Standard	RCN-111 **Interfaces** **Vehicle Side Requirements**	RailCommunity
Issue 27.07.2025		RailCommunity – Verband der Hersteller Digitaler Modellbahnprodukte e.V.

Content

1 General

1.1 Purpose of the standard

This standard is intended as a guideline to correctly implement interfaces for decoders in rolling stock. It is intended as help for a successful design without repeated design cycles. The decoder manufacturing members of the RailCommunity will test their decoder designs against the values provided in this standard. Thus their decoders will work without problems in rolling stock following to this standard.

2 Requirements

2.1 Physical outline

The physical dimensions as laid down in the applicable interface standard must be kept free of components or wiring to ensure interchangeability of decoders.

2.2 Current carrying capability

Wiring and copper traces for the track connections shall be strong enough to withstand the typical short circuit current of power stations, i.e. 2 to 3 A for N scale, 3 to 5 A for H0 scale and 8 to 12 A for G scale, for at least one second. In case the vehicle is creating a short e.g. by running into a turnout set against it, the short circuit current will flow through the internal wiring of the model.

2.3 Power signals

V+ and GND, i.e. the power lines after the rectifier of the decoder, should not be connected with vehicle side rectifiers. In case the vehicle needs these signals without decoder in analogue mode, the rectifying diodes must be placed on the dummy plug for analogue operation.

2.4 Backup Capacitors

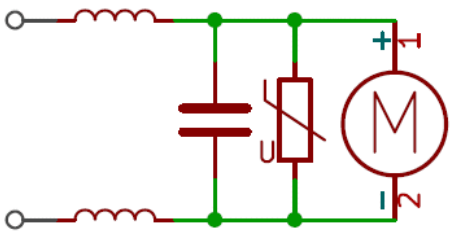
Vcap / Cap.+ must not be powered from the vehicle side. This connection is provided to connect buffer capacitors only. The needed control circuitry to conform to [RCN-530] is part of the decoder.

The connected capacitors shall have a voltage rating of 16 V in case of electrolytic capacitors and of 25 V in case of tantalum capacitors.

Please be aware that all high capacity ceramic capacitors have a significantly reduced capacitance at 16 V DC. Even the X7S type components have a reduction of about 40%. Capacitors with other materials have an even higher reduction of their capacitance.

2.5 Motor noise suppression

Brushed DC Motors shall be adequately EMC suppressed, as required in the CISPR14 based international standards (CE, FCC, IEC). The typical EMC filter for brushed DC motors consists of a ceramic capacitor between the motor connections and two RFI chokes in series to the motor connections. Good starting values for C are 1 to 22nF and 1 to 10µH for L, but the exact values for the motor used can only be found by EMC measurements. The current carrying capacity of the RFI chokes shall be at least the blocking current of the motor used.



It is recommended to equip the brushed DC motor with a ring varistor connected to the commutator. This will reduce the sparking on the commutating system thus easing the requirements on the EMC filter and increase the brush life by reducing spark

erosion. The required minimum breakdown voltage of this ring varistor shall be at least 24V, of the noise suppressing capacitor 50V. The capacitor shall use a low temperature coefficient ceramic dielectric, preferably NP0 or COG. The wiring between the EMC components and the motor connections shall be as short as possible to ensure good performance.

In case extra capacitors to another signal are needed, these capacitors must not be connected to a track signal but GND. This prevents disturbing the motor control.

2.6 Vehicle Side Backup Capacitors

The backup capacitor for the supply voltage should be large enough, to bridge the RailCom gap of about 450 µs without a significant voltage drop. This prevents a large surge current at the end of the RailCom gap. For sure the capacitor needs some device to limit the initial charge current. See [RCN-530] for details.

In case a “keep alive” circuit to buffer the decoder is part of the electronics in the vehicle, its inrush current must be limited according to [RCN-530] including switching of charging and buffering on the programming track in service mode.

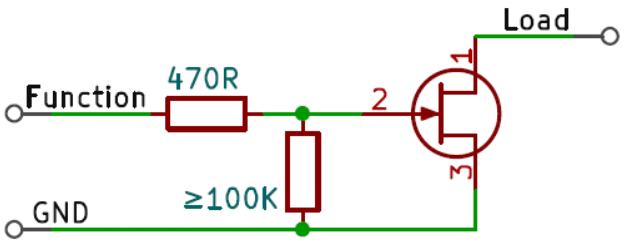
2.7 General Inrush Current Reduction

To reduce the inevitable remaining current spike after the RailCom gap an inductance between the track signal and the decoder interface is recommended. A typical value is 1 µH. These are available for up to 3 A in SMD size 0402. Larger values would affect feedback from the decoder like RailCom or MFX.

Especially when supplying servos, lights with flicker protection and smoke units the inrush current must be limited.

2.8 Logic level signals

All logic level function should work with a low level of ≤ 0.8 V and a high level of ≥ 2.0 V as defined in the interface specifications.



The gates of MOSFETs should not be connected directly to the decoder interface but with a typical resistor of 470 Ω in series and a resistor to GND with ≥ 100 kΩ.

There should be no (large) capacitors parallel to the function loads or at the logic level function outputs. Otherwise, brightness control via PWM with typically 1 to 40 kHz would be disturbed or made impossible. For logic level functions using a 470 Ω resistor the maximum capacity is 2.2 nF, resulting in a time constant of 1 µs not interfering with PWM control.

2.9 Signal interference

To reduce interference between the different signal types of track, motor, speaker and logic level signals like for the SUSI train bus the PCB traces should not run parallel. Rectangular crossing is preferred.

2.10 Labelling

If space permits, the vehicle PCB should provide markings defining cab 1 and 2, right and left or other means to identify the forward direction of the model. This helps to place an almost symmetrical shell in the correct orientation and eases adding features by the modeller.

2.11 Unused Pins

Pins not used by the vehicle, especially VCap/Cap.+, SUSI train bus and amplified functions, should be routed to solder pads and either labelled on the PCB or describe in the manual of the model.

Attachment A: Reference to other Standards

A.1 Normative References

[RCN-114] RCN-114 mtc14 – Interface for small vehicles

[RCN-118] RCN-118 Next18 / Next18S – Interface for small vehicles

[RCN-121] RCN-121 21MTC – 21-pin Interface

[RCN-122] RCN-122 PluX – 22 and 16-pin Interface

[RCN-124] RCN-124 E24 – Interface for small vehicles

[RCN-530] RCN-530 Inrush Current

A.2 Informative References

There are no informative references with this standard.

Attachment B: History

Date	Change since the previous version
27.07.2025	First Version
