



# 1 General

## 1.1 Introduction and Intended Use (Informative)

This Standard is the parent Standard for interfaces between decoders, locomotives, rolling stock and other vehicles on model railroads. There are daughter Standards for each individual type of interface.

S-9.1.1.1	Six and eight pin Interface
S-9.1.1.2	JST 9 Interface
S-9.1.1.3	21MTC Interface
S-9.1.1.4	PluX Interface
S-9.1.1.5	Next18 Interface

The purpose of these Standards is to simplify the installation and exchange of electronic devices (hereafter called decoders) which are designed to control or modify the behavior of motors, lights, and other similar accessories installed in locomotives and other rolling stock

This Standard applies to locomotives and cars of various sizes and scales, all kinds of controllers, (digital command control decoders in particular), and 2-rail, 3-rail, (central or trackside) and overhead wire power distribution systems.

The primary purpose of an interface is to make it easy to install a decoder between the power pick-up system and the motor(s), light(s), and/or other similar accessories within the locomotive, car, or vehicle. The interface should assure an easy, precise, and error-free installation or the exchange of a decoder. Installation or exchanges of decoders would need to use the same type of interface connector. Changing from one type of connector to another will require some rewiring. When an interface and/or decoder are installed in the locomotive or car by the manufacturer, this should be done in such a manner that it does not restrict the removal of the body from the chassis.

If no decoder is installed by the manufacturer; the decoder interface on the System Board shall be replaced by a "dummy plug" that will enable the locomotive or car to operate on DC as if no interface had been present. Enough room must be available around the installed interface to enable the replacement of the "dummy plug" with a decoder and any associated wiring.

Power rating values listed in the tables for each connector is for each pin of the interface. This does not account for the power requirement of the locomotive nor the power capacity of the decoder. Application of each interface must account for the electrical current requirements of the locomotive. It is recommended that locomotive manufacturers clearly document the required power for the motor and each light/function. Similarly, decoder manufacturers should clearly document the power rating capacity for the motor and light/function connections.

## 1.2 References

This standard should be interpreted in the context of the following NMRA Standards, Technical Notes, and Technical Information.

### 1.2.1 Normative

- S-9.1 Electrical Standards for Digital Command Control, which specifies signal voltages.

### 1.2.2 Informative

- TN-9.1.1 DCC Interfaces, which provides commentary on general DCC interface requirements
- TI-9.1.1 Sources for Connectors for DCC, which provides a list of manufacturer part numbers for DCC interface connectors. There are separate TI documents for each Standard e.g. TI-9.1.1.5

## 1.3 Terminology

Term	Definition
Vehicle	Mobile model railroad device. This includes locomotives and other rolling stock.
Decoder	DCC receiver for controlling vehicle animation.
System Board	Electronic circuit board that is considered part of the vehicle which a decoder is intended to be plugged into. Also called a motherboard.
Dummy Plug	A device when inserted in the System Board in place of a decoder will allow the Vehicle to operate on DC.

## 1.4 Requirements

To meet this Standard all mechanical and electrical values mentioned must be met and conform, unless otherwise noted. It is not necessary to implement all connections of the interface. The connections belonging to unimplemented features must remain unconnected. This applies to vehicles as well as for other devices that use this interface.

## 2 Mechanical Properties

Please refer to individual Standards S-9.1.1.X for the specifics of each type of connector.

## 3 Electrical Properties

Please refer to individual Standards S-9.1.1.X for the specifics of each type of connector.

### 3.1 Color Code of Wiring

In some cases a decoder or interface (motherboard) will be installed in the locomotive, car, or vehicle at the factory. The decoder or interface may be designed to install without wires and electrical connections made by means of contact points from the locomotive to the decoder or interface. In addition, the manufacturer may install a decoder or interface (motherboard) by wiring at the factory and shall make all of the connections correctly. If multiple colors of wire are used it is recommended that the color code is followed to facilitate troubleshooting or service later if required.

60 If a decoder requires the end user to install the decoder by making wire connections supplied on the  
decoder, Table 3.1 provides the color code Recommended Practice for these wires. If a decoder is  
supplied where the end user supplies the wire for connections to the decoder or motherboard (light  
board replacement) connection points must be clearly marked and documented in the instructions.  
In all cases the manufacturer is required to provide wiring diagrams or other documentation clearly  
65 showing all connections to the decoder. All other wiring connections beyond those listed have no  
recommended color, but may not reuse any of the colors in the Table 3.1 below. Also, the purpose  
of any other wiring connections must be documented.

Decoders that plug into a system board such as 21 MTC, PluX, Next18 have no wires or color  
codes. They must follow the pin assignment within each of those standards and shall provide  
70 documentation for installation or replacement of the decoder on the system board.

If a decoder has specific outputs and is wired with a connector to a device in a loco such as a smoke  
generator, remote un-coupler or other any color wire may be used so long as the connector is keyed  
is such a way that it is only used for the intended purpose.

COLOR	FUNCTION
RED	right-hand rail power pick-up (center rail, outside third rail, traction/overhead wire) to motor or interface
ORANGE	interface to motor (+) connected to right-hand rail (or center rail, outside third rail, traction wire)*
BLACK	left-hand rail power pick-up to motor or interface
GRAY	interface to motor (-) connected to left-hand rail <sup>1</sup> *
WHITE	output 1 front headlight(s)
YELLOW	output 2 rear headlight(s)
VIOLET (BROWN <sup>2</sup> )	speaker + and -
GREEN	output 3 (Aux 1)
BROWN (VIOLET <sup>3</sup> )	output 4 (Aux 2)
WHITE/GREEN <sup>4</sup>	output 5 (Aux 3)
WHITE/BROWN <sup>4</sup>	output 6 (Aux 4)
PINK <sup>4</sup>	output 7 (Aux 5)
LIGHT BLUE <sup>4</sup>	output 8 (Aux 6)
BLUE	common (+) headlight(s)/output(s) power source
BLACK/WHITE	common (-) power sink or decoder ground

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<sup>1</sup> Present only when an interface is built-in the locomotive or car.

<sup>2</sup> Previously some manufacturers used brown, others violet. Manufacturer must document.

<sup>3</sup> Previously some manufacturers used violet, others brown. Manufacturer must document.

<sup>4</sup> Suggested wire colors. Manufacturer may use other colors but must document.

## 4 Document History

Date	Description
Sep 10, 2020	S-9.1.1 was broken down into separate parts with a Standard for each connector type. S-9.1.1 covers the overview. Errors in wire color code corrected. Added more information on wire color codes and where and how they apply. Added more colors for higher output functions. Moved to the new template format for NMRA documents.

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