



Application Note #101 6-22-10

Connection recommendations for the FC, TC and MC products.

This application note outlines the best connection practices for connecting the high current connections of the load controllers.

It should be noted that the connections to Water Heating loads represent both high voltage and high current. Improper termination can result in excessive contact resistance at the junction of the wires which can result in an excessive temperature rise at the wire junction. This is not a defect of the product or the associated wiring but is an installation issue that must be addressed by the installer and the materials chosen for the installation. As in all electrical appliances and controls, the wiring connections must be proper and low contact resistance.

This document is a compilation of comments from independent installers with experience in installation and is intended as a guide as to their experiences. EnTek does, however, suggest strongly that as with any electrical connection, good mechanical connection be made as well as a sound electrical connection.

Wire nuts are commonly used for connections to Water Heaters and can be used both safely and successfully when the wires are properly stripped and mechanically twisted together before application of the wire nut.

Paraphrased comments from Professional Installers :

- 1) In regard to making the 30A connection from the switches #12 stranded to usually a #10 solid or wire stranded to/from the appliance to be controlled.

The first thing I'd like to mention is that " installation technique" is far more important than the particular brand or type of wire nut or other connecting component. I cannot emphasize this too much.

Wire nuts are not a rated pressure connector for current, they are listed by how many, and what sizes of wires (combinations of wires) that they can contain.

For shop applications, where we are sub-assembling pigtails to the switches, I prefer using Buchanan crimp-on connectors (ferrule and cap style)

For field applications I prefer the Ideal 76B (red) wire nut. This older style has the flat top, fluted sides, no side wings. Again, installation technique is vital, and this style allows for a more consistent installation.

- 2) Scientific Atlanta commissioned a study at Georgia Tech for recommendations for wire nut connections. This study resulted in the recommendation of the 3M Scotch-Lok (red) wire nut based on contact resistance (thus temperature rise) and mechanical security. Once installed properly they absolutely will not come off, and sometimes have to be removed by cutting the wires at the junction point. Proper installation is, however, much more difficult than the Ideal brand. The 3M is hard to

get started, resulting in many of them being scrapped, and/or the chance of a poor connection if not properly threaded making technique again a critical component of the installation.

- 3) The ferrule type connection is the very best and in my view the preferred connection. These connections use high pressure to both secure the wire from moving and lowering the contact resistance through multiple pressure points. The down side to this type of connection is that a tool is required (almost all electricians have one of these) and the connection is permanent. To replace the Load Controller, a small amount of wire must be trimmed off each wire and then re-stripped / terminated. The upside is that the connection resistance is minimal and secure. New types of connections are on the market using high pressure connections (still requiring a crimping tool) and having an integrated insulator over the connection point.

Regardless of the connection means used, good practice must be incorporated where there is sufficient physical wire contact and mechanical integrity to assure that a tight connection will be assured over time. At all times local and National codes must be followed.

While this document appears to represent that these connections are troublesome, there are millions of EnTek and similar controllers successfully installed in the field with good connections. This document is solely to draw attention to these connections so that good practice is used in all connections and that overheated connections are minimized.

It must be stressed that there is nothing in the load controllers that can cause connection temperatures to rise. If there is burning or discoloration of insulation at or near the wire connections the problem is contact resistance from an inadequate connection.