

# Magnetic Sensor Tooling

## PGSISI-2 Interface box

### Application Note

Rev. 1.1, 2011-09-01

**Edition 2011-09-01**

**Published by  
Infineon Technologies AG  
81726 Munich, Germany**

**© 2011 Infineon Technologies AG  
All Rights Reserved.**

### **Legal Disclaimer**

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation, warranties of non-infringement of intellectual property rights of any third party.

### **Information**

For further information on technology, delivery terms and conditions and prices, please contact the nearest Infineon Technologies Office ([www.infineon.com](http://www.infineon.com)).

### **Warnings**

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

## Revision History 2011-09-01, Revision 1.1

Page or Item	Subjects (major changes since previous revision)
Page 9	TLE5009 Evaluation Board new
Page 10	TLE5012B Evaluation Board new
Page 11	TLE5009, TLE5012B Evaluation Kits new
Page 16, 17	new PC software GUI

## Trademarks of Infineon Technologies AG

AURIX™, BlueMoon™, COMNEON™, C166™, CROSSAVE™, CanPAK™, CIPOST™, CoolMOS™, CoolSET™, CORECONTROL™, DAVE™, EasyPIM™, EconoBRIDGE™, EconoDUAL™, EconoPACK™, EconoPIM™, EiceDRIVER™, EUPECT™, FCOST™, HITFET™, HybridPACK™, ISOFACE™, I<sup>2</sup>RF™, IsoPACK™, MIPAQ™, ModSTACK™, my-d™, NovalithIC™, OmniTune™, OptiMOS™, ORIGA™, PROFET™, PRO-SIL™, PRIMARION™, PrimePACK™, RASIC™, ReverSave™, SatRIC™, SIEGET™, SINDRION™, SMARTi™, SmartLEWIS™, TEMPFET™, thinQ!™, TriCore™, TRENCHSTOP™, X-GOLD™, XMM™, X-PMU™, XPOSYS™.

## Other Trademarks

Advance Design System™ (ADS) of Agilent Technologies, AMBA™, ARM™, MULTI-ICE™, PRIMECELL™, REALVIEW™, THUMB™ of ARM Limited, UK. AUTOSAR™ is licensed by AUTOSAR development partnership. Bluetooth™ of Bluetooth SIG Inc. CAT-iq™ of DECT Forum. COLOSSUS™, FirstGPS™ of Trimble Navigation Ltd. EMV™ of EMVCo, LLC (Visa Holdings Inc.). EPCOS™ of Epcos AG. FLEXGO™ of Microsoft Corporation. FlexRay™ is licensed by FlexRay Consortium. HYPERTERMINAL™ of Hilgraeve Incorporated. IEC™ of Commission Electrotechnique Internationale. IrDA™ of Infrared Data Association Corporation. ISO™ of INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. MATLAB™ of MathWorks, Inc. MAXIM™ of Maxim Integrated Products, Inc. MICROTEC™, NUCLEUS™ of Mentor Graphics Corporation. Mifare™ of NXP. MIPI™ of MIPI Alliance, Inc. MIPS™ of MIPS Technologies, Inc., USA. muRata™ of MURATA MANUFACTURING CO., MICROWAVE OFFICE™ (MWO) of Applied Wave Research Inc., OmniVision™ of OmniVision Technologies, Inc. Openwave™ Openwave Systems Inc. RED HAT™ Red Hat, Inc. RFMD™ RF Micro Devices, Inc. SIRIUS™ of Sirius Sattelite Radio Inc. SOLARIS™ of Sun Microsystems, Inc. SPANSION™ of Spansion LLC Ltd. Symbian™ of Symbian Software Limited. TAIYO YUDEN™ of Taiyo Yuden Co. TEAKLITE™ of CEVA, Inc. TEKTRONIX™ of Tektronix Inc. TOKO™ of TOKO KABUSHIKI KAISHA TA. UNIX™ of X/Open Company Limited. VERILOG™, PALLADIUM™ of Cadence Design Systems, Inc. VLYNQ™ of Texas Instruments Incorporated. VXWORKS™, WIND RIVER™ of WIND RIVER SYSTEMS, INC. ZETEX™ of Diodes Zetex Limited.

Last Trademarks Update 2010-06-09

## Table of Contents

	<b>Table of Contents</b>	4
	<b>List of Figures</b>	5
	<b>List of Tables</b>	6
<b>1</b>	<b>Evaluation Kits for Magnetic Sensors with PGSISI-2 Interface box</b>	7
1.1	Evaluation Kits with PGSISI-2 Interface box	8
<b>2</b>	<b>PGSISI-2 Interface box</b>	13
2.1	PCB Interfaces	13
2.2	SUB-D connector	14
<b>3</b>	<b>Evaluation Boards</b>	15
3.1	Linear Hall Sensor	15
3.2	GMR Angle Sensor	15
3.3	Wheel Speed Sensor	15
3.4	GMR Crankshaft and Transmission Sensor	15
<b>4</b>	<b>Software</b>	16
4.1	PC Software for Linear Hall Sensor	16
4.2	PC Software for Angle Sensor	17
4.3	PC Software for Wheel Speed Sensors	18
4.4	PC Software for GMR Crankshaft and Transmission Sensor	19

**List of Figures**

Figure 1	Tool configuration for evaluation of hall sensors with PGSISI-2. ....	7
Figure 2	PGSISI-2 PCB .....	13
Figure 3	GUI for TLE4997 and TLE4998 .....	16
Figure 4	GUI for TLE5009, TLE5011 and TLE5012 .....	17
Figure 5	GUI for TLE4941plusC and TLE4943C .....	18
Figure 6	Excel File for TLE5027 .....	19

**List of Tables**

Table 1	Programmer tools for magnetic sensors. ....	7
Table 2	PGSISI-2 Programmer and Interface box. ....	8
Table 3	Product related Evaluation Boards. ....	9
Table 4	Product related Evaluation Kits. ....	11
Table 5	25 pol. SUB-D connector. ....	14

## 1 Evaluation Kits for Magnetic Sensors with PGSISI-2 Interface box

For evaluation of Infineons magnetic sensors different programmer tools are available, see [Table 1](#).

**Table 1** Programmer tools for magnetic sensors

product family	product	programmer tool
Linear Hall Sensors	TLE4997E, TLE4998	PGSISI-2
	TLE4990	PGSISI <sup>1)</sup>
Angle Sensors	TLE5009, TLE5011, TLE5012, TLE5012B	PGSISI-2
Wheel Speed Sensors	TLE4941plusC, TLE4943C	PGSISI-2
Crankshaft	TLE5025, TLE5027	PGSISI-2
Camshaft	TLE4981, TLE4982, TLE4983, TLE4984	Adhoc tool
Transmission	TLE5025, TLE5027	PGSISI-2
Hall Switches	TLE49x5, TLE49x6	no programmer required

1) PGSISI Programmer for Linear Hall Sensor TLE4990 can be purchased at [www.ertec.de](http://www.ertec.de)

These tools are available in order to get a first impression of the sensor's performance. The programmer tools are designed as lab tools and not for productive use.

This document focuses on evaluation kits with PGSISI-2 Interface box and should help to find the appropriate evaluation kit for the sensor of interest. A short description of the evaluation kits and the ordering codes are listed below.

For evaluation of magnetic sensors all necessary hard- and software to interface and program the sensor are available. [Figure 1](#) shows the typical tool configuration.

- Programmer software (Graphical User Interface)
- Programmer hardware (PGSISI-2)
- Evaluation board with sockets for the sensor
- Engineering samples
- Documentation (data sheet, application notes, quick start guide, how to use evalboard, schematic of adapter board, general conditions for the supply of starter kits, engineering samples disclaimer)



**Figure 1** Tool configuration for evaluation of hall sensors with PGSISI-2



## Evaluation Kits for Magnetic Sensors with PGSISI-2 Interface box

### 1.1 Evaluation Kits with PGSISI-2 Interface box

The PGSISI-2 programmer is interfaced through a standard USB or a RS232 serial connection to any PC running with a Windows operating system.

For a complete evaluation kit the PGSISI-2 programmer box, see [Table 2](#) and an evaluation board acc. to the selected sensor, see [Table 3](#), must be ordered separately. The PGSISI-2 programmer can be used together with all evalboards in [Table 3](#). Alternatively complete evaluation kits with PGSISI-2 programmer and evaluation boards are available, see [Table 4](#).

#### 1.) Basic Programming Tool PGSISI-2 Interface box

**Table 2 PGSISI-2 Programmer and Interface box**

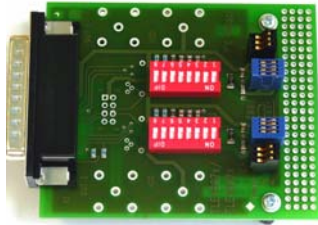
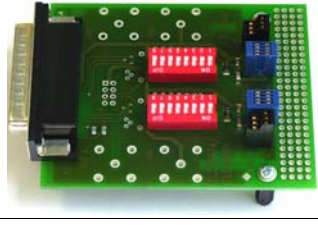
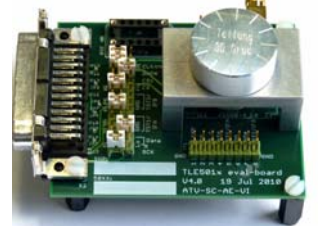


Basic tool	Programmer	ordering code
	PGSISI-2	SP000875082
		content: <ul style="list-style-type: none"> <li>• 24V DC power supply</li> <li>• 4 adaptors for different countries</li> <li>• USB connection cable</li> </ul>



## Evaluation Kits for Magnetic Sensors with PGSI-2 Interface box


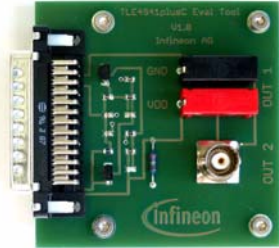


## 2.) Evaluation boards

Table 3 Product related Evaluation Boards

Product	Evaluation Board	Ordering Code / Kit content
TLE4997E	TLE4997 Evalboard 	SP000875086 <ul style="list-style-type: none"><li>• PCB with sockets</li><li>• TLE4997 sensor samples</li><li>• Installation CD:<ul style="list-style-type: none"><li>– programmer software</li><li>– necessary drivers</li><li>– quick start guide and documentation</li></ul></li></ul>
TLE4998	TLE4998 Evalboard 	SP000875090 <ul style="list-style-type: none"><li>• PCB with sockets</li><li>• TLE4998S,-P,-C sensor samples</li><li>• Installation CD:<ul style="list-style-type: none"><li>– programmer software</li><li>– necessary drivers</li><li>– quick start guide and documentation</li></ul></li></ul>
TLE5009	TLE5009 Evalboard 	SP000871466 <ul style="list-style-type: none"><li>• PCB with moveable magnet</li><li>• TLE5009 sensor samples</li><li>• Installation CD:<ul style="list-style-type: none"><li>– programmer software</li><li>– necessary drivers</li><li>– quick start guide and documentation</li></ul></li></ul>
TLE5011	TLE5011 Evalboard 	SP000634322 <ul style="list-style-type: none"><li>• PCB with moveable magnet</li><li>• TLE5011 sensor samples soldered on PCB</li><li>• Installation CD:<ul style="list-style-type: none"><li>– programmer software</li><li>– necessary drivers</li><li>– quick start guide and documentation</li></ul></li></ul>
TLE5012	TLE5012 Evalboard 	SP000634326 <ul style="list-style-type: none"><li>• PCB with sockets and moveable magnet</li><li>• TLE5012 sensor samples soldered on PCB</li><li>• Installation CD:<ul style="list-style-type: none"><li>– programmer software</li><li>– necessary drivers</li><li>– quick start guide and documentation</li></ul></li></ul>








## Evaluation Kits for Magnetic Sensors with PGSI-2 Interface box

Table 3 Product related Evaluation Boards

Product	Evaluation Board	Ordering Code / Kit content
TLE5012B	TLE5012B Evalboard 	SP000912898 <ul style="list-style-type: none"> <li>• PCB with sockets and moveable magnet</li> <li>• TLE5012B sensor samples soldered on PCB</li> <li>• Installation CD: <ul style="list-style-type: none"> <li>– programmer software</li> <li>– necessary drivers</li> <li>– quick start guide and documentation</li> </ul> </li> </ul>
TLE4941plusC	TLE4941plusC Evalboard 	SP000904590 <ul style="list-style-type: none"> <li>• PCB with sockets</li> <li>• sensor samples</li> <li>• Installation CD: <ul style="list-style-type: none"> <li>– programmer software</li> <li>– necessary drivers</li> <li>– quick start guide and documentation</li> </ul> </li> </ul>
TLE4943C	TLE4943C Evalboard 	SP000880418 <ul style="list-style-type: none"> <li>• PCB with sockets</li> <li>• sensor samples</li> <li>• Installation CD: <ul style="list-style-type: none"> <li>– programmer software</li> <li>– necessary drivers</li> <li>– quick start guide and documentation</li> </ul> </li> </ul>
TLE5027	TLE502x Evalboard 	SP000879334 <ul style="list-style-type: none"> <li>• PCB with sockets</li> <li>• sensor samples</li> <li>• Installation CD: <ul style="list-style-type: none"> <li>– programmer software</li> <li>– necessary drivers</li> <li>– quick start guide and documentation</li> </ul> </li> </ul>

## Evaluation Kits for Magnetic Sensors with PGSISI-2 Interface box

Table 4 Product related Evaluation Kits

Product	Evaluation Kit	Ordering Code / Kit content
TLE4997E	TLE4997x Programmer Kit 	SP000439708 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE4997 Evalboard</li></ul>
TLE4998	TLE4998x Programmer Kit 	SP000425300 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE4998 Evalboard</li></ul>
TLE5009	TLE5009 Evalkit 	SP000871462 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE5009 Evalboard</li></ul>
TLE5011	TLE5011 Evalkit 	SP000634330 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE5011 Evalboard</li></ul>
TLE5012	TLE5012 Evalkit 	SP000634334 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE5012 Evalboard</li></ul>
TLE5012B	TLE5012B Evalkit 	SP000912902 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE5012B Evalboard</li></ul>
TLE4941plusC	TLE4941plusC Evaltool 	SP000618000 <ul style="list-style-type: none"><li>PGSISI-2 Programmer</li><li>TLE4941plusC Evalboard</li></ul>

## Evaluation Kits for Magnetic Sensors with PGSISI-2 Interface box

Table 4 Product related Evaluation Kits

Product	Evaluation Kit	Ordering Code / Kit content
TLE4943C	TLE4943C Evaltool 	SP000904594 <ul style="list-style-type: none"> <li>PGSISI-2 Programmer</li> <li>TLE4943C Evalboard</li> </ul>
TLE5027	TLE502x Evalkit 	SP000775322 <ul style="list-style-type: none"> <li>PGSISI-2 Programmer</li> <li>TLE502x Evalboard</li> </ul>

## 2 PGSISI-2 Interface box

The PGSISI (ProGrammer System Infineon Sensor Interface) programmer is the basic hardware tool to interface and program the appropriate magnetic sensors.

It is delivered with universal DC power supply 24V incl. 4 adapters for different countries.

### 2.1 PCB Interfaces

There are different interfaces available on the PGSISI-2 PCB:

- RS232 serial interface
- USB connector
- Analog I/O:
  - 4 voltage outputs (0... 20V)
  - 4 voltage inputs (0... 20V)
- Digital I/O:
  - Hardware SPI
  - 2 CapCom I/O
  - 4 GPIO



**Figure 2 PGSISI-2 PCB**

Connection of the PGSISI programmer to the PC can be done with RS232 or USB. The USB interface is converted into a serial RS232 interface via FTDI chip. Connection to the evalboards is made with a 25 pol. SUB-D connector.

## 2.2 SUB-D connector

Pin configuration of 25 pol. SUB-D connector

**Table 5 25 pol. SUB-D connector**

Pin#	connector	description/usage
1	+24V	directly from power supply
2	VINOUT1	Voltage input/output 0-22V, 0-200mA
3	VINOUT2	Voltage input/output 0-22V, 0-200mA
4	VINOUT3	Voltage input/output 0-22V, 0-200mA
5	VINOUT4	Voltage input/output 0-22V, 0-200mA
6	VIN1 + window detector	Voltage input, 0-20V
7	VIN3	Voltage input, 0-20V
8	P3	general purpose I/O (5V)
9	P1	general purpose I/O (5V)
10	MTSR0	MOSI of hardware SPI or I/O
11	SCLK0	serial clock of hardware SPI or I/O
12	TXD1	Hardware RS232 or I/O
13	PWM0	CapCom input or I/O
14	AGND	GND
15	AGND	GND
16	AGND	GND
17	AGND	GND
18	µC_GND	GND
19	VIN2	Voltage input, 0-20V
20	VIN4	Voltage input, 0-20V
21	P2	general purpose I/O (5V)
22	P0	general purpose I/O (5V)
23	MRST0	MISO of hardware SPI or I/O
24	RXD1	Hardware RS232 or I/O
25	PWM1	CapCom input or I/O

### 3 Evaluation Boards

All adapter boards are designed for the corresponding product families and can be ordered separately as evalboard.

#### 3.1 Linear Hall Sensor

The evalboard for linear hall sensors is designed for:

- TLE4997E with ratiometric analog output
- TLE4998P with Pulse Width Modulation (PWM)
  - TLE4998P3 (PG-SSO-3-10)
  - TLE4998P4 (PG-SSO-4-1)
  - TLE4998P3C (PG-SSO-3-9 incl. capacitor)
  - TLE4998P3C E1200 (PG-SSO-3-9 incl. capacitor with extended gain range)
- TLE4998S with Single Edge Nibble Transmission (SENT)
  - TLE4998S3 (PG-SSO-3-10)
  - TLE4998S4 (PG-SSO-4-1)
  - TLE4998S3C (PG-SSO-3-9 incl. capacitor)
- TLE4998C with Short PWM Code (SPC), protocol allowing enable pulses from a master, synchronized information transfer communication, selection of the magnetic field range and up to 4 slaves on a single line
  - TLE4998C3 (PG-SSO-3-10)
  - TLE4998C4 (PG-SSO-4-1)
  - TLE4998C3C (PG-SSO-3-9 incl. capacitor)

#### 3.2 GMR Angle Sensor

The evalboard for GMR angle sensors is designed for:

- TLE5009, angle sensor with analog output
- TLE5011, angle sensor with bi-directional Synchronous Serial (SSC)-interface that is Serial Peripheral Interface (SPI)-compatible
- TLE5012, angle sensor with SSC, PWM (Puls-Width Modulation), HSM (Hall-Switch Mode), IIF (Incremental Interface)
- TLE5012B, angle sensor with SSC, PWM, HSM, IIF and Short PWM Code (SPC) interface

#### 3.3 Wheel Speed Sensor

The evalboard for ABS sensors is designed for:

- TLE4941plusC with current single pulse interface
- TLE4943C with current PWM protocol

#### 3.4 GMR Crankshaft and Transmission Sensor

The evalboard for GMR crankshaft and transmission sensors is designed for:

- TLE5025 with voltage single pulse interface
- TLE5027 with voltage PWM protocol



## 4 Software

With the PGSISI-2 programmer box and the appropriate evalboard it is possible to get a fast overview of the functionality and performance of the corresponding magnetic sensors. The evalboards are delivered with an installation CD, where all needed documentation and software is available. To use the PGSISI box + evalboard, the evalboard can be directly connected to the PGSISI box using 25 pol. SUB-D connector. Connection of the PGSISI box to the PC is done via USB or RS232 cable.

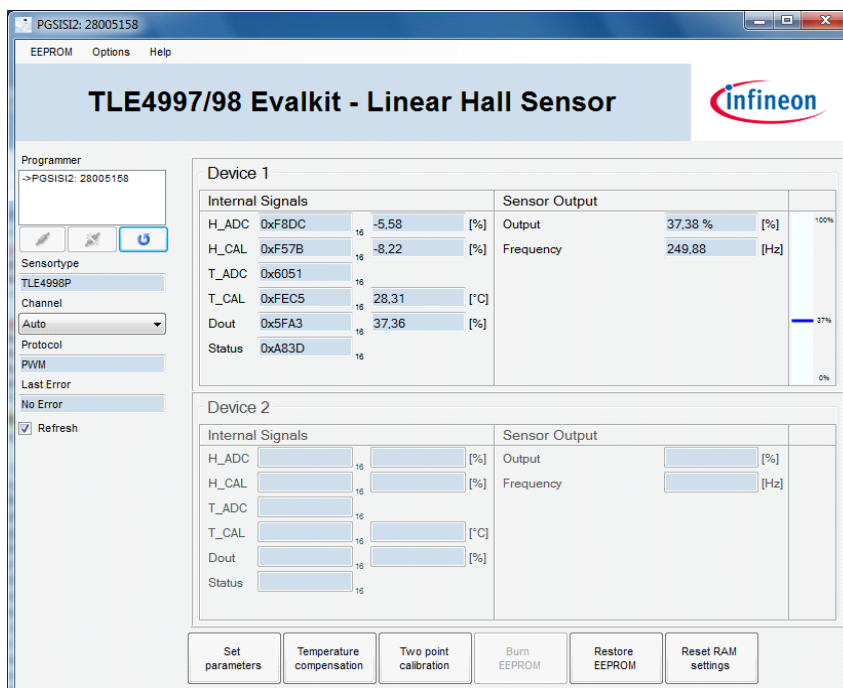
The software delivered with the evaluation kit allows to read the output values from the sensor and perform all relevant programming steps.

To install the software run *setup.exe* which is located in the installation folder. Please follow the instructions described in the *quick start* or *getting started* guide.

After the installation procedure the GUI (Graphical User Interface) is ready to use.

The objective of the software is to visualize the functionality of the sensors. The main features of the connected sensors are the strength of magnetic fields, angle values, register or EEPROM content and status information.

### 4.1 PC Software for Linear Hall Sensor

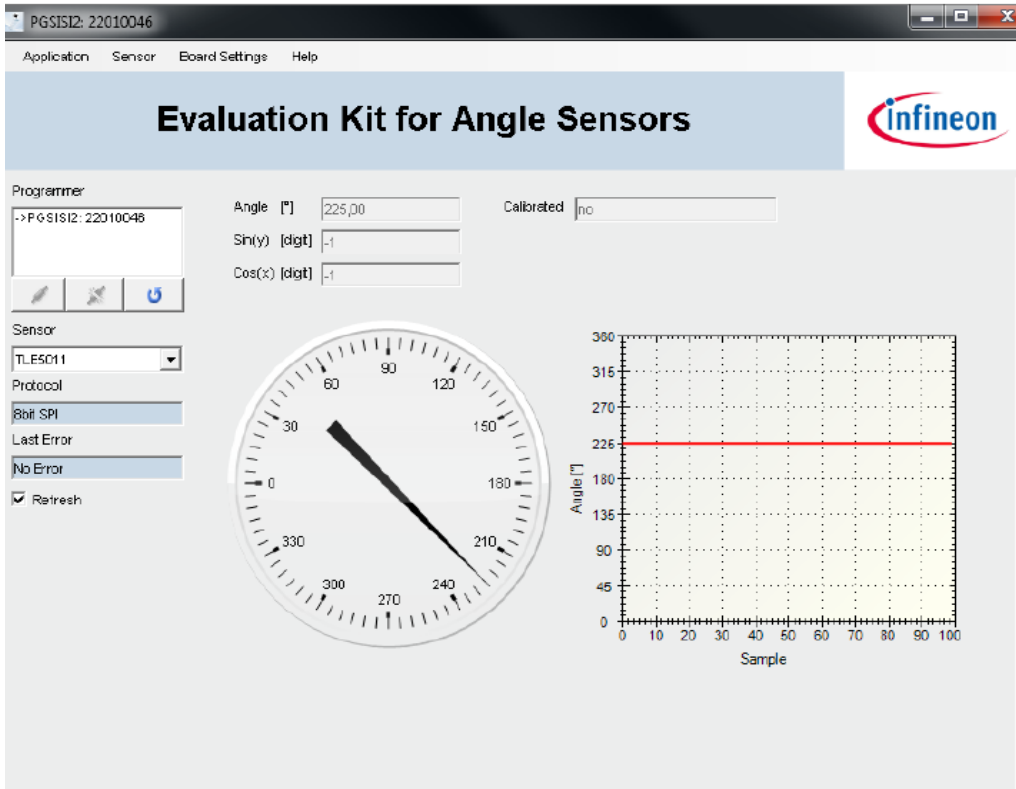


**Figure 3 GUI for TLE4997 and TLE4998**

The TLE4997/98 GUI includes sensor derivatives and protocol types TLE4997E, TLE4998S, TLE4998P, TLE4998C. The main software features are:

- manual setup of all programmable parameters
- guided setting of temperature compensation coefficients
- automatic gain and offset calculation for two point calibration
- real time feedback of sensor registers
- burn and erase functionality for EEPROM memory

## 4.2 PC Software for Angle Sensor



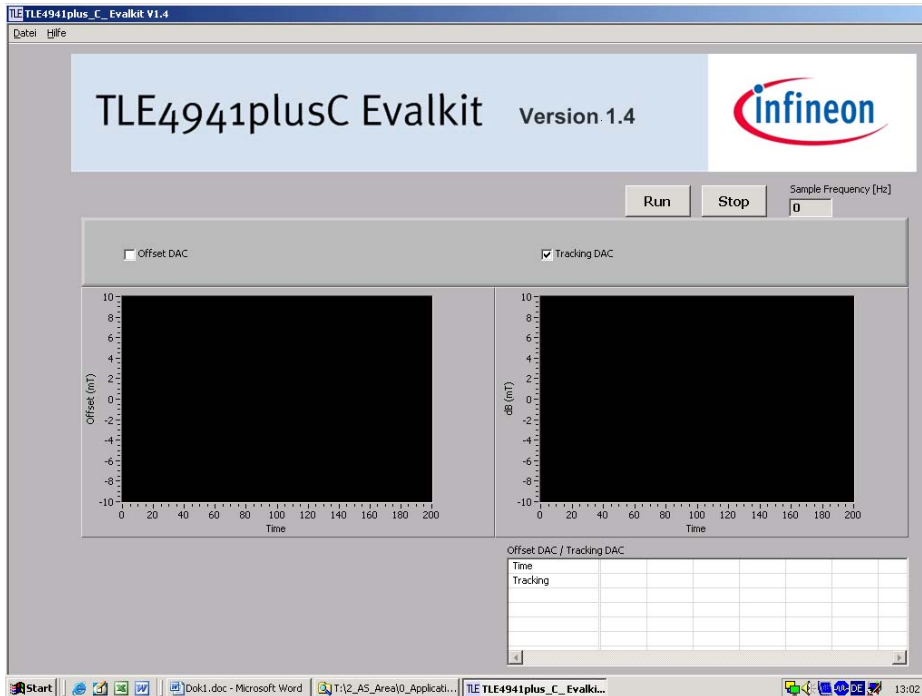
**Figure 4 GUI for TLE5009, TLE5011 and TLE5012**

The TLE5009/5011/5012 product family includes 360° angle sensors that detect the orientation of a magnetic field by measuring sine and cosine angle components with monolithic integrated Giant Magneto Resistance (iGMR) elements.

The data communications are accomplished with a bidirectional Synchronous Serial Communication (SSC) interface that is Serial Peripheral Interface (SPI) compatible. For the TLE5012 additional interfaces are available: PWM (Puls-Width Modulation), HSM (Hall-Switch Mode), IIF (Incremental Interface).

With the evaluation board described in this document it is possible to get a fast overview of the functionality of Infineon's angle sensors. The values can be read out digitally. The GUI makes it easy to understand. Every bit is adjustable within the GUI and the output can be displayed in a time graph or via compass tool

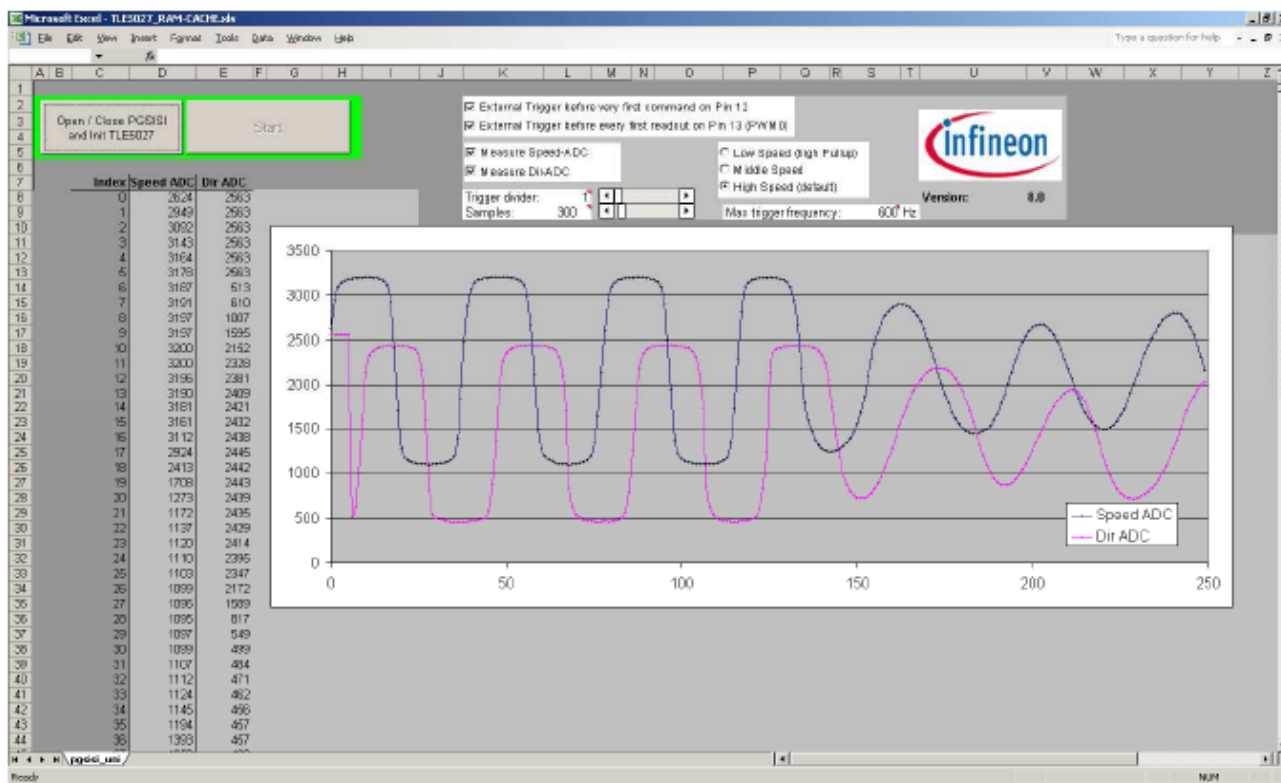
### 4.3 PC Software for Wheel Speed Sensors



**Figure 5 GUI for TLE4941plusC and TLE4943C**

The TLE4941plusC and TLE4943C hall sensors provide information about rotational speed. The differential hall sensor IC detects the motion of ferromagnetic and permanent magnet structures by measuring the differential flux density of the magnetic field. To detect the motion of ferromagnetic objects the magnetic field must be provided by a back biasing permanent magnet

## 4.4 PC Software for GMR Crankshaft and Transmission Sensor



**Figure 6 Excel File for TLE5027**

The main functions of the software are initialization of PGISIS-2 interface box, bringing the sensor into test mode and recording of data. With the Excel software max. 4000 samples are recordable with one ADC or 2000 with both ADCs (direction and speed). Max. sample rate with one ADC: 1.2 kHz, 600 Hz when measuring both ADCs.

[www.infineon.com](http://www.infineon.com)