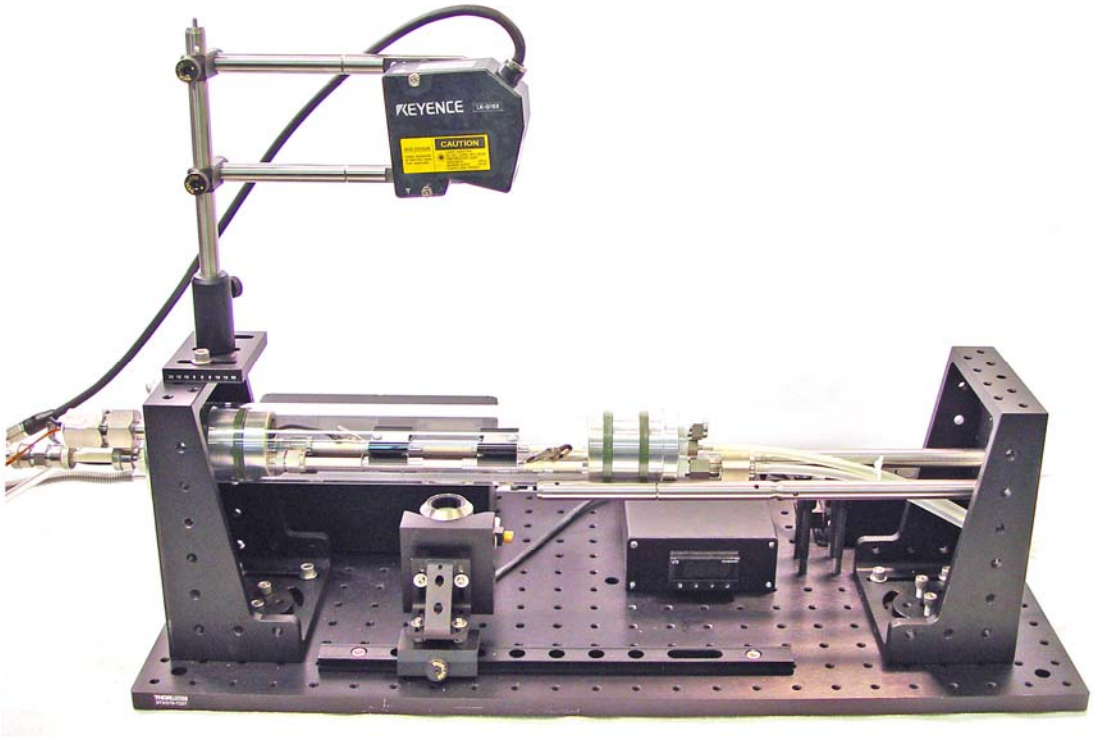
# SabreTube™

A Bench Top Thermal Processing System

|NANO|
Absolute Nano




SabreTube™ Desktop Thermal Processing System
(shown with optional laser displacement sensor; safety shield not shown)

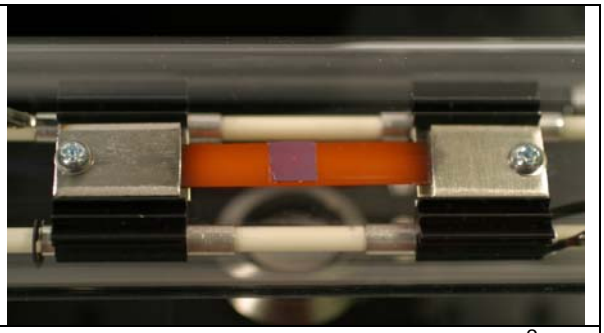
Absolute Nano introduces the SabreTube™ -- a unique tool for rapid development and testing of chemical vapor deposition and thermal annealing processes, such as growth of nanotubes/nanowires, curing of thin films, and thermal processing of microfabricated devices. It features 100ºC/sec heating rates over a 1 cm wide substrate at up to 1000 ºC, with full visual and instrument access. Sample exchanges in less than 1 minute, along with dynamic control and observation capabilities enable high-throughput innovation over wide process ranges.

## SabreTube Base Model Features

- A **small footprint** of 24”x12”x10” enables setup and operation in a small space on a desktop. lab bench, or in conjunction with another instrument, and easy storage in a standard cabinet. The unit is equipped with a **safety shield with interlocked safety switches**.

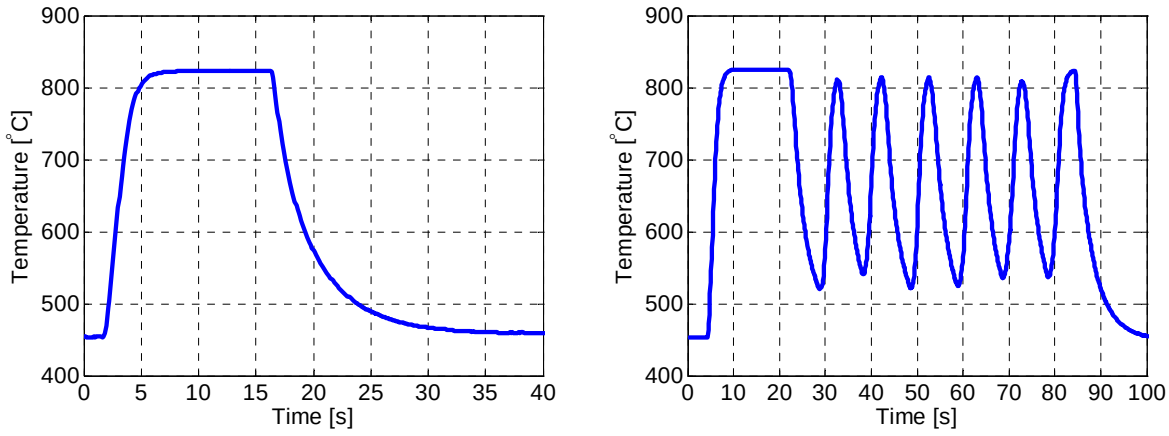
- A **modular resistive heater assembly** features a **replaceable silicon heating platform**. The process sample may be placed directly on the heating element, and the polished surface of the heater enables good thermal contact. The heating element is simply replaced using a screwdriver, and five replacement elements are included with the base model.

Modular heater assembly
(removed from SabreTube)



SabreTube platform heated to 850 $^{o}$C
(laser measurement spot shown)

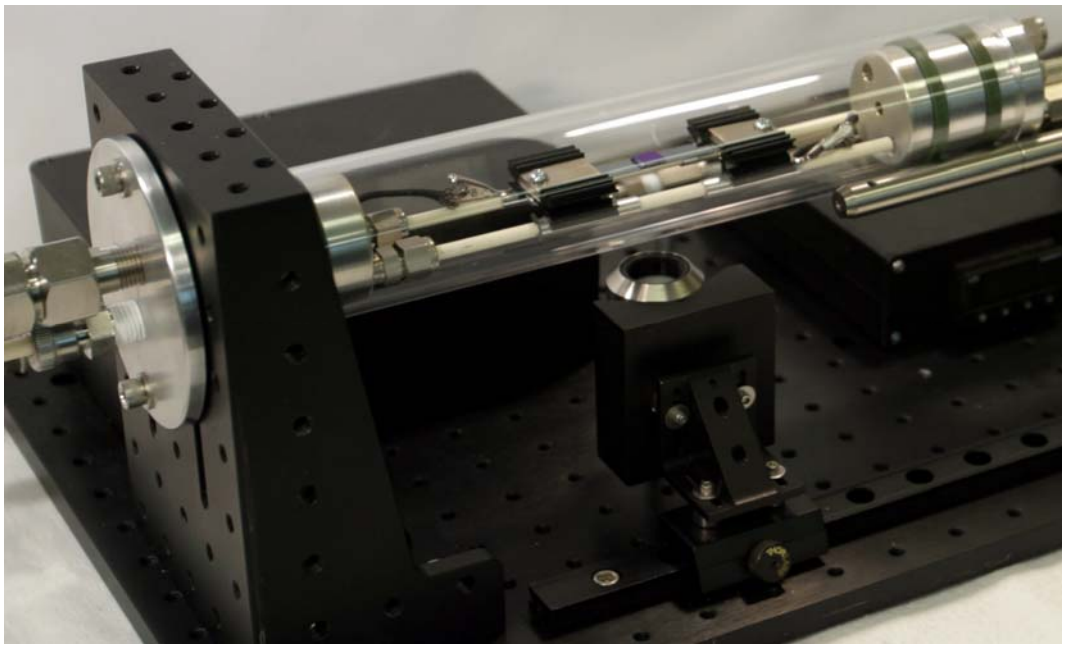
- The low thermal mass of the heated platform enables **rapid heating and passive cooling at rates of up to 100 $^{o}$C/s, to 1000 $^{o}$C**, under atmospheric conditions.




Rapid heating, cooling, and cycling

- The temperature measurement is non-contact using a **high-precision infrared sensor**, located outside and beneath the tube chamber. The sensor is mounted on a linear guide for easy positioning.

- The SabreTube quartz chamber is sealed by aluminum caps with concentric lip seals, and the seal geometry enables **atmospheric and low-pressure operation**, with no mechanical clamps or flanges. The standard input end cap contains a sealed bulkhead with a feedthrough for power transmission and a type K Thermocouple feedthrough.



View showing infrared sensor mounted on rail beneath tube, and output end cap with concentric lip seals (green)

- **Sample exchange is tool-free**; the tube retracts horizontally onto a pair of support rails, revealing the heated platform for full mechanical access.

- When chamber is closed, the **substrate is fully viewable for in situ optical observation**. The SabreTube baseplate and structural mounts have standard ¼”-20 threaded hole patterns for versatile user-specific mounting of additional components.

- The SabreTube can be powered by a **standard DC power supply** in current-regulated mode (user-supplied, 48V-12A recommended), or an optional closed-loop supply with integrated temperature control is also available.

## SabreTube Base Model Specifications

| | |
|---|---|
| Base dimensions (width x depth) | 24” x 12” |
| | |
| Heater power input (Current control strongly recommended) | 0-48 VDC, 0-12A |
| | |
| Substrate material | Highly-doped silicon |
| Maximum substrate temperature | 1000 $^{o}$C |
| Maximum substrate heating rate | 100 $^{o}$C/s |
| Maximum substrate cooling rate (passive) | 80 $^{o}$C/s |
| Substrate size (included; width x length x thickness) | 10 x 50 x 0.5 mm |
| Maximum substrate size (width x length x thickness) | 10 x 100 x 2 mm |
| | |
| Infrared sensor output | K-type, 40 mV at 800 $^{o}$C |
| Infrared sensor range | 540-1370 $^{o}$C |
| | |
| Tube diameter (ID x OD) | 48 x 52 mm |
| Tube length | 300 mm |
| Tube material | Fused quartz |
| | |
| Input gas connections | One 1/4” FNPT threaded hole |
| | One 1/8” FNPT threaded hole |
| | |
| Output gas connections | One 1/4” FNPT threaded hole |
| | One 1/8” FNPT threaded hole |
| | Check valve with ¼” MNPT output |
| | |
| Base construction material | Anodized aluminum |
| End cap material | Aluminum |
| Seal material | Viton |
| Fitting and tubing material | Stainless steel |
| Internal support rail material | Alumina |
| Contact block materials | Aluminum, stainless steel |

## Options and Accessories

- Closed-loop temperature controller with dedicated power supply and temperature display. Integrates directly with IR temperature sensor and furnace safety interlocks.
  - Programmable with up to 16 ramp/soak segment temperature profiles.
  - Available with RS232 or Ethernet communications port.
- Gas pre-heater assembly
  - Also available with dedicated power delivery, integrated thermocouple, and temperature display.
- Laser displacement sensor for measuring real time film thickness and growth rates.
- Additional silicon heating elements.
- Additional heating element mounting brackets.
- Heating elements with $SiO_2$ insulating layer.
- Heating elements with type K thermocouple.

## For more information, please contact:

**|NANO|**
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## Ordering Information

| Item | Part Number |
|---|---|
| SabreTube furnace | 1100-00005 |
| Integrated control system and power supply for SabreTube | 2100-00010 |
| Integrated control system and power supply for SabreTube, with RS 232 communications port | 2100-00013 |
| Integrated control system and power supply for SabreTube, with Ethernet communications port | 2100-00014 |
| Gas pre-heater assembly with integrated pre-heater control system and power supply | 2100-00011 |
| Gas pre-heater assembly with integrated pre-heater control system and power supply, with RS 232 communications port | 2100-00015 |
| Gas pre-heater assembly with integrated pre-heater control system and power supply, with Ethernet communications port | 2100-00016 |
| Laser displacement sensor with mounting hardware | 2100-00017 |
| Additional bare heating elements (package of five) | 2200-00018 |
| Heating elements with $SiO_2$ insulating layer on polished side (package of five) | 2200-00020 |
| Replacement heater mounting brackets with clamps (pair) | 2200-00019 |
| Heating element with integrated K-type fine-wire thermocouple (package of two) | 2100-00021 |