The Thermok is four channel, K-type thermocouple display with LCD display and serial port. It can simultaneous display all four thermocouple channels, and at the press of a button, will display the maximum and minimum observed temperatures. The uses for a Thermok are endless. It was originally developed for monitoring engine exhaust gas temperatures while tuning an ethanol powered racecar engine, but now has been used for everything from engines to baking cookies. For programmers, home brewers, and hardware hackers, the source code is available under the GNU GPL license.

## Thermocouples

The Thermok uses K-type thermocouples with miniature connectors. See product website (www.aprsworld.com) for additional thermocouple information and internet links.

## Power

The Thermok requires 7 to 20 volts. The power connector is 2.1mm x 5.5mm. The center terminal (tip) is positive and the outer terminal is negative. An AC adapter can be purchased from APRS World, LLC, Radio Shack, or a local electronics retailer. It is also possible to operate the Thermok from a 12-volt vehicle power system. A connector pigtail is available from APRS World, LLC for this purpose.

### **Displaying Minimum and Maximum Temperatures**

To display the maximum and minimum measured temperatures, simply press the red button. The maximum temperatures for each channel will be displayed, followed by the minimum temperature. To clear the maximum and minimum temperatures, press the red button and hold until the Thermok display reads '*Mins and Maxs Reset*.'

### **Choosing Temperature Units**

The Thermok will display temperatures in either Celsius or Fahrenheit. Upon startup, the Thermok will display the units currently in use. To change units, simply hold down the red button for approximately two seconds when powering up the Thermok.

### **Serial Interface**

The serial port provides the four temperature measurement channels. The serial port communicates using RS-232 at 9600 baud, 8N1. It can be connected to a computer with a standard USB to serial adapter or by using a straight through serial cable. The specifications for the serial interface can be found on our website.

# **Upgrading Firmware**

The Thermok incorporates a serial boot loader that allows its firmware to be upgraded via its built in serial port. Check the Thermok website for new firmware versions, upgrades, and instructions.

## **Adjusting Display Contrast**

The LCD display contrast can be adjusted by using a small flat screwdriver to adjust the potentiometer inside the Thermok. The adjustment location is a 1/8" hole on the bottom of the case.

## **Connecting to the Computer**

To download data recorded by the Thermok, connect the Thermok to the serial port on your computer. The Thermok kit includes a DE-9 male to DE-9 female extension cable (serial port). Use this cable to connect the Thermok to the serial port on the computer. You may also use a USB to serial adaptor.

# Setup for Collecting Data

If using Microsoft Windows, go to Start, All Programs, Accessories, Communications, and open the program 'Hyper Terminal.' The program will prompt you to give a description for the Thermok connection. Once the connection is described, click 'OK.'

Connection Description	? 🗙
New Connection	
Enter a name and choose an icon for the connection:	
Name:	
Themok	
lcon:	
🛛 🔊 🖉 🖉 🐜	
	>
ОКСа	ncel

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Hyper Terminal will then prompt you to connect to an external port. Click on the pull-down arrow of the 'Connect using' section and, if the Thermok is connected to serial port 1 of your computer, select 'COM1.' Click 'OK.'

Connect To	? 🛛
Thermok	
Enter details for t	the phone number that you want to dial:
Country/region:	United States (1)
Area code:	507
Phone number:	
Connect using:	COM1 💌
	OK Cancel

You will next be prompted to change the port settings for the serial port you are connected to. Using the pull down menus, change the 'Bits per second' to '9600' and change the 'Flow control' to 'None.' Click 'OK.'

COM1 Properties	? 🔀
Port Settings	
Bits per second:	9600
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None
	Restore Defaults
	K Cancel Apply

Hyper Terminal should now be recording data from the Thermok. Only the channels with thermocouples connected will display readings. Channels not in use will display '9999.'

2	Thermo	k - Hyp	erTermi		
Fi	le Edit V	iew Call	Transfe	r Help	
C	) 😅 🍯	3	0 79	P	
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-	li mili				<u> </u>
		25.24		4.4	
CO	nnected 0:	20:21	Auto	detect	9

To capture your data in a format that can be used with graphing software, go to 'Transfer' and click on 'Capture Text.' Choose the directory to save the data, being sure to add the extension '.txt' to specify that you are writing to a text file. Example:

C:\DocumentsandSettings\thermok\thermok.TXT

Capture	Text	? 🗙
Folder:	C:\Documents and Settings\andersoa\My	
File:	C:\Documents and Settings\thermok\therm	Browse
	Start	Cancel

Click 'Start.' Data is now being captured and written to the specified file. When enough data has been captured, go to 'Transfer,' 'Capture Text' and click 'Stop.'

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### Importing the data into Microsoft Excel

The data can be imported into Microsoft Excel or any other spreadsheet. If you don't have spreadsheet software on your computer, we recommend downloading the superb free software from OpenOffice.org. If you mention it at the time of your order, we are more than happy to include a free OpenOffice.org CD with your order.

To open the data in Excel, go to 'Open' and find the directory where the Thermok data was stored. Click on the file you wish to use, and click 'Open.'

Open									2 🗙
Look in:	Thermok	8	•	+ 🔁	< 🖄	•	Tools +		
() History	thermok								
My Documents									
Desktop									
Favorites									
My Network	File <u>n</u> ame:					•		- Open	-
Plàces	Files of type:	Text Files				-		Cance	ł

Since the data is saved as a text file, you will have to go through a series of steps to import the data. In the first step, select the option 'Delimited' and click 'Next.'

this is correc	t, choose	Next, or cho	ose the dat	a type that	at best describe	es your data.	
Original data	type						
Choose the fi	ile type that	at best descri	ibes your d	ata:			
• Delimite	- C	haracters su	ch as comm	as or tabs	s separate each	n field.	
C Fixed w	idth - F	ields are aligr	ned in colum	nns with sp	paces between	each field.	
						-	
					The entered	Windows (ANSI)	-
	Start	t import at ro	w: 11	-	rile origin:		1000
	Start	t import at <u>r</u> o	w: JI	-	rile <u>o</u> rigin:	1	-
Draview of file	Start	t import at <u>r</u> o	w: JI		\thermok_txt	1	-
Preview of file	Start e C:\Docur	t import at <u>r</u> o ments and Se	w: JI ttings\ande	 ersoa\De	.\thermok.txt.	1	
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Preview of file	Start 2 C:\Docur 29 9999 28 9999	nents and Se 9999 9999	w: J1 ttings\ande		.\thermok.txt.		

In step two, select 'Space' as the delimiter and click 'Next.'

Text In	nport	Wizar	d - Step 2	of 3			? 🛛
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9999	0029	9999	9999				<b>_</b>
9999	0028	9999	9999				
9999	0029	9999	9999				
9999	0028	9999	9999				
4	1		1				
				Cancel	< Back	Next >	Einish

In the last step, you are able to choose which sensors you would like to use to graph data. If you would like data from all sensors, simply click 'Finish.' If there are sensors that you do not want to include in the Excel spreadsheet, highlight that column in the 'Data preview' window, and then select 'Do not import column (skip)' in the 'Column data format box. Click 'Finish.' The data should now appear in spreadsheet form.

Fext In	nport	Wizar	d - Ste	ep 3 of	3						? 🔀
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					Canc	el	< <u>B</u> ack	Ne	xt >	Eini	sh

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### **Graphing Data in Microsoft Excel**

To graph the data, highlight the column(s) you are interested in by clicking on the column heading(s) (i.e. 'A'). If you are interested in graphing multiple columns of data, click and drag the mouse to select all columns of interest. Graph the data by going to 'Insert' and then clicking on 'Chart.'

🕅 N	licrosoft Ex	cel - ther	mok 📃	
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	A19	-	= 117	
	А	В	С	-
19	117			
20	100			
21	85			
22	77			
23	149			
24	196			
25	183			
26	164 ► ► ► the	rmok /	4	• •
Dra	w - 🗟 👶	AutoShap	es 🕶 📔 🧯	) »
	Sum=234	19		-Γ/

A series of 'Chart Wizard' windows will pop up. In the firs window, select the 'Line' chart type. Select the first option under 'Chart sub-type.' Click 'Next.'



In the next window, choose to arrange the series in 'Columns.'

Chart Wizard - Step 2 of 4 - Chart Source Data 🛛 🛛 🛛
Data Range Series
250 200 150 100
50
Series in: C <u>R</u> ows Columns
Cancel < Back Next > Finish

The next window allows you to title the chart and axes. It also displays an example of how the final product will look. Click 'Next' again and choose whether the chart should be displayed as a 'New sheet' or as an 'Object in' the original table. Finally, click 'Finish' to view our finished data chart.



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### Specifications

Sensors:

- 4 Thermocouple input channels
- Thermocouple type is K-type (Chromel (+) Alumel (-))
- 4 miniature-sized thermocouple connectors
- 0°C to 1024°C (32° to 1875°F) temperature range
- 1° display resolution
- ±4°C (8°F) measurement accuracy

### Interfaces:

- 16 characters by 2 lines LCD display; Positive transflective LED edge backlit
- E1A/T1A-232 voltage levels; DE-9 Female; DCE; Compatible with all serial ports
- 9600 baud. 8 bits, no stop bit, 1 parity bit (8N1); ASCII based protocol

Physical dimensions and materials:

- Weight: 190g (6.7 oz)
- Overall Dimensions: 139.7mm wide, 101.6mm long, 36.83mm deep (5.5 x 4.0 x 1.5 in)
- Case Material: Flame retardant ABS plastic; UL's best flame rating of 9405VA (case only)

### Power:

- 7 to 20 volt DC
- DB9-Female. Pin 5 ground, Pin 9 positive; 7.7 to 20 volts
- 2.1 x 5.5mm power jack



• 39mA current consumption

### **Further Information**

Further information can be found on our website. Including the device schematic, embedded software source code, programming instructions, thermocouple suggestions, and sample applications.

### Notice

This device is sold as "Test Equipment" for industrial and commercial applications. It is intended to be used for maintenance, research, evaluation, simulation and other analytical and scientific applications.

### Warranty

APRS World's support policy is simple; we want you to be happy! If you have a problem, please feel free to contact us and we will do our best to get you up and running as soon as possible.

The Thermok has a one-year limited warranty. We will repair or replace your Thermok if you encounter any problems within one year of purchase. We reserve the right to charge a reasonable fee for repairing units with userinflicted damage. It is your responsibility to ship the defective unit back to APRS World, LLC. We will pay for shipping the replacement to you. We reserve the right to upgrade your equipment to an equivalent or better model. This warranty does not cover the accuracy of the sensors connected to the Thermok or the accuracy of the data collected by the Thermok.



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