

# AS-One 100

## Rapid Thermal Processor

# Quick Start Guide


**CAUTION**

Not all functions and features are mentioned in this Quick Start Guide; refer to the manuals for further information. Carefully read the different manuals for safety, installation and utilization instructions

**Version 1.5**

## 1. Constructor's foreword

This manual contains original instructions for the manufacturer of the machine.

	<b>⚠ WARNING</b>
	<b>SAFETY INSTRUCTIONS</b> The user must carefully read the following instructions. The user is responsible for installing the system in safe conditions and in an environment that complies with the local regulation.

The Annealsys system can be used for various applications. Many different types of gases can be used in the system; consequently, the user must take all the necessary precautions to prevent hazardous mixtures occurring inside the process chamber.

The customer must be aware of the effects of process gases and vapors used during the process and their consequences on the machine, accessories and vacuum pump. All manuals must be carefully read in order to check the conditions of operations.

The constructor declines all responsibility for any incidents caused by insufficient precautions or handling errors, and their consequences.

The constructor specifies that the Annealsys system has no protection against any possible toxic emanations.

The responsibility for installing the machine in an environment which complies with the relating legislation is left entirely to the initiative and charge of the user, who is considered to be aware of the effects of the gases that he uses, as well as those of the decomposition products and gases generated by the processes in operation.

The user shall be responsible for connecting the exhaust line and the pump exhaust of the system to a gas scrubbing installation which is compatible with the process gases and gas flows and that complies with local regulation.

The user is responsible for ensuring that supply pipes and cables as well as exhaust are routed in such a way to eliminate trip hazard. Also, floor surface is to be suitable and must reduce as far as possible any slip hazard for the operator or others in the vicinity of the machine. Adequate lighting and any fire suppression system is also the responsibility of the user

The constructor also specifies that the quartz, ceramic and graphite parts and all parts in contact with vacuum or process gases must only be handled with gloves to avoid any pollution.

All maintenance and servicing work should be carried out by skilled personnel and, where specified, in relation with Annealsys Customer Service Department.

## 2. Environmental conditions for the furnace

- Temperature: 15°C to 35°C
- Humidity: < 60%

## 3. Handling of parts

The quartz, ceramic and graphite parts and all parts exposed to vacuum or process gases must only be handled with gloves to avoid any pollution that can lead to parts damages.

## 4. System overview

The AS-One rapid thermal processor main features are:

- Stainless steel cold wall chamber with single air cooled quartz window
- Infrared halogen lamp furnace
- Thermocouple and pyrometer temperature control
- One purge gas line and up to 5 process gas lines with mass flow controllers
- Vacuum valve and vacuum gauge, vacuum pumps (optional)
- Full PC control (installed close to the system and connected by an Ethernet cable)

## 5. Before start-up

Check that all the connections have been completed and that the furnace is supplied with:


- Electricity: 3x220V + Ground **or** 3x400V+Neutral + Ground (refer to system plate)
- Water: 2 bars, 10 liters/minute, temperature 2°C over dew point
- Compressed air: 6 bars
- Purge gas and process gases: 1 to 2 bars

Check that the computer is connected to the furnace with the Ethernet cable.

Check that the external safety connector is installed on the rear panel of the furnace.

Make sure that the four feet are adjusted and that the machine is in stable position.

## 6. Electrical power supply

	<b>WARNING</b>
<p>Carefully check the voltage on the power supply terminal before switching-on the general circuit breaker. Wrong wiring may lead to severe equipment damage.</p> <p>Version 3x220V + ground: 220V between the grey terminals, ground connected to green/yellow terminal</p> <p>Version 3x400V + neutral + ground: 400V between the grey terminals, neutral connected to blue terminal, 220V between grey terminals and blue terminal, ground connected to green/yellow terminal</p>	

## 7. Start-up

Procedure to start-up the system:

- Power on the AS-One with the general circuit breaker on the system backside
- Start the computer
- Press the green button to switch-on the AS-One
- Start the software on the computer

It is possible to start the computer after switching on the furnace. This will not affect the system behavior.

## 8. Software utilization

The software utilization is described in a separated manual according to each software version.

Refer to the software manual for the utilization. The software manual describes most of the utilization of the AS-One furnace.

## 9. Open the process chamber

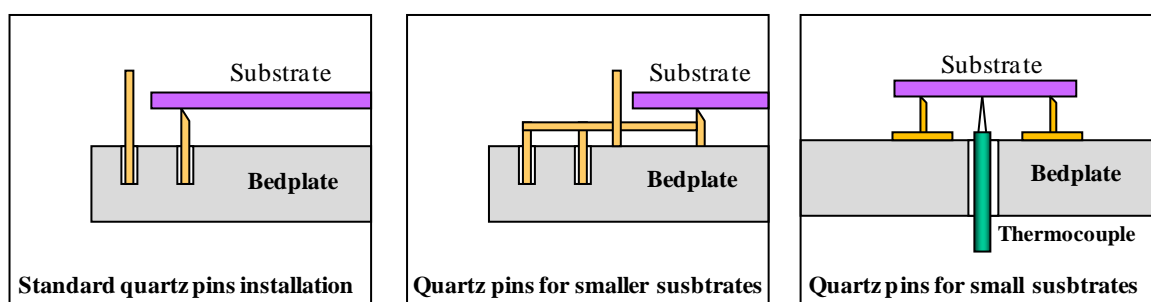
The chamber is locked by an electromagnetic locker. It is locked if the system is not powered on. If the chamber is locked use the software control to unlock it.

To open the process chamber, pull the stainless steel handle and lift the chamber with the handle. The chamber is installed inside a rotating top lid. Two air springs keep the reactor in the open position.

## 10. Quartz pins installation

The substrate is held by 3 beveled quartz pins. Three other higher quartz pins are installed around the substrate in order to facilitate the positioning of the substrate during loading. Just insert the quartz pins in the holes to install them.

Special quartz pins to hold smaller substrates may be provided with the system. These quartz pins are installed using the same holes according to the drawings hereafter.




## 11. Substrate installation

**The substrate must not be installed directly on the bedplate because it could not heat.**

There is some clearance between the substrate and the centering pins. The operator must check that the substrate covers the edge pyrometer viewport hole in case the edge pyrometer is going to be used for process temperature control. Otherwise temperature measurement may be altered and the process may lead to sample damage (overheating).

When a susceptor is used the sample is installed inside the susceptor cavity. The operator must check that the cavity is deep enough and that the susceptor lid does not touch the sample when it comes on top.

## 12. Thermocouple installation

	<b>CAUTION</b>
<p>Carefully read the thermocouple utilization conditions in the user's manual. Thermocouple utilization is restricted to some particular process conditions. Thermocouple may be rapidly broken if the utilization conditions are not fulfilled. The thermocouples are not covered by the warranty.</p>	

*Unsheathed K type thermocouples are sensitive to process gases and must be pre-treated to protect them. At first use, a process in air at 800°C for 5 minutes with a silicon wafer must be carried out to create an oxide sheath that protects the thermocouple wires. Failure to follow this procedure will result in a quick break when using the thermocouples in neutral atmosphere even below 1000°C.*



The thermocouple must be installed if it is going to be used for the temperature control during the process. Refer to the user's manual for installation instructions.

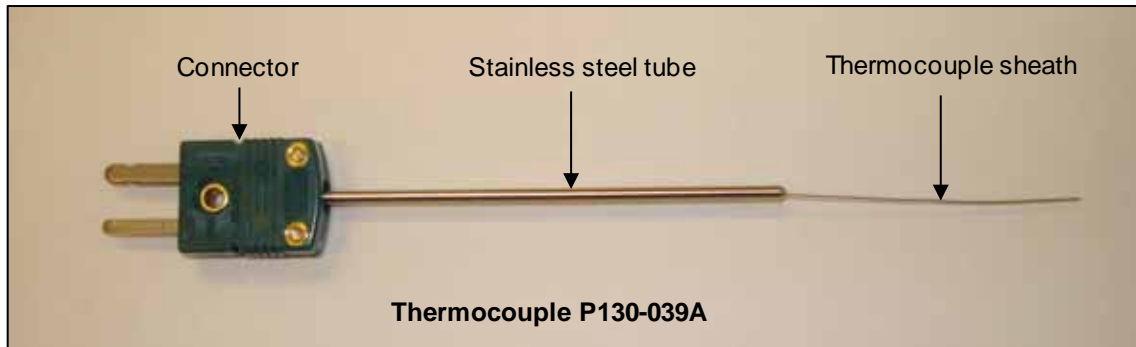
If the susceptor is used the sheathed thermocouple end must be installed inside the small hole on the susceptor edge. Only sheathed thermocouples must be used for temperature control of susceptors.

If susceptor is not used the operator must carefully check thermocouple installation and that there is a good contact between the thermocouple extremity (measuring point) and the substrate.



*Lead free thermocouple must not be used reduced under reducing atmosphere (H<sub>2</sub>) or under vacuum. Annealsys can provide sheathed thermocouple for special applications to offer good resistance to different type of gas atmospheres.*

The thermocouple can withstand a maximum temperature of 1000°C.

	 <b>CAUTION</b>
	<p><b>Sheathed thermocouples</b>                  The bending radius of the thermocouple sheath must not be less than 2 mm in order to avoid thermocouple breakage</p>



**13. Important information on infrared heating furnace**

	 <b>CAUTION</b>
	<p>The utilization of an infrared heating furnace is different from a conventional resistor heating furnace. The system cannot be used without a sample inside the process chamber.                  The utilization of the machine without sample may lead to lamp furnace damages.</p>

**Never operate the furnace without a substrate installed inside the process chamber**



The RTP furnace is using radiation heating. The heat is transferred from the lamps to the substrate and the chamber is not heated. If there is no substrate inside the reactor the system is not able to measure any temperature and will apply full power.

**14. Ramp rate limitations**

The AS-One 100 has a maximum heating rate of 200°C/s on 100 mm diameter silicon wafers.

The heating rate must be limited to 50 C/s when using a susceptor. For a long lifetime of the susceptor we recommend to run processes with a maximum heating rate of 20°C/s.

**15. Susceptor utilization**

	 <b>CAUTION</b>
	<p>The susceptor and susceptor lid are sensitive to temperature gradients.                  High ramp rates generate high temperature gradients that may lead to crack into the susceptor or lid coating cracks and breakage of the parts.  <b>Do not use heating rate over 50°C/s and avoid power peaks with susceptors.</b>                  User must take steps to avoid thermal stress to the susceptor and lid and must carefully read the user’s manual before performing any process.  <b>Only use edge thermocouple or pyrometer for susceptor temperature control.</b>                  The susceptors and lids are not covered by the warranty.</p>

**16. Close the process chamber**

To close the process chamber, take the stainless steel handle with 2 hands and gently pull it down. When the chamber lid reaches the horizontal position slow down descend with the handle and pull the handle to you. When the chamber is in contact with the bedplate, firmly push the handle with 2 hands to tightly close the chamber.

**17. Recipe download**

The process parameters (recipe, calibration tables, PID table and configuration) are saved on the computer's hard disk. During the process the system is controlled by the PLC and the data must be downloaded to the PLC before starting the process.

**18. Process**

Start the process after entering a process historical name. Process is performed automatically according to the recipe that has been downloaded.

During the process the chamber is locked.

*Process can be stopped at any time by clicking on the stop process button.*

**19. Utilization of process gases**

Carefully check the process gases that are going to be used during the process and the safety condition to use these gases.

*The process chamber must be pumped down and purged before opening when hydrogen or other active process gas has been used during the process or in manual mode.*

**20. End of process**

At the end of the process the computer displays a message. After a 3 minute automatic cooling the chamber can be opened and the substrate unloaded.

*After process both substrate and quartz window may still be at high temperature. Wait for sufficient cool down of the substrate before unloading. Wear high temperature gloves to unload the substrate from the process chamber.*

Revision history

Revision History			
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<b>Author</b>	Franck Laporte		
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1.0	Creation	March 18, 2010	FLA
1.1	Constructor's foreword is added	February 23, 2011	FLA
1.2	Thermocouple utilization warning Infrared furnace utilization warning	September 19, 2011	FLA
1.3	Susceptor utilization	January 4, 2012	FLA
1.4	Document contains original instructions of the manufacturer	December 27, 2012	FLA
1.5	Additional warning on susceptor ramp rates Warning on thermocouple bending	December 5, 2013	FLA