# ATHENA III PANEL I/O BOARD

## User Manual

### Revision A     January 2013
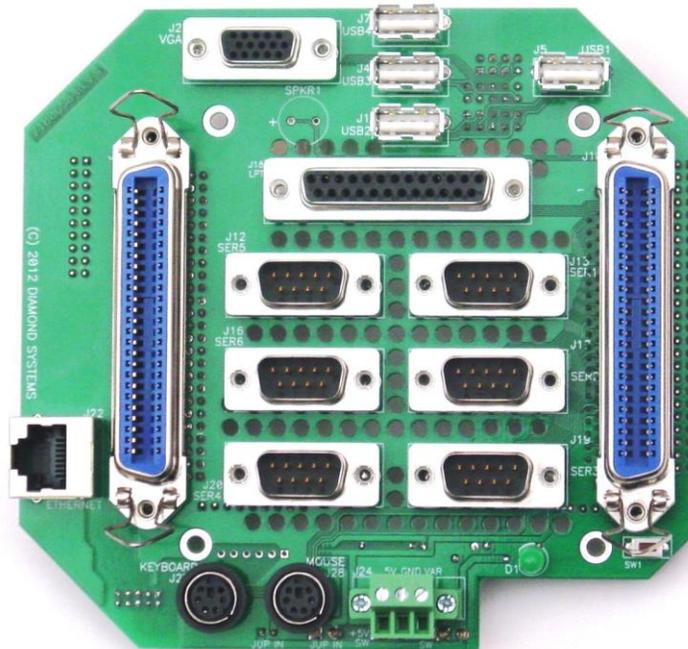


| Revision | Date | Comment |
|----------|---------|-----------------|
| A | 1/10/13 | Initial Release |
| | | |

## CONTENTS

# IMPORTANT SAFE-HANDLING INFORMATION

**WARNING:  ESD-Sensitive Electronic Equipment!**

**Observe ESD-safe handling procedures when working with this product.**

**Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.**

**Always store this product in ESD-protective packaging when not in use.**

## *Safe Handling Precautions*

Aurora contains numerous I/O connectors that connect to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond (or any vendor's) embedded computer boards.

**ESD damage** – This type of damage is almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced.

To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

**Damage during handling or storage** – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

**Power supply wired backwards** – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply. In this case the board will most likely will be unrepairable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

**Bent connector pins** – This type of problem is often only a cosmetic issue and is easily fixed by bending the pins back to their proper shape one at a time with needle-nose pliers. This situation can occur when pulling a ribbon cable off of a pin header. Note: If the pins are bent too severely, bending them back can cause them to weaken unacceptably or even break, and the connector must be replaced.

# 1. DESCRIPTION

The Athena III panel I/O board plugs directly onto the Athena III PC/104 single board computer and provides industry-type I/O connectors for all I/O features on the board. The panel I/O board mounts in the Pandora enclosure to provide a cable-free mounting system for Athena III.

Key feature highlights include:

♦ Plugs onto the Athena III SBC and provides all I/O without cables

♦ Provides additional front panel I/O for 2 additional PC/104 boards

♦ Mounts in Pandora enclosure

♦ Provides connection for power switch

♦ Provides power paths for +5V and variable voltage input

# 2. BLOCK DIAGRAM
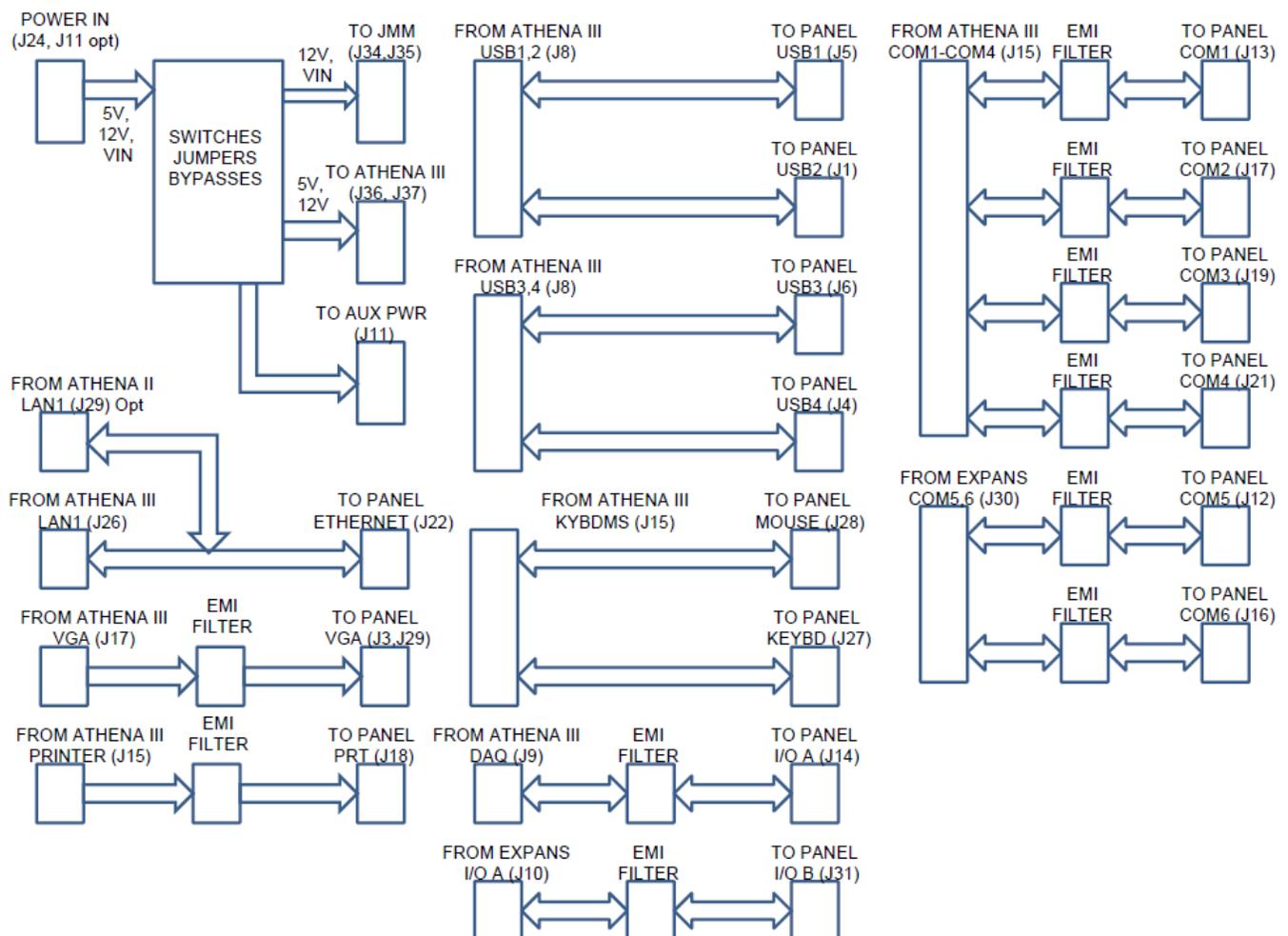
# 3.   MECHANICAL DRAWING

A mechanical drawing of the Athena III panel I/O board connector layout is provided below. The drawing shows the top side of the panel I/O board with the relative connector locations.

All I/O connectors are located on the board so that there is sufficient room to install all connectors without interference with any other connector or mounting hole.

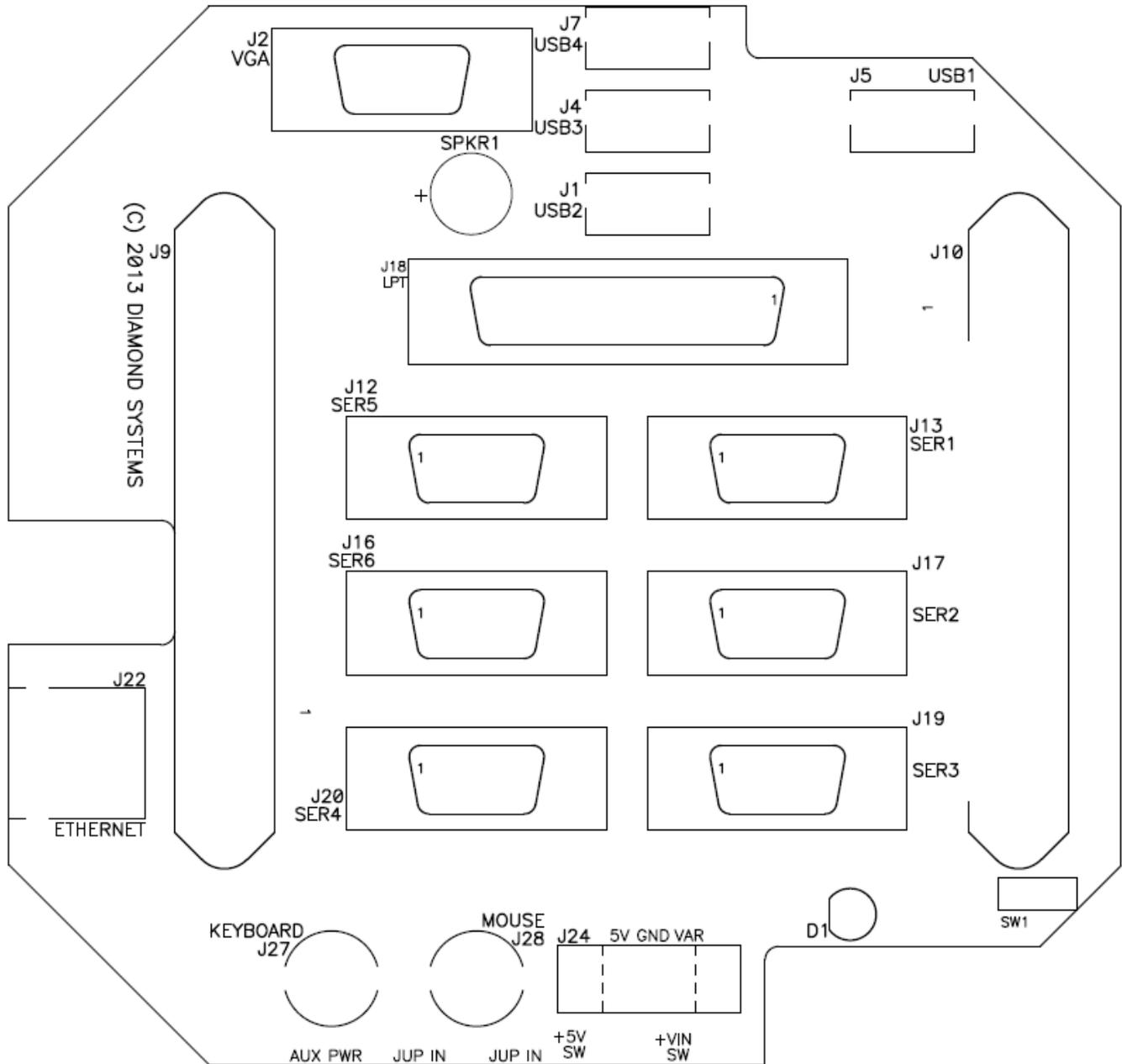Athena III Panel I/O Board Top Side

# 4. FUNCTIONAL DESCRIPTION

The panel I/O board contains three major sections: SBC I/O section, Expansion I/O section, and Power section.

## 4.1 SBC I/O Section

The SBC I/O section brings out all the SBC I/O to the front panel connectors. On the top side it has industry standard I/O connectors, and on the bottom side it provides dual row 2mm pin sockets on the bottom of the board to mate with the corresponding 2mm pin headers on the SBC.

## 4.2 Expansion I/O Section

The Expansion I/O section contains additional connectors for bringing out the I/O from one PC/104 module installed below the Athena III SBC inside the enclosure.

The first feature provides I/O for a generic PC/104 I/O board. It includes a 50-pin 2x20 .1" pitch pin header for mating with a standard ribbon cable that connects to the I/O connector of a PC/104 board. This pin header is on the bottom right side of the panel board in a spot convenient for mating with the standard PC/104 board I/O connector location. On the top side a DB37 connector is provided for external access to this I/O.

The second feature provides I/O for a DSC EMM-XT / EMM-4M-XT serial port board. It provides two 2x10 .1" pitch pin headers in the upper right corner for connection to the EMM board, and 3 DB9M connectors in the top left center and 1 DB9M connector in the right center for external access.

## 4.3 Power Section

The Power section provides two paths for input power coming from either a +5V, +12V or variable input voltage source. The power input connector consists of a 1x4 header that connects to a plug with screw connectors for connections to +5V, +12V or system voltage and ground.

The +5V source is routed through a 1x2 .156" pitch friction lock connector for a front panel switch and then to a pin socket on the bottom side that mates with the Athena III SBC. The switch connector can be bypassed with a jumper if desired.

The +12V or variable input voltage source is routed through another 1x2 .156" pitch friction lock connector for a front panel switch and then to a separate 1x2 .156" pitch friction lock connector for connection to a DC/DC power supply mounted inside the enclosure. The 5VDC output of this DC/DC power supply then has two paths to the Athena III SBC: (1) It can connect directly to the PC/104 bus of the system, if the power supply is mounted on the bus; or (2) it can be routed back to the panel I/O board with another connector and then to the Athena III SBC through the panel I/O board's pin socket connection.

The panel I/O board also provides a path for optional +12VDC output from the power supply to the Athena III SBC through the pin socket.

Another connector provides auxiliary power to any peripherals mounted inside the Pandora enclosure like hard disk drives or other data storage devices or recorders.

The power section contains a green LED which is connected to the +5VDC signal to indicate power status.

# 5.   SBC I/O SECTION – BOTTOM SIDE

All these connectors are on the bottom side of the panel I/O board. Their locations and pinouts match exactly the corresponding connectors on the Athena III SBC. The pin numbering of these connectors, when facing the connector, is reversed from the pin numbering on the male pin headers.

## 5.1   Ethernet

| | | | |
|---:|:--:|:--:|:---|
| NC | 1 | 2 | NC |
| MDI0+ | 3 | 4 | MDI0- |
| MDI1+ | 5 | 6 | MDI1- |
| MDI2+ | 7 | 8 | MDI2- |
| MDI3+ | 9 | 10 | MDI3- |

## 5.2   Input Power

The power signals on these connectors come from either the front panel input power connector via jumpers, or an external switch, and connect to the power signals on the PC/104 connector of the Athena III SBC.

**A**

| | |
|---:|:--:|
| GND | 1 |
| NC | 2 |
| +5V | 3 |
| NC | 4 |
| NC | 5 |
| NC | 6 |
| NC | 7 |
| NC | 8 |
| +12V | 9 |

**B**

| | |
|---:|:--:|
| +5V | 1 |
| NC | 2 |
| GND | 3 |
| GND | 4 |

## 5.3   VGA

This connector provides a connection for VGA monitors. Note that while the DDC serial detection pins are present, there is no 5V supply provided, nor are the old "Monitor ID" pins used.

| | | | |
|---:|:--:|:--:|:---|
| GRN | 1 | 2 | RED |
| BLU | 3 | 4 | GND |
| HSYN | 5 | 6 | DDAT |
| VSYN | 7 | 8 | DCLK |

## 5.4   Serial Ports

This connector provides 4 serial ports, printer port and PS/2 keyboard and mouse signals from the Athena III CPU board. The four serial ports are jumper-configurable for RS-232, RS-422, or RS-485 protocols.

| Signal | A | B | Signal |
|---|---|---|---|
| SERA DCD | A01 | B01 | PPRT_~STRB |
| SERA DSR | A02 | B02 | PPRT_LNFD |
| SERA RXD | A03 | B03 | PPRT_PD0 |
| SERA RTS | A04 | B04 | PPRT_PERR |
| SERA TXD | A05 | B05 | PPRT_PD1 |
| SERA CTS | A06 | B06 | PPRT_~INIT |
| SERA DTR | A07 | B07 | PPRT_PD2 |
| SERA RNG | A08 | B08 | PPRT_~SELP |
| SERA GND | A09 | B09 | PPRT_PD3 |
| SERB DCD | A10 | B10 | PPRT_GND |
| SERB DSR | A11 | B11 | PPRT_PD4 |
| SERB RXD | A12 | B12 | PPRT_GND |
| SERB RTS | A13 | B13 | PPRT_PD5 |
| SERB TXD | A14 | B14 | PPRT_GND |
| SERB CTS | A15 | B15 | PPRT_PD6 |
| SERB DTR | A16 | B16 | PPRT_GND |
| SERB RNG | A17 | B17 | PPRT_PD7 |
| SERB GND | A18 | B18 | PPRT_GND |
| SERC DCD | A19 | B19 | PPRT_~PACK |
| SERC DSR | A20 | B20 | PPRT_GND |
| SERC RXD | A21 | B21 | PPRT_PBSY |
| SERC RTS | A22 | B22 | PPRT_GND |
| SERC TXD | A23 | B23 | PPRT_PPOT |
| SERC CTS | A24 | B24 | PPRT_GND |
| SERC DTR | A25 | B25 | PPRT_SLCT |
| SERC RNG | A26 | B26 | KB CLK |
| SERC GND | A27 | B27 | KB GND |
| SERD DCD | A28 | B28 | KB DATA |
| SERD DSR | A29 | B29 | KB VCC |
| SERD RXD | A30 | B30 | MS CLK |
| SERD RTS | A31 | B31 | MS GND |
| SERD TXD | A32 | B32 | MS DATA |
| SERD CTS | A33 | B33 | MS VCC |
| SERD DTR | A34 | B34 | RST GND |
| SERD RNG | A35 | B35 | ~RST IN |
| SERD GND | A36 | B36 | |
| | A37 | B37 | |
| | A38 | B38 | |
| | A39 | B39 | |
| | A40 | B40 | |

## 5.5   USB 0/1 Ports

This connector provides access to the 2 USB 2.0 ports. The shield pin is tied to system ground. The Key positions are missing to match the key position in the cable to prevent misconnection.

| | | | |
|---|---|---|---|
| NC | 1 | 2 | Shield / Ground |
| USB1 Pwr- | 3 | 4 | USB0 Pwr- |
| USB1 Data+ | 5 | 6 | USB0 Data+ |
| USB1 Data- | 7 | 8 | USB0 Data- |
| USB1 Pwr+ | 9 | 10 | USB0 Pwr+ |

## 5.6   USB 2/3 Ports

This connector provides access to the 2 USB 2.0 ports. The shield pin is tied to system ground. The Key positions are missing to match the key position in the cable to prevent misconnection.

| | | | |
|---|---|---|---|
| NC | 1 | 2 | Shield / Ground |
| USB3 Pwr- | 3 | 4 | USB2 Pwr- |
| USB3 Data+ | 5 | 6 | USB2 Data+ |
| USB3 Data- | 7 | 8 | USB2 Data- |
| USB3 Pwr+ | 9 | 10 | USB2 Pwr+ |

## 5.7 Data Acquisition I/O

This connector provides a connection for the DAQ functions on the Athena III SBC.

| | | | |
|---|---|---|---|
| DIO A0 | 1 | 26 | DIO A1 |
| DIO A2 | 2 | 27 | DIO A3 |
| DIO A4 | 3 | 28 | DIO A5 |
| DIO A6 | 4 | 29 | DIO A7 |
| DIO B0 | 5 | 30 | DIO B1 |
| DIO B2 | 6 | 31 | DIO B3 |
| DIO B4 | 7 | 32 | DIO B5 |
| DIO B6 | 8 | 33 | DIO B7 |
| DIO C0 | 9 | 34 | DIO C1 |
| DIO C2 | 10 | 35 | DIO C3 |
| DIO C4 / Gate 0 | 11 | 36 | DIO C5 / Gate 1 |
| DIO C6 / Clk 1 | 12 | 37 | DIO C7 / Out 0 |
| Ext Trig | 13 | 38 | Tout 1 |
| +5V Out | 14 | 39 | Dground |
| Vout 0 | 15 | 40 | Vout 1 |
| Vout 2 | 16 | 41 | Vout 3 |
| Aground (Vout) | 17 | 42 | Aground (Vin) |
| Vin 0 | 18 | 43 | Vin 8 |
| Vin 1 | 19 | 44 | Vin 9 |
| Vin 2 | 20 | 45 | Vin 10 |
| Vin 3 | 21 | 46 | Vin 11 |
| Vin 4 | 22 | 47 | Vin 12 |
| Vin 5 | 23 | 48 | Vin 13 |
| Vin 6 | 24 | 49 | Vin 14 |
| Vin 7 | 25 | 50 | Vin 15 |

# 6.   SBC I/O SECTION – TOP SIDE

These SBC I/O connectors are on the top side of the panel I/O board. They face out through the enclosure front panel.

## 6.1   Input Power

The input power connector is dual-footprint of two connectors. Connector 1 is a 1x4 Phoenix-type header – screw plug style connector. The input power may be supplied either by +5VDC and/or +12V / +Vin. The +5V is intended to be connected via jumper or switched to the Athena III SBC power connector via an external power switch. If there is +12V available with the +5V then there is an option to jumper the +12V to the +12V bus on the Athena III SBC power connector. Connector 2 is a screw-type circular connector that is optional for customers that want a more secure connection than what Connector 1 has.

The +12V / +Vin is also intended to be connected via jumper or switched via an external power switch to an auxiliary connector on the back side of the board, which then is used to connect to a DC/DC power supply. The output of the DC/DC power supply is then fed either to the PC/104 bus power pins (if the power supply is on the PC/104 bus) or back to the panel I/O board and then to the Athena III SBC through the +5V pins on the SBC's mating power input connector.

| 1 | +12V / Var |
|---|---|
| 2 | GND |
| 3 | +5V |

## 6.2   Ethernet

The Ethernet connector is a vertical metal-shielded RJ-45 jack with industry standard pinout for 10/100/1000Mbps Ethernet. The signals come from the SBC mating Ethernet connector.

Proper isolation must be maintained on all Ethernet signal routing to meet industry standard signal isolation specifications. No ground or power plane should be above or underneath these signals.

## 6.3   VGA

The VGA connector is standard vertical DD15 female connector with industry standard VGA pinout. It has 4-40 thread inserts and hex screwlocks. The signals come from the Athena III SBC mating VGA connector.

## 6.4   USB

The USB connectors are four vertical metal shrouded type A connectors with industry standard pinout for USB. The signals come from the two Athena III SBC mating USB connectors.

## 6.5   PS/2 Keyboard and Mouse

The PS/2 connectors are two vertical Mini-DIN-6 connectors with industry standard pinout for PS/2 keyboard and mouse. The signals come from the Athena III SBC mating PS/2 connector.

## 6.6   Data Acquisition

The data acquisition connector is a vertical 50-pin connector with long ejector/latches for a mating ribbon cable connector with strain relief. The signals come from the Athena III SBC mating data acquisition connector and have a 1 to 1 correspondence with that connector pinout.

## 6.7 Serial Ports

The serial port connectors are six vertical DB9 male connectors. They have 4-40 thread inserts and hex screwlocks. Ports 1-4 signals come from the 80-pin SBC connector. Ports 5-6 signals come from a 2x10 pin expansion connector.  The signal pinouts of the connectors used in the RS-232, RS-422, RS-485 protocols are shown below.

| DB9 Pin | Signal Name | Serial Port Connector | | Signal Name | DB9 Pin |
|---|---|---|---|---|---|
| 1 | DCD 1 | 1 | 2 | DSR 1 | 6 |
| 2 | RXD 1 | 3 | 4 | RTS 1 | 7 |
| 3 | TXD 1 | 5 | 6 | CTS 1 | 8 |
| 4 | DTR 1 | 7 | 8 | RI 1 | 9 |
| 5 | GND 1 | 9 | 10 | NC | |

**RS-232 Configuration**

| | | | |
|---|---|---|---|
| DCD | 1 | 2 | DSR |
| RXD | 3 | 4 | RTS |
| TXD | 5 | 6 | CTS |
| DTR | 7 | 8 | RI |
| GND | 9 | 10 | NC |

**RS-422 Configuration**

| | | | |
|---|---|---|---|
| NC | 1 | 2 | NC |
| TXD+ | 3 | 4 | TXD- |
| GND | 5 | 6 | RXD- |
| RXD+ | 7 | 8 | NC |
| GND | 9 | 10 | NC |

**RS-485 configuration**

| | | | |
|---|---|---|---|
| NC | 1 | 2 | NC |
| NC | 3 | 4 | TXD/RXD- |
| TXD/RXD+ | 5 | 6 | NC |
| NC | 7 | 8 | NC |
| GND | 9 | 10 | NC |

# 7. EXPANSION I/O SECTION

These connectors are on the bottom side of the panel I/O board, outside the PC/104 outline. They do not connect to the Athena III SBC. They are used for other internal connections and functions. These connectors are 0.1" pitch male pin headers.

## 7.1 Serial Port Expansion

The serial port expansion connector is a 2x10 pin 0.1" pitch male pin header. Their signals are brought out to two DB9 male connectors for serial ports 5 and 6 on the top side of the panel board.

## 7.2 VGA Expansion

The VGA expansion connector is a 2x10 pin 0.1" pitch male pin header that is used to connect VGA signals from an alternate source to the VGA connector.

## 7.3 Digital I/O Expansion

The data I/O connector is a 50-Pin Centronics female connector that connects the digital I/O signals from an expansion digital I/O board to the outside world.

## 7.4 AUX Power Connector

The AUX Power connector allows power connection to peripherals mounted inside the Pandora enclosure like HDDs (hard disk drives), recording devices or other devices that cannot get power from the PC/104 stack.

| | |
|---|---|
| +12V/VAR | 1 |
| GND | 2 |
| GND | 3 |
| +5V | 4 |

# 8. POWER SECTION

The power section provides the means to bring power to the system.  The schematic below indicates the power routing between the input power connector and the Athena III SBC through the panel I/O board. Power may be provided in several methods:

1. +5V in from the input power connector directly to the panel I/O board, using either the front panel switch or a direct connection, and then the Athena III SBC through the SBC's input connector.

2. Vin (8-30VDC) from the input power connector to a connector leading to an internal DC/DC power supply, whose output is driven directly onto the PC/104 bus using the PC/104 bus connectors on the DC/DC power supply. The Vin may be routed to the power supply connector either through the front panel switch or through a direct connection.

3. Same as #2 above, except the +5VDC and optional +12VDC outputs of the DC/DC power supply are routed back to the panel I/O board and then connected to the Athena III SBC through the SBC power input connector.

The switch bypass jumpers are 0-ohm ¼ watt T/H resistors. To use the panel power switch, the resistor is cut away, opening the circuit.

The +12V input option jumper is also a 0-ohm ¼ watt T/H resistor used to route +12V from the Vin pin to the +12V pin on the Athena III power connector. If the Vin voltage is not +12V then the resistor is cut away to isolate the +12V pin on the Athena III primary power connector.

If power is being provided by one of Diamond Systems' Jupiter-MM (JMM) power supplies, cable 6981016 can be used to connect jumper block J35 on the Athena III SBC to the Jupiter-MM power supply output.
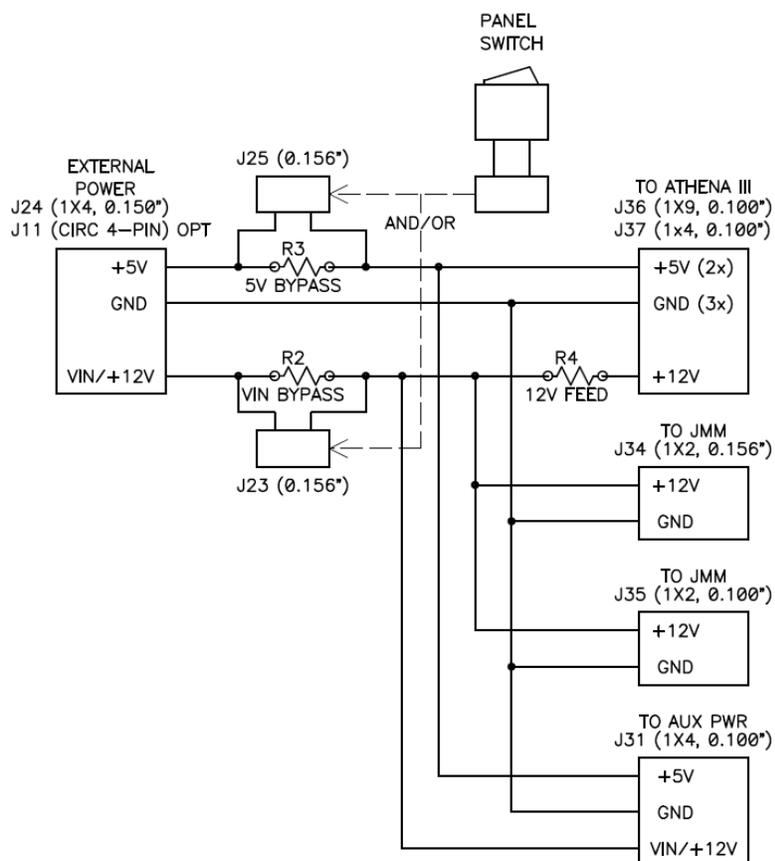


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