Relay Booster for Autoswitch and remote control users

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There are three uses for this Relay Booster in Woodworking.

The first one is for remote controlling a large Dust Collector (DC) such as the Harbor Freight 2 HP unit that draws 60+ amps when starting and nearly 15 amps while running. There are a few inexpensive ($10-13) remote controls which would make it convenient to turn on and off the DC from the tool location. But, the remote controls are generally limited to less than 13 amps on motor control applications, some as low as 500 watts lighting and 1200 watts, resistive. It is hard to find some rated for 1800W motor loads because of the 60- and 70-amp starting surge currents. The schematic for this is shown in Figure 1.

The second application is the Sears Autoswitch (Sears item #00924031000 Mfr. model #24031), a $20 unit that plugs into the wall outlet. You plug a Table saw into the "Power Tool" socket and a Shop Vac or DC into the Accessory socket and when you turn on the power tool, the Accessory unit will come on, with a short delay. And when the power tool goes off, the accessory outlet will go off after a short delay. This works well, but one concern is that 15Amp-rated saws will need all the power from a AC branch circuit. The shop vac on the accessory port may need 8-10 amps itself, this will blow a typical 15-Amp circuit breaker when the saw is loaded down to near full power. The schematic for this is shown in Figure 2.

The third use is to use a 120V control line to control a device running on 220 or 240 volts (or even 440VAC). This may be the case for a Dust collector running off of 220V controlled by the Sears Autoswitch at 120 V or a remote control for 120V devices. The schematic for this is shown in Figure 3.

I have found a contactor, intended for HVAC use, that costs $6 and can easily handle the currents (up to 30Amp motor current) and voltages (up to 440VAC) used by the tools involved. The circuits are simple and besides the relay, very few and no hard to find parts may be needed.

Before you attempt this construction, however, I will warn that the usual issues with building AC circuits are involved – namely the danger of fire and electrocution for yourself and others. Furthermore, this circuit handles high currents, and improper construction techniques can result in fire even if the circuit is wired correctly according to the schematic. Therefore, only persons experienced and knowledgeable in wiring techniques for high voltage and high current electrical equipment should attempt this construction project. Failure to heed this warning and warnings in the text can result in electrocution, shock, fire, and loss of property and/or lives.

You also need to be able to follow simple schematics.

First you will need a contactor, this one was $6 plus $7.42 shipping. The seller's ebay ad said they had 1500 available (BTW Definite Purpose is the manufacturer's name).
http://stores.ebay.com/Pioneer-Breaker-Control-Supply

NEW DEFINITE PURPOSE CONTACTOR 120V coil 30/40amp 2pole

Ebay Item number: 7600447952

Next you will need the following parts:

Duplex grounded AC outlet and cover plate ~$2

AC grounded extension cord or replacement cord 12/3 (preferred) or 14/3, 6 or 10 (preferred) feet long, if you get an extension cord we will cut off the female end. ~$8

Salvaged lamp cord with 2-prong plug $0

Strain relief / cord grip $0.30

Miscellaneous crimp-on terminal lugs and a good crimp tool. You will need four #22 ga. ¼" female quick connects (QC), 4 #12-14 ga, #10 screw spade lugs, and a handful of #12 gauge wire and #22 gauge wire spade lugs to fit #8 screw terminals.

First, if you bought or have a replacement cord, then it has a male connector at one end and a cut-off or pigtailed end at the other. If you have an extension cord instead of a replacement cord, cut off the female connector to make it just like the replacement cord.

You will notice on the attached schematic drawings that I have drawn the wires with red, blue and green lines. The Red lines handle 15 Amps and should be connected with 12 or 14 ga. Wire. I just cut off about 8" inches of the end of the replacement cord to have enough wire for these.

The blue lines can be ordinary zip cord, they won't handle but a small fraction of an amp. I just cut off about 8" inches off my salvaged lamp cord.

The optional green lines (AutoSwitch only) are needed only if you need the second convenience AC outlet. The gauge depends upon the load to be applied. I would leave this off unless you really wanted it, then it would take 12 or 14 gage wires because you never can predict what will be plugged in (might be the DC). You can connect these to the QC terminals at terminal A&C of the contactor.

First wire the AC power cord through the strain relief and clamp it so that the internal wiring will not be strained. Strip and crimp the white and black wires to the large spade lugs. Make sure these are totally and securely crimped because if they are not it might overheat and cause a fire. A good electrical connection is also a good mechanical connection you should be able to tug hard on the wires and the wires should not move in the lug. Connect one lug to the "A" and one to the "C" terminal of the contactor.

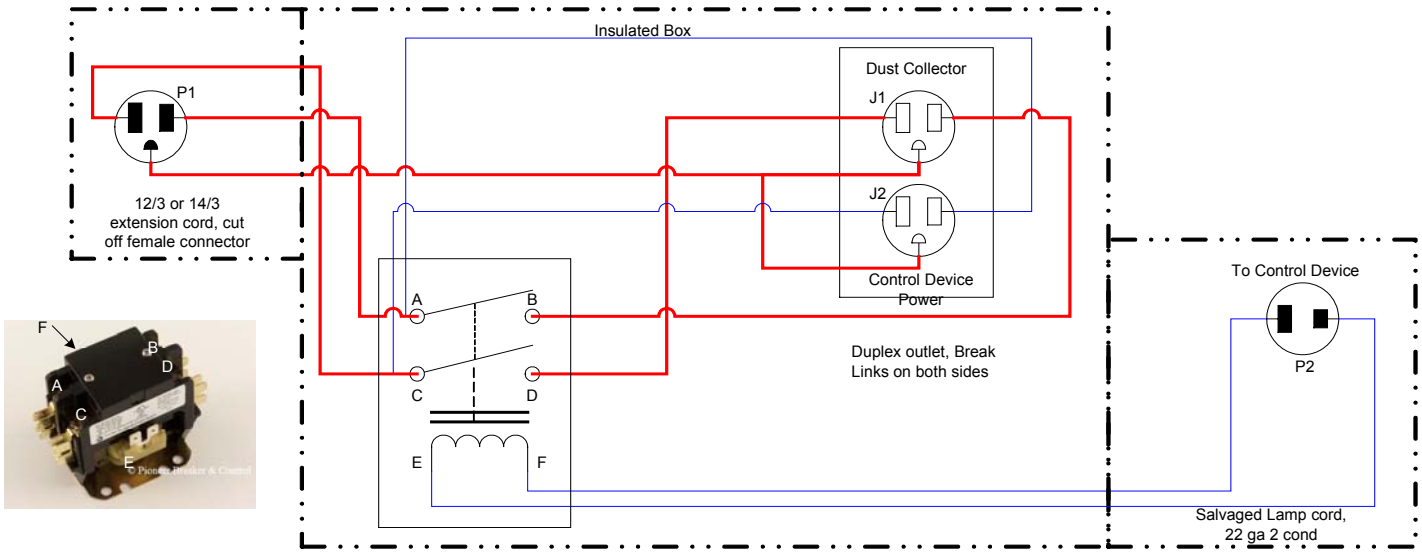
Take the short 14 or 12 ga. Black and white Wires and crimp a large spade lug to both ends. Connect one end to the B and D terminals (matching the color on the A and C terminals). The other end of the white wire to the silver terminal on one socket of the duplex plug. The black wire to the brass colored terminal on the other side of the duplex socket. Connect the ground of the input power cord to the ground on the outlet.

Crimp the ¼" QC lugs to the end of the lamp cord. Connect the lugs to terminals E & F of the contactor.

If you are building the remote control version (figure 1), then you will use the second socket to power the remote receiver, so you need to separate the links that connect the two sockets together. If you are making the second socket always live for a convenience outlet then you also need to

separate the links. If building the voltage booster version, use a simplex outlet for the 220V to the DC.

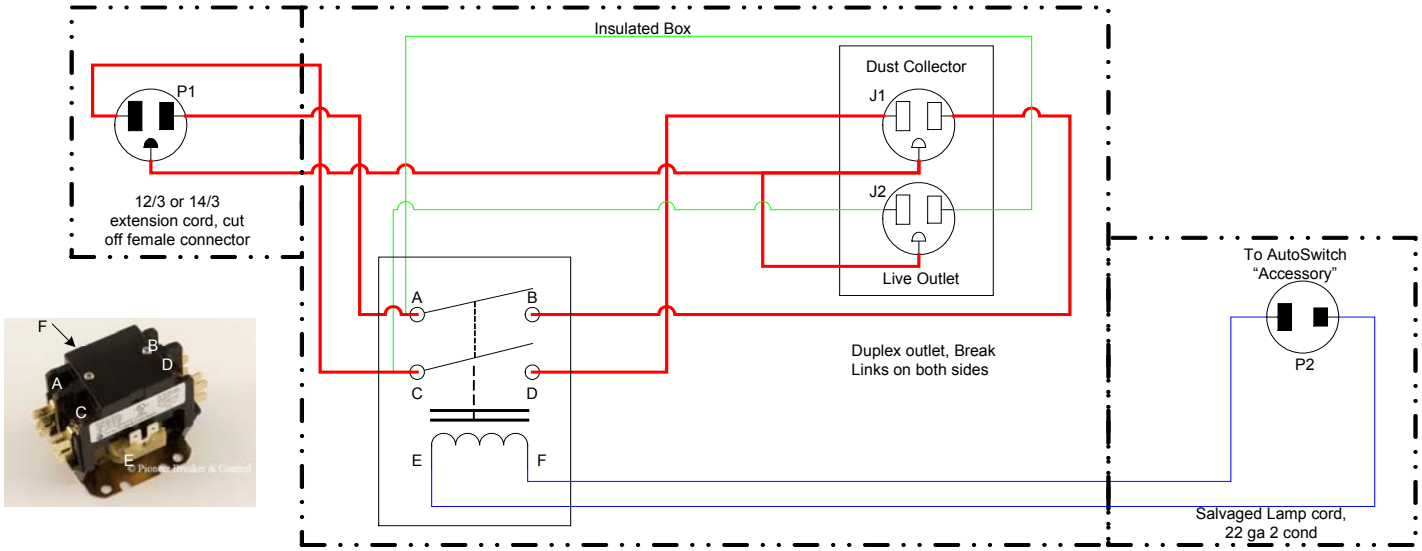
Following are the schematic variations I described for the three uses I described earlier.



Remote Control Booster

Plug P1 into AC outlet. Plug DC into socket J1
Plug remote control into "Control Device Power" socket J2.
Plug "to Control Device" plug P2 into remote control

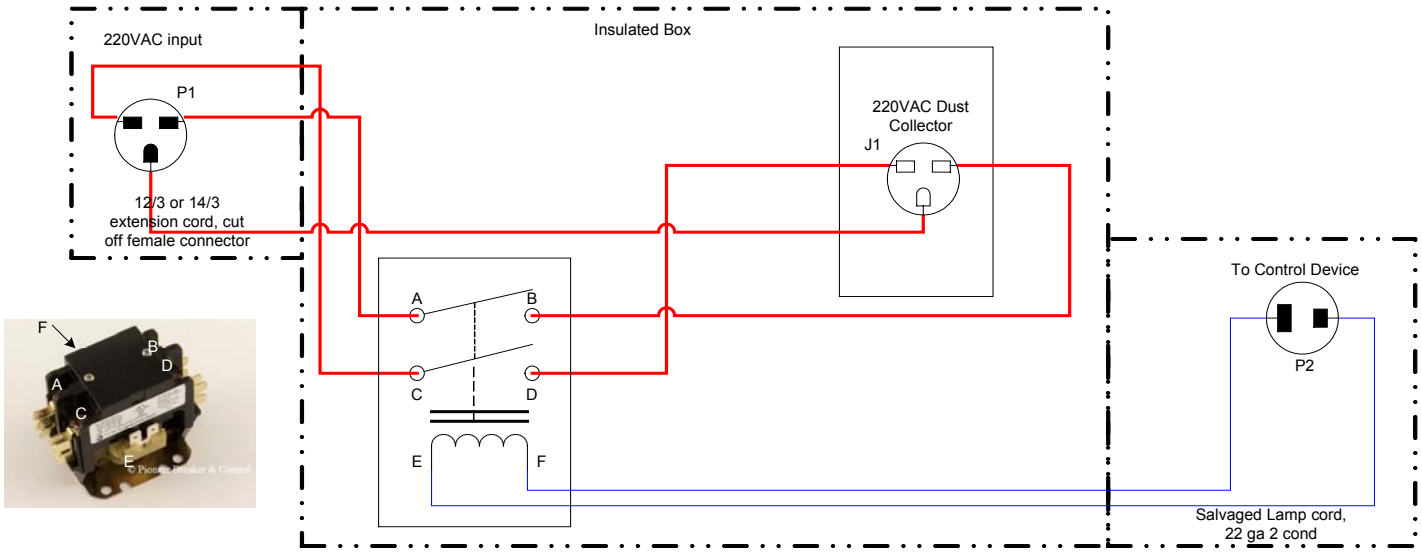
Figure 1



Sears AutoSwitch Booster

Plug Sears AutoSwitch into Wall Socket on circuit to power Table Saw
Plug TS into "Power Tool" socket on Autoswitch
Plug P2 into "Accessory" socket on Autoswitch
Plug P1 into AC branch circuit Different from TS

Figure 2



Switch 220V from 110 control line

Plug P1 into 220VAC shop outlet.
Plug 220VAC Dust Collector unit into socket J1
Plug remote control or Autoswitch into available 110V AC outlet in shop.
Plug "to Control Device" plug P2 into remote control or Autoswitch "Accessory" jack

Figure 3

The construction of the box was done using simple 5/8" MDF. The box was made with an internal space of about 9" long, 3" wide and 3" tall to accommodate the relay and the duplex outlet with sufficient room to place the wiring to the lugs and terminals.

I mounted the contactor to the bottom (although in retrospect it would have been easier to mount it to the top). I mounted the outlet to the top of the box after cutting a hole big enough to pass the guts but secure the outlet by the screw holes on the ears. A normal wall plate covered the outlet. No ventilation was deemed necessary, the internal power dissipation being limited to the contactor holding power requirements of only 5 watts or so. The input power cord I passed through a hole in the end of the box with a cable strain relief to secure it.

The control line cord I simply passed through a small hole in the side of the box, you can strain relieve this with a knot in the cord. You will need just a few inches for this cord if you are plugging into a remote control mounted to the outlet on the top. Or, you will need several feet if you are going to a remote plugged in elsewhere (for example boosting 220V) or to an Autoswitch.

Label the outlets "DC" (or "Dust Collector") and "Remote Control Power".

Figure 4 below shows the box.

Figure 4

Testing is easy, first plug the input cord into the wall and check with a voltmeter that the output socket is dead (near 0 volts) and the supply socket for the remote is at or near 120V. Then make the connections described in the text below the applicable figure. Check with the voltmeter that the DC outlet is at or near zero volts. Activate the remote (or controlling tool if using the Autoswitch) and then see if the DC outlet is supplying the appropriate voltage (120 or 240 as you have wired it). You should hear the contactor relay click at that time. If the contactor does not actuate, you can eliminate the remote control device by plugging in the control cord (old Lamp cord, P2) directly into an active 120VAC outlet – this should click the contactor. If not, check the contactor coil wiring to E&F. If it does click but the DC does not come on, then check the wiring to terminals A, B, C and D of the contactor and to P1 input cord and J1 outlet socket.

If all is well, then plug in your DC and run the test again verifying that the DC is controlled as intended and that everything is running normally (no slow motors or loss of power, dim lights, etc.

Disclaimer – This design is straightforward but I have only tested the Figure 1 configuration. While I believe them to be correct, I do not guarantee them, nor can I guarantee that the schematics or descriptions herein are free from errors. As warned before there are several factors that make this an unsuitable, even dangerous, project for non-technically able persons. I have attempted to illuminate the key points of safety but it up to the builder to ensure final safety. Use this at your own risk. If you feel uncomfortable with your understanding, have them reviewed and constructed by an competent engineer.