

TLE5x09A16(D) Evaluation Kit

Analog AMR/GMR Angle Sensor Evaluation Kit

About this document

Scope and purpose

This document describes the Evaluation Kit for the TLE5x09A16(D) angle sensor. The purpose of this manual is to describe the software installation process and how to use the TLE5x09A16(D) angle sensor Evaluation Kit.

Intended audience

This document is intended for anyone who wants to use the TLE5x09A16(D) Evaluation Kit



Table of contents

Table of contents

	About this document	. 1
	Table of contents	. 2
1	General description	3
2	Installation	4
3	Evaluation Kit for Angle Sensors	6
3.1	Connection to PC and starting the application	6
3.2	Connecting to the device	6
3.3	TLE5x09A16(D) sensor panel	7
3.4	Calibration panel	7
3.5	TLE5x09A16(D) sensor panel	.10
3.6	Sensor config panel	.11
3.7	TLE5x09A16(D) saved sensor acquired data	11
	Revision history	13
	Disclaimer	14



1 General description

1 General description

This kit is based on XMC[™]4700 platform. The kit is equipped with the TLE5x09A16(D) dual die angle sensor and a FTDI chip that implements a high baud rate communication.

The EvalKit consists of:

- Dual Die Angle Sensors Evaluation Board
- Rotation knob (3D printed) with magnet (MTS SD-6x2.5-NI-N35SH)

The EvalKit does not contain:

micro USB cable



Figure 1

Dual Die Angle Sensors Eval Kit with XMC[™] 4700



Figure 2

Rotation knob with TLE5x09A16(D) angle sensor below

The Evaluation Kit includes a GUI software application that can be downloaded from the Evaluation Kit product page



2 Installation

2 Installation

This is the installer entry point.

EvalKit for TLE5X09 Angle Sensor									
>Welcome	The installer will guide you through the steps required to install Dual Angle Sensor Evalkit 1.0.1 on your computer.								
>License									
>Directory									
>Confirm									
>Install	WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extend possible under the law.								
>Finish	Exit < Back Next >								

Installer entry point

- **1.** Click Next to go forward with the process
- 2. Please read the license agreement
 - **a.** Check the *"I accept the terms in the License Agreement"* checkbox
 - **b.** The "Next" button activates only after agreeing with the terms
- **3.** Directory for the software installation
 - **a.** You may select the installation folder recommended is to leave the default installation path
 - **b.** You may select if a desktop icon is generated or not
 - c. The hardware device may only operate on a computer that has the FTDI driver installed
 - **d.** The Software GUI is built in .NET environment 4.5. A check is being done for compatibility and you may choose to install (if not already installed) the .NET framework 4.7 (web installer requires connection to internet)
- 4. Confirm the installation process
- 5. Beginning of the installation process
 - a. Windows UAC (user access control) will prompt for access confirmation
 - **b.** Depending on the security settings, you may need administration rights on the installation machine
 - **c.** Wait for the installation process to finish
- 6. Beginning ot the FTDI driver installation process

Figure 3



2 Installation

- 7. Device driver installation Wizard
 - **a.** This wizard helps you install the software drivers that some computers devices need in order to work
 - **b.** Click next to continue
- 8. Please read the license agreement and check the *"I accept this agreement"* checkbox. The "Next" button activates only after agreeing with the terms
- **9.** Finalize the installation by clicking Finish
 - **a.** Check the message provided by the installer. In case of errors, the Software will not be available for running



3 Evaluation Kit for Angle Sensors

3.1 Connection to PC and starting the application

Connect the hardware to PC using a USB to Micro-USB cable

Start the application (via shortcut on desktop or Start → All Programs → Infineon Technologies → Dual Angle Sensor Evalkit)

1: This GUI component will show any connected devices. You may select the device and open a connection / flash the device.

Note: Press the 'Connect' Button to go on. There are three buttons available: Connect, disconnect, refresh

2: You may select the sensor type via the combo-box and start/stop acquisition.

3: Sensor panel – will be displayed after valid sensor is being selected by the user.

🖲 Dual Angle Sensor Evalkit		- 🗆 ×
File Settings Help		
	Dual Angle Sensor Evalkit	infineon
Programmer 1 2 Sensor Nane 2 Start		3 Sensing the world

3.2 Connecting to the device

While connecting to the device, the animated picture with rotating gears will appear.

The software will check the firmware version and flash if it needs to be updated.

The picture will disappear when the process is complete and the device is ready.





3.3 TLE5x09A16(D) sensor panel

After selecting the sensor from the drop down list, the sensor panel will appear.

You can now start the data acquisition. All controls (Settings, Calibration Panel, Save, Clear) become available only if data acquisition is stopped.

		Dual Angle Sensor Ev	alkit	Infineor
Pogramer osc4708-321 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Citi Sensor Bace Angle Calculation Calcula	AVR. Senser Raw Angle Seave Angle Seave Seave Angle Seave Sea	E Dress Cruz Sau	
[Cilindon Brief	wer Other	Determination	

3.4 Calibration panel

The raw signals of the analog angle sensor TLE5x09A16(D) have to be calibrated to achieve high angle accuracy. A calibration of amplitude, offset and non-orthogonality has to be done when the sensor is used the first time (end-of-line calibration).

When the panel opens the final parameters used for angle calibration are read from the microcontroller.

In this panel the user can start the sensor calibration procedure. Every start will reset the existing calibration parameters stored on the microcontroller.

Below the circle quadrants, instruction messages are displayed.

TLE5x09A16(D) Evaluation Kit Analog AMR/GMR Angle Sensor Evaluation Kit



3 Evaluation Kit for Angle Sensors

Press Start to beginn.

Calibration Panel _ X GMR Sensor AMR Senso 0 Mean AmplitudeX[LSB] 0 Mean AmplitudeY[LSB] 0 0 Mean OffsetX[LSB] 0 0 Mean Offset Y[LSB] 0 0 COS(non-ortho) 0 0 SIN(non-ortho) 0 0 Press Start to begin! Not Calibrated Start Read and Save **Open Last File**

Calibration Panel		—	
		GMR Sensor	AMR Sensor
	Mean AmplitudeX[LSB]	0	0
	Mean AmplitudeY[LSB]	0	0
	Mean Offset X[LSB]	0	0
	Mean Offset Y[LSB]	0	0
	COS(non-ortho)	0	0
	SIN(non-ortho)	0	0
Rotate the knob slowly counter clockwise!			
Stop Not Calibrated!	Read and Save	Open	Last File



Calibration P	anel		—	
Press Sta	Int to begin!	Mean AmplitudeX[LSB] Mean AmplitudeX[LSB] Mean OffsetX[LSB] Mean OffsetY[LSB] COS(non-ortho) SIN(non-ortho)	GMR Sensor 0 0 0 0 0 0	AMR Sensor 0 0 0 0 0 0 0
Start	Calibrated!	Read and Save	Open	Last File

Rotate the knob slowly clockwise.

Rotate the knob slowly counter clockwise.

Calibration finished.



After the calibration process is complete, the user can read and save the calibration parameters stored on the microcontroller.

In the panel are displayed only the final parameters used for angle calibration. By clicking "Open Last File", the user can access the full parameters list stored on a csv file at every "Read and Save".

The example in *Figure 4* shows the calibration parameters amplitude, offset and non-orthogonality of TLE5309(D) sensor. The X value corresponds to the cosine output while the Y value corresponds to the sine. The GMR sensor is placed on the top and the AMR sensor on the bottom of the package. The bottom sensor is in flipped configuration compared to the top sensor in TLE5x09A16(D) dual die variants.



Figure 4 Calibration panel

Files are saved in the computer: "C:\Users\<user>\AppData\Local\InfineonDualAnalogAngleTemp" The calibration procedure is done on the microcontroller with the "Library for One Time Calibration & Compensation".

TLE5x09A16(D) Evaluation Kit Analog AMR/GMR Angle Sensor Evaluation Kit

3 Evaluation Kit for Angle Sensors

	File Home Insert Page Layout	Formulas	Data Re	eview Vi	ew Add-	ins
-	Cut Calibri - 11	- A A	= = 1	æ	Wran Te	wt
	Copy -	~ ~	- 18	1 1	er wiap ie	AL
Pa	ste B I U • 🗄	• <u><u></u>•<u>A</u>•</u>	= = =	()	📑 Merge 8	& Cen
	Cliphoard 5 Fort	5		Aliana	ant	
	capoon di se			Angin	PETR.	
Q	10 • $X \checkmark f_X$					
	A	В	C	D	F	
2	TLE5309D E1211					
3	ADC LSB [mV/LSB]: 0.8057	ADC Resol	ution [bit]:	12		
4	Fields result from differential values (eg	sin = sinP - S	inN)			
5						
6						
7	>	GMR Sense	or Full Calil	oration Per	formed: Tr	ue
8	>	Final calibr	ation para	meters		
9	Mean Amplitude X [LSB]:	2867				
10	Mean Amplitude Y [LSB]:	2878				
11	Mean Offset X [LSB]:	-8,5				
12	Mean Offset Y [LSB]:	0,5				
13	SIN(mean non-orthogonality):	-0,00505				
14	COS(mean non-orthogonality):	0,999987				
15	>	Rotation D	ata CCW			
16	Max COS [LSB]:	2858				
17	Min COS [LSB]:	-2876				
18	Max Sin [LSB]:	2879				
19	Min SIN [LSB]:	-2877				
20	Amplitude X [LSB]:	2867				
21	Amplitude Y [LSB]:	2878				
22	Offset X [LSB]:	-9				
23	Offset Y [LSB]:	1				
24	Found 45 angle:	TRUE				
25	Found 135 angle:	TRUE				
26	Found 225 angle:	TRUE				
27	Found 315 angle:	TRUE				
28	X45 Component Length[LSB]:	2002				
29	X135 Component Length[LSB]:	-2021				
30	Y45 Component Length[LSB]:	2019				
31	Y135 Component Length[LSB]:	2038				
32	X45 Corrected Component Length:	0,70143				
33	X135 Corrected Component Length:	-0,70178				
34	Y45 Corrected Component Length:	0,701181				

Figure 5

Parameter list of calibration process

3.5 TLE5x09A16(D) sensor panel

The TLE5x09A16(D) eval kit displays real-time angle values.

After the sensor is fully calibrated, the calibrated angle value will be displayed.

The user can click and pin a cursor in the signal chart. If the checkbox "Enable Cursor Snap" is checked, the cursor will point to the nearest signal value. The cursor value is displayed in the right corner box.

The user can also zoom into the chart by using mouse scroll.

Sensor panel

3.6 Sensor config panel

This panel can be accessed while data acquisition is stopped at Settings → Sensor Config.

The user can select a predefined acquisition rate for the sensor data read. Lowering the rate will reduce the required processing power (on the microcontroller and computer).

Sensor	Config	- 🗆	×
	Acquisition_10k_Hz ~	AcquisitionRa	te
	Acquisition_1k_Hz Acquisition_2k_Hz Acquisition_3k_Hz Acquisition_4k_Hz Acquisition_5k_Hz Acquisition_6k_Hz Acquisition_7k_Hz Acquisition_8k_Hz Acquisition_9k_Hz Acquisition_10k_Hz		Save

Figure 7 Sensor confi panel

3.7 TLE5x09A16(D) saved sensor acquired data

All sensor acquired data can be saved in a csv file, by pressing "Save" button from the sensor panel.

File Hom	e Insert P	ige Layout	Formulas Data I	Review View Add	I-ins Team	V Tell me	what you wa													Ov	edenie Alexa	andru (IFRO	DCBUC ATV
Cut Copy aste	Calibr at Painter B 1	- 11 U - = -		Wrap 1	fext Gen & Center + 😨	eral • % •	Co	nditional Format a	Normal as Check C	ell E	<mark>3ad</mark> Explanatory	Good		Neutral Linked Cel	Ca	iculation ite	• • •	sert Delete F	ormat	AutoSum * Fill * Clear *	AT Sort & Fin- Filter * Sel	C d& ect*	
Clipboard	9	Font	6	Alignment	6	Number	9					Styles						Cells		Ed	iting		
/3 •	• 1 × •	fr.																					
di la contra di la c	A	В	С	D	E	F	G	н	1	J	к	L 1	м	N	0	P	0	R	s	т	U	v	w
TLE5309D E	E1211		-														-						
ADC LSB [m	V/LSB]: 0,8057	ADC Resolu	ution [bit]: 12																				
Sample Inde	ex	Diagnosis	GMR RawAngle[deg]	GMR CalibAngle[deg]	GMR SinP[LSB]	GMR SinN	GMR CosP	GMR Cosh GMR	SinP[mV]	GMR SinN	GMR CosP	GMR Cosh		AMR Raw/ A	MR Calib	AMR SinP[AMR SinN	AMR CosP A	MR Cosh	AMR SinP[AMR SinN	AMR CosP	AMR CosN
() () () () () () () () () ()	C		-127,37	-127,23	900	3178	1173	2913	725,1	2560,4	945,04	2346,9		51,06	51,24	3445	656	1746	2345	2775,51	528,52	1406,69	1889,28
6	1		-127,37	-127,22	899	3179	1173	2914	724,29	2561,21	945,04	2347,71		51,07	51,25	3446	657	1747	2347	2776,32	529,32	1407,5	1890,89
	2		-127,37	-127,22	900	3180	1174	2915	725,1	2562,01	945,85	2348,51		51,07	51,25	3446	656	1747	2347	2776,32	528,52	1407,5	1890,89
	3		-127,36	-127,22	900	3179	1173	2913	725,1	2561,21	945,04	2346,9		51,07	51,25	3446	657	1747	2347	2776,32	529,32	1407,5	1890,89
	4		-127,36	-127,22	900	3179	1173	2913	725,1	2561,21	945,04	2346,9		51,07	51,25	3446	657	1747	2347	2776,32	529,32	1407,5	1890,89
)	5		-127,37	-127,22	900	3180	1173	2914	725,1	2562,01	945,04	2347,71		51,06	51,24	3446	657	1748	2347	2776,32	529,32	1408,3	1890,89
1	6		-127,34	-127,2	899	3180	1174	2914	724,29	2562,01	945,85	2347,71		51,06	51,24	3447	657	1748	2347	2777,12	529,32	1408,3	1890,89
	7		-127,34	-127,2	899	3180	1174	2914	724,29	2562,01	945,85	2347,71		51,07	51,25	3448	657	1748	2348	2777,93	529,32	1408,3	1891,7
(8		-127,35	-127,21	900	3180	1174	2914	725,1	2562,01	945,85	2347,71		51,06	51,24	3448	657	1748	2347	2777,93	529,32	1408,3	1890,89
1	5		-127,35	-127,21	900	3180	1174	2914	725,1	2562,01	945,85	2347,71		51,06	51,24	3446	656	1747	2346	2776,32	528,52	1407,5	1890,09
s	10		-127.35	-127.21	900	3180	1174	2914	725.1	2562.01	945.85	2347.71		51.06	51.24	3447	657	1748	2347	2777.12	529.32	1408.3	1890.89

Figure 8

Sensor acquired data

Revision history

Revision history

Revision	Date	Changes
Rev. 1.0	2020-06-17	Initial creation

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2020-06-12 Published by Infineon Technologies AG 81726 Munich, Germany

© 2020 Infineon Technologies AG All Rights Reserved.

Do you have a question about any aspect of this document? Email: erratum@infineon.com

Document reference IFX-lpa1591258043489

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, 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.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury