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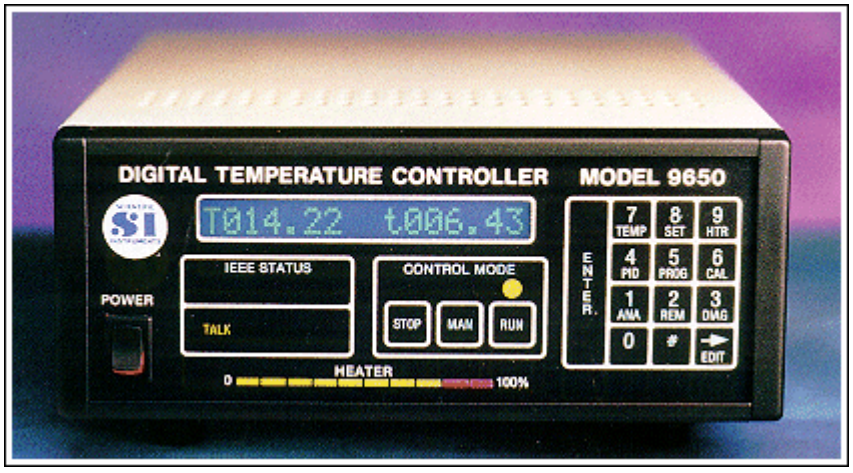
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Model 9650 Cryogenic Temperature Indicator and Controller

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General Description

The Model 9650 Microprocessor based Digital Temperature Indicator/Controller is designed to indicate and control process temperature developed in laboratory cryogenic systems, process controls, cold traps, cryopump regeneration systems and similar applications. It is capable of both indication and control via one remote sensor: A second sensor (standard feature) allows for either backup verification or temperature gradient indication. A sixteen character, liquid crystal module displays system temperature, set point, heater output and other related information. The model 9650 is available in either a free-standing instrument package or as a 19 inch rack mount configuration.



The most commonly specified configuration is the Model 9650-I-1-1 Dual Sensor Silicon Diode Indicator/Controller. The controller offers a wide temperature range (1.5-450K), indicates in Kelvin, and communicates directly over the widely accepted IEEE-488 bus. Various other sensors also provide excellent performance characteristics for specific applications. The specifications provide a comparison of the various sensors compatible with the 9650.

Features

P.I.D. Control

Heater Power output is controlled via software which utilizes an equation involving Proportional, Integral, and Derivative terms. The operator can modify these terms at any time by means of either the remote interface or front panel controls to accommodate changes in system parameters. The ability to adapt to a wide range of system conditions optimizes control to gain the desired response. The result is precise, repeatable characteristics with a minimum of operator attention.

Multiple Temperature

A key feature of the Model 9650 is its ability to ramp the temperature under precise control. Multiple time/temperature points may be entered in nonvolatile memory and then executed as often as desired, beginning at any specified point in the program. Data may be collected in this manner under computer control with very little effort given to the actual temperature control process.

4-Wire Temperature Measurement

Temperature accuracy is achieved with 4-wire connections to the temperature sensors. Specific calibration data points are entered either from the front panel or via a remote control computer link. These points are used to adjust the stored basic characteristic sensor curve to obtain accuracy within unit specifications. A change of sensor data is easily accommodated in this manner with minimum data entry by the user.

Computer Interface

Complete instrument control is available either through the GPIB (IEEE-488) bus or the RS-232C link. The commands are simple to use. All data may either be entered or read by the remote control link.

Model 9650 Configuration

Model Number	Sensor Type	Temperature Range
9650-1	Silicon Diode	1.5K-450K
9650-2	Platinum	50K-600K
9650-3	Germanium	1.5K-100K
9650-5	Thermocouple	4.2K-550K
9650-6	Gallium Arsenide	1.5K-450K
9650-7	Ruthenium Oxide	2.0K-273

Model 9650 Specifications

Input Voltage	90-125 / 180-250 VAC, 50/60 Hz (Switchable)
Displays	1) Sixteen character liquid crystal 2) Bar Graph heater indication
Data Entry	Membrane Switch / Remote Interface
Data Storage	EEPROM
Remote Interface	GPIB (IEEE-488) or RS-232
Program Control	100 points (multi-program capability)
Control Sensor	Programmable to either sensor
Heater Output	60 watts maximum, 30 VDC @ 2 Amps
Controller Mechanical	1/2 DIN package low profile
Nominal Dimensions	3.5" H x 8.0" W x 14.0" D (80 mm x 203 mm x 356 mm)

Sensor Type	**Silicon Diode**		**Platinum**	**Germanium**		**Thermo-couple**	**Gallium Arsenide**		**Ruthenium Oxide**	
Sensor P/N	Si410		P6ABHT	N1G		CG07F	GA-300NN		RO-105	
Temp. Range	1.5-450K		50-600K	1.5-100K		4.2-550K	1.5-450K		2.0-273K	
Excitation	10 µA		1.0 mA	10 mV		N/A	10 µA		10 µA	
Repeat-ability	±0.1K		±0.1K	±0.05K		±0.2K	±0.1K		±0.1K to ±1.0K*	
Set Point	±0.1K		±0.1K	±0.05K		±0.1K	±0.1K		±0.1K to ±6.0K*	
Temp. Parameter	1.5-35K	35-450K	50-600K	1.5-60K	60-100K	4.2-550K	1.5-35K	35-450K	1.5-20K	20-80K
Resolution	±0.01K	±0.01K	±0.01K	±0.001K	±0.002K	±0.01K	±0.01K	±0.01K	±0.01K	±0.03K
Accuracy	±0.1K	±0.5K	±0.1K	±0.07K	±0.1K	±0.3K	±0.1K	±0.5K	±0.05K	±0.1K
Controll-ability	±0.1K	±0.2K	±0.2K	±0.01K	±0.05K	±0.2K	±0.1K	±0.2K	±0.1K	±0.3K
* Specifications for other temperature ranges are available from the factory.										

Indicator & Controller Overview

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