GENERAL®

DT4947SD
USER'S MANUAL

4-CHANNEL THERMOMETER
WITH DATALOGGING SD CARD

Please read this manual carefully and thoroughly before using this product.

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INTRODUCTION

Thank you for purchasing General Tools & Instruments' DT4947SD 4-Channel Thermometer with Datalogging SD Card. Please read this user's manual carefully and thoroughly before using the instrument.

The DT4947SD is a general-purpose handheld instrument that can measure up to four channels of temperature with 0.4% accuracy using either of two kinds of optional accessories: thermocouples or Pt 100 ohm probes (resistance-temperature detectors, or RTDs). RTDs are slowly replacing thermocouples in many industrial applications below 1100ºF (600ºC) due to their superior accuracy and repeatability. When used as inputs to the DT4947SD, Pt 100 ohm probes can measure and display temperatures from -328º to 1562ºF (-200º to 850ºC).

Although thermocouples are not as accurate as other types of thermometers, they more than make up for this shortcoming with an extended measurement range. For example, the DT4947SD can measure and read out temperatures from -148º to 2372ºF (-100º to 1300ºC) using Type K thermocouples, and temperatures from -148º to 2192ºF (-100º to 1200ºC) using Type J thermocouples. Type R and Type S thermocouples have an even higher upper limit. These very wide ranges, plus a fast response time and a low price tag, suit thermocouple thermometers for a variety of commercial and industrial tasks requiring measurement of very high and low temperatures. Examples include applications in the food and chemical processing industries, HVAC (heating, ventilation and air-conditioning), power generation and paper production.

Because it is microprocessor-based, the DT4947SD can make full use of the portability, reliability and large storage capacities that SD memory cards offer. Measurements can be made automatically at any sampling rate between one second and one hour. After time-stamping and storing the measurements on an SD card plugged into the instrument (a process called datalogging), the user can remove the card and plug it into to a laptop or desktop computer either directly or through an SD card reader. The data logs are stored on the card as files with the .xls extension, which can be opened by Microsoft's Excel application.

The DT4947SD has a backlit 2-1/2 in. diagonal display and is powered by six "AA" Alkaline batteries or an optional 9-VDC AC adapter.

KEY FEATURES

- Four independent temperature measurement channels

- Also measures T1-T2 difference between two channels

- Works with and automatically temperature-compensates for six popular thermocouple types: K, J, T, E, S and R

- Combining thermocouple types extends overall measurement range to -148° to 3092°F (-100° to 1700°C)

- Big (2.5 in. diagonal) front-panel green backlit LCD is easy to read

- Displays maximum and minimum readings and holds any reading

- Automatically logs measurements at sampling time settable from one second to one hour

- Also supports manual datalogging and changing of SD card storage location

- Outputs Excel-compatible data logs

- Accepts SD memory cards of up to 16 GB capacity

- Auto power off function

- Powered by six "AA" batteries or optional 9V AC/DC adapter

OPERATING INSTRUCTIONS

WHAT'S IN THE CASE

The DT4947SD comes fully assembled in a carrying case along with two Type K thermocouples, a 2 GB SD memory card and this user's manual.

Optional accessories available from General Tools & Instruments include:

- Pt 100 ohm resistance-temperature detector (RTD) probes

- Types K, J, T, E, R and S thermocouples

- A 9VDC adapter for a 110V power supply

Figure 1 shows all of the controls and indicators on the front, right side, back, top and bottom of the DT4947SD. Familiarize yourself with the positions and functions of these controls, indicators and connectors before moving on to the setup procedure.
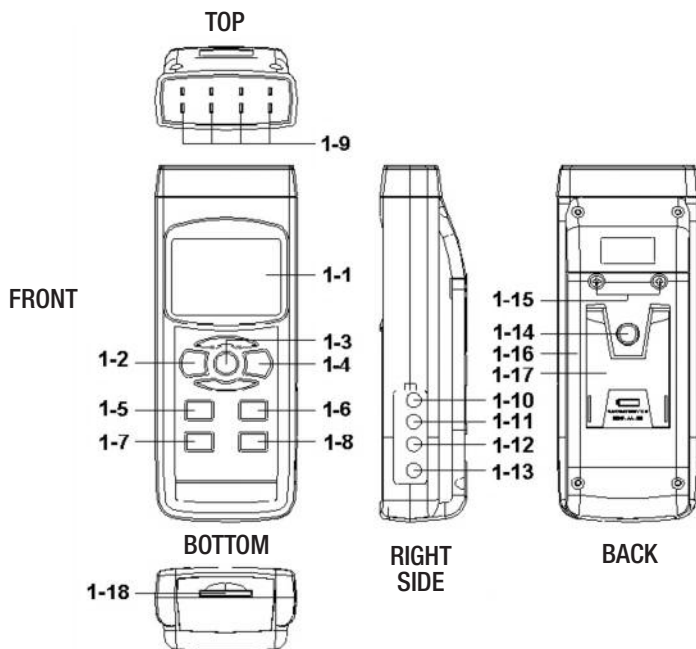
Fig. 1. The DT4947SD's controls and indicators and other physical features

1-1 Liquid-crystal display

1-2 POWER/ESC button

1-3 HOLD/NEXT button

1-4 REC/ENTER button

1-5 Type ▲ button

1-6 T1-T2 ▼ button

1-7 SET button

1-8 LOGGER OFFSET button

1-9 T1 through T4 thermocouple jacks

1-10 PT1 input jack

1-11 PT2 input jack

1-12 RS-232 output jack

1-13 Socket for 9VDC AC adapter

1-14 Tripod attachment nut

1-15 Battery compartment cover screws

1-16 Battery compartment cover

1-17 Kickstand

1-18 SD card socket

SETUP

1. Choose the power source. Before using the DT4947SD, make sure it is powered by fresh batteries or an optional 9VDC AC adapter plugged into the bottom jack on its right side (callout 1-13).

To remove the battery compartment cover (callout 1-16), remove the two screws holding it in place (callout 1-15). Then install six "AA" batteries in the correct orientation, using the polarity marks on the inside of the compartment as a guide. Replace the cover by replacing the two screws.

2. Install an SD card. To prepare for setup, also install the included 2 GB SD memory card or another card of 1 GB to 16 GB capacity in the socket on the bottom of the thermometer (callout 1-18). When installing the card, make sure its gold contacts are facing front and push the card into the socket until you hear a click. To remove the card, push it in until you hear a click and the card pops out.

Now power on the instrument by pressing the POWER/ESC button (callout 1-2) to generate a short beep. (To power off the DT4947SD, press the POWER/ESC button and hold it until the instrument responds with a long beep.)

When the thermometer powers on, a series of transient startup screens will briefly appear. Once the display has stabilized, perform the following seven setup steps in the order presented.

3. Set the date and time. Press the SET button (callout 1-7) and hold it for at least five seconds, until the word "dAtE" appears in the center of the display, along with the flashing value "00.00.00" at the lower left, above "yy.mm.dd".

Set the current year by pressing the Type ▲ or T1-T2 ▼ button repeatedly until the correct value appears above "yy". Quickly (within three seconds), press the REC/ENTER button to store the setting. The next screen that appears will have the value above "mm" flashing. Use the Type ▲ or T1-T2 ▼ button to navigate to the current month and press the REC/ENTER button to store the setting. When the next screen flashes the value above "dd", again use the Type ▲ or T1-T2 ▼ button to navigate to the current day and press the REC/ENTER button to store the setting.

(If you press buttons too slowly in setup mode, the screen will revert to the normal display. To return to the setup sequence, press and hold the SET button again. To move ahead to the next field in the sequence or to the next parameter, press the HOLD/NEXT button.)

Once you have set the date, the display will prompt you to set the hour, minute and second of the current time. Again use the Type ▲ or T1-T2 ▼ buttons to navigate to the correct values, and the REC/ENTER button to store the settings.

4. Choose a decimal point or comma to represent the decimal division between integers and fractions (for example, American-style 20.88 vs. European-style 20,88). Once you have set the date and time, the display will show the word "bASIC" above the phrase "dEC". Press the SET button to make "bASIC" (American style) or "Euro" appear in the upper display, as desired. Press the REC/ENTER button to store the selection as the default.

5. **Enable or disable auto power off**. Once the format of decimal point divisions has been set and stored, the display will show the word "yES' over the term "PoFF". Press the Type ▲ or T1-T2 ▼ button until the desired automatic power off management scheme ("yES" for enable; "no" for disable) is displayed. Press the REC/ENTER button to store the selection. If enabled, the power off function shuts off the DT4947SD after a period of inactivity of ten minutes.

6. **Enable or disable the beeper**. Once the auto power off function has been enabled or disabled, the display will show the word "yES" over the word "bEEP". Press the Type ▲ or T1-T2 ▼ button until the desired setting ("yES" or "no") is displayed, and then press the REC/ENTER button to store the selection as the default.

7. **Select the temperature unit**. Once the beeper has been enabled or disabled, the lower part of the display will show the term "t-CF". Press the Type ▲ or T1-T2 ▼ button until the unit you prefer ("F" for Fahrenheit, "C" for Celsius") is displayed. Then press the REC/ENTER button to store the selection as the default.

8. **Set the datalogging sampling time**. Once the default temperature unit has been selected, the display will show a value above the letters "SP-t". Press the Type ▲ or T1-T2 ▼ button to decrease or increase the value until the desired sampling time appears above "SP-t". The options are 0, 1, 2, 5, 10, 30, 60, 120, 300, 600, 1800 and 3600 seconds (0 seconds to 1 hour).

9. **Format the SD card**. Once the sampling time has been set and stored, the term "Sd-F" will appear in the lower half of the display. Press the REC/ENTER button.

Pressing the REC/ENTER button causes the word "no" or "yES" to appear over the term "Sd-F". Press the Type ▲ or T1-T2 ▼ button to make a selection. Choose "yES" whenever a new SD card is being used, or when a used card is being repurposed (from use with another SD card instrument or a camera, for example) and all data on it is to be erased. Choose "no" to preserve any data on a card previously used with this instrument.

If you choose "yES", after you press the REC/ENTER button the instrument will prompt you to confirm that decision by displaying the term "Ent" below "yES" and sounding three beeps. To confirm that you want to begin the erasure/formatting procedure, press the REC/ENTER button. "Ent" will then flash several times and the instrument will sound another three beeps to confirm that the SD card has been erased and formatted.

Once the SD card has been set up, the display will then either return to the first of the seven steps in the setup sequence—setting the current date and time—or show the term "ESC". If "ESC" appears, press the POWER/ESC button to exit the setup procedure and enter normal operating mode.

ADJUSTING PROBE OFFSETS

To maximize the accuracy of measurements, General strongly recommends that you compensate for (offset) the small measurement error peculiar to each thermocouple and RTD used with the instrument.

1. To adjust the offset of a thermocouple, press the Type ▲ button until the thermocouple's type appears on the display. Then plug the thermocouple into the T1 jack on the top of the thermometer.

Press the LOGGER OFFSET button, hold it for at least three seconds, and then release the button. A screen similar to the one at right should appear:

SEt	oFS
23.7	23.7
▲	▲
measuring value	adjust value
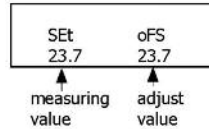
Next, use the Type ▲ or T1-T2 ▼ button to adjust the value under "oFS" to match the value under "SEt". Then press the REC/ENTER button to store the offset adjustment and return the thermometer to measurement mode. Repeat the procedure for each thermocouple to be used.

2. To adjust the offset of a Pt 100 ohm probe, press the Type ▲ button as many times as necessary until the term "Pt" appears the display. Then plug the Pt probe into the PT1 jack (callout 1-10 of Fig. 1) on the right side of the thermometer.

Press the LOGGER OFFSET button, hold it for at least three seconds, and then release the button. A screen similar to the one at right should appear:
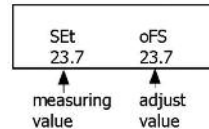
SEt	oFS
Pt 1	Pt 2
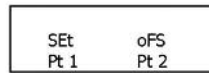
Next, press the Type ▲ button (which has the letter "L" stenciled over it). A screen similar to the one at right should appear:

SEt	oFS
23.7	23.7
▲	▲
measuring value	adjust value

Use the Type ▲ or T1-T2 ▼ button to adjust the value under "oFS" to match the value under "SEt". Finally, press the REC/ENTER button to store the offset adjustment and return the thermometer to measurement mode. Repeat the procedure for each RTD to be used.

NORMAL OPERATION

1. To prepare to make measurements, power on the DT4947SD and make sure an SD card is firmly seated in the socket on the bottom of the unit.

By default, the DT4947SD uses Celsius units for temperature measurements. If you wish to make Fahrenheit units the default, press the SET button to enter the setup procedure and perform Step 7.

2. To use Type K thermocouples to measure up to four channels of temperature, plug one to four of the devices (two are included) into the jacks (callout 1-9 of Fig. 1) on the top of the thermometer. Because Type K is the instrument's default thermocouple type, plugging in the accessories will instantly produce display readings. Any of the four channels that are not used will show the overrange reading "- - - - -".

3. **To use Type J, T, E, R or S thermocouples** to measure up to four channels of temperature, first press the Type ▲ button as many times as necessary until the letter of the thermocouple type you are using appears on the display. Then plug one to four of the optional accessories into the jacks on the top of the thermometer. As with Type K thermocouples, display readings are instantaneous.

4. **To use Pt 100 ohm probes** (resistance-temperature detectors) to measure up to two channels of temperature, first press the Type ▲ button as many times as necessary until the term "Pt" appears on the right side of the display. Then plug one or two of the optional accessories into the dedicated jack(s) on the right side of the thermometer (callouts 1-10 and 1-11). As with thermocouple measurements, RTD measurements appear instantly on the display.

5. **To measure the temperature difference between any two channels** represented by thermocouples or RTDs already plugged into the instrument, press the T1-T2 button with the thermometer in normal measurement mode. Doing so will cause the following screen to appear:
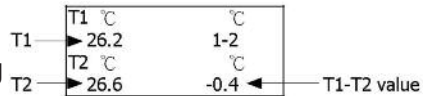
Whenever the thermometer is in measurement mode, you can turn off the backlight (which is on by default) by briefly pressing (but not holding) the POWER/ESC button. To reactivate the backlight, briefly press the button again.

Whenever the instrument is in measurement mode, you also can check the current date and time by briefly pressing the SET button (which has the words "Time check" stenciled to its right). Doing so causes both values to appear briefly at the lower left of the display.

HOLDING AND STORING MEASUREMENTS

1. **To hold a measured value**, press the HOLD/NEXT button during the measurement. Doing so will cause the word "HOLD" to appear at the top of the display. Pressing the HOLD/NEXT button again releases the hold.

2. **To record and recall readings**, press the REC/ENTER button while making measurements. This will make the term "REC" appear at the top of the display. Pressing the REC/ENTER button again, briefly, will make the term "MAX" appear to the right of "REC" and switch the display to the maximum value stored in memory during the last recording session. Pressing the REC/ENTER button again, briefly, will make the term "MIN" appear to the right of "REC" and switch the display to the minimum value stored during the last session.

3. **To exit recording mode**, press the REC/ENTER button and hold it for at least three seconds, until the term "REC" disappears from the top line of the display. The display will then revert to showing the current reading.

AUTOMATIC VS. MANUAL DATALOGGING

The DT4947SD can automatically log data with a user-selected sampling period from 1 second to 3,600 seconds (one hour). To view the sampling time that the instrument has been set up to use, press the LOGGER OFFSET button (which has the words "Sampling check" stenciled below it) once. To change the sampling time, perform Step 8 of the setup procedure.

1. **To start automatic datalogging**, press the REC/ENTER button once. The top line of the display will then show the term "REC". Pressing the LOGGER OFFSET button at this point will make REC flash and add the flashing term "LOGGER" at the top right of the display. This indicates that the instrument is currently storing measured values and their time stamps in memory.

2. **To pause automatic datalogging**, press the LOGGER OFFSET button once; this action makes the flashing term "LOGGER" disappear from the top right of the display and changes the term "REC" from flashing to constant. Pressing the LOGGER OFFSET button again resumes automatic datalogging.

3. **To end automatic datalogging**, press the REC/ENTER button and hold it for at least two seconds. This action causes the "REC" message to disappear.

4. **To log data manually**, set the sampling time to zero using by performing Step 8 of the setup procedure. Then press the REC/ENTER button once. The display will show the term "REC" on the top line, a value in the middle, and below it the letter "P" on the left and a number from 1 to 99 on the same line to the right. The number indicates the position on the SD card that will be used to store manually logged data.

Now press the LOGGER OFFSET button. This will cause the beeper to sound and the term "LOGGER" to briefly appear at the upper right of the display. As in automatic datalogging mode, in this mode the instrument is storing measurements and their time stamps on the SD card.

In manual datalogging mode, however, measurements are being stored continuously (with a sampling time of zero), and their locations on the card can be changed.

5. **To change the storage location of manually logged data**, press the SET button once; this causes the "P" to disappear from the left side of the display and the value on its line to begin flashing. Once the flashing begins, you can use the Type ▲ or T1-T2 ▼ buttons to change the flashing value to any number between 1 and 99. Once you have chosen the storage location, press the REC/ENTER button to save the setting. This causes the value to stop flashing and the "P" to return.

6. **To end manual datalogging**, press the REC/ENTER button and hold it for at least three seconds. This action causes the "REC" message to disappear from the top line of the display.

TRANSFERRING DATA FROM THE SD CARD TO A COMPUTER

After automatic or manual datalogging of measurements, remove the SD card from the instrument and plug it into your computer either directly (if it has an SD card slot) or through an SD card reader.

Because the files containing time-stamped data logs have the file extension .xls, they open in Microsoft's Excel application. Figures 2 and 3 show two kinds of Excel presentations: a data-only screen and a graphics-only screen.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Place	Date	Time	Value	Unit	Value	Unit	Value	Unit	Value	Unit			
2	1	2009/6/19	11:02:10	27.6	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
3	2	2009/6/19	11:02:11	27.6	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
4	3	2009/6/19	11:02:12	27.6	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
5	4	2009/6/19	11:02:13	27.6	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
6	5	2009/6/19	11:02:14	27.6	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
7	6	2009/6/19	11:02:15	27.7	T1 KTemp	27.7	T2 KTemp	27.7	T3 KTemp	27.7	T4 KTemp C			
8	7	2009/6/19	11:02:16	27.7	T1 KTemp	27.7	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
9	8	2009/6/19	11:02:17	27.7	T1 KTemp	27.7	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
10	9	2009/6/19	11:02:18	27.7	T1 KTemp	27.8	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
11	10	2009/6/19	11:02:19	27.7	T1 KTemp	27.8	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
12	11	2009/6/19	11:02:20	27.7	T1 KTemp	27.8	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
13	12	2009/6/19	11:02:21	27.7	T1 KTemp	27.8	T2 KTemp	27.8	T3 KTemp	27.8	T4 KTemp C			
14	13	2009/6/19	11:02:22	27.7	T1 KTemp	27.8	T2 KTemp	27.9	T3 KTemp	27.8	T4 KTemp C			
15	14	2009/6/19	11:02:23	27.7	T1 KTemp	27.8	T2 KTemp	27.9	T3 KTemp	27.8	T4 KTemp C			
16	15	2009/6/19	11:02:24	27.7	T1 KTemp	27.8	T2 KTemp	27.9	T3 KTemp	27.8	T4 KTemp C			
17	16	2009/6/19	11:02:25	27.7	T1 KTemp	27.8	T2 KTemp	27.9	T3 KTemp	27.8	T4 KTemp C			
18	17	2009/6/19	11:02:26	27.7	T1 KTemp	27.8	T2 KTemp	27.9	T3 KTemp	27.8	T4 KTemp C			
19	18	2009/6/19	11:02:27	27.7	T1 KTemp	27.9	T2 KTemp	27.9	T3 KTemp	27.9	T4 KTemp C			
20	19	2009/6/19	11:02:28	27.8	T1 KTemp	27.9	T2 KTemp	27.9	T3 KTemp	27.9	T4 KTemp C			
21	20	2009/6/19	11:02:29	29.3	T1 KTemp	27.9	T2 KTemp	27.9	T3 KTemp	27.9	T4 KTemp C			
22	21	2009/6/19	11:02:30	32.3	T1 KTemp	27.9	T2 KTemp	27.9	T3 KTemp	27.9	T4 KTemp C			
23	22	2009/6/19	11:02:31	32.3	T1 KTemp	30.1	T2 KTemp	27.9	T3 KTemp	27.9	T4 KTemp C			
24	23	2009/6/19	11:02:32	30.8	T1 KTemp	30.1	T2 KTemp	29.2	T3 KTemp	27.9	T4 KTemp C			

Fig. 2. Typical Excel data-only screen
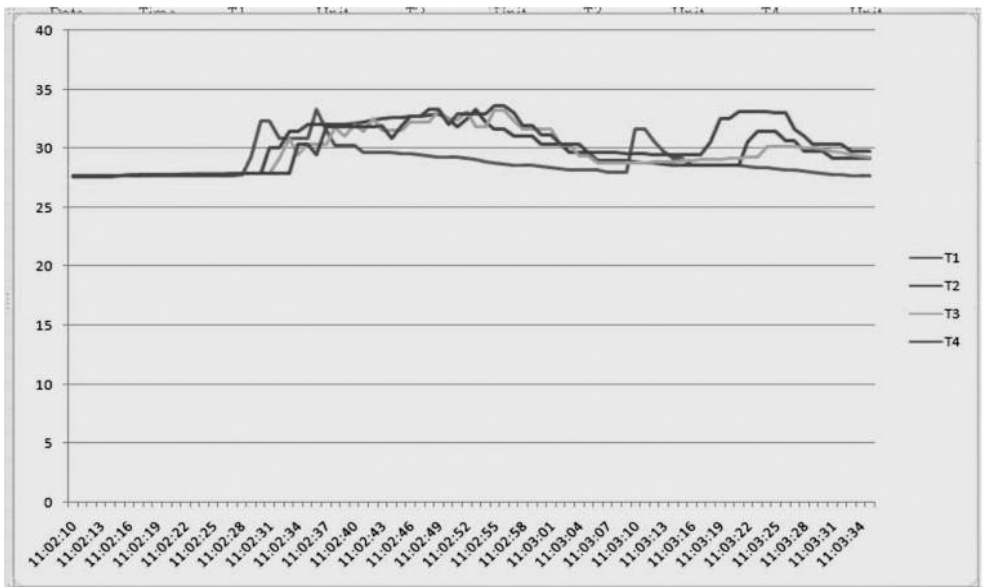
Fig. 3. Typical Excel graphics-only screen

SPECIFICATIONS

Embedded microcontroller	Custom one-chip LSI device
Display type	Liquid-crystal with green backlight
Display size	2.05 x 1.5 in. (52 x 38mm)
Parameter measured	Temperature (in ºF or ºC)
Measurement range	For Pt 100 ohm probes: -327º to 1562ºF; for thermocouples, depends on type
Measurement accuracy	For Pt 100 ohm probes: ± (0.4% of reading + 1.8ºF) from -327º to 999.9ºF, ± (0.4% of reading + 2.0ºF) from 1000º to 1562ºF); for thermocouples: ± (0.4% of reading + 2.0ºF max)
Measurement resolution	For Pt 100 ohm probes: 0.1º (F or C) from -327º to 999.9ºF, 1ºF from 1000º to 1562ºF; for thermocouples: 0.1º (F or C) below 1000ºF and 1º (F or C) above 1000ºF for Types K, J, T and E; 1º (C or F) for Types R and S
Sampling time options	0, 1, 2, 5, 10, 30, 60, 120, 300, 600, 1800 or 3600 seconds (0 seconds to 1 hour)
Settable parameters	Date, time, decimal point or comma decimal division, auto power off, beep sound, temperature unit, sampling time
Storable/recallable readings	Maximum, minimum
SD card capacity	1 GB to 16 GB
Operating temperature	32º to 122ºF (0º to 50ºC)
Operating relative humidity	0 to 85%
Power source	6 Alkaline "AA" batteries or optional 9-VDC AC adapter
Power consumption	8.5 mADC (normal operation, with backlight off and SD card not saving data); 30 mADC with backlight on and card saving data; 44 mADC with backlight on and card saving data
Dimensions of thermometer	6.97 x 2.68 x 1.77 in. (177 x 68 x 45mm)
Weight of thermometer	1.13 lb. (515g)

MAINTENANCE TIPS

Keep your probes and thermocouples clean.

When the icon ⎐⊠ appears in the left corner of the display, it's time to replace the six "AA" batteries that power the thermometer (although measurements will remain valid for several hours after the low-battery indicator first appears). Replacing the batteries requires removing the two screws that hold the battery compartment cover in place, as explained in Step 1 of the setup procedure on page 6. After inserting fresh batteries in the correct orientation, tighten the screws to secure the cover.

Remove the batteries when storing the thermometer for an extended period of time.

Do not drop or disassemble the thermometer or immerse it in water.

OPTIONAL ACCESSORIES

Optional accessories available from General Tools & Instruments include:

- Pt 100 ohm resistance-temperature detector (RTD) probes
- Types K, J, T, E, R and S thermocouple thermometers
- 9VDC adapter for a 110V power supply

WARRANTY INFORMATION

General Tools & Instruments' (General's) DT4947SD 4-Channel Thermometer with Datalogging SD Card is warranted to the original purchaser to be free from defects in material and workmanship. Subject to certain restrictions, General will repair or replace this instrument if, after examination, the company determines it to be defective in material or workmanship for a period of one year.

This warranty does not apply to damages that General determines to be from an attempted repair by non-authorized personnel or misuse, alterations, normal wear and tear, or accidental damage. The defective unit must be returned to General Tools & Instruments or to a General-authorized service center, freight prepaid and insured.

Acceptance of the exclusive repair and replacement remedies described herein is a condition of the contract for purchase of this product. In no event shall General be liable for any incidental, special, consequential or punitive damages, or for any cost, attorneys' fees, expenses, or losses alleged to be a consequence of any damage due to failure of, or defect in any product including, but not limited to, any claims for loss of profits.

RETURN FOR REPAIR POLICY

Every effort has been made to provide you with a reliable product of superior quality. However, in the event your instrument requires repair, please contact our Customer Service to obtain an RGA (Return Goods Authorization) number before forwarding the unit via prepaid freight to the attention of our Service Center at this address:

> General Tools & Instruments
> 80 White Street
> New York, NY 10013
> 212-431-6100

Remember to include a copy of your proof of purchase, your return address, and your phone number and/or e-mail address.

NOTES

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