Electronics and Industrial Automation

PROTEUS MIL 8000
MULTI-SIZE WAFER
MACRO and MICRO
INSPECTION SYSTEM

USER MANUAL
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WAFER INSPECTION SYSTEM

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

It have been especially studied for all that cases where it is required a simple to use, fast and cost effective solution in wafer inspection.
An inspection unit, featuring wafer front 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 or directly mounted into integrated wafer inspection or review stations as a part of the system.

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.

1. Introduction

Proteus 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 Macro System, i.e. the basic installation procedure, the operator interface and the use of its configuration software.

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.

The way to correctly connect is simply to follow the given indications, since there are no cables which can be exchanged.

After have done connections, switch on the main switch on the front right side of the machine,, verifying that EMO switch is released (in case rotate the knob CCW)

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

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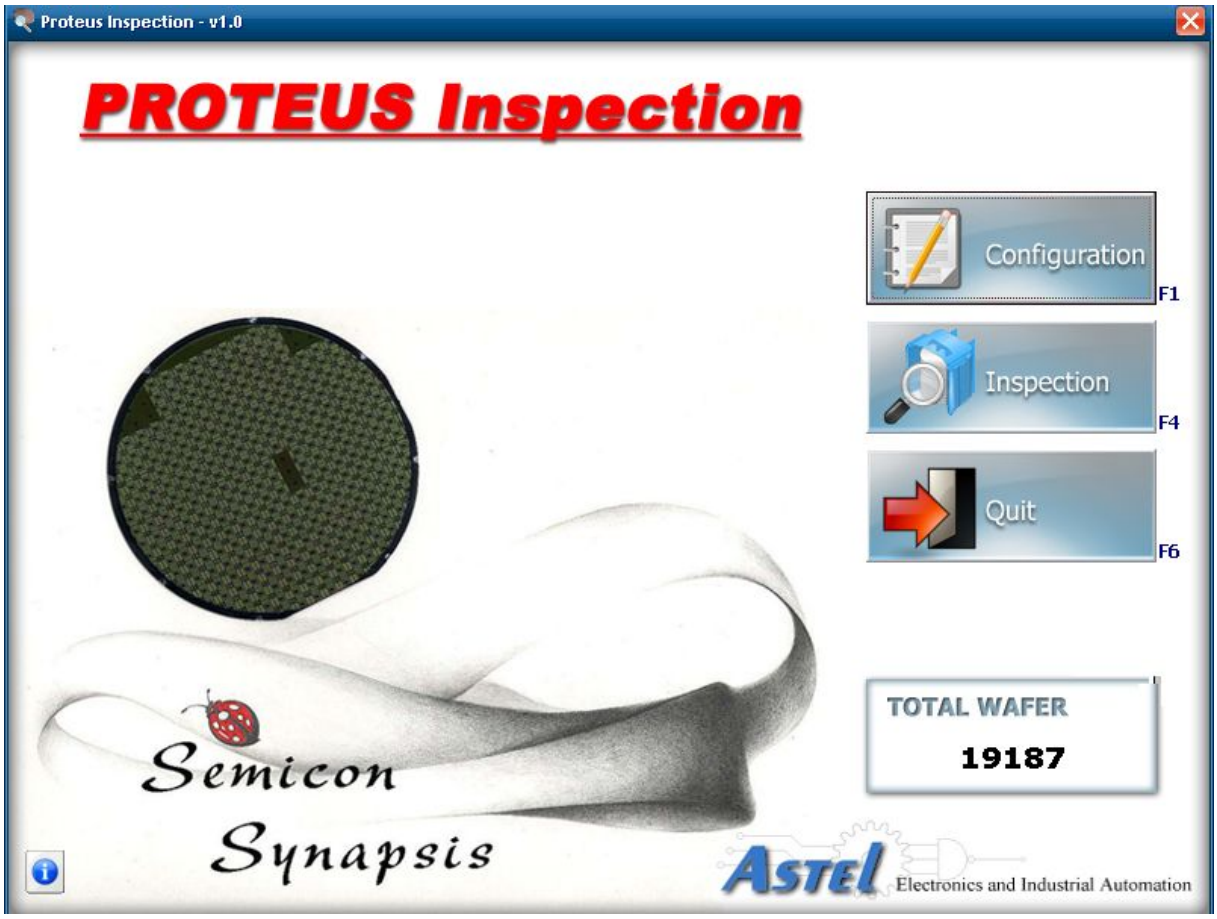
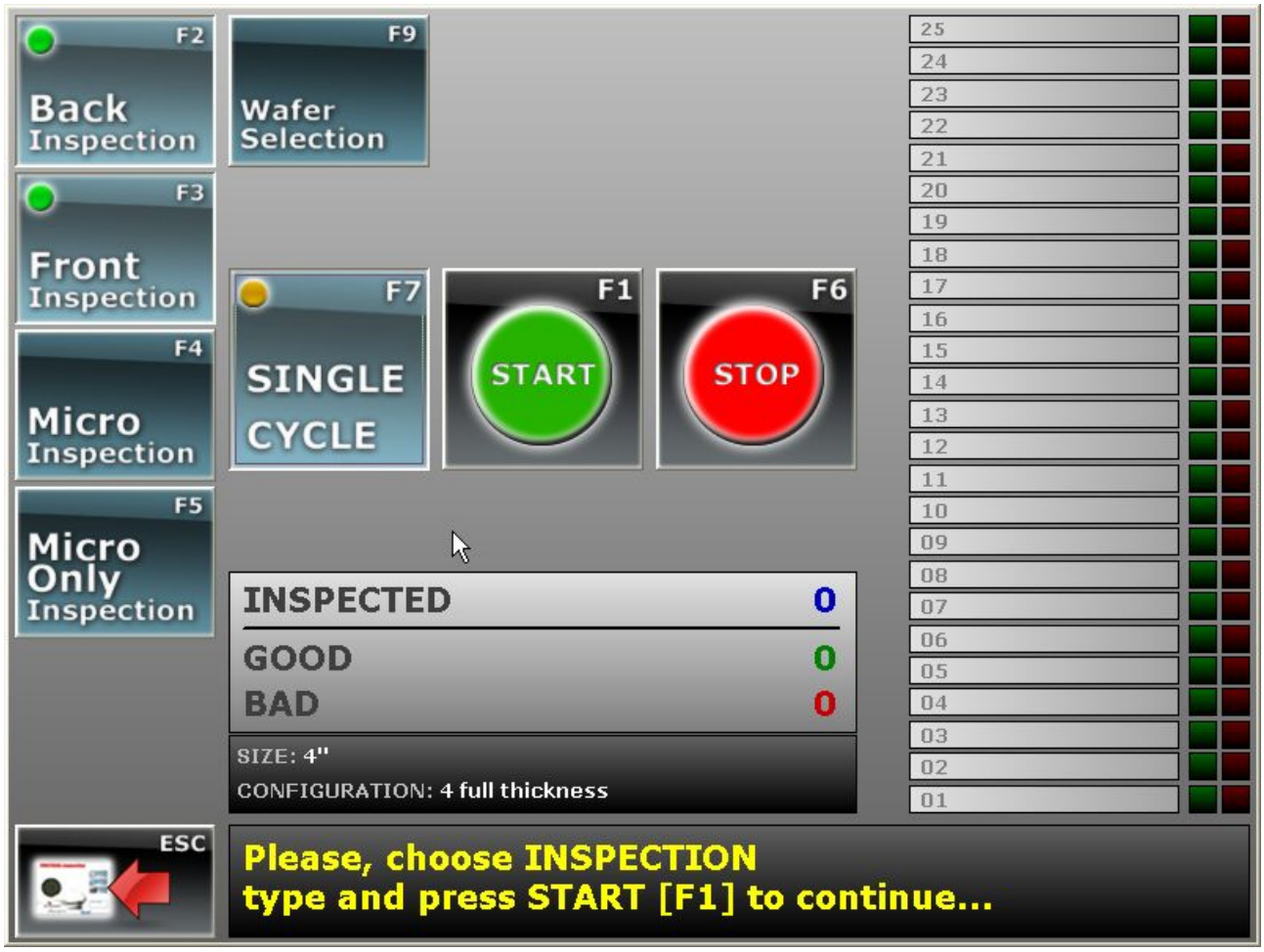
3.System startup

After having switched on computer, (or when launched from the desktop Proteus program will automatically run. After launch, 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.



4.Running machine cycle

The previous figure is 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;
-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 is included (only for stand alone machines) 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]. If the machine is into a protection hood with automated doors, in this moment doors will be opened and must be closed once the cassette is mounted before pressing START.

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 yellow 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 LED flash when one of the keys is pressed, the LED under the button 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.

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

It is possible to stop and start chuck rotation by just pressing the "CONFIRM" key before having pressed GOOD or FAIL. In this case the operation is toggle, switching rotation on and off.

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 microscope for micro inspection, and can be unloaded by pressing the keys on the joystick box.

There is also the option to unload wafers by setting a parameter into the recipe named "Exclude keys". With this parameter enabled the unloading of wafer will be requested by simply putting the microscope stage into the exchange position,

In this case wafers will be always marked as GOOD, unless discarded into the macro inspection.

MICRO ONLY: this mode is intended to speed up inspection when only microscope must be used and macro inspection is not needed.

In this case, during the inspection of one wafer, the next is prepared (unloaded, centered and aligned) and at the end of inspection the two wafers are swapped on the microscope chuck to neutralize the loading times.

There are no keys used to load and unload wafers, which will be just driven by stage movements.

Wafers will be always marked as GOOD, since there will be no operator selection,

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 (F 1) 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.

SIGLE CYCLE cannot be used in the MICRO ONLY and has no meaning when working on inspection stations with microscope software active.

4.2 Step by step operation

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

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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 (F 1) 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.

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.

4.3 Ending a cassette

A cassette inspection will finish at the end of all the selected wafers. It is possible to force a premature end by pressing the END button on the cycle interface. In this case the current wafer will be finished and then cycle will be closed.

4.4 Emergency STOP

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

This will force the machine to completely and immediately STOP.

This will not produce a vacuum or air loss, since the valves used are configured to avoid potentially dangerous situations.

Machine will detect within about 30 seconds the emergency condition, giving a message and then stopping the program from running. In this case program must be terminated and restarted.

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

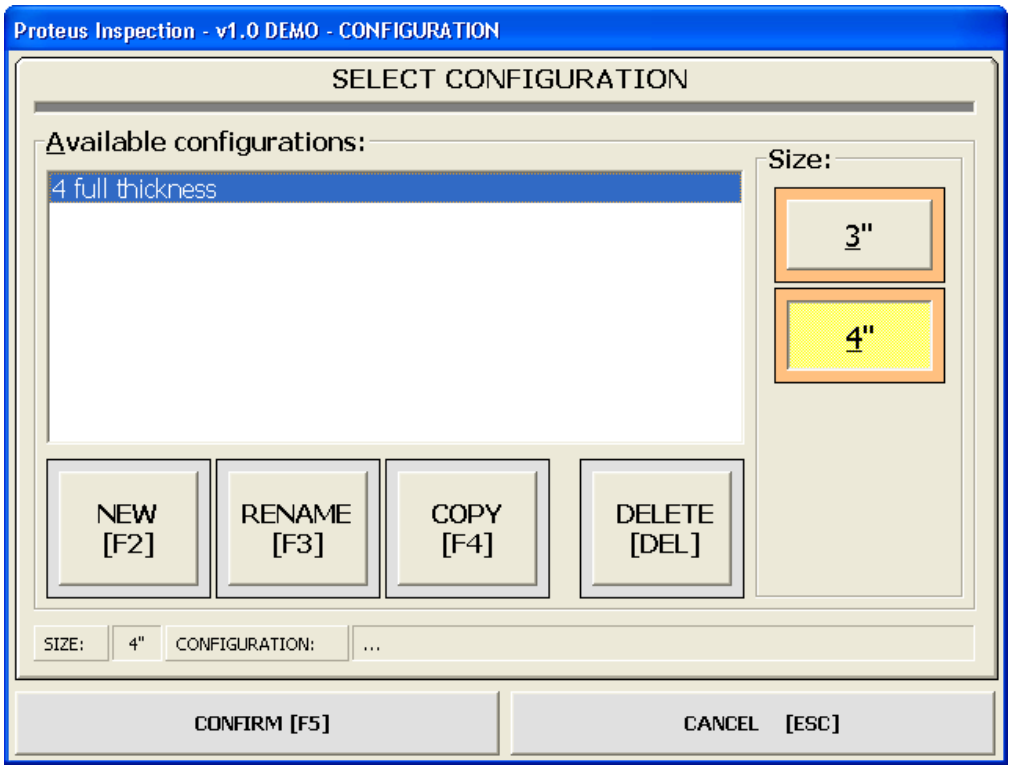
MACRO INSPECTION CHUCK, BERNOULLI AND LOADING ARM ARE PROTECTED AGAINST THE EMERGENCY PRESSED, SINCE VACUUM AND CLEAN AIR FLOW ARE DONE WITH A SAFE HOLD SYSTEM.

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).



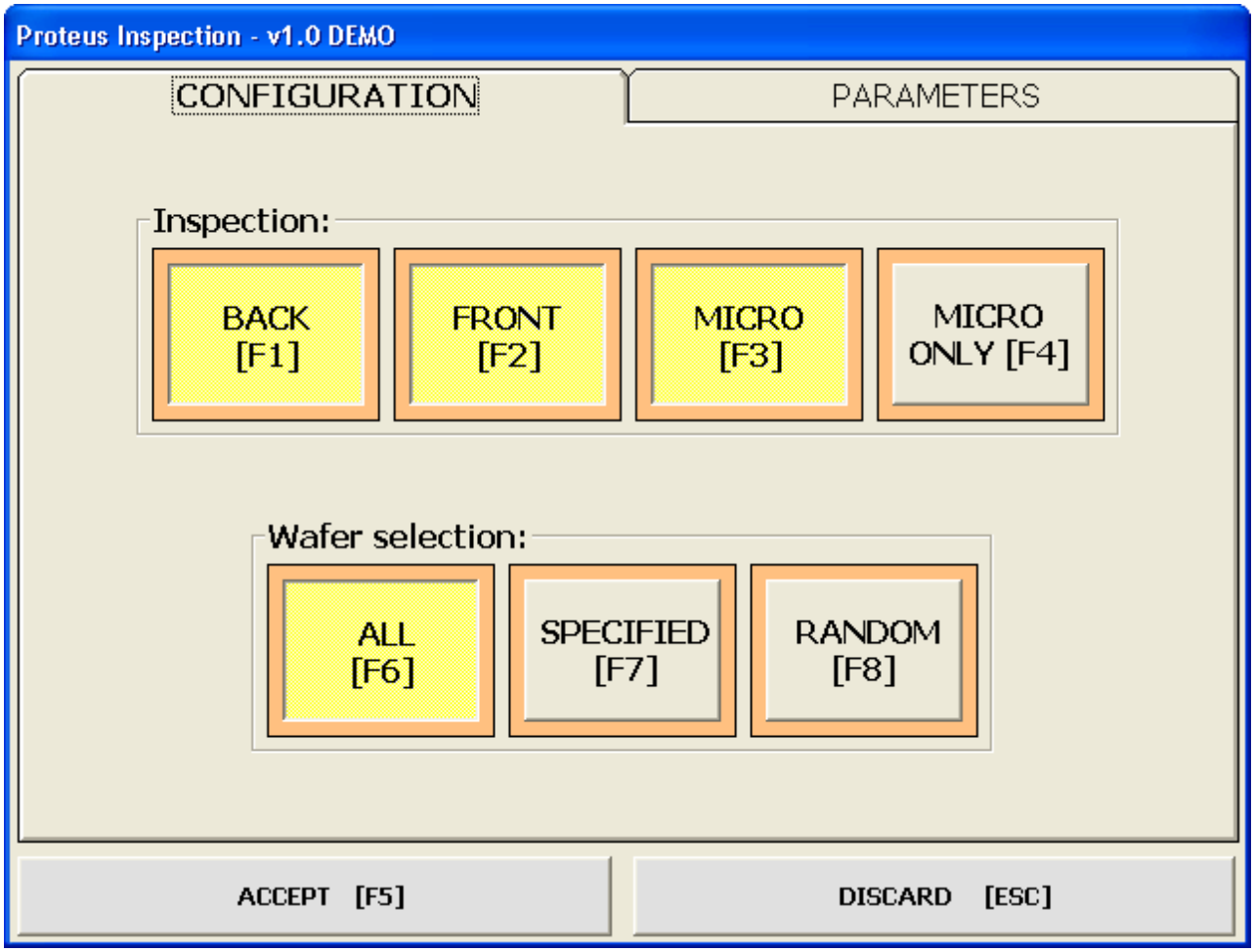
Select before wafer size and then the recipe by clicking its name, then press CONFIRM (F5) to load.

The previous interface will then be displayed and recipe can now be run by loading the proper

cassette with wafers to be inspected.
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.

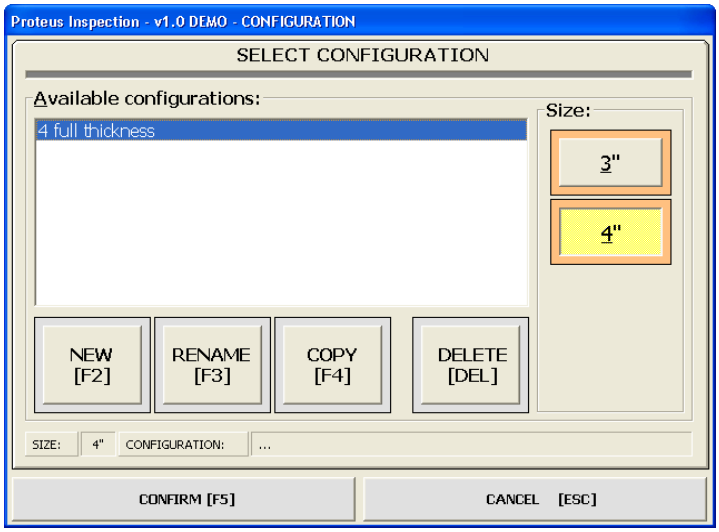


5. Editing Configurations

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 ("assa" is the default at machine delivery, but can be changed) and then the configuration selection display will appear.



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.

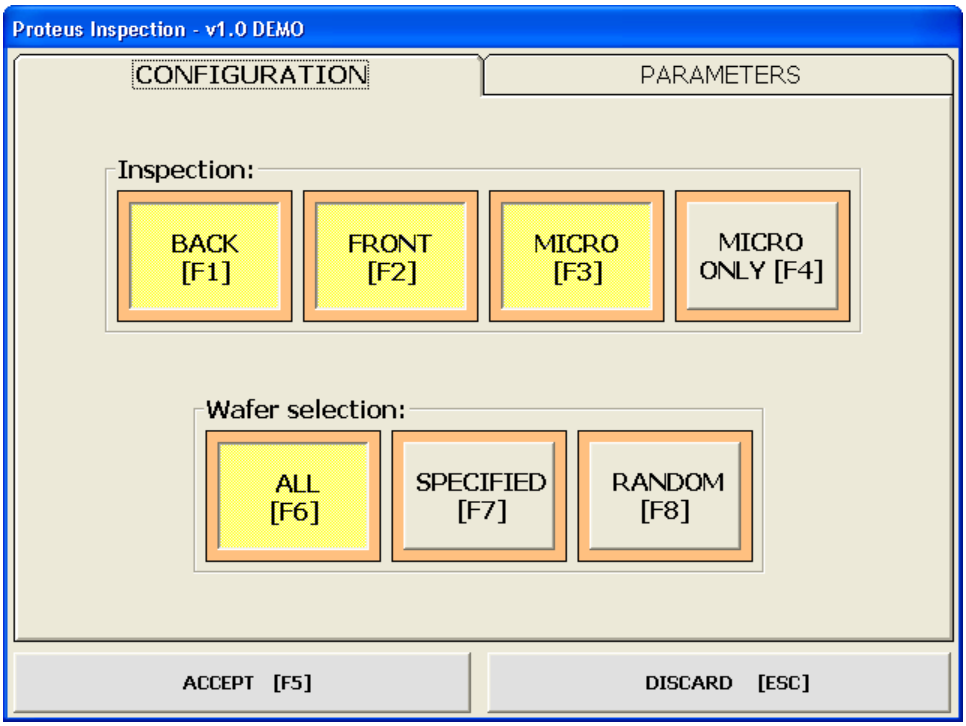
To select a configuration, select before wafer size and then configuration name by clicking on it. When configuration is selected, press CONFIRM (F5) to edit.

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 givenoptions.

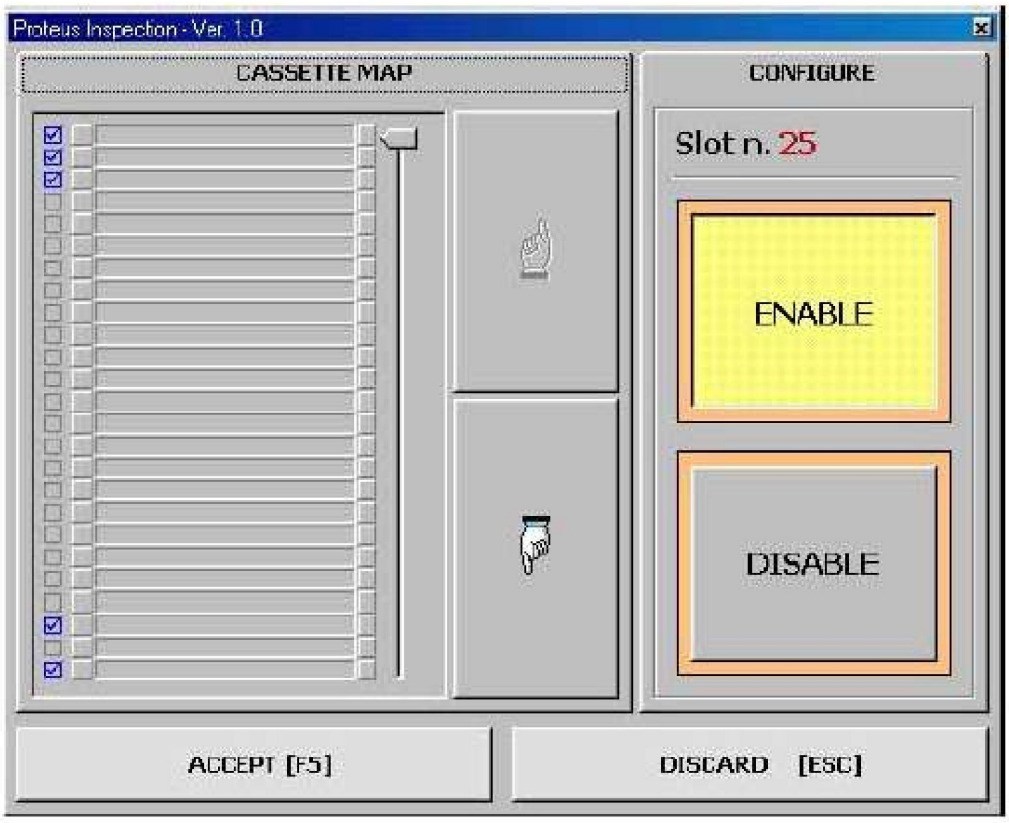
5.1 Choosing inspection strategies

The inspection strategy can be chosen by the selection screen.



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 mustbe 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 de 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 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.

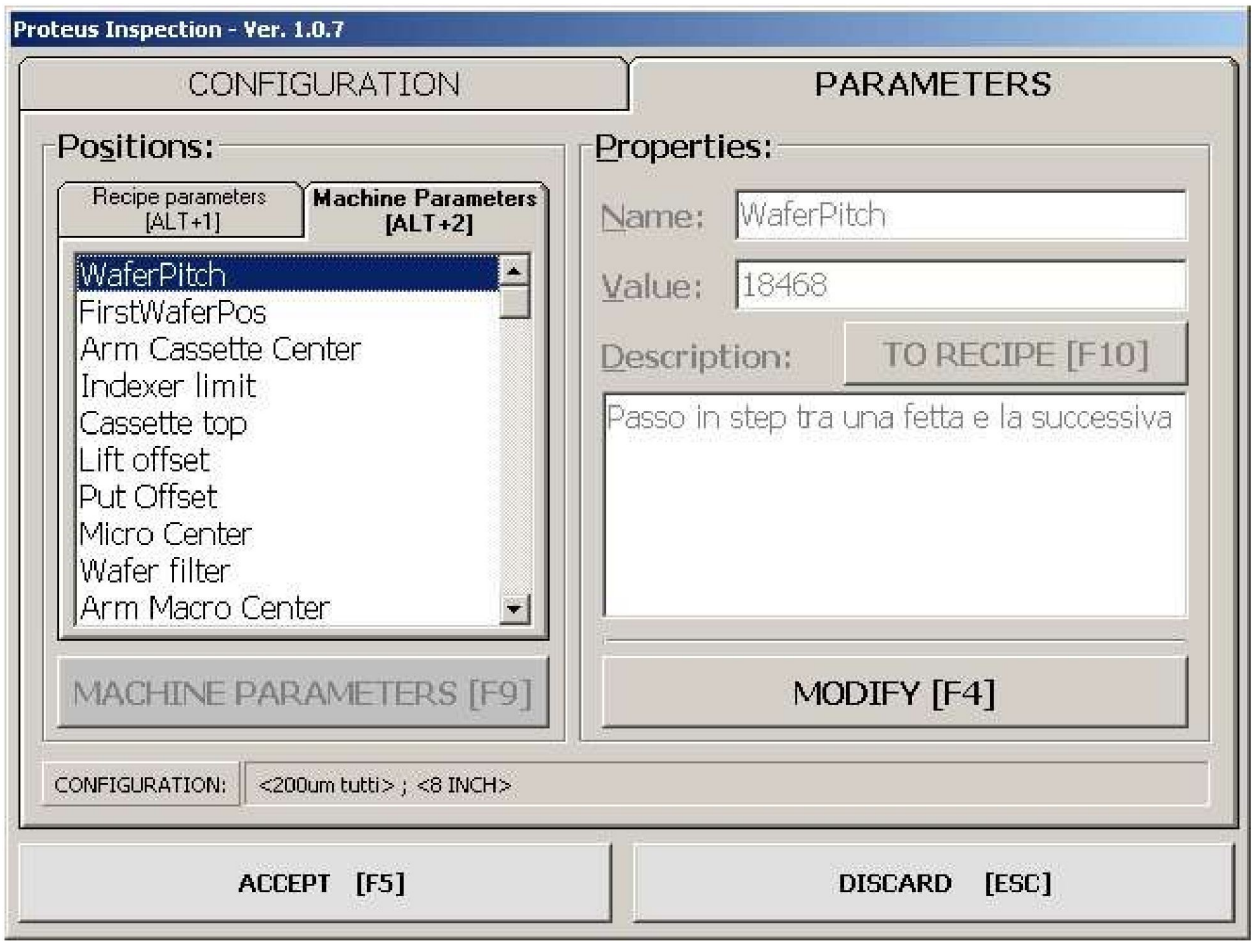
From this screen it is possible also to choose between FRONT and BACK inspection or both. If both modes are selected, the FRONT inspection will be performed at first, followed by BACK inspection.

5.2 Changing positions 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.

When selected, this screen will appear as follows:



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.

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 ckick 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.

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:

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

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

7.Parameters

Please note in the following area each parameter of DEFAULT recipe for all the sizes used configurations, before making any modification. A complete description of recipe parameters is given into the service manual.

PARAMETER NAME	VALUE 5”	VALUE 6”	COMMENTS

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 then will be restarted, going automatically to the main screen.

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.

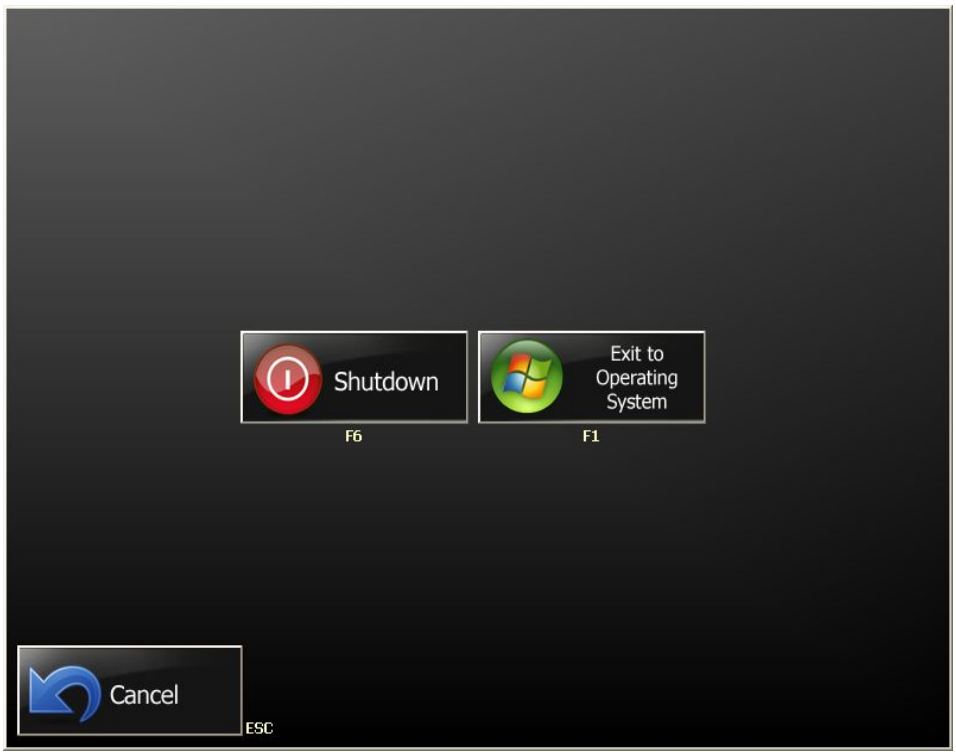
WARNING: BEFORE CONTINUING IN CASE OF ERROR, BE ABSOLUTELY SURE THAT MACHINE IS IN A SAFE CONDITION, TO AVOID WAFER BREAKAGE. IN CASE OF DOUBT, QUIT PROGRAM AND RESTART.

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

9. System shutdown

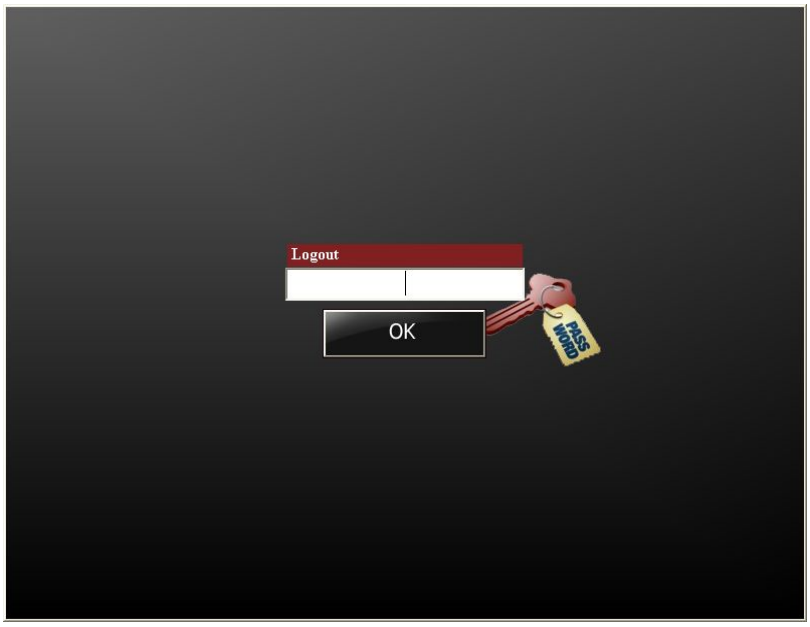
To shutdown the system, follow this procedure: First of all, go to the main machine screen. Then press QUIT (F6). IN CASE OF INSPECTION STATIONS PROGRAM WILL THEN QUIT

IN CASE OF STAND ALONE SYSTEMS, a shutdown screen will be presented as follows:



There are three possibilities:

The first 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.



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 system will shut down, turning the computer off. After computer shut-down, press the main switch button to switch off controller power.

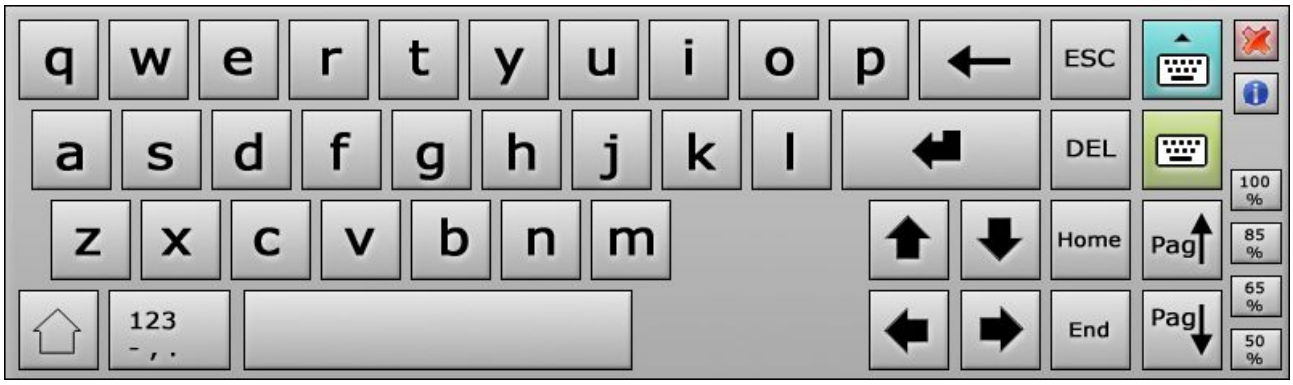
By pressing CANCEL , system will return to the main screen.

10. The Screen Keyboard

Normally the stand alone machine is working without any keyboard connected, even if it is possible to work with a standard keyboard and a mouse. In case of inspection stations, there is no touch screen and then keyboard is present.

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 icon on the screen.

When it is needed to use the keyboard, just tap on it with the touch pen or the fingertip, and it will open as follows. To close keyboard, just click or tap on the green button. Keyboard program termination is disabled and then can't be used.



Keyboard can be used by pressing the buttons with the touch pen or the fingertip, and can be switched on numbers only and vice versa.

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