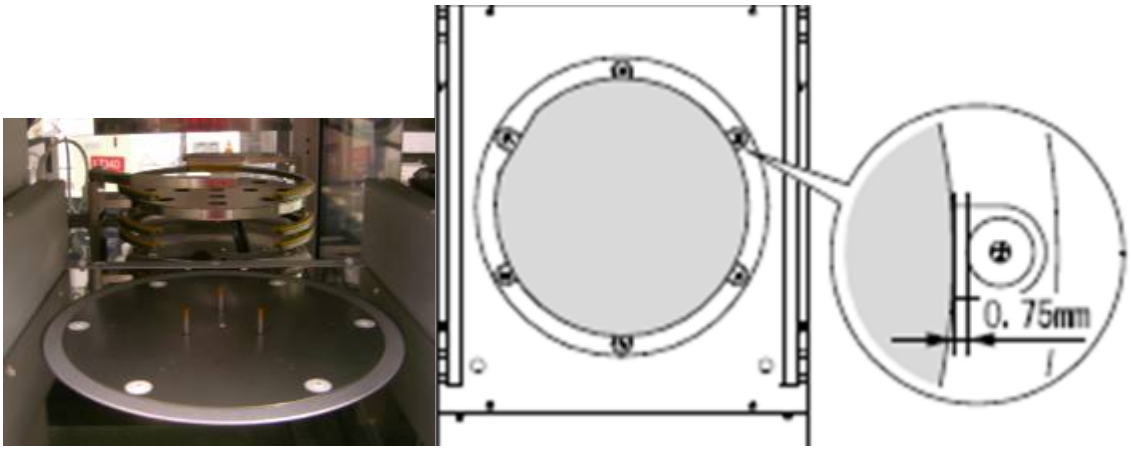
WaferSense® by CYBEROPTICS® SEMICONDUCTOR

Innovating measurement technology™

Using WaferSense® Auto Teaching System (ATS) on 200 mm and 300 mm TEL CLEAN TRACK ACT and Mark Tools

Why Precision Calibration and Handoff Teaching is Critical on TEL CLEAN TRACK ACT and Mark Tools

1. Better resist uniformity
2. Recommended or required as part of routine PM's
3. Required after robot, lift-pin, platen or other component replacements
4. Increased yield due to reduced particle generation with proper alignments and setups
5. Reduced scrap and wafer damage due to misalignments and mishandling
6. Required when system reports wafer placement errors
7. Necessary when troubleshooting unexplained problems such as excessive particles, unexpected tool noises, or unexplained abnormal



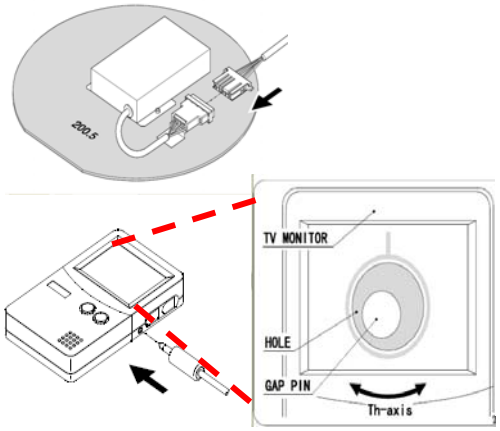
Wafer placements must be exactly within 0.75 mm of each of 6 spacers – A difficult, imprecise, and time consuming procedure without ATS considering each chamber & Pinset combination must be independently taught

Legacy TEL CLEAN TRACK Position Teaching & Quick-check Methods

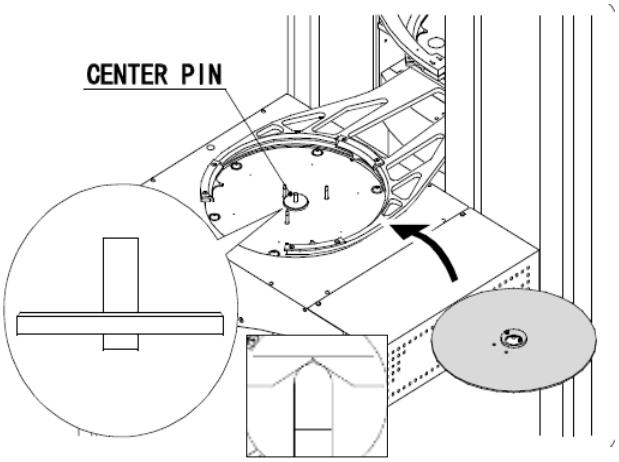
CCD

Wired CCD with cross-hair painted on lens on attached to a wafer with video & power wires running to a small 3" low resolution handheld portable TV. Manually placed into each chamber and/or Pinset chamber

CCD



Centering Tool



Dummy Wafer

Dummy wafer is ran though tool while tech listens for scraps and "where possible" watches for misalignments

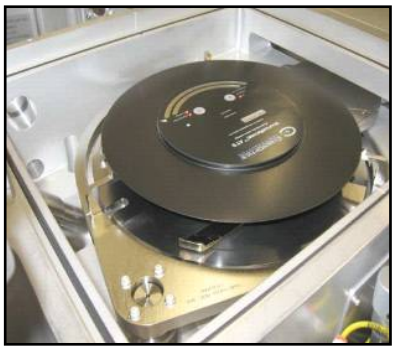
Centering Tool

Consists of a centering pin that fits in the Chiller/heater center hole and a special wafer with a round indentation in the center where the wafer is placed on the pin.

Introducing WaferSense®

Automatic Teaching System (ATS) Teaches CLEAN TRACK Wafer Hand-off Positions & Performs Quick-Checks

Wafer-like, wireless hardware



Intuitive software

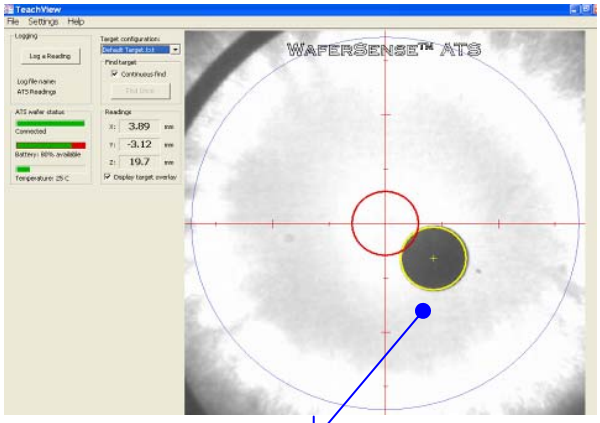
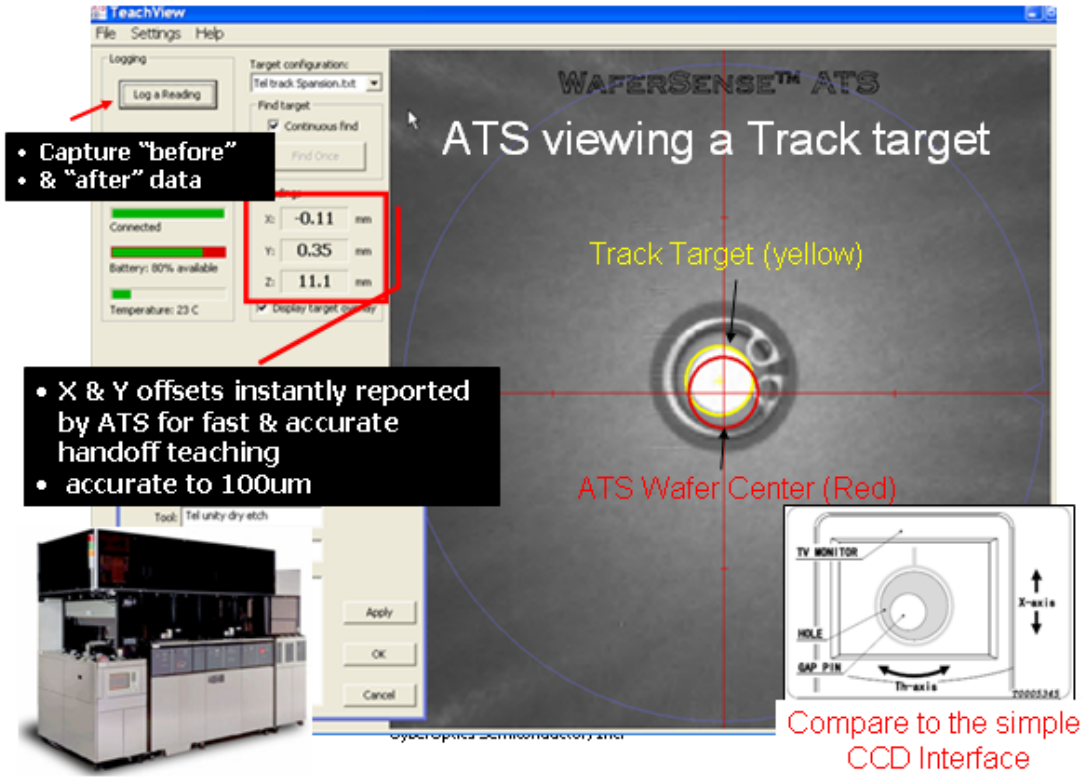


Image of Target Feature acquired by ATS camera

ATS vs. Legacy Method Feature and Benefit Comparison

Benefit	ATS	CCD	Centering Tool
1. Can be passed to each chamber or teach location automatically like a wafer	**YES:** Passed through tool automatically without tool dismantling or bringing off-line	**NO:** Device is thick (approx 28 mm), wired and requires tool dismantling and hand placement into each chamber or Pinset	**NO:** Requires tool dismantling and hand placement of wafer and centering pin into each chamber
2. Objective and accurate numerical "Answers Out"	**YES:** Precision calibrated to 100um accuracy and powerful vision system locates pedestal center & displays Z, X & Z offsets with ultra-high 100um precision accuracy	**NO:** No objective output and users routinely report cross-hair painted on CCD lens inaccurate.	**NO**: Trial and error processing where one tech operates robot and the other watches until the wafer "appears" to be properly placed
3. Chambers and Pinsets easily taught by one tech	**YES:** Discrete X, Y & Z offsets instantly calculated, one chamber typically taught in 3 minutes by one tech without taking tool offline	**NO:** Tool must be dismantle; power and video cables routed, CCD hand placed and then two techs, one at console and one at chamber required	**NO:** Tool must be dismantle and wafer hand placed then two techs, one at console and one at chamber necessary to perform teaching by trial-&-error
4. Repeatable results	**YES:** ATS provides same identical objective precision result regardless of tech performing procedure	**NO:** Quality of results dependant on skill of tech performing procedure and limited by poor accuracy of device	**NO:** Quality of results dependant on skill of tech performing procedure and limited by poor accuracy of device
5. Chambers taught quickly	YES: 3-5 minutes average per chamber with special maintenance recipes	NO: 15 to 20 minutes per chamber- includes tool disassembly, running device wires, hand-placing CCD and tool re-assembly	NO: 15 to 20 minutes per chamber- includes tool disassembly, hand-placing wafer, trial-&-error wafer placements and tool re-assembly
6. Entire tool hand-off teaching procedure completed quickly	YES: Typically completed in 2 hours or less with maintenance recipes to move ATS from chamber to chamber	NO: Typically 8 to 12 hours depending on experience of Techs performing procedure	NO: Typically 8 to 12 hours depending on experience of Techs performing procedure
7. Guaranteed accurate results	YES: 100um accuracy regardless of tech	NO: Accuracy limited by technology and tech experience	NO: Accuracy limited by technology and tech experience
8. Accurate Quick-checks possible	YES: Typically completed in 15 minutes or less with 100um accuracy (using maintenance recipes)	NO: Quick-checks not possible with CCD	NO: Quick-checks not possible with centering wafer

TEL Track ATS Example



ATS Procedure for Tel Track 200 mm and 300 mm Module Position Teaching:

1. Power down tool and hookup teaching laptop
2. Power-up tool in Position Teaching mode
3. Place ATS in FI cassette
4. Select predefined ATS teach recipe for Pinset 1
5. To get ATS past load-port, place target wafer in cassette and pickup with FI robot, then before going into chamber, pause robot and swap with ATS before going into slit valve.
6. Follow TEL procedures for position teaching of all chambers. Teach Pinset 1 and Pinset 2 on all Hot-plates and Chill-plate spinners.

Note: If using ATS to teach Spinner, *DO NOT SPIN ATS.* This risks damaging ATS and/or tool

No need to open tool or hand-place device with ATS

Using ATS for Quick-checks:

Background:

- Dummy wafer is transferred though the tool by one tech while another tech listens for suspicious noises and when possible watches for wafer-misplacements.
- NOT an effective or a repeatable method for identifying and correcting wafer placement issues.
- Neither the CCD or Centering wafers are used for quick-checks since they must be "hand-placed" and consequently do not simulate actual wafer placements

Quick-check Procedure with ATS

1. Place ATS load-port cassette and load into tool (see previous slide step 5 for instructions on getting ATS into tool).
2. Using a predefined ATS maintenance recipe which alternates *Pinset 1, Pinset 2,* send ATS into each chamber and check for wafer placement.
3. Using a predefined ATS maintenance recipe which alternates *Pinset 2, Pinset 1*, send ATS into each chamber and check for wafer placement
4. Using a predefined ATS maintenance recipe which checks Pinset 3 placement.
5. Typically 15 seconds per chamber and 10 minutes for the entire tool is all that is necessary with ATS

Benefit Summary of Using ATS for CLEAN TRACK Handoff Teaching

Event	ATS Benefit Over Old Method
Quick-checks	• Quick-checks not possible with CCD or Centering wafer • ATS provides precision X, Y, and Z offsets accurate to 100um with-in 15 seconds
Tool dismantling	• Not necessary, ATS travels to all tool locations just like a wafer
Manpower requirements	• Only one tech needed with ATS. All TEL legacy methods require two techs
Accessing difficult tool locations	• ATS transferred via tool automation and goes all places that a wafer goes
Time required to teach entire tool	• Position teaching of entire tool completed in 2 hours or less compared to 6 to 12 hours with legacy
Tool alignments and quick handoff checks made with ATS	• High accuracy: Quick real-time hand-off teaching accurate to 100um • Repeatable: Quick and easy teaching performed to same high standards regardless of tech performing the procedure • Calibrations performed under ACTUAL closed chamber production conditions • Real-time feedback, no more trial and error • Discrete Go/No go and Data logging, standards can now be established
Reassemble tool	• No longer necessary to dismantle tool with ATS
Restore production process	• No longer necessary to take off-line with ATS

WaferSense® ATS Tel Track Use-Case Testimonial
Interview with a TEL ACT, Mark Photo Department Manager and Active ATS User

1. What tasks are ATS used for on your TEL Mark and ACT tools?

We use ATS for a number of tool maintenance tasks including routine PM's, quick-checks, and troubleshooting mechanical or process yield related problems

2. How often is the WaferSense® ATS used for TEL Track setup, maintenance and quick-checks?

Typically used once per month per tool for routine PM's

Due to the fact that the ATS makes it quite a bit easier to perform the checks plus provides "instant" results we use ATS several time per month "on the fly" to perform quick-checks.

ATS is particularly useful for not only troubleshooting wafer placement related system alarms, but also correcting them in real-time without having to take the tool off-line

3. What is the time saving per TEL ACT or Mark Track tool taught using the WaferSense system vs. the old Legacy CCD or Centering Wafer Method?

With ATS one tech can typically teach the average Track or Mark tool in about 2 hours compared to two techs in 8 to 12 hours using the CCD method.

With the TEL CCD, every chamber had to be opened up, video and powers ran such that the did get tangled, then one tech needed to observe wafer movement while the other operated to the console laptop in teach mode. This is all very time consuming and no reliable. There have been a number of occasions where the power and video wires got hung-up in the tool and actually caused damage.

With ATS, we just place the ATS in the tool, move it to each teach position, teach and the move on.

4. What quantifiable benefits have been observed using the ATS system as a result of the increased accuracy of the setups?

Consistency is one of the biggest factors. We no longer have to depend on ability of individual techs to determining the accuracy and quality of the position teaching. All techs will achieve the same quick and accurate results

Ease of use due to form factor allows for quick-checks and troubleshooting of issues which were previously never checked before because no adequate method existed to perform these checks

5. Have you observed other benefits such as reduced particles, reduced wafer damage, increased yield, or reduced tool down-time? If so, what types of specific quantifiable benefits have you had?

Reduced down time would be greatest factor so far. Other less quantifiable benefits, but certainly and important benefit is fewer defects or problem passed down-line. For example, if resist uniformity is off due to poor wafer placement, this wafer could be passed on down the production line and the problem not identified until some later step.