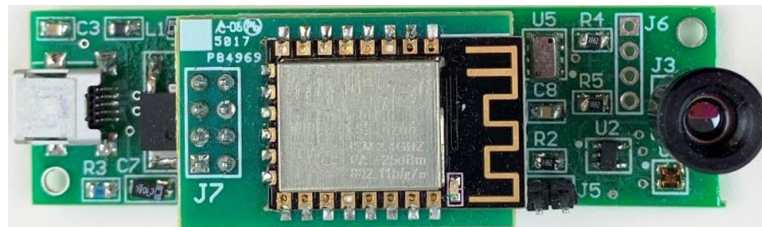




LookingForSolutions.com



**Non-Contact Infrared Temperature
& Thermal Imager Sensor to USB - WiFi output
Model LFS104C, LFS104CW**

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1- Introduction

LFS104C is a non-contact infrared temperature & thermal imager sensor to USB-WiFi output. First, install the application software. Simply download the software from the web site LookingForSolutions.com. Save the zipped file (LFS104C.zip) onto your desktop. Unzip the file. Run setup.exe to install the software. The software will place a shortcut of the program on the desktop. Save the USB driver directory (from the zipped file) on the desktop.

Second, connect the board to your PC USB port with the cable provided. The PC will recognize the board and will start installing the USB drivers. You can view the COM port by going to the Device Manager/Ports. You can also install the USB drivers from the Device Manager/Port/Driver/Update Driver and point the PC to the USB driver directory on the desktop. Now you can run the application software from the shortcut on the desktop.

Figure 1 shows the main screen. You can set the COM port and the Chart Speed (Time interval per data point) from the drop down menus. Click the Start button. The program asks for the name of data file to be saved. You can name your data file (Filename.txt or Filename.csv) and the location where you want to save it. Click the Save (or Cancel) button. The program will start reading and displaying a thermal image of the target. You can view the infrared temperature of every 768 pixels of the thermal sensor array (32 x 24) by moving the mouse over the pixel. A tooltip window will show the temperature of the pixel as shown in Figure 1. There is also a line graph of the average infrared temperature of the thermal image area vs. time. It also shows the model number of the board (LFS104C) and the running Elapsed time. There is a "Save Thermal Image and Data" button to save the thermal image and its (32x24=768) data points on command.

The program keeps track of the Maximum and Minimum values of average infrared temperature since the start of the session which can be reset by pressing the Reset button. The infrared temperature can be displayed in degrees Celsius or Fahrenheit by pressing the engineering unit button. You can display High & Low alarm lines over the average infrared temperature graph line.

There is a software optical zoom function where you can zoom out/in on the thermal image. Figure 2 shows the zoom out thermal image. The main screen also shows the thermal image frame rate (4 Hz) and the color palette (Iron or Grayscale).

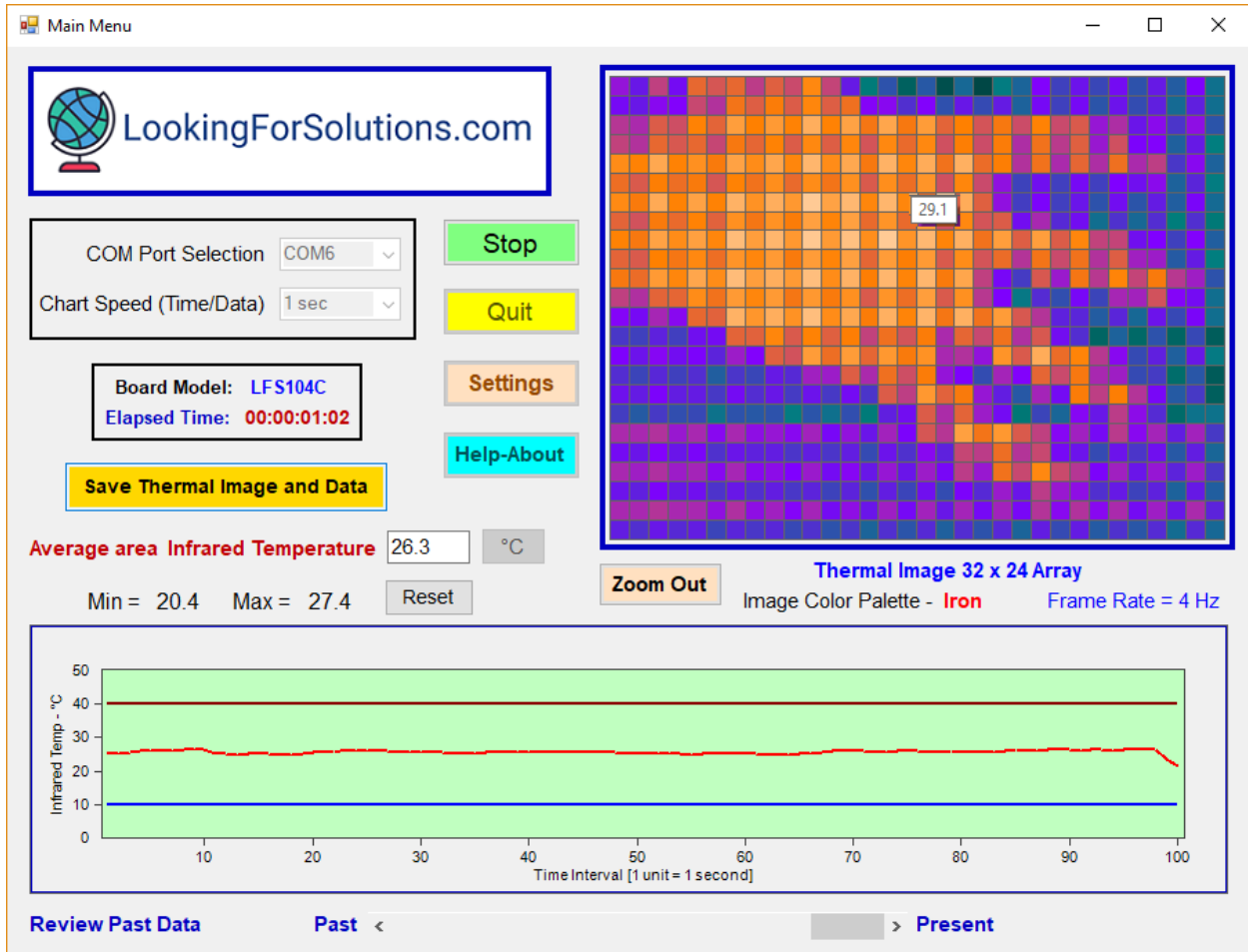


Figure 1 – Main Screen – Real Time, Zoom In Image

Review Past Data - Clicking the Stop button will stop the monitoring. You can now review the past average infrared temperature data by scrolling through the line graph back and forth in time. Clicking the Stop button will stop the monitoring permanently. You will need to start a new monitoring session by clicking the Start button.

When saving a data file (.txt or .csv), the program opens a file and saves up to 20,000 sets of data with date/time stamping, before closing the file and opening a new one.

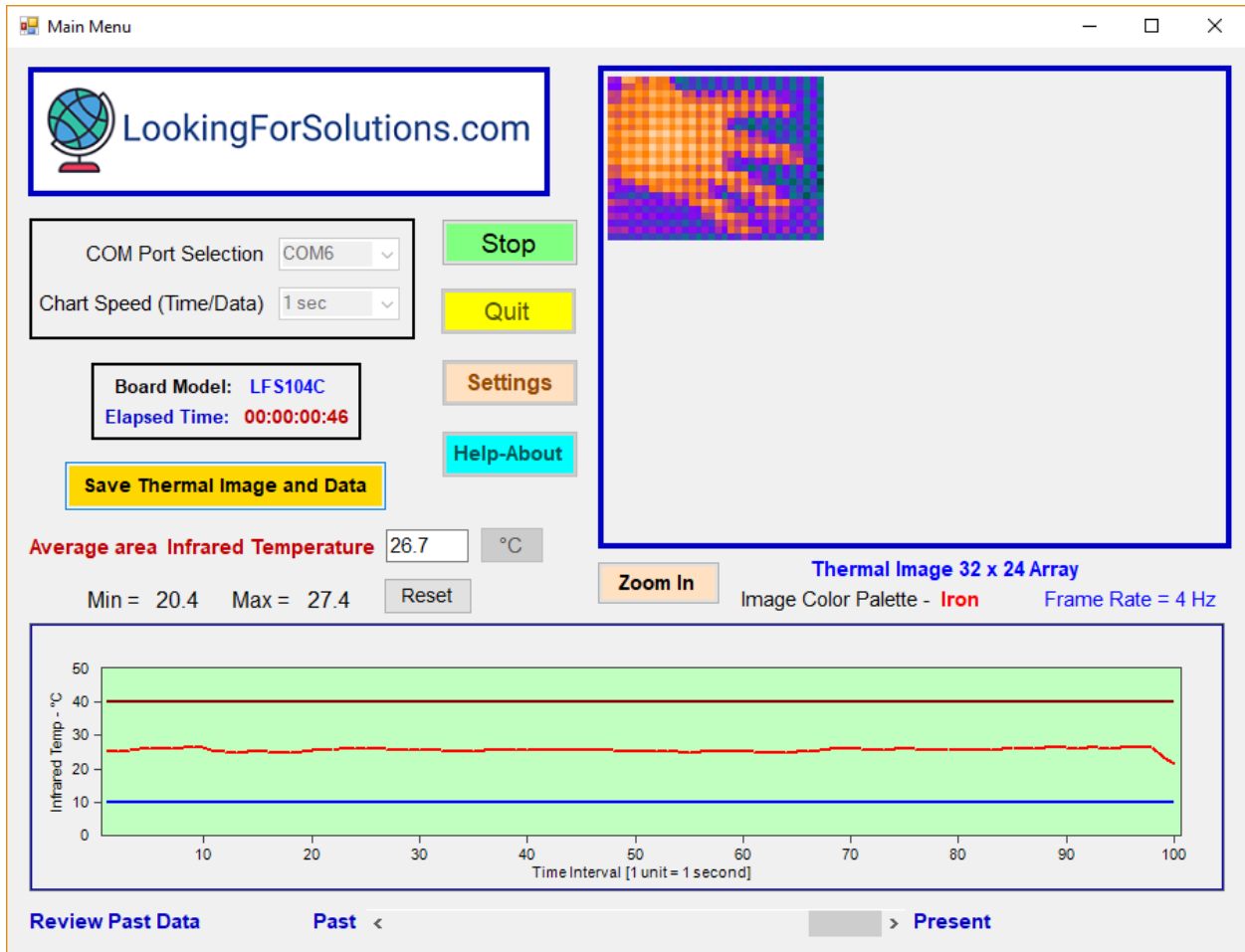


Figure 2 – Main Screen – Real Time, Zoom out Image



Figure 3 – Help-About Screen

Help-About - Clicking the Help-About button will open a new window showing the board picture, firmware version, hardware version, serial number, and the PC software version, see Figure 3.

1.1 – Firmware Update

From the Help-About screen you can update the board's firmware. Click on "Update Firmware" button. A windows popup will display instructions about the update.

- Download the latest firmware (HEX file) from the website (Lookingforsolutions.com)
- Place a Jumper across connector J5.
- Recycle Power to the board. Click OK to continue.
- A new window will open connecting the board to the USB bootloader software (Figure 4)
- Click "Open Hex File" button to load the Hex file.
- Click "Program/Verify" button to program the board.
- Close the program. Remove Jumper across J5 and Recycle power to the board.

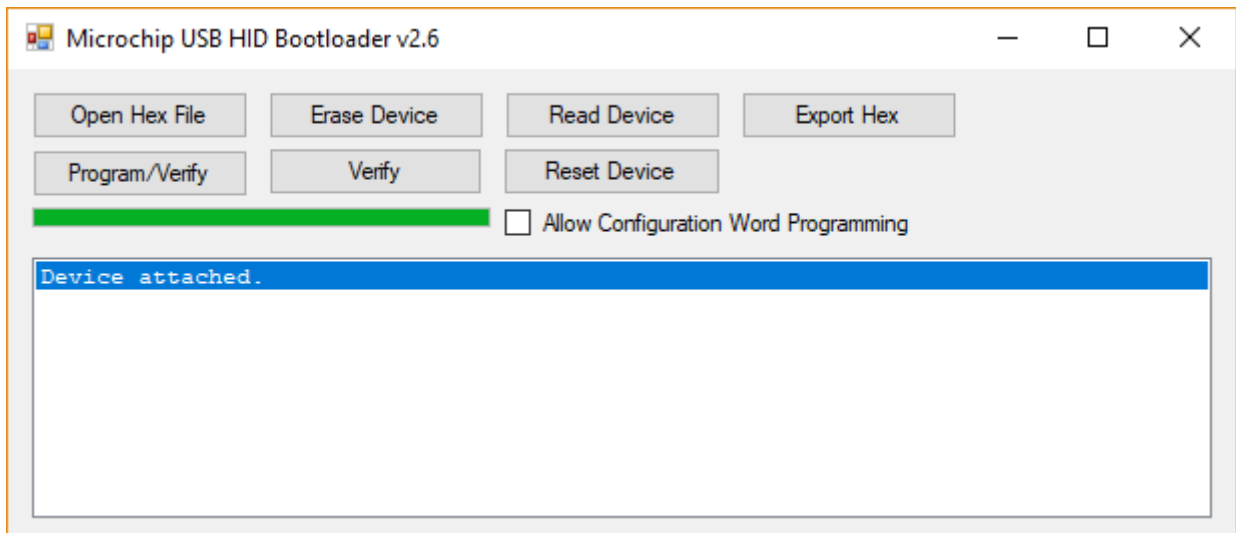


Figure 4 – Bootloader Software Screen

2- Settings Menu

Figure 5 shows the Settings Menu. Here is a list of functions you can perform:

- Read/update the surface Emissivity for the infrared temperature
- Re-scale the Average Infrared Temperature Y-Axis
- Set High and Low Alarm set points for the Average Infrared Temperature
- Re-scale the Thermal Image temperature range or set Auto Scaling
- Set High and Low Alarm set points for Thermal Image Temperature
- Select Thermal Image color palette
- Save Thermal Image and data on alarm conditions
- Record (Save) infrared temperature data to a file on alarm conditions
- Email temperature data/Thermal Image Picture on alarm conditions. Send a test email
- Send Text Message on alarm condition. Send a test Text Message
- Send infrared temperature data to the Cloud – IoT (Thingspeak.com) from the PC
- Read/Configure WiFi Module – Connect to WiFi network
- Set WiFi Module to Serial Mode

2.1- Email Temperature Data / Thermal Image Picture on alarm condition

The software application sends an email of average infrared temperature data and/or thermal image picture every time the infrared temperature or the thermal image pixel temperatures goes into alarm condition. You need to fill in the following items:

- Sender's email address and password.
- Sender's smtp mail server. Either select from the drop down list menu, or type in your specific mail server if it is not in the list.
- Port number and the SSL. It is already set for gmail & yahoo accounts.
- Message title and the Recipient's email address.

You can send a test email to make sure it is functional. Click OK-Save button to save settings and exit.

The screenshot shows a settings window titled 'settings' with the following sections:

- Infrared Temp-Y Axis Re-scaling:** Max. Value (50), Min. Value (0).
- Infrared Temp - Alarm Points:** High Alarm (40), Low Alarm (10), Emissivity (0.95).
- Thermal Image Re-scaling:** Max. Value (100), Min. Value (0), Auto Scaling, High Alarm (55), Low Alarm (12), Save Thermal Image and Data on Alarm.
- From PC:** Send an email on alarm, Send a Text Message on alarm, Record Data on Alarm conditions, Send Infrared Data to Cloud - IoT (Thingspeak.com) API Key (abcdefg12345678), Image Color Palette (Iron).
- Send an Email / Text Message on Alarm Condition:** Title of Email / Message (LFS104C Data), Sender's email address (xxxxxxx@yahoo.com), Sender's email password (masked), Sender's smtp mail server (smtp.mail.yahoo.com), Port Number (25), SSL (False), Recipient's email address (xxxxxxx@gmail.com), Recipient's Cellular carrier (AT&T), Recipient's ten digit cell phone number (1234567890), Send Test email, Send Test Text Message.
- WiFi Wireless Option:** IP Address (192.168.1.111), Port Number (333), Read / Configure WiFi Module, Set WiFi Module to Serial Mode, Connect to WiFi Module, **OK-Save**.

Figure 5 – Settings Menu

2.2- Save Thermal Image and its Data on alarm condition

If you select this Checkbox, the software application saves the thermal image and its temperature data points (32x24=768) every time any thermal image pixel temperature goes into alarm condition. Figure 6 shows a typical thermal image data points saved in a .csv file.

You can also save the thermal image and its data manually by pressing the “Save Thermal Image and Data” button on the main screen. All the thermal image (.jpg) files and their data

points (.csv) files are based on the original data file name entered by the user. The file names are indexed numerically.

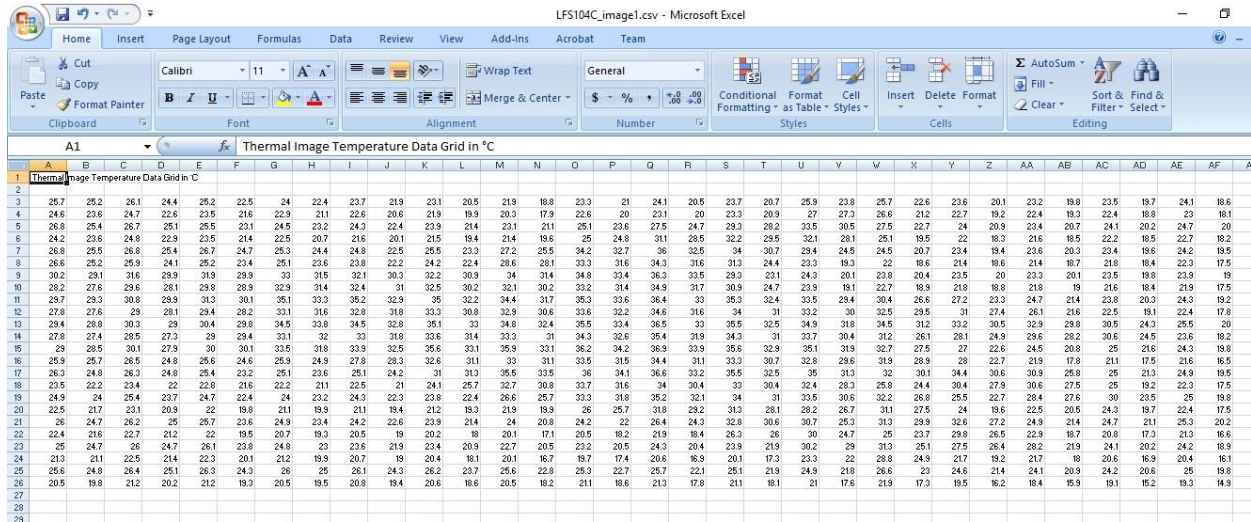


Figure 6 – Thermal Image data points (32 x 24 = 768)

2.3- Send Text Message on alarm condition

The PC software can send a text message to a cell phone every time the average infrared temperature and/or the thermal image pixel temperatures go into alarm condition. Check “Send a Text message on alarm” checkbox and fill in the following additional items:

- Recipient’s Cellular Carrier
- Recipient’s cell phone number.

You can send a test Text Message to make sure it is functional. Click OK-Save button to save settings and exit.

2.4 – Send Infrared Temperature Data to Cloud – IoT (Thingspeak.com)

The PC software can send average infrared temperature data to Thingspeak.com web site for data storage and data visualization.

You need to create an account with Thingspeak.com. After login process, create a new Private Channel. Fill in the Channel settings such as Name, Description, and Field 1 (Infrared Temperature).

From Private View screen, click on **Add Widgets** button. Click on Gauge display and then click Next. A menu comes up where you can fill in the settings for your Gauge display. Note that the gauge display is related to channel field number (Field 1). When complete, click Save to finish. Go to API keys tab and look for “Write API Key”. Copy the API key code.

Go back to the settings menu software. Check off the “Send Infrared Data to the Cloud – IoT Thingspeak.com” checkbox and enter (Paste) the API key in the text box. Click OK and go back to the main menu. Make sure the Chart speed selection is 30 seconds before starting the session. Thingspeak.com provides many features such as data visualization and export, MATLAB analysis and Tweet alerts. Figure 7 shows a typical Thingspeak.com screen.

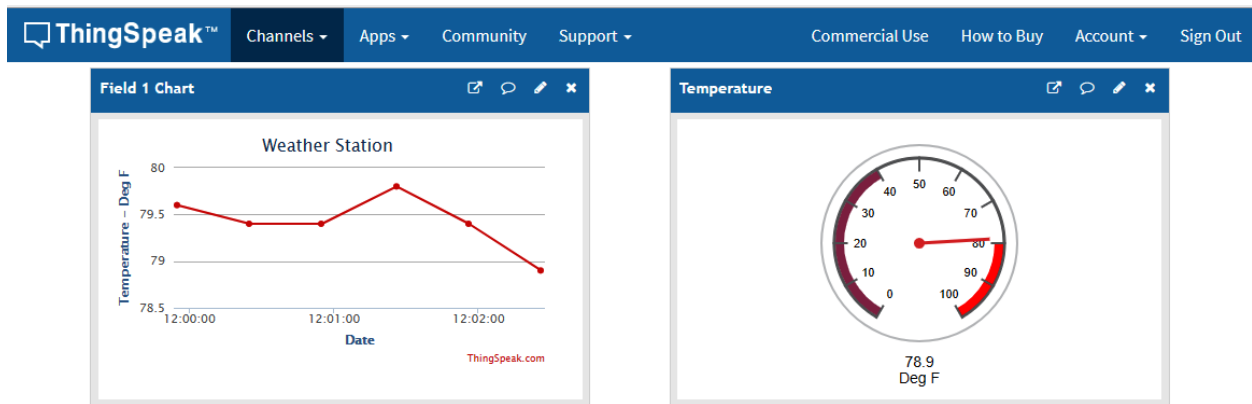


Figure 7 – Typical Thingspeak.com screen, Line and Gauge Graph

2.5- Read/Configure WiFi Module – Connect to WiFi Network (LFS104CW)

The board has a wireless WiFi option where you can read/configure the WiFi module and connect to the WiFi network. From the settings menu, click “Read/Configure WiFi Module” button. A new window will open as shown in Figure 8. You can do any of the following:

- Scan Local WiFi networks
- Connect to a WiFi network by selecting the network and entering the password
- Change the WiFi Module Port number

Once the board is connected to a WiFi network, the window will show the board’s IP address, port number, and the connected network SSID.

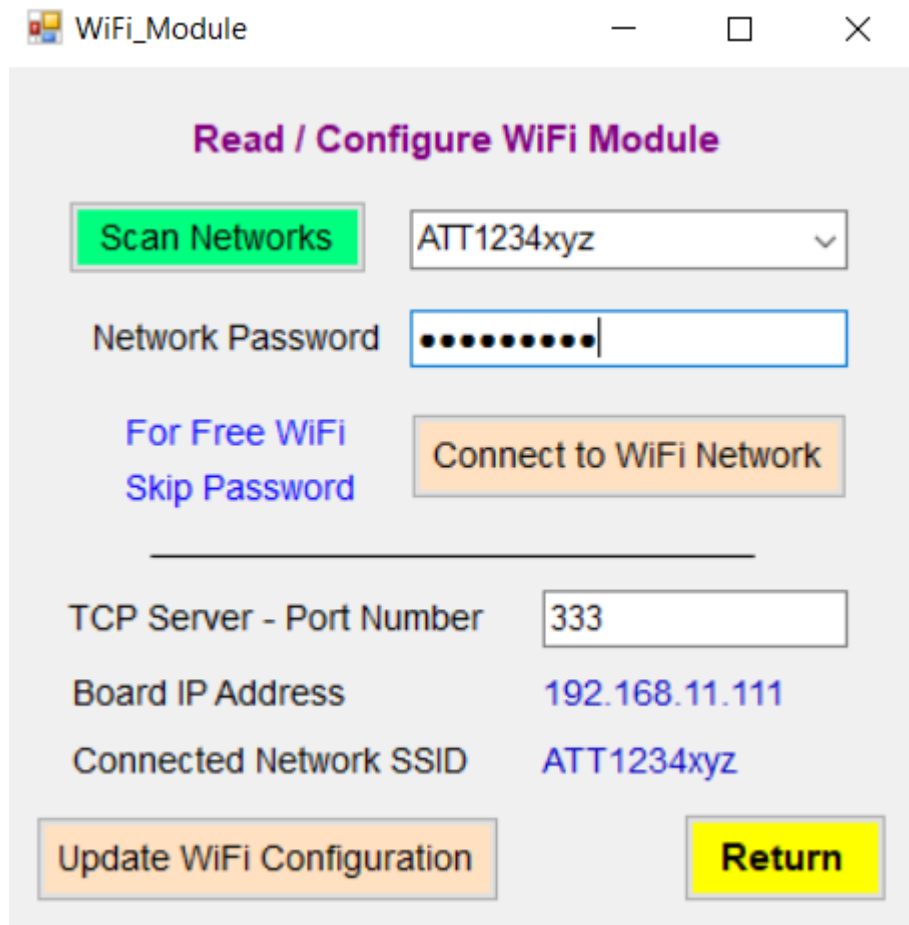


Figure 8 – Read/Configure WiFi Module Menu

Close the Read/Configure WiFi window. Click on “Connect to WiFi Module” button in the settings menu. The PC software is now connecting to the WiFi module and can communicate with the board via WiFi communication. Click OK-Save button to go back to the main menu. You can now display thermal image and read infrared average temperature in real time via WiFi connection as shown in Figure 9.

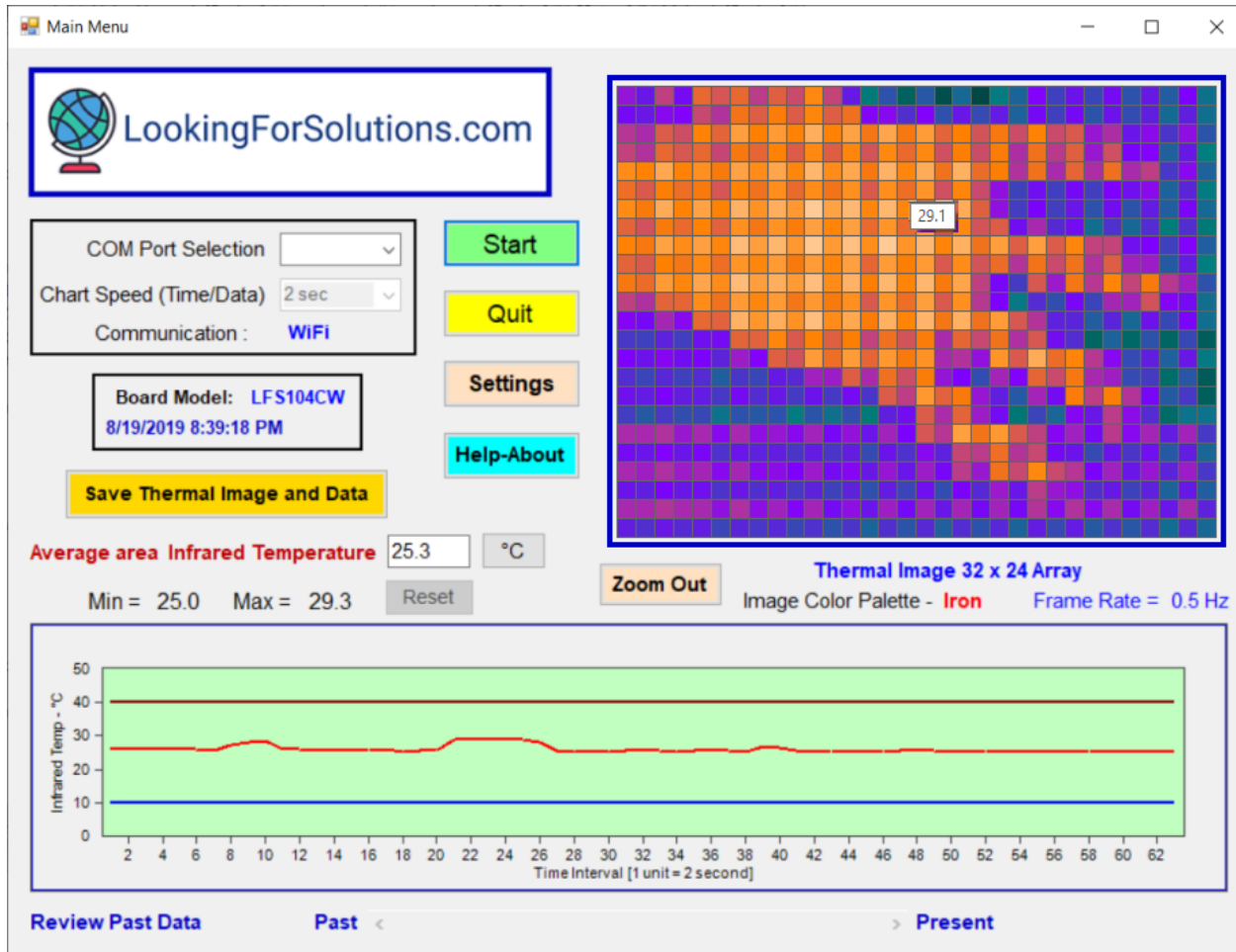


Figure 9 – Main Menu - Review Past data, WiFi Connection

2.6 – Set WiFi Module to Serial Mode

From the settings menu, you can set the WiFi Module to Serial mode by clicking “Set WiFi Module to Serial Mode” button. After the confirmation, close the PC program. Recycle power to the board. You can now communicate directly to the WiFi module from the USB port.

Use a terminal emulator (e.g. Teraterm) program to communicate with the WiFi module of the board. Set the communication settings to 115,200 baud rate, 1 stop bit and no parity. You can use any of the AT commands (Document is included) to communicate and make setting changes to the WiFi module. When done, close the terminal emulator program. Recycle power to the board and use the board normally.

3- Saving Infrared Data / Thermal Image to the Storage Cloud

You can save the average infrared temperature and the thermal image data to any storage cloud service such as Google Drive, One Drive, Dropbox, etc. as follows:

- Install the storage cloud service app on your PC as well as your smart phone or Tablet.
- Run our PC application, and Start the data monitoring/logging session.
- Create a data file under the cloud storage folder (Google Drive, One Drive, etc.), name the data file, and click Save.

Your data file is now created in the cloud storage folder. After closing the data file, you can review the data from your smart phone or tablet.

4- Specifications

Infrared Temperature

Range	-40 to 300 °C (-40 to 572 °F)
Accuracy	1.5°C (3 °F)
Thermal Imager Sensor	32 x 24 Infrared Array, I2C Interface
Resolution	0.1 Degree
Optical Field of view (FOV)	55 x 35 Degrees
Emissivity	Adjustable from 1.00 to 0.10 in 0.01 steps
Frame Rate	4 Hz (LFS104C), 0.5 Hz (LFS104CW)
NETD (K)	0.25 Hz RMS noise
Wavelength Bandwidth	5.5 to 14 um
Software Optical Zoom	3 : 1
Image Color Palette	Iron or Grayscale
PC Sampling Time	250 msec, 0.5 sec, 1 sec, 2 sec (LFS104CW), 10 sec, 30 sec
PC Recording Interval	250 msec, 0.5 sec, 1 sec, 2 sec (LFS104CW), 10 sec, 30 sec
PC Software	Windows 10
Maximum data file	20,000 sets of data per file

Review Past Data on PC	200,000 sets of data
PC Software Serial Comm.	19,200 BPS, 8 bit, 1 Stop bit, No Parity
Power	USB 2.0
IoT Cloud Platform	Thingspeak.com
Size of data saved to Cloud	
30 sec sample rate	3 Million set of data (2.8 Years)
Send Email on alarm	Set via PC software
Send Text Message on alarm	Set via PC software
Export Classification	
LFS104C	EAR99
LFS104CW	5A992c

Wireless Option (LFS104CW)

Wireless	WiFi 802.11 b/g/n
Frequency	2412 to 2452 MHz
Protocols	TCP/IP, UDP/IP, DHCP, HTTP, Telnet, FTP
WiFi Modes	Station / SoftAp (Access Point) / SoftAP+Station
Security	WPA, WPA2
Encryption	WEP / TKIP / AES
Connecting Channels	Up to 5
Serial Mode Communication	115,200 BPS, 8 bit, 1 Stop bit, No Parity
Power Transmit	
802.11 b	17 dBm, 170mA
802.11 g	15 dBm, 140 mA
802.11 n	13 dBm, 120 mA
Power Receive	
802.11 b	-80 dBm, 50mA
802.11 g	-70 dBm, 56 mA
802.11 n	-65 dBm, 56 mA
Dimensions	2.80 x 0.80 inches (71.1 x 20.3mm)

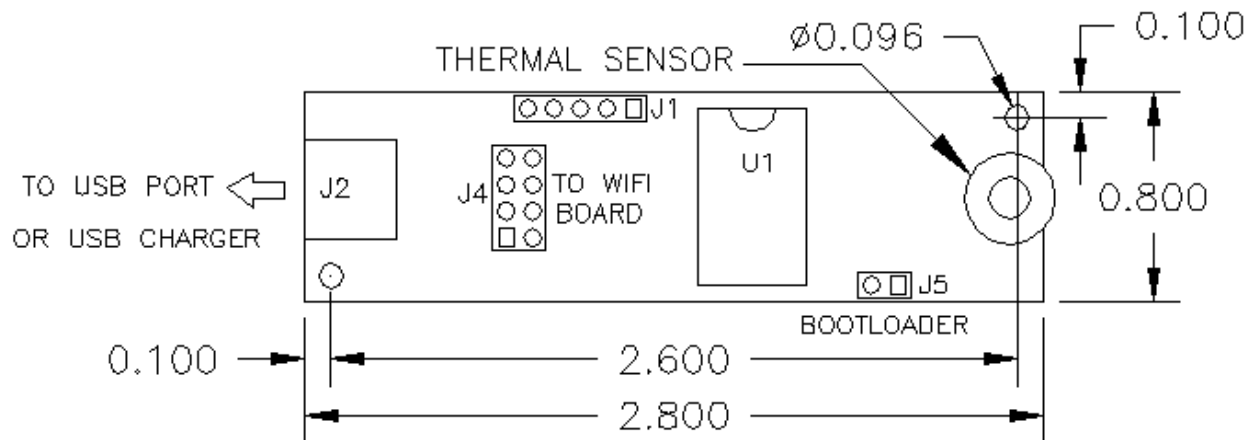


Figure 10 - General Dimensions, LFS104C(W)

5- PC Commands

The following is a list of PC commands used to communicate with the board (CR means Carriage Return):

GETID<CR> - Read the Board ID (Model number)

GETSN<CR> - Read the Board Serial Number yywwxxx

GETFR<CR> - Read the Firmware version of the board

GETHW<CR> - Read the Hardware version of the board

GETM1<CR> - Read the EEPROM Calibration data from the board (Thermal Imager sensor). It provides 832 set of (2 byte) data.

GETM2<CR> - Read the RAM data from the board (Thermal Imager sensor). It provides 768 set of (2 byte) data.

GETM3<CR> - Read the RAM Ambient data from the board (Thermal Imager sensor).

6- Troubleshooting

Here is a list of items you need to be aware of if you get into problems:

- During the software installation, the Windows operating system may indicate “Unknown Publisher” or un-trustworthy source, please ignore and install the software. Our software is virus free and comes from a trusted source.
- Make sure the PC does not go to sleep mode, otherwise you will lose USB communication to the board.
- Make sure your PC is connected to the internet if you are planning to use features like sending emails, text messages, or send data to the cloud.
- Check your antivirus program for any blocking of the application to the internet.
- Check your wireless router for any blocking of the application to the internet.

Yahoo and Gmail accounts have additional security features that does not allow a third party app (Like our app) access the account. In order to access the account from our app, additional steps need to be taken as follows:

Yahoo Accounts:

You need to login to your Yahoo account and under Account Security add our app (LFS104C) and generate a Password. Then use that Password in our app for the account Password in the settings menu. Leave Port number as 25.

Gmail Accounts:

Sign into your Google account. Under Security, there is a section called “Less secure app access”. You need to turn this ON. This allows you to access your Gmail account from our app. Leave Port number as 25.