

# TLK10232 Dual-Channel XAUI/10GBASE-KR Transceiver with Crosspoint Evaluation Module (EVM) Graphical Users Interface User's Guide

This user's guide describes the usage and construction of the TLK10232 evaluation module (EVM) GUI. This document provides a basic overview of the different portions of the program.

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## WARNING

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user, at their own expense, is required to correct this interference.

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### 1 Introduction

The Texas Instruments TLK10232 SERDES evaluation module (EVM) boards are controlled and configured with a custom developed graphical user interface (GUI) developed using National Instrument's LabVIEW<sup>™</sup> 2010 programming language.

High- and low-level manipulation of the registers is possible through this GUI as well as a variety of built-in test modes. Both channels of the TLK10232 and every low-speed input/output lane in each channel is handled independently allowing maximum configurability of the TLK10232 device. Global write register bits exist, allowing the register read/write commands to be applied to every channel, and lane, simultaneously to shorten the configuration time. However, these bits are not implemented in the GUI and the user should be aware that the configuration sequences in the GUI could be optimized for both time and redundancy for the particular use case when implementing the system.

The high speed transmit and receive parameters can be swept through a nested loop of parameter combinations in the *HS Link Optimizer* portion of the GUI. The test results can be reviewed both visually and empirically through a saved test report with the results. Running the *Link Optimizer* saves time when determining the optimal combination of settings for the particular system or test setup.

Advanced functionality and debug capabilities are built into the GUI through the implementation of the Python scripting language. A recording of register read/write transactions can be recorded in real-time while manually using the GUI in order to create a reusable and easily modified script for future work. These scripts can be modified to include any supported Python 2.7 features including loops, file I/O, and command prompt user input.

### 2 Getting Started

Configure the EVM hardware and connect the USB dongle to the PC before starting the TLK10232 EVM GUI. The first time the GUI is started, default settings and configuration files are created and saved into the working directory of the PC causing the GUI to take longer than normal to open.

The TLK10232 EVM implements TI's TCA6424 I<sup>2</sup>C<sup>TM</sup>-to-GPIO device to provide software control and status monitoring of the TLK10232 device's I/O pins. When the board is powered up and the GUI is run, the GUI first initializes the registers of the TCA6424 for their default values and issues a *Main Board Reset*, resetting the TLK10232. This ensures that the GUI and TLK10232 register values are synchronized to their default values prior to configuration. When this reset occurs, the red reset LED on the EVM blinks momentarily and then the green LED relights when the reset operation is complete.

The GUI is designed to control up to two TLK10232 EVMs when one is configured to accept the MDIO and I<sup>2</sup>C control signals from the first board that is connected to the USB port of the PC. Currently, this feature is not fully implemented and tested in both hardware and software. See future revisions of this document for additional information. Use Board 1 settings and registers when only one board is connected to the PC.

Both channels can be configured simultaneously using Channel A's settings as a reference. Selecting the TLK10232 EVM board window from the *Selection Window* menu (Figure 1) allows selection whether or not to simultaneously configure both channels. After making a selection, click the **Save Settings [F5]** button at the bottom of the screen.



Getting Started

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TLK10232 EVM GUI			
Calastics Window			
TLK10232 EVM Board 1		Enable 1st Board	O Enable 2nd Board
TLK10232 EVM Board 2	TLK10232 EVM Board 1	PRTAD[4:1]	PRTAD[4:1]
Low Level Configuration Block Diagram		O Disable Software Control of Pins	O Disable Software Control of Pins
	Apply Channel A Settings to Channel B  Global Fields	I2C Address 0x22 LOW/HIGH PDTRX8_N PDTRX8_N PDTRX8_N MODE_SEL ST LS_OK,IN,B MDIO to RR LY	I2C Address 0x23 LOW/HIGH PDTRX8_N PDTRX8_N PDTRX8_N MODE_SEL LS_OK[IN_8 MDIO HDR RLY MDIO HDR RLY
	Input pin (PRTAD0) is not used as selected	1000	1000
	PRTAD0 Pin Selection	STATUS MDIO RELAY	STATUS MDIO RELAY
	Channel A stopwatch	Continue	Continue
	APRBS_PASS Pin Status Selection Channel A/B HS side	LOSA LOSB LOSSOK_OUT_A	<ul> <li>LOSA</li> <li>LOSB</li> <li>LOS_OK_OUT_A</li> </ul>
		LOS_OK_OUT_B DBBS_DASS	LOS_OK_OUT_B DBBS_DASS
		CLK PRI INPUT	CLK PRI INPUT
		CLK_SEC_INPUT	CLK_SEC_INPUT
		CLK_PLL_LOCK	
		🤔 Refresh	🤔 Refresh
		O Power Down Device	O Power Down Device
		Main Board Reset	Main Board Reset
		Reset TLK10232	Reset TLK10232
		Load Config	Load Config
		Save Config	Save Config
		Load Script	Load Script
		Discard Updates	Discard Updates
Enable Simulation Mode		Apply Updates	Apply Updates
Reset USB Connection	Press 'Control + H' for help	<ul> <li>Device Configured</li> </ul>	Device Configured
	2/25/2013 4:40:05 PM Version: 2.4.0.8 SIMULATION	IDLE 👪 TE	XAS INSTRUMENTS
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Figure 1. TLK10232 EVM GUI Board 1 Window



### 3 High-Level TLK10232 Device Configuration

All of the TLK10232 control and status register fields have been grouped together based upon function and are accessed on an individual basis through the use of a *high-level* control. Expanding the board hierarchy in the GUI's *Selection Window* tree (Figure 2) displays the various channel and window windows. If both channels are chosen for simultaneous configuration, the GUI disables the selection windows for Channel B. The registers are written to the device individually, but the GUI saves time and adopts Channel A's settings into the GUI's register configuration array.



Figure 2. TLK10232 EVM GUI Hierarchical Selection Window Tree

Configuration of the external control pins of the TLK10232 device through the GUI is performed through TI's TCA6424 onboard I<sup>2</sup>C-to-GPIO device. The TCA6424 is configured to control the high and low settings of the device from USB data sent to the board from the GUI. It is also possible to disable the software control and rely on manual settings of these signals. Monitoring external status pins is also possible through this method.



### High-Level TLK10232 Device Configuration

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The GUI and the device settings on the board can be synchronized by initiating all reset signals from the GUI through the various buttons. If the reset button on the board itself was pressed, the GUI would not realize that the registers were reset and continue to display the previous register values. Pressing the **Main Board Reset** button (Figure 3) in the GUI is equivalent to pressing the reset pushbutton on the EVM board and has the added benefit of resetting the GUI's register settings to match the hardware default values applied to the TLK10232 device following a main board reset.method. The



Figure 3. TLK10232 EVM GUI Software Control of TLK10232 I/O Pins and Main Reset

The TLK10232 register settings are configured from the high-level device configuration windows of the GUI. All of the settings of the TLK10232 can be modified from various portions of this tab broken out and grouped into individual windows according to their function.

It is recommended to configure the TLK10232 device by starting at the first window in the GUI's *Selection Window* and work down the tree selecting and saving any settings changed to something other than default.

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By default, the TLK10232 device and GUI are configured to run in *Auto Negotiation 10G-KR* mode. The first window (Figure 4) has a selection box that allows easy configuration for all of the various operational modes of the TLK10232 device. This is a hybrid control and will set all of the various control register bits required for proper operation in that mode. Located to the right of this selection box is an LED indicator panel displaying the value of the various controls bits set in that particular mode.

The default PRTAD[4:1] setting for TLK10232 EVM board and GUI is 4b'0000. If the PRTAD[4:1] value is changed on the TLK10232 EVM board using the dip switch settings, the value must also be entered into the GUI on the Front Panel above the Control pin settings. If there is a hardware/software mismatch, then register read/write operations will fail. The same is true for the I<sup>2</sup>C Address on the TCA6424. Clicking the 0x22 allows the selection of address 0x23.



Figure 4. TLK10232 EVM GUI Operating Mode Configuration

When making changes to a particular control field in any of the high-level control windows, the value is stored into the GUI's register configuration array but is not immediately written to the device. When the settings have changed and the settings of the GUI do not match the actual register settings of the EVM device, the **Require Update?** light glows red, indicating that some setting has changed in the GUI memory and needs to be sent to the device. When the device settings match the GUI's memory the **Device Configured** light glows green indicating that the board is configured as displayed in the GUI.

To change the various register settings in the GUI memory to a new value, simply find the particular parameter field in the various windows, select the new value, and click the **Save Settings** button. The change is discarded if the **Save** button is not clicked and the **Current Value** of the register is kept.



### High-Level TLK10232 Device Configuration

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Saving all the values for the register fields in memory allows selection of the values for the device in any sequence chosen. The TLK10232 device settings and the newly selected register values can be reviewed at any time by clicking the **Review Updates** button on the front panel of the GUI. This will bring up a window that shows the register configuration array (Figure 5) and shows the current and new value for every register field. If the field has a new value, the status box for that array is shaded orange highlighting the changes to be applied to the TLK10232 device. To discard the changes in memory and keep the current settings, click the **Discard Updates** button to reset the new value fields with the current values.

Register values in other windows that are not relevant in the particular operation mode are disabled and become grayed out. This allows easy determination as to which register control fields are relevant for their mode and need to be configured.

TLK10232 EVM GUI					
Selection Window	Mid Level Register Values		<u> </u>	Enable 1st Board	C Enable 2nd Board
Channel A Operation Mode Cfg	Mid-Level	Register Values (Configuration Va	alue) Board1	PRTAD[4:1] OCOO	PRTAD[4:1] O
High Speed TX Cfg	Device Channel #	Search Box		Control of Pins	Control of Pins
High Speed RX Cfg	TLK10232  ChannelA	•	🗙 EXIT	I2C Address 0x22	I2C Address 0x23
Low Speed Output Cfg		New Value (In Line) Comm	at Value (Ja Llau) Status	PDTRXA N	PDTRXA N
LOS Overlay Cfg	Name	New Value (In Hex) Currer	nt value (In Hex) Status	PDTRXB N	PDTRXB N
Lane Alignment Cfg	POWERDOWN	0 0	=	PRBSEN	PRBSEN
Reserved Control Conf	LI_TRAINING_CONTROL	0 0		MODE_SEL	MODE_SEL
Override Cfg	10G_RX_MODE_SEL	0 0		ST	ST
Deeplocal Feedback Co	10G_TX_MODE_SEL	0 0		LS_OK_IN_A	LS_OK_IN_A
Channel Sts	SW_PCS_SEL	1 1		LS_OK_IN_B	LS_OK_IN_B
Channel Status Final Va	SW_DEV_MODE_SEL	0 0		MDIO HDR RLY	MDIO HDR RLY
TX Switch Configuratic	10G_RX_DEMUX_SEL	1 1		MDIO B2B RLY	MDIO B2B RLY
KX Switch Configuratic	10G_TX_MUX_SEL	1 1			
DMA Control Cfr	REFCLK_SW_SEL	0 0		LOSA/B MDIO RELAY	LOSA/B MDIO RELAY
PMA Control Cig E	LS_REFCLK_SEL	0 0		STATUS	STATUS
Link Training Cfg	HS_LOOP_BANDWIDTH	3 3			
Auto Train Learn Mode	HS VRANGE	0 0		A 1054	A201
Link Training Sts	HS ENPLL	1 1		I OSB	
Auto Train Status	HS PLL MULT	D D			
LT Link Partner	HS SWING	Δ Δ			
LT Local Device Contro	HS ENTY	1 1			
LT Local Device Sts		0		PRBS_PASS	PRDS_PASS
KR FEC Control		0		CLK_PRI_INPUT	CLK_PRI_INPUT
KR FEC Sts		0 0		CLK_SEC_INPUT	OCLK_SEC_INPUT
KR Vendor Specific Cfg	HS_AGCCTRL	1 1		CLK_PLL_LOCK	CLK_PLL_LOCK
KR Vendor Specific Sts	HS_AZCAL	0 0		🦈 Refresh	😕 Refresh
PCS Control Cfg	HS_ENRX	1 1		-	_
PCS Sts		<u>^</u>		O Power Down Device	O Power Down Device
Auto Negotiation Cont	HS_ENTRACK	1 0		Main Board Reset	Main Board Reset
Clock Output Cfg	110_0Q1100	*		Reset TLK10232	Reset TLK10232
Channel B	HS_CDRFMULT	1 1			
BER Testing	HS_CDRTHR	1 1		Load Config	Load Config
Latency Testing	HS_PEAK_DISABLE	0 0		Save Config	Save Config
Clock Generator	HS_H1CDRMODE	0 0			as bare comig
TLK10232 EVM Board 2	HS_TWCRF	0 0	N	Load Script	Load Script
UC Link Ontimizer	HS_RX_INVPAIR	0 0		Discard Undates	X Discard Updates
o fachla Simulation Made	HS_TX_INVPAIR	0 0		👌 🧭 Review Updates	👌 🖌 Review Updates
Enable Simulation Mode	HS TWPOST1	0 0		Apply opdates	Apply Updates
Reset USB Connection     Press 'C	Cont			Require Update	Oevice Configured
	2/25	/2013 5:03:02 PM Version: 2.4.0.8	SIMULATION	IDLE 🦊 TEX	XAS INSTRUMENTS

Figure 5. TLK10232 EVM GUI High-Level Review Updates

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After selecting the *Operating Mode* settings, select the *Clock and Rate Configuration* window (Figure 6) from the *Selection Window* tree. All of the standard clock and rate controls listed in the TLK10232 datasheet are implemented using a quick reference lookup table. The *Clock and HS Serial Data Rate* options are operating-mode specific, requiring configuration of the operating mode before configuring the clock so the correct options are presented. Only the *Reference Clock Frequency* and *HS Serial Data Rate* selections are required. All other HS and LS PLL multipliers and rate settings are configured in the TLK10232 register to support that mode.

The selection of which reference clock is used to how to configure the HS Recovered Byte Clock for the selected channel can also be made from this window.

Selecting the **Others** button allows direct control the HS/LS PLL multiplier and rate registers. Entering the *Ref Clock Frequency* and *HS/LS Serial Data Rates* displays the *Output Clock Frequency* calculations for reference, even though they do not have any direct register configuration value.



Save any changes to the **Clock and Rate Configuration** window.

Figure 6. TLK10232 EVM GUI High-Level Device Clock and Rate Configuration

Not all configuration windows will be displayed in this document. Work through the various windows making other necessary configuration settings.

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#### High-Level TLK10232 Device Configuration

Status registers can be read at anytime from the various *Status* windows (Figure 7). Clicking the **Refresh** button located in the top right corner of the *Status* window causes all of the registers associated with that particular window to be read and the results to be displayed.



Figure 7. TLK10232 EVM GUI High-Level Device Status Windows



The red pushbutton controls located on the various windows, such as the **Reset TLK10232 Channel Datapath** button on the *Operation Mode* window, cause an immediate write of that register. Other modes such as the *10G* modes allow for a reset of the Channel TXFIFO and RXFIFOs, and the *10G-KR*, *1G-KX*, and *Auto Negotiation* modes have a pushbutton to restart the *Auto Negotiation* procedure immediately (Figure 8). Depending on which button is pressed, the saved register values may or may not be affected and reset. The GUI only resets the saved values if the register values are reset in hardware based upon the action committed by that particular pushbutton.



Figure 8. TLK10232 EVM GUI High-Level Device Immediate Action Pushbuttons

After changing the various control fields and all settings are saved into the GUI's memory, apply the updated settings to the TLK10232. The TLK10232 EVM GUI configures the device based upon a text file script. This script can be modified and loaded for any various specific or optimized use case and prevents the GUI from having a single hard-coded provisioning sequence. By implementing the use of this script, the provisioning sequence can be easily modified and adjusted without requiring the creation and deployment of a full software revision. A general provisioning file has been created and loaded by default that configures all writable registers of the TLK10232 device when executed. Also provided in the installation are several mode-specific scripts that only write to the registers valid in the particular operating mode. Selecting one of these scripts may reduce the configuration time slightly because fewer registers are being written every time the script is executed.



Low-Level TLK10232 Device Configuration

Any script can be set as the default script by first selecting the script in the **Load Script** button on the front panel of the GUI and then right-clicking the button and selecting the **Set as Default** option. From this point forward, this script is the default script loaded and executed by the GUI. The default script can be reset or changed at any time, as desired. The *Choose Script File* dialog boxes are shown in Figure 9.

Choose Script	File	Sec.	Contraction of the local division of the loc	
Look in:	) TLK10232	•	G 🤌 📂 🛄 -	
(And	Name	*	Date modified	Туре
-	Configuratio	on Files	1/18/2013 11:19 AM	File fol
Recent Places	Documents		1/18/2013 11:19 AM	File fo
	Script Files		1/18/2013 11:19 AM	File fol
	Scripts		1/18/2013 11:19 AM	File fo
Desktop	) Shared Libra	iry	1/18/2013 11:19 AM	File fo
Libraries				
Computer				
Network	•			
Network	File name:		-	ОК
Choose Script	Files of type:	Custom Pattern (*.bd)	•	Cancel
Choose Script	Files of type:	Custom Pattern (*bd)		Cancel
Choose Script	File File Script Files	Custom Pattern (* bd)	• •	Cancel
Choose Script Look in:	Files of type: File Script Files Name	Custom Pattern (*bd)	<ul> <li>▼</li> <li>The modified</li> </ul>	Cancel
Choose Script Look in:	Files of type: File Script Files Name TLK10034_O	Custom Pattern (*txt)	<ul> <li>▼</li> <li>▼</li> <li>■</li> <li>■</li></ul>	Cancel
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Choose Script Look in: Recent Places	Files of type: File Script Files Name TLK10034_0 TLK10034_0 TLK10034_0	Custom Pattern (* bt)	▼	Cancel Type TXT Fil TXT Fil TXT Fil
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Figure 9. TLK10232 EVM GUI High-Level Device Load Script Selection Window

Once the script is selected (no change is required if the default script is desired), click the **Apply Updates** button to execute the script. A popup window opens and displays the register read/writes in real time as they are applied to the TLK10232 device. The current executed command is displayed at the bottom of the window and the value of each register read and write is displayed in the window. The script can be stopped by pressing the **Abort** button.

A text file report of the *Apply Settings* script can be created to log all of the register read/write values that occurred during the script execution. This report can be useful when determining the values needed to be implemented in an FPGA or other system controller.

### 4 Low-Level TLK10232 Device Configuration

Any register can be either read or written at any time through the use of the *Low Level Configuration* window (Figure 10). There are three device types containing register stacks that may need modification. Similar to the GUI *Selection Window* tree, the various registers are grouped in an easily-expanded hierarchal tree, allowing quick navigation to the registers of interest.



The primary device needed to read/write registers is the TLK10232. Expanding the TLK10232 in the tree shows *Board1* and *Board2* options. Select the appropriate board number that the TLK10232 is located and expand that to show the global and channel specific registers. All registers are handled individually for maximum configurability.

Navigate to the desired register and click the register name in the tree. This loads the bit-specific register information into the *Register Data* window and shows the last read/write value of the register in both hex and bit format. The names of the bits are also displayed for easier reference. The *Register Description* box displays the description information from the TLK10232 datasheet for the chosen register, helping to understand the significance of a particular register bit value without having a copy of the datasheet.

To read a register value, simply click the register to read and then click the **Read Reg** button. The new value is returned.

To write a register with a new value, click the register name to load the register information into the *Register Data* window. Click the individual bit fields to change the new values from 1 to 0 or vice versa. A check mark indicates a 1 value and an open box indicates a 0 value. The HEX value of the register is automatically updated. Click the **Write Reg** button to write the new value to the TLK10232 register. Retyping the HEX value directly into the *Write Data* field also writes the value to the register when the **Write Reg** button is pressed and the individual bit fields are updated for the specific HEX value.

If a chosen register has the Write Reg information disabled and grayed out, then that register is read only.

The GUI knows the register communication protocol of all the different registers and writes to the register in the required mode. If a TCA6424 register is read or written, the GUI executes that transaction using the I<sup>2</sup>C protocol. The TLK10232 registers are MDIO Clause 45 Protocol, and the Spartan-6 registers (if using the legacy TLK10002 EVM FPGA daughterboard) are MDIO Clause 22 protocol.

Also, the PHY and Device Address information is used from the various input fields associated with the various board address controls. It is important to ensure that the PRTAD[4:1] address is set appropriately for the boards, and the I<sup>2</sup>C address also matches the addresses set in hardware. The EVM board ships with PRTAD[4:1] = 4'b0000 and the I<sup>2</sup>C Address for the TCA6424 = 0x22.

TLK10232 EVM GUI	Test of the	-	-	_	-	_	states in the local	-	and the second	or Property States or	
File Script Settings Debug Help				_						of the local data when	
Selection Window	Register Map						Current Andre	Write Date	Read Data	Enable 1st Board	C Enable 2nd Board
High Speed TX Cfg	Block / Register Name	Addr	Default	1.W*	IR*		Current Addr	write Data			
High Speed RX Cfg	TI K10232	Auu	Deraute		EIX .	ĥ.	× 0	× U	× U	PRTAD[4:1]	PRTAD[4:1]
Low Speed Input Cfg	Board1							Write Reg	Read Reg	<ul> <li>Disable Software</li> </ul>	<ul> <li>Disable Software</li> </ul>
Low Speed Output Cfg	ChannelA									Control of Pins	Control of Pins
LOS Overlay Cfg	UENDOR						Register Data	Tran	ofer Read to Write	I2C Address 0x22	I2C Address 0x23
Lane Alignment Cfg	CHANNEL_CONTROL_1	0x01	0x0B00	0x0B00	0x0B00			Tun	ister Reduce to tritte	LOW/HIGH	LOW/HIGH
Reserved Control Conf	HS_SERDES_CONTROL_1	0x02	0x831D	0x831D	0xD251		RW			PDTRXA_N	PDTRXA_N
Override Cfg	HS_SERDES_CONTROL_2	0x03	0xA848	0xA848	0x08A4					PDTRXB_N	PDTRXB_N
Deeplocal Feedback Cc	HS_SERDES_CONTROL_3	0x04	0x1500	0x1500	0x1500	=				PRBSEN	PRBSEN
Channel Sts	HS_SERDES_CONTROL_4	0x05	0x2000	0x2000	0x2000					MODE_SEL	MODE_SEL
TX Switch Configuratio		0.07	0xP115	0x0113	0,5522					SI CO	SI CO
RX Switch Configuratic		0,07	0xDC04		0x0865						
Switch Status	LN1 LS SERDES CONTROL	0x07	0xDC04	0xDC04	0x02F3						
PMA Control Cfg	LN0 LS SERDES CONTROL	0x07	0xDC04	0xDC04	0xDE99					MDIO B2B RI V	MDIO R2B RLV
PMA Sts	LN3_LS_SERDES_CONTROL	0x08	0x000D	0x000D	0x000D					MIDIO DED KET	MIDIO DED RET
Link Training Cfg	LN2_LS_SERDES_CONTROL	0x08	0x000D	0x000D	0x000D						
Auto Train Learn Mode	LN1_LS_SERDES_CONTROL	0x08	0x000D	0x000D	0x000D					STATUS MDIO RELAY	STATUS MDIO RELAY
Link Training Sts	LN0_LS_SERDES_CONTROL	0x08	0x000D	0x000D	0x000D					CONTROL	CONTROL
Auto Train Status	HS_OVERLAY_CONTROL	0x09	0x0380	0x0380	0x0380						
LT Link Partner E	LS_OVERLAY_CONTROL	A0x0	0x4000	0x4000	0x4000					LOSA	LOSA
LT Local Device Contro	LOOPBACK_TP_CONTROL	0x0B	0x0D30	0x0D30	0x0D30					LOSB	LOSB
LT Local Device Sts	TL DESERVED STATUS 7	0x0C	0x0330	0x0330	0x0330					LOS_OK_OUT_A	LOS_OK_OUT_A
KR FEC Control	CLK_CONTROL	0.00	0x0000	0x0000	0x0000					LOS_OK_OUT_B	LOS_OK_OUT_B
KR Vendor Specific Cfg		0,00	0,0000	0,2100	0,2100		Register Descrip	ption		PRBS_PASS	PRBS_PASS
KR Vendor Specific Sts	CHANNEL STATUS 1	0x0F	0x0000	0x0000	0x0000					CLK_PRI_INPUT	CLK_PRI_INPUT
PCS Control Cfg	HS ERROR COUNTER	0x10	0xFFFD	0xFFFD	0xFFFD				r r	CLK_SEC_INPUT	CLK_SEC_INPUT
PCS Sts	LS_LN0_ERROR_COUNTER	0x11	0xFFFD	0xFFFD	0xFFFD					CLK_PLL_LOCK	CLK_PLL_LOCK
Auto Negotiation Cont	LS_LN1_ERROR_COUNTER	0x12	0xFFFD	0xFFFD	0xFFFD					Refresh	Refresh
Auto Negotiation Sts	LS_LN2_ERROR_COUNTER	0x13	0xFFFD	0xFFFD	0xFFFD					( ) nonesin	(p nenesii
Clock Output Cfg	LS_LN3_ERROR_COUNTER	0x14	0xFFFD	0xFFFD	0xFFFD					O Power Down Device	O Power Down Device
🕀 Channel B	LN3_LS_STATUS_1	0x15	0x0000	0x0000	0x0000					Main Board Reset	Main Board Reset
BER Testing	LN2_LS_STATUS_1	0x15	0x0000	0x0000	0x0000				-	Peret TLK10232	Recet TI K10232
Latency Testing	LNI_LS_STATUS_1	0x15	0x0000	0x0000	0x0000					· RESET TEREFORD	· Reset TERIOZISZ
Clock Generator		0x15	0x0000	0x0000	0x0000		C C A H	C		Load Config	load Config
HS Link Ontimizer	DST_CONTROL 1	0x10	0x2000	0x0000	0x0000	6	Spartan-o Addre	ess Settings		Cour Config	E Sava Cashia
Low Level Configuration	DST_CONTROL 2	0v18	0x0C20	0x0C20	0x0C20		Board 1 for Chan	nels A/B Board	d 2 for Channels C/	C Save Coning	tal Save Config
Block Diagram	DSR CONTROL 1	0x19	0x3500	0x3500	0x3500	1		~~~~	~~~~	- Load Script	Load Script
	DSR_CONTROL 2	0x1A	0x4C20	0x4C20	0x4C20		PRTAD[4:1		AD[4:1]	💢 Discard Updates	💢 Discard Updates
	DATA_SWITCH_STATUS	0x1B	0x1020	0x1020	0x1020		CDCM6208V1 A	ddress Settin	gs	👌 🖉 Review Updates	👌 🖌 Review Updates
Enable Simulation Mode	LN3_LS_CH_CONTROL_1	0x1C	0x0000	0x0000	0x0000	Ŧ	Decert 0			Apply Updates	Apply Updates
Reset USB Connection	*IW/> Last Write 1*I P> Last Pd	0.40	10.0000		0.0000		Board1 ×0	В	oard2 ×0		
	Last write; LK> Last Kead									Require Update	Device Configured
			2/26/20	12.241.5	2.014					IDIE Die Ter	
			2/20/20	13 2:11:5		Ve	arsion: 2.4.0.8	SIMUL	ATION	IDLE TE	KAS INSTRUMENTS

### Figure 10. TLK10232 EVM GUI Low-Level Device Configuration



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### 5 BER Testing

The *BER Testing* portion of the GUI can be used after configuring the desired TLK10232 settings and applying them to the device. When selecting the *BER Testing* window from the *Selection Window* tree (Figure 11), a page is displayed for running BER tests with any of the supported internal test patterns. The generation and verification enables bits as well as the test patterns must be configured during the initial device configuration and this window only reads and displays the error counter results. Pressing the **Read Counter** button under the *SINGLE READ* title performs a single read of all the error counters. Note that the error counters are cleared on read and the first read should be discarded because it contains a value set prior to the start of the test. Reading an error counter twice initially is always recommended.

A cumulative BER test can be performed by pressing the **Run Test** button under the *AUTO READ* title. This reads all error counters in sequence and continues to read the error counters in a loop until the **Stop** button is pressed. Note that the error counters stop being read at the end of the loop when the **Stop** button is pressed. If the test does not stop immediately when the **Stop** button is pressed, wait a short time to allow for the current loop to complete before the test is allowed to stop.

During the AUTO READ test, the Current Count of error values are displayed for the current read, and any errors are added to the Cumulative Count. Reset the Cumulative Count at any time by pressing the **Reset** Cumulative button under the AUTO READ title.

If bit errors are present, or the user would like to observe how different TX or RX settings affect the bit error rate, the left portion of the window allows access to all TX and RX parametric settings such as TX Swing, Pre-emphasis, and RX Equalization. Any adjustment of these controls will cause the GUI to apply the updated value in almost real time to the device. At the end of every error count read loop the GUI checks to see if any of the register control settings have been changed and the GUI applies writes the new values to the TLK10232 device before returning to the error count loop. All low- and high-speed TX and RX channels and lanes can be selected for control by using the *Transmitter Configuration* and *Receiver Configuration* selection boxes.

The results of the BER tests can be output to the *PRBS\_PASS* LED on the TLK10232 EVM board by use of the *Pin Selection* box located at the top right corner of this window.



### Figure 11. TLK10232 EVM GUI High-Level BER Testing



### 6 Latency Testing

In a similar fashion to the *BER Testing* window, a *Latency Testing* window (Figure 12) is also supplied in the GUI for easier operation of the internal latency counters in the TLK10232 devices. Once the TLK10232 board is configured for proper latency testing and data is passing, select the *Latency Testing* window to configure the test settings and run the test. Each channel of the TLK10232 has a latency counter, but only one channel can be configured and tested at a time. Once the test settings are selected, pressing the **Run Test** button writes the test configuration settings to the TLK10232 and reads the latency status register to determine if the test is complete. If the test is complete, the *Latency Measurement Ready* LED glows green and the *Latency Measurement Count* is displayed. If the *Latency Measurement Ready* status bit fails to indicate the measurement is ready and the test is complete, then the test will time out after the set timeout is achieved. Rereading the counters is performed by pressing the **Re-Read Counter** button.

10 TLK10232 EVM GUI	A Longer Bartin	
File Script Settings Debug Help		
Selection Window TLK10232 EVM Board 1 Channel A Operation Mode Cfg	Board1 : Late	ency Testing
Clock and Rate Cfg     High Speed TX Cfg     High Speed RX Cfg     Low Speed Input Cfg     Low Speed Output Cfg     LOS Overlay Cfg	Channel Selection ChannelA	
Lane Alignment Cfg Reserved Control Conf Override Cfg Deeplocal Feedback Cc Channel Sta Channel Status Final Vi TX Switch Configuratic RX Switch Configuratic Switch Status PMA Control Cfg PMA Sts Link Training Cfg Auto Train Learn Mode Link Training Sts Auto Train Status LT Link Partner LT Local Device Sts	C Enable Latency Measurement Start Location Low Speed Input • Stop Location Low Speed Output • Latency Measurement Clock Selection VCO Clock per Latency • Latency Measurement Clock Divider 1 (Most Accurate Measurement) •	Latency Start Comma Location Status          x       0         Latency Stop Comma Location Status         x       0         Latency Measurement Count         b       0         Latency Measurement Ready
KR FEC Control KR Vendor Specific Cfg KR Vendor Specific Sts PCS Control Cfg PCS Sts Auto Negotiation Cont Auto Negotiation Cont Clock Output Cfg Channel 8 BER Testing Latency Testing Clock Generator TLK10232 EVM Board 2 LS Liek Ontimizer	Timeout - Wait Time For Latency Counter (In Sec) 10 Run Test Test Progress	Re-Read Counter
Enable Simulation Mode     Reset USB Connection		
	2/26/2013 2:32:47 PM Version: 2.4.	0.8 SIMULATION IDLE VIE TEXAS INSTRUMENTS

Figure 12. TLK10232 EVM GUI High-Level Device Latency Testing



### 7 High-Speed Link Optimizer Tests

Once the TLK10232 device registers and settings are applied to the device, switching over to the *High Speed Link Optimizer* tab of the GUI provides some enhanced BER optimization tests allowing for quick evaluation of the health of the channel and what combination of parameter values yields the lowest bit error rate. This portion of the GUI is more applicable when operating modes that do not implement link training as part of their initialization sequence.

It is possible to optimize a link that contains two different devices on two different boards as in a real system and not serial loop back test normally found in a lab test environment. Currently additional testing and verification of the TLK10232 EVM board and GUI is needed to support the two-board solution for this feature of the GUI. Look for future revisions of this document for additional information on how to configure the hardware and software for a two-board setup.

Up to four individual sweeps can be run simultaneously allowing for the entire device to be optimized concurrently. Each of the four sweep setups has an enable check box in the *Set Up* tab to enable that sweep for testing. Not selecting irrelevant sweeps uses fewer PC resources.

Select the *No. of Parameters* from the selection box; up to 6. Notice that if less than 6 parameters are selected, the extra parameters are disabled and grayed out. The board number and channel number are required to ensure the proper board and device's parameters are swept in the two-board test setup. Once a parameter is used by a sweep, it is grayed out as an option for additional sweeps.

For each parameter swept, select the board number, channel, and parameter name. The start and stop values for those parameters are chosen with an associated step size. A step size of 1 sweeps every value; a step size of 2 sweeps every other value, and so forth. If a non-linear step or alternate order of the parameter values is desired, the sequence of values can be input in the form of a comma-separated list in any particular order. Match the syntax of the selected parameter fields in order to ensure the parameter is set properly. Do not include spaces in the comma-separated list. If a comma-separated list is used, the *Start, Stop,* and *Step* fields are ignored.

😰 TLK10232 EVM GUI	And Designed Andrew Andrew States and the Party and the	
File Script Settings Debug Help		
Selection Window Operation Mode Cfg Clock and Rate Cfg High Speed TX Cfg	HS LINK OPTIMIZER	
High Speed RX Cfg Low Speed Input Cfg Low Speed Output Cfg LOS Overlay Cfg Lane Alianment Cfg	Sweep 1         Sweep 2         Sweep 1         Sweep 2           Set Up         Set Up         Test Results         Test Results	Non-Swept Parameters to Log into Report
Reserved Control Conf     Override Cfg     Deeplocal Feedback Cc     Channel Sts     Channel Status Final Ve	Transmitter Selection     Reciever Selection       Board1_ChannelA     Board1_ChannelA	Board1 💌 Global 💌
TX Switch Configuratic     RX Switch Configuratic     Switch Status     PMA Control Cfr.	Sweeping Parameters	Board1 V Global V
MA Sts     Ma Sts     Link Training Cfg     Auto Train Learn Mode     Link Training Sts	Board Channel Parameter Start Stop Step Non Linear Steps(, separated)	Board1 V Global V
Auto Train Status     LT Link Partner     LT Local Device Contrc     LT Local Device Sts	1 ▼ ChannelA ▼ HS_TWPOST1 ▼ 0 ▼ 0 ▼ 1 8 -37.5,+35.0,+32.5,+30.0	Link Optimizer Provisioing Script Path C:\Program Files (x86)\Texas Instrument'\T K1023\Script Files)
<ul> <li>KR FEC Control</li> <li>KR FEC Sts</li> <li>KR Vendor Specific Cfg</li> <li>KR Vendor Specific Sts</li> </ul>	1 ChannelA V REFCLK_SW_SEL V REFCLK_0 V 1 0	Test Time Per Parameter Combination (Seconds)
PCS Control Cfg     PCS Sts     Auto Negotiation Cont     Auto Negotiation Sts	1 ChannelA W REFCLK_SW_SEL W REFCLK_0 W REFCLK_0 W 1 0	Create Report
Clock Output Cfg Channel B BER Testing CLatency Testing		Run Sweep      Abort Sweep
Clock Generator TLK10232 EVM Board 2 HS Link Optimizer Low Level Configuration Plack Discourse	Configure Sweep Combination	Load Report
Enable Simulation Mode     Test     Reset USB Connection	Progress	Test Completed 0 / 0
	2/26/2013 2:55:23 PM Version: 2.4.0.8 SIMULATION I	DLE V TEXAS INSTRUMENTS

Figure 13. TLK10232 EVM GUI High-Speed Link Optimizer Setup

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Once all the sweeping parameters are configured, press the **Configure Sweep Combination** button to create the parameter sweep sequence. Pressing this button opens a new window (Figure 14) that displays the sweep sequence with each combination having its own checkbox. Determine if any of the particular combinations are unnecessary and uncheck the individual fields to exclude them from the sweep. Once those final selections are made, pressing the **Save** button saves the test sweep array to memory and the test is ready to begin.

Parameter 1 Parameter 2 Parameter 3 Parameter 4 Parameter 5 Parameter 6									
Parameter 1	Parameter 2	Parameter 5	Parameter 4	Parameter 5	Parametero				
25	-57.5	1/9							
-2.5	-57.5	1/9			[				
-5.0	-37.5	1/9							
-7.5	-57.5	1/9							
-10.0	-37.5	1/9							
-12.5	-37.5	1/9							
-15.0	-37.5	1/9							
-17.5	-37.0	1/9							
0	+35.0	1/9							
-2.5	+35.0	1/9							
-5.0	+35.0	1/9							
-/.5	+35.0	1/9							
-10.0	+35.0	1/9							
-12.5	+35.0	1/9							
-15.0	+35.0	1/9							
-17.5	+35.0	1/9							
0	+32.5	1/9							
-2.5	+32.5	1/9							
-5.0	+32.5	1/9							
-7.5	+32.5	1/9							
-10.0	+32.5	1/9							
-12.5	+32.5	1/9							
-15.0	+32.5	1/9							
-17.5	+32.5	1/9							
0	+30.0	1/9							
-2.5	+30.0	1/9							

Figure 14. TLK10232 EVM GUI High-Speed Link Optimizer Setup



### High-Speed Link Optimizer Tests

The *Link Optimizer* is similar to the *Apply Settings* portion of the GUI and is executed with a script. There are two versions of the *Link Optimizer* script provided with the GUI; one for a single-board setup, and the other for a two-board setup. The two-board script is loaded by default and while it can be used in a single board setup, the test time takes twice as long because the GUI is trying to configure an entire second board when the second board does not exist. To change the script, click the folder button next to the *Link Optimizer Provisioning Script Path* box and select the single-board script (Figure 15). To set this as the default script, right click the folder button and select the **Set Current File as Default Script**. It should also be noted that the scripts configure every channel of the device independently no matter what channels are implemented. If the channels to be optimized are known, a version of the script can be created that only configures the channels of concern to further reduce and optimize test time.

Choose Script File				2 🛛	Choose Script	File						2 🔀	
Look.jrc	C TLK10034		~ (	) # 🕫 🖽		Look.jn	Cont Files		~	0	100	<b>-</b>	
My Recent Decision Desitop My Documents	Configuration Sorght Files Sorghts Shared Library Trace	Wes				My Frecert Decision Desition My Documents	1 TLK10034_10 1 TLK10034_100 1 TLK10034_100 1 TLK10034_60 1 TL	KO, Hode, Apply, Setting G, Mode, Apply, Setting GR, Mode, Apply, Setting GR, Mode, Apply, Settings Sc et Board Link, Optimizer, or Board Link, Optimizer,	n Sonpilot Sonpilot ga Sonpilot sealot Sonpilot Sonpilot				
<b>Q</b>	File pane:			<b>×</b>	OK.		File pane:	TLK10034_One_Boar	d_Link_Optin	vizer_Sc	wipt t 🛩		OK.
My Network	Files of type:	Custom Pattern (*.txt)		~	Cancel	My Network	Files of type:	Custom Pattern (* tot)			*		Cancel



After loading the desired script, press the **Run Sweep** button to start the test. When this button is pressed, the GUI takes the first set of parameter values in the configuration array and changes those values in the GUI's register configuration memory. The GUI then executes the script responsible for provisioning the TLK10232 device, reading the error counters to clear them, waiting for the amount of test time entered for the BER test, and then rereading the error counters to obtain the BER count. Next the GUI stores the BER values into memory and processes the results. In the *Sweep Test Results* tab, there is an individual square pixel generated for each parameter combination in a matrix-of-matrix's configuration (Figure 16). The square is colored green if there are zero bit errors, yellow if there are bit errors but the maximum value of the error counter was not exceeded, and red if the maximum error count was achieved in the counter. Clicking on a square displays the parameter information for that test as well as the number of bit errors.





Figure 16. TLK10232 EVM GUI High-Speed Link Optimizer Sweep Results Matrix

The sweep can be aborted at any time by pressing the **Abort Sweep** button. This does not discard any test data already collected, but stops the remaining portion of the test configurations from running.

At the completion of the test, the test results can be written to a data file for further analysis or archiving. Pressing the **Create Report** button writes the data to a .csv file. Additional parameters that were not swept as part of the test can be included in the report by entering those values in the top right corner of the *Link Optimizer* window (Figure 17). This information is for manual entry only and not linked to the memory array.



### Python Scripting

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	And and the local manual first work have been	- 0 <b>X</b>
File Script Settings Debug Help	which the same of any time in pressing the stand having taken from any other	
Selection Window Operation Mode Cfg Clock and Rate Cfg Hink Social TX Cfg	HS LINK OPTIMIZER	
High Speed RX Cfg Low Speed Input Cfg Low Speed Input Cfg Low Speed Output Cfg LOS Overlay Cfg	Sweep 1         Sweep 2         Sweep 1         Sweep 2           Image: Set Up         Image: Set Up         Test Results         Test Results	Non-Swept Parameters to Log into Report
Cane Alignment Crg     Reserved Control Conf     Override Cfg     Deeplocal Feedback Cc     Channel Sts	Parameter 1	Board1 V Global V
Channel Status Final Va     TX Switch Configuratic     RX Switch Configuratic     Switch Status     PMA Control Cfg	Parameter 2	Board1 💌 Global 💌
PMA Sts Link Training Cfg Auto Train Learn Mode Link Training Sts Auto Train Status	Parameter 3	Board1 w Global w
LI LINK Partner LT Local Device Contro LT Local Device Sts KR FEC Control KR FEC Sts KR Vender Specific Cfn	Parameter 4	C:\Program Files (x86)\Texas Instruments\TLK10232\Script Files
KR Vendor Specific Sts PCS Control Cfg PCS Sts Auto Negotiation Cont Auto Negotiation Sts	Parameter 5	0.1 Create Report
Clock Output Cfg Channel B BER Testing Latency Testing Clock Generator	Parameter 6	Run Sweep           X         Abort Sweep
TLK10232 EVM Board 2     HS Link Optimizer     Low Level Configuration     Plack Diserce	Bit Error Count	Load Report
<ul> <li>Enable Simulation Mode</li> <li>Reset USB Connection</li> </ul>	Test Progress	Test Completed 0 / 224
	2/26/2013 3:24:12 PM Version: 2.4.0.8 SIMULATION ID	LE VE TEXAS INSTRUMENTS

Figure 17. TLK10232 EVM GUI High-Speed Link Optimizer Test Control Buttons

### 8 Python Scripting

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Advanced operation and control of the TLK10232 device can be performed by using the linked Python Scripting Editor. Register read/writes can be logged into a script while registers are read and written either manually through the low level, or through other areas of the GUI where registers are read or written. These scripts can be modified, written by the user, or enhanced with loops, file I/O and command-prompt entry if the advanced register control not found in the GUI is needed. All aspects of the Python programming language supported in Version 2.7 can be implemented to the Python scripts. Specifics aspects of the Python programming language are not discussed in this document.

To open a Python Script Editor to record a macro script, click the *Script* menu option and select the *Launch Window* option (Figure 18).



### Figure 18. TLK10232 EVM GUI Launching Python Scripting Editor

A blank Python editor window opens (Figure 19).





Figure 19. TLK10232 EVM GUI Blank Python Scripting Editor

On the TLK10232 GUI, click the *Script* menu option again and select *Start Recording*. The header information will be added to the Python Editor window and the color of the window starts to blink between white and green to indicate that it is in a recording mode (Figure 20). All register read and write transactions from this point forward are logged in the Python Editor window.

74 "Untitled"		74 "Untitled"	
Elle Edit Format Run Options Windows Help		Elle Edit Format Run Options Windows Help	
import Device_GUI	-	import Device_GUI	*
Ele Egit Førmat Bun Options Windows tæb Import Device_GUI GUI=Device_GUI.Device_GUI("TLK10034") 	*	Ele Edi Fermat Bun Quitons Woldows Heb Import Device_GUI GUI=Device_GUI.Device_GUI("TLK10034")	Ĩ
	-		-
	Ln: 4 Col: 0	i.	n: 4 Col: 0

Figure 20. TLK10232 EVM GUI Python Scripting Editor in Record Mode (Toggles Color)

To stop a recording click the *Script* menu option and select *Stop Recording* to stop the recording feature and close out the script. Restart the recording at any time and additional read/write transactions are added to the same script.



The script can be rerun as-is by saving the python script with the .py extension and selecting *Run Module* from the *Run* Menu in the Python Editor. The output of the script run is open in the shell window. It displays *Script completed successfully* indicating that the execution is complete. The user can add variables to assign and display read values, or write values directly from the script, or add looping structures, by saving those settings and rerunning the module.

It is recommended that advanced users create small python scripts of commonly used tasks to create a library of macros to enhance their evaluation of the TLK10232 device and reduce their test time.











### 9 GUI Status

Check the status of the GUI by double-clicking the status bar at any time. A *Status Log* window opens showing recent operations performed on the GUI. This window is useful for testing or debug.

Status Log	x
Main Engine.vi -> Device communication closed	
Main Engine.vi -> Device communication initialized	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_0C -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_0D -> 0x3C	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_0E -> 0x1F	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_04 -> 0x1F	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_05 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_06 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_0C -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_0D -> 0x3C	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_0E -> 0x1F	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_04 -> 0x1F	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_05 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_06 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_05 -> 0x1	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_05 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_05 -> 0x1	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_05 -> 0x0	
Main Engine.vi -> Write Register -> TCA6424_Board1 -> GPIO_CONTROL -> REGISTER_04 -> 0x1E	
Main Engine.vi -> Write Register -> TCA6424 Board1 -> GPIO_CONTROL -> REGISTER_04 -> 0x1F	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_04 -> 0x1E	
Main Engine.vi -> Write Register -> TCA6424_Board2 -> GPIO_CONTROL -> REGISTER_04 -> 0x1F	
	-
U	

Figure 23. TLK10232 EVM GUI Status Log Window

This window has menu options for clearing the status log, saving the status log to a file, or setting the buffer limit which holds recent actions and operations done on the GUI. Use this option by right-clicking



## 10 Debug Options

There are a few debug options available that will help in testing and debugging the GUI functionality.

File	Script	Debug	Tools	
Selection Wir		Debu	ig Log	F
		Log t	o File	Th

These options are available through menu options in the GUI.

**Debug Log:** On selecting this option, the *Status Log* window will log all the necessary operations that are needed for testing or debugging the device. It will list all the functionalities and actions done while performing a specific operation. Deselecting this option will log only the general operation done by GUI.

**Log to File:** On selecting this option, the GUI starts logging the operations into a file. (It logs all the data that is recorded in the *Status Log* window). The maximum file size is 10kB. If the file size reaches the maximum, a new file is created. These files can be found inside the *Trace* folder under the *Application* folder.



### 11 Troubleshooting

- 1. Pressing *Control* + *h* opens a help window. Hover the mouse over the target control and find the description on the help window.
- 2. If the GUI doesn't properly read or write a register,
  - (a) Check if the Enable Simulation Mode [below Selection Window] is deselected. If this control is

Enable Simulation Mode

enabled, the GUI will be running on simulation values.

(b) Check if the GUI status shows USB CONNECTED. If it shows SIMULATION, follow the above procedure. If it shows NOT CONNECTED, plug-in the USB device properly and press

Reset USB Connection or restart the GUI.

- 3. Error with Python Scripting. If the Python window is not launched on pressing menu option *Launch Window*.
  - Check if Python 2.7 is installed on working PC. If not, download python 2.7 from the following location and install it. http://www.python.org/download/releases/2.7/
  - Check if Python is added to environment variable. If not, follow the procedure below to add Python to the environment variable
    - Right-click My Computer and select Properties.
    - For the Windows<sup>®</sup> 7 Operating System, select *Advanced system settings* from the options available.





This opens a window as shown below. Press Environment Variables.

System Properties
Computer Name Hardware Advanced System Protection Remote
You must be logged on as an Administrator to make most of these changes.
Performance
Visual effects, processor scheduling, memory usage, and virtual memory
Settings
User Profiles
Desktop settings related to your logon
Settings
Startup and Recovery
System startup, system failure, and debugging information
Settings
Enviro <u>n</u> ment Variables
OK Cancel Apply

For the Windows XP Operating System, select the Advanced tab and press Environment Variables.

System Re	store Automa	atic Updates	Perrete
General	Computer Name	Hardware	Advanced
You must be la	oqqed on as an Administra	tor to make most of th	nese changes
Performance			
Visual effects	s. processor scheduling. m	emory usage, and vir	tual memory
			Settings
User Profiles			
Desktop sett	ings related to your logon		
		-	
		L	Settings
Startup and F	Recovery		
System startu	up, system failure, and deb	ugging information	
1			
			Settings
		_	
	Environment Var	ables Fror F	Reporting
	Enviro <u>n</u> ment Var	ables Error i	Reporting



Troubleshooting

• Select Path from System variables and press the Edit... button.

variable	Value	
PATH	C:\Python27\	
TEMP TMP	%USERPROFILE%\AppData\Local\Temp %USERPROFILE%\AppData\Local\Temp	
ystem variables		
ystem variables Variable	Value	
ystem variables Variable OS Path	Value Windows_NT C:Windows!cstem32:C:Windows:C1	
vstem variables Variable OS Path PATHEXT PROCESSOR A	Value Vindows_NT C:\Windows\system32;C:\Windows;C:\ .COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS; AMD64	

• Add 'C:\Python27;' at the end of Variable value and Press the OK button

Edit System Variable	×
Variable <u>n</u> ame:	Path
Variable <u>v</u> alue:	Program Files (x86) \Perforce; C:\Python27;
	OK Cancel

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As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

#### General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

### For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant

#### Caution

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

#### FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- · Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### Concerning EVMs including detachable antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

#### Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

### [Important Notice for Users of this Product in Japan]

### This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

- Use this product in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
- 2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
- 3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

### Texas Instruments Japan Limited (address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan

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### EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

- 1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
- 2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
- 3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
- 4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

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