How to use Evaluation Kit Software for TLE4997/98

About this document

Scope and purpose

This is the Infineon Evalluation Kit software manual. The purpose of this manual is to describe the software installation process and how to use the TLE4997/98 Linear Hall Evaluation Kit.

Intended audience

This document is intended for anyone who wants to use the Linear Hall TLE4997 /98 Evaluation Kit.

1 EvalKit Package

The figure below illustrates all the components that are shipped within the TLE4997/98 Evaluation Kit.

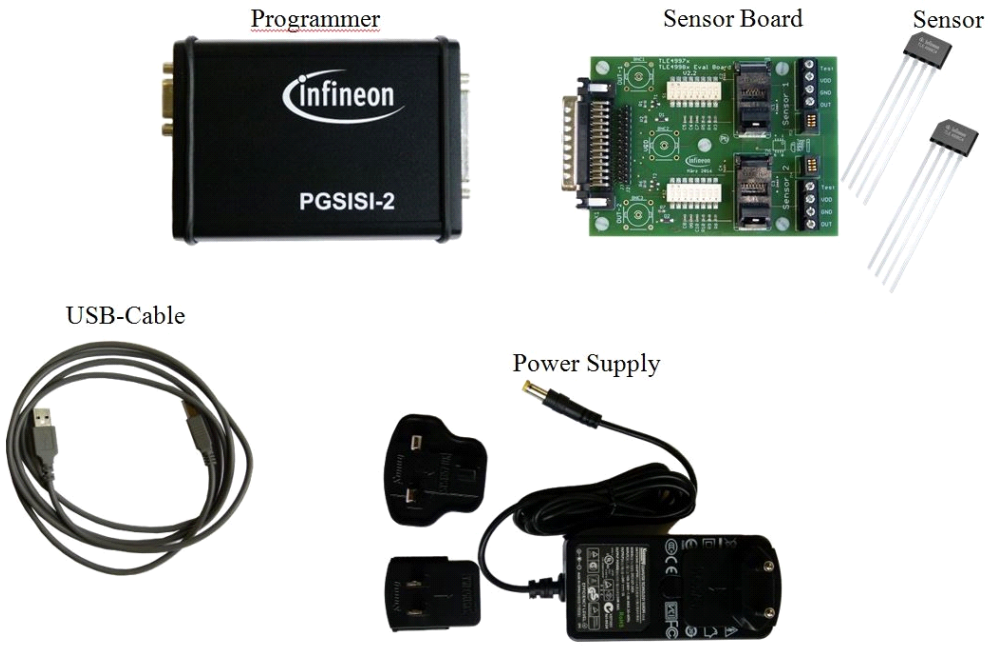

Figure 1 Evalkit Content

Table of Contents

2 Installation

Before connecting the programmer to the PC via the USB-cable install the Linear Hall Evaluation Kit Software. The software can be found on https://www.infineon.com/cms/en/product/sensor/magnetic-position-sensor/linear-hall-ic/tle4997-evalboard/#!tools. The Software also installs the Hardware driver for the programmer. Afterwards the programmer can be connected to the PC.

2.1 Software

Start Setup

First of all please start the installation routine of the Linear Hall Evaluation Kit Software by executing the file setup.exe in the folder "Linear Hall Evalkit" on the CD-ROM. Please be aware that 2 versions are available, one version for 32bit systems and one version for 64bit systems, please select the version accordingly to your system.

Choose directory

After running the EvalkitSoftware.msi it is possible to change the installation folder. Accept the default path or select another directory.

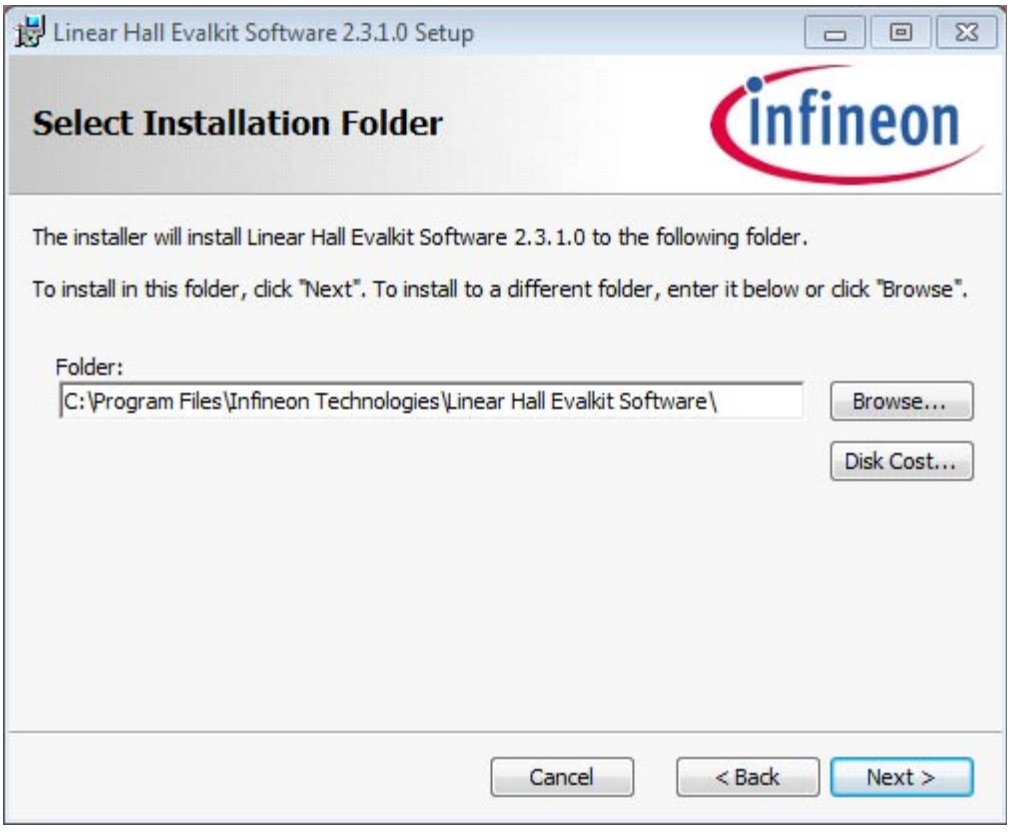

Figure 2 Installation Folder

Start installation

Continue by pressing the "Next" button and then the Install button. Now the installation will be done automatically. Finally only confirm the successful process, when it is finished. With Windows Vista, 7, 8 and 10 an UAC confirmation dialog might pop up. Please click on "Yes" to continue with the installation.

Installation

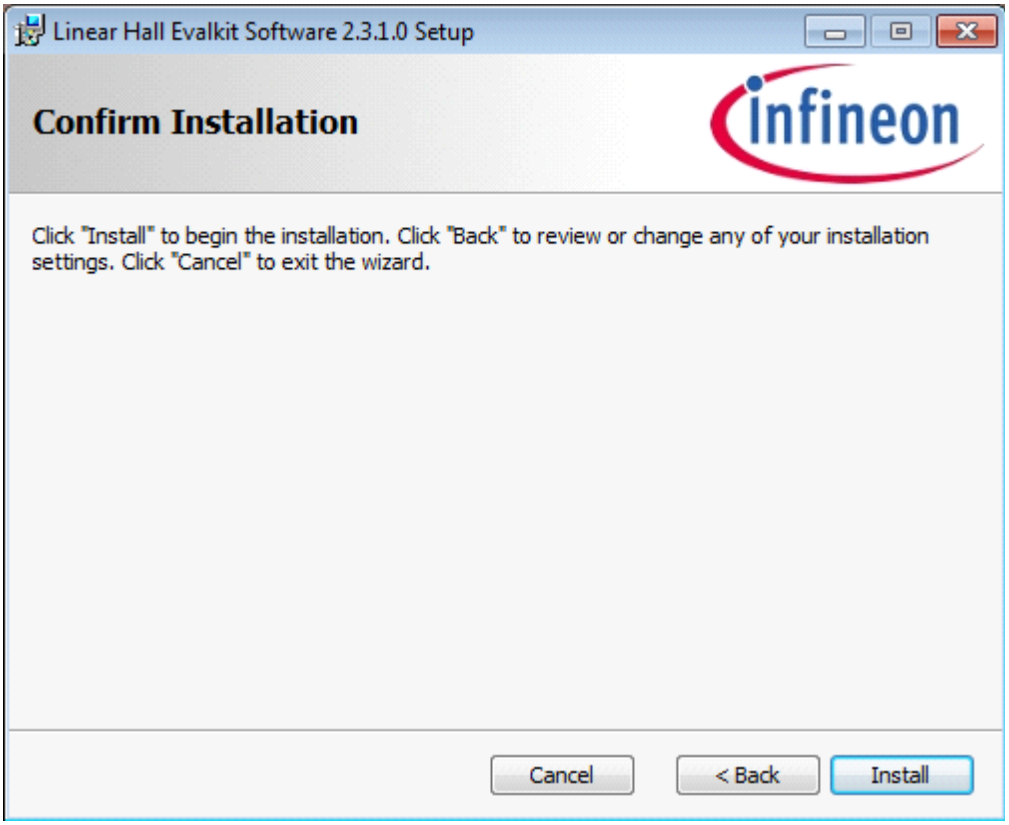

Figure 3 Confirm Installation

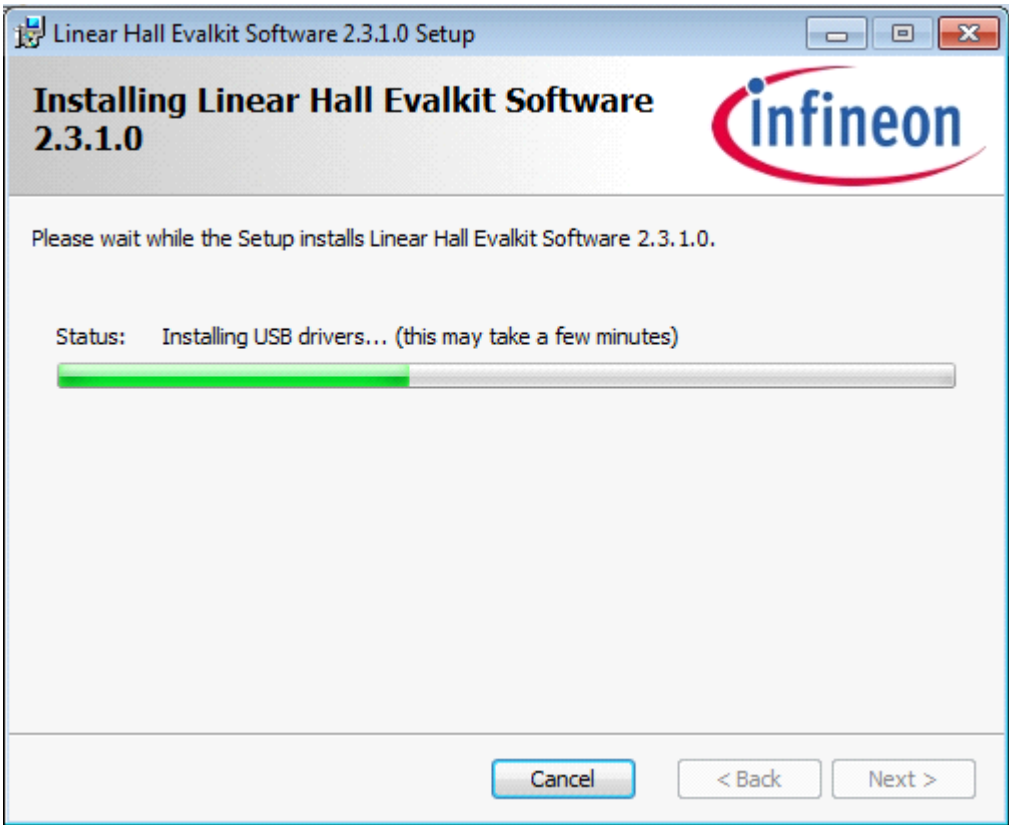

Figure 4 Installing application

2.2 Hardware

Please connect the power supply with the programmer. Then configure the white DIP-Switches of the sensor board depending on the sensor type.

Both the TLE4998 and TLE4997 sensor types are supported by the sensor board. The setting of the two red DIP-Switches of the sensor board must be set differently for the TLE4998 and TLE4997 sensor types.

Please use the following configuration for the TLE4998 sensor:

Note: DIP-Switch number 1 and 8 switch to on and the others to off

Please use the following configuration for the TLE4997 sensor:

Note: DIP-Switch number 2 and 6 switch to on and the others to off

Once the sensor board has been configured it can be connected to the programmer. Afterwards the USB-cable can be connected with both the PC and the programmer. Depending on the operating system installed on the PC a message may appear that new hardware has been detected and the corresponding driver will be installed.

The correct installation of the programmer on the PC can be verified by checking the entries in the device manager as illustrated in the following picture.

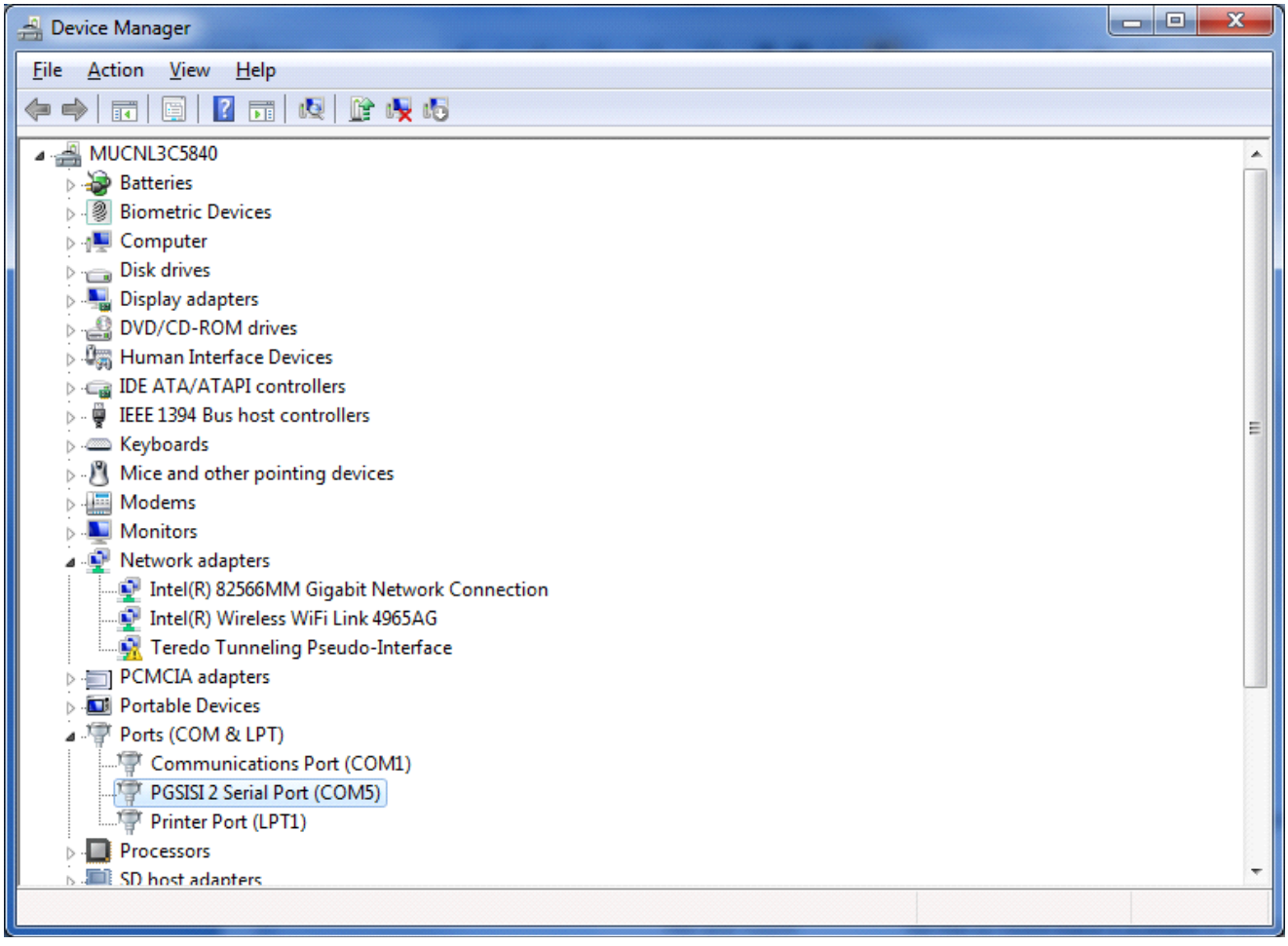

Figure 5 Device manager

If an entry "PGSISI 2 Serial Port (COMxx) exists the programmer has been installed correctly.

3 Starting the application

After installing the software a shortcut can be found under the Start Menu -> All Programs -> Linear Hall Evalkit Software -> TLE4997_98 Evalkit Software.

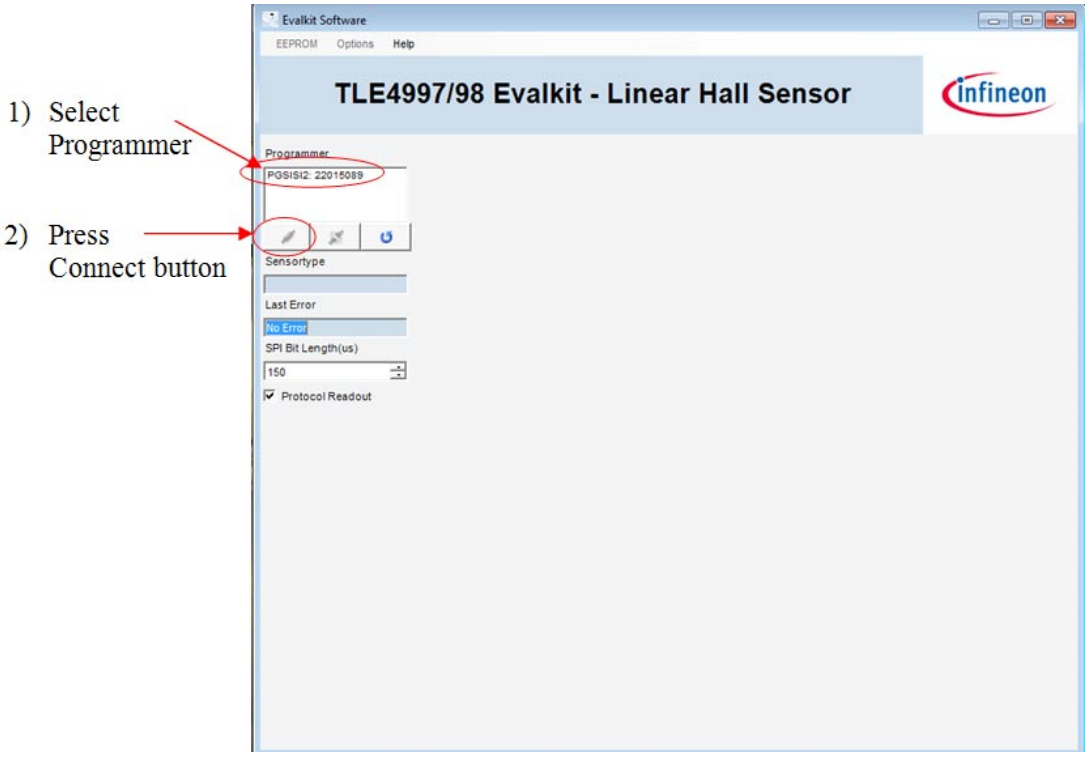

Figure 6 Starting the application

On the left side of the window are the controls for the programmer. At the top is a list of available programmers.

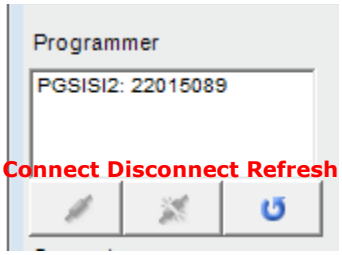

Figure 7 Programmer list

The programmer name and the serial number are displayed. The number can be found on the back side of the programmer.

1)To connect the programmer select an entry in the field Programmer

2)Then, click the connect button (left one).

Clicking the middle button disconnects a programmer and clicking the right one refreshes the programmer list.

4 After starting the application

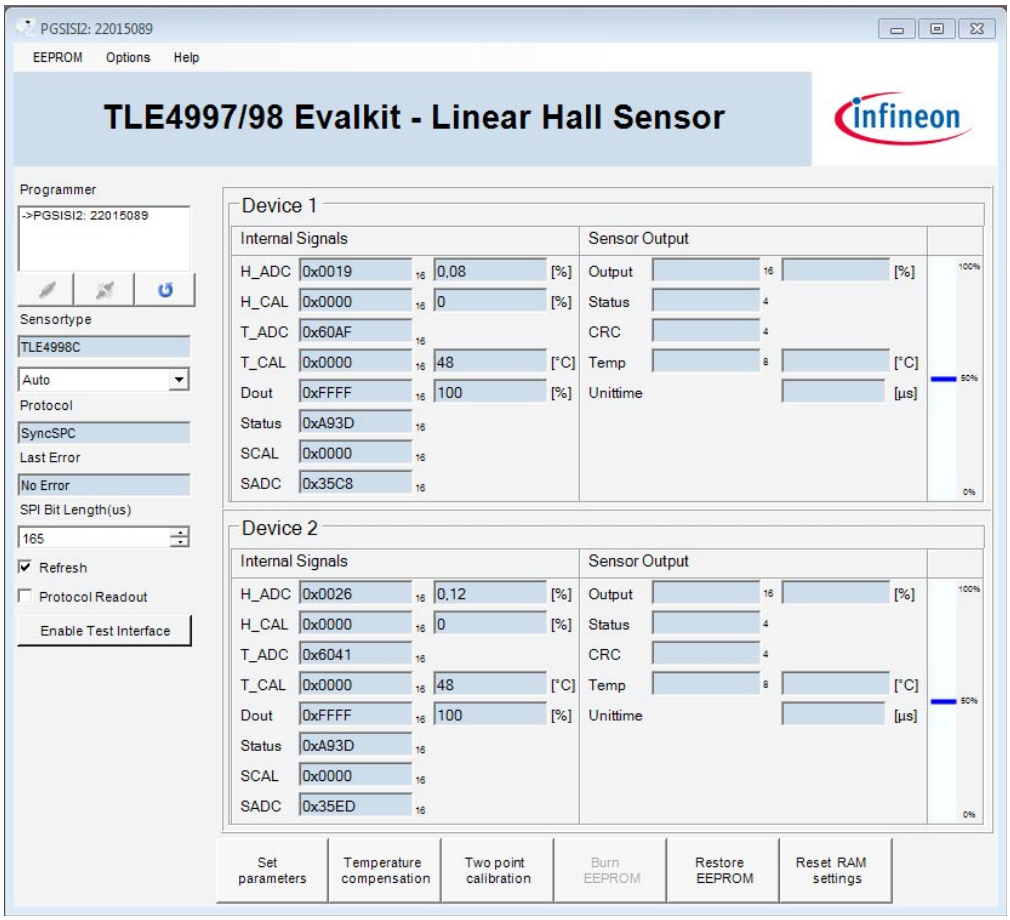

Figure 8 Application GUI

The serial number of the connected programmer is shown on top of the window.

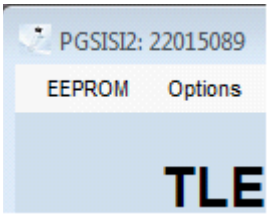

Figure 9 Serial Number

RAM Values

Below the programmer list the following controls are displayed:

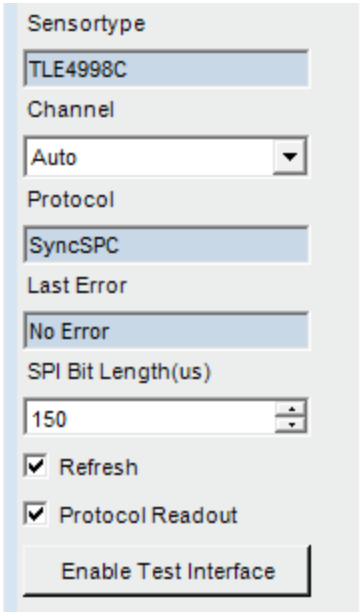

Figure 10 Sensor Type

The first shows which sensor type is connected. With the channel pull-down menu the user can select which channel on the sensor board should be connected. This control can also be used to reset the sensors. Below the Channel pull-down menu the communication protocol of the sensor output is shown. If an error occurred in the firmware the code is shown in the error display. The Refresh check box can enable or disable the periodic update of the RAM and output values. The Protocol Readout check box can enable or disable the check of the protocol.

It is also possible to do a software reset by pressing the Enable Test Interface button, this function allows the user to clean previous error states and reinitialize the sensor.

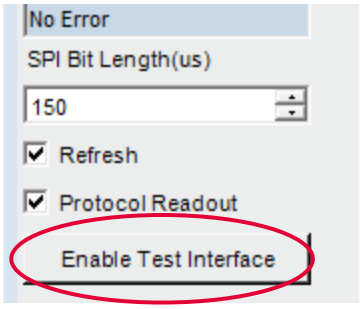

Figure 11 Enable Test Interface

5 RAM Values

In the middle of the window the sensor specific data is summarized. Internal signals are RAM values from the sensor, see the corresponding datasheet and user manual for details of the respective values.

Sensor Output

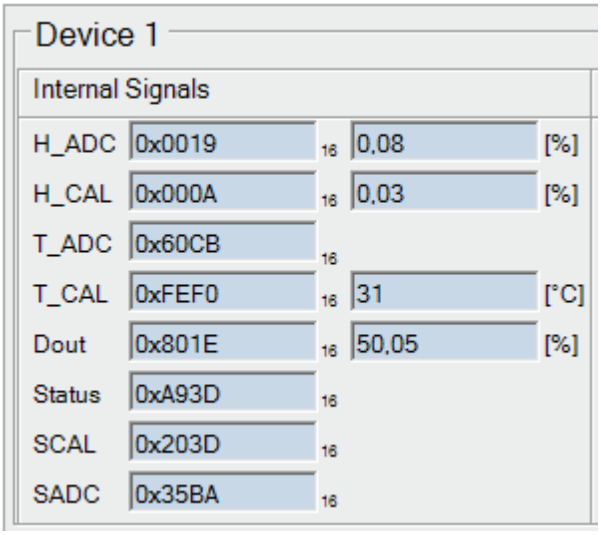

Figure 12 RAM Values

At startup the values on the left are the register values in hexadecimal format and on the right side of each entry the register values are converted.

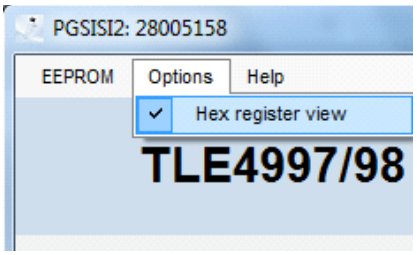

Figure 13 Register view

The register can also be displayed in decimal by unselecting the menu item Options -> Hex register view

6 Sensor Output

The different sensor types have different sensor output protocols. The sensor output in percent is always displayed with this bar.

Figure 14 Sensor Output

100% is when the sensor output reached the maximum value, 0% when the sensor output reached the minimum value. If clamping is activated the respective limits are highlighted with red bars.

6.1 TLE4997E

The TLE4997E has an analog voltage Output. The V_out value is measured with the PGSISI2 and the V_out@5V is related to 5 Volt.

Vdd is the supply voltage and Idd is the supply current of the sensor.

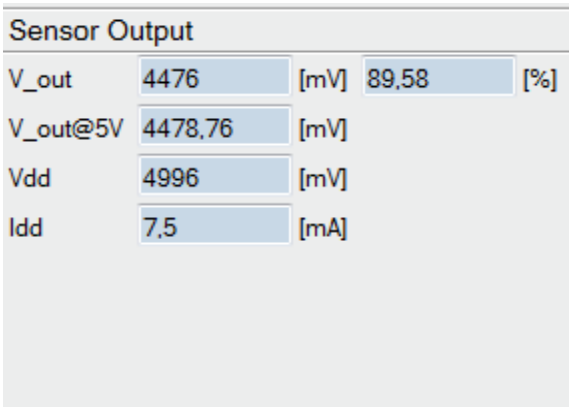

Figure 15 TLE4997E Sensor output

6.2 TLE4998P

The TLE4998P has a pulse width modulated (PWM) output. The frequency and the current duty cycle will be displayed.

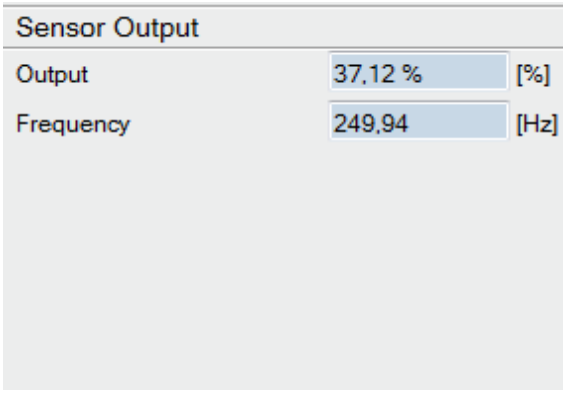

Figure 16 TLE4998P Sensor output

6.3 TLE4998S

The TLE4998S uses the SENT Protocol to send the sensor output. For the TLE4998S3 and S4 the SENT frame has 16 bit for the output, 4 bits for the status of the SENT transmission, 4 bits CRC and 8 bits for the temperature. For the TLE4998S8(D) the protocol is configurable (same as for the TLE4998C, please refer to **Chapter 6.4**). The Unit time is the timing granularity of the SENT transmission. The CRC will be also calculated and compared with the sent CRC. If they match the CRC box will be green, in case a CRC missmatch occurrs the box will be red.

Sensor Output

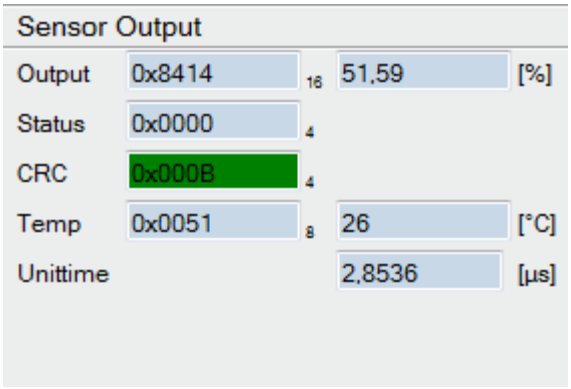

Figure 17 TLE4998S Sensor output

6.4 TLE4998C

The TLE4998C uses the SPC Protocol, which is an extension to the SENT Protocol. The sensor outputs are the same as with the TLE4998S. Only it is possible to control what data should be sent. Possible frames:

Output 16 bits + Temperature 8 bits

Output 16 bits

Output 12 bits + Temperature 8 bits

Output 12 bits

7 EEPROM Values

To set EEPROM parameters click on the "Set parameters" button.

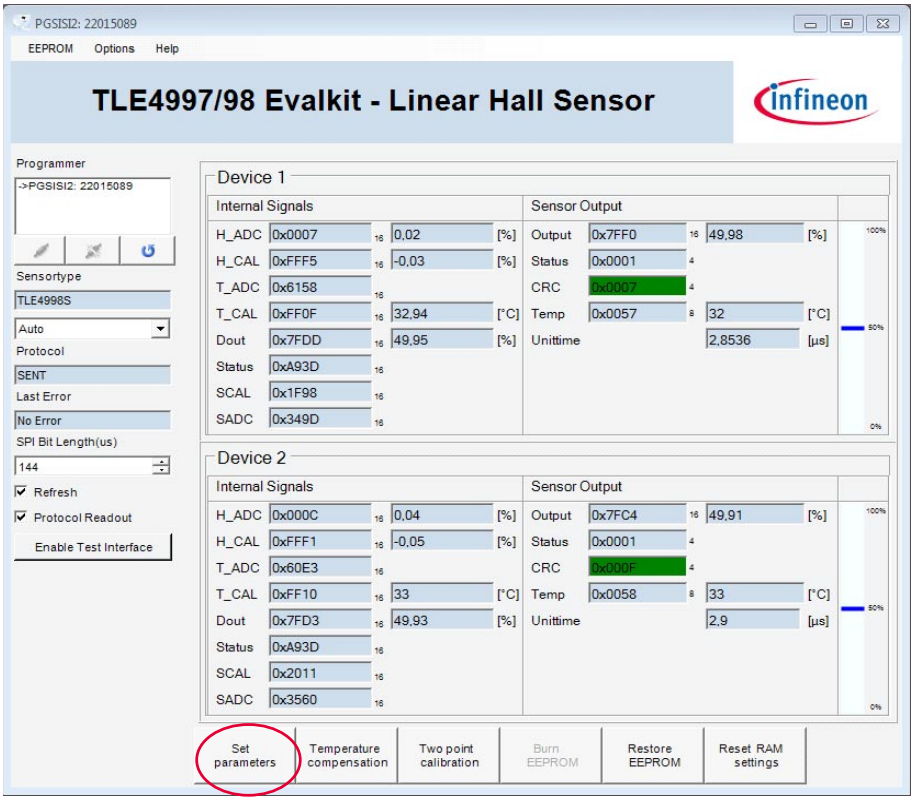

Figure 18 Set parameters

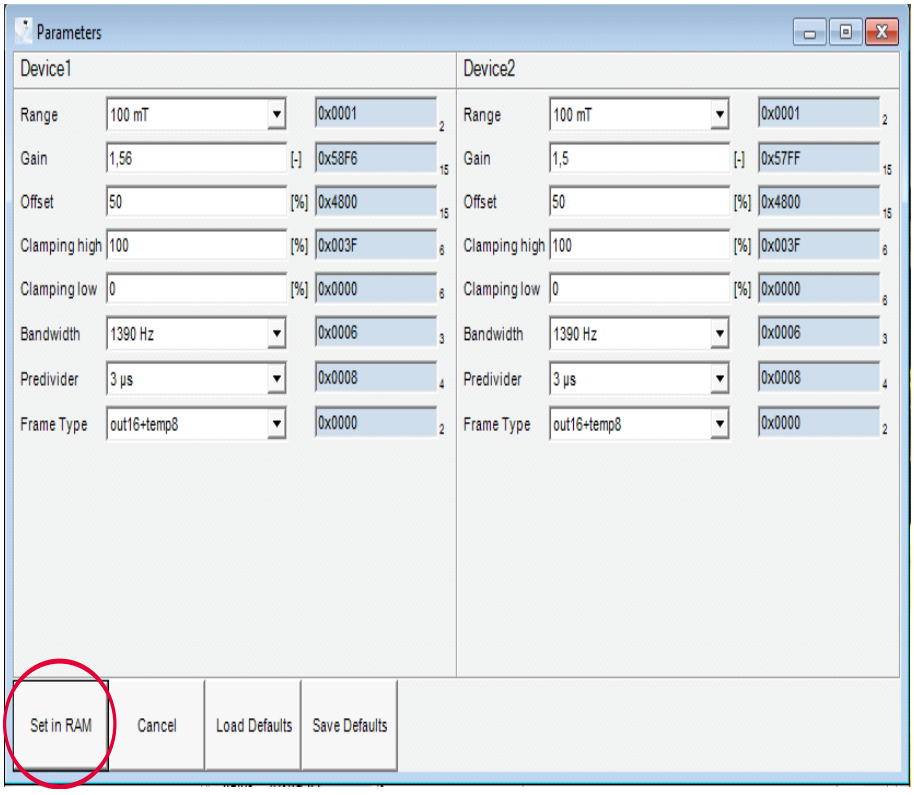

Figure 19 Set in RAM

EEPROM Values

Depending on the sensor type different parameters will be shown. The parameters are displayed as register and calculated values. The changes will be saved in the RAM when "Set in RAM is pressed". To permanently store the new settings in the sensor, press "burn EEPROM". Otherwise, the new settings will be lost when the sensor is reset and the previously stored EEPROM settings will be re-loaded.

Save and Load defaults

In case the user wants to program several sensors in a row with identical parameters, these parameters can be saved as "defaults" by pressing the save defaults button.

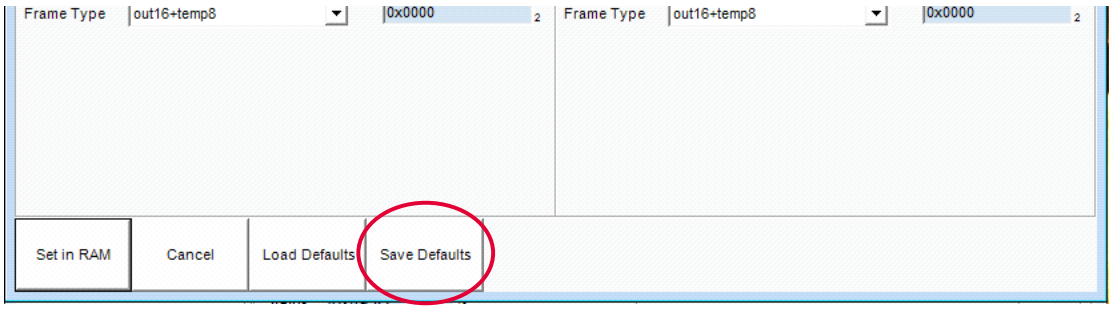

Figure 20 Save Defaults

After the default values are saved, they can be loaded in to diferent sensors by using the load defaults button.

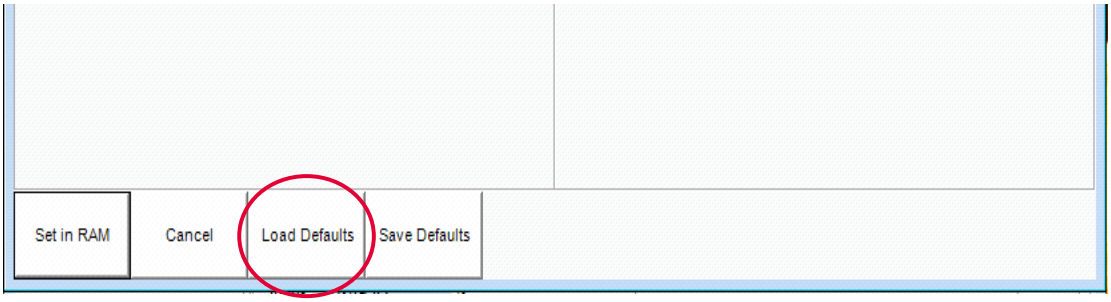

Figure 21 Load Defaults

8 Set Temperature Compensation (TC)

This setup should be performed first to guarantee correct temperature behaviour in the target application, where the magnet(s) have certain temperature behaviour. The required temperature coefficient values have to be specified (please refer to the Temperature Compensation chapter on **TLE4997_User Manual.pdf** or **TLE4998_User Manual.pdf** depending on device type). After that the tool calculates the optimum setup for the device in a single step. The device has now the requested behaviour at a similar error band as the pre-calibrated samples for the "flat" behaviour.

Choose TC parameter

The linear and the quadratic coefficient of the magnet material can be configured manually or predefined materials can be selected via the drop down menu.

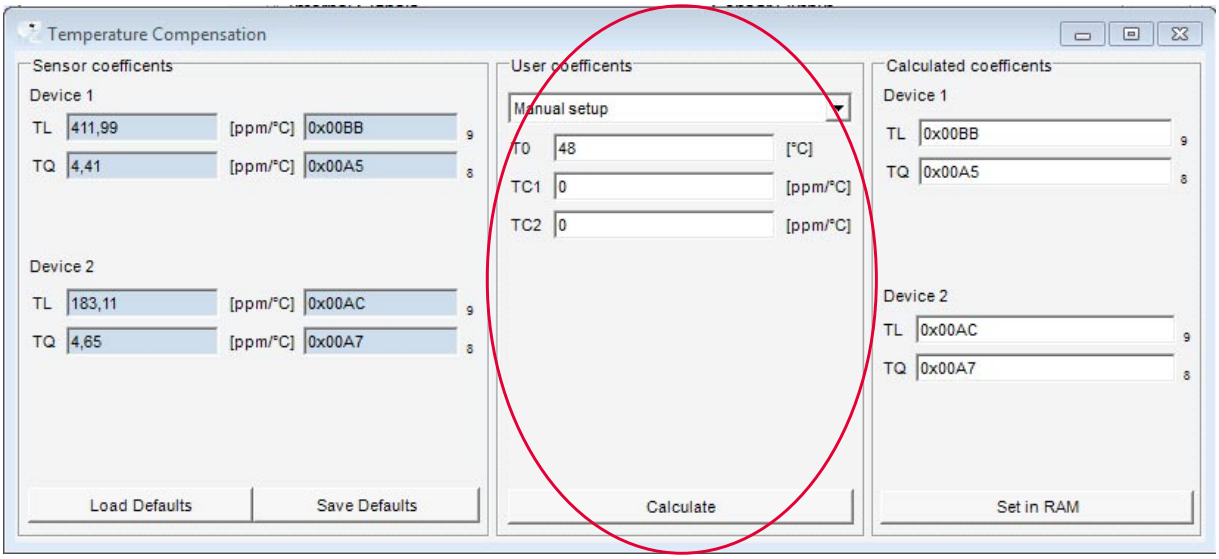

Figure 22 TC user coefficients

Calculate TC parameters

Press the "Calculate" button to start the calculation of the final linear "TL" and the final quadratic "TQ" coefficient.

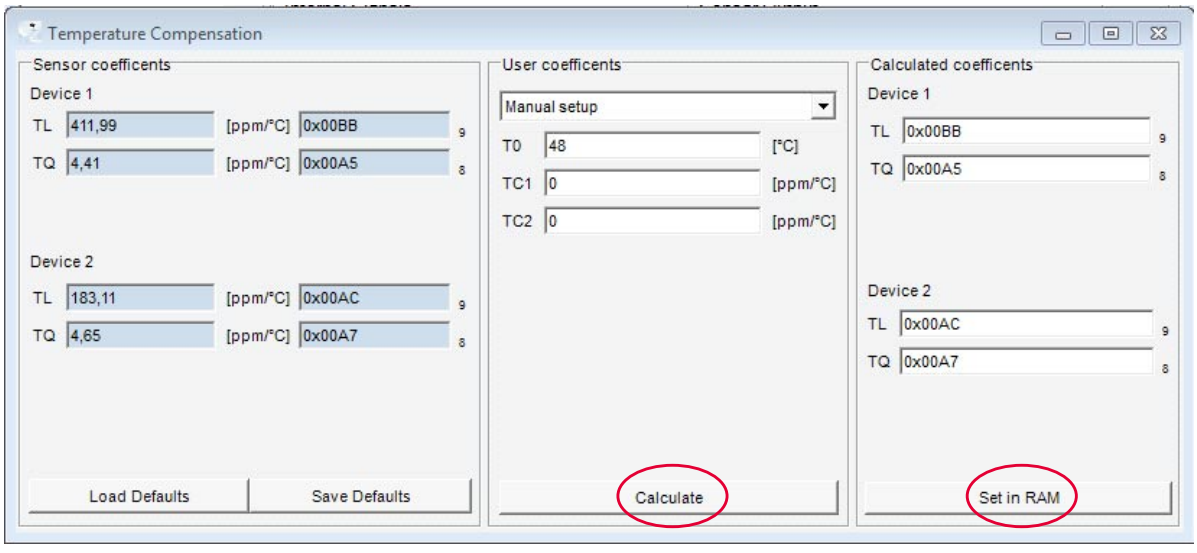

Figure 23 TC parameters

Set Temperature Compensation (TC)

Now the parameters "calc. TL" and "calc. TQ" and the resulting graph are displayed. This sensitivity curve reflects the inverted temperature behaviour of the magnetic setup.

Push "Set in RAM" confirming the settings.

These fields are not editable anymore to prevent overwriting.

Selecting the devices again (using the device selector) or pressing the "read EEPROM" button re-loads the old setting and allows editing again.

Attention: ***This setup requires original, Infineon pre-calibrated IC's. On "top" of this data, the used magnet temperature behaviour is included. Therefore it is not possible to do this setup a second time or on an IC where the temperature coefficients are already modified. But it is possible to restore the IC data to its previous state, if it was stored in the tool database during programming. Then it is possible to setup the user TC again.***

Save and Load defaults

In Temperature compensation menu the save and load default funtions are also available. Once the user has defined the parameters to program, these parameters can be saved as the default values by presing the Save defaults button.

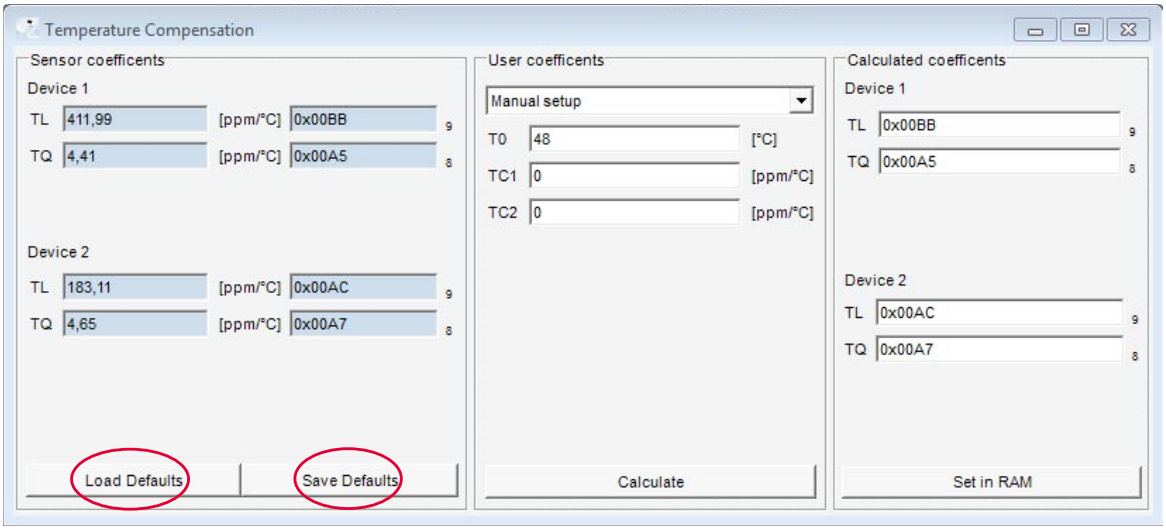

Figure 24 Save and Load Defaults

9 Two Point-Calibration

The next step is the two-point calibration by using the "Two point calibration" button (please refer to the Calibration of TLE4997/98 Characteristic chapter on **TLE4997_User Manual.pdf** or **TLE4998_User Manual.pdf** depending on device type). This routine allows matching the output values to specific magnetic fields. This is done by specifying two output values and then measuring two magnetic fields. Afterwards the program calculates the optimum setup for the device. Ensure that you have the best fitting range setup adjusted before you start the 2 point calibration.

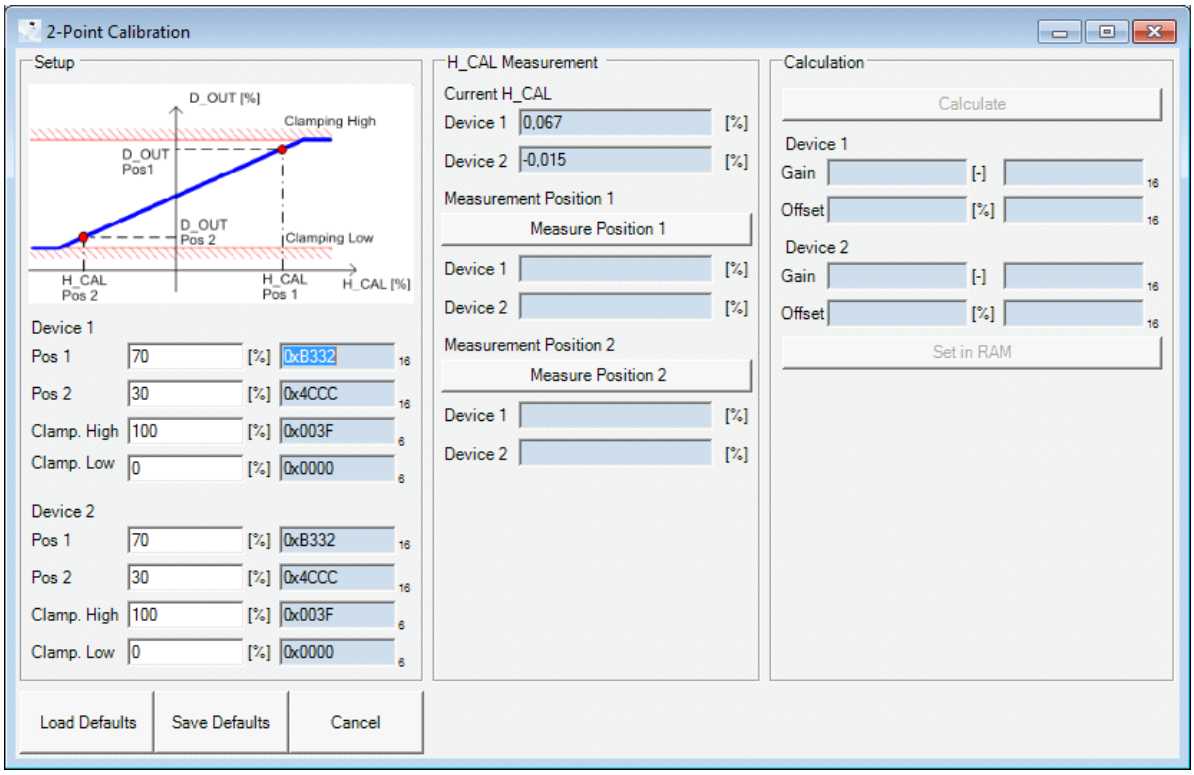

Figure 25 Two Point-Calibration

The values of position1 (in %) and position2 (in %) depend on the selected range in relation to the magnetic field which is used for the calibration.

For a better understanding see following example:

Desired Bin range: -20mT … 20mT

Desired Out range:10% … 90%

Desired Offset:50%

Calibration field:-10mT … 10mT

(Magnetic field which is applied during the calibration)

Sensitivity S=(Out1-Out2)/(Bin1-Bin2)=2%/mT

Build the linear equation.

In this example it is: Out [%] = S [%/mT] * Bin [mT] + Offset [%].

Now calculate the values for 10mT and -10mT:

Out1 [%] = 10 [mT] * 2[%/mT]+ 50[%] = 70%

Out2 [%] = -10 [mT] * 2[%/mT] + 50[%] = 30%

Two Point-Calibration

Clamping high and clamping low are used for limitation. In this case 22.5mT leads to limitation at 95% and -22.5mT to limitation at 5% of the output value.

Calibrate position 1 and position 2

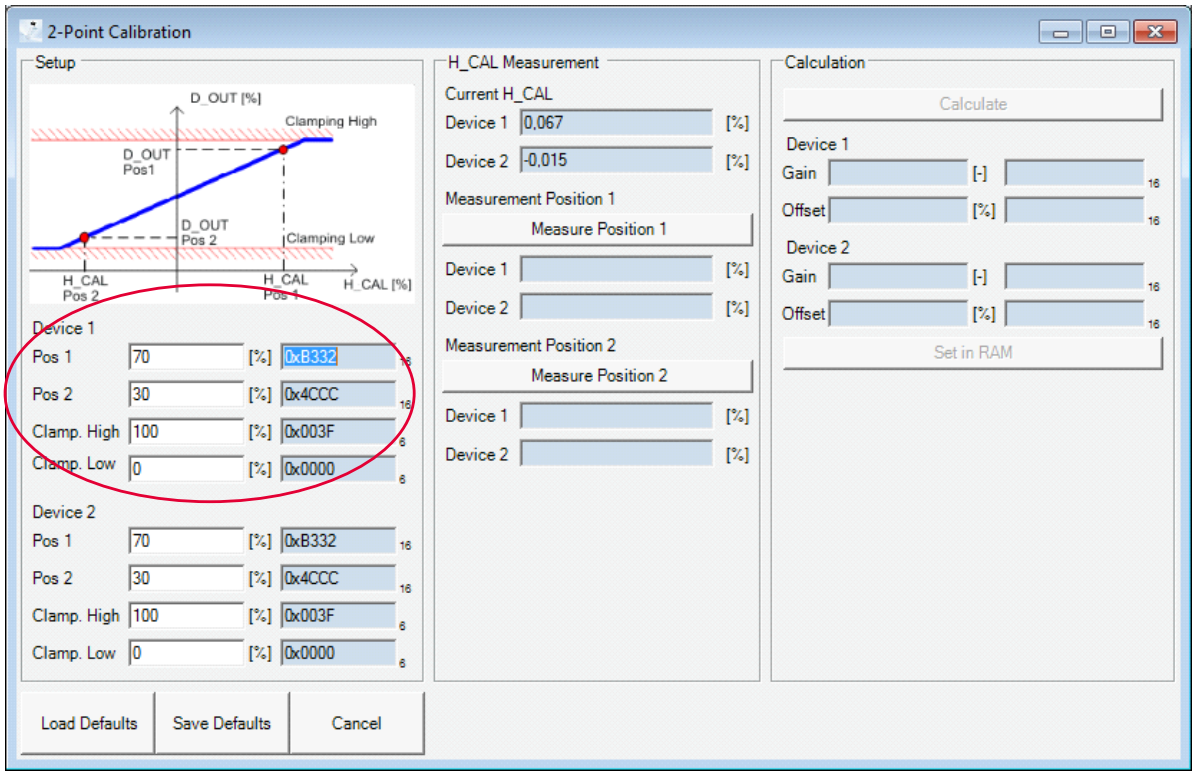

Figure 26 Two Point-Calibration settings

Move the magnet to position 1, then press Measure Position 1. That will need a couple seconds. After that do the same with the second position.

Two Point-Calibration

Calculate two point calibration values and finish calibration

When the measurement is completed the button "Calculate" can be pressed.

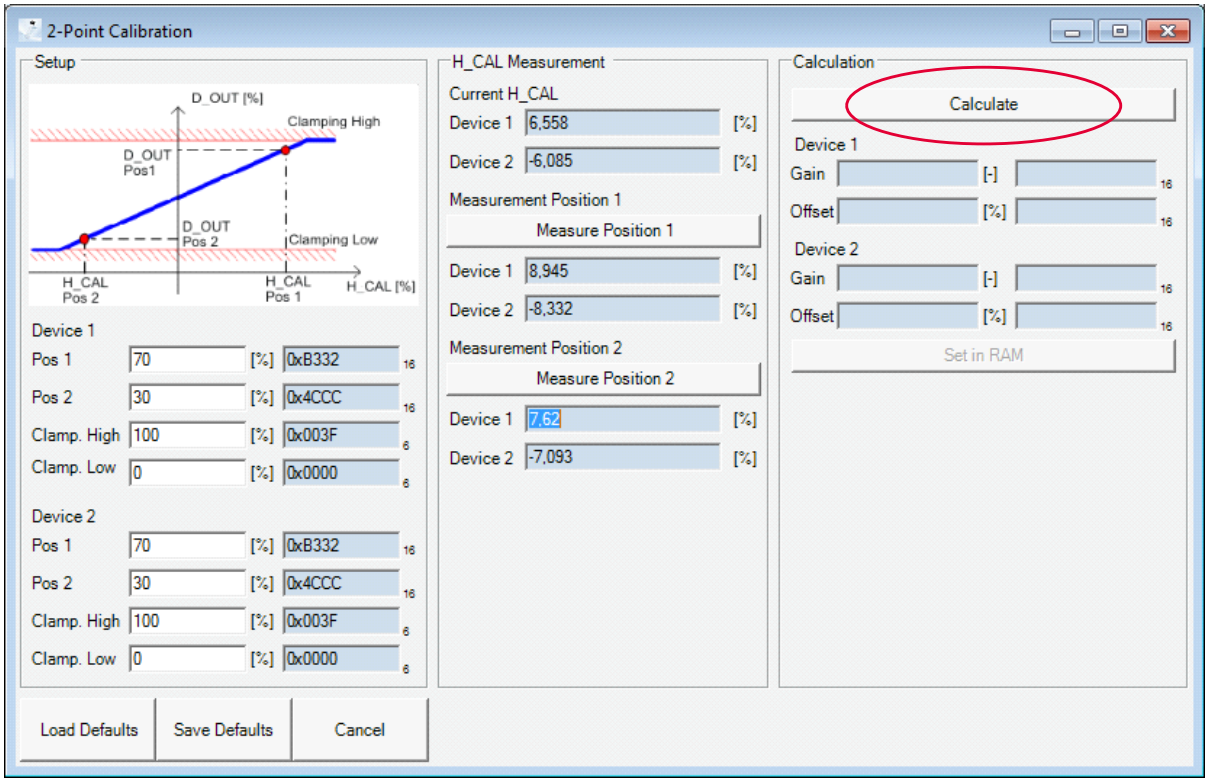

Figure 27 Two Point-Calibration calculate

If the calculated values are in range the button "Set in RAM" can be pressed. To finish the calibration press the "Set in RAM" button. Now the gain and offset is correctly adjusted. After this action the "Main tab" is loaded and the setup completed.

Attention: This calibration should be performed after setup of the temperature calibration values to avoid errors due to an incorrect sensitivity at the temperature where it is performed.

Save and Load defaults

In case the user wants to program several sensors in a row with identical parameters, these parameters can be saved as "defaults" by pressing the save defaults button.

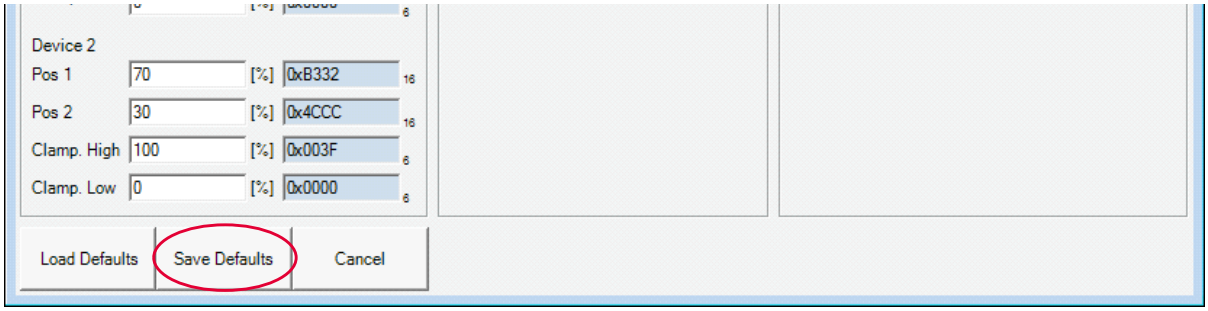

Figure 28 Save Defaults

After the default values are saved, they can be loaded in to diferent sensors by using the load defaults button.

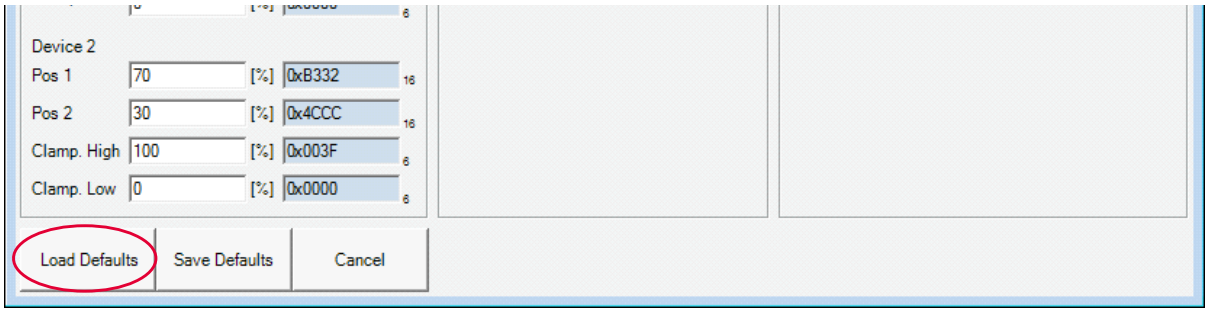

Figure 29 Load Defaults

10 Edit EEPROM map

It is also possible to edit the EEPROM Map directly, by click in the upper menu EEPROM and then selecting EEPROM Map

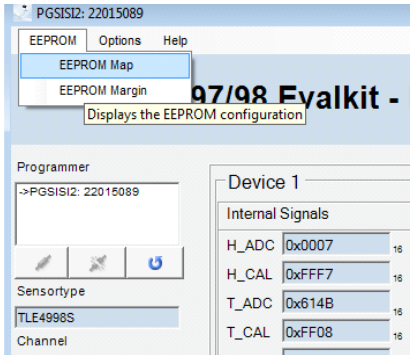

Figure 30 Display EEPROM configuration

The EEPROM configuration will be shown, the user can then select the address and the register to be changed and the values can be writen in decimal or hexdecimal format, the parity bits will be recalculated automatically

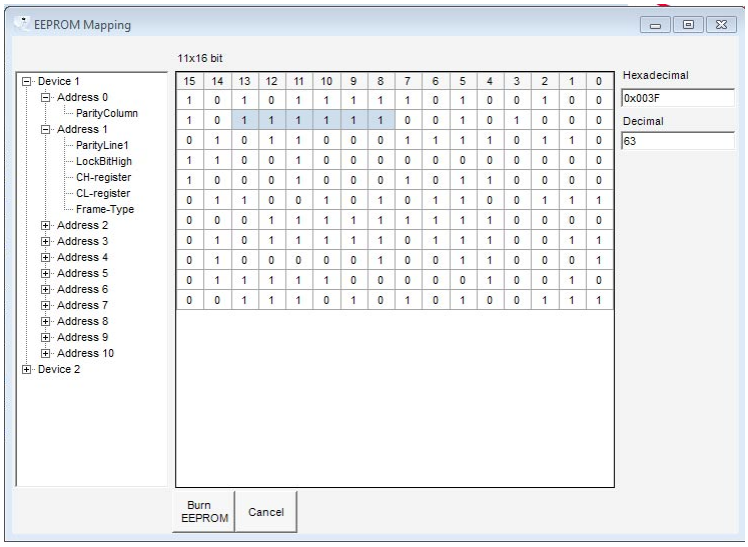

Figure 31 EEPROM map

For the EEPROM map of the sensor being programmed please refer to the corresponding product User Manual

After editing the EEPROM the user can burn the new EEPROM settings, by selecting the Burn EEPROM button (For full details in regards to the burn EEPROM feature please please refer to **Chapter 12**)

11 Check EEPROM Margin

After burning the EEPROM it is possible to verify if the EEPROM was correctly programmed by selecting the EEPROM Margin Check Feature. This function is also useful to verify the stability of the EEPROM after being programmed.

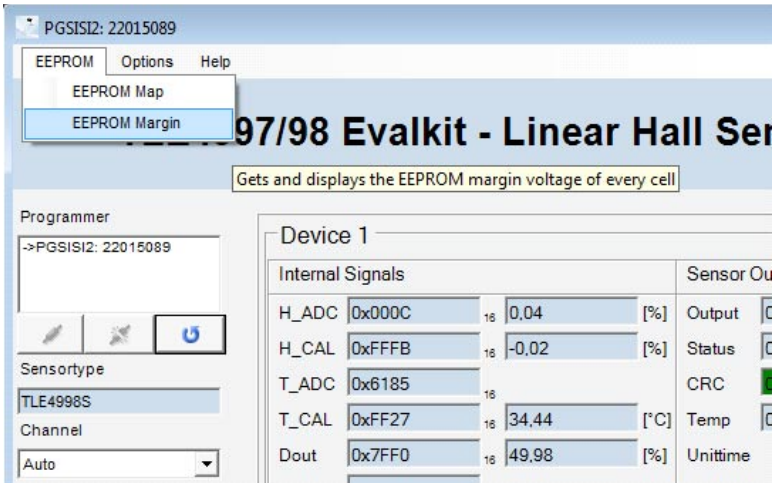

Figure 32 EEPROM margin

Once the EEPROM Margin is selected the EEPROM will be shown, from there the user can select to check the margin voltage of the programed cell by clicking "Check margin voltage 1", if the voltage is inside the limits it means the EEPROM was correctly programmed

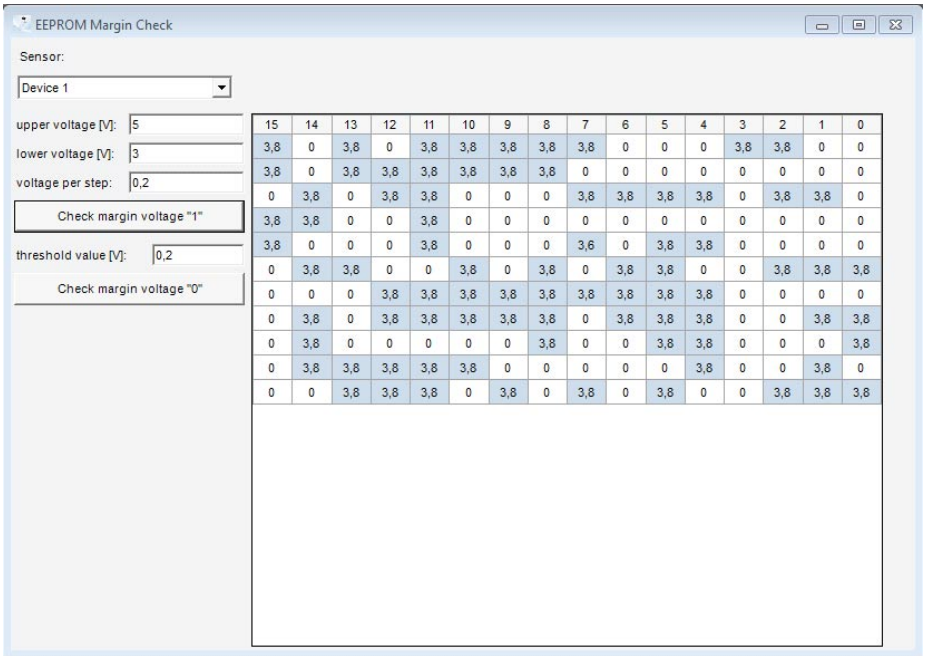

Figure 33 EEPROM Margin check

It is also possible to verify the voltage of the un-programmed cells, this can be done by clicking "Check margin voltage 0", as result the map will be shown with the now programmed cells highlighted in grenn and showing 0, which corresponds to 0 Volt.

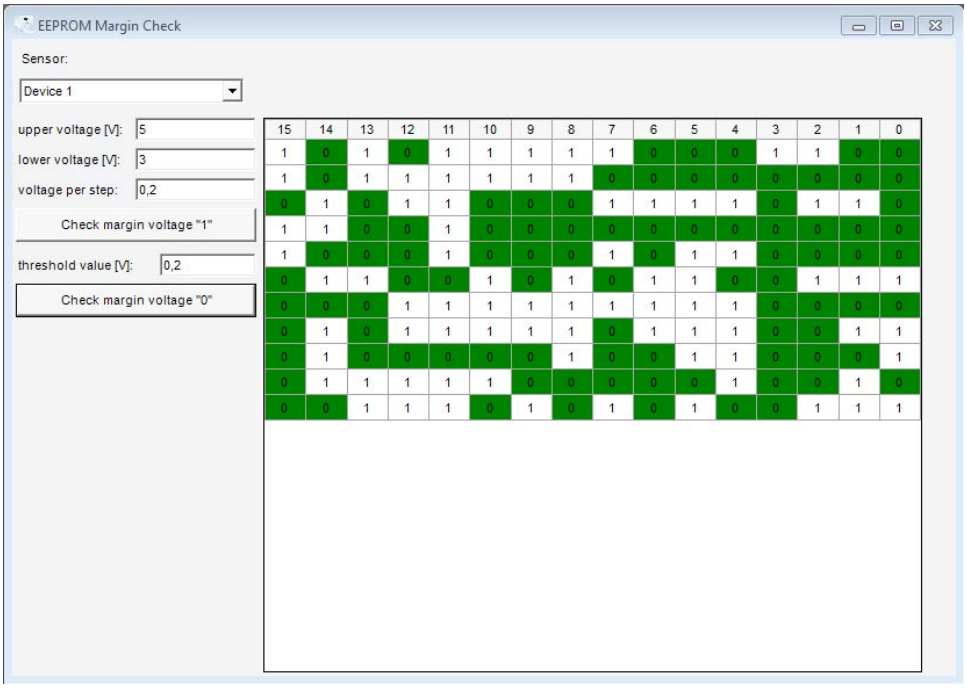

Figure 34 EEPROM Margin check 0V

12 Burn EEPROM

Finally, the EEPROM needs to be programmed. Up to now, the values are only kept in the programmer hardware and the volatile device registers (RAM).

By pressing the "Burn EEPROM" button, a window appears that allows entering a description and the filename for the restore data of this sensor. Then choose, Burn EEPROM or Burn and Lock EEPROM to write changes to the EEPROM of the sensor.

If Burn and Lock EEPROM is clicked the sensor remains in operating mode and the programming interface is not accessible anymore.

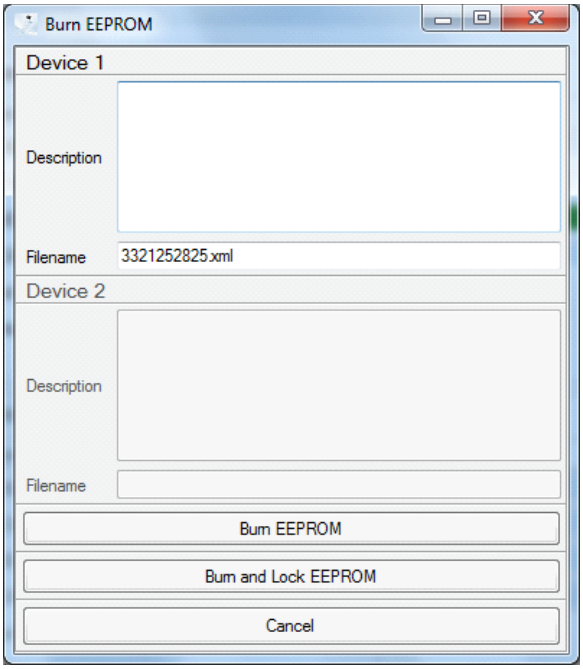

Figure 35 Burn EEPROM

Restore EEPROM

Wait until margin test is finished and continue by pressing the "OK" button.

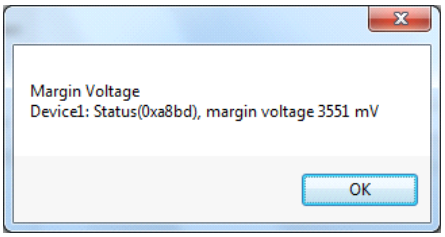

Figure 36 Margin voltage

13 Restore EEPROM

By pressing the "Restore EEPROM" button, a window appears allowing to restore the previous EEPROM data. The programming software compares the given EEPROM setting with the data stored in the database

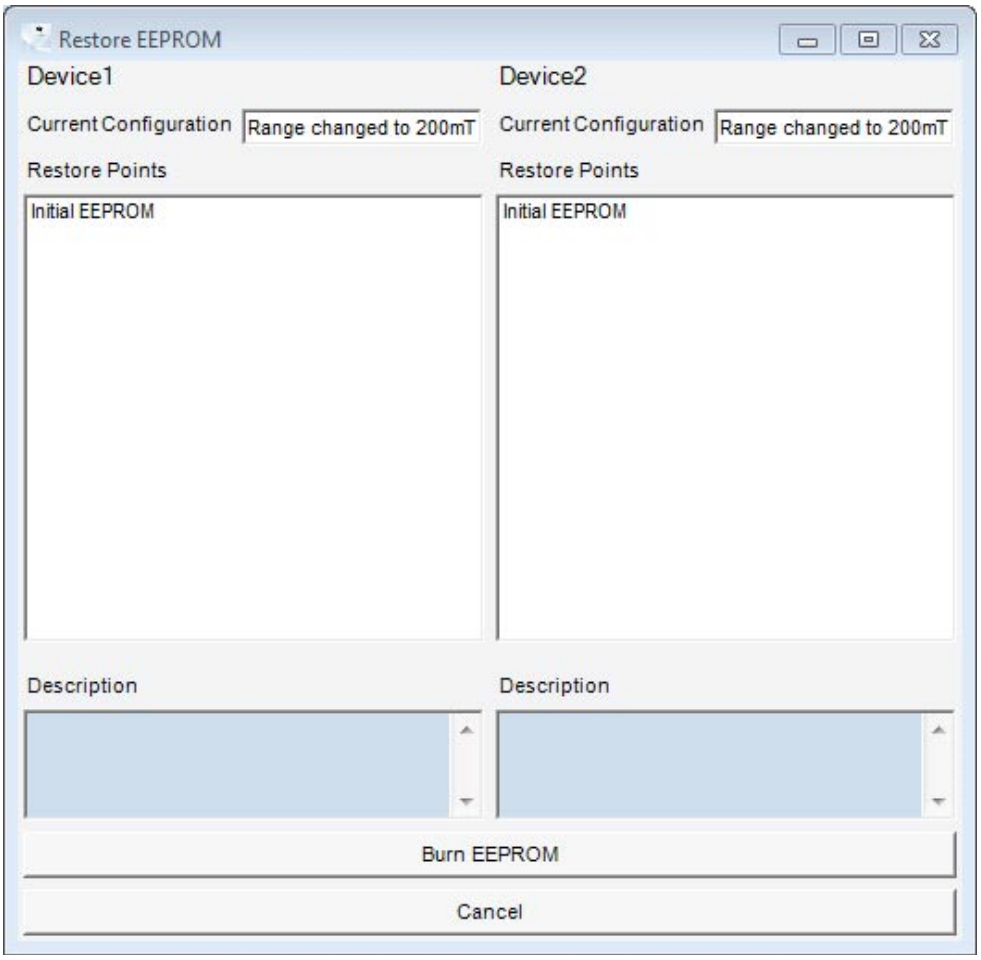

Figure 37 Restore EEPROM

After pressing the "restore" button the previous EEPROM values are burned into the EEPROM again. "Initial EEPROM" is the content of the EEPROM before the first burn.

13.1 Restore database:

Every Sensor has its own File for database. The Files are located in:

"ProgramData\Infineon Technologies\Linear Hall Evalkit Software\RestoreData".

14 Warnings and error messages

14.1 No sensor detected

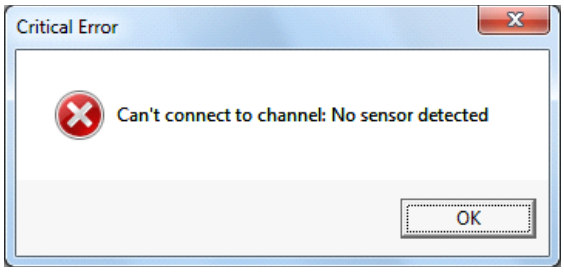

Figure 38 No sensor detected

This error message appears when if no sensor has been connected to the sensor board. It appears also if the SPI interface of the sensor has been locked.

14.2 No TC- setup done

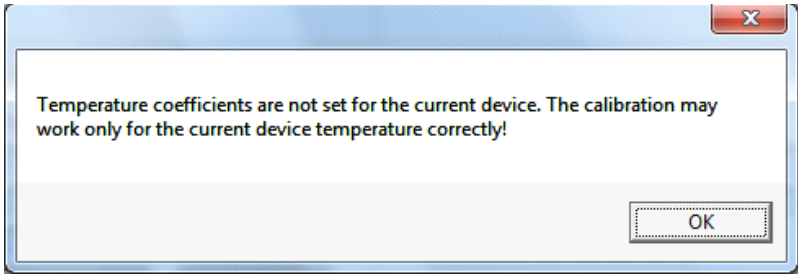

Figure 39 No TC-setup

This error message appears if you start the two-point calibration without having done the TC-setup before.

The temperature coefficients should be calculated and set before the two point calibration because it will increase the accuracy of the calibration

14.3 Set lock bits

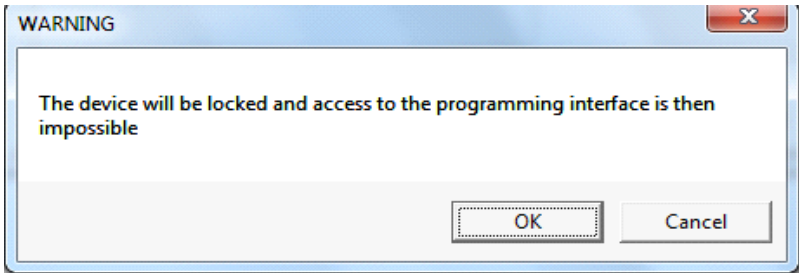

Figure 40 set lock bits

If you press the button "prog & lock", the user is asked before the EEPROM will be programmed and the sensor is locked permanently. After locking, the SPI interface is not accessible anymore.

14.4 Choosing different derivates

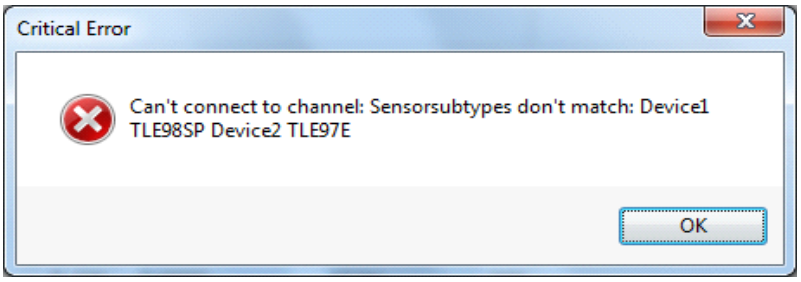

Figure 41 Sensor different subtypes

This message appears if you use two sensors from different derivates or with different protocol types programmed. "no device" is automatically selected after pressing the "OK" button.

15 Annex I

15.1 Error code list

The following is a list of errors which could appear in the main window as indicated below, their meaning and how to react to them

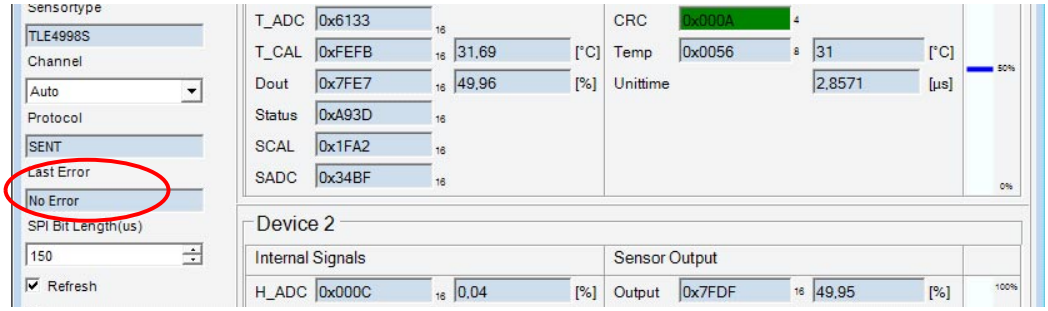

Figure 42 Error window

Error codes

Table 1 Differentiation of error classes by value range of error variables

Error code	Alias	Explanation	Reaction
0x0000	no error		
0x4000	0x4000 is added to the error code if there was already an error saved before (which is now overwritten)		

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Table 2 Errors in PGSIS-2 Box

Error code	Alias	Explanation	Reaction
0x0001 - 0x0FFF	errors in PGSISI-2 box		
0x0012	ERR_CS_STUCK0		
0x0013	ERR_CS_STUCK1		
0x0020	ERR_NOTCALIBRATED	detected during PGSIS-2 initialization	
0x0028	ERR_CALCRCFAIL		
0x0030	ERR_VOUTx_STUCK0		
0x0031	ERR_VOUTx_STUCK1		
0x0032	ERR_VOUT1_TOOLOW		
0x0033	ERR_VOUT1_TOOHIGH		
0x0034	ERR_VOUT2_STUCK0		
0x0035	ERR_VOUT2_STUCK1		
0x0036	ERR_VOUT2_TOOLOW		
0x0037	ERR_VOUT2_TOOHIGH	detected by hw checking routine	please contact Infineon Technologies
0x0038	ERR_VOUT3_STUCK0		
0x0039	ERR_VOUT3_STUCK1		
0x003a	ERR_VOUT3_TOOLOW		
0x003b	ERR_VOUT3_TOOHIGH		
0x003c	ERR_VOUT4_STUCK0		
0x003d	ERR_VOUT4_STUCK1		
0x003e	ERR_VOUT4_TOOLOW		
0x003f	ERR_VOUT4_TOOHIGH		
0x0040	ERR_PORT0_STUCK0		
0x0041	ERR_PORT0_STUCK1		
0x0042	ERR_PORT1_STUCK0		
0x0043	RR_PORT1_STUCK1		
0x0050	ERR_DC_WRONGPORT		
0x0051	ERR_DC_WRONGPORT		
0x0052	ERR_SV_WRONGPORT	errors of misc. general routines	
0x0054	ERR_GV_WRONGPORT		
0x0055	ERR_GC_WRONGPORT		
0x0056	ERR_SO_WRONGPORT		
0x0057	ERR_GO_WRONGPORT		
0x1000 - 0x1FFF	device basic routines		
errors of data receive routine			

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Table 2 Errors in PGSIS-2 Box

Error code	Alias	Explanation	Reaction
0x1010	ERR_D1_NOSFRAME	in SPI communication, LSB of device 1/2 could not be read as '1'	try a slower SPI clock setting (tab Extras in the GUI) and/or a lower capacitance at the output pin use an oscilloscope to check the SPI communication on the EvalBoard
0x1011	ERR_D2_NOSFRAME		
0x1012	ERR_D1_NOEFRAME	in SPI communication, MSB of device 1/2 could not be read as '1'	
0x1013	ERR_D2_NOEFRAME		
0x1014	ERR_D1_WRONGADR	address in answer of device 1 does not match therequested address	
0x1015	ERR_D2_WRONGADR		
0x2000 - 0x2FFF	enhanced device routines		
errors at device detection			
0x2010	ERR_VDD_SHORTCUT	5V supply voltage from PGSISI-2 could not be measured as "5V"	check supply voltage of devices with a multimeter
0x2011	ERR_VDD_OVERDRIVE		
0x2012	ERR_VDD_OUTOFRANGE		
0x2020	ERR_D1_MISSED	an explicit device was selected in the GUI, but could not be detected by the PGSISI-2	use "autoselect" in the GUI
0x2022	RR_D2_MISSED		
0x2021	ERR_D1_UNKNOWN	the PGSISI-2 could not detect the ROM version of the device	please contact Infineon Technologies for an update
0x2023	ERR_D2_UNKNOWN		
errors at misc. enhanced routines			
0x2030	ERR_GR_ILADR	an illegal address was specified while trying to read the RAM/the EEPROM/write the EEPROM	please contact Infineon Technologies
0x2031	ERR_GE_ILADR		
0x2032	ERR_SE_ILADR		
errors at programing			
0x2040	ERR_PE_D1ABORTED	EEPROM programming of device 1/2 was aborted because of the device being already locked or CRC errors in device ROM	please contact Infineon Technologies
0x2041	ERR_PE_D2ABORTED		
0x2050	ERR_PE_NOALGO	no programming algorithm was specified	please contact Infineon Technologies
0x2054	ERR_PE_READERR	EEPROM could not be read during programming	

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Table 2 Errors in PGSIS-2 Box

Error code	Alias	Explanation	Reaction
0x210y	ERR_PE_VERIFAILED	EEPROM verify failed in address 'y' during programming	
0x2800	ERR_ME_READERR	EEPROM could not be read during margin test errors at PWM/SENT/SPC communication	
errors at PWM/SENT/SPC communication			
0x2900		no falling edge at output pin of device 1/2 was detected	check if (at both DIP switches) switch 1 is ON and 2 is OFF use an oscilloscope to check the digital output of the devices on the EvalBoard
0x2901	ERR_D2_SENT_NOINT		
0x2902	ERR_SENT_NODEVICE	no device/no protocol type was specified while trying to receive the digital output of device 1/2	please contact Infineon Technologies
0x2903			
0x2905	ERR_SENT_CRC		
0x2911	ERR_PWM_NODEVICE		
0x2920	ERR_NOPROTOCOL		

16 Annex II

Sensor Board Schematics

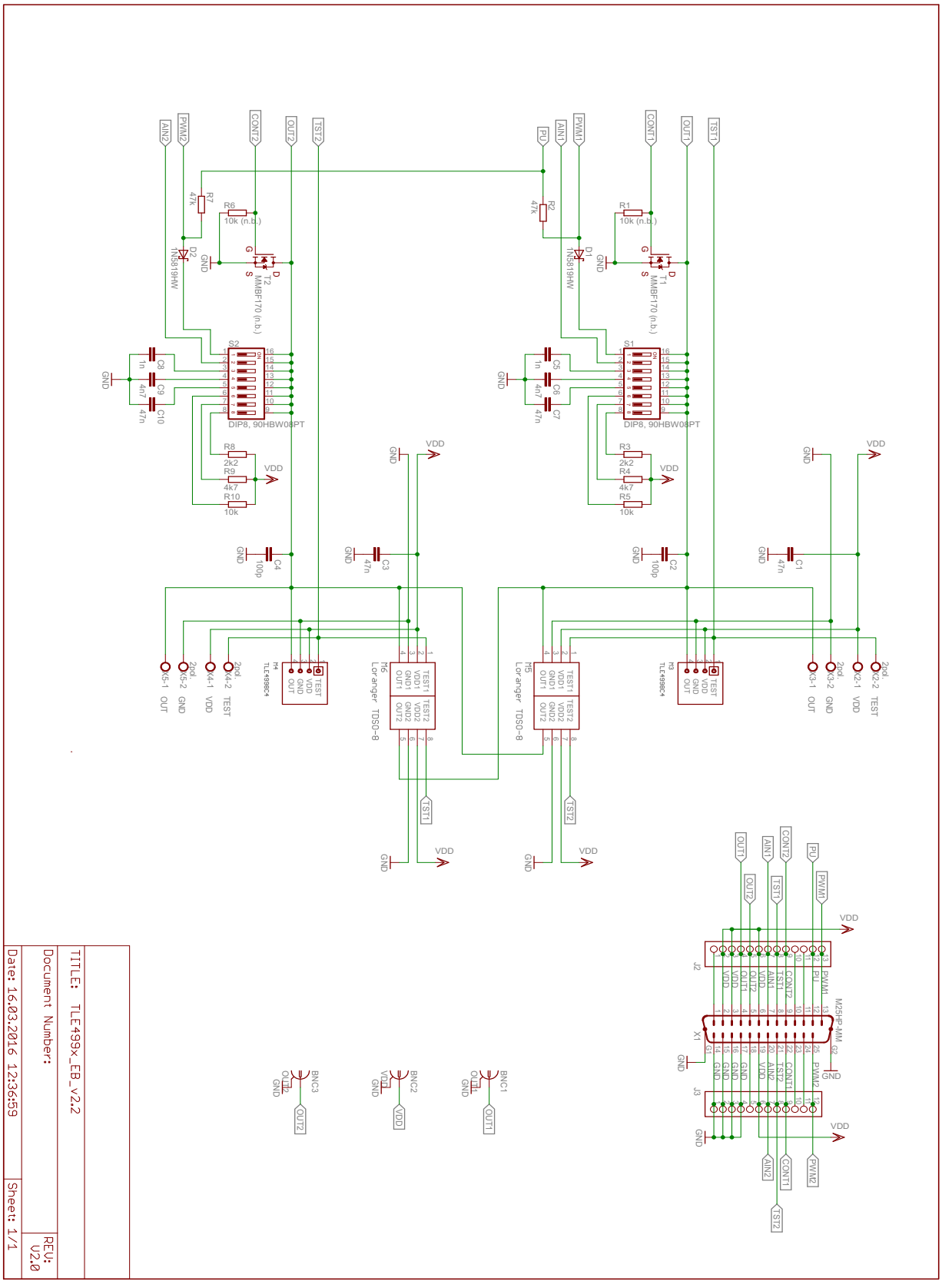

Figure 43 Sensor Board Schematics

17 Revision History

Revision	Date	Changes
2.2	2017-12-08	
Page	**Date**	**Changes**
Page 2	2017-12-08	Updated EvalKit Content Picture (removed CD Rom picture)
Page 4	2017-12-08	Added link to download software on **Installation**

Edition 2017-12
Published by
Infineon Technologies AG
81726 Munich, Germany

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