PGA308EVM

User's Guide

Literature Number: SBOU060
July 2008

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About This Manual

This user's guide describes the characteristics, operation, and use of the PGA308 evaluation module (EVM). It discusses the processes and procedures required to properly use this EVM board. This document also includes the physical printed circuit board (PCB) layout, schematic diagram, and circuit descriptions.

Related Documentation from Texas Instruments

The following documents provide information regarding Texas Instruments integrated circuits used in the assembly of the PGA308EVM. These documents are available from the TI web site under the respective literature number (for example, SBxxnnn). Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this User's Guide. Newer revisions may be available from the TI web site at www.ti.com, or call the Texas Instruments Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

Documents	Literature Number
PGA308	SBOS440
XTR116	SBOS124
TUSB3210	SLLS466
USB DAQ Platform	SBOU056

Information About Cautions and Warnings

This document contains caution statements.

CAUTION

This is an example of a caution statement. A caution statement describes a situation that could potentially damage your software or equipment.

The information in a caution or a warning is provided for your protection. Please read each caution carefully.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense is required to take whatever measures may be required to correct this interference.

Overview

This document provides the information needed to set up and operate the PGA308EVM evaluation module, a test platform for the PGA308 Programmable Bridge Sensor. For a more detailed description of this device, please refer to the PGA308 product data sheet (SBOS440) available from the Texas Instruments web site at www.ti.com. Support documents are listed in the section of this guide entitled *Related Documentation from Texas Instruments*.

The PGA308EVM is an evaluation module that is used to fully evaluate the PGA308 device. The PGA308 is a mixed-signal programmable gain amplifier that has high resolution gain and offset adjustment capability.

The PGA308EVM consists of two PCBs. One board generates the digital signals (USB DAQ Platform) required to communicate with the PGA308 (PGA308_Test_Board), and the second board contains the PGA308, as well as support and configuration circuitry.

Note: Note: Much of the information contained in this document is also contained in the QuickStart Video (SBOU059), which is included with the EVM kit. It is highly recommended that you watch this video before using this EVM.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the PGA308EVM.

1.1 PGA308EVM Hardware

Figure 1-1 shows the hardware included with the PGA308EVM kit. Contact the factory if any component is missing. It is highly recommended that you check the TI web sit at www.ti.com to verify that you have the latest software version. It is also recommended that you watch the QuickStart Video (included on the compact disk) before using the PGA308EVM.

The complete kit includes the following items:

- PGA308 test PCB
- USB DAQ platform PCB
- USB cable
- Universal 6V wall-wart power supply
- QuickStart Video

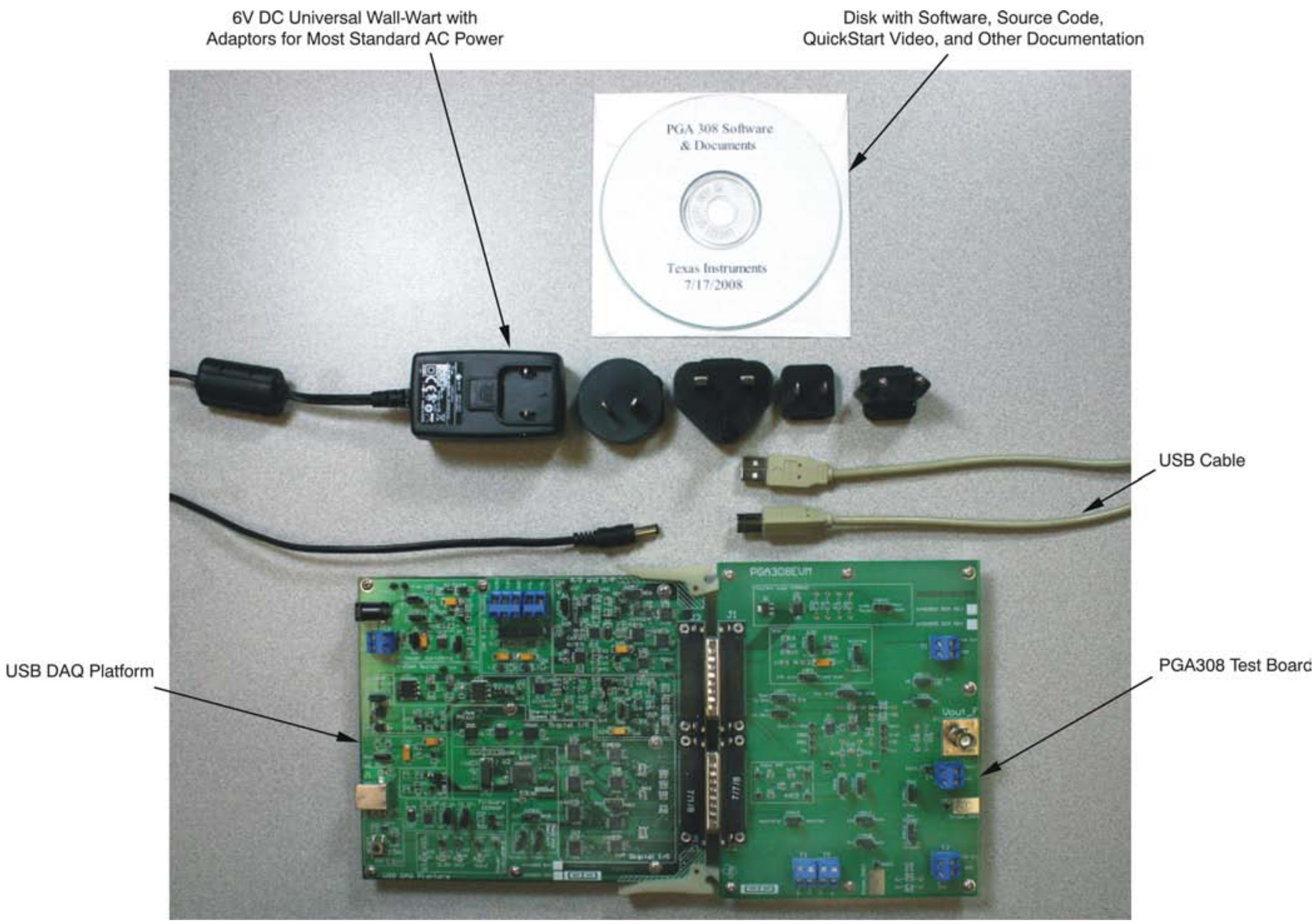

Figure 1-1. Hardware Included with the PGA308EVM

System Setup

Figure 2-1 shows the system setup for the PGA308EVM. The PC runs software that communicates with the USB DAQ platform. The USB DAQ platform generates the digital signals used to communicate with the PGA308 test board. Connectors on the PGA308 test board allow for connection to the system that will be monitored by the user.

Minimim PC operating requirements:

- Microsoft® Windows® XP or higher (including Windows Vista™)
- USB port
- Works on US or European regional settings

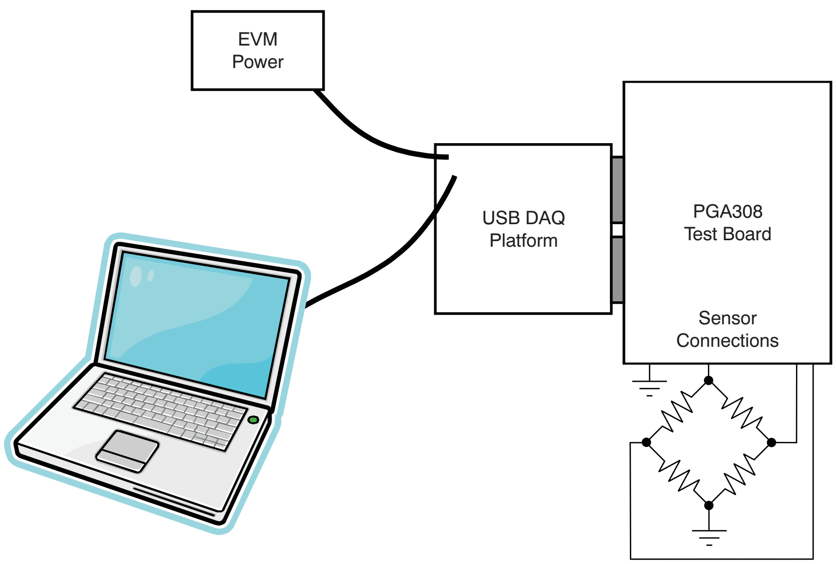

Figure 2-1. Hardware Setup for the PGA308EVM

2.1 Theory of Operation for the PGA308 Test Board Hardware

Figure 2-2 shows the block diagram of the PGA308 test board. The PGA308 test board functionality is relatively simple. It provides connections to the one-wire interface, digital-to-analog converter (DAC), analog-to-digital converter (ADC), and general-purpose inputs/outputs (GPIOs) on the USB DAQ platform. It also provides connection points for external connection of the bridge sensor, reference, and outputs.

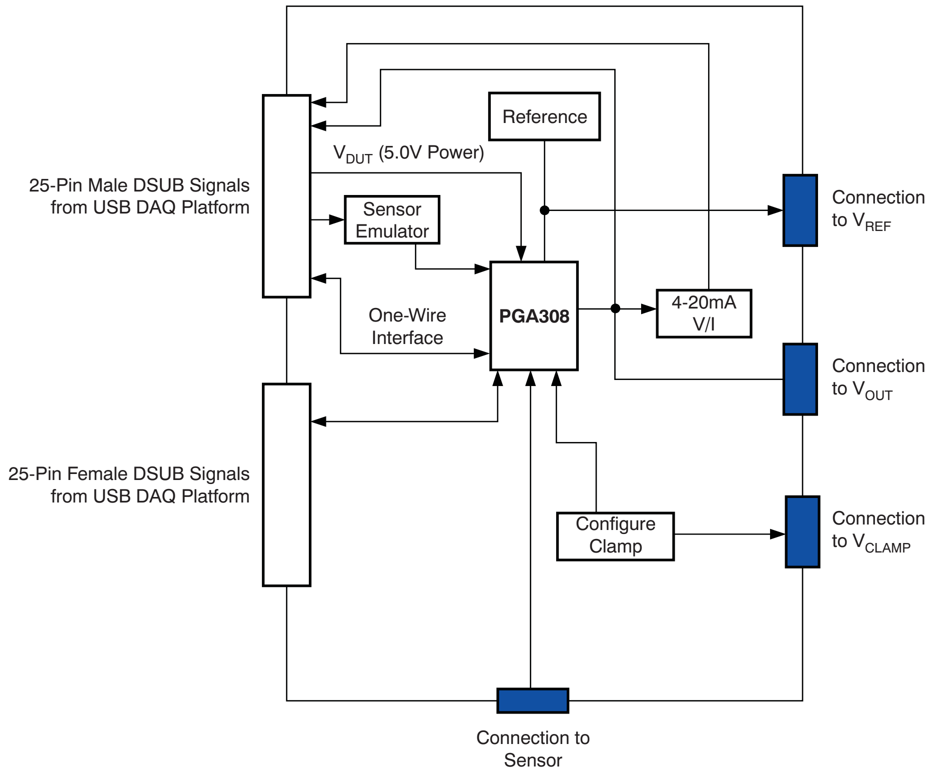

Figure 2-2. Block Diagram of the PGA308 Test Board

Refer to SBOR004 for the PGA308 test board schematic, available for download at www.ti.com.

2.2 Signal Definition of J1 (25-Pin Male DSUB) on the PGA308 Test Board

Table 2-1 shows the different signals connected to J1 on the PGA308 test board. Table 2-1 also identifies signals connected to pins on J1 that are not used on the PGA308 test board.

Table 2-1. Signal Definition of J1

Pin Number	Signal Name from USB DAQ Platform	Description
1	DAC_A	To input amplifier (sensor emulator); 16-bit string DAC A output.
2	DAC_B	To input amplifier (sensor emulator); 16-bit string DAC B output.
3	DAC_C	To input amplifier (sensor emulator); 16-bit string DAC C.
4	DAC_D	Not used
5	ADS1_V_{IN+}	To PGA308 output; 16-bit delta-sigma (ΔΣ) ADC #1 positive input.
6	ADS1_$V_{IN–}$	Grounded for single-ended measurements; 16-bit ΔΣ ADC #1 negative input.
7	ADS2_V_{IN+}	PGA308 V_{IN2} input; 16-bit ΔΣ ADC #2 positive input.
8	ADS2_$V_{IN–}$	PGA308 V_{IN1} input; 16-bit ΔΣ ADC #2 negative input.
9	I^2C_SCK	Not used
10	I^2C_SDA2	Not used
11	ONE_WIRE	PGA308 1W pin; one-wire signal (derived from the UART on the TUSB3210 device).
12	I^2C_SDA_ISO	Not used
13	I^2C_SCK_ISO	Not used
14	XTR+LOOP	To XTR116 pin 7 on EVM. Current-loop positive-loop connection; this signal is connected to the positive-loop supply.
15	XTR–LOOP	To XTR116 pin 4 on EVM. Current-loop negative-loop connection; this signal connects the DUT current output to the current measurement circuit.
16	INA–	Not used
17	V_{DUT}	To PGA308 V_S power-supply pin; switched 3V or 5V supply.
18	V_{CC}	Not used
19	+15V	Not used
20	–15V	Not used
21	GND	Ground
22	SPI_SCK	Not used
23	SPI_CS1	Not used
24	SPI_DOUT1	Not used
25	SPI_DIN1	Not used

2.3 Signal Definition of J2 (25-Pin Female DSUB) on the PGA308 Test Board

Table 2-2 shows the different signals connected to J2 on the PGA308 test board. Table 2-2 also identifies signals connected to pins on J2 that are not used on the PGA308 test board.

Table 2-2. Signal Definition of J2

Pin Number	Signal Name from USB DAQ Platform	Description
1	P3.3	Not used
2	CTRL1	Not used
3	CTRL2	Not used
4	CTRL3	Not used
5	CTRL4	Not used
6	CTRL5	Not used
7	CTRL6	Not used
8	CTRL7	Not used
9	CTRL8	Not used
10	MEAS1	To D_{OUT} on the PGA308. This pin is a measure bit that can read logic signals; it is part of an 8-bit group.
11	MEAS2	Not used
12	MEAS3	Not used
13	MEAS4	Not used
14	MEAS5	Not used
15	MEAS6	Not used
16	MEAS7	Not used
17	MEAS8	Not used
18	SPI_SCK	Not used
19	SPI_CS2	Not used
20	SPI_DOUT2	Not used
21	SPI_DIN2	Not used
22	V_{DUT}	Not used
23	V_{CC}	Not used
24	GND	Not used
25	GND	Not used

2.4 Theory of Operation For the USB DAQ Platform

Figure 2-3 shows the block diagram for the USB DAQ platform. This platform is a general-purpose data acquisition system that is used on several different Texas Instruments evaluation modules. The block diagram shown in Figure 2-3 illustrates the general platform outline. The core component of the USB DAQ platform is the TUSB3210.

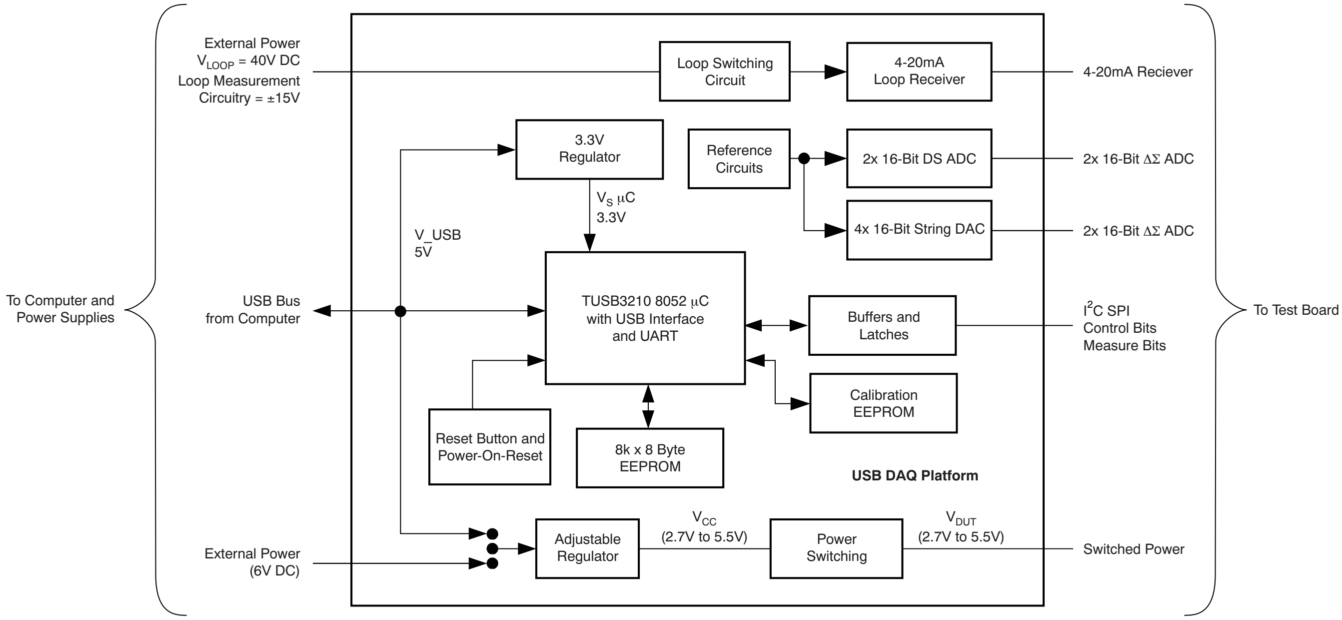

Figure 2-3. Theory of Operation For the USB DAQ Platform

Hardware Connections and Jumper Settings

Many of the components on the PGA308EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

3.1 Typical Hardware Connections

A typical PGA308EVM hardware setup connects the two EVM PCBs, then supplies power and connects an external shunt and load. The external connections may be the real-world system to which the PGA308 will be connected. Figure 3-1 shows the typical hardware connections.

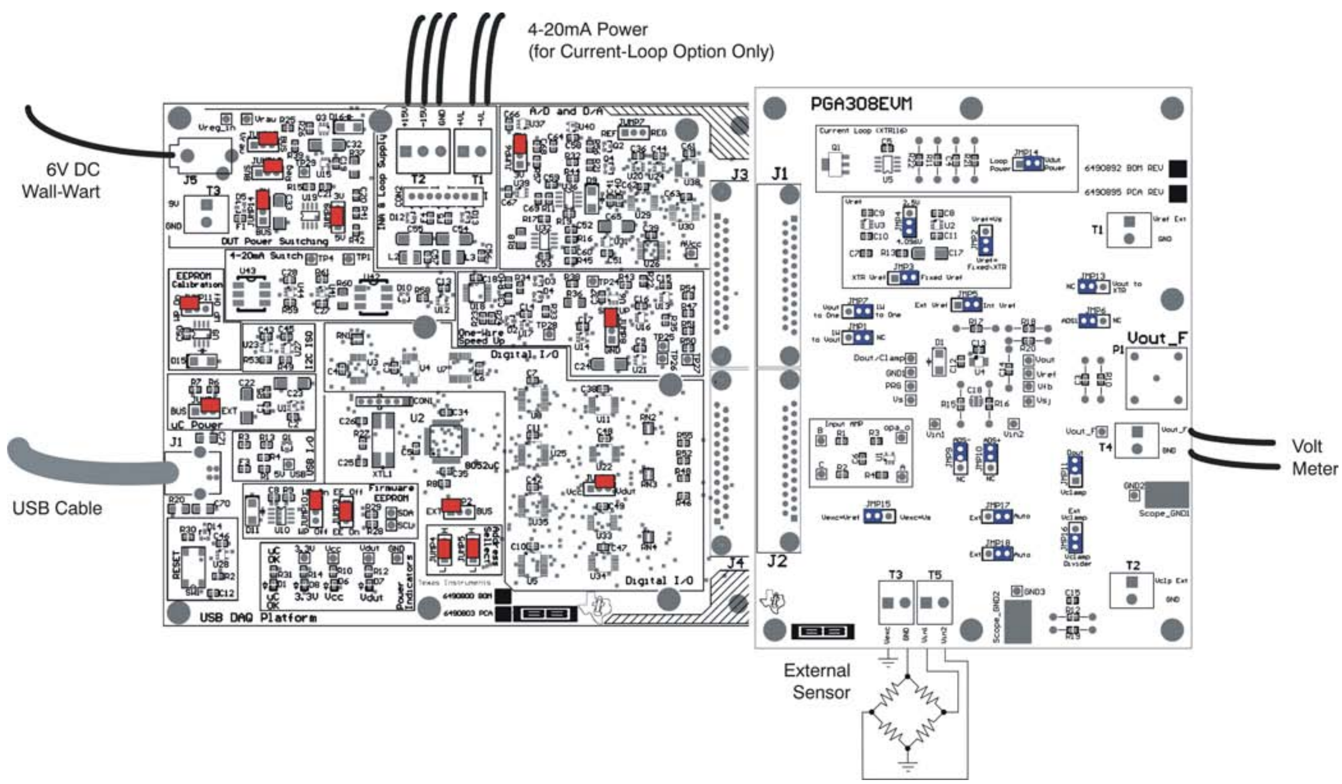

Figure 3-1. Typical Hardware Connections

3.2 Connecting the Hardware

The best way to connect the two PGA308EVM PCBs together is to gently push on both sides of the DSUB connectors, as shown in Figure 3-2. Make sure that the two connectors are completely socketed together; loose connections may cause intermittent EVM operation.

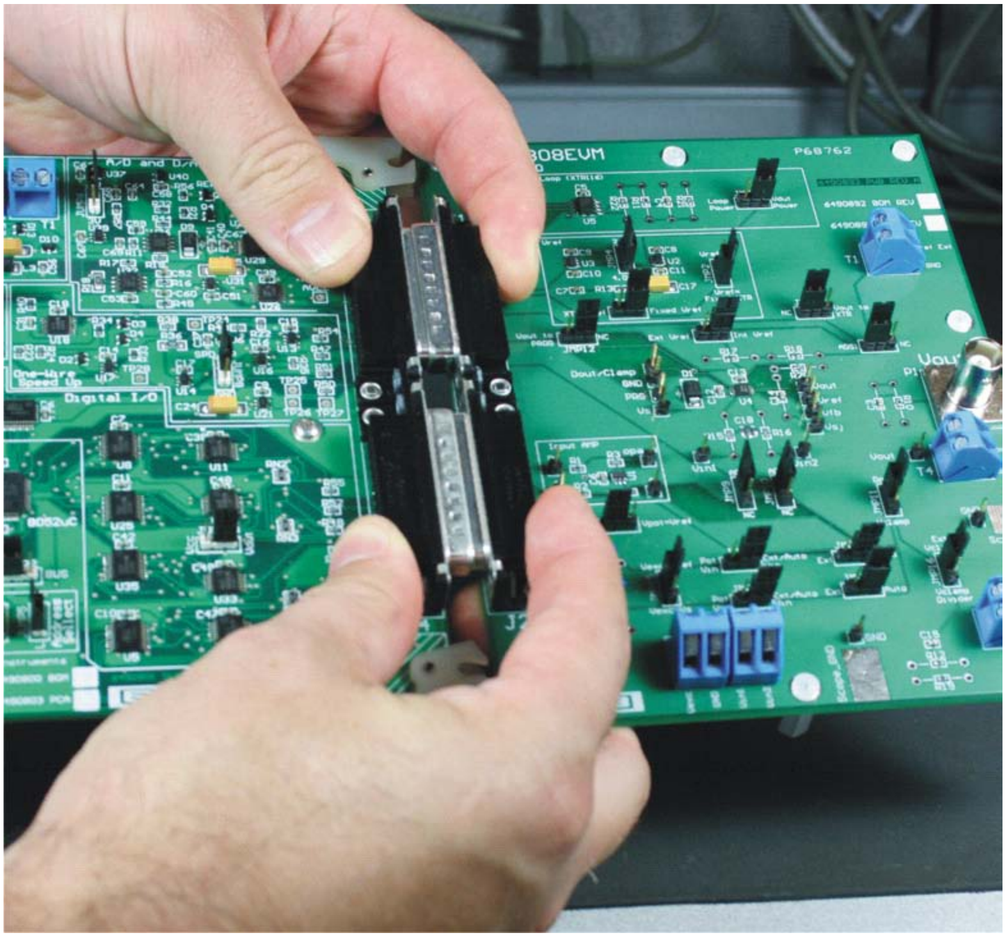

Figure 3-2. Connecting the Two EVM PCBs

3.3 Connecting Power

Connect the two PGA308EVM PCBs before connecting a power source, as shown in Figure 3-3. **Always connect power before connecting the USB cable.** If the USB cable is connected before the power is supplied, the computer will attempt to communicate with an unpowered device, and the device will not be able to respond.

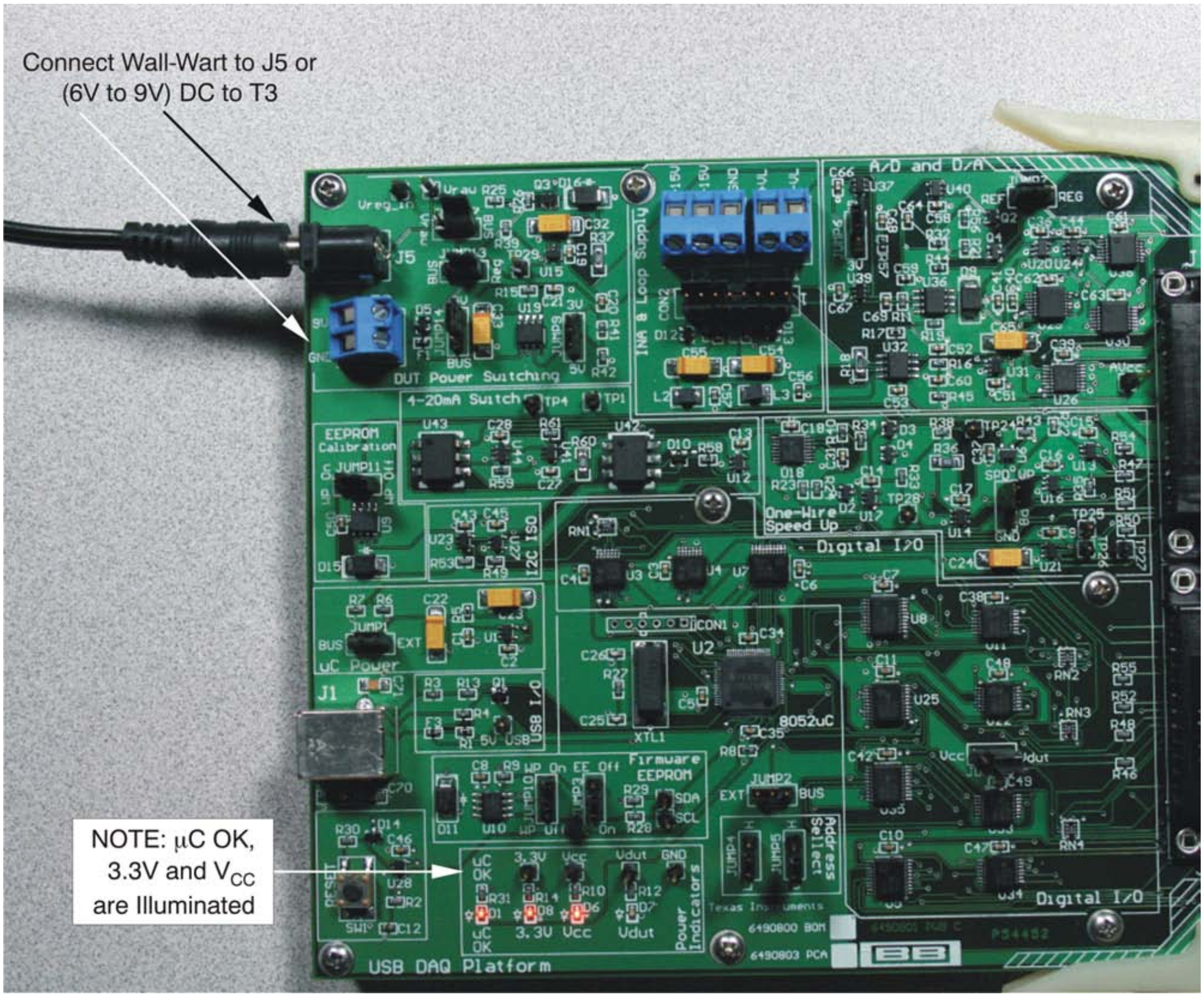

Figure 3-3. Connecting Power to the EVM

3.4 Connecting the USB Cable to the PGA308EVM

Figure 3-4 shows the typical response to connecting the USB DAQ platform to a PC USB port for the first time. Note that the EVM must be powered up before connecting the USB cable. Typically, the computer will respond with a *Found New Hardware, USB Device* pop-up. The pop-up typically changes to *Found New Hardware, USB Human Interface Device*. This pop-up indicates that the device is ready to be used. The USB DAQ platform uses the Human Interface Device Drivers that are part of the Microsoft Windows operating system. In some cases, the *Windows Add Hardware Wizard* will pop-up. If this prompt occurs, allow the system device manager to install the Human Interface Drivers by clicking *Yes* when requested to install drivers.

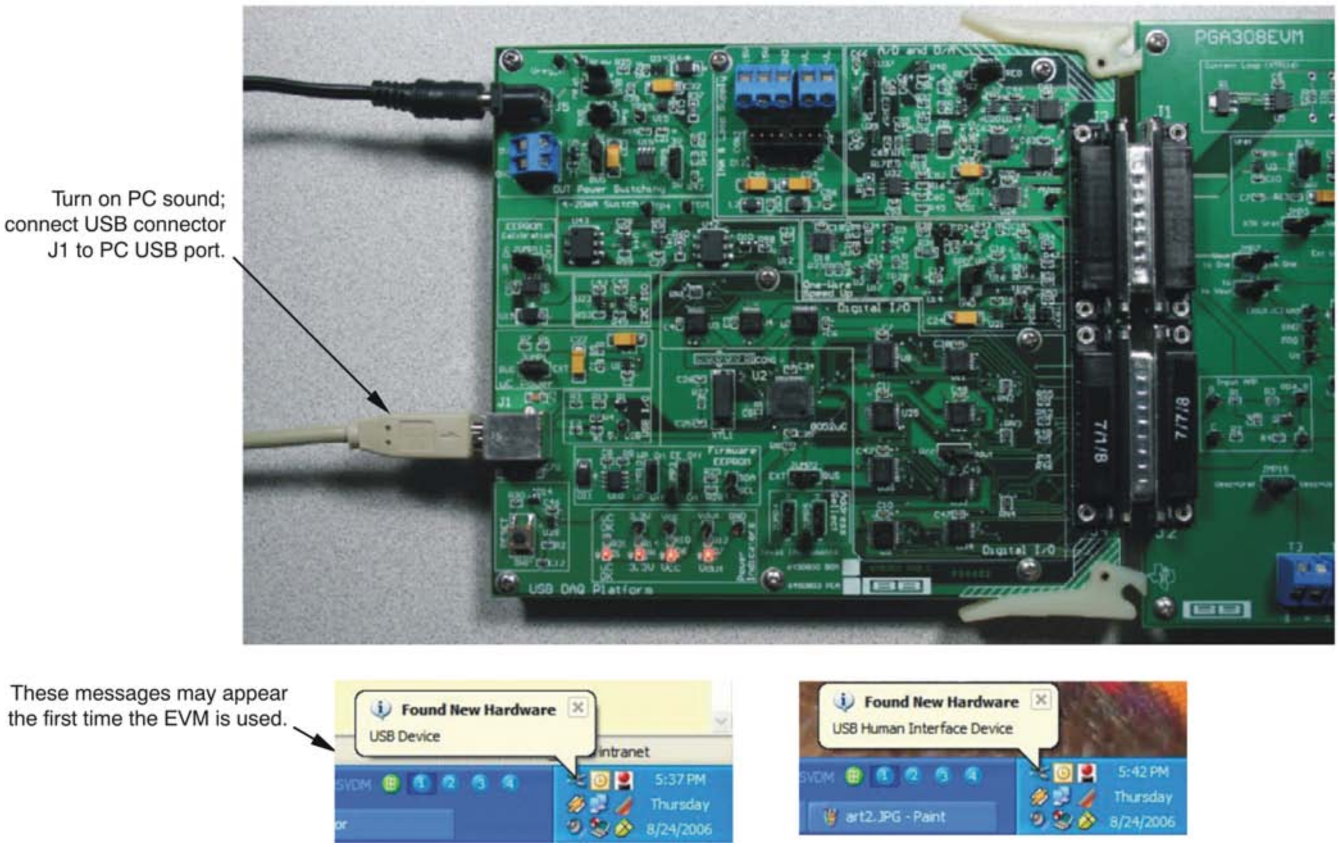

Figure 3-4. Connecting the USB Cable

3.5 Jumper Settings

Figure 3-5 shows the default jumper configuration for the PGA308EVM. In general, the jumper settings of the USB DAQ platform do not need to be changed. However, you may want to change some of the jumpers on the PGA308 test board to match your specific device configuration (for example, to change the reference configuration).

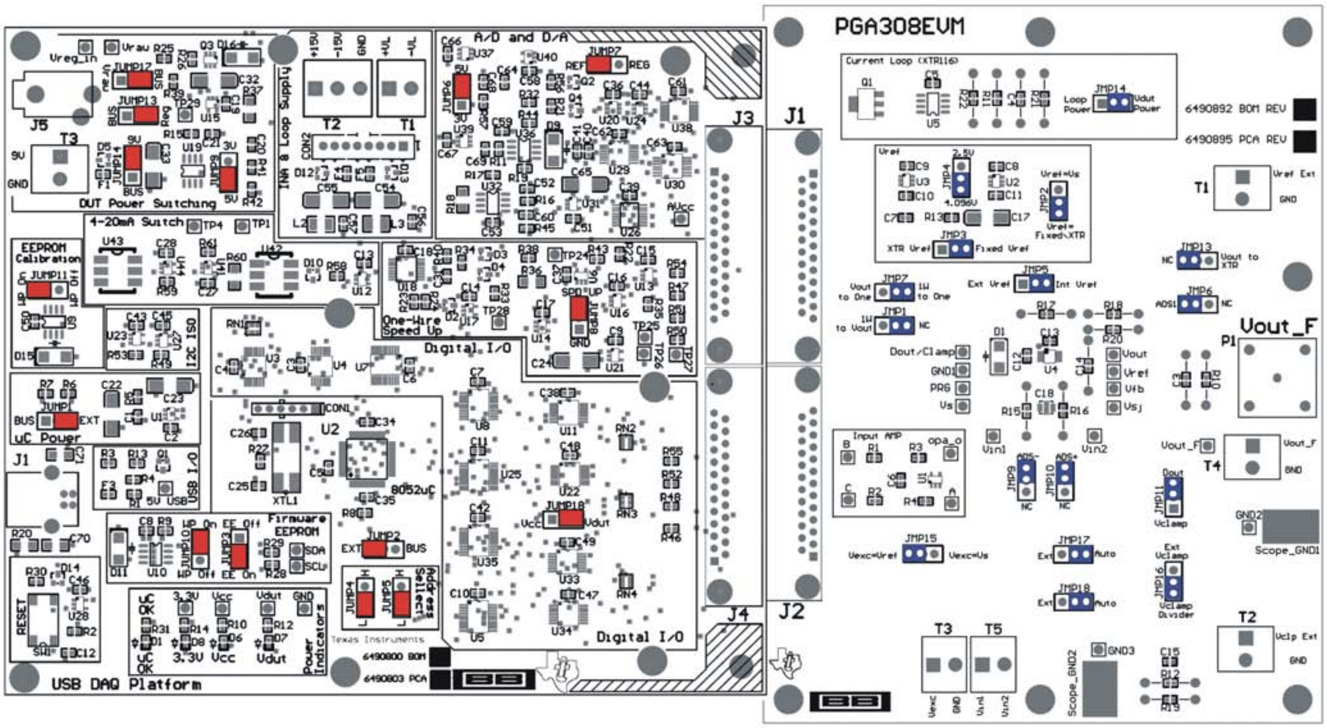

Figure 3-5. Default Jumper Settings

Table 3-1 explains the function of the jumpers on the PGA308 test board.

Table 3-1. PGA308 Test Board Jumper Function

Jumper	Default	Purpose
JMP2	V_{REF} = Fixed/XTR	Select ratiometric or absolute sensor configuration
JMP3	Fixed V_{REF}	Fixed references on the EVM or XTR reference
JMP4	4.096V	*4.096V* or *2.5V* allows selection between the two fixed references on the EVM.
JMP5	Internal V_{REF}	Internal references or external references. (Note: internal references are references on the EVM. The PGA308 does not have a reference inside the device.)
JMP6	ADS1	*ADS1* or *NC* allows you to connect or disconnect the ADC on the USB DAQ platform to the PGA308 output.
JMP17	Auto	*Auto* or *EXT* allows connection of an external sensor or the onboard sensor emulator signal source. The sensor emulator is useful tool during initial development; i.e. learn how the device works before connecting the real sensor.
JMP18	Auto	*Auto* or *EXT* allows connection of an external sensor or the onboard sensor emulator signal source. The sensor emulator is a useful tool during initial development; i.e. learn how the device works before connecting the real sensor.
JMP9	ADS–	*ADS–* or *NC* allows you to connect or disconnect the ADC on the USB DAQ platform to the PGA308 input. Note that the ADC has a switched capacitor input, so it can affect the input signal. It is recommended that ADCs be disconnected when using a real-world sensor.
JMP10	ADS+	*ADS+* or *NC* allows you to connect or disconnect the ADC on the USB DAQ platform to the PGA308 input. Note that the ADC has a switched capacitor input, so it can affect the input signal. It is recommended that ADCs be disconnected when using a real-world sensor.
JMP13	NC	*V_{OUT} to XTR* or *NC*. Allows connection of the current-loop transmitter (XTR). In the *NC* position, the EVM output if voltage only. In the *V_{OUT} to XTR* position, the output is 4mA to 20mA.
JMP1	NC	*V_{OUT} to 1W* or *NC*. In the *V_{OUT} to 1W* position, the communication line (1W) to the analog output (V_{OUT}). This configuration is called a three-wire module because it only requires V_S, V_{OUT}, and GND outputs.
JMP7	One to 1W	*One to V_{OUT}* or *One to 1W*. In the *One to V_{OUT}* position, the communication line (1W) to the analog output (V_{OUT}). This configuration is called a three-wire module because it only requires V_S, V_{OUT}, and GND outputs. In the *One to 1W* position, the communication line is separate from V_{OUT}.
JMP15	V_{EXC} = V_{REF}	*V_{EXC} = V_{REF}* or *V_{EXC} = V_S* allows choice of either the power supply (such as ratiometric) or the reference to excite the sensor (that is, absolute mode).
JMP11	Dout	*D_{OUT}* or *V_{CLAMP}* allows choice between a digital output or a clamp input.
JMP16	V_{CLAMP} Divider	*V_{CLAMP} divider* or *Ext V_{CLAMP}*

Table 3-2 summarizes the function of the USB DAQ platform jumpers. For most applications, the default jumper position should be used. A separate document (SBOU056) gives details regarding the operation and design of the USB DAQ platform.

Table 3-2. USB DAQ Platform Jumper Settings (5V Power Supply)

Jumper	Default	Purpose
JUMP17	BUS	*BUS* or V_{RAW}. *BUS* is the safe mode. The V_{RAW} option is only used for special test modes. In the V_{RAW} position it is possible to damage the USB DAQ platform with voltages above 5.5V.
JUMP13	REG	*REG* or *BUS*. In the *REG* position the regulator provides V_{DUT} power.
JUMP14	9V	*9V* or *BUS*. In the *9V* position an external power supply provides power to the EVM. In the *BUS* position the USB bus powers the EVM.
JUMP9	5V	*5V* or *3V*. In the *5V* position a variable regulator is resister programmed to 5V. In the *3V* position a variable regulator is resistor programmed to 3V.
JUMP6	5V	*5V* or *3V*. In the *5V* position, a stacked 5V reference is connected to the ADCs and DACs on the USB DAQ platform. In the *3V* position, a 3V reference is connected to the ADCs and DACs on the USB DAQ platform.
JUMP7	Ref	*Ref* or *Reg*. In the *Ref* position, a calibrated reference is connected to the USB DAQ platform ADC and DAC. In the *Reg* position, the regulator output (such as a power-supply voltage) is connected to the USB DAQ platform ADC and DAC.
JUMP1	EXT	*EXT* or *BUS*. In the external position the USB DAQ platform receives power from an external dc power source (such as through J5 or T3). The *BUS* position allows for the USB bus to power the EVM. External mode is recommended.
JUMP11	WP_ON	*WP_ON* or *WP_OFF*. In the *WP_ON* position, the calibration EEPROM is write protected. In the *WP_OFF* position, the calibration EEPROM is not write protected.
JUMP8	SPD_UP	*SPD_UP* or *GND*. In the *SPD_UP* position, the one-wire signal has a boost on the rising edge to allow for transmission over long cables. In the *GND* position, the speed-up feature is turned off.
JUMP10	WP_ON	*WP_ON* or *WP_OFF*. In the *WP_ON* position, the firmware EEPROM is write protected. In the *WP_OFF* position, the firmware EEPROM is not write protected.
JUMP3	EE ON	*EE ON* or *EE OFF*. In the *EE ON* position, the firmware EEPROM is connected to the microcontroller for normal operation. In the *EE OFF* position, the firmware EEPROM is disconnected to the microcontroller; this mode is used to program the EEPROM.
JUMP2	EXT	*EXT* or *BUS*. In the external position the USB DAQ platform receives power from an external dc power source (such as through J5 or T3). The *BUS* position allows for the USB bus to power the EVM. External mode is recommended.
JUMP18	V_{DUT}	V_{CC} or V_{DUT}. In the V_{DUT} position, the digital output pull-up resistors are connected to V_{CC}. In the V_{CC} position, the digital output pull-up resistors are connected to V_{CC}.
JUMP4	L	*L* or *H*. This jumper sets the USB DAQ platform USB address.
JUMP5	L	*L* or *H*. This jumper sets the USB DAQ platform USB address.

PGA308 Software Overview

This section explains how to install and use the PGA308 software.

4.1 Operating Systems for the PGA308 Software

The PGA308 software has been tested on Windows XP with United States and European regional settings. The software should also function on other Windows operating systems, including Windows Vista. Please report any compatibility issues to precisionamps@list.ti.com.

4.2 PGA308EVM Software Install

Install the PGA308EVM software by following these steps:

1. Software can be downloaded from the PGA308EVM web page, or from the disk included with the PGA308EVM, which contains a folder called *Install_software/*.
2. Find the file called *setup.exe*. Double-click the file to start the installation process.
3. Follow the on-screen prompts to install the software.
4. To remove the application, use the Windows Control Panel utility, **Add/Remove Software**.
5. The PGA308 Quickstart Video (included on the CD), or available at www.ti.com, gives more details regarding the initialization of the software.

4.3 Starting the PGA308EVM Software

Use the Windows Start menu to start the PGA308 software. From Start, select All Programs, then select the PGA308EVM program. Figure 4-1 shows the software display if the EVM is functioning properly.

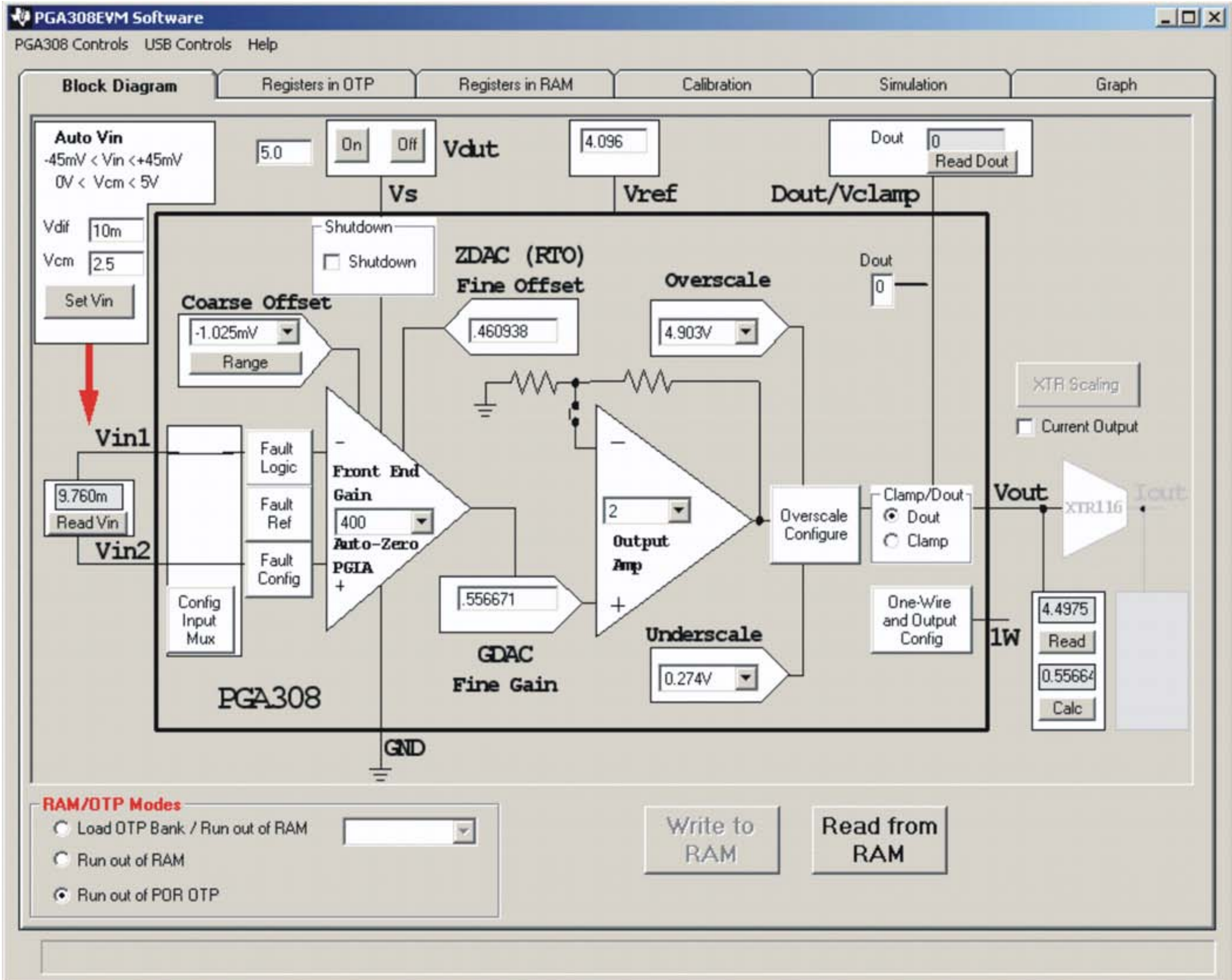

Figure 4-1. PGA308EVM Software—Functioning Properly

Figure 4-2 shows an error that appears if the computer cannot communicate with the EVM. If this error occurs, check to see that the USB cable is connected. This error can also happen if the USB cable is connected before connecting the USB DAQ platform 9V power supply. Another possible reason for this error message is a problem with the USB human interface device driver of the computer. Make sure that the computer recognizes the device when the USB cable is plugged in. If the sound is on, you will hear the distinctive sound that you expect when a USB device is properly connected to a PC with the Windows operating system.

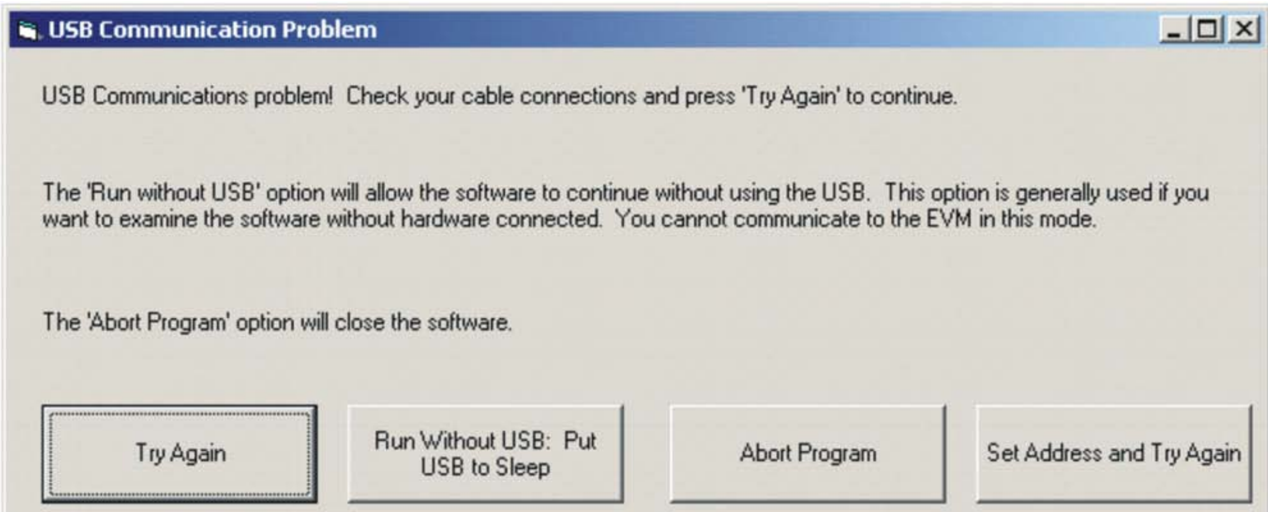

Figure 4-2. PGA308EVM Software—No Communication with the USB DAQ Platform

Figure 4-3 shows an error that will occur if the PGA308 test board is not communicating with the USB DAQ platform. If you get this error, check the connectors between the two boards; make sure the two 25-pin DSUB connectors are completely pushed together. Another possible cause for this error is it that the PGA308 test board jumpers are set in the wrong positions.

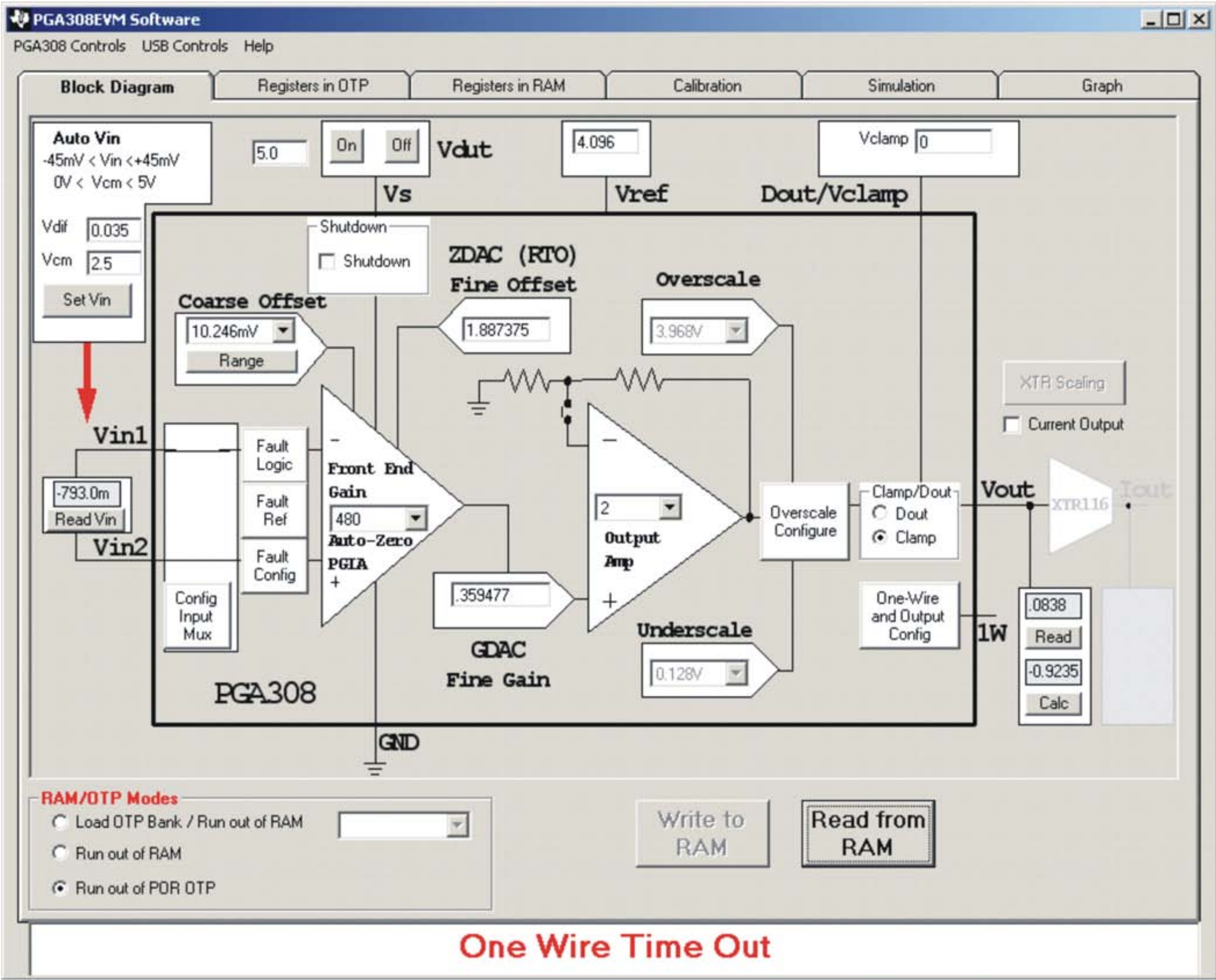

Figure 4-3. PGA308EVM Software—No Communication from USB DAQ Platform to PGA308

4.4 Using the PGA308 Software

The PGA308EVM software has six different tabs that allow you to access different features of the PGA308. Each of these tabs are intended to have an intuitive graphical interface that allows users to develop a better understanding of the PGA308.

4.4.1 Block Diagram

This tab provides full control of the PGA308. It has the following features:

- Allow control of gains, offsets, overscale limits, and clamps
- Measure V_{OUT}, I_{OUT}, V_{IN}, and D_{OUT}
- Control Automatic V_{IN} voltage (sensor emulator signal generated on the USB DAQ EVM)
- Turn on and off the power supply; select reference voltage

4.4.2 Registers in OTP

This tab allows you to read and write to the OTP registers on the PGA308:

- Select and copy RAM to seven banks of user OTP
- Write to final test OTP

4.4.3 Registers in RAM

This tab has the following controls:

- Ability to read from/write to each register
- Detailed help for each register

4.4.4 Calibration

This tab has the following controls:

- Calibrate an external sensor input or sensor emulator input
- Calibrate voltage out or 4mA to 20mA out
- Verify post calibration accuracy (expect 0.1% or better)

4.4.5 Simulation

This tab allows you to do the following tasks:

- Simulation of all the PGA308, including internal nodes
- Common-mode and differential voltages are adjustable
- This feature is useful in checking for design margin

4.4.6 Graph

This tab allows users to:

- Graph voltage output or current output versus time
- Adjust input with sensor emulator or use external sensor

4.5 EVM Pull-Down Menus

4.5.1 PGA308 Controls

The PGA308 configuration (such as register settings) can be saved or loaded using the EVM Controls pull-down menu, as shown in Figure 4-4. The file that the configuration is saved into is a simple text file and can be viewed with any text editor.

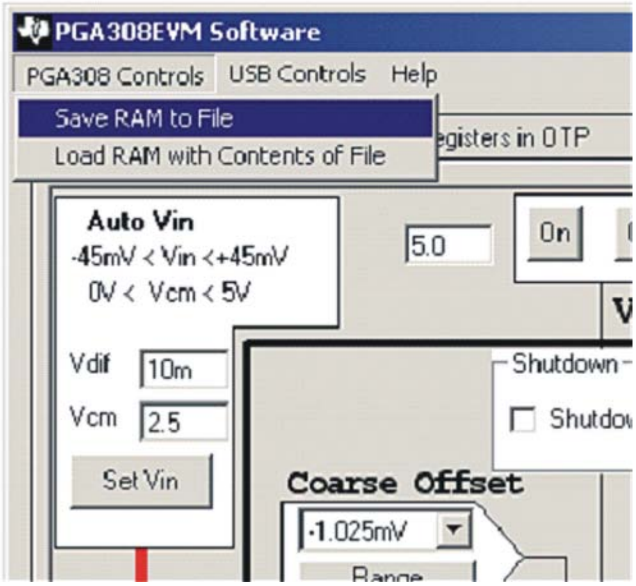

Figure 4-4. PGA309 Controls

4.5.2 USB Controls

The USB Controls feature allows for direct control of communication on the USB DAQ Platform. For example, direct One-Wire, DAC, and ADC control are possible through this feature. Figure 4-5 illustrates the USB controls..

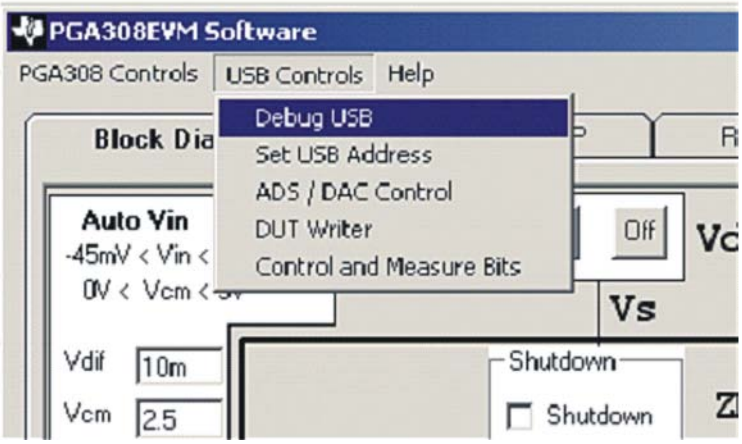

Figure 4-5. USB Controls

4.5.3 Help

The About feature can be used to check the current revision. This document is based on revision 1.2.17, as shown in Figure 4-6.

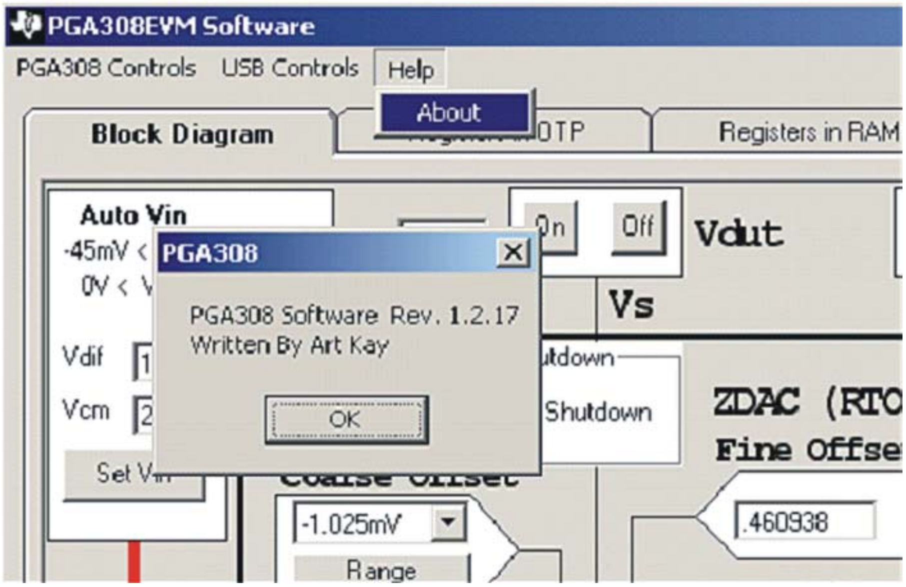

Figure 4-6. Current Revision of Software

Bill of Materials

A.1 Resistors and Capacitors

Qty	Value	Ref Des	Description	Vendor	Part Number
1	4.7µF	C17	Capacitor Tantalum 4.7µF 25V 10% SMD 6032-28 (EIA)	Kemet	T491C475K025AT
10	0.1µF	C6–C15	Capacitor 0.10µF 25V CERAMIC Y5V 0603	Kemet	CC0603ZRY5V8BB104
2	10nF	C3, C5	Capacitor 10000pF 50V CERAMIC X7R 0603	Kemet	C0603C103K5RACTU
1	0.02µF	C4	Capacitor 0.022µF 50V CERAMIC X7R 0603	Kemet	C0603C223K5RACTU
1	1000pF	C18	Capacitor 1000pF, Ceramic Multilayer, X2Y, 1206	JOHANSON DIELECTRICS	501R18W102KV4E
2	100kΩ	R1, R2	Resistor 100kΩ 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1003V
2	1kΩ	R3, R4	Resistor 1kΩ 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-071KL
4	10kΩ	R10–R12, R23	Resistor 10kΩ 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-0710KL
1	100Ω	R20	Resistor 100Ω 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-07100RL
1	191kΩ	R22	Resistor 191kΩ 1/10W 1% 0603 SMD	Yageo Corporation	ERJ-3EKF1913V
1	33Ω	R13	Resistor 33Ω 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-0733RL
1	11.3kΩ	R21	Resistor 11.3kΩ 1/10W 1% 0603 SMD	Yageo Corporation	ERJ-3EKF1132V
2	39.2kΩ	R15, R16	Resistor 39.2kΩ 1/10W 1% 0603 SMD	Yageo Corporation	RC0603FR-0739K2L
1	6.04kΩ	R19	Resistor 6.04kΩ 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF6041V
Omit	Omit	R17, R18	Omit	—	—

A.2 Active Devices and Miscellaneous

Qty	Value	Ref Des	Description	Vendor	Part Number
1	BNC	P1	CONN JACK BNC VERT 50Ω PCB	Tyco Electronics/Amp	5227699-1
1	OPA333AIDBVT	U1	IC OP AMP 1.8V 0-DRIFT SOT23-5	Texas Instruments	OPA333AIDBVT
1	REF3240	U2	IC LDO VOLT REF 4.096V SOT23-6	Texas Instruments	REF3240AIDBVT
1	REF3225	U3	IC LDO VOLT REF 2.5V SOT23-6	Texas Instruments	REF3225AIDBVT
1	XTR116	U5	IC 4 TO 20mA TRANSMITTER 8-SOIC	Texas Instruments	XTR116UA
1	6.8V Transorb	D1	TVS ZENER UNIDIR 600W 6.8V SMB	ON Semiconductor	P6SMB6.8AT3
1	NPN	Q1	IC TRANS NPN SS GP 1.5A SOT223-4	Fairchild Semiconductor	BCP55
5	ED300/2	T1–T5	2-position terminal strip, cage clamp, 45°, 15A, dove-tailed	On-Shore Technology Inc	ED300/2
16	HEADER STRIP	JMP1–JMP7, JMP9–JMP11, JMP13–JMP18	CONN HEADER 0.100 SNGL STR 36POS	3M/ESD	929647-09-36-I
16	SHUNT LP W/HANDLE 2 POS 30AU	Jumpers for JMP1–JMP7, JMP9–JMP11, JMP13–JMP18	Jumper shorting units	Tyco Electronics/Amp	881545-2
6	Standoffs	NA	Standoffs, Hex , 4–40 threaded, 0.500" length, 0.250" OD, aluminum iridite finish	Keystone	2203
6	Screws	NA	Machine screw, 4–40×3/8" Phillips PanHead, steel, zinc plated	Building Fasteners	PMS 440 0038 PH

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 0V to 5.5V and the output voltage range of 0V to 5.5V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than +25°C. The EVM is designed to operate properly with certain components above +125°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265