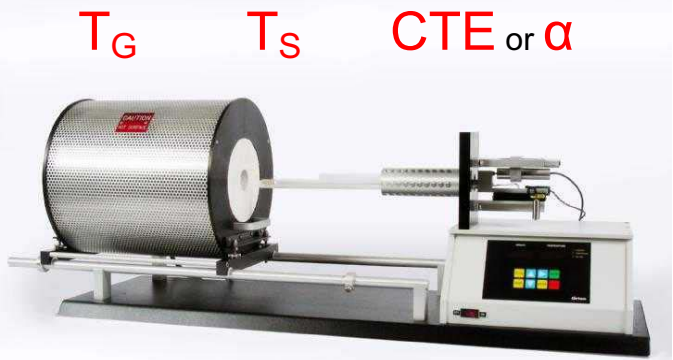


### Orton Glass Dilatometer

(Model DIL 2010 STD)

The Orton DIL 2010 STD is a standard bench top, horizontal, digital dilatometer for ASTM E-228 and C-372 testing that measures the expansion and softening characteristics of a glass specimen from room temperature up to 1,000°C. The Orton software quickly and easily finds the Glass Transition Point ( $T_G$ ) and the Dilatometric Softening Point ( $T_S$ ). By specifying the temperatures, or range of temperatures, the software quickly and easily calculates the Coefficient of Thermal Expansion (CTE) or alpha ( $\alpha$ ).



#### System Description

The Orton glass dilatometer is a digital, horizontal, single sample, compact, benchtop system comprised of a furnace (for operation from room temperature to 1,000°C in air); a fused quartz sample holder and probe rod system; a type “S” control/sample thermocouple; a sample displacement measuring system (probe rod and LVDT sensor); a user-adjustable counterweighted pulley system to provide a constant and uniform contact load on the test sample; the Orton control board for furnace control and data acquisition; and the Orton dilatometer software.



The Orton system is set up for a 1” long sample, and is factory calibrated against a 1” rod of high purity, platinum, thermal expansion standard. The system can be set up and calibrated for up to a 2” long sample upon initial request. The standard system requires 120-VAC, 15-amp, 50/60 hertz power. 240 VAC is available upon request. Standard options include controlled atmosphere/vacuum components, over-temperature protection, and exchangeable furnaces for rapid sample turnaround.

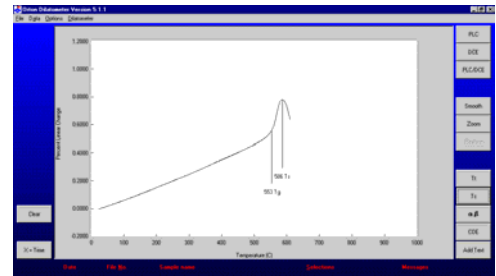
#### Principle of Operation

A sample specimen is placed between the end of the sample holder and the end of the movable probe rod. The furnace is placed over the sample, and heated according to a user defined thermal cycle. As the sample heats and cools, the sample expansion pushes against the probe rod, or the sample shrinkage pulls away from the probe rod. The probe rod is kept in constant contact with the sample by the pulley system. The probe rod transmits the amount of sample movement to the electronic displacement sensor (LVDT) which is located outside of the heated chamber. The LVDT generates an electronic signal corresponding to the change in sample length and continuously sends that signal to the Orton on-board computer. The Orton on-board computer saves the length change data along with the sample temperature from the thermocouple located next to the sample. The PLC and temperature data is downloaded to an independent computer system for real time observation and for post testing analysis

(continued on the next page)

### Orton Standard Dilatometer Software

The Orton Standard Dilatometer Software (Version 5.2.1) is included. The software is loaded on to the PC system supplied by the user, and communicates with the dilatometer. The operator enters the critical run parameters into the user-friendly screens, and the software sends the information to the controller board inside the dilatometer. The software extracts data from the dilatometer during the run so the operator can monitor the run in real time. Upon completion of the run, the software extracts the data from the dilatometer and creates a data file for post testing review and analysis. The operator can view and analyze the past run on the same PC, or can transfer the data file to another PC for independent viewing and analysis.



The software collects and displays time, temperature, and percent linear change data, and stores it in a binary file. PLC data is displayed on the PC monitor in temperature or time based modes. Data can be printed graphically or in tabular form, or exported as an ASCII file. Software features include comparisons against temperature or time of up to six runs; zoom into part of the curve; display differential or alpha CTE curves;  $T_G$  (between 400 and 850°C) softening point temperatures;  $\alpha$ - $\beta$  quartz transition temperature, and coefficient of expansion calculation for any temperature range.

The Orton Dilatometer Software (Version 5.2.1) is supplied on a CD, and is compatible with the operator's PC using the English language version of Windows 95/98/2000/XP/Vista.

### Typical Specifications

<b>Model Number</b>	<b>DIL 2010 STD</b>
<b>Temperature Range</b>	RT to 1,000°C
<b>Furnace</b>	Kanthal Wire
<b>Thermocouple</b>	Type "S"
<b>Sample Holder and Probe Rod</b>	Fused Quartz
<b>Sample Size (max)</b>	50 mm long by 20 mm diameter
<b>LVDT Displacement Range</b>	±0.100 inch (±2.54 mm)
<b>Displacement Resolution<sup>1</sup></b>	0.0000009 inch or 0.9 micro-inch (0.00002 millimeter or 0.02 microns)
<b>PLC Resolution for a 1" Sample<sup>1</sup></b>	0.00009%
<b>Reproducibility Range<sup>1</sup></b>	± 0.004 PLC (± 1 µm / ± 40 µ-inches)
<b>Contact Load</b>	Adjustable minimum 4 grams
<b>Temperature Control</b>	Orton User Programmable, 20-segment, PID Controller with Melting Point Protection
<b>Heat-up Rate</b>	1 to 30°C/minute at 0.01°C increments
<b>Data Acquisition</b>	Orton On-board Computer (data stored in on-board computer at 1°C increments, downloaded to independent PC system)
<b>Data Analysis</b>	Orton Dilatometer Software Version 5.2.1 (Requires English Language Version of Windows 95/98/2000/XP/Vista)
<b>Computer Interface</b>	RS232 Cable for user's PC (Requires English Language Version of Windows 95/98/2000/XP/Vista)
<b>Factory Calibration</b>	1" rod of high purity platinum
<b>Calibration Sample</b>	Pt available as an Option
<b>Secondary Calibration Sample</b>	1" high alumina included
<b>Water Cooled Bulkhead (circulation system not included)</b>	Included
<b>Measuring Head Cover</b>	Available as Option
<b>Controlled Atmosphere Option</b>	Available as Option
<b>Bench-top Footprint (open) Length x Depth x Height</b>	49" x 14" x 17" (1,250 x 360 x 430 mm)
<b>Power Requirements (240 VAC available)</b>	120 VAC, 15 A, 50/60 Hz

<sup>1</sup> - contact Orton for a description and discussion of these specifications