

# TEMPERATURE MONITORS

**9302 / 9304 / 9308**

TWO TO EIGHT INPUT CHANNELS WITH ETHERNET CONNECTIVITY

**Scientific Instruments Temperature Monitors** are the most compact and flexible cryogenic temperature monitors on the market. Virtually any cryogenic temperature sensor from any manufacturer can be selected by a single setting on the front panel. Additionally, custom or specially calibrated sensors require only a simple setup procedure. Unique features include: Low cost per channel, Internal Data Logging, Ethernet connectivity, a large easy to read display and extensive applications software.



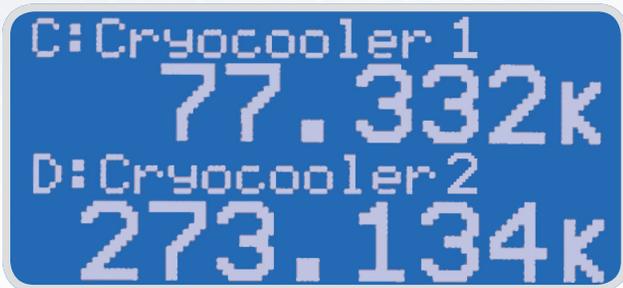
- Two, Four or Eight multipurpose input channels support Diode, Platinum RTD and most cryogenic NTC temperature sensors. Dual thermocouple inputs are optional.
- Operation from 1.0K to over 1500K with an appropriate sensor. Constant-Voltage, AC excitation of resistive sensors minimizes errors and extends their useful temperature range.
- Continuous data logging into internal Non-Volatile memory.
- Two large, dry-contact relay outputs.
- Flexible input power: Power-Over-Ethernet or 7.5-24V AC/DC.
- Built-in web server. Temperature monitoring and instrument configuration can be performed using any web browser.
- Remote interfaces include 100/10 Ethernet and RS-232. USB 2.0 and IEEE-488.2 (GPIB) are optional. LabVIEW™ drivers available for all interfaces.

## INPUT OPTIONS

The Model 9308 has eight input channels, the 9304 has four and the 9302 has two. All inputs are identical and independent with each capable of supporting the same wide range of sensor types. Other than the input channel count, there are no differences in the 9302, 9304, 9308 monitor line.

## EASY TO USE

The monitor's front panel consists of a large, bright TFT-LCD display, a 4-key keypad, an audio alarm and three status LEDs.



Several display formats may be selected. Up to eight temperature readings may be displayed simultaneously or two channels with input names and temperature shown in a large easy to read font. Additional screens include temperature readings along with relay and alarm status information.

A single key press takes the screen to a menu tree where most features and functions of the instrument can be configured.

The status of built-in alarms and relays is indicated by LEDs located below the display.

## INPUT FLEXIBILITY

Silicon Diode sensors are supported over their full temperature range by using 10 $\mu$ A constant-current DC excitation.

Positive Temperature Coefficient (PTC) resistor sensors including Platinum and Rhodium-Iron RTDs use constant-current, AC excitation. Platinum RTD sensors have built-in DIN standard calibration curves that have been extended to 14K for cryogenic use. Lower temperature use is possible with custom calibrations.

Auto-ranged, constant-voltage AC excitation is used to provide robust support for cryogenic Negative Temperature Coefficient (NTC) sensors including Ruthenium-oxide, Carbon-Glass, Cernox™, Carbon-Ceramic, Germanium and several others.

Thermocouple sensors are supported by using an optional dual thermocouple module. This module plugs into any of the input channels. It is powered by the instrument to provide amplification, cold-junction compensation and connection to copper.

### 9302, 9304, 9308 MONITORS, SUPPORTED SENSORS

	TEMPERATURE RANGE	EXAMPLE SENSORS
<b>DIODE</b>	1.4 - 500K	SI440, 430, 410, Cryo-con S900, S800, Lakeshore DT-670, 470
<b>PLATINUM RTD</b>	14 - 1200K	P1, P2, P3 Cryo-con CP-100, Cryo-con GP-100, Cryo-con XP-100, Cryo-con XP-1K
<b>RHODIUM-IRON</b>	1.4 - 800K	Oxford PHZ 0002
<b>GERMANIUM</b>	1.0K - 100K	Lakeshore GR-200A
<b>CARBON GLASS</b>	1.4 - 325K	Lakeshore CGR-1-500
<b>CERNOX™</b>	1.0K - 325K	Lakeshore, all types
<b>CARBON-CERAMIC</b>	1.0K - 300K	TMi-A1
<b>CLTS</b>	4K to 300K	Vishay CLTS-2B
<b>RUTHENIUM OXIDE</b>	1.0K - 200K	R0600, R0105, Cryo-con R400, Cryo-con R500, Lakeshore
<b>THERMOCOUPLE</b>	1.4 to 1500K	All thermocouple types

### INPUT SPECIFICATIONS

	DIODE SENSORS	PTC RESISTOR SENSORS	NTC RESISTOR SENSORS CONSTANT-CURRENT	NTC RESISTOR SENSORS CONSTANT-VOLTAGE	THERMOCOUPLES (OPTIONAL)
<b>INPUT CONFIGURATION</b>	Constant-Current DC	Constant-Current AC	Constant-Current DC Resistance Bridge	Autoranging Constant- Voltage AC Resistance Bridge	DC voltage
<b>INPUT RANGE</b>	0.1V - 2.25V	1.0mA: 0.1 - 750 $\Omega$ 100 $\mu$ A: 1.0 - 7.5K $\Omega$ 10 $\mu$ A: 10 - 75K $\Omega$	100K - 225K $\Omega$	Minimum: 0.5 $\Omega$ Maximum: 2.0M $\Omega$	$\pm$ 70mV
<b>ACCURACY: % RDG <math>\pm</math> % RANGE</b>	0.004% $\pm$ 80 $\mu$ V	0.01% + 0.0005%	0.005% $\pm$ 25 $\Omega$	14 to 30K: 0.05% + 0.05% 0.5 to 2M: 0.15% + 0.15%	0.05%
<b>RESOLUTION: % RANGE</b>	10 $\mu$ V	0.0003%	0.00004%	0.0003%	0.0003%
<b>EXCITATION</b>	10 $\mu$ A DC	1.0mA, 100 $\mu$ A, 10 $\mu$ A	10 $\mu$ A DC	100mV, 10mV 2.5mA to 150nA continuously variable	N/A

## INPUT POWER

The monitors are shipped with a 12VDC@1A external power supply but may be powered by any source providing 7.5 to 24 Volts AC or DC.

The IEEE 802.3at Power-over-Ethernet (PoE) specification is also supported, allowing the monitor to be powered by its local area network connection. Since PoE provides both instrument power and data over a single cable, remote data acquisition and high channel count systems can be simplified. PoE requires the use of a powered hub or power injector. Ethernet cables up to 300 meters may then be used.

## DATA LOGGING

Data Logging is performed by continuously recording temperature and status to an internal circular memory buffer. Data is time-stamped so that the actual time of an event can be determined. Non-volatile memory is used so that data will survive a power failure. The monitors will log up to 800 samples. Each sample includes readings for all input channels.

## ALARMS AND RELAYS

Two 10.0A dry-contact relay outputs are available that can be asserted based on temperature setpoints from user selected input channels. These relays are large enough to switch most cryogenic valves.

The visual, remote and audible alarms are supported. Each may be programmed to assert or clear based on temperature setpoints.

Alarms may be latched. These are asserted on an alarm condition and will remain asserted until cleared by the user.

## ORDERING INFORMATION

PART NUMBER	DESCRIPTION
<b>MODEL 9308</b>	Eight-channel monitor. Includes 12VDC external power supply.
<b>MODEL 9304</b>	Four-channel monitor. Includes 12VDC external power supply.
<b>MODEL 9302</b>	Two-channel monitor. Includes 12VDC external power supply.
<b>305-240</b>	Panel Mount Hardware kit.
<b>162-421</b>	Dual Cable Assembly.
<b>231-574</b>	ANA Connector.

## REMOTE CONTROL

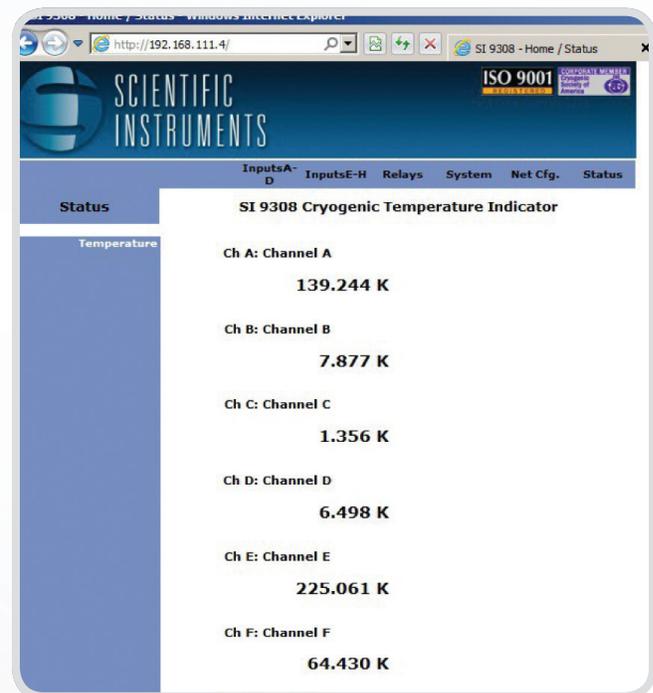
Standard Remote Interfaces include 100/10 Ethernet and RS-232.

An IEEE-488.2 GPIB interface is optional and may be field installed at any time. The option consists of an external module that is automatically configured by the monitor. A USB 2.0 serial port emulator option is also available.

Monitors connect directly to any 100/10 Ethernet Local-Area-Network (LAN).

The TCP and UDP data port servers bring fast Ethernet connectivity to data acquisition software including LabVIEW™.

Using the SMTP protocol, the monitor will send e-mail based on selected alarm conditions.



Using the Ethernet HTTP protocol, the monitor's embedded web server allows the instrument to be viewed and configured from any web browser.

Remote interfaces implement an IEEE-488.2 SCPI compliant remote command language that is easy to learn and easy to read.

LabVIEW™ drivers are available for all remote interfaces.

## FIRMWARE UPDATES

Full instrument firmware updates are available by contacting Scientific Instruments at **1-800-466-6031** or emailing us at [Sales@scientificinstruments.com](mailto:Sales@scientificinstruments.com).

## REAR PANEL CONNECTIONS

**INPUT CONNECTORS:** Four DB-9 receptacles provide 4-wire measurement for two sensors each. The Model 9302 has one connector. The Model 9304 has two and the Model 9308 has four. Any input connector can also be used for the dual thermocouple option connection.

**LAN:** Standard RJ-45 Ethernet connector. Power-over-Ethernet connection, GPIB Option.

**POWER INPUT:** 7.5 to 24 V AC/DC.

**RS-232:** DB9 plug. Also used for USB option connection.



## SPECIFICATIONS

### INPUT CHANNELS

The Model 9308 has eight input channels, The 9304 has four and the 9302 has two. All inputs are identical and independent, each capable of supporting a wide range of sensor types.

**Sensor Connection:** 4-wire differential. DB9 Connectors.

**Thermocouple Connection:** External option. Field installable.

**Sensor Types:** See Supported Sensor Table.

**Sensor Selection:** Front Panel or remote interface.

**Input Configurations:** See input specifications table.

**Excitation Modes:** Constant-Current or Constant-Voltage.

**AC Excitation Frequency:** 1.625Hz bipolar square wave.

**Voltage Excitations:** 100mV and 10mV. Minimum excitation current is 150nA, maximum is 2.5mA.

**Sample Rate:** 7.5Hz per channel.

**Digital Resolution:** 24 bits.

**Measurement Accuracy:** See input specifications table.

**Measurement Drift:** 15ppm/°C.

**Isolation:** Input channels are not isolated.

**Measurement Filter:** 0.5, 1, 2, 4, 8, 16, 32 and 64 Seconds.

**Calibration Curves:** Built-in curves for industry standard sensors plus eight user curves with up to 200 entries each. Interpolation is performed using a Cubic Spline.

### USER INTERFACE

**Display Type:** Graphics TFT LCD, 4mm and 8mm character height.

**Number of Inputs Displayed:** Up to eight.

**Keypad:** Sealed Silicone Rubber.

**Temperature Display:** Six significant digits, autoranged.

**Display Update Rate:** 0.5 Seconds.

**Display Units:** K, C, F or native sensor units.

**Display Resolution:** Up to seven significant digits.

### DATA LOGGING

Time stamped temperature data can be logged into an internal 800 entry circular buffer. Buffer memory is non-volatile and will retain valid data during loss of power. All eight input channel temperatures are recorded.

### STATUS OUTPUTS

**Audible and Visual Alarms:** Independent audible, remote and visual alarms. Alarms can be latched.

**Relays:** Two dry-contact relays. N.O. contacts available. Contact ratings: 10A@125VAC or 5A@30VDC.

### REMOTE INTERFACES

Maximum reading rate for all interfaces is >40 rdg/s.

**Ethernet:** Connects to any 100/10 Ethernet Local Area Network. Electrically isolated. TCP and UDP servers provide remote control by using an ASCII command language. HTTP provides built-in web server. SMTP sends e-mail.

**RS-232:** Standard null modem. Data rates are 9600, 19,200, 38,400 and 57,200 Baud. Connector is a DB-9 plug.

**IEEE-488.2 (GPIB):** External Option, field installable.

**USB 2.0:** External option, field installable. Serial port emulation.

**Programming Language:** IEEE-488.2 SCPI compatible. LabVIEW™ drivers available for all interfaces.

### GENERAL

**Ambient Temperature:** 25°C ± 5°C for specified accuracy.

**Mechanical:** 5.6"W x 2.9"H x 8.8"D.

**Weight:** 3.5 Lbs.

**Power Requirement:** IEEE-802.3at Power-Over-Ethernet (requires powered hub or injector) or 5 - 24V AC/DC. (External power supply included) 10VA.

**Power Switch:** Front panel.

**Conformity:** European CE certified.

**Calibration:** NIST traceable