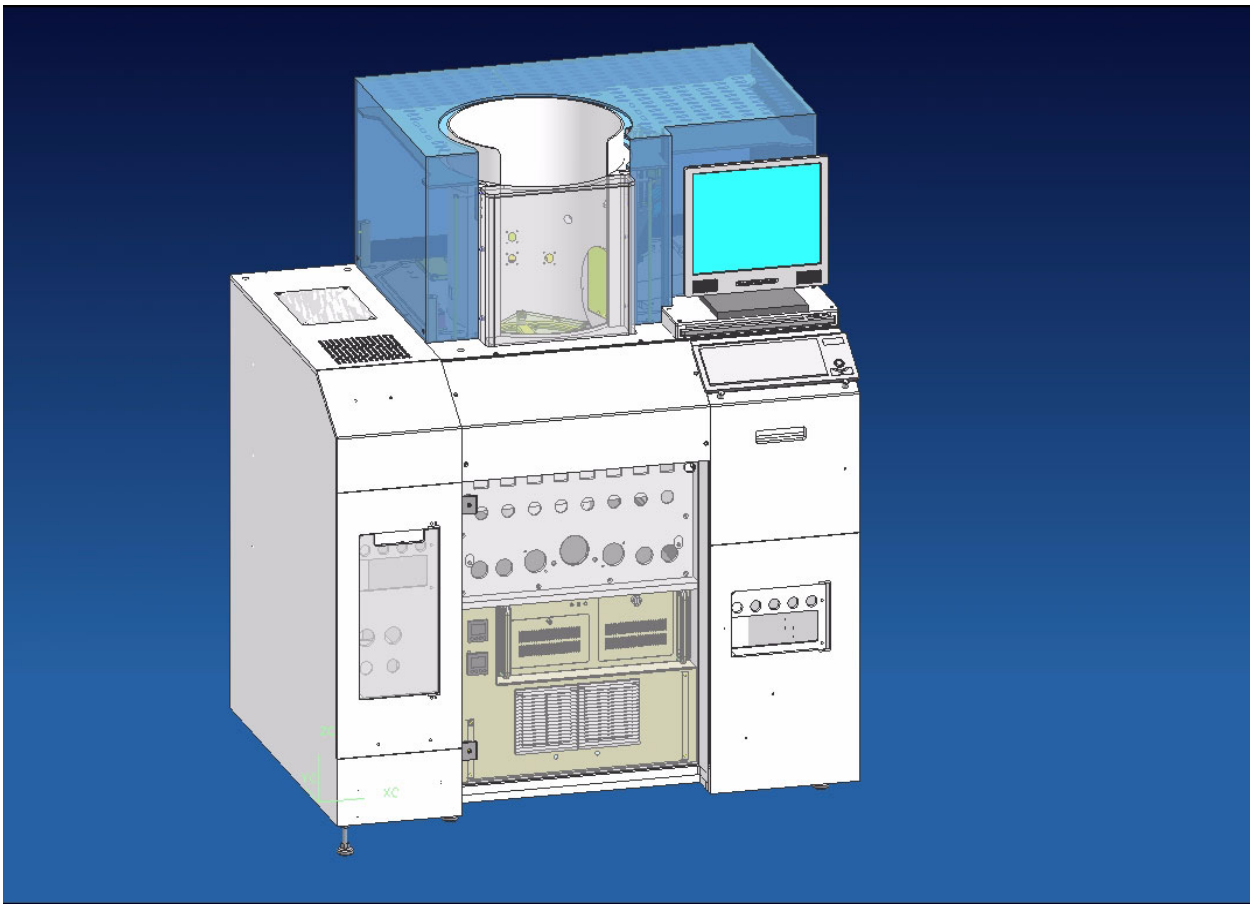

OPERATION

SUPPORT INFORMATION

For assistance, please call or email the following:

Tel: (+49)-(0) 7045-41-254
Fax: (+49)-(0) 7045-41-239
service@hamatech.de

SERVICE AND SUPPORT

For assistance, please call or E-mail the following:

Germany, Headquarter Sternenfels
Phone: +49 (0) 70 45 /41 - 254
Fax: +49 (0) 70 45 / 41 - 239
service@hamtech.de

Branch Office China
Phone: +86 21 6448 0150
Fax: +86 21 6448 0159

Kanematsu Corporation, Japan
Phone: +81 3 3544 6537
Fax: +81 3 5565 0089

JCS CO., LTD., Korea
Phone: +82 31 776 2512
Fax: +82 31 776 2515

Branch Office Taiwan
Phone: +886 3 5788 393
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Fax: +1 408 988 5212

Operating Instructions for

HMX Square

Tool Serial No. A-210379

HamaTech is continuously improving and further developing its product. The documentation can therefore describe a product based on a certain point of development, only. Hence, it is possible that certain parts of this documentation are incomplete or outdated. We apologize for this matter. However, if the user sees the need for further documentation send an e-mail to:
service@hamatech.de.
However, claims of any kind cannot be derived from the said above or from any other contain of this documentation.

The original language of this material is English. Documentation in German and other languages is translated from the English original.
This documentation is written for HMX Square machines. However, it may also contain descriptions of assemblies and software features which are not installed in your particular tool. We apologize for this matter.

Editor: Michael Dürrler

Vers. 1.0 10/2008

Table of Contents

HOW TO USE THIS MANUAL

1. Hazard Notices

In this manual hazard notices are used to point to *potential hazards*. They are designed to prevent injuries and/or damage to property. **Always read and comply with these warnings!**

The following signal words are used in the machine documentation to designate instructions of particular importance.

Hazards or unsafe practices which could result in minor personal injury or product or property damage.

Imminently hazardous situation which, if not avoided, *will* result in severe personal injury or death.

Potential hazards or unsafe practices which could result in severe personal injury or death.

Note:	A note gives you important information about a current subject.

The pictrogram may change to flag for specific hazards:

	Caution, hazardous material

	Caution, flammable and under certain circumstances explosive material
	Caution, hazardous voltages
	Caution, hot surfaces
	Warning of highly poisonous chemicals (e.g. HF)

2. Further Documentation

The manual may refer to external documents as the electrical drawings, MSDS, etc.

To access them see the external document files or use the electronic help system provided on an external CD or as part of the tool software. Electrical drawings, pneumatics drawings of the tool, the MSDSs of the base process, documents describing certain modules or components and this documentation in electronic format are available from there. The documents are usually stored in PDF format.

To view the files, Adobe Acrobat or Acrobat Reader 4.0 or higher is required. Every tool PC of HamaTech APE has an Acrobat Reader 6.0 pre-installed. In addition the setup file is also on the C: drive. Check for the directory \Install\ This file may also be copied to other PCs. For free updates, check the Adobe web side under (http://www.adobe.com/products/acrobat/readstep2.html).

The user should find the following documents in the external documents:

- Electrical drawings[1]
- Pneumatic drawings

[1] Electrical drawings are compiled in a pdf document. Optionally, it can be viewed by a CAD system which must be installed on a local PC.

- This documentation
- Material safety data sheets (MSDS).
- Manuals of individual components

PC information is already pre-installed and can be found on the hard disk. Further documentation may be added without notice if this information increases the value for the customer.

1 STARTING AND STOPPING THE SOFTWARE

1.1 Starting the Tool Software

Usually, the tool software will auto-run after the operating system has started up. A batch file is located in the auto-start directory brings up a small window and starts all necessary processes before the actual tool software appears on the screen. The process window will be active as long as the tool software runs. If an auto-run is not desired, the batch file may be removed from the auto-start directory. In this case, the software must be initiated by double-clicking on the `START.Tool` on the desktop.

1.2 Stopping the Tool Software

The tool software may be terminated by clicking <Shutdown> () in the operating mask and then by clicking <Quit> at the left root bar (icon= ). Optional, all processes can be abruptly aborted by pressing <Exit> in the system process window (only advanced users, please!).

1.3 Shutdown the Entire Tool

Ensure that the tool is idle. Click <Shutdown> () in the operating mask. Press the <Tool Off> at the operator panel. Then, press any EMO button. The tool shuts off.

2 OVERVIEW OF THE HMX SQUARE GUI

The graphical user interface (GUI) of the tool is running on Microsoft Windows XP. The national language of the entire system is usually English. As for now, Windows is the most common operating system and most computer users are familiar with this environment. An easy to use pointing device is employed to get along. Reasons enough for HamaTech to design a tool GUI based on the standard Windows widgets.

The basic organization follows the basic screen layout as recommended in SEMI S95-0200.

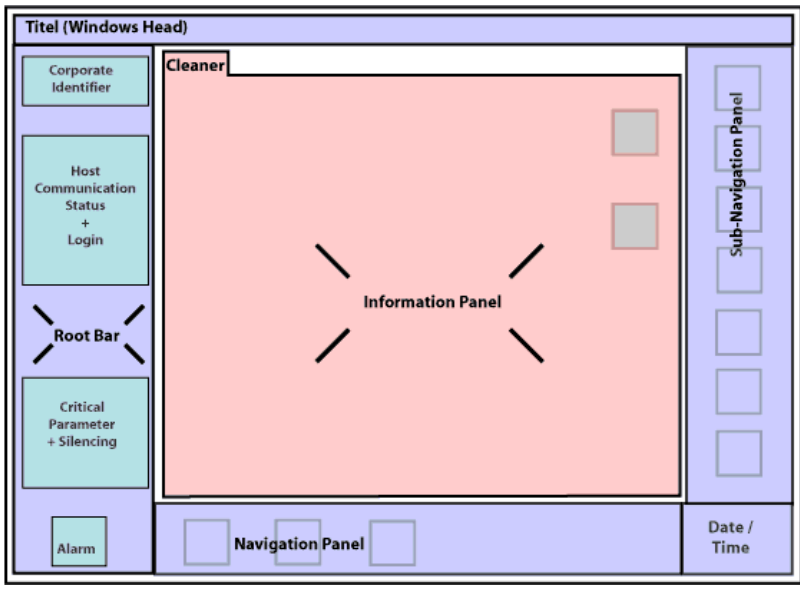


Figure 1: Layout of the Software Screen

The left bar (root bar) offers the most fundamental functions which are independent from the information being displayed. Also, an alarm window can be opened from here. This bar will never change.

Below is the navigation panel, the main menu, and to the right the sub-navigation panel with the submenu belonging to each main menu point. Also, the navigation panel at the bottom never changes.

The center is the information screen and shows the functions, buttons and information of the respective menu and sub-menu point. Where more than one view of informations screens is needed, tabs are used at the top of the information screen.

3 THE ROOT BAR

This part of the screen (highlighted in red in the following screenshot) accommodates the most basic functions and operations required for all parts of the program.

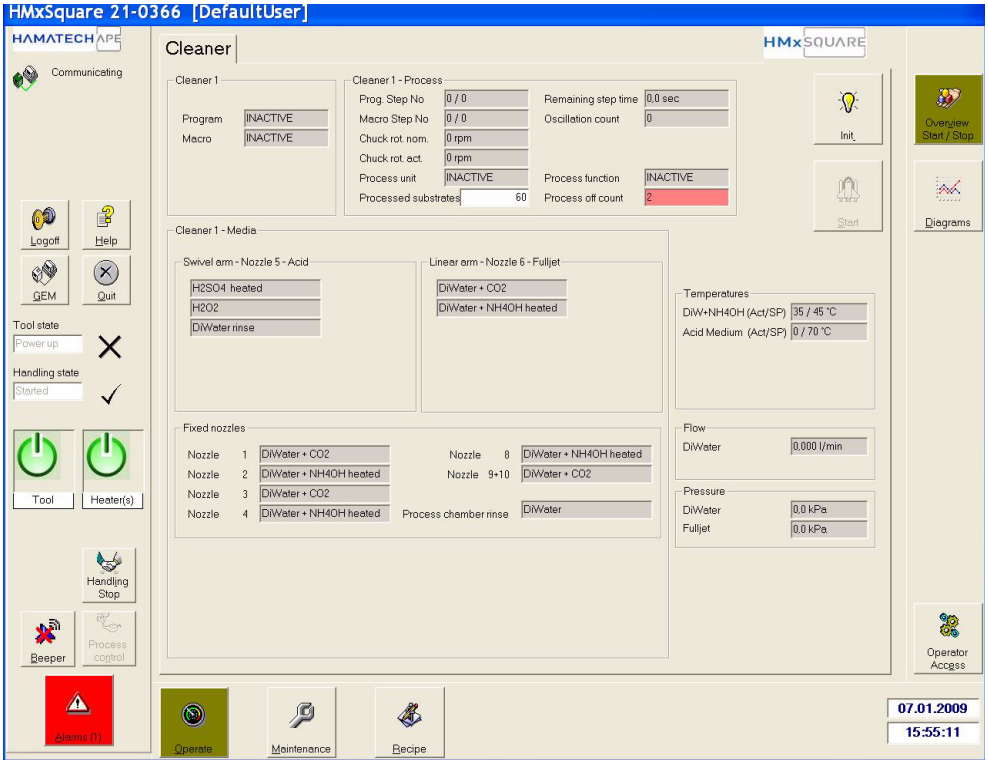


Figure 2: Root Bar

3.1 Host Communication Status and Login

The icon with a label "Communicating" to its right an.

Figure 3: Communication is OK

It tells the user that the different processes of the software talk to each other. If there is a problem the system would show "Not Communicating" as in the table below. During tool startup the communication between the blocks is established. The user may see a note here saying "Startup progress".

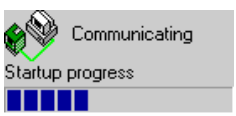
	The system tries to establish communication between the two software blocks

Table 1: Communication Notes

	A fault prevents the communication

Table 1: Communication Notes

If you experience a *Not communicating* problem, call HamaTech software (see beginning of this manual).

Below are 4 buttons. Those are:

1		To logoff and on with different rights. For example, if logged off, maintenance and programming a recipe becomes inaccessible. Also see page 33.
2		To open the help file.
3		The SECS / GEM button. To adjust and enable the Semi factory automation standard. Available only on request
4		To quit the tool software. This button is only enabled if the machine is not initialized. In 'Idle' mode press <Shutdown> in the main screen to get into this state.

The dialogue box "Tool state" shows either "Power up" after program startup (with an 'X' at the side), "Initializing" (with an arrow at the side), "Idle", in ready for processing state (with a check at the side) and "Processing" (with a light bulb at the side). During machine startup the information box may also display "Starting".

The dialog box "Handling State" below displays if the tool is in "Handling Start" (with a check at the side) or in "Handling Stop" (with an "X" at the side) mode. See table below for "Handling Start" and "Stop".

[No message from host] button is only activated if GEM (Generic Model for communication and control of semi equipment) SECS (Semi equipment communications standard) or SECS II is available.

3.2 Critical Parameters and Silencing

Below are four supplementary buttons:

1	 or 	To disable all movement, this button can be pressed. The tool will go into the handling stop mode. Only in this mode (handling stop) it is possible to enter the Move or Teach screens. When you enter the window, the handling mode goes automatically into the stop mode. Be aware, when in handling stop mode, the button displays <Handling Start>. By repressing the button, the tool returns into the normal mode.
2		To en- and disable the beeper alarm
3		Click this button to enter the process control window. The button is disabled during idle mode and will be accessible during processing. See also page page 18.

If tool goes from <Handling Stop> to <Handling Start> some units may start automatically without warning!

3.3 Alarm Button

Further down is the alarm button (). The number in bracket on the button shows the number of alarms. If an alarm is active the button turns red. With this button pressed the alarm viewer can be entered.

When it is entered, the alarm button appears as in Figure 4 in a kind of green since it is currently open. The error messages appear in the main screen.

When a message is double clicked additional alarm properties can be accessed and eventually a recovery executed. On the right side are several buttons also to view alarm properties and to recover an alert. In addition to that a help file can be commanded and the alarm list printed out.

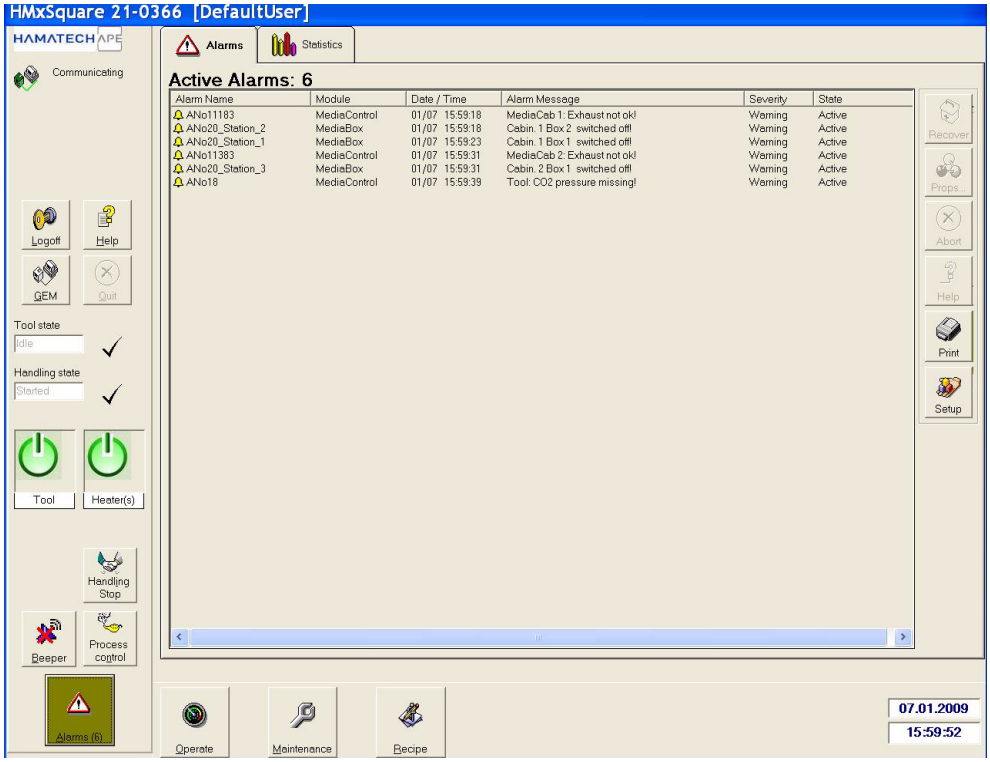


Figure 4: Alarm Viewer

The alarm viewer may be configured by clicking on the alarm setup button ().

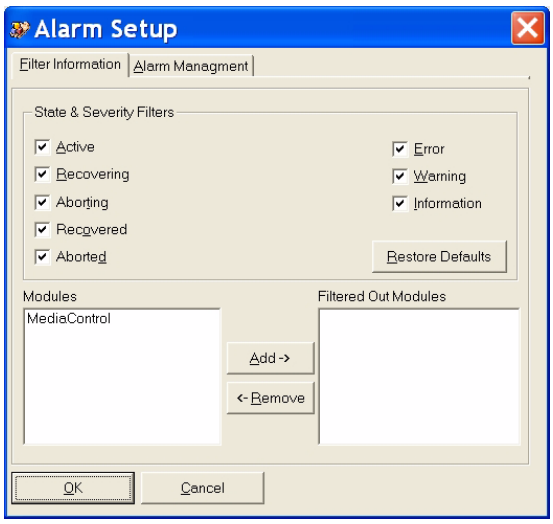


Figure 5: Alarm Setup Screen 1

The first alarm setup screen has been named as 'Filter Information'. With this mask filters can be positioned to filter out types of errors and to filter out errors of certain modules. For the system to show the error types the boxes must be checked.

Presently, the second alarm setup screen named 'Alarm Management' gives an overview of the last errors occurred. To update the list to the current situation click onto <Reset>.

The alarm viewer has two index cards (<Alarms>, <Statistics>). <Alarms> is the standard alarm view as described above. By clicking on the <Statistics> index card a graphic chart of current and past alarm matters will be displayed.

4 NAVIGATION PANEL

The navigation panel is the main menu and found on the bottom of the screen. Each menu point has a subsequent menu. Subsequent menus are always found on the right side of the screen. The main menu comprises of the following:

1. Operate
2. Maintenance
3. Recipe

5 OPERATE MENU

The operate menu is a sub-menu of the Operate navigation and encircles functions and parameter tuning necessary for the daily work of the operator. To enter click on operate ().

On the right the following menu appears:

1. Overview Start/Stop
2. Diagrams

5.1 Overview Start / Stop

This mask is also the startup screen, that appears when the system starts. It is designed as a standard screen and therefore displays all essential process information as actual receipt and step times grouped in the individual stations.

Also the basic operating function buttons are found here like charge start (start process program) and abortion and initialization after startup and shutdown.

- *Recipe.* Describes the current recipe name.
- *Program.* Describes the current program name. Step, RemStep-Time

Describes the Macro step and its remaining step time

- *Rem Time.* Used for station programmed with Recipe>Misc. In here, you can define a program time which exceeds the processing time of the component. For instance, if you program 5 minutes for flipping a substrate, the mask would rest in the flip station after flip until the 5 minutes are completed. In this way, you can program delays into your recipes. The remaining time is displayed here.
  If you don't want any delay, put a zero (0) into the step time.
- *Chuck.* Displays the chuck type. The chuck type is determined by the chuck sensor.
- *Charge.* Means, recipe starts.
- *Substrate Count or Substrate.* Processed substrates.

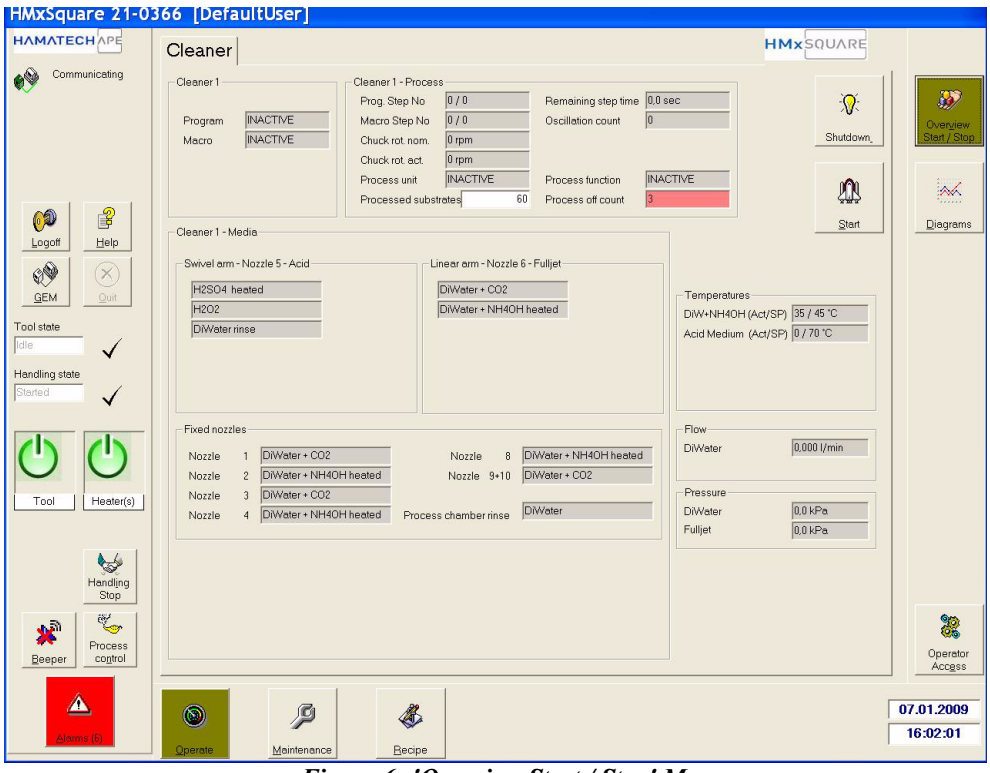


Figure 6: 'Overview Start / Stop' Menu

- *Setup Values.* These are automatic processes which are adjustable in the Setup like Idle- and Pre-Dispense.

  - *Recipe.* Current recipe processed.

  - *Test Scan.* Exhibits the reliability of the last scan in %.

During sending or receiving of information to and from the scanner, a progress bar is displayed below.

Note:	A manual scan and reading or writing of data can be done in the Move screen.

5.1.1 Init / Shutdown

The Init / Shutdown button either initialize the system after startup or prepares the machine for shutdown. The Init function drives all units to the right position and loads all necessary parameters. Thus, without initialization the system is not able to operate.

Init Button	
Shutdown Button	

Table 2: Init and Shutdown Button

In contrast, the shutdown button puts the machine status back to the status before the initialization. Therefore this function does not shutdown the software or the machine. To shutdown the software, click <Quit> on the root bar, to off the machine press the hardware button <OFF>.

The tool state is also at the root bar displayed. “Power up” is shown if machine is not initialized and “Idle” if initialized. During initialization the tool state shows “Initializing” and “Processing” while a process program is active.

5.1.2 Start

Click on the start button () to start a cleaning program. Select in the “Start Window” the desired program number and press the start but-

ton. The splash ring will move down and a operator message will ask for loading the mask. After loading, quit the operator message and the selected program will be processed.

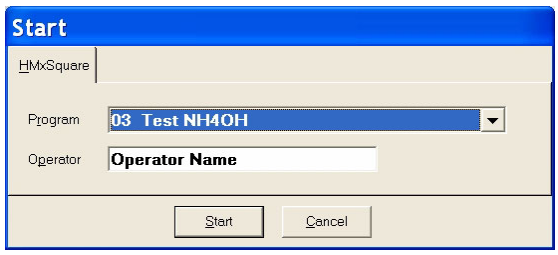


Figure 7: Recipe Start Window

At the bottom of the start window is the input window "Operator". The tool puts the currently logged-in user into the field. However, the input field can be changed as required (for instance, employment numbers or shift id numbers)

One word to the recipe administration. Currently the start handler (software routine to start recipes) can only manage up to 100 recipes. That means, all recipes above 100 can not be seen when starting a charge. Therefore it is highly recommended to organize the recipes yourself when using a lot of recipes. Organizing means here to use a disk management program like the Windows XP Explorer to move those recipes into other directories which are not in use or which are used only occasionally. The recipe folder is

D:\[tool number]\Tool\Block1\RCP.

5.1.3 STOP Button

With this button (

) the process may be aborted. Users should be aware that the routing must be chosen. If the abortion is denied by the system, process control may be attempted.

5.1.4 Process Control

Experienced user have a powerful tool at hand with this option (). It is especially helpful when designing a process program since the user may jump process steps which are not of interest at current.

The button to activate is found on the root bar.

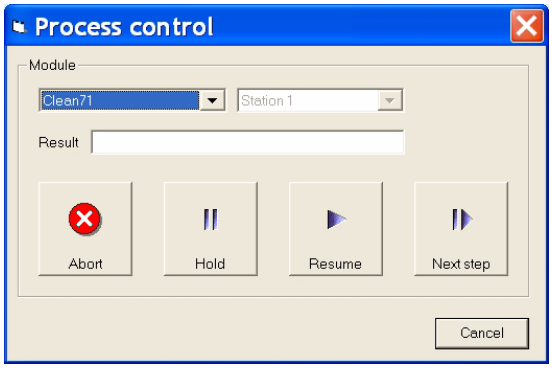


Figure 8: Process Control

Choose a module first and then carry out the process control function.

The available media is a digital list equal to the list found in the Macro programming window. Media 0 is the right bit and the last media is the left bit.

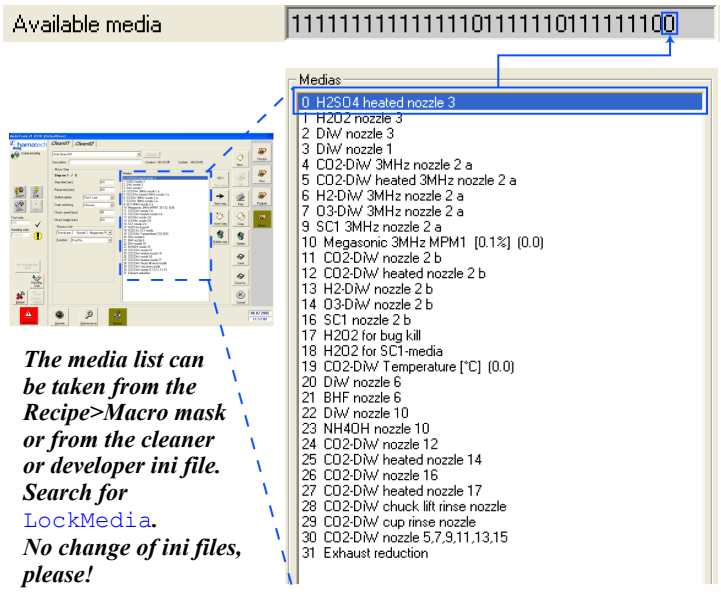


Figure 9: Available Media

5.2 Process Trace

The window attempts to trace the actual process of the individual modules. It gives information about the current process program and the progress of it. Also it gives further technical information about the media used and the amounts. Expected process values are displayed in green. Critical values are yellow and obvious errors are in red.

Some critical conditions prevents the process from starting. This condition is called *process off*. The system counts the process-off conditions and displays them in the entry Process off count.

Most machines require several Process Trace screens. A selection can be made at top of the screen using the register cards.

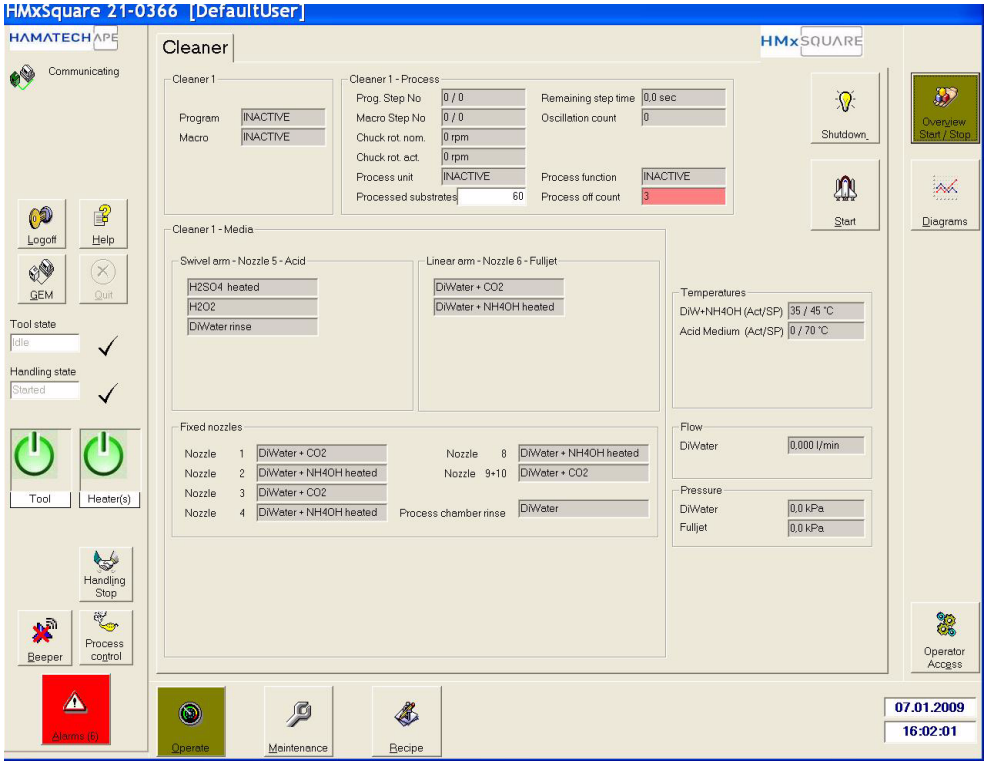


Figure 10: Process Trace Screen

5.3 Diagrams

This mask exhibitions a series of measurements taken by the machine and displays them in X-Y charts. To select a chart click on one of the index card above the current diagram.

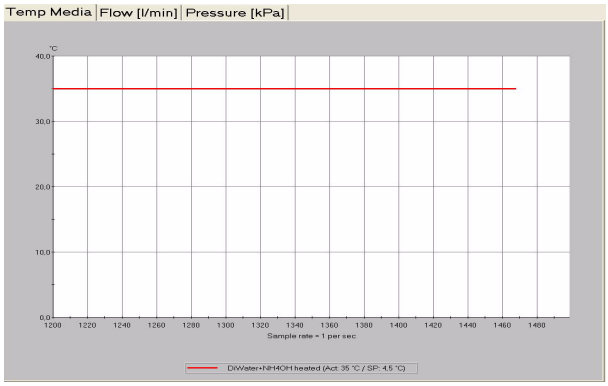


Figure 11: Diagrams Screen

The x-axis always describes the time in seconds. The y-axis displays the units of interest. Below the actual chart is a table located describing which measurement point is displayed.

6 MAINTENANCE

Only technically trained users should enter this menu since functions can be executed without interlocks in place.

Figure 12: Main Menu - Maintenance

This menu has the following menu points:

1. Trace View
2. Move
3. Teach
4. Setup

5. Access
6. Logbook
7. IO Monitor

6.1 Trace View

In this view all modules will display their data. This information is highly technical and from no interest for operators. However, you will find valuable information for troubleshooting specific modules. Editing is not possible in this view. Data displayed in the process trace or in the main screen can also be found within this view.

The information in Trace View is stored into folders and displayed in a manner similar to a file system of a computer displayed by a Windows application.

The mask is divided into two screens. The left screens shows a tree of all modules displayed as folders. On the right side are the actual information, listed all together. Usually the user just needs information from certain modules. In this case, click the concerned module folder on the left and only the data of this module is displayed on the right. If the module is divided in sub modules a plus is in front of the module name informs that sub folders of this module exist. An open folder has a small image in front that looks like an opened box. other folders have a closed box in the front.

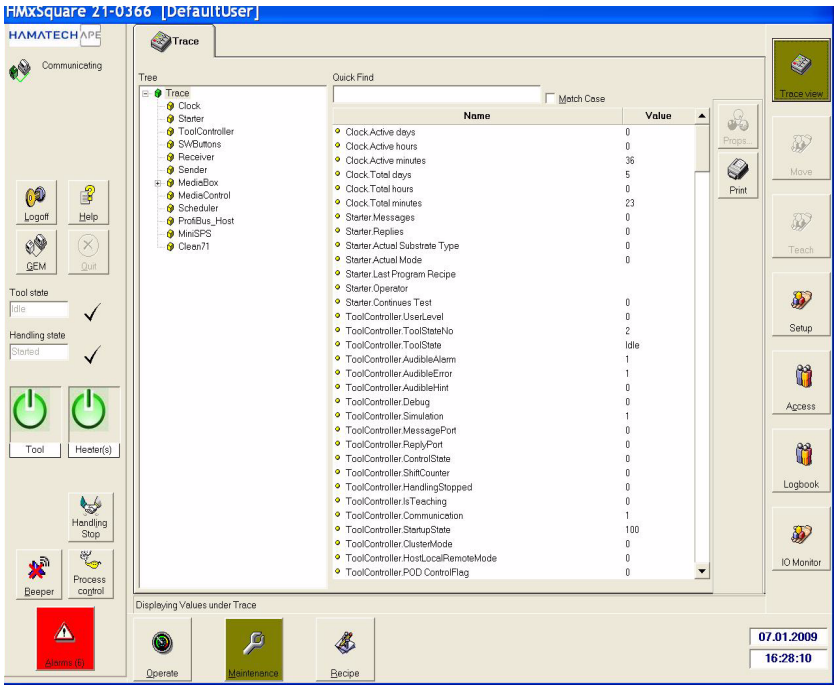


Figure 13: Trace View

To find certain information speedily, a 'Quick Find' dialog box is put onto the top of the screen. While the user is keying his desired information into this box the software tries to match the entered string.

On the left side is a <Print> button to print out the actual displayed trace view list.

6.2 Move

With the 'Move' command (Symbol = ) modules or parts of the modules can be moved, homed or calibrated. Useful is this function during teaching and testing of modules by maintenance staff.

Note:	The tool must be in “Handling Stop” mode to access this function.

To put the machine into “Handling Stop” mode click on Handling Stop on the root bar at the left side of the screen.

To start moving, choose the module and choose a unit. The meaning of unit reflects logical entities.

The unit needs instruction what to do. Hence, what function the unit shell carry out. If the function requires further parameter then additional information is displayed in the parameter window below.

Finally, press <Execute> (Symbol = () to execute the command. Some commands can be aborted after start. The <Stop> button may be used for some function to abort after the <Execute> button has been pressed.

Calibration procedures work the same way and instructions are given along the way – if any.

	Handling Stop button, found on the root bar at the left side of the screen.

Table 3: Handling Stop Button

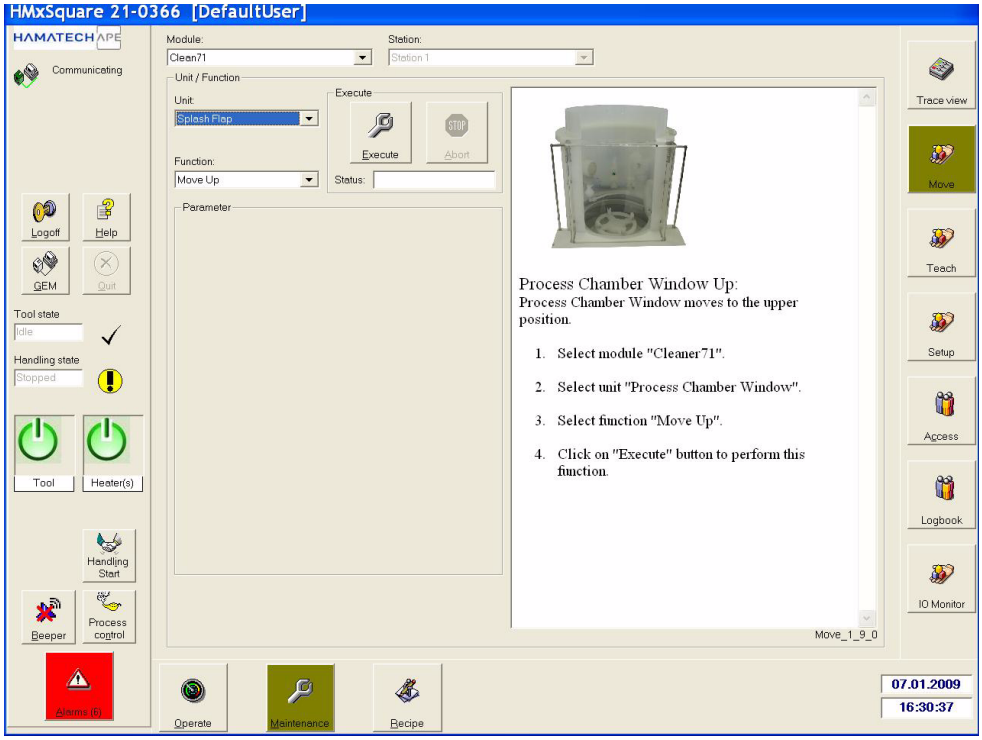


Figure 14: Move Screen

Further information are provided in the window at the right side of the screen.

6.3 Teach Screen

Almost all driving units of the HMX SQUARE are freely teachable. That makes the system very flexible and independent from predefined positions. Units can be updated or changed without modifying other hardware. Processes can be modified in almost all ways desired. However, this also inhibits a danger, that accidental change of teach positions may damage the respective unit and immobilize the entire tool.

The idea of the teach tool is simple. The user travels with the chosen unit to a desired position and saves the coordinates of this position.

Direct or relative coordinates can be directly entered and the unit be advised to travel to this position. Therefore the 'Teach' mask is a very powerful tool. Nevertheless, incorrectly taught positions may damage the tool.

Note:	The 'Teach' screen can only be entered if the tool is in Handling Stop' mode.

	Handling Stop button, found on the root bar at the left side of the screen.

Table 4: Handling Stop Button

To teach select the desired module and unit from the two option fields at the top of the main screen. If the cluster would possesses more than one of the selected units, the "Station field" must be assigned with the unit number. The field "Position" contains pre-configured positions of the chosen unit which the machine travels to when processing. You cannot add, remove or edit this positions.

Below is a list or an array of dialog boxes under each other for information about the axis of the concerned unit. One column represents one axis. The first row provides the already saved positions, the second row informs about the actual (current) positions. The user may enter new coordinates into this field. When <Enter> is pressed the unit moves to the new coordinate. To step by step "sneak" towards the station, a 'Relative Step' function is supplied. This function is usually used to fine tune a position. Enter the “Rel. Step” size. Click on arrow buttons to define the direction of the relative step. Note, no <Enter> is required for execution. The unit will start to move once the arrow is pressed.

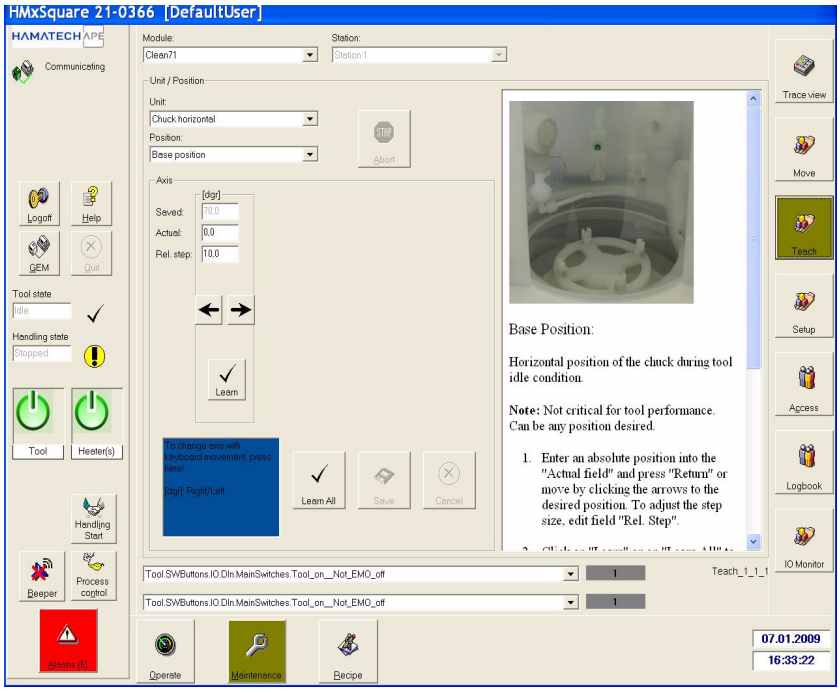


Figure 15: Teach Screen

Essentially, the teach screen defines coordinates of driving axis. Therefore, in the teach view screen, information about the axis position are given as demonstrated in Figure 16: Axis Information.

Once the unit has reached the desired position, click on <Learn> to buffer the obtained position. Click on <Save> to save changes to disk.

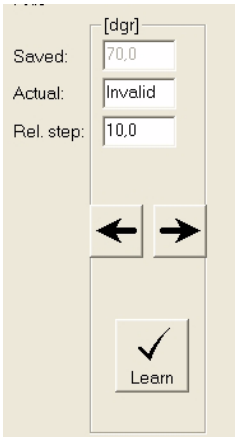


Figure 16: Axis Positions

It follows a short clarification of the buttons used in the Teach window.

	To learn the actual position of the corresponding axis
	To learn the positions of all axis
	To put the learned axis information to disk
	To discard a learned position click on <Cancel>. The previous position cannot be restored after the <Save> has been pressed

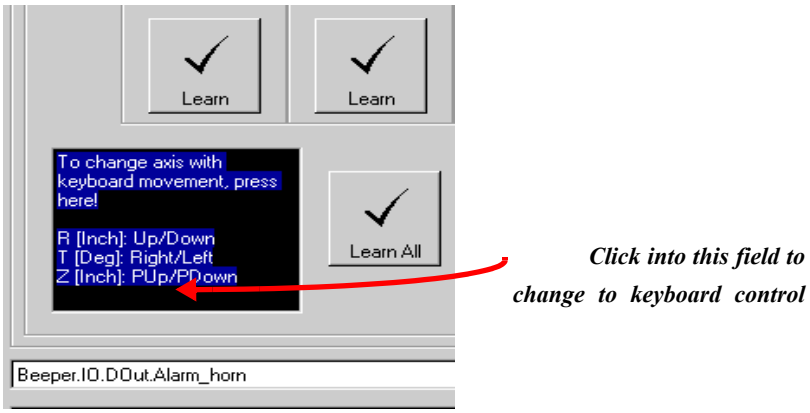
Table 5: Buttons of the Teach Window

If the user wishes to change the saved position without axis movement, key in the location into the 'Actual' box(es) but avoid the <Enter> key. Instead click <Learn> or <Learn All> and then <Save>.

Below the axis block are two dialog boxes situated with a 0 or 1 at their right. With those fields the user may choose digital inputs or outputs and monitor them while teaching.

Keyboard Control

If you prefer to use the arrows on the keyboard instead of using the mouse pointer, click on the window below shown.This feature is also a tribute to users who upgraded from a DOS tool to a Windows tool



Click right on the dark field in the teach screen to enable key-

Figure 17: Keyboard movement field

Furthermore, the windows on the right side of the screen gives valuable information on how to use the respective screen. Each module to be taught has its own window. The information given here is designed to guide the user through this screen.

6.4 Setup Screen

The setup defines the options of the machine and modules. Errors can be enabled or disabled and stations turned on and off.

Optically, the 'Setup' screen is designed in the same way as the 'Trace View' screen. On the left side is a module tree observable and on the right side are the parameters of each module. If no module is clicked all parameters are stringed together. A '+' in front of a tree branch means, there are sub groups below (similar to Microsoft Windows Explorer or similar utilities).

By double click on the parameter a 'Values Properties window opens' and the user may change this parameter. The equal function as the double click has the <Props> button (for properties) on the right side of the screen. The current screen information can be printed by clicking on the printer symbol at the right side of the screen.

The setup contains:

6.4.1 Digital Entries

These are entries which can be either 1 or 0 (on or off). Example: Setup entry to switch a station on or off.

6.4.2 Standard Analog Values

Analog setup data define the range of analog components and constructed as follows:

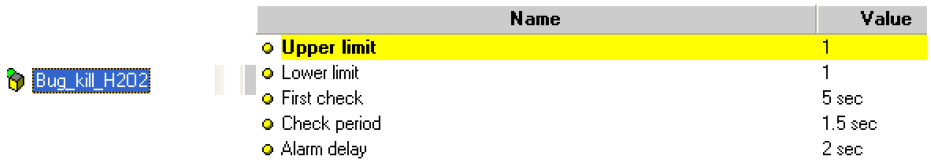


Figure 18: Example of analog Setup values

The entries have the following definitions:

Setup Entry	Description
Upper Limit	High limit of the measurement range without an alarm.
Lower Limit	Low limit of the measurement range without an alarm.
First check	First check after tool startup. Time delay in seconds.
Check period	Time period of the check intervals. Time in seconds.
Alarm delay	Time period the signal must be outside of the given range till an alarm appears.

Table 6: Analog Setup Values

6.4.3 Temperature Analog Values

Temperature control requires the consideration of temperature control delays caused by the thermal properties of the material to be heated. PID (proportional - integral - differential) control is implemented to deal with the more difficult process of temperature control. Temperature ana-

log setup data use the same entries as standard analog sensors plus the PID parameters. Since they need a setpoint, additional thermic entries are required.

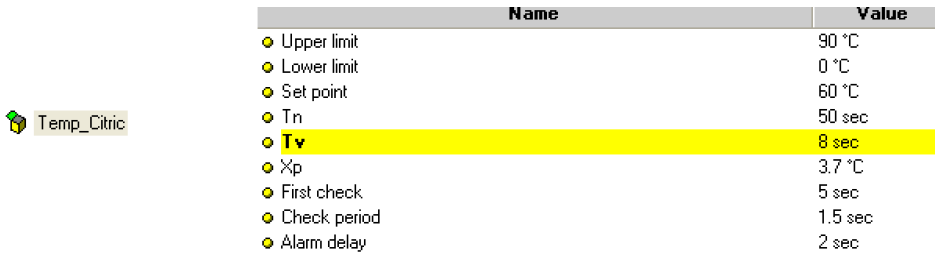


Figure 19: Example of analog PID Setup values

The descriptions are as follows:

Setup Entry	Description
Upper Limit	High limit of the measurement range without an alarm.
Lower Limit	Low limit of the measurement range without an alarm.
Setpoint	Actual temperature setpoint for the heating or cooling unit.

Table 7: Temperature Analog Setup Values

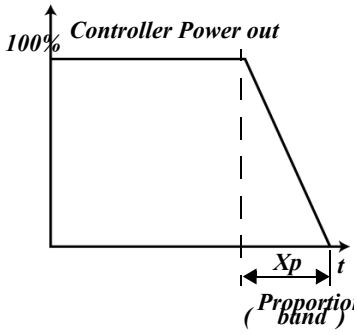
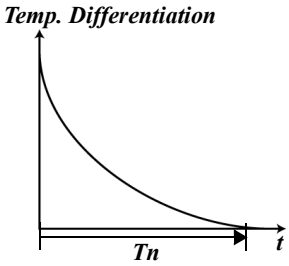
Setup Entry	Description
Xp  	This parameter relates to the *proportional control* of the temperature controller. Simple controls turn the controller output on and off depending of the actual temperature is above or below the setpoint. This approach causes big temperature overshoots caused by the thermal time lag of the heater material. Proportional control manages the power level of the controller output proportional to the temperature deviation to the setpoint. Thereby you define a proportional band (p-band) which is a temperature band in which the controller regulates proportionally. At the maximum temperature deviation of the band or beyond, the controller output is set to 100%. The parameter x_p defines the proportional band in degree C.
Tn  	This parameter relates to the *Integral part* of the temperature controller. When using proportional control you want be able to regulate the temperature exactly to the setpoint. There will be always an offset. The integral part of the control continuously measures the distance between actual temperature and setpoint and correct the difference to zero. The parameter Tn defines the time length to reduce the deviation to zero. Note that short integral times may produce a fast increase of power and rapid temperature changes.

Table 7: Temperature Analog Setup Values

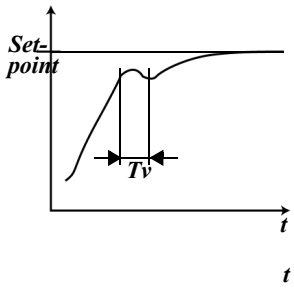
Setup Entry	Description
Tv 	This parameter relates to the *Differential part* of the temperature controller. The proportional and integral controls can only regulate the power to heating element while comparing the actual measurement with the setpoint. Therefore, sudden temperature peaks may occur. The differential part watches the *rate of change of temperature* and cuts off the controller output for short time periods to slowdown the value approaching the setpoint and to reduce overshooting (fish-tailing). The setup uses for TV the unit seconds.
First check	First check after tool startup. Time delay in seconds.
Check period	Time period of the check intervals. Time in seconds.
Alarm delay	Time period the signal must be outside of the given range till an alarm appears.

Table 7: Temperature Analog Setup Values

6.4.4 Dispense Programs

Dispense pumps (as the WaferTec acid pumps) have their own controller. You can program the controller directly or conveniently use the setup to program the controller. The entries are the same.

Please refer to the respective component manual (i.e. WaferTec, Cyborpump manual).

6.4.5 Teachable units

Examples are: Chuck horizontal, swivel arms, etc.

Setup Entry	Description
Norm Speed	Speed for driving to positions.
Norm Ramp	Acceleration for driving to positions.
Free check speed	Speed during substrate detection. Entry is used for vertical chuck movement, only.
Free check ramp	Acceleration during substrate detection. Entry is used for vertical chuck movement, only.
Teach speed	Speed in the Teach mode.
Teach ramp	Acceleration in the Teach mode.
PosTolerance	Tolerance of the vertical chuck position; a required parameter for the motor controller. Factory setting is adjusted for optimal performance.
Speed Tolerance	Speed tolerance of the horizontal chuck drive. Factory setting is adjusted for optimal performance.
Process Ramp	This ramp applies only if you programmed a macro using the segment function of swivel arms. For the segment function you can set the arm speed. The ramp is set with this parameter.

Table 8: Teachable Units

6.5 Access Screen

The engineers responsible for the HMX SQUARE may want to setup different access rights for different operators or maintenance people. (e.g. day shift, night shift, people with less than 3 month experience). The access mask is designed to help the user to setup a system as illustrated above. The user can define different groups and assign his people to them.

	Logoff Button
	Logon Button

Table 9: Logoff/Logon button on the root bar

To change the actual user press <Logoff> at the root bar (see Figure 20). And repress this button which has now changed to <Logon>.

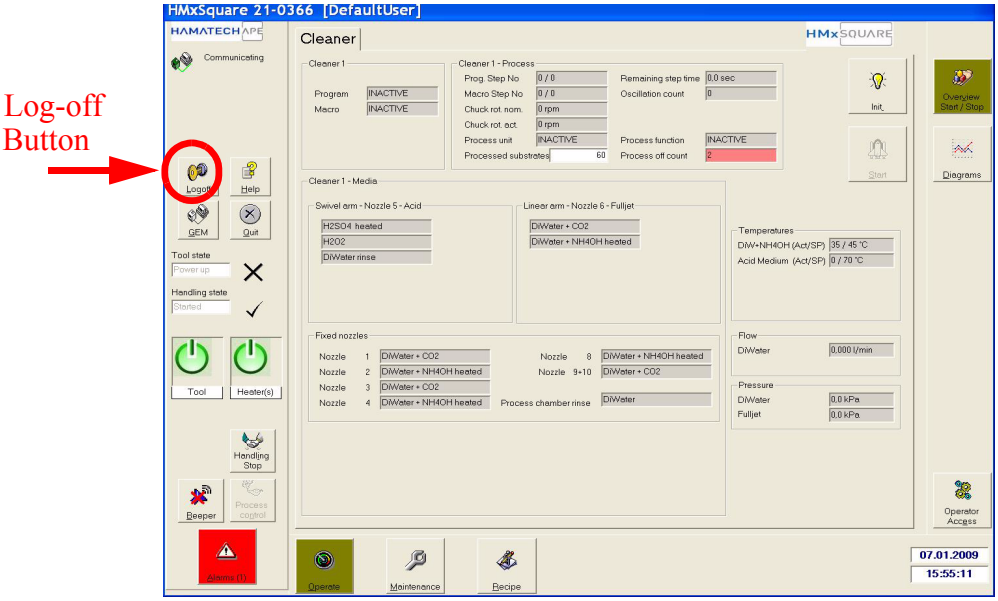


Figure 20: Logoff button

Administrator Password

To logon as administrator (max. rights) use the entries of the image below.

Figure 21: Login as Administrator

Under normal circumstances, you cannot see the password.

The 'Access' mask has two sub-screens, the 'Groups' and 'Users' screen. To enter either one, the 'administrator' (the person with the highest

access rights) needs to enter his user ID and password in the 'Users' screen. Click on <Login> at the left side of the screen to do so. This button has an equal appearance to the <Logon/Logoff> button on the left root bar. After that all defined users or groups respectively are listed on the screen.

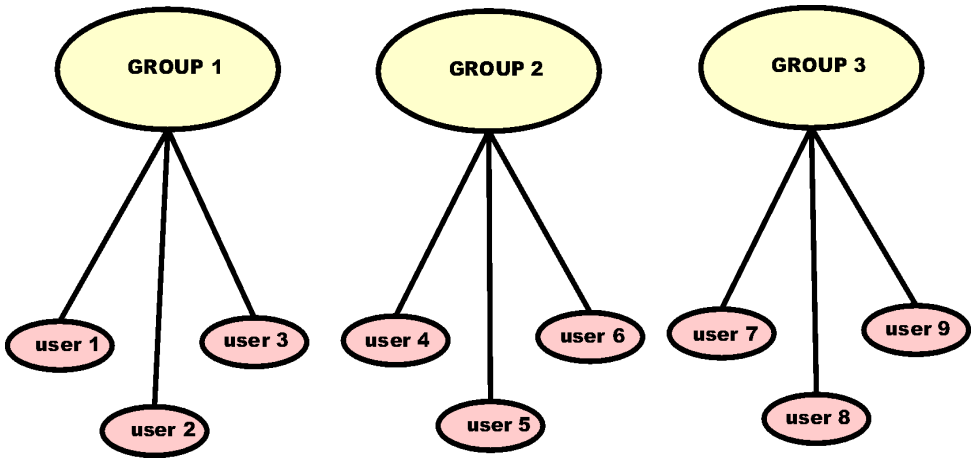


Figure 22: Groups and Users

6.5.1 Groups screen

Different users are combined into groups. Access rights are defined for individual groups.

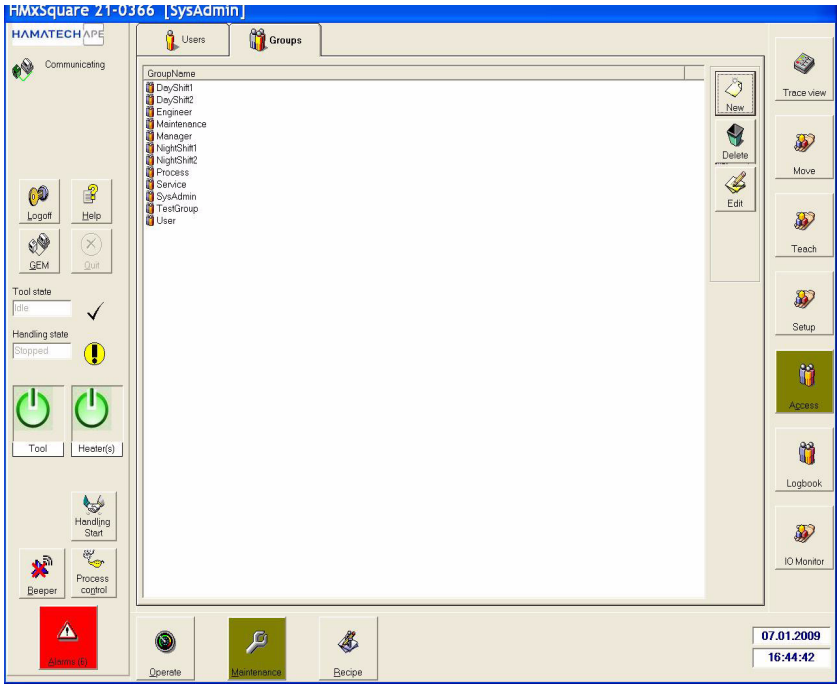


Figure 23: Groups Access Screen

Buttons used in the Groups screen:

	Use this button to create a new group. A window as in figure 24 appears
	To delete a group press this button. A window comes up to re-confirm the deletion
	With this button existing groups can be altered. The window appearance is equal to the 'New' window.

If the <New> button () is pressed the following window appears:

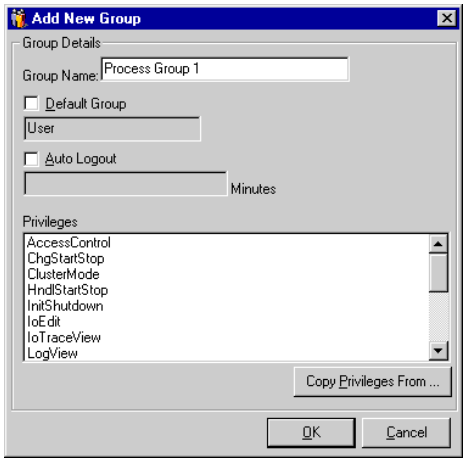


Figure 24: New Group Window

In the top dialog field (see Figure 24: New Group Window) a free chosen group name may be entered. A 'Default Group' is a factory setting group or another previously saved group. This dialog box becomes active if the 'Default Group' check box is clicked. The same is valid for the ”Auto Logout”.

Below the “Auto Logout” dialog box are the privileges listed. Click on a privilege to activate for the respective group. An activated privilege appears blue. If a pre-adjustment of privileges from other groups is desired a copy function is available with the button label '  '.

If the <Edit> button is being clicked, the same window appears as under <New>. Only the name of the window is already entered. In this case the window is named as “Edit Group {GroupName}”.”GroupName” bespeaks the name of the group being edited.

6.5.2 Users Screen

With this mask all users are managed. Each user is part of a group as defined in the “Groups” screen.

	To login into the access window. Only after successful login, the users and groups (in the groups screen) are visible on the screen. This function is designed to avoid misuse of the access screen.
	To create a new user press this button A window appears as in figure 25
	To delete a user name click on the user and press this button. The deletion must be reconfirmed.
	Sometimes, user rights requires to be changed. This can be archived by clicking this button. A window appears equally to the 'New user' window (see figure below). Only the user name cannot be edited.
	To reset the system back to factory setting press <Reset>. Be aware, all previously stored user and group information will be deleted!

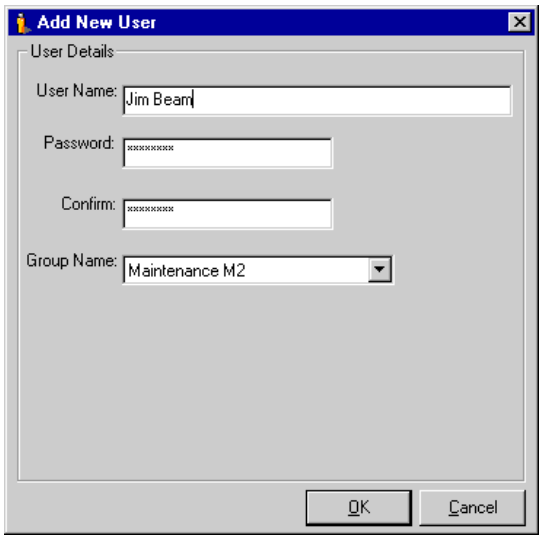


Figure 25: Add new user pup-up

6.6 Logbook

The logbook can be an important tool when troubleshooting. All errors, warnings and further information are saved in there organized by date and time.

To enter click on <Logbook> in the maintenance menu.

Click on <Show / refresh today> to view the logbook list of today. To return to the complete logbook list click on <Show / refresh all>

The logbook can be found on the harddisk under:

21-0367[1]\TOOL\BLOCK1\LOG\logbook.log

This file has ASCII format and can be viewed with all ASCII compatible editors (MS Windows NotePad, TextPad, etc.) or word processors.

However, it is helpful to remember the location of this file. If there are some trouble with the machine, it is eventually very effective to email the file to the HamaTech service.

6.7 IO Monitor

'IO' stands for Input-Output and the IO monitor observes the inputs and outputs of the Profibus system. While inputs can only be read out, the outputs can be set with the IO monitor.

[1] The three variables (###) stand for the three last digits of the tool serial number. It can be found in the top head line of the screen

Each output in the IO can be set manually without any interlock in place. Untrained persons must not be allowed to enter the IO monitor. Damage to machine components or injuries may result.

The IO Monitor is divided into two identical masks. This eases up a comparison of different parameters. Each mask has a tree of modules at the left side and a list of parameters at the right side. The modules are displayed as folders. If a module in the tree has sub components, a plus is placed in front of the name. If the sub-tree is extracted the '+' changes to a '-'. At the right side, only the parameters of the open module are displayed. An open module can be recognized by an open box in front of its name compared to a closed box for a non-open module. If no module is opened all parameters are presented.

The tree shows the host module items, first, divided into several sub-units (for instance media control). The tree entry ProfiBus_Host lists the entire Profibus inclusive slave modules organized in logical modules. This is useful when examining the bus using the electrical drawings.

Each client module (labeled with Machine1, machine2, etc.) has its own entry at the tree root to find IOs easily in those units. Each client has also an individual Profibus list.

In the IO Monitor, the sub modules are usually labeled as Din, Dout, etc. The meaning of this is explained in the table below.

String	Meaning
DIn	**D**igital **In**put
DOut	**D**igital **Out**put
AIn	**A**nalog **In**put
AOut	**A**nalog **Out**put

Table 10: IO Monitor: Abbreviations

However, when you observe the entire parameter list (tree entry IO) you may recognize that the parameter name contain the tree path they are in, and what input the parameter represents (DIn, etc.) and finishes with the actual description of the parameter. This feature is actually caused by the system and how the software assembles its data, Nevertheless, it is helpful for you since in this way you always know where the parameter is actually coming from.

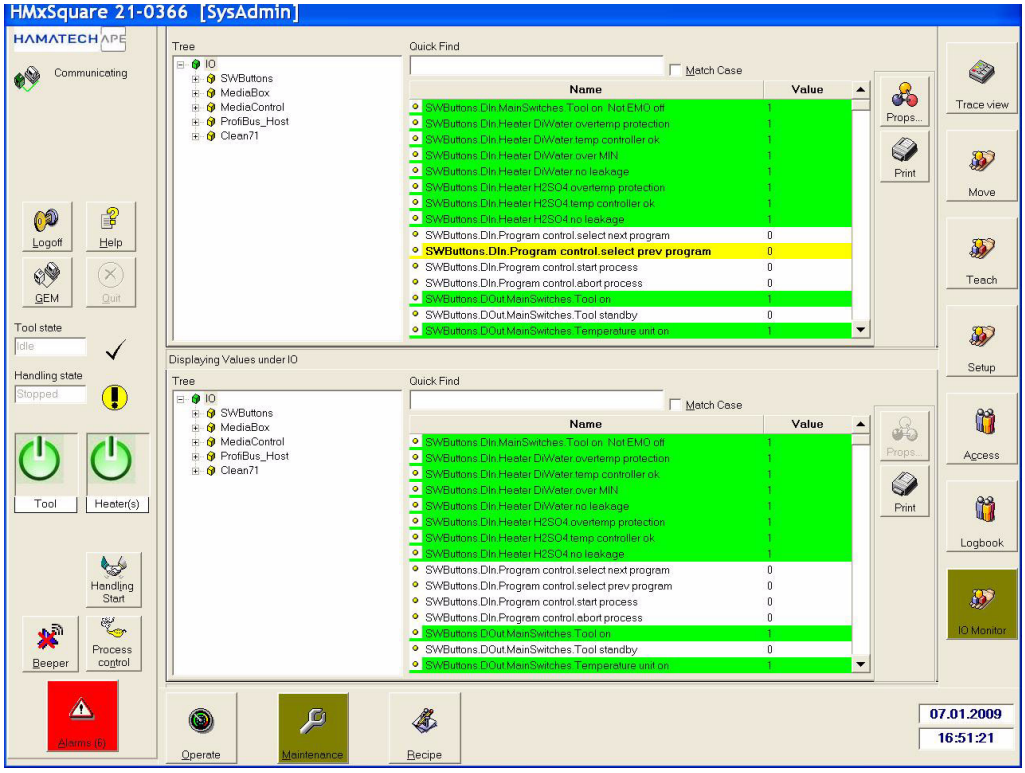


Figure 26: IO Monitor

Additionally, the parameter on the right side are color coded.

Color	Meaning
Green	This in- or output is active
Yellow (fonts are bolted)	Cursor
No color	This in- or output is inactive

Table 11: IO Monitor: Parameter Color Code

To change an output signal either:

a. Double-click the parameter

b. Click the parameter and press <space>

c. Click the parameter and click on the properties button () on the right

An input cannot be altered since it is set by the tool (e.g. by a sensor).

A dialog box is positioned above each parameter window to quick find a parameter without the need to identify the parameter over the modules.

To print out an IO report click on .

7 RECIPE

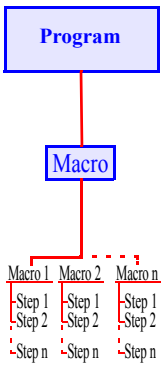
Figure 27: Main Menu - Recipe

This menu has the following menu points:

1. Program
2. Macro

This function is included to enable the user to program process programs, i.e. recipes.

The structure of the recipe is provided in figure 28 below.



NOTE: Entries may change depending on the tool configuratio

Figure 28: Recipe Structure

7.1 Recipe

With this screen, the recipe is put together with programs assigned to the station and defined in *Programs*. Macros describe individual *functions* performed on the stations. They are sub-programs of the stations defined in the *Program* screen.

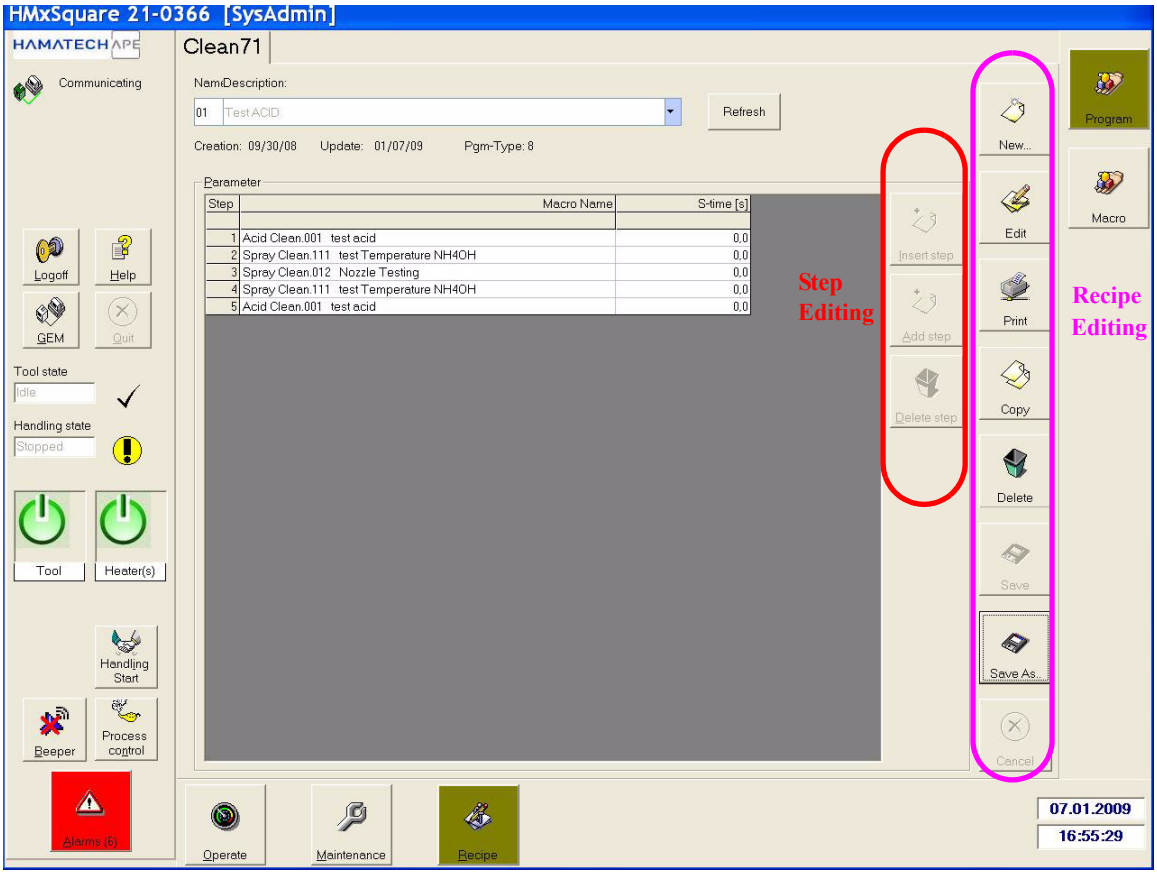


Figure 29: Recipe Screen

The recipe screen shows the program window in the center and a couple of buttons to the right. The left vertical button row is to modify a step the right button row to modify a recipe. On top is a pull down menu to select existing recipes. Below is a description field of the recipe. It can be altered once the right <Edit> button is clicked on. Beside the description field are information displayed about creation and modification dates. A <Refresh> button is provided next to the pull-down menu to reload the recipe list in case recipes have been modified externally over network.

It follows an explanation of the **right** button row of the main screen which governs the overall handling of the recipe.

	To create a new recipe click on this button. The computer prompts with a window to demand a new recipe name. After a new name has been keyed in the system returns to the same screen as before.
	To start programming choose the recipe from the pull-down menu on the top of the recipe screen and click on the **right** <Edit>. The window turns from colorless to white. It is recommended to edit the description field any time the recipe is modified. The description field is the one line string field below the recipe pull-down menu.
	To print a recipe
	To copy a recipe into the Windows clipboard. It can be then pasted into any other Windows application (e.g. word processor, etc.)
	The entire recipe can be deleted with the right delete button (careful, there is no undo)
	To save changes to disk. Also, the recipe window changes again from white to colorless
	To save the recipe under a different name. In this way new recipes can be created based on existing ones

Table 12: Right button row of the recipe screen (Recipe Editing)

	To discard changes not saved, yet. The recipe window changes again from white to colorless (no undo).

Table 12: Right button row of the recipe screen (Recipe Editing)

With the left button row the editing of a recipe step is managed. Click on the **right** <Edit> to enable the button row

	To edit an existing recipe step. Click on the respective step and press this button
	To add another step behind an existing step. If no step is selected the new step will be added at the end of the recipe. Also use this function to insert the first step into a new recipe. A window pops up as shown in figure 30. Select the respective unit and program. Usually it is not required to change the field “Station”. In this case the hot- or cool plate number can be selected in here. If the field is still put to ”Auto”, the system will choose the next free unit to proceed with the recipe.
	To delete a step

Table 13: Left button row of the recipe screen (Step Editing)

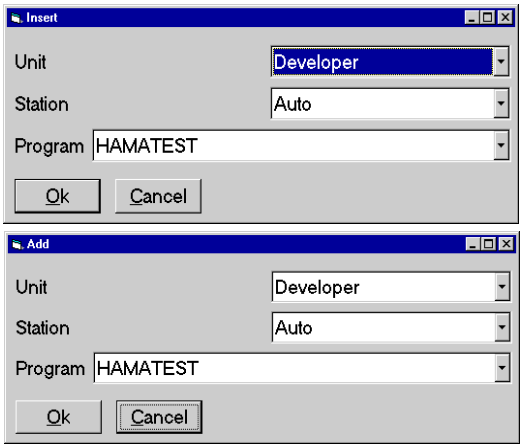


Figure 30: "Insert recipe step" and "Add recipe step" window

7.2 Program

A program is a list of macros which are explained in the following chapter. Below are the buttons explained which can be found at the right side of the screen. Note, that the button are organized in two rows. With the right row buttons the entire program can be modified. With the left row of buttons one step can be modified.

In general the screen appears very similar to the recipe one. On top is the pull-down field to select already written files and below is a description field displaying information about each file. A 'Refresh' button is next to the pull-down field to update the program list.

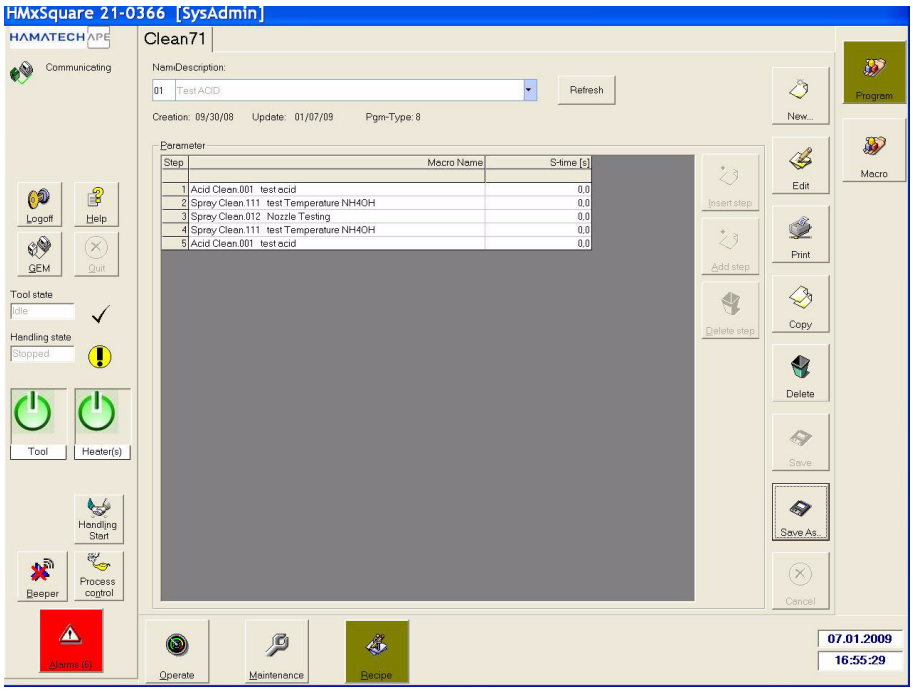


Figure 31: Program Screen

On the right side are buttons which are required to edit the program.

	Creates a new program. After this button has been clicked, a new program name must be entered in the pop-up window. To work on the program press 'Edit'

Table 14: Edit program buttons

	The actual program chosen at the top can be edited now. 'Edit' must also be clicked after a new program has been created with the <New> button. Key in a description at the top of the screen and start editing the program. The entered description is displayed in program list of the recipe. The description will also appear in the <Add> or <Insert> window of the recipe screen to makes it easy for the user to allocate a program
	To printout the actual program
	To copy the program into the Windows clipboard
	To delete the program. A window pops on and ask for reconfirmation
	Click this button to save program changes
	To save the program changes under a different name.
	To discard already performed changes. This button will not affect already saved programs

Table 14: Edit program buttons

	Edits the current step. If no step has been high-lighted the first step will be edited. Optional dou-ble-click on the macro
	Use this button to insert a new macro in front of the current (highlighted) step (macro)
	Add a new macro at the end of the program
	Deletes the current macro from the program. It does not delete the macro file from the disk

Table 15: Edit a step buttons

If the user attempts to add or insert a Macro the following screen comes up:

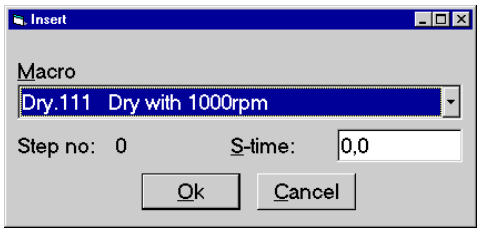


Figure 32: Insert Macro Pop-up

Select the Macro desired. The field S-time means “stretch option time” and is entered in 1/10 sec (e.g. 60 means 6sec). This option gives the experienced user the option to modify quickly critical program steps without actually going into the Macro details. The Macros are divided fur-ther into steps and if the user has entered the “S-time” then the system re-calculates those steps which are marked as “Stretchable” and also re-com-putes the total length of the Macro (for further details on this option and which formulas the software uses, please see chapter below.

7.3 The Macro Editor

The macro editor is entirely different from the other programming screens. To edit a macro some fundamental knowledge about the tool and process engineering is required.

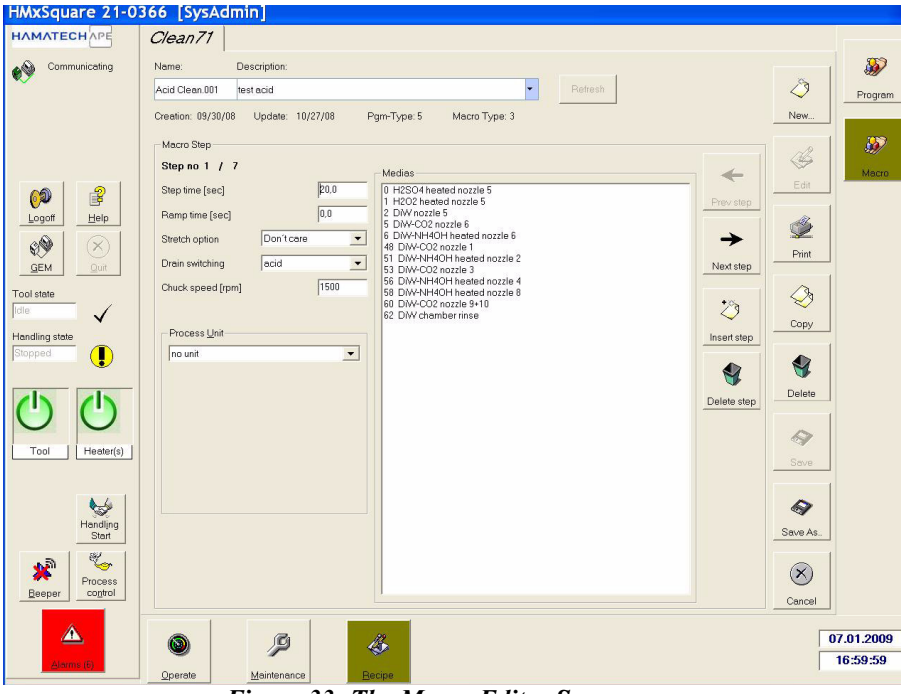


Figure 33: The Macro Editor Screen

First of all, the right side presents the common buttons, known from the recipe or program menu:

	Creates a new macro. After this button has been clicked, a new macro number must be entered in the pop-up window. To enter a comment click on the comment line

Table 16: Macro Editing Buttons

	The actual macro chosen at the top of the screen can be edited now. 'Edit' must also be clicked after a new macro has been created. To insert a new step click on <Insert> or <Add> at the button of the editor mask
	To printout the actual macro
	To copy the macro into the Windows clipboard
	To delete the macro. A window pops on and ask for reconfirmation
	Click this button to save program changes
	To save the macro changes under a different name.
	To discard already performed changes. This button will not affect already saved programs

Table 16: Macro Editing Buttons

Use the right buttons to edit a macro step. This buttons will be enabled when <Edit>  has been clicked.

	Use this button to go to previous step
	Use this button to go to next step

Table 17: Macro Step Editing Buttons

	Use this button to insert a new step in front of the current (highlighted) step
	Deletes the current step from the macro. It does not delete the macro file from the disk

Table 17: Macro Step Editing Buttons

The center screen shows the details of the macro step. The window “Medias” displays all available medias for the tool. This list is different from tool to tool.

Click on the list item to enable this media for the particular step. If the machine required more feedback (e.g. the required flow) a window pops up.

It follows an explanation of the items on the left:

Field	Description
STEP	Actual edited step <of all macro steps>
STEP TIME	The duration of the macro step in seconds (resolution input 1/10 sec) . Also see "Stretch Option"
RAMP TIME	The required time for the chuck to reach the nominal speed (resolution input 1/10 sec.)

Table 18: General Parameter Description Macro Editor

Field	Description
STRETCH OPTION	Use this option to allow stretching of certain macro steps. Sometimes, process engineers want to stretch a macro without undertaking the effort to go into each step and check which one can be stretched or which one must stay constant. To stretch stretchable macro steps, enter a stretch time *S-Time* when you add the macro to a program (see page 47). • *STRETCHABLE.* Use STRETCHABLE to allow stretching to allow stretching of the macro step. • *Constant.* Use CONSTANT to keep the time of the macro step constant. However, macro steps with a constant step time influence the macro steps times which are stretchable (see below). • *Don't Care.* Use DON'T CARE to keep the macro step constant and keep it out of the calculation for the stretched macro steps. Before executing the process program, the stretchable step times are recalculated The technologically relevant duration of a process macro is supposed to be calculated of the time, which is stated for this process program step. Only the durations (Step time) of the macro steps, which are marked "stretchable", will be recalculated before executing the process program. The system uses the following formula to calculate the step time of each stretchable step. $StepTime = \frac{S\angle Time\angle \sum T_{constant}}{\sum T_{stretched}} \times T_{Step}$ *S-Time* is the time you enter into the program editor. $\sum T_{constant}$ are all step times marked as constant of this macro. $\sum T_{stretched}$ is the original step time of all stretchable steps. As you can see all constant and stretched step times and the variable S-Time form a new variable which will be used to recalculate all stretchable step times. The *dont'care* step times are not included into this calculation. However, you can use the *Don't care* steps to calculate the total Macro time: $MacroTime = S\angle Time + \sum Don't\ care$ An example is given below this table.

Table 18: General Parameter Description Macro Editor

Field	Description
DRAIN SWITCHING	If there are programmable drains in the tool the choice-field, "no change" is set at the beginning and means DI water drain. Select the drain required for this macro step. Be careful – Do not mismatch to avoid incompatibilities and head-ups in your facility waste systems. If the machine has no drain option installed the field displays "unused".
CHUCK SPEED	The speed in rpm, positive values will cause clockwise rotation, negative values will cause counter-clockwise rotation
CHUCK HEIGHT	The working position for the substrate (in mm from the home position)
PROCESS UNIT	There are one or more process units, as shown in the process unit list for the different tools, or "no unit", if no process unit is active
FUNCTION	For each process unit there are different functions. Those depend on the process stations and how the stations are equipped. For this reason the unit/function chart is given in the station dependent software description later in this document

Table 18: General Parameter Description Macro Editor

Example of the Stretch Function

Based on the discussion above, here is an example for a better understanding:

The figure below outlines the formulas given.

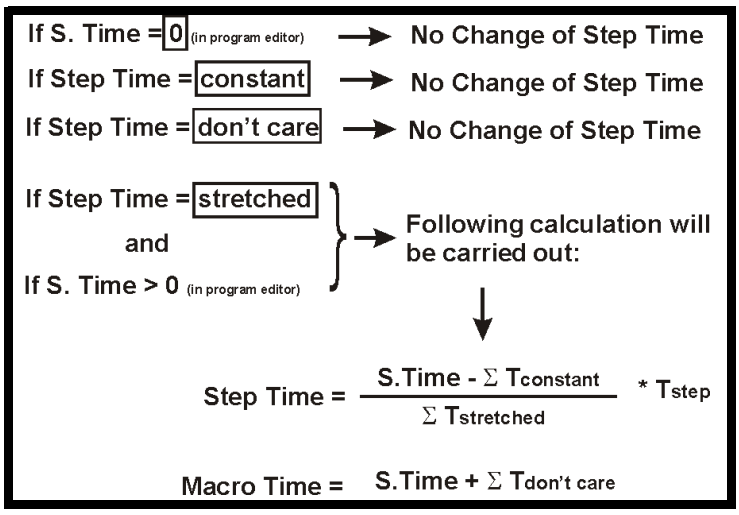


Figure 34: Step Time Calculation

Example:

Macro Step	Step time in sec.	Stretch Option
1 / 4	20	stretchable
2 / 4	30	stretchable
3 / 4	10	constant
4 / 4	40	don’t care
Total:	100	

S-Time is given as 120 seconds.

Table 19: Sample Macro

Step one and two are stretchable and must be recalculated:

$$StepTime1 = \frac{120s \angle 10s}{20s + 30s} \times 20s = \underline{44s}$$

$$StepTime2 = \frac{120s \angle 10s}{20s + 30s} \times 30s = \underline{66s}$$

Afterwards you can perform a check and recalculate the macro time with the second formula:

$$MacroTime = S \angle Time + \sum Don'tCare = 120s + 40s = \underline{160s}$$

This should be equal than the sum of all step times inclusive the stretched once:

$$MacroTime = 44s + 66s + 10 + 40 = \underline{160s}$$

Unit	Function	Parameter (Param-Name, Min, Max, Default)	Description
All arms	ProcPos		Moves to the middle of the process cup (norm speed programmed in the setup). From this point starts StepTime and dispensing of programmed media for this arm
All arms	Oscill./const	Amplitude [0.1 dgr], Speed [0.1 dgr/sec], OscCount	Moves to the middle of the process cup (normspeed programmed in the setup), From this point starts OscCount and dispensing of programmed media for this arm.The macro step finishes the OscCount, first, before moving on even if this exceeds the step time. Movement starts in outside direction at first until unit reached amplitude, stops moving in this direction and moves inside up to the center (OscCount=1) When the StepTime (OscCount=0) has run out, movement will be stopped. The distance from the middle of the process cup (chuck centre) up to the outside edge is (0...1500). If the set value is too large the arm moves after reaching the sensor in the opposite direction. Speed for arm movement and dispensing is (30...541). If equal 0: oscillate with Step time; > 0: Number of oscillations till Osc-Count = 0 (0...1000)

Table 20: Process Parameter Description Macro Editor

Unit	Function	Parameter (Param-Name, Min, Max, Default)	Description
All arms	StandbyPos		Switch off media ; arm moves to BasePosition with NormSpeed from Setup
	ArmNozzleRinse		For rinse in BasePos: operate in BasePosition with media on
	Segment	Amplitude [0.1 dgr], Speed [0.1 dgr/sec], OutsideDi-rectionOn	The arm moves from actual position to set position with its parameters and media dispense. After reaching set position the step ends. The distance from the middle of the process cup (chuck centre) up to the outside edge is (0...1500). If the set value is too large the arm moves in the opposite direction after reaching the sensor. Speed for arm movement and dispens-ing is (30...541) Direction of arm movement: 0: to the middle of process cup 1: to the edge of the process cup

Table 20: Process Parameter Description Macro Editor

Unit	Function	Parameter (Param-Name, Min, Max, Default)	Description
Chamber Unit	Oscillate	Amplitude [0.1 mm], Speed [0.1 dgr/sec], Ramp, OscCount	The chamber unit (splash ring) oscillates between 2 points. The 1st pos results from: The standard teach value for the low pos. The 2nd position results from the amplitude: If amplitude = 0, then LowAreaPosition = amplitude If amplitude > 0, then 1st pos+amplitude = 2nd pos If the resulting position is larger than the MaxPosition then the value is the max value for the 2nd pos. Oscillation begins from the nearest actual pos. Speed defines the oscillating speed in mm/s. Ramp tells the system, how long the chamber unit should take to reach the final speed. OscCount = oscillation count, To define the number of oscillations.

Table 20: Process Parameter Description Macro Editor

8 Idle and Pre-Dispense (Appendix)

With the software of the HMX SQUARE tools, you can define automatic idle dispense and pre-process dispense programs. The contains of the program is not fixed. It is free programmable. Go to the **Recipe** screen and click on **Program**. There you will find the programs _IDLDISP and _PREDISP for idle dispense and pre-dispense.

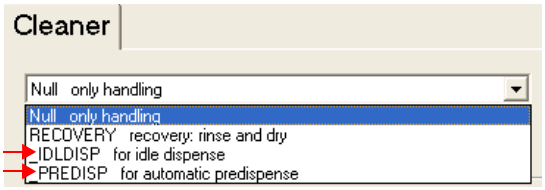


Figure 35: Idle and Pre-Dispense Programs

When it is activated is defined in the **Setup**.

8.1 Idle Dispense

Idle dispense means, there is a dispense while the tool is in idle mode. During process, there is no idle dispense. This function is useful to activate certain media and / or DI water while the machine is in idle mode to prevent crystallization and contamination.

The time between one idle dispense program and the next is determined in the setup with the variable *Time between IdleDispensePrograms*. Go to the **Setup** and select **Cleaner (**or **Processor**, **Developer)**[1] → **Idle Dispense** from the tree. Enter the time in minutes. If the variable set to zero (0), idle dispense is disabled.

The declared time defines also the period after the process to the next idle dispense.

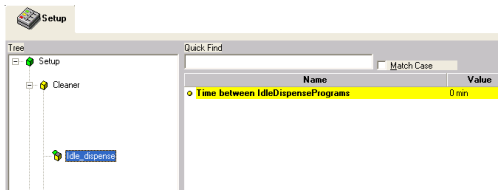


Figure 36: Idle Dispense Setup

8.2 Pre-Dispense

Pre-dispense is an automatic dispense program which starts prior process start. This ensures, that the media is ready to start and there is no delay in the dispense and everything is decontaminated before the first substrate of the charge enters the chamber.

Pre-dispense can be activated before each start of a charge and after a prescribed number of processed substrates.

This is defined in the setup. Click on **Cleaner (**or **Processor**, **Developer)**[1] → **Auto_predispense** to enter the setup screen for pre-dispense.

[1] Depending on the tool type.

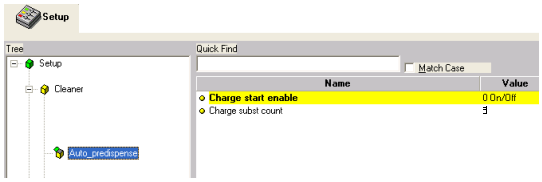


Figure 37: Pre-Dispense Setup

Put the variable *Charge start enable* to 1 and the pre-dispense program is executed before each charge. This is a digital input (1 or 0).

The variable *Charge subst count* defines, *after* how many processed substrates an automatic pre-dispense is executed. At the beginning of each charge, the counter is set to zero. For instance, the variable is set to *3*. A new charge ist started; then, the tool will pre-dispense after the 3rd substrate of the charge and before the 4th one. If you have only 3 substrates in your carrier, there will be no pre-dispense if the first variable (*Charge start enable*) is set to zero.

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