Timing Commander Configuration EEPROM File Checksum for ClockMatrix Devices

This application note outlines how to verify that a EEPROM configuration file generated using the Timing Commander has been properly burned onto an EEPROM. Two cyclic redundancy check calculations can be checked to verify the configuration block header and payload.

For more information on Renesas' Clocking products, visit ClockMatrix Timing Solutions.

1. Introduction

The Timing Commander graphical user interface (GUI) can generate an EEPROM file of the configuration in either a .bin or .hex format. An EEPROM configuration file generated by the GUI contains two cyclic redundancy check (CRC) calculations that can be used to validate the contents of a burned EEPROM. The payload CRC and the header CRC registers can be read from the EEPROM and their contents can be compared against the generated EEPROM configuration file. If their CRC registers match, then the contents of the EEPROM have been successfully burned without error.

2. Verifying an EEPROM Configuration Block

The EEPROM configuration file generated by Timing Commander uses two cyclic redundancy check (CRC) calculations to validate the contents of the EEPROM header and payload. These CRC calculations can be used to verify that a configuration file has been properly burned onto an EEPROM.

All data in the EEPROM file stored in a larger than byte-by-byte format is in little-endian format (the least significant byte is at the lowest address). Text-based fields assume ASCII encoding of characters in a byte-by-byte format. Text strings must end with a NULL character (00).

Figure 1 shows the header and CRC bytes within the EEPROM configuration file. The header is 12 bytes long, extends from offset 0x0 to 0xB, and consists of a marker, the payload length, the payload type, the payload CRC, and the header CRC. The marker is an 8-byte string that is used to indicate the existence of a configuration block on the EEPROM. The 8 bytes of the marker will have an ASCII equivalent of "CMX-CFG".

Following the marker, there are 2 bytes for the payload length and 2 bytes for the payload type. The payload length indicates the size of the payload section in bytes. Only one payload type is currently defined (type 0), therefore, these bytes will always be 0.

The payload CRC is a 4-byte CRC calculated on the payload section. This CRC can be used to validate the payload contents on the EEPROM. Similarly, the header CRC is a 4-byte CRC that can be used to validate the contents of the header. The payload CRC and the header CRC registers can be read from the EEPROM and their contents can be compared against the generated EEPROM configuration file. If their CRC registers match, then the contents of the EEPROM have been successfully burned without error.

Following the header CRC, all remaining data in the configuration file comprises the payload. The payload contains the configuration settings required to program the device.

<table>
<tr><th rowspan="2">Row Address within EEPROM (Hex)</th><th colspan="16">Byte Offset within Row</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th></tr>
<tr><td>XX00</td><td colspan="8">Marker</td><td colspan="2">Payload Length</td><td colspan="2">Payload Type</td><td colspan="4">Payload CRC</td></tr>
<tr><td>XX10</td><td colspan="4">Header CRC</td><td colspan="12">Payload</td></tr>
</table>

Figure 1. EEPROM Configuration Block Header Field Locations

Figure 2 shows an example of an EEPROM configuration file that has been opened in the Total Phase Flash Center software, so that the ASCII equivalent of each byte can be seen. This is done to easily indicate the marker. The CRC bytes and the different sections of the header have been outlined and colour coded.

- Offsets 0 to 7: This is the “CMX-CFG.” header preamble that the chip searches for within the EEPROM image. This is how it determines where to find the config. This is the red outlined data below.
- Offset 0x8 and 0x9 are a 16-bit integer indicating how big the data is (0x0124 bytes in this case).
- Offset 0xA and 0xB indicate are a type field (0x0000). Leave as 00.
- Offsets 0xC to 0xF: This is the CRC for the data.
- Offsets 0x10 to 0x13: This is the CRC for the header, so it the CRC for bytes 0 to 0x13
- The data follows the header. In the excerpt below, the data is offsets 0x14 to 0x137.

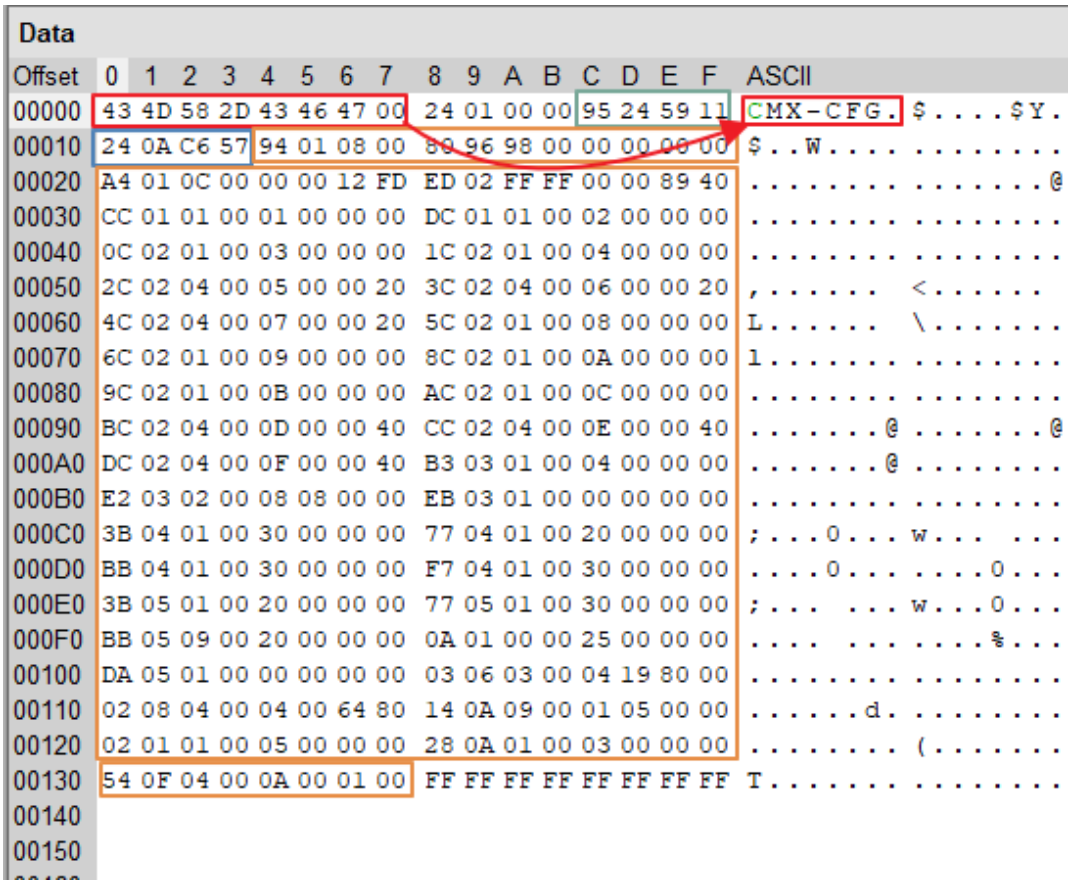

Figure 2. Example of an EEPROM Configuration Block

3. Revision History

Revision	Date	Description
1.00	Nov 1, 2022	Initial release.

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