



NMRA Standard	
Next18 & Next18-S Decoder Interface	
Dec 6, 2020	S-9.1.1.5 Draft

# 1 General

## 1.1 Introduction and Intended Use (Informative)

This standard defines a multi-pole interface for vehicles with limited installation volume for electronic components. It is suitable for N and TT gauges, as well as smaller vehicle installations in HO gauge.

## 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-9.1.1 DCC Interfaces, which specifies general DCC interface requirements
- S-9.2.3 DCC Service Mode, which specifies service mode programming requirements

### 1.2.2 Informative

- TN-9.1.1.5 Next18 and Next18-S Decoder Interface, which provides commentary on the Next18 and Next18-S decoder interface
- TI-9.1.1 Sources for Connectors for DCC, which provides a list of manufacturer part numbers for DCC interface connectors
- TI-9.2.3 Serial User Standard Interface for DCC, which provides information on SUSI
- RCN-118 Decoder Interfaces Next18/Next18-S, with which this standard is intended to be in harmony<sup>i</sup>
- NEM 662 Electrical Interface Next 18, with which this standard is intended to be in harmony<sup>ii</sup>

## 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.
Train Bus	Serial User Standard Interface (SUSI)

## 1.4 Requirements

- 25 To meet this standard all mechanical and electrical values mentioned must be met and respected, 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

- 30 The interface consists of an encapsulated 18-pin socket (Figure 1) on the system board of vehicle and the encapsulated 18-pin plug (Figure 2) on the decoder.

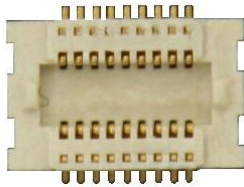


Figure 1: 18-pin socket



Figure 2: 18-pin plug

The electrical connections are arranged symmetrically to prevent damages if installed in a rotated orientation. However, the vehicle shall reserve space such that intended installation orientation is obvious.

- 40 The interface is divided into two installation volumes:
- Next18: electronic components (locomotive and/or function decoder) without sound
  - Next18-S: electronic components (locomotive and/or function decoder) with sound

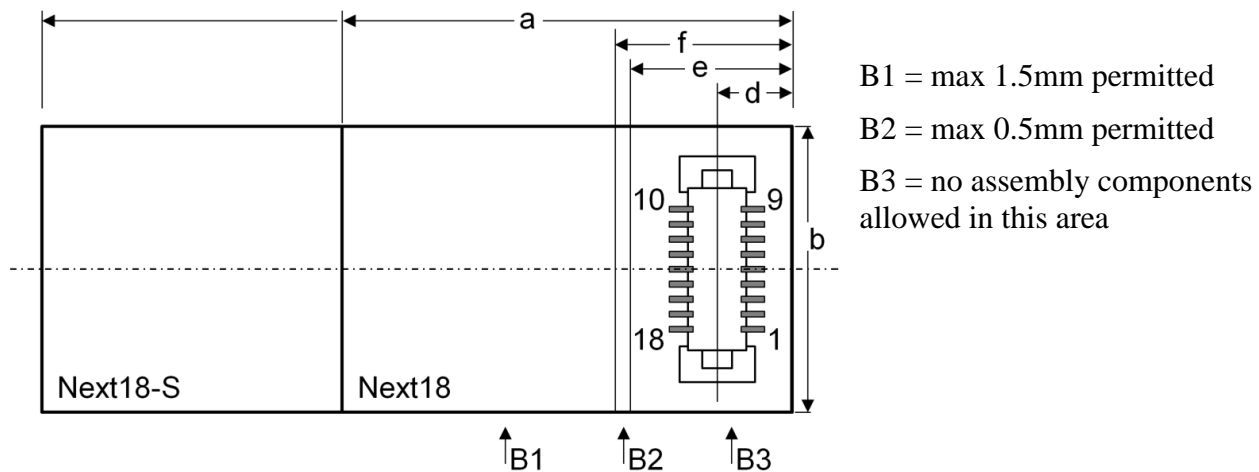
**Table 1: Decoder dimensions**

Dimension	Description	Next18 (without sound)	Next18-S (with sound)
a	Decoder length	15.0mm	25.0mm
b	Decoder width	9.5mm	9.5mm
c	Decoder height	2.9mm	4.1mm
d	Distance from edge of decoder to center of connector	2.5mm	2.5mm
e	Distance from decoder edge to assembly with max height of 0.5mm	5.4mm	5.4mm
f	Distance from decoder edge to assembly with max height of 1.5mm	5.9mm	5.9mm

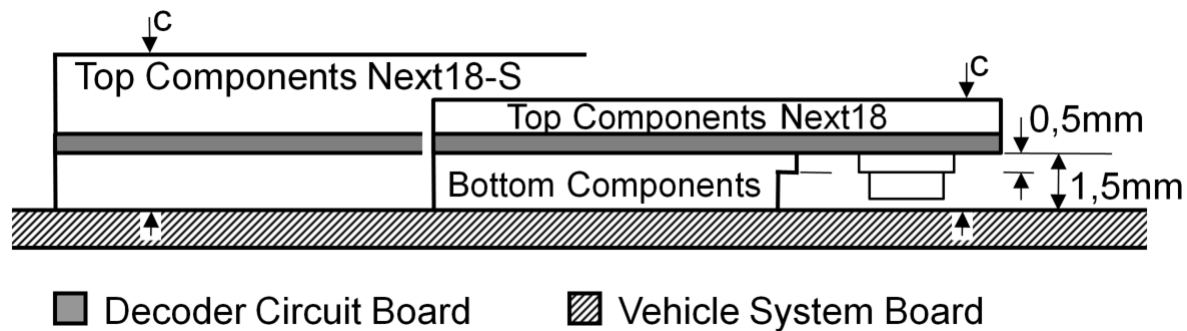
- 45 A decoder with the dimensions permitted for the Next18-S must provide a functional speaker connection.

The installation space in vehicle must be designed so that no components of the decoder touch bare metal parts or conductive traces. The installation space, dimensions according to Table 1 above, should be dimensioned so that the decoder fits into the installation space without pressure or

50 constraint.



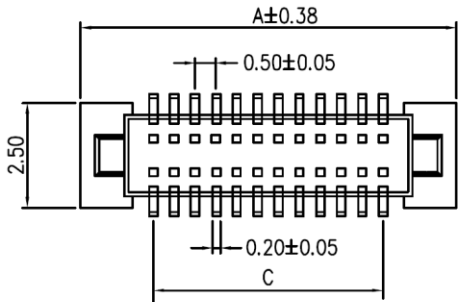
**Figure 3: View from component side of connector**



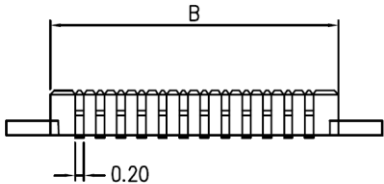
**Figure 4: Decoder side view**

The maximum assembly height of components on the bottom of the decoder is 1.5 mm. The placement height on the top of the decoder is calculated from the maximum decoder height minus the assembly height for bottom components (1.5 mm) and the thickness of the circuit board used.

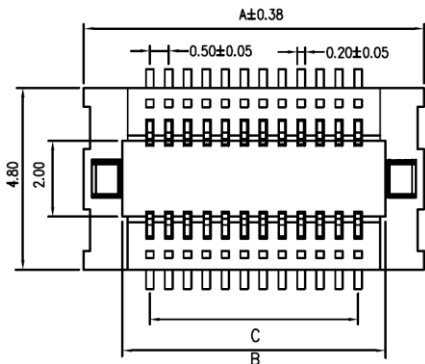
## 2.1 Plug Specification



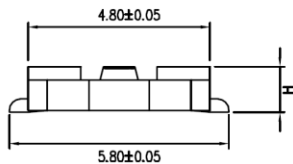
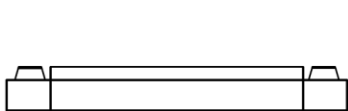
Contacts	Dimension [mm]		
	A	B	C
18	7.50	5.40	4.00



## 2.2 Socket Specifications



Contacts	Dimension [mm]		
	A	B	C
18	7.50	5.45	4.00



## 2.3 Common Plug and Socket Specifications

### Material (Informative)

- 60
1. Housing: High temperature plastic (94-V0)
  2. Contact: Copper alloy ( $t = 0.2\text{mm}$ ) Gold over nickel plating

### Specification (Normative)

- 65
1. Current carrying capacity:  $0.5\text{A}$  max
  2. Insulation resistance:  $1000\text{M}\Omega$  at  $500\text{V}$  DC
  3. Dielectric strength:  $150\text{Vrms}$  AC at  $0.5\text{mA}$  for 1 minute
  4. Contact resistance:  $50\text{m}\Omega$  max
  5. Operating temperature:  $-40\text{C}$  to  $+105\text{C}$
  6. Maximum processing temperature (Informative):  $230\text{C}$  for 30 – 60 seconds

### 3 Electrical Properties

- 70 The contact rating is 0.5A. The track connections as well as V+ and GND (decoder plus and after rectifier) are each made with two contacts making their effective load capacity 1.0 A. The system board of the vehicle, as well as the decoder, must be designed so that if they make different use of the LS\_A/AUX5 and LS\_B/AUX6, no damage to the vehicle system board or decoder will occur.

#### 3.1 Next18 Pin Assignment

Pin	Name	Descriptions	Group
1	Track Right	Track connection right rail	1
2	Motor +	Motor connection 1 plus / forward	2
3	AUX1	Output 1	3
4	AUX3/TBCLK	Output 3	4
5	GND	Decoder ground, after rectifier	
6	V+	Decoder plus, after rectifier	
7	AUX6	Output 6	4
8	F0F	Forward headlight	3
9	Track Left	Track connection left rail	1
10	Track Left	Track connection left rail	1
11	Motor -	Motor connection 2 minus / reverse	2
12	AUX2	Output 2	3
13	AUX4/TBDAT	Output 4	4
14	GND	Decoder ground, after rectifier	
15	V+	Decoder plus, after rectifier	
16	AUX5	Output 5	4
17	F0R	Reverse headlight	3
18	Track Right	Track connection right rail	1

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### 3.2 Next18-S Pin Assignment

Pin	Name	Descriptions	Group
1	Track Right	Track connection right rail	1
2	Motor +	Motor connection 1 plus / forward	2
3	AUX1	Output 1	3
4	AUX3/TBCLK	Output 3	4
5	GND	Decoder ground, after rectifier	
6	V+	Decoder plus, after rectifier	
7	Speaker B	Speaker connection B	4
8	F0F	Forward headlight	3
9	Track Left	Track connection left rail	1
10	Track Left	Track connection left rail	1
11	Motor -	Motor connection 2 minus / reverse	2
12	AUX2	Output 2	3
13	AUX4/TBDAT	Output 4	4
14	GND	Decoder ground, after rectifier	
15	V+	Decoder plus, after rectifier	
16	Speaker A	Speaker Connection A	4
17	F0R	Reverse headlight	3
18	Track Right	Track connection right rail	1

### 3.3 Description of Signals

- Group 1 Track Right (pins 1 & 18) and Track Left (pins 9 & 10) are connected to the vehicle wheels for the incoming power supply.
- Group 2 Motor + (pin 2) is normally connected to the right rail. Motor – (pin 11) is normally connected to the left rail if no decoder is present.
- Group 3 These outputs are open collector/drain switched against ground on the decoder side. The voltage for the load comes from the Track voltage at V+ (pins 6 & 15). In the case where there are taillights connected separate from the headlights, the taillights in the forward direction (cab 1) are connected to AUX1 (pin 3) and the taillights in the reverse direction (cab 2) are connected to AUX2 (pin 12). Maximum load capacity is 100 mA per output.
- Group 4 Outputs are defined as TTL/LVTTL logic-level according to Table 2 below. Maximum load 0.5 mA. If Train Bus is supported, the decoder must include a 470Ω series resistor on AUX3/TBCLK (pin 4) and AUX4/TBDAT (pin 13), and must have a 15KΩ (or greater) pull-up on TBDAT (pin 13) before the 470Ω series resistor. During startup, these decoder outputs may be briefly undefined. If this brief undefined state is critical to the system board operation, then precautions should be implemented on the system board. (AUX5/AUX6 NEXT18 only)
- Group 5 The effective impedance of the speaker(s), as observed by the decoder, is 4Ω - 8Ω and must be documented by the decoder manufacturer. Impedance of factory installed speakers must be documented by the vehicle manufacturer. (NEXT18-S only)

If a voltage V+ is independently generated on the vehicle system board, it must not be connected to V+ (pins 6 & 15) of this interface.

**Table 2: TTL/LVTTL voltage levels**

	Decoder Output Voltage Level	System Board Input Voltage Level
Function switched off	$\leq 0.4V$	$\leq 0.8V$
Function switched on	$\geq 2.4V$	$\geq 2.0V$

### 3.4 Use in Function Only Decoders

This interface can be used in vehicles without a motor. Since there is no motor connection in this case, the decoder must have an internal means of generating the required service mode acknowledgment as defined in S-9.2.3.

### 3.5 Use of Interface with SUSI

This interface can also be used as a SUSI interface according to TI-9.2.3. In this case, only four signals may be used

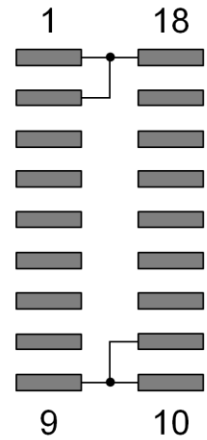
1. GND (pins 5 & 14)
2. V+ (pins 6 & 15)
3. Train Bus Clock (pin 4)
4. Train Bus Data (pin 13)

In particular, the track connections are not to be used when wired as a SUSI interface. All other connections can be used for functions of the SUSI module.

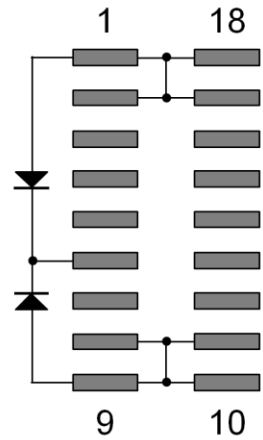
### 3.6 Operation without a decoder

For the operation of the vehicle without electronic components in the interface, a dummy plug must be used.

Minimal Dummy Plug



Bridge plug with Functions F0F and F0R



Bridge plug with functions F0F, F0R, AUX1, and AUX2

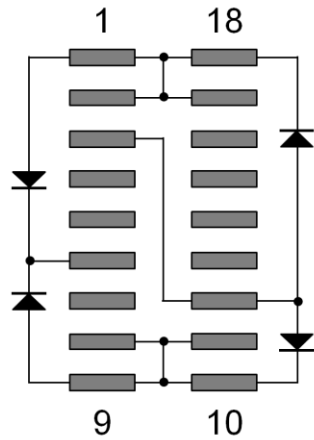


Figure 5: Typical dummy plugs

The typical bridge plug connects the following contacts

Track right: Motor +, F0R, (AUX1 if taillight included in forward direction)

Track left: Motor -, F0F, (AUX2 if taillight included in reverse direction)

Depending on the wiring of the function outputs in the vehicle, the vehicle manufacturer may setup a bridge plug specific to the vehicle if other outputs are connected. In the middle picture, outputs F0F and F0R are controlled depending on the direction. Functions AUX1 and AUX2 are always switched on in the picture on the right.

## 4 Document History

Date	Description
Dec 6, 2020	First Revision

<sup>i</sup> RCN stands for RailCommunity Normen. The direct German to English translation of Normen is Norms and in this context is intended to have an equivalent meaning to Standards. RailCommunity is an organization of manufacturers that creates German language standards for model railway electronics.

<sup>ii</sup> NEM stands for Norms of the European Model Railroads. Norms, in this context, is intended to have an equivalent meaning to Standards. MOROP is the organization that maintains the NEM documents. MOROP is an organization that creates model railway standards primarily targeted at the European market.



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