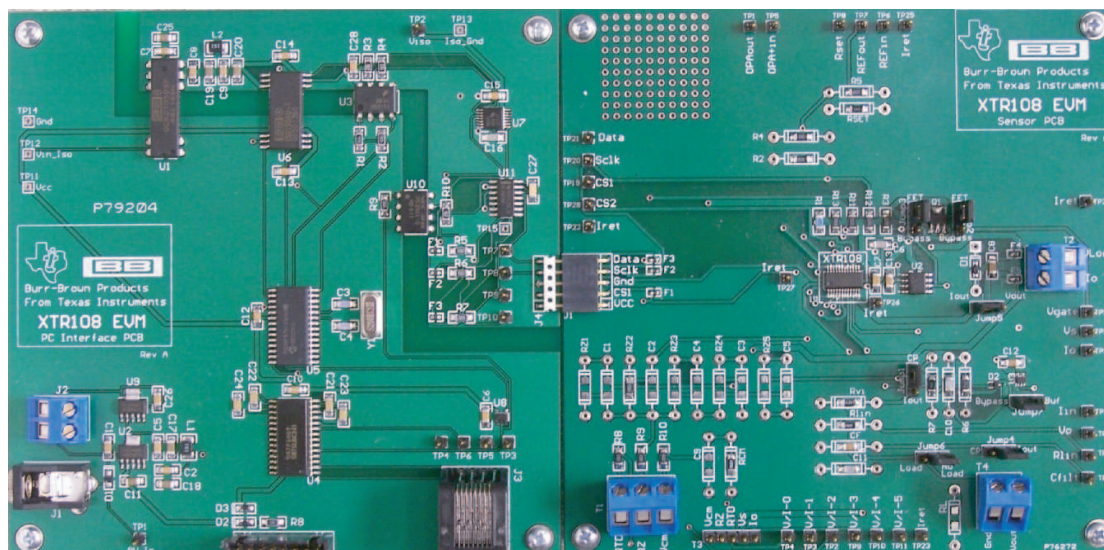


XTR108EVM - Designer's Kit for XTR108



Complete evaluation tool for the XTR108:

- XTR108 hardware Designer's Kit
 - Evaluate XTR108 and User's RTD
 - Fully configurable
- Software control for Designer's Kit:
 - Program XTR108 for evaluation
 - Program XTR108 and User's RTD in final module
 - Calibrate most types of RTDs over wide temperature ranges
 - Software tool helps to select resistor values

Contents

1	Introduction	2
2	Description.....	3
3	XTR108 Sensor Interface Board Overview	4
4	XTR108 PC Interface Board Overview	6
5	Initial Setup and Check-Out.....	7
6	Software Overview	17
7	General Operating Tips	24
8	XTR108EVM PC Cable Drawing.....	34
9	Schematics.....	34

Windows is a trademark of Microsoft Corporation.
SPI is a trademark of Motorola, Inc.
All trademarks are the property of their respective owners.

List of Figures

1	XTR108EVM Typical System Set-up	4
2	XTR108EVM Sensor Interface Board Filter Configuration	5
3	Pin Socket Mechanical Description	6
4	XTR108EVM Sensor Interface Board—Factory Jumper Settings.....	7
5	Hardware Setup - Initial Checkout.....	8
6	XTR108EVM Board Control Software Start-up	9
7	Software Start-up—Main Window and Initial Program View	10
8	Software Start-up: Wrong COM Port	11
9	Software Start-up: General Communication Problem	12
10	COM Port Pop-up Dialog Window	13
11	Load Setup Pop-up Dialog	14
12	Main Window (with XTR108_DK_Test.txt file open).....	15
13	Resistor for 20mA Output	16
14	Resistor for 4mA Output	16
15	XTR108EVM Board Control Software: Summary Tab	17
16	XTR108EVM Board Control Software: Find Resistors Tab.....	18
17	XTR108EVM Board Control Software: Calibration Tab	19
18	XTR108EVM Board Control Software: Registers 1, 3, 4, 5 Tab	20
19	XTR108EVM Board Control Software: Registers 6, 7, 8, 9 Tab	21
20	XTR108EVM Board Control Software: Registers 10, 11, 12, 13, 14, 15 Tab	22
21	XTR108EVM Board Control Software: Calc CRC Box Checked	23
22	Noise on DCR010505 DC-to-DC Converter	24
23	Discrete Charge Pump on Sensor Interface Board.....	25
24	XTR108EVM Board Software: Run-Time Error	26
25	Control Panel Selection	27
26	Windows Control Panel	27
27	Regional and Language Options Window	28
28	Regional and Language Options: Advanced Tab View	28
29	Regional and Language Options, Advanced Tab: Language for Non-Unicode Programs Dialog	29
30	Restart PC Dialog	30
31	Regional and Language Options Window: Regional Options Tab.....	30
32	Regional and Language Options Window, Regional Options Tab: Customize Regional Options Dialog	31
33	Regional and Language Options Window, Regional Options Tab, Customize Regional Options Dialog: Decimal Symbol Selected	32
34	Regional and Language Options Window after Customized Regional Options are Selected	32
35	Windows Control Panel	33
36	XTR108EVM Cables.....	34
37	XTR108EVM PCI Interface Board	35
38	XTR108EVM Sensor Interface Board	36

1 Introduction

The XTR108EVM demonstration board was designed to provide an evaluation and test environment for the XTR108 4-20mA two-wire transmitter. This document provides the information needed to set up and operate the XTR108 evaluation module (EVM). For a more detailed description of the [XTR108](#), please refer to the product datasheet available from the Texas Instruments web site at <http://www.ti.com>. Additional support documents are listed in the [XTR108EVM Parts List](#) section of this guide. Throughout this document, the acronym *EVM* and the phrases *evaluation module* and *demonstration board* are synonymous with the XTR108EVM. This user's guide includes setup and configuration instructions, information regarding operating procedures and input/output connections, an electrical schematic, printed circuit board (PCB) layout drawings, and a parts list for the demonstration board.

1.1 XTR108EVM Parts List (XTR108EVM-US and XTR108EVM-EU)

The following documentation and devices provide information regarding Texas Instruments' integrated circuits used in the assembly of the XTR108EVM. Information regarding these items is available through the TI web site at <http://www.ti.com>.

Device

XTR108 PC Interface Board

XTR108 Sensor Interface Board

PC Cable (8-position RJ45 plug to 9-position female DB9)

Document

Literature Number

XTR108EVM Software CDROM (Rev 1.0.5 or newer)

[XTR108DK](#)

XTR108 Designer's Kit Board Control Software

[SBOC026](#)

XTR108 Designer's Kit Source Code

[SBOC071](#)

XTR108EVM User's Manual

[SBOU014](#)

XTR108 Quick Start System Reference Guide

[SBOA106](#)

XTR108 Data Sheet

[SBOS187](#)

1.2 XTR108 Designer's Kit Board Control Software - Operating System Compatibility

The board control software runs on Microsoft Windows™ Win98, Win2000 and WinXP. Additionally, the regional PC settings should be set to *English (United States)*, with the decimal symbol set to a period (.). More information on issues related to changing regional settings is given in the [Regional Settings](#) section. Contact the factory for compatibility with other operating systems.

2 Description

The XTR108EVM key hardware consists of two boards (see [Figure 1](#)), the XTR108 Sensor Interface Board and the XTR108 PC Interface Board. The XTR108 Sensor Interface Board contains the XTR108, an external SOIC EEPROM, and several jumpers for ease of bridge sensor configuration. The XTR108 PC Interface Board contains an RS-232 serial interface, a PIC16F876 Microcontroller, a dc-to-dc converter, and optical isolation circuitry.

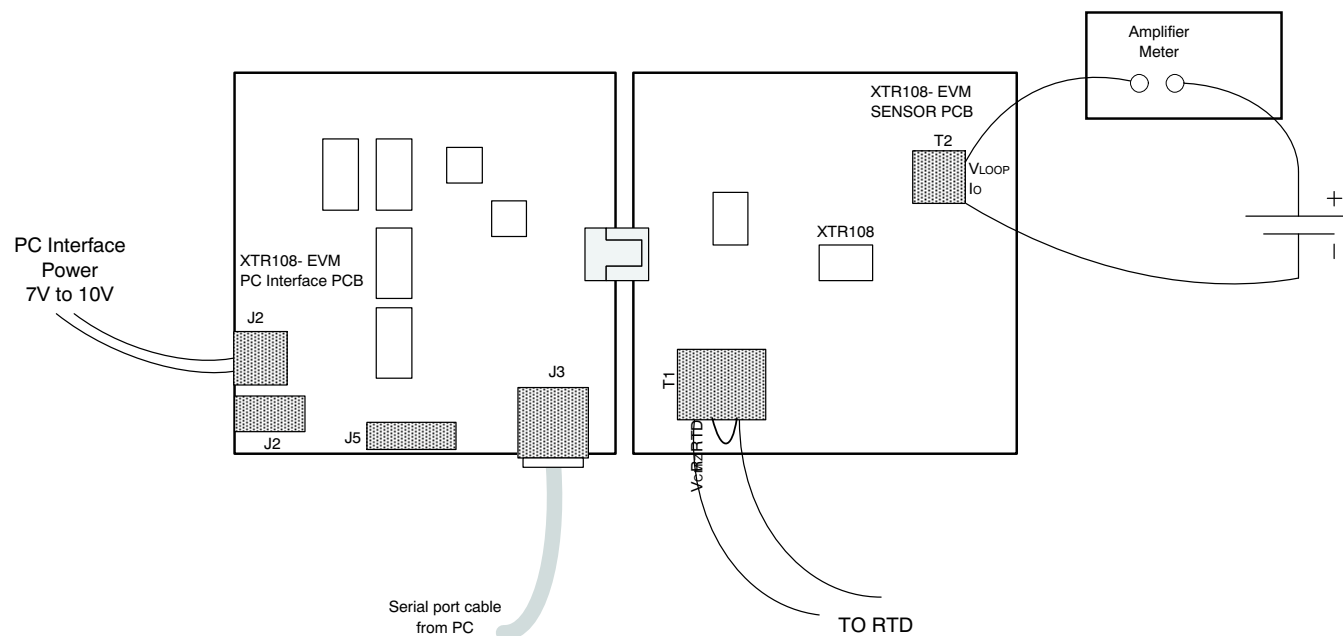


Figure 1. XTR108EVM Typical System Set-up

3 XTR108 Sensor Interface Board Overview

See the XTR108 Sensor Interface Board Schematic ([Figure 38](#)) for additional information.

3.1 Input/Output

The connections from the XTR108 Sensor Interface Board to the XTR108 PC Interface Board are provided through J1 on the sensor interface board, a five-position plug.

3.2 Jumper Configuration

JUMP1, JUMP2, JUMP3, JUMP4, JUMP5, JUMP6 and JUMP7 allow flexibility in the configuration of the connection to an RTD. Specifically, the jumpers can be used to place the XTR108 into voltage output mode or current output mode.

3.3 XTR108 and External SOIC-8 EEPROM

U1 is the XTR108 for evaluation. A 4k-bit, external, SOIC-8, industry-standard SPI™, EEPROM, U2 is also included on-board.

3.4 Protection and Filtering

The XTR108 Sensor Interface Board is configured with components to prevent mis-wiring mishaps. D1 is used to prevent damage from a reverse polarity connection. In some applications, it is desirable to bypass the FET transistor Q1, and apply power directly to the XTR108. In this case, it is important to be careful not to apply more than the 5V supply. Note that in the FET bypass mode of operation, the drop across the diode D1 becomes significant.

Input noise filtering of the zero resistor is provided by C1–C5. C9 is used to filter the noise developed on the common-mode resistor, and a capacitor can be connected directly across the RTD. See Figure 2.

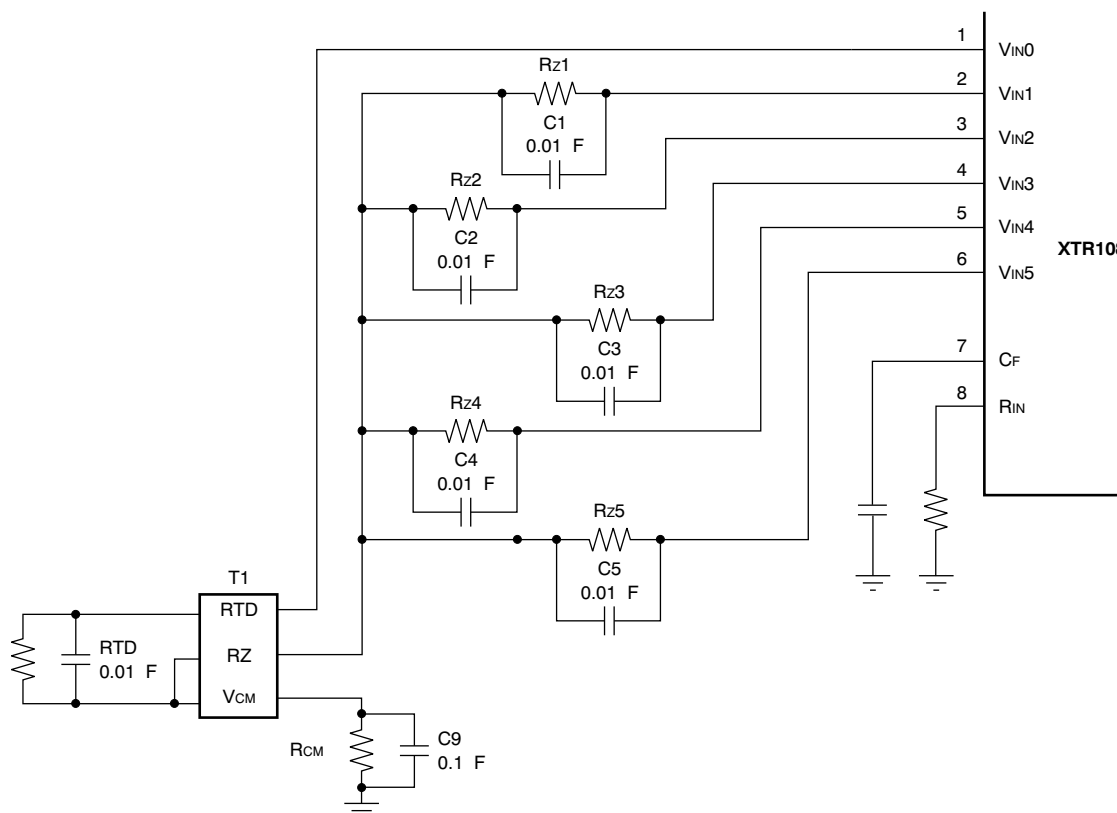


Figure 2. XTR108EVM Sensor Interface Board Filter Configuration

3.5 Test Points and Miscellaneous Breadboard Area

There are several test points, including several connections to I_{RET} . I_{RET} is common for most XTR108 applications, and is provided for ease of measuring analog signals. Reserved areas with plated-through, standard-spacing, 0.1in holes for miscellaneous proof-of-concept breadboarding as desired are provided for a given application. Most of the surface mount components have *pin sockets* associated with them. These pin sockets allow the replacement of a surface mount component with a through-hole component.

The pin sockets provide good contact with the leads of a component without solder, enabling quick reconfiguration of the board for many different XTR108 designs. See [Figure 3](#).

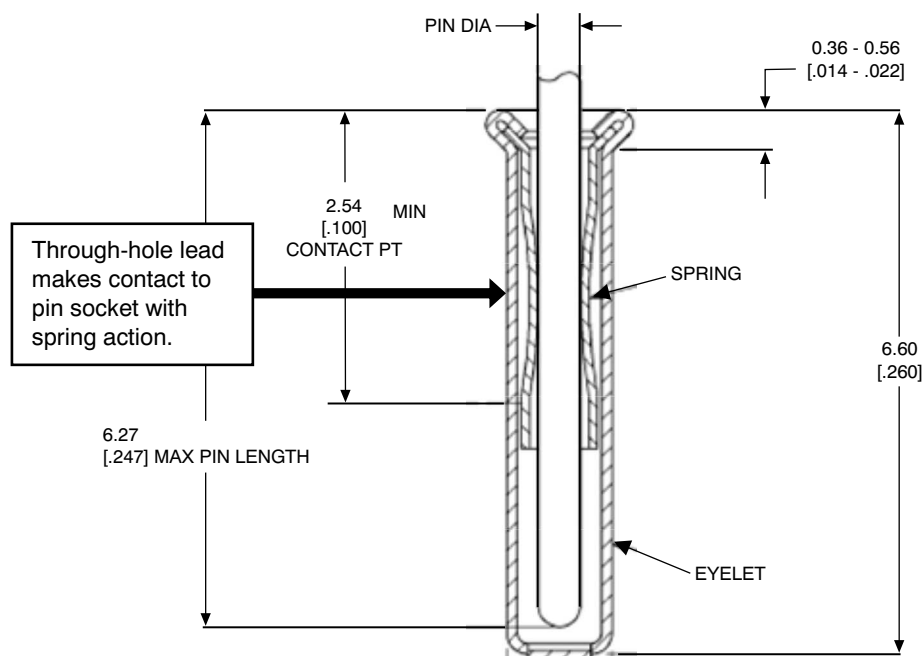


Figure 3. Pin Socket Mechanical Description

4 XTR108 PC Interface Board Overview

See the XTR108 PC Interface Board schematic ([Figure 37](#)) for additional information.

4.1 Input/Output

The connections from the XTR108 PC Interface Board to the XTR108 Sensor Interface Board are provided through J4 on the PC Interface Board.

4.2 RS-232 Interface and PIC16F876 Microcontroller

The PIC16F876 Microcontroller (U5) is used to perform the SPI communications with the XTR108. The PIC firmware is factory-programmed; however, this source code is downloadable from the web for the benefit of engineers who want to develop custom firmware. RS-232 communications are initiated via the serial port (RS-232) on the PC using Visual Basic software. The Visual Basic software source code is also downloadable from the web. As part of the serial port interface, an 75LBC241 (U4) is used to translate the RS-232 logic levels to 5V logic levels.

4.3 DC Power

DC power (7V to 10V) is applied to the XTR108 PC Interface Board through J2. Diode D1 is used to prevent inadvertent damage caused by a reverse polarity connection. Regulators U9 and U2 are used to convert the unregulated input power to a regulated 5V.

4.4 DC-to-DC Converter and Optical Isolation of Digital Signals

A DCR01050 dc-to-dc converter (U1) is used to convert the regulated 5V supply to an isolated regulated 5V supply. This isolated 5V supply provides power for all of the optical isolators U6, U3, AND U10. Optical isolation is used to allow the SPI signals to float to the ground reference of the XTR108 (I_{RET}). This configuration prevents possible grounding issues where the loop supply (V_{LOOP}) is not a floating supply.

One issue with the dc-to-dc converter is that it has a fairly noisy output voltage. The noise is generated by the switching action used to generate the isolated output voltage. If this noise is allowed to feed-through to the XTR108, it can significantly affect the device performance. To avoid this problem, the dc-to-dc converter is only turned on during communications to the XTR108. Normally the dc-to-dc converter is disabled and the digital I/O is disconnected using a 74HC4066 FET switch (U7). Note that the power for the FET switch and its associated optically isolated control signal is derived from the XTR108. This power supply design allows these circuits to function without the power from the dc-to-dc converter.

5 Initial Setup and Check-Out

5.1 XTR108 Sensor Interface Board – Factory Jumper Settings

Confirm and/or set the jumpers on the XTR108 Sensor Interface Board as shown in Figure 4. The desired jumper settings are also described in Table 1.

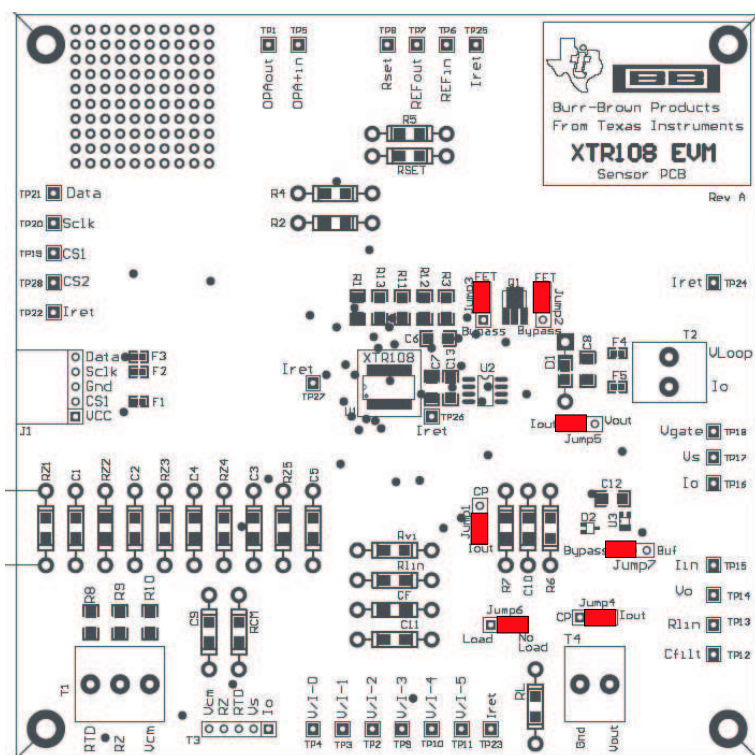


Figure 4. XTR108EVM Sensor Interface Board—Factory Jumper Settings

Table 1. XTR108 Sensor Interface Board—Factory Jumper Settings

Jumper	Position	Comments
JUMP1	I _{OUT}	Use Current Output mode
JUMP2	FET	Use FET subregulator
JUMP3	FET	Use FET subregulator
JUMP4	I _{OUT}	Use current output mode
JUMP5	I _{OUT}	Use current output mode
JUMP6	No load	Do not connect load to voltage output
JUMP7	Bypass	Bypass Voltage Mode Charge Pump

5.2 Hardware Set-up

For additional information, see [Figure 5](#). Connect the XTR108 Sensor Interface Board to the XTR108 PC Interface Board. On the XTR108 PC Interface Board, connect a $7V_{DC}$ ($7V_{DC}$ - $10V_{DC}$) Lab Supply. Connect the XTR108EVM PC Cable from P_{PC} (an RJ-45 jack) on the XTR108 PC Interface Board to an RS-232 serial port on the test computer.

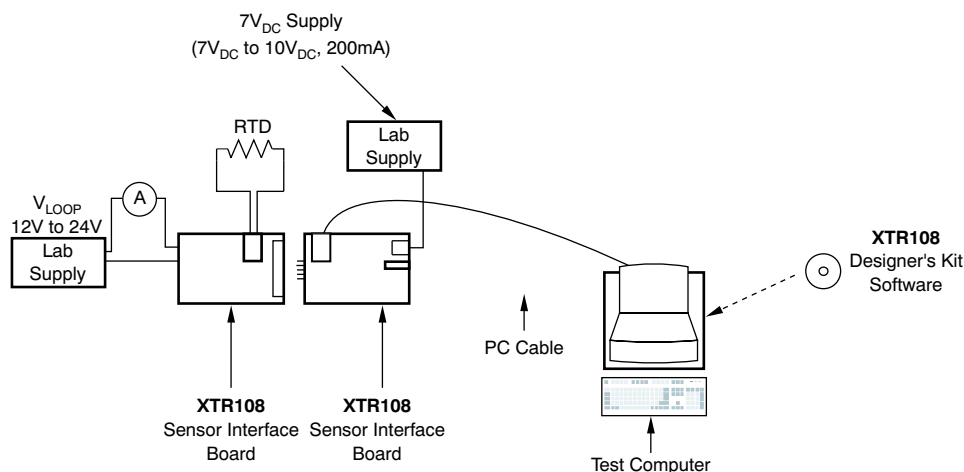


Figure 5. Hardware Setup - Initial Checkout

5.3 Board Control Software Installation

Install the EVM control software using this procedure:

- The XTR108EVM Board Control Software is installed in the normal Microsoft Windows manner. Close all other applications. From **Start** button on the Windows taskbar, select *Run*.
- In the Run dialog box, type: **d:\setup**, where *d* is the letter designating the CD-ROM drive on the PC that contains the XTR108EVM Software CD-ROM.
- Follow the on-screen prompts to install the software.
- To remove the XTR108EVM application, use the Windows Control Panel utility, *Add/Remove Software*.

5.4 Software Start-up

Start the XTR108EVM Board Control Software by clicking on the *XTR108 DK Board Interface* under **Start /All Programs/XTR108 Designer's Kit** as shown in Figure 6.

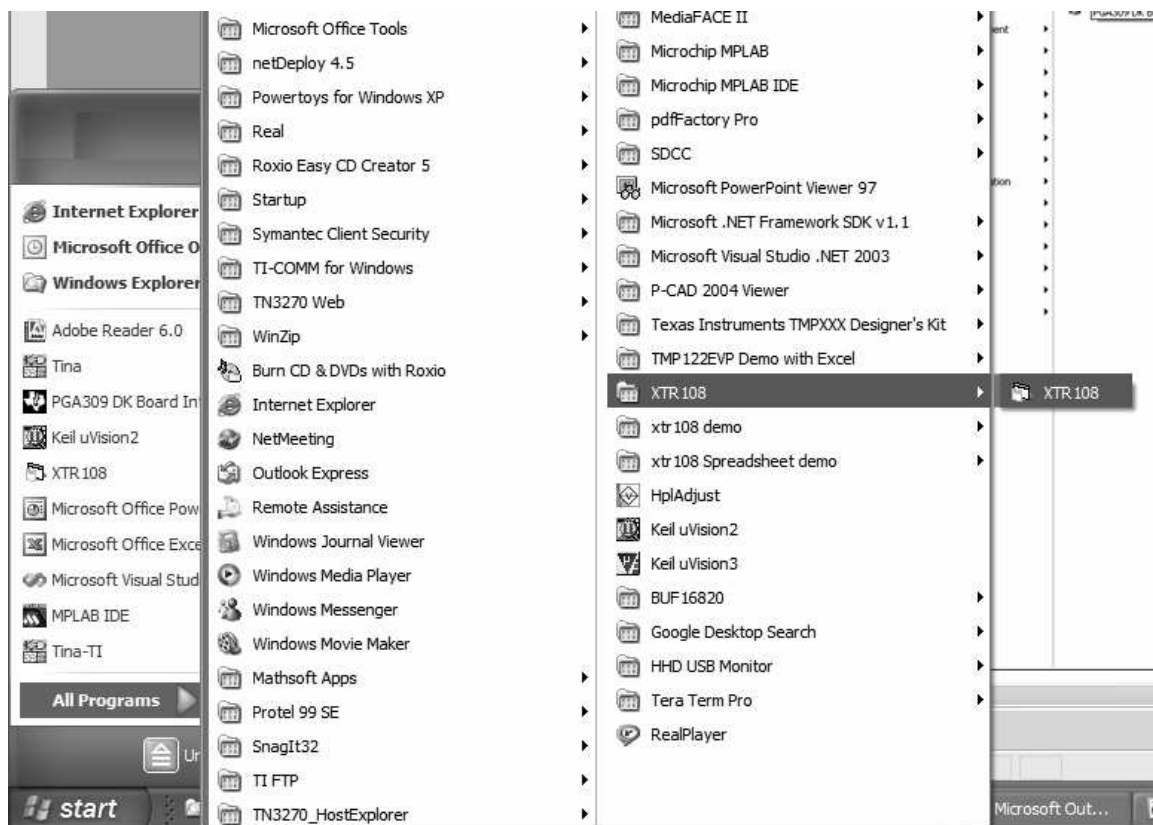


Figure 6. XTR108EVM Board Control Software Start-up

5.5 Default Software Board Communication Setup

On initial software startup, a main window appears with a smaller pop-up window in the middle of the main window. If the initial software start-up does not look like [Figure 7](#), then proceed directly to [Section 5.7](#).

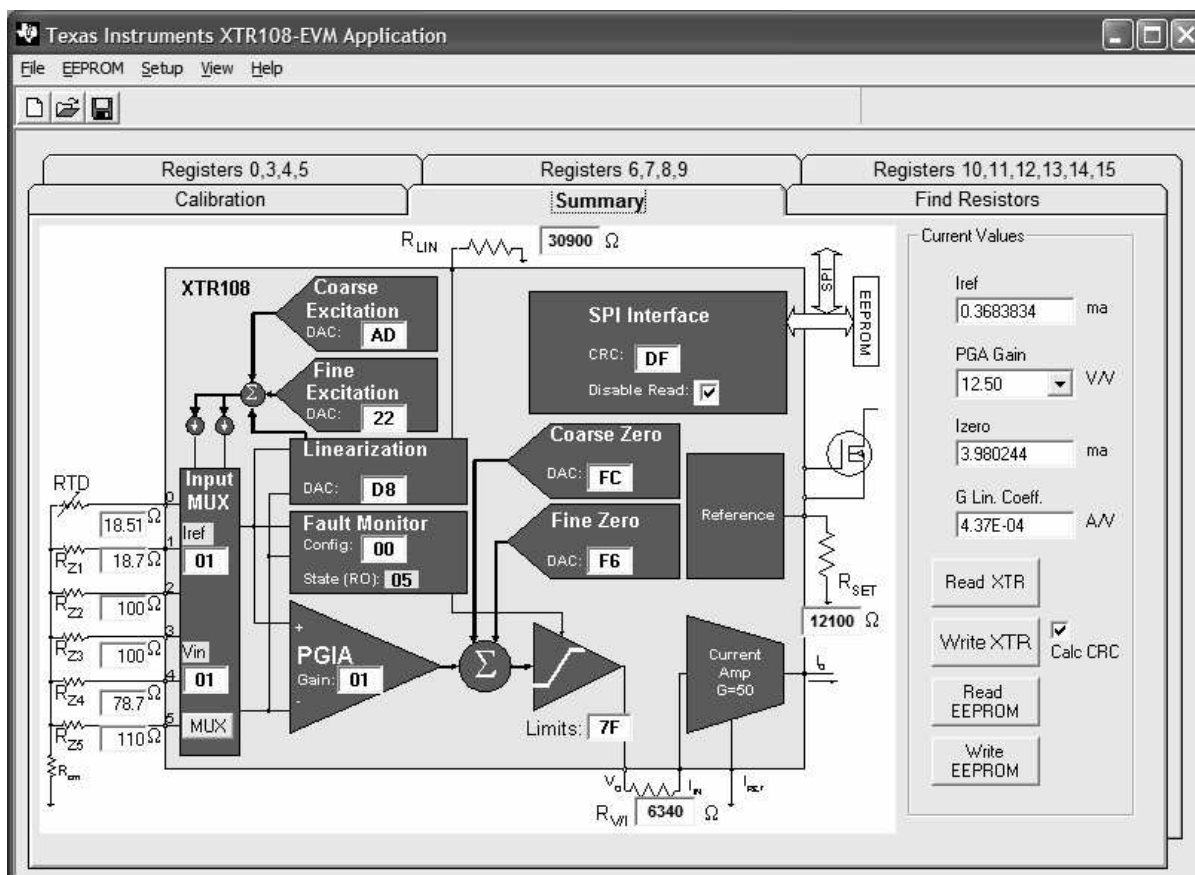


Figure 7. Software Start-up—Main Window and Initial Program View

5.6 Software Board Communication Setup – Manual COM Port Setup

On initial software startup, if the correct COM port on the PC is not selected automatically, then the first screen will look like [Figure 8](#) or [Figure 9](#). If you are getting a different error, your problem could be related to the PC-specific regional settings. More information on regional settings is given in the [Regional Settings](#) section.

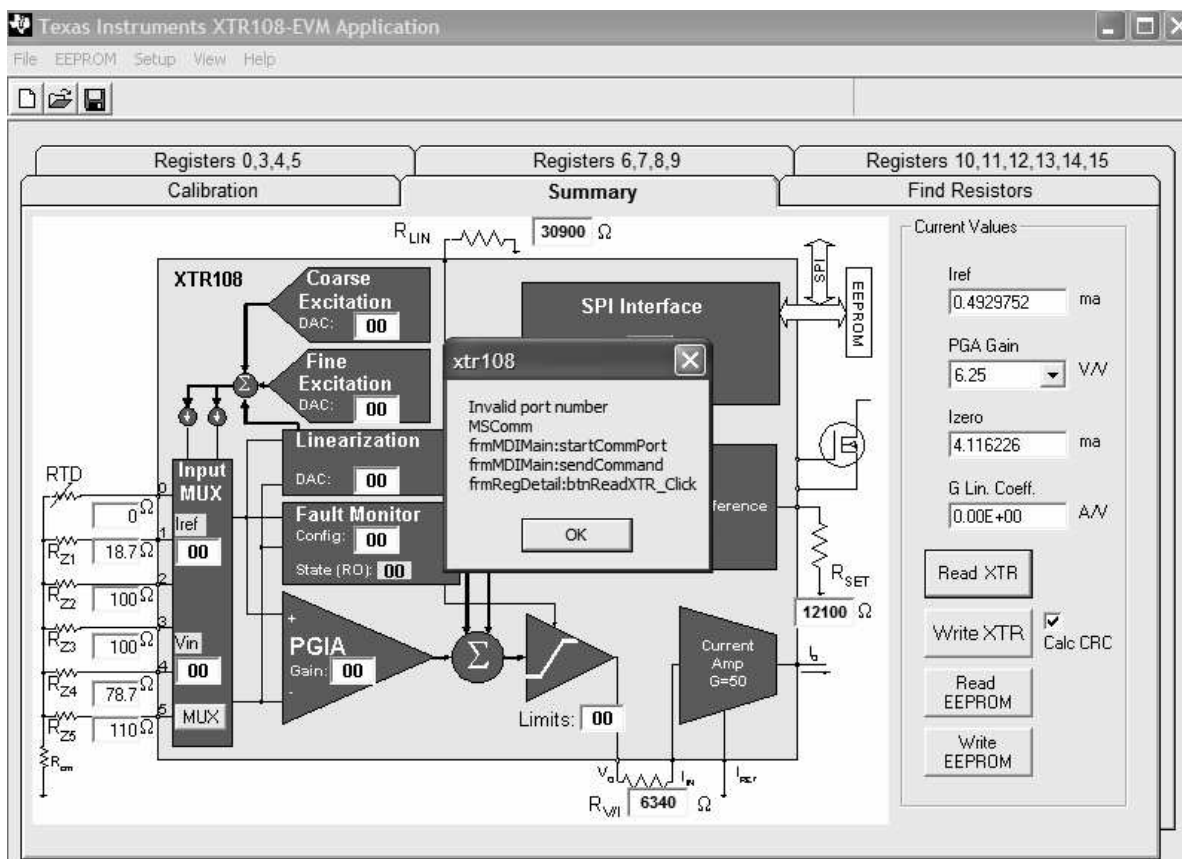


Figure 8. Software Start-up: Wrong COM Port

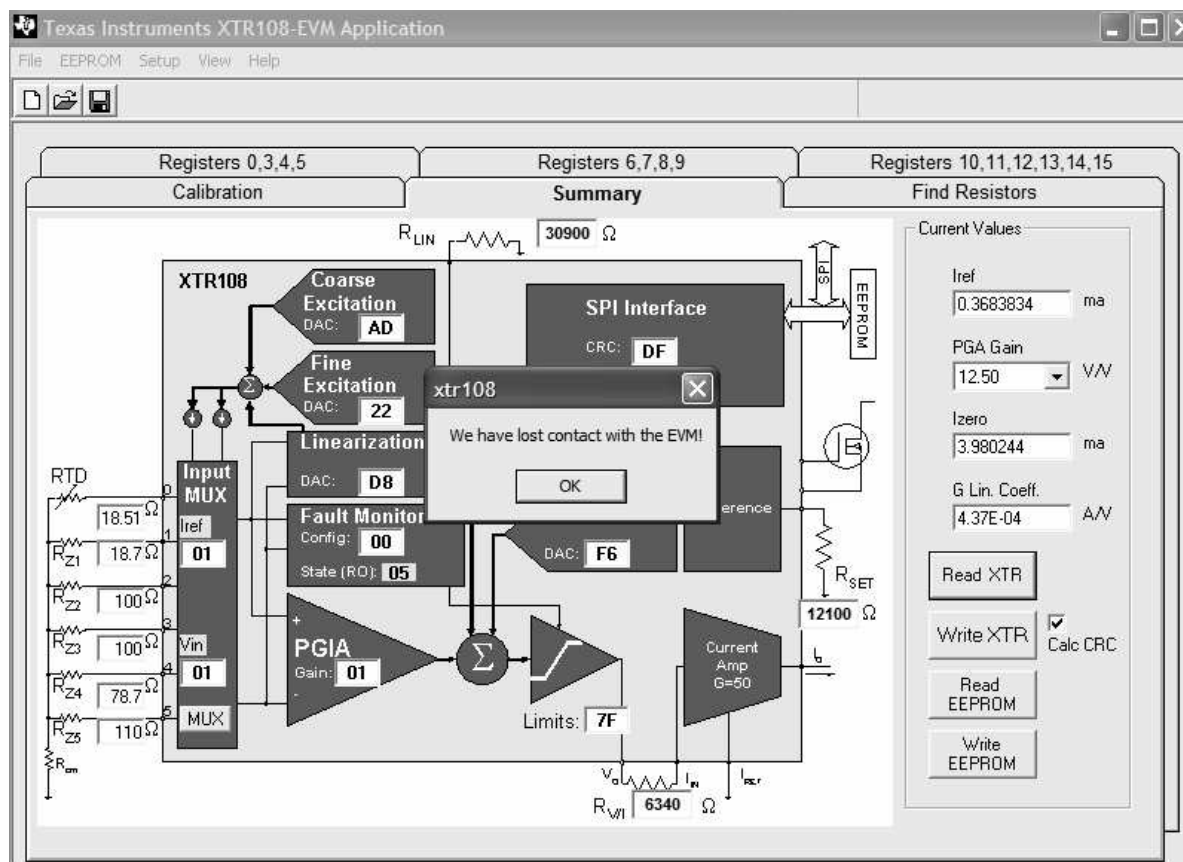


Figure 9. Software Start-up: General Communication Problem

Click on **OK** in the pop-up window shown in [Figure 8](#) or [Figure 9](#). Verify that the power and RS-232 cables are connected. If all connections are secure, you may need to select a different COM Port. To change the COM port, click on **Setup** in the Main Window Menu. Select the **Communication Setup** option from the **Setup** menu. A new pop-up window will appear, as shown in [Figure 10](#). Select the serial port where the board is connected, then click **OK**.

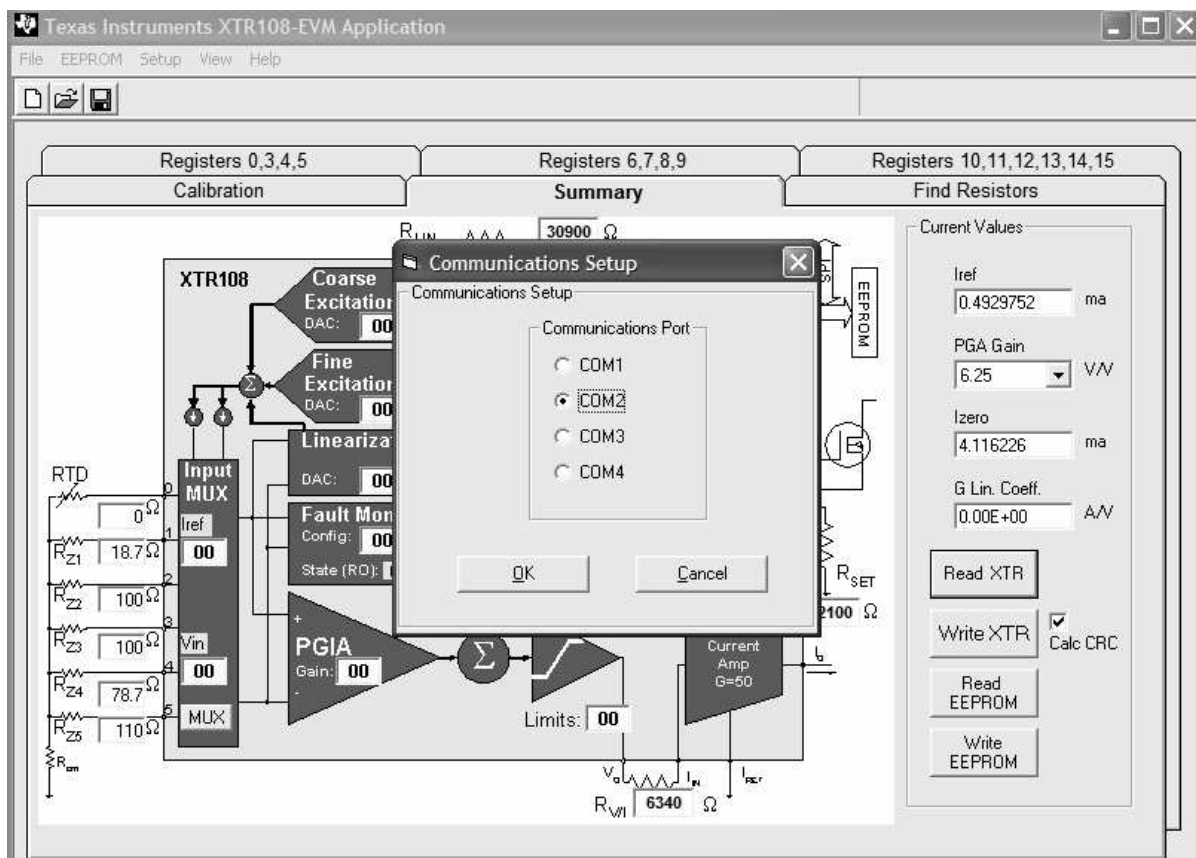


Figure 10. COM Port Pop-up Dialog Window

5.7 Hardware Check-out

In the main window, click on **File/Load Setup**. A pop-up dialog window appears, as shown in Figure 11.

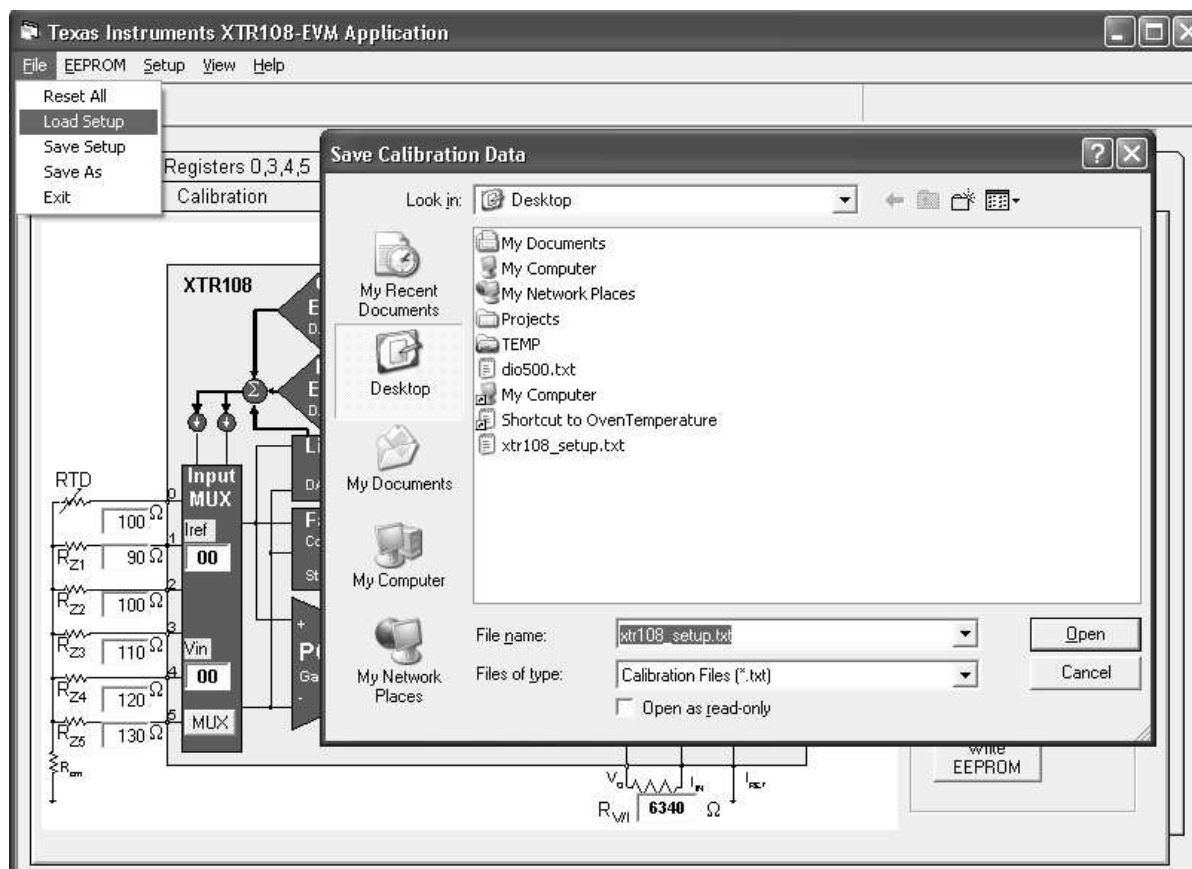


Figure 11. Load Setup Pop-up Dialog

Select *XTR108_DK_setup.txt* and open this file (located in the XTR108EVM Software directory – typically, C:\Program Files\XTR108 Designer's Kit).

Then press *Write XTR*, *Write EEPROM*, and *Read XTR*. The main window appears as illustrated in Figure 12.

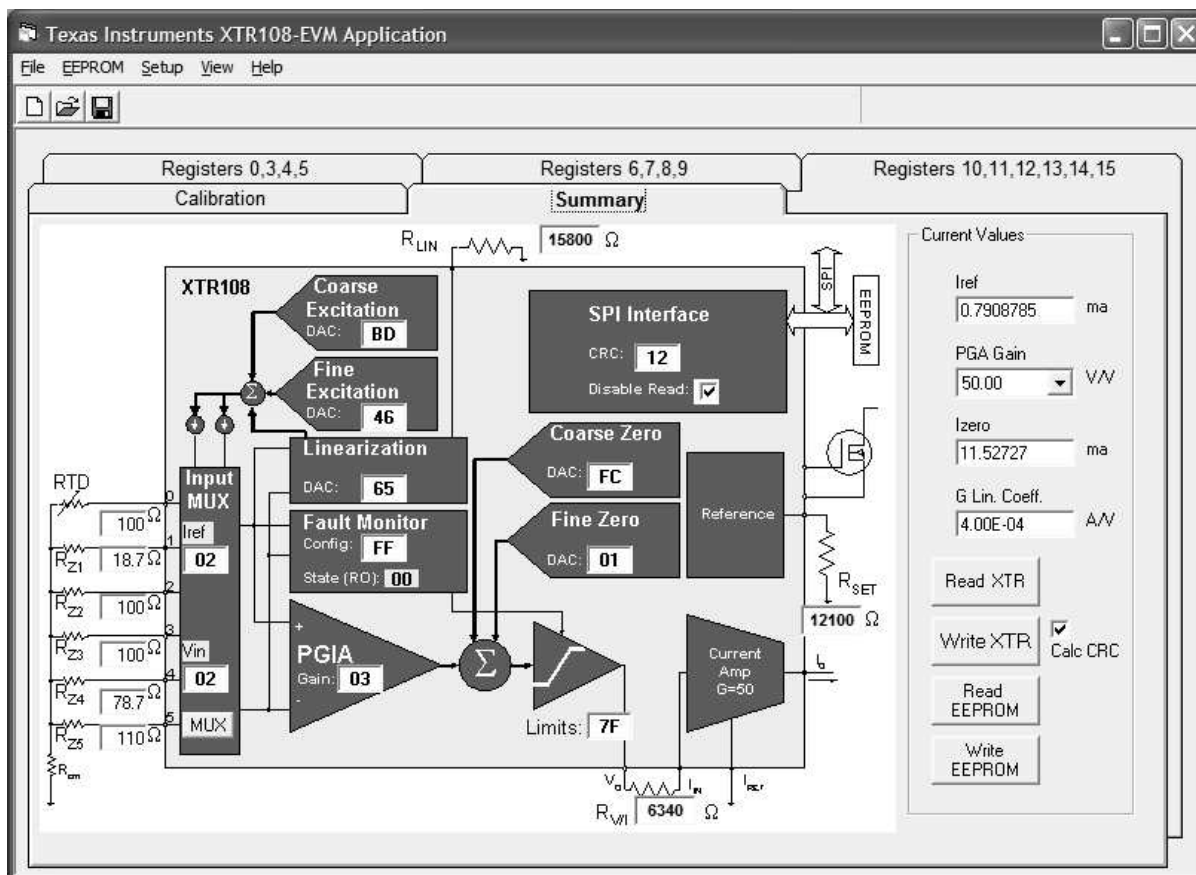


Figure 12. Main Window (with XTR108_DK_Test.txt file open)

Initial Setup and Check-Out

Connecting a 200 Ω resistor across the RTD terminal T1 should produce a 20mA output. See [Figure 13](#).

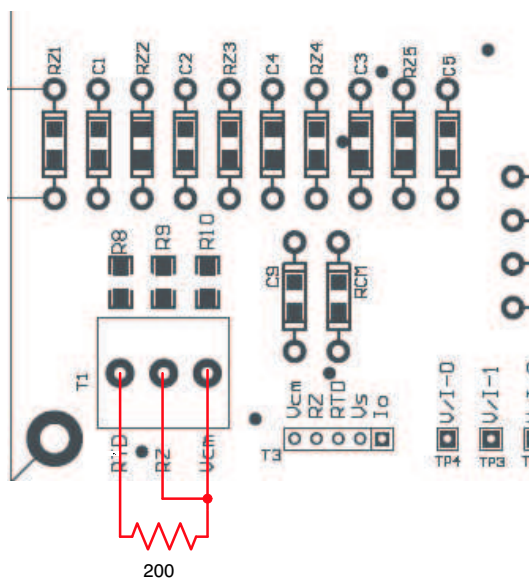


Figure 13. Resistor for 20mA Output

Connecting a 100 Ω resistor across the RTD terminal T1 should produce a 4mA output. See [Figure 14](#).

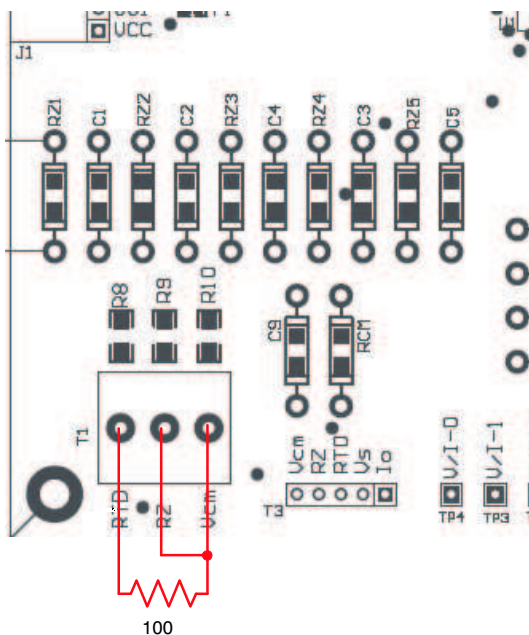


Figure 14. Resistor for 4mA Output

6 Software Overview

6.1 Summary Tab

The summary tab (see Figure 15) allows access to the key registers through an intuitive graphical interface. This screen also allows you to change the values of the external resistors that are used to select the range over which the XTR108 will calibrate RTDs. Note that the configuration of the external resistors will be saved in a file when the software is closed for user convenience.

This tab also has four buttons that conveniently allow the displayed registers to be written to or read from the XTR108 and the XTR108 EEPROM.

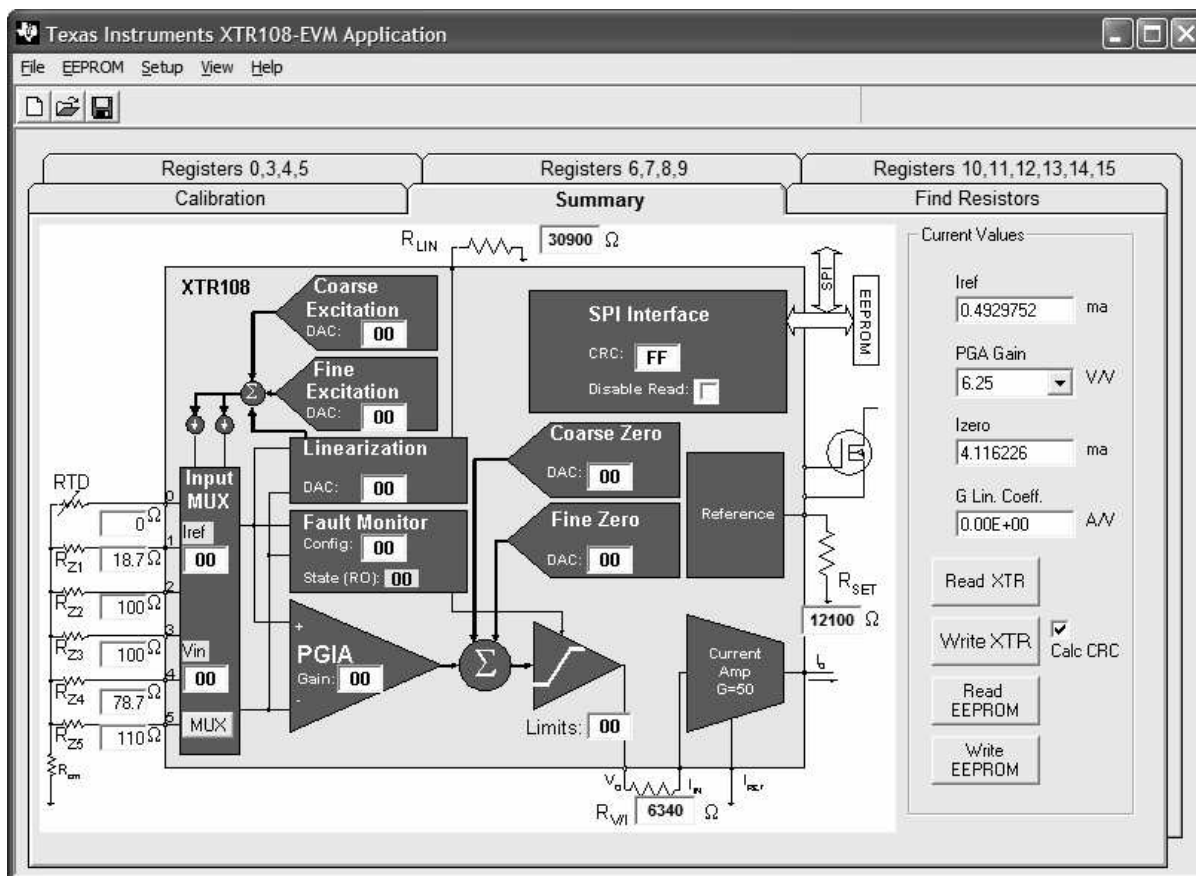


Figure 15. XTR108EVM Board Control Software: Summary Tab

6.2 Find Resistors Tab

The XTR108 has five channels that allow for five different RTD types or temperature ranges. In order to set up the XTR108 so that it can accommodate these ranges, external components must be selected (see [Figure 16](#)). This tab allows the user to enter the RTD type, the temperature range, the Callendar-Van Dusen Coefficients, and the XTR108 output range. Pressing the *Calculate Results* button will compute all the resistors that are required to configure the XTR108 for your specific application. These resistance values will also be copied into the Calibration Tab of the software tool. A more detailed description of this function and a step-by-step calibration example is given in the [XTR108 Quick Start System Reference Guide](#).

Registers 0,3,4,5
Calibration

Registers 6,7,8,9
Summary

Registers 10,11,12,13,14,15
Find Resistors

Enter – RTD Type & Temp Range

Chan.	RTD Type (Ohms)	Min Temp (degC)	Max Temp (degC)
1	100	-200	850
2	100	0	400
3	100	0	125
4	100	-55	125
5	100	25	75

Note: Enter 0 under RTD Type for unused channels.

Enter – Callendar-Van Dusen Coefficients

A	B	C
3.9083E-3	-5.7750E-7	-4.1835E-12
3.9083E-3	-5.7750E-7	-4.1835E-12
3.9083E-3	-5.7750E-7	-4.1835E-12
3.9083E-3	-5.7750E-7	-4.1835E-12
3.9083E-3	-5.7750E-7	-4.1835E-12

Reset to PT100

Enter – General Info

Mode: **Current**

Rvi: **6340** Ohm

I_{max}: **20** mA

I_{min}: **4** mA

Results – Install These Resistors

Rz1	18.7	ohms	Rset	12100	ohms
Rz2	100	ohms	Rlin	30900	ohms
Rz3	100	ohms	Rcm	475	ohms
Rz4	78.7	ohms			
Rz5	110	ohms			

Calculate Results

Figure 16. XTR108EVM Board Control Software: Find Resistors Tab

6.3 Calibration Tab

This tab contains the dialogs that are needed to facilitate the calibration of an XTR108 and an RTD; see Figure 17. The Visual Basic software contains an algorithm that uses the entered XTR108 configuration resistor values, the temperature range, and the measured results to compute the XTR108 register values. The calibration algorithm works for both the Current Output mode and Voltage Output mode. The Visual Basic source code for this software can be downloaded from the [Texas Instruments web site](http://www.ti.com) in case you want to adapt this software for production programming of XTR108 modules. A full step-by-step description of how this process works is described in the [XTR108 Quick Start System Reference Guide](#).

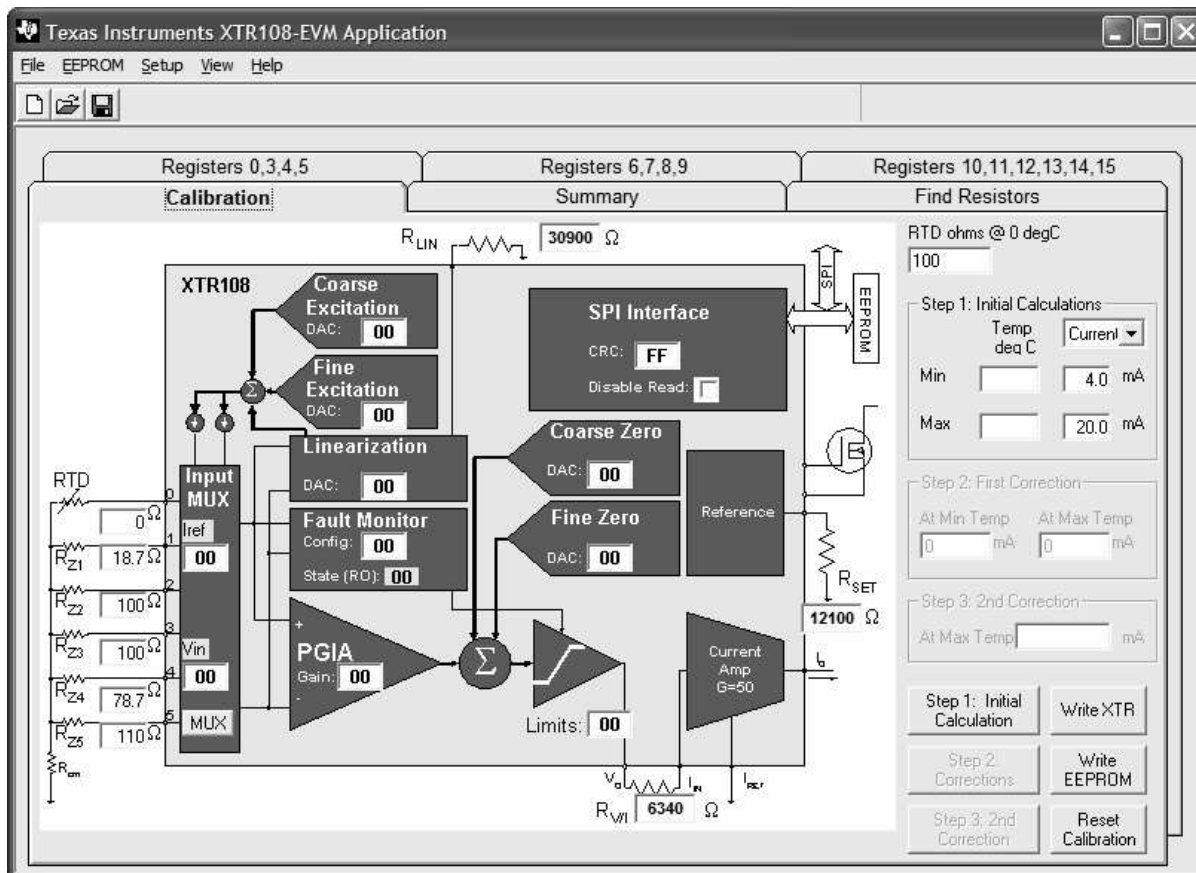


Figure 17. XTR108EVM Board Control Software: Calibration Tab

6.4 Registers 0, 3, 4, and 5

Register 0: The RST feature in Register 0 allows the XTR108 to be reset. The checksum error bit indicates whether checksum passed or not.

Register 3: None of the bits in Register 3 are used.

Register 4: Allows the user to control the Continuous EEPROM read mode. This feature is required if the discrete charge pump is used.

Register 5: Allows the over-scale and under-scale limits to be adjusted. FD disables the over-scale and under-scale limits.

See [Figure 18](#) for an example of the tab window display.

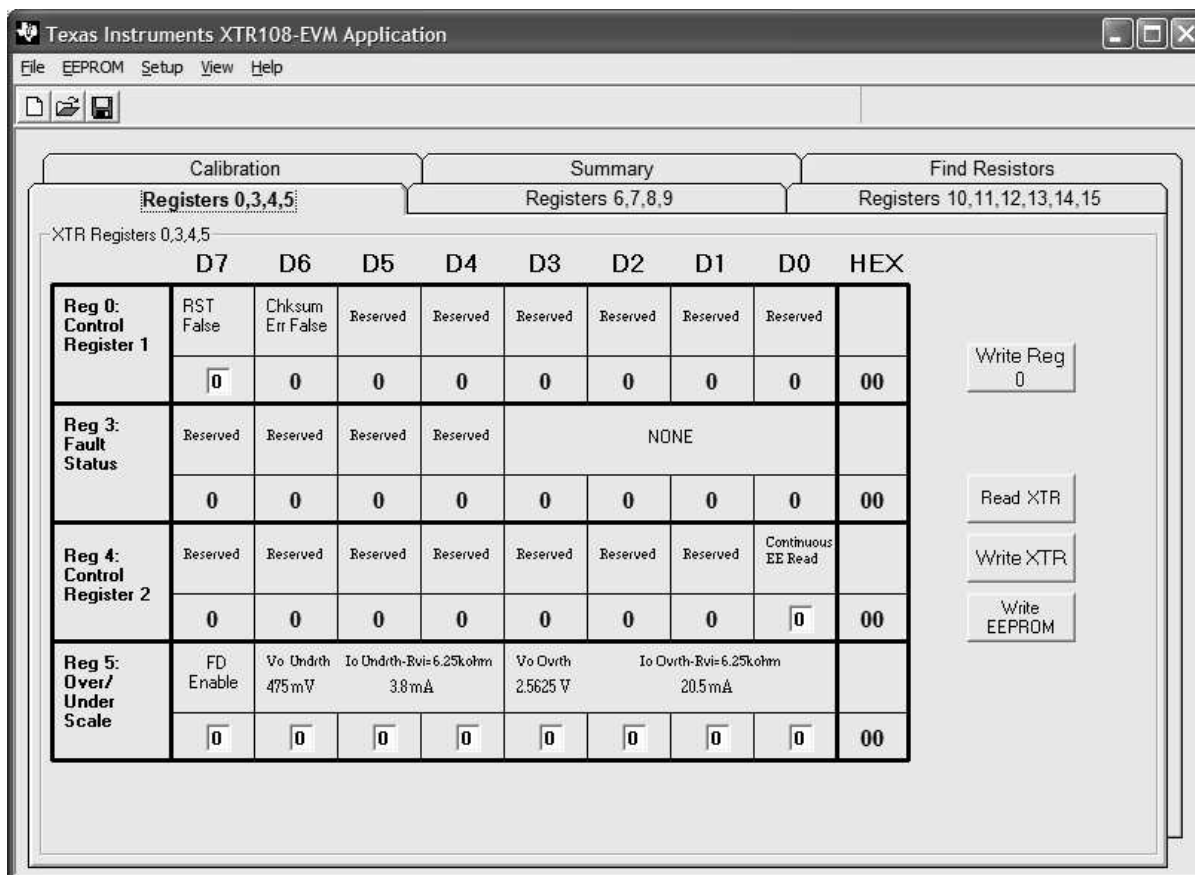


Figure 18. XTR108EVM Board Control Software: Registers 1, 3, 4, 5 Tab

6.5 Registers 6, 7, 8, and 9

Register 6: Sets the PGA gain. This register is set typically during calibration.

Register 7: Allows configuration of the alarm register. This register determines if the XTR108 will go into over-scale or under-scale for various fault conditions.

Register 8: Controls the input multiplexer. This feature is set typically during calibration.

Register 9: Controls the I_{REF} multiplexer. This feature is set typically during calibration.

See [Figure 19](#) for an example of the tab window display.

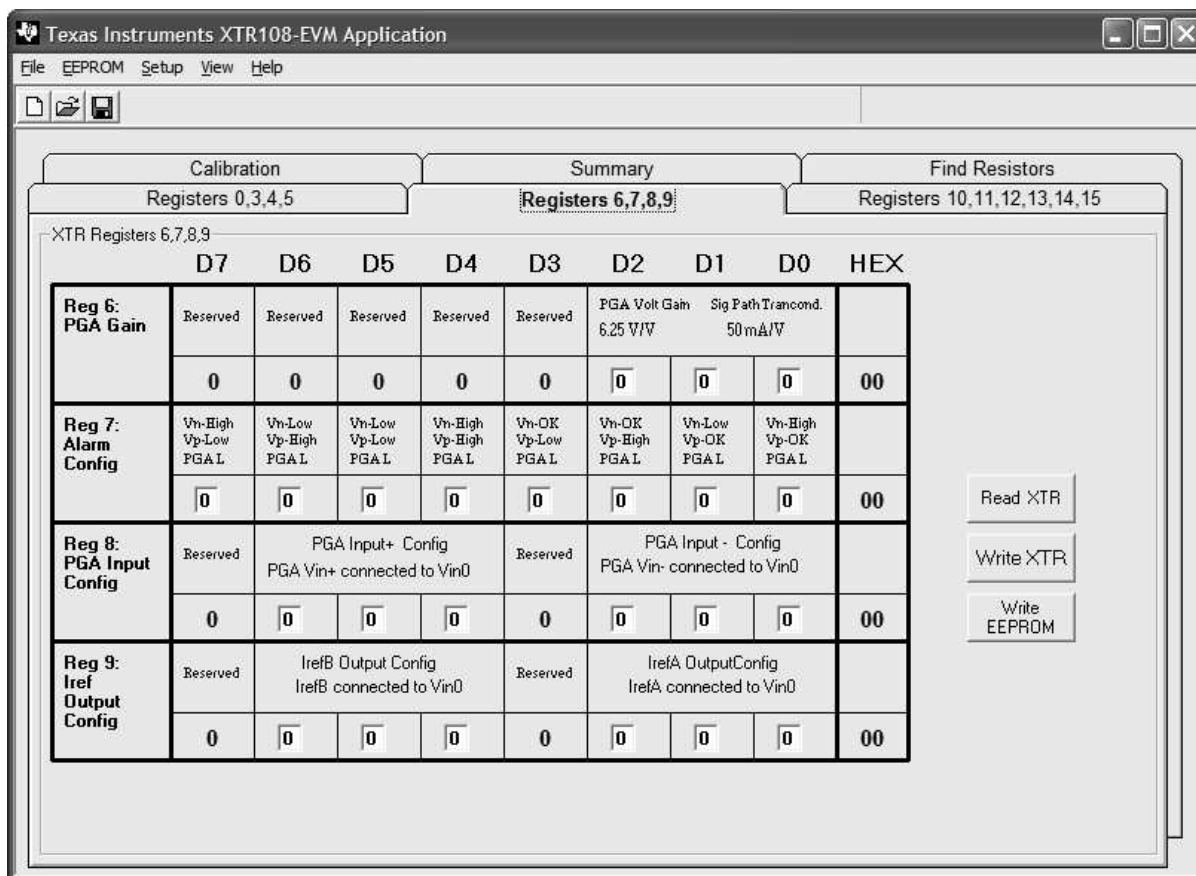


Figure 19. XTR108EVM Board Control Software: Registers 6, 7, 8, 9 Tab

6.6 Registers 10, 11, 12, 13, 14, and 15

Registers 10 to 14: These registers control the various digital-to-analog converter (DAC) settings in the PGA309. These features are set typically during calibration.

See [Figure 20](#) for an example of the tab window display.

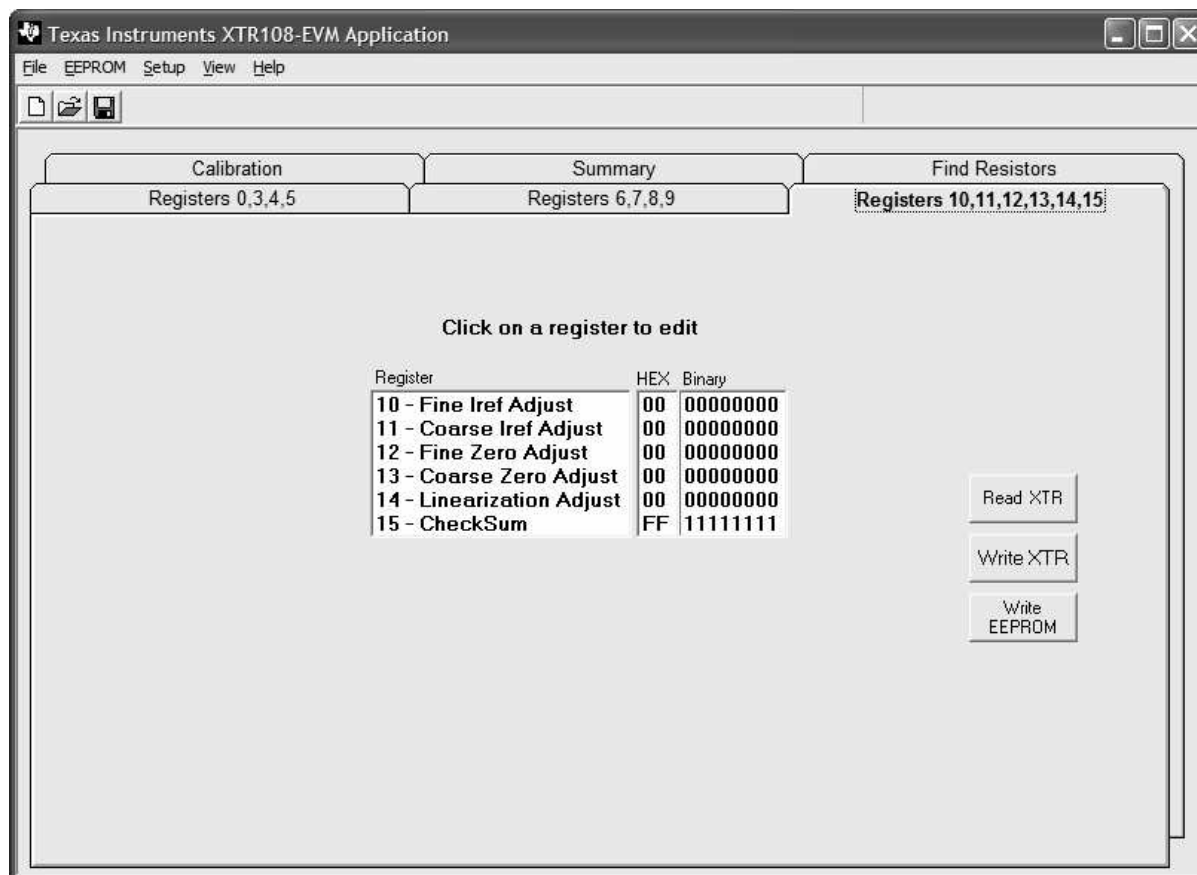


Figure 20. XTR108EVM Board Control Software: Registers 10, 11, 12, 13, 14, 15 Tab

Register 15: The checksum is computed automatically when any register is changed, provided that the *Calculate CRC* box is checked in the Summary tab. If a checksum error is detected, the XTR108 programs itself to the lowest under-scale error level. See [Figure 21](#).

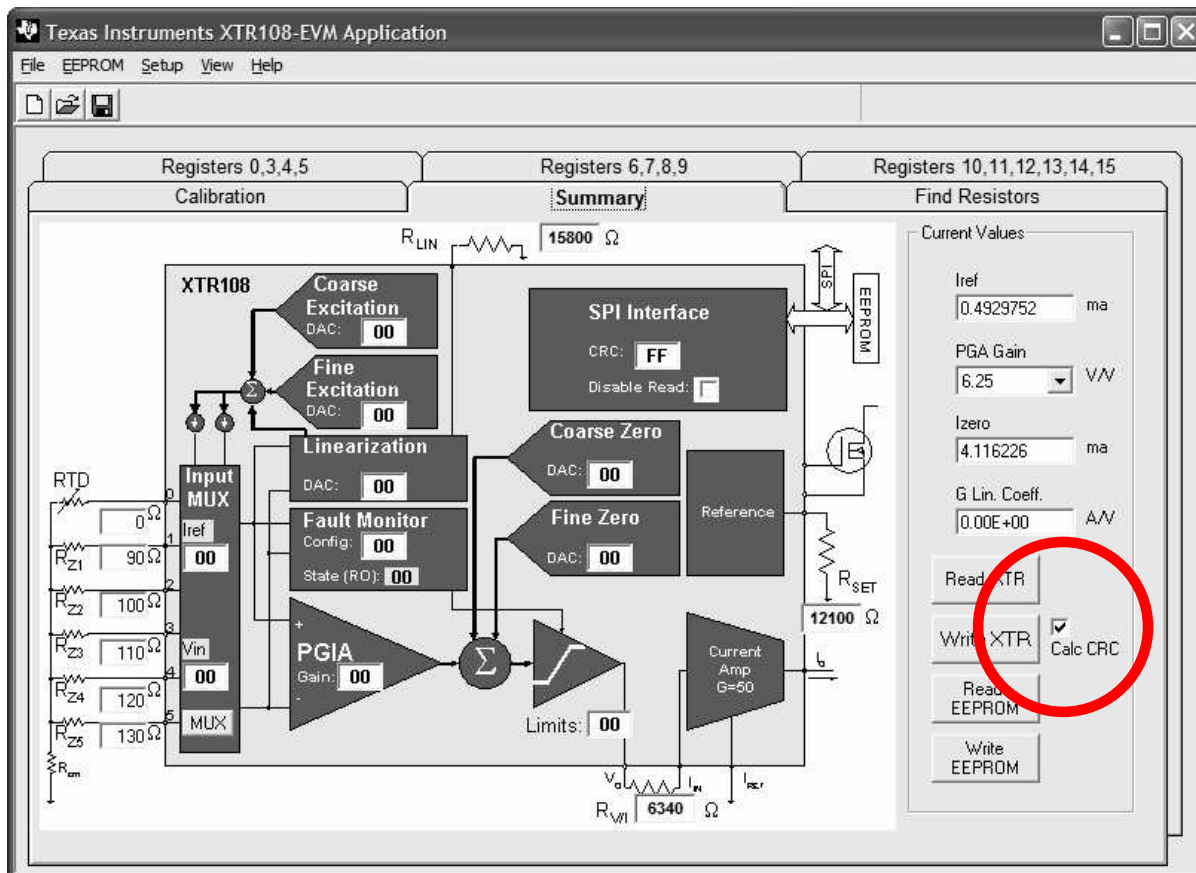


Figure 21. XTR108EVM Board Control Software: Calc CRC Box Checked

Figure 23 illustrates the charge pump configuration.

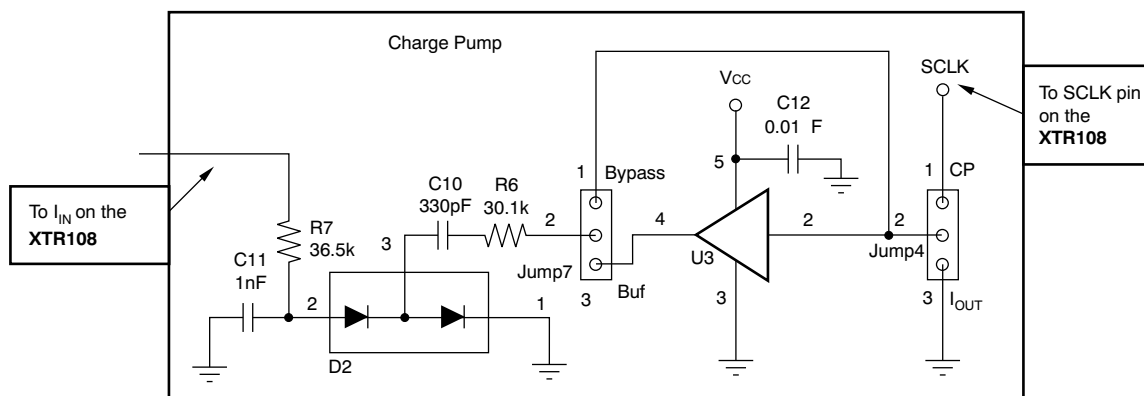


Figure 23. Discrete Charge Pump on Sensor Interface Board

For this circuit to work, the XTR108 clock must toggle continuously. This toggling can be accomplished by keeping the XTR108 in continuous EEPROM read mode. JUMP7 can be used to connect or disconnect an external buffer the clock signal of the XTR108. More information regarding this charge pump is located in the [XTR108 data sheet](#) and the [XTR108 Quick Start System Reference Guide](#).

7.3 Voltage Output Mode

In many applications, it is desirable to bypass the FET and connect the XTR108 directly to the power supply. This configuration can be completed by positioning jumpers JUMP2 and JUMP3 in the *Bypass* position.

Note: You must be careful in this mode to not apply an over-voltage to the XTR108. The XTR108 maximum supply voltage is 5.5V. The voltage drop across D1 reduces the XTR108 supply voltage by approximately 0.7V. To get an accurate idea of the XTR108 supply voltage while in this mode, you should measure at the V_S pin of the XTR108 (TP17 on the EVM).

7.4 Regional Settings

Problem:

In some European PC systems, an error is reported when the XTR108DK Control Software is started, as illustrated in Figure 24.

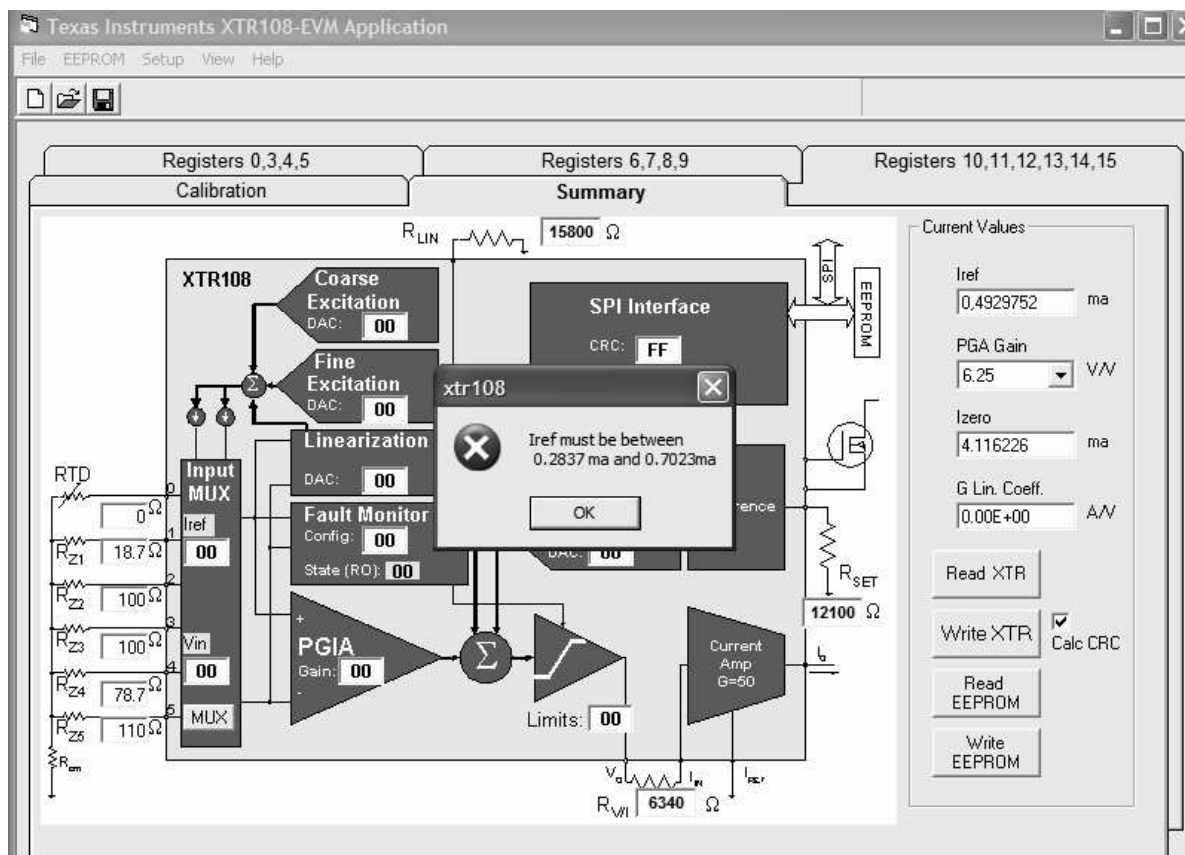


Figure 24. XTR108EVM Board Software: Run-Time Error

Cause:

This error [Runtime Error 13 – Type Mismatch Error] is usually caused by the decimal representation of non-English language computers which use a "," (comma) instead of a "." (period) for the decimal separator [that is, 100.89 represented as 100,89].

Solution:

PC-unique regional settings must be changed in two different places on the specific PC system. For Windows XP or NT, you must be logged on as an Administrator or a Member of the Administrators Group in order to complete this procedure.

1. From the Windows **Start** Menu, select *Control Panel*. (See Figure 25.) The Control Panel opens in a new window, as shown in Figure 26.

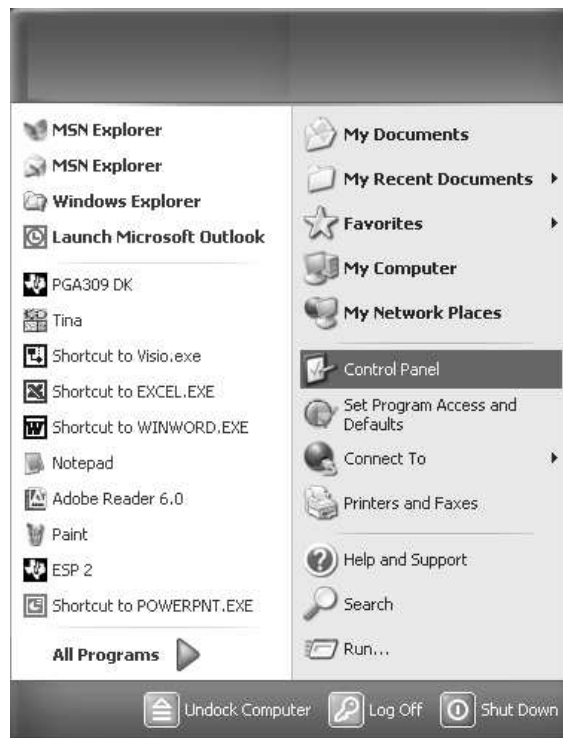


Figure 25. Control Panel Selection

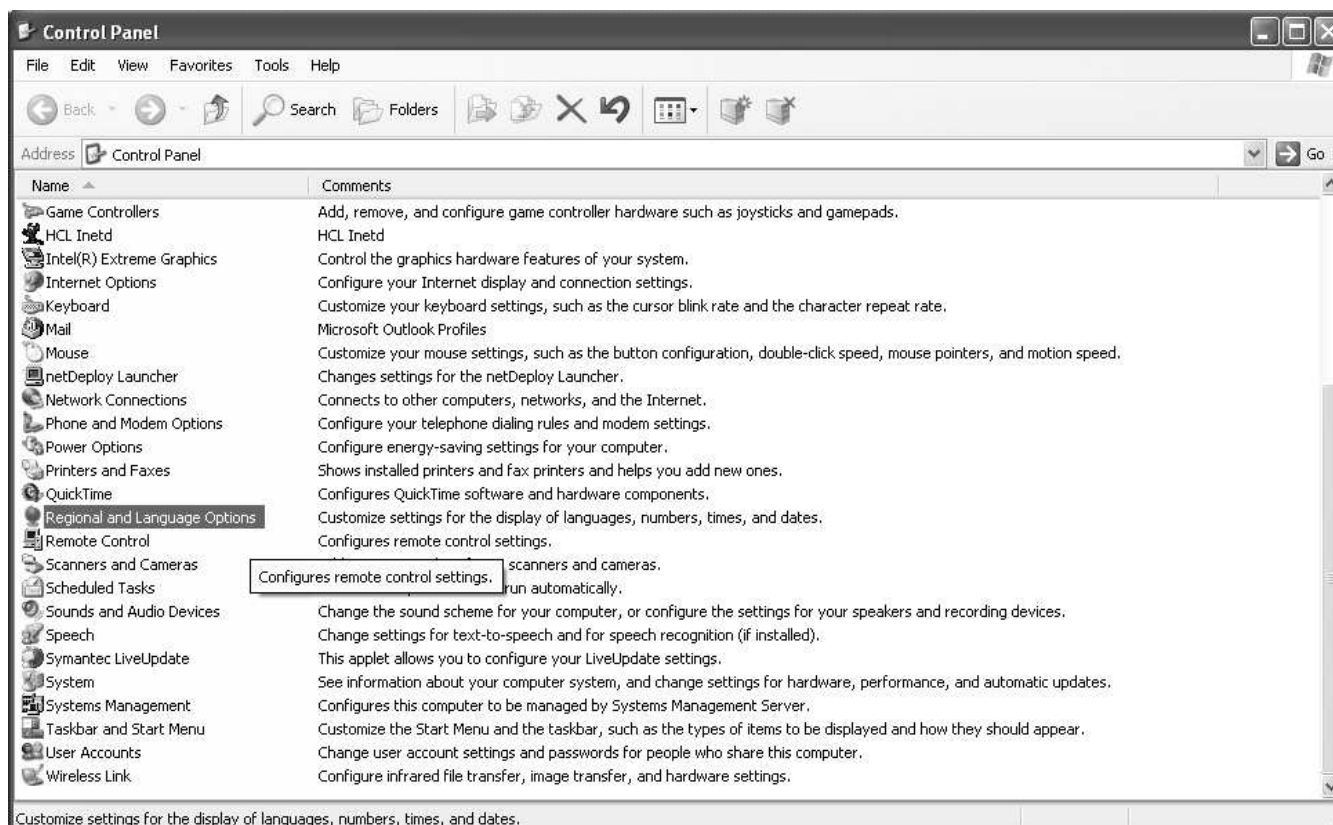


Figure 26. Windows Control Panel

2. Select *Regional and Language Options* in the Control Panel. A new pop-up window, **Regional and Language Options** appears, as [Figure 27](#) shows.



Figure 27. Regional and Language Options Window

3. Click on the *Advanced* tab in the Regional and Language Options dialog. The pop-up window will change as shown in [Figure 28](#).

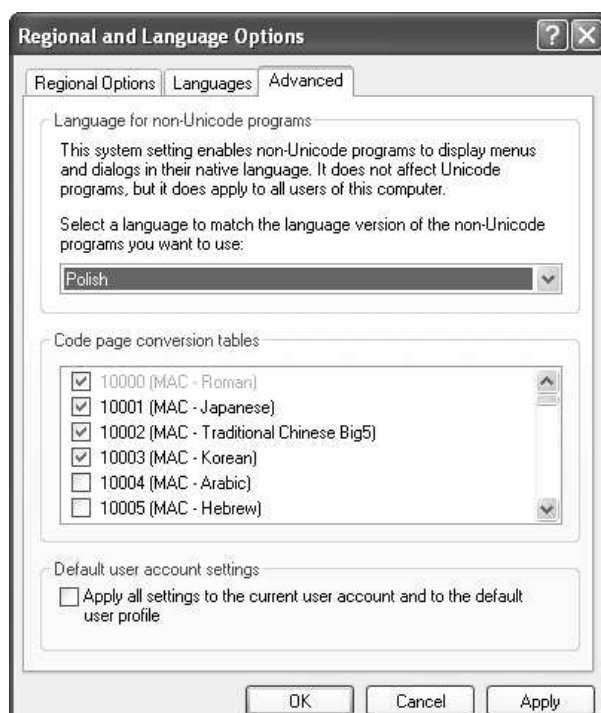


Figure 28. Regional and Language Options: Advanced Tab View

4. In the *Language for non-Unicode Programs* section, click on the drop-down menu arrow and select **English (United States)** as shown in [Figure 29](#). If your computer is already configured for English (United States) as the Language for non-Unicode Programs, skip to Step 6.

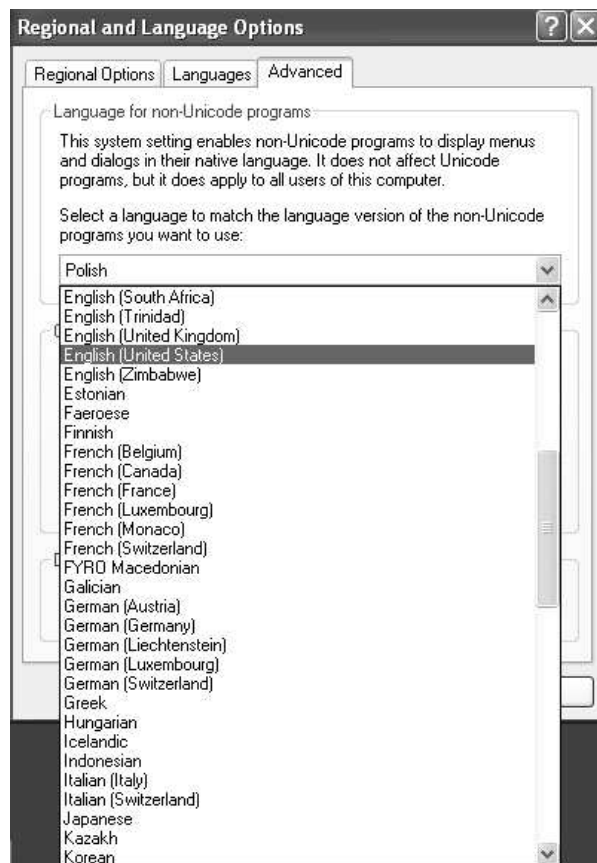


Figure 29. Regional and Language Options, Advanced Tab: Language for Non-Unicode Programs Dialog

5. Click on **Apply**. You will be instructed to restart your computer. (See [Figure 30](#).) Restart your computer, and repeat Step 1 and Step 2 above; then continue with Step 6.

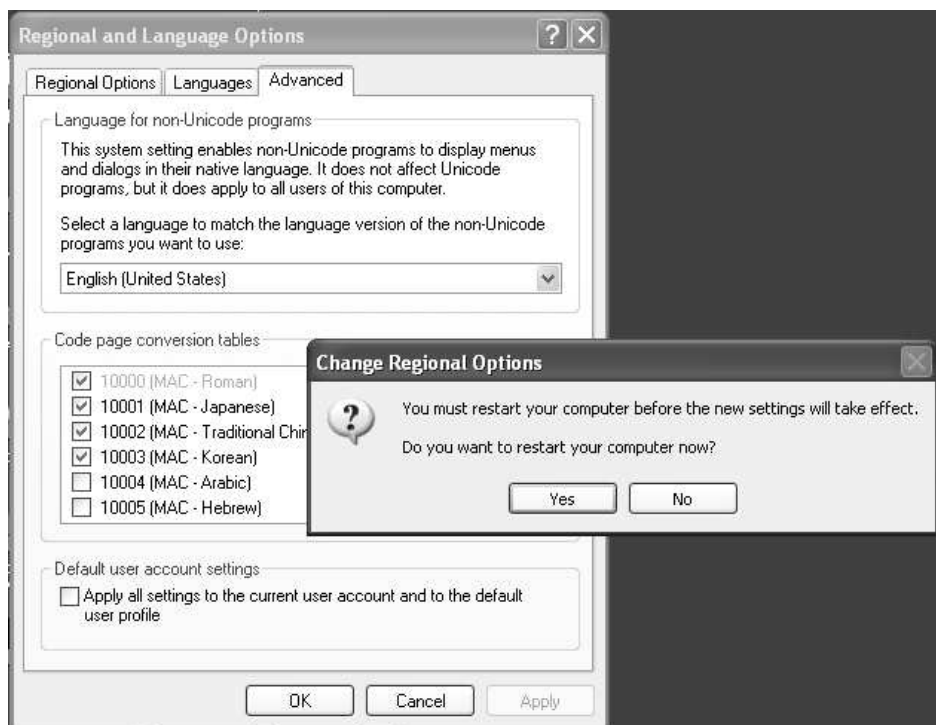


Figure 30. Restart PC Dialog

6. In the Regional and Language Options pop-up window, click on the *Regional Options* tab as shown in [Figure 31](#).



Figure 31. Regional and Language Options Window: Regional Options Tab

- Click on the **Customize** button in the Regional Options tab of the Regional Language Options pop-up window. See [Figure 32](#).

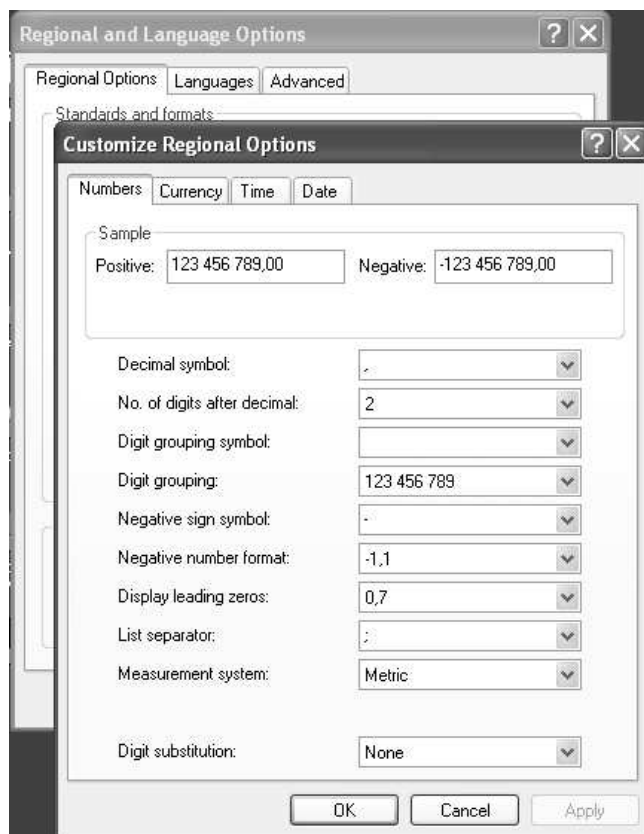


Figure 32. Regional and Language Options Window, Regional Options Tab: Customize Regional Options Dialog

- In the Customize Regional Options dialog, under the *Decimal symbol* option, select "." from the drop-down menu, as shown in [Figure 33](#). Click **OK** in the Customize Regional Options window, which returns you to the Regional and Language Options Window as shown in [Figure 34](#). Notice that under the Number section in this window, the decimal separator of the number displayed is shown as a "." (period) instead of its original setting as "," (comma).

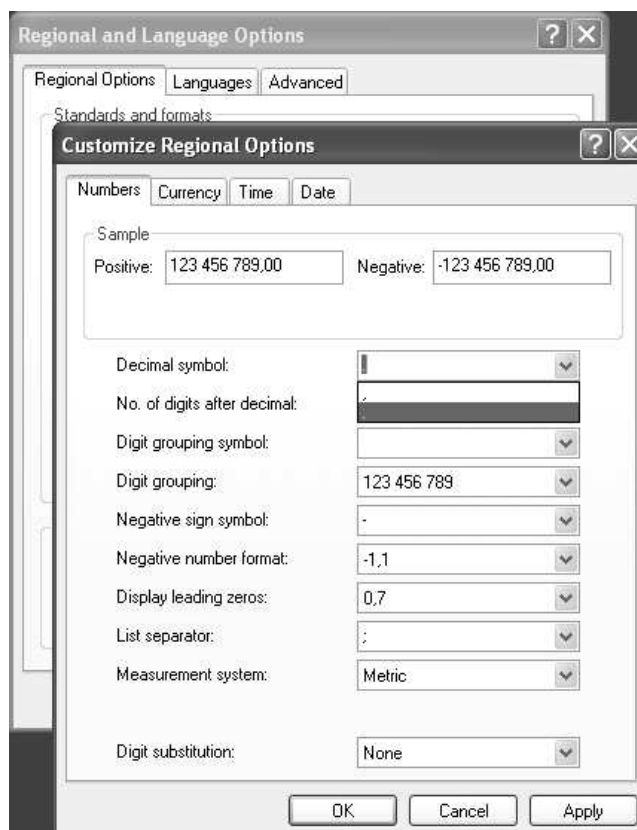


Figure 33. Regional and Language Options Window, Regional Options Tab, Customize Regional Options Dialog: Decimal Symbol Selected



Figure 34. Regional and Language Options Window after Customized Regional Options are Selected

9. In the Regional and Language Options window, as in [Figure 34](#), click on **OK**. This closes all pop-up windows and returns to the main Control Panel window on the desktop. Close this window by clicking on the **X** in the upper right-hand corner of this window, as shown in [Figure 35](#).

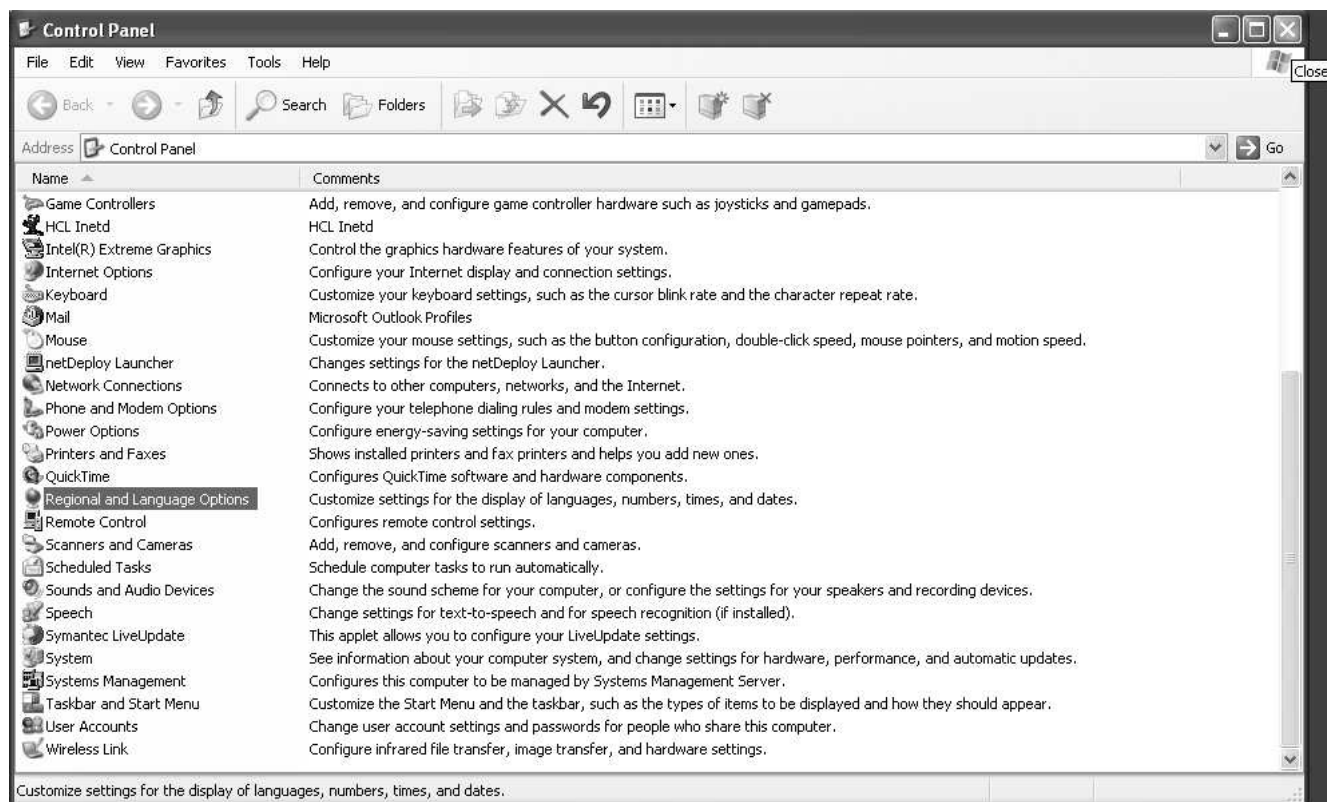


Figure 35. Windows Control Panel

10. Start the XTR108DK Control Software. All features of the XTR108DK software should now work correctly.

8 XTR108EVM PC Cable Drawing

Figure 36 shows the recommended cabling for the XTR108EVM.

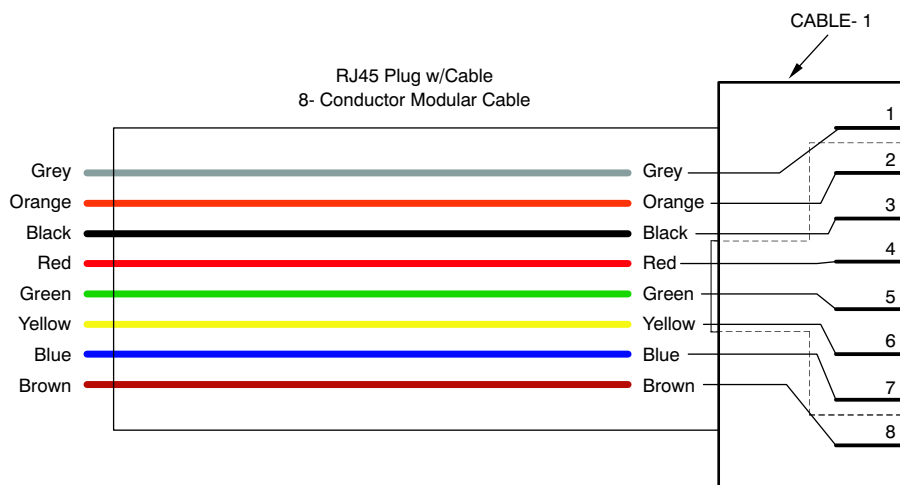
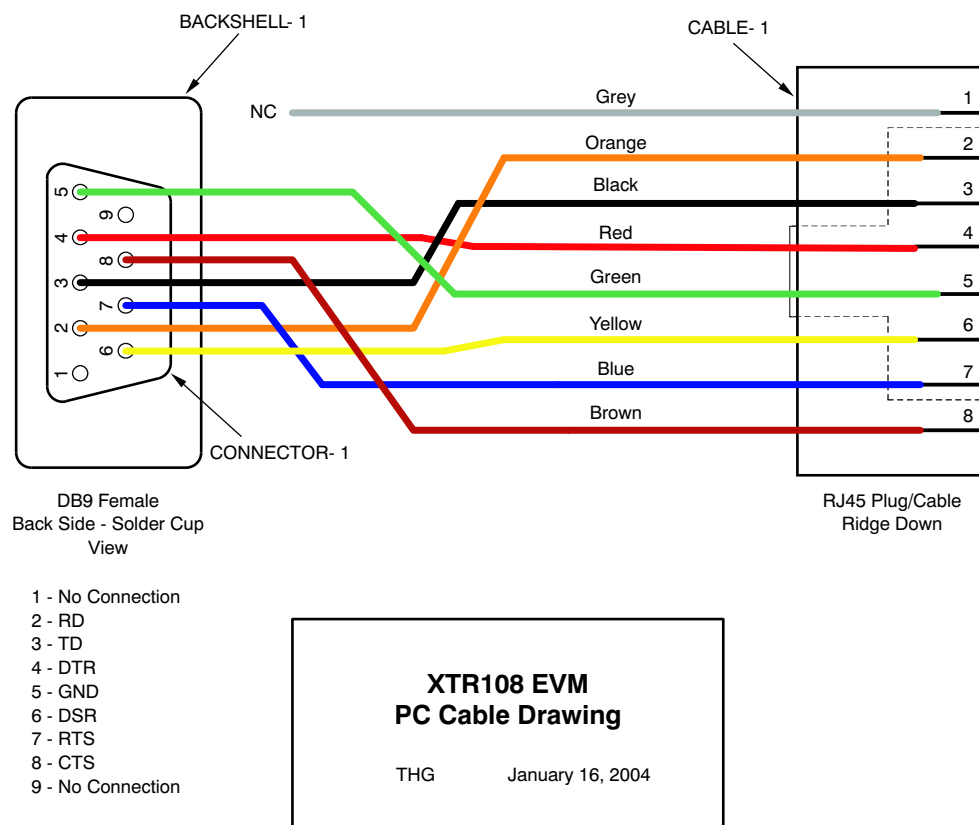


Figure 36. XTR108EVM Cables

9 Schematics

This section describes the physical characteristics of the XTR108EVM-DK. Figure 37 illustrates the PCI section of the XTR108EVM. Figure 38 shows the Sensor Interface Board portion of the XTR108EVM.

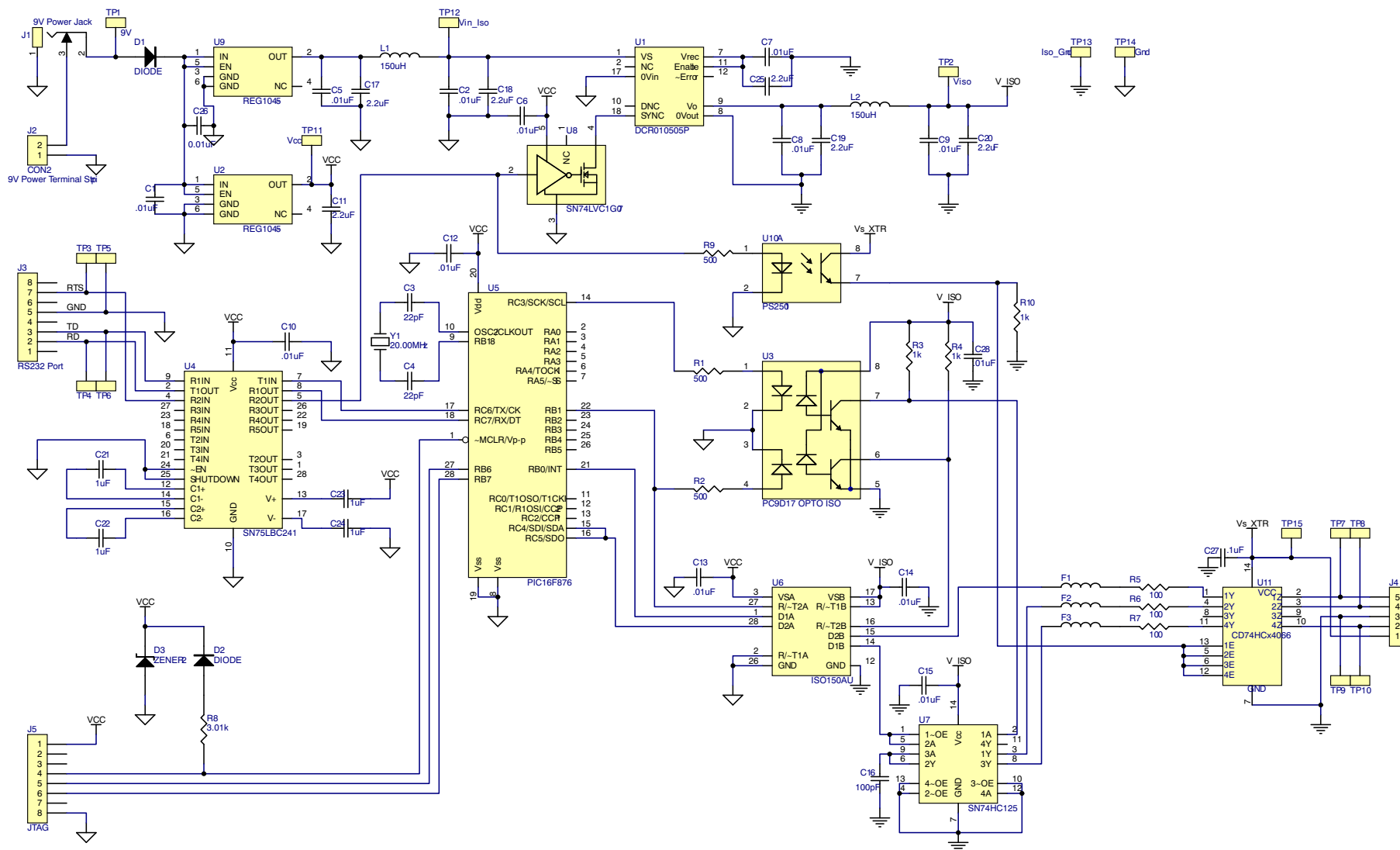


Figure 37. XTR108EVM PCI Interface Board



FCC Warnings

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 will be required to take whatever measures may be required to correct this interference.

EVM TERMS AND CONDITIONS

Texas Instruments (TI) provides the enclosed Evaluation Module and related material (EVM) to you, the user, (you or user) **SUBJECT TO** the terms and conditions set forth below. By accepting and using the EVM, you are indicating that you have read, understand and agree to be bound by these terms and conditions. **IF YOU DO NOT AGREE TO BE BOUND BY THESE TERMS AND CONDITIONS, YOU MUST RETURN THE EVM AND NOT USE IT.**

This EVM is provided to you by TI and is intended for your **INTERNAL ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**. It is provided "AS IS" and "WITH ALL FAULTS." It is not considered by TI to be fit for commercial use. As such, the EVM may be incomplete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product. As a prototype, the EVM does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this EVM not meet the specifications indicated in the EVM User's Guide, it may be returned within 30 days from the date of delivery for a full refund of any amount paid by user for the EVM, which user agrees shall be user's sole and exclusive remedy. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY TI TO USER, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR NON-INFRINGEMENT.**

TI shall have no obligation to defend any claim arising from the EVM, including but not limited to claims that the EVM infringes third party intellectual property. Further, TI shall have no liability to user for any costs, losses or damages resulting from any such claims. User shall indemnify and hold TI harmless against any damages, liabilities or costs resulting from any claim, suit or proceeding arising from user's handling or use of the EVM, including but not limited to, (i) claims that the EVM infringes a third party's intellectual property, and (ii) claims arising from the user's use or handling of the EVM. TI shall have no responsibility to defend any such claim, suit or proceeding.

User assumes all responsibility and liability for proper and safe handling and use of the EVM and the evaluation of the EVM. TI shall have no liability for any costs, losses or damages resulting from the use or handling of the EVM. User acknowledges that the EVM may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the EVM it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE USER'S INDEMNITY OBLIGATIONS SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES WHETHER TI IS NOTIFIED OF THE POSSIBILITY OR NOT.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

User agrees to read the EVM User's Guide and, specifically, the EVM warnings and Restrictions notice in the EVM User's Guide prior to handling the EVM and the product. This notice contains important safety information about temperatures and voltages.

It is user's responsibility to ensure that persons handling the EVM and the product have electronics training and observe good laboratory practice standards.

By providing user with this EVM, product and services, TI is NOT granting user any license in any patent or other intellectual property right.

EVM WARNINGS AND RESTRICTIONS

The PC Interface Board dc supply (J2) input range is 7V to 10V. The loop supply (T2) input voltage range is (5.5V + VD1) when in voltage mode. When operating in Current Loop Output mode, you must consider the power dissipated in the external transistor and the operating temperature of the transistor in order to determine the maximum loop voltage and current. This calculation is determined in the [XTR108 data sheet](#).

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2005, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

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

Copyright © 2005, Texas Instruments Incorporated