

# **FLASHCUT CNC**

CONTROL MADE SIMPLE

®

*Model 501A*

## **Signal Generator**



***Midwest Office***

444 Lake Cook Road, Suite 22  
Deerfield, IL 60015

Phone (847) 940-9305 ♦ Fax (847) 940-9315

[www.flashcutcnc.com](http://www.flashcutcnc.com)

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# 1. Getting Started

## About this Manual

FlashCut 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 Signal Generator 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 FlashCut 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.

FlashCut CNC, 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. FlashCut CNC supplies this product but has no control over how it is installed or used. Always be careful!

FlashCut CNC, 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.

## 2. Hardware Guide

### Overview of the Signal Generator

The Signal Generator provides a flexible interface that controls up to 5 stepper or digital servo motor drivers, 8 output lines and 8 input lines. It works in conjunction with the FlashCut CNC software. Please note that there are several software and hardware settings that affect the use of the Signal Generator. These settings are described in this manual and in the software User's Guide. An optional I/O expansion board provides an additional 24 output and 24 input lines.

### Removing the Signal Generator Top Cover

To remove the cover from the unit, turn the unit over and remove all 4 of the screws. Then flip the unit back over and lift the top cover off.

### Front Panel

The front panel of the signal generator has the power on/off switch and 7 LEDs with the following functions:



1, 2, 3, 4, 5 – Turns green when the respective motor is moving.

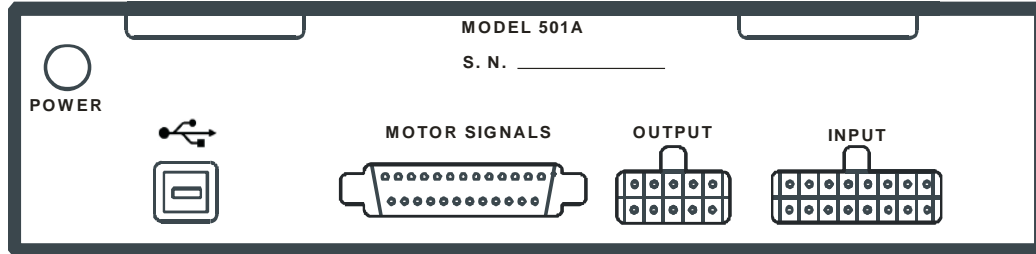
USB – Turns yellow when connected to the host PC USB port.

Power – Turns green when the power switch is turned on.

On/Off Switch – Turns the unit on and off. If there is ever a communications error while running FlashCut CNC, turn the switch off and on to reset the internal microprocessor.

## Rear Panel

The rear panel has connectors for power, and for input and output signals, as described below.



**POWER** – Receptacle for the power supply. The unit is shipped with a 9V DC, 1660mA wall transformer power supply. If needed, an 8.5V – 16V DC or 10 – 12V AC transformer of at least 1200mA can be substituted. A switching DC power supply is recommended for best performance and noise immunity.

The following chart defines the estimated current draw with all operating INPUTS and OUTPUTS asserted at full current.

Configuration	Inputs	Outputs	Motors	Current Draw (mA)
501A Only	8	8	5	1000
501A+I/O Expansion Board	16	16	5	1450
501A+I/O Expansion Board	32	32	5	2150

## External Connections



**USB** – USB connector 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. For the most robust communication, plug the cable directly into the PC, as opposed to a USB repeater or a hub. If the FlashCut software loses communication with the Signal Generator, electrical noise may be the cause. To reduce electrical noise problems, try using 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.

**INPUT** – The connector for up to 8 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 (+5V). When the switch is closed, its input signal is grounded low (0V).

The default setting for each of the input lines is normally closed (NC). The input line settings can be individually changed between normally closed (NC) or



normally open (NO) input lines using FlashCut software. Please refer to the FlashCut User's Guide under "Input Line Settings" for further information.

In the FlashCut CNC 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.

The input lines are all optically isolated. Jumpers J84 and J85 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 and 2 or both must be on pins 2 and 3).

- Internal Power

This is the most convenient option and 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 to the LED side of the optical couplers. When JP84 shorts pins 2 and 3, OPT VCC gets its optically isolated 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:

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

**If you are providing an external voltage through pins 23 and 25 of the DB25 Motor Signal connector or via TB-40, then you must have both JP84 and JP85 jump pins 2 and 3, OTHERWISE SEVERE DAMAGE COULD RESULT.**

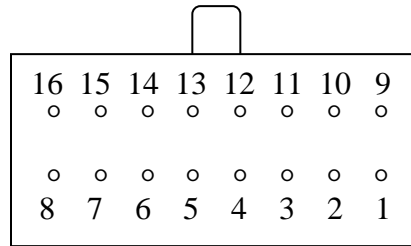
**BE VERY CAREFUL WHEN DOING ANY WIRING. IMPROPER WIRING WILL DAMAGE THE SIGNAL GENERATOR.**

Input lines 1, 2, 3 & 4 are also connected through pins 15, 16, 17 & 18 respectively of the Motor Signal connector, and input lines 5, 6, 7 & 8 are also connected through pins 5, 6, 7 & 8 respectively of the Motor Signal connector. This makes it convenient to send any signals from your motor driver box, such as limit lines or servo position error signal, back to the Signal Generator through the DB25 cable without using a separate input cable. Note that if an input line is being used through the Motor Signal connector, that line must remain open in the Input connector.

The receptacle that plugs into this connector is a Molex-Waldom Mini-Fit Jr. Series 16 pin receptacle (part number 39-01-2160), with female pins (part number 39-00-0039 or 39-00-0047 for 22 gauge or thinner wires).

The Molex 63811-1000 for 14-24 AWG universal or Molex 11-01-0197 Crimp Tools are recommended for installing the pins. Kits containing connectors and pins are available through FlashCut CNC or an electronics distributor.

The input lines as seen from the back of the box are arranged as follows (all connections denoted by “OPT-GND” are optically isolated ground.):



Mini-Fit Jr. Pin No.	Signal	Mini-Fit Jr. 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

**OUTPUT** – The connector for up to 8 output lines. These lines are all compatible with TTL/CMOS level outputs. The Output ports are not setup to 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 go down to 3.9V at full load. Output logic low is normally 0V and can go up to 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 would require a larger power source.

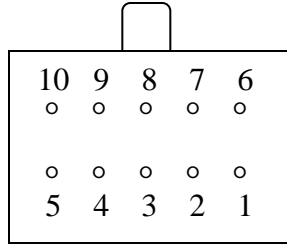
**BE VERY CAREFUL WHEN DOING ANY WIRING. IMPROPER WIRING WILL DAMAGE THE SIGNAL GENERATOR.**

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. This makes it convenient to connect up to 2 output signals to your motor driver box to drive devices such as solid-state relays that might be in your motor driver box.

The receptacle that plugs into this connector is a Molex-Waldom Mini-Fit Jr. Series 10 pin receptacle (part number 39-01-2100), with female pins (part number 39-00-0039 or 39-00-0047 for 22 gauge or thinner wires).

The Molex 63811-1000 for 14-24 AWG universal or Molex 11-01-0197 Crimp Tools are recommended for installing the pins. Kits containing connectors and pins are available through FlashCut CNC or an electronics distributor.

The output lines as seen from the back of the box are arranged as follows:



Mini-Fit Jr. Pin No.	Signal	Mini-Fit Jr. 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 VCC	10	Internal GND

**MOTOR SIGNALS** – The DB-25 male connector for all signals going out to the stepper or digital servo motor driver(s). If you are using one of the FlashCut CNC motor drivers, connect this to the DB-25 female connector on the motor driver using a DB25 M-F interface cable.

**The cable used must be a shielded DB-25 Interface Cable with all 25-pins wired straight through. In high noise situations, a double-shielded cable is recommended.**

The main use of this connector is to provide step and direction signals to the motor drivers. Each of these signals can provide up to 20mA of current.

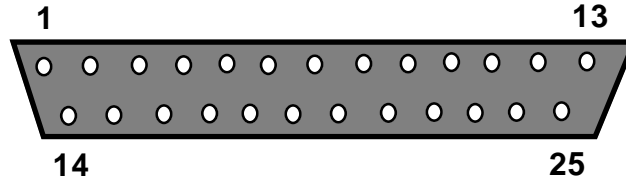
Two input pins are provided for optical ground (pin 25) and optical VCC (pin 23) to power the optical couplers on the input lines (see figure and chart below). You can place a 5 VDC power source across these two pins (the same signal as the 10 pin +5V).

**If you are powering input lines internally then you must have** both JP84 and JP85 jump pins 1 and 2.

**BE VERY CAREFUL WHEN DOING ANY WIRING. IMPROPER WIRING WILL DAMAGE THE MOTOR SIGNAL GENERATOR.**

Two pins are directly connected to ground (pin 24) and +5V (pin 22) from the internal power supply. These are provided to power simple, external, 5V electronics associated with your motor driver. They can source up to 100mA.

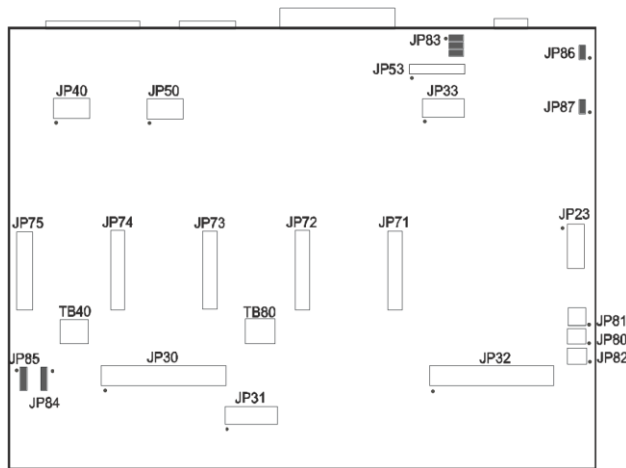
The motor signal lines as seen from the back of the box are arranged as follows:



DB25 Pin No.	Signal	DB25 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		

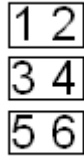
## Jumper Settings

Pin 1 of all jumpers is indicated by a small white dot printed on the PCB.



### JP83 – DB to USB Ground

This connects the DB 25 ground to the USB ground. By default pins 1 and 2, 3 and 4, and 5 and 6 are jumped as pairs. In order to isolate only the USB shield only jumper pins 3 and 5 as well as removing JP 86. In order to isolate only the chassis jumper pins 1 and 2, 3 and 5, and 4 and 6 as well as removing JP 86 and JP 87.

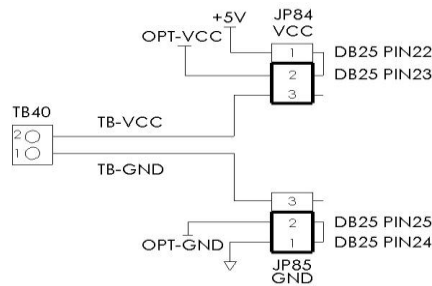


### JP84/JP85 – Input Power Select

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 and 2 or both must be on pins 2 and 3).

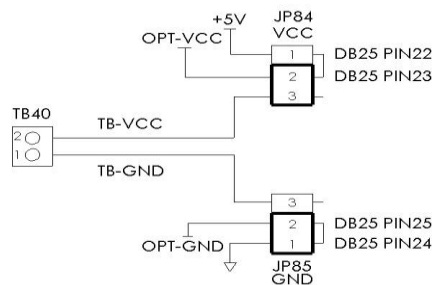
#### Internal Power

This is the most convenient option and 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 to the LED side of the optical couplers. When JP84 shorts pins 2 and 3, OPT VCC gets its optically isolated 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:

1. Connect a power source to the TB 40 screw terminal.
2. Connect a power source through pins 23 and 25 of the DB-25 connector.
3. Check the resistor value in RP41 to make sure it matches the voltage in TB40.

TB40 Voltage

RP41 Value (10 pin 9 Resistor SIP)

5V	3.9kΩ (Default)
12V	11kΩ
24V	22kΩ

**If you are providing an external voltage through pins 23 and 25 of the DB25 Motor Signal connector via TB-40, then you must have both JP84 and JP85 jump pins 2 and 3, OTHERWISE SEVERE DAMAGE COULD OCCUR.**

**JP 86 – USB to Chassis Ground**

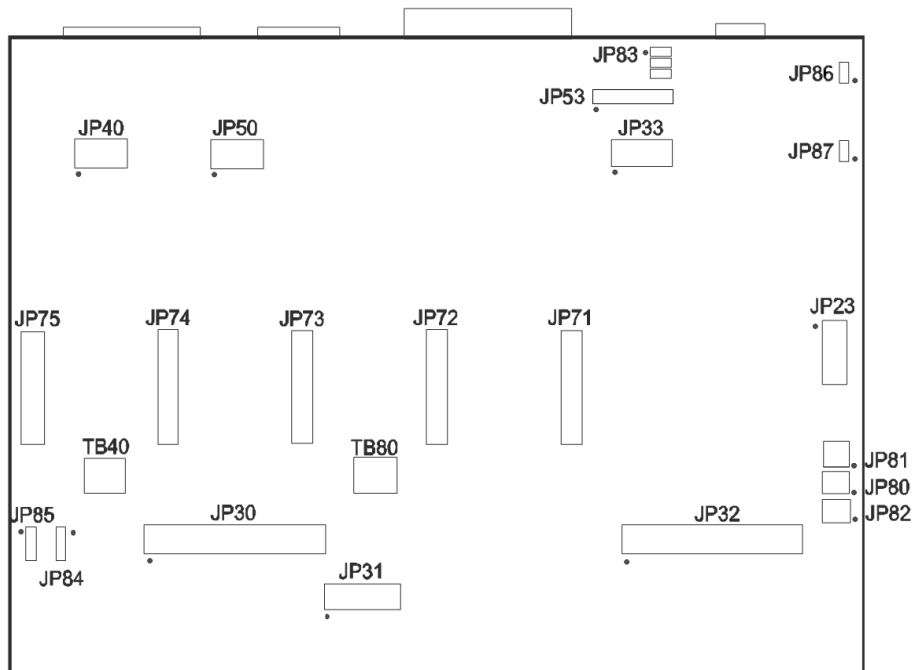
This jumper connects the USB shield to the chassis ground of the Signal Generator when jumped. To isolate the DB 25 shield, the USB shield, and the chassis, remove this jumper as well as JP87. To isolate the DB 25 shield and the USB shield, remove only this jumper. To isolate the USB shield, remove this jumper and make sure only pins 3 and 5 are jumped on JP 83.

**JP 87 – Internal Signal to Chassis Ground**

This jumper connects the internal signal ground to the chassis ground of the Signal Generator when jumped. To isolate the chassis ground, remove this jumper and JP 86, and jump pins 3 and 5 and pins 4 and 6 on JP 83. To isolate the DB 25 shield, the USB shield, and the chassis, remove this jumper as well as JP86.

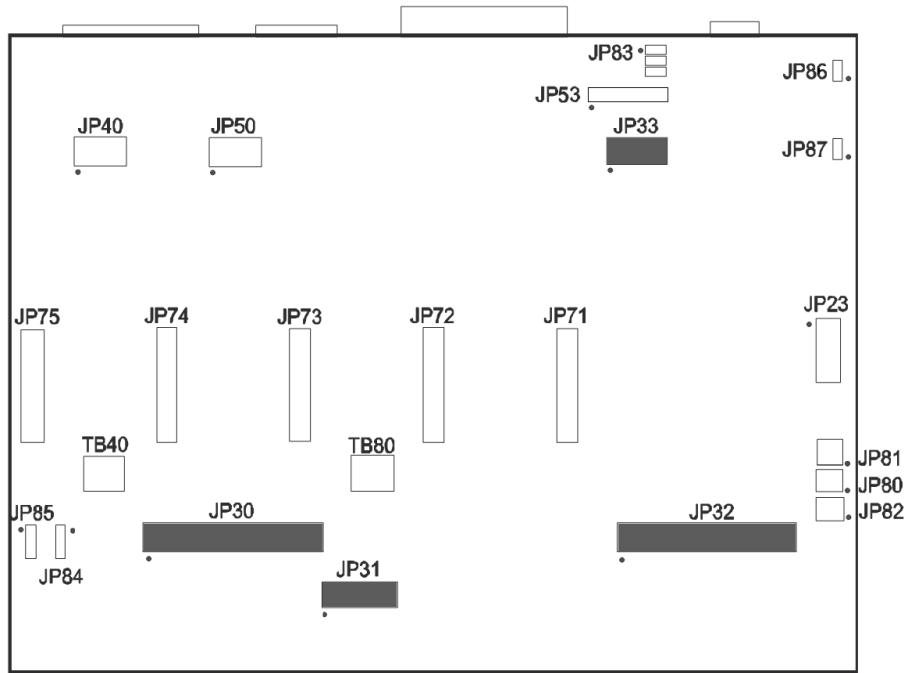
**Internal Connectors**

The diagram below shows the locations of the internal connectors. The top of the diagram corresponds to the back side of the signal generator (where the external connectors are located). The small dot next to some of the connectors designates the number 1 pin position.



On the following diagrams, the positions of the connectors will be highlighted in black.

### Connectors JP30, JP31, JP32, JP33



**JP30 – Auxiliary Inputs**

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39

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

This contains Input Signals 1-8 from the 501A board and Input Signals 9-32 from the I/O Expansion board.

**JP31 – Status LEDs**

2	4	6	8	10	12	14	16
1	3	5	7	9	11	13	15

Signal	Pin No.	Pin No.	Signal
+5V VCC	1	2	N/C
LED-DIR 1	3	4	LED-STEP 1
LED-DIR 2	5	6	LED-STEP 2
LED-DIR 3	7	8	LED-STEP 3
LED-DIR 4	9	10	LED-STEP 4
LED-DIR 5	11	12	LED-STEP 5
LED-AUX	13	14	LED-USB
Internal GND	15	16	LED-PWR

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



**JP32 – Bus Expansion**

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39

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

This contains signal and address lines for the I/O Expansion board.

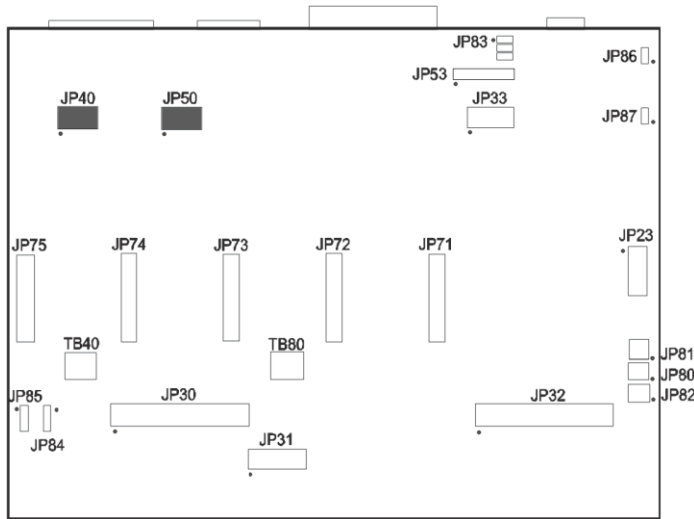
**JP33 – Step & Direction**

2	4	6	8	10	12
1	3	5	7	9	11

Signal	Pin No.	Pin No.	Signal
STEP 5	1	2	ENABLE ALL
STEP 4	3	4	DIRECTION 5
STEP 3	5	6	DIRECTION 4
STEP 2	7	8	DIRECTION 3
STEP 1	9	10	DIRECTION 2
Internal GND	11	12	DIRECTION 1

This contains the step and direction signals for 5 axes of motion.

**Connectors JP40, JP50**



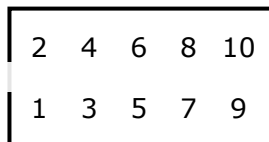
**JP40 – Input Aux Header**



Signal	Pin No.	Pin No.	Signal
INPUT 2	1	2	INPUT 1
INPUT 4	3	4	INPUT 3
INPUT 6	5	6	INPUT 5
INPUT 8	7	8	INPUT 7
OPT-GND	9	10	OPT-GND

This contains the same signals as the Mini-Fit Jr. Input Connector. It is provided for the convenience of using a different input connector or an external input connector on a custom chassis.

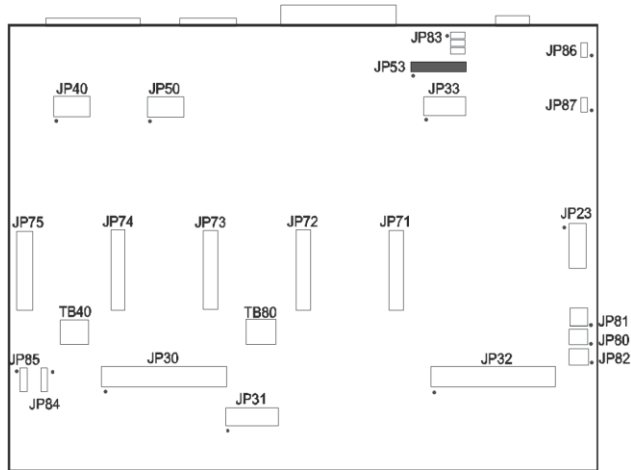
**JP50 – Output Aux Header**



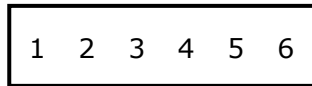
Signal	Pin No.	Pin No.	Signal
OUTPUT 2	1	2	OUTPUT 1
OUTPUT 4	3	4	OUTPUT 3
OUTPUT 6	5	6	OUTPUT 5
OUTPUT 8	7	8	OUTPUT 7
Internal GND	9	10	+5V VCC

This contains the same signals as the Mini-Fit Jr. Input Connector. It is provided for the convenience of using a different output connector or an external output connector on a custom chassis.

## Connector JP53



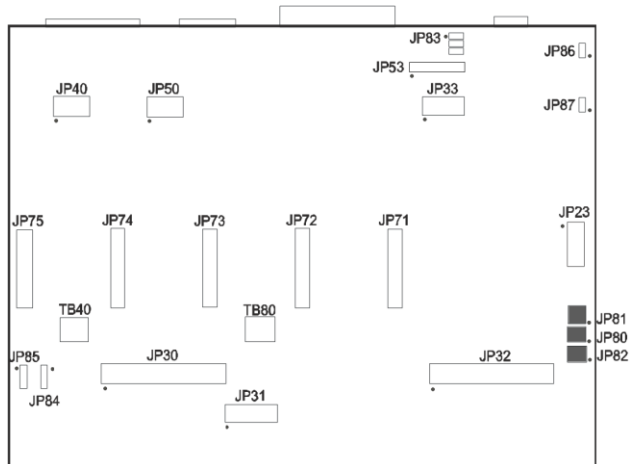
### JP53 – Output 1 & 2 Low Side Driver



Signal	Pin No.
+5V VCC	1
CLAMP for OUTPUT 2	2
OUTPUT 2 Low Side Driver	3
OUTPUT 1 Low Side Driver	4
CLAMP for OUTPUT 1	5
Internal GND	6

This contains buffered signals for outputs 1 and 2. These outputs can sink up to 300mA.

## Connectors JP80, JP81, JP82



### JP80 – Rear Panel Power

Connect the main power here. It can be 8.5V – 16V DC or AC. See current draw chart on page 8 for power requirements.

### JP81 – Rear Panel Fuse

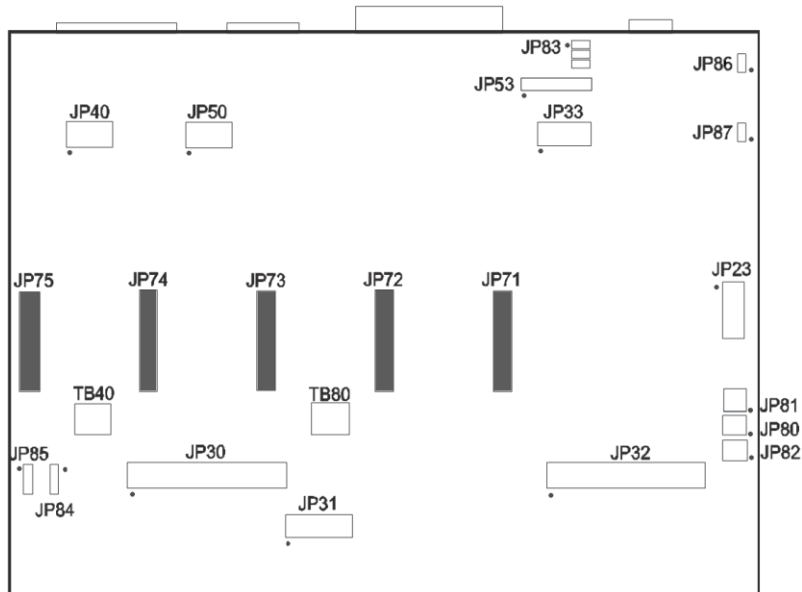
This is for an optional power fuse. The unit is shipped with a shunt instead of a fuse. If you replace the shunt with a fuse, it should be sized according to your power requirements.

### JP82 – Front Panel Switch

Connect the main power switch here.

## Plug-In Card Interfaces

### Plug-In Cards JP71 – JP75



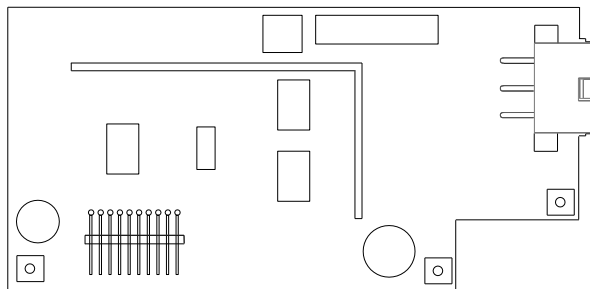
The plug-in card interfaces are used to add additional functions to the main signal generator board. For example, a stepper drive plug-in card will enable you to drive a stepper motor directly from the signal generator box.

20	19
18	17
16	15
14	13
12	11
10	9
8	7
6	5
4	3
2	1

Each of these plug-in cards is a SKT10X2 connector, with the pin configuration on the left. Pin numbers 1-5, 7, 13, 15 and 17-20 perform the same function on each connector.

Per the chart below, pins 6, 8-12, 14 and 16 have different values of Status, Fault, InputA, Dir, InputB, Step, SCOM and CS respectively for each plug-in card.

Pin No.	Label	Function	JP-71	JP-72	JP-73	JP-74	JP-75
1	HV-PWR	High Voltage Power	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR
2	HV-PWR	High Voltage Power	HV-PWR	HV-PWR	HV-PWR	HV-PWR	HV-PWR
3	HV-GND	High Voltage Ground	HV-GND	HV-GND	HV-GND	HV-GND	HV-GND
4	HV-GND	High Voltage Ground	HV-GND	HV-GND	HV-GND	HV-GND	HV-GND
5	RxD2	Serial Com. Receive	RxD2	RxD2	RxD2	RxD2	RxD2
6	STATUS	Status	<b>STATUS1</b>	<b>STATUS2</b>	<b>STATUS3</b>	<b>STATUS4</b>	<b>STATUS5</b>
7	TxD2	Serial Com. Transmit	TxD2	TxD2	TxD2	TxD2	TxD2
8	FAULT	Fault Indicator	<b>FAULT1</b>	<b>FAULT2</b>	<b>FAULT3</b>	<b>FAULT4</b>	<b>FAULT5</b>
9	INPUTA	Input A	<b>IN8</b>	<b>IN10</b>	<b>IN12</b>	<b>IN14</b>	<b>IN16</b>
10	DR	Direction	<b>DR1</b>	<b>DR2</b>	<b>DR3</b>	<b>DR4</b>	<b>DR5</b>
11	INPUTB	Input B	<b>IN9</b>	<b>IN11</b>	<b>IN13</b>	<b>IN15</b>	<b>IN17</b>
12	ST	Step	<b>ST1</b>	<b>ST2</b>	<b>ST3</b>	<b>ST4</b>	<b>ST5</b>
13	SM0	SM0	SM0	SM0	SM0	SM0	SM0
14	SCOM	SCOM	<b>SCOM1</b>	<b>SCOM2</b>	<b>SCOM3</b>	<b>SCOM4</b>	<b>SCOM5</b>
15	SM1	SM1	SM1	SM1	SM1	SM1	SM1
16	CS	Chip Select	<b>CS1</b>	<b>CS2</b>	<b>CS3</b>	<b>CS4</b>	<b>CS5</b>
17	ENA	Enable	ENA	ENA	ENA	ENA	ENA
18	+5V	+5V	+5V	+5V	+5V	+5V	+5V
19	Earth	Earth	Earth	Earth	Earth	Earth	Earth
20	GND	Ground	GND	GND	GND	GND	GND



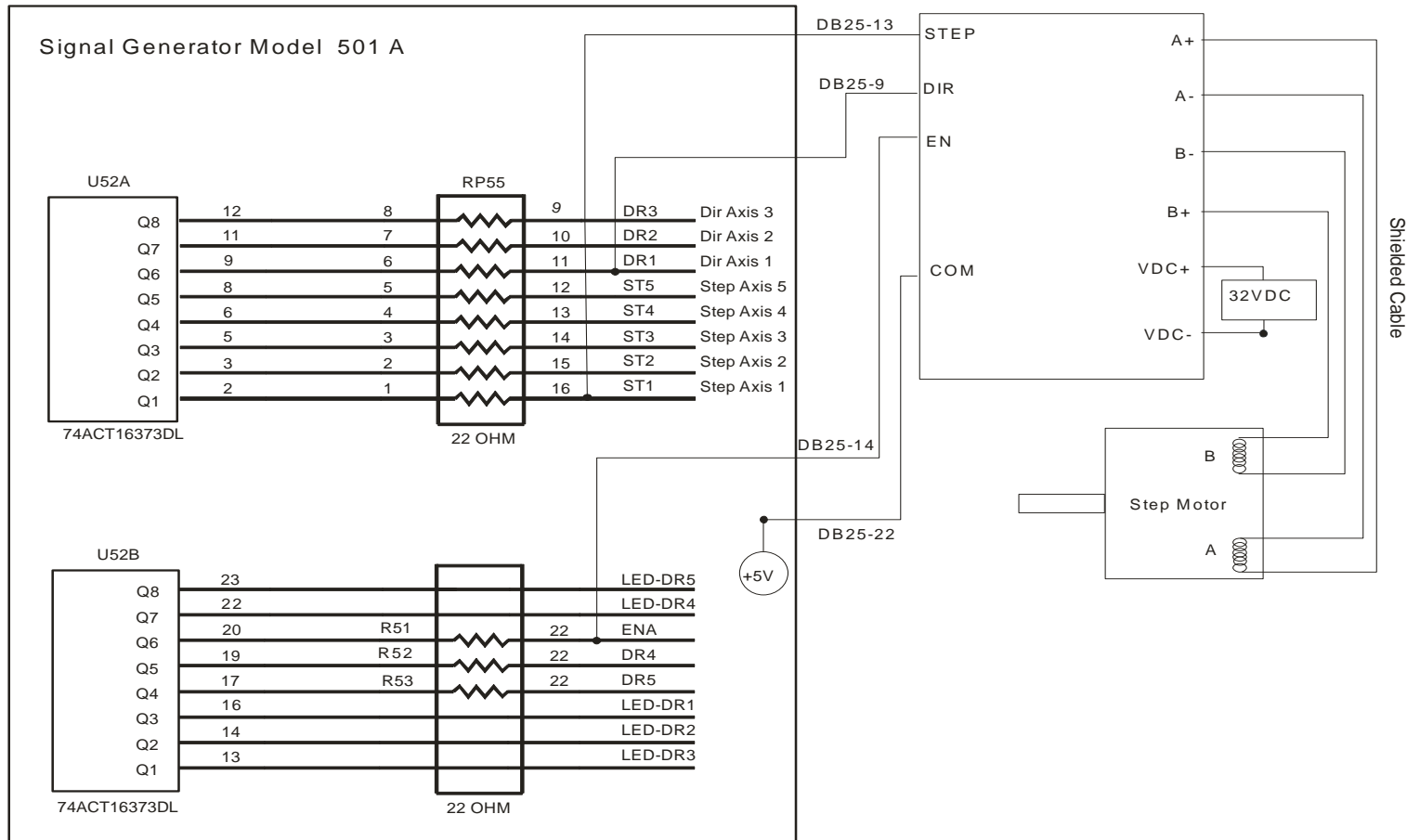
Basic Layout of a Plug-In Board

Connection to the main circuit board is made through the rows of pins on the lower left.



### **3. Sample Wiring Diagrams**

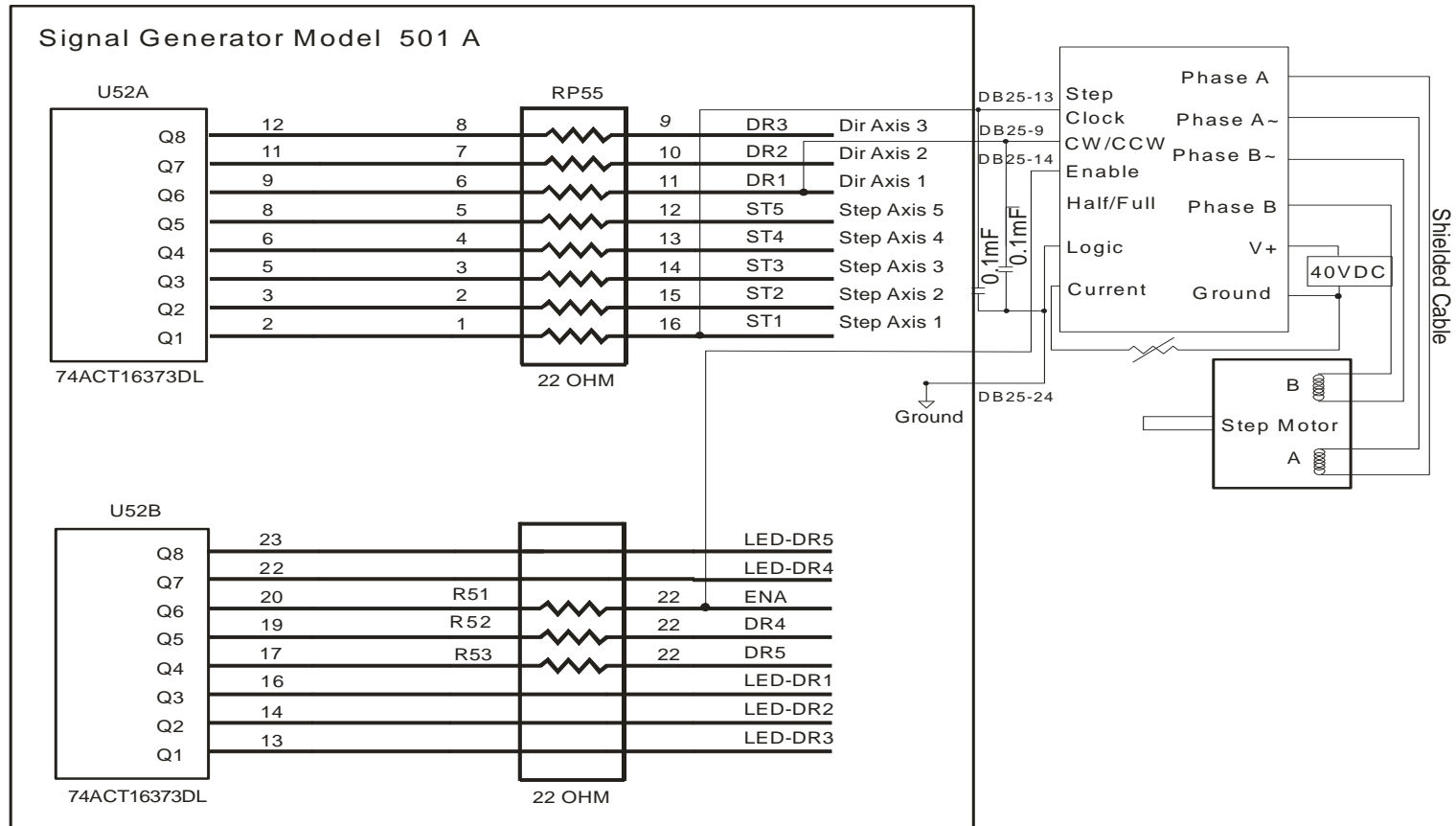
## Typical Motor Signal Circuit for Half-Stepping and Micro-Stepping Drives



The above schematic shows a typical connection of a single axis motor driver to the motor signals of the Signal Generator. Each of the step and direction signals has a 22 ohm resistor in series with its output. This is to reduce any “ringing” at the transient switching points.

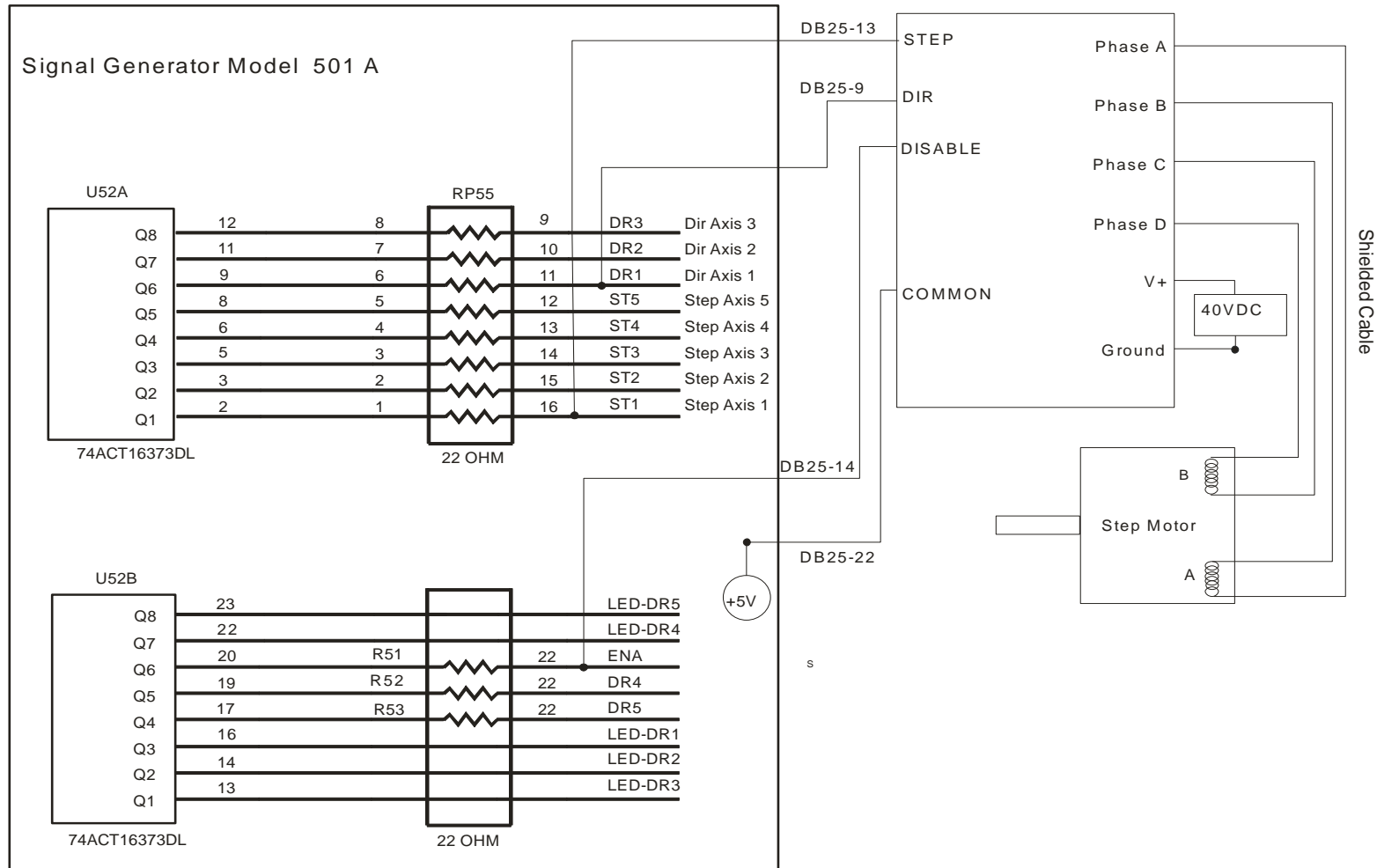


## Typical Motor Signal Circuit II



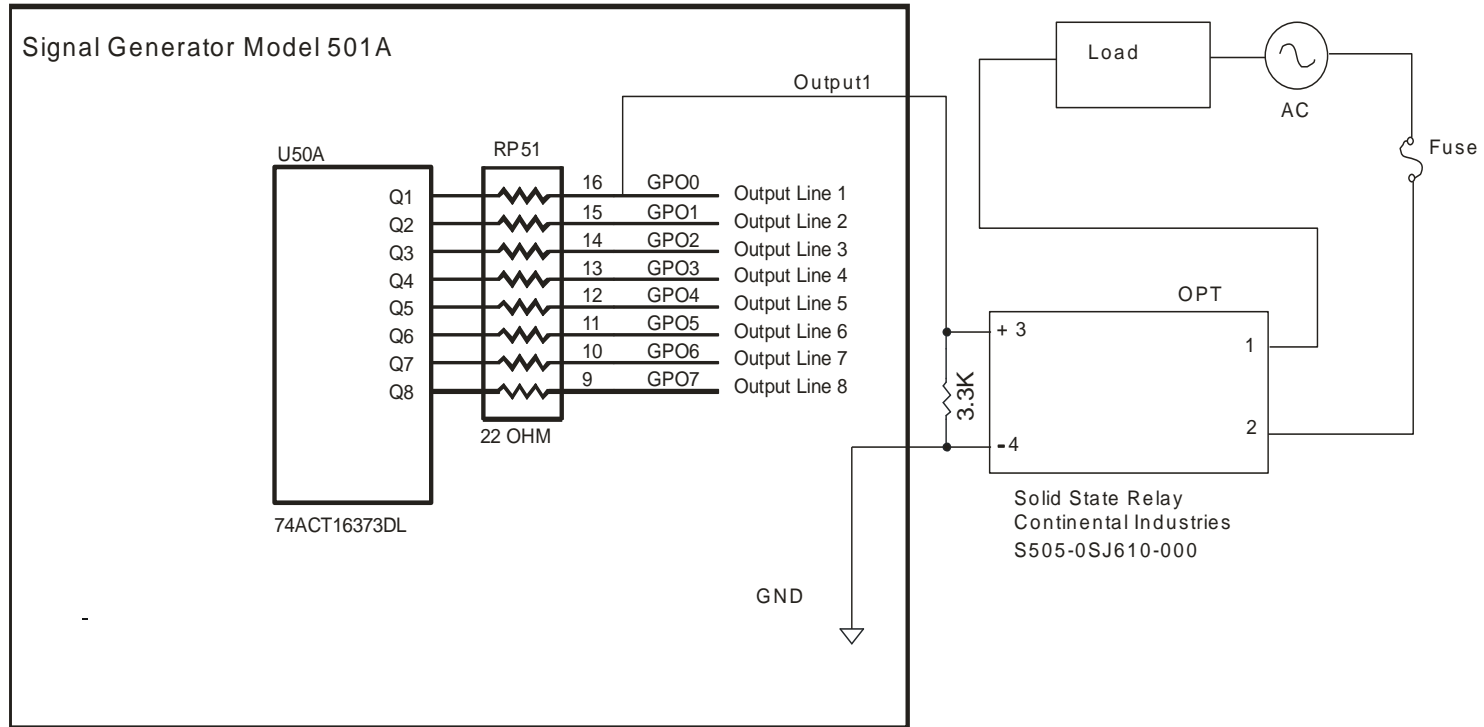
The above schematic shows a typical connection of a single axis motor driver to the motor signals of the Signal Generator. Each of the step and direction signals has a 22 ohm resistor in series with its output. This is to reduce any “ringing” at the transient switching points. In this example a 0.1mF capacitor was placed between the step signal and ground and between the direction signal and ground. This filters out any transient noise in the signals. It is better to place these capacitors on the drive unit rather than the Signal Generator.

## Typical Motor Signal Circuit for Gecko Drives



The above schematic shows a typical connection of a single axis motor driver to the motor signals of the Signal Generator. Each of the step and direction signals has a 22-ohm resistor in series with its output. This is to reduce any “ringing” at the transient switching points.

## Typical Output Line Circuit



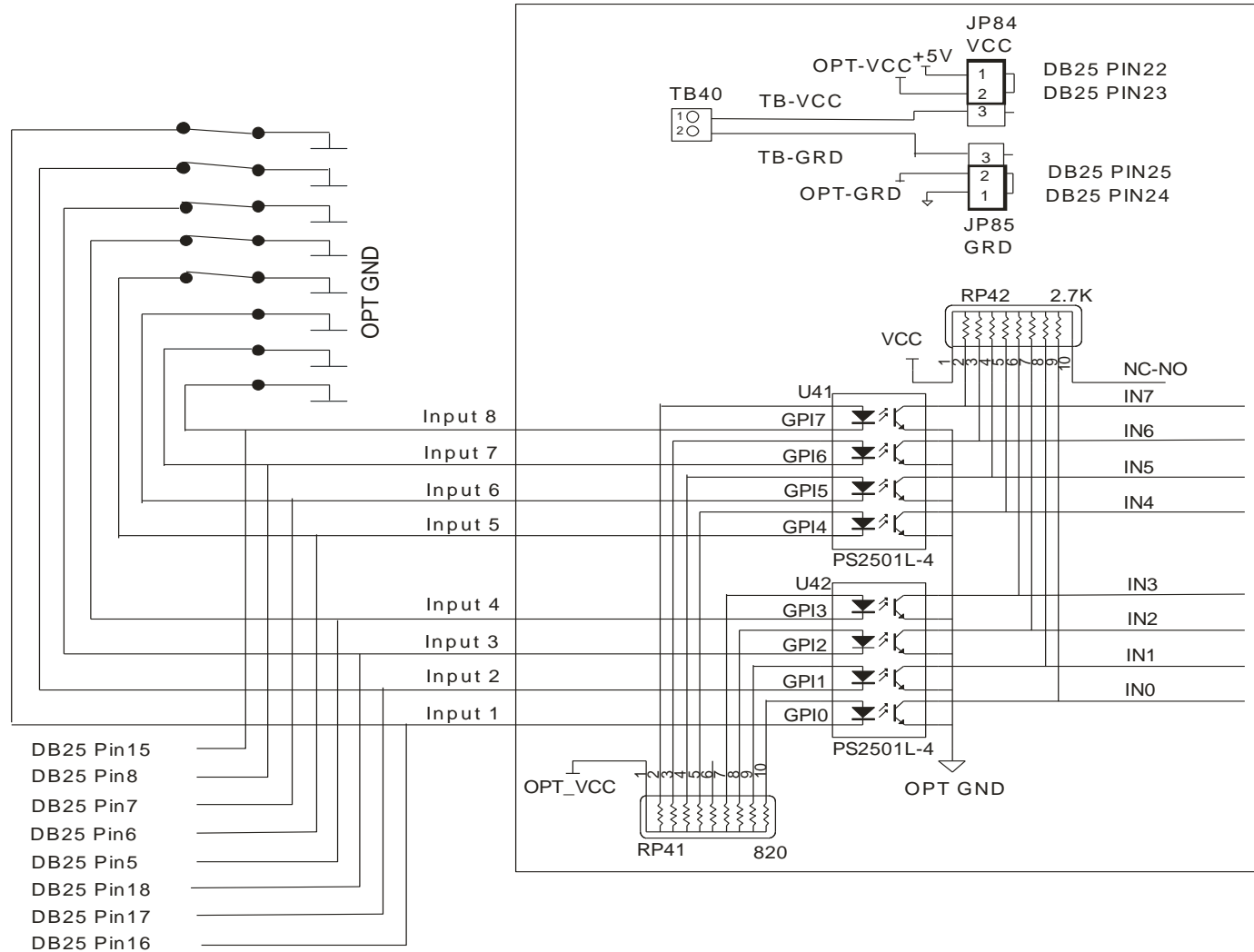
The above schematic shows a typical connection of one solid state relay controlled by output line 1 of the Signal Generator. A typical load would be a spindle, a vacuum, a laser, etc. In this example, the solid-state relay used is a Continental Industries model S505-0SJ610-000. It takes a 3 to 32VDC input and has an output of 24-330VAC.

Each of the output signals has a 22-ohm resistor in series with its output. This is to reduce any “ringing” at the transient switching points. Ground and 5V are provided on this connector for your convenience.

The FlashCut Spindle On/Off Relay Box is wired as shown in the above schematic.

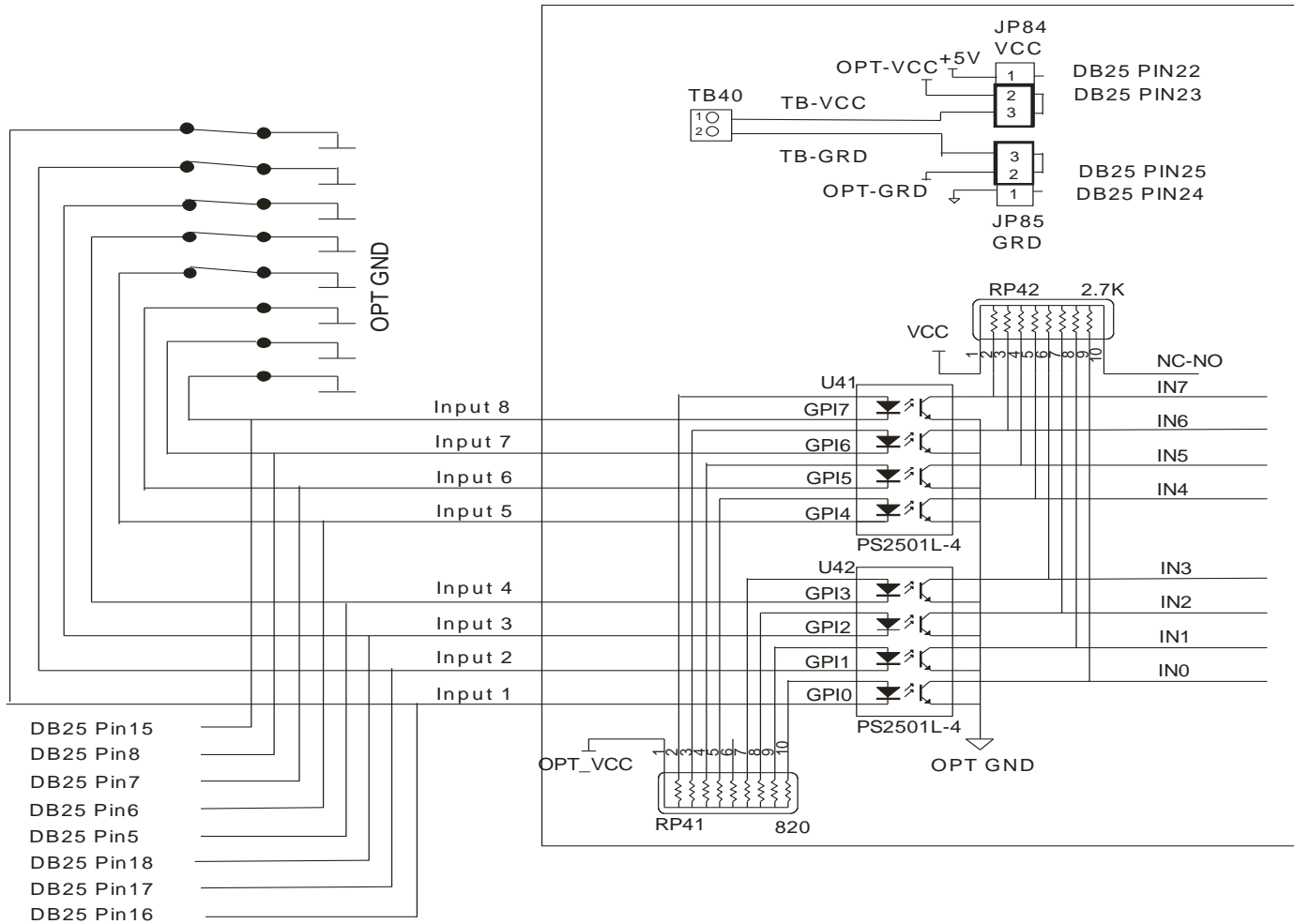
# Typical Input Line Circuit – Internal Power

Signal Generator Model 501 A



# Typical Input Line Circuit – External Power

Signal Generator Model 501 A



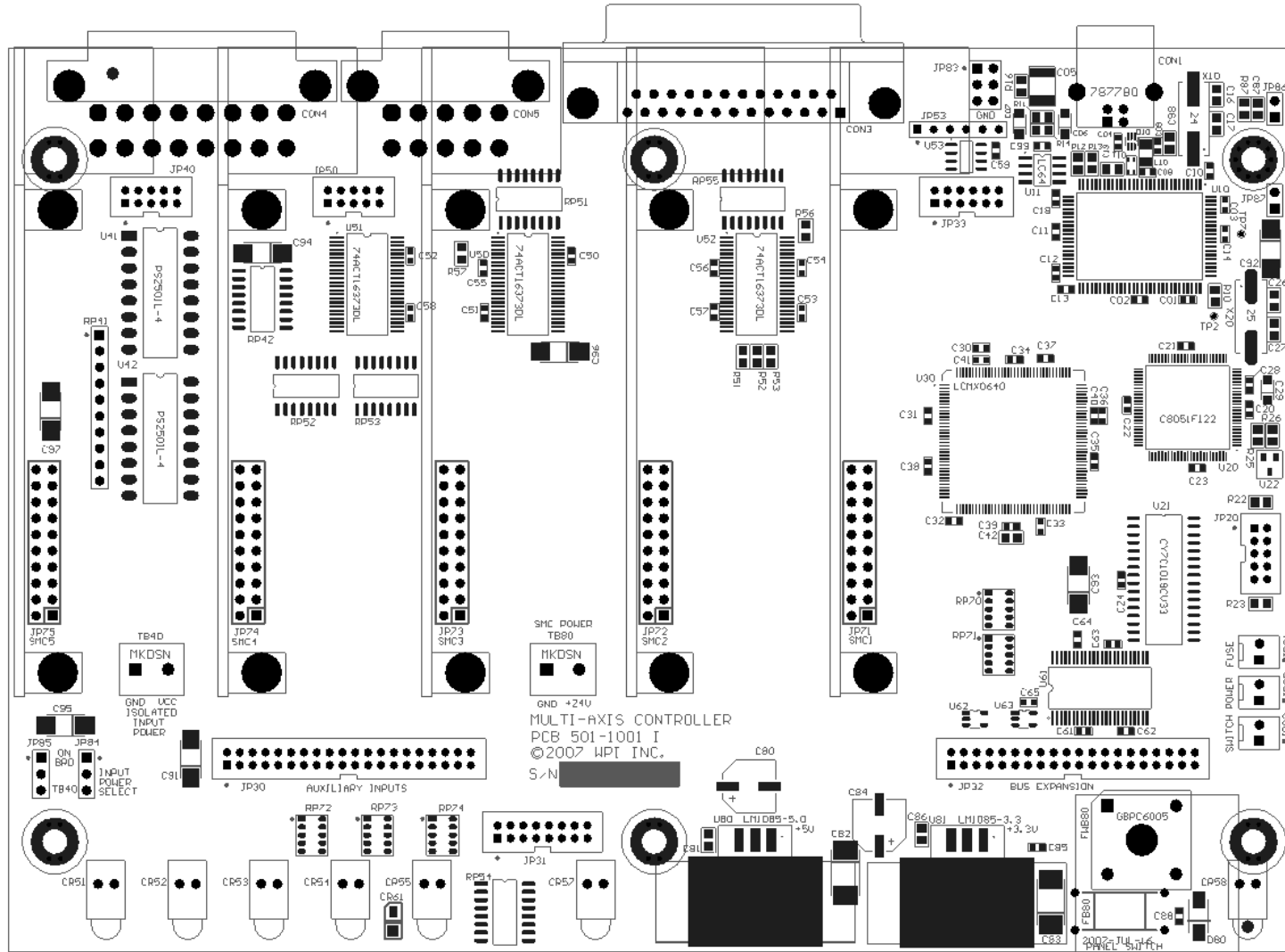
The above schematic shows a typical connection of 5 normally closed switches. These switches are connected between input lines 1-5 and ground. Lines 6-8 are connected directly to ground with jumper wires. All external connections shown are made through the Input connector on the back of the Signal Generator. This resistor pack (RP41) is socketed so that you can change the value if needed for your application.

The input lines are all optically isolated. In this example, pins 1 and 2 of JP84 and JP85 are shorted using the internal power to source the external side of the optical couplers. However, for the best isolation, pins 2 and 3 of JP84 and JP85 should be shorted, 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 FlashCut CNC limit switch kit has the same wiring as shown in this example.

# 4. Appendix

## Signal Generator Board Layout



## Connector Pin-Out Table

### EXTERNAL CONNECTORS (RED)

#### CON1: STANDARD USB TYPE-A

#### CON3 – DB25F

OUTPUT 1	1	14	ENABLE ALL
OUTPUT 2	2	15	INPUT 1
STEP 5	3	16	INPUT 2
DIRECTION 5	4	17	INPUT 3
INPUT 5	5	18	INPUT 4
INPUT 6	6	19	DIRECTION 4
INPUT 7	7	20	DIRECTION 3
INPUT 8	8	21	DIRECTION 2
DIRECTION 1	9	22	Internal VCC
STEP 4	10	23	OPT-VCC
STEP 3	11	24	Internal GND
STEP 2	12	25	OPT-GND
STEP 1	13		SHIELD

#### CON4 - INPUTS

OPT-GND	1	9	INPUT 1
OPT-GND	2	10	INPUT 2
OPT-GND	3	11	INPUT 3
OPT-GND	4	12	INPUT 4
OPT-GND	5	13	INPUT 5
OPT-GND	6	14	INPUT 6
OPT-GND	7	15	INPUT 7
OPT-GND	8	16	INPUT 8

#### CON5 - OUTPUTS

OUTPUT 1	1	6	OUTPUT 2
OUTPUT 3	2	7	OUTPUT 4
OUTPUT 5	3	8	OUTPUT 6
OUTPUT 7	4	9	OUTPUT 8
+5V VCC	5	10	Internal GND

### INTERNAL CONNECTORS (ORANGE)

PIN 1 OF ALL HEADERS IS INDICATED BY A SMALL WHITE DOT PRINTED ON THE PCB.

#### JP30 – AUXILIARY INPUTS

2 X 20 - 2MM SPACING

+3.3V	1	2	+3.3V
INPUT 32	3	4	INPUT 1
INPUT 31	5	6	INPUT 2
INPUT 30	7	8	INPUT 3
INPUT 29	9	10	INPUT 4
INPUT 28	11	12	INPUT 5
INPUT 27	13	14	INPUT 6
INPUT 26	15	16	INPUT 7
INPUT 25	17	18	INPUT 8
Internal GND	19	20	Internal GND
INPUT 24	21	22	INPUT 9
INPUT 23	23	24	INPUT 10
INPUT 22	25	26	INPUT 11
INPUT 21	27	28	INPUT 12
INPUT 20	29	30	INPUT 13
INPUT 19	31	32	INPUT 14
INPUT 18	33	34	INPUT 15
INPUT 17	35	36	INPUT 16
+3.3V	37	38	+3.3V
Internal GND	39	40	Internal GND

#### JP31 – STATUS LEDs

2 X 8 - 2MM SPACING

+5V	1	2	N/C
LED-DIR 1	3	4	LED-STEP 1
LED-DIR 2	5	6	LED-STEP 2
LED-DIR 3	7	8	LED-STEP 3
LED-DIR 4	9	10	LED-STEP 4
LED-DIR 5	11	12	LED-STEP 5
LED-AUX	13	14	LED-USB
GND	15	16	LED-PWR

### INTERNAL CONNECTORS (ORANGE)

#### JP32 – BUS EXPANSION

2 X 20 - 2MM SPACING

+3.3V	1	2	GND
CS6	3	4	STATUS6
TXD2	5	6	FAULT6
RXD2	7	8	AUX1-STB
OUT-ENA	9	10	AUX2-STB
OUT2-STB	11	12	OUT1-STB
OUT4-STB	13	14	OUT3-STB
+5V	15	16	+5V
Internal GND	17	18	Internal GND
A0	19	20	A1
DATA1	21	22	DATA2
DATA3	23	24	DATA4
DATA8	25	26	DATA7
DATA6	27	28	DATA5
+7V	29	30	+7V
SPHOME	31	32	ENC CLK
+3.3V	33	34	ENC DIR
AGND	35	36	AV+
DAC2	37	38	DAC1
ADC1	39	40	AGND

#### JP33 – STEP & DIRECTION

2 X 6 - 2MM SPACING

STEP 5	1	2	ENABLE ALL
STEP 4	3	4	DIRECTION 5
STEP 3	5	6	DIRECTION 4
STEP 2	7	8	DIRECTION 3
STEP 1	9	10	DIRECTION 2
Internal GND	11	12	DIRECTION 1



**INTERNAL CONNECTORS (ORANGE)****JP40 – INPUT AUX HEADER**

2 X 5 - 2MM SPACING

INPUT 2	1	2	INPUT 1
INPUT 4	3	4	INPUT 3
INPUT 6	5	6	INPUT 5
INPUT 8	7	8	INPUT 7
OPT-GND	9	10	OPT-GND

**JP50 – OUTPUT AUX HEADER**

2 X 5 - 2MM SPACING

OUTPUT 2	1	2	OUTPUT 1
OUTPUT 4	3	4	OUTPUT 3
OUTPUT 6	5	6	OUTPUT 5
OUTPUT 8	7	8	OUTPUT 7
Internal GND	9	10	+5V VCC

**JP53 – OUT 1&2 LOW SIDE DRIVER**

1 X 6 - 2MM SPACING

+5V VCC	1
CLAMP for OUTPUT 2	2
OUTPUT 2 Low Side Driver	3
OUTPUT 1 Low Side Driver	4
CLAMP for OUTPUT 1	5
Internal GND	6

**JP80 - REAR PANEL POWER****JP81 - REAR PANEL FUSE****JP82 - FRONT PANEL SWITCH****CONFIGURATION JUMPERS (BLUE)**

PIN 1 OF ALL JUMPERS IS INDICATED BY A SMALL WHITE DOT PRINTED ON THE PCB.

**JP83: DB25 TO USB GROUND**

ALWAYS LEAVE JUMPED UNLESS DIRECTED OTHERWISE BY FLASHCUT TECH SUPPORT

**JP84/JP85: INPUT POWER SELECT**

SHOULD BE JUMPED THE SAME WAY...  
1-2: INPUTS DRIVEN BY ON-BOARD VCC  
2-3: INPUTS BIASED BY VOLTAGE ON TB40

**JP86: USB TO CHASSIS GROUND**

CONNECTS USB GROUND TO CHASSIS GROUND

**JP87: INTERNAL SIGNAL TO CHASSIS GROUND**

CONNECTS INTERNAL SIGNAL GROUND TO CHASSIS GROUND

**TERMINAL BLOCKS (GREEN)****TB40: ISOLATED INPUT POWER**

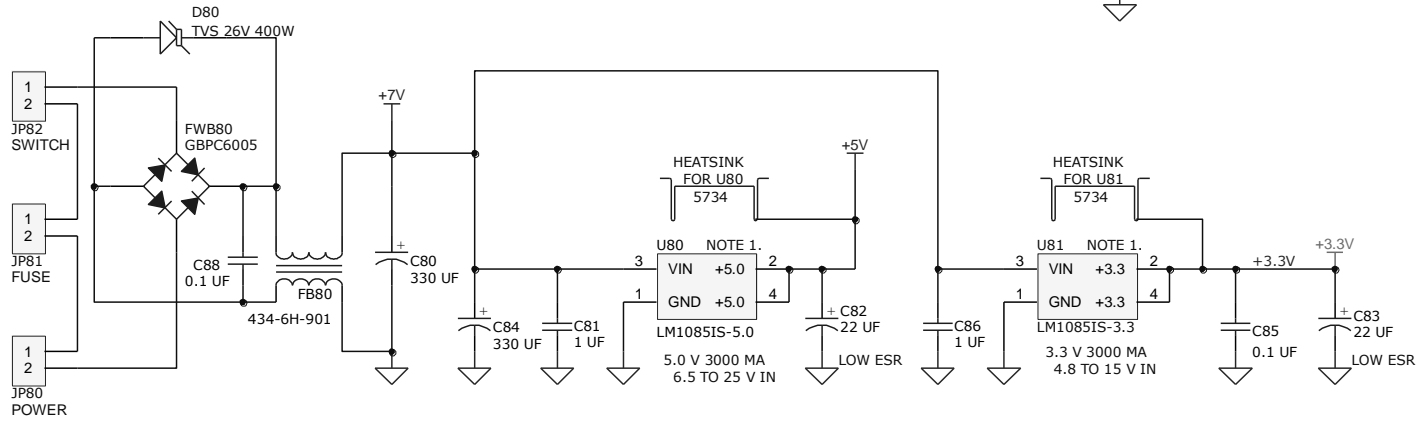
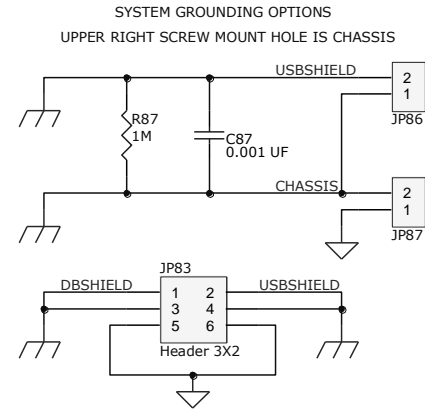
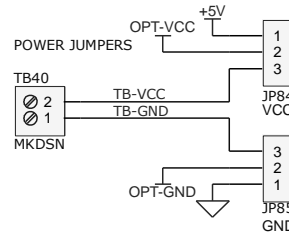
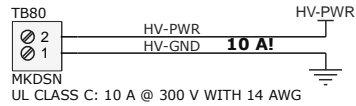
VOLTAGE APPLIED HERE BIASES INPUTS IF JP84/JP85 ARE SHORTED PINS 2-3; DO NOT EXCEED 5V ON THIS TERMINAL UNLESS SPECIFICALLY ARRANGED WITH FLASHCUT TECH SUPPORT.

**TB80: SMC POWER (24V)**

APPLY 24 VDC HERE TO BIAS THE STEPPER MOTOR CONTROLLER BOARD(S) PLUGGED INTO SLOTS SMC1-SMC5

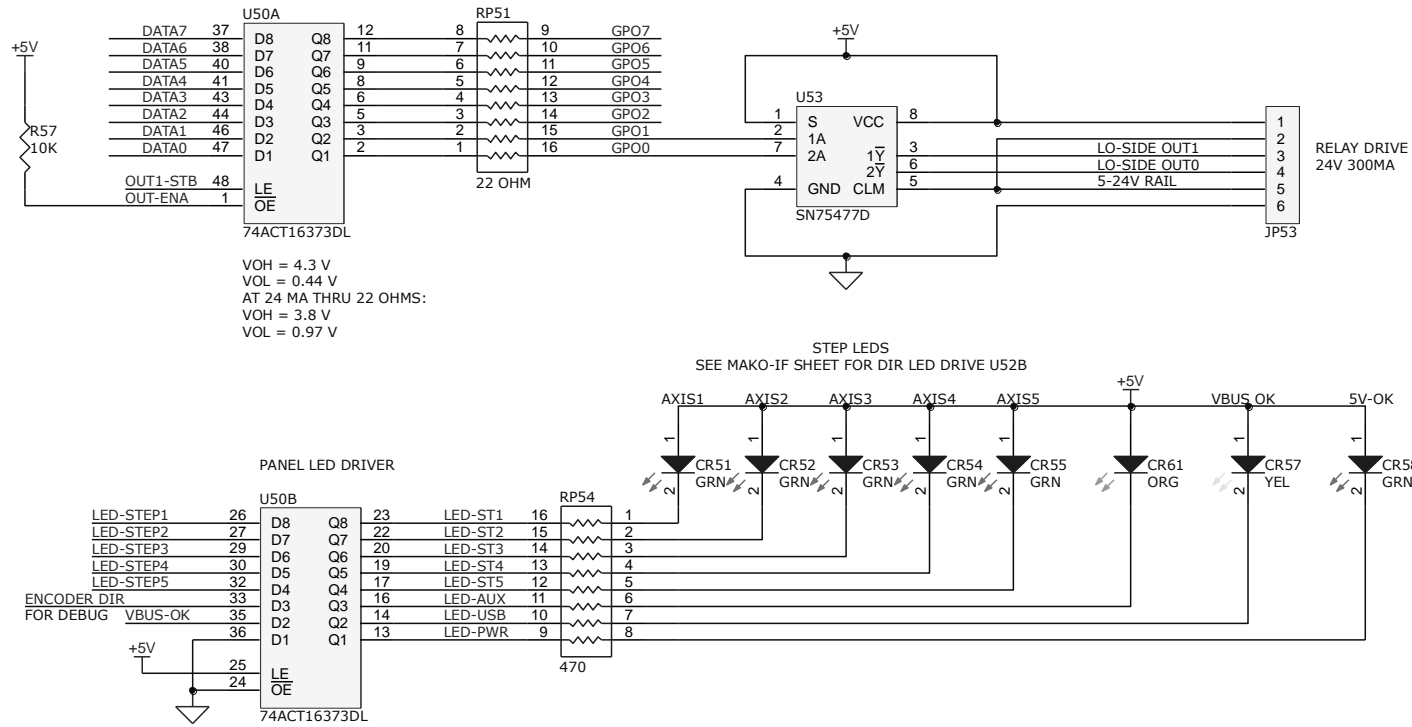
# Power

24-40 V AT UP TO 10 A FOR FUNCTION SLOTS

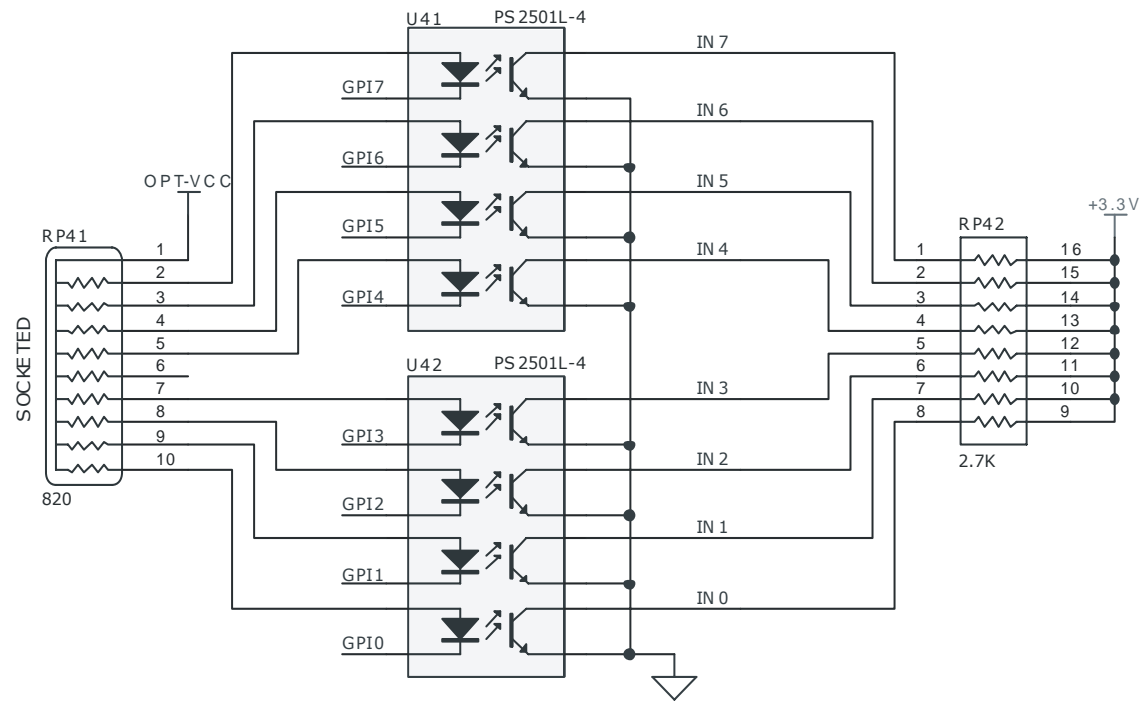


LOGIC POWER  
9 - 24 VDC @ 2 A

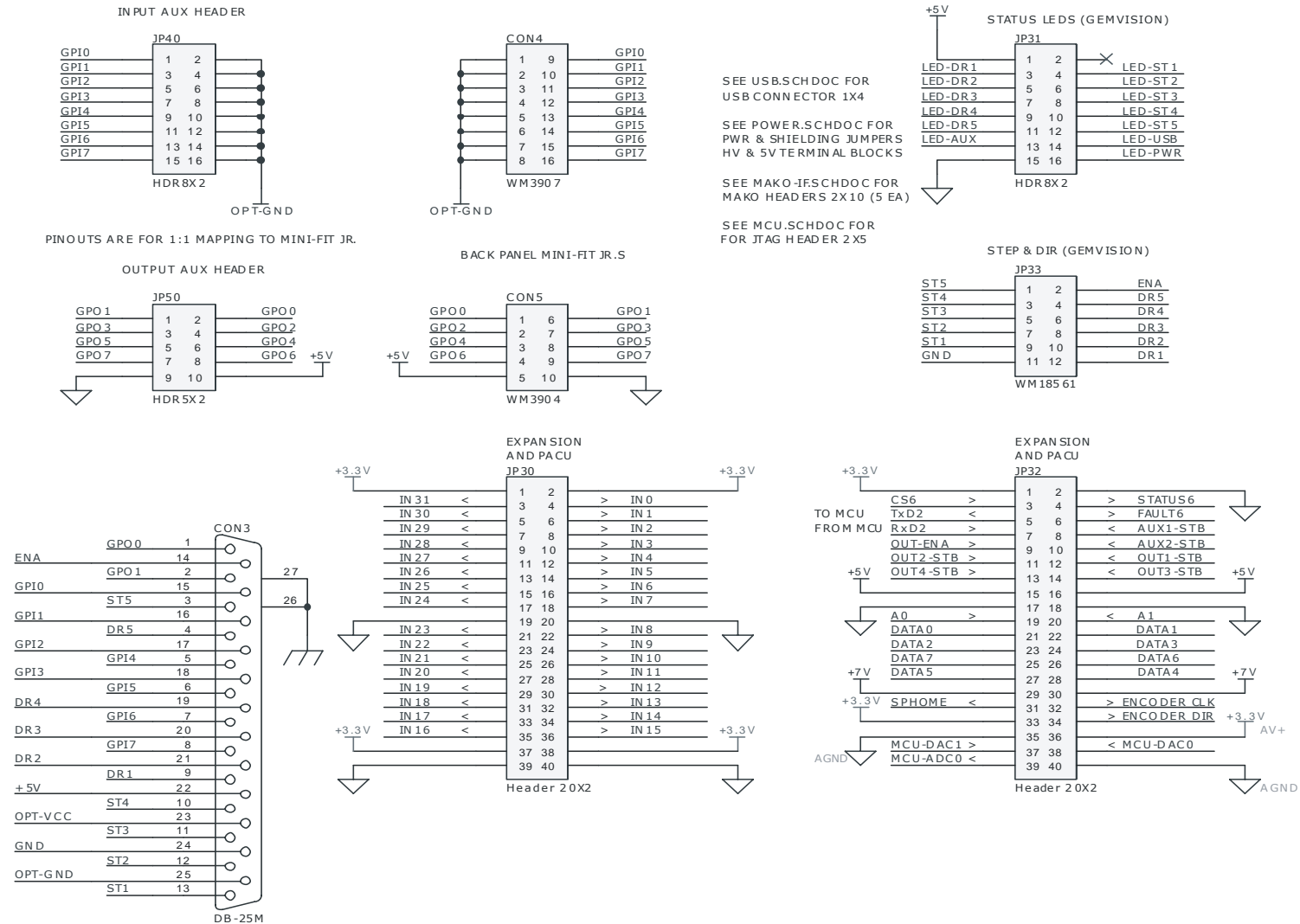
# Outputs



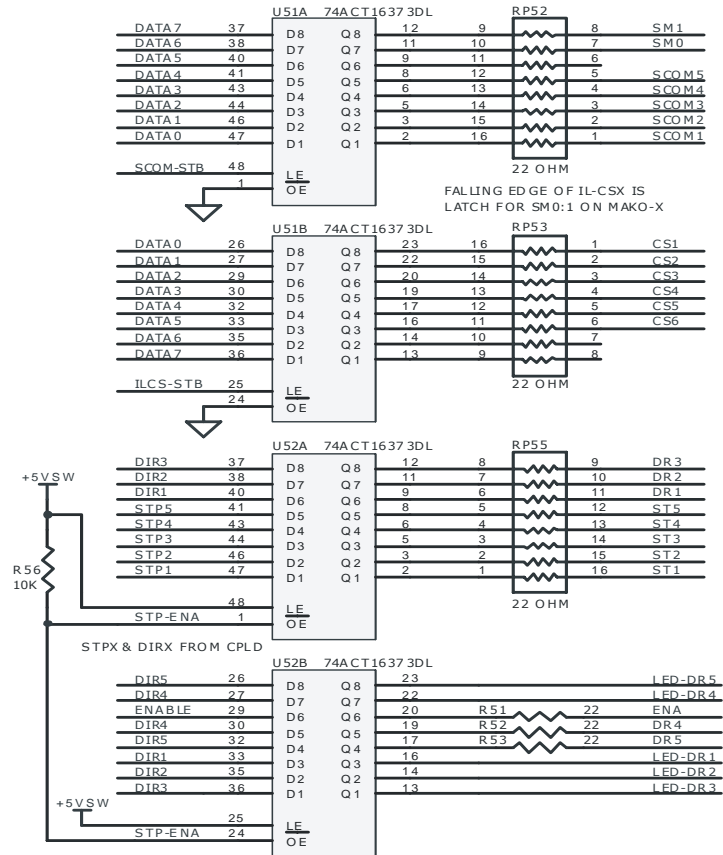
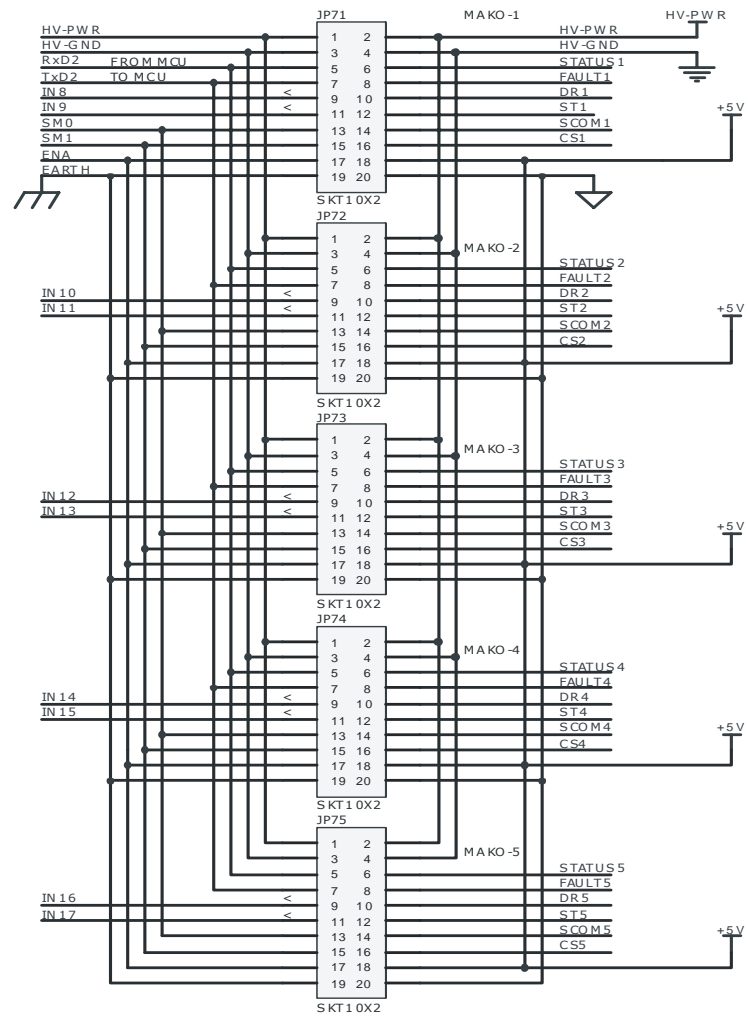
# Inputs



# Connectors



# Plug-In Card Interface



FALLING EDGE OF IL-CSX IS LATCH FOR SM0:1 ON MAKO-X