

Calgary Free-mo

Standards and Construction Guidelines

1.0 Overview

The main purpose of this modular group is to provide a place to operate finely detailed HO scale standard gauge models in a realistic fashion. Operating trains is the important aspect of meets, so the layout setup does not follow the traditional "endless circle" format of modular layouts. Instead it follows a "free-form" configuration that does not readily lend itself to continuous running; trains originate from one point on the layout, traverse it, and then terminate at the other end (or back at the starting point). This format results in modules that are viewed from both sides, and that are designed to be reversible (rotated 180 degrees).

This type of operation requires end points, typically in the form of stub end yards or reverse loops. A layout may then take on the form of an "out-and-back" or a "point-to-point". Other more complex formats are possible if "junction" modules are built; for example a wye module could allow a branch line operation.

Between the end points of the layout are modules which carry the single track main line from one end to the other. Large modules may be assembled from small, easily transportable "sections" to create a large layout feature; for example a passing siding long enough for a full-length freight train could be created as a multi-section module. At this point in time we are constructing double track modules.

2.0 Definitions

MODULE:

Any layout component (or group of "sections") meant to be operated as a single unit in a fixed configuration. A module can have any number of sections. Both ends of a module comply with the Free-mo physical and electrical standards defined within this document.

SECTION:

A part of a larger module, complete with bench work, track, scenery, etc. Except where otherwise noted, standards for module end interfaces do not apply to inter-section interfaces, as these are considered to be internal to the module.

ENDPLATE:

The standardized end surface of a module that joins with an adjacent module in a Free-mo layout. The physical aspects of the endplate are defined in the Frame Work description, below.

FITTER RAILS:

The 2" long removable rails and joiners used to bridge the joints between adjacent modules or sections. Must be Code 83.

TRACK (POWER) BUS:

The continuous two wire bus feeding power and DCC commands to the track.

ACCESSORY (POWER) BUS:

The continuous two wire bus powering electrical accessories such as turnout motors, structure lighting, animation, etc.

LOCONET (DCC) BUS:

The continuous six-wire bus carrying DCC information among the Digitrax system components such as throttles, boosters, radio receivers, etc.

PIGTAIL:

Common name of any of the connector/wire assemblies used to connect the electrical busses together between modules.

3.0 Frame Work

"Frame work" refers to a module's structural frame including endplates, interior supports, legs, and braces. There are no requirements to use specific materials or construction methods; however, the basic trade-off is sturdiness versus weight. To date, frames have been built from dimensional lumber, high-quality plywood such as birch, and medium-density fiberboard (MDF). Other more exotic materials are possible but have not yet been used by Calgary Free-mo (wood/foam sandwich, aluminum, honeycomb structures, etc.). We have had great success using a frame constructed from $\frac{3}{4}$ G1S plywood. See attached drawing.

Generally, dimensional lumber is discouraged due to warping issues.

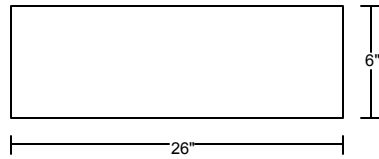
See diagram next page.

Calgary Free-Mo

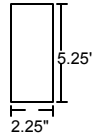
Basic Module Frame Design

All Material is 3/4" Plywood.

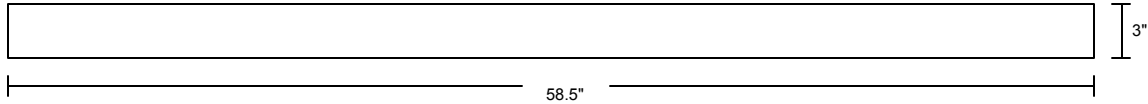
G1S fir or pine is a minimum grade.



End Plates - 4 Pieces required



Leg Pockets and spacers -
20 Pieces required

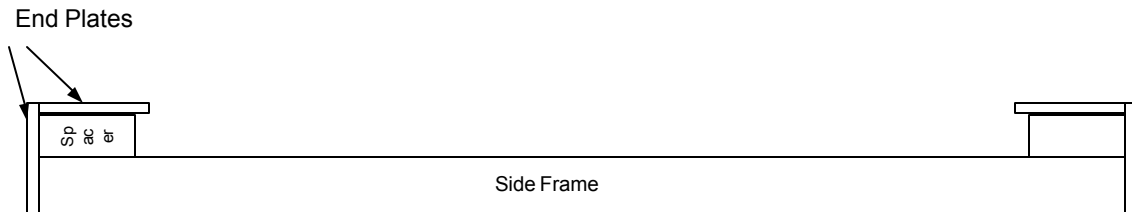


Side Frames - 2 Required

58.5" length gives 60" module

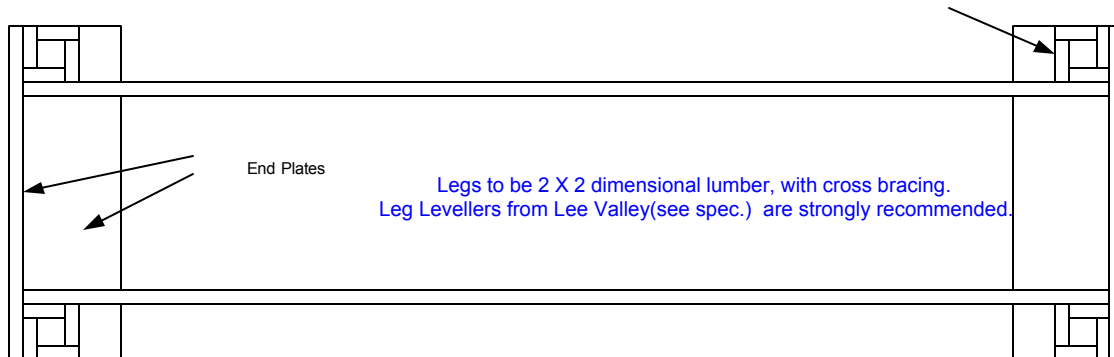
Adjust length to give desired module length

Side View Without Pocket Legs Shown



Bottom View - With Leg Pockets Shown

Leg Pocket
Made with 4 Leg Pocket/Spacer pieces



Height:

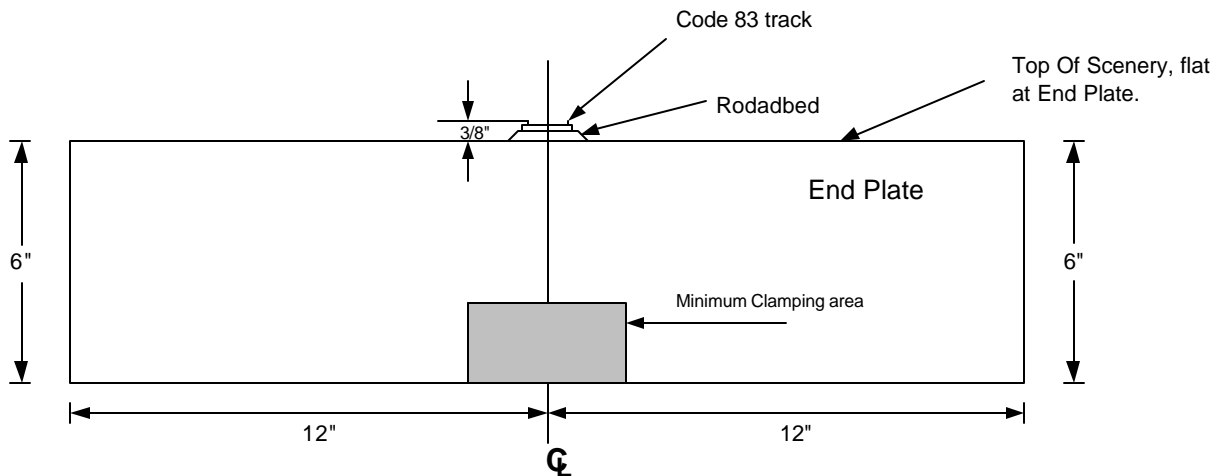
The nominal module height measured from floor to top of rail shall be 50", adjustable from 49" to 51", with selected public shows of Calgary Free-mo modules only at a child-friendly height of 42", adjustable from 41" to 43". Members are strongly encouraged to have a means of displaying their module(s) at both heights.

Suggestion: the height adjustment range of 2" is a minimum; a larger range is acceptable and highly recommended.

Width, Length and Shape:

See Endplate specifications (below); otherwise free. As a note for ease of use, it should be noted that a module over 6' in length becomes very hard to handle by one person; both in size and weight. If you plan to build a module over 6' in length you should consider making it in two or more sections.

Endplate – Single Track:



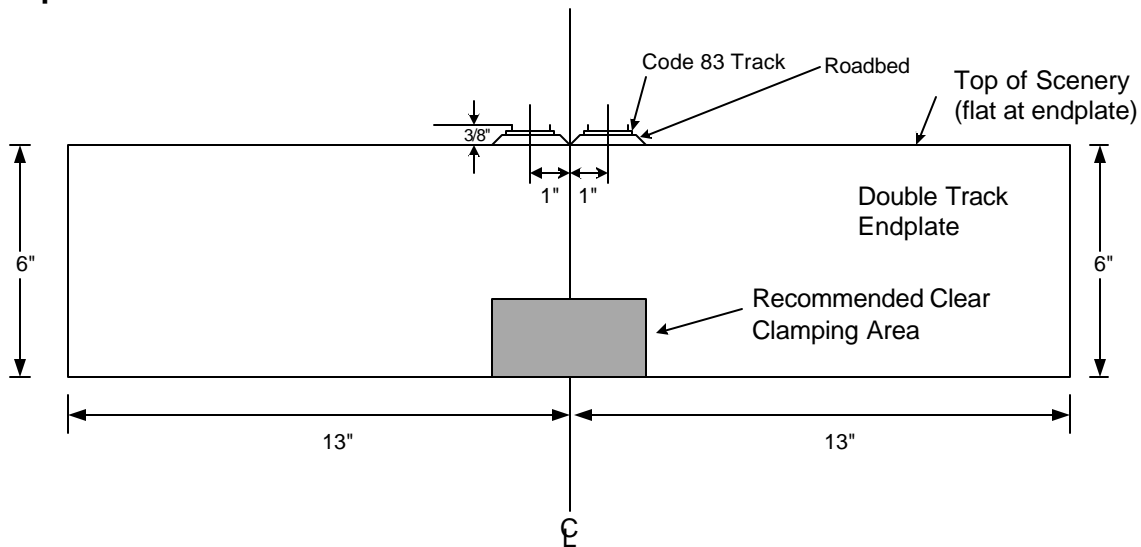
24" wide, 6" tall from bottom to scenery top surface; roadbed and track adds 3/8" to top of rail. See drawing above. Single track must be centered on the endplate.

Endplates MUST be parallel to each other, and perpendicular to track both vertically and horizontally. They must be as flat as possible (e.g. not bowed, twisted, etc.). Material must be solid and sturdy for C-clamping to adjoining modules.

Suggestions:

- ✓ Make endplates from 3/4" plywood or equivalent stable material to maintain flatness. Dimensional pine lumber is not recommended as it often warps over time.
- ✓ To allow room for C-clamps, keep inner surface of endplate clear of obstructions (electrical terminal blocks, LocoNet connectors, etc.). Recommended clearance area is 2" high by 4" wide, centered at bottom edge of endplate inner surface. To help prevent the C-Clamps from damaging the endplates it is recommended that a piece of Masonite be mounted on the inner surface. It can be glued, screwed or both.
- ✓ Cut handholds into endplates to assist transporting and positioning the module.
- ✓ Paint endplates Behr Mayan Green. Use "flat" to prevent modules sticking together. Note: Mating 24" -wide single track and 26" -wide double track modules results in small fascia offsets.

Endplate – Double Track



Double track endplates are 26" wide; the two tracks are centered 2" apart, each centered 1" from endplate centerline. Rail tops of both tracks are at the same height, 3/8" above the scenery top surface.

Endplates **MUST** be parallel to each other, and perpendicular to track both vertically and horizontally. They must be as flat as possible (e.g. not bowed, twisted, etc.). Material must be solid and sturdy for C-clamping to adjoining modules.

Track spacing may deviate from 2" centers within a module (e.g. broader through curves). See NMRA standards for spacing specifications.

Some legacy modules have more than one track at a 24"-wide endplate. Mating them with 26"-wide double track modules results in small fascia offsets.

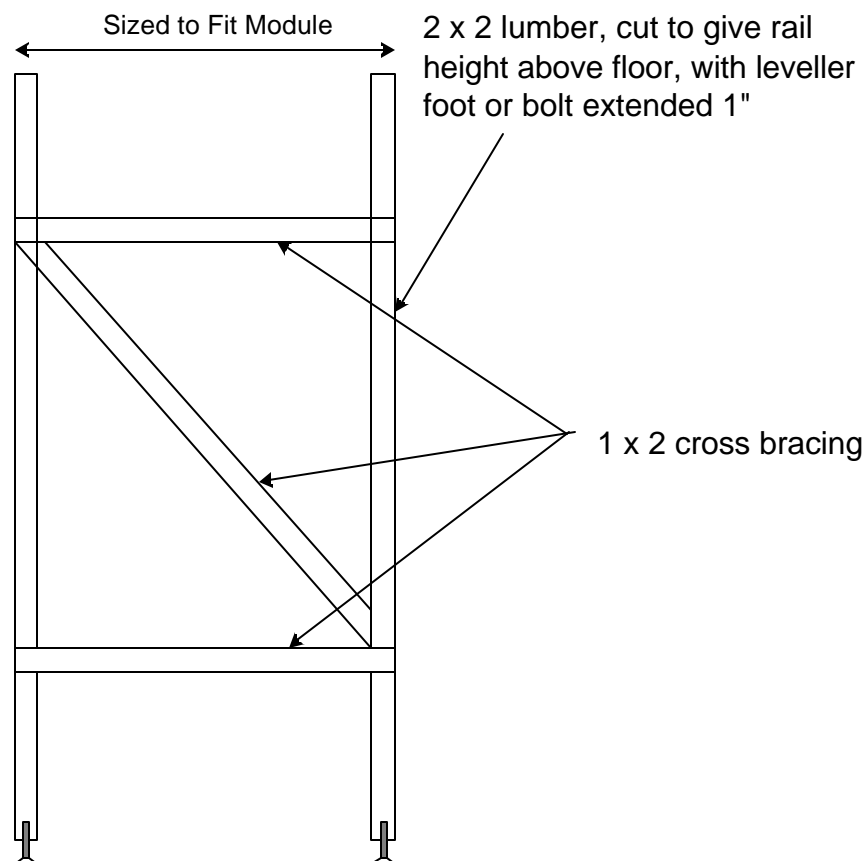
Mating 24"-wide single track and 26"-wide double track modules results in small fascia offsets.

Legs and Longitudinal Bracing:

Each module must have legs that support the module. A module must stand secure and level independent of other modules. Each leg must include vertical adjustment of plus and minus 1" minimum to compensate for uneven floors (e.g. rail top height above floor must be adjustable minimum of 49" to 51"). If painting the legs use the same paint as the fascia. Suggestions:

- ✓ Design and construct legs as part of the frame, making them an integral part of a module structure.
- ✓ Install cross- and angle-bracing on legs for added stability.
- ✓ Add angled longitudinal braces to prevent module from swaying parallel to the track. This stabilizes the module for fine adjustments during setups, and when working on the module during construction.

- ✓ We recommend using Lee Valley Catalogue #01S04.05 Panel Brackets (sold as a set of 4) c/w catalogue #01S06.04; 4" long Leveler Feet. 'T' nuts with machine bolts are acceptable. Ensure that the bottom of the feet have a means of attaching a protective base to prevent damage to flooring at any set up locations.
- ✓ Cut leg cross bracing once legs are installed in pockets (see frame drawing). This will ensure that the legs are correctly spaced.



Fascia:

Fascias must be smooth and made of a solid, sturdy material (plywood, hard board, Masonite, etc.). Fascia must be 6" tall at the endplates continuing this height 6 3/4" in from the face of the endplates. If the module is flat across the entire length, the fascia will be 6" tall from top of module to bottom of fascia. If the module has rivers, hills, canyons, gulleys etc. that show at the edge of the layout, construct the fascia accordingly to provide a neat and clean edge appearance and a means to attach skirting. Mount a 3/4" wide strip of "Velcro" loop material the full length of the module on both sides. The bottom of the strip to be 6" down from rail height. Used for attaching skirting.

End plates and fascia shall be painted Behr Satin Enamel Wall and Trim, Behr base number 513 Deep Base; Mayan Green* All other exposed wood, frame work or base scenery on the top surface to be painted with Behr Flat Super Scrub Dried Bark.* It should be noted that the top of the module must be painted with the Dried Bark so that if any other scenery products happen to come off, there will be no bare wood showing.

Suggestions:

- ✓ Avoid protruding items like toggle switches to prevent accidental damage or injury to operators; recess these items into cutouts in the fascia.
- ✓ Label both module sides with name of module. Lamecoid plaques will be made available at a nominal fee.
- ✓ Label electrical switches and other operational items. Brother "P-Touch" labels are acceptable. Confirm print size.

* Special notes on paint:

Mayan Green is a Behr/Home Depot colour, for other retailers use the following formula: (858ml size) #513 Deep Base, Satin Enamel Wall and Trim; B5, C16, D43, E 1 Y 3, KX15.

Dried Bark is a Behr universal colour.

Module-to Module Attachment:

C-clamps are used at the endplates, positioned near the endplate center (directly below the tracks).

Suggestion: Use "deep-throat" C-clamps to apply pressure closer to module top and draw track ends together.

4.0 Track Work

General:

All NMRA standards must be met.

Sub-Roadbed:

Sub-roadbed construction and materials are free, but must be built to prevent sagging or flexing, and must be installed to comply with the endplate requirements (see section 3.0 "Frame Work"). Track MUST be perpendicular to the endplate both horizontally and vertically!

Suggestions:

- ✓ To date Calgary Free-mo modules have used plywood, Homasote, and foam insulation board. The main trade-off is rigidity/stability versus weight.
- ✓ If foam board is used, run interior wood track supports parallel to the track to provide maximum support for the foam, resulting in a flat track profile.

Roadbed:

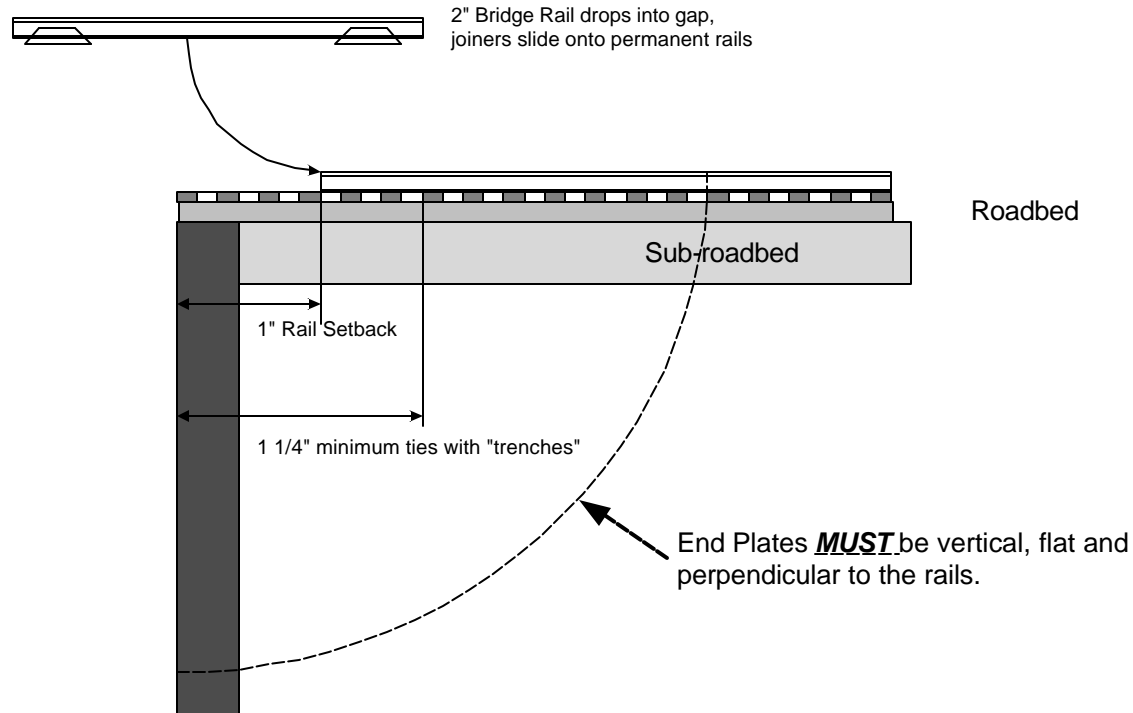
Material is free, but must comply with the 3/8" standard for top-of-scenery to rail-top dimension. See section 3.0.

Suggestion: Standard HO scale cork roadbed used under flex track meets the 3/8" requirement.

Mainline Location:

The mainline must cross the module end plate centered on the 24" width or centered 12" from either side of the 26" endplate for double track modules; it **MUST** be perpendicular to the endplates both horizontally and vertically! The mainline must run straight and level for at least 6" from each endplate. Otherwise its location is free (within limits of standards for curves and turnouts). This guideline ensures there is at least 12" of straight track between reverse curves. The mainline should run no closer than 6" to edge of free-form module

Joining Track Between Modules:



Rails end 1" from end of module (outer surface of the endplates). Ties and ballast continue to end of module. The ties within 1.25" (minimum) must accommodate installation of fitter rails with accompanying rail joiners, which are slid onto the module's fixed rail ends (typically these ties have a small "trench" where the spikes normally are found). Modules are connected with 2" fitter rails and rail joiners, which are dropped into the rail gaps and joined to the module rail ends.

Suggestions:

- ✓ Use Atlas code 83/100 joiners on fitter rails (their profile provides a surface for pushing into place).
- ✓ Use weathered code 83 rail for fitters.

Rail:

All track must be nickel-silver commercial or hand laid. Mainline track must be Code 83. Other track may be smaller (e.g. Code 70 or 55), but must permit reliable travel by rolling stock with NMRA RP25 flanges. All active rails must be clean and flange ways clear. Paint sides of rail and tie plates with an appropriate colour. To reduce shine on plastic ties paint with Poly S or Modelflex Flat Finish.

Rail colour to be a mix of PollyScale, Acrylic Weathered Tie Brown and PollyScale Acrylic Engine Black in the following proportions:

- 1 fl. oz. (standard size bottle) W.T.B.
- 2 full eyedroppers (3" x 3/16) of E.B.

Clean rails and clear flangeways before each operating event.

Curves:

Minimum radius is 42" for mainline, 36" for branch and industrial trackage. There must be at least 12" of straight track between reverse curves. All mainline curves should include easements; an article for creating easements can be found on the internet at <http://www.trains.com/Content/Dynamic/Articles/000/000/001/647dsuww.asp> Even though we specify a minimum of 42", the use of a 48" or larger radius curve looks so much better. 36" radius curves will be permitted on mainline j junction connecting tracks and on staging loops with 2 ½ " track spacing.

Double Track:

Double tracks at a 26" double track endplate must be centered 2" apart, with each track centered at 1" from the endplate centerline (see drawing on Page 5). It is important that the 2" centre between tracks is maintained, and that one track be centred *exactly* 12" from one edge of the faceplate. This ensures that when connecting double track modules the tracks line up properly. If both tracks are measured from the edge of an endplate that is not exactly 26" wide, the 2" rail spacing could be compromised, creating problems matching with other modules. Rail tops of all tracks must be at the same height, extending perpendicular from the endplate face for a minimum of 6".

Multiple Tracks – Legacy Modules:

Some legacy module designs have more than one track at a 24"-wide endplate. In this case the single main line track must be centered on the endplate. Tracks adjacent to the centred main line must be centred at 2" from the main track to align properly with double track modules. Rail tops of all tracks must be at the same height, extending perpendicular from the endplate face for a minimum of 6 inches.

Super-Elevation and Grades:

Super-elevation of mainline curves, vertical track curves, and grades are permitted, appropriate for mainline operation of contemporary long cars (90' cars must be able to negotiate these track profiles without derauling or uncoupling from adjacent cars). The maximum mainline grade is two percent (1/4" rise per foot of run). Track must be level for at least six inches from each end of module.

Suggestion: when constructing track that includes vertical curves as described above, use a straight edge of at least 12" laid on top of the rail to measure the rate of change of the rail height. Measure each rail separately. The space between rail top and straight edge should not exceed 1/16" within 12" of horizontal run.

Note: grades are possible within a large module, as long as nominal rail-top height is 50" from floor at both endplates of the module.

Turnouts:

Minimum #6 for mainline but #8 is preferred. Peco Code 75, large radius turnouts are also acceptable on the mainline, ensure that the track height of the turnout is adjusted to match Code 83 track at installation. Minimum #5 for branch and industrial trackage. All mainline turnouts are controlled locally or through DCC. Point throw must reliably and completely close the point rails against the stock rails. Method of throw (powered or manual) is free. Tortoise switch machines can be used as the powered devices for turnout control. If using turnouts for crossover purposes between the two mainlines, the switch machines MUST be interlocked to prevent incorrect alignment. When using powered switch machines the frogs must be power routed from stock rails (relying on the contact between point and stock rails to conduct power through points into the frog is to be avoided).

Note: DCC accessory decoders are allowed for turnout control as long as there is at least one other method available to throw the turnout (fascia buttons, hand throw, etc.). DCC decoder addresses must be registered with the set up coordinator so as to avoid any duplicate addresses.

Clearances:

All clearances (curves, tunnels, structures, etc.) must meet NMRA standards. It is recommended that if you constructing your own module that you purchase an NMRA HO track gauge to ensure that all clearances are met. Note: potentially every type of rolling stock will run over all modules; clearances must accommodate the tallest double stack, longest piggyback flat, etc.

Industrial Trackage:

All non mainline track, whether it be a branchline, industrial, interchange, etc.; can be of any reliable construction method using any track size equal to or less than code 83. All trackwork must be reliable and be able to operate the designated traffic it is constructed for.

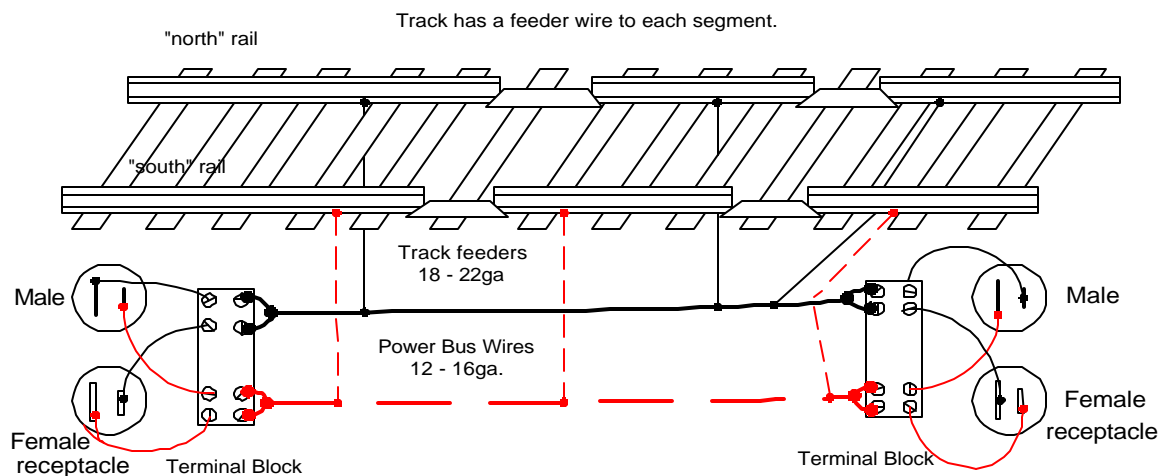
5.0 Electrical

Three simple electrical "busses" run through each module and connect them together.

1. Track Power Bus. 2 #12-#16 AWG wires.
2. Accessory Bus. Wire as above.
3. Digitrax Loconet Bus. 6 conductor twisted pair or flat satin cord.

Track Power Bus:

The track power bus is a two wire daisy-chain bus that powers the mainline track. Power is supplied from the Digitrax booster(s). Feeder wires are soldered to the rail and connected to the track bus. At the end of each module there is a pigtail with two Cinch Jones connectors. The pigtails must be 12" long minimum and terminate within 6" of module endplates. They must be made with 16 -12 gauge wire. The bus wires terminate on a barrier block as described below.



See the sketch above. Note the male and female connectors are wired differently at either end of the module. It is recommended to define "directions" for a module, i.e. North/East/South/West, to use as orientation keys during wiring. And a good way to verify that the pigtails are correct is:

When facing the module endplate the male connector's pin 1 (the large blade) and the female connector's pin 2 (small receptacle) must both connect to the left-hand rail.

Connect the bus to each segment of track rail with 18-22 gauge feeder wires

Digitrax DCC and Loconet Bus:

Digitrax is the only manufacture of boosters and throttles that are currently accepted for Calgary Free-mo. Any NMRA compatible decoder can be used in the locomotives. Digitrax LocoNet must be wired through all modules.

Any modules with turnouts on them must have a Digitrax UP5 panel connected to the track power. It is recommended that all modules have one. The UP5 must be mounted neatly on any one side of the module, with a two outlet 6 conductor 6 pin telephone jack neatly and

firmly mounted on the opposite side. This double jack would be wired to the auxiliary port of the UP5.

To interconnect modules, terminate the LocoNet bus at each end of the module using either of the two methods described below:

1. Terminate with a 6 pin telephone plug at each end of the module, wired “one-to-one” so that pin 1 of each plug is the same at each end. A double ended 6 conductor inline female telephone jack must be provided for both ends. Use 6 conductor ‘satin’ cord for cables. Wire as shown.
2. Terminate with a 6 conductor telephone jack at each end. Screw terminal or IDC type connections are acceptable. Provide a 12”, minimum, 6 conductor male to male telephone patch cord for each end. Use either satin cord as above or round, twisted pair cable, 6 or eight conductor.

See diagram on next page.

Accessory Power Bus:

This is a two wire bus constructed of 2 - #12-#16 AWG stranded wire, each wire to be a different colour to differentiate polarity. Each wire is to be terminated at the ends of the module onto the barrier terminal block as shown in the accompanying sketch.

Each pair of wires then has a ‘pigtail connector made up of a two pin trailer connector. Ensure that polarity is maintained at each end. These connectors are sold as a short cable with connectors on both ends, cut the cable in half and construct the pigtail so that it is at least 12” in length.

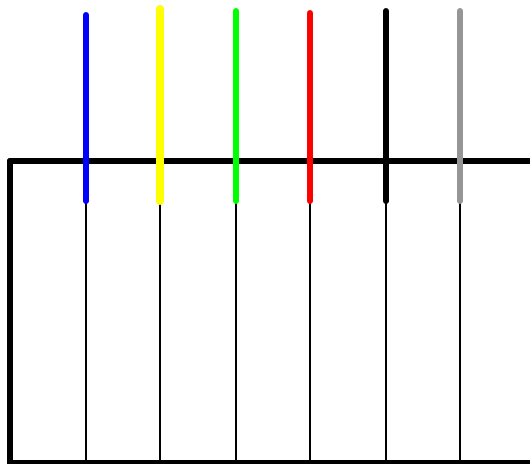
Module end Terminations

Barrier terminal blocks shall be used at the module ends; connect the buses on one side and the pigtail connectors on the other side. Use crimp on spade lugs or tin the bare wires to terminate.

See diagrams on next page for connection details.

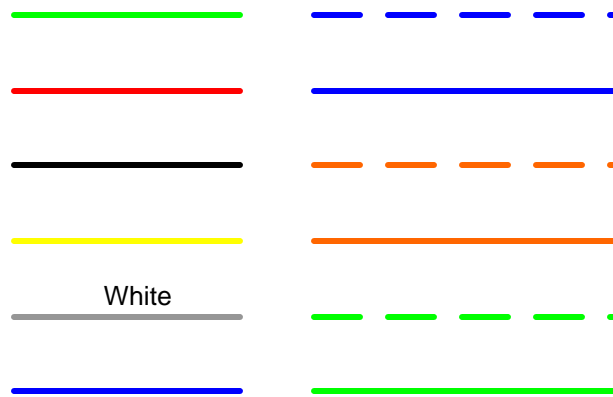
Satin Cord Connection diagram

Note: gray indicates white wire.



Connect one end of cable with centre rib of cable facing up and the other with the rib facing down.

Wiring Cross Reference.



Solid color twisted pair or flat cable.

Band Striped twisted pair cable.

Shopping List for Electrical:

- 2 – Cinch Jones S302-CCT socket connectors
- 2 – Cinch Jones P302-CCT socket plugs
- 2 – Curtis 1506 Barrier Terminals (or equal)
- 2 – 2 pin trailer connectors.
- Misc. crimp on spade lugs #6 stud.

All of these materials are available from B & E Electronics in Calgary, Regina and Saskatoon. (www.be-electronics.ca). Other suppliers include Electrosonic (www.e-sonic.com); Digikey (www.digikey.com). The two pin trailer connector is also available from most department stores and Canadian Tire.

6.0 Scenery

Scenery Style, Materials and Techniques:

Scenery must depict realistic, commonly found rail-oriented scenes, with prototype locations preferred. Scenery must allow hand-cleaning of all tracks using a "track eraser" type cleaner. Materials and techniques are free.

For basic scenery: Initial layer of Woodland Scenics #T44 Burnt Grass with #63 light green sprinkled lightly over top as accent colour/texture. This is a base color allowing ends of modules to match and flow together. Feel free to blend this color into your scene.

Suggestion: Midwestern/Western scenes should be modeled. From the heartland to the Foothills and everything in between. Example: Rolling hills, valleys, small towns with false front buildings, typical industries for the area, junctions, prairie scenery with a mix of deciduous and coniferous trees, etc. Modeling real scenes is encouraged with no need to compress too much into a module.

Mainline Ballast:

Ballast must be "fine Woodland Scenics B1393 "Gray Blend Fine (shaker bottle)". Modules 12 feet or longer may use other ballast colors (to match a prototype locale, for example), but must transition to the standard ballast at module ends.

End Profile and Landscape:

A flat horizontal scenery profile is used at module ends. Scenic "ground level" at module ends is nominal 3/8" below top of rails (see sketch in Section 3.0). Landscaping along the module ends must be designed to smoothly flow into adjacent modules - avoid features such as roads, lakes, and so forth from running against the module ends (see INTER-MODULE JOINT TREATMENT, below).

Suggestion: Using HO cork roadbed under mainline track to meet the 3/8" ground level guideline.

Note: scenic contours within a module between the flat end profiles are free (i.e. entire module does not have to be flat; in fact table-top flat modules are discouraged).

Inter-Module Joint Treatment:

Polyfiber covered with fine ground foam (i.e. Woodland Scenics "turf" material) to simulate undergrowth "thickets" is temporarily placed over joints during a setup, in random patterns, shapes, and colors. This technique hides the joints and transitions scenery from module to module. Polyfiber thickets must be placed clear of the track right-of-way. Any other 'bushy' thicket type of removable scenery will be acceptable as long it is compatible colour-wise with the scenery at the ends of the modules. See "Required Items" further on in this document.

Backdrop

No backdrop is allowed as modules are viewed from either side and are also meant to be reversible.

7.0 Public Displays

Operational Rules:

At this time the Western Canada Free-mo group has only two hard and fast rules regarding operating, as follows:

1. Auto Reverse Loop(Larsen Loop): A train in one of the reversing loops must be completely clear of that loop before another train can enter the same loop.
2. If all of the 6 track staging modules are put together at one single location(mid-way or end) there must be a minimum of one staging track free at all times. If a train arrives and fills the staging yard, another must leave as soon as the yard throat is clear.

As we gain more operational experience other operational rules may have to be implemented.

Skirting:

Fabric:

Fanny's Fabrics 114 cm 65/35 Broadcloth
Colour GY2 (Grey)
Stock Number 6196310

Construction:

The following describes the construction for a module with fascia that has a bottom edge that lines up with the bottom edge of the 6" endplate, and is level across the module.

1. Skirt Height is 35".
2. There is a double 2.5" bottom hem, with a rope lead drapery weight the full length of the skirt.
3. There is a double +/- 2" top heading (depending on the actual width of the fabric, this is adjusted to obtain a 35" overall height).
4. There are double 1" side seams.
5. Skirting panels are made to the length of the side perimeter of the module to which they are applied, plus 4" for 2-inch overlap on the modules on each side.
6. ¾" Black Hook Velcro strip gets attached across the full length on the inside top edge of the skirt, with the top edge of the Velcro 1/8" below the top edge of the skirt.
7. 4" of ¾" Black Loop Velcro strip gets attached to the front top edge from each end, with the top edge of the Velcro 1/8" below the top edge of the skirt.
8. ¾" Black Loop Velcro strip is mounted with contact cement along the bottom edge of the side fascia, with the bottom edge of the Velcro strip at a distance of 6" below rail height.

This construction allows for overlap at each module joint, good fabric support (no droop), and a length that will keep the skirt just off the floor at our minimum adjustment height of 42" rail height +/- 1".

Modules that have special requirements for skirting will have to have the skirting custom designed so that the hems fall to the same level as the normal standard.

Supply:

Currently, standard skirting, can be provided by the group at a cost of \$1.70 per lineal foot per piece, provided the height of the skirt can be obtained from the width of the fabric (hem and heading widths may be adjusted). Pricing is for the finished length of the skirt including overlap, taken up to the next even half-foot. This includes the Hook Velcro to attach to your module. The group has a supply of all materials required for this, and the skirts are made up with no labour charge.

Crowd Control Barrier System:

Spec to follow

8.0 Locomotives and Rolling Stock

Wheels:

- ✓ Metal or clean plastic.
- ✓ Clean
- ✓ Back-to-back spacing meets NMRA gauge
- ✓ Gauge meets NMRA gauge
- ✓ Flange contours are RP-25 or have equivalent flange depth
- ✓ Semi-scale (.088") wheel treads are allowed

Rolling Quality:

- ✓ Cars roll freely down a 3% grade

Trucks:

- ✓ Pivot freely
- ✓ Slight lateral rock on at least one end (three-point mount)
- ✓ Able to negotiate a #5 turnout
- ✓ Able to negotiate a 30" radius curve
- ✓ Able to negotiate vertical rail curves as specified in Section 4.0 TRACK WORK standards

Couplers:

- ✓ Kadee #5 or #58; other brands will be allowed as long as there are no problems with inter-brand coupling. Kadee couplers will take precedence.
- ✓ Match to center of Kadee coupler height gauge or NMRA Standards Gauge, plus or minus 1/32"
- ✓ Knuckle and centering springs work freely
- ✓ Free of flash
- ✓ Metal couplers are insulated from the rail

- ✓ Trip pins clear Kadee coupler height gauge or equivalent
- ✓ OPTIONAL: coupler trip pins may be cut off at the bottom of the coupler body

Car Weight:

- ✓ As long as a car is operating correctly and not causing derailments or other operational problems, we will not be checking weight.
- ✓ We do recommend that a car be weighted to within +10%, -5% of NMRA specification (1 oz + 1/2 oz for each inch of car length:) so that problems are avoided. (see chart below.)

Car Length (Scale ft)	NMRA Weight (oz)
30	3.1
35	3.4
40	3.8
45	4.1
50	4.4
55	4.8
60	5.1
65	5.5
70	5.8
75	6.2
80	6.5
85	6.9
90	7.2

Electronics:

- ✓ Locomotives equipped with DCC decoders compatible with NMRA DCC compliant systems
- ✓ For the time being locomotives use 2-digit address—address is last two digits of locomotive road number. All decoder addresses must be registered with the *Set-Up Coordinator* and will be assigned as above on a first come first served basis. Any conflicts will be resolved by the set up coordinator and the owner of the conflicting locomotive will have to resubmit an address for the conflicting locomotive. First choice should be the middle two digits of the road number if possible.
- ✓ Address 03 and 00 will not be allowed to operate on any set up, but will be allowed for ‘test’ purposes after getting clearance from the set up coordinator.

9.0 Setup Checklist

Required Items:

In addition to the obvious items to bring to a Free-mo setup such as modules, legs, and rolling stock, the following items are required for each module:

- ✓ Minimum of enough 2" fitter rails with joiners to accommodate the one end of your module that has the most tracks to join to the next module (e.g.: only single track = 2 fitter rails, double track end = 4 fitter rails. Additional fitter rails are always welcome. Bring additional fitter rails and joiners to connect any additional tracks that cross module joints (i.e. yard extension modules). Atlas makes a joiner that fits both code 83 and code 100 rail; these seem to work well for fitter rails as they can be pushed easily onto the module's permanent rail ends with a small screwdriver.
- ✓ Minimum of one large C clamp to hold module ends together. Deep-throated clamps are best.
- ✓ Minimum of one 24" six conductor phone cable with RJ12 clip plugs on both ends, wired straight through, to connect the Digitrax DCC LocoNet across module joints.
- ✓ Minimum of one set of polyfiber/ground foam "thickets" to cover one inter-module joint on both sides of main line. 3 or 5 clumps of lichen or other 'bush like' pieces.
- ✓ AC power extension cords and outlet expanders or strips to extend wall power throughout the layout. A 'Block Heater' style extension cord that is at least as long as your module with a 3 way outlet is appropriate. Minimum wire is 16/3 to keep any voltage drop to an absolute minimum.

Suggested Items:

- ✓ Other items suggested to bring, but not required:
- ✓ Digitrax DCC throttles - the more throttles available, the more people can run trains at once.
- ✓ Digitrax DCC boosters – for multiple power blocks or emergency backup should one fail.
- ✓ FRS 14-channel radios – handy for operations in noisy show environments.
- ✓ Tools including rail cutters, files, wood glue, levels, wrenches, screwdrivers, tape measures, pliers, wire cutters and strippers, multi-meter, soldering iron, track gauge, track cleaner, etc. These help resolve problems that may crop up, and to repair minor damage that may occur while transporting modules.
- ✓ Model tools including coupler height gauge, wheel gauge, small screwdrivers, ACC and styrene glues, tweezers, files, etc. These help repair or adjust rolling stock and track to keep things running smoothly.
- ✓ Folding chair or stool.

Dated: February 12, 2004

Subject to Revision.