How to use ICC12 with neCore12M64 and uBUG12

This document will demonstrate the use of ImageCraft ICC12 **Version 6** C compiler with Technological Arts' Adapt9S12NE64 module. uBUG12 is used to erase and program flash memory after the compilation of a test program with ICC12. While other methods can be used to erase and program flash, this example will focus on uBUG12.

This document assumes that the user is already familiar with programming in C. It also assumes that the Serial Monitor has not been erased and is presently in the 9S12NE64 MCU.

ImageCraft Links:

About		×
	ICC12 Version 6.16A Built Jan 26 2004 21:58:29 (650) 493-9326 FAX: (650) 493-9329	
Copyright ((C) 1998-2002 ImageCraft Creations Inc.	
Mailing Lis	ts: http://www.dragonsgate.net/mailman/listinfo	
Web Site:	http://www.imagecraft.com/software	
Demo/Upo	dates: http://www.imagecraft.com/software/demos.html	
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Technological Arts Links:

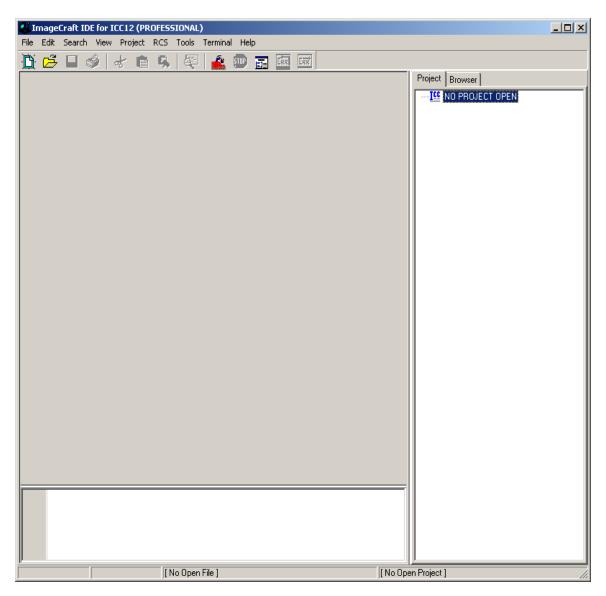
http://support.technologicalarts.ca/files/uBug12.zip

Getting Started:

Double click on the ICC12 icon. If you have not read the ICC12 manual yet, and you just opened the IDE, you will no doubt wonder what to do next. Well wonder no more.

Note the three window panes. The top left pane is greyed out and the right pane displays the project window. The bottom left pane is where the error messages are displayed during compilation.

Before creating a new Project, the hardware target in the Compiler Options must be setup properly for the target MCU. This is to ensure that the compiler will know where program memory, data memory, and registers are located during the linking process. In this example it is neCore12M64.



Compiler Setup:

Click on Project Menu – Options – Target Tab.

ImageCraft IDE for ICC12 (PROFESSIONAL)	<u> </u>	
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Reopen	•	
Make Project Rebuild All	F9 Shift+F9	
Add File(s) Add Topmost Opened File Remove Selected File(s)	Shift+F11	
Options Manual Sort Browser Window	ow	
Close Save As		
[No Open File]	[No Open Project]	

Please note that there is no 9S12NE64 listed in the Device Configuration therefore a Custom must be selected and the memory parameters set manually. Click on the pull down arrow to change the device type.

Compiler Options	×										
Paths Compiler Target											
Device Configuration 9S12DP256 12K RAM Mode Memory Addresses Program Memory 0x1000 Data Memory Stack Pointer 0x4000	PRINTF Version Small (int only, no modifier) Small (int only, no modifiers) float (full function) Additional Lib. Vord Alignment Advanced Other Options No Startup/Lib Non-default Startup										
For Expanded Memory, "Linear S2" and "Map Vector Page" should generally be used. You may need to use the SRecCvt program. Click Help for details. STD and Demo version can access up to 64K of expanded memory. PRO version has no											

Custom Device Configuration:

Program Memory: 0x4000.0x7FFF:0xC000.0xF7FF Data Memory: 0x2000 Stack Pointer: 0x4000

Expanded Memory:

Note the address range is **0xF0000. 0xF7FFF**. That implies that the valid PPAGE range is from \$3C to \$3D. PPAGE \$3E and \$3F correspond to the fixed memory area, and are allocated to **0x4000.0x7FFF:0xC000.0xF7FF**

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Paths Compiler Target										
Device Configuration Custom Memory Addresses Program Memory 0x4000.0x7FFF: Data Memory 0x2000 Stack Pointer 0x4000 Expanded Memory Image: Context of the state of th	PBINTF Version small (int only, no modifier) long (+ long, and modifiers) float (full function) Additional Lib. Word Alignment Advanced Other Options No Startup/Lib Non-default Startup									
 Linear Map Vector Page CPU / Banked Address 										
For Expanded Memory, "Linear S2" and "Map Vector Page" should generally be used. You may need to use the SRecCvt program. Click Help for details. STD and Demo version can access up to 64K of expanded memory. PRD version has no										
OK Cancel Set As Defaul	It Load Default <u>H</u> elp									

On the compiler tab there are several choices of S-record output as shown. Select one that suits you.

Compiler Options										
Paths Compiler Target										
Strict ANSI C Checkings										
Accept Extensions (C++ comments, binary constants)										
🥅 int size enum (for backward compatibility)										
Macro Define(s): Undefine(s):										
Output Format Motorola S19										
Motorola S19 S19 with Source Level Debugging										
S19 with ASM/Source Level Debugging										
Intel HEX										
NOTE: Debug information for structure members is only generated by the										
PRO version										
Execute Command After Successful Build:										
OK Cancel Set As Default Load Default <u>H</u> elp										

Starting a new Project:

Once the compiler options are setup, a new project can be created. Click Project menu – New.

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	Project RCS Tools Termina	Help		
	New Open Open All Files Close All Files	Ctrl+F11	ER	Project Browser
	Reopen	•		
	Make Project Rebuild All	F9 Shift+F9		
	Add File(s) Add Topmost Opened File Remove Selected File(s)	Shift+F11		
	Options Manual Sort Browser Window			
	Close Save As			
	[No Open File]		[No Open Project]	<u>519</u>

ICC12 will prompt to save the new project. You'll need to decide whether to create a new directory to save the new project. In this example a new directory called **Test** was created and the file was saved as **test.prj**.

Save New Pro	oject As	? ×
Save in: 🥯	🛚 Local Disk (C:) 💽 🗢 🖻 💣 🖡	
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🚞 Temp4		
🚞 Temp5		
1		•
File name:		Open
Save as type:	Project Files (*.prj)	Cancel

Type the filename *test.prj* and click on the Save button.

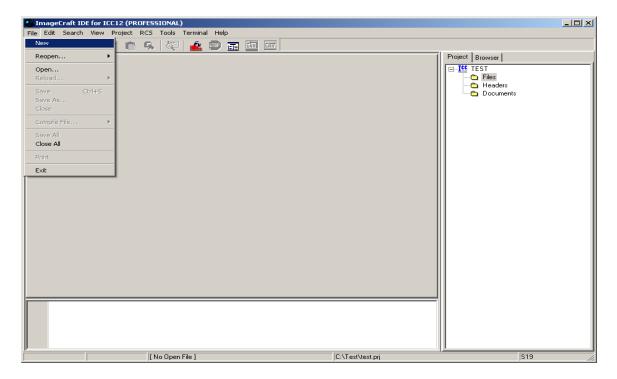
Save New Pro	ject As				? X
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Note that the project window has changed to add Files, Headers and Documents.

Adding new files to the project:

To add files to the project, click on the File menu and select New, as shown.



Note that ICC12 created an untitled file. Save the file as *BlinkLED.C*.

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File Edit Search View Project RCS Tools Terminal Help	
1 🗗 🗗 🛷 🦽 🖻 🧏 🚝 💼 🖬 📾	
Untitled - 3	Project Browser
	Test Headers Documents
1:1 C:\Test\test.prj	S19

To save, click on File menu – Save As

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File Edit Search	View I	Project RC	IS Tools	Terminal He	lp						
New		1 南 1	1	🧟 💷	ERR ERR	ERR					
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Reopen Open Reload)									ect Browser TEST Headers Documents	
1.1							 C:\Test\	Vest pri	 _		\$19

ICC12 will open an explorer window to help save the file. Type BlinkLED.c then press the save button.

Save File As		<u>? ×</u>
Save in: 🗀) Test 💽 🗲 🛍 🐨	
J		-
File name:	BlinkLED.c Save	
Save as type:	Source Files (*.c; *.s)	el

At this point ICC12 has renamed the file to BlinkLED.c.

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File Edit Search View Project RCS To	ools Terminal Help		
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1: 1 C:\Te	est\BlinkLED.c	C:\Test\test.prj	S19 //

To add BlinkLED.c to the Project, click on the Project menu and select Add File(s)

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File Edit Search View	W Project RCS Tools Termin	al Help		
BlinkLED.c	Open Open.All Files Close All Files	Ctrl+F11		Project Browser
	Reopen			- 🔁 Files
	Make Project Rebuild All	F9 Shift+F9		Headers Documents
	Add File(s) Add Topmost Opened File Remove Selected File(s)	Shift+F11		
	Options Manual Sort Browser Windo	w		
	Close Save As			
1:1	C:\Test\BlinkLED	.c	C:\Test\test.prj	\$19

ICC12 will open an explorer window to help you locate the file of interest.

Add Files					? ×
Look in: [Test 💌 🗸	- 🖻	r 🛱	•	
BlinkLED.c					
, File name:	BlinkLED.c			Oper	
Files of type:	Course Files (* o. * o. * b)	-		Cance	_
riles of type:	Source Files (*.c, *.s, *.h)	-		Cance	
	Open as read-only				

Notice that the right window pane has changed to include BlinkLED.c in the Project Files list.

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BlinkLED.c			Project Browser
2: 1 Modified	C:\Test\BlinkLED.c	C:\Test\test.prj	<u> </u>

Locate *vectors.c* and copy it to Test directory. The main reason to do this is project dependencies. It is not good to keep editing a global *vectors.c* if other projects are using this same file. It becomes a problem to keep track of the changes made to the different projects.

To add *vectors.c* to the Project, click on the Project menu – Add File(s)

Add Files	?	×
Look in: 🔀	Test 🔽 🗢 🔁 📸 🖬 -	
BlinkLED.c		
vectors.c		
File name:	vectors.c Open]
Files of type:	Source Files (*.c, *.s, *.h)	
	Open as read-only	

Note that the Project Files list has updated to include *vectors.c* It is important to note that the default *vectors.c* included with ICC12 was written for the 68HC912B32 and 812A4 MCUs. Technically, one should edit the file to include other interrupt service routine (ISR) addresses specific to the 9S12NE64. In this example the file is used "as is".

ImageCraft IDE for ICC12 (PROFESSIONAL) _ 🗆 X File Edit Search View Project RCS Tools Terminal Help 🕒 📂 🔚 🚳 🚽 💼 🕵 🚳 | ERR . Project Browser vectors.c BlinkLed.c 🖃 [🛄 TEST * SCIHandler, ۸ 🗄 🗁 Files */ 🔕 BlinkLed.c. #if defined(HC12) 🚫 vectors.c /* add any interruot vectors in here too for HC12 paged compilation 🛅 Headers */ Documents #pragma nonpaged function start #endif extern void start(void); /* entry point in crt??.s */ #define DUMMY ENTRY (void (*) (void)) 0xFFFF #pragma abs address:0xF7D0 /* change the above address if your vector starts elsewhere */ void (*interrupt vectors[])(void) = { /* to cast a constant, say Oxb600, use (void (*)())0xb600 */ /* 81214 vectors starts at Oxff80, but most entries are not used if you use Key Wakeup H, change the start address to OxffCE and add one entry to the beginning */ DUMMY ENTRY, /* BDLC */ /* Key Wakeup J */ DUMMY ENTRY, /* ATD */ /* ATD */ 30:48 Modified C:\Test\vectors.c C:\Test\test.prj S19

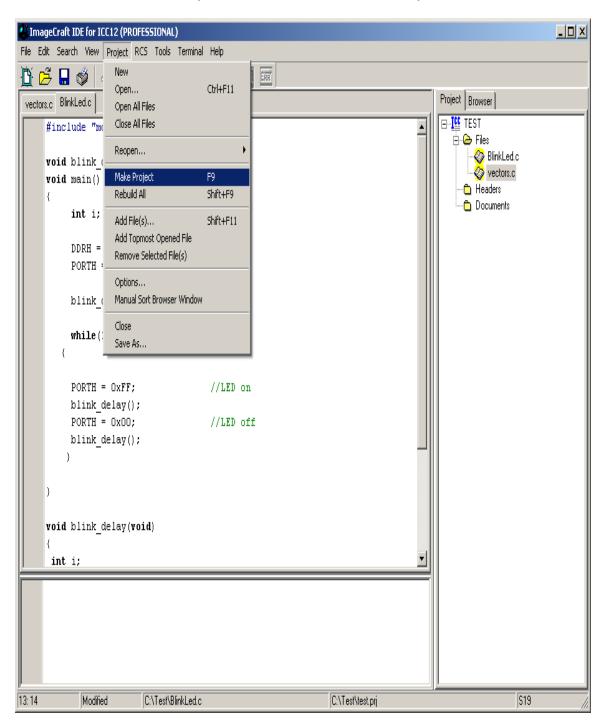
Edit the line #pragma abs_address:0x*FFD0* to #pragma abs_address:0x*F7D0*

Enter the lines of program code shown below into the BlinkLED.c file. The next step is to compile/make/build the code.

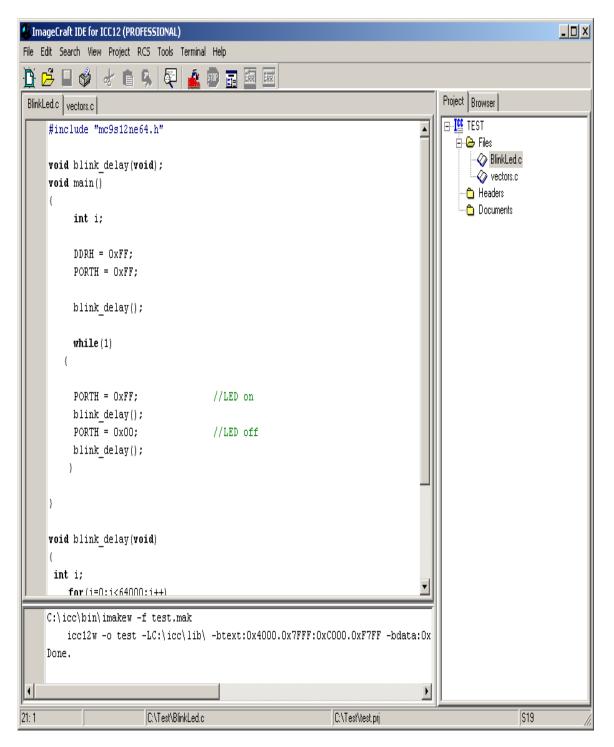
```
#include "mc9s12ne64.h"
void blink_delay(void);
void main()
{
       int i;
       DDRH = 0xFF;
       PORTH = 0xFF;
       blink_delay();
       while(1)
   {
       PORTH = 0xFF;
                                       //LED on
       blink_delay();
       PORTH = 0 \times 00;
                                       //LED off
       blink_delay();
      }
}
void blink_delay(void)
{
 int i;
      for(i=0;i<64000;i++)
      {
                                ;
      }
}
```

Compile/Build/Make the file:

To make the file, click Project menu and select Make Project, as shown.



You'll notice that the bottom window pane shows messages to display how the build progressed. Any errors will be shown in this window. In this case, the build completed without error, so we can move on to erasing and programming the 9S12NE64.



Note in passing that some other intermediate files are created during a Make.

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12 14 12 1		BlinkLED.c	1 KB	C source file	10/21/2004 3:	10/21/
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10 I T 🕻	5 P	🗐 BlinkLED.lis	З КВ	Text Document	10/21/2004 3:	10/21/
	S R	BlinkLED.o	1 KB	O File	10/21/2004 3:	10/21/
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		🛅 test.lk	1 KB	LK File	10/21/2004 3:	10/21/
	5	📅 test.lst	4 KB	list file	10/21/2004 3:	10/21/
1. 1. 1.	57	🖬 test.mak	1 KB	MAK File	10/21/2004 3:	10/21/
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10 D 33 2	5 ;	test.s19	1 KB	S19 File	10/21/2004 3:	10/21/
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)T	Vectors.s	1 KB	ASM File	10/21/2004 3:	10/21/
	u]\\	test.prjdefICC12.prj	1 KB	EmbeddedGNU Proj	10/21/2004 3:	10/21/

Use WordPad to open and inspect the content of test.s19

S10E4000CF200016405587CE04008E30 S110400B040027056A000820F6CE405ACDB7 S111401804008E405A2706180A307020F51650 S1074026402A20FE0A S110402A34B7751B9EC6FF7B025AC6FF7B90 S110403702584A80003C2010C6FF7B02584E S10D40444A80003C7902584A8000CB S10A404E3C20EEB757303DA2 S2123C800034B7751B9ECC00006C1E2007EC1E91 S2123C800EC300016C1EEC1E8CFA0025F2B75720 S2063C801C300AE7 S111F7D0FFFFFFFFFFFFFFFFFFFFFFFFFFFFF535 S111F7DEFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF S111F7ECFFFFFFFFFFFFFFFFFFFFFFFFFFFF S109F7FAFFFFFFFF4000C9 S10840551D0016073DEB S9034000BC

If you look closely at the S-record you'll see a mixture of S1 and S2 lines. This is a typical file of S-records generated by ICC12. S1 records are programmed in the **0x4000 – 0x7FFF** and **0xC000 – 0xF7FF** memory blocks. ISRs are always placed in the fixed memory region. An ISR can call any routine inside a PPAGE when necessary. S2 records can also reference fixed memory regions, but are typically paged by ICC12

Below is the vector address as S1 record.

Note the address at 0xFFFE|0xFFFF contains 0x4000, telling the MCU where to start executing code following power up or RESET.

S109F7FAFFFFFFFFF**4000**C9

The S-record below shows the actual first few bytes of code in the program

S10E4000CF200016405587CE04008E30

ICC12 also generated a banked S2 record with S-record.

S2123C800034B7751B9ECC00006C1E2007EC1E91

PPAGE = 0x3C

S2123C800034B7751B9ECC00006C1E2007EC1E91

Memory address = 0x8000.

Programming:

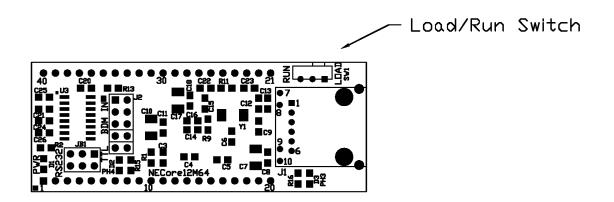
This document assumes that the Serial monitor is present on neCore12M64. It also assumes that one is using a School Board or the RX and TX line of the module is connected to PC COM port appropriately.

Find uBug12 on the CD that came with your evaluation or demo package. If you don't have it, you can download uBUG12 from Technological Arts, at http://support.technologicalarts.ca/files/uBug12.zip

For Windows98 users the .NET framework must be installed before running uBUG12. The Microsoft site link is

http://www.microsoft.com/downloads/details.aspx?FamilyID=d7158dee-a83f-4e21-b05a-009d06457787&displaylang=en

After installing uBug12, slide the Run/Load switch on neCore12M64 to the Load position, and apply power to the School Board.



Double click on the uBUG12 icon to launch it.

ma uBug12	
File Help	
con 1	
MonStatus ErrorText ComPort	li.

In the command bar type *con 1* to connect to COM 1 (or *con 2* if you're using COM 2). A *CONNECTED* message will appear to indicate that a connection between your PC and neCore12M64 has been established.

💏 uBug12	
File Help	
>con 1 Connection Error: Unable to open COM1 >con 1 Connection Error: Read Error: Timeout error	
>con 1 CONNECTED	
Cold Reset Executed Unknown Error COM 1	1.

Two possible errors can occur:

Connection Error: Unable to open COM1 <- Another application is using the COM port

Connection Error: Read Error: Timeout error <- The MCU is not currently in LOAD mode, not powered up, or the cable is disconnected from either the PC or the E128 board.

🙀 uBug12		_ _ _ ×
File Help		
>con 1 CONNECTED		
fbulk		
Cold Reset Executed Unk	nown Error COM 1	h.

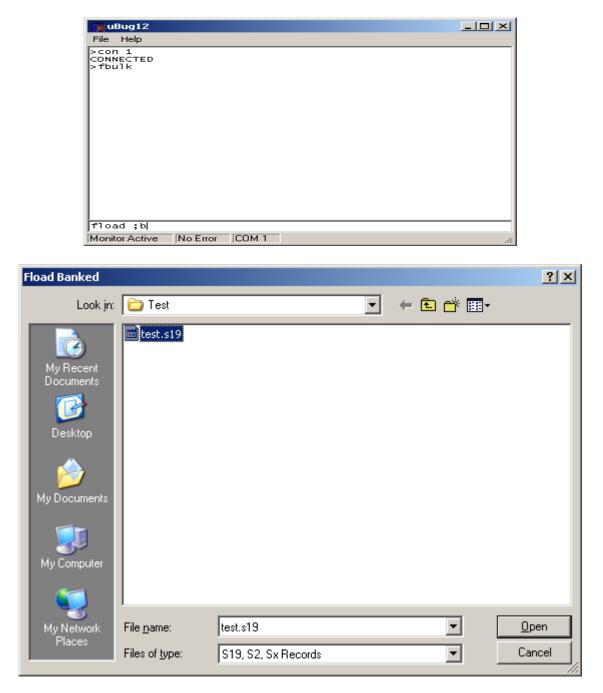
Now erase the flash memory by typing the command FBULK.

🙀 uBug12	
File Help	
>con 1 CONNECTED >fbulk	
Monitor Active No Error COM 1	1.

To load your program, type the command *FLOAD* ;*B* for banked S19, S2, SX and formatted S19 (i.e. went thru SrecCVT program) records. To load a file containing non-banked S2 records, the command is *FLOAD*.

Uploading Banked S-record:

The command to upload banked S-records is *FLOAD*;*B*. It is important to include the ;*B* option to let uBUG12 know that the S-record is banked. Make sure you become familiar with the differences between S19, SX, S2. See Appendix A for an explanation of S-records.



Double click on the file to initiate upload.

🚋 uBug12	
File Help	
>con 1 CONNECTED >fbulk >fload ;b LOADED OKAY: 0.125Sec. Tranfer rate was 6Kb/sec	
Monitor Active No Error COM 1	1.

A good upload will show *LOADED OKAY* messages.

After successful programming, slide the Run/Load switch to Run and press the reset button. The application will begin blinking the LED connected to the port pin.

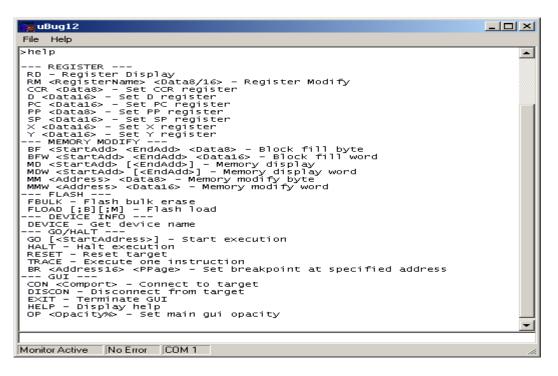
To disconnect uBUG12 from the serial port type the command *discon*.

wBug12	<u>- 🗆 ×</u>
File Help	
>con 1 CONNECTED >fbulk >fload ;b LOADED OKAY: 0.203125Sec. Tranfer rate was 3.6923Kb/sec	
discon	
Monitor Active No Error COM 1	li.

A Disconnected message will appear to indicate that the serial port is available for use by another application (eg. *HyperTerm* or *Tera Term*).

💏 uBug12	- D ×
File Help	
>con 1 CONNECTED >fbulk >fload ;b LOADED OKAY: 0.203125Sec. Tranfer rate was 3.6923Kb/sec	
>discon DISCONNECTED	
Monitor Active No Error COM 1	1.

A list of other uBUG12 commands can be viewed by typing the *help* command.



The commands are pretty well self explanatory but you should try them out to be familiar with their usage and capability.

This concludes the use of ICC12 from erasing and programming FLASH with using uBUG12.