



NMRA Technical Note	
21MTC Decoder Interface	
Dec 1, 2020	TN-9.1.1.3

# 1 Introduction

Decoder interface standards exist in order to aid in installation of decoders into vehicle system boards. Installation can be performed by the vehicle manufacturer or separately by the individual modeler.

## 5 2 Served Use Cases

The intent is that any decoder which conforms to the standard, from any manufacturer, will operate with any vehicle system board which conforms to the standard, from any manufacturer. Operate is further defined as not to cause any permanent damage of the decoder or vehicle system board.

### 2.1 Unserved Use Cases

10 It is not the purpose of the standard to ensure that every decoder and vehicle system board implements all of the possible features defined by the standard. Operation is limited to the features supported by the decoder and/or vehicle system board, as documented by the respective manufacturers.

## 3 Annotations to the Standard

### 15 3.1 References

Additional relevant references are found in S-9.1.1.3.

- S-9.1.1.3 21MTC Decoder Interface

### 3.2 Requirements

20 It is important to note that a product is not required to implement all connections of the interface. A manufacturer may choose to omit certain features, for example the number of function outputs. It is incumbent on the manufacturer to document for users the supported features of their product(s).

### 3.3 Mechanical Properties

25 The mechanical properties are provided in general terms so as not to codify into the standard any limit to alternative sources. Proper connector sources will result in the proper seating of the decoder on the locomotive mainboard so that the decoder's socket mounts flush with the mainboard pin header. TI-9.1.1 contains a list of manufacturer and part numbers for connector sources that have been tested for conformance to the standard.

30 The NMRA Conformance and Inspection committee may allow exemptions up to 3.5 mm maximum in mainboard pin header height, at their discretion, depending on when the decoder under test was originally designed.

## 3.4 Socket Specifications

### 3.4.1 Pin Header Specifications

35 If a male pin header is provided that is terminated in wires, it is recommended that the wire colors follow the color codes defined in S-9.1.1.

## 3.5 Electrical Specifications

### 3.5.1 Function Output Variations

40 The 21MTC defines output pins 7, 8, 14, and 15 as Open Collector/Drain switched (heretofore indicated as OC) outputs. Variations exist with output pins 3,4,13, and 17, identified as outputs AUX3 to AUX6. Refer to Table 1 below. S-9.1.1.3 requires providing outputs higher than AUX2 as logic level outputs. While AUX3 through AUX6 are always required to support TTL/LVTTL logic-level outputs, an open collector/drain option switched against ground may be provided. The default configuration must support TTL/LVTTL logic level on AUX3 through AUX6..

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Pin	Output	Open Collector	Logic Level	Notes
1	AUX7		●	
2	AUX8		●	
3	AUX6		●	
4	AUX4		●	Supported as LL on OEM motherboards
5	AUX9		●	
6	AUX10		●	
7	F0r	●		Standard Reverse Light Output
8	F0f	●		Standard Forward Light Output
13	AUX3		●	Supported as LL on OEM motherboards
14	AUX2	●		Supported as OC on OEM motherboards
15	AUX1	●		Supported as OC on OEM motherboards
17	AUX5		●	

**Table 1:** Function Output Variations

### 3.6 Existing variant

50 There is a variant of the 21MTC interface on the market that was created before the standardization by the MOROP and does not correspond to this standard. This variant is documented here in order to show the differences.

55 According to this standard, only the outputs F0f (Pin 8), F0r (Pin 7), AUX1 (Pin 15) and AUX2 (Pin 16) are amplified outputs, ie equipped with a driver transistor switching to GND on the decoder. In the variant, the outputs AUX3 and AUX4 (Pins 13 and 4) are also implemented as amplified outputs and not as outputs with logic level. The addition is AUX6 (Pin 3) is used as input.

This variant is mainly used by Märklin. This variant is used in all newer vehicles from Märklin, but not in older vehicles. Therefore, when replacing the factory-installed decoder, you should check which type of decoder is required. There is a corresponding list on the Märklin company homepage.

60 Products that have an interface corresponding to this variant must be marked with "21MTC-M" and the instructions must refer to the amplified outputs. Under this condition, after the usual test, the products according to this variant can also bear the NMRA conformity logo.

Products with or for amplified outputs AUX5 and AUX6 (Pins 17 and 3) do not comply with this standard and may not bear the NMRA conformity logo.

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## 4 Document History

Date	Description
Dec 1, 2020	First Release of TN-9.1.1.3

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