COP8™ FLASH ISP HANDBOOK – FLASHDOS Programmer's Guide

ABSTRACT

This application note describes the use of the In System Programming software for the DOS/WIN3.1/WIN95/WIN98 environment. This document details the procedures necessary to perform ISP with the FLASHDOS 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 DOS environment allows the user to easily program and modify the FLASH contents of the COP8 FLASH Family microcontroller.etailed step by step procedures are presented and documented. Currently the DOS ISP program will only work with a DOS/WIN3.1, WIN95, and WIN98. F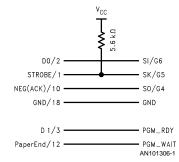ile/Data loading and saving proce-dures are discussed in this document. Other application notes that relates to COP8 FLASH ISP software include AN-1150 (Introduction to In System Programming (ISP)), AN-1151 (Parallel Port Programming Adapter), AN-1152 (FLASHDOS Programmer Source), AN-1153 (Virtual E^2 Guide), and AN-1154 (FLASHWIN 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 six wire interface.

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

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FIGURE 1. Parallel Port Connection Diagram

TABLE 1. PARALLEL PORT <-> MICROWIRE CONVERSION

DB25 Printer Port Pin Name	DB25 Printer Port Pin Number	Function
STROBE	1	SK/G5
DO	2	SI/G6
NEG(ACK)	10	SO/G4
GND	18	GND
D 1/3	3	PGM_RDY
PaperEnd	12	PGM_nAIT

1.1 FLASHDOS 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 from flash. The user may choose each function by typing in the appropriate key. Te user may exit two ways. Either by CTRL-Break, or by typing in 'Q' at the command prompt..

```
?. About The FLASHDOS Program.
A. Automark Facility
B. Bulk Erase The Flash.
C. Set the CLOCK CKI Frequency.
D. Download To The Flash.
E. Change Lpt port: 1=lpt1, 2=lpt2, 3=lpt3."
F. Verify The Flash.
L. Block Read From The Flash.
M. Page Erase The Flash.
O. Set the Option Register.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
R. Read A Byte From The Flash.
S. Set the Security.
T. Block Write To The Flash.
U. Upload From The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>:
```

FIGURE 2. The FLASHDOS ISP Main Menu

1.2 THE SET SECURITY FUNCTION—Set the Security Bit

Description: *Figure 3* shows the enabling of security. Choosing the Security Function will read the OPTION Register, Modify the OPTION register and then save the result into the OPTION register location. When completed, the DOS software will respond in the Status screen. If successful the software will respond a message stating: "security have been set".

```
?. About The FLASHDOS Program.
D. Download To The Flash.
F. Verify The Flash.
L. Block Read From The Flash.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
R. Read A Byte From The Flash.
S. Set the Security.
T. Block Write To The Flash.
U. Upload From The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: s

Setting the security bit.
The security is set

Enter the FLASH Command>:
```

FIGURE 3. FLASHDOS 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. screen. If successful, the software will respond in the screen with a *"FLASH Micro Accepted Clock Setting"*, otherwise, the software will respond with *"Error!, Check Connections." Figure 4* shows how the display should look like when a successful SET CKI-CLOCK is achieved.

```
?. About The FLASHDOS Program.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
V. Programmer Wait (Wait for PGM_WAIT low)
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: c

Enter the CLOCK CKI Frequency ( in Mhz.) : 10
Programming Clock is set to 10 MHz.

Enter the FLASH Command>:
```

FIGURE 4. FLASHDOS Set CKI Clock Function

1.4 THE BULK ERASE FUNCTION—Mass Erase the Microcontroller

Description: *Figure 5* 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 Return Key is pressed. *Figure 5* shows how the software responds after the BULK_ERASE function is sent.

```
?. About The FLASHDOS Program.
B. Bulk Erase The Flash.
D. Download To The Flash.
F. Verify The Flash.
L. Block Read From The Flash.
M. Page Erase The Flash.
O. Set the Option Register.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
R. Read A Byte From The Flash.
S. Set the Security.
T. Block Write To The Flash.
U. Upload From The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: b

The Flash has been erased.
Enter the FLASH Command>:
```

FIGURE 5. FLASHDOS Bulk Erase Function

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 pressing the return key, the DOS ISP Software will send a request for a READ_BYTE for location 0xFFFF. 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 6* shows the screen the format of the OPTION BYTE function.

```
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.

 Enter the FLASH Command>: o

 Flex=0, Execute flash program memory upon Reset"
 Halt=0, Halt mode enabled"
 WD=0, Watchdog disabled"
  SEC=0, Security disabled"

Set Security ? (Y/N) > n
Set Watchdog ? (Y/N) > y
Set Halt ? (Y/N) > n
Set Flex ? (Y/N) >n

Option Register Updated.
Setting option bits.
Enter the FLASH Command>:
```

FIGURE 6. The FLASHDOS OPTION Screen

Option Register Bit Assignments:

Bit 7 -   Reserved

Bit 6 -   Reserved

Bit 5 -   SEC - Security bit

       =1 Security enabled

       =0 Security disabled

Bit 4,3 - Reserved

Bit 2 -   WD - Watchdog

       =1 Watchdog feature is disabled with G1 being a standard I/O.

       =0 Watchdog feature is enabled to G1 output with weak pull-up enabled when output is not valid.

Bit 1 -   HALT - Halt Enable

       =1 Halt mode is disabled

       =0 Halt mode is enabled

Bit 0 -   FLEX -FLASH execution

       =1 Execute from FLASH memory upon exiting Reset (Reboot Button)

       =0 Execute from Boot ROM upon exiting Reset (Reboot Button)

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

Description: *Figure 7* 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 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 screen.

```
?. About The FLASHDOS Program.
D. Download To The Flash.
F. Verify The Flash.
L. Block Read From The Flash.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
R. Read A Byte From The Flash.
S. Set the Security.
T. Block Write To The Flash.
U. Upload From The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: r

Enter the Starting Address: 0x000E
Data read 00 ..

Enter the FLASH Command>:
```

FIGURE 7. FLASHDOS ISP Read Byte Function

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

Description: *Figure 8* shows the format of the WRITE_BYTE routine. The WRITE_BYTE function will transfer a byte from the DATA screen 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.

```
?. About The FLASHDOS Program.
L. Block Read From The Flash.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
R. Read A Byte From The Flash.
T. Block Write To The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: w

Enter the Starting Address:  0x0000

Enter the Data:  0xFC
Writing of FC Completed..
Enter the FLASH Command>:
```
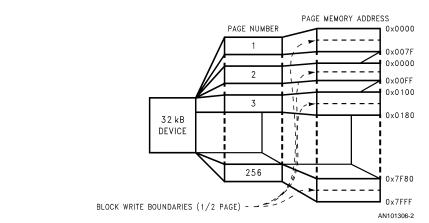
FIGURE 8. FLASHDOS ISP Write Byte Function

1.8 THE BLOCK READ FUNCTION — Read a Block of FLASH

Description: *Figure 9* 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 screen.

```
?. About The FLASHDOS Program.
L. Block Read From The Flash.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
T. Block Write To The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: l

Enter the Starting Address: 0x0000
Enter Bytecount: 0x0003

Data read #0000: 0xFC ..
Data read #0001: 0x00 ..
Data read #0002: 0x00 ..

Enter the FLASH Command>:
```

FIGURE 9. FLASHDOS Block Read Function

1.9   THE HEX UPLOAD FUNCTION—Saving a program to a hex file

Description: *Figure 10* 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. After the upload is complete the host software will display the received contents in the display prompt. *Figure 10* shows how the screen should look like after the file is downloaded.

```
Uploading From The Flash.
Please enter the filename > example.hex

Enter the Starting Address: 0x0000

Enter Bytecount: 0x003D

:10000000DD6FAC0200000000000000000000000000
:10001000000000000000000000000000000000000
:10002000000000000000000000000000000000000
:0D003000000000000000000000000000000000

Flash Checksum = 00 01FA
Enter the FLASH Command>:
```

FIGURE 10. Writing to a Hex File (Downloading)

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

Description: *Figure 12* 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 32KB device or 64 bytes for a 4KB and 1KB devices). A depiction of a 128 byte page can be found in *Figure 11*. Therefore, the user must not write data blocks that are larger that 64 bytes for a 32KB device and 32 bytes for a 1KB and 4KB 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 11. Depiction of a PAGE Segment and the BLOCK_WRITE Limitation

```
?  About The FLASHDOS Program.

P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.

Enter the FLASH Command>: t

Enter the Starting Address: 0x0000

Enter Bytecountlo: 0x05
Enter data #0000> 01
Enter data #0001> 02
Enter data #0002> 0A
Enter data #0003> 0B
Enter data #0004> 0C
Download complete, 05 written.
```

FIGURE 12. Issuing the Block Write Function

1.11 THE DOWNLOADER FUNCTION—Download a Hex File 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 upload the intended data. *Figure 13* depicts data transfers by using the hex file. At the end of downloading the total bytes downloaded will be computed and displayed at the prompt.

```
Please enter the file name> light2.hex

Total Bytes Downloaded: 0062
Enter the FLASH Command>:
```

FIGURE 13. Flashing by using a Hex File (Downloading)

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

Description: *Figure 14* depicts how to enter the 16 BIT ADDRESS of the target FLASH location. After pressing return, 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.

```
U. Upload From the Flash.
D. Download To The Flash.
F. Verify The Flash.
R. Read A Byte From The Flash.
W. Write A Byte To The Flash.
L. Block Read From The Flash.
T. Block Write To The Flash.
M. Page Erase The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)
V. Programmer Wait (Wait for PGM_WAIT low)
?. About The FLASHDOS Program.

P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.

Enter the FLASH Command>: m

Erasing a page from flash.
Enter the Starting Address: 0x0000
Page Erasing of 0000 Completed..
Enter the FLASH Command>:
```

FIGURE 14. 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 is set. *Figure 15* shows how to execute the REBOOT function.

```
?. About The FLASHDOS Program.
L. Block Read From The Flash.
M. Page Erase The Flash.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
T. Block Write To The Flash.
V. Programmer Wait (Wait for PGM_WAIT low)
W. Write A Byte To The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)

Enter the FLASH Command>: l
Enter the Starting Address: 0x0000
Enter Bytecount: 0x0003
Data read #0000: 0xFC ..
Data read #0001: 0x00 ..
Data read #0002: 0x00 ..
Enter the FLASH Command>:
```

FIGURE 15. Performing a REBOOT Function

```
F. Verify The Flash.
R. Read A Byte From The Flash.
W. Write A Byte To The Flash.
L. Block Read From The Flash.
T. Block Write To The Flash.
M. Page Erase The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)
V. Programmer Wait (Wait for PGM_WAIT low)
?. About The FLASHDOS Program.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.

Enter the FLASH Command>: Z
Programmer Ready (Set/Reset the PGM_RDY line)
What is the PGM_RDY Mode Reset/Set (R/S) > R

Enter the FLASH Command>:
```

FIGURE 16. Set Programmer Status Function

```
A. Automark Facility
C. Set the CLOCK CKI Frequency.
E. Change Lpt port: 1=lpt1, 2=lpt2, 3=lpt3.
B. Bulk Erase The Flash.
O. Set the Option Register.
S. Set the Security.
U. Upload From The Flash.
D. Download To The Flash.
F. Verify The Flash.
R. Read A Byte From The Flash.
W. Write A Byte To The Flash.
L. Block Read From The Flash.
T. Block Write To The Flash.
M. Page Erase The Flash.
X. Set the Flex Bit And Reboot.
Z. Programmer Ready (Set/Reset the PGM_RDY line)
V. Programmer Wait (Wait for PGM_WAIT low)
?. About The FLASHDOS Program.
P. Print Out the Flash ISP Commands.
Q. Quit the Flash ISP Program.
Enter the FLASH Command>: v
Waiting for the PGM_WAIT to be cleared.
Waiting for the PGM_WAIT to be cleared.
Waiting for the PGM_WAIT to be cleared.
Waiting for the PGM_WAIT to be cleared.
Waiting for the PGM_WAIT to be cleared.
```

FIGURE 17. Wait for an External Signal Function

Notes

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