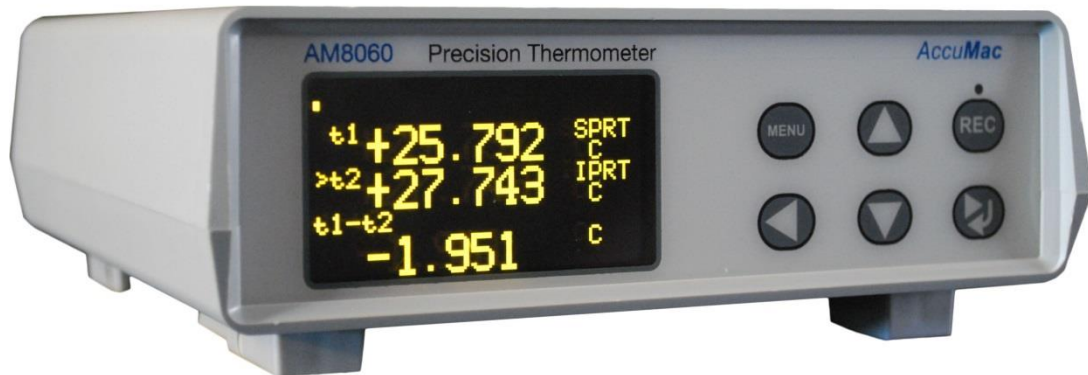


# AM8060 Precision Thermometer User's Guide



**AccuMac**  
Technology Inc

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*Please read the “Important Notice” information on the next page before turning on the instrument!*

## ***Important Notice ---- Warning***

- ❖ **Check the position of the “Measurement/Calibration Switch” on the rear panel before turning on the device. Please refer to Figure 2. The switch must be at the measurement (left) position. Loss of calibration data will occur if the switch is at the calibration (CAL) position when the instrument is used in measurement application.**
  
- ❖ **The instrument is calibrated before shipment. Only qualified calibration agencies with proper standard resistors should perform the calibrations of this device. Please refer to 5. Instrument Calibration And Accuracy Adjustments**

# 1 Introduction

The AM8060 precision thermometer is a dual-channel PRT readout. It can be used either as a temperature measurement device or a temperature reference standard. It is capable of working together with various types of platinum resistance thermometers (PRTs) and can measure temperatures from two probes simultaneously. The measured temperature is calculated by the embedded microcontroller by following ITS-90 standard. The device has a strong data acquisitions capability by using a wireless module (optional), an USB connection to PC or a flash drive interface that can do 'plug-and-record'. With these flexible peripherals, temperature data can be easily captured and saved in real time.

## 1.1 Main Application

- Temperature measurement with standard platinum resistance thermometers (SPRTs), secondary platinum resistance thermometers (Secondary PRTs) and precision industrial platinum resistance thermometers (IPRTs).
- PRT calibrations or comparisons.
- Temperature reference for dry-wells or temperature baths.

## 1.2 Main Features

- High accuracy: 0.008 °C at 0 °C
- High resolution, 0.001 °C
- Concurrent two PRTs measurements and data capturing.
- Display of two PRTs temperature in Celsius °C, °F, resistance  $\Omega$  and temperature difference.
- 2.7" OLED display.
- Touchpad for function control.
- Flexible probe/sensor parameter adjustments and settings.
- USB interface for transmitting and saving real time temperature data.

- Wireless real time temperature data capturing with optional external wireless module (optional).
- Real time temperature data capturing and saving to flash drive.

## 2 Specifications

### 2.1 Specifications

- Temperature range: -200 °C ~ 850 °C
- Resolution: 0.001 °C
- Accuracy:

25Ω SPRT/IPRT	100Ω SPRT/IPRT
±0.01 °C @ -196 °C	±0.010 °C @ -200 °C
±0.008 °C @ 0 °C	±0.008 °C @ 0 °C
±0.009 °C @ 232 °C	±0.009 °C @ 232 °C
±0.015 °C @ 420 °C	±0.015 °C @ 420 °C
±0.025 °C @ 660 °C	±0.020 °C @ 660 °C
	±0.025 °C @ 850 °C

- Short term stability:
  - ±0.001 °C (with 100Ω platinum probe)
  - ±0.003 °C (with 25Ω platinum probe)
- Working environment: 15°C ~ 35 °C
- Power supply: AC 100V ~ 240V
- Power consumption: < 15 W
- Dimensions : 180 mm x 65 mm x 200 mm
- Weight : 0.7 lbs (300 g)

### 2.2 Probe Types

- SPRT or PRT with temperature coefficient  $\alpha=0.003925$  ( $W_{Ga} \geq 1.11807$ ).
- IPRT with temperature coefficient  $\alpha=0.00385$ .

### 3 User Interface

#### Front Panel:

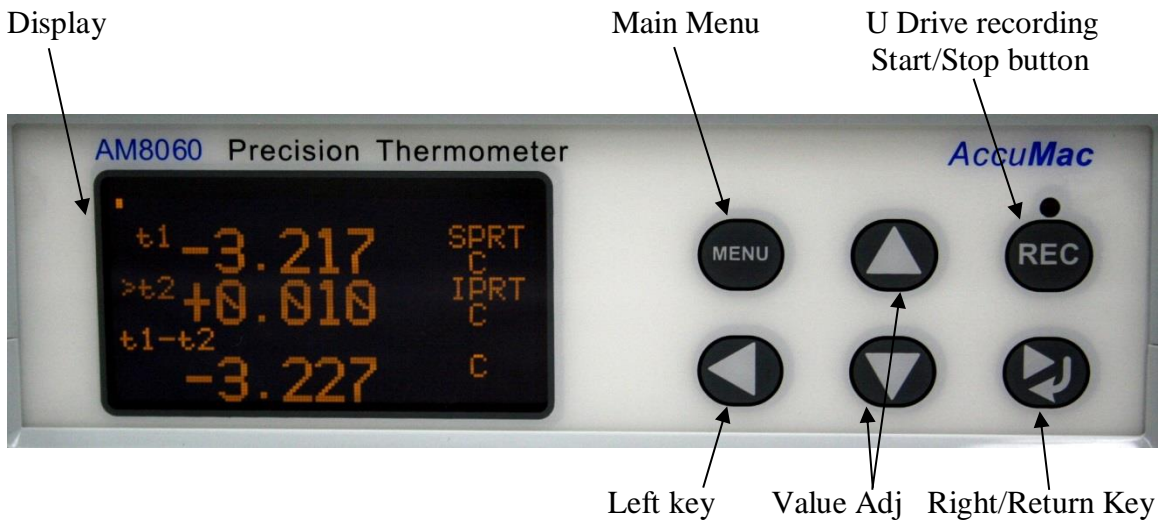
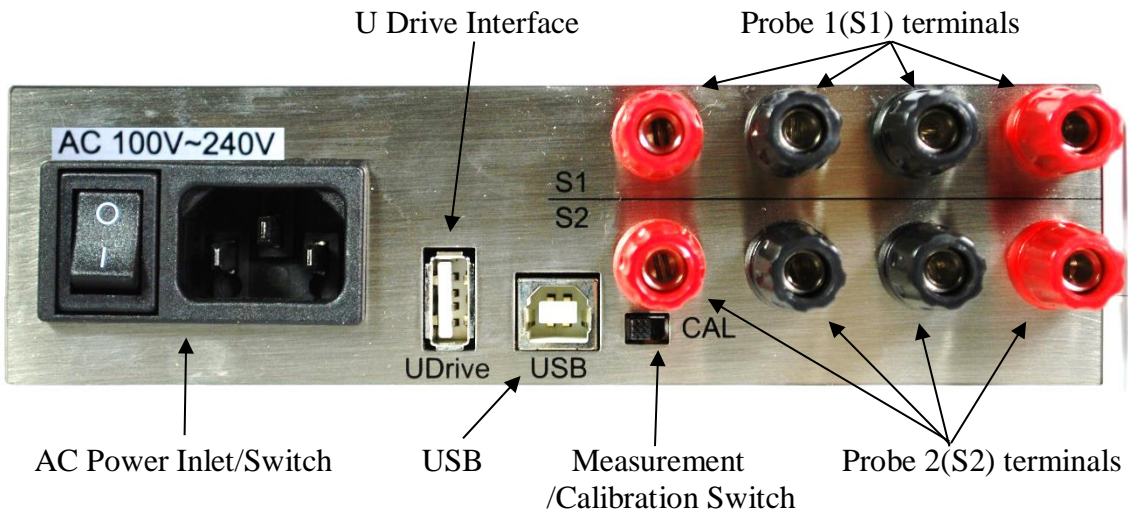


Figure 1: Front Panel

#### Rear Panel:



**Warning: unless calibration is needed, do NOT put the switch on 'Cal' position.**

Figure 2: Rear Panel

## 4 General Operations

The AM8060 precision thermometer is a dual-channel temperature readout. It can measure temperature of two probes concurrently. It can also be used with just one probe for single channel temperature measurement.

### 4.1 Connecting the probes

The AM8060 can work with one or two probes for temperature measurement. Figure 3 shows the rear panel of the AM8060. Probe 1 can be connected to terminals marked with S1, and Probe 2 to S2.

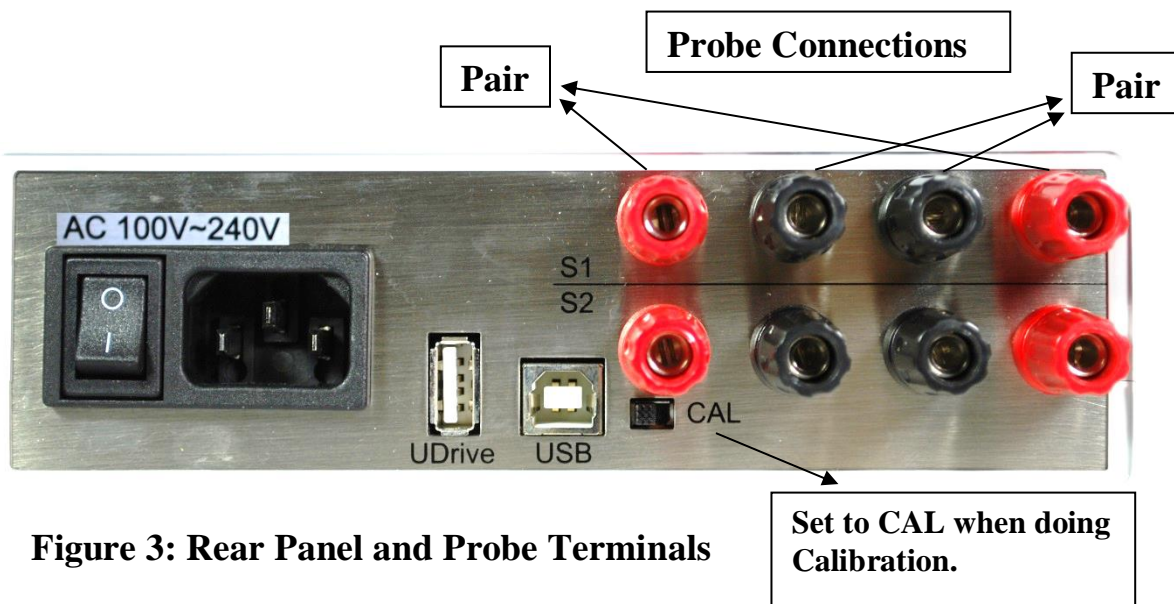


Figure 3: Rear Panel and Probe Terminals

### 4.2 Instrument connection with AC power

AM8060 operation requires power of AC100V~240V.

### 4.3 Instrument front panel display and touchpad

After the power is turned on and the probes are connected, the device should show initialization information, including the instrument interface status, measured temperatures of the



probe/probes and temperature difference. This information is shown in 4 lines, as seen below:

Udr	ZB xx	USB		Line 1
>t1	<b>-4.525</b>		SPRT C	Line 2
t2	<b>+529.474</b>		SPRT C	Line 3
t1 t2	<b>-533.98</b>		C	Line 4

Line 1 is the instrument interface status, including USB flash drive, wireless communication status and USB to computer interface status. If the “Udr” is shown in Line 1, a USB flash drive is connected to the USB host interface; if “ZB-xx (where “xx” are numbers) displays on Line 1 as shown above, it means the Zigbee wireless data capturing is working; if the display shows “USB” on Line 1, then AM8060 is connected via its USB client interface.



Line 2, which is indicated with ‘t1’, shows the measured temperature of Probe 1 (S1). The “SPRT” at the end of the Line 2 tells the type of probe of Probe 1 (S1). The AM8060 supports two types of probes. “SPRT” indicates a 25Ω or 100 Ω standard platinum resistance thermometers. “IPRT” indicates a 100Ω industrial platinum resistance thermometer. The “C” shown at the end of Line 2 indicates that the temperature is in Celsius.

Line 3, which is indicated with ‘t2’, shows the measured temperature of Probe 2 (S2).

A “>” will toggle in front of “t1” or ”t2” to indicate which probe is being measured. Each toggling instance is one measurement.

Line 4, which is indicated with “t1-t2”, shows the temperature difference of the two probes.



#### 4.4 Selecting Units

Users can select to display °C, °F or  $\Omega$  by scrolling touch keys up or down ( or )

#### 4.5 Selecting Sensors/Probes and Adjusting Parameters

##### 4.5.1 Probe Types

AM8060 can work with different types of PRTs. Users can choose probe types and input the parameters of the probes.

The menu key  and return/right shift key  can be used for probe selections and parameter adjustments.

The probes compatible with AM8060 are:

- 25  $\Omega$  or 100  $\Omega$  SPRTs, or
- 25  $\Omega$  or 100  $\Omega$  Secondary PRTs, or
- 100  $\Omega$  IPRTs.



The temperature coefficient of these probes can either be 0.00385  $\Omega/\Omega/^\circ\text{C}$  or 0.003925  $\Omega/\Omega/^\circ\text{C}$ .

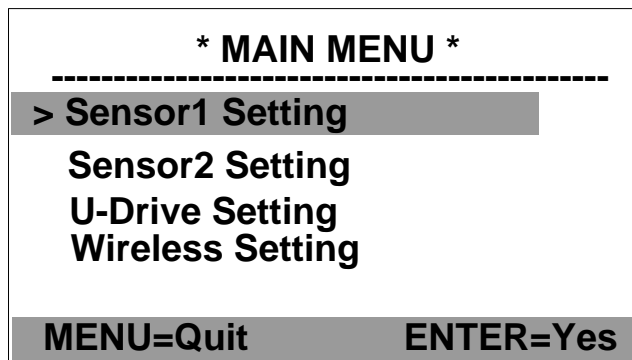
The probe types working with AM8060 are classified and displayed as IPRT and SPRT:

- *If the probe is an industrial or precision platinum resistance thermometer probe with a temperature coefficient of 0.00385  $\Omega/\Omega/^\circ\text{C}$ , AM8060 will categorize the probe as “IPRT”. AM8060 calculates temperature according to CVD (IEC751) equation.*

- *If the probe is a precision platinum resistance thermometer probe or secondary PRT with temperature coefficient of  $0.003925 \Omega/\Omega/^\circ\text{C}$  ( $W_{Ga} \geq 1.11807$ ), AM8060 will categorize the probe as "SPRT". AM8060 calculates temperature according to ITS-90 standard platinum resistance thermometer equations.*
- *If the probe is a standard platinum resistance thermometer, the probe will be displayed as "SPRT". AM8060 calculates temperature according to ITS-90 standard platinum resistance thermometer equations.*

## 4.5.2 Selecting Sensors/Probe and Parameters Input

4.5.2.1 To select the type of sensor, press  key and then hold  key. After 3 seconds, AM8060 will display the parameter adjustment main menu:



There are four options for parameter adjustments:






**Sensor 1 Setting.** This is for Sensor 1 (S1) parameter adjustment. Users can select the Sensor 1 type and do parameter adjustment.

**Sensor 2 Setting.** This is for Sensor 2 (S2) parameter adjustment. Users can select the Sensor 2 type and do parameter adjustment.

U-Drive Setting. Users can select this to change settings for saving data to an external drive.

Wireless Setting. Users can select this to change the settings for wireless communication.

*Although only “Sensor 1 Setting” is illustrated below, the procedure of Sensor 1 and Sensor 2 adjustments are identical.*

**4.5.2.2** Press  or  key to move the selection line with the “>” symbol to “Sensor 1 Setting”. Press  key to enter the Sensor 1 setting adjustment program as shown below. The probe type can either be “IPRT” or “SPRT”. Users can select either one by moving the “>” to the sensor type, and then press  key. Users can exit this selection by pressing  key. The figure below shows that SPRT is selected.

```

[SENSOR 1 SETTING]
-----
SENSOR 1 = SPRT

IPRT
>SPRT

MENU=Exit      ENTER=Yes
  
```

**4.5.2.3** Press  key to go to the parameter adjustment menu:

```

[SENSOR 1 SPRT]
-----
>SET Rtp      SET a4
SET a         SET b4
SET b
SET c

MENU=Exit      ENTER=Adj
  
```

**4.5.2.4 If the sensor type is SPRT, the adjustable parameters are Rtp, a, b, c, a4 and b4. The details of these parameter definitions can be found from the ITS-90.**

As an example, calibration agencies provide following parameters after SPRT is calibrated:

Rtp: probe's resistance at triple point of water.

a4 and b4: low temperature range parameters.

a, b and c: high temperature range parameters (b and c can be "0" for some instances. (Please refer to ITS-90 for more information.)

If the sensor type is IPRT, the adjustable parameters are R0, A, B and C:

[SENSOR 1 IPRT]	
-----	
>SET R0	
SET A	
SET B	
SET C	
MENU=Exit	ENTER=Adj






The details of the parameter definitions can be found from the industrial platinum resistance thermometer calibration procedure.




As an example, calibration agencies provide following parameters after IPRT is calibrated:

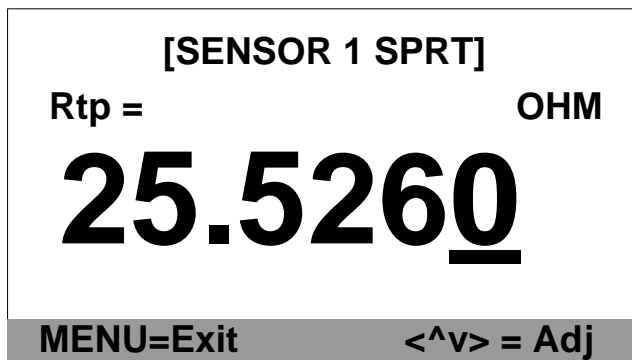
R0: the probe's resistance at 0°C.





A and B: the temperature coefficients at temperature range above 0°C.




C: the temperature coefficient at the temperature range below 0°C.

**4.5.2.5** The , , ,  and  keys can be used together to adjust these parameters. The parameters can also be saved into the instrument. The following is the procedure of adjusting and saving the parameters of Rtp and a4 for an SPRT type probe. The other parameter adjustments follow the same process.

**4.5.2.6** To adjust Rtp (continuing from step 4.5.2.4) press  or  key to move the cursor to “>SET Rtp”, and then press  key to go into the Rtp adjustment program.



The instrument will display the current Rtp value. The digit underlined with the blinking bar indicates the adjustable position. Users can use  and  keys to move this position and use  and  keys to adjust the value.

**4.5.2.7** After the Rtp is adjusted, press  key, the display will remind user to save the adjusted value by flashing the adjusted Rtp on screen. Press  key to save the value or press  key to exit the program without saving and go back to the parameter adjustment menu.

**4.5.2.8** The following is a4 adjustment procedure (Continuing from step 4.5.2.4). Pressing  and  keys to move the





cursor to “>SET a4”, and then press  key to go into the a4 adjustment program, as seen below:

```

[SENSOR 1 SPRT]
-----
a4= - 4.129934e-05

SET a4=0
>ADJUST a4





MENU=Exit      ENTER=Yes
  
```





The second line (a4 = -4.129934e-05) displays the current a4 value, while the next two lines show the adjustment selections. The a4 adjustment is different from Rtp, as the value of a4 can be “0”. If a4 is “0”, the user can move the cursor by using  and  keys to “SET A4=0” line and press the  key to confirm the selection. If a4 is a value other than “0”, the user can move the cursor to “ADJUST a4” line and then press  key to go into the a4 adjustment program.

```

[SENSOR 1 SPRT]
-----
SET a4=
- 4.129934e-05

MENU=Exit      <^v> = Adj
  
```

**4.5.2.9** The current a4 value will be displayed. To adjust this value, press  or  key to move the cursor to the position where the value will be adjusted and then adjust it with  or  key.

- 4.5.2.10** After adjustment, users can choose to save or quit by pressing the  key. The a4 line will be flashing to remind the user that a change has been made. To save the changes, press  key; otherwise, press  key and the program will go back to the previous screen.
- 4.5.2.11** Other parameter adjustments are similar to the above Rtp and a4 adjustment.
- 4.5.2.12** After all of the desired adjustments are made, users can go back to the main menu by pressing  key multiple times until the AM8060 goes back to the main screen.



## 5 Instrument Calibrations and Accuracy Adjustments

AM8060 is designed for temperature measurements by measuring a probe's resistance and converting it into temperature. Consequently, the resistance measurement is very critical, and the instrument must be calibrated correctly. Every AM8060 is calibrated before shipment.

AM8060 needs regular calibration performed by qualified professionals. A one year calibration interval is recommended.

Users can calibrate AM8060 using standard resistors with calibrated values.

***Warning: It is required to set correct  $R_0$  (or  $R_{tpw}$ ) values in Sensor 1 (S1) before calibrations. To calibrate AM8060 in the range from  $10\ \Omega$  to  $50\ \Omega$ ,  $R_0$  (or  $R_{tpw}$ ) needs to be set to  $25\ \Omega$ . To calibrate AM8060 in the range from  $50\ \Omega$  to  $375\ \Omega$ ,  $R_0$  (or  $R_{tpw}$ ) needs to be set to  $100\ \Omega$ .***

***In the event of AM8060 being out of tolerance, its accuracy can be adjusted by re-calibrations. Standard resistors of  $25\ \Omega$  and  $100\ \Omega$  are needed for AM8060 calibrations.***

The calibration should be done in an environment with room temperature of  $22 \pm 2^\circ\text{C}$ .

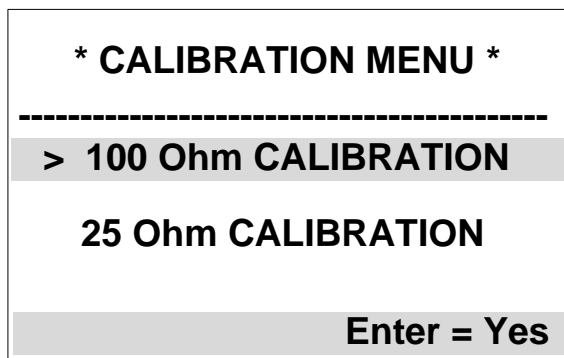
**Instrument calibration procedure: (No special sequence for  $100\ \Omega$  and  $25\ \Omega$  calibration)**




## 5.1 100 $\Omega$ calibration

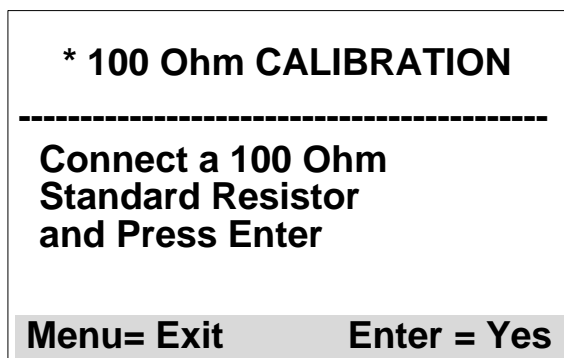
**5.1.1** Turn off the power, put the measurement/calibration switch to the “CAL” side (right side). Please see Figure 3 for details.


**5.1.2** After turning on the power, AM8060 shows the calibration main menu. It can be seen that there are two calibrations required: 100 Ohm CALIBRATION and 25 Ohm CALIBRATION.


The following is an illustration of 100 Ohm CALIBRATION.

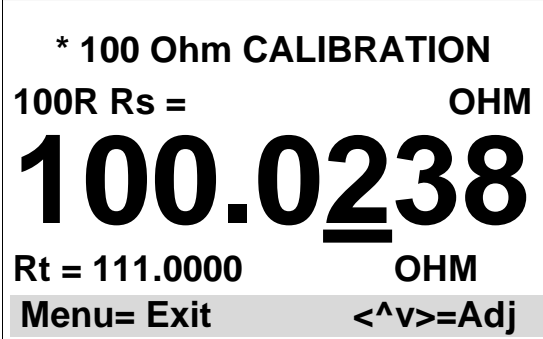


**5.1.3** Use  or  key on the keypad to select the calibration. A “>” sign will be displayed in front of the selected line. For example, the above figure shows that 100 Ohm CALIBRATION has been selected. Pressing the  key will start the calibration program, and the following display will appear:







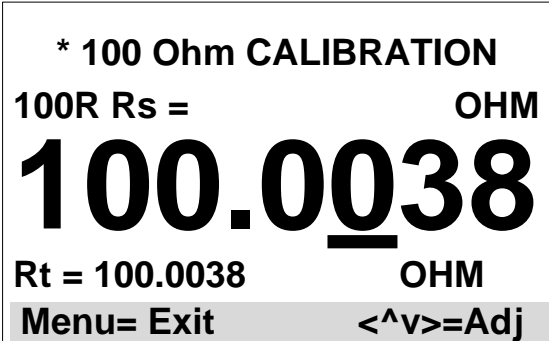
**5.1.4** The instrument will show the phrase “Connect a 100 Ohm Standard Resistor and Press Enter” to indicate that a 100Ω standard resistor must be connected to sensor1 (S1) terminals as Figure3. Users can exit the calibration by pressing  key to go back to the main menu (\*CALIBRATION MENU\*).

**5.1.5** After the probe is correctly connected, press  key to start the calibration. The instrument will display “Waiting...” while the resistance is calibrated. When the process is finished, the screen will display the result as seen below:







```
* 100 Ohm CALIBRATION
100R Rs =                OHM
100.0238
Rt = 111.0000            OHM
Menu= Exit                <^v>=Adj
```

**5.1.6** To calibrate the instrument, users must adjust the value (100.0238 as shown above) to match the standard resistor's resistance. For example, if the resistance of the standard resistor is 100.0038 ohm, users can move the underline cursor to the desired position using  and  keys, and users can adjust the value by using  and  keys. The adjusted result will appear like the picture below:





```
* 100 Ohm CALIBRATION
100R Rs =                OHM
100.0038
Rt = 100.0038            OHM
Menu= Exit                <^v>=Adj
```

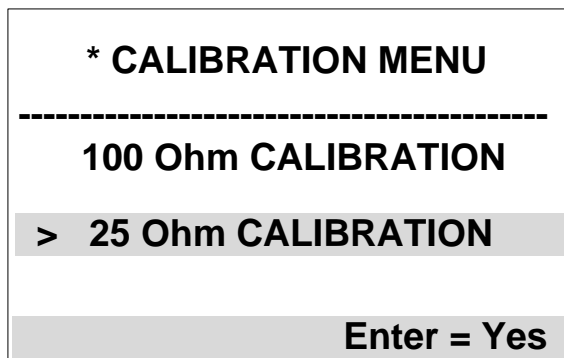
**5.1.7** It is required to wait for 10 seconds for the data to be stable. Each second is shown with a blinking dot at the top left hand corner of the display. Once this is completed, the next step involves saving the calibrated data. To save the data, press the  key and the third line of data will blink to indicate the option to save.


**5.1.8** To save this calibration value, press and hold the  key and then press the  key. This will store the calibration data to the instrument, and the program will go back to the main menu (\*CALIBRATION MENU\*). If users DO NOT want to save the data, press the  key and bring the program back to main menu ( \*CALIBRATION MENU\*).

## 5.2 25 Ω calibration

**5.2.1** The process of 25 Ω calibrations is similar **to** that of 100 Ω calibrations. First, turn off the power of the instrument and ensure the measurement/calibration switch at the rear panel is moved to the “CAL” side (right side), as shown in Figure 3.

**5.2.2** Choose the 25 Ohm CALIBRATION under main menu (\*CALIBRATION MENU\*) by touching  or  key to move the “>” to the “25 Ohm CALIBRATION” line:




5.2.3 Touch  key to start the program of 25 Ohm CALIBRATION. The instrument will display the following message:



```
* 25 Ohm CALIBRATION
-----
Connect a 25 Ohm
Standard Resistor
and Press Enter



Menu= Exit      Enter = Yes
```

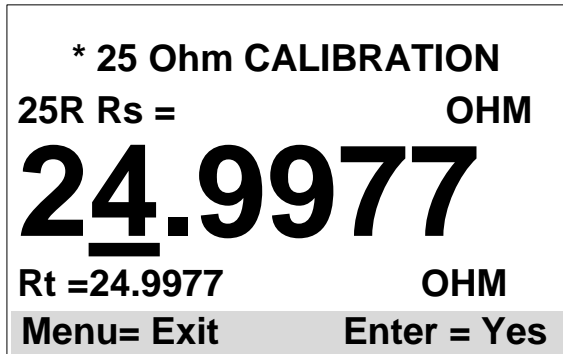
5.2.4 Follow the “Connect a 25 Ohm Standard Resistor and Press Enter” instructions to connect a 25Ω standard resistor to Probe 1 (S1). A standard resistor of 25Ω must have a resistance close to 25Ω, otherwise the calibration will not be accurate.

5.2.5 Touch  key to start the 25Ω calibration. The instrument will display “Waiting...” for a few seconds while the resistance is calculated, and the following message will appear:


```
* 25 Ohm CALIBRATION
25R Rs =           OHM
25.9977
Rt =25.0000       OHM
Menu= Exit      Enter = Yes
```




5.2.6 The value on the third line is the parameter to be adjusted and this value must match the standard resistance of the 25Ω resistor. For example, the above figure shows the current value as 25.9977, but the standard resistor's value is 24.9977. This value can be adjusted by using  or  key to move the “\_”

(underscore) to the desired, and using  or  key to adjust the value. After the adjustment, the instrument will display:



\* 25 Ohm CALIBRATION  
25R Rs = OHM  
**24.9977**  
Rt =24.9977 OHM  
Menu= Exit Enter = Yes

**5.2.7** It is required to wait for 10 seconds to ensure the reading is stable. Each second is shown with a blinking dot at the top left hand corner of the display. The next step is to save the calibrated data to the instrument. To start the data saving, touch the  key, and the third line of data will blink to indicate the option to save.

**5.2.8** To save this calibration, press and hold the  key and then press the  key. This will save the calibration data to the instrument, and the program will go back to the main menu (\*CALIBRATION MENU\*); If users DO NOT want to save the data, press the  key will bring the program back to the main menu ( \*CALIBRATION MENU\*).

### **5.3 Reset the measurement/calibration switch after calibration**

**5.3.1** After the calibration, turn off the AC power

**5.3.2** Set the Measurement/Calibration switch at the rear panel to the left side (away from “CAL”)

## 6 Wireless Data Acquisition

The AM8060 precision thermometer can transmit temperature data through a wireless transmission module. Free software for this feature is included with the AM8060. To transmit data wirelessly, users will need the followings:

- AM8060-W, precision thermometer with embedded wireless function.
- Wireless Transceiver .
- USB cable with length of 2m to 5m.
- Computer with USB interface and Windows operating system.

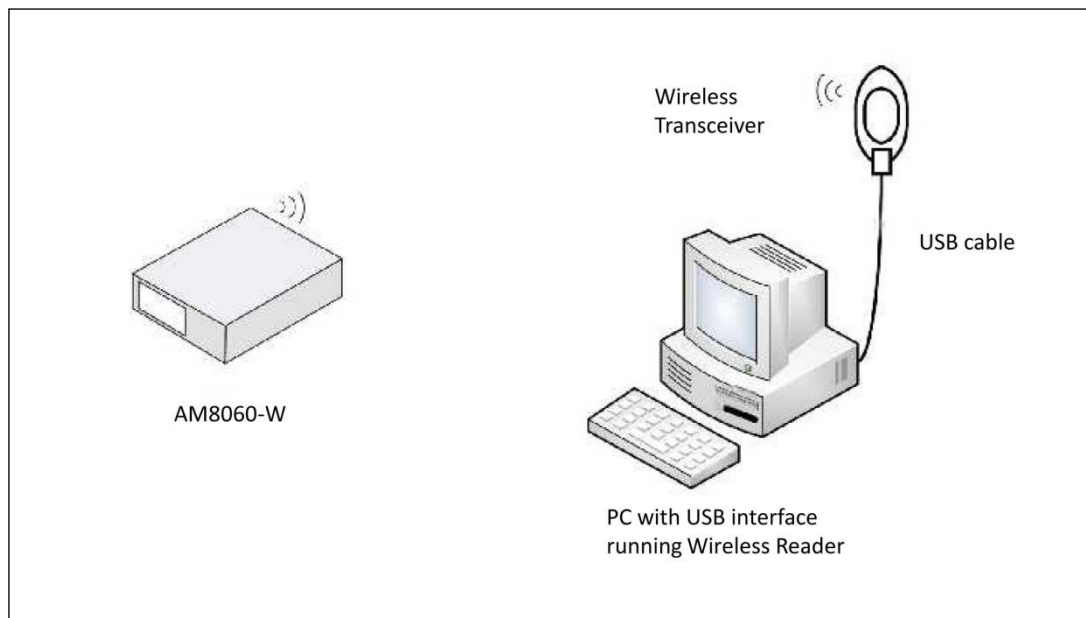
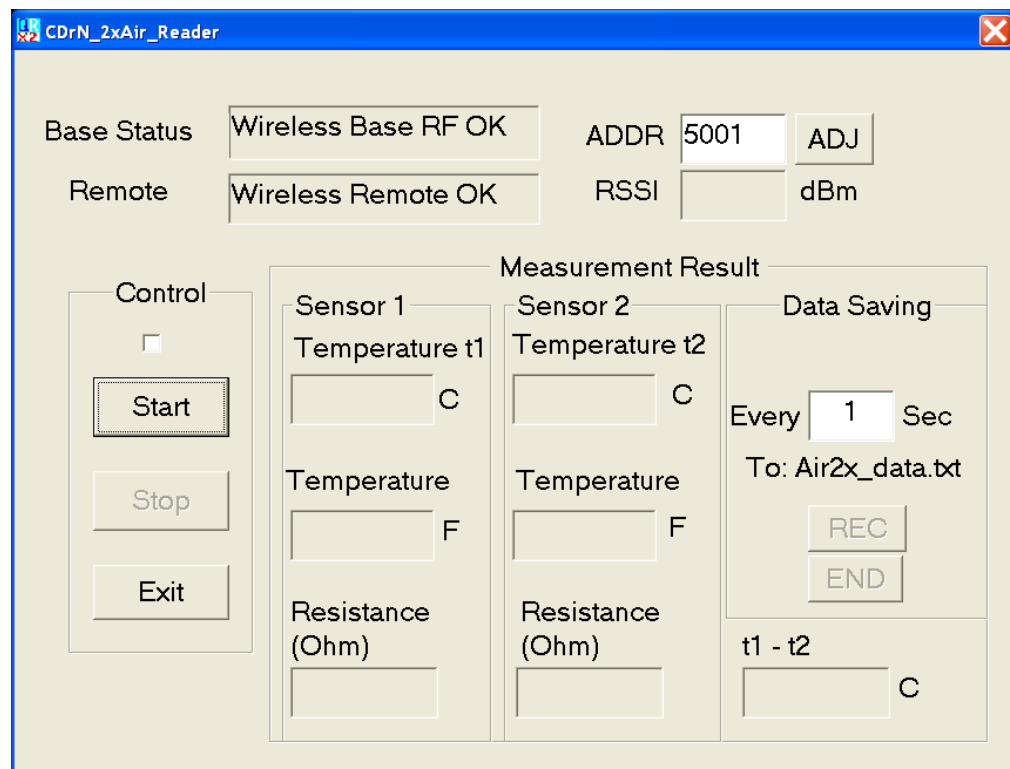


Figure 4: AM8060 Wireless Data Acquisition and Data Storage

Directions for setting up the wireless communication system:

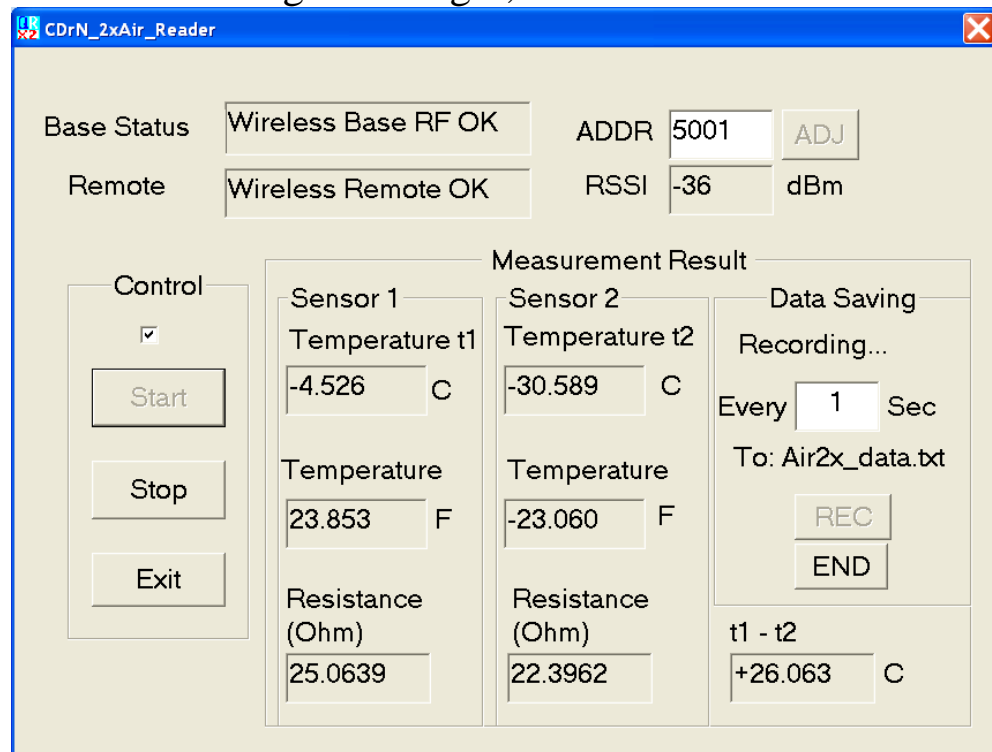
- 1) The AM8060 precision thermometer must be on and connected to a probe.
- 2) The computer and Wireless Transceiver must be within 50m (indoors) or 80m (outdoors) from the AM8060. The computer must be powered on.

- 3) Connect the Wireless Transceiver to the computer with a USB cable. Place it at a high spot for best performance. The system setup is shown in Figure 4.
- 4) After connecting the Wireless Transceiver to the computer, the user will be required to install USB drivers unless the PC is running on Windows7 operating system. The detailed instructions for this are shown in the Appendix.
- 5) After the installation of the USB driver the user will need to install the free software on the CD included with the AM8060. Insert the CD into the computer's CDROM drive and copy the file named CDrN\_2xAir\_Reader.exe to the computer.
- 6) Once the file has finished copying, double-click it to begin the installation. Follow the installation steps on screen to complete the process. After it has finished installing, double-click the icon "CDrN\_2xAir\_Reader", and the following screen will display:





- 7) “The Base Status” and “Remote” will display “Wireless Base RF OK” and “Wireless Remote OK” to confirm the wireless connection. The value after “ADDR” shows the wireless address of the AM8060. The value after “RSSI” is the wireless signal strength, which will not display until the user clicks on “Start”. The RSSI should be greater than -99dBm. Otherwise, the wireless signal is too weak and the link is not stable. To increase the strength of the wireless connection, users can move the AM8060 closer to the computer or increase the height of the CoolDragon Air Base. If the signal is still too weak, the environment is not suitable for the wireless transmission of data.
- 8) To begin the wireless data acquisition, click on “Start”. If the wireless signal is good enough, the AM8060 should display “ZB-xx” where “xx” indicates the wireless signal strength. At the same time, CDrN\_2xAir\_Reader should also show the signal strength, as seen below:

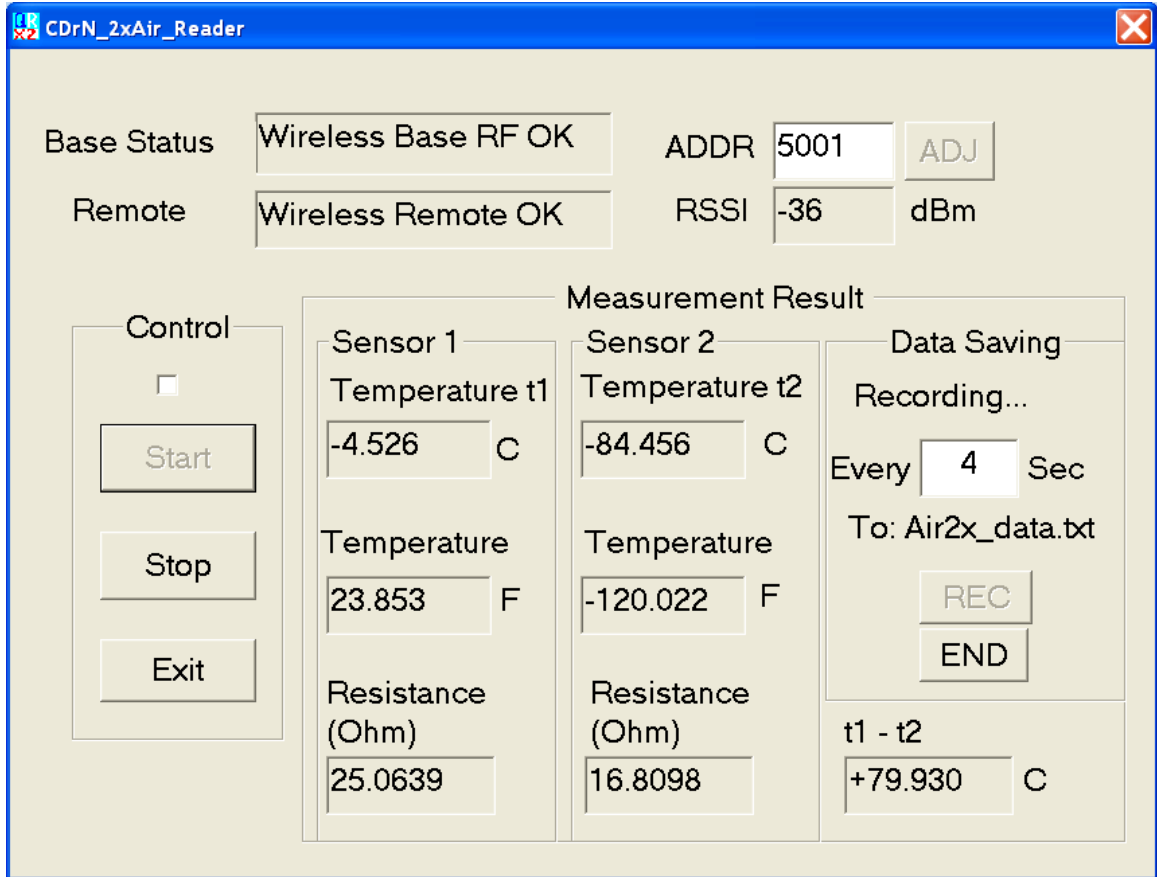


- 9) The wireless data acquisition can be halted by clicking on “Stop”, or by clicking on “Exit” to quit the program. The default setting for a sampling period is 1 second. The data acquisition process can be restarted by clicking on “Start”.
- 10) CDrN\_2xAir\_Reader can also save the captured data to a file, entitled “Air\_data.txt”. The data sampling rate can also be adjusted. The minimum sampling period is 1 second.

Users can adjust the data sampling rate by typing in an integer into the box “Every x Sec” below “Data Saving”. X indicates the sampling period in the unit of seconds. The sampling period can be adjusted only when the sampling is stopped. The data sampling can be restarted after the modification.

Users can save data by clicking on “Start”, and then clicking on the “REC” button. The captured temperature data is saved into “Air\_data.txt”, and the phrase “Recording...” will appear under “Data Saving” to indicate the recording process has begun. To stop data saving, clicking on “END” or “Stop” will cease the temperature data capture.

The following is an example with a 4 second sample period:



11) The data saved in the file Air2x\_data.txt will be in the following format:


```

Time      t1(C)      t2(C)      t1-t2(C)
16:23:19 -4.526     -84.456    79.930
16:23:20 -4.526     -84.456    79.930
16:23:21 -4.526     -84.456    79.930
end recording
Time      t1(C)      t2(C)      t1-t2(C)
10:48:45 -4.526     -84.456    79.930
10:48:49 -4.526     -84.456    79.930
end recording
    
```



The first column indicates the sampling time, which should be same as the computer time. The second column lists the Probe 1 temperatures, while the third column lists the Probe 2

temperatures. The fourth column is the difference between Probe 1 and Probe 2. Each time “Stop” is pressed, the data saving will be halted, and the phrase “end recording” will be added to the file. To continue data saving, users can click on “REC”, and new data will be added to the last line of the previous data. The above example shows data stored with two different sample periods: the first time with 1 second, the second time with 4 seconds.



## 7 Using a Flash Drive (U disk) for Data Acquisition


The flash drive recording start/stop key  can be used for saving data to the USB flash drive.

There is a USB port on the rear panel of the AM8060 which can be used to store the measured temperature data to a flash drive. Any flash drive with size lower than 4 gigabytes can be connected to the “UDrive” connector at the rear panel. The following steps explain how to transfer data from the AM8060 to a flash drive:


- 1) Connect a flash drive to the “UDrive” USB port at the rear panel of the AM8060.
- 2) When the flash drive is connected, the display will say “Device Detected” “D:/p” to indicate that the flash drive is detected. The top left hand corner of the display should display “UDr” to remind users that a flash drive is connected and is available for data capturing.
- 3) If the flash drive is connected while the AM8060 is turned off, AM8060 will display “Device Detected P2” during initialization to indicate that the flash drive is detected, and the upper left hand corner of the display will show “UDr” to remind users that a flash drive is connected and available for data capturing.
- 4) To save the temperature data measured by the AM8060 to the flash drive, just press the  key on the front panel. AM8060 will emit a short beep and the LED above the  key will be turned on. This is to inform the user that the

temperature data is being written to the flash drive. The saved file name is U2DATA.txt.

- 5) If users want to stop the data saving, just press  key on the front panel. AM8060 will produce a short beep and the LED above  key will be turned off to indicate the process has been halted.



The following list is an example of data saved in the U2DATA.txt file on a flash drive. Time column indicates time in unit of seconds; t1, t2 and t1-t2 indicate temperature readings from sensor 1, sensor2 and difference of two sensors in Celsius. An “end” is written to the file when  key has been turned off.

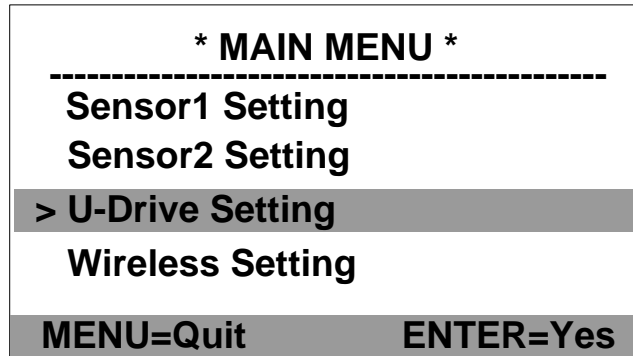
Time	t1	t2	t1-t2
0.23	-4.525	+529.475	-534.000
1.44	-4.524	+529.475	-534.000
2.64	-4.524	+529.475	-533.999
3.85	-4.524	+529.475	-533.999
5.05	-4.524	+529.475	-534.000
6.26	-4.524	+529.475	-534.000
7.46	-4.524	+529.476	-534.000
8.67	-4.524	+529.476	-534.000
end			




- 6) The above operations can be repeated to do multiple time data saving.
- 7) The temperature data file U2DATA.txt in the flash drive can be transferred to a computer. Just unplug the flash drive when it is stopped (when the LED above the  key is off) and plug it into a computer's USB connector. Once the flash drive is detected by the computer's OS, users can copy the file over normally.

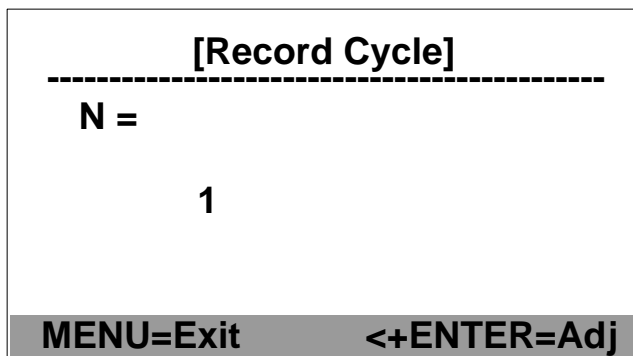
While using the flash drive, the data saving period can be adjusted with the front panel. The default saving period is 1.21 seconds, and it





can be set as a multiple of this value, with the multiple ranging between 1 and 65,535. The instructions for this are as follows:

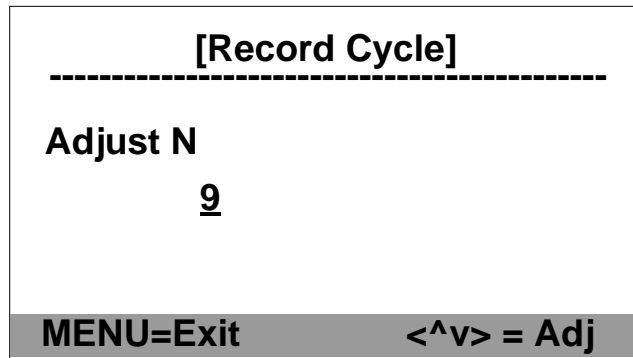
- A. When AM8060 is in a normal working state, press  key and then hold  key for 3 seconds. The AM8060 will display the main menu as below:











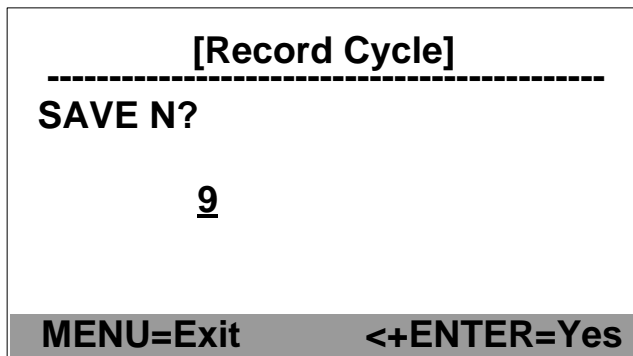
- B. Press  key or  key to move the cursor line with ">" sign to "> U-Drive Setting", then press  key to go to the "Record Cycle adjustment" program, as seen below. "N" represents how often the temperature will be saved as a multiple of 1.21 seconds. The current value is "1".



- C. To set a sample frequency other than "1", press and hold  key while pressing  key, and a display similar to the one below will appear.
- It should be noted that this operation is a two-key operation. Don't release the  key before touching  key.



- D. Press  key or  key to adjust the “N” value (which must be equal or greater than 1).
- E. After the adjustment, press  key. The new adjusted value will blink to indicate whether the user wishes to save this new N value. For example, the above picture shows the new N value as 9, which means the AM8060 will save data to the file every 9x1.21 seconds. To save this value, press and hold  key and then press  key. If users **DON'T** want to save, just press  key to exit.
- **Note: saving the N value is a two-key operation: do not release  key before pressing  key. Otherwise the new value will not be saved.**



- F. After the adjustment, press  multiple times until the AM8060 returns to its normal working state.



***Note: The parameter adjustments should only be performed while the flash drive is not in the data saving process.***

## 8 Using the USB Interface for Data Acquisition

AM8060 precision thermometer is designed with a USB interface for temperature data acquisition and saving temperature data to a file.

The following section describes the process of setting up a USB temperature data acquisition system:

- 1) Connect a USB cable to the USB (USB B type) port at the rear panel of the AM8060 digital thermometer to a computer.

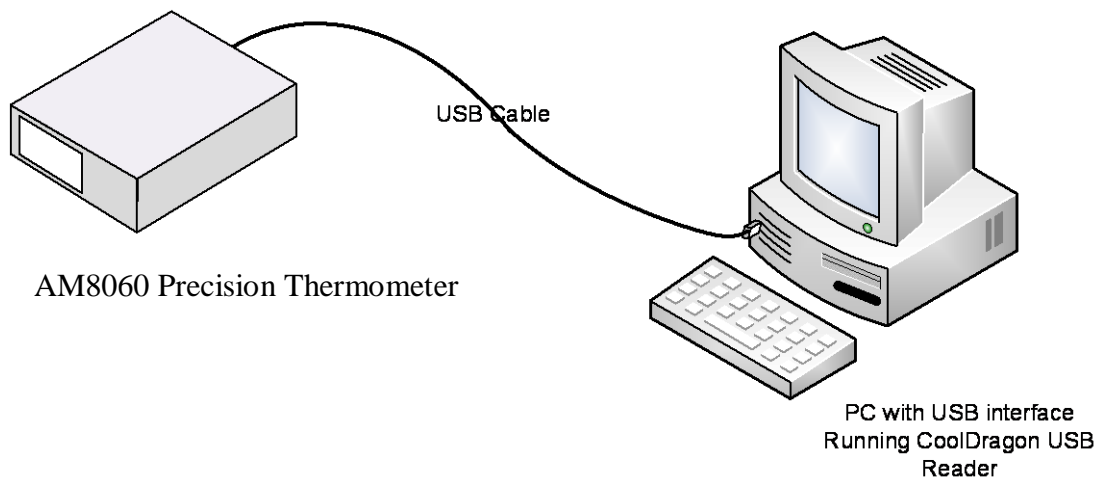
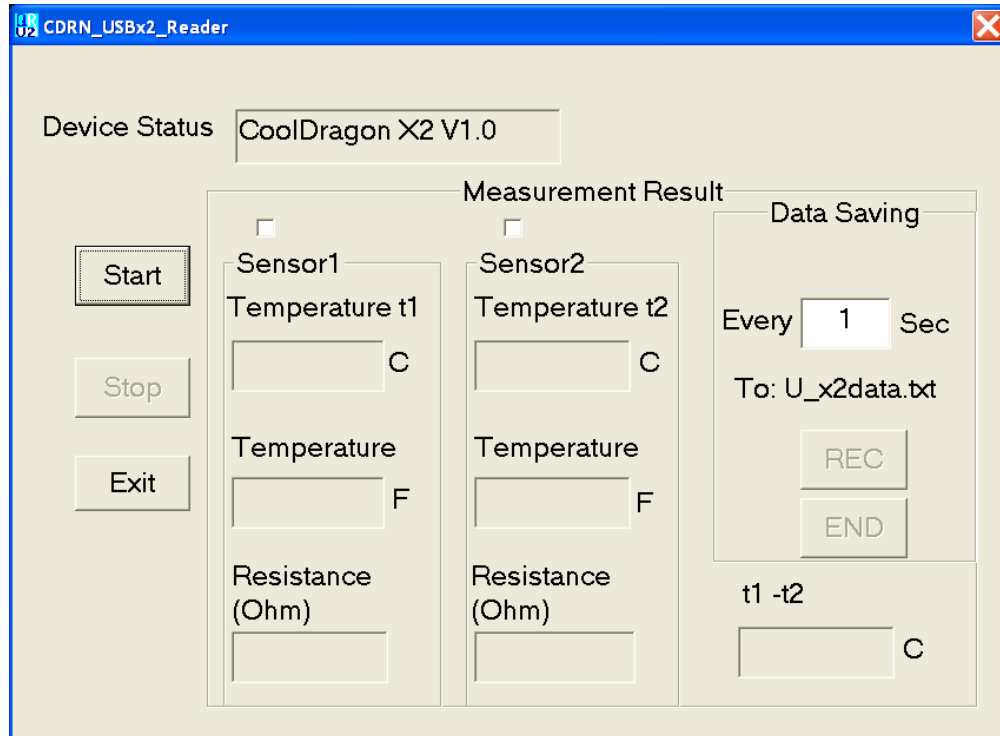


Figure 5: AM8060 USB Temperature Data Acquisition System

- 2) The first time the AM8060 digital thermometer is connected to a computer, the computer will require the installation of USB drivers. Detailed instructions for this process are illustrated in the Appendix. After the installation of these USB drivers, no further drivers will need to be installed.
  - a. Copy the file “CDRN\_USBx2\_Reader.exe” from the attached CD to the computer’s desktop.
  - b. Double click on “CDRN\_USBx2\_Reader” to start the software. The following screen will appear:



- c. The measurement can be started by clicking on “Start”, stopped by clicking on “Stop”, or quit by clicking on “Exit”. The default sampling period is 1 second.

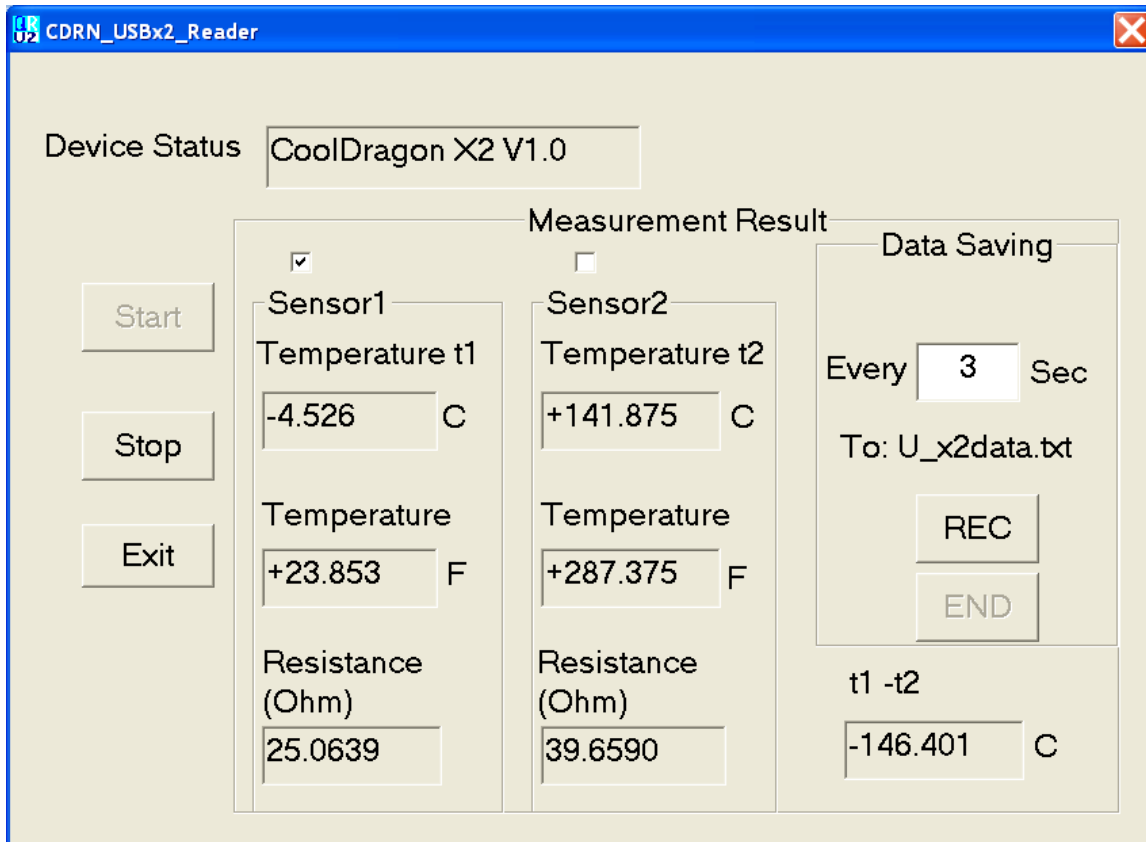
The free software “CDRN\_USBx2\_Reader” also has a data saving function to save the captured temperature to a file, named “U\_x2data.txt”. Users can also adjust the sampling period for their requirements. The shortest sampling period is 1 second. The instructions below detail how to adjust the sampling period.

Find the “Every x Sec” section of the “Data Saving” section at the right side of the software’s GUI. The unit of the sampling period is seconds. If a sampling period other than 1 second is required, users can adjust the value in the box. Any adjustment must be done when the measurement is in the “Stop” state as shown in the figure above.

To save the captured temperature data, click on “Start”. The temperature data should be displayed with a blinking tick mark to indicate the data capturing, then users can click on “REC” to start the data saving. The phrase “Recording...” will be displayed on the

screen as the data is saved to the file, named “U\_x2data.txt”. To stop the data saving, just click on “END” or “Stop”, and the temperature data saving will be stopped.

The following figure shows that the data is saved to file with a sampling period of 3 seconds.



Data saved in “U\_x2data.txt” will appear in the following format:

```

Time   t1(C)    t2(C)    t1-t2(C)
23:50:57 -4.524   +529.476 -534.000
23:51:00 -4.524   +529.475 -533.999
23:51:03 -4.524   +529.475 -533.999
end recording

```

## 9 Appendix: Installation of USB Driver

**Important Update: if your PC is running Windows7 operation system or above versions, which have 'Plug-n-Play' ability, you can skip USB driver installation process. Otherwise, please follow the instructions below.**

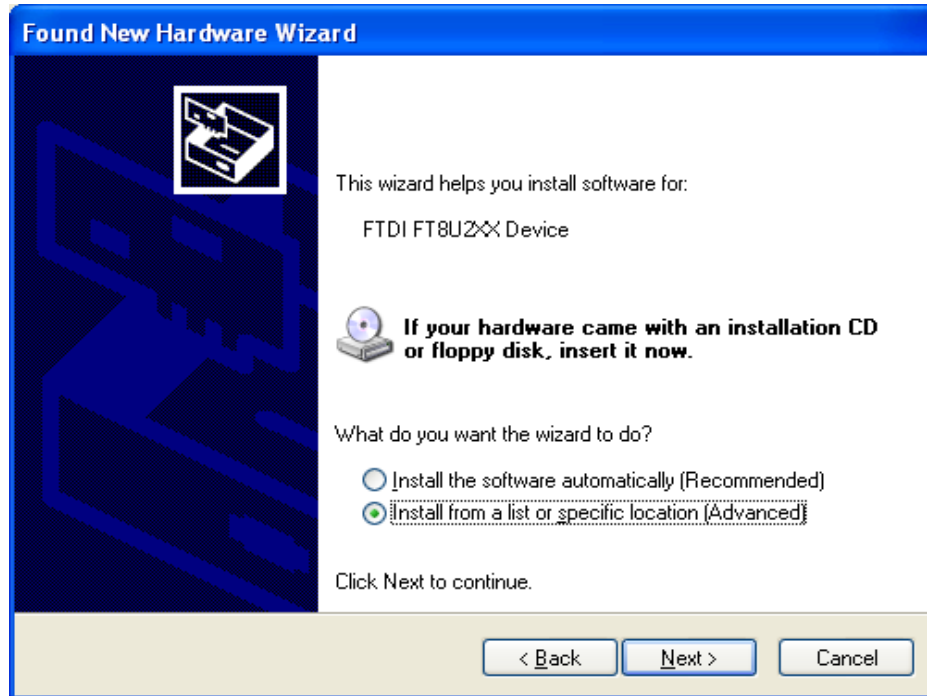
The installation of USB drivers are required the first time these instruments are connected to a computer.

The USB drivers for the AM8060 precision thermometer and Wireless Transceiver are the same. The following steps describe the installation process:

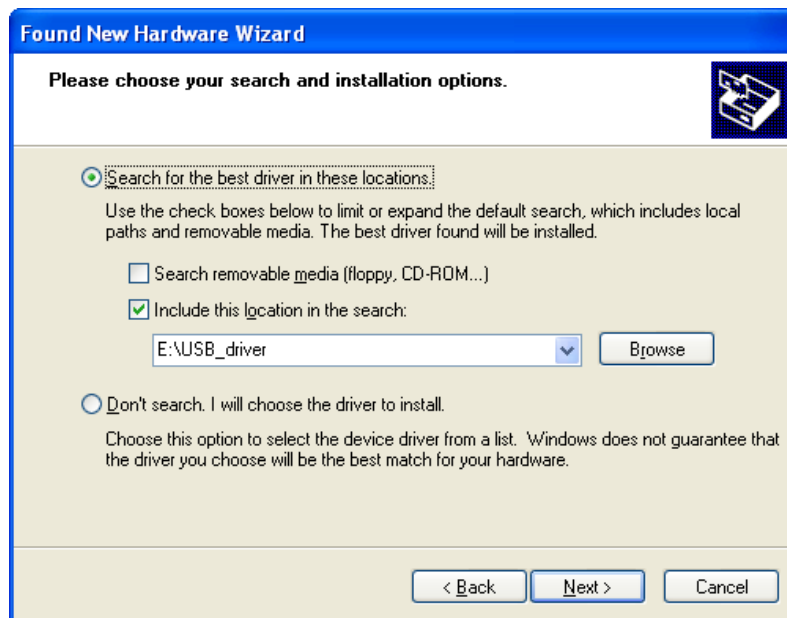
1. When AM8060 precision thermometer and Wireless Transceiver are first connected to a computer, the OS will display the "Found New Hardware" wizard.



2. Put the attached CD into the CDROM drive, and then select the "No, not this time" button and click on "Next".



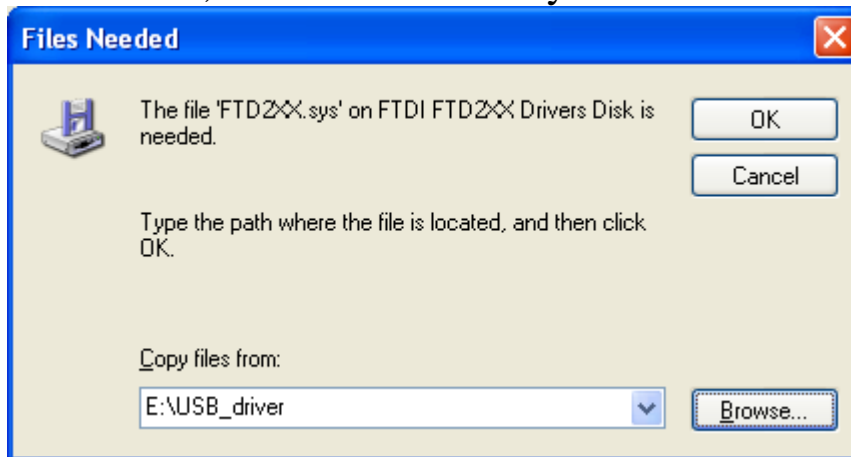
3. Select “Install from a list or specific location (Advanced)” and then click “Next”.



4. Click “Browse” to select the CD drive containing the attached CD (in this example, the CDROM drive is E:), then click “Next”.



5. Select "Continue Anyway". The computer will search for another file, called "FTD2XX.sys".



6. Click "Browse" to find and select the file named "FTD2XX.sys", and then click "OK". After the installation, the computer will display the following screen:



7. Click “Finish” to end the installation.
8. The computer will display a message saying, “Your new hardware is ready to use” to indicate the USB drivers are correctly installed.



## ***10 Limited Warranty & Limitation of Liability***

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