



1. Purpose

This standard serves for establishing common interfaces for the safe and rapid installation or exchange of decoders in vehicles.

2. Introduction

In the field of model trains there is an ever increasing deployment of electronic systems for the control of locomotives and for the switching functions. Not all models are equipped from the factory with a module for the reception of control information (decoder). Therefore standardized electrical interfaces should be instituted within the vehicles so that the user can subsequently connect decoders matching their control systems. Sufficient room should be provided for this purpose (installation space).

3. Definitions

Interface:

Connection of several electrical conductors, which through the use of a two part connector (plug / socket) remains mechanically separable.

Left/right vehicle side:

The designations per NEM 631 apply: When viewed from the rear over the locomotive, it must move forward in analog operation when the positive voltage is applied to the right rail.

4. Mechanical Implementation of the Interfaces

The mechanical implementation of the interfaces, including the capacity of the contacts, is not uniform, and is instead to be found in the individual interface standards NEM 651 and the following.

The connection "1" on plug and socket is to be clearly labeled.

Every connection is to be labeled such that it can easily be identified. Numbers or a specified color code are recommended.

4.1 Vehicle onboard implementation

Dependent on the available space within the model, this part of the interface can be implemented as fixed or movable. A problem free assembly / disassembly of the vehicle body must be ensured with or without installed decoder.

Fixed Implementation: The connector is attached mechanically to a circuit board, the frame, or something similar. This implementation assumes that the location of the connector is selected within the installation space such that a direct plugging in of the decoder is possible.

Movable Implementation: The connector is attached to the end of a cable whose length is set such that an attached decoder can be fit and secured within the installation space.

Provided the fixed implementation for the attachment of a connector utilizes a connector on an existing circuit board within the vehicle, the connections necessary for the functioning of the vehi-

cle can be achieved via circuit board traces. These connections are to be arranged such that when installing an electronic module, it is possible to simply remove or separate them (such as via a blind plug), insofar as that is not already achieved via a bridge plug on the interface needed for analog operations.

4.2 Decoder Implementation

On the decoder, the connector is installed as a normal part on the circuit board. The location of the connector is to be chosen such that it is in direct proximity to and parallel to the circuit board edge, insofar as the individual interface standards do not specify a location. It is permitted to implement a movable connector attached to a wiring harness.

Standards compliant decoders can support supplemental functions which are not routed through the standard defined plug interface. These functions should be routed through individual cables so that the user can determine which vehicle functions are controlled by which decoder supplemental function outputs. In this case the corresponding color codes from section 6 must be used for the wires, if applicable.

5. Electrical Construction of the Interfaces

On the vehicle onboard part of the connector, the following minimum connections are to be made available:

- Power pickup from track (2 connections),
- Motor (2 connections),
- Headlights front and
- Taillights rear.

If the connection points for the electrical facilities of the vehicle are on a circuit board within the vehicle, then these should be connected to each other via a blind plug and/or corresponding trace routing such that conventional operation is possible without any additional electronics. With that it should be ensured that these connections, including any potentially present diodes for the implementation of travel dependent head and tail lights, can easily be separated or removed during the installation of a decoder.

If the vehicle is normally outfitted with a wiring harness instead of a circuit board, these connections are to be implemented via a circuit board that is plugged into the vehicle's onboard connector. This circuit board also contains the eventually necessary diodes for the implementation of direction of travel dependent headlights and taillights.

6. Wire Colors for Interfaces

Red:	Electricity pickup right (and/or to center conductor, 3 rd outer rail, overhead power pickup – however with symmetrical supply systems per NEM 620) to interface (or to motor connection 1) *)
Orange:	From the interface to motor connection 1 or to field winding forwards
Black:	Electricity pickup left to interface (or to motor connection 2) *)
Gray:	From interface to motor connection 2 or to the field winding backwards
White:	(-) Headlight or possibly also taillight for driving direction 1
Yellow:	(-) Headlight or possibly also taillight for driving direction 2
Blue:	(+) Common conductor for signals and functions
Green:	AUX 1, freely assignable function output
Violet:	AUX 2, freely assignable function output
Brown:	Loudspeaker connections

*) Applies to older vehicles with one of the two connections on the vehicle grounding and the power pickup and motor.

All other cables have no specification; however none of the named colors may be used.

If a manufacturer cannot adhere to the specified wiring color code for fabrication technical or other important reasons, then a wiring diagram must be supplied. All information necessary for the correct installation of a decoder must be obtainable from said diagram.

With a factory installed interface one must still, even when deviating from the recommended colors, utilize the NEM specified interface connection assignments.

Even manufacturers who don't install a factory interface should strive to deliver a wiring diagram with each vehicle (integrated into the operations manual). That guarantees problem free subsequent modification.