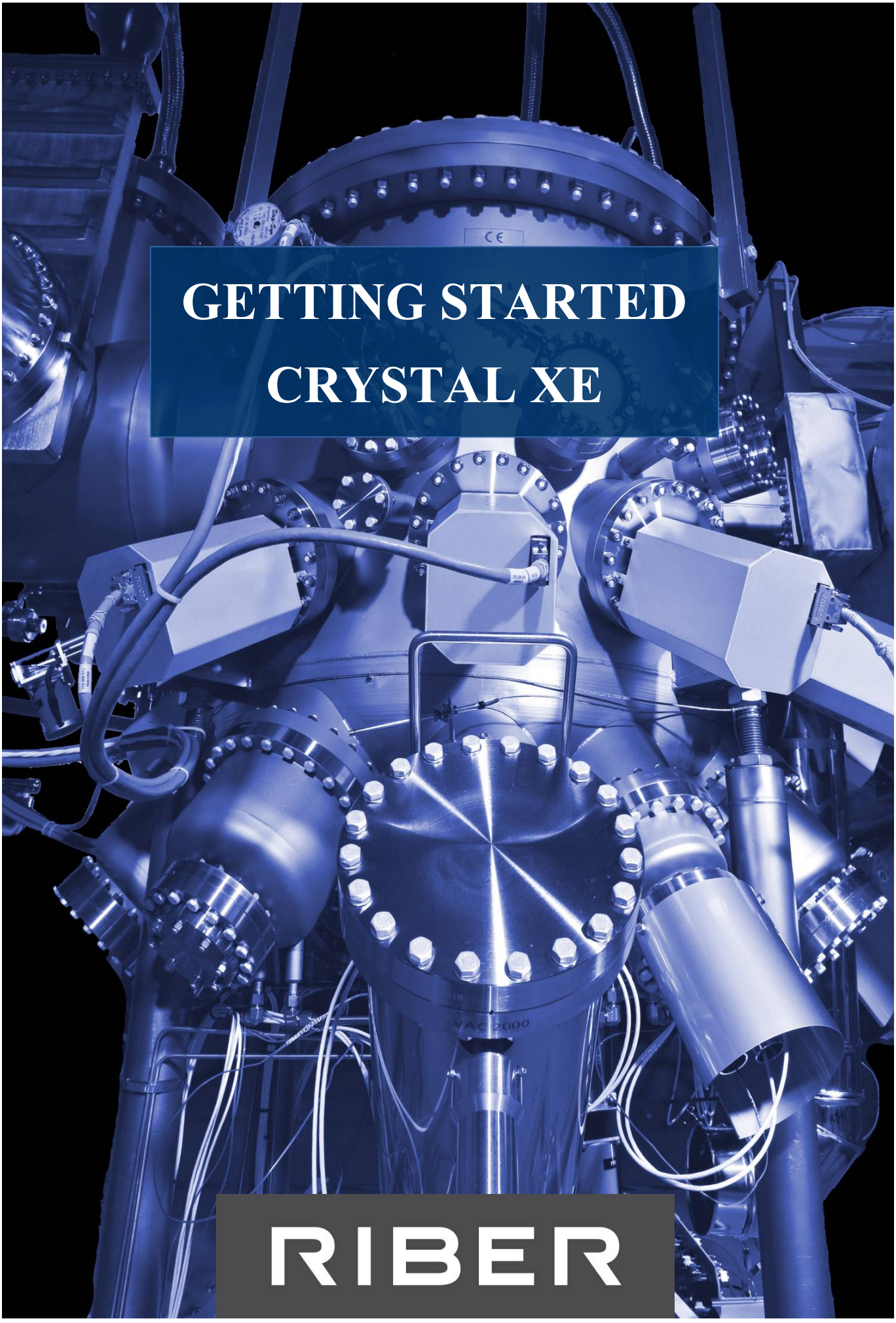


GETTING STARTED
CRYSTAL XE

RIBER

This manual introduces Crystal XE software interface and its main features. It demonstrates the basics of using Crystal XE.

CONTENTS

Rev	Date	Description
3	29 August 2019	Update with the last version 2.02 build 1 of Crystal XE
2	04 sept 2017	Update with the last version 1.05 build 8 of Crystal XE
1	09 sept 2015	Original issue

I. INSTALLATION

1. Installation

If Crystal XE is preinstalled on your computer, the default directories are the following:

- Program directory: c:\riber\CrystalXE
- Project directory: d:\riber\<Project name>

To download the latest version of Crystal XE, you need to create your account on http://www.crystalXE.com. After receiving the activation confirmation, go in MY CRYSTAL XE and download the setup program.

Run the setup program and follow the installation instructions (select the demo files) in the dialog box to complete the installation.

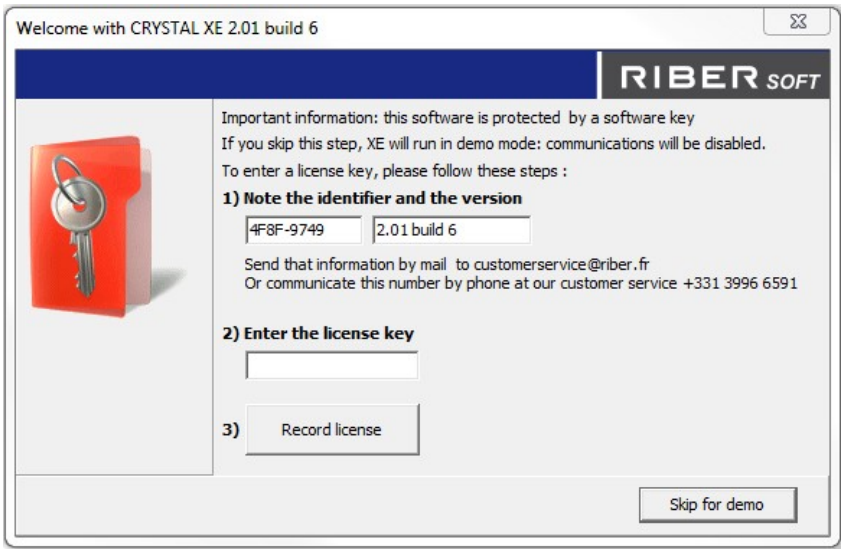
In Crystal XE, a ***project*** corresponds to the directory name in which you can find the data files specifying your application (configuration file, synoptic, security files etc.).

A Crystal XE shortcut icon should be available on your desktop. If not, create the shortcut from the *'CrystalXE.exe'* file located in the directory c:\riber\CrystalXE.

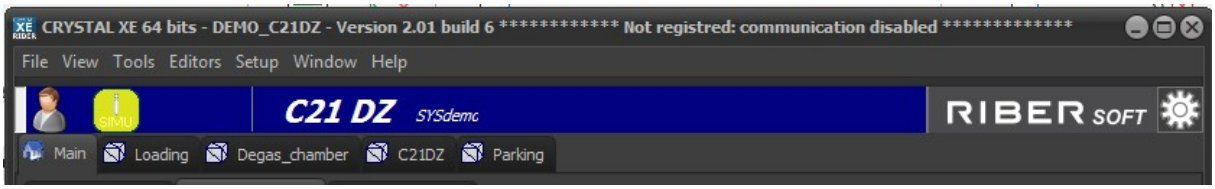
2. License key

To benefit from all the features of the software, a license key will be required at the time of the execution of the application. You can skip this step for demo. In demo mode, only communications with devices are disabled, all other features remain available.

To receive your license key, note down your software information and send it to RIBER customer service to the indicated email address.



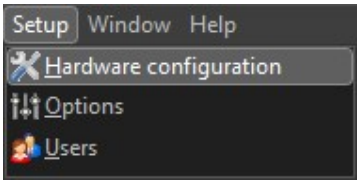
II. SETTINGS

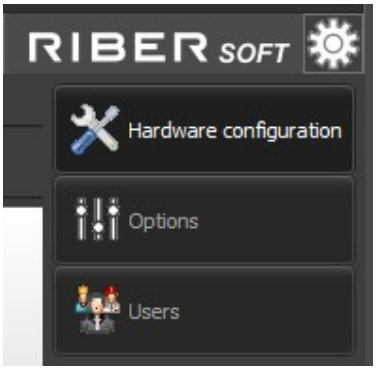


Click on the *Setup* menu to display the drop-down menu or *click on the following icon in the top right-hand corner of the interface*  .

3. Hardware configuration

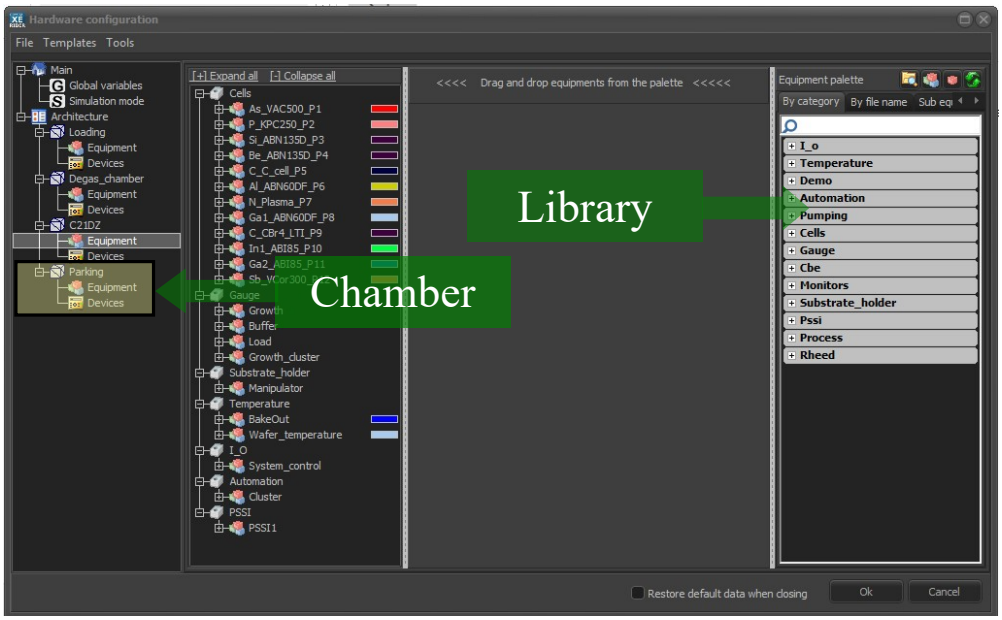
Click on the *Hardware configuration* submenu.

In the menu 

or on the setup button 

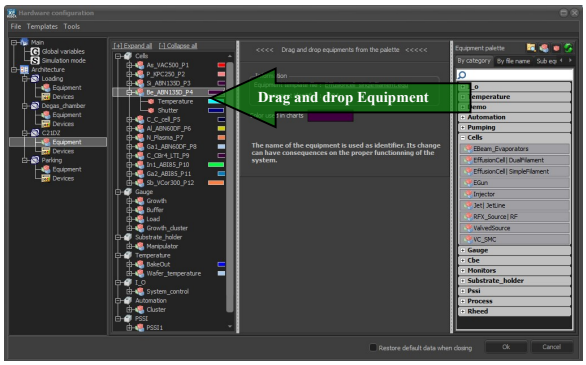
 You cannot modify the hardware configuration when a recipe is executing.

Crystal XE comes with a library of equipment and devices.
For each chamber (sub-system), click *Equipment* or *Devices* (*left*) to display the available items palette (*right*).



Add or modify equipment and devices

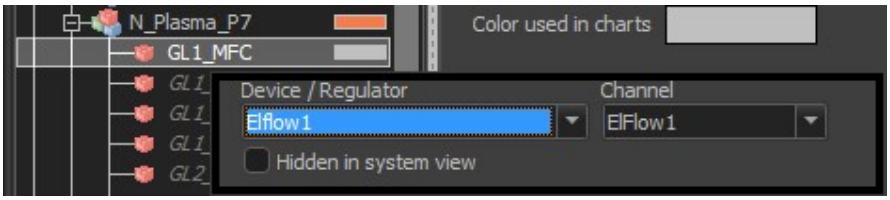
Drag and drop the equipment and devices from the palette directly to the equipment tree structure or to the devices graphical view.



Adding equipment

Adding devices

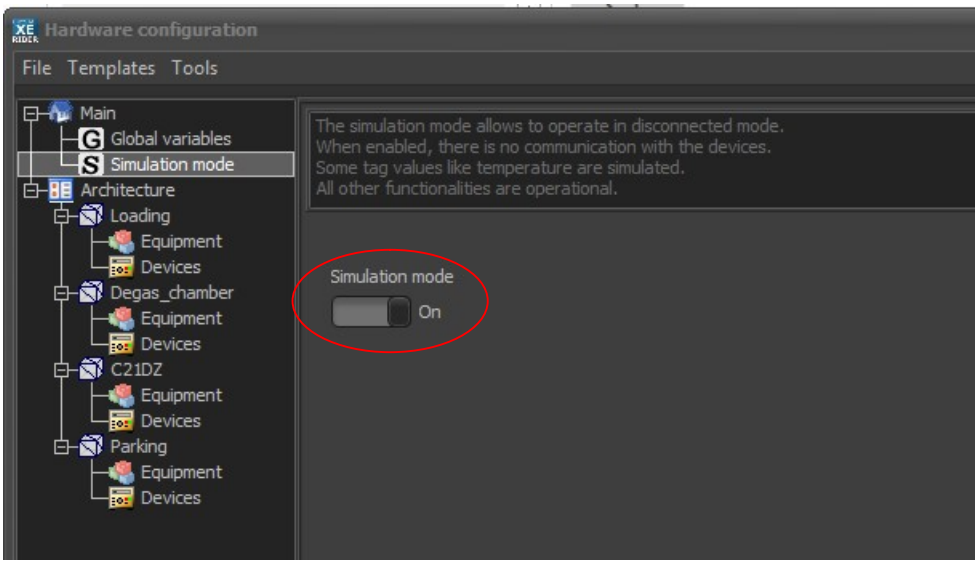
To be operational, a sub equipment must be linked to a device and conversely, in order for Crystal to communicate with a device, the module must be linked to a sub equipment.
To link sub equipment to a device, click on the desired sub equipment name in the equipment tree structure and select the device and the channel to be linked with from the drop-down menu.



When a sub equipment is not linked to a device, it is displayed in italic gray.

Simulation mode

Switch from *Online* mode to *Simulation* mode, and conversely, by moving the following switch:

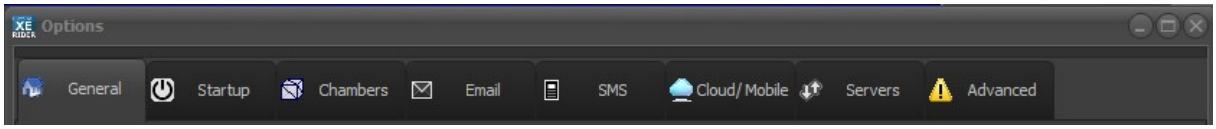


You must have a valid license to switch to the online mode.

4. Options

The *Options* dialog allows you to configure Crystal XE software.

You can configure the software even if a recipe is currently executing.

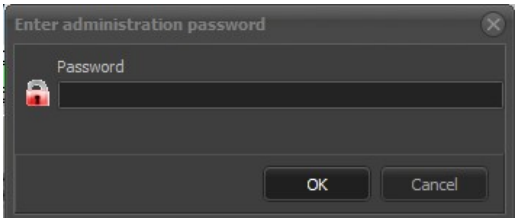


For more details, refer to the user manual.

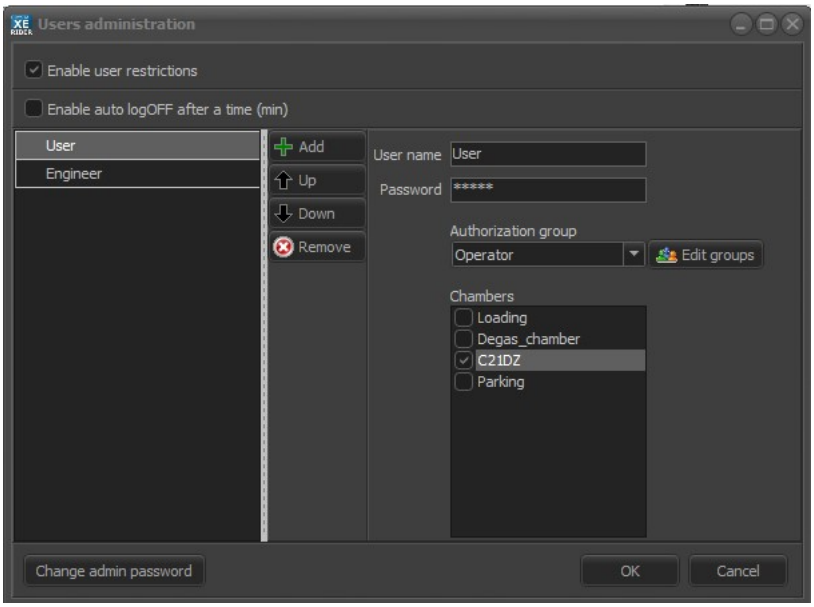
5. Users

The *Users* submenu, allows you to manage the different users and their permissions.

You systematically need to enter a password to open the *Users administration* window.



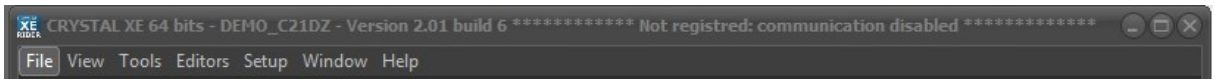
The default password is **'admin'**.
You can change the password by clicking on the *Change admin password* button, in the bottom left-hand corner of the window.



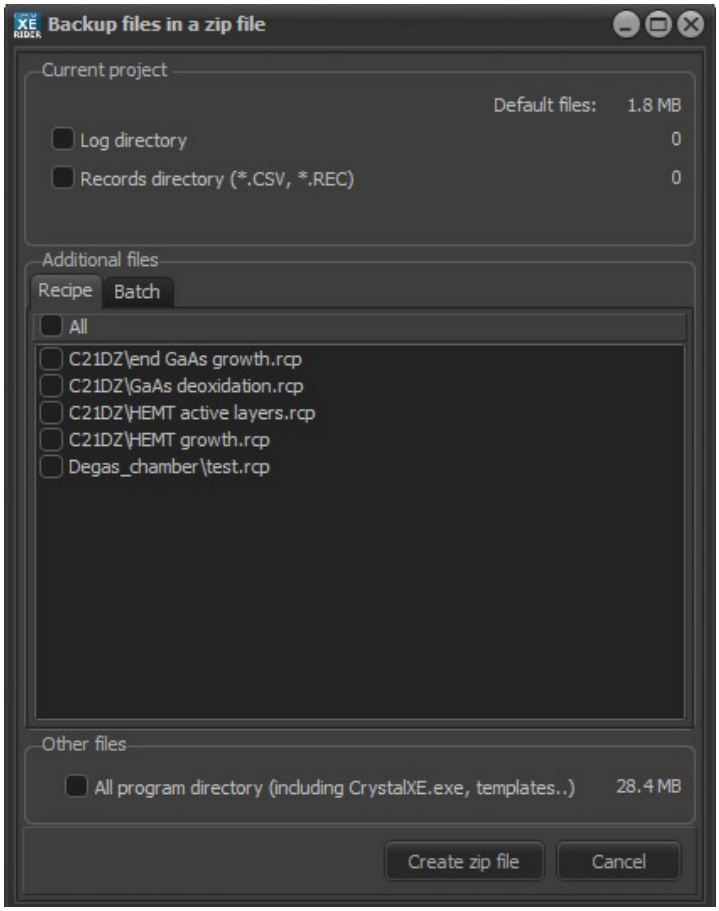
In this window, you can add new users, you can associate a user to a group of user and chambers. You can also create new group of users and change the rights of each group.

You can also open the Users administration window by right-clicking on the User icon  *located in the top left-hand corner of the main interface, and selecting Manage Users.*

III. BACKUP



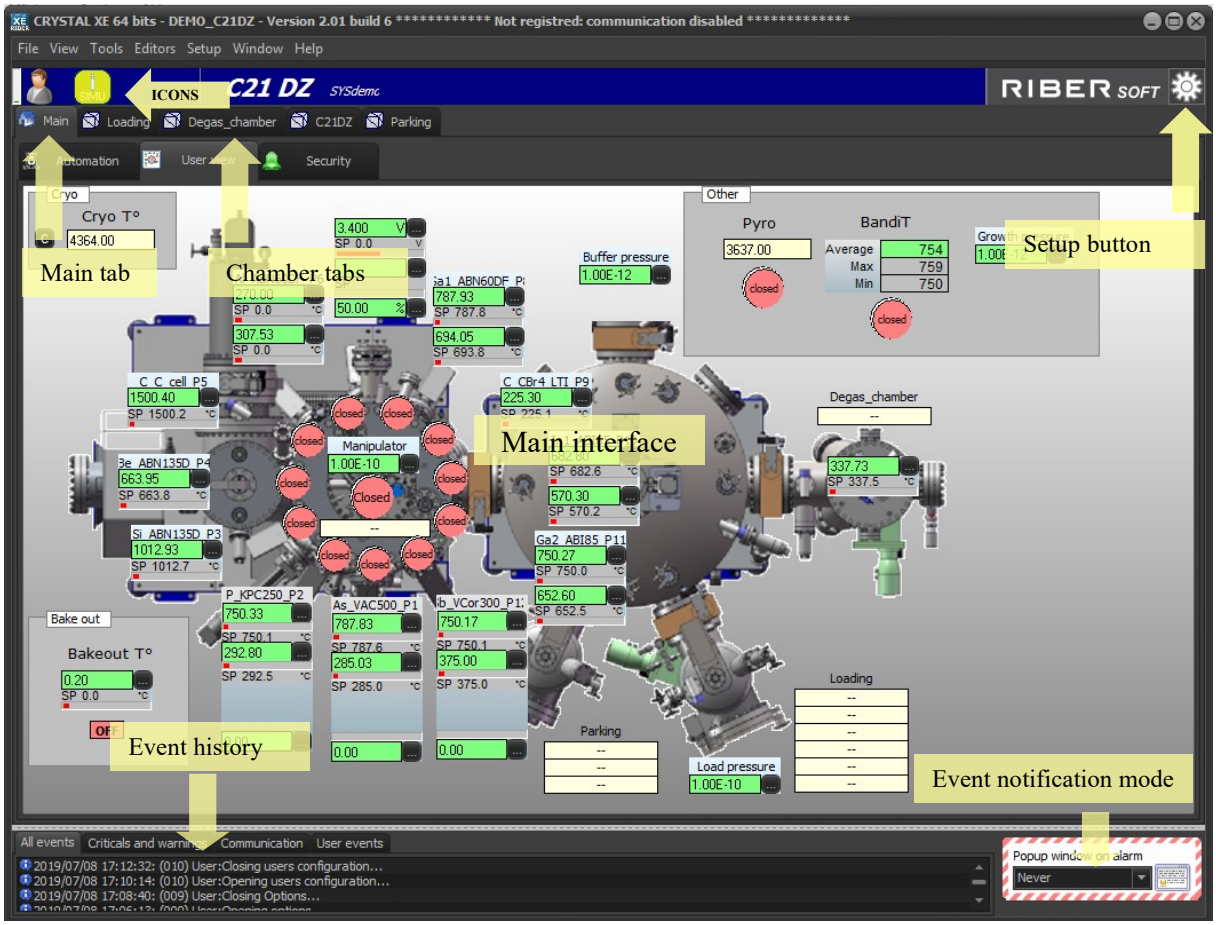
To save the configuration of your current project and clone the software to another computer, click on the *File* menu and select *Backup*.



You can choose specific files to be saved by checking the corresponding boxes.

If you check the *Records* or *Black box* (if available) boxes, large files might be generated.

IV. INTERFACE OVERVIEW



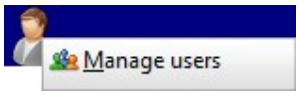
1. Icons overview

1.1 User icon

Click on the following icon to display the list of users and log in
(if user restrictions are enabled)

The following icon indicates that you are logged in or that user restrictions are disabled

You can open the *Users administration* window by right-clicking on the user icon and selecting *Manage users*.



1.2 Simulator icon

The following icon indicates that Crystal XE is operating in simulation mode.

In simulation mode, all communications with peripheral devices are disabled and some values are simulated.

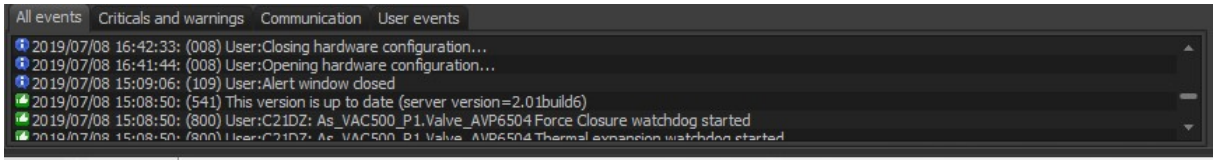
You can switch from *Simulation* mode to *Connected* mode by checking the corresponding box in the *Project configuration* window, that can be accessed from the *Setup* menu > *Hardware configuration*.

1.3 Alarm icon

The alarm icon indicates that at least one alarm is activated.
Click on the alarm icon to display all the alarms in a pop-up window.

2. Event history

The history area at the bottom of the interface displays all the recorded events.



▫ You can choose to display only a specific event type using the filter tabs:

- To **delete** the event history, right-click the history area and select *Clear all logs* (this does not delete the log file, this action only clears the display)

- Double-click on any of the events to **open** the *Log viewer* and display event details

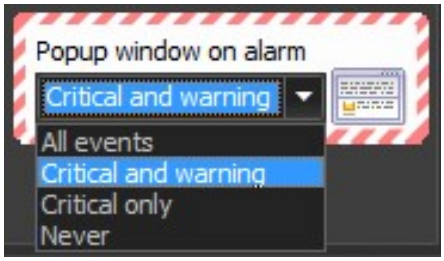
Or right-click and select Open in a new window.

Events are saved automatically as text files to the ***Log* folder**, in your project directory.

To open your project directory, click on the File menu and select Browse project directory.

3. Event notifications

These drop-down list boxes in the lower-right corner of the interface, allow you to define when you want to be notified by a pop-up window or an email alert (only available if email settings are defined in the options).



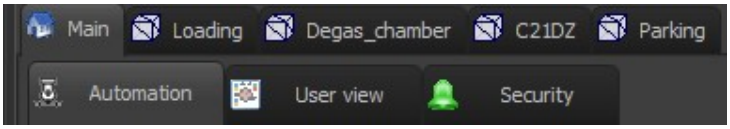
All events: Enable email alerts / pop-up windows for all events (all alarms, user events, etc.)
Critical and warnings: Enable email alerts / pop-up windows for critical level or warning level alarms
Critical only: Enable email alerts / pop-up windows for critical level alarms only
Never: Disable all email alerts / pop-up windows

Use the corresponding drop-down list to select your choice.

The choice “Critical and warnings” is recommended.

The choice « Never » is not saved when exiting Crystal XE.

V. THE MAIN TAB



1. Automation

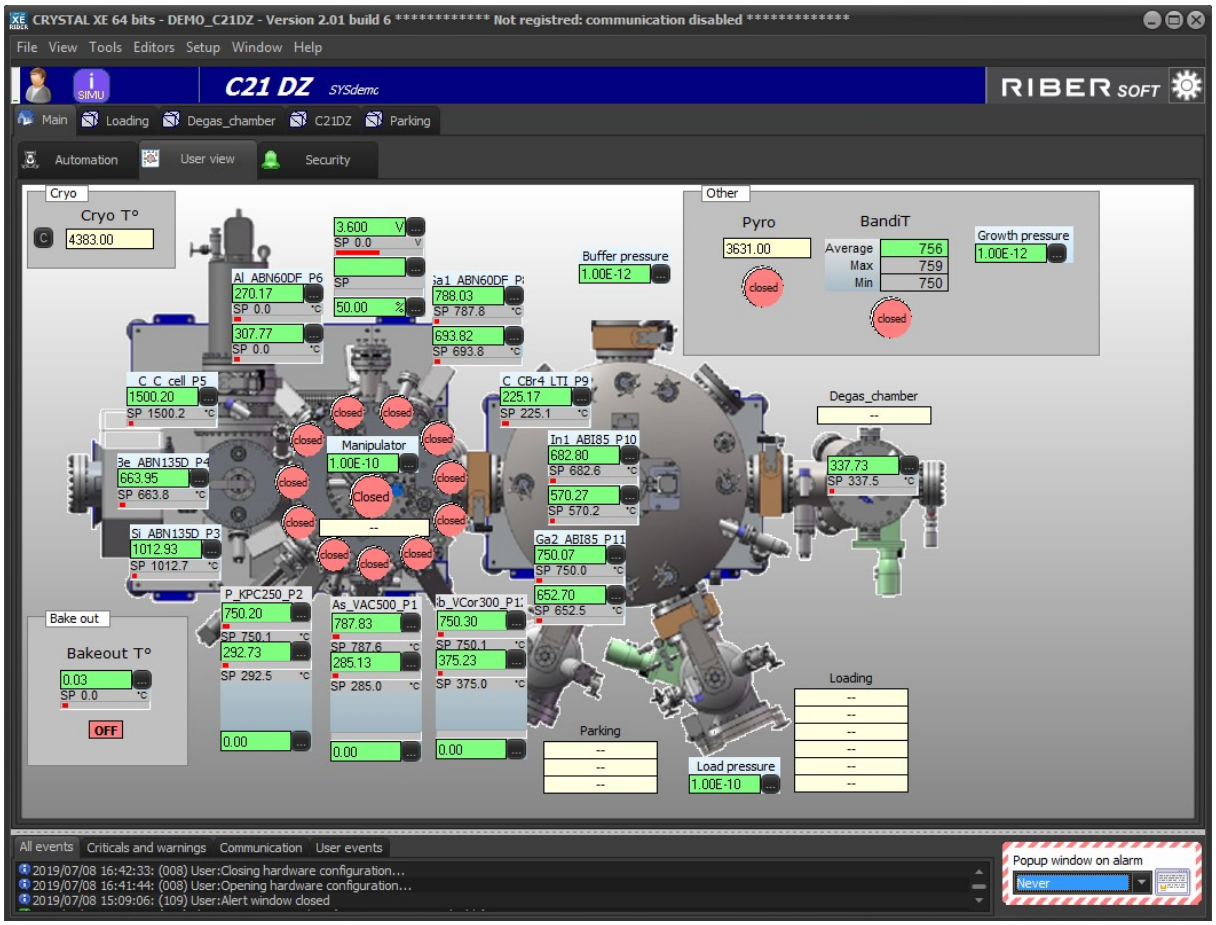
The *Automation* tab allows you to create, edit and execute production batches.

A batch is used to organize each operation performed by the different parts of the epitaxy system, in parallel or in sequence. A "batch file" contains the description of the movements of the platens in the system.

→ *For more details, please refer to the chapter* ***Platens automation*** *in this manual.*

2. User view

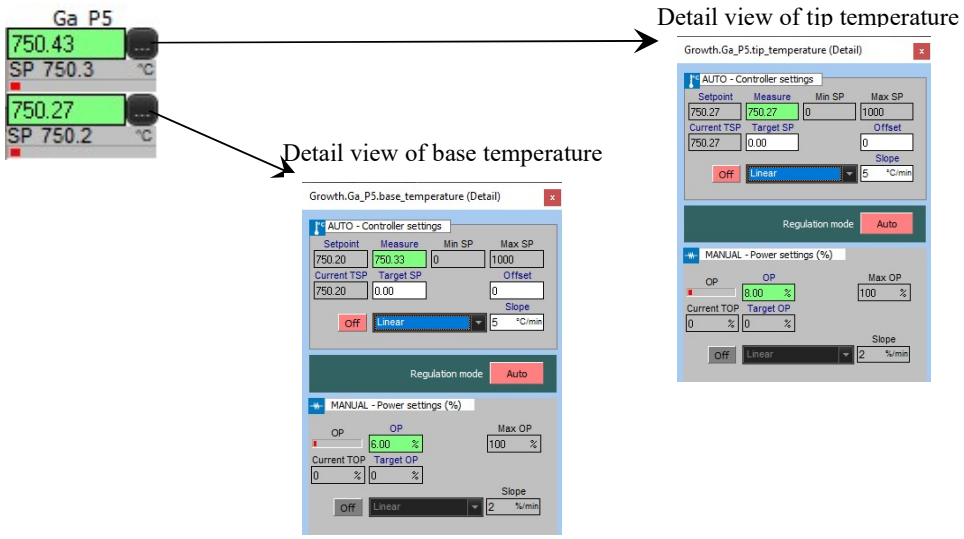
The user view interface is a visual representation of the MBE system that allows you to monitor and control the operation of equipment.



The *User view* interface depends on your configuration.

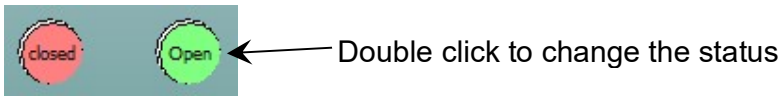
Example of equipment representation

Cell *Ga2_ABI85_P11* and its three pieces of sub equipment (insert, base and shutter)



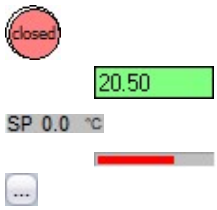
Click on the following button [...], from the desired sub equipment's item, to open the *Detail view* window.
→ For more details about the *Detail view*, please refer to the chapter **System view** in this manual.

Shutter



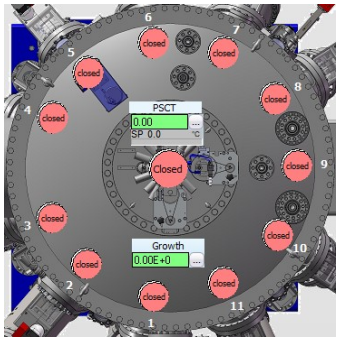
The interface allows you to perform the following actions:

- Opening / closing shutters
- following the measured value
- viewing the set point value
- following the output power bar graph
- opening the *Detail view* window



Interacting with the equipment

Opening / closing shutters



You can open/close a shutter by double-clicking on the desired shutter icon.
Green icon indicates that the shutter is open while red icon indicates that it is closed.

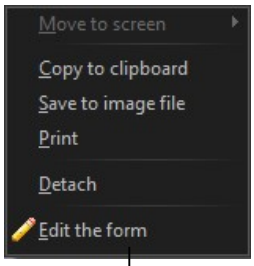
>> When you first click on the shutter icon, a progress bar appears over the icon 

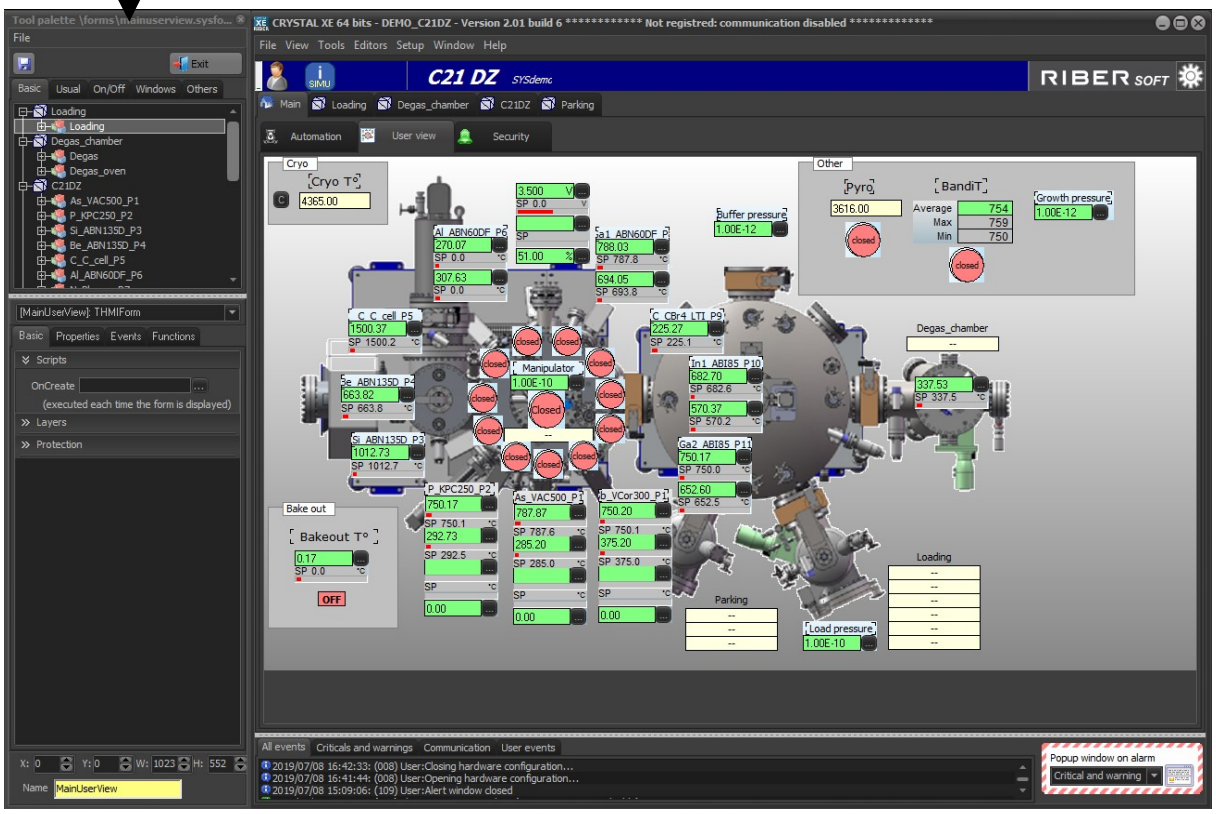
.

Double click before the time (yellow) is up.

Customizing the User view interface

Right-click on any part of the *User view* interface background and select "*Edit the form"* to open the *Tool palette (left)*.





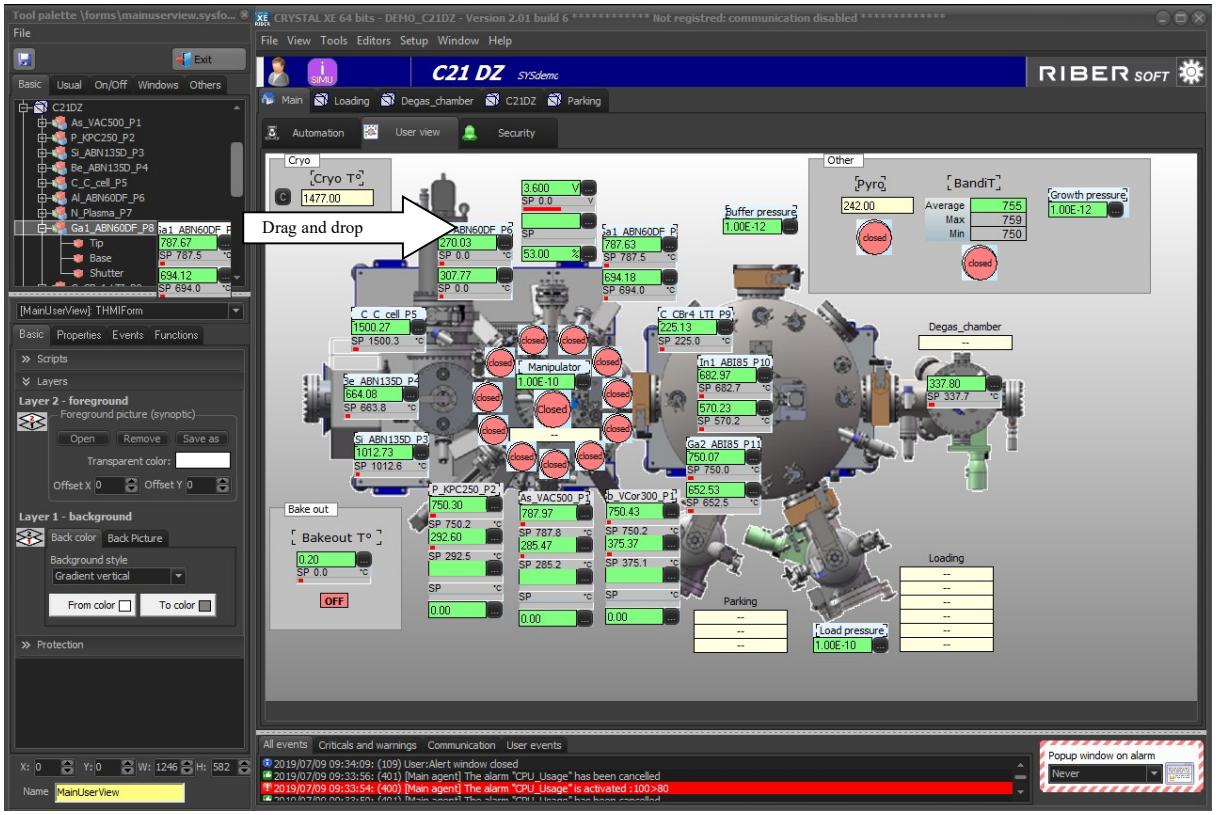
Moving items

When the *Tool palette* is open, you can move any of the items directly from the interface. Click on the desired item, hold down the left mouse button and move it to another part of the interface.

Press the keyboard arrow keys to move the selected item pixel by pixel on the grid. You can change grid options by right-clicking on the interface and selecting *Grid options.*

Adding equipment or sub equipment

Select the basic tab and drag and drop equipment in the user view.



The equipment and sub equipment are listed in a tree view in the *Tool palette* in the basic tab. You can drag and drop the desired equipment and sub equipment directly to the *User view* interface.

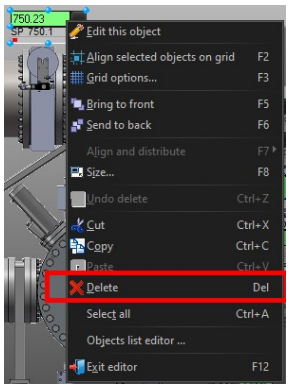
- Not all types of equipment have a user view representation. You might need to expand an equipment list in the tree structure and add sub equipment only.

Example: to add a shutter, expand the cell item's list (click on the '+' sign), then drag and drop the shutter directly to the *User view* interface.

Deleting equipment or sub equipment

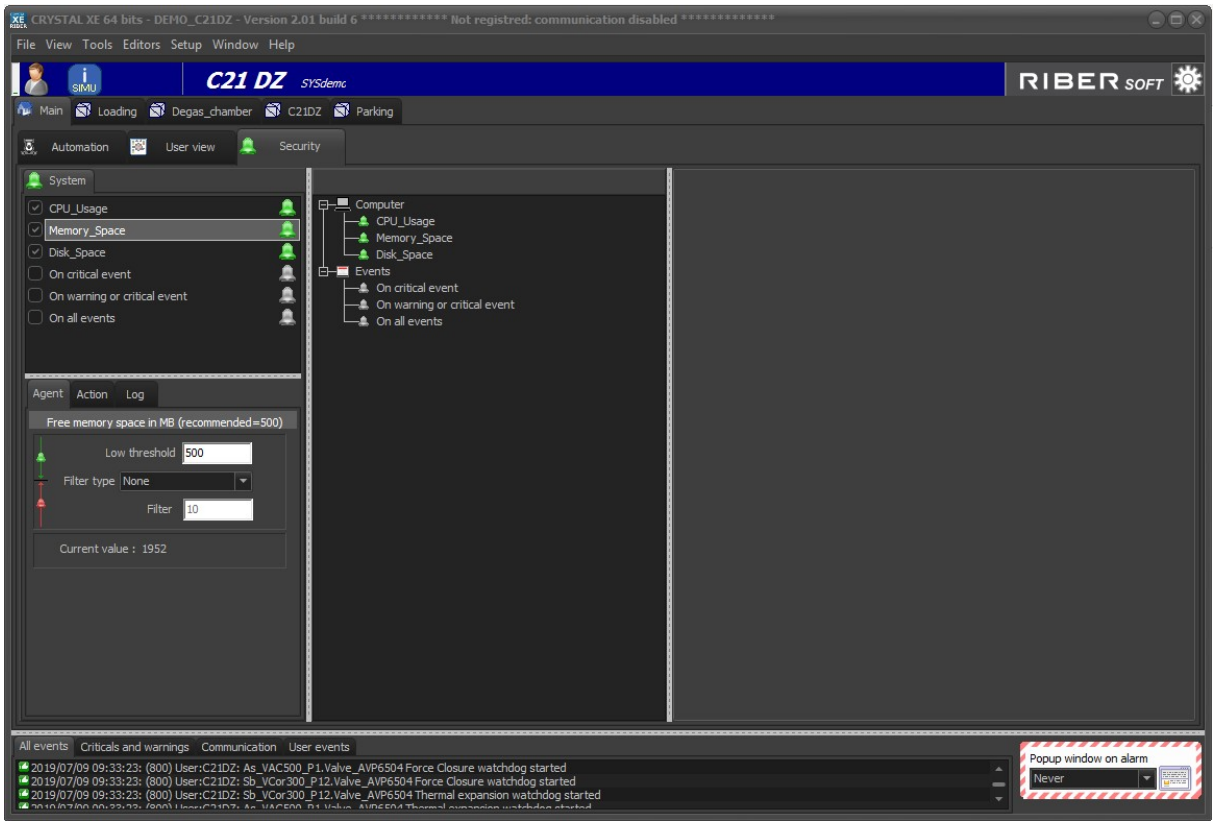
When the *Tool palette* is open, you can remove any equipment or sub equipment from the *User view* interface:

- select the desired item,
- right-click to display the drop-down menu,
- select Delete (or press Delete key on the keyboard).



3. Security

The *Security* tab allows you to enable or disable alarms for the system security agents.



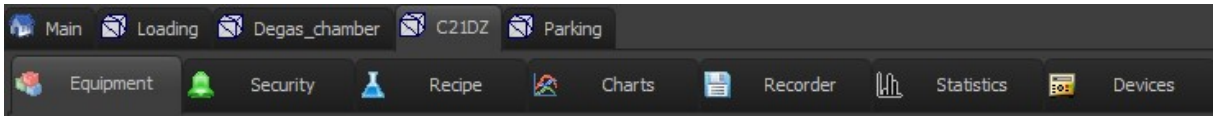
For example, after selecting the *Memory Space* security agent, you can set a 500 MB low threshold value from the *Agent* tab. An alarm will be activated as soon as the amount of

memory available drops under 500 MB. The *Action* tab allows you to configure alarm notifications (sound, email, SMS, etc.).

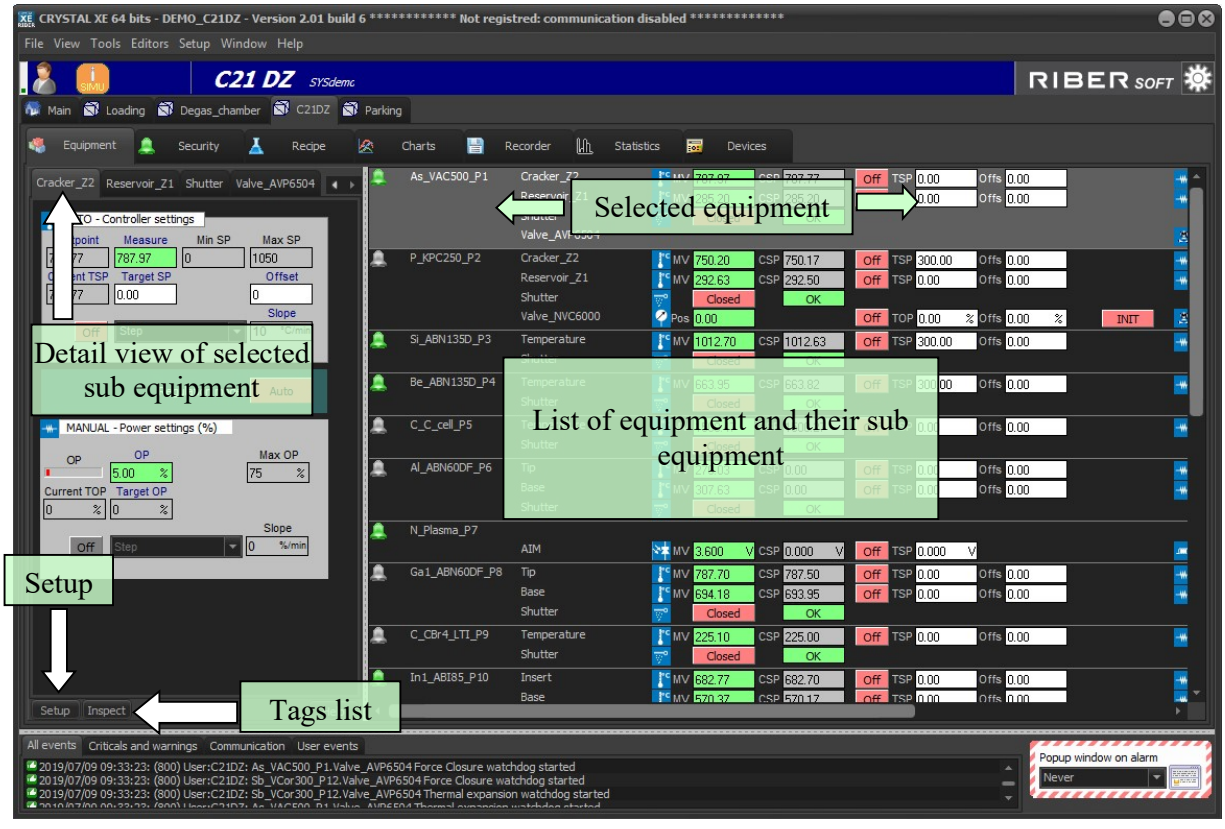
VI. CHAMBER TABS

On the right side of the *Main* tab, chamber tabs allow you to display chamber features. The number of visible chambers depends on your configuration.

Click on the desired chamber tab to display the chamber's menu.



1. System view



The *System view* interface displays all equipment in a **list view** *(right)* depending on your configuration.

You can directly interact with some of the equipment's from the list view (closing/opening shutters, modifying target set point values, etc.).

Click on the desired equipment from the list view to display its associated **Detail view window** *(left)*.

1.1 Equipment list view

Each line displays an overview of the equipment and all its associated sub equipment.

Example: List view of the *As_VAC500_P1* equipment and its four pieces of sub equipment (Cracker, Reservoir, Shutter, Valve):

Alarm icon

The alarm icon (bell), located on the left side of each piece of equipment, indicates the state of the equipment alarm:

 **Gray bell**: the alarm is disabled

 **Green bell**: the alarm is enabled

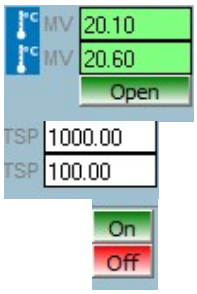
 **Red bell**: the alarm is activated

Interact with the equipment

From the list view, you can directly modify some of the sub equipment parameters.

Example:

- opening/closing shutters
- modifying the values
- stopping a running linear ramp



The editable fields and available features depend on the type of equipment and sub equipment.

Customizing the list view

- To **change the equipment order**, drag and drop the equipment directly from the interface to move it up or down.
- To hide or display the equipment:

Click and hold down on the equipment item to display the trash icon  .
To hide equipment, drag and drop the desired equipment item into the trash icon.

You can display all hidden equipment by right-clicking on any part of the interface and selecting *View all hidden equipment.*
To display only specific equipment, right-click on any part of the interface, move the cursor over *Show specific equipment* and select the equipment to be displayed.

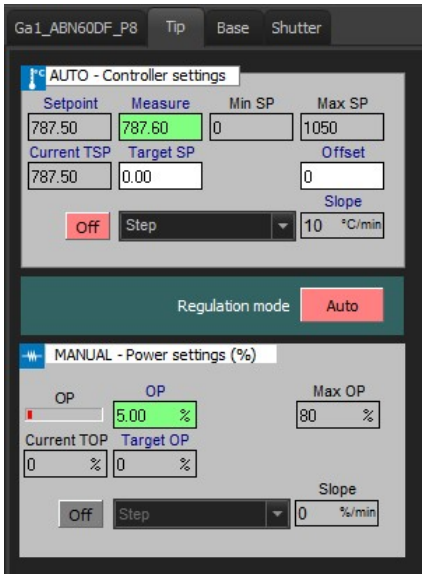
The equipment reappears at its previous order.

1.2 Example of Detail view window (temperature)

The *Detail view* window displays all the configurable parameters of the sub equipment and allows you to follow and edit their values (when editable).

Each type of equipment displays a specific *Detail view* window.

Example: Detail view window of the *Ga1_ABN60DF_P8* equipment with its three associated pieces of sub equipment (broken into three tabs):
- *Tip*
- *Base*
- *Shutter*



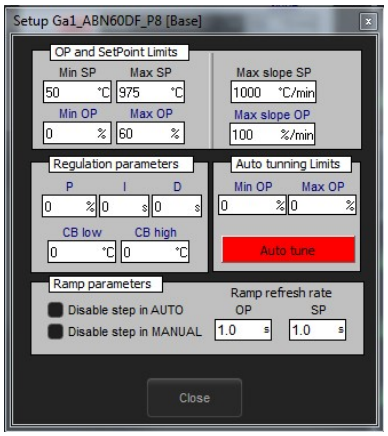
Click on the desired sub equipment tab to display the configurable parameters.

Setting maximum and minimum values

Maximum and minimum value fields, such as maximum set point or maximum output power, are not directly editable.

To set maximum and minimum values:

- Select the desired chamber from the chamber tabs.
- On the *System view* tab, select the desired equipment in the list to display the associated *Detail view* window.
- Click on the Setup button Setup, located in the bottom left-hand corner of the window, to open the *Setup* pop-up window and modify the parameters.



You will need suited user permissions to access this window.

Automatic mode and manual mode

The automatic mode consists of a regulation operated by the temperature controller which is associated with the equipment. In manual mode, the output power of the controller is directly used as the setpoint of the power supply. In manual mode, there is no regulation, the power is constant or follow a ramp.

As for some types of equipment, you can **switch the regulation mode** from *Automatic* to *Manual* by double-clicking on the *Regulation mode* button:

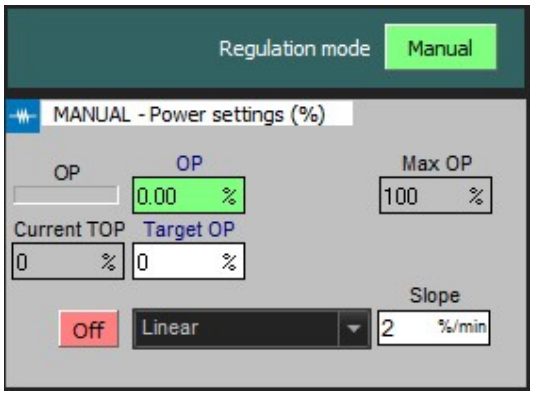
Regulation mode Manual Regulation mode Auto

>> When you first click on the button, a progress bar appears Auto
Click again before the time (yellow) is up.

If a linear ramp is running On, you cannot switch the regulation mode.
Stop the linear ramp Off before switching the regulation mode.

- The **Automatic mode** allows you to specify a target set point value (°C) to be reached. Click on the *Target SP* field to type the desired value.

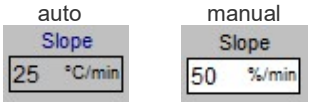
- The **Manual mode** allows you to specify a constant power set point (%) to reach the required temperature. Click on the *Target OP* field to type desired value.



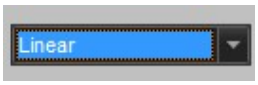
Step and linear ramp

- **Step**: select *Step* from the drop-down list to directly set a target set point value (in *Automatic* mode) or a target output power value (in *Manual* mode).

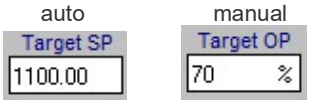
- **Linear ramp**: select linear from the drop-down menu to modify the temperature by programming a rise using a linear ramp until reaching the target set point value (in *Automatic* mode) or the target output power value (in *Manual* mode):
  - Set the ramp slope



  - Select '*Linear*' from the drop-down list



  - Set a target set point



  - The ramp activity button is turned on (green) when a linear ramp is running

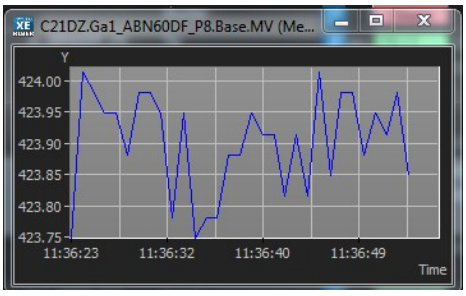
- To stop a running linear ramp, turn off the ramp activity button On by double-clicking on it.

>> When you first click on the button, a progress bar appears On.
Click again before the time (yellow) is up).

- Other ramps (custom profiles) can be defined using the *Options* menu.

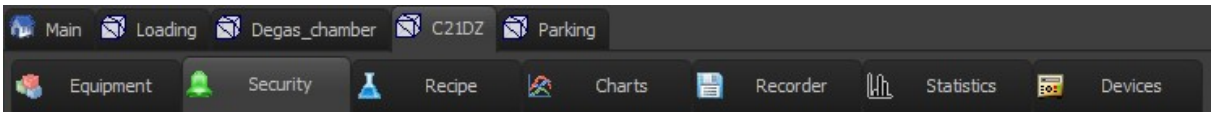
Following in charts

Right-click on a parameter's value and select *Follow in a chart* to open the corresponding chart in a pop-up window.



To save this chart, right-click on any part of the chart window, select *File* > *Save as* and then select the desired file format.

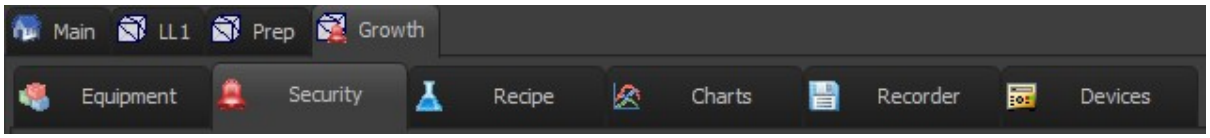
2. Chamber security



The alarms management interface allows you to:

- configure security agents for each type of equipment,
- set an alarm for each security agent,
- choose the action to be performed if the alarm is activated.

- If one of the chamber's alarms is activated, a red bell icon will appear over the chamber's tab and the *Security* tab alarm icon will turn red as follows:



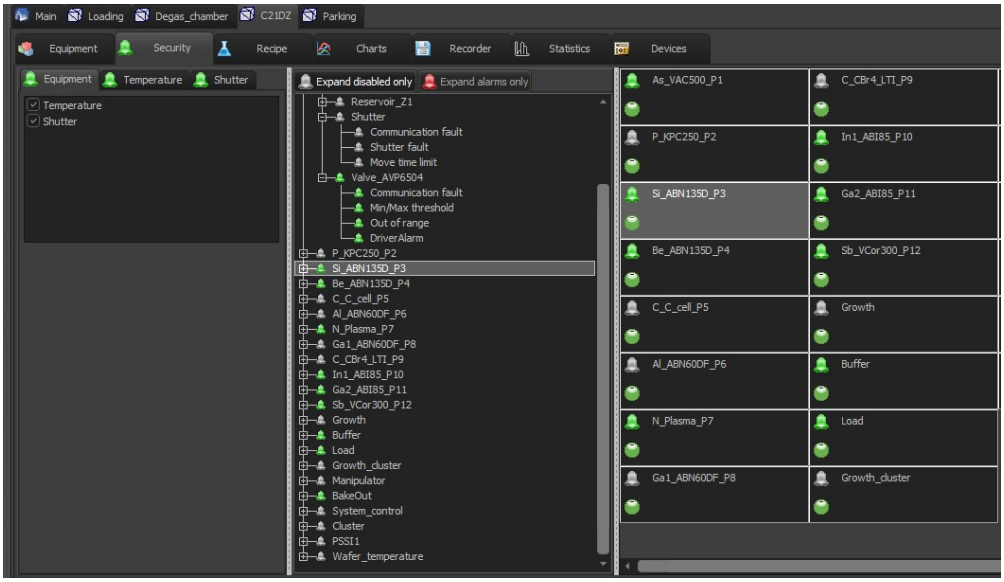
- Bell icons indicate the state of the alarms as follows:

 **Gray bell**: the alarm is disabled

 **Green bell**: the alarm is enabled

 **Red bell**: the alarm is activated

- The security interface is divided into three parts as follows:
  - the equipment view (right),
  - the tree view (center),
  - the security agent management panel *(left).*



Security agents panel Tree view Equipment view

2.1 Equipment view

The equipment view displays all the functioning equipment, depending on your configuration.

Click on the desired equipment to highlight the equipment line in the tree view and display the associated security agents panel on the left side of the interface.

- The bell icon indicates the state of the equipment's alarm (enabled, activated or disabled). The equipment alarm is activated if at least one of the equipment's security agents' alarms has occurred.

- The following circle icon  indicates that the equipment alarm has occurred. The digit indicates the number of times the alarm of the equipment occurred.

For example, the following icon  indicates that the equipment's alarm occurred four times.

This icon will remain, even if there is no longer any activated alarm.

Click on this icon to acknowledge the activation of the alarms. Once all alarms have been acknowledged, the icon will turn green  .

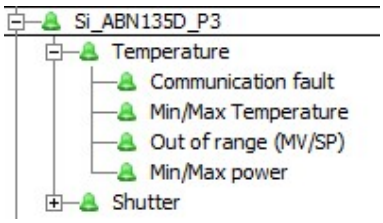
 You cannot acknowledge an alarm as long as the alarm is activated.

2.2 Tree view

All the equipment and sub equipment alarms are visible in a tree view as follows:

equipment **>** sub equipment **>** security agents

Example: tree structure of the *Si_ABN135D_P3 equipment*

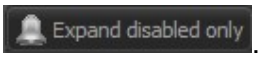


- *Si_ABN135D_P3* **equipment** with two pieces of **sub equipment**:
  - *Temperature*
  - *Shutter*

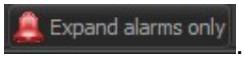
- *Temperature* sub equipment with four security agents:
  - *Communication fault*
  - *Minimum and maximum temperature*
  - *Out of range*
  - *Minimum and maximum power*

- In the tree structure, double-click *(or click on the + / - icons)* to expand / collapse a list.

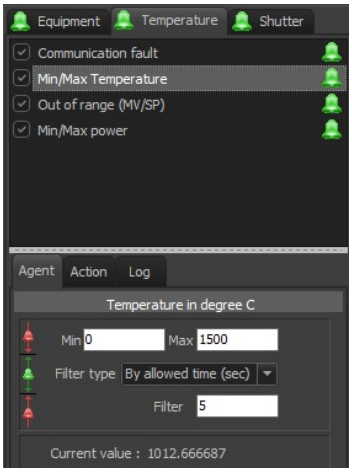
- You can choose to expand only the security agents whose alarms are disabled by clicking on the *Expand disabled only* tab:



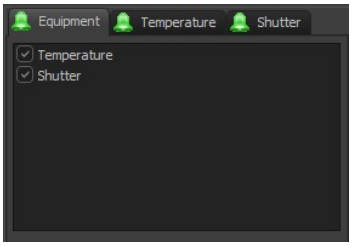
You can also choose to expand the equipment level alarms only to have a quick view on the alarms' state, by clicking on the *Expand alarms only* tab:



2.3 Security agents management panel

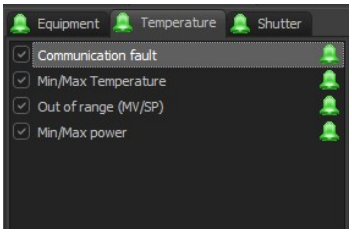


Each type of equipment displays a specific panel, located on the left side of the interface.



Example: Si_ABN135D_P3 equipment

The *Equipment* tab displays all sub equipment of the selected equipment.
Click on one of the sub equipment tabs, to display the sub equipment's security agents.

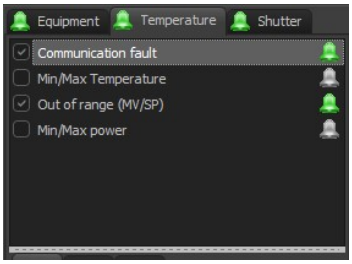


In this example, the Temperature sub equipment has four security agents (Communication fault, Minimum and maximum temperature, Out of rang and Minimum and maximum power).

2.4 Enabling/disabling alarms

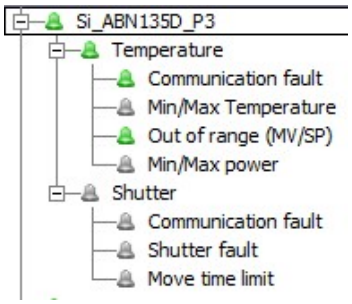
In the tree structure, right-click on the desired security agent and select *Enable* to enable the alarm (green icon) .
Right-click and select *Disable* to disable the alarm (gray icon) .

Or check/uncheck the security agents' boxes in the Security agents panel to enable / disable the alarms as follows:



You can disable or enable alarms at the security agent level or at the sub equipment level in the tree structure.

You cannot disable alarm at the equipment level.



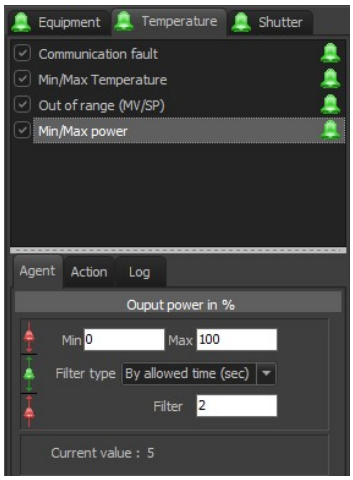
If one of the security agents' alarms is activated, the sub equipment alarm and the equipment alarm are activated.

If the alarm of the sub equipment is disabled, all alarms of the sub equipment's security agents are disabled as well.

The sub equipment level alarm must be enabled to allow you to enable its different security agents' alarms.

2.5 Configuring the security agents

You can configure the security agents using the security agents management panel, located on the left side of the *Security* interface:

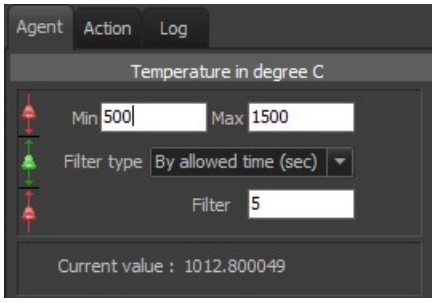


Click on the sub equipment tab and select desired security agent to display the settings below. The available settings depend on the type of the selected security agent.

Agent

The *Agent* tab allows you to set threshold values and configure the activation of the alarm.

For example, using the *Temperature* security agent panel, you can specify minimum and maximum temperature values.

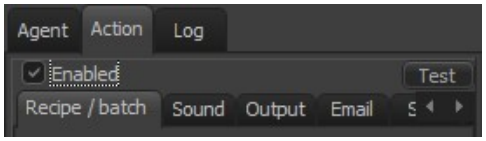


In this example, if the temperature value drops below 500 °C or exceeds 1500 °C for 5 seconds (filter), the alarm will be activated .

The current value of the parameter is displayed bellow.

Action

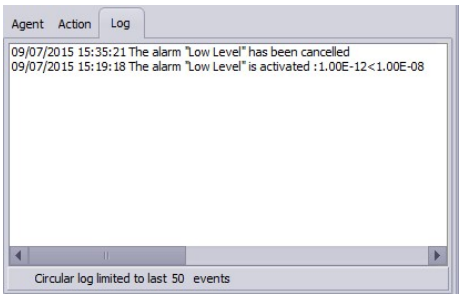
On the *Action* tab, check the *Enabled* box to display the available actions tab bar.



You can define actions to be performed whenever the alarm is activated using these different tabs.
For example, if the alarm occurs, you can be notified by a sound, or receive an email alert with a customized message.

Log

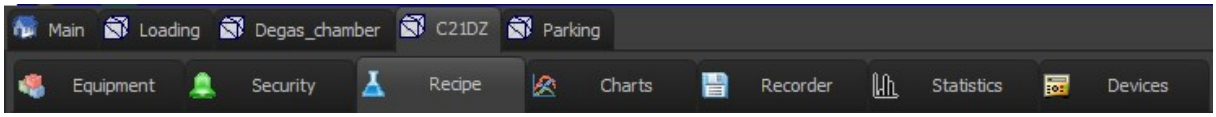
The *Log* tab displays all alarm related events.



The events are saved automatically as '.txt' files to the *Log* folder, in your project directory.

To open your project directory, click on the File menu and select Browse project directory.

3. Recipe



The *Recipe* interface allows you to create, edit or execute your recipes.

In Crystal XE, the recipes are made of a succession of layers. All the actions defined in a layer are executed at the beginning of the layer's timer (temperature, opening the shutter, opening valve, etc.). The ramp duration can be defined over the layer's duration or can be customized.

3.1 Creating a new recipe

You can edit a new recipe using either:

- the **recipe editor** (graphical interface),

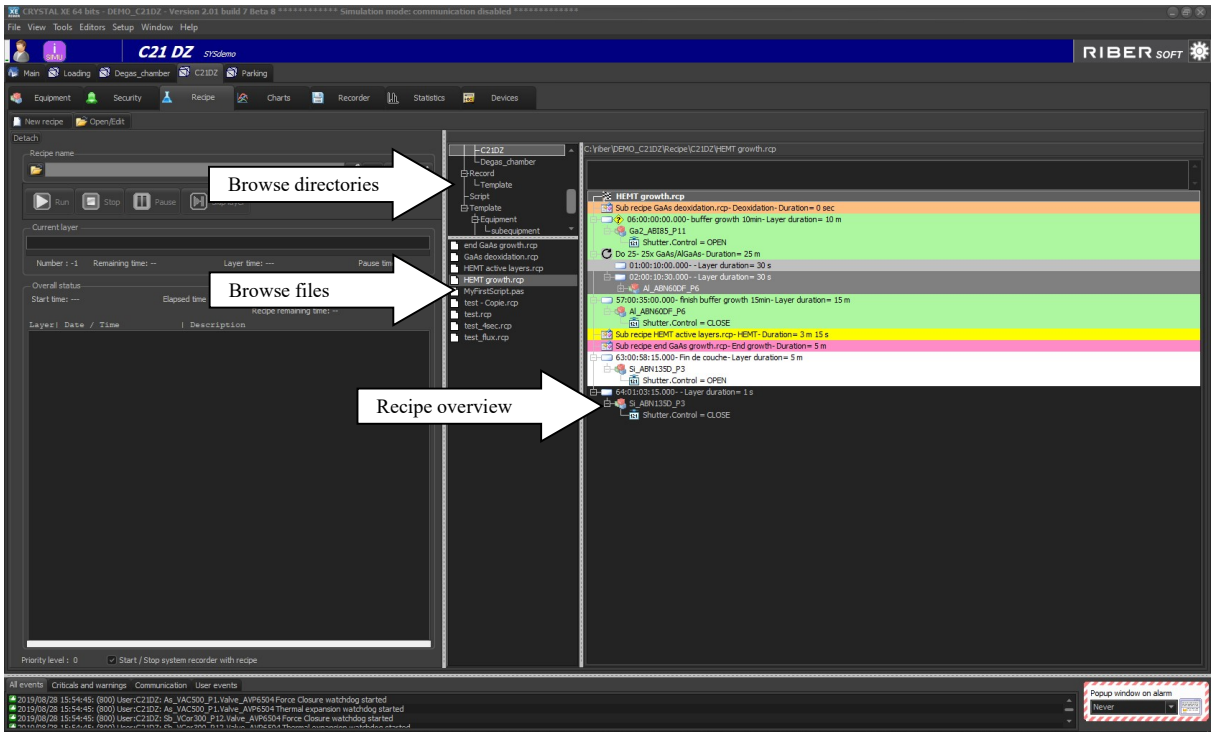
or

- the **script editor** (Pascal language).

The recipe files can be accessed from the *Recipe* folder, in your project directory.

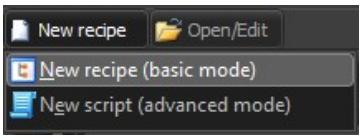
To open your project directory, clicking on the File menu and select Browse project directory.

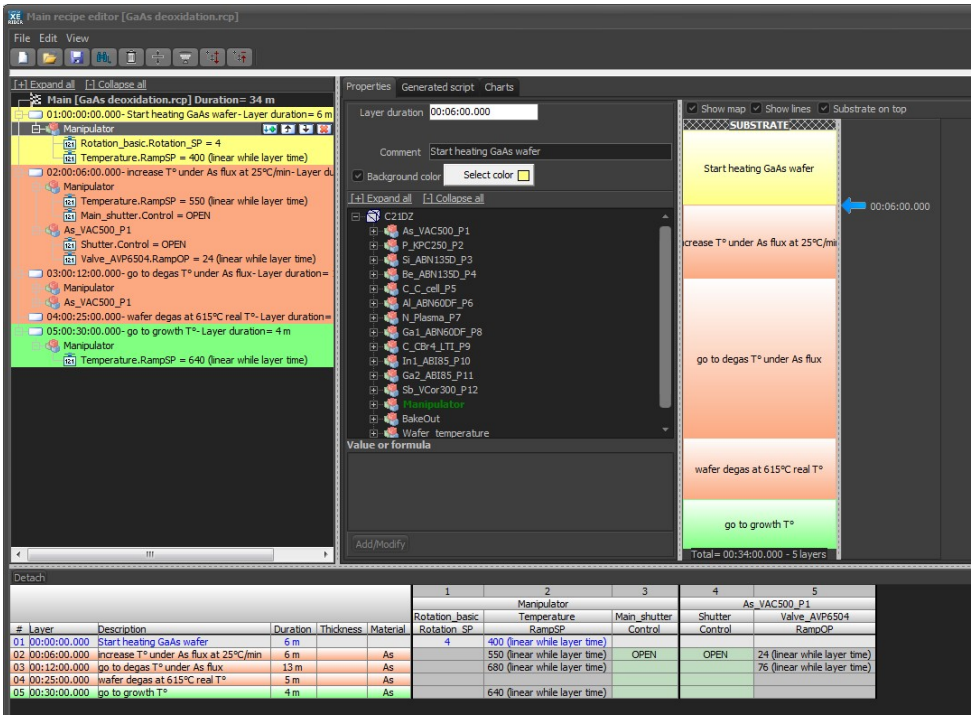
In the recipe tab, you can also browse the recipe directory and preview the contents of those recipes.



Graphical recipe editor

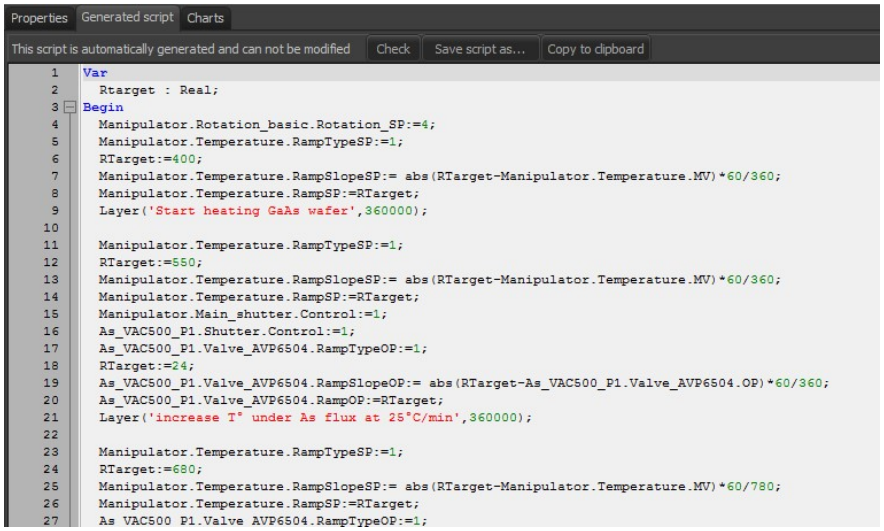
Click on *New recipe* and *New recipe (basic mode)* to open the *Main recipe editor*.



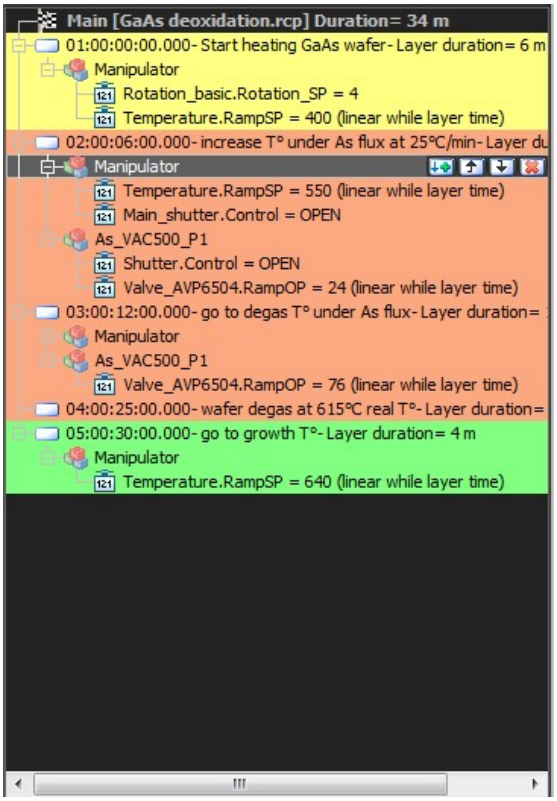


The *Main recipe editor* is a graphical interface allowing you to easily create your recipe. The created recipe is saved as a '*.rcp'* file.

- Click on the *Script* tab to display the recipe's script. If you want to edit a recipe using the *Script editor*, use this tab to copy the script and paste it in the script editor (recommended):

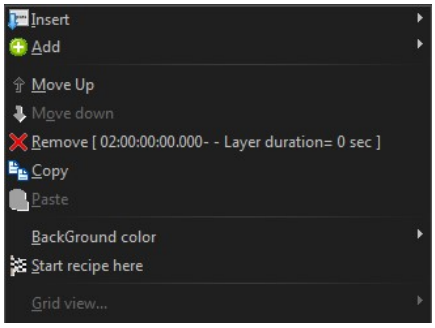


- Creating your layers

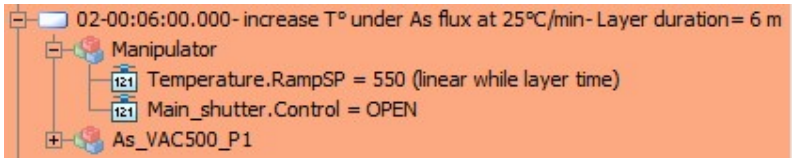


On the left side of the *Main recipe editor* window, you can create news layers, displayed in a tree structure.

- Use the button to add a layer or or to move the selected layer, or to delete the selected layer.
- Right-click on any of the layers to display other available options.



For each layer, you can expand the list of equipment and associated parameters that have been defined:



Example of a layer

- Defining the parameters

In the center of the *Main recipe editor* window, *the Properties* tab displays all equipment and sub equipment and their associated configurable properties, listed in a tree view.

For each layer, you can specify the layer duration, define a background color and then configure and add the desired parameters (properties) to the layer.

Expand the equipment list and select the desired property to configure / add the parameters using the pane below.

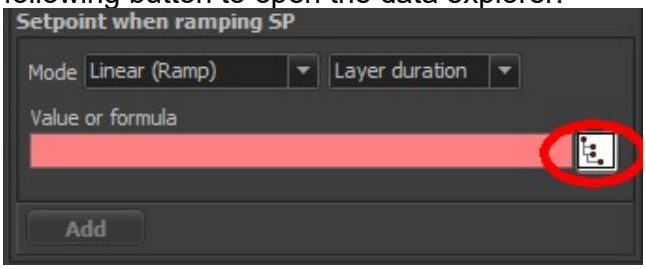
The configured parameters will be added to the layer in the tree structure on the left side of the editor window.

- Conditional recipes

It is possible to execute a layer only if a condition is true or wait for a condition is true before to continue.
For more information, refer to the document *"CrystalXE_conditional_recipes.pdf"* available on http://ww.crystalxe.com/manuals

- Uses variables in recipes

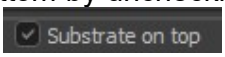
  The values used as setpoint for the cells or manipulator and all other values that is used as parameters can be either a constant value or a property or a variable. Click on the following button to open the data explorer:



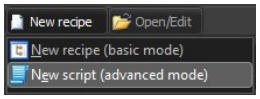
- Graphical representation

On the right side of the editor window, a graphical representation of the recipe allows you to view the chronological sequences (layers) and their time duration.

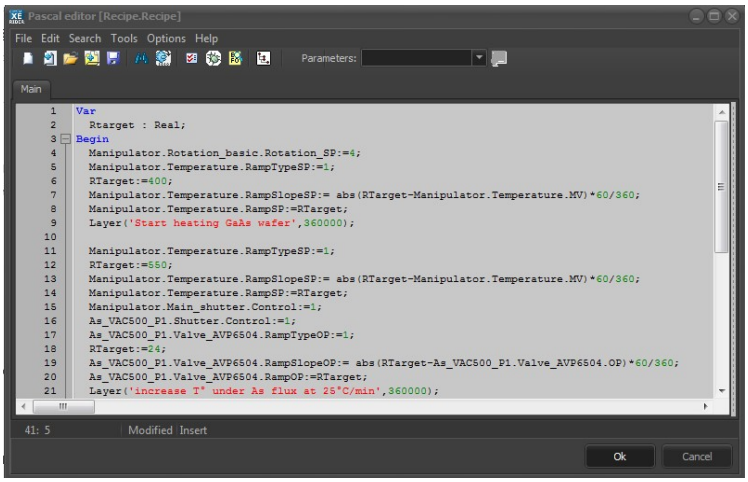
By default, the substrate appears at the top and the layers are displayed from top to bottom, following a chronological order.

You can invert this representation and display the substrate at the bottom by unchecking the *Substrate on top* box as follows: 

Script recipe editor

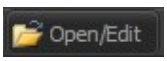


Click on "*New recipe"* and "*New script (advanced mode)"* located in the top left-hand corner of the recipe interface, to open the *Script editor*.

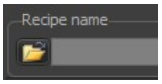


Use the *Script editor* to create a recipe using Pascal programming language.
The created recipe is saved as a *'.pas'* file.

3.2 Editing an existing recipe

Click on *Open/Edit* 

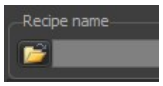
to edit a recipe file.

You can also open the recipe file by clicking on the following file icon 

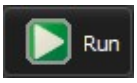
and then clicking on the pencil icon  *to open the recipe editor.*

You can edit either *'.pas'* files (edited with the script editor) or *'.rcp'* files (edited with the recipe editor).
Clicking on the following icon  clear the file name input field but does not delete the recipe file.

3.3 Executing a recipe

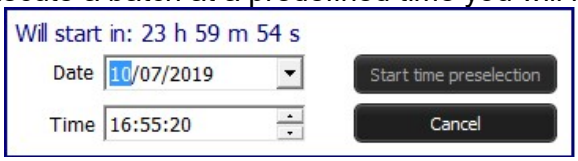
Click on the following icon 

in the *Recipe name* input field to select the desired recipe file.

Click on the *Run* button 

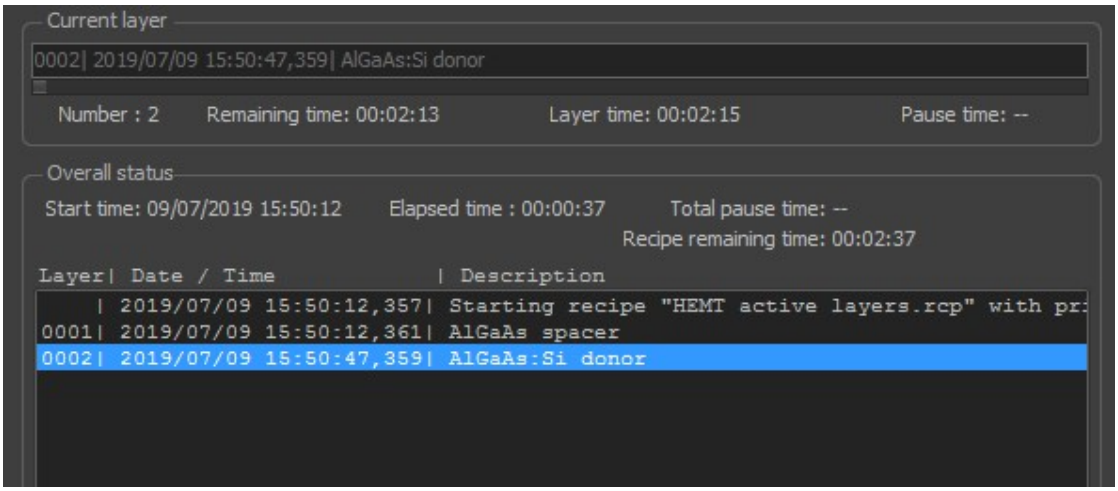
. This will display a popup menu with two choices "Run now…" and "Run at...". Clicking on "Run at..." allows you to start the recipe later.

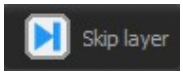
- If you choose to execute a batch at a predefined time you will have this window:



As soon as you click on the *Start time preselection* button, the system starts counting down and executes the recipe at the fixed time.

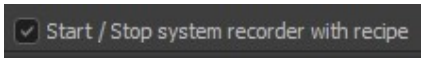
- **Supervise the execution** of the recipe using the *Recipe inspector*:



- The *Skip layer* button 

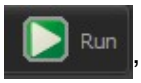
allows you to abort the ongoing layer and starts the execution of the next one

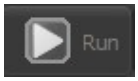
- If the box '*Start / Stop system recorder with recipe'* is checked, the data recorder will start recording as soon as the recipe starts executing and will stop when the recipe terminates.



4. Charts

The *Charts* tab allows you to easily follow the data using a chart view. Charts are generated automatically depending on your system configuration.

Click on the *Run* button 

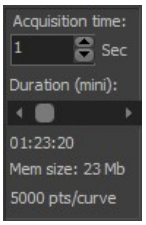
, in the top left-hand corner of the interface, to run the charts. A gray *Run* button 

indicates that the charts are currently running.

- Right-click on a chart to display the available options.

- On the left side of the interface, the following box allows you to **display or hide a chart** by clicking on it.

The displayed charts are highlighted.



- The charts record the data over the configured time duration. You can **adjust the time duration** using the scroll bar from the settings pane, located on the left side of the interface.

You can increase the duration by increasing the acquisition time.

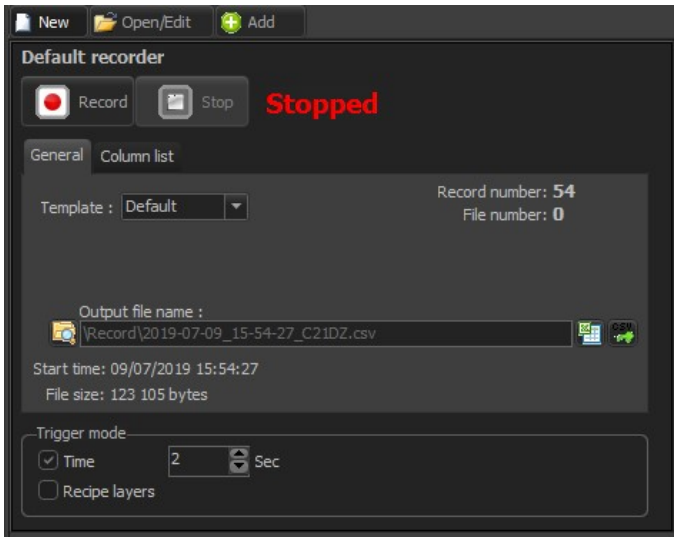
- Charts are not saved automatically onto your hard disk.

You can **save a chart** by right-clicking on the desired chart and Selecting *File* > *Save as* and then selecting the desired file format.

You can save a chart as a CHR, CSV or image file.

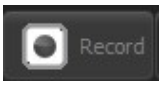
5. Recorder (data logger)

The recorder saves the main data onto the hard disk.

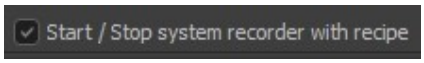


The recorder window

Click on the *Record* button to start recording. 

A grey *Record* button indicates that the system is currently recording. 

To automatically start the recorder when opening Crystal XE, go to the Options and in the chambers tab, change the “Recorder status” of the relative chamber to "Started".

- If the check box 

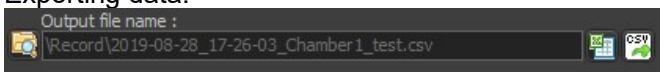
located in the Recipe interface, is checked, the recorder will start automatically as soon as a recipe starts executing and will stop when the recipe terminates.

5.1 Saving the data

The recorded data is saved as a ‘*.csv*’ file (text format) that can be accessed from the *Record* folder, in your project directory.

To open your project directory, click on the File menu and select Browse project directory.

Exporting data:



Click on the *CSV* icon 

, located in the top right-hand corner of the recorder window, to copy the file onto your hard disk. You can save the data during or after recording.

To open the recorded file, click on the spreadsheet icon 
. You can open the file even if the data is still being recorded.

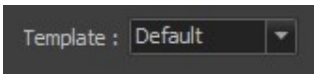
5.2 Recorder templates

On the *Template* drop-down menu, you can select either:

- default template,

or

- custom template.



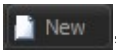
The **default template** records all the main data while a **custom template** allows you to choose only specific data to be recorded.

Custom template is recommended in order to reduce the size of the generated file.

You can run **four** different recorders at the same time.

Creating a customized recorder template

The customized template must be created before recording.

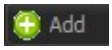
Click on the *New* tab 

, from the recorder tab bar, to open the *Record editor* pop-up window and create a new customized template.

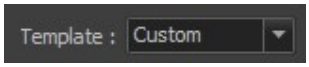
The customized template is saved as a '.rec'.
Template files can be accessed from your project directory > *Record* > *Template*.

To open your project directory, click on the File menu and select Browse project directory.

Opening a customized record template

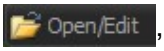
Click on the *Add* tab 

and select the desired customized template file.

Or, on the Template drop-down list, select Custom 

and click on the file icon  *below to open the desired customized template file.*

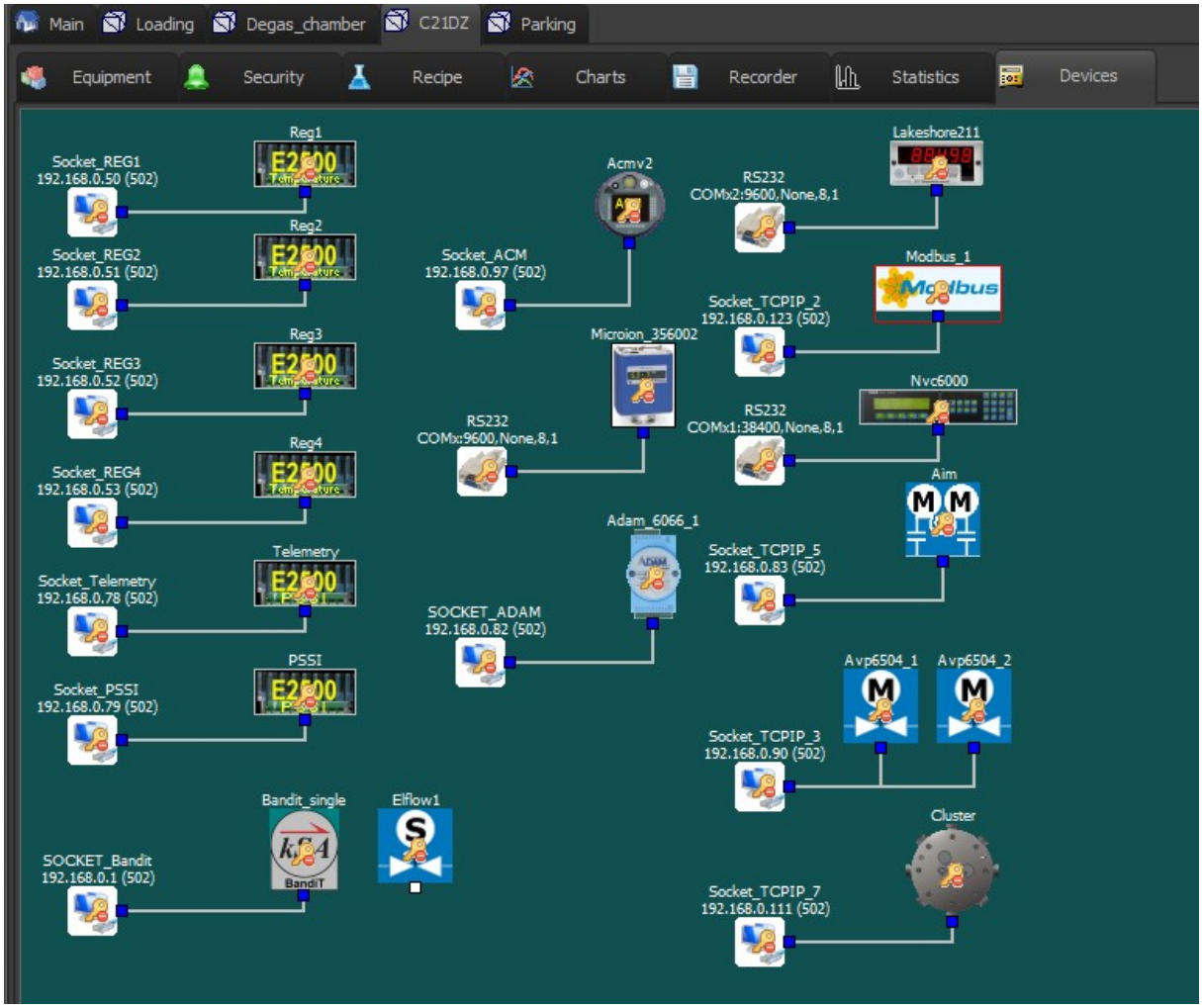
Editing a customized record template

To edit an existing customized template file, click on the *Open/Edit* tab 

, from the recorder tab bar. Select the desired template file to open the *Record editor* pop-up window.

Or click on the pencil icon  *in the top left-hand corner of the recorder window.*

6. Devices



The *Devices* tab displays all the electronic devices that are able to communicate with Crystal XE and easily detect a communication or a connection problem.

If the connection has failed, the following alert icon will appear over the device icon as follows:

The absence of icon indicates that the connection has succeeded.

Right-click on a device to display the available options:

- analysing the connection to the device (select *Analyser*),
- configuring the device (select *Setup*),
- enabling / disabling the device (select *Disable*).

VII. PLATENS AUTOMATION

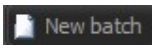
The *Automation* tab allows you to create, edit or run production batches. The *Automation* feature is available only with the MBE systems that are equipped with a transportation system like a cluster or a pick and place (MBE49,6000,8000)

In Crystal XE, a batch is used to organize the movements of one or more platens in the MBE system.
For each platen, you can define its path to follow by selecting:

- The first chamber,
- One or several process chambers and at least one recipe to be executed in,
- The last chamber.

For each of these steps, you can also define the position of the platen in the cassette.

1. Creating a new batch

Click on the *New* batch button 

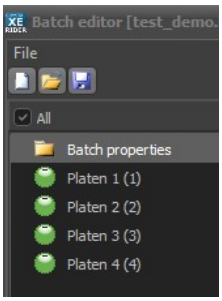
to open the batch editor.

Crystal XE asks you if the platen positions in the system must be loaded (unavailable in simulation mode). Select *Yes* (recommended) to open the *Batch editor* pop-up window.

The batch is saved as a *'.batch'* file that can be accessed in your project directory / *Batch.*
To open the project directory, click on the *File* menu and select *Browse project directory*.

2. Batch editor overview

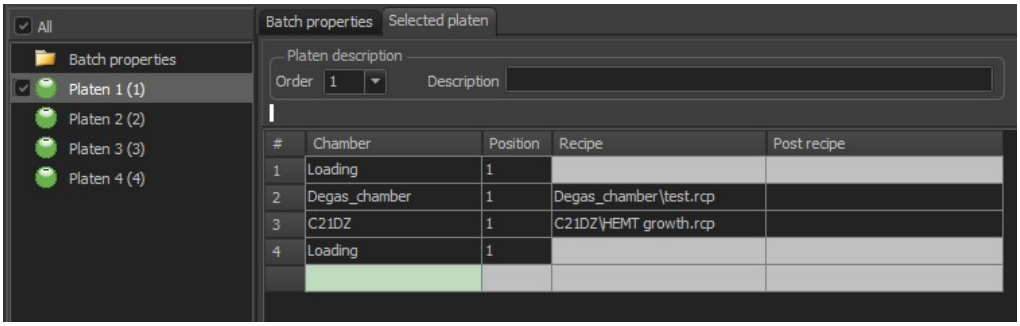
The platens are displayed in the following pane located on the left side of the *Batch editor*.



Platens are assigned a default order (in parenthesis).

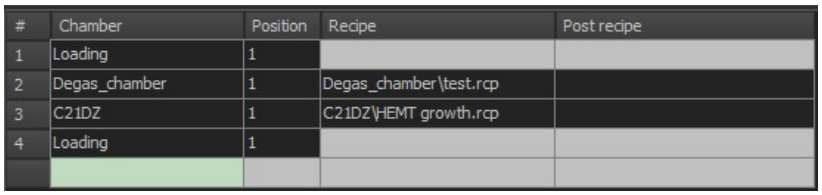
You can change a platen order using the drop-down list in the *Platen description* box:

The platen numbers must match those defined with the touch panel of the cluster PLC (Programmable Logic Controller).
Select the desired platen (check the box) to define its path.



Platen path

The path of the platen in the MBE system is composed of several configurable steps:

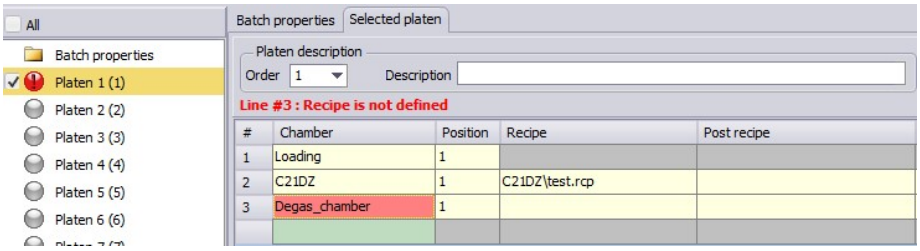


In the example just above, the platen will move from the load chamber at position 1 to the degas chamber and it will execute the recipe test.rcp located in the Degas_chamber sub directory.
When the recipe will be terminated, the platen will move to the growth chamber C21DZ and run the recipe HEMT growth.rcp.
When the recipe will be terminated, the platen will move back to the load chamber at the same position.
To optimize platens processing time then when a recipe is running, Crystal can move another tray to another location and run another recipe.

For each step, select your choice from the corresponding drop-drop list:

- **Chamber** (required)
  The platen will be dropped to this chamber. The list displays the chambers that are connected to the cluster only.
- **Position** (required)
  The position in the cassette, if several platens can be stored in the chamber
- **Recipe** (required for process chambers)
  The recipe to be executed in the selected chamber
- **Post recipe** (optional)
  A second recipe will start as soon as the first recipe ends.

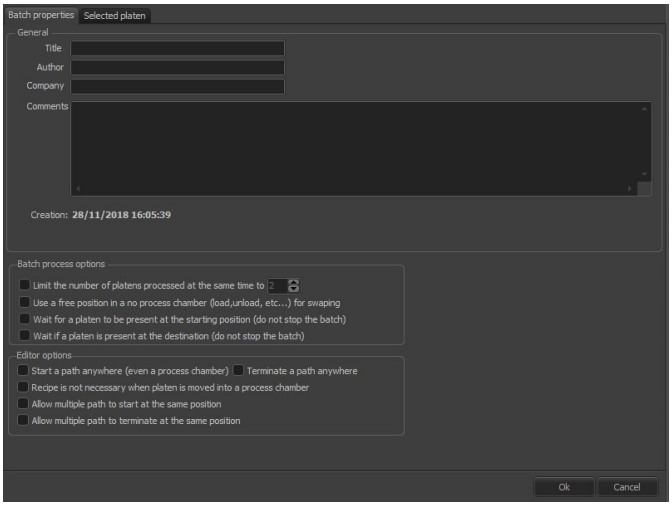
- If the batch contains an error, a message warns you and the platen icon turns red as follows:



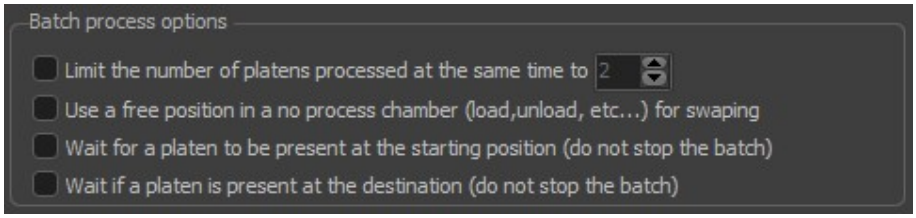
Error examples:
- no recipe selected when required
- two platens start at the same position in the cassette

Batch properties

Click on the *Batch properties* tab to display the configurable options of the Batch editor.

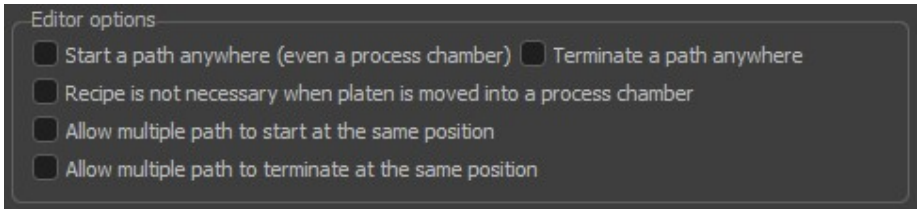


Batch process options



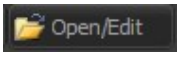
Limit the number of platens processed at the same time.	By default, a maximum of platens is processed simultaneously. You can limit the number of platens to be processed at the same time by checking the following box and selecting the desired number
Use a free position in a no process chamber (load, unload, etc..) for swapping.	If two platens need to be dropped to the same chamber, you might need swapping the platens. Check this box to allow the cluster to swap platens to an auxiliary storage when needed.
Wait for a platen to be present at the starting position (do not stop the batch)	This option is useful when you want to perform continuous production. This allows the operator to unload the platen, reload another one and start the same path again.
Wait if a platen is present at the destination (do not stop the batch)	This option allows you to unload the platens always in the same place.

Editor options



Start a path anywhere (even a process chamber) **Terminate a path anywhere**	By default, a platen may not start or terminate its path in a growth chamber. Check either one or both boxes to allow the platens to start or/and terminate their path in any of the chambers
Recipe is not necessary when platen is moved into a process chamber.	By default, some chambers require at least one recipe to be defined. You can allow the batch to be executed even if no recipe has been defined by checking this box.
Allow multiple path to start at the same position **Allow multiple path to terminate at the same position**	These options are useful when you want to perform continuous production.

3. Editing an existing batch

Click on the *Open/Edit* button 

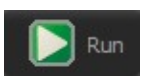
and select the desired file. The file will open in the batch editor.

Or you can click on the file icon  *to open the desired file and then click on the pencil icon*  *to open it in the Batch editor.*

Clicking on the following icon  clears the *Batch name* file input field but <u>doest not</u> delete the batch file.

4. Executing a batch

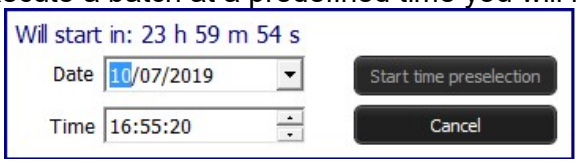
On the *Batch name* file input field, click on the file icon  to open the desired batch file.

Click on the *Run* button to start the batch. 

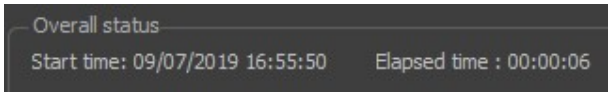
This will display a popup menu with two choices “Run now…” and “Run at...”. Clicking on “Run at...” allows you to start the recipe later.

During an ongoing movement, if you click either on *Pause* or *Stop* buttons, the platens will stop only once this movement has been completed. When paused, click on Resume to start the next movement.

- If you choose to execute a batch at a predefined time you will have this window:



As soon as you click on the *Run* button, the system starts counting down and executes the batch at the fixed time:



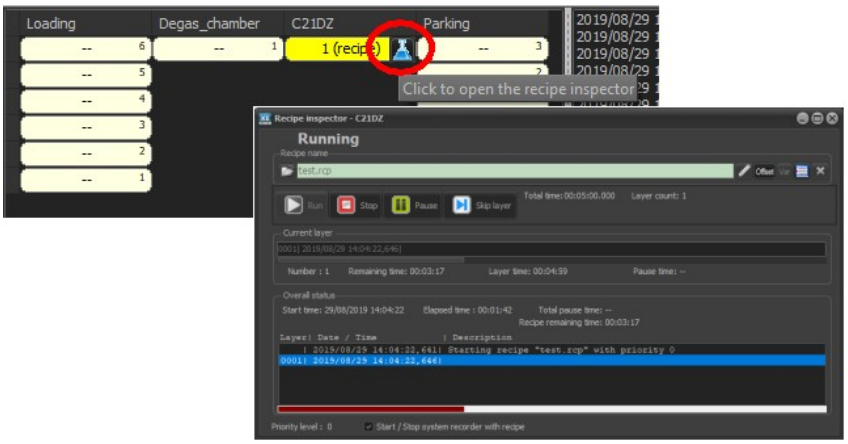
- You can execute the same batch over and over by checking the *Infinite* ***batch*** box 

. The batch will automatically start again when all the platen will be completely terminated. Click on the *Stop* button to end the loop.

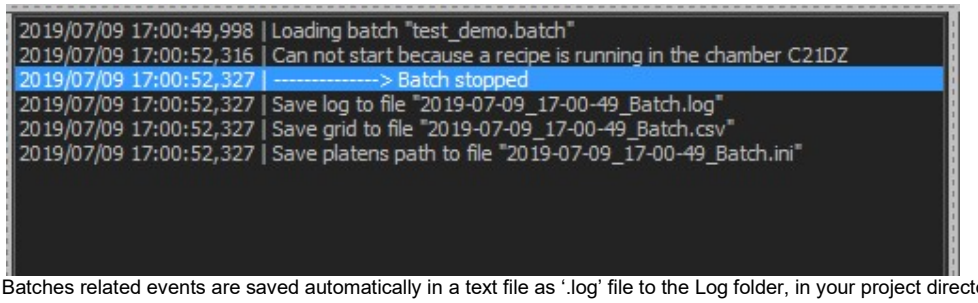
- Select le choice 

to restart automatically each platen path independently when it is completed. This choice is different from the infinite batch because it does not wait until the other platens are finished.

- You can can monitor the execution of the recipe using the *Recipe inspector* window. On a process chamber column, click on desired platen and then click on the flask icon to open the *Recipe inspector* in a pop-up window.

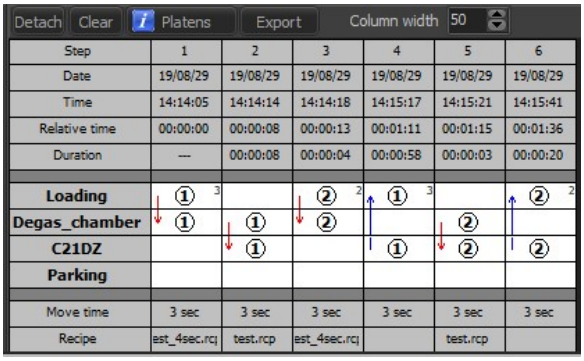


- The *Transport system* log box displays history of the batch events.



Batches related events are saved automatically in a text file as '.log' file to the Log folder, in your project directory.

- The chronogram displays in a table the different movements of the platens. Each column represents the movement of a platen from one position to another.

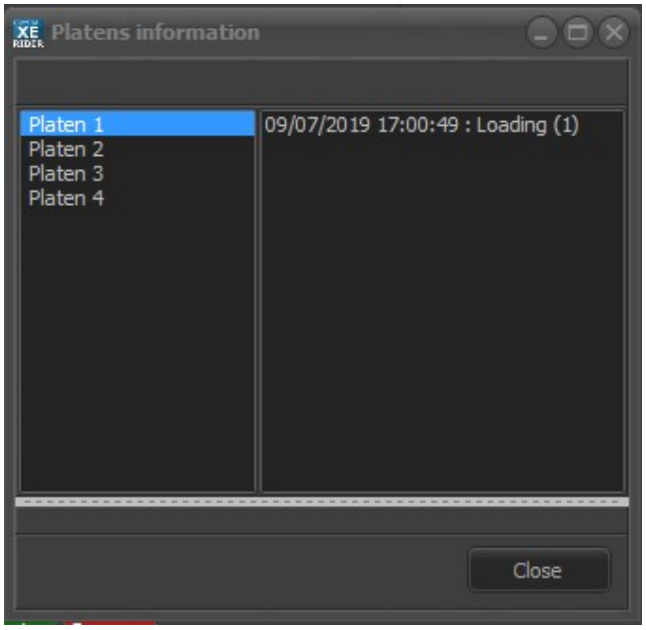


Step	1	2	3	4	5	6
Date	19/08/29	19/08/29	19/08/29	19/08/29	19/08/29	19/08/29
Time	14:14:05	14:14:14	14:14:18	14:15:17	14:15:21	14:15:41
Relative time	00:00:00	00:00:08	00:00:13	00:01:11	00:01:15	00:01:36
Duration	---	00:00:08	00:00:04	00:00:58	00:00:03	00:00:20
Loading	① 3		② 2	① 3		② 2
Degas_chamber	①	①	②		②	
C21DZ		①		①	②	②
Parking						
Move time	3 sec	3 sec	3 sec	3 sec	3 sec	3 sec
Recipe	est_4sec.rcj	test.rcp	est_4sec.rcj		test.rcp	

Chronogram is saved automatically in a text file as '.csv' files to the Log folder, in your project directory.

To open your project directory, click on the *File* menu and select *Browse project directory*.

- Click on the *Info* button  to open the *Platens information* pop-up window.



For each selected platen, the *Platens information* windows gives you the date and exact time the platen was dropped into a chamber and allow you to control whether the path was correctly executed.