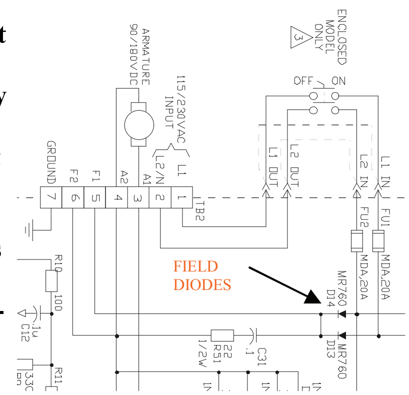
Shop "Tech Talk" May 2008

Q.	**When a small dc motor , a motor whose control is fed from a single phase line, stops working how can we find out if it is the motor or the drive that is the problem?**

Troubleshooting Small DC Motors and Controls

1. First things first. Turn off the power to the control and motor. Next lay your hands on the motor and feel its temperature, also open the drive enclosure and look for visible sign of damage. While doing all this notice if the motor or the control has a burned smell to it. If either one does then it is probably damaged beyond immediate repair.
2. If no adverse smells then we need to disconnect the motor wires from its control. Then we should check out any fuses in the drive and then turn on the power to the control and measure the voltage to make sure it is correct and present. At the same time we should measure the field voltage to see if it is present. If we have a permanent magnet dc motor we will not have any wires connected to the drive's field terminals. The field voltage is immediately present at the field terminals as soon as the ac power is switched on, incoming ac power goes through the drive fuses then to the 2 field diodes and then to F1 and F2 . If everything looks good then the next thing to check is whether the control can vary the dc armature voltage.
3. To do this we need to put a load across the A1 and A2 armature voltage terminals. My suggestion is to use the pigtail lamp holder device as shown in the picture. If the drive is hooked up for 120v ac input then all we need is the lampholder with a 120v,100 watt light bulb watt screwed into it and its 2 wires connected to A1 and A2 terminals. Make sure the bulb is good before you start this. It may strike you as strange that you can test out a drive with light bulbs but it is true and the same technique can be used on much larger drives. If you now turn up the speed pot the bulb should start to glow and eventually be real bright as you get to 90v. If the motor is 180v armature, 230v single phase input, then you will need to put 2 of the lamp holders in series and connect the outer 2 wires to A1 and A2. If the motor should have a tach generator connected to it for tach feedback then this test will not work unless we remove the tach wires connected to the drive and re-configure the drive for armature feedback (usually a jumper connection). It is rare on a small dc drive to have tach feedback but it is as well to be warned ahead of time.



<u>Now we need to check out the dc motor</u>

If the motor is a dc permanent magnet motor then we do not have a field winding only an armature winding, brushes and stationary field magnets. What we can check is the following:

1. Is the armature grounded. If we were blowing fuses in the drive this could be a possible cause. Check with megger A1 and A2 to ground, should be greater than 2 meg ohms minimum
2. Are the brushes worn out? Remove brushes and see what the face of the brush looks like to see how much of the face is being used in the commutation process and how short the brushes are.
3. The resistance of the armature is going to be less than 5 ohms so resistance measurement may not be accurate but at least we can tell if we have an open circuit between A1 and A2
4. The only way without a special field strength meter to check the magnet assembly is when you have a running motor and drive to measure the no load speed of the motor with full armature and field voltage applied. When the magnets weaken this running speed will be higher than nameplate value. Whenever we weaken a dc motor field by reducing the field voltage at the motor terminals the motor will speed up. If the field magnets have weakened then I would replace the motor.

If the motor is a wound field motor and if we assume it is a shunt motor (series motors very rare in industrial plants) then the field windings are often dual voltage rated with 4 leads for 50/100v or 100/200v. Here we can measure the resistance between F1 and F2 and compare it to the resistance between F3 and F4. They should be equal. If the value of the field winding resistance is not on the nameplate we can see if what we measured looks correct by adding the F1 to F2 resistance and the F3 to F4 resistance together , let's say it comes to 650 ohms. Because we have added the 2 resistances together we are assuming a series hook up which would apply when we apply the maximum of the 2 field voltages to the motor. From the nameplate we see that the max field volts is 200v and the current is 0.3 amps. From ohm's law the resistance should be 200/0.3 = 666 ohms That's close enough. It would be reasonable to assume the field resistance looked good. <u>The nameplate amps, if not specified at what temperature, are always HOT AMPS and we should remember that a field resistance will increase as much as 40% from cold to hot, from say 465 ohms cold to 650 ohms when hot.</u>

Holland Industrial,518 West Montgomery Street,Henderson,NC.,27536

Tel. 1-800-232-7541, Fax 1-252-492-2444 , E-Mail: sales @ hollandindustrial.com