

ECD OvenSENTINEL™

User Operation Guide | A58-6928-06 R1.1.0

ECD | 4287-B S.E. International Way Milwaukie, Oregon 97222-8825 U.S.A.



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ALL COMPONENTS, MATERIALS AND MANUFACTURING PRACTICES MUST MEET THE CURRENT RESTRICTION OF THE USE OF CERTAIN HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT (ROHS) DIRECTIVE OF THE EUROPEAN PARLIAMENT



Welcome to the OvenSENTINEL™ Help Guide! Choose a topic from each topic to find answers and get an overview plus step-by-step instructions.

[Help Guide](#)

This OvenSENTINEL™ Help Guide explains how to use the ECD OvenSENTINEL™ Intelligent Monitoring Solution System and software.

[Graphic Symbols](#)

OvenSENTINEL™ and this Help Guide use graphic symbols which help identify at a glance several Dangers, warnings, functions, as well as indicate the status of the cabinet.

[Operator Safety Information](#)

The safety information in this section is for the benefit of operating personnel. Warnings and Cautions will also be found throughout the manual where they apply.

[Declaration of Conformity](#)

The undersigned hereby declares, on behalf of the ECD Inc., that the above-referenced product, to which this declaration relates, is in conformity with the provisions

[Copyright Information](#)

Information that protects the exclusive right to make copies, license, and otherwise exploit any portion of this Help Guide.

How to use this Help Guide

This Guide is written for users of varied experience. If a section covers information you already know, feel free to skip to the next section.

- You **do not need** to be a computer expert to use this manual or the software.
- The Users Help Guide assumes you are familiar with Microsoft® Windows®.

Graphic Symbols

Product Symbols:



Warning: Whenever this internationally recognized symbol is used on the product, additional information concerning that particular feature or function appears in the Help Guide.



Waste Electrical and Electronic Equipment (WEEE). Unit should be recycled; Do not disposed of in land-fill.



Warning: Electrical Shock / Electrocution Hazard.



Positive Polarity



Direct Current (DC) Power



Alternating Current (AC) Power



Conformity marking for certain products sold within the European Economic Area (EEA)



Moves the control display menu cursor up or increments a user entered value.



Moves the display menu cursor down or decrements a user entered value.



Selects the current highlighted menu item in the display or approves a user set value.

Help Guide Symbols:



Informs the user that the note includes important information.



Informs the user that the note includes a handy tip.



Informs the user of an equation used.



Informs the user that the note identifies conditions or practices that could result in damage to the equipment.



Informs the user that the note identifies conditions or practices that could result in personal injury or damage to property other than the equipment.

Operator Safety Information

Hardware changes or modifications to the components are not expressly approved by ECD. and could void the warranty of the product.



The warranty will not cover damage caused by neglect or abuse of this product. To maintain the safety features incorporated in this product, operation must be in strict compliance with the requirements specified herein.

For protection of the components, observe the following:



- **NEVER** operate the OvenSENTINEL™ components in flammable or explosive atmospheres. Such usage constitutes a fire or explosion risk.
- **NEVER** immerse the OvenSENTINEL™ components in liquids.
- **NEVER** subject the OvenSENTINEL™ components to sharp impacts.
- **NEVER** excessively stress the OvenSENTINEL™ cables.
- **NEVER** expose the OvenSENTINEL™ components to corrosive environments.



Battery Warnings:

- Replace the batteries with same type only. Real-Time Clock/Memory Backup Battery: 3.6V 1.2Ah cell, LS14250 (ANSI 1/2AA, IEC 1/2R6) by Saft or equivalent. Using alternate batteries may present a risk of fire or equipment damage.
- Do not attempt to recharge the Real-Time Clock/Memory Backup Battery, disassemble, or dispose of in fire. Always dispose of used batteries promptly and properly.
- Do not expose to temperature above 100°C (212°F).
- Keep the batteries away from children.
- The batteries may explode if mistreated.
- The batteries contain electrolytes.

Declaration of Conformity



Electronic Controls Design, Inc.

4287-B S.E. International Way

Milwaukie, Oregon U.S.A. 97222-8825

(503) 659-6100 / (800) 323-4548

FAX: (503) 659-4422

Declaration of Conformity

OvenSENTINEL™ Station

E58-6928-42

The undersigned hereby declares, on behalf of the ECD Inc., that the above-referenced product, to which this declaration relates, is in conformity with the provisions of:

SAFETY:

IEC 61010-1 "Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements"

EMISSIONS:

EN 61000-3-2:2014 "Electromagnetic Compatibility (EMC) - Limits For Harmonic Current Emissions ..."

EN 61000-3-3:2013 "Electromagnetic Compatibility (EMC) - Limitation of voltage changes, voltage fluctuations and flicker ..."

EN 61000-6-4:2007+A1:2011 Class A "Electromagnetic compatibility (EMC) - Emission standard for industrial environments"

FCC 15.107:2015 Class A "Conducted Limits"

FCC 15.109(g):2015 Class A "Radiated emission limits"

ICES-003:2012 Class A "Information Technology Equipment (ITE) – Limits"

IMMUNITY:

EN 61000-6-1:2007 "Electromagnetic Compatibility (EMC). Immunity for residential, commercial and light-industrial environments"

The Technical Construction File required by this Directive is maintained at the corporate headquarters of ECD, Inc.

Name: Todd Clifton

Position: President & CEO

Signature: _____

Date: July, 2019

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Patents & Patents Pending: OvenSENTINEL™ #6,799,712;

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This section guides the user through the development of the Baseline Profile, OvenSENTINEL™ Product Creation, Monitoring and Reports.

[Step #1: Baseline Profile](#)

How to create Baseline Profiles.

[Step #2: Product Creation](#)

How to create Products.

[Step #3: Monitoring](#)

How to Monitor Products/oven.

[Step #4: Reports](#)

How to create customized Reports of the recorded Product/oven data.

Step #1: Baseline Profile

The OvenSENTINEL™ System requires a Baseline Profile to be established. To ensure success when monitoring Products with the OvenSENTINEL™ System, it is important that when creating and recording a Baseline Profile (*.XMG) it is properly configured. To complete this process, ECD M.O.L.E.® MAP software is required.

Baseline Profile Settings:

- [Record Baseline Profile \(Data Run\)](#)
- [Read Baseline Profile \(Data Run\)](#)
- [Machine Information](#)*
- [Recipe/Zone Settings \(Setpoints\)](#)
- [Conveyor Speed](#)
- [Zone Lengths](#)
- [Oven Model Alignment](#)*
- [Assembly Information](#)
- [KPI \(Key Process Indicators\)](#)*

**Baseline Profile Vital Setting*



If you have already created M.O.L.E.® MAP thermal profiles that contain these profile settings, proceed to [Step #2: Product Creation](#) where they can be imported using the **Add Product** process.

Record Baseline Profile (Data Run)

This Wizard guides the user through a typical process on how to set a M.O.L.E. Profiler up for recording a Baseline Profile (data run).

- 1) Activate the M.O.L.E.® MAP software.
- 2) Connect the M.O.L.E. Profiler to the computer.
- 3) Set an Reflow Environment. Either open an existing Environment Folder or create a new one.



If the Reflow Environment is not displayed on the **Environment Sidebar**, the user can use either the **Open Environment Toolbar button** or select the **Open Environment Folder** command from the **File Menu**.



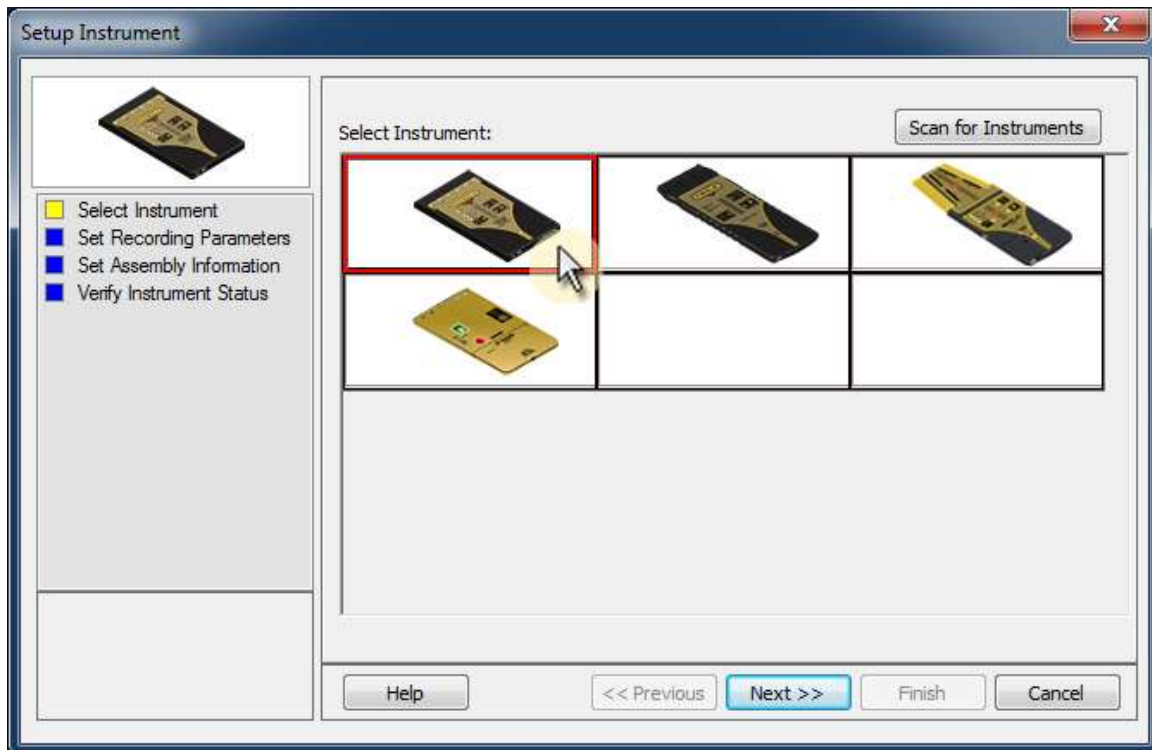
4) On the **M.O.L.E.** menu, click **Setup Instrument** and the workflow wizard appears.



When navigating through the wizard, the step list on the left uses a color key to inform the user of the current step, steps that have been completed and remaining steps.

■ Current ■ Completed ■ Remaining

5) Select the desired instrument from the dialog box to make active. If there are none listed, click the **Scan for Instruments** command button to detect all available instruments.



6) Click the **Next** command button.

7) Set instrument name and recording interval.

Setup Instrument

Instrument Name: M.O.L.E. Profiler

Recording Interval

Hour: 0 Minute: 0 Second: 1 1/10: 0

More >>

Channel	On	Location	Type
1	☒	Sensor 1 Location	Type-K
2	☒	Sensor 2 Location	Type-K
3	☒	Sensor 3 Location	Type-K
4	☒	Sensor 4 Location	Type-K
5	☒	Sensor 5 Location	Type-K
6	☒	Sensor 6 Location	Type-K

Basic Profiling

Help << Previous Next >> Finish Cancel

8) Click the **Next** command button.



When using the SuperM.O.L.E.® Gold Profiler, the sending of data erases any currently stored data.

9) Confirm the assembly information (board size, sensor locations and a product image).

Setup Instrument

Assembly Information

Part Number:

(X) Length: (Y) Width: Thickness: Units:

Channel	Location	X	Y	Z
1	Sensor 1 (U1)	10.20	4.71	0.00
2	Sensor 2 (R7)	7.11	6.63	0.00
3	Sensor 3 (C2)	3.47	7.93	0.00
4	Sensor 4 (R34)	15.09	4.71	0.00
5	Sensor 5 (D24)	13.79	5.02	0.00
6	Sensor 6 (Q11)	5.37	7.81	0.00

10) Click the **Next** command button.

11) Verify the instrument status. This dialog box displays the health of the M.O.L.E. Profiler such as Power Pack charge, internal temperature, thermocouple temperatures.

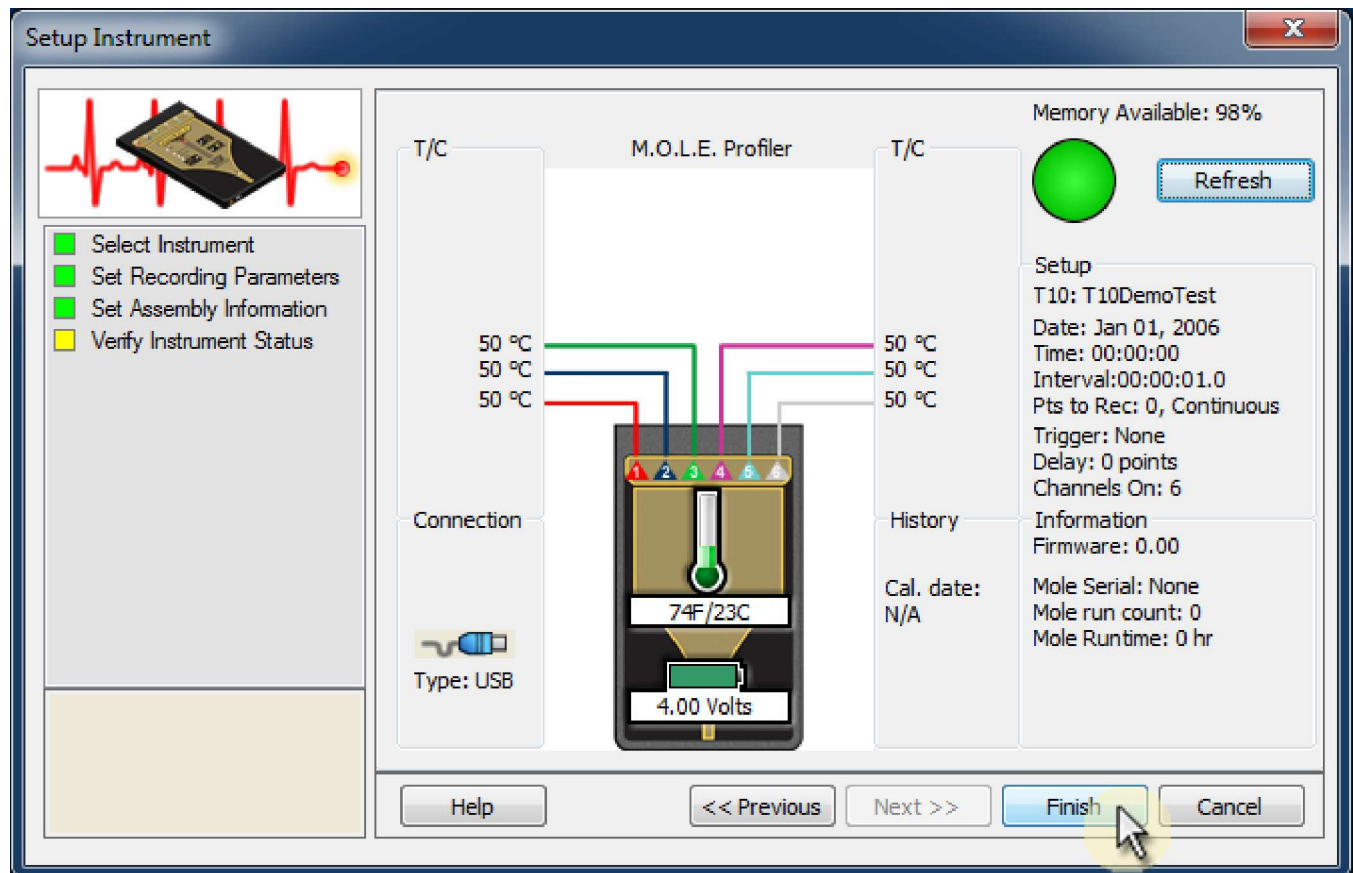
If everything is **OK**, the dialog box displays a **GREEN** symbol. If there are any items that may prevent the user from collecting good data, they are highlighted and a yellow **Warning** symbol is displayed.



OK



Warning



12) Select the **Finish** command button to complete the Setup Instrument wizard.

13) Place the M.O.L.E. Profiler in the appropriate thermal barrier making sure the Thermocouple and/or Sensor wires are not damaged.



Never permit the M.O.L.E. Profiler to exceed the absolute maximum warranted internal temperature, as permanent damage may result. The warranty will not cover damage caused by exceeding the maximum specified internal temperature.

14) After the oven stabilizes, turn the M.O.L.E. Profiler ON and press the record button.



The record button will need to be pressed even if the M.O.L.E. Profiler is configured to start if the start parameters **Trigger Temperature** or **Points Delay** are configured.

15) Pass the thermally protected M.O.L.E. Profiler and test assembly through the machine.



It is highly recommended that protective gloves are used when retrieving the thermal barrier from the oven and when opening the thermal barrier.

16) As the test assembly and M.O.L.E. Profiler emerge from the machine, carry the test assembly with sensors attached and the M.O.L.E. Profiler in the Thermal barrier to a table or flat surface.



If a sensor is removed before the M.O.L.E. Profiler has stopped collecting data, the data for that channel might become distorted.

17) Open the Thermal barrier and if the Activity LED is still flashing this means the M.O.L.E. Profiler is still recording and it must be stopped.

18) Remove the M.O.L.E. Profiler from the Thermal barrier. Handle it carefully, as the case may still be warm.

19) Disconnect the sensors from the M.O.L.E. Profiler and place it near the computer.

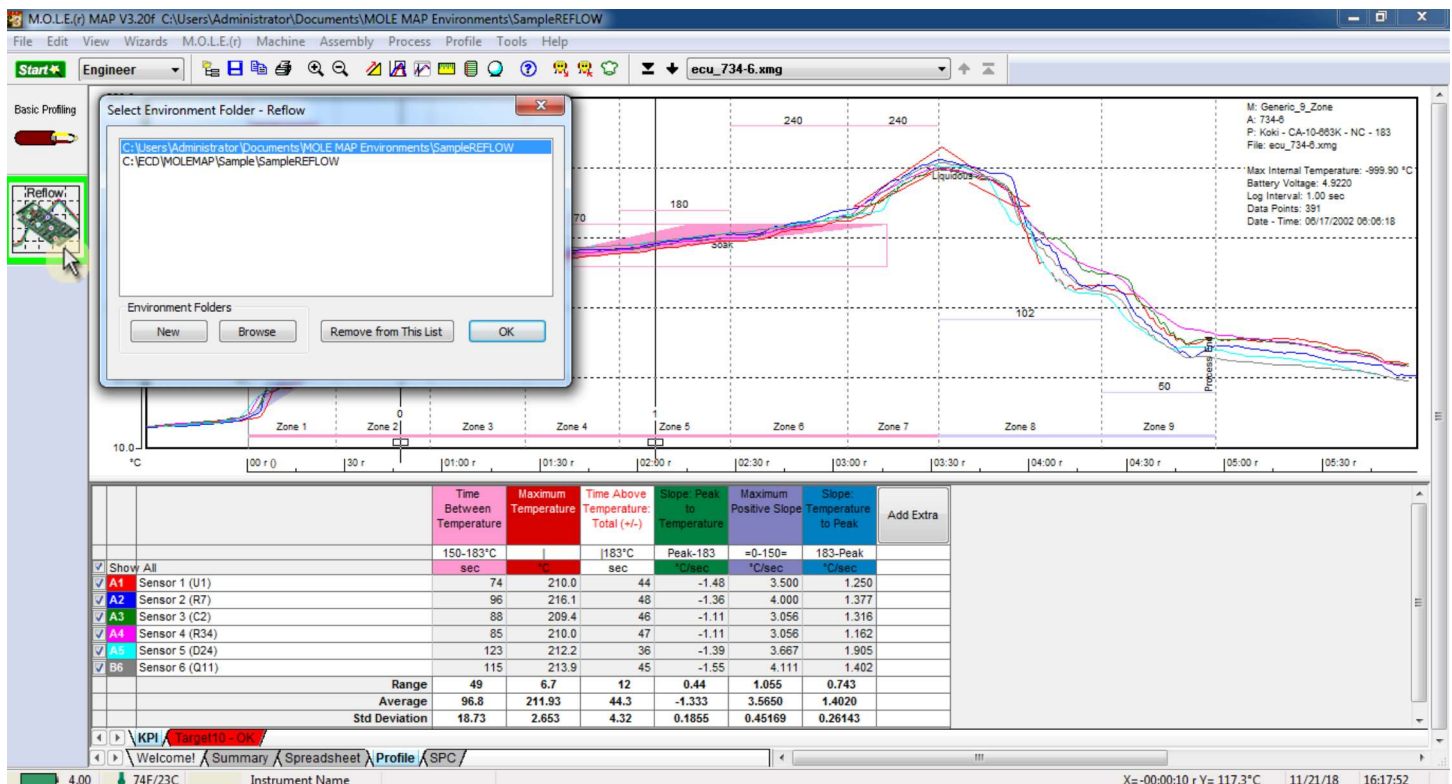
Read Baseline Profile (Data Run)

The Download Data workflow is a wizard that downloads a recorded Baseline Profile (data run) from the M.O.L.E. Profiler.

- 1) Activate the M.O.L.E.® MAP software.
- 2) Connect the M.O.L.E. Profiler to the computer.
- 3) Confirm the correct Reflow Environment is set.



If the Reflow Environment is not displayed on the **Environment Sidebar**, the user can use either the **Open Environment Toolbar button** or select the **Open Environment Folder** command from the **File Menu**.



- 4) On the **M.O.L.E.** menu, click **Read Instrument** and the workflow wizard appears.

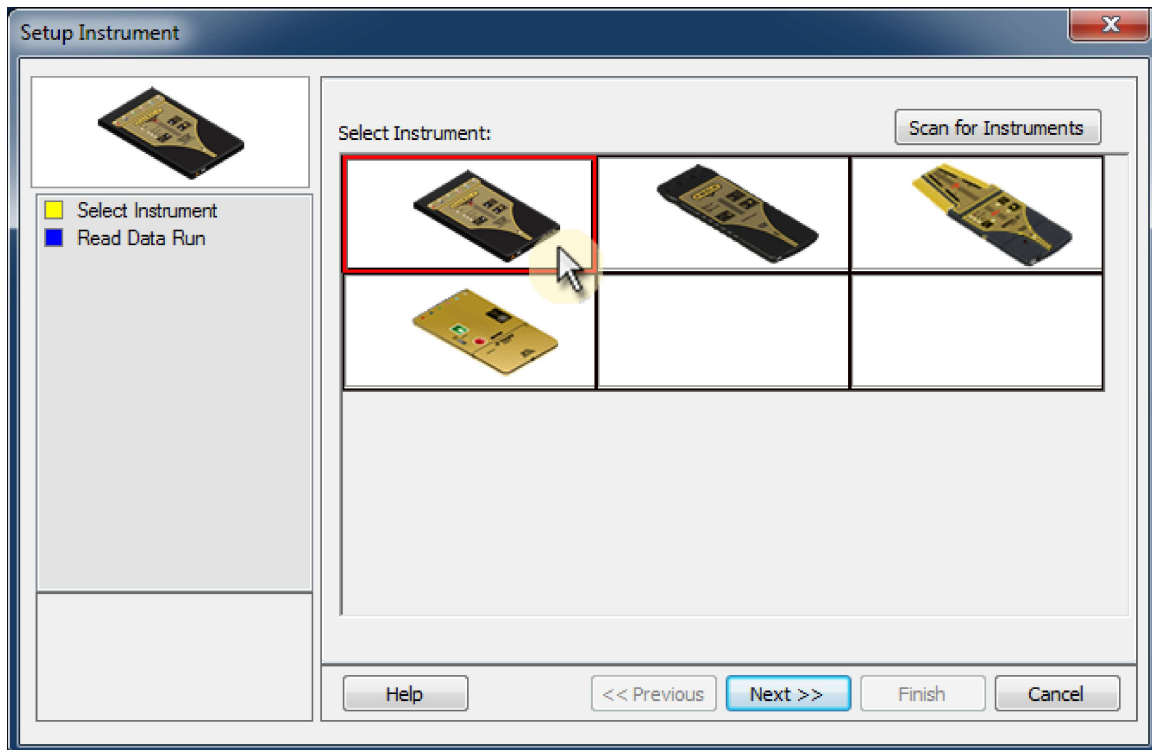
- 5) On the **Start** dialog box, click the **Download Data** command button and the workflow wizard appears.



When navigating through the wizard, the step list on the left uses a color key to inform the user of the current step, steps that have been completed and remaining steps.

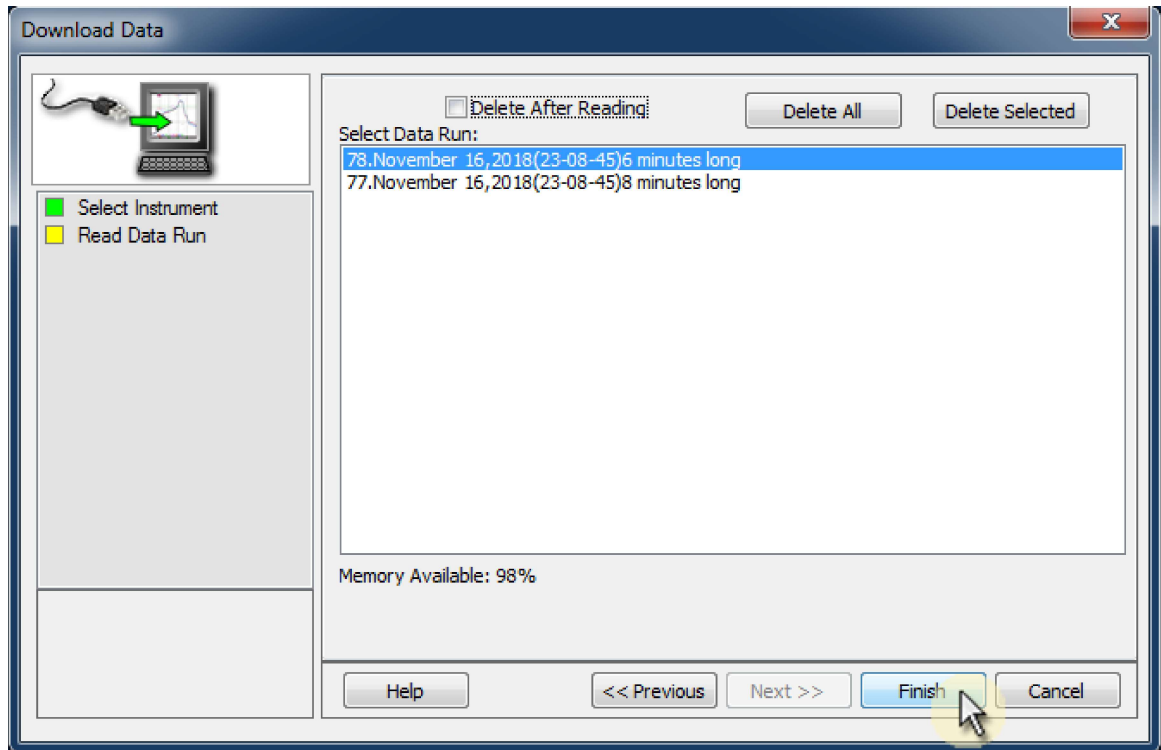
■ Current ■ Completed ■ Remaining

- 6) Select the desired instrument from the dialog box to make active. If a M.O.L.E. Profiler has already been selected during a different process, the software automatically selects the M.O.L.E. Profiler connected to the COM Port previously used.

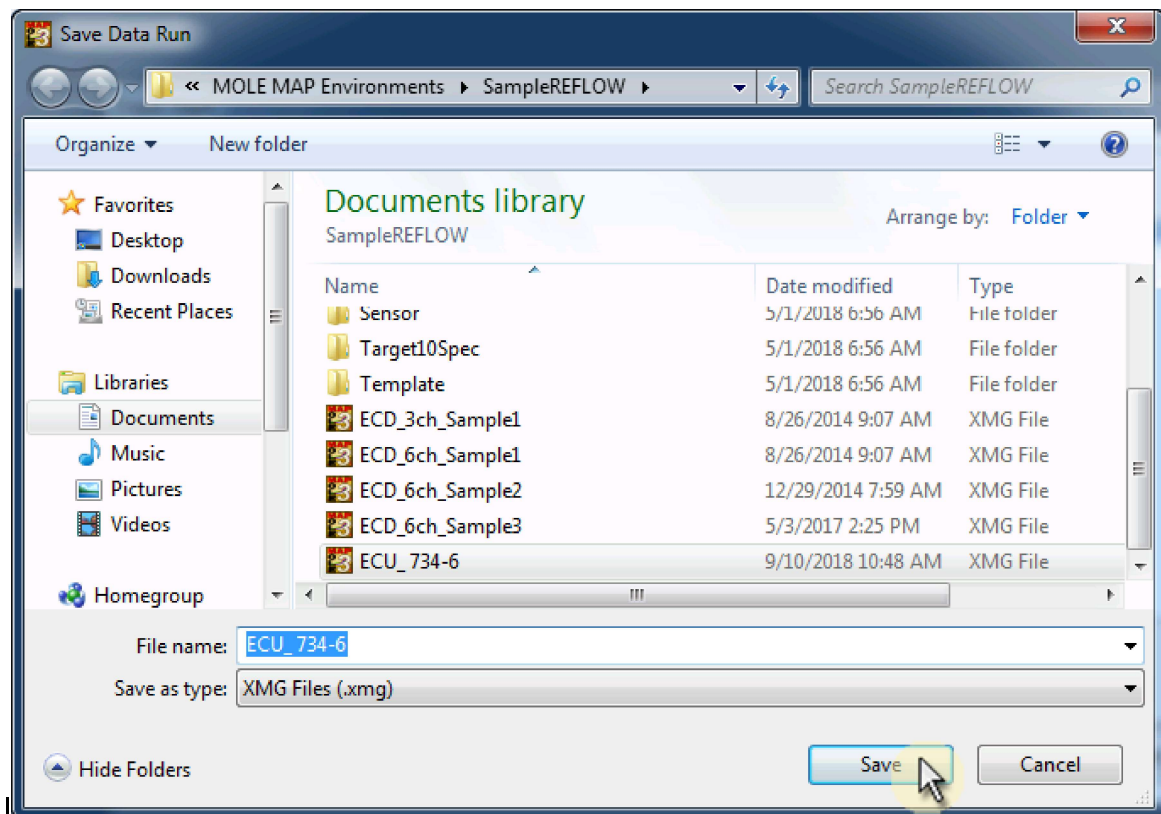


- 7) Click the **Next** command button.

- 8) Select the desired Baseline Profile (data run) and then click the **Finish** command button to complete the wizard and read from the M.O.L.E. Profiler.



- 9) When the Baseline Profile (data run) has been downloaded, the software prompts the user to specify new file name (*.XMG).



- 10) When finished, click the **Save** command button to complete the process.

Machine Information

This sets machine information that is displayed on the Data Graph so the user can visually see how the Baseline Profile (data run) lines up with the machine.

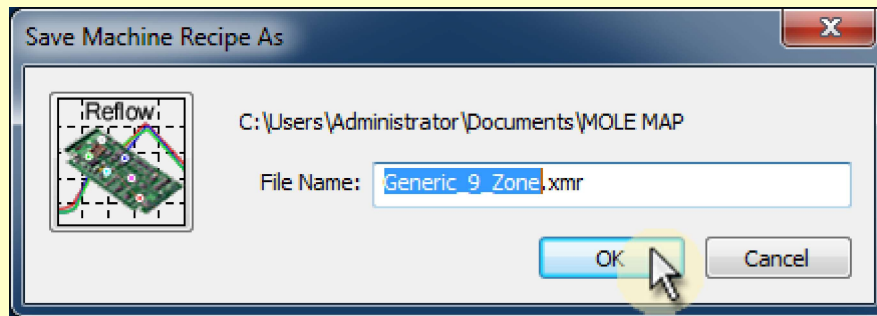


When setting machine information, this data will be applied to the currently selected data run only.

- 1) Activate the M.O.L.E.® MAP software.
- 2) On the **Machine** menu, click **Set Machine Information**.
- 3) Select a machine from the machine drop down list.

	Name	Length	Top	Type
1	Zone 1	32.00	170	Heating
2	Zone 2	33.00	160	Heating
3	Zone 3	34.30	160	Heating
4	Zone 4	33.80	170	Heating
5	Zone 5	39.10	180	Heating
6	Zone 6	42.20	240	Heating
7	Zone 7	33.00	240	Heating
8	Zone 8	58.40	102	Cooling
9	Zone 9	40.70	50	Cooling

If your machine does not appear in the list, continue to set the machine information and select the **Save As** command button to save the new machine settings as an (*.XMR) file in the current Environment. This new machine file will appear in the machine drop down list.



- 4) Set the machine zone units.
- 5) Set the number of all machine zones (heating and cooling).
- 6) Set the machine temperature units.
- 7) Set the machine conveyor speed and units. The software uses this value to calculate the Time (X) Scale values when **Distance** units are displayed.



To properly display a machine model on the Data Graph, a conveyor speed must be set.

- 8) In the machine zone matrix set:
 - Zone names (descriptions)
 - Zone lengths (If you do not have zone measurement information, use a tape measure to determine the zone sizes).
 - Zone temperatures (top / bottom)
 - Zone types (heating or cooling)
- 9) Click the **OK** command button to set the machine information for the displayed thermal profile.

Oven Model Alignment

Oven model alignment accurately reflects how each oven zone influenced the Baseline Profile (data run). All of the KPI measures depend on proper oven model alignment so if it is not, OvenSENTINEL™ recorded data will not be accurate.



If the oven model does not appear on the Data Graph, .

There is two primary methods to align the oven model in M.O.L.E.® MAP, align profile peaks and moving the process origin. Both methods need to align the end of the last hottest zone in the oven model with the Data Plot peaks of the Baseline Profile (data run).

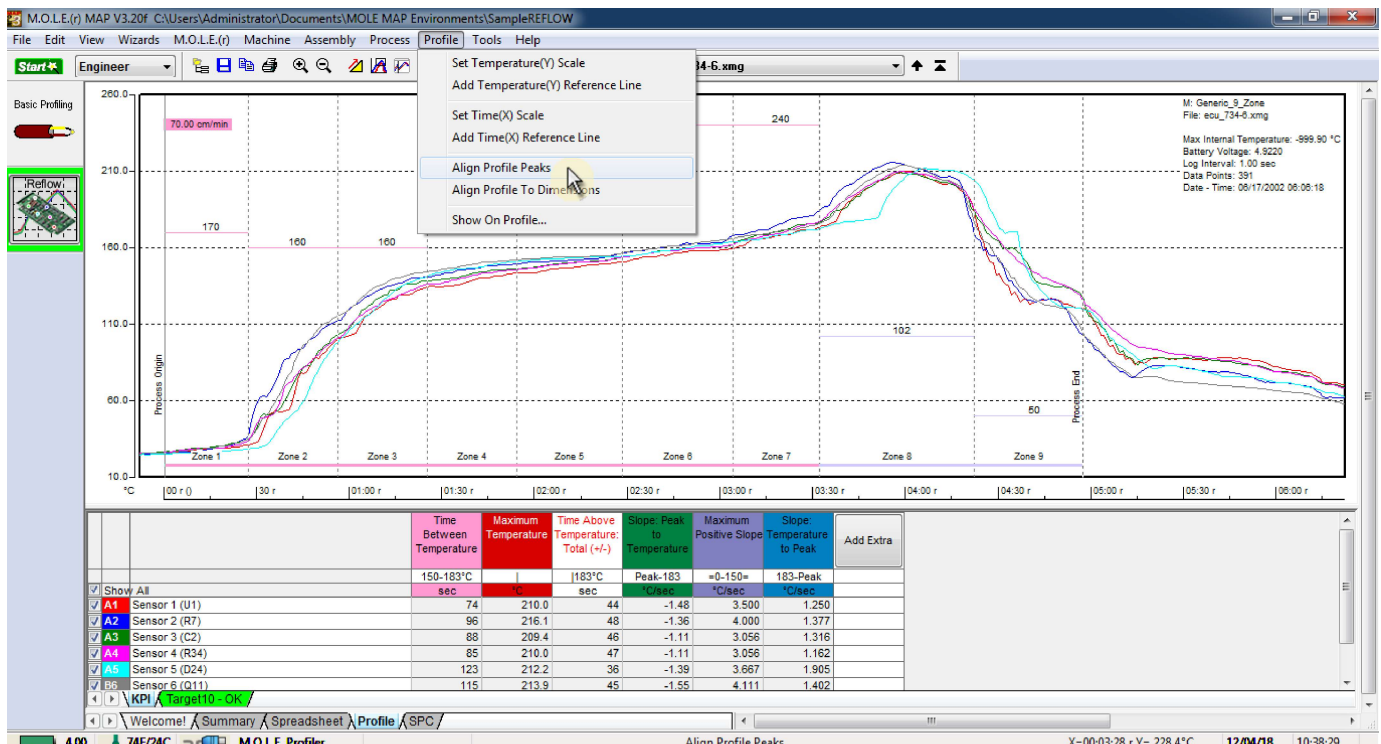
Align profile peaks:

If sensors are placed so they enter and exit machine zones at different times, the resulting Data Plots lag behind one another. The Align Profile Peaks command automatically aligns the Time (X) axis maximum peak values for each Data Plot and the end of the last hottest zone in the oven model.

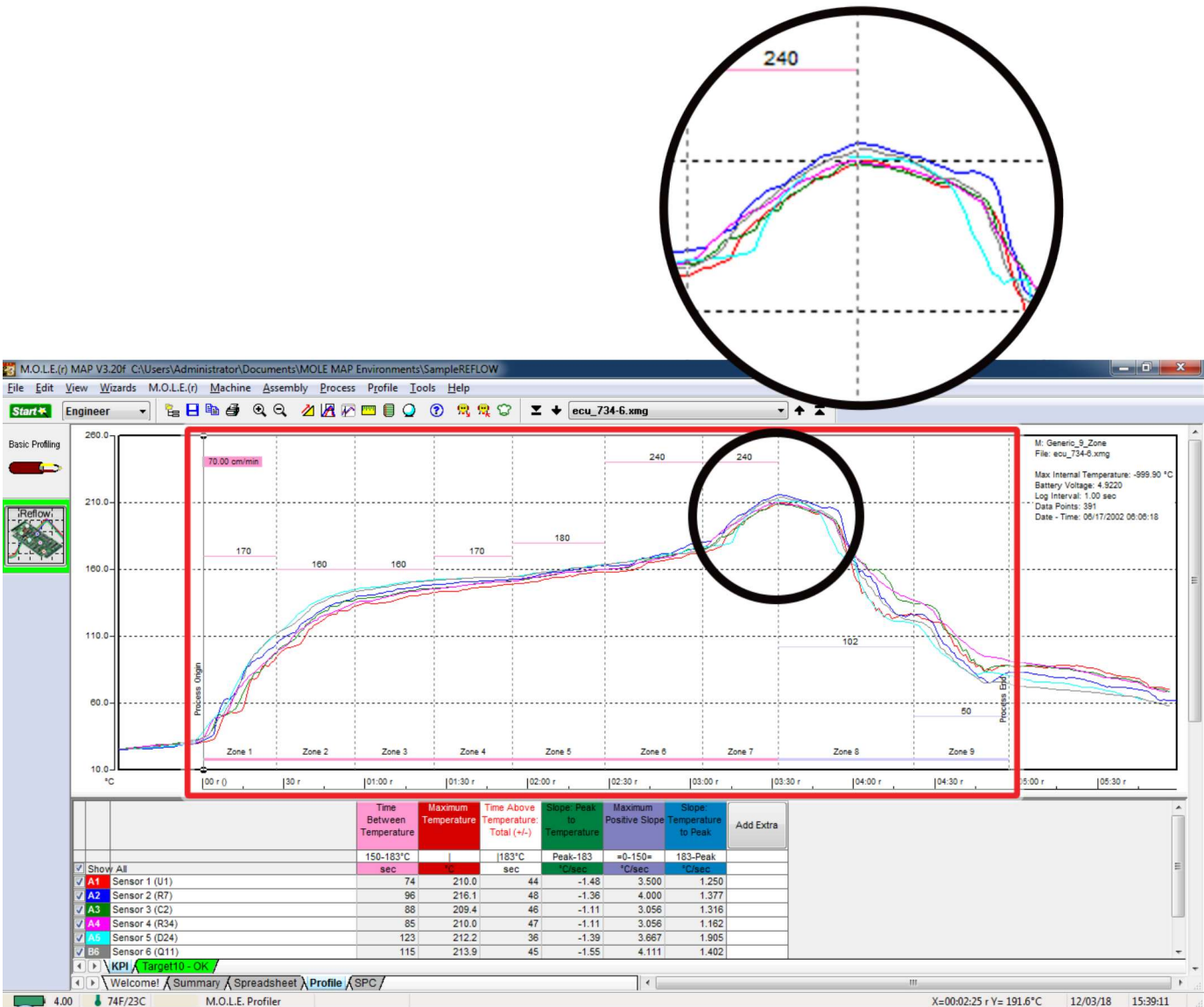


A conveyor speed must be set to properly use this command.

- 1) On the **Profile** menu, click **Align Profile Peaks**.



The channel lag values are automatically calculated, and the Data Plots adjust to reflect them. A check mark appears to the left of the command indicating the software is in **Align Profile Peaks** mode.



If a Data Plot in the Data Graph is bad (i.e. open, intermittent or detached thermocouple) it may prevent the oven model to align. Data Plots can be suppressed by clicking the corresponding channel check box in the Data Table. This allows the software to align good Data Plot peaks and the oven model.

Move the Process Origin:

If there is something preventing oven model alignment using **Align Profile Peaks**, the user can manually adjust the oven model by moving the Process Origin. This is the gray vertical line at the left edge of the oven model that indicates where the assembly process starts. Manually moving the Process Origin may take a couple attempts to align the end of the last hottest zone in the oven model with the Data Plot peaks of the Baseline Profile (data run).



Assembly Information

This sets assembly information associated with the thermal profile.



When setting assembly information, this data will be applied to the currently selected thermal profile only.

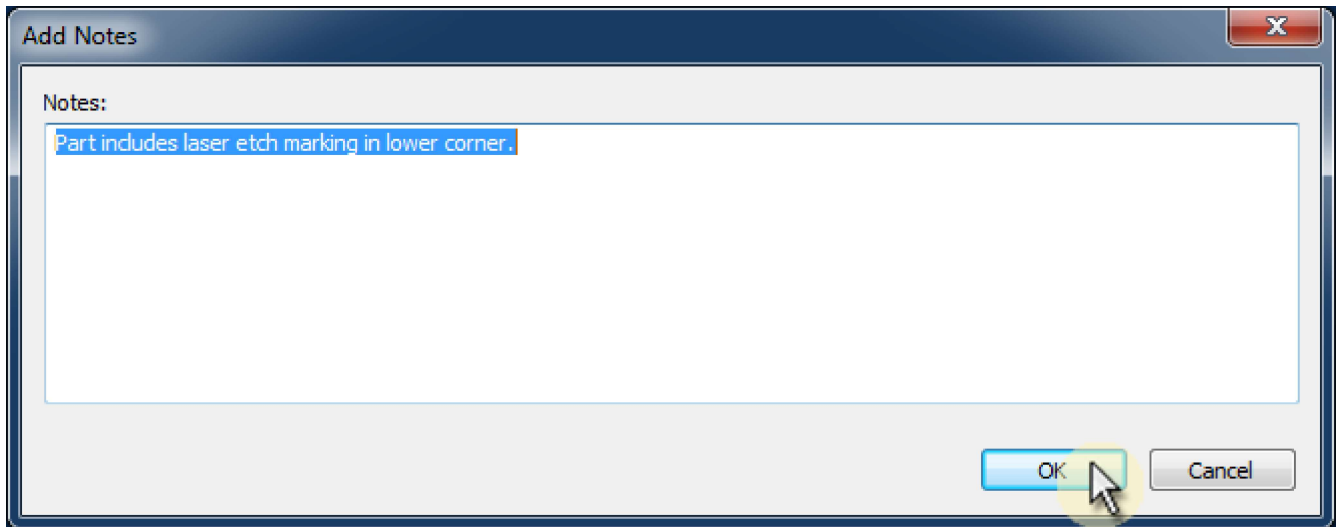
- 1) Activate the M.O.L.E.® MAP software.
- 2) On the **Assembly** menu, click **Set Assembly Information**.
- 3) Enter an assembly part number.

The dialog box titled "Set Assembly Information" contains the following elements:

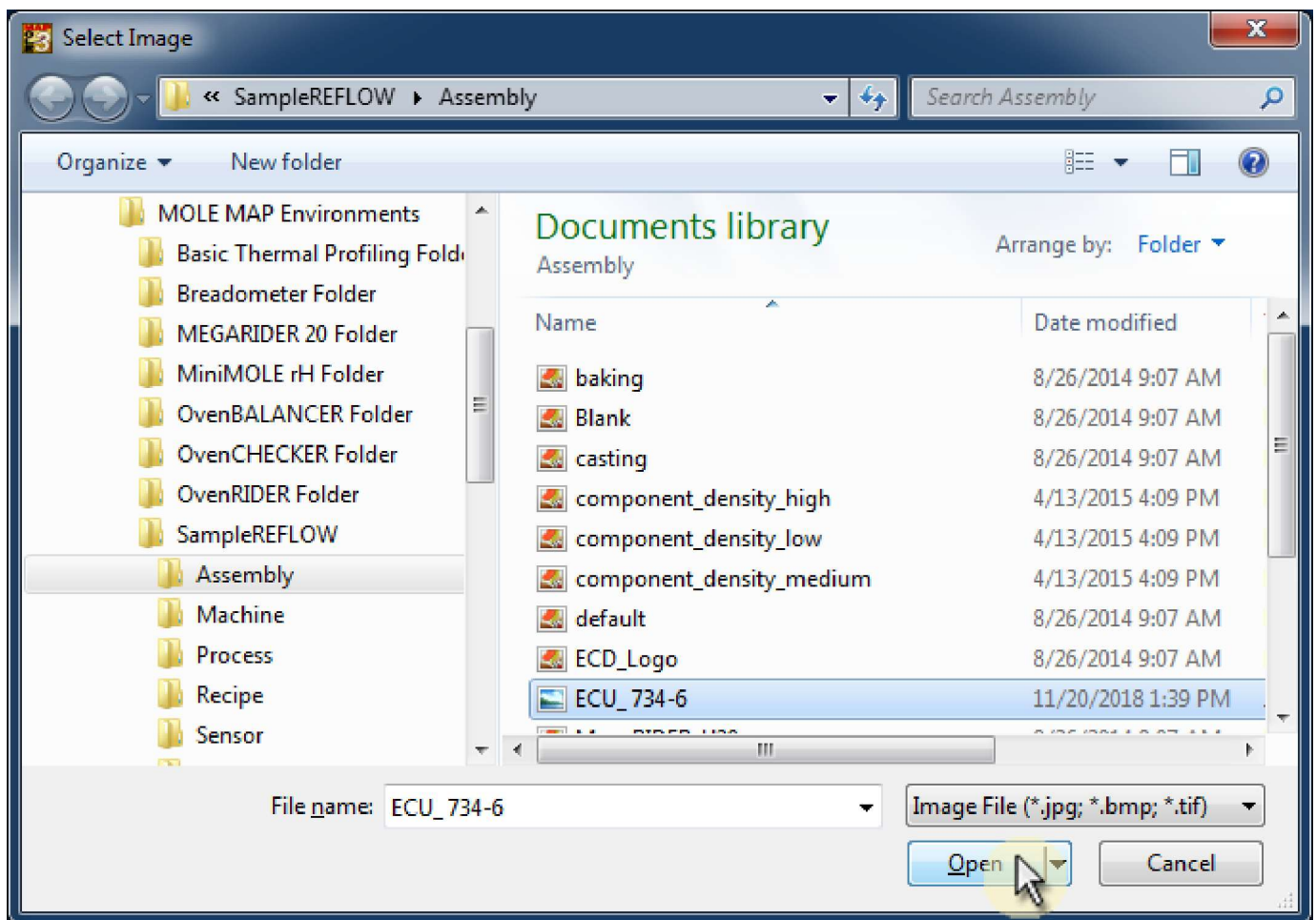
- Assembly Information** section:
 - Part Number: (with a yellow highlight and mouse cursor)
 - Buttons: Notes...
 - (X) Length: (Y) Width: Thickness: Units:
 - Buttons: Load... Save...
- Table with 5 columns: Channel, Location, X, Y, Z.
- Image File... button
- Image of a circuit board with colored sensor locations and X/Y axes.
- Enlarge... button
- OK, Cancel, and Help buttons at the bottom.

Channel	Location	X	Y	Z
1	Sensor 1 (U1)	10.20	4.71	0.00
2	Sensor 2 (R7)	7.11	6.63	0.00
3	Sensor 3 (C2)	3.47	7.93	0.00
4	Sensor 4 (R34)	15.09	4.71	0.00
5	Sensor 5 (D24)	13.79	5.02	0.00
6	Sensor 6 (Q11)	5.37	7.81	0.00

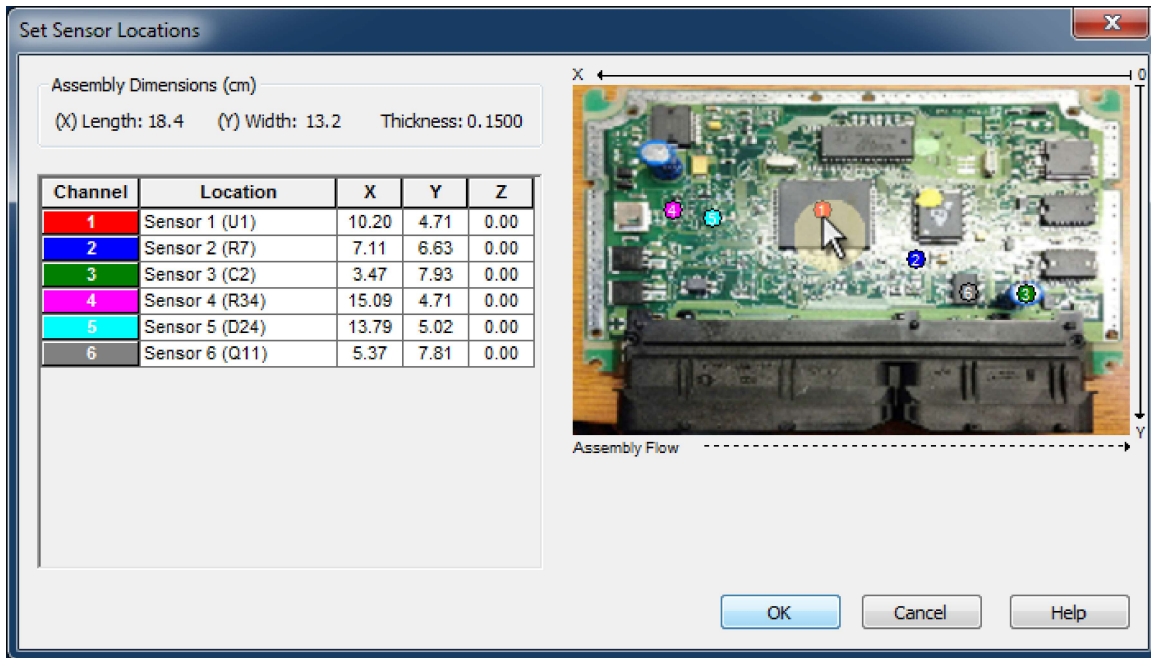
- 4) Click the **Notes** command button if you would like to enter part documentation about the test assembly being profiled.



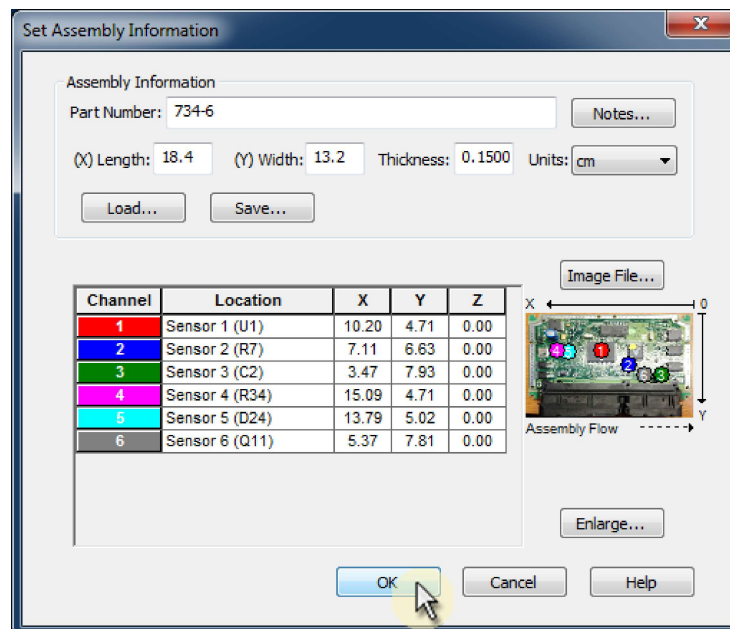
- 5) Click the image file **Browse** command button to select a product image. Image files supported by the software are Jpeg (.jpg), Bitmap (.bmp), and Tiff (.tif).



- 6) Enter the test assembly board length, width and thickness.
- 7) Enter the sensor location descriptions. These descriptions can be the location where each sensor is connected to the test assembly. The channel color associated with the description indicates which Data Plot on the Data Graph it represents.
- 8) Enter sensor location dimensions. Sensor Locations can also be set by dragging sensor location markers on the selected image. To move the markers, click the **Enlarge** command button below the assembly image and the **Set Sensor Locations** dialog box appears.



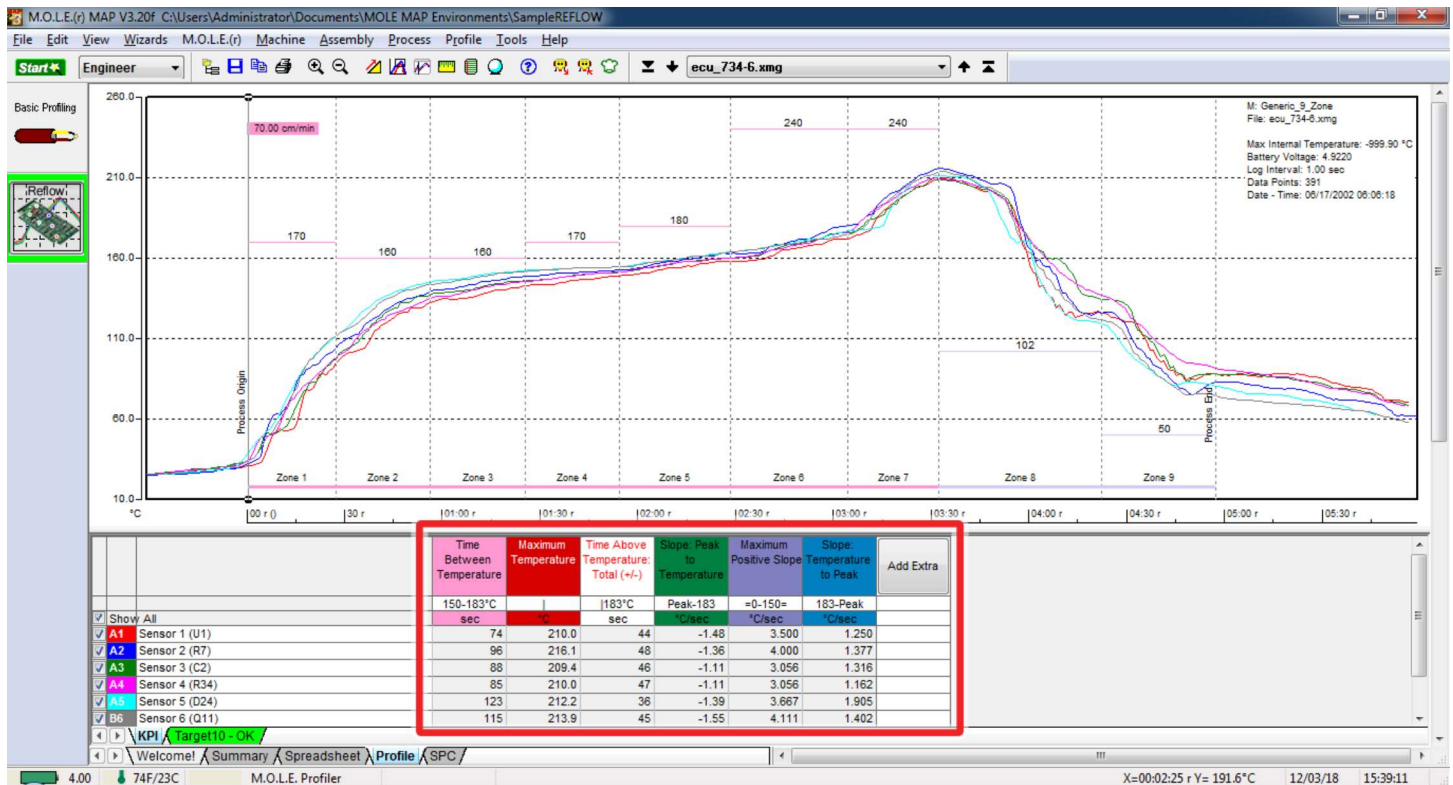
X-dimensions are measured from the leading (right) edge or the first edge to enter the process, and Y dimensions are from the top down.



- 9) Click the **OK** command button accept.

KPI (Key Process Indicators)

The KPI Data Table should include various user configured parameter values that are critical to your Baseline Profile (data run). Each column after the Sensor Locations allows the user to define parameters using the M.O.L.E.® MAP Template commands.



This information is saved with the *.XMG file and will be imported when creating a product. If any KPI measures are configured using M.O.L.E.® MAP Time (X) Reference Lines, they will not be imported as they are not supported in OvenSENTINEL™.

The Baseline Profile (*.XMG) can now be imported into OvenSENTINEL™ software. This Baseline Profile (*.XMG) applies to this oven only as any slight difference in the oven and/or process will affect the success of monitoring product.

Step #2: Product Creation

Once a Baseline Profile has been established, it can be used to create a new Product. Each Product defines the requirements for that product, machine properties that achieve those requirements, and the actions you wish to perform if those requirements are not met.

Product Creation Settings:

- [Process](#)
- [Assembly](#)
- [Machine Settings](#)
- [Alerts](#)
- [Probe Temperatures](#)

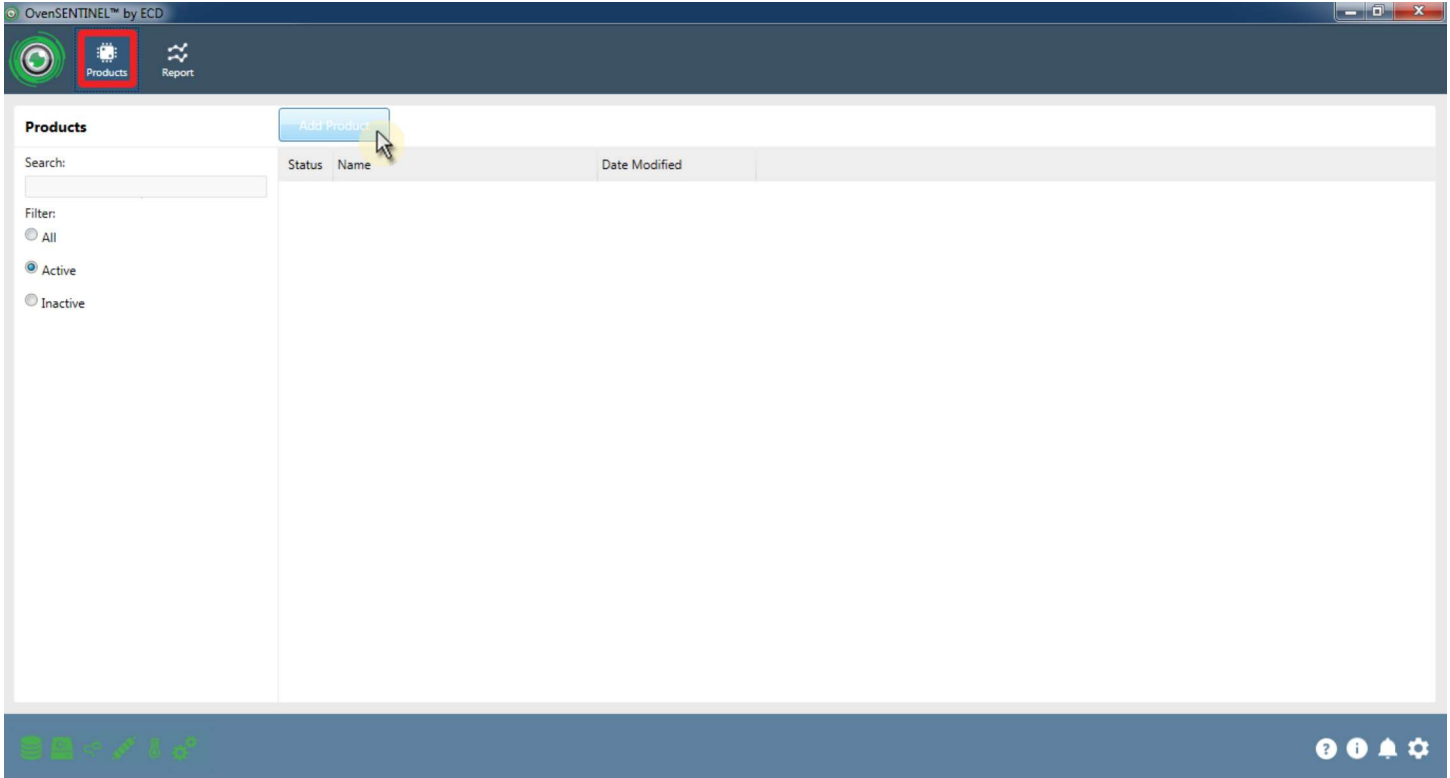


If you have product established, you may proceed to [Step #3: Monitoring](#).

Process

This is where process information for OvenSENTINEL™ Product is established from a Baseline Profile or existing Product.

- 1) Activate the OvenSENTINEL™ software and select the **Product View** button.
- 2) Select the **Add Product** button from the **Product Manager**.



Settings that display an asterisk (*) are required.

- 3) On the **Add Product** window, select **MAP Profile** or **Import OvenSENTINEL™ Product**.



- **MAP Profile** imports an existing (*.XMG) Baseline Profile (data run) specifically for the oven from ECD M.O.L.E.® MAP software. See topic [Step #1: Baseline Profile](#) for more information.
- **Import OvenSENTINEL™ Product** is a copy and tweak process that considerably speeds up the Product creation process. It loads an existing Product created for the oven or an identical oven, and allows the user to modify (tweak) the settings as needed.

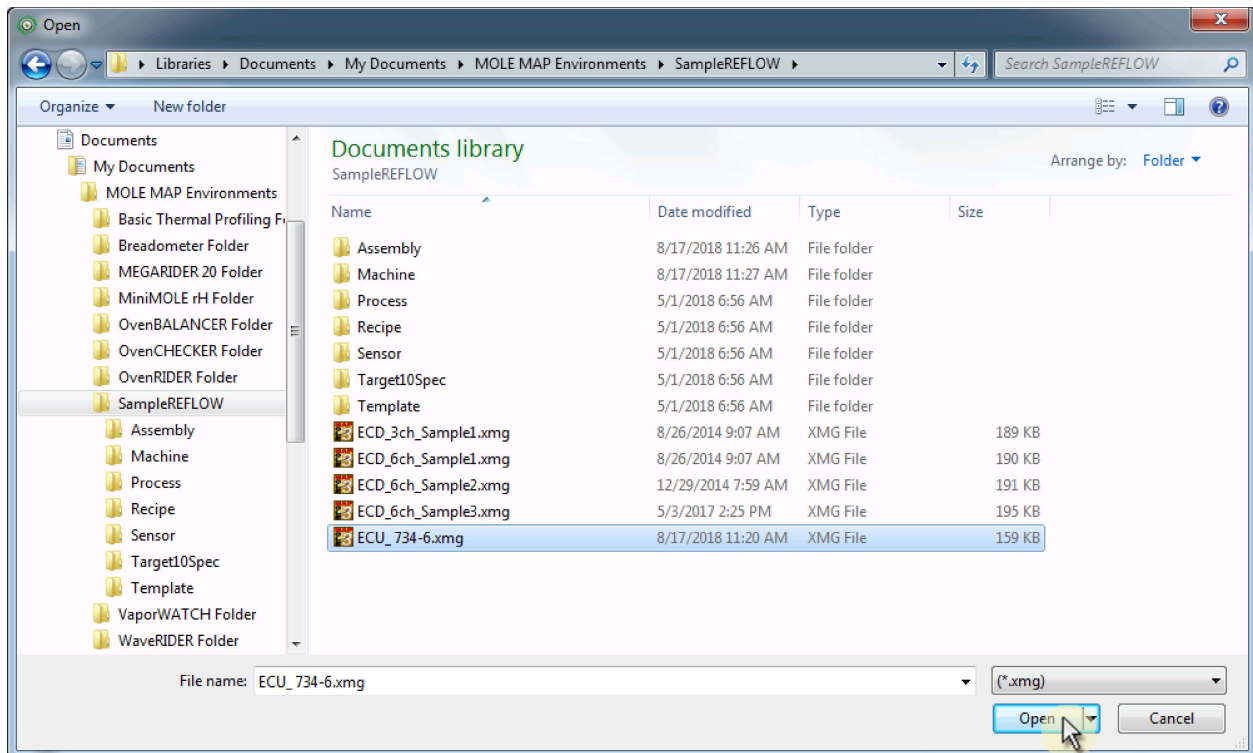
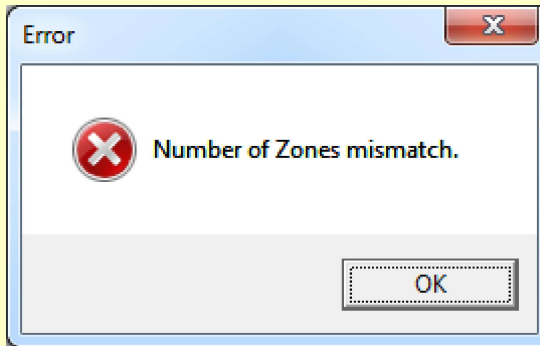
This topic covers the more common process of creating a Product from a **MAP Profile**.

- 4) Select the **Browse** button to navigate to the location of the Baseline Profile (*.XMG) file.

The screenshot shows the 'Add Product' dialog box with the 'Create' tab selected. The 'Profile' section has two radio buttons: 'MAP Profile' (selected) and 'Import OvenSENTINEL™ Product'. Below this, there are two required fields: 'Select baseline profile (.XMG):' and 'Unique product name:'. The first field has a 'Browse...' button next to it, which is highlighted with a yellow circle and a mouse cursor. The second field is an empty text box. To the right of these fields is the 'Status*' section with 'Active' and 'Inactive' radio buttons. Below that is the 'SPC Options' section with a 'Configure...' button. At the bottom of the dialog, there are three buttons: '< Back', 'Next >', and 'Done'. A question mark icon is visible in the bottom left corner of the dialog.

- 5) Select the (*.XMG) file and click the **Open** button. This loads the Baseline Profile data and the KPI calculations established in M.O.L.E.® MAP. It also loads the assembly and machine information.

It is very important that the selected thermal profile (*.XMG) was created on the oven that OvenSENTINEL™ is monitoring. If the selected thermal profile (*.XMG) was not from the same oven, it will be rejected and the user notified of the mismatch.



- 6) Enter a **Unique Product name** in the box. This field is populated with the assembly name from the selected thermal profile (*.XMG). It can be changed however, must remain unique from any existing Product. To assist the user, this box displays a confirmation symbol in addition to a list of currently used Products.



Once a valid profile is loaded, the **Profile Shape** and **Data Table KPI Measures** are displayed.

Add Product

Create

Profile

Start from: ☒ MAP Profile ☐ Import OvenSENTINEL™ Product

* Select baseline profile (.XMG): C:\Users\Administrator\Documents*

* Unique product name: **ECU 734-6 (Lot 180818)** ✓

Status*

☒ Active ☐ Inactive

SPC Options

Profile Shape

Data Table

KPI Import Status

Time Between Temperature 150-183°C ✓

< Back Next > Done

7) Select the **Status** of the product.

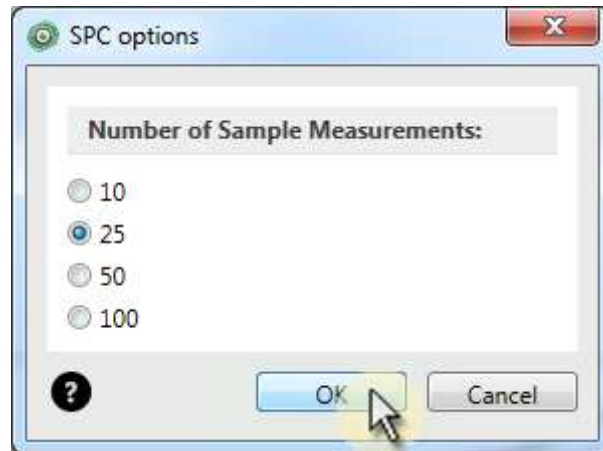
- **Active:** When set, this is displayed in the Product list. This is the default for all new Products.
- **Inactive:** When set, this Product is no longer visible in the Product list, it can be found when using "inactive" on the Product Filter. Products are typically set to inactive when the Product is not likely to be monitored or the user would like to reduce the amount of Products in the list. It can be set to active at anytime by editing the Product.

The screenshot shows the 'Add Product' dialog box with the 'Create' tab selected. The 'Profile' section includes a 'Start from:' dropdown set to 'MAP Profile', a 'Select baseline profile (.XMG):' field with a 'Browse...' button and a file path, and a 'Unique product name:' field containing 'ECU 734-6 (Lot 180818)'. The 'Status*' section is highlighted with a red box, showing 'Active' selected. Below this is the 'SPC Options' section with a 'Configure...' button. The 'Profile Shape' section displays a graph of temperature over time. The 'Data Table' section shows a table with 'KPI' and 'Import Status' columns. The 'Time Between Temperature 150-183°C' is displayed with a green checkmark. Navigation buttons '< Back', 'Next >', and 'Done' are at the bottom right.

- 8) Select the **Configure...** button in SPC Options to set the number of sample measurements. This is how many recorded data points (samples) for this Product to be used in SPC Cp; CpK calculations. Refer to Topic [Appendix>Statistical Process Control \(SPC\) Background Information](#) for more information.



This setting can be edited with the **Product Manager**. Refer to topic Products for more information.



- 9) Click the **Next** button to configure **Assembly** information.

Assembly

Set or edit assembly information associated with the selected Baseline Profile that was selected for the Product.

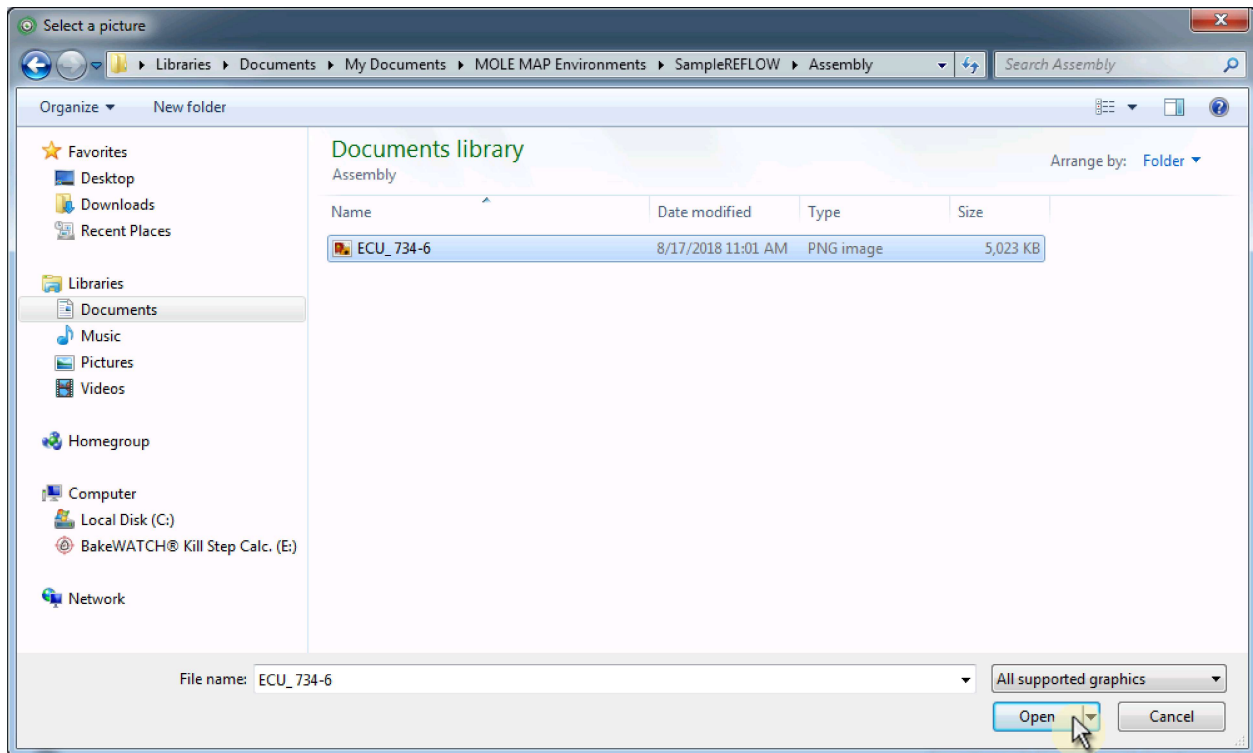


This information is imported from the *.XMG file and can be changed/modified.

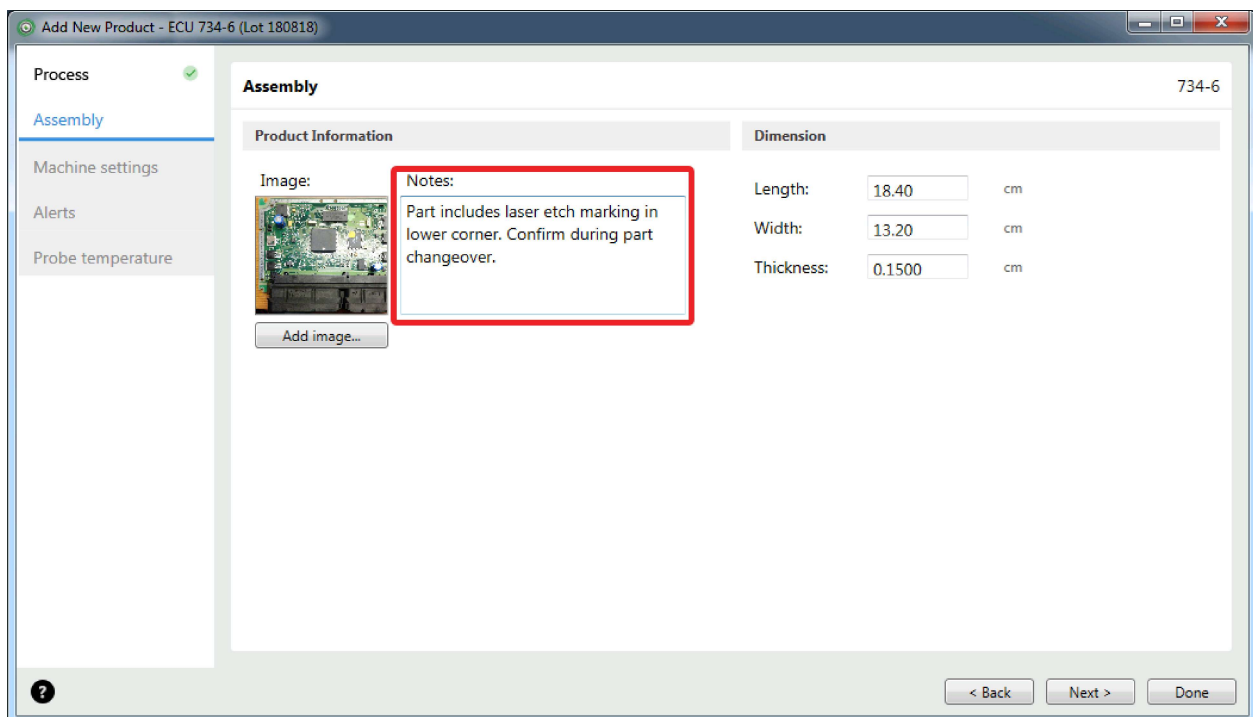
- 1) If you would like to assign or update an identification image, select the **Add image** button to navigate to the location of the Product image. Image files supported by the software are Jpeg (.jpg), and PNG (.png).

The screenshot shows a software window titled "Add New Product - ECU 734-6 (Lot 180818)". On the left is a sidebar with a tree view containing "Process" (with a green checkmark), "Assembly" (selected), "Machine settings", "Alerts", and "Probe temperature". The main area is titled "Assembly" and has a sub-header "734-6". It is divided into two tabs: "Product Information" and "Dimension". Under "Product Information", there is an "Image:" label next to a red rectangular box containing the text "IMAGE NOT AVAILABLE". Below this box is a button labeled "Add image...". To the right of the image box is a "Notes:" label followed by a text area containing the text "Part notes go here Sensor notes go here.". Under the "Dimension" tab, there are three rows of input fields: "Length:" with the value "18.40" and unit "cm", "Width:" with the value "13.20" and unit "cm", and "Thickness:" with the value "0.1500" and unit "cm". At the bottom of the window, there are three buttons: "< Back", "Next >", and "Done". A help icon (?) is located in the bottom left corner.

2) Select the image file and click the **Open** button.



3) If you would like to enter or update part documentation about the Product, add **Notes** to the text box.



4) Enter or update the **Dimensions** of the Product.

The screenshot shows a software window titled "Add New Product - ECU 734-6 (Lot 180818)". On the left is a sidebar with a vertical list of tabs: "Process" (with a green checkmark), "Assembly" (highlighted in blue), "Machine settings", "Alerts", and "Probe temperature". The main area is titled "Assembly" and contains two sub-sections: "Product Information" and "Dimension". The "Product Information" section includes an "Image:" field with a placeholder image of a circuit board and an "Add image..." button, and a "Notes:" field with the text "Part includes laser etch marking in lower corner. Confirm during part changeover." The "Dimension" section contains three rows of input fields: "Length:" with the value "18.40", "Width:" with the value "13.20", and "Thickness:" with the value "0.1500". Each value is followed by a "cm" unit label. A red rectangular box highlights the entire "Dimension" section. At the bottom right of the window are three buttons: "< Back", "Next >", and "Done". A help icon (?) is located at the bottom left.

Product Information		Dimension	
Image:	Notes:	Length:	18.40 cm
	Part includes laser etch marking in lower corner. Confirm during part changeover.	Width:	13.20 cm
<button>Add image...</button>		Thickness:	0.1500 cm

5) Click the **Next** button to configure **Machine Settings**.

Machine Settings

Set or edit machine information that is used to properly display the Dynamic Profile on the Data Graph when Monitoring.



This information is imported from the *.XMG file and can be changed/modified.

- 1) In the machine zone matrix, set or update the zone temperature setpoints (top / bottom).

Process ☒

Assembly ☒

Machine settings ☒

Alerts

Probe temperature

Machine settings

Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
170 C	160 C	160 C	170 C	180 C	240 C	240 C	102 C	50 C

70.00 cm/min ☒ Top and Bottom Setpoints are the same

Machine warm-up delay

Delay: 0 min

Machine settings notes

Recipe notes go here

☐ Require User "OK" before Recording starts

< Back Next > Done

To enter top and bottom zone temperature with different setpoints, un-select the associated checkbox.

Machine settings

Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
170 C	160 C	160 C	170 C	180 C	240 C	240 C	102 C	50 C

70.00 cm/min ☒ Top and Bottom Setpoints are the same

170 C	160 C	160 C	170 C	180 C	240 C	240 C	102 C	50 C
-------	-------	-------	-------	-------	-------	-------	-------	------

Machine warm-up delay: Delay: 0 min

Machine settings notes: Recipe notes go here

< Back Next > Done

- 2) Set or edit the machine conveyor speed and units. The software uses this value to determine the Time (X) Scale for the for the Dynamic Profile during product Monitoring. Refer to Topic [Step #3: Monitoring](#) for more information. This must be set to the speed of the conveyor when the Baseline Profile was recorded.

Machine settings

Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
170 C	160 C	160 C	170 C	180 C	240 C	240 C	102 C	50 C

70.00 cm/min ☒ Top and Bottom Setpoints are the same

Machine warm-up delay: Delay: 0 min

Machine settings notes: Recipe notes go here

☐ Require User "OK" before Recording starts

< Back Next > Done

- 3) If the oven requires a machine warm up delay prior to Product monitoring, enter the desired time in the **Delay** text box. When set, this delay starts a countdown timer after the oven has completed the warm up and met the KPI and oven specifications set in the Alerts table. Refer to topic [Operation>Step #2: Product Creation>Machine Settings>Alerts](#) for more information.

The screenshot shows the 'Add New Product - ECU 734-6 (Lot 180818)' window. The left sidebar has 'Process' and 'Assembly' checked, and 'Machine settings' selected. The main area is titled 'Machine settings'. It contains a table of temperature profiles:

Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
170 °C	160 °C	160 °C	170 °C	180 °C	240 °C	240 °C	102 °C	50 °C

Below the table, there is a gear icon, a speed setting of 70.00 cm/min, and a checkbox 'Top and Bottom Setpoints are the same' which is checked. A 'Machine warm-up delay' section has a 'Delay' field set to 10 min, highlighted with a red box. To the right is a 'Machine settings notes' text area. At the bottom, there is a checkbox 'Require User "OK" before Recording starts' and navigation buttons '< Back', 'Next >', and 'Done'.

- 4) If you would like to enter or update machine notes about the machine or process, add **Notes** to the text box.

The screenshot shows the same 'Add New Product - ECU 734-6 (Lot 180818)' window. The 'Machine warm-up delay' section now has a 'Delay' field set to 0 min. The 'Machine settings notes' text area is highlighted with a red box and contains the following text:

Oven Recipe: ECU 734-6
Paste: Kester EP256
N2: Less than 500ppm

The rest of the interface, including the temperature profile table and the 'Require User "OK" before Recording starts' checkbox, remains the same as in the previous screenshot.

- 5) If you would like to **Require User "OK" before Recording Starts**, select the check box. If this is set for this Product, a check box is displayed during Product changeover on the notification screen. This requires the user to manually allow the software proceed after all prior product boards have exited the oven and the KPI Spec Confirmation process is complete. Refer to topic [Step #3: Monitoring](#) for more information.

Process ✓

Assembly ✓

Machine settings

Alerts

Probe temperature

Machine settings

Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
170 C	160 C	160 C	170 C	180 C	240 C	240 C	102 C	50 C

70.00 cm/min ☒ Top and Bottom Setpoints are the same

Machine warm-up delay

Delay: 0 min

Machine settings notes

Recipe notes go here

☒ Require User "OK" before Recording starts

< Back Next > Done

- 6) Click the **Next** button to configure **Alerts**.

Alerts

The user can assign warning and alarm alert limits and the notification actions. The software allow alerts for KPI measurements, oven measurements and Barcodes (if Barcode is configured with the system). If an alert is issued and the selected associated action is executed.



This information is imported from the *.XMG file and can be changed/modified.

- 1) Select a desired **Warning** check box for **UWL** (upper warning limit), **LWL** (lower warning limit) and/or **CpK** limit to activate. Enter a warning limit value for **UWL**, **LWL** and/or **CpK** that warns the operator when the parameters violate these limits. Typically, these values are set a little tighter than the Alarm specification limits so the system can inform the operator that the value is trending toward violating the Alarm specification.



If setting alerts, the software does not require both warnings and alarms to be set for the desired measurement.

Measurement	UWL	LWL	CPK	USL	LSL
Time Between Temperature 150-183°C	☐ 0.0000 sec	☐ 0.0000 sec	☐	☐ 0.0000 sec	☐ 0.0000 sec
Maximum Temperature	☒ 218.0 °C	☒ 210.0 °C	☒ 1.33	☐ 0.0000 °C	☐ 0.0000 °C

KPI Measurement Warnings

Measurement	UWL	LWL	CPK	USL	LSL
Conveyor Speed 1	☒ 72 cm/min	☒ 68 cm/min	☒ 1.33	☐ 0 °C	☐ 0 °C
Zone Temp Heating 1	☐ 0 °C	☐ 0 °C	☐	☐ 0 °C	☐ 0 °C
Zone Temp Heating 2	☐ 0 °C	☐ 0 °C	☐	☐ 0 °C	☐ 0 °C
Zone Temp Heating 3	☐ 0 °C	☐ 0 °C	☐	☐ 0 °C	☐ 0 °C

Hardware Measurement Warnings

The software allows Alerts to be applied to individual channels. Remove the check mark from the Link check box. This expands the list to reveal the individual channels for the KPI Parameter.

The screenshot shows a software window titled 'Add New Product - ECU 734-6 (Lot 180818)'. The left sidebar has a 'Process' section with 'Process', 'Assembly', and 'Machine settings' all checked. The 'Alerts' section is active, showing 'Probe temperature'. The main area is titled 'Maximum Temperature |' and contains a table of channels and their associated alert values. A mouse cursor is hovering over the 'Link' checkbox in the 'Channels' header row.

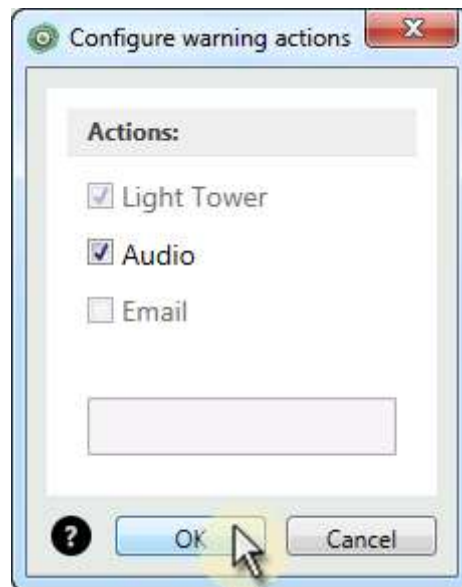
Channels	Link	UWL	Unit	USL	Unit
Sensor 1 (U1)	☒	218.0	°C	221.0	°C
Sensor 2 (R7)	☒	210.0	°C	205.0	°C
Sensor 3 (C2)	☒	1.33		1.33	

At the bottom of the window are buttons for '< Back', 'Next >', and 'Done'.

- 2) Click the **Warning Actions** button select the desired warning actions **Light Tower**, **Audio** , **Prevent Recording** and/or **Email**.



- **Light Tower** warning alert action is always selected, since the included Status Badge always provide a visual alert (Yellow). The light tower is an optional feature.
- **Audio** warning alert action is available if the optional Light Tower is installed with the system and you wish to have audio alerts. **Email** warning alert action is available if **Mail Configuration** is set up for the system and you wish to receive alerts via Email. Refer to topic Software Workspace>Preferences for more information.



- 3) Select a desired **Alarm** check box for **USL** (upper specification limit) and/or **LSL** (lower specification limit) to activate. Enter an alarm value for **USL** and/or **LSL**. The software monitors the selected measurements and issues an alert if the specification limits are violated.



If the oven has a Barcode, alerts can be set for missing and validation of product barcodes.

KPI Measurement Alarms

Hardware Measurement Alarms

Barcode Alarms



The software allows Alerts to be applied to individual channels. Remove the check mark from the Link check box. This expands the list to reveal the individual channels for the KPI Parameter.

Add New Product - ECU 734-6 (Lot 180818)

Process
Assembly
Machine settings
Alerts
Probe temperature

Maximum Temperature |

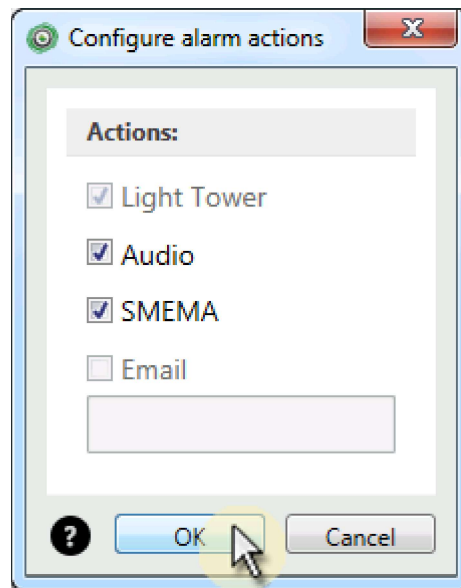
Channels		☒ UWL 218.0 °C ☒ LWL 210.0 °C ☐ CpK 1.33	☒ USL 221.0 °C ☒ LSL 205.0 °C
Sensor 1 (U1)		☒ UWL 218.0 °C ☒ LWL 210.0 °C ☒ CpK 1.33	☒ USL 221.0 °C ☒ LSL 205.0 °C
Sensor 2 (R7)		☐ UWL 0.0000 °C ☐ LWL 0.0000 °C ☐ CpK 1.33	☐ USL 221.0 °C ☐ LSL 205.0 °C
Sensor 3 (C2)		☐ UWL 0.0000 °C ☐ LWL 0.0000 °C ☐ CpK 1.33	☐ USL 221.0 °C ☐ LSL 205.0 °C

?
< Back
Next >
Done

- 4) Click the **Alarm Actions** button to select the desired alarm actions **Light Tower**, **Audio**, **SMEMA** and/or **Email**.



- **Light Tower** alarm alert action is always selected, since the included Status Badge always provide a visual alert (Red). The light tower is an optional feature.
- **Audio** alarm alert action is available if the optional Light Tower is installed with the system and you wish to have audio alerts.
- **SMEMA** alarm alert action is available if the optional SMEMA Interface is installed with the system.
- **Email** alarm alert action is available if **Mail Configuration** is set up for the system. Refer to topic Software Workspace>Preferences for more information.



If the optional SMEMA Interface is installed with the system, activating the alert action will signal the SMEMA to open the machine ready circuit. This is intended to stop upstream product from entering the oven.

- 6) Click the **Next** button to add current **Probe Temperatures**.

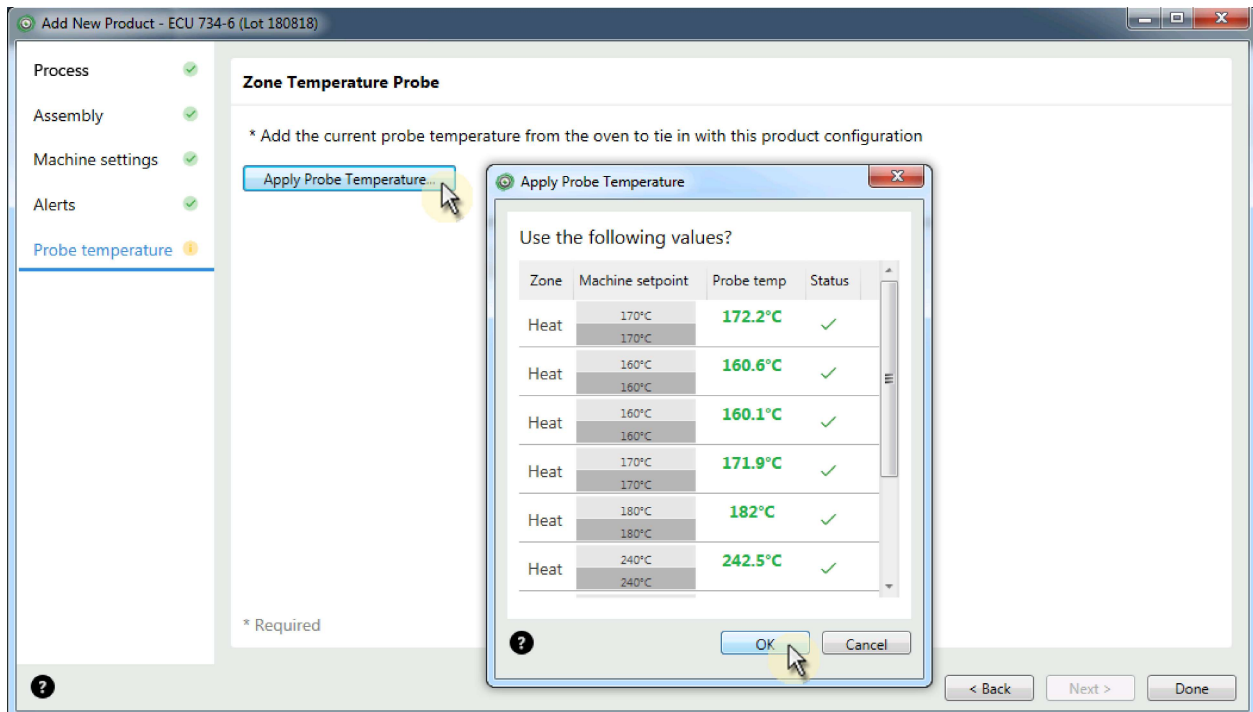
Probe Temperatures

This process records the board level thermal conditions of the oven that created the Baseline Profile. These recorded values are then used when monitoring and recording data for the Dynamic Profile which is a predicted profile based on the current temperatures and conveyor speed of the oven and the Baseline Profile.



Prior to Applying Probe Temps, the oven must be at the same conditions as the oven was when the Baseline Profile was recorded. The software allows a temperature variance for each zone since zone temperatures are not always the same at the board level compared to the zone setpoints from the imported (*.XMG).

- 1) Click the **Apply Probe Temperature** button and a dialog box appears displaying the machine setpoints and actual probe temperatures.



- 2) If all the zone temperature probe values are within 20°C, the software displays the value in **green** and a check mark. If you wish to accept, click the **OK** button record these values.



If any of these values are not met, it is recommended to click the **Cancel** button, confirm the setpoints are correct and wait for the oven to stabilize at the correct settings.

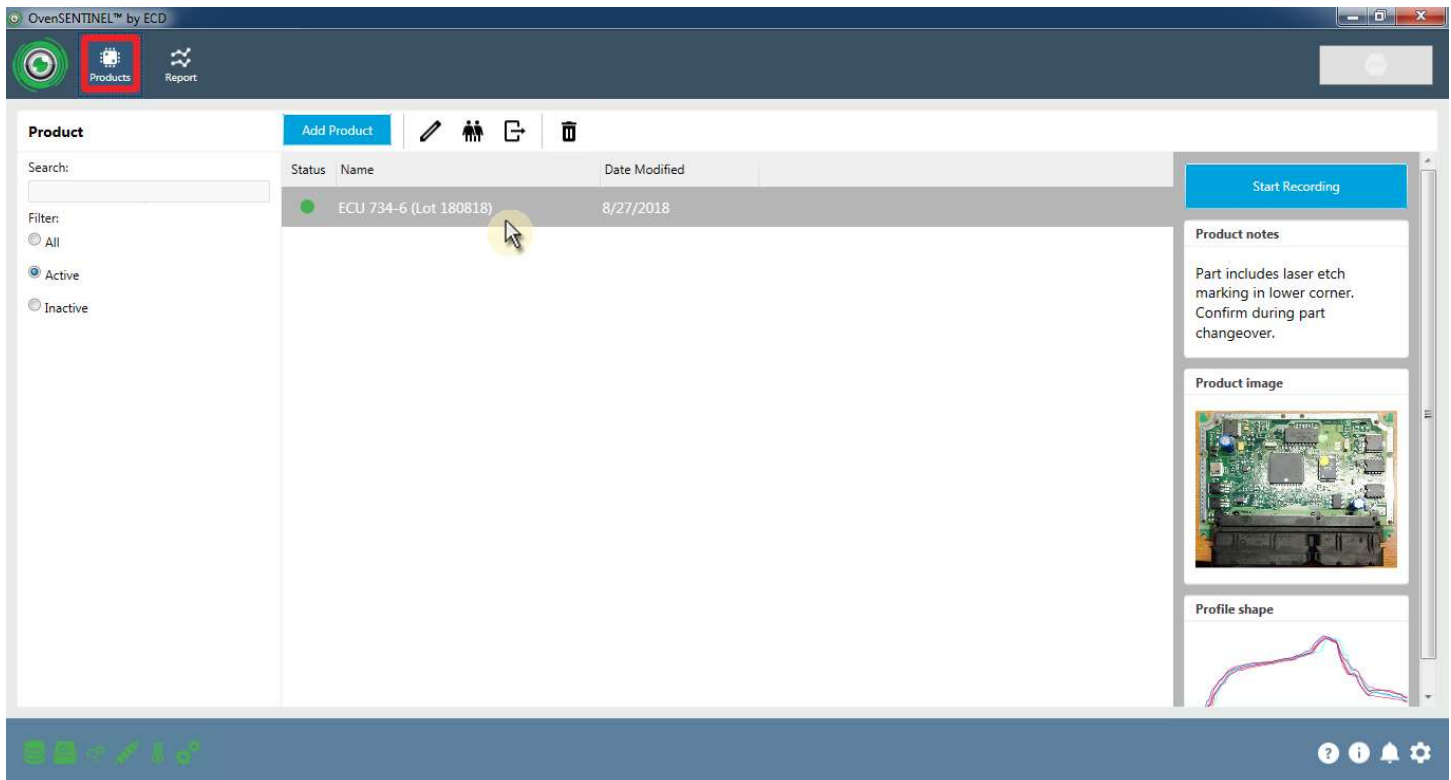
Step #3: Monitoring

When the OvenSENTINEL™ is monitoring and recording the data, there are three views; Profile, Machine and SPC. The Profile represents a predicted "Dynamic" profile based on the current temperatures. The Machine view displays an animation of the recording process when product (boards) are being processed through the oven. The SPC view shows historical control charts for a selected measurement.

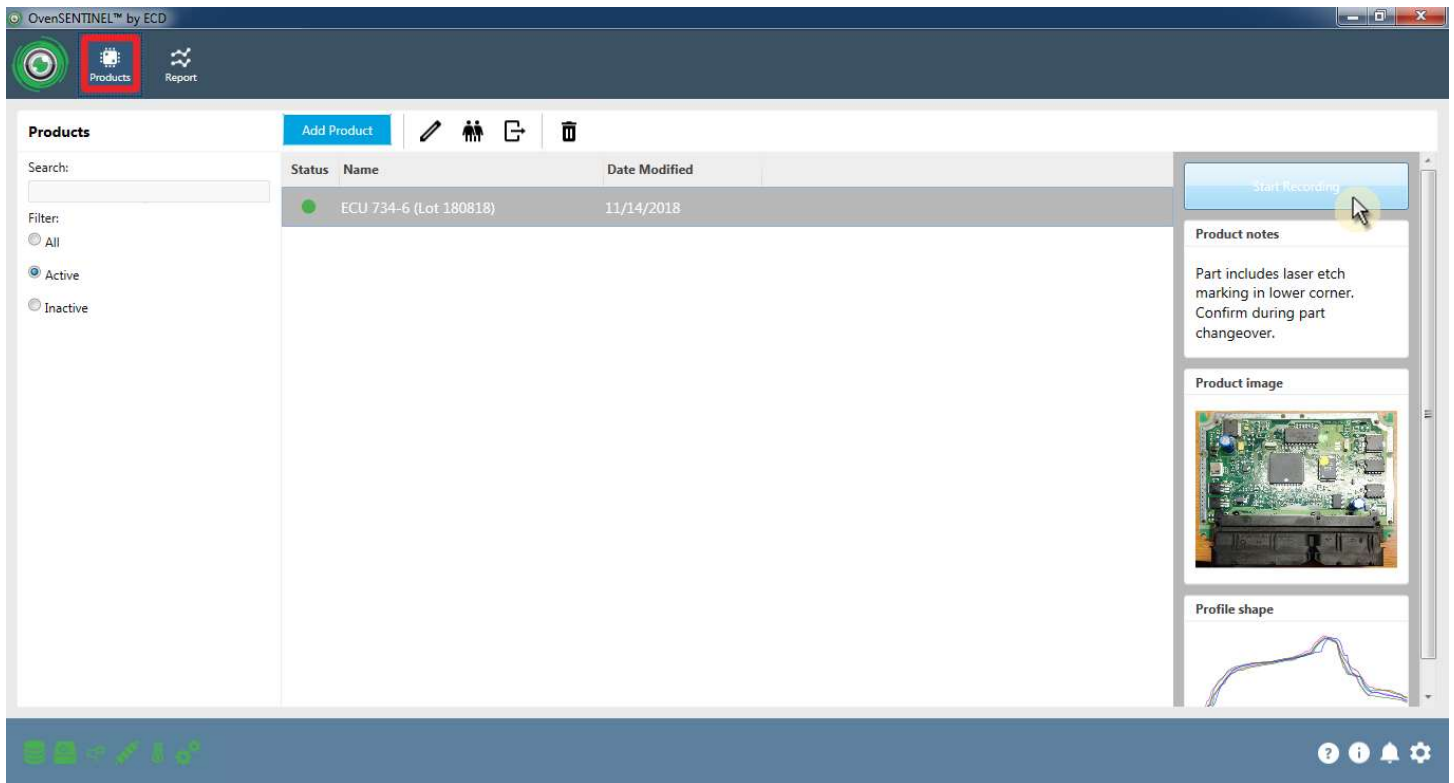
Start Recording

Once or more Products have been properly configured, the user can start monitoring and recording the data for the selected Product.

- 1) On the **Product Management View**, select a Product on the **Product Manager**.



2) Select the **Start Recording** button from the **Product Identifier**.



- 3) Prior to monitoring, the software displays the notification panel. This panel includes the required Machine Settings for the product and an step indicator when initiating the recording process. When the KPI and Oven measurements are in specification, the notification panel auto hides and recording begins.



When the notification panel is displayed, it can be hidden by selecting the **Alerts** button. To display select the **Alerts** button again.

Alerts Button:

The screenshot displays the 'OvenSENTINEL™ by ECD' software interface. The top navigation bar includes 'Products' and 'Report' buttons. The main content area is titled 'Start Recording' and shows 'Stabilizing to KPI: ECU 734-6 (Lot 180818)' and 'Monitoring: ECU 734-6 (Lot 180818)'. Below this is the 'Product Recipe' section, which is divided into 'Machine settings' and 'Specification List'. The 'Specification List' table contains the following data:

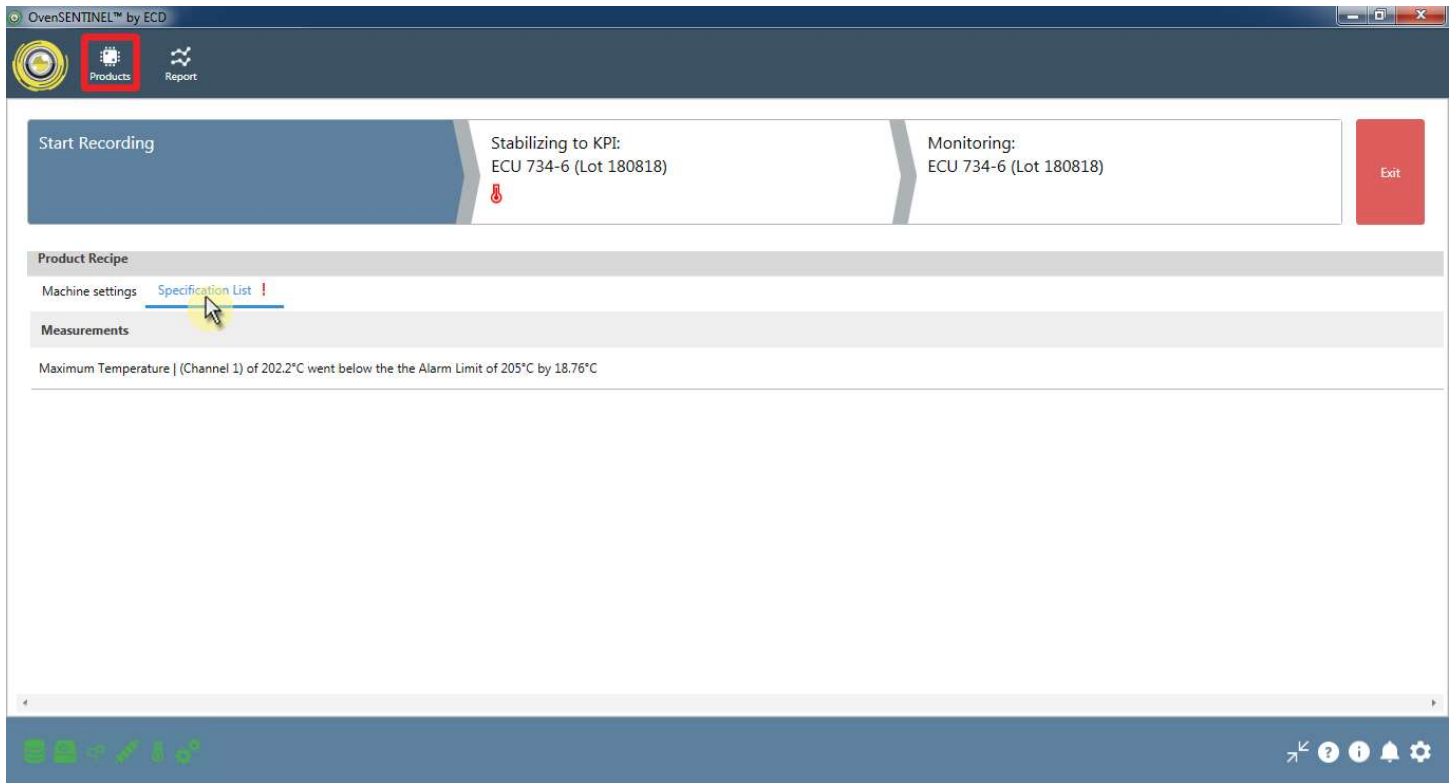
Ramp #1 (1)	Ramp #2 (2)	Soak #1 (3)	Soak #2 (4)	Soak #3 (5)	Spike #1 (6)	Soak #2 (7)	Cool #1 (8)	Soak #2 (9)
170 °C	160 °C	160 °C	170 °C	180 °C	240 °C	240 °C	102 °C	50 °C

Below the table, there is a 'Machine settings' section with a '70.00 cm/min' value and a checkbox labeled 'Top and Bottom Setpoints are the same'. The 'Machine settings notes' section at the bottom contains the following text:

Oven Recipe: ECU 734-6
Paste: Kester EP256
N2: Less than 500ppm



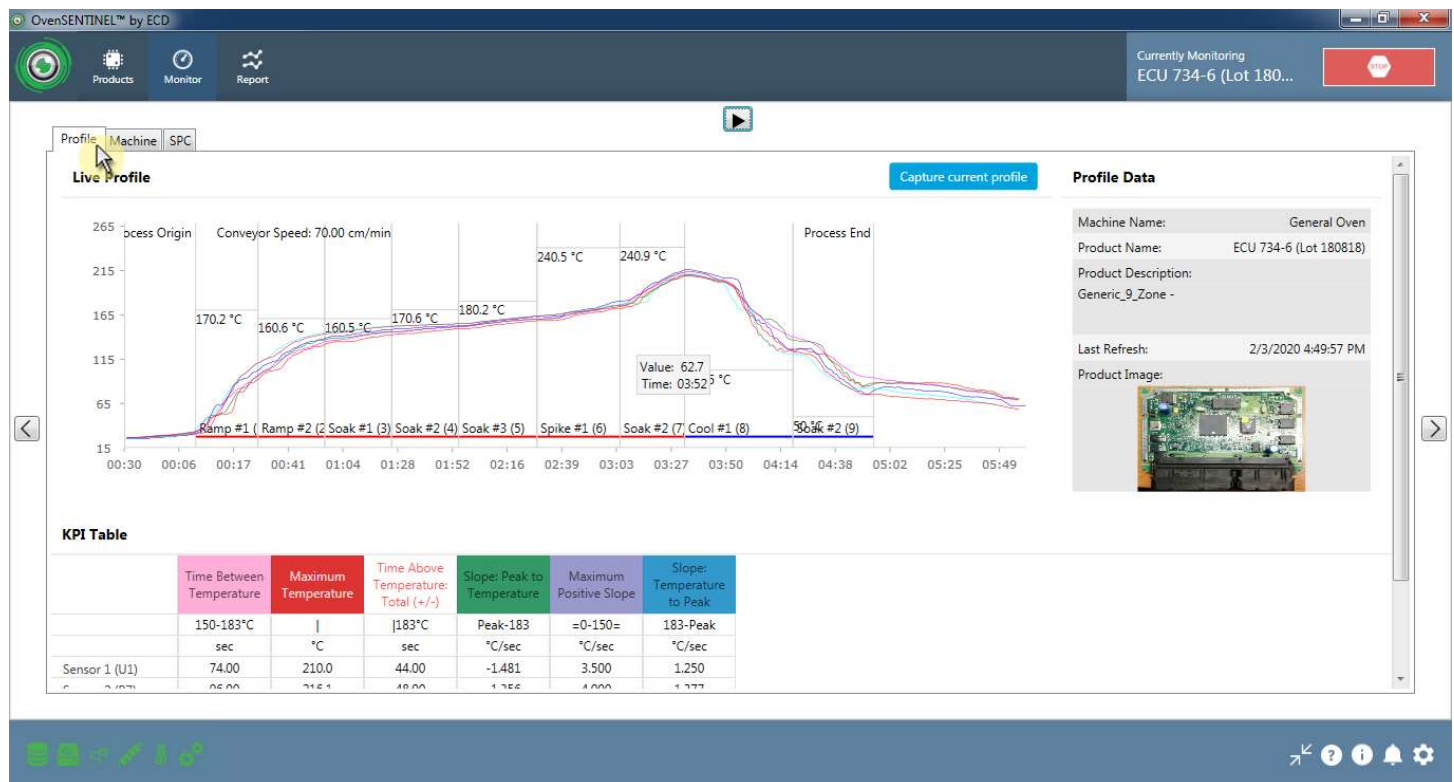
When the user starts the recording process and one or more KPI and/or oven specifications are not met, the software displays them on the Specification List and the associated symbol in the stabilization step is red. Recording does not start until all measurements are within specification.



Monitoring - Profile View

The Profile View is where the Dynamic Profile is displayed when monitoring.

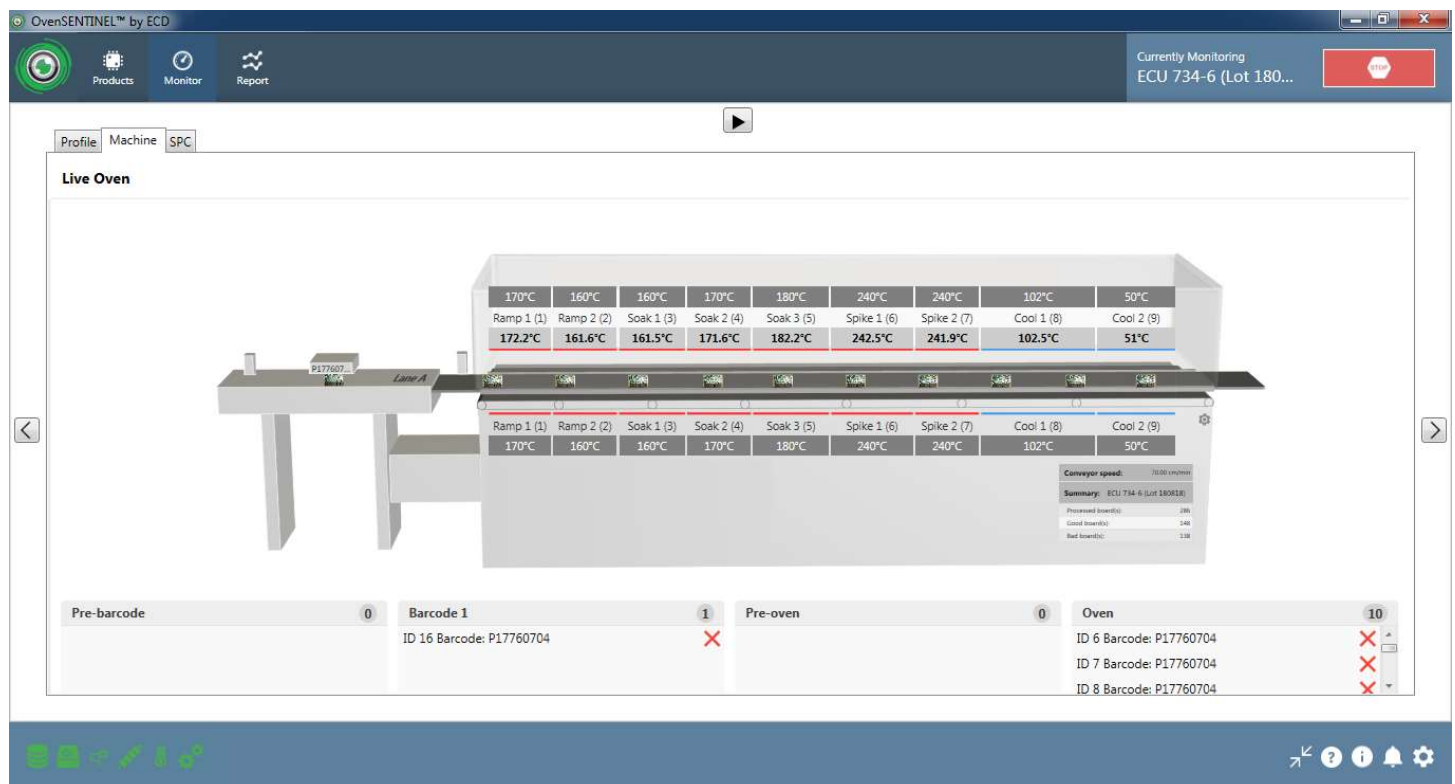
- 1) Select the **Profile** button to display. When OvenSENTINEL™ is monitoring a Dynamic Profile is displayed which represents a predicted profile based on the current temperatures and conveyor speed in the oven plus the Baseline Profile. The KPI Table includes user configured KPI parameter values imported from the Baseline Profile (*.XMG). Each row in the Table represents the channel sensor data.



Monitoring - Machine View

The Machine View displays an animation of the oven and board tracking.

- 1) Select the **Machine** button to display. The user can view current zone temperatures, zone set-points, conveyor speed, hardware components (barcode, in/out sensors, SPC) and product location. The animation displays boards at the various tracking locations specifically configured for your OvenSENTINEL™ System.





If an individual board is physically removed from the process or is falsely reported, the user can select the red delete cross associated with the board to remove it from the Monitoring process.

OvenSENTINEL™ by ECD

Products Monitor Report

Currently Monitoring ECU 734-6 (Lot 180...

Profile Machine SPC

Live Oven

170°C	160°C	160°C	170°C	180°C	240°C	240°C	102°C	50°C
Ramp 1 (1)	Ramp 2 (2)	Soak 1 (3)	Soak 2 (4)	Soak 3 (5)	Spike 1 (6)	Spike 2 (7)	Cool 1 (8)	Cool 2 (9)
172.2°C	161.6°C	161.5°C	171.6°C	182.2°C	242.5°C	241.9°C	102.5°C	51°C

Monitor Machine

Remove Board ??

OK Cancel

Pre-barcode 0 Barcode 1 1 Pre-oven 0 Oven 10

ID 16 Barcode: P17760704

ID 6 Barcode: P17760704
ID 7 Barcode: P17760704
ID 8 Barcode: P17760704

Conveyor speed: 10.00 cm/min

Summary: ECU 734-6 (Lot 180318)

Processed boards: 100
Good boards: 140
Bad boards: 138

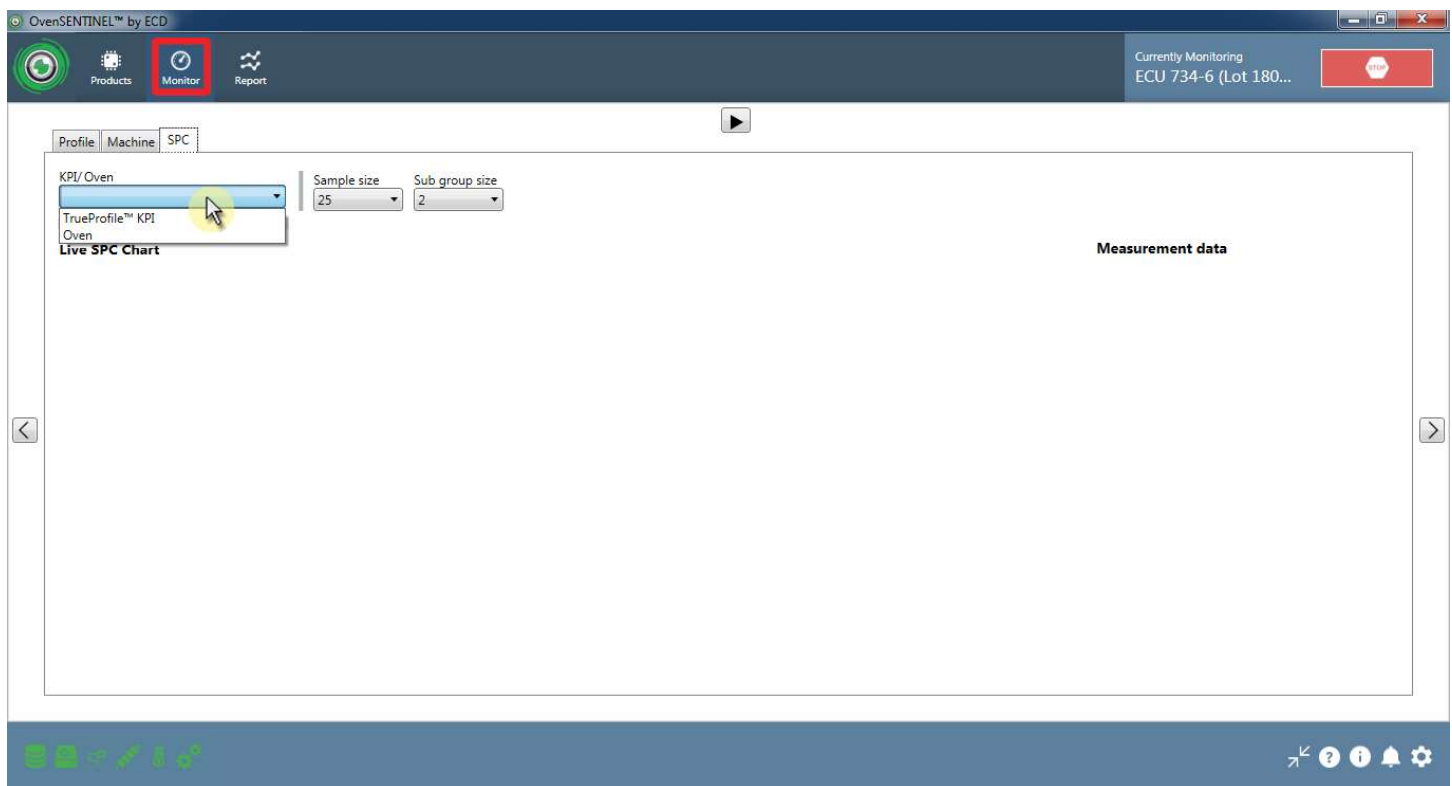
Monitoring - SPC View

The SPC view displays TrueProfile™ KPI or Oven values as an Individual or X Bar and R control charts. The user selects the value to chart from a series of drop down boxes that list the available values to display a SPC chart. Refer to Appendix: [TrueProfile™](#) for the full definition.

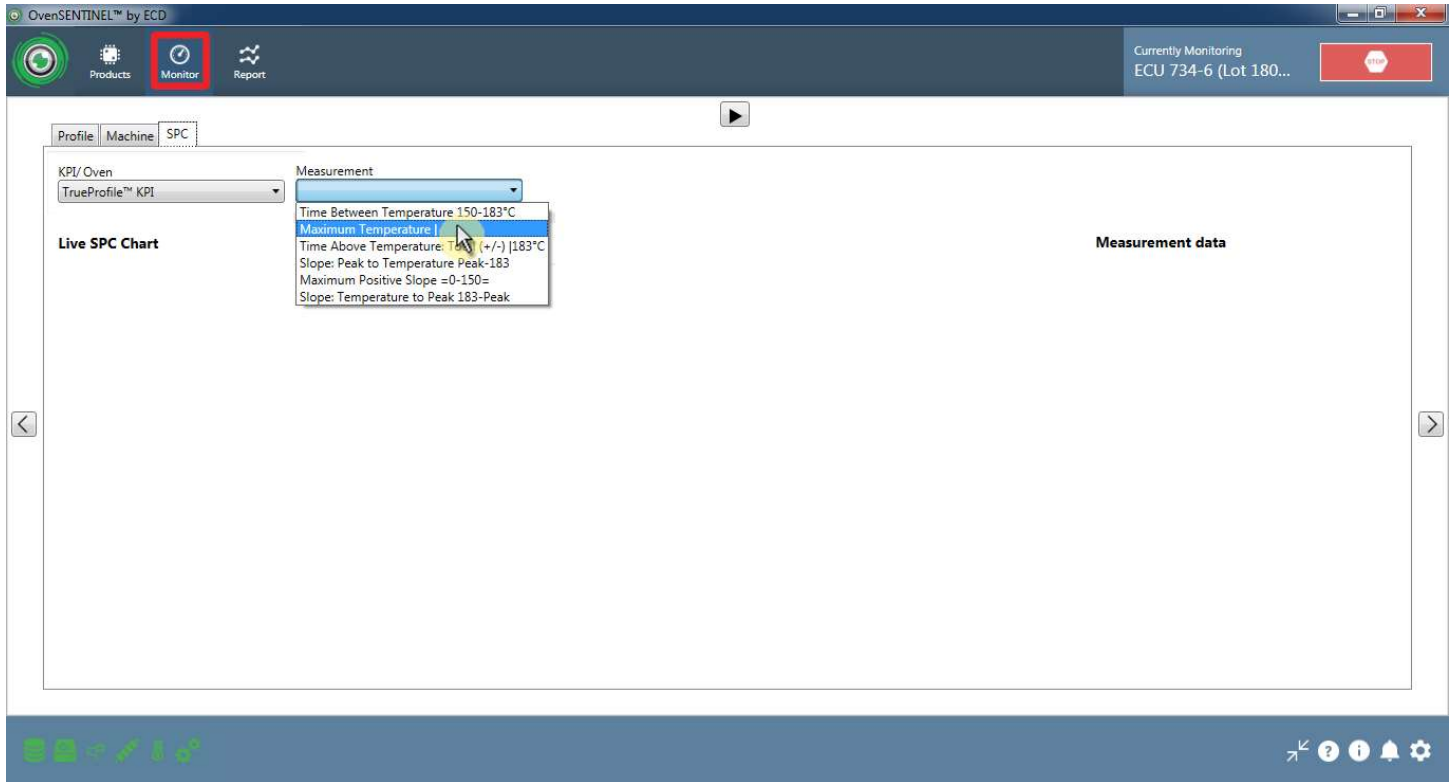


Before a TrueProfile™ KPI SPC Chart can be displayed, boards must have exited the oven. TrueProfile™ KPI values are recorded individually over time for each board as it passes through the oven.

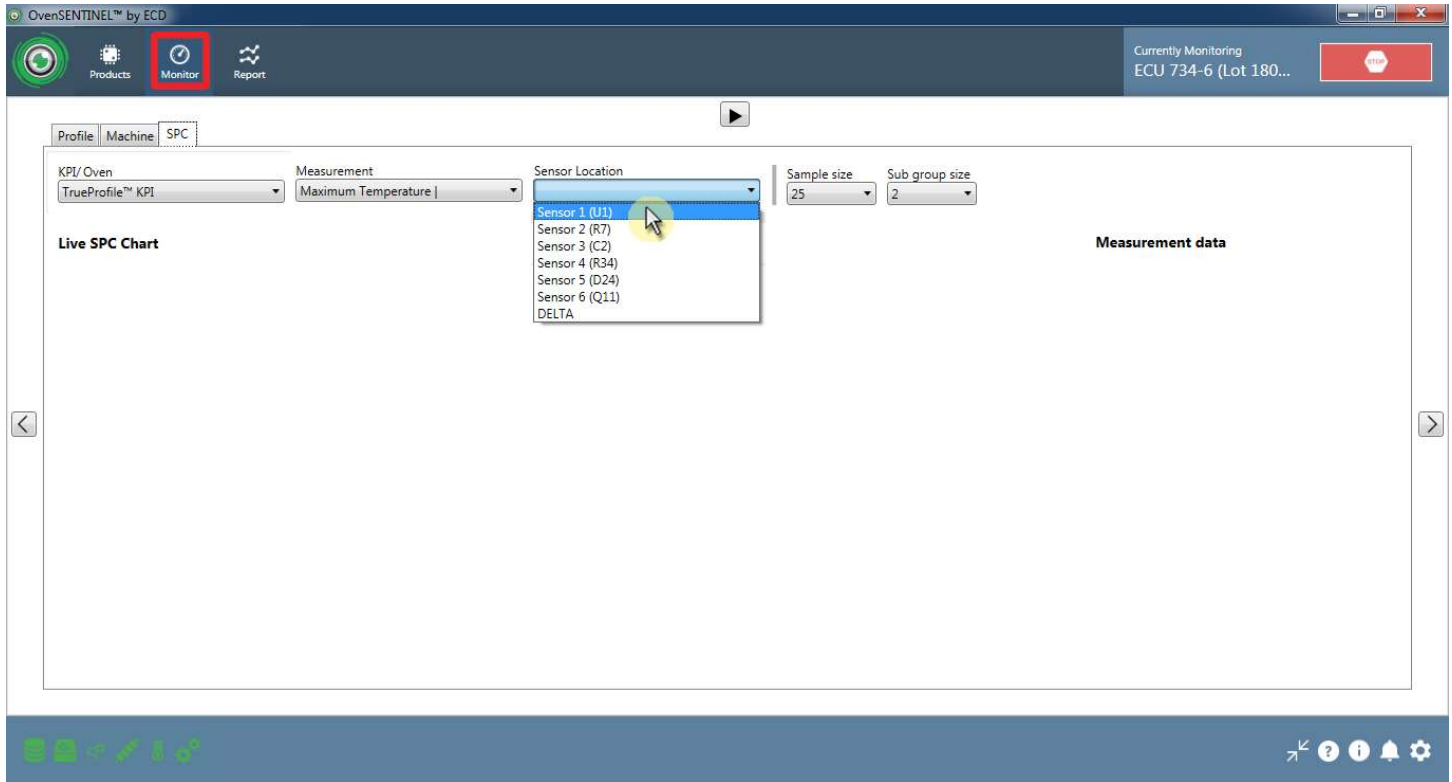
- 1) Select the **SPC** button to display.
- 2) Select **TrueProfile™** or **Oven** from the drop down box. TrueProfile™ key process indicator parameters (KPI) from the Baseline Profile or Oven measurements captured during the monitoring process is selected.



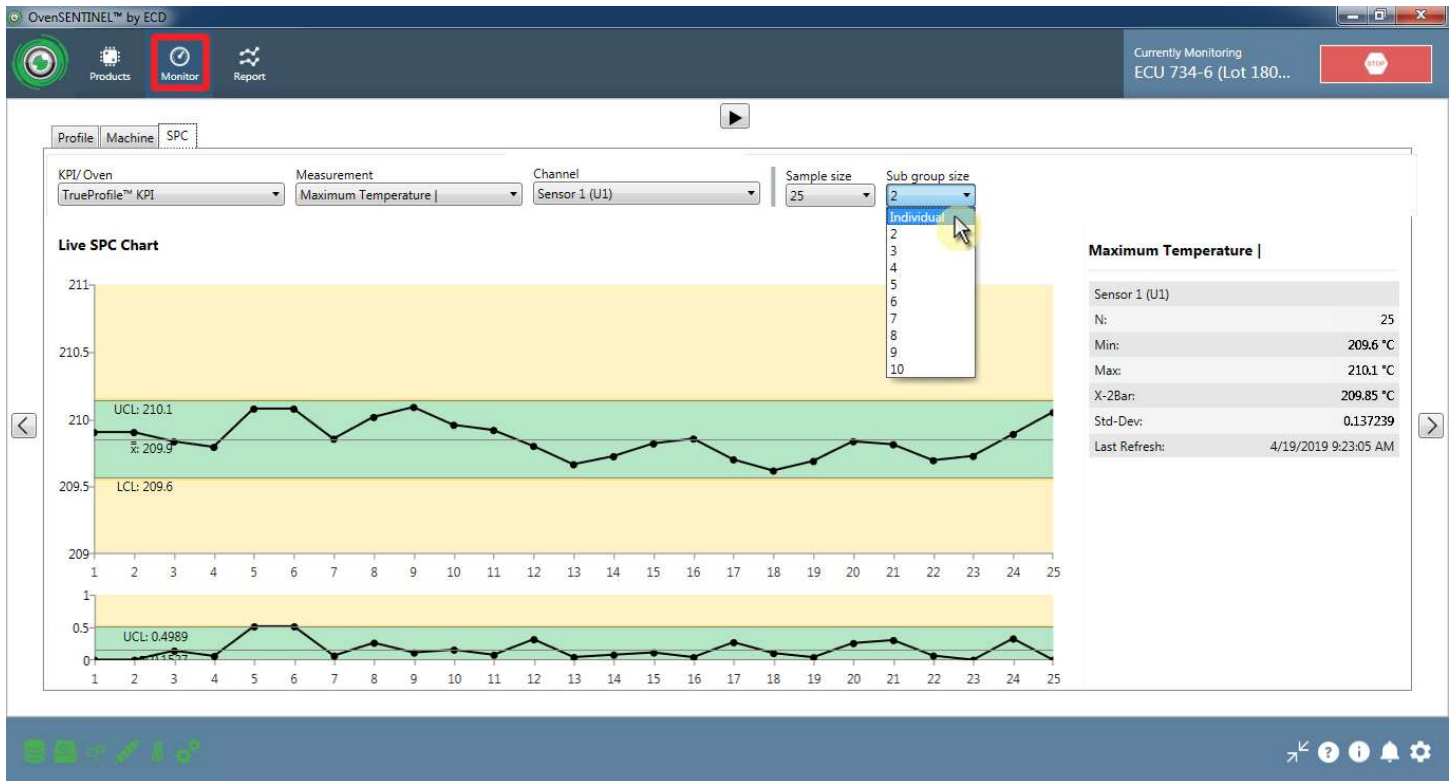
- 3) Select a **Measurement** from the next drop down box. This box is a list of available TrueProfile™ KPI parameters or Oven measurements.



- 4) If selecting a TrueProfile™ KPI Measurement, select a **Channel** from the next drop down box.
This box is a list of available sensor channels from the Baseline profile



- 5) Select a Sample and Subgroup size for the TrueProfile™ KPI Measurements or Oven values. Sample size sets the number of measurements displayed on the SPC view when monitoring. The Subgroup samples are averaged to produce each data point on the SPC chart on an Individual or X Bar R control chart.



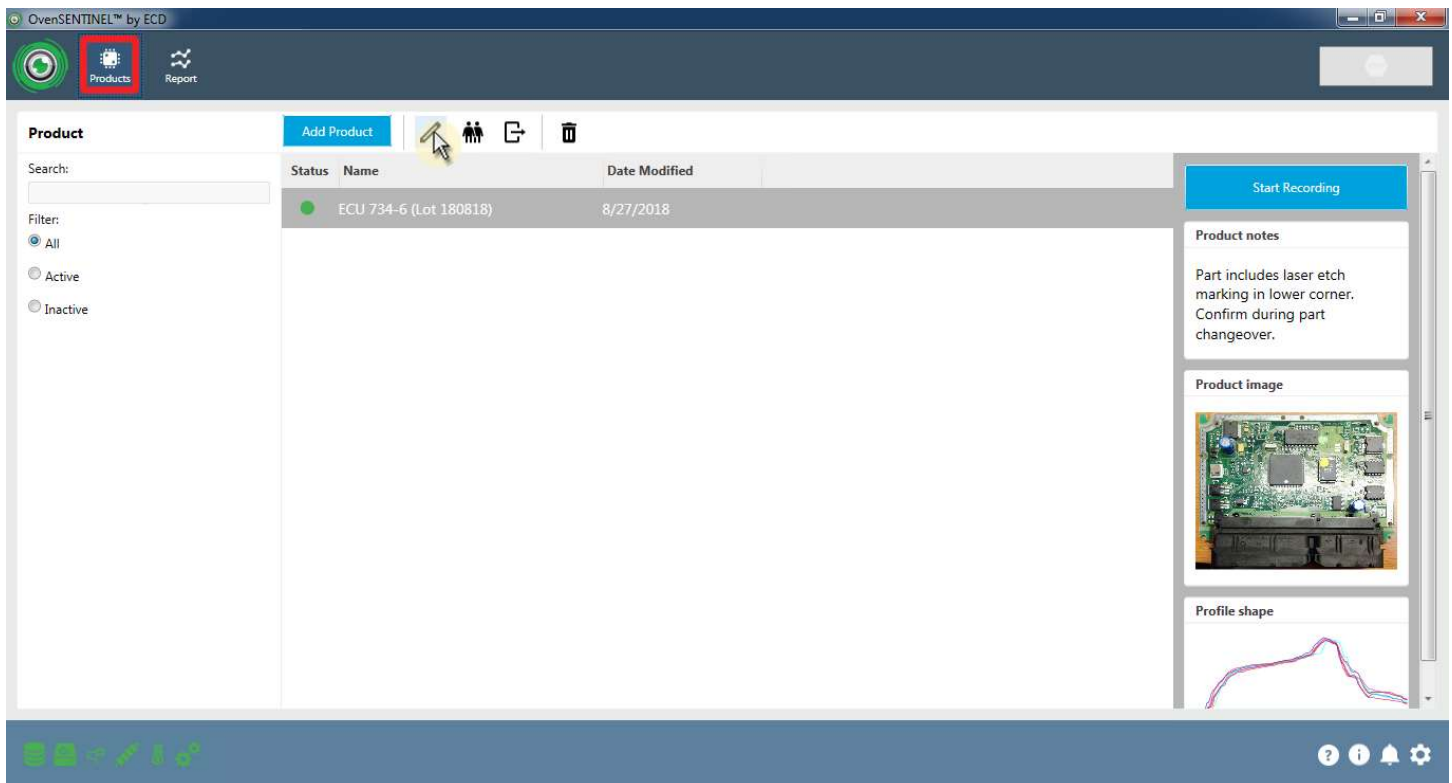
Monitoring – Auto Changeover

The OvenSENTINEL™ software has the ability to automatically changeover products from one Product to another as the new Product is read by the barcode while current product is completing. To enable this feature, the OvenSENTINEL™ System must be equipped with a barcode reader in addition to each product (boards) having unique a barcode.



To evoke auto changeover, the Product being monitored must be configured to be used in changeover in addition to the Product set to enter the oven. Both Products must also have unique barcodes.

- 1) Select a Product from the **Product Manager**.
- 2) Select the **Edit Product** button from the **Product Manager**.



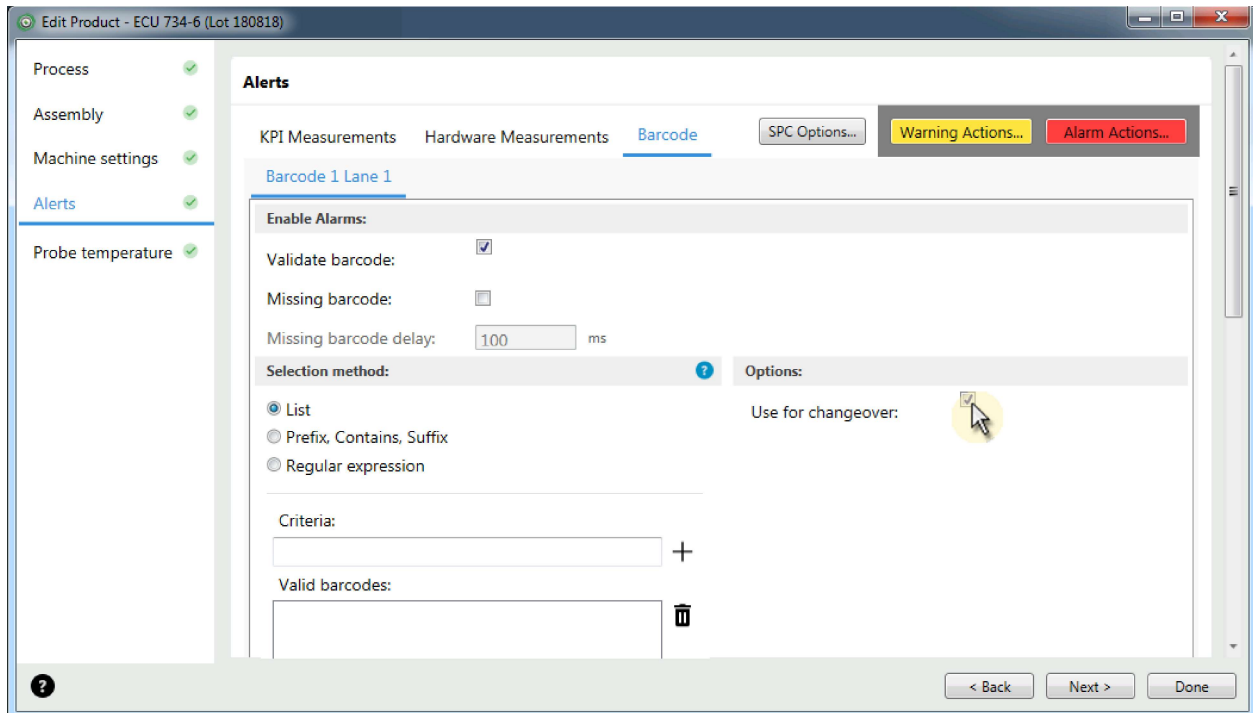
3) Select **Alerts** from the **Edit Product** dialog box.

The screenshot shows the 'Add New Product - ECU 734-6 (Lot 180818)' dialog box. The left sidebar has 'Alerts' selected. The main area is titled 'Alerts' and has tabs for 'KPI Measurements', 'Hardware Measurements', and 'Barcode'. The 'KPI Measurements' tab is active. It shows three sections: 'Time Between Temperature 150-183°C', 'Maximum Temperature |', and 'Time Above Temperature: Total (+/-) 183°C'. Each section has a table with columns for 'Channels', 'UWL', 'LWL', 'CPK', 'USL', and 'LSL'. The 'Maximum Temperature |' section is currently active, showing values like 218.0 °C for UWL and 221.0 °C for USL. Buttons for 'Warning Actions...' and 'Alarm Actions...' are visible at the top right.

4) Select the **Barcode Alerts** tab.

The screenshot shows the 'Edit Product - ECU 734-6 (Lot 180818)' dialog box. The left sidebar has 'Alerts' selected. The main area is titled 'Alerts' and has tabs for 'KPI Measurements', 'Hardware Measurements', and 'Barcode'. The 'Barcode' tab is active. It shows a section for 'Barcode 1 Lane 1'. Under 'Enable Alarms', there are checkboxes for 'Validate barcode' and 'Missing barcode', and a 'Missing barcode delay' field set to 100 ms. The 'Selection method' section has radio buttons for 'List', 'Prefix, Contains, Suffix', and 'Regular expression'. The 'Options' section has a checkbox for 'Use for changeover'. There are also fields for 'Criteria' and 'Valid barcodes'.

- 5) Select the **Validate barcode** and **Use for changeover** check boxes. They both **MUST** be selected for changeover to be evoked.



- 6) Enter a barcode that is associated with the specific Product being edited. Enter by typing in the **Criteria** text box and selecting the **Add** symbol. If the Product requires multiple barcodes, repeat this step for each one.



Barcodes can be specified by adding a list, Filter (Prefix, Contains, Suffix) or an Regular expression. To learn, build, & test Regular Expressions (RegEx / RegExp) you can use [RegExr](#) which is an online tool. For this example List will be used.

Edit Product - ECU 734-6 (Lot 180818)

Process ☒
Assembly ☒
Machine settings ☒
Alerts ☒
Probe temperature ☒

Enable Alarms:

Validate barcode: ☒
Missing barcode: ☐
Missing barcode delay: 100 ms
Selection method: ☒ List ☐ Prefix, Contains, Suffix ☐ Regular expression
Options: ☒ Use for changeover:

Criteria:
Valid barcodes:
P17760704
File: Import...

< Back Next > Done

7) Once the barcode(s) are loaded, select the **Done** button to save the Product.

Edit Product - ECU 734-6 (Lot 180818)

Process ☒
Assembly ☒
Machine settings ☒
Alerts ☒
Probe temperature ☒

Enable Alarms:

Validate barcode: ☒
Missing barcode: ☐
Missing barcode delay: 100 ms
Selection method: ☒ List
☐ Prefix, Contains, Suffix
☐ Regular expression
Options: ☒ Use for changeover:
Criteria:
Valid barcodes: P17760704
File: Import...

< Back Next > **Done**

- 8) Once OvenSENTINEL™ detects a valid barcode associated with a different Product that is configured for auto changeover, the notification panel appears displaying the status of the auto changeover process. If the SMEMA option is configured with the system, it stops additional boards from entering the oven during Product changeover.



When the notification panel is displayed, it can be hidden by selecting the **Alerts** button. To display select the **Alerts** button again.

Alerts Button:

The screenshot displays the OvenSENTINEL™ by ECD software interface. The top navigation bar includes icons for Products, Monitor (highlighted with a red box), and Report. The main area shows a progress bar with four stages: Monitoring (ECU 734-6 (Lot 180818)), Changeover Initiated (Read barcode for Product: ECU 734-6A (Lot 19XXXX)), Clearing Oven of Product (ECU 734-6 (Lot 180818)), and Waiting for oven to stabilize (00:01:00). The final stage is Product Monitoring (ECU 734-6A (Lot 19XXXX)). A red 'Exit' button is visible on the right. Below the progress bar, the 'Estimated Time Remaining' is shown as 00:04:54. A table titled 'Boards in the oven' lists Board IDs and their estimated exit times.

Board ID	Estimated Exit Time
Board 13	4:08 PM
Board 14	4:09 PM
Board 15	4:09 PM
Board 16	4:10 PM
Board 17	4:10 PM
Board 18	4:11 PM

Step #4: Reports

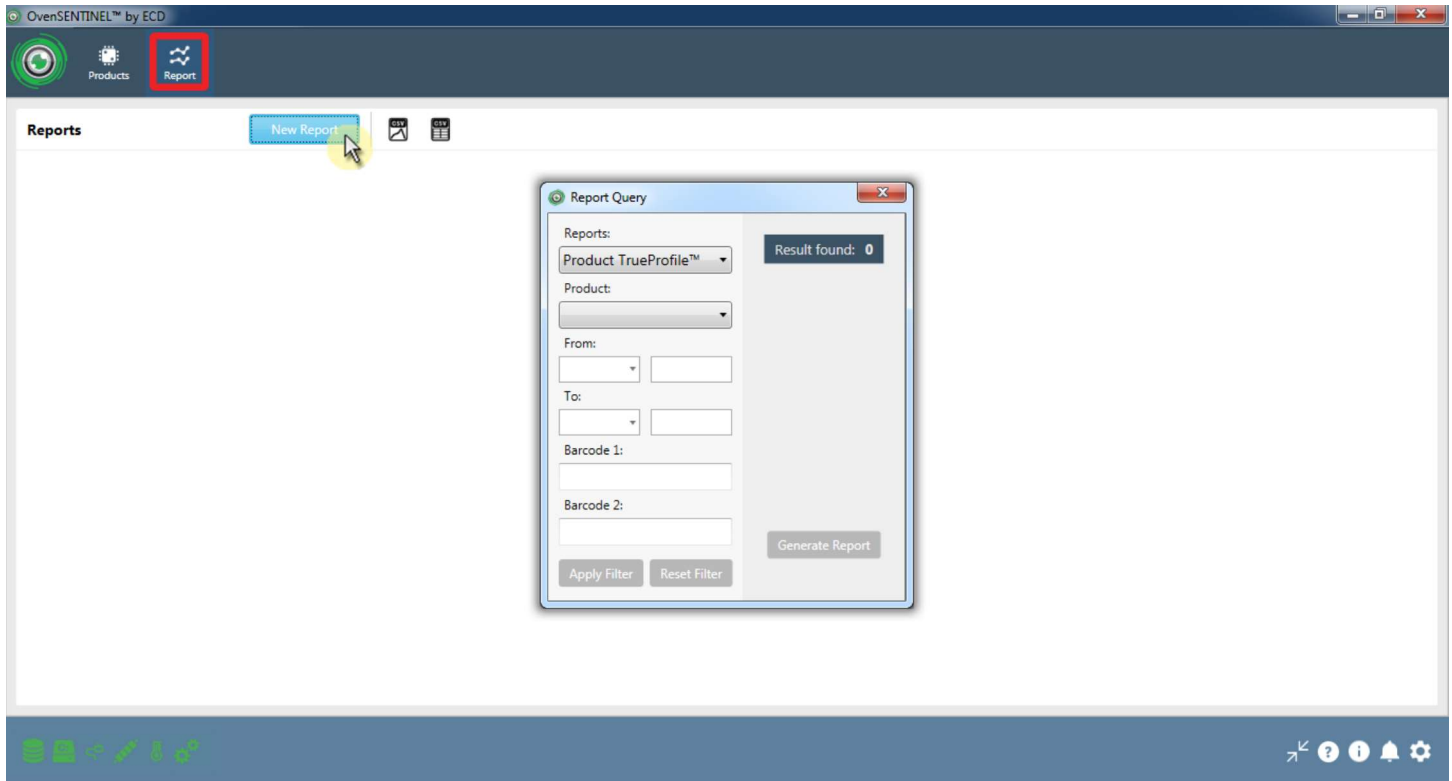
The Reports view allows the user to access historical recorded data in report form.

Standard Reports:

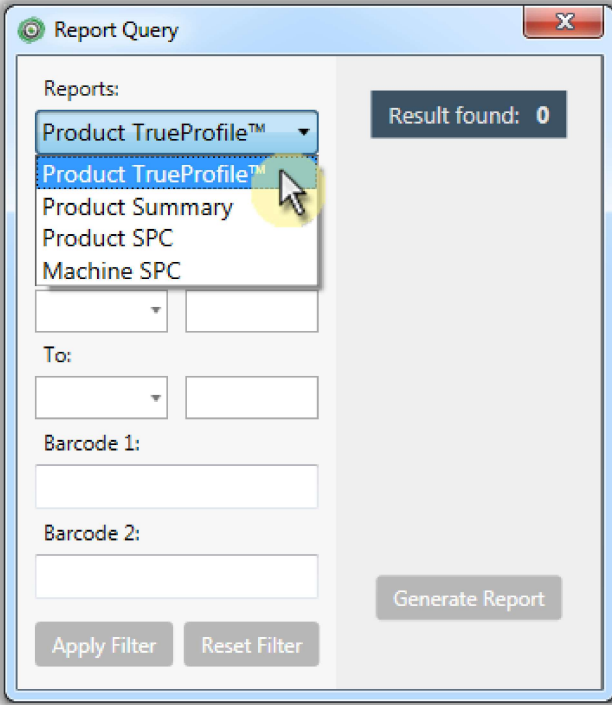


For detailed information on OvenSENTINEL™ Standard Reports, refer to Topic Software Workspace>Reports.

- 1) Select the **Report View** button and select the **New Report** button from the Report Manager.

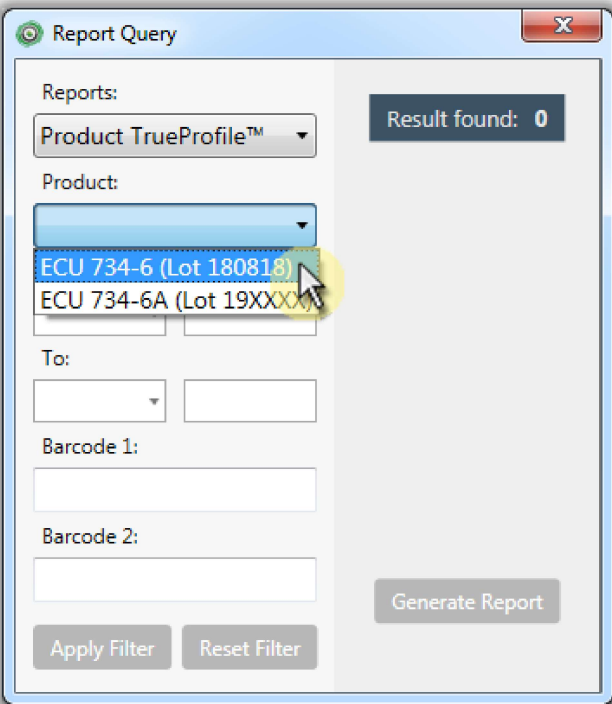


2) Select a desired Report from the drop down list.



The 'Report Query' dialog box is shown with the 'Reports' dropdown menu open. The menu lists four options: 'Product TrueProfile™', 'Product Summary', 'Product SPC', and 'Machine SPC'. A mouse cursor is hovering over 'Product TrueProfile™'. Below the dropdown, there are fields for 'To:', 'Barcode 1:', and 'Barcode 2:'. At the bottom left are 'Apply Filter' and 'Reset Filter' buttons. At the bottom right is a 'Generate Report' button. On the right side of the dialog, a status bar shows 'Result found: 0'.

3) Select a desired Product from the drop down list.



The 'Report Query' dialog box is shown with the 'Product' dropdown menu open. The menu lists two options: 'ECU 734-6 (Lot 180818)' and 'ECU 734-6A (Lot 19XXXXX)'. A mouse cursor is hovering over 'ECU 734-6 (Lot 180818)'. Below the dropdown, there are fields for 'To:', 'Barcode 1:', and 'Barcode 2:'. At the bottom left are 'Apply Filter' and 'Reset Filter' buttons. At the bottom right is a 'Generate Report' button. On the right side of the dialog, a status bar shows 'Result found: 0'.

- 4) Enter a desired **Date** (MM/DD/YY) and **Time** (HH:MM AM/PM) range. Then select the Apply Filter to display the results.



The Report Query includes the Date/Time filter because the reports have a maximum limit of 500 recorded events.

Report Query

Reports:
Product TrueProfile™

Product:
ECU 734-6 (Lot 180818)

From:
02/06/2020 07:00 AM

To:
02/06/2020 08:00 AM

Barcode 1:
Barcode 2:

Apply Filter Reset Filter Generate Report

Result found: 1250

Found result is too many.
Please narrow your query

- 5) Select the desired Board ID and then **Generate Report** button to display the report in the workspace.



The Product TrueProfile™ is the only report that requires the user to select a Board ID.

Report Query

Reports:
Product TrueProfile™

Product:
ECU 734-6 (Lot 180818)

From:
02/06/2020 07:00 AM

To:
02/06/2020 10:00 AM

Barcode 1:
Barcode 2:

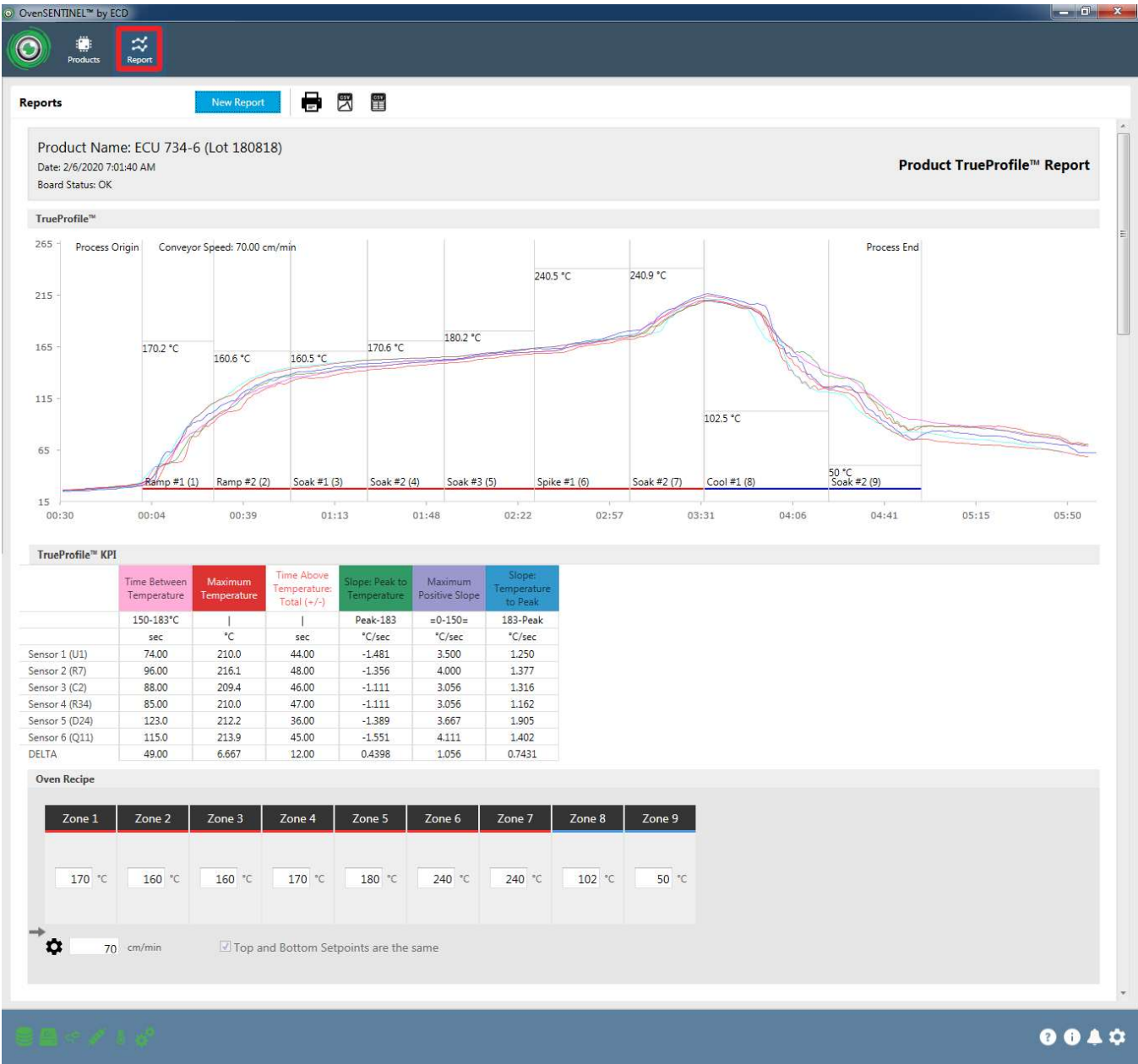
Apply Filter Reset Filter Generate Report

Result found: 362

Board ID	Date	Barcode 1	Barcode 2
628	2/6/2020 7:00:09 AM		
629	2/6/2020 7:00:40 AM		
630	2/6/2020 7:01:10 AM		
631	2/6/2020 7:01:40 AM		
632	2/6/2020 7:02:09 AM		
633	2/6/2020 7:02:40 AM		
634	2/6/2020 7:03:24 AM		

Query found multiple boards. Please select a board to continue

6) The report can be viewed within the workspace or printed.



Workspace Report

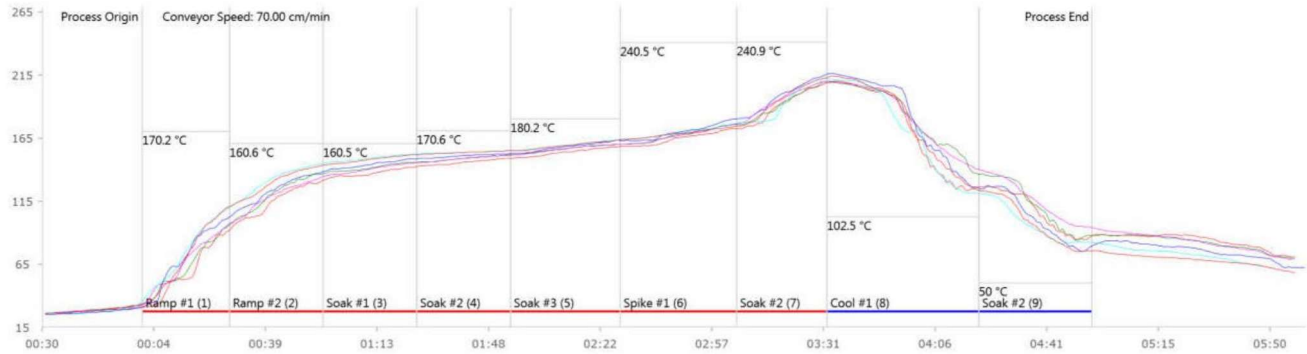
Product Name: ECU 734-6 (Lot 180818)

Date: 2/6/2020 8:01:27 AM

Board Status: OK

Product TrueProfile™ Report

TrueProfile™



TrueProfile™ KPI

	Time Between Temperature	Maximum Temperature	Time Above Temperature: Total (+/-)	Slope: Peak to Temperature	Maximum Positive Slope	Slope: Temperature to Peak
	150-183°C			Peak-183	=0-150=	183-Peak
	sec	°C	sec	°C/sec	°C/sec	°C/sec
Sensor 1 (U1)	74.00	210.0	44.00	-1.481	3.500	1.250
Sensor 2 (R7)	96.00	216.1	48.00	-1.356	4.000	1.377
Sensor 3 (C2)	88.00	209.4	46.00	-1.111	3.056	1.316
Sensor 4 (R34)	85.00	210.0	47.00	-1.111	3.056	1.162
Sensor 5 (D24)	123.0	212.2	36.00	-1.389	3.667	1.905
Sensor 6 (Q11)	115.0	213.9	45.00	-1.551	4.111	1.402
DELTA	49.00	6.667	12.00	0.4398	1.056	0.7431

Oven Recipe

Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9
170 °C	160 °C	160 °C	170 °C	180 °C	240 °C	240 °C	102 °C	50 °C

70 cm/min ☒ Top and Bottom Setpoints are the same

Printed Report

Here is how to contact ECD:

We offer many ways to service your problems. You can call our Service/Test technicians, visit our web site to view our FAQ section (Frequently asked Questions) or send us e-mail explaining your problem in detail.

When calling our Service/Test technicians or sending us e-mail, please include the following information:

- Product Description
- Product Serial Number
- OvenSENTINEL™ Software Version

Telephone: +(1) 800.323.4548

+ (1) 503.659.6100

FAX: +(1) 503.659.4422

Email: support@ecd.com

Internet: <http://www.ecd.com>

This section provides in depth supporting information about the OvenSENTINEL™ System.

Specifications Needs or requirements of the System.	Statistical Process Control (SPC) Background Information The subset of SPC that is incorporated into OvenSENTINEL™ Software.
TrueProfile™ KPI Measurements What is it? How does it work?	

Specifications

SENSORS

Zone Temperature Probe (Custom per Oven Make & Model):

Solid Shell:	
EXTERNAL CONSTRUCTION:	Extension cable - SS Overbraid shield. Probe - ¼" OD x 0.020 Wall SS tubing.
INTERNAL CONSTRUCTION:	Type K conductors with Magnesium Oxide filler.
MAXIMUM PROBE TEMPERATURE:	350°C (662°F)
LIMITS OF ERROR (WHICHEVER IS GREATER):	Special: ±1.1°C (1.98°F) or 0.4%
• T/C junctions are electrically isolated from each other, and the SS tube. • SS tubing and T/Cs must withstand 325°C continuous	
Flexible:	
EXTERNAL CONSTRUCTION:	Extension cable - SS Overbraid shield. Probe - SS Overbraid shield.
INTERNAL CONSTRUCTION	Type K conductors w/Fiberglass Sleeving.
MAXIMUM PROBE TEMPERATURE:	350°C (662°F)
LIMITS OF ERROR (WHICHEVER IS GREATER):	Special: ±1.1°C (1.98°F) or 0.4%

Optical Board Entry and Exit:

SUPPLY:	24VDC
OUTPUT:	NPN (open-collector transistor)
PHYSICAL DIMENSIONS (W x H x D):	11.2mm (0.44") X 25.4mm (1.0") X 20mm (0.79")

Inductive Conveyor Speed:

SUPPLY:	24VDC
OUTPUT:	NPN (open-collector transistor)
PHYSICAL DIMENSIONS (W x D):	8mm (0.31") X 45mm (1.77")

PHYSICAL

Station:

PHYSICAL DIMENSIONS (W x H x D):	266.7mm (10.5") x 241.3mm (9.5") x 47.6mm (1.88")
INPUTS:	
THERMOCOUPLE (24):	Type K, $\pm 1.5^{\circ}\text{C}$ (2.7°F)
DIGITAL (7):	Boolean: True/False (1/0) Frequency: 10-1,000Hz ± 1 Hz Period: 0-10 Seconds ± 1 Millisecond
RS-485 (1):	MODBUS Protocol
RS-232 (2):	ASCII

DISPLAY / NOTIFICATION

Station:

DISPLAY:	2.7" OLED
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Status Badge / Light Tower (Optional):

RED:	Out-of-Spec Indicator
GREEN:	System Ready
YELLOW:	System Warning

ENVIRONMENTAL LIMITATION SPECIFICATIONS

- Temperature range 0-50°C (32-122°F) - Maximum relative humidity 80%
Keep strong electromagnetic fields away. The thermocouple wires serve as an antenna for electromagnetic radiation. If field strength of 3 volts per meter is present (usually due to close proximity of radio transmitters) while the OvenSENTINEL™ Station is collecting data, the accuracy of the data may be compromised.

SOFTWARE REQUIREMENTS

RED:	Out-of-Spec Indicator
GREEN:	System Ready
YELLOW:	System Warning

TrueProfile™ KPI Measurements

TrueProfile™ detects the product entering the oven and tracks the board through the oven, collecting the temperatures of each oven zone, using the sensors in the oven's zones, while the board is in each zone. If the temperature in a given zone is measured more than once, while a board is in that zone, the average of the two or more measurements are recorded for that zone. The same is true for the conveyor speed since it is measured multiple times while each board progress through the oven.

The product's collection of zone temperatures (see Figure 1) and average conveyor speed measurements at the time the board is in each zone are the values used to predict the board's "TrueProfile™" and then extract the KPI measurements. These are the "TrueProfile™" KPI measurements. This is a superior method of performing the prediction because it records the actual zone temperatures over time, the time the board was actually in each zone, verses a snap shot at some instant in time. It also lets you pin point which board or boards truly failed the specifications rather than assuming ALL boards in the oven at the time of the snap shot failed.

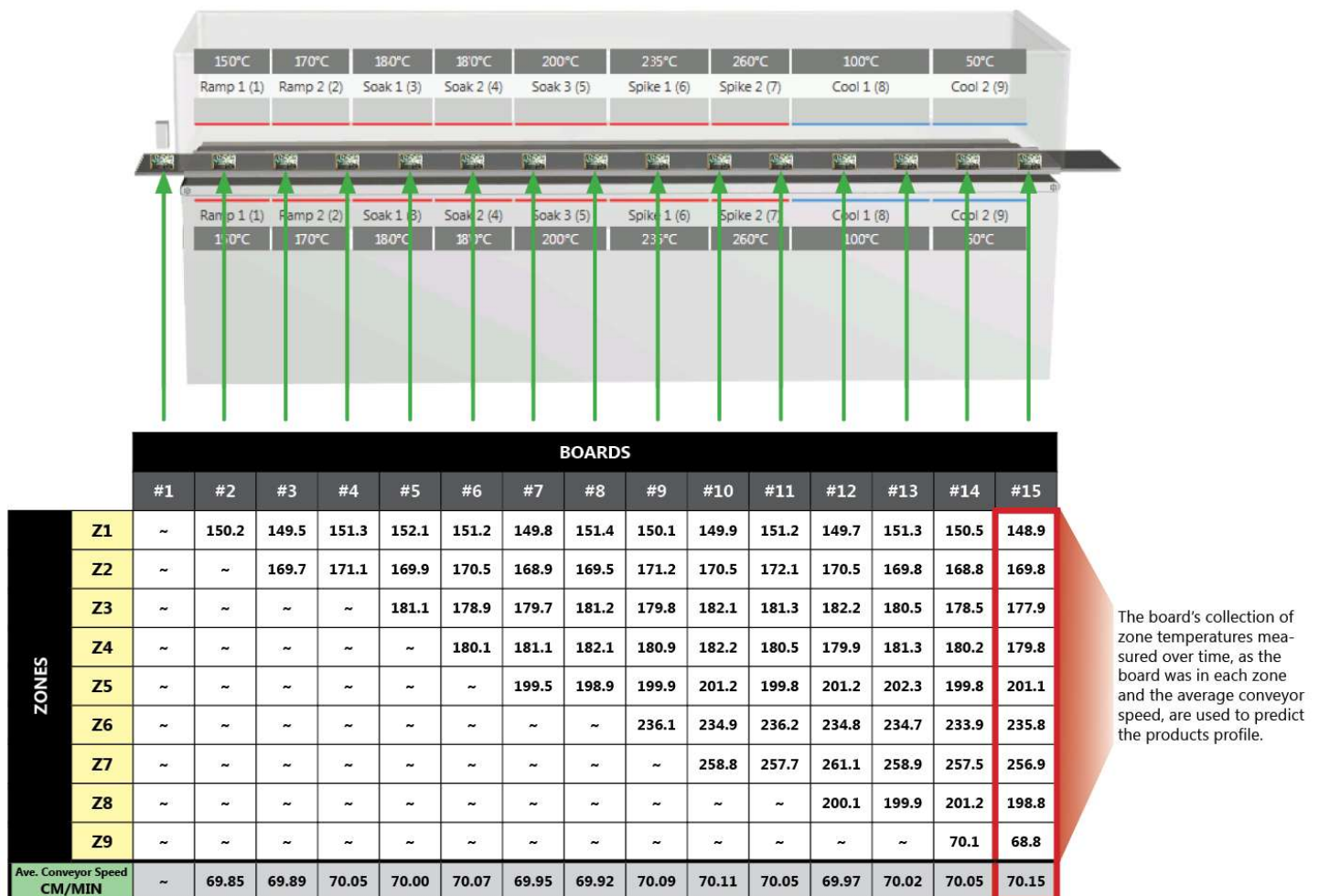


Figure 1: Boards through the oven collect the zone temperatures while they are in each zone

Statistical Process Control (SPC) Background Information

This topic deals with the subset of SPC that is incorporated into software. It does not address general SPC principals. A working knowledge of general statistical principals and SPC terms is assumed and is not addressed here. There are many good basic SPC books such as the DataMyte Handbook where this information may be obtained.

Reflow operators, engineers and production managers are expected to understand their soldering process so as to deliver quality products cost effectively. This is a continuous process.

First, the machine must be checked for consistency. A standard or typical set up should be routinely checked prior to any process set point determinations, or actual production run machine checks. Only after the machine has been determined to be operating correctly and not experiencing abnormal variation, should data from the machine be utilized. SPC is all about identifying common or normal variation from abnormal variation.

Second, the correct process set points must be determined for a particular product. Utilizing the M.O.L.E.® Thermal Profiler, the correct set points for a particular product may be determined. These set points, if selected correctly and followed, should deliver the maximum throughput of quality product.

Third, the machine must consistently deliver the correctly determined set points. SPC will help identify common or normal variation from abnormal variation. Checking the machine using your M.O.L.E.® and the software with its SPC capability will help ensure that the machine is consistently performing to its set points and your expectations.

Fourth, repeat the above three steps. Continuous improvement is a never-ending cycle. Check the long-term variation of the machine by graphing typical set point samples. Using the M.O.L.E.®, re-check/adjust part number specific set points to maximize your quality throughput. Check the machine during a part number run to control the machine variation from that part number's actual ideal set points.

While SPC had its start in high volume repetitive operations, SPC is applicable to many other types of operations as well. However, SPC can be difficult to apply to short runs. Short runs may be runs that take a long time to process, runs in which multiple samples are difficult to collect, and runs where samples are difficult to place into subgroups or runs where small quantities are run.

The software charts will be more meaningful to the user if SPC charts are generated based on data sets that have the same set points each time.

Process Capability

A process capability index is a standard measure of how a process compares with its specification limits—how a process **is** performing relative to how **it is supposed** to perform. As opposed to the

control chart, which shows detailed information about how the data compares with control limits, a capability index is a summary of how the data compares with the specification limits.

Two common capability indicators are Cp and Cpk. These values are shown in the Statistics Box on the SPC Workspace.

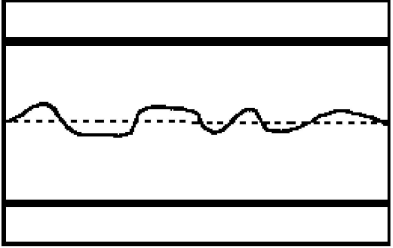
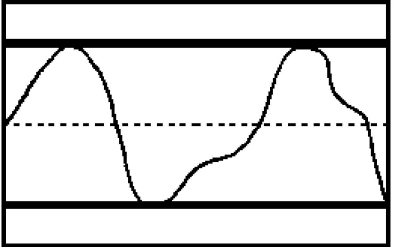
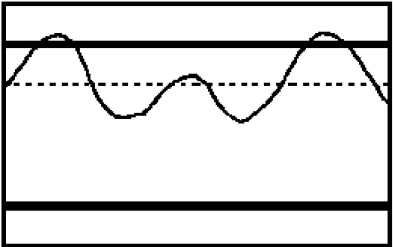
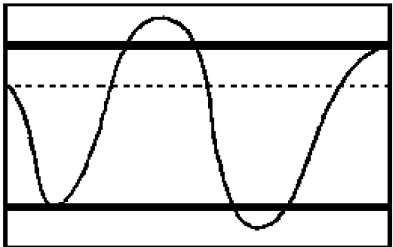
Maximum Temperature	
Sensor 1	
N:	25
Min:	209.3 °C
Max:	210.9 °C
$\bar{x}$:	209.95 °C
Std-Dev:	0.471298
Cp:	5.66
CpK:	3.5

For both of the index values, the data used to determine them is dictated by the subgroup size (N) chosen by the user. In the case where N=1, individual data is used—for N>1, average data is used (x bar).

The charts on the next page give a graphical representation of the concept of Cp and Cpk. Notice that in each graph, the same upper and lower specification limits (USL, LSL) are used. The values of Cp and Cpk will differ according to the data that is compared with those specifications.

Depending on the particular process being monitored, the desired value for Cp and Cpk may differ. In general, however, a Cp and Cpk of 1.33 or above is desired. This assures that the process is not only capable of meeting the required specification limits, but also has a built-in margin for error that may be needed in special circumstances. In addition to targeting a certain minimum Cp and Cpk, it is also desirable to have these two values equal one another. This indicates that the process is well-centered between the specification limits.

	Cp ³ 1.33: Data tightly distributed. Cpk ³ 1.33: Data well inside spec limits.
--	--

 USL $\bar{\bar{x}}$ LSL	Cp = 1.00: Data fills entire spec range. Cpk = 1.00: Data fills entire spec range.
 USL $\bar{\bar{x}}$ LSL	Cp > 1.00: Data tightly distributed. If it were centered between the spec limits, no data would lie beyond those limits. Cpk < 1.00: Some data is outside the spec limits.
 USL $\bar{\bar{x}}$ LSL	Cp < 1.00: Data not tightly distributed. If it were centered between the spec limits, some data would still lie outside those limits.
 USL $\bar{\bar{x}}$ LSL	Cpk < 1.00: Some data is outside the spec limits.

The equations used to calculate the index values are as follows:



$$Cp = \frac{USL - LSL}{6 * (Std.Dev.)}$$

$$Cpk = \frac{USL - \bar{\bar{x}}}{3 * (Std.Dev.)} \quad \text{OR} \quad Cpk = \frac{\bar{\bar{x}} - LSL}{3 * (Std.Dev.)}, \text{ whichever is less}$$

As can be interpreted from the above equations, Cp gives an indication of how narrow the data distribution is relative to the width of the specification limits. Essentially, it indicates how well the process would be able to stay within the specified limits if the data were perfectly centered between those limits.

Cpk compares the widest half of the data distribution to the appropriate specification limit. It indicates whether the process is capable of meeting the specification as indicated by the “worst half” of the measurements. Unlike Cp, the Cpk index measures process capability without assuming the data is well-centered.