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PRS Standard Control Box Installation and Wiring

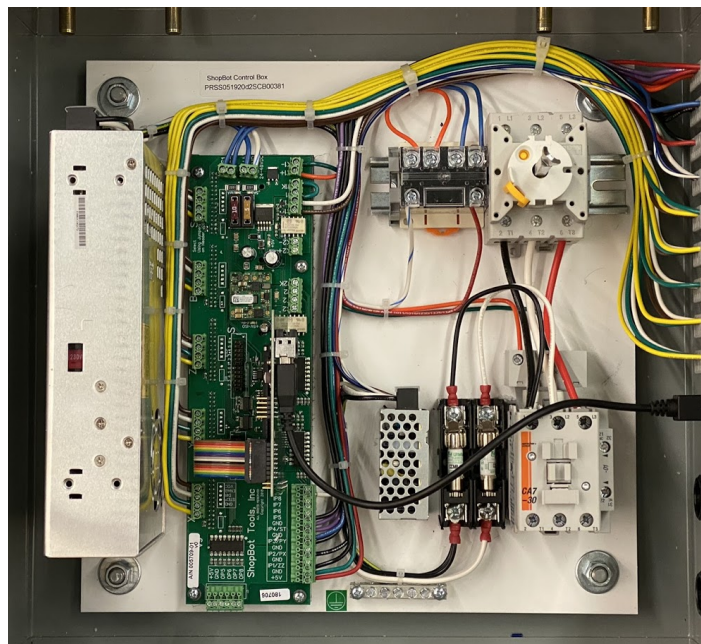


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Introduction

This document will cover the installation and wiring of the control box for ShopBot PRS Standard Gantry Tools. The control box for your PRS Standard tool has been designed for easy, quick installation; internal wiring has all been completed at the factory. All motor, sensor and control connections will be made through connectors on the side of the box, with internal connections only needed for main power and spindle drive power.

Installation

The control box for your PRS Standard will be mounted on the same side of the tool as the E-Chain trough. The box will be positioned at the end of the E-Chain trough where the cables exit the E-Chain as shown in figure 1.



Figure 1: Standard Control Box mounted on 96x48 tool.



Figure 2: Close-up of mounted control box.

Two L shaped brackets are attached to the top side of the control box. Inside the box, there will be a plastic baggie containing a set of screws and drop in “T-Nuts” that will be used for mounting the box. Press the T-Nuts into the bottom T-Slot of the table-side extrusion roughly 12” apart. Hold the box up and align the slot on one of the mounting brackets with one of the T-Nuts in the slot. Insert one of the 5/16-18 bolts through the slot and thread the screw in loosely -- just enough to support the weight of the control box while you align the second mounting screw.

Slide the control box to either the left or right to align the second mounting bracket with the second T-Nut. Insert a screw through the slot and begin to tighten the screw. With both screws inserted, make sure that the control box is positioned roughly 8 inches from the end of the E-Chain trough before tightening the mounting screws. When you are satisfied with the position, tighten both screws to lock the control box in place as shown in figure 2.

Powering the PRS Standard Control Box

 **The power to the PRS Standard Control Box should be wired into a fused disconnect by a licensed electrician familiar with industrial equipment.**

The power requirements for the PRS Standard Control Box and router/spindle vary according to tool configuration. Refer to the power schematic on the inside of the control box door for more information on power requirements.

Exploring the PRS Standard Control Box

 **WARNING: Disconnect electrical power to the PRS Standard Control Box prior to this step!**

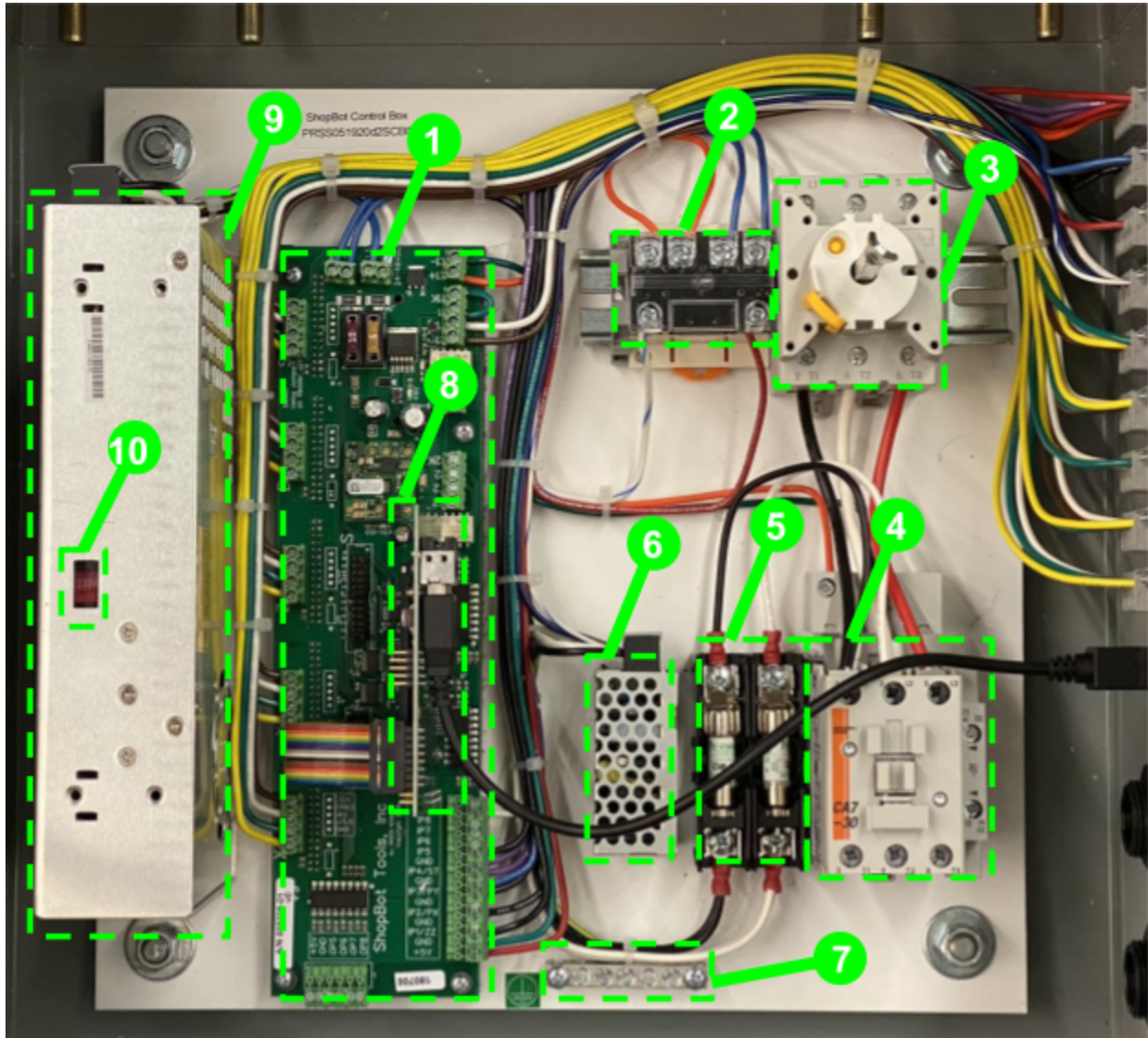


After the electrician has hooked up the PRS Standard Control Box, you can open the box by pushing in on the flip-out handle under the keyhole. The handle will rotate outward, providing a place to grab and pull the control box door open.

When the red main power switch is turned ON, the box will be automatically locked. To access the inside of the box, turn off the main power switch.

A small pouch containing keys to control box lock will be taped to the inside of the control box door. Keep these keys in a secure place.

Inside the PRS Standard Control Box



1. Control Board
2. Spindle Interlock Relay
3. Main Power Disconnect
4. Contactors
5. 10A Fuses
6. 24 VDC Power Supply (for limit switches)
7. Grounding Bar
8. Controller Card
9. 48 VDC Control Power
10. Input Voltage Selector Switch for 48 VDC Power

Connecting Spindle Drive Inside the Control Box

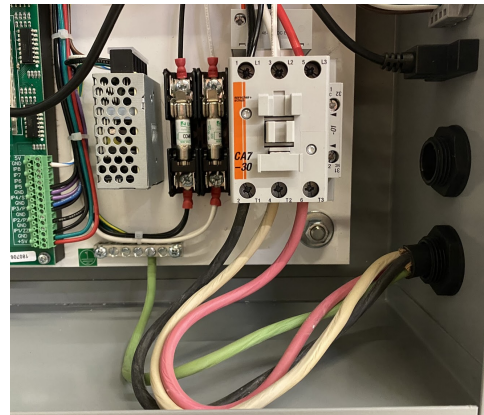


The spindle drive power cable will be connected to the output of the contactor inside the control box. Single phase systems will have a 3 conductor cable and Three phase systems will have a 4 conductor cable.

Pass the loose end of the cable through the cord grip (whichever one that was not used for the main power) on the side of the control box. Make sure that the loose conductors are fully inside the control box, so that the cord grip can clamp onto the black insulation of the cable.

Insert the wires from the cable into the open terminals on the bottom of the contactor (single phase models will have just black and white, while three phase models will have a third, red conductor). Match the colors of the conductors with the colors of the wires entering the top of the contactor. Find an open spot on the grounding bar and clamp the green ground wire into the grounding bar.

Tighten the nut of the cord grip to lock the power cable in place.



Making Connections on the Outside of the Box



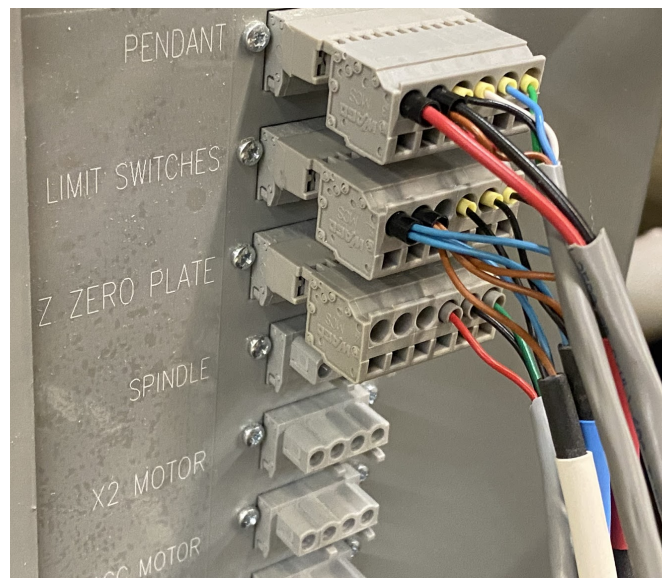
On the outside of the box, above the cord grips, you will find a series of labelled WAGO connectors. These provide connection points for your motors, control pendant, limit switches, z zero plate, spindle logic cable and USB communication cable.

It is important to make sure that the connectors are inserted in the correct orientation. The connectors for the sensors and motors will have one side with holes for voltage measurements and other features while the opposite side will be featureless and smooth -- the smooth side of the connector should always be oriented upwards when making a connection to the box. This will ensure that the correct wires are connected.

First make the connections for your pendant, limit switches and z zero plate.

The pendant connection will have two cables running into it -- one for the handheld pendant and the other for the gantry mounted stop button. The limit switch connector will have three black cables running into it and the z-zero plate cable will have a single cable with just 3 conductors running into it.

Below that is the connector for the spindle logic cable which will be coming from your Spindle Drive (VFD). Under that are the motor connections. Each of your motor wires will be labelled according to the axis it controls. Match up the motor wires with the appropriate connectors.



At the bottom is the USB-B connector where you will plug in the USB cable that is connected to the PC that you will be using to control your ShopBot. **To ensure successful tool operation, be sure to install SB3 (ShopBot Control Software) on your control computer before plugging in your tool for the first time!**

Handheld Pendant Operation

The handheld pendant features three switches. The first is an Emergency Stop; which will cut all power to the spindle and motors of your tool. Only use this in an emergency when you cannot wait for a controlled stop of the tool. Following an E-Stop of the tool, you will need to re-home and z-zero your tool to recover the correct position. To release the E-Stop, twist the red knob clockwise -- the cap of the button will pop up and power will be restored to the spindle and motors.

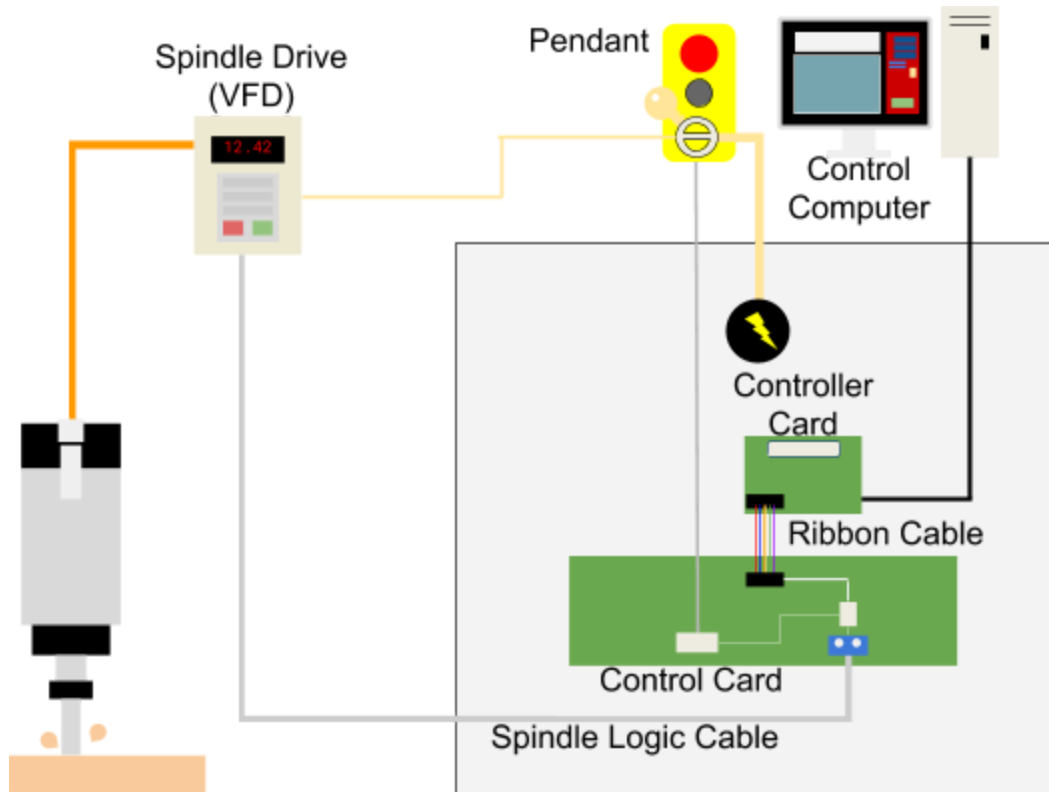


The second button on the pendant is a controlled stop button or “software stop” pressing this button will send a signal to the software to pause the cut and turn off the spindle. This stop will take longer to execute than an emergency stop but the accurate position of the tool will be maintained.

The third switch on the pendant is a spindle interlock key switch. The key must be inserted and the interlock closed in order to allow power to flow to the spindle. If a cut is started without the interlock closed, the spindle will not start and you might break a router bit! The pendant comes with two keys; store the spare in a secure place. If you lose your key, get in touch with ShopBot support to order a new set of keys.

Troubleshooting the Spindle Control System

⚡ WARNING: Disconnect electrical power to the PRS Standard Control Box before touching any wiring!

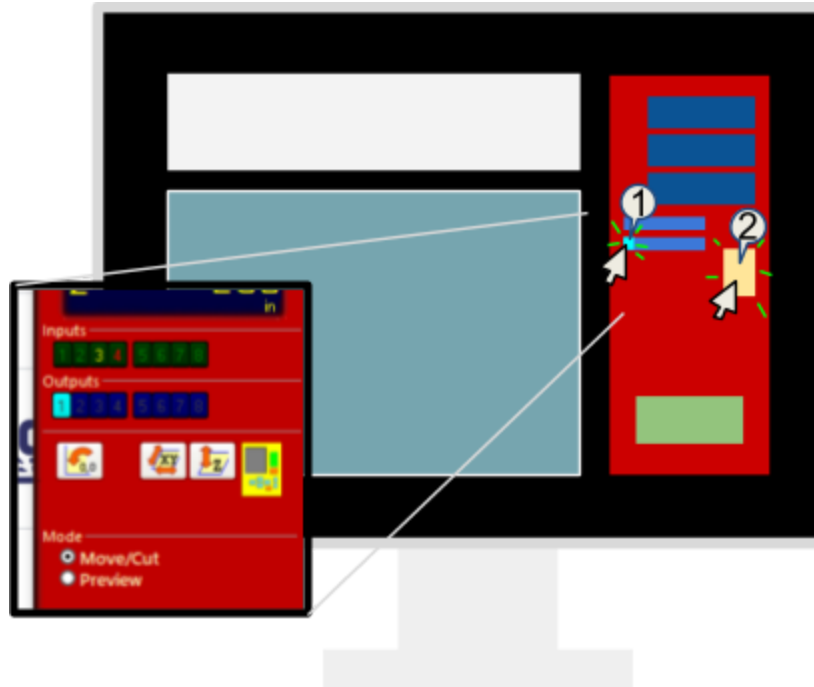


Simplified schematic of the spindle wiring and control

If the spindle on your tool will not start, there are a number of components in the system that may need to be checked. For some tests, it may be necessary to use a digital multimeter; if you do not already own one, it is a great troubleshooting tool and relatively inexpensive. It will also be necessary to have the control box open while powered on to monitor indicator lights; the tool should never be run with the control box door open for safety reasons. To power the control box on with the door open, twist the connector rod that engages the back side of the main power switch until the switch closes and the box powers on.

To test spindle operation, we will use the SB3 interface. Make sure that your software is not set to “easy” mode -- software in “easy” mode will have a blue button with a “?” in the red position window; click this button and choose to set the software to advanced mode in order to display the full set of controls.

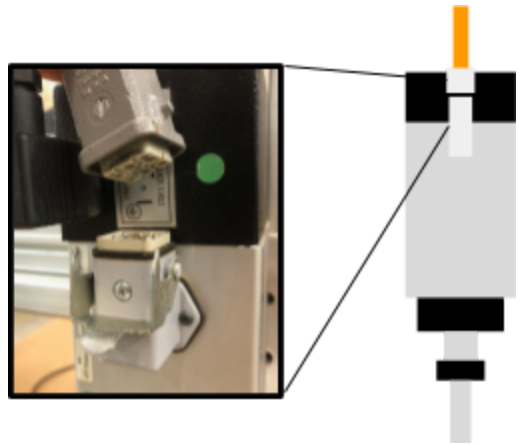
To test-run the spindle, turn on output #1 by clicking the “1” in the list of outputs under the digital position readout. Then open the manual control keypad; you’ll receive a warning that the spindle is about to start. Click “OK” on this warning and see if your spindle starts up. If not -- we’ll need to troubleshoot!



When the box is first powered on, you should hear a loud “clunk” caused by the contactor engaging to supply power to the VFD -- after a few seconds, the VFD should power on. If this does not happen, there may be an issue with the VFD or the circuit providing power to the VFD.

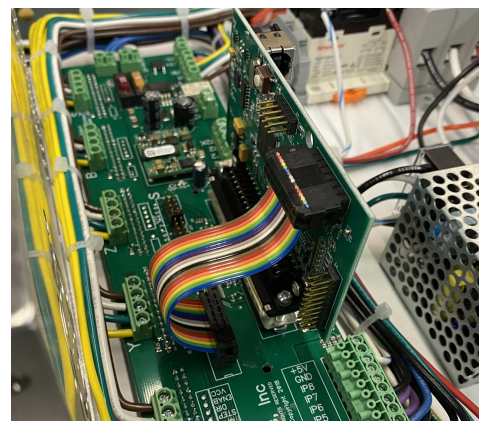
The first thing to check is that the “E-Stop” button is not depressed; twist the cap clockwise on the button to release it if it is depressed. Next, check that the key switch on the pendant is set to “engaged”. When the key switch is engaged, the VFD should receive power and numbers should show on the display. Inside the box, turning the key should engage the spindle interlock relay, causing an LED at the center of the relay to light up green. If either the small relay or the large contactor are not engaged -- there may be a problem with your power supply or the pendant key switch -- contact ShopBot support for more information.

If the VFD is powered on, but your spindle is still not starting, there are a few more things to check. First, make sure that the orange spindle cable is plugged into the spindle on your tool.



Next, check the settings on the VFD. Locate the button labelled “LO/RE” and press it. A red led should light up next to the LO/RE indicator below the VFD display. This will allow you to control the spindle from the VFD control pad. Press the green “RUN” button to start the spindle. Press the red “STOP” button to stop the spindle. Once you are done with this test, press the “LO/RE” button again to turn off the indicator light.

Finally, check that the ribbon cable is plugged in correctly; connecting the controller card to the control board. The blue conductor on the ribbon cable should be on the outside -- and the black connectors on the ends of the ribbon cable must be aligned properly with the headers on both cards. The ribbon cable communicates the spindle start signal from the controller card to the main control board and must be connected for the spindle to function. If you have completed these checks and your spindle still does not start, contact ShopBot support.



Troubleshooting the Motor Control System

If your motors are not moving, first make sure that the E-stop button is not depressed. Twist the E-stop button on the pendant clockwise to disengage. Also check that the spindle interlock is engaged using the key switch on the pendant.

Next check your control software. Perform a settings reset by clicking the utilities menu and choosing “Reset default settings...”. Choose the correct settings file based on the tool you own. Once the reset is complete, try moving the tool around with the manual control keypad.

To check the motor connections--make sure that your tool is powered OFF; plugging or unplugging motor cables with the power on may damage the electronics of the tool. Unplug and replug all motor connectors; checking for any loose wires on the motor lines. Power the tool back on and check for motor motion. If the motors still do not move, open the control box to check on the status of the drivers.

The motors on your PRS Standard tool are controlled using Gecko G250x drivers. These drivers are concealed behind the main control board to protect them from any dust or debris that may get into the control box. With the power to the control box ON, red LEDs should be visible through holes milled in the main control board. These LEDs indicate that the drivers are powered on. If you do not see these lights, one of the drivers may have failed; contact ShopBot support.