MCU PROJECT BOARD

Prototyping Board with Microcontroller Interface

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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 MCU PROJECT BOARD:

   a) This product as shipped from the factory with associated power supplies and cables, has been verified to meet with requirements of CE and the FCC as a **CLASS B** 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 products operation from the factory default as shipped may effect its performance and cause interference with nearby electronic equipment. If such interference is detected, suitable mitigating measures should be taken.

Terminology

This prototyping module uses option selection jumpers to setup configuration. Terminology for use of the option jumpers is as follows:

Jumper – a plastic shunt that connects 2 terminals electrically

Jumper on, in, or installed - jumper is installed such that 2 pins are connected together

Jumper off, out, or idle - jumper is installed on 1 pin only. It is recommended that jumpers be idled by installing on 1 pin so it will not be lost.

Features

The MCU Project Board is a full-featured prototyping platform intended for microcontroller interfacing and programming in conjunction with many MCU development boards. Several Axiom Manufacturing MCU boards for Freescale HCS12, HCS08, and DSP devices plug directly into the project board MCU connector. Other Axiom MCU boards can be interfaced directly to the project board by ribbon cable. The MCU Project Board may also be used as a standalone prototyping environment for testing electronic circuits. The MCU Project Board has been specifically designed for compatibility with the National Instruments_ Educational Laboratory Virtual Instrumentation Suite (NI-ELVIS). MCU Project Board features include:

- Large Breadboard Area (27 sq. in.) with 4 power distribution strips
- MCU Interface Connector
  - 60-pin MCU Port connector
  - 20-pin AUX Port connector
- PCI Style Card-Edge connector designed for use with National Instrument's NI-ELVIS platform
- Signal Breakout arranged logically around Breadboard Area
- Power Input from included wall-plug transformer or from Card-Edge connector
- +5VDC and +3.3VDC output available to user
  - Internal current limit prevents damage from inadvertent short-circuit
- User selectable voltage to on-board logic devices
- Option jumper to enable voltage output to MCU Port Connector
- 2 Banana Connectors
- 1 BNC Connector
- 1 Multi-turn User Potentiometer
- LCD Module interface with Serial to Parallel Shift Register
  - User option to enable/disable interface
- 8-pin Keypad connector
- COM Port
  - 9-pin DSUB connector
  - RS-232 Interface with user option to isolate transceiver
  - COM_SEL jumper selects configuration between:
    - RS-232 signals to transceiver
    - MON08 Interface Port
    - BDM communications port
  - Access to COM signals at Signal Breakout Connector
- Socket for Optional Crystal Oscillator
  - User selectable output amplitude - +5V or +3.3V
- 8 Active High DIP Switches,
- 8 Active High Green LED's, Buffered
  - User option to enable/disable output
- 8 Active Low Push Button Switches
- 4 Power LED indicators for +15V, -15V, +5V, and +3.3V supplies
- Integral HCS12/HCS08 Programming BDM Pod
  - MC9S12C32 MCU
  - 8 MHz oscillator
  - Selection jumper for HCS12/HCS08 mode
  - Standard 6-pin Debug Port connections
  - Simple RS-232 Interface
- Mounting hole placement allows the student to carry the ProtoBoard in a standard 3-Ring binder.

Specifications:
Module Size: 8.5" x 11"
Power Input: +9VDC @ 300mA typical, +6VDC - +16VDC range

GETTING STARTED

The MCU Project Board offers a full-featured prototyping platform with many useful circuits included and ready for use. Several Axiom Manufacturing MCU development boards connect to the MCU Project Board either directly or by ribbon cable. The Project Board may also be used as a stand-alone prototyping platform. The large solderless breadboard area makes circuit construction quick and easy. Header sockets conveniently arranged around the breadboard area provide access to installed components and off-board signals.

The system comes complete with a CD containing software, schematic, and lab manuals. The MCU Project Board comes with a kit of parts to allow immediate construction of common circuits. The CD also includes AxIDE, a simple terminal interface designed exclusively to communicate with Axiom Manufacturing MCU development boards. Example software used in the lab experiments is also contained on the CD. The CD also contains many useful programs that make project development quick and easy.

REFERENCE

Reference documents are provided on the support CD in Acrobat Reader format. Further information can be found on the Axiom Manufacturing web site at www.axman.com.

MCUProjectBoard_SCH_D.pdf	MCU Project Board Schematic, Rev D
MCUProjectBoard_UG.pdf	MCU Project Board User Guide (this document)
CSM12C32_UG.pdf	CSM-12C32 User Guide

Operation

The MCU Project Board allows users to quickly and easily prototype electronic circuits with or without MCU support. The project board provides a variety of commonly used circuits preinstalled and ready for use. Single- and dual-row socket headers placed around the prototyping area allow convenient and logically arranged signal access. Connections between these signals and the breadboard are made by installing solid, 22ga, jumper wire in the proper socket header location. A package of jumper wires is included with the Project Board. The sections below describe, in detail, the functionality of the MCU Project Board.

Power

A unique feature of the MCU Project Board is the ability to be used as a stand-alone prototyping platform or in conjunction with the NI-ELVIS platform. The project board can accept power input from the included wall-plug transformer or from the NI-ELVIS workstation through connector J1. Project Board provides user selectable voltage output to the on-board logic.

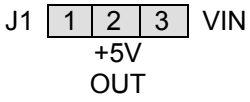
CAUTION: Care must be exercised configuring power input and output selections to prevent damage.

Power Input

The MCU Project Board can accept power input either from a wall-plug transformer connected to a 2.0mm barrel connector, VIN, or from the NI-ELVIS workstation through a PCI style connector, J1. The VIN connector is located to prevent access while the project board is connected to the NI-ELVIS workstation. Voltage input through VIN should limited to DC voltage in the range of 6VDC to 16VDC. This input is connected directly to a voltage regulator located at VR1. Connector J1 routes voltage from the NI-ELVIS workstation directly to the JP1 selection header.

The selection header, JP1, PWR_SEL, is a 3-pin header that allows the user to select the +5V input source supplied to the project board. The J1 selection routes voltage from the NI-ELVIS connector (J1) to the project board. The VIN selection routes the output from the on-board voltage regulator (VR1) to the project board circuits.

Figure 1: PWR_SEL – JP1



Voltage input on pins 1 and 3. +5V output on pin 2. Placing a jumper on pins 2-3 routes +5V from VR1. Placing a shunt on pins 1-2 routes +5V J1.

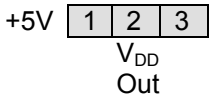
Power Output

The MCU Project Board provides both +5V and +3.3V operating voltages. These voltages are available in all operation modes. The user selectable voltage, V_{DD}, supplies all on-board logic. An option header allows the user to route either operating voltage to V_{DD}. Other voltage levels are available when the MCU Project Board is connected to the NI-ELVIS workstation. Consult the NI-ELVIS User's Guide for details.

When the project board is connected to a wall-plug transformer, +5V is provided from the voltage regulator VR1 and +3.3V is provided from the voltage regulator at VR2. Each regulator is rated for a maximum current output of 250mA. However, the user should note that the VR2 input is connected directly to the VR1 output. This configuration may limit available current in mixed voltage applications. Each regulator is internally current limited to prevent damage from inadvertent, short duration, short circuits.

A 3-pin option header, JP2, VDD_SEL, allows the user to select the operating voltage routed to V_{DD}. The +5V selection routes +5VDC to on-board logic while the +3.3V selection routes +3.3VDC to on-board logic. All voltage levels are conveniently arranged around the breadboard area providing easy access.

Figure 2: VDD_SEL – JP2



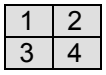
Voltage input connected to pins 1 and 3. V_{DD} output on pin 2. Placing a shunt on pins 2-3 routes +5V to V_{DD}. Placing a shunt on pins 1-2 routes +3.3V to V_{DD}.

CAUTION: Exercise care to select the correct operating voltage when interfacing to on-board logic to prevent damage to circuit elements.

MCU Module Power

The MCU Project Board may optionally power modules attached to the MCU_PORT connector. A 4-pin option header at JP3, MCU_MOD PWR, controls this option. Installing shunts at positions labeled V_{DD} and GND connects MCU_PORT, pin 1 to V_{DD} on the project board and MCU_PORT, pin 3 to GND on the project board. This feature was included to allow use of a line of Axiom Manufacturing Development Modules with the MCU Project Board.

Figure 3: MCU_MOD_PWR – JP3



Placing a shunt on pins 1-2 routes V_{DD} to MCU_PORT signal IO1. Placing a shunt on pins 3-4 routes GND to MCU_PORT signal IO3.

NOTE: **Both shunts must be installed or both shunts must be removed.**

CAUTION: Do not place a shunt on pins 2-4. This configuration will cause a VDD to GND short resulting in damage to the project board.

CAUTION: Do not place a shunt on pins 1-3. This configuration will short IO signals at the MCU_Port and may damage the attached module.

CAUTION: When using this option selections make sure the module connected to the MCU_PORT is not configured to source voltage to the project board. Damage to both the project board and attached module may result.

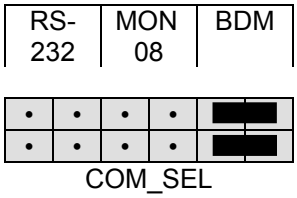
BDM POD

An MCU-based BDM pod compatible with the Freescale Background Debug Mode has been provided to allow the user to program and debug attached MCU modules without the need of high-cost programming hardware. The BDM pod supports Freescale HCS08 and HCS12

MCU's. The BDM Host Interface is the Freescale Serial Binary monitor. The Project Board serial COM connector provides access between the host PC and the BDM pod.

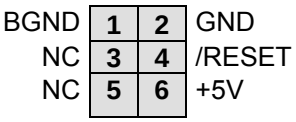
The BDM_OUT connector allows the user to program and debug application code in a target MCU module. To connect to the target MCU, simply install a 6-pin ribbon cable between the BDM_OUT connector on the Project Board and the BDM_PORT connector on the target module. Observe cable orientation to connect. To utilize the BDM pod on the Project Board install shunts as show as shown in the figure below.

Figure 4: BDM POD Communication Settings



The BDM_IN connector is reserved for factory test purposes only. The figure below describes the pin-out of the BDM connector.

Figure 5: BDM_OUT Connector – J20



See the HCS12/HCS08 Technical Reference Manuals for complete documentation of the BDM.

The HCS08_SEL jumper, JP10, selects the operating mode of the BDM pod. With this option installed, the BDM pod is configured for HCS08 access. With this option removed, the BDM pod is configured for HCS12 access.

Table 2: HCS08_SEL – JP10

Shunt	Effect
ON	BDM Pod in HCS08 Access Mode
OFF	BDM Pod in HCS12 Access Mode *DEFAULT*

NOTE: Default operation for the BDM pod is HCS12 mode (**OFF**).

User I/O

The MCU Project Board provides an array of User I/O to allow connection of auxiliary components such as signal input, test equipment, Keypads, or LCD displays.

Banana Jack

The MCU Project Board provides two 4.0mm Banana jacks for use as auxiliary I/O. These connectors may be used for auxiliary signal input or for signal output to test equipment. The Banana jacks are color coded with one jack red and one jack black. The center conductor of each jack is routed to the User I/O Signal Breakout connector located below the breadboard area.

BNC Jack

The MCU Project Board provides one BNC jack for use as auxiliary I/O. This connector may be used for auxiliary signal input or for signal output to test equipment. The center conductor (BNC+) and shield (BNC-) are routed separately to the User I/O Signal Breakout connector located below the breadboard area.

LCD PORT

The MCU Project Board includes a LCD port with supporting shift register logic to allow the user to easily add a LCD display. Two 14-pin connectors, one 1x14 header and one 2x7 header, provide support for various LCD panels. The installed interface, in default configuration, supports displays with up to 80 characters in 4-bit bus mode. The LCD module VEE or contrast potential is set 0 Volts on this board. This configuration requires the LCD module be TN style (Standard Twist) and Reflective to support this VEE potential. The Axiom Mfg. HC-LCD is compatible. The LCD Module is configured for Write only mode. It is not possible to read current cursor position or the busy status back from the module

The LCD_PORT interface is connected to the signal breakout header located adjacent to the breadboard. The interface is configured for connection to the MCU SPI port. This connector is configured for connection to standard rear-mount LCD panels.

Figure 6: LCD Connector – J16

+5V	2	1	GND
RS	4	3	VEE-GND
EN	6	5	R/W-GND
DB1	8	7	DB0
DB3	10	9	DB2
LCD_D5	12	11	LCD_D4
LCD_D7	14	13	LCD_D6

SPI data bit definitions to LCD Port:
LCD_D[7..4] – LCD data bits D[3..0]
DB[3..0] – Unused, 10K ohm pull-downs installed
R/W – Read/Write pin, set to 0 volts, Read only
EN – LCD enable input, 1 = LCD enable
VEE – LCD contrast input, set to 0 volts
RS – Register Select, 0 = LCD Command, 1 = LCD Data

The AUX_LCD connector provides an alternate LCD panel connection. The same feature set applies to this connection as applies to the dual-row connector.

Figure 7: AUX_LCD Connector – J15

GND	1
+5V	2
VEE-GND	3
RS	4
R/W-GND	5
EN	6
DB0	7
DB1	8
DB2	9
DB3	10
LCD_D4	11
LCD_D5	12
LCD_D6	13
LCD_D7	14

SPI data bit definitions to LCD Port:
LCD_D[7..4] – LCD data bits D[3..0]
DB[3..0] – Unused, 10K ohm pull-downs installed
R/W – Read/Write pin, set to 0 volts, Read only
EN – LCD enable input, 1 = LCD enable
VEE – LCD contrast input, set to 0 volts
RS – Register Select, 0 = LCD Command, 1 = LCD Data

Option header JP5 allows the LCD Port logic to be disabled if not in use. This allows using the MCU SPI port for alternate functions without loading the SPI lines. Example LCD Port assembly language driver software is provided on the support CD to demonstrate typical LCD module operation using this technique.

Table 3 : LCD_EN – JP5

Shunt	Effect
ON	Enable LCD Port Output
OFF	Disable LCD Port Output

Keypad

The KEYPAD connector supports connection of a passive 12-key or 16-key keypad. The KEYPAD connector is routed directly to the signal breakout located adjacent to the bread-board. No current-limit is provided on this connection and should be installed by the user if re-quired.

Figure 8: Keypad Connector – J17

KEYPAD 1	1
KEYPAD 2	2
KEYPAD 3	3
KEYPAD 4	4
KEYPAD 5	5
KEYPAD 6	6
KEYPAD 7	7
KEYPAD 8	8

These signal connect directly to the User I/O signal breakout connector located below the breadboard.

Switches

The MCU Project Board provides two types of switches for use as input devices. Eight normally open DIP Switches arranged in two banks of four switches are provided. Eight normally open push button switches are also provided. All switches are biased to provide a known voltage level in the in-active state.

Each DIP switch is configured for active-high operation. When each switch leg is ON (closed), the signal line is pulled to V_{DD} through a 100 Ω series, current limit, resistor. A 10k ohm resistor pulls each signal line to GND when the switch is OFF (open).

Each push button switch is configured for active-low operation. When each switch is pressed (closed) the associated signal line is pulled to GND through a 1 kΩ resistor. A 10k ohm resistor pulls each signal line to V_{DD} when the switch is released (open).

Switch signal outputs are routed to the signal breakout header located adjacent to the breadboard.

LED's

The MCU Project Board provides 8, active-high, green, light emitting diodes, LED's, for use as output indicators. Each LED input is buffered allowing the either +5V or +3.3V input levels to drive each LED. Each buffer input is biased to prevent unwanted LED activation. A 1 kΩ resistor holds each buffer input low until actively driven high. The LED buffer driver may be disabled by removing a shunt at JP6, LED_ENABLE.

Table 4: LED_EN – JP6

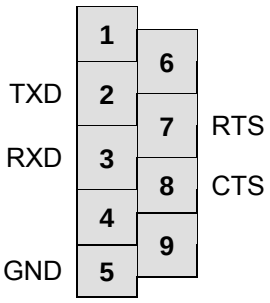
Shunt	Effect
ON	Enable LCD Port Output
OFF	Disable LCD Port Output

COM Port

The MCU Project Board provides a single RS-232 communications port. An RS-232 transceiver (U5) provides RS-232 signal level to TTL/CMOS logic level translation services. Communication and handshake signals may be individually enabled/disabled to the transceiver by option header JP9, COM_EN. The transceiver output may be routed to different usage points by option header JP7, COM_SEL.

In addition to the communications services below, each signal input from the COM connector is routed to the signal breakout connector - located adjacent to the breadboard. This allows the user to implement communications protocols not built-in to the project board.

Figure 9: COM Port Connector – COM



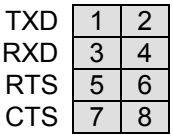
Female DB9 connector that interfaces to the RS232 transceiver. It provides simple 2-wire asynchronous serial communications without flow control.

Pins 1, 4, 6, and 9 are routed to the User I/O Signal Breakout connector located adjacent to the bread-board.

COM_EN Option Header

The COM_EN option header allows the user to disconnect the on-board RS-232 transceiver. This allows the user to implement alternate communications protocols such as RS422/485 with out conflict from the installed transceiver.

Figure 10: COM_EN – JP9

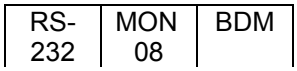


Installing a shunt on each pin pair routes the associ-ated signal from the COM connector to the RS-232 transceiver. Removing the shunt disables the signal to the transceiver.

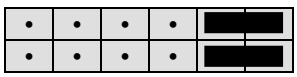
COM_SEL Option Header

The COM_SEL option header is a 12-pin header used to route the RS-232 transceiver output to the appropriate circuit. Outputs for the RS-232 and MON08 functionality are routed to the signal breakout header located adjacent to the breadboard. The BDM output is routed to the BDM pod.

Figure 11: COM_SEL – JP7

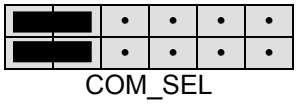


Placing jumpers on appropriate pin pairs enables the associated communications protocol. Each RX/TX pair should be enabled at the same time.



This shunt placement shown enables communica-tions to the on-board BDM pod.

This shunt placement shown enables communica-tions to the on-board MON08 port.



This shunt placement shown enables communica-tions to the on-board RS-232 port.

RS-232

RS-232 signals TX and RX are available to the user at the signal breakout header located adjacent to the breadboard. Handshaking signals RTS and CTS are also available.

MON08

A single wire MON08 interface is available to the user at the signal breakout header located adjacent to the breadboard. A resistor (R21) and zener diode (D3) on the MCU Project Board provide the necessary V_{TST} voltage required to access the MON08 monitor mode. V_{TST} is available when the board is power from either the V_{IN} connector or from the NI-ELVIS workstation.

BDM

Access to the on-board BDM pod is available thought the COM connector.

Potentiometer

The MCU Project Board provides a 20-turn, 10 kΩ, precision, potentiometer with adjustable range for use in circuit prototyping. An option header labeled RANGE allows selection of output range. Installing the option jumper provides the full range output from the POT from GND to V_{DD}. Removing the option jumper places a 10k ohm resistor in series with the POT limiting output from GND to ½ V_{DD}.

OSCILLATOR SOCKET

The MCU Project Board provides a socket for an optional Clock Oscillator. The socket is configured to accept either 14-pin oscillator or 8-pin oscillator packages. An OSC_OPT option jumper allows the use of 5V oscillators to drive 3.3V circuits. Removing the option jumper routes the clock output through a simple voltage divider thereby reducing the output amplitude. Installing the option jumper allows 5V clock output.

Table 5: OSC_OPT – JP8

Shunt	Effect
ON	Oscillator Output at Full Amplitude – $5V_{PP}$
OFF	Oscillator Output at Reduced Amplitude – $3.3V_{PP}$

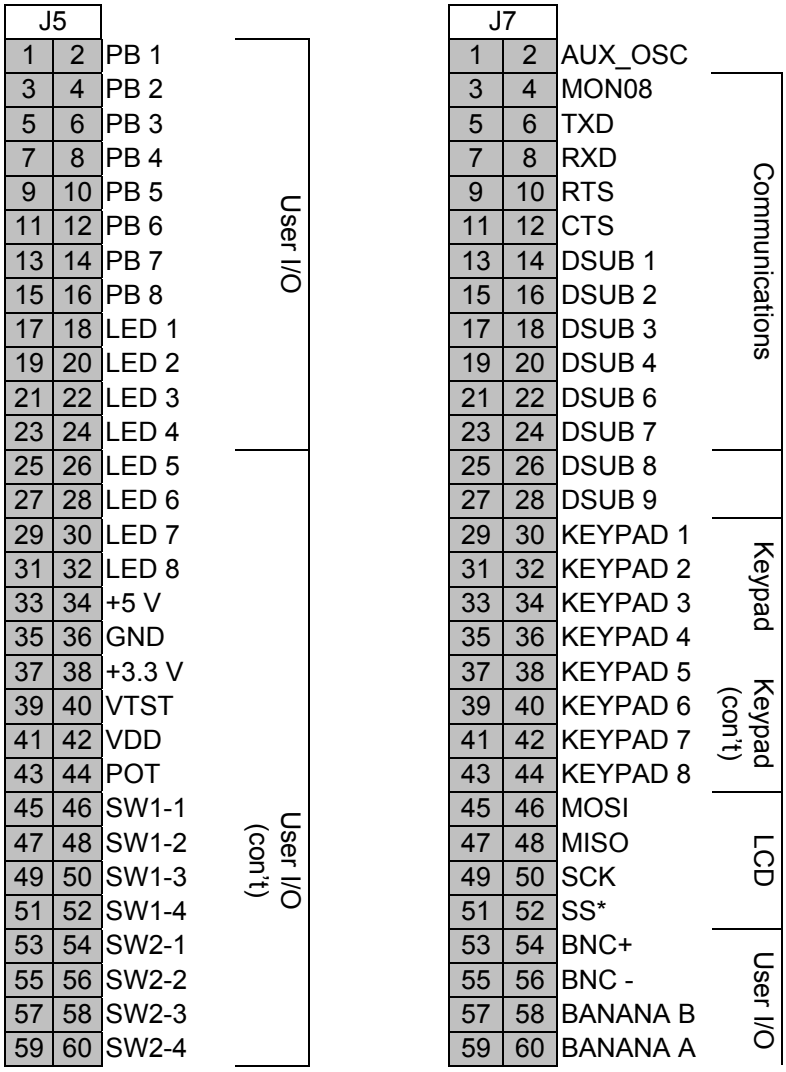
Signal Breakout

A key feature of the MCU Project Board is the large, centrally located, breadboard area. Dual-row socket headers strategically placed around the breadboard provide signal access. Signal breakout may be grouped into 3 broad categories: User I/O Signals, MCU Access Signals, and NI-ELVIS Signals

USER I/O

User I/O signal breakout connectors provide access to all on-board components. These connectors are located below the breadboard with signals strategically located to simplify access. Each signal group is labeled to ease signal identification and location. To ease prototyping, each signal is routed to two socket locations. This allows the user to easily route each to signal to multiple locations if desired. The table below details the USER I/O Signal Breakout connectors.

Figure 12: USER I/O Signal Breakout



MCU ACCESS

A unique feature of the MCU Project Board is the capability to interface directly with a line of Axiom Manufacturing MCU Development Boards. These development boards either plug directly into the MCU_PORT or connect through a ribbon cable. The AUX_PORT allows connecting to the Analog Port of several MCU Development Boards. The signals originating at the MCU_PORT connector or the AUX_PORT connector are routed to two sets of dual-row socket headers located at both ends of the breadboard. All MCU_PORT and AUX_PORT signals are available at both signal breakout locations. This allows the user to easily prototype circuits at either end of the breadboard. Signal placement at these breakout locations is dependent on signal orientation at the MCU_PORT and the AUX_PORT. To ease prototyping, each signal is routed to two socket locations. This allows the user to easily route each to signal to multiple locations if desired.

Figure 13: MCU ACCESS Signal Breakout

AUX_PORT

	J5		
AX1	1	2	AX2
AX3	3	4	AX4
AX5	5	6	AX6
AX7	7	8	AX8
AX9	9	10	AX10
AX11	11	12	AX12
AX13	13	14	AX14
AX15	15	16	AX16
AX17	17	18	AX18
AX19	19	20	AX20

	J6		J7		
AX1	1	2	1	2	AX2
AX3	3	4	3	4	AX4
AX5	5	6	5	6	AX6
AX7	7	8	7	8	AX8
AX9	9	10	9	10	AX10
AX11	11	12	11	12	AX12
AX13	13	14	13	14	AX14
AX15	15	16	15	16	AX16
AX17	17	18	17	18	AX18
AX19	19	20	19	20	AX20

	J8		J9		
AX1	1	2	1	2	AX2
AX3	3	4	3	4	AX4
AX5	5	6	5	6	AX6
AX7	7	8	7	8	AX8
AX9	9	10	9	10	AX10
AX11	11	12	11	12	AX12
AX13	13	14	13	14	AX14
AX15	15	16	15	16	AX16
AX17	17	18	17	18	AX18
AX19	19	20	19	20	AX20

MCU ACCESS Signal Breakout (continued)

MCU_PORT

	J10		
IO1	1	2	IO2
IO3	3	4	IO4
IO5	5	6	IO6
IO7	7	8	IO8
IO9	9	10	IO10
IO11	11	12	IO12
IO13	13	14	IO14
IO15	15	16	IO16
IO17	17	18	IO18
IO19	19	20	IO20
IO21	21	22	IO22
IO23	23	24	IO24
IO25	25	26	IO26
IO27	27	28	IO28
IO29	29	30	IO30
IO31	31	32	IO32
IO33	33	34	IO34
IO35	35	36	IO36
IO37	37	38	IO38
IO39	39	40	IO40
IO41	41	42	IO42
IO43	43	44	IO44
IO45	45	46	IO46
IO47	47	48	IO48
IO49	49	50	IO50
IO51	51	52	IO52
IO53	53	54	IO54
IO55	55	56	IO56
IO57	57	58	IO58
IO59	59	60	IO60

	J11		J12		
IO1	1	2	1	2	IO2
IO3	3	4	3	4	IO4
IO5	5	6	5	6	IO6
IO7	7	8	7	8	IO8
IO9	9	10	9	10	IO10
IO11	11	12	11	12	IO12
IO13	13	14	13	14	IO14
IO15	15	16	15	16	IO16
IO17	17	18	17	18	IO18
IO19	19	20	19	20	IO20
IO21	21	22	21	22	IO22
IO23	23	24	23	24	IO24
IO25	25	26	25	26	IO26
IO27	27	28	27	28	IO28
IO29	29	30	29	30	IO30
IO31	31	32	31	32	IO32
IO33	33	34	33	34	IO34
IO35	35	36	35	36	IO36
IO37	37	38	37	38	IO38
IO39	39	40	39	40	IO40
IO41	41	42	41	42	IO42
IO43	43	44	43	44	IO44
IO45	45	46	45	46	IO46
IO47	47	48	47	48	IO48
IO49	49	50	49	50	IO50
IO51	51	52	51	52	IO52
IO53	53	54	53	54	IO54
IO55	55	56	55	56	IO56
IO57	57	58	57	58	IO58
IO59	59	60	59	60	IO60

	J13		J14		
IO1	1	2	1	2	IO2
IO3	3	4	3	4	IO4
IO5	5	6	5	6	IO6
IO7	7	8	7	8	IO8
IO9	9	10	9	10	IO10
IO11	11	12	11	12	IO12
IO13	13	14	13	14	IO14
IO15	15	16	15	16	IO16
IO17	17	18	17	18	IO18
IO19	19	20	19	20	IO20
IO21	21	22	21	22	IO22
IO23	23	24	23	24	IO24
IO25	25	26	25	26	IO26
IO27	27	28	27	28	IO28
IO29	29	30	29	30	IO30
IO31	31	32	31	32	IO32
IO33	33	34	33	34	IO34
IO35	35	36	35	36	IO36
IO37	37	38	37	38	IO38
IO39	39	40	39	40	IO40
IO41	41	42	41	42	IO42
IO43	43	44	43	44	IO44
IO45	45	46	45	46	IO46
IO47	47	48	47	48	IO48
IO49	49	50	49	50	IO50
IO51	51	52	51	52	IO52
IO53	53	54	53	54	IO54
IO55	55	56	55	56	IO56
IO57	57	58	57	58	IO58
IO59	59	60	59	60	IO60

NI-ELVIS Interface

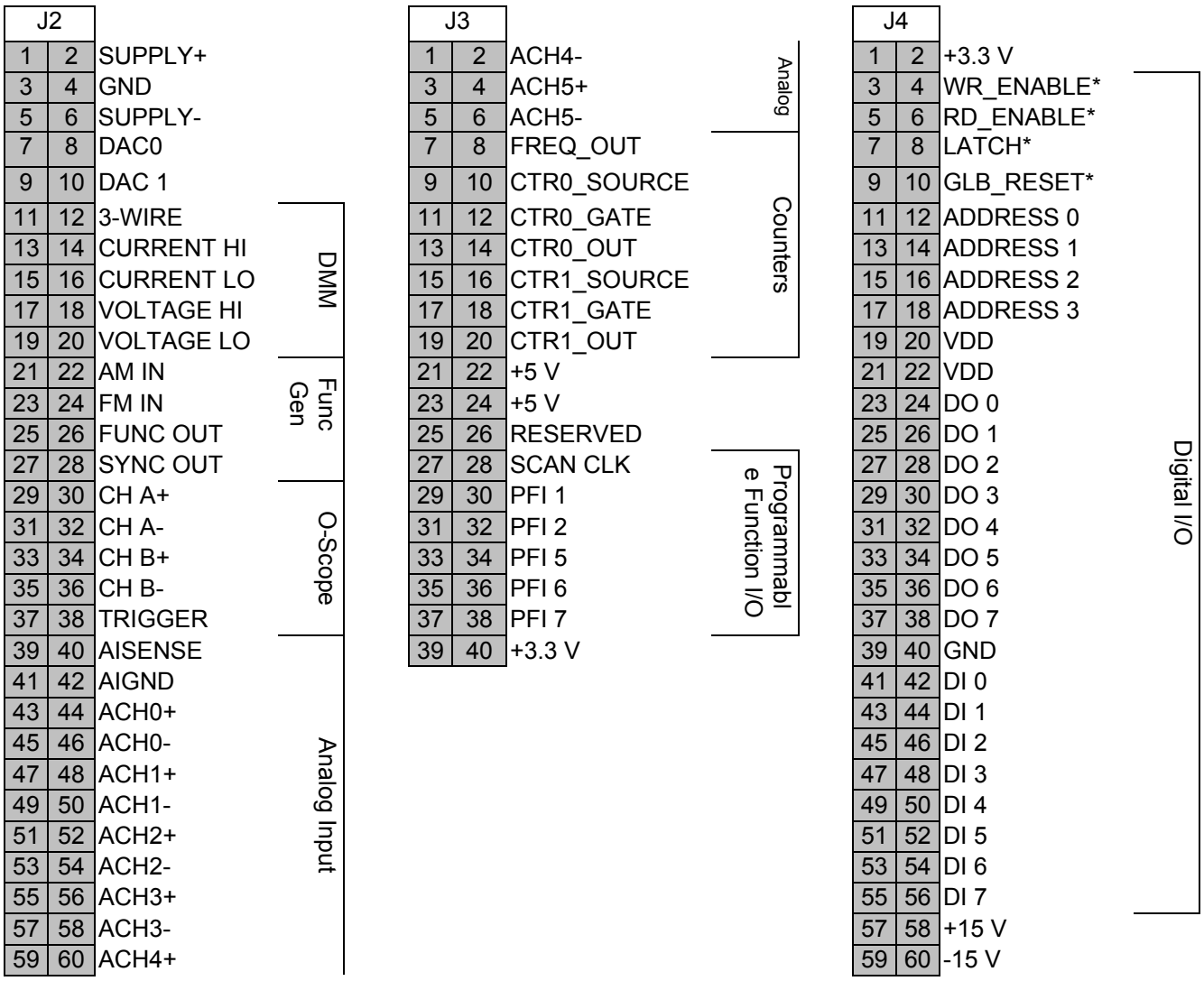
The NI-ELVIS interface consists of a PCI style connector located at J1 and several dual-row socket headers. Connector J1 connects the MCU Project Board directly to the NI-ELVIS platform. This connector is designed to mate directly to the NI-ELVIS workstation in form, fit, and function. All NI-ELVIS signals are routed to a signal breakout connector conveniently located adjacent to the breadboard. Refer to the NI-ELVIS User Guide for details on the functioning of the NI-ELVIS platform.

Figure 14: Edge Connector – J1

+15 V	A1	B1	-15 V	SCAN CLK	A32	B32	PFI 1
+15 V	A2	B2	-15 V	TRIGGER	A33	B33	CTR1_SOURCE
+5V_In	A3	B3	GND	CTR1_GATE	A34	B34	CTR1_OUT
+5V_In	A4	B4	GND	CTR0_SOURCE	A35	B35	CTR0_GATE
+5V_In	A5	B5	GND	CR0_OUT	A36	B36	FREQ_OUT
GND	A6	B6	GND	GND	A37	B37	GND
DO 6	A7	B7	DO 7	VOLTAGE HI	A38	B38	VOLTAGE LO
DO 4	A8	B8	DO 5	AIGND	A39	B39	AIGND
DO 2	A9	B9	DO 3	ACH7+	A40	B40	ACH7-
DO 0	A10	B10	DO 1	ACH6+	A41	B41	ACH6-
GND	A11	B11	GND	ACH5+	A42	B42	ACH5-
PCI KEYWAY	A12	B12	PCI KEYWAY	ACH4+	A43	B43	ACH4-
PCI KEYWAY	A13	B13	PCI KEYWAY	AIGND	A44	B44	AIGND
DI 6	A14	B14	DI 7	ACH3+	A45	B45	ACH3-
DI 4	A15	B15	DI 5	ACH2+	A46	B46	ACH2-
DI 2	A16	B16	DI 3	ACH1+	A47	B47	ACH1-
DI 0	A17	B17	DI 1	ACH0+	A48	B48	ACH0-
GND	A18	B18	GND	AISENSE	A49	B49	N/C
GND	A19	B19	GND	PCI KEYWAY	A50	B50	PCI KEYWAY
GND	A20	B20	GND	PCI KEYWAY	A51	B51	PCI KEYWAY
GND	A21	B21	GND	N/C	A52	B52	N/C
CONN_+5V	A22	B22	GND	SYNC OUT	A53	B53	FM IN
GND	A23	B23	GND	FUNC OUT	A54	B54	AM IN
N/C	A24	B24	ADDRESS 3	GND	A55	B55	CONN_+5V
ADDRESS 2	A25	B25	ADDRESS 1	N/C	A56	B56	GND
ADDRESS 0	A26	B26	GLB_RESET*	CURRENT LO	A57	B57	N/C
LATCH*	A27	B27	RD_ENABLE*	3-WIRE	A58	B58	CURRENT HI
WR_ENABLE*	A28	B28	CONN_+5V	N/C	A59	B59	N/C
Proto Board Present	A29	B29	PFI 6	DAC0_2	A60	B60	DAC 1
PFI 5	A30	B30	PFI 7	GND	A61	B61	GND
PFI 2	A31	B31	RESERVED	SUPPLY-	A62	B62	SUPPLY+

The following chart shows the signal breakout for the NI-ELVIS signals. These connectors are arranged from left to right above the breadboard. All signals are grouped by function and arranged to provide convenient access to the breadboard. Each signal group is labeled to ease signal identification and location. To ease prototyping, each signal is routed to two socket locations. This allows the user to easily route each to signal to multiple locations if desired. The table below details the NI-ELVS signal breakout connectors.

Figure 15: NI-ELVIS Signal Breakout



TROUBLESHOOTING TIPS

The following is a list of useful problem resolution tips to try before contacting Technical Support for assistance. If the MCU Project Board still fails to operate properly, contact Axiom Manufacturing at Support@axman.com.

LED's on the MCU Project Board don't light

- Verify +9VDC at the VIN connector with a volt meter
- If the transformer is connected to a power strip, make sure it is turned on.
- Measure +5VDC between pins VR1-2 and VR1-3
- Measure +3.3VDC between pins VR2-2 and VR2-3
- Make sure JP1, PWR_SEL is set to source power from the on-board voltage regulator

LED's on the MCU Development Module don't light

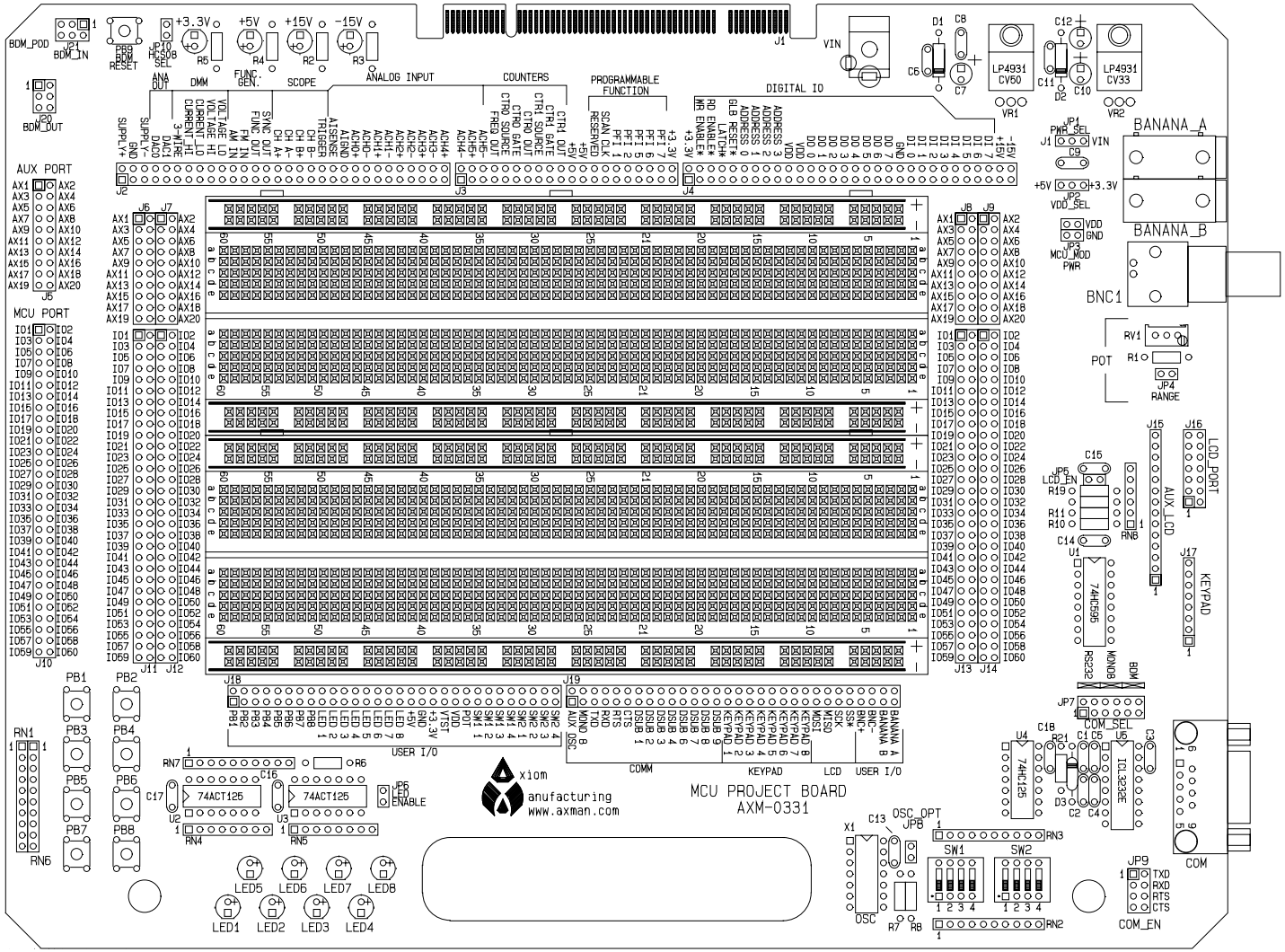
- Make sure the module is properly connected to the MCU Project Board
- Make sure a power cord is not connected to the module
- Make sure the MOD_PWR_SEL option header on the MCU Project Board is setup properly
- Make sure the PWR_SEL option header on the Development Module is setup properly

No Prompt at the AxIDE Terminal

- Make sure the Serial cable is connected to the HOST PC
- Make sure the correct serial port is selected in the AxIDE program
- Make sure the AxIDE program options setting are configured correctly

APPENDIX A

SILKSCREEN



APPENDIX B

BILL OF MATERIALS

	Qty	Title	Ref	Mfr	Mfr-P/N
		BOM, 8/16 Project Board			
1	2	Cap, Tant, 10uF, 10V, Case A (4x7), .1LS, Thru	C7, C10		
2	1	Cap, Elec, 2.2uF, 50V, 5x11, .1LS, Thru	C12	Nichicon	UVR1H2R2MDA
3	10	Cap, Mon, .1uF, 50V, 10%, Case A1, .2LS, Thru	C6, C8, C9, C11, C13, C14, C15, C16, C17, C18		
4	5	Cap, Mon, 1uF, 50V, .3x.36 in, .2LS,Thru	C1, C2, C3, C4, C5	Kemet	C330C105M5U5CA
5	4	Res, Carbon, 10K ohm, 5%, 1/4W, Thru	R1, R6, R19, R20		
6	1	Res, Carbon, 220 ohm, 5%, 1/4W, Thru	R5	NIC	271-220
7	2	Res, Carbon, 2.0K ohm, 5%, 1/4W, Thru	R2, R3		
8	1	Res, Carbon, 100 ohm, 5%, 1/4W, Thru	R10		
9	1	Res, Carbon, 470 ohm, 5%, 1/8W, Thru	R4		
10	1	Res, Carbon, 0 ohm, 1/4W, Thru	R11		
11	1	Res, Carbon, 1K ohm, 1/4W, Thru	R21		
12	1	Res, Carbon, 68 ohm, 1/4W, Thru	R7		
13	1	Res, Carbon, 120 ohm, 1/4W, Thru	R8		
14	1	Res, Pot, 10k ohm, Thru, Top Adj	RV1		
15	1	Res, Ntwk, 1K ohm, Bussed, 10px9r, SIP Thru	RN1	CTS	770101102
16	1	Res, Ntwk, 100 ohm, Bussed, 10px9r, SIP Thru	RN2	CTS	770101101
17	3	Res, Ntwk, 10K ohm, Bussed, 10px9r, SIP, Thru	RN3, RN6, RN7	CTS	770101103
18	1	Res, Ntwk, 10k ohm, Bussed, 6px5r, SIP, Thru	RN8	CTS	77061103
19	2	Res, Ntwk, 470 ohm, Isolated, 8px4r, SIP, Thru	RN4, RN5	CTS	77083471
20	2	Diode, Rect., 1N4001, 50V, 1A, DO-41, Thru	D1, D2		

BILL OF MATERIALS (continued)

21	12	LED, Green, T1 3/4, Thru	LED1, LED2, LED3, LED4, LED5, LED6, LED7, LED8, +15V, -15V, +5V, +3.3V		
22	1	Diode, Zener, 1N5237, 8.2V, 5%, .5W, DO-35, Thru	D3	Vishay	1N5237B
				Fairchild	1N5237B
23	2	Diode, Rect, 1N4148, 30V, 1A, DO-35, Thru	D4, D5		1N4148
23	1	VReg, LDO, 5.0V, 250mA, TO-220AB	VR1	ST	L4931CV50
24	1	VReg, LDO, 3.3V, 250mA, TO220-3	VR2	ST	L4931CV33
25	1	IC, 8b Shift Reg, Latch, 74HC595, 16DIP	U1	ST	M74HC595B1R
26	1	IC, Dual RS232 XCVR, 3.3V, 0.1uF caps, 16 PDIP	U5	Intersil	ICL3232EPC
				Sipex	SP3232ECP
27	2	IC, Quad Buf, 3S, 74ACT125, 14 PDIP, TTL Comp	U2, U3	Fairchild	74ACT125PC
28	1	IC, Quad Buf, 3S, 74AC125, 14 PDIP, CMOS	U4	ST	74AC125B
29	2	Sw, DIP, 4 pos, SPST, Thru	SW1, SW2	Alcoswitch	3-435640-5
30	9	Sw, PB, 5mm Sq, Thru	PB1, PB2, PB3, PB4, PB5, PB6, PB7, PB8, PB9		
31	2	Hdw, Protoboard, 6.5"x2.1", 830 pt		E-Call	161-40-1020
32	1	Socket, IC, 14P Machine DIP, .3 wide, Thru	X1		
33	1	Conn, Dsub, 9P, F, RA, PCB Mount	Com		
34	1	Conn, 2.1mm, Pwr Jack, Barrel, Thru, RA	VIN		
35	1	Conn, Spec, BNC, RA w/ mtg posts, Black, PCB, Thru	BNC1	Amp/Tyco	227161-2
36	1	Conn, Recpt, Banana, 4.0 mm, Black, Thru	BANANA_B	Deltron	164-6218
37	1	Conn, Recpt, Banana, 4.0 mm, Red, Thru	BANANA_A	Deltron	164-6219
38	5	Conn, 1x2 Pin Header, .1" Ctr, Thru	JP4, JP5, JP6, JP8, JP10		
39	2	Conn, 1x3 Pin Header, .1" Ctr, Thru	JP1, JP2		
40	1	Conn, 1x8 Pin Header, .1" Ctr, Thru	J17		
41	1	Conn, 1x14 Pin Header, .1" Ctr, Thru	J15		
42	1	Conn, 2x2 Pin Header, .1" Ctr, Thru	J3		
43	1	Conn, 2x3 Pin Header, .1" Ctr, Thru	J20, J21		
44	1	Conn, 2x4 Pin Header, .1" Ctr, Thru	JP9		

45	1	Conn, 2x6 Pin Header, .1" Ctr, Thru	JP7		

BILL OF MATERIALS (continued)

46	1	Conn, 2x7 Pin Header, .1" Ctr, Thru	J16		
47	5	Conn, Hdr, Socket, 2x10, .1", Thru	J5, J6, J7, J8, J9		
48	1	Conn, Hdr, Socket, 2x20, .1", Thru	J3		
49	9	Conn, Hdr, Socket, 2x30, .1", Thru	J2, J4, J10, J11, J12, J13, J14, J18, J19		
50	12	Hdw, Shunt, 2 Pos, .1"			
51	8	Hdw. Rubber Bumper, .45"x.2", Hemisphere			
52	2	Hdw, Screw, 4-40x.375", SS	VR1, VR2		
53	2	Hdw, Nut, 4-40	VR1, VR2		
54	1	PCB, MCU Project Board, 8.5" x 11.0", 2 Layer, Single Sided			
		Surface Mount Components			
55	1	IC, MCU, MC9S12C32, 16MHz, 48QFP	U6	Freescale	MC9S12C32CFA
56	1	Resonator, Cer, 8.00MHz, w/Caps, 3Pos, SMT	Y1	Murata	CSTCE8M00G55-R0
57		Cap, Tant, 10uF, 10V, SMB	C23, C25	Avx	TAJB106K010R
58		Cap, Mon, .01uF, 50V, 0805	C22, C24, C26		
59		Cap, Mon, .1uF, 50V, 0805	C21, C27, C28		
60		Cap, Mon, 4700pF, 10%, 0805	C19	Kemet	C0805C472K5RACTU
61		Cap, Mon, 470pF, 50V, 5%, 0805	C20	Kemet	C0805C471J5GAC7025
62		Res, Carbon, 1M ohm, 5%, 1/16w, 0805	R27		
63		Res, Carbon, 5.1k ohm , 5%, 0805	R26		
64		Res, Carbon, 4.7K ohm, 5%, 0805	R24, R25		
65		Res, Carbon, 100 ohm, 5%, 0805	R22, R23		