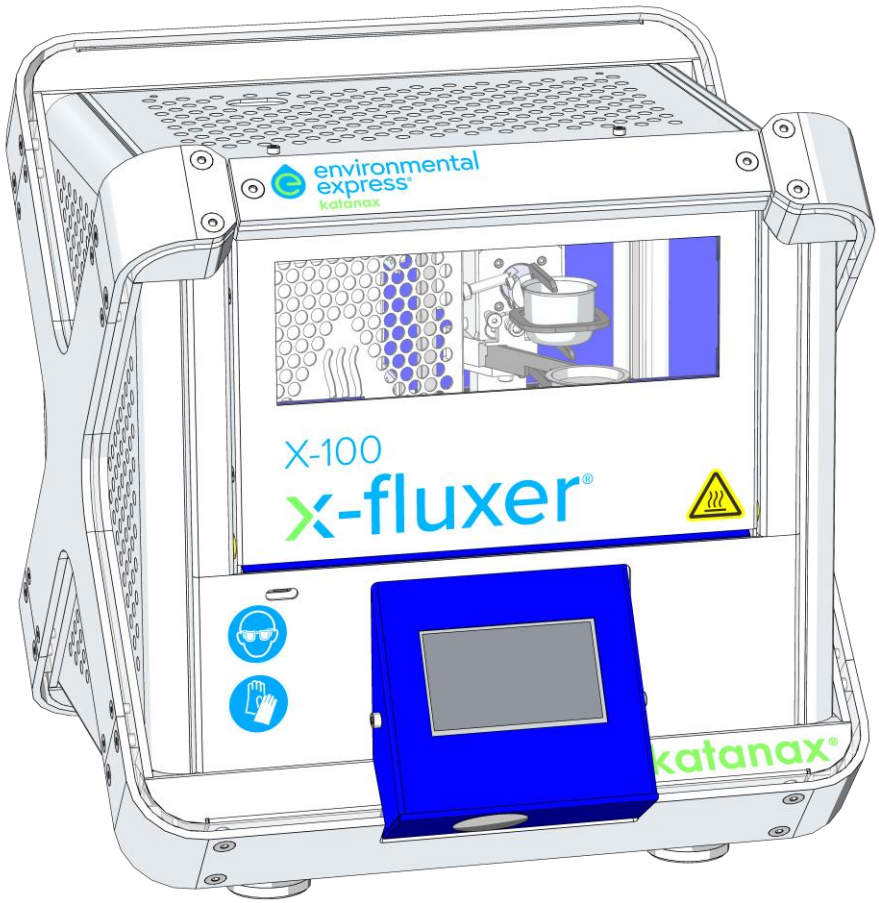
environmental express®
katanax

# X-100 x-fluxer®

## Operating & Instruction Manual

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KP2100A-061025 Rev.1

Signed by:
Jean-Francois Malo
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Contents

## Section 1 - Warranty Information

### LIMITED WARRANTY

All Katanax® instruments have been carefully inspected and tested before shipping and are warranted to be free from defects in parts, material and workmanship for a period of 1-year from date of shipment. Ceramic parts may exhibit small cracks developed under heat and will not be considered defective unless this situation impairs functionality of the instrument. Original heating elements, crucible holder assemblies and mold holders are warranted for a period of 6-months against defects in parts, material and workmanship; however, damage to these parts by oxidation shall be considered normal wear and does not constitute a defect.

During the warranty period, Katanax® guarantees the product against defective workmanship and material, provided the equipment has been installed according to the manufacturer's instructions. This warranty does not apply to any product which has been altered, damaged, tampered with, or subjected to misuse or abuse including substituting parts or accessories of other manufacturers without the written consent of Katanax®. Minor adjustments are not covered by warranty.

Katanax® disclaims any responsibility for misuse, misapplication, negligence or improper installation and maintenance of equipment. Katanax® makes no warranty or representation regarding the fitness for use or the application of its products by the purchaser.

Katanax® is not liable for costs incurred in installation, removal or unauthorized repair of the product or for damage of any type, including incidental or consequential damage.

At its option, Katanax® will repair or replace any defects that are exhibited under proper and normal use. Replacement parts are covered for one month after shipping. All customs- and freight-related charges are customer’s responsibility: items returned to Katanax® for any reason shall be via freight prepaid, while parts sent to customer will be either sent collect, or shipping charges will be invoiced.

Katanax® reserves the right to make changes to the design or to make additions or improvements with respect to its product without incurring any obligation to modify or install the same on previously manufactured products.

## Section 2 - Main features of the Katanax® X-100

*Accuracy*

- Entirely automated
- Fully reproducible fusion methods
- Drift-free durable platinum-rhodium thermocouple
- Perfect reproducibility using a closed electric furnace
- Non-contaminating ceramic holders for crucibles and molds
- Real-time temperature display

*Safety*

- Integrated locking safety shield with glass viewport
- No gases used, so no post-combustion products released
- Minimal heat dissipation: no powerful vent hood required
- No hazardous voltage on the sealed heating elements

*Versatility*

- Make glass disks for XRF using lithium or sodium borate flux
- Can do peroxide or pyrosulfate fusions
- Stores up to 10 different fusion programs
- With optional solution agitation module, can prepare solutions for ICP using lithium or sodium borate flux
- Ready to fuse with built-in methods for oxides, minerals, metals, alloys, sulfides, fluorides and more
- Can perform solid oxidation
- Fully customizable fusion methods
- USB and Ethernet connectivity
- Accept mold sizes from 30 to 40-mm nominal diameters

*Productivity*

- Throughput of up to 4 samples/hour (when preparing acid solutions)
- Fast initial heat-up time of about 15 minutes
- Productivity is enhanced by a user-adjustable holding temperature. Therefore, the temperature between fusions can be maintained to minimize initial ramping time
- Mold blower for fast cooling after fusion
- Automatic detection of major heating components failure (heating elements, solid state relay and thermocouple)
- Servo-controlled motions with automatic positioning correction
- Heating elements can be replaced without cooling the furnace down
- Sample traceability using USB external memory or Ethernet and FTP protocol

*Durability*

- Sealed, non-brittle heating elements are virtually impervious to flux
- All-ceramic platinumware holders without moving parts
- Ability to continue working even with a failed element (115 VAC configuration only)
- Chimneys vent out corrosive halogen gases
- Sturdy industrial-grade modular electronics
- Robust IP65 rated industrial interface

- Dedicated PLC-based programming (not Windows® dependent)
- Low maintenance

*Simplicity*

- Easy installation, easy use
- Single-phase power, no separate power supply
- Intuitive touch-screen color LCD graphics interface
- Easy icon navigation
- Multilingual interface
- A simple, intelligent, high-performance furnace
- Easy component access
- USB-upgradable firmware
- CPLive™ remote access
- 1-year limited warranty

## Section 3 - What Is Included

The instrument comes with its essential accessories. In addition to optional items you might have ordered, the box should contain:

- 1 fluxer X-100
    - 1 support rod (hidden in the electronic compartment of the unit)
- 1 Power cord
- 1 instruction manual (this booklet)
- USB memory stick and hex key set
- 1 Suction pen

Additionally, if you have ordered an X-100 with solution-making capability, you will find:

- 1 unbreakable PTFE beaker, KP0010A
- Magnetic stirring bar (one is included with each beaker)
- The rest of the solution-making assembly is pre-installed into the instrument and is not packaged separately.

## Section 4 - Installation

Congratulations on your acquisition of the X-100 fluxer from Katanax®. Please read the following section for proper commissioning of your instrument. Do not hesitate to contact Katanax® with any question you might have about this crucial step.

### LOCATION

*Vent hood*

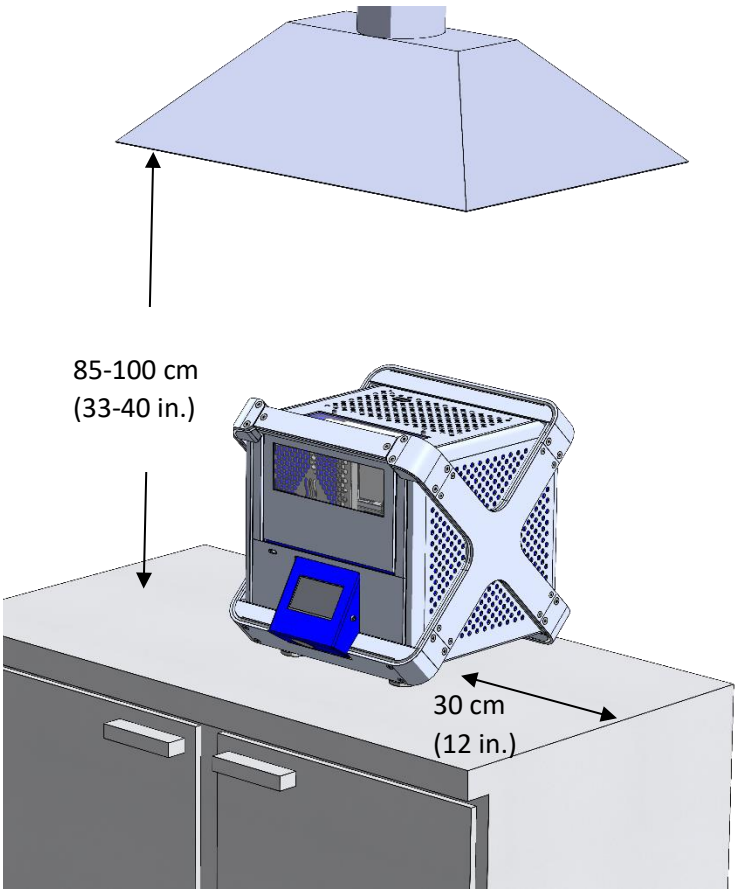
Molten flux, additives and some samples may produce vapors and gases that need to be extracted. In particular, the use of excessive amounts of halogen-based non-wetting agent will potentially cause the deterioration of the fluxer if the corrosive fumes are not properly vented out.

To minimize airflow around the unit, the hood shall ideally be of the canopy type, i.e. with sides and front open. If the sides are closed or otherwise occupied by other instruments, a clearance of 30 cm from combustible materials shall be maintained on either sides and to the back of the instrument.

Sash-type hoods should preferably not be used; or if unavoidable, the sash shall be kept open, so as not to create front-to-back air movements. The hood would need a minimum of 50 cm (20 in) height and 60 cm (24 in) depth.

The funnel (intake section) of the hood shall be approximately equal (or slightly larger than) the size of the instrument's footprint and centered above it to avoid sideways airflow around the fluxer.

The lowest part of the funnel shall sit 45 to 60 cm above the instrument (85 to 100 cm above the tabletop)




***IMPORTANT: Fume hood air speed, measured just above the X-100, shall be around 0.5 m/s.***

Given the nature of the exhausted gases (halogen compounds), Katanax® recommends that the piping be internally coated with a corrosion-resistant finish, PTFE-coated piping being the optimal. (Other corrosive-resistant coatings may be allowed by your local fire codes.) The same applies to the fan / impeller and any other part in contact with the gas flow.

Motor and fan / impeller sizing information can unfortunately not be provided by Katanax®, as those strongly depend on factors linked to each individual installation (pipe diameter, pipe distance to the outside, exhaust baffle type, etc...). Those will need to be calculated locally for each installation by HVAC engineers.

### *Table*

The counter on which the instrument is to be used must be able to safely withstand a weight of 22 kg (49 lbs). It is recommended to use the instrument from a standing position and adjust the table height accordingly.

The tabletop shall be made of a non-combustible material, horizontally flat, rigid, and stable.

> ***IMPORTANT: The instrument can be carried by its bottom plate. The safety shield handle shall NOT be used to carry the instrument.***

### *Safety clearance*

Because your new fluxer will produce heat, a minimal safety clearance must be provided to prevent surrounding material from heating and potentially igniting. All around the instrument, a minimum distance of 30 cm (12'') must be free from combustible materials. Similarly, a clearance of at least 45 cm (18'') must be provided above the top of the instrument.

Your local fire code may require different clearance distances; please check with your local regulations.

### *Environmental condition*

The X-100 is designed for indoor use at altitudes not exceeding 2000 meters. Ambient operating temperature should be kept between 5 and 40°C. The maximum relative humidity is 80% below 31°C and decreases linearly to 50% at 40°C. Acid container should not be kept close to the unit or under the same fume hood, prolonged exposure to acid vapor can damage the unit internal component. The applicable pollution degree is classified as Level 2, meaning the environment where the instrument is used has a moderate level of contamination. The instrument is built to handle occasional moisture-related conductivity issues.

## LEVELING

To obtain glass beads of uniform thickness, it is important that the molds be reasonably horizontal upon pouring. If in doubt, place a bubble spirit level on top of the fluxer and adjust the instrument's feet to compensate for possible slant. (Also see page 53 for Mold Holder Installation Procedure. If mold is correctly leveled but beads are still incomplete, please refer to Fusion troubleshooting, at page 39.)

## CONNECTION

- The X-100 works on 115 or 230 VAC (±10%), 50/60 Hz. Connect the instrument to a mains power with a protective earth connection. The equipment is designated as Transient Overvoltage Category 2 (OVC-II). The instrument intended to be supplied from the building wiring. The instrument is pre-configured to operate under the ordered model (115 or 230 VAC). The operating voltage can be changed if needed. Please contact us to get all the details to proceed (see page 68, Contacting Katanax®).
- When used at 115 VAC, the power line must be able to provide 10 A.
- When used at 230 VAC, the power line must be able to provide 10A.
- If the power cord is replaced, it needs to be able to carry a minimum of 10A.

### MOLD SIZE

On the X-100, the user can easily re-configure the mold holder to accept any mold nominal size from 30 to 40 mm. Please refer to page 51, Mold holder configuration for details.

### CRUCIBLE HOLDER SETUP

Once the mold holder is configured and installed, you may proceed to page 49, Crucible Holder Installation Procedure, for details on how to properly assemble the parts that make up the crucible holder, and install the latter in the instrument.

### QUESTIONS?

Should you have any questions regarding the proper installation and start-up of your instrument, please contact Katanax® directly (see information on page 68) for assistance.

## Section 5 - Introduction

This section aims to introduce the reader to the fusion technique and familiarize the user with the X-100.

### FUSION BASICS

Fusion is a technique used to prepare inorganic samples for analysis by x-ray fluorescence (XRF), laser induced breakdown spectroscopy (LIBS), inductively coupled plasma (ICP), atomic absorption (AA) or any traditional wet chemistry method. Typical samples include cements, ores, slags, sediments, soils, rocks, ceramics, pigments, glass and metals.

A fusion can produce either a small, homogenous solid glass disk (or “bead”) for XRF, or an acid solution for other analytical methods.

The process of fusion as a sample preparation method exhibits many advantages over other methods, as it does not cause mineralogy, grain size or orientation effects and the result is perfectly homogenous.

In sample preparation by fusion, the sample generally does not melt. It is dissolved into a solvent. This solvent, generally a lithium borate flux, is solid at room temperature and must be molten to dissolve anything. This is the only reason the process requires heat.

> ***Therefore, the peak temperature of a sample preparation by fusion is determined only by the type of flux, not the type of sample.***
>
> ***Katanax® does not recommend exceeding 1050°C when using lithium borates.***
>
> ***Katanax® does not recommend exceeding 1000°C when using sodium borates.***
>
> ***Heating above those temperatures could cause flux evaporation that could bias the subsequent analysis, or cause damage to the furnace insulation.***

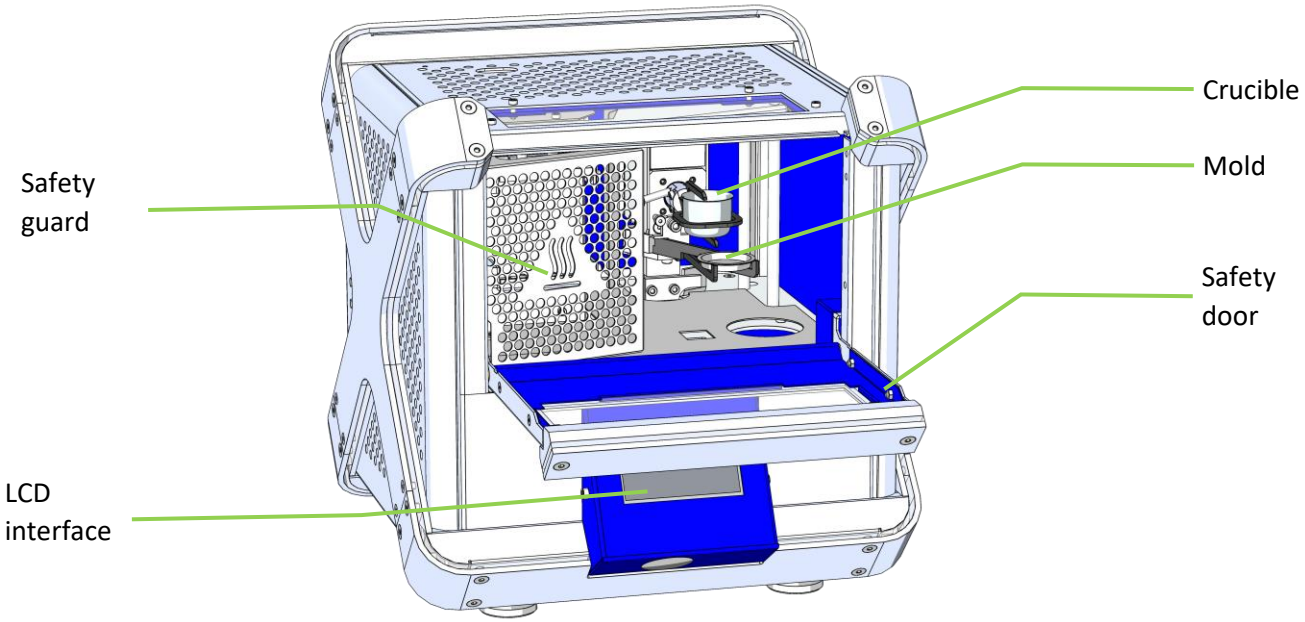
### AUTOMATIC FLUXERS

Because of the potential risk of manipulating red-hot samples, to increase repeatability of temperature, mixing and duration, the industry has now adopted the automated fusion machine as the standard equipment to prepare samples by fusion.

## THE X-100 FLUXER

### *General view*

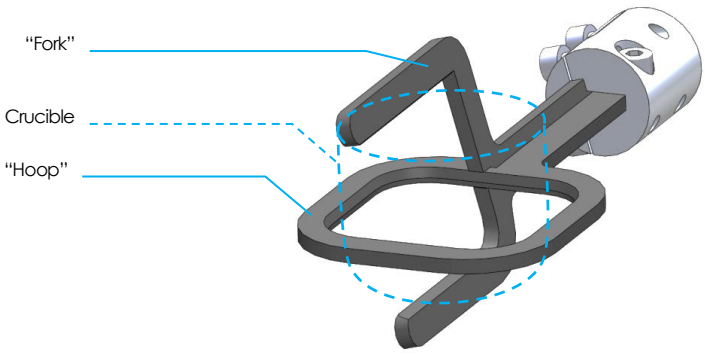
Enter the X-100, the fusion machine that combines the safety and accuracy of electrical heating with unprecedented flexibility and simplicity. It is also a very sturdy unit, as it shares many of its industrial-grade components with its larger brothers, the X-300 and the X-600.




The X-100 comes pre-loaded with various fusion methods that can be used as is or can be customized. Most methods can be renamed, deleted or copied, just like computer files. Only the preset methods are protected to avoid accidental overwriting. Any modifications are virtually immediately saved. If the unit is turned off within less than 1 minute from modifications, these will be lost. Upon turning the instrument on, the furnace will start heating up to prepare for the first fusion cycle. If left idle for an extended period, the furnace will automatically turn off. (Holding temperature and automatic shutoff features are further discussed in, Section 10 -Global parameters, at page 37.)

### *Crucible holder*

Unlike some other units, this fluxer involves no moving part to insert and lock the crucible in place. Locking is achieved automatically due to the dynamic geometry during pouring.



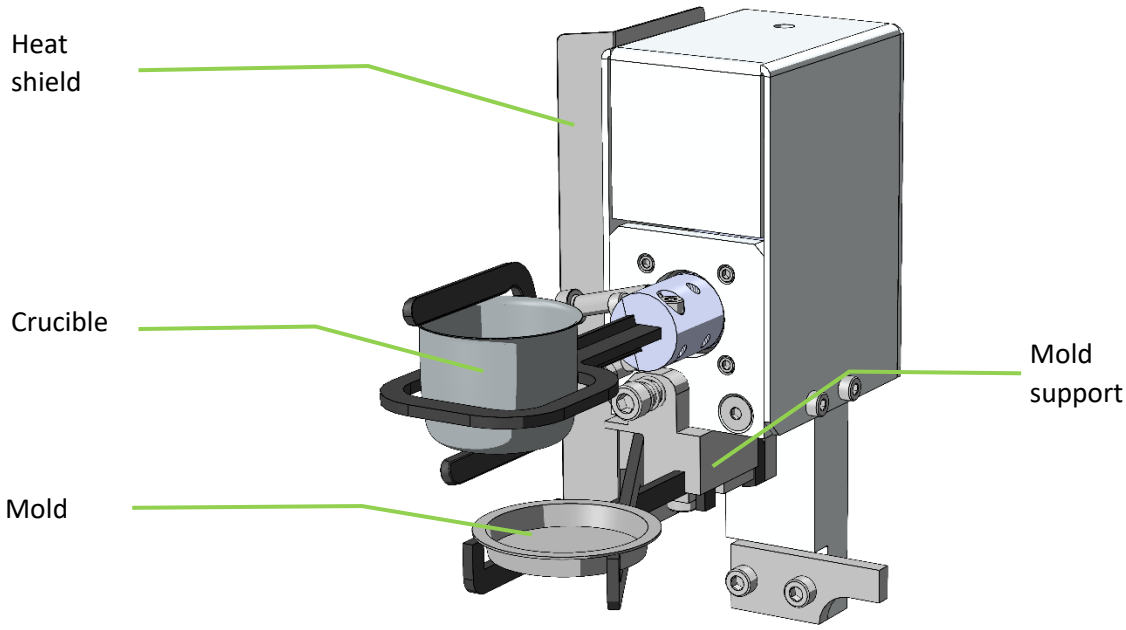

The straight-walled platinum crucibles are loaded with a few grams of powdered sample, an appropriate flux and often other agents. The crucibles are then inserted into the crucible holder.

### *Mold holder*

Platinum molds are installed under the crucible, in a separate holder device. Unlike most other mold holders on the market, this design allows the user to re-configure it to independently accept 30, 32, 35 or 40-mm molds without the need to purchase additional parts.

Please refer to page 51, Mold holder configuration, assembly and alignment for details, to learn how to change mold size.

The crucible holder and the mold holder are referred to collectively as the platinumware holders.




### *Fusion sequence*

When the user instructs the X-100 to launch the actual fusion, the instrument first checks that the initial temperature is reached (see page 37, Holding temperature for more details on this setting). If not, the processor waits until the furnace is ready. Then, the furnace door automatically opens, the platinumware holders enter the furnace, the door closes, and all heating steps are automatically started in sequence. The temperature is constantly monitored and displayed.

Once the flux is molten (after a programmable time), a left-to-right rocking of the crucible holder continuously mixes the flux with the sample. The liquid flux starts dissolving the sample.

When all sample is dissolved (after the programmed time), the furnace door opens, the platinumware holders move forward and, just after the door closes, the crucible is tilted further, to empty its content into the mold.

A blower located underneath cools the mold, while the furnace remains powered, readying for the next cycle. When the mold is completely cooled, the user picks up a perfectly homogenous glass bead, ready for analysis by XRF.

For solution preparation, the hot melt is poured into an unbreakable beaker (instead of mold), which contains a dilute acid that is automatically stirred by a magnetic system (optional, item no. KP2001A).

Some fusion types, such as peroxide and pyrosulfate, do not require pouring. The X-100 is also designed for such fusions, where the whole crucible is dipped into an acid, after the fusion, to prepare a solution by leaching.

## Section 6 - Cautions and Warnings

### READ MANUAL

This documentation must be consulted before operating this unit.

### HIGH TEMPERATURE

Although this instrument has been built to be very safe, it is still capable of reaching temperatures up to 1200ºC inside the furnace. Care must be taken in order to avoid touching hot surfaces.

Even though crucibles and molds are supposed to be cool at the end of a fusion cycle, in order to avoid risks of burns, use appropriate gloves, laboratory tongs or some other adapted tool to manipulate the crucible, mold and glass disk.

The user is advised that this instrument remains very hot for a long time, even after turning it off.

### HIGH VOLTAGE

This instrument is nominally powered by 115- or 230-Volts AC. Although the elements are interlocked with a safety device that removes power when opening the furnace door, reasonable precautions must be taken.

Although heating elements are sealed inside ceramic, broken elements could expose wires and high voltage. Disconnect the power cord before attempting any cleaning, maintenance, or repair operation.

Never turn the unit on or run a fusion process with casing panels removed. Electrical hazards due to high voltage can occur.

Be careful that no liquid infiltrates the unit's casing.

### ACID SPILLS

When making solutions, the user is strongly discouraged from using glass beakers, as acid spills in instruments are dangerous and not covered by warranty. Use only unbreakable PTFE beakers; otherwise, there is a risk of user injury, due to flying glass shards or acid splatter. Wear safety goggles and appropriate equipment protection at all times when operating the unit.

### CRUCIBLE INSTALLATION

To ensure safe operation, proper installation of the crucibles needs to be checked by the user before each fusion. See page 25, Crucible installation, for detailed instructions.

### DAMAGED / DIRTY HOLDERS OR PLATINUMWARE

Never run a fusion if platinumware or their holders are damaged or soiled. Replace damaged items or clean dirty parts immediately.

### GENERAL HAZARDS

Never turn the unit on or run a fusion process with casing panels removed. Mechanical and burn hazards due to accessible moving parts and high temperature components can occur.

### EVAPORATION RISK

This icon will appear to indicate the risk of flux evaporation when the temperature exceeds 1100°C.

## Section 7 - How the unit works

### HEATING

The heating of both the mold and the crucible supports is achieved through advanced heating elements, featuring resistive wire sealed within a ceramic sheath. This design protects the filament from chemical vapors, projections, and spills at all times.

Temperature control is managed by a highly durable platinum thermocouple, which also maintains a preset, constant temperature to expedite initial ramping before a fusion.

### ACCESS TO THE FURNACE

At the start of a fusion cycle, stepper motors automatically open the door, move the platinum holder into the furnace, and subsequently close the furnace door. This sequence is reversed during pouring.

Throughout the fusion process, the safety shield remains locked to prevent accidental burns when the platinum holder moves in and out of the furnace.

### AGITATION AND POURING OF THE MELT

Agitation of the sample and flux is achieved by the alternate rotation of a stepper motor located behind the crucible holder. This motor drives the crucible holder with a left-to-right motion, effectively mixing the melt.

At the moment of pouring, the rocking motor adjusts the crucible holder to an adjustable pouring angle and speed. The melt then pours naturally into the mold, assisted by optional shaking of the crucible in the pouring position.

Following pouring, the crucible holder is automatically returned to the vertical position, preparing it for the next fusion.

Additionally, the pouring step can be disabled for processes like pyrosulfate or peroxide fusions, where immediate transfer of the hot melt is unnecessary.

### COOLING

Once the platinum holder is moved out of the furnace, the mold halts just above a cutout. At a programmed moment, a blower located underneath the hole activates, pushing fresh air upwards and beneath the mold to facilitate cooling.

### SOLUTION AGITATION

Making solutions requires that the instrument be fitted with the optional solution agitation module, item number KP2001A.

***IMPORTANT: Before attempting to make solutions, it is necessary to remove the mold holders, which can otherwise interfere with the top of the beakers and pouring of the hot melt.***

When making solutions, the hot melt is poured directly into beakers containing acid. Those beakers are to be placed into the agitation wells before the beginning of the fusion. This acid solution must be agitated to improve the dissolution speed of the crystallized flux and sample.

To do so, alternatively powered magnetic coils produce a rotating magnetic field under the beakers. By placing a laboratory-type magnetic stirring bar in the acid before fusion, the solution agitation will be performed automatically.

## Section 8 - Using the X-100

### OPERATION OF THE SAFETY SHIELD

The safety shield is the partition that stands between the furnace and the user during a fusion, to protect against accidental burns when the red-hot platinumware holders swing forward at the end of the cycle.

The shield must be manually pulled down to access the platinumware holders. Once ready to start another fusion, the shield must be manually pulled upwards, until it closes completely in the locked position.

#### *Automatic lock operation*

When the unit is first powered on, the safety shield automatically unlocks; The shield will lock automatically once the fusion is started. The shield will unlock by itself at the very end of the fusion cycle, when the cooling fans stop.

A detector ensures that the shield is properly closed before allowing the fusion to start.

Katanax® recommends working in that default configuration, but it is also possible (at the user's risk) to entirely disable the locking mechanism if necessary. Refer to Safety shield protection on page 38 for details.

#### *Electronic unlocking*

When the automatic locking is disabled, the fusion instrument will still lock the door when it is closed. In case the user wants to re-open the shield, simply press on the "Shield unlock" button:

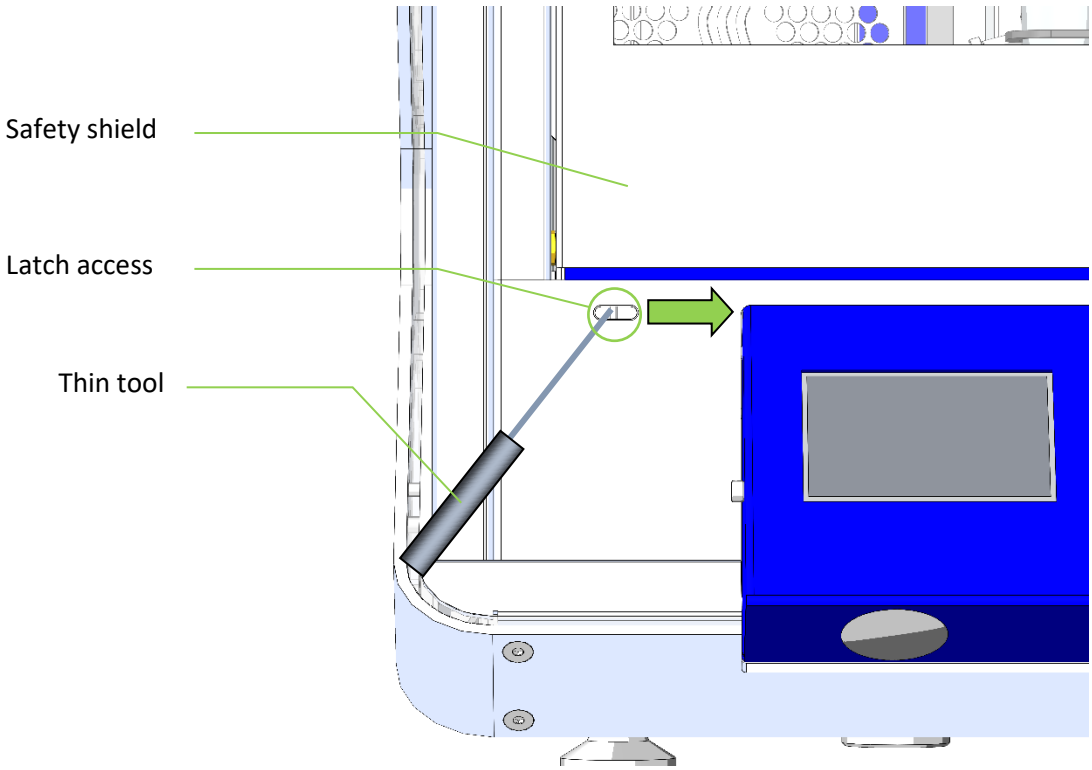
The instrument will then indicate that the shield is unlocked and ready to be opened by showing the icon in grayscale:



When the above icon is shown (in grayscale), you may pull the shield open. It will re-lock when it is closed again.

## MANUAL OVERRIDE

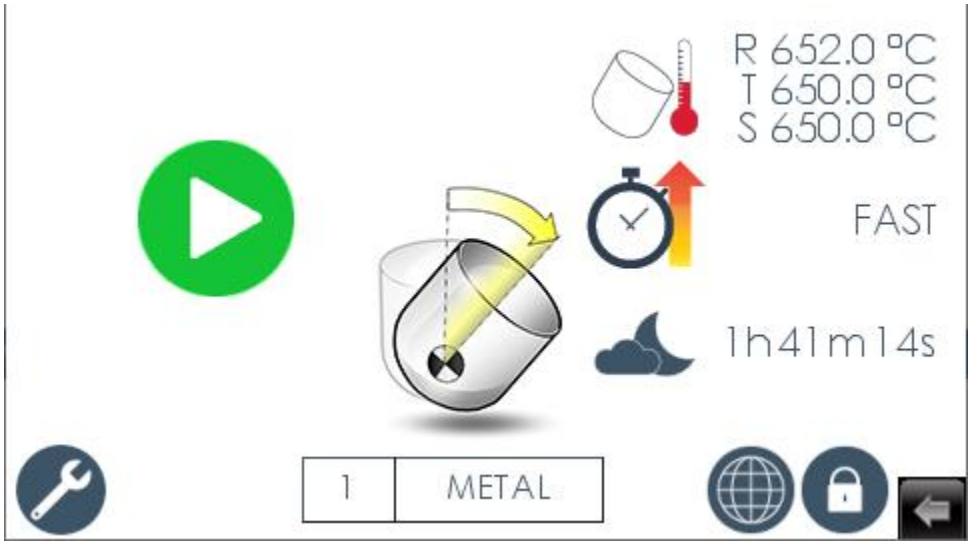
When there is no power (e.g. when cleaning or packing the unit), it is possible to override the locking mechanism to manually open the safety shield.



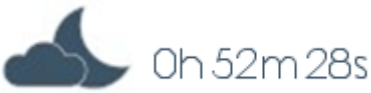

The locking latch bolt can be picked through an oblong opening on the front of the unit, at the left of the screen, under the shield door. Use a thin tool (like the 2.5-mm hex key provided in the tool kit) and reach for the cylindrical part in the top left section of the oblong hole. Gently push this cylindrical part right, to unlatch the shield, and then open the safety shield.

## THE MAIN RUNNING SCREEN

After the booting screen, you will obtain a display similar to the following (not all buttons/icons will appear, depending on the instruments' settings):



Here is a short explanation of the various zones and buttons:

| | |
|---|---|
|  | The “Start” button, quite obviously, is used to launch the currently selected fusion program. It will only appear if the shield is closed. |
|  | This button is used to unlock the safety shield (see Operation of the safety shield, page 17). It will only appear during fusion cycle if automatic locking is disabled. |
|   | This “sleep” button allows the user to put the fluxer in smooth shutdown mode. Pressing it will turn the heating power off but keep the furnace door closed, so that the furnace cools very slowly. This can help extend the life of the insulation. The remaining time shown next to it corresponds to the automatic shutdown timer. When this timer is elapsed, the system falls in sleep mode as if the user has pressed the “sleep” button. |
|  | This activates the sample tracking screen. See Appendix D – CPLive: Data logging at page 63 for more details on how to use this feature. |
|  | The “tilted crucible” icon/button is used to tilt the crucible holder a bit, for easier insertion of the crucibles into the holder. Press again to re-straighten the crucibles. |
|   | The crucible temperature icon is depicted with<br>• the actual measured temperature (with letter R preceding it),<br>• the target temperature, which the crucible heater is in the process of reaching (with letter T preceding it) |
|   | The “ramping” icon informs on the rate at which the current target temperature is to be reached. |
|  | The “parameters” button is used to adjust the individual setting of each program step. More details are given at page 29, Programming the X-100 (advanced). |
|   | This zone is used to select the current program. Click on the method number to switch to a recipe selection screen.<br>Clicking on the recipe name itself will allow you to rename it. More details on this are given at page 33, Managing fusion methods. |
|  | The Copy button is useful to duplicate an existing program, to create a derived recipe. More details are given at page 33, Managing fusion methods. |

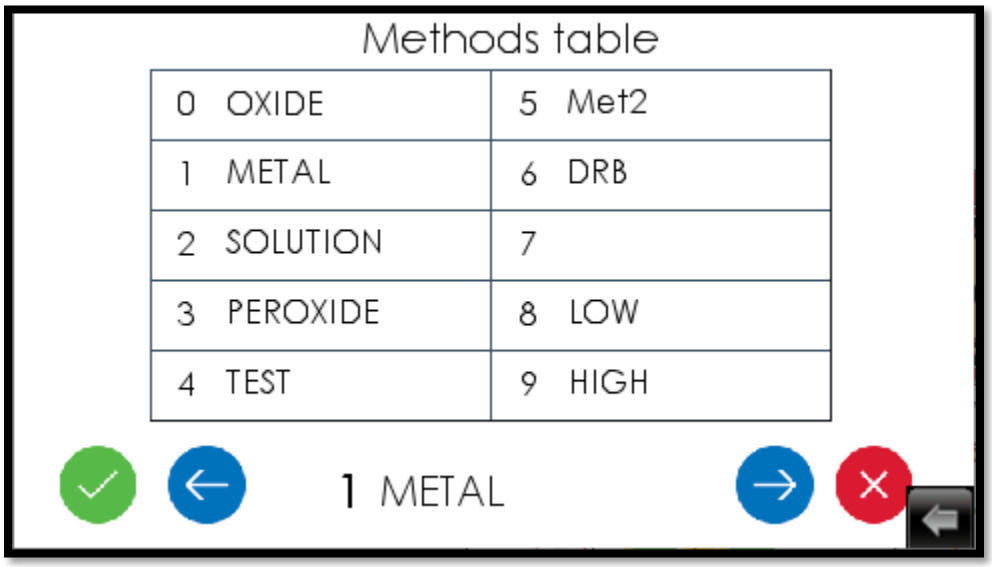
| | |
|---|---|
|  | The Delete button is used to erase a program from memory. More details are given at page 33, Managing fusion methods. |
|  | The Global Parameters button is used to access a screen where general configuration settings can be modified. More details are given at page 37, Global parameters. |
|  <br>  | The padlock icon/button shows the state of the fusion recipe parameters.<br>A closed padlock means that the parameters are locked, and a password is required to unlock parameter access. Conversely, an open padlock means that all parameters can now be freely changed.<br>More details are given at page 29, Programming the X-100 (advanced).<br>Entering the password is also required to modify the parameters of the Global parameters screen. |

## LOADING A PROGRAM

Touching the program number will call the program selection screen.

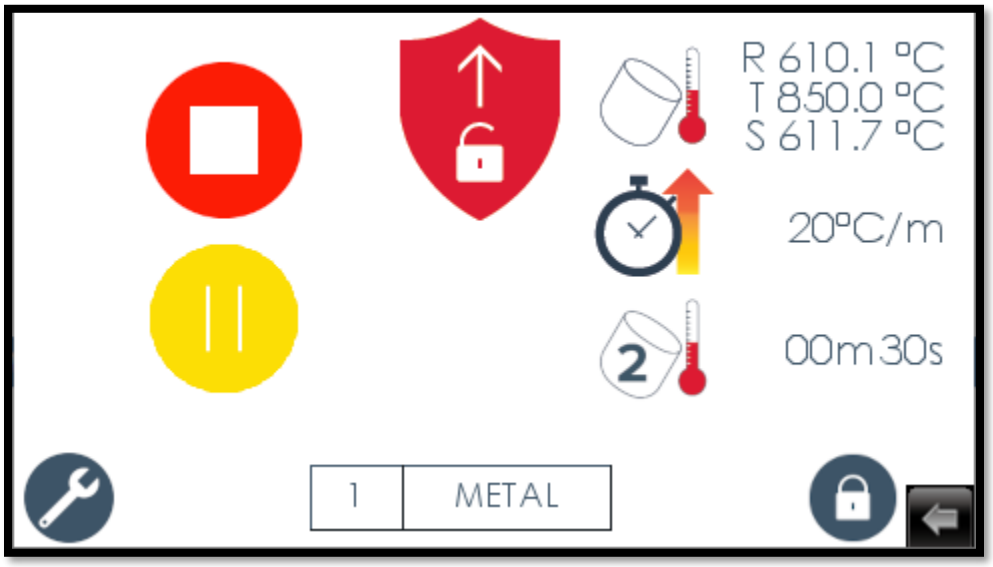
In the program selection screen, you can use the left or right arrows to scroll among the proposed programs, or you can directly select the desired program by touching its name.

Touch the green button to confirm, or the red to cancel.



## DURING A FUSION

While the instrument is running, the main screen will display additional information and buttons, as well as a general estimated timer showing the total time remaining to the fusion program.




Here is the explanation of the additional graphical elements.

| | |
|---|---|
|  | The Pause button is used to temporarily “freeze” the ongoing fusion.<br>In pause mode, timers are suspended, and the current furnace temperature is maintained. Any ongoing motor motion will be continued or completed. This can be useful when some extra time is required to complete an oxidation or dissolution reaction, for example.<br>Press the green resume button to resume normal operation. |
|  | This cluster represents the elapsed time (mm : ss) since the requested temperature is attained, as well as the currently-running step number.<br>See page 28, Description of the fusion steps, for more information on this topic. |
|  | The Stop button, as the name implies, is used to halt the ongoing fusion process, stopping the rocking motor and disabling the heating process.<br>This can be used when one realizes that the crucibles or molds are not properly prepared, or in case of emergency, for example.<br>• Pressing Red resume button will cancel the ongoing program and reset the instrument.<br>• Pressing Green resume button instead will resume the fusion program |

## THE RIGHT INGREDIENTS

From the preceding paragraphs, we already know how to launch a fusion program. There are, however, a few other things than one should know to obtain a perfect disk. These include:

1. Properly preparing the sample for the fusion,
2. Selecting the appropriate flux blend from the sample type,
3. Determining the total mass in the crucible from the mold capacity,
4. Estimating the flux-to-sample ratio,
5. Using the appropriate additives, and
6. Mixing the components together.

### *Sample preparation*

Besides the traditional requirements for a sample to be representative, uncontaminated and dry, Katanax® recommends that the sample be ground to <100µm. This is to ensure that the fusion is completed within a reasonable time.

Additionally, the sample must be fully oxidized before heating the crucible containing the sample.

> ***IMPORTANT: Heating a sample containing metallic species at high temperatures will cause an alloying reaction, damaging the crucible, and possibly damaging the instrument.***

### *Flux blend*

Typical fusions use a mix of lithium metaborate (LiM) and lithium tetraborate (LiT). Lithium metaborate alone typically offers a better sample solubility but can lead to crystallization of the bead. Tetraborate stabilizes the glass but may limit solubility for some samples. Thus, to optimize solubility and obtain stable glass disks, one must use the correct LiT/LiM flux ratio.

The mixing ratio is determined chiefly by the acidity of the sample. Acidic samples require a basic flux (more LiM), while alkaline samples need an acidic flux (more LiT) and neutral samples call for neutral flux (50% LiT + 50% LiM).

Here is a list of common oxides, along with the recommended flux.

| Simple oxide | Recommended flux |
|---|---|
| $K_2O$, $Na_2O$, BaO, SrO, $Li_2O$, CaO, MgO, BeO | Lithium tetraborate |
| $Fe_2O_3$, $Sb_2O_3$, $ZrO_2$, $TiO_2$, $SnO_2$, $V_2O_5$, $SeO_3$, $Ag_2O$, MnO, PbO, CoO, ZnO, CuO, NiO, $Cr_2O_3$ | 50% Lithium tetraborate – 50% lithium metaborate |
| $Al_2O_3$, $B_2O_3$, $SiO_2$, $P_2O_5$, $GeO_2$, $Sb_2O_3$, $TeO_2$ | Lithium metaborate |

Naturally, actual samples are generally composed of more than one oxide type, so a rough proportion must be calculated to determine the optimal flux type.

One notable exception is when one makes solutions. Since making a solution involves the complete dissolution of the melt into an acid, one does not care that the melt crystallize when it cools; it is not only unavoidable, it is desirable. Therefore, when making a solution, one can pretty much always use lithium metaborate only, to increase sample solubility and melt fluidity.

The choice of flux is also governed by the various chemicals that must be added. For example, many samples are initially un-oxidized, and thus need to be oxidized; since borate fluxes only dissolve oxides (metallic material ruins crucibles at high temperatures). Addition of oxidizers is often the easiest solution, but flux type must be adjusted accordingly.

### *Amount of flux and sample to use*

Today's market has seen a proliferation of various mold diameters. Consequently, one must adapt the amount of flux and sample to obtain a full disk that will not overflow out of the mold.

Our recommendation is to measure the actual inner diameter on the bottom of the mold and apply the following formula, to obtain the total mass of sample and flux:

$$Total\ mass\ [g] = \frac{(Mold\ diameter\ [mm])^2}{150}$$

Thus, for a 32-mm inner diameter mold (recommended diameter), we obtain $32^2 / 150 = 6.827$ g, which we can round up to 7 g.

This being said, there are also molds on the market that are very shallow (despite the thickness of the metal they are made of). This can reduce the amount of flux required or cause spillage if the formula is applied to such molds.

### *Flux-to-sample ratio*

After the choice of the right flux, the flux-to-sample ratio is probably the second hardest question to answer. This section intends only to explain general concepts. For more specific information, the customer is invited to contact Katanax® directly.

To obtain the best readability possible on the analytical instrument, one wishes to put as much sample as possible in the preparation. However, putting too much sample will not only take considerably more time to dissolve, but also over-saturate the flux, and leave undissolved sample particles in the disk.

The solubility of samples into the flux being rather hard to predict theoretically, it is recommended to work with the following method:

1. Determine the optimal flux type. If unsure, 67% LiT with 33% LiM is a good starting point.
2. Using the formula above, calculate the total amount of flux and sample required for your mold size.
3. From this mass: weigh 5% sample for 95% flux, directly in the crucible. Mix thoroughly.
4. Proceed with fusion and observe the result.
5. If the bead is perfectly homogenous, it is possible to try increasing the amount of sample a little.
6. If the bead is milky or dusty (presents tiny particles of undissolved sample), try again with less sample, or change the flux type a little. It is also possible that the sample will not be completely oxidized. Just after weighing the sample (before adding the flux), add a small amount of solid oxidizer, liquid acid or liquid base, depending on what reacts better with the sample at hand.

The optimal flux-to-sample ratio is found when all the sample is dissolved and almost saturates the flux solvent in a reasonable time.

Note that increasing fusion temperature does not allow the stable dissolution of more sample. It may quicken the dissolution speed, but when the disk cools down, a precipitate will appear, or the disk will be prone to spontaneous bursting.

### *The non-wetting agent (NWA)*

The non-wetting agent (NWA) acts as a surfactant that makes the melt less prone to sticking to platinumware. Non-wetting agents are halogen compounds (generally containing Iodine, Bromine or Fluorine) and typical formulations include KI, LiI, LiBr and NaI. Only a few milligrams are required. If in doubt, use about 30 mg of LiBr and observe the results. Ammonium iodide (NH4I) is not recommended, as its decomposition temperature is too low.

We strongly recommend using such a non-wetting agent, to lengthen the mold's life expectancy, and to ensure all the melt is transferred into the mold upon pouring. The NWA may be added in solid (powder) form, or as an aqueous solution.

Katanax® also sells flux blends that contain predetermined amounts of non-wetting agent. Please contact Katanax® to obtain this time-saving product.

### *Oxidizing agents*

As previously mentioned, it is of key importance that the sample be oxidized. While it is often safer and easier to oxidize the sample using a liquid acid or base before fusing, it is also possible to use powder reagents to oxidize the sample in a one-step operation.

Typical oxidizers are lithium carbonate (Li2CO3, which reacts at around 700-800°C), lithium or strontium nitrate (LiNO3 or Sr(NO3)2 which react at around 500-700°C) and lithium peroxide (Li2O2, which reacts at around 300-500°C). Several minutes at the reaction temperature must be allowed before heating up further, and temperature ramping can be useful to avoid spills due to too fast reactions (see page 29, Programming the X-100 (advanced) for details on ramping). The amount of selected reagent will depend on the sample contents and can be estimated stoichiometrically. An excess of oxidizer is recommended, but that may require adjusting the flux mixture.

### *Manual mixing*

Once all the components are selected and weighed into the crucible, some manual mixing is recommended, to improve contact between the various reagents.

In particular, very fine sample particles have been observed to agglomerate, and a manual mixing will help break the lumps that might have formed during and after weighing.

Two notable exceptions to this general rule are high-carbonate samples and when using powder oxidizers. In those special cases, one wants to first lay some flux on the bottom of the crucible, then add the sample (and oxidizer) on top. Manual mixing would ideally just be done with the sample and oxidizer, because one wants to have the most intimate contact between the sample and the oxidizer. Flux will merely act as a shield at first, protecting the crucible from alloying with the sample. In the case of high carbonate samples, it is best to lay the sample on top of the flux and not mix; the expelled gases will escape more freely.

## CARE OF THE PLATINUMWARE

Crucibles and molds should be considered an integral part of your fusion machine.

As such, care must be taken to ensure that they are free from leftover flux, molten or in powder. If need be, you can use citric acid or hot 20% HCl (and proper precautions) to clean them. Depending on the amount of deposit, cleaning time can range from several minutes to a full night.

It is also important that the crucible's and mold's interior surfaces be kept polished, to ensure a smooth melt pour, easy bead removal and good analytical results. Katanax® offers a versatile polishing kit (p/n KP9031A or KP9032A, for 115 V or 230 V respectively) comprising a set of very fine diamond pastes with a rotary tool fitted with various soft buffing pads. Contact Katanax® for details.

Finally, crucibles and molds are quite fragile and can distort over time. Re-shape these items without delay to restore their original dimensions. Avoid hitting the mold on the table to remove the bead! You may use a suction cup or an identification sticker to pull the glass bead while keeping track of the bead's ID.

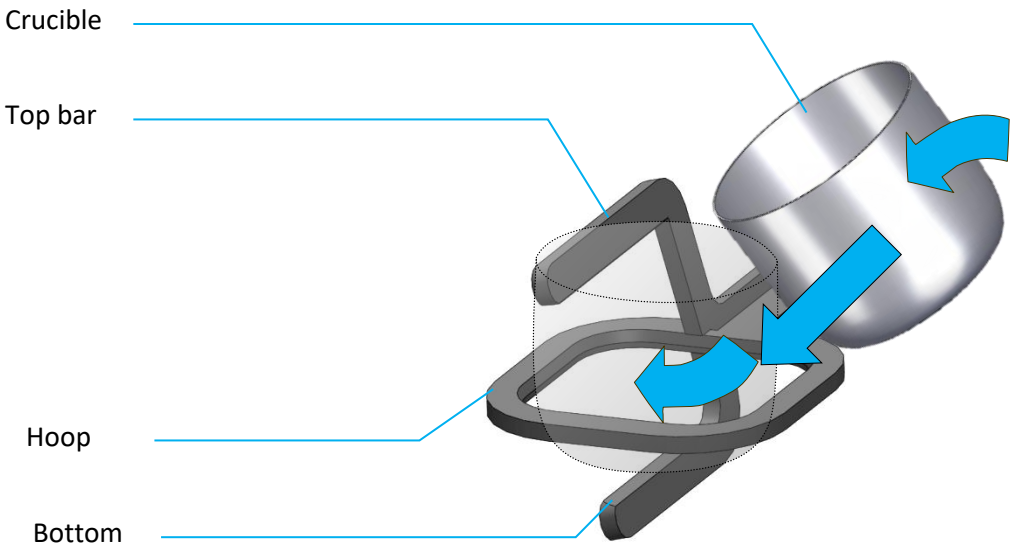
With proper care and fusion method, a crucible can be expected to last for several hundred fusions, while mold typically lasts longer with proper use of non-wetting agents.

## CRUCIBLE INSTALLATION

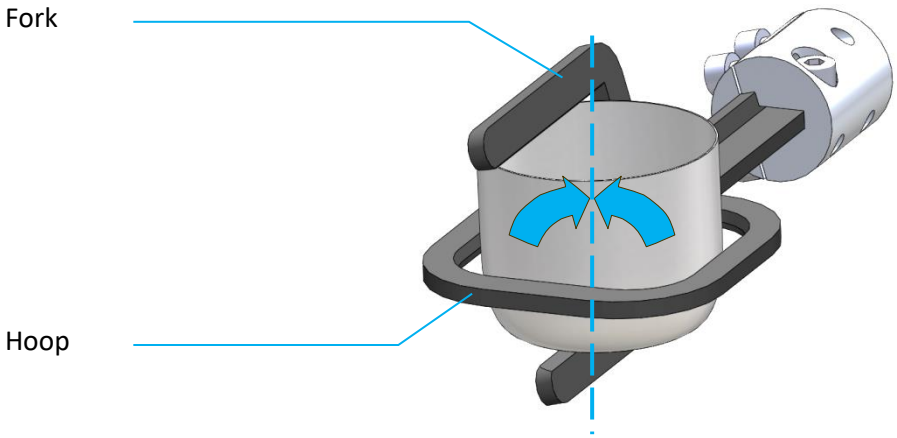
Once the crucible is filled with the proper components, it can be installed in the fluxer.

To install a crucible:

1. Make sure that the crucible holder hoop is horizontal. It is normal that the fork's top and bottom bars be slanted.
2. Simply tilt the crucible's top towards the left (i.e. counterclockwise) and insert the crucible into its holder, between the top bar and the hoop.



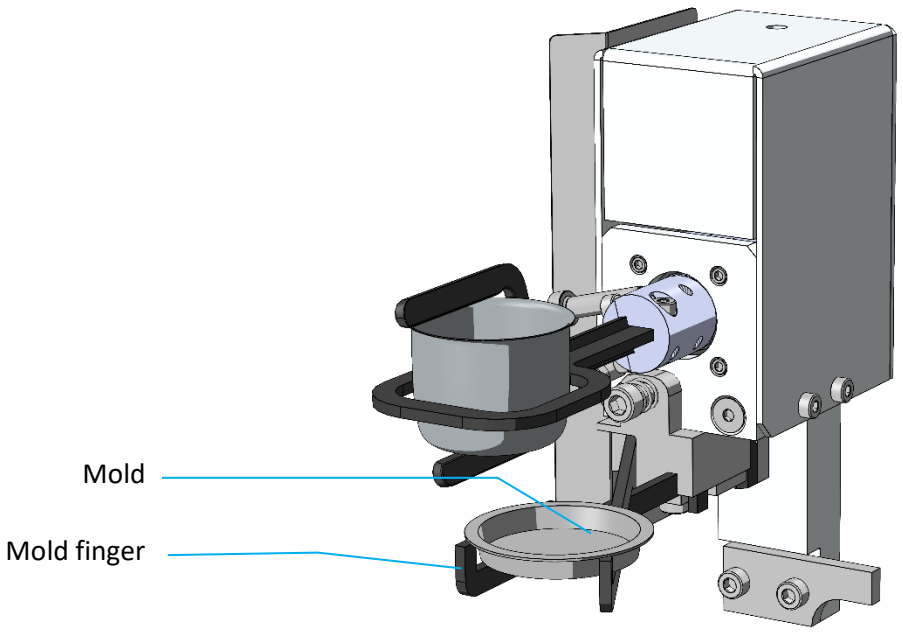

3. Once the crucible is "inside" the holder, it can be tilted back to its natural straight-up stance. (The hoop remains horizontal.)




> ***IMPORTANT: Katanax® recommends that the crucible be filled while not in the instrument. This allows to avoid accidental powder spills on the holders, and ensures that the crucible is not installed in the very same position every fusion (in which case it could be prematurely damaged).***

## MOLD INSTALLATION

After the crucible has been installed, one must place a mold on the horizontal mold fingers.




***IMPORTANT: Forgetting to install the mold will cause the crucible to pour the hot molten glass onto the instrument. In such case, no damage will occur, but sample will be lost.***

***NOTE: If you find that your mold do not fit properly in the fingers, then maybe the fingers are not configured for your mold size. Please refer to page 51, Mold holder configuration, for details on how to re-configure your mold finders to accept your mold size.***

## A GENERAL FUSION

Here are the steps required to perform a fusion on the X-100 fluxer.

1. Preparation for Fusion
   1.1. Power On the Instrument
      - Turn the instrument on by flipping the rocker switch at the back. The main screen will appear, and the platinumware holder will automatically pull out of the furnace. The furnace heating will be turned on to reach the stand-by temperature.
   1.2. Inspect Holders
      - Check the crucible and mold holder for possible flux spills from a previous fusion. (Refer to page 41, Flux spillage on holder procedure for details.)
      - If the holders look vitreous and dirty, clean them immediately; do not start a fusion process with dirty holders, as this could damage the instrument.
2. Perform Fusion
   2.1. Select Fusion Program
      - Select the desired fusion program from the method's table by pressing the method number preceding the current program name.
   2.2. Weigh Flux
      - In the platinum crucible, weigh the required amount of flux.
   2.3. Add Sample
      - Add the sample by weighing it directly into the crucibles on top of the flux.
      - Mix if no solid oxidizer is to be used and the sample is low in carbonates.
   2.4. Prepare Solid Oxidation (if required)

- Add a suitable solid oxidizer (generally, a nitrate or carbonate) to the crucibles.
- Mix thoroughly with the sample, trying to leave the bottom layer of flux untouched.

2.5. Add Non-Wetting Agent

- If not already integrated within the flux, add the non-wetting agent.
- Solid non-wetting agent should be thoroughly mixed with the flux. An aqueous solution of the solid salts can also be prepared and pipetted on top of the dry ingredients.

2.6. Install Crucible

- Place the crucible in the holder.
  - ♦ **Important:** Ensure it is properly installed. Refer to page 25, Crucible installation, for details.

2.7. Install Mold

- Place the mold on the holder.
  - ♦ **Important:** Do not forget to install a mold. Refer to page 25, Mold installation, for details.

2.8. Close Safety Shield

- Close the safety shield, which will lock automatically after the start button has been pressed.

2.9. Start Fusion

- Touch Start to launch the fusion. If the preset temperature is not yet reached in the furnace, a few minutes' delay will allow sufficient heating, then the holder will automatically enter the furnace. The furnace door will open and close automatically.
- Upon heating, the sample reacts if an oxidizer is present. The flux melts and dissolves the sample while simultaneously heating the mold. At the end, the door opens to let the crucible out, and it tilts to pour into the mold. A blower cools the disk.

2.10. Retrieve Glass Disk

- At the end of the cycle, carefully pick up the glass disk.
- Do not tap the mold on a hard surface to remove the bead, as this will warp the mold over time. You may use an identification sticker to pull the bead from the mold.

  - ♦ **Important:** The mold and bead may still be very hot at the end of the cycle, depending on the mold weight and program parameters.

## MAKING SOLUTIONS

***IMPORTANT: Before attempting to make solutions, it is important to remove the mold holder fingers, which can otherwise interfere with the top of the beakers.***

***IMPORTANT: Katanax® does not recommend attempting to prepare solutions in a fluxer not fitted with the optional solution magnetic stirrers.***

When making a solution, the process is quite similar to making glass disk, but the mold installation changes for the following:

2.7. Place Beaker in Instrument

i Remove Mold Holder Fingers

- Completely remove the mold holder fingers by unscrewing and taking out the spring at the front of the mold holder support bracket.
  - ♦ Refer to page 50, Mold holder removal procedure, for details.

ii Fill PTFE Beaker with Acid

- Fill the PTFE beaker with about 100 ml of suitable dilute acid.
  - ♦ **Note:** 10% nitric acid is commonly used.

iii Add Magnetic Stirring Bar

- Add one magnetic stirring bar to the beaker.

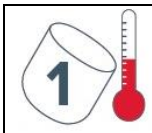
iv Position Beaker

- Place the beaker on the agitator in the beaker hole.
  - ♦ **Note:** The magnetic agitation system is always active, so a swirling motion should be taking place in the beaker.

3. Notification
   - The fluxer will beep when the beakers are ready to be picked up.

## DESCRIPTION OF THE FUSION STEPS

All fusion programs in the X-100 are built the same way and have ten (10) steps. Here is the list of those steps, along with the corresponding icon:

| | |
|---|---|
|  | Heating 1<br>Typically used to pre-heat the sample, with little or no agitation. |
|  | Heating 2<br>Typically used to oxidize the sample at low temperature (e.g. using nitrates), with little or no agitation. |
|  | Heating 3<br>Typically used to oxidize the sample at higher temperature (e.g. using carbonates), again with little or no agitation. |
|  | Heating 4<br>Typically used to melt the flux. |
|  | Heating 5<br>Typically used to dissolve the sample in the flux with a vigorous agitation. |
|  | Heating 6<br>Typically used to de-gas the melt, for a short time at low agitation speed and high rocking amplitude. |
|  | Pouring<br>Used to transfer the crucible contents into a mold or beaker.<br>Not used for some preparations, with peroxide fluxes for example. |
|  | Cooling 1<br>Used for natural-cooling of the mold, or stirring of the solution |
|  | Cooling 2<br>Used for blower-cooling of the mold |

| | |
|---|---|
|  | Cooling 3<br>Used for blower-cooling of the mold |

Each step is launched when the preceding one is completed. It is also possible for a step to have a null duration (i.e. zero seconds) and would simply be executed without duration. Most fusion programs will not use all heating steps.

Note that all heating steps (1 to 6) are identically structured and could be used interchangeably.

Also, some of the steps have built-in on/off switches that allow extra actions to be executed, or sometimes to turn off the step itself (e.g. pouring step).

Manual edition of step parameters is the subject of the next section.

## Section 9 - Programming the X-100 (advanced)

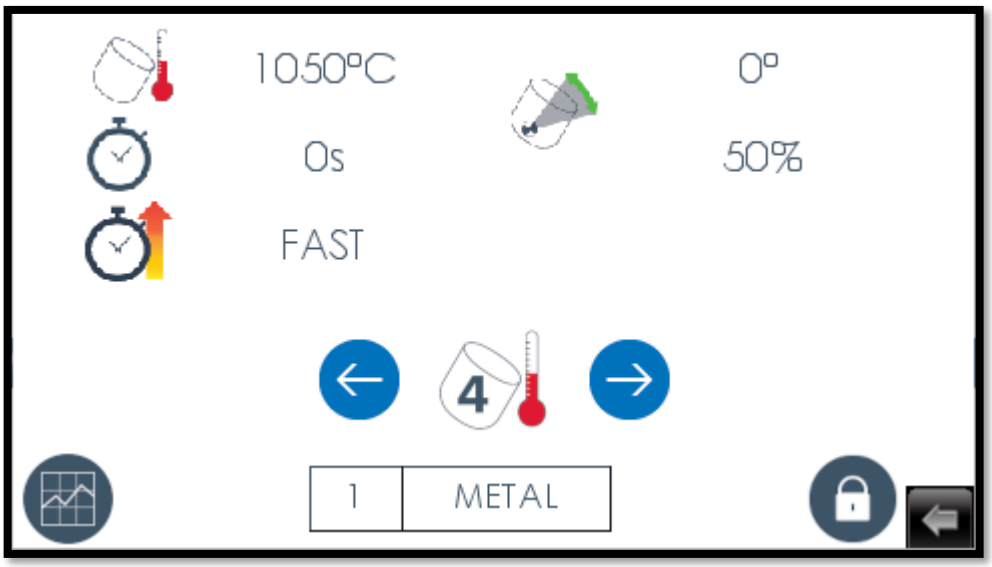
When specific sample types do not seem to be easily processed by a preset fusion method, it is necessary to manually modify the parameters of critical fusion steps.

### VIEWING THE FUSION PARAMETERS

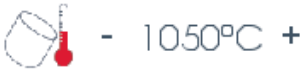
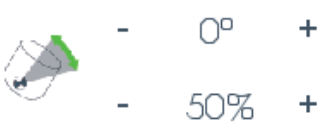
Without risking changing a parameter, any user can look at the values and settings of the current program, step-by-step. This is done by pressing the “Settings” icon, in the lower left corner of the main running screen.

The Settings icon allows to toggle to a screen where the parameters for a given fusion step are displayed. Nothing can be changed unless the advanced mode is unlocked (see page 32, Unlocking the advanced mode).

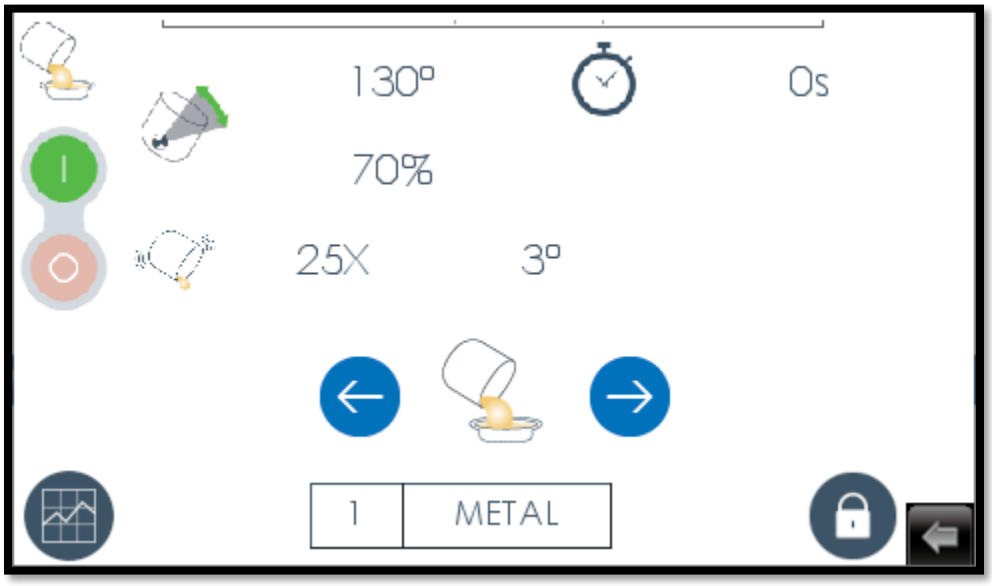
The screen will now look something like this:




Let us now understand the meaning of each symbol.

| | |
|---|---|
|  | The large crucible with red thermometer represents a heating step, and the numeral “4” indicates that we are now viewing the parameters of step “Heating 4”. The Left and Right arrows are used to scroll among the steps of the current program. |
|  | The small crucible with red thermometer icon is placed just beside a cell where the target crucible temperature is displayed. (The Minus and Plus buttons will be used to change the parameter.) |
|  | The stopwatch icon is placed just beside a cell where the step duration is displayed. Note that step durations are calculated after the required temperature is reached. |
|  | The stopwatch with arrow icon is placed just beside a cell that indicates how the target temperature will be reached.<br>Most fusion applications can use the “Fast” setting, but oxidation steps often call for a slow heat-up rate. This is called “ramping”. |
|  | The crucible with angle symbol is used to refer to two rocking parameters.<br>The top one is the amplitude of the rocking.<br>The bottom one is the rocking speed. |
|  | The icon in the lower left corner has now switched to a graph icon.<br>Pressing this button will bring you back to the main running screen. |

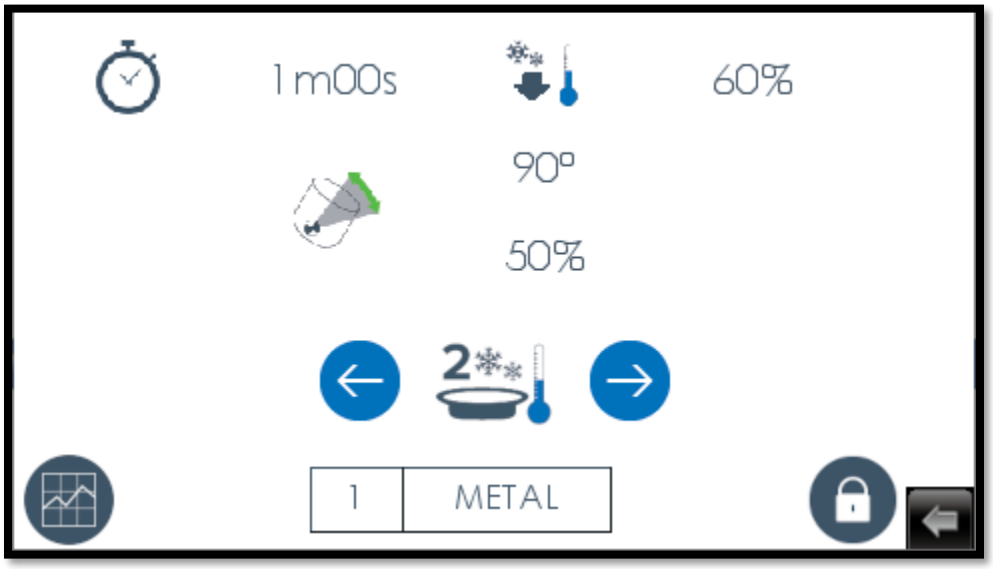
If we scrolled fusion steps towards the right, until we reach the pouring step, we would obtain a screen similar to the following:




Icons and symbols have the following meaning:

| | |
|---|---|
|  | The crucible pouring into a mold shows that we are now viewing the Pouring step parameters. |
|   | This block of icons shows that the pouring is set to On (thus the “green switch”).<br>The parameters to the top right show the crucible angle upon pouring (in degrees), as well as the pouring motion speed (in percent). |
|   | This block represents the settings of the “shaking” feature. After the pouring action, one can program the crucible to shake up and down for a number of times at a given amplitude. |

Again, scrolling to the next step will show us the available parameters for the first three cooling steps. The three cooling steps are built the same way with the same parameters.




And we now recognize the duration parameter, as well as the crucible tilting angle and motion speed. The two crucible-related parameters are used to control the straightening up of the crucible holder. There is typically no rocking motion available in this step, except if the pouring was previously turned off; the system would then assume that the user wishes to perform a "non-pouring" fusion (e.g. pyrosulfate and peroxide).

| | |
|---|---|
|  | The snow flake and Mold indicate that we are viewing a cooling step. The numeral indicate witch of the three cooling step is viewed. |
|  | The freezing icon allows the user to set distinct fan speeds (in percent). |

*Note on the tilting angles during cooling*

Typically, the tilting angle of "Cooling 1" will be the same as the pouring, and the tilting angle of "Cooling 2" and "Cooling 3" will be ninety degrees (90°) to prevent residual drops from sliding on the outside wall of the crucible, or fall onto the cooling bead. This will give some time for the flux to pour completely out of the mold during "Cooling 1", while partially straightening the crucibles when the blower starts at the beginning of "Cooling 2".

## UNLOCKING THE ADVANCED MODE

Before being allowed to manage fusion program and edit parameters, one must enter the correct password. To do so, click on the padlock icon/button.

After touching the padlock button, a numeric keypad will pop up, ready for password entry.


Type the password, which is 2014.

If you make a mistake while typing, press the backspace button to clear your entry.

If you summoned the numeric keypad by error, you can close it by pressing the locking padlock icon.

Once the password is correctly typed, press on the unlocking padlock icon to confirm. The numeric keypad will close, and the padlock icon will now be displayed as unlocked (if the selected method is not write protected).

This icon informs you that you can now modify the fusion program parameters, but also manage the fusion methods (i.e. copy and delete). You are now in “advanced mode”.

> ***NOTE: It is not possible to modify the parameters in the preset programs, and so even entering the correct password will not "unlock" the padlock icon. However, the instrument remains in "advanced mode", and so switching to a custom fusion program will “unlock the padlock” and allow parameter edition.***

To close the advanced mode (i.e. “re-lock” the padlock), simply click the padlock icon and then press on the “locking padlock” icon on the keypad.

## MANAGING FUSION METHODS

Fusion methods can be managed just like files on a computer. In the main screen, you can press the icon corresponding to Copy and Delete. Note, however, that the “advanced mode” needs first to be unlocked to perform any of the following actions.

### *Copying*

The Copy button is useful to duplicate an existing program, to create a derived recipe. Hence, begin with a preset program that is close to the sample type you want to process, and then you will be able to fine-tune the parameters to suit your specific sample. After clicking on the icon, a window will ask for confirmation. Click “Yes” to proceed, or “No” to cancel.

### *Renaming*

Once a method is copied, we suggest that you immediately rename this with some name that is relevant to your application. To rename the program, click on its name (in this case, “Untitled”), and a full keyboard will pop up. (Note that renaming a preset program is not allowed.)

### *Deleting*

The Delete button is used to erase a program from memory. Once a program is erased, it frees the corresponding memory slot, and it cannot be recovered. Furthermore, preset programs cannot be deleted.

## PREPARING A FUSION PROGRAM

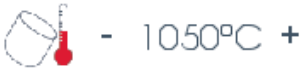
To build your first fusion program, you must first select a preset program template that will be used as a starting point to design your own program. In most cases, the Oxide program is a good all-around program. Copy it under your desired name, as described above.

Once this “editable” program exists, you can adjust parameters to suit your sample. Any change to the Fusion settings is immediately saved to the buffer. The system will automatically save them to non-volatile memory every minute. Therefore, if you turn off the device immediately after a change, the recently changed settings may be lost.

## HEATING STEPS

Heating steps all have the same structure. Hence, if you need only two temperature plateaus, you could use Heating 1 and Heating 2, or Heating 1 and Heating 3, and so on, without affecting anything. For standardization purposes, Katanax® tends to use the last heating steps, and leave the first ones empty when not needed.

*Temperature*




The furnace temperature can be adjusted using the plus and minus buttons located next to the crucible temperature icon. Typically, the temperature profile will either increase or remain constant for a specific method. However, in certain situations, a user may wish to lower the temperature to increase the viscosity of the melt before pouring. This adjustment is permissible, but the principle remains the same: the targeted temperature must be achieved within a range of +/-10°C, after which the duration timer for the step will commence.

It is important to note that excessively high temperatures can lead to analytical issues, primarily due to the evaporation of the flux. Katanax® recommends not exceeding 1050°C when using lithium borates and not exceeding 1000°C when using sodium borates. Heating above these thresholds may cause flux evaporation, potentially biasing the results of subsequent analyses.

A warning will be issued if the temperature exceeds 1100°C. Should you believe that your sample type requires higher temperatures, it is advisable to contact Katanax® for assistance in developing a lower-temperature method tailored to your needs.

> ***Katanax® does not recommend exceeding 1050°C when using lithium borates.***
>
> ***Katanax® does not recommend exceeding 1000°C when using sodium borates.***

*Duration*

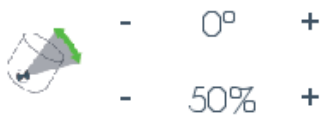

Step duration (mm : ss) is also adjusted by pressing on the plus and minus buttons. The actual step timer will start once the furnace has reached the temperature set for this step. Hence, the length of a step is actually the sum of the time required by the furnace to increase up to the step temperature, plus the duration parameter. For each step, the duration parameter is limited to 19 minutes and 55 seconds.

*Ramping*


The ramping parameter determines how fast the furnace will increase its temperature to reach the one set in the current step. In most applications, we want the furnace to heat up as fast as possible, but it is also possible to set this parameter (by pressing on the plus and minus buttons) to limit the heat-up rate. The other ramping values (besides Fast) are given in °C/minute.

Slow heat-up rates are particularly useful with a solid oxidizer, when we want it to react slowly over a temperature range, typically about 100°C.

*Crucible rocking speed and amplitude*




The crucible content is mixed by a back-and-forth rocking motion, whose amplitude (in degrees) and speed (in % of the max) can be controlled by means of the plus and minus buttons.

Typically, initial heating steps call for very little rocking. This allows for the oxidizer to react, and for flux to melt without risking overflowing from the crucible (molten flux takes up less volume than powder flux).

When the flux is completely dissolved and pouring approaches, speed and amplitude can be used more generously. One exception would be with samples containing gases. Those samples produce bubbles that can remain trapped in the melt, and de-gassing the melt is sometimes better achieved with very slow speeds and large amplitudes, before pouring.

## POURING STEP


The pouring step occurs when the crucible is tilted forward quickly, to empty its contents either into a mold or a beaker containing acid. However, pouring can be turned off altogether, for those fusion types where pouring is not desired: fusions in sodium peroxide or potassium pyrosulfate.

*Basic pouring parameters*

Pouring can be completely turned off and on by pressing the red and green vertical switch.

If pouring is on, the crucible tilting angle and speed can be controlled with the plus and minus buttons.

Generally, a pouring angle of 120° with a speed of more than 30% works well. Adjustment is sometimes required to adapt to melt viscosity and mold size.

*Crucible shaking*


In some cases, a droplet will remain stuck inside the crucible. Once cooled, it can easily be pinged off. However, in some instances, one wishes to completely transfer the melt out of the crucible. This is mostly done with the help of non-wetting agent, but it can also be helped with a mechanical shaking of the crucible after pouring.

The shaking feature is activated by setting the number of shaking motions (0x to 31x) and the shaking amplitude (0° to 7°). Press the right half of the button to increase the parameter, or the left half to decrease. Setting those parameters to zero will cause no shaking.

## COOLING STEPS

The cooling process for bead formation is typically divided into two distinct stages, each playing a vital role in ensuring the quality of the final product.

The first stage, known as Cooling Step 1, utilizes natural-convection cooling, meaning it occurs without forced airflow. This approach allows the melt to completely fill the mold while maintaining high temperatures, which is

crucial for stabilizing the melt. Natural cooling facilitates a rapid transition through phase changes, preventing crystallization and minimizing thermal stress on the mold.

The second stage encompasses Cooling Steps 2 and 3, which finalize the bead cooling. During these steps, it is important to strike a balance between slow cooling—important for reducing or eliminating stress within the bead—and faster cooling, which can decrease the overall fusion time. It is advisable to use the default cooling parameters, making adjustments primarily to the duration based on the size of the beads or the weight of the mold.

When operating without a non-wetting agent (NWA), the cooling steps must be adapted to prevent cracking in the beads. A general guideline for this scenario is to begin with no cooling or very slow cooling during Cooling Step 1, then gradually increase the cooling intensity as the bead temperature decreases. For example, Cooling Step 1 may be set to two minutes without fan assistance, followed by Cooling Step 2 at three minutes with 20% fan speed, and concluding with Cooling Step 3 at five minutes with 60% fan speed.

By adhering to these cooling protocols, one can significantly enhance the quality and durability of the beads while ensuring the longevity of the molds used in the process.

*Duration*


Step duration (mm : ss) is adjusted by pressing on the plus and minus buttons. Generally speaking, a “Cooling 1” duration of one to two minutes is a very good starting point. Thereafter, “Cooling 2” and “Cooling 3” can be set for as many minutes as needed, and this parameter will be roughly proportional with the combined weight of the melt and mold.

*Crucible position after pouring*


In a typical cooling step, the two crucible-related parameters are not used to control the crucible rocking motion, but rather to control the straightening up of the crucible holder, after the pouring.

Typically, the tilting angle of “Cooling 1” will be the same as the pouring (typically 120°), and the tilting angle of “Cooling 2” and “Cooling 3” will be ninety degrees (90°) to prevent residual drops from sliding on the outside wall of the crucible, or fall onto the cooling bead. This will give some time for the flux to pour completely out of the crucible during “Cooling 1”, while partially straightening the crucible when the blower starts at the beginning of “Cooling 2”.

Note that, if pouring is turned off, then the fluxer is in “non-pouring” mode, and so will allow for rocking at this step, just like a normal heating step. This is useful to spread the melt onto the crucible walls when making peroxide or pyrosulfate fusions.

## ON-THE-FLY EDITING

During a fusion, it is also possible to edit parameters on the fly, that is, while the fusion program is running.

To do so, simply edit parameters as explained in the previous paragraphs (from page 29 onwards).

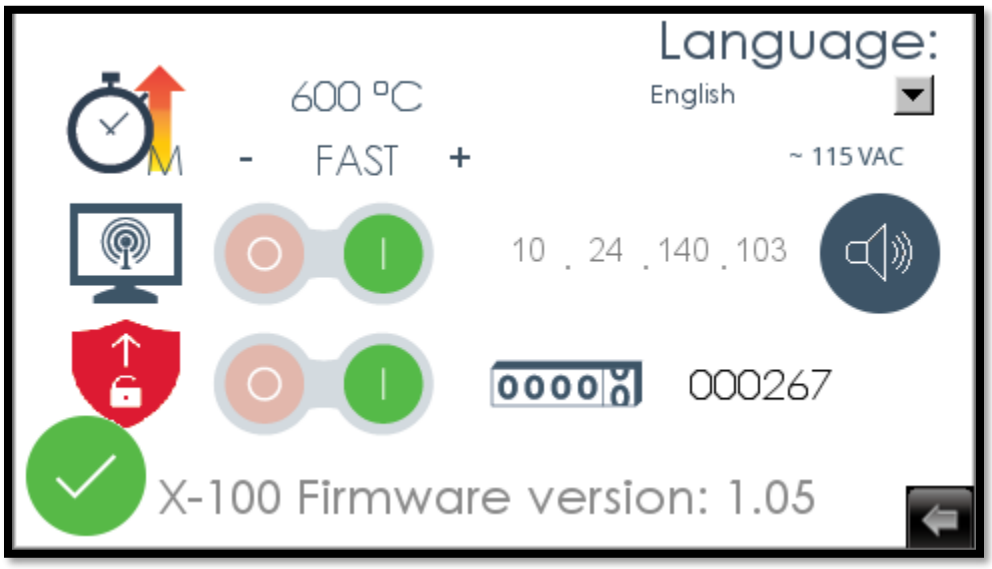
Note, however, that there are logical limitations, and the firmware will automatically limit the accepted parameter range to prevent nonsensical or error-causing combinations. All parameter modifications will take immediate

effect. If the step of modified parameters has already been executed, the modified parameters will have of course no effect on the current execution. They will only affect the next fusion cycle.

## Section 10 - Global parameters

In addition to recipe-specific parameters, your fluxer provides extra versatility through flexible parameters that will apply to all fusion programs.

To modify the global parameters, first unlock the advanced mode (see page 32, Unlocking the advanced mode), then touch the Global Parameters icon that is now available on the main display screen.




### LANGUAGE


In the global parameters page, you can change the instrument's interface language by selecting your preferred language in the list.

### VOLTAGE OPERATION


In the global parameters screen, you can set the operation voltage. The instrument operating voltage has been factory adjusted in accordance with the electrical wiring used. This parameter should not be modified unless advised by Katanax® with detailed instructions. Modifying this parameter without proper electrical wiring will lead to bad operation and could damage the unit.

### HOLDING TEMPERATURE

In order to keep the furnace up and ready for the next fusion, the instrument can maintain power to the furnace to keep it hot. This will help skip the initial ramping time, thus quickening fusions and increasing sample throughput.


In the global parameters screen, you will find a switch to determine if the holding temperature is automatic or manual. To switch between modes, simply tap the icon. If automatic, the temperature

of step 1 of selected method will be used and displayed beside the switch. If manual, the desired “Holding temperature” value can be entered directly in it. This value is unique to the method selected and should be adjusted according to it. Indeed, the holding temperature should be calculated based on the Step 1 temperature.

**Example:**

> In your fusion program, you have set Step 1 with a temperature of 700°C. Then, you will adjust the holding temperature to 700°C to minimize the ramping time after the insertion of the holders and allow some time to heating up the cold crucible and mold before starting the duration timer of the step. Alternatively, if you want to accelerate the fusion as much as possible you may want to use a slightly higher temperature to compensate for the temperature drop in reason of the furnace door opening and the insertion of cold crucible and mold. After trials, you may find that temperature will drop to roughly 700°C if you adjust holding temperature to 900°C. In all cases, the maximum temperature that can be used for holding is 1100°C.

## STARTUP TOLERANCE

When you start a fusion, the crucibles will enter the instrument only once the furnace has reached the holding temperature. Therefore, there may be a delay when you press Start, to allow for the furnace to heat up or cool down to the holding temperature. The permissible temperature range to start a fusion is set to +/- 10°C.

## END BEEP

When a fusion cycle is completed, the instrument will emit beep sounds and display a dialog box. This dialog box needs to be cleared to resume operation and stop the beeping sounds.

The speaker icon allows you to enable or disable the end-of-cycle beeps.

## AUTOMATIC SHUT-OFF DELAY

When the instrument is idle for two hours, the heating will be automatically turned off, to save energy. The remaining time is displayed on the main running screen next to the "sleep" button. The timer is reset each time the screen is touched.

## SAFETY SHIELD PROTECTION

By default, the checking of the safety shield position and locking is enabled, to maximize protection. However, it is possible to disable this security feature.

***WARNING: Disabling the safety shield protection can lead to serious injuries by extreme heat. User is advised that doing so it at the user’s sole responsibility.***

## FUSION COUNTER


In the global parameters screen, there is a read-only parameter that displays the number of fusions since the instrument was built, similar to the odometer on a car.

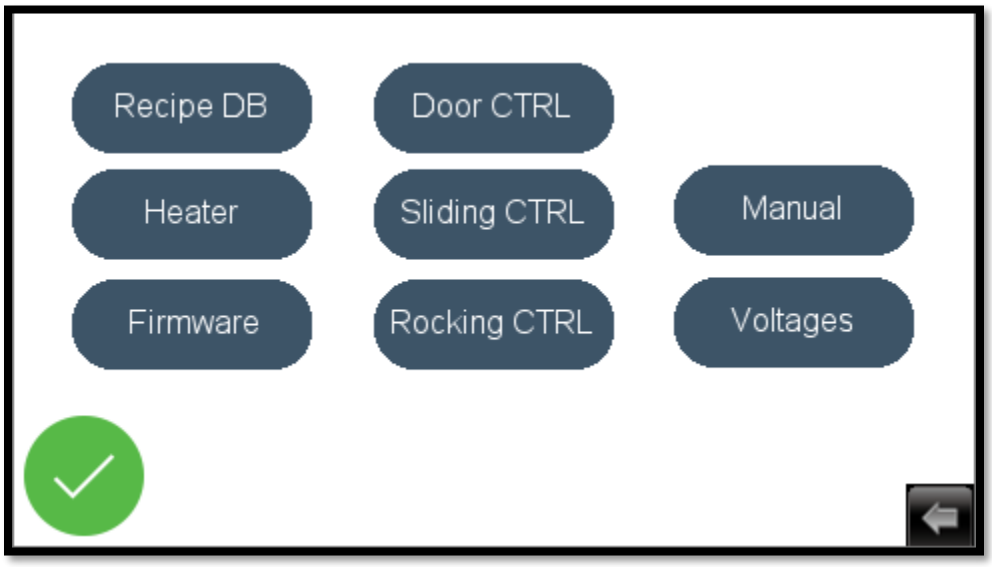
### ETHERNET CONNECTION AND IP INFORMATION

See Section 15 - CPlive Capabilities Page 57 for additional information on the connection possibilities of the instrument.


## Section 11 - Service parameters

This section presents an advanced interface window that can be used to adjust the offset sensitivities of various electro-mechanical sensors on the fluxer.


To access service parameters, first unlock the advanced mode (see page 32, Unlocking the advanced mode), then touch the Service Parameters icon that is now available on the main display screen.




> ***WARNING: Changing these parameters should only be done by trained personnel. Incorrectly setting these parameters could cause damage to the instrument.***

## Section 12 - Fusion troubleshooting

This section presents the most common fusion-related problems. For specific assistance, please do not hesitate to contact us (see page 68, Contacting Katanax®).

### DISK CRACKS

Disk cracking occurs when there is internal stress within the glass bead. The specific causes can vary as follows:

*Glass disk sticks to the mold*

If disk top surface is concave (disk adheres to the mold walls); add non-wetting agent at the beginning or during the fusion. Katanax® recommends lithium bromide.

*Glass disk contains undissolved particles*

Some samples may not be completely dissolved. Make sure that the sample is fully oxidized or decrease the amount of sample.

*Glass disk is improperly cooled*

Generally, cooling a disk too fast can cause its cracking. Allow more time for the still-air cooling (i.e. before starting the cooling blower). Generally, natural cooling (no blower) between 1min. and 1min. 30s should be fine.

## DISK CRYSTALLIZES

Crystallization reaction cause the transparent melt in the mold to become milky-opaque during cooling, typically from the edges towards the center, pushing the still-liquid melt to the center and upwards as crystallization progresses, thus creating a volcano-like structure.

*Inappropriate flux*

Crystallization will occur if too alkaline a flux is used (i.e. too much lithium metaborate). Increase the proportion of tetraborate to compensate. Sometimes the solution is to add a bit of sample (e.g.: SiO2).

*External contamination*

In some circumstances, dirt, dust or other small debris can be sucked into the blower and land onto the glass bead. This type of crystallization will develop from this single point on the surface and radiate outwards. Cleaning the instrument's base and surroundings will correct the problem.

## INCOMPLETE DISK

This symptom causes disks that have the shape of a moon crescent, i.e. a circle with a missing section.

It is caused by the mold not containing enough flux, by the mold not being leveled or by an excessive amount of non-wetting agent. Add flux or level instrument/mold holder accordingly.

## NON-HOMOGENOUS DISK

When holding the glass disk in front of a light source, if you can observe powdery residues, then some sample may not have dissolved.

*Sample is not fully oxidized*

As we know, un-oxidized sample cannot be dissolved in flux, and may also cause damages to platinumware. Make sure to use the proper type and amount of oxidizer.

*Oversaturation*

A fusion being a dissolution reaction, it is perfectly possible to obtain an oversaturated bead. Simply reducing the amount of sample will correct the problem.

*Improper grinding*

If the sample is too coarse, or if it lumps together easily, then the time allotted by the fusion program might not be long enough.

One can either extend the fusion duration or grind the sample to a finer granulometry. We recommend smaller than 100 µm. Also, a manual mixing of the sample with the flux can often prevent the lumping issues.

Sometimes, the small "dust" is actually gas (see below).

## BUBBLES IN DISK

Typical with carbonate samples, this phenomenon exhibits gaseous bubbles that remain imprisoned within the glass disk.

In many cases, simply placing the sample on top of the flux and not mixing will allow the sample to de-gas and thus avoid this problem. However, some samples are known to make lumps and become harder to dissolve if not mixed; if that is the case, then simply allow a period of slow mixing for an extra minute or two, just before pouring.

## Section 13 - X-100 Maintenance

This instrument requires some regular checking, which is very important to keep your instrument up and running.

Katanax® knows that a broken instrument in a laboratory setting causes sample back-up and unnecessary costs. That is why this manual comprises not only a Periodic inspection section, but also a Service operations chapter (see page 46), which guides the user in a step-by-step fashion through operations that sometimes need to be performed on-site.

If unsure, do not hesitate to get in touch with a Katanax® technician (see page 68, Contacting Katanax®). Assistance by phone or email is always free of charge.

Note that no modifications of the instrument are allowed, except those explicitly described and permitted in this manual. Any undue modification automatically cancels the warranty and could endanger the user's life.

> ***WARNING: Some of the procedures described in the following pages imply a risk of death by electrocution; those procedures shall be executed only by trained personnel.***

### INSPECTION SCHEDULE TABLE

| Frequency | Checkpoint | Description | Action (if problem found) | Page |
|---|---|---|---|---|
| Every fusion | Flux spillage on holders | Check for flux deposits | Cleaning | 41 |
| 1 month or 300 cycles | Holder alignment and functionality | Check for mis-aligned, chipped, cracked or broken ceramic parts | Adjust or replace damaged parts | 42 |
| | Furnace chimney cleaning | Check for flux build-up | Clean | 43 |
| | Air filters for cooling (mold and electronic) | Remove the filters for cleaning | Clean | 43 |
| 3 months or 1000 cycles | Element terminal connections | Check for correct tightening and absence of oxidation | Re-tighten or replace | 44 |
| | Furnace cleanliness | Check that furnace is clean and insulation is not cracked | Replace or clean | 44 |
| | Thermocouple junction | Check junction | Replace | 45 |
| | Holder and furnace door motions | Check proper working, look for obstruction | Adjust, or clean | 46 |

### FLUX SPILLAGE ON HOLDER PROCEDURE

This procedure outlines the steps to inspect and clean flux spillages (residues) from the holder, which is crucial to prevent deterioration of key components.

1. Visual Inspection
   1.1. Inspect for Flux Residues
      - Perform a visual inspection before each fusion cycle.
      - Look for vitrified, darker, or colored spots on the ceramic parts of the holder.
   1.2. Clean or Replace Affected Parts
      - If any spillage is detected on the holder components, clean or replace the affected parts immediately.

- Refer to the holder section of this manual for instructions on removing, replacing, or disassembling holders. Be cautious, as molten flux may act as a strong adhesive between components.

2. Disassembly and Cleaning
   2.1. Disassemble Contaminated Parts
   - If any parts are found to be contaminated with flux deposits, carefully disassemble those components.
3. Cleaning Methods
   3.1. Mechanical Rubbing
   - For cleaning ceramic parts, mechanical rubbing is usually sufficient. Use a specialized diamond file or another ceramic part for smaller spills.

> ***WARNING: Do not use these cleaning procedures on platinum crucibles or molds, as they can cause irreversible damage to precious metals.***

   3.2. Chemical Cleaning Solution
   - For larger spills, follow these steps:
     i **Prepare the Solution:** In a large container (e.g., a 2-liter Pyrex beaker), mix a 20% solution of ammonium nitrate ($NH_4NO_3$) with a 20% solution of hydrochloric acid (HCl).
     ii **Heat the Solution:** Place the container on a hot plate and warm the solution to 80°C. (The cleaning solution will be ineffective until this temperature is reached.)
     iii **Stir the Solution:** If your hot plate has a magnetic stirrer, add a magnetic bar to agitate the warm solution, which will help accelerate the dissolution of flux.
     iv **Cleaning Duration:**
     - ♦ For small or recent spills, allow 30 minutes to 1 hour for effective cleaning.
     - ♦ For larger or older spills, up to 2 hours may be required.

   3.3. Use of Rotary Tools
   - For significant spillages, a diamond disc mounted on a high-speed rotary tool (e.g., Dremel™) can be used to remove large portions of spillage. Follow this with the chemical solution for final cleaning.
   - Exercise caution to avoid grinding the ceramic part itself.
4. Final Check
   - After cleaning, ensure all parts are free from flux deposits before reassembling and using the furnace.

## HOLDER ALIGNMENT AND FUNCTIONALITY PROCEDURE

This procedure outlines the steps to ensure proper positioning and functionality of both crucible and mold holders.

1. Preparation for Inspection
   1.1. Safety Measures
   - Unplug the X-100 and allow it to cool down completely.
2. Inspection of the holders
   2.1. Check Mold Holder Position
   - Ensure mold holder is perfectly horizontal.
   2.2. Inspect for Flux Spillage
   - Check for any flux spillage on the holders. If flux deposits are found, refer to Page 41
   2.3. Test Crucible Holder Movement
   - Ensure crucible holder can rock and pour into the molds freely, without any rubbing or hitting. Simulate the rocking and pouring movement manually.

2.4. Tighten Grip Assembly Screws
- Using the appropriate tools, check that screws securing the grip assembly for the mold fingers are tightly fastened.

2.5. Verify Holder Movement Inside the Furnace
- Manually swing the holders to the maximum right position.
- Open the furnace door and gently move the holders inside.
- Close the furnace door, ensuring there is no rubbing or undue contact.
- (Refer to page 51 for Mold holder configuration for additional details.)

If any adjustments or replacements are necessary, please refer to the appropriate section in Section 14 -Service operations (see page 46).

## AIR FILTER MAINTENANCE PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 240 Volts inside! Risk of electrocution!***

The air that is drawn through the blower to cool the mold goes through a filter before actually entering into the unit. This filter will catch medium to large sized airborne particles, and requires periodic cleaning. Similar air filters exist for the general electronic area and the electrical heating components.

1. Procedure preparation
   - Ensure that any platinumware is removed from the mold holder.
   - Move the holder inside the furnace and close the furnace door.
   - Carefully rotate the instrument to rest on its right side.
2. Cleaning the Air Filters
   - Using a vacuum cleaner, remove any accumulated dust from the three air filters
3. Put the instrument back on its feet.

## FURNACE CHIMNEY CLEANING PROCEDURE

The furnace is equipped with a chimney designed to vent chemicals expelled during fusion. Regular inspection and cleaning are essential to maintain efficiency.

1. Visual Inspection
   - Stand on a small step to look directly down into each chimney.
   - The inside walls should appear smooth and solid white.
2. Cleaning Process (if necessary)
   2.1. Safety Measures
   - Unplug the X-100 and allow it to cool down completely.

   2.2. Remove the Chimney
   - Slowly pull the chimney out to detach it from the furnace.

   2.3. Clean the Inside
   - Use a suitable brush or the eraser end of a pencil to scrub away any deposits from the inside walls of the chimney.

   2.4. Reinstall the Chimney
   - Carefully re-install the chimney after cleaning, ensuring it is secured properly.
3. Final Check

- After reinstalling, check that the chimney is correctly positioned and free of obstructions before resuming operation.

## ELEMENT TERMINAL CONNECTIONS PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 115 or 230 Volts inside! Risk of electrocution!***

1. Preparation for Inspection
   1.1. Safety Measures
      - Unplug the X-100 and allow it to cool down completely.
   1.2. Remove the Top Casing
      - Remove the top casing. Refer to Removing top casing procedure on page 47,.
2. Check Integrity of Element Ceramic Connectors and Terminals
   2.1. Visual Inspection
      - Inspect all ceramic connectors and terminals visually.
      - Ensure that none are overly oxidized. If any faulty connectors are identified, replace them immediately.
   2.2. Verify Terminal Tightness
      - Using an appropriate tool, check that all wire terminals on the ceramic connectors are securely tightened, both on the element side and on the wire side.
      - Note: Do not over-torque the screws; simply ensure they have not become loosened.
3. Reassembly
      - After inspection and any necessary replacements, reattach the top casing securely before reconnecting the instrument to the power outlet.

## FURNACE INSPECTION PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 115 or230 Volts inside! Risk of electrocution!***

1. Preparation for Inspection
   1.1. Safety Measures
      - Unplug the X-100 and allow it to cool down completely.
   1.2. Remove Top Casing
      - Remove the instrument's top casing. Refer to page 47 for instructions on the Removing top casing procedure.
   1.3. Position Holders
      - Move the holders to the maximum right position and open the furnace door.
2. Visual Inspection
   2.1. Check heating elements
      - Inspect heating elements visually
      - Ensure there is no visual damage on the elements
         - ♦ Discoloration is normal
   2.2. Check Door and Insulation
      - Inspect the furnace door and insulation visually.

- Ensure there are no parts that may fall or exhibit severe cracks that could impair functionality.

3. Cleaning
   3.1. Dust Removal
   - Wear a dust mask and gloves for protection.
   - Using a vacuum cleaner, carefully remove all dust from the furnace and door.
   - **Caution**: Avoid direct contact between the vacuum tube and the material, as it is very fragile and brittle.
4. Faulty Parts
   4.1. Identify and Replace
   - Any parts found to be faulty should be ordered and replaced as quickly as possible.
5. Final Steps
   - After the inspection and cleaning, reassemble the top casing before reconnecting the instrument to the power outlet.

## THERMOCOUPLE JUNCTION INSPECTION PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 115 or 230 Volts inside! Risk of electrocution!***

The thermocouple used in the instrument is a platinum-platinum/rhodium (type R) model, known for its durability. It is impervious to oxidation and can withstand high temperatures. However, it is important to note that the junction (the tip) can be damaged by mechanical incidents. Regular inspections for visible damage are essential to ensure proper functionality.

1. Preparation for Inspection
   1.1. Safety Measures
   - Unplug the X-100 and allow it to cool down completely.
   1.2. Remove Top Casing
   - Remove the instrument's top casing. Refer to page 47 for instructions on the Removing top casing procedure
   1.3. Position Holders
   - Move the holders to the maximum right position and open the furnace door to access the thermocouple tip.
2. Visual Inspection

   **Note:** The thermocouple appears as a thin white ceramic rod angled at 45°. The actual thermocouple is the metal junction at its tip. A small flashlight may be useful for better visibility.

   2.1. Check for Damage
   - Visually inspect the thermocouple junction for any signs of mechanical damage.
   - Look for any evidence of crushing or other damage that could impair functionality.
3. Action on Damage
   - If the junction is found to be damaged, a new thermocouple should be ordered and installed as soon as possible.
4. Final Steps
   - After completing the inspection, reattach the top casing securely before reconnecting the instrument to the power outlet.

### HOLDER AND FURNACE DOOR MOTIONS PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 115 or 230 Volts inside! Risk of electrocution!***

To perform functionality verification, do the following:

1. Power On the Instrument
    - Power ON the X-100 and select a method that does not heat (e.g., “TEST”).
2. Test Holder Movements

    2.1. Access Service Parameters
    - Access the Service parameters window (see page 39) and then press the manual button.
    - Press the “OUT”  button to slide the holders into the furnace.
    - Press the “IN”  button to slide the holders out of the furnace.

    2.2. Repeat Movements
    - Repeat these operations 4 or 5 times to verify that no jerking movement occurs.
3. Identify Issues
    - If jerking or mechanical interference occurs, identify and resolve the source of interference.
    - If issues persist, contact Katanax® for assistance to adjust parameters for smooth motions in and out of the furnace.
4. Confirmation of Normal Function
    - If movement occurs normally, no adjustment is needed.

## Section 14 - Service operations

This section describes tasks that are performed on a regular basis and are performed to adjust or repair a malfunctioning system of the instrument.

Some sections also describe initial operations, which need to be performed before first using the unit (e.g. assembling the crucible holder and the mold holder).

Should you have any questions, or need further assistance, please do not hesitate to contact us (see page 68,Contacting Katanax®).

Note that your unit is able to be remotely diagnosed by Katanax® service personnel, with a few configuration steps described in Allowing Katanax® support to access your Fluxer Procedure, on page 59.

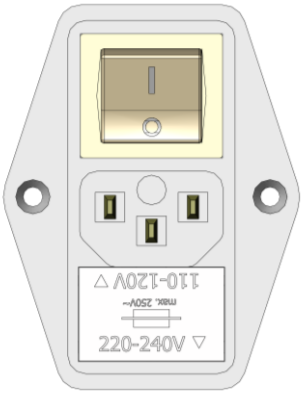
> ***IMPORTANT: Some of the procedures described in the following pages imply a risk of death by electrocution; those procedures shall be executed only by trained personnel. 115 or 230 Volts inside!***

### REPLACE MAIN PROTECTIVE FUSES

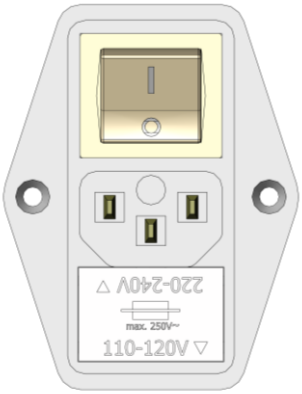
In this section you will find all the information to proceed with the replacement of fuses. In general, blown fuses are observed if there is a short circuit or if too much current is required by the instrument. The most common

case of a blown fuse is that of a heating element that wears out and will create a brief short circuit before dying in an open circuit. Therefore, before replacing a fuse, it is advisable to check the integrity of the heating elements. If a damaged heating element is found, replace it before replacing the damaged fuses.

1. Preparation
   1.1. Safety Measures
      - Unplug the X-100 and allow it to cool down completely.
2. Replace the fuses
      - Make sure the fuse specifications are good: 250 VAC, 10 A (F10AL250V – low capacity and fast acting type – 5X20mm).
      - Detach the power cable from the power inlet module on the back of the unit.
      - Use a small flat screwdriver to pull out the fuse module.
      - Remove the damaged fuses.
      - Install the new fuses.
      - Reinsert the fuse module, ensuring that the orientation is correct for the voltage configuration of the appliance (115 or 230 VAC) and the source. The selected operating voltage is pointed by the arrow as indicated in the picture.




230 VAC Configuration



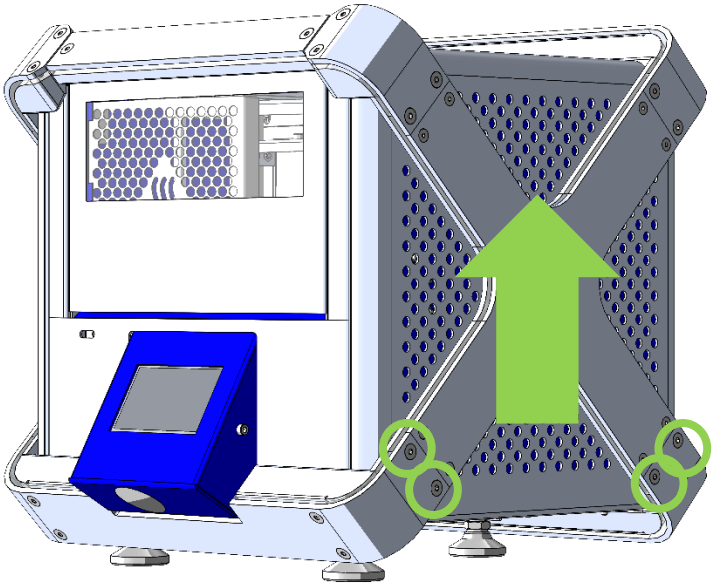

115 VAC Configuration

> ***WARNING: Damage to the instrument or malfunction may occur if the fuse module is not inserted in the correct orientation with respect to the operating voltage.***

      - Attach the power cable to the unit.

## REMOVING TOP CASING PROCEDURE

1. Preparation
   1.1. Safety Measures
      - Unplug the X-100 and allow it to cool down completely.
2. Removing top casing
   2.1. Remove the Screws
      - Locate and remove the screws as indicated.
         - ♦ 4 screws on each side.



2.2. Lift the casing

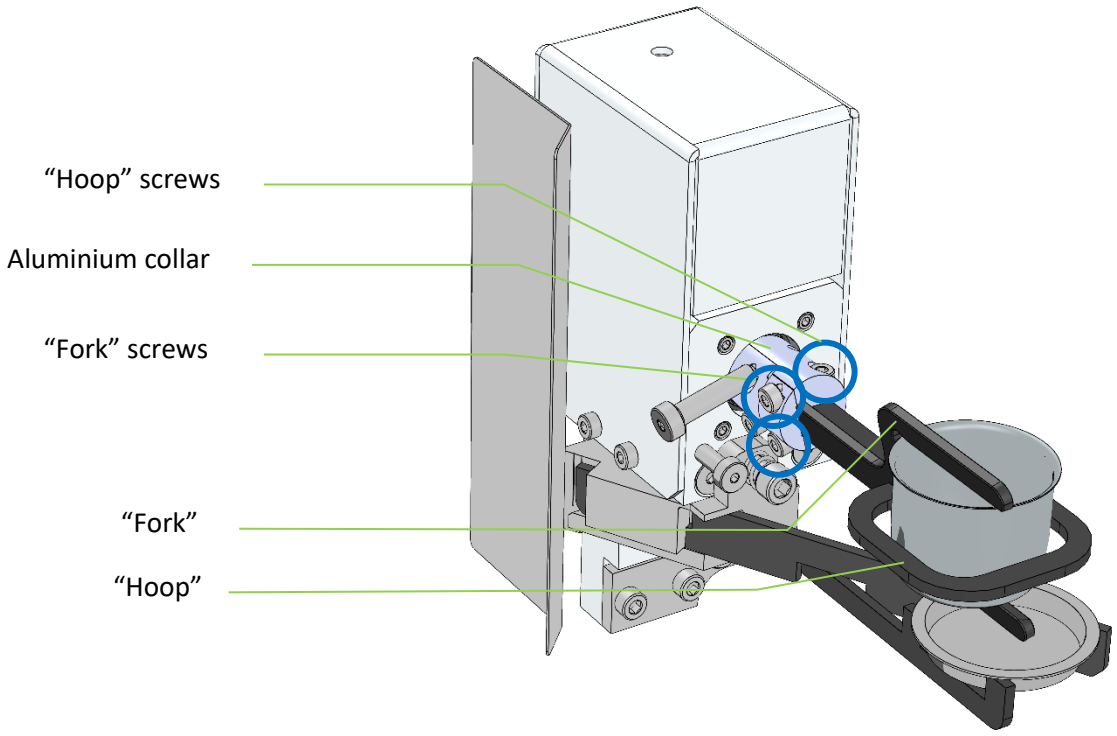
- Carefully lift the casing straight up to disengage the light connection.

## REPLACING TOP CASING PROCEDURE

1. Preparation
   1.1. Safety Measures
   - Unplug the X-100 and allow it to cool down completely.
   1.2. Open the Safety Shield
   - Partially open the safety shield.
2. Placing top casing
   2.1. Lower the casing
   - Carefully lower the casing straight down to engage the light connection on the right ceiling.
   - Ensure the bottom panel holes align with the holes of the base assembly.
   2.2. Install the Screws
   - Locate and install the screws as indicated above.
     - 4 screws on each side.

## CRUCIBLE HOLDER REMOVAL PROCEDURE

1. Preparation
   1.1. Remove Platinumware
   - Remove any crucibles and molds from the holders.
   1.2. Understand Holder Components
   - The crucible holder consists of two parts: the "fork" (with two prongs) and the "hoop" (a closed square with rounded corners).
     - If there is a suspected flux spillage, remove both the hoop and fork simultaneously, as they may be partially “glued” together in flux.




2. Remove the Hoop
   2.1. Locate the Screw
3. Find and un-tighten the screw that is isolated (not part of a group of four). Full removal of the screw is not necessary.
   3.1. Pull the Hoop
      - Gently pull on the hoop to remove it, noting the notch where the holding screw was located.
4. Remove the Fork
   4.1. Locate the Collar Screws
      - Identify and un-tighten the two collar screws closer to the front of the unit. Full removal of these screws is not required.
   4.2. Pull the Fork
      - Gently pull on the fork to remove it.
5. Maintenance
   5.1. Replace or clean any damaged or flux-soiled parts as needed. The use of a small diamond file or a rotary tool fitted with a diamond disk can be effective for removing any forming glass from the holders.

## CRUCIBLE HOLDER INSTALLATION PROCEDURE

In this section, you will find essential information needed to properly re-install the crucible holder. Please follow the instructions carefully to prevent pouring issues.

1. Positioning the Collar
   1.1. Locate the screw
      - Manually rotate the crucible rocking collar until its four grouped screw heads point upwards.
2. Placing the Fork
   2.1. Orient the Fork
      - Examine the fork closely; it is not symmetrical. The prong with the longer transversal branch should be oriented to the right.

2.2. Inserting the Fork

- Fully insert the main stem of the fork into the horizontal slot, ensuring the longer branch remains on the right and that the fork is perfectly aligned with the collar.

2.3. Securing the Fork

- Tighten the two screws that compress and hold the fork stem. Ensure both screws are tightened approximately at the same rate to close the gap uniformly.

3. Placing the Hoop

3.1. Align the collar

- Rotate the collars approximately 90° counterclockwise. A lone screw head (for the hoop) should now be pointing upwards.

3.2. Inserting the Hoop

- Insert the hoop into its designated slot, aligning its notch with the screw, which should face towards the right.

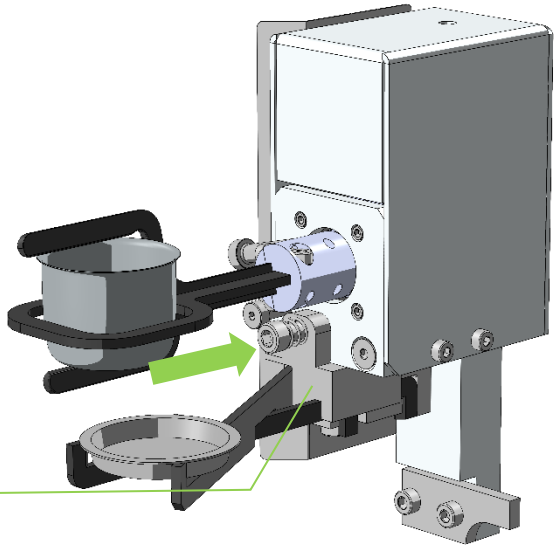
3.3. Securing the Hoop

- Gently tighten the hoop screw. Note that the screw should not compress anything; it is the threaded body of the screw in the hoop's notch that prevents the hoop from coming off.

## MOLD HOLDER REMOVAL PROCEDURE

Removing the mold holder(s) is required when preparing solutions. Please follow the steps carefully to ensure proper handling.

1. Remove the Mold
   - Start by removing any mold from the mold holder(s).
2. Locate the Mold Holder
   - The mold holder consists of two long black ceramic "fingers" that are fastened to a common aluminum support. This support is secured to the motor plate by a single screw threaded through a spring, allowing for some movement if the fragile fingers are bumped.




3. Remove the Support
   - Using a hex key, remove the screw as shown in the provided illustration.
   - Exercise caution not to drop the screw or spring.
4. Store the Mold Holder

- Carefully store the mold holder until they are needed again. Take care, as the fingers are sharp and brittle.
- Ensure that you do not lose the spring or screw.

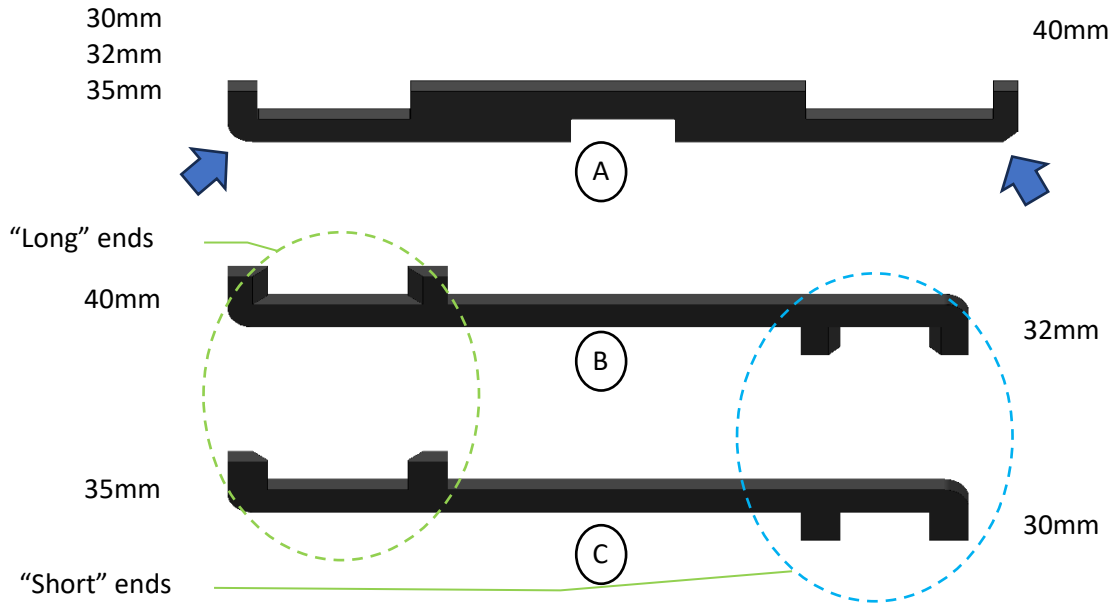
## MOLD HOLDER CONFIGURATION

In this section, you will find essential information needed to properly assemble and align the mold holder assembly.

### *Introduction to the mold holder assembly*

One of the nice features of the X-100 fluxer is the possibility to adapt to various mold diameters. All that is required is a re-configuration of the mold holder assembly.

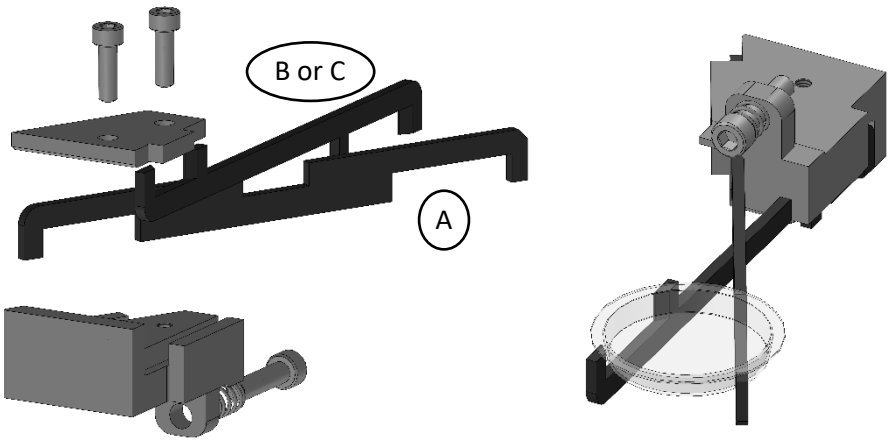
The mold holder comprises up to three “fingers”, designed to accommodate the four common mold sizes (30, 32, 35, 40 mm and more). The molds fit between vertical prongs at the free end of each finger. Finger A is used in all configurations. Finger B is used for the 32mm and 40mm molds. Finger C is used for the 30mm and 35mm molds.




Please refer to page 48, Crucible holder removal procedure, to learn how to remove the mold holders and supports.

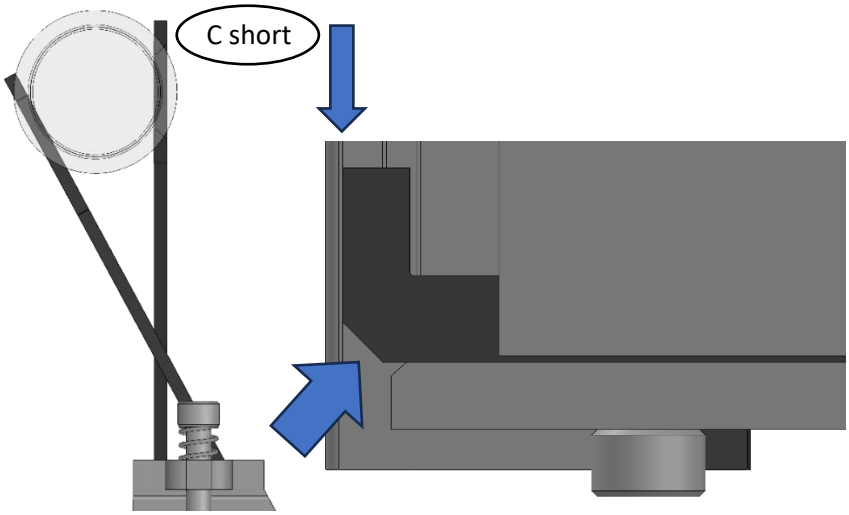
Finger A possess a Round Side and a straight chamfered side. Finger B and C ends with perpendicular prongs; at one end, the prongs are close one to another (“short” end), and they are farther apart at the other end (“long end”). Finger A round side is designed to accommodate molds 30, 32 and 35mm, while the straight side is design to accommodate the mold 40mm. The “short” end of Finger B and C is designed to accommodate the smaller molds (30 and 32 mm), while the “long” end of Finger B and C is designed to accommodate the larger molds (35 and 40 mm).

The mold holder is composed of the Finger A that is used in all configurations and either the Finger B or C. The two fingers are held in place on the holder using a tab and screws as shown below. On the side of the holder, a mark has been engraved. Finger A must be aligned with the corresponding mark to hold the mold correctly.

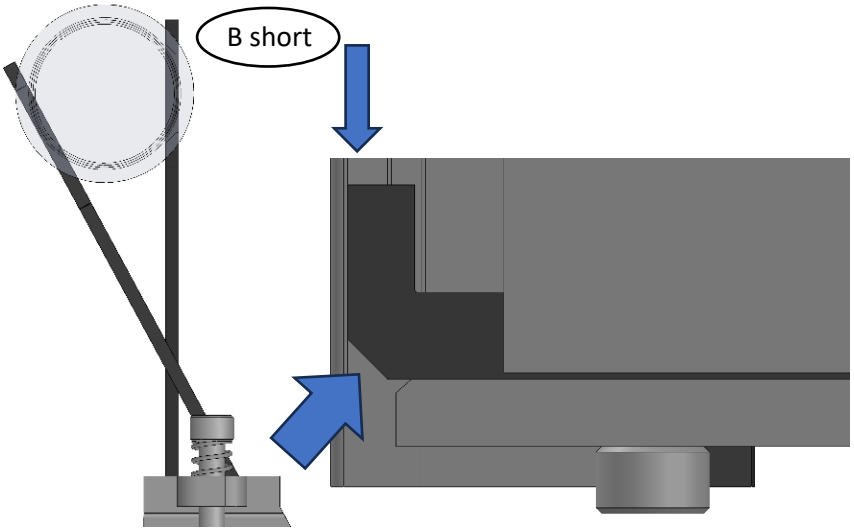



To assemble the desired configuration, refer to the appropriate illustration to select the correct finger, appropriate orientation and locate the correct placement of the finger A.

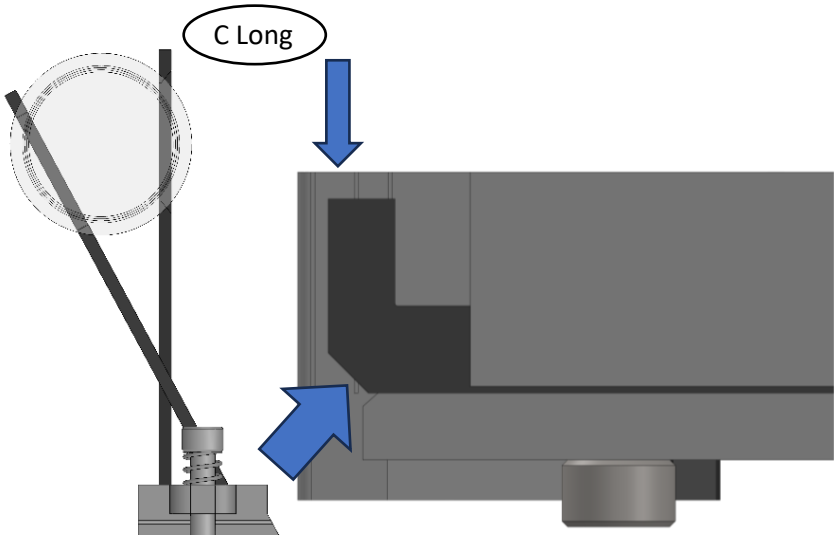
*30mm mold configuration:*



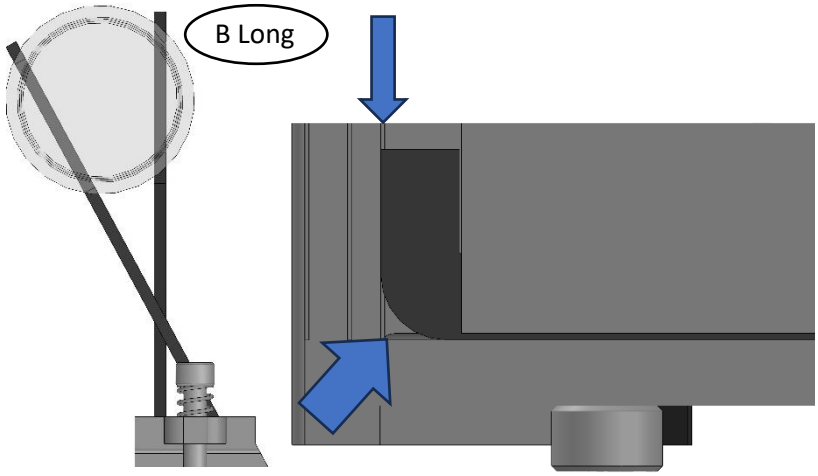

*32mm mold configuration:*



*35mm mold configuration:*




*40mm mold configuration:*




Notice in the picture that the two small molds are fitted in the “short” end prongs, while the two larger ones are in the “long” end prongs. Once the configuration is chosen and assembled, install a mold to check that it is well supported and cannot fall when slid in all directions. If necessary, position of finger A can be slightly adjusted to get a smaller gap and a better holding of the mold.

## MOLD HOLDER INSTALLATION PROCEDURE

To ensure proper installation of the mold holder for the desired mold size, follow these steps carefully.

1. Install Fingers
   1.1. Select Configuration
      - Select the correct configuration for the desired mold size.
      - Install either finger B or C onto the support, ensuring that the correct side for the desired mold size points outward. The unused side should be positioned against the support.
   1.2. Install Finger A
      - Install finger A on the support.
      - Align finger A with the corresponding mark indicating the desired mold size configuration.

1.3. Secure Fingers

- Place the holding tab on top of both fingers and screw it down to lock the fingers in place.

2. Check Mold Fit
   - Ensure that the mold fits securely on the mold support and will not fall.
   - Remove the mold afterward to install the support
3. Install Support in X-100
   - Attach Spring and Secure
   - Place the spring on the screw and secure the support in place. Tighten until you achieve a gentle compression of the spring.

## HEATING ELEMENT REPLACEMENT PROCEDURE

***IMPORTANT: Some of the procedures described in the following pages imply a risk of death by electrocution; those procedures shall be executed only by trained personnel. 115 or 230 Volts inside!***

1. Preparation

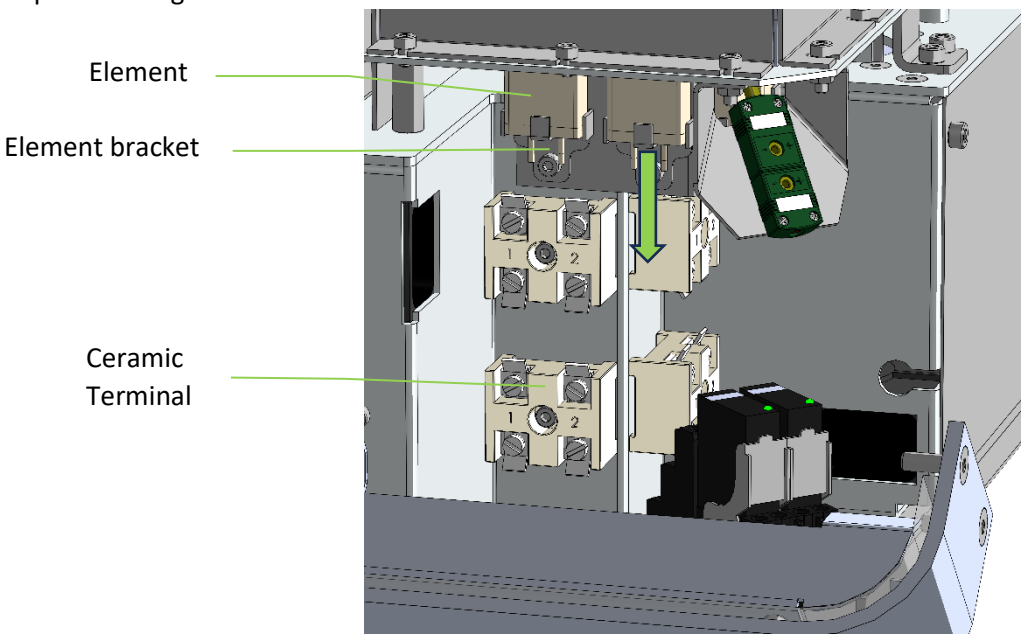
1.1. Turn Off the Fluxer

- Unplug the X-100 and allow it to cool down completely.

1.2. Remove the Top Casing

- Follow the instructions outlined in the Removing top casing procedure, Page 46.

2. Replace damaged element




2.1. Remove the elements

- Loosen the two top screws of the associated ceramic terminal connector.
- Disconnect the fork terminals.
- Unscrew and remove the element holder while ensuring that you hold the heating element to prevent it from falling into the instrument.
- Gently pull the heating element down and discard the damaged element.

2.2. Place new elements

- Gently insert the new heating element into the furnace.
- Securely fasten the element holder using the removed screw and holder.
- Insert the fork terminals of the new element into the ceramic connector.

- Tighten the terminal screws securely.

3. Repeat step 2, until all damaged heating elements have been replaced.
4. Finalization
   4.1. Verification
   - Ensure that all heating elements are fully inserted.

   4.2. Reinstall top casing
   - Follow the Replacing top casing procedure, page 48.

   4.3. Power on
   - Reconnect the instrument.

## ACCESS ELECTRICAL COMPARTMENT PROCEDURE

***IMPORTANT: Always disconnect the instrument from the power outlet when working with panels removed. 115 or 230 Volts inside! Risk of electrocution!***

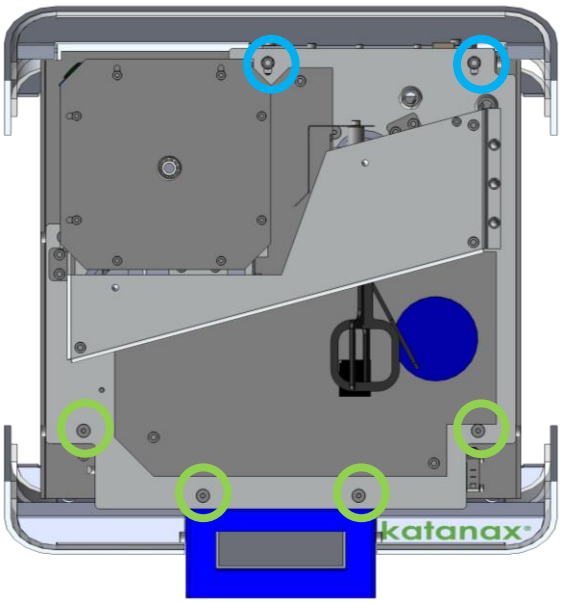
The electrical compartment should not be opened during normal operation unless instructed to do so by Katanax service team. To access the electrical compartment, follow these steps.

1. Preparation
   1.1. Turn Off the Fluxer
   - Unplug the X-100 and allow it to cool down completely.

   1.2. Remove the Top Casing
   - Follow the instructions outlined in the Removing top casing procedure, Page 46.

2. Move the Holders to a secure location.
   2.1. Place holder in furnace
   - Open the furnace and move the holders inside the furnace
   - Close the furnace door to prevent the holder from moving.

3. Access the electrical compartment
   3.1. Locate the screw holding the floor
   - 4 screws in the front
   - 2 nuts in the back
     i It is not required to remove the nut completely




3.2. Open the floor

- Tilt the floor upward to open the electrical compartment.
  - i Make sure the Holders and furnace door are in a secure position and do not swing when the floor is tilted.
- Use the stud to guide the rear of the floor during the opening

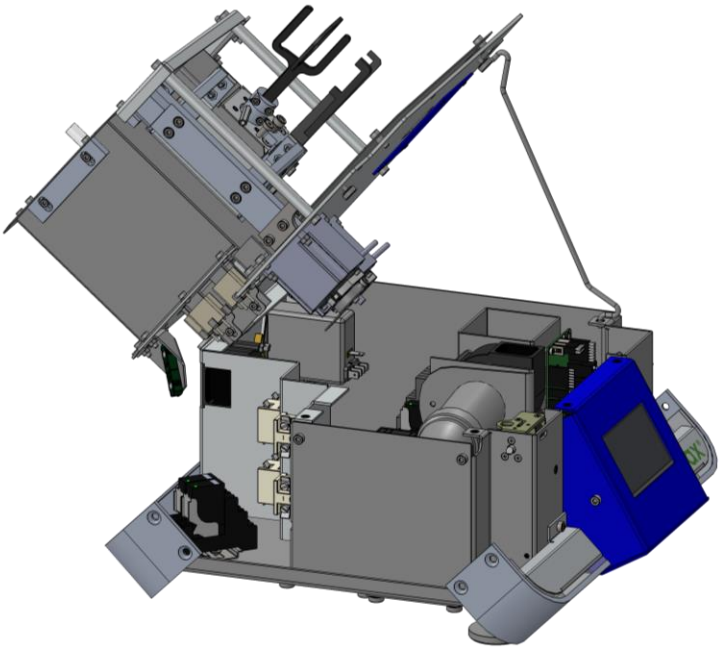
4. Secure the Floor open

4.1. Access the support rod screw under the floor

- Unscrew the 2 thumb screws holding the support rod under the floor.

4.2. Place the support rod

- Place the support rod in the holes of the front screw to secure the floor in place
- If the floor no not feel secure enough partly screw the rear nut until the assembly is stable.

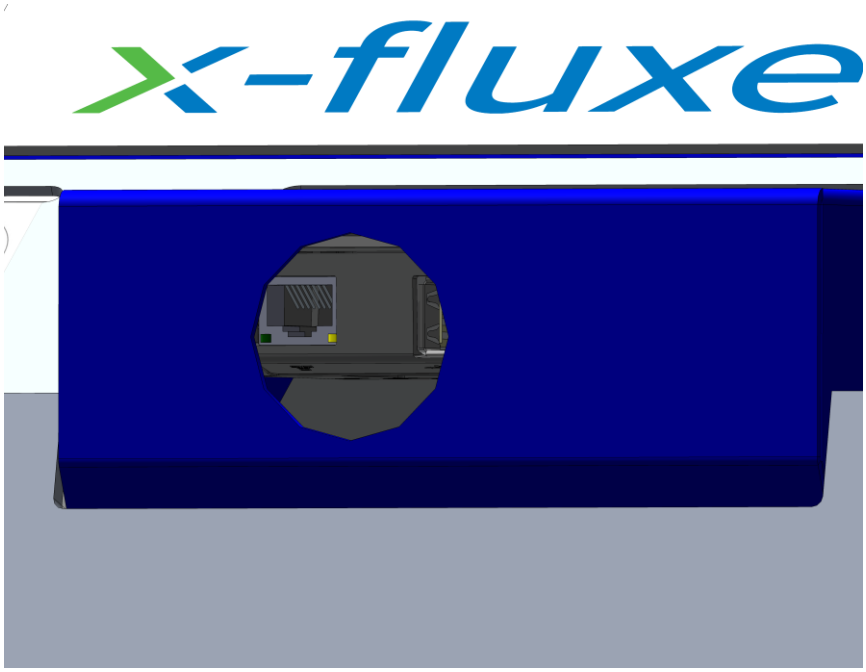


## Section 15 - CPlive Capabilities

### CONNECTING THE FLUXER TO YOUR LAN

It is possible for users to access data log files from stored on the fluxer and even to control it remotely. For these actions to be possible, the fluxer must first be connected to your local area network ("LAN").

5. Preparation
   5.1. Turn Off the Fluxer
      - Begin by turning the fluxer OFF.
6. Connecting the Ethernet Cable
   6.1. Locate Ethernet Port
      - Connect one end of an Ethernet cable to Ethernet Port 1 of the HMI. This port is located under the HMI, on the far left.




   6.2. Connect to Network
      - Connect the other end of the Ethernet cable to a working network outlet in your building.
7. Power On the Fluxer
   7.1. Turn On the Fluxer
      - Turn the fluxer back ON. The device should now be connected to your LAN and assigned an IP address.
8. Check Connectivity and Obtain IP Address
   8.1. Access Global Parameters
      - To verify connectivity and obtain the IP address, click the global parameters button. 


   8.2. Record IP Address

- Write down the IP address displayed for your fluxer, e.g., 10.24.140.99 in the example shown.

8.3. Troubleshoot Connectivity Issues

- If the IP address field shows "0.0.0.0," this indicates a connectivity issue. Verify the Ethernet cable connection and check the LAN wall socket for a signal.

## CONTROLLING THE FLUXER FROM A REMOTE DEVICE

It is possible to remotely access the touchscreen of your fluxer remotely, through a computer, a tablet or a cellphone.

Additionally, with your explicit permission, it is possible for a Katanax® technician to access it, thus allowing for remote diagnostics of your unit.

### *Remote Control of the Fluxer via VNC Procedure*

This allows the user to see a clone image of the fluxer's touchscreen, and even interact with it. Any action that can be done on the fluxer's touchscreen can also be done on the remote device.

> ***IMPORTANT: Ensure that both the fluxer and the controlling device are connected to the same LAN to enable remote control functionality.***

1. Network Connection
   1.1. Connect the Fluxer
   - Connect the fluxer to your local network and note the fluxer's IP address. Refer to Connecting the fluxer to your LAN, page 57 for details.
2. Install VNC Viewer
   2.1. Download VNC Viewer
   - You will need a Virtual Networking Computing (VNC) viewer to control the fluxer. The following example uses the free VNC viewer from RealVNC, which can be downloaded from RealVNC.
     - https://www.realvnc.com/en/connect/download/viewer/

   2.2. Install the VNC Viewer
   - Download and install the VNC viewer on your computer.
3. Configure VNC Viewer
   3.1. Create a New Connection
   - Click "File > New Connection." A new window will appear.

   3.2. General Tab Configuration
   - In the "VNC Server" field, type your fluxer's IP address.
   - In the "Name" field, type a connection name. It is recommended to use the serial number of your instrument.

   3.3. Options Tab Configuration
   - If you wish to access the fluxer in view-only mode, tick the appropriate box.

   3.4. Finalize Connection Profile
   - Click "OK." Your connection profile is now created.
4. Establish Connection
   4.1. Initiate Connection
   - Double-click on the connection profile you just created to initiate the connection process.

   4.2. Handle Security Warning
   - You may receive a warning that the connection with the fluxer will not be encrypted. Tick the box and click on "Continue."

4.3. Enter Password
- If the initial handshake is successful, you will be prompted for a password. Enter “111111” (six times the number one).

4.4. Save Password Option
- Tick the box if you want your device to remember your password, then click “OK” to connect.

5. Interaction and Disconnection

5.1. Remote Interaction
- You are now connected to your fluxer. You can interact with both the computer (remote) and the fluxer touchscreen (local).

5.2. Disconnecting
- To disconnect, simply close the VNC Viewer window.

5.3. Reconnecting
- To reconnect, start this procedure again from step 3.

**NOTE:** If the connection fails on a given day, it may be due to a new IP address assigned to the fluxer by your network’s DHCP server. Check the IP address of the fluxer and reconfigure the VNC connection accordingly.

### *Allowing Katanax® support to access your Fluxer Procedure*

For diagnosis purposes, you can grant a remote access to your fluxer, to a member of the Katanax® service and support department.

1. Contact Service Department
   - Email our Service department at service@katanax.com and provide the serial number of your unit. The serial number can be found on the back of the unit and on the Global Parameters screen.
2. Connect to Your Network
   - Refer to Connecting the fluxer to your LAN on page 57 for instructions on connecting your fluxer to your network.
   - Make sure the LAN is connected to the internet.
3. Power On the Fluxer
   - Turn your fluxer ON and access the Global Parameters screen. 
4. Enable WAN Remote Access

   Activate the WAN remote access switch. This will enable Katanax® to remotely access the screen of your fluxer. If the switch was OFF, turn it ON, wait 1 minute and reboot the unit to allow the remote connection. Visit again the global parameter screen to confirm that the WAN connection is effectively activated.


♦ **Important:** You may turn the switch back to OFF once the service is completed.

## Section 16 - Accessories, Consumables and Services

| Fluxes | Platinum | Polishing kit | Flux penser |
|---|---|---|---|
|  |  |  |  |
| Full range of high-quality fusion fluxes | Full range of high-quality Crucibles and molds | All-inclusive solution for restoring the shiny finish to platinumware. | Automatic flux dispensing machine |

### METHOD DEVELOPMENT

Katanax® offer a service of method development. This service provides help to develop fusion methods for your samples. Use the following link to access the form required to access this service.

### BUY SCRAP

Katanax® offers to buy scrap platinum accessories. Use the following link to access additional information on this service.

## Section 17 - Appendix A – Technical specifications

### ELECTRICAL

Voltage ..... 115 or 230 VAC (±10%)

Frequency ..... 50-60 Hz

Electric power ..... 1250 W

Main fuses ..... 250 VAC, 10 A (F10AL250V – low capacity and fast acting type – 5X20mm)

### PHYSICAL

Weight ..... 22 kg (49 lbs)

Height ..... 45 cm (18 in)

Width ..... 45 cm (18 in)

Depth ..... 45 cm (18 in)

## Section 18 - Appendix B – Firmware and program transfers

### PRESET PROGRAMS

This section lists the methods that are factory programmed into the X-100. It is not possible for the user to alter or delete them.

Note that Katanax® cannot be held responsible for any damage to platinumware or fluxer incurred by the use of those methods. Especially, samples containing un-oxidized material should be fused with extreme care. If unsure, please contact Katanax®. We will be glad to prepare an adapted method for your specific sample.

| Name | Applicable to... | Description |
|---|---|---|
| Oxide | Cement, glass, ceramics, petrochemical catalysts, most geochemistry samples and general oxides | Most common fusion method. Must only be applied to fully oxidized material. |
| Metal | Samples containing un-oxidized material | Applicable to metals that can be attacked by acids or bases. This method has a low-temperature oxidation period, in which the solid oxidizer attacks the sample. Fusion is then completed like an oxide. |
| Solution | Oxidized material to be analyzed by wet method. | It is normally used with lithium metaborate. |
| Peroxide | Samples containing metals, often precious, which are attacked in peroxide or peroxide fluxes | Low-temperature fusion that does not pour. Crucible is removed with tongs at the end, cooled a little on a metallic surface, then immersed into acid. Platinum crucibles are normally not used with this method, as the flux would damage the crucible. |
| Test | Test mechanical movement of the unit | This will be used if troubleshooting is required |

## BACKUP OR RESTORE BY USB PROCEDURE

Once your favorite methods are developed and optimized, you might want to store them on a USB flash drive, especially before upgrading the firmware of your instrument. This can also be useful to transfer fusion programs among several fusion instruments.

Alternatively, you might have received from Katanax® a firmware upgrade that you want to install on your instrument.

1. **Backup Fluxer to USB Drive**
   - 1.1. Insert USB Drive
     - Insert a USB flash drive into the USB port of the fusion machine. A dialog will automatically appear after a few seconds.
   - 1.2. Initiate Backup
     - Touch the “Upload” button.
   - 1.3. Enter Password
     - A dialog will request a password and specify which data to upload. Enter the password “111111” (six times the digit one). You may need to drag the dialog window to the left to display the keyboard for typing the password.
   - 1.4. Select Data to Upload
     - Select “Upload Project Files” to back up the firmware (the instrument’s operating system).
     - Select “Upload History Files” if you wish to back up the parameters of the fusion programs.
   - 1.5. Confirm Upload
     - Touch “OK.”
   - 1.6. Choose Destination
     - Select the destination for the data. Double-click on “USBDISK,” then access the sub-directory named “disk_a_1.”
   - 1.7. Start Transfer
     - Click “OK” to initiate the transfer to the USB drive. The screen will black out, and the fluxer will reboot.
   - 1.8. Completion
     - The firmware or programs are now saved, and you can safely remove the USB drive.
2. **Restore Programs, Firmware, or Upgrade Firmware**
   - 2.1. Insert USB Drive
     - To restore a backup you created, insert the USB drive containing your backup files into the USB port of the fluxer.
   - 2.2. Prepare for Firmware Upgrade
     - If you received new firmware via email, extract the directory structure and files to the root directory of a blank USB drive. Then, insert this USB drive into the instrument’s USB port.
   - 2.3. Initiate Restore
     - A dialog will automatically appear after a few seconds. Touch the “Download” button.
   - 2.4. Enter Password
     - A dialog will request a password and specify which data to download. Enter the password “111111” (six times the digit one). You may need to drag the dialog window to the left to access the keyboard for entering the password.
   - 2.5. Select Data to Download

- Select “Download Project Files” to restore or upgrade the firmware (the instrument’s operating system).
- Select “Download History Files” if you want to restore the fusion program parameters.
    - ♦ **Note that this action will erase ALL fusion programs currently stored on your fluxer.**

2.6. Confirm Download
- Touch “OK.”

2.7. Choose Source
- Select the source for the data. By default, double-click on “USBDISK,” then access the sub-directory named “disk_a_1.” If the data is in a different sub-directory, navigate to it.

2.8. Start Transfer
- Click “OK” to start the transfer from the USB drive. The screen will black out, and the fluxer will reboot.

2.9. Completion
- The new firmware or programs are now loaded, and you can remove the USB drive.

## Section 19 - Appendix D – CPLive: Data logging

### INTRODUCTION TO DATA LOGGING

This new generation of fluxers has the ability to record fusion data and sample names/codes. This allows for sample tracking, for quality assurance purposes and to aid in diagnosing why a specific sample may not have lent the expected analytical results.

In your X-Fluxer, data logging is turned off by default. Once it is turned on, at each fusion cycle the user will have the possibility to enter a sample identification name or number for each fusion crucible, either via the touchscreen keyboard or with the optional barcode reader.

Then, when the fusion cycle is started, a new log line entry will be created with several information fields such as the date, time, sample names/IDs (if entered), fusion method name and completion status (with error code, when applicable).

This log is stored as individual daily files in non-volatile memory. Up to 40 daily files can be stored, after which the fluxer will automatically overwrite the older file. The files can be retrieved via the USB port with a memory stick, or remotely via the Ethernet port using FTP protocol.

In either case, the files are encoded in proprietary format, which can be converted using a small piece of software called EasyConverter, which converts the raw data into Excel tables.

### EASYCONVERTER INSTALLATION PROCEDURE

1. Preparation
    1.1. Insert the USB Drive
        - Insert the Katanax® USB drive into your PC.
2. Extract the Installer
    2.1. Locate the Installer
        - In the root folder of the USB drive, find the zip file containing the EasyConverter installer.
        - If the EasyConverter file is not present on your USB drive, contact Katanax® to obtain your free copy.
    2.2. Extract the Files
        - Double-click the zip file and extract its contents to the same location.
3. Install EasyConverter
    3.1. Run the Installer

- Double-click the setup.exe file to install EasyConverter on your computer.

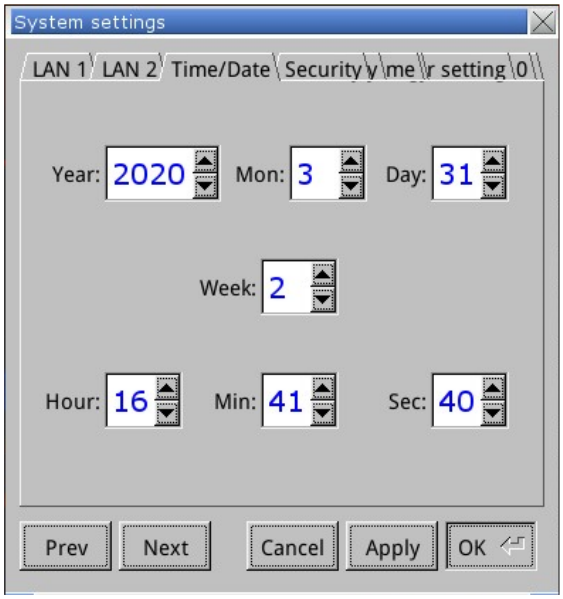
## ENABLE DATA LOGGING PROCEDURE

The Data Logging feature must be activated on the fluxer, in order to record sample identification codes (sample tracking).

1. Preparation
   1.1. Unlock Advanced Mode
   - On your fluxer, unlock the advanced mode (refer to page 32 for details).
2. Activate Data Logging
   2.1. Enable Data Logging
   - Click the global parameter button on the touchscreen.
   - Find the switch near the barcode reader icon.

   - Press the switch until it lights up in green.

   2.2. Exit the Window
   - Data logging is now enabled. You may exit the global parameters window.
3. Adjust Date/Time/Zone (if necessary)
   3.1. Access Parameters
   - Click the arrow button in the lower-right corner of the touchscreen.
   - Click on the Parameters button, enter the passcode 111111, and press OK.
   - Navigate to the “Time/date” tab (the third tab from the left) and adjust it to your local time.




   3.2. Apply Changes
   - Press Apply after entering the correct time and date.

## SAMPLE TRACKING

This process allows for efficient and accurate tracking of samples using barcode scanning or manual input, with a secure method to save the sample IDs for future reference.

1. Preparation
   1.1. Enable Data Logging

- Ensure that data logging is enabled in the system to allow sample tracking.

1.2. Access the Data tracking Window

- On the main screen, click the barcode reader icon to open the data sampling window.

2. Unlock Sample Tracking

2.1. Enter the Password

- In the data sampling window, Press the padlock icon
- enter the password “2014” to unlock the save button.

3. Enter Sample ID

3.1. Keyboard

- Manually enter the sample ID.

3.2. Barcode Reader

- Scan the barcode label using the barcode reader.

3.3. Toggle Between Modes

- click the wide button to toggle between “Keyboard” and “Barcode” modes:
- Keyboard mode activated: 
- Barcode mode activated: 

4. Confirm and Start Fusion

4.1. Confirm Sample ID

- Click the green checkmark button to confirm and exit the window. 7.2. Start Fusion
- Start the fusion process. The entered sample IDs will be saved in the fluxer’s internal log.

## COPYING LOGS TO A USB DRIVE

*Memory Retention*

• The logs generated by the fluxer are retained for up to **40 days**. To retain logs for a longer period, you must copy them to an external device, such as a USB memory drive.

1. Preparation

1.1. Insert USB Drive

- Plug a USB memory stick into the HMI. The USB port is located underneath it.

1.2. Dismiss Menu

- Wait a few seconds for a menu to appear, then click to dismiss it.

2. Accessing and Unlocking Sample Tracking

2.1. Access the Data Tracking Window

- On the main screen, click the barcode reader icon to open the data sampling window.

2.2. Unlock Sample Tracking

- In the data sampling window, press the padlock icon.
- Enter the password “2014” to unlock the save button.

3. Transferring Logs

3.1. Click Disk Icon

- Click on the disk icon to initiate the transfer.

3.2. Wait for Transfer

- Wait approximately 5 seconds for the fluxer to transfer the logs onto the USB drive.

4. Retrieving and Viewing Logs
   4.1. Retrieve USB Drive
   - Unplug the USB drive from the fluxer and insert it into a computer with **EasyConverter** installed.

   4.2. Locate Logs
   - Open the *datalog* folder on the USB root and navigate to the *Fusion logs* folder to view the log files.

   4.3. Convert Logs
   - Double-click a "*.dtl*" file to convert it into an Excel file using **EasyConverter**. Press *F5* to refresh if needed.

   4.4. View Logs
   - Open the Excel file to view the log for the selected day.

## ACCESSING LOGS THROUGH FTP

*Overview*

• The same log files stored for up to 40 days on the fluxer can be accessed remotely via FTP over your local wired network. This method allows for automated data retrieval without manual intervention.

1. Preparing the Connection
   1.1. Connect the Fluxer to Your Network
   - Ensure the fluxer is connected to your local wired network and note its IP address.
   - For details, refer to Section 15 -CPlive Capabilities page 57.

2. Accessing the Fluxer via FTP
   2.1. Open File Explorer
   - Press **Win + E** on your keyboard to open the file explorer on your PC.

   2.2. Enter FTP Address
   - In the address bar, type:
     i ftp://uploadhis:111111@**[yourIPaddress]**
   - Replace **[yourIPaddress]** with the fluxer's actual IP address.

   2.3. Example:
   - ftp://uploadhis:111111@10.24.140.95

3. Navigating the Fluxer Directory
   3.1. Open Directory Structure
   - The file explorer will display the fluxer's directory structure.

   3.2. Locate the Logs
   - Open the first datalog folder, then the second one nested inside.

4. Downloading Logs
   4.1. Copy Log Files
   - Select the desired log file(s) and copy/paste them onto your computer's hard disk.

5. Viewing and Converting Logs
   5.1. Convert to Excel
   - Assuming **EasyConverter** is installed on your computer, double-click the ".dtl" file to convert it into an Excel file.
   - If the file doesn't appear immediately, press F5 to refresh the file browser.

   5.2. View Logs
   - Open the converted Excel file to view the log for the selected day.

## STRUCTURE OF THE DATA LOG FILES

Once the log files are converted into Excel format, they follow a consistent structure with the columns arranged as described below:

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Date | Time | Millisecond | Unused | Left | Middle | Right | Unused | Unused | Recipe number | Recipe name | Fusion counter | Fusion status | Error Code | Fusion time (Sec) | Fusion Checksum |
| 2 | 2020-01-16 | 11:03:53 | 920 | | 20200116L1 | 20200116L2 | 20200116L3 | | | 8 | Limestone | 3580 | OK | | 1109 | 112796 |
| 3 | 2020-01-16 | 11:56:14 | 550 | | 20200116L4 | 20200116L5 | 20200116L6 | | | 8 | Limestone | 3581 | ST | | 18 | 112796 |
| 4 | 2020-01-16 | 13:17:21 | 830 | | 20200116L4 | 20200116L5 | 20200116L6 | | | 8 | Limestone | 3582 | ER | S1 | 14 | 112796 |
| 5 | 2020-01-16 | 15:28:35 | 200 | | 20200116L4 | 20200116L5 | 20200116L6 | | | 8 | Limestone | 3583 | OK | P1 | 1201 | 112796 |

1. **Column A – Date**
   - The date the fusion cycle was started.
2. **Column B – Time**
   - The time the fusion cycle was started.
3. **Column C – Millisecond**
   - Time taken to save the log line in the fluxer.
4. **Columns D – Fusion Positions**
   - This column displays the sample ID.
5. **Column J – Recipe Number**
   - Index number (0-9) of the fusion method that was started.
6. **Column K – Recipe Name**
   - Name of the fusion method that was started.
7. **Column L – Fusion Counter**
   - Incremental value of the fusion cycle counter when the fusion method was started.
8. **Column M – Fusion Status**
   - Displays the final status of the fusion:
     i **OK**: Fusion successfully completed.
     ii **ST**: Fusion was manually stopped.
     iii **ER**: Error occurred, interrupting the fusion and causing a reset.
9. **Column N – Error/Warning Code**
   - Provides the last warning or error code encountered during the fusion:
     **i** If the Fusion Status is **OK**, the code is a Warning Code, which is informational and does not affect the cycle completion.
     **ii** If the Fusion Status is **ER**, the code is an Error Code, which is critical and indicates the fusion cycle did not complete.
10. **Column O – Fusion Duration (s)**
    - The actual fusion time in seconds. Interrupted cycles (manual stops or errors) will have shorter durations compared to successful cycles using the same method.
11. **Column P – Fusion Checksum**
    - A unique number for the set of fusion method parameters. This allows verification of whether any parameter of the method has been modified by a user.

## Section 20 - Contacting Katanax®

Katanax® sales and technical staff can be reached at the following address:

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When contacting us, kindly have the serial number of the instrument at hand.

Customers are invited to visit our web site regularly, since useful information is periodically added.

An illustrated online parts browser is also available; kindly contact us to register.