DEMOAC

Development Board for Freescale FLEXIS AC MCU Family

Supports:
MCF51AC256
MC9S08AC128
MC9S08AC60
MC9S08AC16

Hardware User Guide

AXIOM
manufacturing

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REVISION

Date	Rev	Comments
March 20, 2008	A	Initial Release.
March 29, 2008	B	Minor text corrections
April 3, 2008	C	Remove references to 51JM128 MCU
April 10, 2008	D	Updated Troubleshooting section to account for power-cycling board when powered from USB BDM

CAUTIONARY NOTES

1) Electrostatic Discharge (ESD) prevention measures should be used when handling this product. ESD damage is not a warranty repair item.

2) Axiom Manufacturing does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under patent rights or the rights of others.

3) EMC Information on the DEMOAC board:

   a) This product, as shipped from the factory with associated power supplies and cables, has been verified to meet with FCC requirements as a **CLASS A** product.

   b) This product is designed and intended for use as a development platform for hardware or software in an educational or professional laboratory.

   c) In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate prevention measures.

   d) Attaching additional wiring to this product or modifying the product operation from the factory default as shipped may effect its performance and cause interference with other apparatus in the immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

TERMINOLOGY

This development board applies option selection jumpers. Terminology for application of the option jumpers is as follows:

Jumper on, in, or installed = jumper is a plastic shunt that fits across 2 pins and the shunt is installed so that the 2 pins are connected with the shunt.

Jumper off, out, or idle = jumper or shunt is installed so that only 1 pin holds the shunt, no 2 pins are connected, or jumper is removed. It is recommended that the jumpers be placed idle by installing on 1 pin so they will not be lost.

Cut-Trace – a circuit trace connection between component pads. The circuit trace may be cut using a knife to break the default connection. To reconnect the circuit, simply install a suitably sized 0-ohm resistor or attach a wire across the pads.

Signal names followed by an asterisk (*) denote active-low signals.

FEATURES

The DEMOAC provides a platform supporting a line of Freescale microcontrollers which are part of the Flexis Continuum. Target microcontrollers mount on plug-in modules to support quickly changing the target MCU. Available microcontrollers for the DEMOAC include; the ColdFire V1 MCF51AC256, and the MC9S08AC128/60/16. Application development on the DEMOAC is quick and easy with the integrated USB-BDM, sample software tools, and examples. An optional BDM_PORT port is also provided to allow use of an external BDM cable. An 80-pin MCU_PORT connector provides access to all IO signals on the target MCU.   An expanded feature set, including an E-Field sensor, is provided on the DEMOACEX board. The DEMOACEX connects to the DEMOAC through the 80-pin MCU_PORT connector.

MCU Modules:
- MCF51AC256, 80LQFP
  - 256K bytes FLASH
  - 32K bytes RAM
  - ColdFire V1 Core
  - 50.3 MHz bus

- MC9S08AC128/60/16
  - 128K/60K/16K bytes FLASH
  - 8K/2K/1K bytes RAM
  - HCS08 Core

DEMOAC Features:
- Integrated, USB BDM
- ON/OFF Power Switch
- Power Input Select Option Header
  - On-board 5V regulator
  - Power from USB BDM
  - Optional Power Sourced to Connector J1
- 4MHz XTAL Oscillator
- 3-axis accelerometer
- LEDs – 4 User, 1 Power, 1 Reset
- Push button switches – 4 user, 1 Reset
- 5K ohm POT
- Jumpers to disconnect User Features
- 80-pin MCU PORT provides access to MCU signals
- 4 20-pos pin-headers support plug-in MCU modules
- IIC Termination Select Header
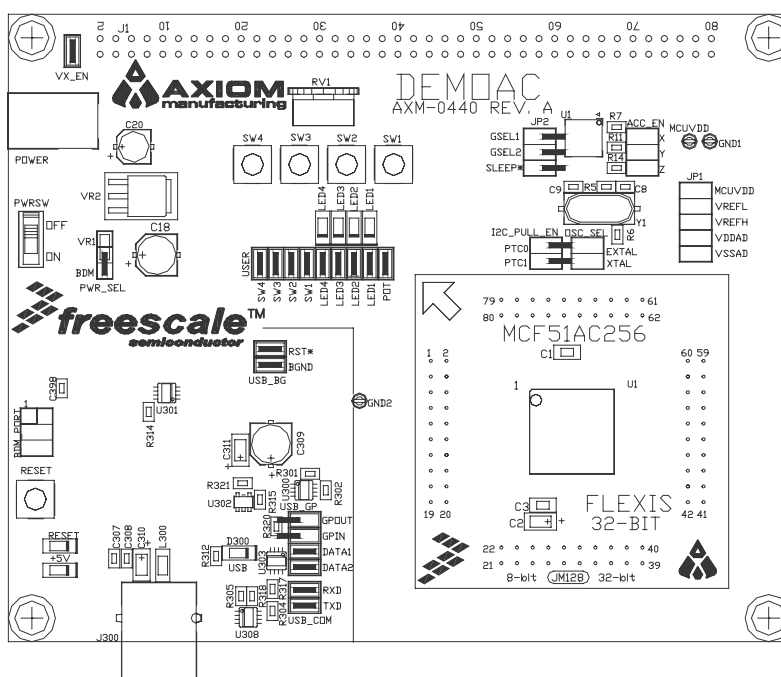
DEMOAC Board Size: 5.0" x 4.0

REFERENCES

The following documents should be referenced during application development using the DEMOAC. These documents are available on the MCF51JM128 and DEMOAC web pages (http://www.freescale.com/coldfire).

DEMOAC_UG.pdf	DEMOAC User Guide (this document)
DEMOAC_QSG.pdf	DEMOAC Quick Start Guide
DEMOAC_SCH_A1.pdf	DEMOAC Schematic
DEMOAC_Silk_A.pdf	DEMOAC Top Silk

GETTING STARTED

To get started quickly, please refer to the DEMOAC Quick Start Guide. This quick start will illustrate connecting the board to a PC, installing the correct version of CodeWarrior Development Studio, and running a simple program.

APPLICATION DEVELOPMENT

CodeWarrior Development Studio for Microcontrollers, Special Edition is provided along with the DEMOAC to support application development and debug. CodeWarrior provides an IDE for application debug and an integrated FLASH programmer to load application code. Refer to the CodeWarrior Development Studio User Guide further details.

HARDWARE CONFIGURATION

The DEMOAC board provides a development or evaluation platform for a line of AC Flexis microcontrollers; including the MCF52AC256, MC9S08AC128, MC9S08AC60, and MC9S08AC16 MCU's. Following are descriptions of the components and options provided on the board.

Integrated BDM

The DEMOAC board features an integrated USB BDM debugger. The integrated debugger supports application development and debugging via the background debug mode. A type B, USB connector provides connectivity between the target board and the host PC.

> **NOTE:** Using the integrated USB BDM requires CodeWarrior Development Studio for Microcontrollers Special Edition, V6.0 or later. Development tools from P&E Microcomputer Systems also support the target device.

The integrated debugger provides power and ground to the target, thereby eliminating the need to power the board externally. Power from the integrated USB BDM is derived from the USB bus; therefore, current consumption is limited by the USB specification. Total current consumption for the target board, and any connected circuitry, must not exceed **350 mA**. Excessive current drain will violate the USB specification causing the bus to disconnect. This will force a target POR.

> CAUTION: Violating the USB specification will cause the USB bus to disconnect forcing the target to reset. Damage to the board or host PC may result.

The integrated USB BDM provides a virtual COM port for serial communication applications. The BMD also provides virtual instrument analyzer function. Refer to the P&E Micro Demo Toolkit for details.

BDM Port Connector

As standard 6-pin BDM connector is also provide to allow use of external BDM cables capable of supporting the MCF51AC26 or MC9S08AC128/60/16 devices.

Figure 1: BDM Connector

BKGD*/MS | **1** | **2** | VSS
| **3** | **4** | RESET*
| **5** | **6** | VDD

POWER

The DEMOAC may be powered from the integrated USB BDM, an on-board voltage regulator, or from the MCU connector at J1. Alternatively, the DEMOAC may be configured to provide power to external circuitry connected to the MCU connect J1.

The PWRSW power switch controls input voltage to the board regardless of input voltage source.

External Power

The power jack at POWER allows the board to be powered from an externally connected power source. This connection accepts a standard 2.1mm, center-positive, barrel plug connector. +VIN should fall between +7VDC and +18VDC. Input voltage applied to the barrel connector should be kept as lows as possible to minimize device heating.

Figure 2: PWR Jack

2.1mm, center-positive, +V input
Applied voltage: +7V to +18V

PWR
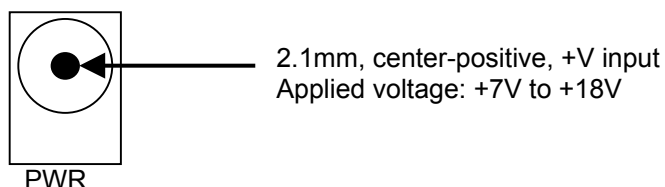
A voltage regulator provides +5V to the target MCU and board circuitry. The regulator provides a maximum of 500 mA. The regulator is over-current and over-temperature protected to prevent damage during fault conditions.

BDM Power

The integrated USB BDM is configured to provide power to the target device and connected circuitry. After the BDM enumerates on the USB bus, the BDM will provide up to 350 mA to the board. Excessive current drain will violate the USB specification and cause de-enumerate the BDM. This will disconnect power to the board and cause a target reset.

> CAUTION: Violating the USB specification will cause the USB bus to disconnect forcing the target to reset. Damage to the board or host PC may result.

Power Switch – PWRSW

The PWRSW easily connects and disconnects input voltage to the board. The silkscreen clearly marks the ON and OFF positions. This switch controls all voltage levels on the board.

Voltage Indicators

A +5V LED indicates the board is powered.

PWR_SEL Option Header

The PWR_SEL option header selects the source of input power to the EVB. The board may be powered from a voltage source connected to either the POWER connector or the integrated USB BDM. The BDM can provide up to 350 mA of current to the EVB.

Figure 3: PWR_SEL Option Header

PWR_SEL
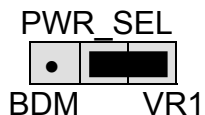
Selects input voltage from POWER connector

BDM   VR1   NOTE: The VR1 input is connected to the regulator at VR2.
                               This is an error in the board silkscreen.

PWR_SEL

Selects input voltage from the integrated BDM

BDM   VR1

> **NOTE:** The voltage regulator reference designator at the PWR_SEL option header does not
> match the reference designator of the voltage regulator.

VX_EN Option Header

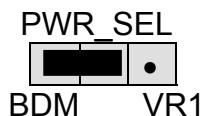The VX_EN option header is a 2-pin jumper that connects the target-board voltage rail to IO
connector position J1-1. IO connector position J1-3 connects directly to the ground plane.
This input requires a regulated +5.0V voltage source. This power input is decoupled to mini-
mize noise input but is not regulated. Also, no protection is applied on this input and damage
to the target board may result if over-driven. Do not attempt to power the target board through
this connector while also applying power through the PWR connector as damage to the board
may result.

Power may be sourced to off-board circuitry through the MCU_PORT. The current limitation of
the on-board regulator must be considered when attempting to source power to external cir-
cuitry. Excessive current drain may damage the target board or the on-board regulator. The
figure below shows the VX_EN option header connections.

Figure 4: VX_EN Option Header

ON   Enable power connection to connector J1
VX_EN
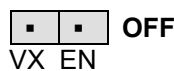
OFF   Disable power connection to connector J1
VX_EN

> **CAUTION:** Do not apply power to connector J1 while also sourcing power from either the
> PWR connector. Damage to the board may result.

> **NOTE**: Do not exceed available current supply from on-board regulator when sourcing power
> through connector J1 to external circuitry.

MCU Power

Each power input is routed through an option header. The option header is not installed in
default configurations and a cut-trace on each power input provides default connections. To

apply an alternate power input, simply remove the cut-trace using a sharp knife. Then either solder a wire to the thru-hole via or install a pin header and wire-wrap a wire connection.

The various power inputs are grouped together at JP1. This allows each voltage input to be selected individually using multiple 1x2 pin headers or all voltage input may be selected using a 2x5 pin header.

MCUVDD

The VDD option header applies board VDD to the target MCU. This jumper may be used to apply alternate voltage levels or to measure input current under operating conditions.

VDDAD

The VDDA option header connects the target device VDDA input to the VDD rail by default. This jumper may be used to apply alternate voltage input or to measure input current under operating conditions.

VSSAD

The VSSA option header connects the target device VSSA input to the EVB digital ground rail by default. This option header may be used to apply ultra clean ground or to measure input current under operating conditions.

VREFH

The VREFH option header connects the target device VREFH input to the VDD rail by default. This jumper may be used to apply alternate voltage input or to measure input current under operating conditions.

VREFL

The VREFL option header connects the target device VREFL input to the ground rail by default. This option header may be used to apply ultra clean ground or to measure input current under operating conditions.

RESET Switch

The RESET switch allow the manual application of the RESET* signal. Application of RESET halts the current operation and initializes internal registers to their default state. The previous operating state of the target device will be lost.

External reset may also be applied directly to the RESET * signal at connector J1A-4.

Reset LED

The RESET indicator will be ON for the duration of a valid RESET* signal. The RESET * signal is driven active while the MCU is in the RESET state.

Low Voltage Detect

The different AC MCU's apply a Low Voltage Detect (LVD) module to detect under-voltage conditions. The LVD may be configured to generate a RESET or an interrupt. Refer to the target device Reference Manual for further details.

MEMORY

No external memory is applied to the DEMOAC board. Memory for application development is internal to the target MCU. Refer to the target device Reference Manual for further details.

TIMING

The DEMOAC board provide a 4Mhz oscillator timing source for use with the target MCU. The OSC_SEL option header allows this input to be disconnected if necessary. In default configurations, the OSC_SEL option header is not installed and cut-traces provide the default connections.

To either disconnect the oscillator input or to apply an alternate frequency, remove the cut-traces. To restore the default connection, install a 2x2 pin header and 2 shunts.

Table 1: OSC_SEL Option Header

●	●	EXTAL	Oscillator or External Clock Input w/ cut-trace in default configurations
●	●	XTAL	Oscillator Input w/ cut-trace in default configurations

CAUTION: Communications with the target may be lost if clock frequency or baud rate changes during application execution.

Communications

The DEMOAC board provides 2 UART ports, 1 IIC port, and 1 CAN port. Serial RS-232 communications is support through the integrated BDM. Access to each MCU UART is also available at connector J1. RS-232 translation is not provided on signals to connector J1.
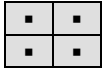
Virtual COM Port

The serial link through the integrated USB BDM is implemented as a virtual COM port running through the USB connection. Use of this link require installation of the P&E Micro Demo Board Toolkit. This toolkit is available on the DVD provided with the DEMOAC.

Refer to the P&E documentation for details and instructions on use of the virtual COM port.

COM_EN

The USB_COM option header individually connects and disconnects the target UART signals to the integrated USB BDM. Removing a shunt disconnects the associated signal. Installing a shunt connects the associated signal.

Figure 5: USB_COM Option Header

	RXD	TXD

Shunt	
On	**Off**
Enabled (*)	Disabled
Enabled (*)	Disabled

(*) – Default condition

> **NOTE:** TGT_TXD and TGT_RXD connect TXD2 and RXD2 lines to the serial input of the integrated BDM.

CAN Port

CAN port signals connect directly between the target MCU and the MCU Port connector at J1. Refer to the target MCU device Reference Manual for details on using this feature.

IIC Port

IIC port signals connect directly between the target MCU and the MCU Port connector at J1. Refer to the target MCU device Reference Manual for details on using this feature. Each IIC signal is pulled up to VDD at the I2C_PULL_EN option header.

Potentiometer

A 5k ohm, single-turn, thumb-wheel type, potentiometer at RV1 provides continuous, variable resistance input for user applications. The potentiometer is connected between VDD and GND with the center tap providing the divider output. The center tap is connected to the MCU at :

Table 2: POT

POT	PTD0/AD1P8/ACMP1+

User Pushbutton Switches

Four user push-button switches are provided for user application input as needed and are configured for active-low signaling. SW1 – SW4 are applied to keyboard interrupt inputs on the target MCU. Use of target device internal pull-ups is required for proper operation. No external bias is applied to any push-button switch input. Use of target device internal pull-ups is required for proper operation.

Table 3: Push Button Switches

Switch	Signal
SW1	PTG0/KBI1P0
SW2	PTG1/KBI1P1
SW3	PTG2/KBI1P2
SW4	PTG3/KBI1P3

User LED's

Eight user LED's are provided for output indication and are configured for active-low signaling. The table below details the LED connections to the target MCU

Table 4: User LED's

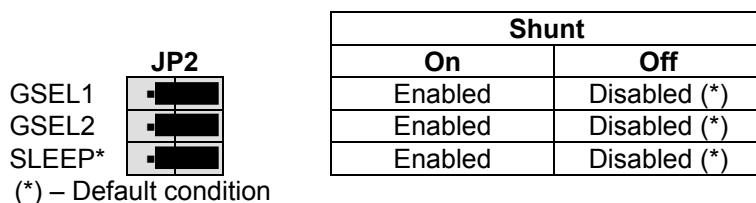| LED	Signal
LED1	PTF0/RGPIO8/FTM1CH2
LED2	PTF1/RGPIO9/FTM1CH3
LED3	PTF4/RGPIO12/FTM2CH0
LED4	PTF5/RGPIO13/FTM2CH1

ACCELEROMETER

The DEMOAC applies the MMA7260Q, 3-axis accelerometer for tilt and motion-sense applications. The accelerometer supports 4 user selectable sensitivities - 1.5g / 2g / 4g / 6g. The SLEEP* input allows the device to be placed in a low-power mode. Separate X-, Y-, and Z-axis readings are routed to the MCU. The X-axis output is routed to two separate inputs on the target MCU. Low-pass filters remove hi-frequency components on each axis output.

Accelerometer Configuration

Accelerometer sensitivity configuration is controlled manually using option select header JP2.

Figure 6: Accelerometer Sensitivity Select Header

	JP2
GSEL1	■
GSEL2	■
SLEEP*	■

(*) – Default condition

Shunt	
On	**Off**
Enabled	Disabled (*)
Enabled	Disabled (*)
Enabled	Disabled (*)

An option header at ACC_OUT allows the user to disconnect the accelerometer output if necessary. The ACC_OUT option header is not installed default configurations and cut-traces provide default connections

Table 5: ACC_OUT Option Header

Signal	MCU Input
X	PTD0/ADP8/ACMP+
X	PTB3/SS2*/ADP3
Y	PTB0/MISO2/ADP0
Z	PTB1/MOSI2/ADP1

MCU_PORT

The MCU PORT provides user access to the DEMOAC I/O ports. Refer to the MCF51AC256 or MC9S08AC128/60/16 Integrated Device Reference Manual for signal details.

Figure 7: MCU_PORT Connector

VDD	1	2	IRQ*/TPMCLK
VSS	3	4	RESET*
PTE0/RGPIO0/TXD1	5	6	BKGD/MS
PTE1/RGPIO1/RXD1	7	8	PTD6/FTM1CLK/AD1P14
PTG0/KBI1P0	9	10	VREFH
PTG1/KBI1P1	11	12	VREFL
PTE2/RGPIO2/FTM1CH0	13	14	PTD0/AD1P8/ACMP1+
PTE3/RGPIO3/FTM1CH1	15	16	PTD1/AD1P9/ACMP1-
PTE6/RGPIO6/MOSI1	17	18	PTB3/AD1P3
PTE5/RGPIO5/MISO1	19	20	PTB2/AD1P2
PTE7/RGPIO7/SPSCK1	21	22	PTB0/TPM3CH0/AD1P0
PTE4/RGPIO4/SS1*	23	24	PTB1/TPM3CH1/AD1P1
PTD2/KBI1P5/AD1P10/ACMP1O	25	26	PTA0/TXCAN
PTD3/KBI1P6/AD1P11	27	28	PTA1/RXCAN
PTG2/KBI1P2	29	30	PTH5/MOSI2
PTG3/KBI1P3/AD1P18	31	32	PTH6/MISO2
PTF0/RGPIO8/FTM1CH2	33	34	PTH4/SPSCK2
PTF1/RGPIO9/FTM1CH3	35	36	PTC4/SS2*
PTF4/RGPIO12/FTM2CH0	37	38	PTC3/TXD2
PTF5/RGPIO13/FTM2CH1	39	40	PTC5/RXD2
PTF2/RGPIO10/FTM1CH4	41	42	PTC0/SCL1
PTF3/RGPIO11/FTM1CH5	43	44	PTC1/SDA1
PTF6/RGPIO14/FTM1FLT	45	46	PTC2/MCLK
PTF7/RGPIO15	47	48	PTC6/FTM2FLT
PTB4/AD1P4	49	50	PTA2
PTB5/AD1P5	51	52	PTA3/ACMP2O
PTB6/AD1P6	53	54	PTA4/ACMP2-
PTB7/AD1P7	55	56	PTA5/ACMP2+
PTD4/FTM2CLK/AD1P12	57	58	PTA6/AD1P16
PTD5/AD1P13	59	60	PTA7/AD1P17
PTD6/FTM1CLK/AD1P14	61	62	PTG5/XTAL
PTD7/KBI1P7/AD1P15	63	64	PTG6/EXTAL
VDDAD	65	66	PTJ0/PST0
VSSAD	67	68	PTJ1/PST1
PTG4/KBI1P4/AD1P19	69	70	PTJ2/PST2
NC	71	72	PTJ3/PST3
PTH0/FTM2CH2/AD1P20	73	74	PTJ4/DDATA0
PTH1/FTM2CH3/PSTCLK0/AD1P21	75	76	PTJ5/DDATA1
PTH2/FTM2CH4/PSTCLK1/AD1P22	77	78	PTJ6/DDATA2
PTH3/FTM2CH5/BKPT/AD1P23	79	80	PTJ7/DDATA3

TROUBLESHOOTING

The DEMOAC is fully tested and operational before shipping. If it fails to function properly, inspect the board for obvious physical damage first. Verify the communications setup as described under GETTING STARTED.

Initial Flash Programming

To program target device FLASH initially, or if device FLASH is erased, apply external power at the PWR jack and set the PWR_SEL option header to VR1. When prompted by P&E software to cycle target power, move the PWRSW to the OFF position momentarily then to the ON position. Otherwise, the BDM will fail to connect to the target device.

Most common problems are related to improperly configured options or communications parameters.

1. If the simulator software requires a device power cycle during FLASH programming, ensure the board is powered externally and the PWR_SEL option header is set to VR1.

2. Verify the +5V voltage indicator is ON.

3. Verify input power is connected. If powered from an external power source, measure at least +7V between VR2-1 and VR2-2 using a multi-meter. If powered from the integrated BDM, measure +5V across capacitor C16

4. Ensure the PWRSW is in the ON position.

5. Verify default option jumper settings and RESET the board.

6. Ensure target module is securely, and correctly, seated on pin headers JM1 – JM4.

7. If a peripheral feature does not function properly, ensure all USER select jumpers are installed.

Contact support@axman.com by email for further assistance. Provide board name and a complete description of the problem.

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