TWEENERS

Models 1502A, 1503, and 1504



Tweeners	Models 1502A, 1503, and 1504
Three Tweeners to choose from	
Battery packs available	
Best price/performance package	

One of Hart's best-selling products is the Tweener thermometer, and there's a reason. No other company, not one, has a thermometer that comes close to the performance and features of the Tweener for anywhere near its price.

Model 1502A PRT Readout

The Model 1502A Tweener features accuracy up to $\pm 0.006^{\circ}$ C (the Model 1504 is even more accurate, up to $\pm 0.003^{\circ}$ C). In addition, it reads both 100ohm and 25-ohm probes, has a resolution of 0.001°C across its entire range and is the smallest unit in the industry. It also has an optional battery pack for completely portable operation. Each Tweener is programmable to match any probe's constants for maximum linearity and accuracy. All probe constants and coefficients are programmed through simple, front-panel keystrokes. Temperature is displayed in °C, °F, K, or resistance in ohms.

The 1502A accurately measures the resistance of the probe and then converts the resistance to a temperature value using its built-in algorithms.

For convenience, the 1502A reads the common industrial grade IEC-751 or "385" ALPHA RTD without any programming. Enter the actual R0 and ALPHA of the individual probe for increased accuracy. For maximum accuracy, use the ITS-90 formulas. The Tweener accepts the subranges 4 and 6 through 11.

ITS-90 formulas reside in its firmware. If your probe has been calibrated for any of the subranges of the ITS-90, you simply enter the coefficients directly into the Tweener.

Each thermometer comes complete with an RS-232 interface for automation of temperature data collection, calibrations, or process control functions. An IEEE-488 interface is available as an option.

The 1502A is calibrated digitally using the front-panel buttons. You never have to open the box to calibrate it. This calibration protocol further reduces the cost of the 1502A. It goes where you go and works the way you want it to.

Want more? There are two more Tweeners for specific applications, including the Model 1503 High Temperature PRT Readout and the Model 1504 Thermistor Readout.

TWEENERS

Model 1503 High Temperature PRT Readout

The Model 1503 Tweener reads lowresistance, high-temp PRT probes used for temperatures above the aluminum point up to 1200°C. It is absolutely the only readout at this price that reads lowresistance, high-temp probes. It reads 0.25-ohm, 2.5-ohm, 3-ohm, and 5-ohm probes. Its general accuracy is ± 0.02 °C and typically ± 0.15 °C at 1200°C. It uses the ITS-90 subranges or a 7th-order polynomial for HTPRTs.

Model 1504 Thermistor Readout

If you need more accuracy in a limited temperature range, the Model 1504 Tweener gives it to you as a thermistor readout. Thermistors are less fragile than PRTs and less likely to be impacted by mechanical shock. Thermistors are more sensitive to temperature, have faster response times, and come in many shapes for different applications.

Typical accuracy of a 1504 is ± 0.002 °C with a resolution of 0.0001 °C.

Software

With our Model 9934 Log*Ware*, all three Tweener models may be used for real-time data acquisition. Collect data and analyze it graphically or statistically. Additionally, Tweeners may be used as reference thermometers with our Calibrate-*it* software. (See our software section starting on page 78.)

Battery Option

If you want freedom from AC power in the field or on the plant floor, order Model 2502 and we'll install a DC power board in your Tweener. Then you can connect your own 12-volt DC power or order Hart's 9313 Battery Pack. Our battery gives you three to eight hours between charges. It includes a charger and a nylon pouch with a belt clip.

Calibration Choices

Each Tweener and its accompanying probe (sold separately) have their own individual calibration reports. Overall system error can be calculated from the



Tweeners are perfect for precision thermometry and as reference thermometers in temperature calibrations (shown here). With LogWare software, they can also now be used for real-time data acquisition.



The thermistor version of the "Tweener" gives you more variety in sensor configurations and even higher accuracy over a limited temperature range.

individual errors, rendering the added cost of system data unnecessary. However, for those requiring it, system data is available at two or more temperatures of your choice. (See Calibration Model 1929-X on page 158.)

Models 1502A, 1503, and 1504

$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Specifications	1502A	1503	1504				
Probe Nominal R _{mp} : 25Ω to 100Ω RTD, PRT, or SPRT Nominal R _{mp} : 0.25Ω, 2.5Ω, 3Ω, and Gu PRT Thermistors Gu PRT Characterizations ITS-90 subranges 6, 7, 8, 10, and 11 IPTS-68: R _o ; α, 8, a, and α, Callendar-Van Dusen: R _o ; α, 8, 10, and 11 IPTS-68: R _o ; α, 8, a, and α, Callendar-Van Dusen: R _o ; α, α, and β ITS-90 subranges 6, 7, and 8 HTPRT 7th-order polynomial callendar-Van Dusen: R _o ; α, α, and β Steinhart-Hart thermistor polynomial Callendar-Van Dusen: R _o ; α, α, δ, and β Resistance Accuracy (ppm of reading) 0Ω to 20Ω: 0.0005Ω 20Ω to 400Ω: 25 ppm 0Ω to 25Ω: 0.0002Ω 2.5Ω to 25Ω: 80 ppm Steinhart-Hart thermistor polynomial Callendar-Van Dusen: R _o ; α, and δ Temperature Accuracy [†] , typical (meter only) ±0.004°C at -100°C ±0.002°C at 10°C ±0.002°C to 100°C: 50.05°C ±0.002°C at 10°C ±0.002°C at 00°C ±0.002°C at 10°C ±0.002°C at 10°C ±0.002°C at 10°C ±0.002°C at 00°C Operating Temperature Resistance Resolution 0Ω to 2ΩΩ: 0.0001Ω Ω to 10 ΩΩ to 0ΩΩ: 0.001Ω Ω to 10Ω: 0.0001Ω Ω to 10 ΩΩ to 10Ω: 0.001Ω Ω to 10Ω: 0.001Ω Ω to 10Ω: 0.001Ω Ω to 10Ω: 0.001Ω Ω to 10 ΩΩ to 10Ω to 10Ω: 0.001Ω Ω to 10Ω: 0.001Ω Ω to 10Ω: 0.001Ω Ω to 10 ΩΩ to 10Ω: 0.001Ω Ω to 10 ΩΩ to 10 ΩΩ to 10Ω: 0.0001Ω Ω to 10 ΩΩ to 10 ΩΩ to 10Ω Ω to 10 ΩΩ to 10 ΩΩ to 10Ω Ω to 10 ΩΩ to 10 ΩΩ to 10Ω Ω to 10 ΩΩ to 10Ω to 10Ω to 10Ω to 10Ω to 10Ω to 10Ω Ω to 10Ω to 10Ω to 10Ω to 10Ω Ω to 10Ω Ω to 10Ω Ω to 10Ω Ω to 10Ω Ω to 10Ω to 10Ω to 10Ω Ω to 10Ω Ω to 10Ω to 10Ω to 10Ω	Temperature Range [†]	–200°C to 962°C (–328°F to 1764°F)	–200°C to 1200°C (–328°F to 2192°F)	Any thermistor range				
RTD, PRT, or SPRT5Ω PRTCharacterizationsITS-90 subranges 4, 6, 7, 8, 9, 10, and 11 IPTS-96, s.m., α, δ, a, and α, c.d. Callendar-Van Dusen: R, α, δ, a, and α, order deviation function Callendar-Van Dusen: R, α, δ, and βITS-90 subranges 6, 7, and 8 HTPRT 7th-order polynomial reference function with optional 2nd- order deviation function Callendar-Van Dusen: R, α, δ, and βSteinhart-Hart thermistor polynomial Callendar-Van Dusen: R, α, δ, and βResistance Accuracy (ppm of reading)00 to 200: 0.0005C at 00°C 200 to 4000: 25 ppm00 to 250: 0.000202 2.50 to 250: 80 ppm00 to 5 KΩ: 0.50 5 KΩ to 200 KΩ: 100 ppm 2.000 KΩ to 1 MΩ: 300 FC 2.000 FC to 100°C: 4.0.3°C 4.000°C to	Resistance Range	0Ω to 400Ω , auto-ranging	0Ω to 25Ω , auto-ranging	0Ω to 1 M Ω , auto-ranging				
IPTS-86 [°] , R., α, δ, a, and c, Callendar-Van Dusen: R., α, δ, and β HTPRT 7th-order polynomial reference function with optional 2nd- order deviation function Callendar-Van Dusen: R., α, and δ Callendar-Van Dusen: R., α, δ, and f Resistance Accuracy (ppm of reading) 0Ω to 20Ω: 0.0005Ω 20Ω to 400Ω: 25 ppm 0Ω to 25Ω: 0.0002Ω 2.5Ω to 25Ω: 80 ppm 0Ω to 5 KΩ: 0.200 KΩ: 100 ppm 2.000 KΩ to 1 MΩ: 300 ppm 2.000 KΩ to 1 MΩ: 300 ppm Temperature Accuracy (typical (meter only) ±0.004°C at -100°C ±0.008°C at 100°C ±0.018°C at 400°C 2.5Ω to 25Ω: 80 ppm 2.5Ω to 200°C ±0.002°C at 28°C ±0.008°C at 100°C ±0.018°C at 400°C ±0.004°C at 25°C ±0.018°C at 400°C ±0.004°C at 25°C ±0.018°C at 400°C ±0.004°C at 28°C ±0.018°C at 400°C ±0.004°C at 78°C ±0.018°C at 400°C ±0.004°C at 78°C ±0.018°C at 400°C ±0.004°C at 78°C ±0.018°C at 400°C ±0.002°C at 100°C ±0.028°C at 100°C ±0.018°C at 400°C ±0.018°C at 400°C ±0.000°C i: ±0.25°C ±0.018°C at 100°C ±0.018°C at 400°C ±0.018°C at 33°C ±0.004°C at 78°C ±0.018°C at 400°C ±0.000°C i: ±0.25°C ±0.018°C at 100°C ±0.018°C at 78°C ±0.018°C at 100°C ±0.018°C at 78°C ±0.010°C at 78°C ±0.018°C at 100°C	Probe			Thermistors				
(ppm of reading)20Ω to 400Ω: 25 ppm2.5Ω to 25Ω: 80 ppm5 KΩ to 200 KΩ: 100 ppm 200 KΩ to 1 MΩ: 300 ppm 200 KΩ to 1 MΩ: 300 ppmTemperature Accuracy1, typical (meter only)±0.004°C at -100°C ±0.009°C at 100°C ±0.009°C at 100°C ±0.009°C at 100°C ±0.009°C at 100°C ±0.012°C at 200°C ±0.009°C at 100°C ±0.012°C at 200°C ±0.012°C at 400°C to 1000°C: ±0.125°C ±0.010°C at 75°C ±0.010°C at 75°C ±0.012°C at 100°C ±0.012°C at 000°C ±0.024°C at 600°C±0.020°C at 00°C ±0.020°C at 100°C ±0.020°C at 100°C ±0.020°C at 100°C ±0.020°C at 100°C ±0.020°C at 600°C±0.020°C at 25°C ±0.010°C at 75°C ±0.010°C at 75°C ±0.010°C at 75°C ±0.010°C at 75°C ±0.020°C at 100°C ±0.020°C at 000°C ±0.020°C at 000°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.0001°C±0.020°C at 00°C ±0.020°C ±0.020°C ±0.020°C ±0.020°C ±0.0001°C ±0.0001°C ±0.0001°C ±0.0001°C ±0.0001°C ±0.0001°C ±0.00	Characterizations	IPTS-68: R_0 , α , δ , a_4 , and c_4	HTPRT 7th-order polynomial reference function with optional 2nd- order deviation function	Steinhart-Hart thermistor polynomial Callendar-Van Dusen: $R_{o},\alpha,\delta,$ and β				
typical (meter only) ±0.008°C at 0°C -200°C to 100°C: ±0.02°C ±0.004°C at 25°C ±0.009°C at 00°C ±0.009°C ±0.004°C at 50°C ±0.004°C at 50°C ±0.012°C at 200°C ±0.01°C to 100°C: ±0.1°C ±0.01°C at 100°C ±0.004°C at 50°C ±0.012°C at 200°C ±0.01°C to 100°C: ±0.1°C ±0.010°C at 75°C ±0.010°C at 75°C ±0.012°C at 600°C 100°C to 100°C: ±0.15°C ±0.010°C at 100°C ±0.020°C at 100°C ±0.024°C at 600°C 100°C to 100°C: ±0.15°C ±0.020°C at 100°C ±0.020°C at 100°C ±0.024°C at 600°C 100°C to 100°C: ±0.15°C ±0.020°C at 100°C ±0.020°C at 100°C 00°C to 100°C: ±0.25°C ±0.020°C at 100°C ±0.020°C ±0.020°C ±0.020°C Operating Temperature Range 16°C to 30°C 13°C to 33°C 13°C to 33°C 13°C to 33°C Resistance Resolution 0.01 to 20Ω: 0.0001Ω 0.00 to 10Ω: 0.0001Ω 0.00 to 10 KΩ: 0.1Ω 100 KΩ to 100 KΩ: 0.1Ω Temperature Resolution 0.001°C 0.01°C 0.01°C 0.0001°C 100 KΩ to 100 KΩ: 0.1Ω 100 KΩ to 100Ω: 0.0001Ω 0.01°C 0.01°C 0.0001°C 0.0001°C 100 KΩ to 100 KΩ: 0.1Ω 100 KΩ to 100Ω: 0.0001°				5 KΩ to 200 KΩ: 100 ppm				
RangeRangeResistance Resolution0Ω to 20Ω: 0.0001Ω 20Ω to 400Ω: 0.001Ω 20Ω to 400Ω: 0.001Ω0Ω to 10Ω: 0.00001Ω 10Ω to 25Ω: 0.0001Ω 10 KΩ to 10 KΩ: 0.1Ω 100 KΩ to 1 MΩ: 1ΩTemperature Resolution0.001°C0.01°C0.001°CExcitation Current0.5 and 1 mA, user selectable, 2 Hz3 and 5 mA, user selectable2 and 10 μA, automatically selectedMeasurement Period1 second11Digital FilterExponential, 0 to 60 seconds time constant (user selectable)Probe ConnectionCommunicationsRS-232 serial standard IEEE-488 (GPIB) optionalDisplay8-digit, 7-segment, yellow-green LED; 0.5-inch-high charactersPower115 VAC (±10%), 50/60 Hz, 10 A, nominal 		±0.006°C at 0°C ±0.009°C at 100°C ±0.012°C at 200°C ±0.018°C at 400°C	-200°C to 100°C: ±0.02°C 100°C to 400°C: ±0.05°C 400°C to 800°C: ±0.1°C 800°C to 1000°C: ±0.125°C 1000°C to 1200°C: ±0.15°C 0.25Ω nominal R _{TPW} 0°C to 500°C: ±0.25°C	$\pm 0.002^{\circ}$ C at 25°C $\pm 0.004^{\circ}$ C at 50°C $\pm 0.010^{\circ}$ C at 75°C $\pm 0.020^{\circ}$ C at 100°C (Using 10 KΩ thermistor sensor,				
20Ω to 400Ω: 0.001Ω10Ω to 25Ω: 0.0001Ω10 KΩ to 100 KΩ: 0.1Ω 100 KΩ to 1 MΩ: 1ΩTemperature Resolution0.001°C0.01°C0.001°CExcitation Current0.5 and 1 mA, user selectable, 2 Hz3 and 5 mA, user selectable2 and 10 µA, automatically selectedMeasurement Period1 second1 secondDigital FilterExponential, 0 to 60 seconds time constant (user selectable)Probe Connection4-wire with shield, 5-pin DIN connectorCommunicationsRS-232 serial standard IEEE-488 (GPIB) optionalDisplay8-digit, 7-segment, yellow-green LED; 0.5-inch-high charactersPower115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specifySize5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm)Weight2.2 lb. (1.0 kg)		16°C to 30°C	13°C to 33°C	13°C to 33°C				
Excitation Current0.5 and 1 mA, user selectable, 2 Hz3 and 5 mA, user selectable2 and 10 μA, automatically selectedMeasurement Period1 secondDigital FilterExponential, 0 to 60 seconds time constant (user selectable)Probe Connection4-wire with shield, 5-pin DIN connectorCommunicationsRS-232 serial standard IEEE-488 (GPIB) optionalDisplay8-digit, 7-segment, yellow-green LED; 0.5-inch-high charactersPower115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specifySize5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm)Weight2.2 lb. (1.0 kg)	Resistance Resolution			10 K Ω to 100 K Ω : 0.1 Ω				
Measurement Period 1 second Digital Filter Exponential, 0 to 60 seconds time constant (user selectable) Probe Connection 4-wire with shield, 5-pin DIN connector Communications RS-232 serial standard IEEE-488 (GPIB) optional Display 8-digit, 7-segment, yellow-green LED; 0.5-inch-high characters Power 115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specify Size 5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm) Weight 2.2 lb. (1.0 kg)	Temperature Resolution	0.001°C	0.01°C	0.0001°C				
Digital FilterExponential, 0 to 60 seconds time constant (user selectable)Probe Connection4-wire with shield, 5-pin DIN connectorCommunicationsRS-232 serial standard IEEE-488 (GPIB) optionalDisplay8-digit, 7-segment, yellow-green LED; 0.5-inch-high charactersPower115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specifySize5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm)Weight2.2 lb. (1.0 kg)	Excitation Current	0.5 and 1 mA, user selectable, 2 Hz	3 and 5 mA, user selectable	2 and 10 μ A, automatically selected				
Probe Connection4-wire with shield, 5-pin DIN connectorCommunicationsRS-232 serial standard IEEE-488 (GPIB) optionalDisplay8-digit, 7-segment, yellow-green LED; 0.5-inch-high charactersPower115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specifySize5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm)Weight2.2 lb. (1.0 kg)	Measurement Period	1 second						
Communications RS-232 serial standard IEEE-488 (GPIB) optional Display 8-digit, 7-segment, yellow-green LED; 0.5-inch-high characters Power 115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specify Size 5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm) Weight 2.2 lb. (1.0 kg)	Digital Filter	Exponent	Exponential, 0 to 60 seconds time constant (user selectable)					
IEEE-488 (GPIB) optional Display 8-digit, 7-segment, yellow-green LED; 0.5-inch-high characters Power 115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specify Size 5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm) Weight 2.2 lb. (1.0 kg)	Probe Connection	4-wire with shield, 5-pin DIN connector						
Power 115 VAC (±10%), 50/60 Hz, 10 A, nominal 230 VAC (±10%), 50/60 Hz, 10 A, nominal, specify Size 5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm) Weight 2.2 lb. (1.0 kg)	Communications							
230 VAC (±10%), 50/60 Hz, 10 A, nominal, specify Size 5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm) Weight 2.2 lb. (1.0 kg)	Display	8-digit, 7-segment, yellow-green LED; 0.5-inch-high characters						
Weight 2.2 lb. (1.0 kg)	Power							
	Size	5.6" W x 7.1" D x 2.4" H (143 x 181 x 61 mm)						
Probes from Hart See pages 66–70 See pages 66–70 See pages 72–75	Weight	2.2 lb. (1.0 kg)						
	Probes from Hart	See pages 66–70	See pages 66–70	See pages 72–75				

Ordering Information

1502A	PRT Thermometer	9934-M	Log <i>Ware,</i> Single Chan- nel, Multi User	1929-5	System Cal Report, Thermistors
1503 1504	HTPRT Thermometer Thermistor Thermometer	9313	Battery Pack		(see page 158)
2502	DC Power Option	9301	1 Carrying Case, fits Tweener and 12" probe	See pad	Add points, each escience for a selection of probes
2505	Spare Connector	9308	Carrying Case, fits Tweener and 6" probe	to use with Tweeners and other Hart	
2506	IEEE Option			readout	
2507	Mini-Printer	1929-2	System Cal Report, RTDs		
2508	Serial Cable Kit		(See page 158)		See our calibration and data acquisi- tion software packages on page 78.
9934-S	Log <i>Ware</i> , Single Chan- nel, Single User		Add points, each		