UV-KUB 2

4" version

Exposure-masking system

USER MANUAL - UVK2-4P-2023-01

The UV-KUB 2, 4 inches version, is a very compact exposure and masking system equipped with a LED based optical head, collimated and homogeneous.

Controlled by touchscreen, the UV-KUB 2 ensures safety through an entirely closed exposure chamber, with both hard or soft contact modes available.

Thanks to its hermetic configuration, this equipment doesn't need to be installed in a clean room.

Summary

UV-KUB 2 *4" version*

Notes

Warranty

The UV-KUB 2 is guaranteed for one year (from date of on-site installation). This warranty covers all material and/or manufacturing defects if used under normal conditions.

Optionally, the company KLOE SAS will repair or replace any part of the UV-KUB 2 proven to be defective during the period covered by the warranty, given the equipment was properly used.

Any intervention on the part of a person not authorized by the company KLOE SAS, intended to modify or repair the UV-KUB 2 machine voids the warranty. Similarly, the loss of or damage to the control label of the machine door located between the cover and back panel voids the warranty.

The manufacturer KLOE SAS is not responsible for any indirect damage.

In the case of equipment malfunction or to obtain information and/or advice for the use of the UV-KUB 2, please contact the company KLOE SAS at the following address. Any defective part must be returned after agreement with KLOE SAS technical support to the following address:

KLOE SAS - S.A.V.
2-4 rue des Arbousiers
34 270 SAINT-MATHIEU-DE-TREVIERS - FRANCE
Tel: (33) (0)4 67 82 19 10 - email: sav@kloe-france.com

Legend of the user manual

Back to summary

Navigation arrows

1 Item of interest clickable

1 Item of interest not clickable

X Click on the cross to close the element

Click on the magnifying glass to display a zoom of the element

text Clickable link

W⚠RNING!

The company KLOE SAS cannot guarantee the accuracy and reliable operation of the machine if the normal conditions of use specified in the UV-KUB 2 equipment manual are not met. The framed annotations that appear throughout this manual should be read and followed scrupulously.

Complaints

For customer service, please contact the company KLOE SAS. KLOE SAS assumes no responsibility for damage during transport.

Throughout the duration of the warranty, KLOE SAS will repair or replace damaged parts free of charge unless said damage is caused by abnormal equipment use. If necessary, the company KLOE SAS may instruct a person to perform an on-site intervention to carry out any repairs. If an on-site intervention should take place, travel expenses for the KLOE SAS technician will be borne by KLOE SAS itself throughout the duration of the warranty unless it appears that the malfunction is actually related to a breach of normal use of the UV-KUB 2.

In all cases, the company KLOE SAS will determine if the failure is due to misuse, a modification, an accident, improper operation or abnormal handling of the UV-KUB 2 device in which case any repair will be charged in full to the user of the machine and every piece repaired will be returned with prepayment of postage.

Compliance

DECLARATION OF CONFORMITY CE

Declaration of conformity

In accordance with Directive 98/37/EC of the European Parliament and the Council of June 22, 1998 regarding the approximation of laws of member States relating to machinery,

Company : **KLOE SAS**

Certifies that the equipment : **UV-KUB 2, Masking Lithography Equipment**

Complies with :

- Regulatory provisions defined by Annex I of the European Directive 98/37/EC.
- The rules defined in Annex I introduced in the Labour Code by Article R.233-84.
- The rules of the decree of November 14, 1988 on the protection of individuals against the dangers of electric machines.
- Directive 89/336/EEC of May 3, 1989, on the approximation of laws of member States relating to electromagnetic compatibility.
- Standard NF EN 60-204, relating to machine electrical equipment.

Manufacturer Contact

Adress : KLOE SAS

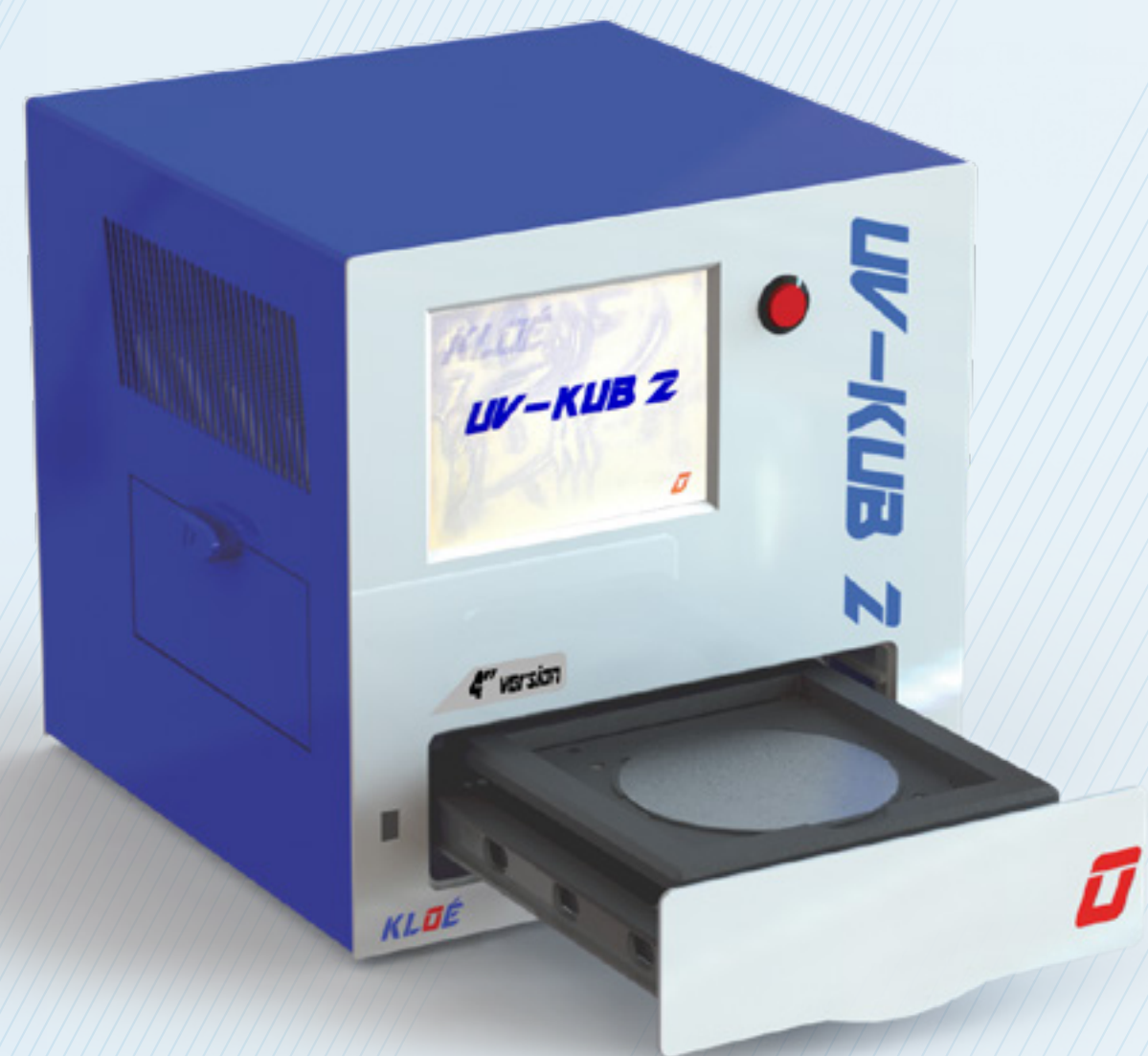2-4 rue des Arbousiers 34 270 Saint-Mathieu-de-Treviers - France

Phone : (33) (0)4 67 82 19 10

Email : contact@kloe-france.com

Paul Coudray

C.E.O.

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The equipment

| Performances	
Resolution	1μm
Divergence angle	< 2°
Number of programmable cycles	10
Exposure cycle (continuous or cyclic)	From 1s to 1h
Processes	Hard (physical) or soft (proximity) contact processes

UV-LED source	
Wavelength	365nm +/- 5nm
Homogeneous exposure	+/- 5%
Lifetime of the LEDs	> 10 000 hours
Power density	40mW/cm² +/- 10%

Working/Writing surface	
Working surface	4" wafer
Accepted masks size	up to Ø 5"
Accepted substrate size	Ø 2" - Ø 4" and 50 x 50mm - 100 x 100mm
Mask/substrate measuring distance resolution	0.5μm
Substrate warm-up during exposure	< 1°C
Compatible photoresist	All photoresists at 365nm including SU8, Shipley, AZ Resist, K-CL resist (developed by Kloe)

Front panel
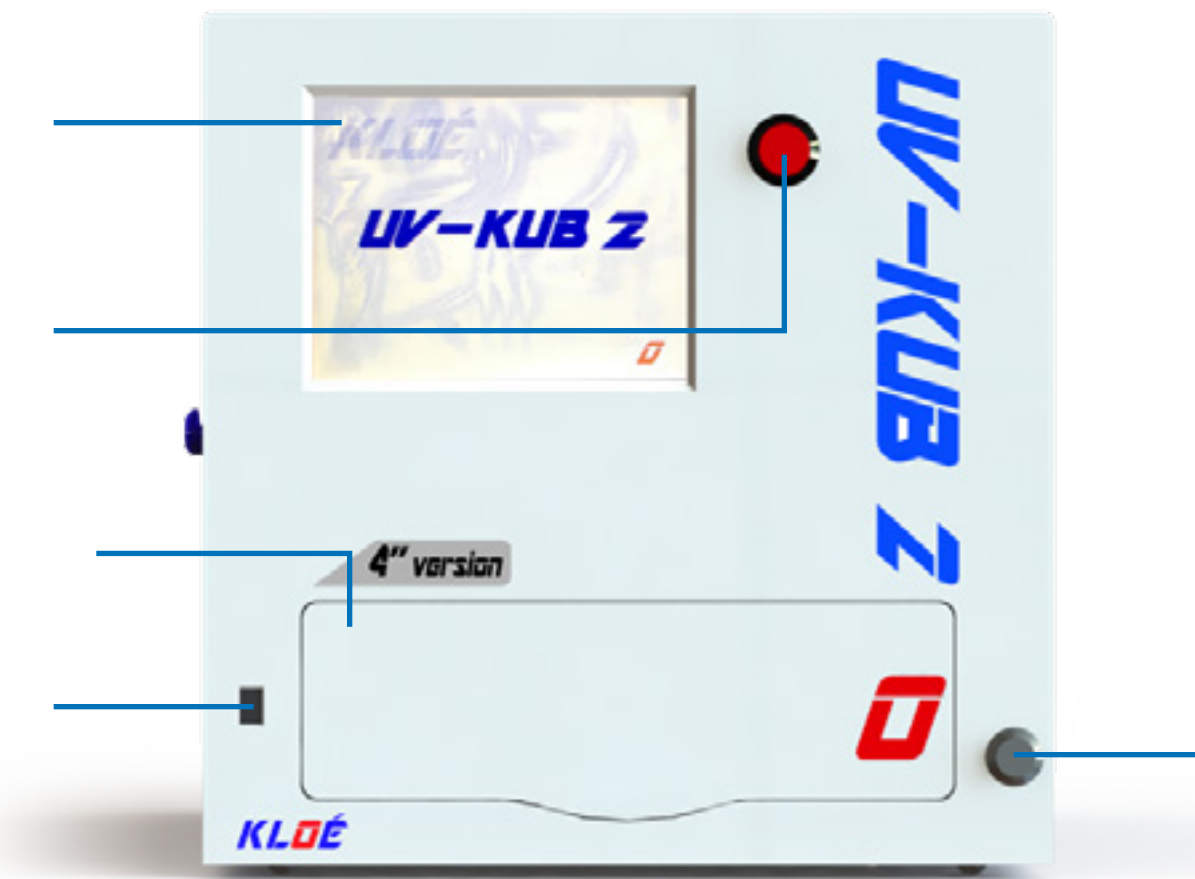
5.7" touchscreen.

W⚠RNING!

The use of the stylet provided with the equipment and adapted to capacitive screens is strongly recommended. Any damage due to a misuse will not be supported by Kloe.

Emergency stop button.

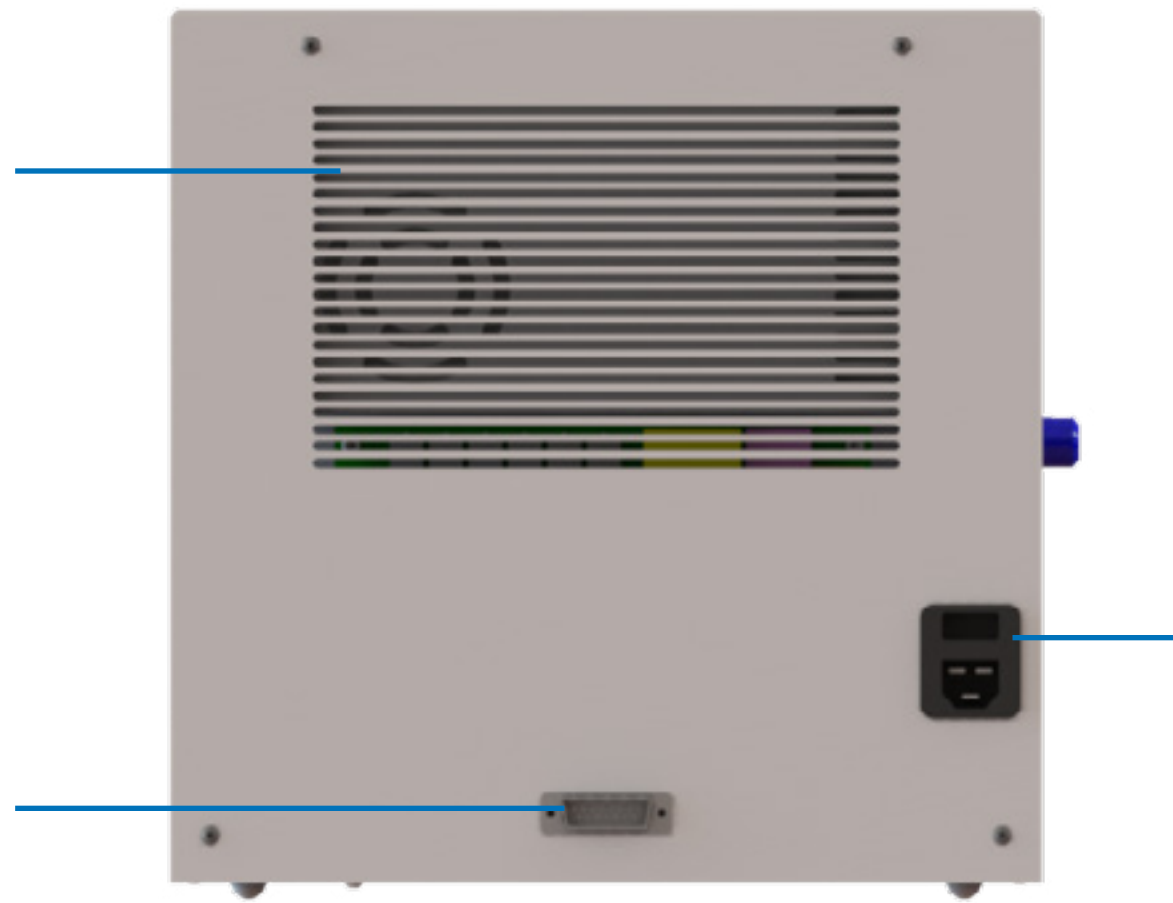Drawer for loading insertion of substrate and photomask in the exposure chamber.

Drawer opening command (IR sensor).

ON/OFF switch.

UV-KUB 2 *4" version*

Rear panel

Ventilation grid.

W⚠RNING!

Leave at least 10cm (4") of free space around this area for optimum cooling of the device.

Sub D plug (for Kloe maintenance service only).

W⚠RNING!
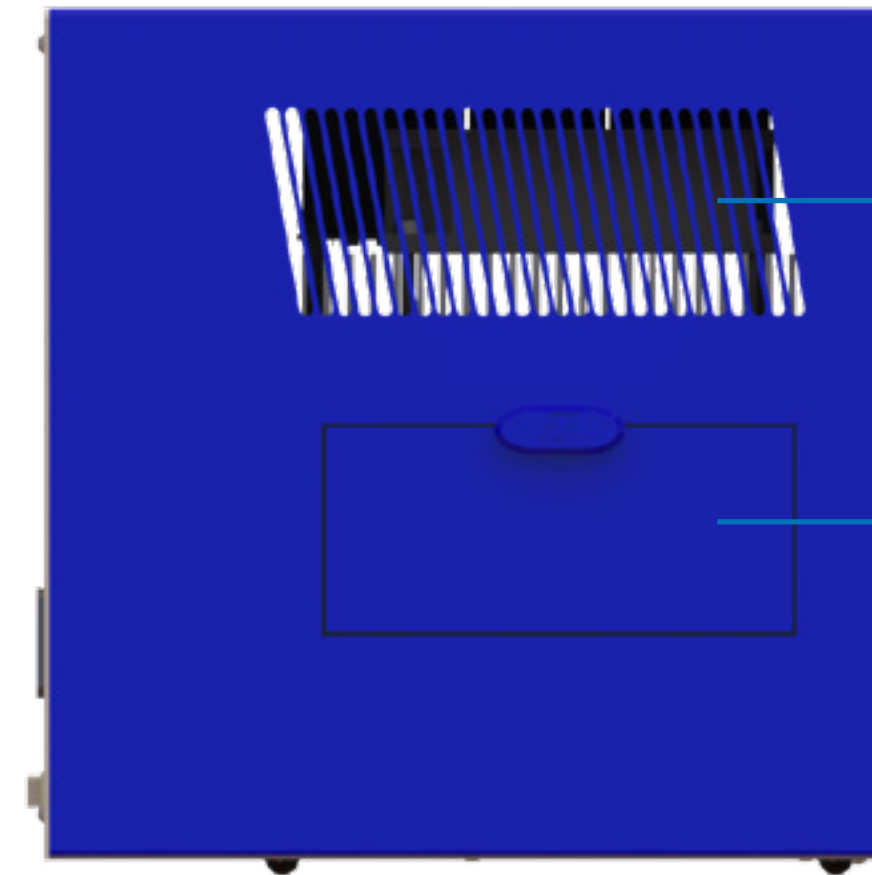
No cable should be connected to this plug without Kloe's permission.

Power plug, equipped with a switch.

W⚠RNING!

Turn the connector switch off to ensure that the machine is completely off, when it's not use for several hours.
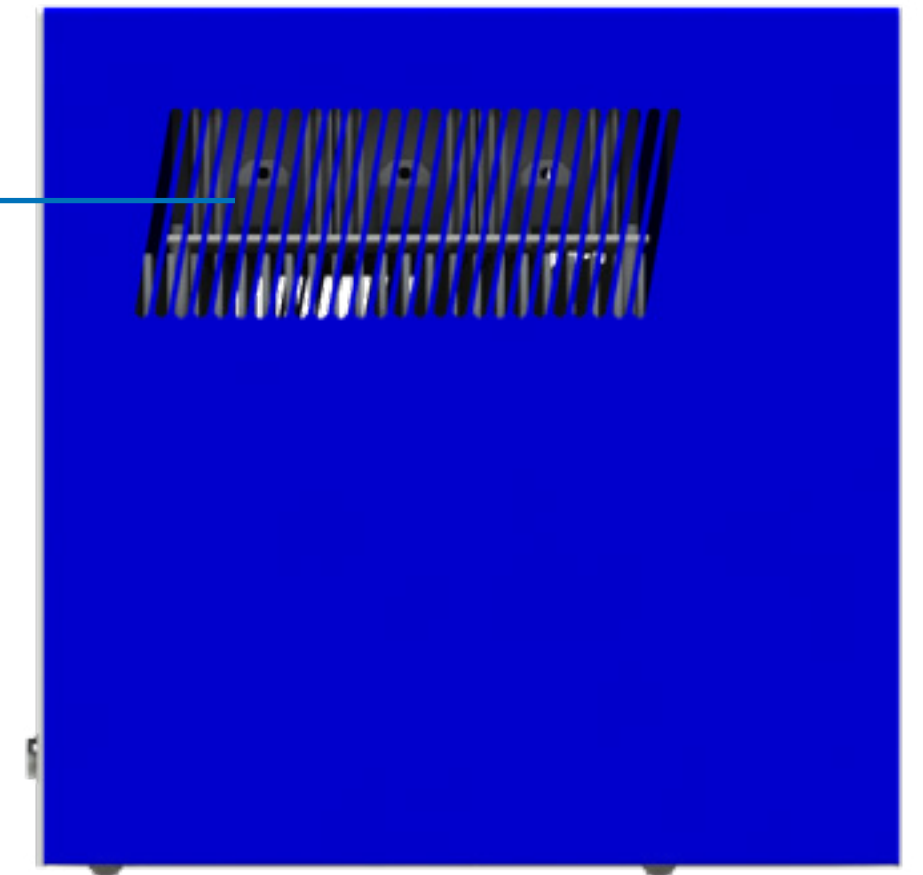
Side panels

Ventilation grids.

W⚠RNING!

Leave at least 10cm (4") of free space around this area for optimum cooling of the device.

G◎◎D TO KNOW

The LED cooling fan is activated only during exposure and stops a few minutes after the interruption.

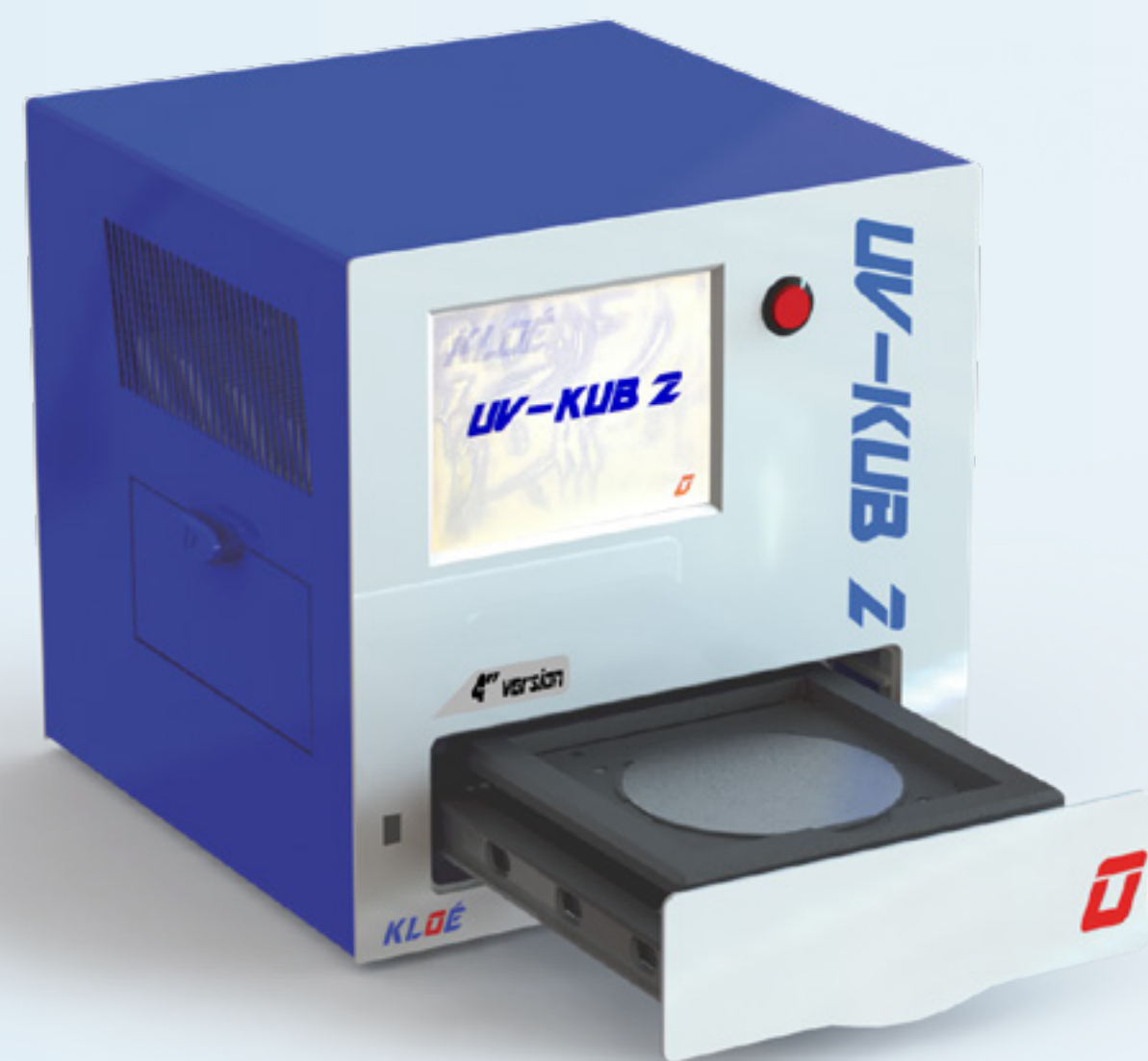Side door: provides access to the exposure chamber to ease cleaning.

W⚠RNING!

Only acces the exposure chamber when the machine is turned off. Should the door be opened while in use, a detector shuts off general power to the machine to avoid any accidental user exposure to UV radiation. Do not open the door when in progress as the exposure would be irretrievably stopped.
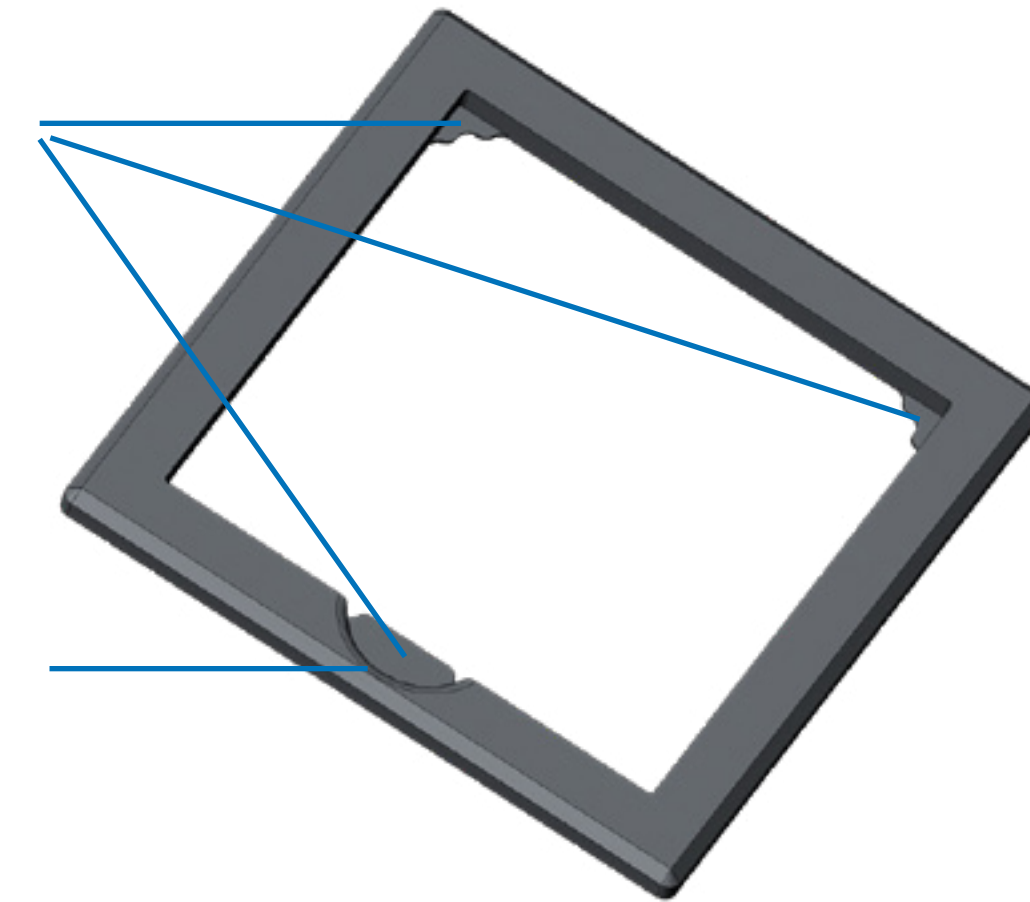
2

Focus on... the drawer

UV-KUB 2 *4" version*

The static photomask holder

W⚠RNING!

For more safety and to avoid damaging the machine, **the drawer's opening system is equipped with a torque limiter.** In case a person or an object is blocking the opening or closing of the drawer, **the system will interrupt the operation and wait for the user to activate again the drawer's opening command.**

The mask holder is divided into **3 support areas**. It accepts square photomasks from 125 to 127.3mm.

A **material recess** is provided to allow easy gripping of the mask by lifting an edge.

G👀D TO KNOW

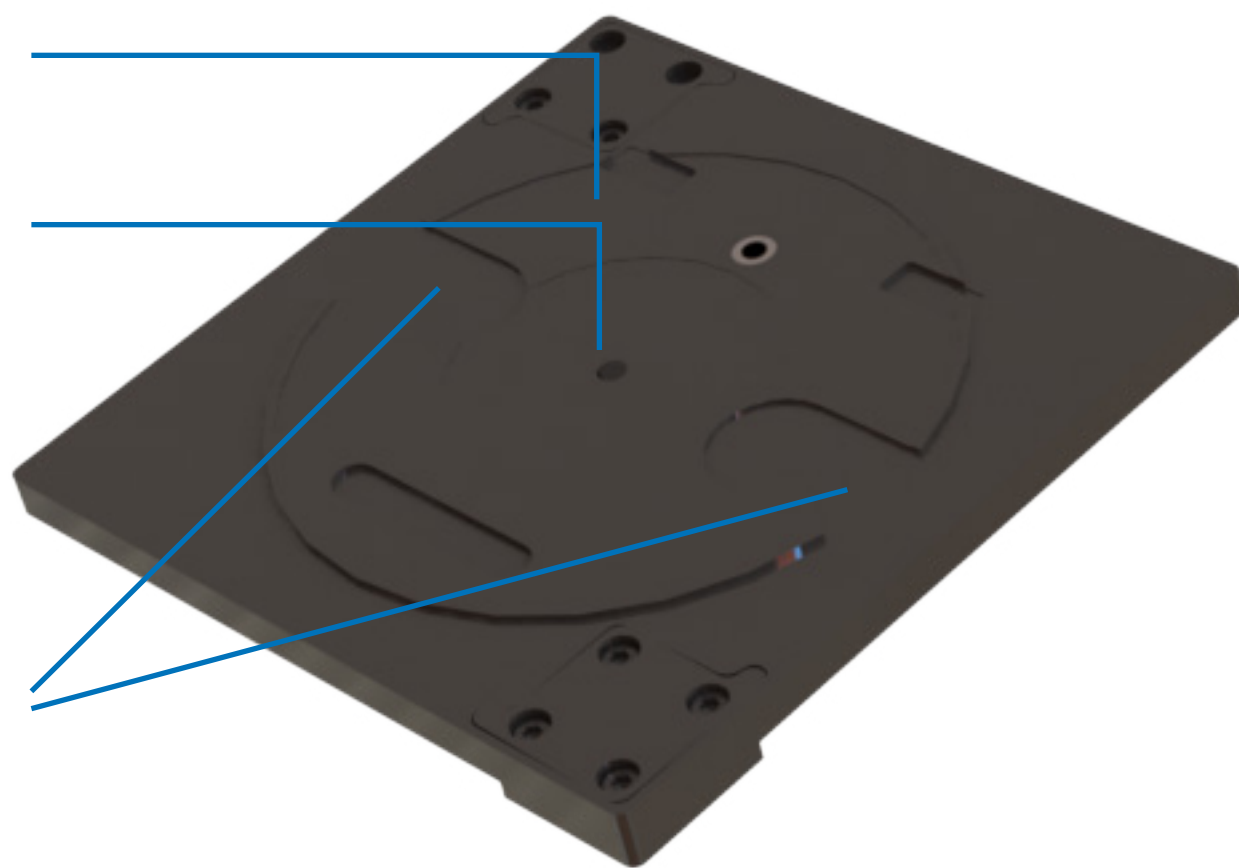**For photomasks of smaller dimensions, an optional adaptater must be used.**

W⚠RNING!

The parallelism between the photomask and the substrate is factory set and must not be modified by the user in any way.
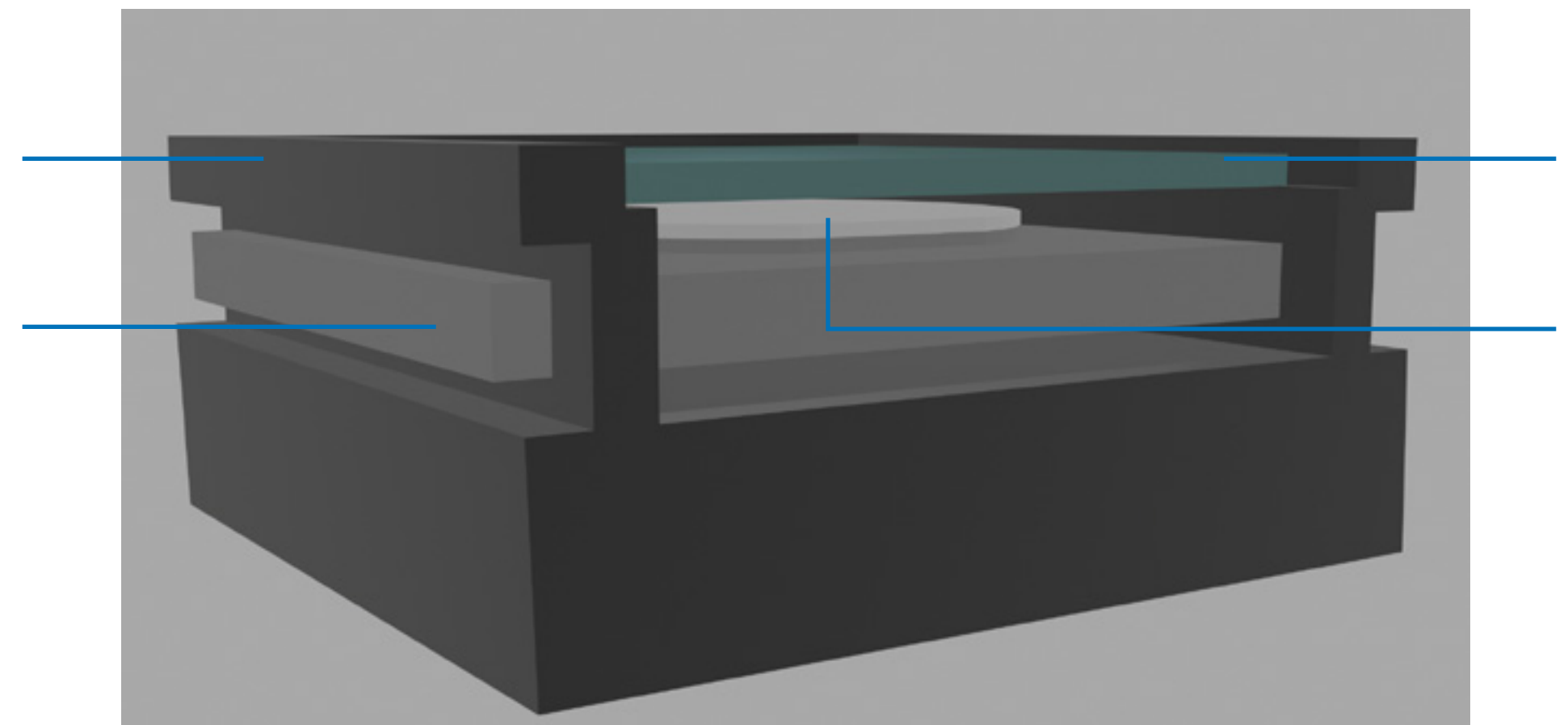
The mobile substrate holder

2 imprints for 2 standard sizes of substrates:

imprint 1 for 4" wafer,

imprint 2 for 2" wafer,

recesses on each side of the imprints: ease the removal of substrates by using a clamp.

GOOD TO KNOW

To facilitate their positioning, both imprints have grooves corresponding to each wafer groove.

for wafer 2"

for wafer 4"

Automated adjusting system for masking distance

Static mask holder

Mobile substrate holder

Mask

Substrate

A motorized system built into the drawer, adjusts the **masking distance** via the touchscreen interface with a +/- 5µm accuracy. The distance between the **footprint of the substrate holder** and the **mask support area** depends on the substrate type used.
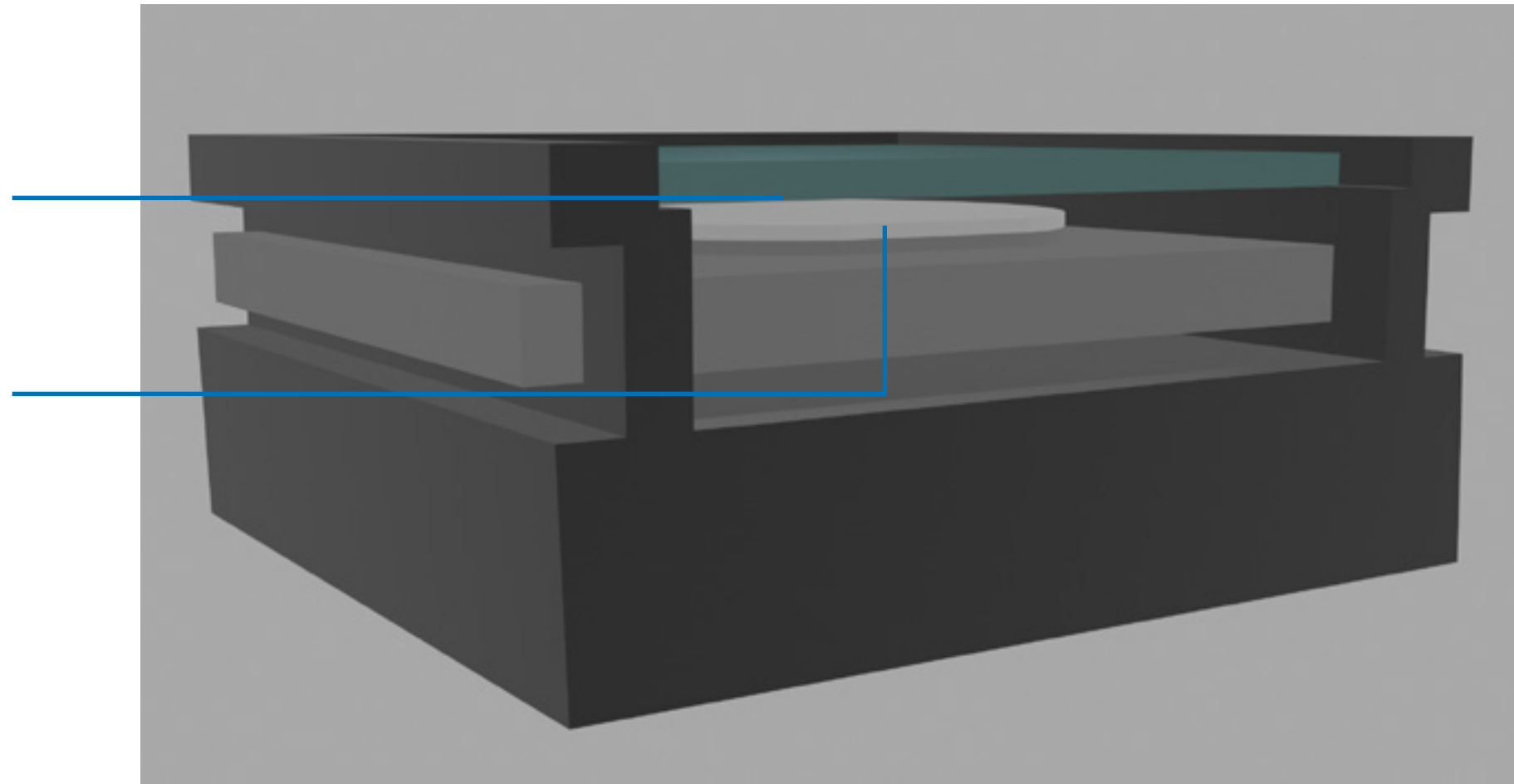
GOOD TO KNOW

By default, the UV-KUB 2 is configured to operate with 4 inches wafers.
The footprint for 2" wafers is 150µm lower than the footprint for 4" wafers. When using a 2" wafer, remember to remove 150µm to the calculation of the total thickness of the sample.

Masking principle

Photodetector

During a masking, the user must enter the masking distance value, defined by the distance between:

the plane defined by the **working side of the mask,**

and the plane defined by the **wafer surface to be exposed.**

To optimally adjust the masking distance, the user must perfectly know **the total stack thickness consisting of layers and substrate.**
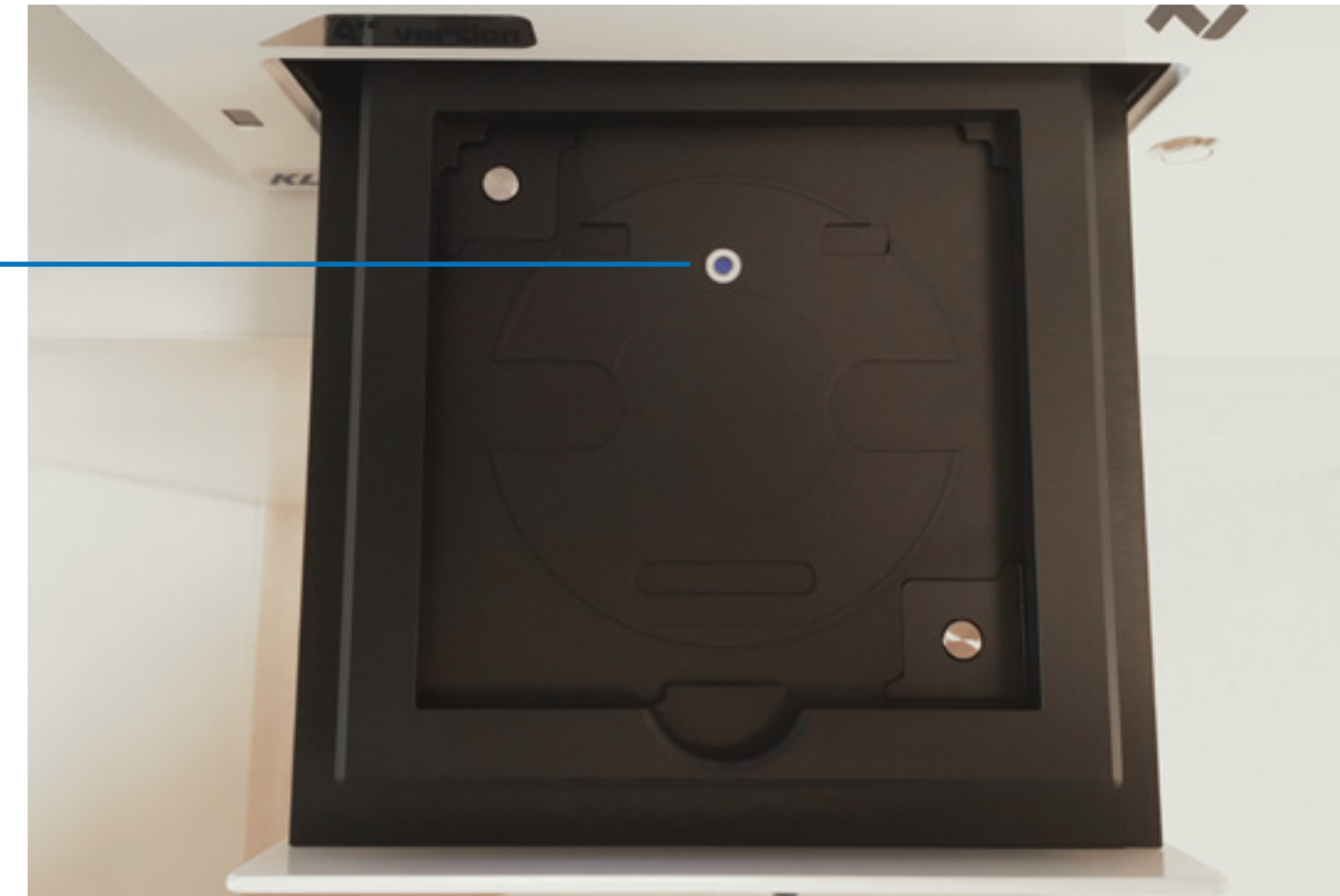
By measuring the incident illumination at the substrate holder level,   **the photodetector** (drawer integrated) confirms that the LEDs are correctly operating.

GOOD TO KNOW

These measurements can only take place in the absence of the wafer.

3

Starting-up

Use conditions specified by the manufacturer

The UV-KUB 2 is a photolithography equipment that can be used as:

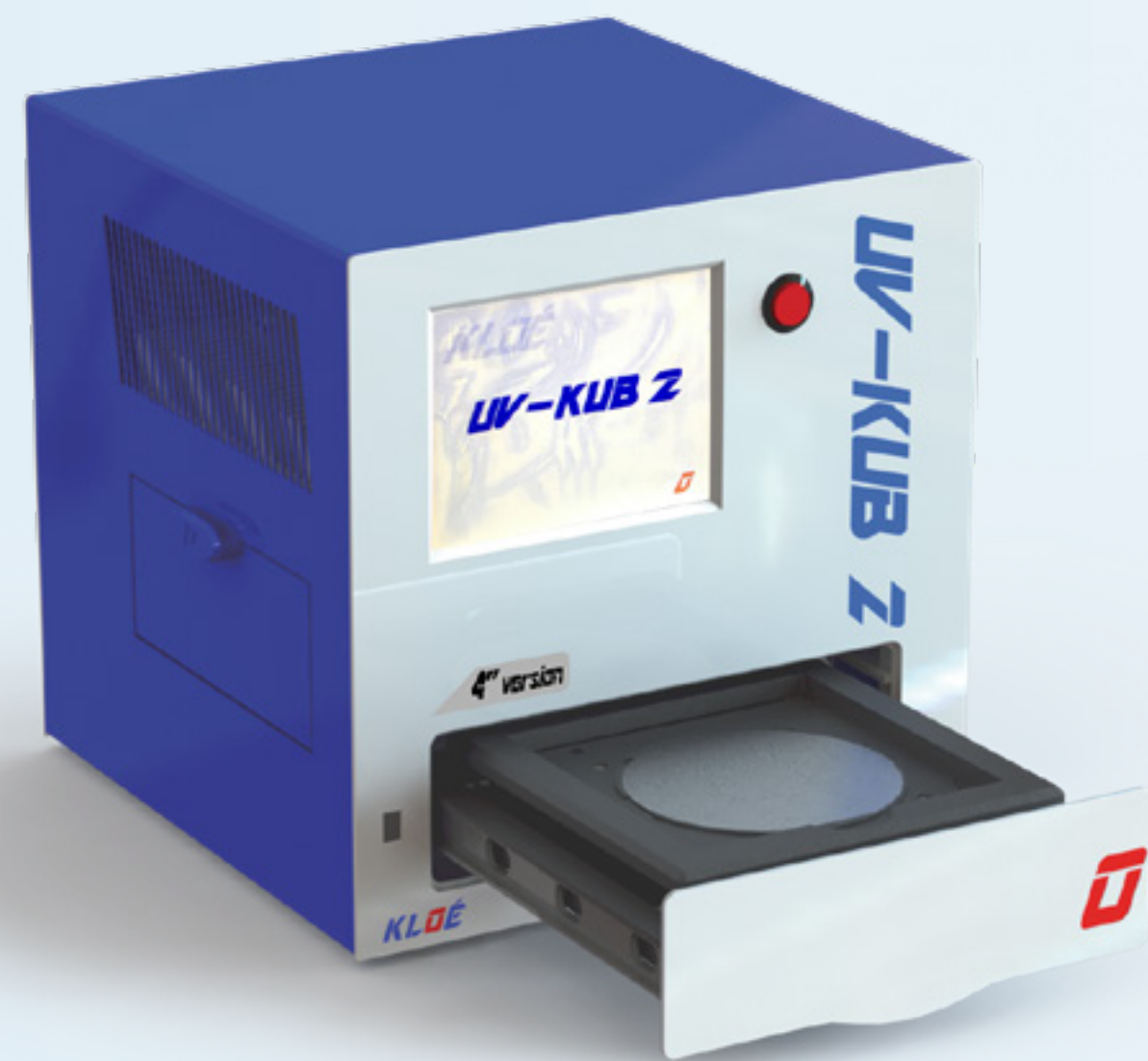- **a simple UV flood exposure system,**

- **a masker**.

The machine is designed for use with **standard substrate wafer types of 4 inches or 2 inches** in diameter. The UV-KUB 2 also works with substrates of thicknesses **up to 2 mm in masking mode and up to 11.5 mm in simple exposure mode.**

The use of masks with external side dimensions smaller than 5", require a mask adaptor not provided with the machine.

It is strongly advised to use the stylus supplied with the machine when using the touchscreen, and to prevent any finger pressure to avoid irreversibly damaging the screen.

Prior checkings

Make sure to place the UV-KUB 2 **on a stable and robust support and and make sure to prevent from any excessive vibrations generated by other equipment, or fans and air conditioner.** This in order to preserve the mechanical factory settings precision and to not disrupt the precise positioning of the substrate holder when using the masking mode.

The equipment must **not be placed in proximity of heat source.**

A proper working of the machine is guaranteed with an **ambient room temperature from 15 to 27°C.** Beyond, the nominal technical specifications may change and equipment lifetime may be affected.

Start-up procedure
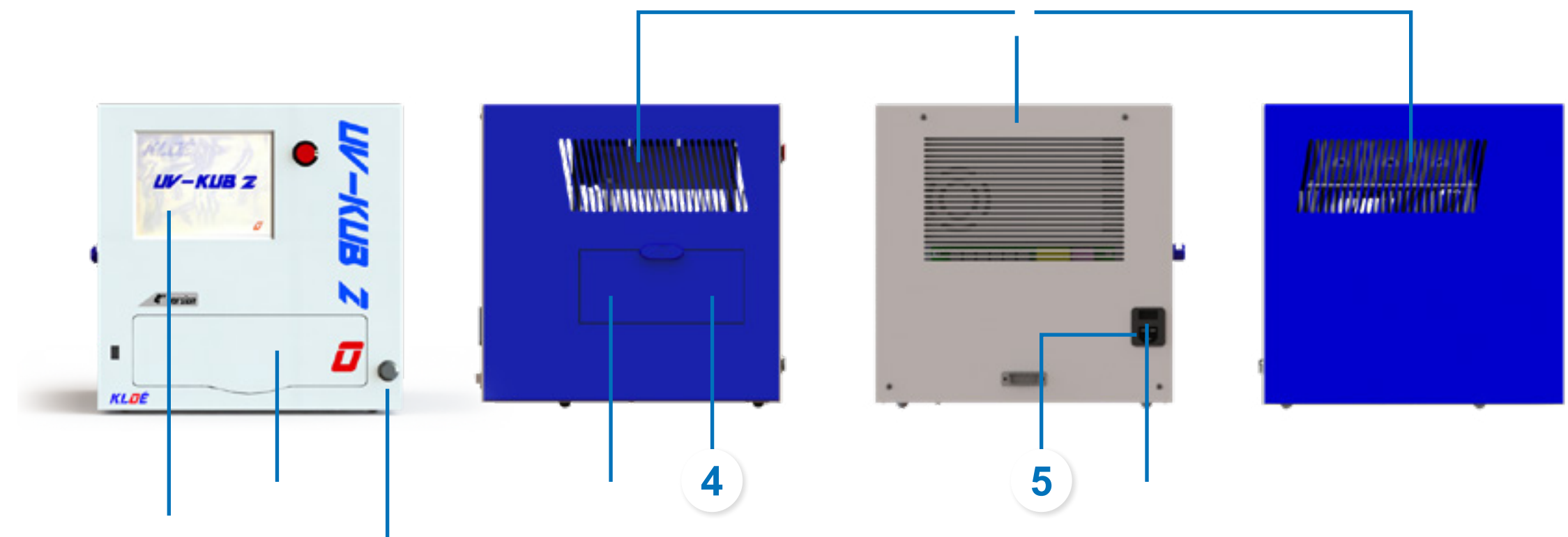
Maintain **a distance of 4 inches or more** between other equipment and the UV-KUB areas fitted with ventilation grids.

Ensure that **no objects block the front drawer.**

Provide **access to the side door** in order to clean the exposure chamber.

4   Ensure that the side door is completely closed, failing to will prevent the machine from starting.

5   Make sure the power cord is connected to the outlet.

On the rear panel, **check that the power plug switch is on position 1.**

Press the **power button** on the front of the machine.

GOOD TO KNOW

Once the homepage screen appears, the user can then display the main menu and open the drawer by pressing the screen.
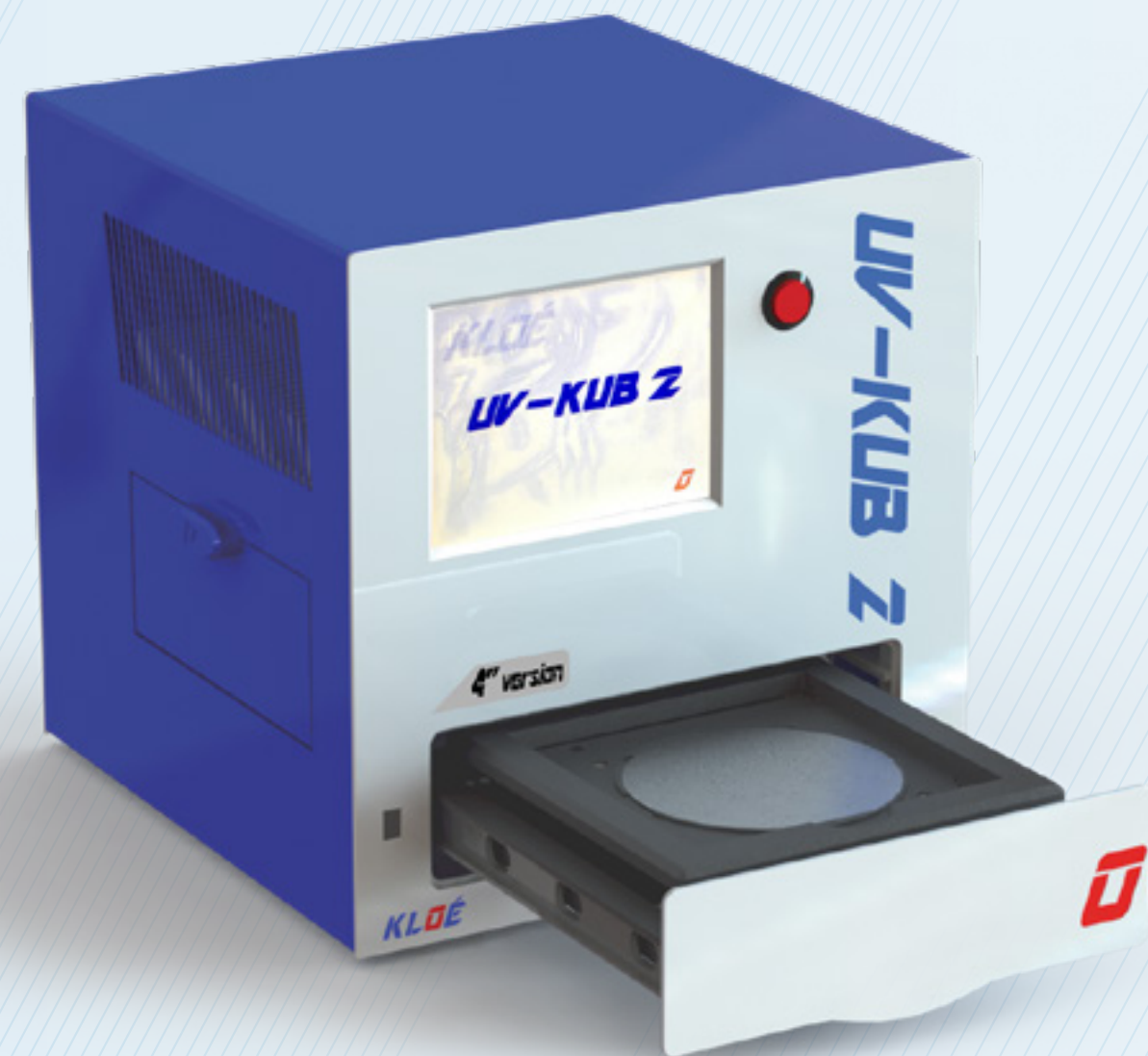
Main menu description

Masking: by selecting this menu, you can then adjust the distance between the substrate and the mask and proceed to an exposure.

Full surface exposure: enables to realize a simple UV exposure of the entire substrate working surface.

Settings: to check the characteristics of the UV-KUB component elements.

4

Full surface exposure

When use the Full surface exposure?

The Full surface exposure mode enables simple UV exposure of the entire substrate working surface, in order to process bondings of optical chips, fiber matrix, pigtailing…

W⚠RNING!

Once you have coated your resist on the substrate, and after the resin has dried, remember to remove the edge bead of the resin before loading the substrate in the UV-KUB 2, in order to prevent the resin from running onto the substrate holder and damaging it.

Substrate loading

Load the substrate on the substrate holder.

W⚠RNING!

Check for absence of dust before putting the substrate in place.

GOOD TO KNOW

Substrates can be of all shapes (round, square) and all sizes up to 100 x 100mm.

GOOD TO KNOW

When using a silicon wafer, enter the substrate at the edges, gently place it on the substrate holder and position the substrate with a clamp so that its groove corresponds to that of the housing.
Make sure before proceeding that the wafer is completely trapped in its housing.
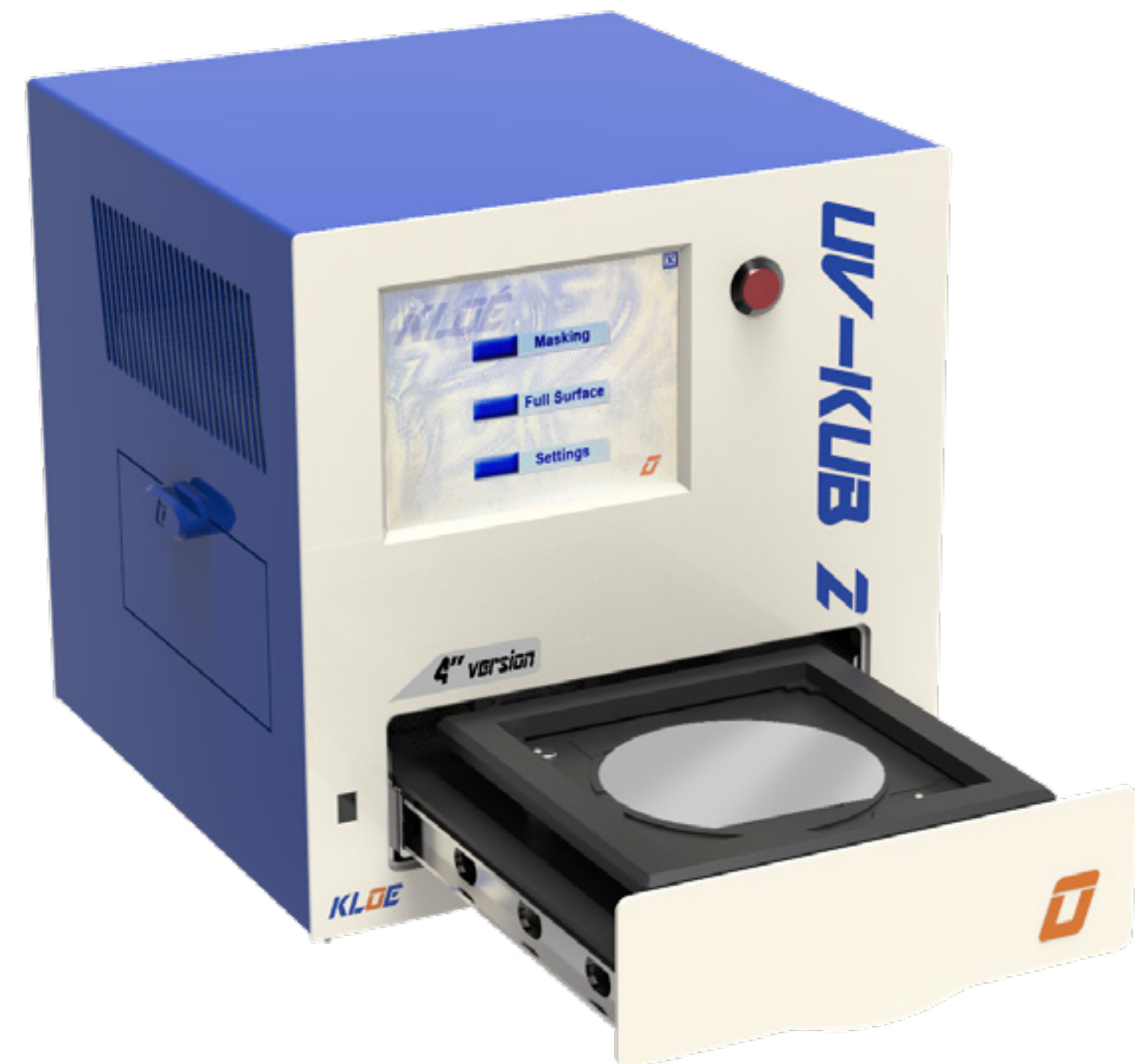
Click on **Full Surface** menu: the drawer closes. You can choose between launching a **New Cycle** or **Memory**, to access the pre-registered cycles.

UV–KUB 2 *4" version*

Exposure cycles settings
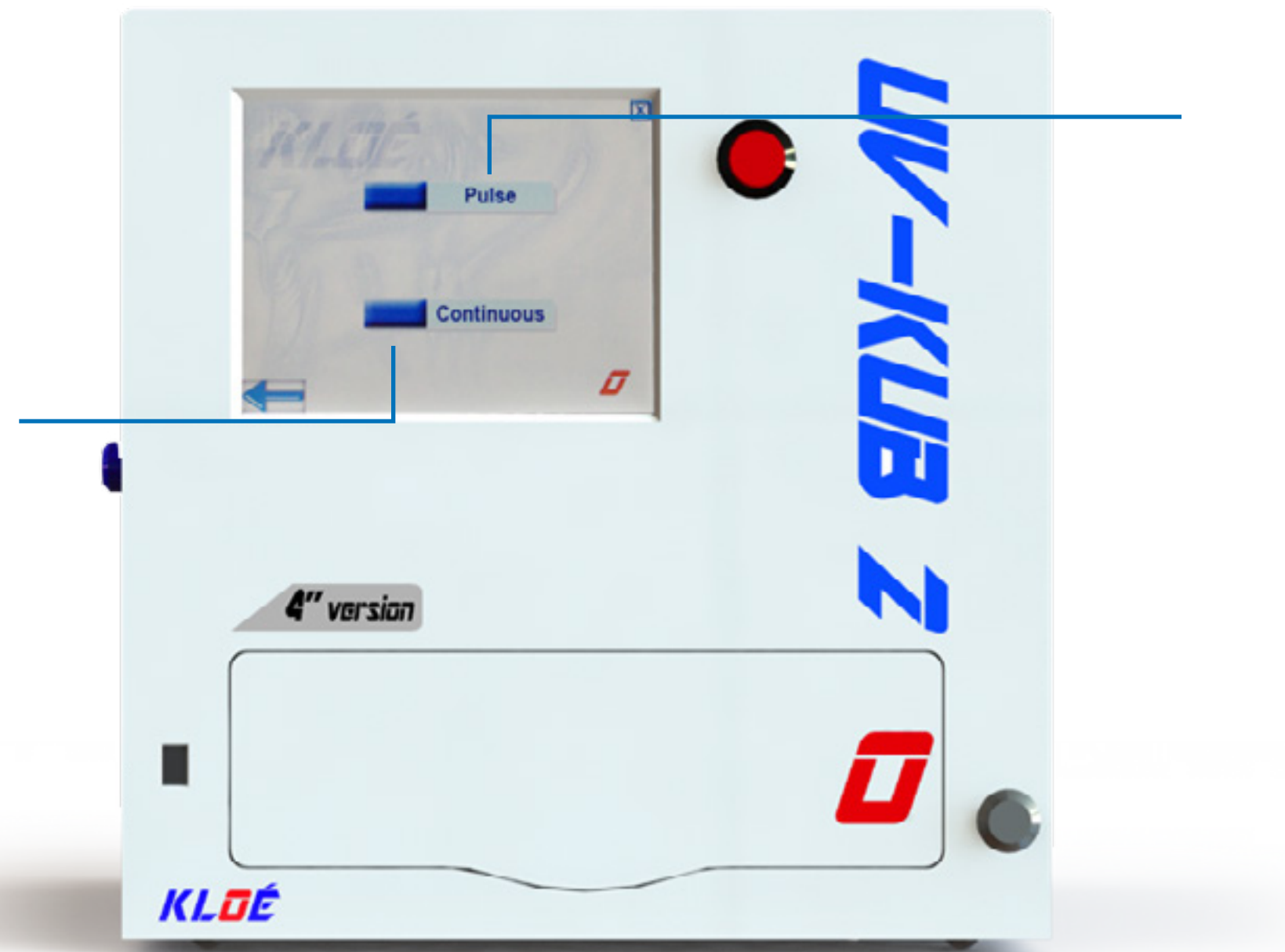

The UV-KUB 2 allows the user to choose between:

a continuous exposure of the substrate during an adjustable time period,

or to emit light pulses of adjustable duration separated by a time pause also configurable.

Continuous exposure

Set the time

The **duration** is expressed in **hours (h), minutes (m), seconds (s)** and is adjustable between 1s and 1h by selecting the numbers/letters on the touchscreen keyboard.

W⚠RNING!

It is essential to specify the units, otherwise the system will indicate "Input error!".
Ex: 1m30s

Confirm your selection by touching the **"V" validation button** on the screen, or correct it by touching the **"C" correction button** as many times as are necessary.

UV-KUB 2 *4" version*
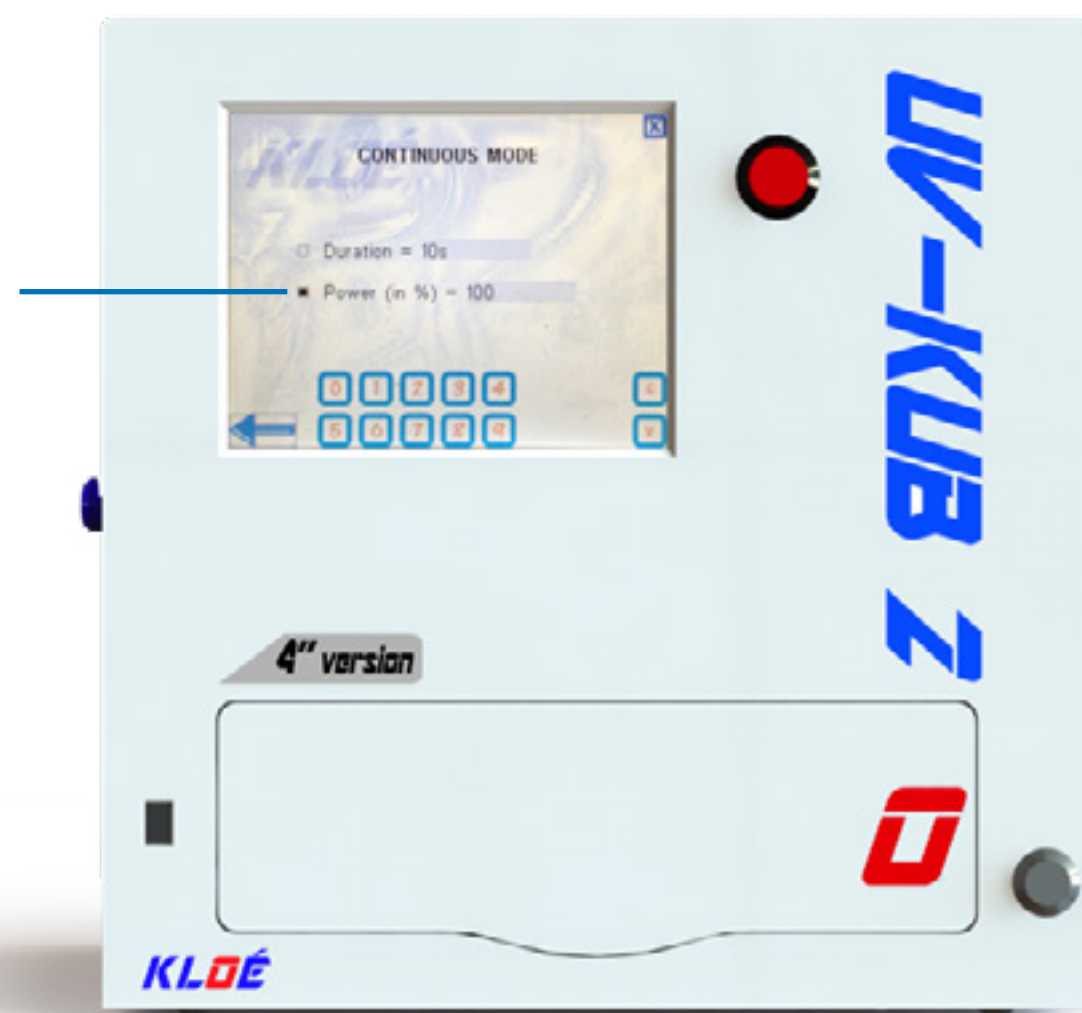
Set the LED transmission power

Pulse exposure

Power is expressed as a percentage of the maximum power emitted by the LED.

It is **adjustable between 5 and 100%** by selecting the numbers on the keyboard.

G👀D TO KNOW

There is no unit of measurement, just enter and confirm the value. Ex: 45% can be entered by pressing 4 then 5 then V to validate.

G👀D TO KNOW

If you want to finally change the duration of exposure, just click the box in front of DURATION with the stylus so you can change the setting. You can thus navigate from one setting to another by clicking the corresponding boxes.

The exposure cycle is defined by successions of light pulses separated by time pauses.

To set a pulse exposure, you must indicate:

• the desired number of pulses: **Cycles,**

• the light pulse duration: **ON Time,**

• the pause duration between two pulses: **OFF Time.**

Then adjust the **exposure power from 5% to 100%**.

G👀D TO KNOW

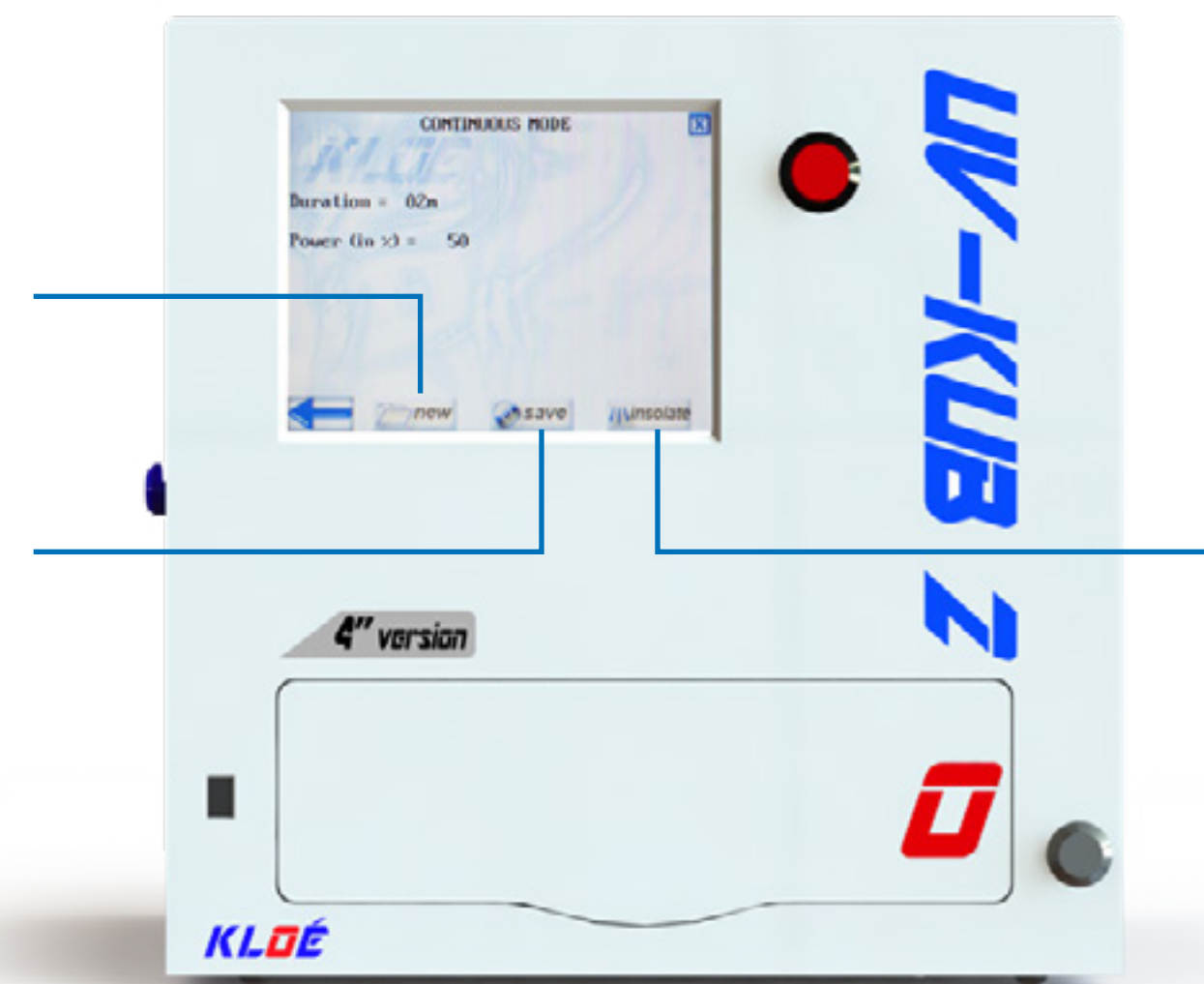By clicking one box with the stylus, one accesses the corresponding setting in order to change it.

Confirm settings

A summary settings menu appears and offers to perform three operations:

New: returns the user to the menu to choose the exposure cycle. **The user can create multiple exposure cycles** in succession and store them one after the other **without going through the complete exposure setup each time.**

Save: allows the user to store the settings you just entered in the internal memory machine so you can reuse thereafter.

Confirm settings - Continuous exposure

G**OO**D TO KNOW

You can store up to ten exposure cycles (pulse or continuous). If all memory locations are free, the boxes will be white with the indication Empty. If you want to save your cycle onto an already existing cycle, you will be asked to override.

Insolate: confirms the previously entered settings.

G**OO**D TO KNOW

Before launching the exposure, you are asked if you want to open the drawer and check your sample.

Confirm settings - Pulse exposure

Exposure in progress

Exposure interruption

During exposure, **the screen displays a summary of the exposure settings:**

- **the temperature of the exposure chamber and the LEDs** are permanently controlled and displayed,

- **a timer** lets you know the time remaining prior to the end of exposure.

W⚠RNING!

Do not attempt to open the side door during exposure. The power to the machine will be automatically shut off to protect the user from UV radiation, and the exposure cycle will be terminated without possible return or memorization.

An exposure can be terminated for three reasons:

- rupture of the power supply,

- machine error: see chapter **Troubleshootings: Error messages**,

- voluntary user pause.

GOOD TO KNOW

To stop an exposure, press the red emergency stop button on the right of the touch screen. In this case the machine will stop the exposure and will suggest to either restart or cancel the exposure. If you decide to restart the exposure, the UV-KUB will continue the originally defined cycle.

Exposure end

- At the end of the exposure, a **buzzer sounds two long tones and the screen flashes.**

- Simply **touch the screen to open the drawer and retrieve the substrate.**

GOOD TO KNOW

To retrieve the substrate, in the case of a wafer, pass the wafer clamp under the substrate by the recess provided for this purpose in the substrate holder.

Touch the screen to go to the next step.
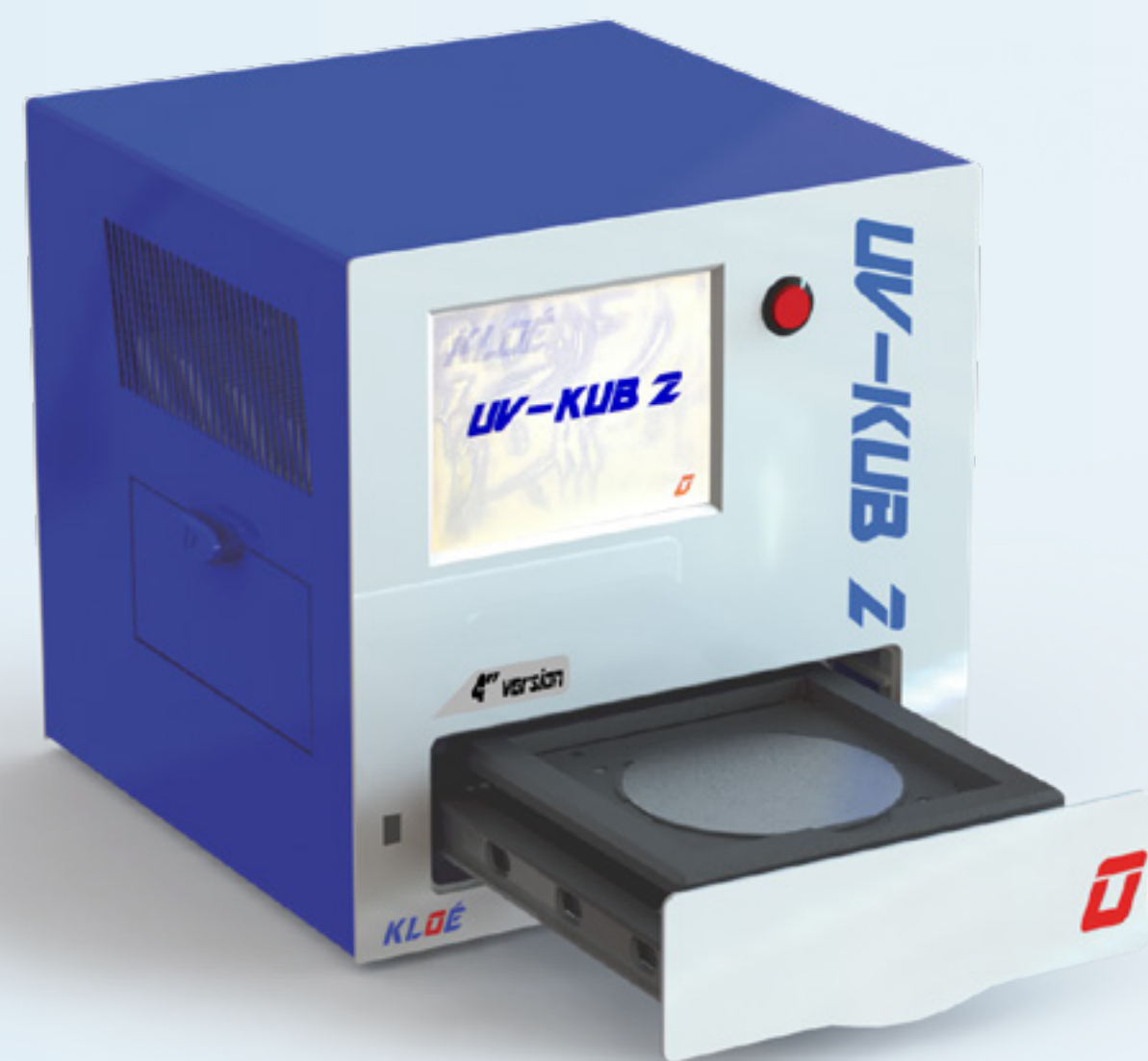
While the drawer is still open, two choices are offered:

- **To renew the exposure, with the same settings:**
  - load a new substrate in the drawer,
  - click on **Continue:** a new exposure will be automatically launched with the identical settings to those of the earlier exposure.

- **If you are finished,** simply select **Cancel** to return to the UV-KUB 2 main screen.

5

Masking

When use the Masking mode?

This mode is use to realize the first level of masking.

GOOD TO KNOW

When using a silicon wafer, enter the substrate at the edges, gently place it on the substrate holder and position the substrate with a clamp so that its groove corresponds to that of the housing.
Make sure before proceeding that the wafer is completely trapped in its housing.

WARNING!

Once you have coated your resist on the substrate, and after the resin has dried, remember to remove the edge bead of the resin before loading the substrate in the UV-KUB 2, in order to obtain the best possible results.

Photomask loading

Substrate loading

Load the substrate on the substrate holder.

WARNING!

Check for absence of dust before putting the substrate in place.

GOOD TO KNOW

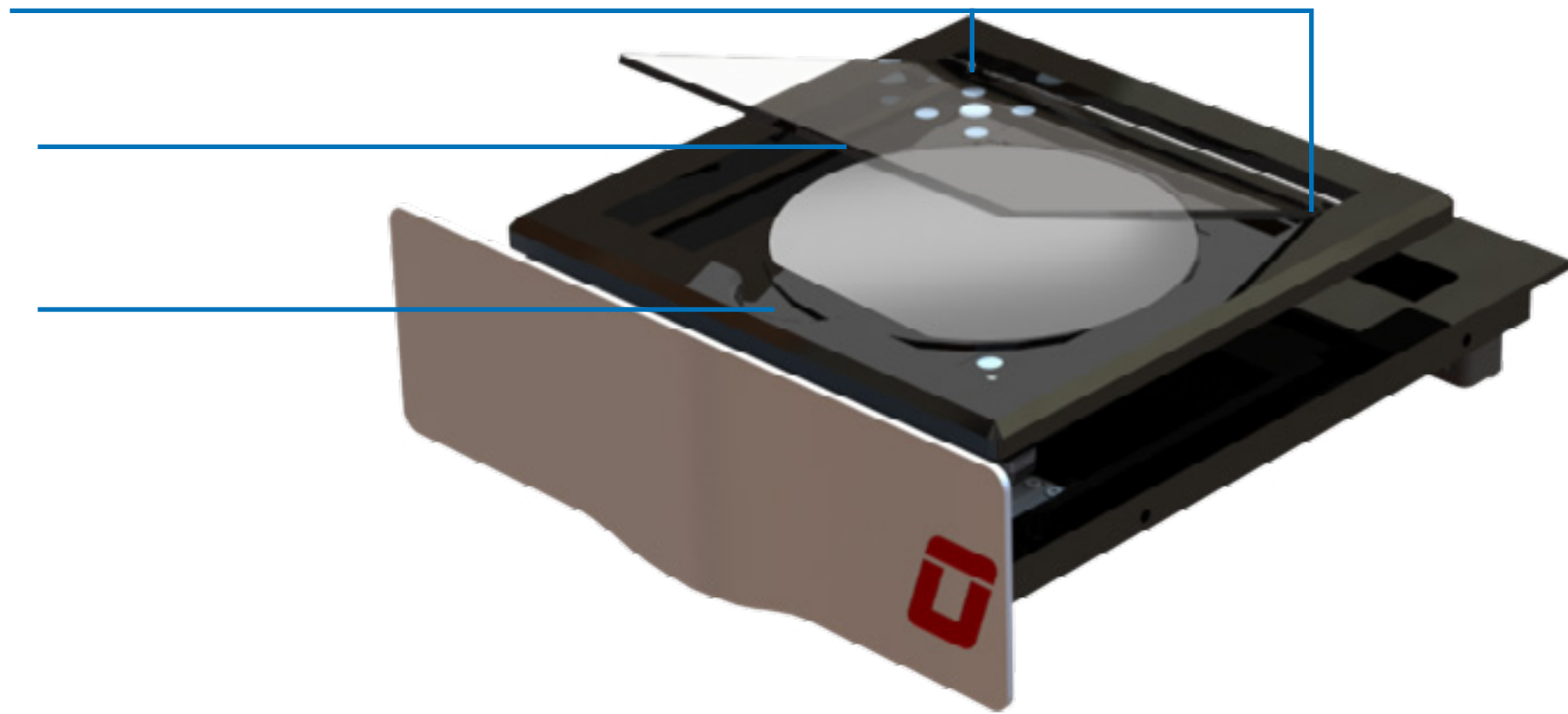Substrates can be of all shapes (round, square) and all sizes up to 100 x 100mm.

GOOD TO KNOW

In the case of mask use for side dimensions smaller than 5", it is essential to use a mask adapter not included with the UV-KUB 2.
The mask adapter is positioned on the mask holder in the same way as standard masks. The positioning of non-standard masks in the adapter takes place in the same way.

W⚠RNING!

Using an adapter mask affects masking distance adjustment.

The UV-KUB 2 mask holder has **three support areas** for receiving the mask.

Lay the corners of the mask against the **two areas opposite the wafer groove.**

Let the mask slowly sit maintaining it,

until it makes contact with the **third support area**.

GOOD TO KNOW

The chrome face of the mask, including the patterns, should be placed upside down, against the substrate.
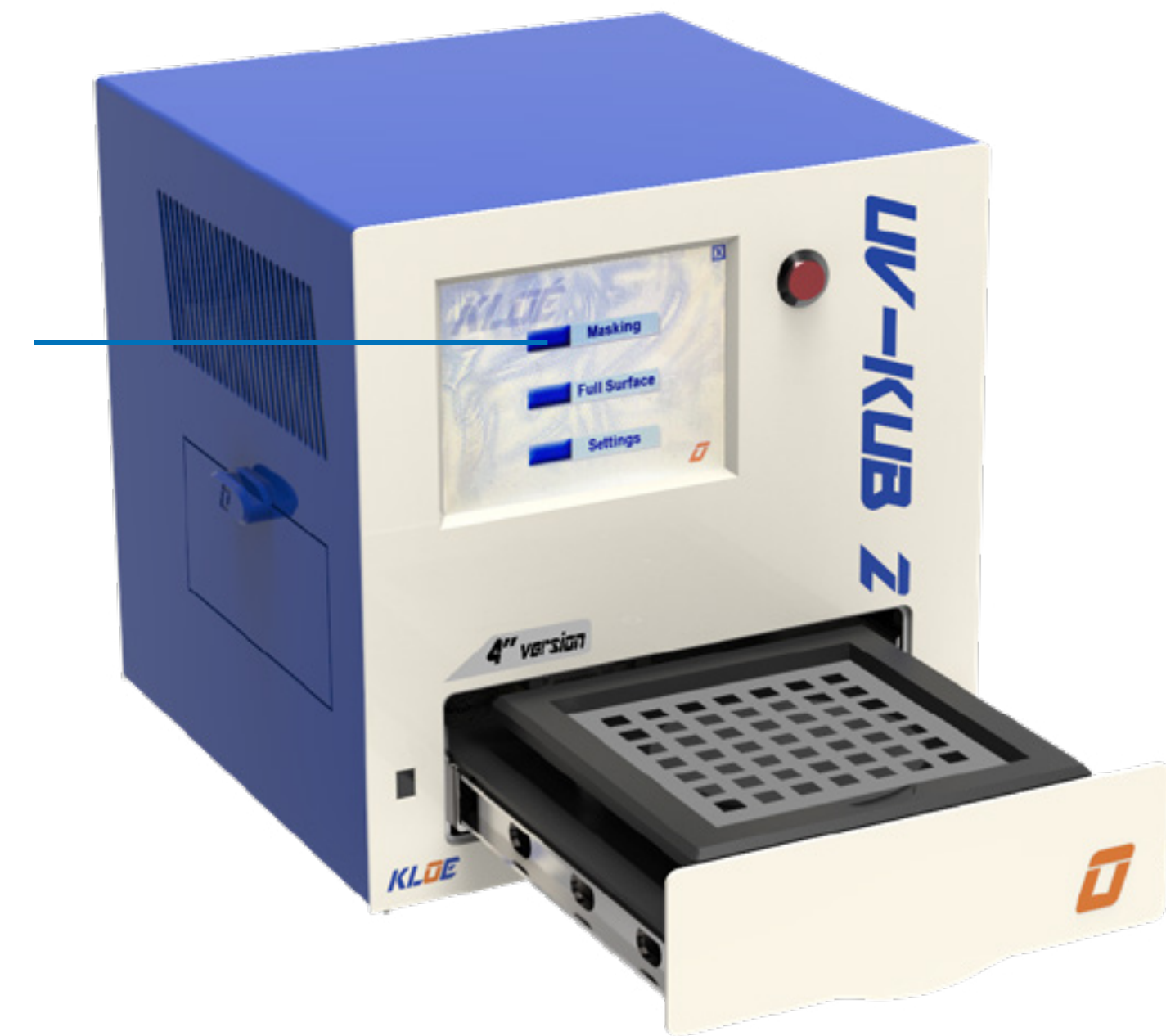
Click on   **Masking menu**

Setting the mask to substrate distance

Then enter the **masking distance.**

GOOD TO KNOW

The drawer is open during all the mask to substrate distance setting.

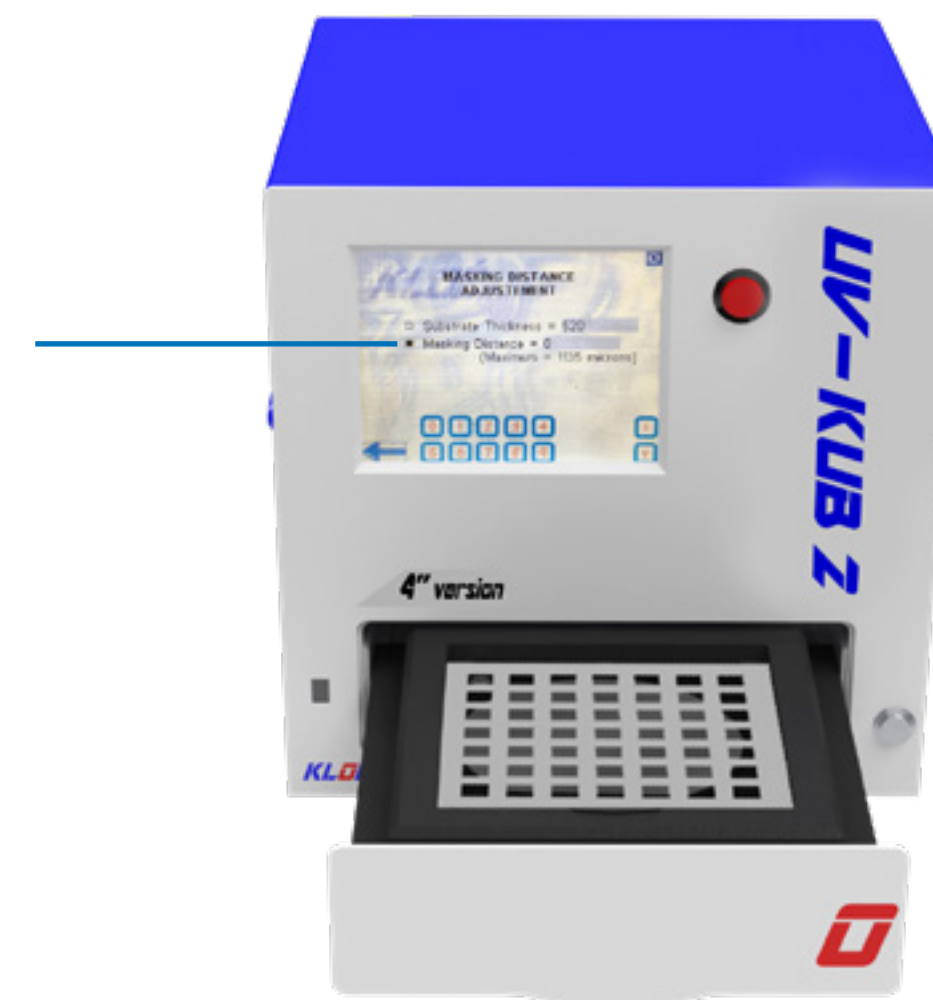Enter the **total thickness of the sample** (substrate + layers).

GOOD TO KNOW

When using a 2" wafer, remember to remove 150µm to the calculation of the total thickness of the sample: **substrate + layers - 150µm**

GOOD TO KNOW

If the values you have chosen do not correspond to the values accepted by the UV-KUB 2, an error message will be displayed indicating the min and max values accepted by the machine.

Click on **Validate**. The substrate holder will rise and position itself at the chosen masking distance.

W⚠RNING!

While leaving the drawer door open during a substrate holder distance adjustment, make sure that nothing hinders the movement of the substrate carrier or you may risk damaging the motorized moving device.

GOOD TO KNOW

It is essential to know as precisely as possible the thickness of your sample (substrate + resin) in order to precisely control the masking distance.
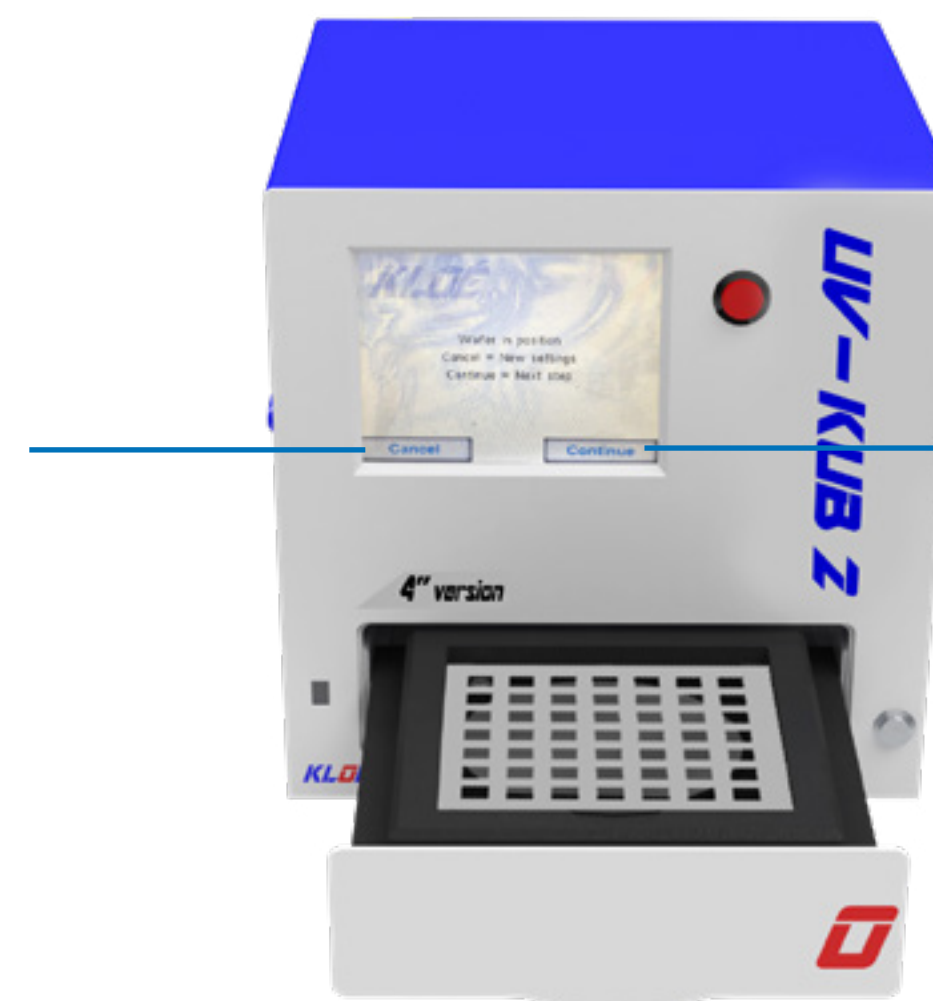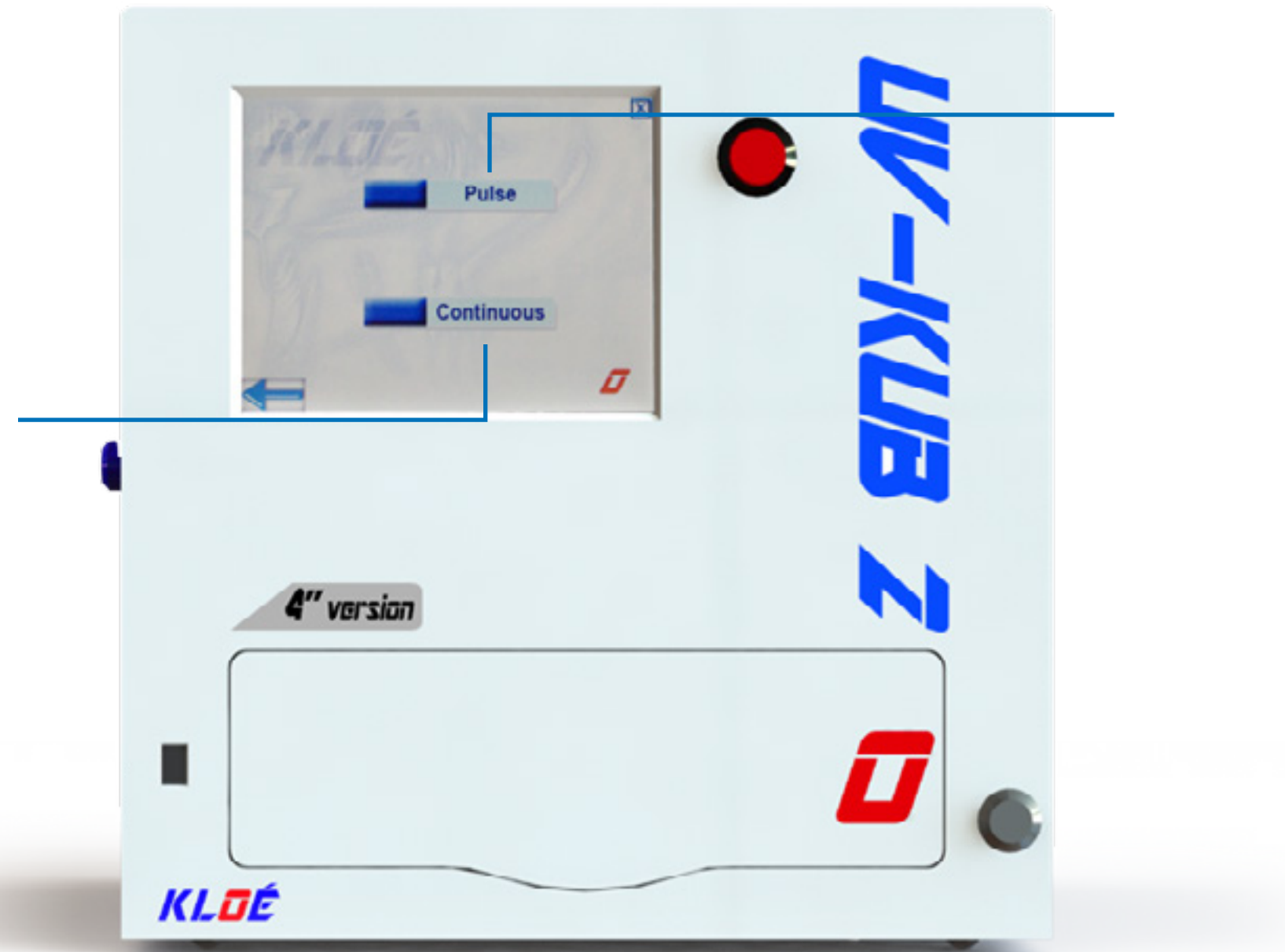
Once the wafer is in position, you can click on:

cancel if you want to **go back to the Masking Distance Adjustment,**

continue to go to the next step: the drawer closes. You can choose between **New Cycle** or **Memory.**
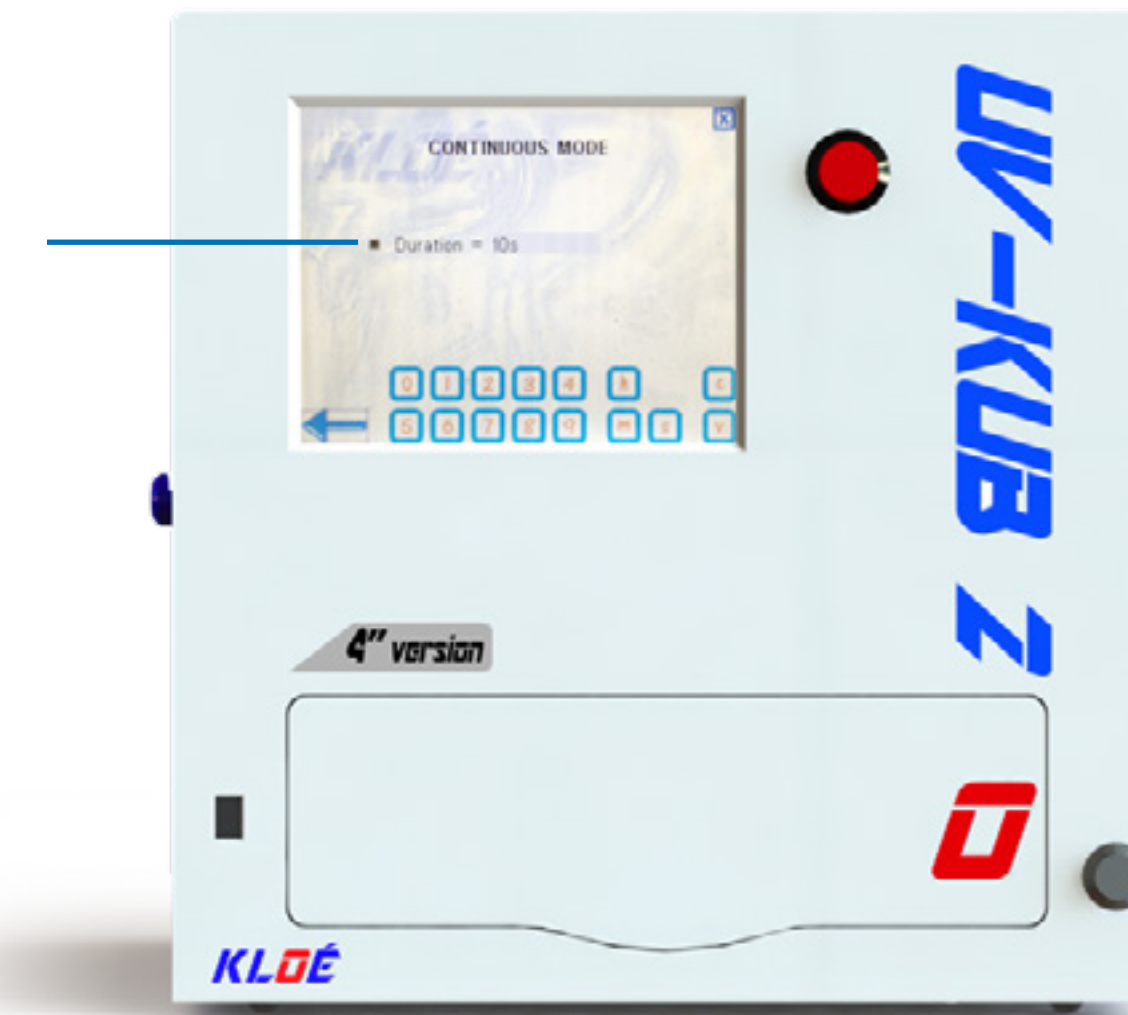
Exposure cycles settings

Continuous exposure

Set the time

The UV-KUB 2 allows the user to choose between:

a continuous exposure of the substrate during an adjustable time period,

or to emit light pulses of adjustable duration separated by a time pause also configurable.

The **duration** is expressed in **hours (h), minutes (m), seconds (s)** and is adjustable between 1s and 1h by selecting the numbers/letters on the touchscreen keyboard.
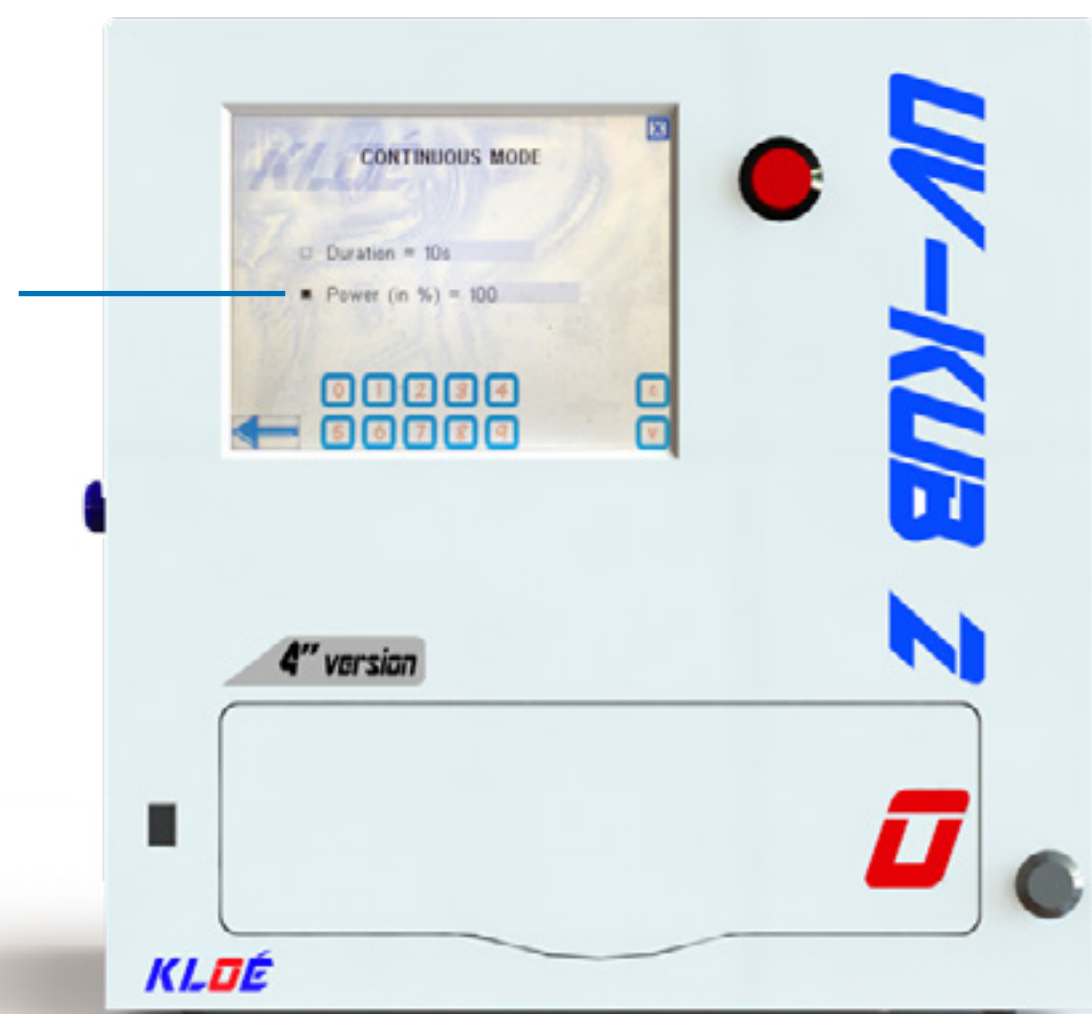
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Pulse exposure

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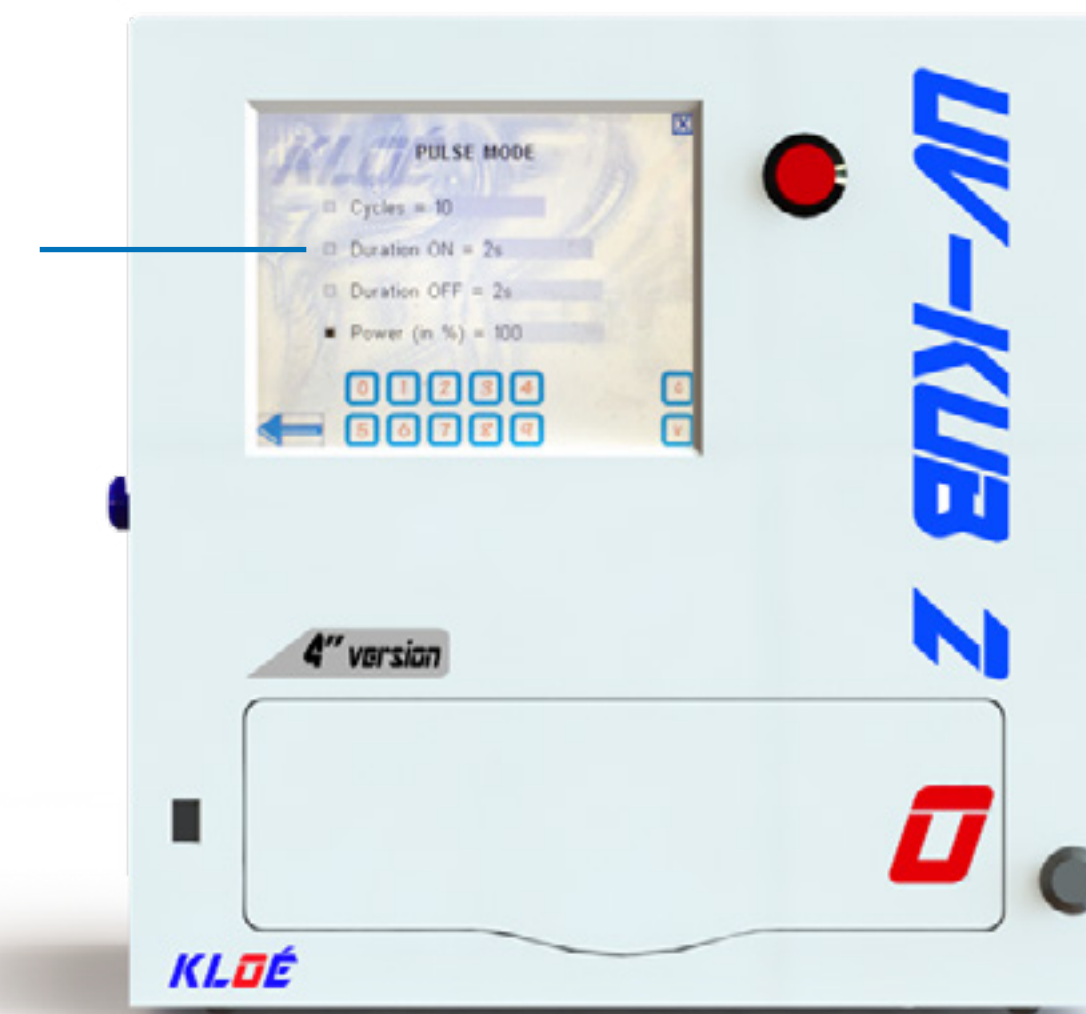It is **adjustable between 5 and 100%** by selecting the numbers on the keyboard.

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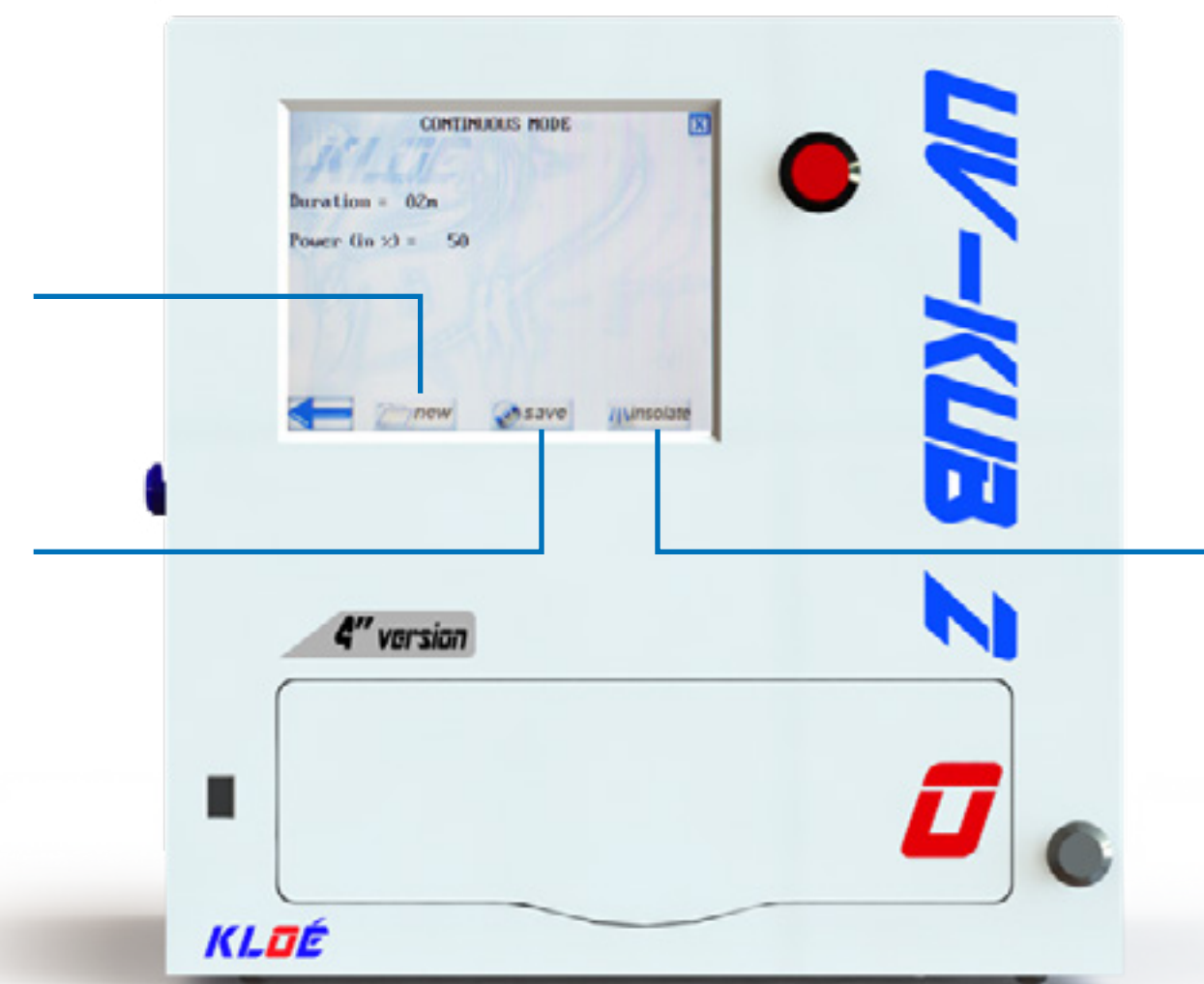
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Confirm settings

Confirm settings - Continuous exposure

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Confirm settings - Pulse exposure

Exposure in progress

Exposure interruption

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• rupture of the power supply,

• machine error: see chapter **Troubleshootings: Error messages**,

• voluntary user pause.

GOOD TO KNOW

To stop an exposure, press the red emergency stop button on the right of the touch screen. In this case the machine will stop the exposure and will suggest to either restart or cancel the exposure. If you decide to restart the exposure, the UV-KUB will continue the originally defined cycle.

Exposure end

- At the end of the exposure, a **buzzer sounds two long tones and the screen flashes.**

- Simply **touch the screen to open the drawer and retrieve the mask and the substrate.**

GOOD TO KNOW

To retrieve the substrate, in the case of a wafer, pass the wafer clamp under the substrate by the recess provided for this purpose in the substrate holder.

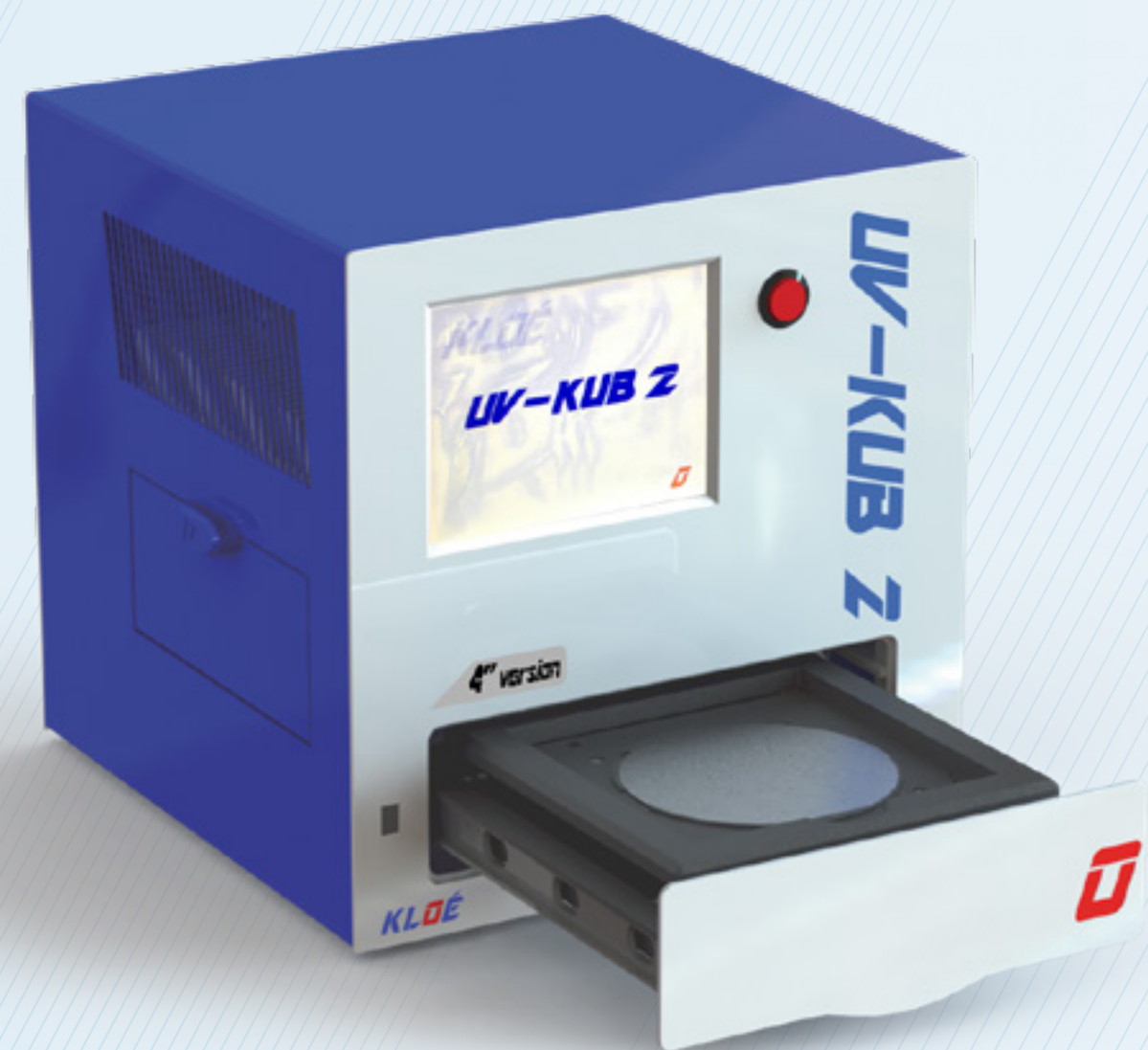Touch the screen to go to the next step.

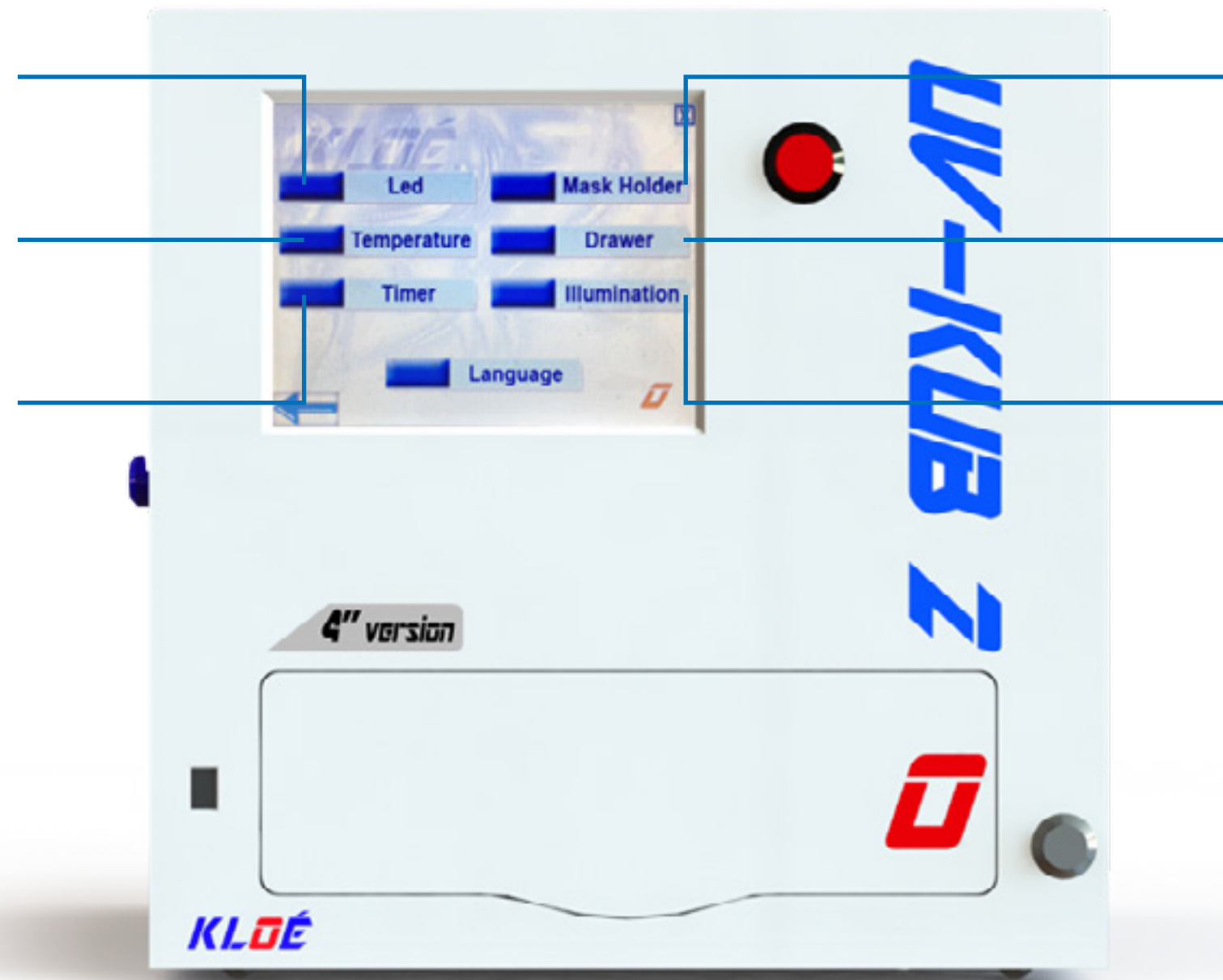While the drawer is still open, two choices are offered:

- **To renew the exposure, with the same settings:**

  - load a new substrate in the drawer, then add the photomask,

  - click on **Continue:** a new exposure will be automatically launched with the identical settings to those of the earlier exposure.

- **If you are finished,** simply select **Cancel** to return to the UV-KUB 2 main screen.

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Settings

Timer: displays the total run time of each LED during exposure.

Mask Holder: opens the setup menu of the masking distance to ensure proper operation of the device for moving the substrate holder.

Drawer: unlocks the drawer

- in order to confirm proper operation
- or to open it for maintenance of the exposure chamber

Illumination: measures the substrate holder illumination in mW/cm² at full power.
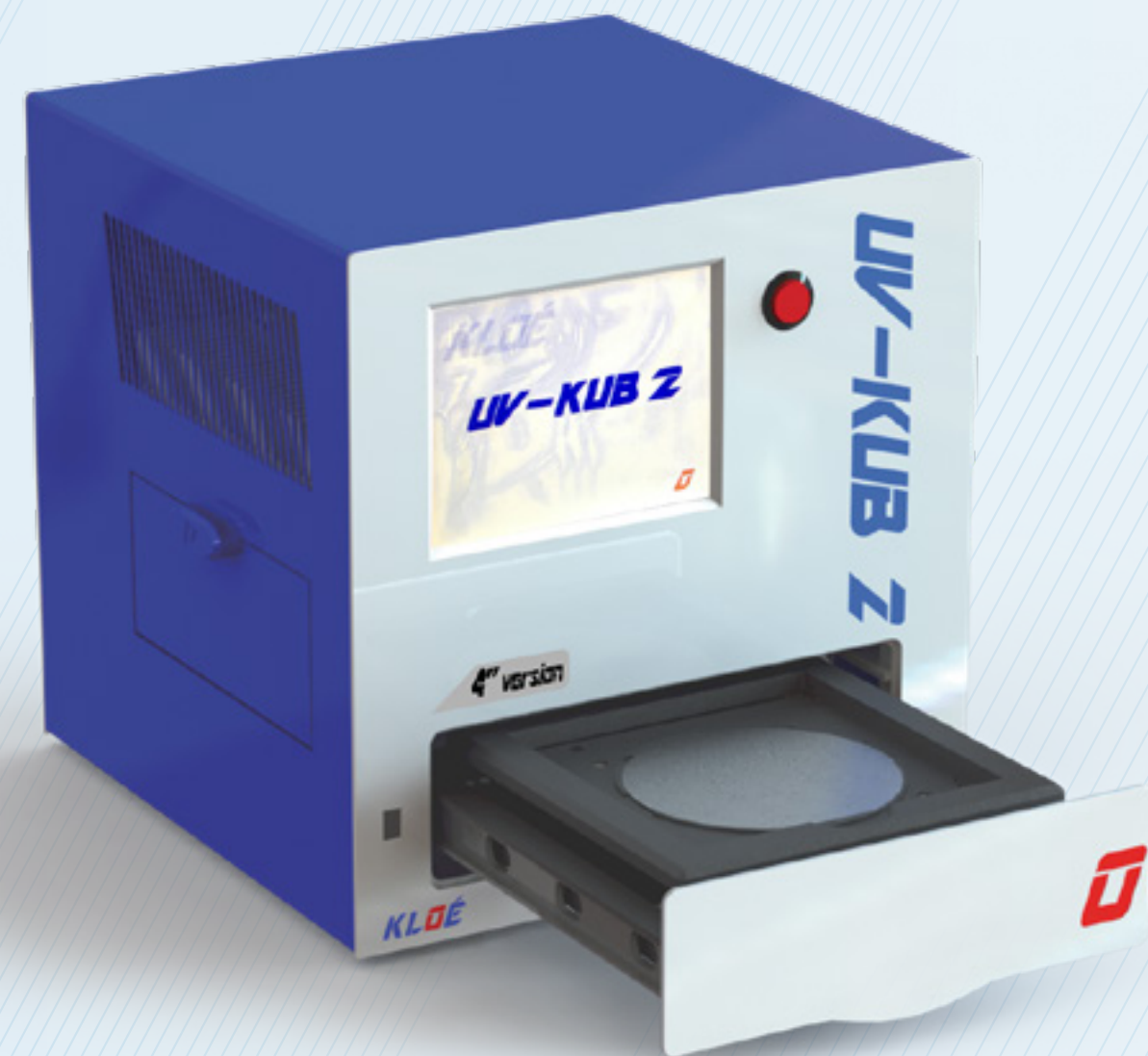
This menu allows you to check the evolution in time of maximum power emitted by the UV-KUB LEDs, and therefore adapt, if necessary, your exposure protocol according to this information.

W⚠RNING!

Ensure that there is no substrate on the substrate holder while measuring otherwise the measure value will be wrong.

LED: confirms that no transmitter is defective. When you select LED in the "settings" menu, the UV-KUB 2 tests each LED and then displays the result next to the corresponding linde on the list.

- If all is well, the status will show **OK**
- If a problem is detected, the status will show **ERROR**

Temperature: displays the exposure chamber and LED temperature.
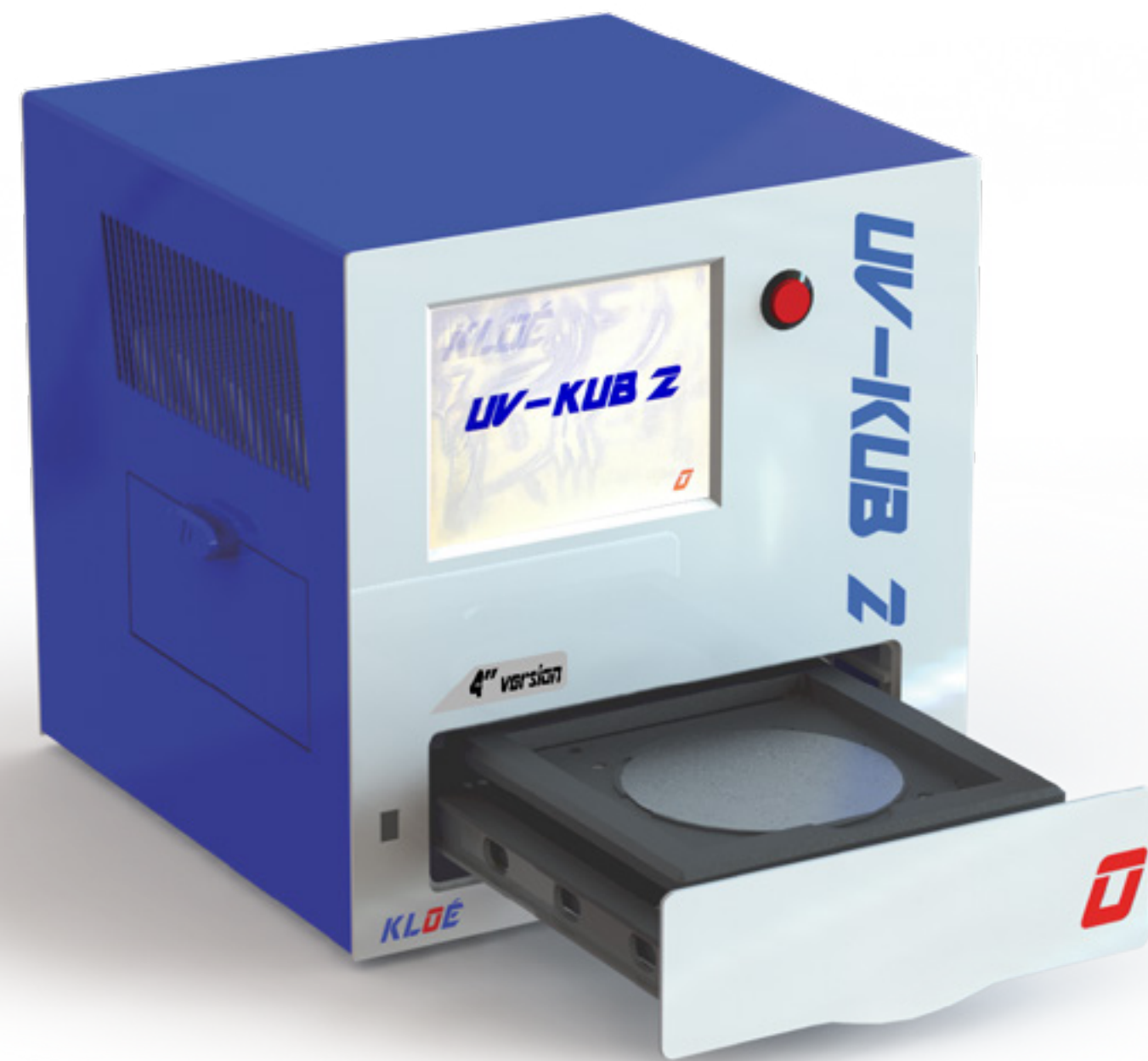
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Maintenance & troubleshooting

UV‑KUB 2 *4" version*

Exterior maintenance

Use a soft cloth to clean the machine's exterior and cover.

W⚠RNING!

Avoid using solvent to clean the touch screen. A soft and dry cloth is recommended. If stains are persistent, turn the screen off and lightly press on the screen with a slightly moist cloth.

Exposure chamber maintenance

To properly clean the exposure chamber, open the drawer and turn the machine off via the UV‑KUB 2 "settings" and "drawer" menu.

One can then reach the exposure chamber through the side door and completely clean it by accessing the space under the drawer when it is closed.

To clean the chamber components we recommend you use a low aggressive solvent such as Isopropyl Alcohol (IPA).

W⚠RNING!

Do not press the optics cover plate when cleaning it inside the exposure chamber.
Using a soft cloth to remove any dust will work. To clean the plate, only use Isopropyl Alcohol (no ethanol).

Troubleshooting

Error messages

During UV-KUB 2 operations, the following error or warning messages may appear:

Error message	How to fix the problem?
Input error / Time duration error	The input is incorrect, you probably made a mistake in the unit or entered a non supported value
LED error	Restart the machine, check the LED status in the "settings/LED" menu. If the status indicates ERROR, contact Kloe customer service.
Temperature sensor error	Restart the machine. If the error persists, contact Kloe customer service.
LED fan error	Restart the machine. If the error persists, contact Kloe customer service.
System temperature too high / Wafer temperature too high	Check: • that no object is obstructing the air vents of the machine, • that the ambient room temperature is not too high, • that no heat source is placed nearby, • that a distance of 4 inches between the machine and other equipment is maintained. Restart the machine. If the error persists, contact Kloe customer service.

Troubleshooting

Possible cause	How to fix the problem?
The UV-KUB machine doesn't turn on	Check, at the rear of the machine: • the power cable • the position of the switch
The touchscreen does not respond	Restart the machine. Check again the response.
The exposure seems less efficient with unchanged settings	Check the illumination value in the "settings/lighting" menu. If it's dropped by over 20% of the original value of the machine, the transmitters are reaching the end of their life. Contact Kloe customer service. Otherwise, increase the exposure duration or power.

If the problem persists despite the solutions implemented,

contact the **Kloe after-sales service : sav@kloe-france.com**

UV-KUB 2

4" version

Exposure-masking system

USER MANUAL - UVK2-4P-2022-01