WaferStorm® & *WaferEtch®* Model 3300/3400

Operation Manual

185 Gibraltar Road · Horsham, PA 19044-2303 · USA · +1 (215) 328-0700

Veeco Precision Surface Processing, LLC
185 Gibraltar Road
Horsham, PA 19044-2303 USA
Phone: +1 (215) 328-0700

Revision History

REV	ECO / ECM	DESCRIPTION	DATE	CHANGED BY	APPROVED BY
		Updates include: - Replacement of SSEC with Veeco PSP or VPSP throughout document - Replacement of SSEC screen images with Veeco PSP Process screen images	2018-11		

Disclaimer

This document describes the proper, safe operation and maintenance practices of highly complex technical equipment. Every effort has been made to include compliant instructions, warnings and guidelines to ensure the safe and productive use of the Systems related to this document.

Contents

1: Getting Started

This Operation Manual consists of descriptions and instructions of how to use the VPSP Tool and its Software. All sections describe a fully configured and properly operating Tool. Hardware descriptions, preventive maintenance, routine maintenance, and troubleshooting guides may be found in the Safety and Maintenance Manual. VPSP Tools are constantly being improved and upgraded. Therefore, the contents of this manual are continuously changing.

The terms “wafer” and “substrate” are used interchangeably throughout the Manual and refer to whatever the Tool is designed to process. VPSP Tools may also process photo-masks, quartz discs, CD masters, glass plates, flat panels, sliders, and many other types of products.

System Requirements (Minimum)

The current Specification (as of 2019-01) for the System PC for Process 7v.66 or greater are:

- Windows 7 Professional 64-bit with Service Pack-1
- Pentium Processor
- 8 GB RAM
- 500 GB Hard Drive (x2, RAID-1 Mirrored Configuration)
- Six (x6) USB 2.0 Ports (2 in Front, 4 in Rear)
- Four (x4) USB 3.0 Ports (2 in Front, 2 in Rear)
- Onboard Ethernet Port
- Dual-Port Intel Pro/1000 Ethernet Card (for GigE Cameras)
- DVD R/W Drive

Contact Veeco/PSP for either a replacement System PC or for an Upgraded System PC.

Powering Up the System

Before Powering Up

An important thing to keep in mind before power up is what was the condition of the Tool when last powered down. This can be critical if a power interruption or an EMO Condition occurred to cause the power down. Here are a few things to check.

- Is the green Power ON Indicator lit? This indicator is on the front of the Tool in an obvious place (usually front-right side). If this is dark, the Tool may have an EMO condition that needs addressing. If this is the case, the EMO condition needs to be addressed before power up proceeds.
- Are all of the Paddles and Arms in a safe position? Doors are either pneumatically controlled or motorized. Arms and Paddles can be damaged if a door closes on them during the initialization cycle.
- Are all utilities on and up to required levels? There are safeguards in the Software that will limit initialization if certain facilities are not within defined limits.

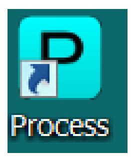
Power Up

The Main Disconnect Switch should be in the "ON" position. All Circuit Breakers in the main AC electrical box (hereafter referred to as an E-Box) should be ON. In this state with the Power OFF to the Tool there is line voltage present to several sub-systems as permitted by Semi S2. The PC will have power and can be started. Power on the Monitor and the PC and let the PC boot up.

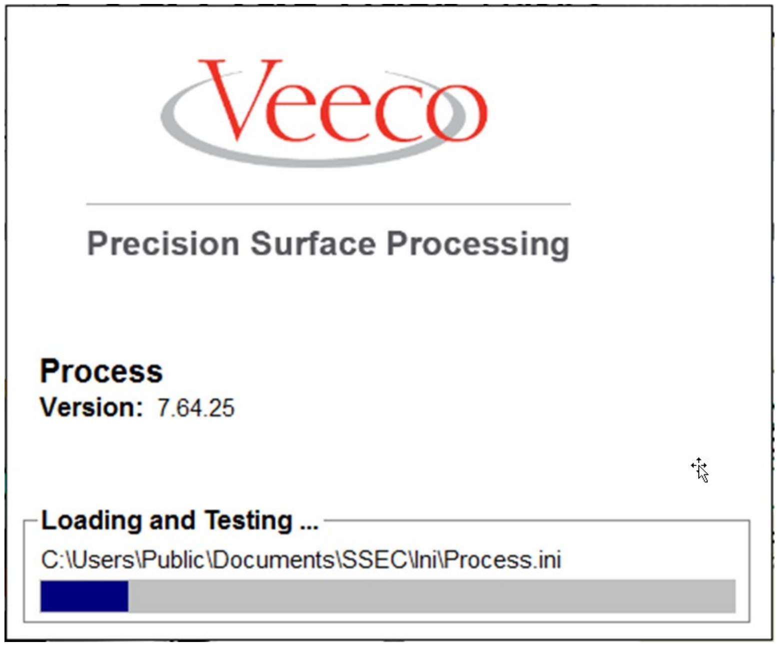
Power the Tool on by pushing the ***Green*** **"**ON" Button on the right front of the M3300/3400. If the Tool uses Solvents, a separate ***Green*** Indicator light will illuminate after an appropriate time delay has passed. This time delay allows any Solvent Fumes that may have accumulated in the electrical boxes to be purged prior to power being applied to all sub-systems.

Startup Sequence

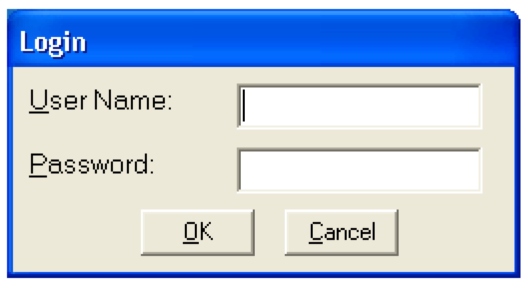
Double-click the "Process" Icon on the Windows Desktop.



A Veeco Precision Surface Processing Logo Window will appear listing the Tool Type and the Software Version.

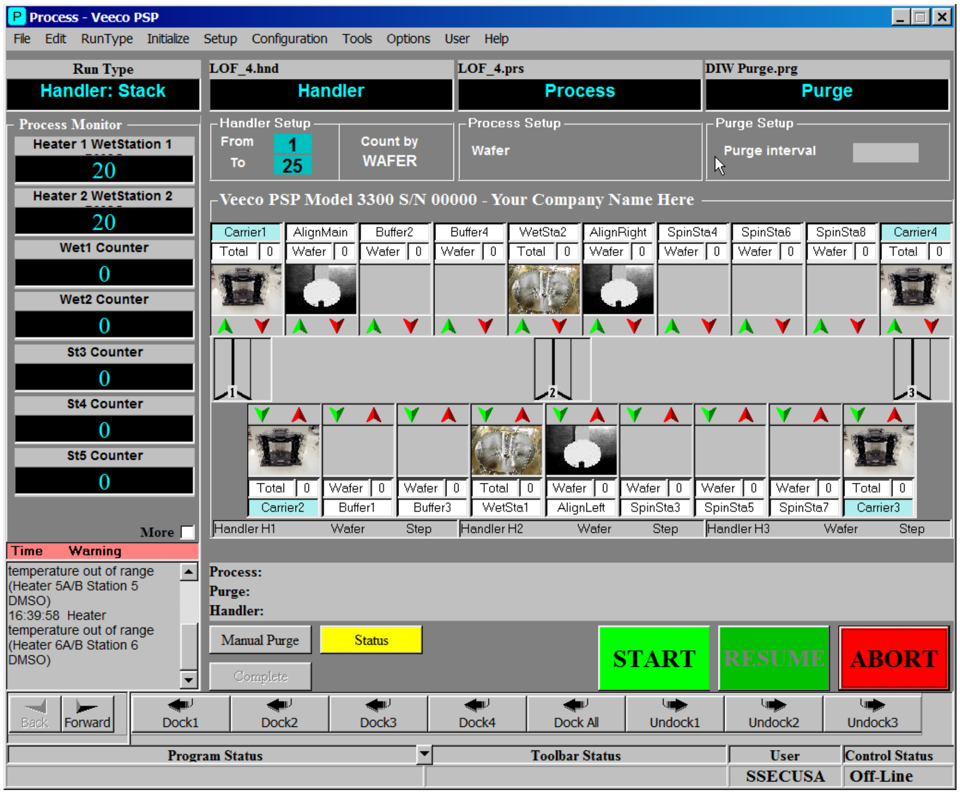


A "Login" Window will also appear.

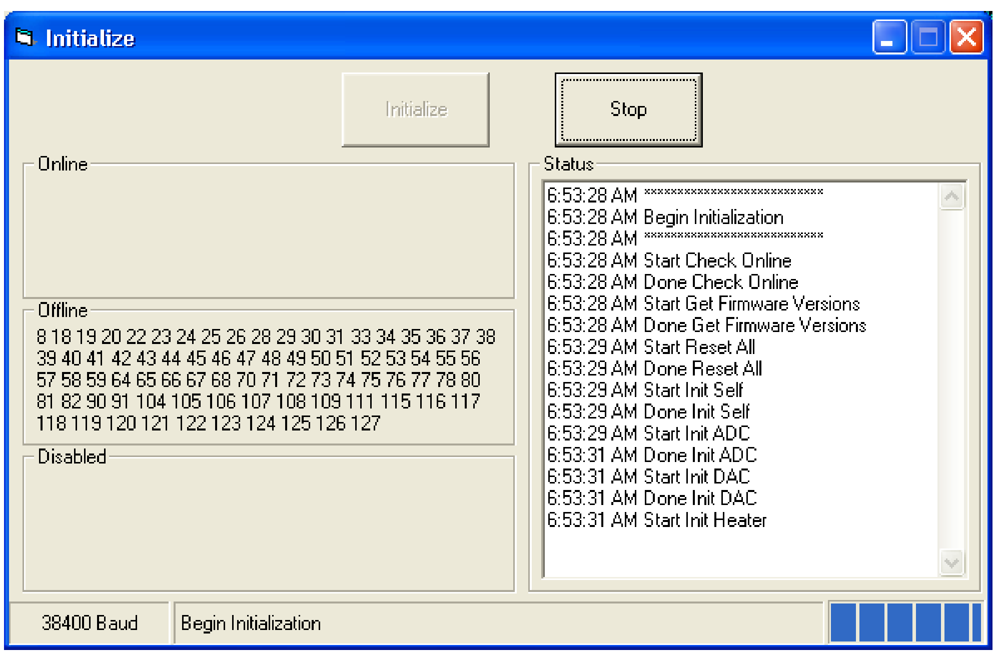


You must enter a valid "User Name" and "Password" to start up the Tool. The inputs are case sensitive. Correct input will allow access to one or all of the available three levels: Supervisor, Administrator and Operator. Reference the section regarding the User List for more information on this topic.

Assuming a valid User Name and Password are entered, the Process Software will be loaded and executed. The main "Process—Veeco PSP" Window will be displayed.



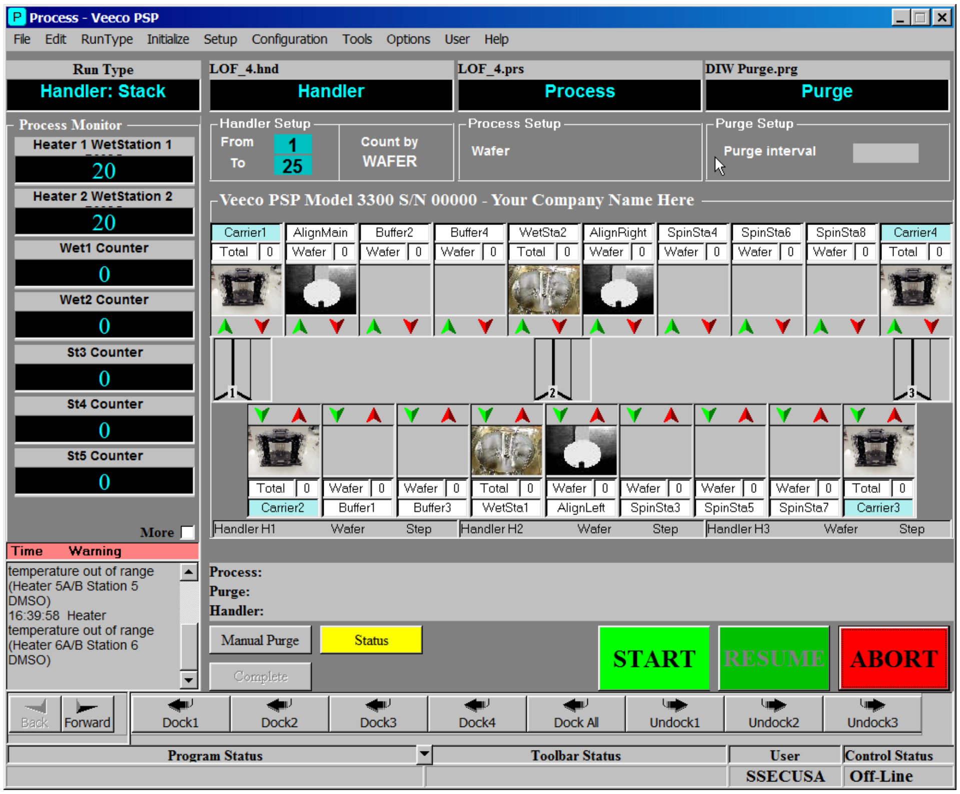
Subsequently, an "Initialize" Window will open, displaying the hardware state of the Tool, and the status of the initialization.



If everything is Online and there are no errors, the Status field will display the sequence of initialization commands preceded by the time of their execution. Once the initialization is complete the Status Window will briefly display "Initialization passed" and the Window will close.

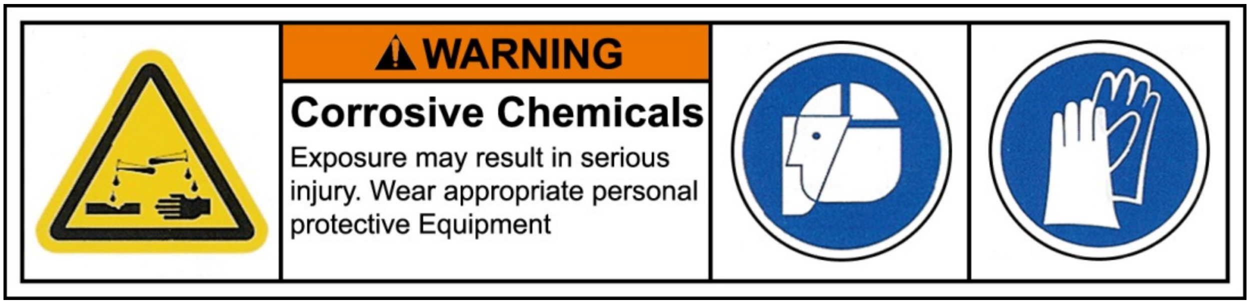
The example Windows above may not mirror your particular configuration. The previous Window shows all addresses offline, as this was run in "Demo" Mode.

With the initialization successfully completed, the Main Window will become available.



Depending on the chosen Password Level, all or only some of the functions may be available. Refer to the "Password" and "Edit User List" sections for detailed information. The System is now ready to process production substrates.

Warning on Wet Chemistry



The VPSP Processor M3300/3400 uses Solvents and Acids that may be corrosive and flammable. Only experienced, trained, 100% protected, Maintenance Technicians should handle wet chemistry being provided to the M3300/3400.

VPSP recommends that the Tool be operated and tested with DI Water thoroughly before applying Chemistry.

Baseline Chemistry

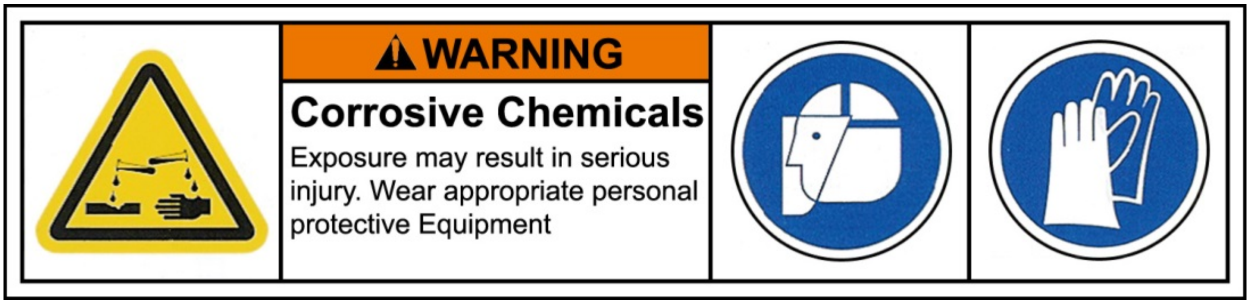
VPSP Systems are customized for each Customer. The VPSP Processor M3300/3400 Solvent Tool has been characterized using Baseline Chemistries that are specified in the Tool order and on the Plumbing & Instrumentation Diagram (PID). A Safety Data Sheet (SDS) for each known Chemistry is supplied in Section 2 of the Safety and Maintenance Manual. Substitution of Chemicals can change the behavior of the System.

Customer Responsibility

When the Customers choose to use their own Chemistry rather than the Baseline Chemistry, they are responsible for thoroughly understanding the behavior and hazards associated with the chemicals used. This includes understanding the interaction of these chemicals and how they affect the System. It includes training in the use of the System and the handling of these chemicals for Operators. Finally it includes supplying safety information including Safety Data Sheets (SDS), formally called MSDS, for each Chemical used so that they are available to Operators and Maintenance Personnel.

Chemical Handling After EMO

In an emergency situation, activating the EMO may closes valves at both ends of the Chemical Lines, therefore these lines may remain under pressure.



Do not open the Chemical Lines or Process Chamber during an EMO situation. In Tools with hazardous chemicals, if the EMO is activated during a process step, the Chamber will contain these Chemicals.

After an EMO situation, follow proper maintenance procedures and allow the Tool start-up to rinse the Process Chamber if configured as such. If further maintenance or other action is necessary, depressurize the Chemical Lines under Software control by executing a proper system shutdown.

It is recommended that:

Only properly trained Maintenance Personnel perform any maintenance on VPSP wet processing equipment, plumbing, pneumatic, or electrical systems. Properly trained is defined as a technician who is familiar with the options and layout of the complete mechanical, plumbing, pneumatic, or electrical systems on which maintenance is to be performed. Also, that the technician has been properly trained on how to handle Hazardous Chemicals, and is familiar with the proper use of Personal Protective Equipment. Proper training on Hazardous Spill Containment and cleanup is also recommended.

That the Maintenance Technician contact VPSP in order to review the plumbing system of the Tool in question with an VPSP qualified Service Engineer. The VPSP Service Engineer can then help recommend the proper procedure to release **stored energy/chemical pressures** which may be present within the VPSP Tool.

Once any required maintenance is complete, the start-up program rinses the Process Chamber, the last used recipe is loaded, and the Tool is ready for processing wafers.

Assumption of Liability and Disclaimer

Check with the factory prior to the use of other chemicals.

⚠	⚠ CAUTION
	APPROVED CHEMICALS ONLY The M3300/3400 and its components have been designed to be used with only specific chemicals; use of unapproved chemicals may result in product failure, damage, or personal injury, including death.

Prior to use, any chemicals (including changes in proportions in existing mixes) used with the equipment should be approved by VPSP. Failure to obtain the prior written approval of VPSP for the use of a chemical, or a combination of chemicals, with the equipment shall result in all warranties becoming null and void.

Customer assumes liability for all injuries or damages caused by leaks, splashes, sprays, or other discharges of chemicals used in conjunction with the equipment. Customer assumes responsibility for ensuring that appropriate protective gear is worn by employees and other individuals who may operate, service, or otherwise come into contact with or enter the vicinity of the equipment.

UNDER NO CIRCUMSTANCES SHALL VPSP BE LIABLE FOR ANY INJURIES, INCLUDING WITHOUT LIMITATION, PERSONAL INJURY, DEATH, OR ANY DAMAGES, DIRECT, CONSEQUENTIAL, PUNITIVE, OR OTHERWISE, BY REASON OF ANY LEAKS, SPLASHES, SPRAYS, OR OTHER DISCHARGES OF CHEMICALS USED IN CONJUNCTION WITH THE EQUIPMENT, NOR BY USE OF THE MACHINE IN ANY MANNER NOT SPECIFIED BY THE MANUFACTURER.

Hardware

The PC that supports the M3300/3400 Tool is a dedicated PC that is solely for the operation of the M3300/3400 Tool. The Network Interface Card will be supplied by VPSP as part of the PC that is running the M3300/3400 Tool.

Software

Any Software that is loaded on the PC for the M3300/3400 should be loaded by VPSP or with the approval of VPSP. There are several types of Software that are known to create problems. Screen savers and some games will cause problems. These should never be loaded onto the PC. Some Customer Local Area Networks are set up to use the anti-virus Software in the PC to do self-scan for certain file types. This will interfere with the operation of the Tool. There are other ways of ensuring network safety, and this may require a discussion with VPSP's technical support group.

In order to limit problems, VPSP has created a Policy for Network Connections. We ask that each Customer read this, sign it, and fax a copy to VPSP at:

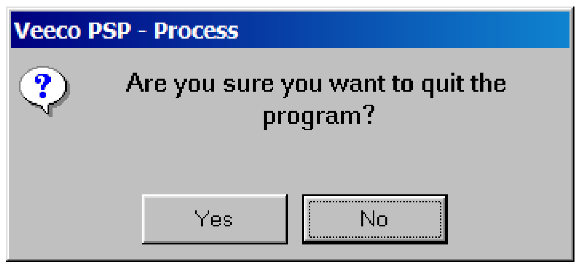
+1 (215) 328-9410

A copy of this form can be found in "Forms for Customer to Sign" folder on the CD/DVD-ROM Disk.

2: Software Basic Operations

General

All "Windows" rules can be applied. You can open, minimize, maximize, or close Windows. Some Windows cannot be resized. If you try to close the main Window, a pop-up Window will ask if you are sure you want to close the program.



A number of Windows can be displayed at the same time. Pull-down Menus can be accessed normally. Clicking on any of the Toolbar Buttons (when available) at the bottom of the Main Window will perform various tasks.

Folders and Files

Folder Structure

The Folder structure is as follows:

C:\Program Files\SSEC

\Archive

\BACKUP

\Bin

\Bmp

\Components

\Data

\Doc

\Flash Programmer

\Ini

\Log

\ProcessView

\Recipe

\Servo

Folder Groups

We differentiate the different folders into several groups:

Data

BMP

Software

Log

Archived Log

Trace

Other

Data Folders: Ini, Recipe, Servo

The data folders are different for each Tool. The files in these folders describe the specific hardware and behavior of the Tool.

BMP Folder: Bmp

This folder is usually different for each Tool. The Bmp Folder contains a set of picture files that can be used for display purposes in the Software.

Software Folders: Bin, Components

These folders should be the same for all Tools running a particular version of Software. The Bin and Components folders contain compiled code.

Log Folders: Log, Ini, Recipe, Servo

These folders are different for each Tool. The files in these folders include all the log folders plus the folders that describe the specific hardware and behavior of the Tool. Most problems that occur with the Tool may be diagnosed by examining the contents of these folders.

Archived Log Folder: Archive

This folder contains all the archived log files.

Trace Folder: Data

This folder contains any data that has been collected by the Software.

Other Folders: Doc, Flash Programmer, ProcessView

These folders aren't really a group – they are just the folders that don't fit into the other categories.

Folder and File Descriptions

Archive

This folder contains all the archived log files.

BACKUP

The Backup Folder may be used by anyone (Software, technical service, or manufacturing personnel) to make backup copies of any of the folders before making changes. When a new Software version is installed, backup copies of some Software files are automatically written into this folder by the Software.

Bin

The Bin Folder contains the Software executable files, the compiled help metafiles, and various other support files.

Examples:

Process.exe – Process Program

SSECMaint.exe – Maintenance Program

ZipArchive.exe – Archiving program

Proc.chm – Process Software help file

Error.txt – Error code messages and their indices

BMP

The BMP Folder contains icon (.ico), bitmap (.bmp), and photo (.jpg) files.

The icon files are used to display icons on the Toolbar Buttons. They are specified in the Toolbar.def file.

The bitmap or photo files are used in the Tool representation on the main screen of the Process program. These files are pictures of the different stations, such as the Wet Station, Alignment station, Brush Boxes, Spin Chambers, etc.

Components

The Components Folder contains Software libraries called by the executable programs in the Bin directory.

Data

The Data Folder contains any Software collected data files. Files created by using the data Trace feature (.csv) or video files created from WaferChek (.avi) are stored here.

Doc

The Doc Folder is for technical service documentation, such as plumbing diagrams, electrical schematics, and assembly drawings.

Flash Programmer

The Flash Programmer folder contains Software for downloading new firmware into the hardware modules. It may also contain specific firmware version (.hex) files.

Ini

The Ini Folder contains initialization files. Most of these contain hardware device descriptions. Some of these contain setup information for the Software or Tool specific initialization sequences.

Log

The Log Folder contains Log files created by the Software. These are time stamped ASCII text files which can be read by any appropriate program. Unless otherwise specified the present (active) file and one backup (.bak) are maintained. The active file is renamed with a ".bak" extension and new log file is created.

Buddy.log.

This log contains a log of the messages that are sent between the computers on dual PC Tools.

capture.log.

This contains data collected from Alignment sensors and Wafer Mapping sensors.

EPD.log.

This file the error and status of the WaferChek end-point detection feature.

EPT.log.

This file keeps track of the state of the various stations of the Tool.

Limits.log.

This file records when the limits.ini file is read or re-read into the Software. Only exists on Tools where multiple handlers may have overlapping operating areas.

Message.log.

This file is the main log file – it logs when the Tool is initialized, when a run cycle begins and ends, errors, etc. This file is written until it becomes 1.27 Mb in size (small enough to fit on a disc). Then a new one is opened and the previous one is closed with a ".bak" extension and also copied to the Archive folder where the log filename has the date and an index number appended to it. The message logs are archived forever.

Model.log.

This file records the state of high level subsystems. The contents of this file are maintained for one week.

Motor.log.

This file logs the accuracy of motor moves. The contents of this file are maintained for one week.

ProcessDB.log.

This file records when the process database interface is running.

S2_.logs.

These are log files created and maintained by the SECSGEM interface.

Sequencer.log.

This is a debug log file. It contains all the commands executed from the Def files. This file is written until it becomes 1.27 Mb in size (small enough to fit on a disc). Then a new one is opened and the previous one is closed with a ".bak" extension and also copied to the Archive folder where the log filename has the date and an index number appended to it. The sequencer logs are archived for one week.

SSECComm.log.

This file logs communications errors that occur between the PC and the VPSP Hardware network. You can also configure the Software to load ALL commands sent over the network by selecting "Tools/SSECComm/Options/Settings/Logging Enabled".

Vision.log.

The vision.log file records each instance that the Software makes requests to the frame grabber board on systems that have vision. The date, time, address accessed, the command sent, and the time that a vision acquisition takes are recorded.

Wafer.log.

This is started by checking the wafer log option on the main screen. If this is checked, it will log exactly how much time a wafer spends in each chamber. This is important for Customers concerned about how much time a wafer spends in a wet station. It can also be used to calculate the total throughput per cassette or wafer. Lot ID numbers can also be captured. This file is written until it becomes 1.27 Mb in size (small enough to fit on a disc). Then a new one is opened and the previous one is closed with a ".bak" extension and also copied to the Archive folder where the log filename has the date and an index number appended to it. The wafer logs are archived forever.

WaferMap.log.

This contains the results of Wafer Mapping calculations.

Infranor.log.

This logs the commands sent between the Infranor motors and their controllers.

ProcessView

The ProcessView Folder contains the ProcessView Software and its support libraries.

Recipe

The Recipe Folder contains the definition files (.def) and their respective recipe files (.prs, .hnd, .tbr, .prg, and .ltw) that describe how the Tool will behave. Recipe and Definition files are Tool-specific and reflect the hardware that is part of the Tool.

Function.def. Instructions for the Process (*.prs) and Purge (*.prg) recipes

Handler.def. Instructions for the Handler (*.hnd) recipes

Light.def. Instructions for the Light Tower (*.ltw) recipes

Toolbar.def. Instructions for the Toolbar (*.tbr) recipes

Servo

The Servo folder contains the servo tuning parameter files (.srv), the Tank I/O module parameter files (.tio), and the heater module parameter files (.htr).

Keyboard and Mouse Usage

The M3300/3400 is designed to be operated with both a mouse and the keyboard. All operations can be performed on both. Entering text using the mouse can be performed using the On Screen Keyboard available from the Accessibility section of the Windows Accessories. Both methods of operation are described below.

Keyboard Usage

Menu Bar Selections

These can be made by pressing and holding the "ALT" key and pressing the underscored letter in the desired menu. The selected menu will then appear. To select a particular item, press the highlighted letter of that item on the menu list. An alternative technique, once the menu list is displayed, is to use the cursor keys to highlight the desired selection and press the "Enter" key. To exit a menu screen, press the "Esc" key.

Entering Numeric Data

Use the cursor keys to position the flashing screen cursor on the number to be changed. Use the numeric keys to enter the new number. When complete, press the "Enter" key. You will notice that when the first number key is pressed, the numeric field will highlight, indicating where data is being input. The field will remain highlighted or selected, until the "Enter" key is pressed.

Entering Other Data

Other data entries may require typing in filenames, entering comments, answering Yes/No requests, or entering production data like wafer IDs. Use the keyboard as normal or press the <Enter> to select the highlighted option.

Mouse Usage

Menu Bar Selections

This is accomplished by maneuvering the cursor to the desired menu name at the top of the screen. Press and hold the left mouse button. While holding the button down the selected menu will appear. Continue to hold the button down and move the cursor down to the desired menu selection. When the selection is highlighted, release the mouse button and the highlighted selection will automatically be opened. To exit a Window, Click on the Windows “X” button as normal.

Entering Numeric Data

Numeric data is entered by moving the cursor to the desired field, and entering the number using the On Screen Keyboard. Some numeric fields may have slider bars to change the value or sets of arrows and double arrows (<< < > >>). These can be clicked on to make the value greater (> >>) or smaller (< <<).

Entering Other Data

Move the cursor to the data field. Other data entries may require typing in filenames, entering comments, answering Yes/No requests, or entering production data like wafer IDs. Use the On Screen Keyboard or click on the default value to select the highlighted option.

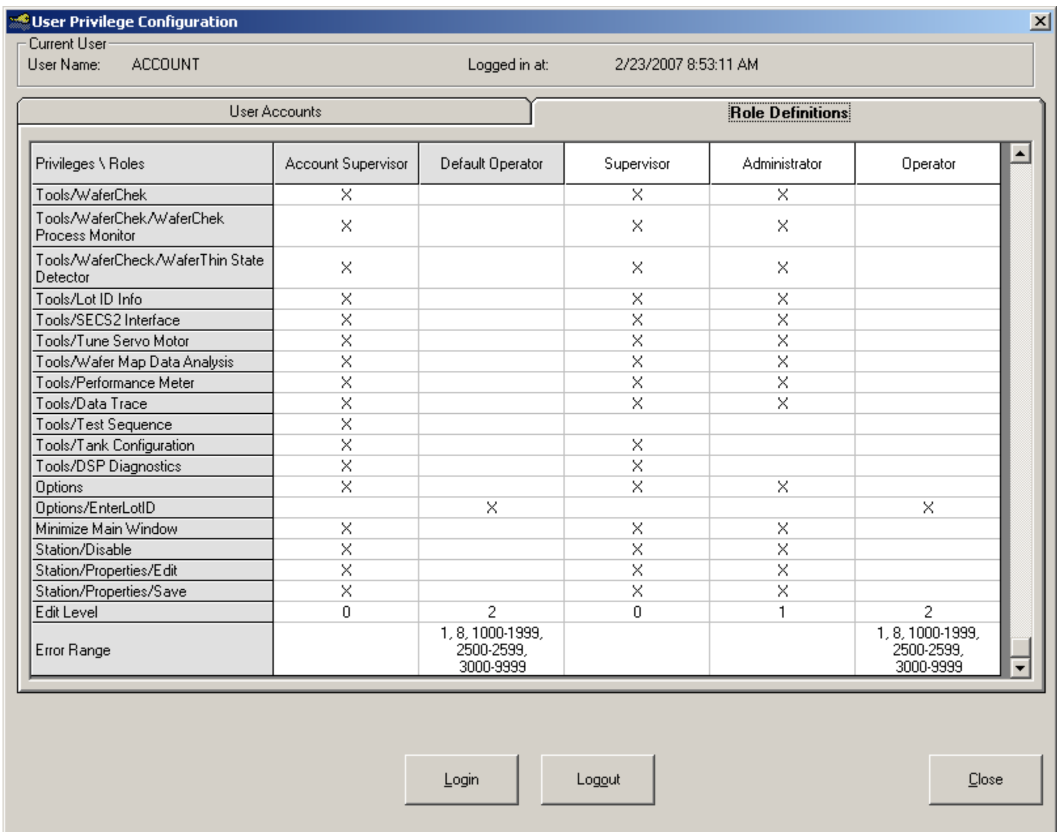
Security Operations

Setting Up Users Accounts and Passwords

Concept

User Accounts consist of two tables: Roles and Users. A Role consists of a Role name plus a list of privileges that are available to that Role. A User consists of a User name plus the Role that is assigned to the User.

Roles



Privileges \ Roles	Account Supervisor	Default Operator	Supervisor	Administrator	Operator
Tools/WaferChek	X		X	X	
Tools/WaferChek/WaferChek Process Monitor	X		X	X	
Tools/WaferCheck/WaferThin State Detector	X		X	X	
Tools/Lot ID Info	X		X	X	
Tools/SECS2 Interface	X		X	X	
Tools/Tune Servo Motor	X		X	X	
Tools/Wafer Map Data Analysis	X		X	X	
Tools/Performance Meter	X		X	X	
Tools/Data Trace	X		X	X	
Tools/Test Sequence	X				
Tools/Tank Configuration	X		X		
Tools/DSP Diagnostics	X		X		
Options	X		X	X	
Options/EnterLotID		X			X
Minimize Main Window	X		X	X	
Station/Disable	X		X	X	
Station/Properties/Edit	X		X	X	
Station/Properties/Save	X		X	X	
Edit Level	0	2	0	1	2
Error Range		1, 8, 1000-1999, 2500-2599, 3000-9999			1, 8, 1000-1999, 2500-2599, 3000-9999

A Role is defined by the Role Name and the list of privileges that are available to the Role.

Privileges

There are three types of Privileges: Screen Capabilities, Edit Level, and Error Range.

Screen capabilities

This is a list of menu items and buttons that can be enabled on a per-Role basis.

Some examples of screen capabilities are:

File menu item

File/New menu item

File/Open menu item

(etc. all the menu items in the File menu)

(Plus all the other menu items from the Process main menu)

(Plus some options for individual screens. For example, there will be screen capabilities that define whether the Motor screen is view-only or if Motors be activated. There will be a capability to define whether Motor properties can be edited.)

Edit Level

The Edit Level is a number used to determine which parameters can be edited in a recipe.

Edit Level = 0 means that all recipe parameters can be edited by this role.

Edit Level = 1 means that only recipe parameters that have a security code of 1 or greater can be edited by this role. The security code is defined in the definition file.

Edit Level = 2 means that only recipe parameters that have a security code of 2 or greater can be edited by this role.

An Edit Level of zero is the most powerful level. The higher the edit level, the less powerful it is.

Error Range

The Error Range is a list of individual error numbers and error ranges that this Role does NOT have ability to acknowledge and resume the equipment.

Predefined Roles

There are two predefined roles that are built in to the Software: Account Supervisor and Default Operator.

Account Supervisor

The Account Supervisor is the only role that is capable of editing user accounts. The Account Supervisor can add and delete users. The Account Supervisor can add and delete roles, and assign specific privileges to a role. By default, the Account Supervisor has all privileges.

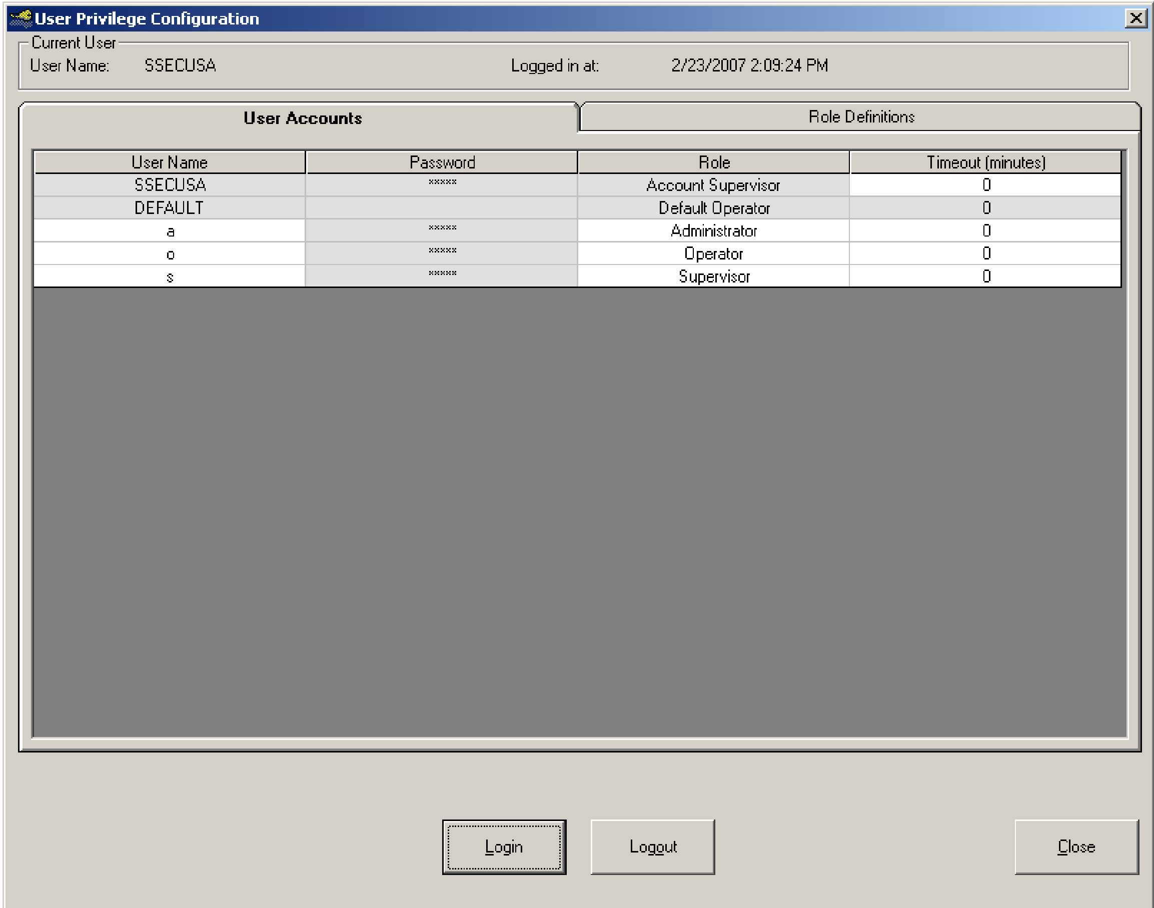
Default Operator

The Default Operator is associated with the predefined DEFAULT user. The DEFAULT user will be logged in when no one else is logged in. By default, the Default Operator role has limited privileges.

Other Roles

Software that is upgraded from the old user account system will automatically have the roles that were previously hardcoded in the Software: Supervisor, Administrator, Operator. These roles can now be edited and deleted, if desired. New roles can be added.

Users



Predefined Users

There will be two predefined users: SSECUSA and DEFAULT.

SSECUSA

The SSECUSA user has the role of Account Supervisor. Only an Account Supervisor can edit user accounts.

DEFAULT

The DEFAULT user has the role of Default Operator. The DEFAULT user will be logged in when no one else is logged in.

User Account properties

User Name

Each user must have a unique name.

Password

Each user is required to have a password EXCEPT for the DEFAULT user. The password can be changed by the user. If a user forgets their password, then the SSECUSA user can delete the user's password. The next time the user logs in, he or she will be prompted to create a new password.

Role

Each user will be assigned a Role, as defined in the Role table. More than one user can have the same Role. For instance, there can be several Operators.

Timeout

The Timeout value is the number of minutes of idle time until the user is logged out. When logged out, the current user becomes the DEFAULT user. "Idle Time" means the time the user interface is idle, that is, the user is not doing anything.

Details

File

The user account data will be stored in a file called "UserAccount.lst". This file will be encrypted, so that it cannot be viewed and edited outside the Software.

Special Cases

UserAccount.lst file is present

If the UserAccount.lst file is present, then the Roles and Users will be read from the file without change.

User.lst file is present (UserAccount.lst file is not present)

The User.lst file is the old user account file. If the new account file is not detected, then the Software will automatically create the Roles of Account Supervisor, Default Operator, Supervisor, Administrator, and Operator. It will assign the users from the User.lst file to the correct roles. This should make the new User Account implementation backwards compatible with the old implementation.

No user file is present

If neither the old or new user account file is detected, then the Software will create the default Roles (Account Supervisor and Default Operator) and Users (SSECUSA and DEFAULT). The first time a user logs in to the Software, they must log in as the SSECUSA user and assign a password. They can then create other Roles and Users as desired.

This Page Left Intentionally Blank.

Reinstalling Software

Reinstalling the ***Software*** only installs the operational parts of the Software and does not install the ***data*** files – the Tool specific hardware initialization and definition files. They must be restored using the ZipExtract program and having the appropriate zipped files. This is described later.

You can reinstall the SSEC Software from the CD that is included in the Safety and Maintenance Manual. Insert the CD in the CD drive of the PC. Open the "Final Docs for CD-ROM" folder, next open the "Software" folder, Open the folder that starts with a "7", for example "7.37.0". Open the "Disks" folder and double-click the "Process Setup.exe" file. This will install the SSEC Process Software version that was on the Tool when it was shipped.

If you also need to install the SECSGEM interface Software, from the Software folder open the folder that starts with a "3", for example "3.13.10". Then open the "Disks" folder and double-click on the "Setup.exe" file. This will install the SECSGEM interface Software version that was on the Tool when it was shipped.

This Page Left Intentionally Blank.

Updating Software

Software Updates via CD

Follow the same procedure as described above in "Reinstalling Software." However, prior to performing the Software update, ZipArchive the Software and the data files and save the resulting files into the backup folder. This will allow you to revert back to the old Software version if a problem occurs during the upgrade process or if the new version has a bug or compatibility problem.

Software Updates via Email

If you received new Software via e-mail, you should do whatever the e-mail says to install it. Generally, Software updates are e-mailed in a zipped file, sometimes with an extension other than ".zip". This is because some e-mail servers will exclude files with specific extensions. This may require re-naming the e-mailed filename. However, prior to performing the Software update, ZipArchive the Software and the data files and save the resulting files into the backup folder. This will allow you to revert back to the old Software version if a problem occurs during the upgrade process or if the new version has a bug or compatibility problem.

This Page Left Intentionally Blank.

Backing Up and Restoring Software

Backing Up Software

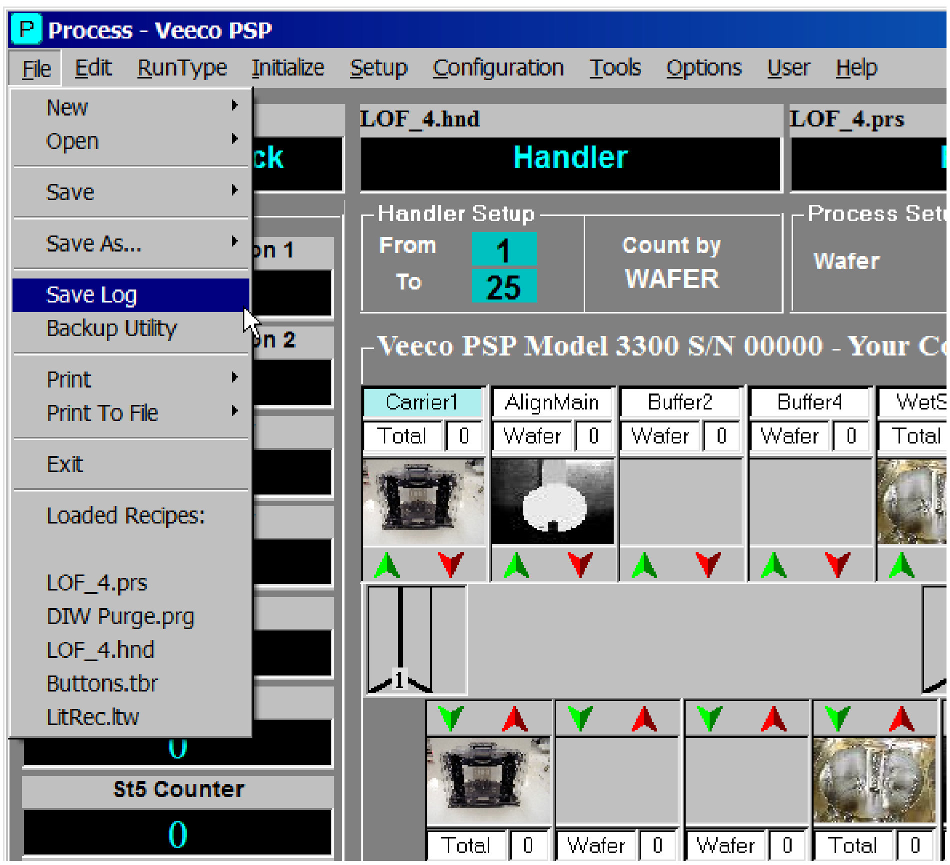
Following are a few different procedures for backing up Software, depending on what you want to accomplish. These utilize the "Zip Archive" executable program (ZipArchive.exe) which can be accessed either from within the SSEC Process Software or directly from the C:\Program Files\SSEC\Bin folder.

Backup of the data files residing in the "C:\Program files\SSEC\Ini" and "C:\Program files\SSEC\Recipe" folders. These are the hardware specific initialization files and the operational recipes with their respective definitions.

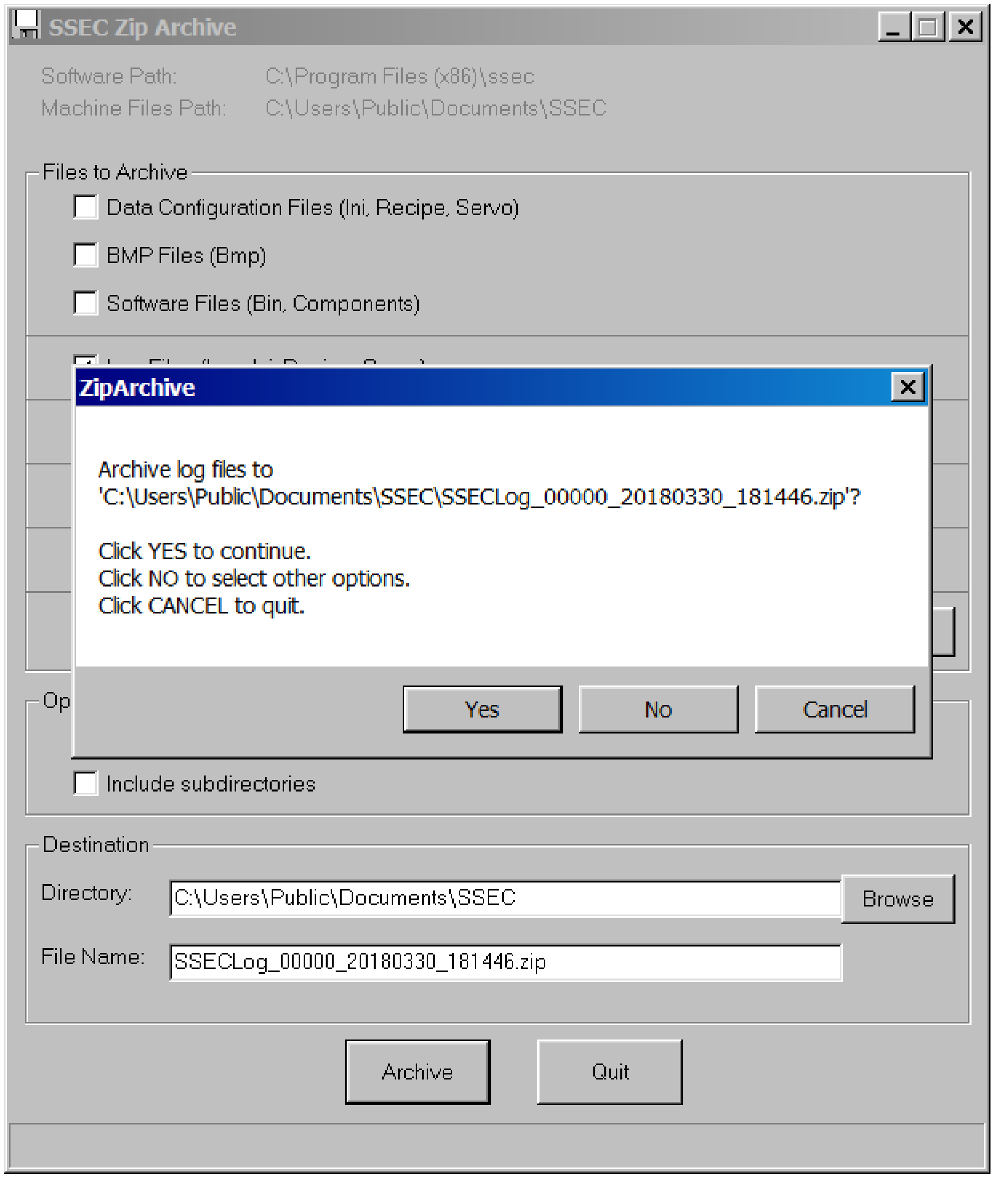
It is advisable to back up these folders at least once a week.

To back up the ***data*** files:

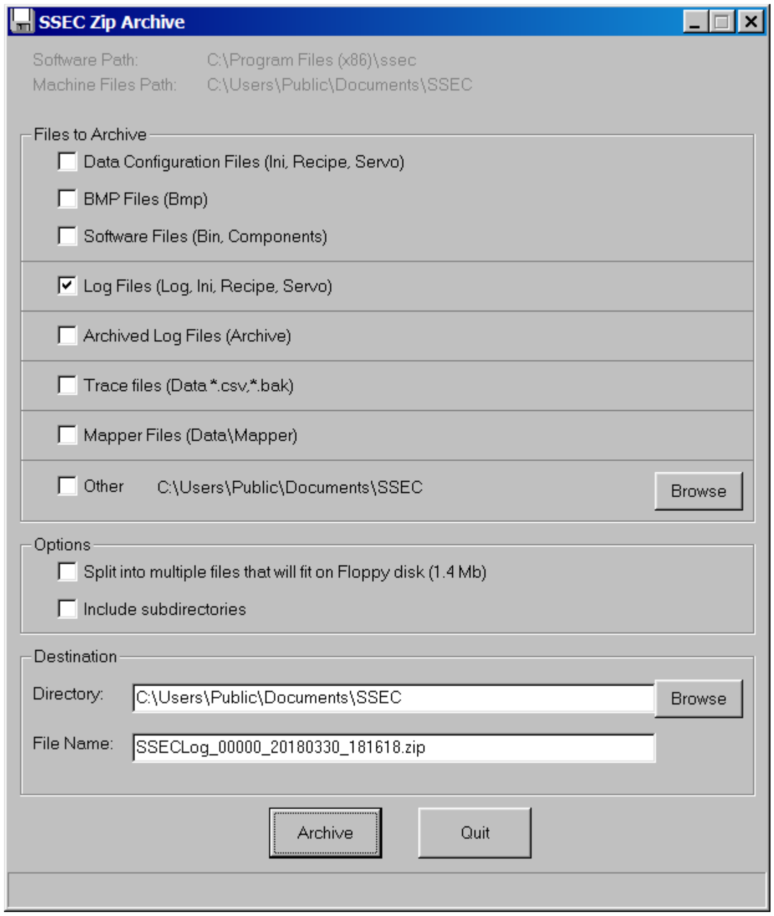
Click on the "File" menu item, which will open a Pull-down Menu, and click on "Save Log".



This will open the following 2 Windows.



Click on the "No" button to select other options. Click off the "Log Files" selection and click on the "Data Files" checkbox as below.

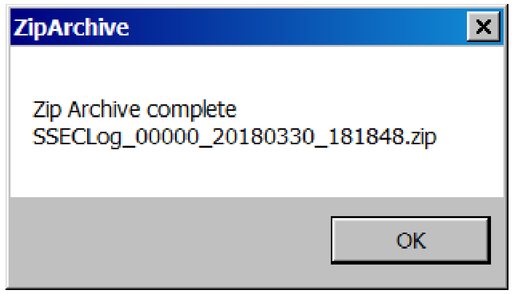


In the Destination Directory panel, click on the "Browse" button to specify a destination – this can be the C:\Program Files\SSEC\BACKUP folder, an external USB memory stick, or any other valid destination or storage device.

If you are backing up to 1.4 Mb floppy discs, be sure to check the "Split into multiple files that will fit on Floppy disk" checkbox in the "Options" panel. The Software will prompt you to label enough disks to save the backup and prompt you when to enter each disk.

If you have created subdirectories in any of your ***data*** folders (Ini, Recipe, or Servo), you may include them in the backup also by clicking on the "Include subdirectories" checkbox in the "Options" panel.

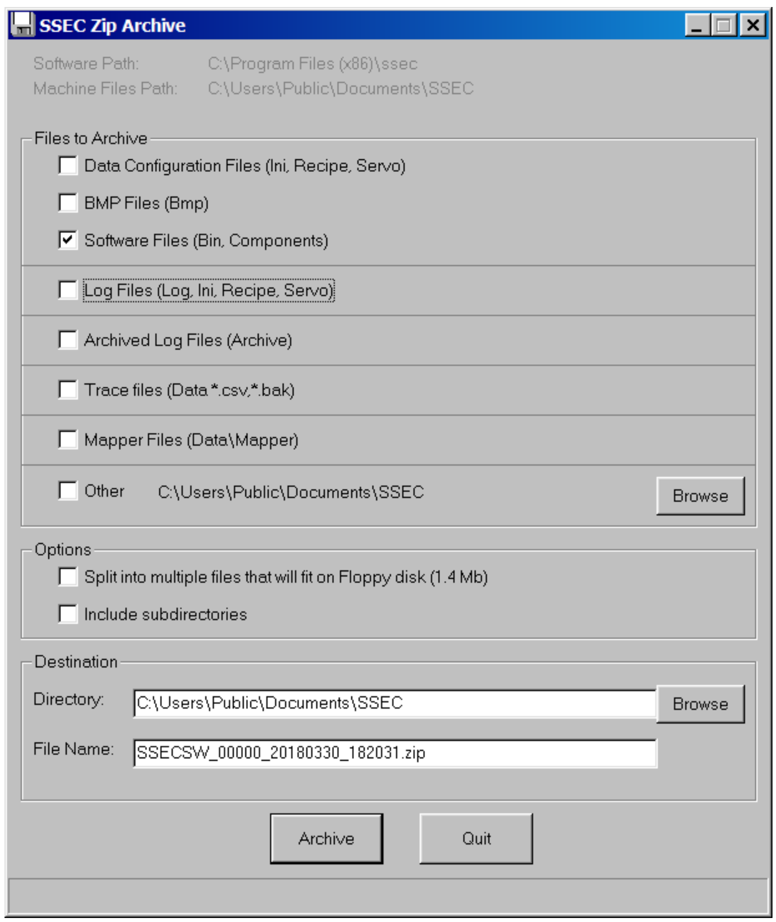
Click on the "Archive" button to create the backup zip file. A small Window will pop-up when the process has completed.



Click on the “OK” button, closing the “complete” Window, and then click on the “Quit” button to close the “SSEC Zip Archive” Window.

Backup of the ***Software*** files residing in the “C:\Program files\SSEC\Bin” and “C:\Program files\SSEC\Components” folders. This should be done prior to installing any new Software versions.

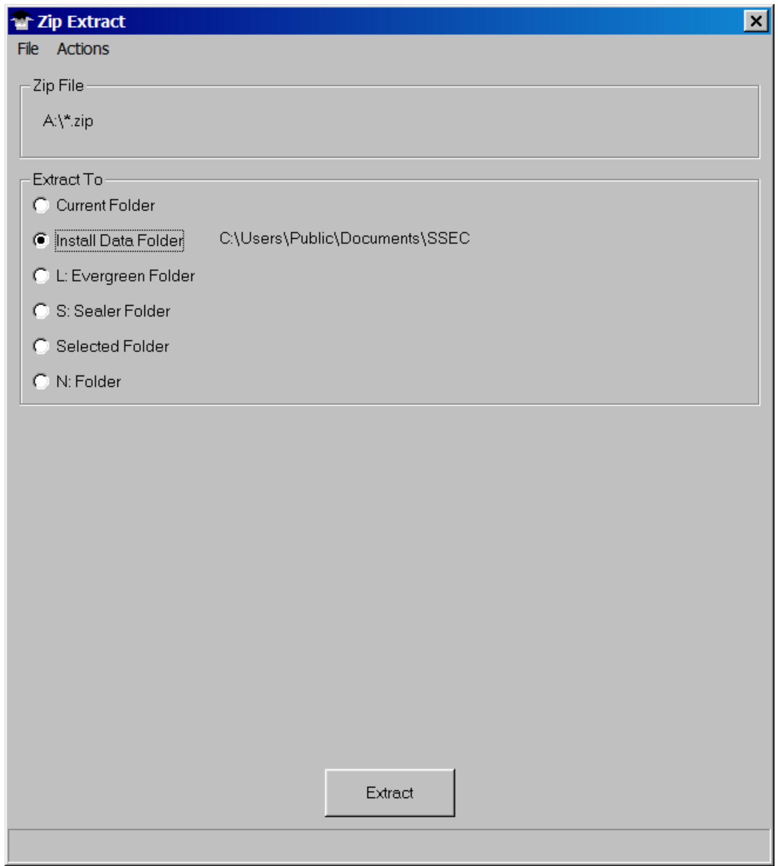
Follow the above directions, except click off the “Log Files” selection and click on the “Software Files” checkbox as below.



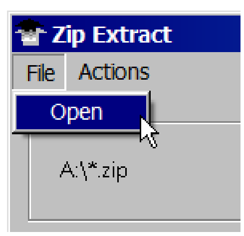
For more complete information about using the Zip Archive utility to backup SSEC Software, refer to “Zip Archive Procedure” later in this chapter.

Restoring Archived Software

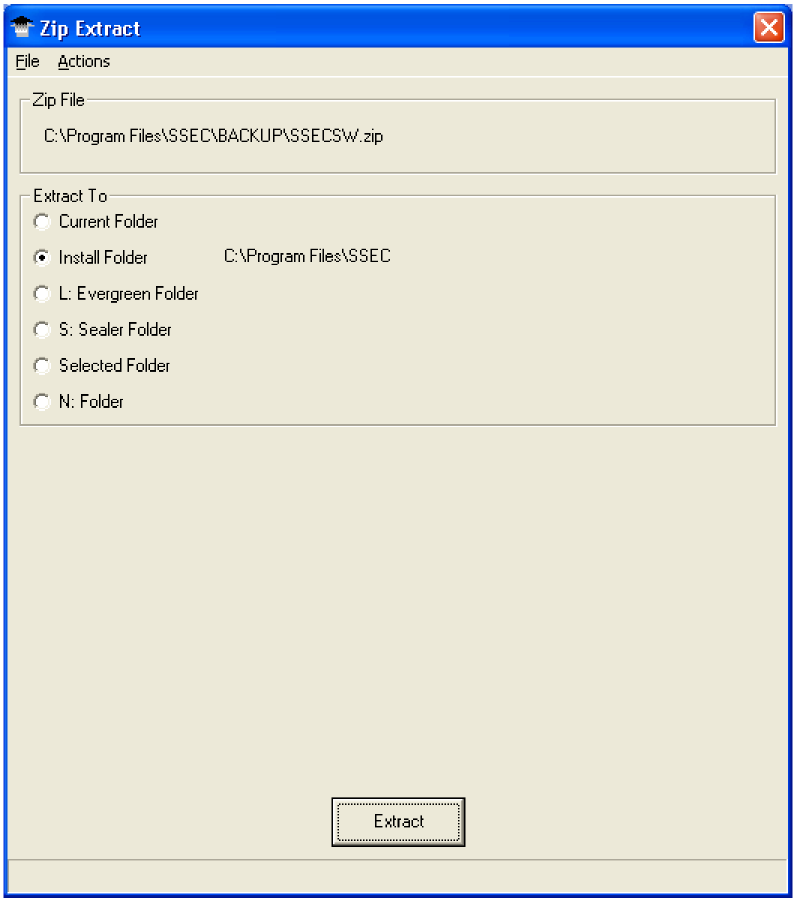
Open the C:\Program files\SSEC\bin folder and double-click on the "ZipExtract.exe" file. The ZipExtract Window will open.



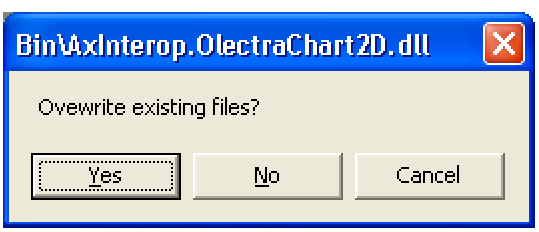
In the top "Zip File" panel of the Window you will see the current default path as to where the archived zip file will be extracted from. You can change this to extract the file from a different source folder by clicking on the "File" menu item at the top of the screen, and then clicking on the "Open" selection.



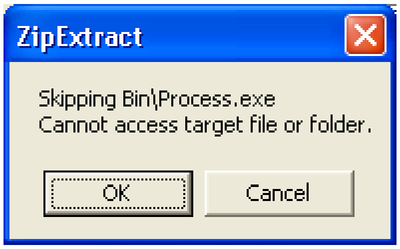
Find the ".zip" folder you wish to restore (i.e., SSECData.zip or SSECSW.zip), open it and it will be displayed in the "Zip File" panel as below. Click on the "Install Folder" radio button. This will display the default location for all SSEC Software files – C:\Program Files\SSEC. Click on the "Extract" button to start the restore.



A small Window will open to ask if you want to overwrite the existing files.

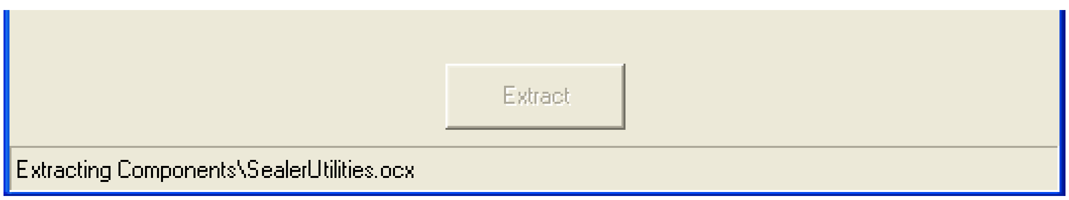


Having previously made a backup you can click on the "Yes" button. If the process Software is running you will not be able to extract all the files. A small Window will pop up and explain that the target file(s) cannot be accessed.

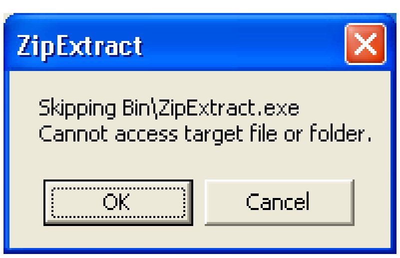


Click on the “Cancel” button, another small Window will confirm the fact.

Click on “OK”, close the SSEC Software, and click on the “Extract” button again. The process will start and you should see the process extracting files as they will be displayed at the bottom of the Window.



During this process a small Window will open for you to confirm that the ZipExtract.exe file cannot be accessed (because it is running).



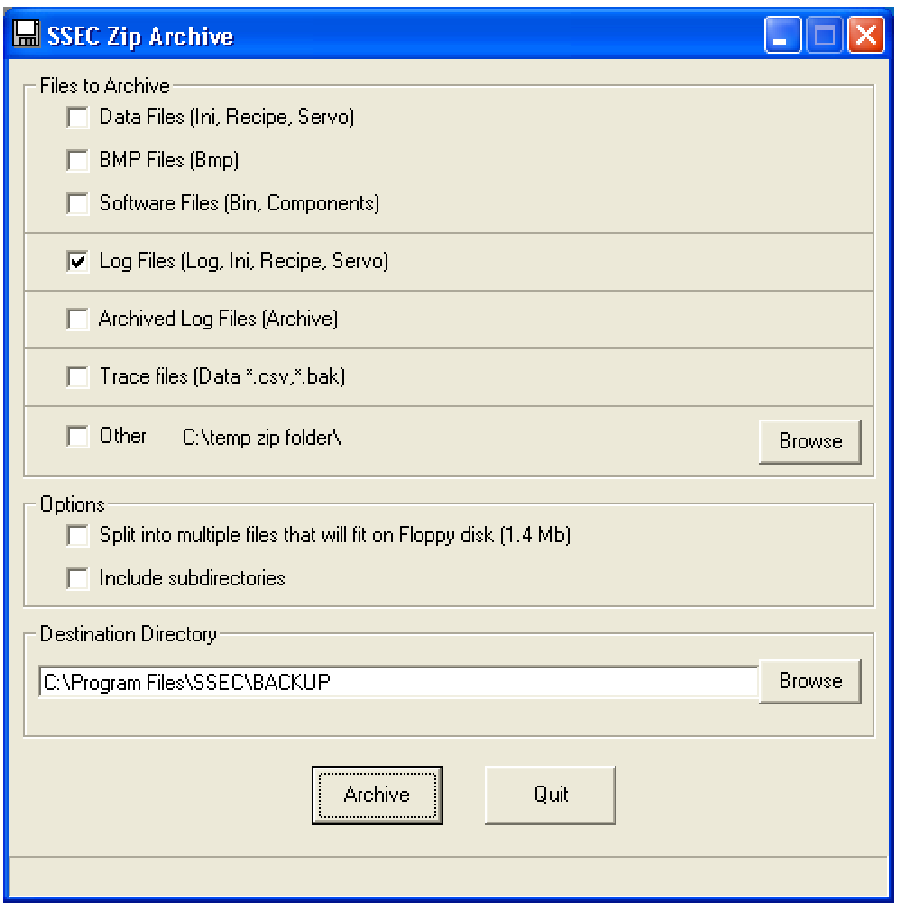
Click on “OK” and the process will continue. When it is finished there will no longer be anything displayed at the bottom of the “Zip Extract” Window. This is the only indication that the process has completed.

This Page Left Intentionally Blank.

Zip Archive Procedure

The purpose of the "ZipArchive.exe" program is to combine and compress the various groups of files into one file (.zip) which can be stored or e-mailed. The resulting file can be extracted using the "ZipExtract.exe" program or can be opened by Windows. Its most useful application is to archive the Log files and e-mail them to VPSP for examination. The majority of problems that are encountered by the Tool user can be determined by examining the log files.

As stated before in the "Backing Up Software" section, the "ZipArchive.exe" program can be accessed either from the "File" menu or from the C:\Program Files\SSEC\Bin folder. The "SSEC Zip Archive" Window is shown below.



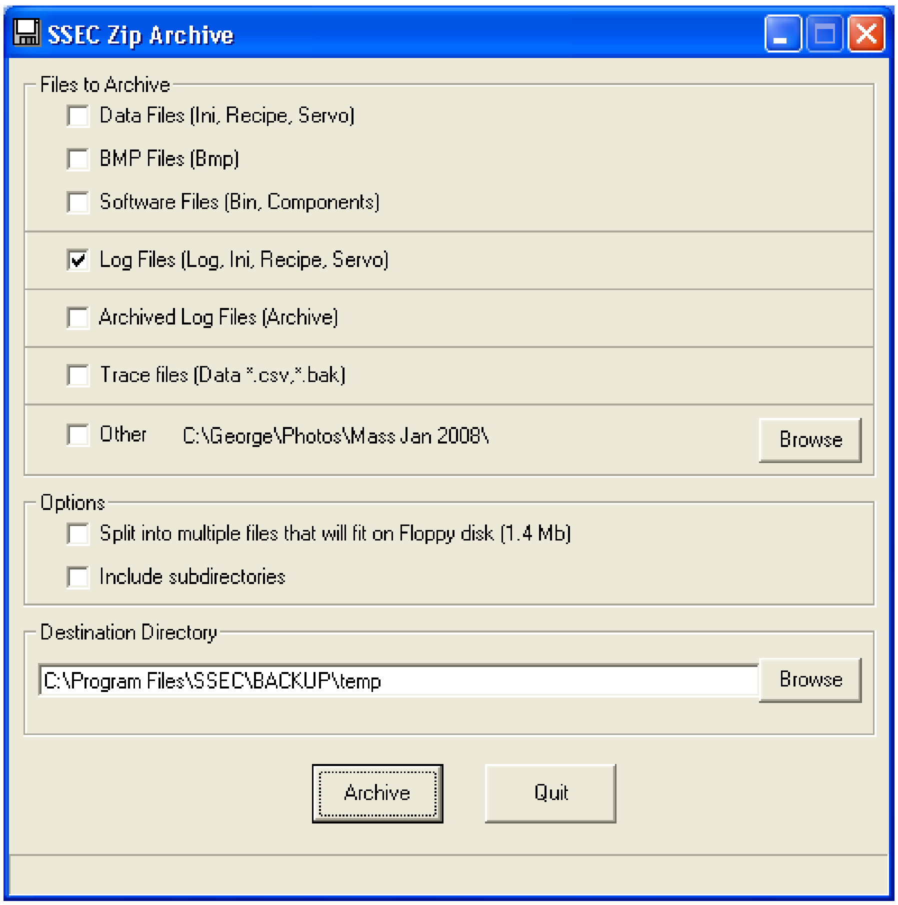
There are seven possible choices available in the "Files to Archive" panel. One or more can be selected. Each selection will result in the creation of a zipped file for each. The choices are: Data Files, BMP Files, Software Files, Log Files, Archived Log Files, Trace files, and Other; the resulting files created will be named: SSECData.zip, SSECBMP.zip, SSECSW.zip, SSECLog.zip, SSECArc.zip, SSECTrace.zip, and SSEC.zip respectively.

Explanations of the seven choices are found previously in this chapter in the "Folder Groups" section.

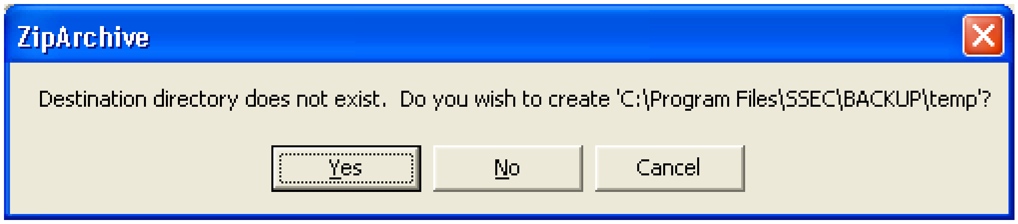
If the "Split into multiple files that will fit on Floppy disk (1.4 Mb)" option has been checked the resulting files created will have a ".zip" extension for the first file and ".Z**" extension for each subsequent file where the "**" will be a two digit number starting with 01 (i.e. – ".Z01", ".Z02", etc.).

Using the "Log Files" as an example:

Double-click on the ZipArchive icon in the C:\Program Files\SSEC\Bin directory to run the "ZipArchive.exe" program. The "SSEC Zip Archive" Window will open.



Click in the "Log Files" checkbox and uncheck any others that are selected. Select any options by clicking in the appropriate checkbox. In the "Destination Directory" panel either type in a destination or use the "Browse" button to specify an appropriate destination for the resulting zipped file or files. If the destination directory does not exist a Window will open stating that and you will be prompted if you would like it to be created.



Answer appropriately and the action will be completed. As before, when the program has completed, a small Window will pop up.

Click on “OK”, closing the Window and then click on the “Quit” button to close the Zip Archive program.

This Page Left Intentionally Blank.

PC Network Policy

If an VPSP Equipment PC is connected to the company Local Area Network (LAN), the following actions are recommended:

- The PC Windows Firewall should be turned ON.
  It may be necessary to add exceptions for functions that use the network, such as the SECS interface.

- Windows Automatic Updates should be turned OFF.
  The reason is that automatic updates can interrupt or reboot the PC.

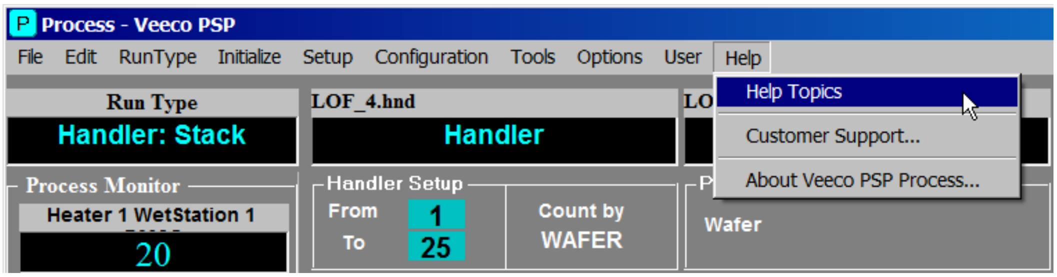
- Windows updates should be performed manually as part of the maintenance schedule. To perform Windows updates:
  - Close the Process Software
  - Start Internet Explorer
  - Enter in the address bar: update.microsoft.com
  - In the update screen, click the Express button

- Antivirus Software should be installed on the PC. Any well-known, reputable antivirus Software should be acceptable.
- If the antivirus Software performs real-time virus scanning, it should be configured to exclude the SSEC directories (C:\Program Files\SSEC and subfolders).

This Page Left Intentionally Blank.

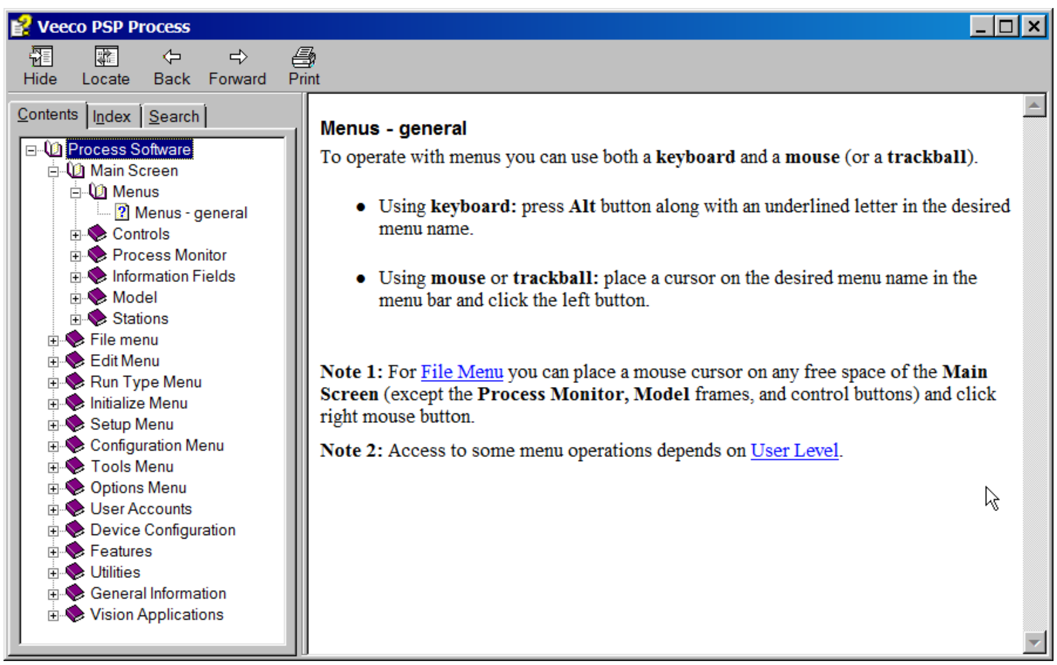
Online Help

You can access help topics at any time while you are operating the equipment by simply clicking on the "Help" Menu and selecting "Help Topics".



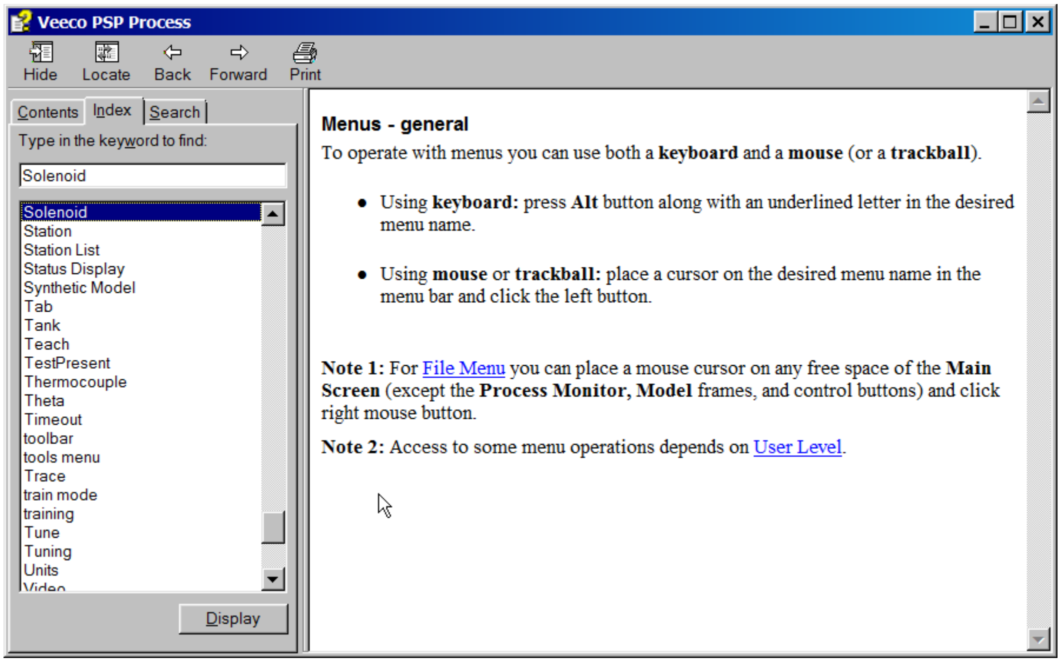
Then:

- Click the "Contents" tab to search through a table of contents for the specific Help topic you are looking for. Click on the Book icons to see chapters and their respective contents. The information will be displayed in the area to the right.

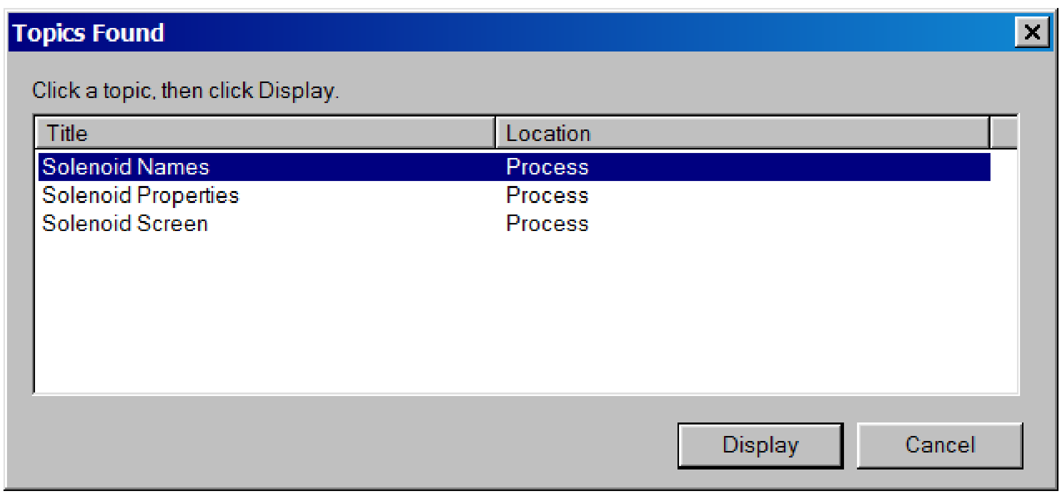


Or

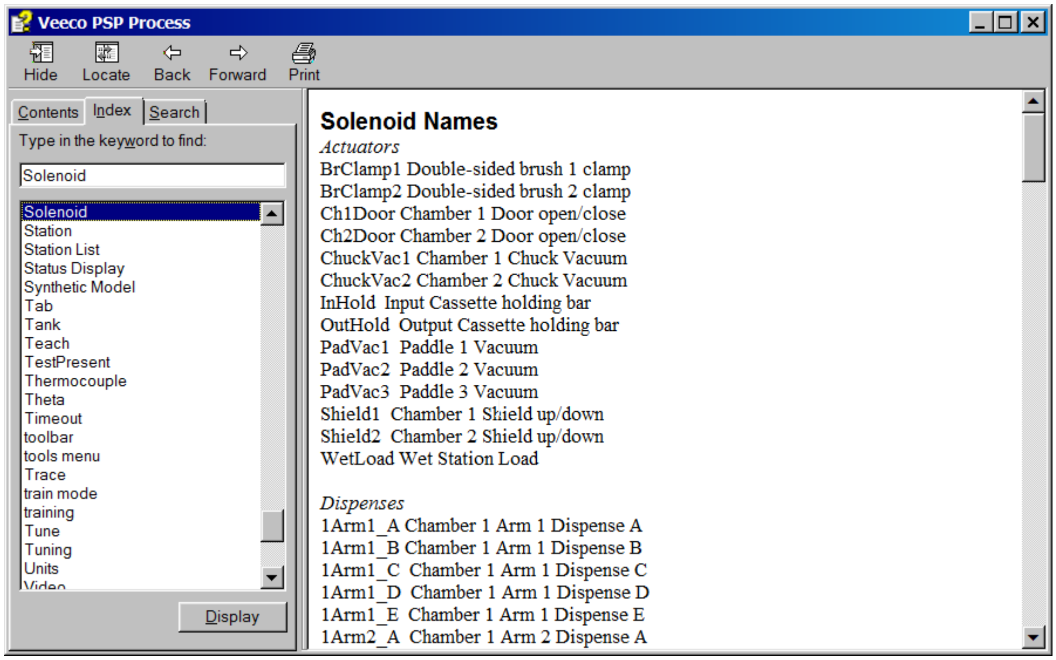
- Click the "Index" tab to search for topics by using an index of Help subjects. Highlight a topic in the listbox or type a keyword into the field and press the <Enter> key or click on the "Display" button to see a list of topics.



A "Topics Found" Window will open with a listing of topics.

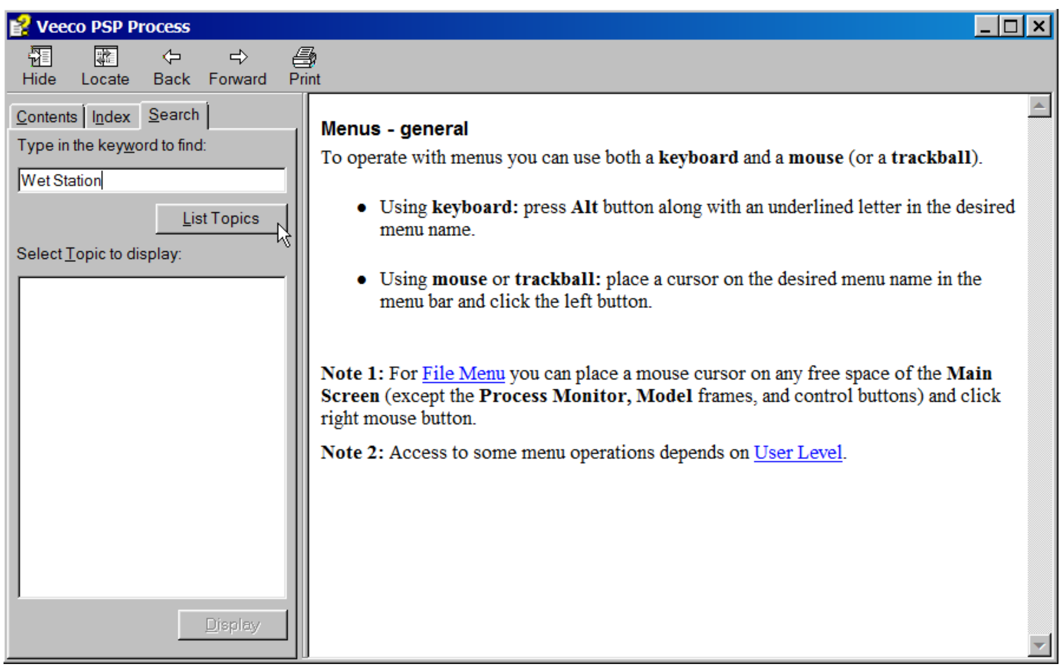


Highlight the title by clicking on it and click on the "Display" button. The selected topic will be displayed.

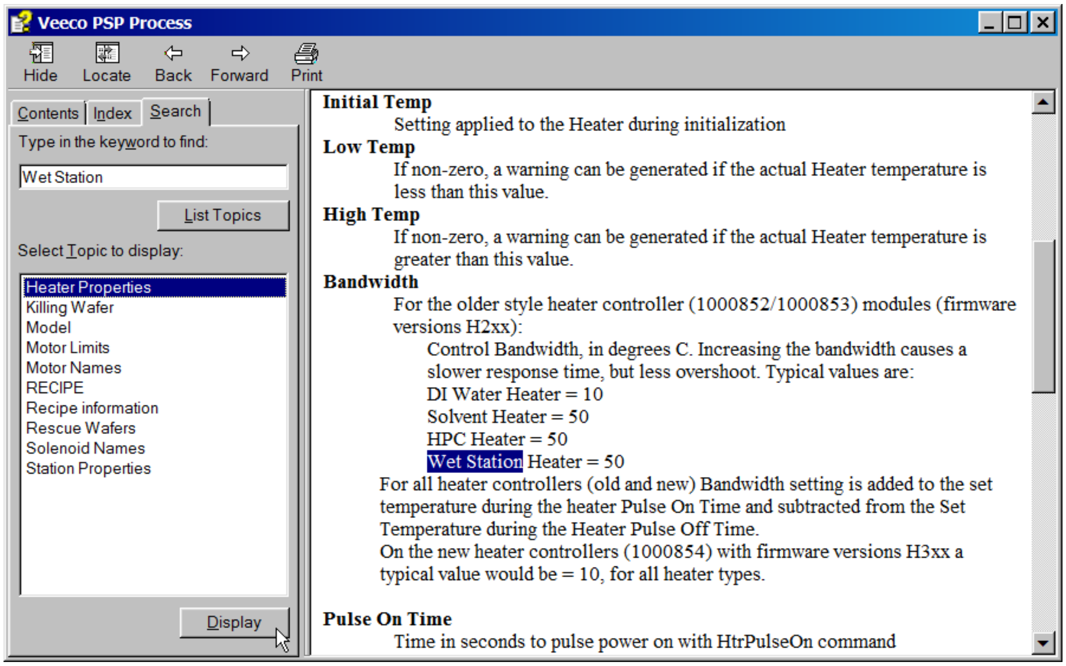


Or

Click the "Search" tab to do a full-text search to look for specific words or phrases.



Type a word or phrase into the keyword field and click on the "List Topic" button. The topics will be displayed in the lower left field. Highlight the desired selection and click on the "Display" button. The topic will be displayed on the right.



If the help information is too small or too large for you to easily read it, you can change the font size:

In the Help topic Window, click Options.

To change the font size, point to Font, and then click Small, Normal, or Large.

NOTE

When you change the font size, it affects only the Help file you are using

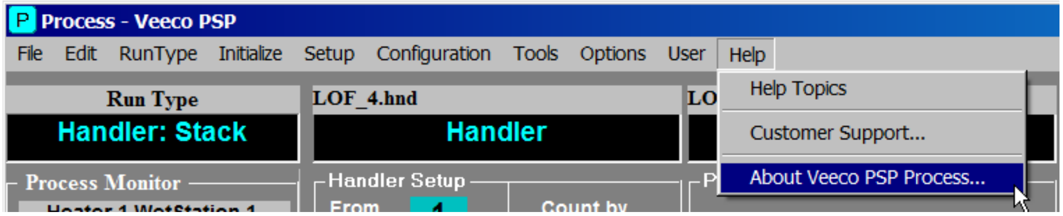
If you want to print out a help topic:

In the Help topic Window, click Options.

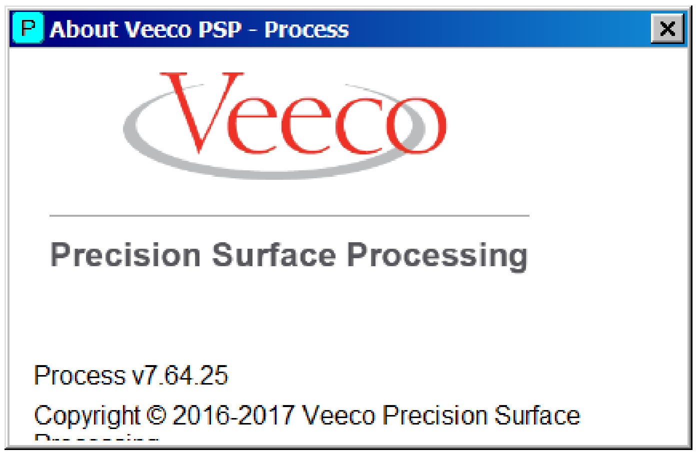
Click Print Topic.

To get the present Software version running on the Tool:

From the "Help" menu select "About SSEC Processor".



A small Window will open displaying the Process Software version number and its creation date and time.



This Page Left Intentionally Blank.

Windows XP User Accounts

Purpose

The Customer wants to block the operators from being able to edit any of the recipe files from Windows, for example using Notepad.

Solution

Set up Windows XP with two Customer accounts: OPER and ADMIN.

The OPER account runs at Windows XP "User" level. The OPER account can't edit any files in the "C:\program files" subdirectories.

The ADMIN account runs at Windows XP "Administrator" level. It has full privileges.

The Process Software needs to run with Windows XP Administrator privileges, so that it can write to Ini, Recipe, Log, etc. files.

The operator will log onto the PC using the OPER account. There will be a shortcut on the OPER desktop to start the Process Software. The shortcut will ask for the ADMIN password. Once the password is entered, the Process Software will start running with ADMIN's Administrator privileges. (It uses the Windows "RunAs" command to do this.)

Account Summary

User Name	Password	Privilege	Notes
ADMIN	admin	Administrator	Customer can change the name/password
OPER	*no password*	Standard User	Customer can change the name/password
SSEC	*(secret password)*	Administrator	CUSTOMER CANNOT DELETE THIS ACCOUNT OR CHANGE THE NAME/PASSWORD. THIS IS REQUIRED FOR Veeco PSP SERVICE PERSONNEL.

Details

- Restore Point 1 – Before starting, set a Windows XP Restore Point, so you can roll back if you get into trouble. Call it "Before creating OPER and ADMIN accounts"

- In Windows XP, set up three accounts:
  - OPER – Runs at Windows XP "User" level. Default Password = "" (no password). This account is for the operator. The Customer can change this password. (Or sometimes we use "oper" as the password.)
  - ADMIN – Runs at Windows XP "Administrator" level. Password = "admin". This account is for the administrators and supervisors. The Customer can change this password.
  - SSEC – Runs at Windows XP "Administrator" level. Password = (See the document "Windows XP User Accounts Secret Password.doc". Hint: this is the same password that we used to use on the old DOS Software.). This account is for VPSP service personnel ONLY. The Customer CANNOT delete this account, change the password, or even know what the password is. This account is required to always be on any Tool that is set up with accounts.

- On the Operator desktop, create a shortcut to Process. For the target line, use:

  RunAs /user:ADMIN "c:\program files\ssec\bin\Process.exe"

- Disable Power Savings – By default, a user level account has power savings enabled to turn on the screen saver and turn off the disk drive after N amount of time. To change this, log into the ADMIN account, give the OPER account Administrator privileges, log into the OPER account, turn off the power savings, then log back into the ADMIN account and remove OPER's Administrator privileges.

- Turn off "Fast User Switching" – We want users to have to close all the programs before switching to another account, so that we don't have multiple users trying to run the Process program. To do this go to: Control Panel – User Accounts – Change the way users long on or off – Uncheck "Use Fast User Switching"

- Restore Point 2 – Set a Windows XP Restore point after you have created the accounts. Call it "After creating OPER and ADMIN accounts"

- Record Keeping – DON'T FORGET TO DO THIS! – On the N drive Release folder, make a document called "Special Notes.doc" and write down that this Tool was configured with user accounts.

Comments

Normally, we set up the equipment PCs to run with one account that is Administrator mode with no password.

This Page Left Intentionally Blank.

3: Menu Command Descriptions

NOTE

Access to some Menu Operations depends on the User Level.

File Menu

Through this menu you can do all standard Windows operations with processing files:

New - create a new recipe.

Open - open an existing recipe.

Save - save a recipe. **Save** command becomes available if at least one recipe has been changed. If more than one recipe has been changed, **All** command becomes available. It allows you to save all changed files by one click

Save as... - save a recipe with a new name, i.e., create a new recipe file and copy an active recipe to it. New recipe becomes active.

Save Log – uses Zip Archive program to create compressed files.

Print - print a recipe.

Print to File – prints a recipe to an ASCII text file (.txt).

Exit - quit the application, prompts to save changed recipe.

Lower part of the File Menu contains filenames of loaded recipes. A checkmark **"v"** on the left margin indicates that this recipe has been changed.

All but the "Save Log" selection contains submenus with recipe types to choose from, they are:

- Process
- Purge
- Handler
- Toolbar
- Light Tower

Selecting the type will perform the operation on the presently loaded file.

Edit Menu

This menu enables any one with the proper access to change parameters. Changes to the Process (.prs), Purge (.prg) or Handler (.hnd) files refer to operational files. Changes to the Toolbar (.tbr) file affect the Toolbar Button parameters. Changes to the Lights (.ltw) file alter how the light tower buzzer and colored light signals are executed.

Choose the File type you wish to edit from the list:

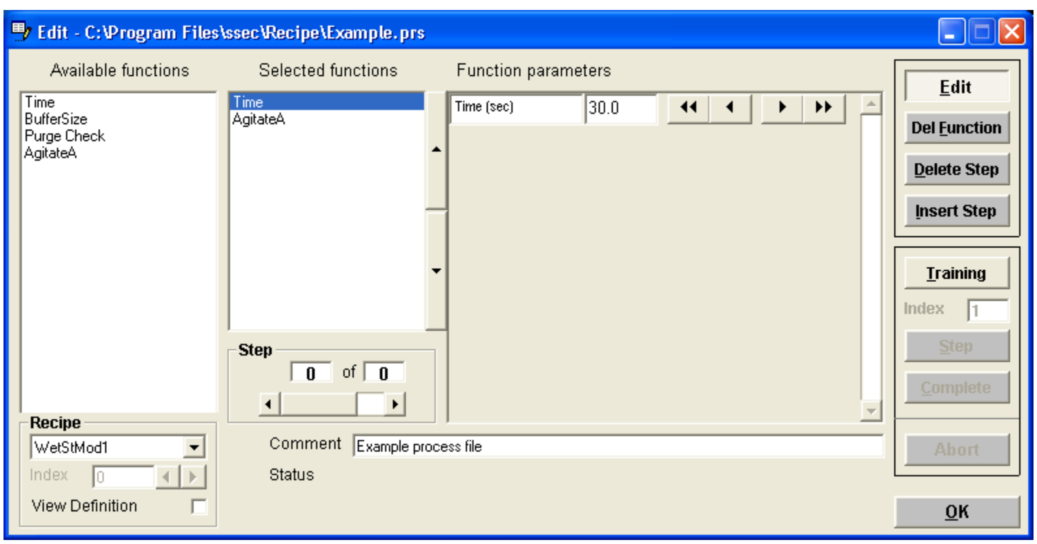
- Process
- Purge
- Handler
- Toolbar
- Lights

This menu allows the user with the appropriate access level to use the "Edit" Window to change any recipe file.

Using Edit Menu Commands to Edit a Recipe

File Editor

The Edit Window allows you to change any file recipe steps and their respective parameters. Each type of file (.hnd. .prs, .prg, .tbr, and .ltw) consists of a list of Recipes each having a series of one or more steps containing selected functions for each step, with the functions possibly having one or more parameters. Refer to Section 7 for creating processing files.



This Window has several sections described below:

Available functions listbox -

Contains all the functions available as defined by the definition file (*.def) for this Recipe type. Functions are selected by double-clicking on the desired function. The selected function will appear in the **Selected Functions** list. The editor will not allow you to pick a function name twice.

Selected functions listbox –

Shows all functions selected for a current recipe step. One of the selected functions can be selected by clicking on it which highlights the name. If the highlighted function has any user programmable parameters, these will be displayed in the "Function parameters" field. To delete a selected function from the recipe step, highlight the function in the "Selected functions" list and click on the "Del Function" button.

Function parameters field –

This field will display any parameters associated with a highlighted function in the "Selected functions" listbox. The parameters can be edited directly by typing a new value or incrementally adjusted by using arrow keys to the right of the value.

Recipe panel –

Use this drop-down listbox to select which recipe of this file you wish to edit. Each recipe type will have its own list of available functions as determined by its respective definition file.

Index field and arrow buttons –

This feature is obsolete.

View Definition checkbox –

Clicking in this checkbox will open a new Window using the DefEditor program and display the corresponding section of the definition file for the selected recipe. To close the DefEditor, click the close (x) button or unselect the check box.

Step counter –

Indicates the current step and the last step number of a multi-step recipe. To navigate through steps use the scrollbar below the counter. To add a step to the end of a recipe, go to the last step and increase step counter by one. Now you can select functions for the new step. If you leave the last step empty it will be deleted when you close the editor. A new step can be inserted before the present one by clicking on the "Insert Step" button. The new step will be inserted before the present one. Steps can be deleted by clicking on the "Delete Step" button. The presently selected step will be the one deleted.

Comment field –

A comment field is provided for each file. You can type a remark of any size in this field, however only 80 characters will be displayed on the main Window. All recipes in a file have one comment. Only the Process, Purge, and Handler comments are displayed on the main Window. Comments saved in the Toolbar and Light Tower recipes can only be seen in the Edit Window.

Edit panel –

The "Edit" Window has two modes of operation, either the Edit mode or the Training mode. They are mutually exclusive. When the "Edit" button is clicked the editor is in the Edit mode. In the edit mode steps can be added or deleted, functions can be selected or deleted, and parameter values can be directly changed.

Training panel –

When the "Training" button is clicked the editor will be in the Training mode. In the training mode the present recipe step can be dynamically executed using the "Step" and "Complete" buttons to execute the function parameters sequentially. Typically the training mode is only used when editing the handler (.hnd) files.

Status field –

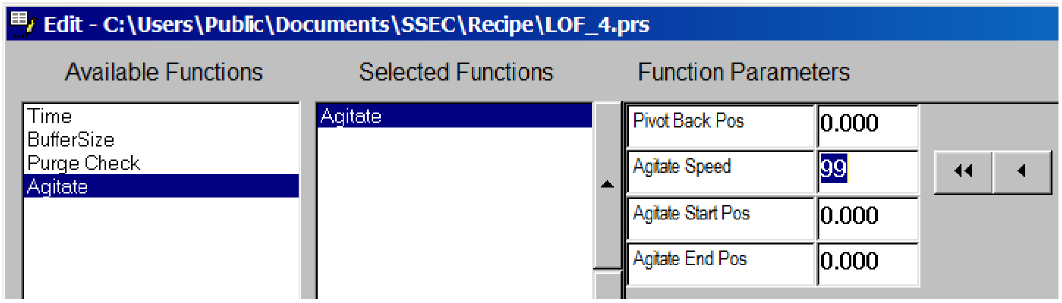
This field will display any messages that are generated by the definition file for the file loaded by the editor. These are typically error messages.

OK button –

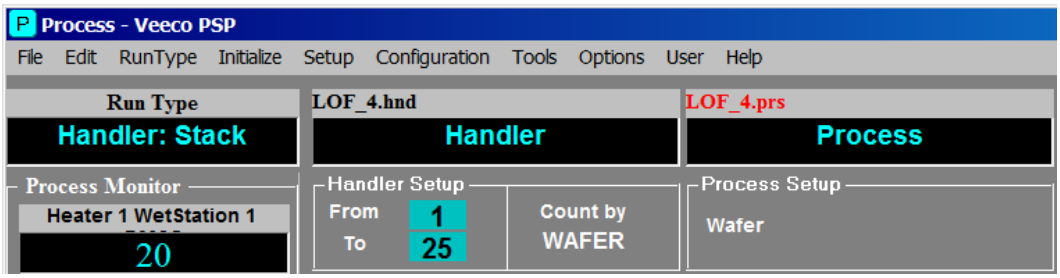
Clicking on this button close the editor Window.

NOTE

This does not save any changes made to the file. If any changes are made to file, the Window title block will display "- change".



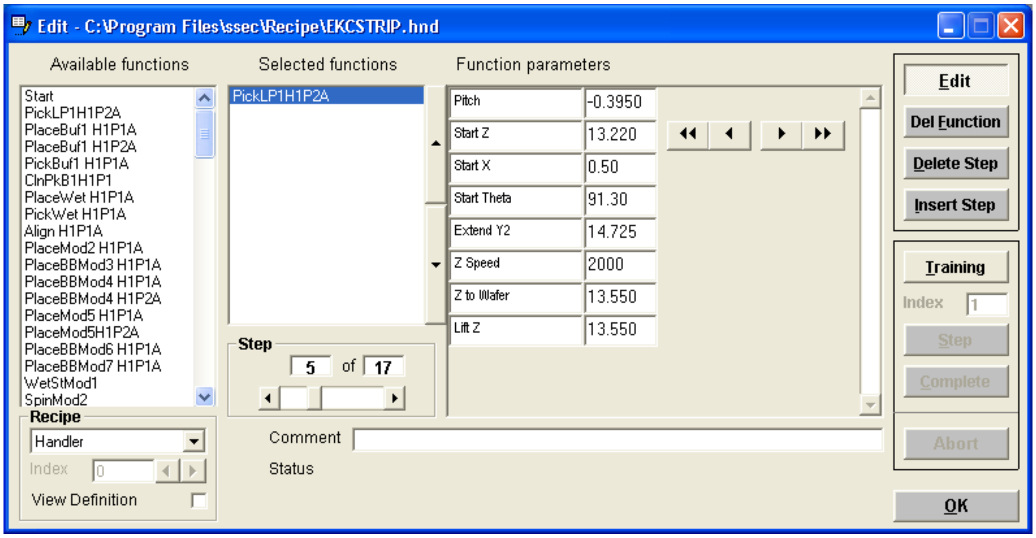
Compare the above example to the previous one. The Agitate Speed parameter has been changed from 100 to 99. If any changes are made to a file, when the editor is closed, the filename will be displayed on the main Window in red.



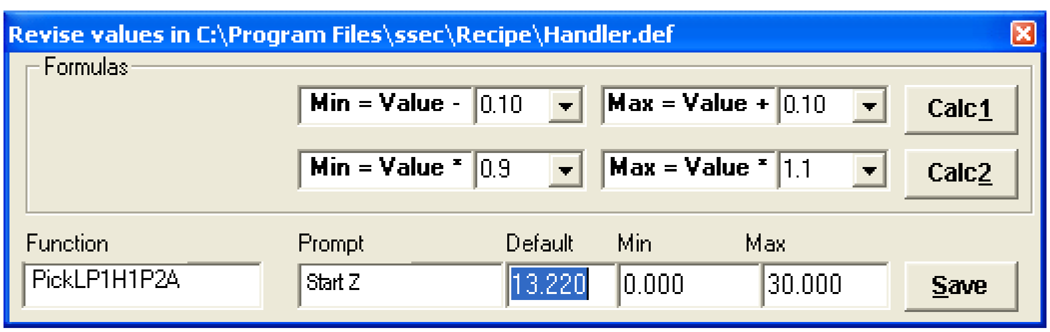
It will remain red until it has been saved. Use the "File" menu to save any changes.

Editing Parameter Ranges

The function parameter default values and allowable ranges as defined in the file's respective definition file can be changed using the file editor. The example below will illustrate the how to set these values for the "Start Z" parameter of the 5th step of the Handler file.



Right-click on the desired parameter's name (StartZ) and a "Revise Values in ..." Window will pop up.



Using this Window you can change the Default value, and Min and Max values for the parameter in the definition file. The editor takes the current parameter value from the recipe as the default one for the definition file, but you can type any numbers in the field.

The Min and Max field values can be changed by either typing in a value directly or using the "Calc1" or "Calc2" buttons. The "Calc1" button will calculate a minimum and maximum value by subtracting and adding an increment to the default value. The increment used can be selected from the drop-down list boxes to the left of the "Calc1" button. The "Calc2" button will calculate a minimum and maximum value by multiplying increments that are less than and greater than 1 to the default value. The increment used can be selected from the drop-down list boxes to the left of the "Calc2" button. Click on the desired button to perform the calculations.

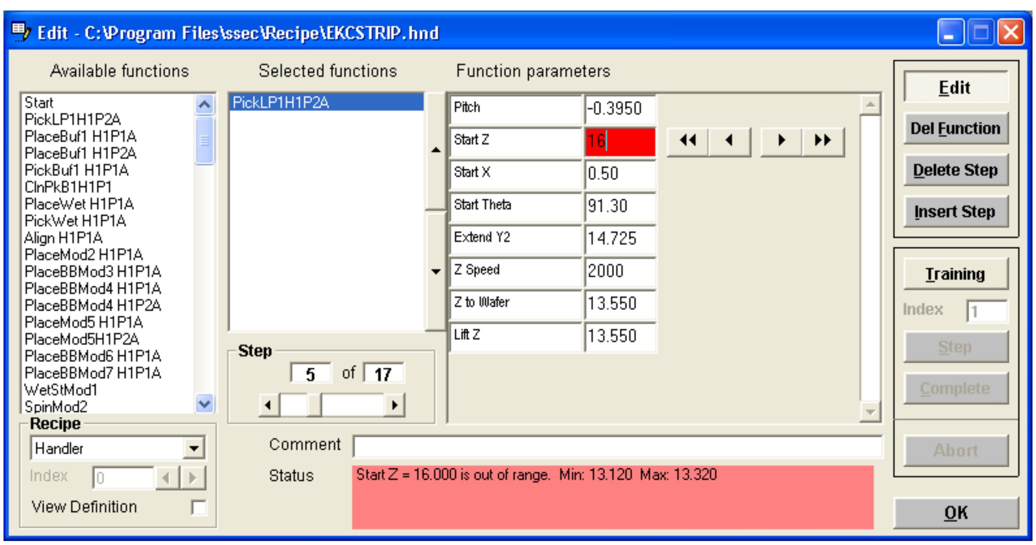
NOTE

Limiting the range of values for parameters will prevent inadvertent damage to the Tool.

To save the parameter changes to the definition file, click the "Save" button. The Software will catch any logical errors, and the incorrect field's background will change to pink. Any errors must be corrected before the changes can be saved.

To close the Window without saving any changes, click Close (x) button.

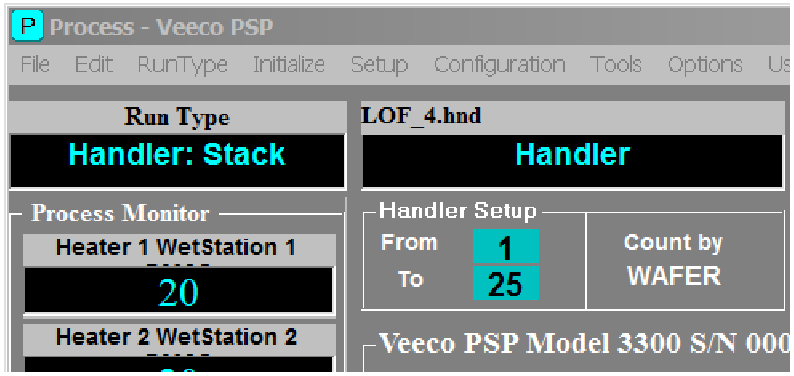
Trying to enter a parameter value that is not within the defined range will result in an error. The field with the out of range value will be backlit in red and the "Status" field will display the error.



This Page Left Intentionally Blank.

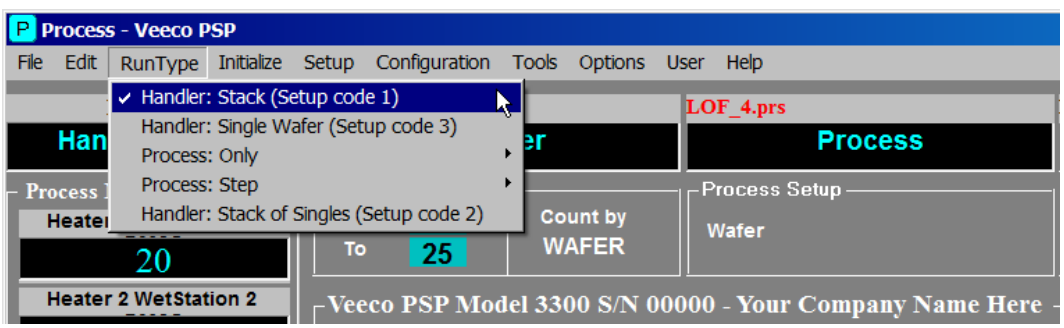
Run Type Menu

From this menu the run type can be selected. A check mark in front of a listed option indicates the current selection. The present RunType is displayed in the top left corner of the main Window.



Run Type

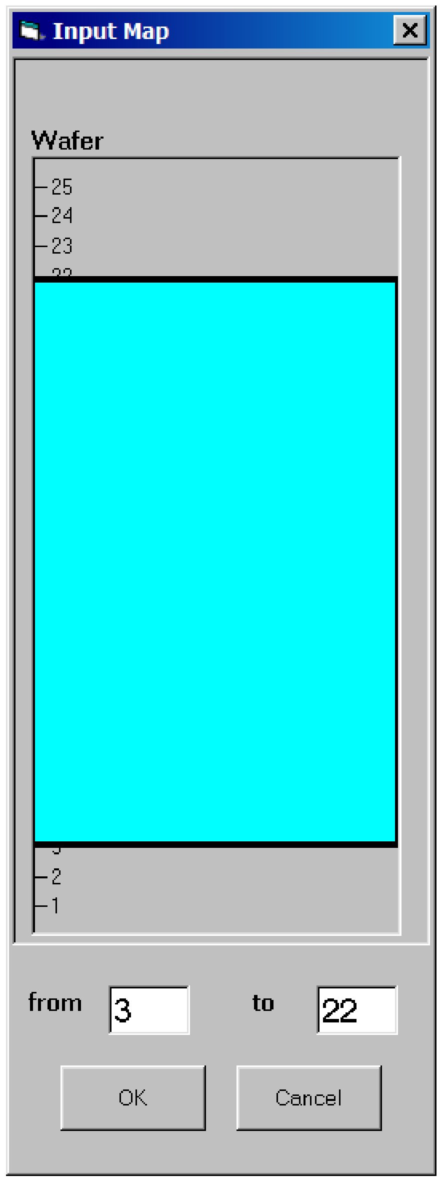
The current system Run Type is shown in the indicator and as a check mark in front of menu item as shown below.



The System has five (5x) Run Types:

Handler: Stack (Setup Code 1) –

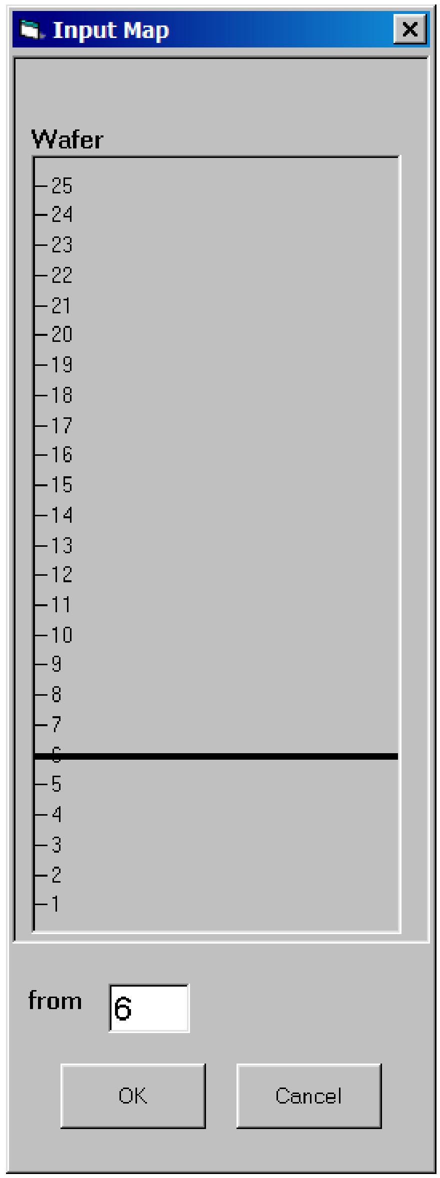
User can process wafers consecutively from the first to the last wafer number. The first number is shown in the "Handler Setup" panel's "From" field in the main Window, and the last one in the "To" field. To change these values, right-click on either number and an "Input Map" Window will pop up where you can enter the wafer from and to values directly into their respective fields or you can click and drag on the black bars in the graphic representation of the wafers and dynamically change the values.



Click on the "OK" button to confirm the selection or click on the "Cancel" button to revert back to the default values. The default values are 1 and the value that is in the "Default stack" field of the "Options" menu.

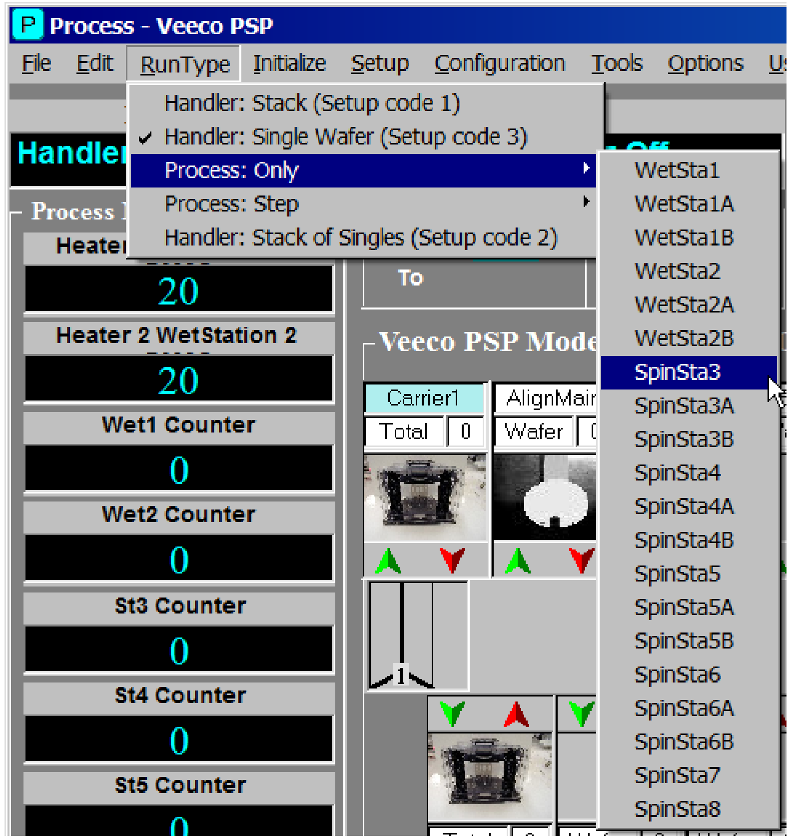
Handler: Single Wafer (Setup Code 3) –

The user can select a single wafer by number and process it. If you are changing the present RunType a single wafer "Input Map" Window will open. If you already have the Single wafer RunType selected and you wish to change the selected wafer, right-click on the "From" number in the "Handler Setup" panel. To change this value, enter the wafer from value directly into the "From" field or you can click and drag on the black bar in the graphic representation of the wafers and dynamically change the value.



Process: Only –

Any Process recipe from the loaded file can be run individually when this RunType is selected. This selection is very useful when trying to develop a new process. When selected from the "RunType" menu a station can be selected.

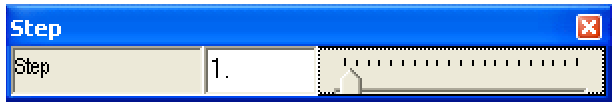


After the selection is made, a Window will pop up directing you to place a wafer in the specified chamber.

Click on the "OK" button to confirm. The "Process Setup" panel will display wafer 1. When the "Start" button is clicked only the process recipe from the loaded process file for that station will be executed.

Process: Single Step –

Any single step of any process recipe can be run in any appropriate station. Select the station as in the previous instructions for "Process: Only". Once you confirm that you have placed a wafer in the appropriate chamber, as in the previous example, a small "Step" Window will pop up.



Either enter a step number directly into the step field or use the slider button to select a step. Then close the Window by clicking on the close "x" button. The "Step" field of the "Process Setup" panel will display the step number.

NOTE

Caution should be used when using this RunType as there may be some unintended consequences when the step completes. Such as a fluid solenoid being left ON or the Spinchuck continuing to rotate.

Handler: Stack of Singles (Setup code 2) –

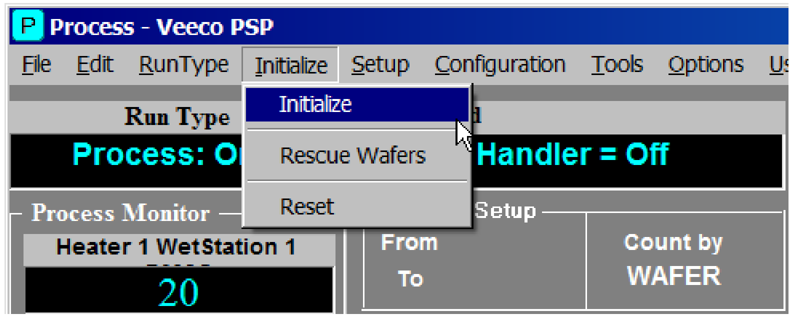
Wafers can be processed one at a time from a stack of wafers in the Stack of Singles RunType. At any time there will be only one wafer in process.

NOTE

The RunType can be made part of the any file type and will be changed when the file is loaded and run. Typically it is recommended that this command be put in the handler definition file.

This Page Left Intentionally Blank.

Initialize Menu

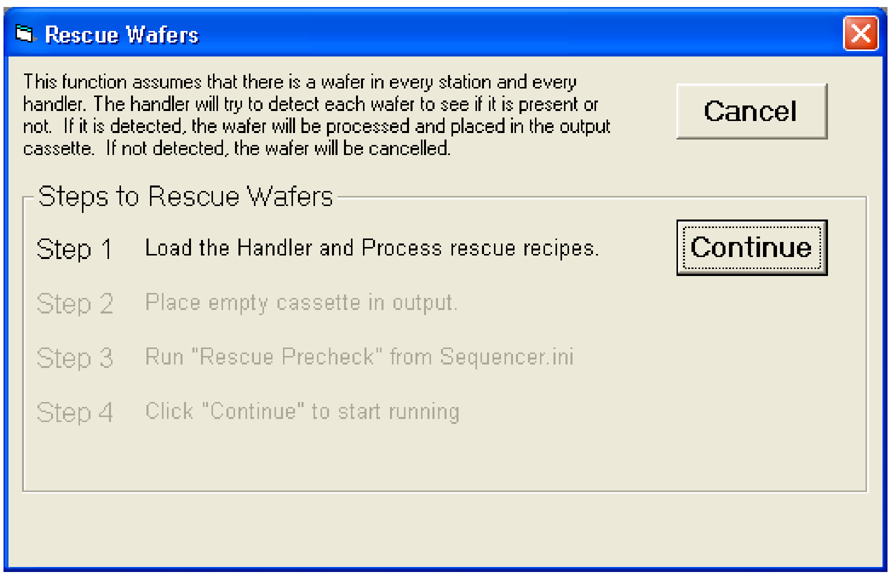


Initialize

This initializes the entire Tool exactly the same way as when it is first powered up. The initialization sequence is determined by two ini files. If the Tool has vacuum chucks, vacuum Paddles, grip Paddles, or any other device that can sense the presence of wafers, and it is configured appropriately, one or more Windows may pop up and ask you to either remove the wafers or to continue without removing them. If the Software has not been closed, it will retain the present location of all wafers in the Tool. If the Software has not been closed and you physically remove any wafers from their positions, these wafer(s) need to be “killed” when the initialization concludes.

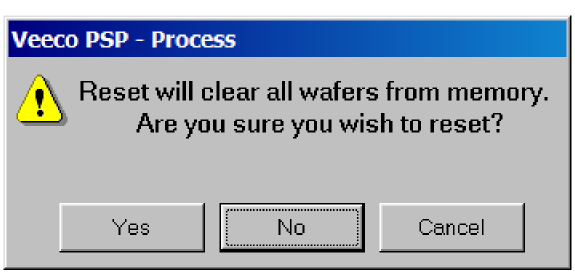
Rescue Wafers

This is selected when the Tool has been stopped and the state and position of any wafers in the Tool is unknown. This can occur if the Software has been closed when running or there was a power outage that caused the PC to shut down. The Software will assume that there may be a wafer in every possible position and process the wafers appropriately, typically starting with the last possible station and working backwards. It is required that specific recipes have been created for the rescue operation. When "Rescue Wafers" is selected, a series of instructional Windows will pop up and direct the steps necessary to complete this task. Follow the instructions and click on the "Continue" button to proceed.



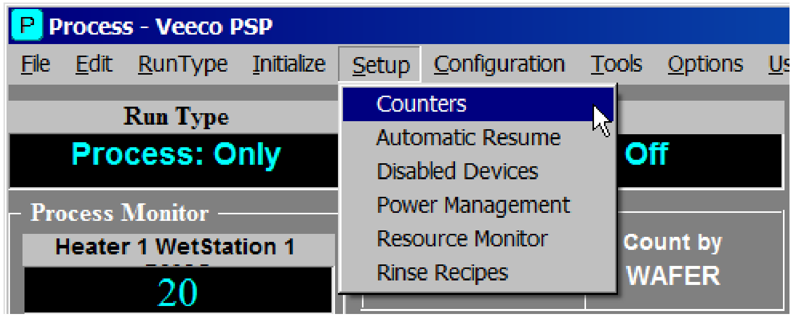
Reset

Reset will clear all the wafers from memory and reset the wafer count values to their default values. This is typically used after having manually removed wafers from the various stations of the Tool. When selected the following Window will open. Click on the appropriate button.



Setup Menu

There are two choices in "Setup" menu – Counters and Rinse recipes.

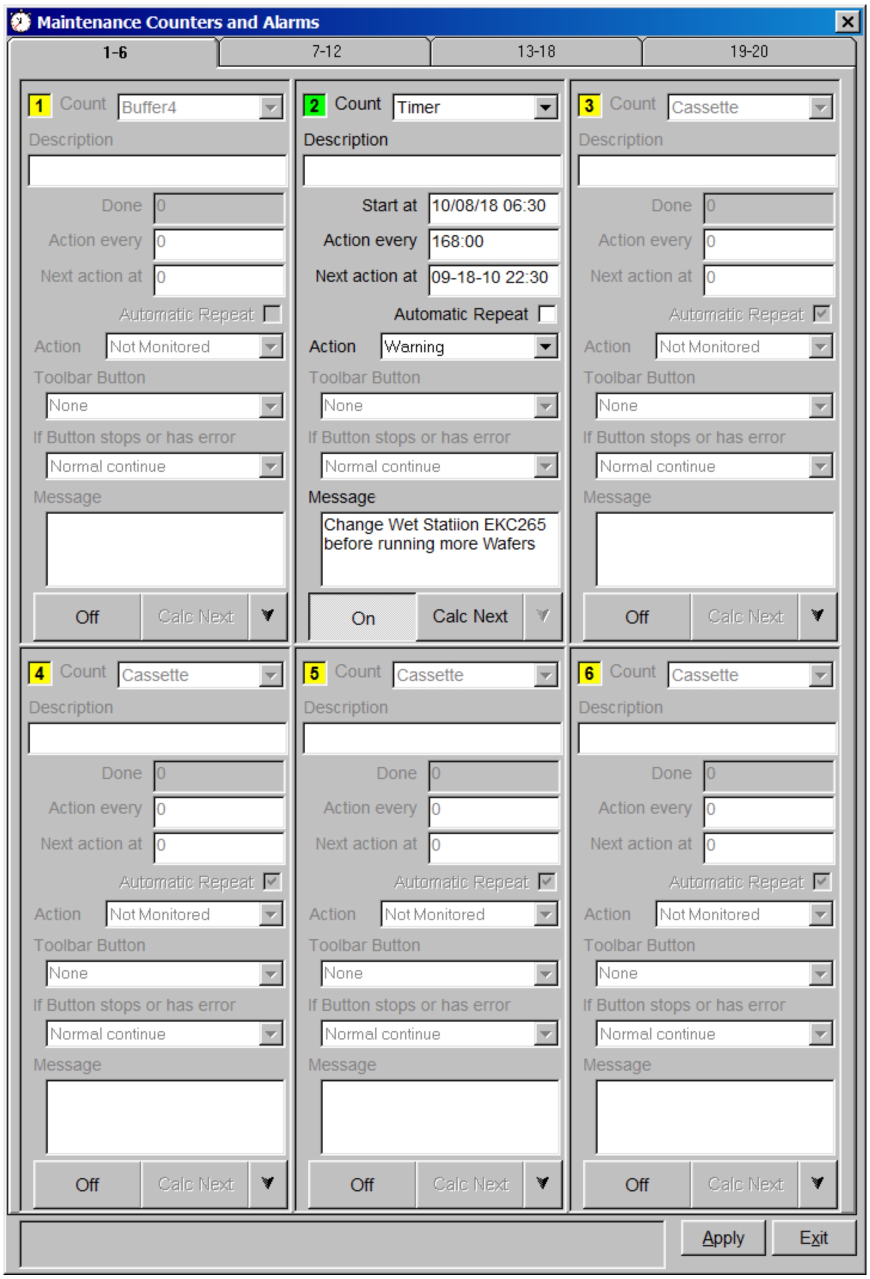


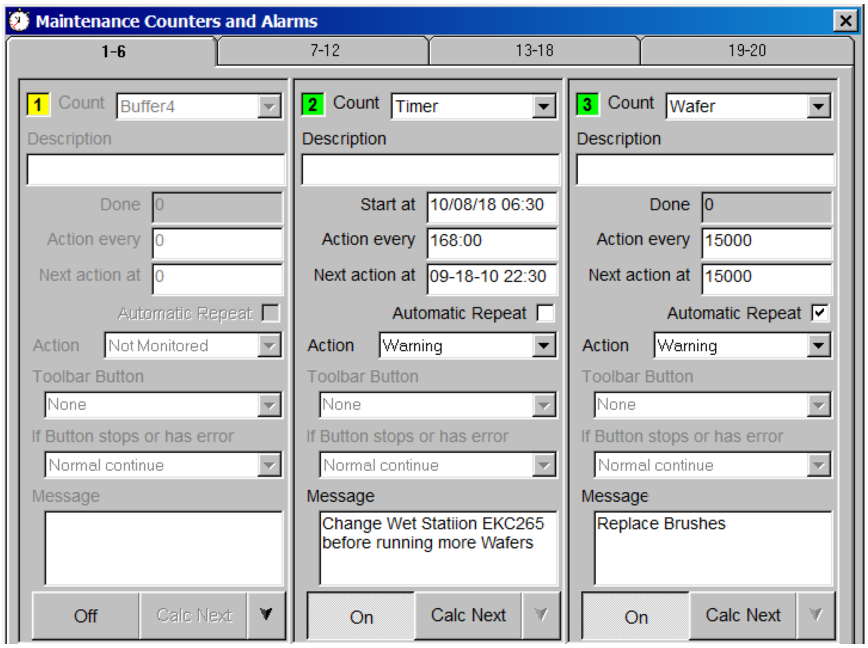
Counters can be used to configure Software counters to aid in routine maintenance. Warnings can be configured to alert the operator that the next scheduled maintenance is due based on time, number of wafers, number of cassettes, etc. These counters can also be configured to perform operations by using Toolbar Buttons.

The Rinse Recipes configuration Window is a read-only Window. It displays the current rinse configuration.

Counters

This Window contains six panels, each of which can be configured as an independent counter. The counters are numbered 1 through 6 at the top left corner of each panel. If the counter is active, the background color of the counter number will be green, if inactive, the background will be yellow. In the example below, 3 counters are configured, but counter #1 is inactive.





Count field – use the drop-down listbox to select what it is you want to count. Selections are: Timer, IdleModeTimer, Cassette, Wafer, and all of the Tool stations except the first one. Our example has 14 possible stations.

Start at/Done field – if the selected counter is either of the two timer types, this field will be labeled "Start at" and an initial starting date and time can be entered here. Holding the cursor over the field will reveal a Tooltip with the correct format for entering a "Start at" time (see counter #2 above). If the selected counter is not a timer, then this field will be labeled "Done". The "Done" field is not editable and will begin at zero. The count will maintained as long as the counter is configured, even if it is turned off, however if the counter is off the count will not be incremented. To clear the "Done" count, turn the counter off and click on the "Clear" button. Clearing a counter will reset everything to default values.

Action Every field – enter either the time to elapse or the number of items to be processed to trigger an action. Holding the cursor over the field will reveal a Tooltip with the correct format for entering an "Action every" value.

Next action at field **–** this field will display when the next action will be triggered. A specific date and time can be entered directly into this field. Holding the cursor over the field will reveal a Tooltip with the correct format for entering a "Next action at" value. Or the "Next action at" value can be automatically calculated by clicking on the "Calc Next" button. The "Calc Next" button will add the "Action every" value to either the "Start at" or "Done" value and put the result in this field. For timers, if no "Start at" time is entered, the "Calc Next" button will enter the present time in the "Start at" field and use the present time in the calculation.

Automatic Repeat checkbox – click this checkbox if you'd like the Software to automatically recalculate the "Next action at" value after each instance of the action.

Action field – select from the drop down listbox the type of action to be done. The selections are the same as an error condition – Not Monitored, Fatal Error, Warning, Error, Button Only, Complete Wafers, Complete Cassette, and Silent Button. Refer to Section 5 regarding error handling.

Toolbar Button field – if the action selected is "Button Only" or "Silent Button", a Toolbar Button must be specified. Select the appropriate Toolbar Button from the drop down listbox. Toolbar Buttons are specific for individual Tools.

Message field – Enter a message in this field that will be displayed in the message panel of the main Window when the action is triggered by the counter.

On/Off button - to activate a counter, click on the "Off" button, the button will appear depressed and switch to "On". To deactivate a counter click on the depressed "On" button. If the counter is a Timer counter this button is also used to stop the timer.

Clear button – click on this button when a counter is turned off to clear the counter and reset the fields to default values.

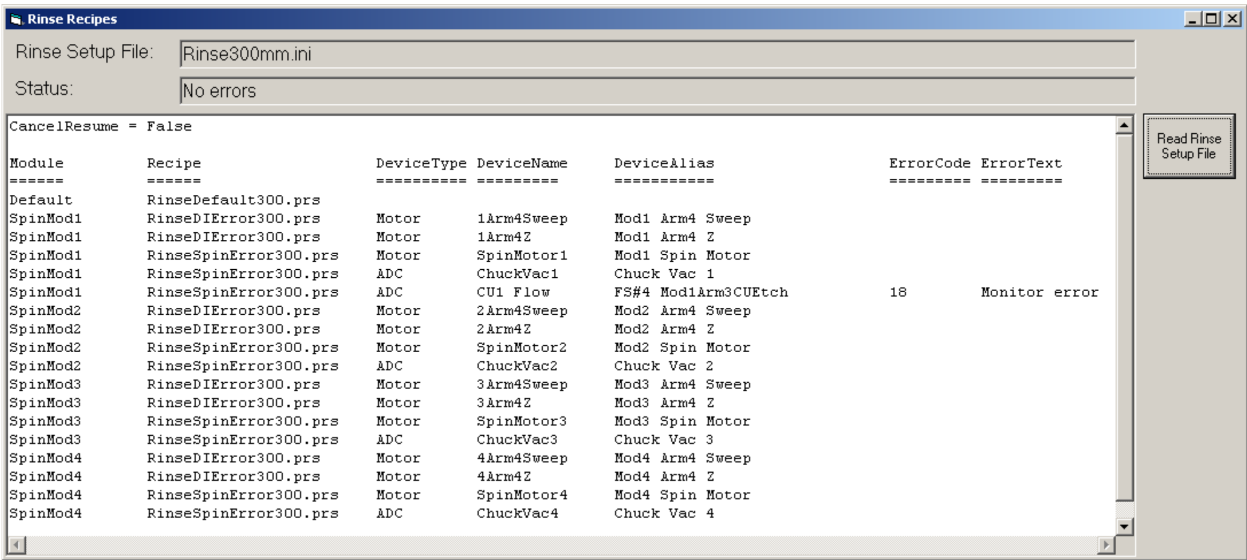
Calc Next button – click this button to calculate a "Next action at" value. See "Next action at" above.

Apply button – click on this button to apply any changes that have been made to the counters. When you click this button, the counter descriptions will be written to the counter.ini file and any counters that are turned on will immediately become active. A message box to the left of the "Apply" button will display a message that the active counters have been saved.

Exit button – click on this button to close the Window.

Rinse Recipes

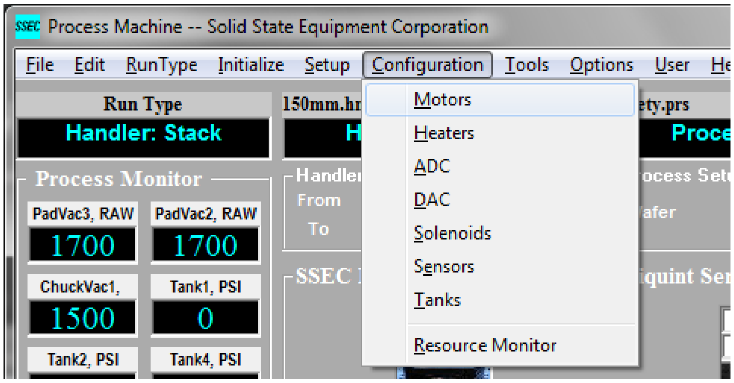
The Rinse Recipes configuration Window is a read-only Window. It displays the current rinse configuration. To change the rinse configuration, the Rinse Setup File (default **Rinse.ini**) should be edited, then click the "Read Rinse Setup File" button.



This Page Left Intentionally Blank.

Configuration Menu

This menu allows an authorized user to directly add, configure, view, or control hardware devices in the Tool and change their properties.



The Configuration menu selections are described in the following pages. Detailed descriptions of the selections can be found in Section 5.

NOTE

Only fully trained personnel should attempt to do anything beyond reading displayed values, as it is possible to create unsafe conditions, crash movable hardware, or damage subsystems. Changing any process or axis value may cause injury, be sure that all changes to these values are properly considered and carefully implemented.

Motors

This Window displays a list of all the motors that are in the Tool, some of their parameters, positional information, and dynamic slider bars with the allowable ranges. An authorized user may run motors directly for purposes of maintenance. This however requires the appropriate privileges. When moving motors from this Window, the Software does not check if the motor move request is appropriate, and the motor will move with limited Software checks. Inappropriate motion requests may result in damage to the equipment. All hardware safety interlocks are still active. Hardware faults, over-current protection, and thermal protection cannot be overridden.

Heaters

This Window displays all heaters and thermocouples in the System. Heaters may be for fluid, N2, wet stations, or hotplates. Thermocouples may be for controlling heaters, reading the heater core temperatures, reading chemistry temperatures, reading tank temperatures, or reading Neslab supply temperatures. The heaters' set temperatures are displayed and can be modified by an authorized user. All devices have a Low and High limit value which can be used to monitor process temperatures. A hardware Status value is also displayed for each device.

ADC

This Window displays all the ADCs, which are the readings received from analog devices and converted to a digital value, or virtual ADCs which are values derived from one or more of the devices. Typical ADC devices are vacuum or pressure transducers, voltage readings, or magnehelic readings. The present value of the device is displayed along with programmable minimum and maximum values that can be used to monitor processes.

DAC

This Window displays all the DACs, which are digital values that are output to various devices. Typical DACs are HPC pump pressure settings, tank pressure settings, and tank volume settings. The present setting value is displayed and an authorized user may change the setting directly from this Window.

Solenoids

This Window lists all the solenoid type devices in the Tool and displays their present state. An authorized user can toggle the solenoids on and off manually. Typically the solenoid field is green when it is turned on and gray when off, however the solenoid can be configured to be the opposite ***or*** the device itself can have its operation inverted. Solenoids can also be virtual devices. When configured as a "Background Pulse" device the field can toggle between light blue and dark blue when turned on. Typical solenoids are fluid valves, pneumatic door cylinders, power switches, and gas valves.

Sensors

This Window displays any of three types of sensors that are in the Tool. The sensor Window displays the current state of the sensors. In most cases the sensor background is green when the sensor is in a logically true or good state and red when not, however just like the solenoid its properties may invert the logic. When a sensor turns red it can be configured to generate an error. Typical sensors are door position sensors, tank overfill sensors, and flow sensors. The 3 types of sensors are:

Normal – all sensors that are not of the following 2 types are considered "normal" sensors.

EMO – these are the EMO (Emergency Tool Off) sensors.

Home – these indicate the status of the home sensors for those motorized axes that utilize them.

Tanks

This Window displays all Software configured tanks, carboys, and bottles in the Tool. The device name, percentage full, status, and whether the tank is currently in use are displayed. Tanks are configured specifically for each Tool.

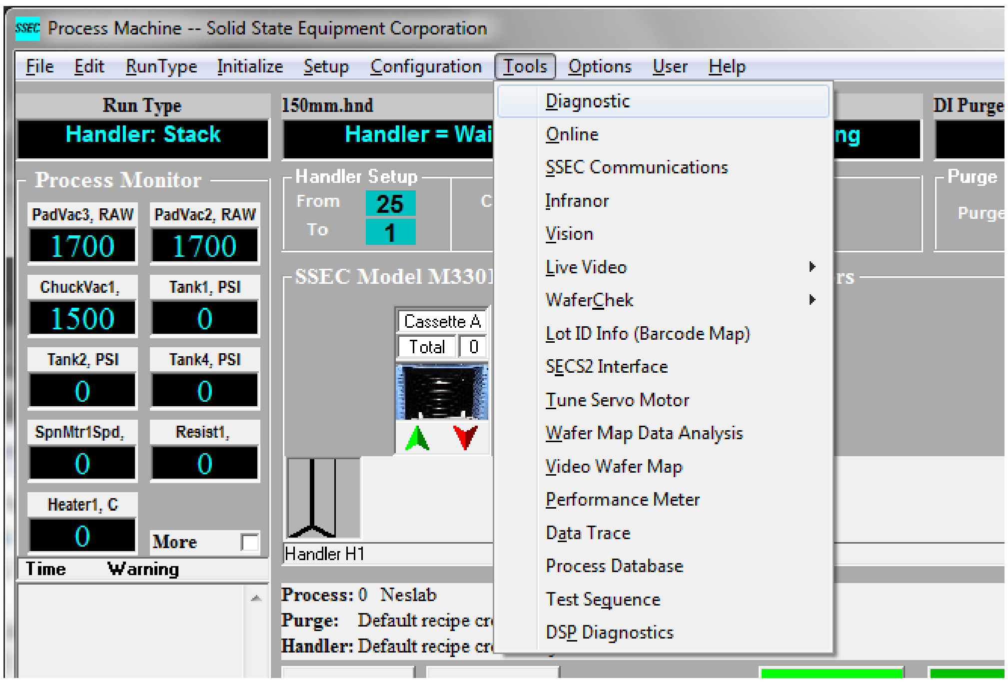
Resource Monitor

The purpose of the Resource Monitor function is to monitor the energy and chemistry consumption of the equipment.

This Page Left Intentionally Blank.

Tools Menu

This menu contains various Software Tools that an authorized user can utilize to diagnose problems, configure hardware and Software, analyze data, and tune hardware. Most of these Tools should only be used by trained personnel. Short descriptions of the various Tools are provided below. Detailed descriptions of the selections can be found in Section 6.



Diagnostic

This is a low level Software interface directly to the hardware. It is an advanced troubleshooting Tool for fully trained personnel only, and requires knowledge of specific hardware to utilize fully.

Online

This Window is used to determine whether all the devices that are configured in the Tool are communicating with the PC. It also will display the status and any communications errors that have occurred for each device. On a separate tab, all the actual hardware and Software devices for each address are listed.

SSEC Communications

Allows the viewing of the actual PC – Tool communications in real time.

Infranor

This Window is used to configure the communications between Infranor spin motors and the PC.

Vision

The "Vision Setup" Window is used to acquire and teach images captured by the camera's frame grabber. Vision is used to position and/or align substrates either for handler positioning or feature alignment.

Live Video

Selecting this option and then a specific camera will open a Window with a live video image from the selected camera. The image can be rotated, inverted, or mirrored.

WaferChek

Either the "WaferChek Process Monitor" or the "WaferThin State Detector" setup Windows can be selected from this menu item. WaferChek is VPSP's endpoint detection system and WaferThin is VPSP's wafer thickness detection system.

Lot ID Info (Barcode map)

This Window will display any barcode Lot ID information if the System is so equipped.

SECS2 Interface

This Window provides access to the SECS2 communications between the Tool and a factory host or to external equipment like Front-Opening Unified Pod (FOUP) loaders.

Tune Servo Motor

This Window is used to adjust and tune the parameters that are used by the servo motor controllers to match the load and impedance of the individual VPSP servo motors.

NOTE

"633" motor controllers use the DSP diagnostics for tuning ***not*** this Tool.

Wafer Map Data Analysis

This Window displays the data, parameters, and resulting outcome of the data acquired during wafer mapping.

Video Wafer Map

This opens the Video Wafer Map Setup Window which is used to teach the Software where to search and how to recognize wafers.

Performance Meter

This Window tracks the throughput and cycle times for wafers as they are processed by the Tool. Any of four different tabs can be selected to view the acquired information.

Data Trace

This feature is used to track data as read by the Tool. Specific devices are selected and the resulting data is collected and displayed in graphical form. This Tool will is recently becoming obsolete with the introduction of the Process Database / ProcessView Software.

Process Database

This Window is used to initialize, enable and configure the Process Database Manager. It also displays the status and Lifespan of the database entries.

Test Sequence

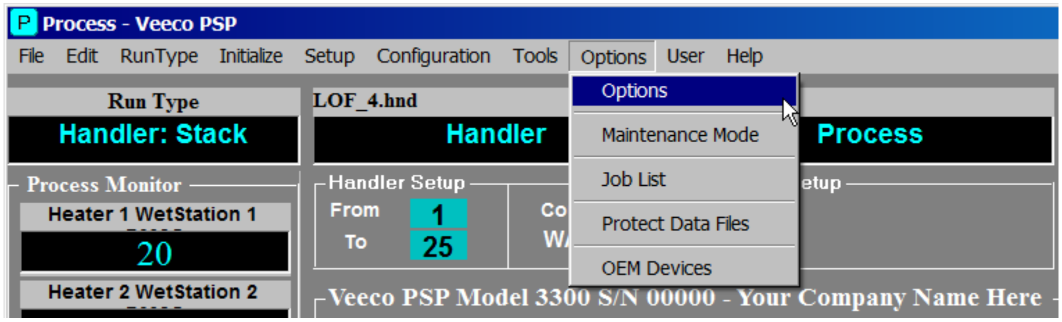
This Tool is used to execute low level hardware testing. This is an advanced troubleshooting Tool for fully trained personnel only, and requires knowledge of specific hardware to utilize fully.

DSP Diagnostics

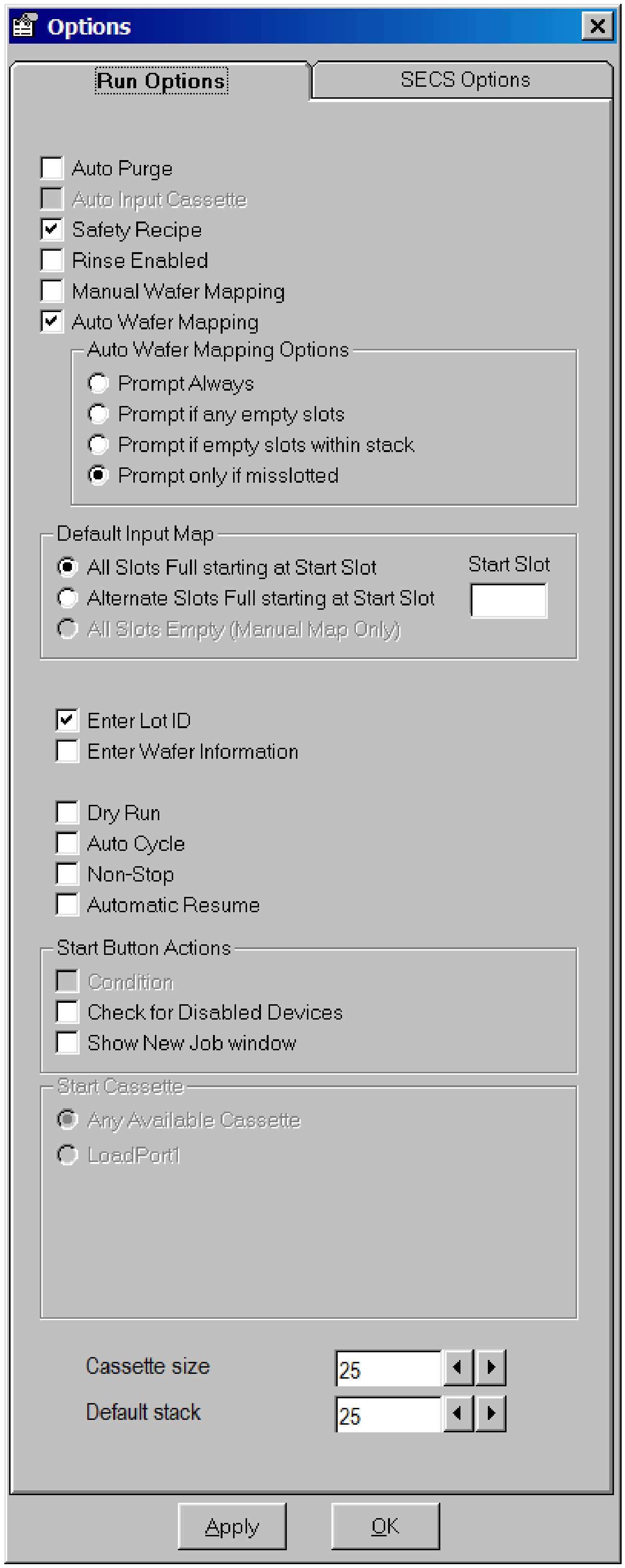
This Tool is used to configure the firmware in modules that have DSP Microcontrollers.

Options Menu

This menu is used to select various options to enhance process operations and also an option to place the Software in "Maintenance Mode" that will prevent processing or purging. There are two selections here – Options and Maintenance Mode.



Selecting Options opens the following Window.



Auto Purge

Clicking in this checkbox will enable the purge timer and the purge process. When toggled on, the Software will automatically start the purge timer to count down the "Purge interval" shown in the "Purge Setup" panel in the main Window. All Windows except the main Window need to be closed for the purge process to start. Otherwise the Tool will generate an error and restart the purge timer.

Auto Input Cassette

Clicking in this checkbox will enable the Auto Input Cassette function. When toggled on, the Tool will automatically unload the input cassette after the last wafer has been taken out.

Safety Recipe

Clicking in this checkbox will enable the Safety Recipe. This requires that a process (.prs) file be created specifically named safety.prs. With this option checked, whenever the Tool is initialized, this program will be loaded and run once after initialization, and then the last process file that was used will be loaded. The safety.prs program should be created to neutralize and rinse any chemistries that may be in a chamber after an EMO or power down condition has occurred. Tools that use acids typically have this implemented.

Manual Wafer Mapping

Selecting this checkbox will display the "Manual Wafer Mapping" Window when the user clicks the Start button. The user can manually select which wafers are present and which ones are to be processed, providing the ability to process cassettes that are not full or allowing the user to skip some wafers.

Auto Wafer Mapping

Selecting this option will start the automatic wafer mapping when the Start button is clicked, if the handler file has mapping defined and selected. If selected, the user has three mutually exclusive options for handling any errors that occur. The desired error handling option is selected by clicking the appropriate radio button in the "Auto Wafer Mapping Options" panel.

Wafer Log

Selecting this option causes the Wafer.log file to be written.

Enter Lot ID

Selecting this option will require Operator level users to enter a Lot ID when the Start button is clicked.

Enter Wafer IDs

Selecting this option will require Operator level users to enter Wafer IDs when the Start button is clicked. The Wafer IDs may be manually entered or entered via a barcode reader if so equipped.

Dry Run

Selecting this option allows the Tool to be run dry, that is, without any fluids being dispensed. This requires the fluid solenoids to have their "Dry" property set to true.

Demo Mode

This field is for information only and shows whether the Tool is in the Demo Mode or in the Real Operation Mode. The Demo Mode can be used to test and learn the SSEC Processor Software without a Tool present. Default setting is the Real Operation Mode (Demo Mode checkbox is unchecked). To change to the Demo mode, the user has to type the keyword "True" in the Demo Mode line of the Process.ini file prior to starting the process Software.

Auto Cycle

Selecting this option causes the Tool to automatically start processing a new cassette after the previous cassette has been completed. This requires that the wafers are picked up and returned to the same cassette and is typically used for testing purposes only.

Condition At Start

Selecting this option will load and execute the condition.hnd and condition.prs programs using the condition wafer prior to processing the production wafers when the Start button is clicked.

Cassette Size

The maximum number of slots of a typical cassette should be entered here. The default value is twenty five. The size can be entered directly into the field or the arrow buttons can be used to change the value.

Default Stack

The default number of wafers that are actually processed in the cassette should be entered in this field. The value must be less than or equal to the Cassette Size. The size can be entered directly into the field or the arrow buttons can be used to change the value.

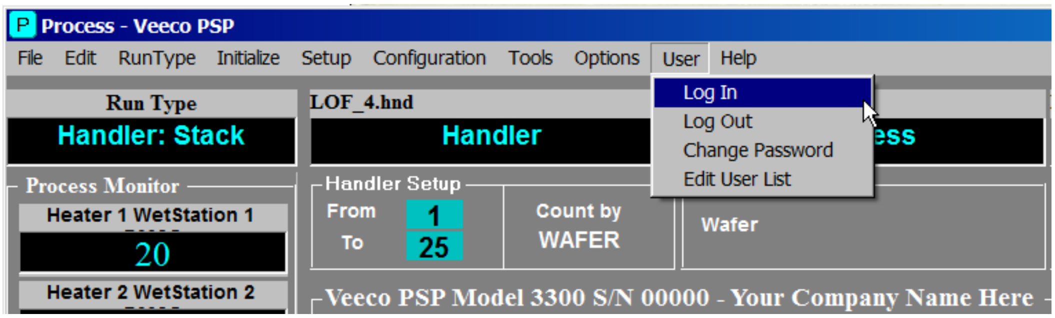
Maintenance Mode

When the Maintenance Mode Window is displayed, the Tool will not purge or start wafer processing.

This Page Left Intentionally Blank.

User Menu

This menu is for logging in and out of the Software, and if authorized, to add users, set log in timeouts, and edit the Role Definitions table.



Log In

Allows a different user to log into the Software. This change is logged in the message.log file for reference.

Log Out

Logging out will change the user status to the DEFAULT user. The DEFAULT user has limited abilities and access as defined by the Role Definitions.

Change Password

The presently logged in user should choose this selection to change their password.

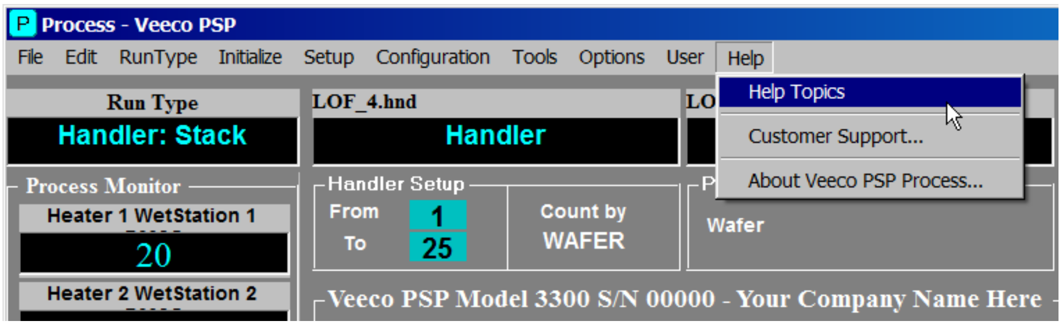
Edit User List

Selecting this option opens "User Privilege Configuration" Window. Any level User can view the list of User Accounts and the table of Role Definitions. However, it takes an authorized Supervisor to make any changes to the User List.

This Page Left Intentionally Blank.

Help Menu

This menu accesses the built-in help files and displays contact information for technical assistance.



Help Topics

Selecting this option opens the "SSEC Processor" online help Window. Tabs are provided to locate information based on contents, by Index, or by searching for keywords.

Technical Support

This Window displays contact information for Technical Support. It displays the Tool serial number and the Software version presently running. It also has a button which will take you to the ZipArchive utility.

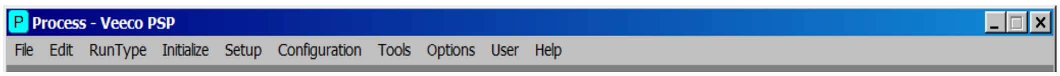
This Page Left Intentionally Blank.

4: Main Window

The various sections of the main Window are described below.

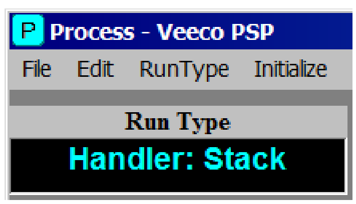
Pull-down Menus

The Pull–down Menus are at the top of the Main Window below the Window Title. These are normal Windows-type Pull-down Menus and are described in Section 3.



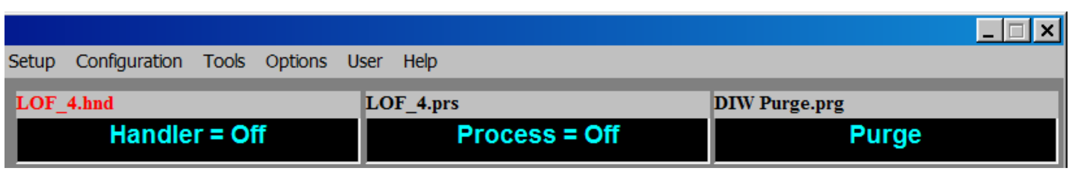
Run Type Box

This box at the upper left of the main Window displays the presently selected RunType.



Recipe Information Fields

Three boxes near the top of the Main Window display the names of the loaded Handler, Process, and Purge files in a gray field and the status of the files in a black field below each.



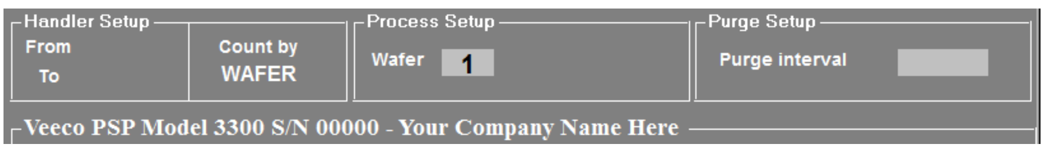
If one of the files has been changed, its Filename becomes red, as in the example above. This is to remind the User that a change has been made. If the revised file is saved, the Filename reverts to black.

The black fields below the Filenames will display a description of the type of file when the Tool is first initialized as above and subsequently the present status once the Tool has been used. The status can be Off, Running, or Waiting.

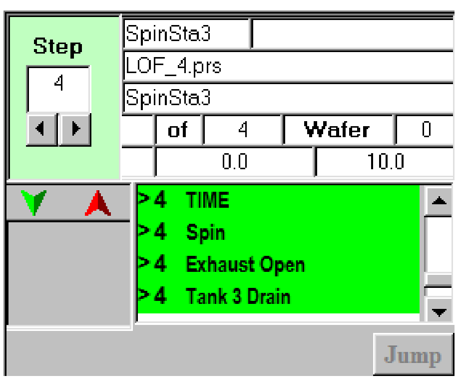
Below the Recipe Boxes are the "Handler Setup', "Process Setup", and "Purge Setup" Frames. The "Handler Setup" Frame displays the Wafer Indicator, which changes depending upon the RunType. When the RunType is "Handler: Stack" or "Stack of Singles", the Frame displays "From" with a Wafer Number in a light blue field, "To" also with a Wafer Number in a light blue field, and "Count by WAFER" (see below).

When the RunType is for a Single Wafer, there is only a light blue field next to the "From" label. The number indicates which Wafer Number is selected.

When the RunType is "Process: Only", there are no light blue fields in the "Handler Setup" frame, and the "Process Setup" frame will display the number 1 to the right of the "Wafer" label.



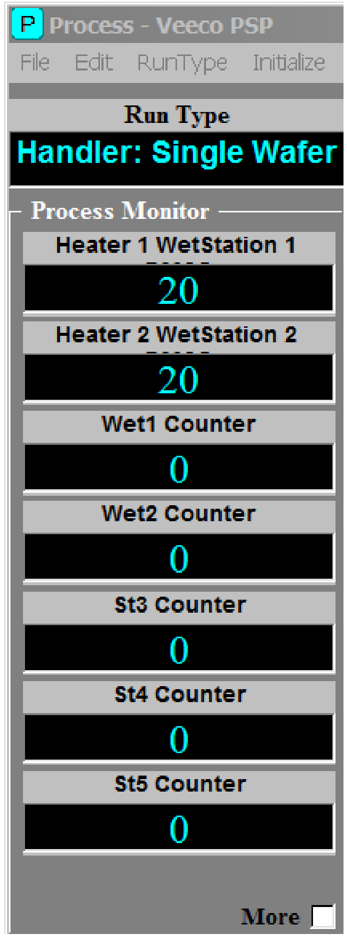
The Process Step number can be edited by clicking on the arrows in the Step field in the Window pops up to change the number.



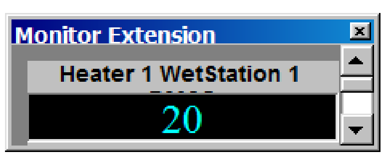
If the Auto Purge option is enabled the "Purge Setup" frame displays the time remaining until the next purge occurs in the gray field labeled "Purge interval". If "Auto Purge" is disabled the gray field will be blank as above.

Process Monitor Frame

The Process Monitor Frame has an area for device readings and a "Warning" message Window. It can display up to fourteen device readings. If more than fourteen device readings are specified to be displayed, a small "More" checkbox will take the place of the last device reading field.



Clicking this Process Monitor Checkbox will open the "Monitor Extension" Window containing the remaining device reading boxes. If the number of device readings exceeds the monitor extension Window's size, then the arrow buttons at each end can be clicked to scroll through them.

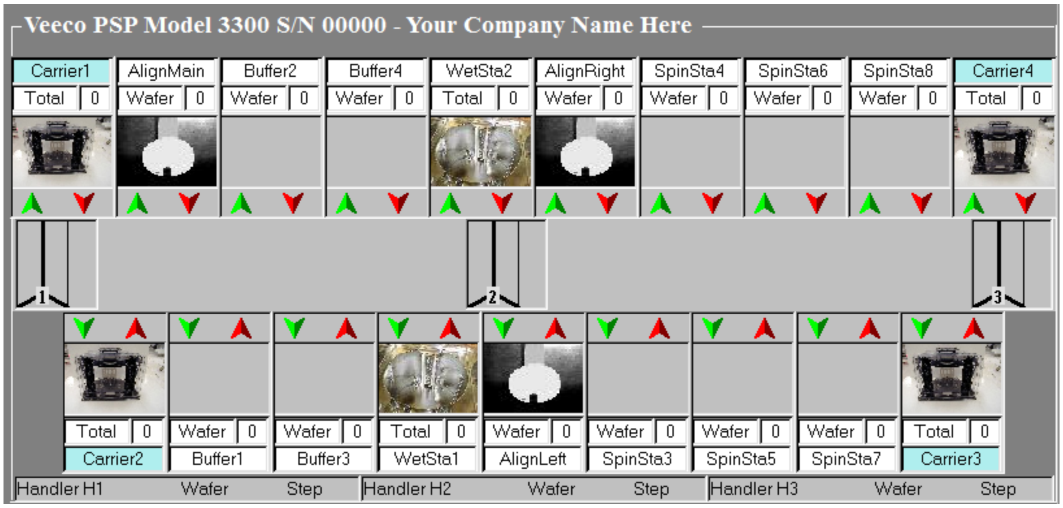


The function definition file can be edited to add, delete, or change the order of the displayed readings. Typically the most relevant or critical process parameters are displayed on the Main Window, with the less important ones in the Extension Window. Typical readings displayed are Spinmotor RPMs, Tank Pressures, and Chemistry Temperatures.

To close the "Monitor Extension" Window, use the close (x) button or click the "More" check box.

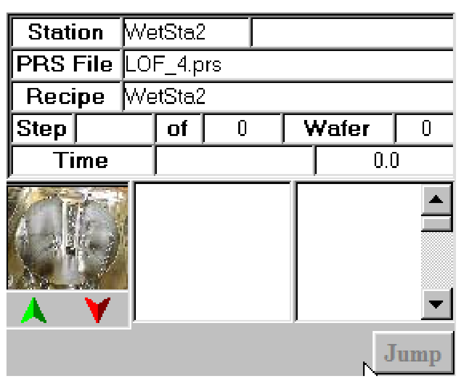
Model Frame

The Model Frame is located in the middle of the Main Window and reflects the Tool's Stations, its Handler(s), and the status of the Stations. The Frame Title typically includes the Model Number, Serial Number, and Customer Name.



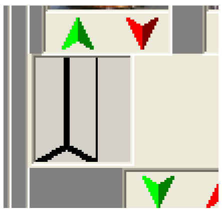
The Stations are represented by rectangular boxes with the logical name of the Station at the top, a Wafer Indicator Field, an actual photo of the Station or its view in the center, and two stylized arrows at the bottom. The Station Name and photo displayed are specified in the function.def file. The Wafer Indicator field will indicate the total number of Wafers in the Input & Output Cassettes, or the specific Wafer Number of the Wafer that is presently at that Station. Before clicking the "Start" Button to process Wafers, the arrows will be displayed as above with the left arrow being green and pointing upwards, and the right arrow being red and pointing downwards. The direction and color of the arrows indicate if a Wafer can be removed from or placed into a Station. A green arrow signifies it is okay for a Wafer to move in the direction of the arrow.

Processing Station Boxes can be maximized by clicking on Station's photo, its title or a picture.

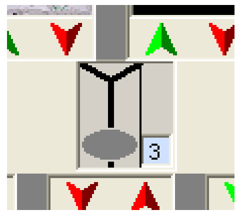


In the maximized Window a little more information is displayed. The Current Step, the Total Steps, the Functions in each Step, and the Total & Elapsed times of timed functions. When the Tool is running the Step Section will scroll down and the presently running and completed steps will have a green background. To minimize the station Window click on the photo.

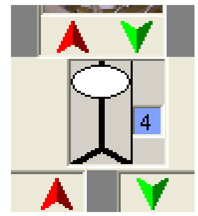
A stylized representation of the System's handler(s) is displayed in a gray field across the width of the stations.



Handler Idle



Handler Placing



Handler Picking

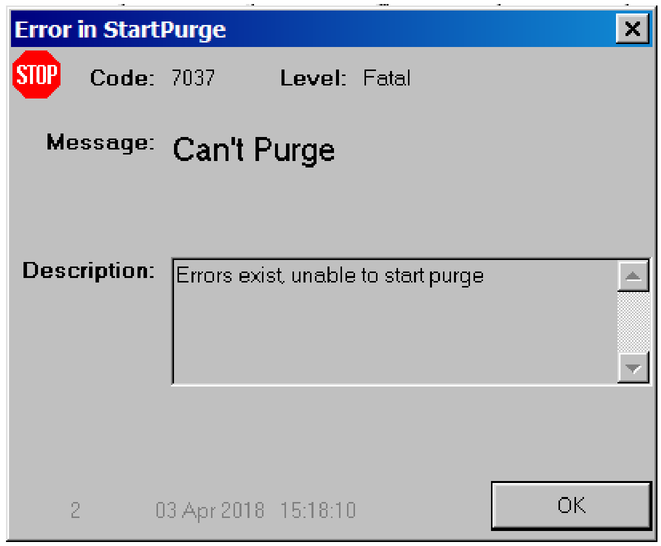
Tools can have up to three (3x) Handlers. When the Tool is transporting Wafers with the Handler an oval icon representing a Wafer with the Wafer Number next to it will be displayed. Handlers can have up to four (4x) Arms that can hold Wafers. The Wafer icon can range from white to dark gray from the uppermost to the lowermost Arms respectively. When the Paddle is performing a Pick the Wafer Number background will be blue. When Placing, the Wafer Number background will be light blue.

Comment Field

This field displays the comments for the Process, Purge, and Handler files that are presently loaded.

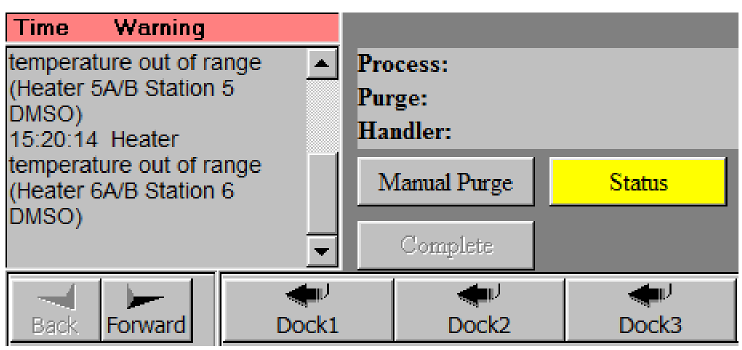
Auxiliary Control Buttons

Manual Purge – click on this button to start the loaded purge program. One cycle of the purge program will be run. The "Manual Purge" button can be clicked any time the Tool is at idle. The purge program may not run if certain Windows are open. An error Window will open and direct you to close the offending Window(s).

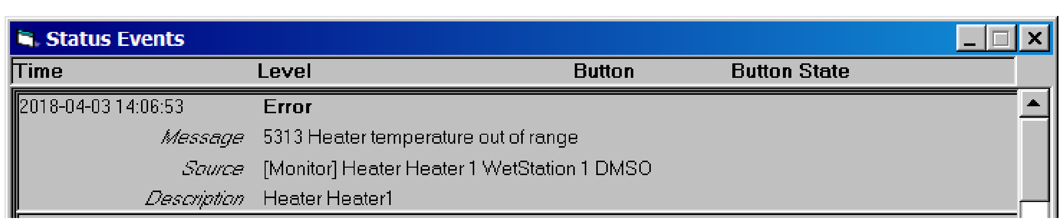


If the Auto Purge Option is ON, the "Purge Interval" Counter will reset.

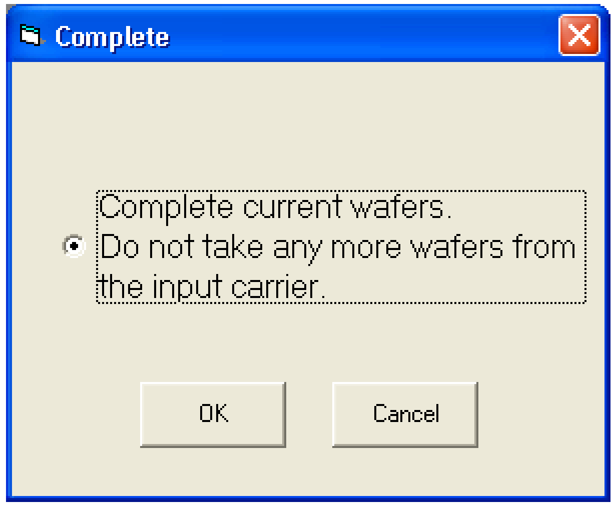
Status – if the "Status" Button's background is yellow, something in the Tool has generated a warning or error, which will be displayed in the message panel. The following example displays a Tank Overfull condition.



Clicking on the "Status" Button will open a Window with a better description of the condition. It will display the type of error, the error message, the source of the error, and which device generated the error.

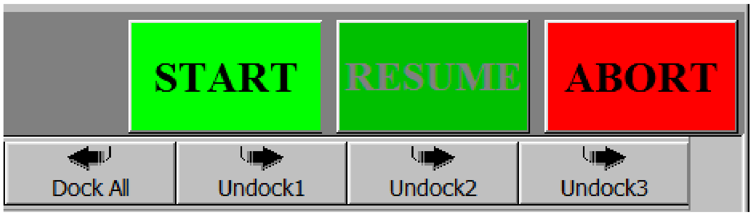


Complete – allows User to complete processing only the Wafers that have been started. The remainder of the Wafers in the Input Station will not be processed. Clicking on this Button will open a Window and ask for the User to confirm the choice.



Click on the "OK" Button to confirm or the "Cancel" Button to continue processing the remaining Wafers. Once "Complete" is confirmed, to process the remaining wafers the present Wafers must be completed and then start again with the remaining Wafers specifically selected.

Main Buttons



START - allows User to start any processes according to RunType. The Button is not enabled when a Process is running.

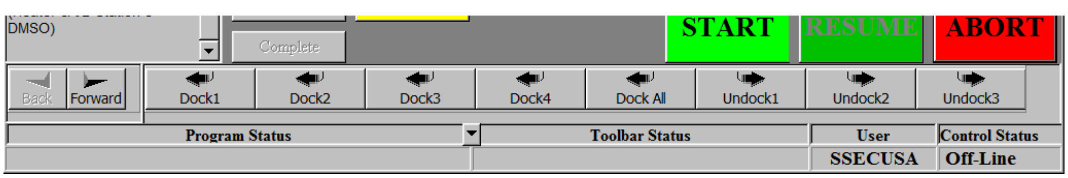
RESUME - allows User to resume any processes being halted. The Button is not enabled when a Process is running.

ABORT - halts all operations immediately. If a current recipe step includes a terminating part ("off-part") it will be executed after stopping. If the Abort Button is clicked for 5 seconds the Software will also abort the off-part operations. Clicking on the Abort Button will display the message "Hold 5 seconds for full abort" on the Button.

To resume operations from where the process was aborted, use the RESUME Button. To restart a process from the beginning, use the START Button.

Toolbar Buttons

The Toolbar Buttons are a set of Control Buttons defined by a file (Toolbar.def) and a recipe file (*.tbr). It is usually used for single-step operations that are frequently needed such as filling and discharging Tanks, opening & closing Doors, or loading & unloading Cassettes. They are located across the bottom of the Main Window. If there are more buttons than the space available, then the "Back" and "Forward" arrow buttons to the left can be clicked to scroll horizontally through them.

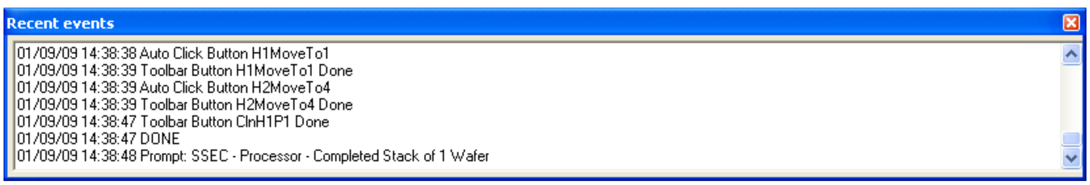


See the section with User Accounts for information on how to enable/disable Toolbar Buttons on a per-user basis.

Status Fields

Across the bottom of the Main Window are the status fields. There are four status fields labeled “Program Status”, “Toolbar Status”, “user”, and “Control Status”. Below the labels their respective statuses are displayed.

The “Program Status” field will display general status conditions such as when the Tool is started, resumed, aborted, when new files are loaded, or if any remote commends are sent. The “Toolbar Status” field will display when one or more Toolbar Buttons are running and when they have completed. The “user” field will display the logged in user’s name. The “Control Status” field will display “Remote” if the Tool is being controlled via the SECSGEM interface or “Off-Line” if not. Clicking on the small downwards pointing arrow between the “Program Status” and “Toolbar Status” labels will open the “Recent events” Window, a small Window that displays the latest entries to the message.log file.

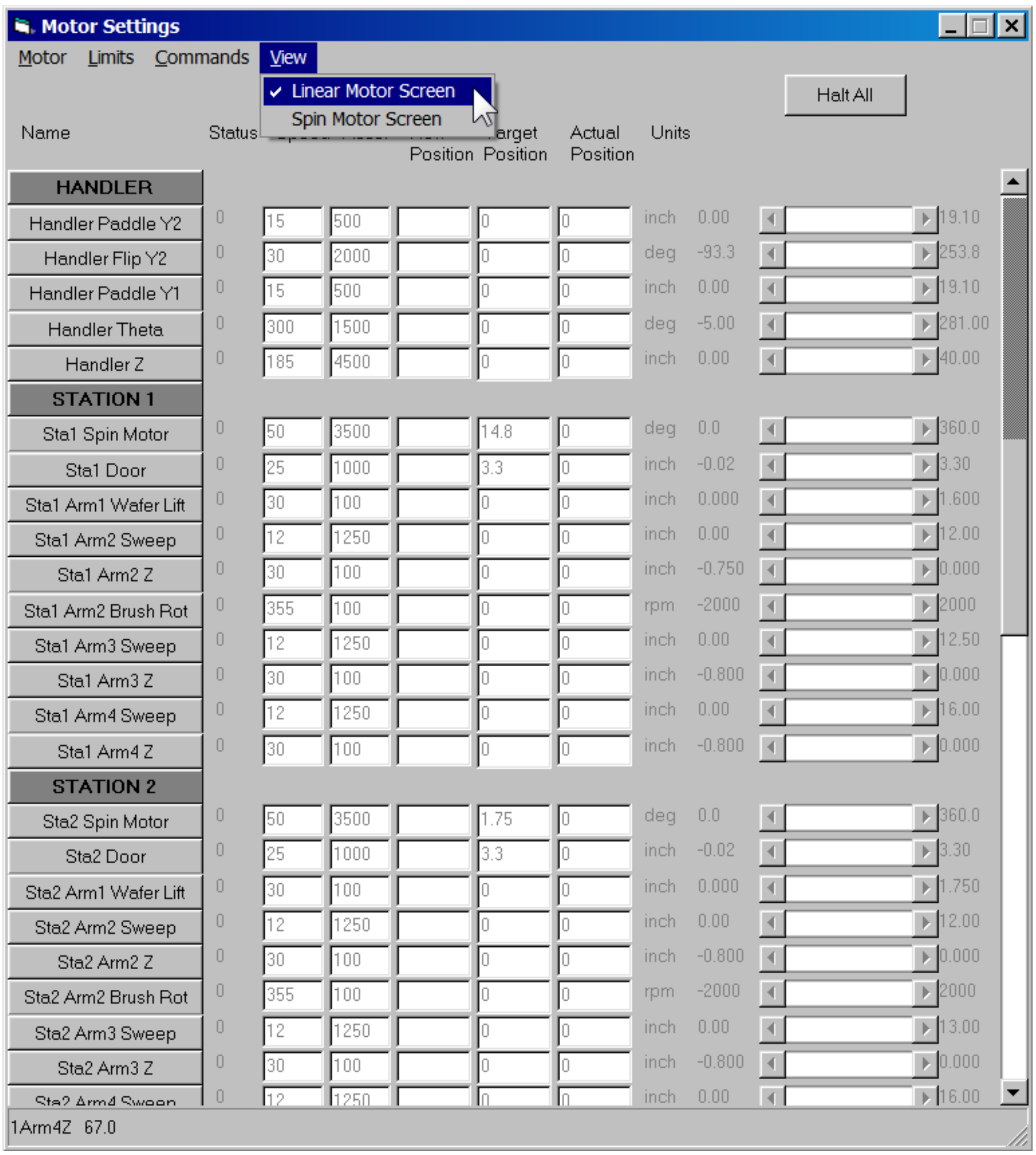


5: Configuration Descriptions

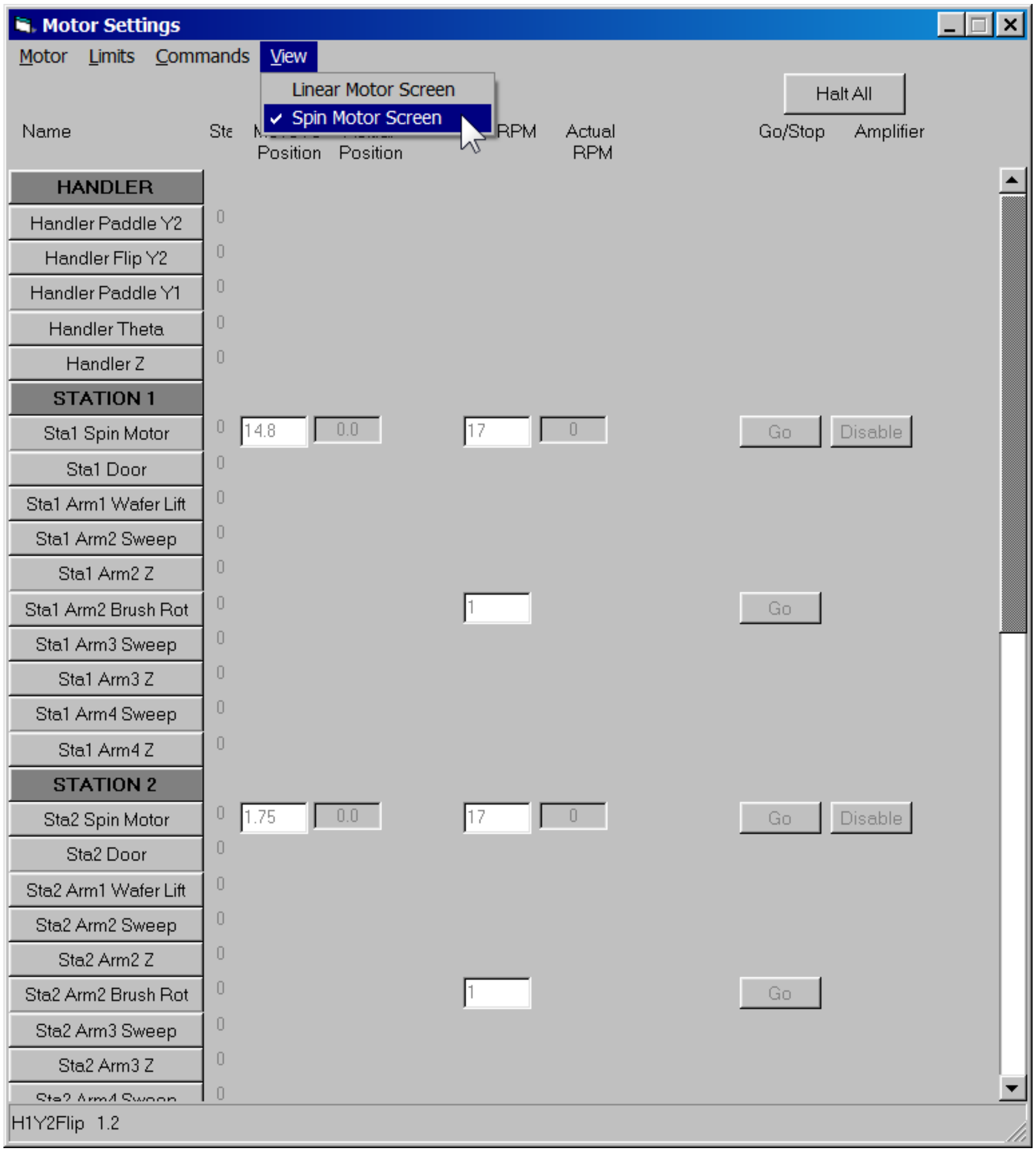
Motors

Motors Window

Linear View



Spin Motor View



The Motor Screen displays all the Motors on the Tool that have VPSP Motor Controllers.

Description

Motors can have these states:

Powered On – The Motor has been powered on and is communicating but has not been reset. The Motor must be reset before it is initialized.

Reset – The Motor has been powered on, reset, and is communicating, but has not been initialized.

Initialized – The Motor has been initialized. At this point, the Motor can be commanded to move.

Disabled – The Motor has been disabled. The name is grayed out on the screen.

Offline – The Motor is not communicating. The Motor name is displayed with a yellow background.

The User can select two views from the Motor Screen menu. The "Linear" view displays the speed, accel, and position information for linear motors. The "Spin Motor" view displays RPM for Brush and Spin Motors and position information in degrees for Spin Motors only.

In the Linear View, the Motor Position, Speed, and Acceleration can be changed by:

Entering a new value in the edit box on the Motor screen.

(Motor Position only) Scrolling the motor position bar on the Motor screen.

Initializing the Motor. During Initialization, the "Init Speed" and "Init Accel" value are used. At the end of Initialization, the "Default Speed" and "Default Accel" values are applied.

Running a Handler, Process, or Purge recipe.

In the Spin Motor View, the following values can be changed:

RPM – Enter the RPM and press Return. If the Go button is depressed, the Motor will move at the specified RPM. (Brush and Spin Motors)

MoveTo Position – Enter the desired position (from 0 to 360 degrees) and press Return. The Motor will move to the specified position. (Spin Motors only)

Go/Stop Button – When the Go button is depressed, the motor will move at the specified RPM. When the Go button is released, the motor will stop. For Spin Motors, the Stop position will be the MoveTo position.

Enable/Disable Button – When the Enable button is depressed, the motor holding current will be disabled. The motor can be moved by hand. (Spin Motors only)

Status Display

For a two-motor controller, the Motor Status byte means:

Bit 0 = Motor 0 Busy

Bit 1 = Motor 1 Busy

Bit 2 through 7 = Error bits

If all bits are set (Status = 255 decimal or FF hex), then the motor needs to be reset.

For Bxxx Servo Motors, the Motor Status byte means:

Bit 0 = Motor 0 Busy

Bit 1= Fault

Bit 2 = Disable

Bit 3 = High Heat

Bit 4 = I2T Error

Bit 5 = Short

Bit 6 = Over/Under-voltage

Bit 7 = EEPROM Error

All bits set (decimal 255 or hex FF) means the motor needs to be initialized.

View Status

The Motor Screen can be in Active or View Only mode. In Active mode, the user can move the motor and change the motor properties. In View Only mode, the user can view the motor position, but cannot make any changes. The Motor Screen will be put in the View Only state if any of these conditions are true:

The Process Cycle is running (Start button has been pushed)

The Recipe Editor is open

"Config.Screens: View Only = True" in the Process.ini file

"Motor Screen: View Only = True" in the Process.ini file

User Access Level = Operator

Menus

Motor

This selection allows an authorized user to add a new motor.

Limits

Select "Read Limits.ini" to force the Software to reload the limits.ini file to have any newly changed limits be utilized.

Select "Enable/Disable" if you want the Software to use the limits specified in the limits.ini file or not respectively.

Commands

Save Default Speed/Accel for all Motors. This saves the current speed and acceleration settings for all motors as their default speed and acceleration.

Check Online for all Motors. Performs an Online Check of all motors.

Reset All for all Motors. Resets all the motor controllers – this will require that they be re-initialized again prior to being usable.

Init All for all Motors. Initializes all motors in the Tool in the order they are displayed in either of the views.

Halt All for all Motors. Sends a halt command to all motors that are online.

View

User can select whether the "Linear Motor Screen" or the "Spin Motor Screen" is displayed. See examples above.

Right-click Menu

Right-clicking on any of the individual motor names will open a menu with the following options.

Enable / Disable

Use these options to enable or disable this specific motor.

Online Check

This will do an online check for this specific motor.

Initialize

Initializes this motor. If the motor has an "Init Sequence" specified and it exists in the sequence.ini file then it will initialize using that sequence.

Move to Rest Position (0)

Immediately moves the motor to the position specified in the "Rest Position" property. The value in the parentheses is the present rest position.

Reset

This will reset the motor controller at the address that this motor has.

NOTE

It will reset ***all*** the motors at this address.

Delete

This option will delete the motor from the Tool. The user will be asked to confirm. This deletes all the motor's properties from the motor.ini file.

Set Soft Home

Selecting this will set the present position as the home position. The user will be asked to confirm.

NOTE

Changing the home position will affect all taught moves and may damage the Tool.

Save Default Speed/Accel

This option saves the values that are presently displayed in the "Speed" and "Accel" fields as the default values.

Properties

Name

Unique identifier of the device. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains "H#Y1" and Number Combobox contains "2", then the Name will be "H2Y1".

Description

Unique user-friendly name.

Enabled

True or False flag that determines whether or not the device is used.

Address

Address of the device on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its controller. Valid ports numbers vary depending upon controller type.

Mode

Specifies the Motor Mode.

- 0 = Use Encoder
- 2 =Uses Non-matching Encoder (2:1 ratio)
- 4 = Use Encoder, ignore Hall effect (servo motors)
- 12 = Do not use OR the motor does not have an Encoder
- 16 = Uses a Non-matching Encoder (ratio unknown)
- 28 = Combines Mode 12 and Mode 16
- 32 = Uses motors in a Master/Slave mode (synchronizes motors)
- 64 = Synchronize Vertical and Theta motors in Arm drives. The Sweep motor mode in the Arm drives are set to 64.
- 128 = Initialize to Hard Stop (no Home Sensor).

CW

- 0 = Initialize Counterclockwise
- 1 = Initialize Clockwise

Pole

- 0 = Motor Home Sensor has Level property = Level 0. Home optic clears the sensor (arm drive sweep axes are typically 0).
- 255 = Motor Home Sensor has Level property = Level 1. Home optic blocks the sensor.

Type

- Normal = Most motors. This causes the motor to initialize until it finds the home sensor.
- Rotary = Brush rotary motors. This causes the motor to ignore the home sensor when initializing.
- Hardstop = Motor initializes to a hardstop rather than a home sensor. Use with Mode 128.
- Special = For motors that don't initialize automatically and require a special initialization sequence. The "Init All" command will not initialize s motor of this type. Obsolete for process equipment.
- Electrode = Electrode Motors. Not used in process equipment.
- Spin Motor = for Process Chamber spin motors.
- Not Used = this is an obsolete type.
- Scara Radial = does not use a linear scale factor for motion.
- Caption - This creates a device that is used for display purposes only. The Caption devices can be used to subdivide a long list of devices into different groups. This makes it easier for the operator to locate and understand different devices.

Steps Per Rev

This is the number of steps in one motor revolution. Typical numbers are 1600, 2000, 4000, 8000. If the Modulo is zero, then no modulo number is sent – the motor default value is used. Modulo is used for motors that drive mechanisms in circles. Examples are brush rotary motors, spin motors, rotary tables, etc.

The Modulo is used to determine the motor RPM. If the Modulo is zero, then the Scale is used to determine the motor RPM instead.

The Modulo is also used to contain the gearing ratio if the motor mode = 64. In this case, the gearing ratio will be sent to the motor during initialization. This is typically used for a dispense Arm theta motor to chain the Z motor to it, so that they move in synchronization. The purpose is to keep the dispense head level as the dispense Arm moves.

Run Current / Angle to optic

This specifies the motor Run Current, in percent. The motor Stop Current is automatically set to half the Run Current.

- 0 = Use motor controller default value
- 33 = Low Torque
- 100 = High Torque

If the “Motor Type” is specified as “Scara Radial”, this property will be named “Angle to optic”. This value is the angle made from the separate links of an axis when it is at the zero (0) position.

Init Speed

This is the initialization speed value.

Init Accel

This is the initialization acceleration value.

Init Sequence

This is the name of the initialization sequence in the sequence.ini file that will be used to initialize this motor.

Min Position

Minimum position the motor can move to (relative to the Soft Home position).

Max Position

Maximum position the motor can move to (relative to the Soft Home position).

Default Speed

This is the speed the motor normally runs at. If the motor speed is changed while running, the “MotorSetSpeed 0” command will set the speed back to this default value.

Default Accel

Default Acceleration.

Home

Position of the soft home relative to the hard home. During initialization, the motor will be initialized to the hard home, then it will move to this (soft) Home position. That position will become the zero position of the motor.

Rest Position

Rest position of the motor. The motor moves to this position after initializing.

Scale / Link Length

Units/Step. For example, if the motor moves 1000 steps per inch, the scale = 1/1000 = .001.

If the "Motor Type" is specified as "Scara Radial", this property will be named "Link Length". This is the length of each length in a "scara" type linear axis.

Units

Motor position units. This is used for display purposes only; the Scale property is what really determines how far the motor moves. Examples: Inch, Steps, Deg, Rev (for Revolutions).

Click

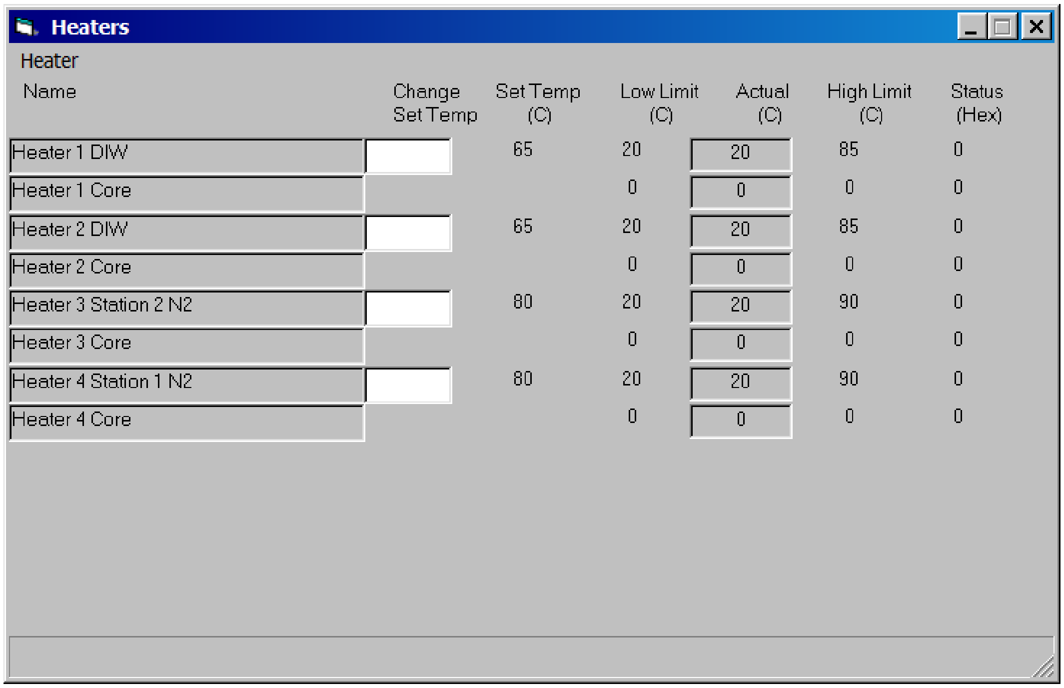
Amount the motor moves each time you click on the ends of the scroll bar in the Motor screen. Typically, if the Units are Inches, Click = .001.

Big Click

Amount the motor moves each time you click on the middle of the scroll bar in the Motor screen. Typically, if the Units are Inches, Click = 0.1.

Heaters

Heaters Window



Description

The Heater screen displays heaters and thermocouples.

Heaters/Thermocouples can have these states:

- **Alive** – The Heater is constantly polled in the background and the actual temperature is displayed.
- **Disabled** – The Heater text is grayed out. The Heater is not polled.
- **Offline** – The Heater is displayed with a yellow background.

The Heater Set Temperature can be changed by:

- Entering a new value in the edit box on the Heater screen
- Initializing the Heater. The value in the "Initial Temp" property is sent to the Heater during initialization. Usually. However, this value is immediately overwritten by a value in the Setup section of a recipe.
- Loading a Handler or Process recipe (if the setting is called out in the Setup section of the recipe)
- Running a Handler, Process, or Purge recipe

If the Heater status is not zero, a heater error has occurred.

Heater Status Codes

A Heater status of 0 means there is no heater error. If the status is non-zero, there is a heater error.

To determine the meaning of a status error, move the mouse pointer over the status code. If the code is not zero, the Windows ToolTip will display the meaning of the error code.

Each bit in the heater status indicates an error condition. The meaning of each bit is described below. If one bit is set, the corresponding hex code will be displayed. However, if multiple bits are set, the “OR” of those bits will be displayed. For example, if bits 0 and 2 are set, the hex code will be 05.

Bit	*Hex Code*	*Meaning*
0	01	Open Thermocouple
1	02	No Fluid in Heater
2	04	Over Temperature
3	08	Fluid Temperature Out of Range
4	10	(not used)
5	20	SS Relay Short
6	40	Heating Element Open
7	80	Heater Error
All	FF	Heater Needs Software Reset Command

Menu

This selection allows an Authorized User to add a new heater or thermocouple.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device.

Change Actual

This property is only available in Demo Mode. Allows the user to change the value that is "read" from the device in demo mode. Typically used to test errors.

Online Check

This will do an online check for this specific device.

Delete

This option will delete the heater from the Tool. The user will be asked to confirm. This deletes all the heater's properties from the heater.ini file.

Properties

Name

Unique identifier of the Heater. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains "Heater#" and Number Combobox contains "3", then the Name will be "Heater3".

Alias

Unique user-friendly name.

Enabled

True or False flag that determines whether or not the Heater or Thermocouple is used.

Address

Address on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its controller. Valid ports numbers vary depending upon controller type.

Mode

Specifies whether the device is a Heater, a Thermocouple or a Caption.

Initial Temp

Setting applied to the Heater during initialization.

Lo Temp

If non-zero, a warning can be generated if the actual Heater temperature is less than this value.

Hi Temp

If non-zero, a warning can be generated if the actual Heater temperature is greater than this value.

Bandwidth

Control Bandwidth, in degrees C. Increasing the bandwidth causes a slower response time, but less overshoot. Typical values are as follows:

DI Water Heater = 10

Solvent Heater = 50

Imtec Quartz Heater = 10

HPC Heater = 50

Wet Station Heater = 50

Pulse On Time

Time in seconds to pulse power on when the HtrPulseOn command is called in the definition file when a process is running.

Pulse Off Time

Time in seconds to pulse Power OFF when the HtrPulseOff command is called in the definition file when a process is running.

Set Temp Offset

Offset in degrees C to adjust set temperature. Actual Set Temp = Set Temp + Set Temp Offset.

ErrCode

The ErrCode property contains a code indicating what error message will be displayed when the device generates an error. The ErrCode is an index into the Errors.txt file which contains a list of error messages.

ErrCodeText

This field is for display only and displays the error code text associated with the error code number specified in the ErrCode field. The error code number is an index into the Error.txt file in the Bin folder if less than 10,000 or into the UserErr.txt file in the Recipe folder.

ErrLevel

Sensors, ADCs, Heaters, and the Infranor motor have an Error Level property. The setting of the ErrLevel property determines what action is taken if an error is detected when monitoring the device.

Possible settings for the ErrLevel property are:

Not Monitored – The device is not monitored in the background.

Fatal Error – The device is monitored. If an error occurs, the Tool is stopped immediately. A message is displayed in the Monitor box of the Process program. The ErrButton function is called.

Warning – The device is monitored. If an error occurs, the Tool keeps running. A message is displayed in the Monitor box of the Process program.

Error – The device is monitored. If an error occurs, the Tool finishes the current processes that are running and the handler finishes whatever action it is currently performing. Then, if the ErrButton property is blank, the Tool is stopped. If the ErrButton property is not blank, the ErrButton function is called, after which the Tool resumes cycling.

Exceptions:

If the ErrLink property links the device to a Solenoid, the error monitoring will only occur if the Solenoid is on.

A Toolbar Button will not stop on a Fatal Error if you started it manually by clicking on the Toolbar Button. This is because you might be running the button to fix the error condition. For instance, if a Tank Empty sensor generates a Fatal Error, you want to be able to run the Toolbar Button to fill the tank. If. However, the Process program started the Toolbar Button while running a process cycle, a Fatal Error will cause it to stop.

Some examples of ErrLevel settings are:

Door Sensors – These would use the **Not Monitored** setting. Door sensors are checked at specific times to see if the door is up or down; however, they are not monitored in the background. Background monitoring implies that a device should always be in a particular state, whereas a Door Sensor may legitimately be either on or off.

Environmental Door Sensors, Leak Sensors – These sensors might use the **Fatal Error** setting. The Tool should be halted immediately if an error occurs.

Flow Sensors – These sensors might use the **Warning** setting. A message would be displayed indicating the problem, but the process would continue.

Tank Low Sensor – These sensors might be set up to use the **Error** setting. If an error occurred, a message would be displayed. The Tool would halt when the processes running in all the Chambers were complete.

ErrLink

The ErrLink property links a Solenoid with one or more Sensor, ADC, or Heater devices. The device will only report Monitor errors when the Solenoid is On.

It is important to note the difference between Monitor errors and recipe errors, because the ErrLink property only applies to Monitor errors. Monitor errors refers to polling the Sensor/ADC/Heater in the background if the ErrLevel is set to Warning or higher. A recipe error is when the Sensor/ADC/Heater is explicitly checked when running a recipe. Monitor errors will only be generated when the linked Solenoid is On, but recipe errors will always be generated if the Sensor/ADC/Heater is in the error condition.

The ErrLink property can contain 0, 1, or more solenoid names. If 0 solenoid names, then the Monitor error is always generated. If 1 solenoid name, then the Monitor error is only generated if the solenoid is On. If 2 or more solenoid names, then the Monitor error is generated if *any* of the linked solenoids are On.

Typical examples of devices that would use the ErrLink property would be:

Flow Sensors – The Flow Sensor might only be monitored if a particular dispense solenoid is on

Brush Pressure – A Double Brush Pressure ADC might only be monitored when the brush is clamped (the clamp solenoid is on)

Resistivity Monitor – A Resistivity Sensor might only be monitored if a particular dispense solenoid is on

ErrStationList

This property requires the ErrLevel to be set to “Error”. When an error occurs it will stop the selected stations immediately.

ErrOnDelay

Time in seconds to wait after an error starts before reporting the error.

ErrButton

The ErrButton property can be used to take corrective action if an error occurs. The ErrButton property is associated with Sensors, ADCs, and Heaters. ErrButton can be either blank, or it can contain the name of a Toolbar Button. The idea is that if an error occurs, the Toolbar Button will be run automatically to correct the error.

ErrButton, ErrLevel, and ErrButtonMode work together to determine how the Tool responds to an error:

ErrLevel determines what type of error is generated: **Warning**, **Error**, or **Fatal Error**.

ErrButton determines if a Toolbar Button should be called after an error.

ErrButtonMode determines if the Toolbar Button should be called only when the Tool is in Run mode, or when the Tool is in Run or Idle mode.

The Toolbar Button will only be called if the ErrLevel is **Error** or **Fatal Error**.

Here are the possible scenarios:

Idle Mode and Toolbar Button is blank

Warning – Monitor Message is displayed.

Error – Monitor Message is displayed.

Fatal Error – Monitor Message is displayed.

Run Mode and Toolbar Button is blank

Warning – Monitor Message is displayed. Tool continues running.

Error – Monitor Message is displayed. Tool finishes current process, then stops.

Fatal Error – Monitor Message is displayed. Tools stops immediately.

Idle Mode and Toolbar Button is not blank

Warning – Monitor Message is displayed.

Error – Monitor Message is displayed. If ErrButtonMode = "Special", the Toolbar Button is called.

Fatal Error – Monitor Message is displayed. If ErrButtonMode = "Special", the Toolbar Button is called.

Run Mode and Toolbar Button is not blank

Warning – Monitor Message is displayed. Tool continues running.

Error – Monitor Message is displayed. Tool finishes current process, then stops. Toolbar Button is called. Tool automatically resumes.

Fatal Error – Monitor Message is displayed. Tools stops immediately. Toolbar Button is called.

NOTE

Toolbar Buttons are only run when the error first occurs. For instance, if a leak sensor generates an error, Toolbar Button is only run when the sensor transitions from ON (Green) to OFF (Red).

ErrButtonMode

The ErrButtonMode property determines when a Toolbar Button is run after an error.

If ErrButtonMode = **Special**, then the Toolbar Button will be called both when the Tool is in Idle mode and when it is in Run mode.

If ErrButtonMode = **Normal**, then the Toolbar Button will be called only when the Tool is in Run mode.

New Properties

Beginning with Process version 7.38.8 there are two new properties on the Heater Properties screen, Gain and Offset as shown below.

The primary purpose is to allow a Customer to adjust the temperatures from a heater or thermocouple to their liking. The Gain and Offset works exactly the same as it does with a typical ADC. For typical operation the Gain should be set to 1 and offset to 0. Any Software upgraded in the field will automatically use a gain of 1 and offset of 0 unless it is changed.

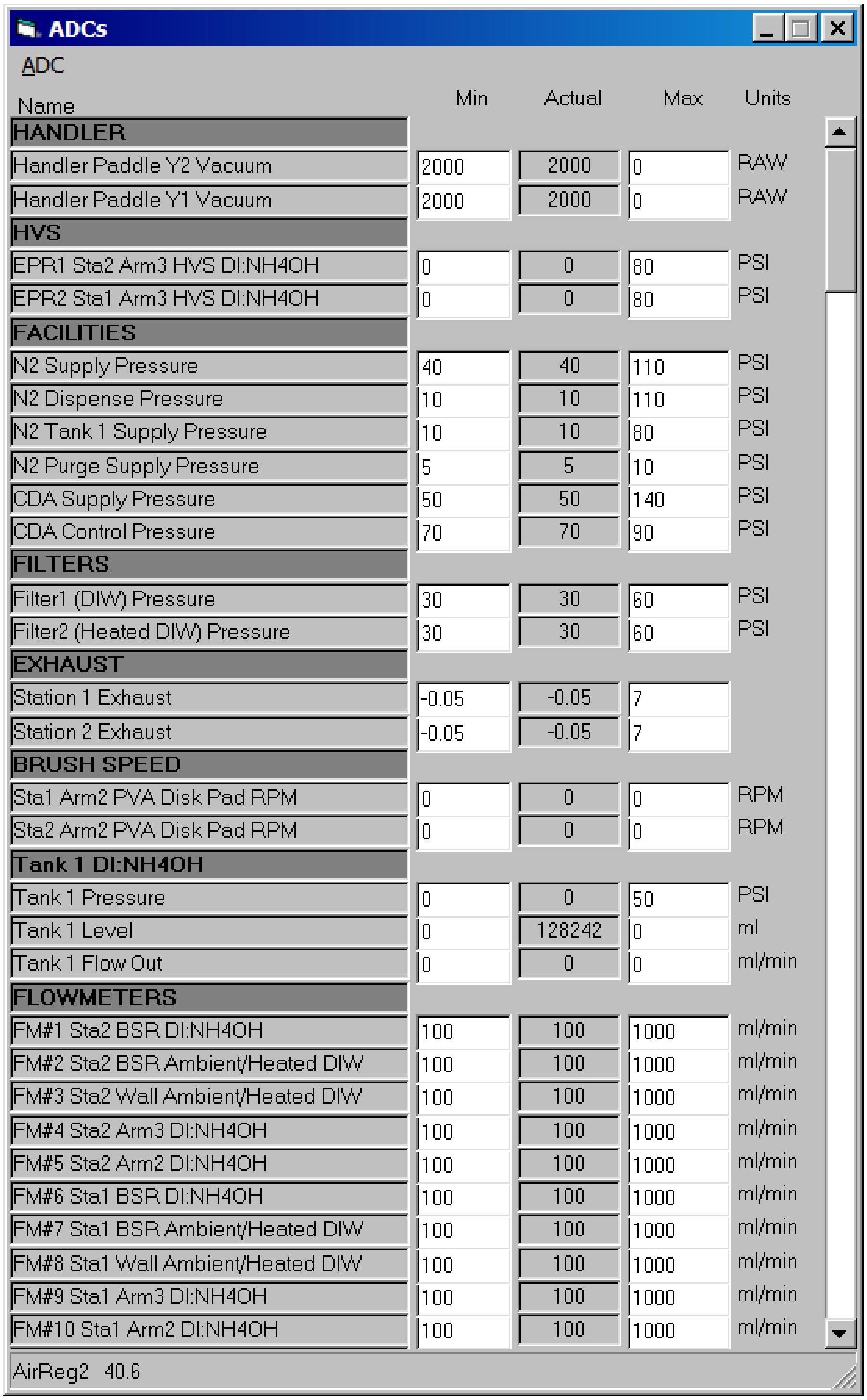
The gain and offset provided on this screen are in ADDITION to the calibration values saved to heater EEPROM on the DSP Diagnostics screen for the new heater controllers, and the Thermocouple offset saved to EEPROM on the old heater controllers. The values in EEPROM are calibrated in the factory using special calibration equipment and should NOT be altered under any circumstances. Heater controller modules in stock have already been calibrated by Chris, Ed, or Rob. All new equipment should use Gain=1 and Offset=0.

When a Customer wishes to perform their own calibration to the heater, that calibration should be done here using the new properties. When a heater controller is replaced, the new heater will already have been factory calibrated and should perform the same as the original. Customer calibration should also not need to be modified when a heater controller is replaced.

These new properties can be used for all heater controllers old and new as well as the Dual Temperature monitor and the Octal Temperature monitor modules.

ADC

ADC Window


ADCs

ADC

Name	Min	Actual	Max	Units
HANDLER				
Handler Paddle Y2 Vacuum	2000	2000	0	RAW
Handler Paddle Y1 Vacuum	2000	2000	0	RAW
HVS				
EPR1 Sta2 Arm3 HVS DI:NH4OH	0	0	80	PSI
EPR2 Sta1 Arm3 HVS DI:NH4OH	0	0	80	PSI
FACILITIES				
N2 Supply Pressure	40	40	110	PSI
N2 Dispense Pressure	10	10	110	PSI
N2 Tank 1 Supply Pressure	10	10	80	PSI
N2 Purge Supply Pressure	5	5	10	PSI
CDA Supply Pressure	50	50	140	PSI
CDA Control Pressure	70	70	90	PSI
FILTERS				
Filter1 (DIW) Pressure	30	30	60	PSI
Filter2 (Heated DIW) Pressure	30	30	60	PSI
EXHAUST				
Station 1 Exhaust	-0.05	-0.05	7	
Station 2 Exhaust	-0.05	-0.05	7	
BRUSH SPEED				
Sta1 Arm2 PVA Disk Pad RPM	0	0	0	RPM
Sta2 Arm2 PVA Disk Pad RPM	0	0	0	RPM
Tank 1 DI:NH4OH				
Tank 1 Pressure	0	0	50	PSI
Tank 1 Level	0	128242	0	ml
Tank 1 Flow Out	0	0	0	ml/min
FLOWMETERS				
FM#1 Sta2 BSR DI:NH4OH	100	100	1000	ml/min
FM#2 Sta2 BSR Ambient/Heated DIW	100	100	1000	ml/min
FM#3 Sta2 Wall Ambient/Heated DIW	100	100	1000	ml/min
FM#4 Sta2 Arm3 DI:NH4OH	100	100	1000	ml/min
FM#5 Sta2 Arm2 DI:NH4OH	100	100	1000	ml/min
FM#6 Sta1 BSR DI:NH4OH	100	100	1000	ml/min
FM#7 Sta1 BSR Ambient/Heated DIW	100	100	1000	ml/min
FM#8 Sta1 Wall Ambient/Heated DIW	100	100	1000	ml/min
FM#9 Sta1 Arm3 DI:NH4OH	100	100	1000	ml/min
FM#10 Sta1 Arm2 DI:NH4OH	100	100	1000	ml/min

AirReg2 40.6

Description

The ADC Screen displays the values for Analog to Digital Converters. These are devices that make measurements from Analog inputs. Typical ADCs are: Vacuum readings, Tank Pressure readings, Brush Pressure readings, HPC Pressure readings.

The screen displays the Actual reading of the ADC.

The ADC can have these states:

- **Alive** – If the ADC is Enabled and Online, then it is constantly being read in the background, and its Actual value is displayed.
- **Disabled** – If the ADC is Disabled, the text is grayed out.
- **Offline** – If the ADC is Offline, it is displayed with a yellow background.

Two of the properties of the ADC are the Minimum and Maximum settings. The ADC may be set up so that its Actual value is monitored to ensure that it remains between these settings. If desired, a warning or error can be generated when the ADC exceeds the Minimum or Maximum limit. A setting of "0" indicates that there is no limit.

The Minimum or Maximum setting can be changed by:

- Entering a new value in the edit box on the ADC screen
- Entering a new value in the ADC Property screen
- Loading a Handler or Process recipe, if the setting is called out in the Setup section of the recipe
- Running a Handler, Process, or Purge recipe

The Set Point value is the nominal setting. The Actual reading is compared to the Set Point to determine the state of the ADC. The Set Point can be changed by:

- Loading a Handler or Process recipe, if the setting is called out in the Setup section of the recipe
- Within a Toolbar Button, if the Toolbar Button recipe calls specifies it

Menu

This selection allows an authorized user to add a new ADC.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device.

Change Actual

This property is only available in Demo Mode. Allows the user to change the value that is "read" from the device in demo mode. Typically used to test errors.

Online Check

This will do an online check for this specific device.

Delete

This option will delete the ADC from the Tool. The user will be asked to confirm. This deletes all the ADC's properties from the adc.ini file.

Properties

Name

Unique identifier of the ADC. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains "Tank#" and Number Combobox contains "3", then the Name will be "Tank3".

Alias

Unique user-friendly name.

Enabled

True or False flag that determines whether or not the Heater or Thermocouple is used.

Address

Address on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its Controller. Valid ports numbers vary depending upon controller type.

Usage

Normal A/D - Reads an ADC Channel.

Differential = Detects the difference between two other ADCs (Diff. Name 1 – Diff. Name 2).

Pulse Width = Reads a pulse width.

Servo Speed = Displays the speed of a servo motor (used to monitor Brush RPM).

Oven Pressure = Displays the oven pressure.

Flow Mix Control = Displays the ratio of one flow over another (Diff. Name 1 / Diff. Name 2).

Status = Displays device status.

Power Resistance = Displays Power supply Resistance.

Power Voltage = Displays Power supply voltage.

Power Level = Displays Power supply level.

Pulse count – Reads the pulse count from the Tank I/O controller.

Servo Current – Reads the current being used back from a servo motor.

Virtual – creates a device that only exists in the Software – it is not from an actual hardware device.

Power ADC – Used to display specific voltage level readings from different ports.

Pulse interval – Reads Pulse Interval for Flow Rate from TankIO board.

Level Sensor – defines ADC as a level sensor for displaying liquid levels in chemistry tanks.

Level Sensor Flow Rate – defines the ADC as using a level sensor's change in value to calculate a flow rate into or out from a chemistry tank.

Motor Encoder RPM – Displays Encoder RPM of motor at matching address and port.

Motor Position RPM – Displays Position RPM of motor at matching address and port. For use with motors that do not have encoders.

Timer – creates a timer.

Caption - This creates a device that is used for display purposes only. The Caption devices can be used to subdivide a long list of devices into different groups. This makes it easier for the operator to locate and understand different devices.

Timer Init

Only available when usage is set to "Timer". Can either be turned "Off" or set to "Start from 0".

Diff. Name1

If Usage = Differential or Flow Mix Control, name of first ADC used in calculation. This property is not used otherwise.

Diff. Name2

If Usage = Differential or Flow Mix Control, name of second ADC used in calculation. This property is not used otherwise.

Min

If > 0, an error or warning can be generated if the Actual reading is less than the Min value.

Max

If > 0, an error or warning can be generated if the Actual reading is greater than the Max value.

Mode

Positive - Only displays readings greater than or equal to zero. Used for cosmetic reasons so that you don't see a negative number.

Resistivity462 - Scaled in Ohms. Used with Pneumatics (462) board.

Normal - Displays positive or negative readings

Invert - Display 1/Reading

Contact Resistivity - Scaled in Ohms. Used with Tank I/O (591) board.

FineVacSense –

Absolute Value –

Non-Contact Resistivity -

Filter

Applies a Software filter to the displayed result.

- None = No filter
- Average 2 samples = Keeps a running average over the last two samples.
- Average 4 Samples = Keeps a running average over the last four samples.
- Peak value = High value from last 10 samples

Gain

Scales the ADC value received from the firmware into meaningful units by using this value as a multiplier. A value of 1 = no scaling.

Offset

Applies an offset to the ADC value received from the firmware by adding this signed value. A value of 0 = no offset.

Decimals

Number of digits displayed after the decimal point

Example:

Suppose the ADC value is 1.234.

If Decimals = 0, the display will be "1"

If Decimals = 1, the display will be "1.2"

If Decimals = 2, the display will be "1.23"

If Decimals = 3, the display will be "1.234"

If Decimals = 4, the display will be "1.2340"

Units

Type of units the data is in. For example, PSI.

ErrCode

See explanation in Heaters above.

ErrCodeText

See explanation in Heaters above.

ErrLevel

See explanation in Heaters above.

ErrLink

See explanation in Heaters above.

ErrStationList

This property requires the ErrLevel to be set to "Error". When an error occurs it will stop the selected stations immediately.

ErrOnDelay

Time in seconds to wait after an error starts before reporting the error.

ErrButton

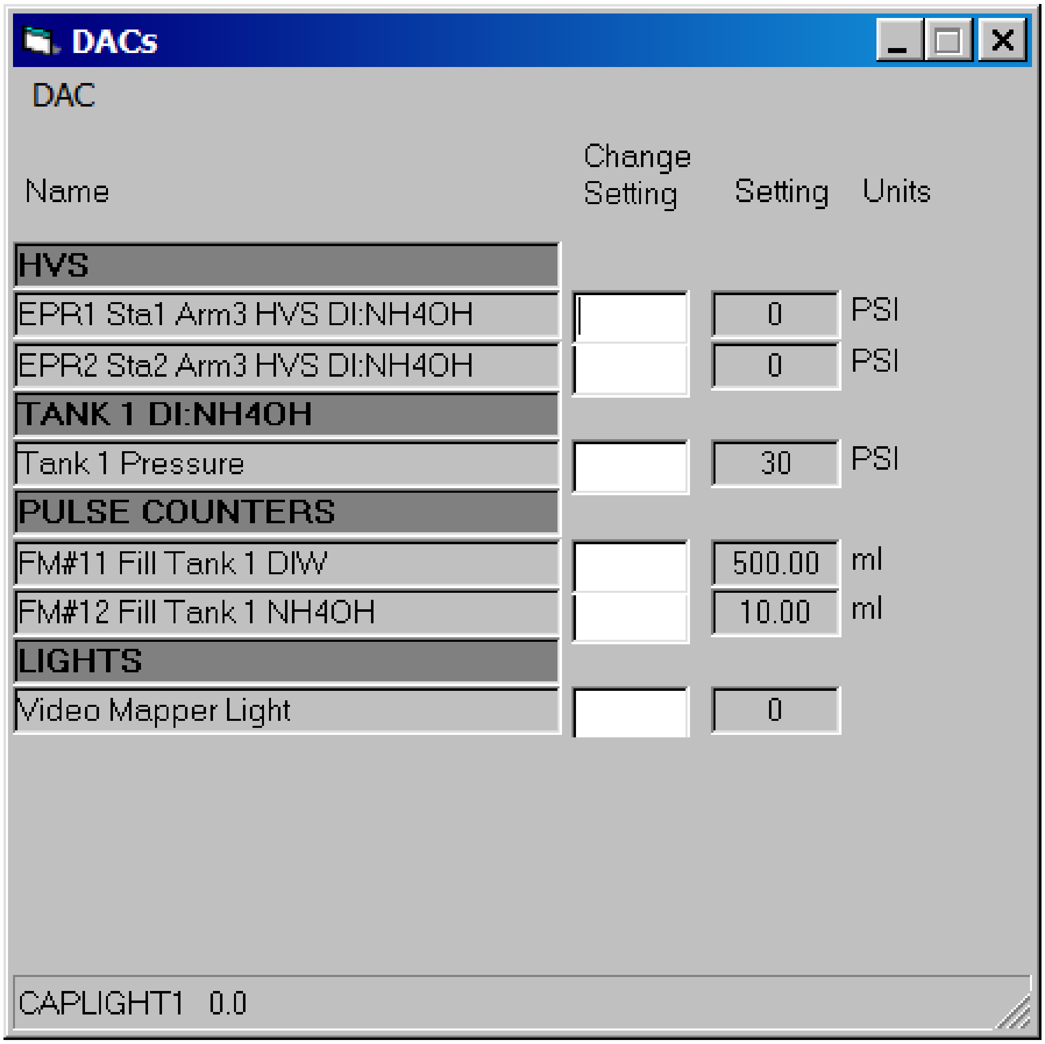
See explanation in Heaters above.

ErrButtonMode

See explanation in Heaters above.

DAC

DAC Window



Description

The DAC screen outputs values to Digital to Analog Converters. These are devices that generate Analog outputs. Typical DACs are: Tank Pressure settings, Brush Pressure settings, HPC Pressure settings.

The screen displays the Actual setting of the DAC.

The DAC can have these states:

- **Alive** – If the DAC is Enabled and Online, then it a new setting can be sent to it.
- **Disabled** – If the DAC is Disabled, the text is grayed out.
- **Offline** – If the DAC is Offline, it is displayed with a yellow background.

The DAC setting can be changed by:

- Entering a new value in the edit box on the DAC screen
- Initializing the DAC. The value in the "Init Setting" property is sent to the DAC during initialization. Usually. However, this value is immediately overwritten by a value in the Setup section of a recipe.
- Loading a Handler or Process recipe (if the setting is called out in the Setup section of the recipe)
- Running a Handler, Process, or Purge recipe

Menu

This selection allows an authorized user to add a new DAC.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device.

Online Check

This will do an online check for this specific device.

Delete

This option will delete the DAC from the Tool. The user will be asked to confirm. This deletes all the DAC's properties from the dac.ini file.

Properties

Name

Unique identifier of the DAC. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains "Tank#" and Number Combobox contains "3", then the Name will be "Tank3".

Alias

Unique user-friendly name.

Enabled

True or False flag that determines whether or not an DAC is used.

Address

Address on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its controller. Valid ports numbers vary depending upon controller type.

Gain

Scales the DAC value sent to the firmware into meaningful units.

1 = No scaling

Offset

Applies an offset to the DAC value.

0 = No offset

Decimals

Number of digits displayed after the decimal point

Example:

Suppose the ADC value is 1.234.

If Decimals = 0, the display will be "1"

If Decimals = 1, the display will be "1.2"

If Decimals = 2, the display will be "1.23"

If Decimals = 3, the display will be "1.234"

If Decimals = 4, the display will be "1.2340

Units

Type of units the data is in. For example, PSI.

Mode

- None = A regular DAC output
- Tank Sensor High = Tank Pressure setting for the Tank IO DEV_TANK board. Must have a Tank Full Sensor that has a logic High output when the tank is full.
- Tank Sensor Low = Tank Pressure setting for the Tank IO board. Must have a Tank Full Sensor that has a logic Low output when the tank is full.
- Tank Scale = Reserved for future use
- Power = For Sealers, sets the Power level of the Power supply.
- Oven Shelf Temperature = Sets the temperature for a shelf in the Oven
- Oven Shelf Bandwidth = Sets the bandwidth for a shelf in the Oven
- Oven Moisture Level = Sets the Oven Moisture Level
- Oven Dry Box Pressure = Sets the Oven Dry Box Pressure Level
- Oven Dry Box Flow = Sets the Oven Dry Box Flow Rate
- Oven Temperature = Sets the Oven Temperature for all shelves
- Oven Analog Output = sends an output temperature to an oven shelf.
- Oven Analog Offset = Adds an offset to the oven reading.
- Flow Rate = Adjusts tank pressure to create the desired Flow Rate
- Auto Flow Rate = Tank I/O board automatically adjusts tank pressure to create the desired Flow Rate
- Flow Mix Control = Desired setting for Flow Mix ratio (should be a number between 0 and 1)
- Pulse Count (OBSOLETE) = Pulse count for tank pre-mixing
- Power Voltage = Voltage setting for Power Supply
- Megasonic Power On = Megasonic Pulse On Time (default = 8, 1unit = 0.1667 ms)
- Megasonic Power OFF = Megasonic Pulse Off Time (default = 32, 1unit = 0.1667 ms)
- Tank Fill Pulse Count, Sensor High = Pulse count for tank pre-mixing. Replaces "Pulse Count" mode. Can be used with the "TankFill" command to fill the tank. Turns off associated fill solenoid when fill is complete. Associated Tank Full Sensor has High True level.
- Tank Fill Pulse Count, Sensor Low = Pulse count for tank pre-mixing. Replaces "Pulse Count" mode. Can be used with the "TankFill" command to fill the tank. Turns off associated fill solenoid when fill is complete. Associated Tank Full Sensor has Low True level.

- Virtual = Maintains setting but does not write to hardware.
- Caption - This creates a device that is used for display purposes only. The Caption devices can be used to subdivide a long list of devices into different groups. This makes it easier for the operator to locate and understand different devices.

Init Setting

DAC Setting sent during Initialization.

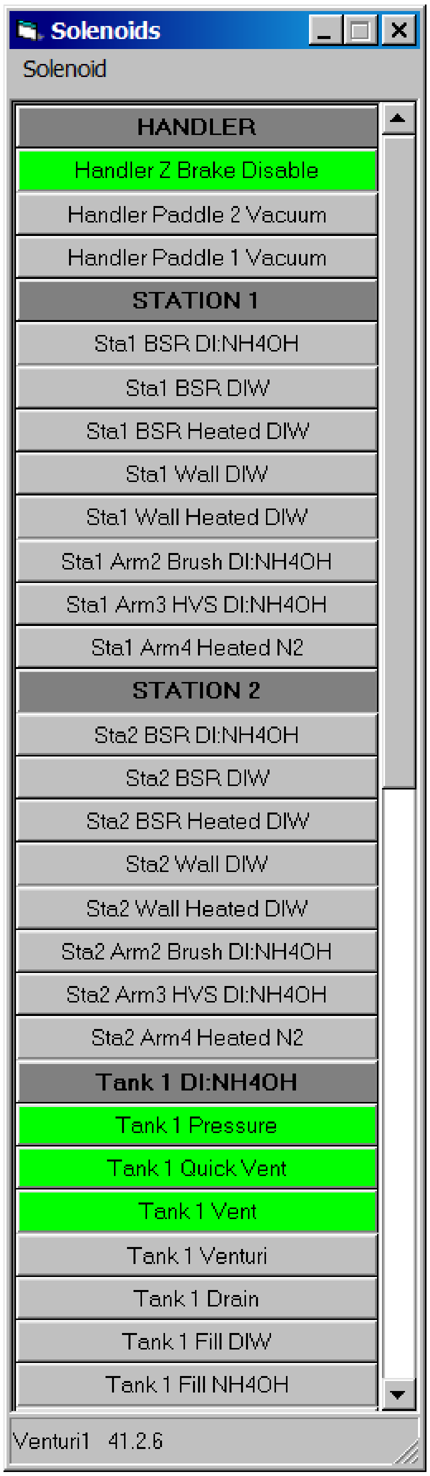
Tank Index

This sets the Tank index column from the EEPROM configuration for the applicable Tank I/O module.

This Page Left Intentionally Blank.

Solenoids

Solenoids Window



Description

The Solenoid screen displays all the solenoids and valves on the Tool.

Solenoids can have the following states: **On**, **Off**, **Offline**, and **Disabled**

- **On** solenoids are displayed with a green background if the Solenoid is in On/Off mode and a blue background if the Solenoid is in Pulse mode.
- **Off** solenoids are displayed with a default button color background
- **Offline** solenoids are displayed with a yellow background
- **Disabled** solenoids are displayed with a darkened background

A Solenoid can be turned on or off by clicking the button.

A Solenoid has a **Locked** property. If this property is True, the user cannot manually toggle the solenoid by clicking the solenoid button. When the solenoid button is depressed, a "LOCKED" message will be displayed. Typically, the user is Locked out of toggling solenoids that may present a danger to the user or to the Tool.

The Solenoid can operate in two modes: **Pulse** mode and **On/Off** mode.

- **On/Off** mode occurs when the Pulse Width property is zero. Clicking the button turns the solenoid on or off. The button turns green when the solenoid is on.
- **Pulse** mode occurs when the Pulse Width property is non-zero. Clicking the buttons turns the solenoid on for the length of time specified by the Pulse Width property. The button turns blue when the solenoid is turned on.

Menu

This selection allows an authorized user to add a new Solenoid.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device.

Online Check

This will do an online check for this specific device.

Delete

This option will delete the Solenoid from the Tool. The user will be asked to confirm. This deletes all the Solenoid's properties from the solenoid.ini file.

Properties

Name

Unique identifier of the solenoid. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains “PadGrip#” and Number Combobox contains “3”, then the Name will be “Padgrip3”.

Alias

Unique user-friendly name

Enabled

True or False flag that determines whether or not a Solenoid can be activated.

Address

Address of the solenoid on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its controller. Valid ports numbers vary depending upon controller type.

Bit

Bit that activates the solenoid. Valid bits are 0-7.

Mode

Determines type of actuation.

- Normal = Turns solenoid on or off
- Maintain Tank Level = Tell Tank I/O board to automatically maintain tank level.
- Tank Polarity Code = Tell Tank I/O board what type of sensors are present.
- Background Pulse – When activated this solenoid turns on and off automatically using the “On Time” and “Off Time” parameters respectively.
- Virtual = For display only, does not send messages
- Caption - This creates a device that is used for display purposes only. The Caption devices can be used to subdivide a long list of devices into different groups. This makes it easier for the operator to locate and understand different devices.

Tank Polarity Code

Used with "Tank Polarity Code" mode. Tells Tank I/O board what logic level the tank sensors put out when they are On (Green). Each bit of the code represents a bit in input port D0 (use Port 0) or D1 (use Port 1).

Typical values:

44 hex for clip-on sensors (Sensors that have a Level property = Level1)

BB hex for float sensors (Sensors that have a Level property = Level0)

Pulse Width

Pulse Width in msec. If Pulse Width is 0, the solenoid is turned on or off. If Pulse Width is not zero, the solenoid is turned on for the amount of time specified by the Pulse Width, after which it automatically turns itself off.

Initial On

If Initial On is TRUE, the solenoid will automatically be turned on after initialization.

Dry

If the Dry flag is TRUE, the solenoid will not be turned on during a dry run. In addition, when the Stop button is pressed or a Fatal error occurs, the solenoid will be turned off. Generally, chamber dispenses should have a Dry flag of TRUE.

Invert

If the Invert flag is TRUE, turning a solenoid on causes a logic level of 1 to be sent to it. If the Invert flag is FALSE, turning a solenoid on causes a logic level of 0 to be sent.

ErrLink

See explanation in Heaters above.

On Time

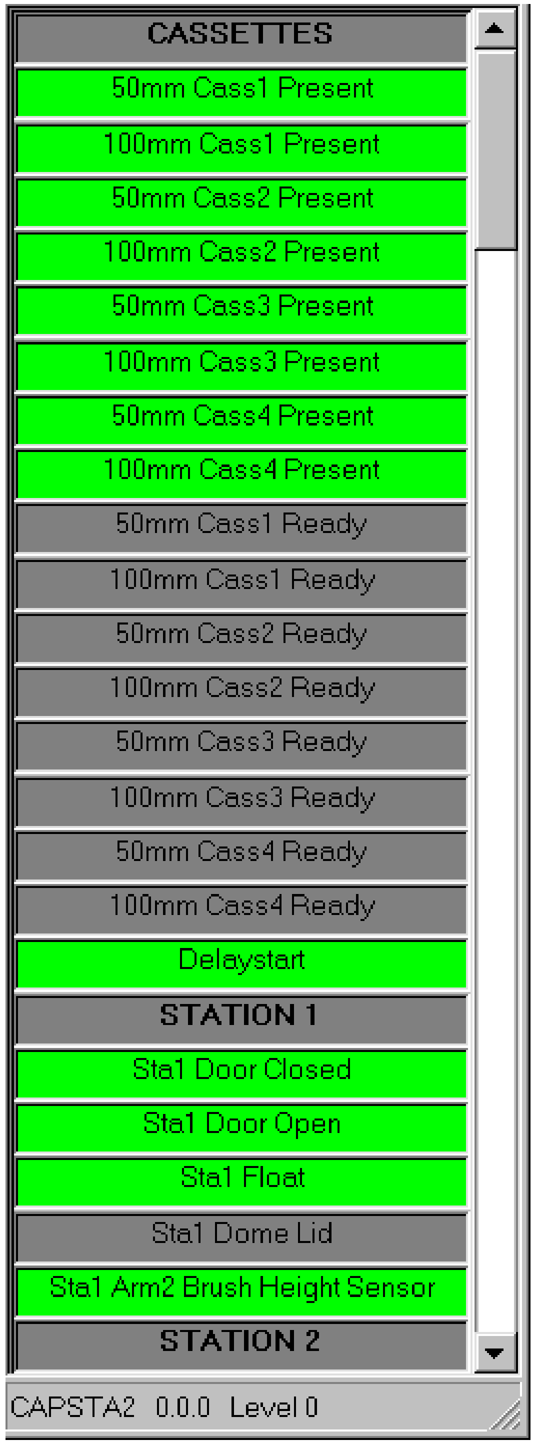
Time on in milliseconds when Mode is "Background Pulse".

Off Time

Time off in milliseconds when Mode is "Background Pulse".

Sensors

Sensors Window



Description

The Sensor screen displays all the sensors on the Tool.

Sensors can have the following states: **On**, **Off**, **Offline**, and **Disabled**.

- **On** sensors are displayed in green.
- **Off** sensors are displayed in red.
- **Offline** sensors are displayed in yellow.
- **Disabled** sensors are displayed in the default button color.

Sensors are binary values read from a specific address/port/bit location on the VPSP Network. Sensors are constantly read in the background, unless they are offline or disabled.

Sensors are generally configured so that the On (Green) state represents the desired sensor value, and the Off (Red) state represents an error condition. For instance, a Door Closed sensor should be set up so that it is Green when the door is closed and Red when the door is open.

Menus

Sensor

This selection allows an authorized user to add a new Solenoid.

View

The View menu selects which category of Sensor to display on the Sensor screen: Normal, EMO, or Home Sensor. The Sensor Category is a property of the Sensor.

Normal

The normal sensors used to determine the state of various hardware in the Tool. Typical normal sensors are door sensors, tank overfill sensors, and fluid present sensors.

EMO

EMO sensors show the state of the emergency Tool off sensors and if any of the sensors have been latched.

Home Sensor

Home Sensors are Sensors that determine whether or not a motor is blocking its home flag.

Home Sensors should be configured so that they are Green when the motor is in the home sensor and Red when the motor is out of the home sensor.

Home Sensors are different from most other sensors in that Home Sensors are not used by the Software running on the PC. They are only used by the firmware on the motor controller card. Home Sensors can be configured in the Sensor screen, but that is only for helping a service technician to troubleshoot the Tool. The fact that the Home Sensors are only used by the firmware is very important, because it means:

Home Sensors do not have to be configured in the Sensor screen. The firmware sees the sensor whether or not it exists in the Sensor screen.

Disabling a Home Sensor has no effect on the firmware.

Changing the Level property of a Home Sensor has no effect on how the firmware sees the sensor.

Frequently, the Home Sensors are configured in the Sensor screen, but they are kept disabled except when troubleshooting the motor. The sensor is disabled so that it doesn't waste communications bandwidth.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device.

ToggleState

Online Check

This will do an online check for this specific device.

Delete

This option will delete the Sensor from the Tool. The user will be asked to confirm. This deletes all the Sensor's properties from the sensor.ini file.

Properties

Name

Unique identifier of the sensor. Click the dropdown box in the Name field to see a list of possible names. (Advanced users may type in a name rather than selecting from the list.) If the name contains a Pound sign (#) then a Number field will be displayed. The selected number will be inserted in the name in place of the pound sign. For example, if Name Combobox contains “Tank#Over” and Number Combobox contains “3”, then the Name will be “Tank3Over”.

Alias

Unique user-friendly name.

Enabled

True or False flag that determines whether or not a Sensor is used.

Address

Address of the sensor on the RS-422 network. Valid addresses are 1-127.

Port

Port of the device on its controller. Valid ports numbers vary depending upon controller type.

Bit

Bit to be read to get the Sensor value. Valid bits are 0-7.

Category

The Category is used by the Sensor “View” menu selections to determine which Sensors to display on the Sensor screen.

Choices are: Normal, EMO, and Home Sensors.

Mode

The Mode determines what type of device the sensor is reading.

- **Sensor** is a typical VPSP equipment sensor
- **Status** is a bit in a status word from a VPSP module
- **Virtual** is a flag that is set be the definition file command SensorSetVirtual (0 or 1)
- **BlockSequencer**
- **UPS Utility Power** reads the utility power status of a UPS device from the Windows UPS service
- **UPSCommunication** reads the communication status of a UPS device from the Windows UPS service
- **Carrier Available**
- **Caption -** This creates a device that is used for display purposes only. The Caption devices can be used to subdivide a long list of devices into different groups. This makes it easier for the operator to locate and understand different devices.

Level

Specifies what logic level the bit should read when it is in the On (Green) state. Choices are: **Level 0**, **Level 1**, **Edge Up**, and **Edge Down**.

The Default is **Level 0**.

- **Level 0** means that the Sensor is On (Green) when the bit reads 0 and the Sensor is Off (Red) when the bit reads 1.
- **Level 1** means that the Sensor is On when the bit reads 1 and Off when the bit reads 0.
- **Edge Up** means the Sensor is On when the bit has transitioned from 0 to 1, and is currently 1.
- **Edge Down** means the Sensor is On when the bit has transitioned from 1 to 0, and is currently 0.
- **Trigger 0** means that the Sensor is On (Green) *except* when a down edge has occurred (the edge condition is usually reset by a "SensorSetEdge 0" command in the definition file)
- **Trigger 1** means that the Sensor is On (Green) *except* when an up edge has occurred (reset by a "SensorSetEdge 0" command)

Timer

Time in seconds to elapse before sensor ON is valid.

Autolink

Specifies an automatic action that will be taken when the sensor is Off. Choices are:

- **WetFill1 Off** turns off the WetFill1 solenoid
- **WetFill2 Off** turns off the WetFill2 solenoid
- **WetFill3 Off** turns off the WetFill3 solenoid
- **WetFill4 Off** turns off the WetFill4 solenoid
- **WetFill5 Off** turns off the WetFill5 solenoid

GoGreenButton

The sensor "GoGreenButton" property identifies a Toolbar Button that will execute when a sensor turns from red to green. Generally, the button would perform a simple action like turning off a valve.

ErrCode

See explanation in Heaters above.

ErrCodeText

See explanation in Heaters above.

ErrLevel

See explanation in Heaters above.

ErrLink

See explanation in Heaters above.

ErrStationList

This property requires the ErrLevel to be set to "Error". When an error occurs it will stop the selected stations immediately.

ErrOnDelay

Time in seconds to wait after an error starts before reporting the error.

ErrButton

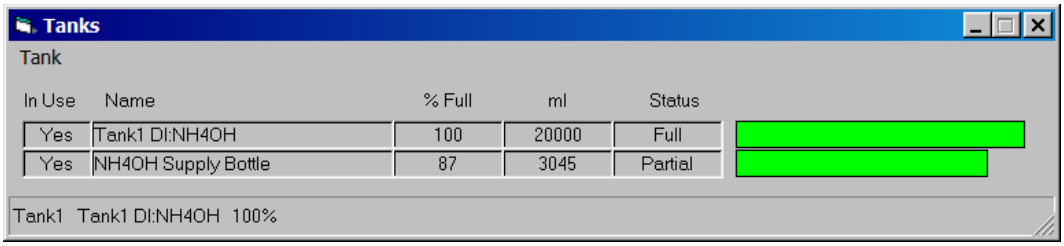
See explanation in Heaters above.

ErrButtonMode

See explanation in Heaters above.

Tanks

Tanks Window



Description

The Tank Screen displays the state of fluid vessels on the equipment. This includes tanks, carboys, and supply bottles. The Tank Screen is an optional feature, so that it may or may not be configured on any particular piece of equipment. If it is not configured, then the same information should be available from other sources, such as the Sensor Screen.

Fields

In Use

The In Use field shows whether the tank is being used by the current process recipe. By default, all tanks are in use. The In Use state can be changed in the definition file using the TankInUse command. If the tank is not in use, it will not generate errors. "Yes" signifies in use; "No" signifies not in use.

Name

The Name field displays the name of the tank (or bottle, etc.).

%Full

The %Full field shows the fluid level of the tank, from 0 to 100 percent. For tanks that use a scale or counters to measure the fluid level, the percent full will closely reflect the level of the tank. For tanks that use Sensors to determine the fill level, the percent full will be a very approximate number.

Status

The Status field shows the tank level and error condition. The level will be Missing, Empty, Low, Partial, or Full. Partial means the level is between Low and Full. A level of "Missing"only applies to scales, and means that the container is not present on the scale. If an error condition is present, then the text in the status field is Red, otherwise it is Black.

(BarGraph)

The %Full value is represented as a bar.

Errors

The tank can be configured to generate errors depending on conditions. If an error condition is present, the Status text will be displayed in Red. Errors are not generated if the tank is disabled or not In Use. See the Tank Properties form for more information.

Ini File

The tank configuration information is saved in the Tank.ini file in the Ini directory.

Definition File Commands

Definition file commands that can be used with tanks include:

TankInUse - Use this in the Setup section of the Process recipe to determine if the tank is used for that recipe.

Menu

Select the "Add" menu item. This will display the Tank Properties form. Each tank must have a unique Name.

Right-click Menu

Enable / Disable

Use these options to enable or disable this specific device. If disabled, it will not generate errors. However, it will still display the fluid level. The Enable state is saved as part of the tank configuration.

Change level

This is available in Demo mode only. It allows the fluid level to be changed to test error conditions.

Delete

This option will delete the Tank from the Tool. The user will be asked to confirm. This deletes all the Tank's properties from the tank.ini file.

Properties

NOTE

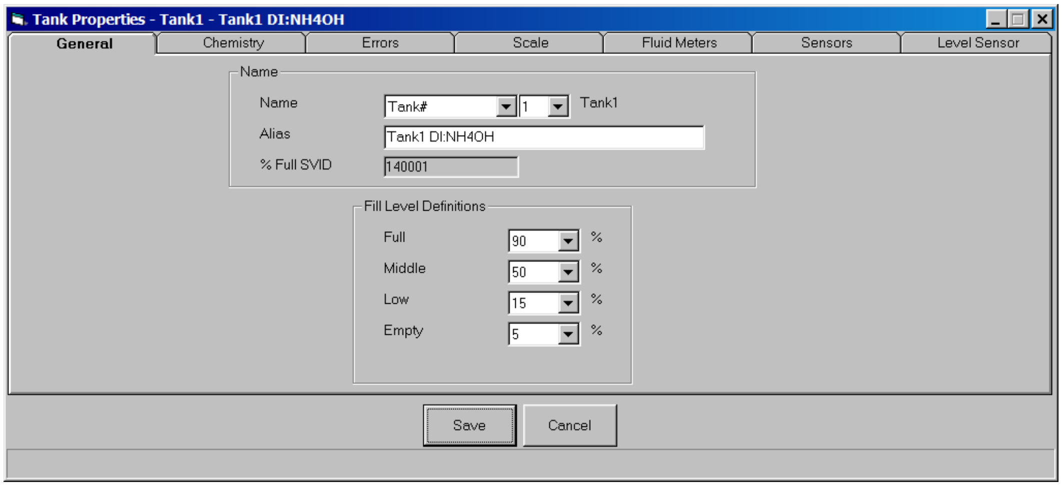
All Tank properties are optional, except for the Tank Name. Only some properties will be filled, depending upon what is appropriate for the Tank. The "Tank Properties" Window has seven tabs.

Click on "Save" button to save any changes that have been made to any of the properties. Click on the "Cancel" button to close the "Tank Properties" Window without saving any changes that have been made.

NOTE

Changes made in the "Level Sensor" tab will not be saved if the "Apply" button has not been clicked first.

General



The General Tab contains these properties:

Name

Required Field.

The name consists of a type (Tank, Bottle, Carboy) and number. The type and number combined generate the tank name, e.g., Tank1. Each tank must have a unique name. (For the purposes of this discussion, the word "Tank" describes all fluid vessels, including Bottles and Carboys.)

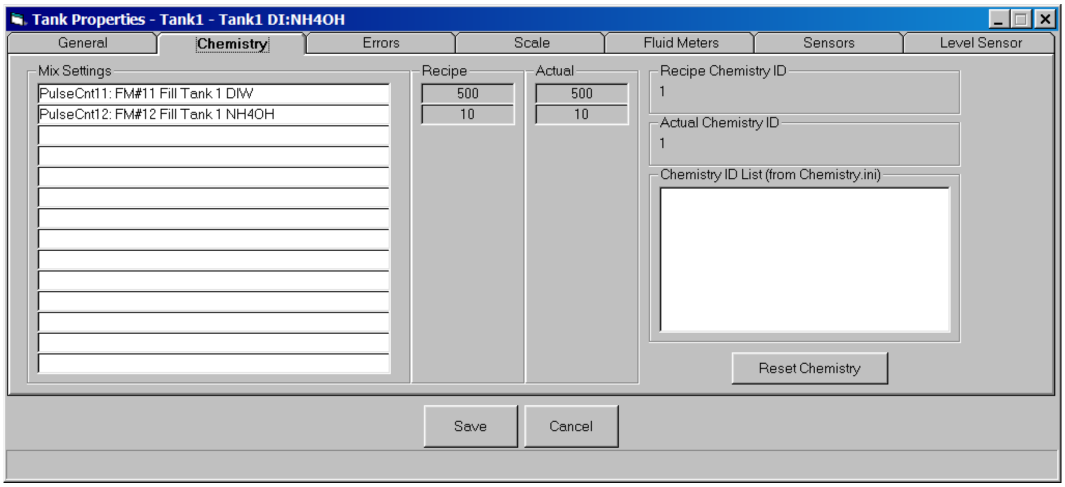
Alias

The Alias field may be left blank, or it may contain a descriptive name for the tank. The Alias must be unique.

Fill Level Definitions (Full, Middle, Low, Empty)

These fields define the meaning of Full, Low, Middle, and Empty in terms of percent full of the tank. These meanings may be used when setting errors (see the Error tab) or in the definition file commands (such as TankFullGoto, TankEmptyGoto, etc.)

Chemistry



The Chemistry Tab defines what type of chemistry and the proportions used to fill the tank. The settings in this tab are used if it is desired to track the type and mix ratio of chemistry in the tank.

Recipe Chemistry ID, Actual Chemistry ID

The Recipe Chemistry ID is the chemistry ID specified in the recipe, using the TankChemID command. The Actual Chemistry ID is the chemistry ID saved when filling the tank, using the TankSaveChem command. For most tanks, the following values can be used:

- 0 meaning tank empty or don't care
- 1 meaning tank filled with chemistry

The only time you need to use other chemistry IDs is if the Chemistry ID is the only way to know what is in the tank. For instance, if you have a single supply bottle that is sometimes filled with Chemistry A and other times filled with Chemistry B, you would specify a Chemistry ID to keep track of what is in the bottle. The Chemistry ID is made available in the Chemistry.ini file.

If you aren't sure whether you need a Chemistry ID other than 0 or 1, you probably don't.

In a definition file, the TankVerifyChem command will generate if the Recipe and Actual Chemistry IDs don't match, if both are not zero.

- If Recipe Chemistry ID = Actual Chemistry ID, no error.
- If Recipe Chemistry ID = 0 and Actual Chemistry ID > 0, no error.
- If Recipe Chemistry ID > 0 and Actual Chemistry ID = 0, no error.
- If Recipe Chemistry ID > 0 and Actual Chemistry ID > 0 and Recipe Chemistry ID != Actual Chemistry ID, then Error.

Mix Settings

The Mix Settings is a list of all the chemistry mixes that may go into a tank. When you click on a Mix Settings field, you get a list of all the DACs with Mode = Pulse Count. Select whichever DAC mixes go into the tank. The DAC settings set in the recipe using the DACSetToRecipe command are displayed in the Recipe column. The DAC settings used last time the tank was filled are displayed in the Actual column. If these values are different and the Chemistry IDs are not 0, then a "Tank Chemistry does not match Recipe" error will be generated. The Actual values will be set equal to the Recipe values when the TankSaveChem command is executed, which is usually in the fill tank Toolbar Button.

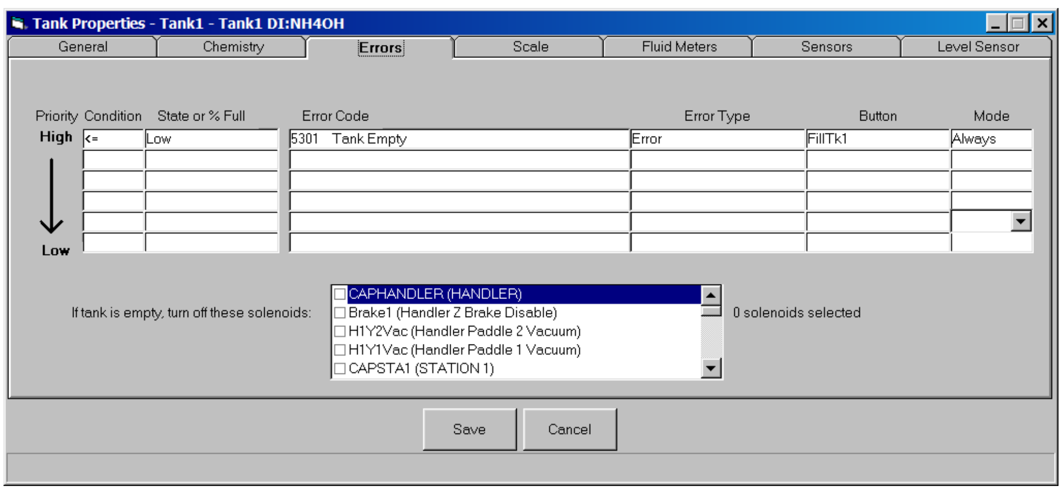
Chemistry ID List

This is a list of chemistry IDs. The list is read from the Chemistry.ini file. Read about Chemistry IDs above for more information.

Reset Chemistry Button

This will copy the Recipe Chemistry ID to the Actual Chemistry ID, and it will copy the Recipe Mix Settings to the Actual Mix Settings. This is the same function as running the TankSaveChem command in a definition file.

Errors



The Errors Tab specifies a list of errors to be generated for a Tank.

Priority

The Errors are listed on the screen in priority order, from highest to lowest. If multiple error conditions are present, *then only the highest priority error will be displayed and acted upon.* For instance, if you have a tank low error condition and a tank empty error condition, the empty error should be listed above the low error.

Condition

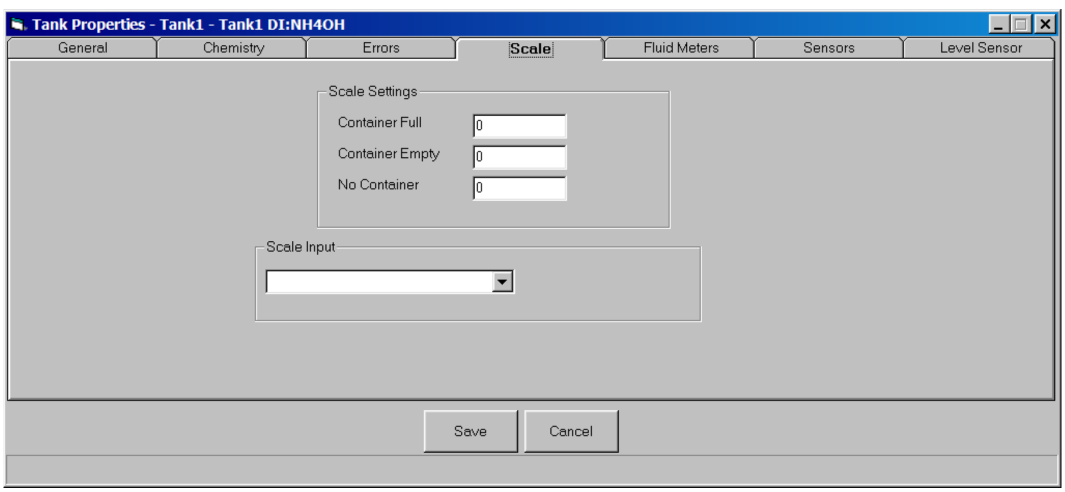
Condition is either "<=" (less than or equal to) or ">=" (greater than or equal to).

Definition File Commands

Definition file commands related to tank properties include:

- **TankChemID** - Sets the Recipe Chemistry ID value. Used in a Toolbar.def file when filling a tank. May also be used in the Setup section of a Process recipe.
- **TankSaveChem** - Saves the Chemistry ID and the Mix Settings from the Recipe to Actual. Used in a Toolbar.def file in a tank fill button.
- **DACSetToRecipe** - Used in the Setup section of a Process recipe or in the Toolbar.def file to set the Recipe Mix Settings value.

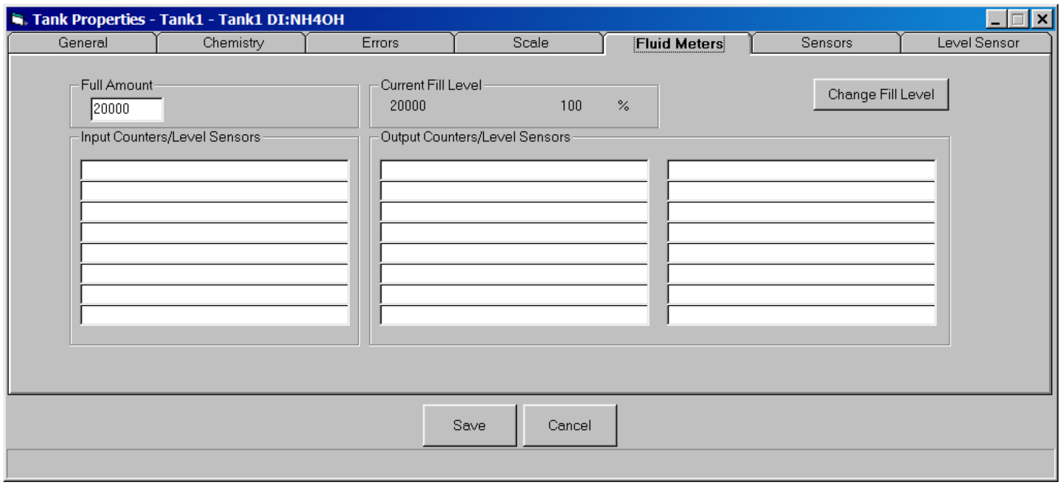
Scale



The Scale tab is used to configure a waste or supply bottle scale used to determine if the vessel is full, empty, or non-existent.

- **Scale Settings -** Values are entered here for a full container, an empty container, and the tare weight for an empty container. An missing container will generate an error.
- **Scale Input** - This field specifies the ADC device to use as the scale.

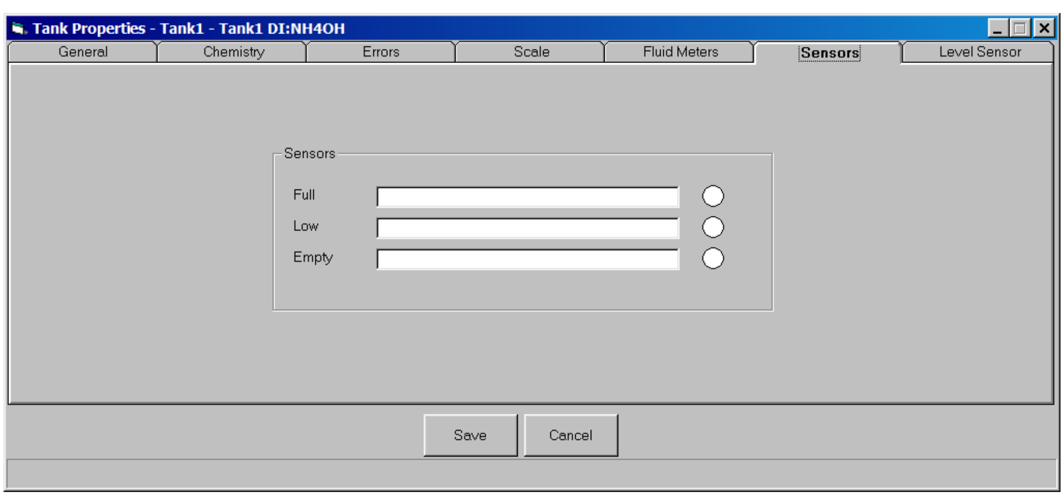
Fluid Meters



The Fluid Meters tab specifies what devices, either flow sensors or level sensors, are to be used to track the fluid level in a tank, bottle, or carboy. It keeps track of the present fluid level based on fluid meter values going into or out of the vessel. Typically used for vessels that do not have their own level floats or sensors.

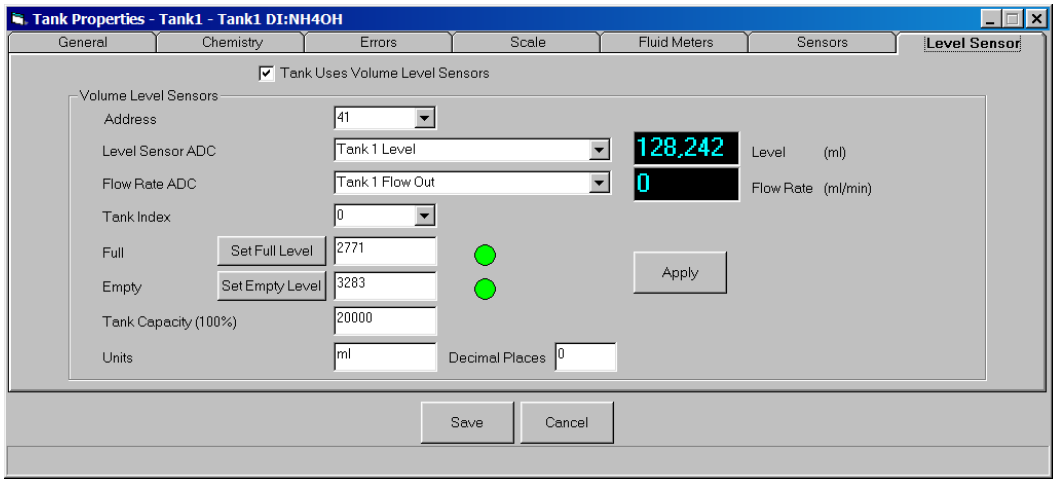
- **Full Amount -** The amount that is determined to be considered full. Generates an error when it reaches this amount.
- **Current Fill Level -** Displays the current level that is calculated from volumes measured by the associated fluid meters.
- **Change Fill Level** button – Click on this button to change the present fill level value.
- **Input Counters/Level Sensors** – Select which devices will measure the amount of fluid going into this vessel.
- **Output Counters/Level Sensor** – Select which devices will measure the amount of fluid coming out of this vessel.

Sensors



The Sensors tab is used to assign the specific float sensors to this vessel. Devices are assigned for Full, Low, and Empty levels. The circles will indicate the sensor states, either red or green, depending on how the sensors are configured.

Level Sensor



The Level Sensor tab is used to configure the hardware level sensor in this tank.

The "Tank Uses Volume Level Sensors" checkbox must be checked to configure the level sensor. Then the "Volume Level Sensors" fields become active.

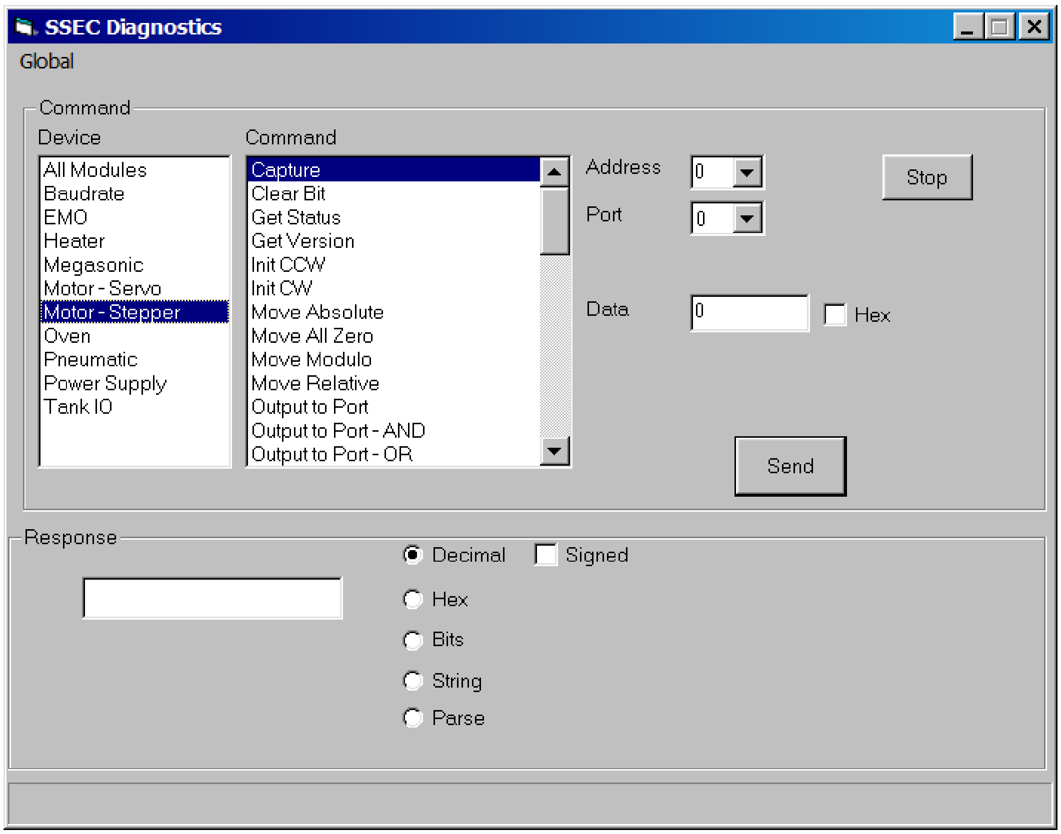
- **Address** – Select the address of the Tank I/O module that reads the level sensor.
- **Level Sensor ADC** – Select the ADC that is assigned to this tank's level sensor.
- **Level (ml)** – This field displays the calculated volume in milliliters in the tank.
- **Flow Rate ADC** – Select the ADC that is assigned to this tank's level sensor.
- **Tank Index** - This sets the Tank index column from the EEPROM configuration for the applicable Tank I/O module.
- **Full** – Displays the raw value that is used to determine at what level the tank is full. The colored circle displays whether the fluid level is at the full level, green if true, red if false.
- **Set Full Level** button – Click on this button to set the raw value returned by the level sensor for a full tank.
- **Empty** – Displays the raw value that is used to determine at what level the tank is empty. The colored circle displays whether the fluid level is at the empty level, green if true, red if false.
- **Set Empty Level** button - Click on this button to set the raw value returned by the level sensor for an empty tank.

- **Apply** button – Click on this button to apply the values that have been entered into the various fields.
- **Tank Capacity (100%)** – Enter the capacity of this tank in the units that are specified in the next field below.
- **Units** – Enter the type of units that will be used to measure the tank capacity, typically "ml" for milliliters.
- **Decimal Places** – enter the number of decimal places that the Level and Flow rate fields are to display.

6: Tools Descriptions

Diagnostic

SSEC Diagnostics Window



The Diagnostic Screen is used for troubleshooting by service personnel. It allows raw commands to be sent to the VPSP Hardware.

A diagnostic command requires the following inputs:

Select the **Device** type. Currently supported devices are "All Modules", "Baudrate", "EMO", "Heater", "Megasonic", "Motor – Servo", "Motor Stepper", "Oven", "Pneumatic", "Power Supply", or "Tank IO".

Select the **Command** from the Command list for that type of device. If the command requires **Port**, **Bit**, or **Data** parameters, those fields will be made visible.

Select the **Address** from the Address list.

If the **Port** list is visible, select the port from the list.

If the **Bit** list is visible, select the bit from the list.

If the **Data** edit box is visible, type in the data to be sent. The data can be typed in as a decimal or hexadecimal number, if a hexadecimal value is entered be sure to check the **Hex** checkbox.

For the **Read Memory** and **Write Memory** commands (Servo Motor only), a **Memory** edit box is displayed. Fill in the hexadecimal address of the memory location to be read from or written to.

For the **Read Memory Block** command, (Servo Motor only) enter the hex location, the number of locations to be read, and the column desired.

Click the **Send** button to send the command.

The response from the Tool will be displayed in the **Response** field. If no response is received, a "Timeout!" message will be displayed.

The **Response** may be displayed in different formats.

Decimal – Displays the response as a decimal series of bytes. Does not display the checksum, if any. This is the most common response format. Click in the **Signed** checkbox if you want to receive a signed decimal value.

Hex – Displays the response as a hexadecimal series of bytes. Does not display the checksum, if any.

Bits – Displays a 1 byte response as 8 bits. This format may be used for a "Read Port" command.

String – Displays the response as an ASCII string. This format should be used for the "Get Version" command.

Parse – Displays the entire message, including the checksum, as hexadecimal bytes.

Most commands receive an Acknowledge response, with the exception of the following commands:

Status Request

Get Version

Any command that is requesting data, such as “Read Port”.

An Acknowledge value of “6” means that the command was received and decoded.

An Acknowledge value of “7” means that the command format was correct, but the command is not supported by the device.

The “Get Version” command is supported by all devices. The Response should be displayed in “String” format.

When a motor device is selected a **Stop** button will be displayed that can be used to stop any moving motors.

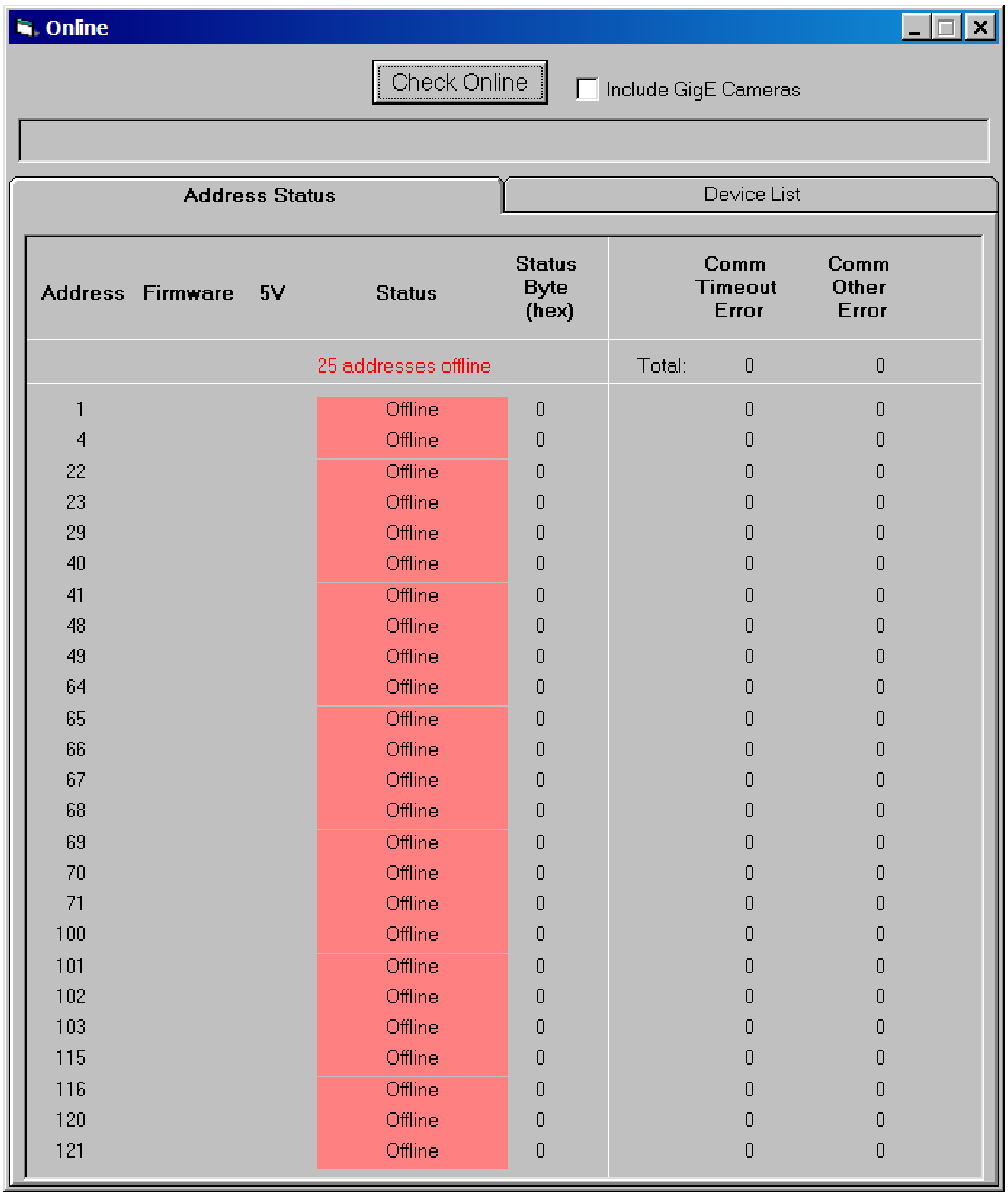
This Page Left Intentionally Blank.

Online

Online Window

The **Online** Window has two tabs, **Address Status** and **Device List**.

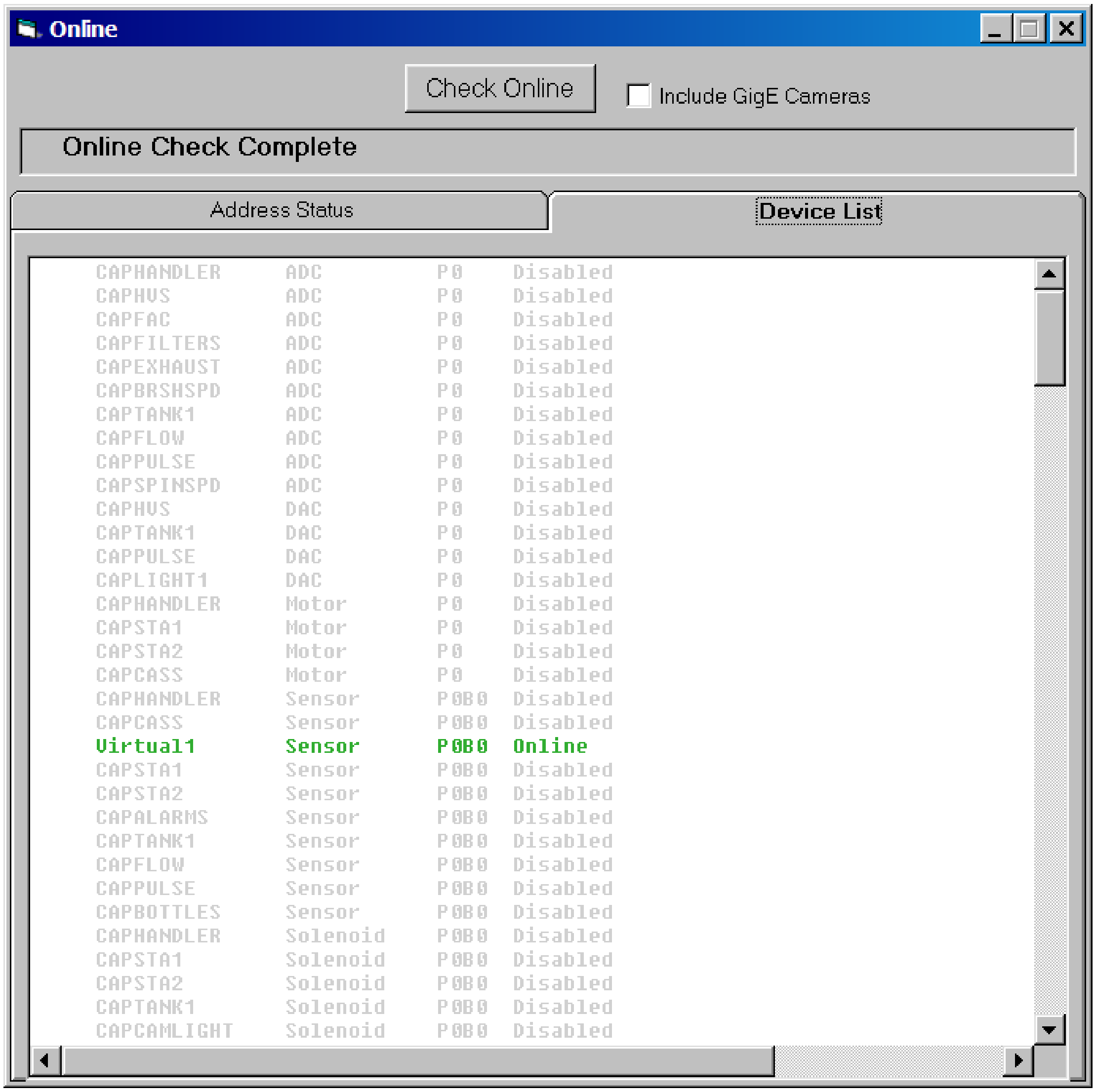
Address Status



Address	Firmware	5V	Status	Status Byte (hex)	Comm Timeout Error	Comm Other Error
			25 addresses offline		Total: 0	0
1			Offline	0	0	0
4			Offline	0	0	0
22			Offline	0	0	0
23			Offline	0	0	0
29			Offline	0	0	0
40			Offline	0	0	0
41			Offline	0	0	0
48			Offline	0	0	0
49			Offline	0	0	0
64			Offline	0	0	0
65			Offline	0	0	0
66			Offline	0	0	0
67			Offline	0	0	0
68			Offline	0	0	0
69			Offline	0	0	0
70			Offline	0	0	0
71			Offline	0	0	0
100			Offline	0	0	0
101			Offline	0	0	0
102			Offline	0	0	0
103			Offline	0	0	0
115			Offline	0	0	0
116			Offline	0	0	0
120			Offline	0	0	0
121			Offline	0	0	0

The **Address Status** tab list all the configured **Addresse**s in numerical order, the **Firmware** version of that controller, its present **Status**, The hex **Status Byte**, the **Comm Timeout Error** count, and the **Comm Other Error** count.

Device List

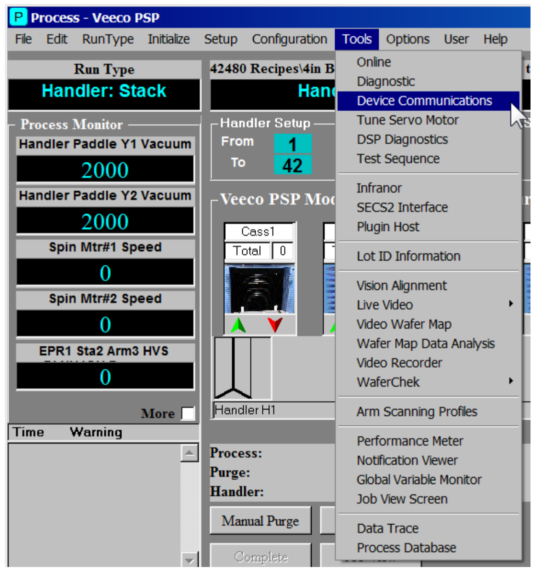


The **Device List** tab displays all the devices that are assigned to each addressed module. After each address the devices are listed by type, with the **Device Name**, device type, the port (and bit if appropriate), and its status. The status may be **Offline**, **Online**, or **Disabled** and the device listing will be displayed in red, green, or yellow type respectively.

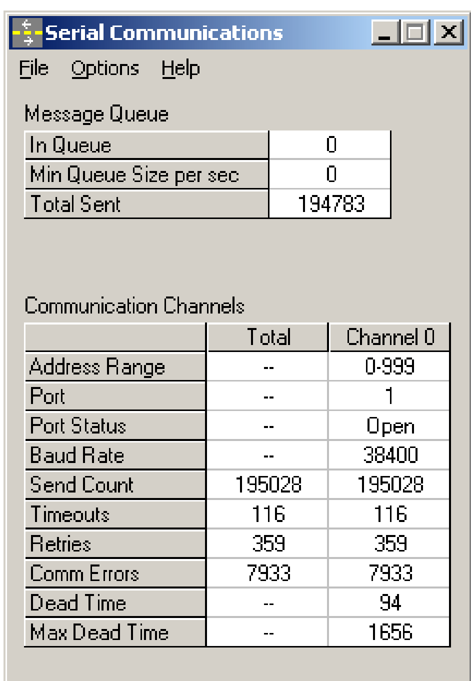
SSEC Communications

Serial Communications Window

The **Serial Communications** Window is accessed through Tools on the Menu Bar and selecting Device Communications.



The **Serial Communications** Window displays a running count of the Message Queue and a table showing the status of all the Communications Channels, with a total if there is more than one channel.

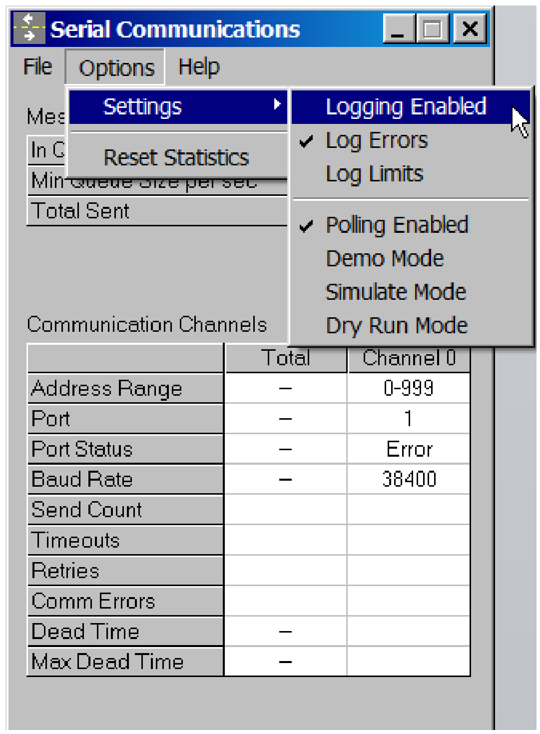


Menus

File

The only selection here is "Read Setup.ini file".

Options



Settings

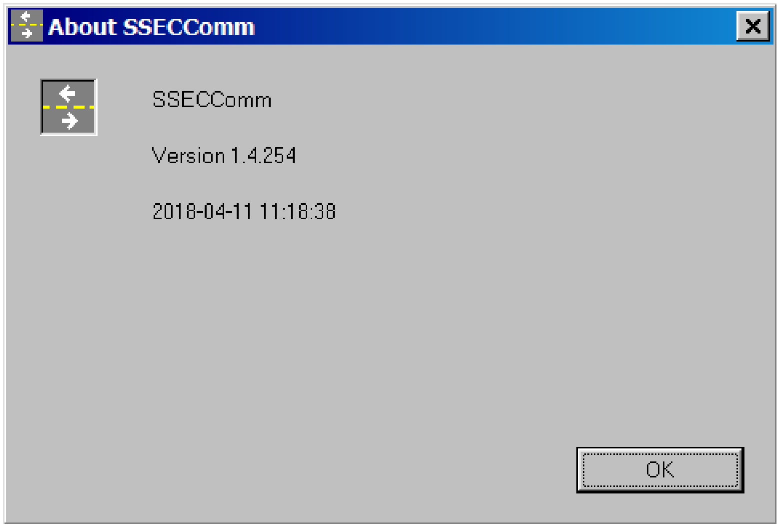
Items with a checkmark next to them are selected. Click on selection to enable or disable. Settings options are:

- Logging Enabled -
- Log Errors -
- Log Limits –
- Polling Enabled –
- Demo Mode –
- Simulate Mode –
- Dry Run Mode -

Reset Statistics

Clicking on this selection resets all the Message Queue and Communications Channels counts to zero.

Help

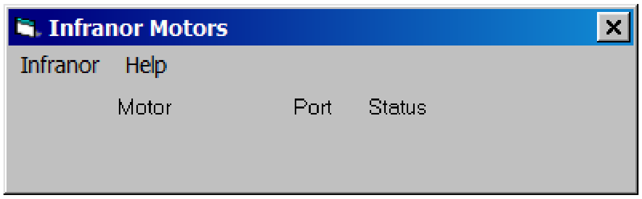


The Help displays the version number of the SSECComm Software.

This Page Left Intentionally Blank.

Infranor

Infranor Motors Window

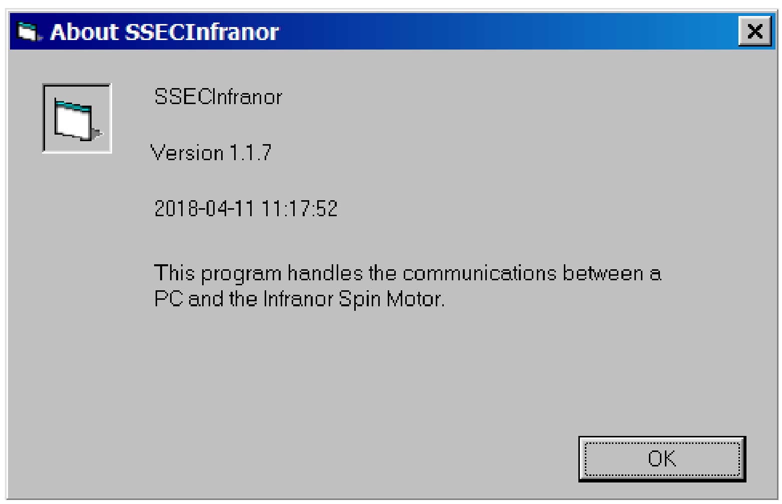


The Infranor Motors Window displays the motor name, the serial port number and the status of the Infranor controller(s) if the Tool is so equipped.

Infranor

Select this to add an Infranor motor.

Help

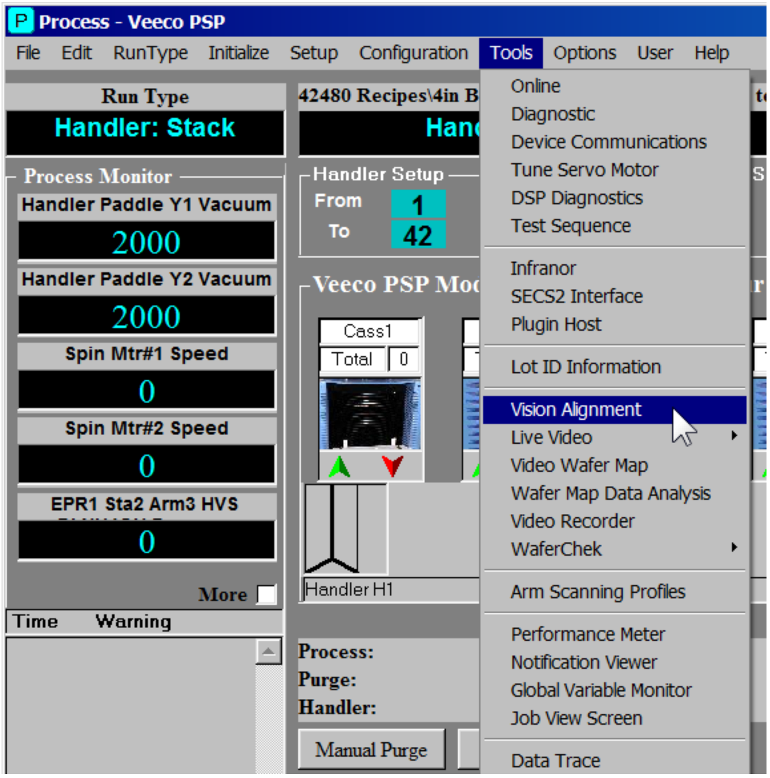


The Help displays the version number of the SSECInfranor Software.

This Page Left Intentionally Blank.

Vision

Vision Alignment Window



Selecting **Tools** on the **Menu Bar**, then **Vision Alignment**, will open the **Vision Setup Window**, which is used to set up Vision Alignment of the Substrate.

See "Vision Alignment Training Procedure" in section 7 to learn how to train the Vision Alignment.

The **Vision Setup Window** consists of the following elements:

Video Display

This is the picture of the wafer displayed on the screen. During the vision alignment process, some lines are drawn overtop the Substrate picture, as follows:

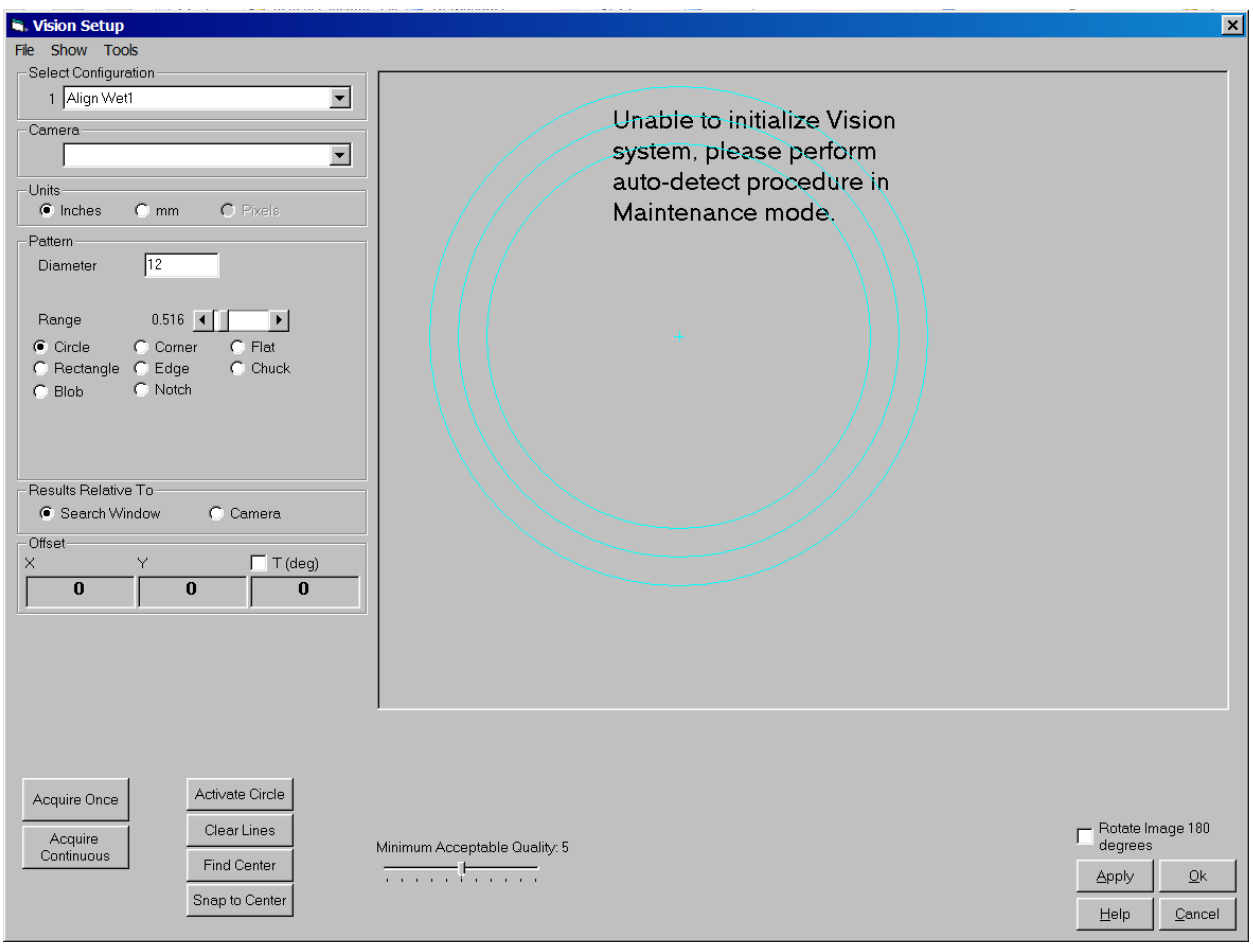
Light Blue Circles – The user initially draws a circle around the circumference of the wafer on the display. After the circle is drawn, the Software will draw two more circles: one inside the original circle and one outside the original circle. These circles represent the **Range** of positions that the wafer can be in.

Light Blue Cross – The Software draws a light blue cross at the center of the circle the user drew.

Red Lines – The Software draws red lines where it detects a wafer edge.

Red Cross – The Software draws a red cross where it calculates the center of the wafer to be.

Dark Blue Lines – The Software draws blue lines through the center of the circle from when it detects both edges of the circle. The edges of the circle must be within **Tolerance** of the specified wafer diameter.



Select Configuration Pulldown Menu

This section identifies the Configuration name and ID. Typically, a different configuration will be set up for each wafer size. The Handler recipe will use the ID to select which configuration to use. The configuration consists of the **Wafer**, **Video**, and **Circle** elements of the screen.

Camera Pulldown Menu

This section identifies the Camera

Units

This section identifies units of measurement in either Inches, Millimeters, and Pixels

Pattern

This section identifies the patterns of measurement for different types of Substrates:

- Circle
- Rectangle
- Blob
- Corner
- Edge
- Notch
- Flat
- Chuck

Results Relative To

Selections available are:

- Search Window
- Camera

Offset

Values for **X**, **Y** and **T (deg)** are displayed below these Checkboxes

Offset T (deg) Checkbox

When checked, this checkbox reveals the following for Circle (Wafer):

Flat/Notch Width – Value in inches/millimeter

Never In Ex Zone – Checkbox

Buttons:

Acquire Once – This button acquires a picture from the camera and displays it.

Acquire Continuous – This button continuously acquires and displays pictures from the camera.

Teach –

Activate Rect –

- **Minimum Acceptable Quality**
- **Pattern Size**
- **Right Mouse Button Control**

Clear Lines –

Find Center - Activate Circle – When this button is depressed, the user can draw a circle over the picture of the wafer to specify where the edge is.

Clear Lines – This button clears the lines drawn by the Software so that the user can view the picture.

Find Center – This button performs the edge detection and center calculations on the current wafer picture. The Edge (Red) and cross-diameter (Dark Blue) lines will be drawn on the picture. The calculated **Offset** values will be displayed.

Snap to Center – This button should be used during training mode to adjust the size and center of the wafer circle (the light blue circle drawn by the user) so that it “snaps” to the detected edges of the wafer on the video. Hitting “Snap to Center” should cause the **Offset** values to become close to zero.

Find Arm –

Find Notch –

Find Flat –

Activate Chuck –

Show Pattern –

Show Live –

Slide Bars:

Minimum Acceptable Quality -

Pattern Size -

Pattern Side Reduction -

Rotate Image 180 degrees:

Checkbox activates this feature

Wafer

Diameter – The wafer diameter is specified here. This number is used by the Software to scale the diameter of the circle drawn around the wafer in the video portion of the display.

Range – This specifies how far from the original wafer diameter the Software will look for the wafer edges.

Tolerance – This specifies how much variation in diameter is allowed between opposing edges of the wafer. The Software uses this number to screen out edges that are too close or too far apart. This might occur when an edges is detect on the flat part of a wafer or the side of the Paddle. The Tolerance should be as small a number as possible!

Video

These settings affect the gain and contrast of the video.

Line Width

These settings affect the width of the lines drawn by the Software on the screen. This is for the user's convenience; it doesn't affect the calculations in any way.

This Page Left Intentionally Blank.

Vision Alignment Training Procedure

This topic describes how to train the Vision Alignment system.

Prior to starting this procedure, the user should have trained the handler to pick up the wafer and move it to a position underneath the camera.

- Open the Vision screen by running selecting Tools/Vision from the menu.

Select the name of the **Configuration** you want to create.

Enter the wafer Diameter in the **Diameter** text box.

Push the **Acquire Once** button. You should see a picture of the wafer appear on the Vision screen.

Push the **Activate Circle** button.

Draw a circle as close as you can around the wafer. Do this by placing the mouse cursor at the edge of the wafer and depressing the left mouse button. Keeping the mouse button depressed, drag the mouse towards the opposite edge of the wafer. You should see a light blue circle being drawn as you drag the mouse. When the circle is as close as you can get to the actual edge of the wafer, release the mouse button.

De-select the **Activate Circle** button.

You should now see three circles on the video screen. Adjust the **Range** so that the circles represent the range of positions the wafer can be in.

Push the **Find Center** button. You should see Red lines, representing edges, and Dark Blue Lines, representing diameters, appear on the Video screen. If you do not see the Red (Edge) lines, then the Software cannot detect the edges. You need to adjust your video to give you a better picture. If you see the Red lines but not the Dark Blue (Diameter) lines, then you need to increase your **Tolerance**.

Adjust the **Tolerance** to be as small as possible as long as you still get plenty of Dark Blue lines.

Click the **Snap to Center** button. The Software will adjust the circle slightly so that it conforms to the detected wafer position. You should see the **Offset** values become zero, or close to zero. This is now your default position for the wafer.

You should now train the handler to place the wafer from this position.

When running a Tool cycle, the Software aligns each wafer by doing the following:

- Take a picture of the wafer

Detect the edges and center of the wafer

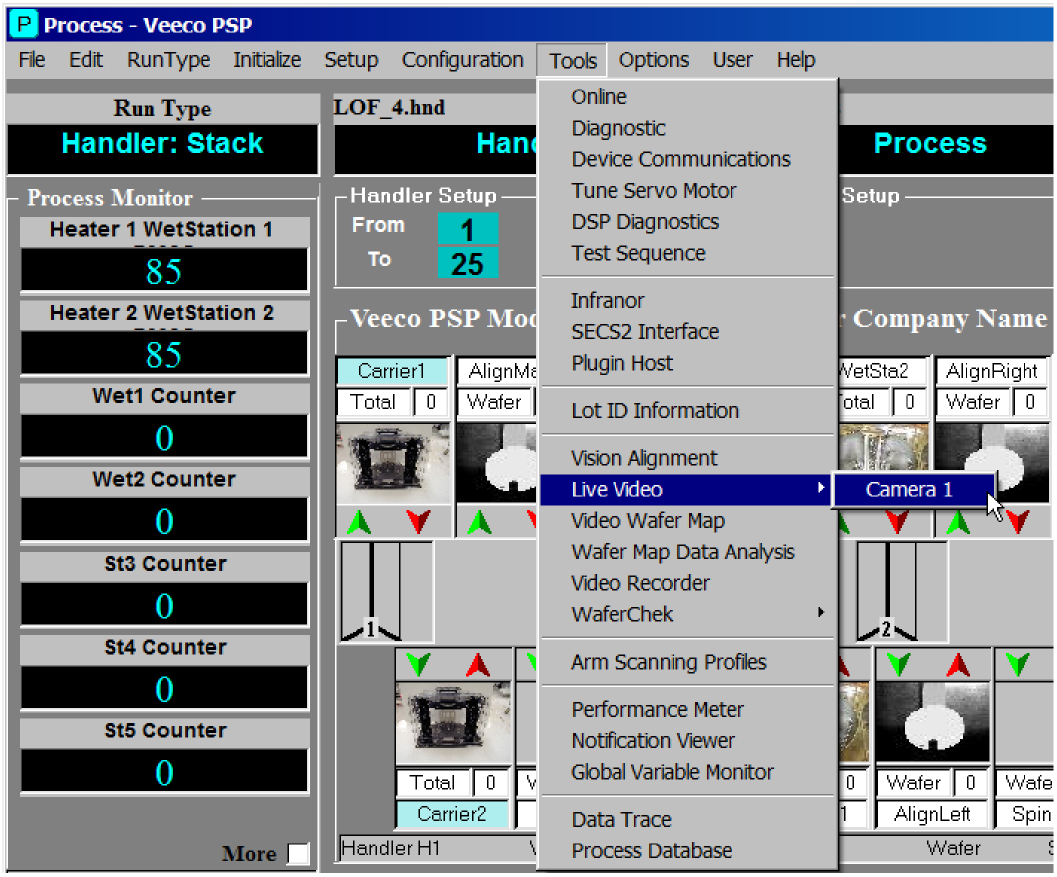
Measure the offset of the wafer center versus the center established in the Vision Alignment Training Procedure.

Adjust the position of the handler by the **Offset** amount when placing the wafer

What the Software does is the equivalent of the user pushing the **Acquire Once** button, followed by the **Find Center** button.

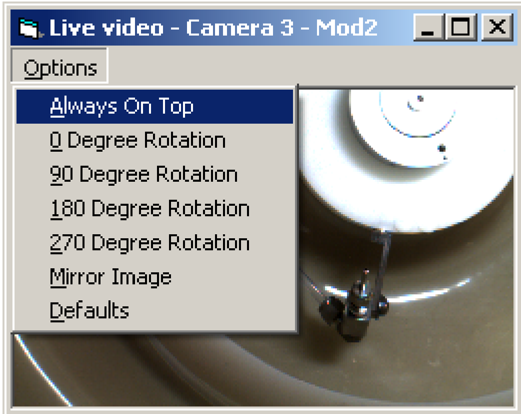
Live Video

Use this selection to see a live video display from any of the cameras in the System. Select the available camera and a Window will open with that cameras live video display.

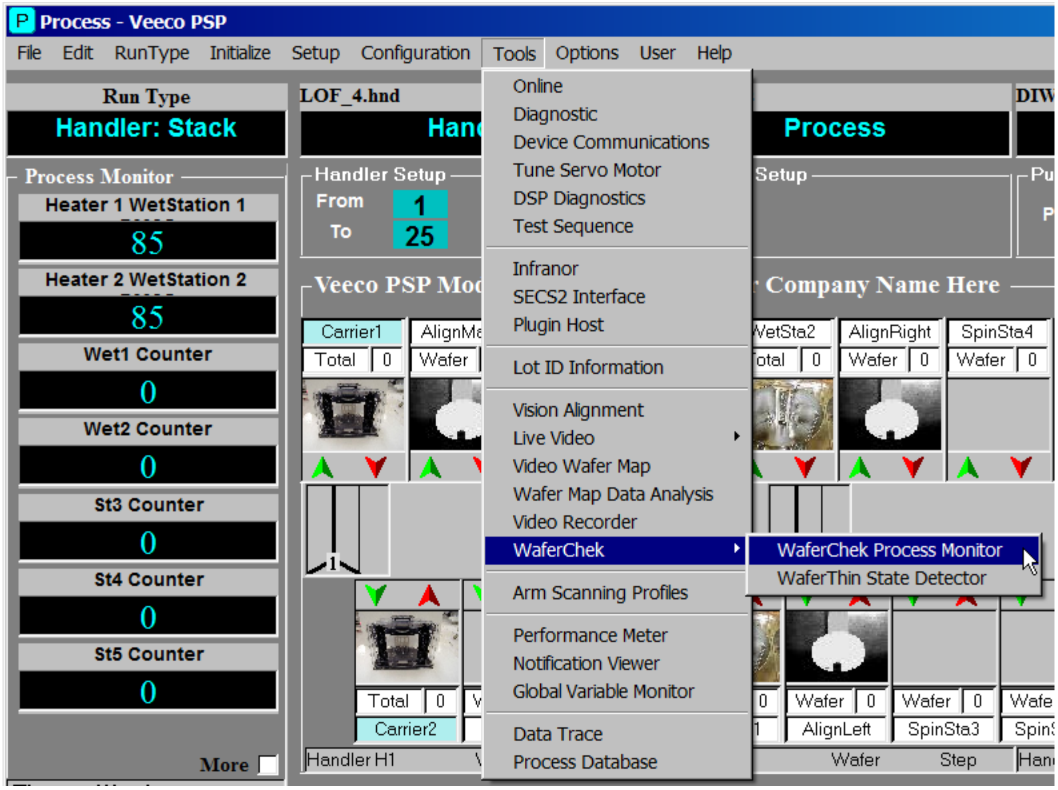


The selected Camera's Window can be resized and moved as a normal Window.

The displayed video can be rotated, mirrored, and be selected as always being displayed as the topmost Window by selecting any of the Options.

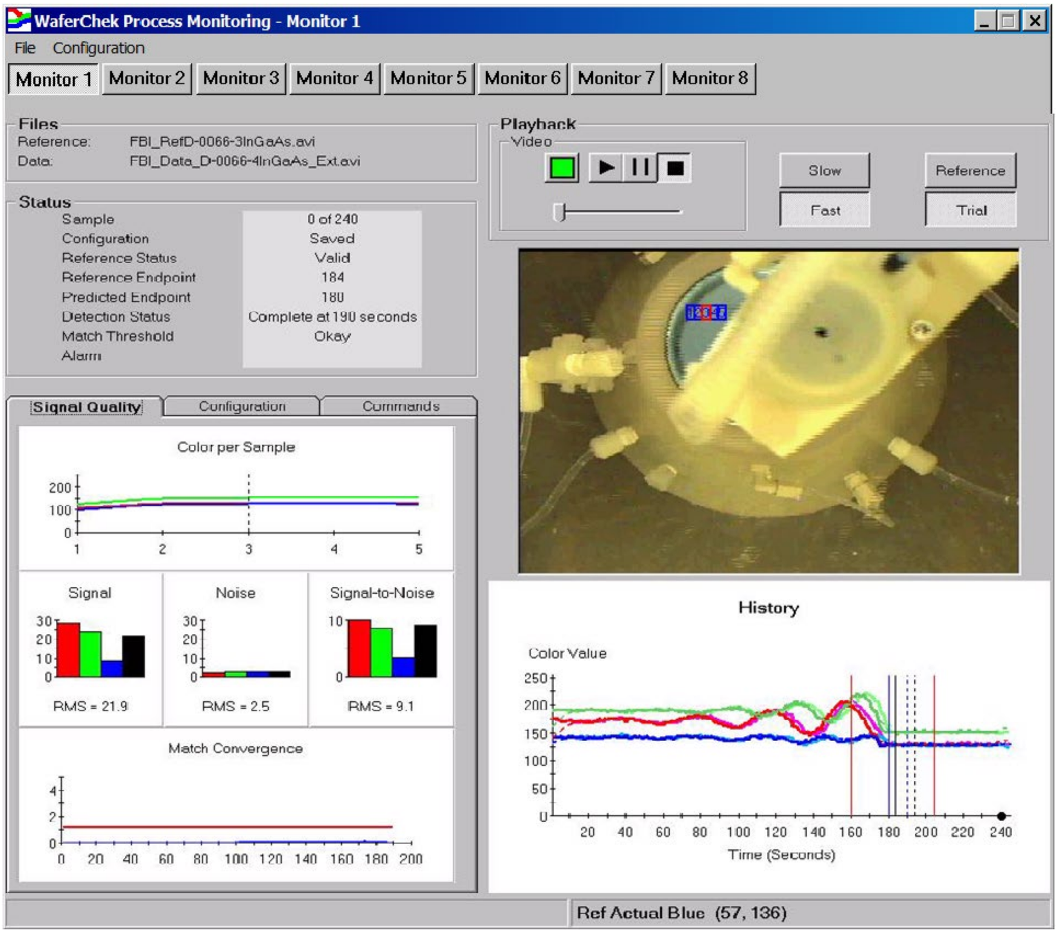


WaferChek



Many semiconductor wafer processing steps result in a significant optical change of the processed wafer. This change is visible with the naked eye, or a video camera, and can be used as an indicator of how the process is progressing. The uniformity of the change is also an indicator of how uniform the process is.

WaferChek Process Monitoring Window



The WaferChek Process Monitor detects the end of a process step by monitoring color changes in the substrate. Typical applications are etching, lift-off, and drying. A color video camera is used to view the process. Color changes are evaluated over the complete visible spectrum. When the color changes match the color changes observed in a previous reference run, the process step is considered complete.

Metal etch is one example where optical Process Monitoring can be used. As the metal is etched away, the color of the wafer changes. With an optimal setup, the color shift appears uniformly over the entire surface of the wafer. The process is complete when the wafer reaches a specified color, plus some pre-determined time. In some processes, several color shifts may occur due to multiple layers or reactions that take place. Process Monitor systems must track all changes to determine the end of the process.

The data collection system consists of recording reflected light intensity levels for each point, as a function of time, under several illumination conditions. The points are selected by the user and consist of multiple pixels, which are averaged. Averaging improves the data accuracy by reducing variations due to noise and distortion from the fluid layer on the wafer. Reference data is collected during the set-up and teach steps, and run-time data is collected during the actual process.

The Process Monitor system is intended for process monitoring and control. It cannot be used to establish the process initially. Prior to running Process Monitor experiments, a working process must be established which yields desired results.

The steps associated with running the Process Monitor system are:

- **Parameter setup.** The user is required to set up all parameters in the end point detection screen. This includes selecting the area of the wafer to use for Process Monitor.

Teach reference data. The System collects process data while an actual process is running. The data must run past the actual process completion. After the wafer is processed, a process engineer determines the time when the process was actually completed and enters it into the process setup screen.

End Point Detection.

Statistical techniques are used to match the run-time data with pre-computed reference data in order to establish the process function to each run. This is a more reliable method than using thresholds or rates of change often used in Process Monitor systems. By comparing complete data sets, the user does not have to rely on a specific feature of a graph.

Monitor Requirements

A minimum screen resolution of 1024x768 pixels is required.

A minimum screen color setting of 24 bits is desired for better viewing of the video, but it is not required.

Process Monitor Files

File Types

Some of the files used by Process Monitor are:

EPD.ini (in C:\Program Files\SSEC\ini). This file contains the configuration data sets (Sample location, Reference Endpoint, Alarm settings, etc.)

*.avi files (in C:\Program Files\SSEC\Data). These files contain the video data collected. Typically, there would be one Reference AVI file and multiple Trial AVI files

*.txt files (in C:\Program Files\SSEC\Data). For each reference file, a corresponding text file is created with the same filename and the .txt extension. This file contains a summary of the Red, Green and Blue color values in the sample rectangle for each frame of reference video. This file is created during reference file collection or playback.

AVI File Naming Conventions

The filename is automatically generated from the Configuration Name, the type of data (Reference or Trial), and the run number. The format is:

Config Name_Type_N.avi

Example: If a the configuration name is "Metal Etch", then the following files will be generated:

Reference Data Metal Etch_Ref.avi There is no run number, since there is only one Reference file per configuration.

Trial Data Metal Etch_Data_1.avi Metal Etch_Data_2.avi ... Metal Etch_Data_100.avi

AVI File Run Numbers

Every time trial data is collected, the Run Number is automatically incremented by one, ranging from 1 to 100. This allows up to 100 trial runs to be stored simultaneously. When the Run Number reaches 100, it wraps back to 1, overwriting any previously existing file with that run number. The Run Number can also be set in the process recipe. Typically, this would be done to set the run number equal to the wafer number.

NOTE

The Run Number is reset to one every time the Process Software is restarted.

Process Monitor Setup

Data Collection

There are two types of data to be collected:

Reference Data is collected to teach the Process Monitor system. The video is collected and the process engineer would specify where the sample should be taken and when the endpoint occurs.

Trial Data is collected during process runs when the Process Monitor system is being used to automatically detect the process endpoint and end the process step.

Typically, the Reference Data is collected when the process is first being established. Thereafter, Trial data is collected.

Monitors

The WaferChek Process Monitor permits up to twelve Process Monitors to run concurrently. Typically, you might run a different Process Monitor for each chamber where monitoring occurs.

Limitations:

Each Monitor must use a different Configuration.

Only one Monitor can be displayed at a time. Change the Monitor display by selecting "Monitor" from the menu.

Definition File Commands

Process Monitoring is typically automated through calls from the Process Recipe. This section briefly describes some of the commands invoked by the Process Recipe.

Examples from a Function.Def file

```
Label On/Off Monitor Command User Prompt Default Min Max Security
EPDGetRef 2 EPDSelect EPD Config ID 1 1 100 1
EPDGetRef 2 EPDRefStart
EPDGetRef 1 2 EPDStop
EPDRun 2 EPDSelect EPD Config ID 1 1 100 1
EPDRun 2 EPDStart
EPDRun 1 2 EPDStop
EPDRunWait 2 EPDSelect EPD Config ID 1 1 100 1
EPDRunWait 2 EPDStart
EPDRunWait 2 EPDWaitDone
EPDRunWait 1 2 EPDStop
```

Screen Displays

Process Monitor Screen

Screen Components

Menu

Monitor Menu Four concurrent processes may be monitored. Only one Monitor may be displayed at a time.

File Menu This can be used to open and rename files. This is generally used for playback purposes.

Configuration Menu Configurations can be added, deleted, renamed, or saved. A different configuration is used for each process monitored.

Filenames

Filenames are displayed at the top of the form. These are the current reference and trial data filenames.

Status

Status information is displayed regarding the state of the process being monitored.

Tab Options

Tab options are displayed on the left side of the form.

Signal Quality. This tab shows graphs displaying the quality of the data.

Configuration. This tab stores the configuration settings.

Commands. This tab allows manual data collection. This is for testing purposes only. Generally, data collection is invoked in the process recipe.

Playback

The Playback options can be used to redisplay collected data from a Reference or Trial Run.

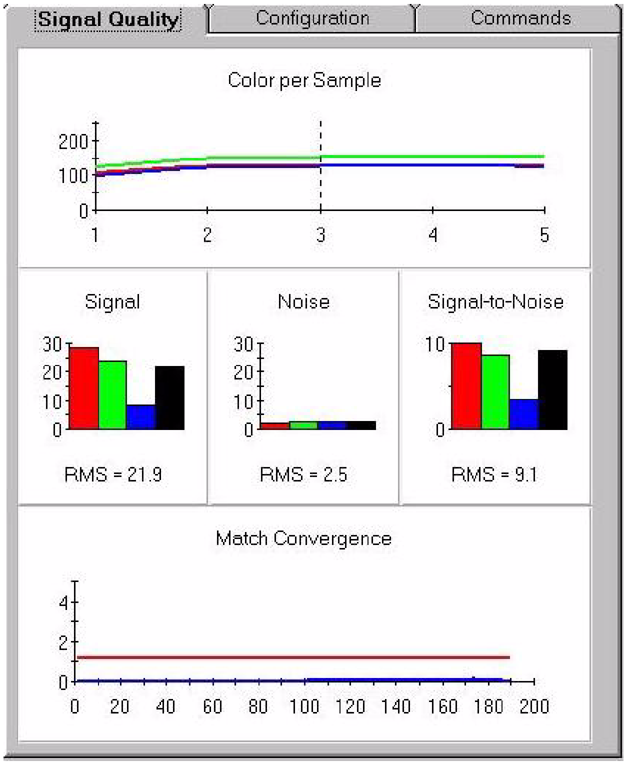
Video Display

The video is displayed in the center right portion of the form.

History Graph

A graph of the color data is displayed at the lower right portion of the form.

Signal Quality Tab



The following graphs display information about the quality of the data available for process monitoring:

Colors Per Sample Graph

The Colors Per Sample graph is updated continuously for live video input, reference data playback, and trial data playback.

The Colors Per Sample graph displays the average color values in each sample rectangle for the current sample.

Graphs of Reference Signal Quality

The Signal, Noise, and Signal-To-Noise graphs display information about the Reference signal. These graphs are updated at the end of Reference Data collection or playback. The graph displays the Signal values for Red, Green, and Blue. The Black bar is the RMS (Root Mean Squared) average of Red, Green, and Blue. These graphs show the quality of the Reference signal. If the Reference signal does not have good quality, indicated by a large value for Signal-To-Noise RMS, then it will be difficult to get good results from the Process Monitor.

Signal

The Signal graph displays the Signal content of the Reference Data. For effective Process Monitoring, the Signal RMS should be large.

Noise

The Noise graph displays the Noise content of the Reference Data. For effective Process Monitoring, the Noise RMS should be small.

Signal-To-Noise

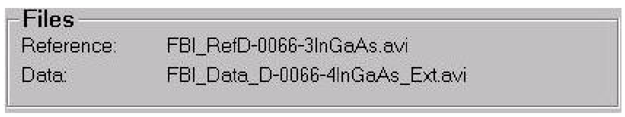
The Signal-To-Noise (SNR) graph displays the Signal-To-Noise ratio of the Reference Data. For effective Process Monitoring, the SNR RMS should be large.

Match Convergence Graph

The Match Convergence graph displays information about the quality of Process Monitoring. This information is calculated while the trial data is being collected.

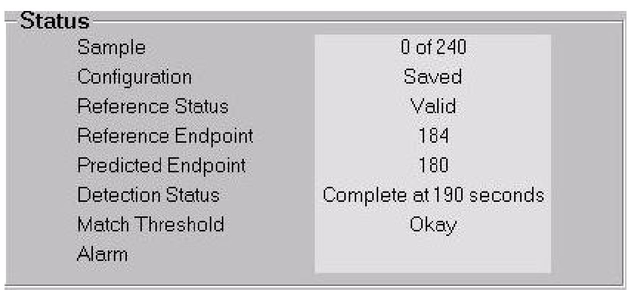
The Match Convergence graph shows how well the Trial Data corresponds to the Reference Data. The horizontal Red line is set at the "Match" threshold. The blue line is the actual Match Convergence for each sample. If the convergence is good, the Match Convergence data will be close to zero.

File Name Display

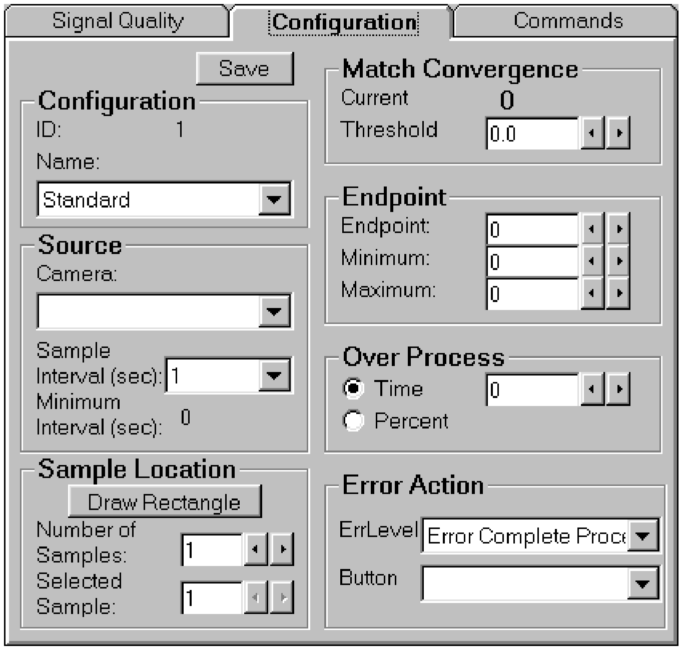


The name of the most recent Reference and Data files for the selected configuration are displayed here.

Status Display



Configuration Tab



The Configuration Tab displays the Configuration Settings.

Configuration Settings include:

Configuration ID

This number is generated by the Software. It is a unique identifier for the process configuration. This number is normally used with the "EPDSelect" command in the Function.def file.

Configuration Name

This is a unique name that identifies the configuration. The Process Engineer creates it when setting up the Process Monitor. It is used by the Process Engineer to identify the process.

Camera Number

This selects which camera is used.

Sample Interval

This selects how often sample data is taken. One sample per second is the default. Faster values can be used for very short processes that change quickly. Slower values should be used for very long processes that change slowly, in order to speed up calculation time and reduce the size of the output AVI files being generated.

Sample Location

Click the "Draw Rectangle" button to enable sample location. You can then draw the sample rectangle on the video display.

Number of Samples

This option selects how many samples are in the sample rectangle.

Selected Sample

This option determines which sample block within the sample rectangle is used for process endpoint determination.

Match Convergence Current

This value displays the calculated convergence of the Trial Data with the Reference Data. The number is updated as the Trial data is being collected.

Match Convergence Threshold

The Match Convergence Threshold is used to qualify the Process Monitor results. For a valid endpoint to be detected, the Match Convergence "Current" value must be less than the Threshold. If the Current value is greater than the Threshold, then the monitoring algorithm rejects the current endpoint calculation and continues to sample the data until an endpoint is detected with a Convergence value less than the Threshold, or until the Max Alarm limit is reached. If the Match Convergence Threshold = 0, then all data is qualified, i.e., the endpoint is always accepted, no matter what the Convergence Current value is. A typical value for Match Convergence is 1. Convergence values greater than this usually mean the Trial Data is not similar enough to the Reference Data for valid process monitoring.

Endpoint: Minimum & Maximum

After collecting the reference data, an Endpoint can be set to indicate where the process step was complete. Minimum and Maximum values can be established. An alarm will be generated during trial data collection if the Minimum or Maximum values are exceeded

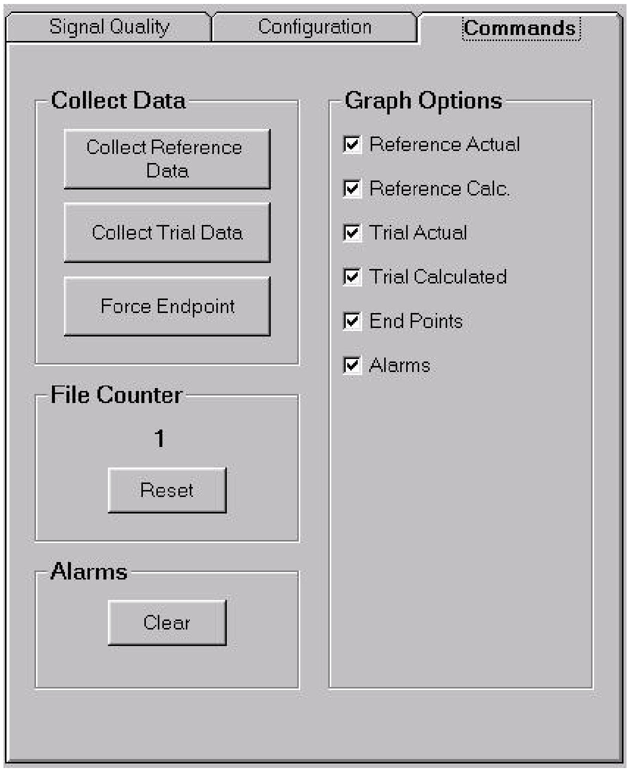
Over Process Time

This is the amount of time to continue processing after the endpoint is reached before the signaling completion.

Over Process Percent

This is the amount of time as a percentage of the detected endpoint to continue processing after the endpoint is reached before the signaling completion.

Commands Tab



Collect Data

The Collect Data section can be used for testing purposes. Generally, these functions are invoked through the Process recipe.

Collect Reference Data

This button starts/stops collecting reference data.

Collect Trial Data

This button starts/stops collecting trial data.

Force Endpoint

This button can be used to force endpoint detection during an endpoint trial.

File Counter

The File Counter is the trial Run number. This number gets updated every time trial data is collected. It is used to identify the Trial output AVI file. See the "Files" section for more information on how the Run number is used.

The Run number can be manually reset by pushing the Reset button. There is generally no need to do this.

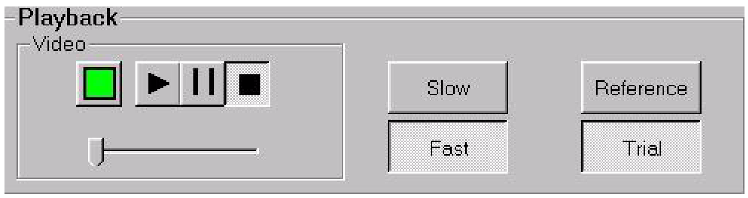
Alarms

Alarms can be cleared by pushing the Alarms "Clear" button. Pushing this button will clear the alarm for all Monitors.

Graph Options

This section selects which data sets are displayed on the Sample History Graph.

Playback



The Playback options can be used to redisplay collected data from a Reference or Trial Run.

Video Source Options

Live: This is the live feed from the camera

Play: The Reference or Trial file is being played

Pause: The file playback has been paused. Click Play again to resume playback from the current position. Click Stop and then Play to restart playback from the beginning of the file.

Stop: The file playback has stopped. The video display is frozen with the most recent frame displayed.

Scroll Bar: File data can be stepped through or sped through by clicking or grabbing the scroll bar.

Playback Speed

Slow: Play back the data at the rate of 1 per second

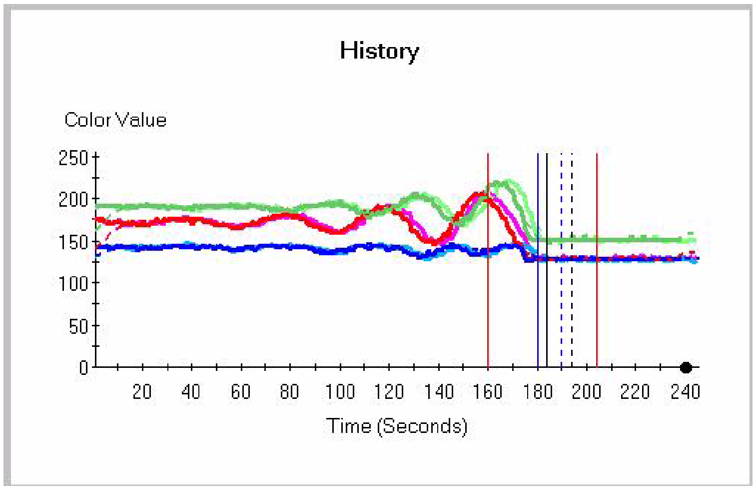
Fast: Play back the data as quickly as possible (depends on computer processor speed)

File Selection

Reference: Play back the Reference Data

Trial: Play back the Trial Data

Sample History Graph



The Sample History graph displays the color intensities measured over time during end point detection. The following data sets are displayed:

Reference Actual

This is the actual color intensities measured during the Reference run.

Reference Calc

This is a filtered representation of the Reference Actual data.

Trial Actual

This is the actual color intensities measured during the Trial run.

Trial Calc

This is the predicted trial data. The predicted data changes as the trial run progresses to reflect the variation of the trial data from the reference data.

Endpoints

Vertical lines represent the specified Reference Data Endpoint and the predicted Trial Data Endpoint.

Alarms

This is the Minimum and Maximum allowable endpoints, if specified.

Playback: Replay Video Scenario

Sometimes it is desirable to replay video for demonstration purposes, or for post process analysis of the data.

You always need to have a valid Reference file selected. Use the following steps:

- Select the desired Reference file. This can be done from the menu "File/Reference Data/Open" function.

Select the Playback "Reference" option

Click the Playback "Play" button.

Wait until the playback completes. You should see the video section of the screen change, as well as the corresponding data lines on the "Sample History" graph.

To replay an Endpoint detection, do the following

- Make sure you have a valid Reference file selected and played.

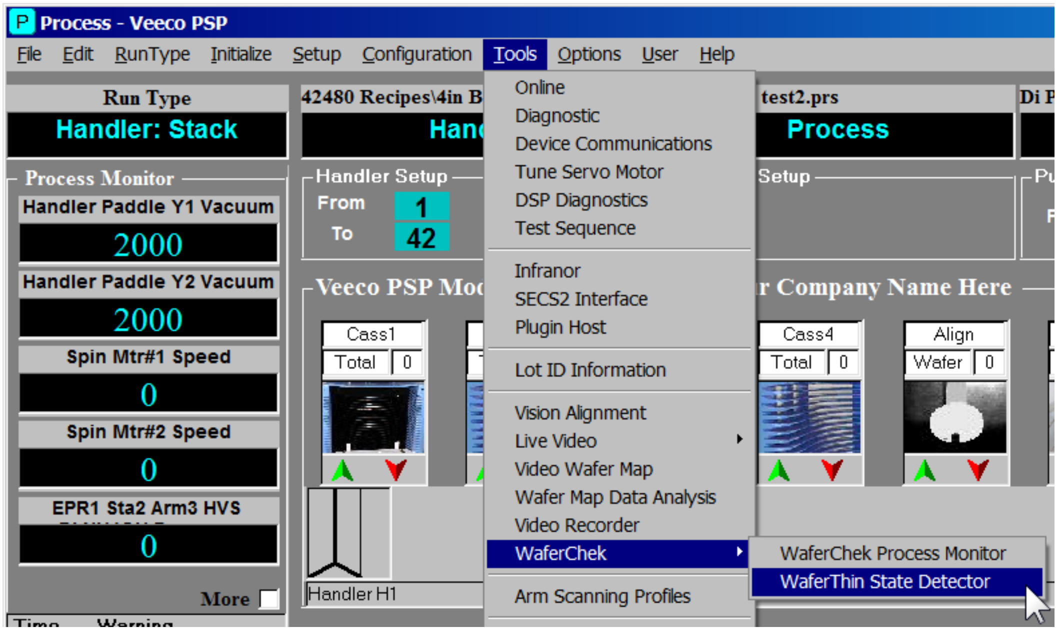
Select the desired Trial file. This can be done from the menu "File/Trial Data/Open" function.

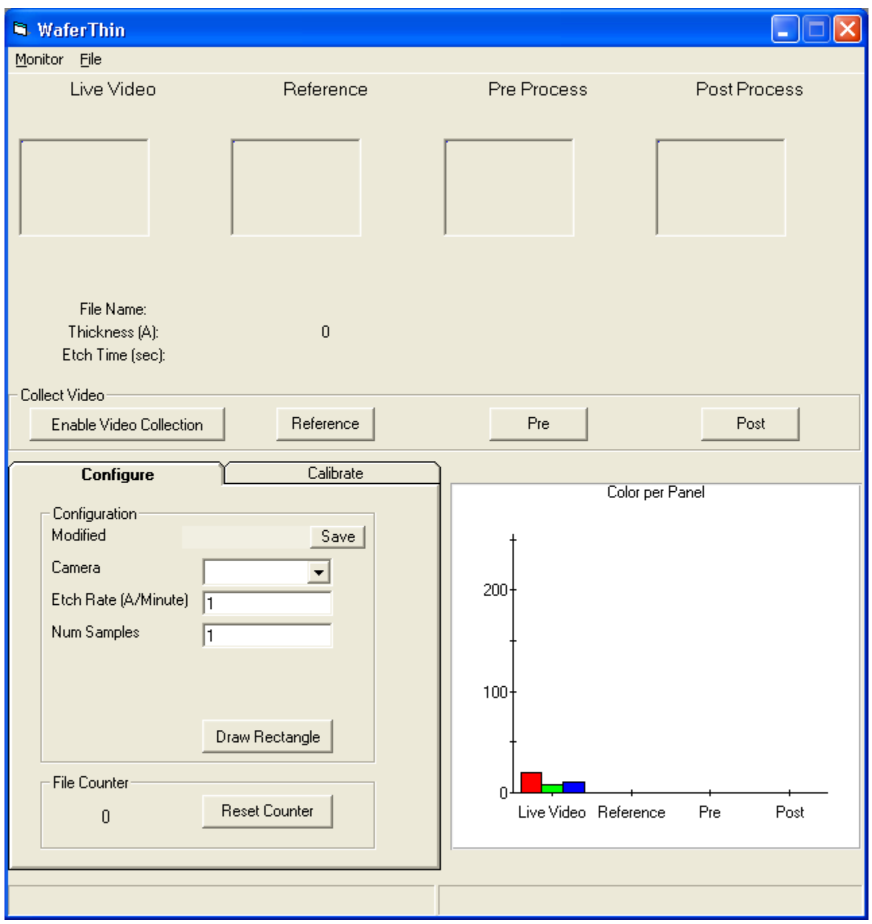
Select the Playback "Trial" option.

Click the Playback "Play" button.

Watch the trial playback.

Wafer Thin Window

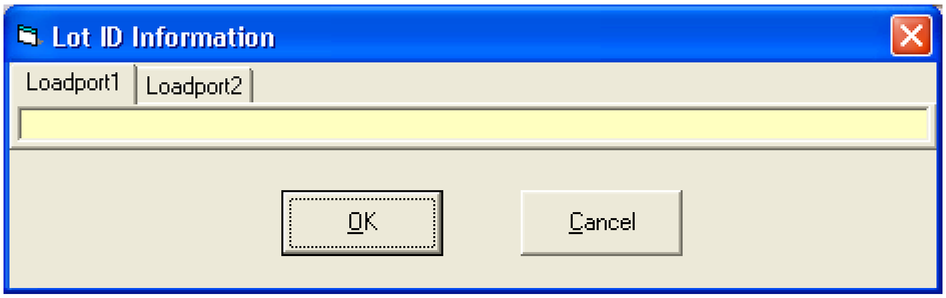




This Page left Intentionally Blank.

Lot ID Info (Barcode Map)

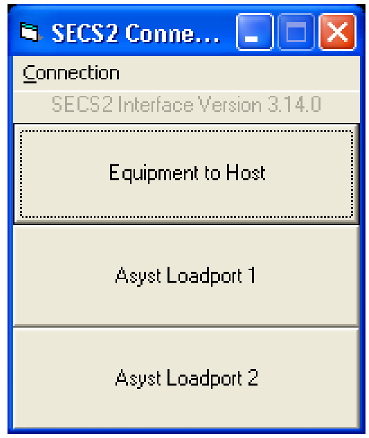
Lot ID Information Window



There are tabs for each input station.

SECS2 Interface

SECS2 Connections Window



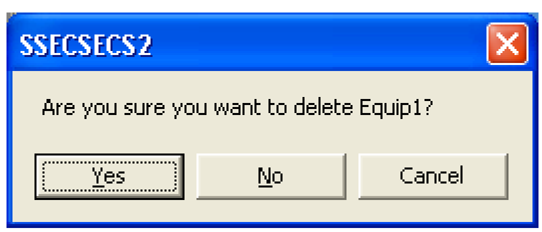
This Window displays any connections from the Tool to other devices capable of SECSGEM interface communications. The currently loaded SECS2 Interface Software version is displayed. Buttons for each device are provided.

Connection

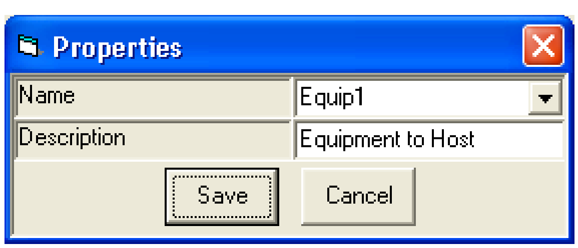
Select this to add another device.

Right-click Menu

- Disable - click this to disable the connection to this device.
- Delete – click this to delete the device. You will be prompted if you are sure.

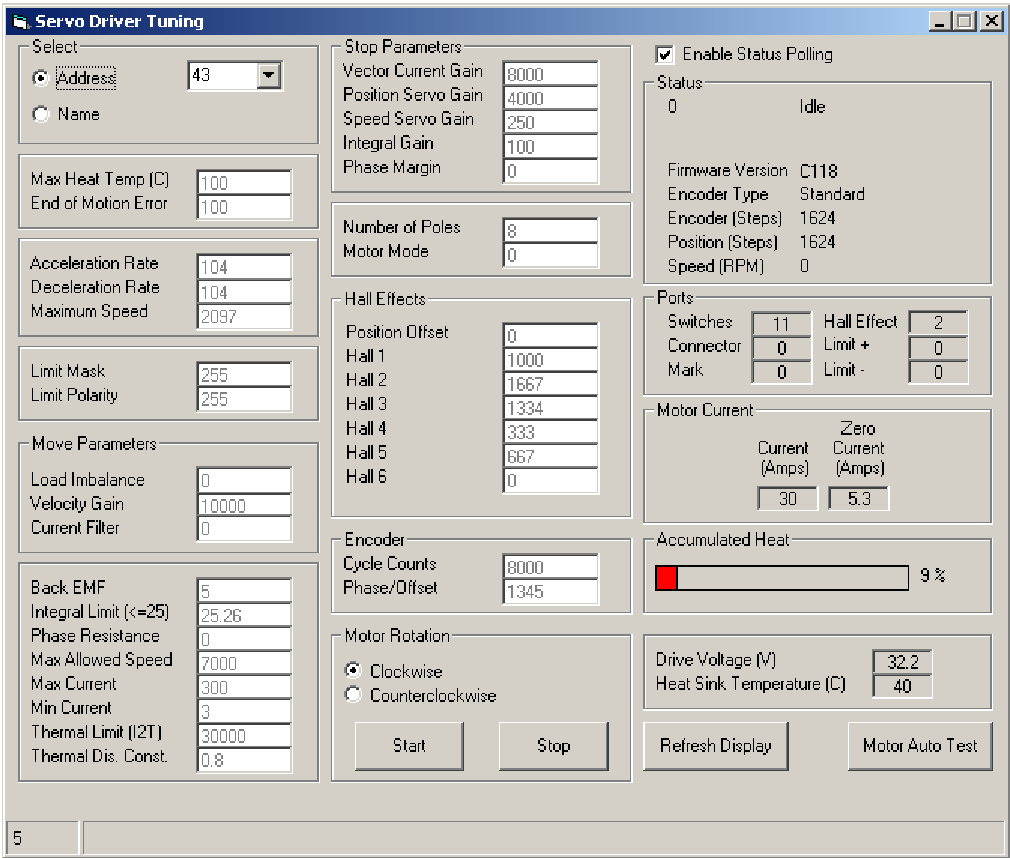


- Properties – click this to see the device name and a description of the connection.



Tune Servo Motor

Servo Driver Tuning Window



The Servo Driver Tuning screen displays the tuning parameters for the SSEC Servo Driver.

There are three different methods of tuning the Servo Motor:

To tune the Servo Motor without a load, select **Commands\Tune (No Load)** from the menu.

To tune the Servo Motor with a load, select **Commands\Tune (With Load)** from the menu.

To tune an individual servo motor parameter, right-click with the mouse on the text box for that parameter.

NOTE

You may have to double-right click.

Servo Driver Memory Variables

Read/Write Addresses

Address	Definition
22E	Maximum heat sink temperature
22F	End of motion error
230	Accel rate
231	Decel rate
232	Max speed
233	Limit mask
234	Limit polarity
235	Position gain (servo loop)
236	Velocity gain (servo loop)
237	Integral gain (servo loop)
238	Back EMF
239	Drive voltage
23A	Phase resistance
23B	Max allowable speed
23C	Maximum current
23D	Minimum current
23E	Thermal limit
23F	Thermal dissipation time constant
240	Vector current gain (vector loop)
241	Position servo gain (vector loop)
242	Speed servo gain (vector loop)
243	Integral gain (vector loop)
244	Load inertia
245	Number of motor poles
246	Motor mode
247	1 Positions at positive transition of hall
248	5
249	4
24A	6
24B	2 Encoder distance between halls
24C	3
24D	1
24E	5. Also, Encoder counts of E cycle
24F	Encoder/phase offset

Read-Only Addresses

Address	Definition
260	Zero phase current phase A
261	Zero phase current phase B
262	Zero phase current phase C
263	Accumulated heat – not used
264	Accumulated heat

Analog Channels

Channel	Description
0	Voltage on phase A
1	Current in phase C
2	Heat sink temperature – 262 counts/C
3	Voltage on phase C
4	Current in phase A
5	Current in phase B
6	Drive voltage
7	Voltage on phase B

All A/D readings are 10 bits, left justified in a 16 bit word.

All currents are relative to the offset value, 1180 bits/amp.

All voltage scales are 1297 bits/volt.

Port Definitions

Channel	Description
0	Bits 0-4 = address, Bits 5-7 = inputs on front connector
1	DSP Port A. Bit 5 = State of "Mark" input
2	DSP Port B. Bits 4-6 = State of Hall effect inputs
3	DSP Port C. Bit 7 = Limit +, Bit 6 = Limit –
4	DSP Port D
5	Unused
6	Unused
7	Unused, returns status byte

Notes:

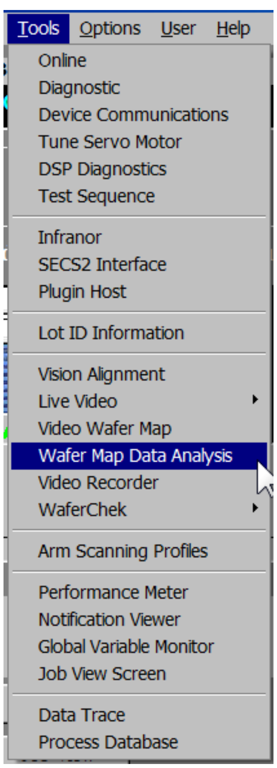
Limit Mask: A value of 255 (FF hex) disables the limit sensors

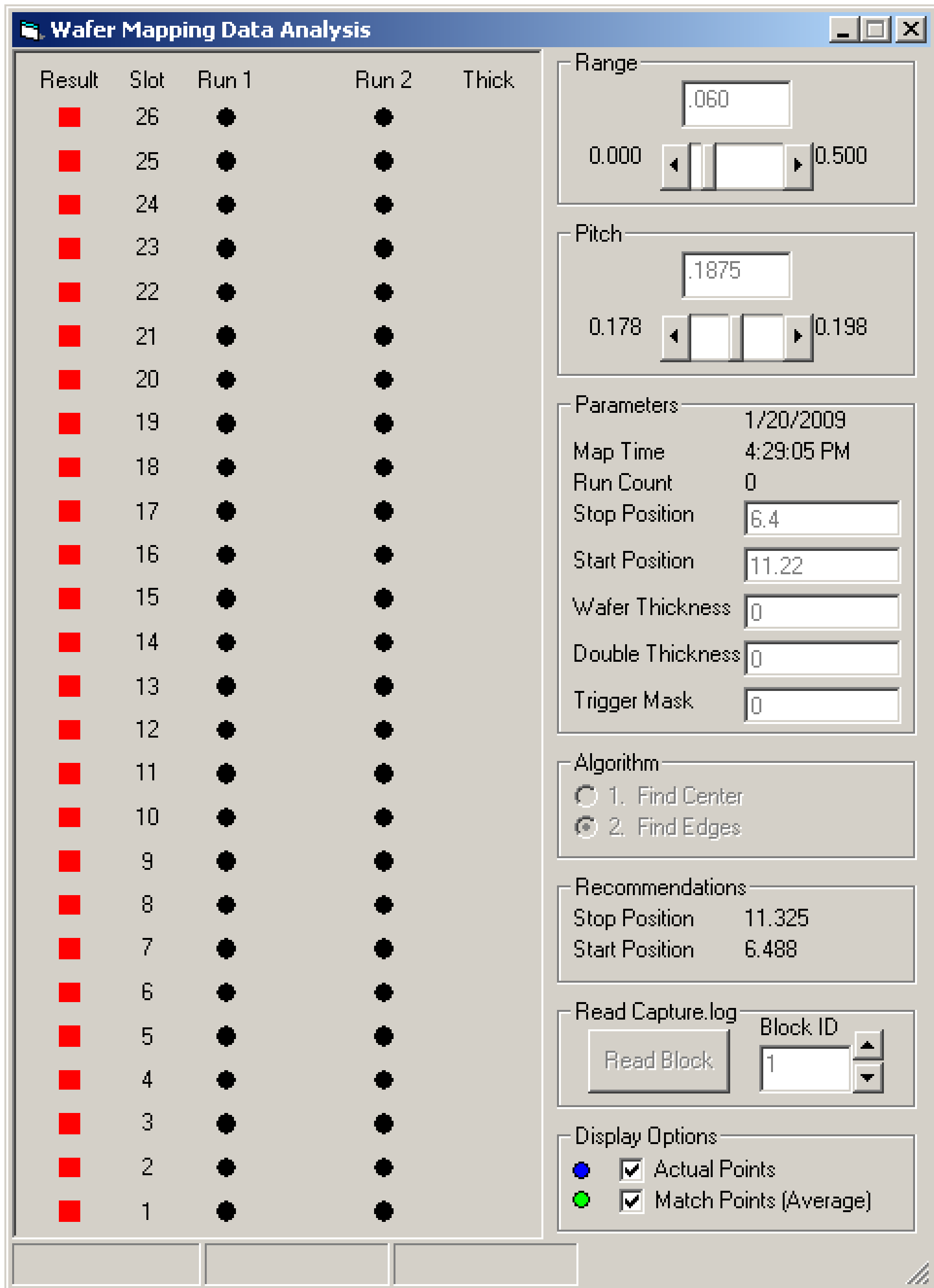
Online Screen: The Online Screen displays all the devices configured in the System and their status:

- Online devices are displayed in green text.
- Offline devices are displayed in red text.
- Disabled devices are displayed in yellow text.

Wafer Map Data Analysis

Wafer Map Data Analysis Window





Wafer Mapping is used to determine how many wafers are present in a cassette. Wafer Mapping is performed by scanning the cassette with a low-level laser located on the handler. A sensor detects reflections from the wafer and determines whether or not a wafer is present.

For the purposes of Wafer Mapping, there are two types of wafers: Reflective and Non-Reflective.

Reflective Wafers

Reflective wafers are those wafers whose edges reflect the laser. Typically, these would be Silicon wafers.

The following issues apply to Reflective Wafers:

- The scanner scans near the center of the cassette, so that the beam from the laser is deflected off the round wafer edge to the sensor.

The scanner will not work on the flat edge of the wafer, because the laser is deflected in a different direction.

Non-Reflective Wafers

Non-Reflective Wafers are those wafers that don't reflect the laser beam. These might be GaAs wafers or Silicon Wafers with a non-reflective coating. In this case, the back of the cassette station is lined with a mirror to reflect the laser beam. The sensor detects the points at which the wafer interrupts the laser beam's reflection from the mirror.

The following issues apply to Non-Reflective Wafers:

- The scanner scans near the edge of the cassette. A scan is performed on both the left and the right sides of the cassette.
- The scanner does not care if the round or the flat edge of the wafer is facing it, since it is using the reflection from the mirror.

Implementation

To turn on Wafer Mapping, do the following:

- Set up the Wafer Mapping parameters in the Handler recipe, under the ScanCass section.

Turn on the "Auto Wafer Mapping" option in the Options screen.

When the user hits the Start button, Wafer Mapping will automatically be performed. If the not all the wafers are present, a screen will be displayed indicating the missing wafers. The operator has the option to Retry, Cancel, or OK (Continue). If any of the wafers are cross-slotted, the operator will not be allowed to select OK (Continue).

Wafer Mapping Trigger

The Wafer Mapping Trigger is entered as a parameter in the Handler recipe file. The Trigger should either have the value of "193" or "129". Both values should work equally well. The difference between the two is that one trigger looks for the sensor's rising edge, and the other trigger looks for the falling edge.

Wafer Mapping Data Analysis

The Wafer Mapping Data Analysis form can be used to examine the data obtained during Wafer Mapping.

It displays the following information:

- Black Dots – Expected wafer positions
- Green Dots – Actual wafer data that matches an expected position
- Red Dots – Actual wafer data that does not match an expected position

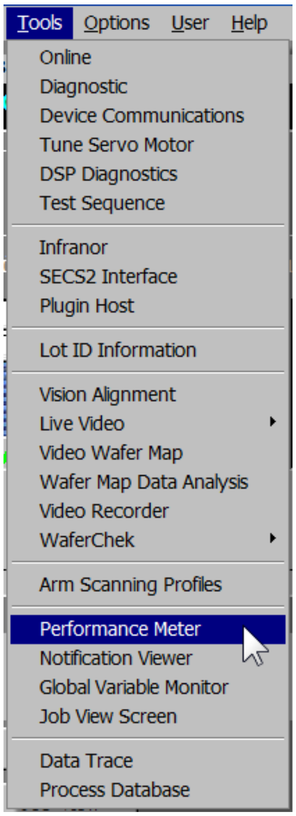
The user can modify the Range and Pitch to determine the best values. These values need to be copied into the Handler Recipe for scanning.

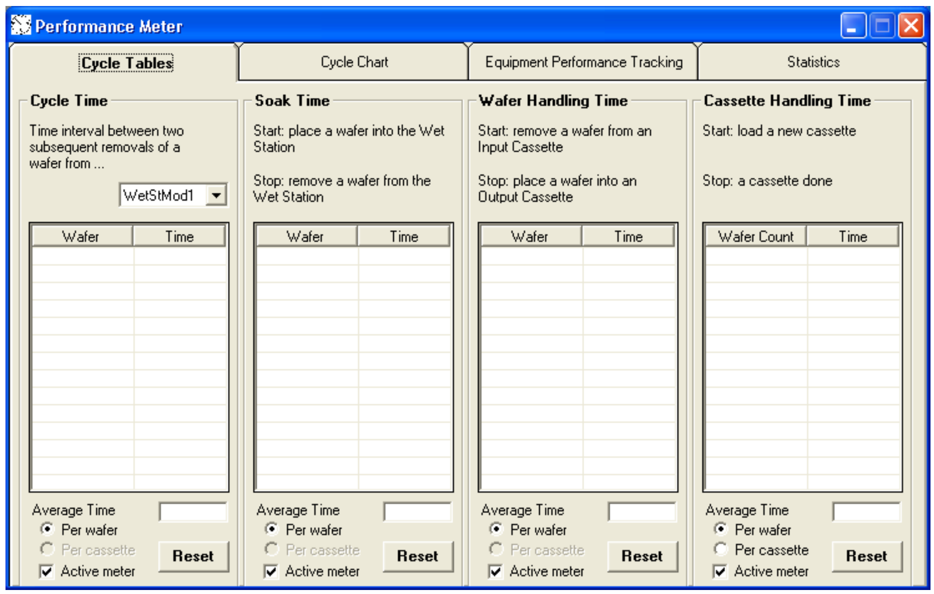
By clicking the "Read" button, the user can read previous logged values of wafer mapping data.

This Page Left Intentionally Blank.

Performance Meter

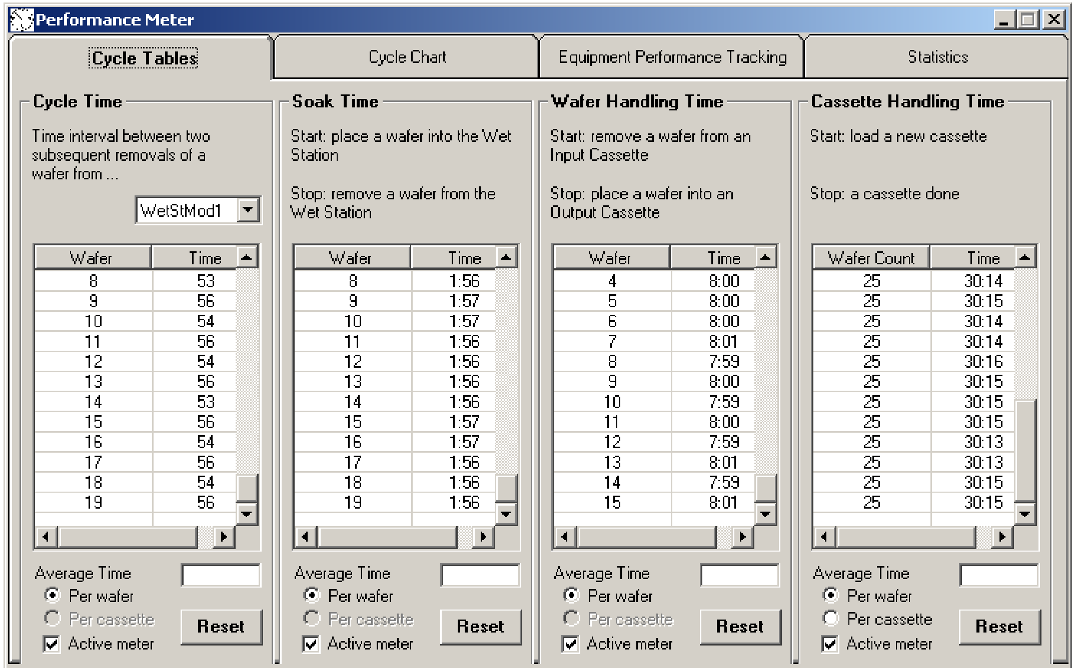
Performance Meter Window



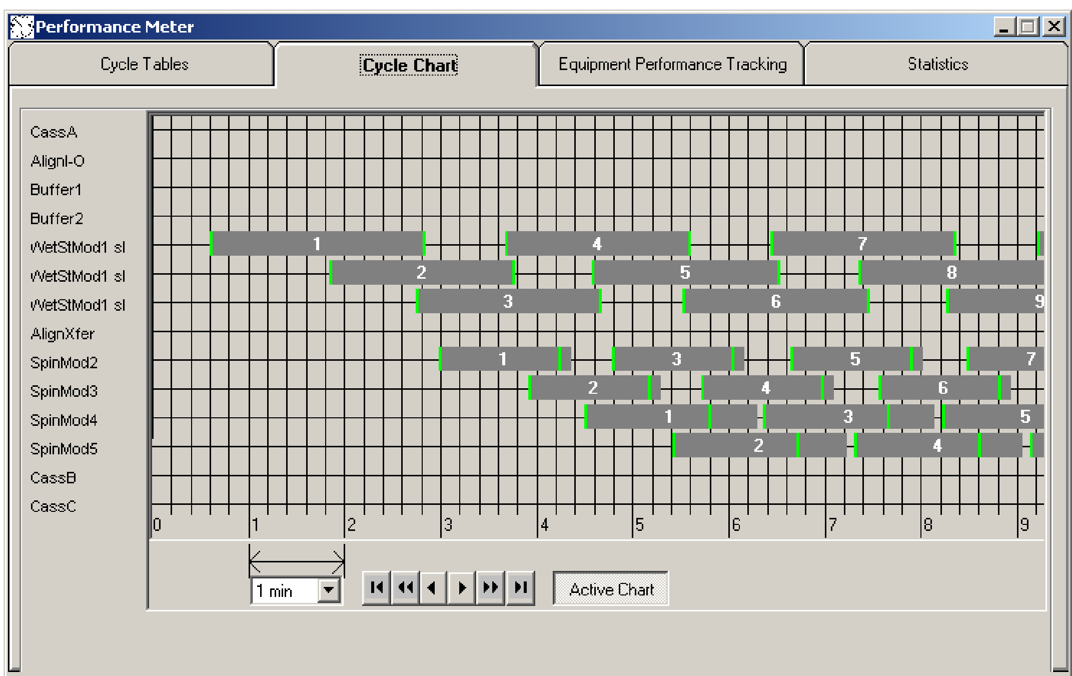


There are four tabs that display various statistics for the Tool while running and during idle times.

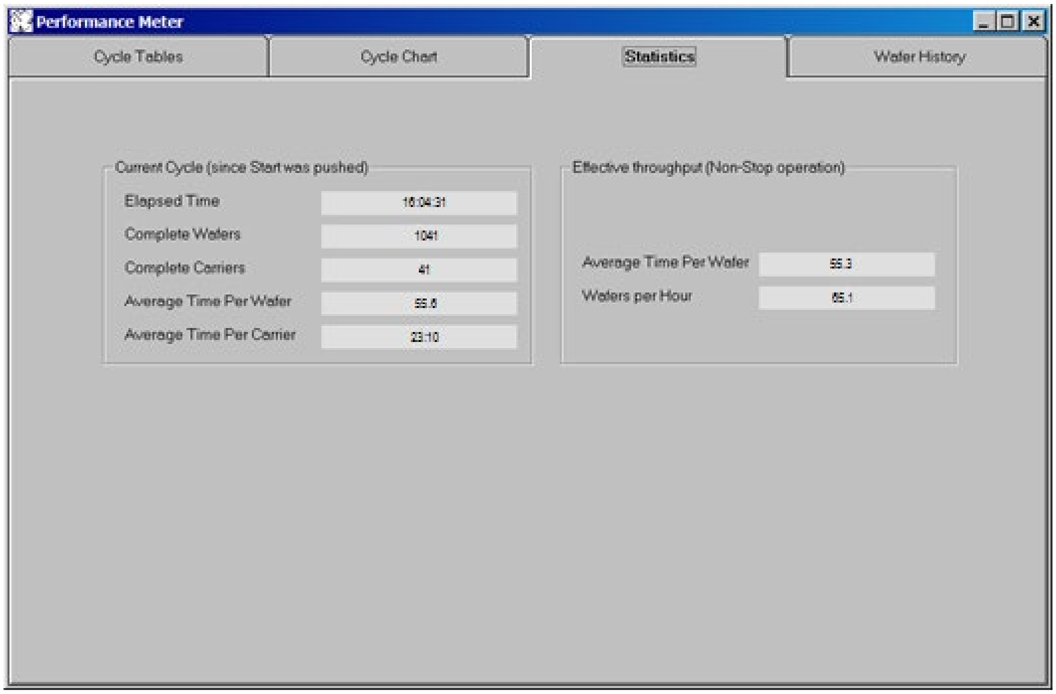
Cycle Tables



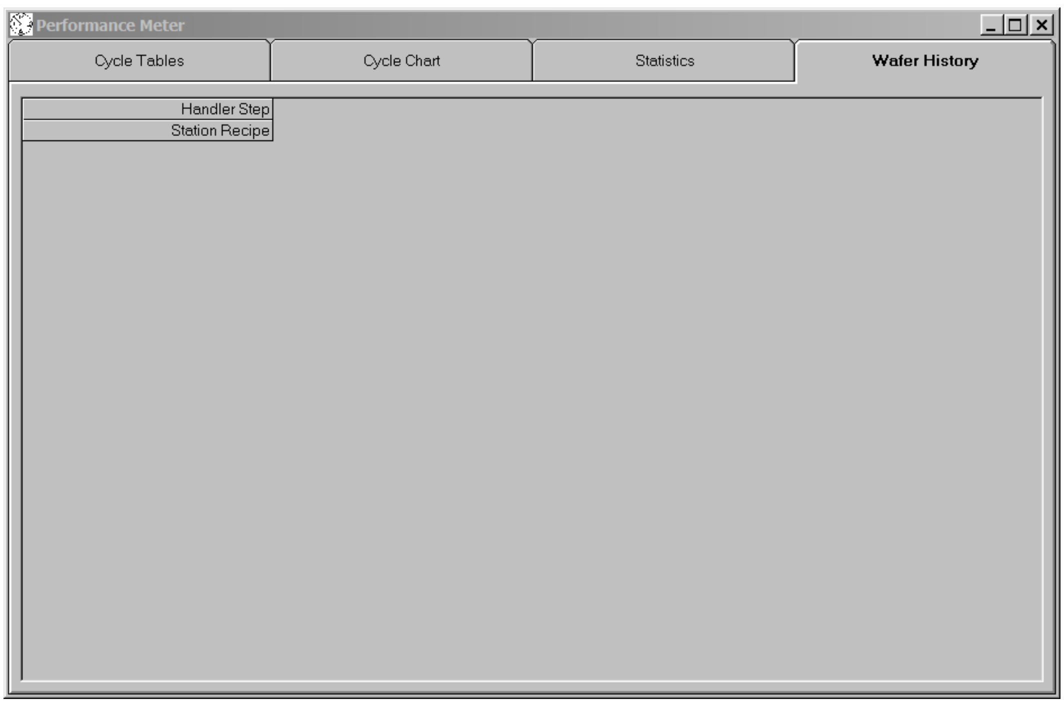
Cycle Chart



Statistics

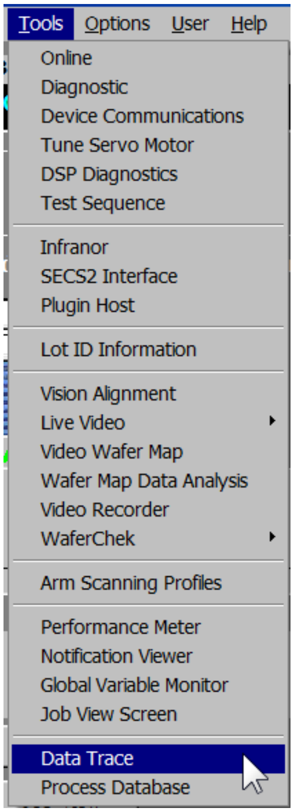


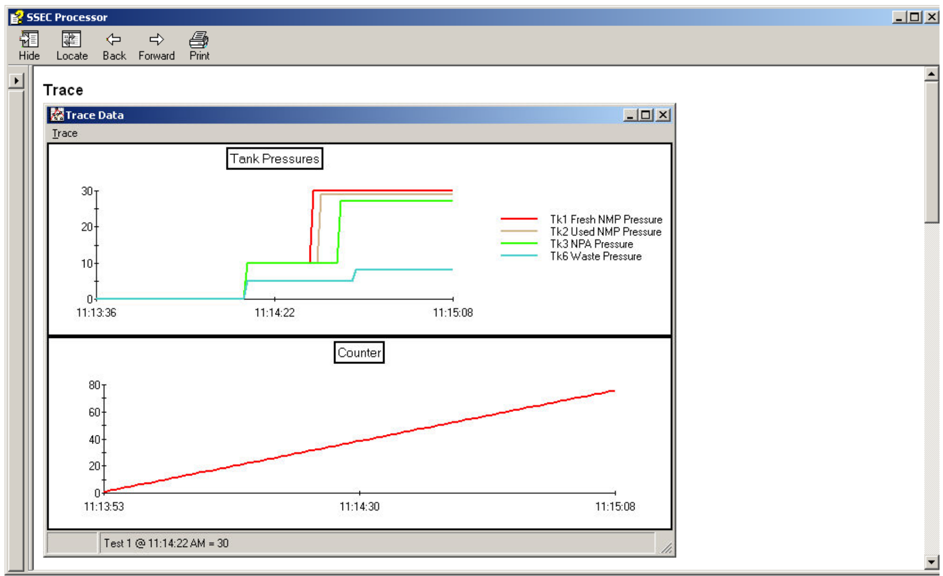
Wafer History



This Page Left Intentionally Blank.

Data Trace





The Trace screen can be used to graph readings such as temperatures, pressures, flow rates, etc. Any ADC, DAC, Heater, Sensor, Solenoid, or Tank value can be traced. In addition, some system variables like memory usage can be traced.

Any number of trace graphs can be created. Each graph can contain from 1 to many data items to be traced.

The trace configuration information is stored in the file Trace.ini in the C:\Program Files\ssec\Ini directory. This file is read as soon as the Software starts running, and graphing and data collection is started automatically.

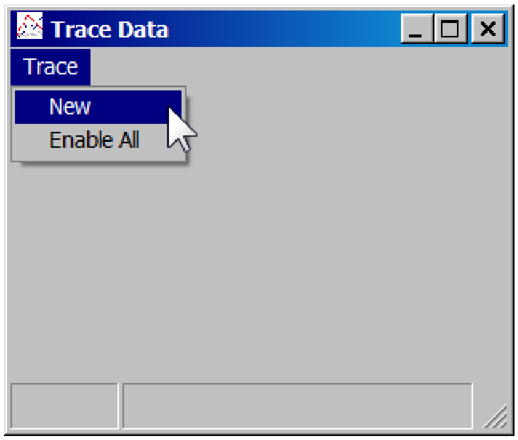
The trace data is stored in the C:\Program Files\ssec\Data directory. A different file is started for each graph. The name of the file is the title (caption) of the graph. The file extension is ".csv", which stands for "Comma-Separated Values". This is a text file where each time the data is sampled, the data values are printed in a line with commas in between each value. An example of a filename might be "Tank Pressures.csv".

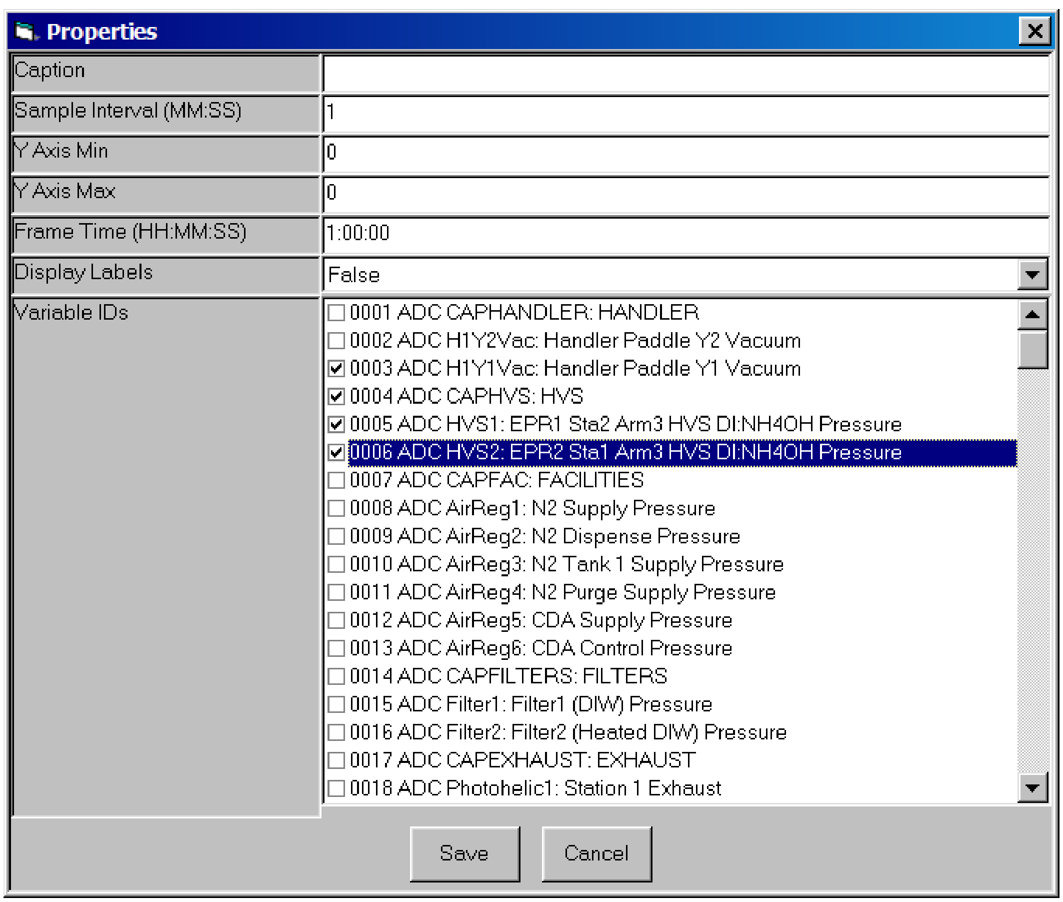
The .csv file has a maximum file size of 1.3 MBytes. When the file becomes full, it is saved with a .bak extension, and a new .csv file is started. The previous .bak file is deleted.

The data in the .csv or .bak file can be read with the ShowCSV program. It can also be read into Microsoft Excel.

The Trace screen can be accessed from the menu under Tools/Data Trace.

To add a trace graph, select Trace/New from the Trace screen menu. This will display the Trace properties screen.





Trace Properties

Caption - This is the title of the graph. The data is stored in a file named <caption>.csv. Each graph must have a unique caption.

Sample Interval - This is how often the data is sampled. The default value is every 1 second. Valid values are from 1 second to 1 hour (60:00). Values can be entered as seconds or in MM:SS format, where MM is the number of minutes and SS is the number of seconds.

Y Axis Min, Y Axis Max - This is the range for the Y axis. If both Y Axis Min and Y Axis Max are zero, then the Y axis is scaled automatically based on the data.

Frame Time - This is how much data is shown on the graph at one time. The time is entered in HH:MM:SS format, where HH is hours, MM is minutes, SS is seconds. By default, the frame time is 1 hour (1:00:00). This means that only the most recent 1 hour worth of data will be displayed. The frame time does *not* affect the .csv file.

Display Labels - If True, then the names of the data items are displayed on the graph. If False, the names are not displayed. This is useful if you have multiple data items on one graph.

Variable IDs - This is a list of all the data items that are available for graphing. Check the checkbox for each item to be included in the graph.

Trace Menu

New - This adds a new graph to the Trace screen. It automatically displays the graph Properties screen.

Disable All or Enable All - You can disable or enable all the graphs. If the graph is disabled, the background will display as gray. No data will be collected. This menu item is useful if you want to synchronize the start time of all the graphs. Select Disable All, then select Enable All, and all the graphs will restart.

Popup Menu

Right-click with the mouse on a graph to reach the popup menu for that graph.

Properties - This displays the properties screen so you can change the properties.

Delete - This deletes the graph.

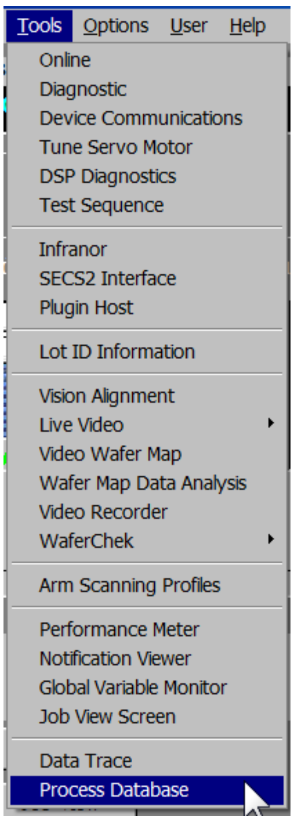
Disable/Enable - You can disable or enable a graph. Data will not be collected while the graph is disabled.

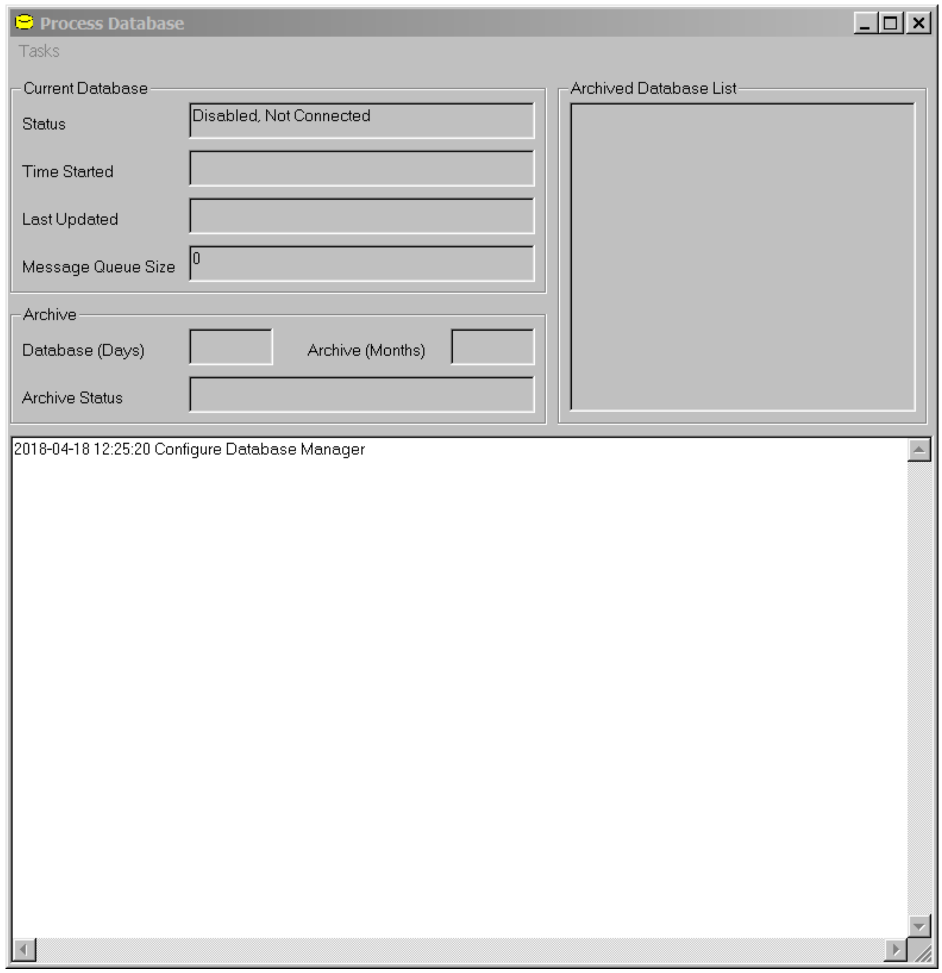
NOTE

With the introduction of the Process Database and the ProcessView Software, this feature is becoming obsolete.

Process Database

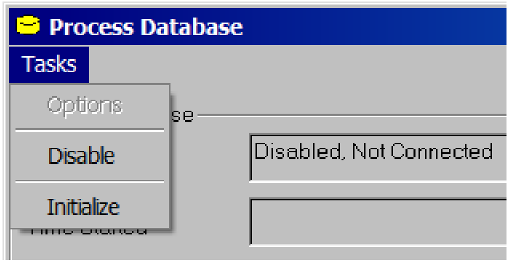
Process Database Window





The Process Database Window displays the description of the SQL database that collects all device data that can be analyzed by the ProcessView Software.

Tasks Menu



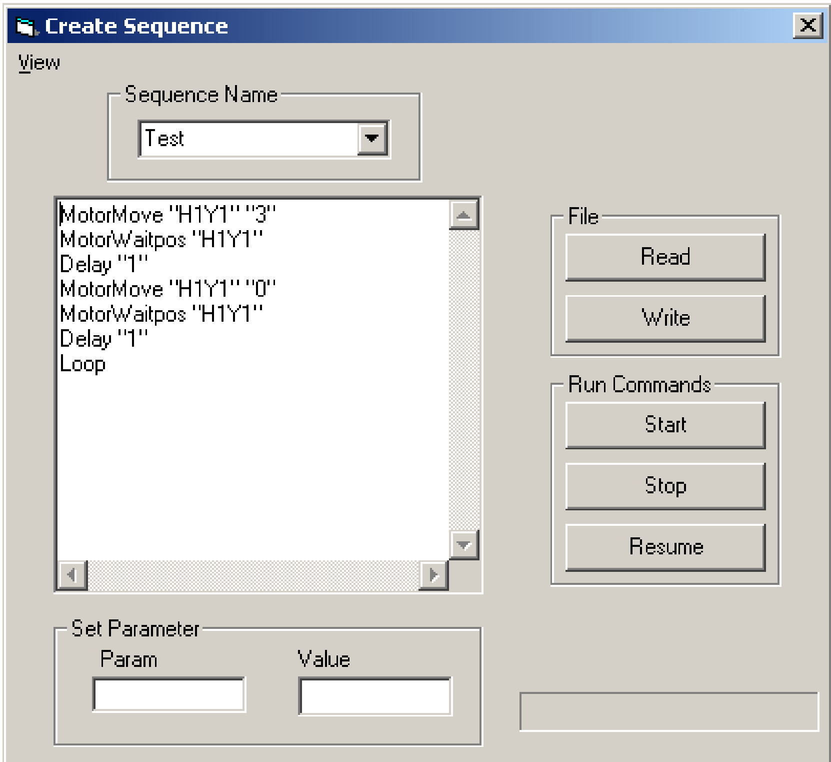
Options

Disable

Initialize

Test Sequence

Create Sequence Window

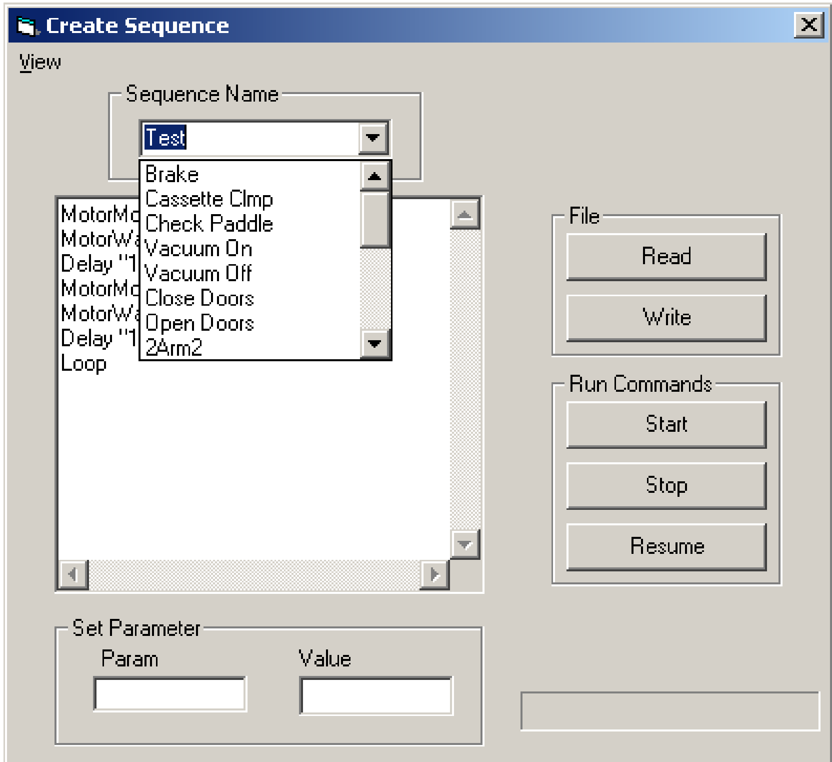


This option is to allow an authorized user to write and execute a test sequence using definition commands.

View

Selecting Refresh reads the entire sequence.ini file. It updates the **Sequence Name** combo box with all the sequence names in the sequence.ini file.

Sequence Name Frame



Sequences already defined in the sequence.ini file can be selected from the **Sequence Name** combo box.

File Frame

- Read – reads the selected sequence into the edit area.
- Write – writes the sequence that is in the edit area to the sequence.ini file.

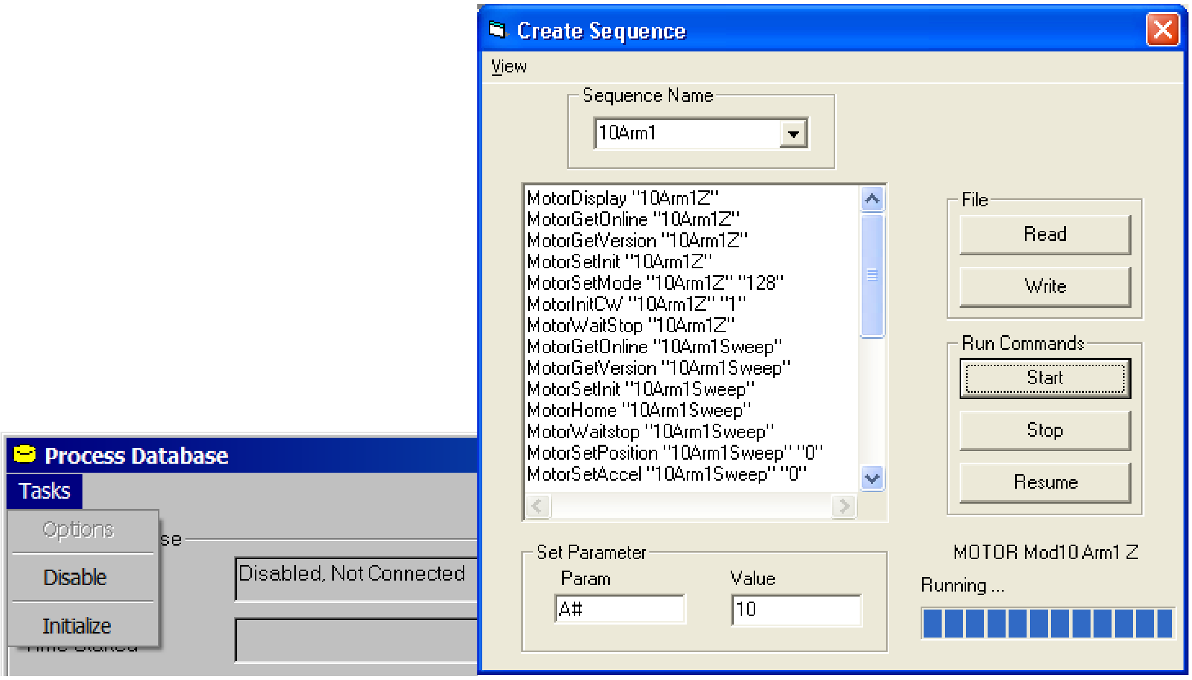
Run Commands Frame

- Start – click here to start the sequence.
- Stop – click here to stop the sequence.
- Resume – click here to resume a stopped sequence.

Set Parameter Frame

- Param – enter the name of a parameter whose value you'd like to modify.
- Value – enter the new value for the parameter.

The lower right corner will display the device name if the appropriate display command is in the sequence. A progress bar will display the current progress of the sequence and above it a status will be displayed – either "Running…" or "Done".


Create Sequence
View
Sequence Name
10Arm1
MotorDisplay "10Arm1Z"
MotorGetOnline "10Arm1Z"
MotorGetVersion "10Arm1Z"
MotorSetInit "10Arm1Z"
MotorSetMode "10Arm1Z" "128"
MotorInitCW "10Arm1Z" "1"
MotorWaitStop "10Arm1Z"
MotorGetOnline "10Arm1Sweep"
MotorGetVersion "10Arm1Sweep"
MotorSetInit "10Arm1Sweep"
MotorHome "10Arm1Sweep"
MotorWaitstop "10Arm1Sweep"
MotorSetPosition "10Arm1Sweep" "0"
MotorSetAccel "10Arm1Sweep" "0"
File
Read
Write
Run Commands
Start
Stop
Resume
Set Parameter
Param
A#
Value
10
MOTOR Mod10 Arm1 Z
Running ...
Process Database
Tasks
Options
Disable
Initialize
Disabled, Not Connected

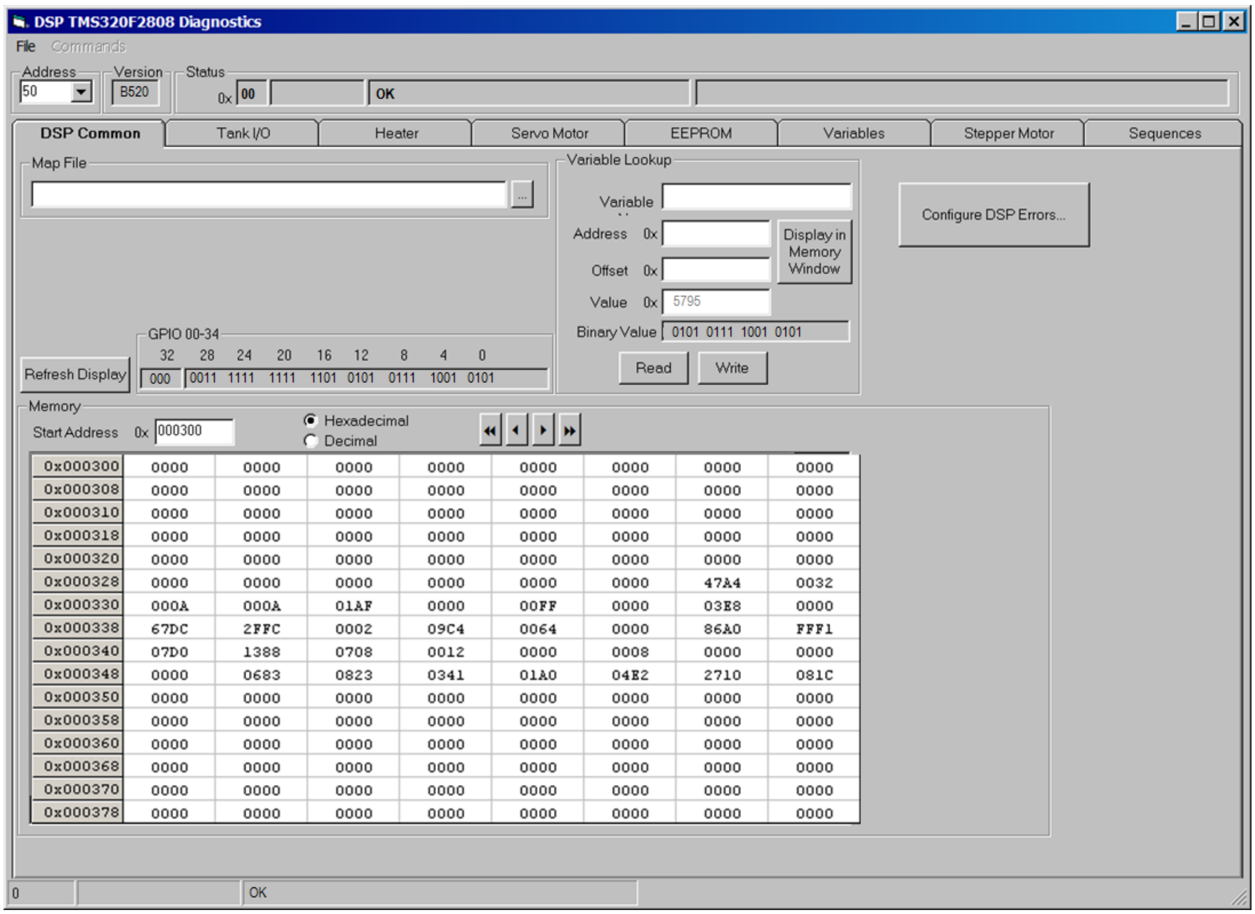
This Page Left Intentionally Blank

DSP Diagnostic

DSP TMS320F2808 Diagnostics Window

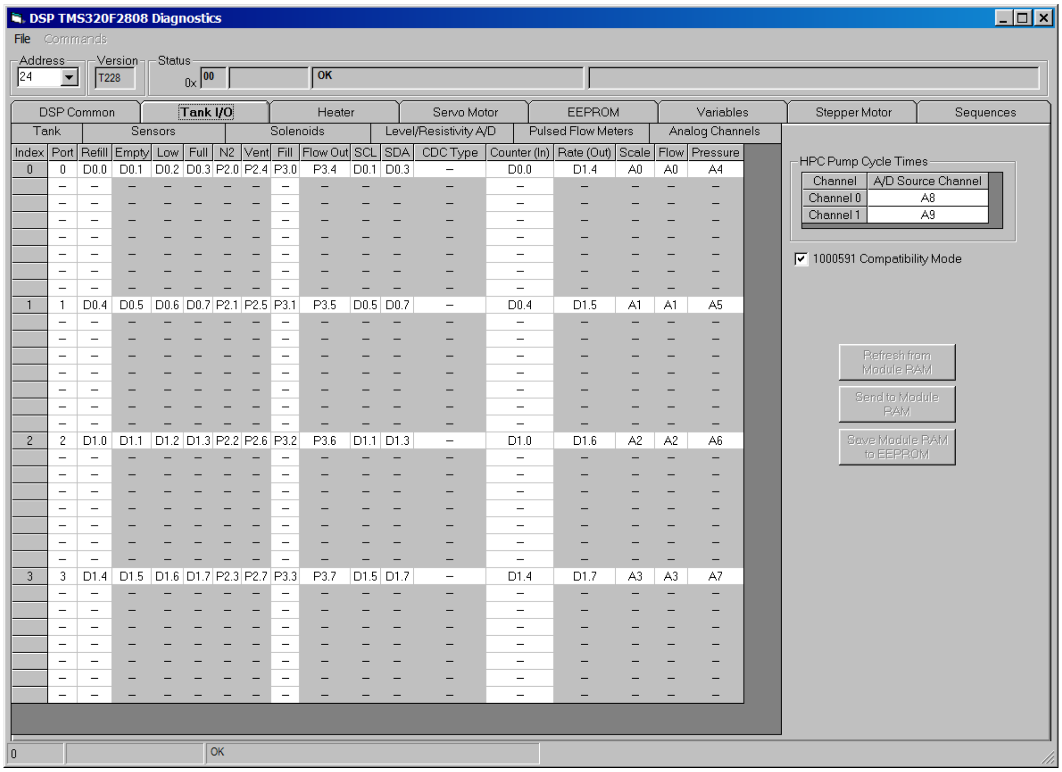
The DSP Window can have three or more tabs depending upon what type of module is being addressed. The following examples illustrate the Windows for a 1000633 Servo Module. There are four tabs for this type of module. This is an advanced diagnostic Tool that only fully trained and authorized users should use.

DSP Common



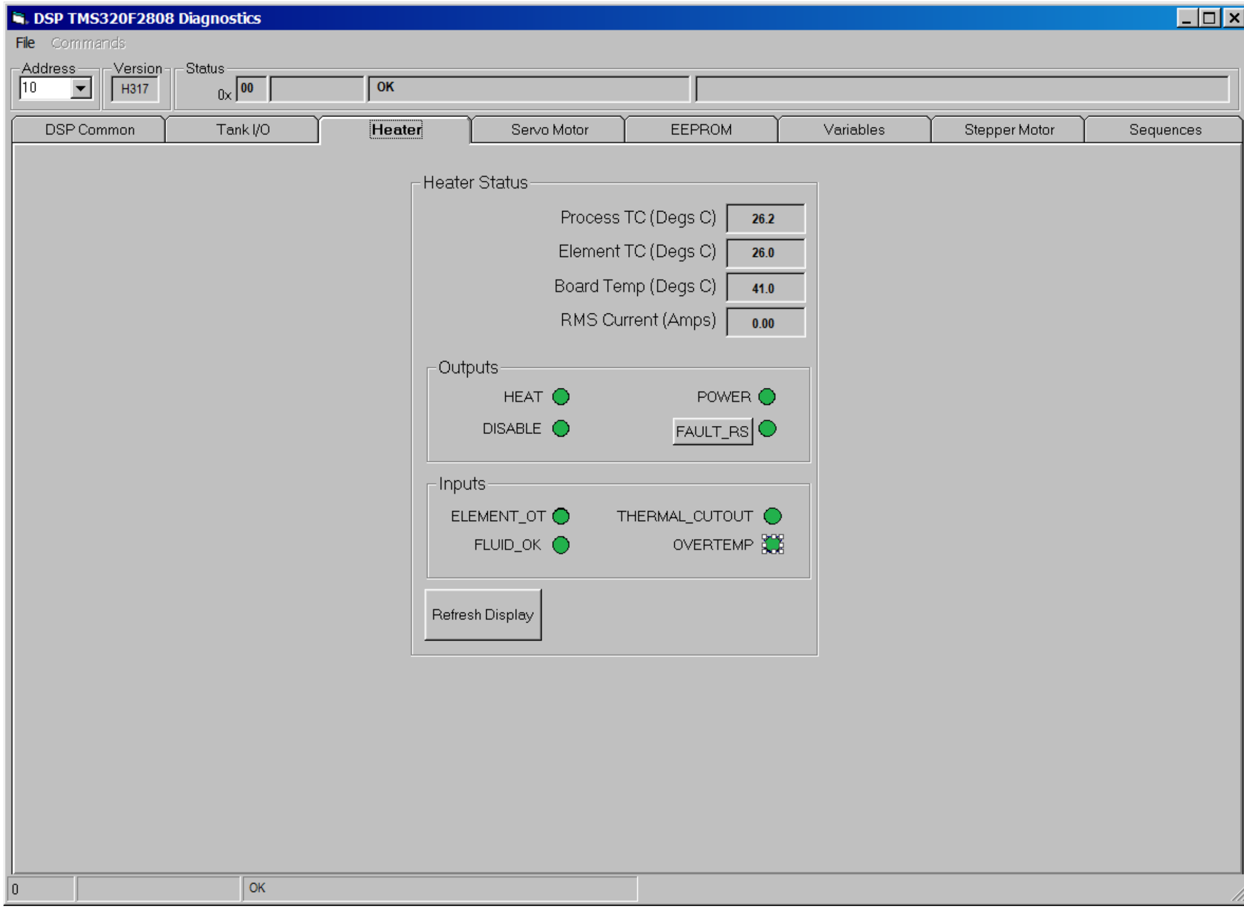
This tab gives direct access to the memory locations in the microcontroller.

Tank I/O



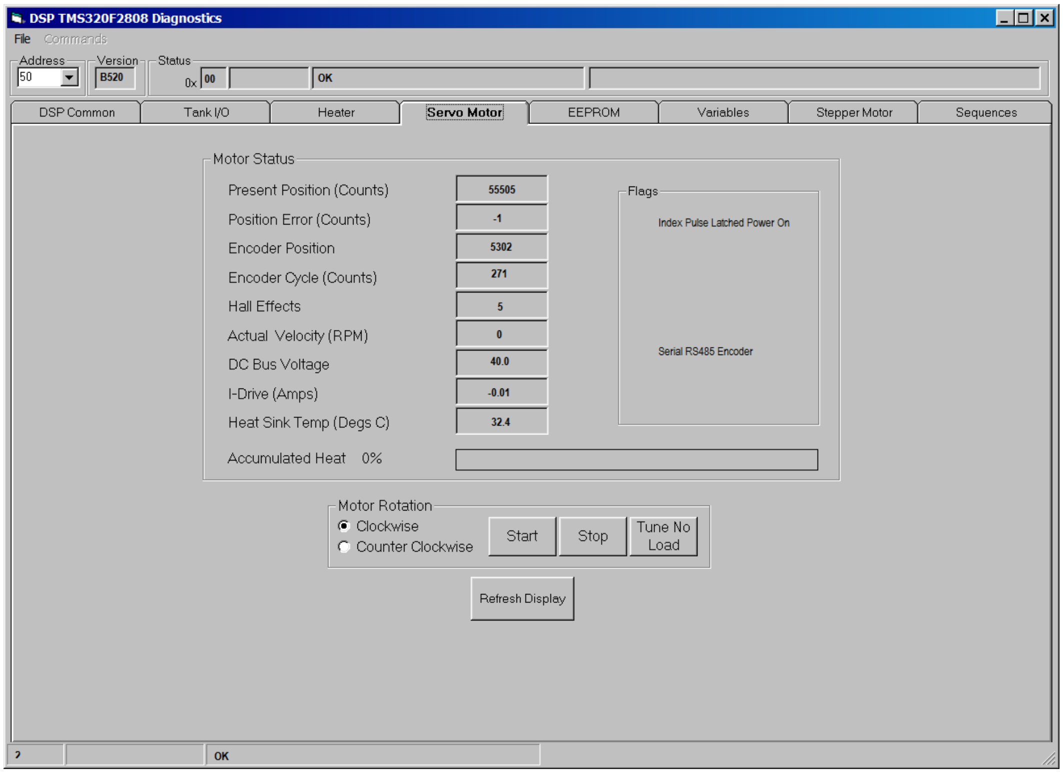
This tab displays how the firmware is mapped to the hardware configuration for devices connected to the selected addressed tank I/O module.

Heater



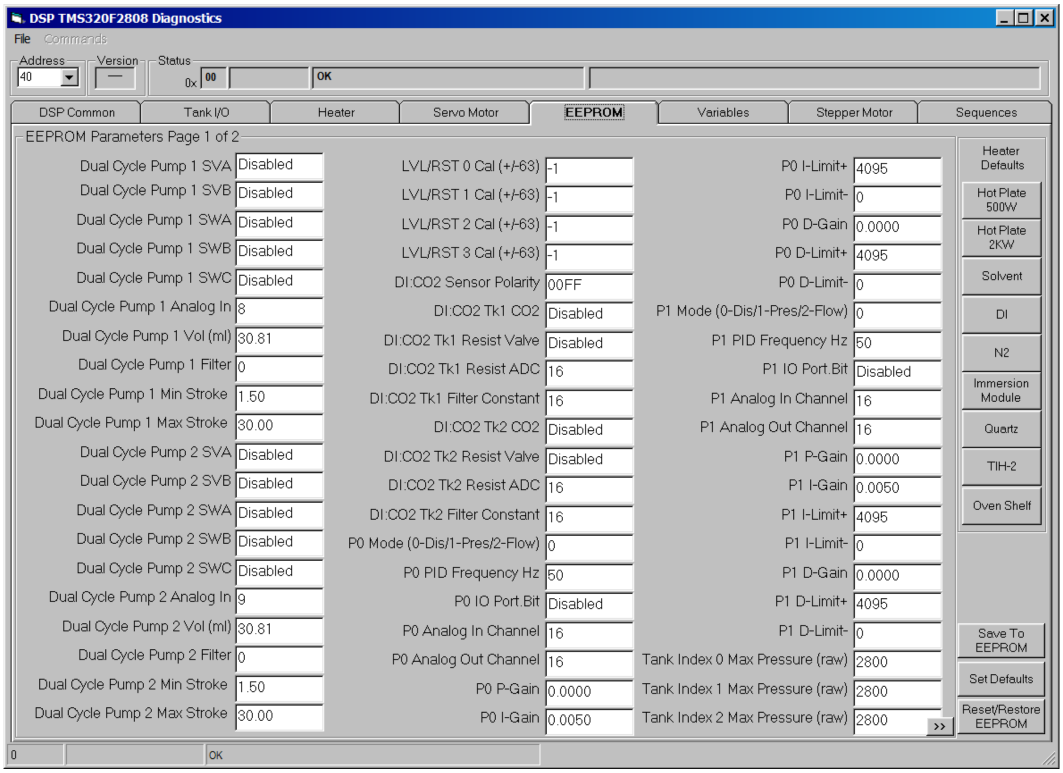
This tab displays the heater status, the inputs such as floats and thermocouples, and the outputs.

Servo Motor



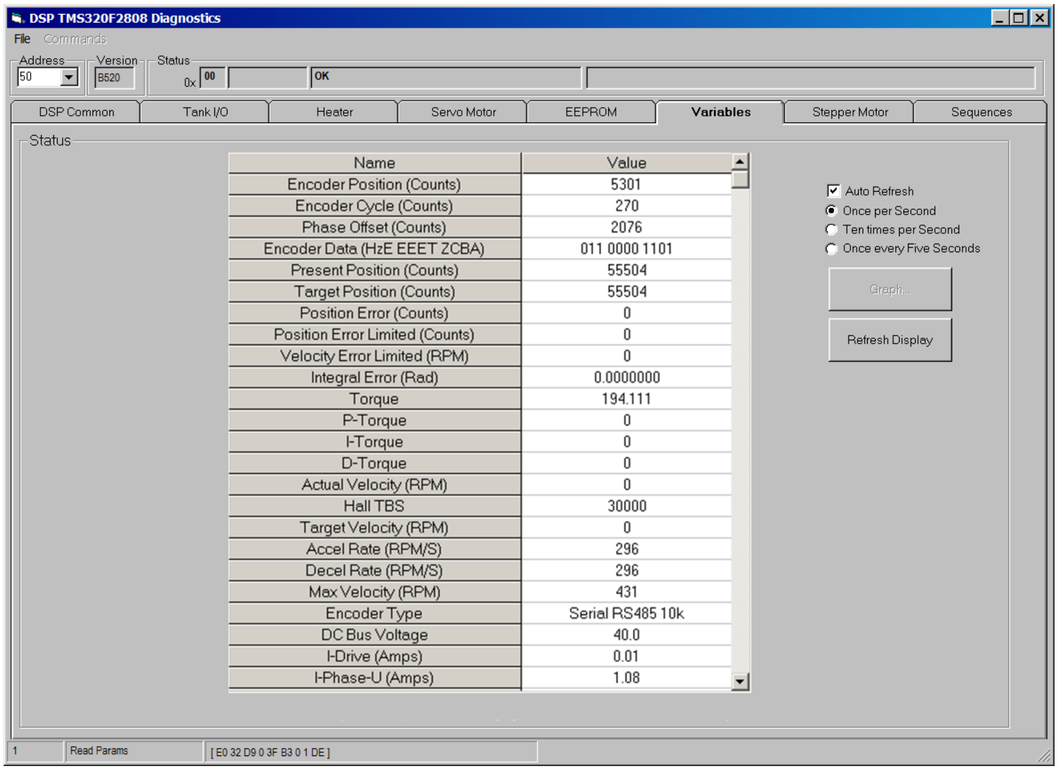
This tab displays servo motor status, any firmware flags that are unique to the particular motor/encoder combination, and the ability to test the motor rotation.

EEPROM



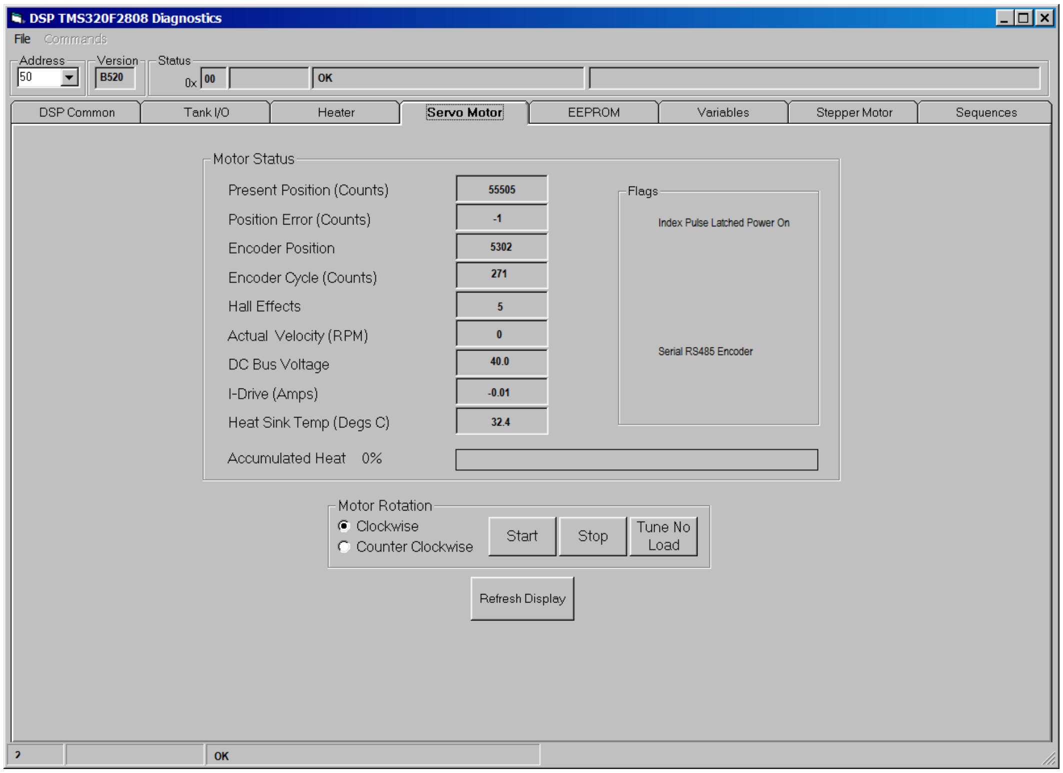
This tab displays the firmware parameters for the addressed module and allows direct access to them.

Variables



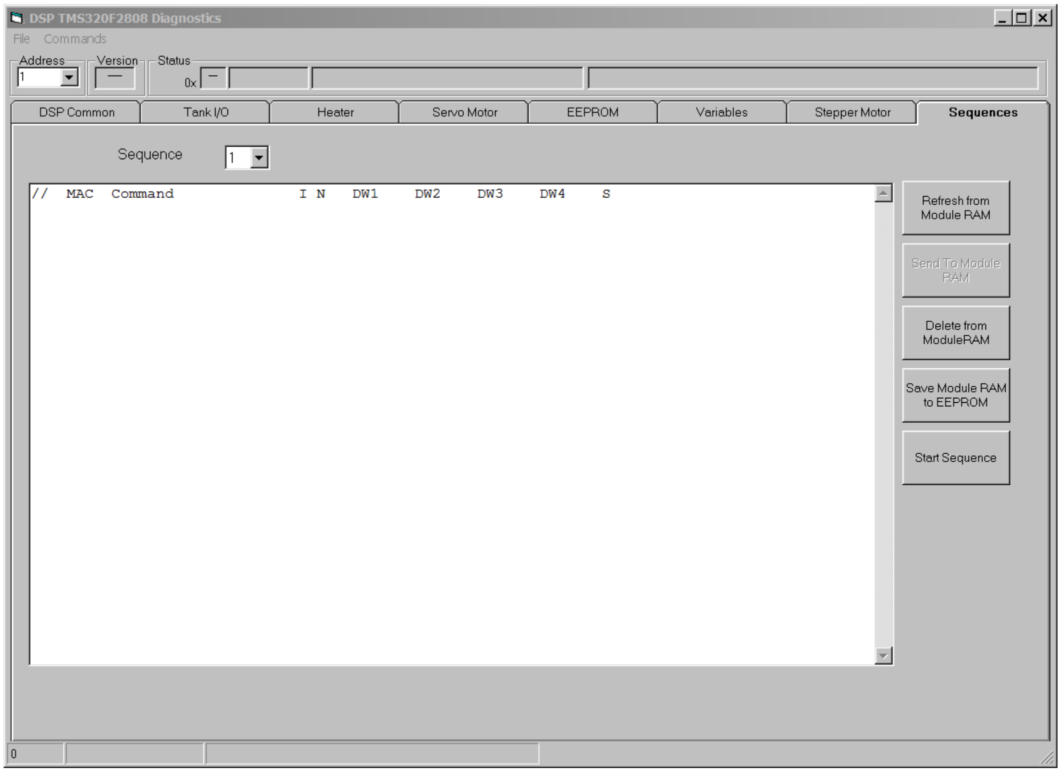
This tab displays the values for module-specific variables.

Stepper Motor



This tab displays stepper motor status, any firmware flags that are unique to the particular motor/encoder combination, and the ability to test the motor rotation.

Sequences



This tab displays …

7: Program Files

Overview

A program file is a set of instructions describing Tool actions. Every program file is based on a Definition file, which contains available functions, involved devices, parameter's range, resolution, and default value. Each type of program file can have one or more recipes incorporated into its definition.

This Tool has 5 types of program files:

Type	Purpose	Definition file	Recipe file
Process	Cleaning process for every cleaning station and brush box, including setup operations which are executed once when a recipe is loading. Can include Toolbar commands.	Function.def	*.prs
Purge	Purge process for every cleaning station and brush box including Purge Delay determining time interval between purge cycles.	Function.def	*.prg
Handler	Instructions for a robotic handler, including setup operations that are executed once when a recipe is loading, and commands to start process recipe in every station. Can include Toolbar commands.	Handler.def	*.hnd
Toolbar	Single step commands associated with Toolbar Buttons on the main screen.	Toolbar.def	*.tbr
Light Tower	Instructions for signal lights and a buzzer.	Light.def	*.ltw

Process program files can have many recipes. These vary by Tool configuration. Typical recipes are:

- **Process Module recipes** – specific process instructions for each process module.
- **Setup** – global parameter settings for devices like heaters, tank pressures, and tank chemistry mixing.
- **Neslab** – set temperatures for heat exchanger Neslabs.
- **Conditioning** – instructions for wafer conditioning of brush boxes.

Purge program files are similar to process program files. These vary by Tool configuration. Typical recipes are:

- **Process Module recipes** – specific purge instructions for each process module.

- **Purge Delay** – time delay specified in seconds for running the purge recipes.

Handler program files can have several recipes. These vary by Tool configuration. Typical recipes are:

- **Handler** – specific handler motion steps and sequences.
- **Setup** – typically sets specific wafer sizes for Tools capable of multiple size wafers.
- **ScanCass** – specific handler motions for scanning cassettes.

Toolbar program file recipes are Tool specific and typically there is only one file. Each recipe is for a specific Toolbar Button and contains the parameters that may be necessary for its execution. Typical recipes are:

- **FillTk*** - instructions for filling a specific chemistry tank.
- **DrainTk*** - instructions for draining a chemistry tank.
- **Open Doors** – opens module doors.
- **Load Cass*** - loads a specific cassette.
- **Retract Y** - retracts all handler Y axes.

Light Tower program file recipes are typically limited to the following:

Ready - Tool is ready for a new cycle / process;

Running - Tool is executing a task determined by Run Type;

No Material - the last wafer has been picked up from an input cassette or a wet station;

Inoperable - a fatal error has not been fixed;

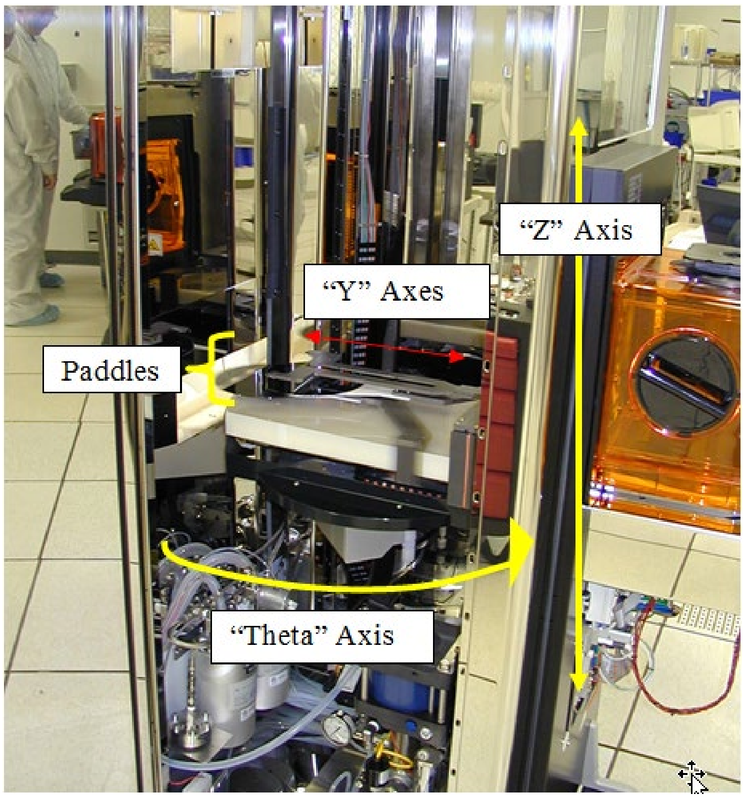
Operator Request - a fatal error has happened, Tool is stopped;

Task Done - a task determined by Run Type has been done, message “Stack / Process Done” appears on a screen.

Handler Programs

The Handler is used to transport Product/Wafers from the input cassette(s) to the Process Chambers, Wet Stations, Brush Boxes, and Output Cassette(s).

Each Handler has three axes of motion, consisting of a Vertical axis ("Z"), a Rotational axis ("Theta"), and as many as four Linear axes (Y1, Y2, Y3 and Y4).

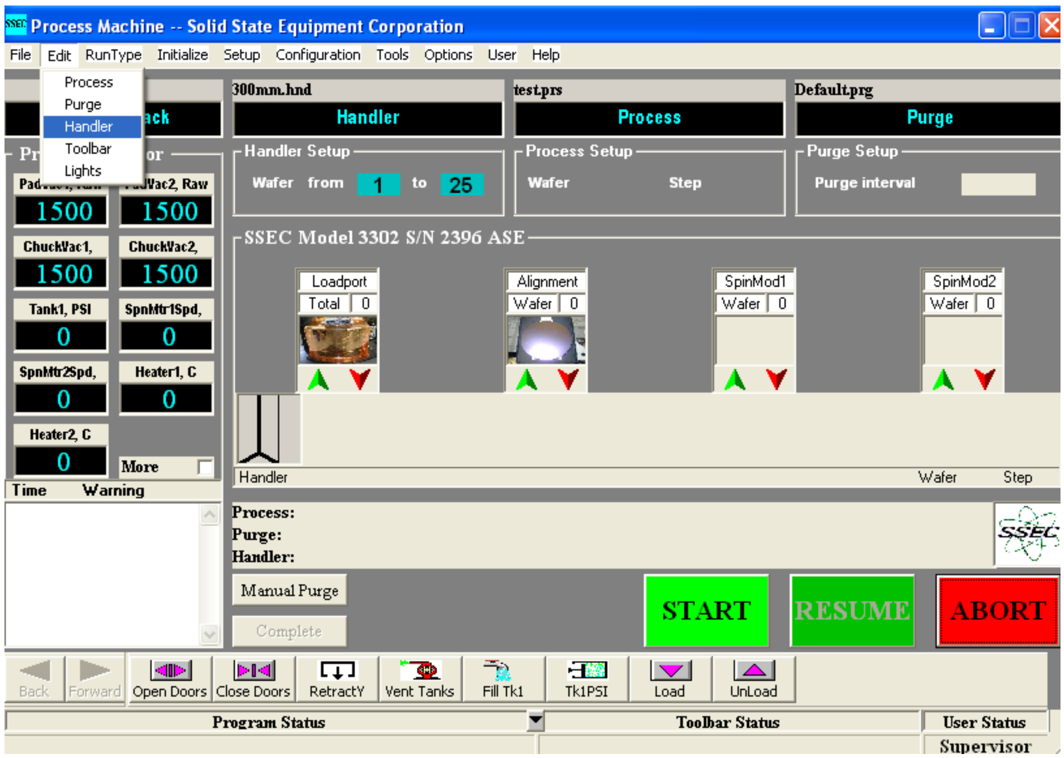


Each of the three linear axes (Y1, Y2, and Y3) include a mechanical Paddle (or end effector) which is used to perform the actual pickup and placement of each wafer into the appropriate station. Each Paddle has a specific function. For example, the bottom Paddle (Y1) picks up a wafer from the cassette, aligns the wafer and then places it in either spin chamber 1 or 2. The middle Paddle (Y2) picks up the processed wafer from spin chamber 1 or 2 and places it into the output cassette. The upper most Paddle (Y3) is used to scan the wafers in the input cassette.

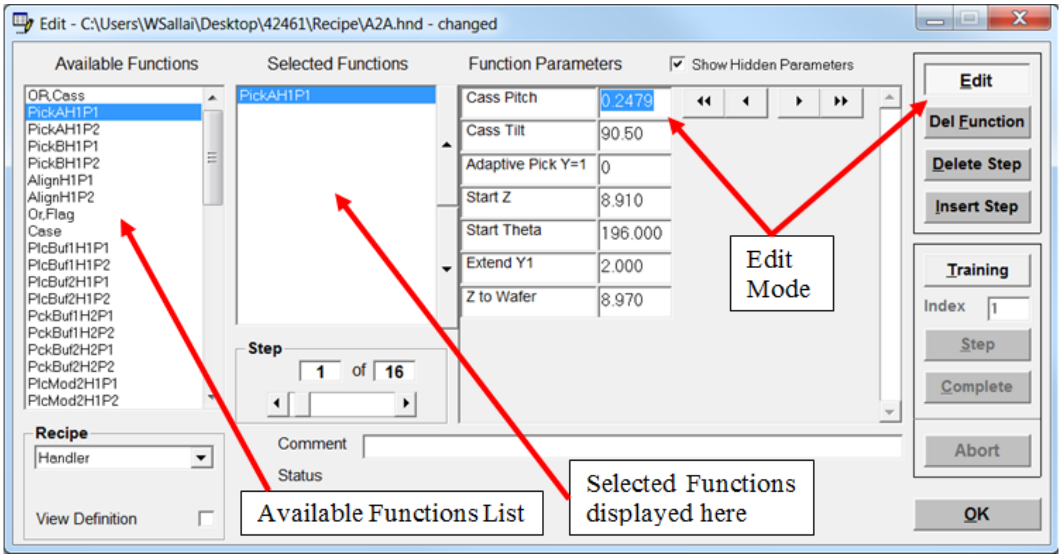
The Paddles are manufactured with vacuum ports which are used to hold and sense the wafer.

The Handler edit/teach program utilizes VPSP proprietary Software and control. The teach process involves picking specific tasks ("available functions") from a Pull-down Menu, and then manually referencing each of the starting and finishing locations of each Handler motion required for that "function".

To access the edit/teach menu, select "Edit" from the SSEC Process screen. Then select "Handler" from the Pull-down Menu. The handler recipe is a step by step list of the available functions used to move the wafers from station to station for processing.



The Edit Menu:



The **"Available Functions"** list consists of functions that can be used to execute a particular action in handler recipe step. These functions can be inserted into the appropriate handler step by "double-clicking" on the function. The function name usually consists of an "Action" (pick or place), "Destination" (FOUP, Mod1, Mod2 etc.) and/or "Paddle used" (p1, P2, etc.). For example: PickMod1P1 = Pick up wafer from Mod1 using Paddle1.

The **"Selected Functions"** list consists of individual steps to move the wafer through the System for processing.

The **"Function parameters"** are the individual movements that the handler will execute during the step.

This process sounds somewhat complicated; however, it is quite simple from an end user stand point as this process has been completed for the end user during the manufacturing process. Any changes or additions to the handler program teach positions can be accomplished by editing an existing handler program. Typically only minor positional changes are required once the teach process is initially completed.

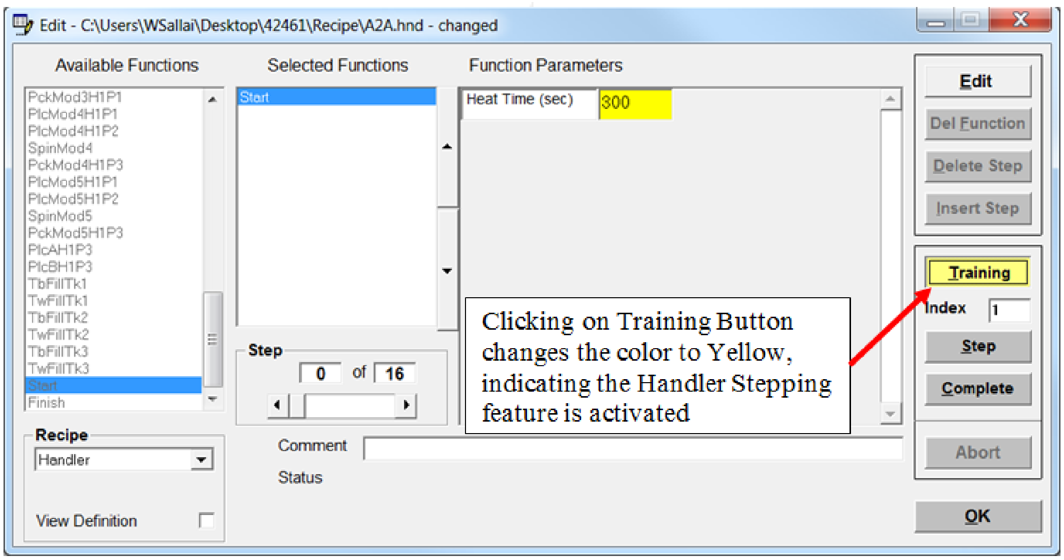
The "Editing" menu can be used to physically move the handler through each sub-step in each "Function parameter" list displayed by opening the handler edit screen and then clicking on the "Training" button.

This Page Left Intentionally Blank.

Training the Handler

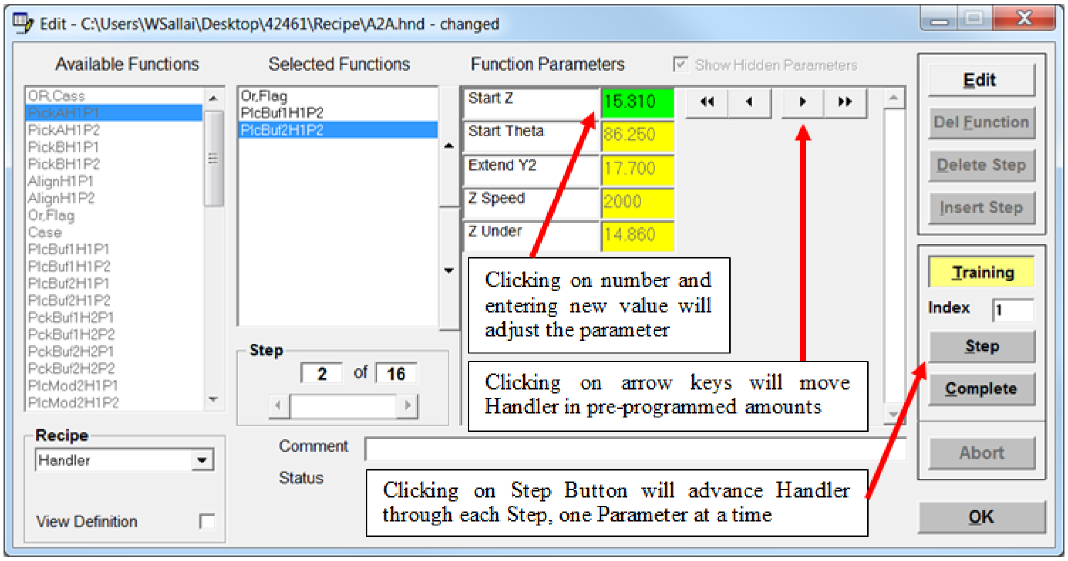
NOTE

It is assumed that the person performing this function is properly trained to avoid activation of this feature while certain error conditions are in place, which could cause the Handler to damage a Wafer or itself.



The steps in a typical Handler Recipe are:

Step 0	Start	Setup handler (Retract Paddles etc.)
Step 1	TCLoad	Dock the FOUP
Step 2	TWLoad	Wait for the FOUP to dock
Step 3	PickInP1	Pick wafer from FOUP using Paddle 1
Step 4	AlignP1	Align the wafer using Paddle 1
Step 5	Case	Enables the handler to place wafers in multiple stations
	PlcMod1P1	Place wafer in Spin Chamber 1 using Paddle 1
	PlcMod2P1	Place wafer in Spin Chamber 2 using Paddle 1
Step 6	Case	Enables the process to run in multiple stations
	SpinMod1	Process the wafer using Spin1 process parameters
	SpinMod2	Process the wafer using Spin2 process parameters
Step 7	Case	Enables the handler to place wafer in multiple stations
	PickMod1P2	Pickup wafer in Spin Chamber 1 using Paddle 2
	PickMod2 P2	Pickup wafer in Spin Chamber 2 using Paddle 2
Step 8	PlcOutP2	Place wafer in the FOUP using Paddle 2
Step 9	TCUnload	Unload the FOUP
Step 10	TWUnload	Wait for FOUP to unload



Clicking on the step button will advance to that step and physically move the handler or enter parameters into memory (such as cassette slot pitch).

NOTE

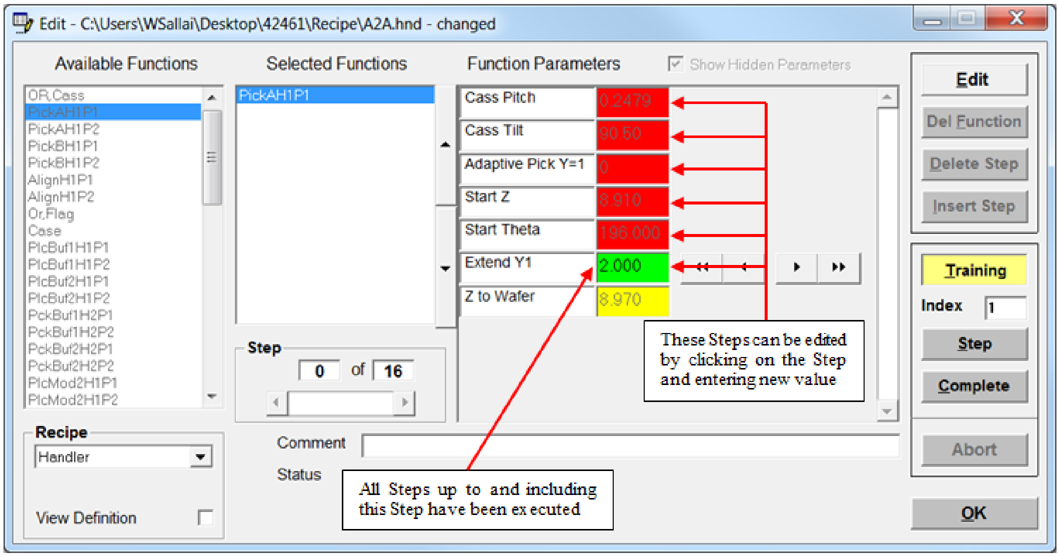
All moves will be executed immediately upon clicking on **Step**.

The Function parameter list will change color from “Yellow” to “Green” which indicates that the entry or movement is complete. Previous steps will turn “Red”. The position or entry can now be “Edited”. Simply click on the value (number) in the highlighted box (Green or Red) and change the value using standard Windows editing procedures or click on the arrow keys will move the handler in programmed amounts. Again, the operator or technician must be properly trained, as the new value entered will be exercised as soon as the “enter” key is pressed (after editing of the value is complete).

The parameters for picking up the wafer can be adjusted simply by clicking on a previously executed step and entering the desired value.

Step 0: Start

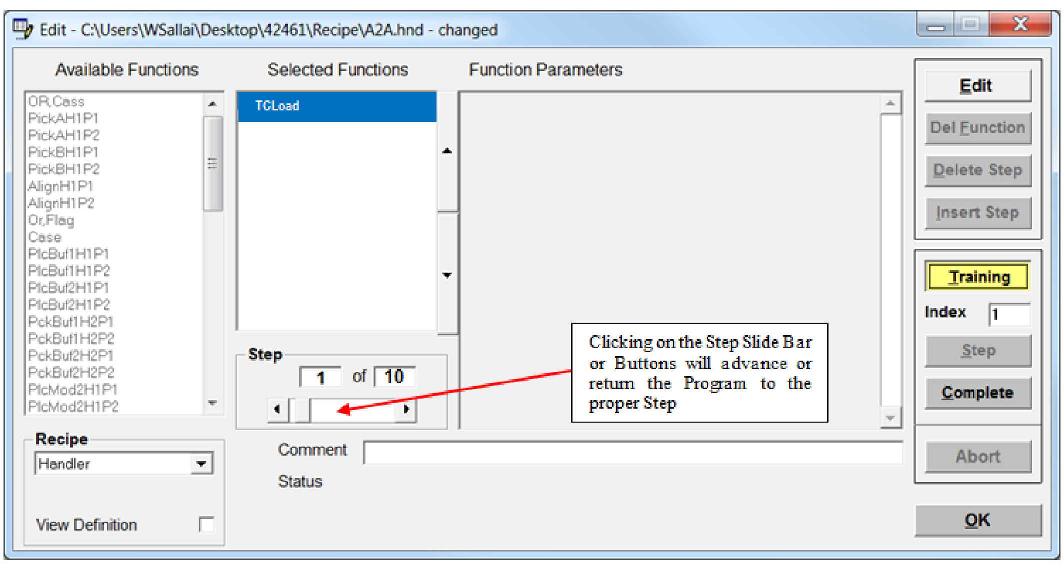
The start command will setup the handler to begin the recipe. Examples are: Retract the Paddles, fill tanks, etc. This command is factory set. There are no user parameters associated with this command.



Step 1: TCLoad (The FOUP will move to the load position).

This step must be present so that the FOUP can move to the "Dock" position before picking up the wafer.

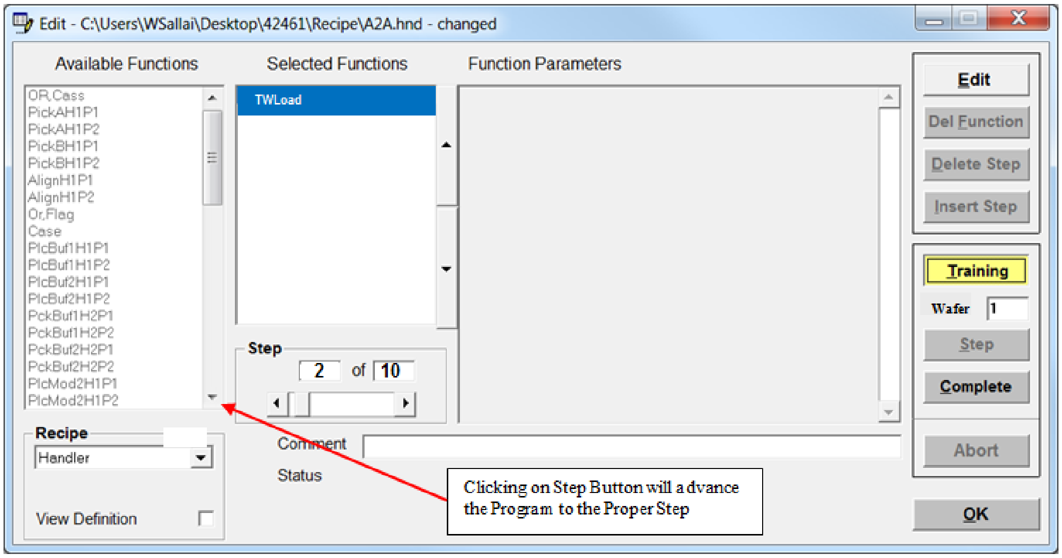
There are no user parameters associated with this command.



Step 2: TWLoad (The System waits for the FOUP to move to the load position).

This step must be present so that the handler does not attempt to pick up the wafer before the FOUP is in the “Dock” position.

There are no user parameters associated with this command.



Step 3: **PickInP1** (Picks up the wafer from the FOUP).

Single input/output cassette:

The vertical height will be the height that allows the Paddle to move into the cassette underneath the first wafer (top wafer position) and above the second wafer without hitting either one. The wafer will be picked from the top slot of the cassette and once processed the wafer will be placed back into the cassette in the same location.

Separate input and output cassettes:

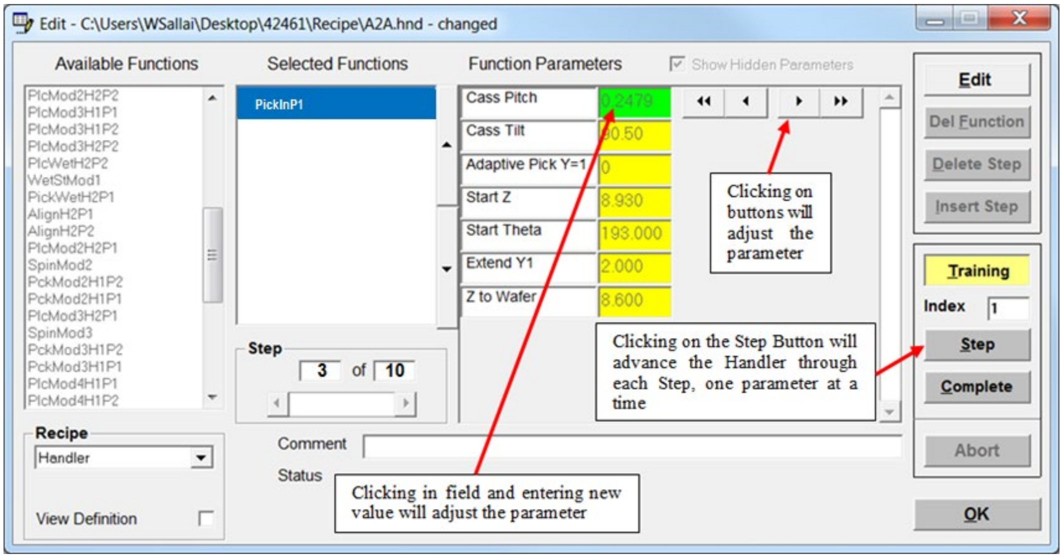
The vertical height will be the height that allows the Paddle to move into the cassette underneath the first wafer (bottom wafer position) and above the “H” bar without hitting either one. The wafer will be picked from the bottom slot of the cassette and once processed the wafer will be placed back into the output cassette in the top location.

The parameters for picking up the wafer from the FOUP are:

PITCH

The first step when picking up a wafer is to set the pitch of the cassette. To set this value simply measure the cassette or consult the manufacture's specs.

The first wafer position is the actual taught position. The pitch is used to calculate the vertical (Z) position of the remaining wafers in the cassette. For example: The vertical location of wafer number 5 is the Start Z value plus 4 additional pitches.



The pitch value can be either a positive value or a negative value.

A positive pitch will move the handler Z up. Positive pitch is used when the handler will be picking the first wafer from the bottom of the cassette.

A negative pitch will move the handler Z down. Negative pitch is used when the handler will be picking up the first wafer from the top of the cassette.

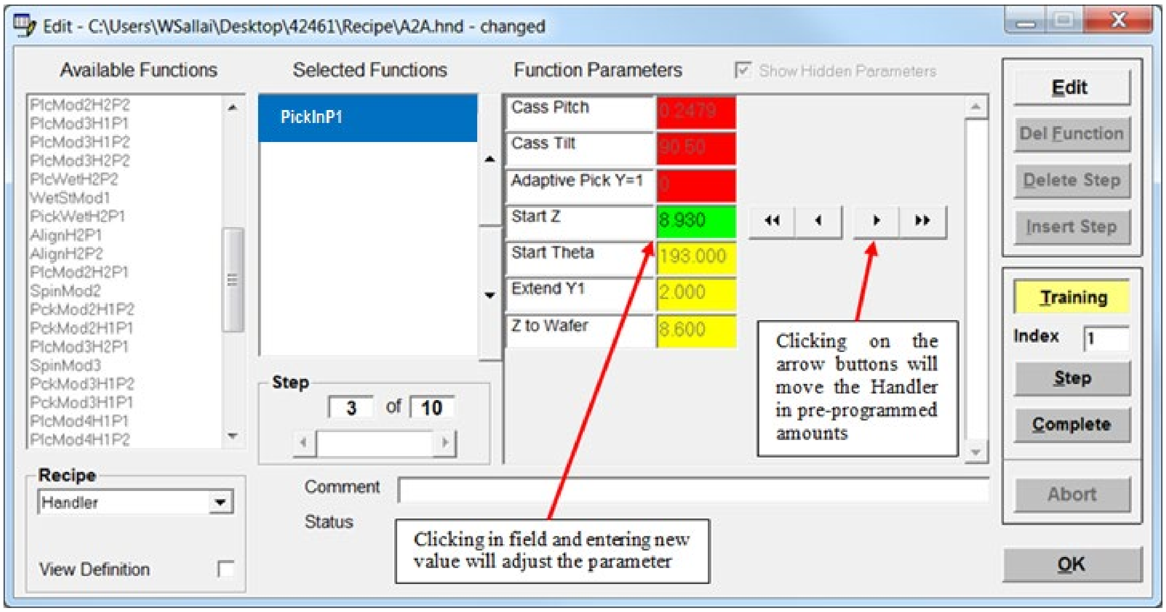
The height can be moved in 0.001" increments.

START Z

This is the vertical height of the handler to pick up the first wafer in the cassette.

The vertical (Z) position for systems using only one cassette for pick up and drop off is from the top slot of the cassette.

Two cassette (Input and Output) systems will pick from the bottom of the input cassette and drop off to the top of the output cassette. The height can be moved in 0.001” increments.



Single input/output cassette:

The vertical height will be the height that allows the Paddle to move into the cassette underneath the first wafer (top wafer position) and above the second wafer without hitting either one.

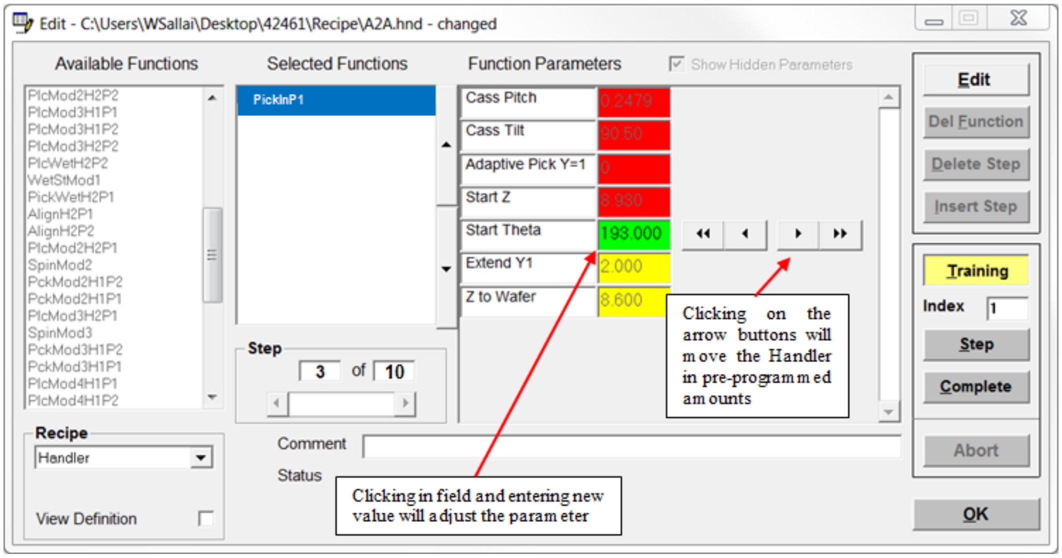
Separate input and output cassettes:

The vertical height will be the height that allows the Paddle to move into the cassette underneath the first wafer (bottom wafer position) and above the “H” bar without hitting either one.

START THETA

This is the rotation value in degrees. The theta position should be set so that the Paddle is centered under the wafer when it is picked up.

The theta can be moved in 0.001" increments.



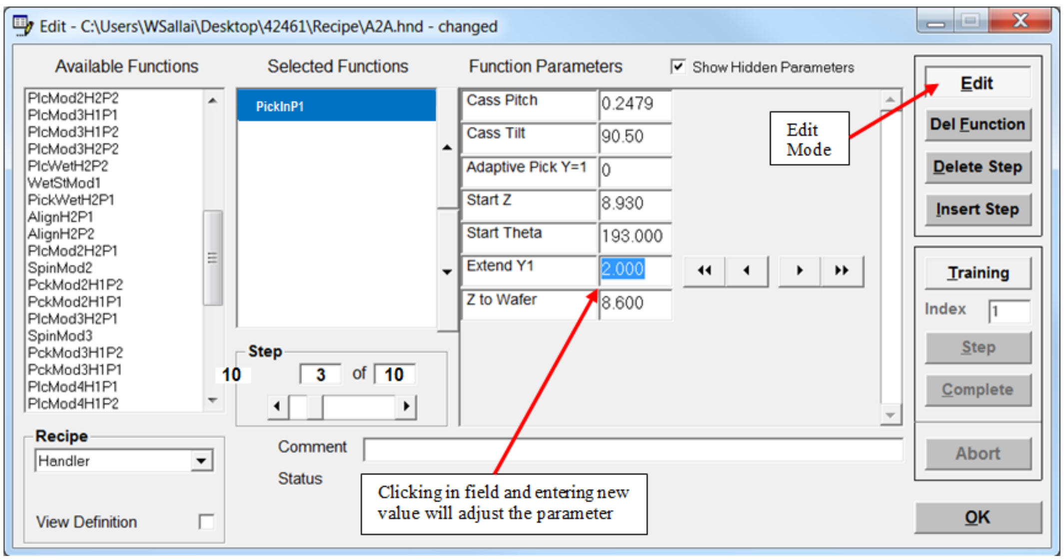
EXTEND Y1

This moves the lower Paddle under the wafer once the Z and Theta axis are in position. The theta can be moved in 0.001" increments.

CAUTION: When moving to this step the Paddle will move to the programmed value. If the "Start Z" or "Start Theta" values are incorrect, damage to the wafer or Paddle could occur.

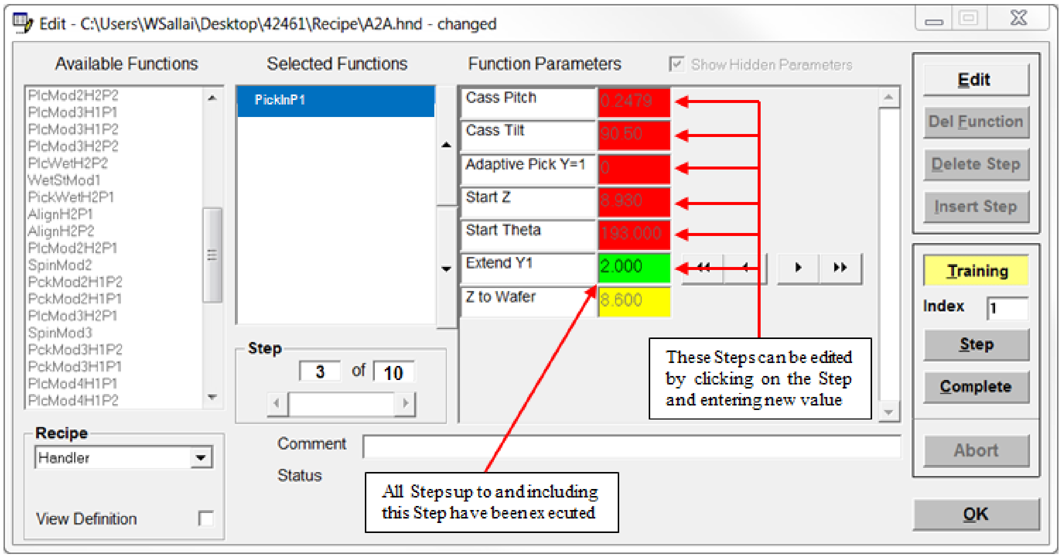
The Extend Y1value should be set to a small number (1 or 2 inches) prior to execution of this step to prevent accidental damage.

Click on the Edit button and then click on the Y1 value and change to a small number. This will move the Paddle a short distance when the move is executed in the training mode



The **Training Mode** can now be selected.

Click on the “Extend Y1” parameter. This will execute all the steps up to and including “Extend Y1”.



The handler will now be in the approximate “Theta” and “Z” positions. The “Y1” Paddle will have moved the amount that was entered in the Edit mode (1 to 2 inches).

Entering a new value in the Extend Y1 step will move the Paddle towards the cassette. The “Start Z”, “Start Theta” and the “Extend Y1” values can be changed to move the Paddle into position under the wafer.

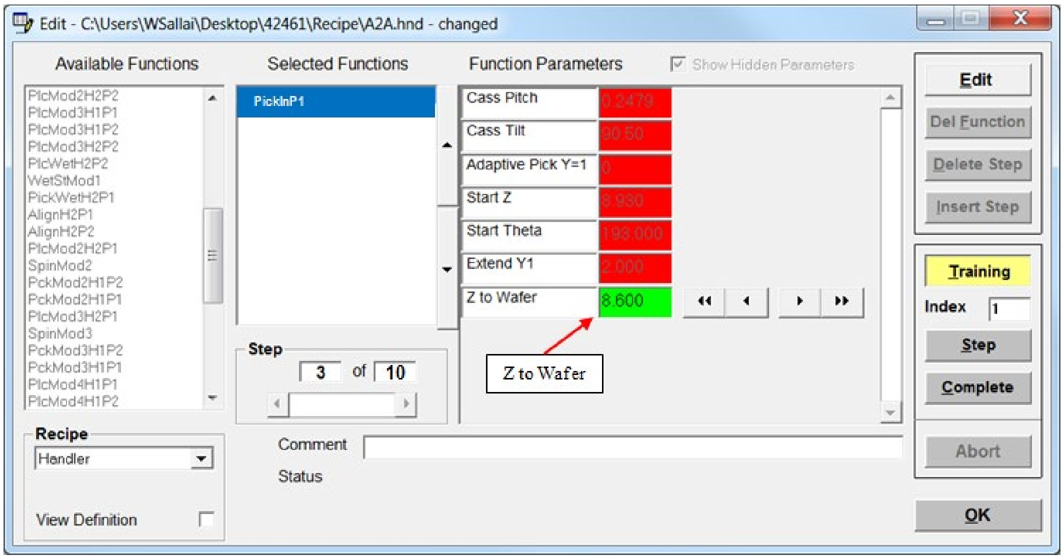
NOTE

If you are editing an existing Handler Program, the values should be close to the proper position and only minor adjustments will be needed.

The changing of the “Y1” and/or the “Theta” values could affect the handling in the remaining positions. You must verify these steps.

Z TO WAFER

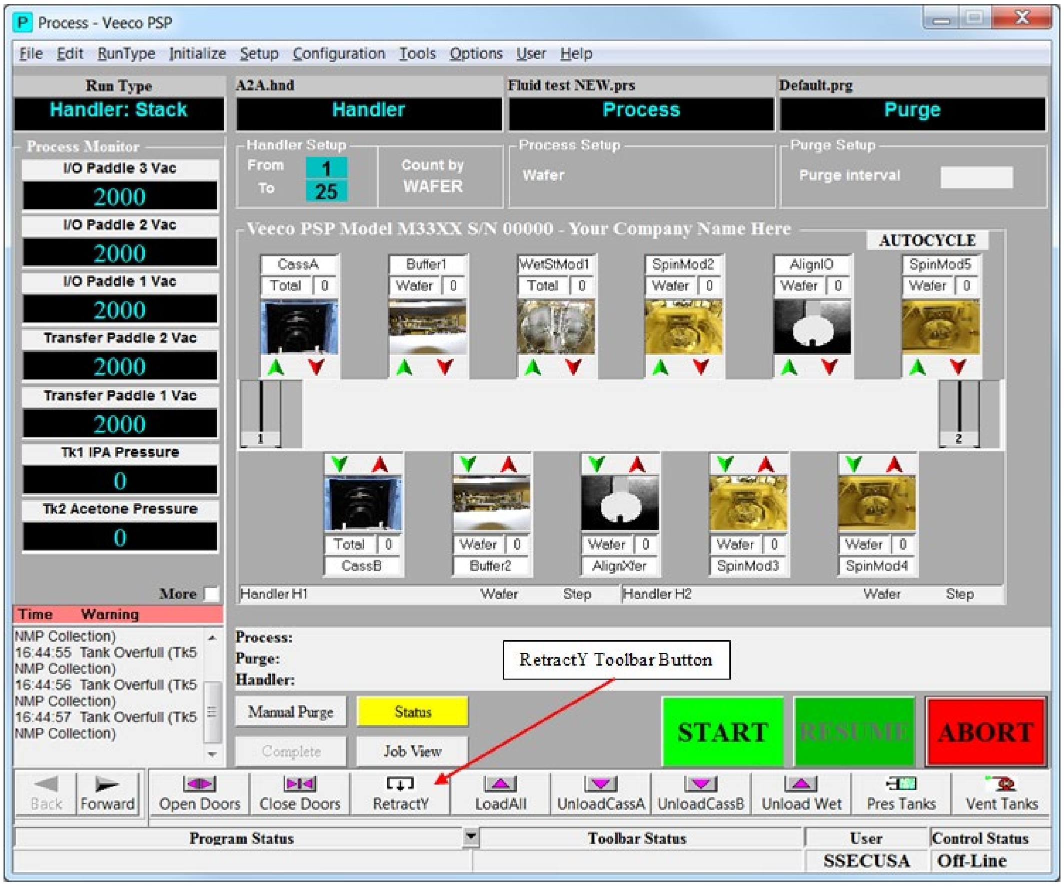
The Paddle vacuum is turned on and the handler moves to this position to pick up the wafer. Once the vacuum threshold is met the handler will retract the wafer and proceed to the next step in the handler recipe.



This value should be set so that the wafer is lifted up within the slot of the cassette but not hitting the top of the slot.

It is not recommended that the “Start Z”, “Start Theta” or “Extend Y1” parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

To retract the Paddle safely, simply click the "RetractY" Toolbar Button on the main process screen.

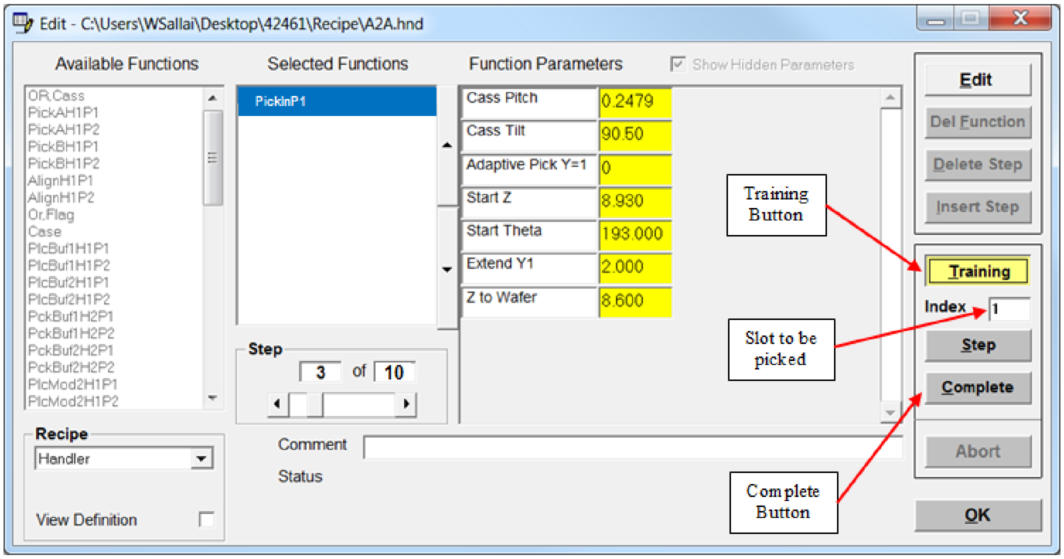


To verify that this step was taught correctly, the complete step can be executed.

Place a wafer in the cassette slot #1 and select "Training".

Clicking on the "Complete" button will execute all of the steps in the function.

Watch for a smooth pickup of the wafer with no hitting or scraping of the wafer or Paddle.



Once the pick is verified, pickup from the other slots of the cassette need to be verified.

Place a wafer into one of the middle slots (i.e., slot 10 or 11). Select the “Training” mode, enter the slot number in the “Wafer” Window and click “Complete”.

Next, place a wafer into slot #25 and verify its proper pick up.

If the wafers in the first few slots (wafer 1, 2, etc.) are handled correctly, but the higher number slots (20, 21, etc.) are not, the “Pitch value may be need to be adjusted.

NOTE

Before adjusting the “Pitch” value, try a different Cassette. A warped Cassette could be the problem.

Step 4: **Align P1** (Aligns the wafer using the video alignment camera).

This step will position the wafer under the video camera and perform an alignment. This allows for the proper placement of the wafer into the spin chambers.

The vision setup is explained in the Vision Teaching section of this manual.

The parameters for aligning the wafer are:

Z START

This is the vertical position of the handler that allows the wafer image to be centered in the camera field of view.

THETA START

This is the rotational position of the handler that allows the wafer image to be centered in the camera field of view.

EXTEND Y1

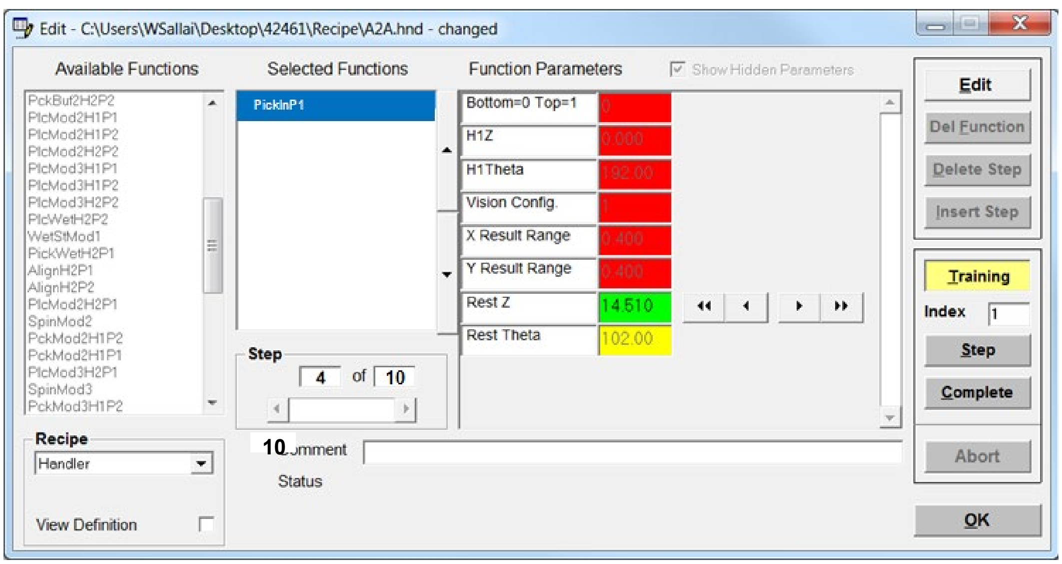
This is the Paddle position of the handler that allows the wafer image to be centered in the camera field of view.

VISION CONFIG

This is the stored pattern number of the alignment image in the frame grabber pcb that is used for wafer alignment.

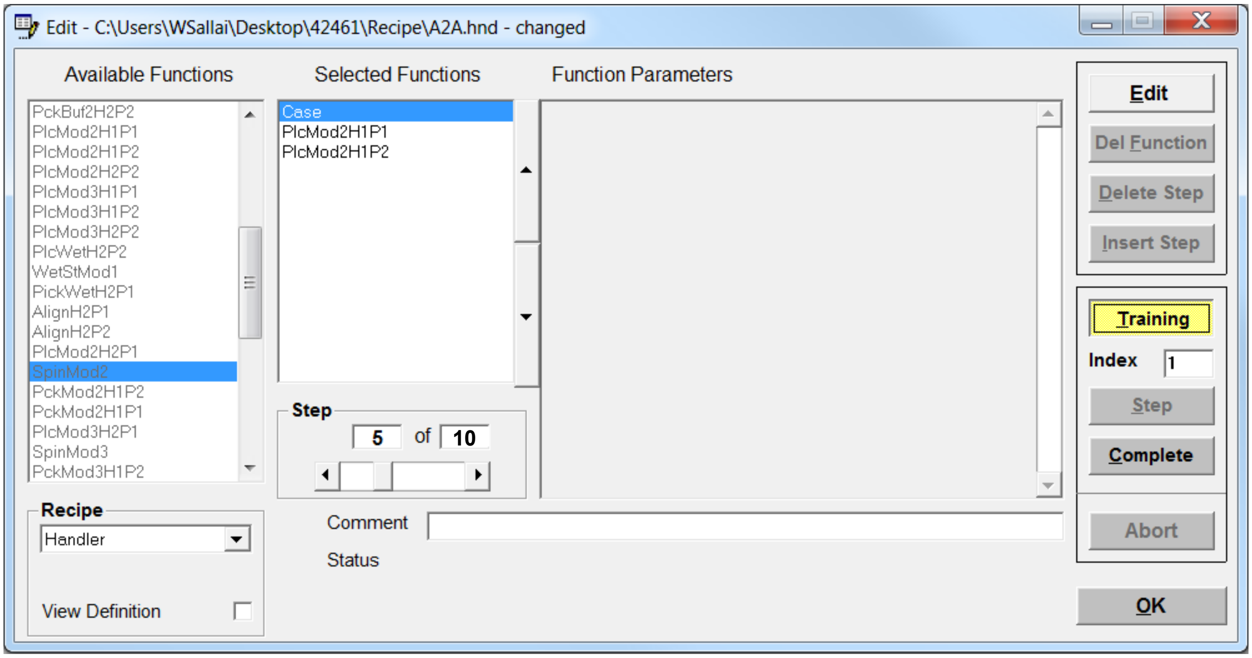
Z REST

This is the z position the handler will go to after the alignment is complete.



Step 5: Case

Allows the handler to go to different stations during this step. The wafer will either be placed into the next available spin chamber (spin chamber 1 or 2).



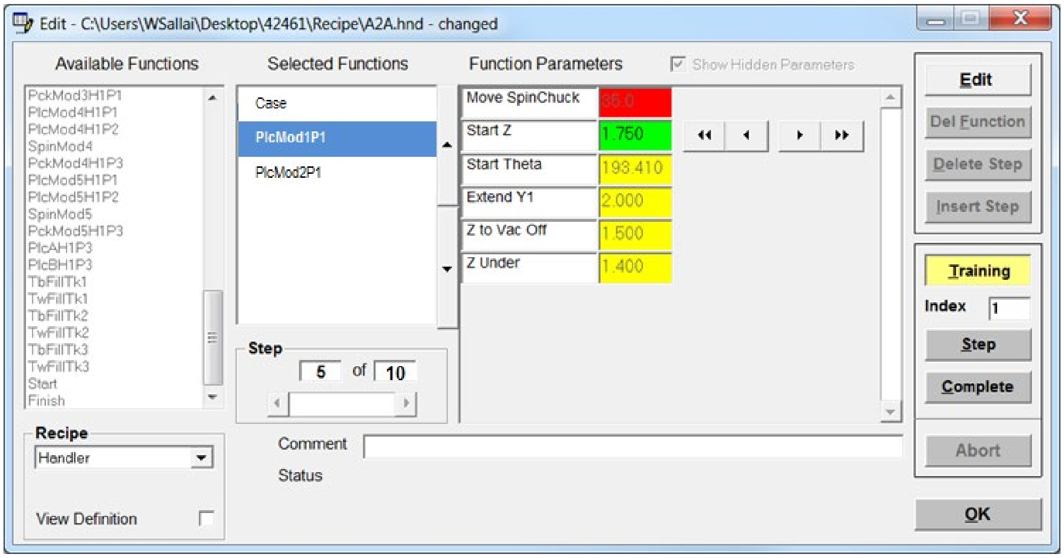
There are three (3) functions in this step. The "Case" function instructs the handler to place in spin chamber 1 (PlcMod1) or spin chamber 2 (PlcMod2). The handler will determine the available spin chamber and execute the moves.

PlcMod1 Places the wafer into Spin Chamber 1 for processing.

The function parameters for placing the wafer into Spin Chamber 1 are:

Z START

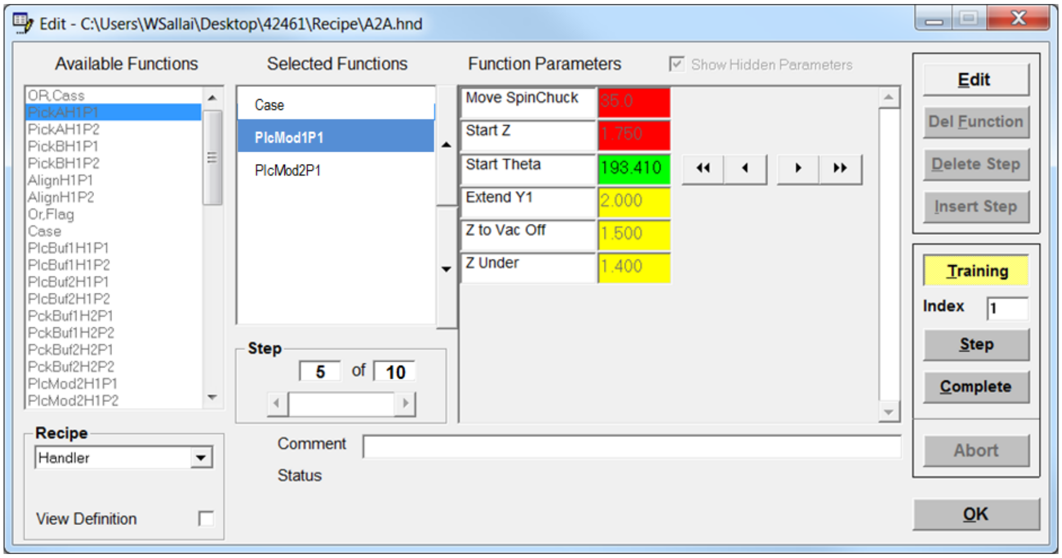
This is the vertical position of the handler that allows the wafer to be moved into the Chamber for placement. The Z can be moved in 0.001” increments.



The correct “Z Start” position should be high enough for the wafer and Paddle to clear the top of the chuck.

START THETA

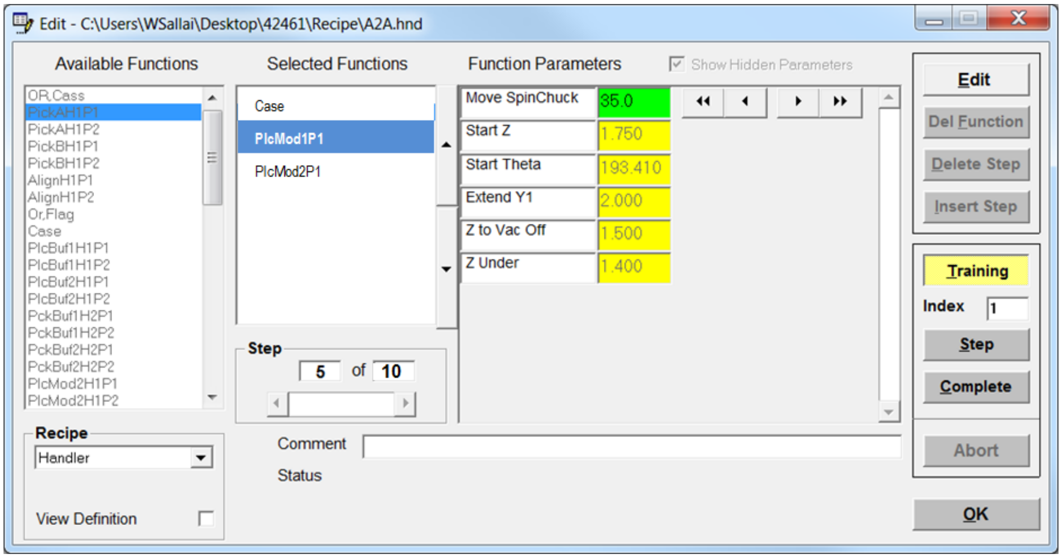
This is the rotational position of the handler that allows the wafer to be centered above the spin chuck for placement. The theta can be moved in 0.001” increments.



The correct “Start Theta” position is when the wafer is centered between the wafer retainers on the chuck.

SPIN POSITION

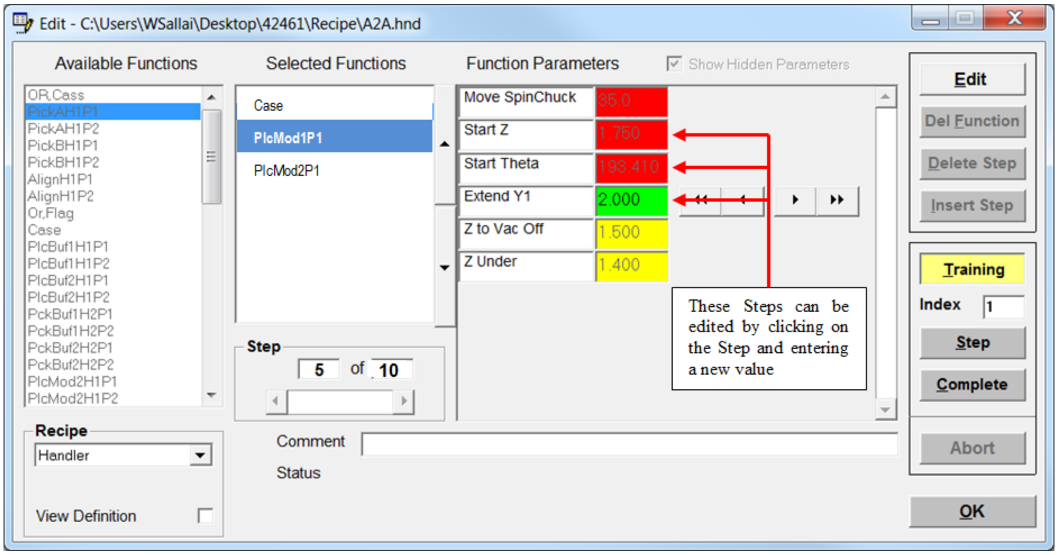
This is the spin motor position (degrees) that allows proper placement of the wafer onto the chuck.



The spin chuck should be positioned so that the posts on the chuck will not interfere with the Paddle when the wafer is placed. This number is in degrees.

EXTEND Y1

This moves the lower Paddle into the Chamber once the Spin Position, Z and Theta axis are in position. The Y1 axis can be moved in 0.001” increments.



The Paddle with the wafer will now be above the spin chuck. Minor corrections for “Start Theta, “Spin Position” and “Extend Y1” can now be made. The final adjustments will be made in the next step.

Z TO VAC OFF

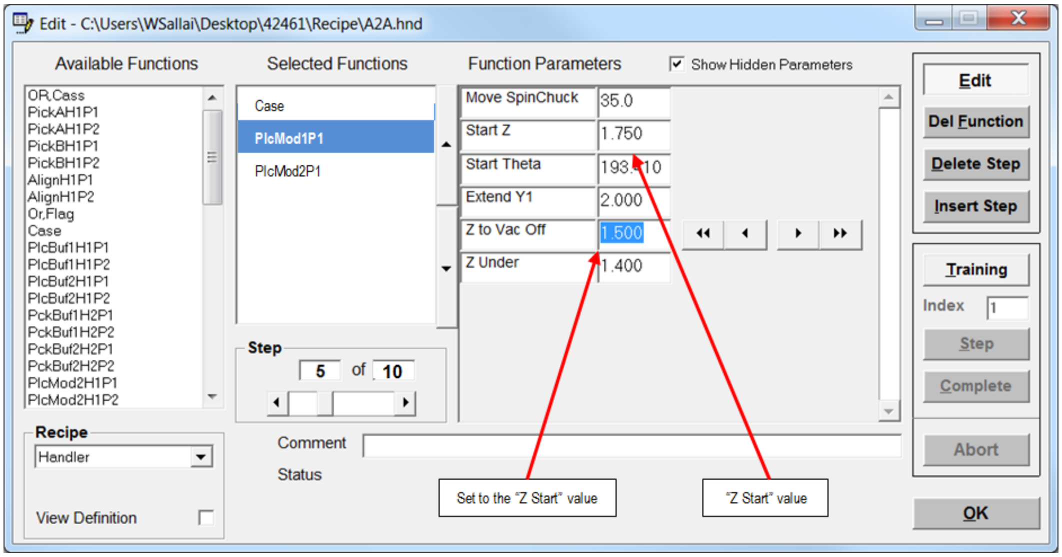
This is the vertical position of the handler when the Paddle vacuum is turned off. The Z can be moved in 0.001” increments.

The position is normally taught so that the wafer is just inside the chuck wafer guides and above the chuck pins. A vacuum check is done for the Paddle at this time to ensure that the wafer will be placed correctly.

CAUTION: When moving to this step the Paddle will move to the programmed value. If the “Start Z” or “Start Theta” values are incorrect, damage to the wafer or Paddle could occur.

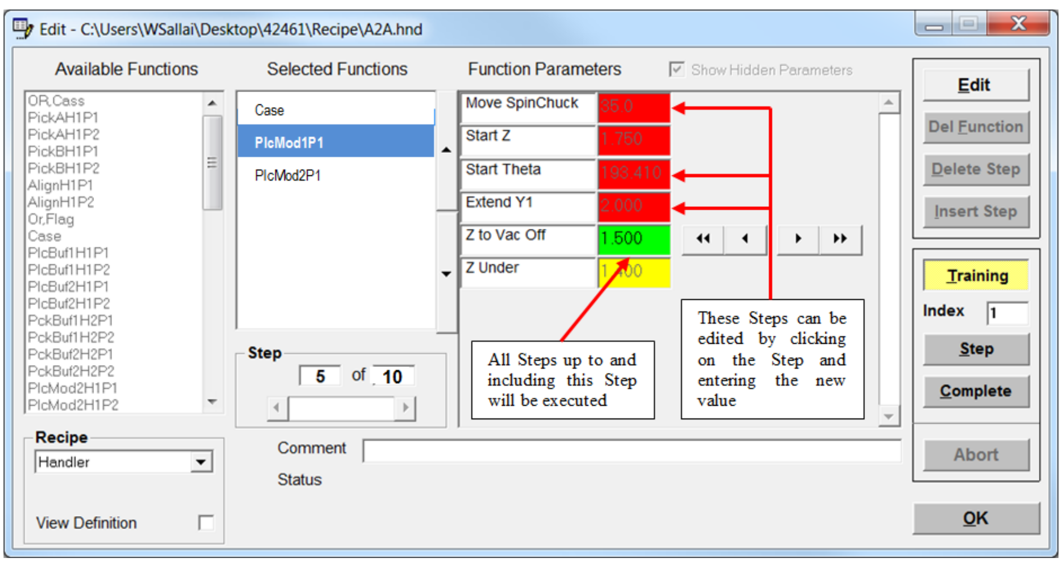
The “Z to Vac Off” value should temporally be set to the same number as the “Z Start” valve prior to execution of this step to prevent accidental damage.

Click on the **Edit** button and then click on the "**Z to Vac Off**" value and change it to the "Z Start value".



The **Training** mode can now be selected.

Click on the "**Z to Vac Off**" parameter. This will execute all the steps up to and including "Z to Vac Off".



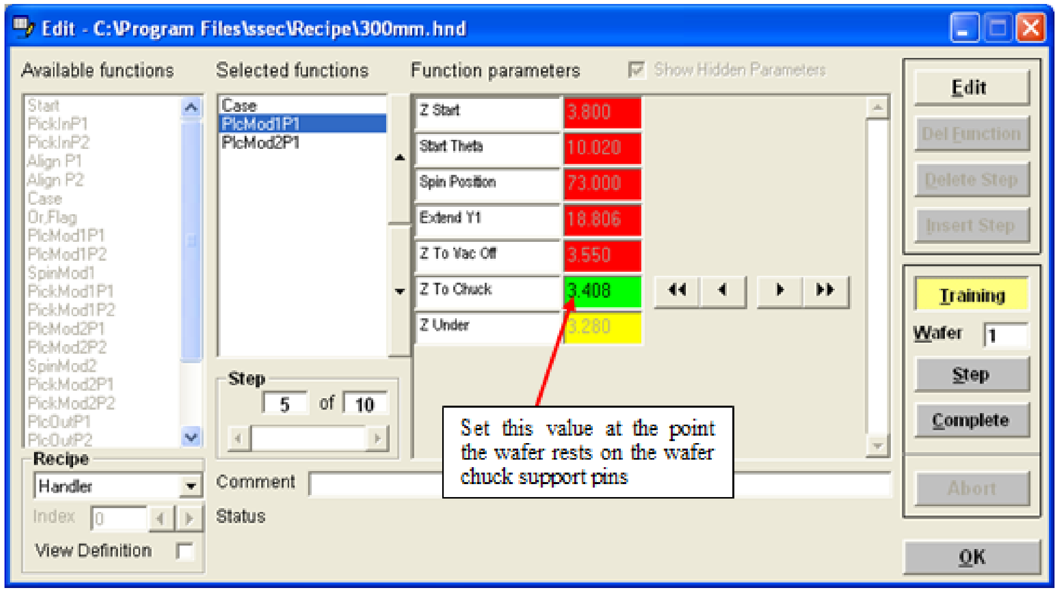
Entering a new value (lower) for "Z to Vac Off" will move the handler down.

The "Start Theta", Spin Position", "Extend Y1" and "Z to Vac Off" parameters can now be adjusted. The correct position for this parameter is when the wafer is just below the top edge of the chuck retainers.

Z TO CHUCK

This is the vertical position of the handler when the wafer is at the chuck pins.

The Z can be moved in 0.001" increments.



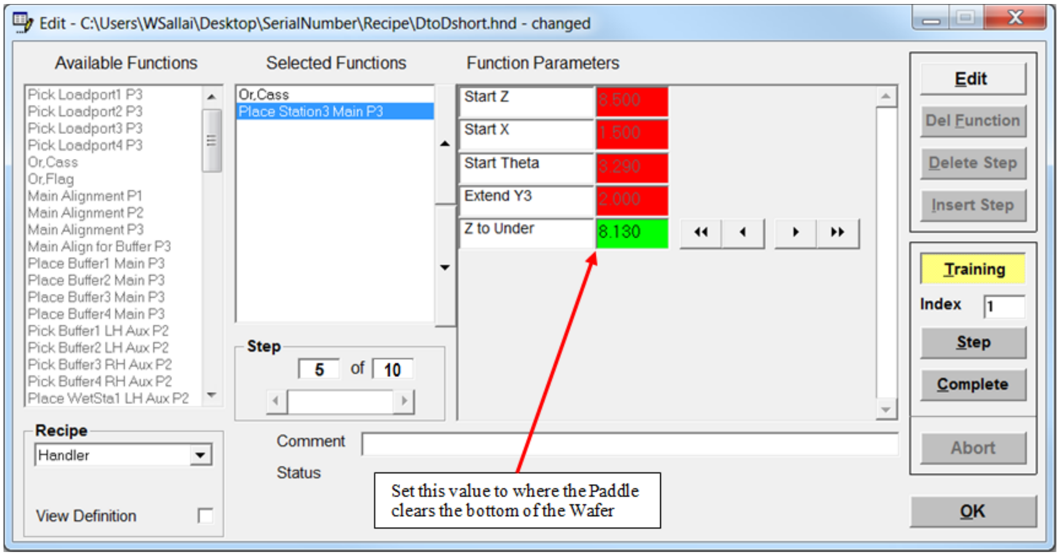
This position should be taught so that the wafer just rests on the wafer support pins of the chuck.

It is not recommended that the "Start Z", "Start Theta", "Spin Position" or "Extend Y1" parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

Z to UNDER

This is the vertical position of the handler to retract the Y1 Paddle and close the Chamber door.

The Z can be moved in 0.001" increments.

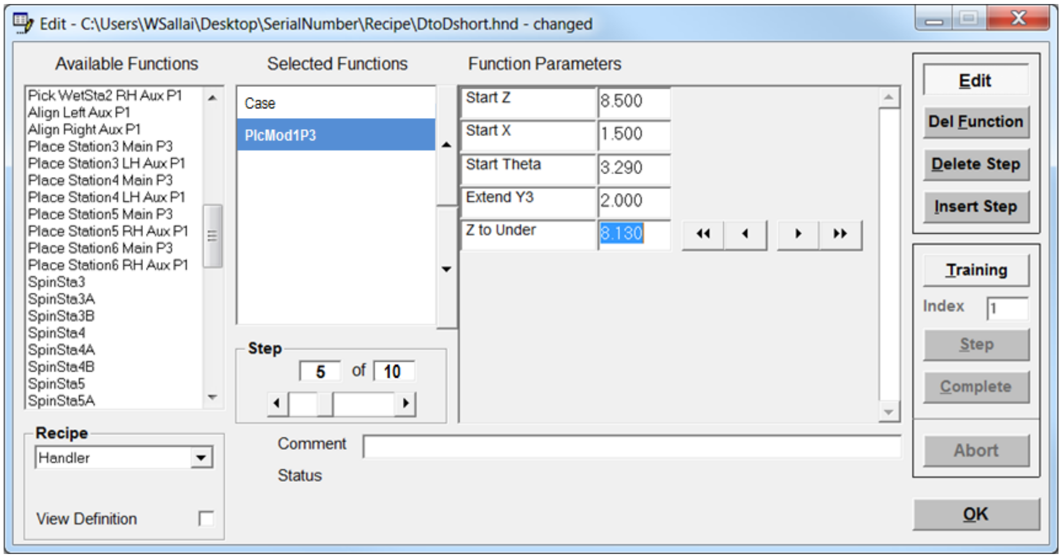


This position should be taught so that the Paddle clears the bottom of the wafer and clear the door when it retracts.

It is not recommended that the "Start Z", "Start Theta", "Spin Position" or "Extend Y1" parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

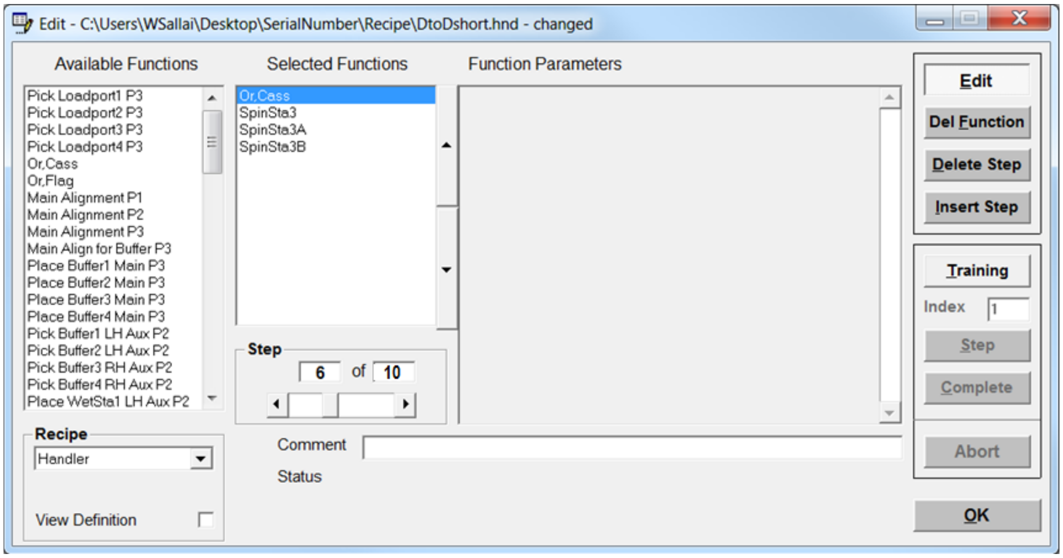
PlcMod2 Places the wafer into Spin Chamber 2 for processing.

The function parameters for placing the wafer into Spin Chamber 2 are the same as for placing the wafer into Spin Chamber 1.

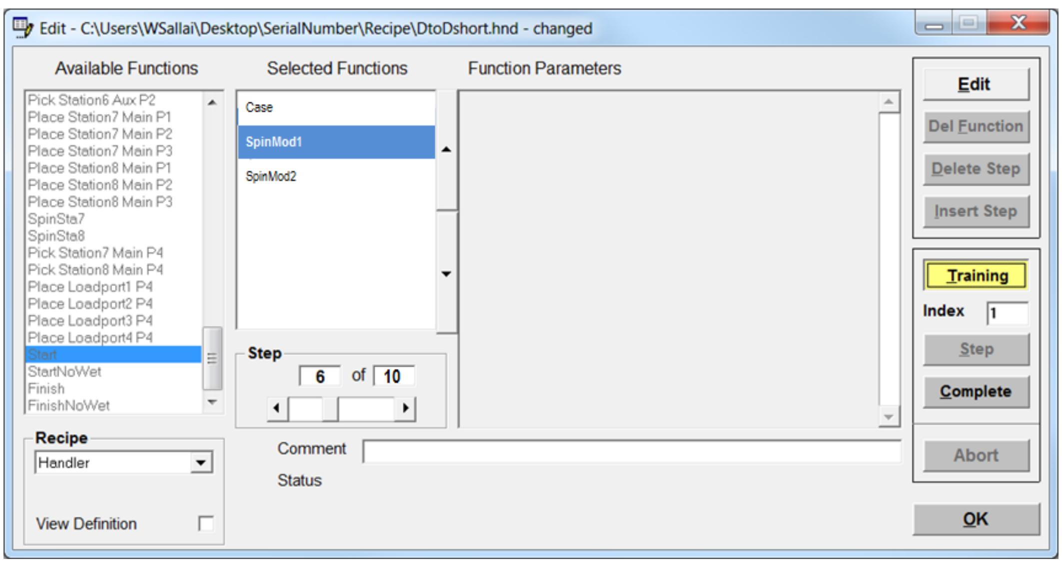


To teach the placement of the wafer in Spin Chamber 2 simply follow the instructions for Spin Chamber 1.

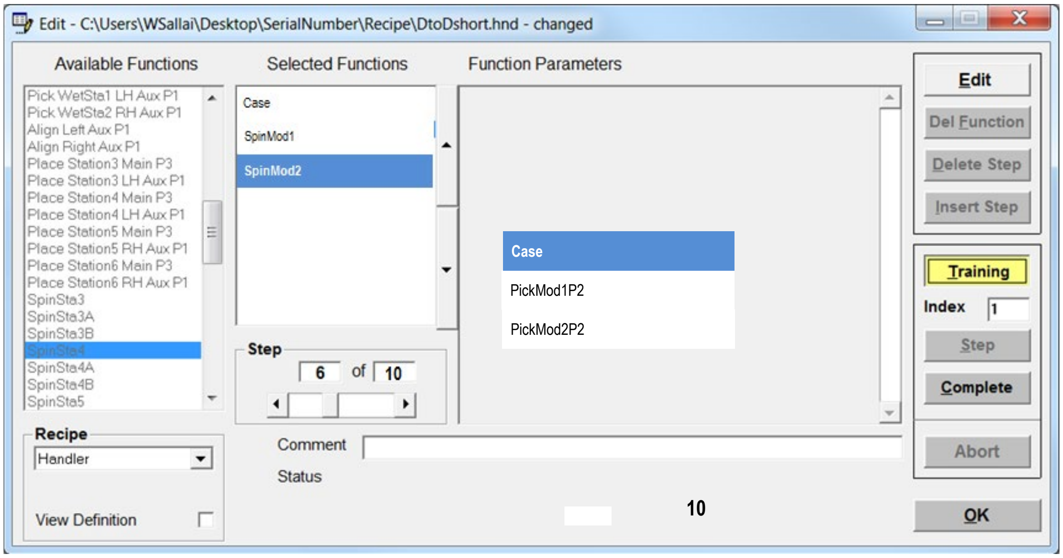
Step 6: Case Allows the handler to select the Spin Module to process the wafer.



Spin Mod1 Runs the process that is currently loaded for spin chamber 1.



Spin Mod2 Runs the process that is currently loaded for spin chamber 2.

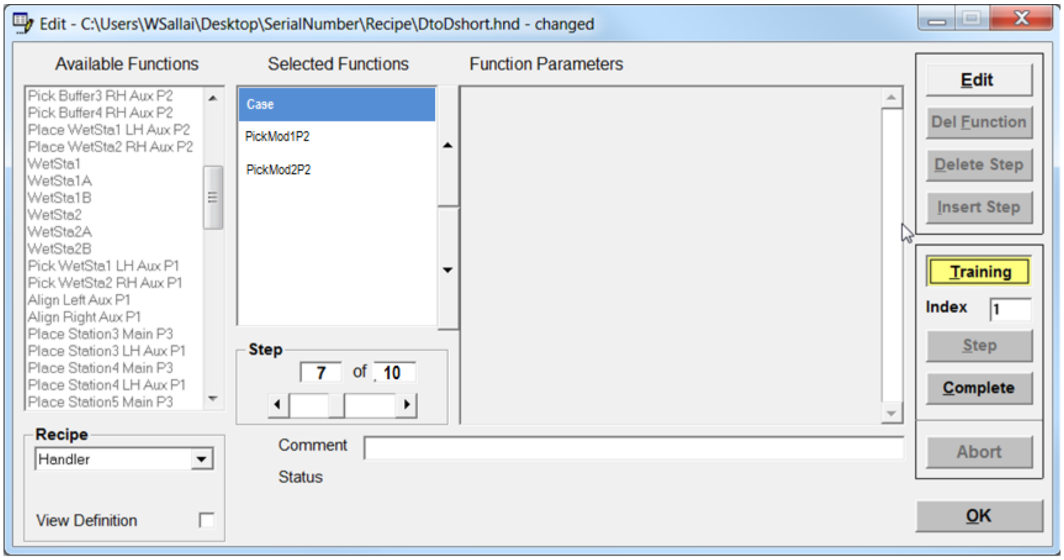


There are three (3) functions in this step. The "Case" function instructs the handler to run the currently loaded process in spin chamber 1 (PlcMod1) or spin chamber 2 (PlcMod2). The handler will determine the available spin chamber and run the loaded process.

NOTE

Executing a "Complete" in the Training Mode during this step will not run the process. These are just commands to run the process during normal operation.

Step 7: Case Allows the handler to go to different stations during this step. The wafer will either be picked up in spin chamber 1 or 2.



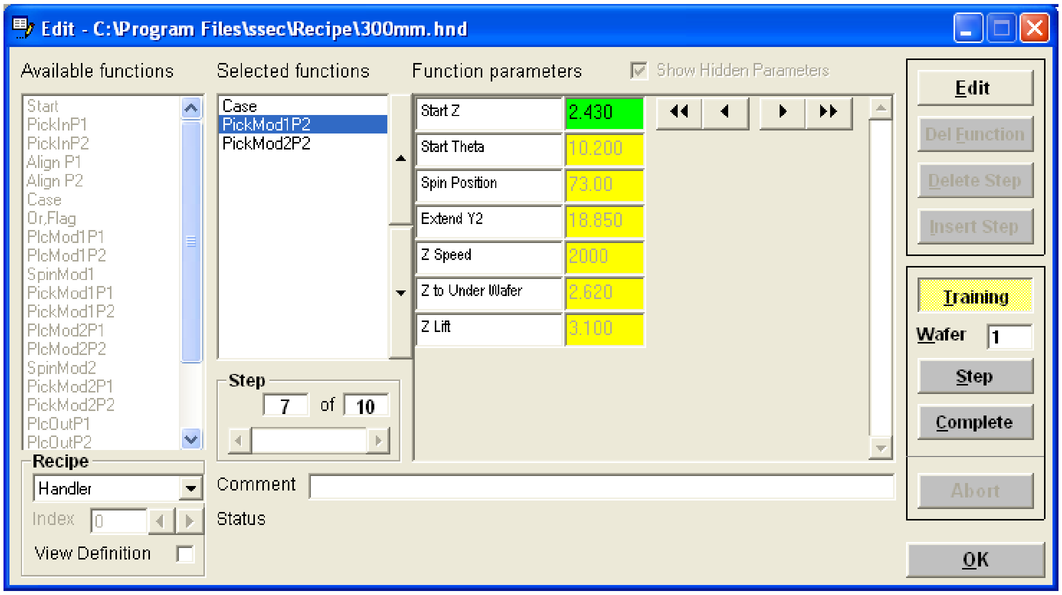
There are three (3) functions in this step. The "**Case**" function instructs the handler to pick up the processed wafer in spin chamber 1 (**PickMod1**) or spin chamber 2 (**PickMod2**) using Paddle 2 ("**Y2**"). The handler will determine the available spin chamber and execute the moves.

Pick Mod 1P2 Picks up the clean wafer from Spin Chamber 1 using Paddle 2 "Y2").

The function parameters for picking up the wafer in Spin Chamber 1 are:

Z START

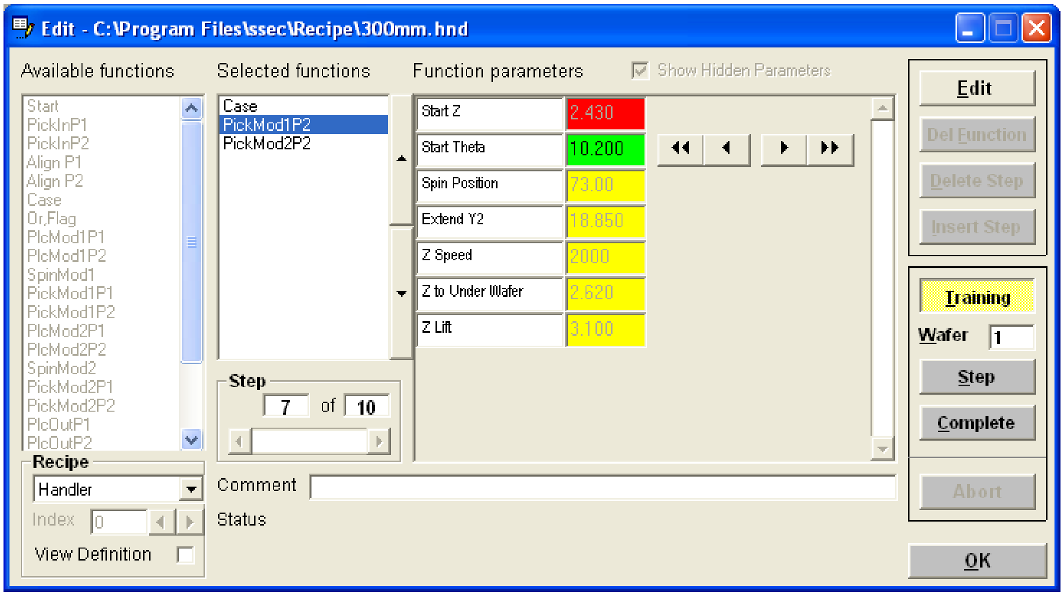
This is the vertical position of the handler that allows the Paddle to be moved into the Chamber for pickup of the wafer. The Z can be moved in 0.001" increments.



The correct "Start Z" position should be low enough for the Paddle to move under the wafer for pick up and clear the Chamber door.

START THETA

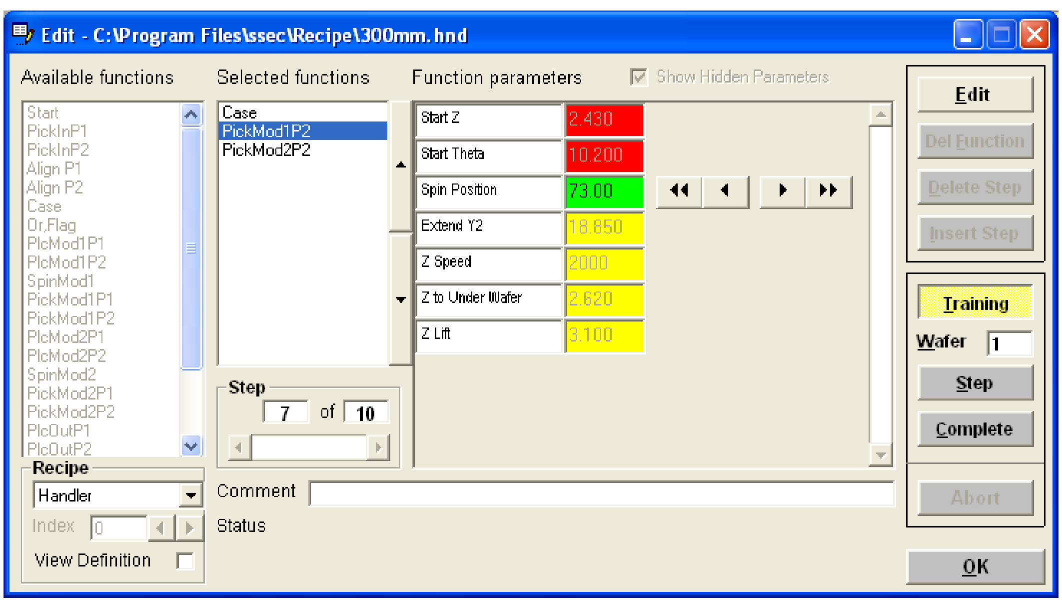
This is the rotational position of the handler that allows the Paddle to be centered below the wafer for pick up. The theta can be moved in 0.001" increments.



The theta position should be set so that the Paddle is centered under the wafer when it is picked up.

SPIN POSITION

This is the spin motor position (degrees) that allows proper pick up of the wafer from the chuck.



The theta position should be set so that the Paddle is centered under the wafer when it is picked up.

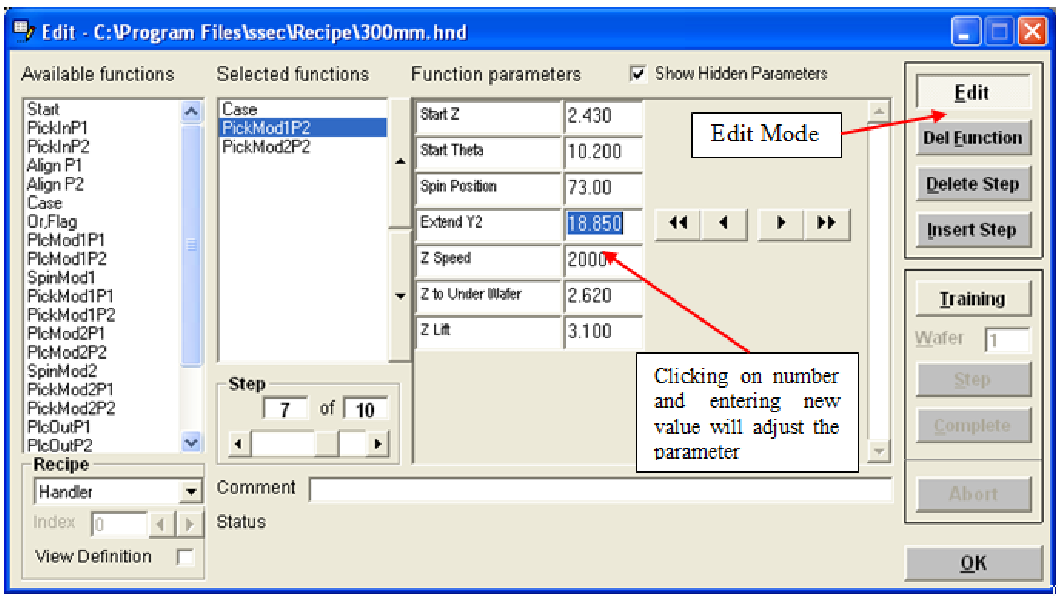
EXTEND Y2

This moves the middle Paddle into the Chamber once the Spin Position, Z and Theta axis are in position. The Y2 axis can be moved in 0.001” increments.

CAUTION: When moving to this step the Paddle will move to the programmed value. If the “Start Z” or “Start Theta” values are incorrect, damage to the wafer or Paddle could occur.

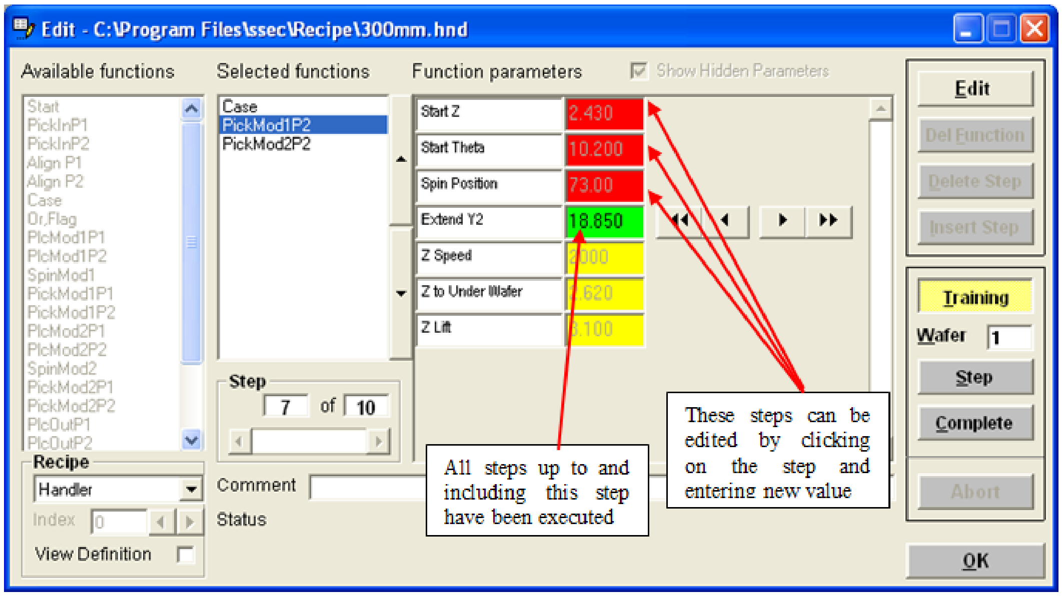
The Extend Y2 value should be set to a small number (1 or 2 inches) prior to execution of this step to prevent accidental damage.

Click on the Edit button and then click on the Y2 value and change to a small number. This will move the Paddle a short distance when the move is executed in the training mode.



Training Mode May now be selected.

Click on the "Extend Y2" parameter. This will execute all the steps up to and including "Extend Y2".



The handler will now be in the approximate "Theta" and "Z" positions. The "Y2" Paddle will have moved the amount that was entered in the Edit mode (1 to 2 inches).

Entering a new value in the Extend Y2 step will move the Paddle towards the cassette. The "Start Z", "Start Theta" and the "Extend Y2" values can be changed to move the Paddle into position under the wafer.

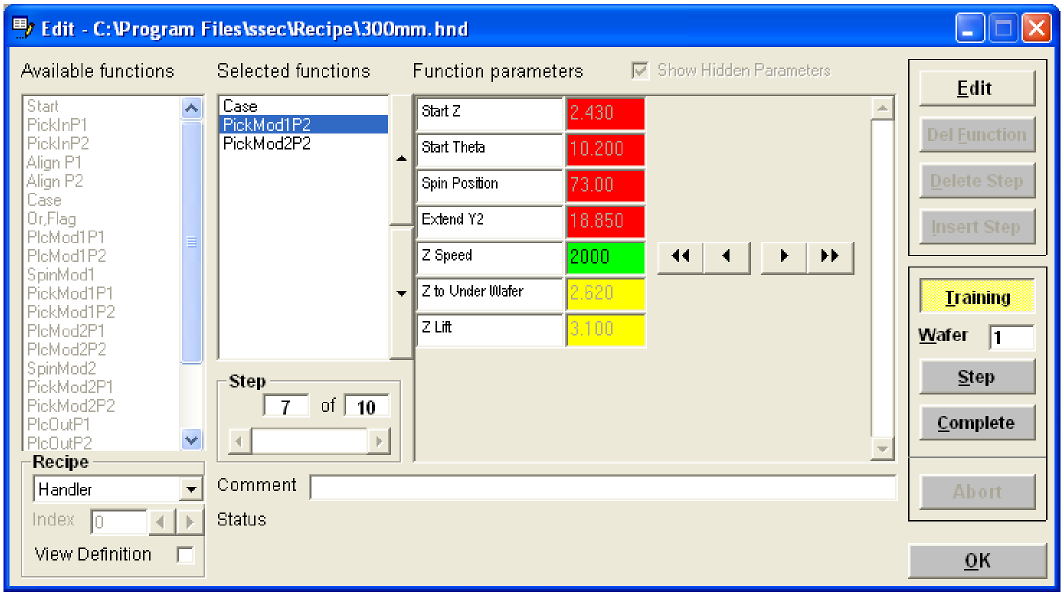
NOTE

If editing an existing Handler Program, the values should be close to the proper position and only minor adjustments will be needed

The changing of the "Y2" and/or the "Theta" values could affect the handling in the remaining positions. You must verify these steps.

Z SPEED

This is the speed (time between motor steps) that the vertical handler will move to pick up the wafer (the higher the number, the slower the speed).

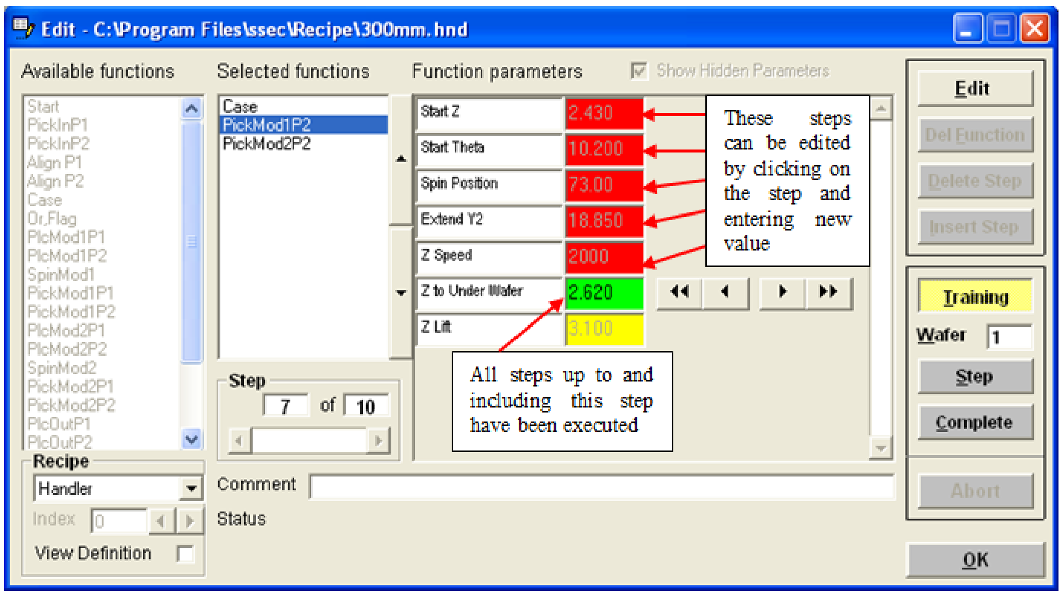


The speed should be set so that the Paddle slowly when picking up the wafer.

Z TO UNDER WAFER

This is the vertical position of the handler when the Paddle has just lifted the wafer above the chuck pins. At this time vacuum will be turned on to the Paddle and vacuum detect will be executed. The Z can be moved in 0.001" increments.

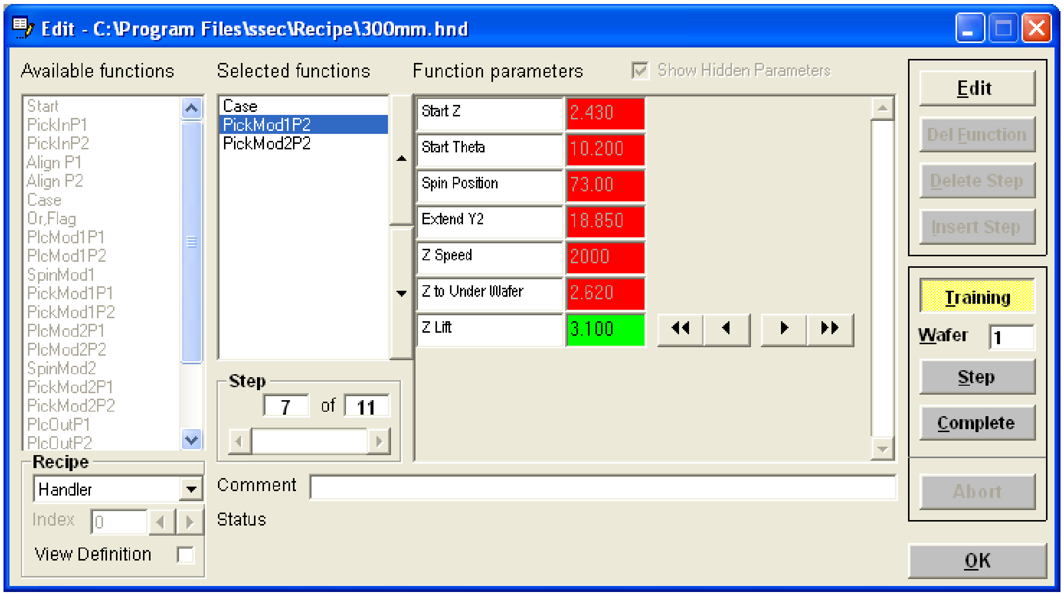
CAUTION: When moving to this step the Paddle will move to the programmed value. If the "Start Z" or "Start Theta" values are incorrect, damage to the wafer or Paddle could occur.



The "Z to under Wafer" value can be changed so that the Paddle has just lifted the wafer off of the chuck pins. A vacuum check is done for the Paddle at this time to ensure that the wafer has been picked up correctly.

Z LIFT

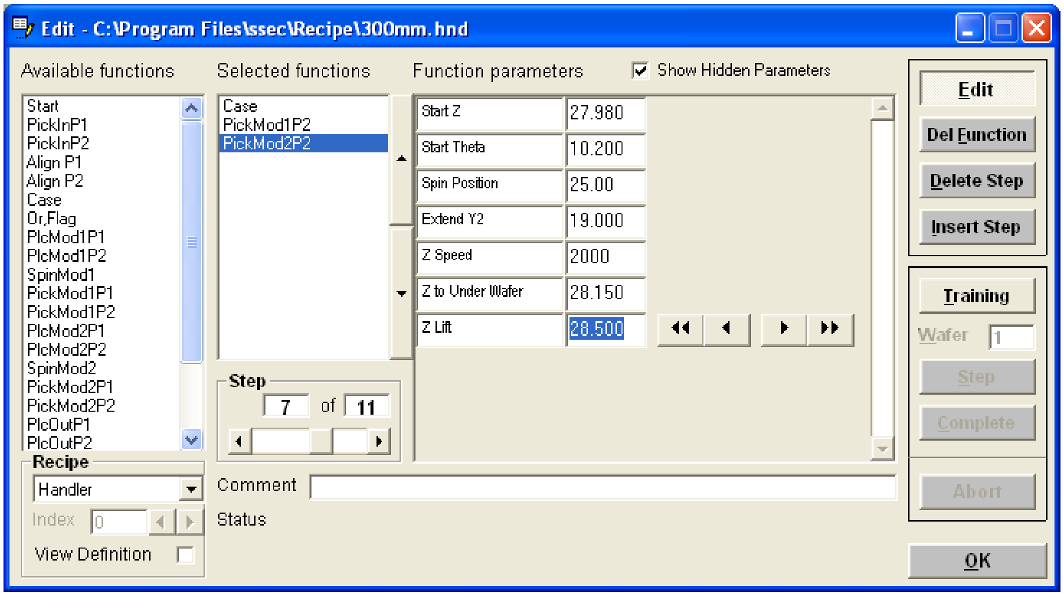
This is the vertical position of the handler that clears the wafer from the chuck retainers. The Y2 Paddle will then retract. The Z can be moved in 0.001" increments.



The "Z Lift" value can be changed so the Paddle and wafer clear the top of the spin chuck.

It is not recommended that the "Start Z", "Start Theta", "Spin Position" or "Extend Y1" parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

Pick Mod 2P2 Picks up the clean wafer from Spin Chamber 2.



To teach the pick in spin chamber 2, follow steps for pick up in spin chamber 1.

Step 8: PlcOutP2 Places the cleaned wafer into the FOUP.

Single input/output cassette:

The vertical height is the height that allows the Paddle with the wafer move into the cassette's top wafer position. The wafer will be placed into the top slot of the cassette.

Separate input and output cassettes:

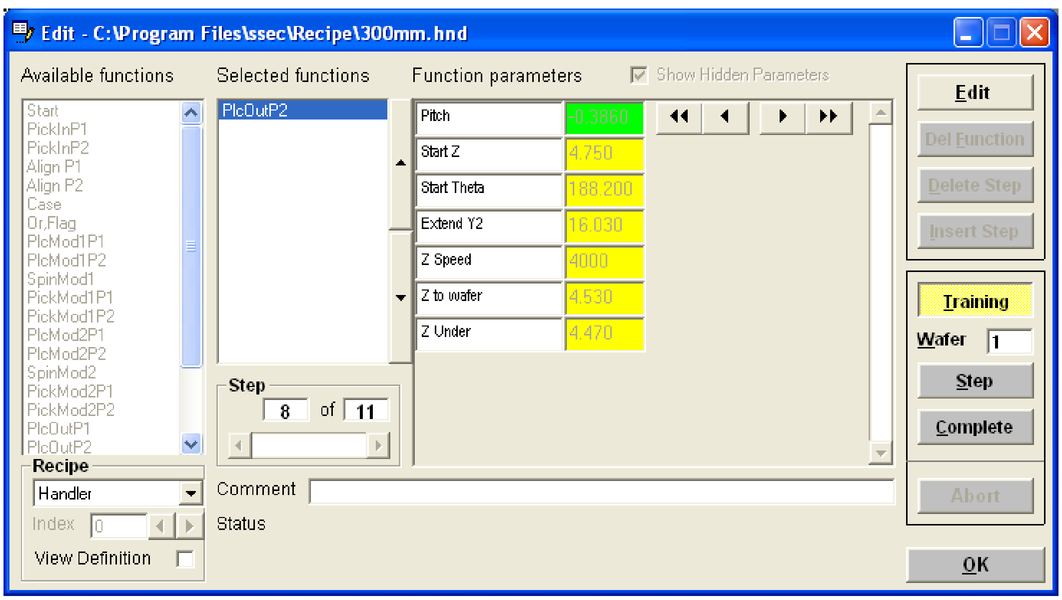
The vertical height is the height that allows the Paddle to move into the cassette's bottom wafer position. The wafer will be placed into the bottom slot of the cassette.

The function parameters for placing the wafer into the Output Cassette are:

PITCH

The first step when placing a wafer into the cassette is to set the pitch of the cassette. To set this value simply measure the cassette or consult the manufacture's specs.

The first wafer position is the actual taught position. The pitch is used to calculate the vertical (Z) position of the remaining slots in the cassette. For example: The vertical location of wafer number 5 is the Start Z value plus 4 additional pitches.



The pitch value can be either a positive value or a negative value.

A positive pitch will move the handler Z up. Positive pitch is used when the handler will be placing the first wafer from the bottom of the cassette.

A negative pitch will move the handler Z down. Negative pitch is used when the handler will be placing up the first wafer from the top of the cassette.

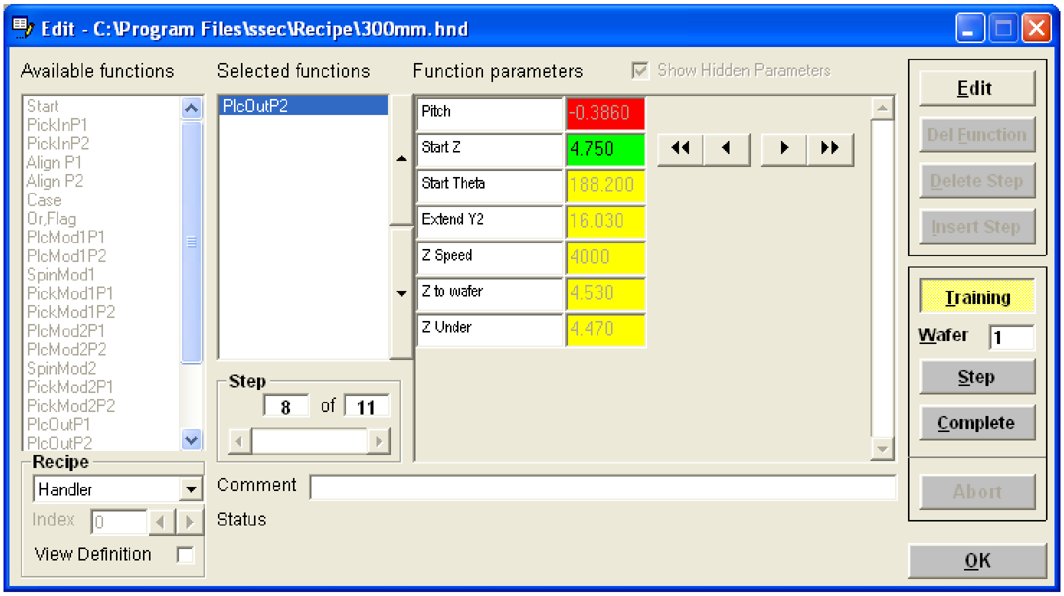
The height can be moved in 0.001" increments

START Z

This is the vertical height of the handler to place the first wafer in the cassette. The height can be moved in 0.001” increments.

The vertical (Z) position for systems using only one cassette for pick up and drop off is from the top slot of the cassette.

Two cassette (Input and Output) systems will pick from the bottom of the input cassette and drop off to the top of the output cassette. The height can be moved in 0.001” increments.



Single input/output cassette:

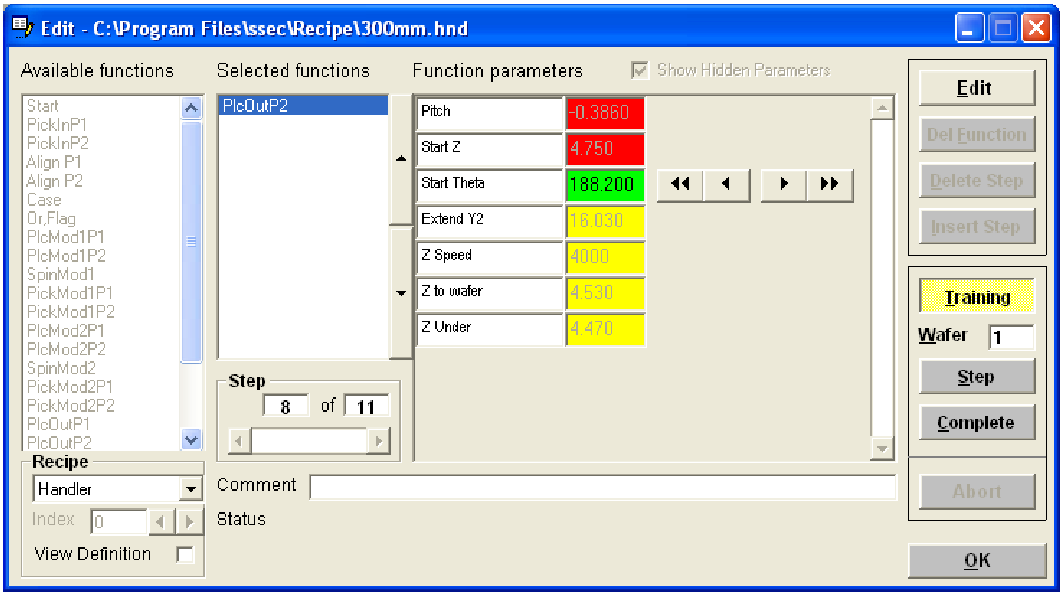
The vertical height will be the height that allows the Paddle to move into the cassette to place the first wafer (top wafer position) into the cassette smoothly.

Separate input and output cassettes:

The vertical height will be the height that allows the Paddle to move into the cassette to place the first wafer (bottom wafer position) into the cassette smoothly.

START THETA

This is the rotation value in degrees. The theta can be moved in 0.001" increments.



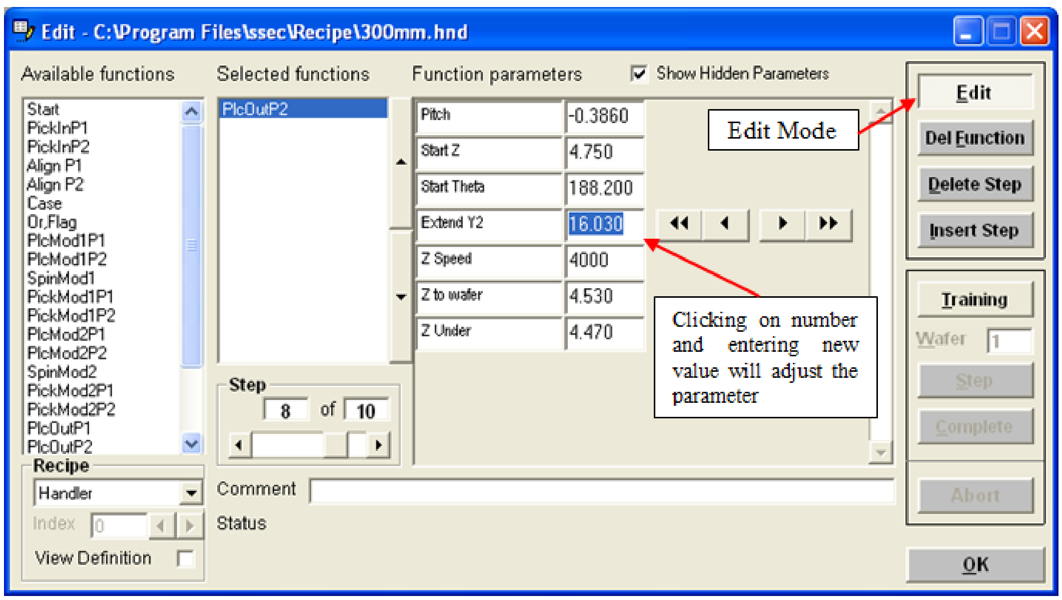
EXTEND Y2

This moves the wafer into the cassette once the Z and Theta axis are in position. The theta can be moved in 0.001" increments.

CAUTION: When moving to this step the Paddle will move to the programmed value. If the "Start Z" or "Start Theta" values are incorrect, damage to the wafer or Paddle could occur.

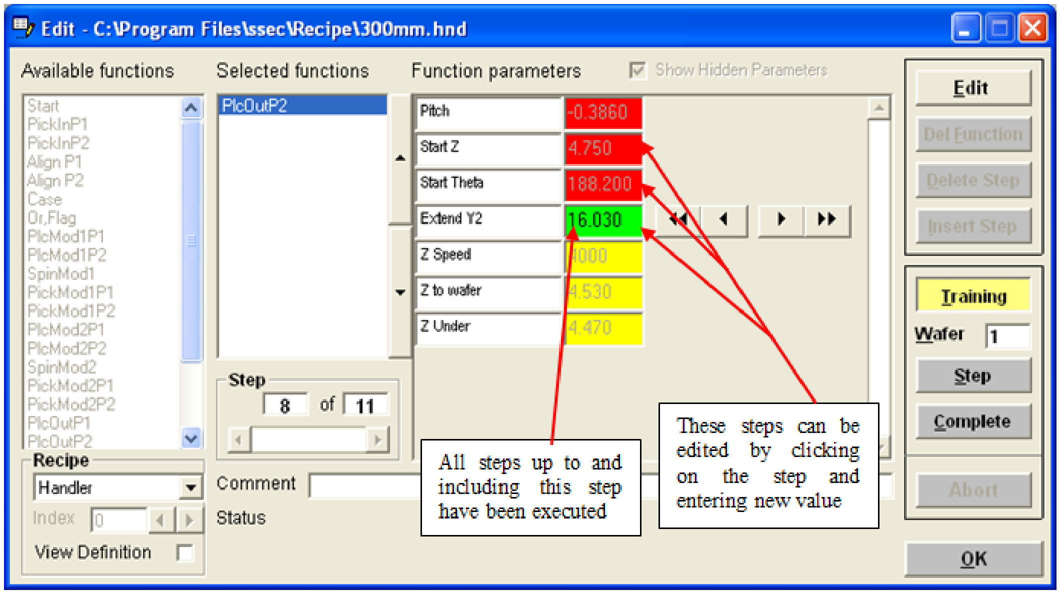
The Extend Y2 value should be set to a small number (1 or 2 inches) prior to execution of this step to prevent accidental damage.

Click on the Edit button and then click on the Y2 value and change to a small number. This will move the Paddle a short distance when the move is executed in the training mode.



The **Training** mode can now be selected.

Click on the "**Extend Y2**" parameter. This will execute all the steps up to and including "Extend Y2".



The handler will now be in the approximate "Theta" and "Z" positions. The "Y2" Paddle will have moved the amount that was entered in the Edit mode (1 to 2 inches).

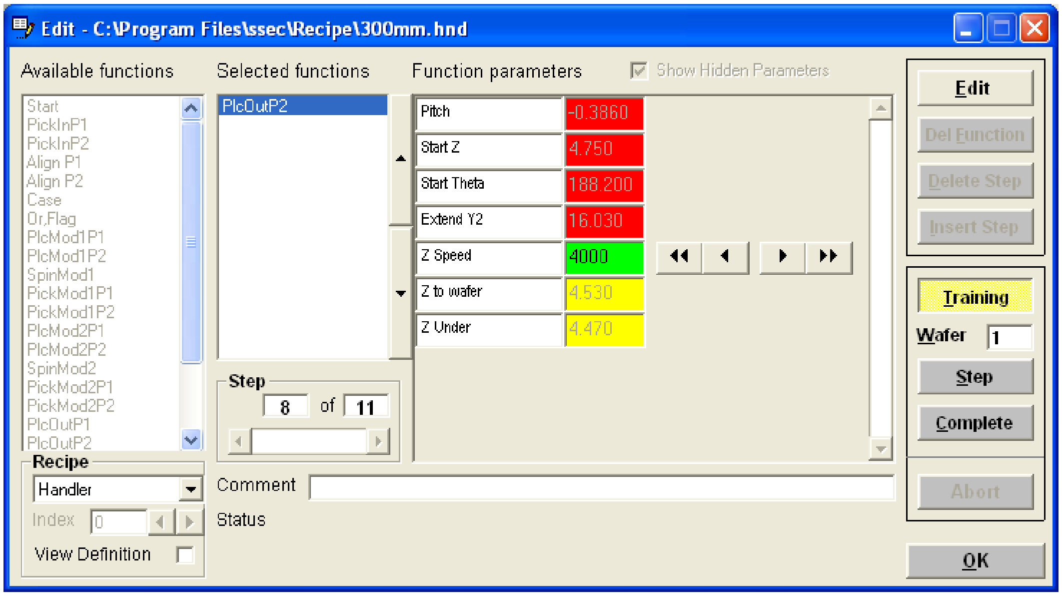
Entering a new value in the Extend Y2 step will move the Paddle towards the cassette. The "Start Z", "Start Theta" and the "Extend Y2" values can be changed to move the Paddle into position under the wafer.

NOTE

If you are editing an existing Handler Program, the values should be close to the proper position and only minor adjustments will be needed.

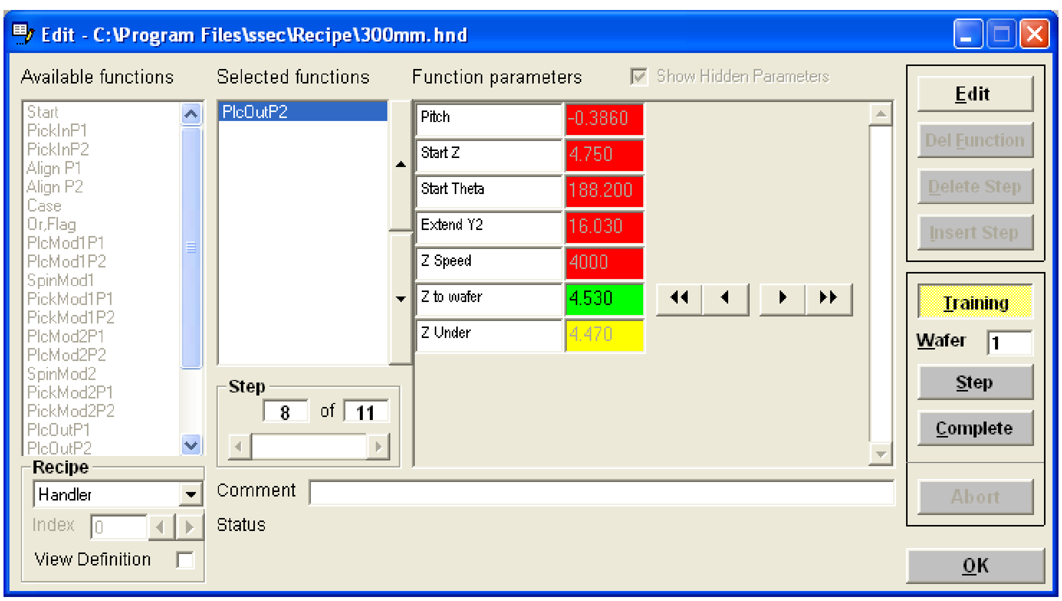
Z SPEED

This is the speed (time between motor steps) that the vertical handler will move when placing the wafer in the cassette. The higher the number, the slower the speed.



Z TO WAFER

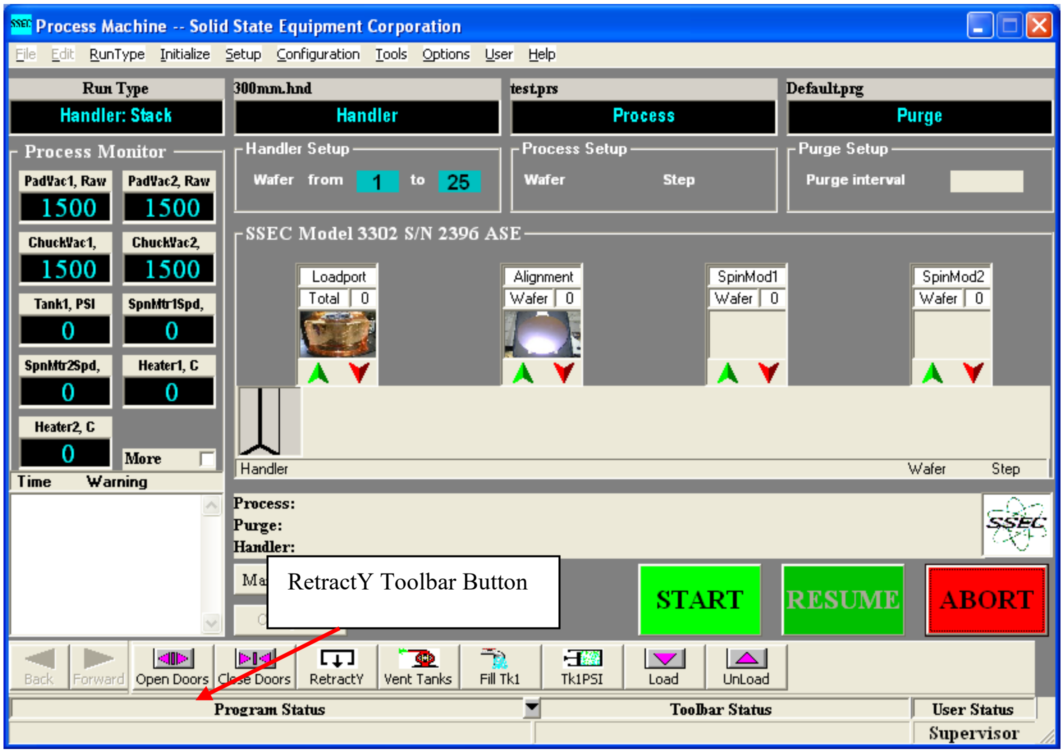
The handler vertical axis moves to this position and Paddle vacuum is turned off. The height can be moved in 0.001" increments.



This value should be set so that the wafer just rests on the slot of the cassette.

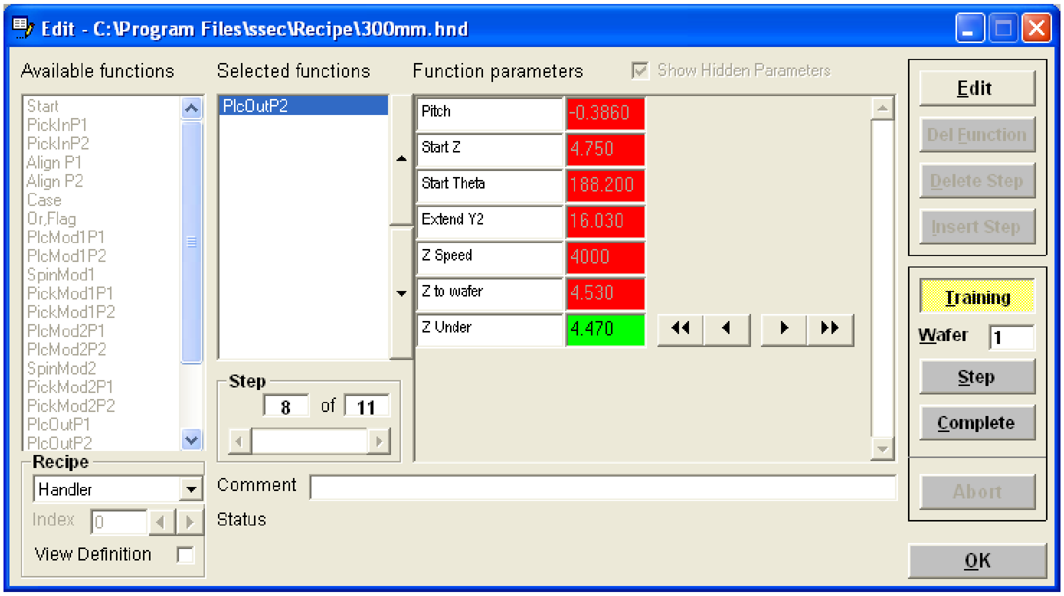
It is not recommended that the "Start Z", "Start Theta" or "Extend Y2" parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

To retract the Paddle safely, simply click the "RetractY" Toolbar Button on the main process screen.



Z UNDER

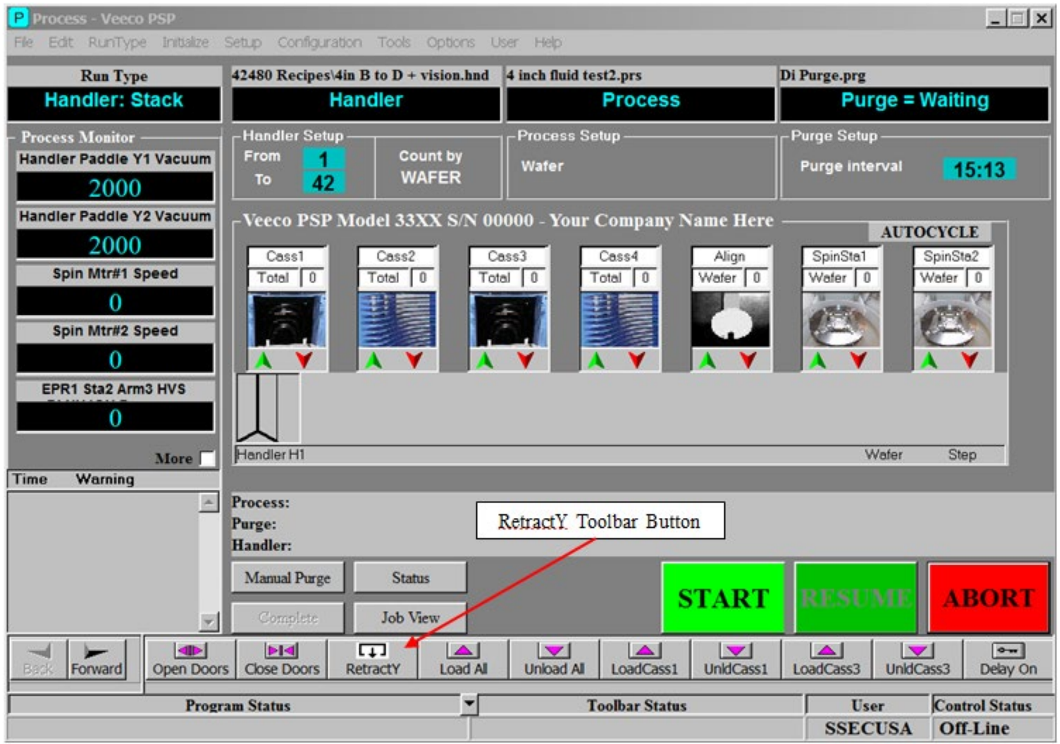
This is the vertical position of the handler to retract the Y2 Paddle. The Z can be moved in 0.001" increments.



This value should be set so that the Paddle just clears the underside of the wafer and does not hit the wafer below or the "H" bar of the cassette.

It is not recommended that the "Start Z", "Start Theta" or "Extend Y2" parameters be changed at this time. Should you need to start over with the previous positions, the Paddle should be retracted.

To retract the Paddle safely, simply click the "RetractY" Toolbar Button on the main process screen.



To verify that place out step was taught correctly, the complete step can be executed.

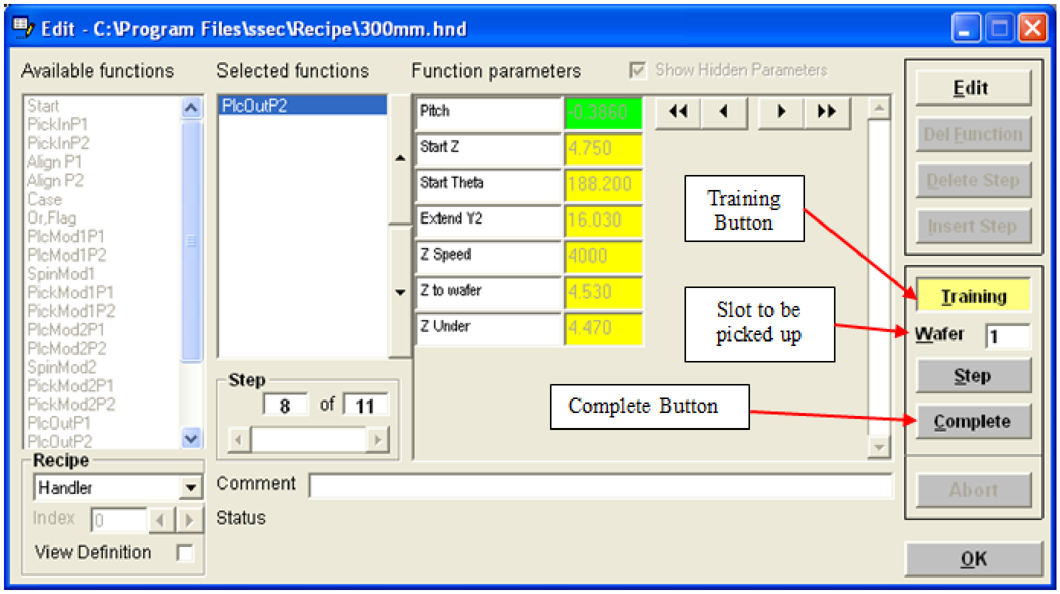
You must start with a wafer on the Paddle.

Place a wafer into the one of the spin chambers and go to the step to pick up the wafer from the spin chamber. Clicking on the “Training” and then the “Complete” buttons will execute all of the steps in the function.

Once the wafer is on the Paddle, go to the step to place the wafer into the output cassette.

Clicking on the “Training” and then the “Complete” buttons will execute all of the steps in the function.

Watch for a smooth drop off of the wafer with no hitting or scraping of the wafer or Paddle.



Once the drop off is verified, placement to the other slots of the cassette need to be verified.

Place a wafer into the one of the spin chambers and go to the step to pick up the wafer from the spin chamber. Clicking on the “Training” and then the “Complete” buttons will execute all of the steps in the function.

Once the wafer is on the Paddle, go to the step to place the wafer into the output cassette.

Select the “Training” mode, enter the slot number in the “Wafer” Window and click “Complete”. Repeat this for various slots.

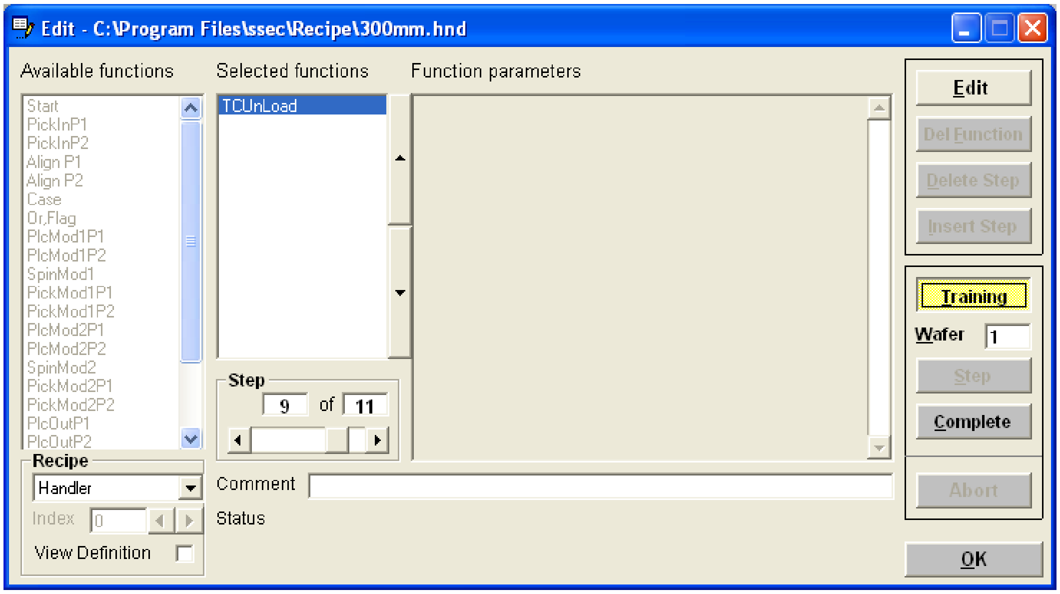
If the wafers in the first few slots (wafer 1, 2, etc.) are handled correctly, but the higher number slots (20, 21, etc.) are not, the “Pitch value may be need to be adjusted.

NOTE

Before adjusting the “Pitch” value, try a different Cassette. A warped Cassette could be the problem.

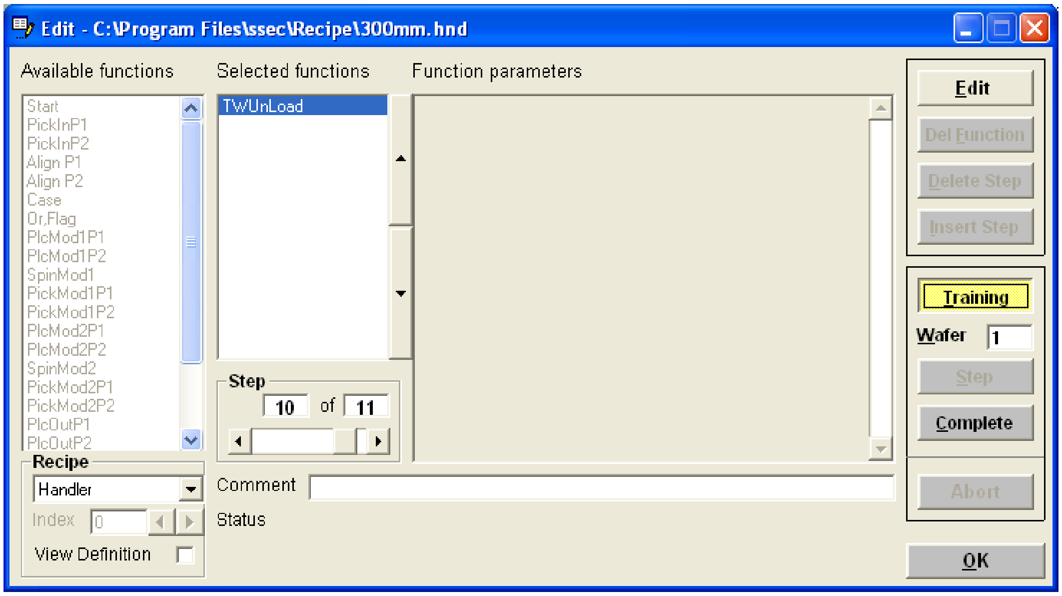
Step 9: TCUload (The FOUP will move to the unload position).

There are no user parameters associated with this command



Step 10: TWUload (The System waits for the FOUP to move to the unload position).

There are no user parameters associated with this command

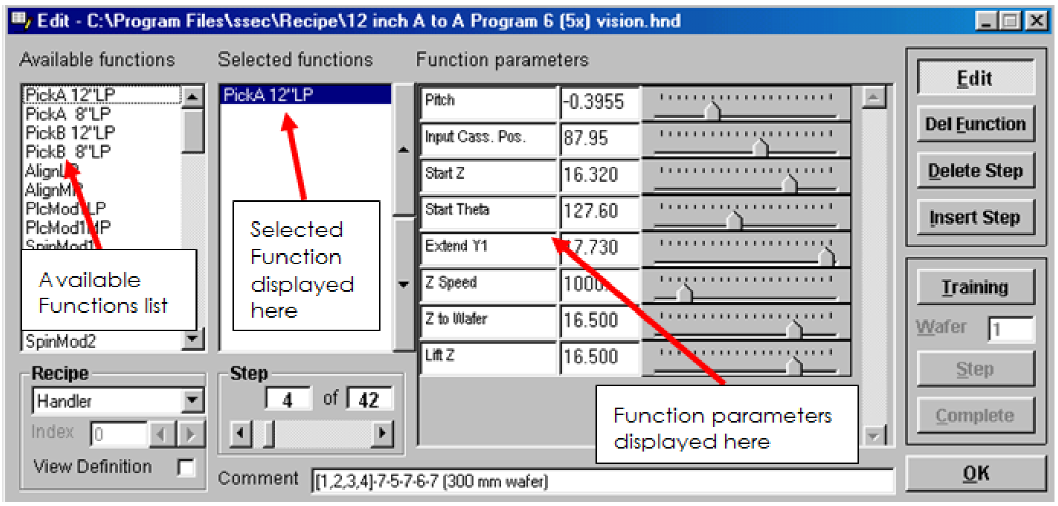


The Handler program can now be saved (once the new value/s are confirmed) and with the new values incorporated into the program.

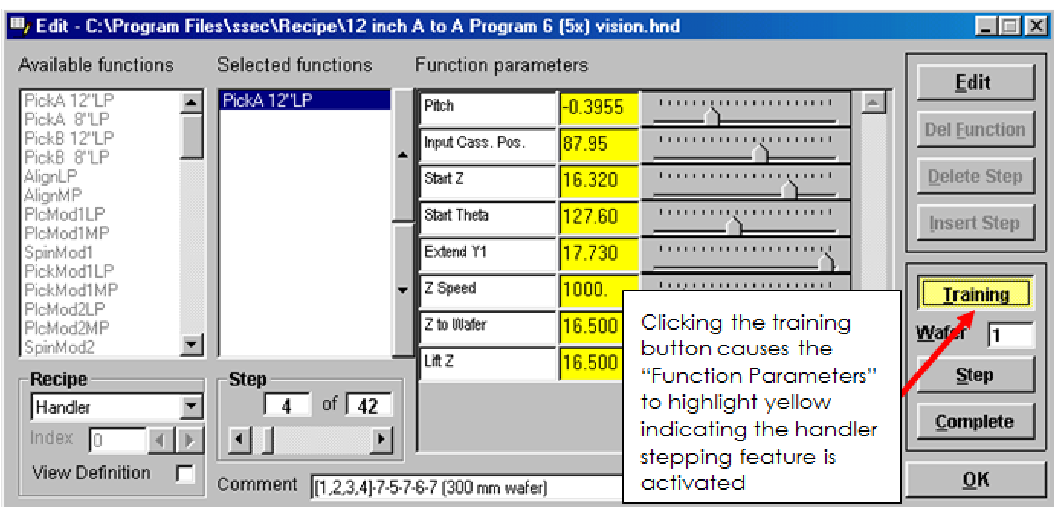
This Page Left Intentionally Blank.

Vision Teaching

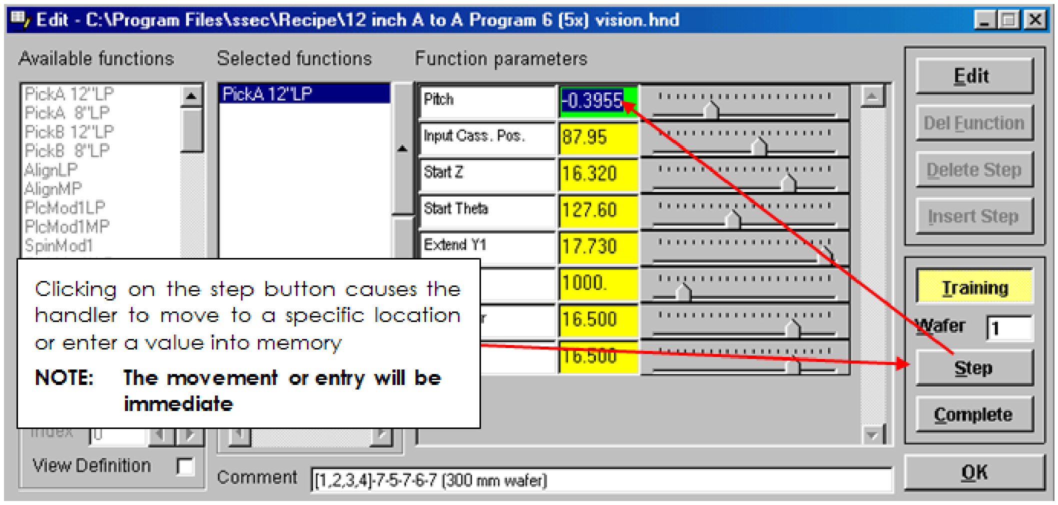
The Handler teach process/program utilizes VPSP proprietary Software and control. The teach process involves picking specific tasks (“available functions”) from a Pull-down Menu, and then manually referencing each of the starting and finishing locations of each Handler motion required for that “function”.



This process sounds somewhat complicated. However, it is quite simple from an end user stand point as this process has been completed for the end user during the manufacturing process. Any changes or additions to the handler program teach positions can be accomplished by editing an existing handler program. Typically only minor positional changes are required once the teach process is initially completed. The “Editing” menu can also be used to physically move the handler through each sub-step in each “Function parameter” list displayed by opening the handler edit screen and then clicking on the “Training” button.



The operator would then click on the step button, which will physically move the handler or enter parameters into memory (such as cassette slot pitch).



NOTE

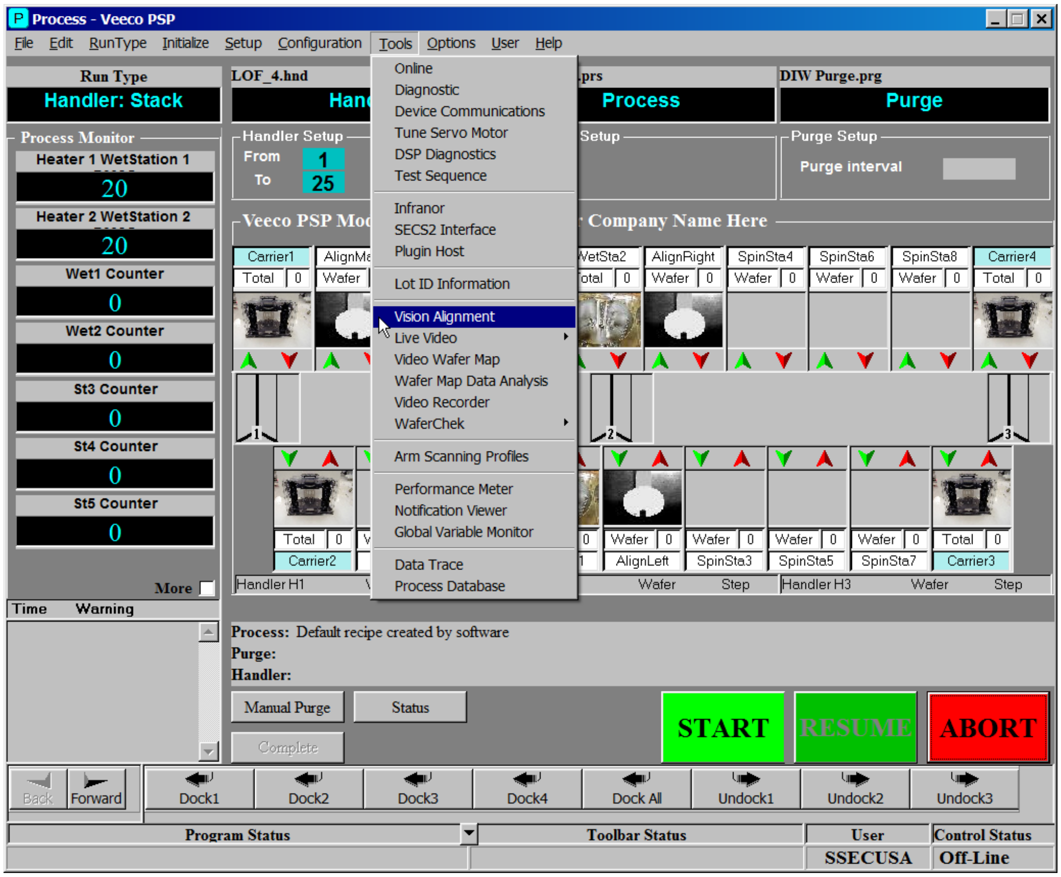
It is assumed that the person performing this function is properly trained to avoid activation of this feature while certain error conditions are in place, which could cause the Handler to damage a Wafer or itself.

The Function parameter list would then change color from "Yellow" to "Green" which indicates that the entry or movement is complete. This is where the position or entry can be "Edited". Simply click on the value (number) in the highlighted box (Green) and change the value using standard Windows editing procedures. Again, the operator or technician must be properly trained, as the new value entered will be exercised as soon as the "enter" key is pressed (after editing of the value is complete).

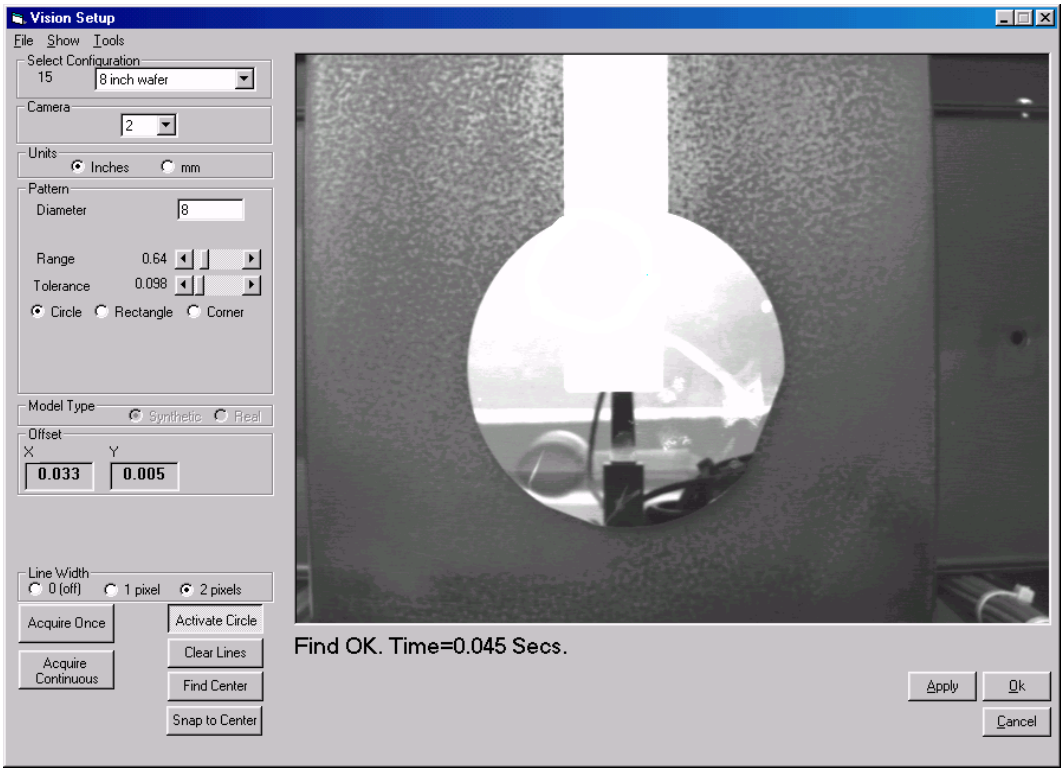
The Handler program would then be saved (once the new value/s are confirmed) and with the new values incorporated into the program.

Vision Alignment Screen

To access the edit/teach menu, select "Tools" from the Process - Veeco PSP screen, then select "Vision Alignment" from the Pull-down Menu.



The Vision Set-up/Teach Menu will appear. Clicking on the “Acquire Once” button will take a snap shot of the wafer. This is just a snap shot stored in memory, not a real time image.



The Vision Setupscreen is used to set up Vision Alignment of the wafer.

The screen consists of the following elements:

Video Display

This is the picture of the wafer displayed on the screen. During the vision alignment process, some lines are drawn overtop the wafer picture, as follows:

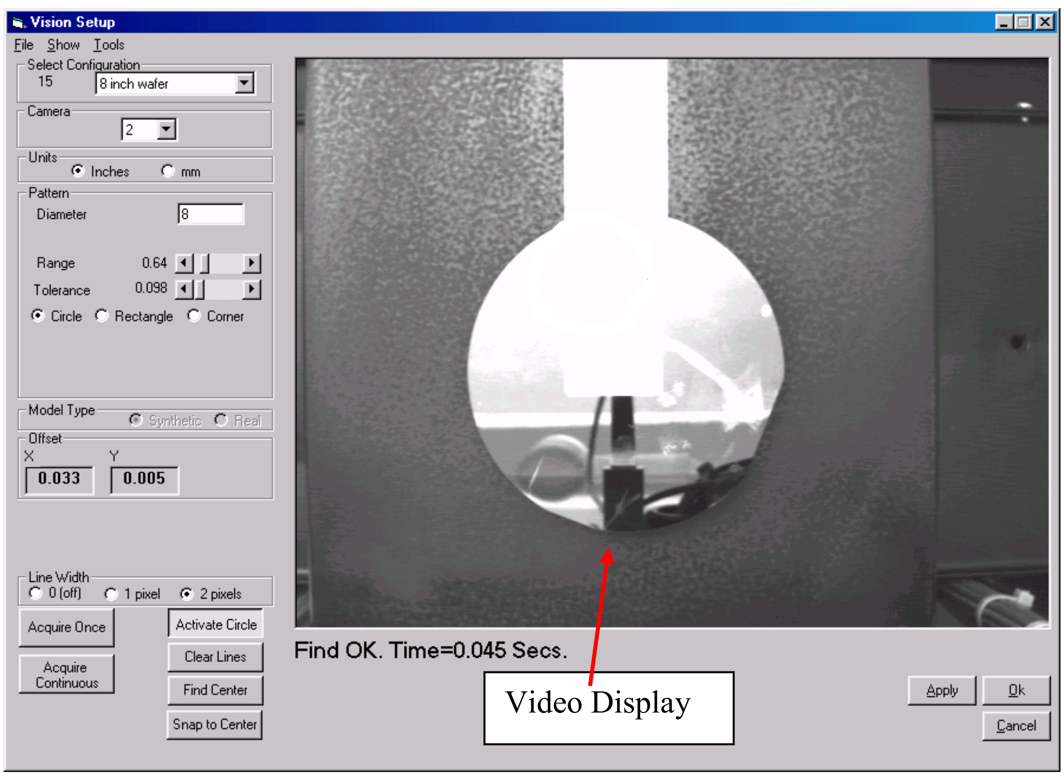
Light Blue circles – The user initially draws a circle around the circumference of the wafer on the display. After the circle is drawn, the Software will draw two more circles: one inside the original circle and one outside the original circle. These circles represent the Range of positions that the wafer can be in.

Light Blue cross – The Software draws a light blue cross at the center of the circle the user drew.

Red lines – The Software draws red lines where it detects a wafer edge.

Red cross – The Software draws a red cross where it calculates the center of the wafer to be.

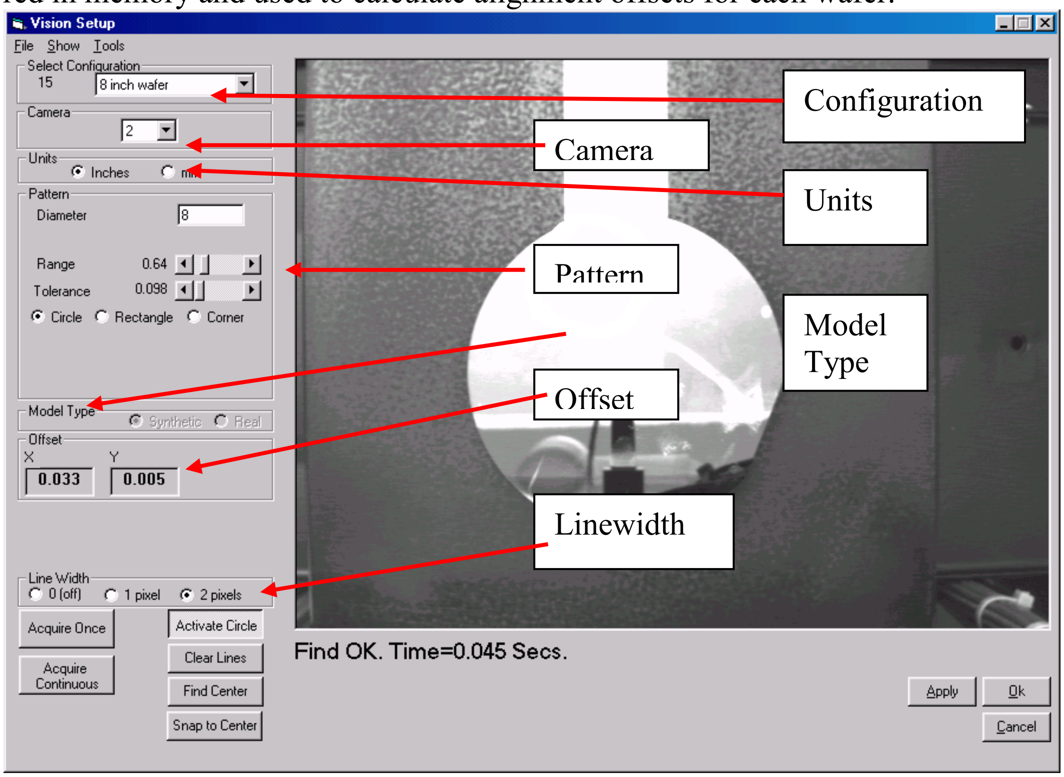
Dark Blue lines – The Software draws blue lines through the center of the circle from when it detects both edges of the circle. The edges of the circle must be within tolerance of the specified wafer diameter.



Select Configuration

This section identifies the configuration name and ID. Each item in this combo box represents a separate configuration that is saved in the Video.ini file. All other settings on the Vision Setup screen are saved for each configuration. New configurations can be added and deleted from the File menu. The number displayed next to this item represents the configuration id number. A handler recipe may select which configuration is to be used for Vision operations by specifying the ID number.

Typically, a different configuration number will be set up for each wafer size. The Handler recipe (Align P1) will use the ID to select which configuration to use. The wafer pattern will stored in memory and used to calculate alignment offsets for each wafer.



Camera

This identifies which camera is to be used by the frame grabber for this configuration. There can be up to 4 cameras (numbered 1-4) attached to a single frame grabber.

Units

Identifies the units of measure for all vision operations as inches or millimeters. It is important to select the same units that are used by the motors that will be affected by vision corrections. To determine the units used by the motors, refer to the motor properties screen. Currently all process equipment units are inches. These ratio buttons can also be used for converting between units. That is, to enter a number in mm on an inch-based system, select mm, and then enter appropriate numbers below in mm. Once all numbers are entered, select inches and the numbers are automatically converted to inches. It is very important that the final setting of this value be appropriate for the equipment that it is running on.

Pattern

Select the type of pattern Circle, Rectangle, or Corner as described below. All numbers are in the above specified units.

Circle - Enter the diameter of the circle and the tolerance. The tolerance specifies that when two edges of the circle are detected by the vision processing system, they must be within the specified diameter +/- the specified tolerance in order to be accepted.

Rectangle - Enter the width across as seen on the video screen of the rectangle. The length is automatically calculated when the rectangle is drawn on the screen.

Corner *- Enter the pixel to mil ratio of the camera, that is the number pixels per one mil (0.001 inches), or select calculate and follow the instructions to calculate the pixel to mil ratio by selecting 2 points that are a known distance from each other on the video screen.*

All patterns require a range setting which is the range that the pattern must fall within in order to be seen. The vision system will search the range in the positive and negative directions when searching for the pattern. Light blue lines or circles drawn on the video screen are used to graphically depict the range.

Range

This specifies how far from the original wafer diameter the Software will look for the wafer edges.

Tolerance

This specifies how much variation in diameter is allowed between opposing edges of the wafer. The Software uses this number to screen out edges that are too close or too far apart. This might occur when an edges is detect on the flat part of a wafer or the side of the Paddle. The Tolerance should be as small a number as possible!

Model Type

Real model -At teach time, an image is captured by the frame grabber and saved it to disk. During a find operation the taught image is used to locate the best pattern match in the current image. This option is not currently available for circular patterns.

Synthetic model -At teach time, an image is captured by the frame grabber and converted to a pure black to white edge transition and saved to disk. Use this to eliminate any imperfections on the image that is being taught. This method is best when the image being taught appears to have clearly visible black to white edge transitions.

Offset

X, Y, and T represent the results of the last Find Center operation and the difference from the position of the pattern when it was taught, and the position of the pattern in the image that was acquired before the Find Center operation was performed.

Line Width

These settings affect the width of the lines drawn by the Software on the screen. This is for the user's convenience; it doesn't affect the calculations in any way.

Buttons

Acquire Once – This button acquires a picture from the camera and displays it.

Acquire Continuous – This button continuously acquires and displays pictures from the camera.

Activate Circle – When this button is depressed, the user can draw a circle over the picture of the wafer to specify where the edge is.

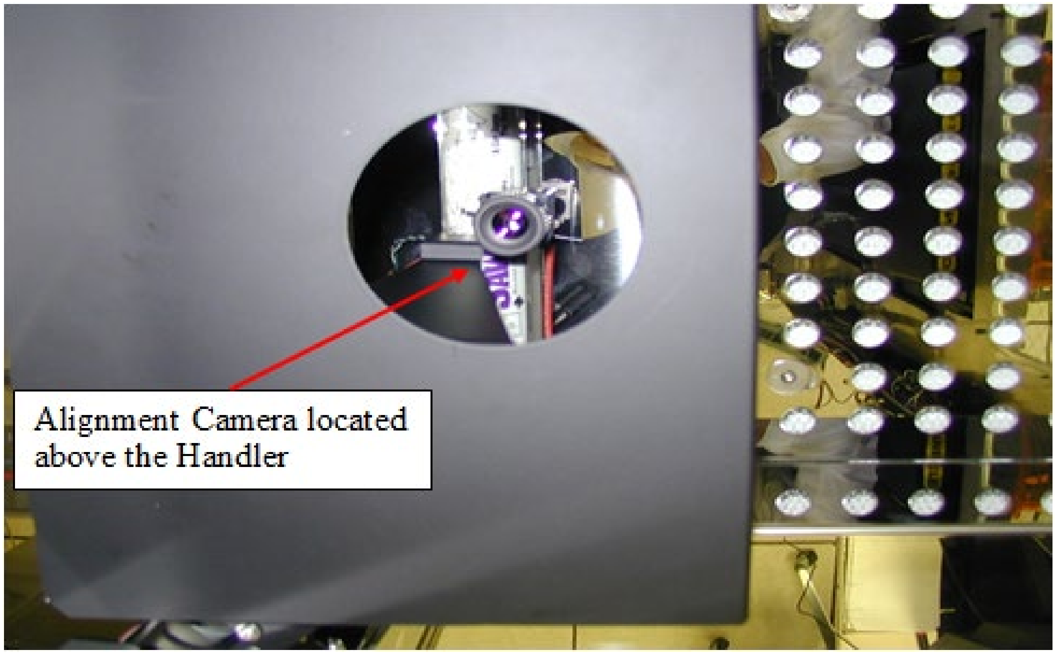
Clear Lines – This button clears the lines drawn by the Software so that the user can view the picture.

Find Center – This button performs the edge detection and center calculations on the current wafer picture. The Edge (Red) and cross-diameter (Dark Blue) lines will be drawn on the picture. The calculated Offset values will be displayed.

Snap to Center – This button should be used during training mode to adjust the size and center of the wafer circle (the light blue circle drawn by the user) so that it "snaps" to the detected edges of the wafer on the video. Hitting "Snap to Center" should cause the Offset values to become close to zero.

Vision Alignment

The VPSP Vision Alignment System is used to correct wafer position inaccuracies before placement onto a Spin Chuck. This is done by positioning the wafer under a camera before placement into one of the spin chambers. The alignment camera is located above the handler.



NOTE

It is assumed that the person performing this function is properly trained to avoid activation of this feature while certain error conditions are in place, which could cause the Handler to damage a Wafer or itself.

The camera is shown the wafer and then taught that this is the wafer's Zero X-Y position. In other words, the wafer is presented to the camera in the "Ideal" position with no X- or Y-axis positioning error. This then becomes the reference to which all other wafers are compared.

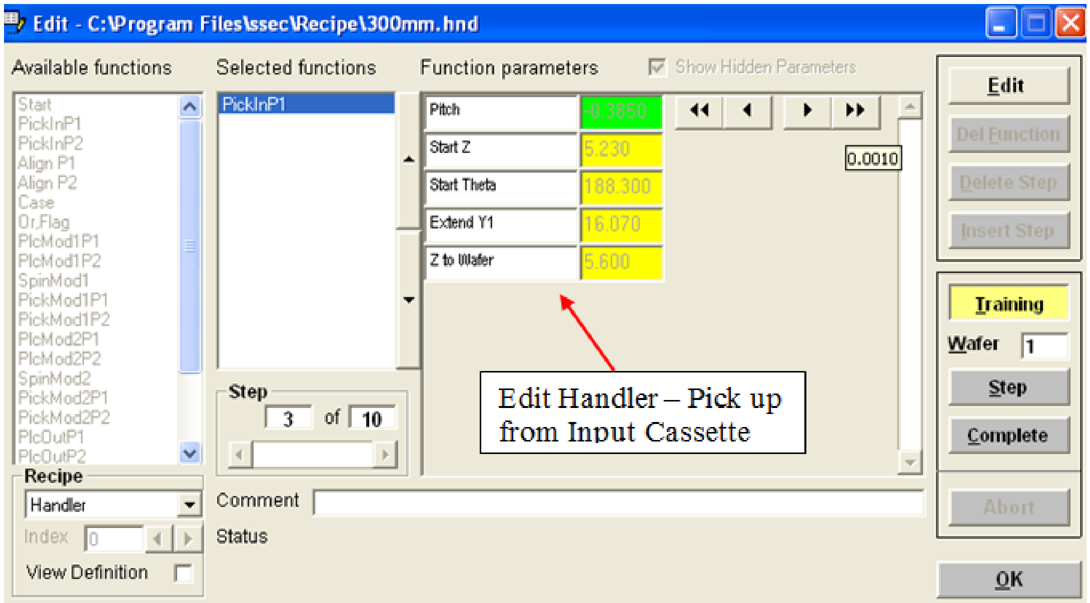
When the next wafer is positioned under the camera, and it is not in the "Ideal" position (X axis or Y axis error), then the vision system calculates this as a position error. This error (value) calculation is reported to the Robotic Handling System, so that an "offset" can be added to the placement routine (placement into the Spin Chamber). The Handler will have an error value **added** to its motion during wafer placement onto the Spin Chuck. The error added is **exactly opposite** of the error identified by the Vision System camera. So for example, the camera registers an X axis error of -.030". Then the Handler will add +.030" to its motion just before placing the wafer onto the Spin Chuck, thereby canceling out the original error. The wafer will then be placed accurately and on center.

The Vision Alignment System recognizes the wafer by identifying the edge of the wafer. Therefore the image presented to the camera must have good contrast between its edge and the background. The image should also be in sharp focus. Adjusting the camera aperture (contrast) and focusing rings will take care of these requirements. It is also assumed that the wafer is centered under the camera and on the Paddle after pick-up. This means that there are some general teaching rules (wafer pickup station, wafer alignment station teach) that have to be followed/accomplished before we teach the Vision Alignment System zero reference.

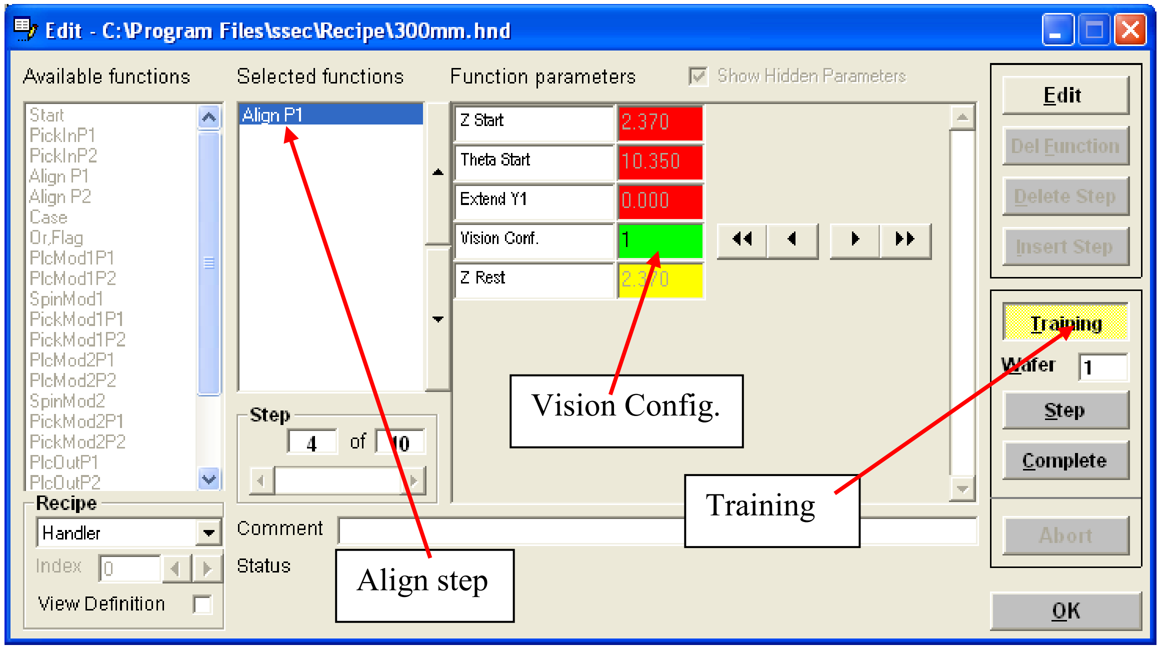
The Manual image acquisition requires that the wafers are first placed below the camera manually. The manual placement below the camera can be done by "stepping" through the Handler Edit screen. Again, it is assumed that the operator has been trained to operate the Handler and also understands VPSP's Editing Software.

To move the wafer to the desired location beneath the camera the wafer must be picked up from the input cassette.

To load the wafer, go to the "Edit Handler" procedure and pick up a wafer from the input cassette.



Once the wafer is loaded, step to the “Align” step, select “Training" and click on the “Vision Config.” Step.



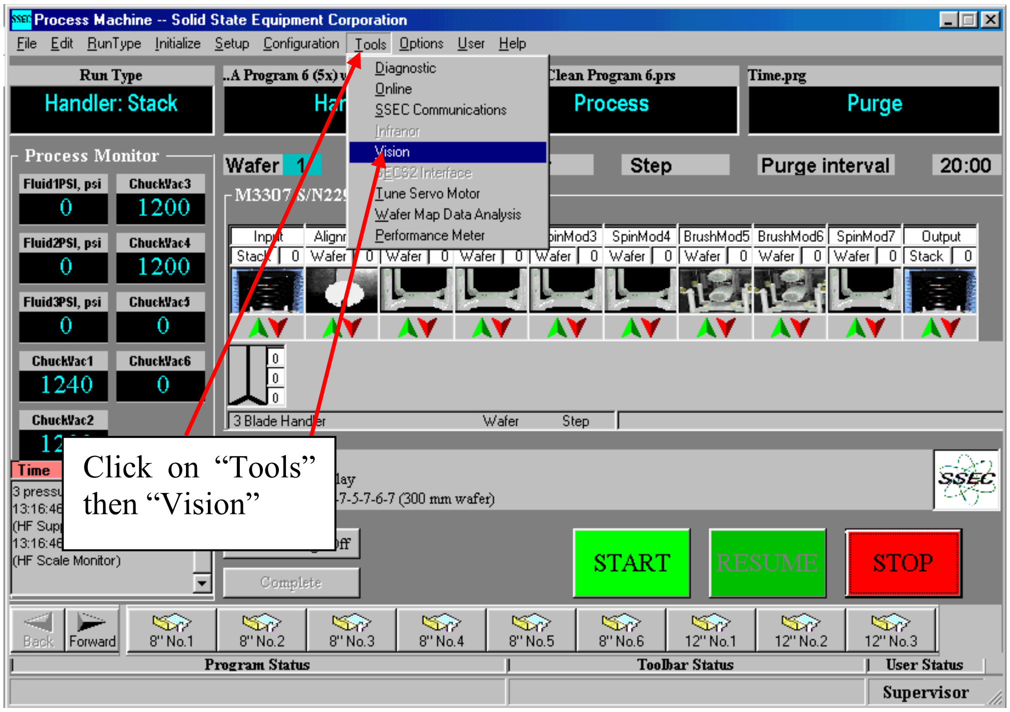
This will move the wafer under the camera for alignment. The Software will perform an alignment at this time.

NOTE

An "Error" will probably occur during this step since the "Taught" pattern may not match the position of the Wafer at this time. Simply clear the error and proceed.

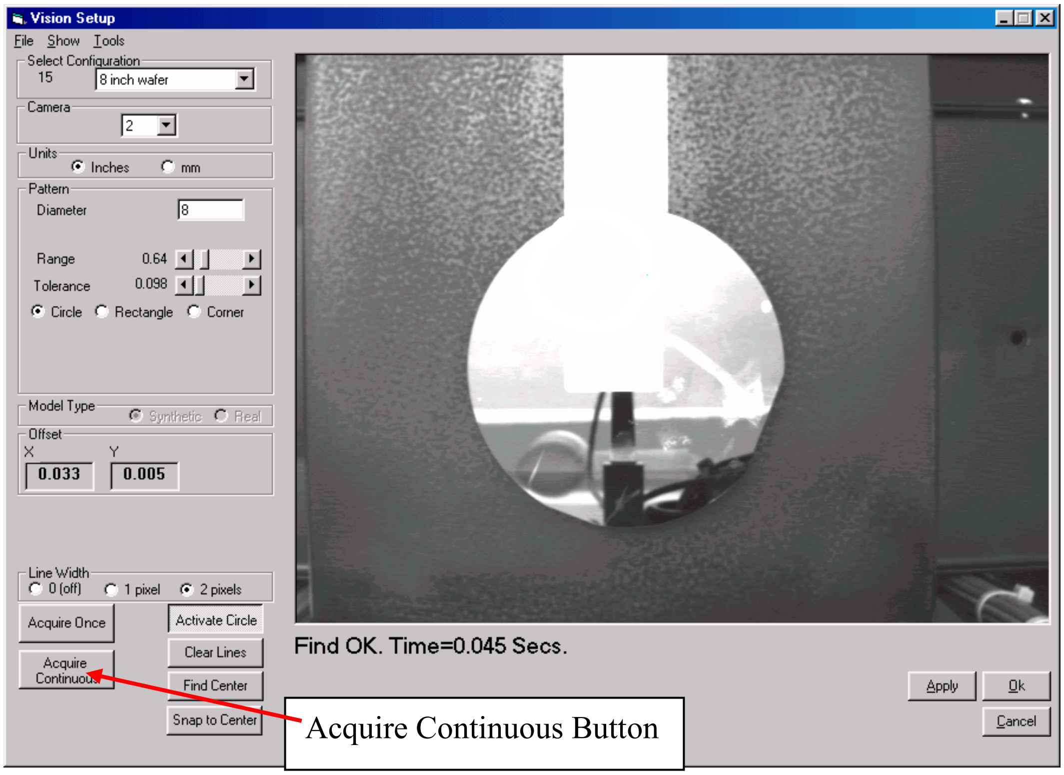
Return to the "Vision" screen to continue with vision training.

Once the wafer is placed under the camera, the operator would begin the teach process by clicking on “Tools” and then “Vision” at the top of the main menu.



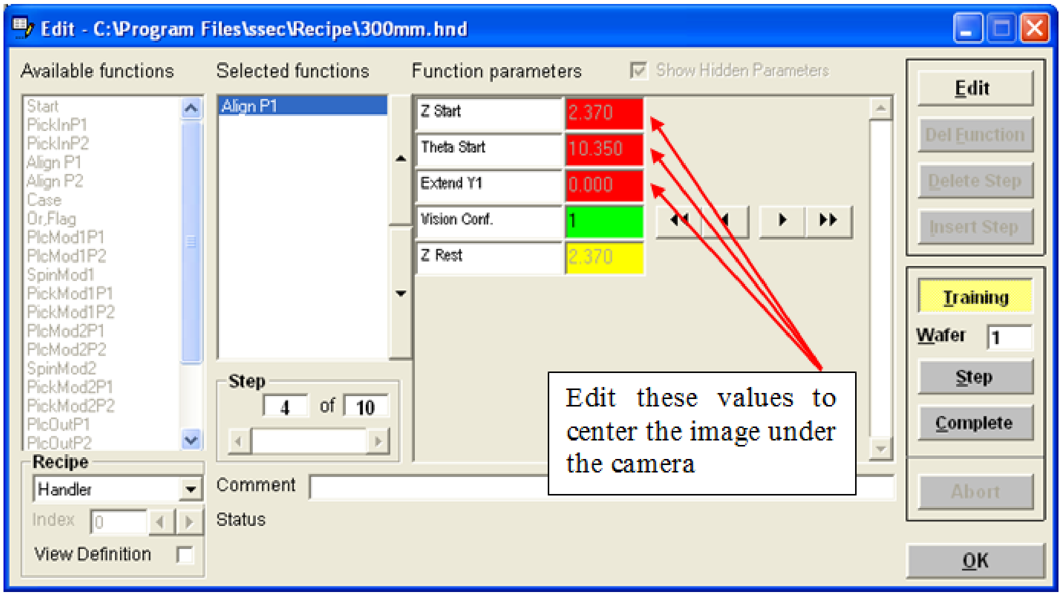
The image below shows a typical view of a wafer image (frame grabber image) as captured or "Acquired" by the vision system. This image can be automatically acquired or manually acquired.

The Handler program performs the automatic acquisition as part of the general handler recipe/program. This acquisition would occur right before placement into the Spin Chuck.



The image presented to the camera must have good contrast between its edge and the background. The image should also be in sharp focus. Adjusting the camera aperture (contrast) and focusing rings will take care of these requirements.

It is also assumed that the wafer is centered under the camera and on the after pick-up. If the wafer is not centered, go back to the Edit Handler" procedure and edit the "Z Start", "Theta Start" and "Extend Y1" values to center the image.

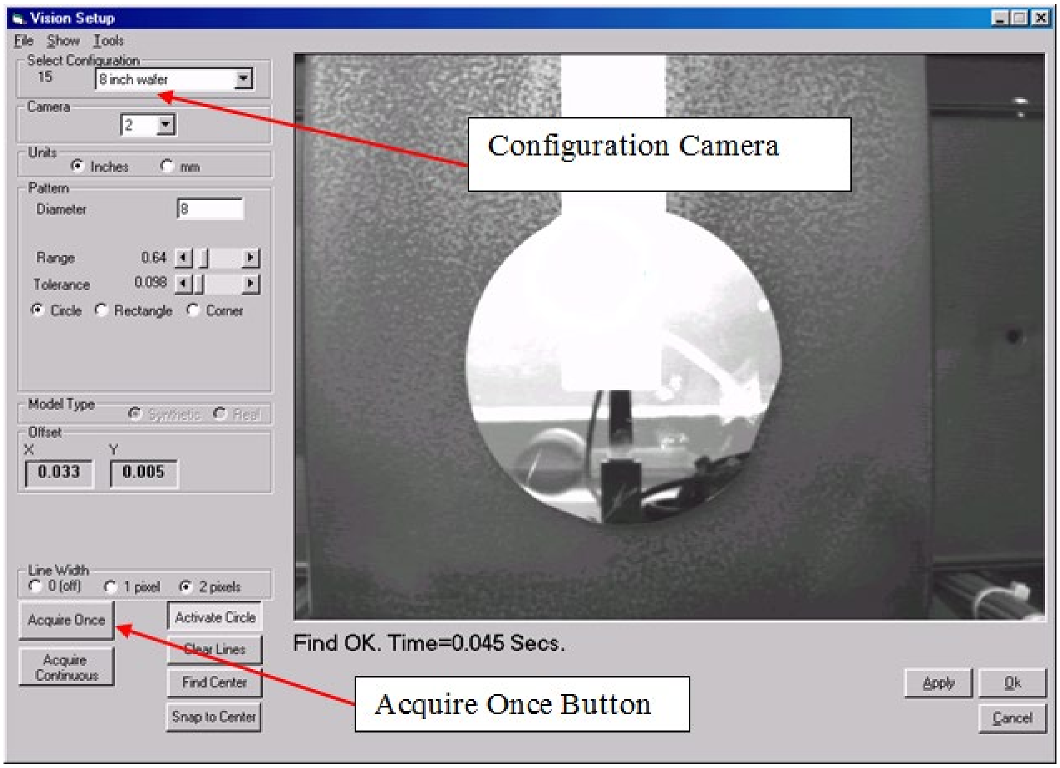


The vision screen can be viewed while editing the handler position by not closing the screen when the "Edit Handler" screen is opened.

Return to the Vision Set-up/Teach Menu.

Select the proper configuration and camera.

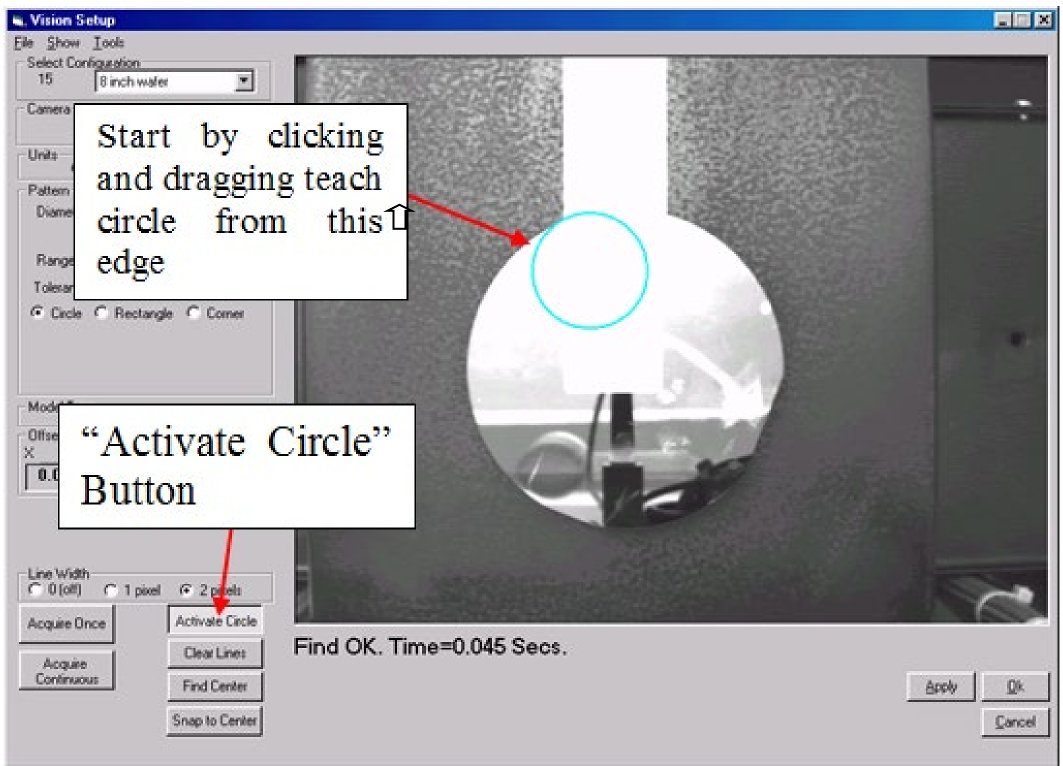
Click on the "Acquire Once" button. This will take a snap shot of the wafer. This is just a snap shot stored in memory, not a real time image.

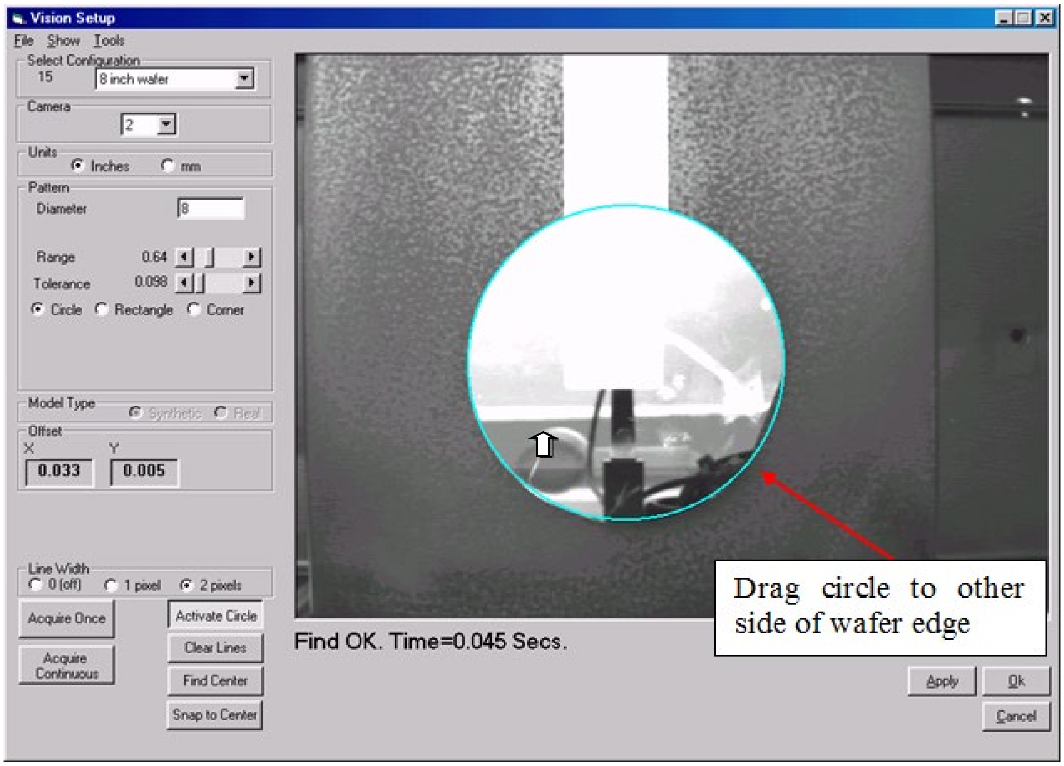


The next step requires (assuming the image is satisfactory and centered) that the operator click the "Activate Circle" button. Then move the cursor to one side of the edge of the wafer image displayed. Next, the operator would left-click and drag the cursor to the opposite edge of the wafer image. A light blue "circle" will appear and follow the cursors motion to the other side of the wafer image.

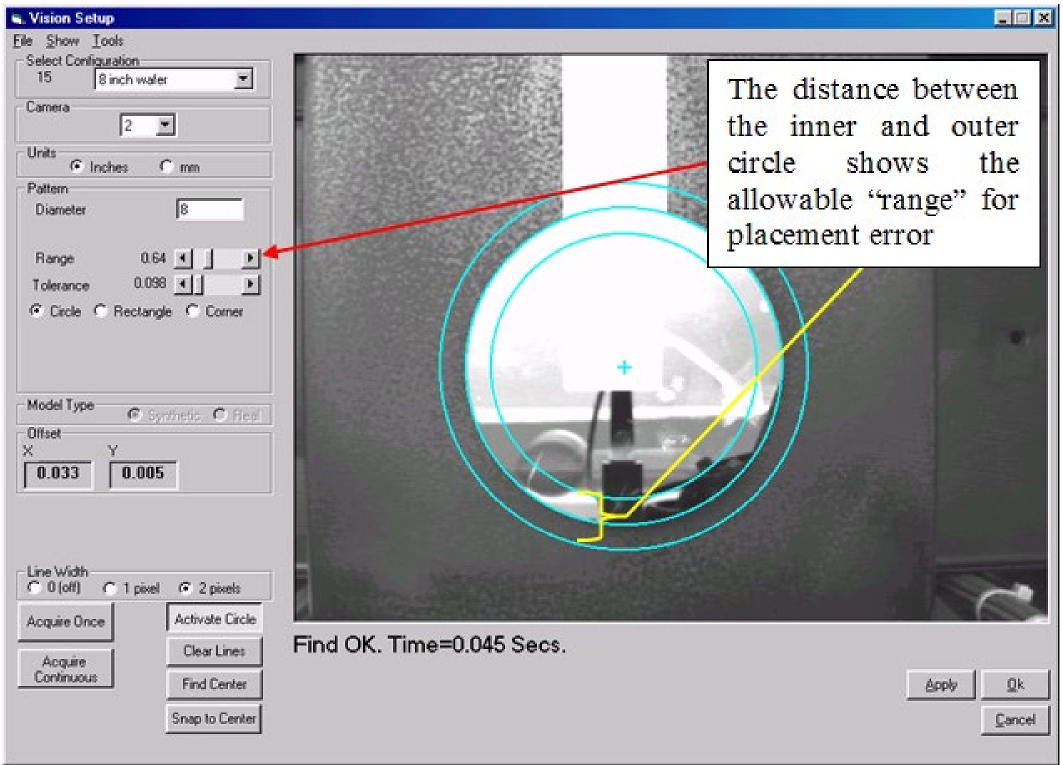
NOTE

Care should be taken to ensure that the circle is at the edges of the Wafer.




Vision Setup
File Show Tools
Select Configuration
15 8 inch wafer
Camera
2
Units
Inches mm
Pattern
Diameter 8
Range 0.64
Tolerance 0.098
Circle Rectangle Corner
Model Type
Synthetic Real
Offset
X Y
0.033 0.005
Line Width
0 (off) 1 pixel 2 pixels
Acquire Once
Acquire Continuous
Activate Circle
Clear Lines
Find Center
Snap to Center
Find OK. Time=0.045 Secs.
Drag circle to other side of wafer edge
Apply
Ok
Cancel

The operator would then release the mouse once the opposite side of the wafer is reached. The image will change from displaying one circle that matches the wafers profile, to three circles with a cross in the center.

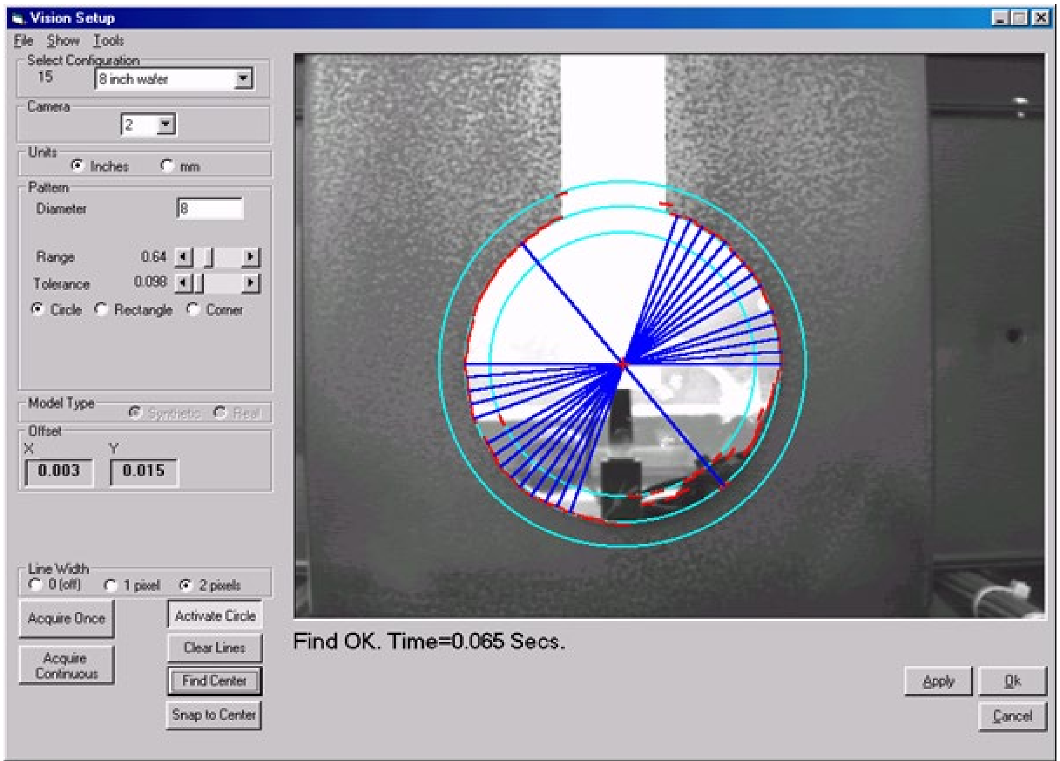


This triple circle image shows the acceptable error range for the Vision Teach program.

The range value can be adjusted higher or lower as require by clicking the arrows next to the "Range" scroll bar. In the example displayed, the value is set for 0.64. Which will allow a plus or minus 0.64" misplacement of the wafer on the Paddle without displaying an error. So the Tool will perform the required handler corrections necessary for proper placement below the 0.64" value. Above this value and a "Vision out of range" error will be displayed causing interruption to the automatic operations of the Tool.

Another parameter value called "Tolerance" (scroll bar directly below "Range") sets the allowable overall diameter variation allowed. So for example, in this value is set for .098", inferring that the diameter can vary by up to .098" without an error. Again above that value and the Tool will automatically stop a display an error.

The next step in the teach process requires that the operator press the "Find Center" Button. If successful, the display will now show multiple blue lines that radiate out from a central point (wafer center) on the wafer image. These lines demonstrate that the Tool is able find the correct edge, within range and tolerance, and then using triangulation (multiple lines) find wafer center.



The example above shows a good "find center" routine with multiple lines displayed. The more lines displayed, the better the image teach, and therefore the more accurate the placement/correction. You can also see a red circle near the actual edge of the wafer. This shows where the vision system has found an "edge". However, a blue line connecting two red points (edges) 180 degrees from each other will only be displayed if these "edges" are within the "tolerance" value programmed above in the "pattern Window" scroll bar. This way only the valid edge is used to calculate center, with the false edge information thrown out or ignored.

The operator would then press the "Snap to Center". This effectively tells the Vision System to save the displayed image as the reference to which all future images will be compared. It also tells the Vision system to consider this the X=0 and Y=0 position. Any X or Y displacement found in the following wafer images will automatically be corrected for by sending the placement error to the Handler system for correction on the fly, before placement onto the Spin Chuck or Brush Station.

Vision Alignment Training Procedure

This section describes how to train the Vision Alignment system.

Prior to starting this procedure, the user should have trained the handler to pick up the wafer and move it to a position underneath the camera.

1. Open the Vision screen by running selecting Tools/Vision from the menu.
2. Select the name of the Configuration you want to create.
3. Enter the wafer Diameter in the Diameter text box.
4. Push the Acquire Once button. You should see a picture of the wafer appear on the Vision screen.
5. Push the Activate Circle button.
6. Draw a circle as close as you can around the wafer. Do this by placing the mouse cursor at the edge of the wafer and depressing the left mouse button. Keeping the mouse button depressed, drag the mouse towards the opposite edge of the wafer. You should see a light blue circle being drawn as you drag the mouse. When the circle is as close as you can get to the actual edge of the wafer, release the mouse button.
7. Un-push the Activate Circle button.
8. You should now see three circles on the video screen. Adjust the Range so that the circles represent the range of positions the wafer can be in.
9. Push the Find Center button. You should see Red lines, representing edges, and Dark Blue Lines, representing diameters, appear on the Video screen. If you do not see the Red (Edge) lines, then the Software cannot detect the edges. You need to adjust your video to give you a better picture. If you see the Red lines but not the Dark Blue (Diameter) lines, then you need to increase your Tolerance.
10. Adjust the Tolerance to be as small as possible as long as you still get plenty of Dark Blue lines.
11. Click the Snap to Center button. The Software will adjust the circle slightly so that it conforms to the detected wafer position. You should see the Offset values become zero, or close to zero. This is now your default position for the wafer.

When running a Tool cycle, the Software aligns each wafer by doing the following:

1. Take a picture of the wafer
2. Detect the edges and center of the wafer
3. Measure the offset of the wafer center versus the center established in the Vision Alignment Training Procedure
4. Adjust the position of the handler by the Offset amount when placing the wafer

What the Software does is the equivalent of the user pushing the Acquire Once button, followed by the Find Center button.

This Page Left Intentionally Blank.

Vision Alignment Conversion Factors

Purpose

The Vision Alignment Screen gives alignment offsets in terms of X, Y, and Theta. This document describes what conversion factors to use to use these for motor movements.

This description applies to the M3301 and M3401 Tools.

There are two things that need to be considered:

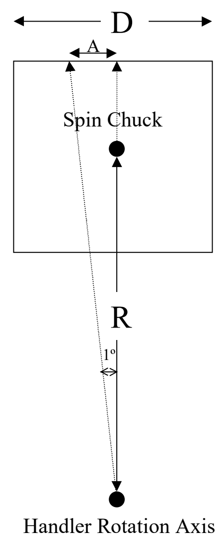
Conversion Factors – Converting the numbers in the Vision Alignment screen into appropriate motor units

Averaging – If we are doing alignment with two cameras (each camera does a separate corner), then we need to average the results.

Conversion Factors

X Offset

The Vision X offset is the distance the Handler Theta motor needs to move. Therefore, we need to convert the X offset from its units (inches or mm) to Handler Theta units (degrees).



R = radius from Handler rotation axis to Spin Chuck Center

D = diameter of square wafer

A = distance in units (inches or mm) for 1 degree of handler theta travel

C = conversion factor

Calculations:

$A = (R + D/2) * \sin(1^{\circ})$ (in units/degree)

$C = 1/A$ (in degrees/unit)

Y Offset

Conversion Factor = 1

Since the Y offset is in the same units as the Handler Y motor, no conversion is needed.

Theta Offset

Conversion Factor = 0

The Vision Theta Offset would be the amount the Spin Motor needs to turn. At this time, the Theta Offset is not used.

Alignment on Two Corners

X Offset

The X offset gets averaged

Xavg = (X1 + X2) / 2

Therefore, divide the correction factor by 2

Y Offset

The Y offset gets averaged

Yavg = (Y1 + Y2) / 2

Therefore, divide the correction factor by 2

Theta Offset

Not used

Results

X Offset

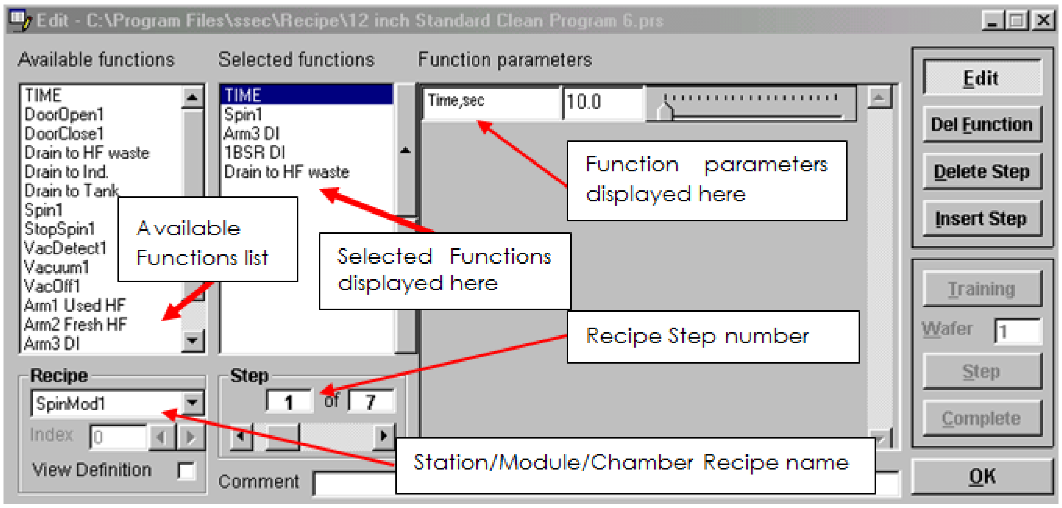
Model	R (distance from handler rotation to spin chuck center)	D (wafer of diameter)	A (units/ degree)	C (degrees/ unit)	C/2 (divide by 2 if averaging 2 corners)
M3401	39.18 inches	14 inches	.806 inch/deg 20.5 mm/deg	1.24 deg/inch .0488 deg/mm	.62 deg/inch .0244 deg/mm
M3401	39.18 inches	16 inches	.823 inch/deg 20.9 mm/deg	1.21 deg/inch .0478 deg/mm	.605 deg/inch .0239 deg/mm
M3401	39.18 inches	400 mm	.821 inch/deg 20.9 mm/deg	1.22 deg/inch .0479 deg/mm	.61 deg/inch .0240 deg/mm
M3301	23 inches	6 inches	.454 inch/deg 11.5 mm/deg	2.20 deg/inch .0868 deg/mm	1.10 deg/inch .0434 deg/mm

This Page Left Intentionally Blank.

Process Programs

Programming the Clean Chamber

Teaching and editing a process recipe using the VPSP process editor is a relatively straight forward process. The teach process involves picking specific tasks ("available functions") from a Pull-down Menu.



These tasks become part of a "Selected function" list, which is a list of functions/actions that will happen together in a particular process step. In the example above, we will use Arm 3 DI water, while we dispense DI Water from the BSR (back side rinse), with the Drain Diverter indexed to HF waste, for a duration of 10 seconds. Only the highlighted "Selected function" (in blue) will display "Function parameters" in the "Function parameters" Window.

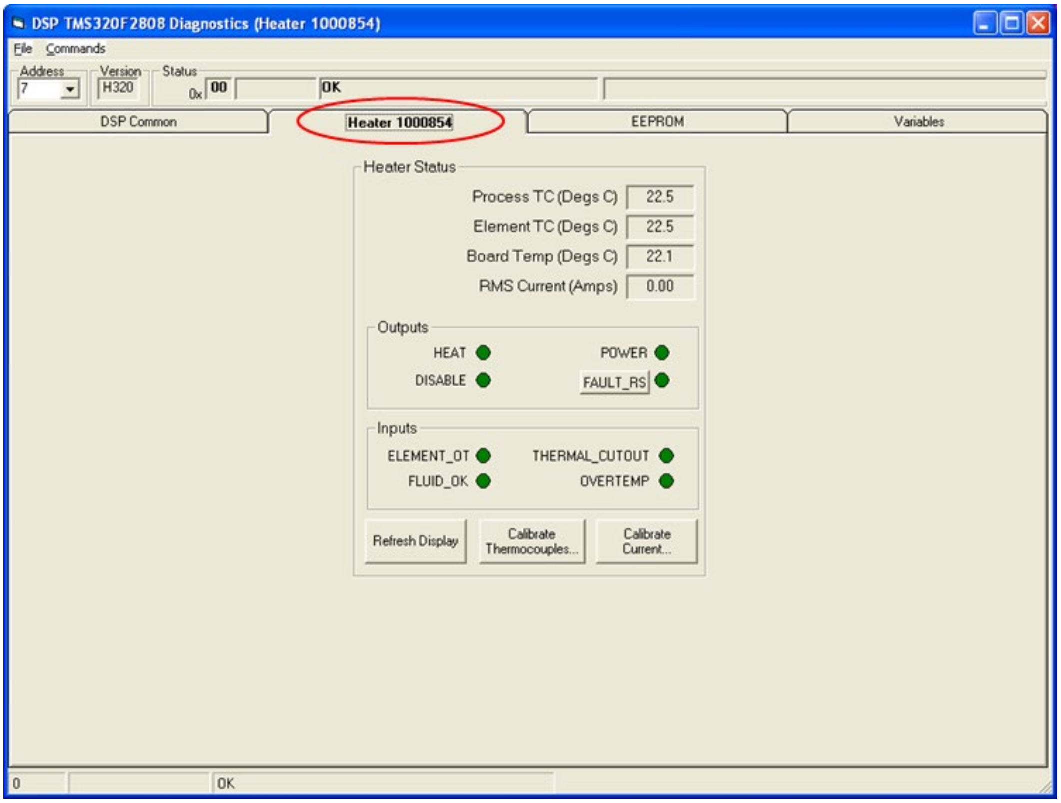
In the example above, "Time" is highlighted, so only the time parameters are displayed. A complete process program is built by adding steps ("Insert step") and then adding the appropriate available functions to the blank "Selected functions" Window. Editing a process consists of deleting steps, inserting steps, adding available functions to an existing step, or deleting selected functions from a process step.

This Page Left Intentionally Blank.

8: Software Options

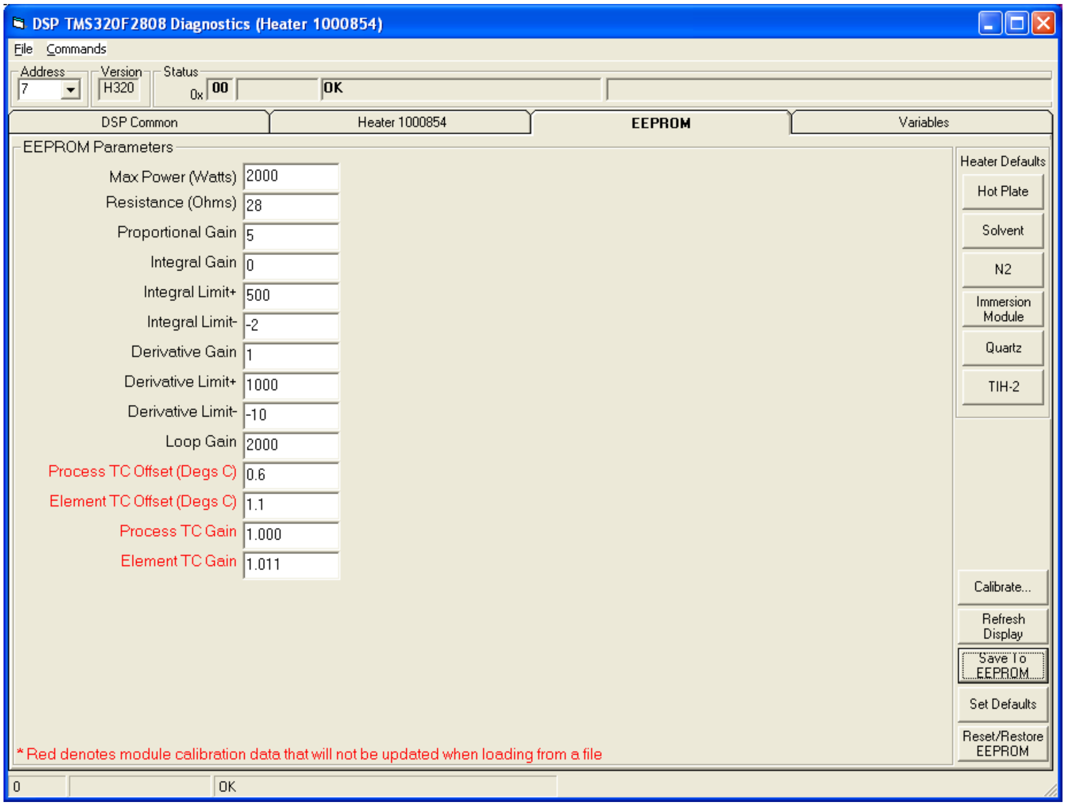
Heater Controller Module 1000854

This document describes how to configure the Heater Controller board 1000854 (110010650-G) EEPROM for operation of the various types of heaters.

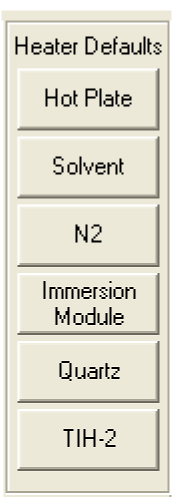


The DSP diagnostic screen shows Heater Status, TC temperatures, Board Temperature, and RMS Current to the heater. The Outputs section indicators become bright green when Heat is ON and Power is detected, dark green when heat is OFF and no power detected. The Disable indicator becomes bright red when the heat has been disabled due to an error and dark green under normal operating conditions. The Inputs section indicators are dark green under normal conditions and become bright red when an error condition occurs.

The calibration buttons are only available in maintenance mode and used only by qualified VPSP service technicians.



The heater EEPROM configuration Window, above, is used to configure the heater controller to be optimized for the type of heater it is controlling.



There are six buttons in the upper right corner of the Window.

These buttons will fill in default values for the type of heater specified. This will not set all values – only those that are specific to the type of heater selected. The values are sent to the controller memory, but are NOT saved to EEPROM.

There are four buttons in the lower right corner of the Window.

Refresh Display reloads the Window with values in the controller memory.

Save to EEPROM saves values in controller memory to EEPROM, where the values are retained through a power loss. (It also saves to file in Servo\AddressXX.htr.)

Set Defaults loads firmware default parameters, but does not save them.

Reset/Restore EEPROM resets the module, which loads values last saved to EEPROM.

A description of the various parameters follows:

Max Power (Watts) **(H320+ firmware versions)** This is the maximum power output through the heater. This should be set to the rated power for the heater (i.e., a 2-KW heater should use 2000).

Resistance (Ohms) This is the resistance of the heater in ohms and must be correct for the current and power readings to be correct. It should come from the heater specification.

Proportional Gain This is the weight associated with the proportional error in the PID control of the heater. Proportional error is the difference between the set temperature and the Process Thermocouple actual temperature.

Integral Gain This is the weight associated with the integral error in the PID control of the heater. Integral error is the sum of the proportional error over time. The total is limited by Integral limit parameters.

Integral Limit +/- These are positive and negative limits on the calculated integral.

Derivative Gain This is the weight associated with the derivative error in the PID control of the heater. Derivative is the rate at which the temperature is changing.

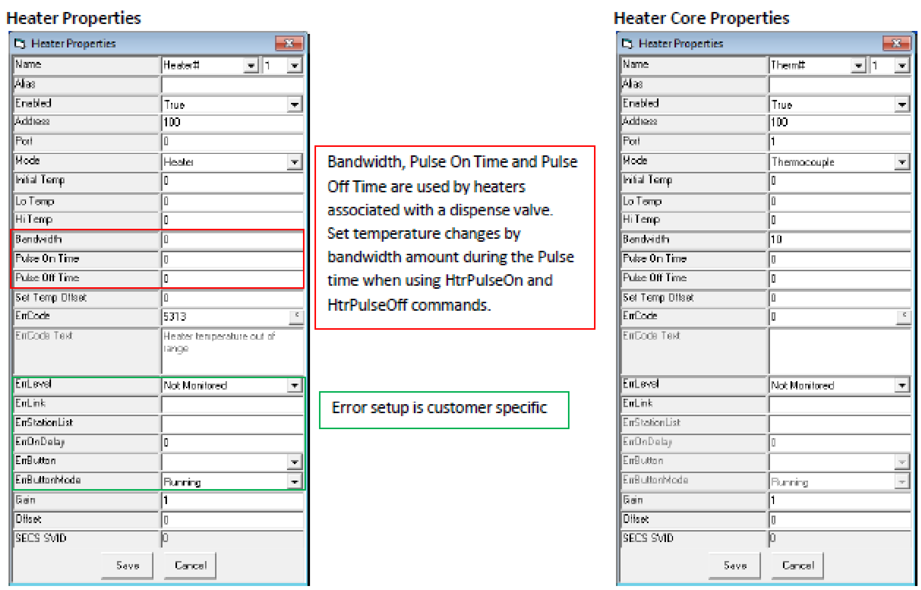
Derivative Limit +/- These are the positive and negative limits on the calculated Derivative.

Loop Gain **(H320+ firmware versions)** This value is used for proportional power output. Values less than 2000 will run the heater with proportional power output. Set equal to max power to force the heater to run at full power whenever it is turned on.

Process/Element TC Offset/Gain	These parameters are calibrated on the bench for each module to correct the TC values. The internal TC value is multiplied by the Slope and the Offset is then added to the result to produce the Process/Element TC values. These are unique to each ***module*** and should **NEVER** be copied from one module to another.
Max Element Temp	When the Element TC reaches this temperature, the firmware will shut off the heater power. The purpose of this parameter is to shut the heater off in firmware before a hardware over-temp error occurs. The hardware over-temp is a fatal error that requires a reset of the heater controller module to recover.

Heater Properties

Every heater requires two heater devices for each address, one for the heater itself (Port = 0, Mode = Heater) and one for the element thermocouple or core (Port = 1, Mode = thermocouple). The core should be set up for all heaters as follows:



For reference purposes, these are the default settings for various heater types:

<u>Hotplate Defaults (for 330x Tools)</u>

Max Power = 500 watts

Resistance = 151 ohms

Proportional Gain = 10

Integral Gain = 1

Integral Limit+ = 100

Integral Limit- = 0

Derivative Gain = 5

Derivative Limit+ = 1000

Derivative Limit- = -10

Loop Gain = 500

Max Element Temperature = 220

<u>Hotplate Defaults (for 340x Tools)</u>

Same as Hotplate for 330x Tools

with the following changes:

Max Power = 2000 watts

Resistance = 29 ohms

Loop Gain = 2000

2-kW Solvent Heater Defaults

Max Power = 2000 watts

Resistance = 28 ohms

Proportional Gain = 5

Integral Gain = 0

Derivative Gain = 1

Derivative Limit+ = 1000

Derivative Limit- = -10

Loop Gain = 2000

Max Element Temperature = 95

3-kW Solvent Heater Defaults

Same as 2-kW Solvent Heater with following changes:

Max Power = 3000

Resistance = 19 ohms

Loop Gain = 3000

N_2 Heater Defaults

Max Power = 400 watts

Resistance = 144 ohms

Proportional Gain = 5

Integral Gain = 0

Derivative Gain = 1

Derivative Limit+ = 1000

Derivative Limit- = -10

Loop Gain = 400

Max Element Temperature = 180

Immersion Module Heater Defaults

Max Power = 2000 watts

Resistance = 24 ohms

Proportional Gain = 5

Integral Gain = 0

Derivative Gain = 1

Derivative Limit+ = 1000

Derivative Limit- = -10

Loop Gain = 2000

Max Element Temperature = 100

3-kW (max 2-kW) Quartz Heater (Imtec)

Max Power = 2000 watts

For 208 VAC systems Resistance = 22 ohms

For 220 VAC systems Resistance = 25 ohms

For 240 VAC systems Resistance = 29 ohms

Proportional Gain = 8

Integral Gain = 1

Integral Limit+ = 500

Integral Limit- = -2

Derivative Gain = 1

Derivative Limit+ = 400

Derivative Limit- = -1

Loop Gain = 2000

Max Element Temperature = 70

3-kW (max 12.5 Amps output) Quartz Heater (Imtec)

Power = 2000 watts

For 240 VAC systems Resistance = 19 ohms

Proportional Gain = 8

Integral Gain = 1

Integral Limit+ = 500

Integral Limit- = -2

Derivative Gain = 1

Derivative Limit+ = 400

Derivative Limit- = -1

Loop Gain = 2000

Max Element Temperature = 70

Teflon Inline Heater (TIH-2)

Max Power = 2000 watts

Resistance = 22 ohms

Proportional Gain = 5

Derivative Gain = 3

Derivative Limit+ = 250

Derivative Limit- = -250

Integral Gain = 0

Loop Gain = 2000

Max Element Temperature = 175

LED Descriptions

There are three LEDs on the Heater Controller module that function as follows:

1. Status LED
   - Blinks green fast at power up, and if there are any errors present
   - Blinks green once/second after Reset, and if there are no errors
2. Fault LED
   - Solid OFF if there are no faults
   - Solid red ON if any hardware faults are present (See next section for a description of hardware faults.)
3. Power
   - Solid OFF if the detected current to the heater element is ≤ 0.1 amp
   - Solid green ON if the detected current to the heater element is > 0.1 amps

Hardware Faults

When a hardware fault occurs, the red fault LED comes on; the mechanical relay shuts OFF so that no power is supplied to the heating element. The fault condition can only be cleared by a Reset. The following conditions result in a hardware fault:

1. **Thermal Cutout** – J3 Pins 7 and 8 open circuit will set the error condition. The pins can either be jumpered together for systems that do not have a thermal cutout switch, or be connected to a thermal cutout switch, which is closed as long as the temperature is below a threshold for the switch. These pins are also labeled TC0-BLK,BLK on the module cover

2. **Solid State Relay Short** – This occurs when the firmware has attempted to turn off power to the heating element, but a current is still detected across the element. A solid state relay short occurs if the heat has been off for at least 1 second, and the detected current is > 1 amp.

3. **Element OT** – Element TC reads higher than a threshold temperature. The threshold temperature is determined by the resistance between pins 1 and 2 on J8 of the heater controller module. Refer to the following chart to determine the threshold temperature, based on the resistor value on J8.

Resistor Value (K Ohms)	Threshold Temperature (Degs C)
0 (Short Circuit)	250
2.00	245
4.20	240
6.50	235
9.00	230
11.50	225
14.50	220
17.50	215
21.00	210
24.00	205
28.00	200
32.00	195
37.00	190
41.00	185
47.00	180
53.00	175
59.00	170
66.00	165
74.00	160
84.00	155
93.00	150
105.00	145
120.00	140
135.00	135
152.00	130
175.00	125
205.00	120
240.00	115
280.00	110
340.00	105
422.00	100
550.00	95
750.00	90
1,200.00	85
2,400.00	80
Open	75

Status Errors

Status errors can occur for various reasons, including, but not limited to, hardware faults. Some status errors latch, meaning that when the error occurs, it can only be cleared by resetting the module. Other status errors are momentary indications of error conditions that are cleared if the error condition goes away. If any status errors are present, bit 7 of the status byte is set, and the status LED will blink fast.

The following status errors will latch until reset:

1. Thermal Cutout – Hardware Fault
2. Element OT – Hardware Fault
3. Solid State Relay Short – Hardware Fault
4. Open TC – this is the only latching error that is not a hardware fault. An open TC will read as a very high temperature, >275 degrees C. If an open process TC is detected and no hardware fault exists, the heater will continue to function. If the error is intermittent, the heater will be able to operate when the error condition no longer exists. As long as the error condition exists, the heat will not turn on, because the process TC is too high. An open element TC will always result in an Element OT, as well, and therefore cause a hardware fault. After an Element OT, the module must be reset in order for the heater to function.

The following status errors do NOT latch, and will automatically clear when the error condition no longer exists:

1. No fluid – If the fluid sensor detects no fluid, the heat is automatically disabled. As soon as the Fluid Present sensor detects fluid, the heat is enabled and can heat again, provided there are no hardware faults or open thermocouples.
2. Temperature out of range – If the process temperature is below the low threshold or above the high threshold sent to the firmware, the error occurs. This is for information only and does not affect heater operation.
3. Heater Element Open – Heat is ON for at least one second and < 0.01 amps is detected across the element. This is for information only and does not affect heater operation.

Module 5V Supply Monitor

To set up an ADC to monitor the 5-v supply on each heater module, create an ADC with the module address and set the Port to 7. The Gain = 0.0014652; Offset = 0; Units = V; Decimals = 2. Everything else can be set to defaults.

Heat Exchangers – Neslab – Phoenix – Software Control

Purpose

This document describes Software control of the heat exchangers from the SSEC Process Software.

Summary

- The heat exchangers are controlled by a serial RS-232 connection from the equipment PC to the heat exchanger.
- The only command supported is the "Setpoint" command. A different version of the "Setpoint" command is used, depending on the type of heat exchanger.
- For some heat exchangers, the communications module is an option that needs to be purchased with the heat exchanger.
- Typically, the heat exchanger can be controlled locally OR remotely. When the heat exchanger is in remote communications mode, it cannot also be controlled locally.

Definition File Commands

The only command supported for the heat exchangers is the "Setpoint" command. There is a different version of the Setpoint command for different types of heat exchangers. Typically, a "Neslab" function is defined in the >>Setup section of the Function.def file. The function sets the setpoint temperature for each Neslab unit. The process recipe (*.prs) calls the Neslab function in its Setup section.

Command format:

The Setpoint command takes the COM port number in the Index column and the desired temperature in the Data column.

Table 1 Example from a Function.def file

```
//Label     Type  Index      Command      Parameter         Data  Min    Max Change Sec
>>Setup
Setup             Tank1      DACSet       Tk1 Etch1 Set     10     0      72     1      0
Setup             Tank1      ADCSetLow    Tk1 Etch1 Low     0      0      72     1      0
Setup             Tank1      ADCSetHigh   Tk1 Etch1 High    20     0      72     1      0

// Set temperature of different types of heat exchangers on serial ports 6,7,and 8
Neslab            6      NeslabSetpoint   RTE 740 Temp      55     0      70     1      0
Neslab            7      NeslabHXSetpoint HX 500 Temp       55     0      70     1      0
Neslab            8      PhoenixSetpoint  Phoenix Temp      55     0      70     1      0
```

Heat Exchanger Specifics

Neslab RTE 740

Process Software	Requires >= Process 7.9.4
Definition File Command	NeslabSetpoint
Serial Cable	Straight connection (9 pin connector: pin-2 to pin-2, pin-3 to pin-3)
Hardware Requirements	The RTE 740 must include the "Digital Plus" option for serial communications. The "Digital One" unit does not have RS-232 control.
Switching the heat exchanger between Local and Remote modes	Plug into the RS-232 connector on the back of the Neslab unit. Put the Neslab unit into Serial Communications mode by pressing the "Computer" button on the front of the unit. Once you do that, the unit can accept commands from the RS-232 connection. It will no longer accept commands from the Neslab keypad, until you press the Computer button to take it out of serial communications mode
Special instructions	If you power down the unit in serial communications mode, you need to do the following to power up again in manual mode (this is from page 22 in the Neslab manual): • Press and hold both arrow keys for 10 seconds • Once the unit powers up, press the Computer button to take it out of serial mode • Turn off the Neslab unit Then you can power on again and you will be in manual mode

Neslab HX 500

Process Software	Requires >= Process 7.40.6
Definition File Command	NeslabHXSetpoint
Serial Cable	Straight connection (9 pin connector: pin-2 to pin-2, pin-3 to pin-3)
Hardware Requirements	None
Switching the heat exchanger between Local and Remote modes	Plug into the RS-232 COMM connector on the back of the unit. To put the heat exchanger into Remote communications mode, follow the Setup Loop flow chart on page 30-31 of the HX 500 manual. A summary of steps is listed below. When the unit is in Remote communications mode, the **RMT Comm** LED on the front panel is lit **To go from Local to Remote mode:** To start the loop, TEMP should be displayed in the LCD display panel. If not, press the Next button to switch the display until TEMP is displayed. TEMP: Hold ENTER key and press NEXT NEXT, NEXT… Press NEXT until you get to COMM OFF COMM OFF: Press No

	COMM ON?: Press NEXT (We don't see COMMADR? or PC COMM selections) RESTRT OFF: NEXT TENTH OFF: NEXT SAVE?: Press Yes You will see Remote LED turn on **To go from Remote to Local mode:** Same as above, except when it says COMM ON, press No to switch to COM OFF.
Special instructions	The SSEC Software requires the Neslab HX units to be in degrees, not .1 degrees. Verify the setting "TENTH OFF".

Phoenix Haake

Process Software	Requires >= Process 7.9.4
Definition File Command	PhoenixSetpoint
Serial Cable	Straight connection (9 pin connector: pin-2 to pin-2, pin-3 to pin-3)
Hardware Requirements	None
Switching the heat exchanger between Local and Remote modes	No special commands are required to switch between Local and Remote modes.
Special instructions	None

This Page Left Intentionally Blank.

Maintenance Counters – Count Wafers Only

Description

This document describes how to set up the Maintenance Counters to only count Wafers. The basic idea is to configure all the maintenance counters to count wafers by setting them all to type “Wafer”. Then in the User Privilege screen, remove the “Counters/Counter Type” and “Counters/Clear” privileges for all user roles, so that no one can change the counter type to anything else.

Procedure

Step 1 – Install Process 7.30.4 or greater

Process 7.30.4 is required to assign user privilege levels to individual fields in the Maintenance Counter screen.

Step 2 – Configure Maintenance Counters

In the Maintenance Counter screen, do the following:

- Open the Maintenance Counter screen by selecting “Setup/Counters” from the Process menu
- Turn all counters “On” by clicking the On button
- Change the counter type to “Wafer” for all counters
- Turn off all the counters

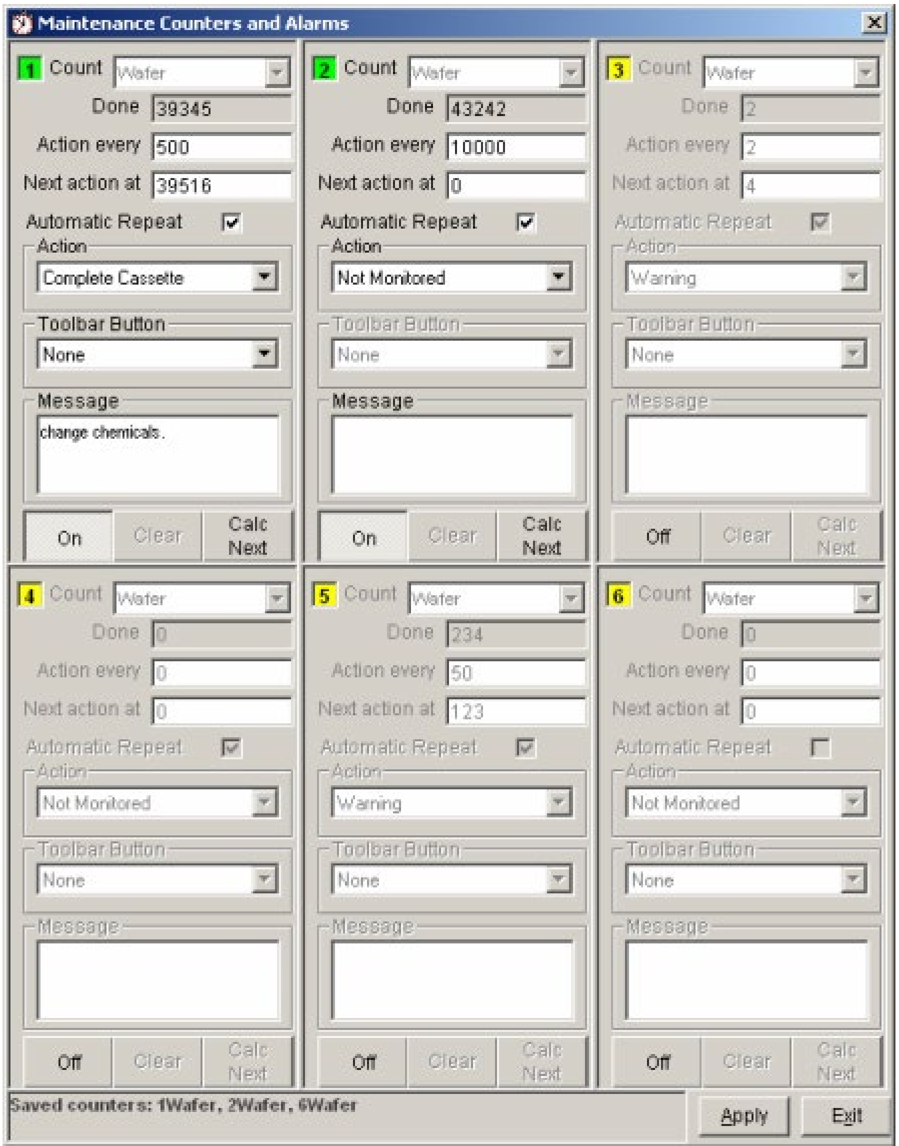


Figure 1 Maintenance Counter Screen

Step 3 – Configure User Privileges

Configure the User Privileges as follows:

- Open the User Privilege Configuration screen by selecting "User/Edit User List" from the Process Menu
- Click the "Login" button. Log in as the Administrative Supervisor, User Name = "SSECUSA". Remember, only the Administrative Supervisor has the privilege to edit the user Role Definitions.
- Select the "Role Definitions" tab
- Find the "Counters/Counter Type" privilege. Uncheck the privilege for all users.
- Find the "Counters/Clear" privilege. Uncheck the privilege for all users.
- Close the User Privilege Configuration screen

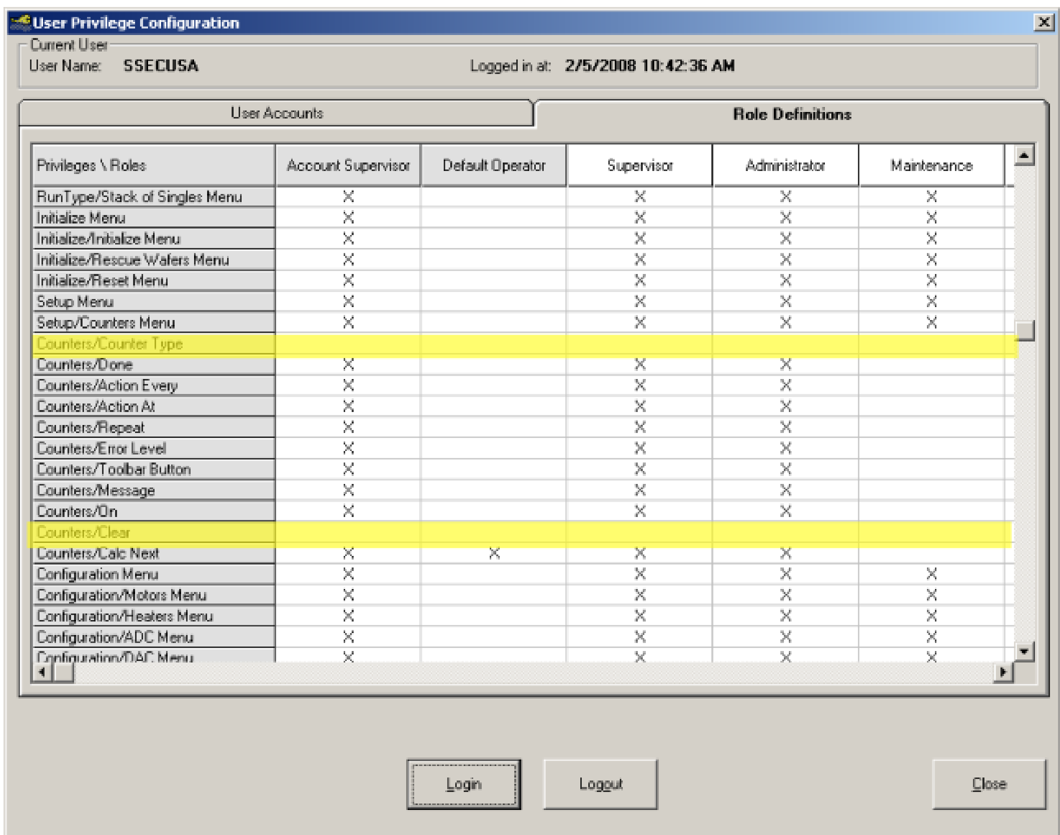


Figure 2 User Privilege Configuration Screen

Step 4 – Verify Counters

- Open the Maintenance Counters Screen
- The Counter Type field should be set to "Wafer" for all counters. The field should be disabled for all user roles.
- The Clear button should be disabled for all user roles.

Process Database

Overview

Process data is written to a database for storage and analysis. This document describes the database, the Process Software that writes the data to the database, and the ProcessView Software that reads data from the database.

Requirements

Equipment PC

These are the minimum requirements for the equipment PC to support the database:

- 2MB RAM
- Operating System
  The following operating systems are supported:
  - Microsoft Windows XP SP2 or SP3
  - Microsoft Windows 7
- Microsoft SQL Server Express 2005
- Microsoft .Net Framework
  - Microsoft .Net Framework 3.5 Required for ProcessView 1.0.0.4 and greater
  - Microsoft .Net Framework 2.0 Required for ProcessView 1.0.0.0 to 1.0.0.3
- SSEC Process 7.36.4 or greater
- SSEC Process View 1.0.0.0 or greater
- SSEC ProcessDataHost 1.0.0.0 or greater required if remote reading capability is used

Remote PC

Reading the data from a remote PC requires the following:

- 2MB RAM
- Operating System
  One of the following:
  - Microsoft Windows XP SP2 or SP3
  - Microsoft Windows 7
- Microsoft .Net Framework 3.5
- SSEC ProcessView 1.0.0.4 or greater

NOTE

The equipment PC must be running SSEC ProcessDataHost.

Components

The database requires three components:

1. Database – The Database is used to store the data
2. Writing - Process Software – The Process Software writes all the data to the database. Data includes the current device settings and readings, as well as events, such as Wafer Moved, Process Started, etc.
3. Reading – ProcessView, ProcessDataHost applications – The ProcessView application reads data from the database. Data can be viewed or stored to a file. The ProcessDataHost application is used for an intermediary for remote connections.

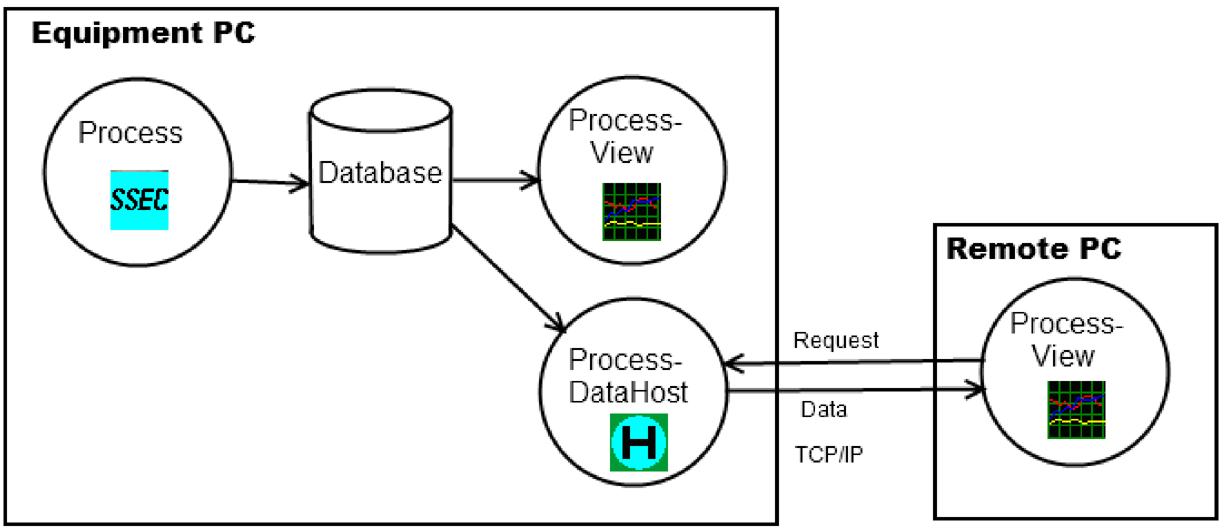


Figure 3 Process Database Components

Database

Data is stored in a Microsoft SQL Server database. The database can be up to 4 GB in size and typically contains 30 days' worth of data. Data older than 30 days is deleted from the database to make room for new data.

There are two main tables in the database. The Process Data Table contains the current value of all devices written every second. This includes all ADCs, DACs, Heaters, Motors, Sensors, Solenoids, and Tanks. The Event Table contains information about events. Examples of events are: Wafer Picked Up, Wafer Placed, Station Process Started, Station Process Ended, Errors, etc.

	TimeStamp	ADC_PadVac1	ADC_PadVac2	HTR_Heater1	HTR_Therm1	HTR_Heater2	SEN_Mod2Float	SEN_Mod2DrClsd	SEN_Mod2DrOpn
1	2010-01-28 16:01:06.000	232	3172	85.7	84.3	32.5	1	0	1
2	2010-01-28 16:01:07.000	232	3172	85.7	84.3	32.5	1	0	1
3	2010-01-28 16:01:08.000	232	3172	85.7	84.3	32.5	1	0	1
4	2010-01-28 16:01:09.000	232	3168	85.7	84.3	32.5	1	0	1
5	2010-01-28 16:01:10.000	232	3172	85.6	84.3	32.5	1	0	1
6	2010-01-28 16:01:11.000	232	3172	85.6	84.3	32.5	1	0	1
7	2010-01-28 16:01:12.000	232	3168	85.6	84.3	32.5	1	0	1
8	2010-01-28 16:01:13.000	232	3172	85.6	84.3	32.6	1	0	1
9	2010-01-28 16:01:14.000	232	3172	85.6	84.3	32.5	1	0	1
10	2010-01-28 16:01:15.000	232	3172	85.6	84.3	32.6	1	0	1
11	2010-01-28 16:01:16.000	232	3172	85.6	84.3	32.6	1	0	1
12	2010-01-28 16:01:17.000	232	3172	85.6	84.3	32.5	1	0	1
13	2010-01-28 16:01:18.000	232	3168	85.6	84.2	32.5	1	0	1
14	2010-01-28 16:01:19.000	232	3172	85.6	84.2	32.6	1	0	1

Figure 4 Process Data Table section

TimeStamp	EventID	EventDescription	ParamName1	ParamValue1	ParamName2	ParamValue2	ParamName3	ParamVa
1/28/2010 5:01:49 PM	4038	Wafer Placed	StationName	SpinMod2	WaferID	CassA3.9	*NULL*	*NULL*
1/28/2010 5:01:49 PM	4096	Station Process Started	StationName	SpinMod2	WaferID	CassA3.9	*NULL*	*NULL*
1/28/2010 5:01:49 PM	4090	Process Step Started	StationName	SpinMod2	WaferID	CassA3.9	Step	0
1/28/2010 5:01:52 PM	4091	Process Step Completed	StationName	SpinMod2	WaferID	CassA3.9	Step	0
1/28/2010 5:01:52 PM	4090	Process Step Started	StationName	SpinMod2	WaferID	CassA3.9	Step	1
1/28/2010 5:01:58 PM	4036	Wafer Picked Up	StationName	SpinMod3	WaferID	CassA3.11	*NULL*	*NULL*
1/28/2010 5:02:02 PM	17	Process Error	ErrCode	5310	ErrLevel	2	ErrMsg	Tank Pre
1/28/2010 5:02:07 PM	4091	Process Step Completed	StationName	SpinMod2	WaferID	CassA3.9	Step	1
1/28/2010 5:02:07 PM	4097	Station Process Completed	StationName	SpinMod2	WaferID	CassA3.9	*NULL*	*NULL*
1/28/2010 5:02:08 PM	4038	Wafer Placed	StationName	SpinMod3	WaferID	CassA3.10	*NULL*	*NULL*
1/28/2010 5:02:08 PM	4096	Station Process Started	StationName	SpinMod3	WaferID	CassA3.10	*NULL*	*NULL*
1/28/2010 5:02:08 PM	4090	Process Step Started	StationName	SpinMod3	WaferID	CassA3.10	Step	0

Figure 5 Process Events Table section

Writing to the Database

All the data is written to the database by the Process Software.

Process Software

The Process Software writes the current device values to the Process Data Table every second. It writes events to the Events table as they occur.

Once the database has been initialized, the Process Software will automatically start writing to it every time the Process Software is started. Database initialization is performed when the equipment is initially configured in the VPSP factory.

To view the Process Database status, select "Tools/Process Database" from the main Process menu.

Initializing the Process Database

To initialize the Process Database, select "Tasks/Initialize" from the Process Database menu. This task only needs to be done one time, when the Process Database is first started. After that, the Process Software will start writing to the Process Database automatically every time the Process Software is started.

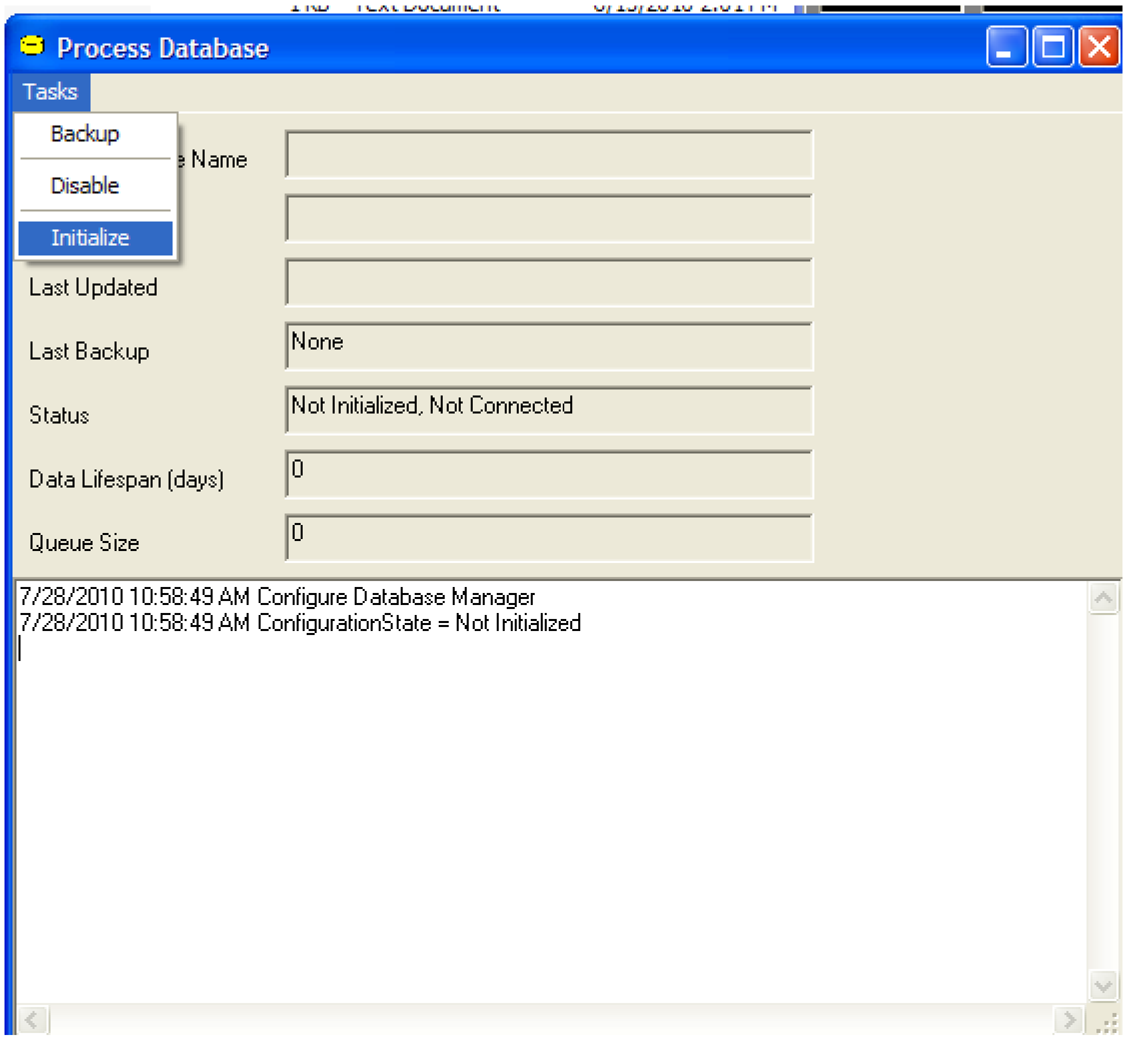


Figure 6   Initialize Process Database

Process Database Status

The status of the Process Database can be viewed by looking at the Process Database screen. If the database is functioning properly, then:

- The **Status** field should say "Initialized, Connected"
- The **Last Updated** field should increment the time every second. This field updates every time the Process Software writes to the Process Data Table.

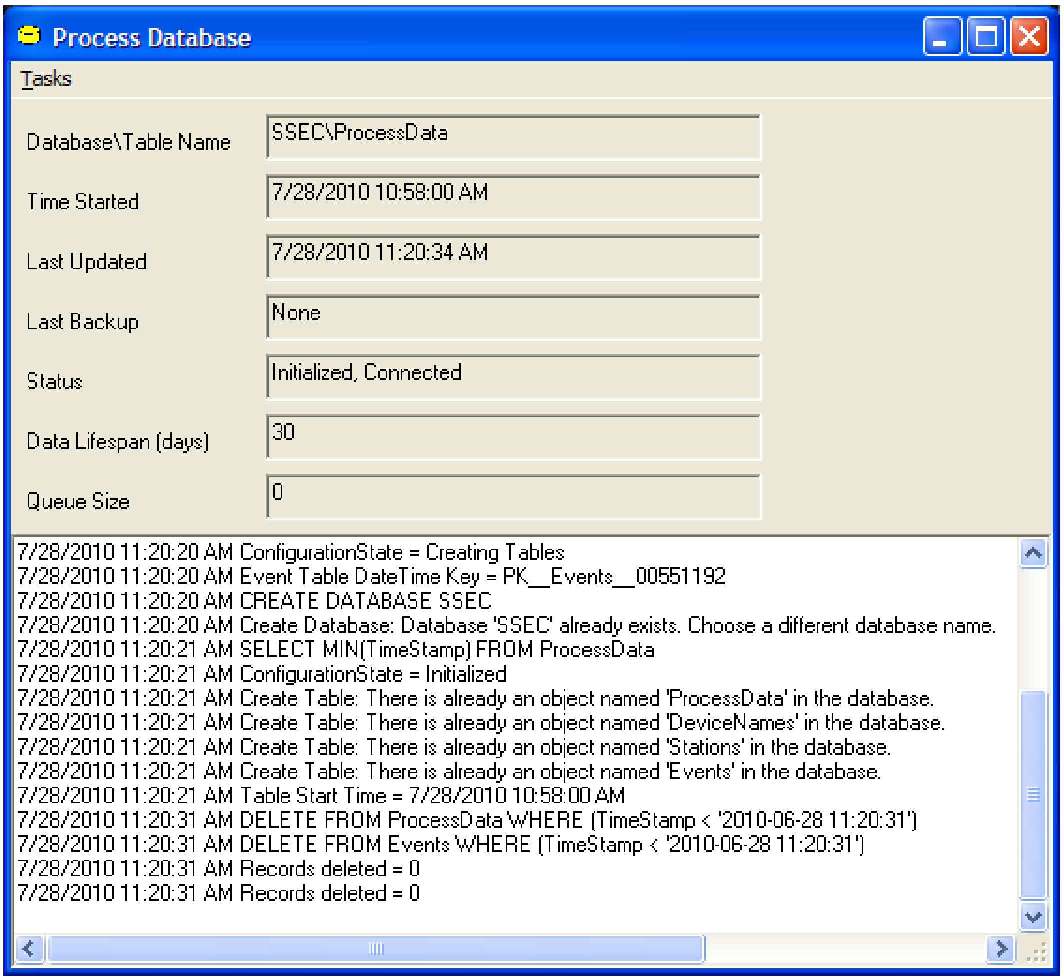


Figure 7 Process Database Status

Disabling the Process Database

It should not be necessary to disable the Process Database. However, if desired, the database can be disabled by selecting "Tasks/Disable" from the Process Database menu. In this case, "disabling" the database means disabling *writing* to the database. The database itself still exists and can still be read with the ProcessView application.

Resources

File resources used by the Process Software for the Process Database are as follows:

- **ProcessDB.config (Ini Directory)**
  The ProcessDB.config file contains configuration information for how the database is accessed from the Process Software. In reality, this configuration information is rarely, if ever, changed.
- **Process.ini (Ini Directory)**
  The Process.ini file contains the "Process Database Enabled" flag. This flag is changed by selecting Enable or Disable from the Process Database "Tasks" menu.
- **ProcessDB.log (Log Directory)**
  The ProcessDB.log file logs significant errors and events in writing to the database.

Reading from the Database

The data is stored in a Microsoft SQL Server database that can be accessed through standard T-SQL queries. This means that the data can be read with the following applications:

- **SSEC ProcessView** – This is the expected method that people will use to view data from the database.
- **SSEC ProcessDataHost** – This application runs on the equipment PC. It connects to an SSEC ProcessView application running on a remote PC to transmit data from the database.
- **Microsoft SQL Server Management Studio Express** – This is a Microsoft application that is installed on the equipment PC.
- **Customer Application** – Potentially, users could write their own application to read and analyze the data.

SSEC ProcessView

The SSEC ProcessView application is the recommended method of viewing the data from the Process Database. The ProcessView application can run on the equipment PC or a remote PC.

Establishing a Connection

The first step in using the ProcessView program is to set up a connection to the database. Once the connection has been configured, the configuration information will be stored on the hard drive. Thereafter, every time the ProcessView program is started, it will automatically load the most recent connection configuration and connect to the database.

Connection Status

If the connection is established, then the Connection Status will say "Connected" on the Connection screen.

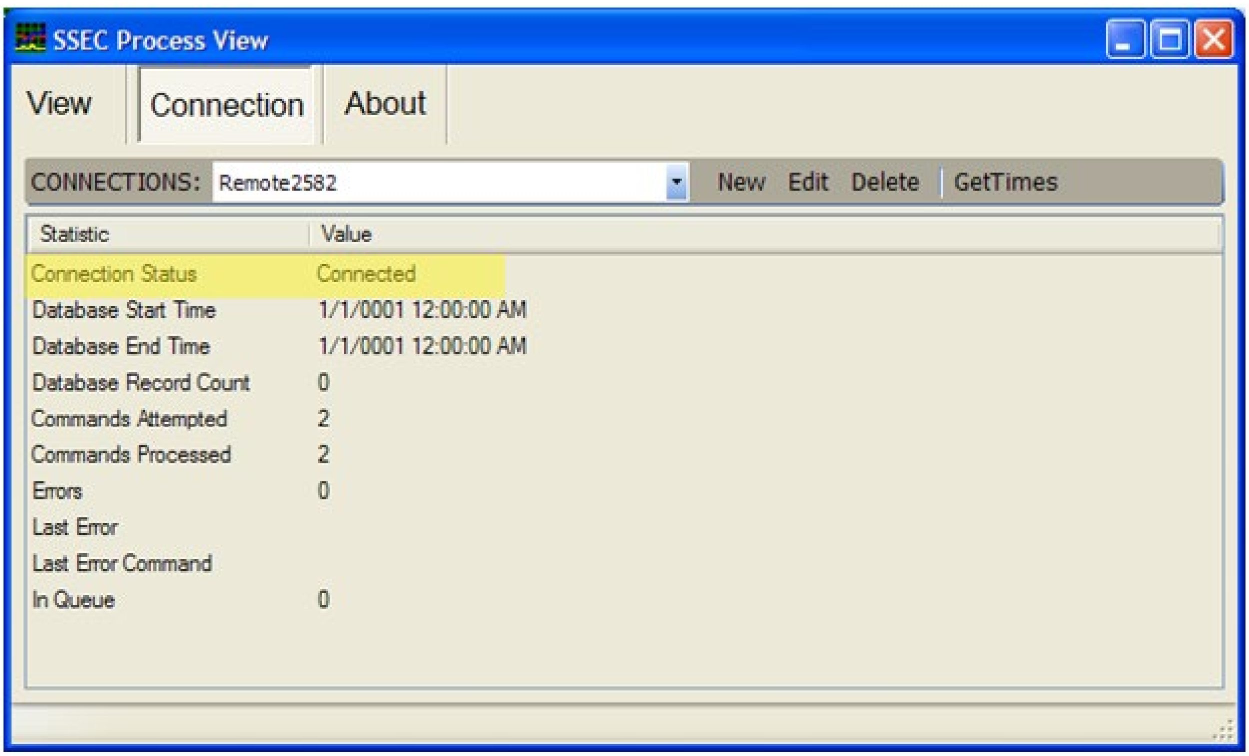


Figure 8 Connection Status

Create Connection

To create a connection, click the "Connection" tab. Select "New" on the menu bar.

Local Connection

To create a local connection, the ProcessView application must run on the PC where the database is located – that is, the equipment PC. Use the following settings in the "Create Connection" screen:

- Connection Name. This is a string typed in by the user to describe the connection.
- Connect To = SQL Server
  This option means that ProcessView will read directly from the SQL Server database.
- Data Source = Local
- Use Custom Connection String = unchecked

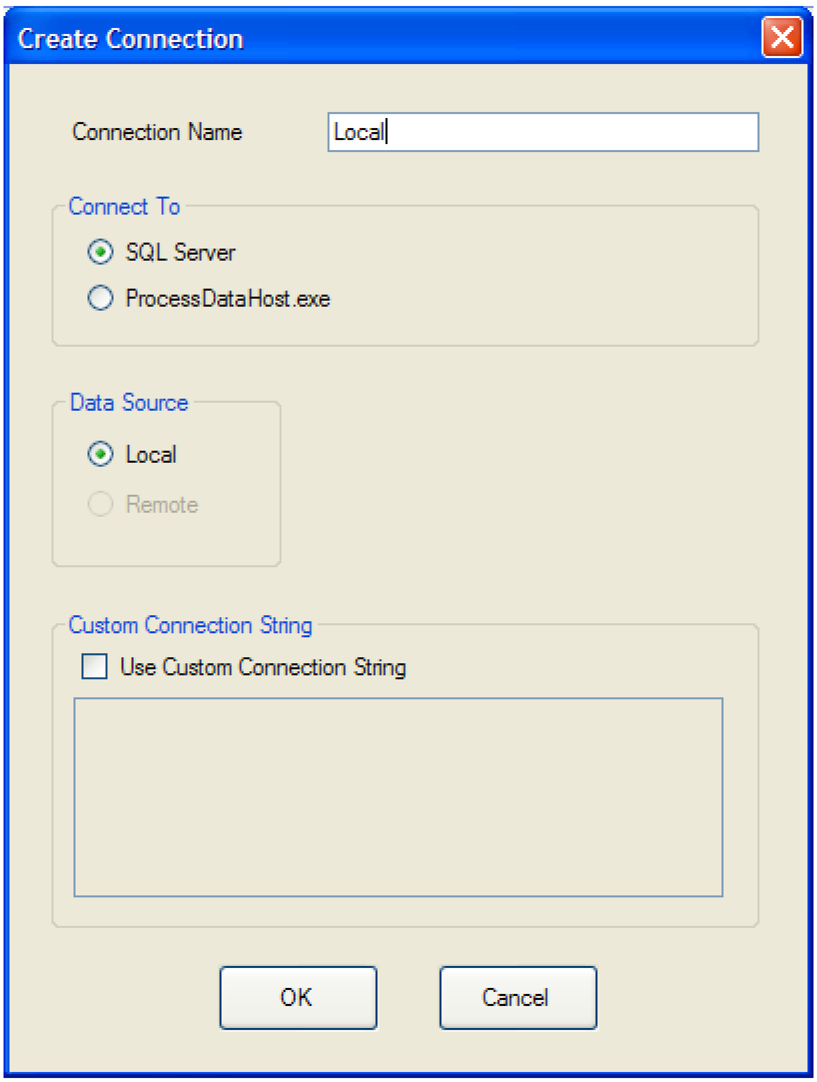


Figure 9 Create a Local Connection on the Equipment PC

Remote Connection

The ProcessView application can run on a remote PC. It can communicate with the SSEC ProcessDataHost application running on the equipment PC using a TCP/IP Ethernet connection. To establish a remote connection, set up the "Create Connection" screen as follows:

- Connection Name. This is a string typed in by the user to describe the connection.
- Connect To = ProcessDataHost.exe
  This option means that ProcessView communicate with the ProcessDataHost application on the equipment PC to retrieve the data from the database.
- Data Source = Remote
- Remote Computer Name or IP Address
  The equipment Computer Name or IP Address is entered here.
- Use Custom Connection String = unchecked

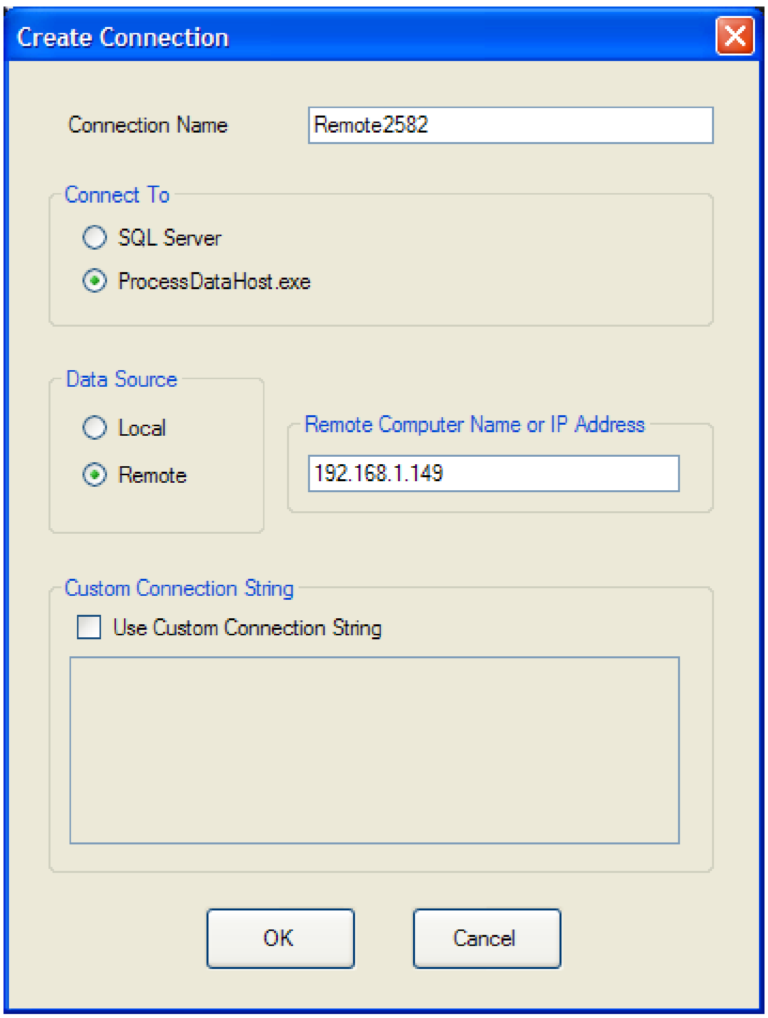


Figure 10 Creating a Remote connection from a non-equipment PC

Viewing Data

Once a connection to the database has been established, the data can be viewed in the View screen.

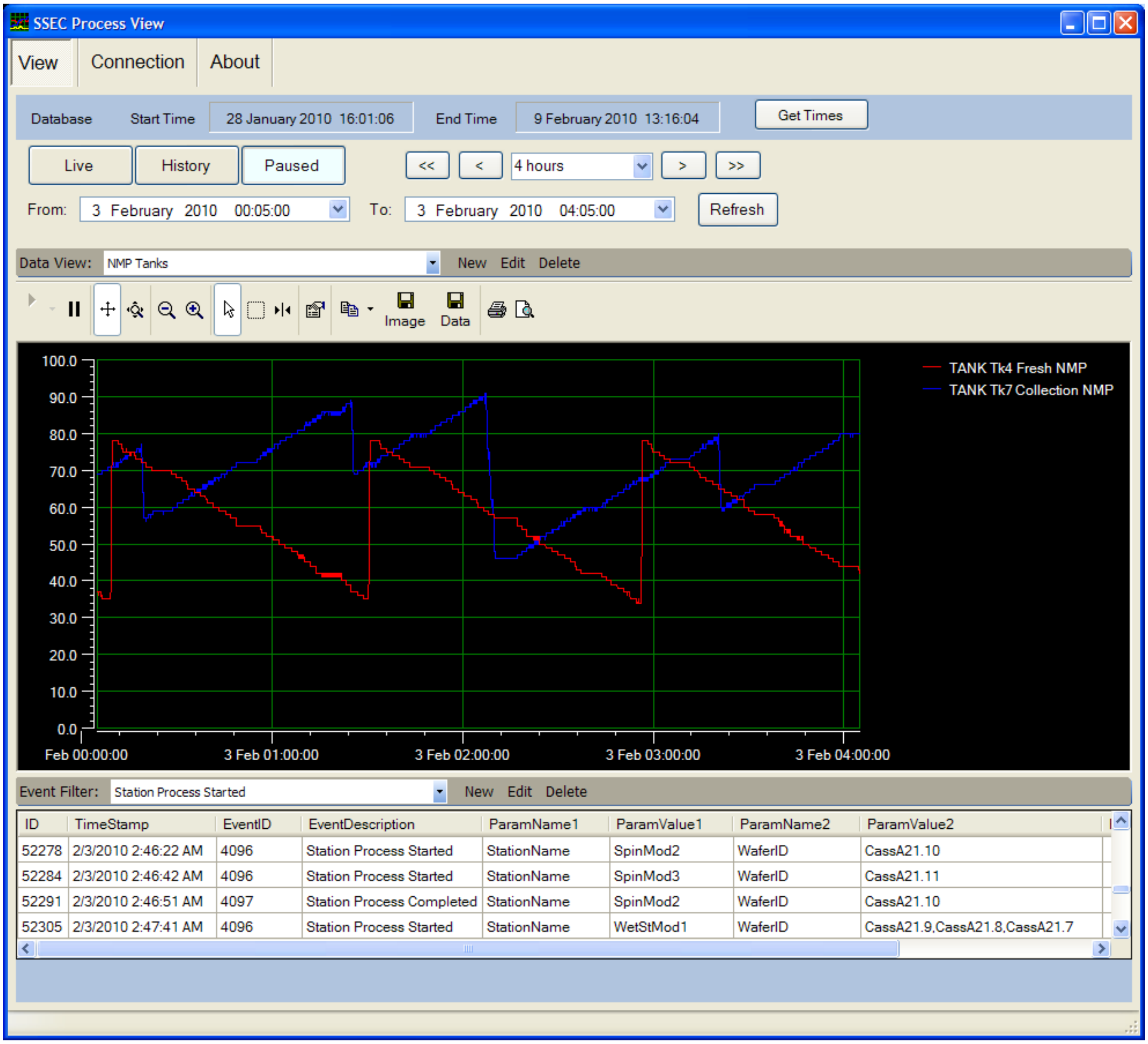


Figure 11 ProcessView View Screen

There are three major functions in the View Screen:

1. Time – Select the time range for the data
2. Data View – Select the data from the Process Data Table to be viewed. This is the device readings, such as ADCs, DACs, Heaters, etc.
3. Event Filter – Select events to be viewed from the Event Table

Time Selection

Database Start and End Time

The “Get Times” button will read the time of the oldest and newest records in the database. These times will be displayed in the “Start Time” and “End Time” fields.

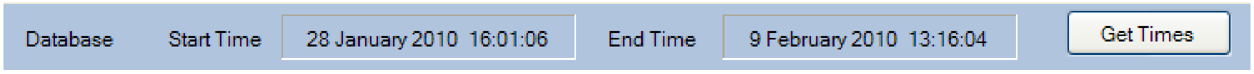


Figure 12 Database Start and End Time

Time Mode

The Live, History, and Paused buttons determine the time display mode.

- Live – Live mode is used while the equipment is running to display the current state of the Tool. The current time frame is displayed. Every second, the time frame will advance by a second and the data will be updated with data from the added second.
- History – History mode displays a running history of time. This acts like Live mode, except it is a replay of the past. The user needs to select Paused mode and enter the desired time frame, then go to the History mode. The data from the selected time frame will be displayed. It will then advance every second and show the next second’s worth of data.
- Paused – In Paused mode, the user can enter a desired “From” and “To” time. The selected time frame is displayed. Unlike Live and History modes, the time does *not* advance every second.

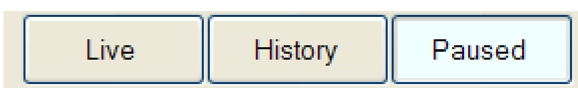


Figure 13 Time Modes

Time Frame Adjustments

The Time Frame Adjustment buttons allow the user to easily move the current time frame.

- The “<<” button moves the time frame back one time frame. For example, if the current time frame is from 5:00 to 9:00, the time will be moved back to 1:00 to 5:00.
- The “<” button moves the time frame back by half a time frame. For example, if the current time frame is from 5:00 to 9:00, the time will be moved back to 3:00 to 7:00.
- The time span dropdown box allows the user to adjust the range of time. For example, assume the time span box says “4 Hours” and the time frame is 1:00 to 5:00. If the user selects a time span of “2 Hours”, then the time frame will change to 2:00 to 4:00. If the user selects a time span of “8 hours”, the time frame will change to 3:00 to 11:00.
- The “>” button moves the time frame forward by half a time frame.
- The “>>” button moves the time frame forward by a full time frame.

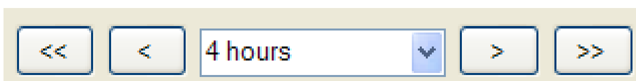


Figure 14 Time Frame Adjustments

Time Frame

The Time Frame is the range of the currently selected data. In the Paused Time Mode, the “From” and “To” times can be directly entered by the User. After changing the times, the user should click the “Refresh” button to fetch the data for the selected time frame. The “Refresh” button is only necessary when the user has entered different values into the “From” or “To” time boxes. In the Live and History modes, the “From” and “To” fields are read-only.

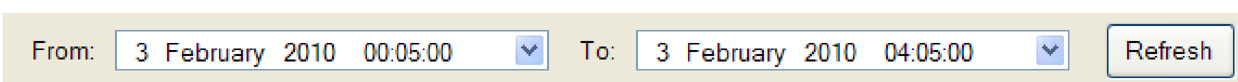


Figure 15 Time Frame

Creating a Data View

A data view contains a list of data items to be extracted from the Process Data Table. A list of available data views appears in the Data View dropdown box.

Figure 16 Data View Dropdown Box

To define a new data view, click “New” on the Data View menu. The “Get Data List” Window will be displayed.

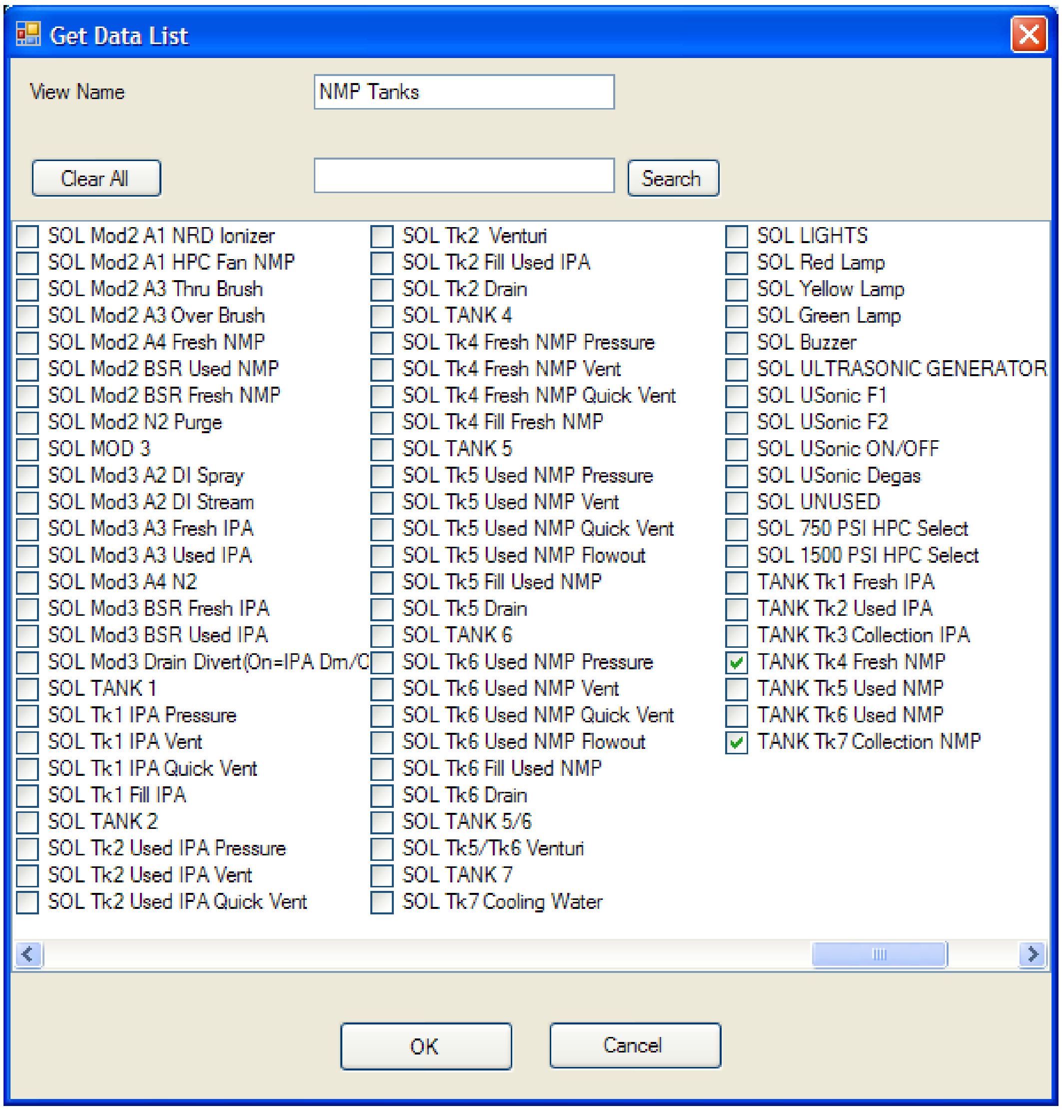


Figure 17 Get Data List Window

View Name

The View Name will appear in the Data View dropdown box. The View Name is a text string entered by the user to describe the type of data selected.

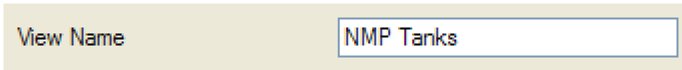


Figure 18 View Name

Clear All

The Clear All button clears all checked items from the data list.

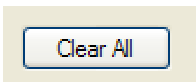


Figure 19 Clear All button

Search

The Search box lets the user search for items in the data list. For example, if the user types "Tk5" into the Search box, then every time the user clicks the Search button, the next data item containing the string "Tk5" will be highlighted.

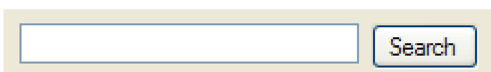


Figure 20 Search Box

Data List

The Data List contains all the data items available in the Process Data Table. Items that are checked will be stored as part of the view. Data for these items will be displayed in the Data View graph.

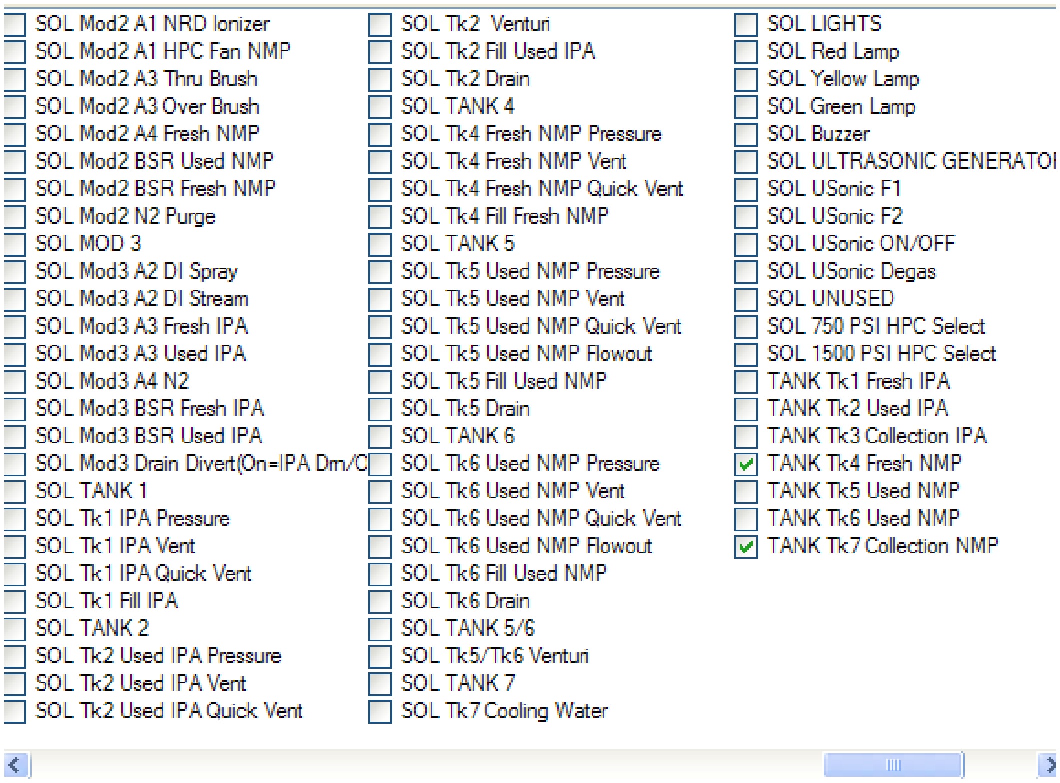


Figure 21 Data List

Data View Graph

The Data View Graph displays the data for the selected Data View over the specified time frame.

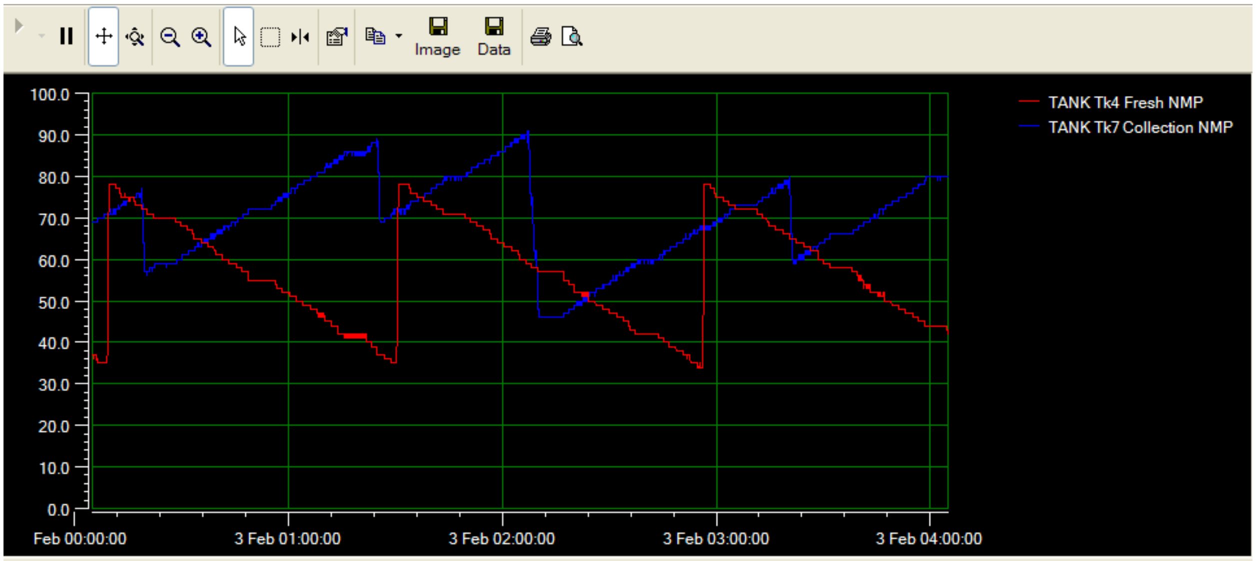


Figure 22 Data View Graph

Some useful functions in the Data View Graph are described below.

Tracking Resume

The Tracking Resume button will be enabled whenever the user has altered the graph display by performing an axes scroll or zoom function. Clicking the Tracking Resume button will restore the graph to its original display.

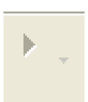


Figure 23 Tracking Resume Button

Axes Scroll

When the Axes Scroll button is clicked, the user can move the graph by moving the mouse while the right mouse key is held down.

Shift+RightMouseButtonDown performs the same function as clicking the Axes Scroll button.

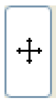


Figure 24 Axes Scroll Button

Axes Zoom

When the Axes Zoom button is clicked, the user can zoom the X and Z axes of the graph by moving the mouse while the right mouse key is held down.

Ctrl+RightMouseButtonDown performs the same function as clicking the Axes Zoom button.

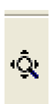


Figure 25 Axes Zoom Button

Zoom-Out and Zoom-In

Clicking the Zoom-Out and Zoom-In Buttons will automatically zoom the graph out and in.

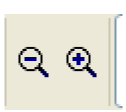


Figure 26 Zoom-Out and Zoom-In Buttons

Zoom Box

The Zoom Box will zoom the graph to the area selected by the user. The user selects the area by drawing a rectangle with the mouse pointer.

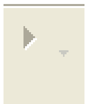


Figure 27 Zoom Box Button

Data Cursor

The Data Cursor will display a Data Cursor over the graph. The user can move the Data Cursor around with the mouse. The Data Cursor will display the timestamp and value of the data. Click the Data Cursor button again to remove the Data Cursor.

Figure 28 Data Cursor Button

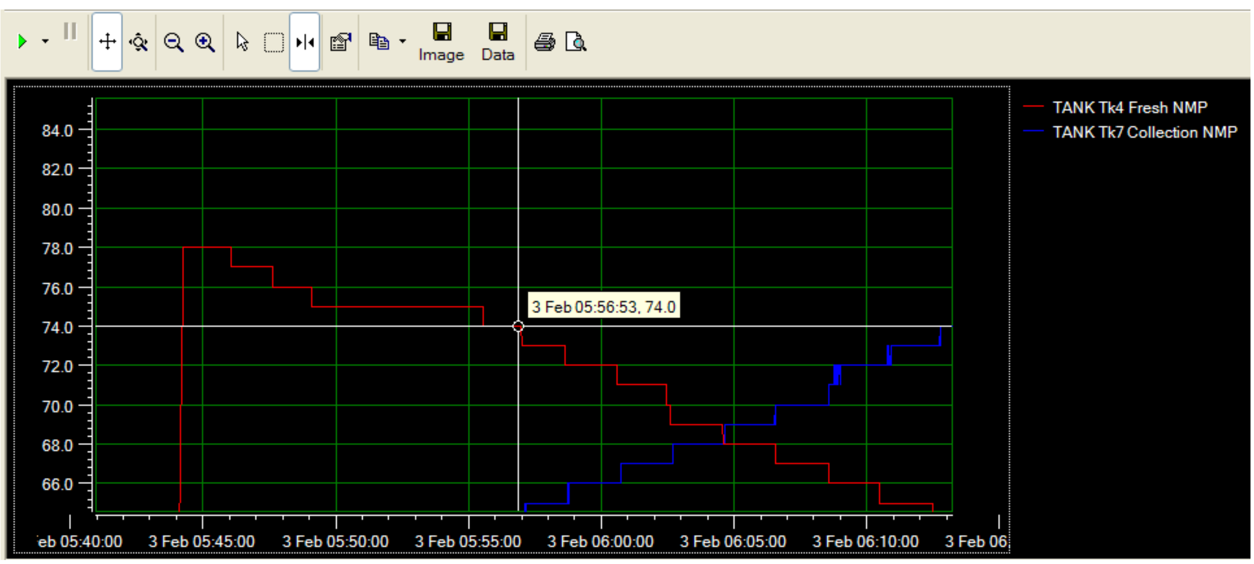


Figure 29 Graph with Data Cursor Displayed

Edit

Clicking the Edit Button will display the graph properties.

Figure 30 Edit Button

Copy to Clipboard

The Copy to Clipboard button will copy data to the clipboard. Copy Picture will copy the image to the clipboard. Copy Data will copy the text data.

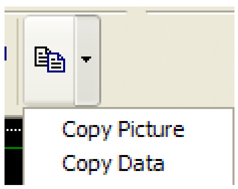


Figure 31 Copy to Clipboard Button

Save Image to File

The Save Image to File button will save the graph image to a file.

Figure 32 Save Image to File Button

Save Data to File

The Save Data to File button will save the data to a text file.

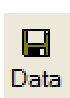


Figure 33 Save Data to File Button

Creating an Event Filter

An event filter contains a list of events to be extracted from the Event Table. A list of available event filters appears in the Event Filter dropdown box.

Figure 34 Event Filter Dropdown Box

To define a new event filter, click "New" on the Event Filter menu. The "Get Event Filter" Window will be displayed.

Get Event Filter Window

The Get Event Filter Window is where the user selects which events to extract from the database.

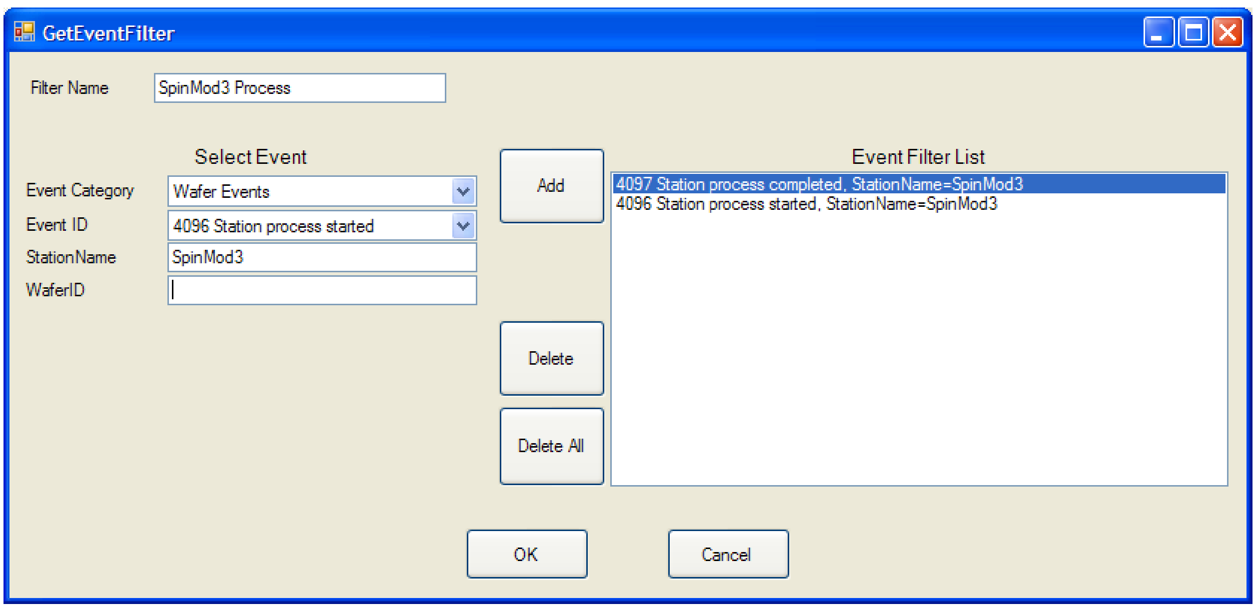


Figure 35 Get Event Filter Window

Filter Name

The Filter Name will appear in the Event Filters dropdown box. The Filter Name is a text string entered by the user to describe the type of events selected.

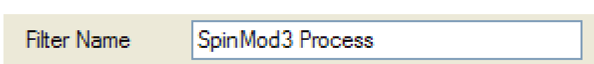


Figure 36 Filter Name

Event Category

The Event Category dropdown box selects which types of events will be displayed in the Event ID list.

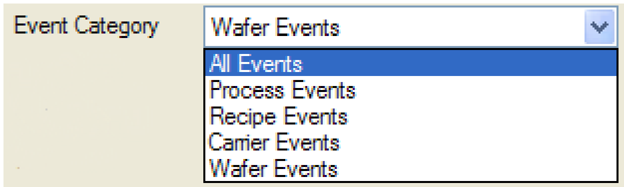


Figure 37 Event Category Dropdown Box

Event ID

The Event ID dropdown box displays a list of available events, depending on the Event Category selected.

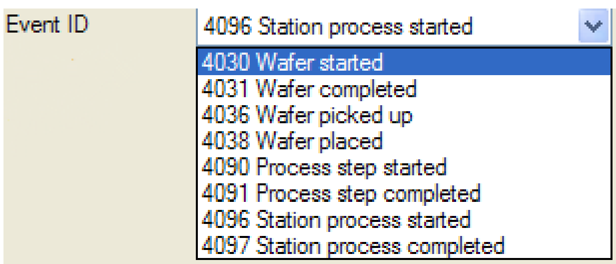


Figure 38 Event ID Dropdown Box

Event Parameters

Depending on the Event ID selected, a list of parameters can be displayed. The user has the option of leaving the parameters blank, in which case all events matching the Event ID will be selected from the database. Or, the user can type in a value, in which case only events that match that value will be extracted.

Example 1:

Event ID = 4096 Station process started

StationName = (station name is left blank)

The "Station process started" event for ALL stations will be extracted from the database.

Example 2:

Event ID = 4096 Station process started

StationName = SpinMod2

The "Station process started" event for SpinMod2 will be extracted from the database. Other stations will not be extracted.

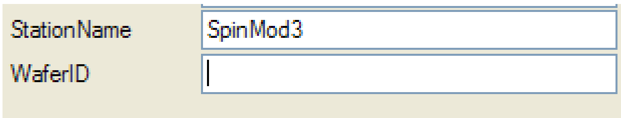


Figure 39 Example of Event Parameters

Event Filter List

After selecting an event and optionally entering event parameters, the user should click the "Add" button to add the event to Event Filter List. One or more events can be added to the list. These are the events that will be extracted from the Event Table.

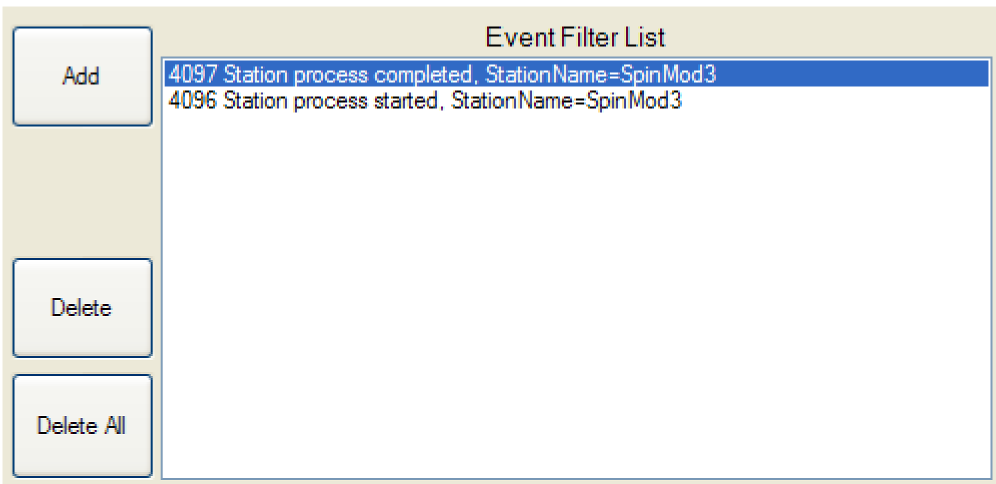
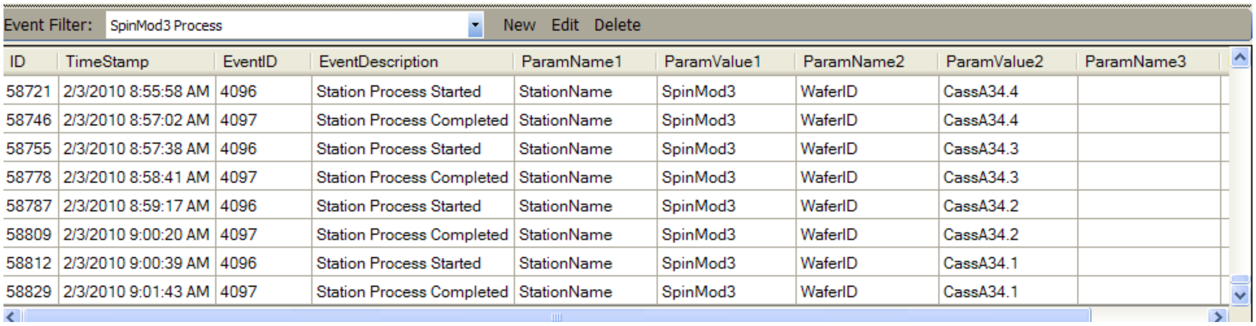


Figure 40 Event Filter List

Selected Events

When an event filter is selected from the Event Filter dropdown box, the events that match the filter criteria and the selected time frame will be displayed in the Selected Events list.


Event Filter: SpinMod3 Process   New Edit Delete

ID	TimeStamp	EventID	EventDescription	ParamName1	ParamValue1	ParamName2	ParamValue2	ParamName3
58721	2/3/2010 8:55:58 AM	4096	Station Process Started	StationName	SpinMod3	WaferID	CassA34.4	
58746	2/3/2010 8:57:02 AM	4097	Station Process Completed	StationName	SpinMod3	WaferID	CassA34.4	
58755	2/3/2010 8:57:38 AM	4096	Station Process Started	StationName	SpinMod3	WaferID	CassA34.3	
58778	2/3/2010 8:58:41 AM	4097	Station Process Completed	StationName	SpinMod3	WaferID	CassA34.3	
58787	2/3/2010 8:59:17 AM	4096	Station Process Started	StationName	SpinMod3	WaferID	CassA34.2	
58809	2/3/2010 9:00:20 AM	4097	Station Process Completed	StationName	SpinMod3	WaferID	CassA34.2	
58812	2/3/2010 9:00:39 AM	4096	Station Process Started	StationName	SpinMod3	WaferID	CassA34.1	
58829	2/3/2010 9:01:43 AM	4097	Station Process Completed	StationName	SpinMod3	WaferID	CassA34.1	

Figure 41 Selected Events

Process Data Host

ProcessDataHost is an application that runs on the equipment PC. It responds to requests from the ProcessView application located on a remote PC, extracts the requested data from the database on the equipment PC, and sends the data back to the remote ProcessView application.

ProcessDataHost will start running automatically when the equipment PC is booted up. The ProcessDataHost icon will appear in the Windows System Tray located in the lower right hand corner of the display screen.

Figure 42 ProcessDataHost icon

Figure 43 System Tray showing ProcessDataHost running

Process Data Host Window

The Process Data Host Window can be viewed by clicking the Process Data Host icon in the System Tray.

The Process Data Host Window shows the following information:

- Software Version - Version number of the ProcessDataHost application
- Computer Name – The name of the computer that the ProcessDataHost is running on. The Computer Name can be entered in the "Create Connection" Window of the ProcessView application.
- IP Address - The IP Address of the computer that the ProcessDataHost is running on. The IP Address can be entered in the "Create Connection" Window of the ProcessView application.
- Message Count – The number of messages from a remote ProcessView program that have been received.

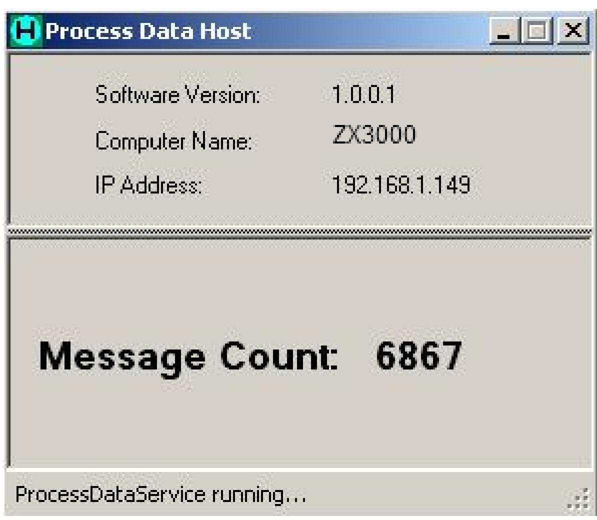


Figure 44 ProcessDataHost Window

Resources

File resources used or created by ProcessDataHost include:

- **Events.log (My Documents\SSEC ProcessDataHost\Log Directory)** Data requests from remote ProcessView programs are written to the Events.log file.

This Page Left Intentionally Blank.

Database Structure

SSEC

|

|____ ProcessData (History) – This is the device readings every second.

|____ DeviceNames (Static) – This is just the user-friendly names of the devices.

|____ Events (History) – This is like the Message.log

|____ Station (Static) – This is a description of what stations are on the Tool

Comments: The ProcessData and Events tables contain N days of history information. These tables will be large. The other tables will contain the current configuration of the Tool and will be small.

ProcessData Table

Purpose

The ProcessData Table contains the settings/readings for all devices on the Tool except for Motors.

Behavior

The Process Software writes to the ProcessData table every second with all the current device readings. The table will have N days' worth of data. Data older than N days will be deleted.

Table Structure

Column Name	Format	Description
ID	Int	This is a unique number for each record. Basically it is just a number that counts up from 1 to infinity every time a record is written
TimeStamp	Datetime Primary Key	This is the date/time the record is written. Contains year/month/day/hour/minute/second/millisecond. Accurate to .01 seconds. However, the process Software only writes every second, so the milliseconds will always be zero.
ADC Names*	Real	This is the ADC scaled reading. See notes below.
DAC Names*	Real	This is the DAC scaled reading. See notes below.
Heater Names*	Real	This is the Heater scaled reading. See notes below.
Infranor Names*	Real	This is the Infranor spin motor speed. See notes below. Requires Process 7.44.8 or greater.
Motor Names*	Real	This is the Motor target position. "Target position" means the position the Process Software commanded the motor to move to. This is not a reading from the firmware of what the position actually is. See notes below.
Sensor Names*	Bit	This is the Sensor state (on or off). See notes below
Solenoid Names*	Bit	This is the Solenoid state (on or off). See notes below
Tank Names*	Real	This is the Tank percent full reading. See notes below

* 1. There will be a column for each device (all ADCs, all DACs, etc.)

* 2. The column name contains the device category and the device short name.

For example, ADC_Fluid1PSI, SEN_EMO1, etc.

ID	TimeStamp	ADC_Fluid1PSI	ADC_Fluid2PSI	ADC_Fluid3PSI	ADC_AirReg1	ADC_AirReg2	ADC_AirReg3	ADC_AirReg4
1	1/3/2008 1:37:20 PM	5	5	5	60	70	70	70
2	1/3/2008 1:37:21 PM	5	5	5	60	70	70	70
3	1/3/2008 1:37:22 PM	5	5	5	60	70	70	70
4	1/3/2008 1:37:23 PM	5	5	5	60	70	70	70
5	1/3/2008 1:37:24 PM	5	5	5	60	70	70	70
6	1/3/2008 1:37:25 PM	5	5	5	60	70	70	70
7	1/3/2008 1:37:26 PM	5	5	5	60	70	70	70
8	1/3/2008 1:37:27 PM	5	5	5	60	70	70	70
9	1/3/2008 1:37:28 PM	5	5	5	60	70	70	70
10	1/3/2008 1:37:29 PM	5	5	5	60	70	70	70
11	1/3/2008 1:37:30 PM	5	5	5	60	70	70	70
12	1/3/2008 1:37:31 PM	5	5	5	60	70	70	70
13	1/3/2008 1:37:33 PM	5	5	5	60	70	70	70

Figure 45 ProcessData Table Example

DeviceNames Table

Purpose

The DeviceNames table contains the user-friendly name for each device in the ProcessData table.

Behavior

The DeviceNames table gets written to once every time the Process Software starts running. The table is cleared and rewritten every time.

Table Structure

Column Name	Format	Description
TimeStamp	Datetime	This is the time the record is written.
DeviceID	Varchar(20)	This is the device time and name. The format is "DEV Name", where DEV is the device type and Name is the user-friendly device name (usually the Alias property in the Process Software). Examples: ADC_Resist1, HTR_Heater1, etc.
LongNmae	Varchar(80)	This is the device type and user friendly name. The format is "DEV Name", where DEV is the device type and Name is the user-friendly device name (usually the Alias property in the Process Software). Example: ADC CDA Supply A pressure
Units	Varchar(20)	This is the units property of the device.

TimeStamp	DeviceID	LongName	Units
1/21/2008 3:15:55 PM	ADC_Fluid1PSI	ADC DI Supply Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Fluid2PSI	ADC IPA Supply Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Fluid3PSI	ADC Mesiylene Supply Pressure	PSI
1/21/2008 3:15:55 PM	ADC_AirReg1	ADC N2 Supply Pressure	PSI
1/21/2008 3:15:55 PM	ADC_AirReg2	ADC N2 Heater Pressure	PSI
1/21/2008 3:15:55 PM	ADC_AirReg3	ADC CDA Supply A Pressure	PSI
1/21/2008 3:15:55 PM	ADC_AirReg4	ADC CDA Supply B Pressure	PSI
1/21/2008 3:15:55 PM	ADC_AirReg5	ADC CO2 Supply Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank1	ADC Tank 1 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank1Level	ADC Tank 1 Level	ml
1/21/2008 3:15:55 PM	ADC_FlowRate1	ADC Tank 1 Flow Out	ml/min
1/21/2008 3:15:55 PM	ADC_Tank2	ADC Tank 2 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank2Level	ADC Tank 2 Level	ml
1/21/2008 3:15:55 PM	ADC_FlowRate2	ADC Tank 2 Flow Out	ml/min
1/21/2008 3:15:55 PM	ADC_Tank3	ADC Tank 3 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank3Level	ADC Tank 3 Level	ml
1/21/2008 3:15:55 PM	ADC_FlowRate3	ADC Tank 3 Flow Out	ml/min
1/21/2008 3:15:55 PM	ADC_Tank4	ADC Tank 4 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank4Level	ADC Tank 4 Level	ml
1/21/2008 3:15:55 PM	ADC_FlowRate4	ADC Tank 4 Flow Out	ml/min
1/21/2008 3:15:55 PM	ADC_Tank5	ADC Tank 5 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_Tank5Level	ADC Tank 5 Level	ml
1/21/2008 3:15:55 PM	ADC_FlowRate5	ADC Tank 5 Flow Out	ml/min
1/21/2008 3:15:55 PM	ADC_Resist1	ADC Tank 1 Resistivity	KOhm
1/21/2008 3:15:55 PM	ADC_HVS1	ADC Mod3 Arm3 HVS Pressure	PSI
1/21/2008 3:15:55 PM	ADC_HPC1	ADC HPC 1 Pressure	PSI
1/21/2008 3:15:55 PM	ADC_HPCFlow1	ADC HPC 1 Flow Rate	cc/min
1/21/2008 3:15:55 PM	ADC_Photohelic2	ADC Mod2Magnehelic	Inch
1/21/2008 3:15:55 PM	ADC_Photohelic3	ADC Mod3Magnehelic	Inch
1/21/2008 3:15:55 PM	ADC_DSP5V40	ADC Tank I/O Address 40 5V	V
1/21/2008 3:15:55 PM	ADC_DSP5V41	ADC Tank I/O Address 41 5V	V

Figure 46   DeviceNames Table Example

Station Table

Purpose

The Station table describes the features of the Tool.

Behavior

The Process Software writes to the Station table every time the Process Software is started. It overwrites the table every time.

Table Structure

Column Name	Format	Description
TimeStamp	Datetime	This is the time the record is written.
StationNumber	Int	This is the same Station Number as used in the Process Software, counting from 0 to NumStations-1. Each station has a unique station number.
StationName	Varchar	This is the name of the station. It is the same name as what is displayed on the main Process screen.
StationType	Varchar	This defines the type of station. Defined values: • Cassette • Wet • Process • Carousel NOTE: Alignment stations appear as type "Process"

TimeStamp	StationNumber	StationName	StationType
1/21/2008 3:15:54 PM	0	LP1	Cassette
1/21/2008 3:15:54 PM	1	Alignment	Process
1/21/2008 3:15:54 PM	2	WetStMod1	Wet
1/21/2008 3:15:54 PM	3	SpinMod2	Process
1/21/2008 3:15:54 PM	4	SpinMod3	Process
1/21/2008 3:15:54 PM	5	LP2	Cassette

Figure 47 Station Table Example

Events Table

Purpose

The Events table contains a list of significant events and event times.

Behavior

The Process Software writes to the Events table every time an event occurs. The table will have N days' worth of data. Data older than N days will be deleted.

Different events have different parameters associated with them. The Events table will have Parameter columns defined. The meaning of the parameter columns will depend on the event.

Table Structure

Column Name	Format	Description
RecordID	Int	This is a unique number for each record. Basically, it is just a number that counts up from 1 to infinity every time a record is written.
TimeStamp	Datetime	This is the date/time the record is written. NOTE: This is *not* a primary key like in the ProcessData table. It is possible to have more than one event with the same timestamp.
EventID	Int	This is an identifier for each type of event.
EventDescription	Varchar(120)	String describing the event.
ParamName1	Varchar(120)	The name of the parameter based on the EventID.
ParamValue1	Varchar(120)	The value of the parameter.
ParamName2	Varchar(120)	The name of the parameter based on the EventID.
ParamValue2	Varchar(120)	The value of the parameter.
ParamName3	Varchar(120)	The name of the parameter based on the EventID.
ParamValue3	Varchar(120)	The value of the parameter.

Event Definitions

EventID	Event Name	Param1	Param2	Param3	*
10	Process State Changed	Name="ProcessState" Values: • "Unknown" • "Initializing" • "Ready" (Idle) • "Executing" • "Busy" • "Aborted" • "Paused" • "Purging" • "Pausing" (not used) • "Stopping" (not used) • "Aborting" • "Error" "Complete"			
12	Process Cycle Completed				
13	Process Cycle Stopped				
15	Process Cycle Started				
16	Process Cycle Resumed				
17	Error	Name="ErrCode" Value=Error Code	Name="ErrLevel" Value=Error Level	Name="ErrMsg" Value=Error Message	
50	Recipe Changed (Edited/Deleted/Created)	Name="Recipe" Value= recipe name			
51	Recipe Loaded	Name="Recipe" Value = recipe name			
60	Material received (carrier loaded)	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID		*
61	Material removed	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID		*
62	Material ready to unload	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID		*
81	Process database started	Name="Version" Value = Process Version string. Example: "7.29.3"	Name="Serial Number" Value = Equipment Serial number from Model.ini "Equipment Serial Number" field.	Name="Customer Equipment ID" Value = Value from Model.ini "Customer Equipment ID" field	*
82	Process Software close request				
84	Process Software information	Name="Version" Value = Process Version string. Example: "7.42.27"	Name="Serial Number" Value = Equipment Serial number from Model.ini "Equipment Serial Number" field.	Name="Customer Equipment ID" Value = Value from Model.ini "Customer Equipment ID" field	*
200	Wafer map complete	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID	Name="Map" Value = Map String	*

EventID	Event Name	Param1	Param2	Param3	*
201	Asyst wafer map complete	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID	Name="Map" Value=Map	*
4003	Run Type Changed	Name="RunType" Values: • "Stack" • "Single Wafer" • "Process Only" • "Step" • "Stack Of Singles"			
4015	User Login Changed	Name="Name" Value=user name			
4028	Carrier started (first access to Carrier)	Name="StationName" Value=Station Name	Name="LotID" Value=Lot ID		*
4030	Wafer started (picked up from input)	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID		
4031	Wafer completed (placed in output)	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID		
4033	Lot Started	Name="StationName" Value=Station Name	Name="LotID" Value="LotID"		*
4034	Lot Completed	Name="StationName" Value=Station Name (Output station)	Name="LotID" Value="LotID"		*
4036	Wafer picked up	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID		
4038	Wafer placed	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID		
4090	Process Step Started	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID List	Name="Step" Value=Step Number	
4091	Process Step Completed	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID	Name="Step" Value=Step Number	
4096	Station Process started (step 0)	Name="StationName" Value=Station Name	Name="WaferID" Value=Wafer ID List		
4097	Station Process completed	Name="StationName" Value=Station Name	Name="WaferID" Value=WaferID		

Notes:

EventID 60 - Modified 21.Nov.2008 - added LotID

EventID 61 - 21.Nov.2008 - added LotID

EventID 62 - Modified 21.Nov.2008 - added LotID

EventID 84 - Added 3.May.2010 Process 7.42.27

EventID 200 - Modified 21.Nov.2008 - added LotID - Moved Map to Param3

EventID 201 - Modified 21.Nov.2008 - added LotID - Moved Map to Param3

EventID 4026 - Modified 21.Nov.2008 - added LotID - Issued by output carrier as well as input carrier

EventID 4033 - Added 21.Nov.2008

EventID 4034 - Added 21.Nov.2008

Event Parameter Definitions

This section defines the format for some of the parameters in the Event Table.

Parameter name	**Description**
Map String	The "Map" parameter is a string defining the map contents. Format = "NNNNNN…" N = 0 ➔ slot empty N = 1 ➔ slot full N = 2 ➔ misslotted where length of string is cassette size. Example: "1112000000" indicates a cassette size of 10 wafers. Slots 1, 2, and 3 are full. Slot 4 is misslotted. Slots 5 through 10 are empty.
Wafer ID List	The Wafer ID List is a list of wafer IDs. For example, a list of all wafer IDs in the wet station. The wafer IDs are separated by commas. Example 1: "C1.3" (one wafer) Example 2: "C1.3,C1.4,C1.5" (three wafers)

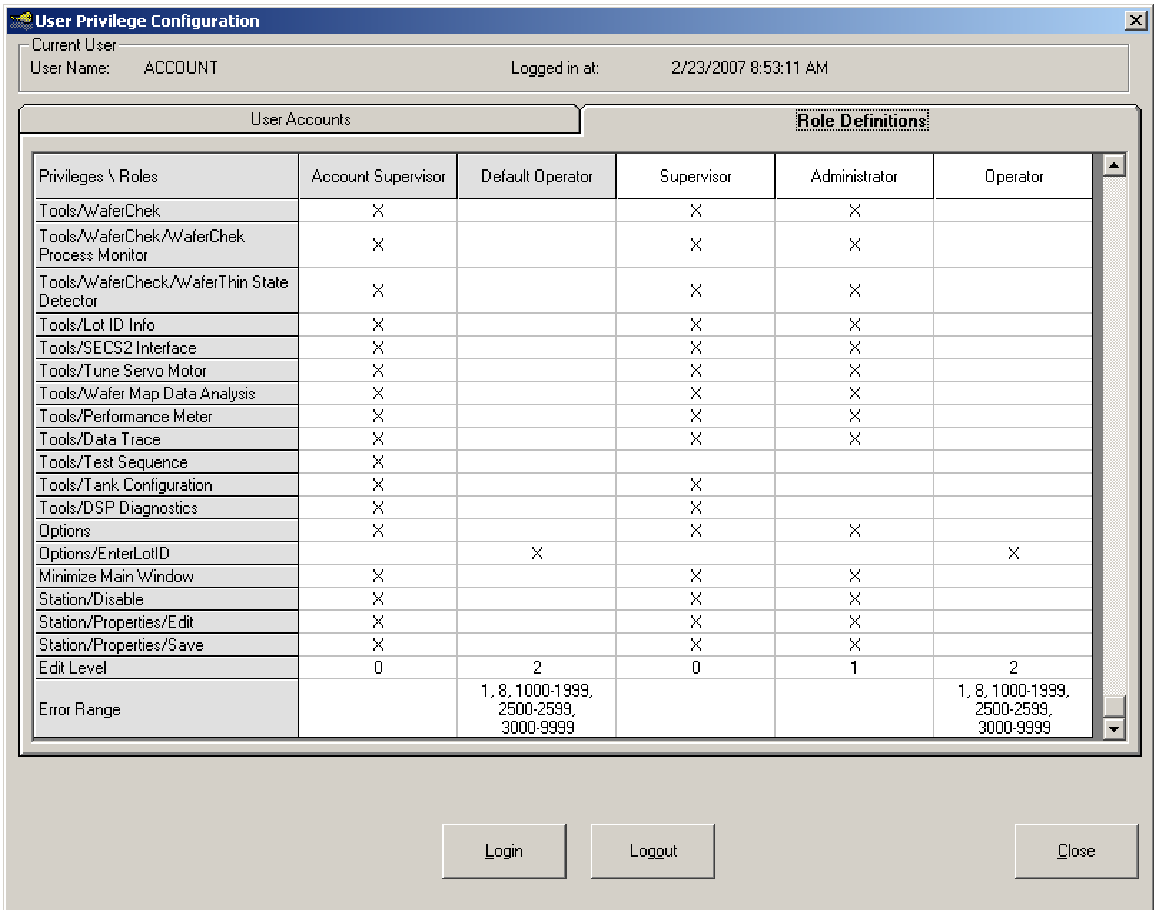
This Page Left Intentionally Blank.

User Accounts

Concept

User Accounts consist of two tables: Roles and Users. A Role consists of a Role name plus a list of privileges that are available to that Role. A User consists of a User name plus the Role that is assigned to the User.

Roles



Privileges \ Roles	Account Supervisor	Default Operator	Supervisor	Administrator	Operator
Tools/WaferChek	X		X	X	
Tools/WaferChek/WaferChek Process Monitor	X		X	X	
Tools/WaferCheck/WaferThin State Detector	X		X	X	
Tools/Lot ID Info	X		X	X	
Tools/SECS2 Interface	X		X	X	
Tools/Tune Servo Motor	X		X	X	
Tools/Wafer Map Data Analysis	X		X	X	
Tools/Performance Meter	X		X	X	
Tools/Data Trace	X		X	X	
Tools/Test Sequence	X				
Tools/Tank Configuration	X		X		
Tools/DSP Diagnostics	X		X		
Options	X		X	X	
Options/EnterLotID		X			X
Minimize Main Window	X		X	X	
Station/Disable	X		X	X	
Station/Properties/Edit	X		X	X	
Station/Properties/Save	X		X	X	
Edit Level	0	2	0	1	2
Error Range		1, 8, 1000-1999, 2500-2599, 3000-9999			1, 8, 1000-1999, 2500-2599, 3000-9999

A Role is defined by the Role Name and the list of privileges that are available to the Role.

Privileges

There are three types of Privileges: Screen Capabilities, Edit Level, and Error Range.

Screen capabilities

This is a list of menu items and buttons that can be enabled on a per-Role basis.

Some examples of screen capabilities are:

- File menu item
- File/New menu item
- File/Open menu item
- (etc. all the menu items in the File menu)
- (Plus all the other menu items from the Process main menu)
- (Plus some options for individual screens. For example, there will be screen capabilities that define whether the Motor screen is view-only or if Motors be activated. There will be a capability to define whether Motor properties can be edited.)

Edit Level

The Edit Level is a number used to determine which parameters can be edited in a recipe.

Edit Level = 0 means that all recipe parameters can be edited by this role.

Edit Level = 1 means that only recipe parameters that have a security code of 1 or greater can be edited by this role. The security code is defined in the definition file.

Edit Level = 2 means that only recipe parameters that have a security code of 2 or greater can be edited by this role.

Etc.

An Edit Level of zero is the most powerful level. The higher the edit level, the less powerful it is.

Error Range

The Error Range is a list of individual error numbers and error ranges that this Role does NOT have ability to acknowledge and resume the equipment.

Predefined Roles

There are two predefined roles that are built in to the Software: Account Supervisor and Default Operator.

Account Supervisor

The Account Supervisor is the only role that is capable of editing user accounts. The Account Supervisor can add and delete users. The Account Supervisor can add and delete roles, and assign specific privileges to a role. By default, the Account Supervisor has all privileges.

Default Operator

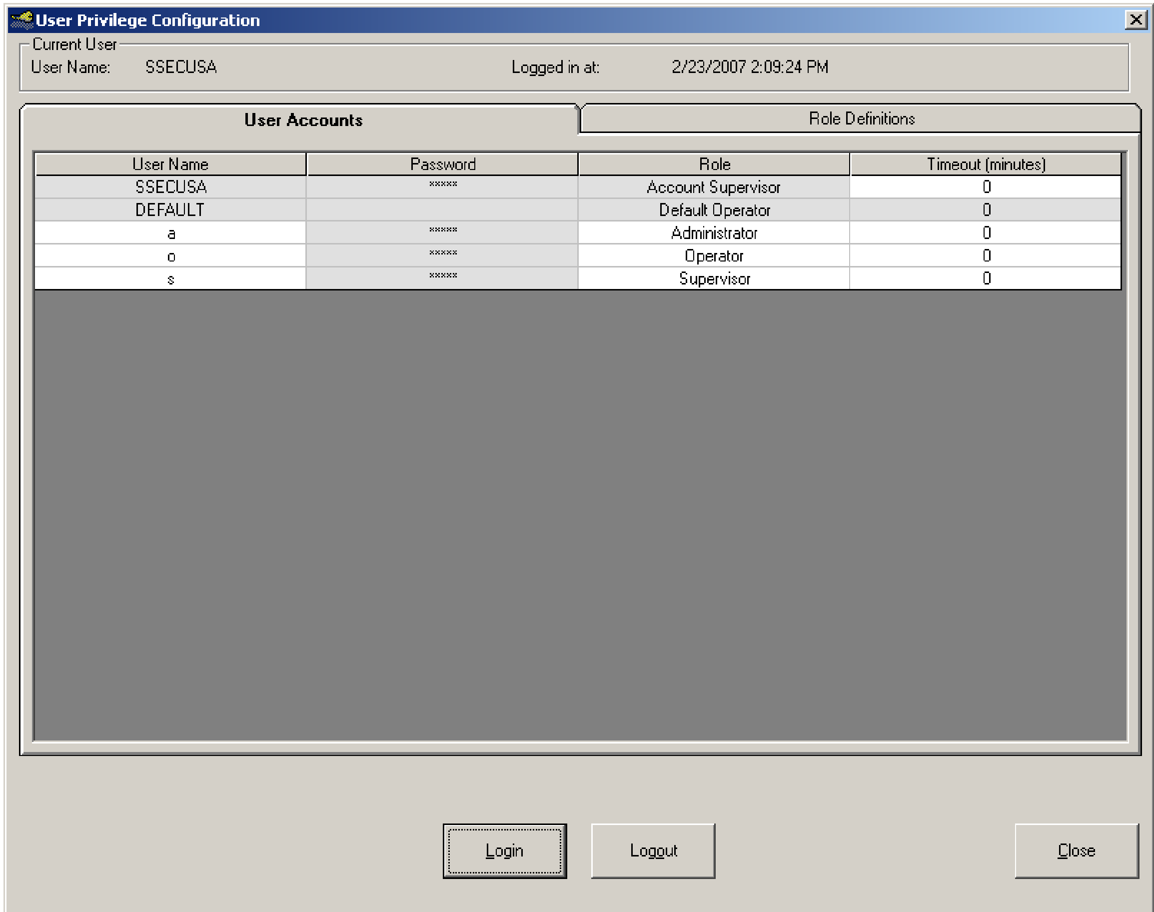
The Default Operator is associated with the predefined DEFAULT user. The DEFAULT user will be logged in when no one else is logged in. By default, the Default Operator role has limited privileges.

Other Roles

Software that is upgraded from the old user account system will automatically have the roles that were previously hardcoded in the Software: Supervisor, Administrator, Operator. These roles can now be edited and deleted, if desired. New roles can be added.

This Page Left Intentionally Blank.

Users



Predefined Users

There will be two predefined users: SSECUSA and DEFAULT.

SSECUSA

The SSECUSA user has the role of Account Supervisor. Only an Account Supervisor can edit user accounts.

DEFAULT

The DEFAULT user has the role of Default Operator. The DEFAULT user will be logged in when no one else is logged in.

User Account properties

User Name

Each user must have a unique name.

Password

Each user is required to have a password EXCEPT for the DEFAULT user. The password can be changed by the user. If a user forgets their password, then the SSECUSA user can delete the user's password. The next time the user logs in, he or she will be prompted to create a new password.

Role

Each user will be assigned a Role, as defined in the Role table. More than one user can have the same Role. For instance, there can be several Operators.

Timeout

The Timeout value is the number of minutes of idle time until the user is logged out. When logged out, the current user becomes the DEFAULT user. "Idle Time" means the time the user interface is idle, that is, the user is not doing anything.

Details

File

The user account data will be stored in a file called “UserAccount.lst”. This file will be encrypted, so that it cannot be viewed and edited outside the Software.

Special Cases

UserAccount.lst file is present

If the UserAccount.lst file is present, then the Roles and Users will be read from the file without change. User.lst file is present (UserAccount.lst file is not present)The User.lst file is the old user account file. If the new account file is not detected, then the Software will automatically create the Roles of Account Supervisor, Default Operator, Supervisor, Administrator, and Operator. It will assign the users from the User.lst file to the correct roles. This should make the new User Account implementation backwards compatible with the old implementation.

No user file is present

If neither the old or new user account file is detected, then the Software will create the default Roles (Account Supervisor and Default Operator) and Users (SSECUSA and DEFAULT). The first time a user logs in to the Software, they must log in as the SSECUSA user and assign a password. They can then create other Roles and Users as desired.

This Page Left Intentionally Blank.

Process Recipe Operator Inputs

Purpose

Sometimes it is desirable to have the operator enter recipe parameters to be used when processing the wafer. A common example is to have the operator specify a recipe time to be used when etching a wafer.

Overview

Operator Inputs are implemented purely through definition file commands. Typically, there is one definition file function that gets the operator prompts. There is a separate definition file function that uses the values from the operator prompts.

For example, the handler recipe may contain a “Start” step. The Start step will display an input screen for the operator to enter data. The process recipe will have a process function that uses the input data.

Requirements

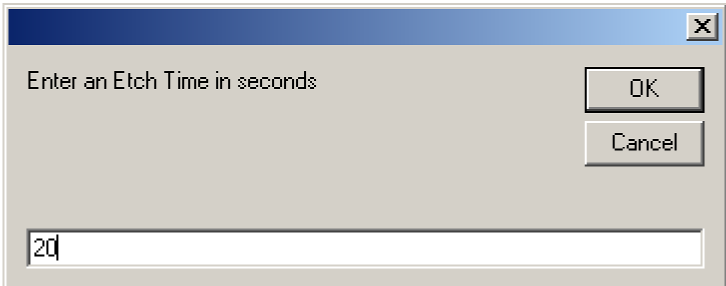
- Process 7.33.6 or greater
- The following definition file commands are useful:
    - InputBoxNum – Prompts operator to enter a single value
    - InputByWafNum – Prompts operator to enter a value per wafer
    - InputDefault – Specifies a default value to be used in the InputBoxNum and InputByWafNum commands

Single Input or Per Wafer Input

There are two ways to collect inputs: Single Input and Per Wafer Inputs.

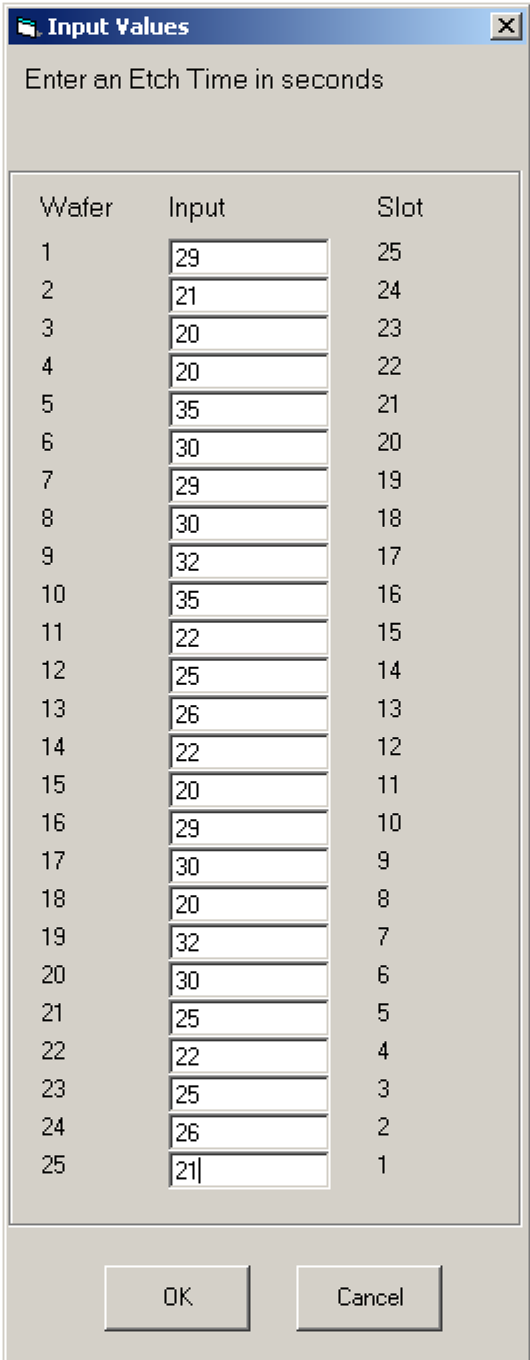
Single Input

A single wafer input is creating using the **InputBoxNum** command.



Per Wafer Inputs

Inputs per wafer are created using the InputByWafNum command.



Command Descriptions

Left Parameter	Command	Right Parameter	Description
	InputDefault	Value	Specifies a default value to shown by the InputBoxNum or InputByWafNum commands. This is optional.
Variable Example: #TIME1	InputBoxNum	Error Code	Displays the single input prompt. The Error Code references a message in the UserErr.txt file. That message will be displayed as the prompt message. The value entered by the operator will be stored in the specified variable.
Indexed Variable Example: #TM(W)	InputByWafNu m	Error Code	Displays a prompt table with an entry per wafer. The Error Code references a message in the UserErr.txt file. That message will be displayed as the prompt message. The values entered by the operator will be stored in the variable array: #TM(1), #TM(2), #TM(3), etc.
Message	WaferLog	Variable Example: #TIME1 Or #TM(W)	The WaferLog command will write the specified Message text and variable value to the Wafer.log file for each wafer.

Indexed Variables

An array of variables can be created that is referenced by wafer number.

The variable format is:

VAR(W) where "VAR" can be any variable name and "(W)" means it is indexed by wafer number.

Some Examples:

#A(W) will create a set of variables #A(1), #A(2), #A(3), etc. These are global variables, which means they are saved in the GlobVar.ini file and can be used anywhere.

$A(W) will create a set of variables $A(1), $A(2), $A(3), etc. These are local variables, which means they can be used only in the current function.

In the definition file examples below, #TM(W) is used to indicate an array of time variables. They don't have to be named #TM. They could be named #BOB(W), $TOM(W), etc. The variable name part can be anything; the (W) part is required to make it indexed by wafer number.

Examples

Single Input

UserErr.txt

Add a message to be displayed in the prompt Window

```
10032   Enter an Etch Time in seconds
```

Handler.def

Add a Start function to be called at the start of the handler recipe.

```
// Enter a single time to be used by all wafers
StGetTime                     InputDefault                20
StGetTime        #TIME1      InputBoxNum               10032
StGetTime   -1    800         OPERCODE
```

Function.def

Add a Time function to be called in the recipe step.

Call this function instead of the regular TIME label.

```
// Use an operator specified time that applies to all wafers
TimeAllWaf      Etch Time  WaferLog                  #TIME1
TimeAllWaf                 Delay                     #TIME1
```

Per Wafer Input

UserErr.txt

Add a message to be displayed in the prompt Window

```
10032   Enter an Etch Time in seconds
```

Handler.def

Add a Start function to be called at the start of the handler recipe.

```
// Enter a time for each wafer
StWafTimes                    InputDefault                20
StWafTimes       #TM(W)      InputByWafNum             10032
StWafTimes -1     800         OPERCODE
```

Function.def

Add a Time function to be called in the recipe step.

Call this function instead of the regular TIME label.

```
// Use an operator specified time per wafer
TimePerWaf       Etch Time  WaferLog                         #TM(W)
TimePerWaf                  Delay                            #TM(W)
```

Keeping Toolbar Button Enabled

Purpose

By default, all Toolbar Buttons are disabled while a process cycle is running. This is so that the operator can't click a Toolbar Button that might disrupt the process. However, sometimes there is a need to be able to click a button while the process cycle is running. This document describes how to keep the button enabled so it can be clicked.

Requirements

- Process 7.42.20 or greater
- **ButtonStayEnabled** command in a definition file

ButtonStayEnabled Command Format:

- Command = ButtonStayEnabled
- Index column = Button Name
- Data column = 0 or 1. 1 enables the button, 0 disables the button.

Example

Overview

In this example, a Tool does two kinds of etch: CU and TIW. When the Tool is doing CU Etch, it is desired to be able to drain and fill the TIW chemistry tanks.

Function.def

In the Setup section of the Function.def file, two functions are added.

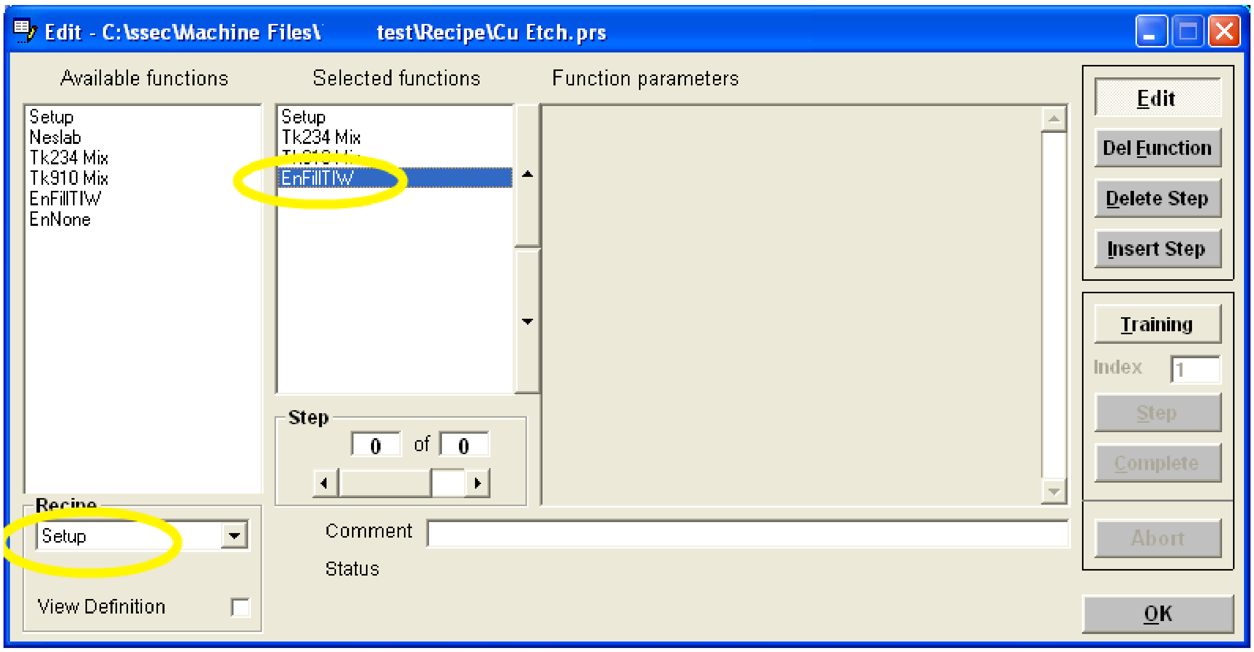
EnFillTIW – Enables the TIW tank fill buttons

EnNone – Enables no buttons (disables the TIW tank fill buttons)

```
>> Setup

// Setup function not shown
// Neslab function not shown
// Tk234 Mix function not shown
// Tk910 Mix function not shown

// Enable buttons to fill TIW while the process is running
EnFillTIW       FillTk2Fr  ButtonStayEnabled                1
EnFillTIW       FillTk2Us  ButtonStayEnabled                1
EnFillTIW       DrainTk2   ButtonStayEnabled                1
EnFillTIW       FillTk4    ButtonStayEnabled                1
EnFillTIW       FillTiWHex ButtonStayEnabled                1
EnFillTIW       DrainTk4   ButtonStayEnabled                1

// Turn off enabled buttons
EnNone          FillTk2Fr  ButtonStayEnabled                0
EnNone          FillTk2Us  ButtonStayEnabled                0
EnNone          DrainTk2   ButtonStayEnabled                0
EnNone          FillTk4    ButtonStayEnabled                0
EnNone          FillTiWHex ButtonStayEnabled                0
EnNone          DrainTk4   ButtonStayEnabled                0
```

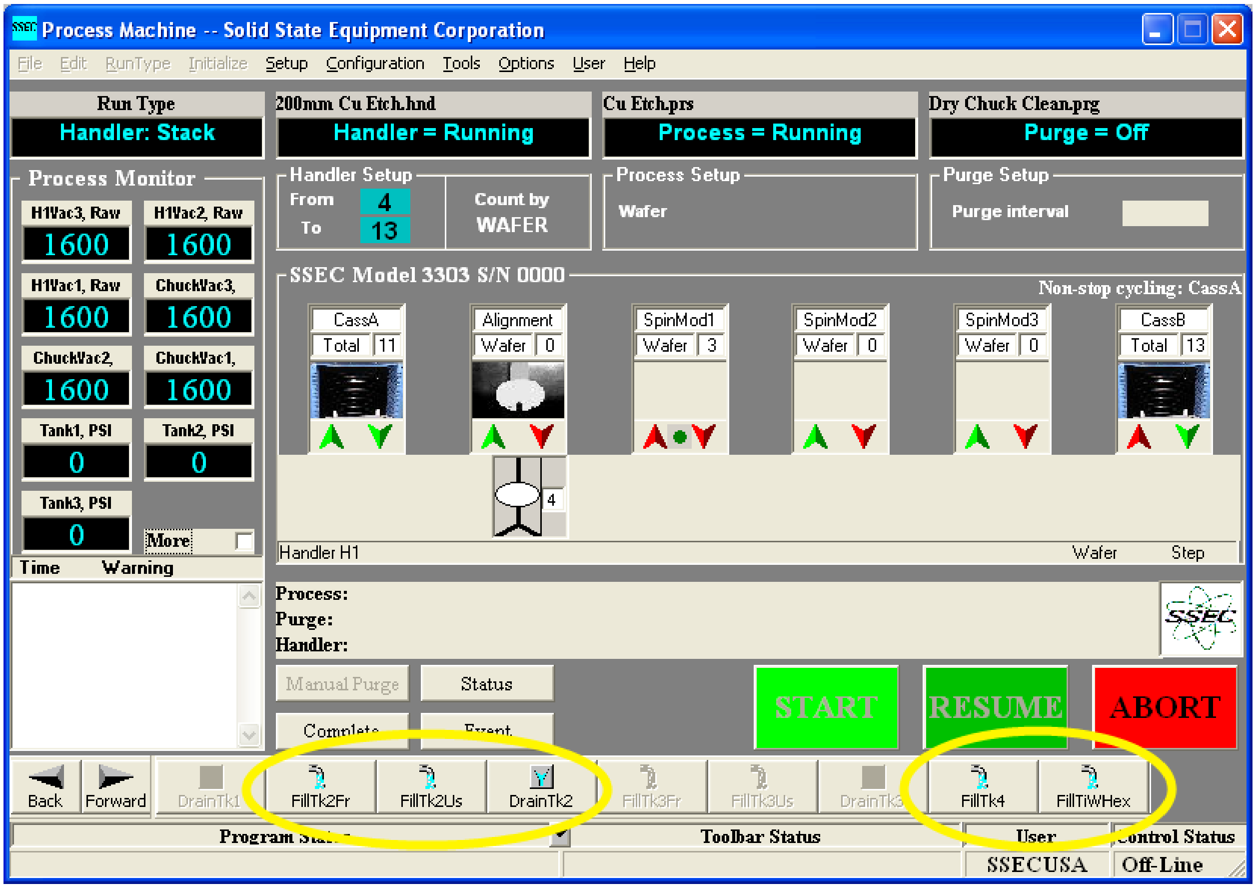
Process Recipe

In the CU Process recipe Setup section, the EnFillTIW function is called to enable the TIW tank fill buttons.



Result

While the process cycle is running, the TIW buttons remain enabled.



Station Abort and Rinse

Purpose

When the etch process running in a station is halted, the wafer needs to be rinsed and dried before fully stopping the Tool. The rinse should be performed for any type of error that halts the process so that the wafer is not damaged.

History

VPSP has used three different methods to perform Rinse after station abort. This document describes Method 3, "Rinse Recipe". This is now the only supported method for Rinsing.

Current Method:

- **Method 3 – Rinse Recipe**

  When an error stops the station, the Rinse Recipe is loaded and runs in that station.

Prior to Process 7.39.0, there were two other methods of performing Rinse. These methods should no longer be used. They are described in the document "Station Abort and Rinse – Obsolete.doc".

Obsolete methods:

- **Method 1 – Jump to Rinse Step**

  When the station halted due to an error, the station would jump to a step in the recipe labeled as the "Rinse Step". The Rinse Step definition contained the command "PostProcessAbort". Starting with Process 7.39.0, an error will be generated if a recipe contains the command "PostProcessAbort".

- **Method 2 – Rinse Toolbar Button**

  When the station halted due to an error, a Rinse Toolbar Button would run. Toolbar Buttons are assigned using the "StationErrButton" command.

Feature Summary

The Rinse Recipe feature specifies that when an error occurs that stops a station while it is running, a Rinse recipe will be loaded into that station and run. Other stations will continue to run their existing recipes. When all stations are complete, the Tool will stop with an error.

This is a summary of the things to know to use the Rinse Recipe feature.

- **Rinse configuration file** – By default, this is the **Rinse.ini** file in the Ini directory.
- **Rinse recipe file** – By default, this is the **Rinse.prs** file in the Recipe directory.
- Different rinse recipes can be specified to run depending on error type, as described later under Multiple Rinse Recipes.
- Multiple Rinse Configuration Files can be used, as described later under Multiple Rinse configurations.
- **Rinse Recipes Window** – The Rinse Recipes Window displays the current rinse configuration. This Window is available from the Process "Setup/Rinse Recipes" menu.

Rinse Recipe

There are varying levels of rinse complexity that can be configured:

- No Rinse
- Basic Rinse – Use a single rinse recipe
- Multiple Rinse Recipes – Assigns multiple rinse recipes, depending on the error condition
- Multiple Rinse Configurations – Assigns different rinse recipes, depending on wafer size

No Rinse

To turn off the Rinse feature, delete the Rinse.ini file.

Basic Rinse

The simplest version of Rinse Recipe uses only the Rinse.ini and Rinse.prs files. The Rinse.ini file establishes that if any error stops the station, the Rinse.prs recipe will be run in that station.

Basic Rinse.ini

Table 2 Basic Rinse.ini File

```
//====================================
// Rinse Recipes
//====================================

// Set CancelResume=True to disable Resume after Rinse runs. This is the default.
CancelResume=True

// Set RinseCompletedWafers=True if you want to rinse wafers after an error even
// if they have completed processing.
RinseCompletedWafers=True

// Default recipe
// This is the recipe that runs unless a more specific error condition is found

DefaultRecipe=Rinse.prs
```

The basic Rinse.ini file has three commands:

- CancelResume
  If set to true, then the operator cannot resume after a Rinse occurs. The Resume button will be disabled.
  If set to false, then the operator can resume after a Rinse occurs.

- RinseCompletedWafers
  If set to true, then if the station receives a stop command, it will run the rinse recipe even if the station has completed the normal process recipe.

- DefaultRecipe
  This command specifies the name of the rinse recipe. In this example, the name of the rinse recipe is Rinse.prs.

Basic Rinse.prs

Table 3 Basic Rinse.prs file

```
// This is an example of a Rinse.prs file

<<SpinMod1
//
 0   DoorClose
 0   Vacuum
 1   TIME            20
 1   Vacuum
 1   Wall DI
 1   Spin1          30,5
 2   TIME            10
 2   Vacuum
 2   Spin1          500,5

<<SpinMod2
//
 0   DoorClose
 0   Vacuum
 1   TIME            20
 1   Vacuum
 1   Wall DI
 1   Spin1          30,5
 2   TIME            10
 2   Vacuum
 2   Spin1          500,5
```

The Rinse.prs file has a rinse section for every process station. The rinse section contains steps to rinse and dry the wafer.

Multiple Rinse Recipes

In the Multiple Rinse Recipes scenario, it is possible to configure multiple rinse recipes to run based on different error situations. Some examples:

- If a DI Arm timeout occurs, run a "Rinse Wall DI.prs" recipe
- If a chuck vacuum error occurs, run a "Rinse No Spin.prs" recipe
- If an etch flow rate error occurs, run a "Rinse DI Wash.prs" recipe

Multiple rinse recipes are configured in the Rinse.ini file.

Table 4 Rinse.ini File for Multiple Rinse Recipes

```
// Example of a Rinse.ini file
//====================================
// Rinse Recipes
//====================================

// Set CancelResume=True to disable Resume after Rinse runs. This is the default.
CancelResume=False

// Set RinseCompletedWafers=True if you want to rinse wafers after an error
// even if they have completed processing.
RinseCompletedWafers=True

// Default recipe
// This is the recipe that runs unless a more specific
// error condition is found

DefaultRecipe=RinseDefault.prs

// Rinse recipes for specific error conditions
//
// Format:
```

```
// RinseError=Module Name,Recipe Name,Device Type,Device Name,Error Code
//
// Device Type, Device Name, and Error Code are optional
//
// Valid Device Types:
// ADC, DAC, Heater, Motor, Sensor, Solenoid, Tank

// SpinMod1

RinseError=SpinMod1,RinseDIError.prs,Motor,1Arm4Sweep
RinseError=SpinMod1,RinseDIError.prs,Motor,1Arm4Z
RinseError=SpinMod1,RinseSpinError.prs,Motor,SpinMotor1
RinseError=SpinMod1,RinseSpinError.prs,ADC,ChuckVac1
RinseError=SpinMod1,RinseSpinError.prs,ADC,FlowRate12,18

// SpinMod2

RinseError=SpinMod2,RinseDIError.prs,Motor,2Arm4Sweep
RinseError=SpinMod2,RinseDIError.prs,Motor,2Arm4Z
RinseError=SpinMod2,RinseSpinError.prs,Motor,SpinMotor2
RinseError=SpinMod2,RinseSpinError.prs,ADC,ChuckVac2
RinseError=SpinMod1,RinseSpinError.prs,ADC,FlowRate22,18
```

The Rinse.ini file uses the following commands:

- CancelResume
  If set to true, then the operator cannot resume after a Rinse occurs. The Resume button will be disabled.

  If set to false, then the operator can resume after a Rinse occurs.

- RinseCompletedWafers
  If set to true, then if the station receives a stop command, it will run the rinse recipe even if the station has completed the normal process recipe.

- DefaultRecipe
  The DefaultRecipe command sets the rinse recipe that will run unless a more specific error condition occurs that calls a different recipe.

- RinseError
  The RinseError command can be used multiple times to set specific error conditions. The format of the command is:

  RinseError=Module Name, Recipe Name, Device Type, Device Name, Error Code Device Type, Device Name and Error Code are all optional.

  Examples:

  - RinseError=SpinMod1,Rinse SpinMod1.prs

    This command specifies that if any error stops SpinMod1, the "Rinse SpinMod1.prs" rinse recipe will be called.

  - RinseError=SpinMod1,Rinse No Spin.prs,ADC,ChuckVac1

    This command specifies that if a Chuck Vacuum ADC error stops SpinMod1, the "Rinse No Spin.prs" rinse recipe will be called.

  - RinseError=SpinMod1,Rinse DI Wash.prs,ADC,FlowRate12,18

    This command specifies that if Error 18 "Monitor Error" occurs on ADC FlowRate12 in SpinMod1, then the "Rinse DI Wash.prs" recipe will be called.

Multiple Rinse configurations

Some equipment may handle two sizes of wafers. In this case, a different set of rinse recipes can be specified for each wafer size.

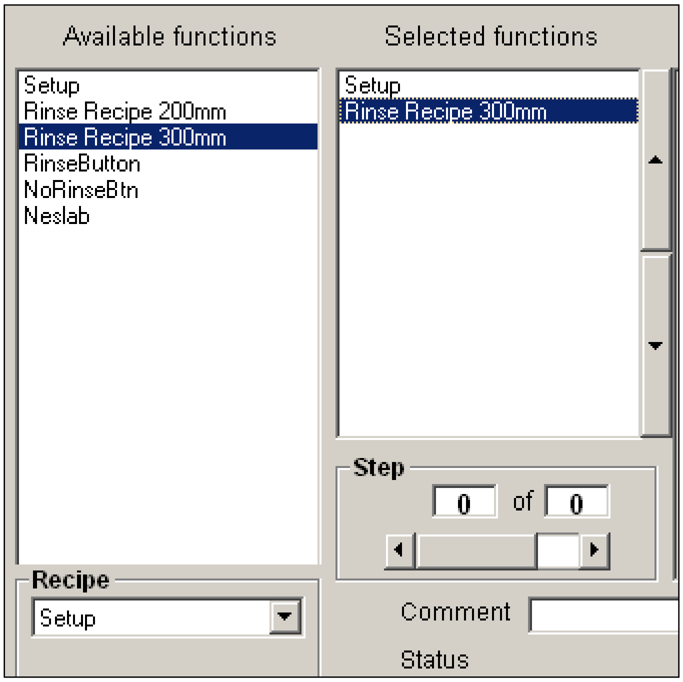
By default, the rinse configuration file is named "Rinse.ini". This can be overridden to call a different rinse configuration file for each wafer size.

- Function.def - In the Setup section of the Function.def file, the "LoadRinseIni" command can be used to specify a particular rinse configuration file.
- Process recipe (*.prs) – In the Setup section of the process recipe, the appropriate rinse configuration file for that wafer size is called.

Table 5 Function.def - Specifying rinse configuration file

```
// Example from the Function.def file
>>Setup

##Rinse200=Rinse Recipe 200mm
Rinse200          LoadRinseIni          Rinse200mm.ini

##Rinse300=Rinse Recipe 300mm
Rinse300          LoadRinseIni          Rinse300mm.ini
```

Table 6 Process Recipe Editor



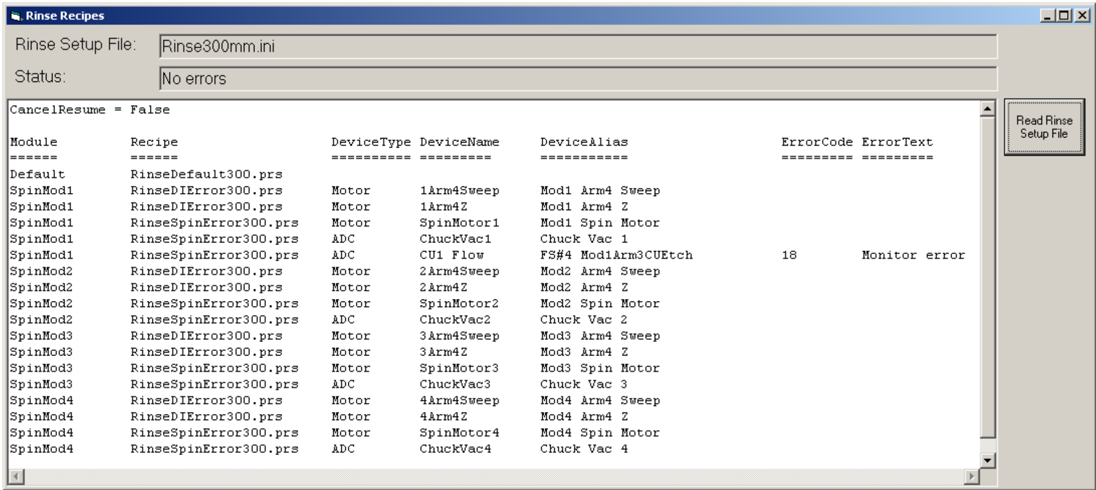
Rinse Recipes Window

The Rinse configuration can be viewed in the Rinse Recipes Window. The Rinse Recipes Window is available from the Process "Setup/Rinse Recipes" menu.

Table 7 Setup / Rinse Recipes menu

The Rinse Recipes configuration Window is a read-only Window. It displays the current rinse configuration. To change the rinse configuration, the Rinse Setup File (default **Rinse.ini**) should be edited, then click the "Read Rinse Setup File" button.

Table 8 Rinse Recipes Configuration Window




```
CancelResume = False

Module         Recipe                   DeviceType DeviceName    DeviceAlias                  ErrorCode ErrorText
======         ======                   ========== =========     ===========                  ========= =========
Default        RinseDefault300.prs
SpinMod1       RinseDIError300.prs      Motor      1Arm4Sweep    Mod1 Arm4 Sweep
SpinMod1       RinseDIError300.prs      Motor      1Arm4Z        Mod1 Arm4 Z
SpinMod1       RinseSpinError300.prs    Motor      SpinMotor1    Mod1 Spin Motor
SpinMod1       RinseSpinError300.prs    ADC        ChuckVac1     Chuck Vac 1
SpinMod1       RinseSpinError300.prs    ADC        CU1 Flow      FS#4 Mod1Arm3CUEtch          18        Monitor error
SpinMod2       RinseDIError300.prs      Motor      2Arm4Sweep    Mod2 Arm4 Sweep
SpinMod2       RinseDIError300.prs      Motor      2Arm4Z        Mod2 Arm4 Z
SpinMod2       RinseSpinError300.prs    Motor      SpinMotor2    Mod2 Spin Motor
SpinMod2       RinseSpinError300.prs    ADC        ChuckVac2     Chuck Vac 2
SpinMod3       RinseDIError300.prs      Motor      3Arm4Sweep    Mod3 Arm4 Sweep
SpinMod3       RinseDIError300.prs      Motor      3Arm4Z        Mod3 Arm4 Z
SpinMod3       RinseSpinError300.prs    Motor      SpinMotor3    Mod3 Spin Motor
SpinMod3       RinseSpinError300.prs    ADC        ChuckVac3     Chuck Vac 3
SpinMod4       RinseDIError300.prs      Motor      4Arm4Sweep    Mod4 Arm4 Sweep
SpinMod4       RinseDIError300.prs      Motor      4Arm4Z        Mod4 Arm4 Z
SpinMod4       RinseSpinError300.prs    Motor      SpinMotor4    Mod4 Spin Motor
SpinMod4       RinseSpinError300.prs    ADC        ChuckVac4     Chuck Vac 4
```

Error Handling Summary

This section describes how the Software will respond to different types of errors.

Error Level	**Cause**	**Response**
Fatal	Abort Button is Pressed	Current process step in all process stations will be terminated, then the Rinse recipe will be loaded and run in all stations.
Fatal	A device (sensor, ADC, Tank, Heater) raises a Fatal error.	Current process step in all process stations will be terminated, then the Rinse recipe will be loaded and run in all stations.
Error	An error occurs while running a station recipe. For instance, a Chuck Vacuum timeout occurs.	The current process step in the station with the error will terminate immediately, then the Rinse recipe will run. All other stations will complete their processes normally.
Error	A device raises an Error level error.	All process in all stations will complete normally.
Error with ErrStationList specified	A devices raises an Error level error. The device ErrStationList property specifies station(s) to be aborted or rinsed. For example, an ADC low flow rate error might terminate the station using that chemistry.	The specified stations will terminate the current step. The Rinse recipe will be loaded in those stations and run. Other stations will complete their processes normally.

Jump to Rinse Step

Requirements

- Process 7.29.3 or later

Stopping a Station

The Process Software can stop one or more specified stations while allowing the other stations to complete their processes. This is done by configuring an ADC, Heater, or Sensor as an error (ErrLevel = Error) and then using the “ErrStationList” property to specify stations to be stopped immediately. The ErrStationList property displays a list of all the process stations appended with the strings “/Abort” or “/Rinse”. For example, you might see the following list:

WetStMod1/Abort
SpinMod2/Abort
SpinMod3/Abort
WetStMod1/Rinse
SpinMod2/Rinse
SpinMod3/Rinse

If you pick “SpinMod2/Abort”, then SpinMod2 will be stopped as soon as the error occurs. The other stations will finish processing. Then an error message will be displayed.

If you pick “SpinMod2/Rinse”, then when the error occurs, SpinMod2 will stop and immediately jump to the Rinse step of the recipe. SpinMod2 will complete all the steps from the Rinse step to the end. The other stations will finish processing. Then an error message will be displayed.

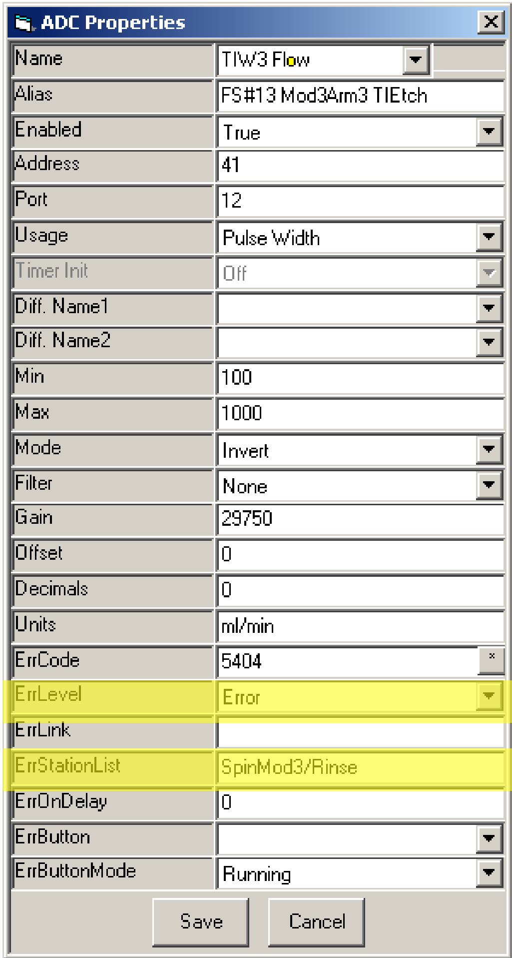


Figure 48 Example of an ADC configured to stop and rinse SpinMod3

Tank Chemistry Management

Purpose

The purpose of Tank Chemistry Management is to verify that the chemistry mix specified in the Process recipe matches the chemistry mix that is actually in the tank.

Definitions

- Recipe Mix Settings – These are the values defined in the process recipe that specify the chemistry mix that the recipe requires.
- Actual Mix Settings – These are the chemistry mix values describing what is actually in the tank right now.

Definition File Commands

- TankChemID – This command defines the type of chemistry used in the rare case where a single supply bottle might contain different types of chemistry. Usually, the Tank Chem ID should always be set to “1”.
- DACSetToRecipe – Stores the DAC pulse counter value as a Recipe Mix Setting. Used in the Function.def Setup section.
- DACSetFromRecipe – Sets the DAC from the Recipe Mix Setting specified with the DACSetToRecipe command. Used in the Toolbar.def Fill Tank button.
- TankVerifyChem – Compares the tank Actual Mix Settings to the Recipe Mix Settings. Raises an error if they don’t match. Used in the Toolbar.def Fill Tank button.
- TankSaveChem – Saves the Recipe Mix Settings to the Actual Mix Settings. Used in the Toolbar.def Fill Tank button.
- TankClearChem – Resets the Actual Mix Settings to 0, indicating that the tank is empty and has no chemistry mix. Used in the Toolbar.def Drain button (or Rinse button or New Chemistry button).

Example

For an example, see S/N #2653 files dated 3/8/2010 or later.

Error Conditions

The tank can only be filled with chemistry if one of the following conditions is true. Otherwise, an error message is generated.

- The “Actual” Mix Settings for the tank are all 0. This means that the tank has been drained of chemistry.
- The “Actual” Mix Settings for the tank are identical to the “Recipe” Mix Settings.

Theory of Operation

Basic Sequence

Here is an example of how Tank Chemistry Management works. In the example, there is one tank that is filled with two chemistries, Chemistry A and Chemistry B.

- In the initial condition, the tank is empty. The Actual mix settings are zero.
  - Chemistry A Actual Mix Setting = 0
  - Chemistry B Actual Mix Setting = 0
- User loads Process Recipe 1. It contains Recipe Mix Settings required by the recipe.
  - Chemistry A Recipe Mix Setting = 50 ml
  - Chemistry B Recipe Mix Setting = 1000 ml
- User presses Start button. An Error message occurs: "Tank is empty"
- User presses "Fill Tank" button. The button reads the Recipe Mix Settings from the recipe and fills the tank with that mix. It stores the Recipe Mix Settings as the Actual Mix Settings.
  - Chemistry A Actual Mix Setting = 50 ml
  - Chemistry B Actual Mix Setting = 1000 ml
- User presses Start button. The process starts running. If the tank empties while running, the Fill Tank button is automatically called to refill the tank. Finally the process completes.
- User loads Process Recipe 2. It contains different Recipe Mix Settings.
  - Chemistry A Recipe Mix Setting = 500 ml
  - Chemistry B Recipe Mix Setting = 500 ml
- User presses Start button. An error is displayed: "Chemical in recipe does not match tank". The process cannot start.
- User presses Fill Tank button. An error is displayed: "Chemical in recipe does not match tank". The tank cannot be filled.
- User presses Drain Tank button. The tank is drained. The tank Actual Mix Settings are reset to 0.
  - Chemistry A Actual Mix Setting = 0
  - Chemistry B Actual Mix Setting = 0
- User presses "Fill Tank" button. The button reads the Recipe Mix Settings from the recipe and fills the tank with that mix. It stores the Recipe Mix Settings as the Actual Mix Settings.
  - Chemistry A Actual Mix Setting = 500 ml
  - Chemistry B Actual Mix Setting = 500 ml
- User presses Start button. The process starts running.
- Etc.

Variations

Some variations to the basic sequence are:

- Rinse Button – To reset the Actual Mix Settings to zero, a Rinse button is used rather than the Drain button. The Rinse button will drain the tank, rinse it with DI, then drain it again.
- New Chemistry Button – This is a more complicated button that performs all the steps required to fill the tank with different chemistry. For example, it might drain the tank, rinse the tank, drain the tank, dry the tank, then fill it with the Recipe chemistry.

Configuration Summary

This section lists the configuration files that contain information required for Tank Chemistry Management.

1. Process Recipe
   a. Function.def file – Setup section defines a function for each tank to specify the chemistry options
   b. Process recipe (.prs) file – Contains the mix settings that correspond to the function definition in the Function.def file. These are called the "Recipe" mix settings.
2. Toolbar.def
   a. Fill Tank Toolbar Button – Saves the mix settings currently used for the tank. These are called the "Actual" mix settings.
   b. Drain Tank Toolbar Button – Clears the mix settings currently in the tank. In other words, the "Actual" mix settings are reset to 0.
3. Tank Configuration Screen (Tank.ini file)
   a. Tank Properties "Chemistry" tab – The pulse counters and tank level counters used to measure the chemistry mix are specified. The Actual and Recipe mix settings are displayed.
   b. Tank Properties "Errors" tab – An error can be configured to prevent processing if the Actual mix does not match the Recipe mix

Configuration Details

Process Recipe

Function.def "Setup" section example

```
>>Setup
Tk1 Mix          Tank1      TankChemID                         1
Tk1 Mix         PulseCnt1B DACSetToRecipe   AM Clean (ml)     10     0     57000 1      0
Tk1 Mix         PulseCnt1C DACSetToRecipe   NH4OH (ml)        10     0     57000 1      0
Tk1 Mix         PulseCnt1D DACSetToRecipe   H2O2 (ml)         10     0     57000 1      0
Tk1 Mix         Tank1Level DACSetToRecipe   DI               100     0     5700  1      0
```

Process recipe (.prs) "Setup" section example

```
                <<Setup
                //
0   Tk1 Mix                100,0,0,1000
```

Toolbar.def

Fill Tank button example

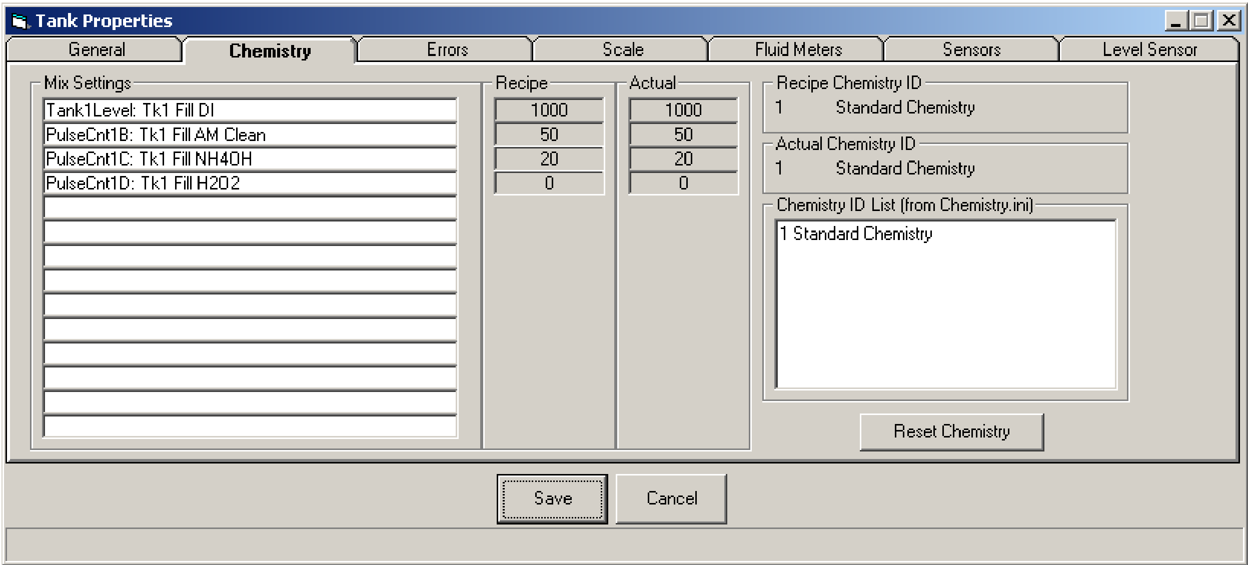
```
>>FillTk1        C:\Program Files\ssec\bmp\fill.ico           Fill Tank1 with SC-1
// Get mix settings from recipe
FillTk1          Tank1Level DACSetFromRecipe
FillTk1          PulseCnt1B DACSetFromRecipe
FillTk1          PulseCnt1C DACSetFromRecipe
FillTk1          PulseCnt1D DACSetFromRecipe
// Verify that recipe mix settings match actual mix in tank
// OR actual mix settings are all 0
FillTk1          Tank1      TankVerifyChem
// Save recipe mix settings as actual mix settings
FillTk1          Tank1      TankSaveChem
// If tank is already full, goto End
FillTk1          Tank1      TankFullGoto                      99
// DO FILL STEPS HERE
//Done
FillTk1          99         Label
// Off Part
FillTk1    1     Venturi1   SolOff
FillTk1    1     Tank1Fill  SolOff
FillTk1    1     Tank1N2    SolOn
FillTk1    1     Tank1Vent  SolOn
FillTk1    1     Tank1QVent SolOn
FillTk1    1     Tank1      ADCSleep                          5
```

Drain Tank button example

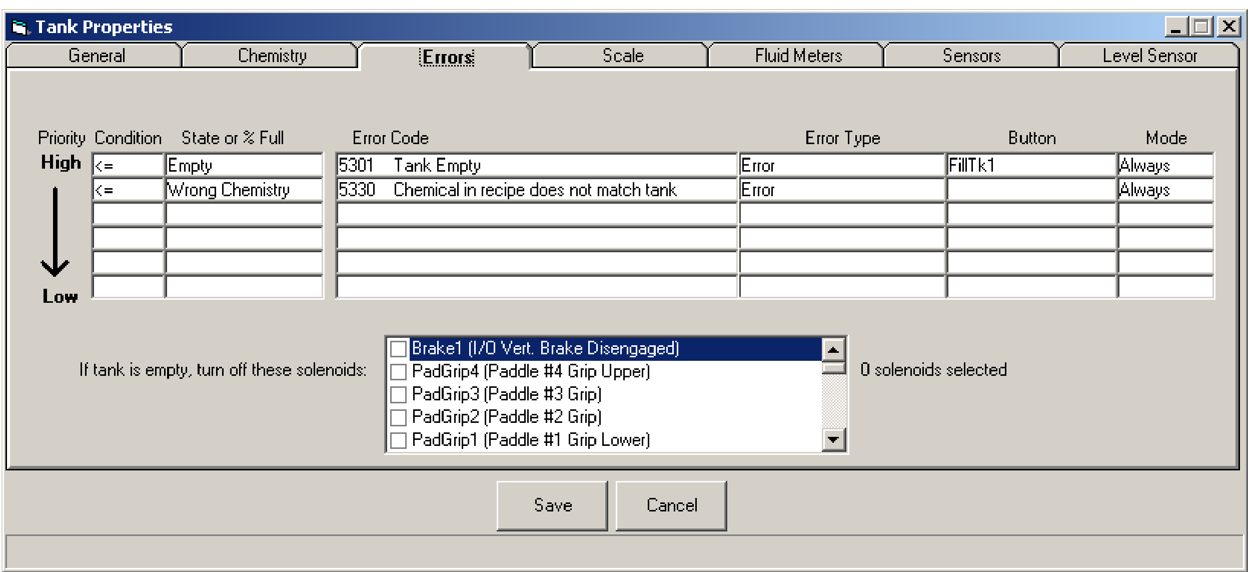
```
>>DrainTk1        C:\Program Files\ssec\Bmp\Drain.ico          Drain Tank 1
DrainTk1          Tank1      DACSaveVar                        #Tk1
DrainTk1          Tank1      DACSet                            20
DrainTk1          FillTk1    ButtonCancel
// DO DRAIN STEPS HERE
// Done
DrainTk1          99         Label
DrainTk1          Tank1      TankClearChem
// Delay required for Tank Empty condition to cancel FillTk1 button
DrainTk1                     Delay                             3
// Off Part
DrainTk1    1     Drain1B    SolOff
DrainTk1    1     Tank1      DACSet                            #Tk1
```

Tank Configuration screen (Tank.ini file)

Tank Properties "Chemistry" tab example



Tank Properties "Errors" tab example



Resource Monitor

Purpose

The purpose of the Resource Monitor function is to monitor the energy and chemistry consumption of the equipment.

Requirements

Requires Process version 7.45.13 or greater.

Overview

To view the Resource Monitor Window, select "Setup/Resource Monitor" from the main Process menu.

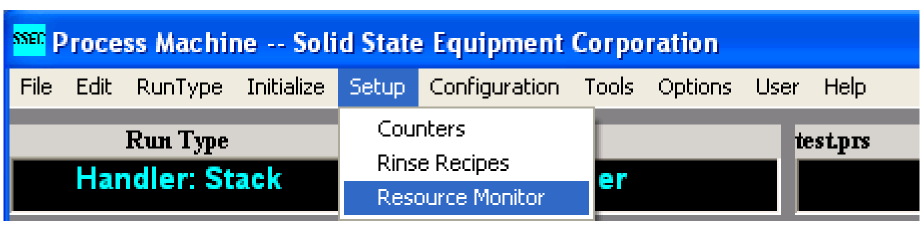


Figure 49 Select Resource Monitor from Process menu

There are three elements to the Resource Monitor:

1. Time Settings (how often the readings are updated, how often they are reset)
2. Energy Monitor
3. Chemistry Monitor

Time Settings

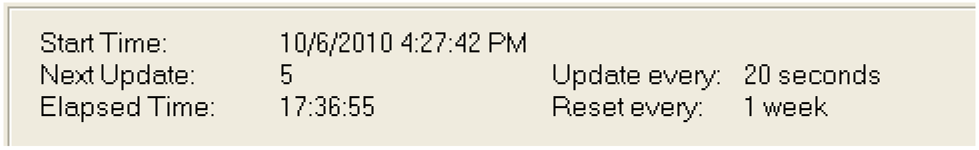


Figure 50 Time portion of the Resource Monitor Window

There are three time settings: Update Time, Total Time, and Normalize Time.

Update Time

Update Time defines how often the Energy and Chemistry usage readings are read from the equipment.

In the Time portion of the Resource Monitor Window, these fields reflect the Update Time:

Next Update – Countdown until the next update occurs

Update every – Displays how often updates will occur

Total Time

The Total Time defines how often the usage readings will be logged and reset back to 0.

In the Time portion of the Resource Monitor Window, these fields reflect the Total Time:

Start Time – Time the current “Total” interval started

Elapsed Time – How much time has elapsed since the “Total” interval started.

Reset Every – The Total interval

Normalize Time

The Normalize Time is used to display the current Total usage in constant time units.

Normalized Amount = Total Amount * Normalize Time / Elapsed Time

The Normalize Time is not displayed in the Time portion of the Resource Monitor Window. It is displayed as the Interval field of the Normalized column of the Energy and Chemistry monitors.

Energy Monitor

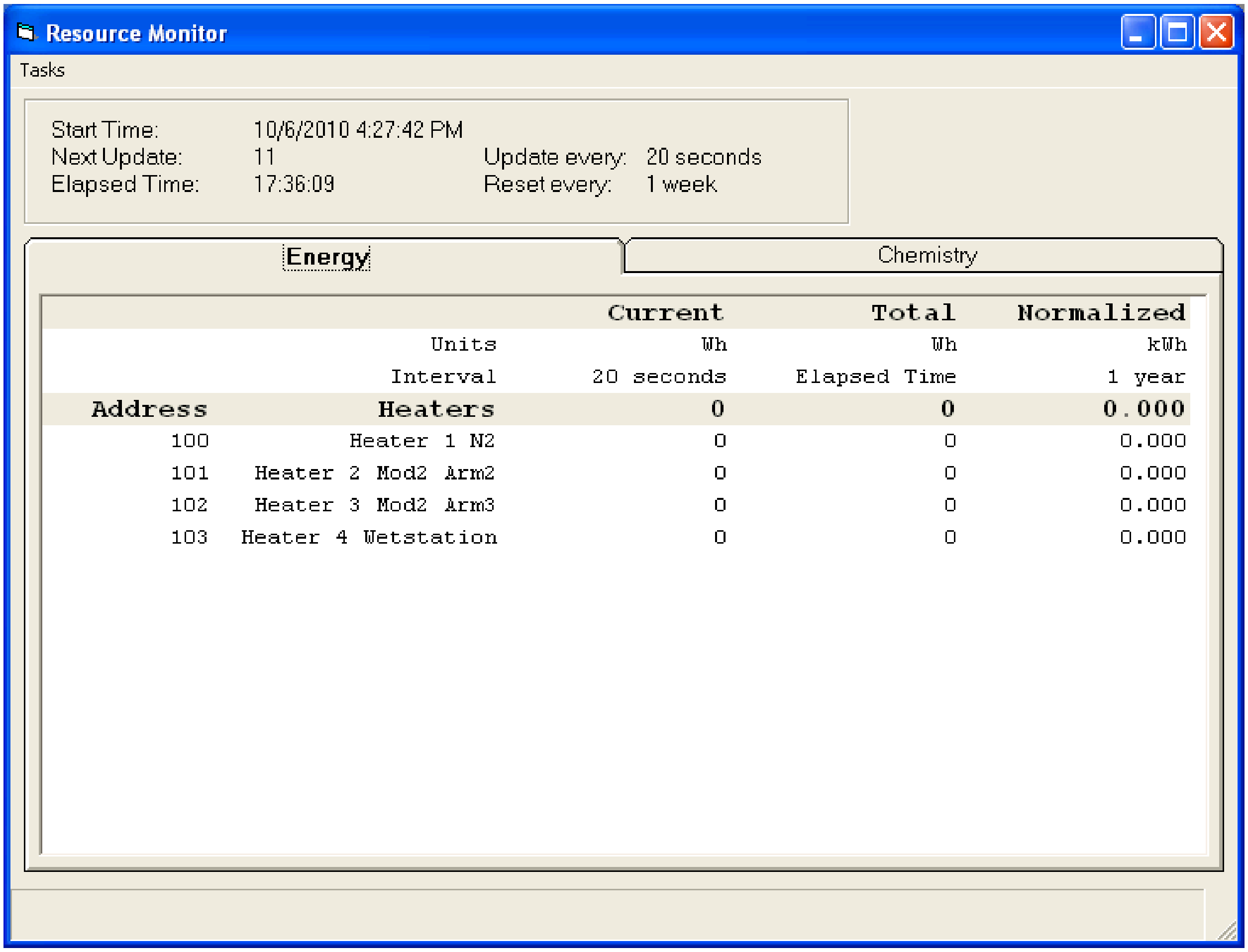


Figure 51 Energy Monitor

The Energy Monitor is automatically configured by the Process Software. It lists all the heaters on the equipment. The heaters are the main energy consumers. For each heater, this Window displays the following:

- Current – The Power Consumption in Watt-hours of the heater read at the end of the most recent Update interval.
- Total – The total Power Consumption since the start of the current Total Interval. The Start Time and Elapsed Time in the Time portion of the Window show the current Total Interval.
- Normalized – The total Power Consumption normalized over the Normalize interval.

Chemistry Monitor

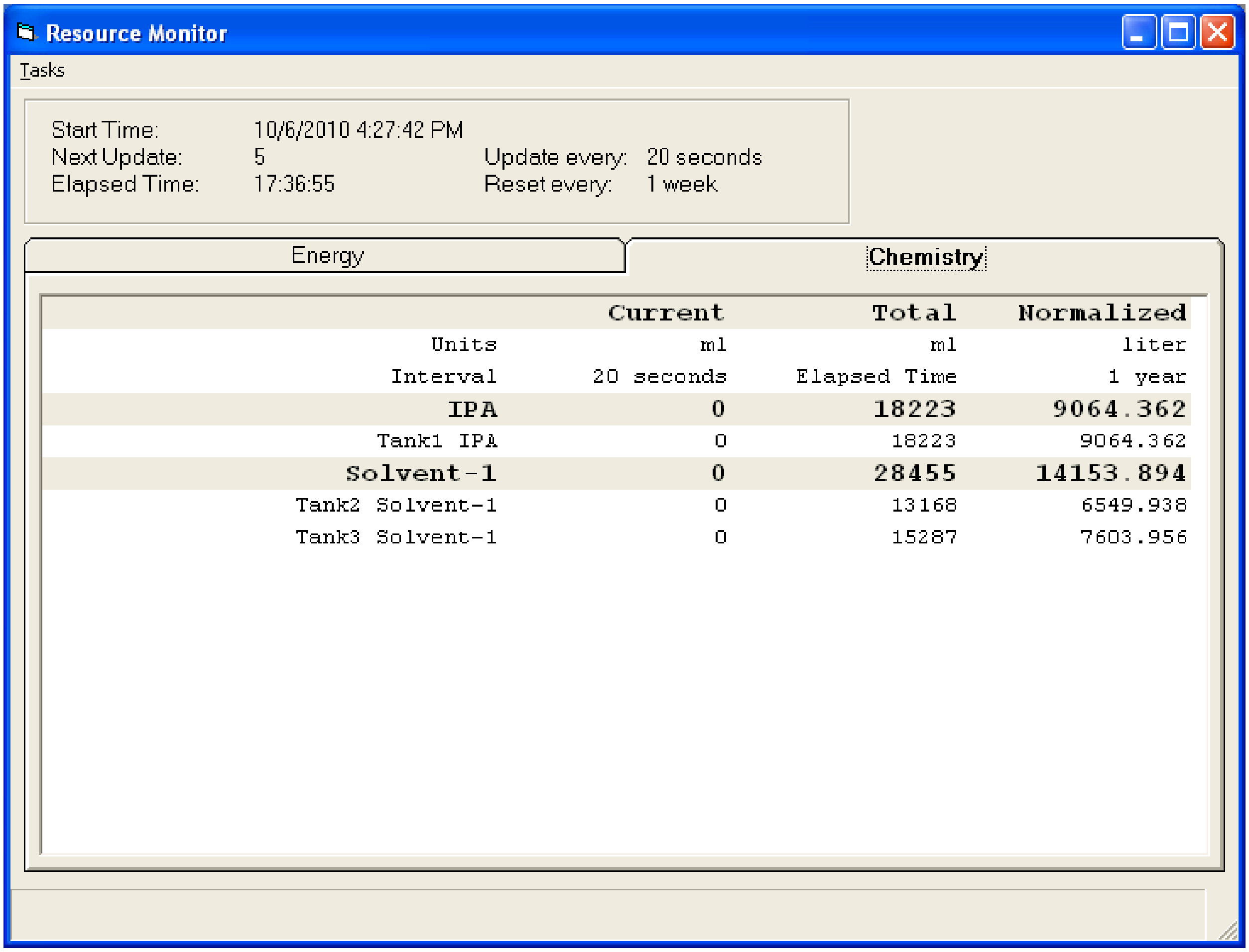


Figure 52 Chemistry Monitor

The Chemistry Monitor must be manually configured in the ResourceManagement.xml file. It contains a list of chemistry types and the ADCs that measure the chemistry input amount.

For each Chemistry, this Window displays the following:

- Current – The current units of chemistry measured at the end of the most recent Update interval.
- Total – The total Chemistry Usage since the start of the current Total Interval. The Start Time and Elapsed Time in the Time portion of the Window show the current Total Interval.
- Normalized – The total Chemistry Usage normalized over the Normalize interval.

Files

Inputs:

- ResourceManagement.xml – located in the Ini folder
  This file defines the Time and Chemistry settings. Energy configuration settings are automatically created by the Process Software.
  At the current time, the only way to change the Time and Chemistry settings is to manually edit the file.
  TODO: Describe the format of the ResourceManagement.xml file
- ResourceManagement_Status.xml – located in the Ini folder
  This file is used by the Process Software to store current readings. The file is automatically maintained by the Software.

Outputs:

- ChemistryManagement.log – located in the Log folder
  The Total and Normalized chemistry values are written to this file at the end of every Total interval.
- EnergyManagement.log – located in the Log folder
  The Total and Normalized energy values are written to this file at the end of every Total interval

Wafer Rescue

Overview

The Rescue Wafers function will locate and process any wafers left in the Tool. You can use this to recover from an event which halted the Tool with wafers in process and the Software lost track of where the wafers were. (Of course, this is not supposed to happen.)

The Rescue Wafers function assumes the following condition for the Tool:

- No wafers in the input cassette

- No wafers in the output cassette

- No wafers on the handler

- A wafer is every process stations that is used by the handler recipe. For a wet station, there is a wafer in each slot as defined by the Wet Buffer (OR_BUFFER) command in the handler recipe.

- Process stations that are not used by the handler recipe are empty.

When you start the rescue function, this is what will happen:

- The process will run in every station. For the wet station, it will assume that the wafers have completed their soak times.

- As stations finish, the handler will go and try to pick up the wafer from the station and move it to the next station or the output cassette. This is exactly like normal operation of the handler.

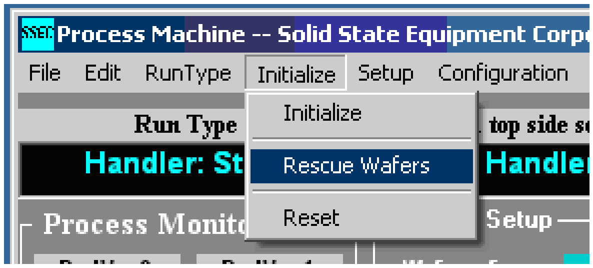
- Wafers are placed in the output cassette starting with the first slot and placing in each slot after that. There is no relationship between wafer number and slot number. If the Software creates wafers number 1, 2, and 3 in the process stations, but it determines that wafer 2 is not present, then wafer 1 will go in the first slot and wafer 3 will go in the second slot. It does not leave a space for wafer 2.

What if there is not a wafer in the station?

- Each pickup step in the Handler.def should contain a "TestPresent" command. When this command is encountered, the Software will use the next command to determine if the wafer is present. If not, the Software will automatically kill the wafer and resume.

- If the TestPresent command is not in the Pickup step, then the Tool will stop with an error, for example a vacuum error, saying that the wafer is not present. At this point, the user can kill the wafer, RETRACT THE PADDLE, and resume.

The Rescue Wafers screen is reached by selecting Initialize/Rescue Wafers from the menu.

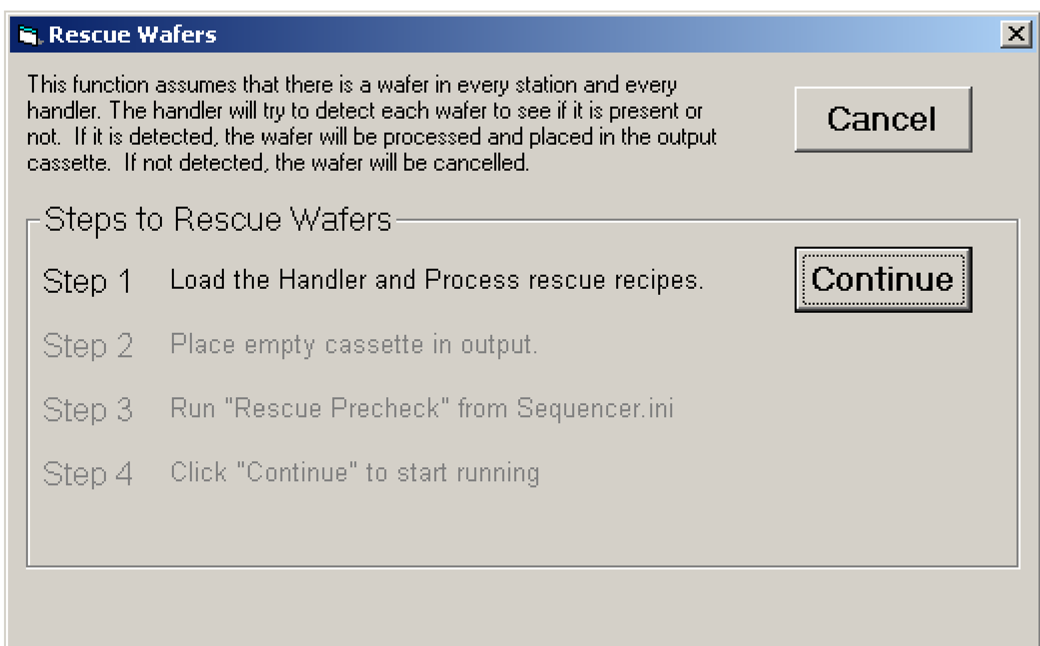


Steps to Rescue Wafers

These steps list an action that the operator should perform. Hit the Continue button to confirm that the step has been completed.

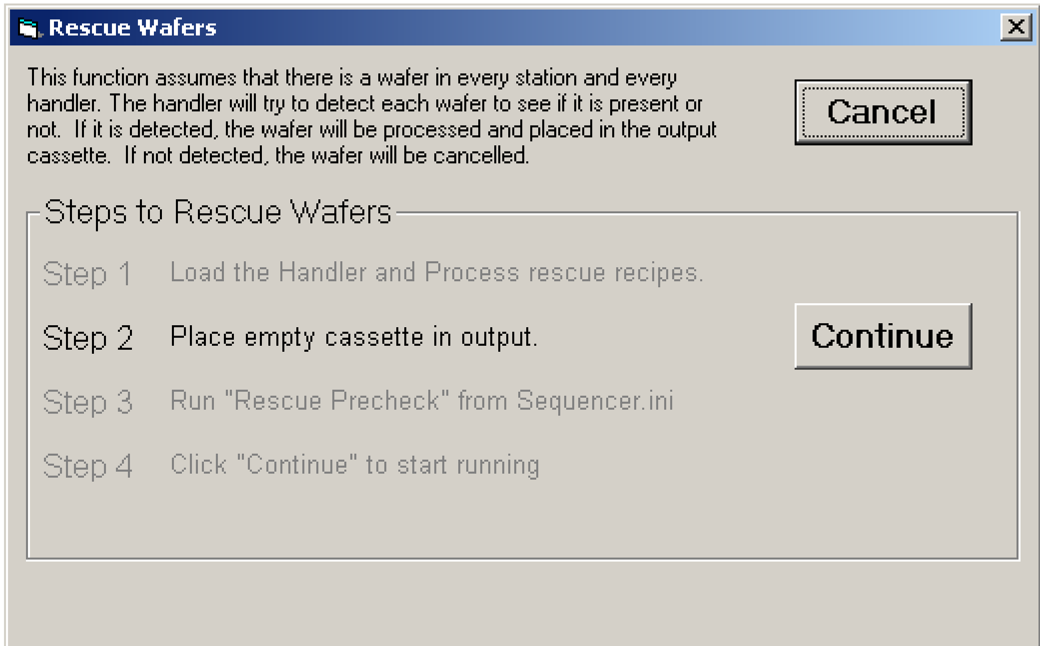
Step 1) Load the Handler and Process rescue recipes

This step gives you the opportunity to load different recipes if you wish. The handler recipe you probably will not change. The process recipe you might change if you want to perform a different recipe than the regular process recipe. For example, you might want to run a process recipe that just does a rinse and dry, rather than the full process.

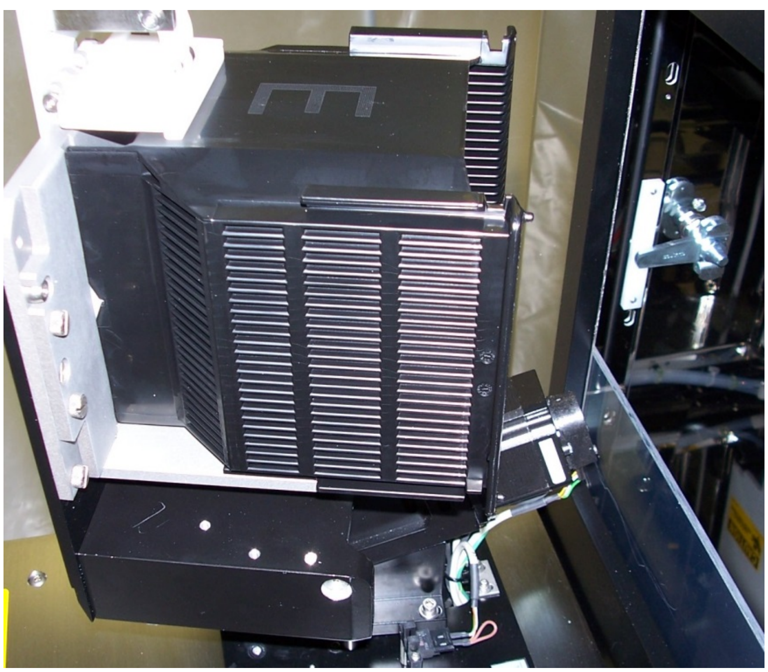


Step 2) Place empty cassette in output

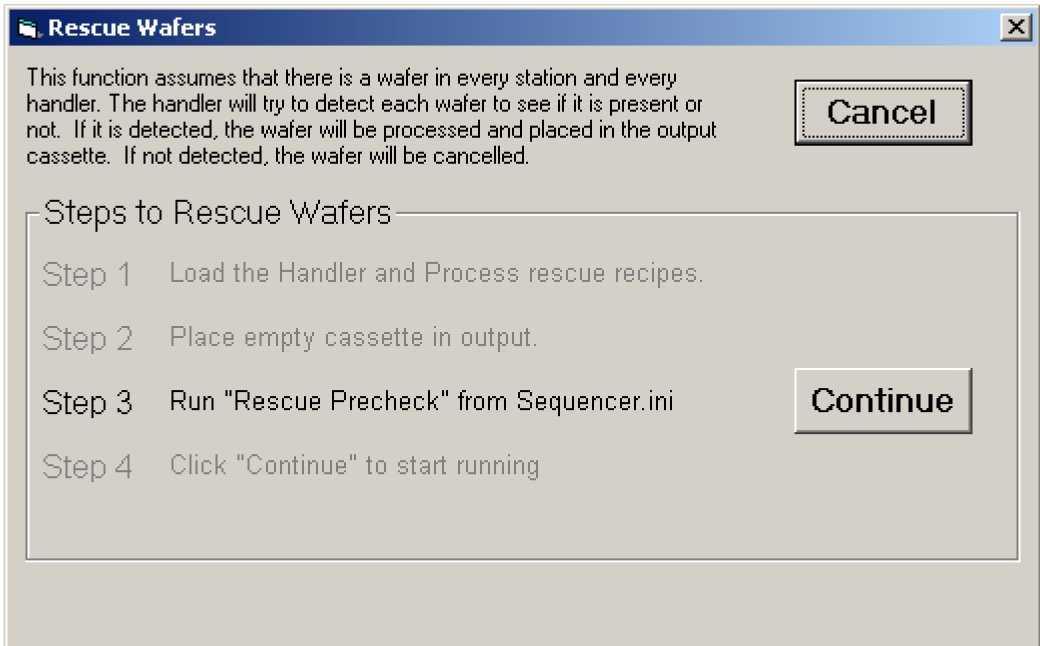
The output cassette MUST be empty. The rescue program loads wafers into the output cassette starting with slot 1.



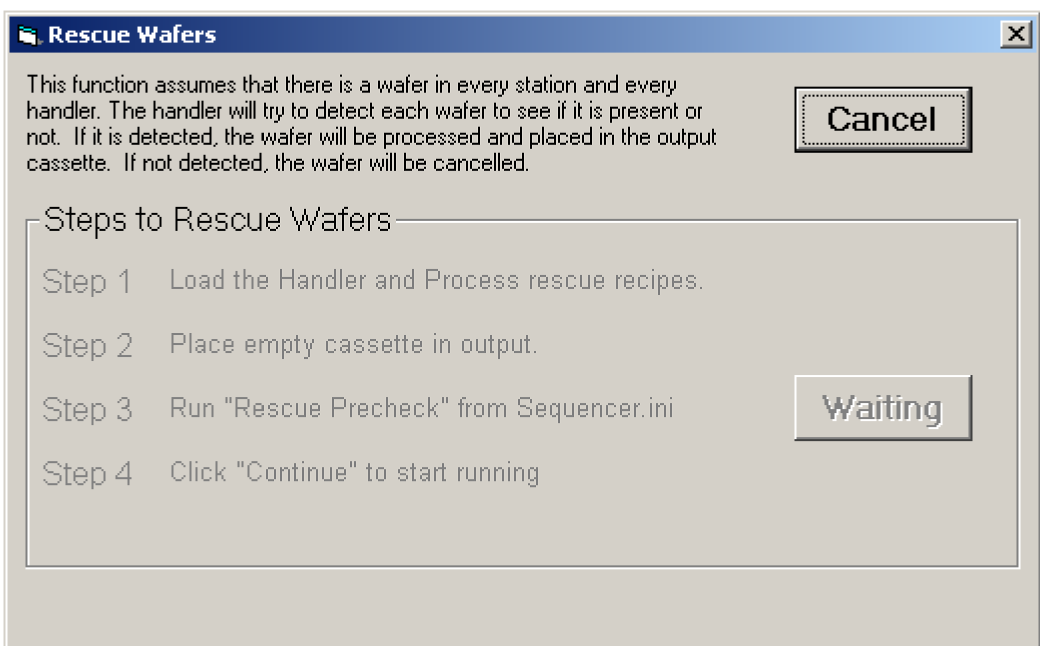
After verifying the output cassette is empty, continue to the next step.



Step 3) Run "Rescue Precheck" from Sequencer.ini
This step will check the Paddles for the presence of a wafer. Click "Continue" and the Software will perform its own check of each Paddle if possible. If the Software is unable to check the presence of a wafer for certain types of Paddles it will assume a wafer is present.



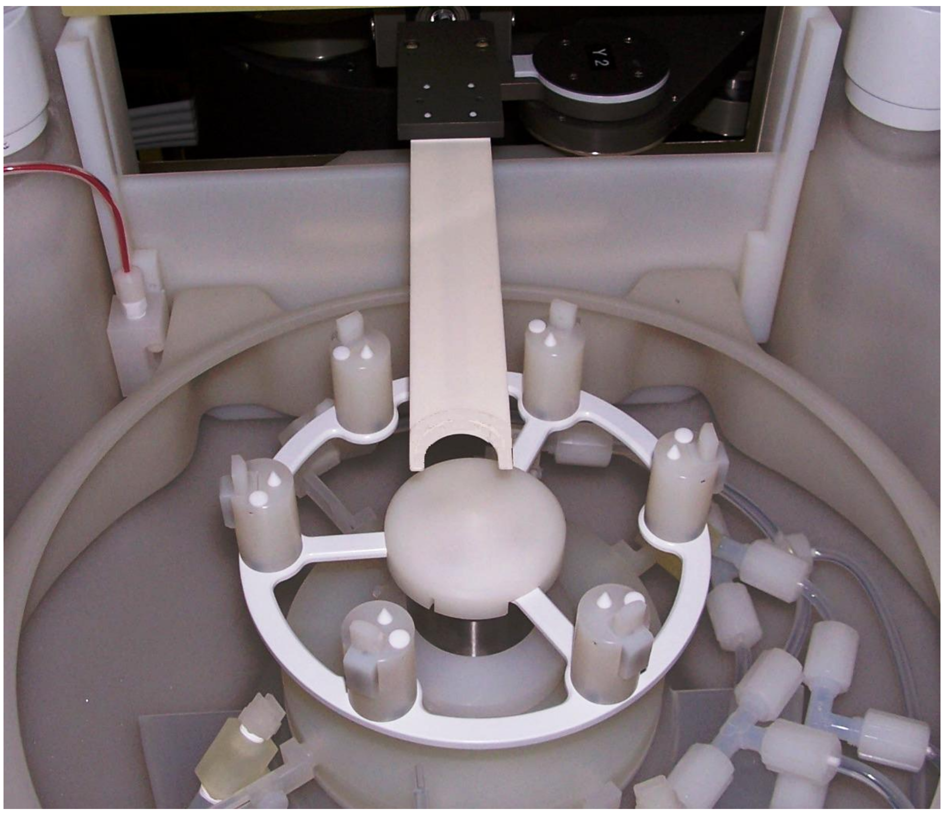
During the check the following screen is displayed:



Step 4) Click "Continue" to start running.

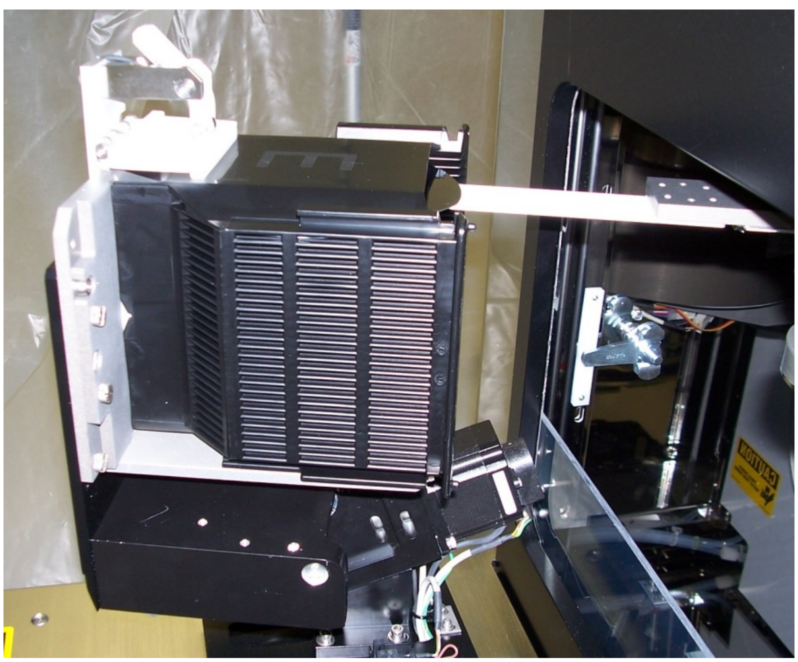
If you look on the main Process screen at this point, you will see that wafer numbers have been assigned in the process stations. You have the opportunity at this point to kill any wafers in stations if you don't want the handler to try to pick them up. When you click the "Continue" button, the process cycle will start running, similar to as if you had pushed the Resume button at this point.

After the process completes the wafers are moved along until they are placed into the output cassette. If no wafer is present in a Process Chamber when the handler attempts to pick one up it will detect no wafer and continue without error.

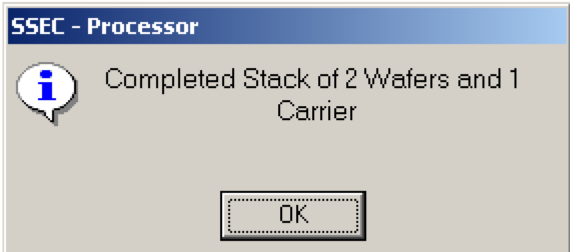


When a wafer is detected it is moved along through each Process Chamber

After the process completes the wafers are placed into the output cassette.



When all of the wafers have been placed in the output cassette a screen similar to this will be displayed:



This Page Left Intentionally Blank.

Setting up the Rescue Wafers function

Process.ini - The flag "Rescue Wafers Screen Enabled" must be set to True in the Process.ini screen to enable the Rescue Wafers screen.

Function.def - The TestPresent command should be added to the Function.def file for each station if that station has a check that determines if the wafer is present. Typically, this would be a Vacuum Check or a Vision Check step. For example:

```
VacDetect      ChuckVac1  SolOn
VacDetect                 TestPresent
VacDetect      ChuckVac1  ADCWaitOver    Timeout (sec.s)  1     0     10    .1    0
VacDetect   1  ChuckVac1  SolOff
```

Handler.def - The TestPresent command should be added to the Handler.def file for every pickup step from a Process Chamber. It is not necessary to use the TestPresent command when picking up from a cassette. However, we will probably include the TestPresent command in all pickup steps just to be consistent. The TestPresent command will be inserted directly before the command that detects the wafer. For example:

```
PickWet P1 -2 WetZ       MotorMove      Wet Z to Wafer   2.9   1.9   3.9   .001  H
PickWet P1    WetZ       MotorWaitPos
PickWet P1               TestPresent
PickWet P1    PadVac1    ADCWaitOver                       10
```

Sequence.ini – A section "[Rescue Precheck]" must be created. This section will check for a wafer on every Paddle (if it can) and if it does not detect a wafer, it kills the wafer on that Paddle. For example:

```
[Rescue Precheck]
SolOn PadVac1
SolOn PadVac2
Delay 5
ADCOverGoto PadVac1 1
KillPaddleWafer 0
SolOff PadVac1
Label 1
ADCOverGoto PadVac2 2
KillPaddleWafer 1
SolOff PadVac2
Label 2
```

This Page Left Intentionally Blank.

Some Comments about the TestPresent Command:

1. The TestPresent command works in combination with the next command in the step. Typically, the next command is a vacuum check (ADCWaitOver) or a vision check (VisDetect) command.
2. How the command works in handler functions is:
   1. The handler tries to pick up the wafer from a station.
   2. If the next command fails (for instance, the ADCWaitOver times out without the vacuum rising above the threshold), then the Software assumes the wafer is not present. Instead of generating an error, the Software automatically kills the wafer. It also runs the rest of the commands in the pickup sequence, for the purpose of getting the handler out of the station.
3. This command is ONLY used during the Rescue Wafers function. It does not have any effect during normal cycling.
4. This command is ONLY used to detect the wafer the first time the handler tries to pick it up to detect if the wafer exists. After that, if another TestPresent step gets an error, it is a real error. For instance, suppose you have a wafer in station 1. The handler picks it up and puts it in station 2. For some reason, when the handler picks up the wafer from station 2, the ADCWaitOver command fails. This will generate a vacuum error message, because the wafer should be there.
5. For TestPresent commands in the function.def file: If the wafer has not yet been detected by the handler, then if the TestPresent command fails (the wafer is missing), the process recipe will be aborted. However, the handler will still try to pick up the wafer. The TestPresent command should fail in the handler pickup step also, and the wafer will be killed.

Suggestion

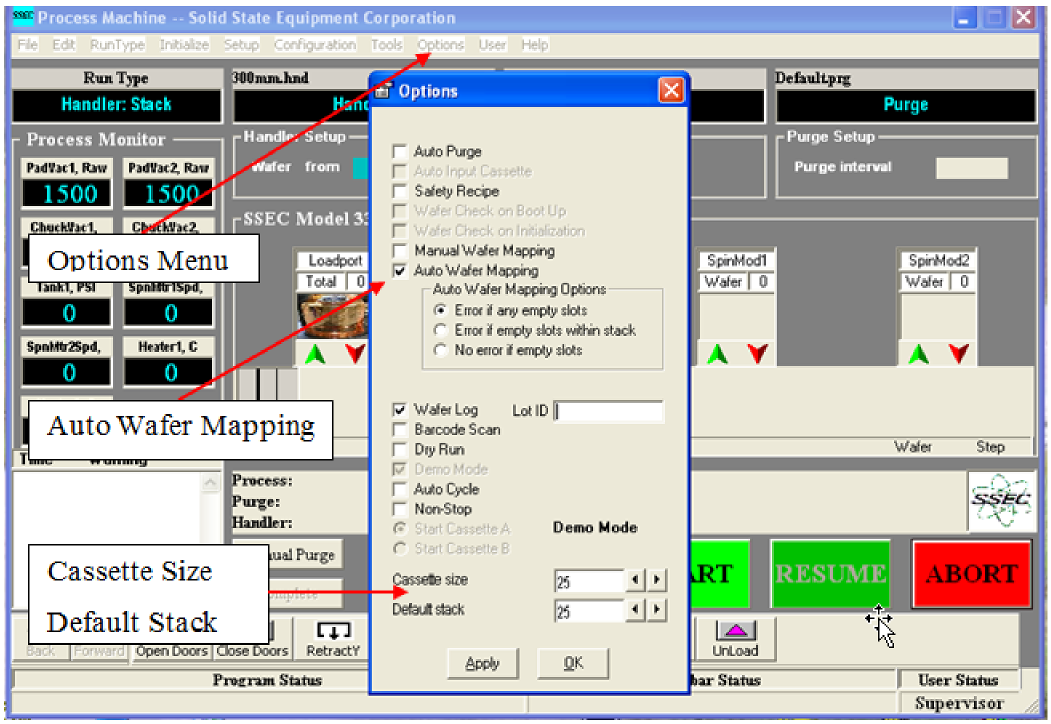
When setting up the rescue function, this is a good procedure to follow:

1. Enable the Rescue Wafers function in the Process.ini file
2. Add the TestPresent command to the pickup steps in the Handler.def and any wafer detect steps in the Function.def.
3. With no wafers on the Tool, run the Rescue Wafers function.
4. The handler will try to pick up wafers in all the stations. It should try all the stations, not detect any wafers, and stop gracefully.

This Page Left Intentionally Blank.

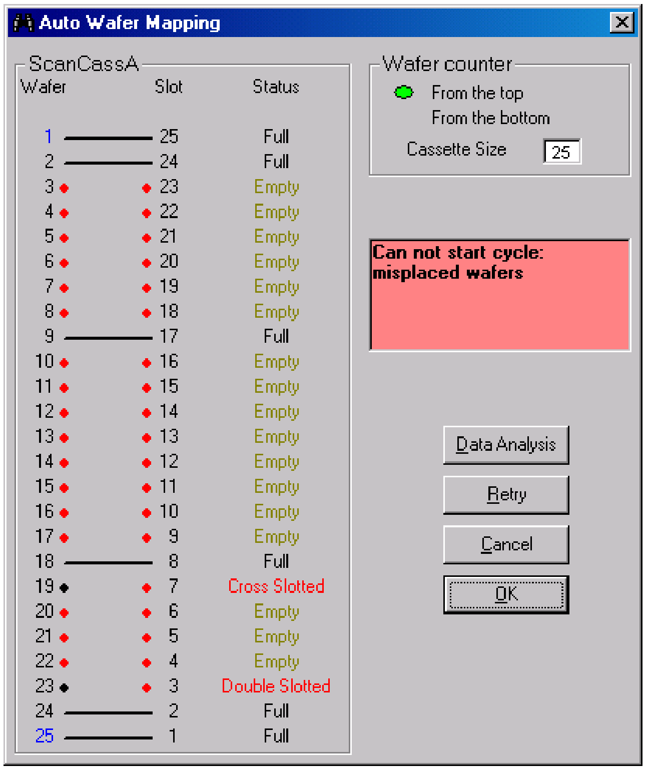
Wafer Scanner

The Wafer Mapping system optically checks the wafer cassette in order to verify wafer quantity. A default stack/cassette size number is programmed into the "Options" Toolbar menu at the top of the main menu. The default stack/cassette size is normally set to 25 and should not be changed. The "Auto Wafer Mapping" option must also be enabled.



The Software uses this number to check the results gathered by the Wafer Mapping optical system. The Software alerts (Alarms) the operator if the number reported does not match the number in the "Options" screen. The Software also identifies and generates Alarms/errors for cross slotted wafers.

The Wafer mapping program compares the scanned wafer count to the programmed wafer count and if they are the same, continues to the Robotic Handling step for wafer pickup. However, the Software will alarm the operator if the count is off or a cross slotted wafer is identified. The Software also displays a visual representation of what wafers it has identified as present, missing, and cross slotted.



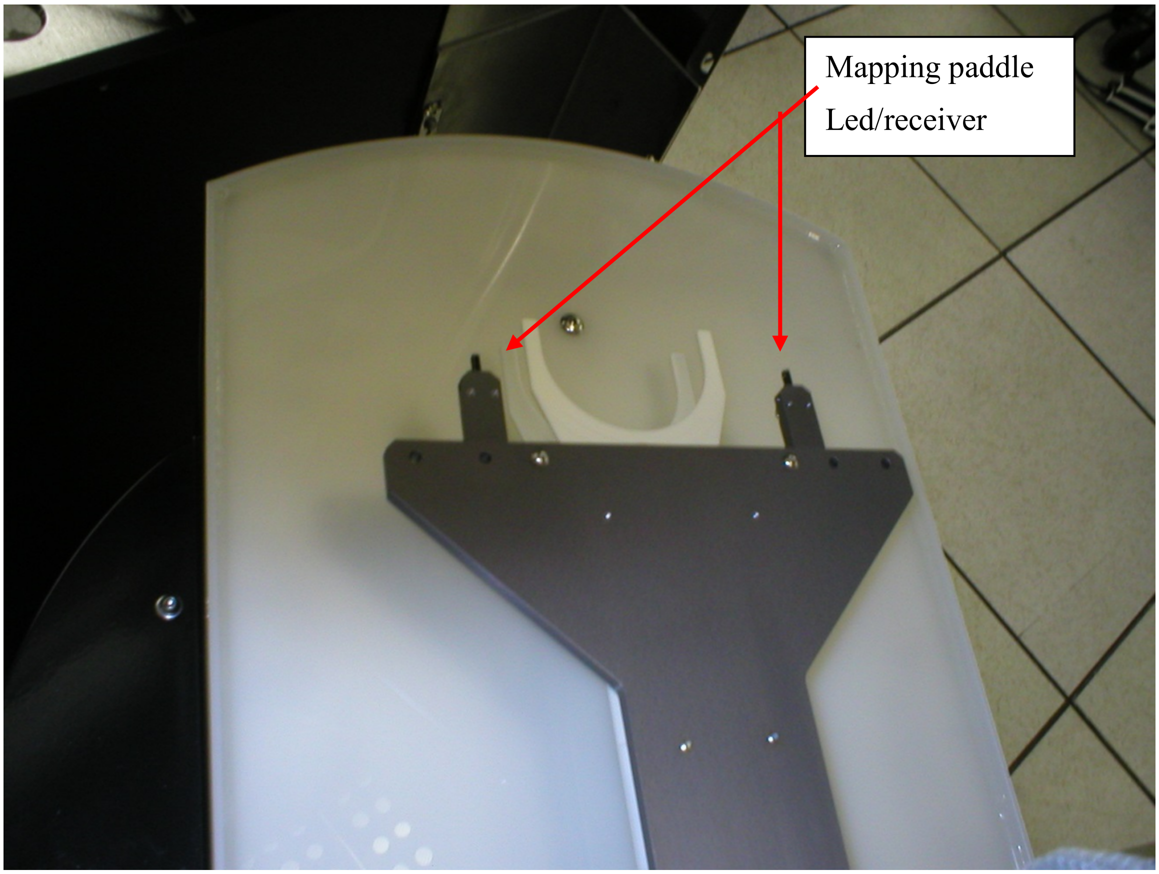
The Operator then has the option of canceling the operation or pressing the OK button which instructs the handler to pick the wafers identified while skipping any empty or cross slotted slots.

There are two (2) methods of wafer mapping used in the VPSP Systems.

1. LED/receiver mounted to the Paddle.
2. Laser emitter/receiver mounted to the end of the Robotic Handler

LED/receiver

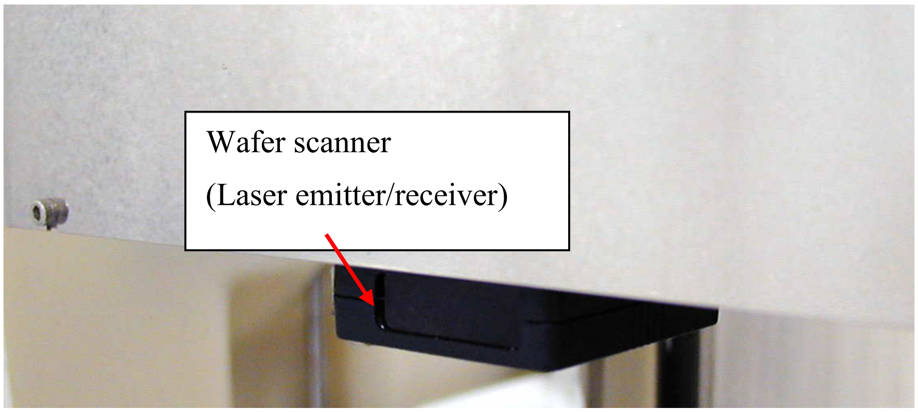
The Optical system consists of an LED/receiver assembly which is mounted to the end of the Robotic Handler. The Handlers "Y", "Z" and "Theta" axes then provide a mechanical means to "scan" the wafer cassette.



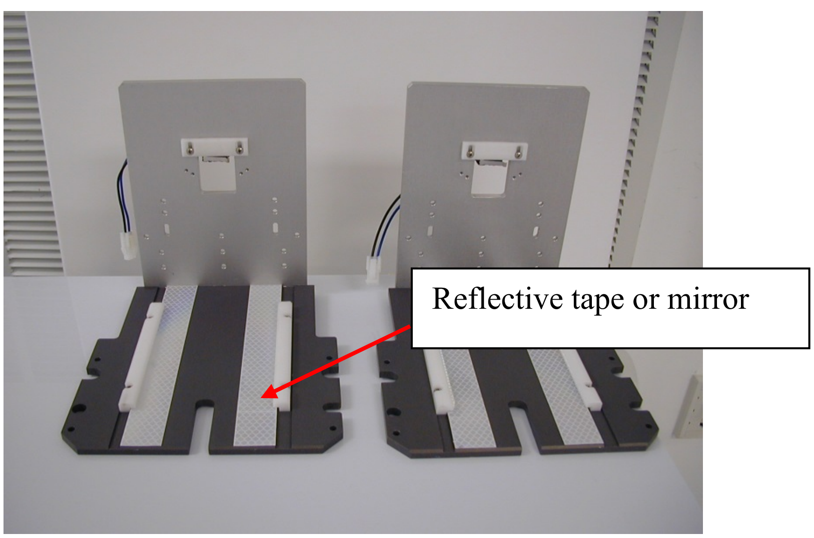
The LED emitter transmits to the receiver. This beam is broken when a wafer passes between the Emitter and the receiver. These on/off pulses are combined with the "Z" axis encoder feedback to form a wafer "map".

Laser emitter/receiver

The Optical system consists of a Laser emitter/receiver assembly which is mounted to the end of the Robotic Handler. The Handlers "Z" and "Theta" axes then provide a mechanical means to "scan" the wafer cassette.



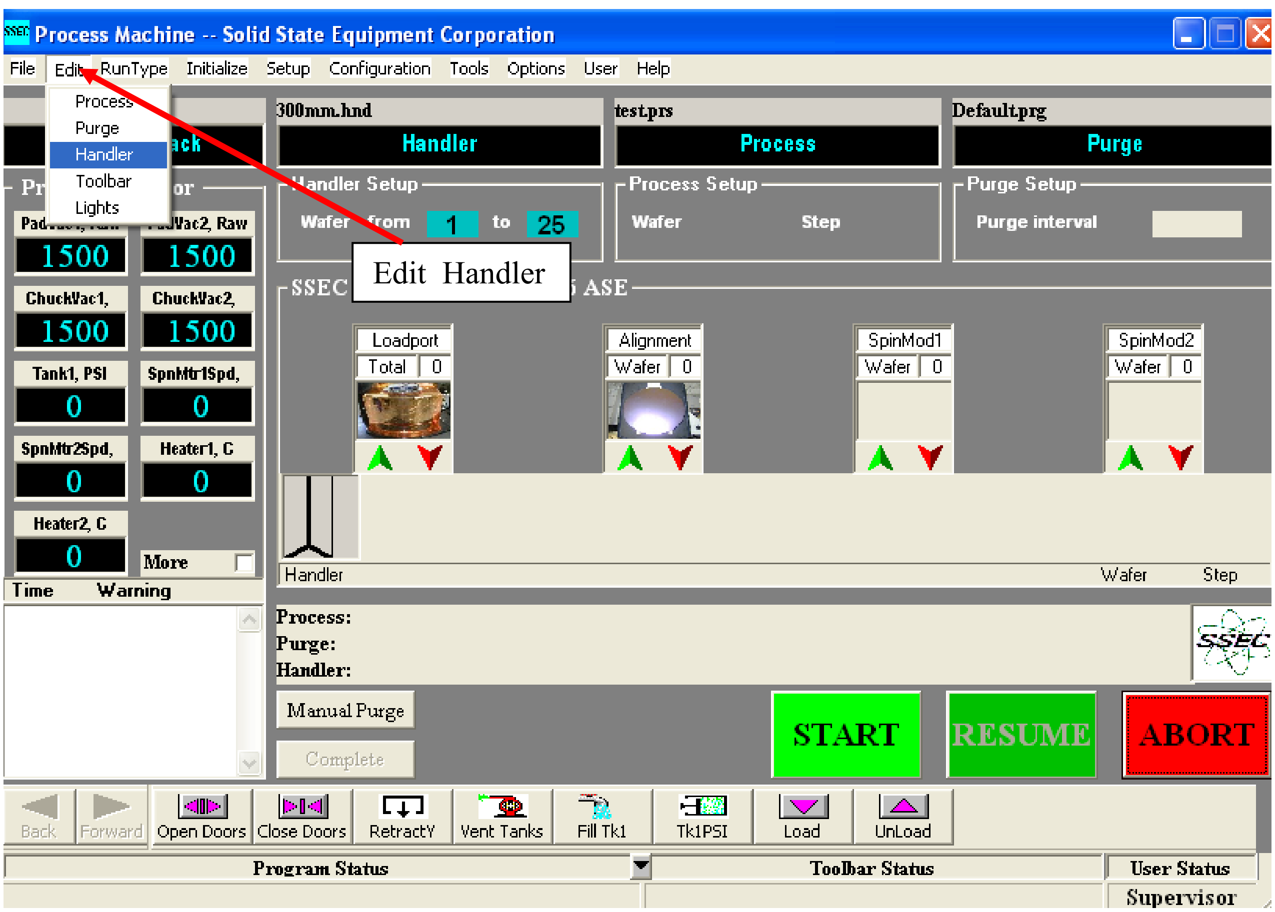
The cassette holder/adapter mechanism has a special reflective tape or mirror applied to its vertical face. The Laser emitter reflects from the tape/mirror and then back to the Laser receiver. The reflected beam is broken when a wafer passes between the Emitter and the tape. These on/off pulses are combined with the "Z" axis encoder feedback to form a wafer "map".



The Handler edit/teach program utilizes VPSP proprietary Software and control. The teach process involves picking specific tasks (“available functions”) from a Pull-down Menu, and then manually referencing each of the starting and finishing locations of each Handler motion required for that “function”.

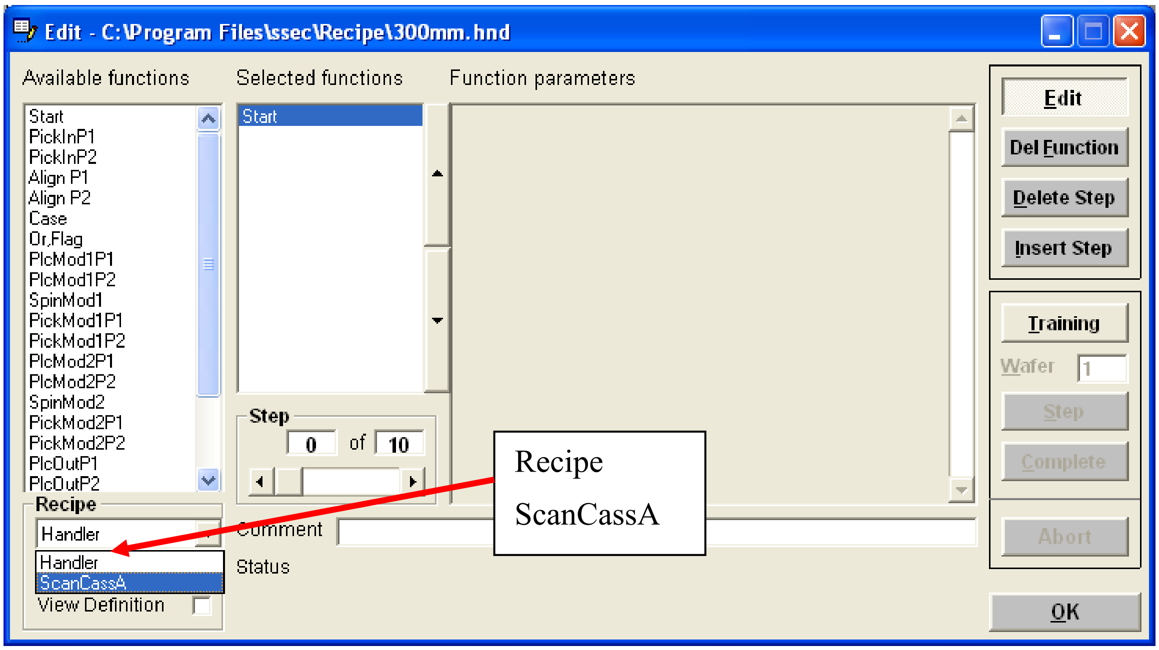
Programming the wafer mapping system is very similar to programming the Robotic Handler. The actual programming instructs the Robotic Handler where to position the Scanner. So all of the same programming steps apply except you are not actually handling a wafer, but moving a scanner. The Wafer Mapping Edit screen is almost identical to the Handler Edit screen. Therefore all of the same editing steps apply.

To access the edit/teach menu, select “Edit” from the SSEC Process screen. Then select “Handler” from the Pull-down Menu. The handler recipe is a step by step list of the available functions used to move the scanner map the cassette.



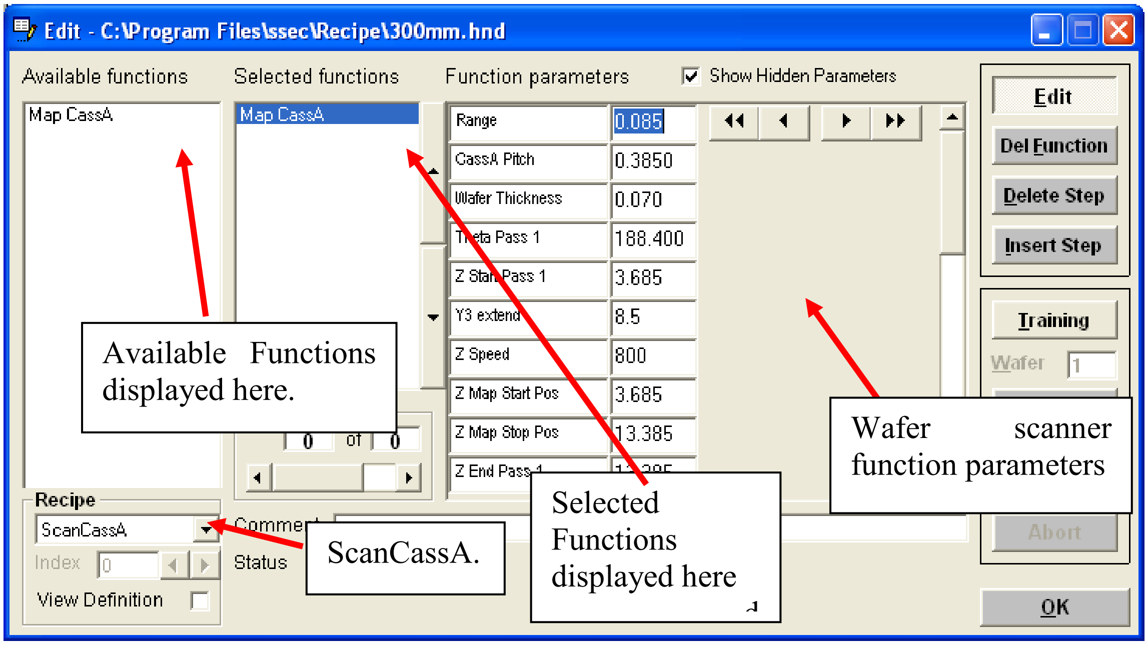
The Edit Menu:

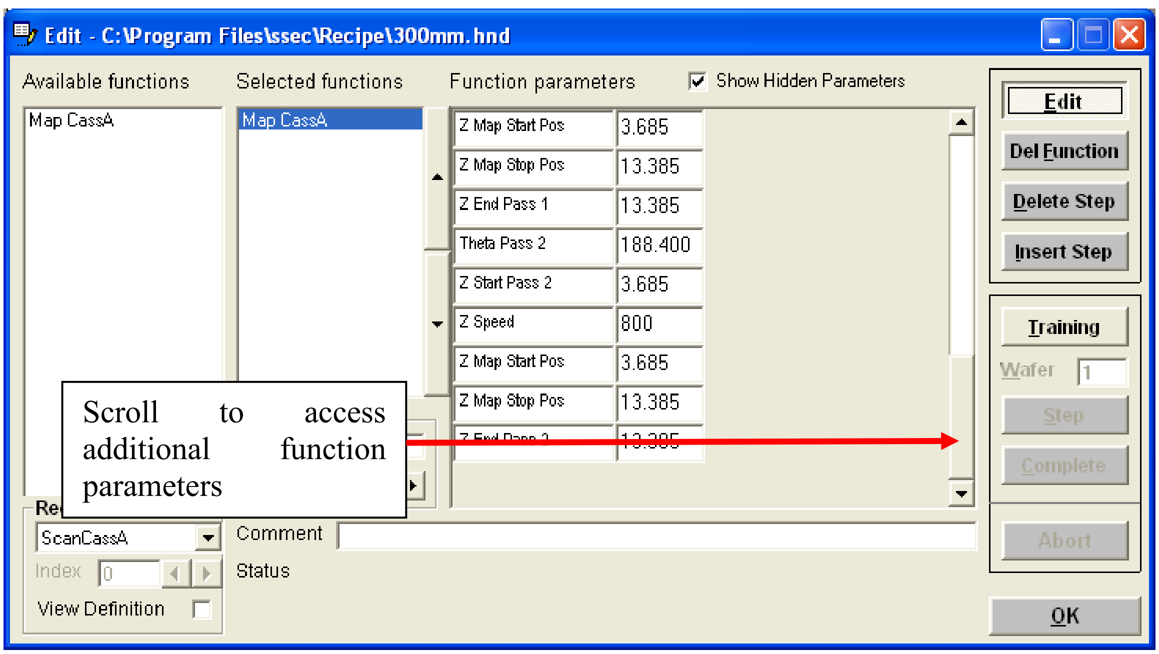
To access the edit/teach wafer mapping menu, click on the "Recipe" tab, then select "ScanCassA" from the Pull-down Menu. The step by step list of parameters will be displayed.



The step by step list of parameters will be displayed.

The **"Function parameters"** are the individual movements that the handler will execute during the step.





The scanner will make two (2) passes of the cassette and compare data to "map" the cassette.

The function parameters for scanning are:

Range

The range is the allowable tolerance for the actual wafer position and the calculated position. The range is set to approximately two (2) times the thickness of the wafer.

CassA Pitch

The pitch of the cassette can be determined by measuring or consulting the manufactures spec.

Cass Tilt

The cassette tilt is the position of the cassette from the home position. Systems that have a "FOUP" will not have this parameter since the position is fixed.

Wafer Thickness

This value is used to determine if a slot has a "double slotted" wafer. The wafer thickness is set to the thickness of the wafer

Theta Pass 1

This is the start position of the "Theta" motor (degrees)

Z Start Pass 1

This is the "Z" height of the handler to start the scan.

Y3 Extend

This is the position of the "Y3" Paddle for the scan. This is used only with the "LED/RECEIVER" scanner.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

This is the "Z" position that the Software will start to collect wafer data.

Z Map Stop Pos

This is the "Z" position that the Software will stop collecting wafer data.

Z End Pass 1

This is the "Z" height of the handler to stop the scan.

Theta Pass 2

This is the start position of the "Theta" motor (degrees) to begin the second pass of the cassette.

Z Start Pass 2

This is the start position of the "Z" motor (degrees) to begin the second pass of the cassette.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

This is the "Z" position that the Software will start to collect wafer data for the second scan.

Z Map Stop Pos

This is the "Z" position that the Software will stop collecting wafer data for the second scan.

Z End Pass 2

This is the "Z" height of the handler to stop the second scan.

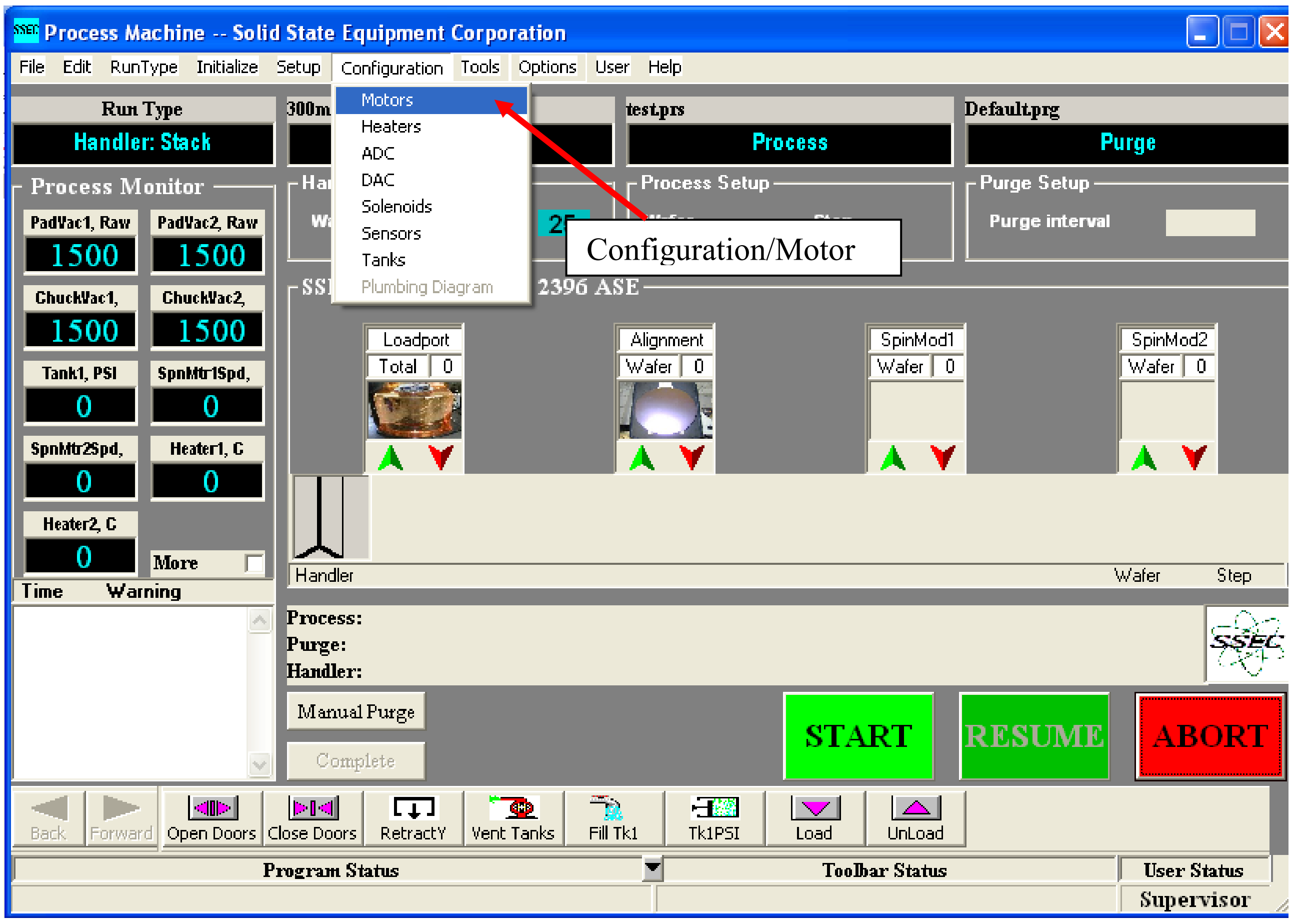
NOTE

It is assumed that the person performing this function is properly trained to avoid activation of this feature while certain error conditions are in place, which could cause the Handler to damage a Wafer or itself.

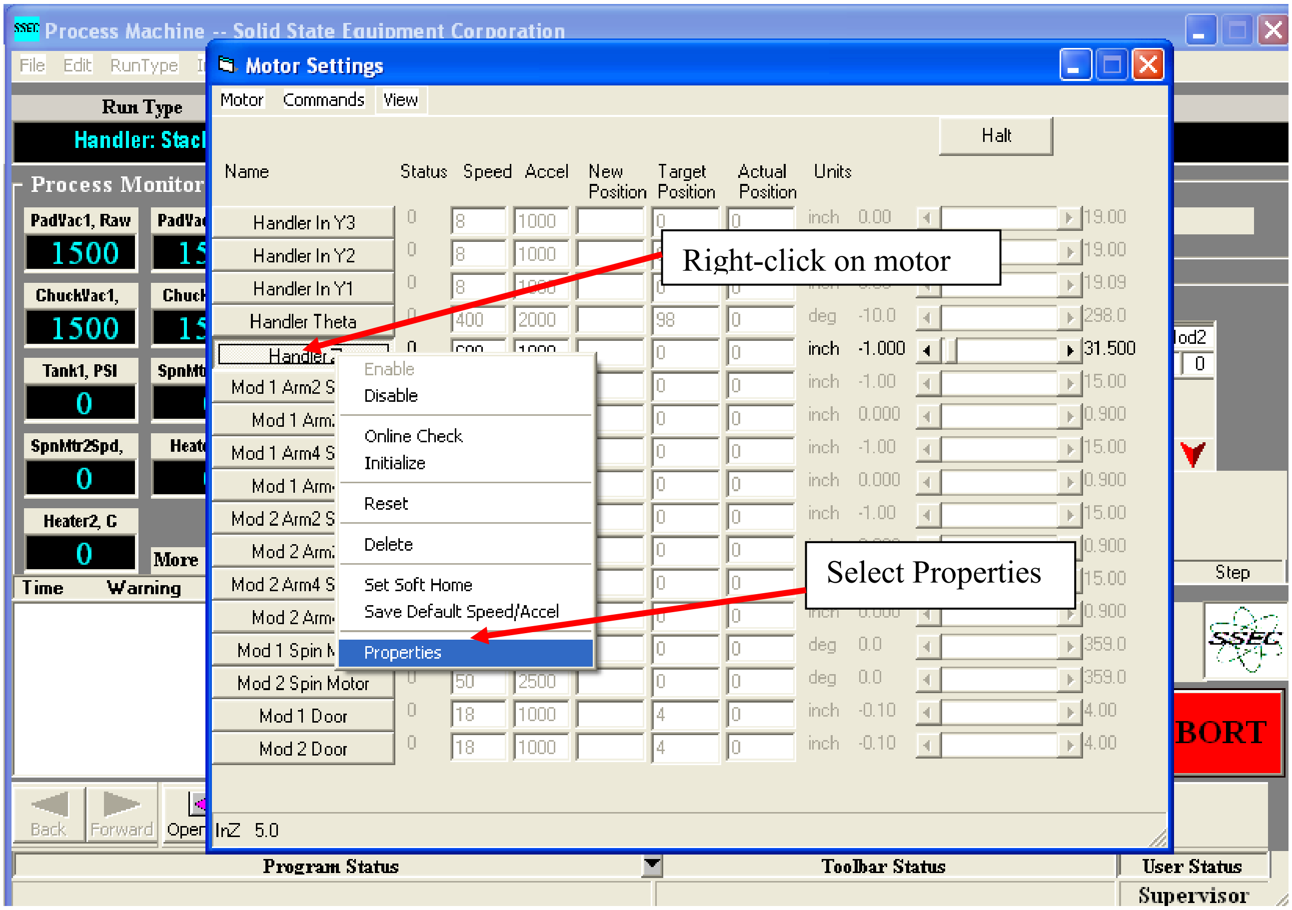
Training the Wafer Scanner

Before determining the handler parameters, the “Z” motor “Scale” factor and “Click” values need to be verified in the motor parameters.

To access the Motor menu, select “Configuration” from the SSEC Process screen. Then select “Motors” from the Pull-down Menu.

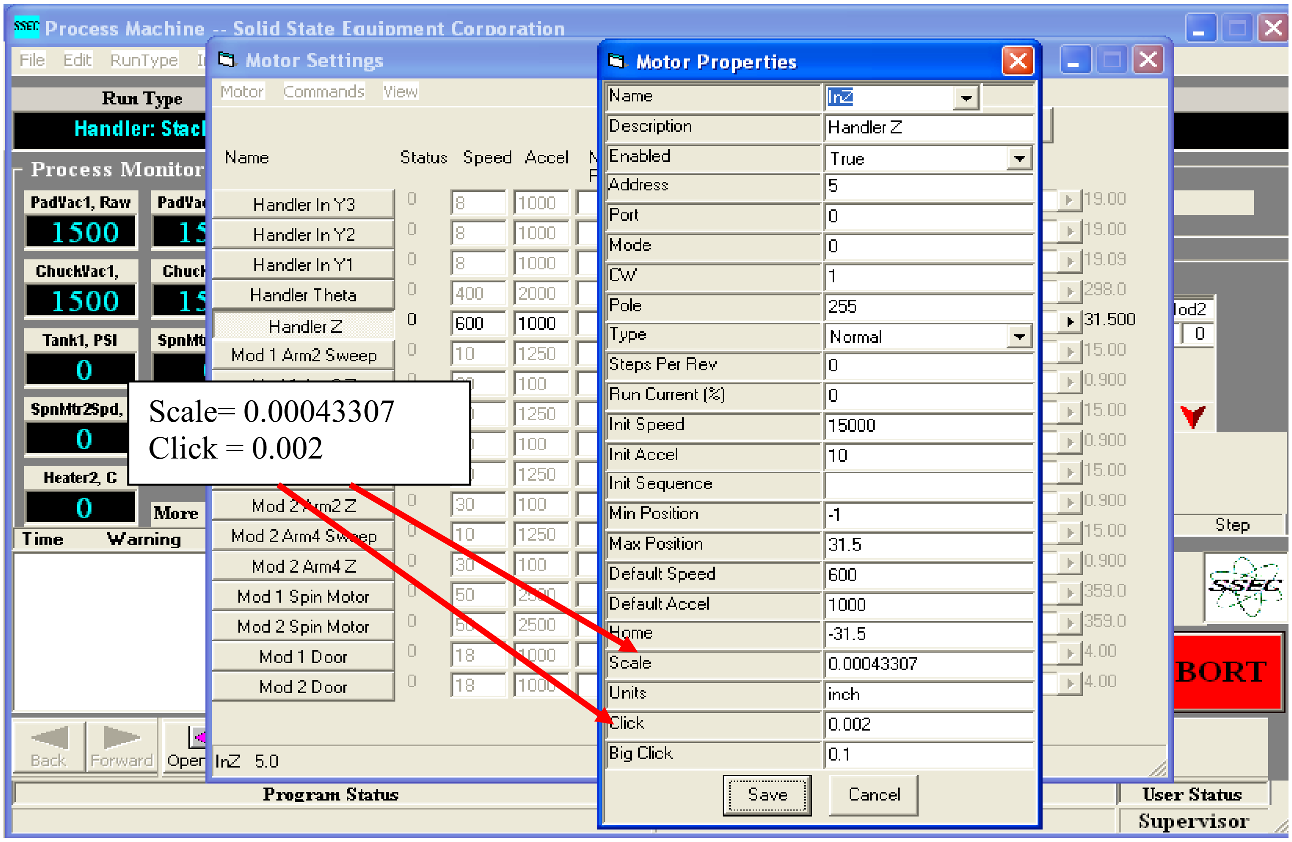


Right-click on the "Handler Z" motor in the motor screen and select Properties.



The “Scale” factor should be 0.00043307 and the “Click” value should be 0.002.

If these values are not correct, enter the correct values.



The procedure for setting up both types wafer mapping is discussed below. Refer to the proper section for your Tool.

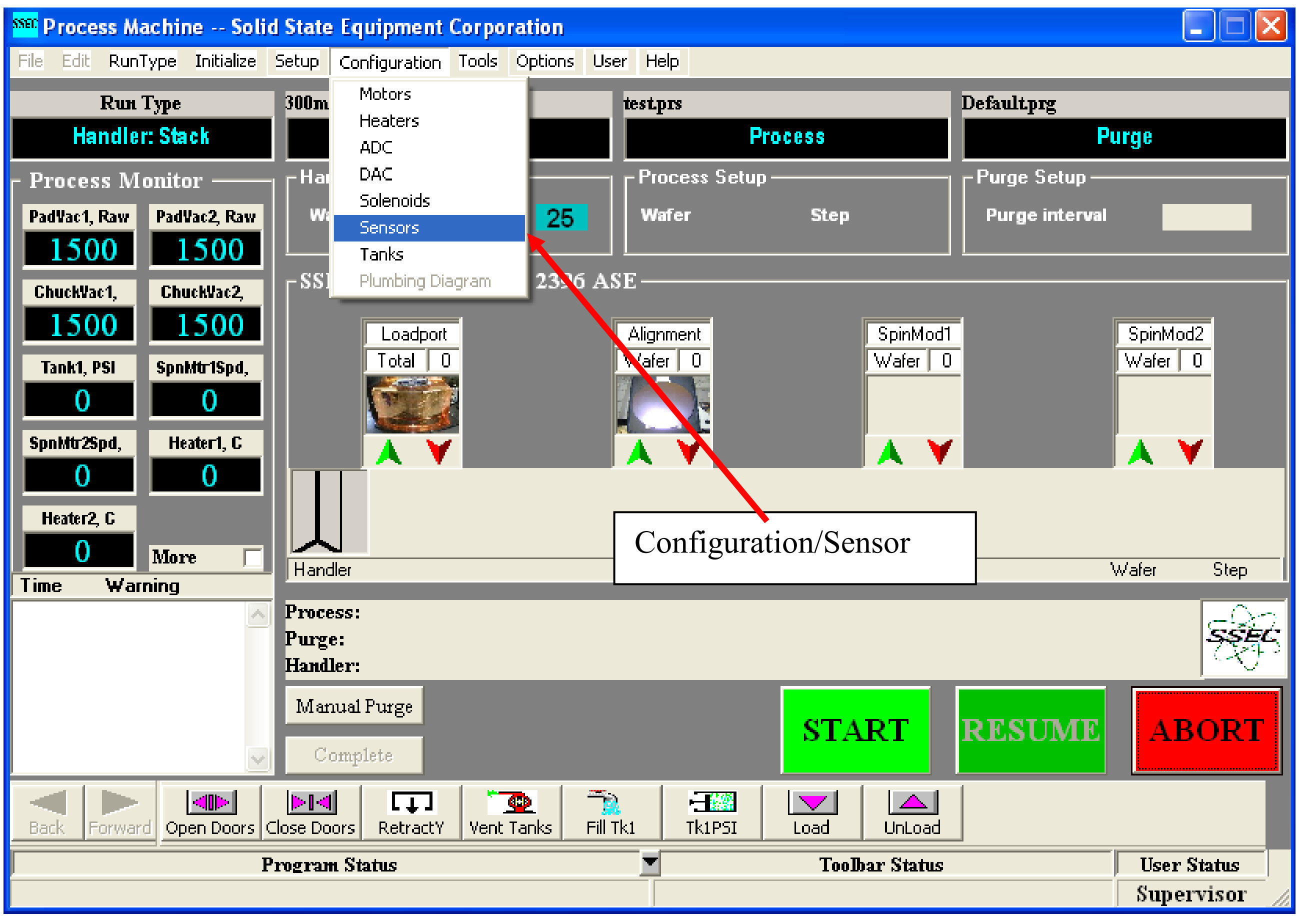
LED/RECEIVER PADDLE

The Optical system consists of an LED/receiver assembly which is mounted to the end of the Robotic Handler. The Handler "Y", "Z", and "Theta" axes then provide a mechanical means to "scan" the wafer cassette.

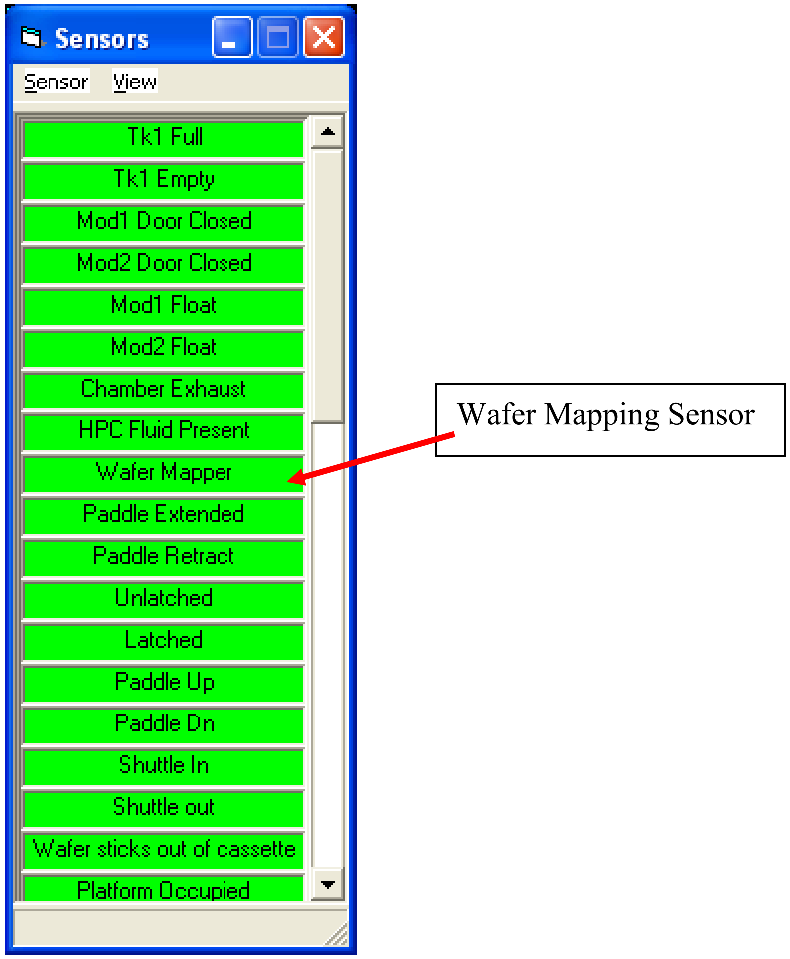
Teaching the scanner parameters

The position of the cassette and the handler ("Y", "Z", and "Theta") need to be set up. First open up the Sensors screen.

From the process screen, select "Configuration", then "Sensors". This will display the Sensors screen.



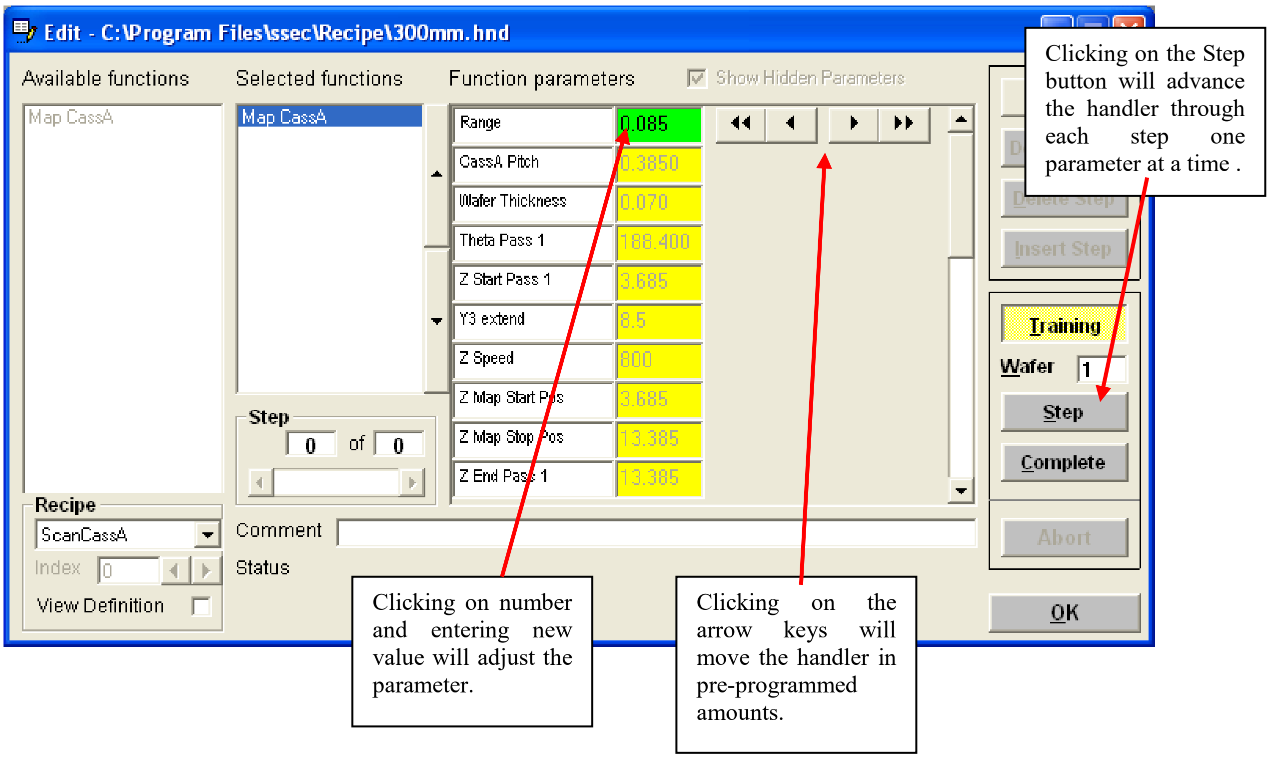
The Sensor Screens will now be displayed.



The handler must be now positioned so the beam will be blocked by a wafer in the cassette.

CAUTION: Serious damage could occur if excessive motor movement for the handler is entered.

The handler can be moved by clicking on the step button. The handler will advance to that step or enter parameters into memory (such as cassette slot pitch).



NOTE

All moves will be executed immediately upon clicking on the step.

The Function parameter list will change color from “Yellow” to “Green” which indicates that the entry or movement is complete. Previous steps will turn “Red”. The position or entry can now be “Edited”. Simply click on the value (number) in the highlighted box (Green or Red) and change the value using standard Windows editing procedures or click on the arrow keys will move the handler in programmed amounts. Again, the operator or technician must be properly trained, as the new value entered will be exercised as soon as the “enter” key is pressed (after editing of the value is complete).

The parameters for scanning the wafer can be adjusted simply by clicking on a previously executed step and entering the desired value.

Range

The first step is to set the range.

The range is the allowable tolerance for the actual wafer position and the calculated position. The range is set to approximately two (2) times the thickness of the wafer.

Pitch

Enter the pitch of the cassette.

The pitch of the cassette can be determined by measuring or consulting the manufactures spec.

Cass Tilt

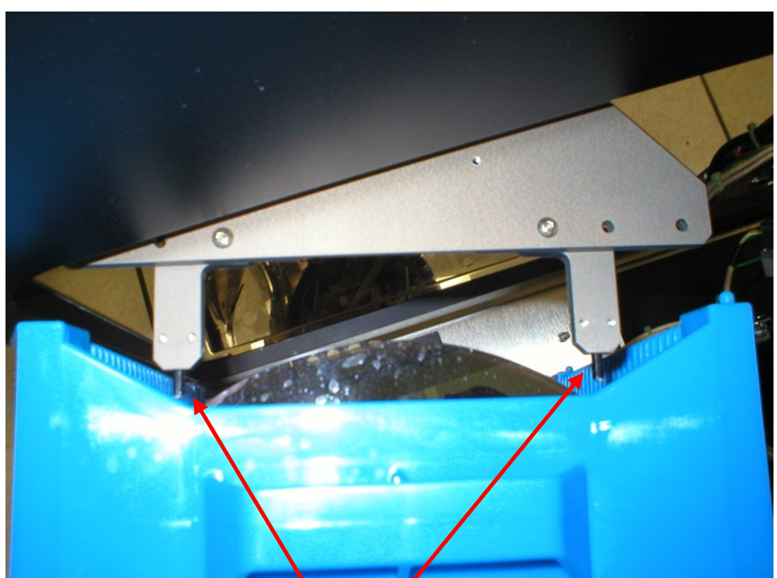
The cassette tilt is the position of the cassette from the home position. Clicking on the "Load" Toolbar Button from the main process screen will move the cassette to the approximate position. *Systems that have a "FOUP" will not have this parameter since the position is fixed.*

Wafer Thickness

This value is used to determine if a slot has a "double slotted" wafer. The wafer thickness is set to the thickness of the wafer

Theta Pass 1

This is the start position of the "Theta" motor (degrees). The theta position should be set so that the Paddle is centered around the wafer when it is scanned.



Theta centered.
Beam blocked by wafer

Z Start Pass 1

This is the "Z" height of the handler to start the scan. The position will be just below the first wafer in the cassette.

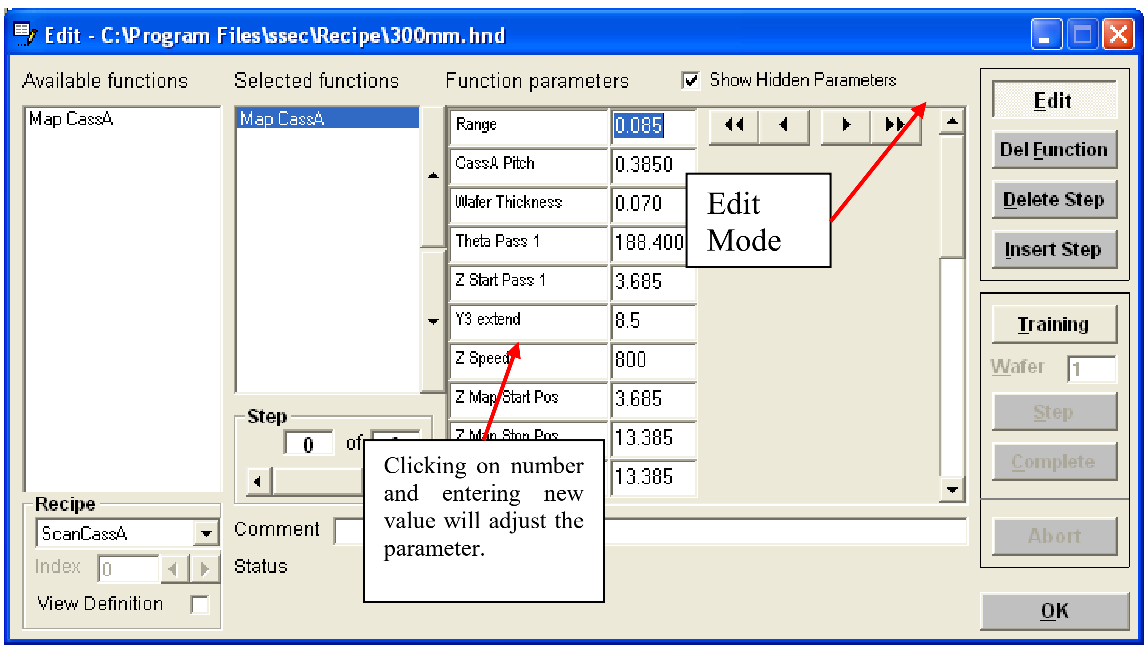
Y3 Extend

This is the position of the "Y3" Paddle for the scan.

CAUTION: When moving to this step the Paddle will move to the programmed value. If the "Start Z" or "Start Theta" values are incorrect, damage to the wafer or Paddle could occur.

The Extend Y1value should be set to a small number (1 or 2 inches) prior to execution of this step to prevent accidental damage.

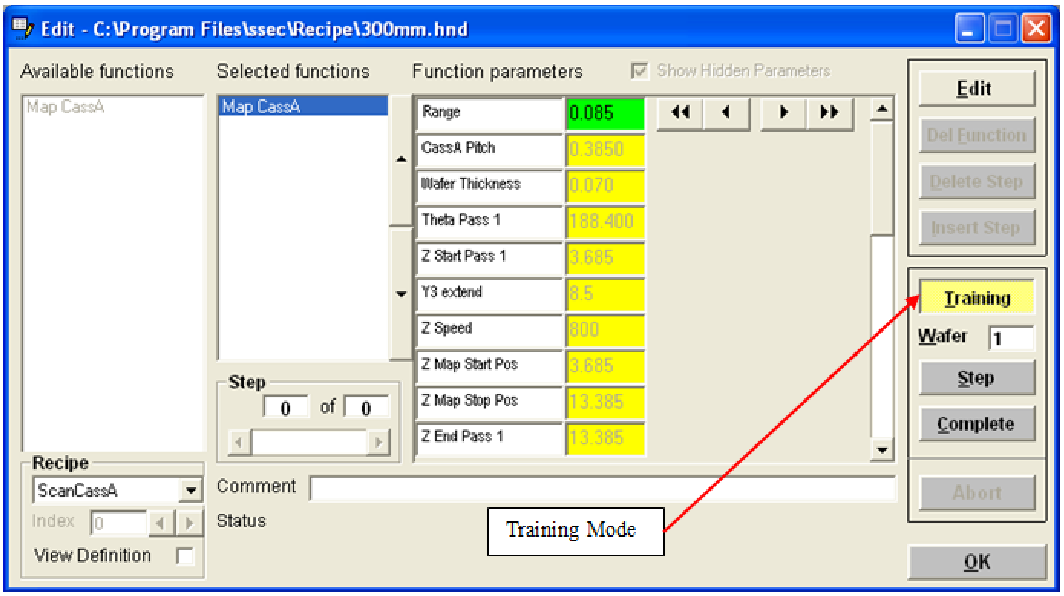
Click on the Edit button and then click on the "Y3 Extend" value and change to a small number. This will move the Paddle a short distance when the move is executed in the training mode.



The **Training** mode can now be selected.

NOTE

If you are editing an existing Handler Program, the values should be close to the proper position and only minor adjustments will be needed.



Click on the "Y3 Extend" parameter. This will execute all the steps up to and including "Y3 Extend"

The Paddle can now be moved out towards the cassette by entering increasing numerical values. The Theta Pass 1 and Z Start Pass 1 parameters can be adjusted simply by clicking on a previously executed step and entering the desired value.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

This is the "Z" position that the Software will start to collect wafer data.

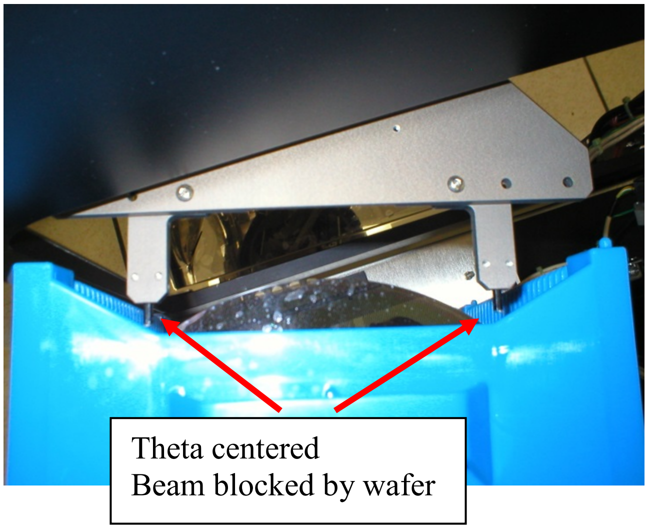
The handler must be now positioned so the beam will be blocked by the first wafer in the cassette.

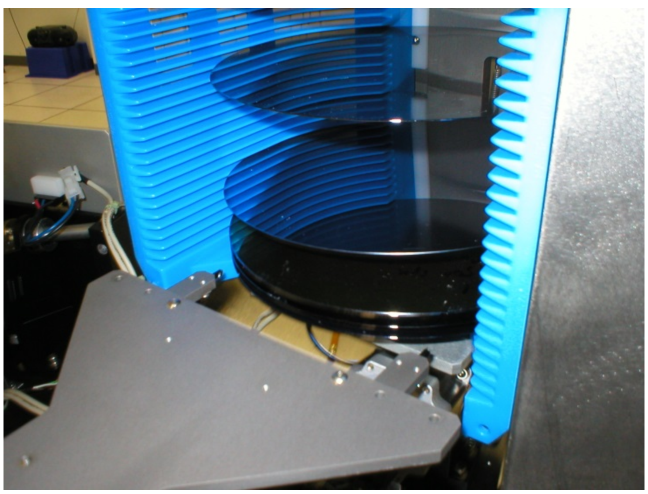
Observing the Wafer Mapping Sensor on the Sensors screen, move the "Z Map Start Pos" parameter so that the beam is blocked by the first wafer (sensor turns red).

Move the "Z" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Z" in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Z" position to be entered into the scan recipe.





Once the beam is interrupted by the wafer, move the "Theta" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Theta" motor in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Theta" position to be entered into the scan recipe.

Systems that are using a FOUP should ignore this next step.

The cassette tilt must also be set up.

Move the "Cassette" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Cassette" in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Cassette Tilt" position to be entered into the scan recipe.

Z Map Stop Pos

This is the "Z" position that the Software will stop collecting wafer data.

The handler must be now positioned so the beam will be blocked by the last wafer in the cassette.

Follow the steps performed in the setup of the "Z Map Start Pos".

Z End Pass 1

This is the "Z" height of the handler to stop the scan (approx. ½ pitch value).

The second pass parameters should be setup using the procedure for the first pass.

Theta Pass 2

This is the start position of the "Theta" motor (degrees) to begin the second pass of the cassette.

Z Start Pass 2

This is the start position of the "Z" motor (degrees) to begin the second pass of the cassette.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

This is the "Z" position that the Software will start to collect wafer data for the second scan.

Z Map Stop Pos

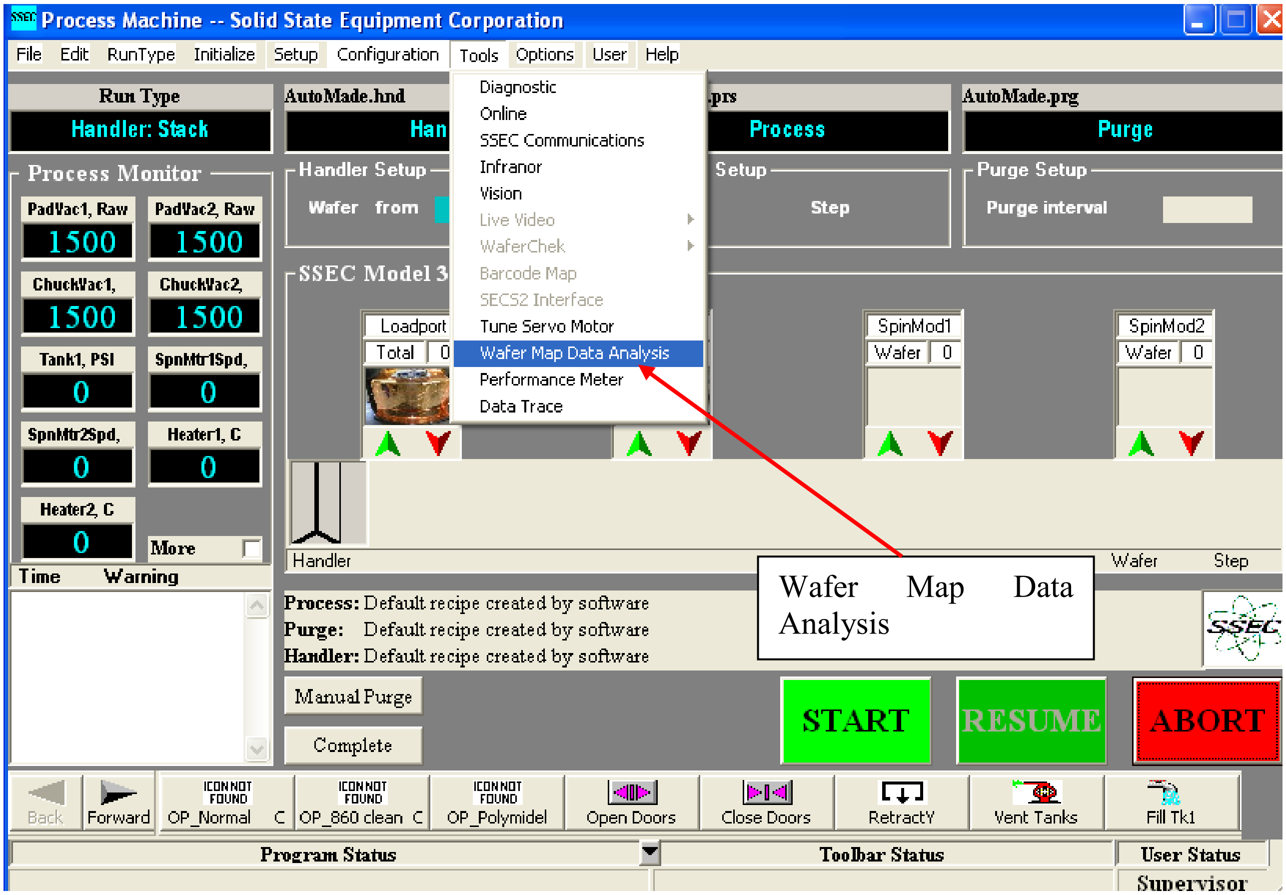
This is the "Z" position that the Software will stop collecting wafer data for the second scan.

Z End Pass 2

This is the "Z" height of the handler to stop the second scan.

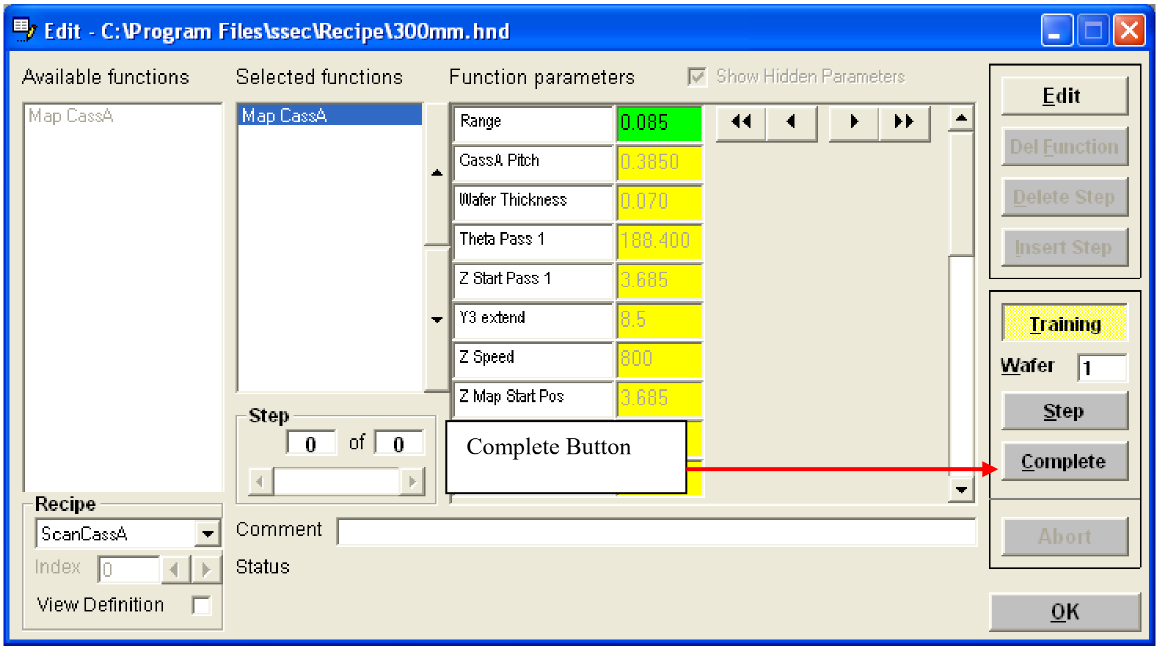
Verifying Taught Positions

Open the "Wafer Data Analysis" screen by selecting "Tools" from the SSEC Process screen then selecting "Wafer Data Analysis" from the Pull-down Menu.



To test the scanner parameters, click on "Training" in the "Edit Handler" menu. Clicking on the "Complete" button will execute a scan of the cassette.

The results of the scan can now be viewed in the "Wafer Data Analysis" screen.



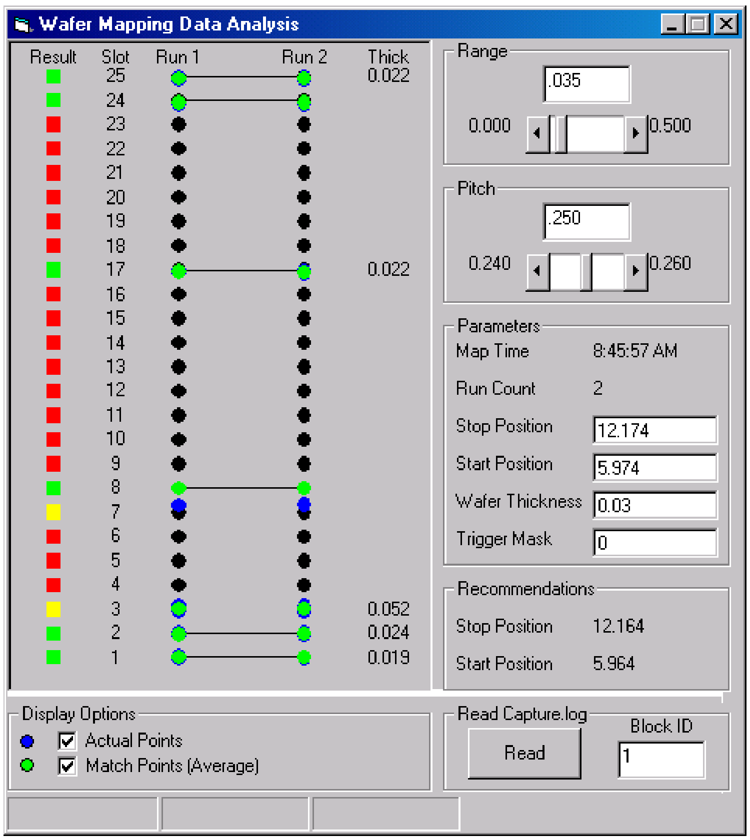
Wafer Mapping Data Analysis

The Wafer Mapping Data Analysis form can be used to examine the data obtained during Wafer Mapping.

It displays the following information:

Black Dots – Expected wafer positions
Green Dots – Actual wafer data that matches an expected position

Red Dots – Actual wafer data that does not match an expected position



LASER EMITTER/RECEIVER

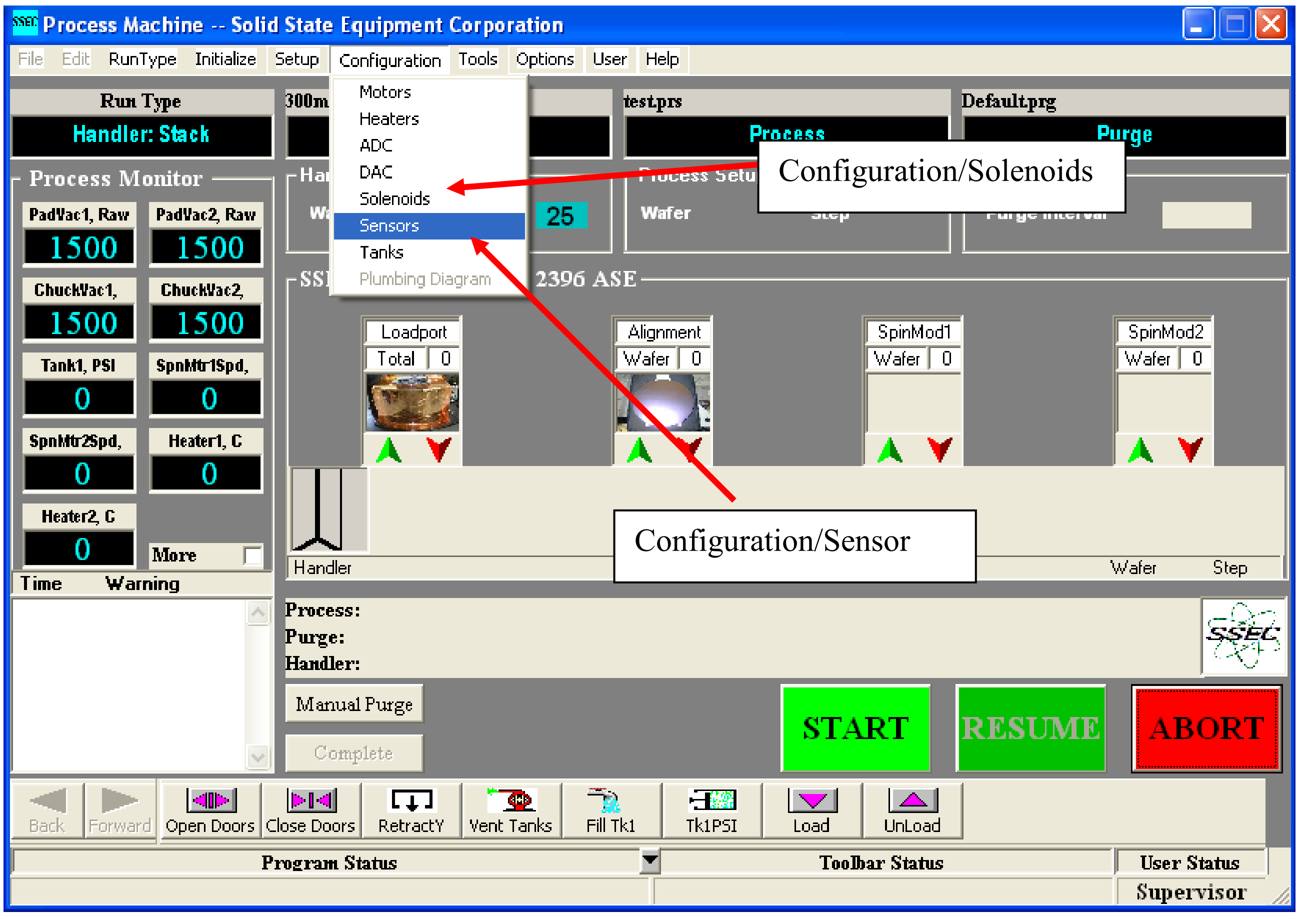
The Optical system consists of a Laser emitter/receiver assembly which is mounted to the end of the Robotic Handler. The Handlers "Z" and "Theta" axes then provide a mechanical means to "scan" the wafer cassette.

The cassette holder/adapter mechanism has a special reflective tape or a mirror applied to its vertical face. The Laser emitter reflects from the tape/mirror and then back to the Laser receiver. The reflected beam is broken when a wafer passes between the Emitter and the tape. These on/off pulses are combined with the "Z" axis encoder feedback to form a wafer "map".

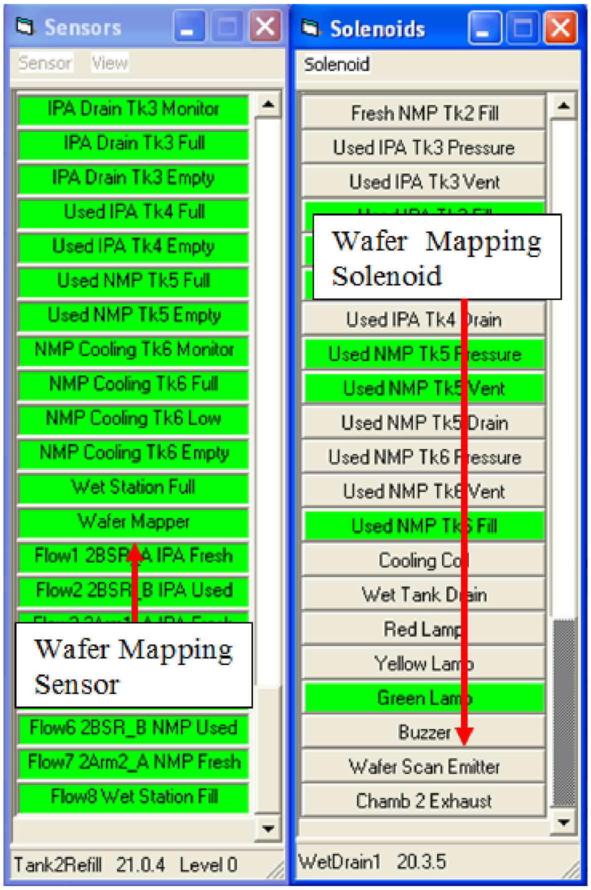
Teaching the scanner parameters

The position of the cassette and the handler ("Z" and "Theta") need to be set up. First open up the Sensors and Solenoids screens.

From the process screen, select "Configuration", then "Sensors". This will display the Sensors screen. From the process screen, select "Configuration", then "Solenoids". This will display the Solenoids screen.



The Sensor and Solenoid Screens will now be displayed.



"Clicking" the Wafer Mapping Solenoid will turn on the laser.

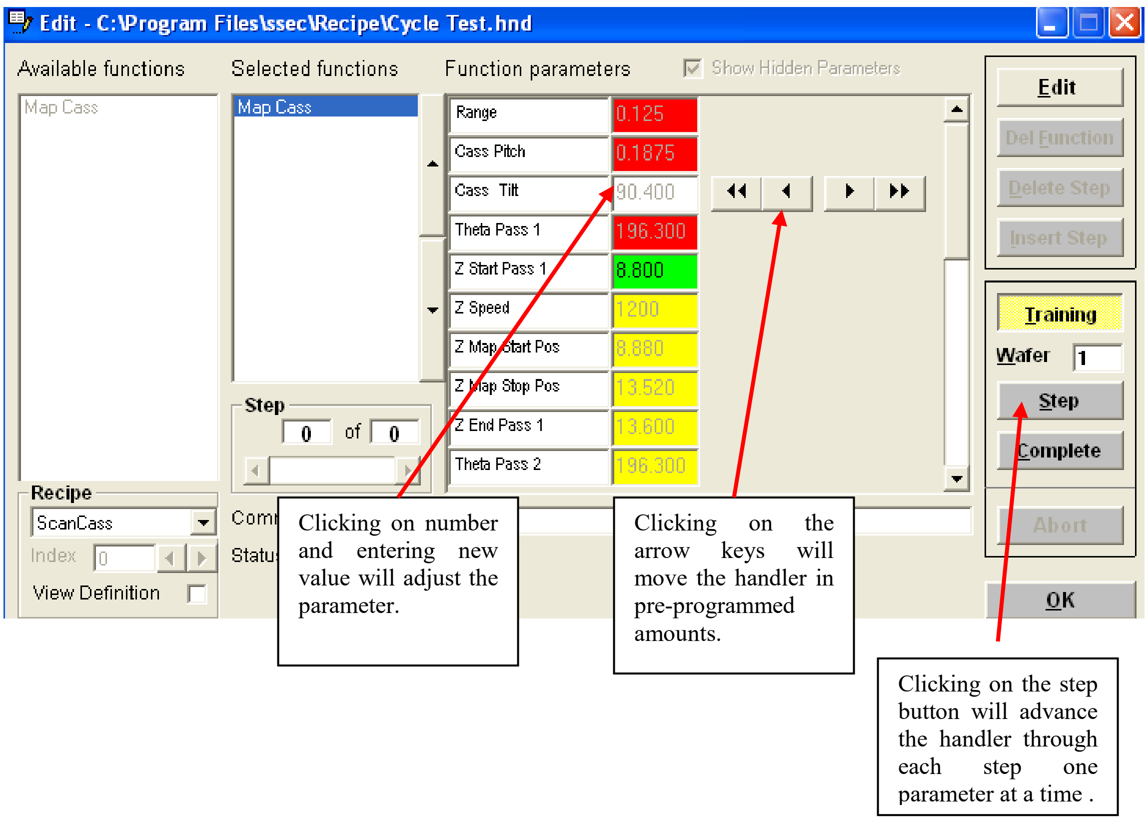
The handler must be now positioned so the beam will be blocked by a wafer in the cassette.

CAUTION

HANDLER

Serious damage could occur if excessive Motor movement for the Handler is entered.

The Handler can be moved by clicking on the step button. The handler will advance to that step or enter parameters into memory (such as cassette slot pitch).



NOTE

All moves will be executed immediately upon clicking on the step.

The Function parameter list will change color from "Yellow" to "Green" which indicates that the entry or movement is complete. Previous steps will turn "Red". The position or entry can now be "Edited". Simply click on the value (number) in the highlighted box (Green or Red) and change the value using standard Windows editing procedures or click on the arrow keys will move the handler in programmed amounts. Again, the operator or technician must be properly trained, as the new value entered will be exercised as soon as the "enter" key is pressed (after editing of the value is complete).

The parameters for scanning the wafer can be adjusted simply by clicking on a previously executed step and entering the desired value.

Range

The first step is to set the range.

The range is the allowable tolerance for the actual wafer position and the calculated position. The range is set to approximately two (2) times the thickness of the wafer.

Pitch

Enter the pitch of the cassette.

The pitch of the cassette can be determined by measuring or consulting the manufactures spec.

Cass Tilt

The cassette tilt is the position of the cassette from the home position. Clicking on the "Load" Toolbar Button from the main process screen will move the cassette to the approximate position. *Systems that have a "FOUP" will not have this parameter since the position is fixed.*

Wafer Thickness

This value is used to determine if a slot has a "double slotted" wafer. The wafer thickness is set to the thickness of the wafer

Theta Pass 1

This is the start position of the "Theta" motor (degrees). The theta position should be set so that the beam is reflected off of the tape/mirror when it is scanned.

Z Start Pass 1

This is the "Z" height of the handler to start the scan. The position will be just below the first wafer in the cassette.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

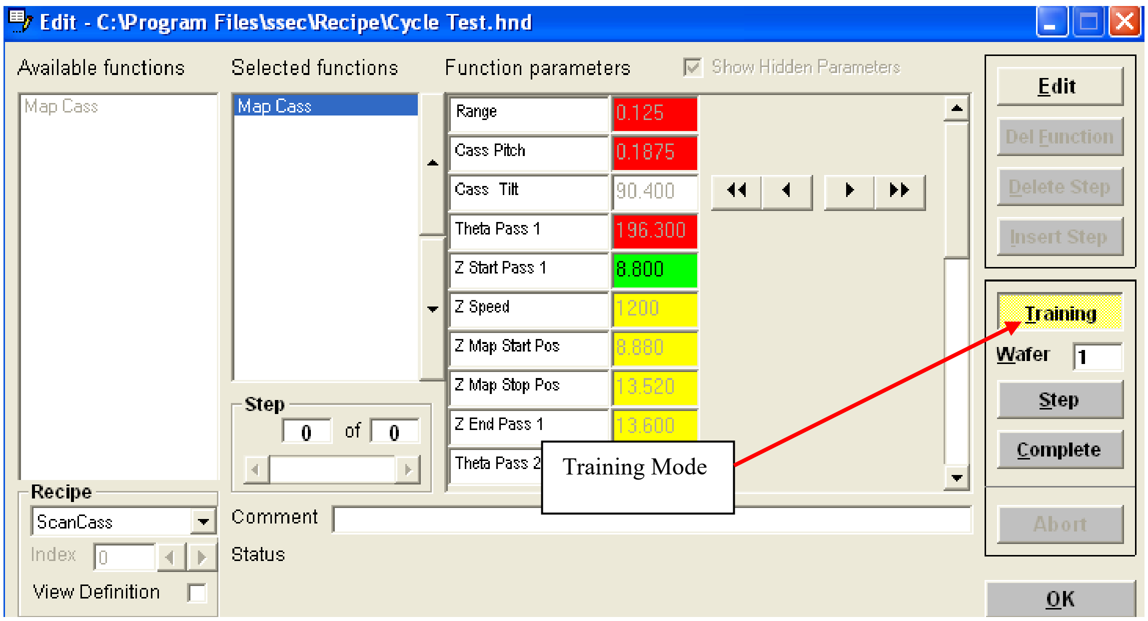
This is the "Z" position that the Software will start to collect wafer data.

The handler must be now positioned so the beam will be blocked by the first wafer in the cassette.

The training mode can now be selected.

NOTE

If you are editing an existing Handler Program, the values should be close to the proper position and only minor adjustments will be needed.



Click on the "Z Start Pos" parameter. This will execute all the steps up to and including "Z Start Pos"

The Z axis can now be moved by entering increasing/decreasing numerical values. The Theta Pass 1 and Z Start Pos parameters can be adjusted simply by clicking on a previously executed step and entering the desired value.

Observing the Wafer Mapping Sensor on the Sensors screen, move the "Z Map Start Pos" parameter so that the beam is blocked by the first wafer (sensor turns red).

Move the "Z" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Z" in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Z" position to be entered into the scan recipe.

Once the beam is interrupted by the wafer, move the "Theta" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Theta" motor in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Theta" position to be entered into the scan recipe.

Systems that are using a FOUP should ignore this next step.

The cassette tilt must also be set up.

Move the "Cassette" motor in the negative direction until the "Wafer Mapper" sensor goes out (red). Write down the actual position of the motor from the motor screen at this time.

Next, move the "Cassette" in the positive direction until the sensor goes out. Write down the actual position of the motor from the motor screen at this time.

The midway point of these two (2) numbers will be the "Cassette Tilt" position to be entered into the scan recipe.

Z Map Stop Pos

This is the "Z" position that the Software will stop collecting wafer data.

The handler must be now positioned so the beam will be blocked by the last wafer in the cassette.

Follow the steps performed in the setup of the "Z Map Start Pos".

Z End Pass 1

This is the "Z" height of the handler to stop the scan (approx. ½ pitch value).

The second pass parameters should be setup using the procedure for the first pass.

Theta Pass 2

This is the start position of the "Theta" motor (degrees) to begin the second pass of the cassette.

Z Start Pass 2

This is the start position of the "Z" motor (degrees) to begin the second pass of the cassette.

Z Speed

This is the speed the "Z" motor will travel during the scan. This number is "time between steps" for the stepper motor. The higher the number, the slower the speed.

Z Map Start Pos

This is the "Z" position that the Software will start to collect wafer data for the second scan.

Z Map Stop Pos

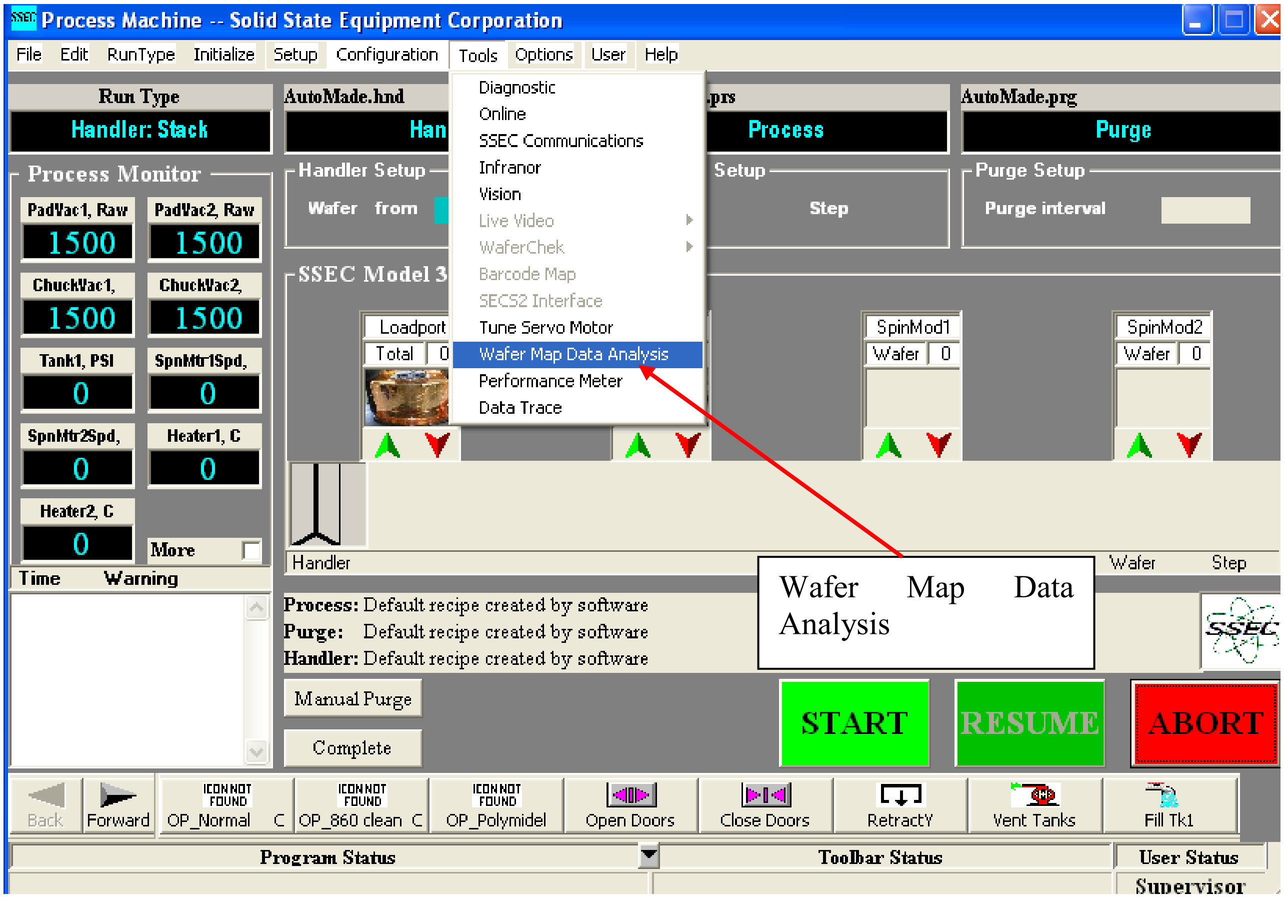
This is the "Z" position that the Software will stop collecting wafer data for the second scan.

Z End Pass 2

This is the "Z" height of the handler to stop the second scan.

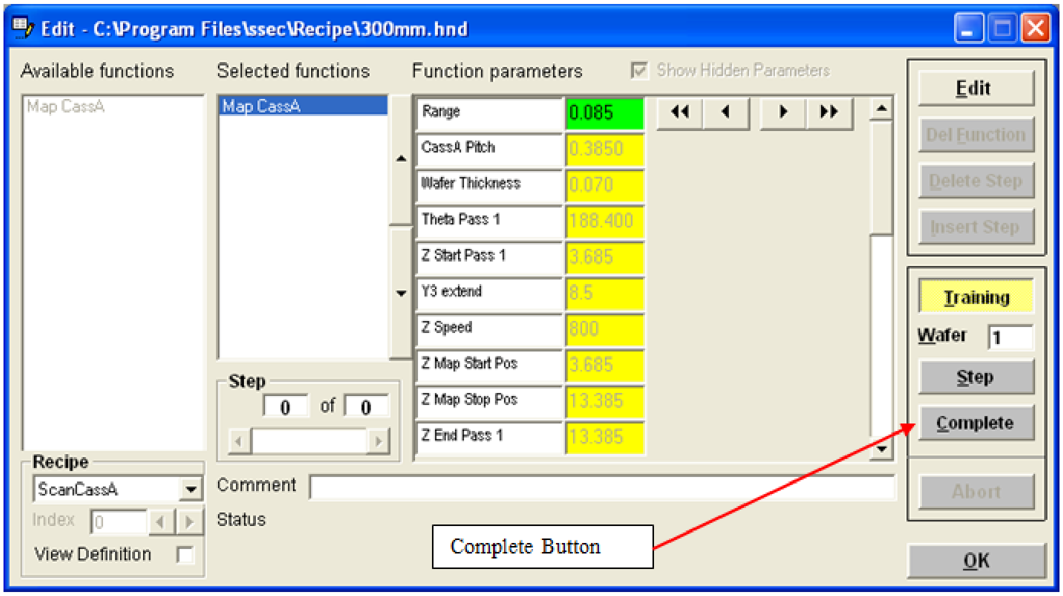
Verifying Taught Positions

Open the “Wafer Data Analysis” screen by selecting “Tools” from the SSEC Process screen then selecting “Wafer Data Analysis” from the Pull-down Menu.



To test the scanner parameters, click on "Training" in the "Edit Handler" menu. Clicking on the "Complete" button will execute a scan of the cassette.

The results of the scan can now be viewed in the "Wafer Data Analysis" screen.



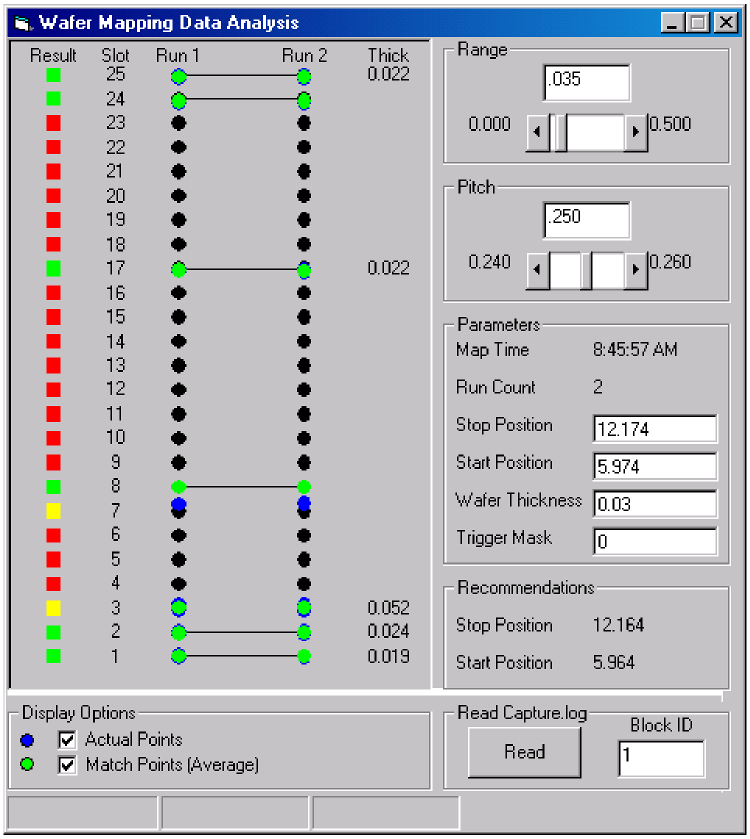
Wafer Mapping Data Analysis

The Wafer Mapping Data Analysis form can be used to examine the data obtained during Wafer Mapping.

It displays the following information:

Black Dots – Expected wafer positions
Green Dots – Actual wafer data that matches an expected position

Red Dots – Actual wafer data that does not match an expected position



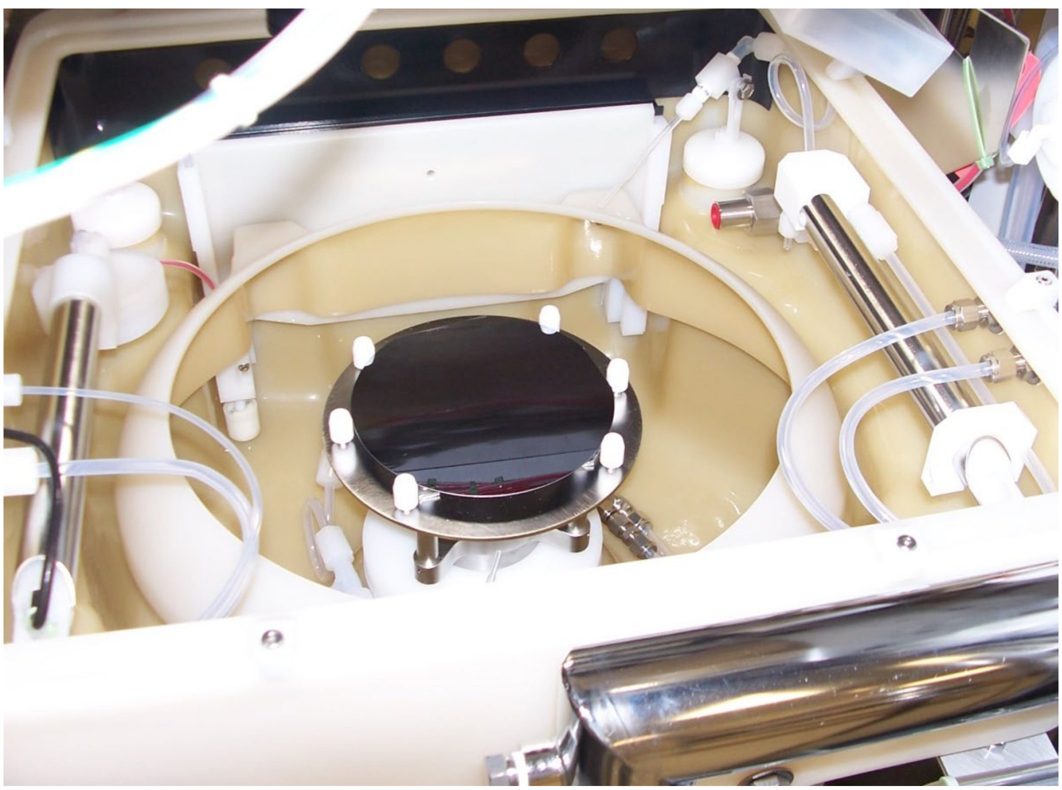
This Page Left Intentionally Blank.

9: Hardware

Dispense Arms

General Description

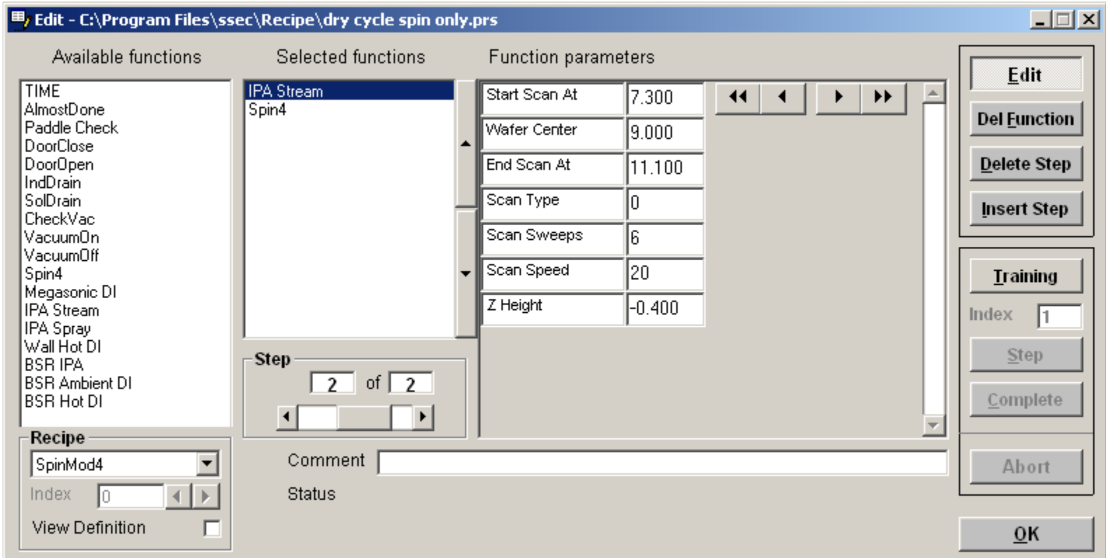
The following description applies to all Arm types. Some Arm types may have additional parameters and will be described later. Dispense Arms are used to dispense chemistries onto the substrates. Up to four Arm drives can be located in the corners of the Process Chambers. On large chambers an additional four Arms can be located in the corners from above. Each Arm drive typically has a vertical, Z axis, and one or two horizontal or sweep axes. The sweep axis's home position (zero) is against one of the adjacent walls. In the following photo a stream dispense Arm can be seen along the right side of the Chamber and a megasonic Arm is along the left side.



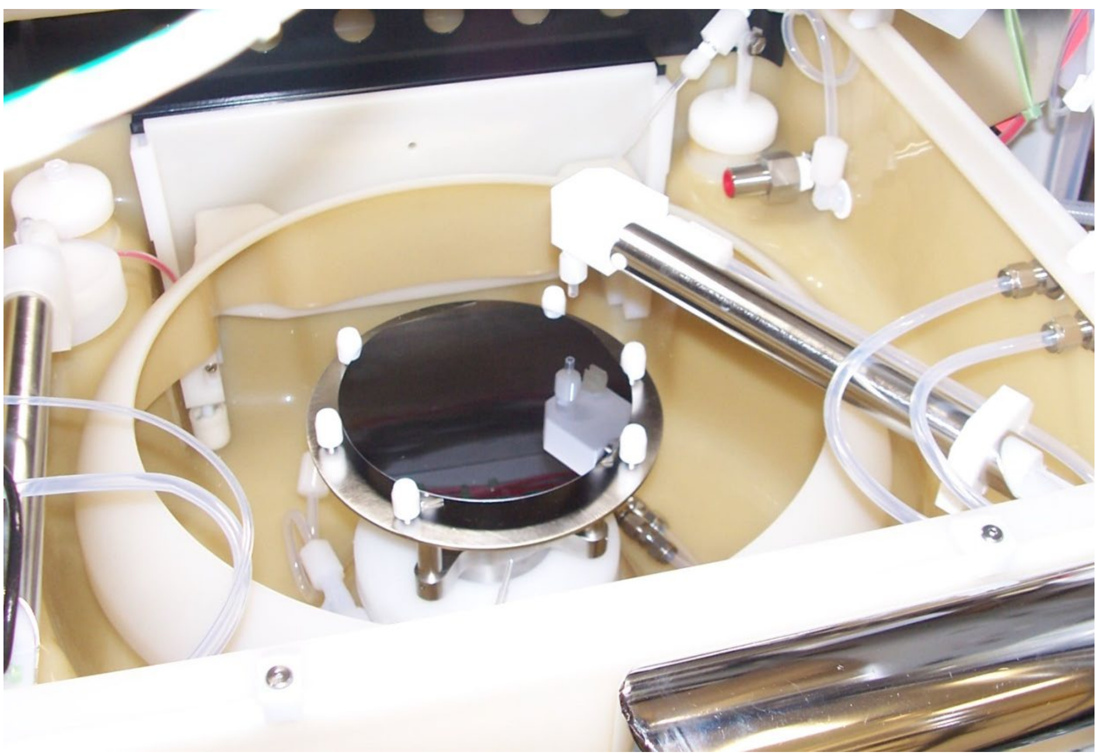
Motion is measured away from the wall in inches along the arc of its swing. The Z home position (zero) can be either at the top or the bottom of its travel depending on how the motor properties are configured. The travel of the Z motor may be restricted due to the Arm type, its size, or other obstructions in the Process Chamber. Arm motion is typically to sweep across the surface of the substrate while it is spinning. The sweep can be edge to edge, center to edge, or edge to center depending on parameters entered and how the specific Arm definition is written. The dispense can be specified by time, number of sweep, or both. The Arm sweep motion can be linear or hyperbolic. There are many types of Arms – stream dispense, spray nozzle dispense, megasonic, high velocity spray, HPC (high pressure control) spray, single brush, double brush, vertical brush, piranha mixing, and N2 drying Arms. Arms may have more than one dispense nozzle.

Programming the dispense Arm

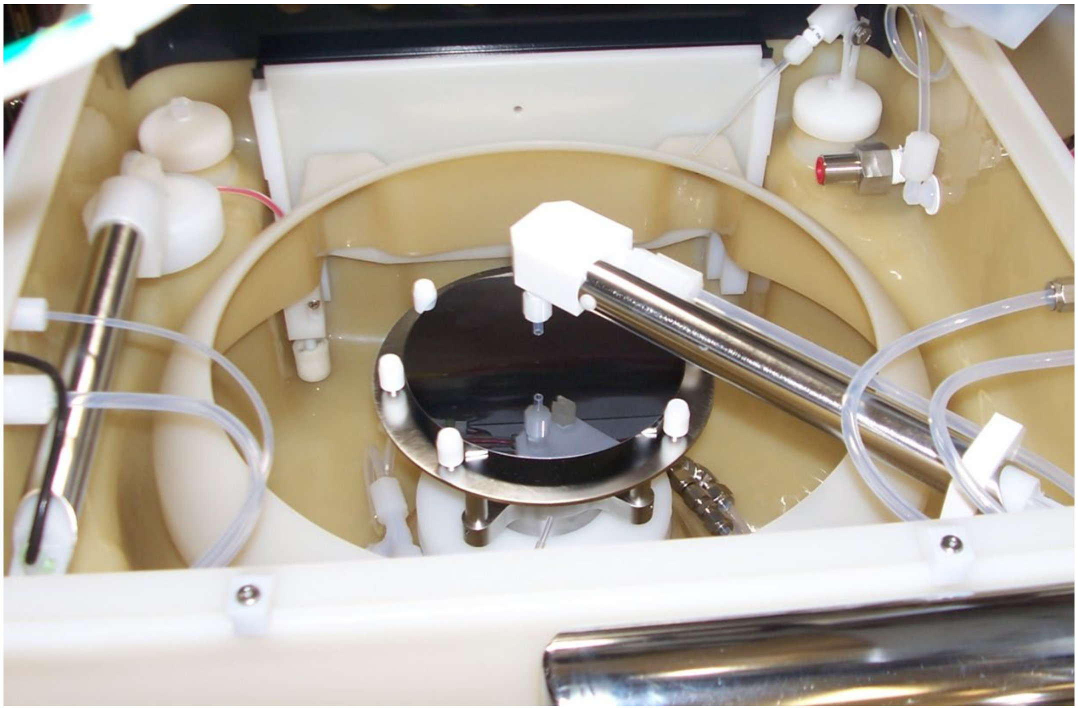
The following example uses a stream dispense. The following recipe editor Window is typical of most Arm dispenses. It shows an IPA Stream dispense function and its parameters. The typical sequence of motions is for the Arm to sweep out to the near edge of the wafer (Start Scan At), move down to position (Z Height), then sweep across the wafer through the middle (Wafer Center), to the opposite edge (End Scan At), and then back again. The “Scan Type” can either be zero (0) for a linear sweep or one (1) for a hyperbolic sweep. A linear sweep moves the Arm back and forth at a fixed speed once it has accelerated to the defined speed. A hyperbolic sweep moves the Arm faster at the center and slower at the edges. The “Scan Speed” defines how fast the Arm sweeps. The time that is spent sweeping is either defined by a separate “TIME” function that is part of the same process step ***or*** by specifying the number of sweeps. A sweep is one pass of the Arm from the start position through the center to the end position. A second sweep would be the reverse – end position, through center, to start position. The “Z Height” value defines how high above the substrate the Arm is to sweep. In most cases the chemistry dispensed by the Arm does not turn on until the Arm has reached the start sweep position and has moved to the Z height. The Arm continues to dispense until either the TIME has expired or the specified number of sweeps has completed. Some Arm dispenses, like brushes, may have the chemistry turned on immediately prior to moving to the start position and remain on until the Arm is parked back at its rest position. The start, center and end positions can be set so that the Arm can sweep from the center to the near edge, from the center to the far edge, from the far edge to the center, or the near edge to the center by making either the start or end value the same as the center value.



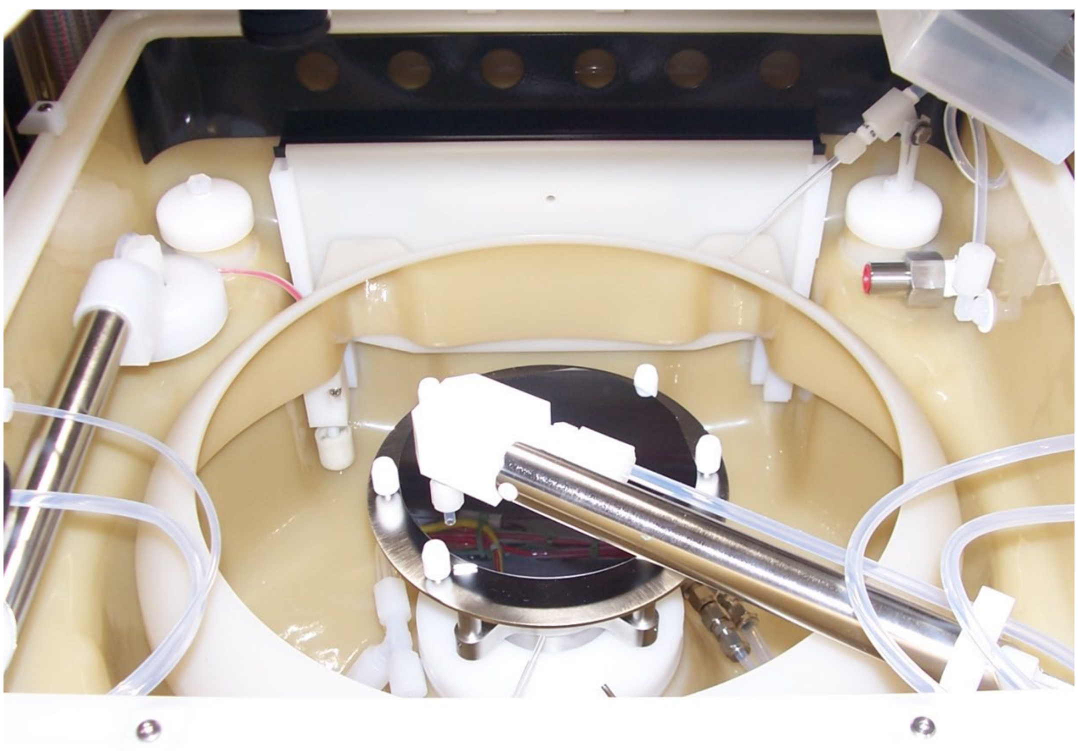
The parameters above are explained in the photos below. Start Scan At – In this example the Arm sweeps out 7.3 inches for its home position.



Wafer Center – The center position of 9.0 inches is specified but is not used in this example. The Arm will travel through the center position on its way to the end position. The center position value is only used when the scan type is hyperbolic (1).



End Scan At – The End Scan At position is 11.100 inches. This is the end of the first sweep.



Scan Type – A Scan Type of zero means that the Arm will sweep at a fixed linear speed. A Scan Type of one is used for a hyperbolic sweep of the Arm which will move faster in the center and slower at the edges. The center value being used for the apex of the of the movement, Scan Sweeps – This is the number of Arm sweeps, six, to be made to complete the process step.

Scan Speed – A scan speed of 20 is relatively fast. The value is the time between motor steps in milliseconds. Consequently a small value will result in a fast speed and a large value will result in a slow speed.

Z Height – The Z height of -0.400 inches means that the Arm will move down that far before it starts sweeping.

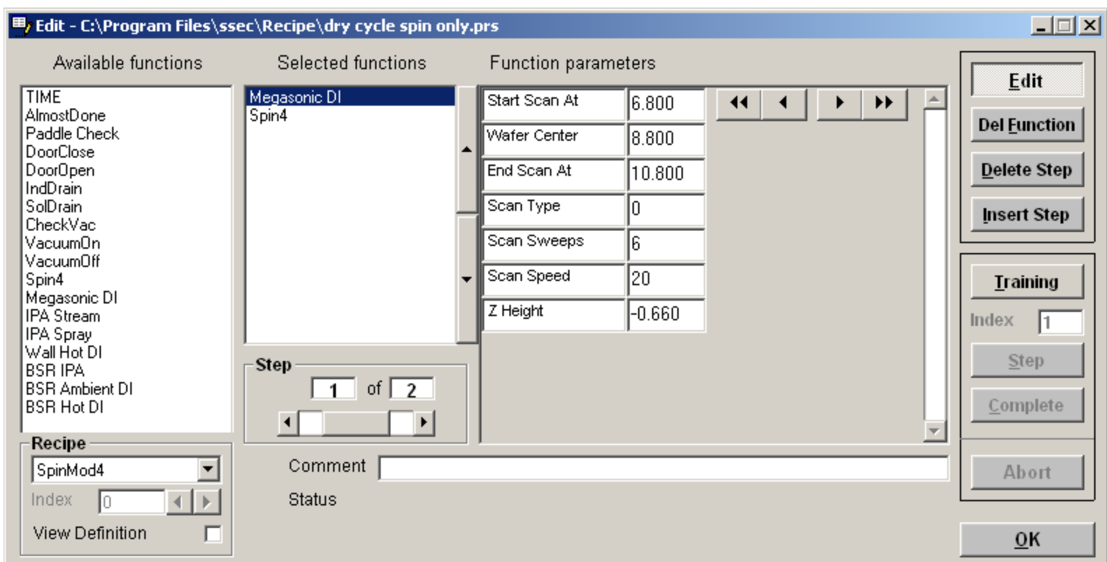
The Arm can dispense to a single fixed position, typically the center, by setting all three positions (start, center, and end) to the same value.

The Arm dispense step normally has a spin function also. Other possible functions that may be included in the step may be TIME, drain selection, wall dispenses, back-side-rinse (BSR) dispenses, collection ring activation, and tank management functions.

This Page Left Intentionally Blank.

Megasonic Arm

The megasonic Arm has an ultrasonic cleaning head on the end of the Arm. It is used for mechanically cleaning a substrate using ultrasonic energy to loosen particles. The head has a clear quartz piece with a hole in the center where DI water or a dilute chemistry is dispensed to act as a couplant for the ultrasonic energy. Set the DIW flow so that fluid weeps out the bleed hole near the top of the dome. The optimal height for the head is 1-2 mm above the substrate – this transfers the most energy based on the frequency of the crystal, which is approximately 1.5 MHz. Verify that the Arm maintains this distance throughout a full sweep. On chucks that have retainers, it is necessary for the Arm to travel to a point inside of the retainers before moving down to the 1-2 mm height. Care should be taken to limit the travel so that the head does not hit the retainers. Because the ultrasonic energy is conducted by the couplant, it actually extends beyond the edges of the head. Typically, the head is swept to within 5 mm of the substrate edge.

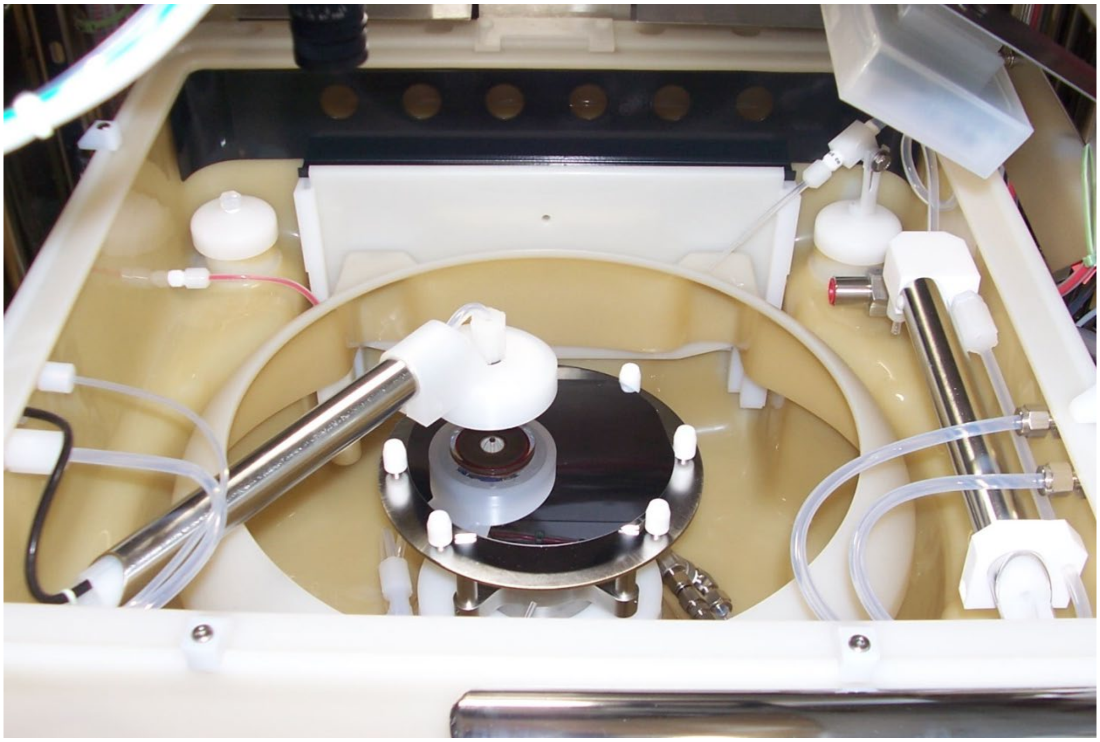


The above function parameters show that the Arm will sweep out to 6.800 inches, move down 0.660 inches, then sweep across the substrate at a scan speed of 20 through the center position of 8.800 inches to the far edge of the substrate at 10.800 inches for the first sweep, then back to the start position for a second sweep, and so on until 6 sweeps are completed. Then the head will move up and sweep back to its rest position. While this is occurring, the substrate is spinning. It is recommended that the spin speed not exceed 40 rpm for glass substrates. For a 300-mm wafer, the scan time should be in the 2-4 second range in hyperbolic mode. Hyperbolic is selected for equal dwell time at the center versus the edge (1,10,700 are typical parameters). A typical megasonic dispense time is 15-60 seconds.

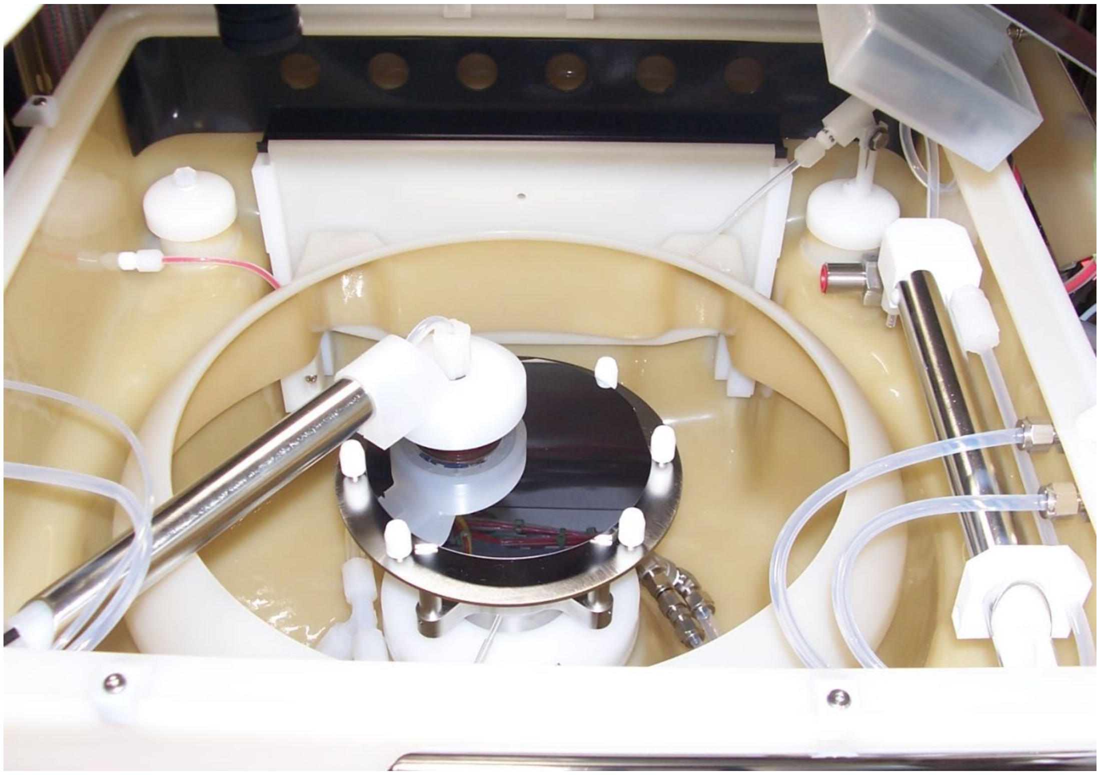
Also, if so equipped, the BSR dispense should be turned on simultaneously to wet the bottom of the substrate. The megasonic energy that is transferred through the substrate can be coupled through the BSR dispense to also aid in cleaning the bottom of the substrate.

The following photos show a typical sequence of Arm movements for a megasonic Arm.

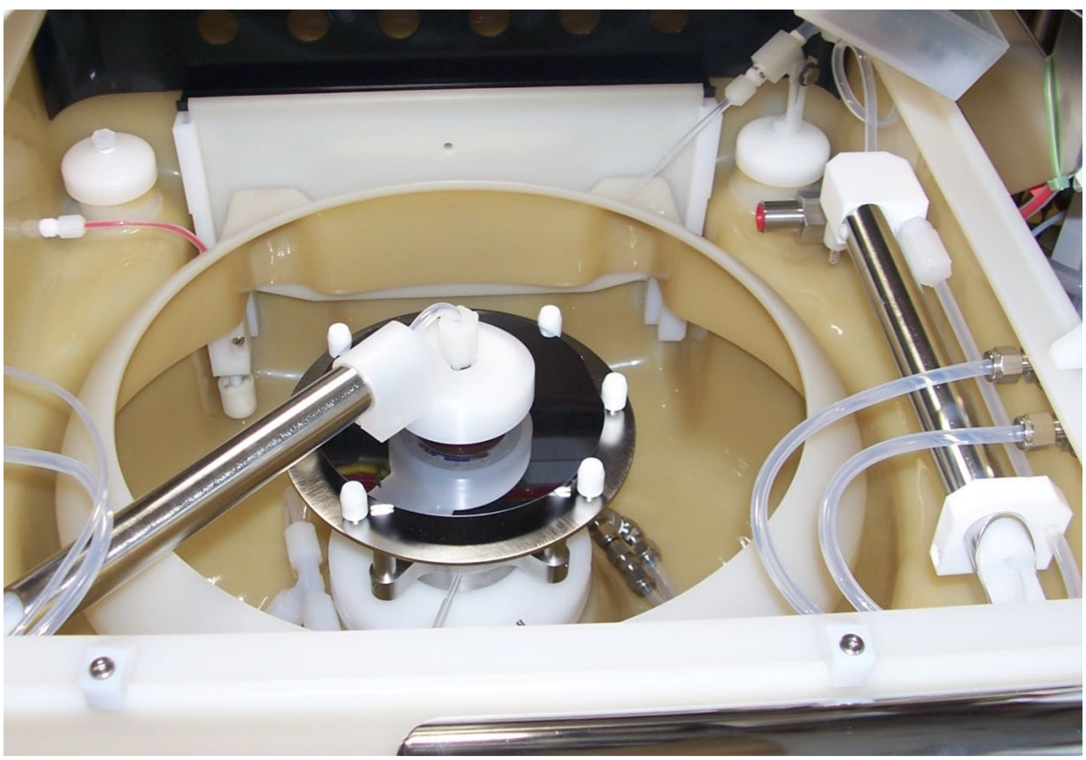
The Arm sweeps out to the substrate…



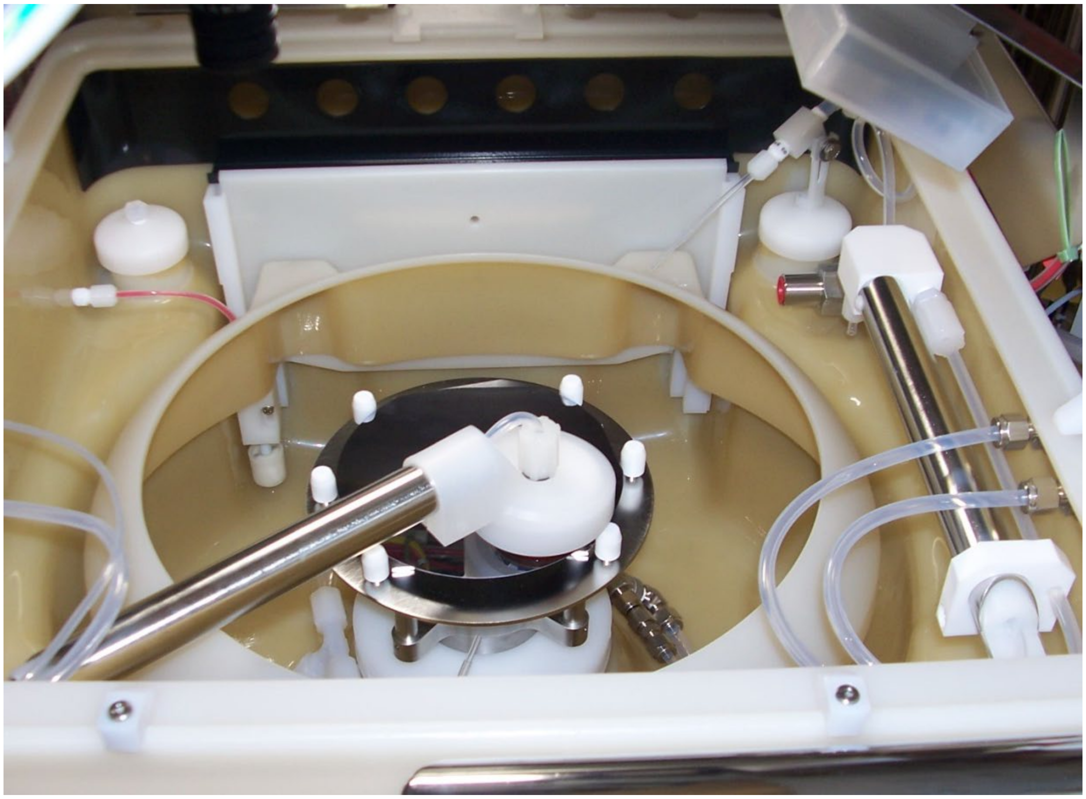
…then moves down to the height that is 1-2 mm above the substrate.



Then it can move through the center…



…to the far edge and back.



The factory default settings are for maximum power to the transducer. Therefore, any changes would decrease power. It is expected the cleaning efficiency will be proportional to power. Because of this, unless there is damage occurring, full power is recommended. The DAC ranges and how they are handled in firmware are outlined in the first table. The second table shows typical ADC values in the off and active states.

DAC	Unit	Setpoint	Default	Max
Volts	v dc	0-45	32	32
On cycle	msec	0-25.5	1	1
Off cycle	msec	0-409.5	6	6

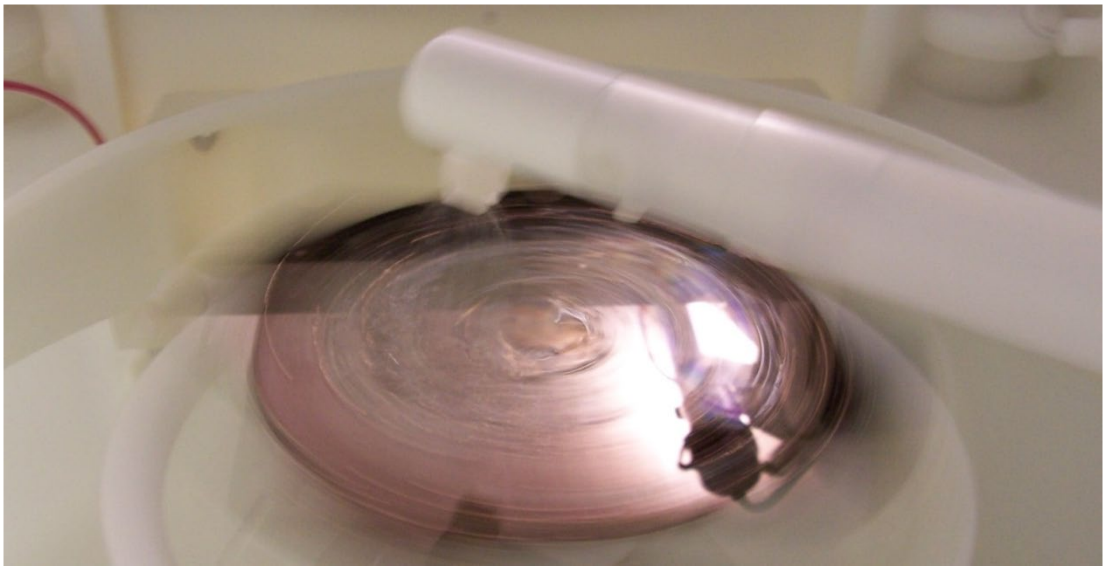
ADC	Unit	Unit off	Unit on (max)
Supply V	v dc	40	40
Meg V	v dc	0	32
Current	amp	0	3.8

Guidelines for using the megasonic are to keep it in the factory default mode and to use it with DIW. Cleaners will be equipped with PVA brushes to remove large particles and with a high-velocity spray (HVS) to remove particles across a spectrum of thesholds. The megasonic Arm is to be used on smaller bin sizes (< 0.1 µm). Accordingly, VPSP considers the megasonic a final cleaning implement used to refine the defect signature on wafers with limited defects.

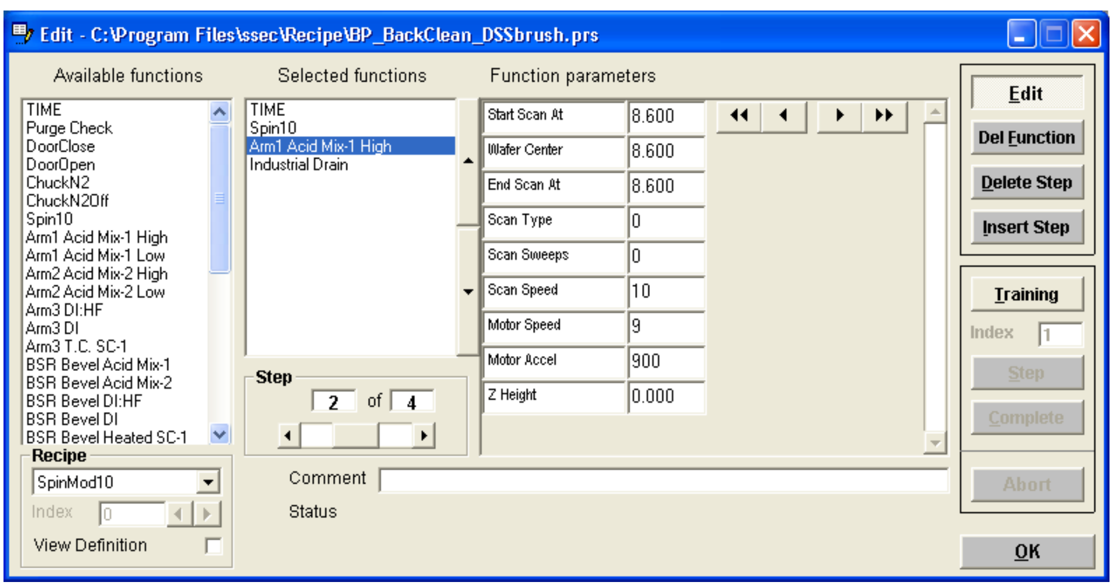
This Page Left Intentionally Blank.

Fan Spray Arm

Fan spray Arms function the same as stream dispense Arms. Replaceable spray nozzles with different spray patterns or flow rates can be fitted into the dispense heads. These may be polypropylene or stainless steel. The nozzles can be turned to direct the fan spray pattern in any direction. Normally it is positioned so that the fan is set parallel to the Arm.



This photo shows a fan spray dispense onto a spinning photomask.



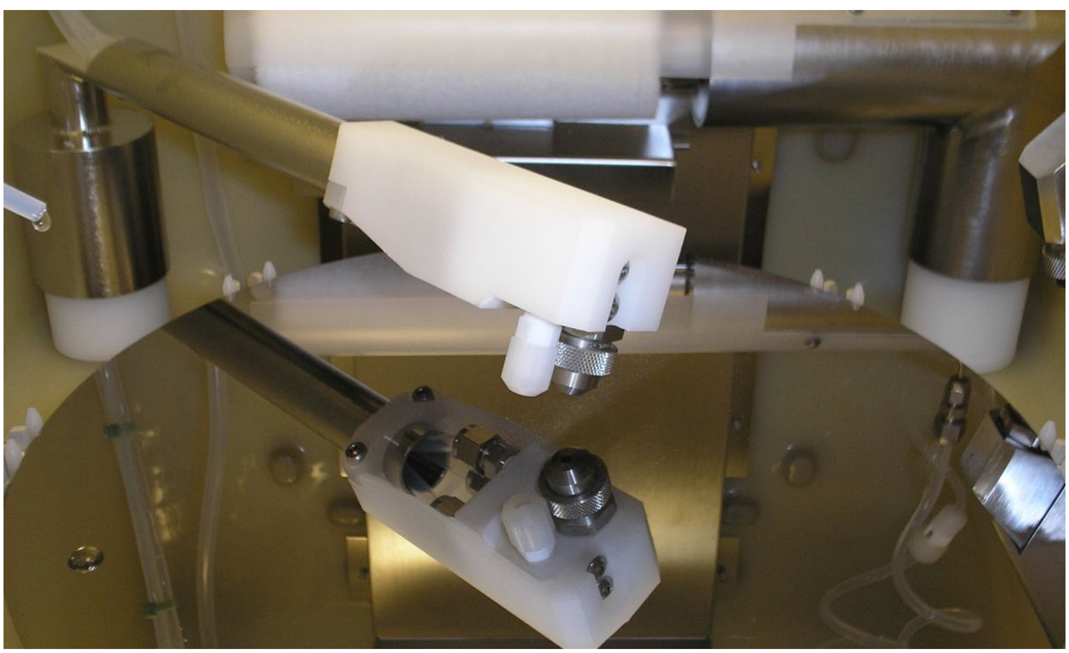
The parameters show a fixed dispense at 8.600 inches (center) with the Z height at home. The TIME function is part of this step and will determine how long the Arm dispenses at the center. The remaining parameters are ignored since no sweeping occurs.

This Page Left Intentionally Blank.

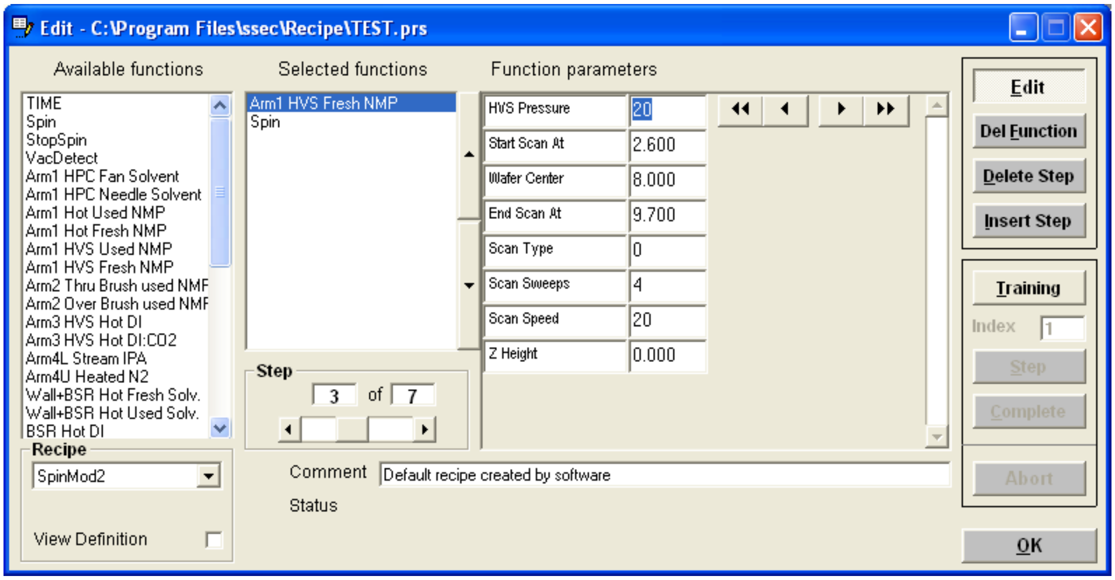
High Velocity Spray Arm

The High Velocity Spray (HVS) Arm uses an electronic pressure regulator to inject a nitrogen into a stream of chemistry to atomize the fluid and spray it with a moderate amount of pressure. The HVS has a pressure range of 1 – 70 psi. The pressure value is one of the parameters for this Arm dispense.

The above photo shows an HVS Arm with a Kynar® nozzle, typically used with dilute chemistries.



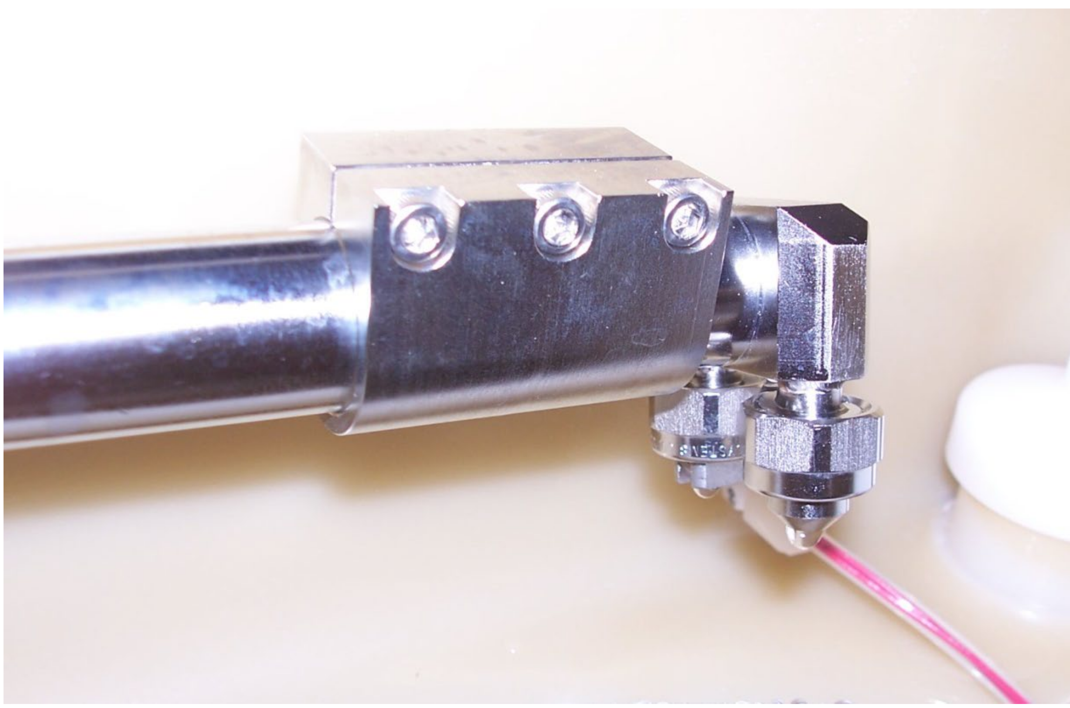
This photo shows a Teflon® stream nozzle on the left and a stainless steel HVS nozzle on the right.



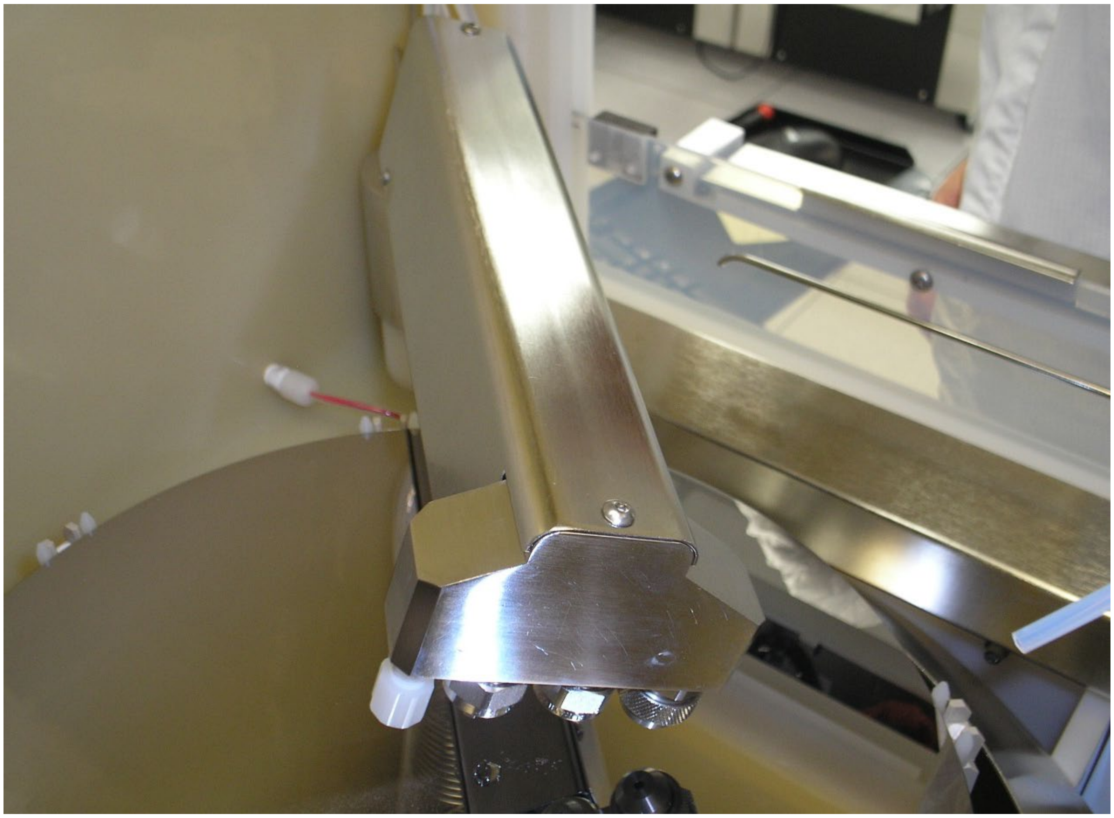
This high velocity spray example will have the Arm go out to 2.600 inches, will not change the vertical height, sweep through the center of 8.000 inches to the end at 9.700 inches, for 4 sweeps, at a scan speed of 20 and an HVS pressure setting of 20 psi.

HPC Arm

The high pressure control (HPC) spray Arm uses an air driven pump to spray chemistry, typically solvents, at a pressure up to 3000 psi, with a tolerance of ±5% or 50 psi, whichever is greater. This type of Arm typically has two stainless steel dispense nozzles that can be individually selected. One is a fan spray nozzle and the other is a needle stream nozzle. The fan spray nozzle can be adjusted to any angle but is usually turned to be parallel to the Arm. The needle stream nozzle directs a focused narrow stream of chemistry at the substrate and is located so that a sweep across the substrate will pass over the exact center. Care should be exercised when selecting an operating pressure, as the HPC stream can damage substrates. Also the high pressure can be injurious to your hand or fingers if working in the Chamber with the pump operating. At high pressures the chemistry can create a fine mist. The process module should be covered when the HPC is running and sufficient exhaust should be provided to prevent inhalation of chemical vapors. Additional parameters specific to HPC dispense Arms are pressure, maximum and minimum pressures, and maximum and minimum flow rates. The latter can be used to define a process Window. Refer to Section 4 of the Safety & Maintenance Manual, HPC Dual-Cycle Pump, for callibration information.

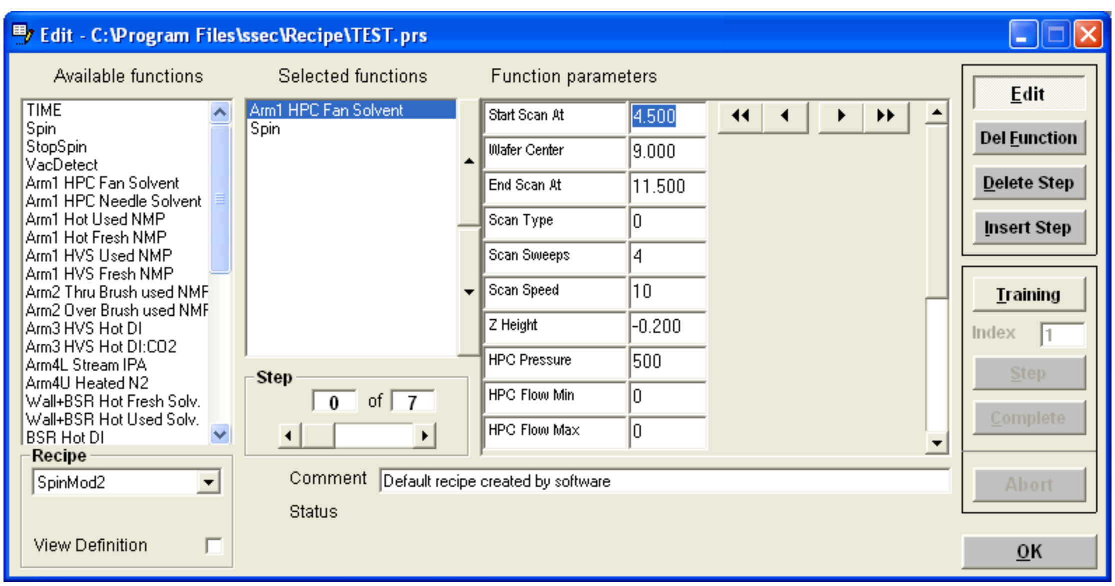


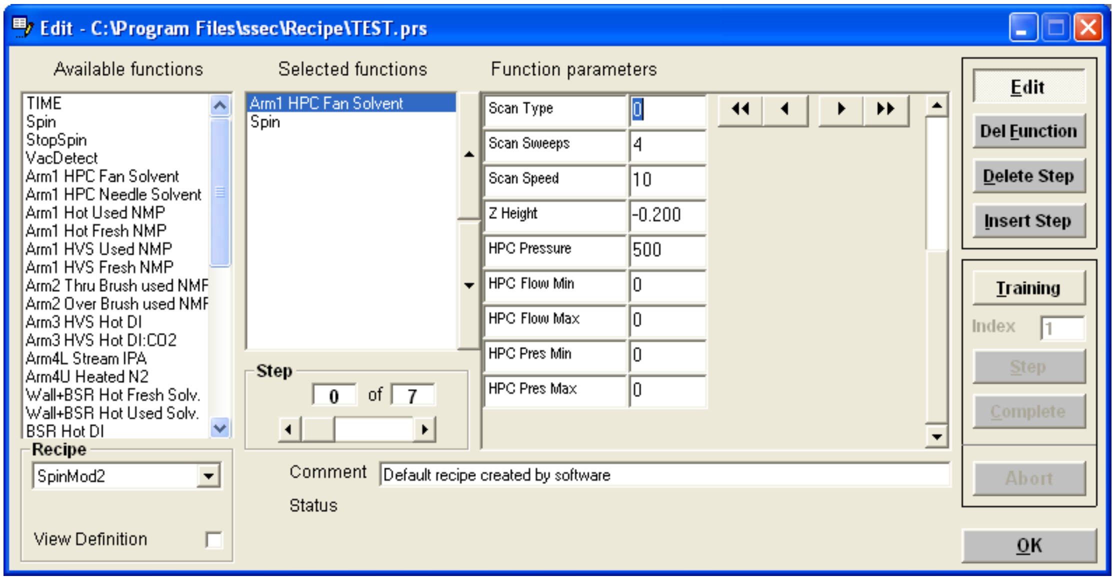
This photo shows the typical dual nozzle HPC Arm with the needle stream nozzle on the right (nearer) and the fan spray nozzle on the left (slightly behind). It can be seen that the fan spray nozzle is aligned parallel to the Arm.



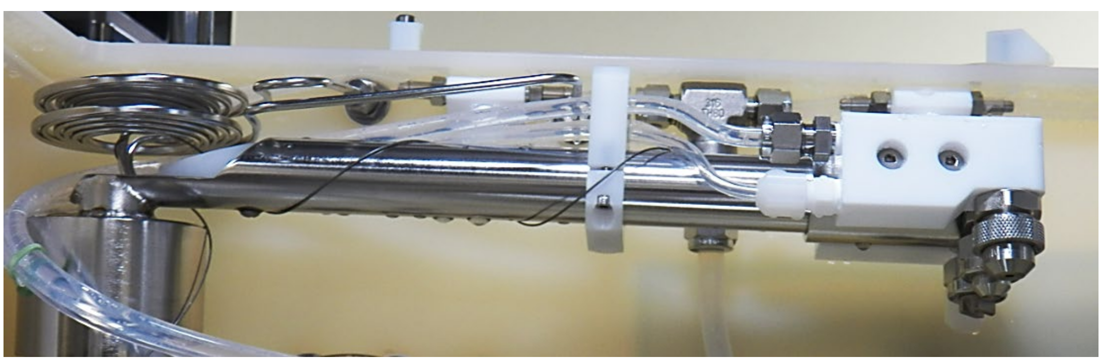
This photo shows a multi-nozzle dispense Arm, from left to right, a stream dispense nozzle, an HPC needle, an HPC fan spray, and an HVS nozzle.

This function has 12 parameters and requires the following two overlapping Windows to display all of them.





The Arm moves out to 4,500 inches, down 0.200 inches, makes first sweep through center of 9.000 inches to 11.500 inches at a scan speed of 10. It sweeps three more times for a total of 4 sweeps at a pressure of 500 psi. The zero values for the last four parameters mean that both the flow rate and the dispense pressure are not being monitored.

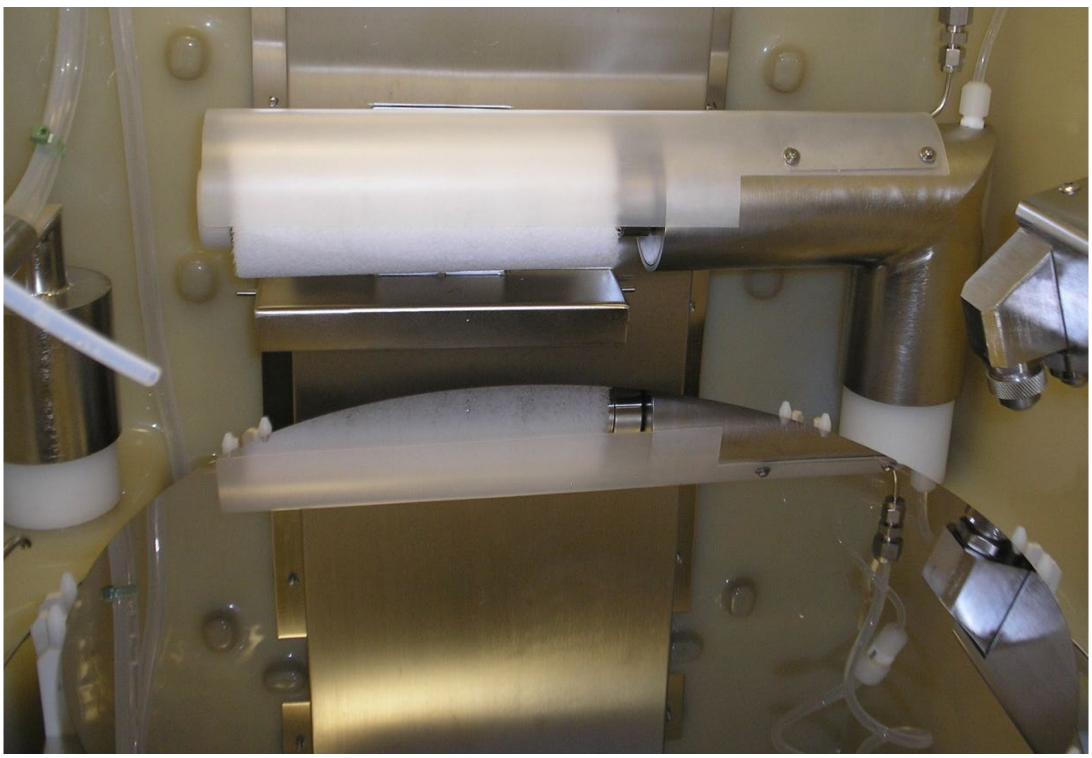


A variation on the multi-nozzle dispense Arm shows (front to back) a high-velocity spray, HPC needle, HPC fan, and stream nozzles.

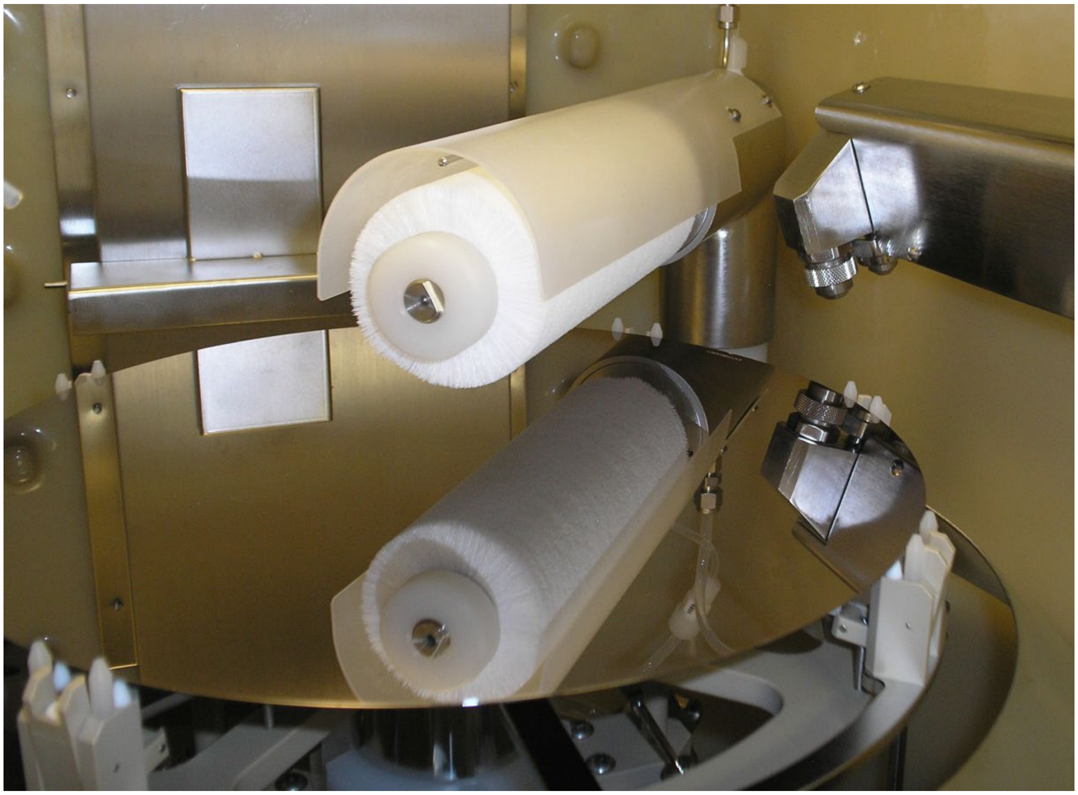
This Page Left Intentionally Blank.

Single Horizontal Brush Arm

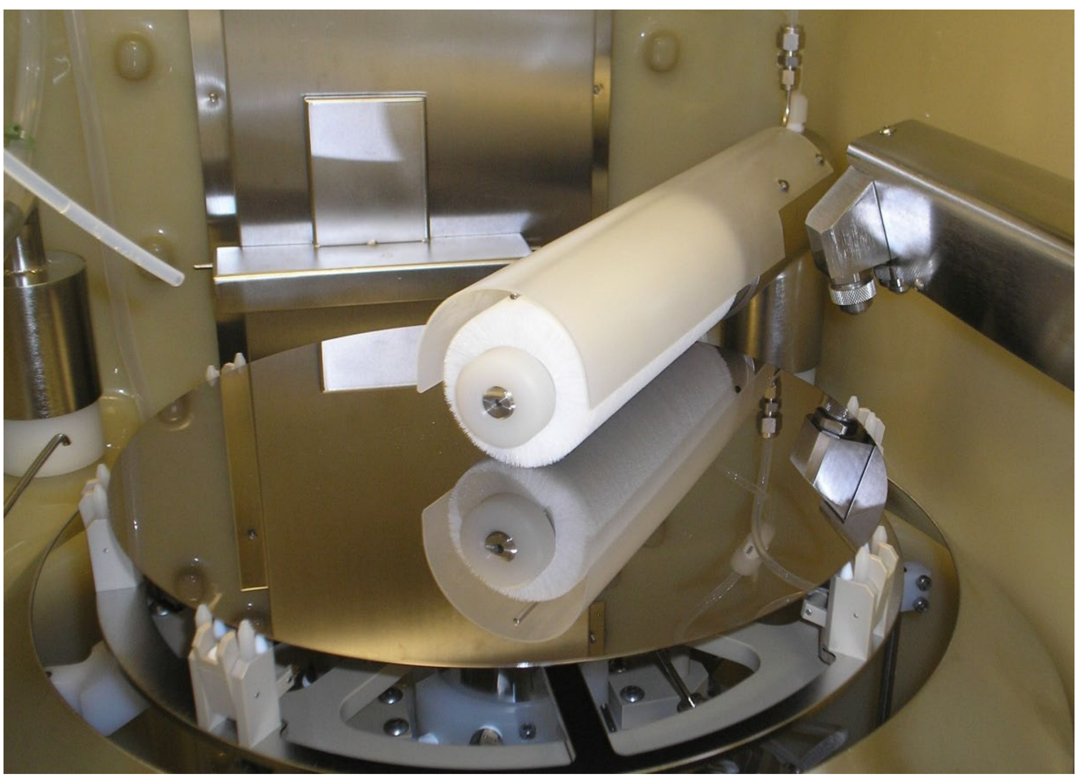
The single horizontal brush Arm moves out over the substrate, then moves down to make contact with the substrate, and rotates while dispensing chemistry. The chemistry is typically dispensed through the core of the brush and may also have a spray bar above it that can dispense onto the top of the brush. The brush can rotate at a specific rpm in either direction. Its rotation can be with the spinchuck's rotation or against it for more aggressive scrubbing. It can also simultaneously sweep across the substrate as it rotates. To keep the Arm stationary, the start, center, and end parameters should all be the same value. The Z height can be directly specified or on those Tools equipped with our auto brush height option the brush height can be automatically determined and adjusted. See the section on the Brush Auto-Height feature. The brush itself can be a bristle brush or a sponge brush. See the brush replacement section in the Safety and Operation Manual.



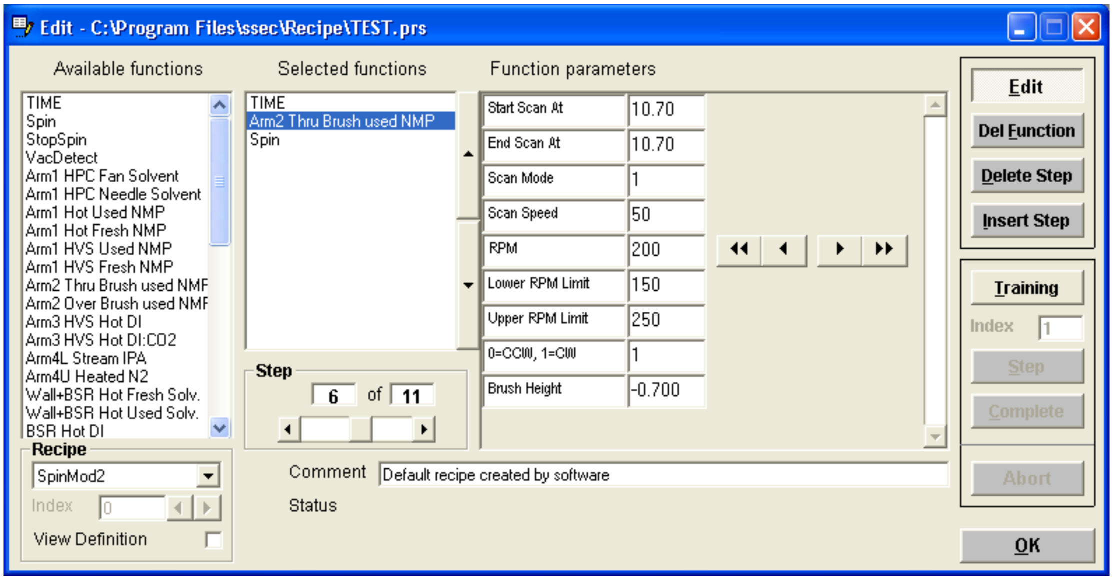
This photo shows the horizontal brush Arm parked at its home over the automatic brush height lever.



The Arm has swung out over the center of the wafer.



Here the Arm has moved down to contact the wafer.

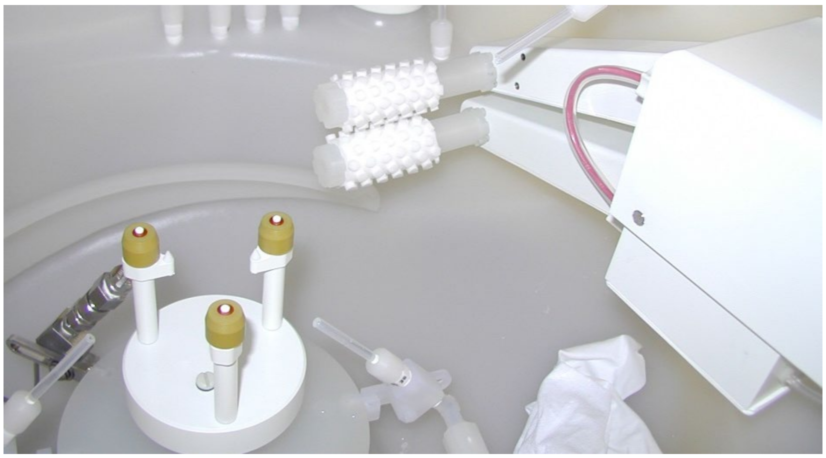


These parameters show the brush Arm moving out to 10.70 inches, down 0.700 inches, and rotating at 100 rpm in the clockwise direction. The speed is being monitored to be between 150 and 250 rpm. Since the “Start Scan At” and “End Scan At” values are the same, the “Scan Mode” and “Scan Speed” parameters are ignored.

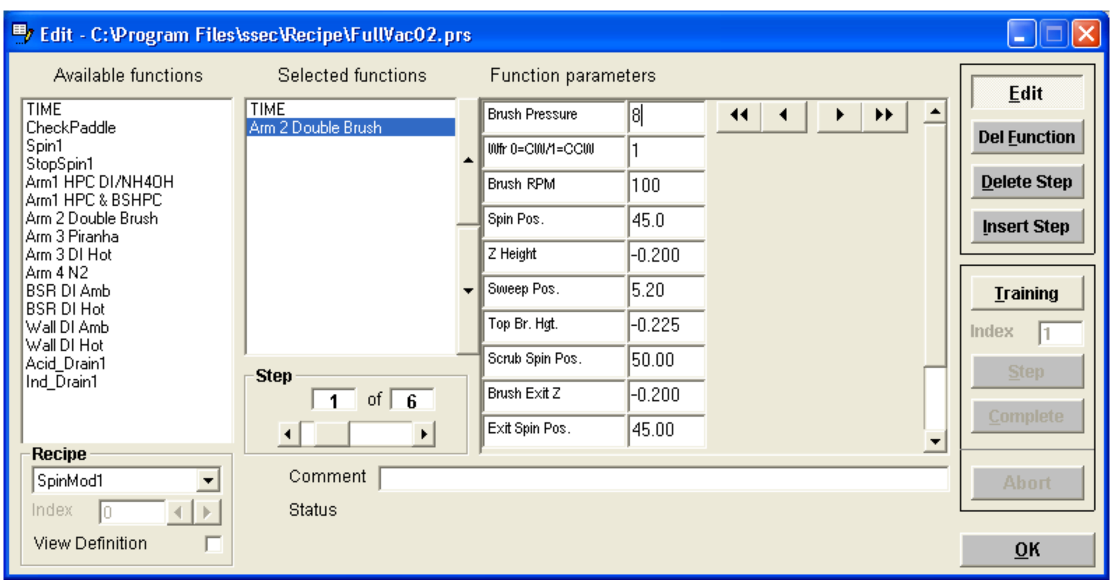
This Page Left Intentionally Blank.

Double Brush Arm

The double brush Arm moves out around the substrate with one brush above and one below with the spinchuck stopped. The brushes spin in opposite directions and then clamp together around the substrate while dispensing chemistry through the brushes. This rotates the substrate in the chuck retainers. Additional parameters may be brush clamping pressure, brush rotation speed, rotation direction, maximum and minimum speeds. Typically the brushes rotate and the chemistry is dispensed before the substrate is clamped. Positioning the brushes around the substrate may require several steps for the Arm to reach its final position with spinchuck turning so that the support posts clear the Arm.



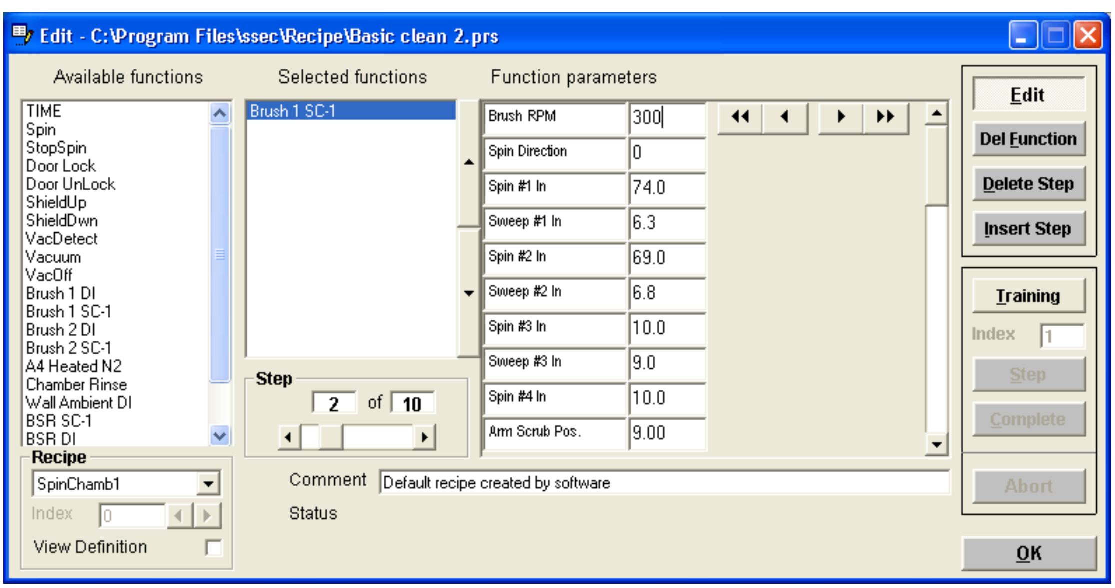
This photo shows a double brush Arm for a micro-chamber.

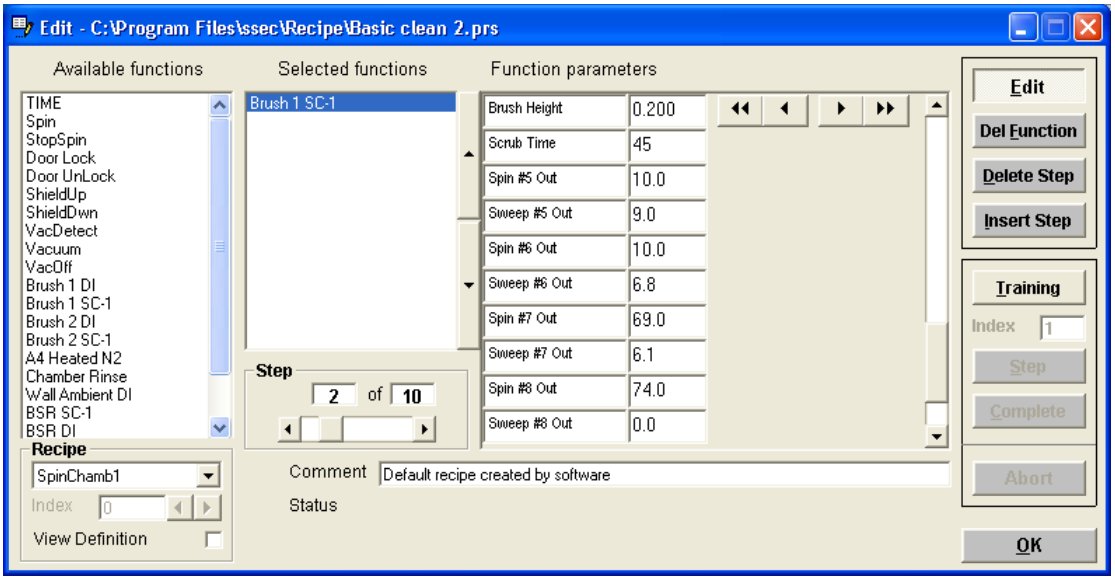


These parameters show that the brushes will start to rotate at 100 rpm in the counter-clockwise direction, the chemistry will start to dispense through the brushes, the spinchuck will move to 45 degrees, the brush Arm will swing out 5.20 inches at a height of -0.200 inches, the spinchuck will then move to 50 degrees, the upper brush will move down to -0.225 inches, and the lower brush will clamp with 8 psi of pressure. When the time specified in the step has expired the brushes will unclamp, clear the substrate, the spinchuck will move to 45 degrees, the Arm will retract, the chemistry will turn off, and the brushes will stop rotating.

This photo shows a large double brush Arm in a standard chamber.

This function has 20 parameters and requires the following two Windows to display all of them.





The above parameters show a counter-clockwise brush rotation speed of 300 rpm at a brush height of 0.200 inches. The numbered positions are instructions for the spinmotor and the Arm sweep motor to move so that the Arm can swing out perpendicular to the substrate so it is over the spinchuck centerline.

This Page Left Intentionally Blank.

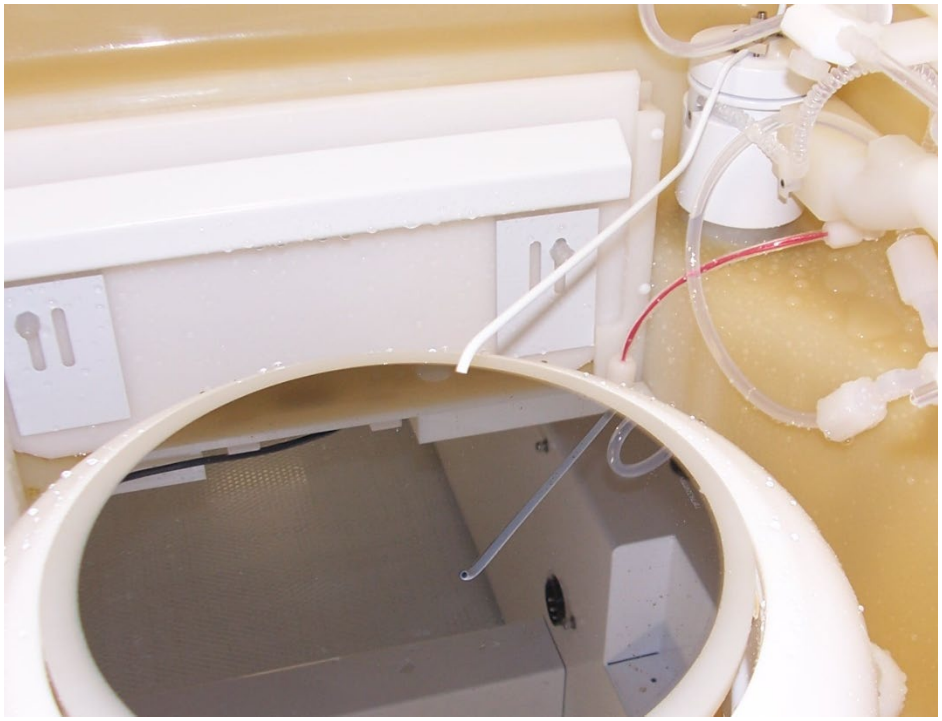
Vertical Rotary Brush Arm

Similar to the operation of the megasonic Arm, the vertical brush Arm moves out to a position inside of the retainers, travels downwards to contact the substrate, and then sweeps while the brush rotates and dispenses chemistry and the chuck rotates. Additional parameters may be brush rotation speed, brush rotation direction, maximum and minimum speeds. This Arm may also have an auto brush height option.

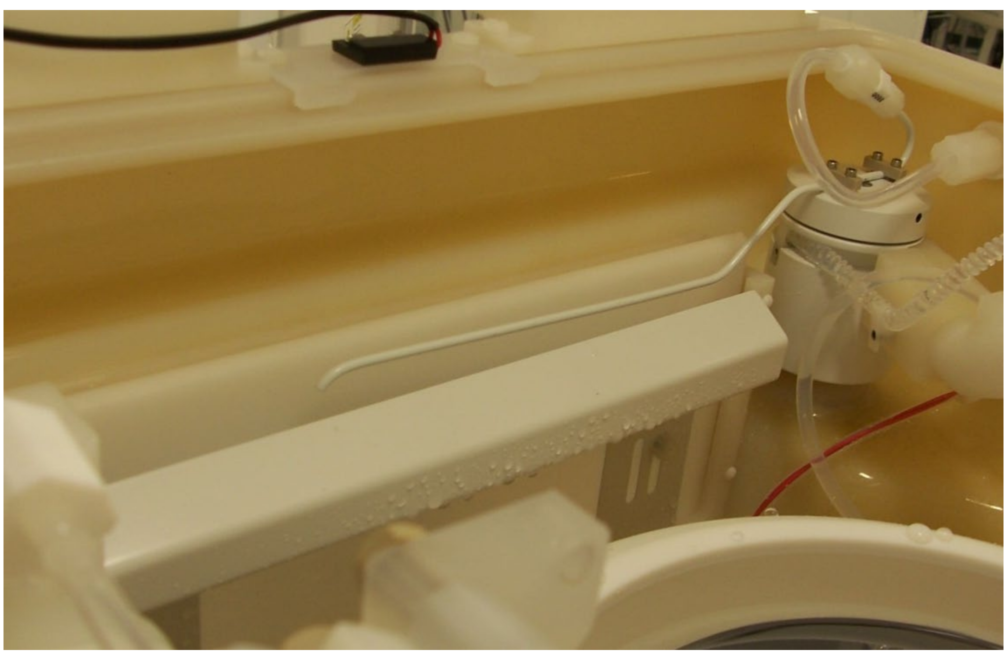
This Page Left Intentionally Blank.

Heated N_2 drying Arm

This small Arm typically is set up to make one sweep from just past center to the outer edge while the substrate is spun dry at a high spin speed.



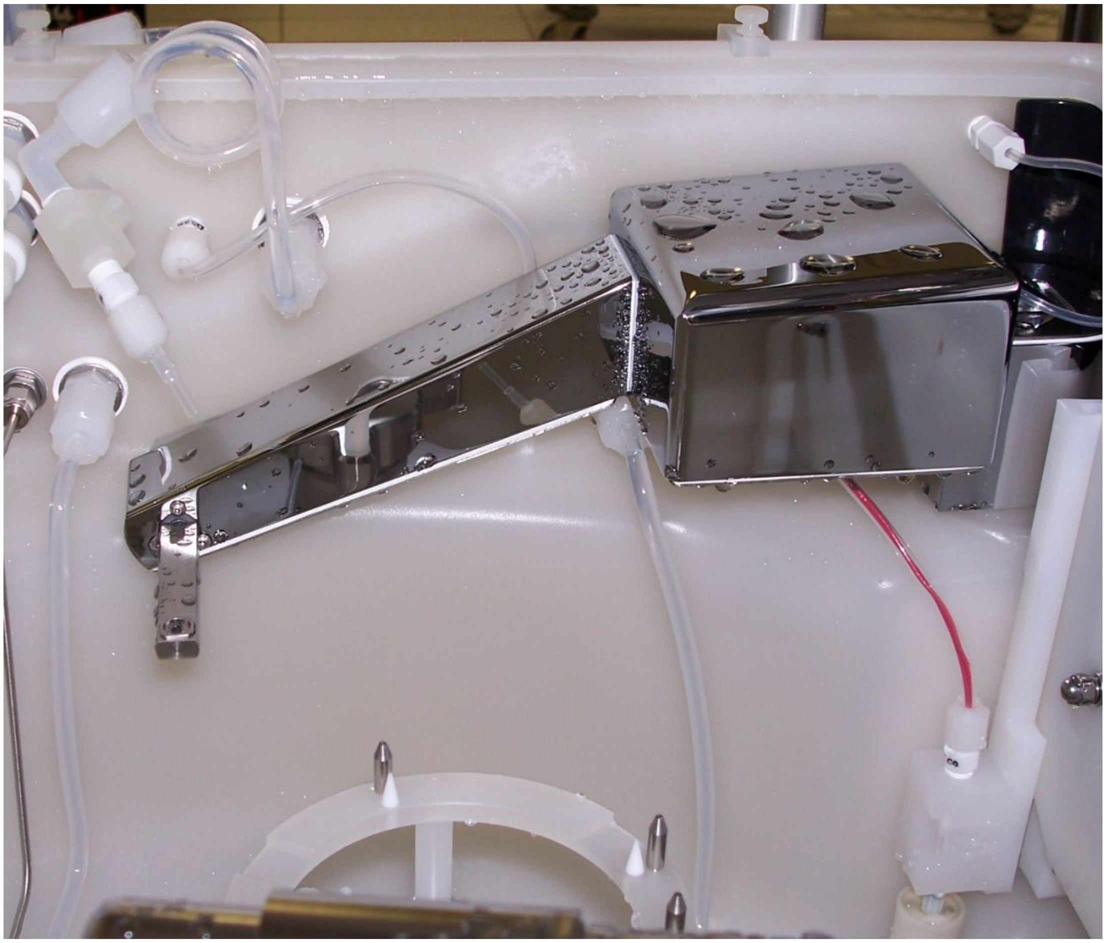
The Arm's rest position is usually under and behind a cover that is mounted on the back of the Process Chamber door.



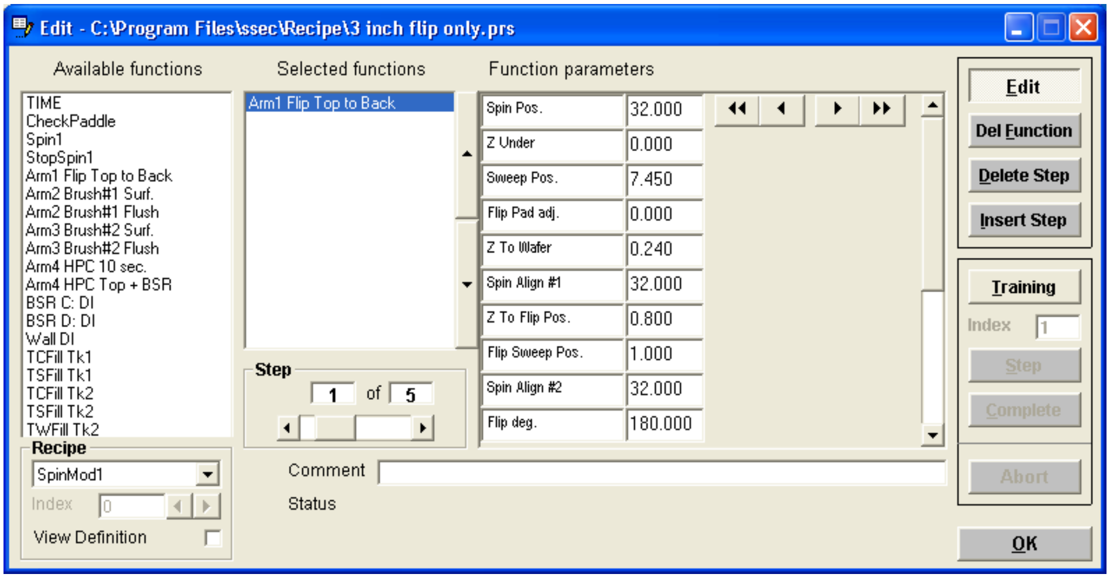
This Page Left Intentionally Blank.

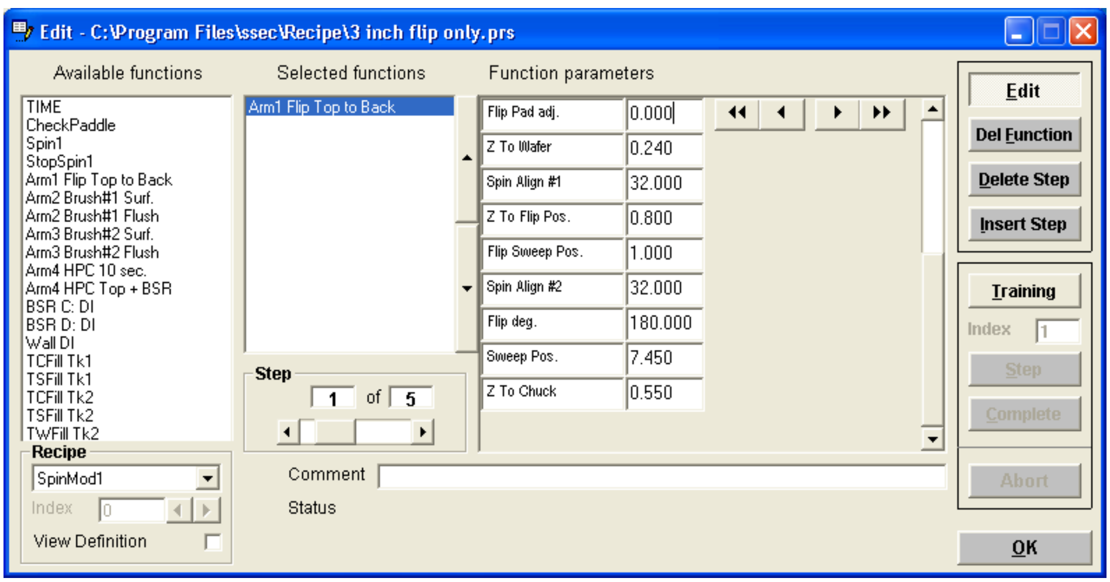
Wafer Flip Arm

The wafer flip Arm is used to flip a wafer over while it is in the Process Chamber so the opposite side can also be processed. The Arm has an extension that rotates with a vacuum port to hold the substrate. The spinchuck stops, the Arm sweeps out so the extension is under the substrate, the vacuum is turned on, the Arm lifts, sweeps to clear the spinchuck, inverts the substrate, sweeps back over the spinchuck, moves down, and releases the substrate onto the spinchuck. Then it moves up and sweeps back to its rest position.



This function has 12 parameters and requires the following two Windows to display all of them.





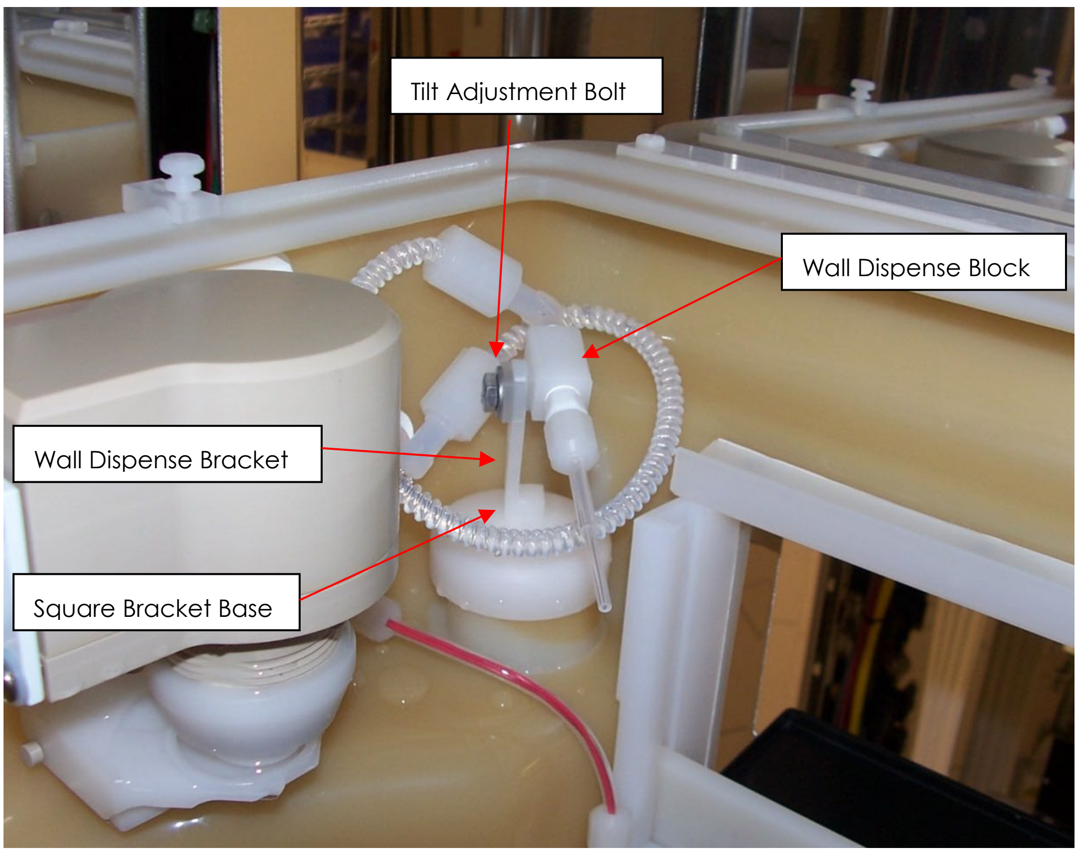
The spinchuck stops at 32 degrees. The Arm sweeps out to 7.450 inches, moves up 0.240 inches, secures the substrate with vacuum, moves up to 0.800 inches, sweeps away from spinchuck to 1.000 inches, flips 180 degrees, sweeps back to over spinchuck, moves down to 0.550 inches, releases the substrate, and returns to its rest position.

Wall Dispenses

General Description

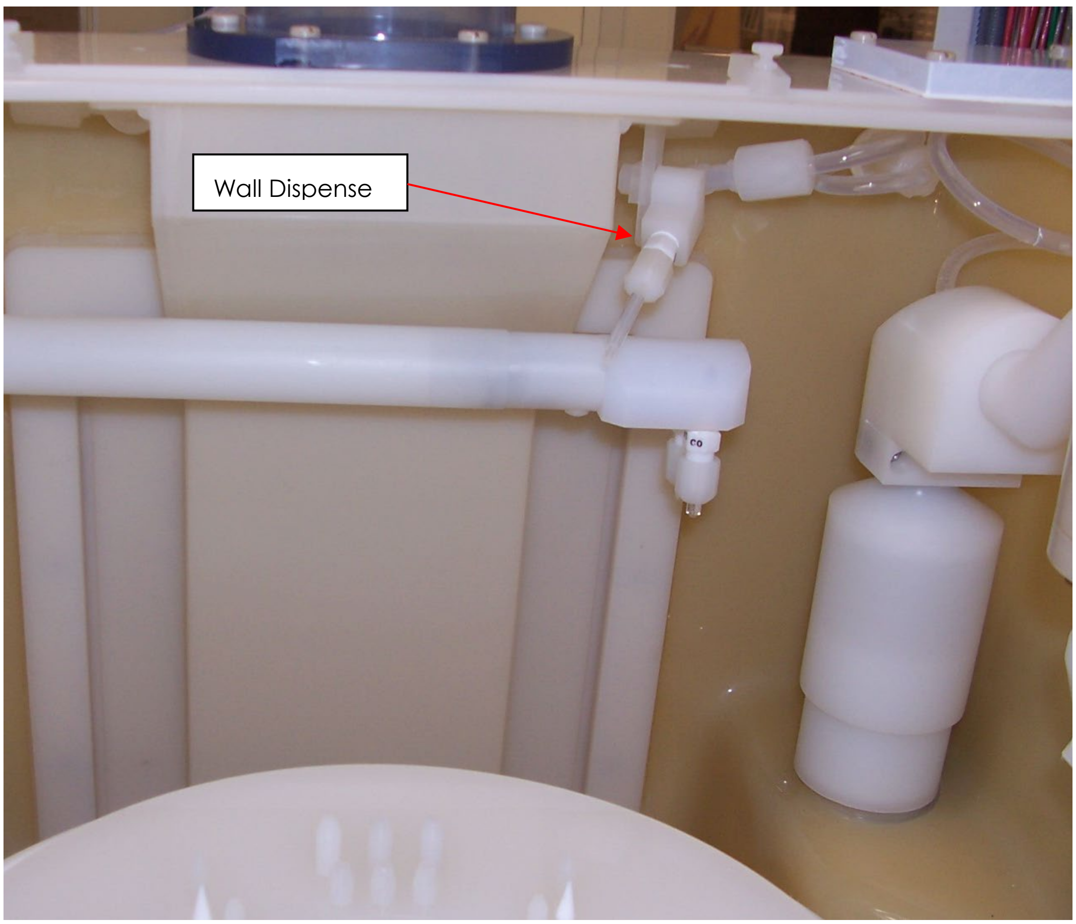
The process modules may have one or more wall dispenses. The wall dispenses are simply stream nozzles that are used to wet the top of the substrate. They are typically fixed in place on adjustable mounts. Depending upon the fluid dispensed they may be assembled from either plastic or metal parts. The dispense stream is normally directed to hit the substrate before the center so that the spinning substrate will distribute the fluid over the entire surface. Most Tools have the stream flow adjusted to minimize the amount dispensed yet still fully wet the substrate. This is done by using fixed restrictors in the fluid path. The stream can also be adjusted by the use of needle valves or by adjusting tank pressure.

Wall Dispenses for Cleaning Tools



The above photo shows the wall dispense for a cleaning Tool. The horizontal sweep direction can be adjusted by turning the square base of the dispense bracket with a wrench. The height is adjusted by adjusting the vertical tilt using the bolt that holds the dispense block to the bracket. The fluid exits the fitting through a 3/16" tube which has a length of 1/8" diameter tube inserted into it to better direct the stream. The smaller tube also increases the pressure of the dispensed fluid. This wall dispense is mounted on an Arm cap in the corner of a micro-chamber.

Wall Dispenses for Etch Tools



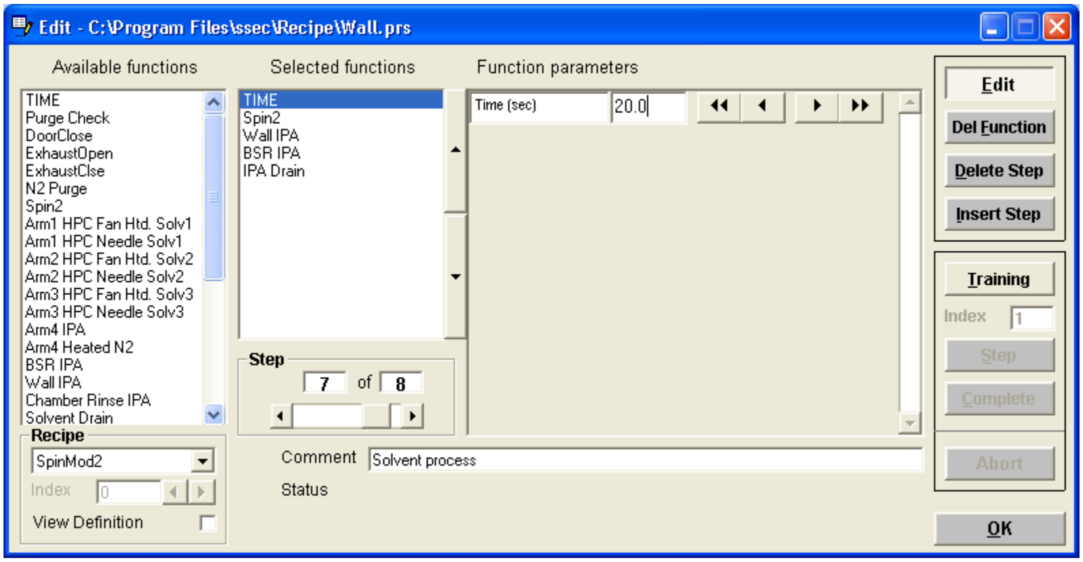
This photo shows the wall dispense for an etch Tool. The direction can be adjusted as in the previous example. This wall dispense hangs from the rear shelf piece of an M3 chamber.

Wall Dispenses for Solvent Tools

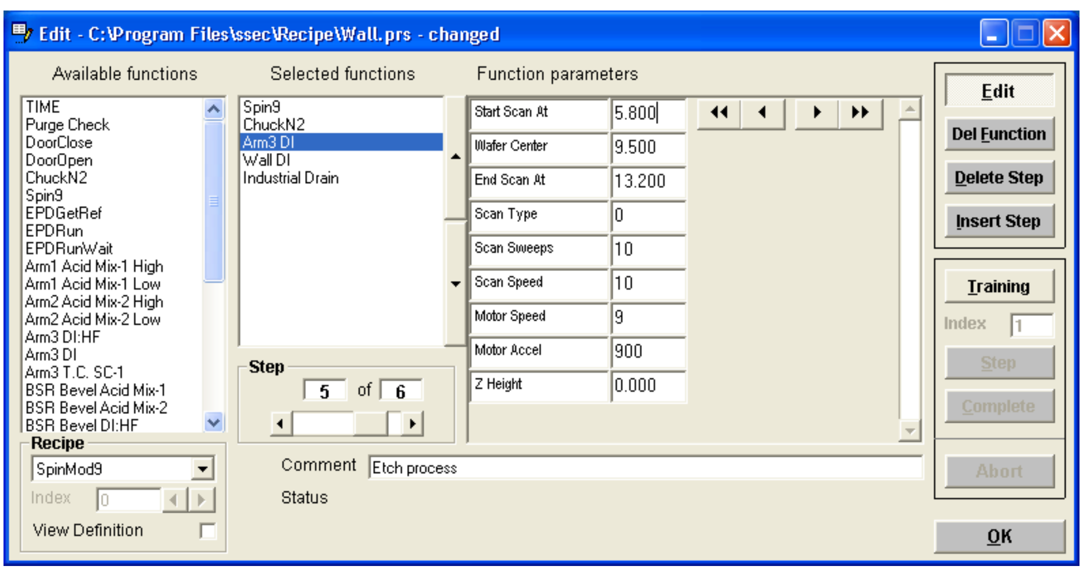
This photo shows the wall dispense for a solvent Tool. The direction can be adjusted as in the previous examples. This wall dispense is mounted on an Arm cap in the corner of a micro-chamber. Notice that all the parts are made from stainless steel.

Programming Wall Dispenses

Wall dispenses are easily added to any process step as there are no parameters associated with them. They are turned on for the duration of the step as specified by the Time or number of sweeps if a dispense Arm is being simultaneously used. The minimum wall dispense step typically has a Time function and a Spin function. The following example has the IPA wall dispense and the IPA back side rinse dispense on for 20 seconds while the substrate spins with the fluid directed to the IPA Drain.



The following example here has the Wall DI dispense on while the substrate spins, the chuck backside N2 is on, the back side rinse DI is on, and while the Arm3 DI makes 10 sweeps, with the fluid directed out the Industrial Drain.

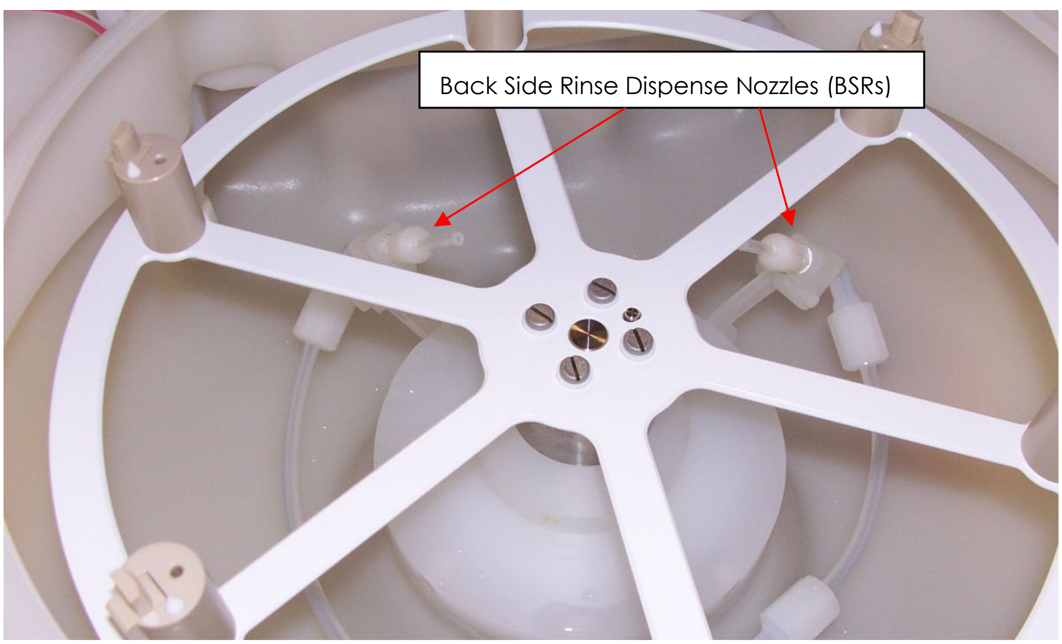


Back Side Rinses (BSR)

General Description

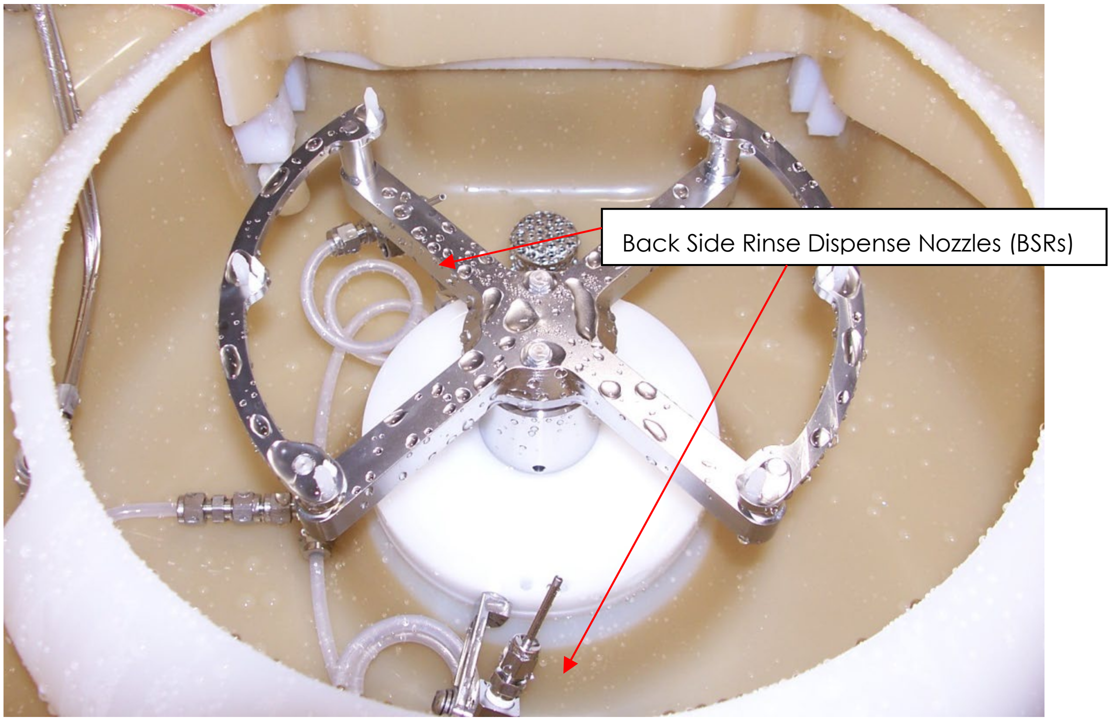
The process modules may have one or more back side rinse dispenses, hereafter referred to as BSRs. The BSR dispenses are simply stream nozzles that are used to wet or rinse the bottom of the substrate. They are typically fixed in place on adjustable mounts. Depending upon the fluid dispensed they may be assembled from either plastic or metal parts. The BSR nozzles are typically in plumbed in pairs spaced such that when they both are on one of the streams will always be contacting the substrate. The BSR stream is normally directed to hit the substrate before the center so that the spinning substrate will distribute the fluid over the entire bottom surface. Most Tools have the stream flow adjusted to minimize the amount dispensed yet still fully wet the substrate. This is done by using fixed restrictors in the fluid path. The stream can also be adjusted by the use of needle valves or by adjusting tank pressure.

BSR Dispenses for Cleaning Tools and Etch Tools



This photo shows the pair of BSRs for a cleaning Tool. They are spaced 120 degrees apart. The mounting brackets are horizontally mounted tangent to the spin chuck. The vertical angle can be adjusted by loosening the bolt that holds the dispense nozzle block to the bracket, swiveling the nozzle, and then re-tightening the bolt. Notice that the parts are made from plastic – typically either Teflon or polypropylene.

BSR Dispenses for Solvent Tools

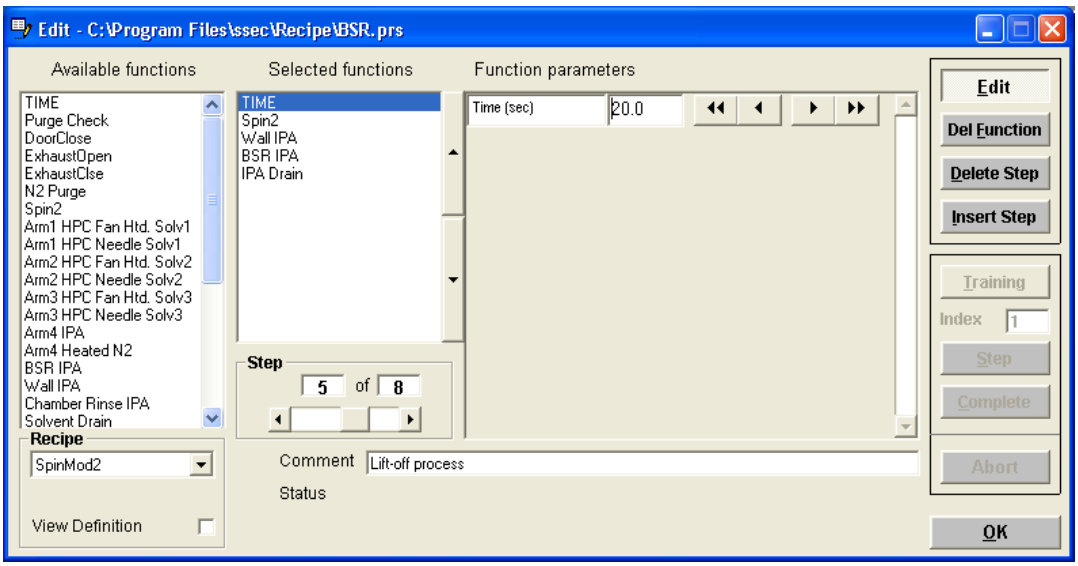


This photo shows the pair of BSRs in the final clean module for a solvent metal lift-off Tool. The dispense direction can be adjusted as in the previous example. Notice that the parts are made from stainless steel.

This photo shows a module with two pairs of BSR nozzles to dispense two different solvents.

Programming BSR Dispenses

BSR dispenses are easily added to any process step as there are no parameters associated with them. They are turned on for the duration of the step as specified by the Time or number of sweeps if a dispense Arm is being simultaneously used. The BSR is typically used during rinse steps but may also be used to keep the substrate wet or minimize any wrap around from the fluid being dispensed onto the top of the substrate. The following example has the IPA back side rinse on along with the Wall IPA dispense for 20 seconds while the substrate spins with the fluid directed to the IPA Drain.



This Page Left Intentionally Blank.

Chamber Rinse

Introduction

The "Chamber Rinse" function is used as a "Post" Process Chamber/Module cleaning Tool. Chamber Rinsing is performed using multiple fixed wall mounted Fan or Cone Pattern spray nozzles. Nozzles are mounted at the top of the Chamber or under the Chamber lip/overhang. These locations achieve the best coverage of the Chamber Wall, Dispense Arm, and Spin Chuck surfaces.

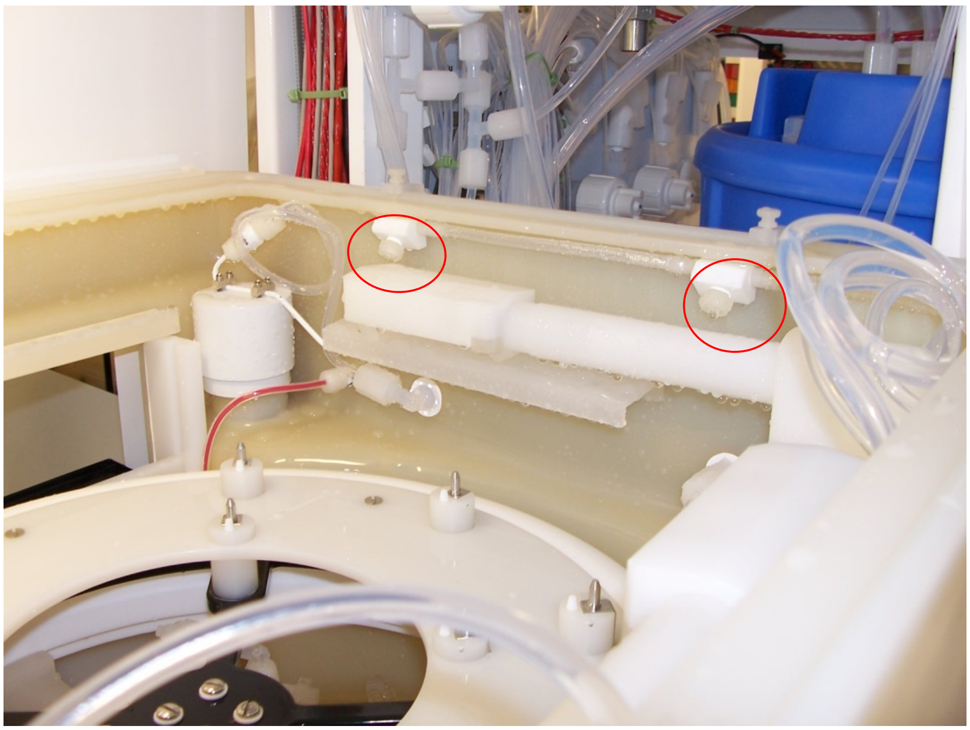


Figure 53 Micro-chamber Chamber Rinse nozzles. (Another pair is mounted on the opposite side.)

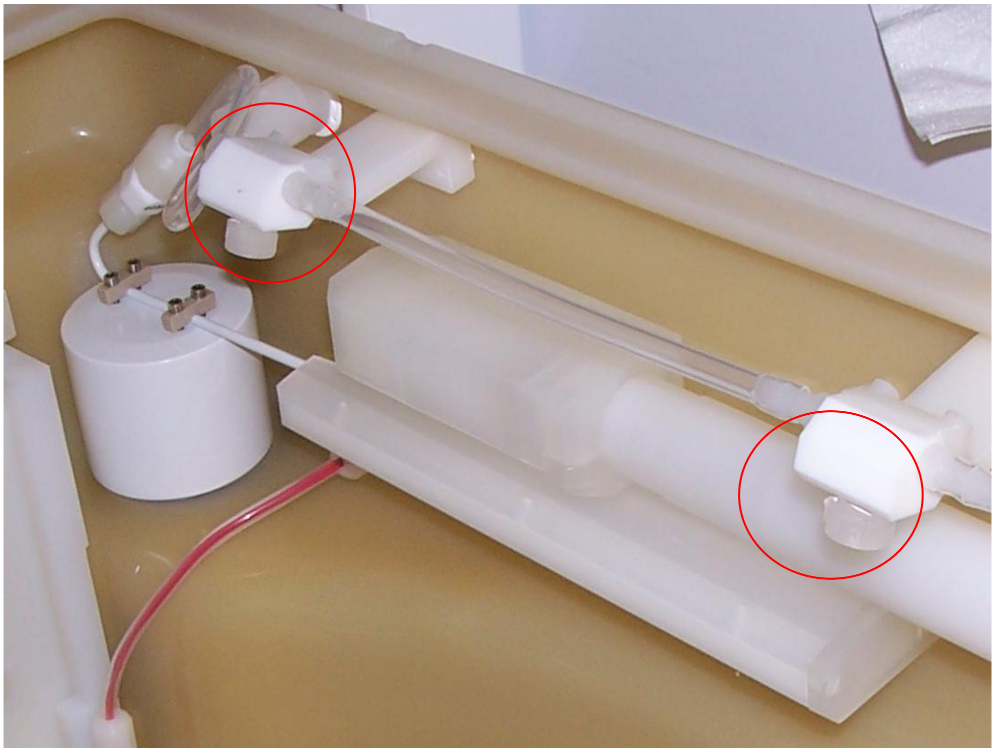


Figure 54 Micro-chamber Chamber Rinse nozzles on extensions

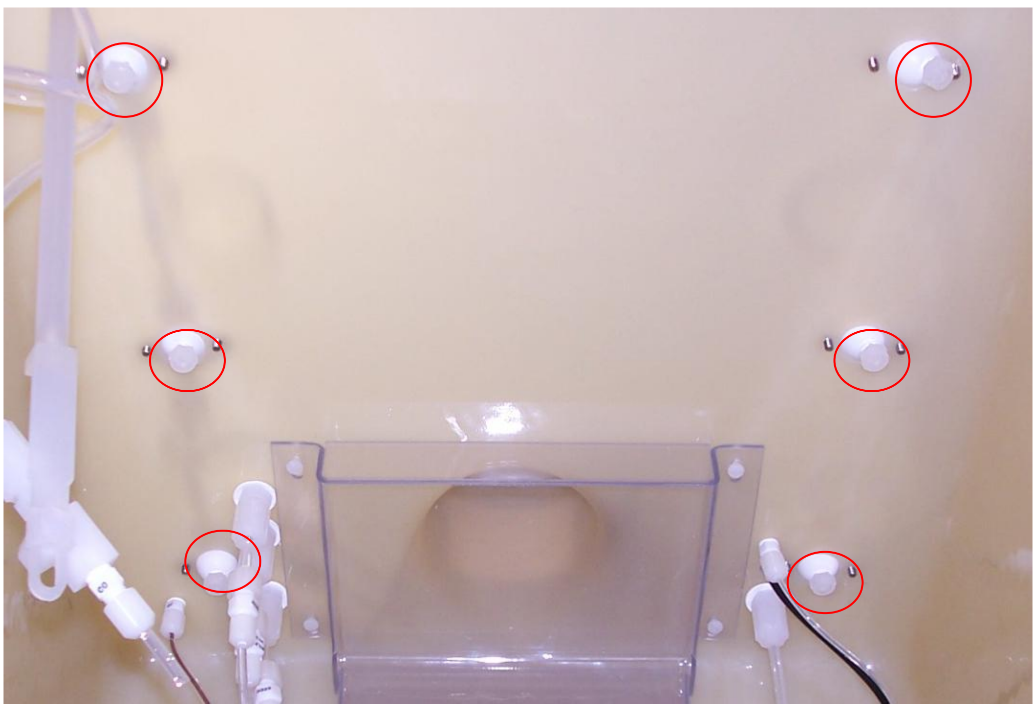
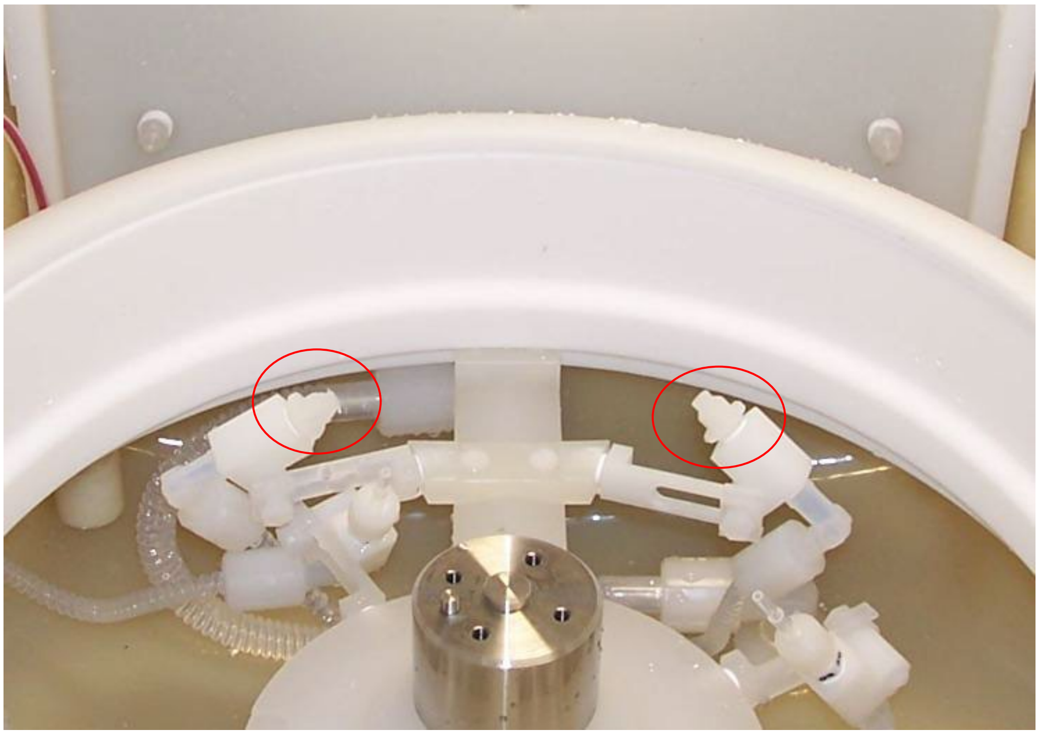


Figure 55 M3400 Series Chamber Rinse Nozzles in ceiling of chamber

There are some Spin Chuck designs which block full Chamber Rinse spray coverage. In these situations there may be additional spray nozzles mounted below the Spin Chuck to allow Chamber Rinse coverage of the back side of the Spin Chuck and shielded Chamber areas.



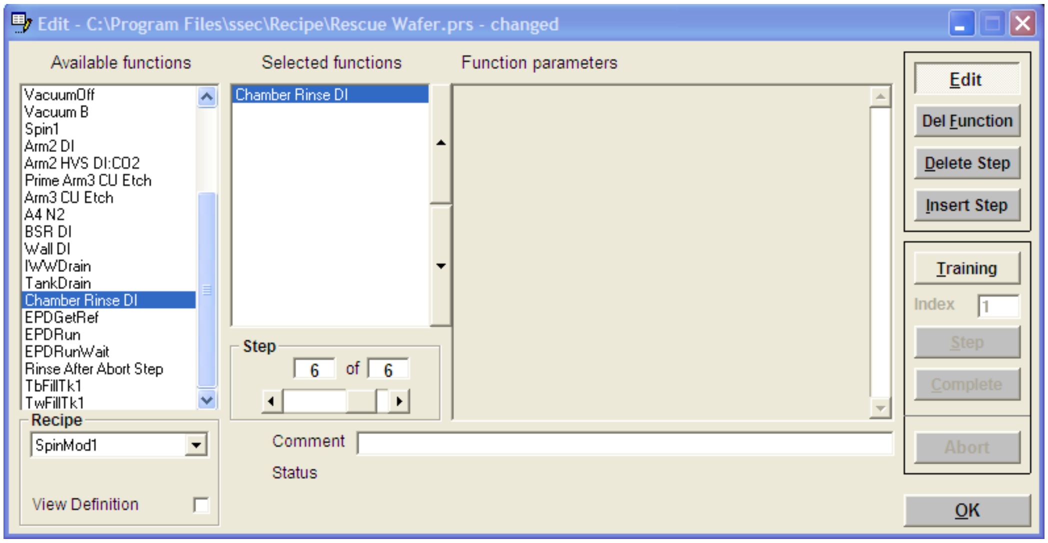
Chamber Rinsing chemical can consist of plain DIW or a Dispense Tank supplied solvent (like IPA or Acetone). Etch and Develop processes typically use DIW, Solvent Strip and Liftoff IPA, and Spin Coaters Acetone. Ideally the Chamber Rinse process should run long enough to thoroughly wash/rinse the Chamber Walls, Dispense Arms, and Spin Chucks of any residual process chemical or particles. Chamber Rinsing is user selectable as an “optional” or “automatic” function and can be triggered to run in a variety of ways. However, the user/operator must fully understand that limitations in the Tool design may not allow the Chamber Rinse function to be operated under certain conditions. Some of the factors which may limit Chamber Rinsing include chemical supply or chemical waste drain recovery tank capacities. In these cases it may necessary to include programming steps that would assure adequate rinse chemical supply and rinse chemical drain capacities. There are also instances where Chamber Rinsing would leave the Chamber in a “Wet” condition. Chemical or DIW residue from the rinsing process could compromise the succeeding process recipe. In these cases “Automated” Chamber Rinsing may not be suitable and may require manual activation as part of a Preventive Maintenance schedule, allowing sufficient time for the rinsing agent to dry/evaporate before continued production.

This Page Left Intentionally Blank.

Programming

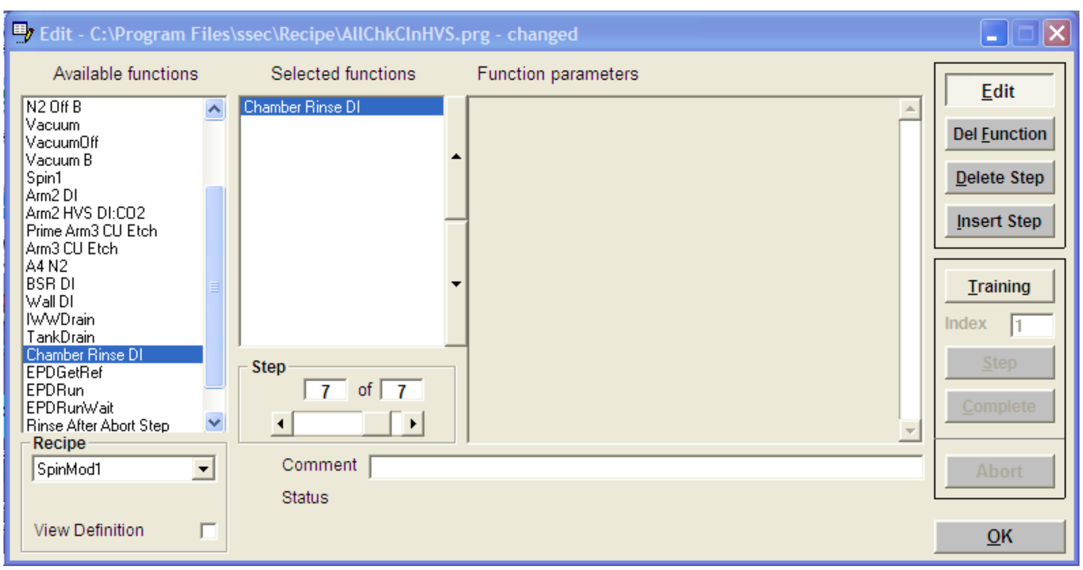
As mentioned earlier, Chamber Rinsing can be triggered to run (rinse) in several ways:

1. As part of a “Process” Recipe step.



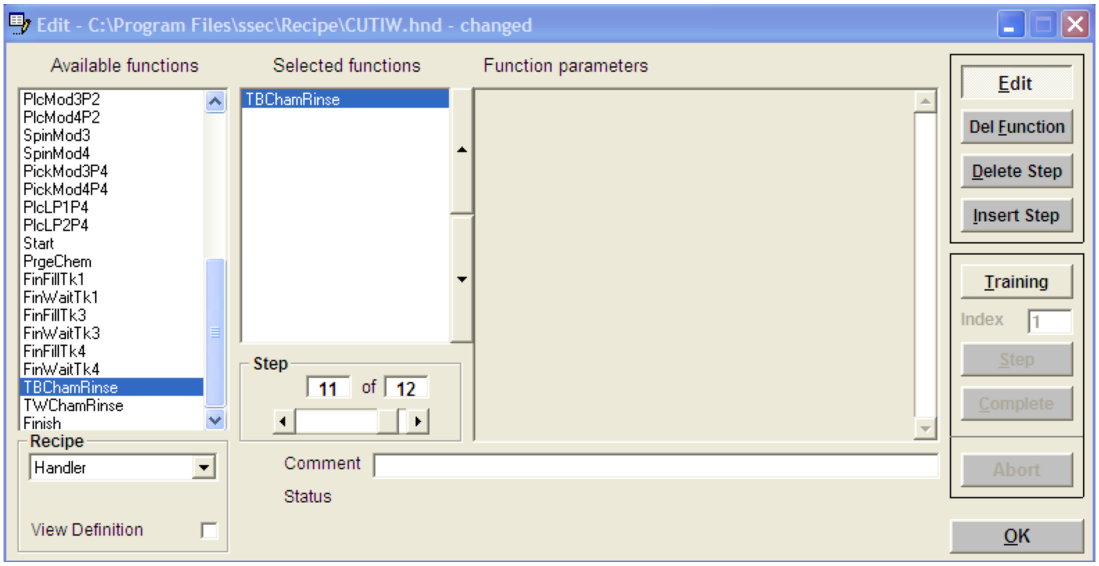
The operator would include the “Chamber Rinse” “Function” in one or more steps of a “Process Recipe” teach. Each wafer (in a cassette of wafers) would be subject to the Chamber Rinse. In other words, every wafer would be sprayed with chemical or DIW by the Chamber Rinse dispense.

2. As part of a “Purge” Recipe step.



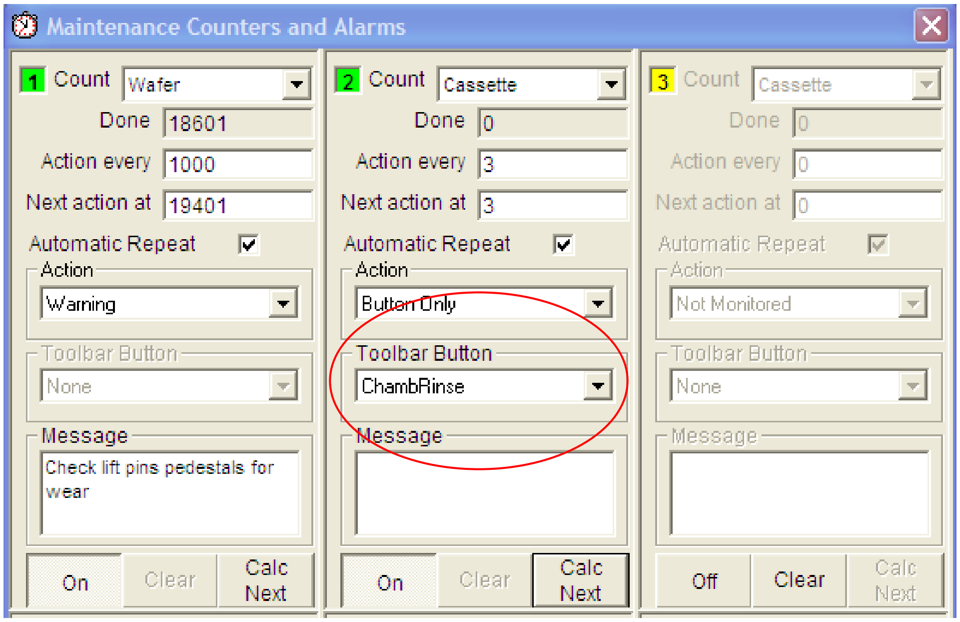
The operator would include the "Chamber Rinse" "Function" in one or more steps of a "Purge Recipe" teach. In most cases there are no wafers in the Process Chamber when Chamber Rinse occurs as part of a "Purge" recipe step. Purging does not occur when a Tool is actively running a normal "Process" recipe. Auto Purge is a requirement when DIW is used for Chamber Rinsing or bacteria growth will occur in the Chamber Rinse DIW plumbing lines.

3. As part of a "Handler" Recipe step.



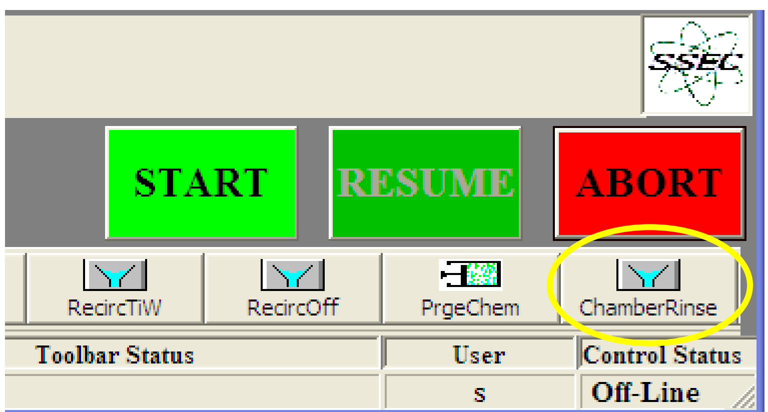
In this case the operator would include a "Chamber Rinse" "Tool Bar Button" step at the beginning or ending step of a Handler recipe. The Chamber Rinse would only occur ONE TIME either at the end of, or at the beginning of a cassette of wafers, unlike the example above where it occurs for each wafer. A preprogrammed "Chamber Rinse" Toolbar Button would have to exist in order to be used with the Handler recipe. In most cases there are no wafers in the Process Chamber when Chamber Rinse occurs as part of a "Handler" recipe "Tool Bar Button" step.

4. As part of "Maintenance Counter and Alarms".



The operator would include the "Chamber Rinse" "Tool Bar Button" option in one or more counter "Action" Pull-down Menu choices. In most cases there are no wafers in the Process Chamber when Chamber Rinse occurs as part of a "Maintenance Counter and Alarms" "Action" selections.

5. When a pre-configured "Chamber Rinse" Tool bar Button is manually actuated.



Tool Bar Button can be activated in several ways some of which have been described above. Manual Tool Bar Button actuation cannot occur when the Tool is actively running a Process recipe. Wafers may or may not be present in the Process Chamber when a Manual Tool Bar Button request (actuation) is made. Damage to production wafers can occur with some devices if the Chamber Rinse function occurs while a wafer is present in the Process Chamber.

This Page Left Intentionally Blank.

N_2 Heaters

Purpose

N_2 is a very dry gas that is used to dry wafers (much like the air blower in a car wash) before removing them from the Chamber. However, when N_2 is sprayed through a nozzle, adiabatic expansion (absence of heat transfer) cools the gas abruptly (Figure 56).

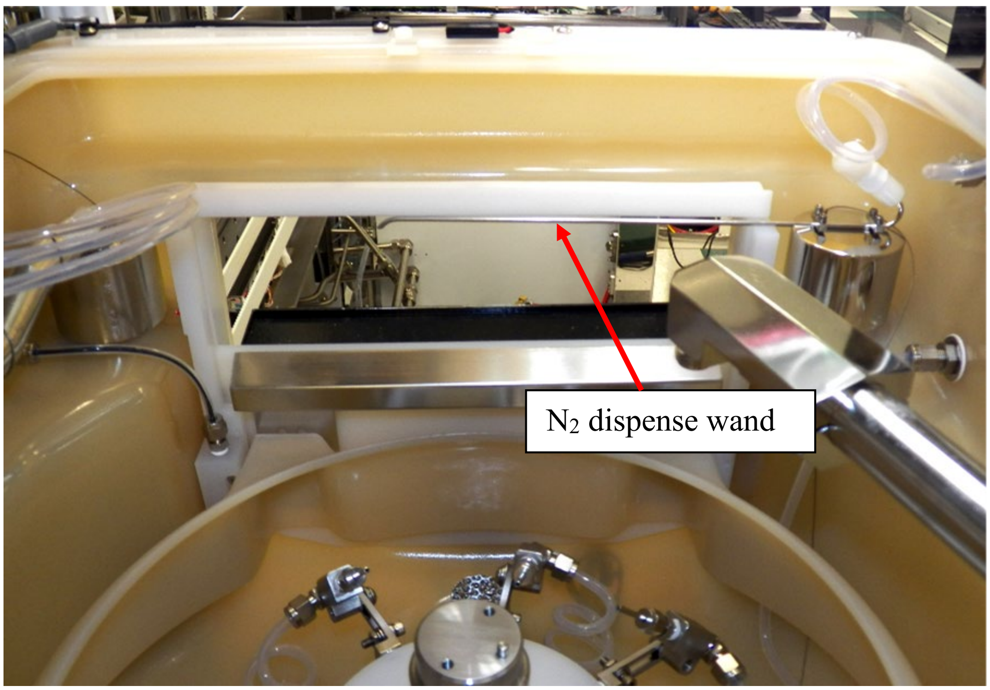


Figure 56 N_2 dispense wand

The relative difference in temperature, between the process in the Chamber and the cooled N_2, causes water vapor in the Chamber to condense on the dispense wand, and then to drip on the drying wafers. Heating the N_2 before it enters the Chamber prevents condensation from forming. Heating the N_2 also allows it to absorb more moisture, thus drying the wafers faster.

Discussion

Only one N_2 heater is used per chamber, but multiple N_2 heaters may be used in a single Tool.

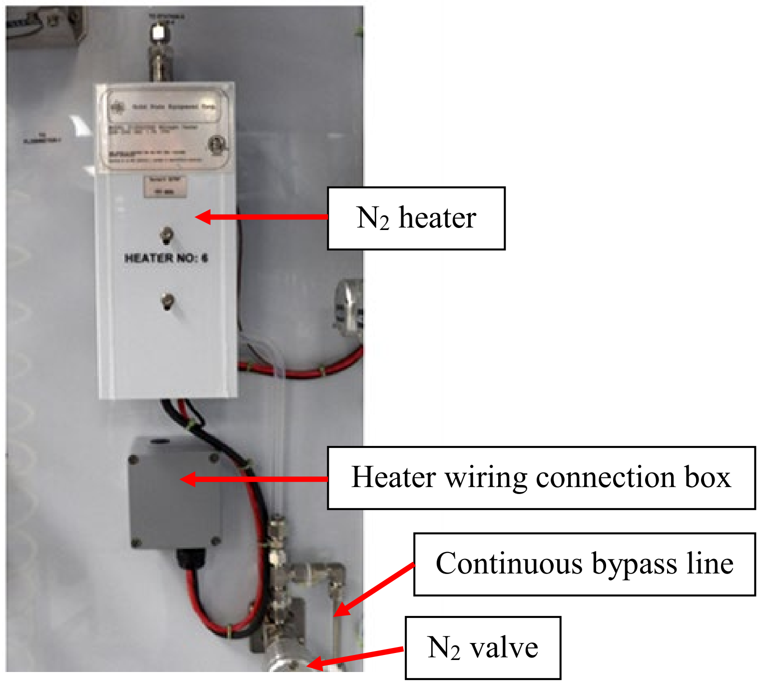


Figure 57 N_2 heater with the protective cover

The continuous bypass line (Figure 57) allows at least a minimum of N_2 (~70ml/min @ 60 psi) into the heater if there is a problem with the N_2 valve.

Regulator knob settings

On the regulator panel (Figure 58), there is also a knob that is used to adjust N_2 pressure to the heater on its way to the dispense Arm.

Figure 58 Regulator panel showing a *Heater N2* knob (may also be labeled *Dispense N2*)

Pneumatic pressure should be set as low as possible, while still achieving dry wafers at an acceptable output rate. A setting as low as 5 psi is feasible, with a maximum of 60 psi.

Decrease the pressure if particle counts are increasing, as a higher pressure can stir up particles within the Chamber.

Increase the pressure if particle counts are not a consideration for the process, while increased wafer throughput (from faster drying times) would be beneficial.

Related N_2 Heater Discussion

For a discussion of heater settings terminology and generic diagnostic Software Windows, see *Heater Controller Module 1000854* in Section 4 of the Safety & Maintenance Manual.

For a *Heaters* configuration *Window* and a description of settings and errors, refer to *Heaters* in Section 5 in this (Operations) manual.

For the *Heater 1000854* diagnostics Window, refer to *DSP Diagnostic* in Section 6 in this manual.

N_2 Heater Properties Window

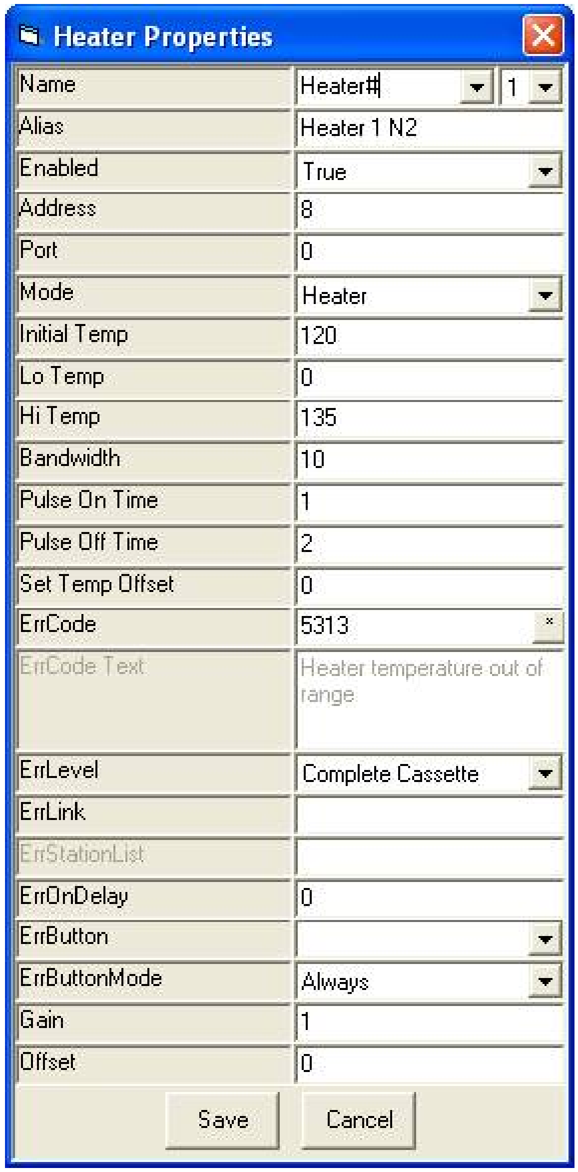
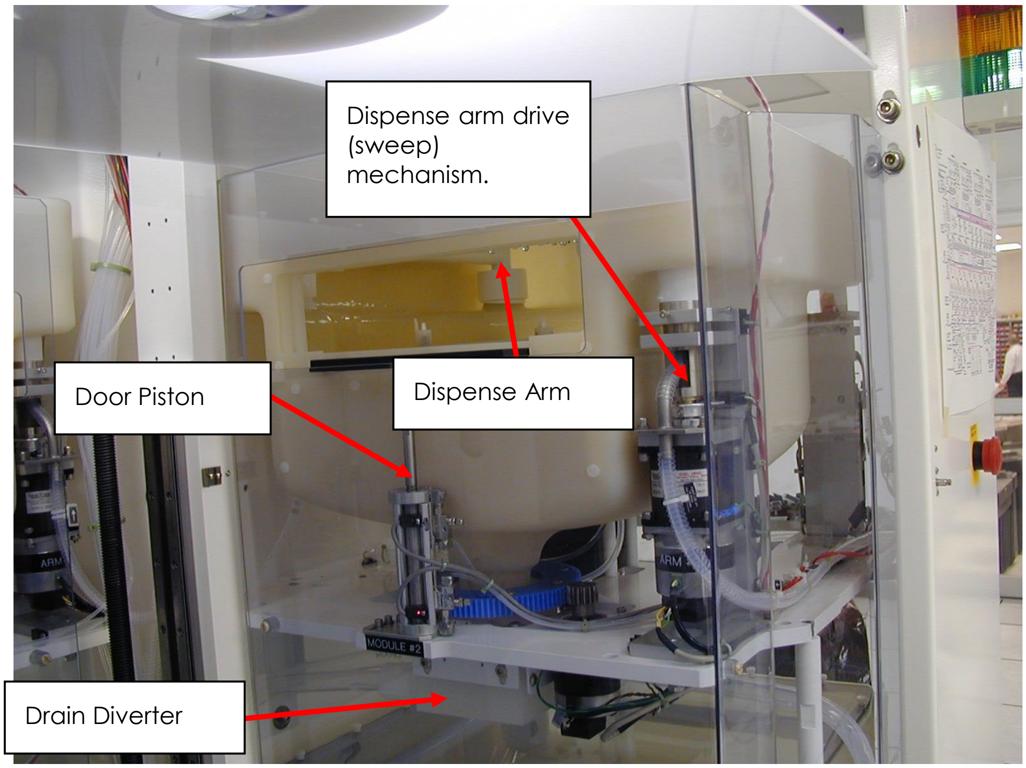


Figure 59 Typical heater parameters for an N_2 drying Arm

The values in EEPROM are calibrated in the factory using special calibration equipment and should NOT be altered under any circumstances.

Etch Station-SRD/Module/Chamber

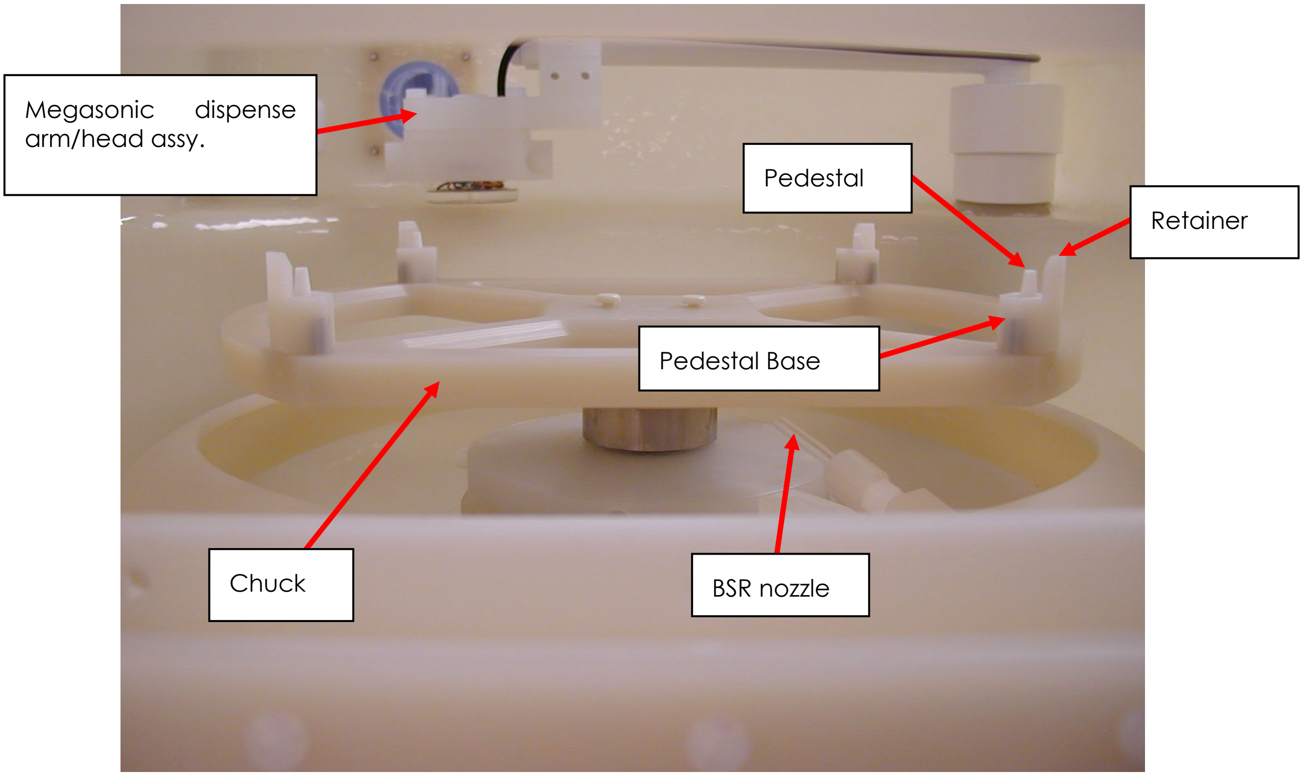
Each Etch-SRD module consists of an enclosure "chamber" with up to three motorized dispense Arms/nozzles (Fresh HF, Used HF, DI Water, or Megasonic).



Each of the motorized dispense Arms can be controlled or programmed individually to follow a recipe consisting of dispense time, flow rate, and sweep profile/position. There is also one fixed dispense for back side rinsing with DI water. The BSR dispense can be utilized in its own individual dispense step or in conjunction with the motorized Arm dispenses.

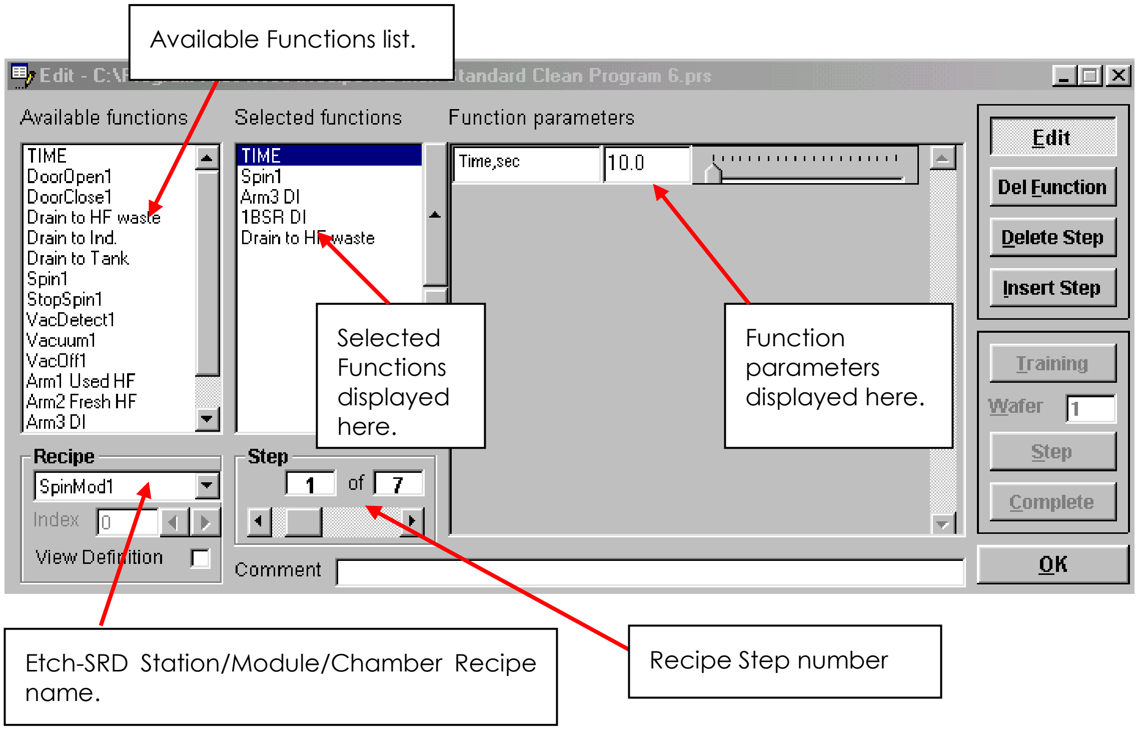
The Chamber is accessed through an air actuated door (cylinder drive). The Etch chamber drain can be controlled/selected by using a motorized rotary valve, thus allowing different disposal/recycling schemes.

Wafers are delivered through the Chamber door opening by a robotic handling system. Wafers are delivered to and held on a fixture called a "Chuck". The Chuck consists of four horizontal posts called "pedestals" with a vertical retainer called a "pedestal base".



Each pedestal contains a vacuum port which is used to sense the proper positioning of the wafer by the handler. An error is generated if one or multiple pedestals are uncovered by the wafer before processing begins. The Chuck is rotated at its base with a AC servo motor (spin motor). Spin speed and duration are programmable parameters.

Teaching and editing a process recipe using the SSEC process editor is a relatively straight forward process. The teach process involves picking specific tasks ("available functions") from a Pull-down Menu.



These tasks become part of a "Selected function" list, which is a list of functions/actions that will happen together in a particular process step. In the example above, we will use Arm 3 DI water, while we dispense DI Water from the BSR (back side rinse), with the Drain Diverter indexed to HF waste, for a duration of 10 seconds. Only the highlighted "Selected function" (in blue) will display "Function parameters" in the "Function parameters" Window.

In the example above, "Time" is highlighted, so only the time parameters are displayed. A complete process program is built by adding steps ("Insert step") and then adding the appropriate available functions to the blank "Selected functions" Window. Editing a process consists of deleting steps, inserting steps, adding available functions to an existing step, or deleting selected functions from a process step.

This Page Left Intentionally Blank.

Recirculator Cooling Fluid Acid Migration

On Tools with heat exchangers that use certain acids, the acid can permeate the Teflon tubing from the chemistry dispense lines into the cooling fluid. Nitric acid (HNO_3), Hydrochloric acid (HCl) or acid mixtures that contain either of those are prone to this permeation. After several days the pH of the cooling fluid in the recirculator can reach an acidic pH. To alleviate this condition the cooling fluid paths have an adjustable needle valve that is opened slightly to bleed off some of the fluid so it can be replaced by the recirculator's autofill capability.

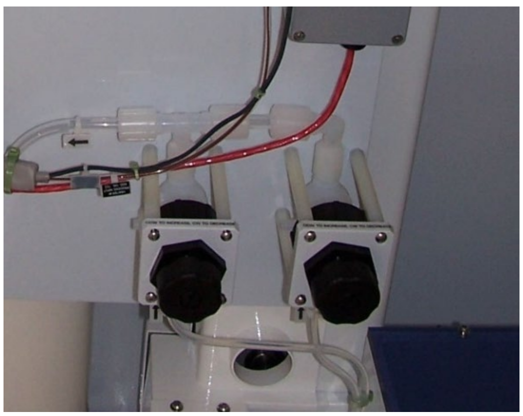
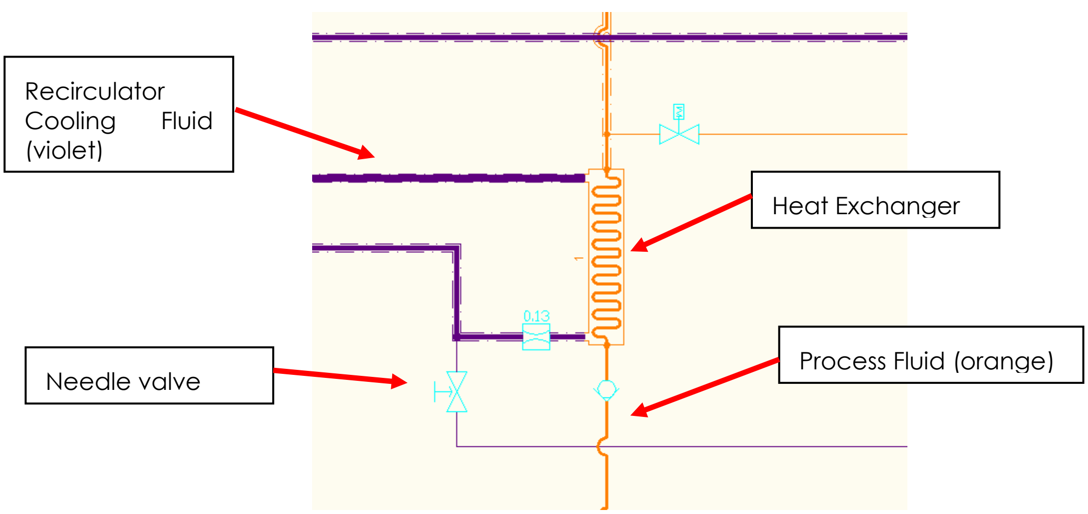


Figure 60 Photo of needle valves



Plumbing Diagram section showing typical Heat Exchanger plumbing

This Page Left Intentionally Blank.

DI-CO_2 Tank I/O Control

This document describes how to configure the Software and Tank I/O module to control a DI:CO_2 tank to maintain a set resistivity. The setup requires PE version **7.55.21** or later and the Tank I/O module requires firmware version **T262** or later.

There are two types of tanks used to maintain resistivity–the stainless steel, and the PFA tank. Configuration is identical in the Software for both types. The hardware and physical differences are discussed in Section 4 of the Safety & Maintenance Manual.

Software Setup

The Toolbar recipes for filling (i.e., "Fill Tk1") and maintaining resistivity level (i.e., "Tk1 PSI") are no longer used and **must** be removed from all definition files. The same is true of any button links to "Empty", "Not Full", and "Resistivity out of range" conditions.

A single Tank I/O Module can be used to control, at most, two DI-CO_2 tanks, and can only be configured as using Tank Index "0" and/or Tank Index "1".

Configure Tank I/O Module on DSP Diagnostics Window

Tank I/O Tab

The DI-CO_2 tank MUST be configured as Tank Index 0 or 1 (Figure 61).

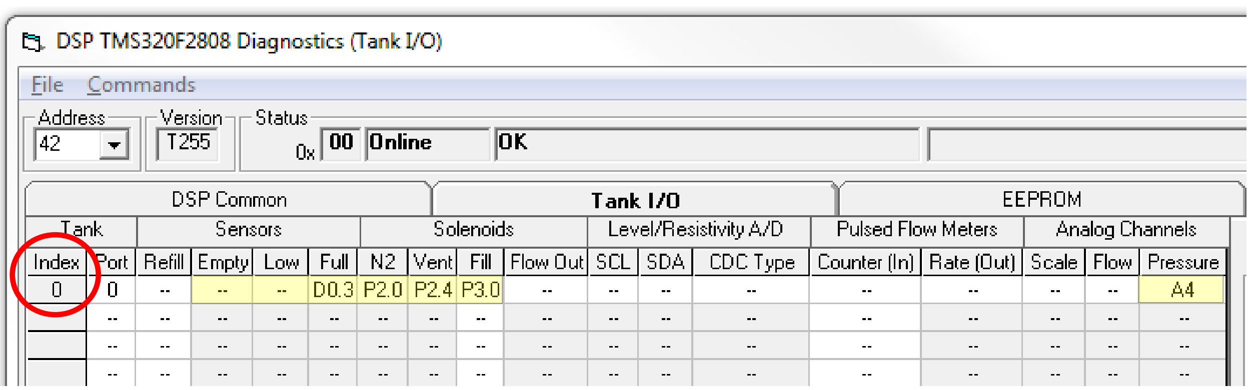


Figure 61 DSP Diagnostics Window

Sensors

Empty Sensor (optional)–Typically, there is no Empty sensor on the current design of DI-CO_2 tanks. However, if one exists, it should be configured here. In the example above, it is disabled.

Low Sensor (optional)–Typically, there is no Low sensor on the current design of DI-CO_2 tanks. However, if one exists, it should be configured here. In the example above, it is disabled.

Full Sensor (required)–This must be set to the port and bit of the Full sensor in the tank.

If a Low sensor is present, the tank will start filling when the Low sensor is not satisfied and stop filling after the Full sensor is satisfied. If there is no Low sensor, but an Empty sensor is defined, the tank will start filling when the Empty sensor is not satisfied, and stop filling when the Full sensor is satisfied. If no empty or Low sensor is present, the tank will fill when the Full sensor is not satisfied, and stop filling when it is satisfied.

Currently the only configuration that exists for new systems is a single Full sensor, which is either a Float switch for the stainless tank, or a Fluid Present switch for the PFA tank.

Solenoids

N2–Set to port and bit of the N_2 valve.

Vent–Set to port and bit of the Vent valve.

Fill–Set to port and bit of the DI Fill valve.

All of the above MUST be configured

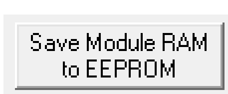
Solenoids			
N2	Vent	Fill	Flow Out
P2.0	P2.4	P3.0	--

Analog Channels

Pressure–Set to the pressure transducer ADC port

After the Tank is set up, click the “Send To Module RAM” button

Click “Save Module RAM to EEPROM”.



EEPROM Tab

Click on the EEPROM tab of the DSP Diagnostics screen. The following values must be configured.

DI:CO2 Sensor Polarity	00FF
DI:CO2 Tk1 CO2	2.2
DI:CO2 Tk1 Resist Valve	Disabled
DI:CO2 Tk1 Resist ADC	10
DI:CO2 Tk1 Filter Constant	14
DI:CO2 Tk2 CO2	Disabled
DI:CO2 Tk2 Resist Valve	Disabled
DI:CO2 Tk2 Resist ADC	16
DI:CO2 Sensor Polarity	00FF

DI:CO_2 Sensor Polarity–Polarity setting hexadecimal value for level sensors in the tank. Set to either 0000 or 00FF to reverse polarity of the level sensors. For both the stainless and PFA tanks currently being used, the default setting should be 00FF. Bits are set to "1" to reverse the polarity of the sensors as shown below:

Bits 8-15 not used

Bit 7 Tank2 Full Sensor Polarity

Bit 6 Tank2 Low Sensor Polarity

Bit 5 Tank2 Empty Sensor Polarity

Bit 4 not used

Bit 3 Tank1 Full Sensor Polarity

Bit 2 Tank1 Low Sensor Polarity

Bit 1 Tank1 Empty Sensor Polarity

Bit 0 not used

DI:CO2 Tk1 CO2	2.2
DI:CO2 Tk1 Resist Valve	Disabled
DI:CO2 Tk1 Resist ADC	10
DI:CO2 Tk1 Filter Constant	14

DI: CO_2 Tk1 CO_2–Set to the port and bit of the CO_2 valve.

DI:CO_2 Tk1 Resist Valve–(Optional) Set to the port and bit of the valve that leads to the resistivity monitor if not already inside the tank.

- **Stainless tank**–The resistivity monitor is inside the tank; it is not used and should be "Disabled".
- **PFA tank**–Optionally, set to port and bit of valve to resistivity monitor. Testing has shown disabling this valve will result in tighter control of the resistivity in the tank due to shorter lag times, but could also result in excessive chemical waste when the tank remains pressurized for extended periods of time when not in use. **Recommended setting is "Disabled"**
- **Tank w/Recirculation pump**–If a recirculation pump is present, set to the port and bit of the valve that enables flow through the pump and the resistivity monitor.
- If no pump or valve is present set to "Disabled."

DI:CO_2 Tk1 Resist ADC–Set to the ADC port of the Contact Resistivity Monitor. This will typically be either 10 or 11.

DI:CO2 Tk1 Filter Constant–Set to one of the following two values:

- **Stainless tank**–Set to **14**
- **PFA tank**–Set to **16**
- **Tank w/Recirculation pump**–Set to **14**

If a second DI:CO_2 tank is configured on Tank Index 1, configure the settings for Tank2.
After all settings are correct, click the "Save to EEPROM" button.

Click the "Reset/Restore EEPROM" button.

Configure an ADC to monitor Resistivity for each Tank

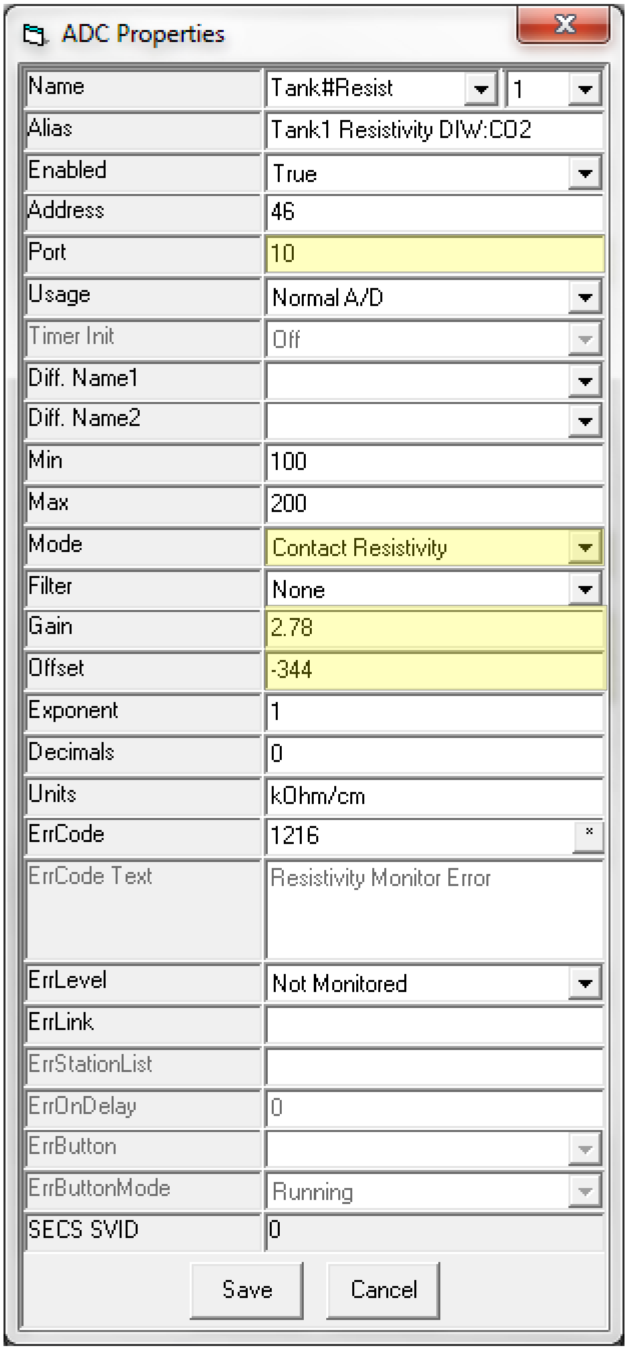


Figure 62 ADC Properties Window

Figure 62 shows the standard configuration for a contact resistivity monitor, used to monitor the resistivity in the tank.

Port = 10 or 11 and should match the value **DI:CO_2 Tk1 Resist ADC** or **DI:CO_2 Tk2 Resist ADC** from the EEPROM Window.

Mode = Contact Resistivity

Current Gain/Offset for new systems

PFA tank **Gain = 0.1218 Offset = -15**
Stainless tank **Gain = 2.78 Offset = -344**

NOTE: Above settings are generic calibrations that will provide accurate readings of resistivity. To achieve the maximum level of accuracy, request the document "DI-CO_2 Tank Resistivity Calibration Procedure.pdf" from VPSP Tech Support.

Configure a DAC to Set Resistivity for each Tank.

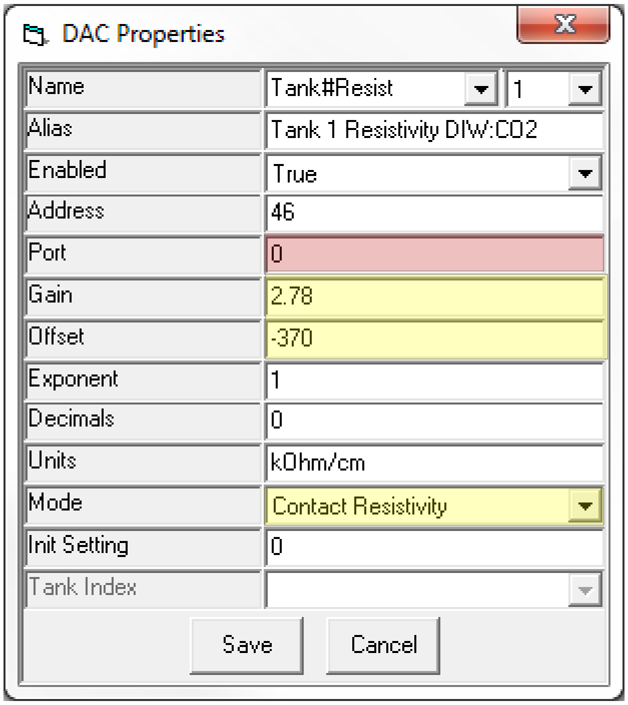


Figure 63 DAC Properties Window

Port = Tank Index (0 or 1 are valid)

NOTE: This is **not** the same as *ADC* port

PFA	**Gain = 0.1218**	**Offset = -15**
Stainless	**Gain = 2.78**	**Offset = -370**

NOTE: DAC Gain must always match ADC Gain. DAC Offset will typically be a larger negative number than ADC offset.

Mode = Contact Resistivity

Configure Solenoids

In addition to the standard N_2 and Vent valves, create a solenoid for CO_2 and, if necessary, the recirculation pump or resistivity valve for each tank. It is **VERY IMPORTANT** that the **Initial On property = False**.

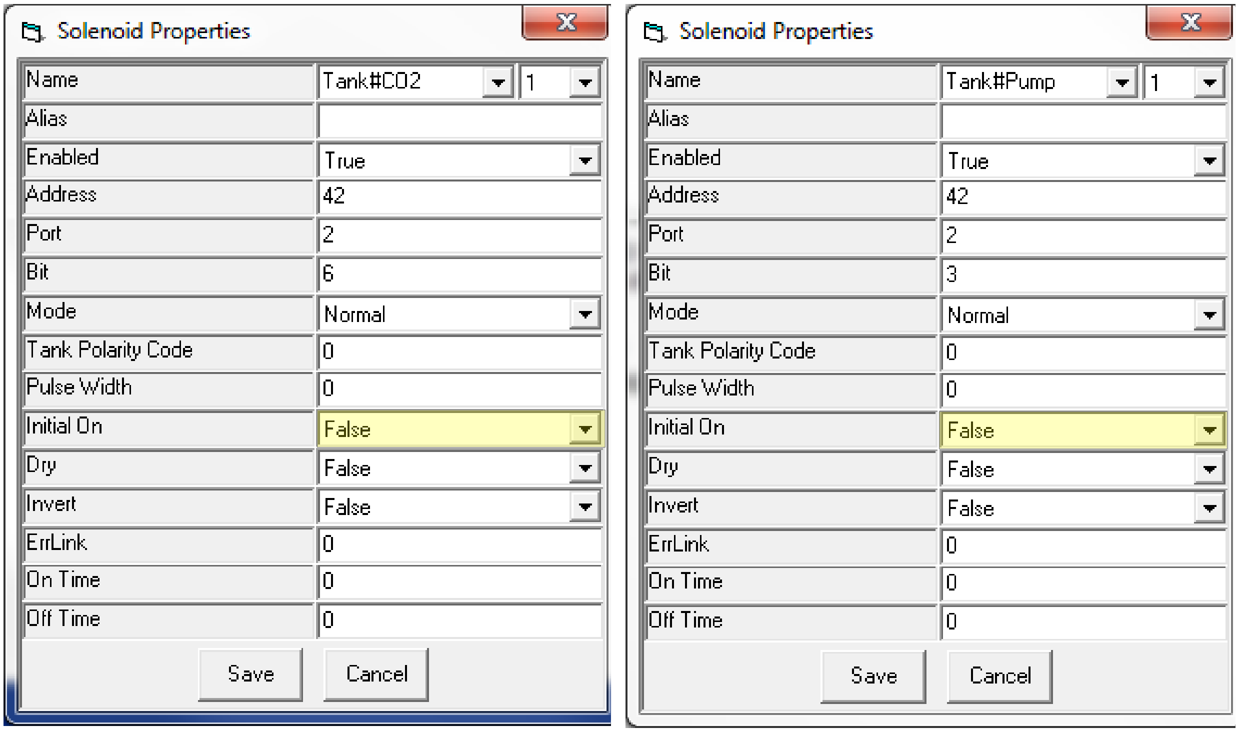


Figure 64 Solenoid Properties Windows

This Page Left Intentionally Blank.

Functionality

Once configured, the firmware will maintain the Resistivity, Tank Pressure, and fill level. The "Pressurize Tanks" button will put the tank into DI-CO_2 control mode, and the "Vent Tanks" button will take the tank out of DI-CO_2 control mode.

NOTE

The activation and deactivation of DI-CO_2 Tank control MUST be performed in the exact order as shown below. Specifically, the DI Fill must always be the last solenoid to turn ON and the first to turn OFF. Only after all other conditions have been met is it safe to turn on the DI Fill solenoid because all other conditions are required for the DI Fill to be configured for automatic shut off when the tank is full. If the DI Fill solenoid is turned on too soon, it will fill the tank beyond the Full sensor and overfill the tank.

DI-CO_2 tank control is enabled by performing the following **in this order**:

In the Process Setup Recipe: (Runs before the Pressurize Tanks Toolbar recipe)

1. Set the Pressure DAC to the desired Tank Pressure (non-zero)
2. Set the Resistivity DAC to the desired resistivity of the Tank (non-zero)

In the Pressurize Tanks Toolbar Recipe: (Runs after the Process Setup recipe)

1. Turn on the N_2 and Vent valves–Pressure regulation begins
2. Turn on the CO_2 valve–Resistivity regulation begins
3. Wait for the Tank pressure to be >= set pressure
4. Turn on the DI Fill valve–Auto Fill begins
5. If present, turn on the Recirculation Pump or Bleeder valve–Auto control of valve begins

In the Process Recipe: (Runs after Process Setup and Pressurize Tanks have both completed)

1. Run dispenses as needed

DI-CO_2 tank control is disabled by performing the following **in this order**:

In the Process Recipe Off-part

1. Turn off all dispenses

In the Vent Tanks Toolbar Recipe

1. Turn off Recirculation pump or Bleeder valve, if present
2. Turn off DI Fill valve
3. Turn off CO_2 valve
4. Turn off N_2 and Vent valves, the tank will de-pressurize

If a Drain Tank recipe is necessary, it should turn off all dispenses AND perform Steps 1-4 from the Vent Tanks Toolbar recipe above before draining the tank.

NOTE

It is very important that these steps be performed in the correct order in any recipe that needs to enable or disable DI-CO_2 tank control. Failure to start and stop in the correct order could result in overfilling, or over-pressurizing the tank.

Requirements:

1. N_2 and DI supply pressures must both be at least 10 PSI above the maximum set tank pressure.
2. CO_2 supply pressure must be at least 5 PSI above the N_2 set pressure (which is set in the process recipe setup section).
3. N_2 and Vent must use 0.030” restrictors.
4. CO_2 must use a 0.020” restrictor.
5. PFA tank resistivity monitor must use a 0.010” restrictor ***after*** the output of the monitor.
6. Set resistivity level should be in the range of 100-300 k Ω/cm.
7. Dispense rate of tank not to exceed 20 Liters/min.
8. CO_2 must enter tank from the correct input as shown in photos on the same side as the DI Fill input.

Definition file examples:

Toolbar.def

The following is an example of a Pressurize and Vent Tanks button recipe:

```
PresTanks         Tank1Vent  SolOn
PresTanks         Tank1N2    SolOn
PresTanks         Tank1CO2   SolOn
PresTanks         Tank1      ADCSetPoint                     #Tk1
PresTanks         Tank1      ADCWaitOver                     30
PresTanks         Tank1FillA SolOn
PresTanks         Tank1Drain SolOn
VentTanks         Tank1Drain SolOff
VentTanks         Tank1FillA SolOff
VentTanks         Tank1CO2   SolOff
VentTanks         Tank1Vent  SolOff
VentTanks         Tank1N2    SolOff
```

NOTE

#Tk1 is a global variable set in the setup recipe of the function.def, and is the set pressure for Tank.

NOTE

Tank1Drain in the example above is the name of the valve that drains through the resistivity monitor.

Function.def

The following is an example of a Tank Setup recipe:

```
Setup          #Tk1       VarSet          Tk1 SetPSI        20    0     55    1
Setup          Tank1      DACSet                            #Tk1
Setup          Tank1      ADCSetLow       Tk1 LowPSI        0     0     50    1
Setup          Tank1      ADCSetHigh      Tk1 Hi PSI        30    0     50    1
Setup          #Tk1R      VarSet          Tk1 Set Resist    250   200   300   1
Setup          Tank1ResistDACSet                            #Tk1R
Setup          Tank1ResistADCSetLow       Tk1 Low Resist    0     0     100   1
Setup          Tank1ResistADCSetHigh      Tk1 Hi  Resist    0     0     999   1
```

This Page Left Intentionally Blank.

Troubleshooting

This section discusses common problems that may occur and their remedies:

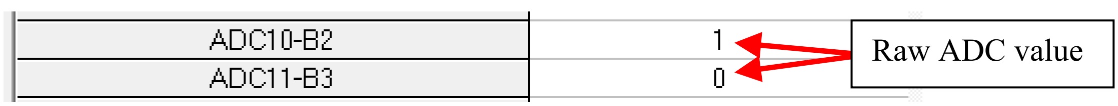
Resistivity ADC reads zero or 999 all the time

- A reading of zero means either the resistivity reading is below the calibrated range, or there is a short circuit.
- A reading of 999 means either the resistivity reading is above the calibrated range, or there is an open circuit.

If this is a stainless tank, be sure that is has been properly purged with DI for several hours or overnight in order to obtain a valid resistivity reading. This ensures that all contaminants are flushed out. Tanks that have not been properly purged will generally read extremely low resistivity levels. These levels are often outside of the calibrated range of the VPSP resistivity monitor and, therefore, will read as zero on the ADC screen. This is typical for a new tank that has not been properly purged.

If this is a stainless tank, confirm that the red wire connects to the probe and the black wire connects to the tank housing

For either tank type, open the DSP diagnostics screen and select the address of the Tank I/O module where the resistivity monitor is connected. Select the Variables tab. Note the value for ADC10-B2 or ADC11-B3, whichever ADC is connected to the resistivity monitor. This is the raw ADC value.



The resistivity monitor ADC is capable of displaying only values in the range of 0-999 k Ω/cm. If the raw value for ADC10-B2 or ADC11-B3 is not in the proper range, the display will read either 0 or 999. Depending on the calibrated gain and offset, the following approximate ranges will display a reading between 1and 998:

Stainless Tank 703-1827
PFA Tanks 42-4095

Values outside of this range indicate that the measured resistivity is outside of the displayable or calibrated range of the ADC. Values < 4095 but > max range value indicate possible contamination in the tank, resulting in low resistivity. Values > 0 and < min range value indicate potential bad connection resulting in very high resistivity. A value of "0" indicates an open circuit and a value of "4095" indicates a short circuit. Either of these two values indicates a potential wiring problem or problem with the Tank I/O module itself.

NOTE

The raw value is inversely proportional to the resistivity such that a higher raw value equates to a lower resistivity, and a lower raw value equates to a higher resistivity.

This Page Left Intentionally Blank.