

# Digital Thermometers

## 2180A, 2189A & 2190A

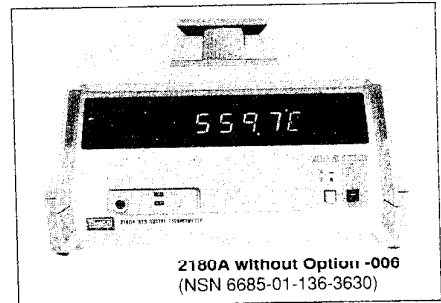


RS-232



2189A Thermometry System

Fahrenheit or Celsius readings. Each is capable of being run from either ac line power or external 12V dc, for field portability.



2180A without Option -006  
(NSN 6685-01-136-3630)

Output Option -002, -004 and Limits Option -006 are usable with any of the three thermometers. Other accessory items electronically connect and stack and latch to the 2180A or 2190A. These include manual multipoints, multiple alarms, a battery pack, and a thermocouple thermometer calibrator. Some are also practical to use with the 2189A.

For automatic scanning, see the section on the 2300A Scanner. A 2020A or 2030A Printer allows you to permanently store data when used with a 2180A or 2190A configured with an output option. Portable temperature logging is available with the factory-tested Temperature Logging Systems - 2383A or 2393A.

### 2180A, 2189A & 2190A TemPak Series

- 0.01° resolution for the 2180A and 2189A and 0.1° resolution for the 2190A
- Capable of running off of 12V dc or ac line power
- Designed to be integrated with a wide variety of instruments and accessories
- °C of °F is selectable via a front panel switch
- A full five digit LED display
- Analog and digital (RS-232-C or GPIB/IEEE-488) output options are available
- The limits option allows peak and valley memory, alarms and delta
- The 2189A consists of a 2180A and platinum RTD probe for greater accuracy
- 6 different RTD types are switch selectable. 4 platinum, 1 nickel, 1 copper (2180A)
- 15 different thermocouple linearizations including 2 DIN and 3 JIS standards (2190A)

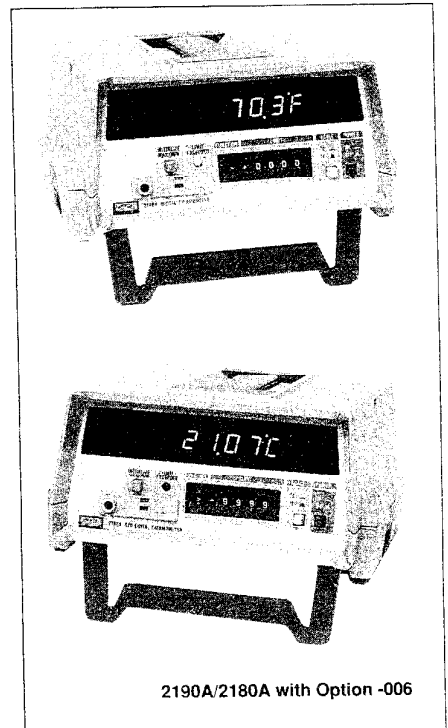
Fluke's most accurate and versatile general purpose digital thermometers are the 2180A and 2189A for RTDs and the 2190A for thermocouples. State-of-the-art accuracy teams with a large family of options and accessories to let you make precision temperature measurements in the lab or out in the field.

The 2180A RTD Digital Thermometer lets you switch-select one of six different types of RTDs, four platinum, one nickel, and one copper. Resolution is 0.01 degrees.

The 2189A Thermometry System consists of a 2180A that is factory-matched to a precision Y2039 Platinum RTD Probe.

The 2190A Thermocouple Digital Thermometer supports ten different thermocouple types, including two that comply to European DIN standards and three to Japanese standards. Resolution is 0.1 degrees. Take your choice from three different standard combinations of thermocouple types.

Each thermometer features a bright, high resolution LED display with pushbutton selection of



2190A/2180A with Option -006

# Digital Thermometers

## 2180A, 2189A & 2190A

### Limits Option (-006)

This option adds three powerful functions to the 2180A and 2190A Thermometers: Alarms, Peak Memory, and Delta. The Alarms function lights an indicator and closes a relay to activate external devices whenever a single preset maximum or minimum set-point is exceeded. Peak Memory stores the highest and lowest temperature reading for later recall. And Delta automatically subtracts a thumbwheel setting from the actual measurement and displays the difference.

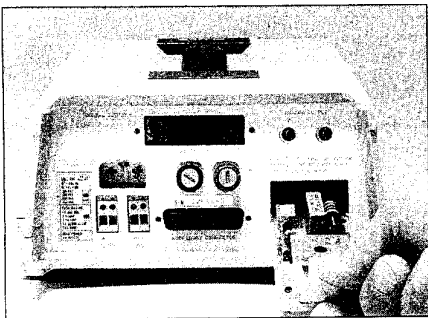
### IEEE-488 Option (-004)

The 21X0-004 is an GPIB/IEEE-488\* output option for the 2180A, 2189A and 2190A thermometers. This option mounts within the thermometer in the same location as the 21X0A-002. Readings are taken in response to an SRQ from the option by an IEEE-488 controller. This interface option does not include analog output capability. For applications requiring analog output and IEEE-488, use Option -002, 2XXXA-522, 1120A and Y7203. Not for use in a 2300A Scanner System.

### Output Option (-002)

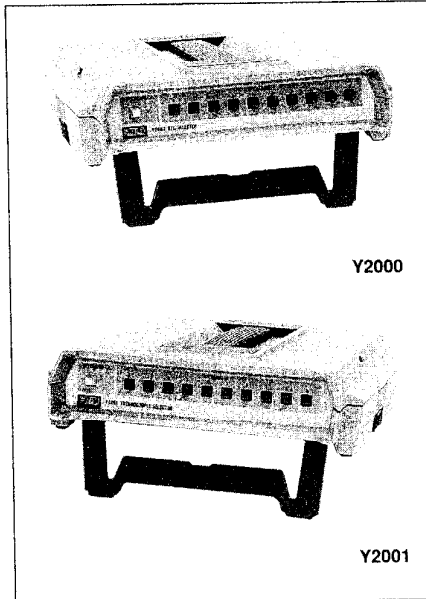
For recording temperature measurements with a 2180A, 2189A, or 2190A, you can use Output Option -002. It provides both an analog output for chart recorders and a digital output for printers or computers, and may be installed in the field. The digital output is available in four forms, depending on connector pins and cabling used: Parallel ASCII, RS-232 C, TTY current loop, and IEEE-488 (using the Fluke 1120A Translator). The Y2026B RS-232-C Cable Adapter is available to convert the 36-pin PTI connector on the option to a standard 25-pin RS-232-C connector, or the user can wire his own cable to the connector provided.

Option -002 is required when the thermometer is being used with a Fluke 2020A-004 or 2030A Printer unless a 2300A Scanner is used.



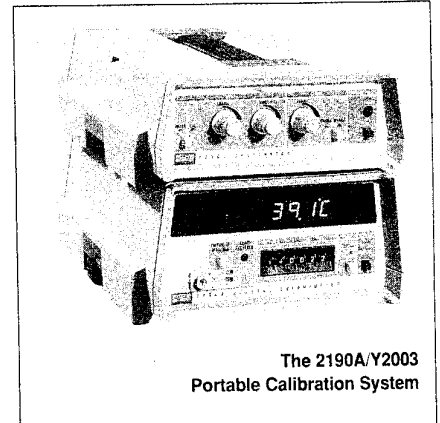
Rear view of 2190A showing the (A) Output Option -002 Connector, (B) Y2030 Thermocouple Input Module, and (C) Limits Option -006 Relay Output.

\* The terms GPIB and IEEE-488 may be used interchangeably throughout this catalog.



### Multipoint Selector (Y2000 & Y2001)

The Y2000 RTD Multipoint Selector (for the 2180A) and the Y2001 Thermocouple Multipoint Selector (for the 2190A) increase the number of points your thermometer can monitor. Connect up to ten sensors to each multipoint selector. Cascade up to ten multipoint selectors for up to 100 measuring points—all using a single 2180A or 2190A Thermometer. Both units have ten pushbuttons to easily access a specific measurement point. To measure or monitor more than one type of RTD or thermocouple, take advantage of internal switching. This allows you to monitor five sensors of one type, five of another. With Output Option -002 or -004 installed, the channel number is sent to your printer or computer, too. For automatic scanning applications see the 2300A, 2383A and 2393A.

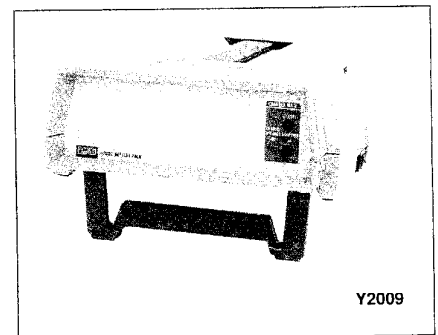


The 2190A/Y2003 Portable Calibration System

### Thermometer Calibration (Y2003)

The Y2003 Thermometer Calibrator and 2190A Digital Thermocouple Thermometer can be used together to check the accuracy of a thermocouple or millivolt-measuring or recording instrument.

Accurate and completely portable, the Y2003-2190A combination provides a variable voltage output from -10 mV to +90 mV. The output voltage simulates a thermocouple output, so that the reading on the 2190A Thermometer can be compared with a corresponding reading on any other thermocouple thermometer, either analog or digital. In addition, the Y2003 and 2190A can be used to calibrate millivolt chart recorders and digital or analog indicators measuring to 90 mV. Besides being used as a portable calibration system, the Y2003 can be used as a battery pack for the 2190A. See Y2009 below for battery usage details.



### Battery Pack (Y2009)

The Y2009 Battery Pack is a rechargeable, self-contained 12V dc nickel-cadmium supply for up to five hours of continuous operation. An indicator light tells you when batteries are low, while an automatic cut-off prevents damage to the cells from excessive discharge.

# Digital Thermometers

## 2180A, 2189A & 2190A

### 2190A Specifications

**Thermocouple Types:** Five, switch-selectable. Which thermocouple types depends on your choice of microcomputer type. See Accuracy chart below.

#### 2190A Accuracy\* (Celsius)

Thermocouples		Maximum Error*		
		±Degrees C		
Type	Applicable Portion of Temperature Range °C	At Cal	90 Days 20°C to 30°C	1 Year 15°C to 35°C
<b>Type 1</b>				
J	-128 to 0 0 to 900	0.18 0.18	0.19 0.31	0.21 0.36
K	-132 to 0 0 to 1350	0.18 0.18	0.19 0.39	0.21 0.47
T	-243 to 0 0 to 400	0.18 0.18	0.20 0.22	0.22 0.25
R	0 to 1708	0.31	0.59	0.70
C**	0 to 2471	0.18	0.60	0.75
<b>Type 2</b>				
J	-128 to 0 0 to 900	0.18 0.18	0.19 0.31	0.21 0.36
K	-132 to 0 0 to 1350	0.18 0.18	0.19 0.39	0.21 0.47
E	252 to 0 0 to 1000	0.18 0.18	0.20 0.33	0.22 0.39
R	0 to 1708	0.31	0.59	0.70
S	0 to 1685	0.22	0.50	0.60
<b>Type 3</b>				
J DIN***	-100 to 0 0 to 760	0.18 0.18	0.19 0.28	0.20 0.33
K	-50 to 0 0 to 1372	0.18 0.18	0.18 0.39	0.20 0.48
T DIN***	-200 to 0 0 to 400	0.18 0.18	0.20 0.22	0.21 0.25
B	420 to 1815	0.21	0.52	0.62
R	140 to 1700	0.18	0.46	0.46

\* Total instrument accuracy. Does not include Thermocouple errors

\*\* C designates Tungsten-5% Rhenium vs. Tungsten 26% Rhenium

\*\*\* DIN 43710, a European Standard until 1984

#### 2190A Accuracy\* (Fahrenheit)

Thermocouples		Maximum Error*		
		±Degrees F		
Type	Applicable Portion of Temperature Range °F	At Cal	90 Days 68°F to 86°F	1 Year 59°F to 95°F
<b>Type 1</b>				
J	-198 to 32 32 to 1652	0.20 0.20	0.23 0.47	0.26 0.58
K	-206 to 32 32 to 2462	0.30 0.30	0.33 0.72	0.37 0.87
T	-405 to 32 32 to 752	0.30 0.30	0.35 0.41	0.39 0.46
R	32 to 3106	0.47	1.01	1.20
C**	32 to 4480	0.30	1.11	1.37
<b>Type 2</b>				
J	-198 to 32 32 to 1652	0.20 0.20	0.23 0.47	0.26 0.58
K	-206 to 32 32 to 2462	0.30 0.30	0.33 0.72	0.37 0.87
E	-422 to 32 32 to 1832	0.30 0.30	0.33 0.61	0.40 0.72
R	32 to 3106	0.47	1.01	1.20
S	32 to 3065	0.38	0.92	1.10
<b>Type 3</b>				
J DIN***	-148 to 32 32 to 1400	0.30 0.30	0.32 0.52	0.36 0.61
K	-58 to 32 32 to 2502	0.20 0.20	0.22 0.63	0.25 0.78
T DIN***	-328 to 32 32 to 752	0.30 0.30	0.34 0.41	0.38 0.46
B	788 to 3299	0.37	0.95	1.15
R	284 to 3092	0.20	0.74	0.93

**Resolution:** 0.1°C, °F

**Input Connection:** 2 wires on screw terminal isothermal block

**Max Source Impedance:** 2 kΩ

**Overrange Detection:** Flashing display

**Open Circuit Detection:** Source impedance of 3 kΩ or more causes of flashing "OC"

**Repertoire:** SH1, AH1, T6, LO, SR1, RLO, PPO, DC0, DT0, C0, E2

**Service Request Usable:** Yes

**Power:** Operates only when powered by AC line

### 2190A/AM Thermocouple Thermometer

The 2190A/AM is a modified 2190A thermometer with fifteen thermocouple linearizations instead of the standard five. The user can select any of the 15 thermocouple types by adjusting the configuration of a multiswitch. The Model 2190A/AM provides all of the benefits of the standard 2190A in accuracy and system capability. The 2190A/AMK is a kit for retrofitting existing 2190As. The 2190A/AM offers the Japanese (JIS) series and European (DIN) of linearizations as well as the U.S. N and D linearizations.

Specifications are equivalent to those of the standard 2190A. Thermocouple Types Supported: NBS types (J,K,T,C,R,E,S,B,N,D), DIN types (J,T), JIS Types (J,K,R)

### Option Specifications

#### Output Option (-002)

##### Analog Output

**Type:** Linearized and isolated

**Voltage:** 1.0 mV/°C or °F to 5 mA max

**Temperature Coefficient:** 200 ppm/°C from 25°C

**Noise:** ≤100 μV at 100 Hz bandwidth

**Accuracy:** ±0.1% of reading ±1 mV

**Drift:** 200 μV/°C from 25°C

**Overload or Open Circuit:** Zero volts via banana jacks

##### Digital Output

**Types:** Four, E.I.A. Standard RS-232-C, TTY

current loop, parallel ASCII, and Fluke PT1

**Connector:** 36-pin AMP "Champ"

**Serial Baud Rates:** 110, 150, 300, 600, 1200, 2400, 4800, or 9600, switch-selectable

**RS-232-C Signals:** Transmitted Data, Request to Send, Clear to Send, Data Set Ready, Signal Common

**Parallel ASCII Signals:** Data: 8 lines; Instrument Address; 4 lines; Address Valid; Data Valid; Acknowledge: Ground; +5V

**TTY Current Loop Signals:** Source and controlled sink, 20 mA

**Out-of Limit Signals:** Exclamation point transmitted with Option -006 only

# Digital Thermometers

## 2180A, 2189A & 2190A

### Limits Option (-006)

**Limits Function:** Lights LED and activates form A (SPST) reed relay when thumbwheel setpoint is exceeded. Reed relay rated 10 VA, 184V dc or 130V ac rms max, 0.5A max, resistive. Selectable either low ( $\leq$ ) or high ( $\geq$ )

**Min/Max Function:** Continuously stores Min and Max temperature

**Delta Function:** Displays difference between thumbwheel setpoint and actual temperature

**Thumbwheels:** 6, for function, sign, and setpoint ( $\pm 9999$ ). Setpoint resolution is 1 degree.

### Accessory Specifications

#### Y2000 RTD Multipoint Selector

**Channels:** Ten per Y2000, up to ten Y2000s per 2180A. Channel number sent to printer or computer when Output Option -002 or -004 are used

**RTD Types:** Same as 2180A. Two types per Y2000

**Power:** Supplied by 2180A

**Interfacing:** Attached 46-cm cable plugs into rear of 2180A or Y2002. Receptacle accepts cable chained from other Y2000s

**Size and Weight:** Style A PTI case, 1.4 kg (3.09 lb)

#### Y2001 Thermocouple Multipoint Selector

**Channels:** Ten per Y2001, up to ten Y2001s per 2190A. Channel number sent to printer or computer when Output Option -002 or -004 are used

**Thermocouple Types:** Same as 2190A. Two types per Y2001

**Maximum Voltage Between Channels:** 125V ac rms

**Power:** Supplied by 2190A

**Interfacing:** Attached 46-cm cable plugs into rear of 2190A or Y2002. Receptacle accepts cable chained from other Y2001s

**Size and Weight:** Style A PTI case, 1.6 kg (3.53 lb)

#### Y2003 Thermocouple Calibrator and Battery Pack

**Thermocouple Types:** Same as 2190A

**Output Voltage:** -10 mV to +90 mV, adjustable. Applied at input terminals of 2190A and thermocouple thermometer of less accuracy to be calibrated

**Adjustments:** Coarse, fine and offset

**Battery Pack:** Same specifications as Y2009

**Interfacing:** Attached 46-cm cable plugs into rear of 2190A

**Size and Weight:** Style B PTI case, 2.6 kg, (5.74 lb)

#### Y2009 Rechargeable Battery Pack

**Output:** 12V dc, 750 mA max

**Battery:** Ten 1/2-D size cells in drip-proof case

**Operating Time:** 5-6 hours typical at 25°C on full charge when connected to 2180A, 2190A

**Recharge Time:** 16 hours typical at 25°C

**Charger:** Built-in on-off-switch, low-battery automatic discharge cut-off

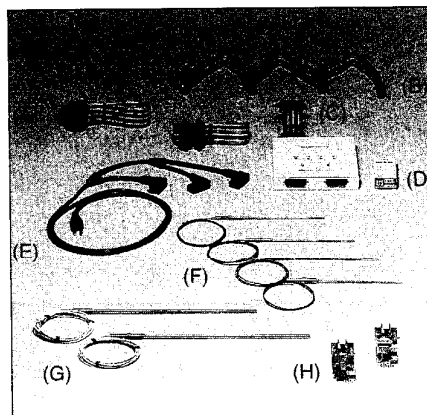
**Output Connectors:** Rear panel screw terminal block

**Operating and Storage Temperature:** 0°C to 40°C

**Power:** 100, 120, 220, or 240V ac  $\pm 10\%$  selectable, 50 to 400 Hz; 10W, typical

**Size and Weight:** Style B PTI case, 2.5 kg (5.52 lb), typical

### A Family of Accessories



Small accessories shown are: (A) Y7203 and Y7204 PTI Polling Cables, (B) Y2036 3-Module PTI Polling Cable, (C) Y2026 Cable/Adapter, (D) Y2022 Calibration Divider, (E) Y2024 3-Module Power Cord, (F) P20-Series Thermocouple Probes, (G) Y2037 and Y2039 RTD Probes, (H) Y2030 and Y2031 Plug-In Modules.

#### Y2022 Thermometer Calibration Divider (D in Picture)

**Function:** Either precision resistor or voltage divider ( $\pm 10$  or  $\pm 100$ )

**Input Voltage:** 0-10V dc

**Output Impedance:** 100 $\Omega$

**Precision Resistor:** 100 $\Omega \pm 0.01\Omega$ , temp coefficient 5 ppm

#### Y2024 3-Module Power Cord (E in Picture)

Connects three PTI family instruments or accessories to single 120V ac power outlet

#### Y2026B RS-232-C Cable Adapter (C in Picture)

**Function:** Routes RS-232-C signals from 36-pin PTI connectors to 25-pin RS-232-C connectors

**Connections:** Two 36-pin PTI connectors (M and F), two 25-pin RS-232-C connectors (M and F). Y7203 cable supplied

**RS-232-C Pin Selections:** Slide switches. Select TD on pin 2 or 3; DTR, DSR and CTS, through or pulled up; Scanner busy, through or to CTS

#### Y2030 Plug-in Module (H in Picture)

Extra plug-in units for 2190A thermocouples. Leave attached to input wire-pair for easy interchange of thermocouple inputs.

#### Y2031 Plug-in-Module (H in Picture)

Extra plug-in unit for 2180A RTDs, leave attached to input wires for easy interchange of RTD inputs.

#### Y2036 PTI Polling Cable (B in Picture)

Connects up to three PTI-family measurement instruments to 2020A or 2030A Printer.

#### Y2037 Platinum RTD Probe (G in Picture)

**Resistance:** 100 $\Omega \pm 0.1\Omega$  at 0°C

**Temperature Range:** -80°C to +480°C

**Curve Conformity:**  $\pm 0.1\%$  of temperature using IPTS 68 with ALPHA = 0.0038994 and DELTA = 1.494

**Stability:** Periodic usage (20% of time)  $\pm 0.03^\circ\text{C}$  if used from 0°C to 200°C and  $\pm 0.22^\circ\text{C}$  if used from -80°C to +480°C

**Hysteresis:** Less than  $\pm 0.08^\circ\text{C}$  when using 0°C and 200°C as end points

**Immersion Effects:**  $\pm 0.005^\circ\text{C}$  when going from 4 inches to 10 inches in an ice bath Transition End Temperature: 150°C maximum

**Physical:** 316 SS Sheath, 0.25 in diameter x 12 in L; four 6 ft leads #22 AWG stripped and tinned

**Handling:** Contains strain-free platinum coil. Must be handled with care.

#### Y2039 Platinum RTD Probe (G in Picture)

**Probe resistance:** 100 $\Omega \pm 0.1\Omega$  at 0°C

**Temperature Range:** -183°C to +480°C

**Performance Standard:**  $R_{100} / R_{0} = 1.3922$ , nominal. Conforms to IPTS 68 within 0.03% of temperature from -50°C to 420°C using ALPHA = 0.0039221 and DELTA = 1.493

**Resistance Stability:** 12 m $\Omega$ /year when exposed at 200°C or 20 m $\Omega$  in 250 hours when exposed at 480°C measured with probe at 0°C. 4 m $\Omega$  = 0.01°C + 0.04% of temperature

**Hysteresis:** Less than 0.01°C at 200°C when using 0°C and 420°C as end points

**Immersion Effects:** The readings shall not vary more than 0.005°C when probe is varied from 4 to 10 inches in an ice bath

**Transition End Temperature:** 150°C maximum

**Time Constant:** 8 seconds maximum when tested in flowing water at 3 feet per second

**Sheath Material:** INCONEL

**Size:** Diameter 0.64 cm (0.25 in), length 30.5 cm (12 in)

**Leads:** 4 wires, 6 ft, #22 AWG, ends stripped and tinned

**Calibration:** Each probe is calibrated at 0°C, 200°C and 420°C. The IPTS 68 constants R<sub>0</sub>, ALPHA, DELTA and A4 are provided

**Handling:** Contains strain-free platinum coil. Must be handled with care

# Digital Thermometers

## 2180A, 2189A & 2190A

### PTI Case Dimensions

Style	Height	Width	Depth
A	5.7 cm (2.25 in)	20.5 cm (8.05 in)	32.6 cm (12.85 in)
B	8.2 cm (3.23 in)		
C	10.5 cm (4.13 in)		
D	12.8 cm (5.03 in)		

### General Specifications

**Display:** °F or °C, switch-selectable; 7 segment 1.1 cm LED

**Measurement Method:** Dual-slope integration, 100 ms integration time, 3.33 readings/second

**Linearization Technique:** Segmented 4th order curve fit

**Temperature Coefficient:** ±15 ppm/°C from 25°C

**Stability:** 175 ppm/90 days, 200 ppm/year  
**Common Mode Voltage:** 350V dc, 250V rms ac, max

**Common Mode Noise Rejection:** ≥160 dB at 50, 60, and 400 Hz ± 0.1% 100Ω unbalance

**Normal Mode Noise Rejection:** ≥90 dB at 50, 60 and 400 Hz ± 0.1%

**Drift:** None, automatic zero correction

**Input Impedance:** 1000 MΩ at dc

**Accessory Connector:** 25-pin rear panel receptacle interfaces thermometer to Y2000, Y2001, Y2003, and 2300A

**Shock and Vibration:** Meets MIL-T-28800C, class 3 specifications

**Ambient Temperature:** 0°C to 50°C operating, -40°C to 75°C non-operating

**Relative Humidity:** ≤80% from 0°C to 50°C non-condensing

**Power:** 12V dc or 100, 120, 220, 240V ac ± 10% selectable, 50 to 400 Hz; 8W typical

**Size:** Style C PTI case, 10.5 cm H x 20.5 cm W x 32.6 cm D (4.13 in H x 8.05 in W x 12.85 in D)

**Weight:** 2.1 kg (4.63 lb)

**Safety:** (2180A and 2190A only) Factory Mutual 3820 approved, CSA 556B certified

**Included with Instrument:** Instruction manual, power cord. Probes are not included except with 2189A

### Ordering Information

#### Models

January 1990 prices

#### RTD Thermometers

2180\* Digital Thermometer ..... \$1135

2189A Thermometry System ..... 1850

\* Contact factory for 3-wire 10Ω copper applications

#### Thermocouple Thermometers

2190A Type 1 — J,K,T,R,C ..... \$1085

2190A Type 2 — J,K,E,R,S ..... 1085

2190A Type 3 — J(DIN), K,T (DIN),B,R ..... 1085

2190A/AM (15 types) ..... on req

2190A/AMK (15 types) Upgrade ..... on req

Kit for 2190A ..... on req

Also see 2383A and 2393A Temperature Logging Systems

#### Options (for 2180A, 2189A, 2190A)

-002\* Analog and Digital Output ..... \$ 395

-004\*\* IEEE-488 Output ..... 450

-006 Limits ..... 265

Note: Above options are customer installable

\*Required for compatibility with 2020A-004 or 2030 Printer or 1120A Translator. However, the option is not required when the thermometer is used with a 2300B Scanner, unless analog output is also needed.

\*\*Cannot be used with Option -002

#### Accessories (Also see Section 17)

##### Used for 2190A

P20J Thermocouple Probe, J type ..... \$ 63

P20K Thermocouple Probe, K type ..... 63

P20T Thermocouple Probe, T type ..... 63

P20E Thermocouple Probe, E type ..... 63

Y2001 Multipoint Selector, Thermocouples ..... 635

Y2003 Thermocouple Calibrator ..... 685

Y2022 Thermometer Calibration Divider ..... 130

Y2030 Thermocouple Input Module ..... 95

#### Used for 2180A & 2189A

Y2000 Multipoint Selector, RTDs ..... \$ 635

Y2031 RTD Input Module ..... 95

Y2037 RTD Probe, 100Ω 390PT ..... 260

Y2039 RTD Probe, 100Ω 392PT ..... 700

#### Joint Accessories

Y2009 Battery Pack, Rechargeable ..... \$ 440

Y2014 5 1/4" Rack Mount Kit PTI, Single, Size C, Offset ..... 95

Y2015 5 1/4" Rack Mount Kit PTI, Double, Size C ..... 95

Y2020 4.80 DIN Panel Mount Kit PTI .... 95

Y2026B Cable Adapter RS-232 ..... 180

Y2024 Power Cord, 3 way ..... 21

Y2036 PTI Polling Cable ..... 83

Y7203 Ribbon Cable PTI, 2 ft ..... 55

Y7204 Ribbon Cable PTI, 5 ft ..... 70

### Customer Support Services

#### Warranty

One-year product warranty. See Section 16 for further information on warranty terms and conditions.

#### Extended Warranty

A 10% discount is available when you order the following at the time of the instrument purchase or when ordered within the factory warranty period.

SC1-2180A Repair ..... \$ 126

SC2-2180A Calibration ..... 63

SC3-2180A Full Service ..... 175

SC1-2189A Repair ..... 134

SC2-2189A Calibration ..... 72

SC3-2189A Full Service ..... 191

SC4-2189A Performance Verification-Plus 43

SC1-2190A Repair ..... 110

SC2-2190A Calibration ..... 63

SC3-2190A Full Service ..... 98

SC4-2190A Performance Verification-Plus 133

Note: Incoming and/or outgoing calibration readings are available as an option.