

How to Rewire a Felder RL-200 Dust Collector to Run off of Single Phase Power Using a VFD

I recently installed a Felder RL-200 dust collector to replace a fractured cyclone unit. Following this discussion of how to make the RL-200 run properly from a VFD with single phase power in, I have copied a couple of Felder Owner's Group postings that describe the circumstances surrounding this change. That will give you more of the context for this short tutorial.

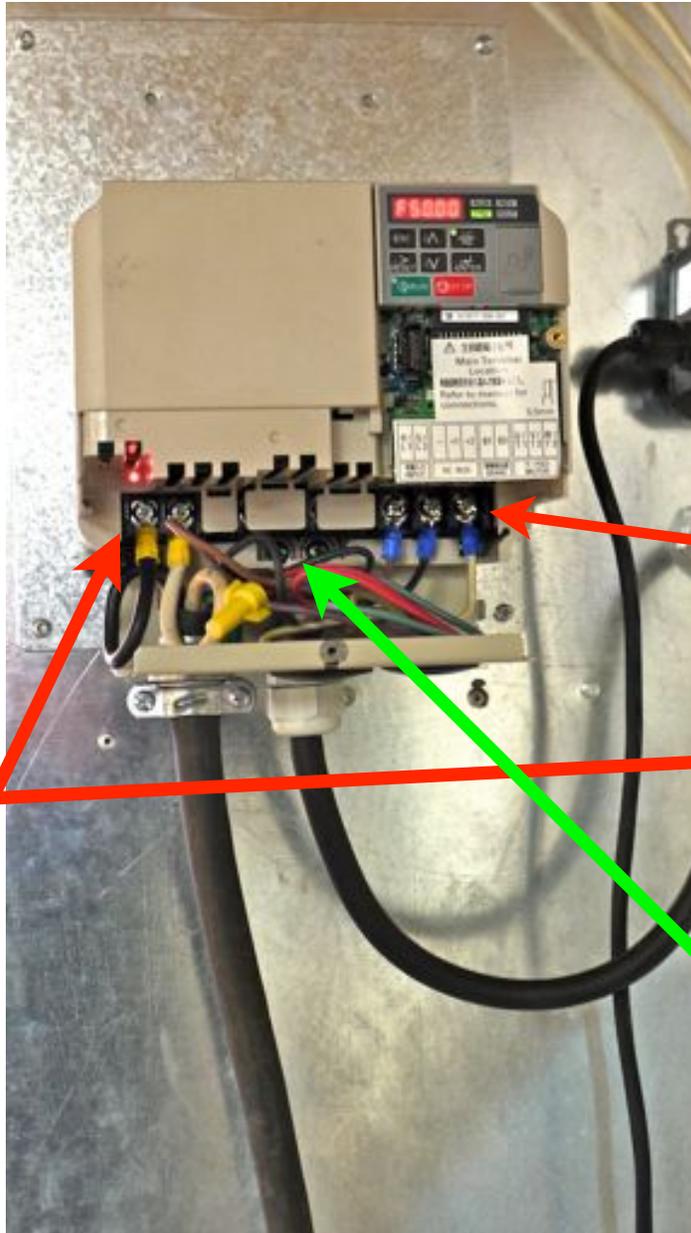
Before going any further, I want to make it clear that I am not an electrical engineer and am only sharing what I did that seems to work. You must decide for yourself what would be right for you. If you do decide to follow some or all of what is outlined here, you do so at your own risk.

The Felder RL dust collectors are highly regarded for their combination of performance and cleanliness. They pass the stringent German indoor air quality standards and return air to the room that is cleaner than the air in the room in the first place.

Felder uses mechanical electronics to provide soft start and motor overload protection. The motor in this unit is a six wire, three phase motor. From the wiring diagram it appears that upon start-up two sets of relays close. One connects the three phase power coming in to an overload protector and from there to the U1, V1 and W1 wires on the motor. The second relay connects three phase power to the U2, V2 and W2 wires on the motor. Apparently that causes the motor to start up in a half speed mode, greatly reducing the amp draw of the motor. After a settable time (6 seconds on my machine) that second set of relays opens and a third relay closes which gangs the U2, V2 and W2 wires together putting the motor into full speed mode which seems to be the normal run mode for the machine.

Additional electronics inside the Felder supplied control box allows an external manometer to shut the unit down if the air pressure differential above and below the filters reaches a set point indicating the filters are too dirty to continue operation and need to be cleaned. There also is the over-amp-load shut down circuit plus some circuits pertaining to automatically starting and stopping the machine from Felder supplied extra cost blast gates.

The Yaskawa AC Drive-V1000 VFD that I used to replace the Felder electronic controls not only converts 220vac single phase power to three phase power covering a user settable range of ac voltages, it also provides for variable speed by allowing the user to alter the frequency, a soft start ramp up/down that minimizes amp draw over a range of operating conditions, and much, much more. It easily allows for simple remote control over the unit by using a simple wireless contactor and it allows the original Felder supplied manometer to also be used to shut the system down if the filters become overly clogged.



Installation could not be simpler. I removed the Felder control box and placed the Yaskawa unit in that same location on the air-in end of the machine. I used the original Felder seven wire bundle running from the motor to the Yaskawa unit. The black, brown and white wires that connect to the U1, V1 and W1 on the motor connect to the T1, T2 and T3 terminals on the output side of the Yaskawa unit as shown here. They are the right most terminals in this picture.

The single phase 220vac wires coming from the breaker panel connect to the two left most terminals in this picture. The ground wire coming in with the 220vac single phase bundle and the ground wire coming in with the three phase seven wire motor bundle both connect to the center ground terminals hiding between the in and out terminal sets. The other three wires coming from the motor (the ones that connect to U2, V2 and W2) are simply ganged together with a wire nut.

That's all there is to it. The rest is all done by programming the Yaskawa unit using the front panel buttons and the display shown. It couldn't be easier.

Here are some pictures of the RL-200 installed in my studio and gallery. The unit is quiet and clean although a bit industrial-ugly in appearance!

The studio and gallery are open to one another on the first floor of this old building. The dust



collector sits along one wall right between these two areas. I may do something to dress it up when I get some time but for now it works just fine and I am pleased by its performance. I am really pleased by how easy it is to change parameters/functions on the Yaskawa unit and how easy it is to monitor a whole range of motor operating parameters.

Here are some early observations on the VFD controlled RL-200. First, my plumbing is far from optimum. It is a combination of an 8" main trunk, two (three planned but the third not yet implemented) 6" laterals going both above on the ceiling and below the floor, each of which have 4" drops, most of those using inefficient flex hose. With the Clearvue and another previous 5hp cyclone, I could effectively work with at most two blast gates open if the filters were clean and the bin empty. More than that and the air flow dropped below acceptable levels, sometimes resulting in plugged laterals (what a mess).

With the RL200 running at a programmable 50 hz with all three blast gates open on my MM CU-300 Smart combo machine, I get as much or more air flow than I did with one blast gate open with the cyclones. With the programmable soft start, amp ramp up peaks at less than 13 amps and then only for less than a second. Normal run with those three gates open is just under 9 amps. Also open the 17" open side wide belt sander blast gate and the amp draw is 9.7 amps. Also open the Jesem router table blast gate and amp draw is 10 amps. Also open the gate on the MM 24" band saw and the amp draw is 10.2. At this point I am plumbing limited. Also opening the lathe 4" blast gate only increases the amp draw to 10.2, then also opening the oscillating belt sander gate and the draw is 10.3, then opening the rest of the blast gates only raises the amp draw to 10.35.

The noise level with the 200 against one wall where the gallery and studio meet is about the same as with the Clearvue cyclone in its sound deadened closet. When I get time I will experiment with a paint like coating called Silent Running made for the marine industry to quiet down engine and generator compartments. It works amazingly well in those applications so may help the noise coming from the RL series DCs as well. Remember, I have programmed the VFD to run my 200 at 50 hz. If I move it up to 60 hz, the noise level and the suction/air flow both increase significantly. I actually think I will be able to run in my normal production sequence with the DC at around 40 hz which will really quiet things down and dramatically reduce the running cost, but time will tell on this one.

Another feature I really like is the smart run monitoring the VFD does of the motor. It keeps track of how often the motor starts, the amp draw and how long it runs. From that info it calculates likely heat loading on the motor and will adjust in real time to make sure the motor never over heats or is over amped. If the filters clog up to the point that amp draw increases, it will monitor how much the amp draw has increased over time and will begin to issue warnings if it thinks the motor is working harder than what you program as your desired max amp draw profile (15 amps in my case).

I have yet to hook up the manometer, but will do so tomorrow. That will ramp things down if the differential in air pressure above and below the filter plates exceeds a set value. It works kinda like the auto over temp circuits on the rolling condo (a bus style motor coach) we full-timed in for four years about ten years ago. When the Cat diesel engine reached a certain temp, the controller would derate the engine by 25%. If you kept pushing it to the point that the temp rose a bit more it would derate by 50%. If you

still didn't get the message it would derate by 75% (barely able to move) and then shut the Cat down all together if it got any hotter to keep you from doing something really stupid. This VFD does much the same thing for the three phase motor in the RL200 or other three phase machines.

If any of you are interested, the VFD is available from Glenn Woodbury, Power and Control, Inc., Medford, OR. 541-779-8062, glenn@powerandcontrol.com. The "Quick start guide" is 213 pages long and it comes with a full set of manuals on a DVD. The cost was in the mid \$500s plus shipping. A very worthwhile way to make virtually any three phase machine work on US 220-240VAC single phase power. The normal disclaimers - no compensation, etc. - just a very satisfied customer at this point. I can't imagine why Felder doesn't ditch the mechanical soft start and motor protection stuff and bury a VFD inside. It would be far cheaper and by simple programming would allow one machine to operate all over the world.

The following is an initial post I made to thank the members of the Felder Owner's Group and others for a really remarkable few days.....

Thanks to the great help from this forum, Felder tech support and a number of others I am back up and in production again less than a week after the impeller housing fractured on my Clearvue cyclone dust collector spewing fine dust all over my studio and gallery. When I got it down for inspection it turns out that the main mounting plate and the motor mounting plate had also both warped and bowed more than an inch from the weight of the unit hanging from the wall so the whole thing would likely have fallen off the wall within a few months. That all happened at the end of last week. The Clearvue folks were great and immediately shipped replacement parts even though I had purchased this unit (their largest) from the previous owner of that business.

When I first installed this unit a few years ago, I made the mistake of building it into a sound deadened area against one wall in my open studio and gallery. I wanted to hide it from view and try to quiet things down since visitors to the gallery would see and hear it. That turned out to have some unintended consequences that always made that Clearvue unit problematic for me. Having it inside a closed area made it hard to get to the filters to clean them. I had to physically remove the filters, take them outside and bang them around on the driveway to remove the caked on fine dust. It also made it hard for me to know when the collection bin was filling up. I had to open a door, remove the lid from the metal drum bin and look to see the level of the chips - something I sometimes did not do often enough. If you ever fill up the bin on a cyclone, the remaining incoming chips and dust will be shunted directly into the cylindrical filters packing them and cutting off the air flow. It all can happen so fast you don't even realize it is occurring until it is too late. Once the filters fill up it is a real mess to remove them, carry them outside dropping stuff everywhere to clean them out. It is a real productivity killer. This is not the fault of the design of cyclones, it is pilot error. But, once you isolate the cyclone bin and filters from easy access, it becomes a real problem for a heavy user like me.

So, while waiting for the needed replacement components I thought I should also see what Felder units might be available as I thought the RL series might well solve several of my issues with cyclones. The Clearvue was the third cyclone I had implemented and was clearly the best of those three, but these productivity issues remained. On Friday I called Felder to see if they had any RL 160 units available in either single or three phase. The answer was there are none in the US available and the next batch would not be here until Feb - too late for my needs. I then made an initial posting on this chat group asking about availability of a used 160. Over the week end I received suggestions from several of you both about 160s and in one case an ad for two 200s that were in Bend, OR, about 225 miles away. First thing Monday morning I called on the 200s in Bend. They were owned by a guitar manufacturer who had just been acquired and the new owners wanted them to implement a central bag house system so they needed to get rid of two of their four 200s.

I made arrangements that morning to buy one of those units and they were willing to deliver it to me here. Around 4:00pm on Monday, the RL200 hit my front door. After making arrangements to buy this 200 (a three phase unit and I only have single phase power in my building) I began searching for a VFD. A friend in the region, Glen Woodbury, President of Power and Control Systems in Medford, OR, suggested a Yaskawa CIMR-BA0018FAA which is a 5hp single phase in, three phase out 17.5 amp unit that seemed perfect for this application. He ordered the unit for me and it arrived today. In the mean time the parts for the Clearvue also arrived so I at least had two chances of getting up and running to make the Christmas deliveries promised to customers. Conversations with Felder tech support resulted in emailed versions of the manual for this 2008 machine and, most importantly, a wiring diagram.

The 200 has very nice mechanical soft start controls and motor overload protection, but the VFD provides those plus variable speed and a host of programmable features way beyond the Felder supplied electronics like built in provisions for wireless remote control and easy implementation of the existing manometer auto shut down feature as well. Plus, it is made by Yaskawa USA in the Chicago region (a highly regarded Japanese manufacturer of industrial motors and controls) and has a 20 year mean time to failure! I removed all the Felder supplied electronics and now drive the 200 with just this VFD.

So, in less than a week, with the help from this group, from Felder tech support, from Glenn Woodbury and from Clearvue I went from dead in the water to back in production. A hearty thanks to each of you!