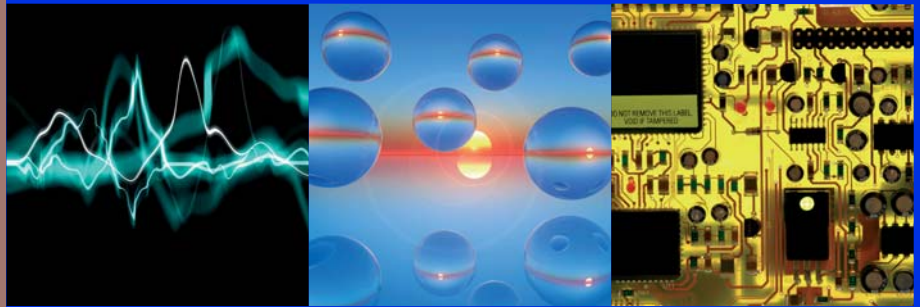




## Thermal Shock Chambers





## Extreme versatility

ACS thermal shock chambers, available as either Air-to-Air or Liquid-to-Liquid, are designed for thermal shock tests to test components or equipment by submitting these to rapid temperature changes automatically. They are suitable for Quality Control Laboratories or in Production plants for the screening of the commercial and military components.

The ACS Air-to-Air thermal shock chambers meet the following standards:

- MIL-STD 202 D/E/F, method 107C/F/G, test conditions A, B, C, F
- MIL-STD 202 D/E, method 102 A
- MIL-STD 883 A, method 1010.1, test conditions A, B, C, D, G
- MIL-STD 883 C, method 1010.6, test conditions A, B, C, D, F
- MIL-STD 883 C, method 1010.7, test conditions A, B, C, D, F
- MIL-STD 883 D, method 1010.7, test conditions A, B, C, D, F
- MIL-STD 883 D, method 1011.4, test conditions A, B, C, D
- IEC 68-2-14 (IEC test Na)

The ACS Liquid-to-Liquid thermal shock chambers, meet the following standards:

- MIL-STD 202 F, method 107G, test conditions AA, BB, CC, DD
- MIL-STD 883 A, method 1011.1, test conditions A, B, C, D (on request E/ F)
- MIL-STD 883 C, method 1011.4, test conditions A, B, C, D (on request E/ F)
- MIL-STD 883 C, method 1011.7, test conditions A, B, C, D (on request E/ F)
- MIL-STD 883 C, method 1011.9, test conditions A, B, C
- MIL-STD 883 D, method 1011.9, test conditions A, B, C
- IEC 68-2-14 (test Nc, severity 1)

The extreme versatility of ACS chambers allows users to carry out a wide range of tests necessary to determine thermal characteristics under the effect of two alternating extreme temperatures.

It is possible to offer standard or custom-designed models, either vertical, horizontal or "walk-in" types. Their wide range of accessories, the large range of temperatures, the reliability of the mechanical cooling systems and the After-Sales Service Assistance contribute to make ACS chambers an essential factor for Quality Control and Production facilities.



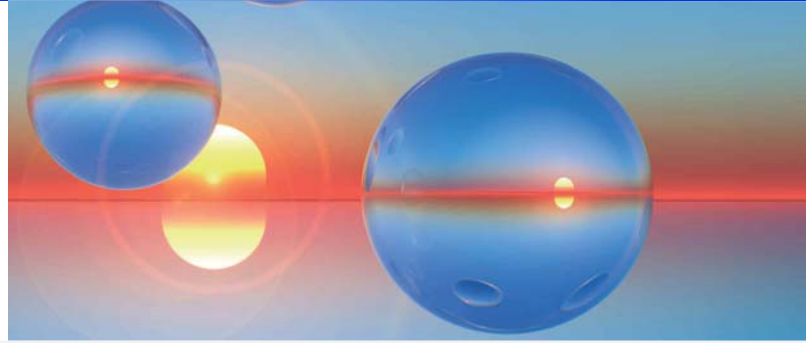
CST1000/2T

## Traditional approach

### Air-to-Air Thermal Shock Chambers: two temperature method, specimen moving with the basket

Traditional version with specimen moving in the basket:  
 Vertical models= CST27/2T, CST84/2T, CST157/2T, CST320/2T  
 Horizontal models= CST500/2T, CST1000/2T

The two test compartments can be placed vertically or horizontally. An electrically driven basket moves between the two temperature zones which will produce a thermal shock on the specimen. Vertical models are available with basket useful volumes ranging from 27 up to 320 litres; horizontal models are available

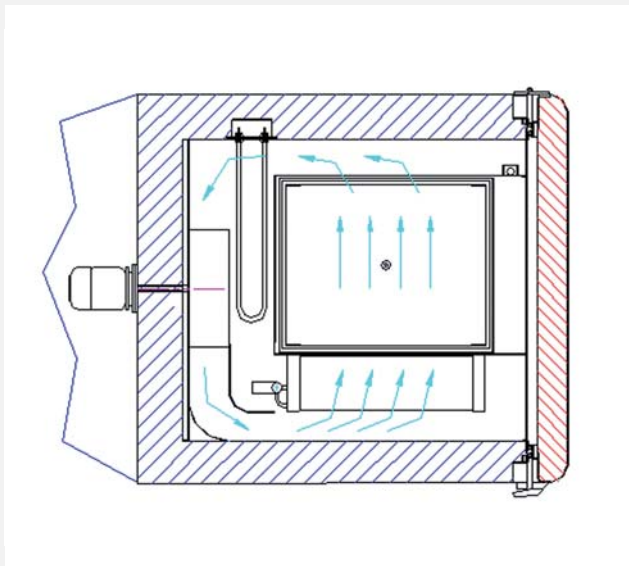


with basket useful volumes of 500 and 1000 litres. Special models are available on request. The external structure is in painted carbon steel grey RAL7035; the interior and the basket are in AISI 304 stainless steel. The doors (one for each test compartment) are fitted with safety microswitches which immediately stop the chamber's operation when one of the doors is open. The basic configuration of vertical models includes two Ø 23 mm portholes and the Gaseous Nitrogen (N2) Purging System.

MODEL NAME	BASKET DIMS MM(WXDXH)	EXT. DIMS. MM(WXDXH)	THERMAL LOAD (KG*)	WEIGHT (KG)	VOLTAGE (**) (VAC)	RATED POWER (KW) AVERAGE-MAX
CST27/2T	300x300x300	1020x2050x1750	2,5/0,5	800	400/50/3+N+G	9-16
CST84/2T	460x460x420	1300x2560x2000	5/2,5	1300	400/50/3+N+G	10-20
CST157/2T	530x660x450	1360x2800x2000	10/4	1400	400/50/3+N+G	20-30
CST320/2T	700x700x650	1530x2900x2400	15/7	1600	400/50/3+N+G	24-40
CST500/2T	630x900x900	3830x2060x2640	25/13	3500	400/50/3+N+G	28-48
CST1000/2T	730x1000x1400	4490x2420x2650	50/30 (***)	4500	400/50/3+N+G	60-94

(\*) reference value in order to achieve the following "recovery times":  
 2 min in the range -55/+125°C 5 min in the range -65/+150°C  
 (\*\*) other voltages or frequencies on request, according to customers' specifications

(\*\*\*) reference value in order to achieve the following "recovery times":  
 6 min in the range -55/+125°C 11 min in the range -65/+150°C



Thermal chambers: horizontal cross-section (top view)



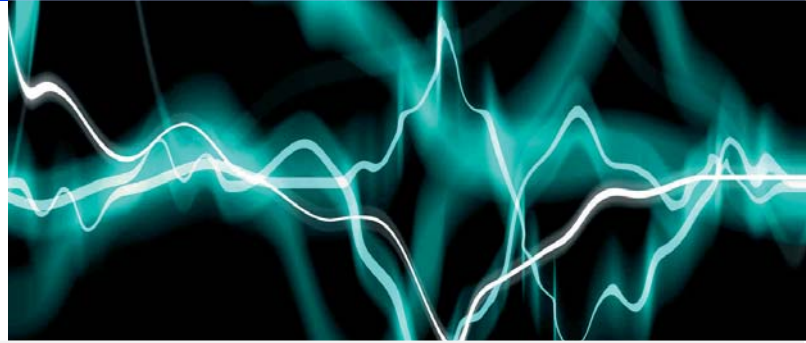
CST84/2T



## Air-to-Air Thermal Shock Chambers: two temperature method, specimen moving with the basket



## New design for CST130/2T "spinner™"



Inside the category of the two temperature method models, ACS has recently introduced a new version, called "spinner™". The design of the CST130/2T "spinner™" had the objective to make the chamber:

### Compact

30% reduced footprint obtained by a new design and the use of scroll compressors.

### Precise

New motor screw design for basket movement, allowing a reduction of vibrations and an improved linearity.

### Quiet

Operating noise reduced thanks to the modification of components parts.

### User-friendly

New controlling S/W and colour LCD interactive touchscreen. Remotely programmable by PC and Winkratos S/W.

### Main technical data

- Basket capacity: 130 lt
- Basket useful dimensions: 614x500x425 (WxDxH) mm approx
- Maximum basket load: 35 Kg
- Chamber external dimensions: 1165x2025x2700 (WxDxH) mm approx
- Temperature range:
  - upper chamber +70/+220°C (±1% and anyhow not less than ±1°C)
  - lower chamber -80/+60°C (±1°C)
- Basket displacement speed: <10 sec.
- Resetting time (on blow-out of air conditioning unit)
  - 2 min. with 5 Kg compact st. steel load with thermal heads in the range -65/+150°C
- Max load with MIL 883 test (15 min resetting time on specimen):
  - 14 Kg with MIL 883 test D
  - 18 Kg with MIL 883 test C
  - 23 Kg with MIL 883 test B
- Gaseous Nitrogen (N<sub>2</sub>) Purging System





Innovative approach

## Air-to-Air Thermal Shock Chambers: two temperature method, specimen fixed in its position



CST130 S "flapper™"

### New version with specimen fixed in its position, "flapper™" models

#### The concept

"flapper™" is an innovative approach to thermal shock which can dramatically improve the space crowded situation of many testing laboratory and increase the use flexibility. The specimen is fixed in its position and the chamber is connected alternatively to hot and cold chambers (by "flappers").

This technical solution creates the possibility of the unit being capable of performing as a standard thermal shock chamber and also gives the possibility to perform ESS tests and conventional thermal cycles.

This style eliminates the problem of having to worry about cables that may need to "travel" with your test items. Since the unit under test stays in place it is easy to connect any wiring or sensors necessary to verify test results. The number of cycles before defrosting is considerably increased thanks to a pressure compensation system (bellows connected to both cold and hot rooms).

#### Dual use

Further to the traditional thermal shock the chamber can be used for standard temperature testing. Considering the performance offered by the machine it means that ESS tests can be run using a much less expensive chamber, saving energy and space.

#### According to

MIL STD 883 and IEC 68-2-14

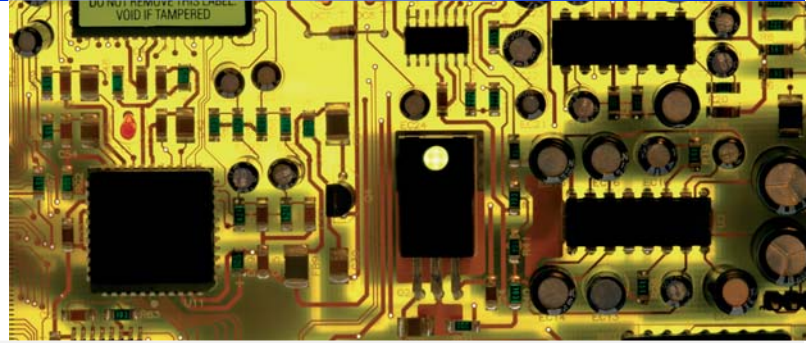


CST320 S "flapper™"

Temperature range	-80°C/+220°C
Temperature accuracy in time	±0.5°C
Heating temperature rate from -55° C to +125° C	40°C/min
Cooling temperature rate from +125° C to -55°C	20°C/min
Recovery time (-55° C / +125° C) with 5 Kg load	15 min

MODEL NAME	INT. USEFUL DIMS. MM(WXDxH)	EXT. DIMS. MM(WXDxH)	MAX LOAD (KG)	WEIGHT (KG)	VOLTAGE (**) (VAC)	RATED POWER (KW) MAX
CST130 S "flapper"	580x510x420	1400x1780x1950	30	900	400 V +6%/ -10%/50Hz/3ph + N + G	17
CST320 S "flapper"	700x700x650	2740x1700x2450	50	2400	400 V +6%/ -10%/50Hz/3ph + N + G	40

To satisfy all needs



### Air-to-Air Thermal Shock Chambers: three temperature method

Some international standards, (MIL-STD, IEC, DIN, etc.) require a short intermediate step at ambient temperature during thermal shock tests. ACS deals with this issue by using three cabinet units; between the hot and cold compartments there is a third cabinet with both heating and cooling units. A sophisticated system allows the basket to be moved from the cold cabinet to the ambient and from this to the hot cabinet (or vice versa). A set

of special sliding gaskets on the basket allow the air seal to be made in various positions of its travel preventing thermal interaction. The three cabinet system, in comparison with the two-cabinet systems, offers the advantage of a lower power consumption for heating. Special models can be manufactured in horizontal configuration. The "/3T3" chamber series have a transparent door for the ambient chamber in order to facilitate the specimen loading and unloading.

MODEL NAME	BASKET DIMS MM(WXDXH)	EXT. DIMS. MM(WXDXH)	THERMAL LOAD (KG*)	WEIGHT (KG)	VOLTAGE (**) (VAC)	RATED POWER (KW) AVERAGE-MAX
CST27/3T3	250x360x300	970x2050x2150	2,5/0,5	1000	400/50/3+N+G	9-18
CST110/3T3	500x500x440	1400x2600x2500	5,0/3,0 (***)	1350	400/50/3+N+G	18-28

(\*) reference value in order to achieve the following "recovery times":  
2 min in the range -55/+125°C - 5 min in the range -65/+150°C  
(\*\*) other voltages or frequencies on request, according to customers' specifications



CST110/3T3



## CST accessories

# Optional accessories for all Air-to-Air Thermal Shock Chambers

### LN2 Auxiliary Cooling

ACS thermal shock chambers can be equipped with an auxiliary cooling system with LN2 supplied by means of centralized tank or bottles. This auxiliary cooling system achieves a fast temperature recovery time when the thermal load in the basket is exceeding the load limits. Another application is when the test has to perform low temperature values that cannot be achieved with the traditional mechanical cooling systems only (e.g. down to  $-180^{\circ}\text{C}$  with LN2). In this case the equipment must be adapted with suitable thermal insulation and special construction.

On request we can supply our chambers with LN2 only, without mechanical cooling. This solution allows a low price and a very quick resetting time.

### Graphic Recorder

A six-channel  $\mu$ processor graphic recorder can be installed to provide a continuous recording of all the temperatures measured by the chamber. The recorder is provided with a digital display showing the actual printed value. It is possible to print the time scale and the values unit dimensioning (according to the International System of Units - ISU). The prints are made with 6 different colours. The six channel recorder is complete with two Pt100 probes (three for CST.../3T3 models), one for each cabinet.

### Specimen Temperature Recording

Additional thermal probes can be connected to the recorder to measure the temperatures at additional points. The probes are installed in the movable basket passing through two special dedicated portholes (see further accessories).

### Connecting Portholes

Various sizes of portholes are available according to chamber models. They allow an easy electric connection between equipment external to the chamber and the devices under test in the basket.

### Gasous Nitrogen (N2) Purging System

This system allows to avoid the condensation of internal humidity on the specimen under test, thus increasing the number of cycles before defrosting. The use of this option also eliminates the presence of oxygen in the chamber to prevent oxidation phenomena at high temperature on the contacts of the components under test. It is optional for 500 and 1000 litres horizontal models, while it is included in all the other models, excluding "flapper™" versions (not available).

### Set of no. 8 auxiliary contacts

### RS 232 interface + Winkratos SW

For remote control and programming via PC.

### Remote air condenser

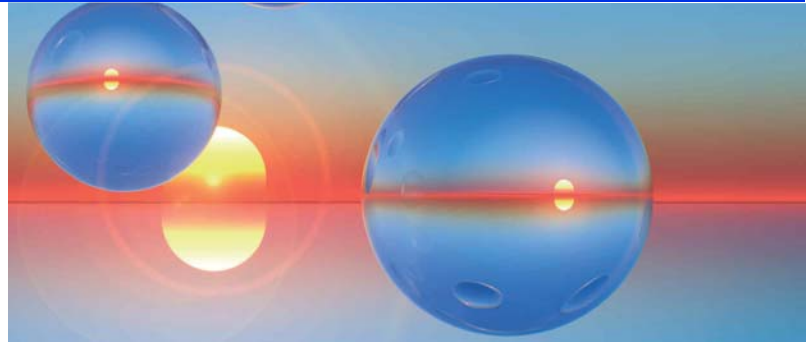
(on request)

### Special voltages or frequency

(on request)



## Air to Air Features and Benefits

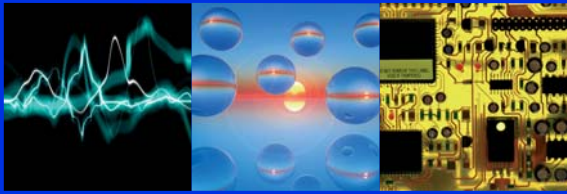


### Constructive features

- Carbon steel, industrial paint finish, exterior; stainless steel AISI 304 interior, 18/8.
- Argon welded internal chamber. The internal structure is connected to the external structure by means of phenolic joints.
- 2 ea. large full-light doors with soft double silicone gaskets and key-locks.
- Internal ventilation realized by means of powerful propeller fans driven by external motors. They are provided with stainless steel shafts.
- Cooling systems driven by two cascade compressors complete with safety valves and thermal protections.  
Refrigerants: R404a for the first stage and R23 for the second stage.
- Heating system by means of armored finned type electric heaters. They are protected by adjustable failsafe overtemperature switches.
- Control and regulation by means of a PLC controller/programmer. Its control is based on PID feedback principle. Input/output are connected to Pt100 platinum variable resistance probes.
- Thermal probes: Pt100 platinum probes with 100 ohms at 0°C as per DIN specifications.
- Electric connections according to IEC specifications.
- Continuous recording with folded paper ribbon.
- Blowers stop during the basket movement.
- Microswitches on chamber doors.
- Safety push button in case of emergency.
- "Undercooling" or "overheating" operation modes available.

### Your Advantages

- Heavy and robust construction, ergonomic features and elegant design. No rust formation.
- No humidity penetration. No thermal bridge between internal chambers and external environment, resulting in energy savings.
- Full accessibility to the chambers. No water vapour infiltration at low temperatures. Possibility to use the cabinets separately.
- Quick response of the specimen to temperature changes. Uniform temperatures inside the cabinets.
- Rapid cooling with low noise level. Maximum reliability of the equipment. Low level of vibration. Ozone friendly and non-inflammable refrigerants. Low cost of operation.
- Fast recovery times due to low thermal inertia. Heat radiation in the cabinet is minimized.
- Fast thermal response with continuous and linear control over the whole range. Precise control of temperatures by means of Pt100 thermal probes.
- Fast response and good linearity in the range  $-100^{\circ}\text{C}$  to  $+200^{\circ}\text{C}$ .
- High reliability and operator safety.
- Fully automatic chamber operation with recorded results.
- Reduced air mixing between the cold and hot chambers.
- Chambers stop in case of doors opening. Operator safety.
- Easy protection of chamber and specimen in case of failure.
- Faster temperature recovery time after basket transfer.



For more severe testing

## Liquid-to-Liquid thermal shock chambers

ACS has developed and is producing a full range of chambers for Liquid-to-Liquid thermal shock tests. This standard range of chambers meets any commercial or military test specification.

The chamber body is gray RAL 7035, the front is blue RAL 5015.

Two powerful compressors are connected in cascade and provide rapid and reliable temperature cooling performance. Environmentally friendly refrigerants are also used. The basket movement is electrically operated.

The time needed by the basket to move from one well to the other is less than 10 seconds. A plexiglass cover door closes the test volume in order to minimize the liquid consumption by evaporation.

The ACS Liquid-to-Liquid thermal shock chambers are designed to use two fluids or one fluid only such as the GALDEN D02.

A special evaporator for the fluid vapour condensation (fitted as standard) is placed over the wells, and allows condensation and recovery of the fluid vapours.

These features put our chambers at the top range of the worldwide production with highly reduced fluid consumption (i.e. approx. 3 g/h for CSTL20 and only 0,5 g/h for the CSTL12 !!). The chamber is equipped with an expansion "bellow" used for pressure compensation during the test operations. This avoids overpressure inside the chamber that can force the door and cause fluorinert leaks.

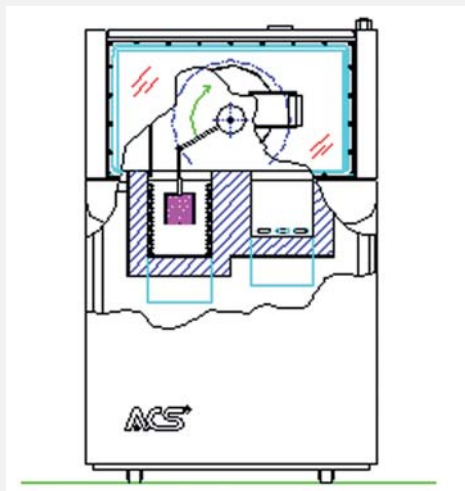
The CSTL models can be equipped with a wide range of accessories (recorders, customized trays for the specimen, vapour suction blower with automatic butterfly valve, etc.).

Special voltage or frequency on request.

MODEL NAME	BASKET DIMS MM(WXDXH)	EXT. DIMS. MM(WXDXH)	THERMAL LOAD (KG*)	WEIGHT (KG)	VOLTAGE (**) (VAC)	RATED POWER (KW) AVERAGE-MAX
CSTL12	120x120x120	1160x1050x1750	1,5/0,8	700	400/50/3+N+G	4-6
CSTL20	200x200x200	1380x1050x2085	2,5/1,5	950	400/50/3+N+G	7-10
CSTL30	300x300x300	2320x940x1950	5/3,5	1200	400/50/3+N+G	12-18

(\*) reference value in order to achieve the following "recovery times":  
2 min in the range -55/+125°C 5 min in the range -65/+150°C

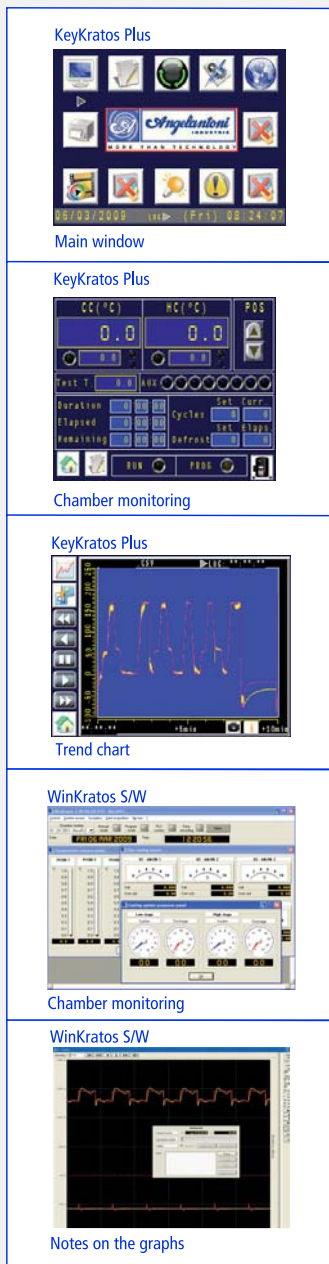
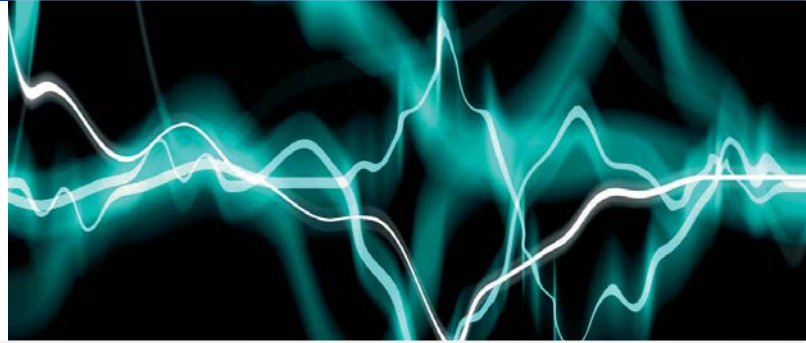
(\*\*) other voltages or frequencies on request, according to customers' specifications



Frontal section



CSTL20



## Basic Configuration: KeyKratos Plus

### Hardware

- 4096 colours with STN tecnology
- Faster control
- 3 types of memory support for storing cycles, recordings, and alarms
- Compact Flash, Pendrive (USB key style), Internal memory

### Software

- User friendly data input during editing, check and administration of cycle.
- Real time recording of temperatures versus time (LOG on compact flash)
- USB interface on front panel for stick or printer
- Recordings in CSV format (Comma Separated Value) for easy export to Excel®, program files are easily convertible into graphic format
- The system is available in 6 languages:  
ITALIAN, ENGLISH, GERMAN, SPANISH, FRENCH, DUTCH

## Optional: WinKratos software for remote control and programming via PC

WinKratos S/W package (running under Windows 2000, XP and VISTA) offers a powerful and flexible control & management system.

It allows the user to:

- Control and Monitor the chamber from a remote personal computer
- Create and Manage a test programs archive
- Record and Manage a test records archive

### Graphic functions

- Graphic monitoring of chamber measure behavior with multiple charts panel
- Delayed Start of the chamber to optimize time scheduling
- Graphic test programs editor with two editing mode: "entry-level" and "advanced"

### Acquisition functions

- Record of occurred events such as alarms, commands, etc.
- Record of chamber values during tests

### Additional functions

- Print test programs in text format
- Export test data recorded in ASCII format
- Possibility to add notes on the graph
- Global monitor to control many chamber at the same time

WinKratos can be installed on PCs supplied by ACS or belonging to the customer.

Angelantoni Industrie headquarters in Massa Martana (Perugia, Italy) extend over an area of 80.000 square metres (more than 16.000 covered square meters).

Massa Martana is located in Umbria, a region rich in art, history and tradition.

No location could be more appropriate; Angelantoni Industrie learns from the past to better understand and anticipate the future. This, combined with dedication and over growing expertise, is why Angelantoni Industrie has become the most complete and diversified European Group for advanced cold technology and test equipment for industry and research.

Established in 1932, Angelantoni Group has today more than 750 employees working in 8 units (4 in Italy, France, Germany, China, India).

**Our core competencies and services for total customer satisfaction:**

- Training, both at our facility and at customer site
- Testing and quality checks
- Installation and start up
- Preventive maintenance
- Service
- Calibration using SIT certified instruments
- "Full risk" assistance contracts
- Extended warranties
- Existing chamber validation
- Retrofitting of older chambers, including instrumentation and new environmentally friendly refrigerants
- Exchange and sale of used chambers
- Research and development
- Production and assembly
- Market analysis and advice
- Special applications



ISO 14001



ISO 9001:2000

**Testing Division**

- environmental test chambers B.U.
- test benches for automotive and aerospace B.U.
- electrodynamic shakers and balancing equipment B.U.

