

CyberOptics
Semiconductor
WaferSense™
ATS User's
Guide



General Information

WaferSense Teaching Wafer and Link

Changes or modifications not expressly approved by CyberOptics Semiconductor, Inc., may void your authority to operate the WaferSense ATS.

The radio contained in the WaferSense ATS meets all the applicable FCC requirements for RF Safety. While in operation, the FCC requires users and nearby persons to maintain a minimum separation distance of 20 cm (8 inches) or farther from the WaferSense ATS.

The WaferSense Teaching Wafer and Link have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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.

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.

WaferSense Technical Support

Technical support is available from CyberOptics Semiconductor Monday through Friday, 8:00 A.M. to 5:00 P.M. Pacific Time.

E-mail:	CSsupport@cyberoptics.com
Phone:	(503) 495-2200 800-366-9131 (US and Canada only)
Fax:	(503) 495-2201

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Chapter 1

Introduction

The CyberOptics Semiconductor WaferSense™ Automatic Teaching System (ATS) measures three-dimensional offsets to teach wafer handoff positions. Using machine vision technology, it “sees” targets inside semiconductor equipment. The TeachView™ software application makes it easy to precisely adjust equipment. The large display and wireless link let you place the computer at a convenient distance from the teaching wafer.

ATS consists of the following components:

- **Teaching wafer.** The ATS is designed with a wafer-like form factor, so it can fit in most wafer-handling equipment. The teaching wafer is also vacuum compatible.
- **TeachView and TeachTarget™ software.** The TeachView software application monitors the teaching wafer and displays X, Y, and Z offsets and other status information in real time. TeachTarget creates target configuration files needed by TeachView. Both applications run on most personal computers that use the Microsoft Windows operating system.
- **Wireless link.** The software communicates with the teaching wafer by using a Bluetooth wireless link that attaches to a USB port on a personal computer.
- **Charging clean box.** The teaching wafer is powered by an internal rechargeable battery, which you recharge by placing the teaching wafer into the charging clean box.
- **Carrying case.** The carrying case makes it easy to take your complete ATS system with you in the plant or on the road.

The following chapter gives you instructions for installing your ATS system.

Chapter 2

Installing Your ATS

This chapter describes the procedures you need to perform to install your ATS and get it ready for use. For best results, perform the procedures in the order they are presented in this chapter:

1. Installing the software
2. Installing the wireless link on the USB port
3. Checking communications between the link and the teaching wafer
4. Registering your teaching wafer
5. Running the TeachView application

Caution

Dropping the teaching wafer or hitting it against a hard object can bend, break, or chip the housing; damage the internal components; or knock the teaching wafer out of calibration. While it is not as fragile as an actual silicon wafer, handle the teaching wafer with care, as you would any precision instrument. If the teaching wafer is damaged or in need of calibration, see [Chapter 5](#), “[Maintaining Your ATS](#).”

Installing the Software

To run the WaferSense ATS software, your computer must have the following:

- Windows 2000, Windows XP, or Windows Vista operating system
- One free high-power USB 1.1 or USB 2.0 port

To install the WaferSense ATS software:

1. Log on using an account with Administrator privileges.

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2. Insert the WaferSense ATS Installation Disk into the CD drive.

The InstallShield Wizard starts automatically, as shown in [Figure 2.1](#). If the wizard doesn't start automatically, use Windows Explorer to view the contents of the CD and double-click the **setup.exe** program.

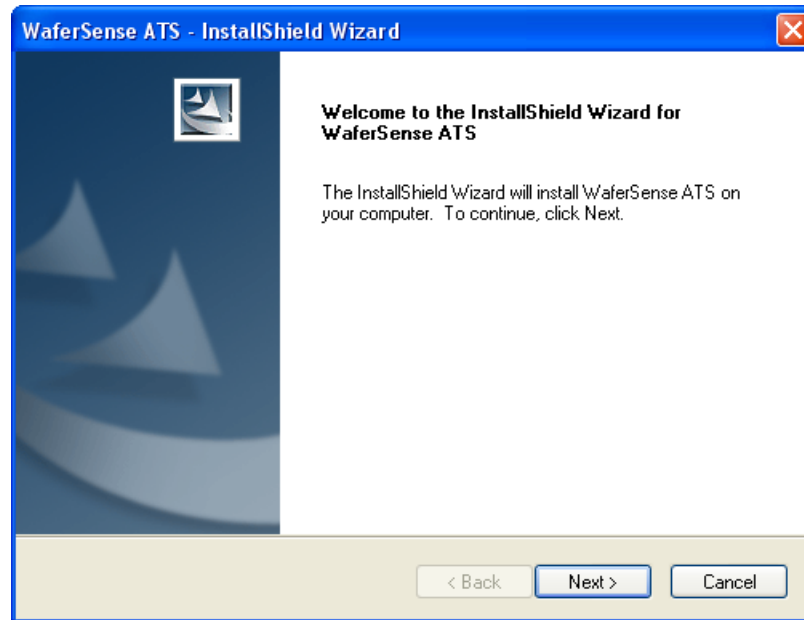


Figure 2.1: The InstallShield Wizard

3. Follow the instructions provided by the wizard to install the software.
4. After you complete the instructions for all of the wizard screens, click **Finish**. If Windows notifies you that the drivers have not passed Windows logo testing, just click **Continue Anyway** to complete the installation.

By default, the Setup program installs the TeachView and TeachTarget applications in a new program group called WaferSense ATS. Setup also installs an online copy of this user's guide, which is available from the TeachView and TeachTarget **Help** menus and in the WaferSense ATS program group in the Windows **Start** menu.

Installing the Wireless Link

To install the wireless link:

1. Turn on your computer.
2. Locate an unused, high-power USB port on your computer. The ATS wireless link module requires a high-power USB port, such as the built-in ports on your computer and ports on USB hubs that have power cords. Unpowered USB hubs won't work.
3. The USB cable provided with your ATS has a different plug on each end. Locate the end with the plug that matches the USB port on your computer and plug the cable into the port.
4. Plug the other end of the cable into the link module.

The Windows operating system recognizes the new link module hardware and displays the Found New Hardware Wizard, as shown in [Figure 2.2](#). If the wizard your system displays doesn't offer to check with Windows Update, skip to step [6](#).



Figure 2.2: Found New Hardware Wizard

5. Choose **No, not this time** and click **Next**.

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The wizard offers to help you install software for the CyberOptics WaferSense link device, as shown in [Figure 2.3](#).

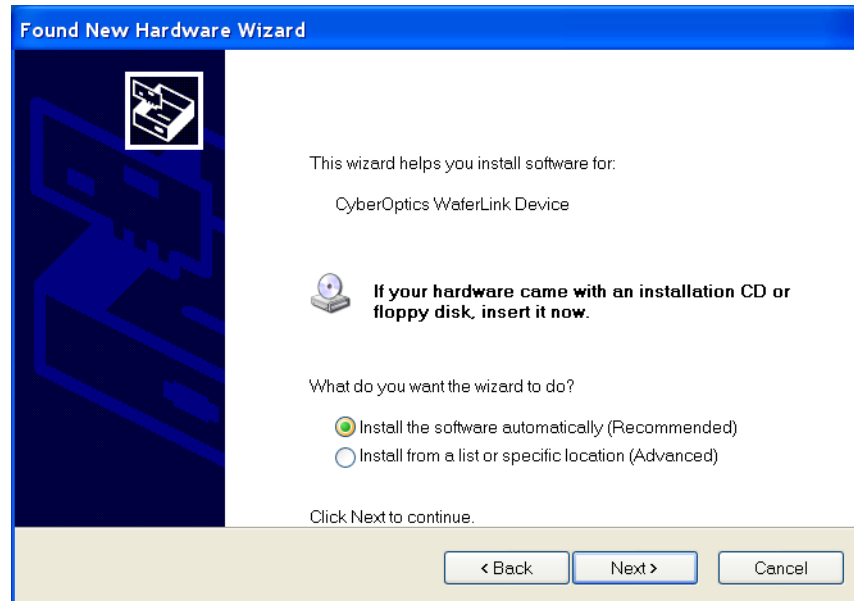


Figure 2.3: Installing the WaferLink Device

6. Choose **Install the software automatically** and click **Next**.

If you already installed the WaferSense ATS software (see [“Installing the Software,” on page 2.1](#)), Windows will automatically find the drivers. If not, the drivers are located in the Utilities folder on the installation CD-ROM.

7. After you complete the instructions for all of the wizard screens, click **Finish**.

The **Power** light on the module turns on indicating that the module is getting power from the USB port. Ignore the **Pair Status** and **Connection Status** lights for now.

Checking Communications Between the Link and the Wafer

To complete the installation, verify that the teaching wafer and link can communicate:

1. The teaching wafer operates from an internal rechargeable battery. Before using the teaching wafer for the first time, charge it for two hours. For information on checking the charge on the battery and the procedure for recharging, see [“Using the Rechargeable Battery,” on page 3.17.](#)

2. Remove the teaching wafer from the charging clean box and press the **ON OFF** button to turn on the teaching wafer.

The **On** light on the teaching wafer turns on.

3. Verify that the **Pair Status** lights on both the teaching wafer and link module are on. If either light is not on, your teaching wafer and link might not be paired with each other. To reset the pairing, see [“Changing the Pairing Between the Teaching Wafer and Link,” on page 3.19.](#)
4. Immediately after turning on the teaching wafer, the **Connection Status** lights on the teaching wafer and link will blink slowly. After a few seconds the teaching wafer and link will connect and both lights will be on and no longer blinking. If the lights continue to blink, see [“Monitoring the Wireless Connection to the Teaching Wafer,” on page 3.18.](#)
5. After starting the TeachView application (see [“Running the TeachView Application,” on page 2.7.](#)), you can verify the connection to the teaching wafer by comparing the serial number printed on the teaching wafer to the serial number shown in the About Your ATS Wafer dialog, which is available in the TeachView application by choosing the **Help > About your ATS Wafer** menu item.

That completes the installation of your ATS.

Registering Your Teaching Wafer for Calibration Service

To maintain optimum performance, every twelve months you should have your teaching wafer calibrated and the battery replaced. These services can be performed only at the factory.

To help you keep track of the next service date so you can schedule this service when it is convenient, register your WaferSense ATS teaching wafer with the factory. When you start the TeachView application (see [“Running the TeachView Application,” on page 2.7](#)), it prompts you to register your teaching wafer for calibration. You can also register your teaching wafer in any of the following ways:

- On the Internet: **www.CyberopticsSemi.com/ws_register.html**
- By phone: 800-366-9131 (US and Canada only)
- By faxing the *WaferSense ATS Calibration Registration* to: (503) 495-2201
- By sending an e-mail message containing the information specified on the *WaferSense ATS Calibration Registration* to: register@cyberoptics.com.

Running the TeachView Application

To start the TeachView application:

1. From the Windows **Start > All Programs** menu, choose **WaferSense ATS > TeachView**.

The TeachView application starts, as shown in [Figure 2.4](#). Initializing communications usually takes less than a second. For information on using TeachView, see [Chapter 3](#), “[Using Your ATS](#).” If you haven’t registered your teaching wafer, TeachView also displays the Calibration Registration dialog. To complete the registration, proceed to the next step.

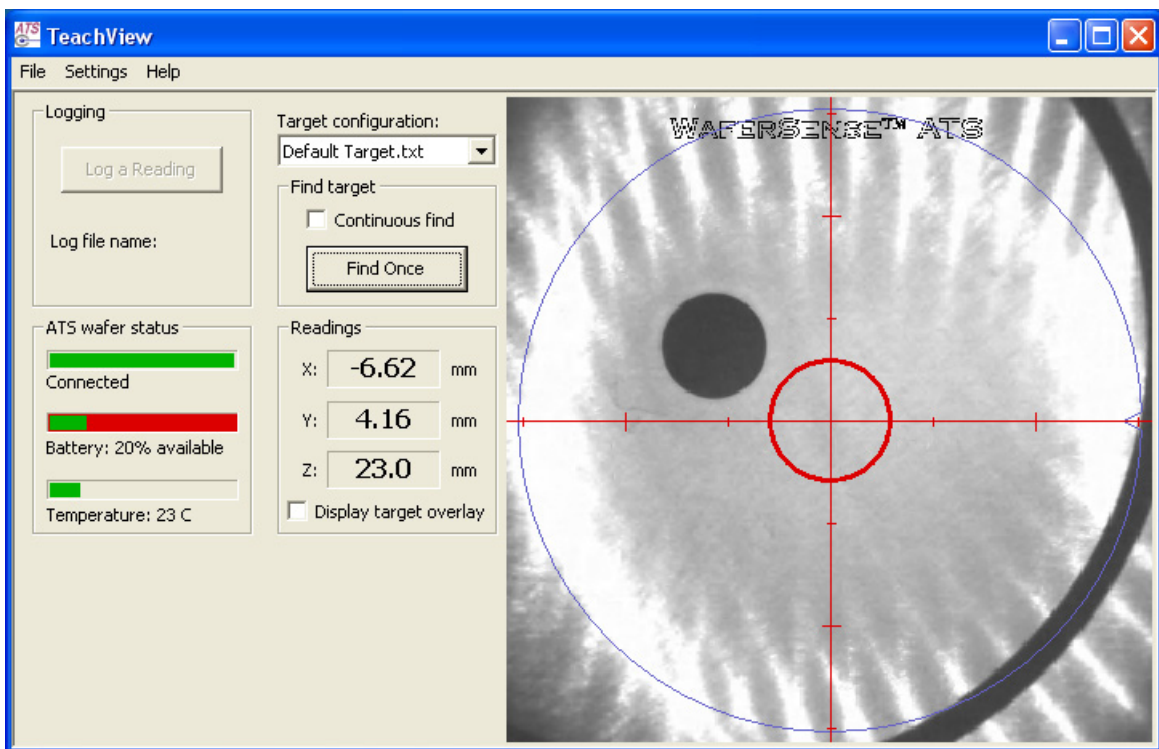


Figure 2.4: Starting the TeachView Application

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2. If TeachView displays the WaferSense ATS Calibration Registration dialog, as shown in [Figure 2.5](#), you haven't registered your teaching wafer. Follow the instructions in the dialog to complete the registration.

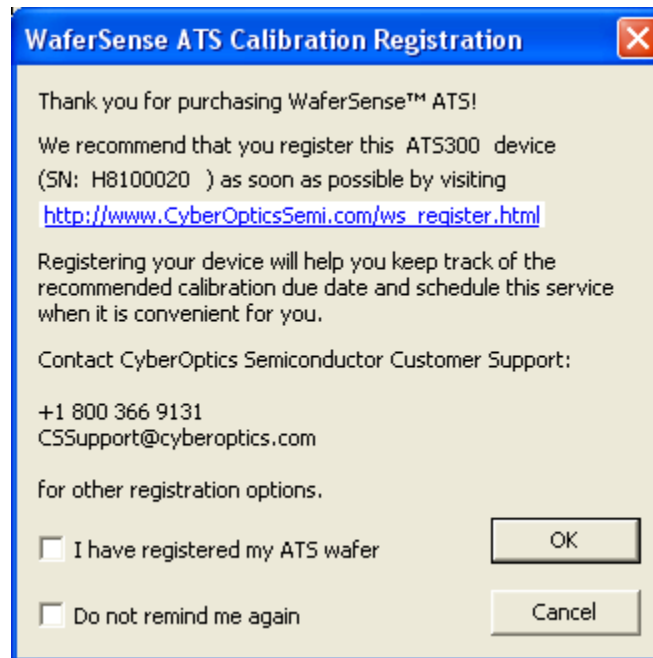


Figure 2.5: Calibration Registration Dialog

The TeachTarget application is described in [Chapter 4](#), “[Creating Target Configuration Files](#).”

Technical Support

CyberOptics Semiconductor offers free technical support to customers. If the ATS hardware or software appear to be malfunctioning, please contact us, and we'll be happy to assist you.

When you contact us, please make sure that you have the following information available:

- A detailed description of the problem you are having, including the exact text of any error messages and a list of steps to reproduce the problem.
- Information about your computer, including manufacturer, CPU type, version of Windows, and memory size.
- The version of the TeachView application. The software version is available in the TeachView application by choosing the **Help > About TeachView** menu item.

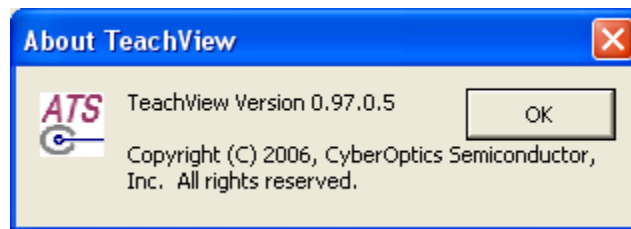


Figure 2.6: The About TeachView Dialog

If you are using TeachTarget, a similar dialog is available from the **Help > About TeachTarget** menu item.

- The serial number of your teaching wafer. The serial number of the teaching wafer is printed on a label on the top of the teaching wafer. The serial number is also available in the TeachView application by choosing the **Help > About your ATS Wafer** menu item.

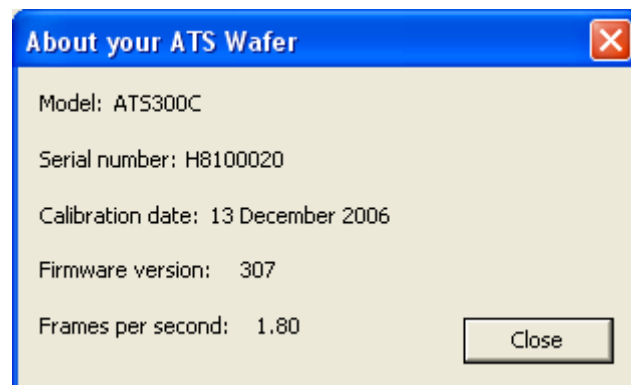


Figure 2.7: The About your ATS Wafer Dialog

Chapter 2. Installing Your ATS

Technical support is available Monday through Friday, 8:00 A.M. to 5:00 P.M. Pacific Time.

- Voice: (503) 495-2200
- Toll free: 800-366-9131 (US and Canada only)
- Fax: (503) 495-2201
- E-mail: CSsupport@cyberoptics.com
- Internet: [**www.CyberopticsSemi.com**](http://www.CyberopticsSemi.com)

Chapter 3

Using Your ATS

This chapter gives you instructions for performing the following tasks with the ATS:

- Using the ATS teaching wafer buttons and indicators
- Performing a basic target measurement
- Using the target overlay
- Using find once and continuous find
- Setting the target criteria for measurements
- Logging your readings
- Printing the TeachView window
- Monitoring the operating temperature
- Using the rechargeable battery
- Monitoring the connection between the teaching wafer and link module
- Changing the pairing between the teaching wafer and link module.
- Saving your settings

Using the ATS Teaching Wafer Buttons and Status Lights

ATS teaching wafers have two buttons:

- **ON OFF.** Turns the teaching wafer on and off.
- **NEW PAIR.** Changes the pairing between a teaching wafer and a link (see [“Changing the Pairing Between the Teaching Wafer and Link,” on page 3.19](#)).

ATS teaching wafers also have the following status lights:

- **On.** Glows red while the teaching wafer is turned on.
- **Charging.** Glows red when the teaching wafer is being charged in the charging case.
- **Charging Done.** Glows red when the battery has reached at least 90% of full charge.
- **Connection Status.** Glows red when the teaching wafer has established communication with the link. Blinks slowly while the teaching wafer is trying to establish a connection with the link.
- **Pair Status.** Glows red when the teaching wafer is paired with a link (see [“Changing the Pairing Between the Teaching Wafer and Link,” on page 3.19](#)).

Finding a Target

The camera in the teaching wafer captures live video from within the semiconductor process equipment. An image processor in the wafer reports the coordinates (X, Y, Z) of the teaching wafer in relation to a target on the equipment. When you tell ATS to find the target, the TeachView application displays the coordinates.

In the video image displayed in TeachView, the center of the field of view for the teaching wafer is indicated by red cross hairs that span the length and width of the video image (see [Figure 3.1](#)). A red circle is centered on the cross hairs and serves as a sight ring for aligning the target image. When the target is within the sight ring, the equipment is aligned within the specified tolerances. For more information on setting tolerances, see [“Setting the Target Criteria,”](#) on page 3.10.

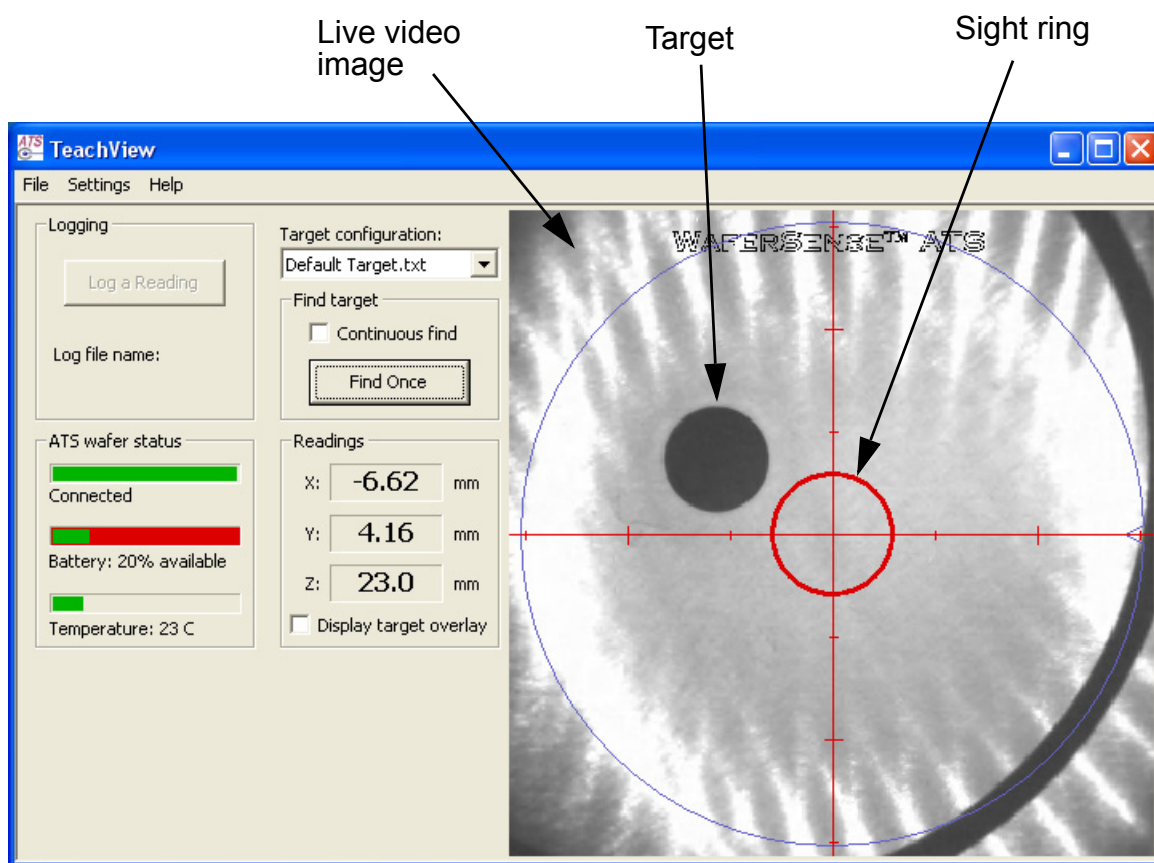


Figure 3.1: The TeachView Application

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To find a target:

1. Make sure the computer running the TeachView application is within the range of the link module, up to 30 ft (10 m).
2. Place the teaching wafer on the equipment you want to check. Align the teaching wafer so it matches the TeachView display by rotating the wafer until the WaferSense™ ATS logo is right-side up and level as you face the wafer, as shown in [Figure 3.2](#).

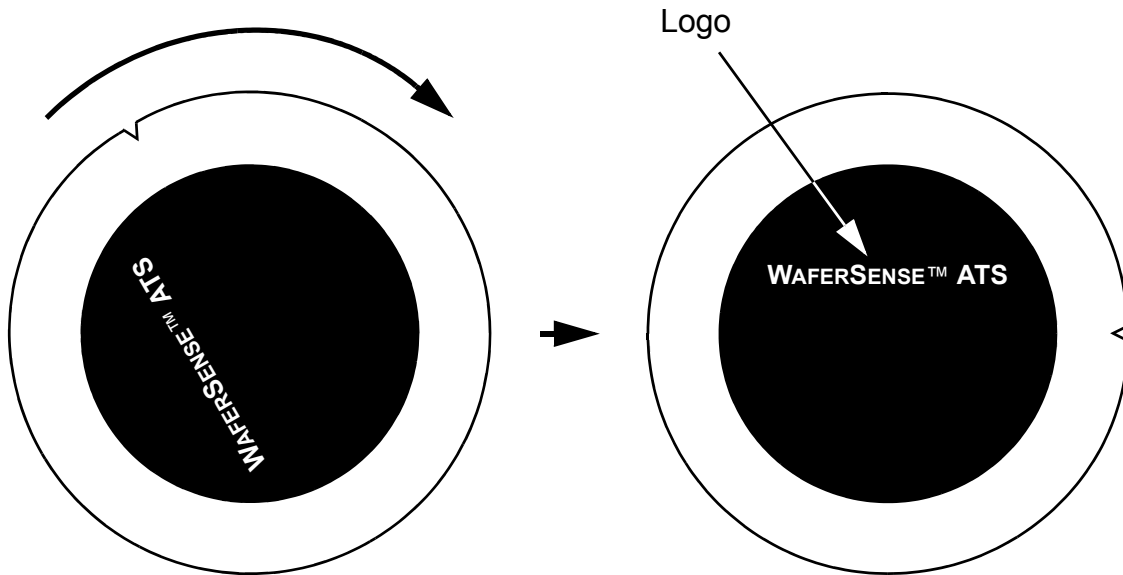


Figure 3.2: Aligning the Teaching Wafer

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- From the **Target configuration** list (see [Figure 3.3](#)), choose the appropriate target configuration file for the equipment you are working on. If the file isn't shown in the list, choose **Select**, which is always the last entry in the **Target configuration** list, or choose the menu item **File > Select Target Configuration File** to locate the file. If you don't choose a target configuration file, ATS can't search for the target, and the **Find Once** button and **Continuous find** box are disabled. For information on creating target configuration files, see [“Creating Target Configuration Files,” on page 4.1](#).

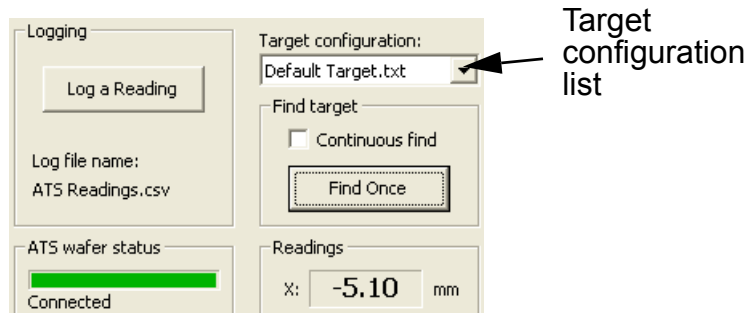


Figure 3.3: Target Configuration List

- Click **Find Once** (see [Figure 3.4](#)).

After a few seconds, the teaching wafer finds the target and sends the information to the TeachView application. TeachView displays the measurements in numeric readouts (see [Figure 3.4](#)).

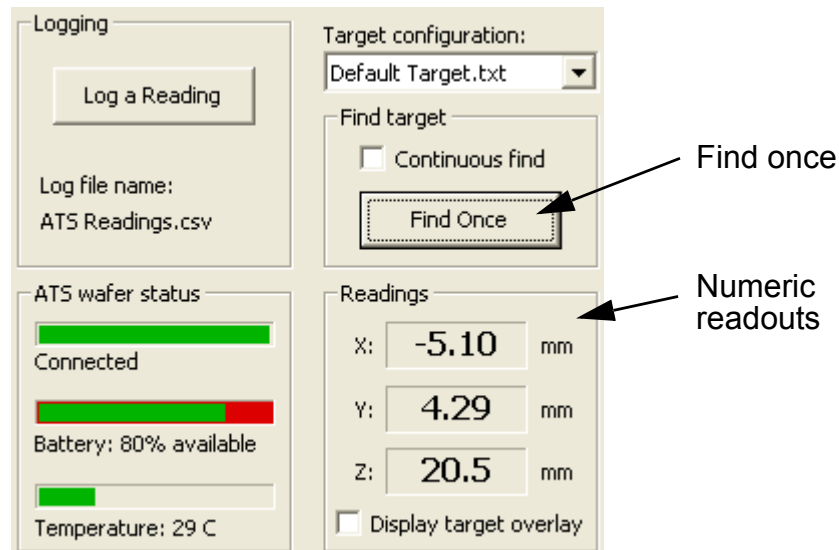


Figure 3.4: Numeric Readouts

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All measurements are in millimeters. Readings outside the working range of the teaching wafer are displayed as #####. If the readings display **None**, ATS was not successful in finding the target. This can be caused by the following:

- **Target too far off center.** The farther the target is initially from the center of the field of view of the teaching wafer, the harder it is for ATS to find the target. Move the teaching wafer so that the target appears closer to the sight ring and try finding the target again. If you are having trouble seeing the target in the video image, you can adjust the image by choosing the menu item **Settings > Optimize Lighting**.
- **Target criteria.** You might not have the target criteria set correctly. For more information, see [“Setting the Target Criteria,” on page 3.10](#). In particular, verify that the Z distance you have specified in the target criteria is within 1 mm of the Z distance used to create the target configuration file. The acceptable range for the Z distance is displayed in the Set Target Criteria dialog (see [Figure 3.7 on page 3.11](#)).
- **Wafer to target distance.** You might have the teaching wafer too close or too far from the target. The distance from the bottom of the teaching wafer to the target should be within 1 mm of the Z distance used to create the target configuration file. The acceptable range for the Z distance is displayed in the Set Target Criteria dialog (see [Figure 3.7 on page 3.11](#)).
- **Target configuration file.** You chose the wrong target configuration file or the target configuration file is not correct. Verify that you are using the correct file. For more information on target configuration files, see [“Creating Target Configuration Files,” on page 4.1](#).

You can use these X, Y, and Z measurements to adjust the equipment to center the target in the sight ring.

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5. Adjust the equipment and click **Find Once** again. Repeat this process until the target is centered in the sight ring, and the X and Y values are zero or close enough (see [Figure 3.5](#)).

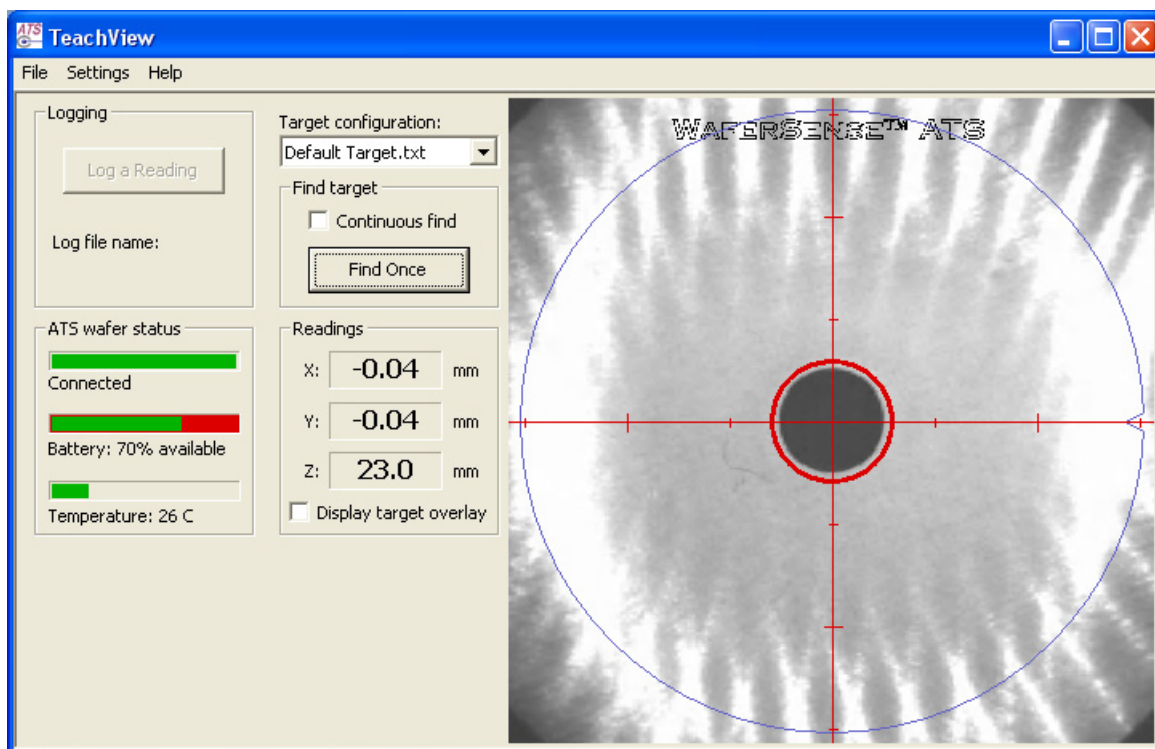


Figure 3.5: Target Centered in the Sight Ring

You can resize the TeachView window to make the video image larger or smaller. The numeric readouts and other controls don't change size when you change the size of the TeachView window.

For information on the accuracy of the readings, see [“Range and Accuracy,” on page 6.1](#).

Using the Target Overlay

A target overlay feature lets you verify that the ATS has correctly identified the target.

To activate the target overlay:

- Check **Display target overlay** below the numeric readouts. The target overlay appears as a circle with cross hairs, as shown in [Figure 3.6](#).

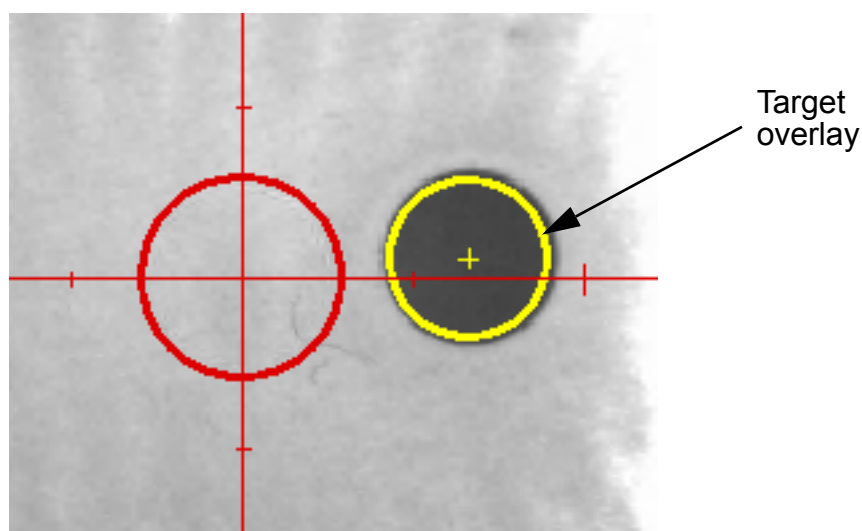


Figure 3.6: Target Overlay

The target overlay should be centered on the image of the target, as shown in [Figure 3.6](#). The target overlay changes from yellow to green when the target is centered in the sight ring to within the specified tolerances and the Z target distance is within tolerance (see [“Setting the Target Criteria,” on page 3.10](#)). After you instruct the ATS to find the target, if the overlay is not centered on the target, the ATS is not correctly recognizing the target. If the target doesn't overlay the feature in the image, check the following:

- **Video stopped.** Make sure the wafer is still sending live video. You can do this by moving the wafer a small amount and watching the video image. If the video isn't tracking the movement, turn off the wafer and then turn it back on.
- **Target too far off center.** The farther the target is initially from the center of the field of view of the teaching wafer, the harder it is for ATS to find the target. Move the teaching wafer so that the target appears closer to the sight ring and try finding the target again. If you are having trouble seeing the target in the video image, you can adjust the image by choosing the menu item **Settings > Optimize Lighting**.

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- **Target criteria.** You might not have the target criteria set correctly. For more information, see [“Setting the Target Criteria,” on page 3.10](#). In particular, verify that the Z distance you have specified in the target criteria is within 1 mm of the Z distance used to create the target configuration file. The acceptable range for the Z distance is displayed in the Set Target Criteria dialog (see [Figure 3.7 on page 3.11](#)).
- **Wafer to target distance.** You might have the teaching wafer too close or too far from the target. The distance from the bottom of the teaching wafer to the target should be within 1 mm of the Z distance used to create the target configuration file. The acceptable range for the Z distance is displayed in the Set Target Criteria dialog (see [Figure 3.7 on page 3.11](#)).
- **Target configuration file.** You chose the wrong target configuration file or the target configuration file is not correct. Verify that you are using the correct file.

Using Find Once and Continuous Find

You can instruct the teaching wafer to take a single reading of the target position or to make continuous readings.

Note that whether you are taking a single reading or continuous readings, the video image is updated continuously.

Taking a Single Reading

As described in [“Finding a Target,” on page 3.3](#), you can use the **Find Once** button to have the ATS make a single measurement of the target coordinates. After the measurement is completed and the results are displayed, you can adjust the equipment as needed.

Note

In find once mode, when you make adjustments that cause the target to move, the coordinates displayed in the TeachView window no longer reflect the correct position of the target. After adjusting the position of the wafer, always click **Find Once** again to update the readings.

Taking Continuous Readings

Rather than taking a single measurement, you can have the teaching wafer take continuous measurements. When the ATS is in continuous find mode, it sends readings to the TeachView application every two to three seconds and the readouts are updated each time new readings are received.

To activate continuous find:

- Check the **Continuous find** box located just above the **Find Once** button.

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While the **Continuous find** box is checked, the **Find Once** button is disabled. To cancel continuous find, uncheck the box.

Setting the Target Criteria

When you have successfully centered the target within the sight ring, the X and Y coordinates will both ideally be zero. In practice, you might not need to have them exactly zero, just close enough. You can specify your desired tolerances for the target measurement. As long as you position the target within the sight ring, you know that it is centered within your specified tolerances.

In addition to specifying tolerances for the X and Y measurements, you can specify a target value and tolerance for the Z coordinate. The specified range for Z is 6.4 mm – 45 mm (0.25" – 1.8"). The target configuration file that TeachView uses to recognize a given target is created from an image of the target that was captured at a specific Z value (for more information, see [“Creating Target Configuration Files,” on page 4.1](#)). When you use a particular target configuration file, the teaching wafer will be able to recognize the target more successfully if the wafer is at the same Z value that was used to create the target configuration file. Specifying a target Z value and tolerance makes it easy to tell when the teaching wafer is at the proper height.

You can set separate tolerance values for the X and Y measurements, or you can specify a single tolerance value for both measurements.

To specify the target criteria:

1. Choose the menu item **Settings > Set Target Criteria**.

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The Set Target Criteria dialog is displayed, as shown in [Figure 3.7](#).

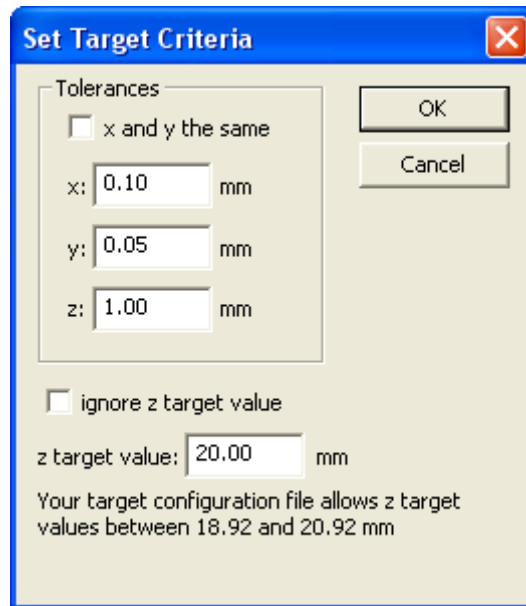


Figure 3.7: Set Target Criteria Dialog

2. To specify one tolerance for both X and Y measurements, check the box for **x and y the same**. To specify the tolerance separately for each, uncheck the box. When you check the box, the dialog changes to display only one set of tolerance criteria for both X and Y.
3. Fill in the tolerances you want to specify. Tolerances must be entered as positive numbers, must be in millimeters, and must be 0.01 mm to 0.5 mm for X and Y, and 0.1 mm to 1.0 mm for Z.
4. If you don't want to set a target value for the Z measurement, check the box **ignore z target value**. Otherwise, uncheck the box and fill in your desired value for **z target value**. The value must be within two millimeters of the value specified in the target configuration file (the range, $Z \pm 1$ mm, is shown at the bottom of the dialog).
5. Click **OK**.

Logging Your Readings

TeachView can keep a record of your activities as you use the teaching wafer to check various pieces of equipment. TeachView keeps the record in a log file. You can specify the log file path (see [“Changing the Log File,” on page 3.15](#)). The log file contains the following information for each entry:

- **Date and Time.** The date and time of the log file entry.
- **Target configuration file.** Path name for the currently selected target configuration file (see [“Finding a Target,” on page 3.3](#)).
- **X, Y, and Z readings.** Measurements for the X, Y, and Z coordinates of the target.
- **X, Y, and Z Tolerances.** The user-specified tolerance for each coordinate measurement (see [“Setting the Target Criteria,” on page 3.10](#)).
- **Z target value.** The user-specified target value for the Z measurement, the height of the teaching wafer above the target (see [“Setting the Target Criteria,” on page 3.10](#)).
- **Tolerance met.** Whether the coordinate measurements were within tolerances.
- **Z target ignored.** Whether the Z value is ignored in deciding if the current readings are within tolerance (see [“Setting the Target Criteria,” on page 3.10](#)).
- **Temperature.** The current operating temperature of the teaching wafer in °C (see [“Monitoring the Operating Temperature,” on page 3.16](#)).
- **Battery.** The percentage of time remaining before the battery must be recharged (see [“Using the Rechargeable Battery,” on page 3.17](#)).
- **Serial number.** The serial number of the teaching wafer.
- **Operator, Tool, Station, and Comment.** Text fields you can use to record your own information with each log entry (see [“Including User-Specified Information in the Log File,” on page 3.14](#)).

The remainder of this section tells you how to:

- Log a reading
- Include additional information in a log entry: operator, tool, station, and comment
- Change the pathname for the log file
- Display readings from a log file

Logging a Reading

TeachView posts entries to the log file on your command.

To post an entry to the log file:

- In the main TeachView window, click **Log a Reading** (see [Figure 3.8](#)).

TeachView immediately writes a log entry each time you click the button.

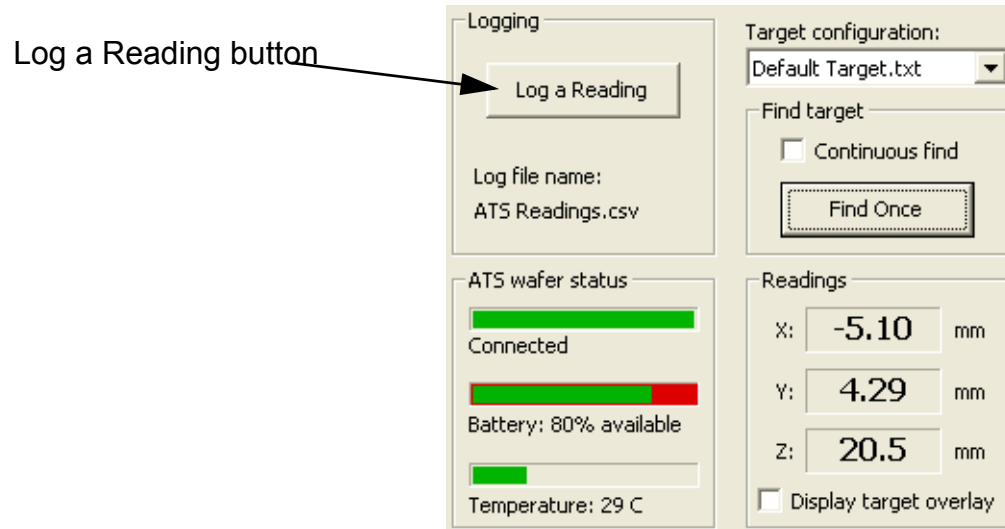


Figure 3.8: Logging a Reading

Including User-Specified Information in the Log File

Operator, **Tool**, **Station**, and **Comment** are text fields you can use to record your own information with each log entry. You can fill in any text information you want in these fields.

To include user-specified information for logging:

1. Choose the **Settings > Set Station Information** menu item.

The Set Station Information dialog is displayed, as shown in [Figure 3.9](#).

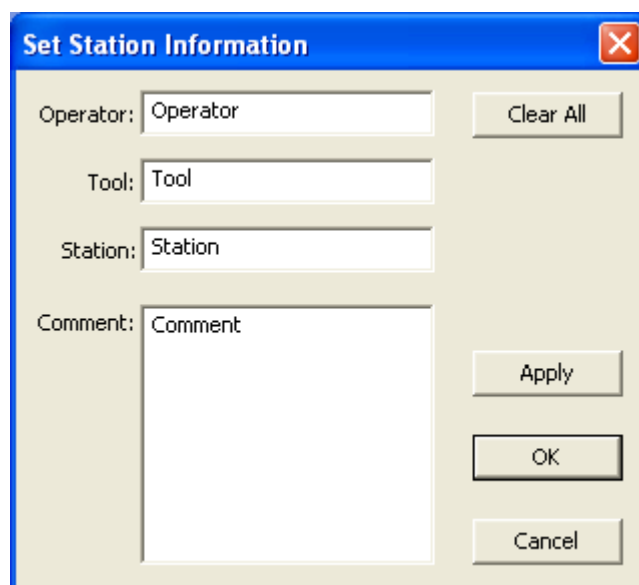


Figure 3.9: Set Station Information Dialog

2. Type your text into the **Operator**, **Tool**, **Station**, and **Comment** text fields.
3. Click **Apply** to accept the changes without closing the dialog. To accept the changes and close the dialog, click **OK** instead.

You can leave the Set Station Information dialog open while using TeachView (drag it off to the side, so it doesn't cover the TeachView window). Doing so makes it easy to change the **Comment** or other fields each time you log a reading, or as needed. Be sure to click **Apply** after you finish making changes, though, or TeachView won't use the latest changes for the next log entry.

You can change or delete this information at any time for future log entries. To quickly clear all of the fields, click **Clear All**.

Changing the Log File

By default, TeachView writes log entries to the file My Documents\ATS Files\ATS Readings.csv. If you prefer, you can specify a different log file. The name of the current log file is displayed below the **Log a Reading** button (see [Figure 3.8 on page 3.13](#)).

To change the log file:

1. Choose the **File > Select Log File** menu item.
2. In the ATS Log File dialog, specify the folder and file name for the log file, and click **Save**.

Displaying Readings from a Log File

Log files are saved in a comma-separated-values (CSV) text format. The file is read-only to avoid accidental data corruption. Files in CSV text format are easy to import into spreadsheet and word processing programs.

Printing the TeachView Window

You can print an image of the TeachView window to have a graphical record of the session.

To print an image of the TeachView window:

1. Choose **File > Print**.
2. In the Print dialog, click **OK**.

You can also select a printer other than the default and change the printer setup, or see a preview of what TeachView will print:

- To select a different printer, change the paper selection or print orientation, or set printer properties, choose the **File > Print Setup** menu item.
- To see a preview of what TeachView will print, choose the **File > Print Preview** menu item.

Monitoring the Operating Temperature

The operating range for the teaching wafer to achieve the specified accuracy for readings is 20 °C to 50 °C. The teaching wafer can withstand exposure to 120 °C (5 minutes or less) if not in direct contact with the heating element. The **Temperature** monitor in the **ATS wafer status** area of the TeachView window (see [Figure 3.10](#)) shows the current operating temperature of the teaching wafer with a numeric readout and a bar graphic.

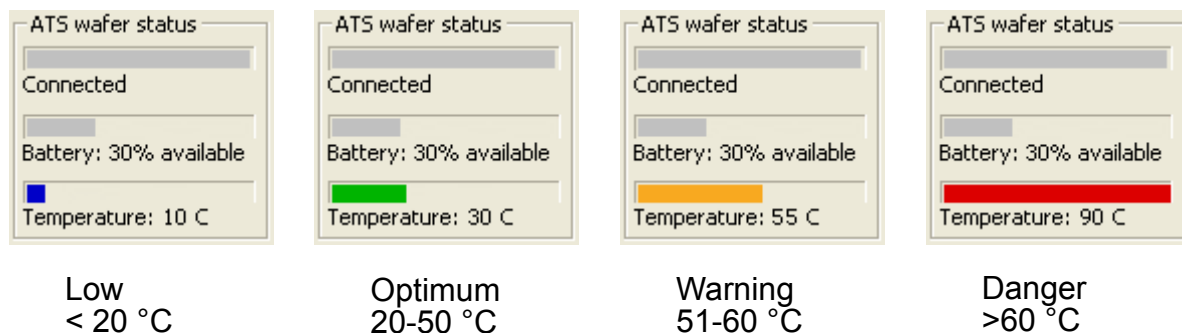


Figure 3.10: Temperature Monitoring Gauge

The temperature bar changes color to indicate where the current temperature is relative to the accurate operating range:

- **Blue.** Less than 20 °C; the teaching wafer is operating below the range where it produces accurate readings.
- **Green.** 20 °C to 50 °C; the teaching wafer is operating in its optimum temperature range, where it produces readings meeting the specified accuracy.
- **Orange.** 51 °C to 60 °C; the teaching wafer is operating above the range where it produces the most accurate readings, but not so hot that the teaching wafer will be damaged.
- **Red.** Greater than 60 °C; the teaching wafer is operating at a temperature so high that it might be damaged.

Using the Rechargeable Battery

The teaching wafer operates from an internal rechargeable battery. From a full charge, the battery provides about two hours of continuous use. Before using your teaching wafer for the first time, charge it for two hours.

The battery can be recharged about 500 times before the charge life starts to degrade significantly. The battery is not user replaceable. For information on replacing the battery, see [“Annual Factory Calibration and Battery Replacement,” on page 5.2.](#)

Battery performance degrades at temperatures outside the optimum operating temperature range: 20 °C - 50 °C.

Monitoring the Battery Level

TeachView receives frequent updates from the teaching wafer on the state of the teaching wafer's battery. The **Battery** indicator in the **ATS wafer status** area of the TeachView window shows the approximate percentage of operating time remaining before you must charge the battery.

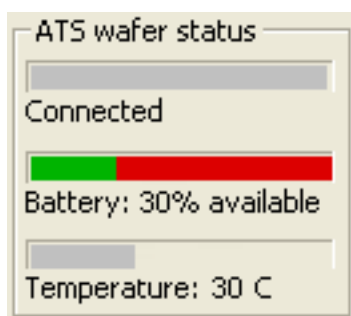


Figure 3.11: Battery Monitor

Charging the Battery

To charge the teaching wafer's battery:

1. Use only the battery charger supplied with your gapping wafer. Using a different battery charger might damage your gapping wafer or create a safety hazard.
2. Do not charge the gapping wafer if its internal temperature is higher than 45 °C. Charging the gapping wafer at a temperature higher than 45 °C might damage your gapping wafer or create a safety hazard.
3. Place the teaching wafer in the charging clean box. Rotate the wafer until the WaferSense ATS logo is right side up and approximately level when the hinged edge of the box is away from you. Close the lid.

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4. Plug the charger line adapter into a 100 VAC to 240 VAC supply and plug the other end into the charging clean box.

The **Charging** light is on while the teaching wafer is charging. If the **Charging** light does not turn on, make sure the lid of the box is closed completely and the charging pins in the charging clean box are making electrical contact with the teaching wafer.

When you first start charging the wafer, it turns on. After about 10 minutes, if TeachView and TeachTarget aren't running, the wafer will turn off and continue to charge.

5. Charge the teaching wafer until the **Charging Done** light turns on or until you need to use the teaching wafer (you don't need to wait until the teaching wafer is fully charged).

Fully charging the battery takes about two hours. Charging for one hour charges the battery to about 80% of its capacity. You can leave the teaching wafer in the charging case when not in use; the battery won't overcharge.

Monitoring the Wireless Connection to the Teaching Wafer

The TeachView application communicates with the teaching wafer by using a Bluetooth wireless link. The wireless link has a range of up to 30 ft (10 m).

The **Connection** indicator in the **ATS wafer status** area of the TeachView window shows the quality of the wireless connection between the teaching wafer and the link module. The connection quality is indicated by the color of the bar and the wording below the bar (see [Figure 3.12](#)):

- **Green - Connected.** The connection between the link and teaching wafer is good. With a good connection, the teaching wafer is sending the maximum number of readings per second to the link module (about one reading every two to three seconds).
- **Yellow - Poor connection.** There is some interference or other problem with the signal that is preventing the link and teaching wafer from communicating at their maximum rate. When the indicator is yellow, the readings are still accurate but aren't being updated as frequently.

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- **Red - No connection.** Indicates that there is no connection between the teaching wafer and link module. The values in the display do not update when the indicator is red.

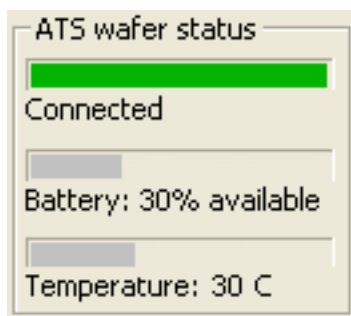


Figure 3.12: Wireless Connection Monitor

The Bluetooth wireless link technology used in the ATS is a low-power technology that operates in the 2.4 GHz radio frequency band. This unlicensed band is also used by many other types of devices, such as cordless phones and microwave ovens. Another 2.4 GHz device operating in close proximity could interfere with the ATS system. When this happens, separating the devices by at least 6 ft (2 m) usually solves the problem.

Other factors can also affect the wireless link, such as the distance between the teaching wafer and link, and obstacles between the teaching wafer and link that block the signal. If TeachView indicates that the connection isn't good, try moving the wireless link module a few feet closer to the teaching wafer.

After turning off the teaching wafer, the Connection indicator might not change to red for a few seconds.

Changing the Pairing Between the Teaching Wafer and Link

Each teaching wafer is paired with a specific link module at the factory and will operate with only that particular link module. However, you can change this pairing, so that you can use your teaching wafer with a different link module, or vice versa.

To pair a teaching wafer and link module:

1. If you are changing the pairing of a teaching wafer that is already paired with a link module, first unplug the currently paired link module. You can't pair a teaching wafer with a new link module while the currently paired link module is powered on.
2. Make sure the **Power** light is illuminated on the link module you want to pair, and make sure the **On** light is illuminated on the teaching wafer.

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3. On the teaching wafer, press and hold the **NEW PAIR** button until the **Pair Status** and **Connection Status** lights start to blink rapidly (about four times per second).
4. On the link module, press and hold the **NEW PAIR** button until the **Pair Status** and **Connection Status** lights start to blink rapidly (about four times per second).

The **Pair Status** and **Connection Status** lights will continue to blink until the teaching wafer and link have established a new pairing, after which the lights will be on and no longer blinking.

Saving Your Settings

Each time you exit the TeachView application, it saves your current settings for the log file; X, Y, and Z tolerances; Z target value; target overlay; and find state (continuous or find once) in the Windows registry. The next time you start TeachView, it restores those saved settings. You can also tell TeachView to save your settings to a file you specify, and you can have TeachView read those settings back at any time. This lets you have several different configurations for TeachView and be able to switch between them easily, without having to reenter the settings.

To save your settings in a file you specify:

1. Choose the **File > Save Settings As** menu item.
2. In the ATS Settings File dialog, specify the directory and file name and click **Save**.

TeachView saves your settings, and the file you specified becomes the current settings file.

To save your settings in the current settings file:

- Choose the **File > Save Settings** menu item.

Each time you start TeachView, the application automatically reads in the most recent settings from the Windows registry, including the last settings file you specified, if any.

Loading Settings from a File

To load settings from a file:

1. Choose the **File > Open Settings** menu item.
2. In the ATS Settings File dialog, specify the directory and file name and click **Open**.

TeachView reads the settings from the specified file and applies the settings. These settings are also written to the Windows registry and will be loaded the next time you start the TeachView application.

Chapter 4

Creating Target Configuration Files

ATS helps you adjust wafer handling equipment so that the equipment can pick up a wafer or put down a wafer in exactly the right position. To determine the correct position, ATS uses a *target*, which is a round physical feature inside the equipment that ATS can recognize and precisely locate. To recognize a target, ATS requires a target configuration file. A target configuration file must contain information that is very specific to a particular target. The two key pieces of information ATS needs are the diameter of the target and the distance from the wafer to the target. Of the two, specifying an accurate target diameter is the most critical. If two pieces of equipment have identical targets and wafer-to-target distances, you can use the same target configuration file for both; otherwise, you need to create separate target configuration files. The TeachTarget application is designed specifically for the task of creating target configuration files.

Choosing a Target

Before you can create a new target configuration file, you need to decide which feature of the equipment to use for the target. Look for a hole or similar round feature that is located in the center of the equipment. A feature with a diameter of a few millimeters up to a few centimeters works best. A target that fills between 1/8 to 1/3 of the view generally gives better results. The target must be small enough that the entire target is visible in the video image in TeachTarget.

When you use TeachTarget, if the target you choose is too small, the application will ask you to identify a secondary target. The secondary target must be concentric with the primary target. For example, if a piece of equipment has a 4-mm hole and 30-mm ring, you could specify the 4-mm hole as the primary target; if TeachTarget requests a secondary target, you would specify the 30-mm ring for the secondary target. If your equipment doesn't have a feature that could be used as a secondary target, TeachTarget will just do the best it can using the primary target.

Measuring the Target

The TeachTarget application will ask for two critical target measurements:

- **Target diameter.** The diameter of the target in millimeters. This is the most critical measurement and should be accurate to 0.01 mm.
- **Target distance.** The distance (Z), in millimeters, from the bottom of the teaching wafer to the target. This measurement should be accurate to 0.5 mm.

More accurate you can make these readings give better results, so make them as accurate as you reasonably can.

Running TeachTarget

To create a target configuration file:

1. Choose the feature of the equipment you will use for the target (see [“Choosing a Target,” on page 4.1](#)).
2. Get the target measurements (see [“Measuring the Target,” on page 4.2](#)).
3. Place the teaching wafer on the equipment. Align the teaching wafer so it matches the TeachTarget display by rotating the wafer until the WaferSense™ ATS logo is right-side up and level as you face the wafer, as shown in [Figure 4.1](#).

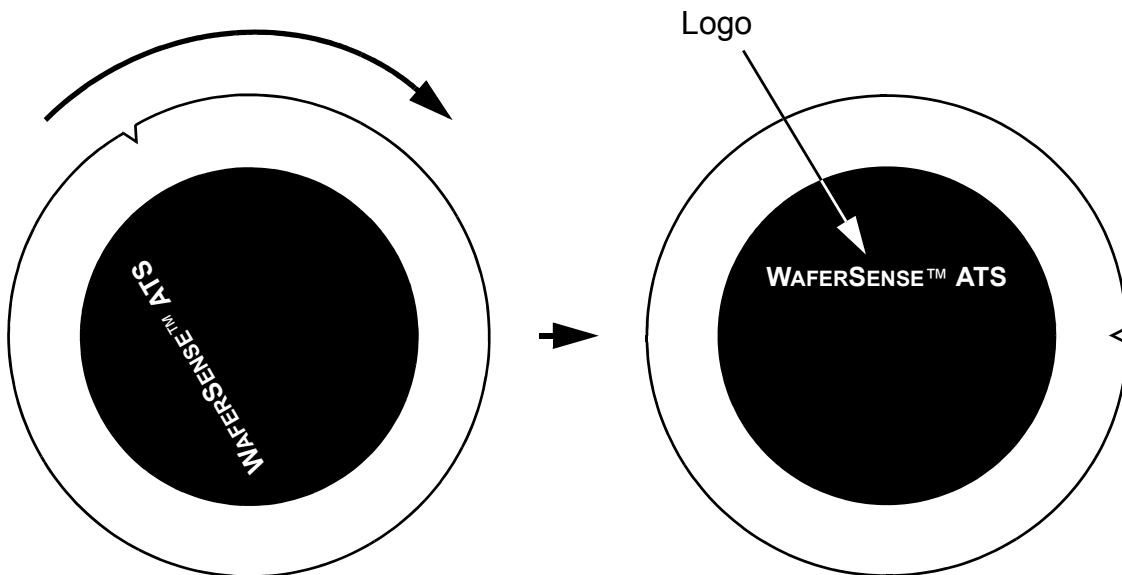


Figure 4.1: Aligning the Teaching Wafer

Chapter 4. Creating Target Configuration Files

4. If TeachView is running on the computer, exit the application. At any given time, only one application can communicate with the teaching wafer.
5. From the Windows **Start > All Programs** menu, choose **WaferSense ATS > TeachTarget**.
6. Make sure the computer running the TeachTarget application is within the range of the link module, about 30 ft (10 m).
7. Resize the TeachTarget window until the target feature in the video image is easy to see. Use the **DARKER** and **LIGHTER** buttons in TeachTarget to adjust the image so that you can distinguish the target from the background. This adjustment is only for your convenience; it doesn't affect the creation of the target configuration file.
8. **Step 1, Position the Wafer.** Move the teaching wafer until the red cross hairs are centered on the target, as shown in [Figure 4.2](#). When the cross hairs are centered, click **Next**.

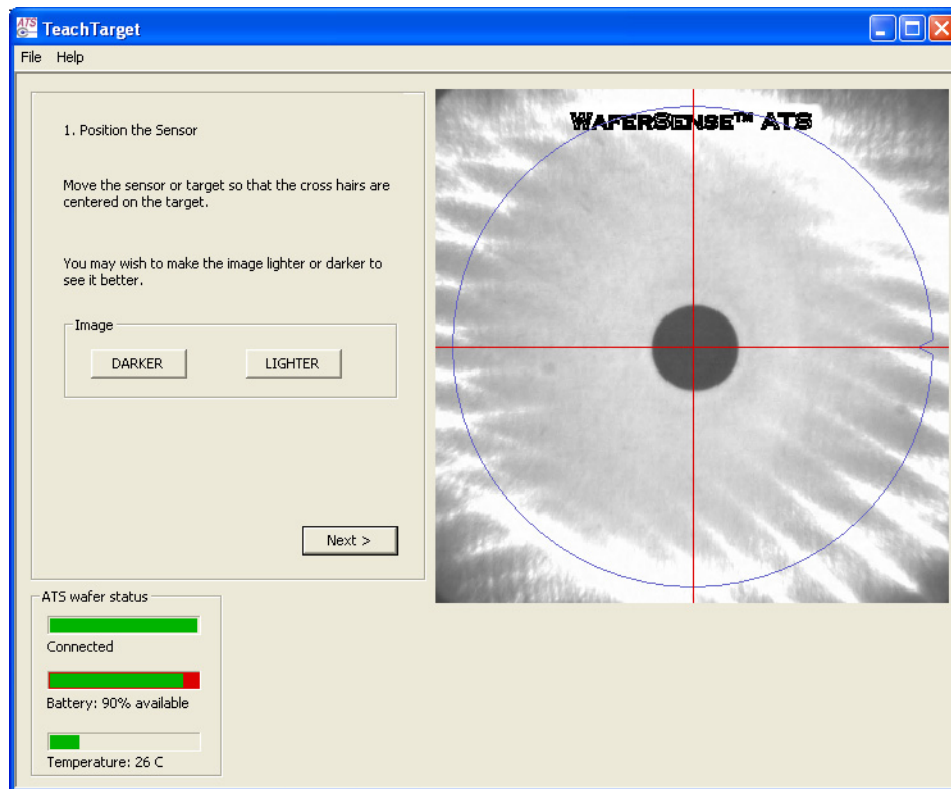


Figure 4.2: Step 1. Position the Wafer

Chapter 4. Creating Target Configuration Files

9. **Step 2, Optimize Lighting.** TeachTarget performs this step all by itself. When **Optimization complete** is displayed below the indicator bar (see [Figure 4.3](#)), click **Next**.

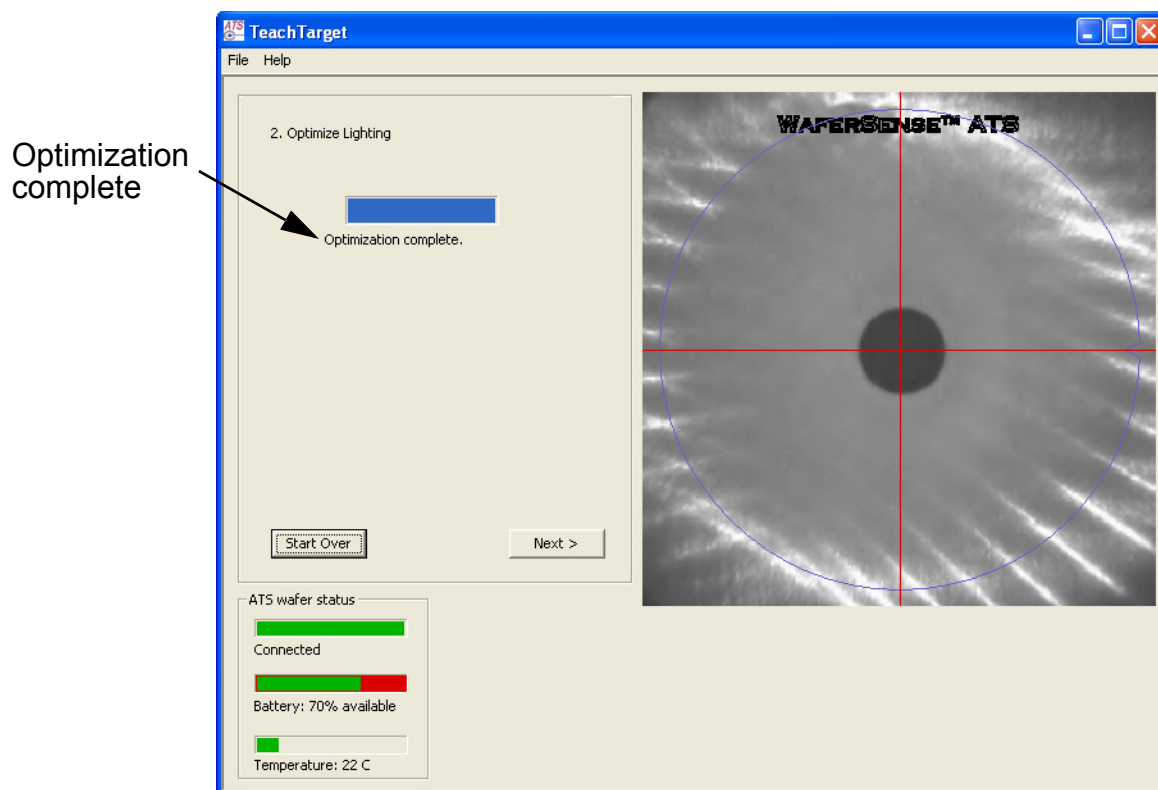


Figure 4.3: Step 2. Optimize Lighting

Chapter 4. Creating Target Configuration Files

10. **Step 3, Acquiring Image.** TeachTarget performs this step all by itself. While the image is being acquired, no video image is displayed. When the step is complete, the video image appears and TeachTarget displays **Image retrieval complete** below the indicator bar (see [Figure 4.4](#)). Note that from this point on, the image displayed in TeachTarget is the captured image, rather than live video. When you are ready to proceed, click **Next**.

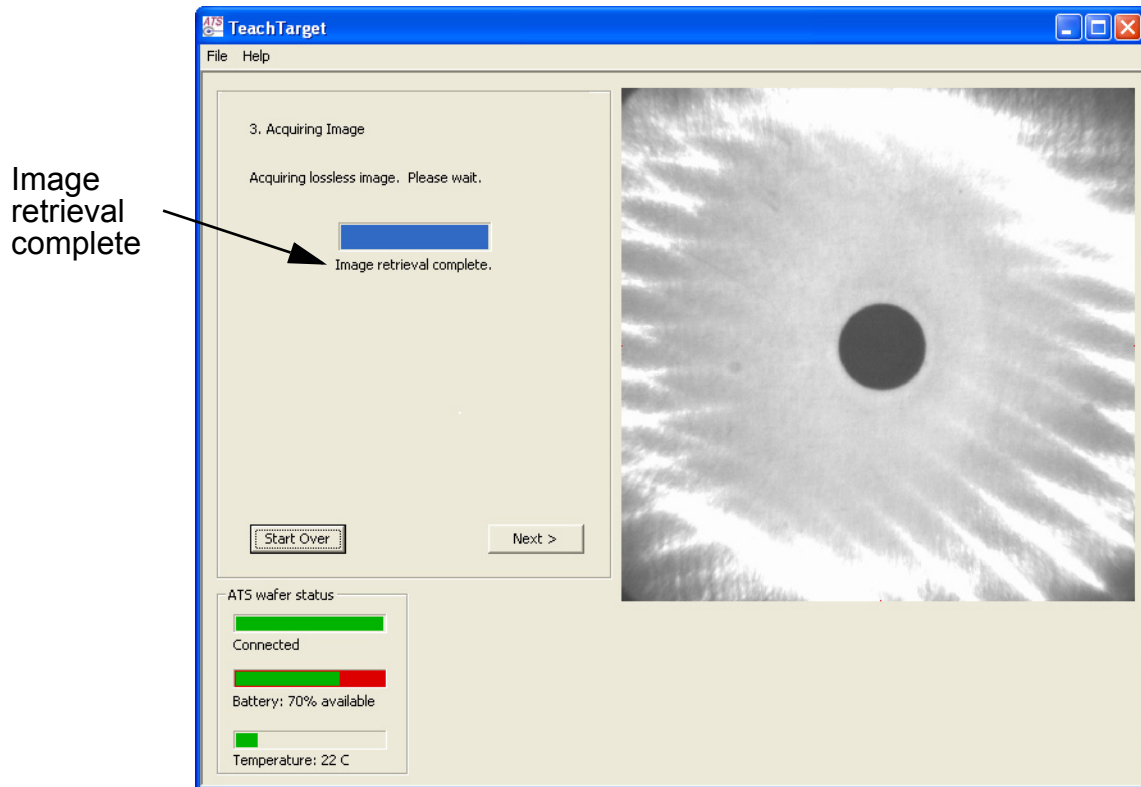


Figure 4.4: Step 3. Acquiring Image

Chapter 4. Creating Target Configuration Files

11. **Step 4, Target Parameters.** Enter the diameter of the target and the distance from the bottom of the teaching wafer to the target (Z distance). For more information on these values, see [“Measuring the Target,” on page 4.2](#). After entering the values, click **Next**.
12. If the image of the target is too small for good recognition (fewer than 80 pixels in diameter), TeachTarget asks you to identify a possible secondary target (for more information on secondary targets, see [“Choosing a Target,” on page 4.1](#)). If you have a feature that you can use for a secondary target, fill in the diameter of the target feature in the **Secondary target** area. If the equipment doesn't have a secondary target feature, fill in zero, and TeachTarget will use the primary target. After entering the secondary target value, click **Next**.

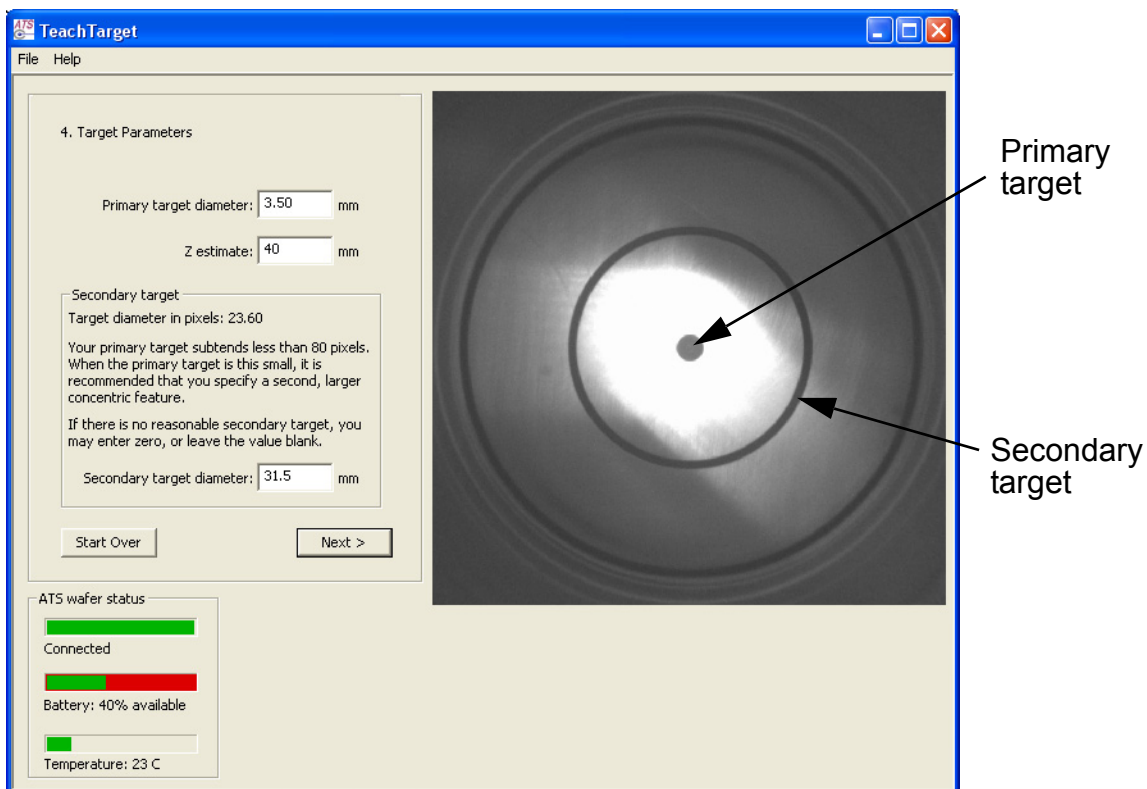


Figure 4.5: Step 4. Secondary Target Parameter

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13. **Step 5, Overlay Alignment.** For this step, you'll find it helpful to have a very large video image, so resize the TeachTarget window to make the video image as large as possible. TeachTarget adds two concentric red overlay rings to the captured image of the target (see [Figure 4.6](#)). If you identified a secondary target in the previous step, TeachTarget adds the red rings to the secondary target, as shown in [Figure 4.7 on page 4.8](#).
14. If the rings aren't centered on the target, use the **Ring position** buttons to center them.
15. Use the **GROW** and **SHRINK** buttons to adjust the size of the rings until they just enclose the edge of the target feature (see [Figure 4.6](#)). For a secondary, ring-shaped target, choose either the target's inner edge or outer edge to enclose with the red rings (see [Figure 4.7 on page 4.8](#)).

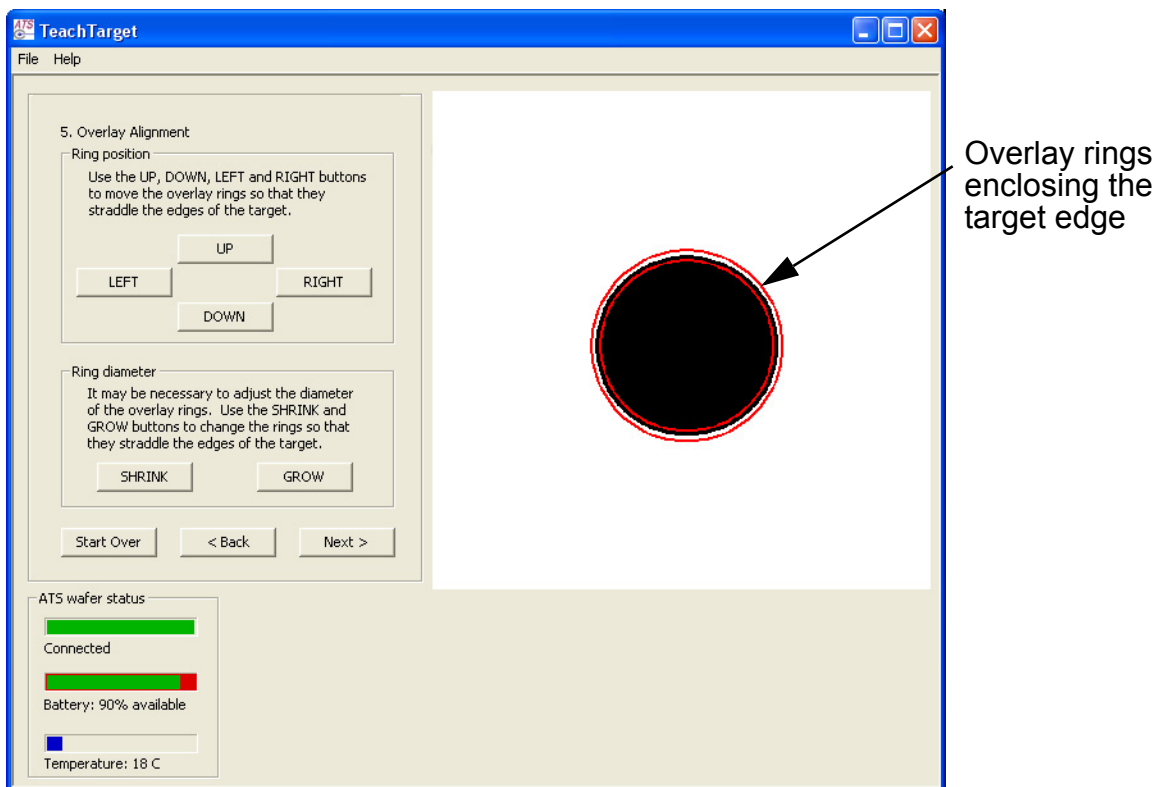


Figure 4.6: Step 5. Overlay Alignment, Primary Target

Chapter 4. Creating Target Configuration Files

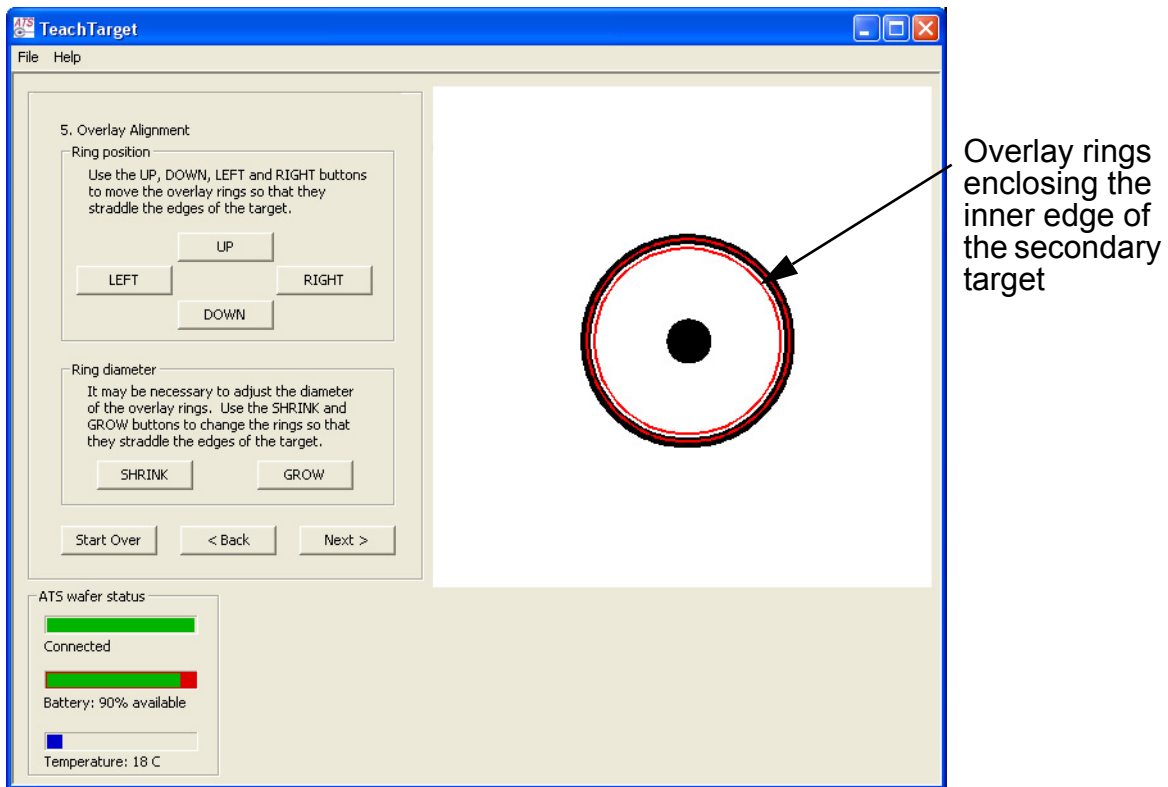


Figure 4.7: Step 5. Overlay Alignment, Secondary Target

16. When you have the rings aligned on the target, click **Next**.

Chapter 4. Creating Target Configuration Files

17. **Step 6, Generating Target Parameters.** TeachTarget immediately begins generating the parameters for the target configuration file (see [Figure 4.8](#)). When the parameter generation is complete, click **Save Target File**, fill in a name for the file, and click **Save**. By default, target configuration files are saved in c:\Documents and Settings\All Users\Application Data\CyberOptics Semiconductor\ATS\Target Files\.

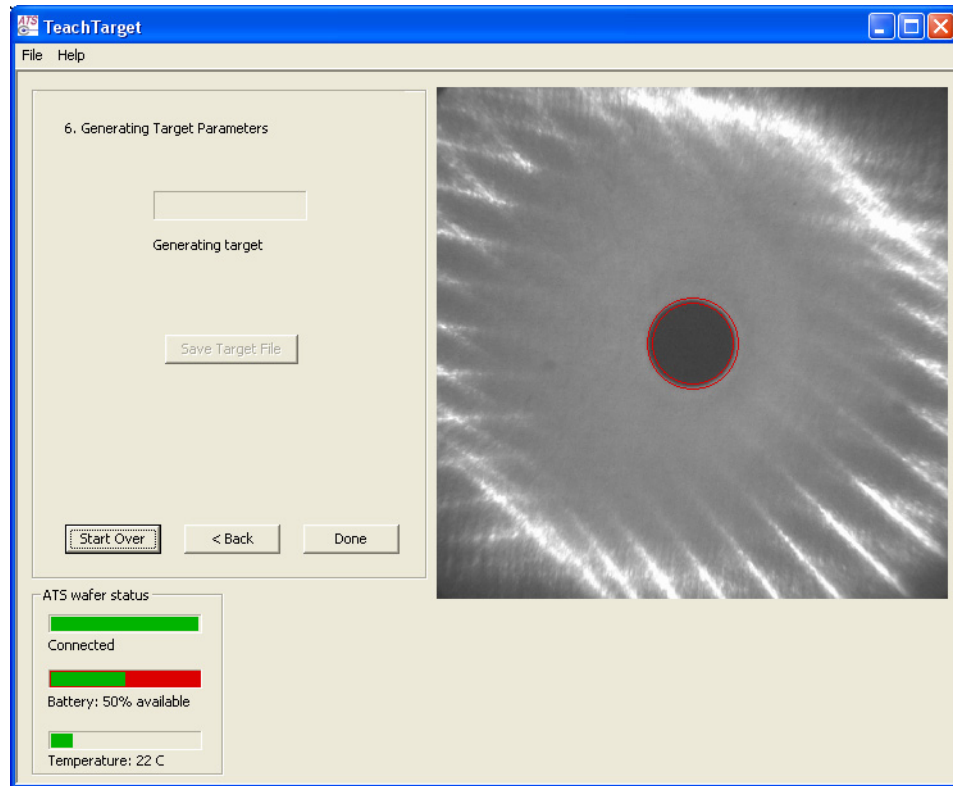


Figure 4.8: Step 6. Generating Target Parameters

18. When you have finished saving the file, click **Done**. TeachTarget exits.

The target configuration file you just created is ready to use. Be sure to click **Done** to exit TeachTarget, or use the menu **File > Exit**, before running TeachView. Only one application at a time can communicate with the teaching wafer.

Chapter 5

Maintaining Your ATS

This chapter discusses the following:

- Annual factory calibration and battery replacement
- Battery use and disposal
- Updating your ATS wafer firmware

Warning

The edges of the ATS teaching wafer are thin. It may be possible to sustain an injury from these edges if the teaching wafer is not handled with proper care.

Warning

Protection afforded by compliance to EN61010-1 (2001) may be impaired if the equipment is not used as specified.

Periodic calibration and battery replacement is the only regular maintenance your ATS requires:

- **Annual Calibration and Battery Replacement.** Once a year, you should have your teaching wafer calibrated and the internal rechargeable battery replaced by returning the teaching wafer to the CyberOptics Semiconductor factory.
- **Cleaning the Teaching Wafer.** If cleaning is required, wipe the outside of the teaching wafer with IPA (isopropyl alcohol). If the teaching wafer is used in a clean environment, follow proper procedures for cleaning devices for this environment.

Warning

Do not immerse the teaching wafer or the link module in liquid. Do not spill liquids on the teaching wafer or on the link module.

Annual Factory Calibration and Battery Replacement

Every twelve months, you should return your teaching wafer to the CyberOptics Semiconductor factory, where we will calibrate the teaching wafer and replace the internal rechargeable battery. You can find the date when the teaching wafer was last calibrated at the factory by choosing the **Help > About your ATS Wafer** menu item in the TeachView application.

When the date for calibration approaches, the TeachView application will occasionally notify you by displaying the ATS Wafer Calibration Status dialog, as shown in [Figure 5.1](#).

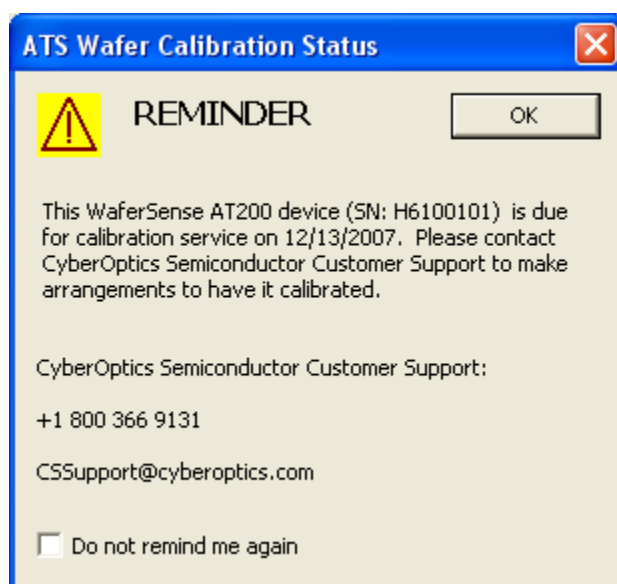


Figure 5.1: ATS Wafer Calibration Status Dialog

If you drop the teaching wafer or suspect that it is no longer in calibration, contact CyberOptics Semiconductor technical support (see [“Technical Support,” on page 2.9](#)).

Battery Use and Disposal

Your ATS teaching wafer contains a lithium-polymer battery. To avoid damage to the teaching wafer, use the supplied charger only. Do not charge the teaching wafer at temperatures outside the specified range (0 °C to 45 °C). Do not incinerate or dispose of the teaching wafer into fire. Do not immerse the teaching wafer when cleaning or spill liquids on the teaching wafer.

Chapter 5. Maintaining Your ATS

For proper battery disposal, please return the teaching wafer to CyberOptics Semiconductor, Inc.:

CyberOptics Semiconductor, Inc.
13555 S.W. Millikan Way
Beaverton, OR 97005

or contact customer support (see [“Technical Support,” on page 2.9](#)).

Updating Your ATS Wafer Firmware

Your ATS includes a software application, called ATS Firmware Updater, for updating the firmware that is onboard the ATS teaching wafer. The current firmware version is available by choosing the **Help > About your ATS Wafer** menu item in either TeachView or TeachTarget.

To update the firmware on your ATS teaching wafer:

1. Turn on the teaching wafer.
2. If either TeachView or TeachTarget is running on the computer, exit the application.
3. From the Windows **Start > All Programs** menu, choose **WaferSense ATS > ATS Firmware Updater**.

The ATS Firmware Updater application starts, as shown in [Figure 5.2](#).

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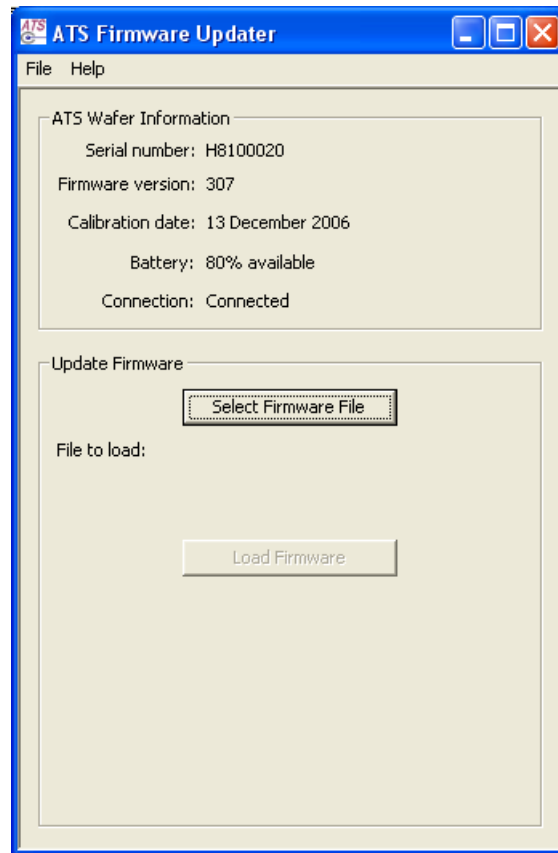


Figure 5.2: Starting the ATS Firmware Updater Application

4. In the ATS Firmware Updater window, verify that the battery level is at least 50%. You can't update the firmware if the battery level is below 50%. If necessary, recharge the battery before proceeding (see [“Charging the Battery,” on page 3.17](#)).
5. Click **Select Firmware File**.
6. In the ATS Firmware File dialog, find and select the firmware file and click **Open**. By default, the ATS Firmware Updater looks for firmware files in c:\Documents and Settings\All Users\Application Data\CyberOptics Semiconductor\ATS\Firmware\.

Caution

In the next step, you will start the load firmware process. Once you start the process, the firmware is automatically uploaded to the wafer, committed, and verified. Do not interrupt this process by turning off or cycling the power to the teaching wafer. If you do so, the wafer might be disabled, and you will need to return it to the factory to fix the problem.

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7. Click **Load Firmware**.

The firmware file is uploaded to the wafer, committed, and verified. This process takes a few minutes, and the ATS Firmware Updater displays progress bars and messages so you can follow the progress. When the firmware has been verified, you will be prompted to cycle the power on the teaching wafer, as shown in [Figure 5.3](#).

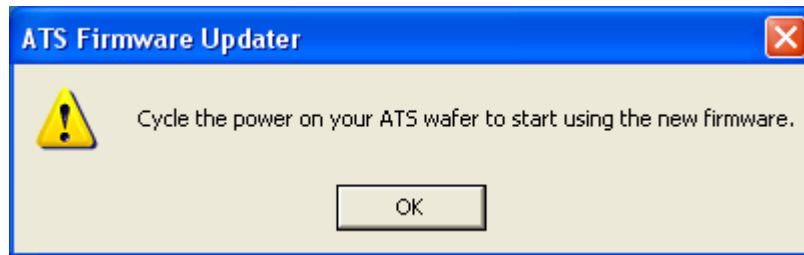


Figure 5.3: Cycle Power dialog

8. Press the **ON OFF** button on the teaching wafer to turn off the wafer, then press it again to turn on the wafer. The teaching wafer doesn't start using the new firmware until you cycle the power.
9. Click **OK** to close the dialog.
10. Choose **File > Exit** to exit from the ATI Firmware Updater application.

Chapter 6

Specifications

System Requirements

To run the WaferSense ATS software and link, your computer must have:

- Windows 2000, Windows XP, or Windows Vista operating system
- One free high-power USB 1.1 or USB 2.0 port

ATS Hardware

Environmental

Operating pressure range: $\leq 10^{-6}$ Torr to atmospheric.

Storage temperature range: -20 °C to 70 °C.

Charging temperature range: 0 °C to 45 °C

Operating temperature range: Optimum 20 °C to 50 °C. Can withstand exposure to 120 °C (5 minutes or less) if not in direct contact with heating element.

Power

Battery charger requires 100 - 240 VAC at 47 - 63 Hz input.

Battery usage on a full charge: approximately 2 hours. Battery performance degrades at temperatures outside the optimum operating temperature range.

Typical battery recharge cycles: approximately 500.

Range and Accuracy

X and Y accuracy: ± 0.1 mm (± 0.004 ")

Z range: 6.4 mm to 45 mm (0.25" to 1.8")

Z accuracy: ± 0.5 mm (± 0.02 ")

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