interface device which can accommodate 5 Pan+Dough Probes.



## Bake Cycle S-Curve Analysis

Bakers rely on Bake Cycle S-Curve Analysis to optimize the baking profile. This analysis provides critical insight needed to make adjustments to ingredients, bake time, and zone temperature settings. SCORPION® Software Version 8 (SV8) automatically calculates the three key S-Curve data points: Yeast Kill, Gelatinization and Arrival.

### Pan-Dough Interface Temp & Bread Core Temp

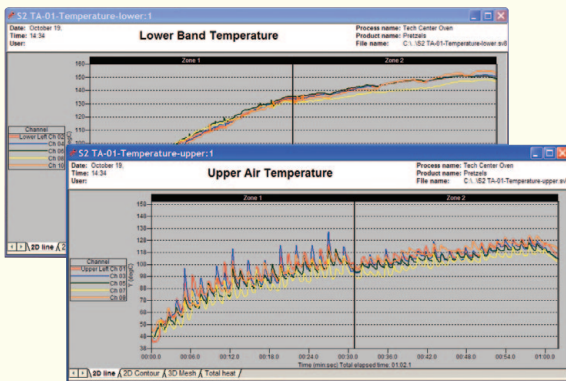
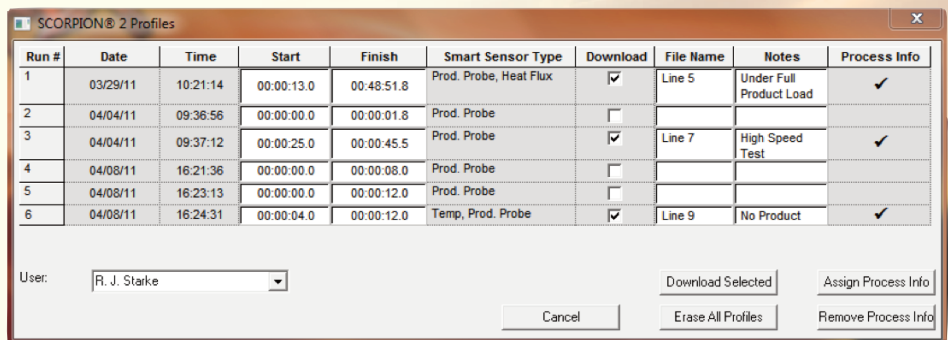


# SCORPION® Software Version 8 (SV8)

Filled with customer-driven user-friendly enhancements, collected over years of input from SV7 Users, **SCORPION® Software Version 8 (SV8)** takes data analysis to a whole new level. Developed specifically to support the new SCORPION® 2 hardware, SV8 also maintains compatibility

and can be used with the older SCORPION® data loggers dating back to 1990. While significantly enhanced, it retains traditional on screen displays so that existing SV7 Users can easily transition to SV8 without having to relearn the data analysis/interpretation process.

**Data Download** – choose one or several profiles to be Downloaded from the data logger. Edit profile “Start” and “Finish” times, enter File Names, add Notes and assign Process Information.

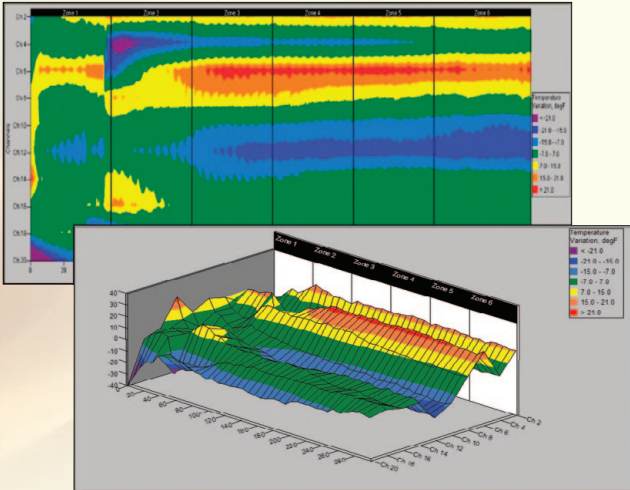


2D Line Graphs

Each profile appears in its own SV8 window for analysis. Temperature Sensor Array data (containing upper and lower measurements) is automatically separated and displayed in upper and lower graphs.

DATA COLLECTION  
ANALYSIS  
PROBLEM SOLVING

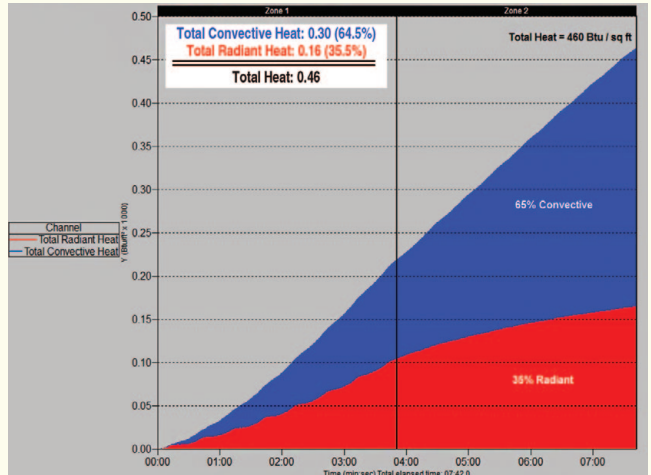
2D Contour Graph



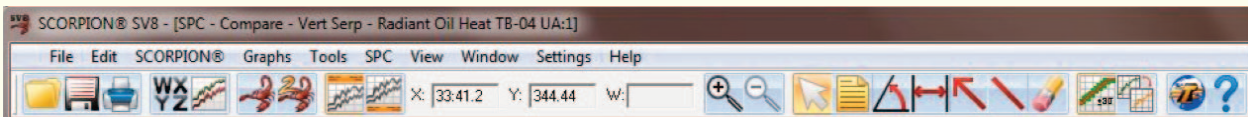
3D Mesh Graph

The Heat Flux Sensor measures the Total Heat experienced by the product and is conveniently displayed in the **Total Heat Graph**. The convective and radiant percentages are automatically calculated and displayed on the graph.

**Data Analysis** – the click of a button transforms **2D Line Graphs** into **2D Contour** or **3D Mesh Graphs** for enhanced data analysis.



Total Heat Graph

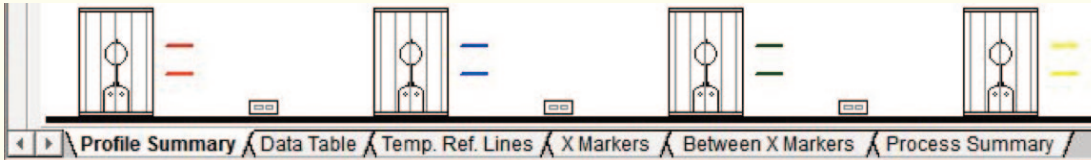


	File Open		Zoom In
	File Save		Zoom Out
	Print		No Tool
	Graph Axis		Add Notes to Graph
	Graph Format		Slope Measurement
	SCORPION® Connect		Measure
	SCORPION® 2 Connect		Draw Arrow
	Header		Draw Line
	Footer		Erase
X: 00:33.8	Arrow X Axis Value		SPC Compare
Y: 100.14	Arrow Y Axis Value		Overlay Profiles
W: 53.61	Arrow W Axis Value		Reading Thermal Website
			Electronic User Guide

**SV8 Toolbar** – provides easy access to the major features of the software.

# SCORPION<sup>®</sup> Software Version 8 (continued)

**Additional Features** are easily accessed with “Footer Tabs”:

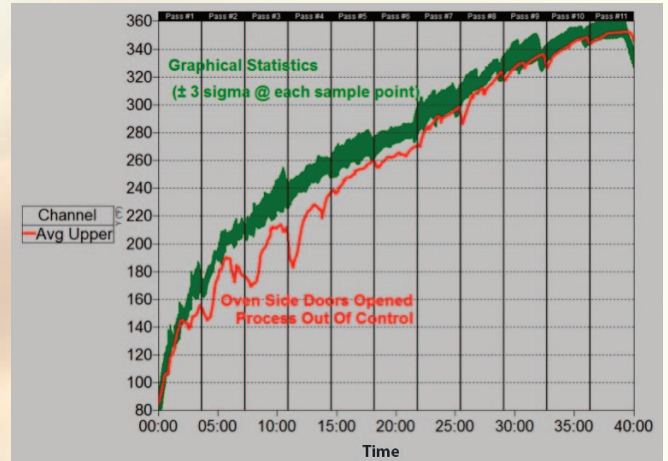


- **Profile Summary:** a complete description of the profile including time and date, scan rate, user name, sensor used, data logger used, maximum internal temp reached by the data logger, calibration dates of data logger and sensor and start/finish data trimming capability.
- **Data Table:** raw data collected by the data logger which can be exported to other programs.
- **Temp. Ref. Lines:** display channel time and average temp between four temp reference lines. Used in Food Safety applications to calculate % Kill.
- **X Markers:** display channel values at four X axis positions.
- **Between X Markers:** display channel minimum, maximum and average values between four X axis positions.
- **Process Summary:** a complete description of the process being profiled including process name, product name, equipment type, conveyor type, number of zones and zone lengths.



## Advanced Features built into SV8 include:

- **Units of Measure:** work in SI (°C, m) or US (°F, ft)
- **Calibration Reminders:** remind the user when data logger and sensor calibrations are due.
- **Data Trimming:** easily trim the profile data “start” and “finish” times, before or after download, without editing the raw data table. Start and finish times are entered as hh:mm:ss.
- **Overlays:** profiles of the same and different type can be overlaid on the same graph. For example a temperature profile can be overlaid on an air velocity graph.
- **Averages:** averages can be created for a specific data set and overlaid data sets. Averages-of-averages can also be created.
- **Cursor Display:** on screen display of x, y and w data values as the cursor arrow is moved over a graph.
- **X Axis Display:** display time, distance (ft / m) or percent travel through the process.
- **Help:** easy to use electronic manual.
- **Graphical SPC:** graphical statistical process control available with all sensors.



SPC Graph

## Data Logger Compatibility

SV8 Communicates with all previous SCORPION® Data Loggers. It supports the simultaneous use of a SCORPION® 2 Data Logger and an older SCORPION® Data Logger. Each has its own toolbar button for communication, allowing users with mixed hardware to use a single software program.

## Data Compatibility

Opens all previous profile data collected with SV5, SV6 or SV7.

## System Requirements

- Windows XP / Windows 7, 32 or 64bit
- 1Gb RAM
- 1Gb free hard disk space
- 1 free USB 2.0 port
- 17" or larger color display
- Color Printer

# Online Training Program

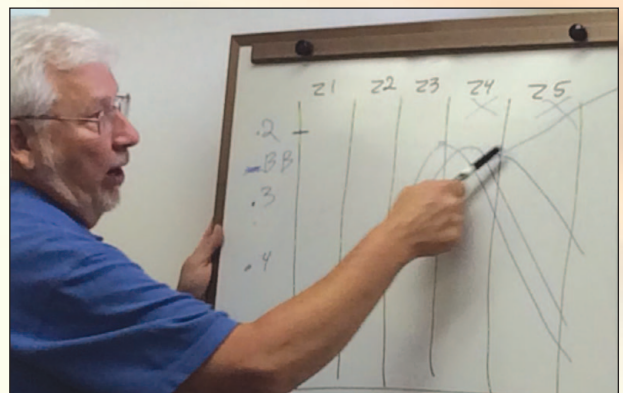
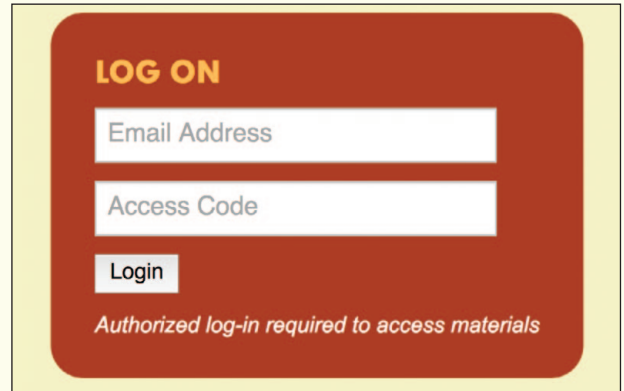
Reading Thermal has developed a comprehensive Online Training Program for the SCORPION® 2 Data Logging Measurement System. The program includes unlimited access to a library of modules, each complete with an audio/video component, diagrams, and visual reference handouts for note taking.

The training program allows both new and experienced users to maximize their time in data collection, analysis and problem solving.

The training modules cover all aspects of the SCORPION® 2 hardware and software components, integrating real process examples throughout. The modules contain over 3 hours of audio and video supported by more than 500 slides in printable handouts.

## With this program you can:

- Absorb information on your schedule
- Easily focus on specific areas as needed
- Get new hires up to speed quickly
- Increase the number of employees trained
- Have unlimited views of the information
- Access on-demand training, eliminating the need to gather employees in one room for an extended part of the day
- Cross-train less technical employees to collect and interpret data





## Training Modules Included:

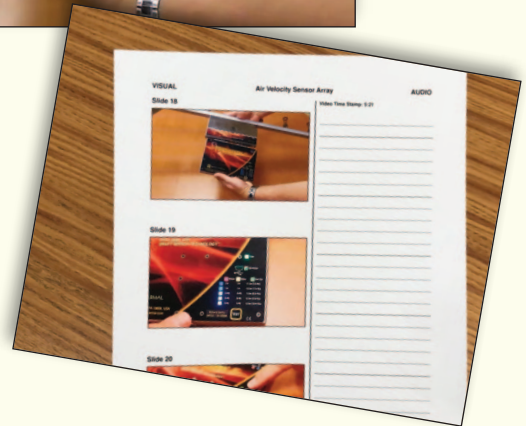
- Introduction
- SCORPION® 2 Data Logger
- Thermal Barriers and Headroom Checkers
- Smart Charger
- Smart Sensor Technology
- Temperature Sensor Array
- Air Velocity Sensor Array
- Heat Flux
- Humidity Sensor
- SCORPION® Software Version 8 (SV8)
- Profiling Procedure



*Visual Handouts  
for Note Taking*

## Also Available:

- Visual Handouts for each Module
- Visual Handouts Spanish Versions
- Other Supporting Documents



## The Online Training Program Provides:

- Detailed descriptions of all SCORPION® equipment
- Video and illustrative segments demonstrating equipment connectivity and usage
- Overviews of various baking processes
- Profile examples showing data collected and interpreted
- Case studies from actual production environments
- Software overviews and the details

A one-time purchase of the Online Training Program allows unlimited use by all members of your organization at a specific location. An access code is provided by Reading Thermal to each registered user with a valid company email address.

***Completion of the Online Training Program is a prerequisite for a follow-up Hands-On Training Visit for customers who would like additional on-site support.***

# Packaging

Protecting your SCORPION® 2 investment during travel and storage is extremely important and easily done with our full line of Custom Cases. Whether you're traveling with the equipment, shipping the equipment, transporting the equipment within a factory or simply storing it for a time, you will fully appreciate these custom cases.



Top loading light weight resin case with retractable pull handle and wheels. Rigid interior foam fitted for SCORPION® 2 Base Packages which can include:



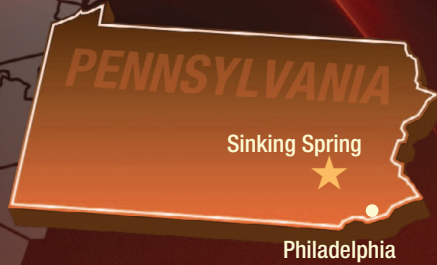
- Data Logger
- Charger, Cables and Gloves
- 40mm Thermal Barrier
- Product Probes
- Two of the following:
  - Heat Flux Sensor
  - R&D Smart Sensor
  - Humidity Sensor
  - Temperature Interface
  - Product Probe Interface



Flat loading aluminum frame case with pull handle and wheels. Rigid interior foam fitted for Temperature and Air Velocity Sensor Array lengths of 1500mm (59.1") to 2000mm (78.75").



Flat loading light weight resin case with pull handle and wheels. Rigid interior foam fitted for Temperature and Air Velocity Sensor Array lengths of 300mm (11.8") to 1200mm (47.25").



**Reading Thermal** is located in Sinking Spring, Pennsylvania, approximately 70 miles North West of Philadelphia. This is home to the Research, Development, Manufacturing and Sales operations.

All SCORPION® 2 equipment is manufactured in-house; this gives us total control over the manufacturing process and allows us to customize equipment based on customer specific needs. Please don't hesitate to contact us with questions or to discuss your specific profiling needs.



It has been a pleasure introducing you to the SCORPION® 2 Data Logging Measurement System. Contact us directly for pricing and quotations:

7 Corporate Boulevard  
Sinking Spring, PA 19608 USA  
Ph: 610-678-5890  
Fax: 610-693-6262  
E-mail: [info@readingthermal.com](mailto:info@readingthermal.com)  
[www.readingthermal.com](http://www.readingthermal.com)



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7 Corporate Boulevard • Sinking Spring, PA 19608 USA • Ph: 610-678-5890 • Fax: 610-693-6262 • E-mail: [info@readingthermal.com](mailto:info@readingthermal.com) • [www.readingthermal.com](http://www.readingthermal.com)