

## 1. Purpose

The identification of electrical conductors (insulated wires or stranded conductors) between the various electrical equipment on a model railroad layout (power supply, control equipment, accessories) and the connection to the track layout (track wiring) simplifies error finding in the wiring, working with schematics, as well as the assembly of modular layouts.<sup>1)</sup>

This standard does not apply for the internal wiring of the equipment.

## 2. Identification of Conductors

For identification of the function of the conductors we have the following possibilities:

- Color of the insulation surround of the conductors (color code, section 2.1)
- Markings on the conductor ends at the connectors (section 2.2)

### 2.1 Color Codes

Conductor are used with colored insulation according to the "International Color Code for UL-/CSA-Control Lines" according to Table 1.

**Table 1: Conductor Identification Colors**

Conductor Type	Color	D	F	GB
<b>Power supply lines, direct current:</b>				
Common return (ground, GND)	black	sw	nr	BK
Direct current conductor (positive vs <b>GND</b> )	red	rt	rg	RD
Direct current conductor (negative vs <b>GND</b> )	blue	bl	bl	BU
<b>Power supply lines, alternating current:</b>				
Alternating current conductor	gray	gr	gr	GY
Alternating current conductor pair ( one conductor with markings)	gray			
<b>Power supply lines, digital power:<sup>2)</sup></b>				
Conductor of positive waveform	red	rt	rg	RD
Conductor of negative waveform	brown (color copper)	br	br	BN
<b>Control lines Motor or electromagnetic items:</b>				
Switching current Return line for Turnouts, Signals, Accessories	white	ws	bhc	WH
Switching current for straight or positive position	yellow	ge	jn	YE
Switching current for branching or negative position	green	gn	vt	GN
<b>Signaling and Feedback Conductors:</b>				
general color code	brown	br	br	BN
<u>by choice</u> this conductor also in orange	orange	or	or	OG
<b>Other Conductors</b>	violet	vi	vi	VT

<sup>1)</sup> To understand the terms used, see standards NEM 600, 602 und 603.

<sup>2)</sup> Due to the symmetry of the digital power supply, a paired conductor is recommended.

For more detailed differentiation of these control, signal, and feedback conductors, these may be identified by two color schemes as described in tables 2 and 3.

**Table 2: Two Color Identification of Control Wires**

Turnouts	green (without additional color)
Railway Signals	green-red
Other Accessories	green-gray, green-white

**Table 3: Two Color Identification of Signaling and Feedback Wires**

Occupancy reporting, static	brown (without additional color)
Occupancy reporting, dynamic	brown-yellow
Feedback turnouts	brown-green
Feedback railway signals	brown-red
Feedback other accessories	brown-gray

**Important Notice:** The color combination **green-yellow** is exclusively reserved for safety conductors in the low voltage mains power network (110V or 230V networks) and should only be used for those purposes! (also see NEM 609)

## 2.2 Markings at the Conductor Ends

If utilizing conductors of only one (arbitrary) color, one should mark their ends with heat shrink or labels in the color codes corresponding to tables 2-4.<sup>3)</sup>

The wiring of model railroad accessories generally requires several connections with the same color code. This is why their conductor ends may need supplemental marking with multiple colors.<sup>4)</sup>

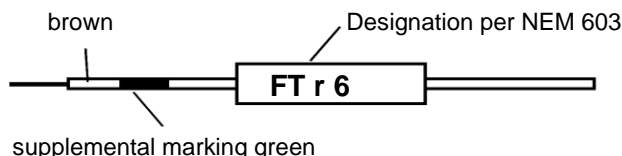
The utilized supplemental marking should be documented in the schematics. The supplemental markings are not needed if the conductor ends are labeled according to section 2.3.

## 2.3 Conductor End Marking

It is recommended, that the ends of the conductors are also labeled according to NEM 603 Figure 1 and if appropriate, sequentially numbered.

**Figure 1: Example for the exact marking of a conductor end:**

Feedback conductor for turnout 6, branching to the right position, color code brown, marking green



<sup>3)</sup> If no heat shrink is available, one can cut small tubes using the insulation of a larger diameter conductor of the same color, which can then be slid onto the ends of the conductors.

<sup>4)</sup> Example: A distance signal which has two green lights, gets for the first (upper) light a single marking in green, and for the second (lower) light two markings in green.

### **3. Usage of Multi-Core Cables**

#### **3.1 Round Cable**

The color code used for the individual conductors of these cables generally don't match the colors listed in section 2.1.

Round cables that contain a green-yellow conductor must not be used.

The ends of the individual conductors should be marked in accordance to sections 2.3 or 2.3.

#### **3.2 Flat / Ribbon Cable**

With flat or ribbon cable there is generally no color markings other than on one edge conductor. One should sequentially number the conductors starting with 1 for the color-marked edge conductor. This color-marked conductor will be GND insofar as it is utilized.

Conductors for power supply should be placed on the higher numbered conductors.

The small conductor cross section can be enlarged by using several parallel conductors (see NEM 604).

With ribbon cable marked according to international color coding, the outer conductor marked brown or red should be used as conductor number 1.

The assignments of the conductors is to be documented in the schematic.