

CMD12-A4

Development Board



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GETTING STARTED

The Axiom CMD12-A4 single board computer is a fully assembled, fully functional development system for the Motorola 68HC12A4 Microcontroller, complete with wall plug style power supply and serial cable. To get started quickly, perform the following test now to make sure everything is working correctly:

1. Install the software on your PC:
 - Create a directory on your PC hard drive for the utility software and copy the contents of the UTL12 disk to that directory. **NOTE:** the AX12.EXE utility on this disk requires DOS and will not run under NT.
 - If your board came with the AX12 for Windows software, run the SETUP.EXE program on the setup disk. This software will work with any 32-bit version of windows (95+), including NT.
 - If you have the Background Debug Module, install the BDM software from the floppy disk by running the SETUP.EXE program.
2. Connect one end of the supplied serial cable to a free COM port on your PC. Connect the other end of the cable to the COM1 port on the CMD12-A4 board.
3. Apply power to the board by plugging in the wall plug power supply that came with the system.
4. If you have AX12 for Windows:
 - Run the AX12W program. From Edit/Options menu, select the COM port you're using on your PC.
5. If you do not have AX12 for Windows:
 - Change to the directory containing the utility software and execute the program: **AX12 . EXE**.
 - Select the PC COM port that you're using and when asked for board type select CMD12-A4.
 - From the main menu select "Terminal Window".
6. Press then release the RESET button on the CMD12-A4 board now.
7. If everything is working properly, you should see the monitor prompt in the terminal window. Your board is now ready to use!

If you do not see the monitor/debugger message prompt, or the text is garbage, see the **TROUBLESHOOTING** section of this manual.

DEVELOPMENT PHILOSOPHY

Software development on the CMD12-A4 can be performed using either the DBUG12 monitor utility programmed into EEPROM (sockets U10/U11) or a Background Debug Module (BDM) connected to the DEBUG connector. Either of these tools can be used to assist in creating and debugging your program stored in external RAM (see the Memory Map).

By default, the CMD12-A4 ships with EEPROMS in sockets U10/U11 and RAM in sockets U8/U9. For debugging under DBUG12, your program should locate itself above the internal registers and memory, for example \$2000.

If you have a BDM, you may want to install RAM in sockets U10/11 while debugging. In this case you should locate your code in EEPROM memory, for example \$8000. You can then use the RAM in U8/U9 for your application.

After satisfactory operation running under a debugger, your program can be written to EEPROM thru the BDM or by relocating its start address, \$8000 for example, then selecting "Program Code Memory" from the AX12 (or AX12W) utility program. When programming is complete your program will run automatically when the CMD12-A4 is powered on or RESET is applied.

To return to debug mode, you can re-program the DBUG12 monitor file: **AX-DB12 . S19** or simply re-connect the BDM.

SOFTWARE

There are many useful programs on the UTL12 disk included with the CMD12-A4 that can make developing projects easier. You can also download the latest version of this disk free at any time from our web page at: <http://www.axman.com>.

All of the utilities on the UTL12 disk require DOS, or a dos window running under MS Windows™. The main programming interface to the CMD12-A4 board is the AX12 program. This program also provides an interface to the assembler and compiler software provided by Karl Lunt. The DOS version is included on the UTL12 disk and there is also a Windows version available from the manufacturer. The DOS version will not work with Windows NT.

Both versions of AX12 communicate with the board via its COM1 port and include a Terminal window for interfacing with other programs running on the CMD12-A4, such as the monitor/debugger program DBug12.

In addition to the AX12 terminal, most communications programs will work with the CMD12-A4. Even the Terminal program in Microsoft Windows™ will do an adequate job. Communications settings should be set to 9600 baud, 1 start, 1 stop, 8 data, no parity.

See the **README** file on the utility disk for a complete listing of all programs and files on the UTL12 disk.

Axiom also manufactures a Background Debug Module for this board, which is a powerful real-time source level debugging tool. Contact Axiom for more information.

DOCUMENTATION

All of the documentation for the CMD12-A4 hardware and software is available in electronic form. See the MANUAL.TXT file on the UTL12 disk or select HELP from the menu for the AX12 for DOS documentation.

Complete documentation for the AX12 for Windows and BDM Software products are available from the Help menu of these programs.

Owners manuals and Users guides for the M68HC12-A4 micro and programming interface is available in Adobe Acrobat (.pdf) on the Axiom web page (www.axman.com). Here you will also find updates to this document as well as supporting part and schematic documentation. You can also download a free viewer for Acrobat (.pdf) files.

TUTORIAL

This section should help you get started with the specifics of the CMD12-A4 development process. Be sure to read the rest of this manual as well as the documentation on the disk if you need further information.

You can develop 68HC12 software with the CMD12-A4 board using either:

- your PC's serial port and the DBUG12 monitor utility with AX12 for DOS
- your PC's serial port and the DBUG12 monitor utility with AX12 for Windows
- your PC's Parallel port and a Background Debug Module (BDM) connected to the DEBUG connector on the board.

The following sections take you thru the complete development cycle of a simple "hello world" program using each of these development methods.

Using AX12 for DOS

Example Program

For this tutorial we'll use an assembly language program on the UTL12 software disk called HELLO.ASM. This is a simple program that just sends a text string to your PC serial port using the HC12 SCI0 (COM1) port. You can substitute your own program here if you wish but, to verify everything is working properly, it's a good idea to start with something simple.

1. If you haven't done so already, verify that the board is connected and operating properly by following the steps under "GETTING STARTED".
2. At your PC's DOS command line prompt, change to your UTL12 software directory.
3. Execute the command: **AX12** ↵
This will launch the Axiom programming interface for the HC12 development boards.
4. Select "**Assembler**" from the main menu and input the file called HELLO.ASM which is located in the program directory. This will assemble our test source code.
5. If any errors are found, the program listing will be displayed on the screen which contains the errors. Otherwise, you should have a new file called **HELLO.S19** (a Motorola hex object file) in your directory.
6. Select "Terminal Window" from the menu.
7. Make sure MODE switches 1,2,3 and 4 are all switched OFF then press and release the RESET button on the board.
8. You should see the monitor prompt. Press any key to start the debugger.
9. Type **LOAD** ↵
This will prepare the monitor to receive a program.
10. Press the Page Up key and when prompted for a file name, select the file you just created called **HELLO.S19** then select [OK]. Your program will be sent to external RAM.
11. When the program is finished loading, hit the ENTER key to complete the upload.
12. Type **CALL 2400** ↵
This tells the monitor to execute the subroutine at address \$2400, which is the start of our test program.
13. If everything is working properly you should see the message "Hello World" echoed back to your terminal screen then, since we return at the end of our program, lines containing the internal register status followed by the monitor prompt.
14. If you didn't get this message, try going thru this tutorial once more then, if still no go, see the **TROUBLESHOOTING** section in this manual

You can modify the hello program to display other strings or do anything you want. The procedures for assembling your code, uploading it to the board and executing it are the same. The monitor has many powerful features such as breakpoints, memory dump and modify and program trace. Type HELP at the monitor prompt for a listing of commands available.

Programming the External EEPROM

When you're finished with program development, you will probably want to write your program to EEPROM so that it executes automatically when you apply power to the board. The following procedure is the easiest way to accomplish this:

1. Use a text editor to modify HELLO.ASM. You can use the built in "Edit" command in AX12 if you wish.
 - Change the start of your program defined by the , org MONSTRT to org PRGSTRT by commenting out the first (adding a comment character in front of) and removing the comment in front of the second. This change will re-map the code to start at address \$8000 instead of \$2000 which is the beginning of the external EEPROM.
 - Remove the comment character in front of the **LDS #STACK** line next. This will load the stack pointer when the program starts. It is important that this NOT be done when running your program under D-Bug12 because it must handle the stack.
 - Add a comment character in front of the first **RTS** line. This will allow the program to end gracefully in an endless loop, since it will not be returning to D-Bug12.
2. Select "**Assembler**" from the AX12 menu to re-assemble the modified HELLO.ASM program.. This will prompt you for that file name then execute the batch file DO_ASM.BAT which automates the assembly process and creates a listing file.
3. Select "**HC12 Utilities**" from the menu. Follow the onscreen instructions for executing the utilities firmware. If you have trouble here, see the TROUBLESHOOTING section.
4. From the utilities menu, select "Program Code Memory" and when prompted for a file name, type:
HELLO.S19
then select [OK].
5. Follow the instructions on screen. When finished programming select "Auto Start Setup" from the menu. Set Auto Start to "YES" and change the starting address to 8000 hex, which is the new starting address of our HELLO program.
6. Put the MODE switches back to their original positions (usually all off)
7. Select "Terminal" from the menu then cycle power or press RESET on the CMD12-A4 board. Your new HELLO program should start automatically.

To return to development mode, simply restart the "HC12 Utilities" and turn off Auto Start. Don't forget to change the MODE switches back to run mode (usually all off).

This method works well for small programs (less than 2K). If you want to use the entire onboard EEPROM memory area for your program, you can use "Program Code Memory" to write your program over the top of the debug monitor. You must also change the HC12 reset vector at \$FFFE-\$FFFF to point to the start of your program instead of the debug monitor.

You can always reprogram the debug monitor to EEPROM, the file is on the disk called **AX-DB12.S19**.

Using AX12 for Windows

Example Program

For this tutorial we'll use a sample assembly language program in the EXAMPLES sub-directory called HELLO.ASM. This small program sends a text string to your PC serial port.

1. If you haven't done so already, verify that the development board is connected and operating properly by following the steps under GETTING STARTED.
2. From the File Menu, select Assemble or press Control-A.
3. Change to the Examples directory and double-click the source file HELLO.ASM. This will launch a DOS window and execute the batch file DO_ASM.BAT to assemble the hello program.
4. If any errors were found they would be displayed on the screen. Press any key to close the DOS window and return to the AX12W program.

You should now have the new file **HELLO.S19** (a Motorola hex object file) in the EXAMPLES directory. The HELLO program is memory mapped to the development boards EXTERNAL RAM, starting at address \$2000. Follow these steps to load and execute the program using the D-Bug12 Monitor program:

1. Apply power to the board or press RESET to make sure you have a D-Bug12 Monitor prompt.
2. In the AX12W main terminal window, Type LOAD and press ENTER. This will prepare D-Bug12 to receive a program.
3. From the File Menu select Send, or press Control-U.
4. Select the file named HELLO.S19 in the EXAMPLES sub-directory.
5. The program will be sent to the development board thru the serial port. Press the ENTER key to let D-Bug12 know you're finished uploading. If you're familiar with hex record format, you can see the first S1 record starts at \$2000.
6. Type CALL 2000 and press ENTER.
This tells D-Bug12 to execute the subroutine at address \$2000, which is the start of our test program.

If everything is working properly you should see the message "Hello World" echoed back to your terminal screen and, since we return at the end of the hello program, a status message and lines containing the internal register status displayed by D-Bug12. You're then returned to the D-Bug12 prompt.

If you do not get this message try going thru this tutorial once more then, if still no go, see the **TROUBLESHOOTING** section. If the HELLO.ASM file has been modified you'll need to re-load it from the disk, or change it back for this to work.

You can modify the hello program to display other strings or do anything you want. The procedures for assembling your code, uploading it to the board and executing are the same.

D-Bug12 has many powerful features such as breakpoints, assembly/disassembly, memory dump and modify and program trace. Type HELP at the D-Bug12 prompt for a listing of commands.

Programming the External EEPROM

When you're finished with program development you'll probably want to write your program to EEPROM so that it executes automatically when you apply power to the board. There are 2 methods provided by the AX12 software to do this - programming the RESET Vector and Using the Auto-Start feature. If your program is less than 2K, using the Auto-Start feature is simplest because it doesn't over-write D-Bug12, allowing you to switch between it and your program without re-programming.

If your program is greater than 2K or uses interrupt vectors, you'll need to add a RESET vector to your program and must re-program D-Bug12 to use it again. The following tutorial will show you how to program your code using both methods:

1. Use a text editor to modify the HELLO.ASM file used in the previous section as follows:
 - A. Change the start of your program defined by the `, org MONSTRT` to `org PRGSTRT` by commenting out the first (adding a comment character in front of) and removing the comment in front of the second. This change will re-map the code to start at address \$8000 instead of \$2000 which is the beginning of the external EEPROM.
 - B. Remove the comment character in front of the `LDS #STACK` line next. This will load the stack pointer when the program starts. It is important that this NOT be done when running your program under D-Bug12 because it must handle the stack.
 - C. Add a comment character in front of the first `RTS` line. This will allow the program to end gracefully in an endless loop, since it will not be returning to D-Bug12.
2. Save the modified hello program as HELLO2.ASM.
3. Return to AX12W and press Control-A. Assemble the new HELLO2.ASM program. If there are any errors fix them and try again.
4. Select Utilities from the Tools menu or press the Utilities button. Make sure your board is selected and follow the instructions in the dialog box to configure it for programming mode then press RESET on the board.
5. Select Continue to send the programming utilities to the board. **REMEMBER:** If power is removed or the board is RESET at any time, you MUST select Utilities and re-send these instructions again for the programming tools work. This is necessary because the utilities are executing from RAM.
6. Press the Program button and select your new assembled HELLO2.S19 program. This will write it to external EEPROMS.
7. The final step is to tell the board to start your program instead of D-Bug12 whenever power is applied. To do this, select the AutoStart button. Check the box on the left and make the auto-start address the beginning of your program, which we changed to 8000 in step 1. Select OK and now the AutoStart is enabled.
8. To test your new program, remove power from the board and change the MODE switches to run mode (all off). Your program should now start whenever power is applied.

The other method of programming your code to EEPROM so that it starts on powerup is exactly the same, except that instead of using the D-Bug12 AutoStart, you simply program the HC12 RESET vector in your code. Here's how to do that:

1. Use a text editor to modify the HELLO2.ASM file. Remove the comment characters in front of the 2 reset vector lines at the end of the file. Save this new version as HELLO3.ASM.
2. Press Control-A under AX12W and assemble HELLO3.ASM.
3. Select the Utilities button and follow the instructions to re-load the utilities.
4. Turn OFF AutoStart by Un-Checking the box in the AutoStart dialog box.
5. Program the new HELLO3.S19 file using the Program button.
6. Place the MODE switches back in run mode, all off. Your new program now will run at RESET or power-on in place of D-Bug12.

To restore the D-Bug12 monitor, follow the steps above for loading the utilities and programming a file, substituting the file **AX-DB12.S19** located in the AX12W program directory.

Using the Axiom BDM

If you purchased the Axiom 68HC12 BDM, the easiest way to get started is to become familiar with the BDM software. If you have not done so already, install the BDM software now.

After installing and running the BDM software, you must **Configure** it to work properly with the CMD12-A4 board. Select the menu item Config / Configure to see the configuration dialog box.

Make sure the Device select is set to **812A4**. Also the reset Macro file should be selected and point to the directory you installed the BDM software into. There is an example reset macro called RESET.MAC that you should use for now, you can change this later if you like. The macro file will enable the external bus even if it is jumper'd to Single Chip Mode.

To debug code using External RAM set the "Mode after reset" option to Expanded Wide. Whenever the BDM software is RESET, it will use External Memory addressing and will go fetch the address at \$FFFE-\$FFFF as the reset vector and set the Program Counter to this address.

After closing the configuration dialog, click the RESET button in the BDM software so the configuration changes will take effect. The memory will most likely change and the program counter will reset to whatever value is in external RAM location \$FFFE. If you have RAM installed there, you can modify this value using the data window. It's a good idea to set this word in the application program you're debugging.

Example Program

Included on the software disk is a program called HELLO.ASM. This is a simple program that outputs a text string to the HC12 serial port. It can be modified and assembled using the included free assembler, but for now just load it into the BDM by selecting File / Load S19 or Hex from the menu. The file name is HELLO.S19.

This program starts at address \$8000, but since it does not include a RESET vector, you must change the Program Counter manually. Double click the PC address in the Regs window. Type in 8000 and click OK. The Program window should now change to the beginning of the Hello program at address \$8000.

Since this program outputs text to the serial port, you need some way of monitoring that port. If you have not done so already, connect a serial port from your PC to the development board as described under Getting Started. Run the AX12 program and select Terminal Window (or any windows terminal program set to 9600,N,8,1) to monitor the serial port.

Switch back to the BDM program and select GO. To see the result of the program switch back to the Terminal, you should see the message "Hello World" displayed there.

You can use AX12 for DOS or Windows to write your program to external EEPROM.

DEBUG MONITOR

The Debug/Monitor software provides an embedded means for uploading your application software to RAM and executing it in a controlled environment using software breakpoints, trace and memory monitoring features. The Debug software itself resides in the on-board EEPROM devices shipped from the factory. The debug/monitor shipped with this board was originally written by Motorola and modified by Axiom and is called D-Bug12. The code for this program is available on the UTL12 disk in the file called **AX-DB12.S19**.

Unfortunately, the D-Bug12 software resides at address \$A000-\$FFFF starting in the Program Memory Expansion Window Page and is too large to allow complete use of the program page window.

To execute the Debug/Monitor software the MODE switch must be in a Normal Run Mode (see Operating Modes). For most users this will mean all MODE switches are in the default off position.

You should also connect the CMD12-A4 COM1 serial port to your PC COM port with the supplied serial cable and start the AX12 program "Terminal" window. When power is applied to or RESET pressed on the CMD12-A4 the Debug/Monitor prompt will display in the terminal window.

Type HELP at the > prompt to see a current list of commands. If you are familiar with monitor software, such as the Motorola Buffalo monitor, this should be very familiar.

Command	Parameters	Description
ASM	<Address> <CR> <.,>	Assemble/Disassemble Disassemble next instruction Exit assembly/disassembly
BAUD	<baudrate>	Set communications rate for the terminal
BF	<StartAddress> <EndAddress> [<data>]	Fill memory with data
BR	[<Address>]	Set/Display user breakpoints
BULK		Erase entire on-chip EEPROM contents
CALL	[<Address>]	Call user subroutine at <Address>
G	[<Address>]	Begin/continue execution of user code
GT	<Address>	Execute user code to address (temp breakpoint)
HELP		Display this D-Bug12 command summary
LOAD	[<AddressOffset>]	Load S-Records into memory
MD	<StartAddress> [<EndAddress>]	Memory Display Bytes
MDW	<StartAddress> [<EndAddress>]	Memory Display Words
MM	<StartAddress> <CR> </> or <=> <^> or <-> <.,>	Modify Memory Bytes Examine/Modify next location Examine/Modify same location Examine/Modify previous location Exit Modify Memory command
MMW	<StartAddress>	Modify Memory Words (same subcommands as MM)
MOVE	<StartAddress> <EndAddress> <DestAddress>	Move a block of memory
NOBR	[<address>]	Remove One/All Breakpoint(s)
RD		Display all CPU registers
RM		Modify CPU Register Contents
T	[<count>]	Trace <count> instructions
UPLOAD	<StartAddress> <EndAddress>	o Dump Memory in S19 record format
VERF	[<AddressOffset>]	Verify S-Records against memory contents
PC SP X Y A B D	<Register Value>	Set register contents
S XM H IM N Z V C	<CCR Status>	Set Status Bit (1 or 0)

MEMORY MAP

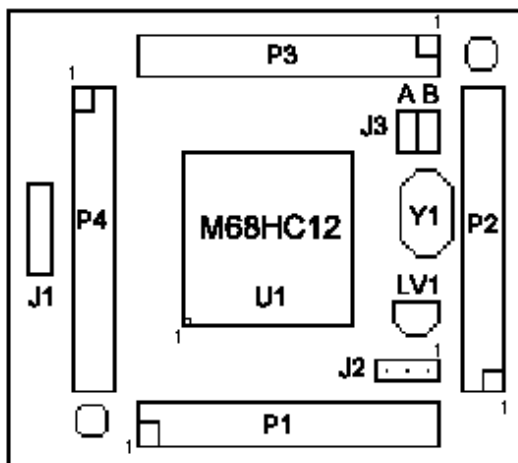
Following is the **DEFAULT NON-EXPANDED** memory map for this development board:

FFFF	RESET Vector	2 Bytes	
FFFE	CSP0 Chip Select		
FFFD	CMD12-A4 ROM SPACE	16K	Page Window
C000			
BFFF	Program Memory Expansion Window Page	16K	
8000			
7FFF		4K	
7000	Data Memory Expansion Window Page		
6FFF			
	CMD12-A4 RAM SPACE	20K	
	CSD Chip Select		
2000			
1FFF			
1F80	Axiom Bootload Kernel		
1F7F			
	HC12 Internal EEPROM Program or Data	4K	
1000			
0FFF	CMD12-A4 RAM Space CSD	1K	
0C00			
0BFF	HC12 Internal RAM	1K	
0800			
07FF	CMD12-A4 RAM Space CS3 EPAGE if used	1K	
0400			
03FF	CS0, CS1, CS2, CS3 if used CMD12-A4 RAM SPACE	512 Bytes	
0200			
01FF	68HC12A4 Internal Registers	512 Bytes	
0000	See HC12A4 Technical Summary (MC68HC812A4) for complete listing and usage information		

HARDWARE

PB68HC12A4 CONTROLLER MODULE

The PB68HC12A4 is installed on the CMD12-A4 board standard to allow replacement if necessary. The CMD12-A4 will mount the MC68HC812A4 Microcontroller directly, please contact the factory if this option is preferred.



OPTIONS AND CONNECTORS

The Option Jumpers on the PB68HC12A4 should not be used while installed on the CMD12-A4 board. The CMD12-A4 performs the necessary option configuration. See OPERATING MODES.

J1 SCI0 Header

The J1 header provides access to the HC12 SCI0 serial channel as follows:

- Pin 1** HC12 Tx/D0
- Pin 2** HC12 Rx/D0
- Pin 3** +Vdd (5 volts)
- Pin 4** Vss (Ground)

J2 Debug Header

The J2 header is an auxiliary Background Debug Port connector.

- Pin 1** RESET active low
- Pin 2** Vss Ground
- Pin 3** BGND debug pin

J3 Mode Option

J3 should be left open while the PB68HC12A4 is installed on the CMD12-A4 board.

P1, P2, P3, P4 I/O Connectors

Refer to Port Connectors section for details.

FEATURES and OPERATION

Y1 Crystal Oscillator

Y1 is 16.00MHz standard. This provides an instruction clock / bus speed of 8mhz to the CMD12-A4.

LV1 Reset Generator

LV1 is a voltage detector that will generate an active low RESET state if Vdd is below +4.4 VDC. This duplicates the operation of the CMD12-A4 RESET Generator.

BOOTLOADER FIRMWARE

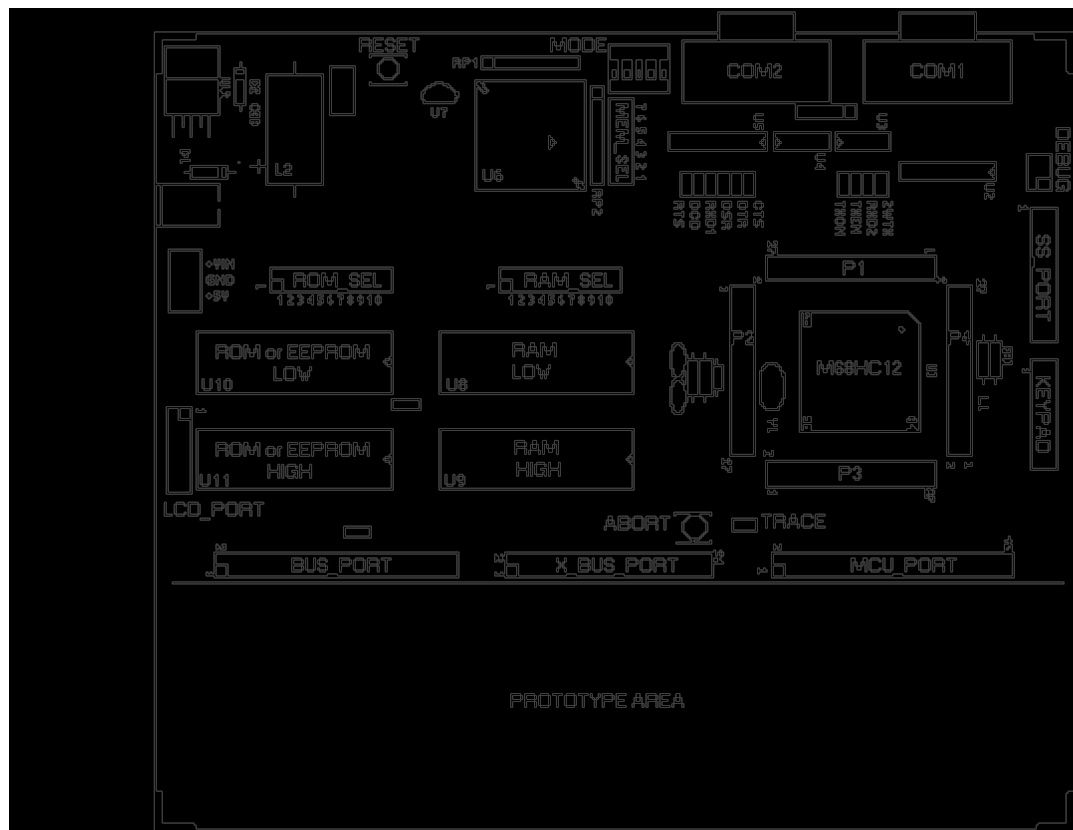
The MC68HC812A4 is pre-programmed with bootload firmware that operates in conjunction with the AX12 Utility software to provide a low cost debugging and programming environment for the M68HC12. The 64 Byte firmware is programmed into the internal HC812A4 EEPROM and becomes operational when the HC812A4 is in Single Chip Mode to support AX12 utility operations. Firmware memory is mapped as follows:

Single Chip Mode (normal)	\$FF80 - \$FFBF and \$FFFE/FFFF = Reset Vector
Expanded Modes (default)	\$1F80 - \$1FBF and \$1FFE/1FFF = \$FF80

Caution should be used when programming or erasing the internal 68HC812A4 EEPROM to assure the bootloader firmware is not erased or corrupted. The EEPROT Register (Location \$00F1 default) bits 0 and 1 should be set high during the users software initialization sequence to protect the bootloader firmware.

If the bootloader firmware is erased or corrupted it can be re-installed with the Monitor/Debugger operating in Normal Run Modes by loading the BOOTLOAD.S19 file and executing a G \$0800 instruction. If the Monitor/Debugger has been overwritten in the on-board EEPROMs also, then a EEPROM programmer must be used to reprogram the EEPROM(s) with the program file called **AX-DB12.S19** to restore the Monitor operation and then reload the Bootloader as described above.

CMD12-A4 BOARD



OPERATING MODES

The CMD12-A4 allows maximum use of the features of the MC68HC12A4 by allowing the user to select the size of the data bus and memory space. This allows the user to configure the board for maximum use of the I/O lines, memory size, execution speed and other requirements. To provide these features, allow for programmability and provide a low cost development method the CMD12-A4 board uses an ON-BOARD MEMORY CONTROLLER (OBMC). The OBMC provides the necessary control signals required to program the On-Board EEPROM Memory, perform data bus size switching so both 8 and 16 bit devices can share the data bus, supply control signals to access off-board memory and determine on-board memory space size.

The operating mode of the 68HC12A4 and the CMD12-A4 OBMC are defined by the MODE SWITCH and MEM_SEL Option Jumpers. The MODE Switch defines the operating mode of the 68HC12A4 and OBMC. The MEM_SEL jumpers enable the 68HC12A4 predefined chip selects (CSP0, CSP1, CSD, CS3, and CS2) to access on-board memory via the OBMC. MEM_SEL also enables the use of address lines A20 and A21 for expanded memory space access or other 68HC12A4 features.

NORMAL RUN MODE

Normal Run Mode refers to the CMD12-A4 and the HC12 operating in a normal expanded memory access mode. MODE Switch position 4 must be OFF. In this mode the HC12/CMD12-A4 is operating via instruction and data accesses to on or off-board external memory.

PROGRAM MODE

Program Mode refers to the CMD12-A4 in programming mode with MODE Switch position 4 on and the HC12 is in single Chip Mode with MODE Switch positions 1 and 2 on. This allows the Bootloader kernel (firmware) to operate and have access to all of memory space for reading or programming. In Programming Mode the HC12 is configured for maximum memory access (expanded memory windows enabled for CSP0 and CSD). External devices connected to the X_BUS_PORT or MCU_PORT that may affect high order address lines or data lines should be removed.

MODE SWITCH

The MODE Switch selects the HC12 operating mode and the CMD12-A4 ON-BOARD MEMORY CONTROLLER (OBMC) memory access mode.

- Positions 1 & 2** HC12 MODA and MODB inputs respectively select the HC12 operating Mode. OFF places a high level and ON places a low level on the corresponding Mode pin.
- Position 3** Selects CMD12-A4 On-Board memory space expansion off or on (16 or 21 bit addressing) in Normal Run Mode. Selects Programming Mode 16 or 8 bit data bus width in Programming Mode.
- Position 4** Selects Normal Run Mode or Memory Programming Mode.
- Position 5** Selects chip select CSP1 Swap on or off. This allows CSP1 to access On-Board RAM Space instead of On-Board Program Space for debugging purposes. Normally RAM Space is reserved for chip select CSD. Note that if Swap is on, both CSD and CSP1 access the same On-Board memory devices.

Following is a table of the **VALID** Mode Switch settings for different operations:

1	2	3	4	5	
✓ ■	■	■	■	■	Expanded Wide (16 bit Bus), 32K Data, 32K Program Space On-Board
■	On	■	■	■	Expanded Narrow (8 bit Bus), 32K Data, 32K Program Space On-Board
■	■	On	■	■	Expanded Wide (16 bit Bus), 512K Data, 2M Program Space On-Board
■	On	On	■	■	Expanded Narrow (8 bit Bus), 512K Data, 2M Program Space On-Board
On	On	■	On	■	Single Chip, Program Mode (16 bit data bus width/ U10&U11 installed)
On	On	On	On	■	Single Chip, Program Mode (8 bit data bus width/ only U11 installed)
			On		CSP1 = Swap On, Access On-Board RAM
			■		CSP1 = Swap Off, Access On-Board EEPROM

- Narrow mode uses memory devices: U9 for Data-RAM, U11 for Program-EEPROM
U8 and U10 removed
- Wide Mode uses memory devices: U8 and U9 for Data-RAM
U10 and U11 for Program-EEPROM

The CMD12-A4 should be RESET whenever the Mode Switch is changed.

MEM_SEL (CHIP SELECT) Option Jumpers

The Memory Select Option Jumpers enable or disable the 68HC12A4 predefined chip selects and high order address lines A20 and A21 for use by the On-Board Memory Controller.

Position Function Jumper Installed = Enabled ✓ = default on

✓ 1	Enable address line 21
2	Enable address line 20
✓ 3	Enable CS2 – Peripheral Chip Select (128 bytes at \$380 - \$3FF)
4	Enable CS3 – EPAGE Extra Page, RAM
✓ 5	Enable CSD – Data
6	Enable CSP1 – Page Chip Select
✓ 7	Enable CSP0 – Must be installed for programming

- CS2 must be ON to use the LCD_PORT connector (8 bit access enabled in software).
- CSP0 must be enabled for on-board program to operate.

ROM_SEL and RAM_SEL - Memory Device Selection Jumpers

The type and size of memory devices installed on the CMD12-A4 board is configured using the RAM_SEL and ROM_SEL option jumpers. Devices installed in U10 and U11 sockets should be either EPROM, EEPROM, or FLASH EPROM type devices. Devices installed in U7 and U8 should be Static RAM or EEPROM type devices. Larger memory devices in 32 pin packages may be used without memory space expansion or high order address lines enabled (Mode switch position 3). The On-Board Memory Controller will allow access to the lower addresses of the large memory device by forcing Memory Address lines MA16 thru MA21 low.

The factory setting for the jumpers should be correct for the memory devices that came with your board. If you add or modify the type or size of memory, you must change the following jumpers accordingly. All jumpers are two-pin jumpers and are installed vertically.

ROM_SEL

x = Jumper Installed

1 = Jumper is WRITE ENABLE. Protects EEPROM and FLASH from accidental overwrite if removed after programming.

Device	Size (in bytes)	1	2	3	4	5	6	7	8	9	10
27256	32K ROM		x						x	x	
✓ 28256	32K EEPROM	x							x		1
27512	64K ROM		x						x	x	
29512	64K FLASH		x				1			x	
27010	128K ROM		x						x	x	
28010	128K EEPROM	x					1			x	
29010	128K FLASH		x				1			x	
27020	256K ROM		x					x		x	
29020	256K FLASH		x				1	x		x	
27040	512K ROM		x		x	x		x		x	
28040	512K EEPROM	x		x			1	x		x	
29040	512K FLASH		x	x			1	x		x	
27080	1024K ROM		x		x	x		x		x	

RAM_SEL

x = Jumper Installed

1 = Jumper is WRITE ENABLE

Device	Size (in bytes)	1	2	3	4	5	6	7	8	9	10
✓ 62256	32K RAM	x							x		1
28256	32K EEPROM	x							x		1
62010	128K RAM	x		x		x			x		1
28010	128K EEPROM	x					1			x	
62040	512K RAM	x		x		x		x			1
28040	512K EEPROM	x		x			1	x		x	

You can determine the size of a memory device by reading the label on top of the chip. Memory devices that contain 256 in the part number are usually 8K byte. Those with 512 are usually 64K. If you don't recognize the memory type you can look up the part number in a catalog or device manual. If the chip is by Atmel™ or XICOR™ it's probably an EEPROM. If it has HY or SEC it's probably RAM.

Address Decoding and Expanding Memory

The CMD12-A4 ships standard with 128K bytes of on board memory. The 68HC12 Microcontroller can access up to 4 Megabytes of program space (CSP/CSP1) memory or 1 Megabyte of data space memory (CSD or CS3 EPAGE) using special memory expansion address windows and memory page operations. The CMD12-A4 On-Board Memory Controller can also provide additional address decoding to allow on and off board memory operations. On-Board RAM (U8 and U9) space is accessed with HC12 chip select CSD normally. Access to RAM is also provided via the CS3 EPAGE or CSP1 chip select if enabled. On-board ROM (U10 and U11) space is accessed with HC12 CSP0 normally and CSP1 optionally.

The CMD12-A4 board is configured to allow memory expansion in 2 basic modes determined by MODE Switch position 3 in normal run modes. Switch 3 OFF configures the CMD12-A4 to provide 64K bytes of on-board memory and all other memory off-board. Switch position 3 ON enables memory expansion on-board up to half the available HC12 addressable memory space with 2M Byte Program space and 512K Byte of Data space.

When memory expansion is enabled on the CMD12-A4, the memory map is split in the center so that Data space (CSD or CS3 EPAGE) expands from address 0 upward to 512K (A19 low) and resides in RAM (U8 & 9). Program space (CSP0 or CSP1) expands downward to 2M byte (A21 high) from address \$3F,FFFF hex and resides in ROM (U10 & U11). The rest of the Data space (A19 high) and Program space (A21 low) may be accessed off board. X_BUS_PORT Control signals EXDAT and EXPRG (both active low) provide off-board address access decoding.

For example, to expand memory space the appropriate bits in the HC12 WINDEF register will enable memory paging with the HC12 chip selects. If CSD expansion is enabled with DPAGE, memory between \$7000 - \$7FFF is available as 256 x 4K data pages of which the lower 128 pages may be accessed on-board. The DPAGE register contains the data page number currently being accessed. Also available are 256 x 16K program pages from \$8000 - \$BFFF if the PPAGE is enabled. The PPAGE register contains the program page number.

Off-board memory expansion is possible via the BUS_PORT and X_BUS_PORT Connectors. Section 10 of the Motorola HC12 Reference Manual explains this technique in detail. Also see Section 8 of the MC68HC812A4 Technical Data book for complete configuration register and chip select information.

PORTS and CONNECTORS

PB68HC12A4 - I/O Connectors

The Motorola M68HC12 Microcontroller is attached to four dual row 14 pin connectors (28 pins each) which are configured as follows:

P1														P2													
Vss	1	1	2	2	Vdd					D9/PC1	29	1	2	30	PC2/D10												
PJ0	3	3	4	4	PJ1					D11/PC3	31	3	4	32	PC4/D12												
PJ2	5	5	6	6	PJ3					D13/PC5	33	5	6	34	PC6/D14												
PJ4	7	7	8	8	PJ5					D15/PC7	35	7	8	36	PE0/XIRQ												
PJ6	9	9	10	10	PJ7					IRQ/PE1	37	9	10	38	PE2/R/W												
A16/PG0	11	11	12	12	PG1/A17					LSTR/PE3	39	11	12	40	/RESET												
A18/PG2	13	13	14	14	Vdd					Vss	41	13	14	42	Vdd												
Vss	15	15	16	16	PG3/A19					Vddpll	43	15	16	44	XFC												
A20/PG4	17	17	18	18	PG5/A21					Vsspll	45	17	18	46	EXTAL												
BKGD	19	19	20	20	PD0/D0					XTAL	47	19	20	48	PE4/ECLK												
D1/PD1	21	21	22	22	PD2/D2					MODA/PE5	49	21	22	50	PE6/MODB												
D3/PD3	23	23	24	24	PD4/D4					ARST/PE7	51	23	24	52	PB0/A0												
D5/PD5	25	25	26	26	PD6/D6					A1/PB1	53	25	26	54	PB2/A2												
D7/PD7	27	27	28	28	PC0/D8					A3/PB3	55	27	28	56	PB4/A4												

P3														P4													
A5/PB5	57	1	2	58	PB6/A6					V _{RH}	85	1	2	86	V _{RL}												
A7/PB7	59	3	4	60	PA0/A8					PAD0	87	3	4	88	PAD1												
A9/PA1	61	5	6	62	PA2/A10					PAD2	89	5	6	90	PAD3												
A11/PA3	63	7	8	64	PA4/A12					PAD4	91	7	8	92	PAD5												
A13/PA5	65	9	10	66	PA6/A14					PAD6	93	9	10	94	PAD7												
A15/PA7	67	11	12	68	PF0/CS0					V _{DDA}	95	11	12	96	V _{SSA}												
CS1/PF1	69	13	14	70	PF2/CS2					RxD0/PS0	97	13	14	98	PS1/TxD0												
CS3/PF3	71	15	16	72	PF4/CSD					RxD1/PS2	99	15	16	100	PS3/TxD1												
CSP0/PF5	73	17	18	74	PF6/CSP1					SDI/PS4	101	17	18	102	PS5/SDO												
PH0	75	19	20	76	PH1					MOSI/PS6	103	19	20	104	PS7/SCK												
PH2	77	21	22	78	PH3					PT0	105	21	22	106	PT1												
Vdd	79	23	24	80	Vss					PT2	107	23	24	108	PT3												
PH4	81	25	26	82	PH5					PT4	109	25	26	110	PT5												
PH6	83	27	28	84	PH7					PT6	111	27	28	112	PT7/PAI												

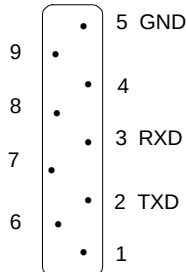
- The small numbers next to the connector pin numbers are MC68HC812A4 package pin numbers for reference.
- The PB68HC12A4 contains the crystal oscillator and an additional RESET generator.
- See the M68HC812A4 Technical Manual or PB68HC12A4 Manual for more information.

SERIAL COM PORTS

COM1 interfaces to the HC12 internal SCI0 serial port (I/O PS0 and PS1) and is a simple three wire asynchronous serial interface with hard wired Clear to Send (CTS) and Data Terminal Ready (DTR). These two logic level signals are coupled thru an RS232 level shifter to the COM1 connector.

COM1 is the default serial interface for the Monitor/Debugger and AX12 utility software.

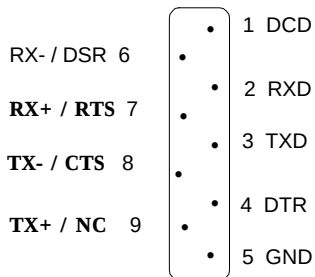
COM1 DB9S Style Connector



- Permanent jumpers between following pins:
4 → 1 and 6 (DTR/DSR/DCD)
7 → 8 (RTS/CTS)
- COM1 is set to connect directly to a PC serial port with a straight thru type of cable (supplied).

COM2 interfaces to the HC12 SCI1 serial port (I/O PS2 and PS3) and can be implemented either as an RS232 communications port or as an RS422/RS485 communications port. Additional HC12 I/O lines are available to provide control and handshake signals for the serial port. Normal 422/485 interface access is provided at the 485 Header, however, these signals can be coupled to the COM2 DB9P connector with a simple modification.

COM2 DB9P Style Connector



- To connect COM2 to a PC serial port you must use a NULL modem cable or NULL modem adapter.
- Option jumpers RXD1 and RXD2 select the serial receive data source as RS232 or RS422/485 respectively. Only one jumper should be installed.
- Handshake and Control signals may be provided by HC12 I/O Port J lines PJ0 to PJ3. Port J provides Interrupt capability to enhance the operation of COM2 in software.
- RX-/RX+/TX-/TX+ are 422/485 signals if the option is used.

COM2 RS232 Option Jumpers

RXD1	ON selects COM2 Receive as RS232 mode
DTR	ON selects HC12 PJ0 as DTR control output
CTS	ON selects HC12 PJ1 as CTS control input
DSR	ON selects HC12 PJ2 as DSR control input
DCD	ON selects HC12 PJ3 as DCD control
RTS	ON selects HC12 PJ0 as RTS control output

NOTE: Port J must be configured in software to perform the control function. Control output options not selected are defaulted to the active level on the CMD12-A4 board.

COM2 RS422/485 Option Jumpers

The RS422/485 interface translators are specified for the higher load of 485 type networks. However, the interface can be option configured to operate as both 422, 485, or a modified version of either. HC12 Port J0 line provides the TX enable for multi-drop applications. Following is the option chart:

RXD2	ON selects COM2 Receive as RS422/485 mode
2WTX	ON selects 2 wire Transmit and Receive with PJ0 as the TX enable control. 2W Interface is 485 header pins 1 and 2 and optionally COM2 pins 6 and 7.
TXEN	ON selects 4W Mode with PJ0 as the TX enable control. 485 Header pins 1 and 2 are Receive and pins 3 and 4 are Transmit (optionally COM2 pins 6,7,8 and 9).
TXON	ON selects 4W mode with Transmit Enabled ON, no control. (Jumper is TXEN or TXON, never both)

485 HEADER

1	2W TX/RX or 4W RX B wire (-)
2	2W TX/RX or 4W RX A wire (+)
3	4W TX B wire (-)
4	4W TX A wire (+)
5	Ground

COM2 DB9P to RS422/485 Connection Option

To connect the COM2 DB9P connector pins 6 to 9 to the 422/485 interface the following modification can be performed:

1. Remove the U5 (MC145406) IC from its socket and store for possible future use.
2. Install shorting wires on the underside of the CMD12-A4 across empty component pads labeled R11, R12, R15 and R16.
3. To restore RS232 operation, remove shorting wires at R11, R12, R15 and R16 and re-install U5.

KEYPAD Connector

The KEYPAD connector is an eight position connector that implements HC12 Port H as a passive keypad interface. This interface is implemented as a software keyscan. Pins PH0 - PH3 are columns which are reset low to read the row condition on PH4 - PH7 which are active low. See the file **KEYLCD12.ASM** on the software disk for an example program using this keypad connector.

1	2	3	4	5	6	7	8
H0	H1	H2	H3	H4	H5	H6	H7

LCD_PORT Connector

The LCD Display interface is connected to the data bus and memory mapped to locations \$3F0 thru \$3F3 and controlled by CS2 which must be jumper enabled (see MEM_SEL). Due to bus speed requirements of the LCD Modules the read and write addresses of the LCD are separated. Addresses \$3F0 and \$3F1 are Command Write and Data Write respectfully. Addresses \$3F2 and \$3F3 are Command Read and Data Read respectfully. Caution must be used not to Write to the Read addresses as a bus conflict will occur.

The interface supports all OPTREX™ DMC series displays up to 80 characters and provides the most common pinout. Power, ground, and Vee are also available at the LCD_PORT connector. The potentiometer, VR1 Vee ADJUST located near the RESET Switch, is used to adjust the contrast of the LCD display by varying Vee from +5 to -5 Volts.

See the file **KEYLCD12.ASM** on the software disk for an example program using this LCD connector.

+5V	2	1	GND
MA0	4	3	Vee
LCDCS	6	5	MA1
D9	8	7	D8
D11	10	9	D10
D13	12	11	D12
D15	14	13	D14

3F0/3F2 LCD Control Register

3F1/3F3 LCD Data Register

BUS_PORT			MCU_PORT			X_BUS_PORT		
GND	1 2	D11	PH0	1 2	PH1	GND	1 2	D3/PD3
D10	3 4	D12	PH2	3 4	PH3	PD2/D2	3 4	D4/PD4
D9	5 6	D13	PH4	5 6	PH5	PD1/D1	5 6	D5/PD5
D8	7 8	D14	PH6	7 8	PH7	PD0/D0	7 8	D6/PD6
MA0	9 10	D15	+5V	9 10	GND	MA14	9 10	D7/PD7
MA1	11 12	MA2	V _{RH}	11 12	V _{RL}	MA16	11 12	MA15
MA10	13 14	MA3	PAD0	13 14	PAD1	MA18	13 14	MA17
/OE	15 16	MA4	PAD2	15 16	PAD3	PG4/A20	15 16	MA19
MA11	17 18	MA5	PAD4	17 18	PAD5	SIZE	17 18	A21/PG5
MA9	19 20	MA6	PAD6	19 20	PAD7	/EXDAT	19 20	/EXPRG
MA8	21 22	MA7	PT0	21 22	PT1	CS0/PF0	21 22	PF1/CS1
MA12	23 24	MA13	PT2	23 24	PT3	CS2/PF2	23 24	PF5/CP0
/WR	25 26	Y0	PT4	25 26	PT5	CSD/PF4	25 26	PF6/CP1
Y1	27 28	Y2	PT6	27 28	PT7	+5V	27 28	PE5/MA
Y3	29 30	Y4	PJ0	29 30	PJ1	LST/PE3	29 30	PE6/MB
Y5	31 32	/IRQ	PJ2	31 32	PJ3	ARS/PE7	31 32	GND
+5V	33 34	CS3	PJ4	33 34	PJ5	XIRQ/PE0	33 34	GND
R/W	35 36	Y6	PJ6	35 36	PJ7			
ECLK	37 38	Y7	PG0/A16	37 38	A17/PG1			
GND	39 40	/RESET	PG2/A18	39 40	A19/PG3			

The **BUS_PORT** and **X_BUS_PORT** support off-board memory or peripheral devices. The **MCU_PORT** provides access to the peripheral features and I/O lines of the HC12.

BUS_PORT Signals

D8 - D15	High Byte Data Bus in Wide Expanded Mode, Data Bus in Narrow Expanded mode or for 8 bit accesses in Wide Mode.
MA0 – MA13	Memory Address 0 to 13, Driven by Bus Size Switch for bus addressing.
/OE	Memory Output Enable signal, Active Low. Valid with ECLK and R/W high.
Y0 - Y7	Auxiliary Chip Selects, 16 Bytes each located at \$380 hex to \$3FF hex driven by HC12 CS2 chip select. MEM_SEL option jumper 3 to enable.
/WR	Memory Write Enable signal, Active Low. Valid with ECLK high and R/W low.
/IRQ	HC12 IRQ (PE1) Interrupt Input.
CS3	HC12 chip select CS3 (PF3). BUS_PORT can expand to memory or peripheral devices using the CS3 chip select.
R/W	HC12 Read/Write (PE2) control signal.
ECLK	HC12 ECLK (PE4) bus clock signal. Stretch should be enabled in software.
/RESET	CMD12-A4 active low RESET signal.

X_BUS_PORT Signals and I/O

PD0/D0 - PD7/D7	HC12 Port D lines, Low Byte Data Bus in Wide Expanded Mode.
MA14 – MA19	Memory Address 14 to 19, Driven by Bus Size Switch for proper bus size addressing. MA16 to MA19 are forced low if not using Expanded Memory Access (see Mode Switch). PG4/A20 - PG5/A21 HC12 Port G4/5 or A20/A21 address lines respectfully.
SIZE	Bus width signal generated by OBMC (see Operating Modes). High level signal is 16 bit (Wide) data bus and low level signal is 8 bit (narrow) bus. Signal operates the on-board bus size switch.
/EXPRG	External (off-board) Program Memory Access signal. Low active signal when HC12 CSP0 or CSP1 chip select access is outside on-board ROM Space memory range.
/EXDAT	External (off-board) Data memory Access signal. Low active signal when HC12 CSD chip select is outside on-board RAM Space memory range.
CS0/PF0 - CSP1/PF6	HC12 Programmable Chip Selects or Port F I/O port.
PE3/LSTRB	HC12 Port E3 is used as the LSTRB signal to indicate bus size changes to the OBMC. User initialization software should support this operation.
PE5/MODA - PE6/MODB	HC12 Mode Select A and B or Port E5 and 6 I/O lines. These lines must be available as inputs during RESET operation to select the HC12 operating mode.
PE7/ARST	HC12 Port E7 is available as a general purpose I/O.
PE0/XIRQ	HC12 Port E0 or XIRQ interrupt input is used as the ABORT Switch while the Debug/Monitor is operating.

MCU_PORT Lines

PH0 - 7	Port H I/O lines. Also used as the CMD12-A4 Keypad Port.
Vrh/Vrl	HC12 A/D Converter Reference Pins. See A/D Reference Section.
PAD0 - PAD7	HC12 Port AD is an input port or the A/D Converter inputs.
PT0 - PT7	HC12 Port T is a general purpose port or Timer I/O port.
PJ0 - PJ7	HC12 PortJ lines. Also used as CMD12-A4 COM2 and SS_Port control.
PG0/A16 - PG3/A19	HC12 Port G I/O lines, available if expanded memory space not used.

A/D Reference Lines

The VRH and VRL lines from the HC12 are connected to +5v through R2 and to ground through R1 respectively. These two surface mount resistors are on the bottom (solder) side of the CMD12-A4 board. The resistors are identified on the silk screen by their reference designators. The appropriate resistor(s) need to be removed in order to apply an external reference to the VRH and/or VRL inputs.

SS_PORT Connector

The Simple Serial connector can be used to communicate with external devices through the SPI Port features of the 68HC12. Up to five separate SPI serial devices can be supported by the SEL lines defining PJ4 - PJ7.

See the files **SS-AD12.ASM** and **SS-DA12.ASM** for example programs using this connector. Prebuilt Simple Serial devices with software drivers are available from the manufacturer.

		----- SPI -----				----- Select Lines -----			
		MISO	MOSI	SCK	SS	SEL1	SEL2	SEL3	SEL4
1	2	3	4	5	6	7	8	9	10
+5	GND	PS4	PS5	PS6	PS7	PJ4	PJ5	PJ6	PJ7

CMD12-A4 OTHER FEATURES

Trace Jumper

The Trace Jumper is not used at this time and should not be installed.

RESET Generation

The CMD12-A4 has a voltage level detector (U7) that generates an active low Reset when the supply voltage is below ~4.5VDC. The RESET Switch will apply a ground to the Reset line as long as the switch is depressed.

Power Supply

The CMD12-A4 has a switching regulator power supply that accepts +6 to +30VDC and outputs +5VDC at up to 500ma. Normally input voltages are supplied by the provided wall-plug installed into J6. TB1 provides access to output or optional input to the +V input voltage, Ground and +5VDC system supply. Caution should be used if supplying an external +5VDC system voltage so that a voltage level of +6VDC is not exceeded or permanent damage to components on the CMD12-A4 board may occur.

ABORT Switch

The Abort Switch applies a Ground to the HC12 XIRQ interrupt input. It is used by the Debug/Monitor to abort user programs executing under the Monitor.

PHASE-LOCKED LOOP

CMD12-A4 HC12 PLL loop filter components RX1, CX1 and CX2 are not installed. If PLL operation is desired, the user should review the Motorola Application Note and determine the component values to be used for the frequency of desired operation.

DEBUG Port

The CMD12-A4 Debug Port is a 6 pin header compatible in pinout with the Motorola BDM Pod specification. Axiom manufactures a Background Debug Module for this board, the part number is **AX-BDM12**.

TROUBLESHOOTING

The CMD12-A4 board is fully tested and operational before shipping. If it fails to function properly, inspect the board for obvious physical damage first. Ensure that all socketed IC devices are properly seated in their sockets.

The most common problems are improperly configured communications parameters and attempting to use the wrong COM port (on the PC AND on the development board). Verify that your communications port is working by substituting a known good serial device, or by doing a loop back diagnostic. Verify that no other devices are conflicting with the port (such as a mouse, modem, etc.).

Check your hardware configuration jumpers and switches. Verify the power source. You should measure 9 volts between GND and +9V test point pads on the board near J1. If no voltage is found, verify wallplug connections to 115VAC outlet and power connector. Disconnect all external connections to the board except for COM1 to the PC and the wall plug. Follow these steps in the order given:

Troubleshooting Steps

1. Visual Inspection
2. Verify that all MODE switches are switched OFF.
3. Verify power by checking for +9 volts between GND and +9V test point pads.
4. Verify the Monitor EEPROM for proper installation (no bent pins) and proper jumper settings for the device used.
5. Re-Check the communications parameters.
6. Disconnect any peripheral devices including display and keyboard.
7. Make sure that the RESET line is not being held low.
8. Verify presence of 8MHz sine wave on the crystal if possible.
9. Please check off these steps and any others you may have performed before calling so we can better help you.

Tips and Suggestions

Following are a number of tips, suggestions and answers to common questions that will solve most problems users have with the AX12 development system. This information is also available in the AX12 program under Troubleshooting, which will have the most complete, updated information. There also may be a newer version of the AX12 utility software available. You can download the latest version for FREE on our web page at: WWW.AXMAN.COM

AX12 Program

- If you're trying to program memory or start the HC12 Utilities, make sure MODE switches 1, 2 and 4 are all ON and 5 is off. Switch 3 should be ON for 8-bit mode, OFF for 16-bit mode.
- If you're trying to execute a program, for example running the Debug Monitor from the Terminal window, the MODE Switches must be set to Expanded mode. Usually this means all switches OFF, however check the MODE Switch section if you're not sure.
- If every other byte you read is wrong (\$FB for example) then the board is probably set to 16-bit mode and you are accessing it as 8-bit mode.
- Be certain that the data cable you're using is bi-directional and is connected securely to both the PC and the board. Also, make sure you are using the correct serial port.
- Make sure the correct power is supplied to the board. You should only use a 9 volt, 300 mA adapter or power supply. If you're using a power strip, make sure it is turned on.
- Make sure you load your code to an address space that actually exists. See the Memory Map if you're not sure.
- If you're running in a multi-tasking environment (such as Windows™) close all programs in the background to be certain no serial conflict occurs.
- If the Assembler menu option doesn't work properly on your system you can modify it's operation by editing the file DO_ASM.BAT in the AX12 directory. This can also be done from the Options menu.
- You can reset all AX12 configuration options to their original state by deleting the file named AX12.CFG. This file will be re-created the next time you run AX12.

Code Execution

- Make sure ALL jumpers are set correctly according to your board's configuration. Read the hardware manual section on jumpers carefully if you're not sure.
- Always remember to move the MODE switches 1,2,3 and 4 back to their correct positions after programming memory.
- If you're using D-Bug12 breakpoints are not acknowledged if you use the monitor CALL. You must use one of the GO commands instead. This will be fixed in a later version.
- If you programmed your code into EEPROM memory over the Debug Monitor and it doesn't run check the HC12 reset vector located at FFFEh - FFFFh. These 2 bytes contain the address in the micro. where execution will begin when the unit is powered on.