Sentinel Metal Detector Quick-Start Guide

Installing Hardware

Here's how to install the following critical Sentinel hardware. Follow the order given below.

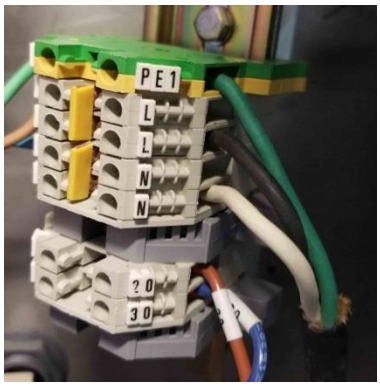
Attaching the Power Cord

Here's how to do this.

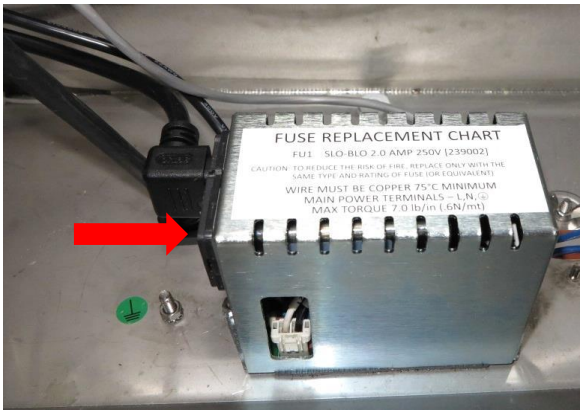
1) Remove the eight bolts from the Sentinel's front cover using a 10mm wrench. Gently open the door, being careful not to damage the rubber seal below.

2) Feed the power cable into the Sentinel enclosure, using one of the conduits in the base of the cabinet.

3) Connect the three AC power leads (100 VAC to 240 VAC) to the Sentinel's AC Power terminal strip, and ensure there is a good earth/ground connection to PE1.



4) Locate the internal power-supply box and ensure the switch is in the ON position.



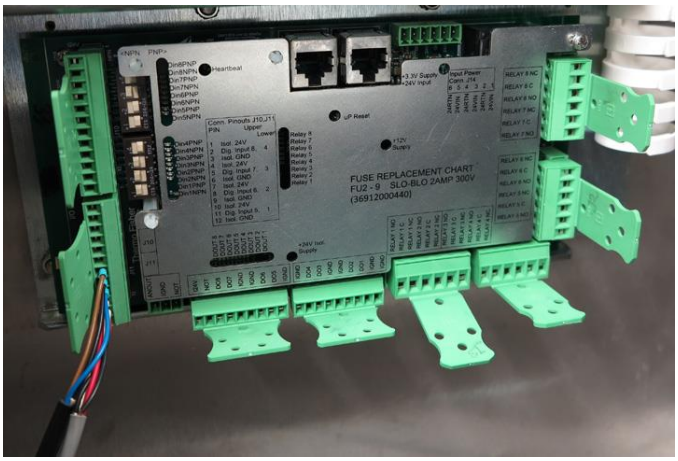
Attaching Encoder and In-Feed Photo-Eye

Here's how to do this.

1) Make absolutely sure the Sentinel is powered down.

2) Install the in-feed photo-eye (IFPE) adjacent to the conveyor, upstream of the search head.

3) Find the Sentinel's I/O board and locate the Input terminals.



4) Feed the Encoder (if present) and the IFPE cables through the cable entries in the base of the cabinet. Attach the Encoder leads to Input 1. Attach the IFPE leads to Input 2. (Input 2 is the default, but you may attach the IFPE to any input *except* Input 1, which is reserved for the speed encoder.)

Attaching Reject Device

Here's how to do this.

1) Install the reject device adjacent to the conveyor, downstream of the search head.

2) Feed the cable from the reject device through one of the conduits in the base of the cabinet, and attach the leads to Output 1 on the I/O board. (Output 1 is the default, but you may attach the reject device to any other Output.) Double-check you've wired the reject device to the *output* side of the I/O board!)

3) Re-install the front cover, being careful not to over-tighten the bolts.

4) Power up the Sentinel.

Configuring Hardware

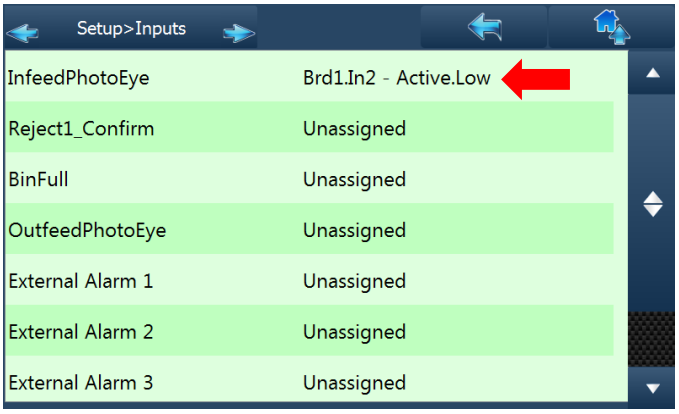
This section tells you how to configure the newly installed IFPE and reject device, and tells you how to set up other critical parameters that are needed for the Sentinel system to work properly.

Configuring the In-Feed Photo-Eye

Here's how to do this.

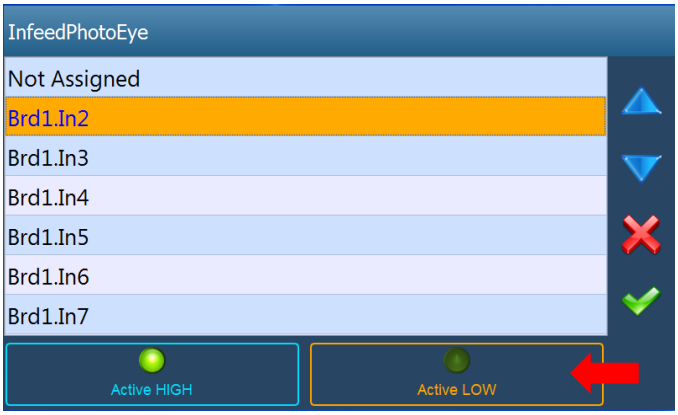
1) Make sure the Run screen is currently being displayed.

2) Press the Main Menu, Setup, and Input buttons and the Setup Inputs screen appears.



3) Press the line containing "Infeed Photo Eye" and the assignment screen appears.

4) Press the line containing "Brd1.In2" (I/O Board 1, Input 2) and the line is highlighted in orange. (If you attached the IFPE to another input, highlight the appropriate input.)



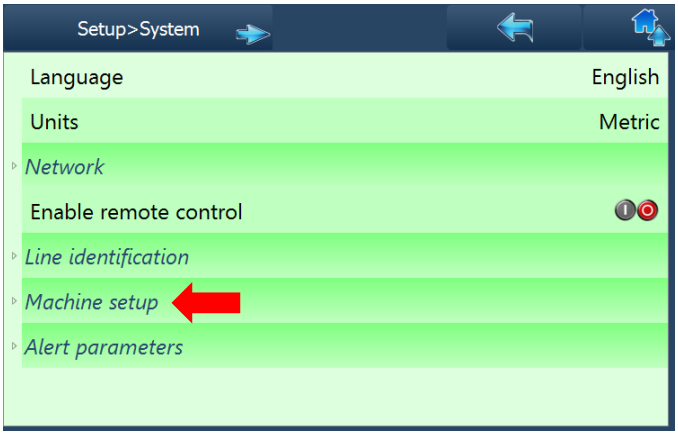
5) Note that the default status for the IFPE is "Active LOW" (because the button is highlighted in orange). Note that "Active LOW" is the correct setting for most IFPEs, because it alerts the Sentinel only when the beam is broken by a passing piece of product.

6) Press the Save button (in the assignment screen).

7) Press the Save button (in the Setup Inputs screen) to save your settings.

8) Repeatedly press the Return button until the Run screen appears.

9) Press the Main Menu, Setup, and System buttons and the Setup System menu appears.



10) Press the line containing "Machine setup."

11) Press the line containing "Infeed photo eye distance" and the Sentinel keyboard appears.

12) Measure the distance from the IFPE to the *in-feed* edge of the search head.

13) Enter the distance and press the keyboard's Save button.

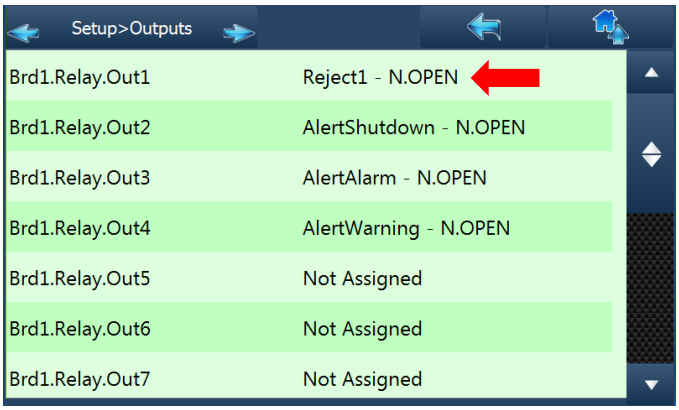
14) Press the Save button in the Setup System screen to save your settings.

Configuring the Reject Device

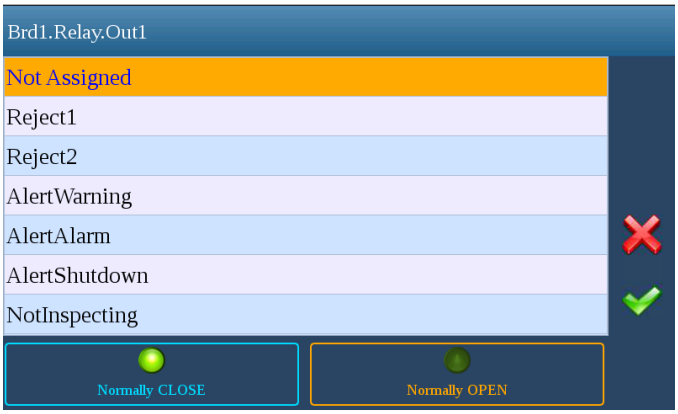
Here's how to do this.

1) Make sure the Run screen is currently being displayed.

2) Press the Main Menu, Setup, and Output buttons and the Setup Outputs screen appears.



3) Press the line showing "Brd1.Relay.Out1" (I/O board1, Relay Output 1) and the assignment screen appears.



4) Note that "Normally OPEN" is the correct setting for most reject devices, meaning current must flow to the relay to activate the reject device.

5) Follow steps 6 through 10 in the "Configuring IFPE" section above.

6) Press the line containing "Reject-1 distance" and the Sentinel keyboard appears.

7) Enter the distance from the *out-feed* edge of the Sentinel's search head to the center of the reject device, and press the keyboard's Save button.

8) Press the Save button in the Setup System screen to save your settings

Enabling the Speed Encoder

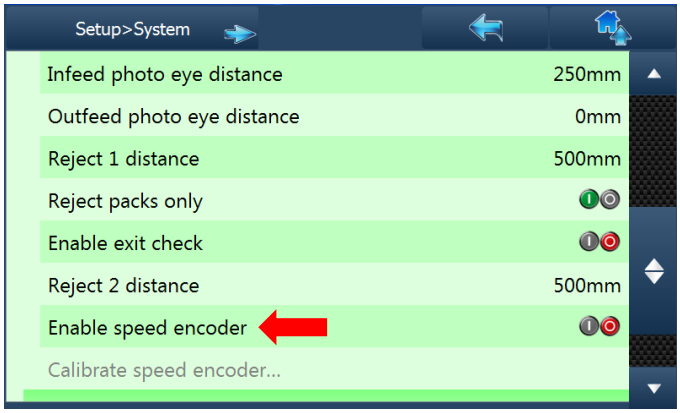
The Sentinel cannot detect metal, if the belt speed is incorrect, because the metal signals will be filtered out. For this reason, we strongly recommend you use a speed encoder. If you don't, you *must* enter the correct belt speed for every product the Sentinel monitors.

To enable the speed encoder, do the following.

1) Make sure the Run screen is currently being displayed.

2) Press the Main Menu, Setup, and System buttons and the Setup System menu appears.

3) Press the line containing "Machine setup" and scroll down to "Enable speed encoder."



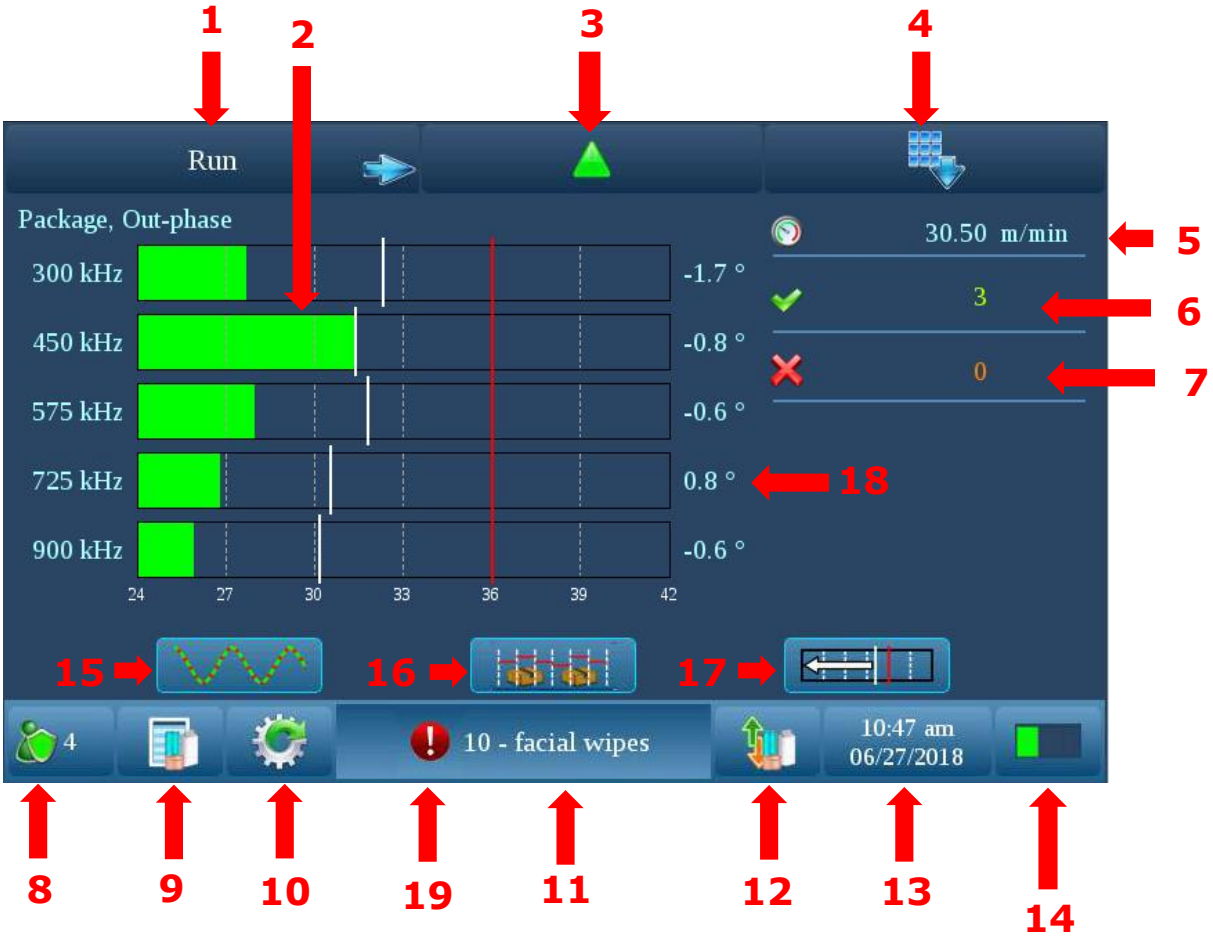
4) Press the line containing "Enable speed encoder" and the left radio-button turns green. Press the Save button.

Calibrating the Encoder or Entering a Belt Speed

This is the last critical parameter you must set up for the Sentinel system to work properly. Please refer to the *Sentinel Metal Detector User Manual* for details on how to do this.

Run Screen

This section gives you an overview of all functions and buttons in the Sentinel Run screen.



Run Screen Functions

Here is a brief description of each function.

1) Navigation bar and right-arrow (for accessing additional closely related menus).

2) Bar-graph of detector signal strength. (Bars are only displayed, when products are being monitored.)

3) The Active Alarms button shows the current Alarm status of the Sentinel system. (A green triangle means the Sentinel system is operating normally.)

4) Menu button (to access other menus available to the currently logged-in user).

5) Conveyor speed.

6) Number of accepted products (since the last reset).

7) Number of rejected products (since the last reset).

8) User button. (The number indicates which type of user is currently logged in.)

9) Product Setup button. (Allows Administrators to go directly to the Product Set-Up menu.)

10) Adjust Detection button. (Allows Administrators to go directly to the Adjust Detection screens.)

11) Product number and name of the currently running product.

12) Product List button. (Allows you to go directly to the Product List menu.)

13) Current date and time.

14) The "Single/Multi-Bar" toggle button. (Allows you to view the signals of multiple frequencies individually, or view a single maximum signal.)

15) The "In-Phase/Out-Phase" toggle button. (Allows you, when viewing multiple bars, to choose whether the Run screen displays a graph of the in-phase or out-phase product signals. As a general rule, it is best to have the Sentinel display the out-phase product signals, because these are the ones that are usually responsible for detecting contaminants in your products.)

16) The "Package/Live View" toggle button. (For conveyor applications, this should be set to Pack View—meaning the word "Package" is displayed just above the peak-signal graph, as shown on page 4.)

17) The Reset Peaks button. (Allows you to reset the peak display in the Run screen to 24 decibels.)

18) Phase-angle delta. Shown only in "Pack" view—see item number 16 above. For strongly phased products, this shows the difference between the learned phase angle and the phase angle of the last piece of product that passed through the search head.

19) Product not learned Icon. This informs the User that the product has not been learned yet. This same icon is also shown on the Product List/Select screen.

Understanding the Run Screen Bar Graphs

Here's an overview of what the bar graphs are telling you about the product that has just passed through the search head.

The Product Is Good (Bars Are Green)

The Product Is Rejected (Bars Are Red)

The Product Is Marginal (Bars Are Yellow)

This product was close to being rejected.

Sentinel Functions

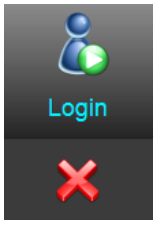
This section gives a brief overview of frequently used Sentinel functions.

Logging In

Here's how to log in to the Sentinel.

1) Press the User button (item #8 in the Run screen on page 4) and the Users Login screen appears.

2) Press the line containing your name and the Login button appears.



3) Press the Login button and the Sentinel keyboard appears.

4) Type in your password. (Please note that passwords are case sensitive.)

5) Press the keyboard's Save button and the Run screen reappears.

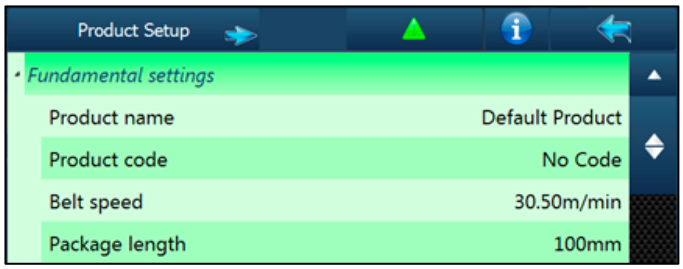
Learning a New Product

Here's how to have the Sentinel learn a new product. (As a general rule, only Administrators can do this.)

Step Zero—Naming the New Product

First, you must give the new product a name.

1) Press the Product Edit button (item #9 in the Run screen on page 4) and the Product Setup screen appears.



2) Open the Fundamental Settings menu, press the line showing "Product name," and the Sentinel keyboard appears. Type in the name of your new product and press the keyboard's Save button.

3) If your Sentinel is *not* equipped with a speed encoder, measure the belt speed with a tachometer. Press the line showing Belt Speed and the Sentinel keyboard appears. Enter the belt speed and press the keyboard's Save button.

4) Press the line containing "Package length," and the Sentinel keyboard appears. Enter the length (or diameter) of your product and press the keyboard's Save button.

5) In the Product Setup screen press the Save button (which is flashing) to save the values you have just entered above.

Step One—Setting the Start-Up Attenuation for the Product

Here's how to do this.

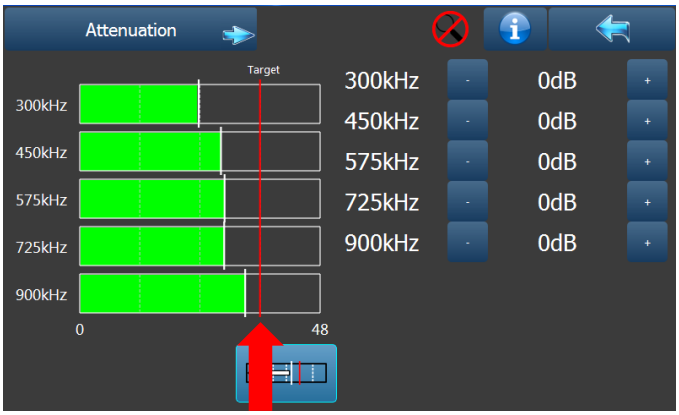
1) Press the Product List button (item #12 in the Run screen on page 4) and the Product List screen appears.

2) Press the line containing the product you want the Sentinel to learn, and the Learn button appears.

3) Press the Learn button and a confirmation screen appears. Press the Save button. The Sentinel displays two additional information screens, before displaying the Attenuation screen (shown below).

4) Pass three pieces of *uncontaminated* product through the search head, and watch the screen as you do this. If the signals are all green, the attenuation setting is good, because all the signals are just to the left of the Target line—as shown on page 7.

   However, if any of the signals are red (and to the right of the Target line), use the plus button beside each frequency to increase the attenuation—that is, move the signal to the *left* of the Target line. Repeat step 4 to make sure all the signals are now green. When attenuation is maxed out then switch to a low frequency schedule and relearn (Wet/conductive products).



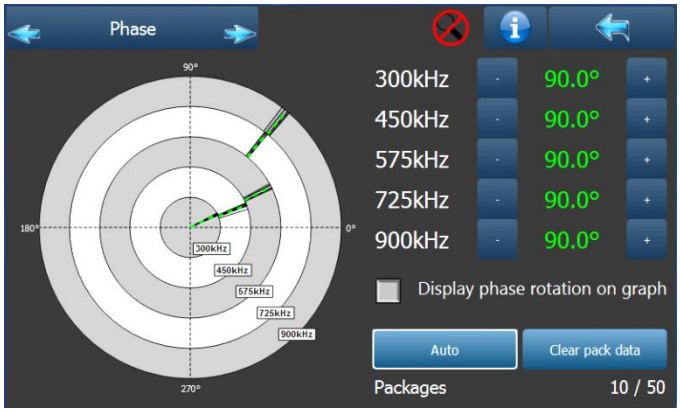
Step Two—Doing a Detailed Phase Learn
Here's how to do this.

1) In the Attenuation screen, press the blue right-arrow button and the Phase screen appears.

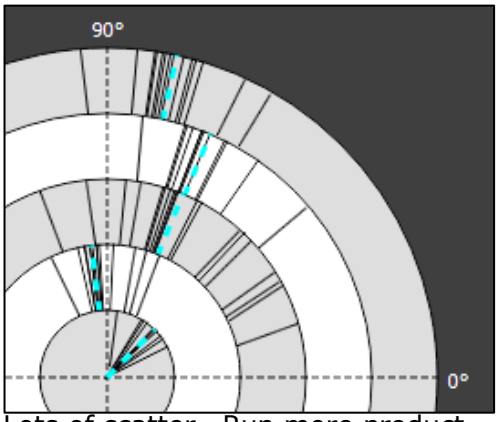
2) Press the "Clear pack data" button (a confirmation screen appears) to set the pack count to zero.

3) Manually pass 10 units of product through the search head (the Packages counter will increment).

4) When you have passed all 10 pieces of uncontaminated product, the Phase screen should look like something this. (Your product signals, most likely, will look different.)



5) If one or more phase angles in your "archery" target show significant scatter (as shown in the figure below), pass 25–50 units of product (or more, if needed, because the more product you pass, the more information the Sentinel is able to gather about the scatter). To do this, pass 25–50 products, press the Auto button, press the Save button, and press the blue right-arrow button.

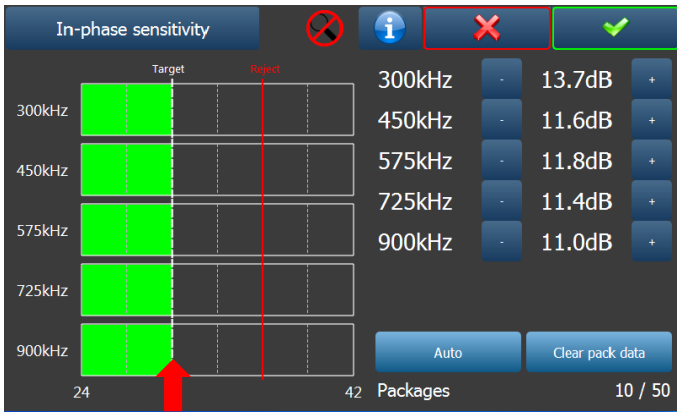


Lots of scatter—Run more product

Step Three—Setting the Detection Threshold
Here's how to do this.

1) In the Phase screen, press the blue right-arrow button and the In-Phase Sensitivity screen appears.

2) Press the Auto button, so the phase bars are aligned on the Target line.



3) Press the Save button, and the right-arrow reappears at the top of the screen.

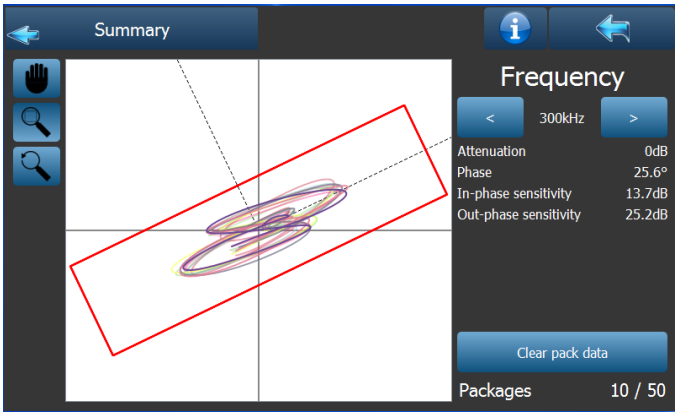
4) Press the right-arrow button, and the Out-Phase Sensitivity screen appears. Press the Auto button, so the phase bars are aligned on the Target line.

5) In the Out-Phase Sensitivity screen, press the Save button to save the out-phase sensitivity settings.

Step Four—Viewing the Summary Screen
Here's how to do this.

1) In the Out-Phase Sensitivity screen, press the blue right-arrow button and the Summary screen appears.

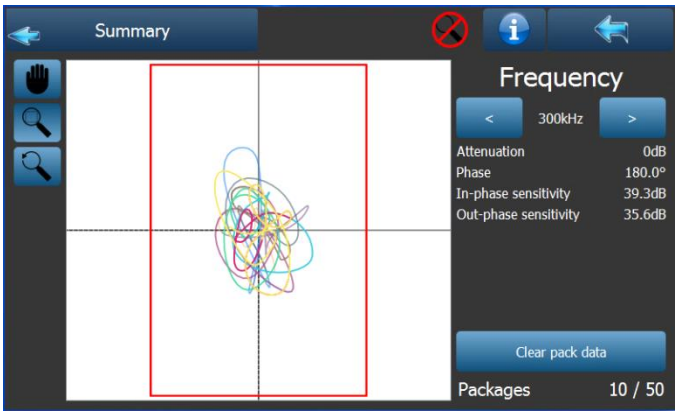
2) Your summary screen should look something like this.



The default screen shows the phase diagram for the 300 kHz frequency. Please note that each piece of product produces its own particular pattern in the Summary screen. As a result, your phase diagram will, most likely, look different.

3) Press the small right-arrow button to view the product signals for the other frequencies.

4) If any of the frequency summaries appear as shown below (where the red "reject boundary box" is square and not rectangular), pass an additional 25–50 pieces of uncontaminated product through the search head.

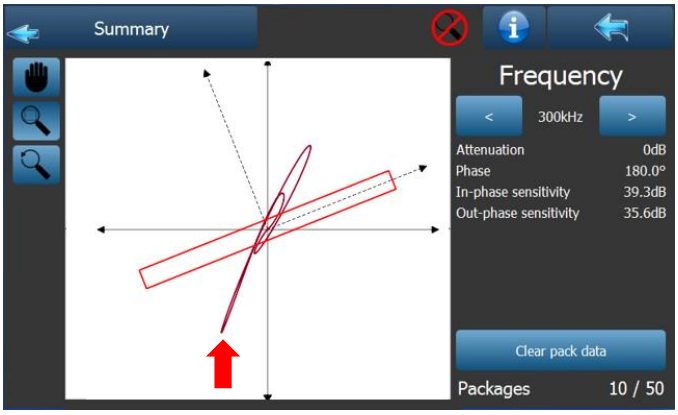


Step Five—Pass a Contaminated Product
The final step is to verify that the Sentinel, having learned your uncontaminated products, will now tag a contaminated sample for rejection. Please note that, for safety reasons, your reject device is *disabled* during the product-learn process, and will not actually eject the contaminated sample from your production line.

1) Make sure the Summary screen is still being displayed.

2) Tape a test piece of metal to an uncontaminated unit of product, then pass the contaminated sample through the search head.

   Your summary screen should look something like this. In the example below, the product signal falls well outside the red "reject boundary box," so the Sentinel has definitely tagged this product for rejection.



5) To end the Learn process and return to the Run screen, press the Return button (in the top-right corner of the Summary screen).

Dealing With False-Positive Rejects

Here's how to do this.

1) Make sure the Run screen is currently being displayed.

2) Press the blue right-arrow button and the Recent Reject screen appears.

3) Identify the reject of interest, press the small right-arrow button (at the left of the line), and detailed frequency data appears.

4) Press any row of frequency data and the Adjust Detection button (item #10 on page 4) appears.

5) Press the Adjust Detection button and the "Out-Phase Sensitivity" screen appears.

6) Adjust the sensitivity of any frequency showing yellow and/or red bars using the plus and minus buttons to eliminate false rejects.

Selecting a Product to Run

Please note that you can only run a product the Sentinel has learned—as described above on page 6.

1) Press the Product List button (item #12 on page 4) and the Product List screen appears.

The currently running product is highlighted in blue. (Your list of products, clearly, will be different.)

2) Press the line containing the new product you want the Sentinel to monitor, and the Run button appears.

3) Press the Run button. The Sentinel stops inspecting the previous product, runs the frequency-balance function for the new product (which can take 1–2 minutes to complete), and displays the Run screen.

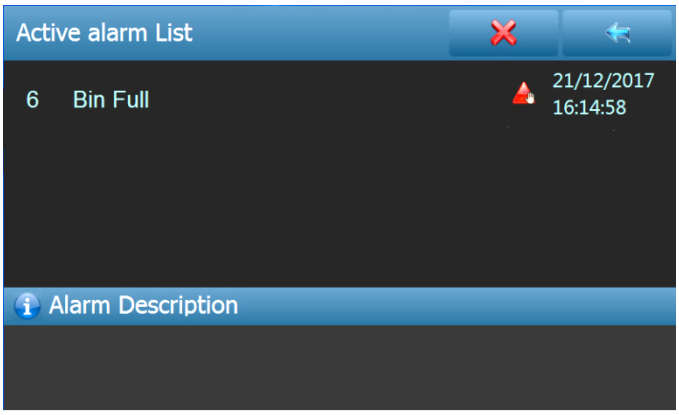
4) In the Run screen, note the displayed belt speed for this product.

5) Place a tachometer on the Sentinel conveyor, and verify that the belt is, indeed, running at the indicated speed.

Resolving an Alert

Here's how to resolve an alert.

1) In the Run screen, press the Active Alarms button (item #3 on page 4), and a summary screen appears showing what caused the Sentinel to issue the alert.



2) Go to the table on page 10 to get a more detailed description of the alert.

3) Resolve the problem causing the alert—for example, by clearing out the reject bin.

4) In the "Active Alarm List" screen, press the Close button to clear the list of alerts.

Logging Off

Here's how to do this.

1) In the Run screen, press the User button (item #8 on page 4). Press the line containing your User name and the Logout button appears.

2) Press the Logout button and the Run screen reappears. You are now logged out.

List of Sentinel Alerts

Alert Text	Problem	Solution
Phase Limit Reached	The phase-tracking parameter has exceeding its specified limit.	• Notify the Administrator at your facility.
SD Card Nearly Full	The Sentinel cannot store any more data on the SD card.	• Notify the Administrator at your facility.
File System Nearly Full	The Sentinel cannot store any more basic operating files in the HMI's hard drive.	• Notify the Administrator at your facility.
Latched Reject	A reject output will stay active until manually reset through the HMI.	• Notify the Administrator at your facility.
Out Of Balance	The frequencies used by the search head are currently out of balance.	• Notify the Administrator at your facility.
Infeed PE Blocked	The photo-eye that monitors products flowing into the Sentinel is blocked.	• Clear the obstruction from the photo-eye and try to determine why it was blocked.
Watchdog Reset	The Sentinel has detected a SCU reset.	• Notify the Administrator at your facility.
SCU Disconnected	The SCU board is disconnected, causing the Sentinel to shut down.	• Notify the Administrator at your facility.
IO Board Missing	The Sentinel software cannot, for some reason, contact the I/O board.	• Notify the Administrator at your facility.
Minimum reject distance	The minimum reject distance parameter has been violated.	• Move the rejector and re-enter the Reject distance/Reject offset, and ensure that the Detection no pack distance is 0.
Detection No Pack	A contaminant was detected at a belt position, when no product tripped the photo-eye.	• Verify that a metal sample was inside the product being tested.
Detection Belt Stopped	A contaminant was detected but the belt is stopped.	• Check the conveyors upstream of the Sentinel to see why products have stopped flowing.
Excess Rejects	A large number of consecutive rejects has occurred.	• Notify the Administrator at your facility.
Bin Full	The reject bin is full.	• Empty the reject bin.
Reject Confirm Failure	A product the Sentinel marked for rejection was not, in fact, rejected.	• Notify the Administrator at your facility.
Outfeed Backup	Products are backing up on the Sentinel's out-feed conveyor.	• Clear the "log jam" of products on the out-feed conveyor.
External Alarm 1	An external alarm has been signaled using the external alarm-input function.	• Check notices, if any, posted near the Sentinel. • If none, check with a shop-floor supervisor about what may be causing the problem.
External Alarm 2	Same as above.	• Same as above.
External Alarm 3	Same as above.	• Same as above.
Exit Check	A product that the Sentinel passed as "Good" is not present on the out-feed conveyor.	• Check that the "good" product tripped the out-feed photo eye.
SCU Sync Lost	The HMI is unable to communicate with the Sentinel's HMI.	• Notify the Administrator at your facility.
Package Info Discarded	This problem usually occurs when products are moving through the search head at high speed and there is a large number of sequential rejects.	• Notify the Administrator at your facility.

Contact Information

Technical support contact information may be found at the following web address.

www.thermofisher.com/sentinel5000