

TERMINATING VFD CABLE INSIDE INTERMEDIATE TERMINATION BOXES

Proper termination of variable frequency drive (VFD) cable is essential to realizing the benefits that can be achieved from using this special cable. These benefits include reducing electromagnetic interference (EMI), minimizing ground currents, controlling common mode current (which if left uncontrolled can damage motor bearings), and more. These benefits result in reduced downtime, fewer drive trips, and improved system performance. These benefits, however, can only be achieved through proper termination of the cable.

Southwire Company, LLC has a great application note on VFD cable termination, titled **Begin with the End in Mind – Proper VFD Cable Termination**. While that application note discusses the basics, it only addresses the simple system involving a drive, a motor, and a cable connecting them. If that's the system you have, that application note is all you need. But many systems are more complex. Some systems involve a quick disconnect between the drive and the motor. Other systems may have a junction box between the drive and the motor. And still other systems might have both. In cases like this, it is important to know how to handle cable termination into and out of these additional components.

The concept is simple. Ideally, you only want a VFD cable between the drive and the motor, with the cable's shield terminated at both ends with low impedance at high frequency terminations. With this in place, you now have a shield which minimizes radiated EMI and acts as a return path for the high frequency common mode current which the drive creates and pushes down the cable to the motor.

But sometimes stuff gets in the way of this simple, ideal path. Someone decides they need a quick disconnect in the system or someone has a junction box they are just dying to install along the way. These devices interrupt the continuous path of the shield, so, if the termination at these devices is not handled properly then poof – you lose the benefits your VFD cable provides.

So, what do you want to do? You want to maintain a continuous path through the cable shield so the common mode current that is generated can flow back from the motor to the drive through that shield. This can be achieved by bonding the cable's shield at the device input and output. The bond should be low impedance at high frequency (just like the cable shield). In addition, this bond should be isolated from the device ground just like the cable shield is isolated from building ground along its entire run length. The reason for this is to prevent a jumping off point for this high frequency current. You want the current to be contained inside the cable as it returns to the drive. If not, that current can jump off and make its way back to the drive through building steel, which, because of its large surface area, has a very low transfer impedance at high frequency due to the skin effect. If the current jumps off, it will return to the drive via an uncontrolled path. If that path takes that high frequency current close to sensitive control or communication equipment, that equipment can have problems operating properly. Problems like this can be difficult to troubleshoot!



So how can this be done? That depends on both the kind of cable and the kind of device you are going in and out of.

If your cable has a copper tape or copper braid shield and your termination box is metal

1. Bring the jacketed cable into the enclosure and secure with a cable gland
2. Expose the cable shield inside enclosure
3. Terminate each cable shield to a shield bonding braid with a constant force spring
4. Slide a section of shrink wrap over each shield bonding braid and shrink. This isolates the bond from the enclosure
5. Connect braids together with nuts and bolts. Insulate the braid and connection with electrical tape and/or shrink/wrap

If your cable has a copper tape or copper braid shield and your termination box is not metal

1. Bring the jacketed cable into the enclosure and secure with an insulating cable gland
2. Expose the cable shield inside enclosure
3. Terminate each cable shield to a shield bonding braid with a constant force spring
4. Connect braids together with nuts and bolts. Insulate the connection with electrical tape

If you are using Armor-X® cable and your termination box is metal

1. Isolate your box from building steel. This can be done by using nylon bolts, nuts, and washers
2. Use standard armor connectors on each cable end
3. Terminate phase and ground wires in normal fashion

If you are using Armor-X® cable and your termination box is not metal

1. Use standard armor connectors on each cable end
2. Terminate phase and ground wires in normal fashion
3. Bond cable connectors with grounding bushings and shield bonding braid