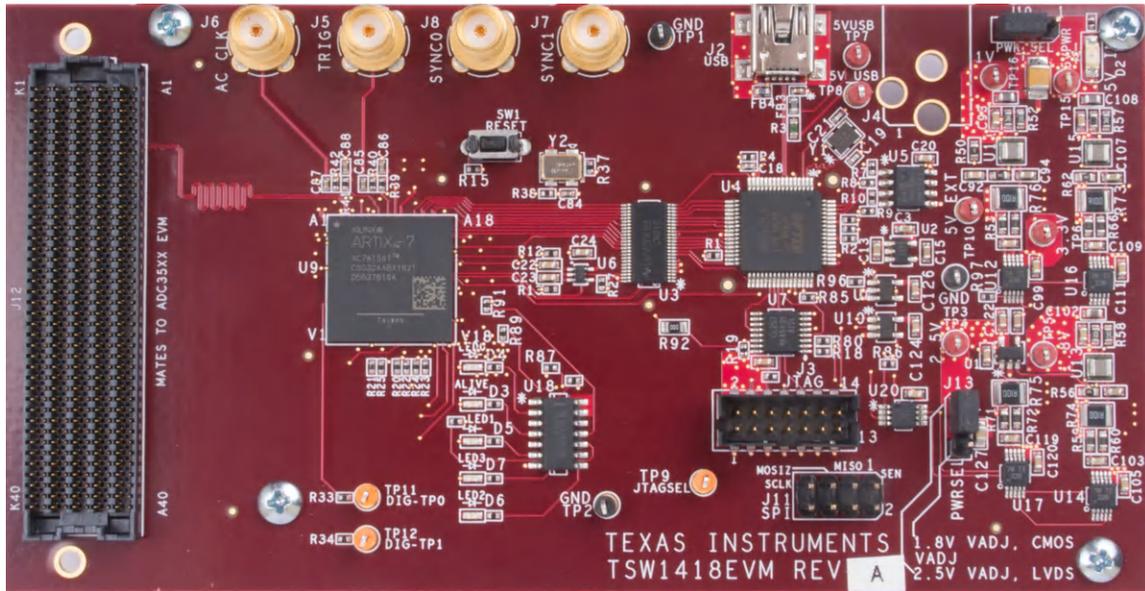


TSW1418EVM High-Speed Data Capture Card



ABSTRACT



This user's guide describes the characteristics, operation, and use of the TSW1418 evaluation module (EVM) entry level data capture card. Throughout this user's guide, the abbreviations *EVM*, and the term *evaluation module* are synonymous with the TSW1418EVM, unless otherwise noted.

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1 Introduction

The TSW1418EVM is an entry-level, low-cost, FMC interface data capture card used to evaluate performances of TI's family of high-speed analog-to-digital converters (ADCs). The TSW1418EVM is used to demonstrate data sheet performance specifications by capturing the sampled data over a low-voltage differential signaling (LVDS) or complementary metal-oxide-semiconductor (CMOS) interface when using a high-quality, low-jitter clock, and a high-quality input frequency. Using Xilinx® based firmware, the TSW1418EVM is dynamically configurable to support LVDS speeds up to 950Mbps, and up to 18 data outputs. With the accompanying [High-Speed Data Converter Pro Graphic User Interface](#) (HSDC Pro GUI), the TSW1418EVM is a complete system that captures and evaluates data samples from ADC EVMs.

1.1 REACH Compliance

In compliance with the Article 33 provision of the EU REACH regulation, we are notifying you that this EVM includes a component containing at least one substance of very high concern (SVHC) above 0.1%. These uses from Texas Instruments do not exceed 1 ton per year. The SVHC summary is listed in [Table 1-1](#).

Table 1-1. SVHC Summary

Component Manufacturer	Component Part Number	SVHC Substance	SVHC CAS (when available)
Abracon	ABM8G-12.000MHZ-B4Y-T	Diboron Trioxide	1303-86-2
Abracon	ABM8G-12.000MHZ-B4Y-T	Lead Oxide	1317-36-8

2 Functionality

The TSW1418EVM has a single, industry-standard FMC connector that interfaces directly with TI non-JESD204B/C ADC EVMs using FMC connectors. When used with an ADC EVM, LVDS or CMOS data is captured and formatted by a Xilinx Artix® 7 XC7A100T field-programmable gate array (FPGA). The data is then stored into the FPGA internal memory, enabling the TSW1418EVM to store up to 64K 16-bit data samples. To acquire data on a host PC, the FPGA transmits the data on a high-speed, 8-bit parallel interface. An onboard USB-to-parallel converter bridges the FPGA interface to the host PC and GUI.

The major features of the TSW1418EVM are:

- Entry-level, low-cost data capture platform
- USB powered
- 21 differential LVDS pairs with speeds up to 950Mbps dual data rate (DDR)
- 64K of 16-bit samples of internal FPGA memory
- Supports 1.8-V CMOS IO standard
- Onboard FTDI USB device for JTAG and SPI to the FPGA
- Spare clocking and general-purpose I/O available through FMC port or SMA's
- Supported by TI HSDC PRO software
- FPGA firmware developed with Xilinx Vivado® v17.2
- Digilent JTAGHS2 FPGA PROGRAMMING CABLE, PN: 410-249

Figure 2-1 shows a block diagram of the TSW1418EVM.

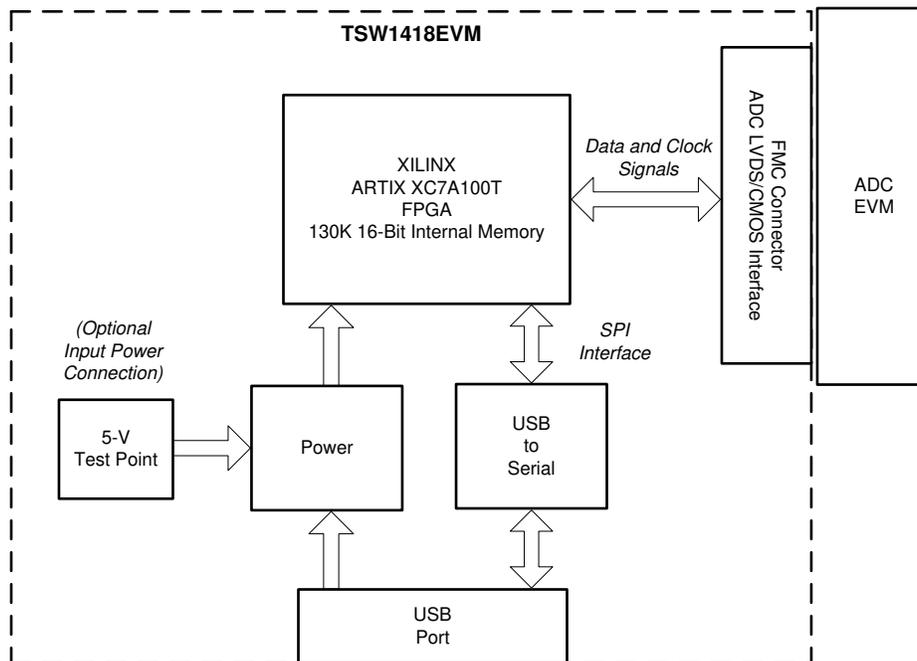


Figure 2-1. TSW1418EVM Block Diagram

2.1 ADC EVM Data Capture

New TI high-speed ADCs now have LVDS outputs that are up to 18 bits. These devices are available on an EVM that connect directly to the TSW1418EVM. The common connector between the EVMS and the TSW1418EVM is a Samtec 400-pin, high-speed, high-density FMC connector (SEAF-40-05.0-S-10-2-A-K-TR) that is an excellent choice for high numbers of differential pairs operating up to 28Gbps. A common pinout for the connector across a family of EVMS has been established. At present, the interface between the EVMS and the TSW1418EVM has defined connections for:

- 21 differential LVDS pairs or 42 single-ended CMOS signals
- 3 data clock pairs
- 5 SPI signals
- An I²C interface
- 2 FPGA optional sample clock pairs
- 4 GPIO signals

The board has:

- Four SMA interfaces to the FPGA
- A push-button hardware reset switch
- Several spare test points routed to the FPGA
- Five status LEDs

The firmware in the FPGA on the TSW1418EVM is designed to accommodate any of TI's non JESD204B/C FMC based ADCs operating in either CMOS or LVDS mode, at up to 18 bits.

The GUI loads the FPGA with the appropriate firmware based on the ADC device selected in the device drop down window. Each ADC device that appears in this window has an initialization file (.ini) associated. This .ini file contains information, such as number of channels, maximum sample rate, output interface type, number of bits, and other parameters. This information is loaded into the FPGA registers after the user clicks on the capture button. After the parameters are loaded, valid data are then captured into the FPGA internal memory. See section 2.3, *Device ini Files*, in the [High-Speed Data Capture Pro GUI Software User's Guide](#) for more information. Several .ini files are available to allow the user to load predetermined ADC interfaces. For example, if the user selects the ADC named *ADC3683_2w_18bit*, the FPGA is configured to capture data from the ADC3683EVM with the ADC interface configured for bit wise DDR mode, 18-bit LVDS, 2 converters, with a max data rate of 65 MHz.

The TSW1418EVM can capture up to 64K, 16-bit samples at a maximum data rate of 950Mbps that are stored inside the FPGA internal memory. To acquire data on a host PC, the FPGA reads the data from memory and transmits parallel data to the onboard, high-speed parallel-to-USB converter.

3 Hardware

This section describes the various portions of the TSW1418EVM hardware.

3.1 Power Connections

The TSW1418EVM hardware is designed to operate from a single supply voltage of 5 V DC. The power input can either be from the USB interface or test point TP10 (5 V) and any black test point (5-V return). The selection is controlled by jumper J10. By default, the board is setup to operate from USB power. As an example, the TSW1418EVM draws approximately 0.120 A at power-up and 0.3 A when capturing data from an ADC3683EVM sampling at 65 Msps. Another option for input power is through connector J4 (not installed by default).

3.2 Switches, Push-Buttons, Jumpers, and LEDs

3.2.1 Switches and Push-Buttons

The TSW1418EVM contains one switch that preforms an FPGA hardware reset. The description of the switch can be found in [Table 3-1](#).

Table 3-1. Switch Description

Component	Description
SW1	FPGA hardware reset

3.2.2 Jumpers

The TSW1418EVM contains several jumpers (JP) that enable certain functions on the board. The description of the jumpers can be found in [Table 3-2](#).

Table 3-2. Jumper Descriptions

Component	Description	Default
J13	Sets the VADJ voltage level for the FPGA banks to be used with either LVDS or CMOS level inputs. The default setting is for LVDS interface	1 to 2
J10	Power input select. Options are USB interface or test points. Default is USB interface.	2 to 3

3.2.3 LEDs

3.2.3.1 Power LED

One LED on the TSW1418EVM is used to indicate the presence of power on the board. The description of this LED can be found in [Table 3-3](#).

Table 3-3. Power and Configuration LED Descriptions

Component	Description
D2	If this is on, then that indicates the presence of 5 V on the board.

3.2.3.2 Status LEDs

The TSW1418EVM contains five status LEDs. The status description for each are as follows:

D3 – Not used

D4 – Not used

D5 – Not used

D6 – Not used

D7 – Not used

3.3 Connectors

3.3.1 SMA Connectors

The TSW1418EVM has four SMA connectors. The connectors are defined in [Table 3-4](#).

Table 3-4. SMA Connector Descriptions

Jumper No.	Jumper Name	Description
J5	TRIG_IN	Currently not supported. Future firmware uses this jumper as an ac-coupled trigger input. Default level is 3.3 V.
J7	SYNC-OUT-1	Currently not supported. Future firmware uses this jumper as a CMOS sync output. Default level is 3.3 V. By installing R98 and removing R44, this output level is determined by jumper J13 setting. Shunt across pins 1-2 is 2.5 V. Shunt across pins 2-3 is 1.8 V.
J8	SYNC-OUT-0	Currently not supported. Future firmware uses this jumper as a CMOS sync output. Default level is 3.3 V. By installing R99 and removing R46, this output level is determined by jumper J13 setting. Shunt across pins 1-2 is 2.5 V. Shunt across pins 2-3 is 1.8 V.
J6	AC_CLK	Spare ac-coupled input clock to the FPGA.

Note

When implemented in firmware, the SYNC-OUT-0 and SYNC-OUT-1 SMAs are used to provide output SYNC signals. Use cables of equal length for each SYNC signal to make sure that the SYNC signal arrives at the same time for all boards.

3.3.2 FPGA Mezzanine Card (FMC) Connector

The TSW1418EVM has one connector to allow for the direct plug in of new TI LVDS and CMOS interface ADC EVMs. The FMC connector, J12, provides the interface between the TSW1418EVM and the ADC EVM under test.

In addition to several clocks and the 21 LVDS signal pairs or 42 CMOS single-ended signals (depending on how the FPGA is configured), there are several CMOS single-ended signals and spare LVDS differential signals are connected between the FMC and FPGA. In the future, these signals can allow the HSDC Pro GUI to control the SPI serial programming of ADC EVMs that support this feature. The connector pinout description is shown in [Table 3-5](#).

Table 3-5. FMC Connector Descriptions

FMC Signal Name	FMC Pin	Description
FPGA_REFCLK_P/N	G6 and G7	Optional input sample clock from ADC EVM (LVDS or CMOS)
FPGA_CLK_P/N	H4 and H5	Optional output sample clock to ADC EVM (LVDS or CMOS)
FCLK_P/N	E2 and E3	Input frame clock from ADC EVM (LVDS or CMOS)
DCLKIN_FPGA_P/N	K16 and K17	Output data clock to ADC EVM (LVDS or CMOS)
DCLK_P/N	F4 and F5	Input data clock from ADC EVM (LVDS or CMOS)
HA05_P/N	E6 and E7	Input data from ADC EVM (LVDS or CMOS)
HA09_P/N	E9 and E10	Input data from ADC EVM (LVDS or CMOS)
HA013_P/N	E12 and E13	Input data from ADC EVM (LVDS or CMOS)
HA016_P/N	E15 and E16	Input data from ADC EVM (LVDS or CMOS)
HA20_P/N	E18 and E19	Input data from ADC EVM (LVDS or CMOS)
HA04_P/N	F7 and F8	Input data from ADC EVM (LVDS or CMOS)
HA08_P/N	F10 and F11	Input data from ADC EVM (LVDS or CMOS)
HA12_P/N	F13 and F14	Input data from ADC EVM (LVDS or CMOS)
HA15_P/N	F16 and F17	Input data from ADC EVM (LVDS or CMOS)
HA19_P/N	F19 and F20	Input data from ADC EVM (LVDS or CMOS)
HA03_P/N	J6 and J7	Input data from ADC EVM (LVDS or CMOS)
HA07_P/N	J9 and J10	Input data from ADC EVM (LVDS or CMOS)
HA11_P/N	J12 and J13	Input data from ADC EVM (LVDS or CMOS)
HA14_P/N	J15 and J16	Input data from ADC EVM (LVDS or CMOS)
HA18_P/N	J18 and J19	Input data from ADC EVM (LVDS or CMOS)
HA22_P/N	J21 and J22	Input data from ADC EVM (LVDS or CMOS)
HA02_P/N	K7 and K8	Input data from ADC EVM (LVDS or CMOS)
HA06_P/N	K10 and K11	Input data from ADC EVM (LVDS or CMOS)
HA10_P/N	K13 and K14	Input data from ADC EVM (LVDS or CMOS)
HA21_P/N	K19 and K20	Input data from ADC EVM (LVDS or CMOS)
HA23_P/N	K22 and K23	Input data from ADC EVM (LVDS or CMOS)
FMC_GPIO_0	G21	General purpose I/O
FMC_GPIO_1	G22	General purpose I/O
FMC_GPIO_2	G24	General purpose I/O
FMC_GPIO_3	G25	General purpose I/O
FMC_SCLK	G27	ADC clock (SCLK) for SPI from FMC connector
FMC_SEN	G28	ADC enable (SEN) for SPI from FMC connector
FMC_POCI	G30	ADC input data (POCI) for SPI from FMC connector
FMC_PICO	G31	ADC output data (PICO) for SPI from FMC connector
FMC_PICO_EN	G33	FPGA output data enable for SPI from FMC connector
FMC_SCL	G34	I2C enable from FMC connector
FMC_SDA_OUT	G36	I2C data out from FMC connector

Table 3-5. FMC Connector Descriptions (continued)

FMC Signal Name	FMC Pin	Description
FMC_SDA_IN	G37	I2C data in from FMC connector

3.3.3 JTAG Connector

The TSW1418EVM includes one industry-standard JTAG connector that connects to the JTAG ports of the FPGA. The FPGA JTAG port is also connected to the USB interface device U4 (FT2232HL from FTDI). This USB interface is the default method for programming the FPGA. This configuration allows the FPGA to be programmed by the HSDC Pro software GUI. Every time the TSW1418EVM is powered-down, the FPGA configuration is removed. The user must program the FPGA through the GUI after every time the board is powered up.

3.3.4 USB I/O Connection

Control of the TSW1418EVM is through USB connector J2. This connector provides the interface between HSDC Pro GUI running on a PC using the Windows® operating system and the FPGA. For the computer, the drivers needed to access the USB port are included on the HSDC Pro GUI installation software that can be downloaded from the Texas Instruments website. The drivers are automatically installed during the installation process. On the TSW1418EVM, the USB port is used to power up the EVM, identify the type and serial number of the EVM under test, load the desired FPGA configuration file, and capture data from ADC EVMs.

4 Software

4.1 Installation Instructions

- Download the latest version of the [HSDC Pro GUI](#) to a local location on a host PC. This file can be found on the TI website by searching for *high speed data converter pro gui installer*.
- Unzip the software package to generate a folder named *High Speed Data Converter Pro - Installer v6.0.exe*, where 6.0 is the version number. Run this program to start the installation.
- Make sure to disconnect all USB cables from any EVM boards before installing the software.
- Follow the onscreen instructions during installation.
- Click on the *Install* button.
- A new window opens. Click the *Next* button.
- Accept the license agreement. Click on the *Next* button to start the installation.
- After the installer has finished, click the *Next* button one last time.
- The installation is now complete. The current release of GUI executable and associated files resides in the following directory:
C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro. Future releases can be located in other locations.
- Connect the USB cable between J2 of the TSW1418EVM and a host PC. LED D2 is now illuminated.
- To start the GUI, click on the file named *High Speed Data Converter Pro.exe*, located under *C:\Program Files\Texas Instruments\High Speed Data Converter Pro*.

Note

If an older version of the GUI has already been installed, then make sure to uninstall the older version before loading a newer version.

Note

When new TI high-speed data converter EVMs or new interface modes become available that are not currently supported by the latest release of High Speed Data Converter Pro GUI, there is a path file available. The *HSDCProv_xpxx_Patch_setup* executable file allows the user to add these new EVMS and modes to the GUI device list. The patch file is available on the TI website under the High Speed Data Converter Pro Software product folder: <http://www.ti.com/tool/DATACONVERTERPRO-SW>.

After the patch has been downloaded, follow the on-screen instructions to run the patch. The software displays the files to be added. After running the patch, open HSDC Pro, and the new parts and modes appear in the ADC device drop-down selection box. The patch is always specific to a core GUI version, and does not work for a GUI version for which the patch was not explicitly created.

4.2 USB Interface and Drivers

Click on the *High-Speed Data Converter Pro* icon that was created on the desktop panel, or go to *C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro* and double click on the executable file labeled *High Speed Data Converter Pro.exe* to start the GUI.

The GUI attempts to connect to the EVM USB interface first. If the GUI identifies a valid board serial number, then a pop-up window opens to display this value, as shown in [Figure 4-1](#). The user can connect several TSW1418EVMs to one host PC, but the GUI can only connect to one EVM at a time. When multiple boards are connected to the PC, the pop-up window displays all of the serial numbers that are found. The user then selects which board to associate to the GUI. Future versions of the GUI allow multiple copies of the GUI to be open at the same time on one PC.

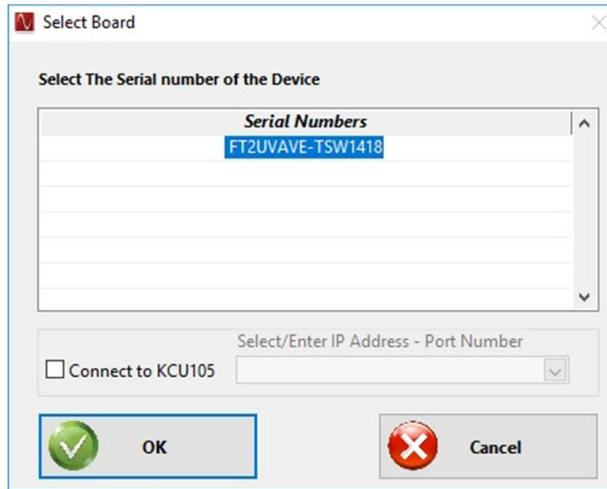


Figure 4-1. TSW1418EVM Serial Number

Click **OK** to connect the GUI to the board. The top-level GUI opens and appears as shown in [Figure 4-2](#).

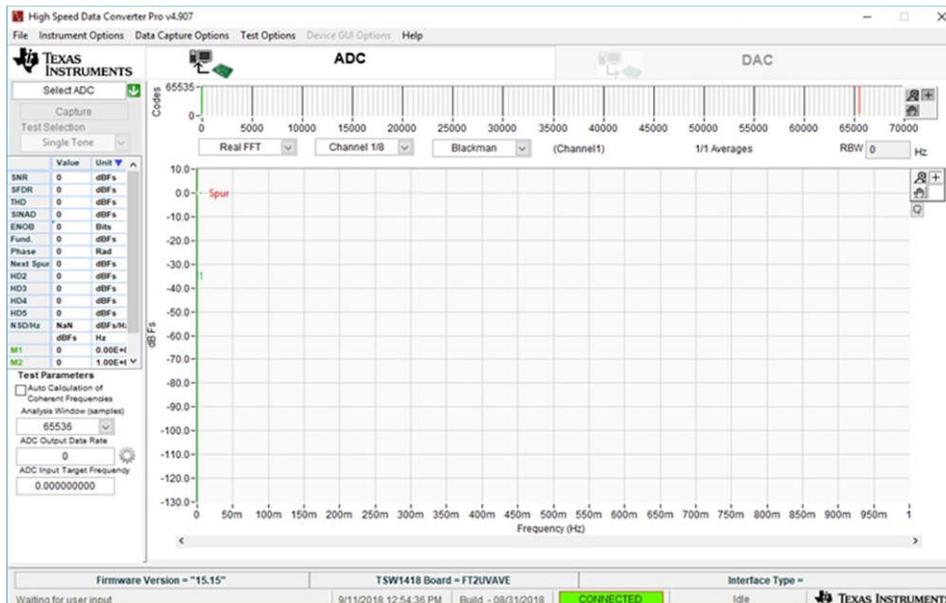


Figure 4-2. High-Speed Data Converter Pro GUI: Top Level

If the message *No Board Connected* appears, then:

1. Double check the USB cable connections
2. Verify that jumper J10 has a shunt installed between pins 2 and 3
3. Remove the USB cable from the board
4. Reinstall
5. Click on the *Instrument Option* tab at the top left of the GUI
6. Select *Connect to the Board*

If this process does not correct this issue, then check the status of the host USB port.

When the software is installed, and the USB cable is connected to the TSW1418EVM and the PC, the TSW1418EVM USB converter appears in the hardware device manager under the universal serial bus controllers, as shown in [Figure 4-3](#) (labeled as *USB Serial Converter A* and *USB Serial Converter B*). When the USB cable is removed, this driver is no longer visible in the device manager. If the drivers are present in the device manager window and the software still does not connect, remove the USB cable from the board, and then reconnect. Attempt to connect to the board. If the problem still exists, try another USB port.

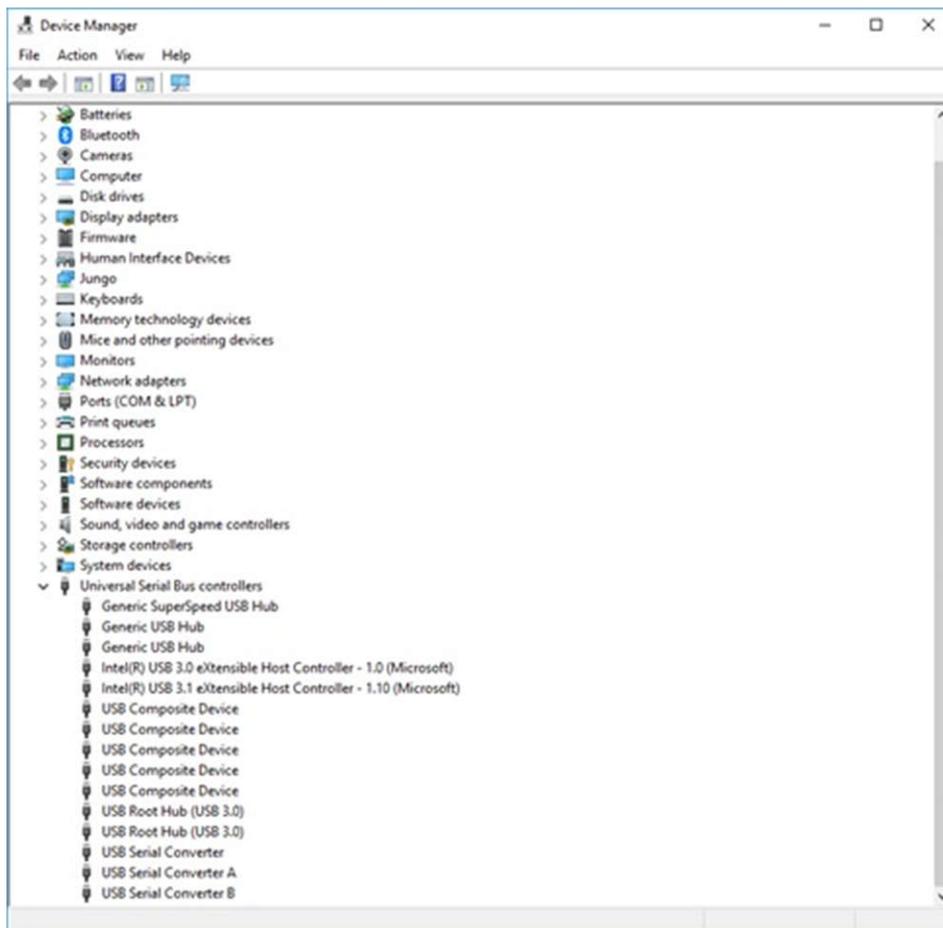


Figure 4-3. Hardware Device Manager

4.3 Downloading Firmware

The TSW1418EVM has a Xilinx Artix 7 device that requires firmware to be downloaded every time power is cycled to operate. The firmware files needed are special .bin formatted files that are provided with the software package. The files used by the GUI currently reside in the directory called *C:\Program Files (x86)\Texas Instruments\High Speed Data Converter Pro\1418 Details\Firmware*.

To load a firmware, after the GUI has established connection, click the *Select ADC* window in the top left of the GUI and select the device to evaluate; for example, *ADC3683_2CH_2W_18bit*, as shown in [Figure 4-4](#).

The GUI prompts the user to update the firmware for the ADC. Click Yes. The GUI displays the message *Downloading Firmware, Please Wait*. The software now loads the firmware from the PC to the FPGA, a process that takes about 3 seconds. After completion, the GUI reports an interface type in the lower right corner.

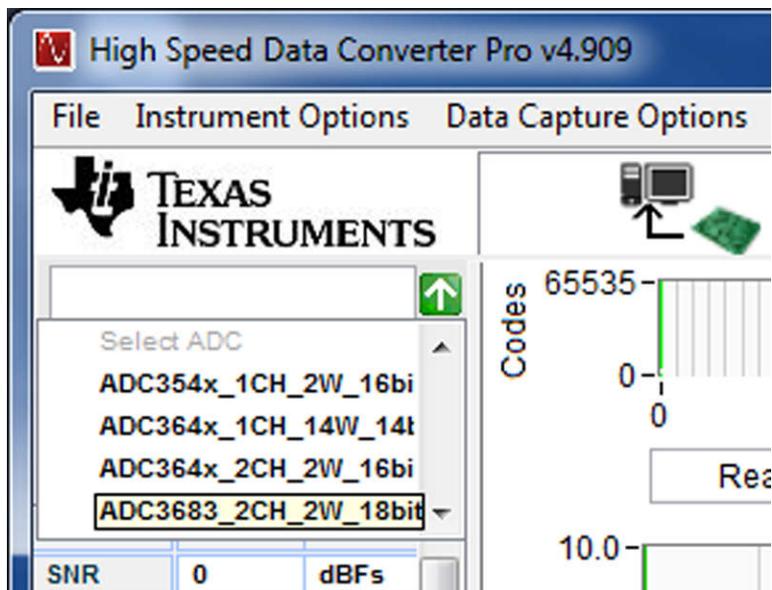


Figure 4-4. Select ADC Firmware to be Loaded

For information about the use of the TSW1418EVM with an ADC EVM, consult the [High-Speed Data Converter Pro GUI User's Guide](#) and the individual ADC EVM user's guide, both available on www.ti.com.

If the message appears as shown in [Figure 4-5](#), then verify that all jumpers are in the default position and all power status LED D2 are illuminated. If certain jumpers are not installed in the proper location, then the USB controller does not boot from flash memory. If the power status LED is off, then there can be a problem with the power from the USB port, which can prevent the firmware from downloading. Unplug and reinstall the USB connector, and try to connect to the board. If this process fails, then try another USB port, or use an external 5-V DC source rated for 1 A and connected to test point TP10 (5 V) and either TP1, TP2 or TP3 (5-V return) to try to correct this problem. Before trying this option, first move the shunt on J10 to pins 1 and 2 to reroute the input power path to this test point.

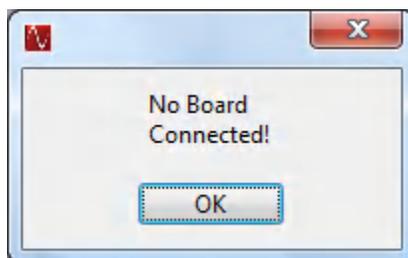


Figure 4-5. Download Firmware Error Message

5 Revision History

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

Changes from Revision * (September 2018) to Revision A (November 2023)	Page
• Changed all instances of legacy terminology to POCl and PICO where SPI is mentioned.....	8
• Updated <i>Installation Instructions</i>	10

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 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

NOTE: 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

NOTE: 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.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

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.

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.

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.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿 6 丁目 2 4 番 1 号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4. *EVM Use Restrictions and Warnings:*
 - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
 - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
 - 4.3 *Safety-Related Warnings and Restrictions:*
 - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
 - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
 - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
 5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
 6. *Disclaimers:*
 - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
 - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
 7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL 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 HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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