SE-PROBE™
Dynamic test cell controller for wafer sort optimizes quality, throughput and efficiency

Reduces Cost of Test
- Improves test cell throughput
- Improves test floor efficiency
- Reduces startup errors
- Rapid detection of problems
- Smart retest strategies
- Easy for production personnel to use
- One-button start command
- Unified operator console

Improves Quality
- Good lot setup
- Good prober setup
- Real-time trend monitoring

Improves Data Management
- Equipment status available from both tester and prober
- Better data integrity improves accuracy of other upstream analysis systems
- Data consistency across different types of equipment
- Source of data for upstream OEE

Since first introduced in 1999, SE-PROBE has grown into the industry’s leading solution for optimizing throughput at the wafer sort (probe) test station. As test floors are increasingly adopting on-line software solutions for improving overall efficiency, the role of the test station controller has also become critical for insuring high data integrity.

The Challenge
Managers in charge of modern test operations are always looking for ways to improve test floor efficiency and quality. The performance within the individual test stations is probably the most important contributor to overall test floor efficiency. Challenges include:

- Operator errors
- Setup errors
- Limited insight into equipment issues
- Late detection of yield issues
- Poor data integrity for upstream systems
- Inefficient retest strategies
- Multiple control consoles
- Inconsistent data formats
- Incompatible equipment interfaces
**Target Users**

SE-PROBE is ideal for companies that own and operate large fleets of testers.

SE-PROBE also appeals to companies whose legacy test floor automation systems are no longer adequate. Frequent complaints we hear about current systems include:

- The task of maintaining the wide variety of equipment types that must be interfaced with is burdensome. Internal software support is slow to respond and falling behind your needs.
- The current system is unable to be scaled to provide new capabilities required.
- Data collected from the test cells is incomplete and incompatible, thus making upstream data analysis tools ineffective.
- The current systems cannot monitor test station activity in real-time.

**Architecture**

SE-PROBE runs on a dedicated PC so that no overhead is added to the tester or prober. TCP/IP, RS-232, TTL and GPIB interfaces are included as shown in Figure 1. Data, including parametric results, is collected in real-time from the tester via Salland’s ATE Daemon. A comprehensive GUI is included. The system is highly scalable and designed for additional functionality to be easily added in the future.

![Figure 1: System Overview](image)

**Dashboard**

Figure 2 shows the dashboard that provides the operator with a comprehensive view of all activity within the test cell. Yield trends, binning results, details of the current process and recipe, and all equipment status is instantly available.

![Figure 2: SE-PROBE Dashboard](image)
Dashboard Details

From the dashboard, the operator can gain immediate access to a variety of detailed real-time displays shown here.

Individual site yield by bin is monitored and can be quickly displayed.

Comprehensive wafer maps are available including the extended lot report shown here.

A System Utilization Report is also continuously updated as shown below. Note: Salland offers a complete OEE solution – see TestScape-OPS.
Standard Features

- **On-line Monitoring:** The status of both the tester and prober is monitored in real-time.
- **Parametric Monitoring:** Real-time parametric test results are collected from the ATE providing a complete view of test station behavior.
- **Control Optimization:** Interaction between the prober and the tester is optimized by SE-PROBE. Knowledge from one system is used to save time on the other equipment by avoiding wasted time on testing or handling where the outcome is already known. Overall cell throughput is increased.
- **Resource Management:** The system includes tools for managing the test cell itself as well as its equipment and users.
- **One-button Start:** The operator may start and pause and restart the entire test cell from the SE-PROBE console. Efficiency is improved by allowing the operator to monitor test cell performance on one dashboard instead of individual screens for the tester and prober.
- **Intelligent Data logging:** Data logging can be offloaded from the tester. Complete and correct STDF files can be created by SE-PROBE. Improved data integrity will lead to better efficiency across the entire test operations.
- **Trend Monitoring:** User may define their own trend rules and have alerts sent to them on the console. Yield trends and binning results can be monitored as well as multi-site yield.
- **Interface to MES and OEE:** Data collected within the test cell may be shared with your MES systems. SE-PROBE can also be integrated with Salland’s TestScape data management system. This includes essential OEE data for further improving the overall equipment utilization of your test operations.

Throughput Optimization Tools

Cost of test will be significantly reduced using SE-PROBE’s numerous capabilities to optimize throughput at wafer sort. Standard features are listed here. See Advanced Features below for more methods to reduce test time.

- **Smart Sample Probe:** Experienced product engineers know that overall cost of test can be reduced by sample probing at wafer sort knowing that 100% testing will be conducted at final test. SE-PROBE includes special algorithms that further refine this strategy by dynamically expanding its sample pattern around areas where rejects are located. This minimizes unnecessary yield loss at final test.

- **Retest with Different Site:** Multi-site variation is usually caused by differences in the test hardware (DIB, etc.) SE-PROBE can be configured to dynamically shift the site being used during retest. This “best site” technique further accelerates throughput.

- **Retest Recovery Analysis:** SE-PROBE includes dynamic logic for analyzing the effectiveness of retesting. By monitoring bin signatures in real-time, retest effectiveness is improved further reducing overall cost of test.

Efficiency Maximization Tools

Additional capabilities are available to monitor equipment and void unnecessary interruptions.

- **Dynamic Routing Optimization:** SE-PROBE can automatically update the touchdown pattern based lot-specific data. A typical example is to use wafer inspection data to avoid probing bad sites, e.g. double bumps. Test cell efficiency is improved by minimizing
interruptions and damage to probe cards and membrane cores.

- **Controlled Touchdowns per Die**: Additional efficiency is achieved by controlling the number of potentially destructive touchdowns than can be repeated on the same location.

**Advanced Features**

SE-PROBE has been designed to allow additional plug-ins to be easily added. Salland offers optional modules that give the user additional control over throughout and quality.

- **Touchdown Optimization**: Figure 3 illustrates how test time can be saved by optimizing the touchdown routing. Rules and probe patterns are easy to define, e.g. multiple touchdown, skip die, etc. SE-PROBE further insures that all touchdowns are within the wafer.

- **Trend Monitoring**: The user can define rules for real-time monitoring of parametric results like Cp, Cpk, averages, extremes, etc.

- **Dynamic Clean**: One example of trend monitoring is the ability to clean contacts on an intelligent basis. In addition to monitoring contact resistance, SE-Probe can use other parametric tests results or groups of tests to determine the optimum time for contact cleaning. Minimizing unnecessary interruption to work flow will increase cell throughout.

- **Outlier Detection**: Outlier Detection is a post-processing module used to improve device quality and reliability. Based on the parametric test results, the module will identify devices on the wafer which behave differently than the majority on selected tests even though results are within spec limits. This technique is an essential component for achieving zero defects. It is recommended for high quality applications like automotive electronics as well as storage, network server and medical devices.

**Figure 3: Touchdown Optimization**

**Standard Probe Pattern = 150 Touchdowns**  
Probe out of wafer

**Optimized Probe Pattern = 138 Touchdowns**  
8% Reduction & No Probes out of Wafer
SE-PROBE's Outlier Detection Module has the following features:

- Compensates for measurement offsets introduced by the lithography process.
- Compensates for multisite variations.
- Detects outliers based on a linear relationship between two tests.
- Detects outliers by looking for devices behaving oddly compared to the whole wafer using Dynamic Part Average Testing (DPAT) per AEC guidelines.
- Supports Nearest Neighbor Residual (NNR) methods to identify good devices in bad neighborhoods.
- Supports multiple dynamic limits for an individual test.

**Adaptive Test Techniques:** SE-PROBE has advanced modules for performing dynamic “flow switching.” Using this technique, a variety of methods can be used on-line for further reducing test time and improving quality.

**Salland’s Advantage**

- **Strong Roadmap:** SE-PROBE is part of a complete test data management solution. It can be extended to support the needs of upstream systems like OEE, SPC, and equipment configuration tracking. See Salland’s TestScape product family for further information.
- **Modular and Scalable:** SE-PROBE can be deployed to a few or many of your testers. It is an open system that can be interfaced with your existing MES and ERP systems.
- **Easy to Deploy:** SE-PROBE has been designed to be integrated into your existing IT infrastructure. SE-PROBE can be incorporated into your test cells without requiring changes to your test databases, network infrastructure or other test floor automation tools.
- **Worldwide Support:** Salland has earned a reputation of providing great customer satisfaction throughout the world for all of our products. We have technical support throughout Europe, North America, Taiwan, China, Korea, Japan and Southeast Asia.

About Salland Engineering

Salland Engineering International B.V. is a leading supplier of test solutions for the semiconductor industry. Our solutions are delivered via a unique combination of hardware, software, test applications services and in-depth expertise. We enable our customers to achieve lower cost of test, higher quality and reliability, improved test floor efficiencies, faster time to market and streamlined interfaces with their supply chain. Since 1992, Salland has delivered thousands of production proven results to leading integrated device manufacturers (IDMS), fabless semiconductor manufacturers, ATE vendors and outsourced test and assembly services (OSATs) around the world. We are consistently profitable and presently employ over 100 people. Salland is headquartered in The Netherlands with additional development centers in Texas. We have worldwide sales and support centers in Texas, California, Italy, UK, Singapore, Japan, Korea, and Taiwan. [Click here for Trademarks] of Salland Engineering. Visit [www.salland.com](http://www.salland.com)