SMARTPROBE SYSTEM SPECIFICATIONS;

- INTRODUCTION -

FUNCTIONS & FEATURES

o Ultra-High Instrument Accuracy (up to ±O.OO5°C)
o High Resolution (up to 0.001°C)
o Wide Range (-40°C to + 150°C)
o Accepts a variety of thermistor probes
o Hold, Min/Max, Delta T, Store, F/C functions
o Selectable Auto Shut-Off Period/Manual Shut-Off
o Over/Under Range Indication
o Low Battery Indication
o RS-232 Output
o User-Friendly Key Pad
o User-Assigned Special Functions
o NIST Traceable

The 4500 series thermometers are multipurpose, ultrahigh accuracy high-resolution, hand-held digital thermometers. The 4500 series thermometers accept a wide range of plug-in probes equipped with Al[pha Technics' proprietary SmartProbe system. Each SmartProbe has it's own calibration data stored in the SmartProbe adapter. Ultrahigh system accuracy is achieved because the thermometer and probe function as if they were calibrated together as a system.

Along with HOLD, degrees F/C selection, MIN/MAX, STORE, DELTA T, Normal/High resolution, and low battery indication features, the RS-232 port can also download data from the thermometer to a standard PC. Data can be manipulated and sent to other programs using the optional software package ThermalView.

Thoughtful design has resulted in a user-friendly enclosure and key pad format. All functions can be easily accessed through the MODE and FUNCTION keys. Functions are user-assigned to desired keys.

- INTRODUCTION -

Large Probe Selection
The Model 4500 accepts Alpha Technics high accuracy thermistor probes and a variety of other thermistor probes with SmartProbe termination.

Computer Interface
An RS-232 computer interface allows the user to download Information from the Model 4500 to their own PC to create reports and graphs. PC software, called ThermalView is available.

Friendly Key Pad
A user-friendly KEY PAD allows the operator to program the most frequently used functions into the unit. The functions include:
HOLD, MIN/MAX, F/C selection, STORE for recording readings, Delta T for measuring the difference between a stored value and the current reading, Normal/High resolution.

Big Display
Large .6" LCD numbers allows for viewing. All functions such as HOLD, STORE, Delta T, F/C, etc., are easily readable and logically arranged.

Low Noise Circuitry
Patented circuitry allows for very clean low noise signals. Even background electronic noise is substantially reduced. Self-heating, lead resis-tance, thermistor anomalies and other factors are taken into account and corrected in the calcula-tions.

Battery Door
The 9 Volt Alkaline battery is easily accessible.

RS232 Connector

d.c. input connector 12V@20mA

Probe input

Figure 1. Rear Panel connections.

-OPERATING INSTRUCTIONS-

1. Determine that a Alpha Technics SmartProbe is connected to the unit.

2. Press the green colored rubber key marked "ON/OFF" to turn the unit ON. (Pressing this key again will turn the unit OFF.)

3 READOUT:

Display	Explanation
°C/°F symbols	Reading is displayed in degrees C or F
-40.00 to +150.00* (-40.00 to +299.98)	Actual temperature in degrees Celsius (Fahrenheit)
"LO" *	Temperature is below -40.00°C (-40.00°F) or a probe is not inserted
"HI" *	Temperature is above 150.00°C (299.98°F)
Flashing battery symbol	Battery needs replacement**

*Some versions of 4500 Series SmartProbes will have different temperature ranges. See the specifications in the back of this manual or those packed separately with the unit.

**To ensure that erroneous results are not displayed, the numerical segments are disabled (all turned on or all off) one hour of running time after the battery symbol starts flashing.

-OPERATING INSTRUCTIONS-

4. FUNCTIONS:

LCD Readout

HOLD: "Freezes" the display at the present temperature when the HOLD function is activated.

MIN/MAX: Displays the lowest (MIN) and highest (MAX) temperature from the time of turning on the meter.

STORE: Records a temperature when the STORE function is activated. (The "STORE'd" value can be retrieved and displayed in the DELTA T function.) The value is kept in memory until it is replaced or the unit is turned off.

DELTA T: Calculates and displays the present temperature minus the STOREd temperature.

°C/°F: Selects either degrees Celcius or Fahrenheit as the units to be displayed.

CHK CAL: CHECK CAL allows the user to display three significant decimal places on the LCD screen, i.e .001 degree resolution. Tens and hundred units are not displayed in .001degree LCD readout mode. The CHK CAL icon stays on while in this mode.
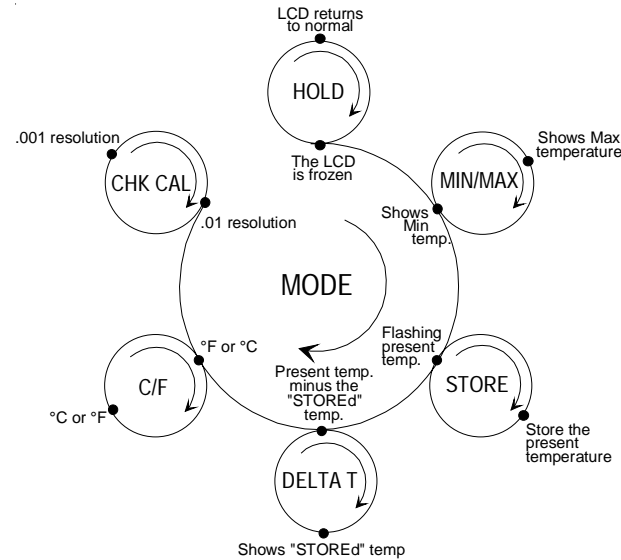

-OPERATING INSTRUCTIONS-

5. KEY PAD OPERATION:
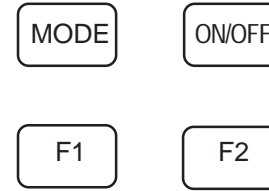
Key Pad

All functions can be accessed through the MODE and FUNCTION (F1 & F2) keys. The user can assign any of the aforementioned functions to either the F1 or F2 keys by scrolling through the functions using the MODE key, then pressing either F1 or F2.

Key pad functional flow chart

-OPERATING INSTRUCTIONS-

5. KEY PAD OPERATION:

When the MODE key is pressed, the active function icon flashes and the other function icons turn on solid. Pressing MODE again scrolls the display to the next function. When the desired function icon is flashing, pressing F1 or F2 assigns that function to the selected key and enters the thermometer into that selected function mode.

If a function has not been selected, the MODE operation will automatically end after four flashes of the display (about 4 secs.) or if MODE is scrolled past CHK CAL.

-OPERATING INSTRUCTIONS-

5. KEY PAD OPERATION:

Example #1: You want F1 to be the F/C function, and F2 to be the HOLD function.

Turn on the unit.

After the unit has initialized, press the MODE key down 5 times (C or F will be flashing).

Press F1. (F1 is now the degrees C/F function key. The thermometer has also changed from C to F or from F to C.)

Now, assign HOLD to the F2 key.

Press MODE once. (HOLD is flashing)

Press F2. (F2 is now the HOLD function. The thermometer has also been put into the HOLD mode. Press F2 again to go back to normal mode.)

Example #2: You want to take Delta T measurements. (The difference between a value you have stored, using the STORE function, and the meter's present reading. In this example, let us assume that you are taking the temperature difference between two beakers of water, beaker A and beaker B.)

-OPERATING INSTRUCTIONS-

5. KEY PAD OPERATION:

First, you need to assign the STORE function to the F1 key, and the DELTA T function to the F2 key. (You can assign them differently if you wish.)

Press the mode key 3 times. (The STORE icon is flashing.)

Press the F1 key. (F1 is now the STORE function.) Press F1 again to return to normal operation.

Press the MODE key 4 times. (The DELTA T icon is flashing.)

Press the F2 key. (F2 is now the DELTA T function) Press F2 two more times to get back to normal operation.

Now, F1 is STORE, and F2 is DELTA T.

TAKING THE DELTA T READING:

Put your probe into beaker A. Allow the reading to stabilize.

Press F1 (the STORE function). The STORE icon and the temperature numbers are flashing on and off. This lets you know that you are about to put a value into memory (erasing any previous value which had been stored). When F1 is pressed a second time, the value on the display is put into memory and the thermom-

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-OPERATING INSTRUCTIONS-

5. KEY PAD OPERATION:

Put the temperature probe into beaker B.

Press F2 (DELTA T). The DELTA T icon will appear and the numerical reading will show the difference between the stored value, beaker A, and the temperature of the present reading, beaker B. This is a real-time delta measurement. As the temperature of beaker B changes, you will see the difference between beaker B and the earlier stored value of beaker A.

Press F2 again. The stored value is displayed (beaker A). Press F2 again, and the thermometer returns to normal operation. Press F2 again, and you will see the delta measurement again, and so on.

6. AUTO SHUTOFF:

The thermometer is factory set to automatically turn itself off 10 minutes after being turned on or 10 minutes after the last function key entry. You may turn the unit off at any time by pressing the ON/OFF switch . Using a terminal program on a PC with an RS-232 interface this auto shut off can be disabled or set to any time between 3 and 998 minutes. (See pages 11 and 12, RS-232 INTERFACE).

When using the RS-232 interface or the optional external power supply, the auto shutoff feature is automatically disabled.

-RS-232 INTERFACE-

The RS-232 interface allows temperature data from the 4500 Series thermometers to be sent to a standard Personal Computer. An optional software package known as ThermalView allows for easy data capture and manipulation in a Windows environment. Other data capture programs may be used.

When using non-ThermalView data capture programs, the following information may be necessary:

The 4500 Series thermometers enter the HOST mode when the RTS line becomes active true. When the RTS line becomes FALSE, the 4500 returns to the normal mode of operation.

Baud Rate:	9600
Data Length:	8 Bits
Parity:	None
Stop Bits:	1
Hardware	None

The 4500 has a standard DB9 female connector with the following pins:

PIN	DIRECTION	SIGNAL NAME
1		No Connection
2	to Host RX	(Receive Data)
3	From Host	TX(Transmit Data)
4		No Connection
5		GND
6		No Connection
7	From Host	RTS(Request to Send)
8		No Connection
9		No Connection

-RS-232 INTERFACE-

The 4500 will display H232 on the LCD when properly connected to an active RS-232 port. In a terminal program you will see a prompt >_ indicating that the 4500 and PC are communicating properly. You may need to hit enter a few times to synchronize the communication link. To see a list of the available commands type H on the keyboard followed by ENTER (carriage return). Follow the prompts given by the 4500 on the screen. The T command will continuously send temperature readings about every 1/2 second to the P.C. in the format of SXXX.XXX always in degrees Celsius. S = sign, a minus sign (-) is shown if a negative number is being displayed and no sign is shown if a positive number is being displayed. XXX.XXX = up to three significant whole digits with always three significant decimal places, i.e 102.248 or - 12.315. The 4500 will continue to send the temperature to the P.C. until the thermometer is turned off.

- BATTERY REPLACEMENT -

When replacing the battery, place the unit onto it's face and remove the battery door at the bottom of the case. Remove the battery by prying it out of the mounting terminals by using your thumb or forefinger. Replace with a 9 Volt alkaline battery, Duracell MN1604 or equivalent.

The old battery may be pried out from the mounting terminals by using your thumb or fore finger.

When putting in the new battery, be sure that the terminals line up and snap firmly into the terminal on the circuit board. (The unit will not be damaged if you accidentally try to put the battery in backwards.) Replace the battery door.

- CARE AND CLEANING -

Extensive testing has proven this case to be rugged and reliable. It is splash resistant, but not water proof. The case may not be submerged! Liquid will flow in and damage or ruin the thermometer!

DO NOT AUTOCLAVE THE UNIT! ! If it is necessary to decontaminate the thermometer, a weak chlorine solution may be gently wiped on to the case by a well rung out soft cloth. Do not let any liquid go into the jacks. Your readings will be affected.

The clear plastic LCD lens can be easily scratched and/or fogged by inappropriate cleaning products. Use only plastic approved lens cleaners. Alcohol, acetone, lacquer thinners and other harsh chemicals will fog the lens and damage the case and rubber key pad.

Keep the 8 pin DIN receptacle on the Model 4500 and the pins on the SmartProbe clean. Periodically wipe off and clean the probe plug contacts. Be sure to ground yourself before touching the pins on the SmartProbe adapter. There are active electronic components inside. Dirty contacts will cause reading errors.

Warning   Never use Alcohol or thinners as these will damage the instrument.

Warning   If Model 4500 is used in a manner not specified by Alpha Technics, then the protection provided by the instrument may be impaired.

- RECALIBRATION -

The Model 4500 Thermometer should be recalibrated at least once every two years, A SmartProbe should be recalibrated at least once a year to maintain its accuracy. (Some SmartProbes may require a 6 month recalibration cycle). Check the Report of Calibration, which came with the thermometer, or the recalibration label on the unit to determine the next recalibration due date.) SmartProbes will display the recalibration date on the LCD screen of a Model 4500 when powered up. Recalibration should be performed at Alpha Technics. When the Thermometer requires recalibration, forward it, postage paid, to:

Alpha Technics
Att. Service/Repair
1560 Orangethorpe Way
Anaheim, CA 92801
Phone: (714) 578-9205
Fax: (714) 773-9327

Contact Alpha Technics for current prices and include with the unit a purchase order, a ship to / bill to address, a phone number, and a contact name. Ship the unit in its original carrying case or box enclosed in a suitable shipping container.

- REPAIR -

If the Thermometer fails, forward it, postage paid, to Alpha Technics. Include a description of the difficulty, place the Thermometer in its carrying case or box and pack the unit securely in a suitable shipping container. Alpha Technics shall assume NO responsibility for damage in transit.

IN WARRANTY:

Instruments covered by the limited warranty will be promptly repaired or replaced, at Alpha Technics' option, and returned at no charge. SEE LIMITED WARRANTY, PAGE 17, FOR ITEMS COVERED AND COMPLETE WARRANTY TERMS. (Other manufacturers probes are not included under Alpha Technics' warranty unless otherwise stated.)

OUT OF WARRANTY:

The Thermometer will be repaired and returned for a fixed fee. (Repairs needed because of abuse or accidental damage will be quoted.) Contact Alpha Technics for current prices. Include a purchase order with the unit.

- WARRANTY -

ALPHA TECHNICS THERMOMETER 1 YEAR LIMITED WARRANTY

The thermometer manufacturer, Alpha Technics, warrants your thermometer to be free from defects in material and workmanship under normal use and service. The warranty period for the Thermometer is 1 YEAR from the date of purchase and DOES NOT apply to batteries, or when the instrument has been misused, altered or damaged by accident or abnormal conditions of operation.

For warranty service, send the instrument with a description of the difficulty, postage prepaid, to Alpha Technics. Alpha Technics assumes no risk for damage in transit. Alpha Technics will, at its option, repair or replace the defective instrument free of charge. However, if we determine that the failure was caused by misuse, alteration, accident, or abnormal condition of operation, you will be billed for the repair. The repaired instrument will be returned, postage prepaid.

ALPHA TECHNICS MAKES NO WARRANTY INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, OTHER THAN THE WARRANTY STATED ABOVE. ALL WARRANTIES ARE LIMITED TO A PERIOD OF 1 YEAR FROM THE DATE OF PURCHASE. ALPHA TECHNICS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

Note (U.S.A. only): Some states do not allow limitations of implied warranties, or exclusion of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may have other rights which vary from state to state.

- SPECIFICATIONS -

GENERAL INSTRUMENT SPECIFICATIONS:

ENVIRONMENTAL CONDITIONS:
Operating:
   Temperature   0 - 40°C (32 to 104°F)
   Humidity   0 - 85%
Storage:
   Temperature   0 - 60°C (32 to 140°F)
   Humidity   0 - 70%

READING RATE: 2/sec. (one reading every 524msec)

DISPLAY: 4 1/2 digit LCD

POWER: 9 VDC battery, alkaline. Type PP3 or equivalent.

Auto shut off time: 10 minutes. Auto shut off can be disabled or shut off time changed via the RS-232 port. Optional 110VAC adapter is available.

External universal PSU is available as an option

12V@20Ma

BATTERY LIFE: 20 hours typical (15 hours using RS-232); battery symbol flashes when less than one hour running time remains. All LCD segments turn on or off after the one hour of running time.

DIMENSIONS: 210H x 108W x 44D mm
         (8.25"H x 4.25"W(max) x 1.75"D(max))

WEIGHT: 405g (14oz.)

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP110 SmartProbe:

THERMISTOR: ~10k Ohms @25°C

PROBE: Mid range, high accuracy micro probe.

MEASUREMENT RANGE:
     -20.00°C to +55.00°C
     (-4.00°F to +131.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD: 12 months.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
0 to 50	0.025	0.010	0.020
-20 to 55	0.060	0.010	0.030

TIME CONSTANT:
 0.200 ± 0.05 Seconds
(63% of instantaneous ambient to 37°C shift.)

* Ambient temperature between 18°C and 28°C.
  Traceable to NIST.
** Probe not exposed to temperatures above 50°C.
*** See "CHK CAL" operation on page 4.

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP130 SmartProbe:

THERMISTOR: ~22k Ohms @25°C

PROBE: Extended range, high accuracy micro-probe.

MEASUREMENT RANGE:
-20.00°C to +130.00°C
(-4.00°F to +266.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD: 12 months.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
0 to 100	0.025	0.010	0.020
-20 to 130	0.050	0.010	0.020

TIME CONSTANT:
0.200 ± 0.05 Seconds
(63% of instantaneous ambient to 37°C shift.)

* Ambient temperature between 18°C and 28°C.
   Traceable to NIST.
** At or above 100°C for less than 50 hours/year.
*** See "CHK CAL" operation on page 4.

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP64X SmartProbe:
SP640   4.85"
SP642   6.5"
SP646   12"

THERMISTOR: ~30k Ohms @25°C

PROBE: Wide range, high accuracy general purpose stainless steel probe.

MEASUREMENT RANGE:
-40.00°C to +150.00°C
(-40.00°F to +299.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD: 12 months.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
0 to 100	0.025	0.010	0.020
-25 to 130	0.050	0.010	0.020
-30 to 150	0.100	0.020	0.030
-40 to 150	0.150	0.020	0.030

TIME CONSTANT:
3 ± 0.5 Seconds
(63% of instantaneous ambient to 37°C shift.)

* Ambient temperature between 18°C and 28°C.
   Traceable to NIST.
** At or above 100°C for less than 50 hours/year.
*** See "CHK CAL" operation on page 4.

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP212 SmartProbe

THERMISTOR: 10k Ohms @25°C

PROBE: 20 µL THERMAL CYCLER PROBE :

MEASUREMENT RANGE:
-20.00°C to +105.00°C
(-4.00°F to +221.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD:
Probe 12 months. <50 hours at 100°C/yr.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
4 to 99	0.100	0.010	0.100

Offset* at cal points:
In circulating water bath with the following offsets;

4°C	- 0.500°C	37°C	- 0.320°C
65°C	- 0.200°C	95°C	- 0.050°C

TIME CONSTANT:
1 ± 0.5 Seconds
(63% of instantaneous ambient to 95°C shift.)

* Ambient temperature between 18°C and 28°C.
   Traceable to NIST.
** At or above 100°C for less than 50 hours/year.
*** See "CHK CAL" operation on page 4.

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP230 SmartProbe

THERMISTOR: 10k Ohms @25°C

PROBE: 200 µL THERMAL CYCLER PROBE :

MEASUREMENT RANGE:
-20.00°C to +105.00°C
(-4.00°F to +221.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD:
Probe 12 months. <50 hours at 100°C/yr.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
4 to 99	0.100	0.010	0.100

TIME CONSTANT:
1 ± 0.5 Seconds
(63% of instantaneous ambient to 95°C shift.)

* Ambient temperature between 18°C and 28°C.
   Traceable to NIST.
** At or above 100°C for less than 50 hours/year.
*** See "CHK CAL" operation on page 4.

- SPECIFICATIONS -

A MODEL 4500 WITH AN SP252 SmartProbe

THERMISTOR: 10k Ohms @25°C

PROBE: 500 µL THERMAL CYCLER PROBE :

MEASUREMENT RANGE:
-20.00°C to +105.00°C
(-4.00°F to +221.00°F)

RESOLUTION: 0.01°/0.001° ***

CALIBRATION PERIOD:
Probe 12 months. <50 hours at 100°C/yr.

RANGE (±°C)	ACCURACY* (±°C)	REPEAT-ABILITY(±°C)	ONE YEAR DRIFT**(±°C)
4 to 99	0.100	0.010	0.100

TIME CONSTANT:
1 ± 0.5 Seconds
(63% of instantaneous ambient to 95°C shift.)

* Ambient temperature between 18°C and 28°C.
   Traceable to NIST.
** At or above 100°C for less than 50 hours/year.
*** See "CHK CAL" operation on page 4.

- NOT E S -

- ACCESSORIES -

145600 ThermalView Data Acquisition Software

140621 RS-232 Cable
10' cable to connect the 4500 to a PC.

139221 Carrying Case
Space for the 4500 and a probe.

138724 Deluxe Carrying Case
Space for the 4500, several probes,
power supply, ThermalView software,
Cal plugs, etc.

- GLOSSARY -

ACCURACY: The degree of absolute conformity to a standard.

NIST: National Institute of Standards and Technology

PRECISION: The accuracy with which a number can be represented; sharply defined; conforming to a pattern; tolerance

REPEATABILITY: The ability of a probe or instrument to give the same output or reading under repeated identical conditions within an 8 hour period.

RESOLUTION: The least significant digits shown on a digital display.

RS-232: A standard computer interface protocol.

SENSOR SELF-HEATING: The internal heat generated in the sensor by passing a current through the sensor to measure its resistance.

TEMPERATURE STANDARD: An instrument who's calibration is directly traceable to the NIST.

STABILITY: The ability of a device to maintain a constant output with the application of a constant input.

SYSTEM ACCURACY: The total accuracy of the probe plus the accuracy of the thermometer.

SYSTEM CALIBRATION: Calibration of a thermometer and probe combination.

THERMISTOR: A temperature sensing element composed of semiconductor material whose resistance varies greatly, in a known manner, with the change of temperature. (The 4500 uses negative temperature coefficient thermistors - as temperature increases, resistance decreases).

PN 139908 Rev A

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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