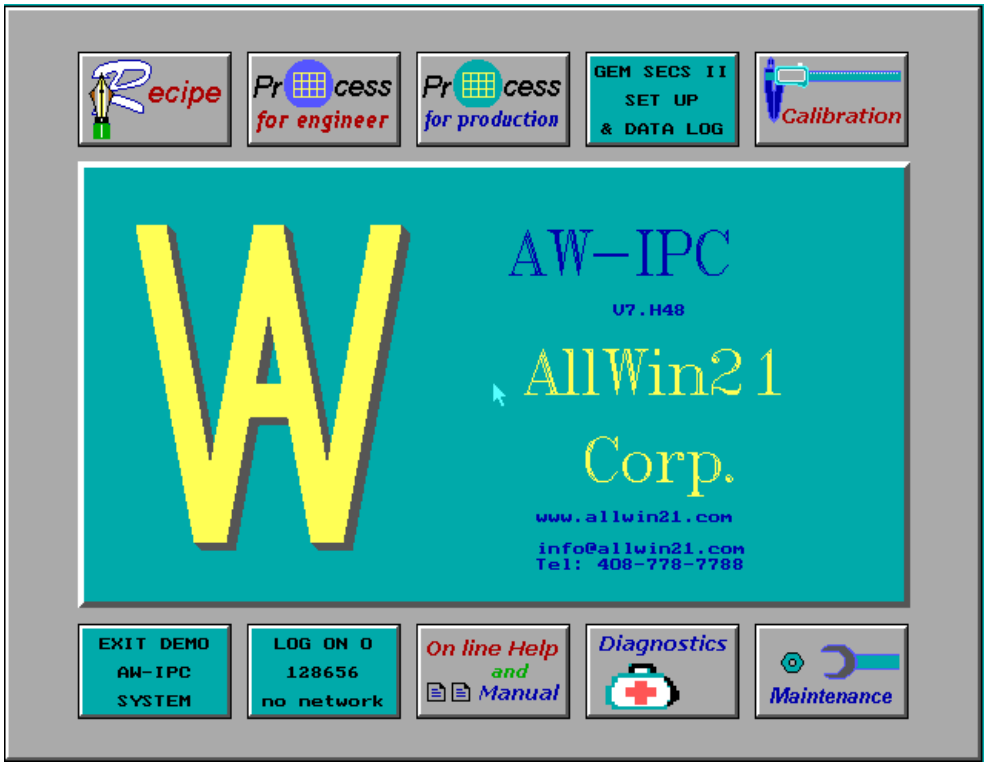
Allwin21 Corporation

Branson / IPC 3000
Plasma System
with
Allwin21 Upgrade Kit



Operations Manual

Allwin21 Corporation
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Morgan Hill CA 95037

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BRANSON / IPC 3000
PLASMA SYSTEM
WITH
ALLWIN21 UPGRADE KIT

AW-B3000
OPERATIONS MANUAL

Allwin21 Corporation
220 Cochrane Circle
Morgan Hill, California, 95037

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Written by: Rick Forney
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PREFACE

INTENDED AUDIENCE

This manual has been written for technicians, process development engineers and maintenance engineers working with the AW-B3000, a Branson/IPC 3000 Plasma System with the Allwin21 Upgrade Kit. It provides an overview of the system operation procedures. Please read this manual carefully before operating the Branson/IPC 3000 Plasma System with the Allwin21 Upgrade Kit.

DOCUMENT CONVENTIONS

FONT CONVENTIONS

The following font conventions are used in this manual.

Bold

Software screen selections are represented in **bold** type.

Italic

Screen names are shown in *italic* type.

First Letter Capitalized

Operating modes are shown in normal type with the first letter capitalized.

For example:

"Select **Recipe** from the *Main Menu* screen to enter the Recipe Programming mode."

TABLE OF CONTENTS

LIST OF FIGURES

1. INTRODUCTION

This manual describes the operation of the Allwin21 AW-B3000 control software on the Branson/IPC 3000 Plasma System. For a detailed description of the Branson/IPC 3000, please refer to the Instruction Manual for the Branson/IPC 3000 Plasma System.

1.1 SOFTWARE OVERVIEW

The AW-B3000 software is an advance control software for the Branson/IPC 3000 Plasma System. This document provides a general discussion of the function and calibration of the control software.

The AW-B3000 control software allows full control and diagnostics of the Branson/IPC system. It allows the creation of recipes for automated control of all aspects of the process. In addition, the operator has the ability to calibrate the system from within the software, and save all process data for later review.

The control software uses a set of operating instructions known as recipes to automatically control the Allwin21 system. These recipes are created by the Process Engineer to monitor and control the parameters of the processing cycle. The Operator then uses the software to select and run the process parameters (steady state temperature, process time, ramp rates, etc.). The process periods are typically 1-600 seconds in duration, although periods of up to 9999 seconds can be programmed.

The AW-B3000 control software is also used to create, delete, copy, modify and store the recipes and to execute system diagnostics.

There is an 80GB hard drive in the computer, so an almost unlimited number of recipes and process data can be stored. The process data can latter be retrieved and taken to a desktop computer for viewing and importing into reports.

1.2 FEATURES

- Closed-loop temperature control with pyrometer or thermocouple temperature sensing.
- Precise time-temperature profiles tailored to suit specific process requirements.
- Fast heating and cooling rates unobtainable in conventional technologies.
- Consistent wafer-to-wafer process cycle repeatability.
- Elimination of external contamination.
- Small footprint and energy efficiency.
- The watchdog timer shuts down the lamps to prevent run-away heating of the wafer.

2. SAFETY

2.1 OVERVIEW

This section provides information intended to prevent damage to the AW-B3000 system and injury to operation and maintenance personnel. All hazards are not covered, only those most prevalent and serious. Your full understanding of the capabilities and limitations of this equipment is necessary for safe and efficient operation.

Please read and refer to the Branson/IPC 3000 Instruction Manual for all safety precautions. What is mentioned here is only some of what should be known.

☠ WARNING

Only ALLWIN21 or qualified personnel should install, start up, operate and/or repair the AW-B3000 system. Damage to the system or injury to personnel could result if the preceding actions are carried out by unqualified personnel.

Prior to applying power or starting up the AW-B3000 system, follow these safety precautions:

- Check all utilities for proper connections. Connect only those gases specified for use in the system.
- Make sure the cabinet covers are on and the doors are closed.
- Check the scrubber exhaust to make sure it is properly connected to the facility scrubber. Ensure the facility scrubber is operating properly. Check the vacuum outlet for any restrictions.

2.2 NOTES, CAUTIONS AND WARNINGS

When operating and maintaining the AW-B3000 system, the following safety procedures and precautions must be followed to avoid certain hazards. Observe all warnings and cautions. Their purpose is to protect personnel from injury and long term health hazards and to protect the machine from damage.

Pay special attention to notes, cautions and warnings located in appropriate areas in this manual.

NOTE

Notes provide additional important information which requires special attention.

CAUTION

Cautions alert you to avoid system damage.

WARNING

Warnings are given for personnel safety to prevent bodily harm.

3. BASIC OPERATION

3.1 OVERVIEW

The AW-B3000 system is a Plasma System. The process periods are typically 1-600 seconds in duration, although periods of up to 9999 seconds can be selected.

> **NOTE**
>
> **Process periods longer than 600 seconds in duration are normally used only for maintenance testing purposes.**

The AW-B3000 system is fully controlled by a computer running the AW-B3000 GUI control software on the front touch screen display.

The AW-B3000 control software uses a set of operating instructions known as recipes to control the AW-B3000 system. These recipes are created by the Process Engineer to monitor and control the parameters of the processing cycle. The Operator then uses the software to select and run these recipes.

The AW-B3000 software program is also used to create, delete, copy, modify and store the recipes and to execute system diagnostics.

To get an understanding of how to operate the AW-B3000 system using the Allwin21 AW-B3000 control software, you must first be familiar with the use of the screens to execute and interrupt a cycle in Run mode. This section provides a discussion of the operation of the AW-B3000 software. Calibration and diagnostics of the AW-B3000 software are discussed in the maintenance section.

3.2 SOFTWARE FEATURES

The system is controlled by menu commands from the control software. The AW-B3000 software allows a great deal of flexibility and control of the AW-B3000 machine.

The AW-B3000 control software features the following:

- Automated calibration of all subsystems from within the control software. This allows faster, easier calibration, leading to enhanced process results.
- Closed-loop temperature control with thermocouple temperature sensing.
- Recipe creation. It features a recipe editor to create and edit recipes to fully automate the processing of wafers inside the chambers.
- Validation of the recipe so improper control sequences will be revealed.
- Storage of multiple recipes, process data and calibration files so that process and calibration results can be maintained and compared over time.
- Passwords provide security for the system, recipe editing, diagnostics, calibration and setup functions.
- Simple and easy to use menu screens which allow a process cycle to be easily defined and executed.
- Troubleshooting features which allow engineers and service personnel to activate individual subassemblies and functions.
- The control software runs on any Pentium class PC computer with a parallel (printer) port. The computer interfaces to the AW-B3000 system with only 1 cable, the control interface cable.
- The interface board inside the machine that translates the computer commands to control the machine has a watchdog timer. If this board looses communication with the control software, it will shut down all processes and halt the system until communication is restored.

3.3 USING THE MENU SCREENS

After a successful power-up, the controller displays the *Main Menu* screen as shown below. From this screen, any mode of operation can be accessed by using the mouse to click on the desired button.

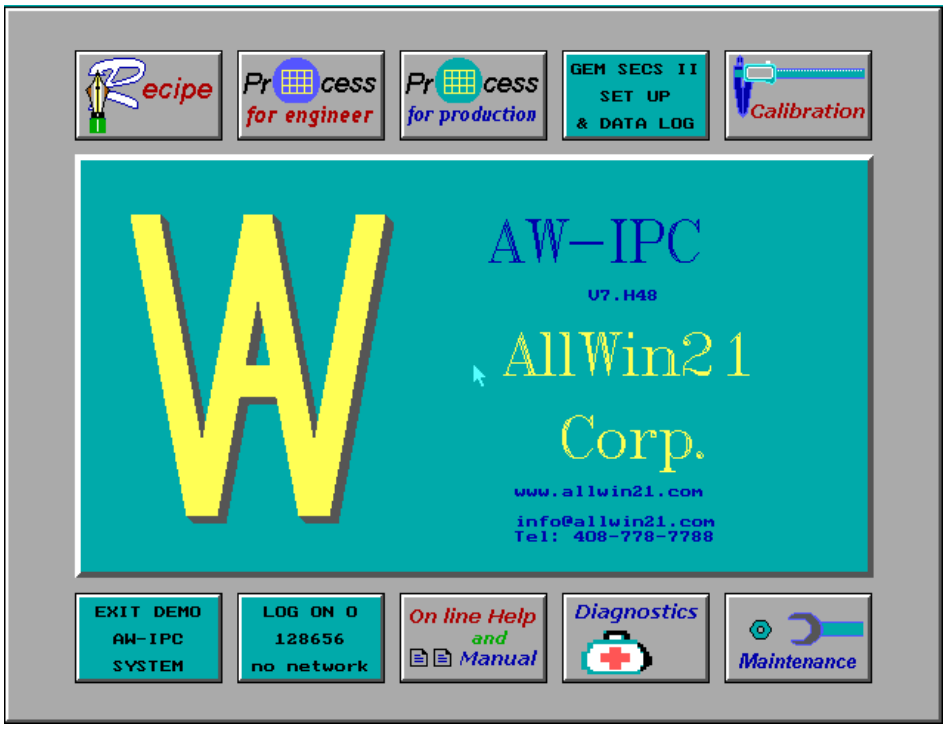

Figure 3-1: Main Menu

This section is a general description of how to use the controls of the AW-B3000 Control Software. It will cover the use of buttons, editable fields, data display fields and filename lists.

Buttons

Buttons are rectangular boxes with a phrase on them describing their function. They may also have a value on them describing its current state. The color of a button is also important. It also defines the current state of the function of the button. The color, however, is defined by the function of the button. Buttons that are gray in color are inactive and cannot be selected.

Clicking on a button changes its state. Thus, the button may change color and the value describing the current state will change.

Editable Fields

Editable Fields are data entry fields where the operator can enter information into the software.

To edit the field, the operator must first select it by clicking on it. This enables the ability to edit the field. The operator now types in the desired information and presses ENTER when finished. The information now is displayed in the field, replacing what was there previously.

Data Display Fields

Data Display Fields are very similar to Editable Fields, except the operator cannot change the information being displayed in them. They look just like Editable Fields, except they are like a pushbutton that is always down. Also, when the operator clicks on them, nothing happens.

Filename Lists

Filename Lists display a list of filenames or directories pertaining to the type of information the file contains in a List Box. For example, filenames of files which contain recipes are only displayed in Recipe Filename Lists.

The number of filenames the Filename List can display is limited to its size on the screen. However, there may be more filenames for that type of list than can be displayed at one time. The operator can scroll through the list of filenames by using the slider to the right of the list, or using the up and down arrow keys on the keyboard.

A selected filename is highlighted in red. It may be selected by clicking on the name. It is also displayed in the field above the list of filenames. The operator can also select a filename by manually typing in the filename into the field above the list (refer to Editable Fields above).

A filename can also be deleted. The operator would first select the filename to be deleted. Then the operator would either click on the red box with an 'X' in it (located in the upper right corner of the List Box) or press the **Delete** key on the keyboard.

NOTE

Deleting a filename will permanently remove the filename and all information it contains.

Exit a Screen

Exit the screen by clicking on the 

button or pressing **ESC** on the keyboard.

Many screens allow the user to change the values for parameters, such as the *Recipe Editor* and the *System Setup*. The user needs to save the information before exiting the screen. However, if the user didn't save the information before exiting the screen, a dialog box will appear asking if the information should be saved.

Click **Yes**	(or press **Y** on the keyboard) to save the information.
Click **No**	(or press **N** on the keyboard) to discard all changes since the last save.
Click **Cancel**	(or press **ESC** on the keyboard) to go back to the editing screen and continue editing. It does not save any changes.

3.4 START A PROCESS

The controller uses a set of operating instructions known as recipes to control processing wafers in the system process chamber. These recipes are created by the Process Engineer to control the parameters of the processing cycle. The operator then uses the menu-driven control software to select and run the sequence.

The operator can Load and Run a Recipe to process a wafer from the *Process for Production* screen as shown below or the *Process for Engineer* screen (Figure 3-3), whichever security level access the operator has. The *Process for Production* screen is intended for daily operation of the AW-B3000 system. This mode is available to all users.

This section will explain step-by-step how to load and run a recipe. This procedure is the same for the *Process for Production* screen and the *Process for Engineer* screen. These screens can be accessed by clicking on the appropriate button

from the *Main Menu*, 

or 

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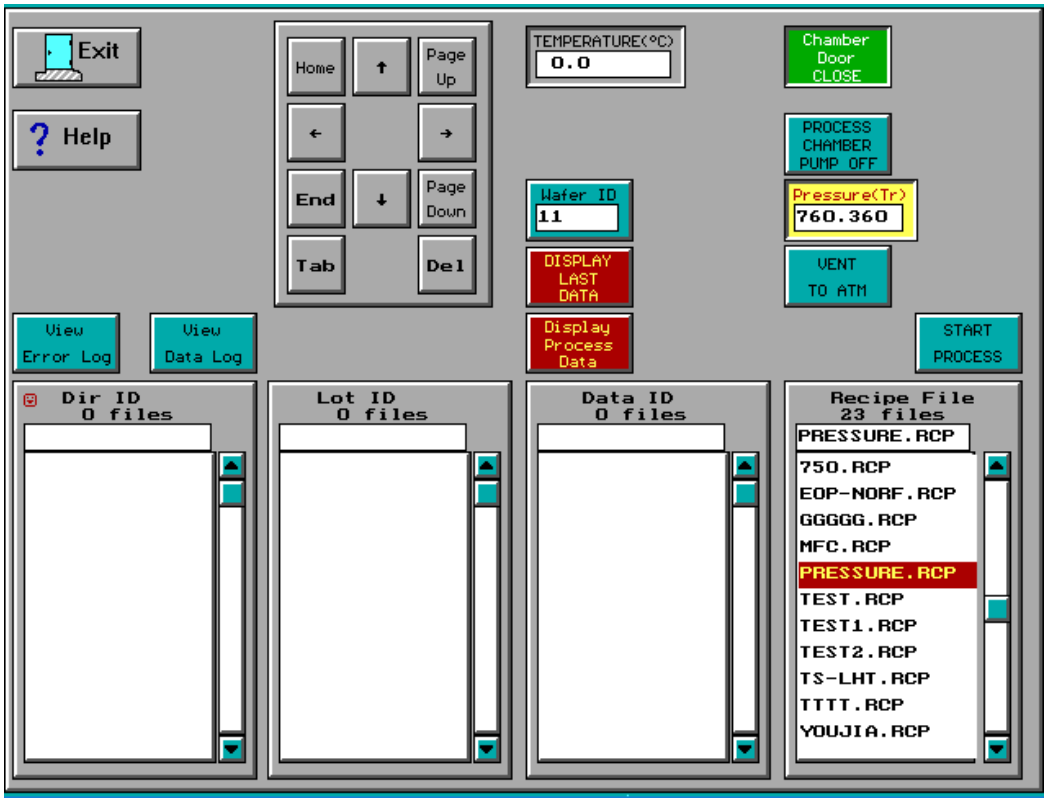


Figure 3-2: Process for Production screen, basic functions
Location: Main Menu ➔ Process for Production

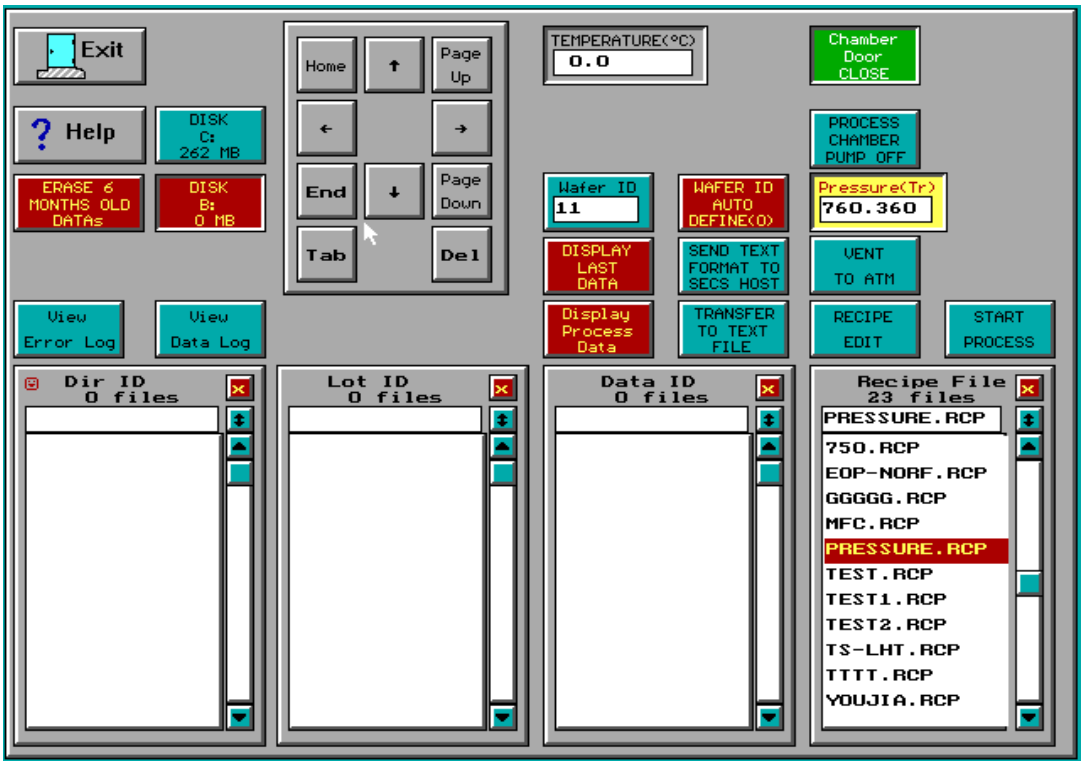


Figure 3-3: Process for Engineer screen

Location: Main Menu ➔ Process for Engineer

STEP 1. **SELECT A RECIPE**

The first step for using the AW-900 software is to select a recipe. Select a Recipe from the list of Recipes in the column "Recipe File". A highlighted Recipe means it is selected. Use the slider to the right of the list to display Recipes that are not visible in the list window. Click on the Recipe to select it.

STEP 2. **SELECT WHERE THE PROCESS DATA WILL BE STORED**

The process data for each wafer are stored on the hard drive after the process ends. The place on the hard drive they will be stored needs to be specified so they can be recalled later without searching through possibly hundreds or thousands of files.

First, select a "Dir ID" from the list of available Directory IDs. Then select a "Lot ID" from the list of Lot IDs.

STEP 3. **RUN THE RECIPE**

To run the selected Recipe, click on the **Start Process** button. This will display the *Process Monitor* screen as shown below. When this screen is displayed, the process will begin processing the wafer inside the process chamber according to the selected Recipe.

Process Monitor Screen

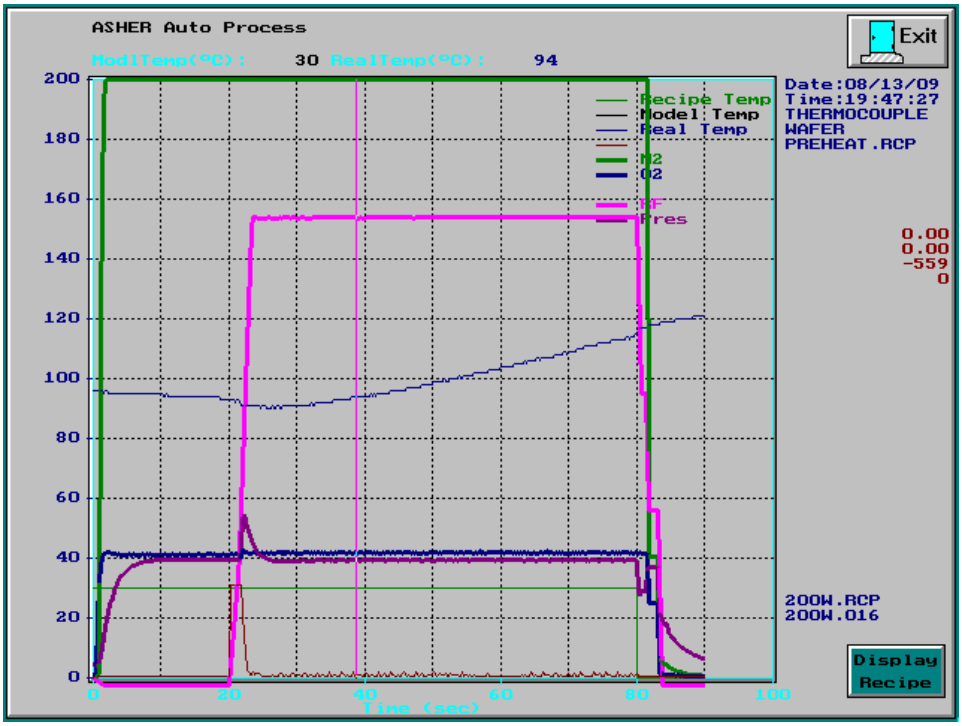


Figure 3-4: Process Monitor screen

The *Process Monitor* screen shows a completed process curve. In the figure above, the x-axis indicates the process time and the y-axis indicates the process temperature. There are four curves to display the monitored process:

thin Green	The recipe temperature as defined by the Recipe.
Blue	The real, measured temperature during the wafer process.
Red	The intensity of the lamps.
thick Green	The N_2 flow rate
Purple	The pressure inside the process chamber.

3.5 STOP PROCESS

A process may be interrupted and stopped by pressing the ESC key on the keyboard or clicking on the EXIT button.

3.6 REVIEW THE PROCESS DATA

To view the last run process data graphically, click on the **Display Last Data** button. This will display the process data on a screen very similar to the *Process Monitor* screen.

To view process data from previous runs, select the process data to be viewed from the "Data ID" column, and then click on the **Display Process Data** button.

4. ADVANCED OPERATION

4.1 OVERVIEW

This section is designed for the process and maintenance engineers to create and edit recipes for processing wafers in the process chamber. The Recipe Editor allows specifying temperatures, gas flow rates, chamber pressure and RF power. It also allows the fine adjustment of temperature control parameters and uniformity.

4.2 SOFTWARE ORGANIZATION AND USAGE

The operation of Allwin21 AW-B3000 software is by using the computer keyboard, mouse and the graphical user interface (GUI) menu screens. The easy-to-use menu-driven display enhances reliability and greatly reduces the learning process.

The menu screens are designed to allow straightforward operation. The figure below illustrates the menu organizational map. It outlines the overall control screen architecture.

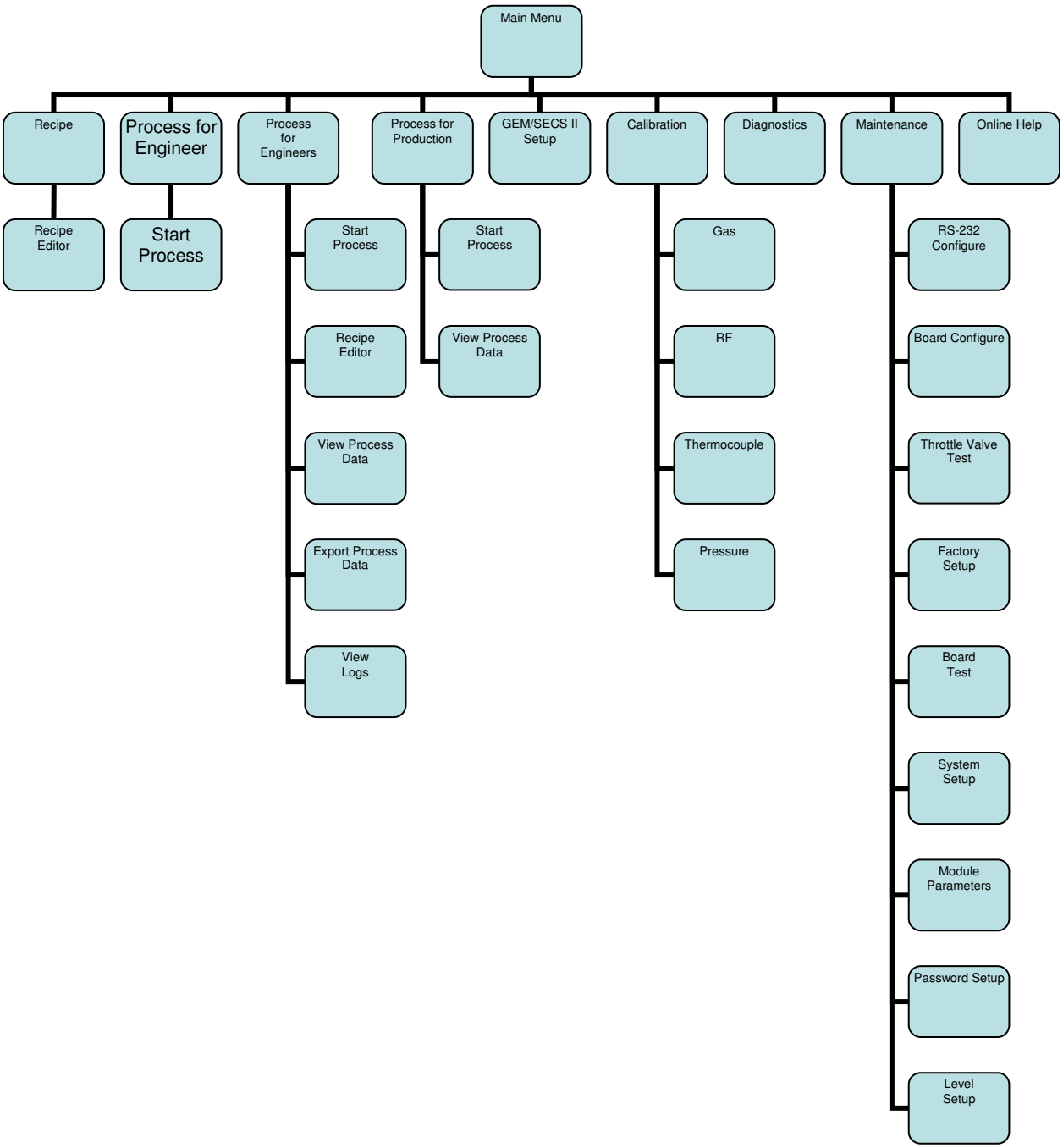


Figure 4-1: Menu Organizational Map

This section is designed for the process and maintenance engineers to create, edit and run recipes for processing wafers in the process chamber.

The *Recipe Editor* allows the Engineer to create and edit a Recipe for controlling the process of the wafer in the process chamber. Here, the recipe can be fine tuned to give precise control of the parameters for the process.

There are global parameters that need to be setup and defined. These parameters are normally set during factory testing and machine installation and never changed, unless an option is added or removed. They can be accessed from several screens in the *Maintenance Menu* and are divided into categories.

4.3 RECIPE PROGRAMMING

The control software allows the creation of recipes for automated control of the temperature, RF, vacuum and process gas flow.

It uses a set of operating instructions known as recipes to automatically control the Branson/IPC 3000 system. These recipes are created by the Process Engineer to monitor and control the parameters of the processing cycle. The Operator then uses the control software to select and run the recipes (steady state temperature, process time, ramp rates, etc.).

The control software is also used to create, delete, copy, modify and store the recipes.

The recipe editor allows the process engineer to create and edit process recipes for desired temperature profiles, RF levels, vacuum and gas flow rates. The recipe editor allows the selection of the desired temperature feedback device and adjustment of the process control parameters.

4.3.1 CREATE AND MODIFY A RECIPE

The procedures for creating a new recipe and editing an existing recipe are very similar. These procedures essentially involve loading an existing recipe, editing the recipe's parameters, and then saving the changes. The differences between creating a new recipe and editing an existing recipe occur when the changes are saved. Creating a new recipe also involves changing the **Recipe Name** field, as discussed later in this section.

The steps to create or edit a recipe would be:

Step 1. Select a pre-existing Recipe.

Step 2. Edit it. (If a new Recipe is to be created, also change the **Recipe Name** field before saving.)

Step 3. Validate the Recipe.

Step 4. Save the Recipe.

The *Recipe Edit Selection* screen as shown below allows the engineer to select an existing recipe and load it into the recipe editor. The recipe can then be modified or a new recipe can be created based on this recipe.

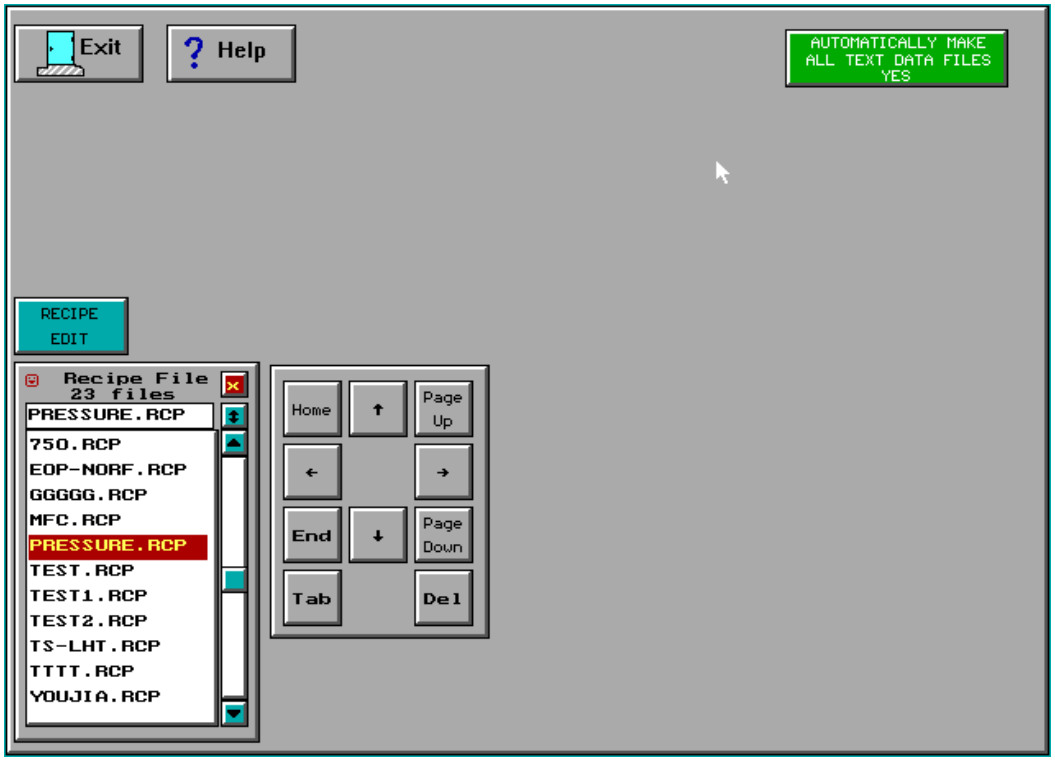


Figure 4-2: Recipe Edit Selection screen

Location: Main Menu ➔ Recipe

Select a Recipe. Use the slider to the right of the list to display Recipes that are not visible in the list window. Click on the Recipe to select it. Click on the **Recipe Edit** button to display the Recipe Editor.

Alternatively, a Recipe can be created or modified from the *Process for Engineer* screen, figure 3-3. First, select a recipe from the "Recipe File" list. Then click on the **Recipe Edit** button to display the Recipe Editor.

4.3.2 RECIPE EDITOR

The *Recipe Editor* screen as shown below allows the engineer to modify and validate the recipe. This editor offers a great deal of flexibility in designing profiles to construct process cycles. The engineer can specify variable ramp rates, the temperature monitor control, a gas flow rate, chamber pressure and to use the RF for each step.

The *Recipe Editor* is used to create and edit recipes. It is designed like a spreadsheet for easy data entry and readability. The editor is divided into two main sections. The top section (header) is where the engineer inputs information pertinent to the overall recipe. The lower section (data entry area) is for the process recipe data entry.

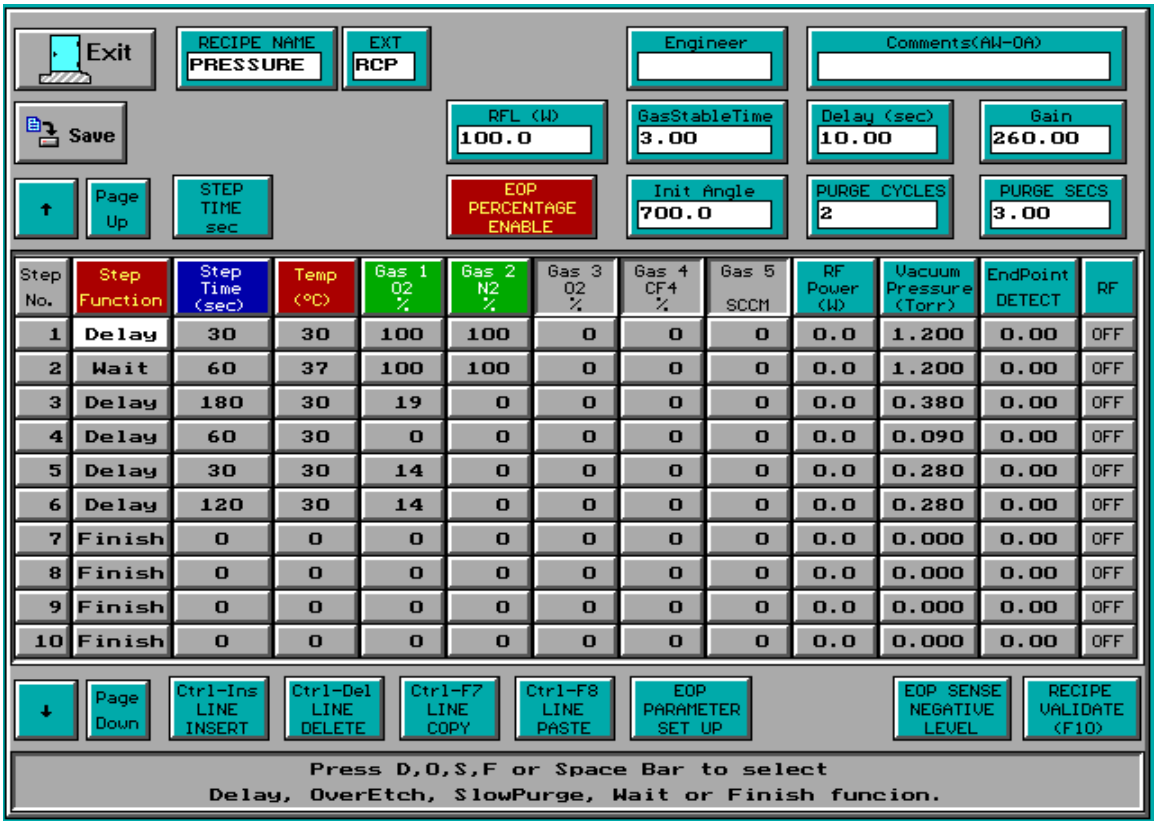


Figure 4-3: Recipe Editor

At the end of this chapter, you should be able to:

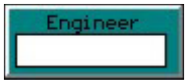
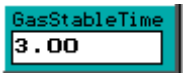
- Change an existing recipe
- Create a new recipe
- Adjust the temperature control parameters within the recipe

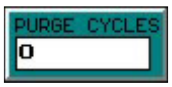
4.3.3 THE HEADER

The header is the top part of the *Recipe Editor* and it describes the substrate, the sensor type and performance variables that are used during the entire process cycle of the recipe, along with the Recipe Name.

The Recipe Name can be edited. This should be done if a new recipe is to be created. However, leave the EXT field as RCP. This is the filename extension and the control software expects it to be RCP for a recipe.

The variables (Delay and Gain) are for fine tuning the temperature control performance.

	The name of the recipe when it is saved to the hard disk. The Recipe Name can be edited. This should be done if a new recipe is to be created.
	Leave the EXT field as RCP. This is the filename extension and the control software expects it to be RCP for a recipe.
	The name or initials of the engineer creating the recipe
	A comment about the recipe
	Set the tolerance of the reflected RF power in watt. If the absolute magnitude of difference between the reflected RF power and the set point is larger than this tolerance, the alarm will be set.
	Set the delay time in second in order for the gas to stably fill the chamber. When the **Start Process** button is clicked, the step 1 of the recipe proceeds only after the gas specified goes through MFC and the time delay of this value is reached,
	Set the delay time in second before checking the chamber pressure and adjusting the throttle valve. Only after RF is turned on and the starting time is delayed with this value, the pressure checking and throttle valve adjustment proceed.
	Set the gain for throttle valve's control algorithm. The higher the gain, the more sensitive to the difference of pressure set point and pressure feedback reading.

	Select the time scale of **Step Time** in second or minute
	Enable/Disable EOP's percentage-of-voltage-level mode. Note that this button also appears in *EOP Parameter Set Up* screen.
	Set the initial angle of throttle valve before the throttle valve's closed-loop control proceeds.
	This will cycle the chamber from vent to pumpdown and finally vent to atmospheric pressure. The value is the number of cycles to vent and pumpdown. If this field is only zero (0), then the control software will only vent to atmospheric pressure.
	This is the number of seconds the chamber will be vented and the number of seconds the chamber will be pumped down after the process ends.

4.3.4 DATA ENTRY AREA

The recipe contains steps or instructions that describe the process cycle. Each step describes the state of the process for a certain amount of time. The steps are defined in the data entry area of the *Recipe Editor*. Up to 40 steps can be defined. Each column of the data entry area describes a parameter that is to be controlled or is used to describe how to control a parameter.

	This is the Step Number. It denotes the step number and is non-editable.
	This is the Process Function, which describes the type of process function for that step. It can be DELAY, RAMP, STEADY, or FINISH.
	The Delay step instructs the controller to set the lamps to an intensity of 0 percent (off) while setting and maintaining the setpoint of the other controlled parameters, until the specified time spent in the step has elapsed.
	The Ramp step instructs the controller to increase the temperature at a constant rate until the specified temperature has been reached. The rate is calculated by dividing the difference between the temperature specified in the step and the temperature specified in the previous step by the time specified in the step. The gas flow is set to the specified value as in a STEADY step. The process controller can not do two consecutive RAMP steps.
	During the Steady step, the controller increases and decreases the lamp intensity so the specified temperature can be maintained. It then maintains that value until the specified time spent in the step has elapsed.
	After RF is turned on and then when the temperature reaches the specified degree C, jump to the next step even if the specified time has not elapsed. Note that this step is usually applied during the preheat by N2 plasma.
	Finish ends the recipe. This is the last step in the recipe. Once the process controller sees a "FINISH", it stops all processing.

This is the amount of time, in seconds, to act on the current step. The time can be from 1 - 32000 seconds in increments of 1 second. If there is a need for a step that is longer than 32000 seconds, break the step into two or more steps.

CAUTION

Extremely long processes may be a problem for the Allwin21 system.

This is the target temperature of the wafer during this step.

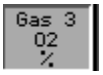
If the step function is **STEADY,** then this is the setpoint temperature that is to be maintained.

If the step function is **RAMP,** then this is the ending temperature of the ramp.

If the step function is **DELAY,** then this field has no effect if this is a DELAY step. The lamps are turned off during this step.

Specify the flow rate of GAS 1 for the system, %, SLPM, or SCCM as selected by the **Unit** field of the *System Setup* screen

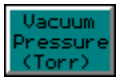
Specify the flow rate of GAS 2 for the system, %, SLPM, or SCCM as selected by the **Unit** field of the *System Setup* screen



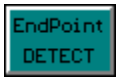
Specify the flow rate of GAS 3 for the system, %, SLPM, or SCCM as selected by the **Unit** field of the *System Setup* screen

Specify the flow rate of GAS 4 for the system, %, SLPM, or SCCM as selected by the **Unit** field of the *System Setup* screen

The RF power level to set the RF generator.



This is the desired pressure in the process chamber. It is specified in Torr.



Where the plasma spectrum changes below this value, if the End Point is attached and selected.

This turns on the RF generator.

ON	turn on the RF generator
OFF	turn off the RF generator

When entering data values into the data entry area, the recipe editor checks for out-of-range entries. If a value is out-of-range, the editor will alert you and will advise you of the proper range.

Validating the Recipe

The recipe can be validated by clicking on the **Recipe Validate** button on the left bottom corner or pressing **F10** on the keyboard. If the recipe is invalid, an error message will appear. Once the error has been corrected, validate the recipe again. It will check for more errors. All errors need to be corrected before the recipe can be used for processing.

Saving the Recipe

The recipe can be saved at anytime by clicking on the 

button or pressing **F2** on the keyboard.

Exiting the Recipe

Exit the *Recipe Editor* by clicking on the 

button or pressing **ESC** on the keyboard. If exiting the *Recipe Editor* before saving the recipe, a dialog box will appear asking if the recipe should be saved.

Click **Yes**	(or press **Y** on the keyboard) to save the recipe.
Click **No**	(or press **N** on the keyboard) to discard all changes since the last save.
Click **Cancel**	(or press **ESC** on the keyboard) to go back to the *Recipe Editor* and continue editing the recipe. It does not save any changes.

EOP Parameter Set Up

EOP Parameter Set Up screen as shown below is displayed when the **EOP Parameter Set Up** button of the *Recipe Edit* screen is clicked**.**

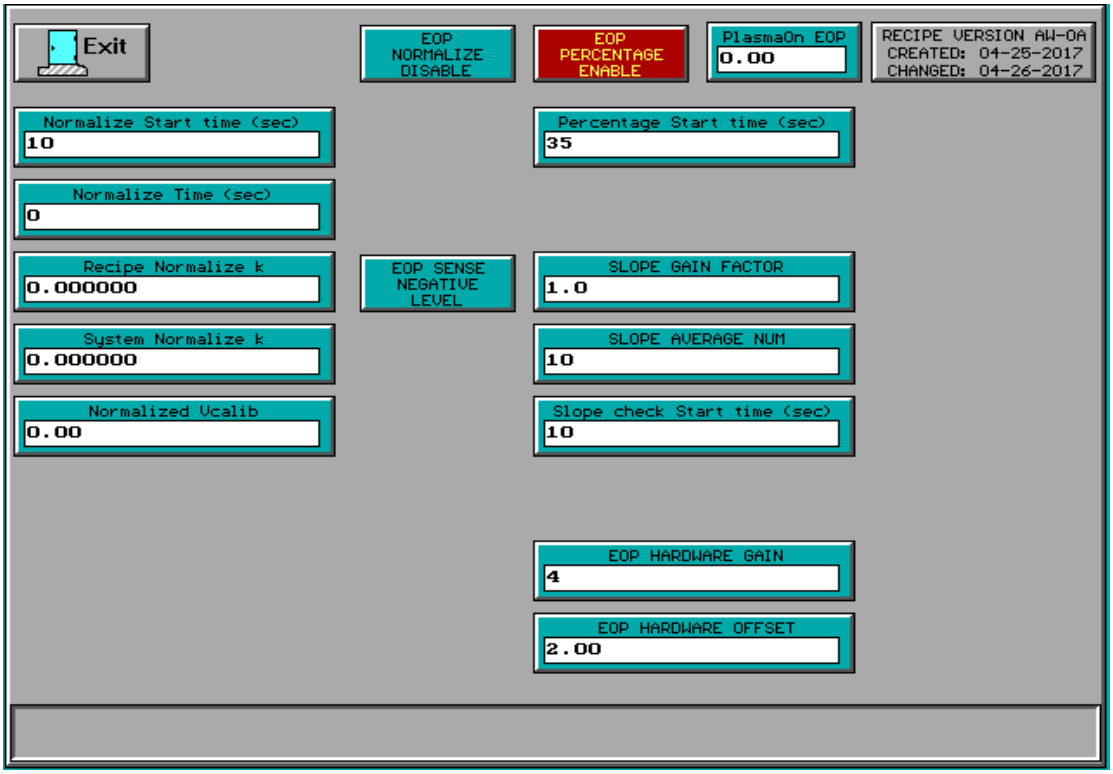
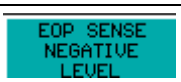
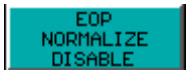


Figure 4-4: EOP Parameter Set Up screen

	Enable/Disable EOP's percentage-of-voltage-level mode. Note that this button also appears in *Recipe Edit* screen.
	When **EOP Percentage** mode is enabled, set the delay time to start checking of EOP by the percentage as set by the **Endpoint Detect** field of the *Recipe Edit* screen.
	Set the EOP level to check whether the RF plasma is generated or not. The time delay before checking RF plasma is set in "*Main menu/Maintenance/Module Parameter Description/Recipe"* screen. Note that if the value is set to 0, then this checking is not enabled. If the value is set to, say 0.5, when EOP is less than 0.5 after the time delay, the alarm is turned on.
EOP Sense	Set one of four modes where the end of process (EOP) is decided
	EOP is decided by the positive level of EOP voltage as set by the **Endpoint Detect** field of the *Recipe Edit* screen
	EOP is decided by the negative level of EOP voltage as set by the **Endpoint Detect** field of the *Recipe Edit* screen

	EOP is decided by the positive slope of EOP voltage as set by the **Endpoint Detect** field of the *Recipe Edit* screen
	EOP is decided by the negative slope of EOP voltage as set by the **Endpoint Detect** field of the *Recipe Edit* screen
	Set the gain factor of the slope when either one of slope EOP sense modes is selected.
	Set the number of the slope averaging when either one of slope EOP sense modes is selected.
	Set the time delay to start checking the slope when either one of slope EOP sense modes is selected.
	Set the hardware gain of raw EOP voltage before the voltage is sampled by ADC. This gain along with the offset is to achieve the largest possible dynamic range of EOP voltage.
	Set the hardware offset of raw EOP voltage before the hardware gain is set and the voltage is sampled by ADC. This offset along with the gain is to achieve the largest possible dynamic range of the EOP voltage.
	EOP Normalize function is disabled
Normalize XX	All Normalize functions are not used currently

4.3.5 KEYBOARD EDITING KEYS AND MEANINGS

F2	Save recipe.	
ESC	Exit the *Recipe Editor*.	
Home	Go to the first column of the step.	
End	Go to the last column of the step.	
↑	Move up one line.	
↓	Move down one line.	
←	Move left one column.	
→	Move right one column.	
PgUp	Move up one page.	
PgDn	Move down one page.	
Ctrl + Home	Move to the top of the page yet stay in the same column.	
Ctrl + End	Move to the bottom of the page yet stay in the same column.	
Ctrl + PgUp	Go to the beginning of the recipe.	
Ctrl + PgDn	Go to the end of the recipe.	
Ctrl + Ins	**Line Insert**	Insert a step above the current step.
Ctrl + Del	**Line Delete**	Delete the current step. (click on the step number to select it).
Ctrl + F7	**Line Copy**	Copy the current line into a memory buffer. (click on the step number to select it).
Ctrl + F8	**Line Paste**	Insert a step above the current step and then Paste the step that was copied into the memory buffer into the inserted step.
F8	Show the recipe on a graph.	
F10	Validate recipe.	

While in the process function column (**Step Temp Func**), pressing the first letter of the function name is another way to select the function (i.e. S = STEADY, R = RAMP, D = DELAY and F for FINISH).

4.3.6 ALARM PARAMETERS

The control software has alarm parameters that will cause an alarm if a parameter goes beyond the set tolerance. These alarm parameters will warn of certain conditions developing during the process.

The values of these alarm parameters can be changed by the user to prevent a condition that may ruin a wafer or even damage the machine. It is unlikely the machine will be damaged, though, because it has built-in safeguards.

Refer to the appropriate section of an Alarm Parameter for a greater explanation of these parameters.

The following parameters can be found in the *System Setup* section.

- MaxTemp (WFR)
- Trmp Tolerance
- Tstd Tolerance
- Gas Tolerance
- Check Gas

4.4 PROCESS ADMINISTRATION

PROCESS FOR PRODUCTION

The *Process for Production* screen, figure 4-5 and 4-6, is designed for the production operator in mind. It features a limited amount of controls so the operator only needs to press a few buttons to start running a process. It allows the selection and processing of predefined recipes. It also allows viewing graphically the process data.

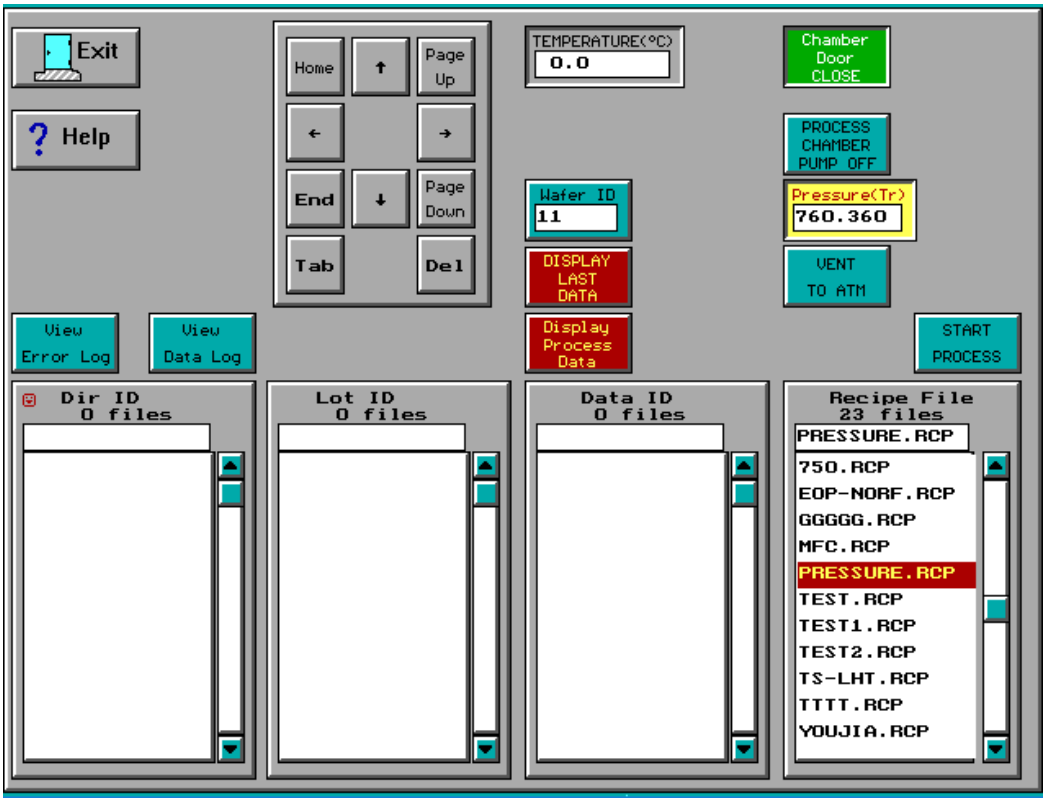


Figure 4-5: Process for Production screen, basic functions

Location: Main Menu ➔ Process for Production

Figure 4-5 shows the basic set of buttons allotted to the production operator. The *Process for Production* screen may have additional buttons for added functionality, see figure 4-6, for full functionality. The determining factor to display these buttons is controlled in the *Factory Setup screen* by toggling the **Production Full Function** button.

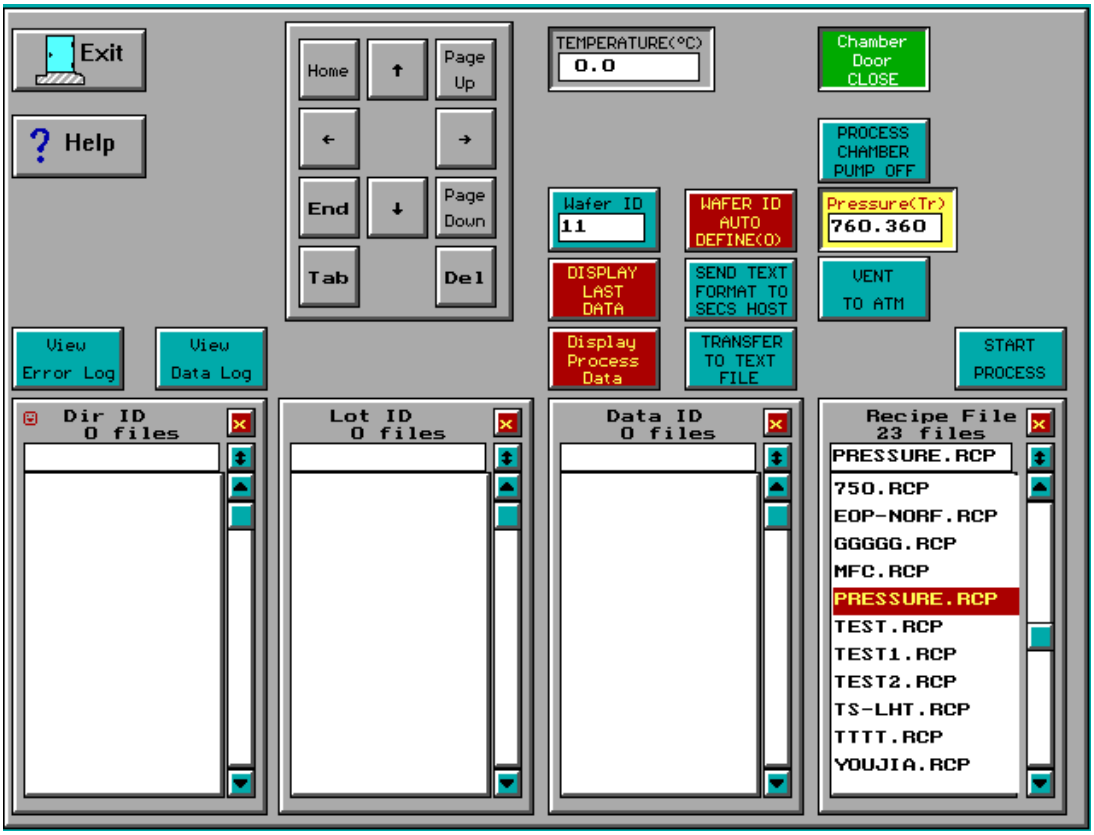


Figure 4-6: Process for Production screen, full function

	The number of wafers that have been processed for the selected recipe. This will be used for the wafer ID for the next wafer that will be processed with the selected recipe.
	View the process data of the last wafer that was processed graphically on the *Process Plotting* screen.
	Display the selected process data graphically on the *Process Plotting* screen.

Dir ID	This list groups certain types of lots together.
Lot ID	The user defined lot ID. All process data pertaining to this lot should be kept under here.
Data ID	The process data from each wafer is stored here. The operator can review the process of each of the process data.
Recipe File	This lists the available recipes. The operator needs to select a recipe before processing the wafer.

PROCESS FOR ENGINEER

The *Process for Engineer* screen as shown below, is designed for the production and maintenance engineers in mind. It is a flexible dialog which allows the engineer to create recipes and process a single wafer.

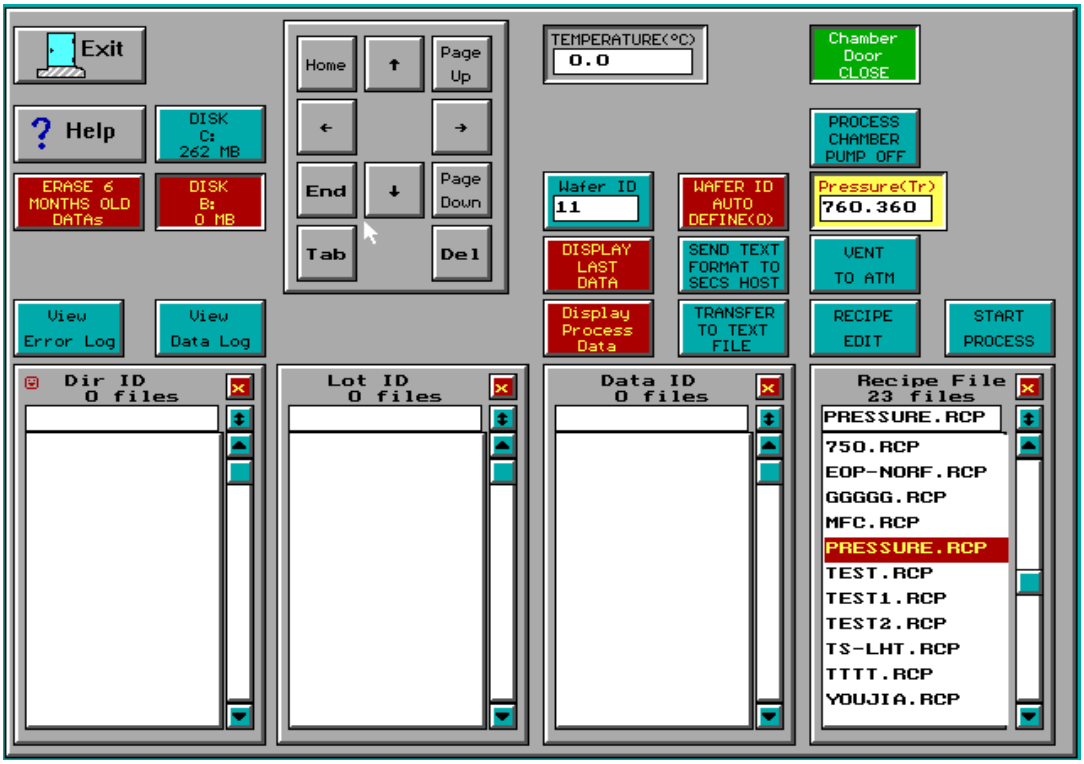
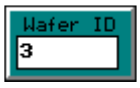


Figure 4-7: Process for Engineer screen

Location: Main Menu ➔ Process for Engineer

	The number of wafers that have been processed for the selected auto sequence. This will be used for the wafer ID for the next wafer that will be processed with the selected auto sequence.
	Automatically increment the "Wafer No." (process wafer number) for the selected recipe, or the user has to manually change the wafer number. **Auto** — Automatically increment the process wafer number **Manual** — User manually changes the wafer number
	View the process data of the last wafer that was processed graphically on the *Process Plotting* screen.

	Display the selected process data graphically on the *Process Plotting* screen.
	Loads the selected recipe file into the *Recipe Editor* to allow the engineer to modify the recipe.
	Start processing the wafer that is in the process chamber, using the recipe that is selected.

Dir ID	This groups certain types of lots together.
Lot ID	The user defined lot ID. All process data pertaining to this lot should be kept under here.
Data ID	The process data from each wafer is stored here. The operator can review the process of each of the process data.
Recipe File	The list of recipes which are available to be used to process wafers in the process chamber.

4.5 FILE ADMINISTRATION

The *Process for Engineer* screen includes 3 additional options for file administration:

	This button creates a translation of the selected process data file to text. To copy it to a floppy disk (drive A:), precede the filename with **A:**.
	Delete Recipes, Data files, Auto Sequences, Lots and Directories. The delete button is located on each of the list boxes. (See **Filename Lists** in the "How to Use the Menu Screens" section.) It is used to delete the selected item in the list box. Example: To delete a recipe, select the recipe and then click on the red box in the Recipe File list box. Note: Recipes cannot be deleted from the *Process for Engineering* screen. Only from the *Recipe Edit Selection* screen.

FILE EXTENSIONS

The manual recommends using "RCP" for recipe extensions, but the control software does not force you to do this. "RCP" makes it easier for a user to determine the type of file based on its extension. The control software, however, separates the different types of files into their respective directories. So it really depends on which directory the file came from that determines the type of file it is, according to the control software. However, you don't want to put a calibration file into the recipe directory. It will be listed in the "Recipe File" list box. But if you try to load it into the recipe editor, it will give unpredictable results.

Recommended (but not necessary) extensions:

RCP	for recipes
WFR	for calibration files for a wafer
001 - 999	for process data files

5. SOFTWARE SETUP

5.1 OVERVIEW

There are many different ways the control software can be setup. Some settings depend on the factory configuration. Sometimes the customer configures the control software their own particular way. This section will guide and explain the many choices to setup the control software.

Many of these settings will never be changed once the control software has been setup, and many of them are already setup at the factory.

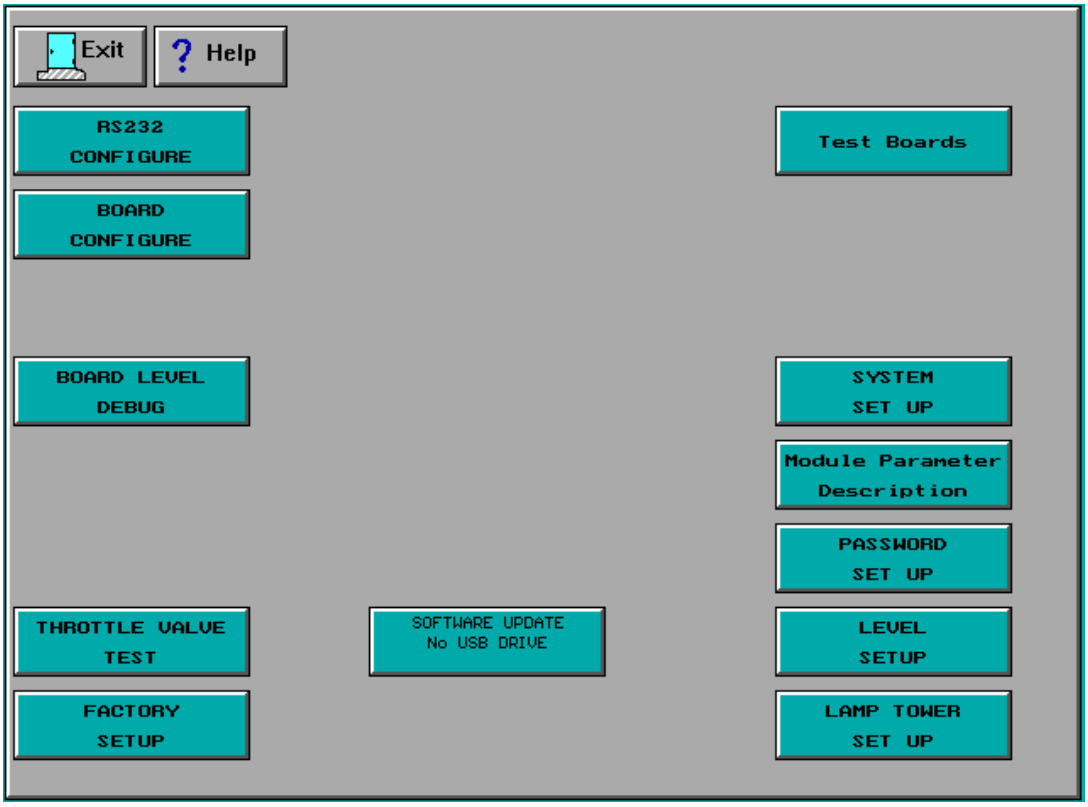


Figure 5-1: Maintenance Menu

Location: Main Menu ➔ Maintenance Menu

The *Maintenance Menu,* as shown above, allows access to the screens that allow changing and configuring of the settings.

5.2 RS-232 CONFIGURATION

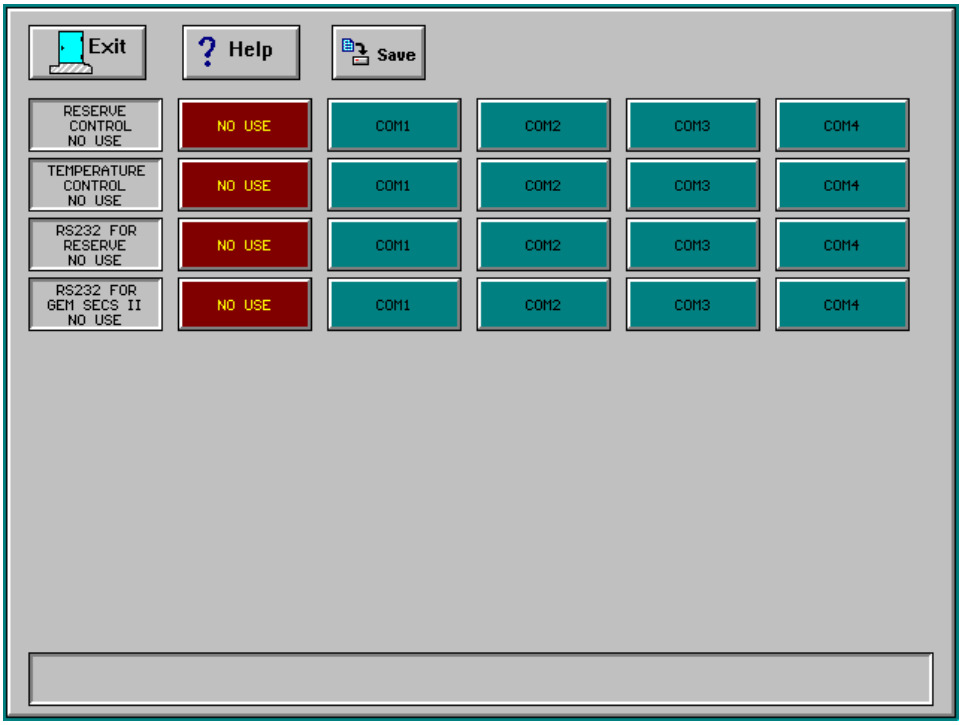


Figure 5-2: RS-232 Configure screen

Location: Main Menu ➔ Maintenance Menu ➔ RS232 Configure

The *RS-232 Configuration* screen, as shown above, allows the control computer RS-232 communication ports to be re-configured, depending on the cable setup. There is no need to swap cables, just redefine which port the external equipment are connected to. This also makes it more flexible to reconfigure equipment ports if one goes bad or a particular port has to be used by some other special equipment.

The *RS-232 Configuration screen* allows the user to setup the communication ports between the control computer and the system equipment. The normal settings are:

(reserved)	NONE
(reserved)	NONE
(reserved)	NONE
GEM-SECS II	NONE or COM3

NOTE

Whenever the RS-232 configuration has changed, the system must be rebooted after saving to have the values take effect.

Press CTRL-ALT-DEL simultaneously.

5.3 CONTROL BOARD SELECTION

The proper configuration depends on the hardware that is used in the Allwin21 system. The figure below shows the different communication and control boards available.

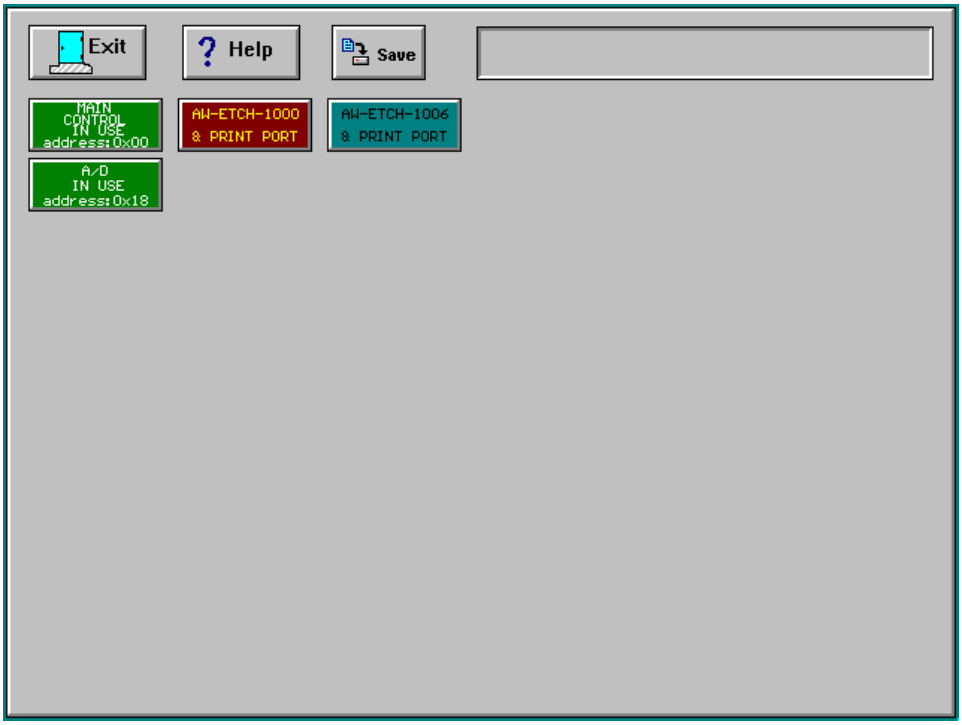


Figure 5-3: Board Configuration screen

Location: Main Menu ➔ Maintenance Menu ➔ Board Configure

Main Control	AW-ETCH-1000	AW-ETCH-1006

NOTE

Whenever the board configuration has changed, the system must be rebooted after saving to have the values take effect.

Press CTRL-ALT-DEL simultaneously.

5.4 THROTTLE VALVE TEST

The type of the throttle valve is selected by the **Valve Cntl** field in the *"Main Menu/Maintenance/Factory Setup"* screen.

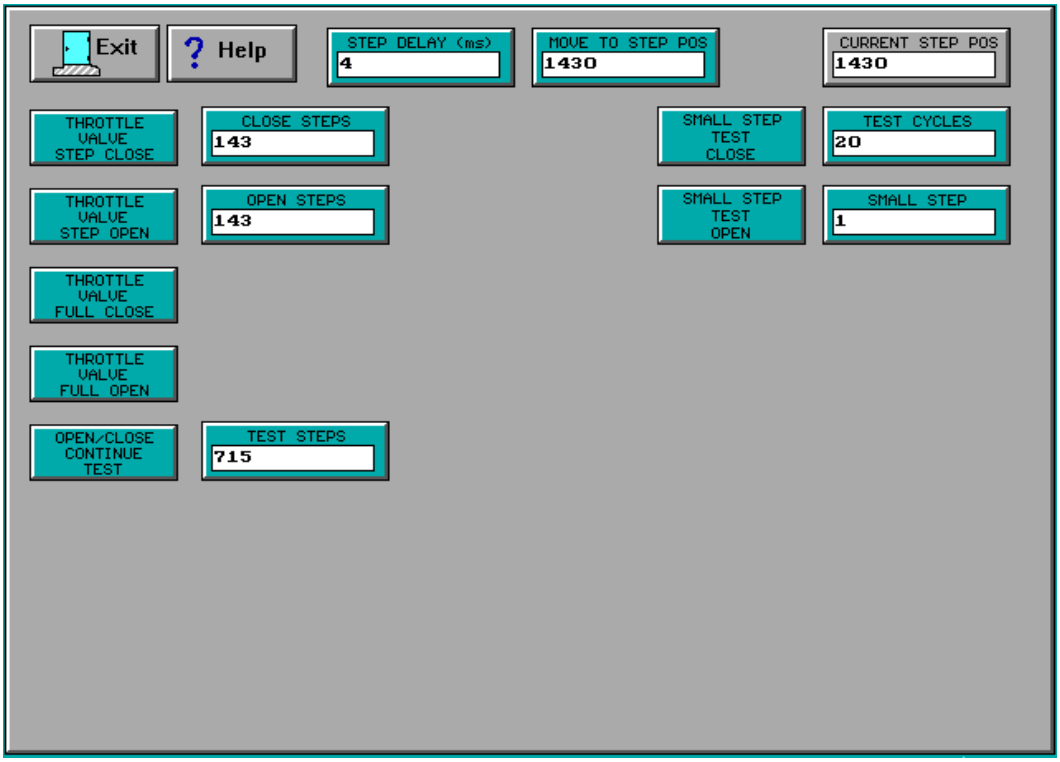
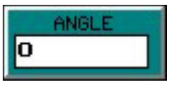


Figure 5-4: Throttle Valve Test screen

Location: Main Menu ➔ Maintenance Menu ➔ Throttle Valve Test

MOTOR SPEED 20	The speed the motor will turn to move the throttle valve.
THROTTLE VALVE STEP CLOSE	Move in the close direction for one step.
THROTTLE VALVE STEP OPEN	Move in the open direction for one step.
THROTTLE VALVE FULL CLOSE	Fully close the throttle valve.
THROTTLE VALVE FULL OPEN	Fully open the throttle valve.

	
	The current angle of the throttle valve.

5.5 FACTORY SETUP

The *Factory Setup* screen, as shown below, allows configuring the system to settings the factory deems proper for the system. These settings should not be changed by the user.

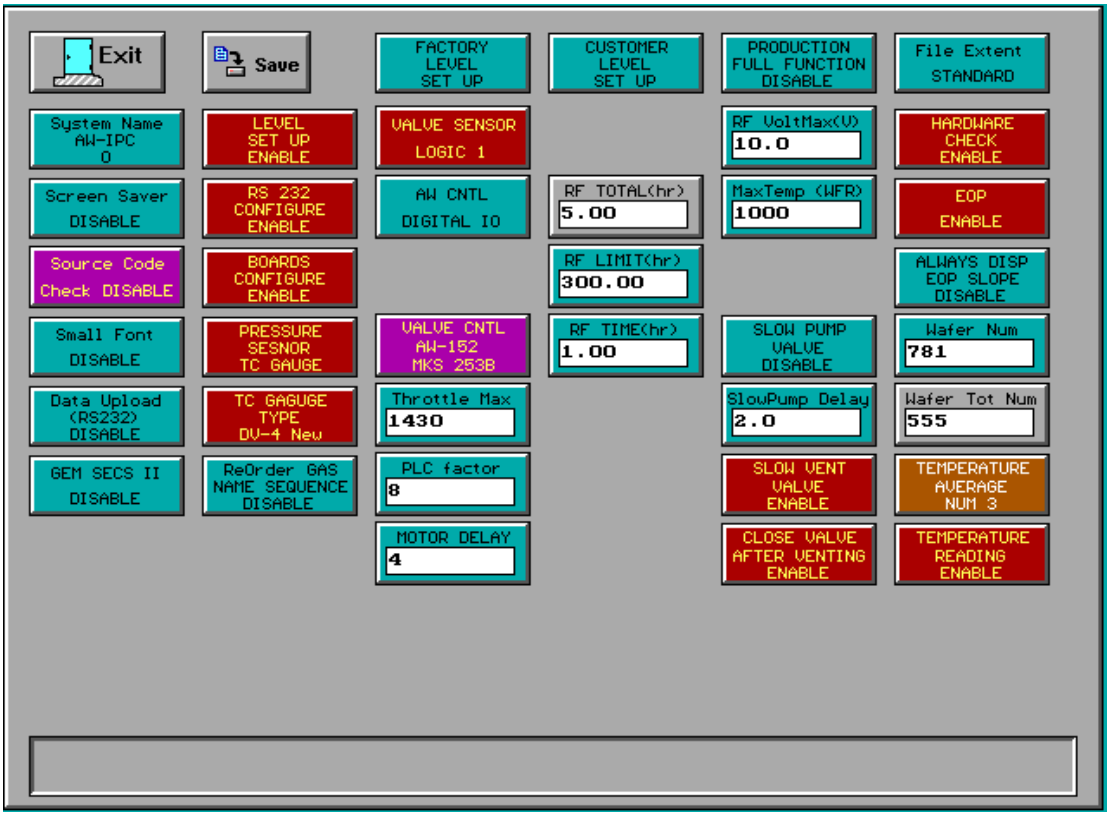
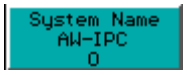
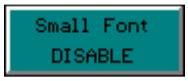
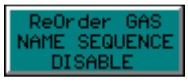


Figure 5-5: Factory Setup screen

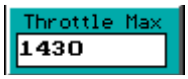
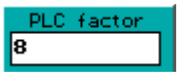
Location: Main Menu ➔ Maintenance Menu ➔ Factory Setup

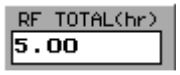
Save	Save the changes to the system and configuration file
FACTORY LEVEL SET UP	Revert back to the factory default settings
CUSTOMER LEVEL SET UP	Change to the customers last saved settings
PRODUCTION FULL FUNCTION ENABLE	Process for production displays all buttons. The only thing a user can't do is edit a recipe.

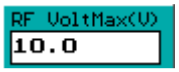
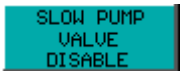
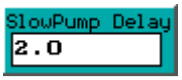
	STANDARD – the standard 3 character extension for a filename
	Select the appropriate name for the system. This defines the system so the control software knows which machine is connected to the computer. NOTE: This is configured at the factory and should not be changed by the user.
	not implemented yet
	For factory diagnostics
	Enable (yes) / Disable (no) the Small Font
	not implemented
	Enable (yes) / Disable (no) the GEM SECS II communication.

	Ability to access the Level Setup screen.
	Allows access to the RS-232 Configuration setup screen.
	Ability to access the Board Setup screen.
	Select the pressure sensor type, TC gauge or Baratron
	Select the TC gauge type, DV-3, DV-4 old, DV-4 new, or DV-6
	Allows the user to change the order of the gas names.

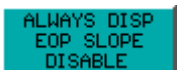
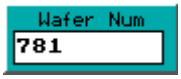
	Factory setup for the throttle valve
	Select the controller of the throttle valve, Digital IO (the AW software), PLC240, or 8254
	Select the throttle valve MKS 253A, MKS 253B, or no throttle valve

	Set the maximum throttle count. Note that this is set in the factory and should not be changed by the users.
	Set the PLC factor when the controller of the throttle valve is PLC240. The smaller PLC factor the faster throttle adjustment.
	Set the motor delay parameter when the controller of the throttle valve is selected as Digital IO (the AW software).
	Set the motor speed parameter when the controller of the throttle valve is selected as PLC240. The higher the motor speed, the faster the response time.

	Display the sum of RF run time in hours whenever RF is turned on.
	Set the limit of RF run time in hours for maintenance. When the **RF Time(hr)** reaches this number, the alarm is turned on to remind the RF maintenance is needed.
	Manually set the starting RF run time (usually set to 0) and display the sum of current RF run time in hours when RF is turned on. The usage is to manually set the RF run time to 0 and the RF run time will be added. When **RF Time(hr)** reaches **RF Limit(hr)**, the alarm is turned on and users can do the RF maintenance and set **RF Time(hr)** back to 0.

	Set the maximum voltage of the RF set point range.
	Set the maximum allowed temperature for a wafer
	Enable/disable the slow pump valve when it is installed. If the slow pump valve is not installed, disable this selection.
	Set the delay of slow pump in second
	Enable/disable the slow vent valve
	Enable/disable the action to close the vent valves after venting is finished

	Enable/disable the checking of the hardware during a process so the system will not alarm because of some non-existent hardware problem.

	Enable/disable EOP (end of process) detection
	Enable/disable the display of EOP slope when the EOP slope mode is not selected
	Set the wafer number and display the sum of the wafers processed by the machine. Users can manually compare for the maintenance purpose.
	Display the number of total wafers processed by the machine since it was built at the factory.
	The number of consecutive temperature samplings to average for a reading of the temperature to be displayed and logged.
	Enable/disable the temperature reading, if TC is installed.

5.6 SYSTEM SETUP

The *System Setup* screen, as shown below, contains global settings the user can change for their desired system setup.

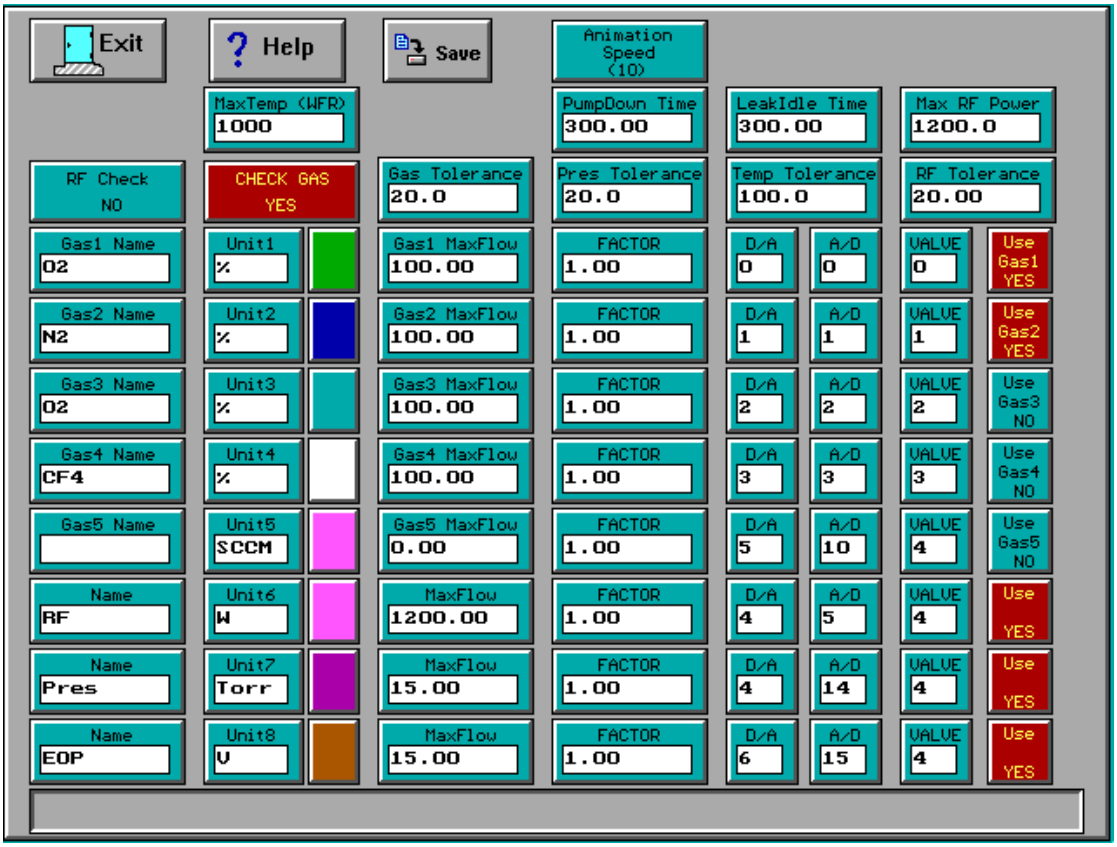
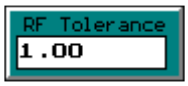
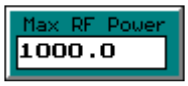


Figure 5-6: System Setup screen

Location: Main Menu ➔ Maintenance Menu ➔ System Setup

	Save the settings to the configuration file.
	This controls the speed of the animated bitmap buttons in the main menu. The larger the number, the slower the animation. (0 = no animation)
	The maximum allowed temperature for a wafer

	The number of seconds to pumpdown the chamber while doing a leak check.
	The number of seconds to wait after pumping down the chamber before taking a pressure reading for the leak check.
	If **YES**, then machine will check plasma signal during process
	
	The maximum allowable power the RF generator can be set to.
	Check to see if the gas is flowing during the process.
	The amount the **Gases** can deviate (+/-) from the setpoint during a process. (Specified in percent of maximum gas flow rate.)
	The percentage of the maximum pressure that is allowed to be off from the setpoint
	The amount the measured temperature during a RAMP step of a process can deviate (+/-) from the model temperature during a process. (Specified in percent of maximum temperature.)
	The amount the measured temperature during a STEADY step of a process can deviate (+/-) from the model temperature during a process. (Specified in percent of maximum temperature.)

Gas Name	The name of the gas that will be displayed on various screens throughout the control software.
Unit	The unit of gas flow through the MFC (SLPM or SCCM)
(color)	The color to plot the gas flow on the process run screen
Gas MaxFlow	The maximum gas flow allowed by the MFC
FACTOR	The gas conversion factor relative to nitrogen (or whatever the MFC was calibrated for).
D/A	The D/A channel the MFC is connected to. Normally, these values will never be changed.
A/D	The A/D channel the MFC is connected to. Normally, these values will never be changed.
Valve	The digital channel the On/Off gas pneumatic valve is connected to. Normally, these values will never be changed.
Use Gas	Enable (yes) / Disable (no) using the gas. If disabled, then this gas cannot be used anywhere in the control software.

☠ WARNING

The D/A, A/D and Valve channels are determined at the factory and should NOT be changed. Changing them will either prevent gas flow or create an undesirable gas mixture or flow rate.

PLEASE LEAVE THESE ALONE.

5.7 MODULE PARAMETER DESCRIPTION

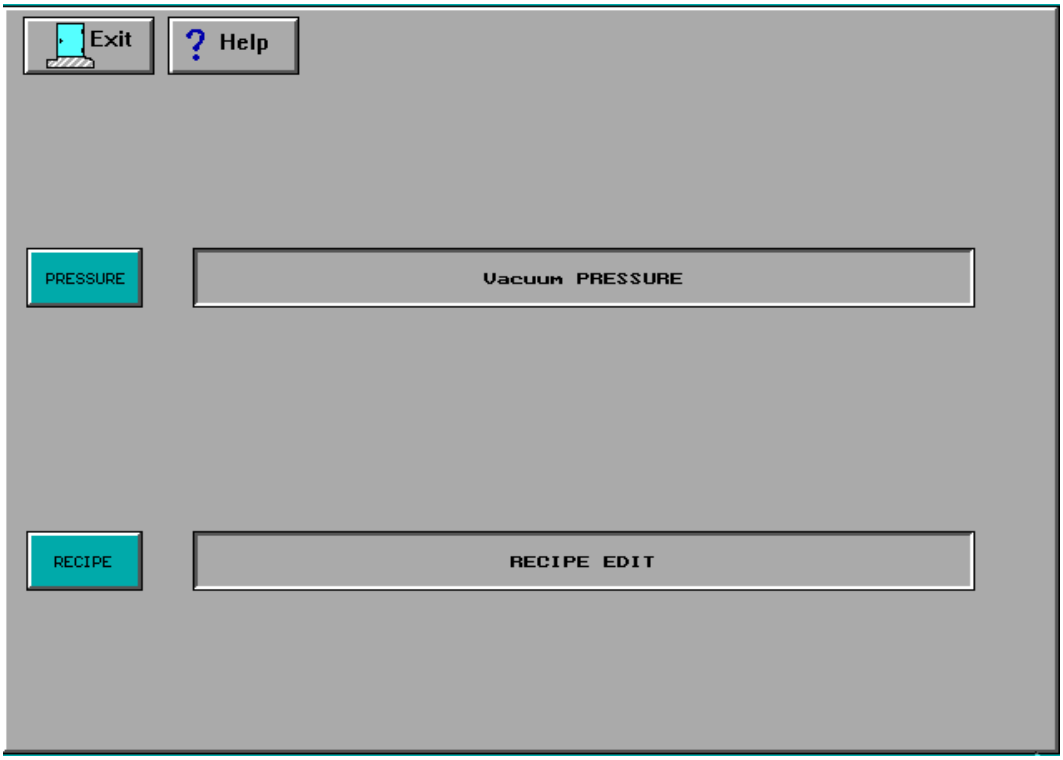


Figure 5-7: Modular Parameter Description menu

Location: Main Menu ➔ Maintenance Menu ➔ Modular Parameter Description

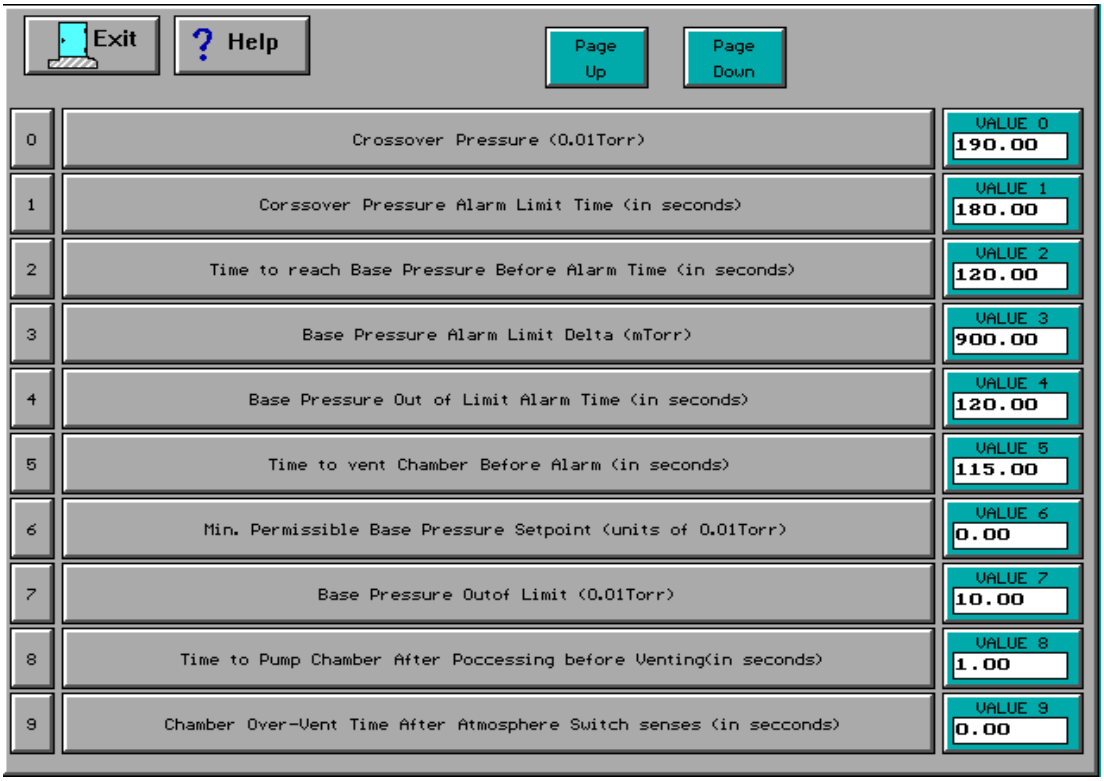


Figure 5-8: Pressure Parameter menu

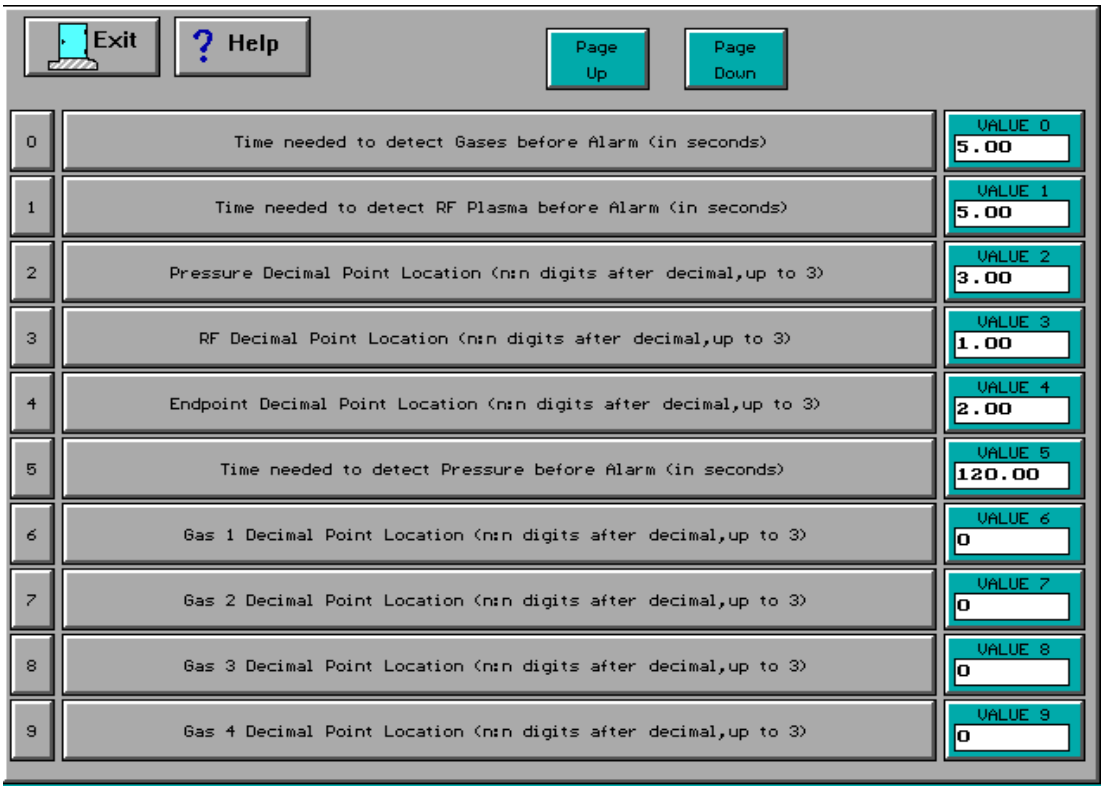


Figure 5-9: Recipe Parameter menu

6. SECURITY

6.1 PASSWORD SETUP

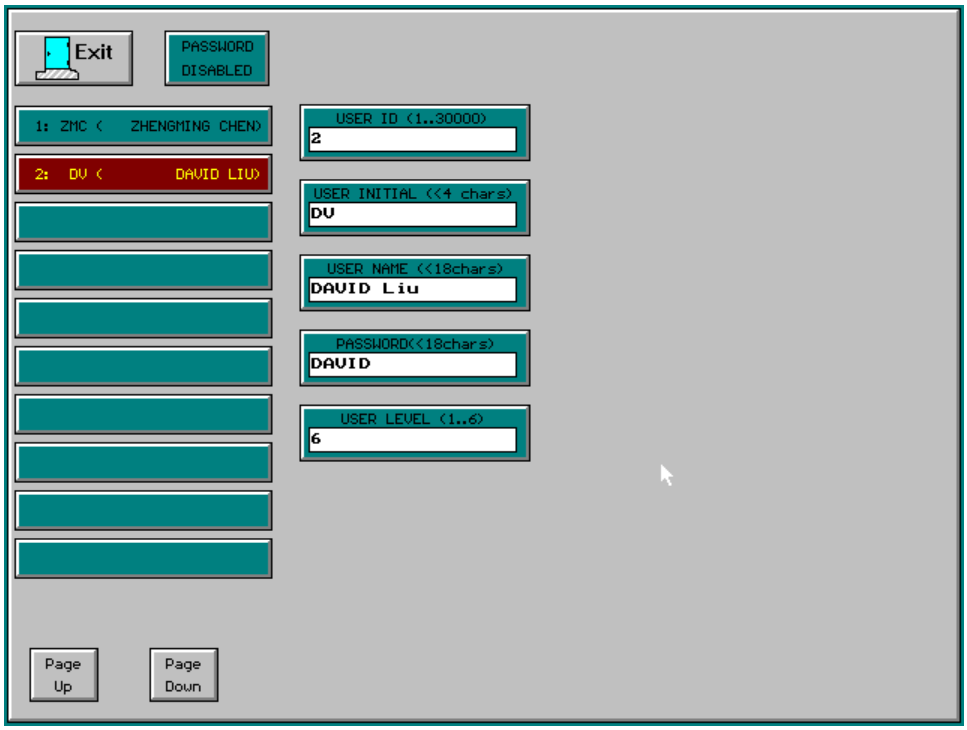


Figure 6-1: Password Setup screen

Location: Main Menu ➔ Maintenance Menu ➔ Password Setup

To setup a user account, enter in the USER ID, USER NAME, PASSWORD and USER LEVEL.

There are 7 password levels available to manage user accounts. (See the Level Setup section for an explanation on the levels.)

Click the **PASSWORD DISABLE / ENABLE** button to disable or enable the password protection. When password protection is enabled, users have to logon on, before access to the control software is allowed.

6.2 LEVEL SETUP

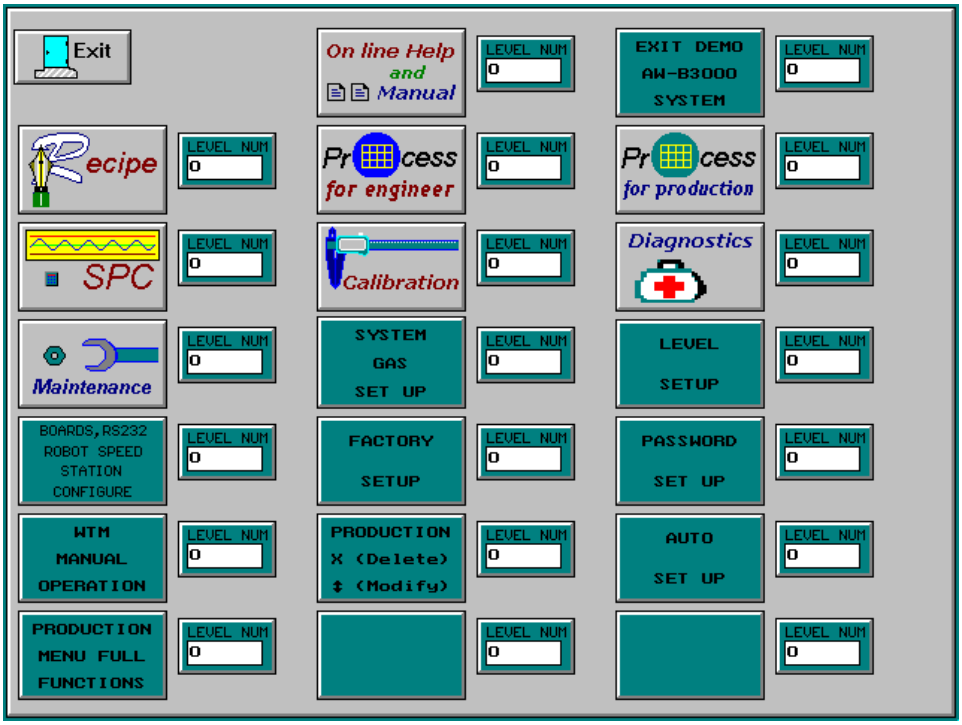


Figure 6-2: Level Setup

Location: Main Menu ➔ Maintenance Menu ➔ Level Setup

The *Level Setup* screen, as shown above, allows system administrators to change the degree of level for different screens. There are 7 levels of password protection. Level 0 allows anyone access to that item. Level 6 allows only system administrator access.

User Access Level	User's Accessibility
0	Can only access level 0
1	Can access levels 1 and 0
2	Can access levels 2, 1 and 0
3	Can access levels 3, 2, 1 and 0
4	Can access levels 4, 3, 2, 1 and 0
5	Can access levels 5, 4, 3, 2, 1 and 0
6	System Administrator... Can access levels 6, 5, 4, 3, 2, 1 and 0

After the levels have been changed, the control software has to be re-booted.

If the user tries to access a function that has a level which he is not allowed to enter, the control software will display the message:

“You don’t have the right level for this function”.

The user must log on with an appropriate level. Either the user logs on with another user name and password with the appropriate level or have the system administrator change the level for the user.

7. MAINTENANCE

7.1 OVERVIEW

☠ WARNING

Maintenance to the system should be done by a qualified service person.

☠ WARNING

Follow proper lock-out/tag-out procedures.

This section describes how to use the AW-B3000 control software to help calibrate and diagnose problems with the Branson/IPC 3000 Plasma System.

7.2 SOFTWARE CALIBRATION

7.2.1 OVERVIEW

Calibration of the Allwin21 system is done entirely from within the control software for maximum performance, accuracy and ease-of-use. The calibration functions are automated which means less time is spent calibrating the system. There are calibration routines for the thermocouple circuit, TC gauge circuit, pressure control circuits, RF control circuit and gas flow circuits, as presented on the *Calibration Menu*, as shown below. Note that the name of the TC gauge selected is displayed as the name of the TC gauge calibration button in the *Calibration Menu*.

Calibration is done at the factory and does not need to be repeated for installation. Nor does it need to be repeated unless something that affects the thermocouple, gas control, RF control or vacuum control has changed, such as the chamber or the control board.

If there is a change in the temperature, uniformity or gas flow, do not immediately suspect the system needs to be calibrated. Make sure there are no mechanical problems first. See the respective *Troubleshooting* sections for possible other problems with the system that could affect temperature, uniformity, gas flow, etc. before suspecting a calibration problem.

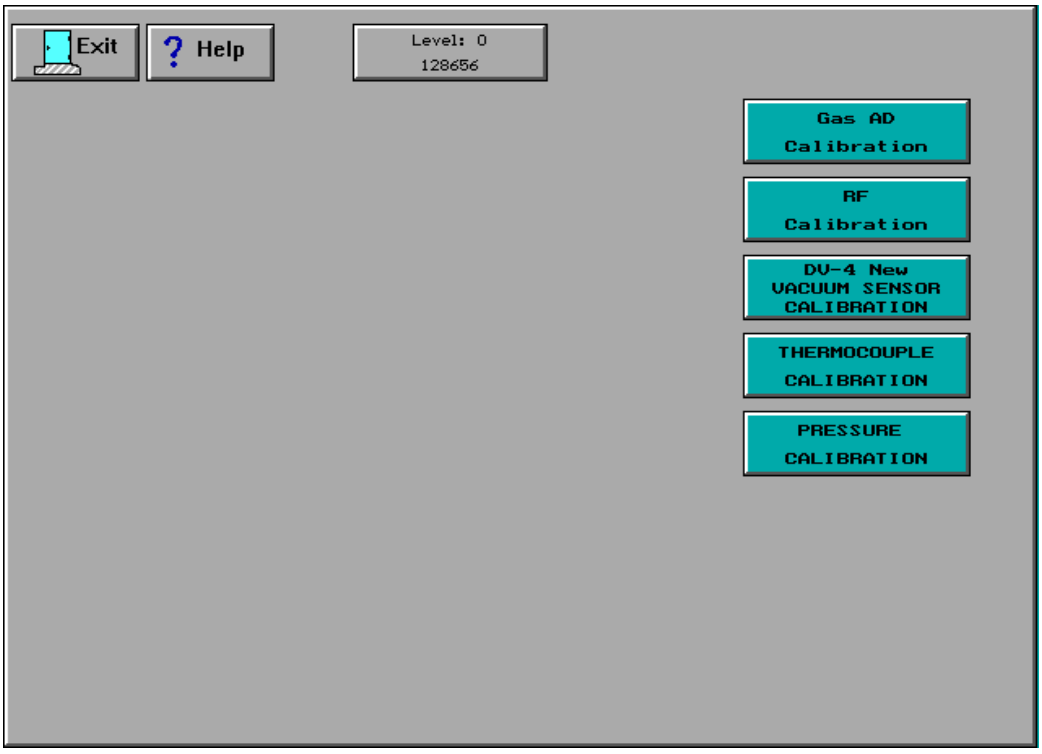


Figure 7-1: Calibration Menu

Location: Main Menu ➔ Calibration

7.2.2 GAS CALIBRATION

This calibrates the analog and digital circuits for the feedback of each of the MFC's.

The procedure is very similar to the thermocouple calibration routine.

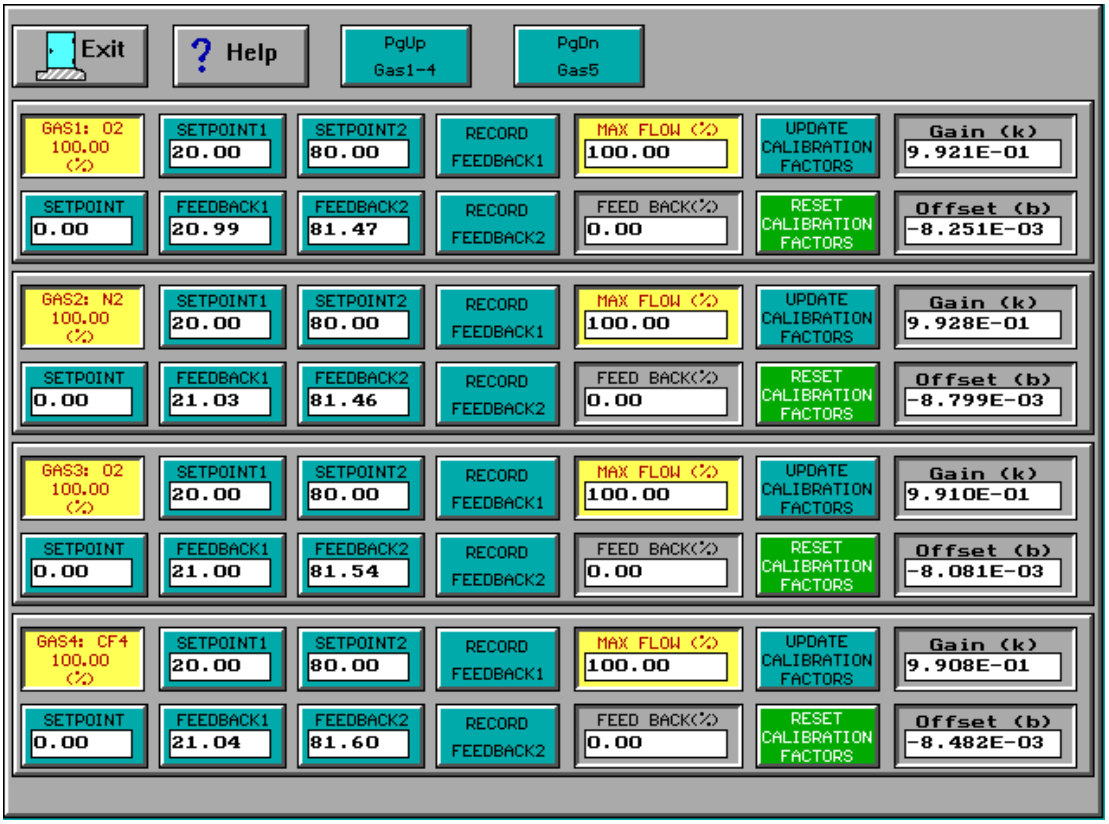


Figure 7-2: Gas Calibration screen

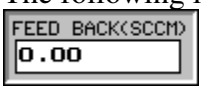
Location: Main Menu ➔ Calibration Menu ➔ Gas Calibration

Gas Calibration, as shown above, is used to correct for any offset that might develop in the gas flow circuitry. There are 2 kinds of offset: the zero offset (k) and the linear offset (b).

The control software uses the following equation to correct the offsets:

$$y = (k * x) + b$$

where x is the reading from the computer A/D converter, and y is the calibrated gas flow.

The following is a step-by-step procedure for calibrating the gas flow. The 

on the *Gas Calibration* screen always displays the gas flow rate from the gas A/D channel.

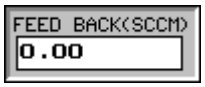
The following steps are for one gas flow. The other gas flows are calibrated in exactly the same manor.

Step 1. Click on 

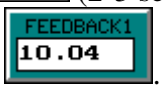
to reset the factors to k=1 and b=0.

Step 2. Set 

to the appropriate low gas flow rate, usually 20% of the max flow rate. (For example: if the maximum flow rate is 200 sccm, then 40 should be entered into this field.) If this field already has the correct value, click on it and press Enter. This will set the setpoint.

Step 3. Wait for the flow rate to stabilize in 

(2-3 seconds). Then click 

. The flow rate will be recorded to 

.

Step 4. Set 

to the appropriate high gas flow rate, usually 80% of the max flow rate. . (For example: if the maximum flow rate is 200 sccm, then 160 should be entered into this field.) If this field already has the correct value, click on it and press Enter. This will set the setpoint.

Step 5. Wait for the flow rate to stabilize in 

(2-3 seconds). Then click the 

. The flow rate will be recorded to 

.

Step 6. Click on 

to calculate the factors.

Step 7. Check the result of the Gas Calibration. Change the gas flow rate to several different setpoints in 

to verify the gas flow rate factors are good.

7.2.3 RF CALIBRATION

This screen calibrates the software for the discrepancies between the A/D, D/A and RF Generator.

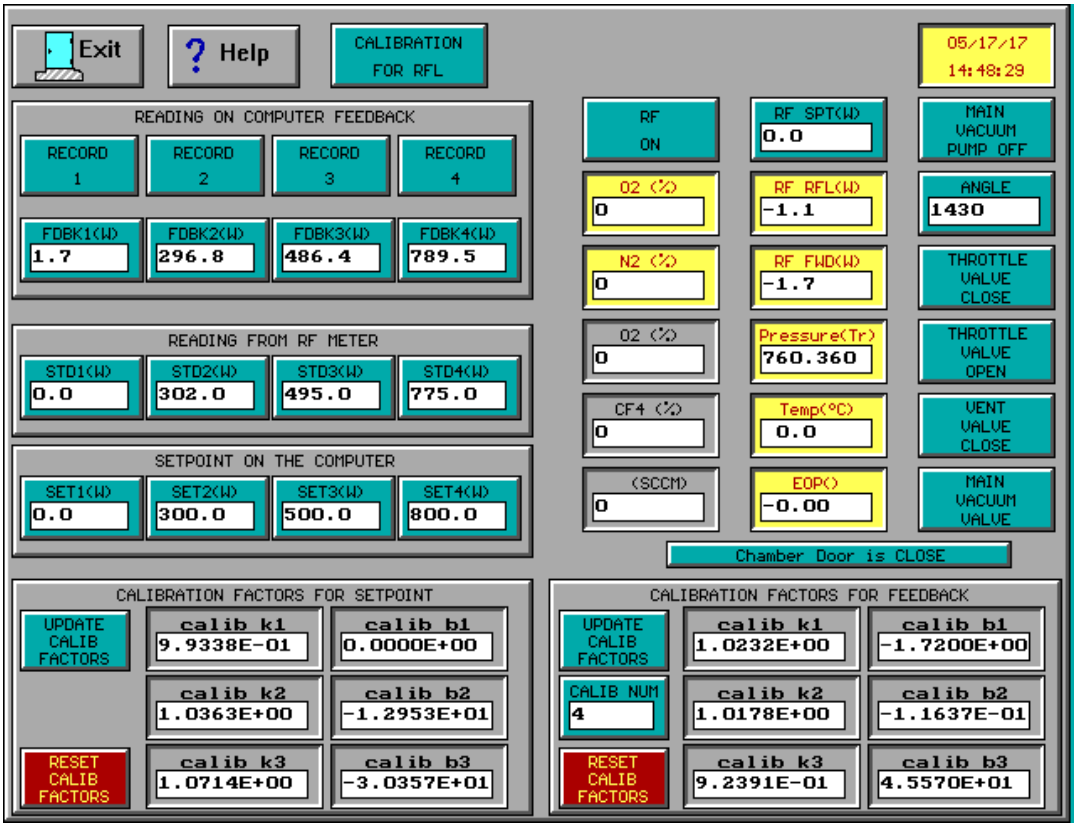


Figure 7-3: *RF Calibration (for Forward Power)* screen

Location: Main Menu ➔ Calibration Menu ➔ RF Calibration

RF Calibration screens as shown in figure 7-3 and figure 7-4 are used to correct for any offset that might develop in the RF control and feedback circuitry.

The AW software is capable of four-piece-wise curve fitting and uses the following equation to correct the offsets for each piece. There are 2 kinds of offset: the zero offset (k) and the linear offset (b).

$$y = (k * x) + b$$

For the setpoint, x is the input to the computer D/A converter, and y is the calibrated RF Power setpoint. This corrects any offsets in the computers D/A converter and the RF Generator so the RF Power meter shows the same value as the setpoint.

For the feedback reading, x is the reading from the computer A/D converter, and y is the calibrated RF Power feedback. This corrects for any offsets in the RF Generator and the computer A/D converter so the feedback is the same as the setpoint.

RF calibration is performed for both RF forward power and reflected power.

Calibration of RF Forward Power

The following is a step-by-step procedure for calibrating the RF forward power. The **RF FWD(W)** field on the *RF Calibration(for Forward Power)* screen (Figure 7-3) displays the RF forward power from the feedback A/D channel of RF Generator.

Step 1. Pump down the process chamber.

Step 2. Set the pressure and gas flow rate to the desired values.

Step 3. Click the **Calib Num** field to select the desired number of pieces for piece-wise calibration. Note that

- **Calib Num** can only be specified as 2, 3 or 4.
- Although there are four fields in the boxes of **Reading On Computer Feedback**, **Reading From RF Meter**, and **Setpoint On The Computer**, we only need to perform calibration and to fill out the number of fields as specified by **Calib Num**.
- The number of fields in the boxes of **Calibration Factors For Setpoint** and **Calibration Factors For Feedback** will change accordingly to be the same as (**Calib Num**– 1).

Step 4. Click on the **Reset Calib Factors** button of the **Calibration Factors For Setpoint** box to reset the factors to k=1 and b=0 for the setpoints.

Step 5. Click on the **Reset Calib Factors** button of the **Calibration Factors For Feedback** box to reset the factors to k=1 and b=0 for the feedbacks.

Step 6. Specify and enter the RF power in each field of the **Setpoint On The Computer** box. The leftmost field should be always 0 and the rightmost field should be the desired or up to the maximum RF power as specified in the RF generator's manual. The RF power specified in the fields, if any, between leftmost and rightmost fields is recommended to be equally divided between 0 and the RF power in the rightmost field.

☠WARNING

Entering a RF power value larger than the RF generator's specification may result in a hazard that could cause harm to personnel and/or the system.

Step 7. For each **SETx(W)** field of the **Setpoint On The Computer** box, perform the following:

(i) Enter into the **RF SPT** field the desired RF power that is specified in the **SETx(W)** field.

(ii) Click on the **RF On/Off** button to turn on the RF Generator.

(iii) Look at the RF Generator's forward power meter and record the value in the **STDx(W)** field of the **Reading From RF Meter** box corresponding to the same **SETx(W)** field's location.

(iv) Wait for the feedback A/D channel to stabilize in the **RF FWD(W)** field. Then click the **Record x** button of the **Reading On Computer Feedback** box corresponding to the same **SETx(W)** field's location. The power will be recorded in the **FDBKx(W)** field.

(v) Click on the **RF On/Off** button to turn off the RF Generator.

☜ NOTE

When changing the RF setpoint and RF SPT fields, be sure the RF Generator is powered off (RF ON LED is off).

Step 8. Click the **Update Calib Factors** field of the **Calibration Factors For Setpoint** box. This will calculate the proper k and b factors for the setpoint. The RF Generator's forward power meter will now be the same as the entered setpoint value.

Step 9. Click the **Update Calib Factors** field of the **Calibration Factors For Feedback** box. This will calculate the proper k and b factors for the feedback reading of forward RF power. The feedback A/D reading of forward power will now be the same as RF Generator's forward power meter.

Step 10. Check the result of the RF Calibration. Change the RF Power to several different setpoints to verify the RF Generator's power meters and feedback readings are good

Calibration of RF Reflected Power

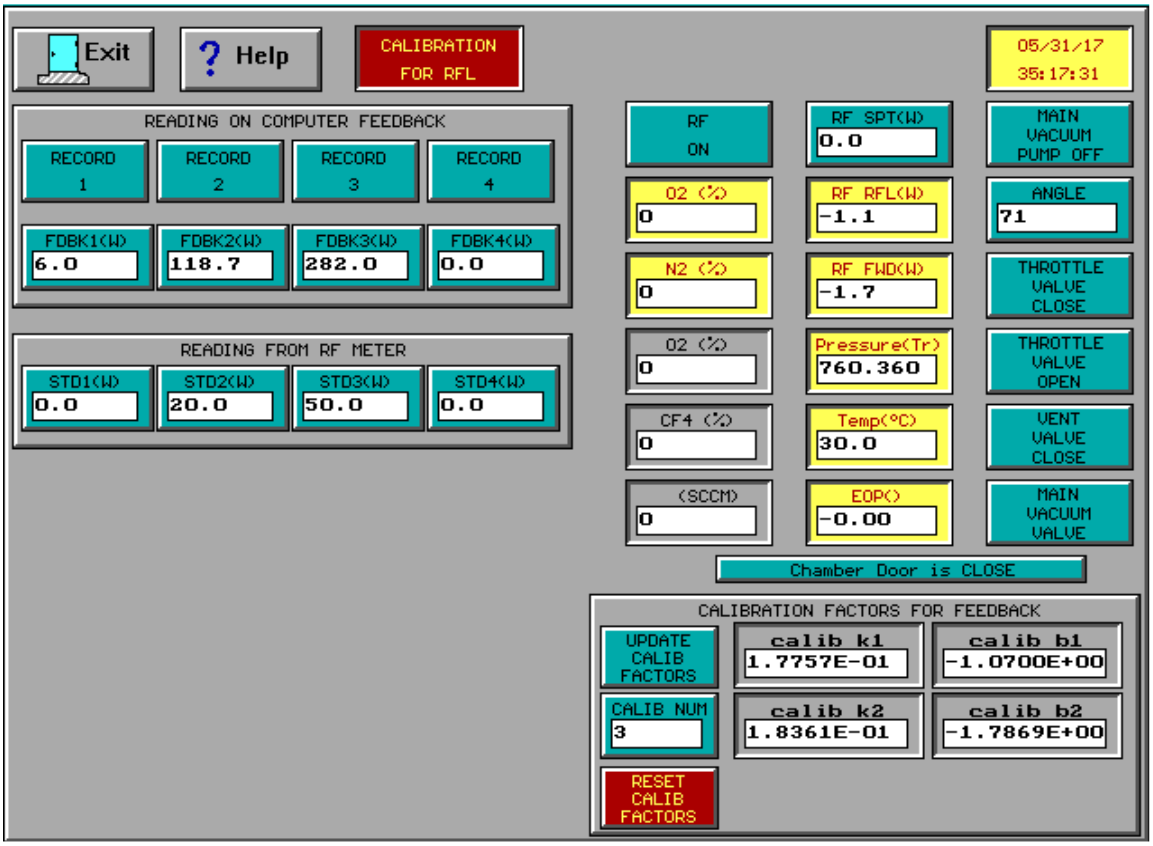


Figure 7-4: *RF Calibration (for Reflected power)* screen

Location: Main Menu ➔ Calibration Menu ➔ RF Calibration ➔ Calibration for RFL

The following is a step-by-step procedure for calibrating the RF reflected power. The **RF REVS(W)** field on the *RF Calibration (for Reflected Power)* screen (Figure 7-4) displays the RF reflected power from the A/D channel of the RF generator.

Step 1. Disconnect from the RF Generator the coaxial cable connector to the matching box.

Step 2. Pump down the process chamber.

Step 3. Click the **Calibration For RFL** button to switch from *RF Calibration* screen for forward power to *RF Calibration* screen for reflected power. Note that the **Setpoint On The Computer** and **Calibration Factors For Setpoint** boxes disappear.

Step 4. Set the pressure and gas flow rate to the desired values.

Step 5. Click the **Calib Num** field to select the desired number of pieces for piece-wise calibration. Note that

- **Calib Num** can only be specified as 2, 3 or 4.
- Although there are four fields in the boxes of **Reading On Computer Feedback** and **Reading From RF Meter**, we only need to perform calibration and to fill out the number of fields as specified by **Calib Num**.
- The number of fields in the **Calibration Factors For Feedback** box will change accordingly to be the same as (**Calib Num**– 1).

Step 6. Click on the **Reset Calibration Factors** button ofthe **Calibration Factors For Feedback** box to reset the factors to k=1 and b=0 for the feedbacks.

Step 7. Prepare before-hand the **Calib Num** set of the desired RF reflected power values. The first value should be always 0 and the last value should be the maximum RF reflected power as specified in the RF generator's manual. For any other RF reflected power needed, if any, between the first and last values is recommended to be equally divided between the first and the last values.

☠WARNING

Entering a RF reflected power value larger than the RF generator's specification may result in a hazard that could cause harm to personnel and/or the system.

Step 8. For each value prepared in previous step, perform the following:

(i) Enter this value into the **RF SPT** field.

(ii) Click on the **RF On/Off** button to turn <u>on</u> the RF Generator.

(iii) Look at the RF Generator's reflected power meter and record the value in the **STDx(W)** field of the **Reading From RF Meter** box corresponding to the same order.

(iv) Wait for the feedback A/D channel to stabilize in the **RF RFL(W)** field. Then click the **Record x** button of the **Reading On Computer**

Feedback box corresponding to the same order. The power will be recorded in the **FDBKx(W)** field.

(v) Click on the **RF On/Off** button to turn off the RF Generator.

NOTE

When changing the RF SPT field, be sure the RF Generator is powered off (RF ON LED is off).

Step 9. Click the **Update Calib Factors** field of the **Calibration Factors For Feedback** box. This will calculate the proper k and b factors for the feedback reading of reflected RF power. The feedback A/D reading of reflected power will now be the same as RF Generator's reflected power meter.

Step 10. Check the result of the RF Calibration. Change the RF Power to several different setpoints to verify the RF Generator's power meters and feedback readings are good

7.2.4 THERMOCOUPLE CALIBRATION

When in use, the thermocouple is situated inside the process chamber and positioned so that it is in contact with the wafer to be processed.

There is one type of thermocouple used in this Allwin21 system: the J type.

The linearizing circuit and the analog circuit for the thermocouple have to be calibrated by using a TC calibration meter set to J-type thermocouple. This meter is plugged into TC1, a yellow connector on the control board where the thermocouple is normally plugged into. Set the TC calibration meter to a particular temperature and the meter sends a voltage to the control board that is equivalent to a J-type thermocouple at the temperature that the meter was set at.

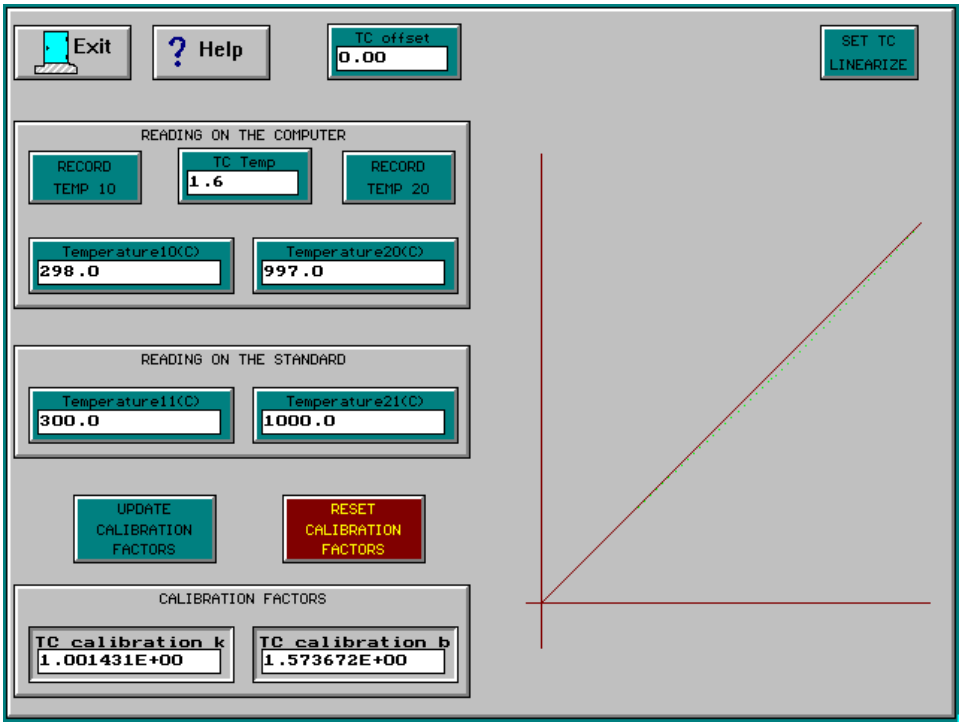


Figure 7-4: Thermocouple Calibration screen

Location: Main Menu ➔ Calibration ➔ Thermocouple Calibration

Thermocouple Calibration, as shown above, is used to correct for any offset that might develop in the thermocouple circuitry. There are 2 kinds of offset: the zero offset (k) and the linear offset (b).

The control software uses the following equation to correct the offsets:

$$y = (k * x) + b$$

where x is the reading from the computer A/D converter, and y is the calibrated temperature. A thermocouple calibration meter (i.e. Omega Engineering model CL25) is used for the calibration standard. This corrects for any offsets in the computer A/D converter.

The following is a step-by-step procedure for calibrating the thermocouple. The **TC Temp** field on the *Thermocouple Calibration* screen always displays the temperature from the TC A/D channel.

Step 1. Connect a thermocouple calibration meter to the thermocouple connector on the Allwin21 system. Set the calibration meter to the type of thermocouple that is used in the system, typically J-type.

Step 2. Go to the *Thermocouple Calibration* screen by clicking on the **Thermocouple Calibration** button in the *Calibration Menu*.

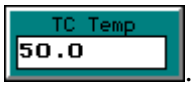
Step 3. Click on this 

to reset the factors to k=1 and b=0.

Step 4. Set 

to the appropriate low temperature value (300 ºC).

Step 5. Set the thermocouple calibration meter to the same value as in Step 4.

Step 6. Wait for the temperature to stabilize in 

. Then click 

.

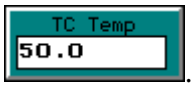
The temperature will be recorded to 

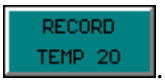
.

Step 7. Set 

to the appropriate high temperature value (1000 ºC).

Step 8. Set the thermocouple calibration meter to the same value as in Step 7.

Step 9. Wait for the temperature to stabilize in 

. Then click 

.

The temperature will be recorded to 

.

Step 10. Click on 

to calculate the factors. If a message-box pops-up saying "Temperature readings on the computer T1 and T2 are too close", record the higher temperature to make the temperature difference at least 100 ºC.

Step 11. Check the result of the TC Calibration. Change the thermocouple calibration meter to several different setpoints to verify the TC readings are good.

7.2.5 PRESSURE CALIBRATION

This calibrates the analog and digital circuits for the feedback of the Baratron meter.

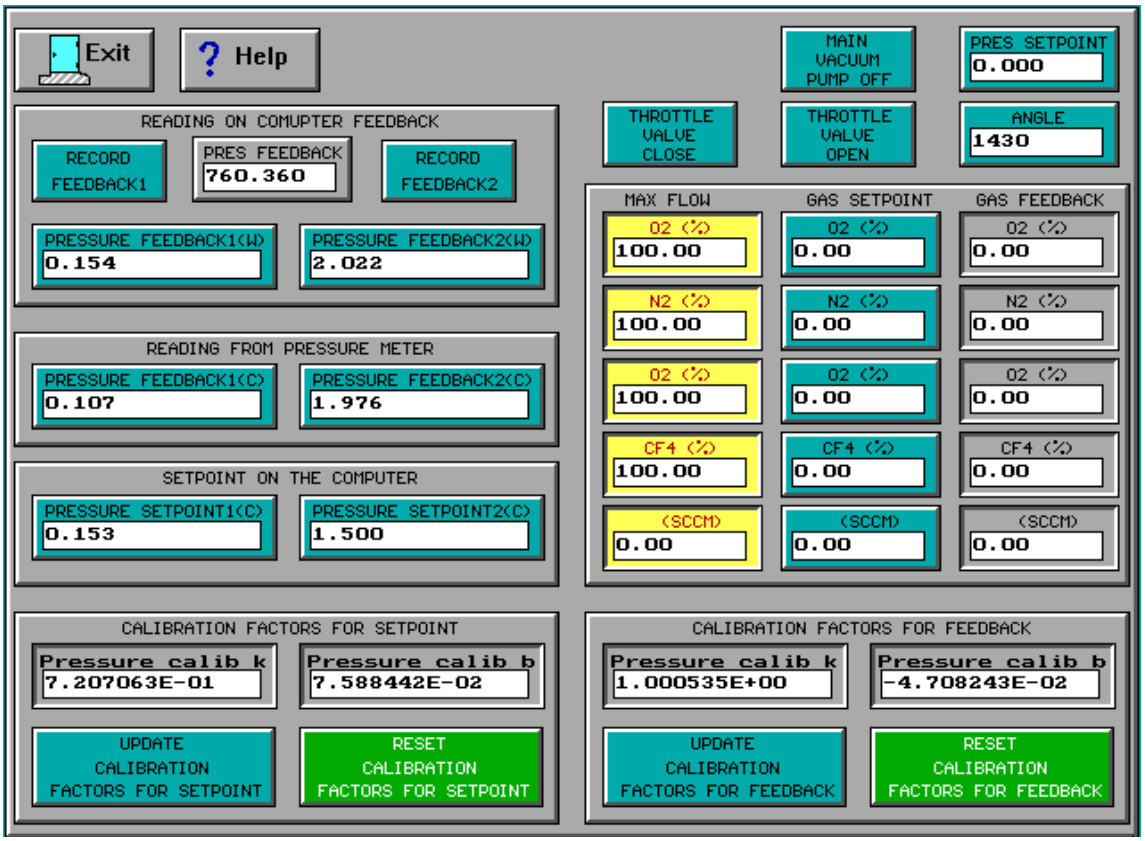


Figure 7-5: Pressure Calibration Screen

Location: Main Menu ➔ Calibration Menu ➔ Pressure Calibration

Pressure Calibration, as shown above, is used to correct for any offset that might develop in the pressure circuitry. There are 2 kinds of offset: the zero offset (k) and the linear offset (b).

The control software uses the following equation to correct the offsets:

$$y = (k * x) + b$$

where x is the reading from the computer A/D converter, and y is the calibrated pressure.

The following is a step-by-step procedure for calibrating the pressure. The 

field on the *Pressure Calibration* screen always displays the pressure from the pressure A/D channel.

The following steps are for the pressure.

Step 1. Click on the 

button to reset the factors to k=1 and b=0 for the setpoint

Step 2. Click on the 

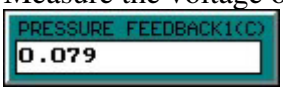
button to reset the factors to k=1 and b=0 for the feedback.

Step 3. Click on the 

field and press **Enter**. This is usually 20% of the pressure meter range. This will set the setpoint.

Step 4. Wait for the pressure to stabilize in the 

field (2-3 seconds).

Step 5. Measure the voltage output of the baratron. Record the measurement in the 

field.

Step 6. Then click the 

button. The pressure will be recorded to the 

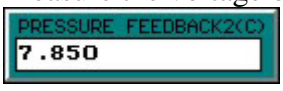
field.

Step 7. Click on the 

field and press **Enter**. This is usually 80% of the pressure meter range. This will set the setpoint.

Step 8. Wait for the pressure to stabilize in the 

field (2-3 seconds).

Step 9. Measure the voltage output of the baratron. Record the measurement in the 

field.

Step 10. Then click the 

button. The flow rate will be recorded to the 

field.

Step 11. Click 

to calculate the proper k and b factors for the setpoint. The input voltage at the baratron will now be the same as the entered setpoint value.

Step 12. Click 

to calculate the proper k and b factors for the feedback. The 

will now be the same as the output voltage at the baratron.

Step 13. Check the result of the Pressure Calibration, both computer reading and baratron measurement. Change the pressure to several different setpoints in the 

field to verify the pressure factors are good.

7.2.6 TC GAUGE CALIBRATION

TC gauge is used to measure the chamber pressure. The type of the TC gauge is selected by the **TC Gauge Type** button in the *"Main Menu/Maintenance/Factory Setup"* screen. Here the DV-4 New TC is used as an example. The following screen is used to calibrate the software for the discrepancies between the real pressure and A/D reading of TC gauge's voltage. Note that an external pressure measurement device, such as Baratron, is required as a reference for TC gauge calibration. One end of the T-shape connector can be connected to this external pressure measurement device while the other end is already connected to the TC gauge.

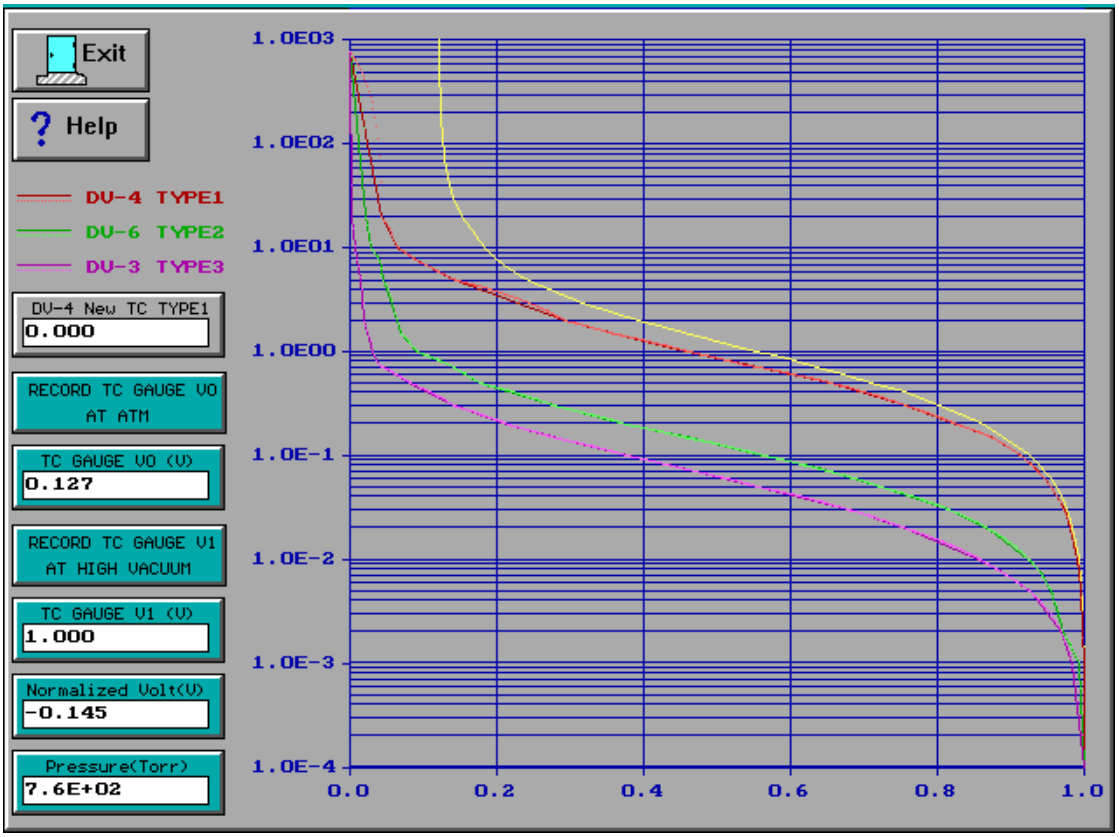


Figure 7-6: TC Gauge Calibration Screen

Location: Main Menu ➔ Calibration Menu ➔ (TC Gauge) DV-4 New Vacuum Sensor Calibration

Step 1. Click the **Vent to ATM** (atmosphere) button in the *"Main Menu/Diagnostics"* screen. And the text of the button becomes **Vent Valve Open**. Wait for the text of the button to become **Vent to ATM**.

Step 2. Click the **Record TC Gauge V0 At ATM** button such that the A/D reading of TC gauge is recorded onto the **TC Gauge V0 (V)** field.

Step 3. Click the **Process chamber Pump Down/Off** button to **Down** in the *"Main Menu/Diagnostics"* screen to pump down the chamber.

Step 4. Wait at least 5 second before proceeding to the next step.

Step 5. Click the **Main Vacuum Open/Close** (valve) button to open so the chamber is pumped down.

Step 6. Check the pressure indication of the external pressure measurement device. Proceed to the next step when its reading reaches 0.

Step 7. Click the **Record TC Gauge V1 At High Vacuum** button such that the A/D reading of TC gauge is recorded onto the **TC Gauge V1 (V)** field. Note that

- The **Normalized Volt(V)** field is updated.
- The **Pressure(Torr)** field is also updated to indicate that the chamber pressure field is calibrated.

7.3 SOFTWARE DIAGNOSTICS

7.3.1 OVERVIEW

Software Diagnostics are used to monitor and test the performance of different functions of the Allwin21 system independently of each other. The tools that are provided in the control software for monitoring and testing are:

- **Diagnostics** allows the checking of the operation of each device in the system.
- **Board Test** allows the checking of the individual hardware channels. This is to be used in the most extreme cases where it is unclear if the problem is with the input or output channel of the device.

A safety feature that is built into the Allwin21 system control board is a watchdog timer. This watchdog timer shuts off the RF generator if it is not reset by the control software every two seconds. If the computer "locks up" or the communication cable is not securely connected, the RF will shut down so there will not be a run-away condition.

The software diagnostics allows the operator to test the following with either a manual or automatic method:

- The gas flow can be set to flow one or more of the gases.
- The temperature from the thermocouple is displayed graphically in real-time.

7.3.2 DIAGNOSTICS SCREEN

The *Diagnostics* screen, as shown below, can be used to diagnose many problems with the Allwin21 system. It is used to verify the proper operation of each device in the Allwin21 system independently of the other devices. The lamp power, vacuum, RF and each gas flow can be manually set to any desired value within the limits of the device. It can also be used to determine if the control software is communicating with the oven unit.

CAUTION

It is possible to damage the machine if the user does not follow proper safety precautions with the gases, RF, and temperature.

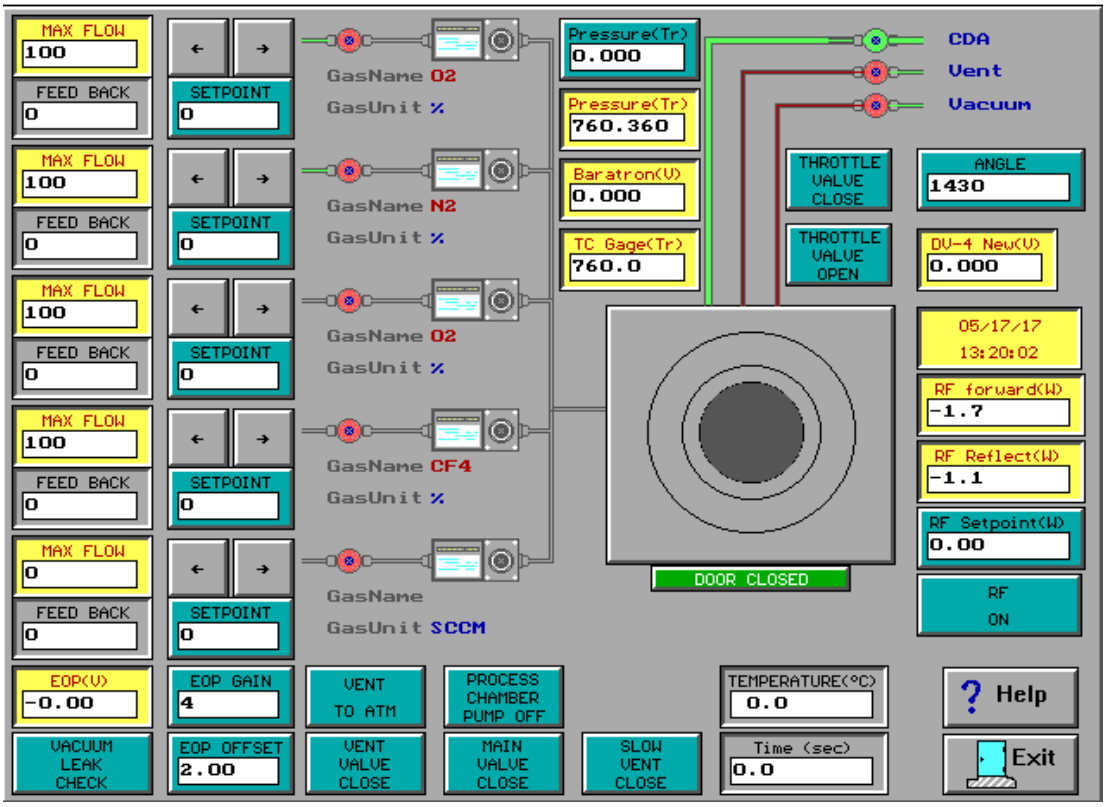
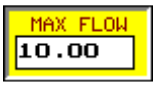
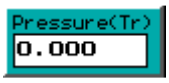
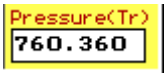
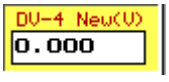


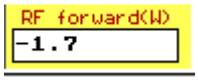
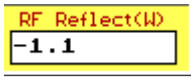
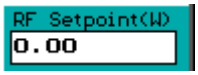
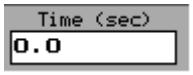
Figure 7-7: Diagnostics Screen

Location: Main Menu ➔ Diagnostics

	The maximum allowable flow rate for the gas
	The current flow rate of the gas as controlled by the MFC
	Increase the setpoint of the gas flow rate by 1%
	Decrease the setpoint of the gas flow rate by 1%
	The setpoint for the MFC to control the gas flow rate
	Enables (green) / Disables (red) the gas flow. Sets the setpoint to 0 and closes the gas pneumatic valve.
GasName	The name of the gas for that line
GasUnit	The units of gas flow for that line

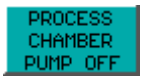
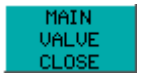
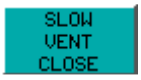
	Set the pressure setpoint in Torr.
	Display the pressure of the chamber in Torr. This is the pressure value used by the control software. The source of the pressure measurement is selected by the **Pressure Sensor TC-Gage/Baratron** button in the "*Main Menu/Maintenance/Factory Setup*" screen.
	Display the Baratron's voltage, if installed, which is proportional to the pressure measured. Note that the Baratron can only measure the pressure much less than the atmosphere.
	Display the calibrated pressure in Torr measured by the TC gage, if installed.
	Display the TC gage's voltage which is inversely proportional to the pressure measured. Note that the name of the type of TC gauge selected is displayed.

	The CDA icon allows opening and closing the CDA valve.
	The vent icon displays the position of the vent valve.
	The vacuum icon displays the position of the main vacuum valve.
	Fully Close the Throttle Valve.
	Fully Open the Throttle Valve.
	Set the Angle of the Throttle Valve.
	Displays the position of the chamber door, open or closed.

	Display the RF forward power in Watts
	Display the RF reflected power in Watts.
	Set the setpoint of the RF power. Note that RF generator is turned on only when both **RF On** and **RF Setpoint** is non-zero.
	Turns on and off the RF Generator power. Note that RF generator is turned on only when both **RF On** and **RF Setpoint** is non-zero.
	Display the temperature, if TC is installed
	Display either as a down counter during vent or as a up counter during leakcheck

	Display the hardware EOP voltage after the **EOP Gain** and **EOP Offset** are taken into account.
	Select the hardware resistor network setting which is equivalent to a certain gain of raw EOP voltage. The higher the number, the higher the gain although it is not linear.
	Set the hardware EOP offset which is to be added to the raw EOP voltage.

	A routine to check for vacuum leaks. It will pumpdown the chamber for the T1 time, close all valves and then wait for T2 time. It will then calculate the leak rate by the amount the pressure inside the chamber increased. T1 is the pumpdown time as specified in the System Setup screen. T2 is the Idle time as specified in the System Setup screen.
	Click to vent the chamber to the atmospheric pressure in two stages. The first stage is a slow-vent stage where only the slow vent valve is opened. When the pressure reaches 10 Torr, the slow vent valve is closed, the fast vent valve is opened and this is the second stage. Also the **Time (sec)** field of this *Diagnostics* screen is loaded with the value from the **Time to vent Chamber Before Alarm (in seconds)** field in the *"Main Menu/Maintenance/Module Parameter Description/Pressure"* screen and starts to count down. When the **Time (sec)** field reaches 0, the fast vent valve is closed.
	Click to open/close only the fast vent valve and also indicate the status of the fast vent valve when the **Vent to ATM** button is clicked. Note that there is no slow vent operation associated with the operation of this button.

	Click for Process Chamber Pump down/off. When clicked to pump down, the chamber door is checked whether closed or not. If the door is closed, the pump-down proceeds in two stages. The first stage is a slow pump-down operation where the main valve (i.e. isolation valve) is opened and the throttle valve is opened gradually from fully close position so any smaller wafer in the chamber is not impacted by the gas flow inside the chamber during pump-down. One parameter of the slow pump-down operation is set by the **SlowPump Delay** field ranging from 0 to 60 in the *"Main Menu/Maintenance/Factory Setup"* screen. The longer the Slowpump delay, the slower the slow pump-down operation. When the **Crossover Pressure** is reached during slow pump-down operation, the throttle valve is fully opened right away and this is the second stage. The **Crossover Pressure** can be set in the *"Main Menu/Maintenance/Module Parameter Description/Pressure"* screen and the unit is in 0.01 Torr. In addition, the chamber is pumped down for T1 time, or until the crossover pressure has been reached. If the crossover pressure has not been reached within T1 time, there will be an alarm. T1 is the **Pumpdown** time field as specified in the *System Setup* screen.
	Click to open/close the main valve and also indicate the status of the main valve when the **Process Chamber Pump Down** button is clicked. The chamber door is checked whether closed or not. If the door is closed, the main valve (i.e. isolation valve) is opened.
	Open/close the slow vent valve .

7.3.3 GAS FLOW DIAGNOSTICS

There are three methods to determine the health of the gas flow control. All three methods check the communication between the MFC's and the controller.

If the gas flow can be controlled, then the communication between the controller and oven is functioning correctly. Otherwise there is a problem between the MFC and the controller and maintenance is required.

1) Gas flow diagnostics in the ***Diagnostics*** screen is used to turn on and set the gas flow. This is the simplest method to determine if a gas flow can be controlled properly.

   Purpose: Input a specific gas flow rate and monitor the feedback to determine MFC functionality and flow rate accuracy.

   Procedure:

   Step 1. Enable the Gas to be tested  .

   Step 2. Enter in a value in 

   that is greater than zero (0), but less than the max flow rate specified for that MFC (i.e. 5 SLPM).

   Step 3. Observe the feedback gas flow rate 

   .

   Step 4. Turn off the gas flow by entering in zero (0) in 

   and disable the gas  .

2) Writing and running a recipe for the gas to be tested allows observation of the response graphically for the MFC to setpoint commands.

   Write the recipe so only the gas is controlled. Create several steps with different setpoints. Allow at least 5 seconds for the MFC to stabilize before going onto another step and changing the setpoint.

□ NOTE

Remember: The height of the graph represents 100% of the maximum flow rate of the MFC.

3) Using the ***Board Test*** screen to test the gas control is the most direct method. It allows setting a specific voltage for the setpoint and measuring the voltage at the MFC. Conversely, the output (feedback) voltage from the MFC can be measured and compared to the input analog channel value displayed for that gas.

   The ***Gas Setup*** screen defines the input and output analog channels for the gases.

7.3.4 BOARD TEST

The *Board Test* screen, as shown below, allows the maintenance person to inspect each individual A/D, D/A and digital channel in the system. It can also be used to diagnose problems at the digital or analog channel level. This is the lowest level of the control software to control and monitor the hardware. This is very helpful to determine if a device and its cabling are working properly.

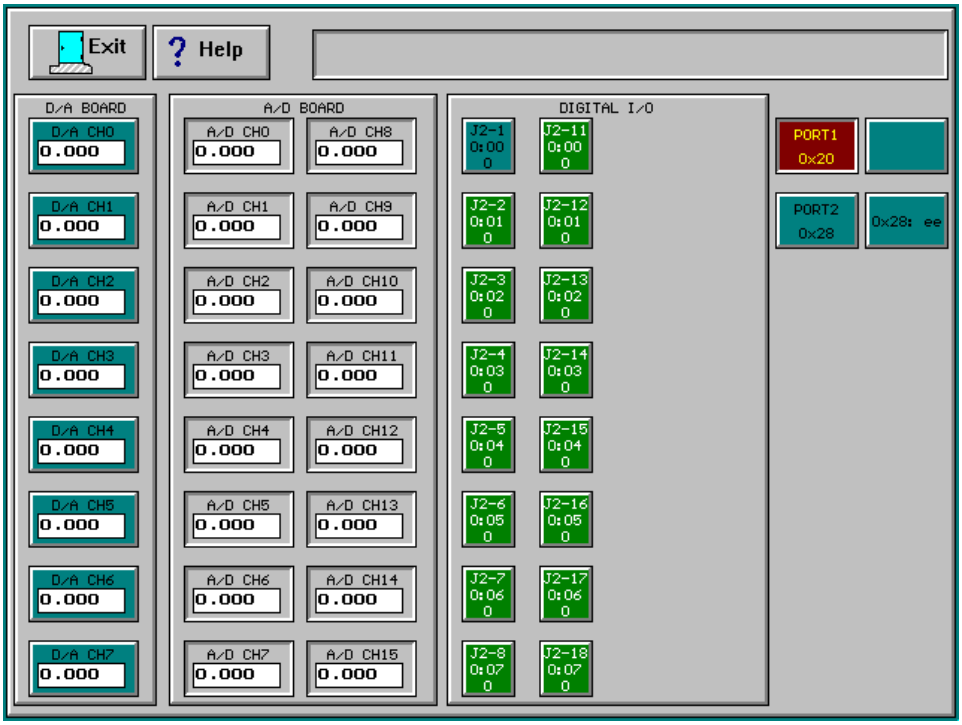


Figure 7-8: Board Test screen

Location: Main Menu ➔ Maintenance Menu ➔ Board Test

APPENDIX

A. ALARM CODES

Alarm ID	Alarm Text	Comments
0000	Communication Down	Refer to chapter 11, section "No Communication Between the Oven Unit and the Computer".
0001	MFC X has a low flow rate.	The gas flow for Gas #X is too low from the setpoint. Refer to section "Gas Control" in the "Troubleshooting" chapter.
0002	MFC X has a high flow rate.	The gas flow for Gas #X is too high from the setpoint. Refer to section "Gas Control" in the "Troubleshooting" chapter.
0003	MFC X Flow is Unstable.	The gas pressure for Gas #X fluctuates too much. Refer to section "Gas Control" in the "Troubleshooting" chapter and the System Requirements.
0004	MFC X Max Flow too small.	
0005	Cooling Water Flow Not Detected.	Cooling water flow rate or the water pressure is too low. Refer to the System Requirements.
0006	Cooling Water Pressure Out of Range.	Cooling water pressure is either too low or too high. Refer to the System Requirements.
0007	Cooling Fan Flow Not Detected.	
0008	Gas Panel Exhaust Flow Not Detected.	Not enough negative pressure in the facilities exhaust.
0009	Phase/Voltage Loss Detected.	
0010	Remote EMO Activated.	The remote EMO has been pressed.
0011	Toxic Gas Alarm Activated.	The toxic gas sensor has detected a toxic gas. There is a gas leak in the cabinet.
0012	Gas Line Pressure Abnormal.	The gas line pressure is either too high or too low. Refer to the System Requirements.

Alarm ID	Alarm Text	Comments
0013	Compressed Air Pressure Out of Range.	If the compressed air pressure is too low, then devices may not actuate fully. If too high, a seal or connection may rupture. Adjust the compressed air pressure according to the System Requirements
0014	Over Temperature Detected on Chamber.	The thermocouple is disconnected.
0015	Cassette not Ready.	There is no cassette on the cassette station or it isn't seated down properly.
0016	Cassette missing	The cassette has been removed or is no longer activating the sensor. Replace the cassette.
0017	Cassette Swivel In Not Detected.	
0018	Cassette Swivel Out Not Detected.	
0019	The Gas Box Door is Open.	
0020		
0021		
0022		
0023	Power sum is over the spec.	
0024	The Gas Box Door is Open.	
0025		
0026		
0027		
0028		
0029	Pyrometer Error.	
0030	Thermocouple Error.	
0031	Pneumatic Valve Problem.	
0032	Front Panel Display Error	
0033	RS-232 (Front Panel) Error	
0034	RS-232 problem For the Robot	The computer cannot communicate to the robot controller. Check connections and power for the robot controller.
0035	RS-232 problem For the Aligner	
0036	RS-232 problem For the GEM(SECSII)	

Alarm ID	Alarm Text	Comments
0037	Over Temperature or connecting problem!	The temperature inside the chamber is too high or the thermocouple is disconnected. Refer to the "Maintenance" chapter, section "Thermocouple".
0038	Temp sensor problem TC connect Reversed	The temperature is going down when the wafer is being heated. The thermocouple leads have been connected in reverse. Refer to the "Maintenance" chapter, section "Thermocouple".
0039	Temp sensor problem or Lamp not work! Software Protecting	
0040	Temperature offset problem	
0041	RF plasma not on! Plasma Failure!	Plasma was not detected.
0042	RF warning problem	The RF generator issued a warning. Check the RF generator.
0043	RF over heat!	The RF generator overheated. Check the RF generator.
0044	Pressure problem vacuum pressure far away offset!	The vacuum is either too high or too low from the recipe setpoint during a process run.
0045	Door can not be opened	The chamber door did not open completely. This could be cause by the pneumatic air pressure being too low.
0046	Door can not be closed	The chamber door did not close completely. This could be cause by the pneumatic air pressure being too low.
0047	The Robot X motor can not move to the zero position	The robot did not completely move to the zero position. This is caused by an obstruction or a loose cable. Check all cables for the robot and robot controller.
0048	Robot vacuum sensor does not detect the wafer.	The robot could not detect a wafer on the robot end-effector. Either the vacuum pump is not on, or there is a leak in the robot vacuum line, or the wafer is not making a good seal with the end-effector. Clean the end-effector.

Alarm ID	Alarm Text	Comments
0049	The vacuum sensor has detected wafer on the robot arm.	The robot has detected a wafer on the end-effector when there shouldn't be one. Either the robot needs to be realigned with the station because it couldn't deposit the wafer on the station, or the robot vacuum line has an obstruction in it, or the vacuum is too great, or the robot vacuum sensor needs to be adjusted.
0050	The Robot can not reach the setpoint position	The robot did not completely move to the taught position for that station. This is caused by an obstruction or a loose cable. Check all cables for the robot and robot controller.
0051	Arm X has a wafer. It can not pick another wafer.	The robot has detected a wafer on the end-effector when there shouldn't be one. Either the robot needs to be realigned with the station because it couldn't deposit the wafer on the station, or the robot vacuum line has an obstruction in it, or the vacuum is too great, or the robot vacuum sensor needs to be adjusted.
0052	Station X, axis X, Arm X, pos is out of range	The robot needs to be initialized.
0053		
0054	The door closed Load Arm could not go out!	
0055	Cassette missing Check cassette please!	The cassette station does not detect a cassette. Make sure the cassette is seated properly or place a cassette on the cassette station.
0056	Wrong Cassette Pitch!	The cassette pitch does not match the wafer size.
0057	Wrong Maximum Slots!	The cassette maximum slots does not match the wafer size.
0058		
0059	There is a wafer (in) on the X.	
0060		
0061	RF power is too low.	The RF power is too low from the setpoint.
0062	RF power is too high.	The RF power is too high from the setpoint.
0063	RF power is Unstable	The RF power fluctuates too much.

Alarm ID	Alarm Text	Comments
0064	Reverse RF is too high	The reverse RF power is too high from the setpoint.
0065		
0066		
0067		
0068		
0069		
0070		
0071		
0072		
0073		
0074		
0075		
0076	GEM SECS II connecting Problem!	The control software cannot communicate to the factory host computer. Check serial connections and GEM/SECS II settings.
0077		
0078		
0079		
0080	GEM SECS II connecting Problem!	The control software cannot communicate to the factory host computer. Check serial connections and GEM/SECS II settings.
0081		
0082		
0083		
0084		
0085		
0086		
0087		
0088		
0089		
0090		
0091		
0092		

Alarm ID	Alarm Text	Comments
0093		
0094		
0095		
0096	Recipe not validated	The recipe has not been validated. Load the recipe into the recipe editor and validate.
0097	Process Aborted	The process has been aborted by the operator.

B. DOS COMMANDS AT A GLANCE

Refer to a DOS manual for a full explanation of these and other DOS commands.

B.1 FILENAMES

- Filenames have no more than eight characters.
- Contain only the letters A – Z, the numbers 0 – 9.
- Cannot contain spaces, commas, backslashes, or periods.

B.2 PATH

In DOS, you list the path where a file is stored by separating the directory names with the backslash (\).

For example:

\doc\info

The first backslash represents the root directory. The second backslash separates the INFO directory from its parent directory, DOC.

B.3 WILDCARDS (*, ?)

If you want to perform the same task for a group of files, you don't have to use the same command repeatedly for each filename in the group. You can use wildcards to specify groups of files. A wildcard acts as a substitute for a name or extension.

There are two wildcards:

- The asterisk (*) represents a whole word or group of characters.
- The question mark (?) represents a single character.

For example, list all of the files and directories in the current directory that start with the letter 'c':

dir c*.*

B.4 COPY FILES

copy *source destination*

Copies one or more files to another location.

source
Specifies the location and name of a file from which you want to copy.

destination
Specifies the location and name of a file to which you want to copy.

B.5 XCOPY

xcopy *source destination /s*

Copies files and directories, including subdirectories. This is more powerful than **copy**. It is able to copy subdirectories.

source
Specifies the location and names of the files you want to copy. Source must include either a drive or a path.

destination
Specifies the location and names of the files you want to copy.

/s
Copies directories and subdirectories.

B.6 DELETE FILES

del *filename*

Deletes specified files.

filename
Specifies the name of the file you want to delete.

B.7 LIST DIRECTORY

dir

Display a list of a directory's files and subdirectories.

B.8 CHANGE DIRECTORY

cd *path*

Changes the current directory.

path
Specifies the directory to which you want to change.

B.9 MAKE DIRECTORY

md *path*
or
mkdir *path*

Create a new directory.

path
Specifies the name of the new directory.

B.10 CHANGE CURRENT DRIVE

To change the current drive, type the letter of the drive followed by a colon (**:**).

For example, to change the current drive to E, type the following:

e:

B.11 SYS

sys *drive:*

Copies DOS system files and the DOS command interpreter (COMMAND.COM) to the disk in the drive you specify.

drive:
Specifies the drive to which you want to copy the system files. These files can only be copied to the root directory and not to a subdirectory.

B.12 FORMAT

format *drive: /s*

Formats the disk in the specified drive to accept DOS files.

drive:
Specifies the drive containing the disk you want to format.

/s
Copies the operating system files after the disk has been formatted. This works as if you typed the command **sys**.

C. UPDATING THE CONTROL SOFTWARE

The version of the control software is made up of 2 parts: the major and the minor. These parts are separated by a decimal point. The minor part of the version (the right side) follows the decimal point. It is made up of 3 characters. Each character position has a specific meaning as described in the following table.

Character Position	Meaning	Format	Example
1	year	hexadecimal	6=2006 A=2010
2	month	hexadecimal	1=January 2=February 3=March 4=April 5=May 6=June 7=July 8=August. 9 = September A=October B=November C=December
3	release number	hexadecimal	1 - F

Whenever an updated version of the control software has been received, the extension of the filenames will be coded the same as the version of the control software.

For example: If the filename is AW-ASH.7B2, then the minor version of the control software is 7B2.
7 = 2007
B = November
2 = variant #2

This software was released in November, 2007. It is the second variant for the month.

If a notification has been sent that there is an update of the AW-ASH control software, download the files onto your computer. After downloading the files, copy them onto a USB drive that is 2 GB or smaller, or a 3.5", 1.44 MB floppy disk. Take these files to the machine and load them into the same directory as the control software.

If a USB drive is being used, it will have to be inserted into the USB port and then the computer needs to be rebooted. The USB drive may be assigned as drive B: or E:

Step 5. Once the computer is showing the Main Menu, **note** what the 3 character minor part of the version is.

Step 6. Press the 'Q' key to exit the control software and go into DOS.

Step 7. Copy your existing control software with the file extension being the minor part of the version code. Use the following command substituting the minor part of the version, that was noted as described above, for 123.

COPY AW-ASH.EXE AW-ASH.123

Step 8. Copy the files from the floppy disk (drive A:) or the USB drive (drive E:) into the control software directory. For example:

Step 9. If the source drive is the USB drive, then type the following command:

COPY E:AW-ASH.* C:AW-ASH.*

Step 10. If the source drive is the floppy disk, then type the following command:

COPY A:AW-ASH.* C:AW-ASH.*

Step 11. Change the extension of the new filenames to EXE. Use the following command substituting 123 for the minor part of the version, as described above.

COPY AW-ASH.123 AW-ASH.EXE

Step 12. If the computer asks you to overwrite a file, type "**a**" for "All" and press ***ENTER*** to replace the old files.

Step 13. You have just updated your control software. Now reboot the computer to have it take effect.

D. BACKING UP AND RESTORING THE SOFTWARE

D.1 OVERVIEW

It is always advisable to make a backup copy of the AW-ASH software. It may be needed in the event that the system is damaged, and problems develop on the computer which necessitates reloading the software.

Refer to this section for information on how to make a backup copy of the system. Make as many copies of the Allwin21 system software as you deem necessary. Store the backups in separate places in case the software must be reloaded in the future.

The procedures listed below will backup all information from the hard drive to a USB drive that is 2 GB in size.

D.2 BACK UP PROCESS DATA, RECIPES, CONTROL SOFTWARE

This procedure will backup the process data, recipes and control software to a USB drive. These files can be archived on a server. They can also be viewed on your office computer that is running the AllWin21 control software in demo mode.

Step 1. Connect the USB drive to the USB port on the machine's computer.

Step 2. Reboot the computer.

Step 3. When the computer has booted and is idle at the Main Menu, exit the control software. (Refer to the appendix section "Exiting the Program".)

Step 4. Change drive to the USB drive. For example, if it is drive "e:", then type the following DOS command:

e:

Step 5. Create a directory for the backup data (if it has not been created). For example, if the directory name is "backup", then type the following DOS command:

mkdir backup

Step 6. Change to that directory. For example, if the directory name is “backup”, then type the following DOS command:

cd backup

Step 7. Type the following DOS command:

xcopy c:*.* . /s

D.3 BACK UP THE ENTIRE DRIVE C:

Drive C: contains the operating system, drivers and the control software and generated files (i.e. recipes, calibration data and process data on drive C:) that the machine is depended on.

This procedure will backup all files that reside on drive C:.

Step 1. Connect the USB drive to the USB port on the machine’s computer.

Step 2. Reboot the computer.

Step 3. When the computer has booted and is idle at the Main Menu, exit the control software. (Refer to the appendix section “Exiting the Software”.)

Step 4. Change the drive to drive “C:” by typing the following DOS command:

c:

Step 5. Change to the root directory of drive “C:” by typing the following DOS command:

**cd **

Step 6. Change the drive to the USB drive. For example, if it is drive “E:”, then type the following DOS command:

e:

Step 7. Create a directory for the backup data (if it has not been created). For example, if the directory name is "backupAW", then type the following DOS command:

mkdir backupAW

Step 8. Change to that directory with the following DOS command:

cd backupAW

Step 9. Type the following DOS command:

xcopy c:*.* . /s

This will backup all files to your USB drive. These files can be archived on a server.

D.4 BACK UP DRIVE D:

Drive D: usually contains only process data. The amount of process data is usually dependent on the amount of wafers being processed.

To back up this drive, follow the procedure "Back Up The Entire Drive C:", but substitute "d" for "c".

D.5 CREATING A BOOTABLE 3.5" FLOPPY DISK

Creating a bootable floppy disk allows booting the computer and restoring all files if the hard disk has to be replaced because it failed.

Step 1. When the computer is idle at the Main Menu, exit the control software. (Refer to the appendix section "Exiting the Software".)

Step 2. Change to the root directory of drive "C:" by typing:

**cd **

Step 3. Insert a 3.5" floppy disk into the floppy disk drive.

Step 4. Type the following DOS command to make the floppy disk bootable:

sys a:

Step 5. Type the following DOS command to transfer all DOS utilities necessary to help restore the hard drive:

xcopy bootdisk*.* a:*.* /s

The following list of utility files should be in the DOS subdirectory.

xcopy.exe
deltree.exe
di1000dd.sys
fdisk.exe
format.com
himem.sys
sys.com
usbaspi.sys

D.6 RESTORING THE HARD DRIVE

Allwin21 system uses DOS 7.10 as the operating system for the control software. It has a size limit of 100 GB per drive. However, some of our functions were made before this time using DOS 6.22 which has a size limit of 2 GB per drive. Therefore, drive C: is partitioned to 2000 MB, while drive D: uses the rest of the drive space.

The following procedure will restore the hard drive and will destroy all information and data on the hard drive.

Step 1. Partition the hard drive using the DOS utility **fdisk**. Partition it so the Primary DOS Partition is 2000 MB in size and the Extended DOS Partition uses the rest of the disk space. Partition the Extended DOS Partition with one Logical DOS Drive, which will use the entire Extended DOS Partition.

Step 2. Exit **fdisk** and reboot the computer. This will make the partitions permanent.

Step 3. Format and copy the system files to the first partition as drive C: by typing the DOS command:

format c: /s

Step 4. Format the second partition as drive D: by typing the DOS command:

format d:

Step 5. Using the USB drive that has the files that you backed up when you backed up the **Entire Drive C:**, attach it to the computer. Reboot the computer.

Step 6. Copy the files that you backed up when you backed up the entire drive C:. If the USB drive is drive E: and the directory name is “backupAW”, then type the following DOS command:

xcopy e:\backupAW*.* c:*.* /s

E. SOFTWARE STARTUP

E.1 OVERVIEW

The control software is already installed on the hard disk of the control computer. All you need to do is power-up the system and make sure the monitor is on. At this point, the *Main Menu* will appear on the screen as shown on the first page of this manual.

It is always advisable to make a backup copy of the control software. It may be needed in the event that the system is damaged, and problems develop on the computer which necessitates reloading the control software.

Refer to the section "Backing Up and Restoring the Software" of this software manual for information on how to make a backup copy of the system. Make as many copies of the Allwin21 system software as you deem necessary. Store the backups in separate places in case the software must be reloaded in the future.

E.2 STARTING THE PROGRAM

To start the program, at the DOS prompt (C:\>), type:

CD \AW-ASH <CR>
AW-ASH <CR>

This will load the control software. When the program has loaded and ready to use, the *Main Menu* screen as shown on the first page of this manual is the first screen displayed.

To use the control program with the RTAPRO, refer to the Power Up Procedure.

E.3 EXITING THE PROGRAM

Press 'Q' (or 'q') on the keyboard from the *Main Menu* to exit the control software and go to DOS.

To abort and reset the control software at any time, simultaneously press and hold down the [**CTRL**, **ALT** and **DEL**] keys on the PC keyboard. This will reboot the computer and reload DOS -- This procedure could not be used if there is no response from the keyboard.

Alternately, the system can be powered down and then powered up.

F. SELECTION OF THE PURITY OF GASES

Gases are available in a range of purity grades. These purity grades are identified by names such as "Research Grade", "Ultra High Purity", "Zero", "Prepurified", etc., which give an indication of relative purity such that "Ultra High Purity" is purer than "Prepurified". These terms, however, are not absolute. "Research Grade" Argon is not the same purity as "Research Grade" Methane or even "Research Grade" Nitrogen. The same purity name may be used for the same gas by different manufacturers, each offering the product with different specifications. The grade name therefore does not tell the user what the actual purity level is – it varies from product to product and manufacturer to manufacturer.

The important measures of purity are the overall percentage purity of the gas and the identity and levels of the impurities present.

A simple system used to signify the percentage purity is a digitized grade system. In this system the first digit signifies that number of 9's in the percentage purity. The second digit indicates the next number that differs from a 9. Thus:

Helium 4.5

There are four 9's in the purity and the next digit is a 5 –

99995 as a purity percentage is 99.995%

Similarly Argon 6.0 is 99.9999% (Six 9's and the next digit is a 0)

Often of more importance in a particular application is knowing what impurities are present and at what level. If Nitrogen is used as a zero gas for a ppm Oxygen analyzer, it is important to know the Oxygen level of each grade of Nitrogen when selecting which to use.

Summary Purity Table

Percentage Purity	Grade	Total Impurities
99.99%	4.0	100 ppm
99.995%	4.5	50 ppm
99.999%	5.0	10 ppm
99.9995%	5.5	5 ppm
99.9999%	6.0	1 ppm

G. HOW TO ORDER / RETURN EQUIPMENT

The information contained in this appendix includes the following:

- How to order equipment and parts
- How to return parts
- How to exchange parts
- What to do when the system is down
- Service Agreements

G.1 HOW TO ORDER EQUIPMENT AND PARTS

To order parts from Allwin21 Corporation, call:

Allwin21 Corporation
Customer Service
Phone: 1-408-778-7788

To obtain a quote and information concerning part availability, please have the following information ready:

- System model number (example: AW610)
- Serial number of the system
- Part number of the required part
- Purpose of order (spares, failed part, etc.)
- "Ship To:" address
- "Bill To:" address
- Purchase order number

G.2 HOW TO RETURN PARTS

NOTE

An RMA (Return Material Authorization) number must be obtained from AllWin21 prior to shipping any parts back to AllWin21.

A Return Material Authorization (RMA) Number is required in order to return or exchange system parts. To obtain an RMA number, call:

Allwin21 Corporation
Customer Service
Phone: 1-408-778-7788

Return any failed parts to the following address:

Allwin21 Corporation
220 Cochrane Circle
Morgan Hill, CA 95037
Attn: RMA # _____

Ensure that the RMA (Return Material Authorization) number is included with any returned part(s). Include the following information with the part:

- System model number (example: AG4100)
- Part number of failed part
- Detailed failure information
- Serial number of system and of the failed parts (if applicable)
- "Ship To:" address
- "Bill To:" address
- Purchase order number
- RMA (Return Material Authorization) number

As the customer, it is your responsibility to return the part(s) in a proper packing container. Failure to return the part properly could result in further damage to the part.

NOTE

The RMA (Return Material Authorization) number must be visible on the outside of the package when returning a failed part. Allwin21 Corporation will not accept returned parts without an RMA number. This could result in the sender being billed for the full purchase price.

G.3 HOW TO EXCHANGE PARTS

After troubleshooting to isolate a failed part, replace the part with a site spare if one is available. If the system is down due to an isolated failed part and no site spare is available, call:

Allwin21 Corporation
Customer Service
Phone: 1-408-778-7788

Contact Allwin21 Corp. Field Service to properly identify the failed part. Allwin21 Corp. will issue an RMA (Return Material Authorization) number to you which must be included when the failed part is returned. The failed part MUST be returned to Allwin21 Corp. within ten (10) days in the proper packing container or the full purchase price will be billed. Replacement parts under warranty are shipped out in the timeliest manner possible.

All returned parts must be shipped in the same packing material as the replacement part. Failure to return the part in the proper packing container could result in further damage to the part.

G.4 WHAT TO DO WHEN SYSTEM IS DOWN

If the system is down and you cannot isolate or fix the problem within a reasonable period of time, call Allwin21 Corporation Customer Service for telephone assistance or a service visit. Telephone numbers are staffed by trained Allwin21 Corporation technicians, who can provide on-the-spot help with difficult problems and advice on repairs.

Allwin21 Corporation
Customer Service
Phone: 1-408-778-7788

H. MAINTENANCE PLANS

H.1 EXTENDED MAINTENANCE PLANS

AllWin21 commitment to customer support carries on past the warranty period. By offering a choice of extended maintenance plans, we can satisfy most of your service requirements. Contact AllWin21 Field Service or Sales Administration for more details.

H.2 SERVICE TRAINING

The Allwin21 system uptime may be increased dramatically by having trained in-house personnel and spare parts kits. Operator and Service training are available at AllWin21 Corp. for a fee. These courses cover the following types of information:

- System overview
- Operation
- Software use
- Recipe construction
- Temperature control and optimization
- Preventive maintenance
- Electronics operation and troubleshooting
- Temperature monitoring using the thermocouple and pyrometer

Students are usually Applications Specialists, Equipment Engineers, System Operators and Maintenance Technicians. Emphasis is on hands-on work, as the classes are small and allow personalized instruction.

I. MANUAL REVISION HISTORY

Date	Description
Sept. 2009	Initial Release
June 2017	All major sections updated
July 2018	(B.4)Update RF reflected power calibration