NMRA Standard	
Decoder power modes	
Mar 20, 2026	S-9.1.3 Draft

1 General

1.1 Introduction and Intended Use (Informative)

This standard describes power modes for digital decoders, in particular, with respect to startup ~~.~~ ~~Especially~~ inrush current and service mode compatibility.

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

When using the corresponding interface, the following standards must be referenced:~~complied:~~

- [S-9.2.3] Service mode programming

1.2.2 Informative

The standards and documents listed here are for information only and are not part of this standard.

- [S-9.4.1] SUSI bus communication interface

1.3 Terminology

Term	Definition
Inrush current	Current drawn by the electronic device at the beginning of operation~~YW~~.
Energy storage	Usually, capacitors used for the storage of energy to cover~~pass~~ brief interruptions caused by insufficient contact with the rails.

2 Requirements

2.1 Power modes

For purpose of this document, three power modes are defined.

- **Standard** – in this power mode, the decoder uses power for normal operation ~~usual work~~ (function outputs, motor output, and accessory decoder outputts are enabled). High consumption devices (for example, energy storage devices) are disabled.
- **Low power** – in this mode, the decoder utilizes minimum power. The decoder's current consumption must be less than 250 mA as required by S-9.2.3 (including connected modules). All decoder outputs shall be disabled except for ACK pulses. In this mode, disable energy storage devices and any other powered devices such as smoke units, so the command station can recognize the ACK pulse.
- **High power** – in this mode, the decoder may draw all necessary power, including energy storage device charging.

The same power modes are valid for decoders and the same applies to potential modules connected via the Train Bus.

Commented [JF1]: Is it necessary to mention multiple decoders in one loco?

Commented [MM2R1]: Yes; could be high-demand items like smoke units which may be controlled by the decoder but powered directly from the rails. They do need to be disabled to enable low-power operations.

2.2 Power mode usage and switching

2.2.1 Default mode

When the decoder first connects to the DCC signal, it can use Standard or Low power mode, depending on its configuration. It remains in its initial state until the requirements are met to move to another state.

2.2.2 Switch to low power mode

When the decoder recognizes two or more reset packets, as defined in S-9.2.3, it is entering service mode programming. The decoder shall immediately change to low power mode. If the decoder supports any Train Bus (for example, S-9.4.1 – SUSI bus), the decoder shall inform all connected modules of the entry into Low power mode (for example command 0x6C 0x00 for SUSI). All connected modules shall immediately switch to low power mode.

2.2.3 Switch to high power mode

A mobile decoder may switch to High power mode when it recognizes any packet addressed to the decoder's primary address or consist address; this does not include any ~~. It cannot be~~ a broadcast packet. If the decoder supports any Train Bus (for example, S-9.4.1 – SUSI bus), the decoder shall inform all connected modules of the entry into High power mode. All connected modules may switch to High power mode.

An accessory decoder with significant DCC power consumption must minimize its inrush current by utilizing a random delay before switching to High power mode. This random delay must be defined as the multiplication of high power pulse used for accessory switching.

Commented [JF3]: **Ken**: I was unclear about the meaning of the last sentence …
Jindra: some decoders for PECO or Rokuhan switch machines charge capacitors and when switching request appear, they discharge capacitor to switch machine. Then start next round of charging.

Commented [MM4R3]: I'd suggest that if such an accessory decoder is powered by a separate power but, rather than a DCC "track" signal, it may use High Power mode from that power bus at any time such power is available. We're onlt restricting power demands on the DCC "track" bus here.

2.2.4 Power mode validity

Power mode is valid until the next switching situation appears. For decoders with energy storage, power mode remains valid when a small interruption of the DCC signal appears, provided the interruption is covered by the installed energy storage device.

2.3 TODO

Ken: We must characterize the energy storage device's worst-case charging time to define the minimum and maximum time a decoder must wait before entering High power mode. The worst-case charging time is also the random holdoff increment.

Ken: We will need to define the random number generator algorithm and the initial seed. I recommend using a seed based on the primary decoder address to prevent all decoders from waiting the same random delay and hitting the booster simultaneously.

Commented [MM5]: It's well known that high-capacity ESDs can take upwards of 20 seconds to charge, some maybe minutes to full charge, though that is tempered by the fact that their charging rate is slowed internally. Key is to enable the booster to start powering the DCC track signal and settle its power supply before high demands are made on it. Most boosters can then cope with the demand of many ESD charging. I for one on my old layout would commonly be charging 70+ such high capacity ESDs with no issues, via two 8-amp nominal boosters (a Digitrax DB220). Instant current readings on startup were often over 5 amps on each. Most boosters can discriminate between a short and ESD charging startup, as the rise time of a short is much faster than is that of ESD charging.

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4 Document History

Date	Description
2026.03.20	First Draft

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