User's Guide SNAU163C-August 2014-Revised October 2016





The FDC1004EVM evaluation kit is a plug and play system to test and evaluate the FDC1004, 4-Channel capacitive to digital converter. The EVM is a breakable PCB which consists of 3 sections. The first section is a USB to I2C converter based on MSP430F5528 micro-controller, the second section contains the FDC1004 and the third section is a touchless sensor (to demonstrate the sensitivity of the FDC1004). The third section can be removed and replace with customized sensors to evaluate the capabilities of the FDC1004 in various applications. The FDC1004EVM can be used with the Sensing Solutions EVM GUI. The software is able to configure the FDC1004's registers, graph the measured values, and export the data in CSV format.

The EVM contains one FDC1004 (See Table 1).

Table 1. Ordering

DEVICE	IC	Package
U1	U1 FDC1004DSC	

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1 Setup

This section provides a general description about FDC1004EVM, its I/O connectors and how to properly setup the evaluation module.

1.1 FDC1004EVM

The FDC1004EVM is divided in three sections:

- 1. USB to I2C section: this has the purpose to interface the communication of FDC1004 to a USB port.
- 2. FDC1004 section: this section embeds FDC1004 capacitive to digital converter.
- 3. Sensor section: this section contains a capacitive sensor that can be used for both human proximity and simple gesture recognitions ..

The EVM has precut lines on the borders of each section that allow for a flexible and specific system design. As an example of the flexibility of this design, the sensor can be replaced with a customer sensor, or the MCU section can be separated to allow for a remote placement of the FDC1004.



USB to I2C

Figure 1. FDC1004EVM : Sections

1.2 Input/Output Connector Description

J1, J2: 4x1 Header: the I/O ports of sections between the USBtoI2C and the FDC1004 sections. This provides the I2C communication channel and the power connections between these two sections should the EVM be separated into sections. A simple 4 wire cable can be used to interface the sections.

Table 2. J1, J2 Pin Out

Pin	Pin	Description
J1.1	J2.1	GND
J1.2	J2.2	VDD
J1.3	J2.3	SCL
J1.4	J2.4	SDA

J3: USB interface to connect the EVM to a PC; it also provides power to the EVM.

J4: 10x1 Headers. This is not populated by default. It provides an easy method to change sensors or to remotely place the sensor away from the FDC1004. This connector with its counterpart, J5, allows the communication of the two modules through a 10-wire cable.

Table 3. J4 Pin Out

Pin	Description
J4.1	GND
J4.2	SHLD1
J4.3	CIN1
J4.4	CIN2
J4.5	SHLD1
J4.6	SHLD2
J4.7	CIN3
J4.8	CIN4
J4.9	SHLD2



Table 3. J4 Pin Out (continued)

J4.10	GND

J5: 10x1 Header, for the electrical connection between the FDC1004 and the sensor section.

Table 4. J5 Pin Out

Pin	Description
J5.1	GND
J5.2	SHLD1
J5.3	CIN1
J5.4	Not Connected
J5.5	SHLD1
J5.6	SHLD2
J5.7	Not Connected
J5.8	CIN4
J5.9	SHLD2
J5.10	GND

1.3 HW Setup

The power supply of FDC1004 is provided by the LDO (U4), which is sourced from the USB 5.0V. The I2C communication with FDC1004 is fully managed by the MSP430F5528IRGC microcontroller (U3). The FDC1004 has a fixed I2C address.

2 Sensing Solutions EVM GUI

The Sensing Solutions EVM GUI provides direct device register access, user-friendly configuration, and data streaming.

2.1 System Requirements

The host machine is required for device configuration and data streaming. The following steps are necessary to prepare the EVM for the GUI:

- The GUI and EVM driver must be installed on a host computer
- - The EVM must be connected to a full speed USB port (USB 1.0 or above)

The Sensing Solutions EVM GUI supports the following operating systems (both 32-bit and 64-bit):

- Windows XP
- Windows 7
- Windows 8 and 8.1
- Windows 10

2.2 Installation Instructions

The Sensing Solutions GUI and EVM driver installer is packaged in a zip file. Follow these steps to install the software:

- 1. Download the software ZIP file from the EVM tool page
- 2. Extract the downloaded ZIP file
- 3. Run the included executable
- 4. If prompted by the User Account Control about making changes to the computer, click "Yes"

5





Figure 2. User Account Control Prompt

5. After the setup wizard starts, click "Next"

🗣 Setup	
	Setup - Sensing Solutions EVM GUI
	Welcome to the Sensing Solutions EVM GUI Setup Wizard.
	< Back Next > Cancel

Figure 3. Software Installer Wizard

6. Read the license agreement, select "I accept the agreement", and click "Next"

6



🗣 Setup	
License Agreement	1
Please read the following License Agreement. You must ac agreement before continuing with the installation.	cept the terms of this
Source and Binary Code Internal Use License A	greement
IMPORTANT PLEASE CAREFULLY READ THE FOLLOWIN WHICH IS LEGALLY BINDING. AFTER YOU READ IT, WHETHER YOU ACCEPT AND AGREE TO ITS TERMS. D READ AND AGREE UNLESS: (1) YOU WILL USE THE L YOUR OWN BENEFIT AND PERSONALLY ACCEPT, AGREE BOUND BY THESE TERMS; OR (2) YOU ARE AUTHORIZ	G LICENSE AGREEMENT, YOU WILL BE ASKED O NOT CLICK I HAVE ICENSED MATERIALS FOR TO AND INTEND TO BE ED TO. AND INTEND TO
Do you accept this license? I accept the agreement I do not accept the agree BitRock Installer	ment
< Back	Next > Cancel

Figure 4. Software Installer License Agreement

7. Use the preselected installation directory and click "Next"

Setup	
Installation Directory	
Please specify the directory where Sensing Solutions E	VM GUI will be installed.
Installation Directory C:\ti\Sensing Solutions EVM.G	UI-1.8.8
BitRock Installer	
< B	ack Next > Cancel

Figure 5. Software Installation Directory



8. Start the installation by clicking "Next"

🖗 Setup		
Ready to Install		
Setup is now ready to begi	in installing Sensing Solutions	s EVM GUI on your computer.
itRock Installer		
	Constraint	

Figure 6. Software Installer Ready

9. Wait for the installation to complete

8



Setup		
Installing		1
Please wait while Setup install	s Sensing Solutions EVM GUI on yo	our computer.
	Installing	
Unpacking C:\ti\Sensi	Installing IIDC16xxRevB_EVM_Firmware_so	urce\library\crc8.c
BitRock Installer		
	< Back	Next > Cancel

Figure 7. Software Installer In Progress

10. When the "Device Driver Installation Wizard" appears, click "Next" to install the EVM driver

Device Driver Installation Wiza	rd
	Welcome to the Device Driver Installation Wizard! This wizard helps you install the software drivers that some computers devices need in order to work.
	To continue, click Next. < <u>Back</u> Next > Cancel

Figure 8. Device Driver Installer Wizard



Sensing Solutions EVM GUI

11. Wait for the driver installation to complete

Device Driver Installation Wizard	
The drivers are now installing	
Please wait while the drivers inst	all. This may take some time to complete.
	< <u>B</u> ack Next > Cancel

Figure 9. Device Driver Installer In Progress

12. After the driver installation is completed, click "Finish"





Figure 10. Device Driver Installer Completed

13. Click "Finish" to complete the installation

Setup	
	Completing the Sensing Solutions EVM GUI Setup Wizard
	Setup has finished installing Sensing Solutions EVM GUI on your computer.
	< Back Finish Cancel





Sensing Solutions EVM GUI

2.3 Starting the GUI

Follow these steps to start the GUI:

- 1. Select the Windows start menu
- 2. Select "All programs"
- 3. Select "Texas Instruments"
- 4. Select "Sensing Solutions EVM GUI"
- 5. Click "Sensing Solutions EVM GUI"
- 6. Splash screen will appear for at least two seconds

Server OneUI: Server	
	- • • • •
	Sensing Solutions
	EVM GUI Tool
	TEXAS INSTRUMENTS
	Copyright 2015. Texas Instruments Incorporated. All rights reserved.

Figure 12. Splash Screen

7. After the splash screen is displayed the main window will open



Sa One	neUI Application	- 🗆 🗙
	MENU Sensing Solutions EVM GUI	1.8.8
	Introduction to Inductive Sensing	*
	Inductive sensing is a highly reliable solution for detecting the position of conductive materials using a simple wire wound coil. PCB coil, or spring. By configuring the coil and target shape, inductive sensing can be applied to many different applications that require proximity measurement, rotational and linear position sensing, as well as simple event counting.	tive
	Overall reliability is improved and system cost is reduced with the integration of multiple channels making this an attractive solution for metal buttons, motor position, bill counting, lens position, a many other applications.	and
	Introduction to Capacitive Sensing	
	Capacitive sensing is a high-resolution, low-cost contactless sensing technique that can be applied to a variety of applications such as liquid level sensing, proximity sensing, gesture recognition ice/rain detection and collision avoidance.	le,
	The sensor in a capacitive sensing system is any conductor, such as copper on PCB, conductive ink or a piece of metal, allowing for low cost and highly flexible system design. This conductor a a proximity sensor or liquid level sensor depending on the use case.	cts as
	Introduction to Humidity Sensing	
	Humidity affects many properties of air, and of materials in contact with air. Water vapor is a key agent in both weather and climate, and it is an important atmospheric greenhouse gas. Humidity measurements are used wherever there is a need to prevent condensation, corrosion, mold, warping or other spoilage of products. This is highly relevant for foods, pharmaceuticals, chemicals fuels, wood, paper, and many other products. Air-conditioning systems in buildings often control humidity, and significant energy goes into cooling the air to remove water vapor. Humidity measurements are necessary to maintain comfortable environmental conditions. An accurate humidity sensor can work in synergy with heating and cooling systems to reduce a building energy footprint.	
	Benefits of TI technology and the FDC2x14 and FDC2x12 Families	
• •	Not connected SSP EVM disconnected TEXAS INSTR	UMENTS

Figure 13. Introduction Page

2.4 Navigating the GUI

To navigate to different pages of the GUI follow these steps:

1. Click "Menu" in the upper left corner



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S OneUI Application	×
MENU Sensing Solutions EVM GUI v1.8.8	
Introduction to Inductive Sensing	Â
Inductive sensing is a highly reliable solution for detecting the position of conductive materials using a simple wire wound coil, PCB coil, or spring. By configuring the coil and target shape, inductive sensing can be applied to many different applications that require proximity measurement, rotational and linear position sensing, as well as simple event counting.	
Overall reliability is improved and system cost is reduced with the integration of multiple channels making this an attractive solution for metal buttons, motor position, bill counting, lens position, and many other applications.	
Introduction to Capacitive Sensing	
Capacitive sensing is a high-resolution, low-cost contactless sensing technique that can be applied to a variety of applications such as liquid level sensing, proximity sensing, gesture recognition, lce/rain detection and collision avoidance.	
The sensor in a capacitive sensing system is any conductor, such as copper on PCB, conductive ink or a piece of metal, allowing for low cost and highly flexible system design. This conductor acts as a proximity sensor or liquid level sensor depending on the use case.	
Introduction to Humidity Sensing	
Humidity affects many properties of air, and of materials in contact with air. Water vapor is a key agent in both weather and climate, and it is an important atmospheric greenhouse gas. Humidity measurements are used wherever there is a need to prevent condensation, corrosion, mold, warping or other spoilage of products. This is highly relevant for foods, pharmaceuticals, chemicals, fuels, wood, paper, and many other products. Air-conditioning systems in buildings often control humidity, and significant energy goes into cooling the air to remove water vapor. Humidity measurements are necessary to maintain comfortable environmental conditions. An accurate humidity sensor can work in synergy with heating and cooling systems to reduce a building energy forbrint.	
Benefits of TI technology and the FDC2x14 and FDC2x12 Families	
Not connected SSP EVM disconnected TEXAS INSTRUMENT	s

Figure 14. Mouse Hovered Over Menu Button

2. Select the desired page from the menu shown on the left

San OneUI Application	
	Sensing Solutions EVM GUI v1.8.8
Introduction	ing
Device	ble solution for detecting the position of conductive materials using a simple wire wound coil, PCB coil, or spring. By configuring the coil and target shape, inductive different applications that require proximity measurement, rotational and linear position sensing, as well as simple event counting.
EVM	system cost is reduced with the integration of multiple channels making this an attractive solution for metal buttons, motor position, bill counting, lens position, and
Configuration	nsing
🗠 Data Streaming	lution, low-cost contactless sensing technique that can be applied to a variety of applications such as liquid level sensing, proximity sensing, gesture recognition, oldance.
1 Firmware	g system is any conductor, such as copper on PCB, conductive ink or a piece of metal, allowing for low cost and highly flexible system design. This conductor acts as sensor depending on the use case.
	ing
	of air, and of materials in contact with air. Water vapor is a key agent in both weather and climate, and it is an important atmospheric greenhouse gas. Humidity er there is a need to prevent condensation, corrosion, mold, warping or other spoilage of products. This is highly relevant for foods, pharmaceuticals, chemicals, her products. Air-conditioning systems in buildings often control humidity, and significant energy goes into cooling the air to remove water vapor. Humidity maintain comfortable environmental conditions. An accurate humidity sensor can work in synergy with heating and cooling systems to reduce a building energy
	the FDC2x14 and FDC2x12 Families
Not connected SSP EVM of the second sec	disconnected Texas Instruments

Figure 15. Menu Display After Clicking Button

2.5 Connecting the EVM

Follow these steps to connect the EVM to the GUI:

- 1. Attach the EVM to the computer via USB
- 2. The GUI always shows the connection status on the bottom left corner of the GUI

0 📓	neUI Application
	MENU Sensing Solutions EVM GUI v1.8.8
	Introduction to Inductive Sensing
	Inductive sensing is a highly reliable solution for detecting the position of conductive materials using a simple wire wound coil, PCB coil, or spring. By configuring the coil and target shape, inductive sensing can be applied to many different applications that require proximity measurement, rotational and linear position sensing, as well as simple event counting.
	Overall reliability is improved and system cost is reduced with the integration of multiple channels making this an attractive solution for metal buttons, motor position, bill counting, lens position, and many other applications.
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	The sensor in a capacitive sensing system is any conductor, such as copper on PCB, conductive ink or a piece of metal, allowing for low cost and highly flexible system design. This conductor acts as a proximity sensor or liquid level sensor depending on the use case.
	Introduction to Humidity Sensing
	Humidity affects many properties of air, and of materials in contact with air. Water vapor is a key agent in both weather and climate, and it is an important atmospheric greenhouse gas. Humidity measurements are used wherever there is a need to prevent condensation, corrosion, mold, warping or other spoilage of products. This is highly relevant for foods, pharmaceuticals, chemicals, fuels, wood, paper, and many other products. Air-conditioning systems in buildings often control humidity, and significant energy goes into cooling the air to remove water vapor. Humidity measurements are necessary to maintain comfortable environmental conditions. An accurate humidity sensor can work in synergy with heating and cooling systems to reduce a building energy footprint.
	Benefits of TI technology and the FDC2x14 and FDC2x12 Families
•	EMI resistant solution: Narrow band architecture eliminates unwanted noise and interferences enabling EMI-resistant proximity sensor and gesture recognition applications. Fast sensor excitation rate with wide frequency range: Allows sensing of all liquids including conductive ones such as detergent soap, and ink and allows flexibility in sensor design. Connected SSP EVM connected - FDC1004

Figure 16. FDC1004 Connected to GUI

2.6 Configuring the EVM Using the Register Page

The register page allows users to control the device directly with the register values. The user may also use this page to read the currect register values on the device.

2.6.1 Automatically Update GUI Register Values Using Auto-Read

Autoread will periodically request the register values on the device. Click the dropdown box next to "Auto Read" to select the update interval.



neUI Application																		- 0
MENU S	ensing Solution	ns EVM GUI															v	1.8.8
Registers																		
Auto Read Off Off Every 1/4 sec Every 1/2 sec Every 1/2 sec Every 1/2 sec Register Write Re Every 5 sec	r Update Mode: Imme	ediate 🔻																
Every 10 sec Every 20 sec	Address	Current Value								В	its							
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MEAS1_MSB	0x00	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MEAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
MEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0
MEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
MEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
MEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
MEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CONF_MEAS1	0x08	0x1c00	0	0	0	1	4	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
FDC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
Connected Wrote registers: C	ONF_MEAS1													-i	Тех	as Ir	NSTR	UMEN

Figure 17. Selecting Auto-Read Interval on Register Page

2.6.2 Manually Update Device Register Values

There are two methods to change register values: update the entire register value or change a single bit within the register. The recommended update mode is always "Immediate" and not "Deferred". To update register values, follow these steps.

1. Double-click the current value of the register that needs to be changed. The text will turn into an editable text box



neUI Application																		- 0	
MENU	Sensing Solu	tions EVM GUI															v1	.8.8	
Registers																			
Auto Read Off	± ±																		
✔ Write Register ∮ Read	Register Update Mode:	Immediate V		_	_	_	_	_	_			_	_	_	_	_	_	_	-
Register	Address	Current Value	15	14	13	12	11	10	9	8	nts 7	6	5	4	3	2	1	0	
MEAS1_MSB	0x00	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	Ì
MEAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	
MEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	
MEAS2_LSB	0x03	0xaf00	1	0	4	0	4	1	4	1	0	0	0	0	0	0	0	0	
MEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	(1)	1	1	0	l
MEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
MEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0	
MEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	
CONF_MEAS1	0x08	0x1c00 T	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
DC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	
Connected Read regi	ster undefined										_			i,	Texa	s In	STR	JME	N

Figure 18. Selecting a Register's Current Value for Editting on Register Page

2. Type the new hexadecimal value into the box and click enter. The text box changes to normal text and the GUI will send a command to the EVM to update the device register

To change individual bit values rather that entire register values follow these steps.

1. Hover the mouse over the desired bit to change



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MENU	Sensing Solution	ns EVM GUI															v	1.8.8
egisters																		
Auto Read Off •	* 1																	
Write Register KRead Re	egister Update Mode: Imm	ediate •									74 m ⁻¹				_			
tegister	Address	Current value	15	14	13	12	11	10	9	8	ns 7	6	5	4	3	2	1	0
IEAS1_MSB	0x00	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
IEAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
IEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0
IEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
IEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
IEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
IEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
1EAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
ONF_MEAS1	0x08	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
DC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
											_		-	100				

Figure 19. Hovering Mouse Over Register Bit Value on Register Page

2. Double-click the bit to toggle its value and the register's current value will update automatically

2.6.3 Reading Register Values without Auto-Read

To read register values follow these steps.

1. Select the register to update by clicking any column of the register row in the table



neUI Application																		
MENU	Sensing Solution	ns EVM GUI															V	.8.8
legisters																		
Auto Read Off	ż î																	
Write Register Y Read Regis	Address	Current Value								в	ite							_
tegister	7 adress	ourient value	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MEAS1_MSB	0x00	0x0f0d	0	0	0	0	1	1	1	1	0	0	0	0	1	1	0	1
MEAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
MEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0
MEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
MEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
MEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
MEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CONF_MEAS1	0x08	0x1c00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
FDC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
Connected Register loading	complete														TEX	AS I	ISTR	UMEN

Figure 20. Selecting a Register on Register Page

2. Click the "Read Register" button to update the selected register's current value and bit values in the table



neUI Application																		- 0
MENU S	ensing Solutio	ns EVM GUI															V	1.8.8
Registers																		
Auto Read Off 🔹	1																	
Write Register Kead Register	Update Mode: Imm	ediate 🔻																
Register	Address	Current Value						10		В	its -		-					
	0.00	0.70	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MEAST_MSB	0x00	0.700	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MEAS1_LSB	0x01	0x1600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
MEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0
MEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
MEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
MEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
MEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CONF_MEAS1	0x08	0x1c00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
FDC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
Connected Dead register und	ofinod													1	Terr		10000	

Figure 21. Reading the Current Device Register Value on Register Page

2.6.4 Saving Device Configurations

To save the current register settings of the device follow these steps.

1. Click the button immediately right to the "Auto-Read" selection dropdown



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MENU	Sensing Solution	ns EVM GUI															v	1.8.8
egisters																		
Auto Read Off	±																	
Write Register Read Re	egister Update Mode: Imm	ediate •		_	_	_	_	_	_		ite	_	_	_		_	_	_
legislei	Address	Current value	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
EAS1_MSB	0x00	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
EAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
EAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	(1)	0	0	0	1	1	0
IEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
IEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
IEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
IEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
IEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
ONF_MEAS1	0x08	0x1c00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
ONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
ONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
ONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
DC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
onnected Wrote registe	ers: CONF_MEAS1				_			_					_	- i	TEX	AS I	NSTR	UMEN

Figure 22. Save Register Values to File on Register Page

2. Choose a name for the JSON file and the directory to save it within. Then click "Save"

2.6.5 Loading Previously Saved Configurations

- To load previously saved register settings from a JSON file follow these steps.
- 1. Click the button furthest right from the "Auto-Read" selection dropdown



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	Sensing Solutior	s EVM GUI															V	1.8.8
Registers																		
Auto Read Off •	*																	
	ister Update Mode: Imme	ediate 🔻																
Register	Address	Current Value								В	its							
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MEAS1_MSB	0x00	0x7fff	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MEAS1_LSB	0x01	0xf600	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0
MEAS2_MSB	0x02	0x0246	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0
MEAS2_LSB	0x03	0xaf00	1	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0
MEAS3_MSB	0x04	0x012e	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0
MEAS3_LSB	0x05	0x4100	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
MEAS4_MSB	0x06	0x10a8	0	0	0	1	0	0	0	0	1	0	1	0	1	0	0	0
MEAS4_LSB	0x07	0xe500	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0
CONF_MEAS1	0x08	0x1c00	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS2	0x09	0x3c00	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS3	0x0A	0x5c00	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0
CONF_MEAS4	0x0B	0x7c00	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
FDC_CONF	0x0C	0x0dff	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1
Connected Registers expo	orted successfully.														Тех	as Ir	NSTR	UMENT

Figure 23. Loading Previously Saved Register Values from File on Register Page

2. Select the JSON file with the desired settings and click "Open"

2.7 Configuring the EVM Using the Configuration Page

The Sensing Solutions GUI is capable on configuring the device more intuitively than the direct register values. The "Configuration" page provides an easy-to-use tool for updating the device configuration and provides additional information about how the device will perform.



MENU			sensing Solu	tions EV	IN GUI							1.0.0
leasurement	Setting	S										
Sampling R 100 Samples/ 200 Samples/ 400 Samples/	ate second second second	Single (Measure C	Channel Meas	Suremer Take Meas	nts Co surement ⊮E	ntinuous Multi-Cl nable continuous multi-cl	nannel Measu	rements ts				
Channel Me	easure	ment Se	ttings t Channels	с	APDAC	Calibrat	ion		Measured S	ensor Data		ĉ
Measurement	Enable	СНА	СНВ	Code	Capacitance (pF)	Offset Capacitance (pF)	Gain	Register Code	Two's Complement Value	Saturated	Capacitance (pF)	
1		CIN1 T	DISABLED V	0	0.000	0	1	986622	986622	۲	1.881832	e
2		CIN2 V	DISABLED V	0	0.000	0	1	149197	149197	۲	0.284571	
3	•	CIN3 V	DISABLED V	0	0.000	0	1	77733	77733	۲	0.148264	8
4		CIN4 V	DISABLED V	0	0.000	0	1	1091553	1091553	۲	2.081972	ē.
onfiguration	Page S	ettings										
odate measure ote: Use Data S	ment reg Streaming	isters rate: page for hig	500 ms h speed data loggir	ig and visua	alization							
	1											

Figure 24. Configuration Page

The FDC1004 measures in a round robin mode and can make up to four measurements. If all four measurements are enabled and the sample rate is 400 samples per second new data for all four measurements would be available at a rate of 100 Hz. If a single measurement were enabled rather than all four, again with the sampling rate set to 400 samples per second, new data for the single measurement would be available at a rate of 400 Hz.

To make a single measurement only once, select the measurement channel and click "Take Measurement". This will disable the "Enable continuous multi-channel measurements" setting. Continuous measurements must be enabled for the data streaming function of the GUI and EVM.

Please reference the FDC1004 datasheet for more information regarding individual measurement settings.

2.8 Streaming Measurement Data

The Sensing Solutions GUI and EVM provide a tool to capture, display, and log measurement data. The section describes how to use the data measurement tools from the "Data Streaming" page accessible from the GUI menu.

2.8.1 Choosing the Graph and Visible Channels

Select the drop down menu on top of the y-axis to choose the graph to display.



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Security OneUI Application	
MENU Sensing Solutions EVM GUI	v1.8.8
Data Streaming: Start Stop	Show Graph Configuration (C) Show Statistics (I)
Capacitance (pF) → Capacitance (pF) → Raw Code	Select Log File: 🛓 C;\data\data.csv
0.9	
0.8	
0.7	
0.6	
0.5	
0.4	
0.3	
0.2	
0.1	
	0.7 0.8 0.9 1.0
🚫 MEASI_FF 🚫 MEASI_FF 🚫 MEASI_FF	
0	Range: 64
Connected Register loading complete	🐳 Texas Instruments

Figure 25. Select the Data Graph on Data Streaming Page

To select which channel measurements are displayed in the graph, check or uncheck the available channels shown next to the graph units. Selecting or not selecting the channels only affects the graph and not the data logged to a file. If a channel is not enabled in the Configuration page it will not appear on the Data Streaming page.

2.8.2 Logging Data to a File

Follow these steps to log measurement data to a file.

1. Click the button in the upper right under next to "Click to Select Log File"



Sector Constant Const			
MENU Sensing Solutions EVM GUI			v1.8.8
Data Streaming: Start Stop		Show Graph Configur	ation (C) Show Statistics (I)
Capacitance (pF) Show: MEAS1_pF MEAS2_pF MEAS3_pF MEAS4_pF		Select L	.og File: C:\data\data.csv
1.0-			U
0.5			
3.8			
6.7			
0.6			
5.5			
0.4			
5.3			
0.2			
6.3			
0.0 0.1 0.2 0.3 0.4	0.5 0.6	0.7 0.8	0.9 1.0
🛇 meysi"de 🌀 meysi"de 🔇 meysi"de 🄇 meysi"de			980 1024
D			Range: 64
Connected Register loading complete			Texas Instruments

Figure 26. Select Log File Button on Data Streaming Page

- 2. Select a file name and directory to save the data to and then click the "Save" button
- 3. Whenever data streaming is running the data for all channels will be logged to this file. The selected file is shown next to the button.



Sensing Solutions EVM GUI

_ 0 <u>_ X</u> Sa OneUI Application v1.8.8 MENU Sensing Solutions EVM GUI Data Streaming: Start Stop Show Graph Configuration (C) Show Statistics (I) Select Log File: C:\data\fdc1004_data.csv Capacitance (pF)
Show: MEAS1_pF
MEAS2_pF
MEAS3_pF
MEAS4_pF 1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3 0.2 0.1 0.0+ 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 😡 меляцрг 😞 меляцрг 😞 меляцрг 😞 меляцрг 1024 Range: 64 TEXAS INSTRUMENTS Connected Register loading complete

Figure 27. Selected Log File Shown on Data Streaming Page

2.8.3 Starting and Stopping Data Streaming

To start data streaming click the "Start" button.



SoneUI Application										
■ MENU	Se	nsing Solutio	ns EVM GUI							v1.8.8
Data Streaming	Start Stop						Sho	w Graph Configura	ation (C) Sh	ow Statistics (I)
Capacitance (pF) ▼ Show: MEAS1_pF	MEAS2_pF 🗹 I	MEAS3_pF 🗹 MI	EAS4_pF 🗹				Select Log File:	🛓 C:\data	\fdc1004_data.csv
1.0-										
0.9										
0.8										
0.7										
0.6										
0.5										
0.4										
0.3										
0.2										
0.1										
0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
~) MEAS1_PF 😞 MEAS2_PF 😞	мелзз_рг 😞 мелз4_р	5							980 1024
Q										Range: 64
								1.0	a Tours	
Connected	Register loading cor	nplete							P IEXAS I	NSTRUMENTS

Figure 28. Start Button on Data Streaming Page

To stop data streaming click the "Stop" button.



Sensing Solutions EVM GUI

_ 0 <u>_ X</u> Sa OneUI Application v1.8.8 Sensing Solutions EVM GUI MENU Data Streaming: Start Stop Show Graph Configuration (C) Show Statistics (I) Capacitance (pF)
Show: MEAS1_pF
MEAS2_pF
MEAS3_pF
MEAS4_pF Select Log File: 📥 C:\data\fdc1004_data.csv 1.8 1.6 1.4 1.2 1.0 0.8 0.6 0. 0.2 0.0. 25,695 25,700 25,705 25,710 25,715 25,720 25,725 25,790 25,735 25,740 25,745 25,750 25,755 😞 MEAS1_PF 😞 MEAS2_PF 😞 MEAS3_PF 😞 MEAS4_PF 980 1024 Range: 64 TEXAS INSTRUMENTS Data streaming started Connected

Figure 29. Stop Button on Data Streaming Page

2.8.4 Data Statistics

Click the "Show Statistics" button to view the measurement statistics.



Section Section	
MENU Sensing Solutions EVM GUI	v1.8.8
Data Streaming: Start Stop Show C	Graph Configuration (C) Show Statistics (I)
Capacitance (pF) ▼ Show: MEAS1_pF MEAS2_pF MEAS3_pF MEAS4_pF	Select Log File: C:\data\fdc1004_data.csv
2.2	
••••••••••••••••••••••••••••••••••••••	
0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-	
1.6	
1.4	
1.2	
1.0	
0.8	
0.6	
0.4	
0.2 ••••••••••••••••••••••••••••••••••••	
0.0	3,770 3,775 3,780
🚫 MEASI_PF 🚫 MEAS2_PF 🚫 MEAS3_PF	980 1024
D	Range: 04
Connected Data streaming started	🐺 Texas Instruments

Figure 30. Show Statistics Button on Data Streaming Page

Click the "Hide Statistics" button to hide the measurement statistics.



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OneUI Application													
MENU	Ser	ising Solutio	ons EVM GUI										v1.8.8
Data Streamin	g: Start Stop							S	how Gr	aph Co	nfigura	tion (C)	Hide Statistics (
Capacitance (p	F) Show: MEAS1_pF	✓ MEAS2_pF	MEAS3_pF 🗹 MEAS	4_pF 🗹		S	tatistics		Se	lect Log	File:	Ł C:\da	ta\fdc1004_data.c:
2.2						I	Data Series	Current	Min	Max	Delta	Average	Std. Deviation
2.0							MEAST_PF	° 1:68 ° °	1.87 6	1.884	°0.005	• 1.882 •	•-•D90A-•
							NEA6329-9-8-	•-De286- •	-0.683	-002607-	00065-	•-@235-•	
1.44							MEAS3_pF	0.149	0.146	0.150	0.004	0.148	0.001
1.6							MEAS4_pF	2.084	2.080	2.085	0.006	2.082	0.001
1.4							Decimals	3	3	3	3	3	3
1.2													
1.0													
0.8													
0.6													
0.4													
0.2													
0.0-	4,365 4,370	4,375	4,380 4,385	4,390	4,395	4,400	4,40	5	4,410	4,	415	4,420	4,425
6) MEAS1_PF MEAS2_PF 🚫 :	мелаз_рг 🤕 мелач_	pF										
													980 Repose 64
													U
											100		

Figure 31. Hide Statistics Button on Data Streaming Page

2.8.5 Configuring the Graph

To configure the graph, click the "Show Graph Configuration" button.



OneUI Application											
E MENU	Sens	ing Solutions I	EVM GUI								v1.8.8
Data Streaming:	Start Stop						S	how Graph	Configuratior	I (C) Show	v Statistics (I)
Capacitance (pF) •	Show: MEAS1_pF 🗹	MEAS2_pF 🗹 MEAS	S3_pF 𝕙 MEAS4_p	F				Select	Log File: 🛓	C:\data\fo	c1004_data.csv
2.2											
2.0											
1.8											
11.6											
1.4											
1.2											
1.0											
0.8											
0.e											
0.4											
0.2	• • • • • • • • • • • • • • • • • • • •										
0.0	a eeo - a ees	4.470	675 A 680	4 485	4 400	4 605	4 700	4 705	4 710	4 718	4 120
NEA MEA	4,000 4,000	33 DF 🔿 MEAS4 DF	1,000	4,600	4,050	4,055	4,100	4,100	1,710	47/149	17.20
0		- <u>*</u> -									950 1024 Range: 64
Connected	Data atraaming started								l " lia a	Ervac In	
Connected	Data streaming started									IEXAS IN	STRUMENTS

Figure 32. Show Graph Configuration Button on Data Streaming Page



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Graph Confi	guration			
Display Fram	e Rate		ĺ	b
16.0 ms = 62.	5 Hz			
New Data Sa	mple Rate	e		
EVM Outp	ut Rate (II	nfinity ms = 0.	0 Hz)	
Add sample	le to grapi	h every	100	ms
Minimum:		0		
Minimum:	uxis (Y1)	0		
Maximum:		100		
Autoscale	Autosca	le & Lock		
Sample Cour	nts			
Display:	64	≈ 0.000 s		

Figure 33. Graph Configuration Button on Data Streaming Page

The configuration window displays the actual frame rate of the graph, the rate at which data is added to the graph, the vertical scaling, and the sample buffer size. The display rate is the rate at which the graph updates on the computer display and is not configurable. It is automatically optimized by the GUI.

The "New Data Sample Rate" allows the user to choose when new data is added to the graph. Selecting "EVM Output Rate" will display data on the graph as fast as is available from the EVM. This should not be confused with the actual sampling rate of the device on the EVM which could be different. The "Add sample to graph every ... ms" will add a new sample to the graph at the specified rate.

The "Verical Scaling" allows the user to either manually set the minimum and maximum values of the yaxis on the graph or use auto-scaling. The "Autoscale & Lock" button scales the graph based on the data of the current display and then locks those vertical scaling settings.

The "Sample Counts" allows the user to specify the number of samples displayed on the graph and the total number of samples stored in the buffer. Please note the buffer size does not affect data logging to a file.

To hide the configuration window, click the "Hide Graph Configuration" button.



apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS2_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS3_pF ♥ MEAS4_pF ♥ apacitance (pF) ▼ Show: MEAS1_pF ♥ MEAS4_pF ♥ apacitance (pF) ♥ Meas4_pF ♥ apacitance (pF) ♥ Show: MEAS1_pF ♥ MEAS4_pF ♥ apacitance (pF) ♥ Meas4_pF ♥ apacitance (pF) ♥ Meas4_pF ♥ apacitance (pF) ♥ apacitance (Hide Graph Conliguration (1) Show Statistics (1
2.2 Display Frame Rate 103.5 ms = 9.7 Hz 2.0 New Data Sample Rate 1.4 EVM Output Rate (11.30 ms = 68.5 Hz) 1.4 Add sample to graph every 50 ms 1.4 Vertical Scaling 1.4 Vertical Left Axis (Y1) 1.2 Maximum: 20 0.6 Autoscale Autoscale & Lock 2.6 Sample Counts 0.6 Display: 64 * 3.200 s 0.7 102 - 51,200 s	pacitance (pF) ▼ Show: MEAS1_pF Ø MEAS2_pF Ø MEAS3_pF Ø MEAS4_pF Ø	Graph Configuration Select Log File: 🛃 C:\data\fdc1094_data.cc
103.5 ms = 9.7 Hz 1.0 1.1 1.2 1.4 1.5 1.6 1.7 1.8 1.9 1.9 1.0 <t< td=""><td>2 2-</td><td>Display Frame Rate</td></t<>	2 2-	Display Frame Rate
2.5 New Data Sample Rate 1.6 EVM Output Rate (11.30 ms = 68.5 Hz) 8 Add sample to graph every 50 ms 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.6 1.7 1.8 1.9 1.0 0.8 0.8 0.8 0.8 0.4	•=== •=•=•=•=•=•=•=•=•=•=•=•=•=•=•=•=•=	103.5 ms = 9.7 Hz
1.6 EVM Output Rate (11.30 ms = 68.5 Hz) 1.6 Add sample to graph every 50 ms 1.6 Vertical Scaling 1.7 Minimum: -20 1.0 Maximum: 20 0.8 Autoscale Autoscale & Lock 0.8 Sample Counts 0.4 Display: 64 = 3.200 s 9.4 Jurger 1024 = 51,200 s	2.0	New Data Sample Rate
Add sample to graph every 50 ms 1.4 Vertical Scaling 1.2 Minimum: -20 1.0 Miximum: 20 0.e Autoscale Autoscale & Lock 0.e Sample Counts Display: 0.4 Display: 64	1.8	EVM Output Rate (11.30 ms = 88.5 Hz)
Vertical Scaling 1.4 1.2 1.0 0.8 0.6 0.6 0.7 0.8 0.6 0.7	3.6	Add sample to graph every 50 ms
1.2 Minimum: -20 1.0 Maximum: 20 0.2 Autoscale Autoscale 0.4 Sample Counts 0.4 Display: 64	1.4	Vertical Scaling
1.0 Maximum: 20 0.8 Autoscale Autoscale 0.4 Sample Counts 0.4 Display: 64	1.2	Minimum: -20
o.e o.e o.e o.e o.e Display: 64 ≈ 3.200 s Buffer:1024 _ ≈ 51,200 s	1.0	Maximum: 20
o.c o.4 Sample Counts Display: 64 ≈ 3.200 s Buffer:1024 ≈ 51.200 s	0.8	Autoscale & Lock
0.4 Display: 64 ≈ 3.200 s Butiger102412241224	lole	Sample Counts
		Display: 64 ≈ 3.200 s
	····	
	0.0-24,830 24,835 24,840 24,845 24,850 24,855 24,860	24,865 24,870 24,875 24,880 24,885 24,890
0.0 		
0.0 24,850 24,828 24,840 24,845 24,850 24,858 24,860 24,868 24,870 24,878 24,870 24,878 24,880 24,888 24,890		980

Figure 34. Hide Graph Configuration Button on Data Streaming Page

2.8.6 Navigating the Data Streaming Buffer

The Sensing Solutions EVM GUI stores a buffer of data samples and then displays a subset of those samples. The data buffer can be navigated using the horizontal slider below the graph. To show more samples on the graph, click either the slider on the left or right side of the green bar and drag it closer or further from the other slider. The number of samples displayed is shown between the left and right sliders in the green bar.



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S OneUI Application	
MENU Sensing Solutions EVM GUI	v1.8.8
Data Streaming: Start Stop	Show Graph Configuration (C) Show Statistics (I)
Capacitance (pF) ▼ Show: MEAS1_pF MEAS2_pF MEAS3_pF MEAS4_pF	Select Log File: C:\data\fdc1004_data.csv
2.0	
1.8	
1.6	
1.4	
1.2	
1.0	
0.8	
0.6	
0.4	
0.2	
0.0	
25,620 25,640 25,660 25,680 25,700 25,720	25,740 25,760
🛇 MEAS1_pT 🚫 MEAS2_pT 🚫 MEAS2_pT 🚫 MEAS4_pT	853 1024
Connected Data streaming stopped	Texas Instruments

Figure 35. Changing Number of Samples Displayed in Data Graph

By clicking on the green bar and dragging the mouse left or right, previous samples in the buffer can be displayed.



CneUI Application MENU Se Data Streaming: Start Stop	ensing Solutions EVM GUI	v1.8.8 Show Graph Configuration (C) Show Statistics (I)
Capacitance (pF) Show: MEAS1_pi	F ♥ MEAS2_pF ♥ MEAS3_pF ♥ MEAS4_pF □	Select Log File: C:\data\fdc1004_data.csv
20 8 6 4 2		
0- 25,740 ⊘ MEAS1_pr ⊘ MEAS2_pr 0	25,760 25,780 25,800 25,820 25,840)xEx33_pf ⊘ xExx4_pf	25, 960 25, 950 25, 900

Figure 36. Displaying Previous Data Samples on the Data Streaming Page

2.9 Updating the EVM Firmware

To upload new firmware to the EVM, navigate to the "Firmware" page from the GUI menu and follow these steps. The images below show uploading the FDC2214 EVM firmware, but the steps are identical for any LDC, FDC, or HDC EVM when using their respective firmware files.

1. Click the button to select a TI-TXT firmware file



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CneUI Application	
MENU Sensing Solutions EVM GUI	v1.8.8
Firmware Upgrade	
Select TI-TXT firmware File:	
1	
Connected SSP EVM connected - FDC2214	Texas Instruments

Figure 37. Select TI-TXT File Button on Firmware Upload Page

2. Select the firmware file and click "Open"



rganize 🔻 🛛 New fold	er					8=	•	
- Favorites	Name	Date modified	Туре	Size				
Conner Blair	FDC2v14 LDC13vyRevB LDC16vyRevB EVM Firmware so	11/5/2015 10-01 AM	File folder					
Desktop	HDC10x0 EVM Firmware source	11/5/2015 10:01 AM	File folder					
🖳 Recent Places	FDC2x14_LDC13xxRevB_LDC16xxRevB_EVM_Firmware.txt	6/11/2015 3:34 PM	Text Document	10	1 KB			
📕 UserData	HDC10x0_EVM_Firmware.txt	6/15/2015 2:08 PM	Text Document	9	3 KB			
GIT_Repositories								
🗼 ti								
Downloads								
Box Sync								
Blair Conner (P)								
Libraries								
Computer								
🏭 OSDisk (C:)								
P								
Network								
					_ 74			
File n	ame: FDC2x14 LDC13xxRevB LDC16xxRevB EVM Firmware.txt				-	Notepad++ Docu	ment	

Figure 38. Selecting TI-TXT Firmware File for Upload to EVM

3. Click the "Upload Firmware" button



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Se OneUI Application	
MENU Sensing Solutions EVM GUI	v1.8.8
Firmware Upgrade	
Select TI-TXT firmware File: 🔹 C:\ti\Sensing Solutions EVM GUI-1.8.8\EVM Firmware\FDC2x14_LDC13xxRev8_LDC16xxRev8_EVM_Firmware.txt	
Upload Firmware	
Connected SSP EVM connected - FDC2214	exas Instruments

Figure 39. Upload Firmware Button on Firmware Upload Page

4. Wait for the firmware to upload. Do NOT disconnect the EVM from the PC at this time! Also note that the GUI will disconnect from the EVM. The upload process should not take more than one minute. If the upload fails or lasts longer than one minute, unplug the EVM and restart the GUI.

Section OneUI Application		
≡ MENU	Sensing Solutions EVM GUI	v1.8.8
Firmware Upgrade		
Coloct TI TVT firmware File:		
Wait for upload to complete	C: (II/Sensing Solutions EVH GUI-1.6.8/EVH Firmware/FUL/X14_LULISXXKeVb_LULI6XXKeVb_EVH_Firmware.TXT	
	Universities Please do NOT disconnectilito FVM	
Not connected SSP EVM di	isconnected 🛛 🐺 TEXAS	5 INSTRUMENTS
	Figure 40. Firmware Upload in Progress	



Second Application	
MENU Sensing Solutions EVM GUI	v1.8.8
Firmware Upgrade	
Select TI-TXT firmware File: C:\ti\Sensing Solutions EVM GUI-1.8.8\EVM Firmware\FDC2x14_LDC13xxRevB_LDC16xxRevB_EVM_Firmware.txt Upload Firmware	
Success!	
Not connected Firmware successsfully updated!	🐺 Texas Instruments

Figure 41. Firmware Upload Success

3 Board Layout

Figure 42 and Figure 43 show the board layout of the FDC1004EVM.

Sensor layout has been designed to demonstrate the possible trade-off between sensor sensitivity and protection from interferences. SHLD1 surrounds "LEFT" sensor and it has a bigger area than SHLD2 that surrounds "RIGHT" sensor. As a consequence, the "LEFT" sensor is better shielded from interferences but at the cost of lower sensitivity.



Figure 42. Top Layer Routing



Figure 43. Bottom Layer Routing



Schematic

4 Schematic

Sil

CIN

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Sil



Figure 44. FDC1004EVM Schematic

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Table 5. Bill of Materials

Qty	Designator	Description	Footprint	Manufacturer Part Number
1	C1	CAP, CERM, 0.1uF, 6.3V, +/-10%, X5R, 0402	402	C1005X5R0J104K050BA
1	C2	CAP CER 10UF 10V 10% X5R 0603	603	C1608X5R1A106K080AC
4	C3, C5, C11, C19	CAP CER 0.1UF 16V 5% X7R 0402	402	0402YC132KAT2A
1	C4	CAP, CERM, 0.01uF, 25V, +/-5%, C0G/NP0, 0603	603	C1608C0G1E103J080AA
1	C6	CAP CER 220PF 50V 1% NP0 0402	402	0402YC132KAT2A
1	C7	CAP, CERM, 2200pF, 50V, +/-10%, X7R, 0603	603	C0603X222K5RACTU
2	C8, C9	CAP CER 18PF 100V 5% NP0 0603	603	GRM1885C2A300JA01D
1	C10	CAP, CERM, 220pF, 50V, +/-1%, C0G/NP0, 0603	603	06035A221FAT2A
1	C15	CAP, CERM, 2.2uF, 10V, +/-10%, X5R, 0603	603	C0603C225K8PACTU
1	C17	CAP, CERM, 0.47uF, 10V, +/-10%, X7R, 0603	603	C0603C474K8RACTU
1	C20	CAP, CERM, 1uF, 6.3V, +/-20%, X5R, 0402	402	C1005X5R0J105M050BB
2	CS1, CS2	CAP, CERM, 51pF, 50V, +/-5%, C0G/NP0, 0402	402	GRM1555C1H510JA01D
1	D1	LED SMARTLED GREEN 570NM 0603	603	LG L29K-G2J1-24-Z
1	D2	LED 660NM SUPER RED DIFF 0603SMD	603	SML-LX0603SRW-TR
1	D21	Diode, Zener, 5.6V, 500mW, SOD-123	SOD-123	MMSZ5232B-7-F
2	J1, J2	Header, TH, 100mil, 4x1, Gold plated, 230 mil above insulator	TSW-104-07-G-S	TSW-104-07-G-S
1	J3	Connector, USB Type A, 4POS R/A, SMD	CONN_USB_04803722 00	480372200
1	J4	Receptacle, 50mil 10x1, R/A, TH	CONN_851-43-010-20- 001000	851-43-010-20-001000
1	L1	INDUCTOR POWER 10UH .45A SMD	VLS201610E	VLS201610ET-100M
1	R5	RES, 33k ohm, 5%, 0.063W, 0402	402	CRCW040233K0JNED
2	R6, R7	RES 1K OHM 1/10W 5% 0402 SMD	402	CRCW040233R0JNED
2	R8, R9	RES, 33 ohm, 5%, 0.063W, 0402	402	CRCW040233R0JNED
2	R10, R11	RES, 4.99k ohm, 1%, 0.063W, 0402	402	CRCW04024K99FKED
1	R20	RES,1M ohm, 5%, 0.063W, 0402	402	RC0402JR-071ML
1	R40	RES 1.5K OHM 1/16W 5% 0402 SMD	402	CRCW04021K50JNED
1	U1	4-Channel Capacitance-to-Digital Converter for Capacitive Sensing Solutions, DSC0010B	DSC0010B	FDC1004DSC
1	U2	4-CHANNEL ESD-PROTECTION ARRAY FOR HIGH-SPEED DATA INTERFACES, DRY006A	DRY0006A	TPD4E004DRY
1	U3	Mixed Signal MicroController, RGC0064B	RGC0064B	MSP430F5528IRGCT
1	U4	Micropower 150 mA Low-Noise Ultra Low-Dropout Regulator, 5-pin SOT-23, Pb-Free	MF05A_N	LP2985AIM5-3.3/NOPB
1	Y1	CRYSTAL 24.000MHZ 18PF SMD	ABMM	ABMM-24.000MHZ-B2-T



Revision History

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Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Cł	nanges from B Revision (August 2014) to C Revision	' age
•	Changed Sensing Solutions EVM GUI section	5
•	Changed Updated Part Number	41



Ch	anges from A Revision (August 2014) to B Revision	Page
•	Added Description of the sensor	. 39



Revision History

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Ch	anges from Original (August 2014) to A Revision	Page)
•	Changed photo of board	1	

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