



Proteus Inspection

WAFER MACRO AND MICRO INSPECTION SYSTEM

USER MANUAL
Rev. 1.4
July 2005



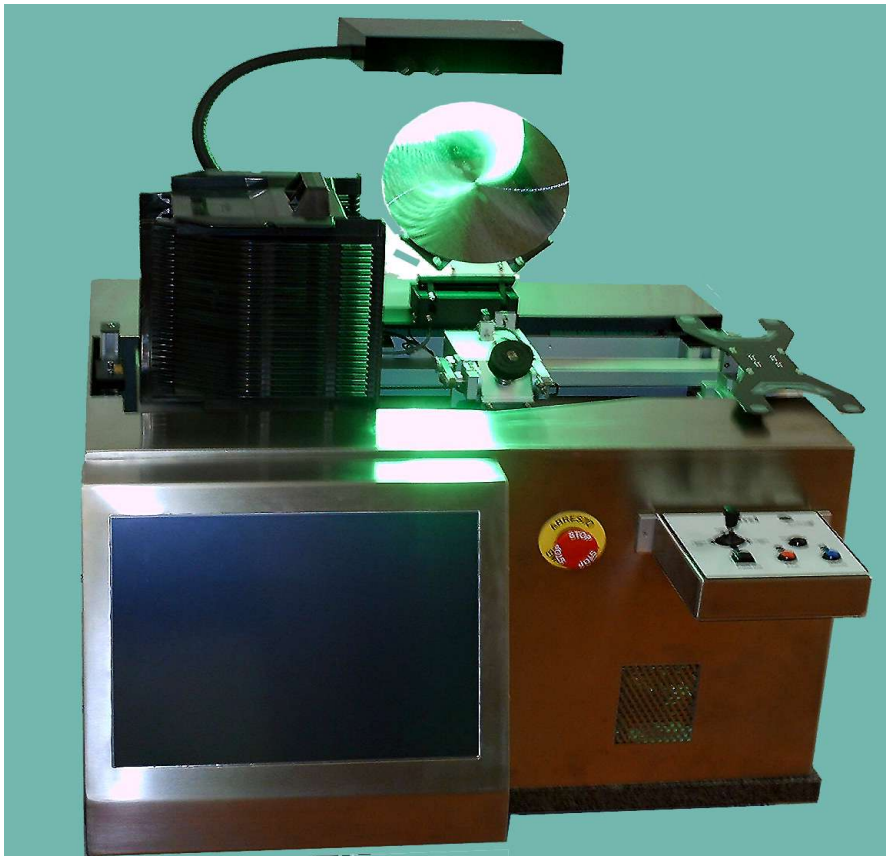
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WAFER INSPECTION MACHINE

Proteus Inspection is a simple and effective tool for wafer visual control.

It has been especially studied for all those cases where it is required a simple, fast and cost effective solution in wafer inspection.

An inspection unit, featuring wafer BACK and rotation, or back inspection with Bernoulli end effector is provided for the proper inspection phase. Machine can be interfaced with microscopes and measurement systems to build a powerful inspection unit.



The system is computer controlled, and its use and programming is really easy and user friendly. It is possible, if needed, to edit and recall recipes, and each recipe includes inspection strategies (all wafers, fixed wafers and random access for statistical inspection) and handling parameters.

Proteus Macro Inspection is mounted on a vibration free granite base, and can be supplied also with different kinds of inspection lamps for any different need.

Semicon Synapsis is a division of *Astel*

Via Torino, 253 – 10015 Ivrea (TO) – Italy
Tel. +39 0125 230105 Fax +39 0125 633482
e-mail info@semiconsynapsis.com
WWW.SEMICONSYNAPSIS.COM



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1. Introduction

Proteus Micro/ Macro Inspection system have been especially designed to be used as a tool for silicon wafer macro inspection.

It is composed of four different parts:

Mechanical part;
Motion and I/O controller;
Pneumatic controller;
Computer with display and keyboard.

All the parts are contained in a single stainless steel body, with a granite base for better vibration insulation.

The whole system have been designed to be easy to use and maintain, and in particular the provided computer interface have been studied to allow a simple use and configuration.

In the following we will introduce the basic use of Proteus System, i.e. the basic installation procedure, the operator interface and the use of its configuration software.



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2. Installation and Facilities

Installing Proteus system can be done in three simple steps.

First of all, put the machine in its place.

Following the indications on the rear panel, connect the unit to the facilities and to the microscope adapter..

The way to connect is given into the service manual.

After have done connections, switch on computer and verify if controllers is also switched on (main switch is in the rear section, aside supply connector) and that the emergency stop button is released (if needed, turn the button clockwise to release).

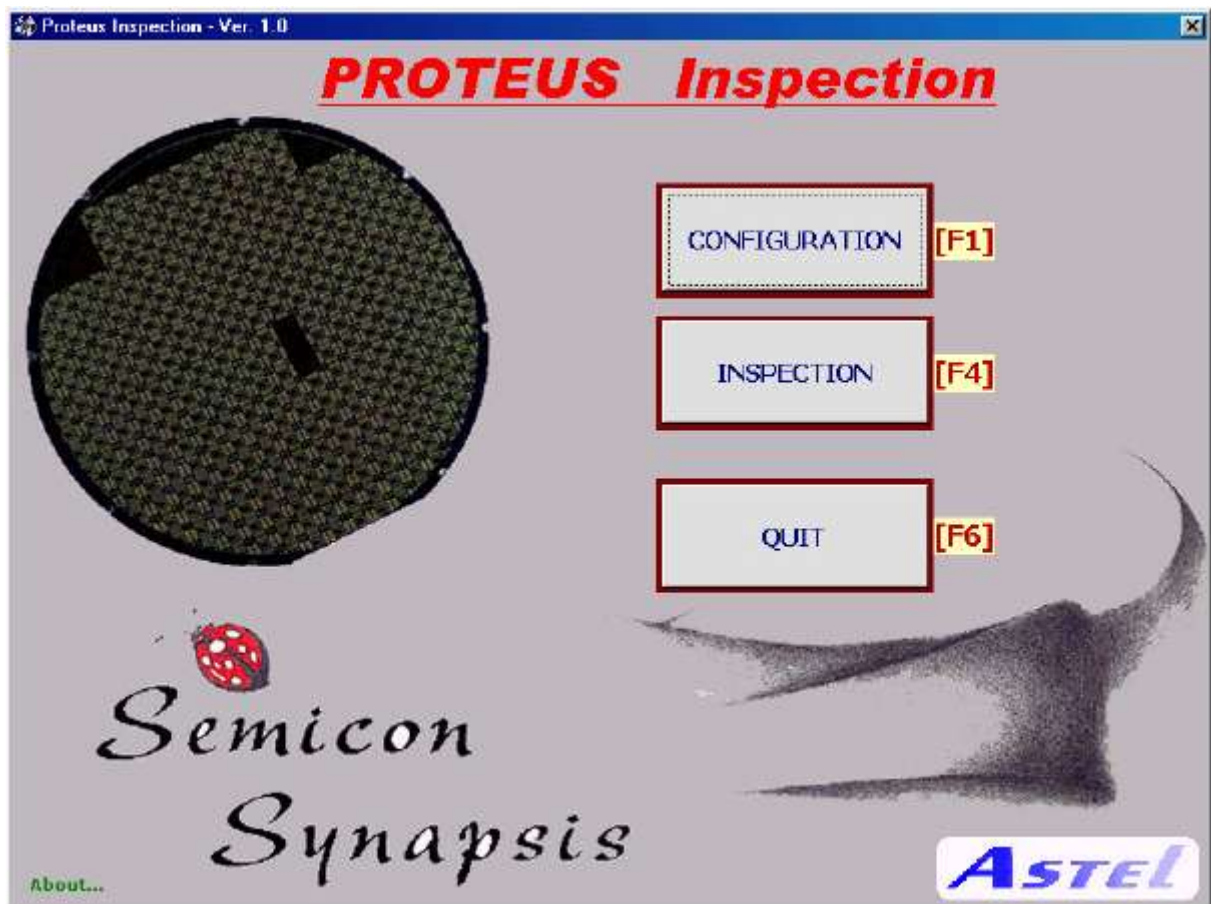
Proteus control program will be automatically run at startup; wait for its introductory screen.



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3.System startup

After having switched on computer, Proteus program is automatically run.
After machine bootstrap, the first screen displayed is the following one:



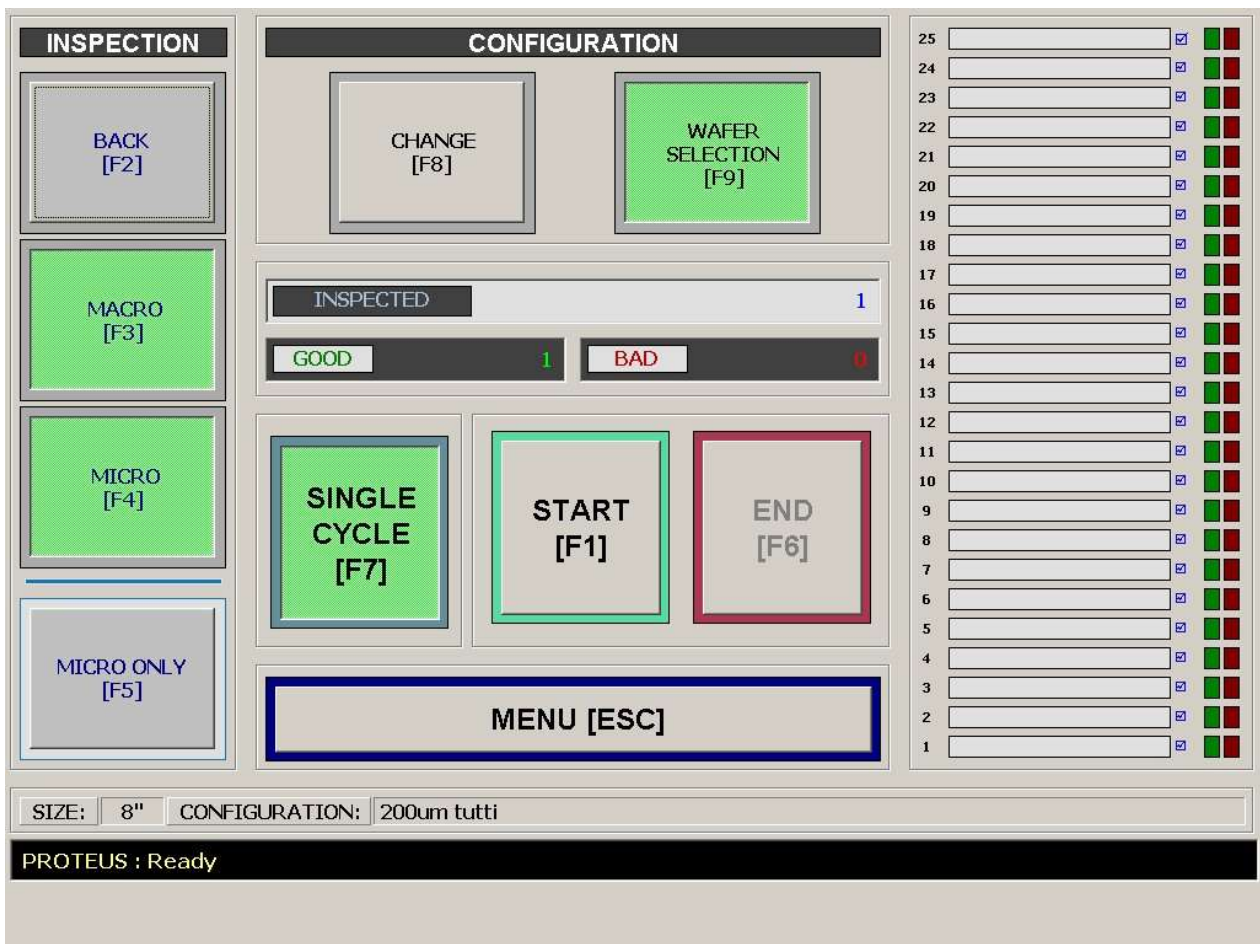
To run machine with the last configuration used, press the INSPECTION button, will then run the next interface, which is the proper user interface.



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4. Running machine cycle

This will be the screen displayed when accessing the normal cycle run interface:



This screen has five different parts:

- button section, where all the functional button are placed;
- cassette display section, where the current cassette is represented, giving information about its status;



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- counter bar, where three counters (inspected, good and discarded) give the status of inspection;
-
- information bar, where are given: wafer size and configuration (recipe) name;
- message line, where is displayed a message with machine status or operator recommendations.

Buttons can be accessed by clicking , by pressing the display if touch screen or pressing the F”nn” key if a keyboard is connected

To start machine cycle, place a cassette with wafers on the indexer platform, and press START [F5]

Platform will then be driven to home position, and wafer mapping will be started to identify present wafers after the confirmation by the operator at the message “LOAD CASSETTE”.

When mapping is finished, machine will proceed extracting the first wafer starting from cassette top and found wafers will be colored jellow into the cassette status section.

Wafer will be extracted and placed on the macro inspection chuck.

At this point, there are different options, depending on the inspection type programmed into the recipe (configuration) loaded. Types of inspection possible are:

MACRO INSPECTION: wafer is loaded on the inspection chuck, centered and driven to the inspection level.

Wafer is then tilted in front and rotated, and inspection light is switched ON, to enable the operator to visually inspect wafer surface – operator can then accept the wafer by pressing the GOOD key or discard it by pressing the FAIL key on the remote console provided. If FAIL is pressed, wafer is put back into the cassette and marked RED on the cassette interface.

The GOOD and FAIL keys are enabled with a double “beep” ad when one of the keys is pressed, a continuous beep is activated to ask the operator to confirm the choice by pressing the CONFIRM key on the console panel.

If the CONFIRM key is not pressed within 5 seconds, the pressed key is deselected and the system will wait for a new key pressed. This is to allow the correction of the pressed key in case of mistake.



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The operator can also adjust the tilt position by acting on the joystick provided on the console (Tilt UP/ Tilt down).

BACK INSPECTION: wafer is loaded from the inspection chuck to the Bernoulli unit to show its back with the back inspection light. Wafer can be tilted by the joystick unit– operator can then accept the wafer by pressing the GOOD key or discard it by pressing the FAIL key; in case of fail, wafer is centered and then placed back into the cassette.

The mimic of GOOD/FAIL and CONFIRM keys remains of course the same.

MICRO INSPECTION: wafer is loaded on the inspection chuck, centered and aligned and then loaded on the microscope or measurement machine XY stage chuck – inspection is terminated again by pressing GOOD or FAIL keys.

The three different inspections are made in the following order: MACRO, then BACK, then MICRO, and can be done separately or together.

If the MICRO mode is the only selected into the loaded recipe, machine will work in the MICRO ONLY mode, which is intended to load wafers just on the microscope and to prepare the next wafer during the inspection.

While MICRO, MACRO and BACK modes can be selected at any time by selecting the SINGLE CYCLE mode and waiting the end of the current wafer, MICRO ONLY mode can be selected only at the first start of each batch.

Any of the inspection type can be selected or deselected also by a button on the panel (which turns to green when inspection type is enabled).

To load the microscope, there are some operations which must be performed.

First of all, the XY table must be pushed to the inner limit on the Y axis, and the X axis must be at the left limit.

Then, the microscope interface mechanism must be put in the left position, until the small plunger on the inner section is into its receptacle on the machine. The right position is detected by a high precision sensor, which will enable wafer loading and unloading only when activated.



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The interface must be moved to the exchange or inspection position only when the proper message is displayed.

Also the inspection position is detected by a sensor, and it is important to remember that the system will not proceed to the next working step until the interface table will not be into the proper position.

There are some additional features which can be accessed from the main screen during operation.

4.1 Single Cycle operation

It is possible to enable SINGLE CYCLE operation, by pressing its button or the right key.

This will force the machine to process a wafer at a time, waiting for a START (F1) key before proceeding with the next one.

SINGLE CYCLE can be disabled by pressing again its key or F3, and then START (F1) to proceed.

SINGLE CYCLE cannot be used in the MICRO ONLY mode.

4.2 Step by step operation

It is possible, for example for setup purposes, to run machine in step by step mode

To do so, simply press F1 key during operation. It can be seen that START button changes to PAUSE when machine is running.

Pressing PAUSE (F1) during operation forces machine to stop at the end of the current phase or movement. Pressing again the key (which will turn to START) starts again the operation. It is important to remember that this key is not an instant stop key. The current movement is anyway finished and then machine stops.

If a mapping is running, it will be finished before stopping.



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4.3 Ending a cassette

If a cassette inspection must be aborted, simply press the END (F6) key. Machine will stop after the end of the current wafer and will be ready for a new cassette.

During the MICRO ONLY mode, the system will finish the current couple of wafers, which means the wafer under inspection and the one already centered.

4.4 Emergency STOP

It is possible, in case of severe malfunction, to stop machine by pressing the EMERGENCY button placed on the left side of the machine.

This will force the machine to completely and immediately STOP.

This will also produce a vacuum or air loss, which can result in wafer breakage.

Machine will detect within about 20 seconds the emergency condition, giving a message and then stopping the program from running. In this case program must be terminated and restarted.

Sometimes, depending on the conditions, computer stops to run when EMO is pressed. In this case, press the ON button for 10 seconds about to force the power down, and then restart.

WARNING: USE EMERGENCY STOP BUTTON ONLY IN CASE OF REAL NEED, SINCE ITS IMPROPER USE CAN RESULT IN WAFER BREAKAGE

MACRO INSPECTION CHUCK AND BERNOULLI ARE PROTECTED AGAINST THE EMERGENCY PRESSED, SINCE VACUUM AND NITROGEN FLOW ARE DONE WITH A SAFE HOLD SYSTEM.



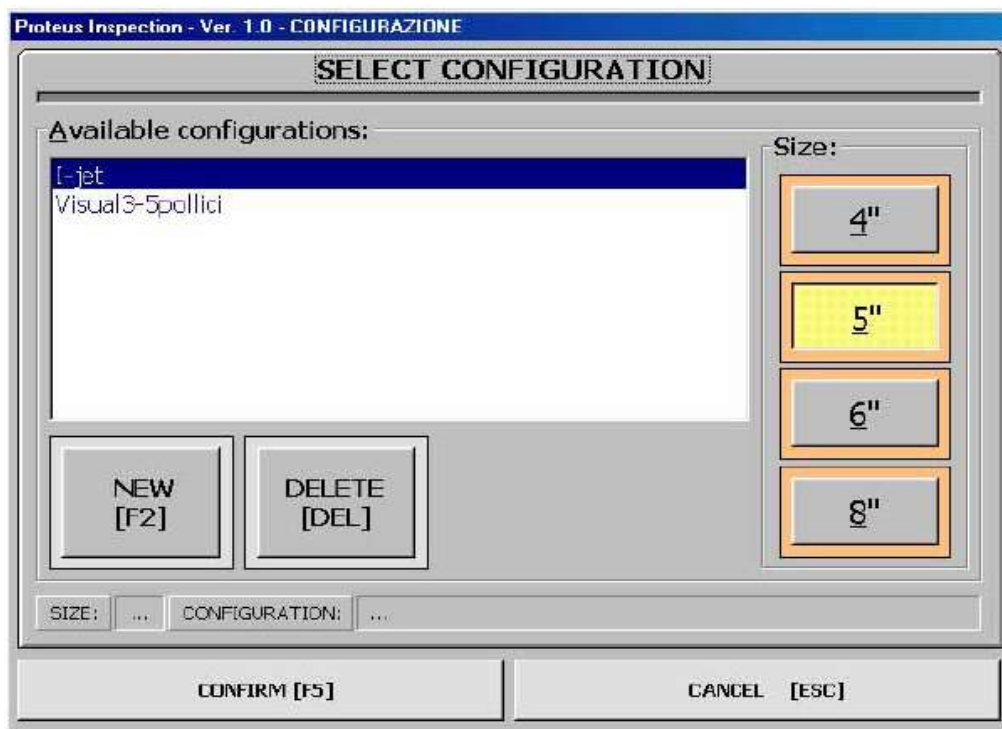
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4.5 Changing a configuration

It is possible to run a different recipe for inspection. Basically differences from a recipe (configuration) to another can be in wafer size, motion parameters or inspection strategies.

We will describe in the proper section how to modify a configuration, but switching from one configuration to another can be done by pressing CHANGE key.

The configuration selection screen will then be displayed (not all the machines has the possibility to choose between multiple sizes – refer to the type of machine you are working on).



Select before wafer size and then the recipe by clicking its name, then press CONFIRM (F5) to load.

The previous interface will then be displayed and recipe can now be run by loading the proper cassette with wafers to be inspected.



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Machine will usually change size automatically. If changes have to be done the proper instructions will be given into the service manual.

4.6 Going back to startup menu

It is possible to access the startup menu from operator interface screen. This can be useful if it is needed to access the recipe editing section.

To do so, press the MENU (Esc) key. The startup menu will then be displayed.



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5. Editing Configurations

From the Main menu, it is possible to access configuration menu. To do this, press CONFIGURATION (F1) key. To access the configuration menu in EDIT mode, a password will be required.

A dialog box as showed will then be displayed.



Input the correct password and then the configuration selection display will appear.





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This menu is similar to the one which can be accessed from the CHANGE key on the user interface, but in this case it is possible to act with editing capabilities.

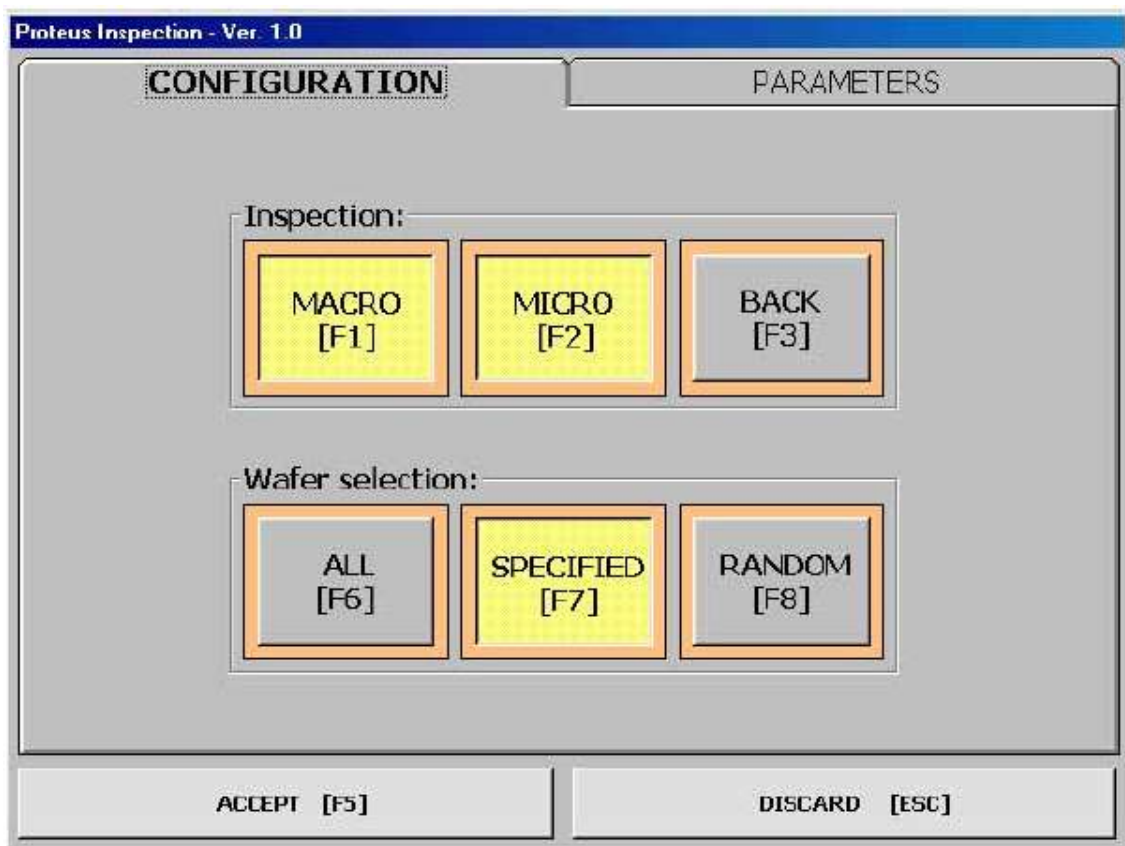
To select a configuration, select before wafer size and then configuration name by clicking on it. When configuration is selected, press CONFIRM (F5) to edit.

There are two sections inside editor. The first one is about inspection strategies and the second is about motion parameters.

Inspection strategies can be selected from the following given options.

5.1 Choosing inspection strategies

The inspection strategy can be chosen by the selection screen.

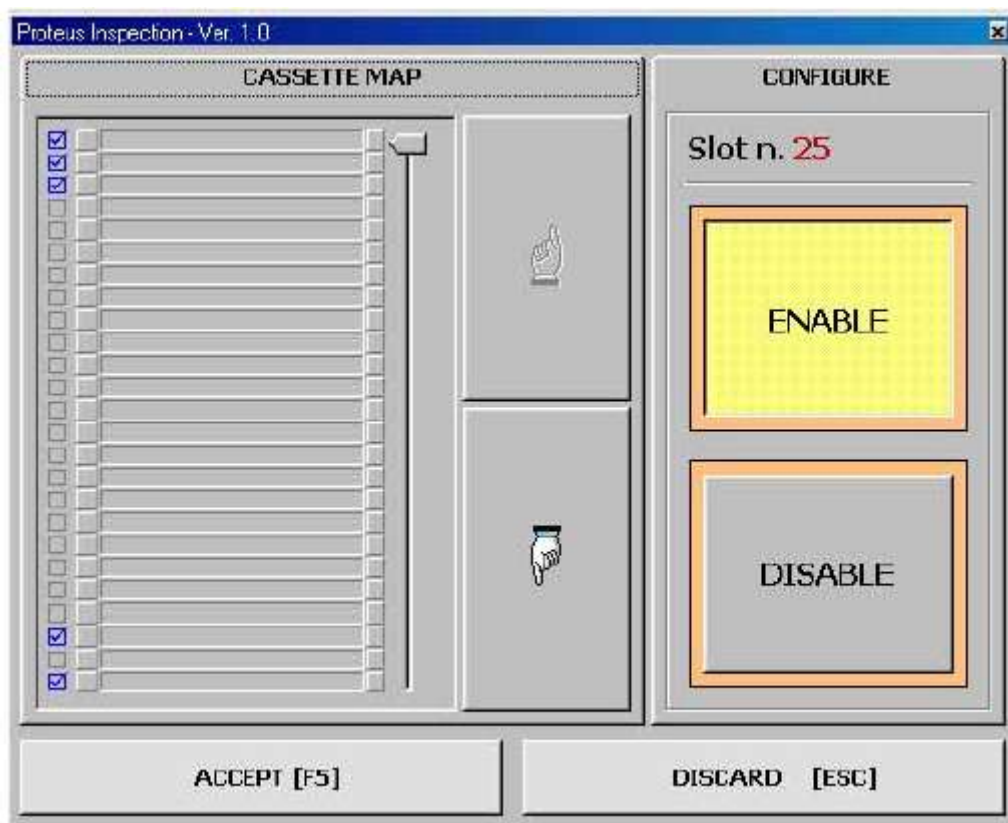




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It is possible to program ALL (F6) wafers for inspection, and this option will not imply any further choice.

If the SELECTION (F7) mode is selected, only specified wafers will be inspected, and these wafers must be selected in a further screen as follows, by selecting it with up/down arrows and by pressing, the ENABLE or DISABLE key (only clicking). Selection can also be performed by pressing the key on the main screen, and in this case the found wafers will be displayed and selection can be done by clicking on it to select or deselect.



Selected wafer will then be marked and will remain until deselected.

When done, press CONFIRM (F5) or CLOSE (ESC). If confirmed, modifications will be



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recorded into the recipe data base.

If the RANDOM (F8) option is selected, the user can define a number of wafers to be inspected, and each time the recipe is run (for each cassette) the given number of wafers will be randomly selected within the 25 cassette slots. If a selected slot is empty, wafer will not be inspected.

The number of wafers to be inspected will be given in the following dialog box.



Input wafer number and click OK or press ENTER.

Wafer positions will be generated by a random number generator, to allow inspection of different wafers each time.

5.2 Changing position and program parameters

From the parameters section of recipe editing it is possible to change some control parameters, such as positions and some threshold and setup for centering and alignment system.

This section can be accessed by clicking on the PARAMETERS folder bar from the default editing screen.



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When selected, this screen will appear as follows:

The screenshot shows the Proteus Inspection - Ver. 1.0.7 software interface. The window is divided into two main sections: CONFIGURATION and PARAMETERS.

CONFIGURATION:

- Positions:** A list of parameters is shown, with "WaferPitch" selected. The list includes: WaferPitch, FirstWaferPos, Arm Cassette Center, Indexer limit, Cassette top, Lift offset, Put Offset, Micro Center, Wafer filter, and Arm Macro Center.
- Machine Parameters [ALT+2]:** A button to switch to machine parameters.
- MACHINE PARAMETERS [F9]:** A button to view machine parameters.
- CONFIGURATION:** <200um tutti> ; <8 INCH>

PARAMETERS:

- Properties:**
 - Name:** WaferPitch
 - Value:** 18468
 - Description:** TO RECIPE [F10]
 - Description text:** Passo in step tra una fetta e la successiva
- MODIFY [F4]:** A button to modify the parameter.

At the bottom of the window, there are two buttons: **ACCEPT [F5]** and **DISCARD [ESC]**.

The parameter section is divided into two sections: RECIPE PARAMETERS and MACHINE PARAMETERS.

To access MACHINE PARAMETERS it is needed to input the password. The password required is the same, but the request is intended to ask the operator to be sure about his request to access machine parameters.

It is strongly recommended not to change any value if machine is correctly running and to perform changes by working on a dummy wafers cassette.



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On any machine each value is described into the description section, to allow a correct understanding of its meaning. In another part of this manual a list of the default recipes for each wafer size is given.

To change a value, select the desired position or parameter by clicking on it, then click MODIFY (F4), input new value and then click MODIFY (F4) again to accept modifications. When done click CONFIRM (F5) to accept or DISCARD (Esc).

**IF THERE ARE DOUBTS IN MODIFYING PARAMETERS, CREATE A PAPER COPY OF THE ORIGINAL CONFIGURATION AND ACT ON A NEW RECIPE WITH THE SAME PARAMETERS BEFORE.
ERRORS MAY RESULT IN WAFER BREAKAGE: BE CAREFUL!!!!!!!!!!**

It is also possible to change parameter name and description, in the same way used to change values.

Finally, it is possible to move parameters from the Machine section to the Recipe section, by pressing the given button (F10) during the MODIFY mode. This is intended to allow the operator to access easily to parameters which will be often modified.

5.3 Creating a new configuration

To create a new configuration, when accessing in edit mode to the configuration menu, press NEW (F2) key.

This will access the dialog box where the name of new configuration can be given.





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Write the name and press CONFIRM (F5) to accept. CANCEL (Esc) will abort new configuration creation.

After this, access the Strategies and parameters sections. Values will be, at this point, the same than DEFAULT configuration, and can be modified according to needs.

5.4 Deleting a configuration

To delete a configuration, select configuration to delete by clicking on the list and then choose DELETE (DEL) on the configuration selection screen.



6. Password change

Password is required to access recipe editing menu.

There is a simple system to manage password change. When accessing to the password request box, press MODIFY (F2) key to access the password change dialog box as follows:

A dialog box titled "Password" with a blue header. The main area contains the text "Please enter your password:" followed by a single text input field. At the bottom, there are three buttons: "MODIFY... [F2]", "CONFIRM [F5]", and "CANCEL [ESC]".

Simply insert the old password in the first line, then the new one in the second and confirm it in the last one.

A dialog box titled "Modify Password" with a blue header. The main area contains three numbered text input fields: "1. Password:", "2. New Password:", and "3. Confirm Password:". At the bottom, there are two buttons: "CONFIRM [F5]" and "CANCEL [ESC]".

When done, press CONFIRM (F5) or CANCEL (Esc) to accept or reject new password.



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7.Parameters

Please note in the following area each parameter of DEFAULT recipe for all the sizes used configurations, before making any modification.

PARAMETER NAME	VALUE 6"	VALUE 8"	COMMENTS
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8.Errors and malfunctions

There are some conditions which can result in errors.

These conditions are especially related with sensor verification, and especially vacuum sensor and position sensors.

Basically, when an expected sensor is not activated, or deactivated, within a given time (timeout), an error occurs.

In this case, a dialog box with the error message will be displayed.

There are two possibilities:

ERROR IS NOT RECOVERABLE: click on ABORT or press Enter and program will be quit and machine must be restarted, preferably by switching controller OFF and then ON and verifying if error conditions are solved (e.g.if vacuum or air pressure are present, if mechanics is free and so on).

In this case restart program by double clicking its icon on computer desktop.

ERROR IS RECOVERABLE OR HAVE BEEN ALREADY SOLVED: (this condition can happen for example in case of a momentary loss in vacuum, or other similar conditions) click on IGNORE to make the program continue.

The dialog box has a third button, RETRY, which has no effect if pressed. Its presence was necessary to make the user choose between the two alternatives without making mistakes.

The dialog box includes also the indication of description, number of sensor and hardware module, to enable the service to understand what happens. Number of line and module are represented into the schematic diagram given with this documentation.

WARNING: BEFORE CONTINUING IN CASE OF ERROR, BE ABSOLUTELY SURE THAT MACHINE IS IN A SAFE CONDITION, TO AVOID WAFER BREAKAGE. IN CASE OF DOUBT, QUIT PROGRAM AND RESTART.

If arm is in a dangerous position, such as inside a full cassette, it can be manually moved. In this case, RESTART MACHINE.

For a complete troubleshooting refer to SERVICE MANUAL.

Semicon Synapsis is a division of *Astel*

Via Torino, 253 – 10015 Ivrea (TO) – Italy
Tel. +39 0125 230105 Fax +39 0125 633482
e-mail info@semiconsynapsis.com
WWW.SEMICONSYNAPSIS.COM



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9. System shutdown

To shutdown the system, follow this procedure:

First of all, go to the main machine screen.

Then press QUIT (F6).

A shutdown screen will be presented as follows:



There are four possibilities:

The first (F1) is leave the computer and restart under Windows. This operation is allowed only to service personnel and requires a special password which is not public. When pressing this key, a next screen will be presented to enter password.



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If password is not correct, the system will not be allowed to restart under Windows. If password is correct, system will reboot under Windows. A special procedure have to be followed shutting down Windows to restore machine at the next restart.

By pressing SHUTDOWN (F6) system will shut down, turning the computer off. After computer shutdown, press the EMO button to switch off controller power.

By pressing CANCEL (Esc) system will return to the main screen.

By pressing the SYSTEM DIAGNOSTICS (F7) button the system will ask the service password and will start the I/O and motor direct control.

This mode is described into the service manual, and requires a trained person to be used.

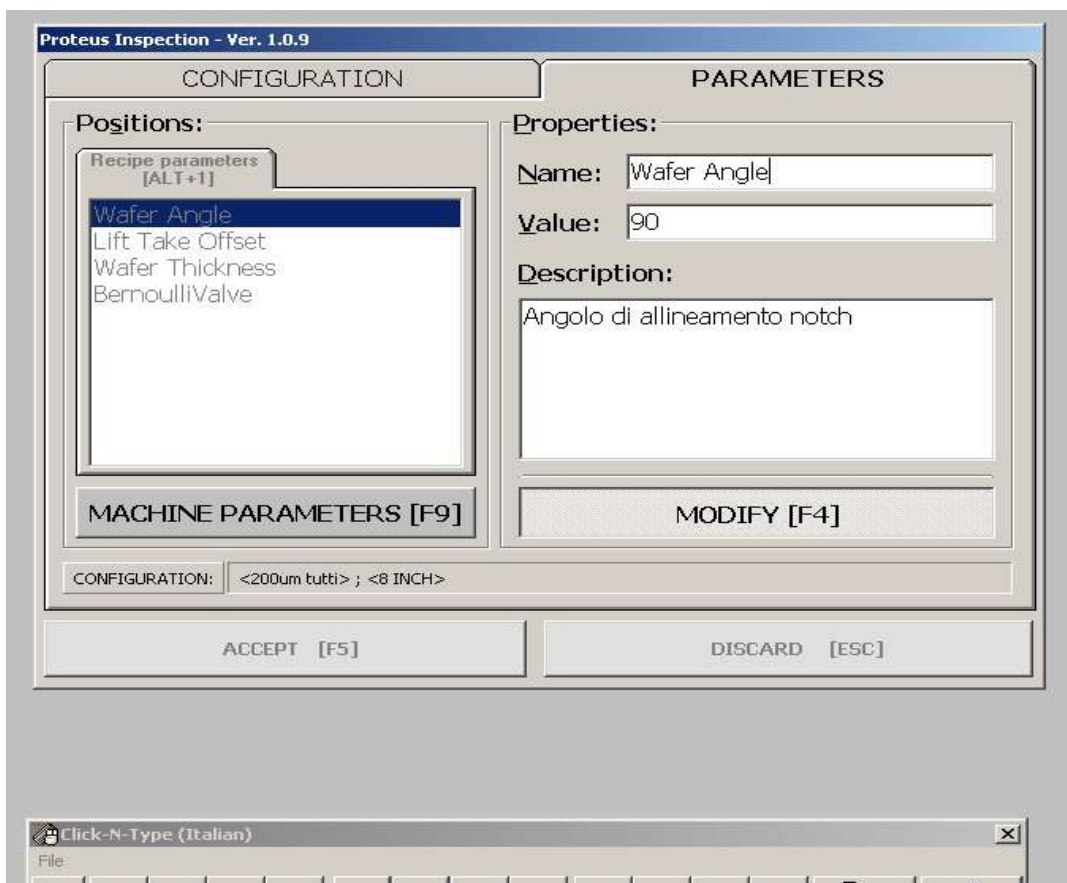


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10. The Screen Keyboard

Normally the machine is working without any keyboard connected, even if it is possible to work with a standard keyboard and a mouse.

To input passwords or parameters, a screen keyboard is provided and launched together with the machine software to enable the user to type data. Screen keyboard is launched at startup and normally appears as a small stripe on the low edge of the screen (here on the recipe programming screen):

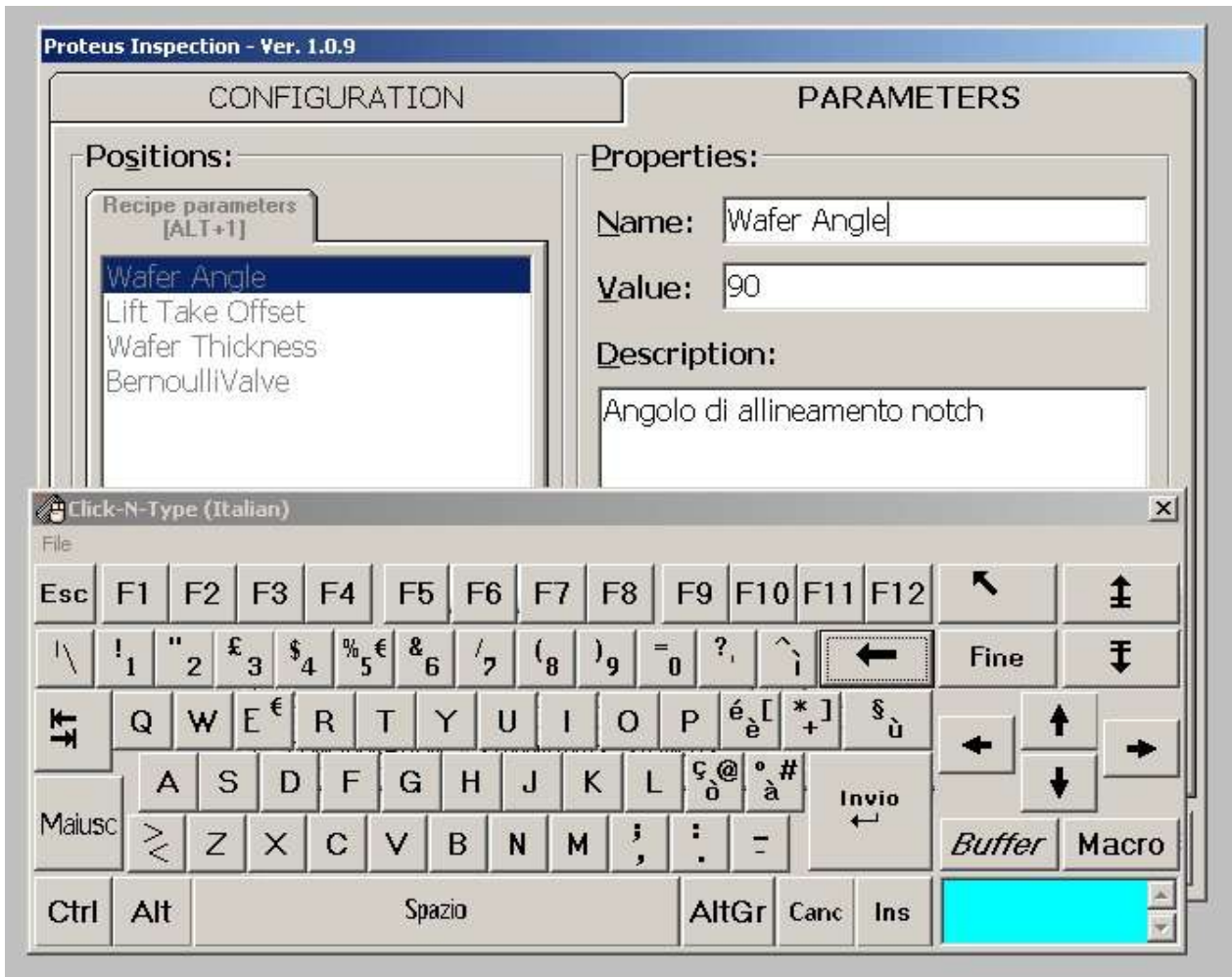


When it is needed to use the keyboard, just tap on it with the touch pen or the fingertip, and it will



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open as follows.



Keyboard can be used by pressing the buttons with the touch pen or the fingertip, and can be closed by tapping outside it.



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NOTE

Semicon Synapsis is a division of *Astel*
Via Torino, 253 – 10015 Ivrea (TO) – Italy
Tel. +39 0125 230105 Fax +39 0125 633482
e-mail info@semiconsynapsis.com
WWW.SEMICONSYNAPSIS.COM