Using Function Blocks 163 and 164 to write and read the Microchip MCP7940M I2C Real-Time Clock/Calendar device

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INTRODUCTION

This application note demonstrates the use of Function Blocks 163 and 164 to write to, and read from a 7bit addressable I2C slave devices. The MCP7940M RTCC from Microchip is used in these examples.

WRITE OPERATION

Function Block 163 is used for writing to the I2C device. This FB can be configured for:

Mode 0: Complete Write message consisting of START, CONTROL BYTE, up to 7 data bytes, and STOP.
Mode 1: Partial Write message consisting of START, CONTROL BYTE, and up to 7 data bytes.
Mode 2: Partial Write message consisting of up to 7 data bytes.

Mode 3: Partial Write message consisting of up to 7 data bytes and STOP

When using FB163 in mode 0 or 1 it is required to enter into the FB's configuration pop-up a 7-bit slave address, which is 111 in the case of the MCP7940M. For write messages containing from 1 to 7 data bytes use mode 0. To illustrate this Figure 1 shows how the MCP7940M clock is initialized by writing values for SECONDS, MINUTES and HOURS Figure 1 also indicates the parameter setting for the I2C Write function block FB163. Note that you must set the ST bit to start the on-board crystal oscillator as indicated in the message format shown in Figure 2.
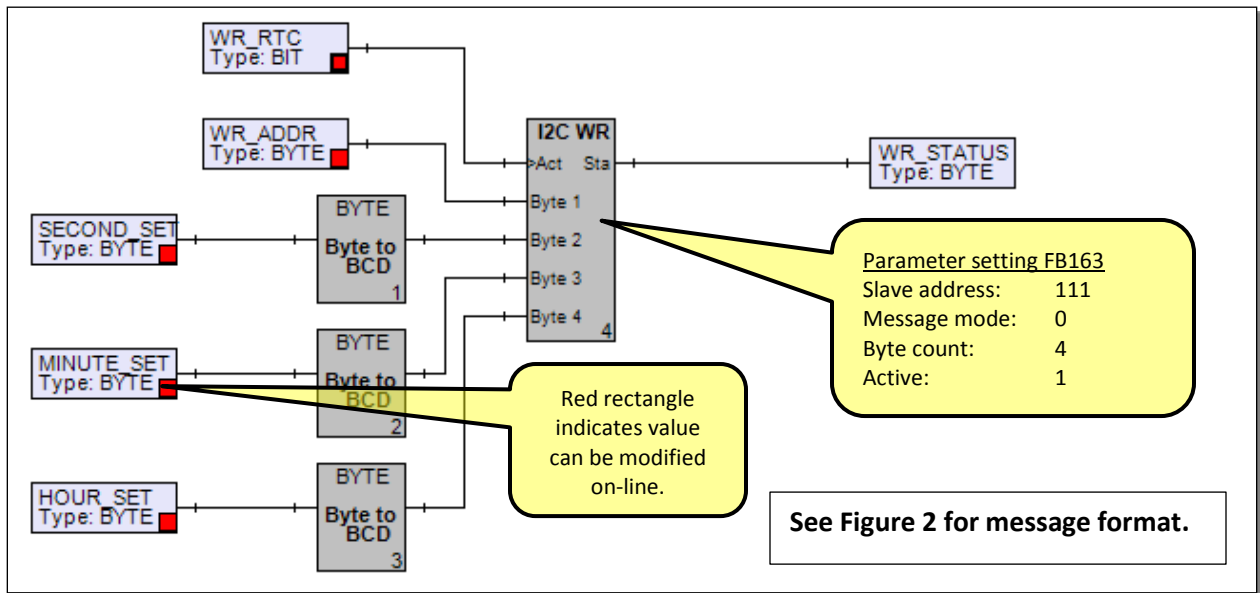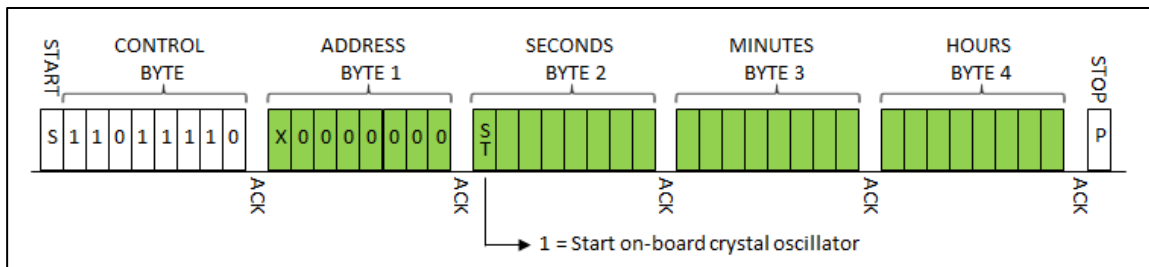.

Figure 1. Function Block configuration to set SECONDS, MINUTES and HOURS.

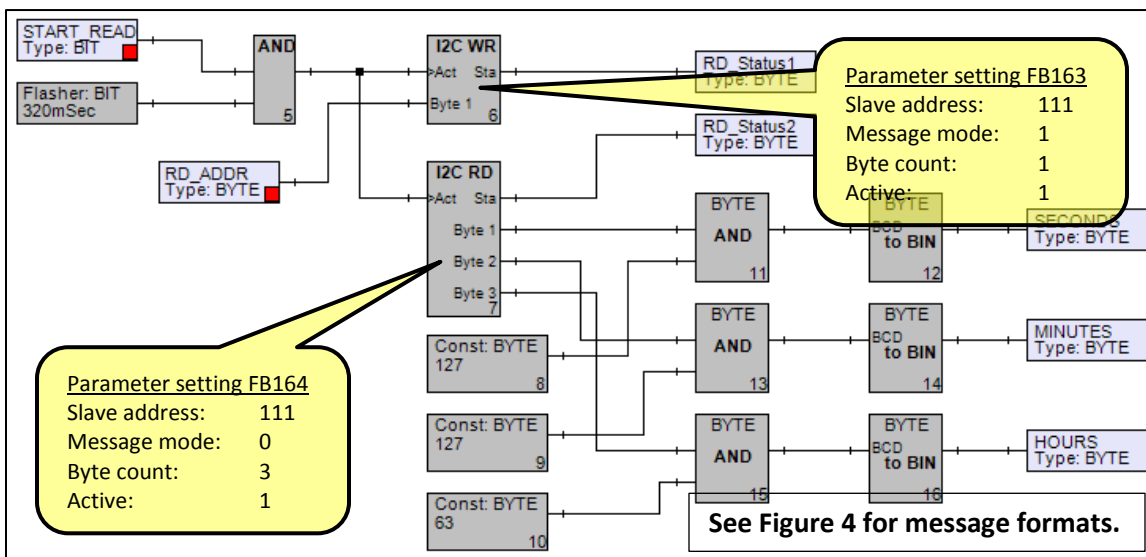**Figure 2. Message format to set SECONDS, MINUTES and HOURS.**

READ OPERATION

Function Block 164 is used for reading from the I2C device. This FB can be configured for:

Mode 0: Complete Read message consisting of START, CONTROL BYTE, up to 7 data bytes, and STOP.

Mode 1: Partial Read message consisting of START, CONTROL BYTE, and up to 7 data bytes.

Mode 2: Partial Read message consisting of up to 7 data bytes.

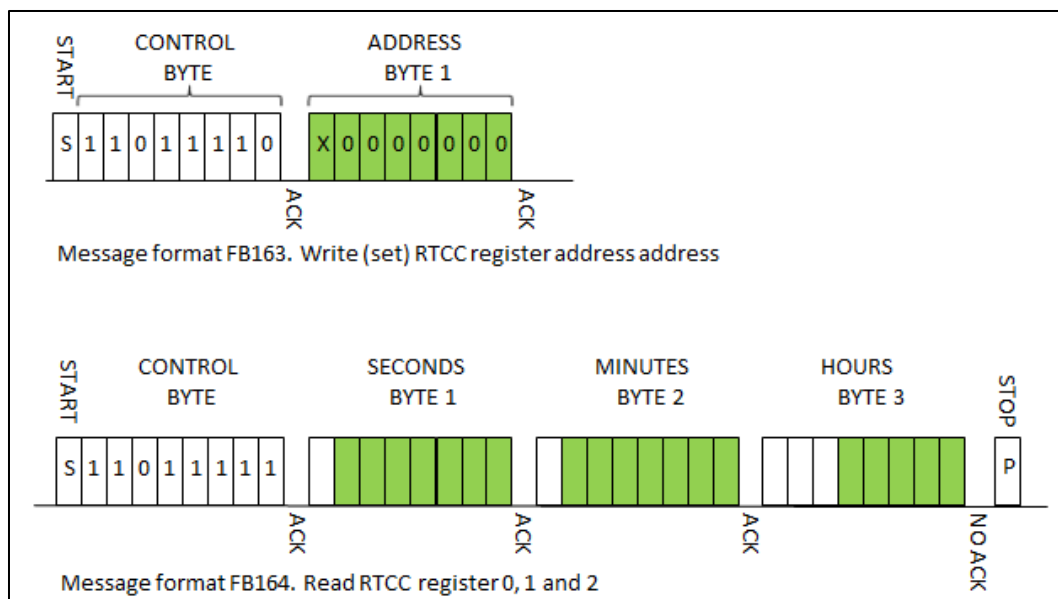Mode 3: Partial Read message consisting of up to 7 data bytes and STOP

When using FB164 in mode 0 or 1 it is required to enter into the FB's configuration pop-up a 7-bit slave address, which is 111 in the case of the MCP7940M. For read messages containing from 1 to 7 data bytes use mode 0. Read messages containing more than 7 data bytes can be configured using two or more FB164 blocks each with its appropriate mode setting. FB164 can also

be combined with FB163 to facilitate composite messages to/from I2C slaves. To illustrate this Figure 3 shows how a random byte-read operation can be performed on the MCP7940M RTCC to obtain the SECONDS, MINUTES and HOURS data. The write FB (I2C WR) writes the RTCC register address of the MCP7940M, in this case address 0, to read from. The read block (I2C RD) then acquires 3 bytes from the RTCC starting at the register address set previously. These 3 data bytes contain the SECONDS, MINUTES and HOURS data together with some additional information. Figure 3 shows the logic blocks required to mask-out the additional information to obtain the time information. It also contains function blocks to trigger a time-read operation every 320mSec.

You are referred to the Microchip data sheet for the MCP7940M for details of the RTCC memory map.
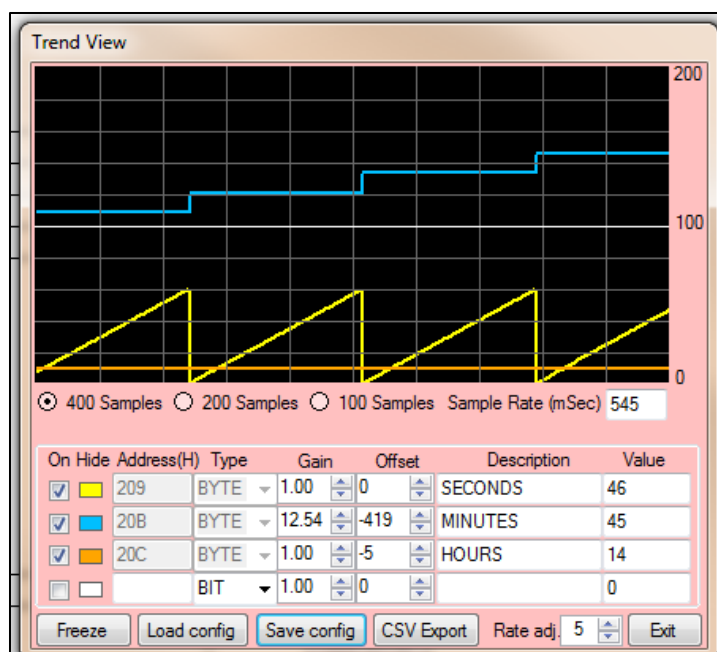

Figure 3. Read SECONDS, MINUTES and HOURS from RTCC.

Figure 4. Message format to read SECONDS, MINUTES and HOURS.

Figure 5 is a screenshot of VPS_P18 Trend View debug screen showing the real-time performance of the RTCC.

Figure 5. RTCC performance.

NOTE:
If you plan to use the MCP7940M RTCC it is advisable to consult Microchip Application note AN1365, "RTCC Best Practices" (DS01365).