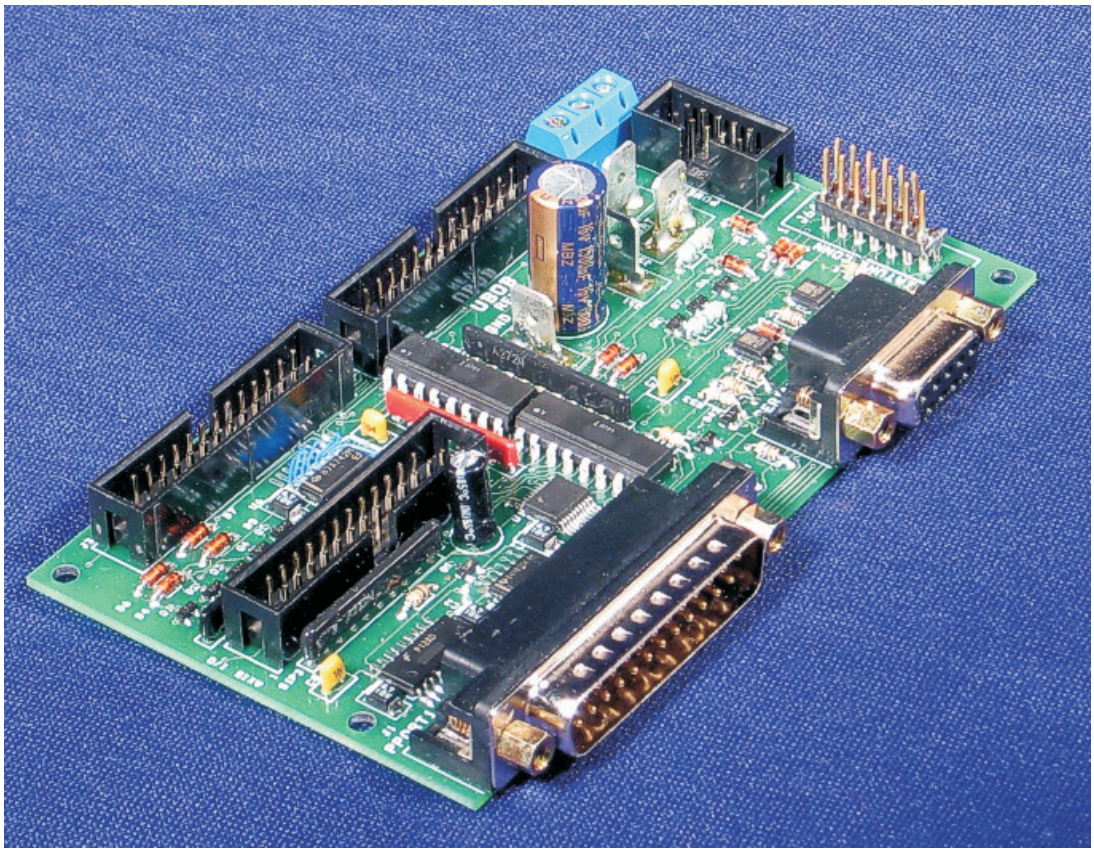
UBOB - The Ultimate Breakout Board



USER MANUAL **REV3 10/15/2008**
Covers UBOB, UBOB Builders Kit.

For ver 4 and 2 of UBOB

Contents:

The UBOB is a third generation, powered, isolated Breakout Board. It is a unique and radically different deign from our previous Breakout products.

A breakout board is designed to take low level logic signals from a PC parallel port and buffer (amplify) them and shift them to standard 5 volts from a lower logic type such as the newer 3.3V logic levels found in a lot of new Motherboards and laptop parallel ports. In addition it provides a level of protection from the noise and spikes of the outside world using **Opto Isolation**. That breaks the grounds apart and prevents noise from being transmitted across a common connection. The UBOB uses two distinct regulated power sources not connected through a common ground to drive the isolated inputs. The internal logic runs on a PC referenced (same ground as the PC) + 5VDC. The “floating voltage” is a 12VDC supply that provides a totally separate ground and voltage source to drive the input optos and external relays on the optional Table I/O II

The limiting factor of all breakout cards is that there are only a specific number of discreet inputs and outputs on a standard parallel port. The normal parallel port has the following I/O capability under control of MACH or EMC:

12 high speed outputs for Step & Direction and/or relay interface. Typically 8 are used for 4 axis of motion, one is used for the Charge Pump (more about that later) and three are open for auxillary outputs (relays, enable pins, etc). Even more limited is the inputs. There are only 5 and one is for E-stop. That leaves the other 4 for Homes and limits, probes, index inputs, etc.

The UBOB is the first BOB design to utilized an advanced **Port Stretcher Technology** that expands the I/O FROM A SINGLE PORT to:
9 high speed (step & Dir + Charge Pump)outputs, and 8 low speed aux outputs for relays. All 8 lines are double buffered and can handle several hundred milliamperes of current each. The inputs are expanded from 5 to 9 providing the added inputs to setup probes, or handle other external signals (external rotary encoders CANNOT be used).

The UBOB uses Surface Mount Techology to keep the size down and supports a wide array of plug-in option cards. It ships with a **free custom plug-in** to handle the advanced port expansion capabilities

The UBOB is design to be a stand alone BOB and port interface or to interface with our EZPlug© Gecko Interface Cards to quickly build anything from a 3 axis table top router/mill to a 5 axis 5 X10 router/plasma table.

The following document covers setup, configuration and testing of the basic UBOB including the setup in MACH3. Several of the common option cards are covered. If you bought a “Builders Pak” or other package deal this manual can serve as a reference for all of the cards. If you bought just the bare bones UBOB you will not have the other option cards in this manual. You can always purchase them at any time and upgrade your UBOB.

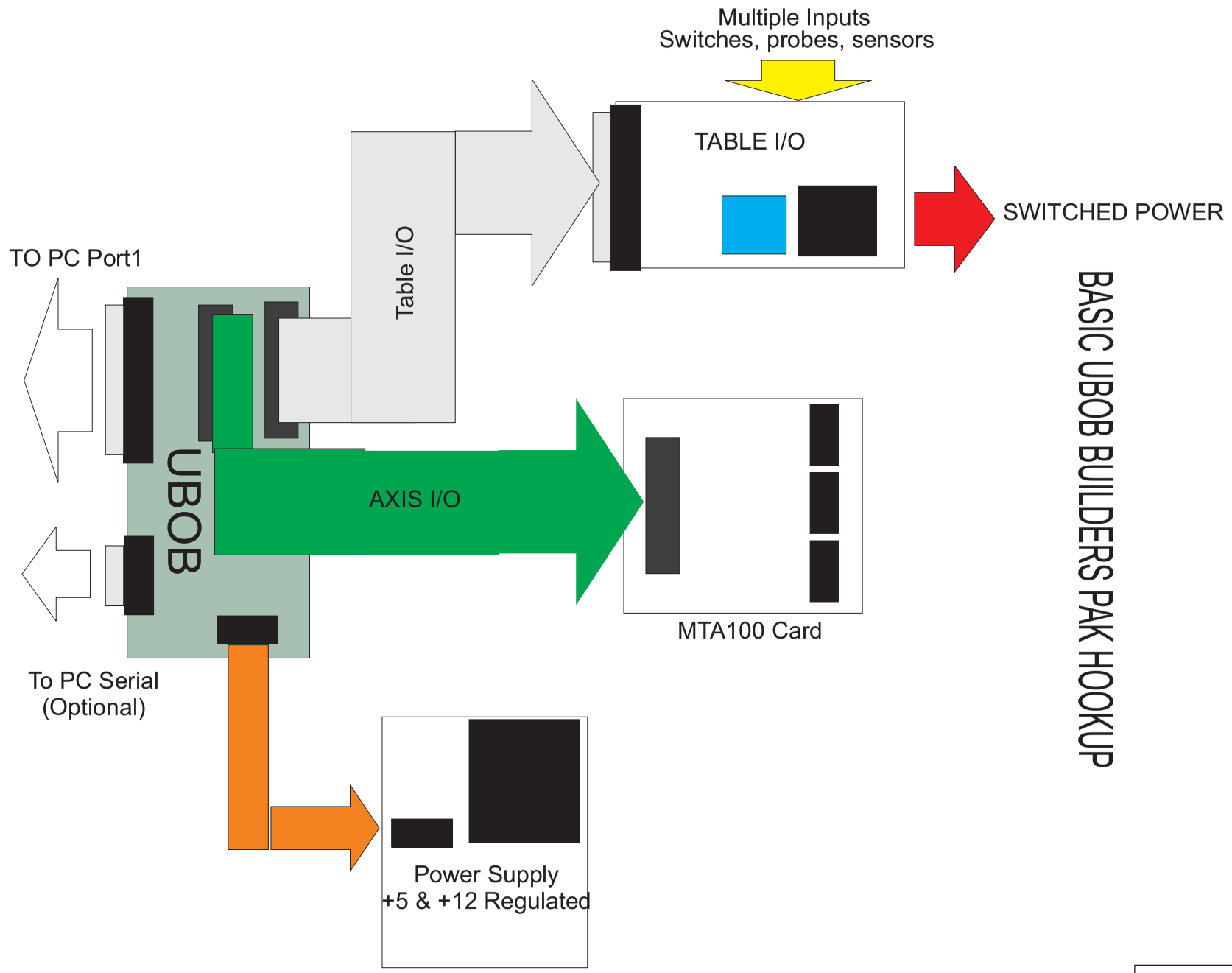
IMPORTANT!!

The UBOB requires the version of MACH shipped on the CD (or later versions we can certify) AND our MACH specific plug-in (UBOB.dll). IT WILL NOT WORK WITH OLDER MACH VERSIONS THAN 3.041 and the PLUG-IN MUST be installed and configured for the outputs to work correctly. Please take a few minutes to go down the QUIK START List to make sure you have the basics in place.

QUIK START LIST.

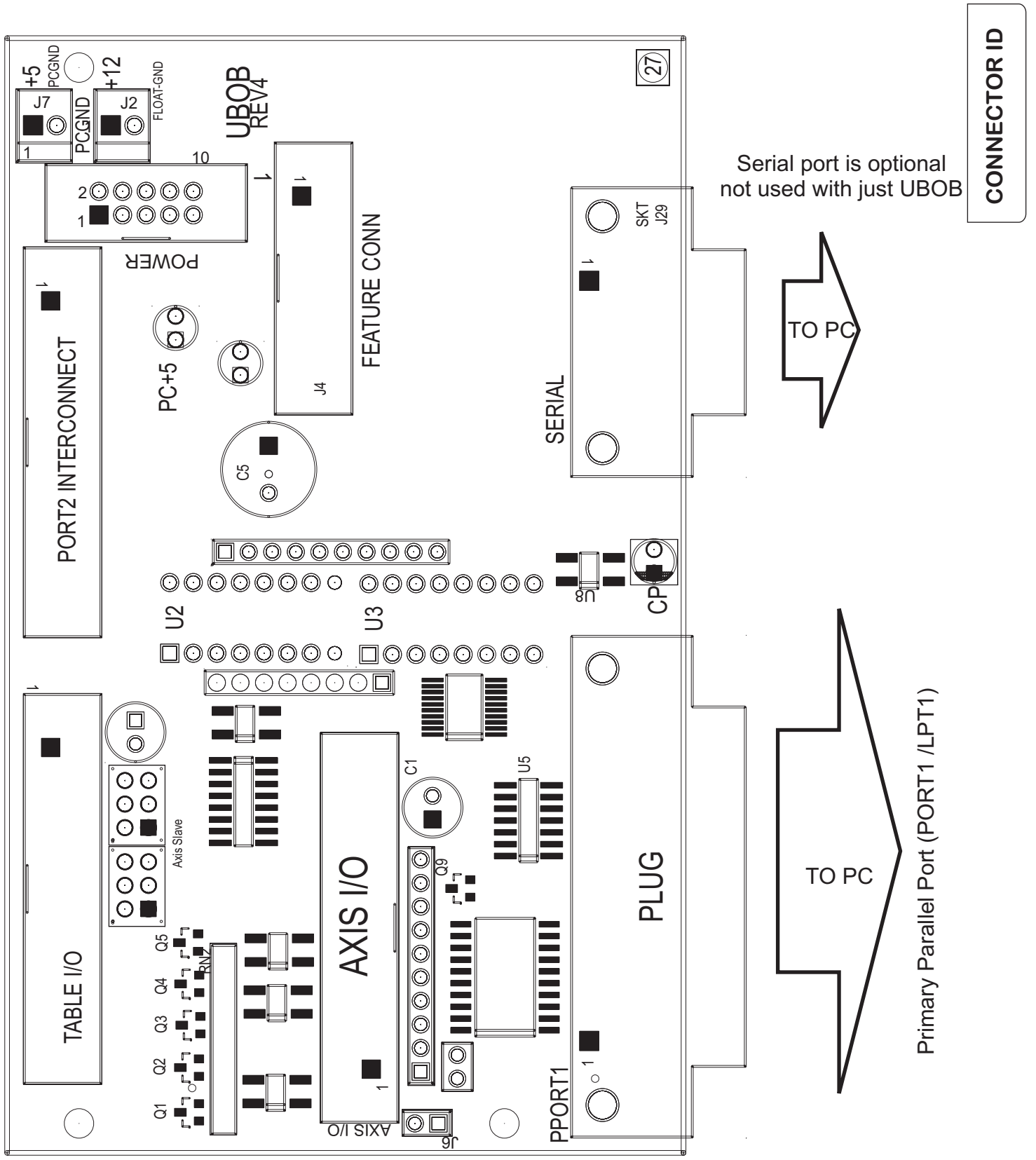
Do the following setup with a motor(s) disconnected from your table (or drive belt removed) to confirm proper setup and motor rotation/direction

- MACH version from CD (or download) installed/updated. Version 3.042.020 required (See Addendum section for software step-by-step)
- If you have a version of MACH running with another Breakout make a copy of the (entire) MACH folder as a backup. You can open it and retrieve the motor tuning and other custom settings to save time.
- **INSTALL** from CD or Download Run INSTALL and files show up in MACH
- Use the MP3000-Install. That will setup the UBOB and all the cards.
- Open **Config Plugins** from MACH3 menu and verify CCC_UBOB plug-in is ENABLED (Green Check)
- For Builders Pak and modular products see the section on hooking up power. The UBOB needs a source of +5 and (separate) source of +12 both at 500ma. The Quad Power Module (Only one side populated for UBOB applications) uses a single ribbon cable interface to power the UBOB and Table I/O cards.
- Power up UBOB and connect to computer (PC) parallel port one (Port1)
- Serial port interface is **not** required for basic operation. On UBOB ONLY installs there is no serial communications. The UBOB serial is a pass-through for other CandCNC devices/expansion cards.
- Connect the Table I/O card and **make sure the EPO jumper on the card is in place. (**also sse the MTA card and notes about the EPO jumper there**)**
- Get the UBOB installed WITHOUT Homes or Limits to begin with.
- The proper Ports and Pins configuration for the UBOB is in the MP3000 profile(XML). When you select that profile in the MACH loader you should only have to make changes in the **Motor Tuning** and **Motor Outputs** (Dir change). The only other changes might be in **Homing/Limits** as to the homing direction.
- Make sure in MACH running the MP3000 Profile you can come out of RESET
- Turn all the power off and connect up the Axis I/O cable to the MTA100 Card. That card is designed to be a multi-purpose breakout for direct (screw terminal) connections to motor drives that use Step & Direction and a Common connection, or by using ribbon cables, connects directly to our EZPLug Stepper or EZPlug Servo interface cards. Sections of this manual cover the interconnects.
- The circuitry in the UBOB requires that the Charge Pump signal from MACH be OFF in RESET The default setup profile has that set right...do not change it.
- Once you have the motor drives connected and DC power to them (supplied by a separate DC motor power supply). the motors should “lock up” when DC power is supplied. Start with just one motor (X). Confirm lockup and then with the UBOB powered up and the DC power to the motor drives jog the X axis from the keyboard using the left and right arrow keys.
- Confirm the other axis jogs by moving the X motor **Make sure you turn off DC to the drives BEFORE you plug or unplug a motor!**
- The Inputs for Homes, limits, probes, etc are via the Table IO card and into the Table I/O connector to the UBOB. There are also two relays on the Table I/O card that are controlled by Output1 and Output2 in MACH. By default those outputs are setup to be triggered by Spindle on/off (M03/M05 G-code commands) and by M06 and M08 for the output2. There are also buttons on the Program Run Screen we supply.



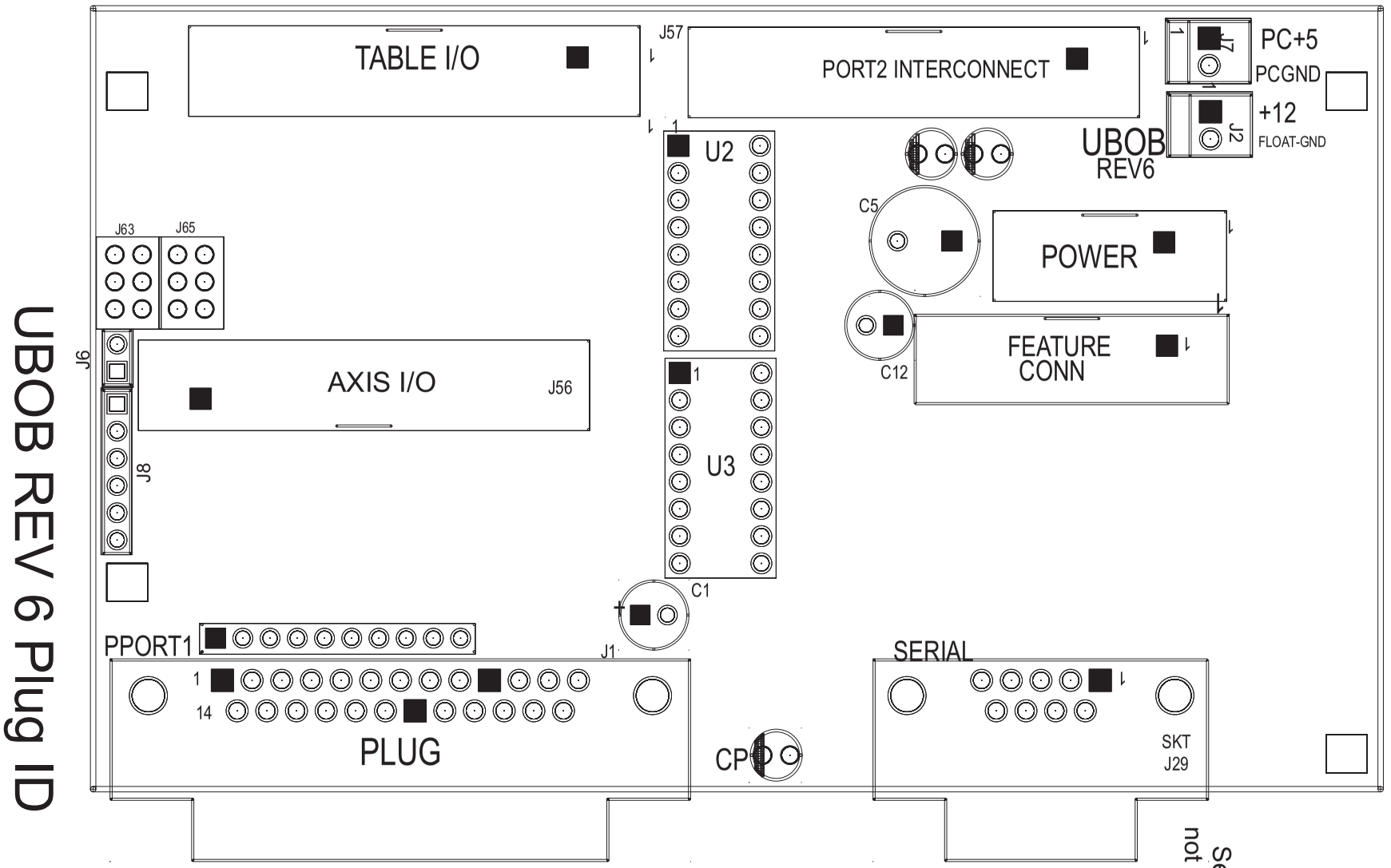
BASIC UBOB BUILDERS PAK HOOKUP

BLOCK DIAGRAMS


CONNECTOR ID
Serial port is optional
not used with just UBOB
TO PC
TO PC
Primary Parallel Port (PORT1 /LPT1)
+5
PCGND
+12
FLOAT-GND
J7
J2
PCGND
UBOB
REV4
27
POWER
FEATURE CONN
J4
PC+5
C5
SERIAL
SKT
J29
PORT2 INTERCONNECT
U2
U3
U8
CP
TABLE I/O
Axis Slave
AXIS I/O
C1
U5
Q9
PLUG
PPORT1
Q1
Q2
Q3
Q4
Q5
RN7
J6

UBOB Plug ID

UBOB REV 6 Plug ID

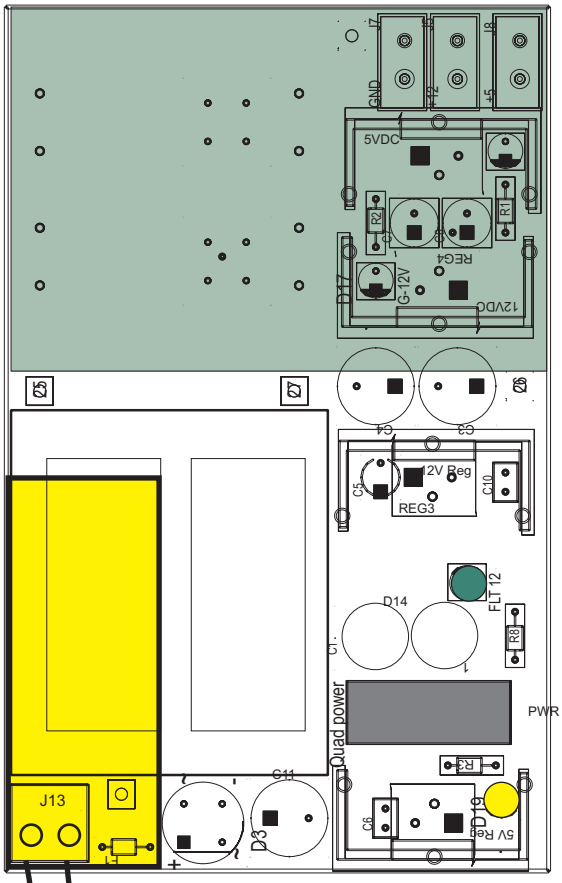


CONNECTOR ID

Second Power supply for use with BladeRunner and EZPLUG G250 installs. Not populated on UBOB only units

All other areas are low voltage

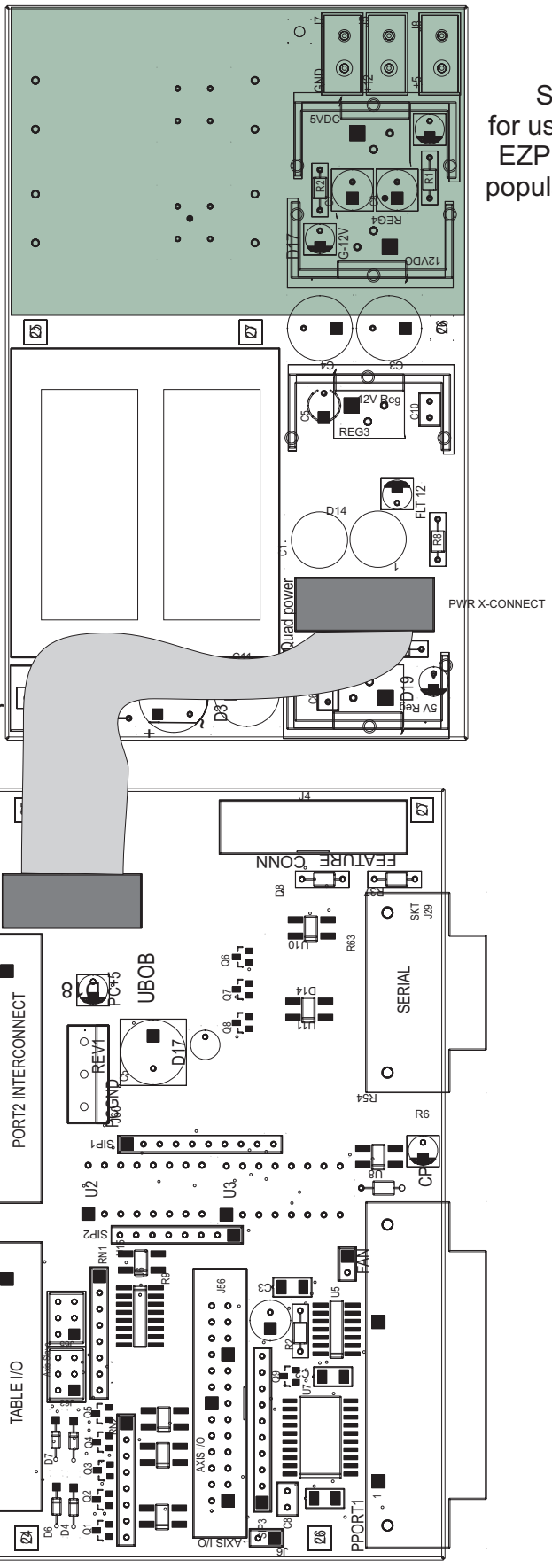
DANGER AREA on TOP AND BOTTOM OF CARD IN YELLOW AREA HIGH VOLTAGE!



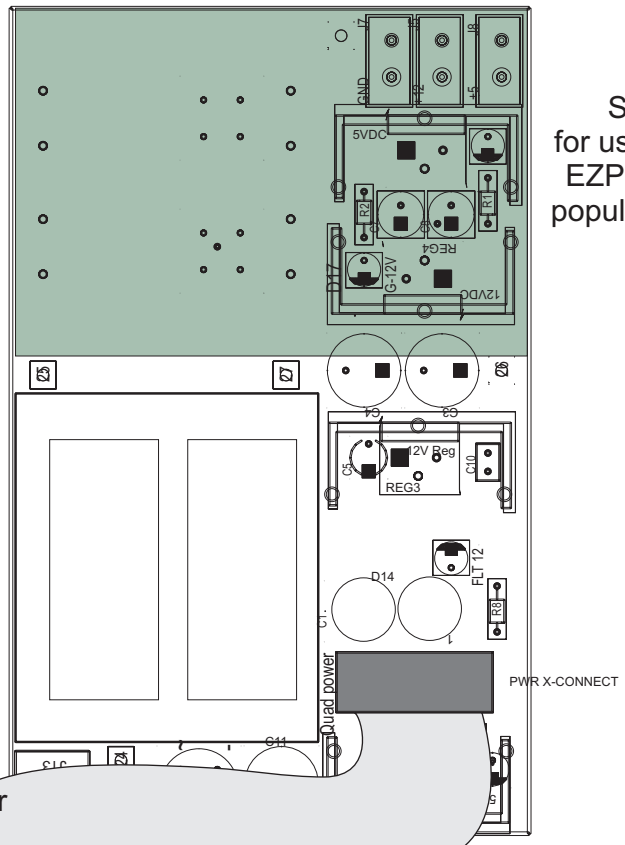
AC INPUT 105 - 125VAC 60HZ

The Quad output Power Module is designed to furnish a source of 5V regulated and a separate (floating) source of 12V regulated. It cross connects to the UBOB via a single 10 pin ribbon cable. A source of 120VAC AC is needed. **The hookup if the AC into the Power Module is the responsibility of the user/builder. AC volts over about 65 VAC is dangerous and can case seroius injury or death. NEVER MAKE A CONNECTION WITH THE AC CORD PLUGGED IN. If you cannot safely hook two wires up to wall current DO NOT ATTEMPT THE PROCESS, SEEK PROFESSIONAL HELP. There is an area on the card that is at high voltage. DO NOT PICKUP OR MOVE THE CARD with the AC PLUGGED IN!**

Powering UBOB from Quad Power Module

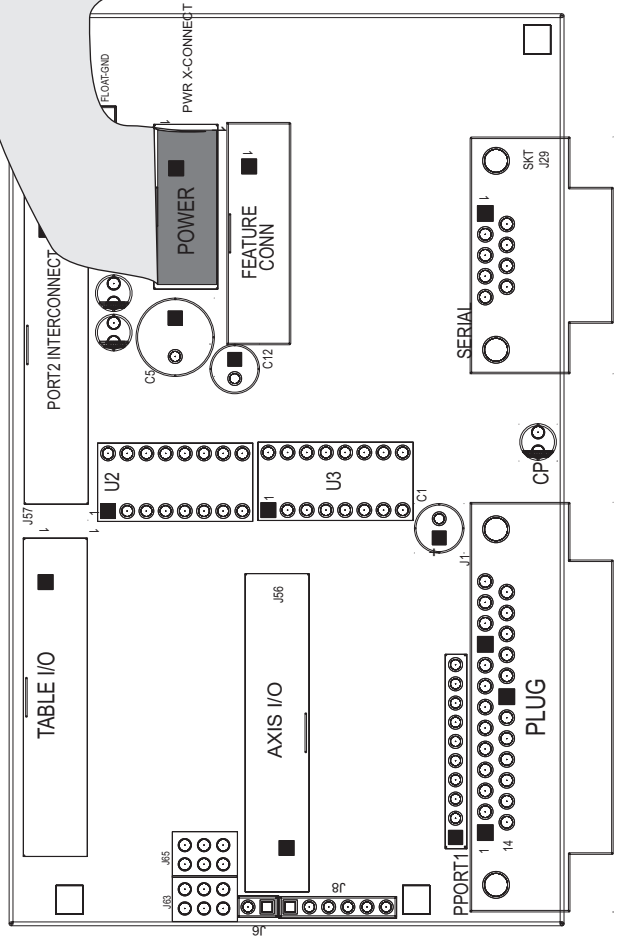


Powering UBOB from Quad Power Module

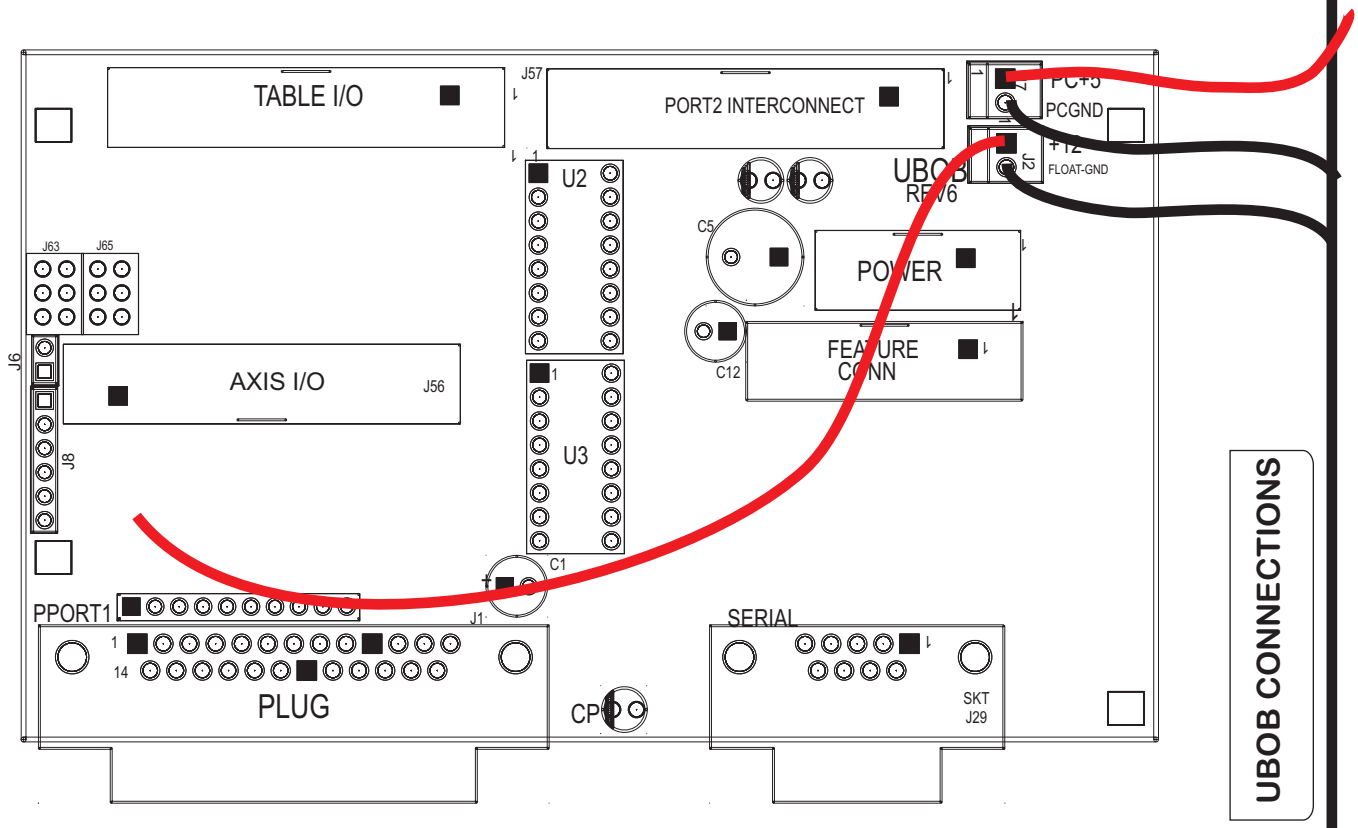


Second Power supply
for use with BladeRunner and
EZPLUG G250 installs. Not
populated on UBOB only units

10 PIN IDC cable for power
interconnect



POWER CROSS CONNECT TO REV 6 CARD



POWERING THE UBOB FROM OTHER SOURCES THAN THE QUAD POWER MODULE

If you do not have the Dual or Quad Power Module you can power the UBOB from several sources. The +5 is referenced (shares the same ground return) with the PC +5. The parallel port on a PC DOES NOT HAVE a source of +5 other than leak pull-ups on logic lines. The USB part has a +5 line and the internal power supply of most PC's has a +5 output. You can get tap plugs that allow access to the internal +5 on a PC. The wires used to power hard drives and CD drives has +5 (Red Blk pair). Make sure the voltage is +5 regulated and NOT +12.

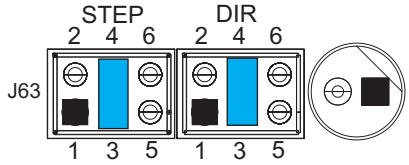
You can supply the +5 from any regulated +5 power that can handle a minimum of 250ma. Examples are wallplug transformers, Desktop power supplies (for some laptops, etc) and open board power supplies from hobby sources. The ..1 solderless (crimp on) terminals are marked with PC+5 and PCGND for the 5 volt input.

The +12 input HAS to be a separate power supply rated at 500ma or higher with a separate ground return (not connected to the +5 ground return) Most dual output power supplies share the same ground connection so will not work for the required voltages. The +12 drives the inputs of the Opto's (from the Table I/O card) and also drives the relays.
IF YOU DO NOT USE SEPARATE POWER SOURCES WITH THE 12V RETURN COMMON WITH THE +5 (PC GROUND) YOU LOOSE ALL THE ADVANTAGES OF THE INPUT ISOLATION AND THE OPTO's
Do not use the +12 in the PC as it is connected to PCGND.

Hardware Slaving Options.

If you do not have or use a 5th motor and driver then the Hardware Slaving option does not matter

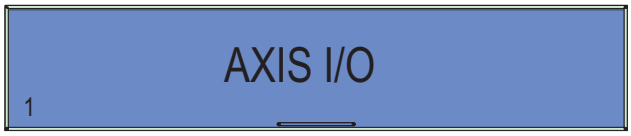
Hardware Slave shown in “X” Position

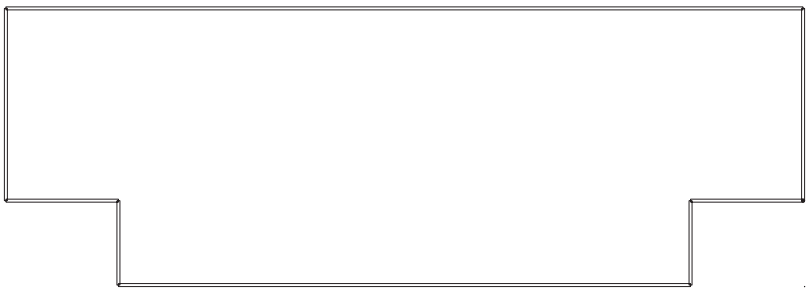


Axis Slave

Both OPTION BLOCKS MUST be jumpered the same.

1-2 External drive FROM PORT2 card
3-4 Slave 5th Axis to X
5-6 Slave 5th Axis to Y

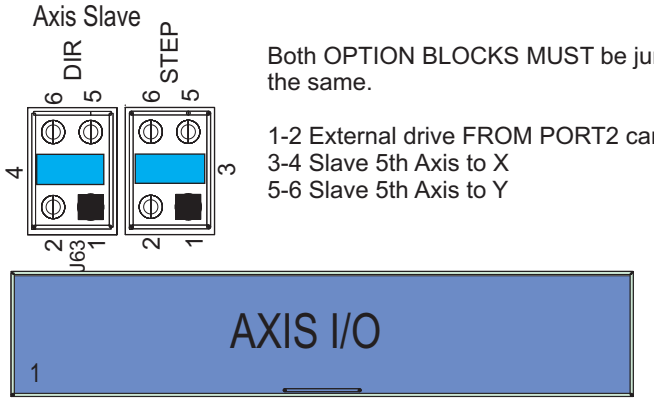




Hardware Slaving Options. (REV6)

If you do not have or use a 5th motor and driver then the Hardware Slaving option does not matter

Hardware Slave shown in “X” Position



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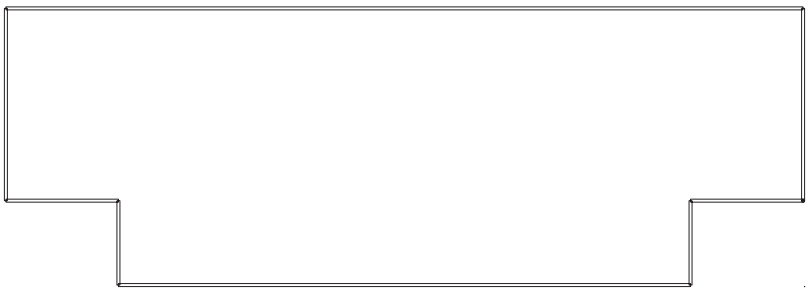


J6 E-stop pass through JUMPER

Remove J6 Jumper if you connect to a G250-5 Card or use the UBOB with any of the Enhanced System Power conrollers (CandCNC product)

REV 6 Card

REV 4 CARD

J6 Must be jumped if the UBOB is used without a G250-5 Ezplug Drive Module (BladeRunner) or an ESP series Power Controller

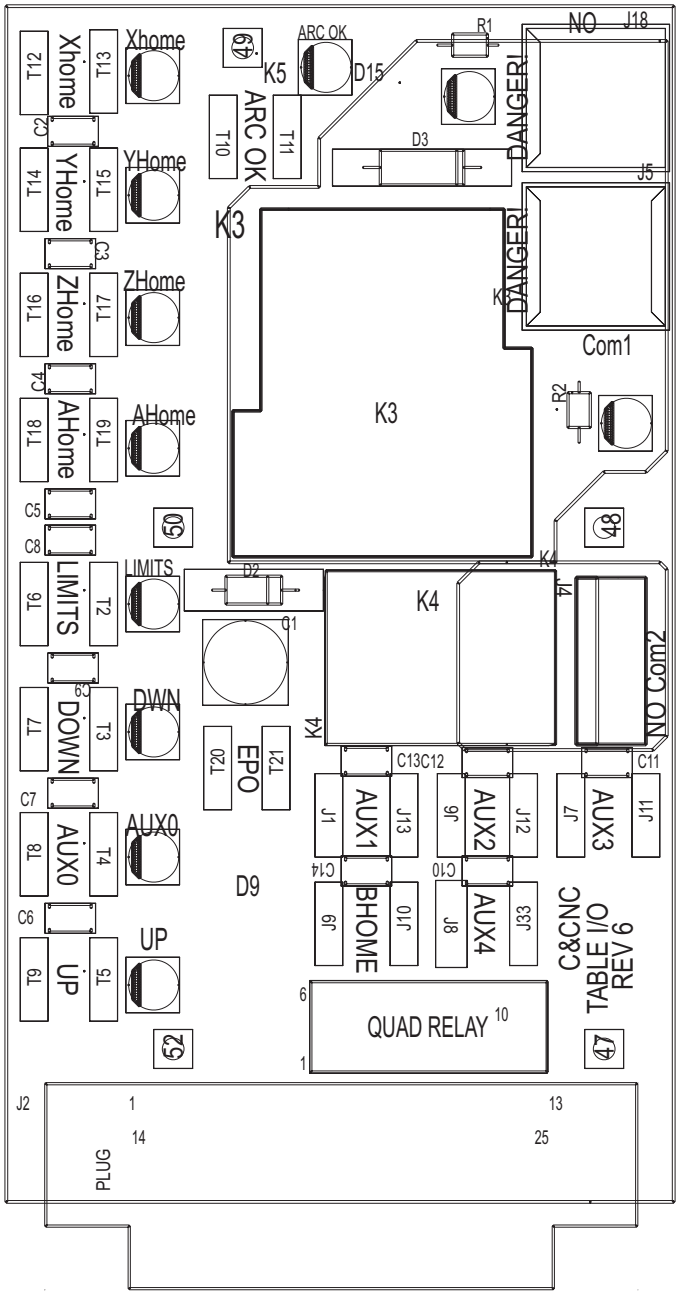
TABLE I/O II CARD

The TableI/O card provides a breakout of inputs and outputs. It connects to the UBOB via a 25 pin computer cable into the TABLE I/O plug (see overlay next page). The card can be close to or up to 15ft from the UBOB card. You have the option to mount the card close to the UBOB and pull the Homes and other inputs into the card or you can mount the card out on the Table and connect allof the inputs with short runs. Having the Power relays out on the table for larger machines can be an advantage.

HOME INPUTS
Use Normally Open Switches.
X - A Home are port 1 inputs
Limits are typically setup as normally closed and connected in series at the switches with beginning and end of string into the LIMITS Tabs.

The DOWN, AUX0, UP and ARC OK inputs are also Port 1 inputs and can be used for any switch type input.

The EPO is the E-stop (software) input. IT HAS TO BE CLOSED. A JUMPER IS NEEDED IF IT"S NOT USED WITH A NC E-stop Button (not



K3
Main Relay Output
20A Normally open contacts

See hook up details for driving external loads

K4

Secondary Relay 10A

Normally open contacts.

See hook up details for driving external loads.

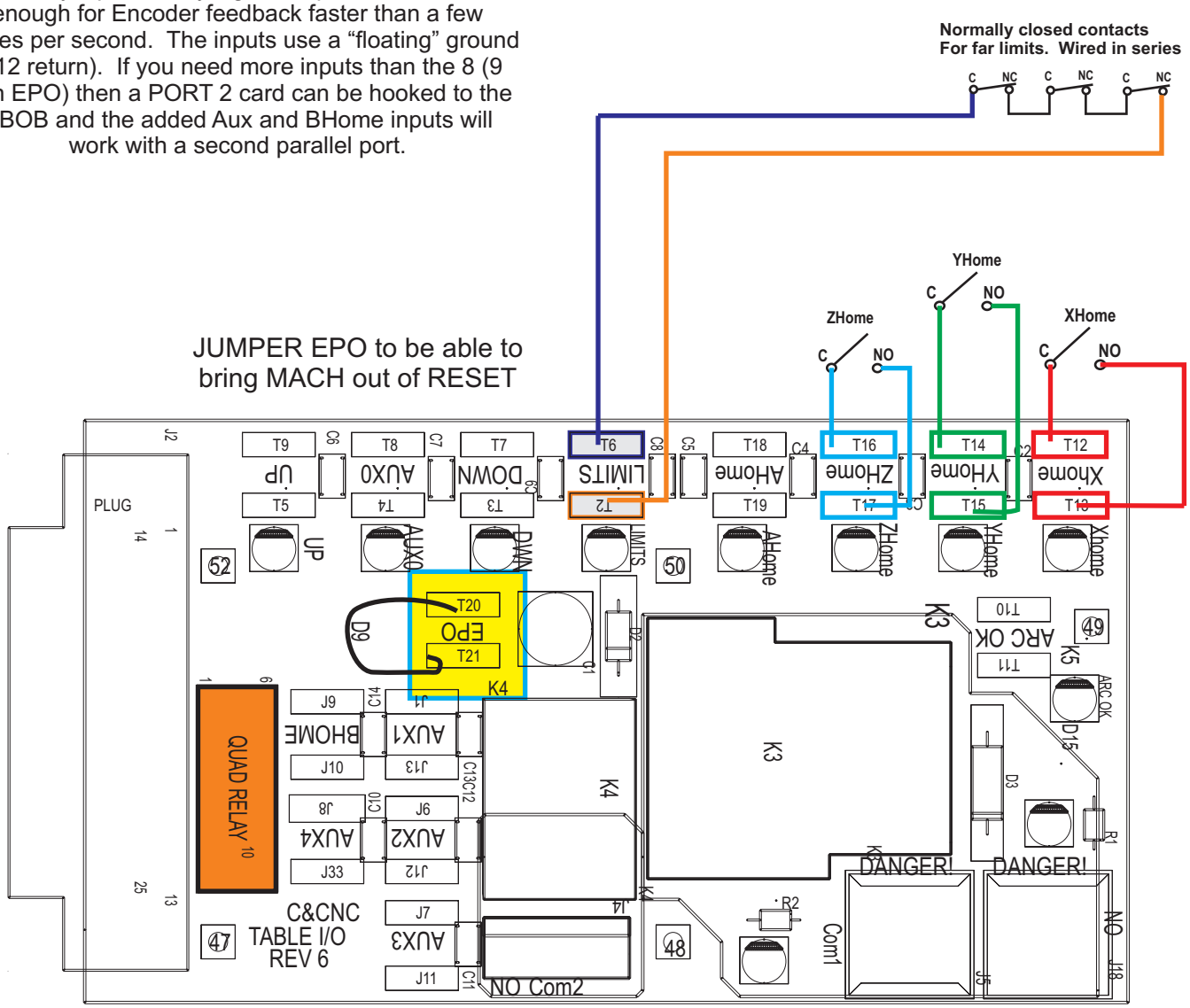
AUX 1 - AUX4 and B Home are PORT2 inputs and only work if you have the optional Port 2 card installed and a 2nd parallel port on thePC active and

LED's are indicators that the circuit is working when a switch is closed. They only come on if the Table I/O is connected to the UBOB and the UBOB is powered up. You can short across an input Pair (example: T12 to T13 for X Home. The LED should light and the X Home Screen LED in MACH for X Home should light. The LED is in series with the Input Opto and is a good indication

Home and limit switch hook ups

Typical connections for Homes and Limits

All of the inputs are opto isolated and map to a specific pin on the parallel port(s). In reality you can use any input for any signal. Inputs are not fast enough for Encoder feedback faster than a few pulses per second. The inputs use a “floating” ground (+12 return). If you need more inputs than the 8 (9 with EPO) then a PORT 2 card can be hooked to the UBOB and the added Aux and BHome inputs will work with a second parallel port.



QUAD RELAY HEADER
is for an optional quad relay card
and adds 4 more relays to the outputs.

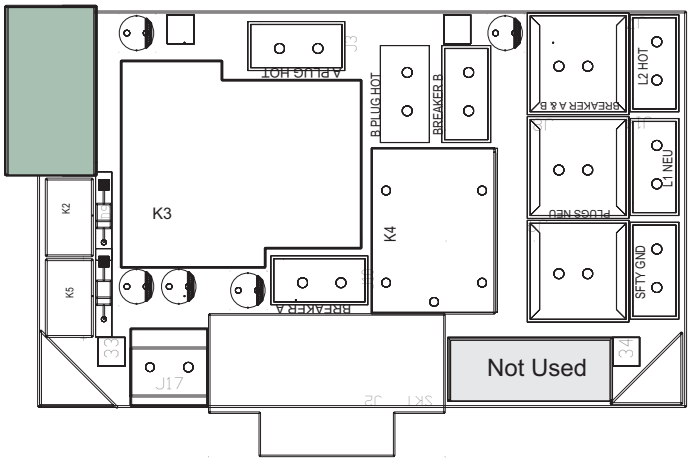
UBOB CONNECTIONS

^6 RELAY SETUP USING OPTIONAL QUAD RELAY EXPANSION CARD
or QUAD RELAY BOX

See Quad Realy Manual for Connection details

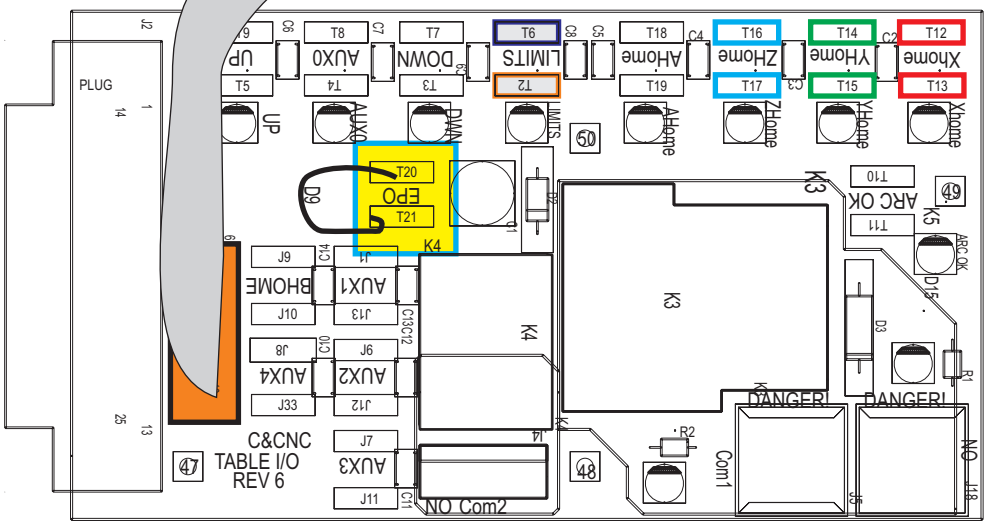
Outputs for 2 low
Current Relays

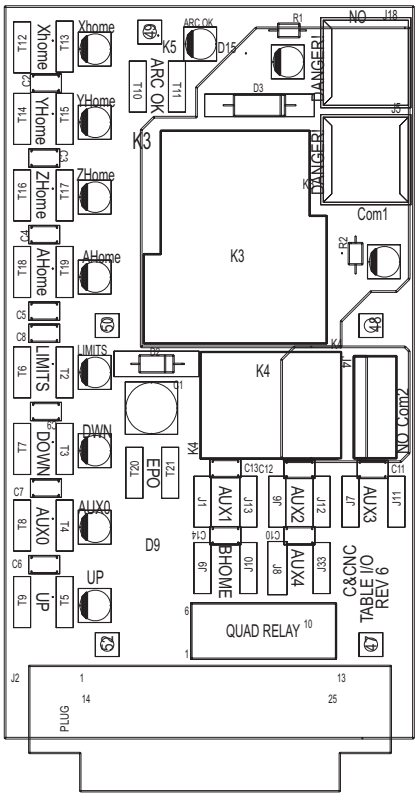
QUAD RELAY EXPANSION CARD



Db9 Fem to DB9 Male EXTENSION CABLE
up to 25ft can be used

IDC 10 to DB9 Male
Adapter



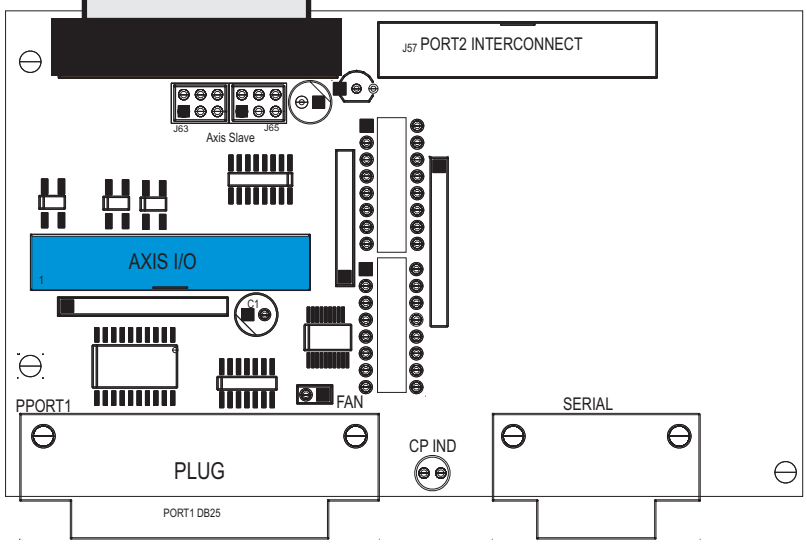


Connection of TABLE IO Card to UBOB.

Card will plug directly into DB25 adapter or can be used with a 15 ft or shorter DB25 extension cable.

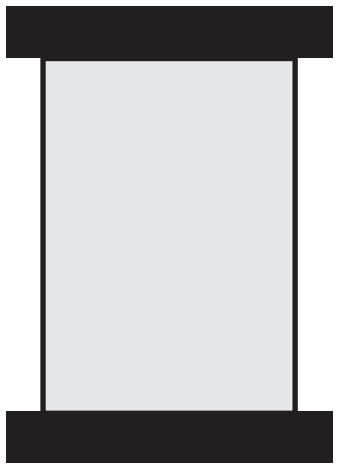
DB25M to DB25F Extension Cable of appropriate length

IDC to DB25 Female cable adapter (Furnished)

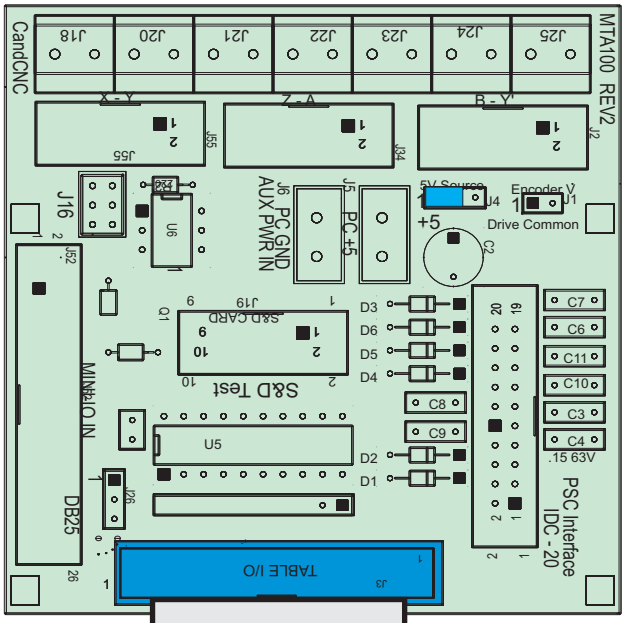


Interconnect of MTA100 Card and UBOB

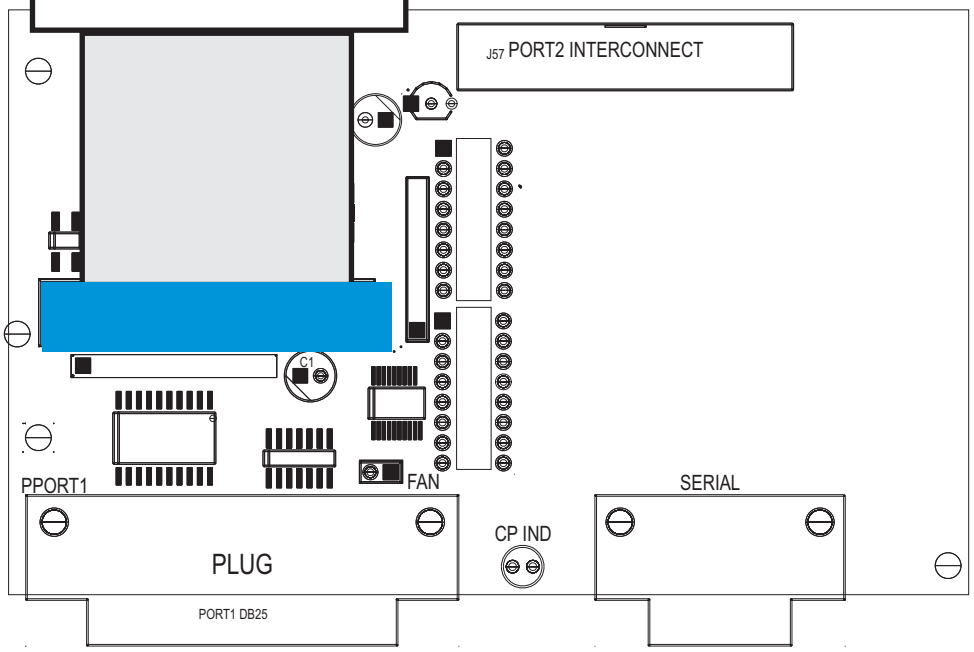
MTA100 Card not used in BladeRunner



IDC to IDC short interconnect cable for close mounting



DB25 Male to DB25 Male
Extension cable
Up to 5 meters



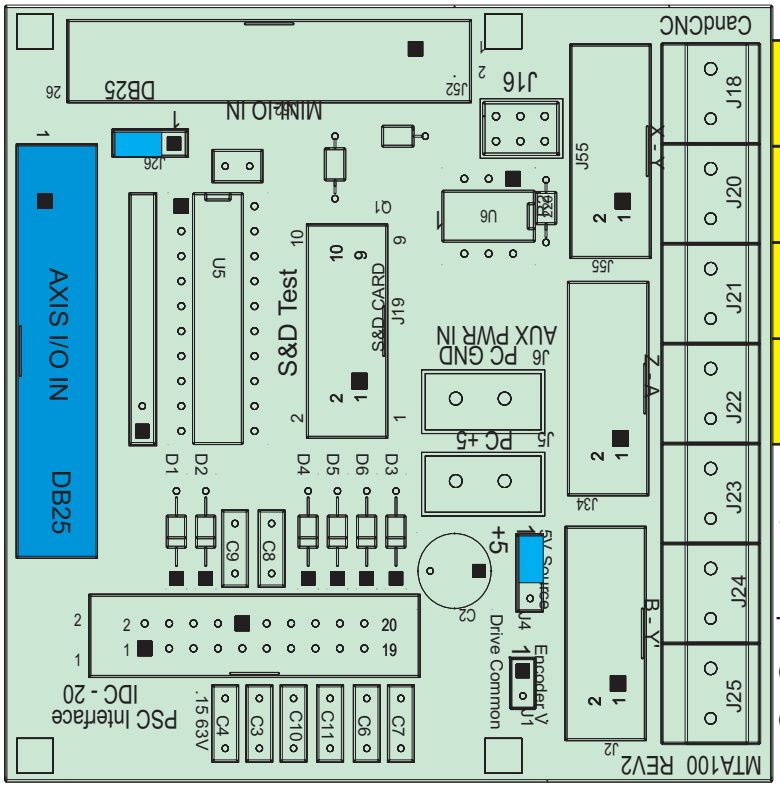
UBOB CONNECTIONS

MTA100 Card not used
in BladeRunner

REV2 INTERFACE CARD

JUMPER SETTINGS FOR MTA100 REV2 CARD. DEFAULT SETTINGS ARE SHOWN
Most installs will use these settings

For Interface to UBOB set J26 (upper left) to pins 2-3. pin 2 is the center pin, and pin 3



X	Dir
	STEP
Y	Dir
	STEP
Z	Dir
	STEP
A	Dir
	STEP

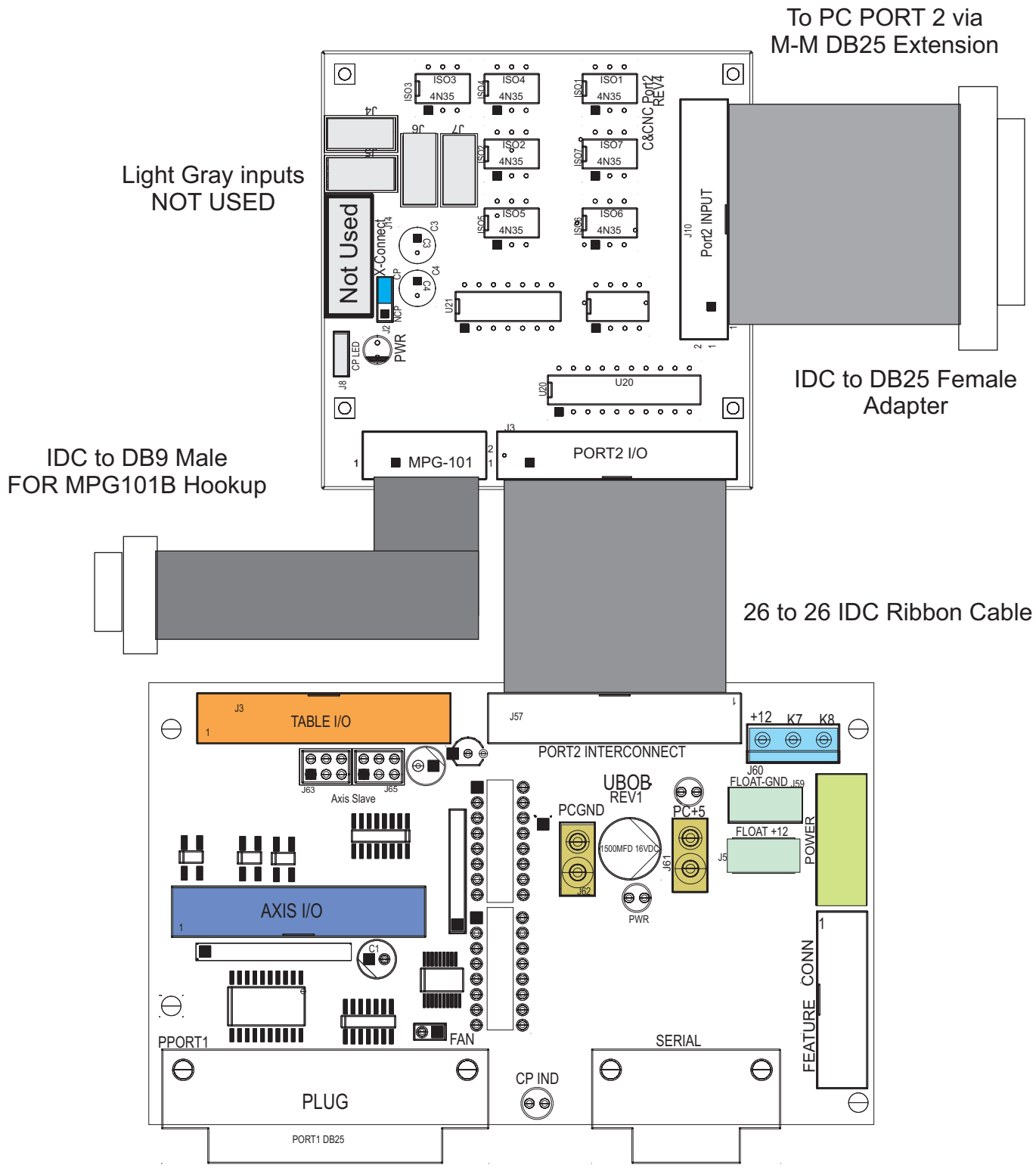
+5
For +5 Common Drives
+5
+5
For +5 Common Drives
+5

GND
GND
For GND Common Drives
(Gecko 203)

Screw Terminals for Hard wiring Drives (non-EZPLUG)

J4: Sets the source of 5V for Servo Card Encoder. CAUTION DO NOT CHANGE THIS UNLESS YOU ARE TOLD to DO SO. This option is for systems running encoders that draw more than 50ma. Ours do not.

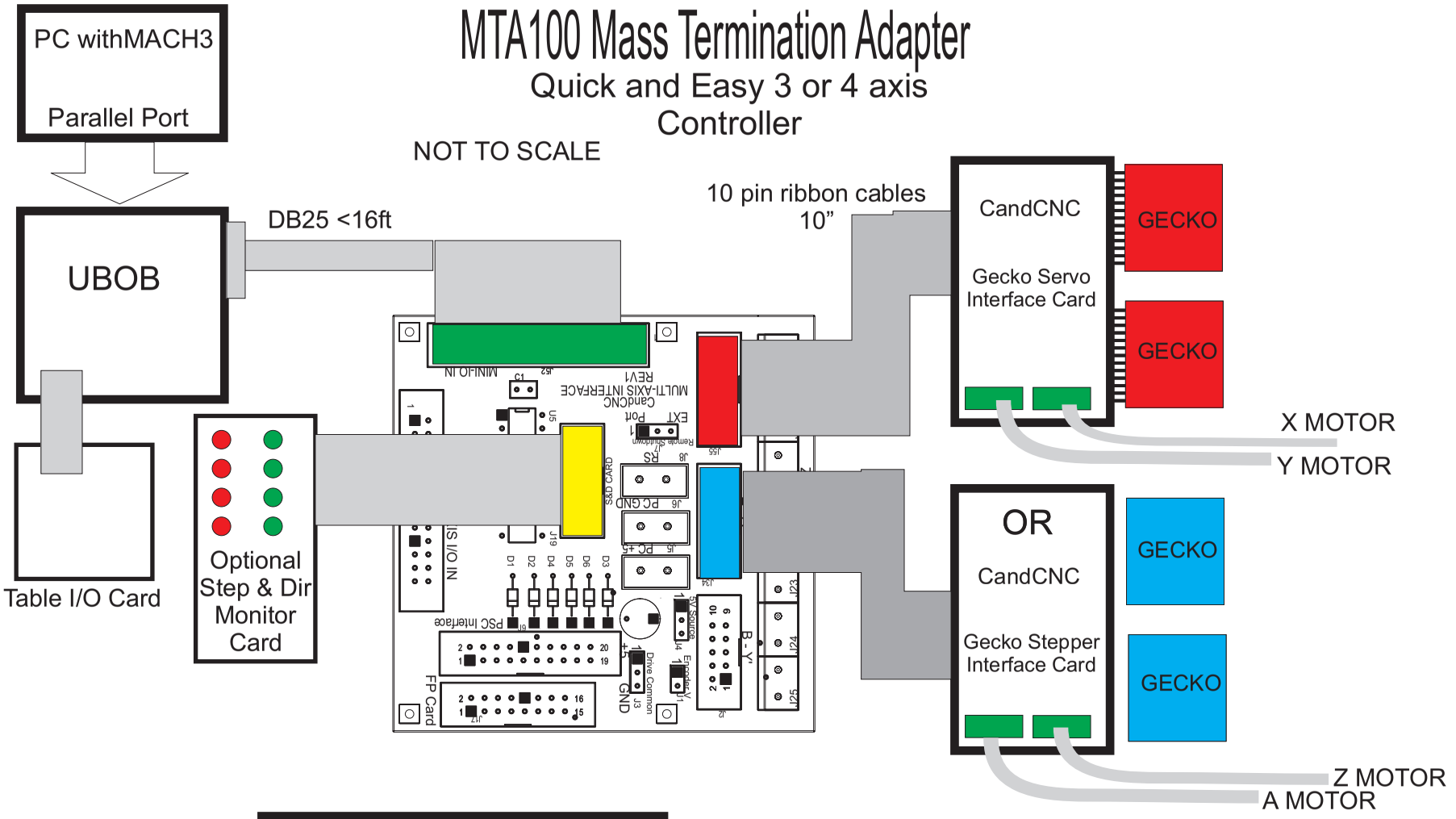
ADDING AN OPTIONAL PORT2 CARD FOR I/O EXPANSION



MTA100 Mass Termination Adapter

Quick and Easy 3 or 4 axis Controller

NOT TO SCALE



All connections to motors have plug connectors Furnished with Cards

CandCNC Carries a complete line of card level and box level Solutions for CNC builders. All our products are design to work together

BLOCK DIAGRAMS

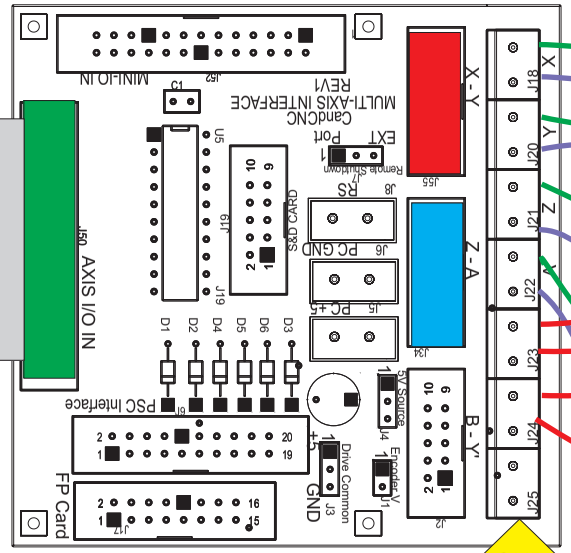
MTA100 Mass Termination Adapter

LOW Cost Interface with discreet wiring

MOTOR POWER AND ENCODER (Servo models) CONNECTIONS
NOT SHOWN

UBOB
(not to scale)

DB25 <16ft



GECKO — X MOTOR
GECKO — Y MOTOR
GECKO — Z MOTOR
GECKO — A MOTOR

D
S
COM

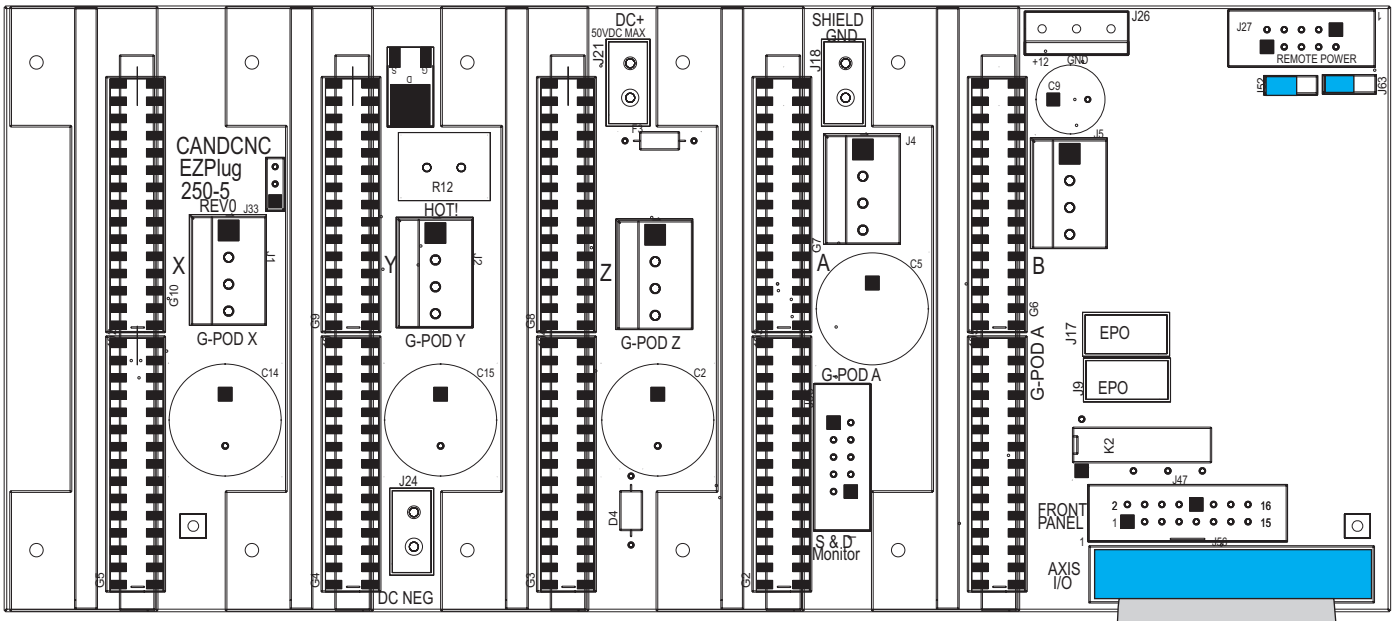
GND Common for Gecko 203 Common

DC Volts to Geckos

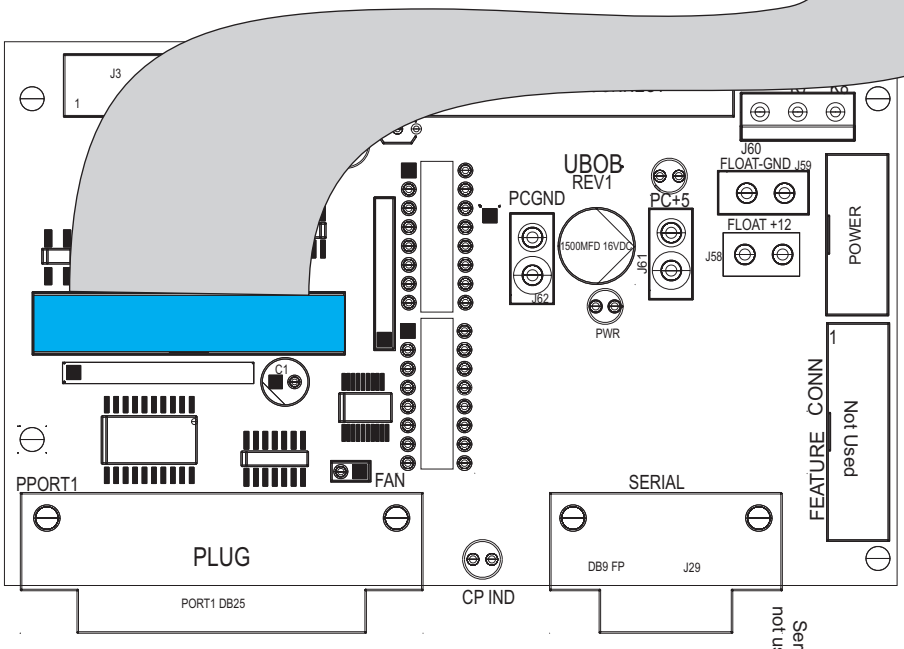
See Page 5 for screw terminal signal names

BLOCK DIAGRAMS

UBOB CONNECTION TO G250-5 EZPlug Motor Driver Interface



UBIB Uses AXIS IO Connection for interface to G250-5



TO PC

Primary Parallel Port (PORT1 /LPT1)

TO PC

Serial port is optional not used with just UBOB

BLOCK DIAGRAMS

ADDENDUM SECTION

Following Pages includes information that aids in setup and testing

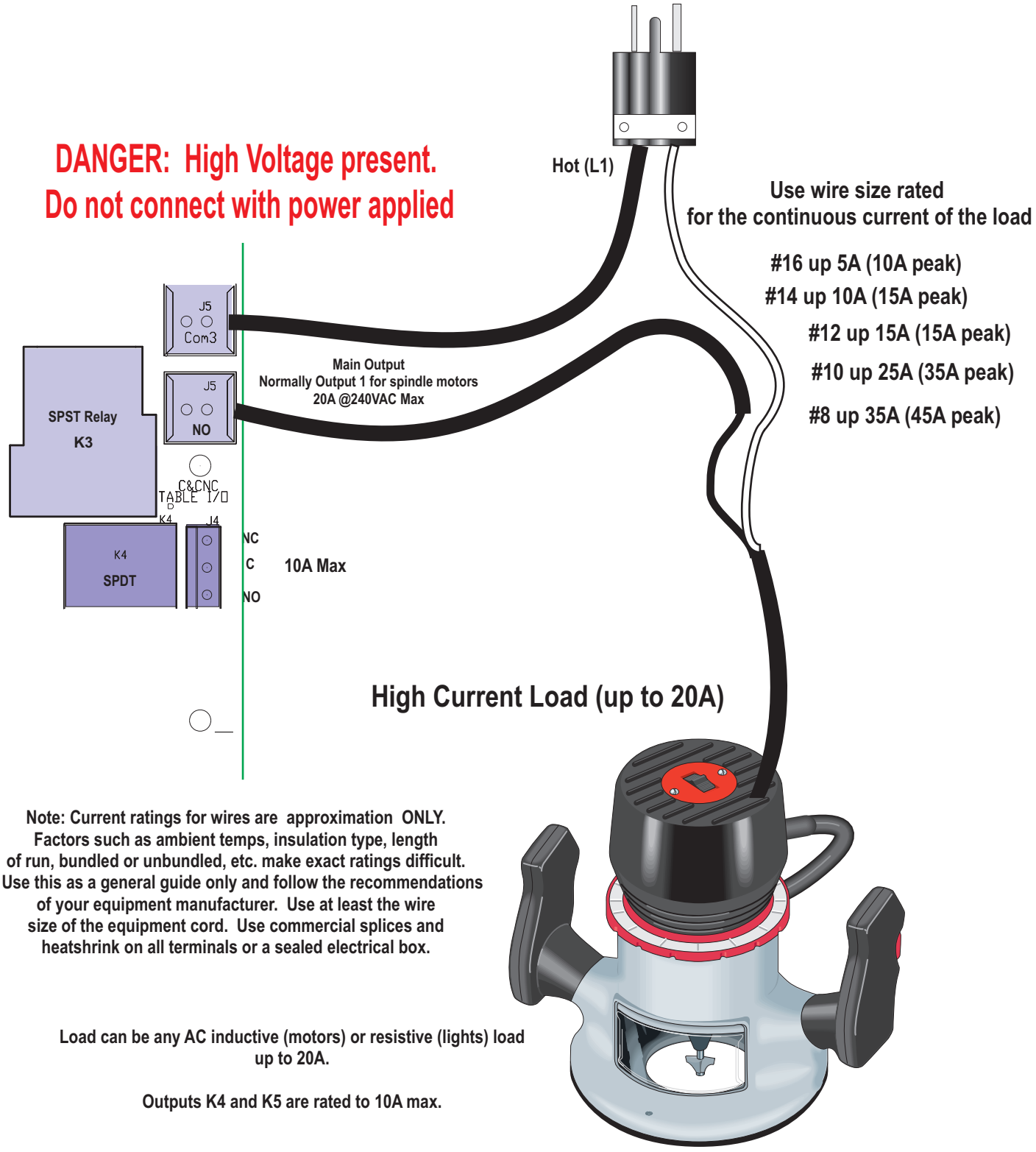
- Hooking up AC loads to the Table I/O card
- Pinout Chart
- SOFTWARE INSTALL.
  - MACH3 Load
  - BladeRunner Install (includes UBOB Drivers)

USING OUTPUT RELAYS

TABLE IO CARD II

Connect Safety ground (GreenWire) on equipment that has three conductors

DANGER: High Voltage present.
Do not connect with power applied



Note: Current ratings for wires are approximation ONLY. Factors such as ambient temps, insulation type, length of run, bundled or unbundled, etc. make exact ratings difficult. Use this as a general guide only and follow the recommendations of your equipment manufacturer. Use at least the wire size of the equipment cord. Use commercial splices and heatshrink on all terminals or a sealed electrical box.

Load can be any AC inductive (motors) or resistive (lights) load up to 20A.

Outputs K4 and K5 are rated to 10A max.

PORT1 I/O Pins						
PPORT #	**PPORT PIN**	**FUNCTION**	**POLARITY**	**TYPE**	**OUTPUT TO**	
1	1	Shift	Active High	Control	MUX	
1	2	STEP X	Active High	Out	AXIS IO Pin 2	
1	3	DIR X	Active High	Out	AXIS IO Pin 3	
1	4	STEP Y	Active High	Out	AXIS IO Pin 4	
1	5	DIR Y	Active High	Out	AXIS IO Pin 5	
1	6	STEP Z	Active High	Out	AXIS IO Pin 6	
1	7	DIR Z	Active High	Out	AXIS IO Pin 7	
1	8	STEP A	Active High	Out	AXIS IO Pin 8	
1	9	DIR A	Active High	Out	AXIS IO 9	
1	10	ESTOP	Active Low	Input	AXIS IO Conn	
1	11	X Home	Active Low	Input	TABLE-IO PIN 14	
1	12	Y Home	Active Low	Input	TABLE-IO PIN 15	
1	13	Z Home	Active Low	Input	TABLE-IO PIN 16	
1	14	Output 18	Active High	Control	MUX	
1	15	A Home	Active Low	Input	TABLE-IO PIN 17	
1	16	Output 19	Active High	Control	MUX	
1	17	Charge Pump	Active Low	Safety	N/A	
1	18-25	PCGND			Axis IO Pin 10	
Virtual Pins are used to provide mapping to shared inputs and muxed outputs. They are setup in MACH using Non-Hardware Port numbers.						
Virtual Outputs (MACH)						
4	1	Output 5	Active High	K1	TABLE IO PIN 13	
4	2	Output 3	Active High	K2	TABLE IO PIN 12	
4	3	Output 1	Active High	K3	TABLE IO PIN 11	
4	4	Output 2	Active High	K4	TABLE IO PIN 10	
4	5	Output 8	Active High		THC ON /SS ON	
4	6	Output 7	Active High		SS REV	
4	7	Output 6	Active High	K6	TABLE IO PIN 25	
4	8	Output 4	Active High	K5	TABLE IO PIN 9	
Virtual Port Pins (MACH)						
8	11	Limits	Active Low	Input	TABLE IO PIN 1	
8	12	Arc OK	Active Low	Input	TABLE IO PIN 2	
8	13	THC Up	Active Low	Input	TABLE IO PIN 21	
8	15	THC Dwn	Active Low	Input	TABLE IO PIN 24	
		Floating GND			TABLE IO PIN 5&6	
		Floating +12			TABLE IO PIN 18&19	
		EPO		Input	TABLE IO PIN 20	
		AUX1		Input	TABLE IO PIN 3	
		AUX2		Input	TABLE IO PIN 4	
		AUX 3		Input	TABLE IO PIN 7	
		AUX 4		Input	TABLE IO PIN 8	

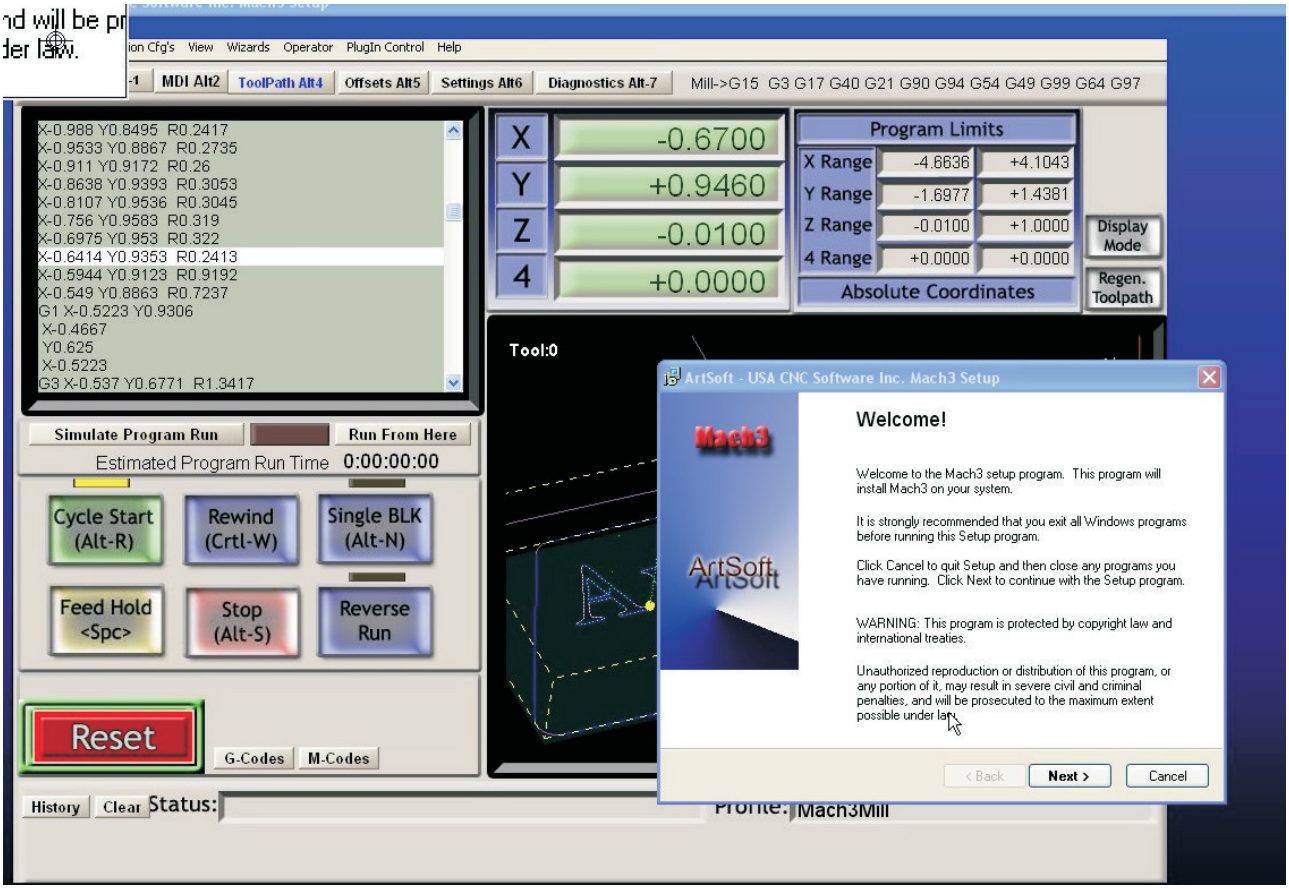
Software Install Instructions

If you are installing from the Support CD you can find the MACH3 ver 3.041 in the BladeRunner\MACH-PROG folder as *Mach3VersionR3.041.exe*. If you are installing from a web download you will first have to UNZIP the files you downloaded and place them in a Folder on your PC. Name the folder something that you can easily identify later. Unzip the files all into that folder (MACH3 program, BladeRunner-Install.exe, etc)

While MACH will run under Windows Vista a lot of other programs you may need won't. Vista uses LOT's of resources so your PC needs to be the fastest one with 2G of RAM to have a shot at making it work. We do not currently support Vista so PLEASE don't call and ask for support for MACH from us if you are running anything but WIN2000 or XP (any level).

A NOTE ABOUT HARDWARE (PC) THAT YOU NEED TO RUN MACH:

1. Not all hardware is compatible with MACH3 regardless of how fast the PC is. It's rare that a PC rated over 1.8GHZ won't run MACH but not unheard of. Usually the problems show up as jerky motor movements, bad motion in running code and other control problems. Things like Inputs and Outputs and not getting any motor movement is NOT typically a MACH / PC issue. If in doubt about the ability of the PC run DriverTest.exe (With MACH not running) located in the MACH3 folder.
2. The minimum computer recommended is a 1 GHZ processor with 256MRam. We find that a 1.8 or 2.4 GHZ with 512M RAM tends to work better especially if the MB has on-board video. The higher you can run the core freq in MACH the more Steps per Second you can get and the smoother the pulse train of those steps. There are also Windows processes that can effect the timing in MACH. Never run realtime virus protection or other "tray" programs not need for basic Windows functions.



Start Install of MACH3 software by clicking on the ***MACH3ver3.041.exe*** file . If you already have a version of MACH on the PC, you will be prompted to upgrade the version. Let it upgrade. If you have a version ***NEWER*** than 3.041 then you will need to first **uninstall** that newer version. Make a backup of the XML and SET files in the new version first THEN remove and re-install. You will see the screen above when you start the install.

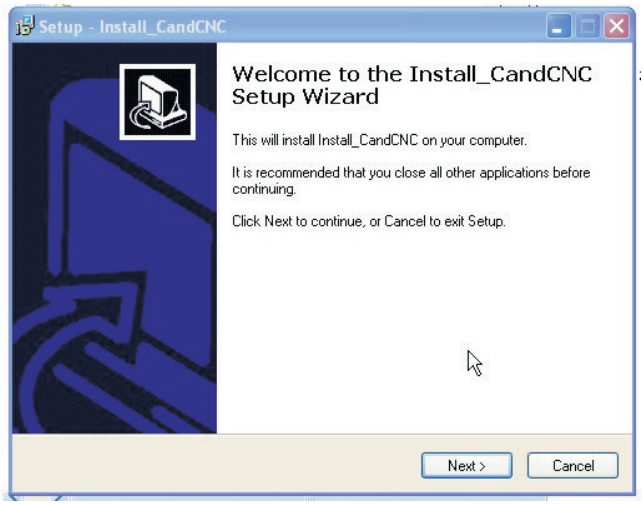
After You Install MACH you will see that it has placed 3 or 4 ICONs on your Desktop in Windows. To check the install click the Mach3Mill Icon and make sure MACH loads and you get a screen. That setup/screen WILL NOT RUN the BladeRunner and does not have the correct Plug-ins for the UBOB (used in the BladeRunner). YOU SHOULD NOT EVEN HAVE YOUR HARDWARE CONNECTED TO THE PARALLEL PORT AT THIS POINT!

The Next step in the install is to find the INSTALL.EXE either in BladeRunner Folder on the CD OR in the UNZIPPED BladeRunner-Install.zip file.

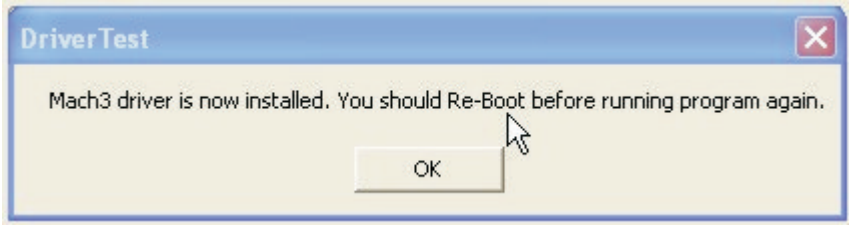
The BladeRunner Auto Install does the following:

- Installs the custom XML (Profile) and SET (Screen file) files into the MACH3 directory
- Installs the 3 custom Plug-ins used in all of CandCNC's products including the Pendant plug-in. If you are not using the serial communications or pendant you can disable the plug-ins in MACH later. It won't hurt to leave them running.
- Adds in the proper side files for the screen files (embedded VB)
- Removes the default Icons MACH installs on the Desktop (except for LOADER) and puts a BladeRunner Icon on the Desktop so you can start your BladeRunner directly from that ICON.
- Removes unneeded XML's from MACH so they don't show up in the Loader List.
- Replaces the MACH engine with a special engine configured for the UBOB

Below are a few of the dialog windows you see when running the CandCNC BladeRunner Install:



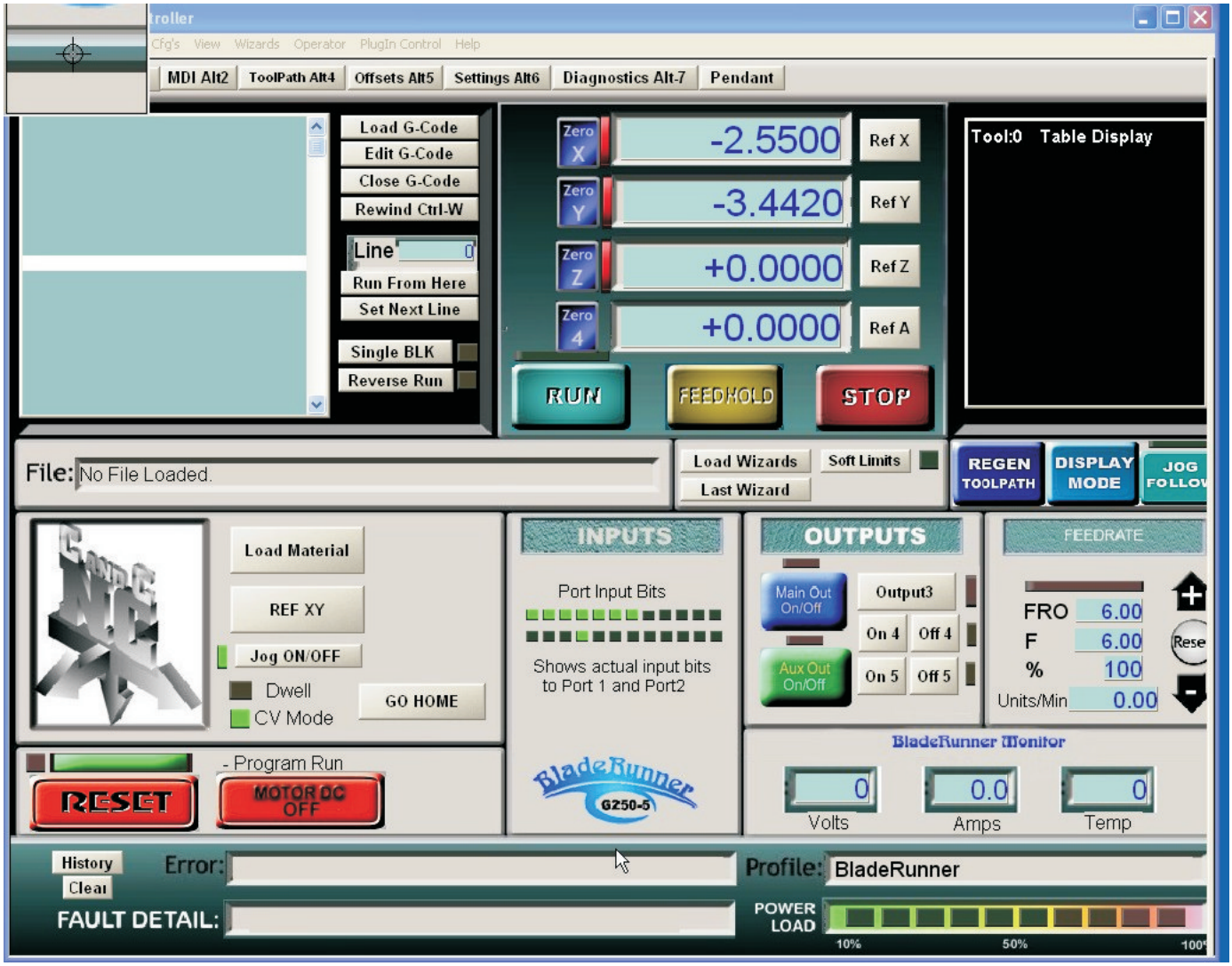
AFTER you go through the file transfer screens you should be presented with the following dialog box.



If you do not see this box and have the option to click OK then the Pulsing Enfine in MACH is not being updated!. If MACH is running (even minimized on the Desktop) it will not let you replace the Engine and MACH will not run the BladeRunner correctly. Contact us and we can tell you how to do the steps manually to replace the Pulsing Engine

After you finish the BladeRunner Install Process:

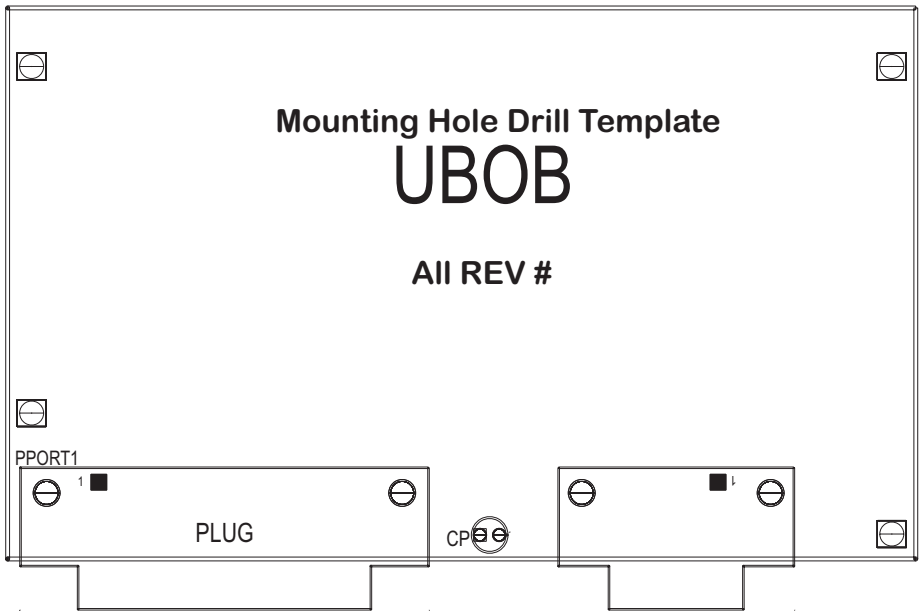
- Reboot the PC and select the BladeRunner Profile by using the Desktop Icon OR from the BladeRunner Entry in the Mach Loader list.
- Go to the Quik Start Section and hook up your hardware.

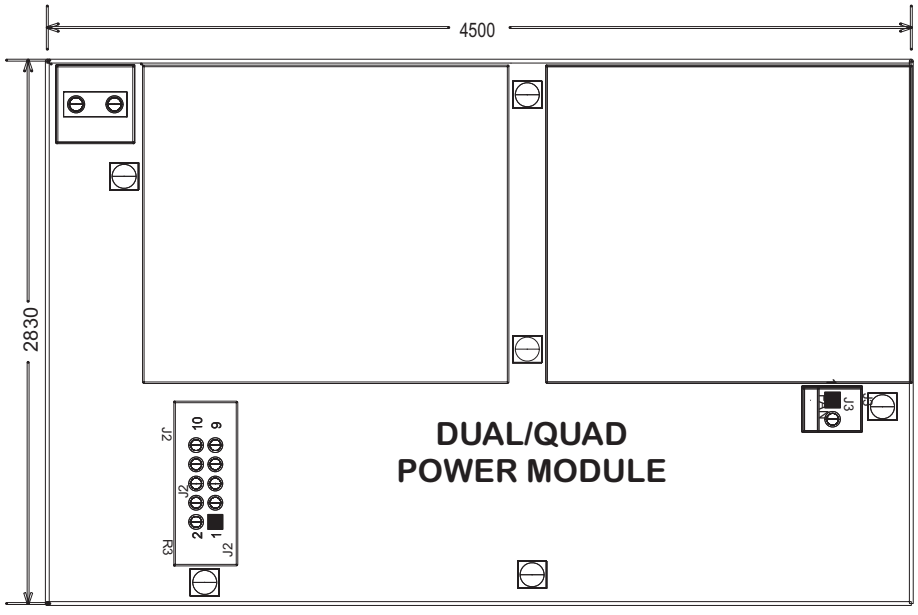


NOTE: The BladeRunner Monitor section of the screen (Lower right) will not display parameters if you do not have the Serial Port on your PC connected to the BladeRunner Serial Input on the front panel. See the BladeRunner User Manual for more informatrion.

DRILL TEMPLATES

1:1 draiwngs for drill holes





DRILL TEMPLATES

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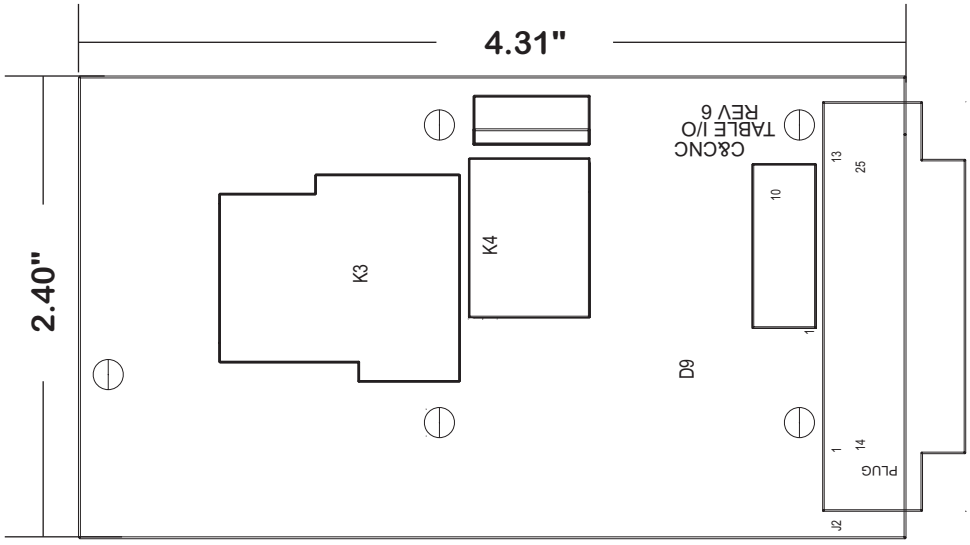
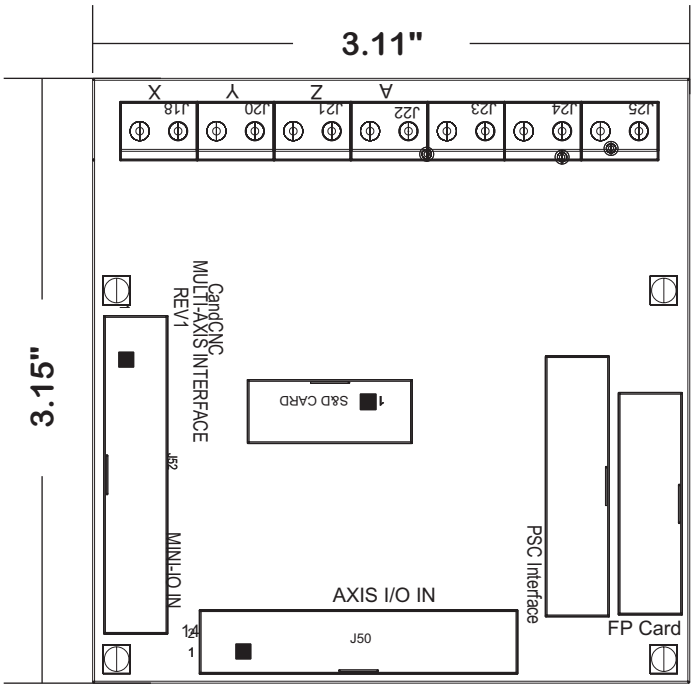
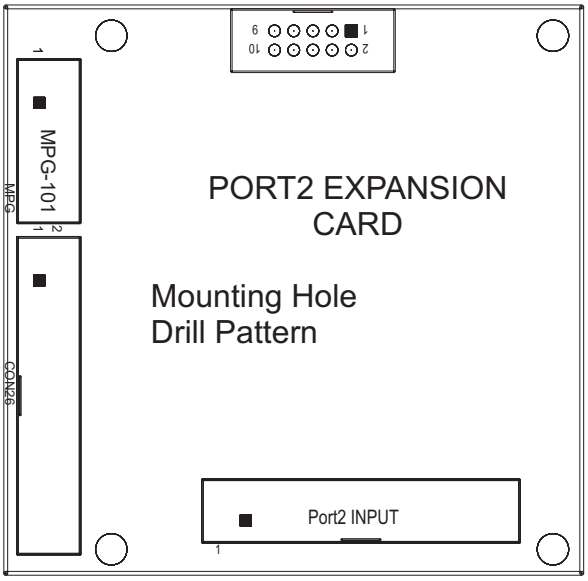




DRILL TEMPLATES

1:1 draiwngs for drill holes



Step & Dir Monitor (S&D-04A)