

PSMC Series Hardware Reference Manual



Motion Controller Card



Optimal Engineering Systems, Inc.
6901 Woodley Avenue
Van Nuys, California 91406
U.S.A.

Phone (818) 222-9200
FAX (818) 222-9580
sales@oesincorp.com
www.oesincorp.com

This card is an easy-to-use, plug-and-play and cost effective solution for single and multi-axis motion control applications. It may be used as a stand-alone unit or may be commanded by an external device.

These series supports up to 4 axes of motion, 16 TTL / CMOS compatible inputs, 16 TTL / CMOS compatible outputs, 3 analog inputs, and up to five optical encoder inputs. The command port is provided for stand-alone operation.

The powerful programming instructions with more than 120 commands include motion control, system configuration, data flow, program flow commands, 32-bit logical and mathematical operations, and other miscellaneous instructions.

These cards can also be operated using an analog joystick or a trackball with quadrature outputs. The speed of the motor is proportional to the tilt angle of the joystick or the rotational speed of the trackball. The joystick has three speed selection keys; fast, medium and slow speed.

The card may be controlled in different ways;

1) Stand-alone

In this mode, the controller does not need an external device such as a PC to operate. The controller is programmed in a simple programming language. The code is developed, downloaded to the controller, run and saved in the controller's non-volatile memory using the supplied Integrated Development Environment (IDE) software.

2) Externally Controlled

In this mode, the external host such as a PC, micro-controller or PLC sends a series of commands to the controller via the RS-232 serial port. The controller processes and performs the incoming commands and responds with proper messages.

3) Control Panel

The supplied user friendly Control Panel software allows the user to set-up the module quickly. The operator is able to move the mechanism to different positions by pressing the corresponding buttons of the Control Panel or by using the joystick and/or trackball.

Modes of motion include point-to-point positioning, jogging, contouring, electronic gearing, and electronic cam.

Features

- Compact
- Plug-and-Play
- Quick and Easy to Install
- Very Compact and Easy to Use
- Low Power Consumption, High Torque Motors, High Speed Capability
- Easy Programming Language, No Compiler or Assembler Required
- Programmable, Teachable or Manual Control
- Different Modes of Operation:
 - 1) Host Controlled
 - 2) Stand-alone, No PC Required to Operate
 - 3) Joystick / Trackball Controlled
- Optical Encoder Feedback

Software

- Easy System Setup and Evaluation
- Menu Driven
- Free Software Included

TECHNICAL DATA

Modes of Motion

- Point-to-Point Positioning
- Jogging

Supported No. Of Axes

- Up to 4 Axes

Range of Motion Parameters

- Position: +/- 2147483648 Steps
- Velocity: 200 - 200 KHz Step Rate
- Acceleration: 40,000 - 40 Million Steps / sec²

Communication Interface

- RS-232 Interface

Software

- Easy System Setup and Evaluation
- Menu Driven

Joystick

- Single Handed 2 or 3-axis Control
- Motor Speed Proportional to the Tilt Angle
- Three Speed Selection Keys
- Long Life

Trackball

- Precision Positioning
- Long Life

Dedicated Inputs

- Positive and Negative Limit Switches per Axis
- Home Switch per Axis
- CONTINUE, END, RUN, STOP, and UPLOAD-and-RUN for Stand-alone Mode Operation

Dedicated Outputs²

- Step, Direction, and Driver Enable Outputs per Axis
- Status LED Output

General Purpose Digital Input / Output

- 16 TTL / CMOS Inputs
- 16 TTL / CMOS Outputs
- Up to Five Optical Encoder Inputs

General Purpose Analog Input

- 3 Inputs
- 8 Bits of Resolution
- Adjustable Gain
- Offset Adjustment Potentiometer for each Input

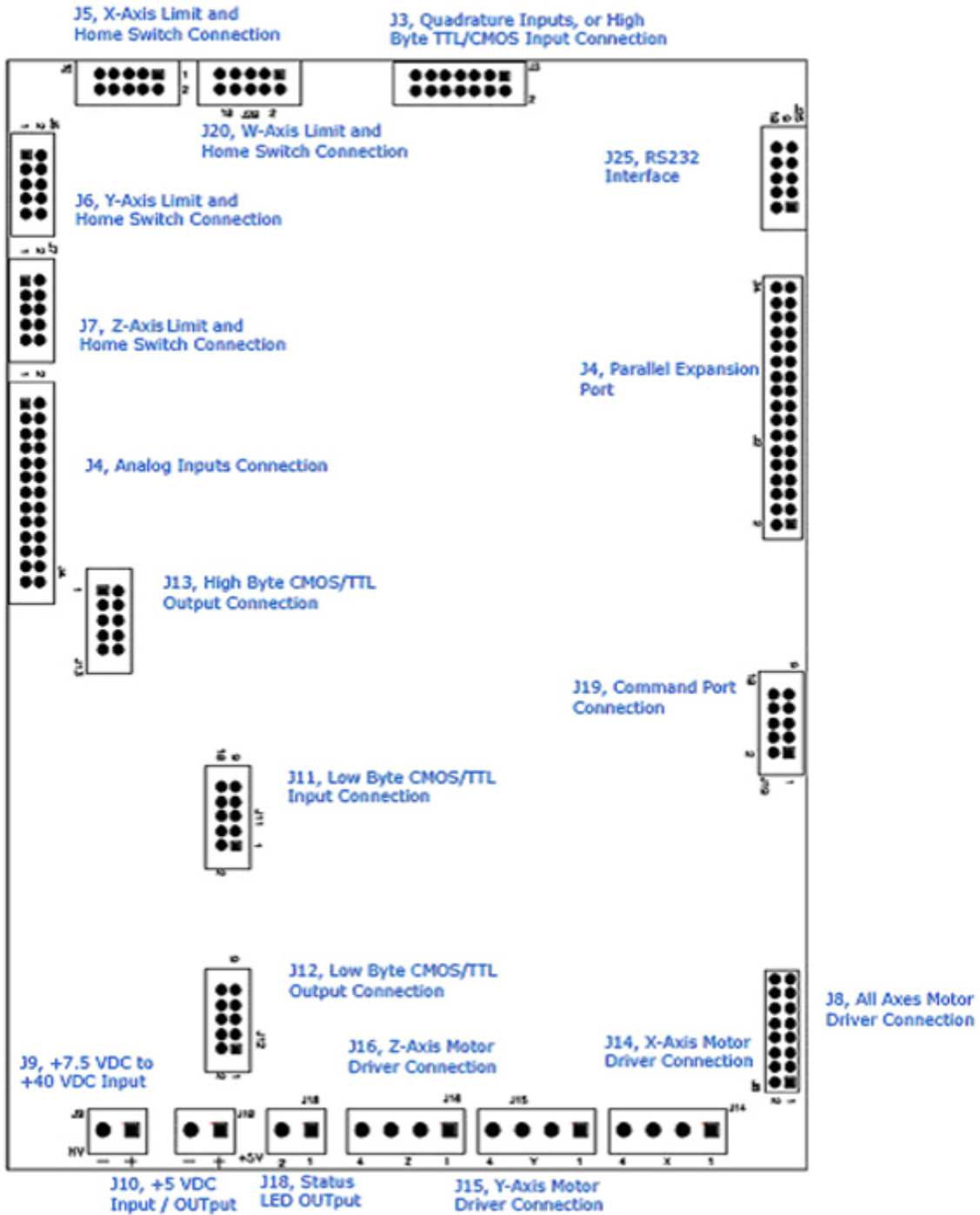
Memory

- Up to 448 Kbytes of Non-volatile Memory
- 22 General Purpose Variables, 32 Bits of Resolution
- 7500 Bytes of Program Memory

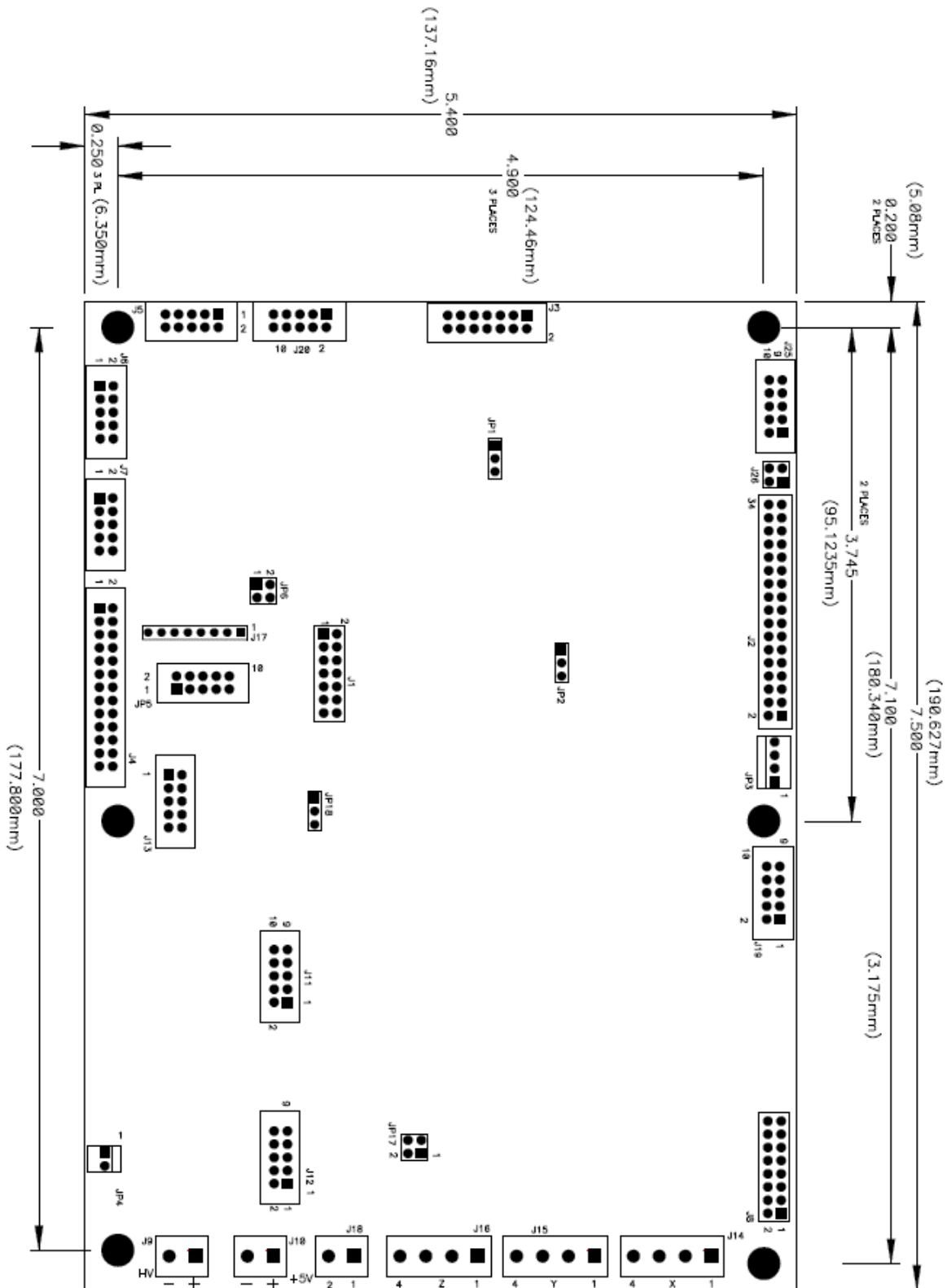
Power Requirement

- +5 VDC **or** +7.5 to +40 VDC
- 2 Watts Power Consumption

Connections



Mechanical Specifications



Pin Assignment and Description

J10, +5 VDC Input / Output

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|------------|-------------|-----------------------|
| 1 | +5 VDC | +5 VDC Input @ 400 ma |
| 2 | GND | +5 VDC Return |

J9, +7.5 to +40 VDC Input

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|------------|--------------|------------------------|
| 1 | HIGHVOLT | +7.5 to +40 VDC Input |
| 2 | HIGHVOLT-RTN | +7.5 to +40 VDC Return |

Please note that that only one of the above voltages is required for operation of the module.

J18, Status LED Output

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|------------|-------------|-------------------------------------|
| 1 | +5 VDC | +5 VDC Output |
| 2 | STATUS-LED | Status LED Output Open Collector |

J14, X-Axis Motor Driver Connection

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|-----|--------|--|
| 1 | +5 VDC | +5 VDC Output |
| 2 | STEP-X | Step Pulse Output, 50 % Duty Cycle CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 3 | DIR-X | Direction Output CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 4 | DIS-X | Disable Output, Active Low CMOS level signals, 40 mA sink and source capability, +5 VDC |

J5, X-Axis Limit and Home Switch Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|---------------|--|
| 1 | POS-LIMIT-X * | Positive Limit Switch Input, Active High |
| 2 | +5 VDC | +5 VDC |
| 3 | GND | +5 VDC Return |
| 4 | HOME-X ** | Home Switch Input, Active High |
| 5 | +5 VDC | +5 VDC |
| 6 | GND | +5 VDC Return |
| 7 | NEG-LIMIT-X * | Negative Limit Switch Input, Active High |
| 8 | +5 VDC | +5 VDC |
| 9 | GND | +5 VDC Return |
| 10 | NC | No Connection |

* A normally closed switch should be placed between this pin and GND.

** A normally closed switch should be placed between this pin and GND, if necessary.
A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J15, Y-Axis Motor Driver Connection

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|-----|--------|--|
| 1 | +5 VDC | +5 VDC Output |
| 2 | STEP-Y | Step Pulse Output, 50 % Duty Cycle CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 3 | DIR-Y | Direction Output CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 4 | DIS-Y | Disable Output, Active Low CMOS level signals, 40 mA sink and source capability, +5 VDC |

J6, Y-Axis Limit and Home Switch Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|---------------|--|
| 1 | POS-LIMIT-Y * | Positive Limit Switch Input, Active High |
| 2 | +5 VDC | +5 VDC |
| 3 | GND | +5 VDC Return |
| 4 | HOME-Y ** | Home Switch Input, Active High |
| 5 | +5 VDC | +5 VDC |
| 6 | GND | +5 VDC Return |
| 7 | NEG-LIMIT-Y * | Negative Limit Switch Input, Active High |
| 8 | +5 VDC | +5 VDC |
| 9 | GND | +5 VDC Return |
| 10 | NC | No Connection |

* A normally closed switch should be placed between this pin and GND.

** A normally closed switch should be placed between this pin and GND, if necessary.
A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J16, Z-Axis Motor Driver Connection

Screw Terminal Type

| PIN | NAME | DESCRIPTION |
|-----|--------|--|
| 1 | +5 VDC | +5 VDC Output |
| 2 | STEP-Z | Step Pulse Output, 50 % Duty Cycle CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 3 | DIR-Z | Direction Output CMOS level signals, 20 mA sink and source capability, +5 VDC |
| 4 | DIS-Z | Disable Output, Active Low CMOS level signals, 40 mA sink and source capability, +5 VDC |

J7, Z-Axis Limit and Home Switch Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|---------------|--|
| 1 | POS-LIMIT-Z * | Positive Limit Switch Input, Active High |
| 2 | +5 VDC | +5 VDC |
| 3 | GND | +5 VDC Return |
| 4 | HOME-Z ** | Home Switch Input, Active High |
| 5 | +5 VDC | +5 VDC |
| 6 | GND | +5 VDC Return |
| 7 | NEG-LIMIT-Z * | Negative Limit Switch Input, Active High |
| 8 | +5 VDC | +5 VDC |
| 9 | GND | +5 VDC Return |
| 10 | NC | No Connection |

* A normally closed switch should be placed between this pin and GND.

** A normally closed switch should be placed between this pin and GND, if necessary.
A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J8, All Axes Motor Driver Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|--------|------------------------------------|
| 1 | +5 VDC | +5 VDC Output |
| 2 | STEP-X | Step Pulse Output, 50 % Duty Cycle |
| 3 | DIS-X | Disable Output, Active Low |
| 4 | DIR-X | Direction Output |
| 5 | +5 VDC | +5 VDC Output |
| 6 | STEP-Y | Step Pulse Output, 50 % Duty Cycle |
| 7 | DIS-Y | Disable Output, Active Low |
| 8 | DIR-Y | Direction Output |
| 9 | +5 VDC | +5 VDC Output |
| 10 | STEP-Z | Step Pulse Output, 50 % Duty Cycle |
| 11 | DIS-Z | Disable Output, Active Low |
| 12 | DIR-Z | Direction Output |
| 13 | +5 VDC | +5 VDC Output |
| 14 | STEP-W | Step Pulse Output, 50 % Duty Cycle |
| 15 | DIS-W | Disable Output, Active Low |
| 16 | DIR-W | Direction Output |

J20, W-Axis Limit and Home Switch Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|---------------|--|
| 1 | POS-LIMIT-W * | Positive Limit Switch Input, Active High |
| 2 | +5 VDC | +5 VDC |
| 3 | GND | +5 VDC Return |
| 4 | HOME-W * | Home Switch Input, Active High |
| 5 | +5 VDC | +5 VDC |
| 6 | GND | +5 VDC Return |
| 7 | NEG-LIMIT-W * | Negative Limit Switch Input, Active High |
| 8 | +5 VDC | +5 VDC |
| 9 | GND | +5 VDC Return |
| 10 | NC | No Connection |

* A normally closed switch should be placed between this pin and GND.

** A normally closed switch should be placed between this pin and GND, if necessary.
A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J4, Analog Joystick Interface

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|------------|--------------|------------------------------|
| 1 | ANALOG-X | Analog-X Input |
| 2 | NC | No Connection |
| 3 | ANALOG-Y | Analog-Y Input |
| 4 | ANALOG-Z | Analog-Z Input |
| 5 | HIGH-SPEED | High Speed Selection Input |
| 6 | GND | +5 VDC Return |
| 7 | MEDIUM-SPEED | Medium Speed Selection Input |
| 8 | GND | +5 VDC Return |
| 9 | LOW-SPEED | Low Speed Selection Input |
| 10 | GND | +5 VDC Return |
| 11 | SPARE | SPARE key of Joystick |
| 12 | +5 VDC | +5 VDC |
| 13 | NC | No Connection |
| 14 | +5 VDC | +5 VDC |
| 15 | NC | No Connection |
| 16 | +5 VDC | +5 VDC |
| 17 | NC | No Connection |
| 18 | OUTBIT9 | Discrete Output 9 |
| 19 | OUTBIT10 | Discrete Output 10 |
| 20 | OUTBIT11 | Discrete Output 11 |
| 21 | OUTBIT12 | Discrete Output 12 |
| 22 | OUTBIT13 | Discrete Output 13 |
| 23 | OUTBIT14 | Discrete Output 14 |
| 24 | OUTBIT15 | Discrete Output 15 |
| 25 | OUTBIT16 | Discrete Output 16 |

26**NC**

No Connection

All outputs are CMOS level signals, 10 mA sink and source capability, +5 VDC.

J13, Discrete Output Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|------------|-----------------|--------------------|
| 1 | OUTBIT9 | Discrete Output 9 |
| 2 | OUTBIT10 | Discrete Output 10 |
| 3 | OUTBIT11 | Discrete Output 11 |
| 4 | OUTBIT12 | Discrete Output 12 |
| 5 | OUTBIT13 | Discrete Output 13 |
| 6 | OUTBIT14 | Discrete Output 14 |
| 7 | OUTBIT15 | Discrete Output 15 |
| 8 | OUTBIT16 | Discrete Output 16 |
| 9 | GND | +5 VDC Return |
| 10 | +5 VDC | +5 VDC |

All outputs are CMOS level signals, 10 mA sink and source capability, +5 VDC.

J11, Discrete Input Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|--------|------------------|
| 1 | INBIT1 | Discrete Input 1 |
| 2 | INBIT2 | Discrete Input 2 |
| 3 | INBIT3 | Discrete Input 3 |
| 4 | INBIT4 | Discrete Input 4 |
| 5 | INBIT5 | Discrete Input 5 |
| 6 | INBIT6 | Discrete Input 6 |
| 7 | INBIT7 | Discrete Input 7 |
| 8 | INBIT8 | Discrete Input 8 |
| 9 | GND | +5 VDC Return |
| 10 | +5 VDC | +5 VDC |

A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J12, Discrete Output Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|-----|---------|-------------------|
| 1 | OUTBIT1 | Discrete Output 1 |
| 2 | OUTBIT2 | Discrete Output 2 |
| 3 | OUTBIT3 | Discrete Output 3 |
| 4 | OUTBIT4 | Discrete Output 4 |
| 5 | OUTBIT5 | Discrete Output 5 |
| 6 | OUTBIT6 | Discrete Output 6 |
| 7 | OUTBIT7 | Discrete Output 7 |
| 8 | OUTBIT8 | Discrete Output 8 |
| 9 | GND | +5 VDC Return |
| 10 | +5 VDC | +5 VDC |

All outputs are CMOS level signals, 10 mA sink and source capability, +5 VDC.

J19, Command Port Connection

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|------------|-------------------------|--|
| 1 | STOP * | STOP Motion on all axes |
| 2 | END * | END the running program |
| 3 | RECALL-and-RUN * | RECALL and RUN the code |
| 4 | RUN * | RUN the code |
| 5 | CONT * | CONTINUE execution of the code |
| 6 | Spare | SPARE Input |
| 7 | HI / LO * | Select the states of the outputs on power-up |
| 8 | Spare | SPARE Input |
| 9 | GND | +5 VDC Return |
| 10 | +5 VDC | +5 VDC |

* A normally open switch should be placed between this pin and GND, if necessary. A 10 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J3, Quadrature Encoder Interface

0.1" (2.54 mm) Pitch Header

| PIN | NAME | DESCRIPTION |
|------------|----------------------------|--|
| 1 | +5 VDC | +5 VDC |
| 2 | GND | +5 VDC Return |
| 3 | +5 VDC | +5 VDC |
| 4 | GND | +5 VDC Return |
| 5 | +5 VDC | +5 VDC |
| 6 | GND | +5 VDC Return |
| 7 | YA INBIT16 | Phase-YA Quadrature Input Discrete Input 16 |
| 8 | XA INBIT14 | Phase-XA Quadrature Input Discrete Input 14 |
| 9 | YB INBIT15 | Phase-YB Quadrature Input Discrete Input 15 |
| 10 | XB INBIT13 | Phase-XB Quadrature Input Discrete Input 13 |
| 11 | YSELECT INBIT11 | Y-axis Select, , Active Low Discrete Input 11 |
| 12 | ZSELECT INBIT9 | Z-axis Select, , Active Low Discrete Input 9 |
| 13 | XSELECT INBIT10 | X-axis Select, , Active Low Discrete Input 10 |
| 14 | INBIT12 | Discrete Input 12 |

A 2.2 KOHM pull-up resistor is placed between all inputs and +5 VDC.

J25, RS232 Interface

0.1" (2.54 mm) Pitch Header




| PIN | NAME | DESCRIPTION |
|-----|----------|------------------------------------|
| 3 | DATA-XMT | Data Transmit to PC |
| 4 | RESET | RESET Signal from PC to Controller |
| 5 | DATA-RCV | Data Receive from PC |
| 9 | GND | +5 VDC Return |

JP5, Joystick Speed Selection

| JP5 1 - 2 | JP5 3 - 4 | JP5 5 - 6 | JP5 7 - 8 | Micro- Stepper Resolution | Maximum Slow Speed (RPS) * | Maximum Medium Speed (RPS) * | Maximum Fast Speed (RPS) * |
|--------------|--------------|--------------|--------------|---------------------------------|-------------------------------|------------------------------------|-------------------------------|
| IN | IN | IN | IN | 10 | 0.44 | 1.33 | 4.00 |
| OUT | IN | IN | IN | 10 | 0.56 | 1.67 | 5.00 |
| IN | OUT | IN | IN | 10 | 0.67 | 2.00 | 6.00 |
| OUT | OUT | IN | IN | 10 | 0.78 | 2.33 | 7.00 |
| IN | IN | OUT | IN | 50 | 0.02 | 0.30 | 6.00 |
| OUT | IN | OUT | IN | 50 | 0.02 | 0.30 | 7.00 |
| IN | OUT | OUT | IN | 50 | 0.02 | 0.30 | 8.00 |
| OUT | OUT | OUT | IN | 50 | 0.02 | 0.30 | 9.00 |
| IN | IN | IN | OUT | 125 | 0.03 | 0.50 | 1.00 |
| OUT | IN | IN | OUT | 125 | 0.03 | 0.50 | 2.00 |
| IN | OUT | IN | OUT | 125 | 0.03 | 0.50 | 3.00 |
| OUT | OUT | IN | OUT | 125 | 0.03 | 0.50 | 4.00 |
| IN | IN | OUT | OUT | 250 | 0.03 | 0.50 | 2.50 |
| OUT | IN | OUT | OUT | 250 | 0.03 | 0.50 | 4.00 |
| IN | OUT | OUT | OUT | 250 | 0.03 | 0.50 | 5.50 |
| OUT | OUT | OUT | OUT | 250 | 0.78 | 2.33 | 7.00 |

* 200 Steps per Revolution Motor

Mating Pin and Housings

| | Mfr. Part # | DESCRIPTION |
|--|-------------|---|
|  | 86016-5 | AMPMODU MOD. IV Receptacle Contact, 24-20 AWG, gold |
|   | 87456-6 | AMPMODU MOD. IV Connectors Non-Polarized Housing, 5x2 |
| | 1-87456-0 | AMPMODU MOD. IV Connectors Non-Polarized Housing, 7x2 |
| | 1-87456-2 | AMPMODU MOD. IV Connectors Non-Polarized Housing, 8x2 |
| | 102387-1 | AMPMODU MOD. IV Connectors Center Polarized Housing, 5x2 |
| | 102387-2 | AMPMODU MOD. IV Connectors Center Polarized Housing, 7x2 |
| | 102387-3 | AMPMODU MOD. IV Connectors Center Polarized Housing, 8x2 |
| | 102387-6 | AMPMODU MOD. IV Connectors Center Polarized Housing, 13x2 |

Mfr: Tyco Electronics / AMP

Specifications are subject to change without notice.

LIMITATION OF LIABILITY

Optimal Engineering Systems, Inc. (OES) hardware and software products are not intended or authorized for use in any manner where human life or safety is at risk. OES' products are not intended for life support equipment.

In no event shall Optimal Engineering Systems, Inc. be liable to any customer for costs or damages, including lost profits, lost savings or other incidental or consequential damages arising out of the use or inability to use such products even if Optimal Engineering Systems, Inc. or an authorized Optimal Engineering Systems, Inc. representative has been advised of the possibility of such damages, or for any claim by any other party. In any event, Optimal Engineering Systems liability arising in any manner in connection with the products, whether based in contract, product liability or tort, shall not exceed the purchase price of the product.

LIMITED ONE-YEAR WARRANTY

Optimal Engineering Systems, Inc. warrants to the original purchaser that this product to be free from defects in material or workmanship for a period of one year from date of purchase. Optimal Engineering Systems, Inc. agrees to repair any such defect or exchange the product with a new or equal replacement. Defective product must be returned to Optimal Engineering Systems, Inc. in the original package, postpaid. This warranty is void for any product that has been modified by the customer in any way. If failure of the Product has resulted from accident, abuse, or miss-application, Optimal Engineering Systems, Inc. shall have no responsibility under this One-Year Warranty.