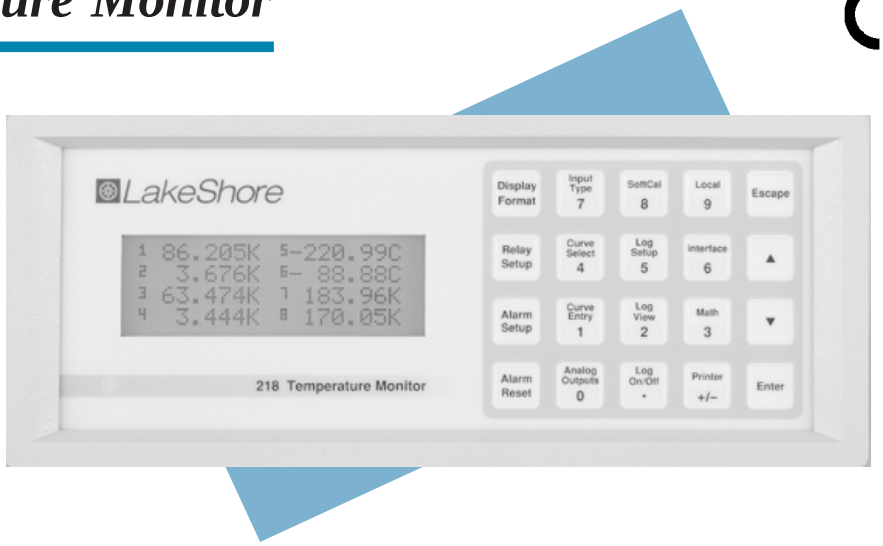
Model 218 Temperature Monitor

- Eight sensors read twice each second
- Supports platinum RTDs, diodes and NTC resistors
- Cryogenic and high temperature applications
- High accuracy, high resolution
- Eight readings displayed in K, °C, V or Ω
- Flexible interface options



Description

The Model 218 is an eight input temperature monitor that can be used with diode or resistive temperature sensors. The measurement input was designed for the demands of cryogenic temperature measurement. The monitor's low noise, high resolution and wide operating range make it ideal for noncryogenic applications as well.

There are two versions of the Model 218, the Model 218S and Model 218E. Both versions have the same sensor measurement and display capabilities but include different interfaces.

The **Model 218S** has many interface features intended for system integration and automated data collection that make it useful for cryogenic and noncryogenic applications. The Model 218S includes two computer interfaces, IEEE-488 and serial. Data logging memory and printer capability are included to help automate data collection. Two analog voltage outputs, an alarm feature and eight relays enhance system integration.

The **Model 218E** is configured to have a lower selling price but maintains the same level of performance. It includes a serial computer interface, data logging memory and printer capability. The alarm feature is also present on the Model 218E, but there are no relays. *The 218E has all the features and specifications of the 218S except IEEE-488 interface, analog voltage outputs and relays.*

PTC Resistor Measurements

The Model 218 can read up to eight 100 Ω, 1000 Ω PTC (positive temperature coefficient) or any other PTC resistive sensors using their standard curves or individual calibrations. Platinum RTDs are known for their wide range of operation and uniform sensitivity. The Model 218 can read Platinum RTDs to achieve temperature readings greater than 1000 K (727 °C). Platinum RTDs sold by Lake Shore are limited to 800 K (527 °C).

Diode Measurements

The Model 218 can read up to eight Lake Shore DT-470s or any other diode temperature sensor. Diode sensors are easily interchangeable and provide a wide measurement range from 1.4 K to 475 K. Many diodes, like the DT-470, follow a standard temperature response curve that may eliminate the need for costly or time consuming individual calibration. The convenient SoftCal™ feature can be used to improve the accuracy of less expensive DT-470 sensors.

NTC Resistor Measurements

The Model 218 can read up to eight NTC (negative temperature coefficient) resistor sensors using their standard curves or individual calibrations. NTC resistor sensors are typically used in specialized applications such as magnetic and radiation environments. In some applications, the constant current excitation of the Model 218 may limit the useful range of NTC resistor sensors (see the Model 218 Sensor Input Performance Chart on the next page).

Configurable Sensor Inputs

The Model 218 has eight constant current sources (one for each input) which can be configured for a variety of sensors. The inputs can be configured from the front panel or via computer interface and are grouped in two sets of four. Each set of four inputs is configured for the same sensor type (i.e. all 100 Ω Platinum, all Silicon Diodes, etc.).

Sensor Input Reading Capability

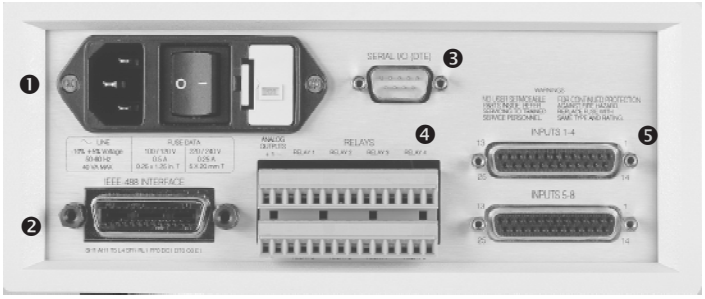
The Model 218 has two high resolution A/D converters to increase its update rate. It can read sensor inputs more quickly than other scanning monitors because it does not have to wait for current source switching. The result is 16 new readings per second allowing all inputs to be read twice each second. Inputs can be turned off to obtain a higher reading rate on fewer sensors. All readings can be read from the instrument with the IEEE-488 interface. The serial interface can also be used for all readings if it is operated efficiently. The display is updated twice per second.

Temperature Response Curves

The Model 218 has standard temperature sensor response curves for silicon diodes and platinum RTDs. It can support a wide variety of temperature sensors that do not have a standard curve because a unique 200 point user curve can be stored for each of the eight inputs. CalCurves™ for Lake Shore calibrated sensors can be stored as user curves. User curves can be entered from the front panel or with a computer interface. The built in SoftCal™ algorithm can also be used to generate improved curves for DT-470 diodes and platinum RTDs that are stored as user curves.

Configurable Display

The eight display locations on the Model 218 are user configurable. These locations can be used to display a single readout for each of the eight inputs or for more than one readout for fewer inputs. Sources for readout data are temperature units, sensor units and results of the math function. Input number and data source are always displayed for convenience.



Model 218 rear panel

1 - Line Input Assembly
2 - IEEE-488 Interface (218S only)
3 - Serial I/O or Printer Interface
4 - Terminal Block with Relays and Analog Voltage Outputs (218S only)
5 - Sensor Inputs

Lake Shore Supported Sensors*

Diodes		
Silicon Diode	DT-470	1.4 - 475 K
GaAlAs Diode	TG-120	1.4 - 475 K
Positive Temperature Coefficient RTDs		
100 Ω Platinum	PT-100, 250 Ω full scale	30 - 675 K
100 Ω Platinum	PT-100, 500 Ω full scale	30 - 800 K
Rhodium-Iron	RF-800-4	4 - 400 K
Negative Temperature Coefficient RTDs		
Germanium	GR-200A-1000	2 - 100 K
Germanium	GR-200A-250	1.2 - 40 K
Carbon Glass™	CGR-1-500	3 - 325 K
Cernox™	CX-1050 AA or SD	3.5 - 325 K
Cernox™	CX-1030 AA or SD	2 - 325 K
Rox™	RX-102A	3 - 200 K
Rox™	RX-202A	3 - 300 K
Thermox™	TX-104-GB	110 - 325 K

* Sensors sold separately

Sensor Input Performance Chart

Sensor Type	Silicon Diode	GaAlAs Diode	100 Ω Platinum RTD 500 Ω Full Scale	1000 Ω Platinum RTD	Cernox™ RTD
Temperature coefficient	Negative	Negative	Positive	Positive	Negative
Sensor units	Volts (V)	Volts (V)	Ohms (Ω)	Ohms (Ω)	Ohms (Ω)
Input range	0 - 2.5 V	0 - 7.5 V	0 - 500 Ω	0 - 5000 Ω	0 - 7500 Ω
Sensor excitation (Constant current)	10 µA ±0.01%	10 µA ±0.01%	1 mA ±0.3%	1 mA ±0.3%	10 µA ±0.01%
Display resolution Sensor units	100 µV	100 µV	10 mΩ	100 mΩ	100 mΩ
Example LSCI sensor	DT-470-CO-13 with 1.4H Cal.	TG-120SD with 1.4H Cal.	PT-103 with 14J Cal.	PT-1001(2) with 1.4J Cal.	CX-1050-SD with 4L Cal.
Temperature range	1.4 - 475 K	1.4 - 475 K	30 - 800 K	30 - 800 K	3.5 - 325 K
Standard curve Typical sensor sensitivity	LSCI Curve 10 -30 mV /K at 4.2 K -1.9 mV /K at 77 K -2.4 mV /K at 300 K -2.2 mV /K at 475 K	Requires Calibration -180 mV /K at 10 K -1.25 mV /K at 77 K -2.75 mV /K at 300 K -2.75 mV /K at 475 K	DIN 43760 0.19 Ω /K at 30 K 0.42 Ω /K at 77 K 0.39 Ω /K at 300 K 0.35 Ω /K at 675 K 0.33 Ω /K at 800 K	Scaled from DIN 43670 1.9 Ω /K at 30 K 4.2 Ω /K at 77 K 3.9 Ω /K at 300 K 3.3 Ω /K at 800 K	Requires Calibration -770 Ω /K at 4.2 K -1.5 Ω /K at 77 K -0.1 Ω /K at 300 K
Measurement resolution: **Sensor units** **Temperature equivalence**	 20 µV 1 mK at 4.2 K 11 mK at 77 K 10 mK at 300 K 10 mK at 475 K	 20 µV 1 mK at 10 K 16 mK at 77 K 10 mK at 300 K 10 mK at 475 K	 2 mΩ 10.6 mK at 30 K 10 mK at 77 K 10 mK at 300 K 10 mK at 675 K 10 mK at 800 K	 20 mΩ 10.6 mK at 30 K 10 mK at 77 K 10 mK at 300 K 10 mK at 800 K	 50 mΩ 1.0 mK at 4.2 K 33.3 mK at 77 K 500.0 mK at 300 K
Electronic accuracy: **Sensor units** **Temperature equivalence**	 ±160 µV ±0.010% RDG ±11 mK at 4.2 K ±138 mK at 77 K ±88 mK at 300 K ±77 mK at 475 K	 ±160 µV ±0.02% RDG ±6 mK at 10 K ±300 mK at 77 K ±150 mK at 300 K ±110 mK at 475 K	 ±0.004 Ω ±0.02% RDG ±25 mK at 30 K ±18 mK at 77 K ±70 mK at 300 K ±162 mK at 675 K ±187 mK at 800 K	 ±0.06 Ω ±0.04% RDG ±40 mK at 30 K ±33 mK at 77 K ±135 mK at 300 K ±370 mK at 800 K	 ±0.1 Ω ±0.04% RDG ±1 mK at 4.2 K ±88 mK at 77 K ±1.144 K at 300 K
Temperature accuracy incl. electronic accuracy, CalCurve™ and calibrated sensor	±31 mK at 4.2 K ±193 mK at 77 K ±138 mK at 300 K ±177 mK at 475 K	±21 mK at 10 K ±390 mK at 77 K ±190 mK at 300 K ±210 mK at 475 K	±45 mK at 30 K ±38 mK at 77 K ±105 mK at 300 K ±262 mK at 675 K ±287 mK at 800 K	±60 mK at 30 K ±53 mK at 77 K ±170 mK at 300 K ±470 mK at 800 K	±9 mK at 4.2 K (1) ±138 mK at 77 K (1) ±1.284 K at 300 K (1)
Magnetic field use	Recommended for T ≥ 60 K and B ≤ 3 T	Recommended for T > 4.2 K and B ≤ 5 T	Recommended for T > 40 K and B ≤ 2.5 T	Recommended for T > 40 K and B ≤ 2.5 T	Recommended T > 2 K and B ≤ 19 T

(1) *Specified accuracy does not include effects of thermal EMF voltages. An error of 3 mΩ will result from each 1 µV of thermal EMF voltage. In a well designed system, thermal EMF voltage should be less than 10 µV.*
(2) *No longer available from Lake Shore.*

Specifications

Thermometry

Number of inputs: Eight
Input configuration: Inputs separated into two groups of four. Each group must be the same input type.
Measurement type: Four lead differential
Excitation: Eight constant current sources
Supported sensors: Silicon Diodes, GaAlAs Diode, 100 Ω Platinum RTD, 1000 Ω Platinum RTD, Germanium RTD, Carbon Glass™ RTD, Cernox™ RTD, Rox™ RTD and Thermox™ RTD
Accuracy: See performance chart
Resolution: See performance chart
Maximum update rate: 16 readings/s
Standard curves: DT-470, CTI-C, DT-500D, PT-100, PT-1000
User curves: Room for eight (one per input), 200 point max. for each
SoftCal™: Improves accuracy of DT-470 diode to ±0.25 K from 30 K to 375 K. Improves accuracy of Platinum RTDs to ±0.25 K from 70 K to 325 K. Stored as user curves.
Math: Maximum, minimum and linear equation
Filter: Averages 2 to 64 input readings

Front Panel

Display type: Four line by 20 character backlit LCD display
Number of input displays: 1 to 8
Displays units: K, °C, V, Ω
Display update rate: All inputs displayed twice in one second
Temperature display resolution: 0.001° from 0° - 99.999°, 0.01° from 100° - 999.99°, 0.1° above 1000°.
Sensor units display resolution: Sensor dependent, to five digits
Display annunciators:

R	Remote Operation
A	Alarm
D	Data Logging
>	Max
<	Min
/	Linear

Keypad: 20 key membrane, numeric and specific functions
Front Panel Curve Entry: Yes

Interface

IEEE-488.2 Interface (218S):
SH1,AH1,T5,L4,SR1,RL1,PP0,DC1,DT0,C0,E1
Serial interface: RS-232C Electrical, DE-9 Connector, 9600 BAUD
Printer capability: Support for serial printer through serial interface port. Used with data log parameters.
Alarms
- Number: 16 - High and low for each input
- Data source: Temperature, sensor units, linear equation
- Settings: Units, High Setpoint, Low Setpoint, Deadband, Latching or Nonlatching, Audible on or off
- Actuators: Display annunciator, beeper, relays (218S)

Relays (218S)
- Number: Eight
- Contacts: Normally open (NO), normally closed (NC) and common (C)
- Contact rating: 30 VDC at 5 A
- Operation: Each input may be configured to actuate any or all of the eight relays. Relays may be activated on high, low or both alarms for any input, or manually.

Analog Output (218S)
- Scale: User selected
- Data source: Temperature, sensor units, linear equation, manual
- Range: ±10 V
- Resolution: 1.25 mV
- Accuracy: ±2.5 mV
- Minimum load: 1 kΩ

Data Logging

Readings: 1 to 8 in a record
Operation: Data log records can be stored in memory or sent to the printer. Stored data may be displayed, printed or retrieved by computer interface.
Data memory: Maximum of 1500 single reading records, nonvolatile

General

Ambient temperature: 15° - 35 °C (59 - 95 °F) to specified accuracy; 10° - 40 °C (50 - 104 °F) with reduced accuracy
Power requirement: 100, 120, 220, 240VAC, +5% -10%, 50 or 60Hz, 18 VA
Size: 217 mm wide x 90 mm high x 317 mm deep (8.5” x 3.5” x 12”), half rack
Weight: 3 kg (6.6 lb)
Approval: CE Mark

Ordering Information

Part number	Description
218S	Standard Temperature Monitor (8 inputs, IEEE-488 and serial interface, alarms, relays, analog output, data logging, printer support)

Please specifiy AC line voltage requirement (100, 120, 220 or 240 VAC)

218E	Economy Temperature Monitor (8 inputs, serial interface, alarms, data logging, printer support)

Options

8001	CalCurve™, Factory Installed Consists of the breakpoint table from a calibrated sensor stored in the instrument
8002	CalCurve™, Field Installed Consists of the breakpoint table from a calibrated sensor stored in a NOVRAM for installation at the customer location

Accessories

MAN-218*	Model 218 User’s Manual
106-253*	Sensor Mating Connector DB-25 D-style plug used for sensor input connector (quantity 2)
106-255*	Shell for Sensor Mating Connector DB-25 D-style shell used for sensor input connector (quantity 2)
106-772*	Terminal Block Mating Connector 14 pin connector used for relays and analog outputs (218S only) (quantity 2)
115-006*	Detachable 120 VAC line cord
RM-1/2	Rack Mount Kit For mounting one 1/2 rack temperature monitor in 482.60 mm (19") rack
RM-2	Rack Mount Kit For mounting two 1/2 rack temperature monitors in 482.60 mm (19") rack
4005	218 IEEE-488 Cable Kit 1 meter (3.3’ long) IEEE-488 (GPIB) computer interface cable assembly. Includes extender which is required to use both IEEE cable and relay terminal block simultaneously

* Accessories/options included with a new Model 218

See Reference Section for information on SoftCal™, CalCurve™ and Curve 10.

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