![ANALOG DEVICES]

EVAL-AD7714-3EBZ User Guide
UG-761

Evaluation Board for the AD7714-3, 24-Bit Low Power Sigma-Delta (Σ−Δ) ADC

FEATURES

Full featured evaluation board for the AD7714-3
Standalone USB interface
Various linking options
PC software for control of AD7714-3

EVALUATION KIT CONTENTS

EVAL-AD7714-3EBZ board
Software CD
USB cable

GENERAL DESCRIPTION

This user guide describes the evaluation board for the AD7714-3, which is a low power, 24-bit signal conditioning Σ-Δ ADC.

The AD7714-3 is a complete analog front end for low frequency measurement applications. It can be configured to have three fully-differential inputs or five pseudo-differential inputs. It employs a sigma-delta conversion technique to realize up to 24 bits of no missing codes performance. The input signal is applied to an analog modulator. The modulator output is processed by an on-chip digital filter. The analog input channel of the AD7714-3 accepts analog input signals of $\pm V_{REF}$/gain, with gain equal to 1 to 128. Simultaneous 50 Hz/60 Hz rejection is available when the data update rate is set to 10 Hz.

Full data on the AD7714-3 is available in the AD7714 datasheet available from Analog Devices, Inc. and should be consulted in conjunction with this user guide when using the evaluation board.

Note that the AD7714-3 evaluation board software should be installed before connecting the AD7714-3 evaluation board to the PC.

Other components on the AD7714-3 evaluation board include the ADP3303 high precision, low power, 3.3 V output voltage regulator, which is used to power the USB/SPI interface.
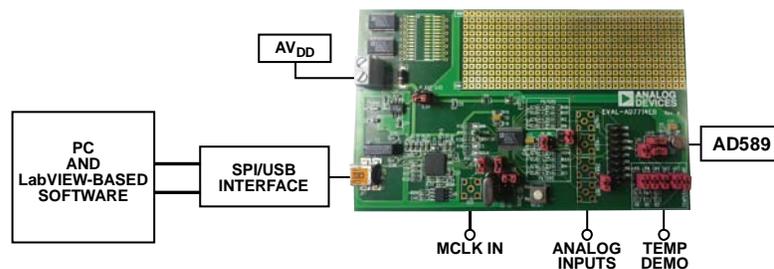
TYPICAL SETUP

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

12/14—Rev. A to Rev. B

GETTING STARTED

SOFTWARE INSTALL PROCEDURES

Use the following steps to install the software:

1. Start Windows® and insert the CD.
2. The installation software should launch automatically. If it does not, use Windows Explorer to locate the **setup.exe** file on the CD. Double-click this file to start the installation procedure.
3. At the prompt, select a destination directory, which is **C:\Program Files\Analog Devices\AD7714-3** by default.
4. Once the directory is selected, the installation procedure copies the files into the relevant directories on the hard drive. The installation program creates a program group called **Analog Devices** with a subgroup AD7714-3 in the **Start** menu of the taskbar.

Once the installation procedure is complete, double-click the AD7714-3 icon to start the program.

EVALUATION BOARD SETUP PROCEDURES

Interfacing to the evaluation board is via a standard USB connector, J1. J1 is used to connect the evaluation board to the USB port of a PC. A standard USB connector cable is included with the AD7714-3 evaluation board to allow the evaluation board to interface with the USB port of the PC.

Because the board is powered via the USB connector, there is no need for an external power supply, although if preferred one may be connected via J3.

Communication between the AD7714-3 and the PC is via the USB/SPI interface. The on-board USB controller (U2) controls this communication.

To set up the USB/SPI interface, use the following procedure:

1. Install the AD7714-3 evaluation board software using the supplied AD7714-3 evaluation board CD before connecting the board to the PC.
2. After the AD7714-3 evaluation board software has been installed, connect the board to the PC via J1 on the AD7714-3 evaluation board and via the USB port on the PC using the supplied USB connector cable (see Figure 1). The PC automatically finds the new USB device and identifies it as the **AD779x Evaluation Board** (see Figure 2).
3. Follow the on-screen instructions that appear. During the installation process if the **Hardware Installation Wizard** appears as shown in Figure 2, select **Continue Anyway** to successfully complete the installation of the AD7714-3 evaluation board.
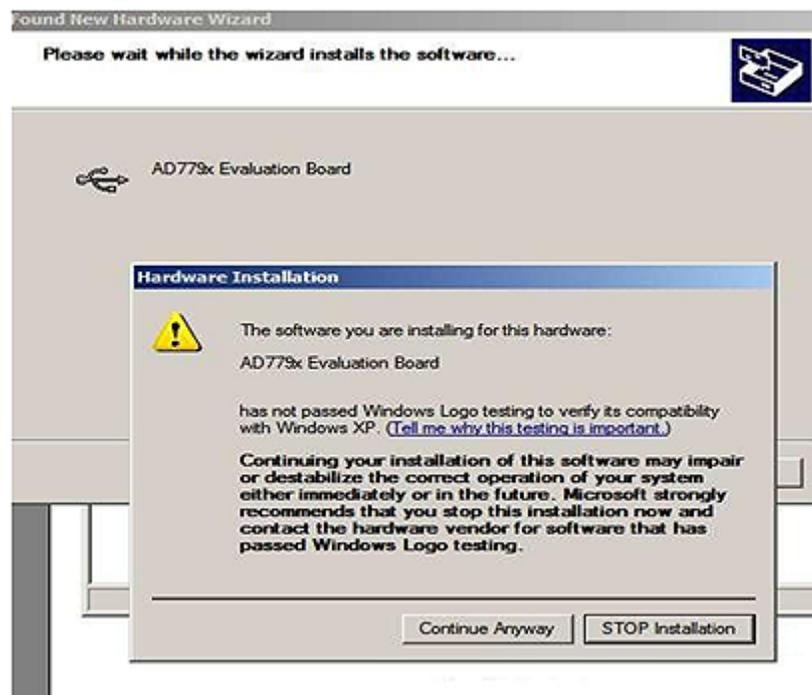

Figure 2. Hardware Installation Window

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The AD7714-3 evaluation board is powered via the 5 V supply from the USB connector, J1. This 5 V supply can be used to power the AD7714-3 directly. A 3.3 V regulated voltage from the on-board ADP3303 (a high precision, low power, 3.3 V output voltage regulator) can also be used. Alternatively, the AD7714-3 can be powered using an external 3 V or 5 V power supply via J3.

LINKS

There are fifteen link options that must be set for the required operating setup before using the evaluation board. The functions of these link options are outlined in Table 1.

Table 1. Evaluation Board Link Settings

Link	Default	Description
LK1	In	This link is used to externally short the AIN1 input channel to the reference. With LK1 and LK2 in place, Pin AIN1 is shorted to Pin AIN2 and both are biased at REFIN+. This allows a noise analysis to be performed. With this link out, an external voltage may be applied to AIN1 using the SMB connectors.
LK2	In	This link is used to short Pin AIN1 to Pin AIN2. When both LK1 and LK2 are inserted, noise analysis can be performed. With this link out, an external voltage can be applied to AIN2 using the SMB connectors.
LK3, LK4 LK5, LK6, LK7	Out	These links are used to connect the on-board temperature demonstration circuit to the ADC, and must all be in place when attempting to measure ambient temperature. When the on-board temperature demonstration circuit is selected in software, LK7, when in place, connects AV_{DD} to the temperature demonstration circuit. LK4 and LK5 when in place connect the 1 kΩ thermistor to the AIN1 − AIN2 analog input channel, and with LK2 and LK3 in place a ratiometric configuration of the temperature demonstration circuit is in place.
LK8, LK9	In	These links are used to connect the AD589 reference to the AD7714-3. When both links are in place, the 1.23 V generated by the band gap reference is used as the reference source to the AD7714-3. When these links are removed, another reference source can be applied to the AD7714-3 using the SMB connectors. LK8 and LK9 need to be removed when the temperature demonstration is operated.
LK10	A	LK10 is used to select the polarity of the AD7714-3 SCLK. With LK10 in Position A, POL is connected to DV_{DD} so that data is output on the SCLK falling edge. With LK10 in Position B, POL is connected to AGND and data is output from the AD7714-3 on the SCLK rising edge.
LK11	A	LK11 controls the $\overline{STANDBY}$ pin of the AD7714-3. With LK11 in Position A, $\overline{STANDBY}$ is pulled high and the AD7714-3 is powered up. With LK11 in Position B, $\overline{STANDBY}$ is pulled low and the AD7714-3 is placed in power-down mode.
LK12	A	LK12 is used to enable or disable the AD7714-3 analog input buffers. With LK12 in Position A, the pin BUFFER is tied high and the analog inputs of the AD7714-3 are buffered. With LK12 in Position B, the BUFFER pin is tied low and the analog inputs of the AD7714-3 are unbuffered.
LK13, LK14	In	LK13 and LK14 are used to connect the 2.4576 MHz crystal to the AD7714-3. When these links are in place, the on-board crystal is connected to the AD7714-3. When these links are removed, an external clock source can be applied to the AD7714-3 via the SMB connector.
LK15	B	LK15 is used to select the power source for AV_{DD} on the AD7714-3. LK15 in Position A selects an external power supply, supplied via J3. LK15 in Position B selects the 3.3 V regulated output from the on-board ADP3303 voltage regulator.

SETUP CONDITIONS

Ensure that all link positions are set per the required operating mode before applying power and signals to the evaluation board.

Table 2 shows the position in which all the links are initially set.

SOCKETS

There are six sockets relevant to the operation of the AD7714-3 on this evaluation board. The functions of these sockets are outlined in Table 3.

PUSH-BUTTON RESET

There is also a push-button switch on the evaluation board, which is used to perform a reset. When the button is pressed, the $\overline{\text{RESET}}$ pin of the AD7714-3 is tied to ground and the AD7714-3 registers are set to their default conditions.

Table 2. Initial Link and Switch Positions

Link No.	Position	Function
LK1	In	AIN1 is connected to REFIN+.
LK2	In	AIN2 is shorted to AIN1.
LK3, LK4	Out	The temperature demo is not connected to AIN1 − AIN2.
LK5, LK6	Out	The reference pins of the AD7714-3 are not connected to the temperature demonstration.
LK7	Out	AV_{DD} is not connected to temperature demo circuit.
LK8, LK9	In	The AD589 is used as the reference source to the AD7714-3.
LK10	A	POL is pulled high so data is output on the SCLK falling edge.
LK11	A	The AD7714-3 is powered up.
LK12	A	The analog inputs are operated in buffered mode.
LK13, LK14	In	The 2.4576 MHz crystal is used as the clock source to the AD7714-3.
LK15	B	The 3.3 V regulated voltage is used as the power supply to the AD7714-3 and the AD589.

Table 3. Socket Functions

Socket	Function
AIN1	Subminiature BNC (SMB) connector. The analog input signal for the AIN1 input of the AD7714-3 is applied to this socket.
AIN2	Subminiature BNC (SMB) connector. The analog input signal for the AIN2 input of the AD7714-3 is applied to this socket.
REFIN+	Subminiature BNC (SMB) connector. This socket is used in conjunction with REFIN− to apply an external reference to the AD7714-3. The voltage for the REFIN+ input of the AD7714-3 is applied to this socket.
REFIN−	Subminiature BNC (SMB) connector. This socket is used in conjunction with REFIN+ to apply an external reference to the AD7714-3.The voltage for the REFIN− input of the AD7714-3 is applied to this socket.
CLK	Subminiature BNC (SMB) connector. An external clock source can be applied to the AD7714-3 using this socket.
J2	16-pin (2×8) pin straight header. This socket is used in conjunction with the prototype area to interface any signal to the AD7714-3.

HOW TO USE THE SOFTWARE

SOFTWARE DESCRIPTION

The AD7714-3 evaluation board is shipped with a CD containing software that can be installed onto a standard PC to control the AD7714-3. The software communicates with the AD7714-3 through the USB cable, which accompanies the board. The software allows you to configure the AD7714-3 and to read conversion data from the AD7714-3. Data can be read from the AD7714-3 and displayed or stored for later analysis. For further information, see the AD7714-3 data sheet available from Analog Devices.

USING THE SOFTWARE

Figure 3 shows the main window that is displayed when the program starts. The Main Window (Registers Window) section briefly describes the various menu and button options on the main window. The Cal Registers Window and Temp Demo Window sections describe the most commonly used evaluation software windows.

The data that has been read can be exported to other packages such as MathCAD™ or Microsoft® Excel for further analysis.

During power-up, the AD7714-3 evaluation board software configures the device to have a gain of 1, the AIN1/AIN2 channel is selected, the update rate is set to 60 Hz and the word length is set to 24.
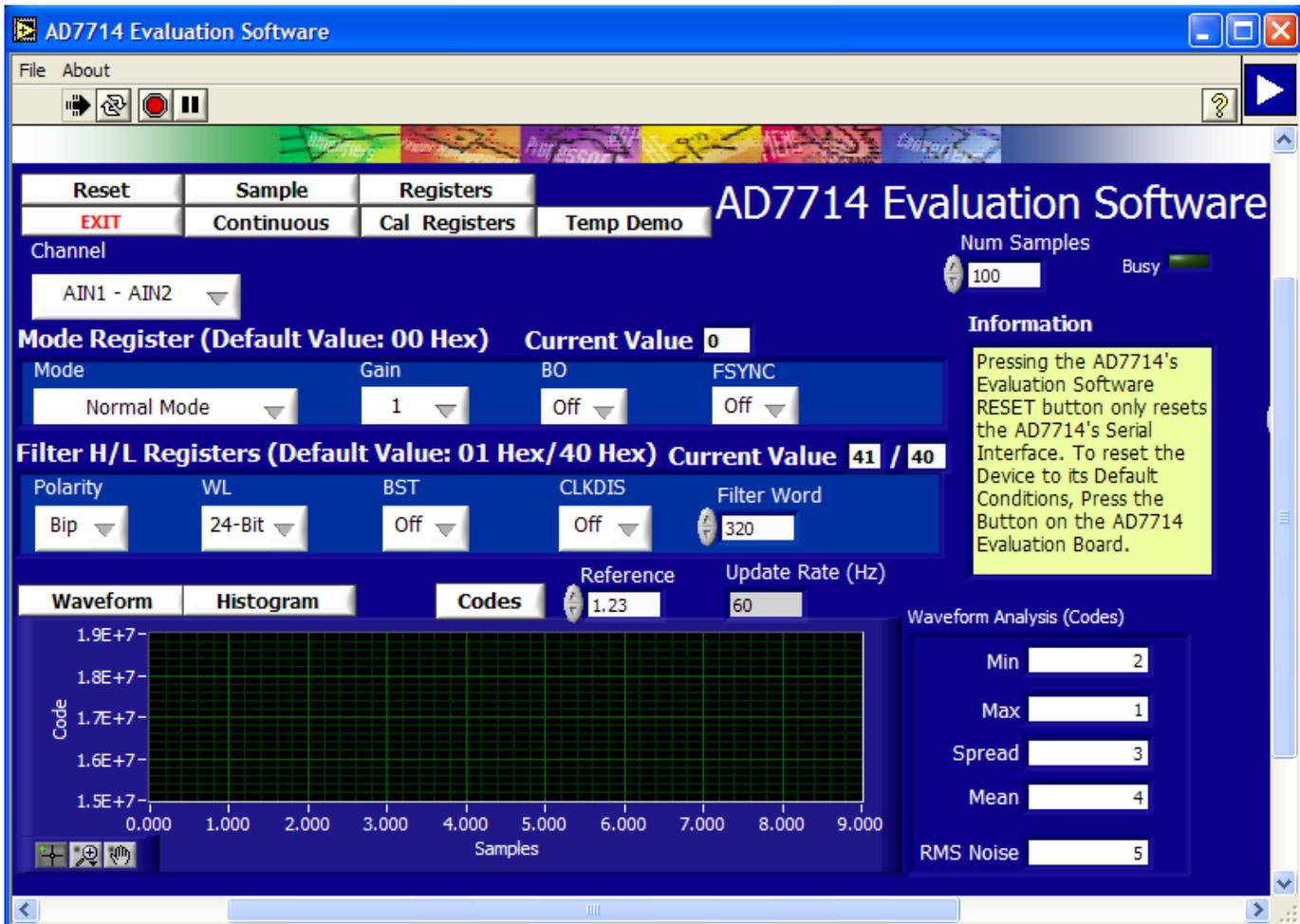
Figure 3. AD7714-3 Evaluation Software Main Window

MAIN WINDOW (REGISTERS WINDOW)

Menu Bar

File

The **File** menu allows the user to read previously stored data for display or analysis, write the current set of data to a file for later use, and exit the program.

About

The **About** menu provides information on the revision of software used.

Buttons

Reset

The **Reset** button allows the user to reset the AD7714-3 and set the registers to the power up conditions as specified by the software (channel = AIN1/AIN2, gain = 1, update rate = 60 Hz).

Exit

The **Exit** button allows the user to exit the software. It serves the same purpose as **Quit** in the **File** pull-down menu.

Sample

The **Sample** button allows the user to read a number of samples from the AD7714-3. Noise analysis is then performed on the samples. These samples can be stored for further analysis. The sample size is entered in the **Num Samples** text box.

Continuous

The **Continuous** button allows the user to read a number of samples continuously. The software gathers a number of samples as specified by the **Num Samples** text box, performs noise analysis on the samples, and then gathers the next group of samples.

Registers

The **Registers** button selects the main window which allows the user access to the mode register and the filter high/low registers. This window allows you to change items such as polarity, update rate, and gain. Consult the AD7714-3 data sheet for further details on the bit functions.

Cal Registers

The **Cal Registers** button allows the user to access the offset register and full-scale register.

Temp Demo

The **Temp Demo** button allows the user to access the temperature demonstration software.

Waveform

The **Waveform** button gathers conversions and displays them in graph form.

Histogram

The **Histogram** button gathers samples are uses them to generate a histogram.

Codes

The **Codes** button gathers samples and can display them in codes or in voltage format. When the **Codes** option is selected, the values are displayed as code. The **Codes** button changes to **Volts**. To display the information in volts, click **Volts**.

Reference

The value of the external reference should be entered in the **Reference** text box.

CAL REGISTERS WINDOW

Click **Cal Registers** to access the **Cal Registers** window (see Figure 4). This window displays the contents of the offset calibration register and the full-scale calibration register.
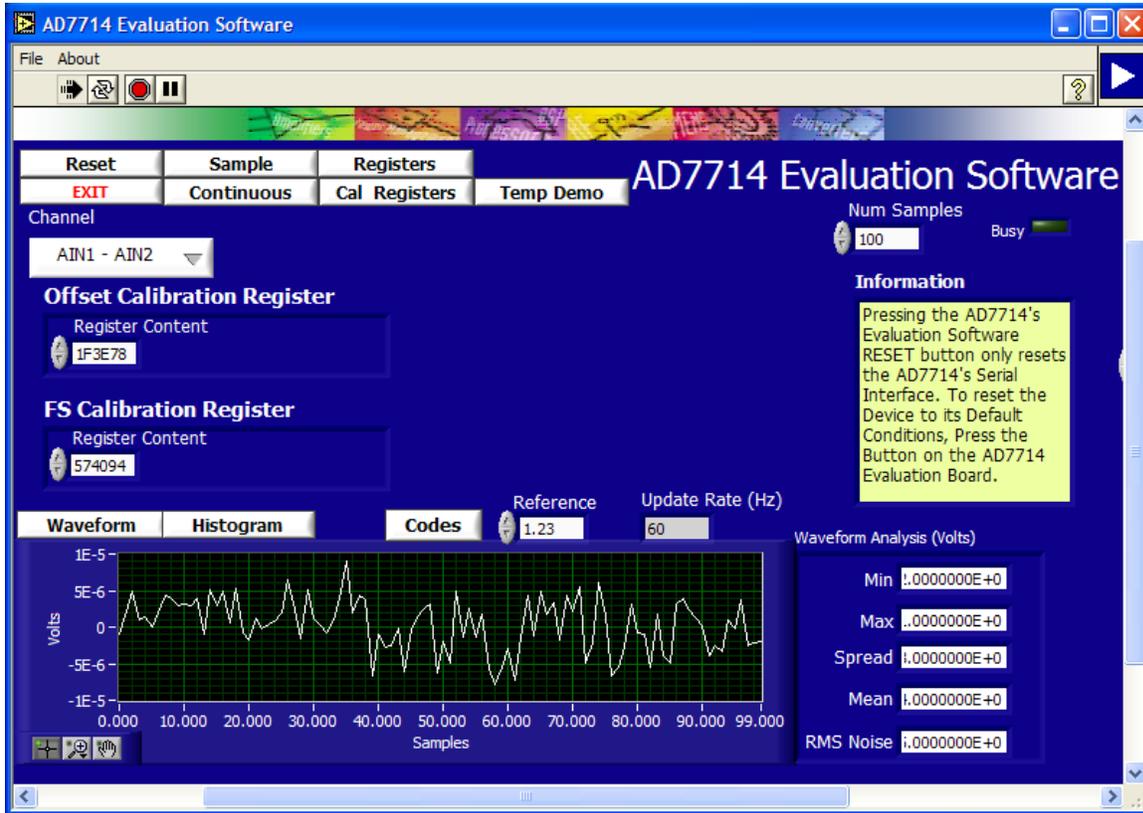
Figure 4. *AD7714-3 Evaluation Software Cal Registers Window*

TEMP DEMO WINDOW

Click **Temp Demo** to access the temperature demonstration window (see Figure 5). The AD7714-3 evaluation board has a temperature demonstration included on the board. To operate the temperature demonstration, LK3 to LK7 should be inserted and LK1, LK2, LK9, and LK12 should be removed. With these links in place, AV_{DD} is connected to a 1 kΩ thermistor which is connected across the AIN1/AIN2 pins. In series with the thermistor is a 5 kΩ precision resistor, which is used to generate the reference voltage so that a ratio metric configuration is used. The temperature demonstration software saves the values in the mode register, filter high/low registers, offset register, and full scale register. The software then configures the AD7714-3 to operate with a gain of 1, the AIN1/AIN2 channel is selected as the analog input, and the update rate is set to 60 Hz. When you select **Run**, the software continuously reads the conversion from the AIN1/AIN2 channel and converts the result to temperature using a look-up table.

When **Run** is clicked again, the temperature demonstration execution is halted. To exit the temperature demonstration, click the **Back** button. The software sets the mode register, filter registers, and calibration registers to their previous values.
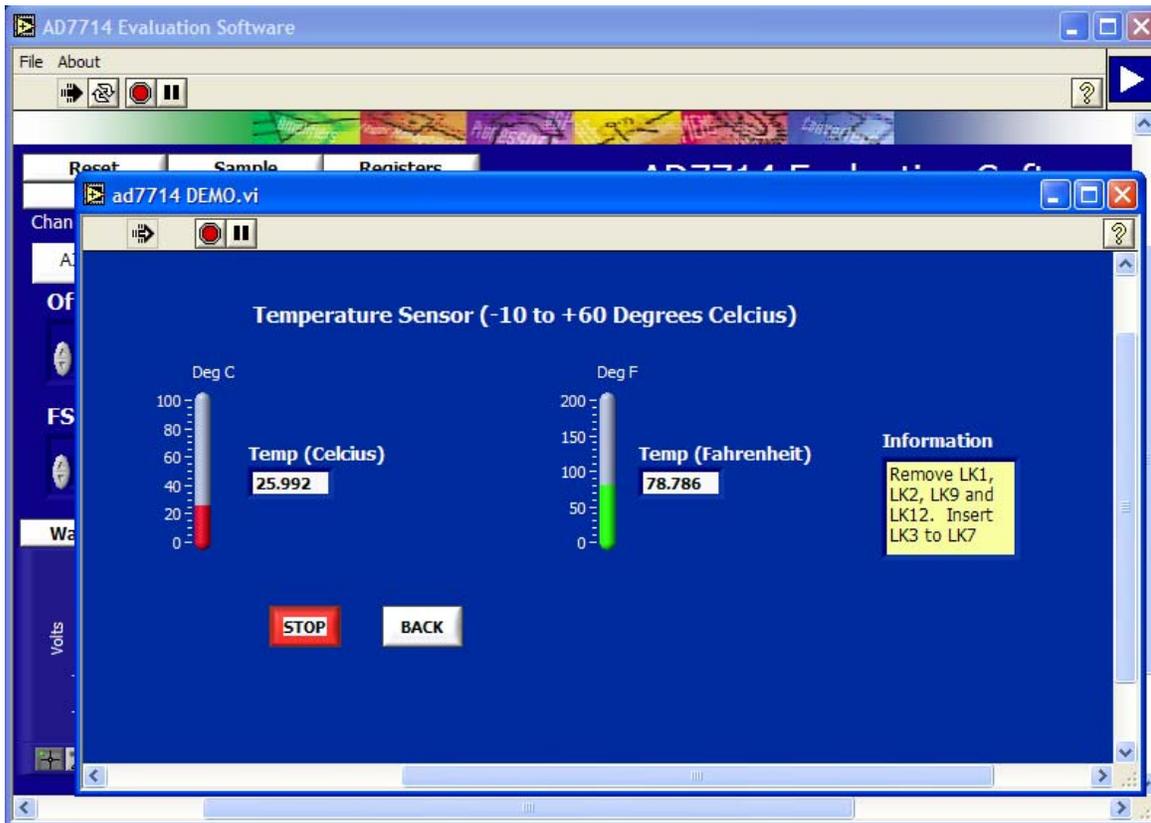
Figure 5. AD7714-3 Evaluation Software Temperature Demo Window

RELATED LINKS

Resource	Description
AD7714-3	Product Page, CMOS, 3 V/5 V, 24-Bit Sigma-Delta Conditioning ADC
ADP3303	Product Page, High Accuracy anyCAP 200 mA Low Dropout Linear Regulator
AD589	Product Page, Two-Terminal IC 1.2 V Reference

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

www.analog.com