

Documentation EVA3011 User Guide





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1 Revision History

Version	Date	Changes	Page
Initial Version 1.0	10/2010		



2 Overview

The EVA3011 is especially designed to evaluate the PE3011 HF RFID Integrated Circuit of Productivity Engineering GmbH featuring an integrated temperature sensor, external capacitive sensor interface and real time clock as well as an 8kBit EEPROM for data monitoring. Digital external sensors can also be incorporated with the help of a microcontroller through the SPI interface of the chip. The EVA3011 serves as a demonstrator and evaluation kit with these features:

- PCB with IC, LED, resistors, sensors and battery
- Two touch sensors to be used as capacitive on/off switches (e.g. box open/closed)
- passive RFID HF transponder with ISO 15693 protocol interface
- recording of time, sensor and temperature events in a defined time interval, either in normal mode or in outband mode
- recording of time and sensor events as interrupt function
- readout of all stored data via HF-RFID interface (ISO15693)
- detailed representation of data in MS Excel format for a graphical view in Windows OS
- default configuration of Evaluation Kit (BAT; L1=R1=R2=00hm; PE3011; JP1)
- R3 and LED1 (indicator alarm port optional)
- JP2 (boost range) not mounted



Figure 1 - Evaluation Kit PE3011 v1.0



3 Controlling software "EVA3011"

3.1 Installation

After downloading the software to manipulate the Data Monitor with a SCEMTEC Reader it needs to be installed by executing the file "Install_EVA3011_1.0.exe".

The EVA3011 comes with a graphical user interface for WindowsXP [™] platforms. It is recommended to start with this simple software interface to learn about the basic functionality of the chip on the board.

All necessary files will be copied into the target directory and a group will be created in the "Start" Menu. To communicate with SCEMTEC Reader the internal USB to RS232 driver with DLL will be used. Readers from other vendors may not work properly. Typically each reader requires its own USB driver interface. Driver installation can be done through standard software installation or through the "Start" Menu.

SCEMTEC

The driver interface for USB must be installed with the reader software from the reader vendor. For the operation with SCEMTEC a DLL and special internal C++ functions are available. A SCEMTEC reader SIR 2710 can communicate with these functions through the USB to RS232 conversion. The software automatically checks the devices connected to the ports and connects with the reader.

Note: A software driver might or might not be required. More readers can be incorporated by PE on request if a driver is not available from the reader manufacturer. Available source codes are free to be used.



3.2 Software description – Connect Reader

After starting the software (over "Start" Menu) and the access of a HF-Reader the connection can be established. For this action the menu "File" and the point "Connect Reader" or the icon should be used.

PE EVA3011 Sensor Monitor 1.0	
Eile Options Help	
👱 🖬 🕦 🧿	
Connect Reader pry Sensor Monitor	Sens Cap Def 🛛 Monitor Results 👋 Graph Temp 👌 Graph extSens 🖉 🔍 🖉
Inventory	
Tag UID:	
۹,	
Tag Flags:	
AFI	
DSFID	
Reader Default	
No Reader Connected	Windows XP (build 2600, Service Pack 3)

After pressing "Scan" it will now scan the ports for a connected reader. If it finds a valid reader the connection can be established by confirming "**OK**".





If no reader is found the "Inventory" button is not usable and the software is working without any tag information or activities.

PEEVA3011 Sensor Mon	itor 1.0					
File Options Help	ิด					
		Song Can Dof	Monitor Becults	Craph Tomp	Graph avtSanc	d b
Invento Tag UII	ry D:		Profileor Resolts	arapit renip	Graph excerts	
Tag Flaç	js:					
	AFI					
	DSFID					
Reader Defa	ault.					
No Reader Connected			Windows XP	(build 2600, Serv	ice Pack 3)	

After a successful reader connection the software can "Inventory" a tag for UID, AFI and DSFID data.

PE EVA3011 Sensor Monitor 1.0		_ 🗆 🗙
Eile Options Help		
See 👔 🗿		
Tag Inventory Sensor Monitor	Sens Cap Def Monitor Results Graph Temp Graph extSens	⊲ ⊳
Inventory		Í
Tag UID:		
V	E0 3E 13 2A 40 02 49 9E	
Ť		
Tag Flags:		
AFI	80	-
DSFID	00	-
Reader Default		
SCEMTEC STK	Windows XP (build 2600, Service Pack 3)	





It is possible to use the Reader Console (menu "**OPTIONS**" -> "**Reader Console**" or the icon) to see the internal data transfer between software reader and tag.

PB Reader Console	_ 🗆 🗵
• =	
Connected Reader: STKX/U	
TX >> [STX]1003FFFE[ETX]	
TX >> [STX]1011020002[ETX]	
TX >> [STX]1c31010000[ETX]P	
Rx << [ACK] [STX]1C31[ETX]w	
TX >> [STX]1c31020000[ETX]S	
Rx << [ACK] [STX]1C31[ETX]w	
TX >> [STX]1c31030001[ETX]S	
Rx << [ACK] [STX]1C31[ETX]w	
Tag Inventory	
TX >> [STX]4C16n[ETX][US]	
Rx << [ACK] [STX] 4C160y0F9E4902402A133EE00080FF01A1 [ETX] 4	
Tag Inventory	
TX >> [STX]4C16n[ETX][US]	
Rx << [ACK] [STX] 4C160y0F9E4902402A133EE00080FF01A1 [ETX] 4	
	-

The button "**Reader Default**" sets all reader specific flags to default configuration. This is necessary if the reader is not set to ISO15693 conformity.

₽E EVA3011 Sensor №	1onitor 1.0					_ 🗆 🗵
File Options Help						
🧏 🖬 🕥	0					
Tag Inventory	Sensor Monitor	Sens Cap Def	Monitor Results	Graph Temp	Graph extSens	4 ⊳
Inven	ntory					
Tag l	JID:					
			Reader set t	o default	status	
Tag F	lags:					
	AFI					_
	DSFID					
Reader [Default					
			har to see			
SCEMTEC STK			Windows XP (build 2600, Serv	ice Pack 3)	

This way all reader and tag pre-definitions are completed.



3.3 Software description – Sensor Monitor

To read and manipulate the Sensor Monitor of the PE3011 tag the tab "Sensor Monitor" can be used.

PE EVA3011 Sensor Monitor 1.0	_ 🗆 🗙					
<u>File Options H</u> elp						
Tag Inventory Sensor Monitor Sens Cap Def Monitor Results Graph Temp Graph extSens	< ▷					
Get Monitor Status ✓ X-Sensor Interrupt Area: ✓ Y-Sensor Interrupt Time: ✓ Y-Sensor Interrupt Time: Interrupt Mode X/Y Sensor Avarage: 0 2^AV	d					
Startup Time: 0 min Log Intervall: 0 min Temp Limit High: 5.0 °C Temp Limit Low: -5.0 °C Temp Average: 0 2^AY Alarm Monitor Count: 20 0 to	429					
Delta X-Sens Limit High: 0.000 pF -2 to 2 Delta X-Sens Limit Low: 0.000 pF -	2 to 2					
Start Monitor Stop Monitor Read Monitor Data Save to File Load Preset Save Preset						
SCEMTEC STK Windows XP (build 2600, Service Pack 3)						



Get Monitor Status

At first it is possible to use the button "Get Monitor Status". This shows the current status of the Data Monitor in the text field. It is possible to see the actual status of the tag at every cycle of the monitoring.

Select X-Sensor, Y-Sensor, Temperature, Interrupt Mode

These check boxes define the available sensor modes to monitor measured values. Basis for these modes are the connected sensors on tag. If one wants to use the Y-Sensor the X-Sensor must be activated and available. In Interrupt Mode only the X-Sensor is usable. If no X or Y-Sensor is activated the Temperature Mode will be used. Depending on sensor mode other set input values for sensing can be activated.

- Interrupt Area Active in Interrupt Mode. Set the number of interrupt measurements for the X-Sensor, (min 1; max 10; default 10; 0x14)
- Interrupt Time Active in Interrupt Mode. Set the time between interrupt measurement in milliseconds (typical is 10 ms) for the X-Sensor, (min 10; max 100; default 10; 0x11)
- X/Y Sensor Average Active if Y and/or X-Sensor is selected. 2 over x measured values are being used to build the mean value, mean value is stored as one X and/or Y value, (min 0; max 7; default 0; 0x11)
- Log Mode The Data Monitor has two "Log Mode" definitions in Temperature Mode. In "Continuous" mode the chip will sample and log data after the "Startup Time" at every "Log Interval". In "Outband" mode the chip will sample and log data which are higher or lower than the values defined in "Temp Limit High" respectively "Temp Limit Low" after the "Startup Time" at every "Log Interval" for Temperature mode and if used X/Y-Sensor.
- **Startup Time** time before the monitor is starting in minutes, wait-till-log-starts, (min 0; max 6000; default 1; 0x15)
- Log Interval time between measurements in minutes, (min 1; max 255; default 1; 0x15)
- **Temp Limit High** upper limit in "outband" mode in °C, not usable in Continuous Log Mode, (min -20.0; max 80.0; default 5.0; 0x12)
- Temp Limit Lowlower limit in outband mode in °C, not usable in Continuous Log Mode,
(min -20.0; max 80.0; default -5.0; 0x12)
- Temp Average2 over x measured values are being used to build the mean value, mean value
is stored as one temperature value,
(min 0; max 15; default 0; 0x14)
- Alarm Monitor Count set alarm port to high if MonitorCounter > Alarm Monitor Count, (min 0; max 429; default 20; 0x14)
- X-Sens Limit High delta of upper limit to X calibration value in Interrupt Mode in pF, (min -2.000; max 2.000; default 0.000; 0x16)
- X-Sens Limit Low delta of lower limit to X calibration value in Interrupt Mode in pF, (min -2.000; max 2.000; default 0.000; 0x16)



Start Monitor

The button **"Start Monitor"** resets the monitor status (interrupts a running measurement), writes all configuration from the Window to the MONREG bank and restarts the measurement Sensor Mode and Log Mode constrained. After this event the PE3011 tag can be used as autonomic sensor measurement system just supported by a battery.

PE EVA3011 Sensor Monitor 1.0
<u>File Options</u> Help
Tag Inventory Sensor Monitor Sens Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph
Get Monitor Status Logging Started
✓ X-Sensor Interrupt Area: 0 1 to 10 ✓ Temperature
✓ Y-Sensor Interrupt Time: 50 ms Log Mode
□ Interrupt Mode X/X Exprort Augustone 0 20 AV
Startup Time: 1 min Log Intervall: 2 min
Temp Limit High: -40.00 °C Temp Limit Low: -40.00 °C
Temp Average: 0 2^AV Alarm Monitor Count: 20 0 to 429
Delta X-Sens Limit High: -0.042 pF -2 to 2 Delta X-Sens Limit Low: -0.186 pF -2 to 2
Start Monitor Stop Monitor Read Monitor Data Saye to File
Load Preset Save Preset
J SCEMTEC STK Windows XP (build 2600, Service Pack 3)

Note: It is necessary to calibrate the sensor on analog capacitive sensor interface to use external sensors. This will be described in tab "Sens Cap Def" -> "Calibration" below.



Stop Monitor

Push the button **"Stop Monitor"** to stop any sensor measurement cycle. This button stops all measurements (timing dependent), saves all actual monitor data and displays the actual status in the Window.

PE EVA3011 Sensor Monitor 1.0	X
Eile Options Help	
Tag Inventory Sensor Monitor Sens Cap Def Monitor Results Graph Temp Graph extSens 4	⊳
	_
Get Monitor Status	
✓ X-Sensor Temperature	
▼ Y-Sensor Interrupt Time: 50 ms Log Mode	
Interrupt Mode X/Y Sensor Avarage: 0 2^AV Continuous C Outband	
Startup Time: 1 min Log Intervall: 2 min	
Temp Limit High: -40.00 °C Temp Limit Low: -40.00 °C	
Temp Average: 0 2^AV Alarm Monitor Count: 20 0 to 429	
Delta X-Sens Limit High: -0.042 pF -2 to 2 Delta X-Sens Limit Low: -0.186 pF -2 to 2	
Start Monitor Stop Monitor Read Monitor Data Save to File	
Load Preset Save Preset	
SCEMTEC STK Windows XP (build 2600, Service Pack 3)	

Note: If Monitor started with "Startup Time" then a stop of the monitoring cycle is only possible after this Startup Time. After Startup Time it is possible to stop monitoring at any time.



Read Data Monitor

It is possible to read all monitor and tag relevant data at any time from the PE3011 tag. The main information will be displayed in the Window.

EVA3011 Sensor Monitor 1.0	×
ile <u>O</u> ptions <u>H</u> elp	
Tag Inventory Sensor Monitor Sens Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Temp Graph extSens Image: Cap Def Monitor Results Graph Results Graph Results Image: Cap Def Monitor Results Graph Results Gra	Þ
Get Monitor Status Stopped with Count: 1	
✓ X-Sensor Interrupt Area: 0 1 to 10 ✓ Temperature	
▼ Y-Sensor Interrupt Time: 50 ms Log Mode	
□ Interrupt Mode X/X Sensor Avarage: 0 204V	
Startup Time: 1 min Log Intervall: 2 min	
Temp Limit High: -40.00 °C Temp Limit Low: -40.00 °C	
Temp Average: 0 2^AV Alarm Monitor Count: 20 0 to 429	
Delta X-Sens Limit High: -0.042 pF -2 to 2 Delta X-Sens Limit Low: -0.186 pF -2 to 2	
Start Monitor Stop Monitor Read Monitor Data Save to File	
Load Preset Save Preset	
CEMTEC STK Windows XP (build 2600, Service Pack 3)	

A MemoryDump.txt File will be created in the execution directory. This File shows the complete EEPROM data of the tag.



Save to a File

After successful reading of monitor data it is possible to write detailed information to a Text-File (text file with tab-separated values usable in "MS Excel") in "SensorData_YYYYMMDD_hhmmss.txt" format. Reading back data from the PE3011 can also be done without any battery support.

PE EVA3011 Sensor Monitor 1.0	
Eile Options Help	
😪 🔁 🕦 🔘	
Tag Inventory Sensor Monitor Sens Cap Def Monit	or Results Graph Temp Graph extSens 4 👂
Get Monitor Status	topped with Count: 1
	11-10
▼ X-Sensor	I to IU V Temperature
▼ Y-Sensor Interrupt Time: 50	ms Log Mode
☐ Interrupt Mode X/Y Sensor Avarage: 0	2^AV
Startup Time: 1 min	Log Intervall: 2 min
Temp Limit High: -40.00 °C	Temp Limit Low: -40.00 °C
Temp Average: 0 2^A¥	Alarm Monitor Count: 20 0 to 429
Delta X-Sens Limit High: -0.042 pF -2 to 2	Delta X-Sens Limit Low:
Start Monitor Stop Monitor	Read Monitor Data Save to File
Load Preset	Save Preset
SCEMTEC STK	indows XP (build 2600, Service Pack 3)

Save Preset / Load Preset

These buttons allow to save all set parameter in tab "Sensor Monitor" and tab "Sens Cap Def" and their reload into the program. This allows for quick programming of the tag. Data is stored in the execution directory in the file Configuration_ YYYYMMDD_hhmmss.txt. The file should not be changed manually.

EVA3011 User Guide PE3011 Evaluation Board



The current status of Data Monitor is displayed below. The fields show the read values, the limit settings and interval times. At the end of the file the measured sensor data and calculated timing data are provided. Measurements can be displayed as a graph using standard MS Excel functions.

Microsoft Excel - SensorData_20100406_142515.txt									_ 🗆 🗵
Datei Bearbeiten Ansicht Einfügen Format Extras	Daten Eenster ?						Frage h	nier eingeben	• _ 8 ×
i 🗋 💕 🛃 🚔 🛃 🔍 🖤 🛍 i 🛦 🗈 🛍 - 🕩 🄊	• 🔍 - 🙀 Σ - ½↓ 🏨	🕡 🚆 Arial	- 10	• F K U		🔤 🕎 % 000	€ \$,0 \$,00	╡╡ ╡╡ 🛄 •	🔕 - <u>A</u> - 📮
🔚 🖆 🖆 🥥 🥸 🗇 🕉 🔒 📲 😭 🖤 Bearbeitt	ung zurücksenden Bearbeitung	j beenden 📘 👬 📘					1 - 4	2	- • - 2
J44 🕶 fx			,						
A	В	C D	E	F	G	Н	I	J	К
31 Artith. Average [2 ^A V]:	0								
32 AlarmMon. Counter [nbr]:	20								
33 Interrupt Area ExtSens [nbr]:	0								
34 Interrupt Timer ExtSens [nbr]:	50								
35 Interrupt Average ExtSens [ms]:	0								
36 X-Sensor Limit High [pf]:	-0.08								
37 X-Sensor Limit Low [pf]:	-0.37								
38 Adjust. positive X-Capacity:	U								
39 Adjust. negative X-Capacity:	0.10								
40 Adjust. positive Y-Capacity:	0.18								
41 Adjust, negative T-Capacity. 42 Normalisation X Sansar (1 x SansarData) + 0	U								
42 Normalisation X-Sensor: (1 x SensorData) + 0									
43 Normalisation Poensol. (Tx DensolData) 1 0									
45 Calibration Constant X	0x082e							ů	
46 Calibration Constant Y:	0x07e3								
47									
48 Date	Temp [°C]								
49 06.04.2010 13:17	35.5								
50 06.04.2010 13:18	35	50 -							
51 06.04.2010 13:19	36.5								
52 06.04.2010 13:20	39.5			***```````````````````````````````````					
63 06.04.2010 13:21	41.5	45							
54 Ub.U4.2010 13:22	40.5	-	a de la compañía de l	1					
55 06.04.2010 13:23	41	-	Ast		L				
50 00.04.2010 13.24 57 00.04.2010 12:25	41.5	40	+		1				
58 06.04.2010 13:25	42.5	-	1		*				
59 06 04 2010 13:20	43.5		†		- }				
60 06.04.2010 13:28	44.5	35			1		••**	 Reihe1 	
61 06.04.2010 13:29	45				-X				
62 06.04.2010 13:30	45.5	1 20			- \				
63 06.04.2010 13:31	46	30			<u> </u>	**			
64 06.04.2010 13:32	46				- ` ` `				
65 06.04.2010 13:33	46.5	25				- F			
66 06.04.2010 13:34	46.5	20				nd -			
67 06.04.2010 13:35	47								
68 06.04.2010 13:36	47	20							
69 06.04.2010 13:37	47.5		00.04.0040	00.04.0040	00.04.0040	00.04.0040	00.04.0049		
70 06.04.2010 13:38	47.5	- 06.04.2010	00.04.2010	10:04.2010	00.04.2010	00.04.2010	00.04.2010		
71 U6.U4.2010 13:39 70 06.04.2010 40:40	47.5	13:12	13:26	13:40	13:55	14:09	14:24		
72 U6.04.2010 13:40 72 06.04.2010 12:41	47.5	-L							L]
00.04.2010 13.41	47.5			-1.1					
(()) \SensorData_20100406_142515/				1.					<u>•</u>
Bereit								NF	

Note: To use measured data for a graphical view in MS Excel it is necessary to set the decimal separator to a 'Point' in "Extra"->"Options"->"International".



3.4 Software description – Sens Cap Def

To manipulate the external sensors and calibrate the sensors on Y and/or X-Port this tab was programmed. A normalization function completes this tab.

PEEVA3011 Sensor Monitor 1.0	
Eile Options Help	
See 10 10 10 10 10 10 10 10 10 10 10 10 10	
Tag Inventory Sensor Monitor Sens Cap Def Mo	nitor Results Graph Temp Graph extSens 🛛 🖉 🕨
Differential X-Sensor	Differential Y-Sensor
🗌 Enable CPX 🛛 Adjustable posit	ve Capacity X: 0.000 pF
🗌 Enable CNX 🛛 Adjustable negat	ve Capacity X: 0.000 pF
🗌 Enable CPY 🛛 Adjustable posit	ve Capacity Y: 0.180 pF
Enable CNY Adjustable negat	ve Capacity Y: 0.000 pF
Normalisation X-Sensor: (1	× SensorData) + 0
Normalisation Y-Sensor: (1	× SensorData) + 0
Calibration IV auto Cal	bration Constant X: 0x082E bration Constant Y: 0x07E3
J SCEMTEC STK	Windows XP (build 2600, Service Pack 3)

Differential X-Sensorcheckbox to select differential (checked) or single ended (not checked)
mode on X-Port if X-Sensor (tab Sensor Monitor) is available.
(MONREG 0x11)Differential Y-Sensorcheckbox to select differential (checked) or single ended (not checked)
mode on Y-Port if Y-Sensor (tab Sensor Monitor) is available.
(MONREG 0x11)Enable CPX / CNXcheckbox to use internal adjustable positive/negative capacity if X-Sensor is
available. (MONREG 0x1A)Enable CPY / CNYcheckbox to use internal adjustable positive/negative capacity if Y-Sensor is
available. (MONREG 0x1A)



Adjustable positive/negative Capacity X

value to set internal capacity for fine tuning of external sensor on X-Port if Enable is set. (min 0; max 2.000; default 0; MONREG 0x1A), During Calibration with auto mode automatic set.

Adjustable positive/negative Capacity Y

value to set internal capacity for fine tuning of external sensor on Y-Port if Enable is set. (min 0; max 2.000; default 0; MONREG 0x1A) During Calibration with auto mode automatic set.

Normalisation X-Sensor

Gain and offset for measured sensor results on X-Sensor. (MONREG 0x18) default Gain = 1, Offset = 0.

Normalisation Y-Sensor

Gain and offset for measured sensor results on Y-Sensor. (MONREG 0x19) default Gain = 1, Offset = 0.

Calibration (default auto)

Button to calibrate the external Sensor. This function is automatic with active checkbox "auto" and sets the "Calibration Constant" and "Adjustable positive/negative Capacity" for the used external Sensor. If checkbox auto is disabled a manual calibration is possible.

Note: During calibration it is necessary to hold the external sensors in a defined static mode.

Calibration Constant X

Show the value after calibration or after "Load Preset". (MONREG 0x1B)

Calibration Constant Y

Show the value after calibration or after "Load Preset". (MONREG 0x1B)

Calibration Status Display

Show the status during calibration.



3.5 Software description – Monitor Results

The tab is designed to read the tag and monitor information directly from tag internal memory.

Get Monitor Results

It is possible to use the button "Get Monitor Results", this shows the current content of tag memory as ASCII text.

PE EVA3011 Sensor Monitor 1.0	
File Options Help	
See 10 10 10 10 10 10 10 10 10 10 10 10 10	
Tag Inventory Sensor Monitor Sens Cap Def Monito	r Results Graph Temp Graph extSens 4 🕨
Get Monitor Results	
EVA3011 Sensor Monitor 1.0	<u> </u>
Date: 06. Apr 2010, 14:2	5:23
UID: 0xE03E132A4002499E	
Tag AFI: 0x01 TAG MFC: 0x3E PE GmbH Tag Version: v00 Tag Revision: v511	
Mon Status: Logging Started Activity Status: Logging is Active Memory Status: Memory OK Alarm Status: Alarm not set Batt Status: Batt OK Monitor Mode: Temperatur (Contin Interrupt Flag: no Interrupt	uous)
Mon Size: 224 Mon Counter: 16 Interrupt Counter: 0	
Startup Date: 06.04.2010 Startup Time [min]: 0 Mon Intervall [min]: 1 Temp Slope [°C/1sb]: 0.50 Temp Offset [°C]: 40.00 Temp Limit Vick (°C): 40.00	13:17
SCEMTEC STK	Vindows XP (build 2600, Service Pack 3)



3.6 Software description – Graph Temp

To view a simple graphic diagram on measured temperature data directly from tag it is possible to use this tab. This view is only a memory map if a tag is on reader and measured data are available.

Get Monitor Graphic

It is possible to use the button "**Get Monitor Graphic**", this shows the current monitored time and temperature information in a simple diagram. The x-axis shows timing information in minutes after starting monitoring. Start date is displayed in the window. The y-axis shows the temperature (°C) in relation to timing information.



The zero point of the x-axis is the Start Date and the start of the curve is the first temperature information in minutes after Startup Time (see tab "Sensor Monitor" -> "Startup Time"). Hot key functions to manipulate graphic curve:

'e'	- zoom in	'z'	- zoom out	's'	- zoom fit	'd'	- zoom in x
'a'	- zoom out x	'w'	- zoom in y	'x'	- zoom out y	'left'	- pan left
'right'	- pan right	'up'	- pan up	'down'	- pan down		



3.7 Software description – Graph extSens

To view a simple graphic diagram on measured external data directly from tag it is possible to use this tab. This view is only a memory map if a tag is in reading distance and measured data are available.

Get Monitor Graphic

It is possible to use the button "Get Monitor Graphic", this shows the current monitored time and sensor information in a simple diagram. The x-axis shows timing information in minutes after starting monitoring. Start date is displayed in the window. The y-axis shows the sensor data in relation to timing information.



The zero point of the x-axis is the Start Date and the start of the curve is the first sensor information in minutes after Startup Time (see tab "Sensor Monitor" -> "Startup Time"). Hot key functions to manipulate graphic curve:

'e'	- zoom in	'z'	- zoom out	's'	- zoom fit	'd'	- zoom in x
'a'	- zoom out x	'w'	- zoom in y	'x'	- zoom out y	'left'	- pan left
'right'	- pan right	'up'	- pan up	'down'	- pan down		

150 9001 / 150 14001	ISO	9001	/ ISO	14001
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4 Memory definition

The memory for the Data Monitor is inside the RFID IC and is organized as specified in the ISO15693 standard. The monitor configuration and the trimming values are stored in the MONREG bank.

Tag Bank	EEPROM Block	Data
	00h	VICC, DSFID, Flags ISO15693 conform
	01h	AFI ISO15693 conform
	02h	UID[63:32] ISO15693 conform
	03h	UID[31:0] ISO15693 conform
UD	04h-0Bh	LOCK ISO15693 conform
	0Ch-0Dh	RFU
	0Eh	TempScaling
	0Fh	MonCycle
	10h	MonCount
	11h	ExtSensFlags
	12h	Temp, RTC
	13h	TMS
	14h	Area
MONREG	15h	TimeDef
	16h	IntDataX
	17h	IntDataY
	18h	CoeffNormX
	19h	CoeffNormY
	1Ah	CPCN
	1Bh	CalibConst
	1Ch	IntDatExtSense
ΜΟΝΠΑΤ		IntDatExtSense
WONDAT	1Ch+IntDataArea-1	IntDatExtSense
Read Only!	1Ch+IntDataArea	MonitorData
ficad Only:		MonitorData
	MonDataEnd	MonitorData
LISER	MonDataEnd+1	UserDat
Bank 11h		UserDat
	FFh	UserDat

All measured data will be stored in MONDAT-Bank. In USER-Bank additional data, like monitor start date, can be stored. The edge between USER and MONDAT-Bank can be changed by configuration byte MonDataEnd.

The MONDAT-Bank is defined for measured data from sensor and timing information. For the measurement several Modes are defined - collection of all values, acquisition of all values outside a defined boundary area, interrupt mode for external sensor or a combination of all modes.

Note: PE GmbH delivers samples and production volume ICs in calibrated condition (RTC, TMS). The nature of the chip allows everybody to access AND change these values at any time as long as the MONREG-Bank is not locked. If the MONREG bank will be locked the data monitoring setup can not be changed any more. The values are trimmed in the test process during manufacturing and are guaranteed to be within specified limits.



4.1 Header for PE3011 Tag definition in C++

The complete source code is available from Productivity Engineering GmbH.

```
* Name:
           tagdefs.h
 * Purpose: tag defines
 * Author: Jens Grosse
 * Created: 02-2010
                *****
#ifndef __tagdefs___
#define __tagdefs___
// Sensor definitions
#define FSENSSLOPEDIV
                         1
#define FSENSSLOPESINGLE
                             2
#define FSENSOFFSET 127
#define FSENSFEMTO2PICO 0.001
#define FYSENSSLOPE
                       0.1
#define FYSENSOFFSET 0
#define BANK USER
                       0x03
#define BANK_RESERVED 0x00
#define ICMFG_ADR 0xA0
#define ICMFG_DATA
                       0x3E
// memory size
#define MONREG_INTDATAAREA 0x05
#define MONREG_MONDATAEND 0xFA
// memory bank size
#define MIN_UID
                       0x00
#define MAX_UID
                       0x0F
#define MIN_MONREG
                       0x10
                     0x1B
#define MAX_MONREG
#define DELTA_MONREG MAX_MONREG - MIN_MONREG
                      0xFF // user bank size (USER_SIZE = MAX_USER - MONDATAEND)
0x1C // reserved bank size (RESERVED_SIZE = MIN_MONDAT + MONDATAEND)
#define MAX_USER
#define MIN_MONDAT
#define MAX_MONDAT 0xFF
// memory addresses epc bank
#define UID_FIRST
                         0x00
#define UID TMPSCALING 0x0E
                    0x02
#define UID_UID2
#define UID_UID1
                        0x03
#define UID_AFI
                       0x01
// memory addresses tid bank
#define MONREG_FIRST 0x10
#define MONREG_MONSTATUS 0x10 - MONREG_FIRST
#define MONREG SENSFLAGS 0x11 - MONREG FIRST
#define MONREG_TEMPLIMIT 0x12 - MONREG_FIRST
                       0x14 - MONREG_FIRST
0x15 - MONREG_FIRST
#define MONREG_AREA
#define MONREG_TIMER
#define MONREG_XSENSELIM 0x16 - MONREG_FIRST
#define MONREG_YSENSELIM 0x17 - MONREG_FIRST
#define MONREG_NORMX0x18 - MONREG_FIRST#define MONREG_NORMY0x19 - MONREG_FIRST#define MONREG_CPCN0x1A - MONREG_FIRST#define MONREG_COLUE0x1A - MONREG_FIRST
#define MONREG_CALIB
                            0x1B - MONREG_FIRST
#define MONREG_MONSTATUSADR 0x10
#define MONREG_SENSFLAGSADR 0x11
#define MONREG_TEMPLIMITADR 0x12
#define MONREG_AREAADR
                               0x14
#define MONREG_TIMERADR
                               0x15
#define MONREG_XSENSELIMADR 0x16
#define MONREG_YSENSELIMADR 0x17
#define MONREG_NORMXADR
                               0x18
#define MONREG NORMYADR
                               0x19
#define MONREG_CPCNADR
                               0x1A
```



// memory addresses user bank
#define USER_STARTDATE 0xFF
#define USER_STARTDATEADR 0xFF

// memory addresses reserved bank
#define MONDAT_FIRST 0x1C

// MONREG block status flag register

#define	GET_TEMPSLOPE(reg)	((reg	&	0x0000FF00)	>>	8)
#define	GET_TEMPOFFSET(reg)	((reg	&	0x00000FF)	>>	0)
#define	GET_MONDATAEND(reg)	((reg	&	0x00000FF)	>>	0)
#define	GET_MONCOUNT(reg)	((reg	&	0x00000FF)	>>	0)
#define	GET_INTADDRCNT(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_TAGAFI(reg)	((reg	&	0x00000FF)	>>	0)
#define	GET_FIRMA(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_VERSION(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_MSI(reg)	((reg	&	0x0000FFFF)	>>	0)
#define	GET_MONSTATUS(reg)	((reg	&	0x0000FF00)	>>	8)
#define	GET_STARTTIME(reg)	((reg	&	0xFFFF0000)	>>	16)
#define	<pre>GET_INTERVALLTIME(reg)</pre>	((reg	&	0x00000FF)	>>	0)
#define	GET_TEMPLIMITHI(reg)	((reg	&	0xFF000000)	>>	24)
#define	GET_TEMPLIMITLO(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_MWSIZE(reg)	((reg	&	0x00000F00)	>>	8)
#define	GET_ALARMMONCNT(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_SENSFLAGS(reg)	((reg	&	0x000000F)	>>	0)
#define	GET_DIFFFLAGS(reg)	((reg	&	0x0000300)	>>	8)
#define	GET_INTDATAREA(reg)	((reg	&	0xFF000000)	>>	24)
#define	GET_INTSAMPLE(reg)	((reg	&	0x00FF0000)	>>	16)
#define	GET_INTMWSENSE(reg)	((reg	&	0x0000030)	>>	4)
#define	GET_INTDATAHI(reg)	((reg	&	0x0FFF0000)	>>	16)
#define	GET_INTDATALO(reg)	((reg	&	0x00000FFF)	>>	0)
#define	GET_CPX(reg)	((reg	&	0x00003F00)	>>	8)
#define	GET_CPY(reg)	((reg	&	0x3F000000)	>>	24)
#define	GET_CNX(reg)	((reg	&	0x000003F)	>>	0)
#define	GET_CNY(reg)	((reg	&	0x003F0000)	>>	16)
#define	GET_GAIN(reg)	((reg	&	0x0FFF0000)	>>	16)
#define	GET_OFFS(reg)	((reg	&	0x00000FFF)	>>	0)
#define	GET_CALIBX(reg)	((reg	&	0x0000FFF)	>>	0)
#define	GET_CALIBY(reg)	((reg	&	OxOFFF0000)	>>	16)
#define	GET_RTC(reg)	((reg	&	0x0000FFFF)	>>	0)
#define	GET_CLK1M(reg)	((reg	&	0x0F00000)	>>	24)
#define	GET_ACTDATE(reg)	((reg	&	OxFFFFFFF)	>>	0)
#define	GET LOGWORD(reg)	((rea	&	0x00FF3FFF)	>>	0)

// reserved block data (logsize = 0x1AE)
#define TEMP_START 0x1C // 384 blocks

// status values #define MONSTATUS_STARTLOG 0x80 #define MONSTATUS_MEMOVERFLOW 0x20 #define MONSTATUS_ACTIVE 0x40 #define MONSTATUS_ALARM 0x04 #define MONSTATUS_BATT 0x08 #define MONSTATUS_OUTBAND 0x02 #define MONSTATUS_INTEXT 0x01 #define SENSFLAG_XSENSOR 0x02 #define SENSFLAG_YSENSOR 0x04 #define SENSFLAG_TEMP
#define SENSFLAG_INTMODE 0x01 0x08 #define DIFFFLAG_DIFFENX 0x01 #define DIFFFLAG_DIFFENY 0x02 #define CPN_CPENX 0x00004000 #define CPN_CPENY 0x40000000 #define CPN_CNENX 0x00000040 #define CPN_CNENY 0x00400000





// calibration values
#define CAL_TEMPSLOPEDIV 100.0 //
#define CAL_TEMPOFFSETDIV 1.0 //
#define CAL_XSLOPEDIV 0.200 // 200 fF/bit
#define CAL_XOFFSETDIV 0.0 //
#define CAL_YSLOPEDIV 0.200 // 200 fF/bit
#define CAL_YOFFSETDIV 0.0 //
#define CAL_LIMIT2CNTDIF 1000.0 //

#define CAL_LIMIT2CNTSINGLE 500.0 //

#define CAL_CPNSLOPE 0.180 // 180 fF/bit

#endif // __tagdefs___



5 Introduction of EVA3011 Hardware

Features PE3011:

- Passive RFID HF transponder chip with integrated sensor monitor
- Compliance according to ISO15693 standard (limited read/write range)
- 8kBit EEPROM read-/writeable access via RF field and/or sensor monitor
- EEPROM memory to store measurement data with time stamp
- Power supply via RF field (for communication) or with battery (sensor monitoring)
- Intelligent power management for different power domains
- Continuous battery control and automatic shutdown
- Extra signal output for "out-of-limits" detection
- Additional function with SPI interface (for using external devices)
- Real Time Clock to provide an accurate clock signal of 8.738 kHz
- Internal temperature sensor and ADC for external capacitive sensors

5.1 PE3011 General Description

The PE3011 is an integrated circuit for tracking and controlling logistics. It monitors temperature, extern capacitive sensor data and related time data of goods during transport or storage. While not in an RFID reader field and so not being supplied through the reader the system draws the required energy from the battery. While in a HF reader field the system is supplied by the reader's field energy and communicates to the reader based on the standard protocol. Besides standard ISO15693 communication additional functionality to read out temperature or other data is implemented. The integrated SPI interface allows a communication with other external devices like a microcontroller that can provide additional sensor functionality like digital interfaced sensors.

Memory access is granted through the HF reader controller as well as through the data monitoring controller. Both blocks have the same priority. No started memory access will be interrupted by a request for another access. The started access will be finished first before the new access request will be acknowledged. Detailed information can be found in the PE3011 datasheet.



6 How to design an application

Basically the EVA3011 comes as a complete application. The system has a spare connector spot for 2 external capacitive sensors. Sensors can be mounted directly at this location (e.g. humidity). It also features two capacitive touch button areas which can be used as switches along with a metal plate that comes close to the sensor and this way changes the capacitance. This way it is easy to observe an open/closed state of a box. A combination of temperature and humidity monitoring along with a switch function can be realized easily just be adding a capacitive humidity sensor. Good experiences have been made with a sensor of IST AG (www.ist-ag.com), the P14-Rapid. A spare solder location for a Microfab PE1.3N/PE8.0T-3.0SQ (http://www.microfab.de/) capacitive pressure sensor is on the board. Along with a humidity sensor temperature, pressure and moisture can be measured with just this simple system.

6.1 PCB specification

The PCB (printed circuit board) in the original state consists of a network for antenna matching, a battery with a corresponding connector to the PE3011, the two touch sensors and an interface for SPI communication.

Supply voltage (battery) 3.3V It is possible to assemble more devices, e.g. an optical indication for an active alarm port. Zero ohm jumpers might be necessary to select the different capacitive sensors that can be mounted on the board.

6.2 SPI

When using a microcontroller with SPI it is possible to use also external sensors. The measurement data of these sensors can be written to the EEPROM via the SPI and can be read out through the RFID interface.

Note: Refer to the datasheet of the PE3011 for read/write commands to EEPROM via SPI.

6.3 Alarm Port

The alarm port becomes active, when user defined sensor limits are violated and a measurement cycle is running. Refer to the datasheet of PE3011 for an active alarm. For getting an optical indication when the alarm port is activated, it is necessary to assemble resistor R4 and the LED. The recommend data for R4 and LED can be found in the BOM.

When the alarm port gets activated, the signal is switched to ground and the LED illuminates.

Calculation for series resistor:

$$R_3 = \frac{V_{BAT} - V_F}{I_F}$$

For a red LED with low current the following parameters have to be accounted for: Forward voltage $V_F=1,8V$, forward current $I_F=2mA$, battery voltage 3V:

$$R_3 = \frac{3V - 1.8V}{2mA} = 600Ohm$$

 R_3 =560Ohm shall be chosen here.

Note: The LED can only be applied, when using a 3V battery.



7 Description

The Evaluation Kit was designed to help understand and evaluate the features of the PE3011 HF RFID IC. Used external devices are standard components and do not represent a completely fine-tuned OEM application. The BOM (bill of material) for a final application may look different.

7.1 Evaluation Board Specifications

Parameter	Symbol	Min	Тур	Max	Unit	Notice
Operating temperature	T _{amb}	-40	27	80	°C	
Frequency RF field	f _{rf}		13,56		MHz	
Battery Voltage	V _{BAT}	2,4	3,3	3,6	V	Not possible if LED is used to indicate alarm port
Current Alarm Port	I _{Alarm}		5		mA	Open drain output

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7.2 General Schematic



Figure 2 - Basic Schematic of the Evaluation Kit

7.3 Eagle Data

Application documentation and PCB layouts are availabe at the web site www.pe-gmbh.com . Those are meant to serve as basis for new different developments.









Figure 3 - Layout of the Evaluation Kit (standard credit card format)

7.3.2 Schematic



Figure 4 - Complete Eagle Schematic of the EVA3011

C2 is required to overcome read range limitations by buffering the internal digital supply voltage.



8 Operation

8.1 Using only the HF interface

The HF interface is accessible at any time on the EVA3011. The battery has not to be populated for this operational mode. JP1 can be closed or open. The PE3011 can be controlled with a HF Reader. The HF transmission distance can be extended in certain environments by attaching JP1 and JP2 so that the HF functional electrical blocks have battery backup for operation. The antenna network is optimized for good electro-magnetic performance of the antenna with the chip. It is recommended to use the GUI3011 software to configure the PE3011 registers. The chip responds to any standard ISO15693 Reader by sending the UID.

The configuration and measurement commands are described in the PE3011 datasheet.

8.2 Using only the data monitor

For using only the data monitor the battery has to be mounted (default) and JP1 has to be closed. The PE3011 can be controlled via the SPI interface or the RF field when the GUI3011 software will be used.

The configuration and measurement commands are described in the PE3011 datasheet.

8.3 Using HF interface and data monitor

For using both HF interface and data monitor the same requirements are necessary as described in chapter 8.2

This mode is recommended for measurement tasks.

Accessing the EEPROM is possible in two ways (RFID interface and data monitor). Both have the same priority. If an access to the EEPROM occurs, the memory is locked until the access has finished. The configuration and measurement commands are described in the PE3011 datasheet.

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9 Notes

01/06/2016



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