5 Amp Micro Stepping Compact CNC Controller Hardware Guide

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Getting Started

About This Manual

CNC is a unique application involving hardware and software. We recommend that you read all of these instructions before using the product.

Since automated machining is potentially dangerous, please take the time to completely read through this manual and the software User's Guide to understand the operation of the electronics, software and machine before cutting a part.

Turning Off the Controller

Always turn off the CNC Controller when it is not in use.

Safety and Usage Guidelines

When running an automated machine tool, safety is of the utmost importance. For proper and safe use of the CNC program and your CNC machine, the following safety guidelines must be followed:

1. **Never let the machine tool run unattended.**
2. **Require any person in the same room as a running machine tool to wear safety goggles and to stay a safe distance from the machine.**
3. **Allow only trained operators to run the machine tool. Any operator must have:**
   - **Knowledge of machine tool operation.**
   - **Knowledge of personal computer operation.**
   - **Knowledge of Microsoft Windows.**
   - **Good common sense.**
4. **Place safety guards around the machine to prevent injury from flying objects. It is highly recommended that you build a safety shield around the entire tool envelope.**
5. **Never place any part of your body within the tool envelope while the machine is online, since unexpected machine movement can occur at any time.**
6. **Always keep the tool envelope tidy and free of any loose objects.**
7. **Be on alert for computer crashes at all times.**

WPI, Inc. is not responsible for the safe installation and use of this product. You and only you are responsible for the safety of yourself and others during the operation of your CNC machine tool. We supply this product but have no control over how it is installed or used. Always be careful!

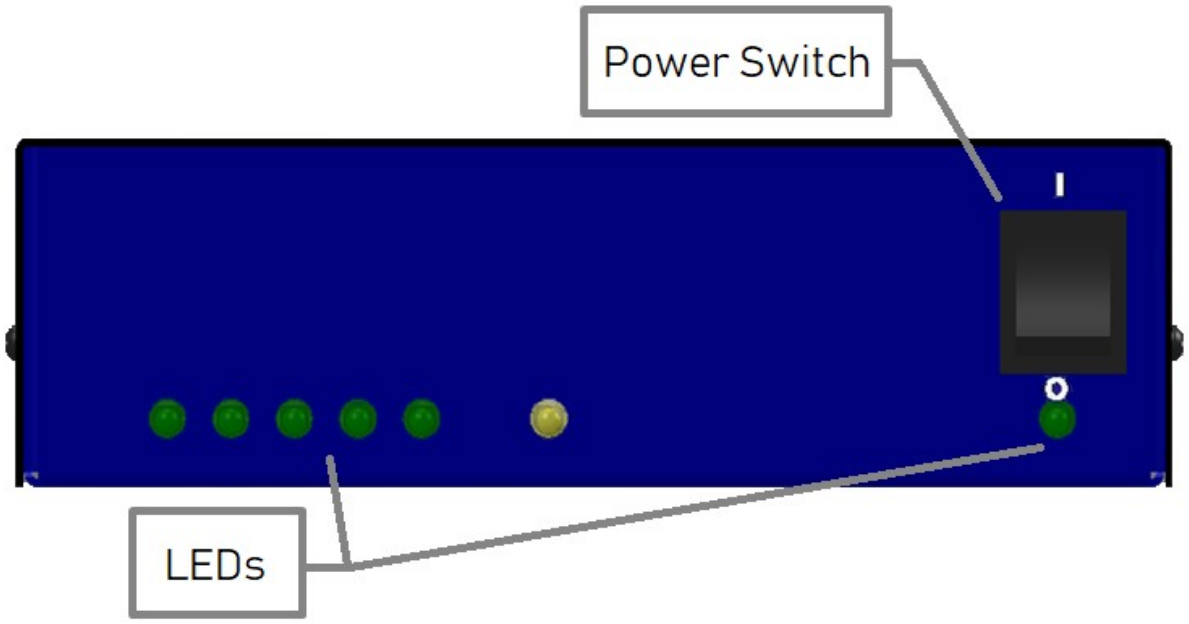
WPI, Inc. or its affiliates are not responsible for damage to any equipment or workpiece resulting from use of this product.

If you do not understand and agree with all of the above safety guidelines, do not use this product.

Micro Stepping CNC Controller

Front Panel

The front panel provides the main power switch and diagnostic LEDs.

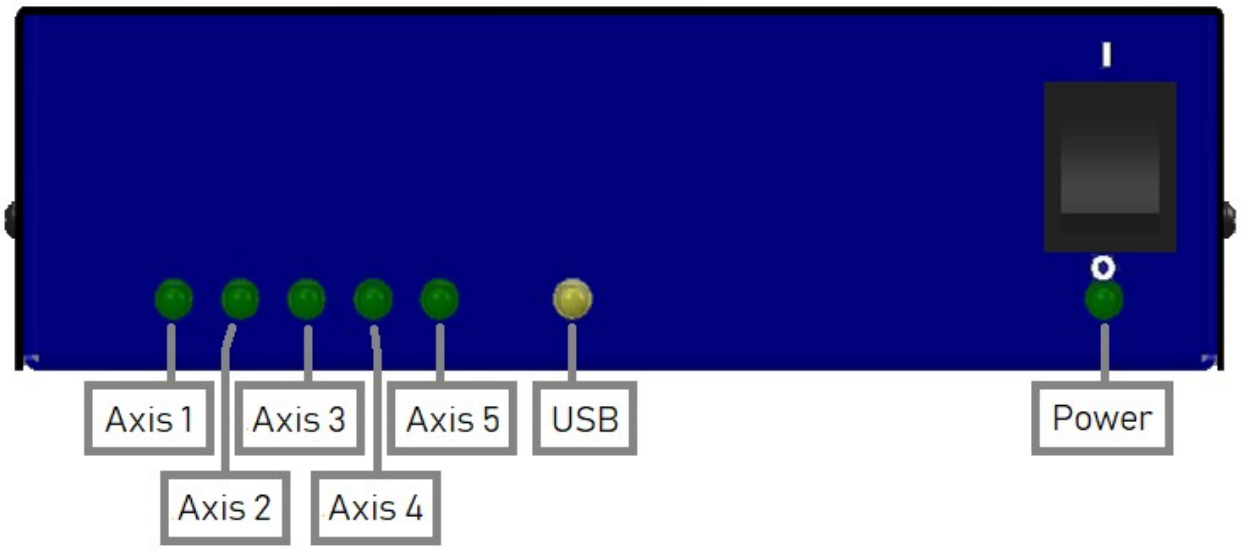


Power Switch

The power switch turns the unit on and off. If there is ever a communications error while running the system, it may be necessary to turn the switch off, wait 10 seconds and turn it back on to reset the internal microprocessor.

LEDs

The front panel LEDs can be used as a diagnostic tool to know the state of the system.



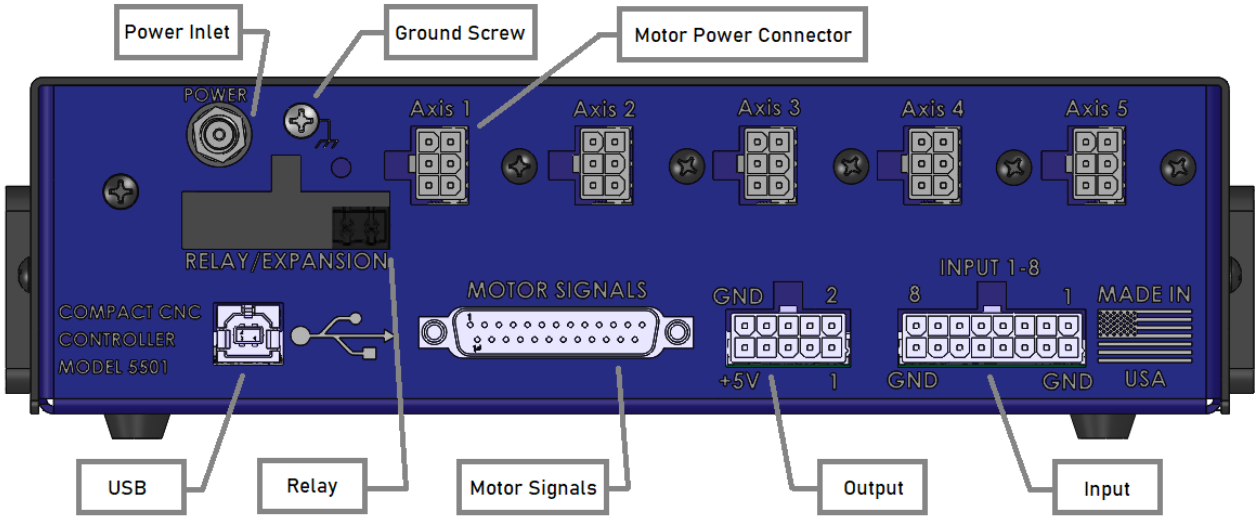
The five LEDs grouped on the left indicate the motion on axes 1-5. The brightness of the LED is based on the step rate of the axis. The faster an axis is moving, the brighter the axis LED will be. The axis LEDs are numbered 1-5 going left to right.

The amber LED indicates that the controller has a physical connection to the USB port on the PC. This is not an indication that the controller is connected through the software.

The LED to the right is the power/diagnostic LED. This LED is used to indicate that the unit is powered on.

Rear Panel

The rear panel of the CNC controller provides a connection point for main power, ground and all control signals used in the CNC system.



Power Inlet

The power inlet is a receptacle for supplying power to the controller. The unit is shipped with an external DC power supply unit (PSU). This PSU has extra protection against the electrical demand to drive motors. If the controller is powered by a third-party PSU, damage may occur. Please contact the Support Team for information on an approved replacement.

Model Number	*Voltage (VDC)*	*Amperage (A)*
501A Signal Generator	9	1.67
5501-#-050-M	42.5	5

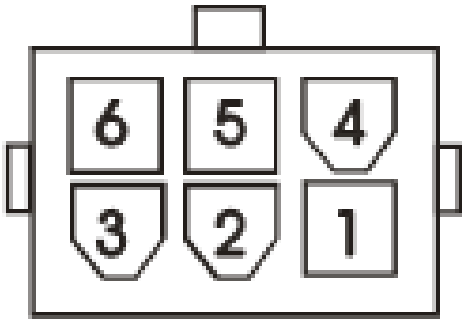
Relay

The relay connector provides a switch closure for controlling both AC and DC devices. This connection is not polarity-sensitive and has a 0.5 Amp maximum current load. If the controller comes equipped with a Mini I/O Expansion Board, this connector is not wired as a relay because the same signal is available on the Mini I/O Expansion Board. This connector may be used for a constant 24VDC source and will be marked as such. This power source can be used for proximity sensors and other low-current devices.

Motor Power Connectors

The motor power cables plug into these connectors. The numerical motor lines are correlated to any combination of the X, Y, Z, A and/or B axes in the Axes menu in the CNC software. Each motor connector is a male Mini Fit Jr 6 Pin Receptacle (see the section on Motor Cabling for mating connector and compatible terminal information). The pin assignments for the motor power connector are as follows:

Mini Fit Jr 6 Pin for Motor Power	
Pin No.	***Signal***
1	B+
2	Shield
3	A+
4	B-
5	No Connection
6	A-



Motor Signals

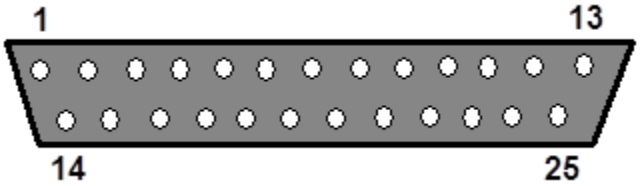
The Motor Signals connector uses a DB-25 connector to send step and direction signals from the Signal Generator to an external drive box.

The Motor Signals connector also provides a connection point to inputs 1-8 and outputs 1 & 2. Inputs 1-8 are the same signals found on the Input connector. Output 1 & 2 are the same outputs found on the output connector.

The Motor Signals connector can be used to tap into the internal +5V power supply as well as provide an externally isolated power supply for the inputs. Refer to the signal generator section of this hardware guide for further information on input voltage compatibility.

The voltage levels for each Output, Step, Direction and Enable signals are all 5V logic.

DB-25 Connector for Motor Signals			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OUTPUT 1	14	ENABLE ALL
2	OUTPUT 2	15	INPUT 1
3	STEP AXIS 5	16	INPUT 2
4	DIRECTION AXIS 5	17	INPUT 3
5	INPUT 5	18	INPUT 4
6	INPUT 6	19	DIRECTION AXIS 4
7	INPUT 7	20	DIRECTION AXIS 3
8	INPUT 8	21	DIRECTION AXIS 2
9	DIRECTION AXIS 1	22	INTERNAL VCC +5V
10	STEP AXIS 4	23	OPT. VCC (INPUT)
11	STEP AXIS 3	24	INTERNAL GND
12	STEP AXIS 2	25	OPT. GND (INPUT)
13	STEP AXIS 1		



USB

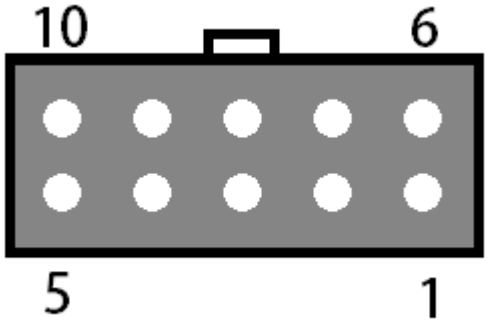
The USB connector is used for communication with the USB port on the host PC. Use a USB-A to B cable with a maximum length of 3 meters to make the connection. Plug the cable directly into PC, as opposed to a USB repeater or a hub. If the software loses communication with the Signal Generator, electrical noise may be the cause. To reduce electrical noise problems, use a shorter USB cable or attach one or more ferrite chokes to the USB cable. Toroid-shaped chokes are more effective than snap-on cylindrical chokes. If you need more than 3m of USB cable length, use an active extension cable.

For the most robust USB connection, make sure the controller is communicating with the PC in Full-Speed mode rather than Hi-Speed mode. This setting can be found in the configuration dialog of your CNC software and will not decrease performance compared to Hi-Speed.

Outputs

This connector is for up to eight output lines. The Output ports cannot drive a 24V external system unless it accepts TTL/CMOS levels. They are all driven by HCT family logic. Output logic high is normally 5V and can be as low as 3.9V at full load. Output logic low is normally 0V and can be as high as 0.3V at full load. Each of these signals can provide up to 20mA of current. Information about the mating connector can be found in the Signal Generator section.

10-Pin Mini-Fit Jr. Connector for Outputs			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OUTPUT 1	6	OUTPUT 2
2	OUTPUT 3	7	OUTPUT 4
3	OUTPUT 5	8	OUTPUT 6
4	OUTPUT 7	9	OUTPUT 8
5	+5V	10	GND

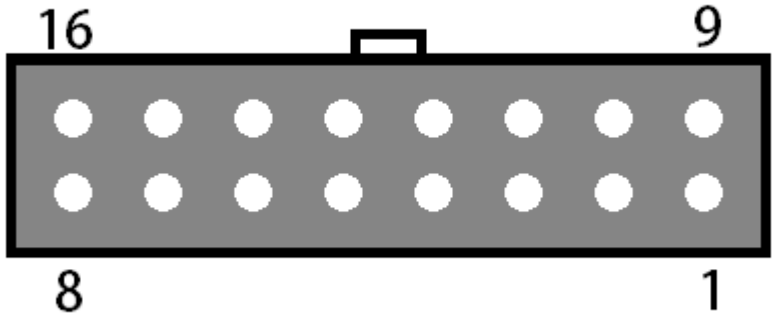


Inputs

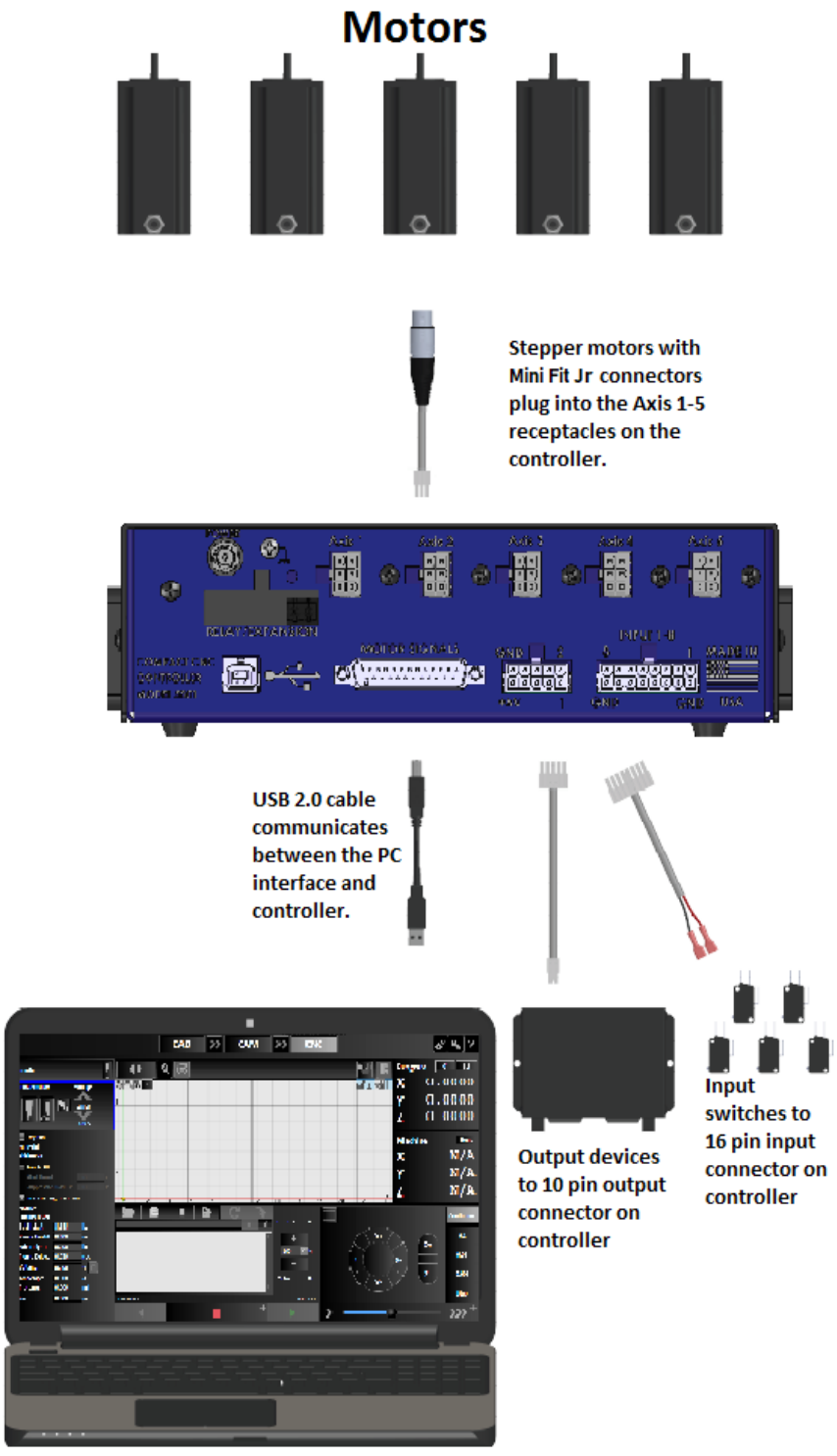
The input connector provides a connection point for up to eight input lines. The most common use of the input lines is for limit or safety switches. These lines are all TTL and CMOS compatible, optically-isolated inputs. When a switch is open, its input signal is high (5VDC). When the switch is closed, the input signal is grounded low (0VDC). If you need more than eight input lines, an I/O expansion board is available.

The input circuit can be configured to be compatible with higher voltages and optical isolation. NPN type proximity sensors are compatible with the input lines, but may require a different voltage to power. For configuration and mating connector information, refer to the Signal Generator section of this manual.

16-Pin Mini-Fit Jr. Connector for Inputs			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OPT. GND	9	INPUT 1
2	OPT. GND	10	INPUT 2
3	OPT. GND	11	INPUT 3
4	OPT. GND	12	INPUT 4
5	OPT. GND	13	INPUT 5
6	OPT. GND	14	INPUT 6
7	OPT. GND	15	INPUT 7
8	OPT. GND	16	INPUT 8



Connection Diagram



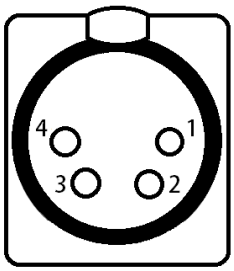
Stepper Motor Cabling

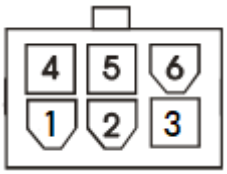
Cable and Wiring

The cable used for stepper motor wiring should be two 18 AWG twisted pairs (four conductors) with a foil shield and shield wire. Each twisted pair connects one coil in the motor to the stepper drive. An example of appropriate cable is Alpha Wire P/N 2242C. If the cable is an extension (between the controller and existing cabling), the shield wire should be terminated on both ends. If the cable is directly connected to the motor, the shield should only be terminated on the controller side. The mating connectors are female XLR4 (such as Neutrik part number NC4MX) and female Mini Fit Jr 6 pin (such as Molex part number 39-01-2060). The Mini Fit pin-out is provided for legacy systems that use this connector at the motor.

XLR4 Connector for Motor Power	
Pin No.	***Signal***
1	B-
2	B+
3	A+
4	A-

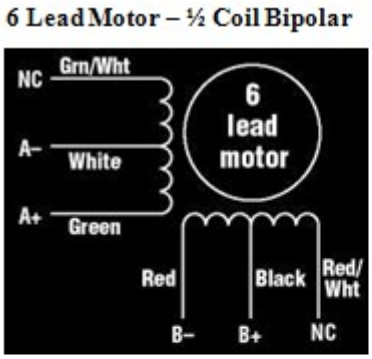
Mini Fit Jr 6 Pin for Motor Power	
Pin No.	***Signal***
1	B+
2	Shield
3	A+
4	B-
5	No Connection
6	A-

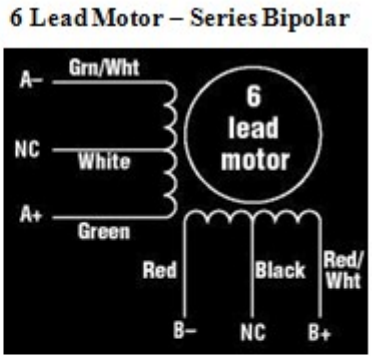


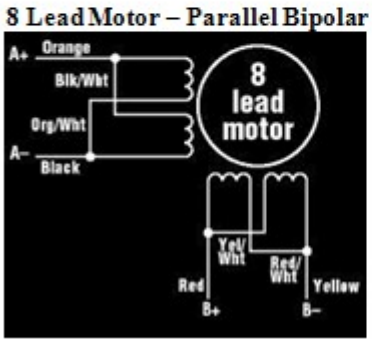


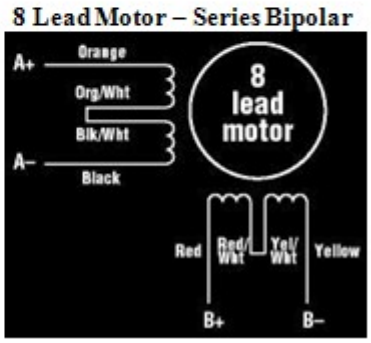
Motor Wiring for Third-Party Stepper Motors

If you have your own stepper motors, you can use the following charts for wiring. Please note that the motor colors will vary. To determine the wiring of a six- or eight-wire motor—when unknown—take resistance reading between several leads and refer to the following table.









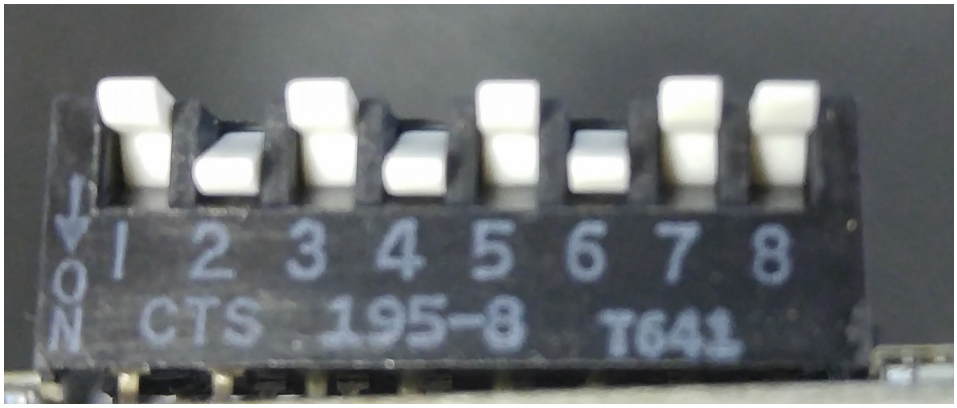
Lead Pair	*Resistance*
A+ & A-	1-10 Ω
B+ & B-	1-10 Ω
A+/- & B+/-	No continuity
A(center) & A+/-	½ of A+ & A-
B(center) & B+/-	½ of B+ & B-
A(center) & B+/-	No continuity
B(center) & A+/-	No continuity

If the A+ & A- , B+ & B- or A & B coils are reversed, the motor will spin in the opposite direction. This can be corrected in the software configuration on the “Machine....Axes” page. Changing the Direction for the motor in question should correct the problem.

Motor Drive Settings

Configuring the Drives

Each drive module has a group of dip switches for configuring the drive for your specific requirements. The configuration of the dip switches may vary depending on your application. The default settings are shown below.



Decay Mode Setting

Switches 1–3 determine the decay mode. These settings should be left at default (bold) except at the direction of a support technician.

Decay Mode Setting; Switches 1–3			
Switch 1	***Switch 2***	***Switch 3***	***Decay Setting***
OFF	OFF	OFF	Always slow
ON	OFF	OFF	Slow increasing; mixed decreasing
OFF	**ON**	**OFF**	**Always fast**
ON	ON	OFF	Always mixed
OFF	OFF	ON	Slow increasing; auto mixed decreasing
ON	OFF	ON	Always auto mixed
OFF	ON	ON	Reserved for future use
ON	ON	ON	Reserved for future use

Current Output Setting

The maximum current for the motor being driven is given in the model number of your controller. By default, this is set to a reduced value to better manage heat. This can be adjusted using switches 4–6. Never exceed the rating of your motor. These settings should be left at default (bold) except at the direction of a support technician.

Current Output Setting; Switches 4–6			
Switch 4	***Switch 5***	***Switch 6***	***Motor Current Output***
OFF	OFF	OFF	0.60A
ON	OFF	OFF	1.20A
OFF	ON	OFF	1.80A
ON	ON	OFF	2.40A
OFF	OFF	ON	3.00A
ON	**OFF**	**ON**	**3.60A**
OFF	ON	ON	4.20A
ON	ON	ON	5.00A

Make sure that the result of the switch current settings don't exceed the rating of your motor.

Step Mode Setting

Switch 7 determines whether the drive will accept fine step mode settings. The software must be set to match one of the listed step modes. See the section on Software Configuration for more information.

Valid Step Modes	
Switch 7 Off	***Switch 7 On***
1	32
2	64
4	128
16	256

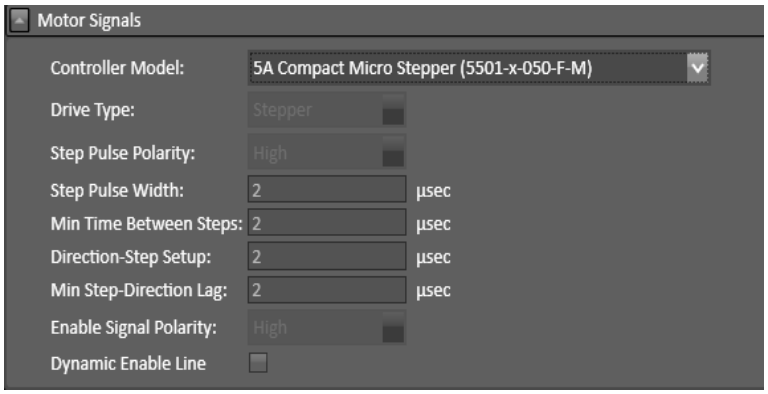
Idle Current

Motor heating and power consumption can also be reduced by lowering the motor current when it is not moving. This setting is controlled by switch 8. The drive will automatically reduce the motor current when idle to either 50% or 90% of the running current. The 50% idle current setting will lower the holding torque to 50% of the set current, which is enough to prevent the load from moving in most applications. This reduces motor heating to 25% while idle. In some applications, such as supporting a vertical load, it is necessary to provide a high holding torque. In such cases, the idle current can be set to 90% as shown below. This settings should be left at default (off) except at the direction of a support technician.

Software Configuration

Motor Signal Setup

In the software, go to “System…Controller” in the configuration and make sure the 5A Compact Micro Stepper Controller is selected.



Signal Generator

LEDs

The Signal Generator has seven LED indicators on-board to show different states of the system.

Power-On Sequence

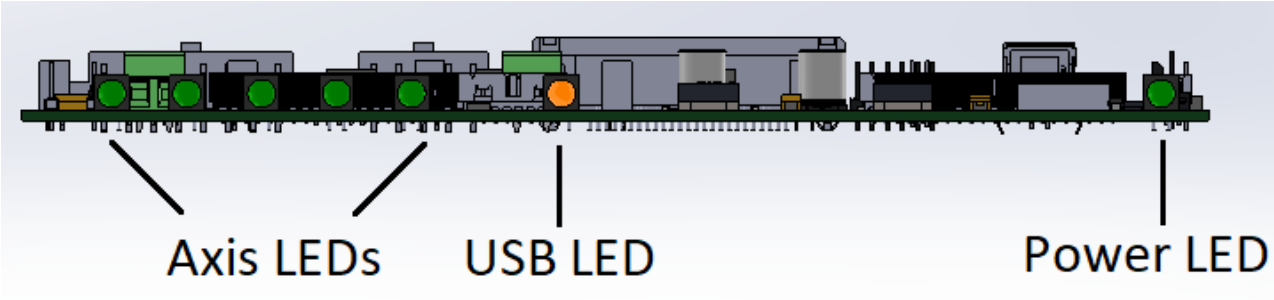
When power is first applied to the Signal Generator, the seven LED indicators go through a start-up sequence to indicate that the firmware is in a healthy state. First, all LEDs blink once. Then, each LED blinks once in order from Axis 1 to Power.

After the light sequence is complete, Axis 1-5 LEDs will remain off and the Power LED will be on. The USB LED will be on if a USB cable is connected between the controller and PC, otherwise the USB LED will be off.

If the LEDs do not sequence on power-up as described, either there is no power to the Signal Generator or the firmware on the controller has become corrupted and the controller will need to be repaired.

During Operation

Each Axis LED will pulse when its corresponding axis is commanded to move. This causes the LED to appear to increase in brightness as the commanded motion becomes faster.



Inputs

Inputs 1-8 are all optically isolated to provide a measure of protection from overvoltage and transient voltages. The inputs' reference voltage can be supplied by the Signal Generator's internal logic power or by an external voltage wired to the Signal Generator's TB40.

Internal Power

This option works well for most applications but negates some of the signal isolation. When JP84 shorts pins 1 and 2, OPT VCC gets its power from the internal 5V power source. When JP85 shorts pins 1 and 2, OPT GND is directly connected to the internal GND.

External Isolated Power

For the best noise immunity, connect an external 5V-24V power supply using one of the following methods. This is the default configuration. Ensure that all of your input devices are compatible with the supplied voltage. When JP84 shorts pins 2 and 3, OPT VCC gets its power from the TB-VCC. When JP85 shorts pins 2 and 3, OPT GND is directly connected to the TB-GND.

Choose only one of the following methods to supply power:

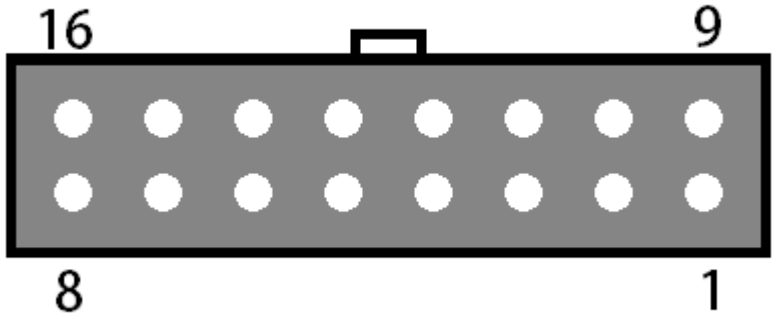
- Connect a power source to the TB-40 screw terminal.
- Connect a power source through pins 23 & 25 of the DB-25 connector.

If you are providing an external voltage through pins 23 & 25 of the DB-25 Motor Signals connector or via TB-40, then you must have both JP84 & JP85 jumpers on pins 2 & 3. OTHERWISE, SEVERE DAMAGE COULD RESULT.

The input line settings can be individually changed between normally closed (N.C.) or normally open (N.O.) input lines using the software config. Please refer to the software User's Guide under "Input Line Settings" for further information. In the software, the Input Line Status dialog displays "OPEN" for a high-level input voltage, or open switch, and "CLOSED" for a low-level input voltage or closed switch. Each of these inputs are also accessible on the Motor Signals connector. These are the same—electrically—between this location and the Motor Signals connector.

The receptacle that plugs into this connector is a Mini-Fit Jr. Series 16 pin receptacle (Molex part number 39-01-2160), with female pins (Molex part number 39-00-0039 or 39-00-0047 for 22 gauge or thinner wires). The Molex 63819-0901 crimp tool is recommended for installing the pins. Kits containing connectors and pins are available through us or at an electronics distributor.

16-Pin Mini-Fit Jr. Connector for Inputs			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OPT. GND	9	INPUT 1
2	OPT. GND	10	INPUT 2
3	OPT. GND	11	INPUT 3
4	OPT. GND	12	INPUT 4
5	OPT. GND	13	INPUT 5
6	OPT. GND	14	INPUT 6
7	OPT. GND	15	INPUT 7
8	OPT. GND	16	INPUT 8



Outputs

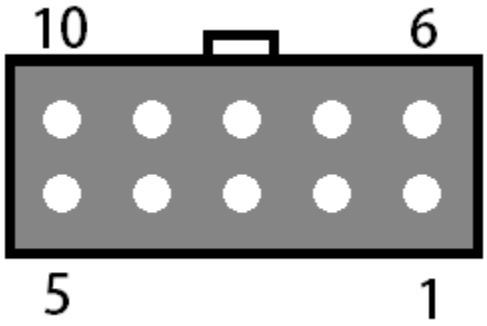
This connector is for up to eight output lines. These lines are all compatible with TTL/CMOS level outputs. The Output ports cannot drive a 24V external system unless it accepts TTL/CMOS levels. They are all driven by HCT family logic. Output logic high is normally 5V and can be as low as 3.9V at full load. Output logic low is normally 0V and can be as high as 0.3V at full load. Each of these signals can provide up to 20mA of current.

Two additional pins on this connector are provided for your output lines: ground and +5V. These are connected to GND and +5V and are not optically isolated. This 5V circuit can source up to 100 mA. Any larger current demand requires a larger power source.

The output lines are all initialized to low (0V) when you turn on the Signal Generator. Output lines 1 and 2 are also connected through pins 1 and 2, respectively, of the Motor Signal connector. These are the same—electrically—between this location and the Motor Signals connector.

The receptacle that plugs into this connector is a Mini-Fit Jr. Series 10 pin receptacle (Molex part number 39-01-2100), with female pins (Molex part number 39-00-0039 or 39-00-0047 for 22 gauge or thinner wires). The Molex 63819-0901 crimp tool is recommended for installing the pins. Kits containing connectors and pins are available through us or at an electronics distributor.

10-Pin Mini-Fit Jr. Connector for Outputs			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OUTPUT 1	6	OUTPUT 2
2	OUTPUT 3	7	OUTPUT 4
3	OUTPUT 5	8	OUTPUT 6
4	OUTPUT 7	9	OUTPUT 8
5	+5V	10	GND



Motor Signals

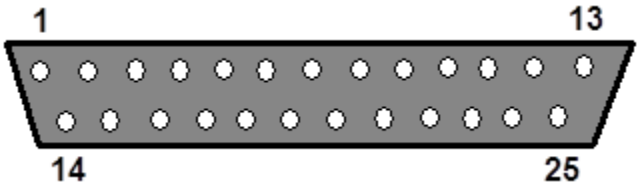
The Motor Signals connector uses a DB-25 connector to send step and direction signals from the Signal Generator to an external drive box.

The Motor Signals connector also provides a connection point to inputs 1-8 and outputs 1 & 2. Inputs 1-8 are the same signals found on the Input connector. Output 1 & 2 are the same outputs found on the output connector.

The Motor Signals connector can be used to tap into the internal VCC +5V power supply on the signal generator as well as provide an externally isolated power supply for the inputs. Refer to the signal generator section of this hardware guide for further information on input voltage compatibility.

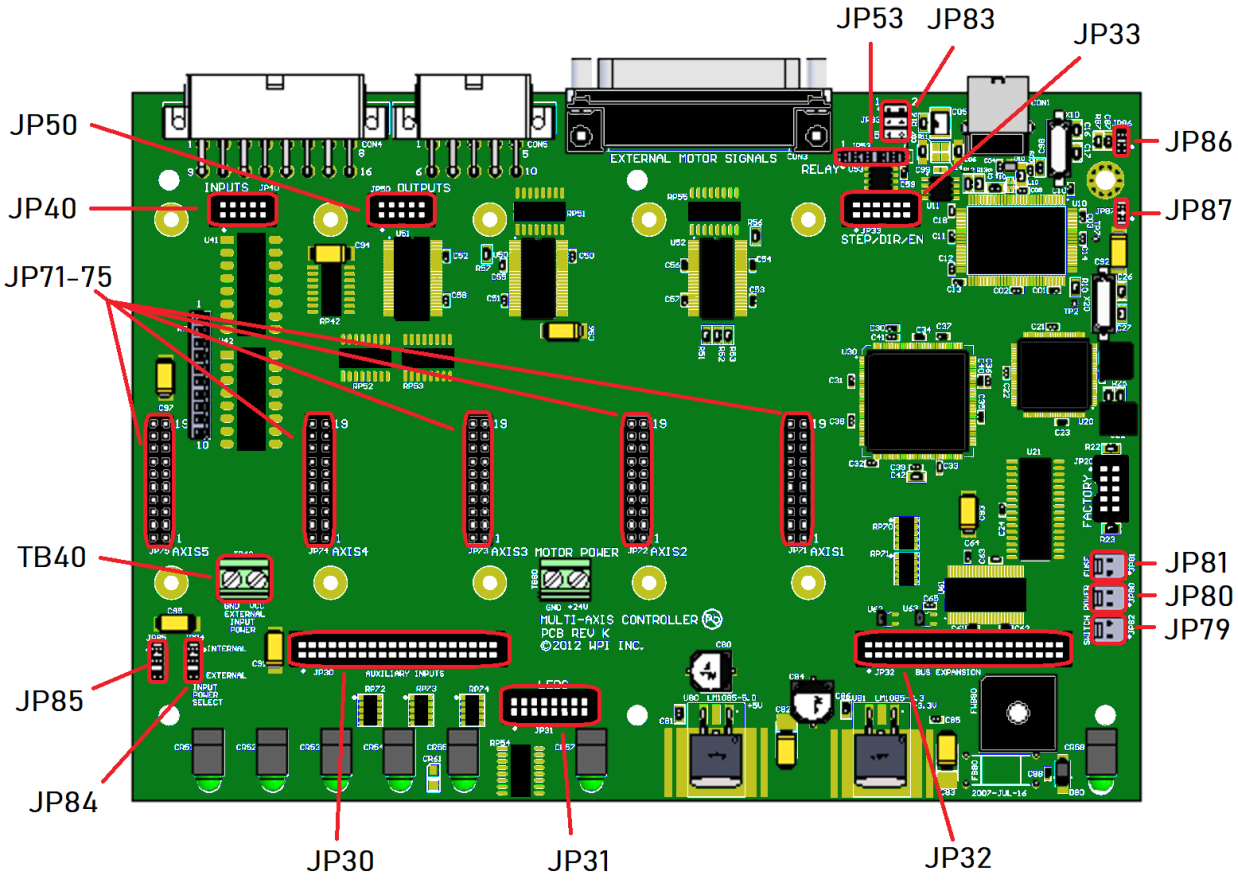
The voltage levels for each Output, Step, Direction and Enable signals are all 5V logic.

DB-25 Connector for Motor Signals			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	OUTPUT 1	14	ENABLE ALL
2	OUTPUT 2	15	INPUT 1
3	STEP AXIS 5	16	INPUT 2
4	DIRECTION AXIS 5	17	INPUT 3
5	INPUT 5	18	INPUT 4
6	INPUT 6	19	DIRECTION AXIS 4
7	INPUT 7	20	DIRECTION AXIS 3
8	INPUT 8	21	DIRECTION AXIS 2
9	DIRECTION AXIS 1	22	INTERNAL VCC +5V
10	STEP AXIS 4	23	OPT. VCC (INPUT)
11	STEP AXIS 3	24	INTERNAL GND
12	STEP AXIS 2	25	OPT. GND (INPUT)
13	STEP AXIS 1		



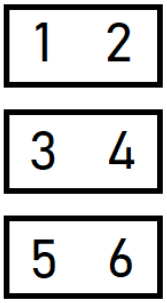
Jumper Settings

Pin 1 of each jumper can be identified by a small, white dot printed on the PCB. A complete description of all jumpers and pin assignments can be found in the Wiring Appendix.



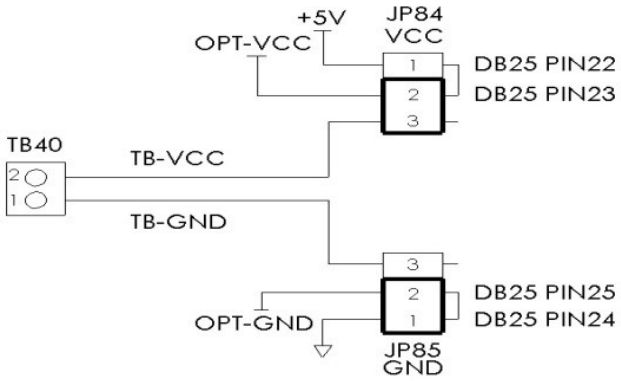
JP83 – DB to USB Ground

This connects the DB-25 ground to the USB ground. By default pins 1 & 2, 3 & 4, and 5 & 6 are jumped as pairs. In order to isolate only the USB shield, only jump pins 3 and 5 and remove JP86. To isolate only the chassis, jump pins 1 & 2, 3 & 5 and 4 & 6 and remove JP86 and JP87. For further information, please see the USB Communications Troubleshooting Guide.



JP84/JP85 – Input Power Select

These two jumpers enable you to choose between the internal power of the Signal Generator and isolated power from an external source. Both jumpers must be set on the same pair of pins (either both must be on pins 1 & 2 or both must be on pins 2 & 3). See the Input section of this guide for further details.



JP86 – USB to Chassis Ground

This jumper connects the USB shield to the chassis ground of the Signal Generator when jumped. In order to isolate the USB shield remove this jumper and make sure only pins 3 and 5 are jumped on JP83. In order to isolate the DB-25 the USB shields, remove this jumper. In order to isolate the DB-25 shield, the USB shield and the chassis remove this jumper as well as JP87.

JP87 – Internal Signal to Chassis Ground

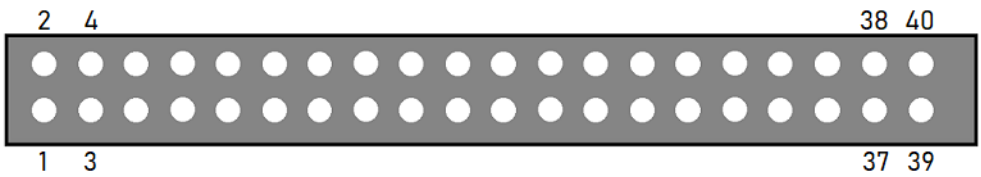
This jumper connects the internal signal ground to the chassis ground of the Signal Generator when jumped. In order to isolate the chassis ground, remove this jumper in addition to JP86 and jump pin 3 and 5, and 4 and 6 on JP83. In order to isolate the DB-25 shield, the USB shield and the chassis, remove this jumper as well as JP86.

Internal Connections

JP30 – Auxiliary Input

This header contains the input signals from the Signal Generator for optional I/O Expansion. Connections should be made with approved peripherals, otherwise damage may occur.

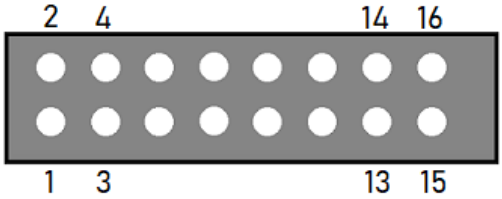
JP30 – Auxiliary Input			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+3.3V	21	GPI-24
2	+3.3V	22	GPI-9
3	GPI-32	23	GPI-23
4	GPI-1	24	GPI-10
5	GPI-31	25	GPI-22
6	GPI-2	26	GPI-11
7	GPI-30	27	GPI-21
8	GPI-3	28	GPI-12
9	GPI-29	29	GPI-20
10	GPI-4	30	GPI-13
11	GPI-28	31	GPI-19
12	GPI-5	32	GPI-14
13	GPI-27	33	GPI-18
14	GPI-6	34	GPI-15
15	GPI-26	35	GPI-17
16	GPI-7	36	GPI-16
17	GPI-25	37	+3.3V
18	GPI-8	38	+3.3V
19	GND	39	GND
20	GND	40	GND



JP31 – Status LEDs

This is for connecting wired LEDs from a custom chassis to the 501A LED signals.

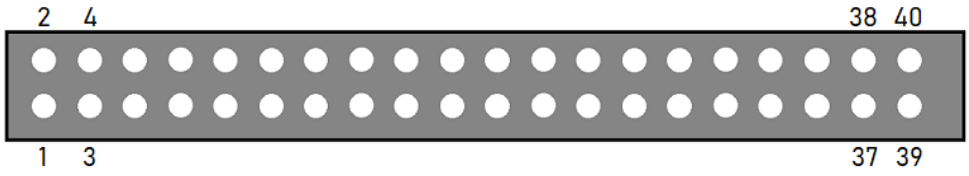
JP31 – Status LEDs			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+5V	9	LED-DIR4
2	N/C	10	LED-STEP4
3	LED-DIR1	11	LED-DIR5
4	LED-STEP1	12	LED-STEP5
5	LED-DIR2	13	LED-AUX
6	LED-STEP2	14	LED-USB
7	LED-DIR3	15	GND
8	LED-STEP3	16	LED-PWR



JP32 – Bus Expansion

This header contains signal and address lines for an optional I/O Expansion board. Connections should be made with approved peripherals, otherwise damage may occur.

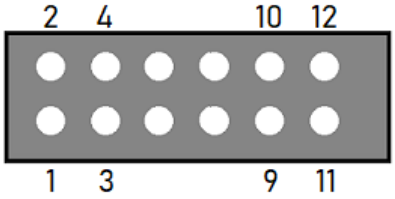
JP32 – Bus Expansion			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+3.3V	21	DATA1
2	GND	22	DATA2
3	CS6	23	DATA3
4	STATUS6	24	DATA4
5	TXD2	25	DATA8
6	FAULT6	26	DATA7
7	RXD2	27	DATA6
8	AUX1-STB	28	DATA5
9	OUT-ENA	29	+7V
10	AUX2-STB	30	+7V
11	OUT2-STB	31	SPHOME
12	OUT1-STB	32	ENC CLK
13	OUT4-STB	33	+3.3V
14	OUT3-STB	34	ENC DIR
15	+5V	35	AGND
16	+5V	36	AV+
17	GND	37	DAC2
18	GND	38	DAC1
19	A0	39	ADC1
20	A1	40	AGND



JP33 – Step and Direction

This header contains each step and direction signal for all five axes of motion as well as the global enable signal and the common ground reference.

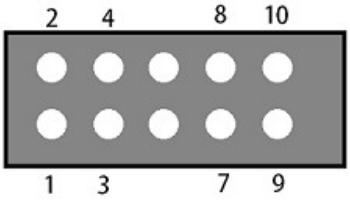
JP33 – Step and Direction			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	STEP5	7	STEP2
2	ENA	8	DIR3
3	STEP4	9	STEP1
4	DIR5	10	DIR2
5	STEP3	11	GND
6	DIR4	12	DIR1



JP40 – Input Aux

This header contains the same signals as the Mini-Fit Jr. Input Connector. It is provided to use an internal input connector or an external input connector on a custom chassis.

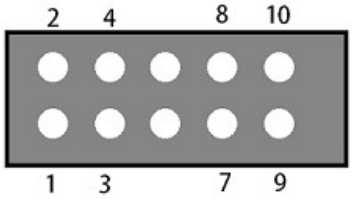
JP40 – Input Aux			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	GPI-2	6	GPI-5
2	GPI-1	7	GPI-8
3	GPI-4	8	GPI-7
4	GPI-3	9	OPT-GND
5	GPI-6	10	OPT-GND



JP50 – Output Aux

This contains the same signals as the Mini-Fit Jr. Output Connector. It is provided to use an internal output connector or an external output connector on a custom chassis.

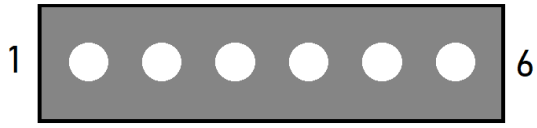
JP50 – Output Aux			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	GPO-2	6	GPO-5
2	GPO-1	7	GPO-8
3	GPO-4	8	GPO-7
4	GPO-3	9	GND
5	GPO-6	10	VCC



JP53 – Low-Side Relay

This header contains duplicate signals for Outputs 1&2 in order to drive an internal relay. (Either mounted here or on the power board, depending on configuration.) The clamps provide a reference voltage for use in signal isolation. The output low pins will sink current to drive devices.

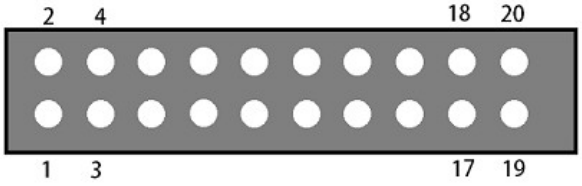
JP53 – Low-SideRelay			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+5V	4	GPO-1 LOW
2	GPO-2 CLAMP	5	GPO-1 CLAMP
3	GPO-2 LOW	6	GND



JP71-75 – Axis Plug-In Interfaces

There are five plug-in interfaces—one for each axis. They are used to add additional functions to the main signal generator board. Most typically, these provide signals to motor drives.

JP71-75 – Axis Plug-In Interfaces						
Pin No.	***Function***	***JP71***	***JP72***	***JP73***	***JP74***	***JP75***
1	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR
2	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR
3	Ground	GND	GND	GND	GND	GND
4	Ground	GND	GND	GND	GND	GND
5	RxD2	RxD2	RxD2	RxD2	RxD2	RxD2
6	Status	STATUS1	STATUS2	STATUS3	STATUS4	STATUS5
7	TxD2	TxD2	TxD2	TxD2	TxD2	TxD2
8	Fault Input	FAULT1	FAULT2	FAULT3	FAULT4	FAULT5
9	Input A	IN8	IN10	IN12	IN14	IN16
10	Direction	DR1	DR2	DR3	DR4	DR5
11	Input B	IN9	IN11	IN13	IN15	IN17
12	Step	ST1	ST2	ST3	ST4	ST5
13	SM0	SM0	SM0	SM0	SM0	SM0
14	SCOM	SCOM1	SCOM2	SCOM3	SCOM4	SCOM5
15	SM1	SM1	SM1	SM1	SM1	SM1
16	CS	CS1	CS2	CS3	CS4	CS5
17	Enable (Global)	ENA	ENA	ENA	ENA	ENA
18	+5V	+5V	+5V	+5V	+5V	+5V
19	Ground	GND	GND	GND	GND	GND
20	Ground	GND	GND	GND	GND	GND



JP80 – Rear Panel Power

Connect the main power here. It can be 8.5V – 16V DC.

JP81 – Rear Panel Fuse

This is for an optional power fuse. The unit is shipped with a shunt instead of a fuse. If you replace the shunt with a fuse, it should be rated to 1A slow-blow or time-delay.

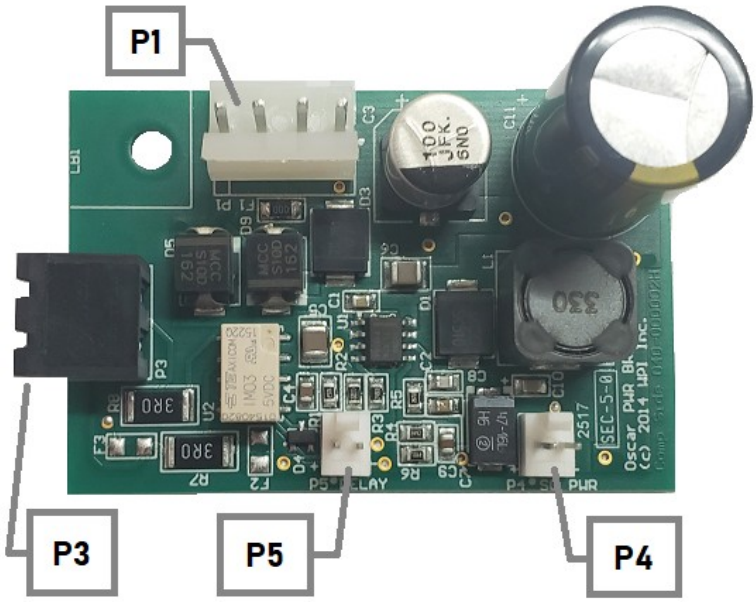
JP82 – Front Panel Switch

If the power supplied to JP80 is not switched, you can connect the main power switch here.

Power Board

The Standard Power Board supplies logic and motor power, indicates system status and contains a control relay circuit.

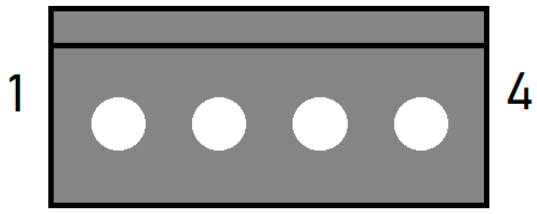
Internal Connections



P1 – Input and Motor DC Power

This header is the DC power input and motor power output.

P1 – Input DC and Motor Power			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	Motor DC Power	3	Input DC Power
2	GND	4	GND



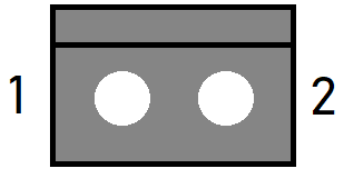
P3 – Relay Connector

This terminal contains a normally open relay driven by Output 1. This relay supports devices with a signal power up to 0.5A. The mating connector is Molex part number 39530-0002.

P4 – Signal Generator Power Out

This header supplies DC power for the Signal Generator board.

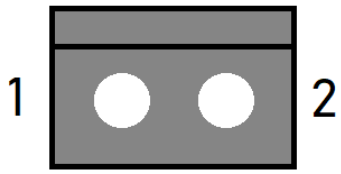
P4 – Signal Generator Power Out			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+12V	2	GND



P5 – Relay Signal Input

This header receives a logic signal that closes the relay accessed on P3.

P5 – Relay Signal Input			
Pin No.	***Signal***	***Pin No.***	***Signal***
1	+5V	2	GPO-1 LOW



Pin Location Index

Signal Locations

This table contains every instance of each signal in the system.

Signal Locations																		
	Signal Generator									**Mini I/O**	**Ultra I/O**							
Signal	**CON5**	**CON4**	**CON3**	**JP30**	**JP40**	**JP50**	**JP53**	**JP33**	**JP71–JP75**	**P103**	**CON 1301**	**CON 1302**	**P1301 P1302**	**JP 1301**	**JP 1302**	**JP 301**	**JP 302**	**JP 303**
Input 1		9	15	4	2													49
Input 2		10	16	6	1													48
Input 3		11	17	8	4													47
Input 4		12	18	10	3													46
Input 5		13	5	12	6													45
Input 6		14	6	14	5													44
Input 7		15	7	16	8													43
Input 8		16	8	18	7													42
Input 9				22					JP71.9							47		
Input 10				24					JP71.11							46		
Input 11				26					JP72.9							45		
Input 12				28					JP72.11							44		
Input 13				30					JP73.9							43		
Input 14				32					JP73.11							42		
Input 15				34					JP74.9							41		
Input 16				36					JP74.11							40		
Input 17				35					JP75.9									41
Input 18				33					JP75.11									40
Input 19				31						10			P1.10					39
Input 20				29						12			P1.12					38
Input 21				27									P2.10				49	
Input 22				25									P2.12				48	
Input 23				23													47	
Input 24				21													46	
Input 25				17								9		2			45	
Input 26				15								10		1			44	
Input 27				13								11		4			43	
Input 28				11								12		3			42	
Input 29				9								13		6			41	
Input 30				7								14		5			40	
Input 31				5								15		8			39	
Input 32				3								16		7			38	

Signal Locations

	Signal Generator									Mini I/O	Ultra I/O							
Signal	**CON5**	**CON4**	**CON3**	**JP30**	**JP40**	**JP50**	**JP53**	**JP33**	**JP71–JP75**	**P103**	**CON 1301**	**CON 1302**	**P1301 P1302**	**JP 1301**	**JP 1302**	**JP 301**	**JP 302**	**JP 303**
Output 1	1		1			2	4			6&15			P1.6&15					37
Output 2	6		2			1	3			7&16			P1.7&16					36
Output 3	2					4							P2.6&15					35
Output 4	7					3							P2.7&16					34
Output 5	3					6												33
Output 6	8					5												32
Output 7	4					8												31
Output 8	9					7												30
Output 9																39		
Output 10																38		
Output 11																37		
Output 12																36		
Output 13																35		
Output 14																34		
Output 15																33		
Output 16																32		
Output 17																		29
Output 18																		28
Output 19																		27
Output 20																		26
Output 21																	37	
Output 22																	36	
Output 23																	35	
Output 24																	34	
Output 25													1		2		33	
Output 26													2		1		32	
Output 27													3		4		31	
Output 28													4		3		30	
Output 29													5		6		29	
Output 30													6		5		28	
Output 31													7		8		27	
Output 32													8		7		26	
Analog Input 1										18				P1.18		30		
Analog Input 2														P2.18		29		
Analog Output 1										17				P1.17		27		
Analog Output 2														P2.17		26		
PWM Output 1										14				P1.14		1		
PWM Output 2														P2.14		7		

Signal Locations																		
	Signal Generator									**Mini I/O**	**Ultra I/O**							
Signal	**CON5**	**CON4**	**CON3**	**JP30**	**JP40**	**JP50**	**JP53**	**JP33**	**JP71–JP75**	**P103**	**CON 1301**	**CON 1302**	**P1301 P1302**	**JP 1301**	**JP 1302**	**JP 301**	**JP 302**	**JP 303**
Step Axis 1			13					9	JP71.12									
Step Axis 2			12					7	JP72.12									
Step Axis 3			11					5	JP73.12									
Step Axis 4			10					3	JP74.12									
Step Axis 5			3					1	JP75.12									
Direction Axis 1			9					12	JP71.10									
Direction Axis 2			21					10	JP72.10									
Direction Axis 3			20					8	JP73.10									
Direction Axis 4			19					6	JP74.10									
Direction Axis 5			4					4	JP75.10									
Enable			14					2	17									

Voltage/GND Locations

+5VDC

- Signal Generator
  - CON5.5
  - CON3.22
  - JP50.9
  - JP53.1
  - JP33.11
  - JP71-75.20
- Mini I/O
  - P103.13
- Ultra I/O
  - CON1302.9
  - P1301.13
  - P1302.13
  - JP1302.10

GND

- Signal Generator
  - CON5.10
  - CON3.24
  - JP30.19, 20, 39, 40
  - JP50.9
  - JP53.6
  - JP33.11
  - JP71-75.20
- Mini I/O
  - P103.4, 5, 8, 9
- Ultra I/O
  - CON1302.10
  - P1301.4, 5
  - P1302.1, 3, 4, 5
  - JP301.1, 2, 3, 4, 5, 6

OPT-VCC

- Signal Generator
  - CON3.23
- Ultra I/O
  - JP301.24, 48
  - JP302.25, 50
  - JP303.25, 50

OPT-GND

- Signal Generator
  - CON4.1, 2, 3, 4, 5, 6, 7, 8
  - CON3.25
  - JP40.9, 10
- Ultra I/O
  - CON1301.1, 2, 3, 4, 5, 6, 7, 8
  - JP301.16, 17, 18, 19, 20, 21, 22, 23, 24
  - JP302.13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
  - JP303.13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
  - JP1301.9, 10

Analog GND

- Ultra I/O
  - P1301.8, 9
  - P1302.8, 9
  - JP301.25, 28, 31

5-24VDC Clamp Voltage

- Signal Generator
  - JP53.2, 5
- Ultra I/O
  - JP301.8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
  - JP302.1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
  - JP303.1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

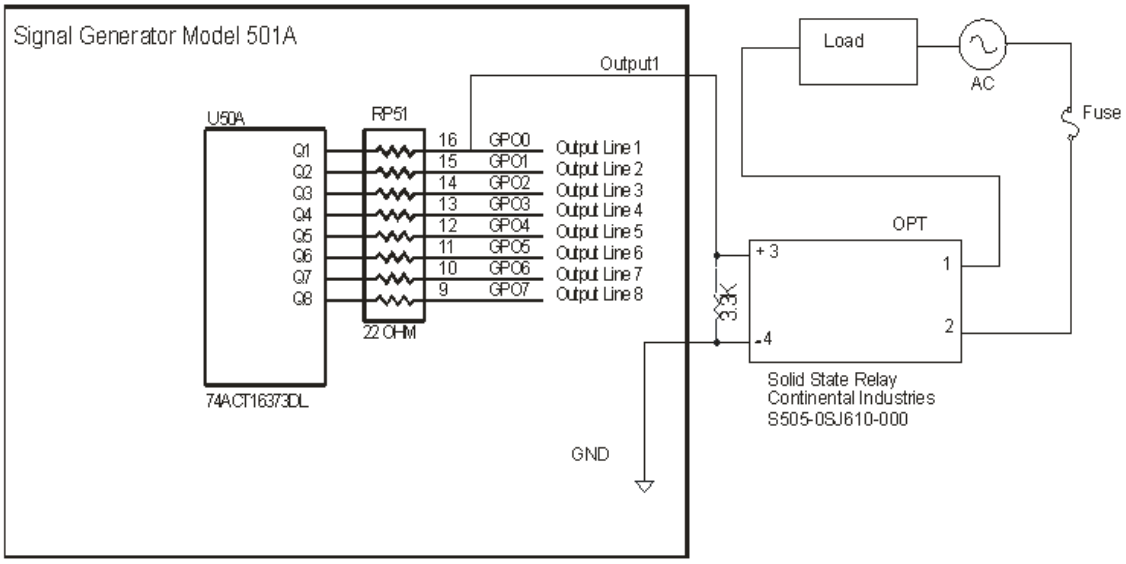
Wiring Appendix

Example Wiring

Typical Output Line Circuit

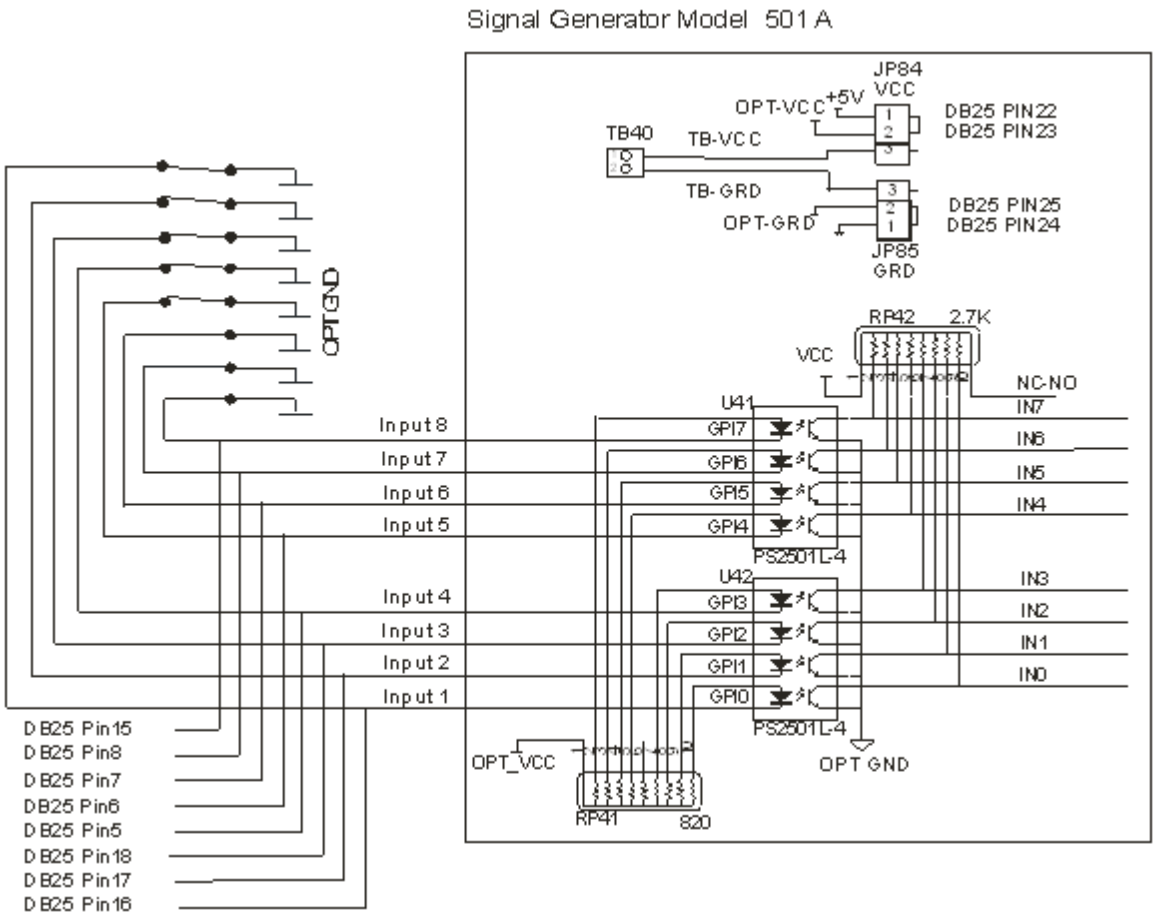
The schematic below shows a typical connection of one solid state relay controlled by output line 1 of the Signal Generator. A typical load could be a spindle, a vacuum, a laser, etc. In this example, the solid-state relay used is a Continental Industries model S505-0SJ610-000.

Each of the output signals has a 22-ohm resistor in series with their outputs. This is to reduce any "ringing" at the transient switching points. Ground and 5V are provided on this connector for your convenience. Our Spindle On/Off Relay Box is wired as shown in the below schematic.



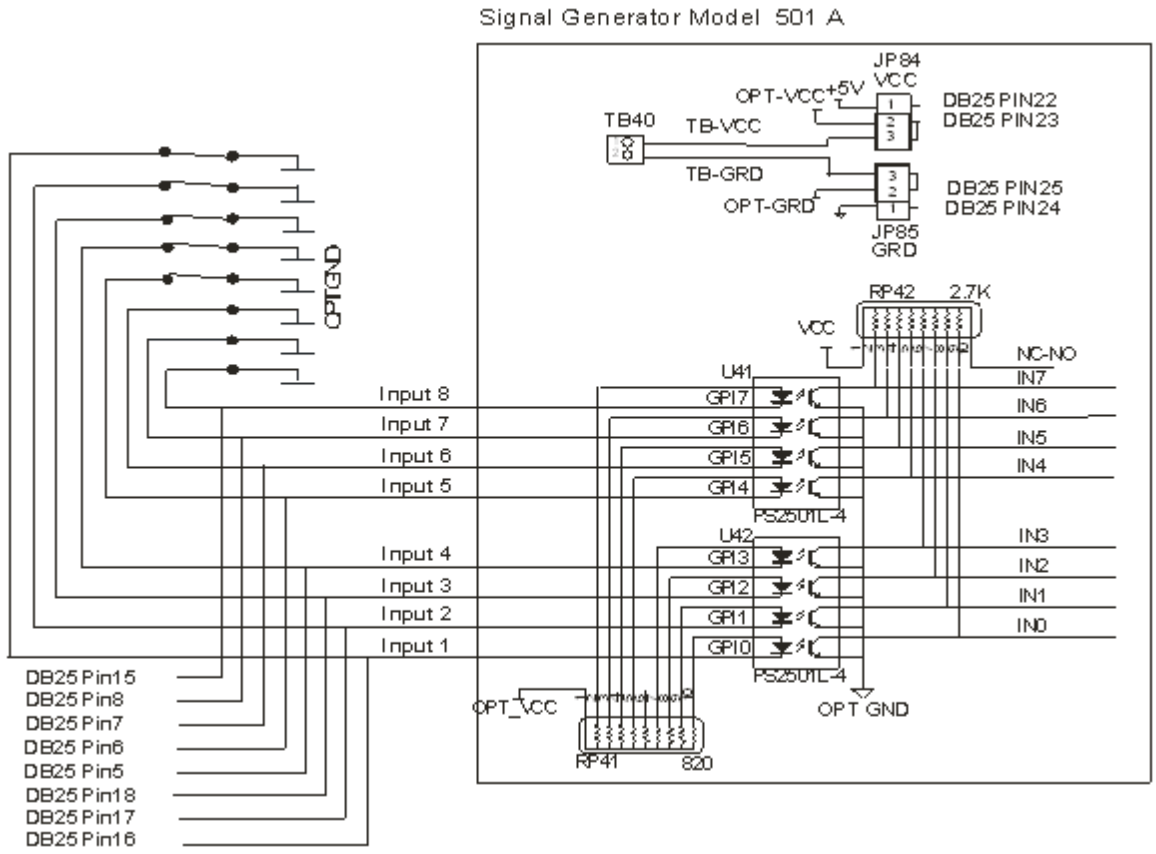
Typical Input Line Circuit – Internal Power

The following schematics show a typical connection of five normally closed switches. These switches are connected between input lines 1-5 and ground. Lines 6-8 are connected directly to ground with jumper wires. All external connections shown are made through the Input connector on the back of the Signal Generator. This resistor pack (RP 41) is socketed so that you can change the value if needed for your application.



Typical Input Line Circuit – External Power

The input lines are all optically isolated. In this example, JP84 and JP85 are shorted using the internal power to source the external side of the optical couplers. However, for the best isolation, JP84 and JP85 should be open, and power should be provided through pins 23 and 25 of the DB25 Motor Signal connector. Input lines 1-4 and 5- 8 are internally connected to pins 15-18 and 5-8 respectively of the DB25 Motor Signal connector.

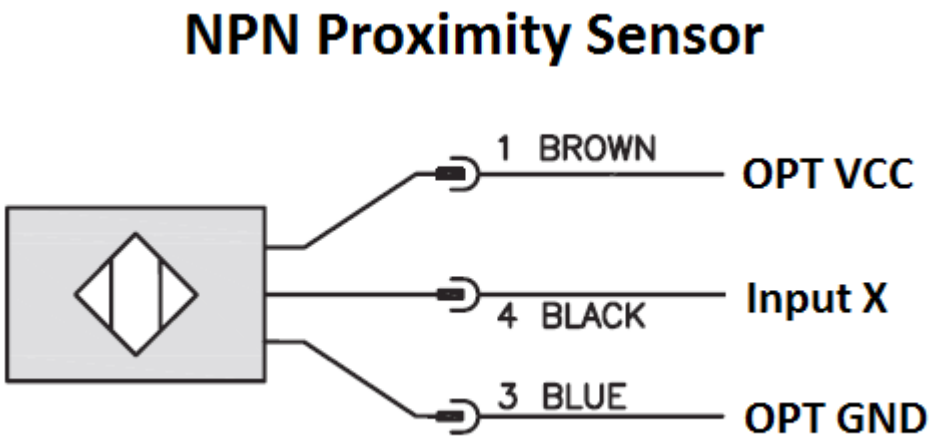


Note that the limit switch kit has the same wiring as shown in this example.

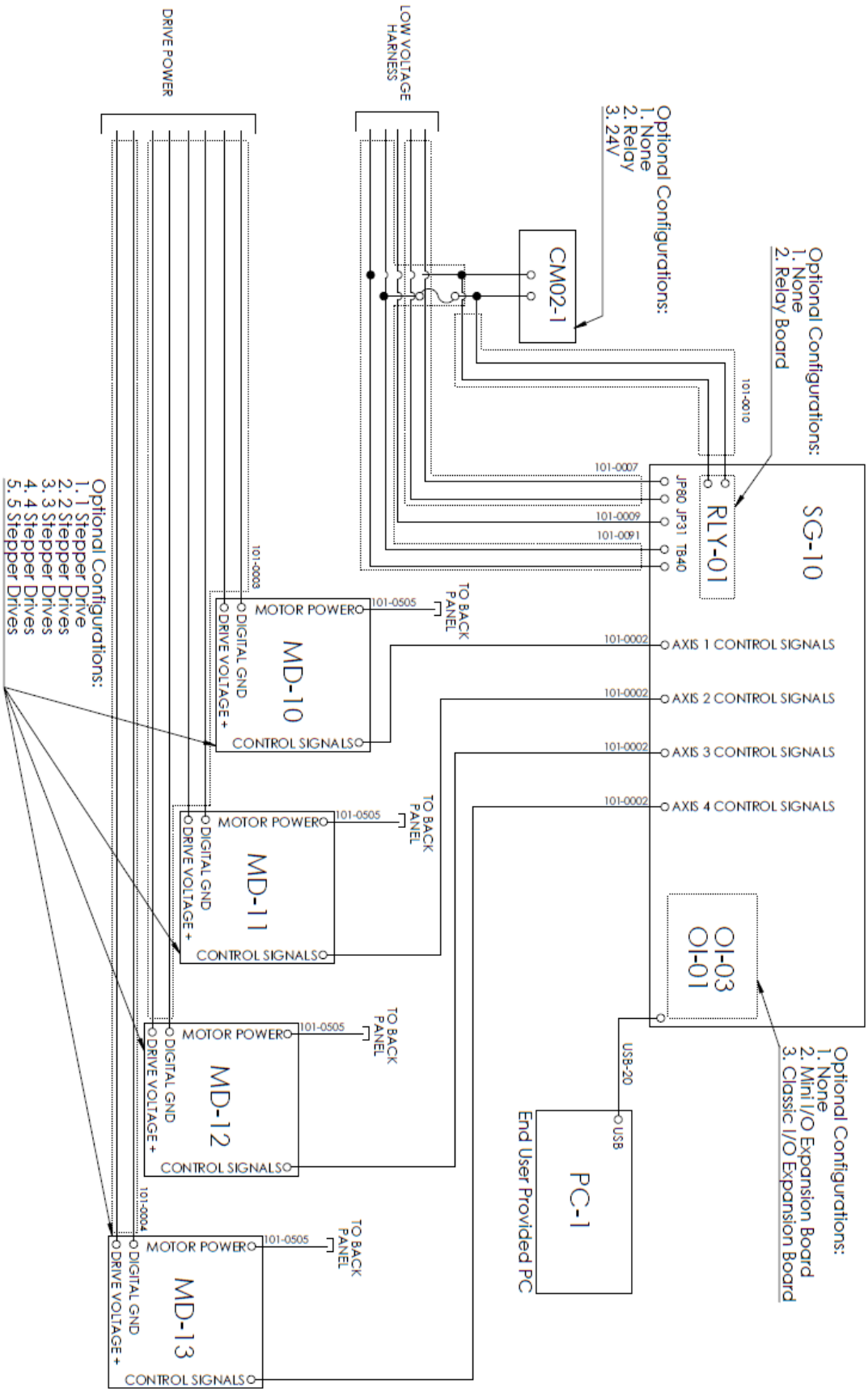
Proximity Sensors

When connecting a proximity type sensor, connect to the controller using the following diagram.

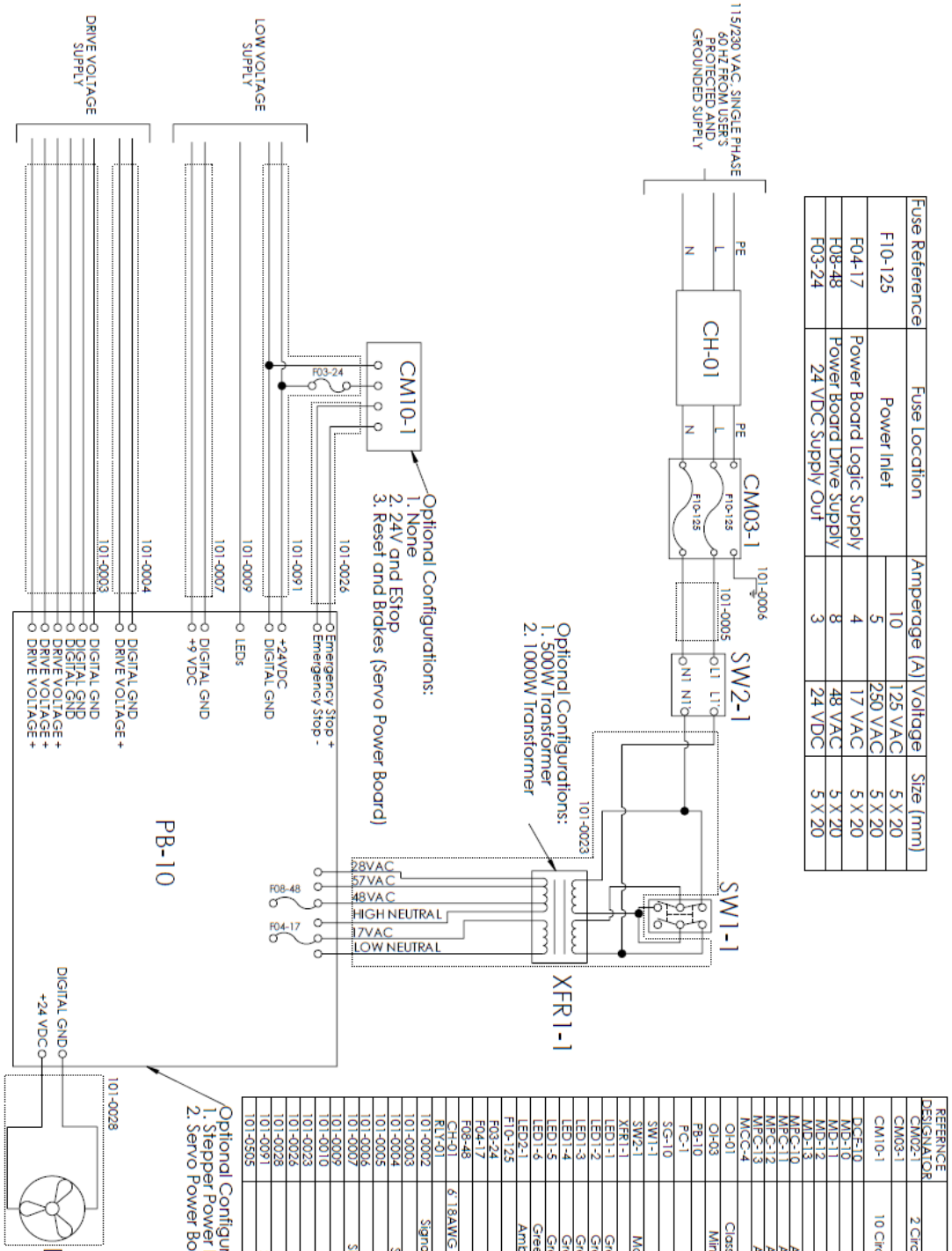
Please note only NPN type proximity sensors are compatible with the controller. Most sensors require the use of a higher, external voltage supply than the standard 5V to operate. Please see the information on Inputs in the Signal Generator section for more information on wiring OPT VCC.



Internal Schematic



Fuse Reference	Fuse Location	Amperage (A)	Voltage	Size (mm)
F10-125	Power Inlet	10	125 VAC	5 X 20
		5	250 VAC	5 X 20
F04-17	Power Board Logic Supply	4	17 VAC	5 X 20
F08-48	Power Board Drive Supply	8	48 VAC	5 X 20
F03-24	24 VDC Supply Out	3	24 VDC	5 X 20



REFERENCE DESIGNATOR	DESCRIPTION
CM02-1	2 Circuit Male Pluggable Terminal Block
CM03-1	IEC 320 Fused Power Inlet
CM10-1	10 Circuit Male Pluggable Terminal Block
DCF-10	24VDC Fan
MD-10	Axis 1 Motor Drive
MD-11	Axis 2 Motor Drive
MD-12	Axis 3 Motor Drive
MD-13	Axis 4 Motor Drive
MPC-10	Axis 1 Motor Power Connector
MPC-11	Axis 2 Motor Power Connector
MPC-12	Axis 3 Motor Power Connector
MPC-13	Axis 4 Motor Power Connector
MCC-4	Motor Connector Cover
OI-01	Classic I/O Expansion Daughter Board
OI-03	Mini I/O Expansion Daughter Board
PB-10	Power Board
PC-1	End User Supplied PC
SG-10	Signal Generator Board
SW1-1	Voltage Selector Switch
SW2-1	Maintained On-Off Toggle Switch
XFR1-1	Toroidal Transformer
LED1-1	Green LED Axis 1 Motion Indicator
LED1-2	Green LED Axis 2 Motion Indicator
LED1-3	Green LED Axis 3 Motion Indicator
LED1-4	Green LED Axis 4 Motion Indicator
LED1-5	Green LED Axis 5 Motion Indicator
LED2-1	Green LED Controller Power Indicator
LED2-2	Amber LED USB Connection Indicator
F10-125	5X20mm Fuse 10A, 250VAC
F03-24	5X20mm Fuse 3A, 250VAC
F04-17	5X20mm Fuse 4A, 250VAC
F08-48	5X20mm Fuse 8A, 250VAC
CH-01	6' 18AWG NEMA 5-15 to IEC-320 C13 Power Cord
RLY-01	Relay Daughter Board
101-0002	Signal Generator to Drive Signal Cable
101-0003	3 Axis Drive Power Cable
101-0004	Single Axis Drive Power Cable
101-0005	Mains Power In to Switch
101-0006	Protective Earth Cable
101-0007	Signal Generator Power Cable
101-0009	LED Cable
101-0010	Relay Cable
101-0023	Transformer Harness
101-0026	Servo Relay Cable
101-0028	Fan Harness
101-0091	24 VDC Power Supply Cable
101-0505	Stepper Motor Power Cable

Revision History

Revision C

Revision	***Date***	***Comments***
A	02/12/20	Extensive rewrite from original
B	02/23/21	Corrected legacy motor connector diagram
C	04/27/21	Replaced Classic I/O Expansion with Ultra