

Flash Lamp Annealing System



Semi-Line 3.0

-Operation Manual -

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Note:

ROVAK undertakes all efforts to ensure highest product quality and optimum process and technology performance. Therefore, parts of the hardware or software of the system may be upgraded, modified or replaced by new versions.

This also includes possible modifications of the manual. To perform any kind of procedure or system operation, make sure, that the latest version of the manual is used!

ROVAK GmbH

1 Safety Instructions

1.1 General Information



Please **read carefully all safety instructions**, these **Operating Instructions**, as well as the instructions for use of the individual components. Please ensure that these instructions are followed. The equipment may only be operated in the normal condition as described in the Operating Instructions and it must be serviced and maintained by trained personnel. Please also observe the locally applicable and state-imposed requirements and regulations.



CAUTION !

The working and operating procedures must be strictly adhered to, in order to prevent any danger to persons.

CAUTION !

Please refer to the Work and Operating Procedures, which must be followed precisely, in order to avoid damage and destruction of the device.

1.2 Personnel Qualifications

Professional Personnel:

The system may only be operated by persons who have the appropriate technical training and who have the necessary experience or who have been trained by the operator.

Qualified Personnel

Under qualified personnel qualified electricians or specially trained people in the EN sense to understand 60204 Part 1, 3:55 or 3:30.

1.3 Important Safety Information

Failure to comply with the following precautions may cause serious injury or death.

1.3.1 Mechanical Hazard



Caution!

Danger of pinching when lowering the flash lamp unit using the lift.

1.3.2 Electrical Hazard



Caution!

Danger of electrocution. The flash module carries voltages up to 4000V. For working on live parts, the module must remain switched off and it must be protected against being switched on again. The capacitor batteries are to be discharged.

Work on the electrical system may only be carried out by qualified personnel.

Warning!

You may only connect or disconnect the cables when the power is off.



Caution!

The emergency stop button serves to switch off the devices outside the control cabinet. The cabinet itself remains energised. When working on this unit, it must be disconnected from the mains supply.



Caution!

Voltages up to 4000 V can be applied to the connections of the capacitors in the control cabinet.

The door of the control cabinet has a safety switch. Opening the door interrupts the charging process and discharges the capacitors.

Do not disable the safety switch!



Caution!

Unconnected capacitors can generate dangerous voltages.

When working on the capacitors and during storage, they must be short-circuited.

The capacitor plug-ins are equipped with a relay which moves down when the control cable is disconnected from the plug-in unit, thus short-circuiting the capacitors in order to prevent self-charging.

1.3.3 Hazards Caused by Flash



Caution!

Flash Hazard.

The flash may cause damage to the eyes.

The flash module may only be used in closed installations without viewing windows.



Caution!

Danger for the respiratory system caused by ozone.

The high flash light energy generates ozone. The flash light module may only be operated with an extraction unit which neutralises the ozone.

The extraction unit is not an integral part of the module.

Not applicable when working in an oxygen-free atmosphere.

1.3.4 Hazard from Hot Surfaces



Caution!

Danger of burns from hot surfaces.

The high temperature of the infrared heater results in heating of the surrounding surfaces. Touching these surfaces can cause skin burns!

1.3.5 Notes

Failure to observe the following points can lead to damage to the system.

- Do not expose the system to any dripping or splashing
- You may only connect or disconnect the cables when the power is off.
- Connection and disconnection of the cable connections while the power is on can destroy the device.

2 Description of the Flash Lamp System

The flash lamp system is used to generate ultrashort flashes to heat surfaces. For this purpose, the substrates are introduced into a vacuum chamber. Below the substrate holder, there is a lamp heater for preheating the substrates. The flash lamp unit is raised with a lift to open the chamber and to insert the substrate.

2.1 Construction of the Flash Lamp System

1. Frame with an aluminum vacuum chamber
 - 1 turbopump Pfeiffer Vacuum HiPace80 / DN 63 ISO-K
 - 1 fore-vacuum measuring device PSG500, DN16 ISO-KF
 - 1 fore-vacuum measuring device PCG550 with ATM, DN16 ISO-KF
 - 1 vacuum measuring device MAG500, DN25 ISO-KF
 - 1 gate valve DN 63 ISO-K
 - 2 angle valves DN 16 ISO-KF
 - 3 diaphragm valves
 - 1 MFC, MKS GE50A, 100 SCCM
 - lifting system for the lamp house
 - chamber and lamp house water cooled
 - IR substrate heater with QRC coating
2. One control cabinet E01
 - 1 SPS CX8010 EtherCAT
 - 1 power supply unit 24V / 20A
 - heater control
 - 1 main switch
 - 1 emergency-stop button and safety technology
 - decentralised EA-points for control
3. Three power cabinets E02 with
 - 1 flash lamp control unit ROVAK Flash-Control X18
 - 1 pulse form control
 - 2 Capacitors (space for 2 extra ones)
 - 4 coils
 - 1 grounding switch for maintenance
4. One control computer

2.2 Delivery

The flash lamp unit is supplied by ROVAK GmbH as a vacuum chamber with flash lamp unit, one control cabinet and three power cabinets.

2.3 Technical Data

Type:		Semi-Line 3.0
Serial number:		21125860
Year of construction:		2021
Manufacturer:		ROVAK GmbH
Power supply:		400 V, 3 phase
Network frequency:		50 Hz +/- 3%
Power consumption:		ca. 5 kW, max. 12 kW
recommended fuse:		3 x C32 A
Masses:	Flash module	500 kg
	Control cabinet E01	300 kg
	Power cabinet E02	450 kg
Dimensions (WxDxH)	Flash module	920 x 720 x 1550 (1850) mm ³
	Control cabinet E01	800 x 400 x 2200 mm ³
	Power cabinet E02	600 x 800 x 2200 mm ³
Ambient temperature:	In operation	18 to 35°C
Installation altitude:		up to max. 1000 m above sea level (NN)
Maximum processed substrates area:		Ø100
Charging voltage:		max. 4 kV
Pulse duration:		adjustable
Pulse current:		max. 2.5 kA
Substrate heater:		max. 850 ° C
Pressure in the system:		max. 1.0 bar
Compressed air supply:		6 bar
	Particle density	≤ 10 mg/m ³
	Particle size	≤ 40 µm
	Oil content	≤ 10 mg/m ³
Cooling water supply:		max. 6 bar

3 Installation

3.1 Intended use

The flash lamp system is used to generate ultrashort flashes to heat surfaces. The flash module must not be used when there are combustible materials in the chamber or if substrates are used, which contain layers of hazardous materials.

3.2 Environmental conditions

Ambient temperature: The permissible ambient temperature for operation is 18 to 35°C.
Do not expose the unit to dripping, splashing or condensation.

Dust: The operation of the system in rooms with high dust concentration is not permitted.

Potentially explosive areas: Operation in potentially explosive atmospheres is not permitted.

Installation altitude: Installation heights up to 1000 m above sea level (NN) are possible without restrictions. At altitudes above 1000 m, the heat dissipation is deteriorated by the ambient air. For those cases, please inquire for more information.

3.3 Construction of the Module

The flash unit is mounted on a light-tight vacuum chamber. Safety switches must not be deactivated.

3.4 Electrical connection



Caution!

Work on the electrical system may only be carried out by qualified personnel; see the Safety Instructions.

At the terminal 1X1, 3 phases alternating current 50Hz 400V / 32A is to be connected to the right-rotating rotation field + N + PE.

The flash unit must be connected to the control cabinets using the supplied cords and plugs.

4 Operation

4.1 Switching the module on

- Check that water, gas and sufficient compressed air (6 bar) are connected to the system.
- Turn main switch 1S1 ON.
- Switch on the PC and log on to the PC.
- The user interface will start automatically.
- Reset the emergency stop by pressing the "Res" button (1 sec.)

4.2 Handling of the module

4.2.1 Raising and Lowering the Flash Unit

To raise the flash unit, the chamber must be vented, that is by pressing the **Vent** button (see chapter 4.4.2.1). Lifting and lowering is done by pressing the buttons ▲ or ▼ on the flash module.



Chamber closed

Buttons for lifting



Chamber opened



Caution!



Warning!

Hazard of catching during the lowering of the lamp housing!

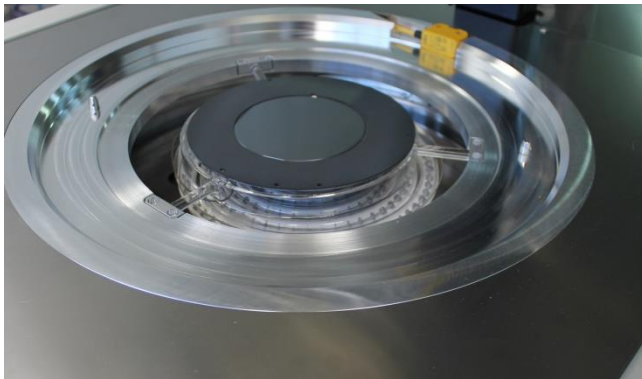
Do not hold your fingers or hands between the chamber and the lamp housing during lowering.

Do not place objects in the area of the lamp housing! Make sure that the substrate holder and the substrates are correctly placed in the chamber!

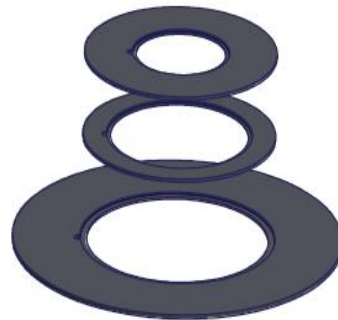
Make sure that the vacuum seal is not scratched. Do not place any parts on the vacuum seal

4.2.2 Substrate holder

The flash module Semi-Line 3.0 is equipped with a $\varnothing 4''$ substrate holder by default. Additional substrate holders, e.g. for $\varnothing 3''$ and $\varnothing 2''$ substrates, are available on request.



Substrate holder for substrates up to $\varnothing 4''$
(similar to illustration)



Substrate holder for
 $\varnothing 4''$, $\varnothing 3''$ and $\varnothing 2''$ substrates



CAUTION !

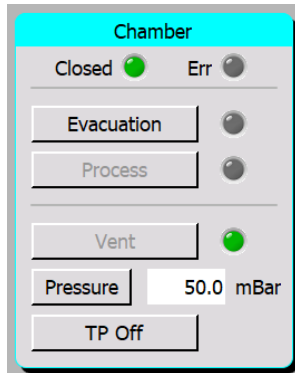
Do not operate the unit without substrates in the various substrate holders!

The heater can damage the flashlights or the flashlights can damage the heater!

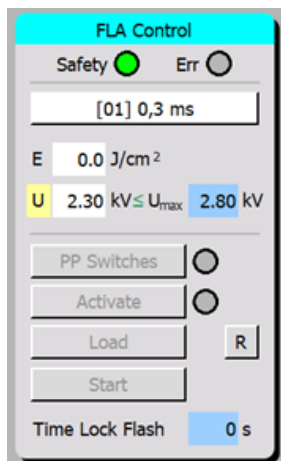
4.2.3 Operating Sequence for the Flash Mode

When using the flash module, proceed as follows:

- Position the substrates on the substrate table
- Lower the flash unit
- Press the **Evacuation** button



- Set the pulse duration of the flash using the "drop down" menu

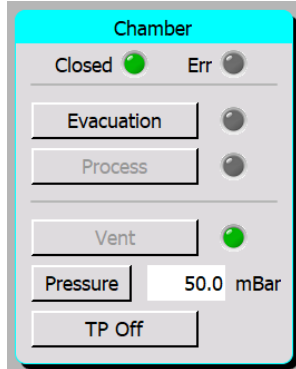


- Set the desired energy density
- Enable the pulse duration with the **PP Switches** button
- Press the **Activate** button
- Press the **Load** button, charging starts and the start button gets activated, when charging is complete
- Press the **Start** button
- **Note:** If the Start button is not pressed within a 120 s after the capacitors have been successfully charged, the capacitors will be discharged automatically.
- The next flash can be performed again after 120 s waiting time.

4.3 Exiting Process Mode and venting the chamber

To exit the process mode, you should:

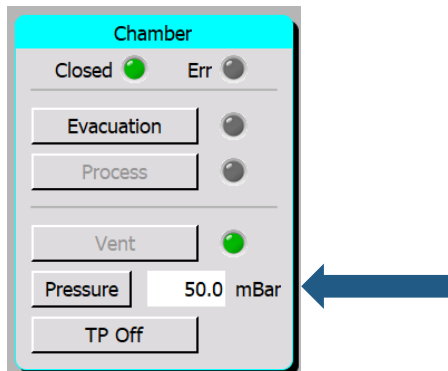
- Press the **Evacuation** button



- The chamber is evacuated again until the vacuum base pressure is reached. → The **Nitrogen Fl.** button can be activated
- Press the **Nitrogen Fl.** button
- The chamber will be vented
- Raise the flash unit

Venting at elevated temperatures:

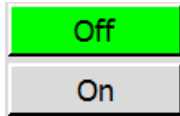
- Conventional venting is only possible below 135°C substrate temperature
- If the pressure button is activated, flushing at higher temperatures is possible
- The nitrogen supply starts until desired pressure is reached (max. 500mBar)
- Below 135°C venting starts automatically until atmospheric pressure is reached



4.4 User interface of the module

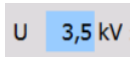
4.4.1 Symbols and Abbreviations

Input and output

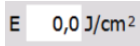


The button is pressed

The button is not pressed

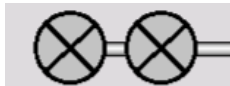


Display box (Parameter, value and unit)



Input box (Confirm the value with the Enter button)

Lamp circuit:



Flash lamp

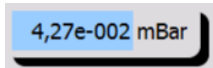


Capacitor



Discharge resistor

Vacuum Measurement Technology:



Vacuum gauge with pressure indicator and bars for the representation of the measuring range

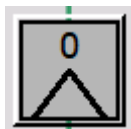
Valves



Vacuum valve (closed / open) with actuation

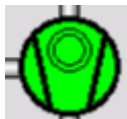


Gas supply and control







Mass flow controller

Pumps



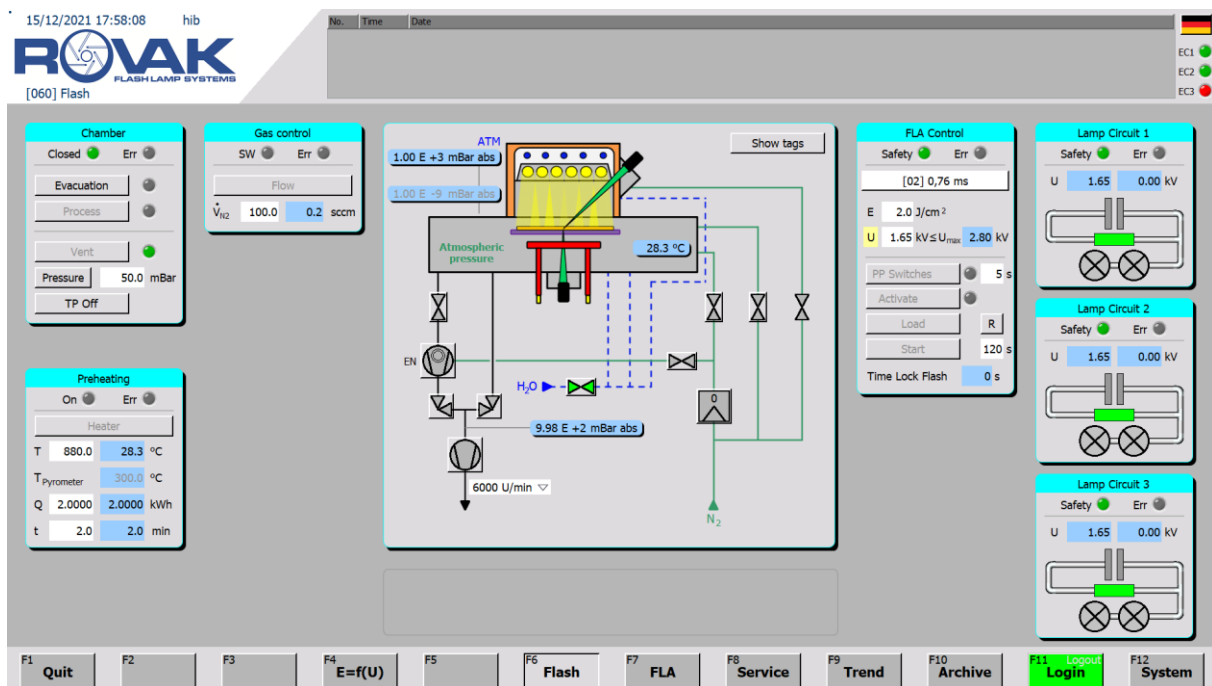
Vacuum pump (on / off) with actuation

Status indicators

	No action
	ongoing process
	achieved status
	Error

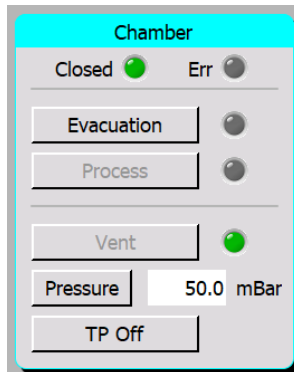
4.4.2 The Flashing Menu

Interlocks are activated. The possibility of the operation is controlled by the access rights of the logged on user. Registration is concluded by pressing the **F11** button. Right next to the logo, there is the alarm table indicating the currently pending alarms and warnings. Next to it, you will also be able to see the logged-on user. In the middle, you will find an overview screen of the module. The control elements for the vacuum generation, as well as for the heater and the gas supply, are located on the left side. The control elements for the FLA can be seen on the right side.



In the footer you can open additional windows with the F-keys: Quit, E=f(U), Flash, FLA, Service, Trend, Archive, Login and System.

4.4.2.1 Vacuum and general process control



Pressing the **Evacuation** button starts pumping the chamber. The current status of the process is indicated with the circle behind the button (see 4.4.1).

Pressing the **Process** button releases the interlocks for the power supply, the gas inlet and the heater. It becomes active, when the vacuum base pressure of 1E-04mbar is reached.

The **Vent** button vents the chamber. The status light next to the button indicates that the chamber is being vented. If the **Pressure** button is active, the nitrogen supply starts at elevated temperatures.

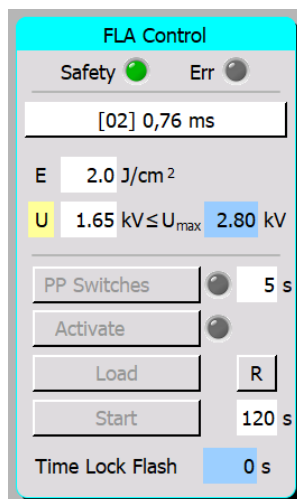
If the **TP Off** button is pushed, the turbo pump will be turned off while the venting cycle. Otherwise the turbo pump will run on for a faster evacuation after a sample change.

4.4.2.2 Flash lamp control unit

The flash lamp unit consists of three lamp circuits, each with a capacitor bank, a PP switch bank, a coil, 2 flash lamps and a discharge resistor.

In this menu, both the pulse time as well as the energy density can be adjusted (input must be selected before the **Load** command is given). The appearance of the lamp circuits as well as the colour of the capacitors and the lamps change, depending on the position of the buttons and the charging state of the capacitors.

Furthermore, the following values can be seen: the charging voltage of the capacitor, the capacity used and the maximum charging voltage (depending on the selected pulse time).



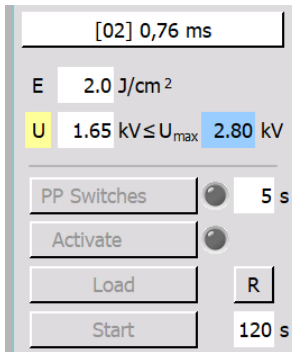
Input Values:

← Pulse duration

← Energy density

After triggering a flash, the FLA process is disabled. In order to release another flash, **FLA** must be activated once again. The next reload is possible after a waiting time of 120s.

If an error occurs during loading, the **Err** lights up in red.



In the input boxes, you can specify the energy density. The voltage automatically adjusts itself according to the calibration curve a (see window $E = f(U)$). It is possible to use the direct voltage input. The active value is yellow highlighted.

Button **PP Switches** activates the pulse configuration

Button **Activate** initializes the safety check

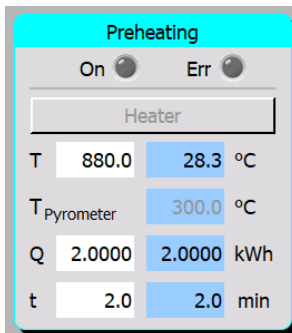
Pressing the **Load** button starts the loading after all safety circuits are ok.

Start becomes active when loading is finished

Pressing the **Start** button: The flash is released for all activated circuits (for activating /deactivating, see 4.4.4.2).

4.4.2.3 Heater control

In the **Preheating** menu, there are several set points and actual values.



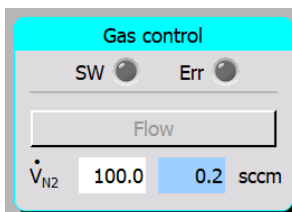
On the left, enter the temperature set point in the white box **T**. In the blue box, you will see the actual temperature value. In the blue box below you can see the actual temperature value measured by the pyrometer (range: 300 – 850 °C). Watch out for IR transparent temperature ranges of your used sample.

The heating time is limited by a total energy limitation **Q**. The higher the temperature, the shorter is the heating time. Zeroing is performed once the temperature of 135°C has been undershot.

The timer **t** can be used for the automated stop of the preheating. The timer starts, when the temperature set point is reached.

4.4.2.4 Gas inlet through MFC

In this control panel you can adjust the gas flow controller(s).





You can specify a set point for the gas flow in the white box. In the blue box, you will see the current value indicated. Pressing the **FLOW** button will switch the flow controller to gas flow.

SW lights up green, when the set point has been reached.

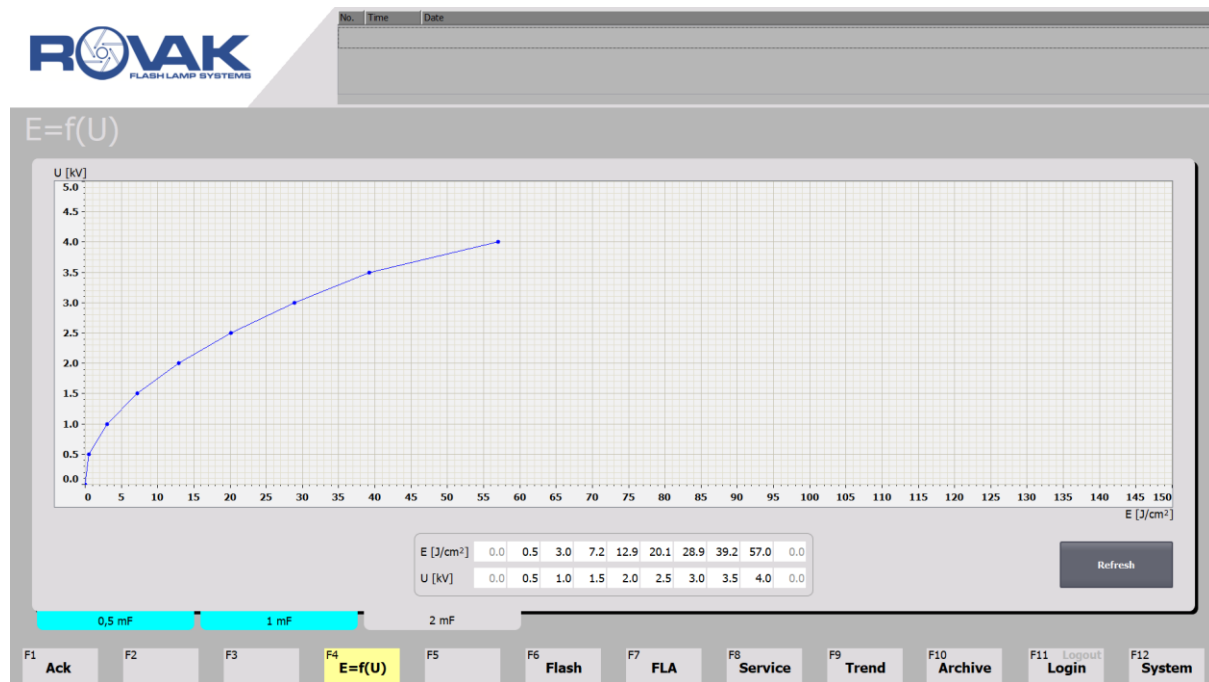
Err lights up red, when any error occurs.

4.4.2.5 Manual Mode

In the manual mode, certain components can be switched on directly (pumps, valves and MFC's). Pushing a component button (e.g.  for a valve) will open a drop-down menu. By pressing the  button in the drop down menu, the manual mode can be enabled (only possible when logged in as Service - user). Automatic mode (e.g. evacuation) is disabled, if one component is in manual mode.

4.4.3 The window $E = f(U)$

The **F4** key will open this window:



For loading, there are four calibration curves (in case of complete capacitor range) corresponding to the capacitor configurations for the energy, depending on the voltage and for the voltage as a function of energy. For set points, you can specify the energy in the upper blue box and obtain the corresponding voltage in the lower box or vice versa. Calibration is carried out using a suitable measuring device.

By pressing the **Refresh** button, the curves can be saved.


4.4.4 Service FLA window

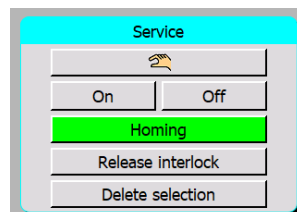
You can open the service FLA window by pressing the **F7** key. Use of the service menu is only possible when logged in as Service - user. By pressing the **ON/OFF** button, each individual lamp circuit can be activated / deactivated. Each measured voltage as well as the charging current are displayed in this menu, corresponding to the respective lamp circuit. In addition, the status of the relays and circuit breakers is displayed (green-switched, grey-open, red-error).

This window is just for maintenance purpose - only after consultation with the supplier.



4.4.4.1 Flash lamp component control

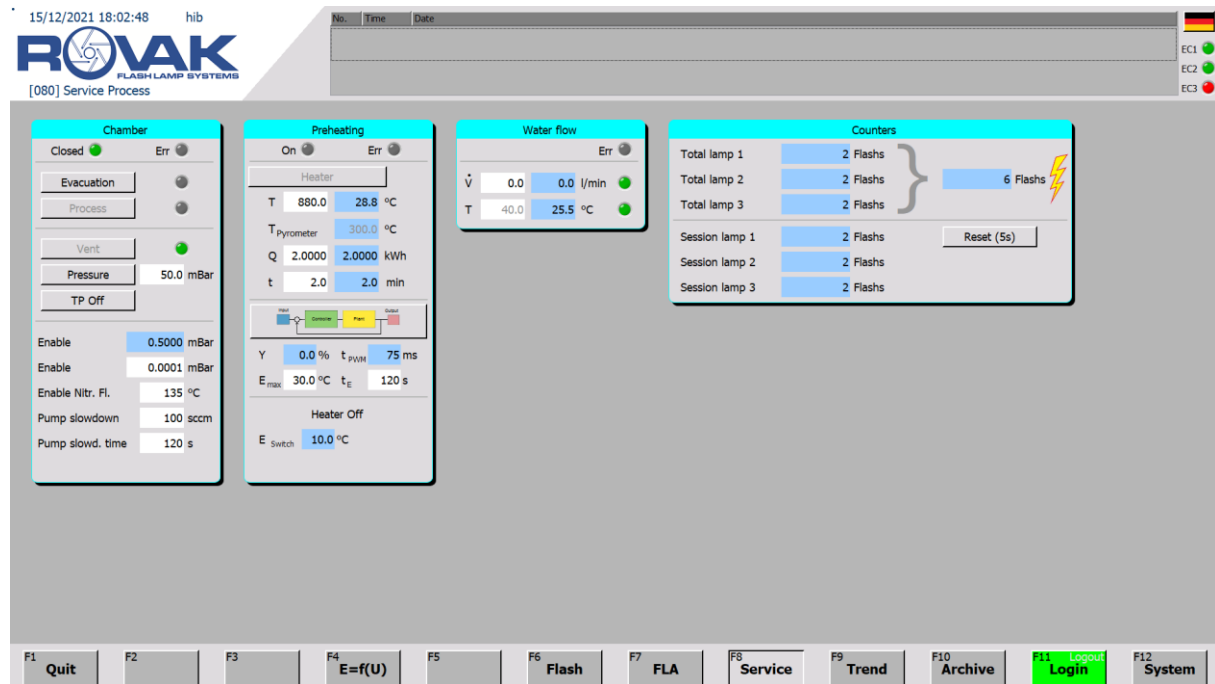
It is possible to switch each electrical component individually. This mode is just for experts after consultation with the supplier. The component has to be selected and the manual mode must be activated by the  button.



4.4.5 General Service window

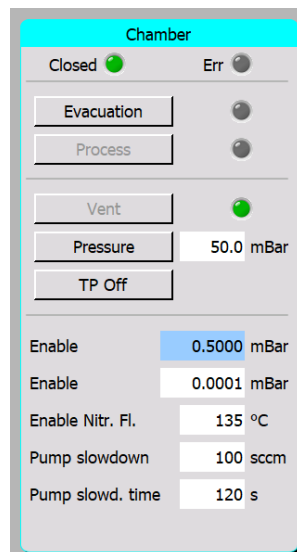
You can open the service FLA window by pressing the **F8** key. Use of the service menu is only possible when logged in as Service - user.

This window is just for maintenance purpose - only after consultation with the supplier.



4.4.5.1 Submenu Chamber control

In the submenu **Chamber** in the service settings you may enter:

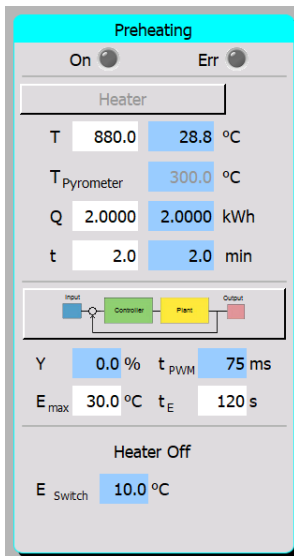


- ← the pressure to achieve the process to release
- ← the maximum temperature which allows venting
- ← flow for turbo pump venting
- ← active slow down time of the turbo pump

It is only possible to change these values as Admin - user.

4.4.5.2 Submenu Preheating

In this submenu you can set the following parameters:



The screenshot shows the 'Preheating' submenu with the following parameters and controls:

- On** (radio button) and **Err** (radio button)
- Heater** (text label)
- T**: 880.0 (setpoint) and 28.8 °C (current temperature)
- T_{Pyrometer}**: 300.0 °C
- Q**: 2.0000 (setpoint) and 2.0000 kWh (current energy)
- t**: 2.0 (setpoint) and 2.0 min (current time)
- Control Loop Diagram**: A block diagram showing 'Input' connected to a 'Controller' block, which is connected to a 'Plant' block, resulting in 'Output'.
- Y**: 0.0 % (setpoint) and **t_{PWM}**: 75 ms (current PWM time)
- E_{max}**: 30.0 °C (setpoint) and **t_E**: 120 s (current time)
- Heater Off** (text label)
- E_{Switch}**: 10.0 °C

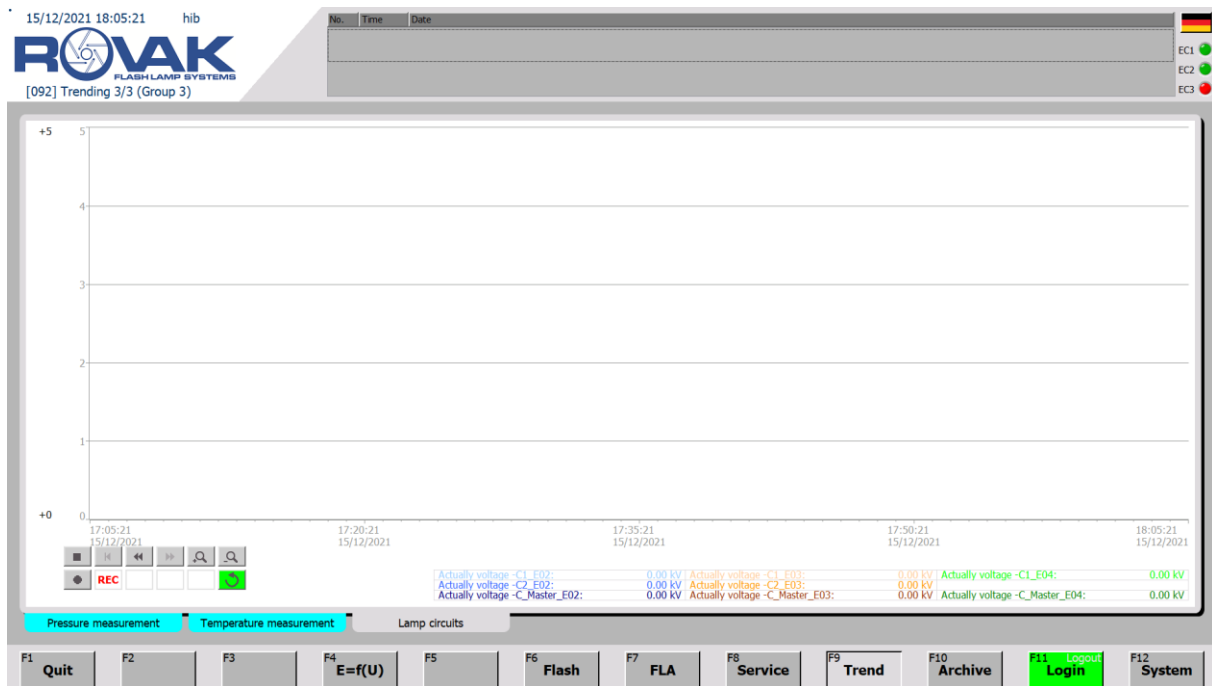
← Maximum amount of heat energy for one cycle

← Parameters for the automatic heating control


The changing of the control parameters is not necessary during normal operation.

4.4.6 Archive

Pressing the **F10** key a WinCC Online Trend Control window pops up.



The  button enables / disables the recording of the measurement data.

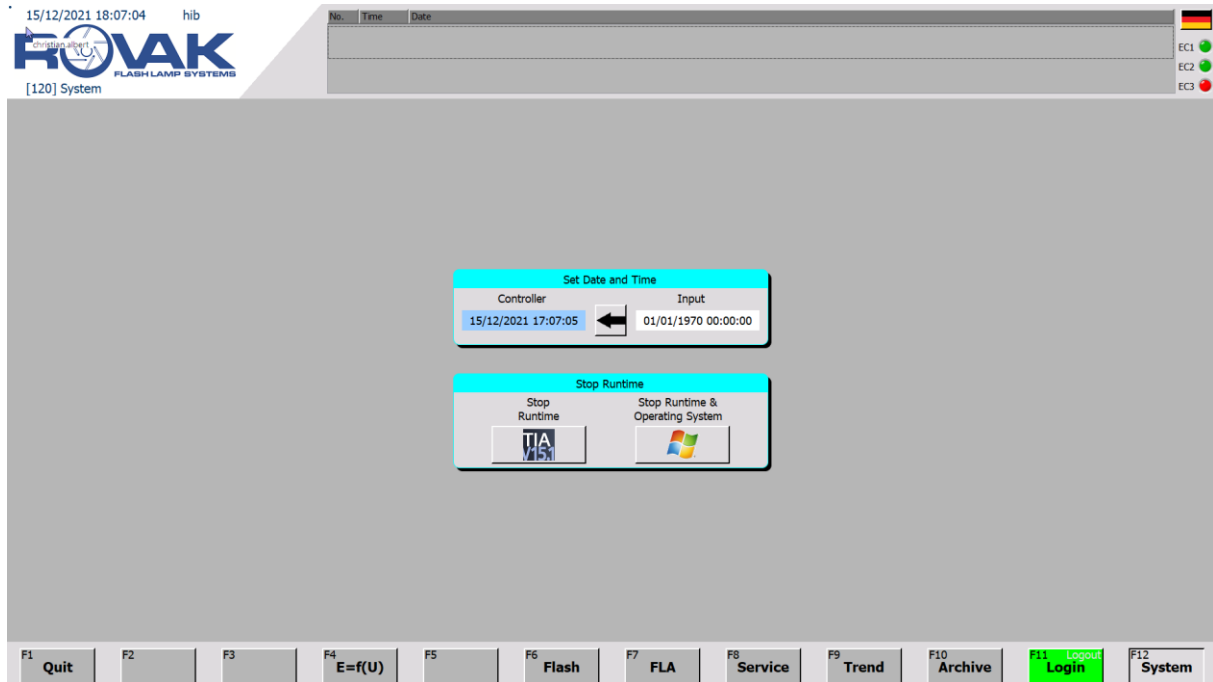
Pressing the  button, the graph in the trend display is updated automatically. The sub-items of pressure measurement, chamber and voltage are shown in the respectively selected display data.

4.4.7 Alarm Display

In the main window at the very top, you can see the current alarms and warnings. Warnings may be acknowledged by pressing the **F1** key or the blue reset button next to the user PC.

4.4.8 The System Window

Using the **F12** key, you can open the following window.



It is possible to change the language between English and German. In addition, time and date can also be adjusted. To exit Runtime, push the **Stop Runtime** button. For additional shut down of the computer push the **Stop Runtime & Operating System** button.

4.4.9 WinCC - directories and licenses

The control computer contains 2 partitions on the installed harddrive:

- Partition C:\
 - operating system Microsoft Windows 10
 - Software programs, e.g. for visualisation / HMI
 - Siemens Simatic WinCC Runtime Advanced (TIA V15.1 Update 4)
 - Simatic TIA Runtime Project
 - Licences for Siemens software
- Partition D:\
 - recovery partition (for reset of partition C, only after consulting with the supplier)

In case of a necessary re-installation, please contact ROVAK for support. Please regard our backup recommendations (see chapter 4.4.10).

In case of any software question, please do not hesitate to contact ROVAK or the Siemens Hotline: +49 180 50 50 222.

4.4.10 Backup

Since there is no automatic backup of the control computer, we recommend strongly doing backups as following:

- Backup of partition C:\ and D:\ once after the delivery
- Backup of the directory D:\logs\ (contains trend lines, archives and error logging) regularly, e.g. every four weeks

All input variables in the FLA control cannot be saved as a backup and should therefore be documented by the user.

5 Maintenance

5.1 Maintenance schedule for individual components

Please note the information stated in the instructions with regard to the use of the individual components

Component	Interval	Working
Turbo pump HiPace80	every 4 years	Bearing replacement, to be carried out by the manufacturer
Pirani gauge PSG500	every six months	Check and adjust the zero point; vented and evacuated
Measuring tube PCG 550 Pirani /Capacitive	every six months	Check and adjust the zero point; vented and evacuated Synchronise the atmospheric pressure sensor
Penning measuring tube MAG 500	Annually	Cleaning

5.2 Use of grounding switch

In any case of maintenance, use the grounding switch. In case of failure during discharge procedure, also use the grounding switch for discharging the capacitors.

Flash position:



Grounding position:



Explosion hazard through short-circuit of capacitors

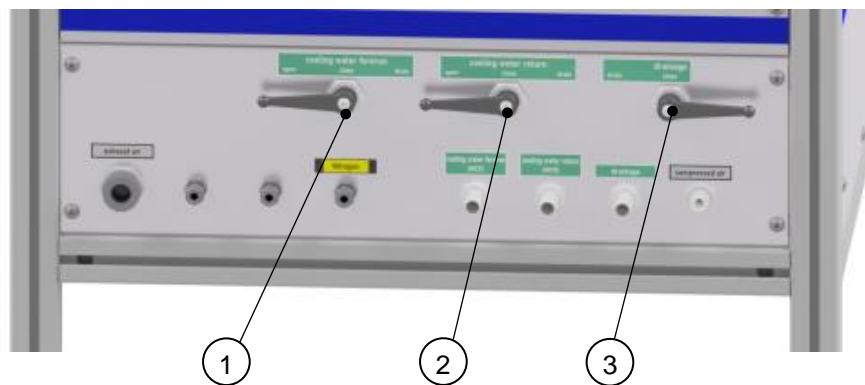
Never use another discharger.

Do not use this specific discharger to any other device! It is only allowed to use it for the FLA system.

5.3 Maintenance affecting the cooling water circuit

All components that require cooling water are connected via hoses to the media interface. This consists of the following:

- Cooling water forerun with a three-way valve (1) as a shut-off valve for the flow
- Solenoid valve (stops the return flow)
- Cooling water return run with a flow meter incl. temperature measurement and a three-way valve (2) as a shut-off valve for the return run
- Drainage connection with a shut-off valve (3) and a non-return valve



Media Control Panel

Before removal of various components or during maintenance work carried out on the system, it is required to blow out the cooling water. To do this, proceed as follows:

- Exit all processes and vent the chamber to atmosphere.
- Log in as Service (if you haven't done so yet) and check that the cooling water valve VW-1 is still opened.
- On the media panel: Close the three-way valve for the forerun (1) (lever up -> "close").
- Close the three-way valve for the return run (2) (lever up -> "close").
- Move the three-way valve for the return run into the "drain" position (2) (lever to the right -> "drain").
- Move the three-way valve for the forerun into the "drain" position (1) (lever to the right -> "drain").
- Open the "drainage" valve (3) slowly to begin with, and then fully (lever to the left -> "drain"), until all water has been blown out of the circuit.
- The blown-out cooling water escapes from the "Drainage" port and it can be discharged by means of a $\varnothing 13$ mm hose.
- Close the "drainage" valve (lever up to the "close" position).
- Bring the three-way valves for forerun and return into the "close" position (lever up).

- Switch off the system or its components and perform maintenance on the blown circuit.
- After that, turn on the system and all components. Check that the cooling water valve VW-1 is opened again.
- Open the three-way valve again for forerun and return run to fill up the cooling water circuit.
- Check the circuit for leaks.

**CAUTION !**

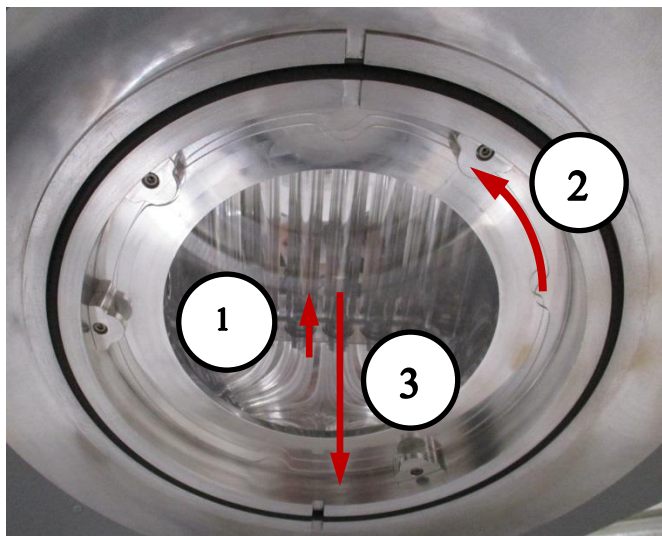
When blowing out, make sure that the three-way valves (1) and (2) are in the "drain" position, since otherwise the blow-out occurs not or through the water flow meter, which can lead to its damage.

5.4 Maintenance of protective screens

The lamp housing is equipped with a quartz glass protective screen (part no. 108374) which protects the reflector and the lamps. It lies on little lugs and can be removed tool-less. The plate can be covered with vaporised material and, if so, it needs to be cleaned or replaced.

Check the quartz glass protective screen regularly, especially after working at high performance capacity.

- In the case of visible condensation, lift the lamp housing completely (see chapter 4.2.1).



- Carefully lift the quartz glass plate until it can be revolved (1)
- Revolve the plate approx. 45°, so that the lugs fit through the recesses of the plate (2)
- Lead the plate out of the lamp housing (3)
- Clean or replace the protective screen
- Insert the protective screen into the lamp housing

The heater is also protected by a quartz glass plate (part no. 108374), that lies directly on the heater. It can be replaced by help of a vacuum pick-up tool or very carefully e.g. with a spatula.



CAUTION!

Handle the glass with care!

Use gloves when working with the quartz glass plates.

Don't let anything fall into the chamber. It may damage the heater or peripheral parts!

6 Disposal



CAUTION!

The unit may be contaminated by this process or by environmental influences. In this case, it must be properly decontaminated.

We offer this service. For those cases, please inquire for more information.



Damage to Health
and the
Environment

Contaminated parts can be detrimental to health and they may cause environmental damage.

Prior to the commencement of works, obtain information regarding a possible contamination. When handling contaminated parts, comply with the relevant regulations and take the necessary protective measures.

Disassemble the clean equipment, sort it according to the type of materials and disposed of it. We offer this service. For those cases, please inquire for more information.

7 List of failures

Code	Description	Action
[001]	Emergency circuit EC1 opened	check emergency switches
[002]	Emergency circuit EC2 opened	check grounding switches, close cabinet doors and chamber
[003]	USV not ready	wait for end of charging
[004]	Replace USV Battery	ask for support
[005]	Main power supply off	check main power supply
[006]	Alert voltage selection module -F24.1	ask for support
[007]	Alert voltage selection module -F24.2	ask for support
[008]	Alert pressure air	check air pressure
[009]	Failure PLC internal	power cycle necessary
[017]	Alert PN-IO-Slave #2 Pilz PNOZ in +E03	ask for support
[018]	Alert PN-IO-Slave #3 VIPA 053 PN Station in +KK	ask for support
[019]	Alert PN-IO-Slave #4 ifm IO LINK AL1102 in +E02	ask for support
[020]	Alert PN-IO-Slave #5 ifm IO LINK AL1100 in +E04	ask for support
[021]	Alert PN-IO-Slave #6 Mass flow controller -MFC1	ask for support
[033]	Safety door +E02 open	close the door
[034]	Safety door +E03 open	close the door
[035]	Safety door +E04 open	close the door
[037]	Manual discharging +E02 active (kill switch)	grounding switch to flash position
[038]	Manual discharging +E03 active (kill switch)	grounding switch to flash position
[039]	Manual discharging +E04 active (kill switch)	grounding switch to flash position
[041]	Temperature discharge unit +E02 exceeded	ask for support
[042]	Temperature discharge unit +E03 exceeded	ask for support
[043]	Temperature discharge unit +E04 exceeded	ask for support
[044]	Alert hardware interlock (Relay -KNA3.3 off)	ask for support
[045]	Flash chamber open	close chamber
[046]	Alert EDM feedback EC1	ask for support
[047]	Alert EDM feedback EC2	ask for support
[048]	Alert EDM feedback EC3	ask for support
[049]	Alert switch -PP1_E02	check air pressure (6 bar recom.)
[050]	Alert switch -PP2_E02	check air pressure (6 bar recom.)
[051]	Alert switch -PP3_E02	check air pressure (6 bar recom.)
[052]	Alert switch -PP4_E02	check air pressure (6 bar recom.)
[053]	Alert switch -PP5_E02	check air pressure (6 bar recom.)
[054]	Alert switch -PP6_E02	check air pressure (6 bar recom.)
[055]	Alert switch -PP7_E02	check air pressure (6 bar recom.)
[056]	Alert switch -PP8_E02	check air pressure (6 bar recom.)
[057]	Alert switch -PP9_E02	check air pressure (6 bar recom.)

[058]	Alert switch -PP10_E02	check air pressure (6 bar recom.)
[059]	Alert switch -PP11_E02	check air pressure (6 bar recom.)
[060]	Alert switch -PP12_E02	check air pressure (6 bar recom.)
[061]	Alert switch -PP13_E02	check air pressure (6 bar recom.)
[062]	Alert switch -PP14_E02	check air pressure (6 bar recom.)
[063]	Alert switch -PP15_E02	check air pressure (6 bar recom.)
[064]	Alert switch -PP16_E02	check air pressure (6 bar recom.)
[065]	Alert switch -PP1_E03	check air pressure (6 bar recom.)
[066]	Alert switch -PP2_E03	check air pressure (6 bar recom.)
[067]	Alert switch -PP3_E03	check air pressure (6 bar recom.)
[068]	Alert switch -PP4_E03	check air pressure (6 bar recom.)
[069]	Alert switch -PP5_E03	check air pressure (6 bar recom.)
[070]	Alert switch -PP6_E03	check air pressure (6 bar recom.)
[071]	Alert switch -PP7_E03	check air pressure (6 bar recom.)
[072]	Alert switch -PP8_E03	check air pressure (6 bar recom.)
[073]	Alert switch -PP9_E03	check air pressure (6 bar recom.)
[074]	Alert switch -PP10_E03	check air pressure (6 bar recom.)
[075]	Alert switch -PP11_E03	check air pressure (6 bar recom.)
[076]	Alert switch -PP12_E03	check air pressure (6 bar recom.)
[077]	Alert switch -PP13_E03	check air pressure (6 bar recom.)
[078]	Alert switch -PP14_E03	check air pressure (6 bar recom.)
[079]	Alert switch -PP15_E03	check air pressure (6 bar recom.)
[080]	Alert switch -PP16_E03	check air pressure (6 bar recom.)
[081]	Alert switch -PP1_E04	check air pressure (6 bar recom.)
[082]	Alert switch -PP2_E04	check air pressure (6 bar recom.)
[083]	Alert switch -PP3_E04	check air pressure (6 bar recom.)
[084]	Alert switch -PP4_E04	check air pressure (6 bar recom.)
[085]	Alert switch -PP5_E04	check air pressure (6 bar recom.)
[086]	Alert switch -PP6_E04	check air pressure (6 bar recom.)
[087]	Alert switch -PP7_E04	check air pressure (6 bar recom.)
[088]	Alert switch -PP8_E04	check air pressure (6 bar recom.)
[089]	Alert switch -PP9_E04	check air pressure (6 bar recom.)
[090]	Alert switch -PP10_E04	check air pressure (6 bar recom.)
[091]	Alert switch -PP11_E04	check air pressure (6 bar recom.)
[092]	Alert switch -PP12_E04	check air pressure (6 bar recom.)
[093]	Alert switch -PP13_E04	check air pressure (6 bar recom.)
[094]	Alert switch -PP14_E04	check air pressure (6 bar recom.)
[095]	Alert switch -PP15_E04	check air pressure (6 bar recom.)
[096]	Alert switch -PP16_E04	check air pressure (6 bar recom.)
[097]	Alert reed relay loader -KR1_FC1	ask for support
[098]	Alert reed relay thyristor -KR2_FC1	ask for support

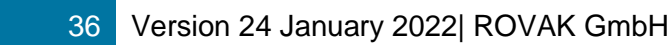
[099]	Alert reed relay simmer -KR3_FC1	ask for support
[100]	Alert reed relay direct -KR4_FC1	ask for support
[101]	Alert reed relay loader -KR1_FC2	ask for support
[102]	Alert reed relay thyristor -KR2_FC2	ask for support
[103]	Alert reed relay simmer -KR3_FC2	ask for support
[104]	Alert reed relay direct -KR4_FC2	ask for support
[105]	Alert reed relay loader -KR1_FC3	ask for support
[106]	Alert reed relay thyristor -KR2_FC3	ask for support
[107]	Alert reed relay simmer -KR3_FC3	ask for support
[108]	Alert reed relay direct -KR4_FC3	ask for support
[109]	Alert thyristor -UQ1	ask for support
[110]	Alert thyristor -UQ2	ask for support
[111]	Alert thyristor -UQ3	ask for support
[112]	Alert simmer -T2	restart process
[113]	Alert simmer -T3	restart process
[114]	Alert simmer -T4	restart process
[115]	Alert loader -TL1	ask for support
[116]	Alert loader -TL2	ask for support
[117]	Alert loader -TL3	ask for support
[121]	Alert broken wire measuring capacity -C1_E02	ask for support
[123]	Alert broken wire measuring capacity -C2_E02	ask for support
[125]	Alert broken wire measuring capacity -C3_E02	ask for support
[127]	Alert broken wire measuring capacity - C_Master_E02	ask for support
[129]	Alert broken wire measuring temperature -BT1	ask for support
[131]	Alert broken wire measuring capacity -C1_E03	ask for support
[133]	Alert broken wire measuring capacity -C2_E03	ask for support
[135]	Alert broken wire measuring capacity -C3_E03	ask for support
[137]	Alert broken wire measuring capacity - C_Master_E03	ask for support
[139]	Alert broken wire measuring temperature -BT2	ask for support
[141]	Alert broken wire measuring capacity -C1_E04	ask for support
[143]	Alert broken wire measuring capacity -C2_E04	ask for support
[145]	Alert broken wire measuring capacity -C3_E04	ask for support
[147]	Alert broken wire measuring capacity - C_Master_E04	ask for support
[149]	Alert broken wire measuring temperature -BT3	ask for support
[161]	Alert turbo pump -M1	restart evacuation
[162]	Alert forepump -M2	restart evacuation
[165]	Alert angle valve -V1	ask for support
[166]	Alert angle valve -V2	ask for support
[167]	Alert nitrogen valve -V3	ask for support

[168]	Alert turbo pump valve -V4	ask for support
[169]	Alert nitrogen valve -V5	ask for support
[170]	Alert process gas valve -V6	ask for support
[171]	Alert process gas valve -V7	ask for support
[173]	Alert chamber valve -V9	ask for support
[174]	Alert nitrogen valve -V10	ask for support
[175]	Alert water valve -VW1	ask for support
[181]	Alert mass flow controller -MFC1	ask for support
[185]	Alert broken wire low vacuum pressure -BP1	ask for support
[187]	Alert broken wire low vacuum pressure -BP2	ask for support
[189]	Alert broken wire high vacuum pressure -BP3	ask for support
[191]	Alert broken wire water flow -BFT1	ask for support
[192]	Alert broken wire water temperature -BFT1	ask for support
[193]	Alert broken wire measuring temperature -BT4	ask for support
[195]	Alert broken wire measuring temperature -BT5	ask for support
[201]	Alert heater -E1	ask for support
[209]	Alert loading sequence	restart flash process
[210]	Loading time of loader -TL1 exceeded	ask for support
[211]	Loading time of loader -TL2 exceeded	ask for support
[212]	Loading time of loader -TL3 exceeded	ask for support
[213]	Alert loading sequence, step 2, voltage in +E02 not complete	use grounding switch and ask for support
[214]	Alert loading sequence, step 2, voltage in +E03 not complete	use grounding switch and ask for support
[215]	Alert loading sequence, step 2, voltage in +E04 not complete	use grounding switch and ask for support
[216]	Alert loading sequence, step 5, Flash discharging +E02 not successful	use grounding switch and ask for support
[217]	Alert loading sequence, step 5, Flash discharging +E03 not successful	use grounding switch and ask for support
[218]	Alert loading sequence, step 5, Flash discharging +E04 not successful	use grounding switch and ask for support
[225]	Alert shut down FLA control	restart the system
[226]	Alert loading sequence, step 6, discharging +E02 by thyristor not successful	use grounding switch and ask for support
[227]	Alert loading sequence, step 6, discharging +E03 by thyristor not successful	use grounding switch and ask for support
[228]	Alert loading sequence, step 6, discharging +E04 by thyristor not successful	use grounding switch and ask for support
[229]	Alert loading sequence, step 7, discharging +E02 by reed relay not successful	use grounding switch and ask for support
[230]	Alert loading sequence, step 7, discharging +E03 by reed relay not successful	use grounding switch and ask for support

[231]	Alert loading sequence, step 7, discharging +E04 by reed relay not successful	use grounding switch and ask for support
[241]	Alert Evacuation process chamber: Locked valve/pump demanded	restart evacuation cycle or ask for support
[242]	Alert Evacuation process chamber: Vacuum pressure limit 1 (turbo pump) not reached	leakage or pump error
[243]	Alert Evacuation process chamber: Vacuum pressure limit 2 (process) not reached	leakage or pump error
[244]	Alert flushing process chamber: Locked valve/pump demanded	restart flushing cycle or ask for support
[245]	Alert flushing process chamber: Check nitrogen supply	check nitrogen supply
[246]	Alert preheating: Set point temperature -BT5 not reached	check if thermocouple has contact to sample
[249]	Cooling water flow too low	check cooling water supply
[250]	Cooling water temperature too high	check cooling water supply

8 Wear part list

part name	part no.	installation place	probability of default	plant availability in case of failure	number installed	number required	min. order quantity
protective screen (flash)	108375	flash head	medium	limited	1	1	1
protective screen (heater)	108374	chamber	medium	stop	1	1	1
glass plate (pyrometer)	108373	flash head / chamber	low	stop	2	2	2
glass tube	108372	flash head	medium	stop	6	6	1
flash lamp	104299	flash head	low	limited	6	6	1
substrate holder	108371	chamber	low	stop	1	1	1
substrate adaptor 3"	105261	chamber	low	limited	0	0	1
substrate adaptor 2"	105260	chamber	low	limited	0	0	1
O-ring	108376	chamber	low	stop	1	1	1
O-ring	108377	flash head	medium	stop	2	2	2
O-ring	108378	chamber	low	stop	2	2	2
O-ring	108379	flash head	medium	stop	12	12	6
O-ring	108381	flash head / chamber	low	stop	2	2	2
O-ring	108382	chamber	low	stop	2	2	2



Declaration of Conformity

Declaration of Conformity for Machinery (according to Machinery Directive 2006/42/EC)

The Manufacturer:

Rovak GmbH
Zum Teich 4, D-01723 Grumbach (Germany)

hereby declares, that the system:

Model: SEMILINE 3.0 - FLV21-02-0000
Tool ID - S/N: 21125860
Origin: Germany
Year of fabrication: 2021



is in conformity with the provisions of the following further EC Directives and their amendments applicable at the time of issuing of the declaration:

- EC Machinery Directive (2006/42/EC)
- EC Low Voltage Directive 2005/95/EC
- DIN 60204-1 Electrical Equipment and Machines with Voltages Above 1 kV
- EC Electromagnetic Compatibility Guideline EMV 2004/108/EC
- And the normative regulations: EN ISO 12100, EN 60204-1, EN 50178, BGV A3, BGR 132, EN 12198, EN ISO 14121-1, BGV B11, BGR B11

The operation of the tool remains prohibited until it has been ascertained that the above-specified machine complies with the provisions of Machinery Directive 98/37/EC on completion, either alone or within the framework of an installation.

Grumbach, 24 January 2022

ROVAK GmbH
Udo Reichmann (Managing Director)