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1 Introduction

Decoder Interface Standards exist to aid in installation of decoders into vehicle system boards. Installations can be performed by the vehicle manufacturer or separately by the individual modeler.

1.1 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 to not cause any permanent damage to the decoder or vehicle system board.

1.2 Unserved Use Cases

It is not the purpose of the standard to ensure that every decoder and vehicle system board implements all 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,

2 Annotations to the Standard

2.1 General

2.1.1 Introduction and Intended Use (Informative)

2.1.2 References

Additional relevant references to the connectors may be found in the technical documents noted below from Molex, and are incorporated into this document by inclusion.

2.1.2.1 Normative

2.1.2.2 Informative

2.1.2.3 Description of the Interface

2.1.3 Terminology

2.1.4 Requirements

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 upon the manufacturer to document the supported features of their product(s) for users.

2.2 Mechanical Properties

The mechanical properties provided in the standard are listed in general terms so as not to codify into the standard any limit to alternative sources, however they are based on the connectors provided by MOLEX, as enumerated in the Standard and discussed below.

The MOLEX connectors as utilized by this standard are completely described in the following MOLEX technical documents, and references cited therein. For the decoder connector, see: https://www.molex.com/en-us/products/part-detail/5052702412?display=pdf, For the vehicle side connector, see: https://www.molex.com/en-us/products/part-detail/5050702422?display=pdf.

When working with these connectors, please note carefully the following issues (abstracted from the above) as regards general installation and longevity for Model Railroading use.

- The connectors are rated with a Maximum Durability of 30 mating cycles. It is incumbent upon manufacturers and users to limit the number of cycles to ensure longevity of vehicles and decoders utilizing this interface.
- The connectors do not have a locator pin, or similar device to ensure proper orientation. It is incumbent upon manufacturers to design the vehicle such that an E24 decoder cannot be installed in an improper orientation or else damage to the decoder and/or vehicle will occur. While the connectors are listed as having PCB retention, in practice this may not be sufficient for certain installations. It has been noted that these connections may come apart when subjected to normal handling conditions, especially when the decoder is installed in an "underslung" mounting beneath the vehicle system board. While not required, additional methods to secure or mechanically reinforce the connections are suggested to mitigate issues with product shipping (for manufacturer installed vehicles), rough handling, or even general operation.
- Mating of the decoder and vehicle connectors must be done with the two elements held parallel to each other, and with uniform force not to exceed 43.2 Newtons applied across the aligned connector to ensure proper mating. Unlike other connectors utilized for DCC interfaces, where connectors can/should be inserted unevenly (such as on an angle, or favoring insertion of one end before the other) such techniques will result in poor connection with the E24 connector, and are liable to deform the pins or otherwise damage the interface. Insertion Angles of less than 10 degrees are possible, but are not recommended by MOLEX. Unmating the connectors should not be done at any angle, as damage is likely to result.

2.2.1 Dimensional Requirements

2.2.1.1 Decoder

2.2.1.2 Vehicle

2.3 Electrical Characteristics

The electrical specifications for the decoder socket and system board connector are described fully in the MOLEX documentation (decoder side: https://www.molex.com/en-us/products/part-detail/5052702412?display=pdf, vehicle side: https://www.molex.com/en-us/products/part-detail/5050702422?display=pdf.) The table below summarizes several key values:

Maximum Voltage	50 V AC(rms) / DC
Contact Load Capacity	0.3A Maximum, pins 1-24 (“Terminal”) 3.0A Maximum, Guide Pins (“Nail”)
Insulation Resistance	100 M Ohm, Minimum @ 250V DC
Dielectric Strength	250 V rms AC @ 0.5 mA for 1 minute
Contact Resistance	80 mOhm max, pins 1-24 (“Terminal”) 30 mOhm max, Guide Pins (“Nail”)

2.3.1 Pin Assignments

Pins 23 and 24 are named as ZBCLK and ZBDATA in RCD-124. The names have been changed to TBCLK and TBDATA to reflect the English translation from ZugBus (ZB) to Train Bus (TB) as listed in the descriptions.

2.3.2 Description of Signal Assignments

If a vehicle generates a local V+ on the system board to power functions, etc., it is important that this separate V+ NOT be connected to V+ (pin 17) of the interface, as this would disrupt the internal power management of the decoder.

2.3.2.1 Functional Support Minimal Requirements

2.3.3 Vehicle Operation Without Decoder

The examples shown for representative jumper plugs are not intended to be limiting, and manufacturers may create jumper plugs to enable additional functions as appropriate. It is incumbent on the manufacturer to provide documentation of such plugs when enabling functions beyond the minimal motor functions indicated and those required under Section 3.2.1 of the Standard.

2.3.4 Additional Interface Use Cases (Electrical)

2.3.4.1 Use of the Interface as a Function Only Decoder

For the purpose of conformance, a Function Only Decoder is a decoder which does not provide motor control output to Motor (+) (pins 6 and 7) and Motor (-) (pins 4 and 5).

2.3.4.2 Use of the Interface with SUSI

This use case is if the E24 Decoder Interface is used for connection between a SUSI slave device and another host decoder acting as a SUSI master device, pursuant to conformance with TI-9.2.3.

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3 Document History

Date	Description
Jun 31, 2025	First Draft

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