

# NMRA Seacoast Division Module Group (SMG) Free-mo Standard

## Legend

S = Standard. All Free-mo modules and participants must conform to the requirement/standard stated.

RP = Recommended Practice. These are procedures or specifications which are strongly encouraged for maximal reliability or fidelity.

## 1.0 Introduction

S1.1 Objective: The objective of this Free-mo Standard is to provide design and construction specifications for HO scale Free-mo modules that allow compatibility with other HO Free-mo standards while meeting the needs of the members of this group of members of the Seacoast Division of the Northeast Region of the National Model Railroad Association. This standard is based on:

- The Free-mo SLO Standards & Recommended Practices [<http://free-mo.org/standard>]
- The Sn2 Free-Mo Standards and Guidelines [[http://www.narrowtracks.com/Sn2/Free-Mo/Sn2Free-Mo\\_StandardsAndGildeLines.pdf](http://www.narrowtracks.com/Sn2/Free-Mo/Sn2Free-Mo_StandardsAndGildeLines.pdf)]

We recognize their contribution to the hobby and thank them for their work.

S1.2 Interoperability: This Free-mo Standard maintains the module-to-module mechanical interface of the Free-mo SLO Standards & Recommended Practices. The key deviations in this standard from the Free-mo SLO Standards & Recommended Practices are allowing DCC systems other than Digitrax® and different electrical connectors used to interconnect modules. The members of this group realize they are responsible to provide any adapter cables or connectors to allow their modules to be used at events where the Free-mo SLO Standards are used.

S1.2 Definitions:

S1.2.1 MODULE: An assembly of benchwork, track, scenery and wiring built to this standard and meant to be connected to, and operated with, other modules to make a larger Setup (layout). A module can be made from smaller assemblies called Sections. A module must have one or more end plates that comply with mechanical and electrical standards defined within this document. (Stub terminals have only one end plate, junctions have 3 or more end plates).

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- S1.2.2 SECTION: A part of a module, complete with bench work, track, scenery, etc. Except where otherwise noted, standards for module interfaces do not apply to inter-section interfaces, as these are considered to be internal to the module.
- S1.2.3 ENDPLATE: The standardized end surface of a module that joins with an adjacent module in a Free-mo setup. The physical aspects of the endplate are defined in the Frame Work description below.
- S1.2.4 TRACK (POWER) BUS: The continuous two wire bus feeding power and DCC command to the track.
- S1.2.5 ACCESSORY (POWER) BUS: The continuous two wire bus powering electrical accessories such as turnout motors, structure lighting, animation, etc.
- S1.2.6 DCC NETWORK (DCC) BUS: The continuous six-wire bus carrying DCC information among the DCC system components such as throttles, boosters, radio receivers, etc.
- S1.2.7 EVENT: An organized gathering (show, meet, convention, etc ) that includes the display of model railroads.
- S1.2.8 SETUP: A collection of free-mo modules connected together to form a layout. There may be more than one setup at an event.
- S1.2.9 HOST: Person(s) or organization(s) responsible for organizing the participants, selecting themes, providing DCC system(s), and securing space and utilities with event staff. A Host may be a participant.
- S1.2.10 PARTICIPANT: A person who contributes to a setup by bringing module(s), rolling stock or other components.
- S1.3 Module Overview
  - S1.3.1 A Free-mo module is a free-form module that conforms to the Free-mo Standard as outlined below.
  - S1.3.2 A Free-mo module can be any length and its end plates can be at any angle to each other.
  - S1.3.3 A Free-mo module can be one section or a set of two or more sections that form a module.
  - S1.3.4 Free-mo modules fall into three basic categories:
    - S1.3.4.1 Mainline - Mainline modules represent Mainline rights-of-way. Mainline modules are designed with large radius curves and minimal grades.
    - S1.3.4.2 Branchline - Branchline modules represent Branchline rights-of-way. Branchline modules can have smaller radius curves and steeper grades than Mainline modules.

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S1.3.4.3 Mini-mo - Mini-modules (mini-mos) have end plates that are narrower than the standard width end plate. With this in mind, a mini-mo can be Mainline or Branchline module, single-track or double-track. Mini-mo type modules are intended to be a Free-mo subset and not replace or exclude an equivalent length standard module. Full width modules are generally more stable and should be used wherever possible.

## **2.0 Framework/ Mechanical**

- S2.1 End plates shall be 3/4" plywood or equivalent to provide sufficient strength for clamping to adjacent modules. (RP2.1.1)
- RP2.1.1 Avoid dimensional lumber for your frame work. It can warp or cup with changes in humidity causing track mis-alignment. Plywood (Baltic birch plywood recommended) warps and twists less than dimension lumber.
- RP 2.1.2 A minimum 3" X 4" X 1/8" non-compressible plate will be installed on center in the inside surface of the end plate with it's bottom edge 1/2" above the bottom edge of the end plate. Suitable materials include, but are not limited to: aluminum, G-10 laminate, tempered hardboard (Masonite). These are intended to prevent coupling clamps crushing the surfaces of the end plates.
- S2.2 Single-track end plates shall be 24 inches wide by 6 inches tall.
- S2.3 Double-track end plates shall be 26 inches wide by 6 inches tall.
- S2.4 Roadbed shall be 1/4 inch cork or equivalent on 1/2 inch plywood or equivalent. Foam tops are acceptable if braced to prevent sagging or flexing.
- S2.5 The nominal and minimum height of the railhead, at the end plate, is 50 inches from the floor.
- S2.6 On modules with grades, the elevation of the high end shall be some multiple of 3/4 inch above low end.
- S2.7 The maximum height of railhead, at the end plate, is 62 inches from the floor.
- S2.8 The module (set) shall have at least four legs and stand on its own.
- S2.9 Legs shall have continuous adjustment of plus or minus 1 inch (screw type foot).
- S2.10 The bottoms of the legs shall have rubber tip or equivalent floor protection.
- S2.11 Modules may be used with operators and spectators on either or both sides.
- S2.12 There are no special benchwork construction requirements for Mainline Modules in excess of the standards specified above (S2.1 through S2.11).

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### **3.0 Track**

- S3.1 Modules shall use flex or hand-laid track.
- S3.2 The center line of the mainline tracks shall be 4 inches or more from the sides of the module at all times.
- S3.3 On a Single-track module, the through track shall be centered on the 24-inch end plate.
- S3.4 On Double-track modules, the two through track center lines shall be spaced precisely 2 inches apart and centered on the 26-inch end plate; i.e. the center line of each track will be 1 inch off the module center line
- S3.5 Track on the through route must be perpendicular to the end plate for 6 inches from each end of the module.
- S3.6 Track on the through route must be straight and level for 6 inches from each end of the module.
- RP3.6.1 The points of a turn out should not be within 6" of the end of a module.
- S3.7 Rail shall be cut off 1 inch away from module end; ties and ballast shall be continued to the module end for good appearance and matching with the adjacent module. Ties shall be notched under the ends of the rails and to the module end, to clear bridge rail joiners and provide freedom of adjustment for bridge rails.
- RP3.7.1 To enable DCC power districts, your module must be able to accommodate insulated rail joiners at each Free-mo end plate.
- RP3.7.2 Free-mo printed circuit board tie plates are recommended for ends. A source is BNM Hobbies [<http://www.bnm-hobbies.com>].
- RP3.7.3 Tie plates where the fitter rails go over should be excavated slightly to permit fitter rails to accommodate any vertical irregularity in track alignment between adjacent modules.
- S3.8 Mainline turnouts shall be at least #6. Turnouts on a siding may be #4 minimum with the normal route being part of the siding.
- RP3.8. Turnouts on the module mainline should be #8 or larger.
- S3.9 There shall be a minimum of 12 inches of straight track between reverse curves.
- S3.10 Track on the through route of a Mainline Module must ALL be Code 83 nickel-silver rail without exception.
- S3.11 Sidings, spurs and other tracks of a Mainline Module may be Code 83 or smaller, but shall be no smaller than Code 40.

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- S3.12 The minimum permitted curve radius on a through route of a Mainline Module is 42 inches. This includes through track sidings and other tracks where through traffic will run.
- RP3.12.1 While the minimum permitted radius of curves on the through route of a Mainline module is 42 inches, 48 inch or larger curves are preferred.
- RP3.12.2 Easements are recommended for all curves.
- S3.13 Spacing between tracks on curves of a Mainline Module shall allow for long cars to operate without fouling each other; observe NMRA Standards S-8 Track Centers <<http://www.nmra.org/standards/sandrp/s-8.html>> for "Class Ia" equipment.
- S3.14 Mainline maximum permitted grade on the through route of a Mainline module is 2.0 percent (approximately 1/4 inch per foot).
- S3.15 Vertical curves on the through route of a Mainline module shall be appropriate for Mainline operation of contemporary long cars, see Standard S-7 Clearances and the NMRA Gage [<http://www.nmra.org/standards/sandrp/gauge.html>], and NMRA Recommended Practices RP-11 Curvature and Rolling Stock [<http://www.nmra.org/standards/sandrp/rp-11.html>].

#### **4.0 Wiring**

- S4.1 Wiring consists of 2 pairs of wires (track buss and accessory buss) and a 6-conductor cable for throttles/ cabs.
- R.P.4.1.1 Flat, 6-wire telephone cable is recommended for the throttle buss.
- S4.2 Track and accessory buss wire shall be #14 AWG stranded or larger.
- S4.3 All modules and sections will use at least one terminal strip; 4 position for single track, 6 position for double track; mounted under to interconnect buss wires to track or accessory feeds.
- RP4.3.1 Single track modules with mainline longer than 4' shall have a 4 position, minimum, barrier strip at each end, under the layout for track and accessory buss wiring.
- RP4.4.2 Double track modules with mainlines longer than 4'shall have a 6 position minimum barrier strip at each end, under the layout for track and accessory buss wiring.
- S4.5 Anderson Powerpole 15 -30A connectors, or other connectors that can mate to the Powerpole, will be used to interconnect track and accessory busses between modules.

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- S4.5.1 The Accessory Buss will use gray Anderson Powerpole housings joined horizontally to form a two contact/ pin connector assembly and the drop shall be on the vertical center line of the end plate and hang 6" to 8" below the bottom of the end plate.
- S4.5.2 The track buss will use red and black Anderson Powerpole housing pair at each end of a module with the drop on the vertical center line of the track above and hang 6" to 8" below the bottom of the end plate The red/ black pair at each module end will be stacked vertically (hood up, tongue down). Black will be on top and shall connect to the left rail, as you face the endplate. The bottom will be red and shall connect to the right rail (the trick to remembering is the R in Red and Right). When modules are interconnected the red connector will mate to a black and vice versa.

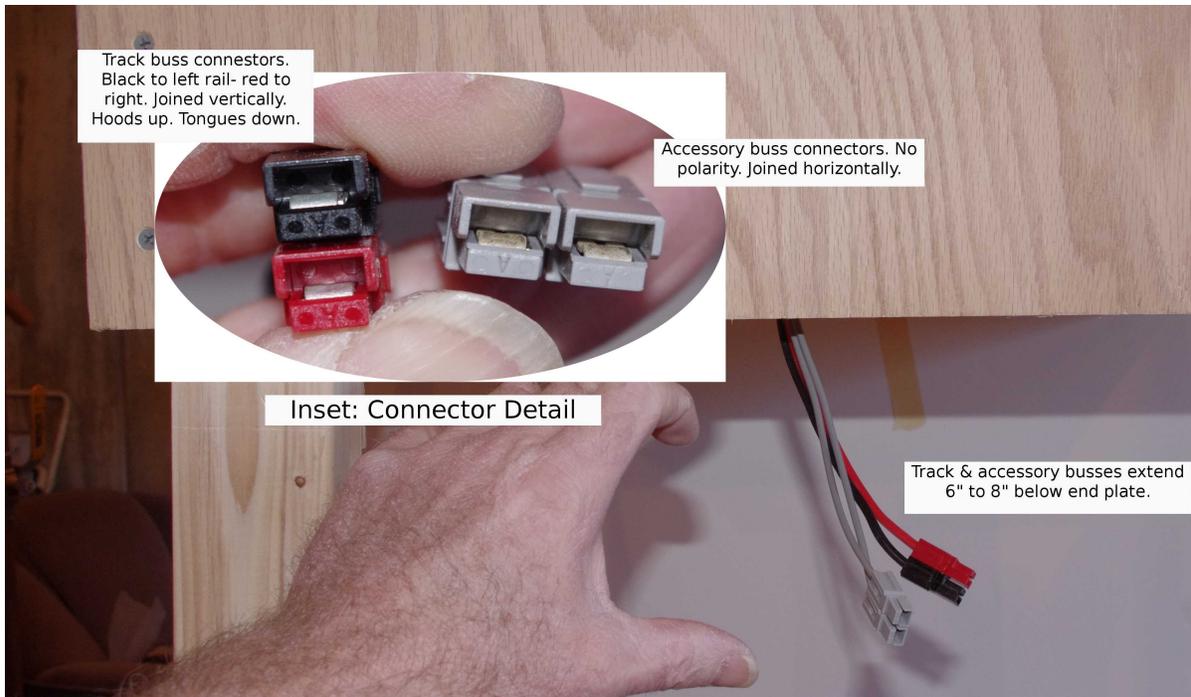


Figure 4.5.1 Single Track End Plate Interconnection Wire Drops

- RP4.5.1 Refer to Figure 4.5.1 for location, lengths and colors of module track/ rail and accessory buss connection wire drop relative lengths and locations.
- RP4.5.2 On double track modules, to facilitate optional train signaling/detection, separate feeders are recommended for each track so that detection can discern a train on track A or track B.
- S4.6 Track feeds must be 24 AWG, solid or stranded, minimum and not longer than 6 inches.

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- S4.7 All turnout frogs shall be powered. Turnouts shall not rely on switch points to power the frog.
- S4.8 Accessory power shall be approximately 16 volts AC or DCC. The buss is wired straight through. A bridge rectifier and filtering capacitor may be used to convert AC or DCC signal to DC. Applications that require AC or DCC signal may utilize power directly from the buss.
- S4.9 For throttles, each module will have at least one RJ-12 6 position 6 conductor (6p6c) jack recess mounted behind each fascia.
- RP4.9.1 In areas where operators congregate (such as yards), additional jacks should be provided to avoid physical crowding.
- RP4.9.2 Multi-section modules should have RJ-12 6 position 6 conductor (6p6c) jacks separated by no more than 8 feet on each exposed side.
- S4.10 All modules shall have a surface mount RJ-12 6p6c jack mounted to the inside of all end plates. See S4.14.
- S4.11 The throttle/ cab buss is connected between modules with a 2-foot RJ-12 to RJ-12 type straight through cable terminated w/ a 6p6c plug at each end. See S4.10.
- S4.12 All throttle/ cab cabling must be connected straight through (i.e. pin 1 - pin 1, pin 2 - pin 2, pin 3 - pin 3, etc.). Note telephone voice cables with RJ-12 6p6c plugs attached are NOT wired straight through.

## **5.0 Control**

- S5.1 The Event Host will specify the DCC equipment to be used and ensure that sufficient boosters and throttles/ cabs will be available to Participants.
- S5.2 For a given turnout, turnout controls must be on all sides of the module or module section, excepting any end plates.
- RP5.2.1 Turnout controls should be recessed behind the fascias, and not on the horizontal or vertical surfaces of your scenery.

## **6.0 Scenery**

- RP6.1 All benchwork shall be hidden by some form of scenery.
- RP6.2 Module fascia color shall be Valspar (Lowes) 5005-6C Billiard Room, eggshell or equivalent
- RP6.3 Scenery at the Free-mo standard end(s) shall have a flat profile 3/8" below the top of the rail on the through route.
- RP6.4 The through route shall be ballasted Woodland Scenics Fine Light Gray or equivalent,

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- RP6.5 Standard rail color on the through route is Floquil/Polly-S Roof Brown or equivalent.
- RP6.5.1 Ballast on Through route is to be weathered with a fine mist of thinned Floquil/Polly-S grimy black or equivalent.

### **8.0 Revision History**

19 Feb 12    Rev 1    Released.