

## Conductor Identification for Control Cables



Who says cables are boring -- that they're just round and black? In fact, they are often composed of a rainbow of colors. A better understanding of conductor identification methods can help you reach that "pot of gold at the end of the rainbow".

### A Night of Color

We suspect that electrical inspectors and electrical engineers dream in color. When inspectors dream, they probably dream of catching cable users in the act of violating NEC (National Electrical Code) requirements for color coding. The electrical engineer, on the other hand, has nightmares in which he must *correctly* hook up each conductor of, say, a 37 conductor control cable that has *no* color code. Have you ever tried to open a safe without it's combination?

To prevent such unpleasant and expensive situations, ICEA (Insulated Cable Engineers Association) and NEMA (National Electrical Manufacturers Association) standards describe *methods* of application and *color sequences* for conductor identification. In the latest ICEA/NEMA standard for control cables dated 1990 (ICEA S-73-532/NEMA WC 57), conductor identification methods and color sequences are given in Appendix E. In earlier documents they were located in Appendix K.

### Methods

Each conductor identification method has been assigned a reference number by ICEA/NEMA and are known as "Method 1", "Method 2", "Method 3", etc. The most common methods are:

- **Method 1** -- Solid base color with colored stripes
- **Method 4** -- Surface printing of numbers (no colors)

### Color Sequences

Color sequences are the base (background) and stripe colors that are assigned to each conductor in the cable, starting at the center and working outward in a circular pattern. The color sequence is clockwise when viewed from one end of the cable and counter clockwise

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(C-2 continued)

when viewed from the other. An example of a color sequence is black for conductor # 1, white for # 2, red for # 3, etc. The most common ICEA/NEMA color sequences, E-1 and E-2, are reproduced in **Wire Wisdom** No. C-3.

### **Who Uses What?**

Although there are eight different ICEA/NEMA methods and six different ICEA/NEMA color sequences for conductor identification, thankfully, only three combinations are in common use:

- **Method 1 using the Table E-1 color sequence**
- **Method 1 using the Table E-2 color sequence**
- **Method 4 using printed numbers (no colors)**

The NEC specifies that white conductors can *only* be used as neutral (ground) conductors and that green conductors can *only* be used as equipment grounding conductors.

The E-1 color sequence has repeating white and green conductors. So Table E-1 colors can not, in general, be used for NEC applications. The E-1 color sequence is typically used by utilities because their facilities are frequently *not* subject to the NEC.

The E-2 color sequence does *not* include white or green conductors. The E-2 colors are normally used in industrial and commercial facilities subject to the NEC where neutral and grounding conductors are not required by the equipment being interconnected. If white and/or green conductors are needed in an otherwise E-2 coded cable, ICEA allows them to be inserted as the 2nd and/or 3rd conductor in Table E-2. All remaining colors are then “bumped” up one (or two) positions on the list.

<b>Type of User</b>	<b>ICEA/NEMA Method</b>	<b>ICEA/NEMA Color Sequence</b>
Utilities (non NEC)	1	E-1 (formerly K-1)
Industrial/Commercial (NEC)	1	E-2 (formerly K-2)
Miscellaneous	4	Not Applicable

If all this talk about colors has left you seeing red, take a deep breath and relax. Just remember that detailed information on conductor identification methods can be found in the control cable section of Anixter’s Wire & Cable Catalog as well as in Anixter’s Wire & Cable Technical Information Manual.