SPS Smart Profiler Hardware Guide

Publication Number PTG-330310-000 Rev. C

SPS Smart Profiler Hardware Guide

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Introducing the SPS Smart Profiler

Built with the latest data processing and wireless technologies available – a smart device
The **SPS** (**Smart Profiling System**) **Smart Profiler** and **Smart Dock** are packed with the latest in data processing and wireless technologies.

- Sampling capabilities up to 50 readings per second
- Real-time data collection through a secure, private Wi-Fi network with Smart Profiler and Smart Dock pairing using ANT technology
- The latest in durable high temperature rated materials.
- **NiMH rechargeable batteries** make for a **reliable and safe** power source
- Profile Stacking: Store multiple profile runs in a row before downloading
- KIC Mobile Sync and Mobile Profile Viewer app: view profile data and graphs on your mobile device

The SPS Smart Profiler stands out as the best and "smartest" temperature profiling data collection system available. The hardware is the best in temperature tolerance design using an **LCP** (Liquid Crystal Polymer) enclosure for better protection and faster cooldown between profiles. The design of the SPS thermal shields allows for easy and secure opening and closing, durability that meets the most stringent of drop tests, and temperature tolerance capabilities that exceed all previous KIC profiler and shield models.
The SPS Smart Profiler is available in 7, 9, and 12 channel versions using standard type K thermocouples. Thermal profile data are conveniently transferred to your computer via a USB connection or real-time via Wi-Fi depending on the model. With complex power management algorithms and state-of-the-art circuitry, the SPS allows for long use between charges and longer battery life. Recharging and powering can be done via the USB cable when connected to a computer or to a wall socket.

The SPS Smart Profiler raises the bar for Smart Factory systems and is another of the many smart devices and systems KIC offers to improve your production quality, productivity, and documentation.

 Refer to this hardware guide for additional information when you see this warning symbol.

 This symbol indicates HOT SURFACE on the SPS Smart Profiler and shield. It is used in this guide anywhere where warnings are indicating safety procedures or warnings concerning hot surfaces.

Review Your Profiler Kit

Upon receiving your profiler kit, check it to make sure that all the required components are there. The specific contents of your kit will match the configuration— datalog or wireless—that you ordered. The full catalog of parts appears below.

Part Description
SPS Smart Profiler - datalog or Wi-Fi model (7, 9, or 12-channel)
Smart Dock (Wi-Fi models only)
AC charger/power supply
USB communication cable (A-Male/Micro-B)
Thermal shield
Thermocouples (7, 9 or 12—standard type K)
Aluminum tape for attaching thermocouples
Scissors for cutting the tape
Gloves for handling the profiler and test product, hot from the thermal process
SPS Smart Profiler Getting Started Guide
SPS Smart Profiler CD containing:
Profiling Software 2G
SPS Smart Profiler Hardware Guide
Profiling Software 2G User Manual
USB Software Dongle Key (Needed to run the Profiling Software 2G)
Calibration Certificate
Carrying Case

Your Smart Profiler Software

Profiling Software 2G provides all the tools you need for thermal profiling with your SPS Smart Profiler. It lets you set operating parameters, monitor your hardware, graphically display analytical data, and manage multiple profile data sets. While this Hardware Guide uses images from the Profiling Software 2G to illustrate procedures, you may use the SPS Smart Profiler with KIC's automatic system software.

SPS Smart Profiler Hardware Initialization

To begin profiling in either datalog or Wi-Fi mode, you must first set up your SPS Smart Profiler for use on your PC. Both modes communicate to the computer through a standard USB port – datalog mode uses a cable, Transmitter (Wi-Fi) mode uses the Smart Dock. If the computer has no available USB ports, use a standard 2-8 port *hub* to add an open port.

Note: *Install Profiling Software 2G BEFORE connecting the SPS Smart Profiler hardware to the computer. Connecting the hardware before the software is installed may result in Windows OS selecting the incorrect driver for the device and it will not connect to the software.*

The normal setup routine **must** follow the sequence shown below:

1. Install the software.

2. Install the USB security dongle.

3. Connect the SPS Smart Profiler hardware to the computer.

Note: *When connecting the SPS Smart Profiler to laptop computers that utilize a floating ground connection (2-prong power plug) manually ground the laptop before connecting the SPS Smart Profiler. This procedure will prevent unwanted electrical interference that may distort the temperature data collected by the SPS Smart Profiler.*

If you have any questions or need assistance connecting your hardware, contact KIC Technical Support tech@kicmail.com.

Warranty Protection Impairment

Caution: RISK OF VIOLATION OF WARRANTY
Improper handling may limit our liability for damage to equipment and may also violate your instrument warranty. As well improper handling or use could impair the protection provided by the equipment.

The SPS Smart Profiler LEDs

LED Name/ Icon/Color	Mode	LED Behavior	Mode Description
Battery	Charging	Combined solid and flashing. See description	Plugged into USB for charging. Each LED represents 1/3rd of battery capacity. Starting from the left the lights go from flashing to solid as the battery charge fills. Full charge when all 3 are solid.
	Using battery power	Flashing every 3 seconds	LEDs will flash depending on amount of charge left. Minimum to 1/3rd charge left – LED 1 1/3rd to 2/3rd charge left – LED 1-2 2/3rd to full charge left – LED 1-2-3
Alert	Not Ready	Solid On	Cannot profile: due to TC 1 missing, TCs too hot, SPS too hot, Battery too low, startup failure, voltage too low to charge or memory full. Plug into PC and software to identify alert.
	Ready	Off	Ready to begin profiling.
Data Collection	Profiling	Fast Flashing	Profiling in progress.
	Profile Complete	Flashing every 3 seconds	One or more profiles are complete and stored in memory.
	Data Empty	Off	No profiles stored in memory.
Wi-Fi	No Communications	Off	Wi-Fi not in use or not available.
	Wi-Fi In Use	Fast flashing	When profiling or downloading.
	Wi-Fi Ready	Slow flashing	Flashing every 3 seconds when paired with Smart Dock
ANT	Beacon	Flashing	Beacon mode starts when device is tapped. LED flashes until SPS finds a Smart Dock beacon and pairs with it to make private Wi-Fi connection.

The Smart Dock LEDs

LED Name/ Icon/Color	Mode	LED Behavior	Mode Description
Power ⏻ 🟢	Power	Solid	Power to Smart Dock from USB established
Alert ⚠ 🔴	Not Ready	Solid On	Cannot profile: due to TC 1 missing, TCs too hot, SPS too hot, Battery too low, startup failure, voltage too low to charge or memory full. Plug into PC and software to identify alert.
	Ready	Off	Ready to begin profiling.
Data Collection 🔴	Profiling	Fast Flashing	Profiling in progress.
	Profile Complete	Flashing every 3 seconds	One or more profiles are complete and stored in SPS memory.
	Data Empty	Off	No profiles stored in SPS memory.
Wi-Fi 🟠	No Communications	Off	Wi-Fi not in use or not available.
	Wi-Fi In Use	Fast flashing	When profiling or downloading.
	Wi-Fi Ready	Slow flashing	Flashing every 3 seconds when paired with Smart Dock
ANT 🔵	Beacon	Flashing	Beacon mode starts when device is tapped. LED flashes for 30 seconds waiting for compatible device to pair. During this time Smart Dock will automatically pair with a compatible device within range.

Power the SPS Smart Profiler

The SPS is powered by an internal NiMH battery pack. You charge the battery using the USB cable into your computer or the USB cable into the plugged-in AC charger.

Typical Charging Time

Normal Charge – 4 hours

NOTE: If the Alert LED is lit and the software indicates the battery is low, but you need to get a profile done, you can charge it for a minimum of 10 minutes to clear the alert and run one profile.

Battery LED Behavior

| LED Name/ Icon/Color	Mode	LED Behavior	Mode Description
Battery	**Charging**	Combined solid and flashing. See description	Plugged into USB (or AC charger) for charging. Each LED represents 1/3rd of battery capacity. Starting from the left the lights go from flashing to solid as the battery charge fills. Full charge when all 3 are solid.
	Using battery power	Flashing every 3 seconds	LEDs will flash depending on amount of charge left. Minimum to 1/3rd charge left – LED 1 1/3rd to 2/3rd charge left – LED 1-2 2/3rd to full charge left – LED 1-2-3

The Power Button

- Push power button momentarily to turn on or off
- Hold power button for 10 seconds for a hard reset of the hardware

Set Up the SPS Smart Profiler

In datalog mode, the profiler records data as it moves through the thermal process that it later will transfer to the computer through a cable.
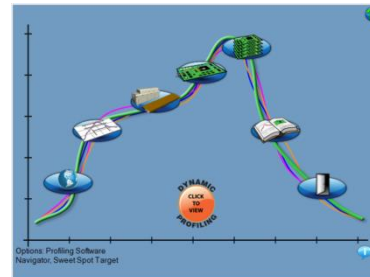
Note: Once the Profiling Software 2G is installed and running, whenever you connect an **SPS Smart Profiler** to a USB port, a message in the lower right of the screen reports whether the device is connected or not. This is true for the **Smart Dock** as well:
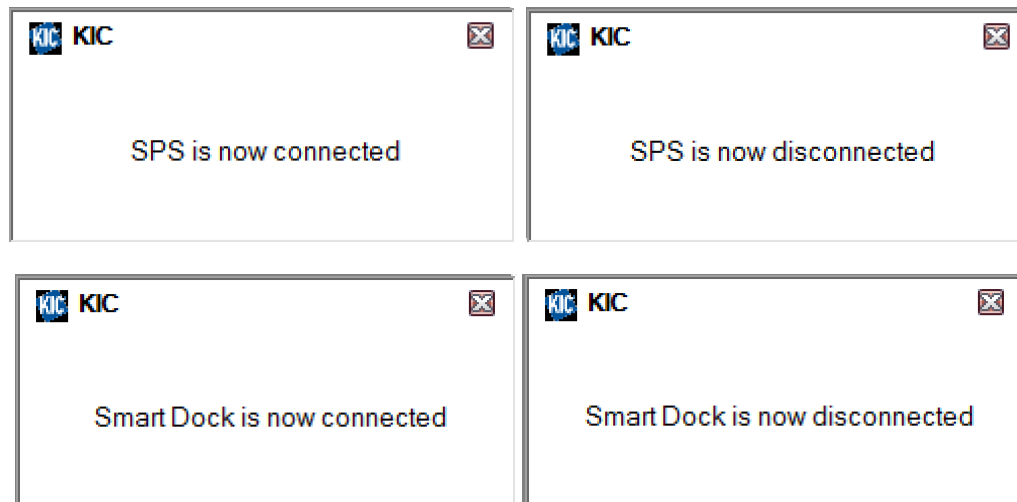
Choosing the Mode of Profiling

Datalog Mode
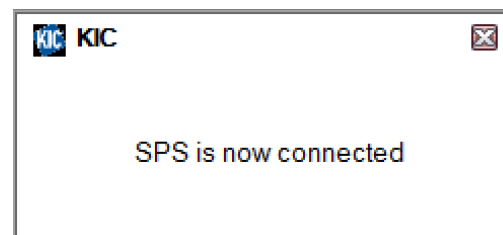
1. Launch Profiling Software 2G. Your Profiling Software USB Security Dongle is required to use all features in the software.
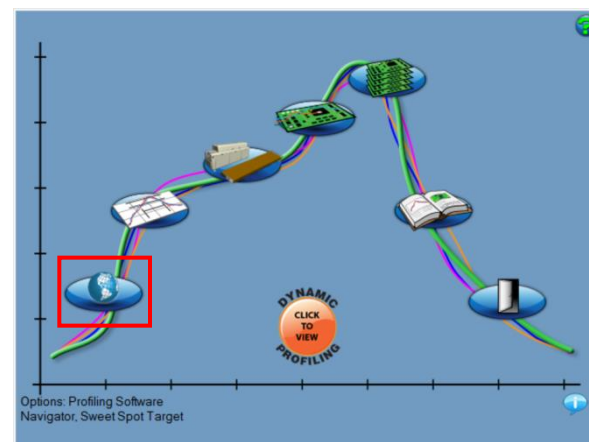

2. Use the communication cable to connect the SPS Smart Profiler to a USB port on the computer.

3. A message appears confirming the powered connection.

4. From the **Main** screen, click on the **Globe** button to display the **Global Preferences** screen.

5. The software shows the SPS Smart Profiler as detected in the Profiling Hardware panel and displays radio button choices for specifying the communication mode.
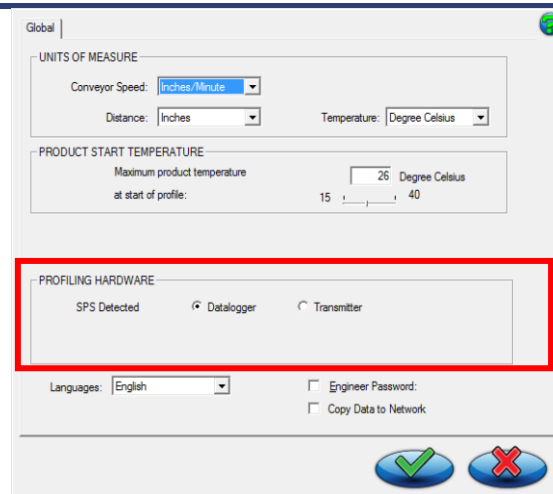
6. Click the radio button for **Datalogger,** followed by the **Save** (green check) button:
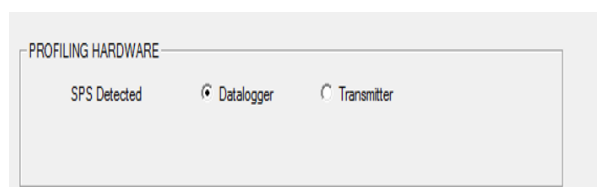
7. Click **OK** on the message boxes (no messages appear if the Datalogger radio button was already selected).

You are returned to the Main screen.

8. When the Main screen appears, click the **Hardware Status** button.
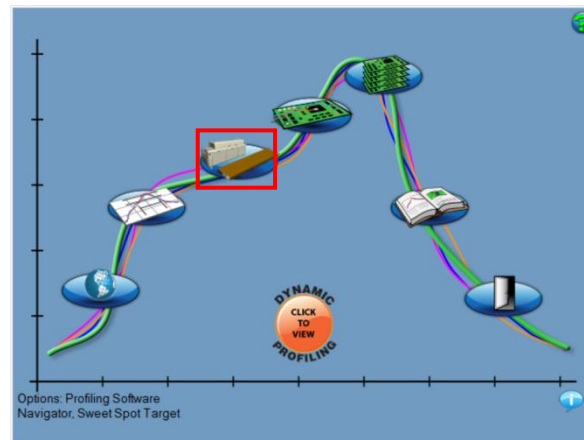
9. The Hardware Status screen appears, showing the
    status of the profiler, and confirming that the
    software is connected to the SPS Smart Profiler
    and receiving live readings.

    Note: The Profiler panel displays live temperature
    values and the current battery voltage. TC
    connections display the live temperature or appear
    as open (opn) if no TC is connected.
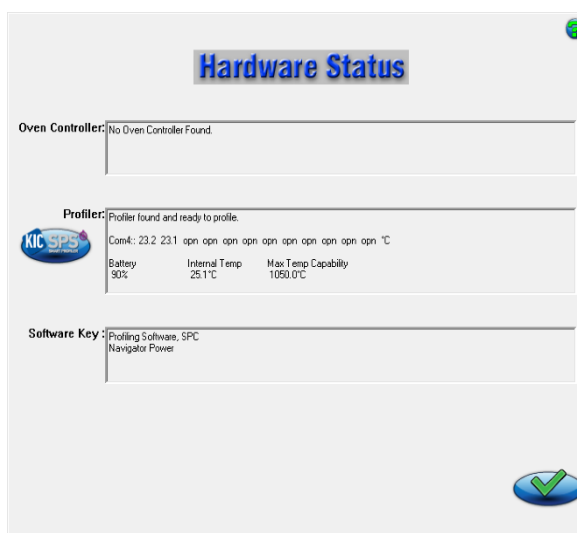
Wireless Mode

1. Launch Profiling Software 2G. Your Profiling Software USB Security Dongle is required to use all features in the software.

2. Use the communication cable to connect the SPS Smart Profiler to a USB port on the computer.

3. A message appears, confirming the powered connection
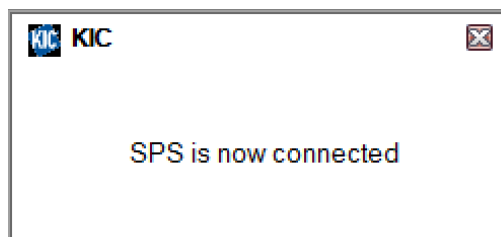
4. From the Main screen, click on the Globe button to display the Global Preferences screen.
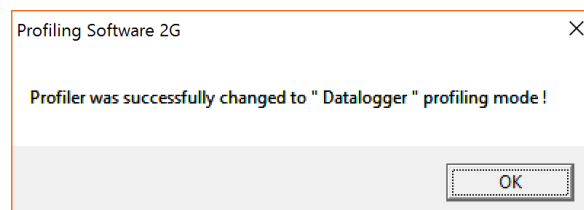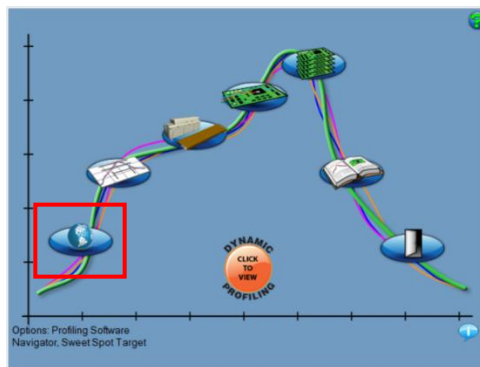
5. The software shows the SPS Smart Profiler as detected in the Profiling Hardware panel, and displays radio button choices for specifying the communication mode.
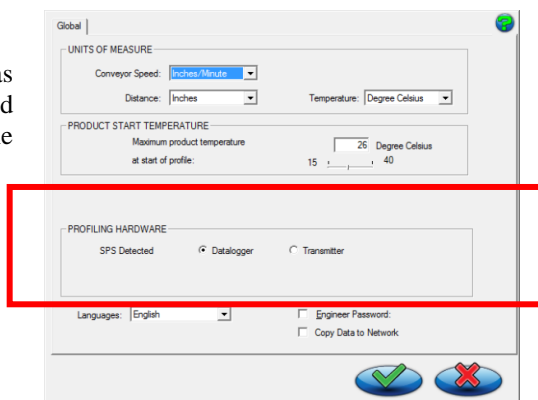
6. Click the radio button for **Transmitter,** followed by the **Save** (green check) button
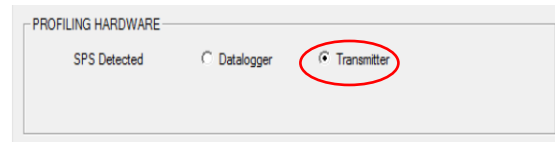
7. Click **OK** on the message boxes. You will then be returned to the main screen.
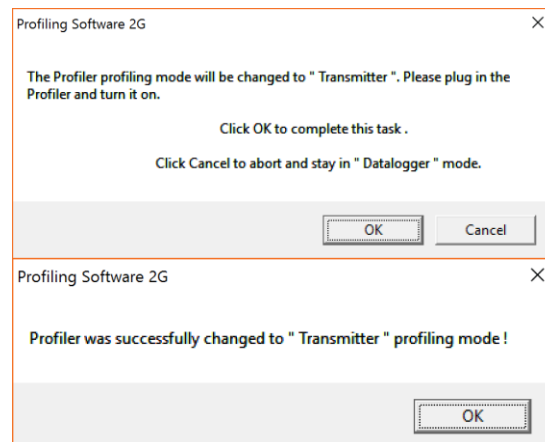
8. Remove the cable from the SPS and insert it into the Smart Dock.

9. Tap the SPS on the Smart Dock to pair it.

10. The ANT blue LED on both devices flashes until the devices are paired.

11. The Wi-Fi orange LED on both devices flashes every 3 seconds indicating a successful Wi-Fi connection.

12. When the Main screen appears, click the **Hardware Status** button.
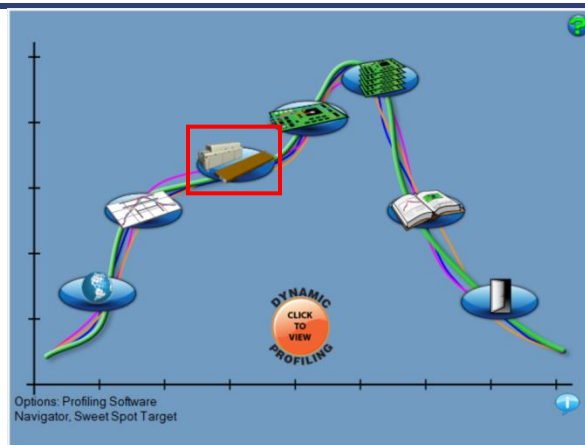
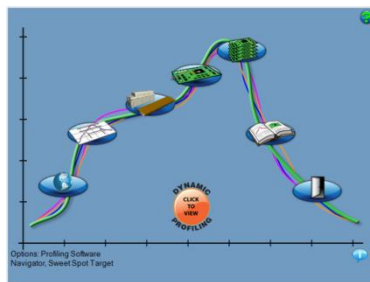13. The Hardware Status screen appears, showing the status of the profiler, and confirming that the software is receiving the live Wi-Fi signal from the SPS Smart Profiler.

    Note: The Profiler panel displays live temperature values and the current battery voltage. TC connections display the live temperature or appear as open (opn) if no TC is connected.
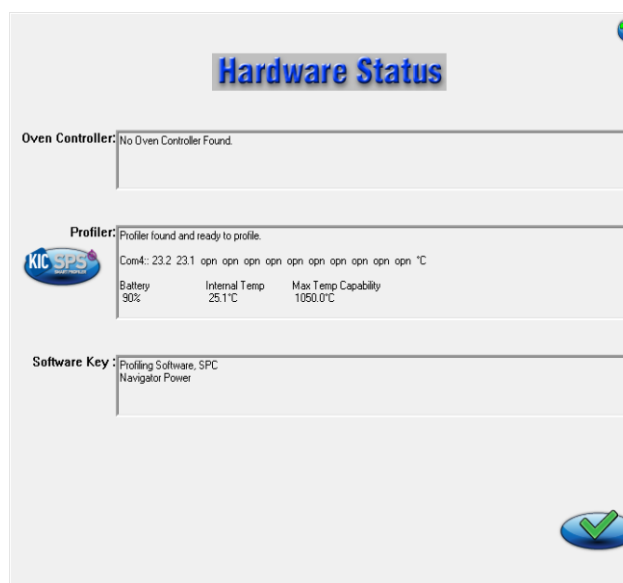
# Hardware Status: LED Status Window

With the SPS connect you can access an LED Status Window from the Hardware Status screen. This pop up window will indicate the matching status of the SPS LEDs on the SPS hardware, along with brief status descriptions. This will allow you to identify the state or mode of the SPS based on the LED display.
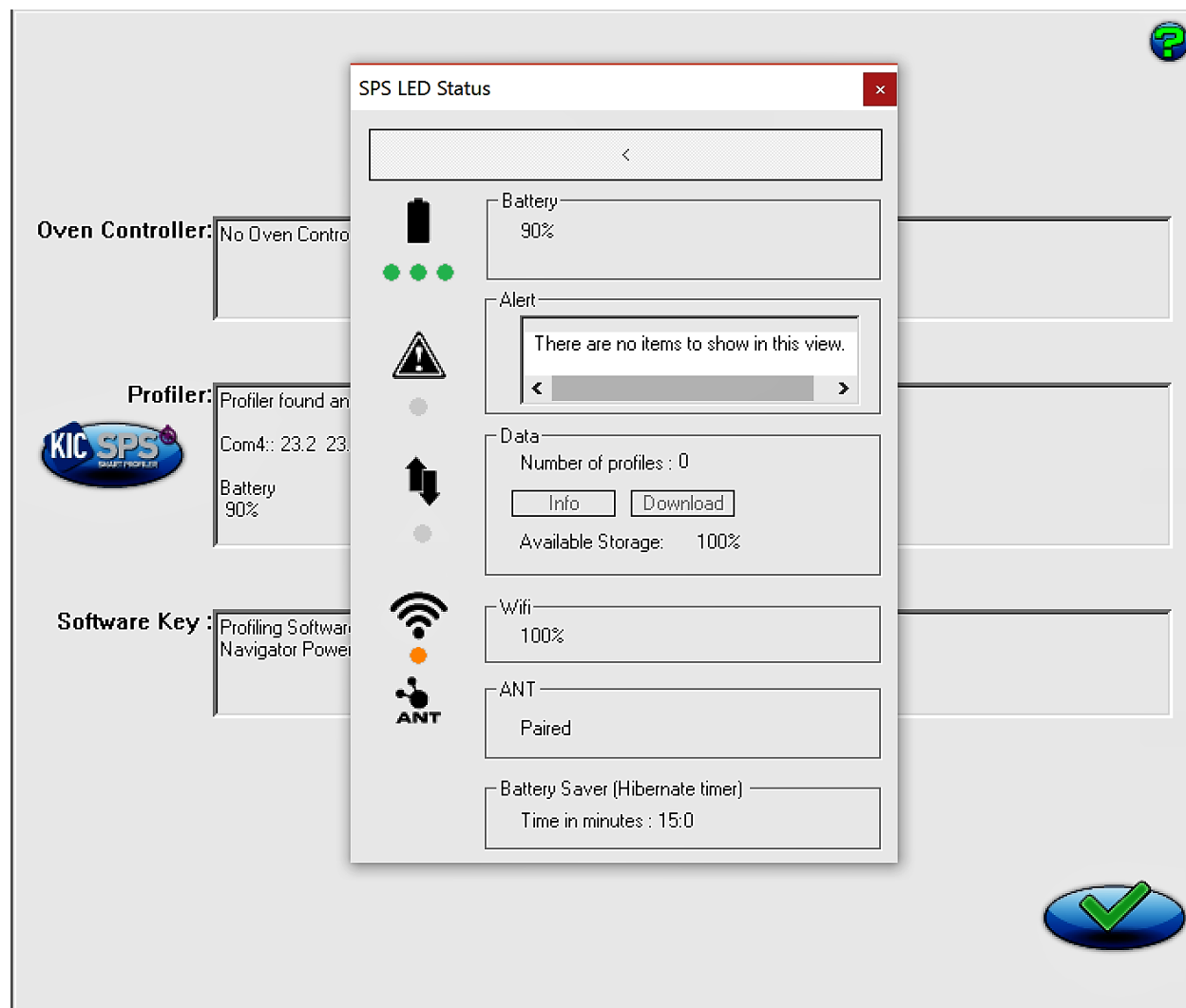
Battery indicates percent of battery charge.

Alert (if LED is on) will list any and all alerts in the list box.

Data LED status will indicate the number of profiles currently stored in the SPS with access for information on the stored profiles and the ability to download them. It also displays the amount of available storage (as a percentage).

Wi-Fi indicates the signal strength of the Wi-Fi connection to the Smart Dock (displayed as a percentage).

ANT will list if the SPS is paired with a Smart Dock or not.

Battery Saver indicates the time in minutes the SPS will turn off automatically if left idle.

Using the Thermal Shield

The SPS Smart Profiler kit includes a *thermal shield*—a stainless steel enclosure that protects the profiler against extreme heat during runs through a thermal process. Your shield may have a stainless outer surface, or Cool Touch – a special heat insulating material that makes the shield more comfortable to handle after absorbing oven heat.

Caution: *The SPS Smart Profiler's maximum internal temperature is 85°C.* <u>*ALWAYS*</u> *use the thermal shield to protect the* **SPS Smart Profiler** *from heat damage.*

Note: G*loves are required* when the profiler has just emerged from the oven. Your profiler kit includes a pair of specially selected safety gloves.

1. The top side of the shield has the latching tab and hooks on it. Place the SPS Smart Profiler into the bottom half of the shield.
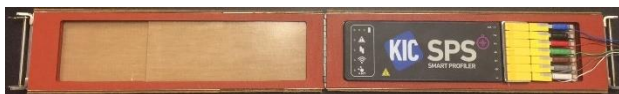
2. Make sure the thermocouple wires clear the sides and exit from the front of the shield.
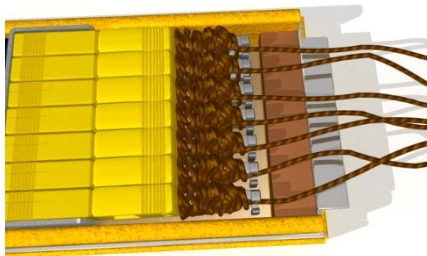
3. Close the lid of the shield and rotate the latch downward to lock it in place, being careful not to damage exiting wires.

Safe Handling after Exiting the Oven

As the profiler emerges from the oven, its shield will be too hot to touch. Your profiler kit includes a pair of safety gloves, and it is absolutely required that you use these gloves for handling the unit after an oven run.

The safety gloves provided with your profiler kit feature a fabric construction that is rated to permit holding an object heated to 120°C (250°F) for up to 30 seconds. Operators should never hold a profiler longer than 30 seconds and should only hold it as long as needed to move it safely to a workbench or other appropriate flat surface.

Caution: Never substitute gloves that are not rated for similar temperature and holding cycle specifications. Contact your profiler manufacturer for replacement or extra pairs.

Safely Remove the Profiler from the Oven

Hot Surface: Wear the safety gloves supplied with your profiler kit during this procedure.

1. As the PCB reaches the end of the conveyor, carefully support the board with a gloved hand.

2. Matching the speed of the conveyor, slowly move the board away from the oven keeping the thermocouple wires away from any entangling machinery.

3. As the profiler reaches the end of the conveyor, carefully support it with your other gloved hand.

4. Carry the PCB and profiler away from the oven area, and place the shielded profiler on a flat, level surface that is unaffected by the unit's heat.

5. Follow the procedure titled Safely Remove the Profiler from the Shield.

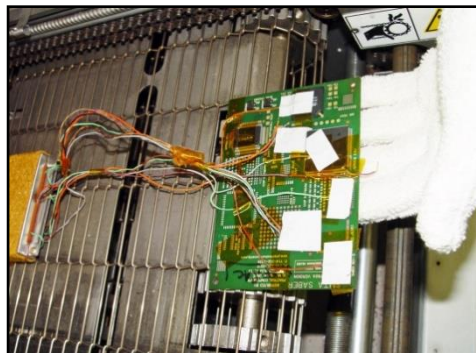# Safely Remove the Profiler from the Shield

Hot Surface: Wear the safety gloves supplied with your profiler kit during this procedure.

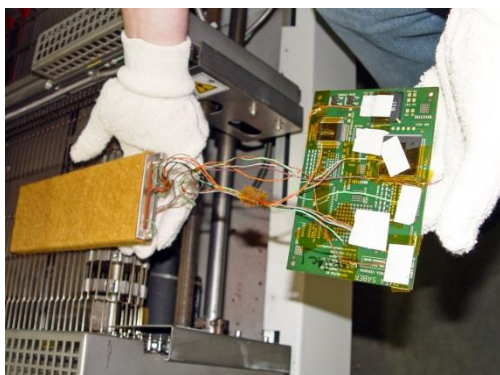1. Carefully pull up on the latch to open the shield.

2. Carefully lift the profiler out of the shield.

3. If desired, you can place the profiler and/or shield in front of a fan or other cooling station arrangement to aid in the cooling process.

Specifications and normal environmental conditions

Accuracy:	±0.5°C
Resolution:	±0.1°C
Internal Operating Temp:	0°C to 85°C
Humidity Range:	20-85% non-condensing
Measurement Range:	-150°C to 1050°C
Sample Rate:	Up to 50 readings per second
Data Points:	72000 per channel
PC Connection:	USB 2.0 (Std-A/Micro-B)
Power:	NiMH battery: 2.4Vdc USB connection to PC: 5Vdc, 500mA
Wireless Communication:	Wi-Fi2.4 GHz and ANT 2.4 GHz
Thermocouple Compatibility: 7, 9, and 12-Channel Models	Type K, Standard
Dimensions (L x W x H mm):	
7-Channel Model:	188.0 x 60.0 x 17.0
9-Channel Model:	188.0 x 75.0 x 17.0
12-Channel Model:	188.0 x 98.0 x 17.0
For Indoor Use Only	
Overvoltage Category 1	

⚠ **Caution: The SPS Smart Profiler measuring circuits are intended for use with non-energized equipment/test-samples only.** *Do not plug in and attach thermocouples to anything that is energized.*

- Max constant voltage handled: 3.15v
- Max transient voltage handled: 60v for less than 1ms

Cleaning Procedure

Clean the exterior surfaces of the chassis with a dry lint-free cloth. If any dirt remains, use a cloth or swab dipped in a 75% isopropyl alcohol solution. Use a swab to clean narrow spaces around the button and connector. Do not use abrasive compounds on any part of the chassis, as they may damage it.

Avoid the use of chemical cleaning agents, which might damage the plastics used in this instrument. Use a 75% isopropyl alcohol solution as a cleaner and wipe with a clean cloth dampened with deionized water. Before using any other type of cleaner, consult your KIC representative.

Regulatory Compliance

FCC

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

To comply with FCC RF exposure requirements a separation distance of at least 20 cm must be maintained between this device and all nearby persons.

Industry Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil.

This device complies with Health Canada's Safety Code. The installer of this device should ensure that RF radiation is not emitted in excess of the Health Canada's requirement. Information can be obtained at http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-eng.php

To comply with ISED RF exposure requirements a separation distance of at least 20 cm must be maintained between this device and all nearby persons.

Cet appareil est conforme avec Santé Canada Code de sécurité 6. Le programme d'installation de cet appareil doit s' assurer que les rayonnements RF n'est pas émis au-delà de l'exigence de Santé Canada. Les informations peuvent être obtenues: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct/index-fra.php

Pour satisfaire aux exigences d'exposition aux RF ISED une distance d'au moins 20 cm doit être maintenue entre cet appareil et toutes les personnes à proximité.

Calibrating the SPS Smart Profiler

To keep your profiler operating at proper factory specifications, KIC recommends calibrating the unit *every 12 months*. The procedure detailed below lets you calibrate the profiler to within $\pm 1.1°C$ ($\pm 1.9°F$).

The calibration procedure follows a sequence of three parts:

1. Establishing hardware/software communication
2. Setting the Cold Junction Reference (CJREF) offset value
3. Adjusting temperature gain

The CJREF offset is the amount of temperature to add or subtract from the base profiler readings. KIC recommends setting this value to the same temperature as the CJREF (Internal) temperature. You can view the CJREF (Internal) temperature by clicking the *Get Current TC* button on the *Calibration Log* screen displayed during the procedure.

The *Gain Adjust* portion of the calibration procedure affects the accuracy of the profiler across its temperature capability range. For maximum accuracy, set the *Gain Adjust* calibration value to the highest temperature you expect to read for your thermal process.

Note: The *maximum temperature* setting is the highest temperature that the SPS is set to read. The highest temperature that the profiler is *capable of reading* is 1050°C (1922°F). This profiler is factory preset at 1050°C (1922°F), but you can change the setting to suit your needs.

Note: Only qualified persons should perform the calibration procedure. If you need assistance, training, or need to arrange for KIC to calibrate your SPS Smart Profiler contact KIC Technical Support tech@kicmail.com, asia.tech@kicmail.com, europe.tech@kicmail.com.
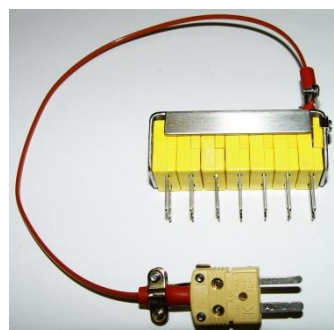
Before starting the procedure

Assemble the following hardware:

- o SPS Smart Profiler
- o Micro USB communication cable
- o Type K thermocouple simulator
- o Calibration Adapter* (7, 9, or 12 channel)

*Contact KIC to acquire the correct calibration adapter cable. sales@kicmail.com

TC Simulator   Calibration Adapter (7-channel shown)

Be prepared to run the *Profiling Software 2G* application and its *Profiler Hardware Utility*.

Do not attempt to calibrate the profiler with an ungrounded computer as this may produce inaccurate results.

Establish communication

1. Connect the profiler to the computer USB port.

2. Turn on the profiler power.

3. Connect the calibration adapter to the profiler, making sure to occupy all of the thermocouple inputs as required.

4. Connect the other end of the adapter to the **output port** (left side when instrument viewed upright) of the type K thermocouple simulator.

5. Turn on the power to the thermocouple simulator, and set the output value to 25°C (77°F).

6. Open the **SPS Utility** folder and double click the SPS Util icon SPSUtil (default folder location = *C:\Profiling Software 2G\SPS Utility)*,

7. The **SPS Profiler Hardware Utility - Calibration** screen and the **Calibration Log** screens appear:
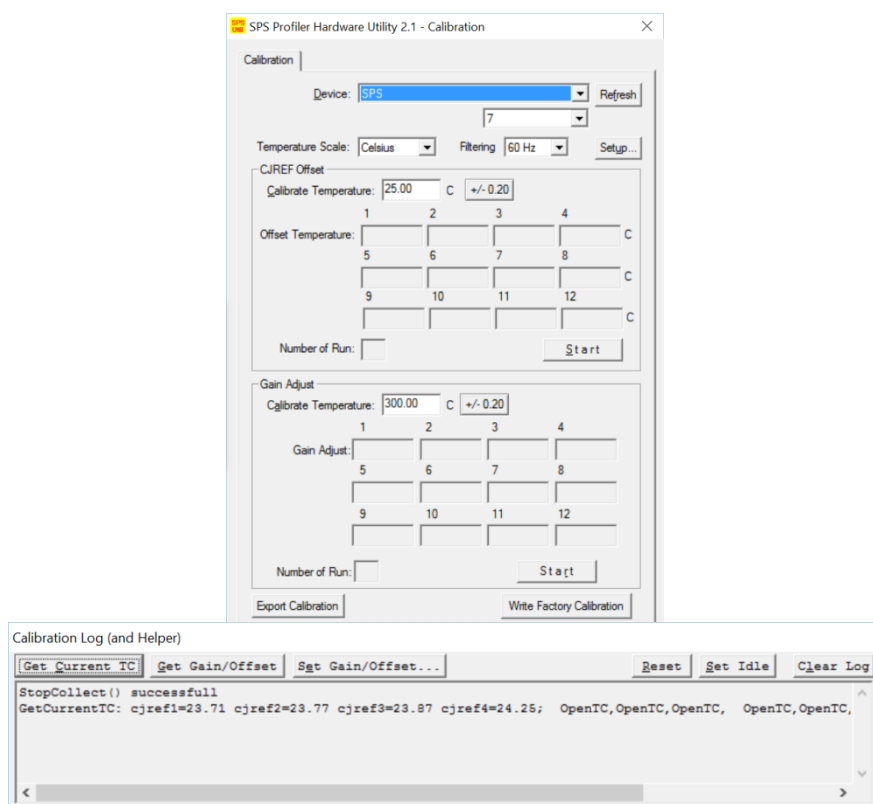
8. Ensure that **SPS** is displayed in the Device field, the proper number of channels is identified, the appropriate temperature scale is selected, and the proper filtering for your location is selected.

   Note: When the software utility is open and the hardware connected, if the profiler unit does not appear in the Device field, clicking the **Refresh** button forces the utility to search for the presence of the hardware and display the name in the field if found:

9. On the Calibration Log (and Helper) window, click the **Set Idle** button, and then click the **Get Current TC** button to verify communication between the software and the profiler. (If communicating properly the current live temperature readings from the profiler appear as shown in example above.)

Specify the CJREF offset

1. Open the **SPS Profiler Hardware Utility - Calibration** screen.

2. In the **CJREF Offset** panel's **Calibrate Temperature** field, accept the recommended default temperature of 25°C (77°F) or type in a new value between 10°C (50°F) and 500°C (932°F).

Note: The Calibrate Temperature value should be selected to represent an *anticipated ambient temperature*. Calibrating to this temperature will likely yield acceptably accurate performance. The selected default (25°C) approximates typical room temperature and is recommended for most lead-free soldering applications. However, the number of ovens present or other site-environment factors might influence your selection of this value. You can type in whatever value better matches your specific situation. If your thermal process is well established around specific temperatures, it may make sense to focus calibration on these target values.

Note: Older versions of software may indicate other values as the default temperature.

3. Adjust the output on the thermocouple simulator to match your specified calibration temperature.

4. When the values match, click the-**Start** button to begin calibration.

   The software automatically adjusts the calibration temperature for each of the thermocouple ports, typically resulting in different values among the four ports. Electronic adjustments also tune the profiler for maximum accuracy at the specified temperature.

   When the software completes the offset calibration, a status messages appears in the Calibration Log area at the bottom of the utility screen:
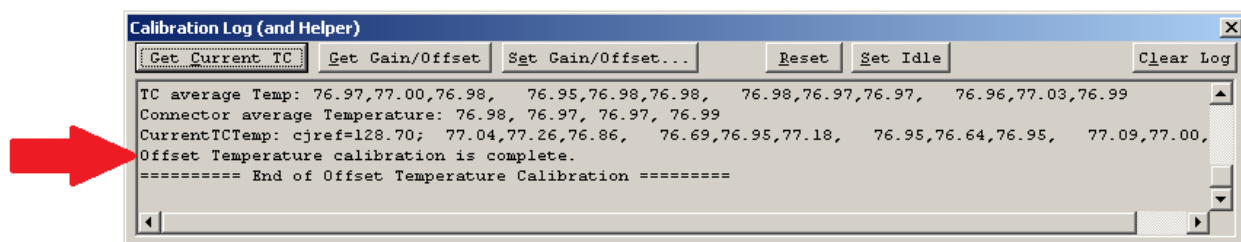
Specify the gain adjustment

1. Open the **SPS Profiler Hardware Utility - Calibration** screen.

2. In the **Gain Adjust** panel's **Calibrate Temperature** field, accept the recommended default temperature of 300°C (572°F) or type in a new value between 10°C (50°F) and 500°C (932°F).

   Note: The recommended default temperature is selected for its suitability to typical lead-free soldering applications. The range of values presented offers you the choice of calibrating to a *maximum temperature* or to a specific *temperature of interest*. Calibrating to the maximum temperature will yield acceptably accurate performance throughout the range. Alternatively, if your thermal process is well established around specific temperatures, it may make sense to focus calibration on these target values.

   Note: Older versions of KIC software may indicate other values as the default temperature.

3. Adjust the output on the thermocouple simulator to match your specified calibration temperature.

4. When the values match, click the-**Start** button to begin calibration.

   The software automatically adjusts the Gain setting while electronic adjustments tune the profiler for maximum accuracy at the specified temperature.

   When the software completes the gain adjustment, a status messages appears in the Calibration Log area at the bottom of the utility screen:
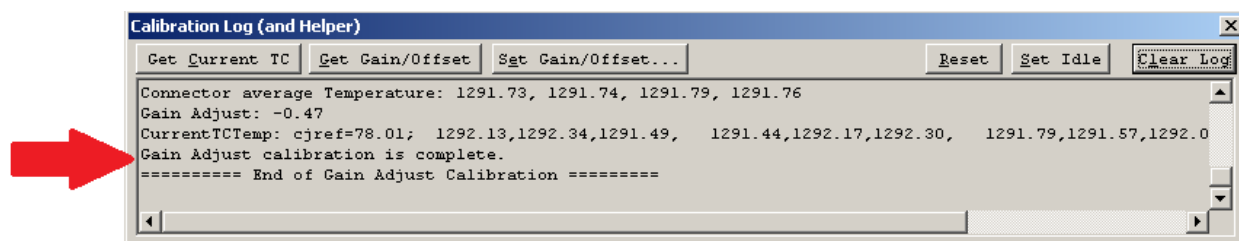
5. Close and exit the software to end the procedure.

   Note: In the Gain Adjust panel, the *Number of Run* field displays a running count of the number of times you needed to run the final gain adjustment part of the calibration procedure. The count can go to a maximum of eight. While it is typical to restart the gain adjustment two or three times before achieving final calibration, a run count number that exceeds five or six can indicate that the profiler has a problem that should be analyzed by KIC technical support. tech@kicmail.com

Contact KIC

On the Web

You can find the latest KIC product news along with a library of useful information at our website:

www.kicthermal.com or www.kic.cn

KIC Technical Support

KIC Tech Support is available by email:

USA: tech@kicmail.com
Europe: europe.tech@kicmail.com
Asia: asia.tech@kicmail.com

KIC Service/Repair

All service and repair of the SPS Smart Profiler or Smart Dock, other than the calibration, requires contacting a KIC Service center and having the service/repair conducted by personnel authorized by KIC.

KIC Product Training

Contact KIC Customer Support by email, training@kicmail.com

KIC Sales

Contact KIC sales:

USA: sales@kicmail.com
Europe: europe.sales@kicmail.com
Asia: asia.sales@kicmail.com
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Find the KIC Representative in Your Area

Send an email, or visit our web page to find a local representative.