

COP8™ FLASH ISP HANDBOOK – FLASHWIN Programmer's Guide

National Semiconductor
Application Note 1154
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ABSTRACT

This application note describes the In System Programming software for the Windows environment. This document details the procedures necessary to perform ISP with the Windows 95/98 software and the COP8 FLASH Family microcontrollers.

INTRODUCTION

In-System Programming (ISP) allows the user to re-program a microcontroller without physical removal. The COP8 ISP software package for the Windows environment allows the user to easily program and modify the FLASH contents of the COP8 FLASH Family microcontroller. Data loading and saving procedures are discussed in this document. Other

application notes that relates to COP8 FLASH ISP software include AN-1150 (Introduction to In System Programming (ISP)), AN-1151 (Parallel Port Programming Adapter), AN-1152 (FLASHDOS Programmer Source), AN-1153 (Virtual E² Guide), and AN-1161 (FLASHDOS Programmer's Guide).

1.0 PC TO MICROWIRE CONNECTION DIAGRAM

Figure 1 shows the necessary connections to attach the MICROWIRE/PLUS™ to the PC's parallel port. The FLASH microcontroller connection to the PC will be accomplished via a four3 + GND wire interface.

Figure 1 shows the necessary connections used in the building of the parallel adapter for the COP8 FLASH Family microcontroller.

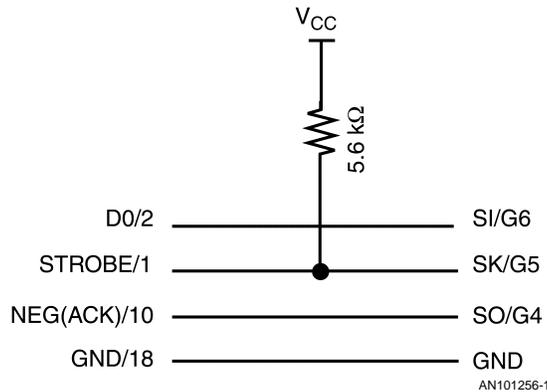


FIGURE 1. Parallel Port Connection Diagram

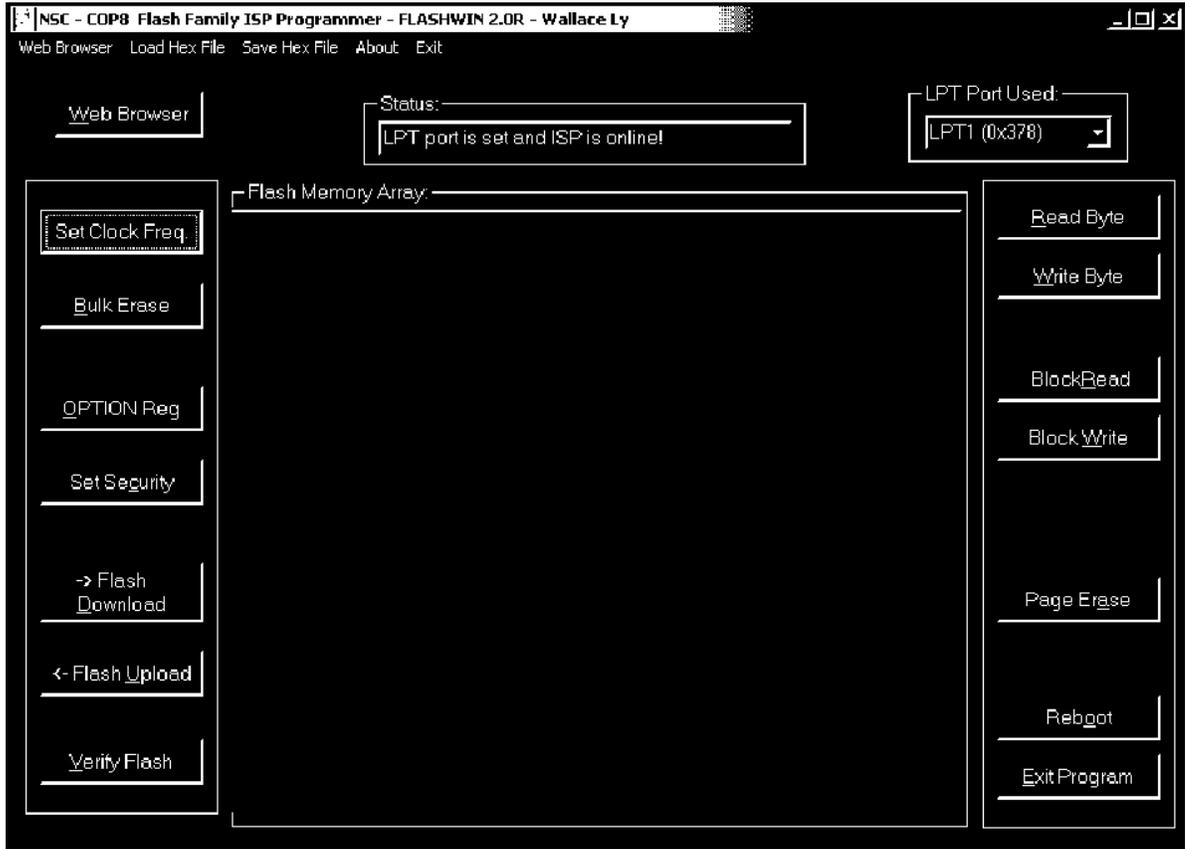
TABLE 1. PARALLEL PORT <-> MICROWIRE CONVERSION

DB25 Printer Port Pin Name	DB25 Printer Port Pin Number	Microwire Pin Name
STROBE	1	SK/G5
DO	2	SI/G6
NEG(ACK)	10	SO/G4
GND	18	GND

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1.1 FLASHWIN ISP Software Main Menu

Figure 2 shows the Main Menu of the ISP Software. There are 13 functions available the user. They are: Set Security, Set CLOCK Freq, Bulk Erase, Read OPTION, Exit Program, Read Byte, Write Byte, Block Read, Block Write, Page Erase, Reboot, Hex Upload and Hex Download. The user may choose each function by clicking on the appropriate button. The user may exit two ways. Either clicking on the Exit Program Button or by clicking on the Exit selection.



AN101256-2

FIGURE 2. The FLASHWIN ISP Main Menu

1.2 THE SET SECURITY FUNCTION—Set the Security Bit

Description: *Figure 3* shows the enabling of security. Clicking on the “Security Button” will read the OPTION Register, Modify the OPTION register and then save the result into the OPTION register location. When completed, the Windows software will respond in the Status dialogue box. If successful the software will respond a message stating: “security have been set”.

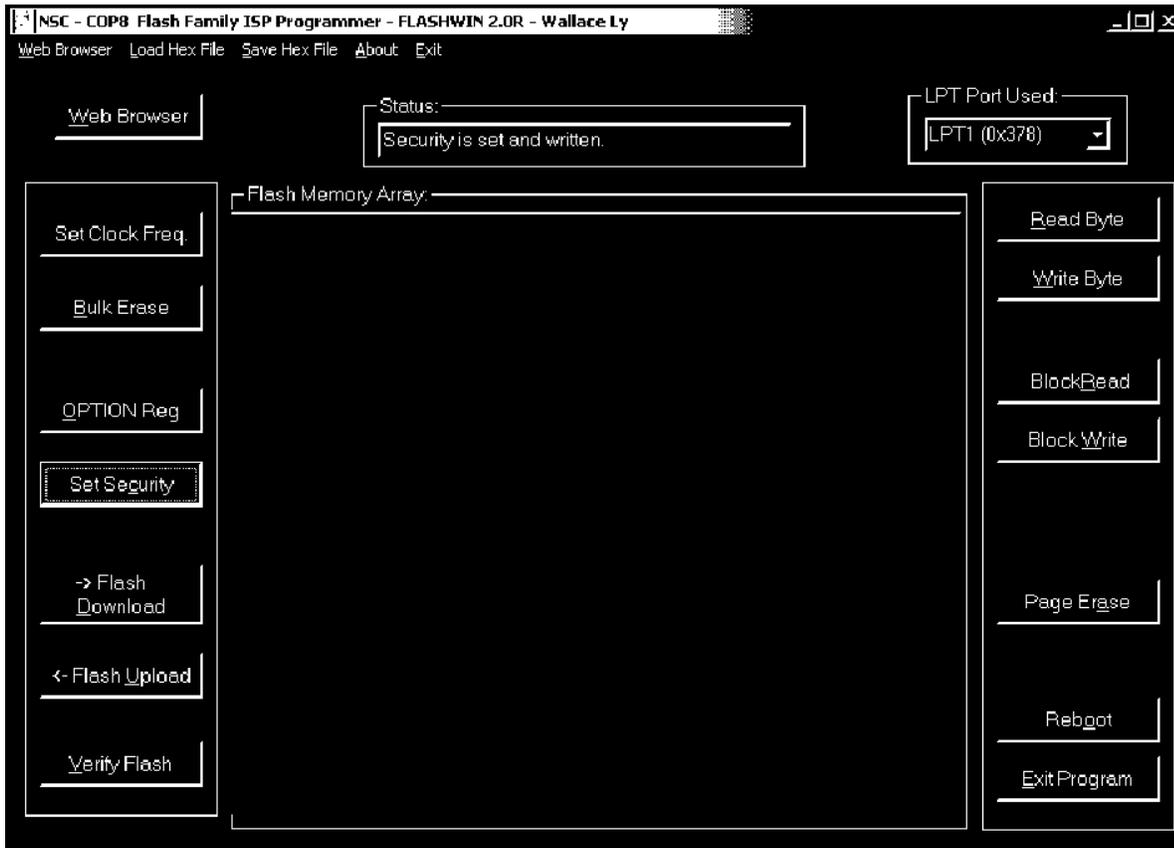
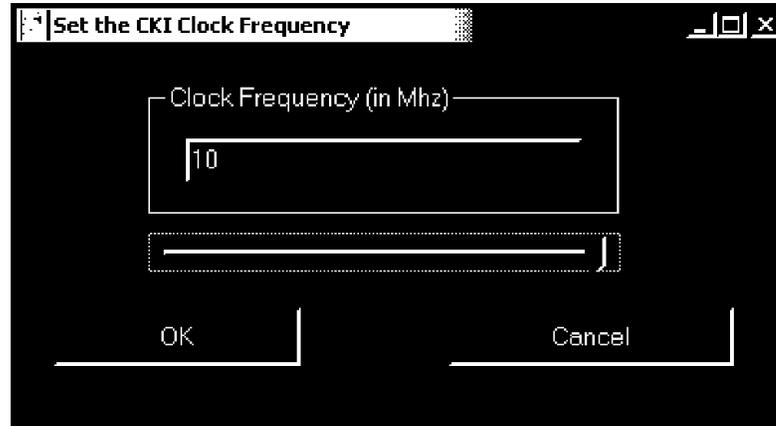


FIGURE 3. FLASHWIN ISP Security Function

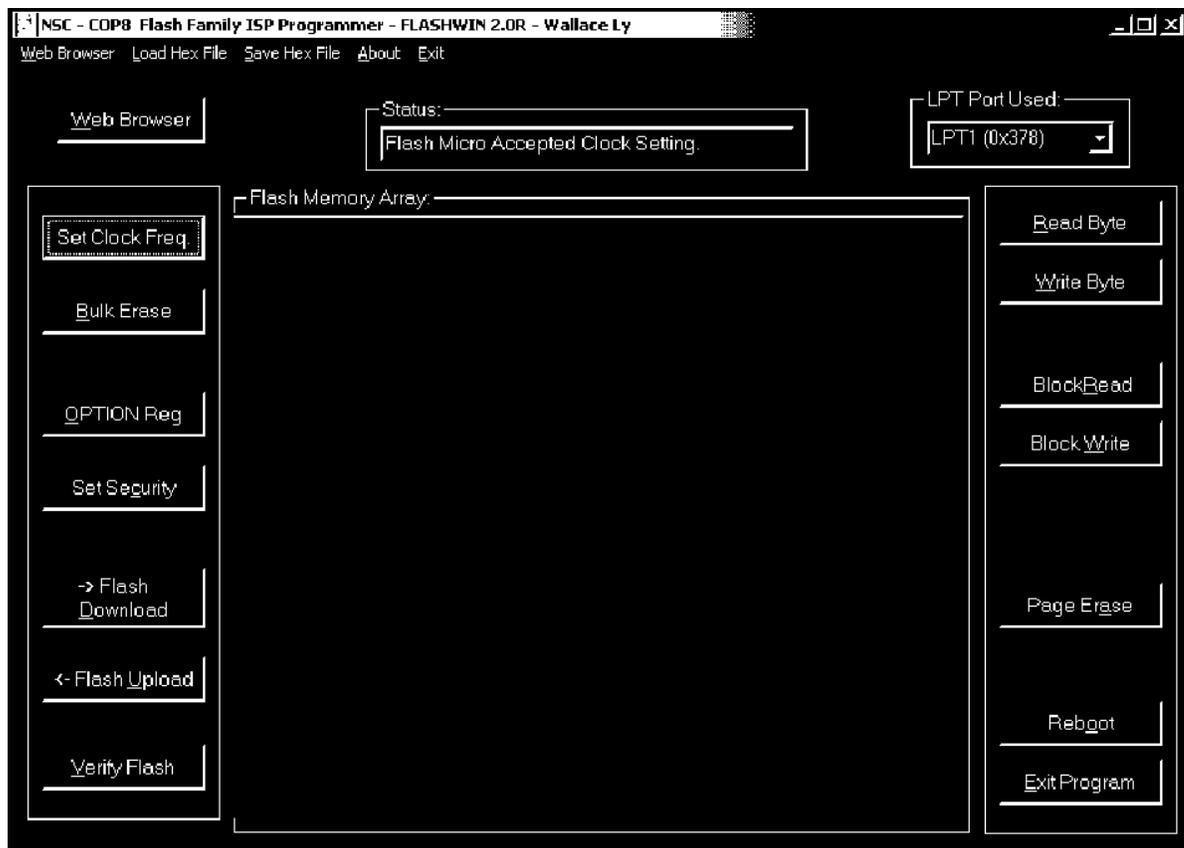
1.3 THE SET THE CKI CLOCK FREQUENCY FUNCTION—Set the FLASH Programming Timer Register

Description: *Figure 4* shows the **Set the CKI CLOCK Frequency (SET CLOCK Freq.)** function. This function will transfer the timer value into the FLASH programming time register *PGMTIM*. The user **MUST** set the CKI Clock Frequency before any writes can occur (i.e., pgerase, bulk erase, write byte, etc). The slider can be used to increase/decrease the value in the Clock Freq. dialogue. If successful, the software will respond in the dialogue box with a “FLASH Micro Accepted Clock Setting”, otherwise, the software will respond with “Error!, Check Connections.” *Figure 5* shows how the display should look like when a successful SET CKICLOCK is achieved.



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FIGURE 4. FLASHWIN ISP Set CKI Clock Function

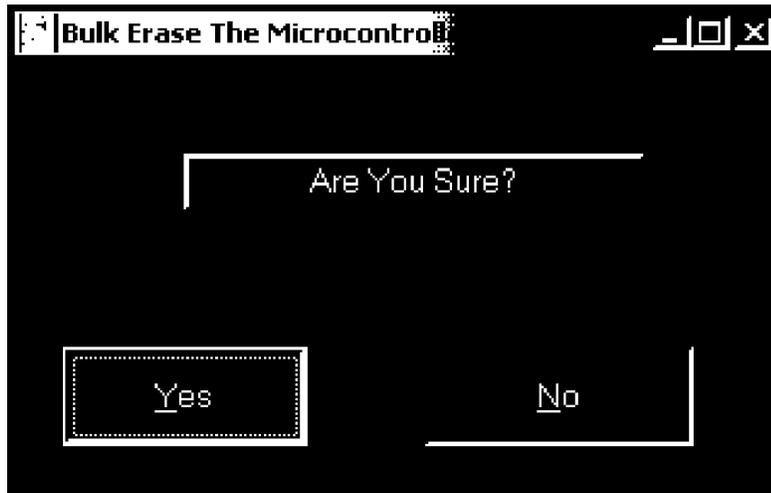


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FIGURE 5. FLASHWIN ISP Set Clock Frequency Function

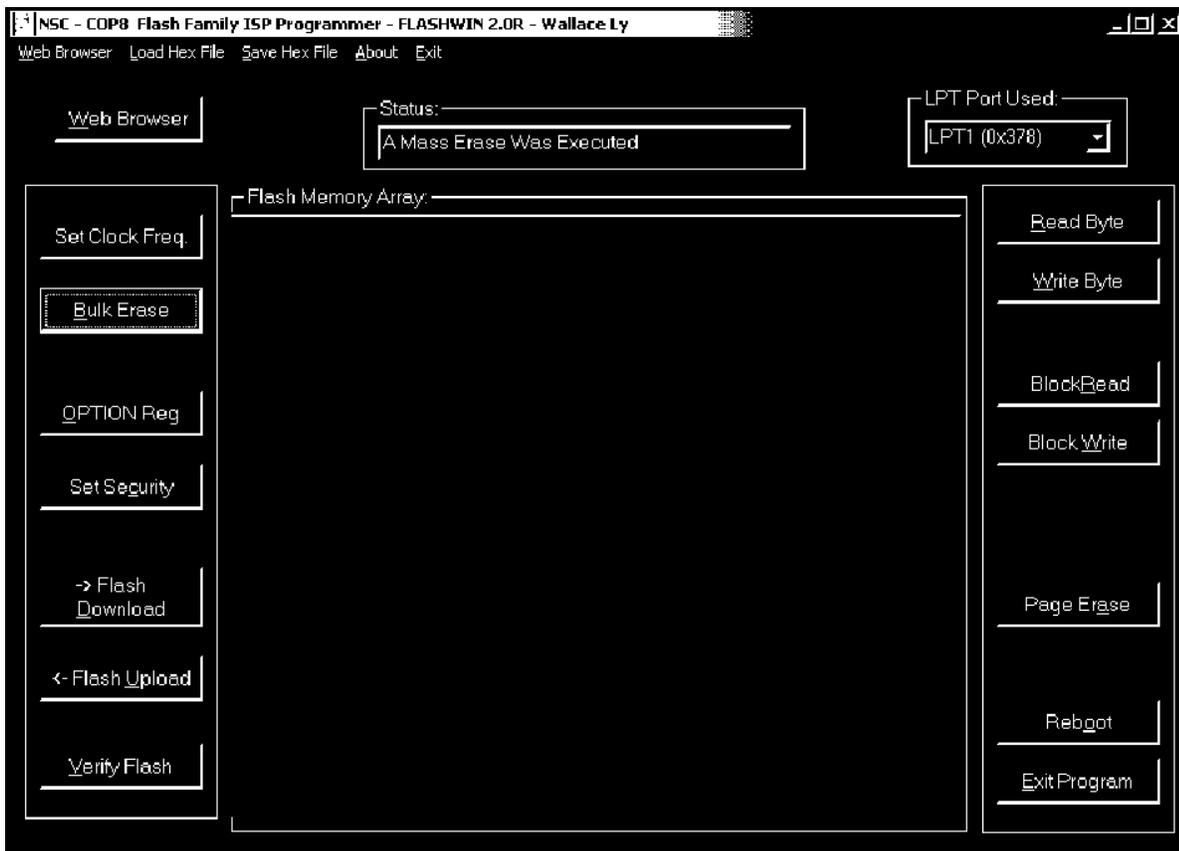
1.4 THE BULK ERASE FUNCTION—Mass Erase the Microcontroller

Description: *Figure 6* shows the format of the BULK_ERASE function. The BULK_ERASE function will erase the entire FLASH memory. The function will erase the entire FLASH once the “Yes” Button is clicked. *Figure 7* shows how the software responds after the BULK_ERASE function is sent.



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FIGURE 6. FLASHWIN Bulk Erase Function

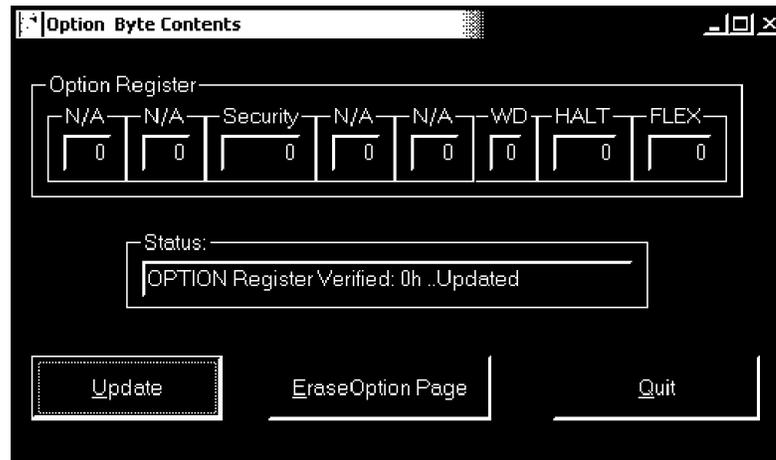


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FIGURE 7. FLASHWIN Bulk Erase Function (After Execution)

1.5 THE OPTION BYTE FUNCTION—Set/Reset the Option Bits/Byte from the FLASH Microcontroller

Description: The OPTION BYTE FUNCTION will read the option register located at 0xFFFF in the FLASH Microcontroller and allow read/writing/erasure of the OPTION byte. By clicking the "Update" button, the Windows ISP Software will send a request for a READ_BYTE for location 0xFFFF. *Figure 10* shows how the software responds after the button was clicked. The user may choose to erase the OPTION BYTE, along with the entire page (128 bytes for 32 KB device and 64 bytes for 1 KB and 4 KB devices). Refer to *Figure 16* for additional information regarding a PAGE segment. The erasure of the OPTION PAGE may be accomplished via the "ERASEOPTION PAGE" button. The OPTION BYTE FUNCTION is always available for *READING* of the OPTION BYTE regardless of security. However, if security is set, the user is not allowed to write or erase the OPTION BYTE. *Figure 8* shows the screen the format of the OPTION BYTE function. *Figure 9* shows how the software responds after ERASEOPTION PAGE button is clicked.

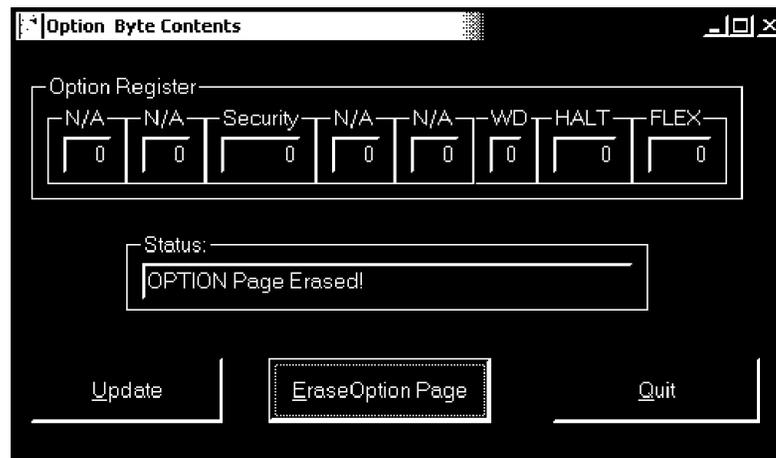


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FIGURE 8. The OPTION Dialogue

Option Register Bit Assignments:

Bit 7 - Reserved		=0 Watchdog feature is enabled to G1 output with weak pull-up enabled when output is not valid.
Bit 6 - Reserved	Bit 1 - HALT - Halt Enable	=1 Halt mode is disabled
Bit 5 - SEC - Security bit		=0 Halt mode is enabled
=1 Security enabled	Bit 0 - FLEX -FLASH execution	=1 Execute from FLASH memory upon exiting Reset (Reboot Button)
=0 Security disabled		=0 Execute from Boot ROM upon exiting Reset (Reboot Button)
Bit 4,3 - Reserved		
Bit 2 - WD - Watchdog		
=1 Watchdog feature is disabled with G1 being a standard I/O.		

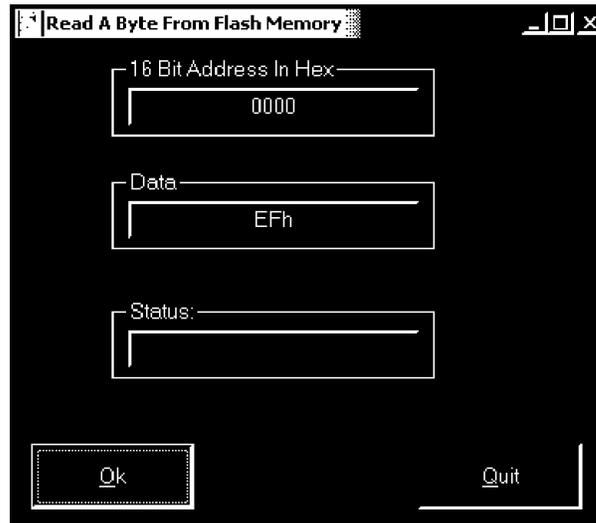


AN101256-9

FIGURE 9. The Erase OPTION Page Button

1.6 READ A BYTE OF FLASH—Read a Byte of Memory from the FLASH

Description: *Figure 10* shows the format of the READ_BYTE function. The READ_BYTE function will read a byte from the FLASH memory. The 16 BIT ADDRESS refers to the target FLASH location. If security is on, the user is only allowed to read 0xFFFF (Option Register). In other words, if the 16 Bit ADDRESS=0xFFFF then the firmware will allow that operation, otherwise it will send back a 0xFF in the DATA dialogue box.

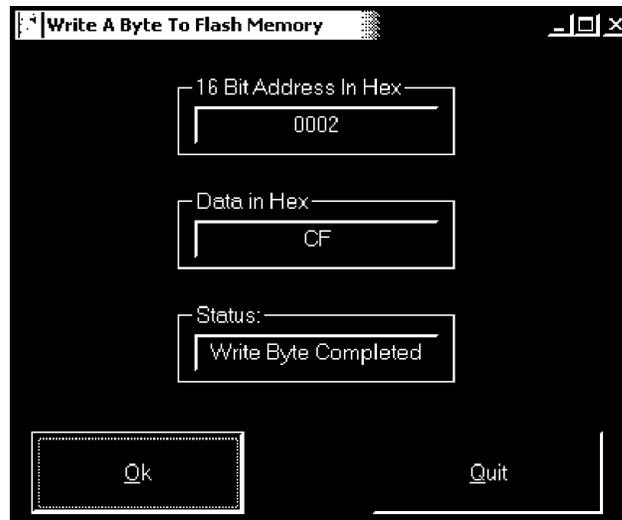


AN101256-10

FIGURE 10. Windows ISP Read Byte Function

1.7 THE WRITE BYTE FUNCTION—Write a Byte of FLASH Memory

Description: *Figure 11* shows the format of the WRITE_BYTE routine. The WRITE_BYTE function will transfer a byte from the DATA dialogue box to FLASH memory. The 16 BIT ADDRESS refers to the target FLASH location. This function, WRITE_BYTE, is NOT always available (i.e., it is security dependent.) If security is on then the function will be aborted and no acknowledgment will be returned.

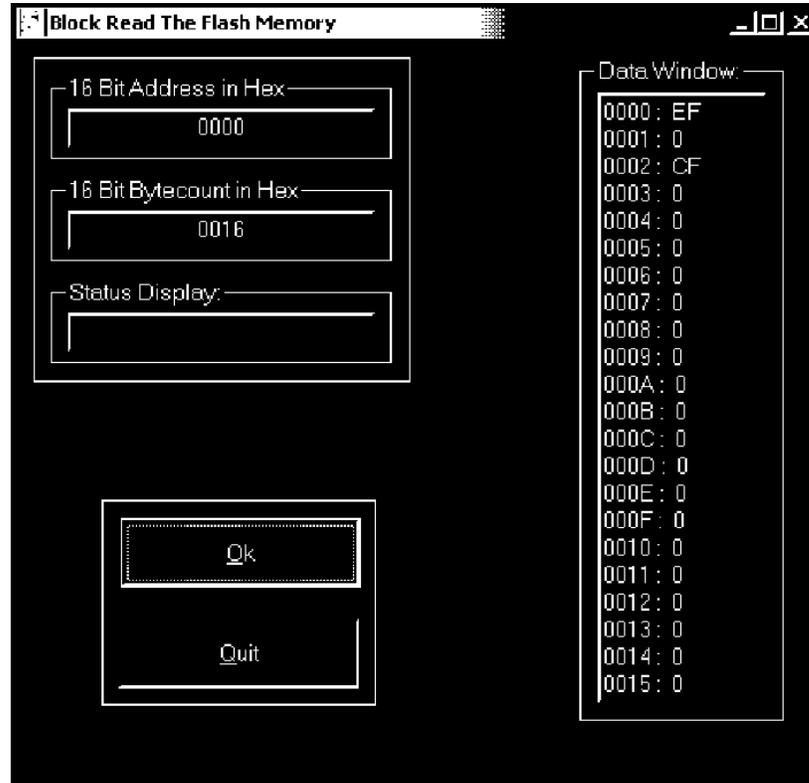


AN101256-11

FIGURE 11. Windows ISP Write Byte Function

1.8 THE BLOCK READ FUNCTION—Read a Block of FLASH

Description: *Figure 12* shows the BLOCK_READ function. The BLOCK_READ function will read multiple bytes from the FLASH memory. The 16 BIT ADDRESS refers to the starting address of the target FLASH location. The 16 BIT BYTECOUNT refers to the number of bytes to be transferred. The maximum value of BYTECOUNT is 32 KB (0x0000–0x7FFF). If BYTECOUNT=0 then the software will abort. This function is capable of sending up to 32 KB of FLASH memory through the microwire. This function is security dependent. If security is set, only location 0xFFFF can be read, any attempt to read any other location other than 0xFFFF while security is set, will be responded with a 0xFF in the DATA_WINDOW:.



AN101256-12

FIGURE 12. Windows ISP Block Read Function

1.9 THE HEX DOWNLOAD FUNCTION—Download a Program to a Hex File

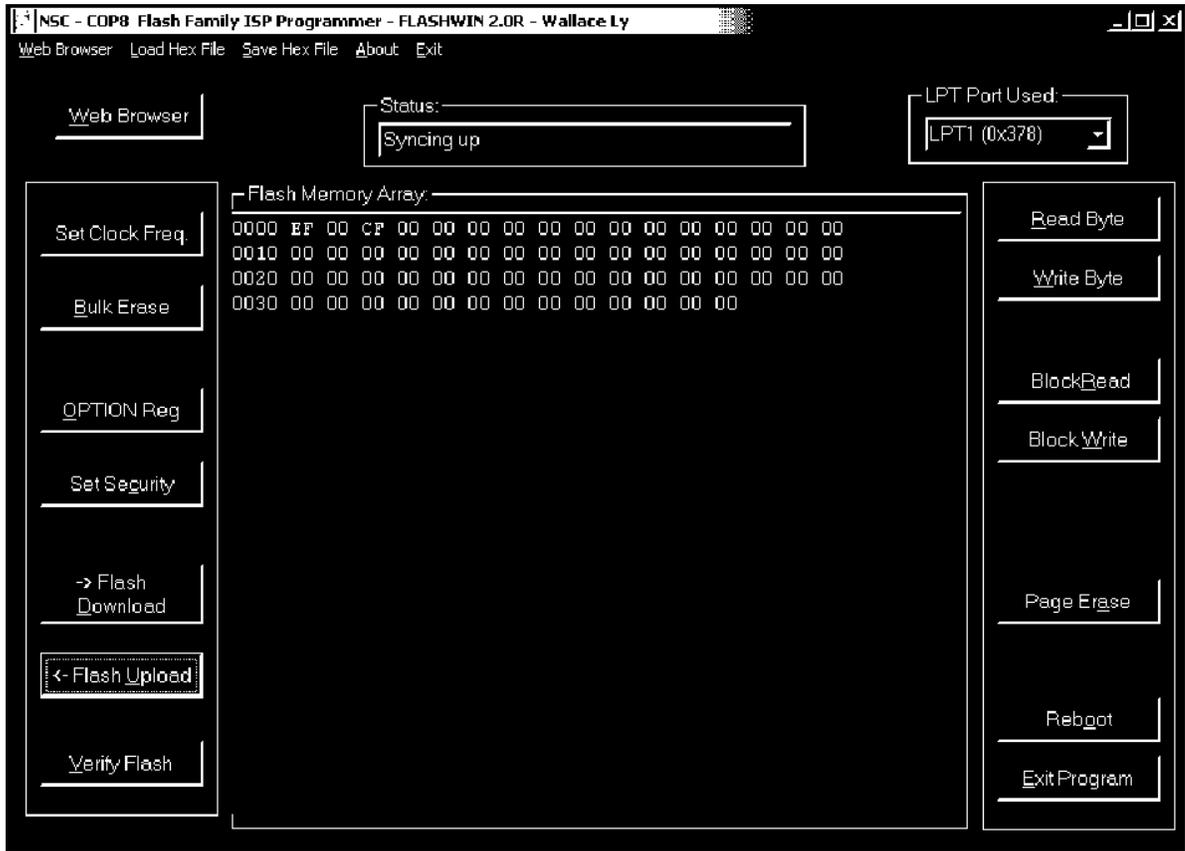
Description: *Figure 13* depicts downloading to a hex file. The user must provide the following parameters: Filename, 16 Bit BYTE-COUNT, and the 16 BIT STARTING BIT ADDRESS. The user may also wish to observe the *diassembled* code after downloading the data from the device. This can be accomplished by clicking on the *DISASSEMBLER STATUS* box. *Figure 15* show the format of the *DISASSEMBLER WINDOW*. The disassembled instructions are show on the left hand side of the window. The software also displays on the right hand side of the *DISASSEMBLER WINDOW* the usage and program location of where Virtual E²/User Routines are accessed. Clicking the *Ok Button* will cause the program to send the appropriate commands to the FLASH micro-controller in order to download the intended data. The then calculates the appropriate checksum in order to be in compliance to the Intel Corporation™ hex file standard. After the download is complete the host software will display the received contents in the “Flash Memory Array Window.” *Figure 14* shows how the screen should look like after the file is downloaded.

The screenshot shows a software window titled "Upload from the Flash" with the following elements:

- File Name:** A text input field containing "example.hex".
- 16 Bit Starting Address in Hex:** A text input field containing "0000".
- 16 Bit ByteCount in Hex:** A text input field containing "003D".
- Downloaded:** A text input field containing "3Dh (61) Decimal".
- Flash CheckSum:** A text input field containing "1BEh".
- Status Display:** A text input field containing "Hex Dowloaded Completed".
- DisAssembler Status:** A checkbox labeled "DisAssembler Disabled" which is currently unchecked.
- Buttons:** "Select File", "Ok", and "Exit" buttons are located on the left side.
- Progress Indicators:** Two horizontal progress bars are shown, labeled "Bytes read from the FLASH:" and "Byte written to file:". Both bars are approximately 75% full.

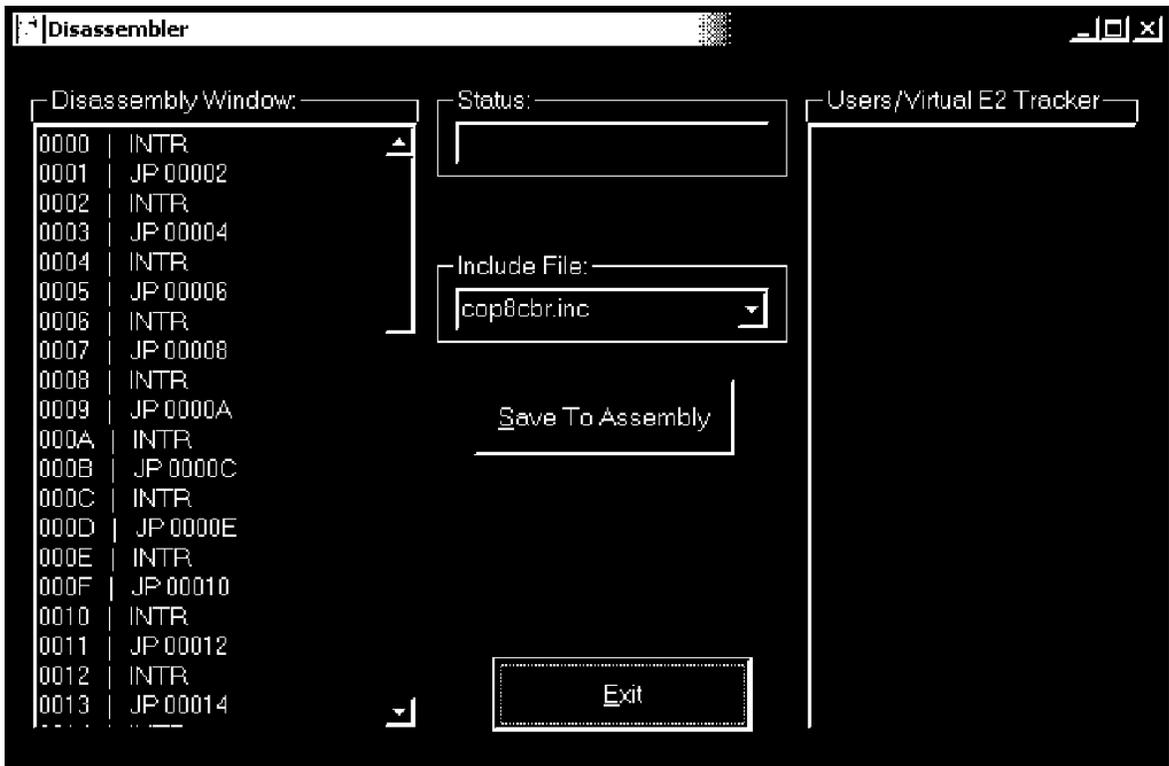
AN101256-13

FIGURE 13. Writing to a Hex File



AN101256-14

FIGURE 14. Hex Dump



AN101256-15

FIGURE 15. Hex File Disassembly Dump

1.10 BLOCK WRITE—Write a Block of Data to the FLASH Memory Array

Description: *Figure 17* shows the BLOCK_WRITE function. Data is written in sequential order. This function is intended to write blocks of data which will reside in a page of FLASH memory. The 16 BIT ADDRESS refers to the starting address of the target FLASH location. BYTECOUNTLO refers to the number of bytes to be written. The data cannot cross 1/2 page boundaries. A page is a continuous segment of FLASH memory (either 128 byte for a 32 KB device or 64 bytes for a 4 KB and 1 KB devices). A depiction of a 128 byte page can be found in *Figure 16*. Therefore, the user must not write data blocks that are larger than 64 bytes for a 32 KB device and 32 bytes for a 1 KB and 4 KB device. The data must also begin and end in the same 1/2 page segment. The maximum value for BYTECOUNTLO is 16. If BYTECOUNTLO exceeds 16, then it may not be guaranteed that all of the bytes were written properly. If BYTECOUNTLO=0 then the software will abort. The function (BLOCK_WRITE) is **NOT** always available (i.e., it is security dependent). If security is set then the function will be aborted.

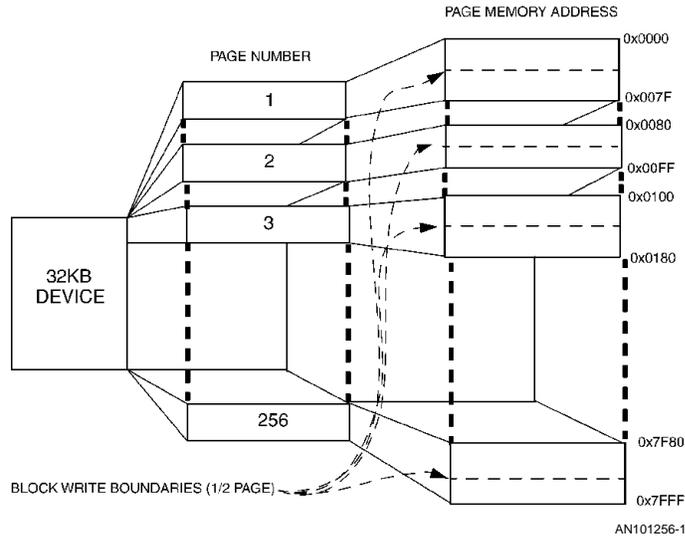


FIGURE 16. Depiction of a PAGE Segment and the BLOCK_WRITE Limitation

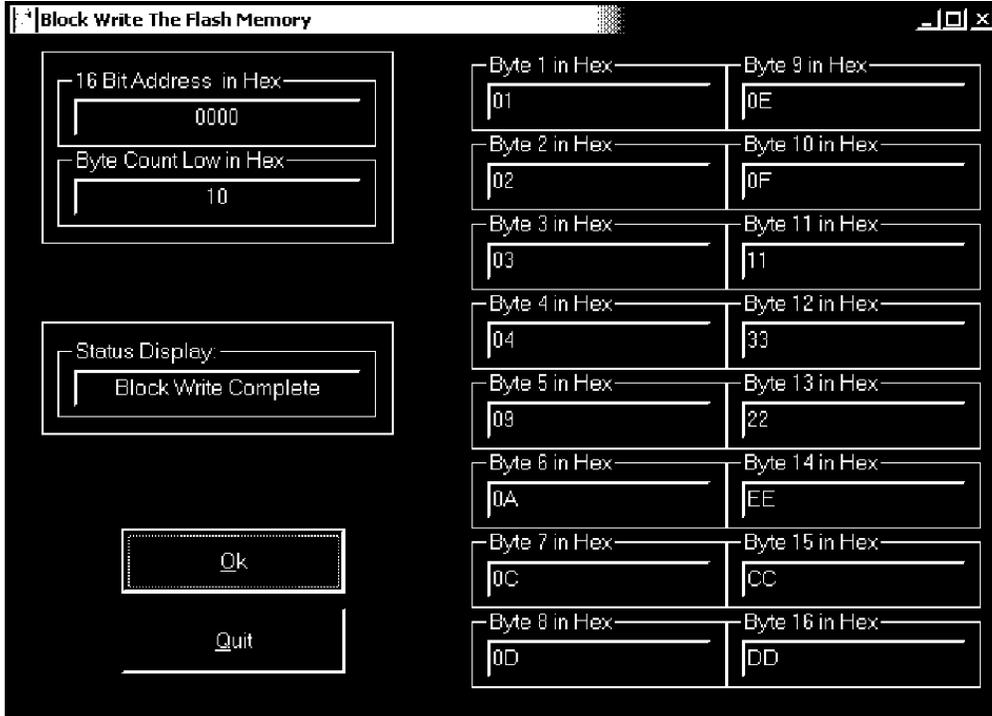
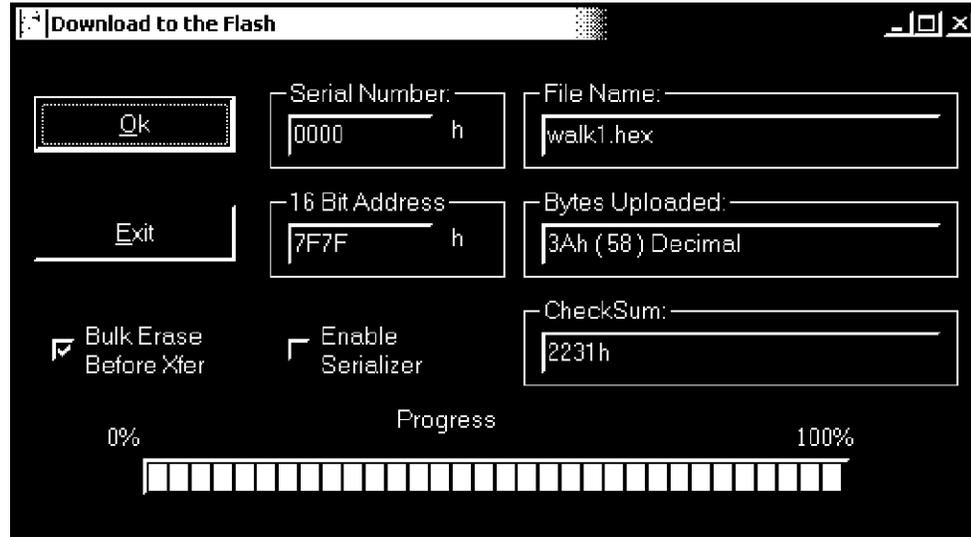


FIGURE 17. Issuing the Block Write Function

1.11 THE HEX DOWNLOAD FUNCTION—Download a Program to the FLASH Micro

The user must provide the FileName. The program will then send the appropriate commands to the COP8 FLASH micro in order to download the intended data. *Figure 18* depicts data transfers by using the hex file (Uploading). At the end of uploading the total bytes uploaded will be computed and displayed on the *BYTES UPLOADED* box.

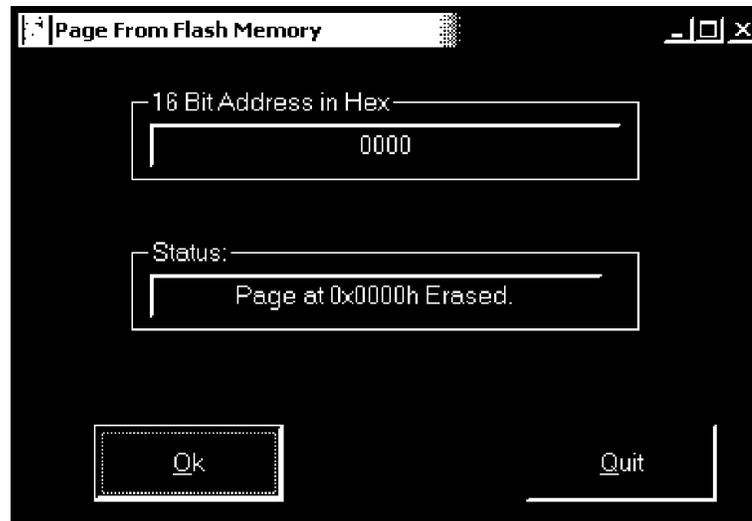


AN101256-18

FIGURE 18. Flashing by Using a Hex File (Uploading)

1.12 THE PAGE ERASE FUNCTION—Erase a Page from the FLASH

Description: *Figure 19* depicts how to enter the 16 BIT ADDRESS of the target FLASH location. After clicking Ok, the software will send the proper command byte along with the target address. The user may click Quit in order to abort the command. This command is **NOT** always available. If the security is set the command will be aborted and no acknowledgment will be returned to the user.



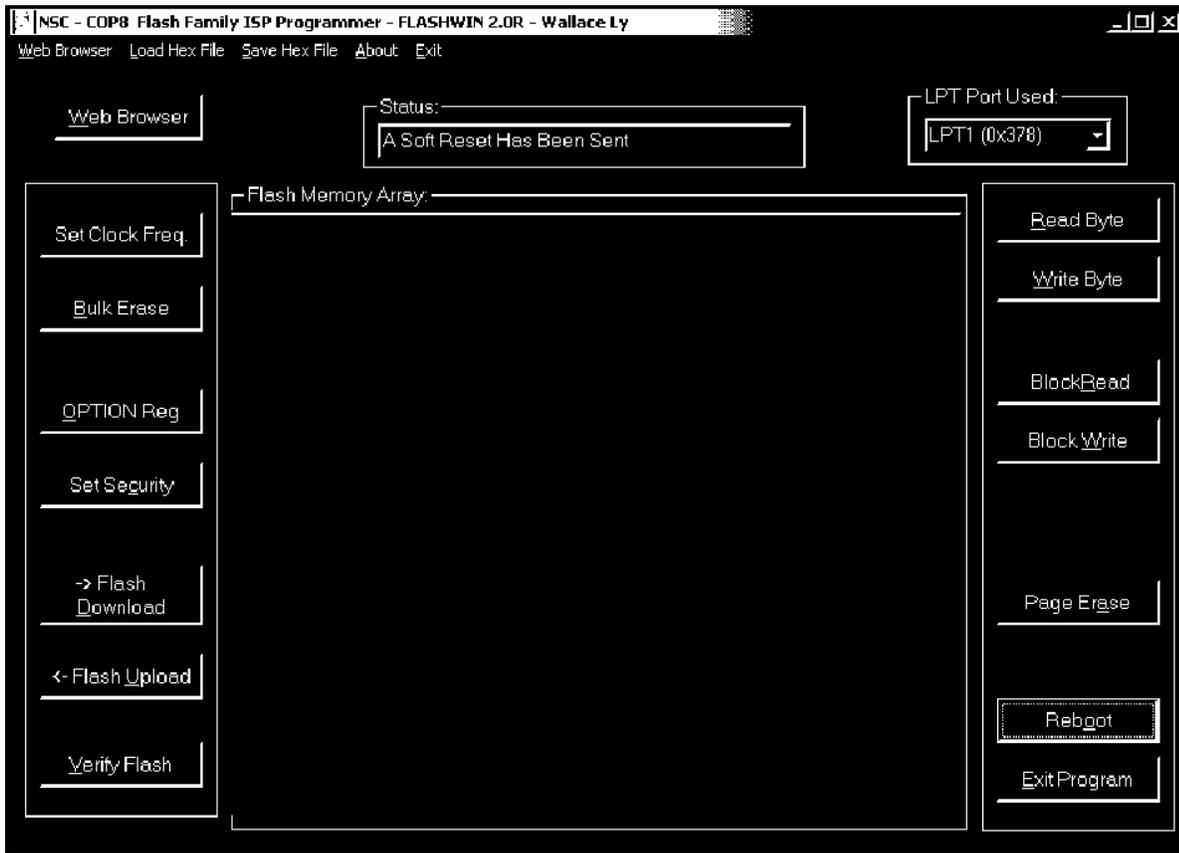
AN101256-19

FIGURE 19. Performing a Page Erase Function

1.13 THE REBOOT FUNCTION—Soft Reset the Microcontroller

Description: The REBOOT FUNCTION will send the proper command byte to tell the COP8 FLASH micro to cause an EXIT. The microcontroller will then reset itself. Execution will begin from FLASH memory if the *FLEX BIT* (Note 1) is set. *Figure 20* shows how to execute the REBOOT function.

Note 1: See 1.5 *THE OPTION BYTE FUNCTION—Set/Reset the Option Bits/Byte from the FLASH Microcontroller* for additional information regarding the FLEX BIT and the OPTION REGISTER.

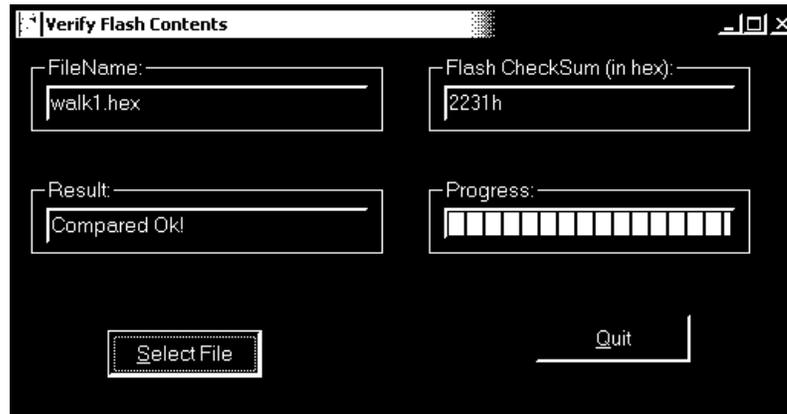


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FIGURE 20. The Reboot Function

1.14 THE VERIFY FUNCTION —

Description: The VERIFY FUNCTION will read the contents of a hex file and compare with the contents of the flash. Otherwise, it will respond with a message "Data miss-matched at location XX". If it matches then the software will respond with a "Compared OK!". The user may select the file with the "Select File" button. The flash Checksum will also be displayed. *Figure 21* shows the format of the "Verify" window.



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FIGURE 21. The Verify Function

2.0 FAQ (Frequently Asked Questions) For the ISP Programmer Error Responses

2.0.1 Clicking on the CLOCK Setting Button responds with "Error, Check connections"

The response "Error, Check Connections" typically occurs when either of the following occur:

Example 1: The user did not reset the part properly upon power up. The COP8 FLASH Microcontroller will not go into BOOT ROM if the device is not given a reset upon power up. This may occur if the device is connected to the PC while at power up. Some parallel ports are able produce enough current to raise the voltage present at COP8 FLASH Micro reset line during a power up condition.

Solution: Either disconnect the connection to the PC before powering up the device (thus allowing the reset circuitry to function) or issue a reset after powering up.

Example 2: The user's computer parallel port has the wrong mode set for the ISP software.

Solution: The user may solve this problem using the following guidelines. LPT modes can be set typically by going into the BIOS (Basic Input Output Operating System) Setup. The user may have to restart the computer by clicking on the Start|Shutdown|Restart button and holding on a key down (typically F2 or ESC, depending on the BIOS manufacture) during boot up. Set the MODE either to Standard (Unidirectional/Normal Parallel Port) or EPP (Enhanced Printer Port). Either mode may/may not work depending a lot on the parallel peripheral chip manufacturer. Set LPT1 for address 0x378h. Then the user must save the settings to the CMOS/

FLASH and issue a reboot. When Windows has fully restarted, the user may check that Microsoft's Operating System recognizes the parallel port. The user port setting may be found by clicking on Start|Settings|Control Panel|System and clicking on the Device Manager. Next Click on the Parallel Port (LPT1) icon to observe specific details on the mode of the Parallel Port.

Example 3: The Flex bit was set (FLEX=1) from a previous programming event.

The user may solve this problem using the following:

Solution 1: Attach the Flash-ICE and erase the flex bit location (i.e., page erase location 0xFFFF).

Solution 2: Put the device into a parallel programmer and erase location 0xFFFF.

Solution 3: Apply high voltage ($2x V_{CC}$) on the G6 pin and hold reset down for the pre-defined amount of cycles. Then issue a bulk erase via the FLASHWIN Software. This technique of applying HV can accomplished by using the prototype board in the following fashion.

Detach the ISP cable from the target board. Apply HV ($2x V_{CC}$, i.e., 10V for the prototype board) to TP4(-) and TP3(+). Press and hold reset button (count for 3 seconds), then let the reset go. Detach the HV from TP4(-) and TP3(+), attach the RJ11 cable. Go into the FLASHWIN Software and issue a SET CLOCK. The program should respond "Flash Micro Accepted Clock Setting" if everything is working correctly. If systems persists in replying "Error, Check Connections" , the user should go to solution 2 (above) and check the LPT mode was set properly.

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