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ABSTRACT

The UCD90xxx family devices are flexible and powerful enough to meet sequencing and monitoring needs. This application note addresses how to interpret UCD90xxx CSV File exported from TI Fusion Digital Power Designer™ GUI. This document does not apply to the UCD9080 and UCD9081 devices.

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1 Introduction

The UCD90xxx family of digital sequencers, also known as system health monitors, are flexible and powerful enough to meet user sequencing, monitoring, margining and other needs. The entire families of devices are designed to have similar behaviors, but with a different number of rails or some other minor features. Users only need to learn how to use the device once, and can then seamlessly switch to other devices within the family that best fit their future designs. This document is to help applications to interpret data flash csv file exported from TI Fusion Digital Power Designer GUI. This document does not apply to the UCD9080 and UCD9081 devices. All commands listed in the document can be found in the publications listed in [Section 5](#).

All byte values are represented in hexadecimal format. These are the codes to understand all I²C communications that occur:

- [S] - I²C Start bit.
- [Sr] - I²C Restart bit. It is identical to the Start bit.
- [Sp] - I²C Stop bit.
- [A] - I²C Acknowledge bit.
- [N] - I²C No Acknowledge bit or NACK.
- [Wr] - I²C device address with the Write bit.
- [Slave Address] - I²C device address
- [Rd] - I²C device address with the Read bit.
- [W:x55] - Example of a write byte for value 55 hexadecimal.
- [Data_Byteⁿ] - Indicates that a byte is being write or read by the I²C master. The n subscript is an ordered integer use to distinguish multiple bytes read back.

2 Options to Generate CSV File

Fusion Digital Power Designer GUI provides multiple options when generated the data flash script file as [Figure 2-1](#). Application can choose the best programming steps to include in script such as: DEVICE_ID verification, read back.

PEC byte is optional and when it is selected, a PEC byte is added for reach individual command.

Enable configuration security is selected if application want to enable the security feature so that any authorized writes is NACKed by the device.

when Block length byte is selected, the block length byte is added automatically into each block write command.

The screenshot shows the 'Data Flash Script' export options dialog. It includes the following sections:

- Description:** Explains that the export will read data flash from the device and save a script for use by a microcontroller. It notes that this tool is only available for devices that support reading data flash while in program mode (UCD92XX and UCD90XX).
- Device's Flash Export Not Available in Offline Mode:** A note stating that flash can only be exported when in 'online' mode (a TI device is connected to your PC using the I2C adapter).
- Programming Steps to Include in Script:** A list of checkboxes for including various steps:
 - Verify compatible device by reading DEVICE_ID
 - Read back & validate flash
 - Reset device to load new data flash configuration
 - Verify program is now running through DEVICE_ID check
 - Clear flash logs (logged faults, logged peaks, etc.; not applicable to all devices)
- Script Style:** Radio buttons for SMBus (selected) and I2C.
- Wait Time:** A text box set to 200 μs, with a note that this is the wait time between each flash write for UCD90320 devices.
- Program Flash Checksum Mode:** Radio buttons for 'Export "bad" checksum (Stay in ROM)' and 'Calculate and export a valid checksum (Automatically execute program)'. The latter is selected. A note states that this option does not apply to this device as data flash is written in normal mode.
- PEC:** Add PEC byte.
- File Format:** Radio buttons for CSV (selected) and Tab Separated.
- Hex Format:** Radio buttons for 0xAABB (selected), AABB, and AA-BB.
- Comment Style:** Radio buttons for "Comment" token (selected), Proceed with // (C++ style), and Proceed with # (Shell style).
- How to Handle Multiple Data Bytes:** Radio buttons for 'Compact together into one field' (selected) and 'Break apart into separate fields'. A note explains that compacting data into one field uses a single field with 0xAABB, AABB, or AA-BB style.
- Security:** Enable configuration security. A 'Set Password' button is visible. A note states that the SECURITY_BIT_MASK is always written, and checking this box sets a security password.
- Embedded Device Address:** Radio buttons for 'Use current device address' (selected) and 'Use alternative address'. A text box shows '115' decimal.
- Block Length Byte:** Add block length byte to read block and write block commands in SMBus mode. A note mentions that earlier versions of the GUI did not add block length to block reads/writes.
- Delay Timing:** A text box for 'Reset wait time' set to 5,000 ms.

Figure 2-1. CVS File Options

3 Examples

This section demonstrates how to interpret the CSV file. The example in this document is based on the below format

Script type = SMBus Format=CSV; Hex=CoderUpper; BreakOutBytes=False; PEC=True;
IncludeBlockLength=True

In the csv file, all data is formatted as shown [Table 3-1](#).

Table 3-1. CSV Example

Command Keyword	Device Address	Command Code	Data Byte(PEC is optional)
BlockWrite	0x13	0xE3	0x04F819000013

Command keyword is to tell which command protocol is used

Device Address is 7Bit(SMBus) or 8bit (I2C) Device Address.

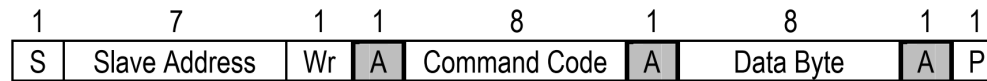
The command code is covered in the [Section 5](#)

Date Byte is the payload data for the given command.

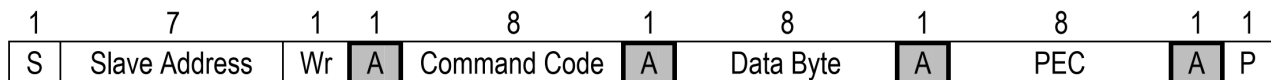
All lines in the csv file start with comments are comments and shall not be executed by the I2C host.

3.1 WriteByte

WriteByte is a SMBus protocol which sends the command mode followed by one byte data [Figure 3-1](#).



Write byte protocol



Write byte protocol with PEC

Figure 3-1. WriteByte

Table 3-2. WriteByte Example

Command Keyword	Device Address	Command Code	Data Byte(PEC is optional)
WriteByte	0x13	0x00	0xFFCD

[Table 3-2](#) tells that the current row is a write byte protocol:

Device address is 0x13, command code is 0x00, Data is 0xFF and the last byte 0xCD is the PEC which is up to whether PEC is set or not when generating the CSV file.

3.2 BlockWrite

BlockWrite is a SMBus protocol which sends the command code followed by various length of data as shown in Figure 3-2.

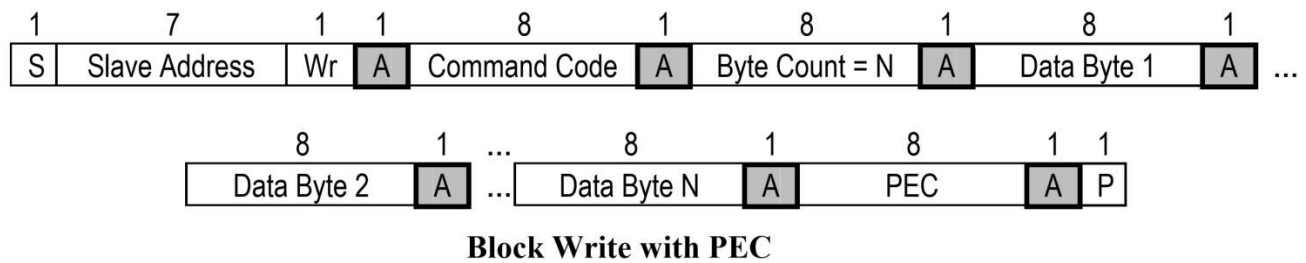
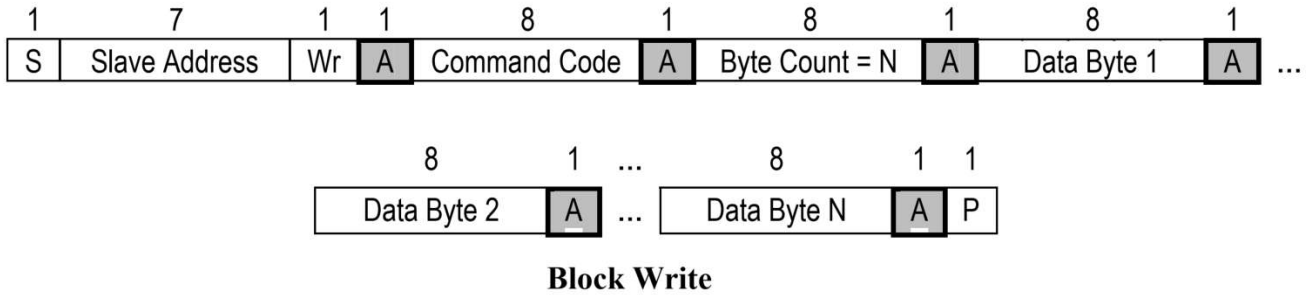


Figure 3-2. BlockWrite Protocol

Table 3-3. BlockWrite Example

Command Keyword	Device Address	Command Code	Data Byte(PEC is optional)
BlockWrite	0x13	0xE3	0x04F819000013

Table 3-3 tells that the current row is a block write protocol:

Device Address is 0x13. Command Code is 0xE3, Data Length is 4, Data is 0xF8190000 and the last byte 0x13 is PEC

Note: the data length byte is optional in the csv file which controlled by Figure 3-3

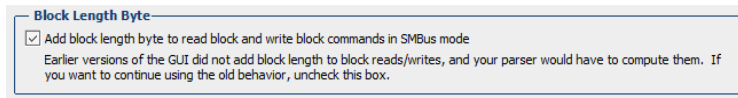
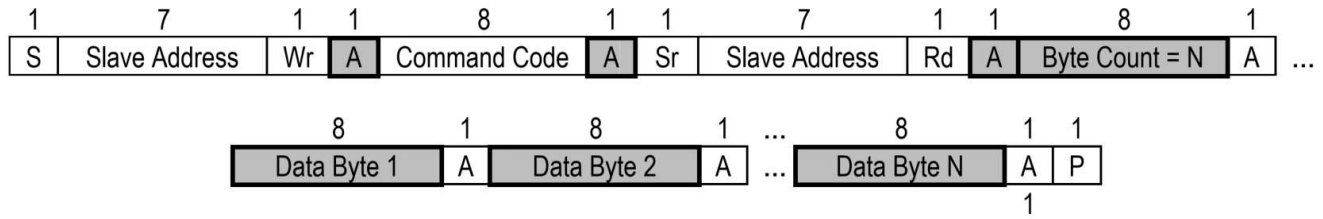


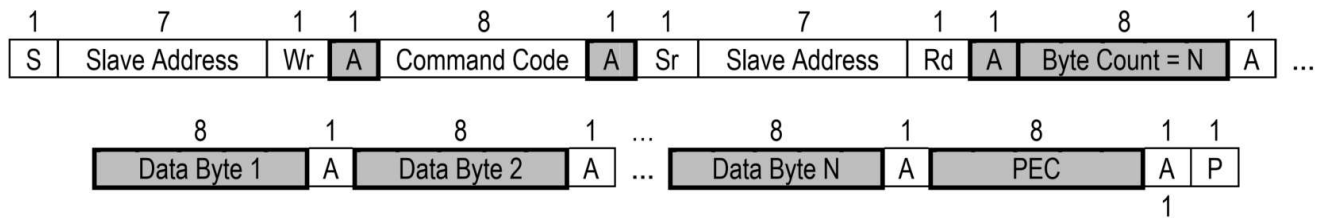
Figure 3-3. Block Length Byte Setting

3.3 BlockRead

Block Read is a SMBus protocol which read various length bytes from target device based on the command code [Figure 3-4](#). The length of commands are listed in the document can be found in the publications listed in [Section 5](#).



Block Read



Block Read with PEC

Figure 3-4. BlockRead Example

Table 3-4. BlockRead Example

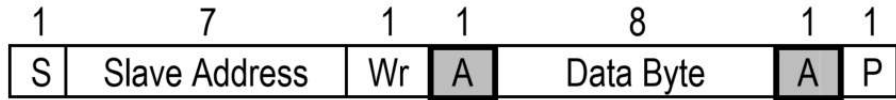
Command Keyword	Device Address	Command Code	Data Byte(PEC is optional)
BlockRead	0x13	0xE3	0x10E58C0100A90B0030F819000064D4652

[Table 3-4](#) tells that the current row is a block read protocol

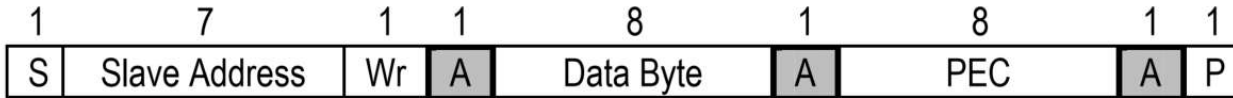
Device Address is 0x13, command code is 0xE3, Data Length is 0x10. Data is 0xE5 0x8C 0x01 0x00 0xA9 0x0B 0x00 0x30 0xF8 0x19 0x00 0x00 0x06 0x4D 0x46 and 0x52

3.4 SendByte

Sendbyte is a SMBus protocol which sends one byte only [Figure 3-5](#).



Send byte protocol



Send byte protocol with PEC

Figure 3-5. SendByte Protocol

Table 3-5. SendByte Example

Command Keyword	Device Address	Command Code	Data Byte(PEC is optional)
SendByte	0x13	0xDB	

[Table 3-5](#) tells that the current row is a sendbyte protocol:

Device address is 0x13, Command code is 0xDB and there is no data byte.

3.5 Pause

The pause keyword is in milliseconds to pause before next command. The application is responsible to add this delay into the program

[Figure 3-6](#) shows that 0.2ms pause is required before executed the next blockwrite command

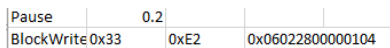


Figure 3-6. Pause Example

4 Summary

This application note outlines how to parse the data flash csv file generated from TI Digital Fusion GUI designer for UCD90xxx sequencer family device. The application engineer can follow this guide to develop software to program the UCD90xxx Sequencer with any third-party programming hardware.

5 References

- Texas Instruments, [UCD90xxx Sequencer and System Health Controller PMBus Command Reference User's Guide](#).
- Texas Instruments, [UCD90320 Sequencer and System Health Controller PMBus Command Reference User's Guide](#).
- Texas Instruments, [UCD90320U Sequencer and System Health Controller PMBus Command Reference User's Guide](#).
- [System Management Bus\(SMBus\) Specification 2.0](#).
- [The PMBus Power System Management Protocol Specification Part II - Command Language, Revision 1.1](#).

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