CMS12-A4

Development Board

xiom
Manufacturing

 717 Lingco Dr., Suite 209 • Richardson, TX 75081 • (972) 994-9676 FAX (972) 994-9170
email: Gary@axman.com • web: http://www.axman.com

CONTENTS

GETTING STARTED 3

CMS12 BOARD 3
DEVELOPMENT PHILOSOPHY 4

SOFTWARE 4

DOCUMENTATION 4

MEMORY MAP 5

BOOTLOADER FIRMWARE 5

HARDWARE 6

PB68HC12A4 CONTROLLER MODULE 6
PORTS AND CONNECTORS 7
PB68HC12A4 - I/O Connectors 7
SERIAL COM PORT 8
A/D Reference 8
CMS12 OTHER FEATURES 8

TROUBLESHOOTING 9

GETTING STARTED

The Axiom CMS12-A4 board is a fully assembled, single chip development board 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 CMS12-A4 board.

3. Apply power to the board by plugging in the wall plug power supply that came with the system.

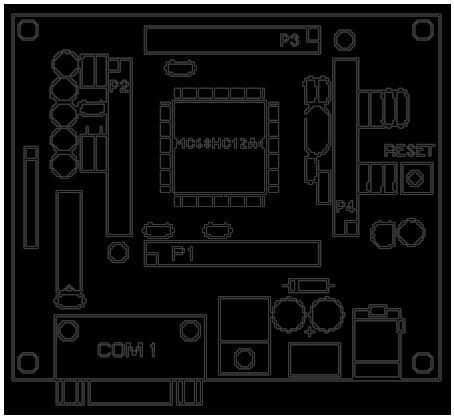
4. If you have AX12 for Windows:
   - Run the AX12W program. From Edit/Options menu, select the COM port you're using on your PC.
   - Press the Utilities button and select the CMS12-A4 board.
   - Follow the instructions onscreen to send the utilities software to the board.

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 CMS12-A4.
   - From the AX12 menu select HC12 Utilities.
   - Follow the instructions onscreen to send the utilities software to the board.

6. If everything is working properly, the bootload software should be sent to the CMS12 board after which you can read and write to the 68HC12 Internal EEPROM memory.

If you receive an error message, see the **TROUBLESHOOTING** section of this manual.

CMS12 Board



Development Philosophy

Software development on the CMS12-A4 can be performed using a Background Debug Module (BDM) connected to the DEBUG connector on the PB module to assist in creating and debugging your program stored in RAM or Internal EEPROM (see the Memory Map).

After satisfactory operation running under a debugger, your program can be written to Internal EEPROM thru the BDM or using the AX12 (or AX12W) utility program. When programming is complete your program will run automatically when the CMS12-A4 is powered on or RESET is applied.

SOFTWARE

There are many useful programs on the UTL12 disk included with the CMS12-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 CMS12-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 CMS12-A4.

In addition to the AX12 terminal, most communications programs will work with the CMS12-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 manufacturers a Background Debug Module for this board, which is a powerful real-time source level debugging tool. Contact Axiom for more information.

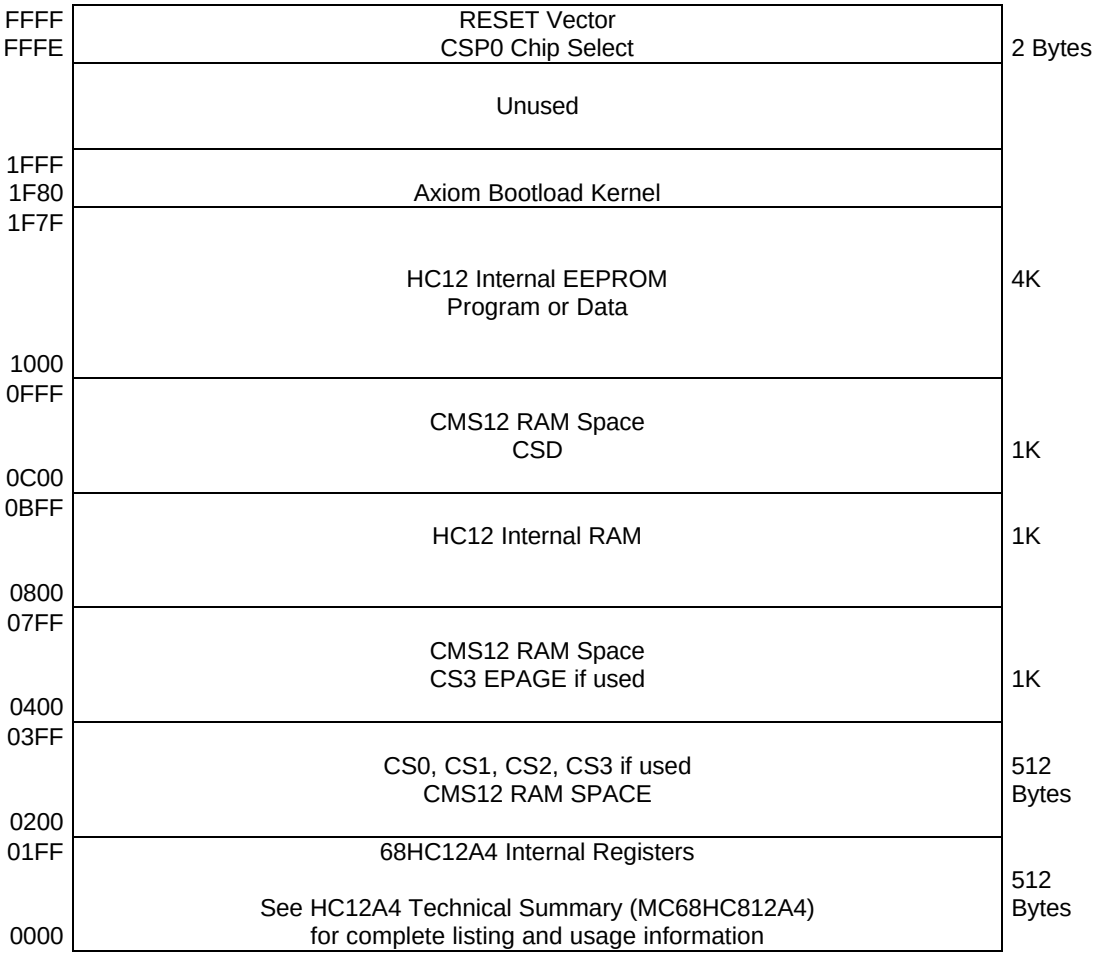
DOCUMENTATION

All of the documentation for the CMS12-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.

MEMORY MAP



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

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

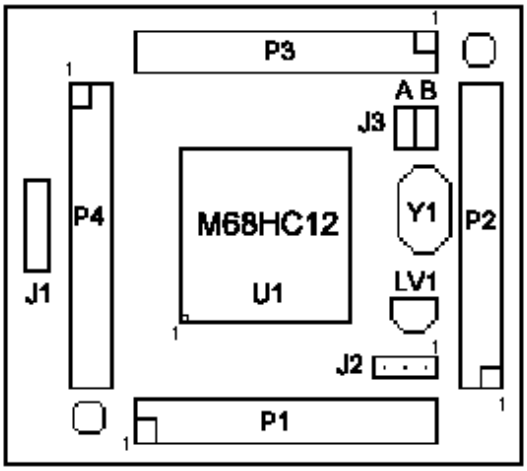
Caution should be used when programming or erasing the internal 68HC812A4 EEPROM to assure the bootload firmware is not erased or corrupted. The EEPROT Register (Location $00F1 default) bits 0 and 1 should be set high during the users software initialization sequence to protect the bootload firmware.

HARDWARE

PB68HC12A4 Controller Module

The PB68HC12A4 is installed on the CMS12 board as a standard to allow replacement if necessary. The CMS12 will mount the MC68HC812A4 Microcontroller directly, please contact the factory if this option is preferred.

The Options Jumpers on the PB68HC12A4 should not be used while installed on the CMS12 board.



J1 SCI0 Header

The J1 header provides access to the HC12 SCI0 serial channel.

PIN 1	HC12 TxD0
PIN 2	HC12 RxD0
PIN 3	+Vdd (5 volts)
PIN 4	Vss (Ground)

J1 Debug Header

The J2 header is an auxiliary Background Debug Port.

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 CMS12 board.

Y1 Crystal Oscillator

Y1 is 16.00MHz standard. This provides an instruction clock / bus speed of 8mhz to the CMS12.

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 CMS12 RESET Generator.

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

Vss	1	**1**	**2**	2	Vdd
PJ0	3	**3**	**4**	4	PJ1
PJ2	5	**5**	**6**	6	PJ3
PJ4	7	**7**	**8**	8	PJ5
PJ6	9	**9**	**10**	10	PJ7
A16/PG0	11	**11**	**12**	12	PG1/A17
A18/PG2	13	**13**	**14**	14	Vdd
Vss	15	**15**	**16**	16	PG3/A19
A20/PG4	17	**17**	**18**	18	PG5/A21
BKGD	19	**19**	**20**	20	PD0/D0
D1/PD1	21	**21**	**22**	22	PD2/D2
D3/PD3	23	**23**	**24**	24	PD4/D4
D5/PD5	25	**25**	**26**	26	PD6/D6
D7/PD7	27	**27**	**28**	28	PC0/D8

P2

D9/PC1	29	**1**	**2**	30	PC2/D10
D11/PC3	31	**3**	**4**	32	PC4/D12
D13/PC5	33	**5**	**6**	34	PC6/D14
D15/PC7	35	**7**	**8**	36	PE0/XIRQ
IRQ/PE1	37	**9**	**10**	38	PE2/R/W
LSTR/PE3	39	**11**	**12**	40	/RESET
Vss	41	**13**	**14**	42	Vdd
Vddpll	43	**15**	**16**	44	XFC
Vsspll	45	**17**	**18**	46	EXTAL
XTAL	47	**19**	**20**	48	PE4/ECLK
MODA/PE5	49	**21**	**22**	50	PE6/MODB
ARST/PE7	51	**23**	**24**	52	PB0/A0
A1/PB1	53	**25**	**26**	54	PB2/A2
A3/PB3	55	**27**	**28**	56	PB4/A4

P3

A5/PB5	57	**1**	**2**	58	PB6/A6
A7/PB7	59	**3**	**4**	60	PA0/A8
A9/PA1	61	**5**	**6**	62	PA2/A10
A11/PA3	63	**7**	**8**	64	PA4/A12
A13/PA5	65	**9**	**10**	66	PA6/A14
A15/PA7	67	**11**	**12**	68	PF0/CS0
CS1/PF1	69	**13**	**14**	70	PF2/CS2
CS3/PF3	71	**15**	**16**	72	PF4/CSD
CSP0/PF5	73	**17**	**18**	74	PF6/CSP1
PH0	75	**19**	**20**	76	PH1
PH2	77	**21**	**22**	78	PH3
Vdd	79	**23**	**24**	80	Vss
PH4	81	**25**	**26**	82	PH5
PH6	83	**27**	**28**	84	PH7

P4

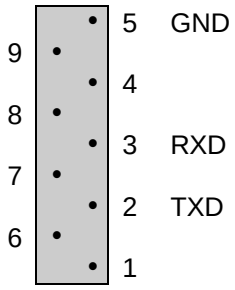
V_{RH}	85	**1**	**2**	86	V_{RL}
PAD0	87	**3**	**4**	88	PAD1
PAD2	89	**5**	**6**	90	PAD3
PAD4	91	**7**	**8**	92	PAD5
PAD6	93	**9**	**10**	94	PAD7
V_{DDA}	95	**11**	**12**	96	V_{SSA}
RxD0/PS0	97	**13**	**14**	98	PS1/TxD0
RxD1/PS2	99	**15**	**16**	100	PS3/TxD1
SDI/PS4	101	**17**	**18**	102	PS5/SDO
MOSI/PS6	103	**19**	**20**	104	PS7/SCK
PT0	105	**21**	**22**	106	PT1
PT2	107	**23**	**24**	108	PT3
PT4	109	**25**	**26**	110	PT5
PT6	111	**27**	**28**	112	PT7/PAI

- Small numbers next to Connector pin Numbers are MC68HC812A4 package pin number 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 PORT

COM1 interfaces 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 through a RS232 level shifter to the COM1 connector.

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).

A/D Reference

The V_{RH} and V_{RL} 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 CMS12 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 V_{RH} and/or V_{RL} inputs.

CMS12 Other Features

RESET GENERATION

The CMS12 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 CMS12 has a regulated power supply that accepts +7 to +25VDC 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 CMS12 board may occur.

PHASE-LOCKED LOOP

CMS12 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.

TROUBLESHOOTING

The CMS12 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 socket IC devices are properly seated in the their sockets.

The most common problems are improperly configured communications parameters and attempting to use the wrong COM port on the PC. 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 wall plug 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 power by checking for +9 volts between GND and +9V test point pads.
3. Re-Check the communications parameters.
4. Make sure that the RESET line is not being held low.
5. Verify presence of 16MHz sine wave on the crystal if possible.
6. 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 that 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 are using AX12 you must access the board in Single-Chip mode only.
- Be certain that the data cable you are 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 are 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 are not sure.
- If you are running in a multitasking environment (such as Windows) close all programs in the background to be certain no serial conflict occurs.
- If the Assembler menu option does not work properly on your system you can modify it is 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 are not sure.