# *GALAXY SERIES CNC ROUTERS*

## Quick Start Guide
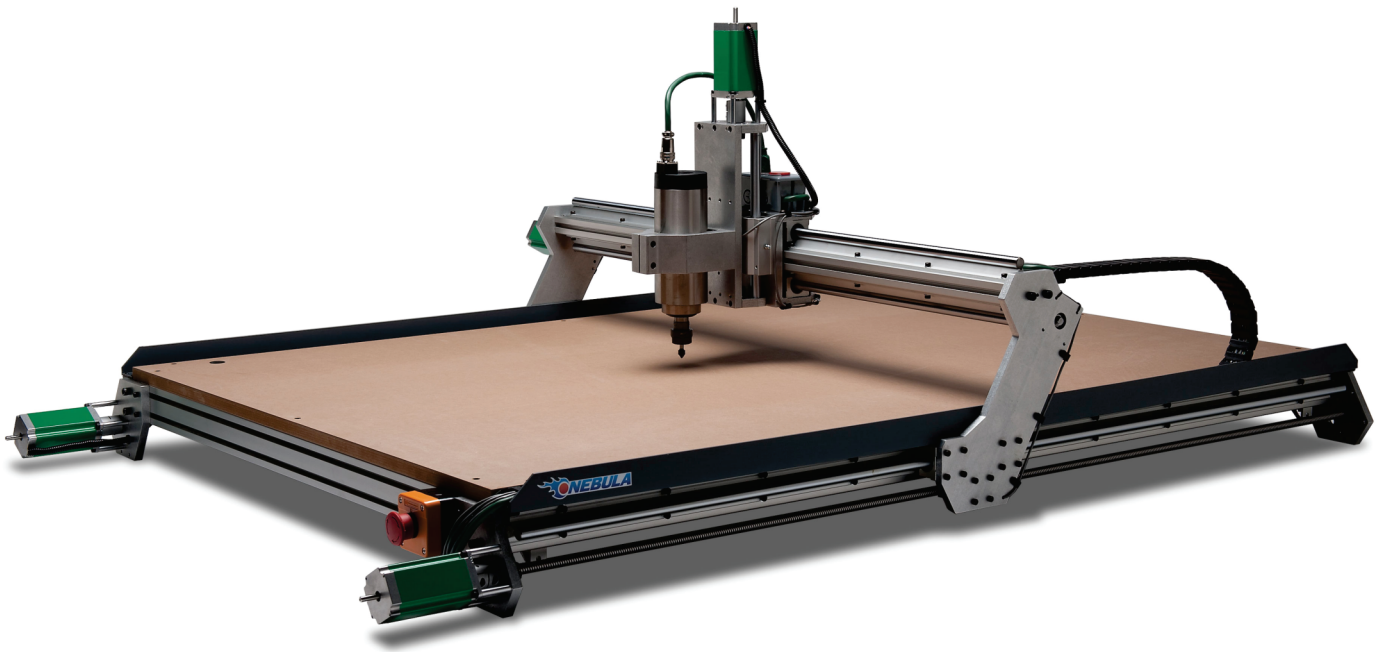
# HOW TO GET HELP

## Online Support

http://www.probotix.com/wiki/
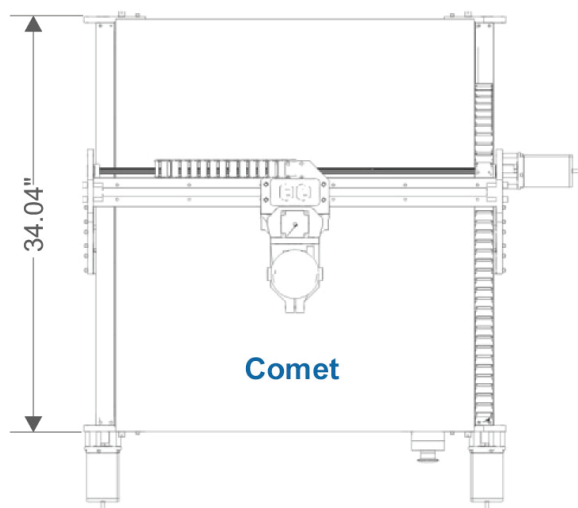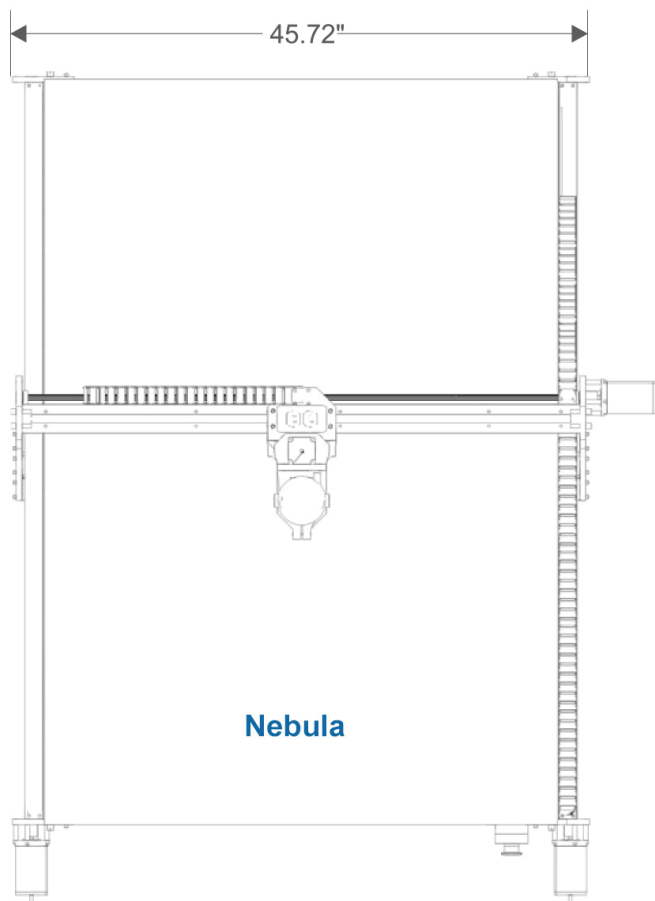
http://www.probotix.com/forum/

## Telephone Support

309.691.2643

# MACHINE FOOTPRINTS

34.58"

45.72"

61.41"

**Meteor**

**Nebula**

34.04"
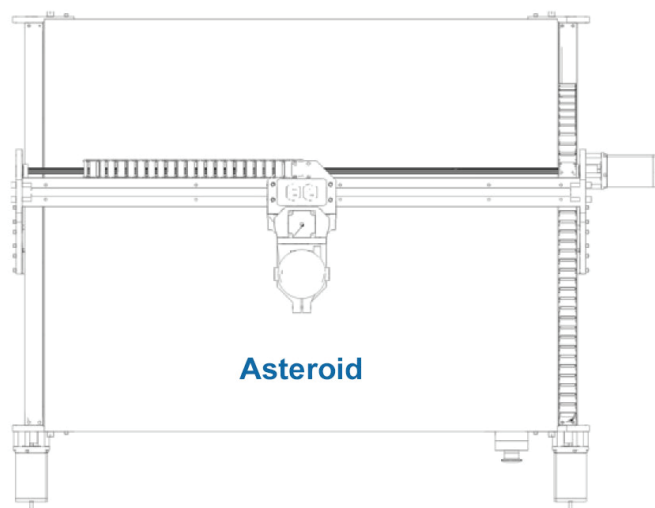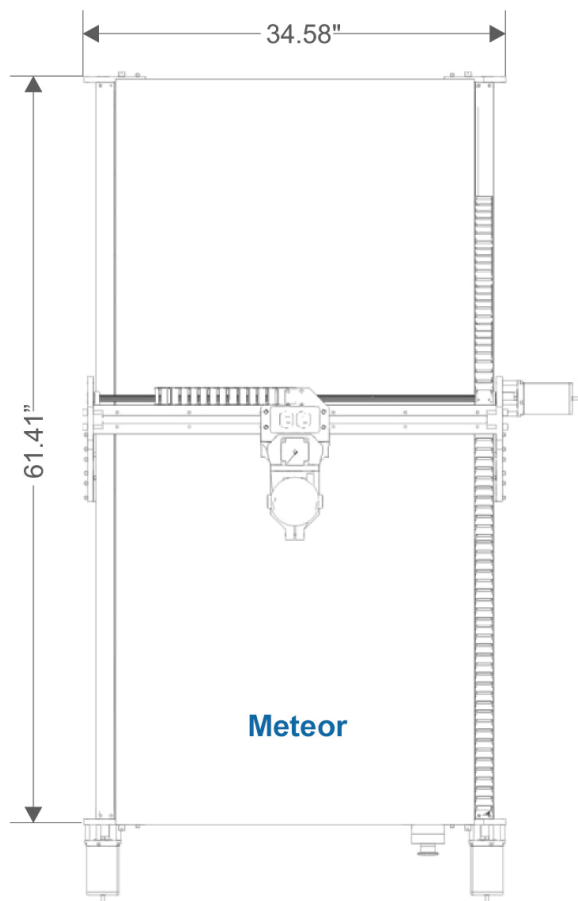
**Comet**

**Asteroid**

# BUILDING A TABLE - COMET
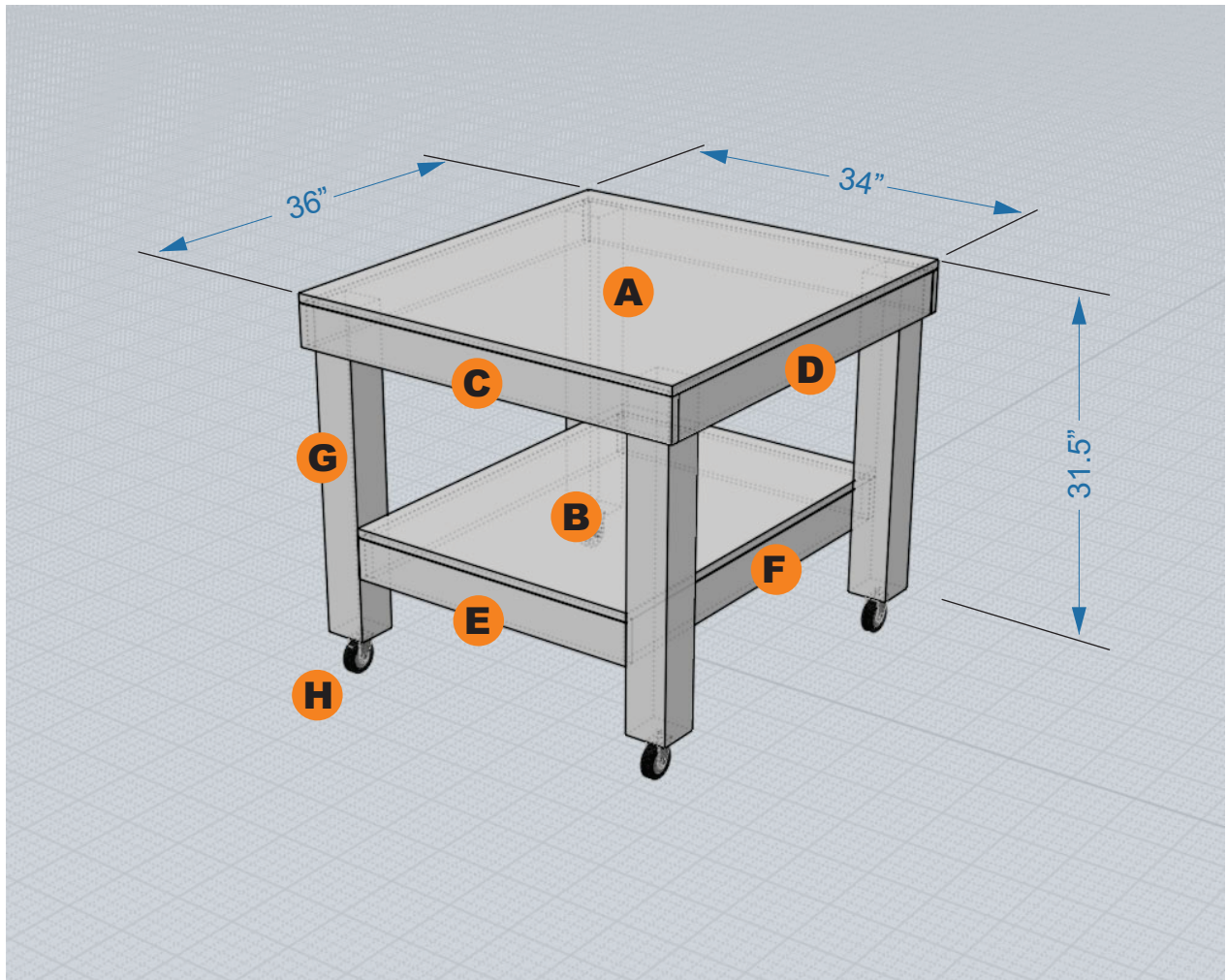


| | |
|---|---|
| **A** | 3/4" MDF or Plywood, 34" x 36" |
| **B** | 3/4" MDF or Plywood, 24.5" x 34.5" |
| **C** | 2pcs 1x4 Pine, 34" Long |
| **D** | 2pcs 1x4 Pine, 34.5" Long |
| **E** | 2pcs 1x4 Pine, 25.5" Long |
| **F** | 2pcs 1x4 Pine, 33" Long |
| **G** | 4pcs 4x4 Pine, 27.25" Long |
| **H** | 4pcs 3.5" Tall Locking Castors |

# BUILDING A TABLE - ASTEROID
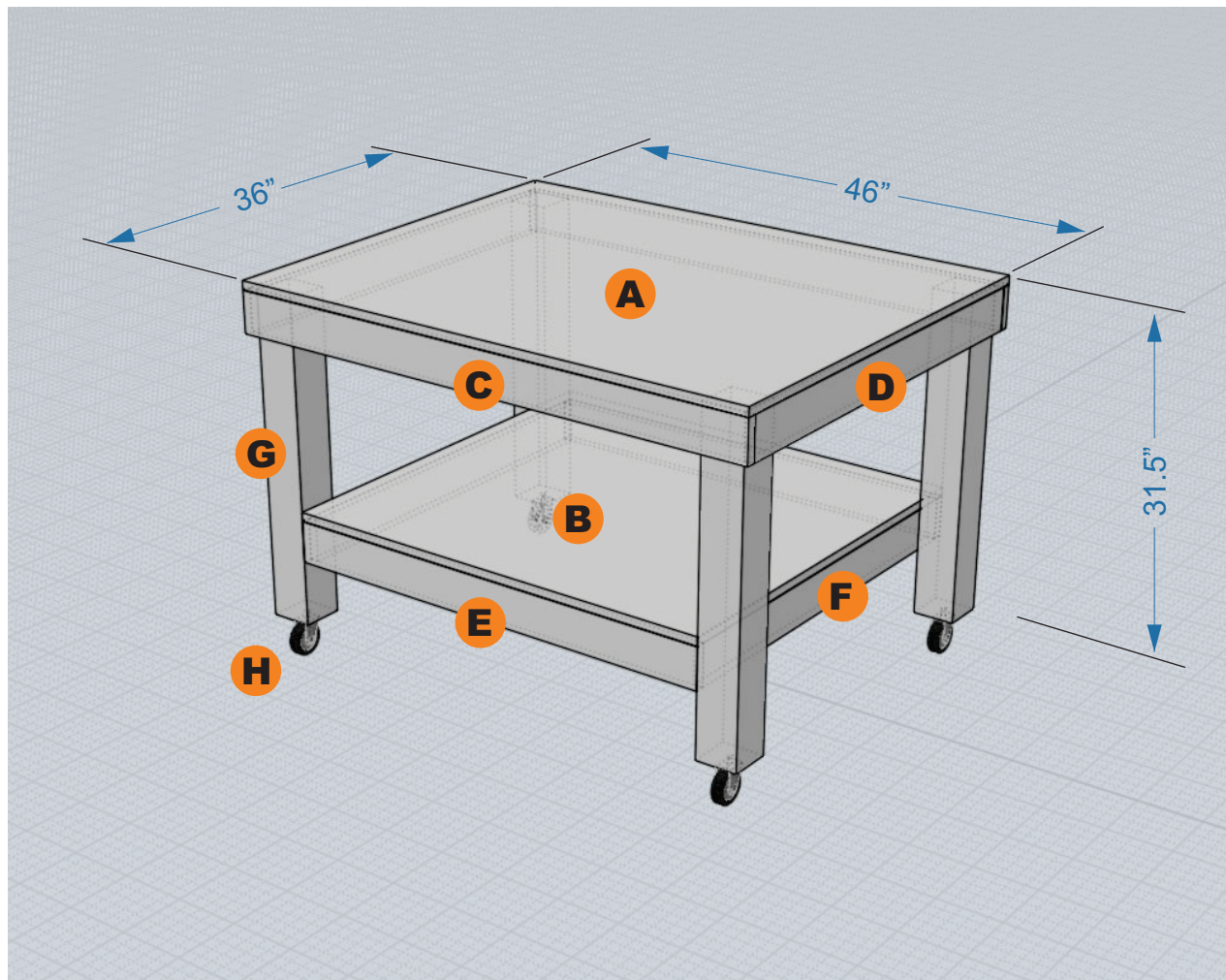


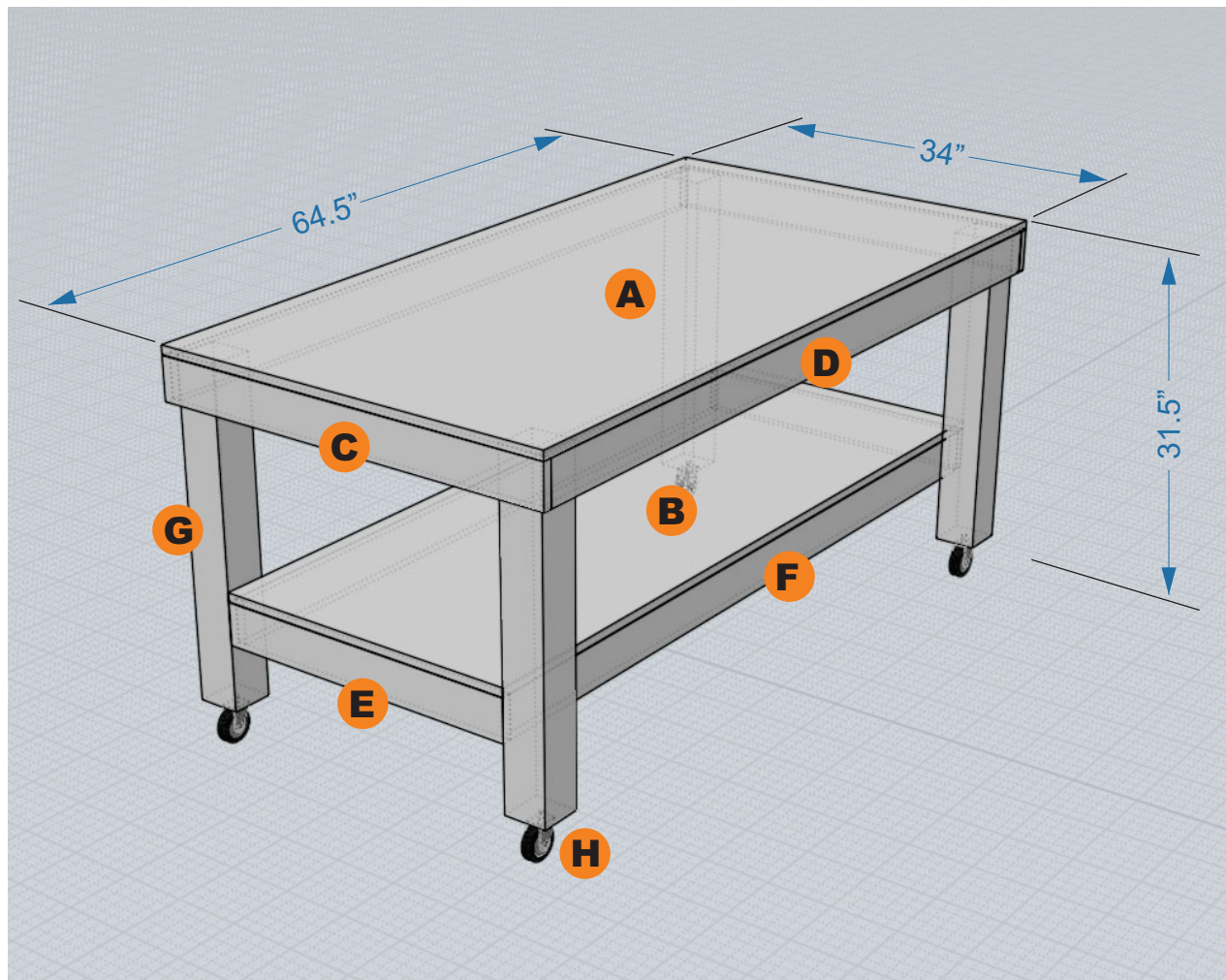| | |
|---|---|
| **A** | 3/4" MDF or Plywood, 46" x 36" |
| **B** | 3/4" MDF or Plywood, 37.5" x 34.5" |
| **C** | 2pcs 1x4 Pine, 46" Long |
| **D** | 2pcs 1x4 Pine, 34.5" Long |
| **E** | 2pcs 1x4 Pine, 37.5" Long |
| **F** | 2pcs 1x4 Pine, 33" Long |
| **G** | 4pcs 4x4 Pine, 27.25" Long |
| **H** | 4pcs 3.5" Tall Locking Castors |

# BUILDING A TABLE - METEOR



**A** — 3/4" MDF or Plywood, 34" x 64.5"

**B** — 3/4" MDF or Plywood, 25.5" x 63"

**C** — 2pcs 1x4 Pine, 34" Long

**D** — 2pcs 1x4 Pine, 63" Long

**E** — 2pcs 1x4 Pine, 25.5" Long

**F** — 2pcs 1x4 Pine, 61.5" Long

**G** — 4pcs 4x4 Pine, 27.25" Long

**H** — 4pcs 3.5" Tall Locking Castors

# BUILDING A TABLE - NEBULA
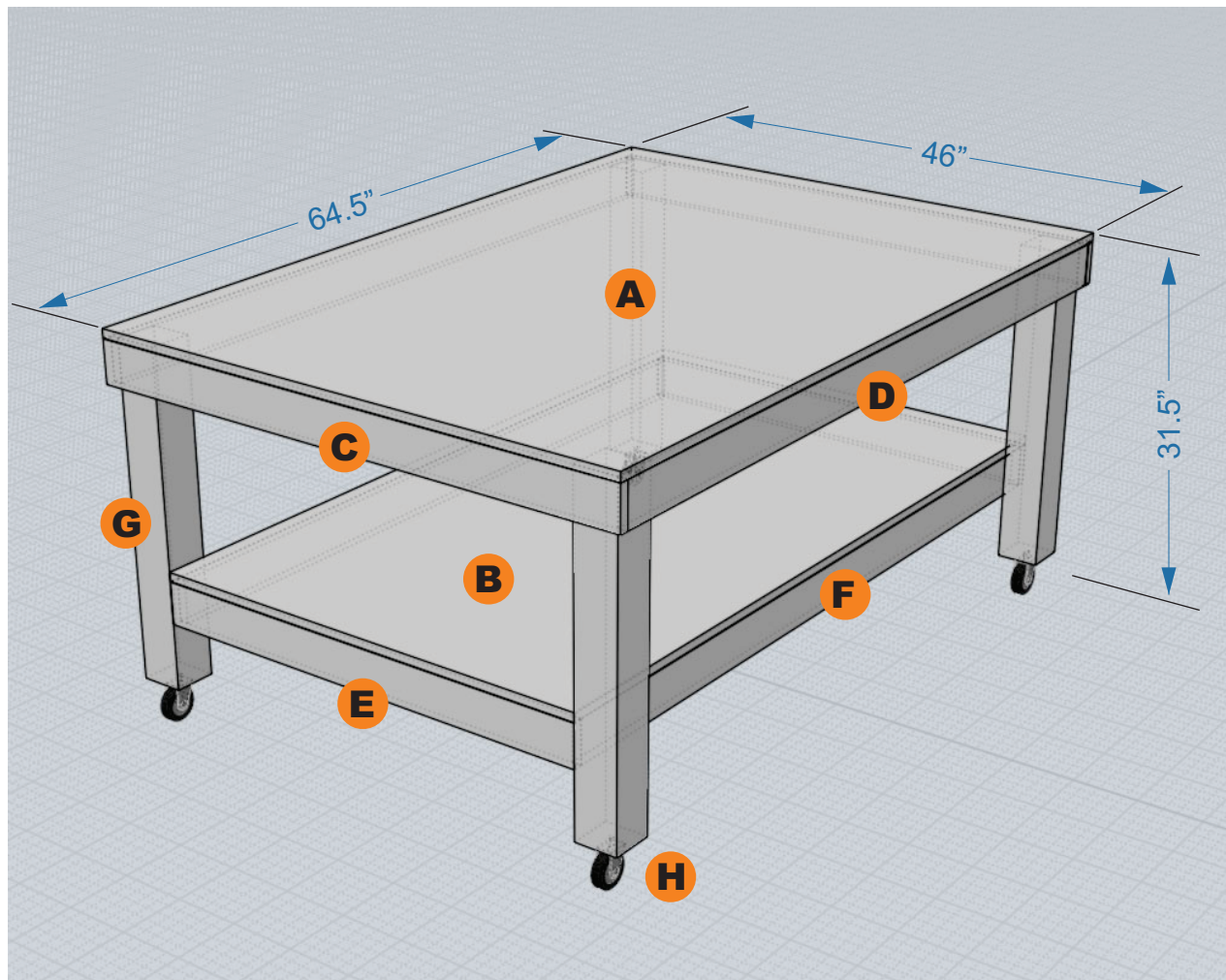


| | |
|---|---|
| **A** | 3/4" MDF or Plywood, 46" x 64.5" |
| **B** | 3/4" MDF or Plywood, 37.5" x 63" |
| **C** | 2pcs 1x4 Pine, 46" Long |
| **D** | 2pcs 1x4 Pine, 63" Long |
| **E** | 2pcs 1x4 Pine, 37.5" Long |
| **F** | 2pcs 1x4 Pine, 61.5" Long |
| **G** | 4pcs 4x4 Pine, 27.25" Long |
| **H** | 4pcs 3.5" Tall Locking Castors |

# CONNECTION DIAGRAM (ROUTER)
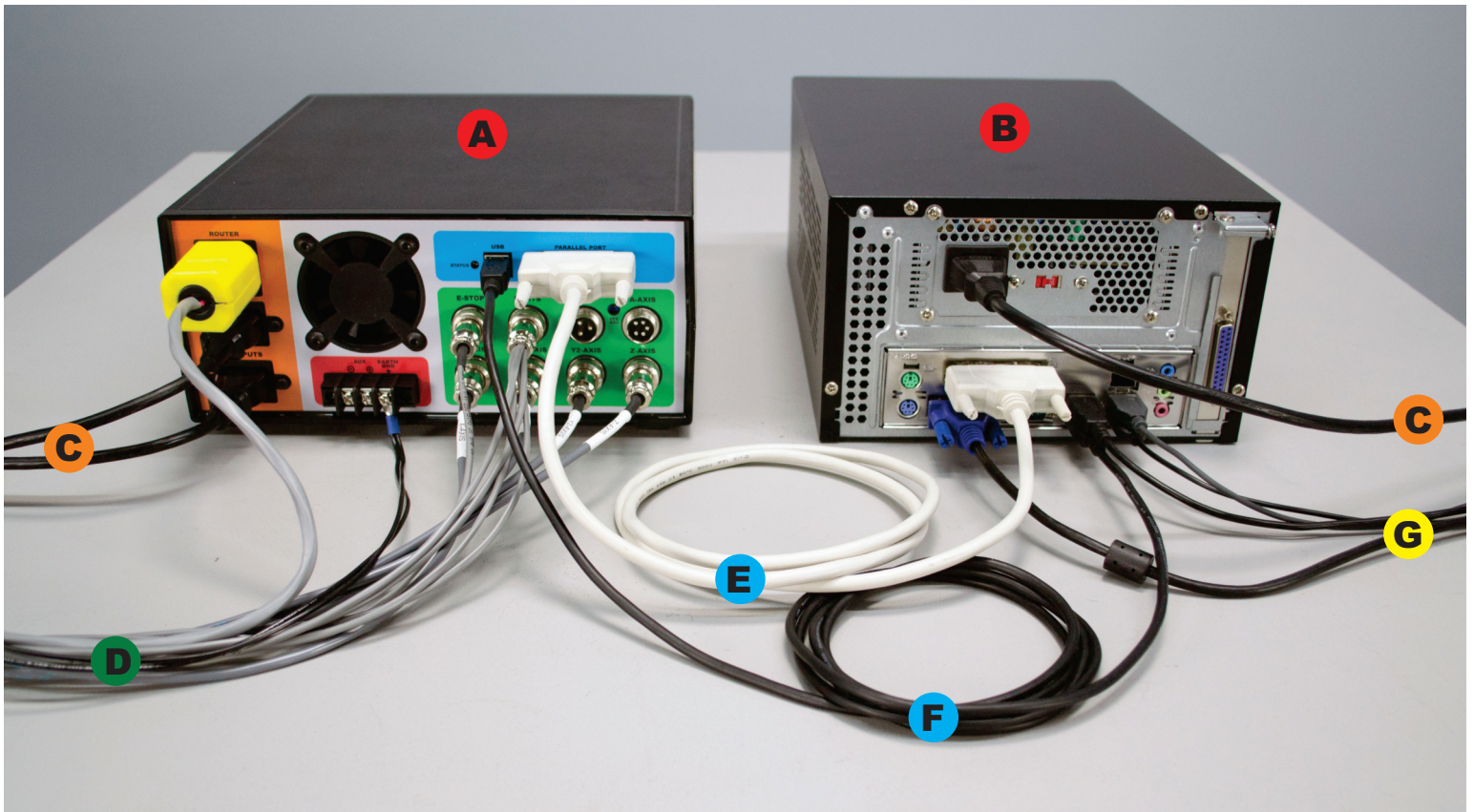


| | |
|---|---|
| **A** | UNITY CONTROLLER |
| **B** | COMPUTER |
| **C** | 110VAC POWER |
| **D** | MACHINE HARNESS |
| **E** | PARALLEL CABLE |
| **F** | USB CABLE |
| **G** | KEYBOARD, MOUSE, MONITOR, JOG PENDANT |

# CONNECTION DIAGRAM (VFD SPINDLE)
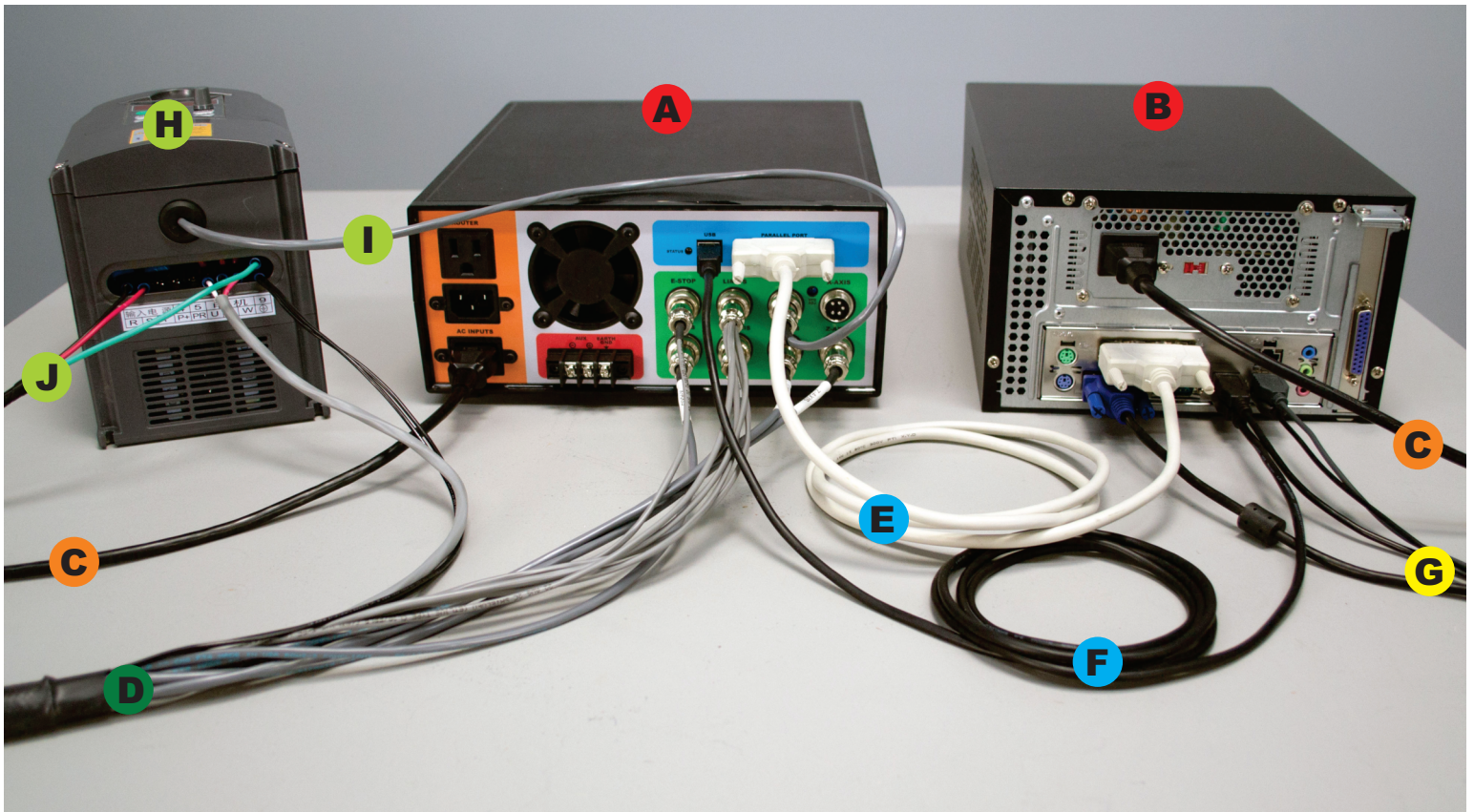


| | |
|---|---|
| **A** | UNITY CONTROLLER |
| **B** | COMPUTER |
| **C** | 110VAC POWER |
| **D** | MACHINE HARNESS |
| **E** | PARALLEL CABLE |
| **F** | USB CABLE |
| **G** | KEYBOARD, MOUSE, MONITOR, JOG PENDANT |
| **H** | VFD |
| **I** | VFD CONTROL CABLE |
| **J** | 220VAC |

# UNITY CONTROLLER PORTS

A: AC INPUT - Primary power input for power supply.

B: AC INPUT - Power input here is switched by relay to the (C) ROUTER output.

C: ROUTER - Connect to the green power cable from the machine harness. On-screen spindle controls, as well as M3/M5 g-codes will control this output. When a VFD spindle is used instead of a router, this outlet can be used with for a shop vac and is controlled by M8/M9.

D: USB - Connect to USB connector on PC.

E: PARALLEL PORT - Connect to the primary (built onto the motherboard) DB-25 connector on the PC.

F, G, H, I, J: MOTOR CONNECTIONS - Connect to each of the labeled motor connections from the machine harness.

J: A-AXIS - For optional rotary axis.

K: VFD - Connect to 3-pin VFD pigtail for speed control of a VFD spindle.

L: LIMITS - Connect to the 8-pin limit switch connector from the machine harness.

M: E-STOP - Connect to the 2-pin e-stop connector from the machine harness.

N: EARTH GND - It is recommended that the machine is grounded to earth. Connect the two black wires from the machine harness to this connection. If using a VFD, ground the machine frame to the VFD earth ground terminal instead. Additional earth grounding may be necessary when working with certain spindles or certain types of materials that may cause excess EMI or static electricity.

O: AUX - This is a 5V logic level signal that can be connected to a PowerSwitch Tail or other 5V@20mA relay circuit. This signal is controlled by the flood coolant controls in the software (M8/M9). Do not use if running a VFD spindle.

# VFD WIRING DETAIL
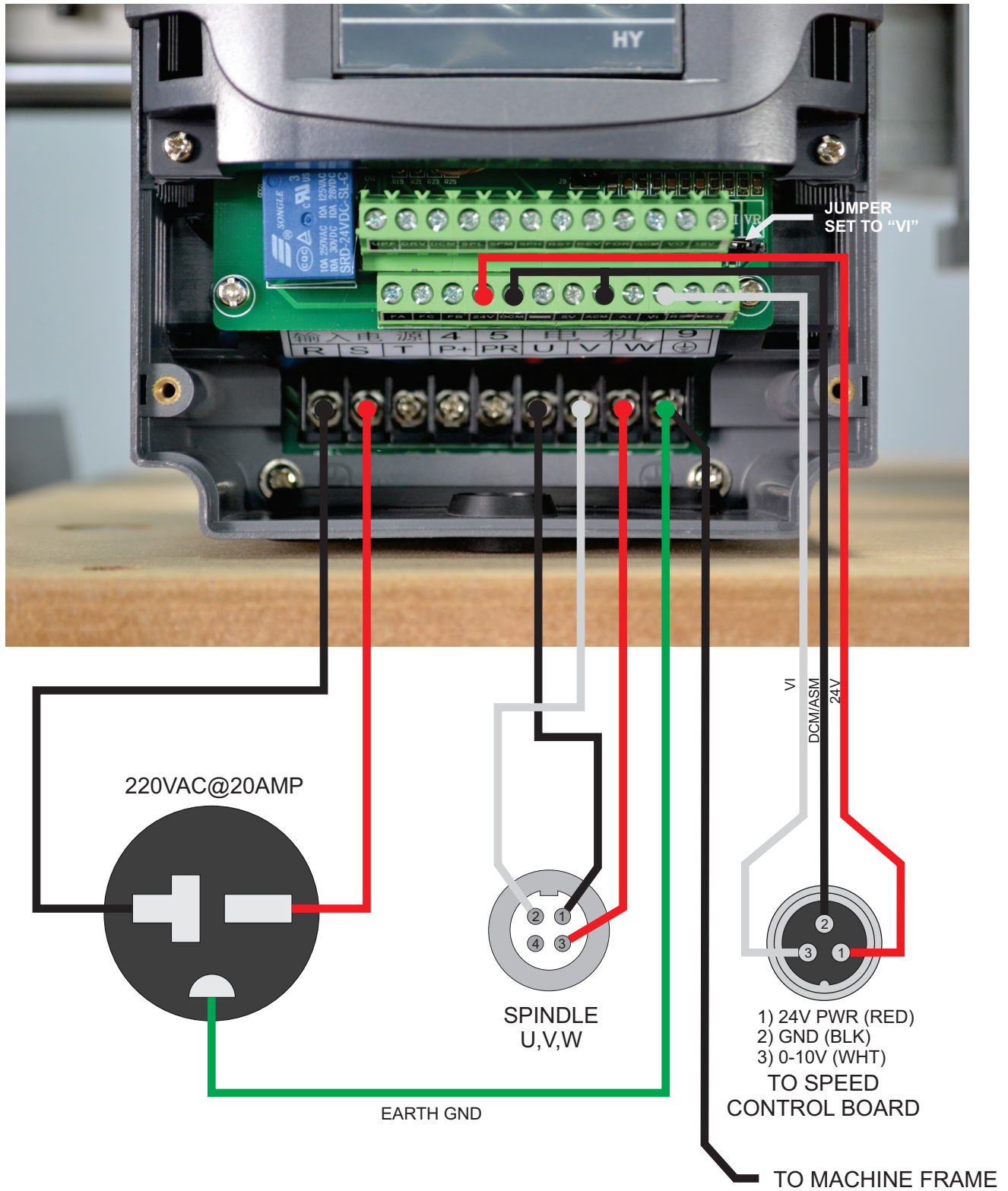


JUMPER SET TO "VI"

220VAC@20AMP

VI

DCM/ASM

24V

SPINDLE
U,V,W

1) 24V PWR (RED)
2) GND (BLK)
3) 0-10V (WHT)
TO SPEED
CONTROL BOARD

EARTH GND

TO MACHINE FRAME

NOTE: Internal wiring of Chinese spindles is not consistent. If spindle spins in reverse, swap U & V

# VFD WIRING DETAIL
# (SUNFAR)
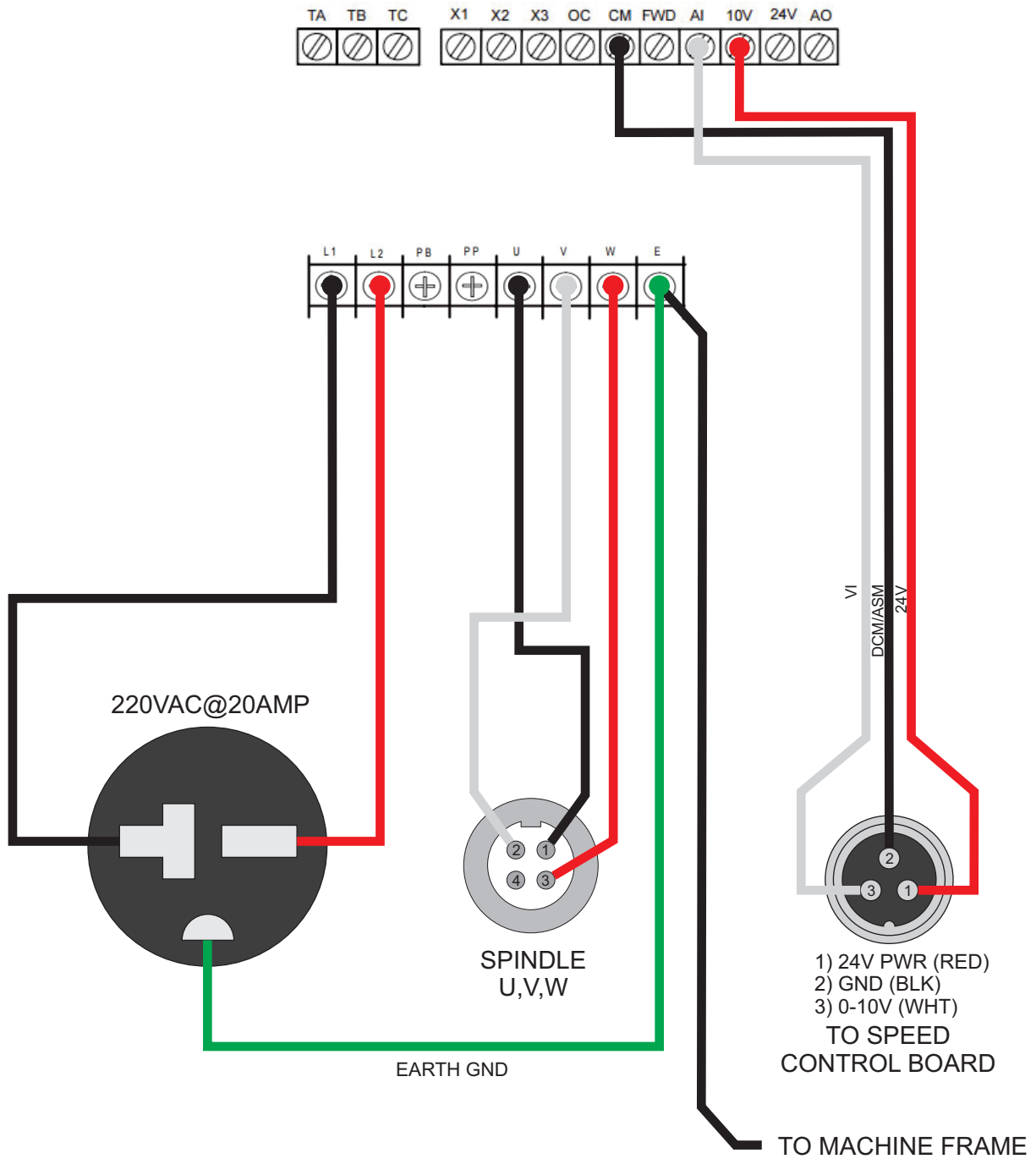


TA  TB  TC      X1  X2  X3  OC  CM  FWD  AI  10V  24V  AO

L1  L2  PB  PP  U  V  W  E

220VAC@20AMP

VI

DCM/ASM

24V

SPINDLE
U,V,W

1) 24V PWR (RED)
2) GND (BLK)
3) 0-10V (WHT)
TO SPEED
CONTROL BOARD

EARTH GND

TO MACHINE FRAME

NOTE: Internal wiring of Chinese spindles is not consistent. If spindle spins in reverse, swap U & V

# LIMIT SWITCHES
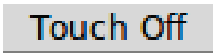
The Y1 and Y2 limit switches have been removed to protect them during transport. Reinstall them as seen above before running the machine.
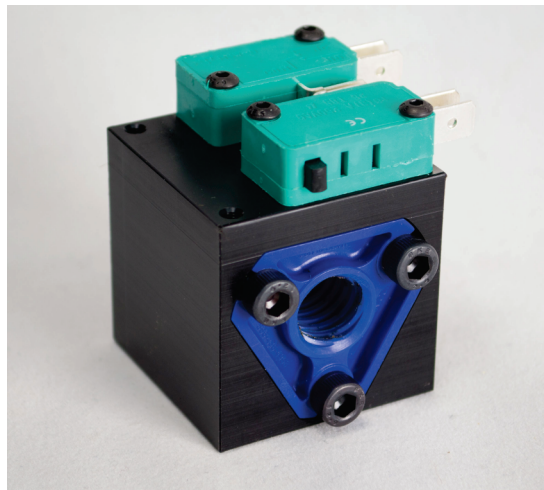
# GETTING STARTED

## Start Up Procedure:

- Start computer
- Launch LinuxCNC from icon on desktop
- Turn power on Unity Controller
- Verify red E-Stop indicator follows physical e-stop
- Click orange Machine Power button
- Click the Home All button   Home All
- Click folder icon to open g-code file
- Load tool into spindle or router
- Mount stock on the table
- Jog machine to place tool on origin of part
- Perform touch-off sequence (all 3 axis)   Touch Off
- Verify spindle power switch is on
- Hit the Run button
- Watch in awe

# MAINTENANCE

**<u>Daily Use:</u>**

Put a couple of drops of 3-in-1 oil on each of the six linear rails before homing the machine each day. This will allow a tiny amount of oil to be sucked up into the bearing housings before cutting any parts.

Use the included linear motion grease on the leadscrews. A light coating is enough, as Delrin is self-lubricating. You can use WD-40 and an air nozzle to remove debris from the screw. Be sure to dry the screw of the WD-40 before re-applying grease as WD-40 is a solvent and will dissolve the grease.

The Grease Zerks on the z-axis bearings are not used.

All of the other bearings are sealed. The most important thing is to keep any dust cleaned off of the machine, especially if you are cutting abrasive materials such as MDF, fiberglass, or carbon fiber.

**<u>High Humidity Environments & Storage:</u>**

If you use your machine in a high humidity environment, ie in a shed or other non-airconditioned environment, or if you plan to store it without use, rust can form on the linear rails, leadscrews, and the black-oxide machine fasteners. Coat these surfaces with grease or WD-40 often. Again, be sure to dry the screws and rails of the WD-40 before re-applying grease and oil before use. The black-oxide machine fasteners will not need to wiped dry.

**<u>Bearing Replacements:</u>**

Depending on the amount of use and the loads on the machine for your application, the linear bearings and leadscrew ball bearings will need to be replaced eventually. You will notice excess slop, marks on the rails, or jerky motion on the affected axis. Replace them annually for worry free operation.

**<u>Anti-backlash Nuts:</u>**

The Delrin anti-backlash nuts are designed to wear and may need to be replaced periodically, depending upon the amount of use and abuse your machine receives. When they fail, you will notice backlash on the affected axis. You can check them by pulling and pushing on each axis and observing slop between the leadscrew and the drive nuts. The replace them, you will need to remove the leadscrews. Replace them annually for worry free operation.

# LINUXCNC KEYBOARD SHORTCUTS

| | |
|---|---|
| ESCAPE | E-STOP |
| F1 | TOGGLE E-STOP |
| F2 | TOGGLE MACHINE POWER |
| F3 | MANUAL MODE |
| F4 | AUTO MODE |
| F5 | MDI MODE |
| F6 | RESET INTERPRETER |
| F7 | TOGGLE MIST |
| F8 | TOGGLE FLOOD |
| F9 | TOGGLE SPINDLE FORWARD |
| F10 | TOGGLE SPINDLE REVERSE |
| F11 | DECREASE SPINDLE SPEED |
| F12 | INCREASE SPINDLE SPEED |
| X | SELECT X-AXIS |
| Y | SELECT Y-AXIS |
| Z | SELECT Z-AXIS |
| LEFT/RIGHT ARROW | JOG X-AXIS |
| UP/DOWN ARROW | JOG Y-AXIS |
| PAGE UP/DOWN | JOG Z-AXIS |
| HOME | HOME SELECTED AXIS |
| END | TOUCH-OFF SELECTED AXIS |
| </> | DECREASE/INCREASE JOG SPEED |
| C | SELECT CONTINUOUS JOGGING |
| I | SELECT INCREMENTAL JOGGING AND TOGGLE BETWEEN INCREMENTS |
| 1-9,0 | FEED OVERRIDE 10%-90%, 0 IS 100% |
| @ | TOGGLE COMMANDED/ACTUAL POSITION DISPLAY |
| # | TOGGLE ABSOLUTE/RELATIVE POSITION DISPLAY |
| O | OPEAN A PROGRAM |
| R | RUN THE OPENED PROGRAM |
| P | PAUSE PROGRAM |
| S | RESUME PAUSED PROGRAM |
| A | STEP ONE LINE IN PAUSED PROGRAM |
| B | TAKE SPINDLE BREAK OFF |
| ALT-B | PUT SPINDLE BRAKE ON |
| ALT-S | START LOGGING |
| ALT-P | PAUSE LOGGING |
| ALT-F | SAVE LOG FILE |
| CTRL-P | PRINT LOG FILE (ONLY WITH XGRAPH) |

# G-CODE QUICK REFERENCE

| | | |
|---|---|---|
| **Motion** | | |
| G0 | | Rapid motion |
| G1 | | Coordinated motion ("Straight feed") |
| G2, G3 | I J K or R | Coordinated helical motion ("Arc feed") CW or CCW |
| G38.2 | | Straight Probe |
| G80 | | Cancel motion mode |
| G81 | R L P | Drilling Cycle |
| G82…G89 | R L P Q | Other canned cycles |
| G33 | K | Spindle-synchronized motion |
| G33.1 | K | Rigid Tapping |
| G76 | P Z I J R K Q H L E | Multipass lathe threading cycle |
| **Plane Selection (affects G2, G3, G81…G89, G40…G42)** | | |
| G17 | | Select XY plane |
| G18 | | Select XZ plane |
| G19 | | Select YZ plane |
| **Distance Mode** | | |
| G90 | | Absolute distance mode |
| G91 | | Incremental distance mode |
| **Feed Rate Mode** | | |
| G93 | | Inverse time feed rate |
| G94 | | Units per minute feed rate |
| G95 | | Units per revolution |
| **Units** | | |
| G20 | | Inches |
| G21 | | Millimeters |
| **Cutter Radius Compensation** | | |
| G41, G42 | D | Start cutter radius compensation left or right |
| G41.1, G42.1 | D L | Start cutter radius compensation left or right, transient tool |
| G40 | | Cancel cutter radius compensation |
| **Tool Length Offset** | | |
| G43 | H | Use tool length offset from tool table |
| G43.1 | I K | Use specified tool length offset for transient tool |
| G49 | | Cancel tool length offset |
| **Return Mode in Canned Cycles** | | |
| G98 | | Retract to R position |
| G99 | | Retract to prior position |
| **Path Control Mode** | | |
| G61 | | Exact Path mode |
| G61.1 | | Exact Stop mode |
| G64 | P | Continuous mode with optional path tolerance |
| **Stopping** | | |
| M0 | | Pause Program |
| M2 | | End Program |
| M1, M30, M60 | | Other stop codes |
| **Spindle Control** | | |
| M3, M4 | S | Turn spindle clockwise or counterclockwise |
| M5 | | Stop spindle |
| G96 | D S | Constant surface speed mode (foot/minute or meter/minute) with top speed |
| G97 | | RPM mode |
| **Coolant** | | |
| M7 | | Turn mist on |
| M8 | | Turn flood on |
| M9 | | Turn all coolant off |
| **Other Modal Codes** | | |
| F | | Set Feed Rate |
| S | | Set Spindle Speed |
| T | | Select Tool |
| M50…M53 | P0 (off) or P1 (on) | Feed Override, Spindle Override, Adaptive Feed, Feed Hold |
| G54…G59, G59.1…G59.3 | | Select coordinate system |
| **Flow-control Codes** | | |
| O … | sub/endsub, while/endwhile, if/else/endif, do/while, call, break/continue/return | |
| **Non-modal Codes** | | |
| M6 | T | Change tool |
| G4 | P | Dwell (seconds) |
| G10 L2 | P X Y Z A B C | Coordinate system origin setting |
| G28 | | Return to home |
| G30 | | Return to secondary home |
| G53 | | Motion in machine coordinate system |
| G92 | X Y Z A B C | Offset coordinate systems and set parameters |
| G92.1 | | Cancel offset coordinate systems and set parameters to zero |
| G92.2 | | Cancel offset coordinate systems but do not reset parameters |
| G92.3 | | Apply parameters to offset coordinate systems |
| M101…M199 | P Q | User-defined M-codes |
| (…) | | A comment "…" to the user |
| (MSG,…) | | Display the message "…" to the user (e.g., in a popup) |
| (DEBUG,…#123…#<foo>) | | Display the message (with variables substituted) like MSG |
| (PRINT,…#123…#<foo>) | | Display the message (with variables substituted) to stderr |

**Table 1. Coordinate System**

| P Value | Coordinate System | G code |
|---------|-------------------|--------|
| 0 | Active | n/a |
| 1 | 1 | G54 |
| 2 | 2 | G55 |
| 3 | 3 | G56 |
| 4 | 4 | G57 |
| 5 | 5 | G58 |
| 6 | 6 | G59 |
| 7 | 7 | G59.1 |
| 8 | 8 | G59.2 |
| 9 | 9 | G59.3 |

File   Machine   View                                                                    Help

Manual Control [F3]    MDI [F5]          Preview   DRO                        Load 1st Tool

Axis:    ○ X   ● Y   ○ Z                    X:  -0.0000                          G28
         ○ A                                Y:  -0.0000
                                            Z:   0.0000                          G30
    -  +  Continuous  ▼                     A:   0.0000
                                          Vel:   0.0000
    Home All    Touch Off

    ☐ Override Limits

Spindle:  Stop  ↻

Coolant:
    ☐ Flood

PROBE: ○

Feed Override:      100 %
Jog Speed:      200 in/min
Jog Speed:    5100 deg/min
Max Velocity:   200 in/min

```
1: %
2: (PROBOTIX LinuxCNC)
3: G0 G54 G17 G20 G90 G40 G49 G64 P0.010
4:
5: G0 Z0.2000
6: G0 M3 M8 S24000
7: G0 X0.5845 Y0.6105
8: Z0.2000
9: G1   F47.2 Z-0.0100
```

ON            Tool 1, offset 0.5, diameter 0.0625     Position: Relative Actual