CONSIDERATIONS FOR T-TRAK MODULES & LAYOUTS

BBMRA T-Trak – N, HO, Z, T, O, G

ABSTRACT

Model railroading is an intriguing hobby for young and old. Newer technologies and techniques are engaging when working with others focused on similar tasks. This guide will assist you in learning about the standards and guidelines for building T-Trak modules for N Scale railroaders with considerations for the standards for other scales as well. The basic premise is the same for all scales except for the measurement specifications relative to each scale being reviewed. Read, Learn, and Enjoy!

September 20, 2019

Acknowledgments

This document is a work in progress. Many BBMRA members and friends from other organizations have contributed information, time, and effort in developing this resource guide. As new information becomes available this guide will be updated and revised.

Dr. Neal Meadows, Stacy Elliot, Robert Feuerstein, and Andy Zimmerman, President
Editors

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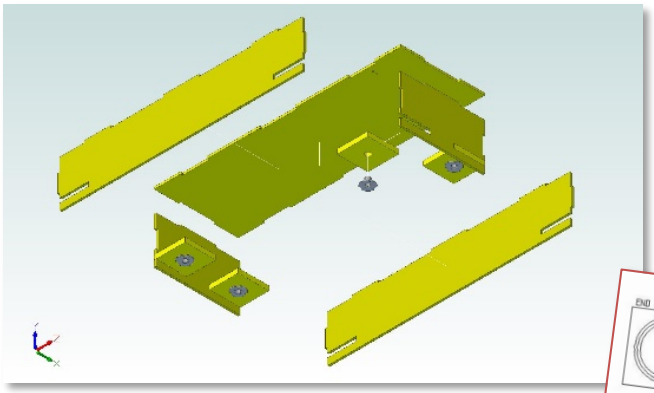
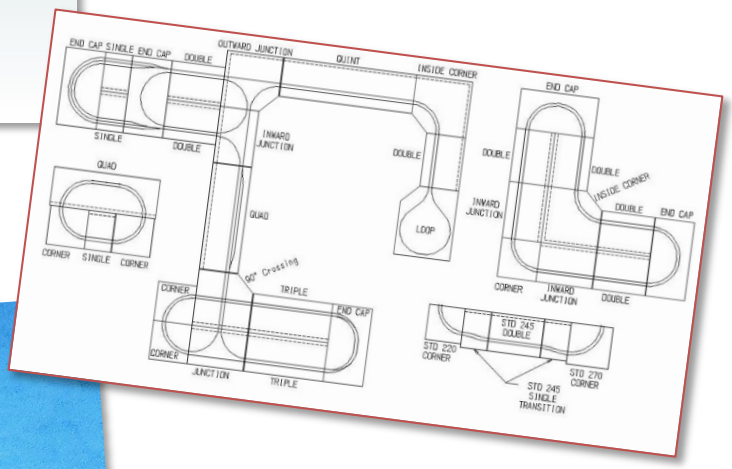
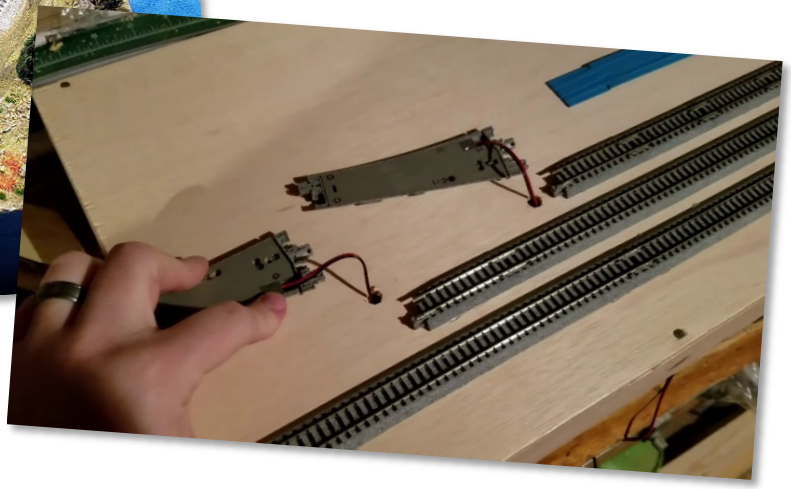






1. Introduction

This document is a compilation of a lot of information being gathered about T-TRAK from reading various documents, visiting T-TRAK related web sites, constructing T-TRAK modules and participating in train shows featuring T-TRAK layouts. The information is being gathered in preparation for authoring several documents including, but not limited to, the following:

- T-TRAK Standards and Recommended Practices
- This document will be unique to the BBMRA but will ensure full compatibility with T-TRAK standards so BBMRA T-TRAK modules will be fully connectable and interoperable in T-TRAK layouts.
- DCC for T-TRAK Layouts: Design Considerations
- The T-TRAK version of the N-TRAK DCC Design Consideration document as requested by Lee Monaco-FitzGerald and Jim FitzGerald.

Each section, where applicable, starts with a listing of T-TRAK standards plus our BBMRA position on these standards; the BBMRA position may be reflected as Recommended Practices.

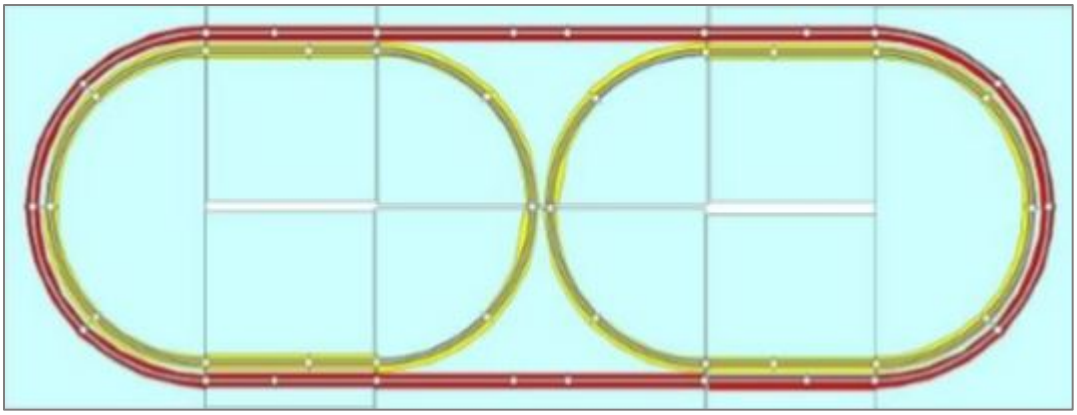
A highly recommended and valuable reference resource is “The Unofficial T-TRAK Handbook”, written by Paul Musselman and available online at http://T-TrakHandbook.com.

Another site is the Northern Virginia NTRAK Club’s T-TRAK Division web site at http://www.nvntrak.org/about/t-trak. Additionally, the North Raleigh Model Railroad Club web site has useful information for T-Trak standards and operations. https://nrmrc.org.

2. Terminology Used in This Document

The following terminology is used in this document:

- Front, rear, left and right refer to the T-TRAK module when looking at the module from the audience side — typically the two main tracks run side to side across the front of the module.
  - Width or length is the dimension the mainline tracks follow along the top of the module — width is used in this document.
  - Depth is the dimension from the front edge to the back-edge of the module.
  - Height is the dimension from the bottom edge to the top edge of the module base, not counting the adjusting bolts (i.e., The bottom of Unitrack pieces,) this is normally 2¾”.
  - Running Height is the dimension from the tabletop to the bottom of the Kato Unitrack.
- The front main track is referred to as the “Red” track; some clubs refer to this as “Track 1”.
- The rear main track is referred to as the “Yellow” track; some clubs refer to this as “Track 2”.
- Outside rail refers to the front rail on the Red track and the rear rail on the Yellow track.
- Kato wire colors are used to establish connections to the main tracks following the pattern with blue to the outside (i.e. blue — white — white — blue) from front to rear or vice-versa.
- Track Bus refers to the external cable used to carry track current from the control unit or power pack to the various modules.
- Accessory Bus refers to the optional external cable used to carry **12VDC** (white & black) or **15/16VAC** (brown & black) to modules for lighting, animation, signaling, and other non-track needs.
- Leveling Bolts refer to the required bolts which allow the module height to be adjusted from 2¾" to 4". These should be ¼” x 20 bolts or set screws with hex nuts on the bottom at all four corners.
- Inner Loops are isolated loops of the Yellow track when Junction modules are used.
- For layout planning, space available is expressed in the term of equivalent single-width T-TRAK modules (i.e. 310 mm).



3. T-TRAK Module Construction
Standards & Recommended Practices – Base Modules

T Trak N Scale Modules (1:160)

Item	T-TRAK – N Base Modules Standard	B.B.M.R.A. Recommended
Standard Straight Module (Single)	*Standard Dimension* 308 mm W x 210 mm D x 70 mm H (12-1/8" W x 8¼" D x 2¾" H). Height adjustable to 4"	Same as T-TRAK at left. Depth can be 14-3/8" (365 mm) maximum Recommended: 8¼" (210 mm), 12¼" (310 mm), or 14-3/8" (365 mm) Max depth modules [14-3/8" (365 mm)] with skyboard must have depth reduced by the thickness of skyboard. Full-Depth Module: 28-13/16"
Multiple Length Module 2X (Double)	*2x Dimensions* 618 mm W x 210 mm D x 70 mm H (24-5/16" W x 8¼" D x 2¾" H)	
Multiple Length Module 3x (Triple)	*3x Dimensions* 928 mm W x 210 mm D x 70 mm H (36½" W x 8¼" D x 2¾" H)	
Multiple Length Module 4x (Quadruple)	*4x Dimensions* 1238 mm W x 210 mm D x 70 mm H 48-11/16" W x 8¼" D x 2¾" H	
General Rule: (310 mm x N–5 mm leaves about 1/16" overhang at each end)		
Outside Corner Module	*Single Outside Corner* 310 mm W x 310 mm D x 70 mm H (12¼" W x 12¼" D x 2¾" H) *Alternate Single Outside Corner* 365 mm W x 365 mm D x 70 mm H (14-3/8" x 14-3/8" x 2¾")	*Double outside corner permitted* 732 mm W x 365 mm D x 70 mm H (28-13/16" W x14-3/8" D x 2¾" H")
Inside Corner Module	*Single Inside Corner* 518 mm W x 518 mm D x 70 mm H (20-3/8" W x 20-3/8" D x 2¾" H) *Alternate Single Inside Corner* 559 mm W x 559 mm D x 70 mm H (22" W x 22" D x 2¾"H)	*Alternate Single Inside Corner* 559 mm W x 559 mm D x 70 mm H (22" W x 22" D x 2¾"H) The front and back corners can be truncated to form a 6-sided module for ease of transport and storage NMRC.ORG has a dimension of 18-1/4" square
Common Corner Module Track Radii	282mm | 315mm	

Junction Module (See Note 1 below)	No standard	596 mm W x 365 mm D x 70 mm H (23-7/16" W x 14-3/8" D x 2¾ "H) (NVNTRAK Design) The outside track requires the use of a Kato 20-050 expansion track or cutting a standard piece of track.
Module Front/Sides Color	Modeler's Choice	BBMRA Standard color brown. See Module Color page 10.
Leveling Bolts	¼-20 x 2" Full thread carriage bolt and ¼-20 threaded T-Nuts installed in all 4 corners of the base, ¾" inset from front and rear of the module.	Nylon Flat Point Socket Set Screw, ½"–20 Thread, 2-1/2" Length, with ¼"-20 threaded insert nuts (in place of T-Nuts) installed in all 4 corners of the base, ¾" inset from front and rear of the module, with a hole drilled through the top of the module. (See Note 2 below)
Track Interface	Kato Unitrack	
Outer Line Track Offset	38 mm 1.5" (Centerline)	
Track Spacing	33 mm	
Electrical Connections	BWWB	
Electrical Connector	Kato or Anderson Power Pole	Anderson Power Pole

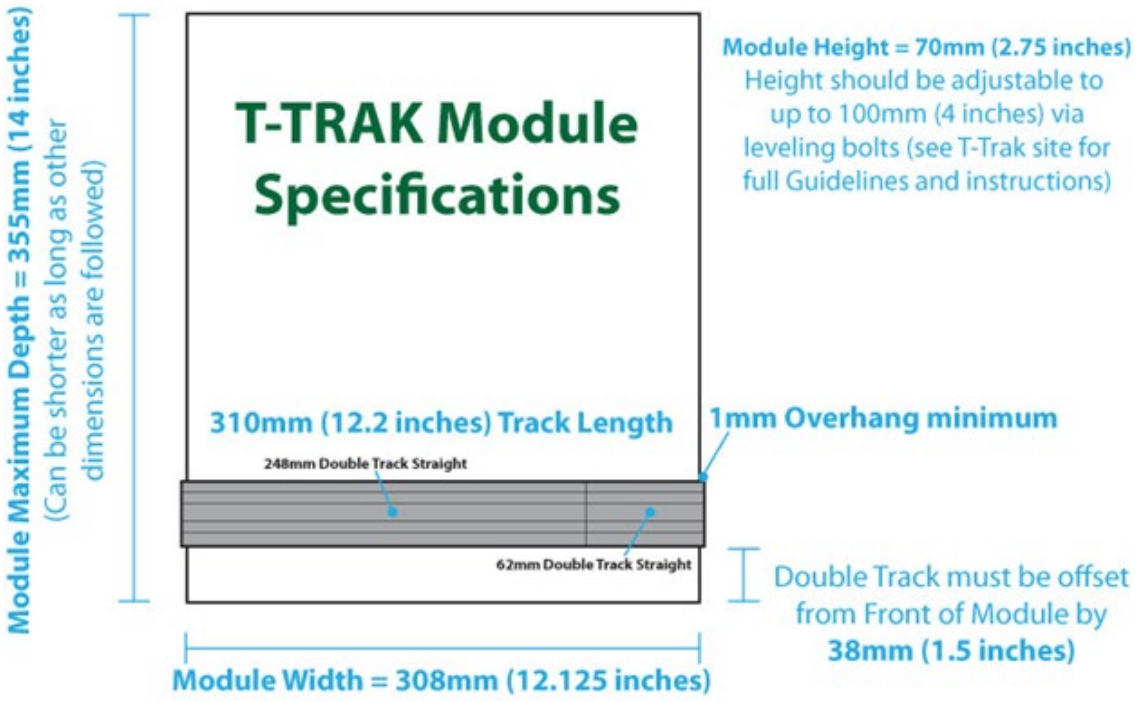
Note 1: Junction Modules are not the same width as any other module. This is not a problem when there are two Junction modules on opposite sides of the layout, joined by the curved tracks. But a single Junction placed along one side of the layout will not match the width of the straight modules on the opposite side of the table. The difference in the width must be accounted for within the layout.

Note 2: The Set Screw allows turning from the top of the module with a hex wrench. This does not require the module to be lifted or otherwise disturbed, which could affect adjacent module, and can be easily done with the module in place on the layout. Cover the hole with a movable structure or bush.

The ¼-20 insert nuts use a 5/16" hole and screw into the wood using a ¼" or 5/16" screwdriver bit. These are available from Home Depot (#54454) and other retailers. Insert nuts that are nailed in are also available.

- The Nylon Flat Point Socket Set Screw is available from McMaster-Carr (www.mcmaster.com) as Catalog. No 94564A115. The hex driver is McMaster-Carr 5497A39 or 7268A56.

On all modules, the track must extend 2 mm/ 1/16" beyond the ends of the module. This allows the UniJoiners to lock onto the next module and hold the layout together.



T Trak TT Scale Modules (1:120)

Item	T-TRAK-TT Standard	B.B.M.R.A. Recommended
Single Module Track Length	498 mm	
Single Module Length	497 mm 19-9/16”	
Maximum Module Depth	305 mm 12”	
Common Corner Module Track Radii	353 mm | 396 mm	
Corner Module Dimensions	482.6 x 482.6 mm 19 x 19”	
Height (all Modules)	70-100 mm 2.75-4.0”	
Track Interface	Tillig	
Outer Line Track Offset	86 mm (Centerline)	
Track Spacing	43 mm	
Electrical Connections	Blue White/White Blue (BWWB) Polarity is reversed on inside track from the polarity on the outside track.	
Electrical Connector	?	

T Trak T Scale Modules (1:450)

Item	T-TRAK-T Standard	B.B.M.R.A. Recommended
Single Module Track Length	120 mm	
Single Module Length	118mm or 4-5/8”	
Double Module Length	238 mm or 9-3/8”	
Maximum Module Depth	160 mm or 6-5/16”	
Common Corner Module Track Radii	145 mm / 157.5 mm	
Corner Module Dimensions	186 mm x 186 mm 7-5/16” x 7-5/16”	
Height (all Modules)	70-100 mm 2.75”-4.0”	
Track Interface	Eishinado	
Outer Line Track Offset	TBD	
Track Spacing	TBD	
Electrical Connections	Blue White/White Blue (BWWB) Polarity is reversed on inside track from the polarity on the outside track.	
Electrical Connector	Anderson Power Pole	

TBD = To Be Determined

T Trak Z Scale Modules (1:220)

Item	T-TRAK-Z Standard	B.B.M.R.A. Recommended
Single Module Track Length	220 mm 8-11/16”	
Single Module Length	218 mm 8-9/16”	
Double Module Length	438 mm 17-1/4”	
Maximum Module Depth	270 mm 10-5/8”	
Common Corner Module Track Radii	195 mm | 220 mm (11-5/8”) 220 mm | 245 mm (12-19/32”) 245 mm | 270 mm (13-9/16”)	
Corner Module Dimensions	295 x 295 mm | 11-5/8” 320 x 320 mm | 12-19/32” 345 x 345 mm | 13-9/16”	
Height (all Modules)	70-100 mm	

Item	T-TRAK-Z Standard	B.B.M.R.A. Recommended
	2.75-4.0”	
Track Interface	Rokuhan	
Outer Line Track Offset	76 mm 3” (Centerline)	
Track Spacing	25 mm or 1”	
Electrical Connections	BWWB	
Electrical Connector	Rokuhan or Anderson Power Pole	

HO Scale Modules (1:87)

Item	T-TRAK-HO Standard	B.B.M.R.A. Recommended
Single Straight Module	490 mm W x 610 mm D x 70 mm H (19 3/8” W x 24” D x 2¾” H)	Depth should be 24” Height can be 4”
Double Straight Module	1219 mm W x 610 mm D x 70 mm H (48" W x 24" D x 2¾" H)	Depth should be 24” Height can be 4”
Outside Corner Module	711 mm W x 711 mm D x 70 mm H (28” x 28” x 2¾”)	Height can be 4”
Inside Corner Module	1010 mm W x 1010 mm D x 70 mm H (?” W x?” D x 2¾”H)	The front and back corners can be truncated to form a 6-sided module for ease of transport and storage
Junction Module	1156 mm W x 711 mm D x 70 mm H (45½” W x 28" D x 2 ¾ “H)	
Leveling Bolts	¼-20 x 2” carriage bolt and ¼-20 threaded T-Nuts installed ¾” inset from edges of the module.	¼x20x2” socket set screws with holes in the top of the module can be used to allow height adjustment from above with a hex wrench.
Height (all Modules)	70-100 mm 2.75-4.0”	
Track Interface	Kato Unitrack	
Outer Line Track Offset	83 mm 3.25” (Centerline)	
Track Spacing	60 mm	
Electrical Connections	BWWB	
Electrical Connector	Kato	

T Trak S Scale Modules (1:64)

Item	T-TRAK-S Standard	B.B.M.R.A. Recommended
Single Module Track Length	30 “	
Single Module Length	29.875 “	
Maximum Module Depth	24”	
Common Corner Module Track Radii	20” | 25”	
Corner Module Dimensions	28” x 28”	
Height (all Modules)	70-100 mm 2.75-4.0”	
Track Interface	MTH S-Trax	
Outer Line Track Offset	5” (Centerline)	
Track Spacing	5”	
Electrical Connections	BWWB	
Electrical Connector	?	

T Trak O Scale Modules (1:48)

Item	T-TRAK-O Standard	B.B.M.R.A. Recommended
Single Module Track Length	40”	30”
Single Module Length	39.875”	35”
Maximum Module Depth	24”	30”
Common Corner Module Track Radii	36” | 48”	
Corner Module Dimensions	28 x 28”	30 x 30”
Height (all Modules)	70-100 mm 2.75-4.0”	
Track Interface	Lionel Fastrack	
Outer Line Track Offset	4” (Centerline)	
Track Spacing	6”	
Electrical Connections	BWWB	
Electrical Connector	?	Molex 9 Pin

T Trak L Scale Modules (1:87 Lego)

Item	T-TRAK-L Standard	B.B.M.R.A. Recommended
Single Module Track Length	TBD	
Single Module Length	TBD	
Maximum Module Depth	TBD	
Comm n Corner Module Track Radii	TBD	
Corner Module Dimensions	TBD	
Height (all Modules)	70-100 MM 2.75-4.0”	
Track Interface	Lego and ME Models	
Outer Line Track Offset	32 mm	
Track Spacing	128 mm	
Electrical Connections	N/A	
Electrical Connector	N/A	

TBD = To Be Determined

T Trak G Scale Modules (1:22.5)

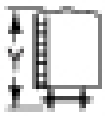
Item	T-TRAK-G Standard	B.B.M.R.A. Recommended
Single Module Track Length	TBD	
Single Module Length	TBD	
Maximum Module Depth	TBD	
Common Corner Module Track Radii	TBD	
Corner Module Dimensions	TBD	
Height (all Modules)	TBD	
Track Interface	TBD	
Outer Line Track Offset	TBD	
Track Spacing	TBD	
Electrical Connections	BWWB	
Electrical Connector	?	

TBD = To Be Determined

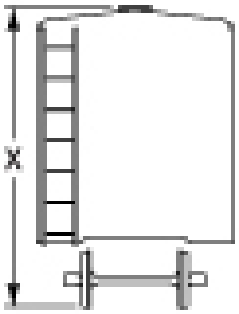
Scale/gauge designation	Proportion to prototype	Track gauge	Approximate length of 50' boxcar	Minimum radius
Z	1:220	6.5mm	2¾"	5¾"
N	1:160	9.0mm	3¾"	7½"
HO	1:87	16.5mm	7"	15"
S	1:64	⅞"	9¼"	22½"
O	1:48	1¼"	12½"	24"
Gn3	1:22.5	1¾"	19"	24"

SCALE AND GAUGE

Scale is model's proportion to real thing, here Y:X

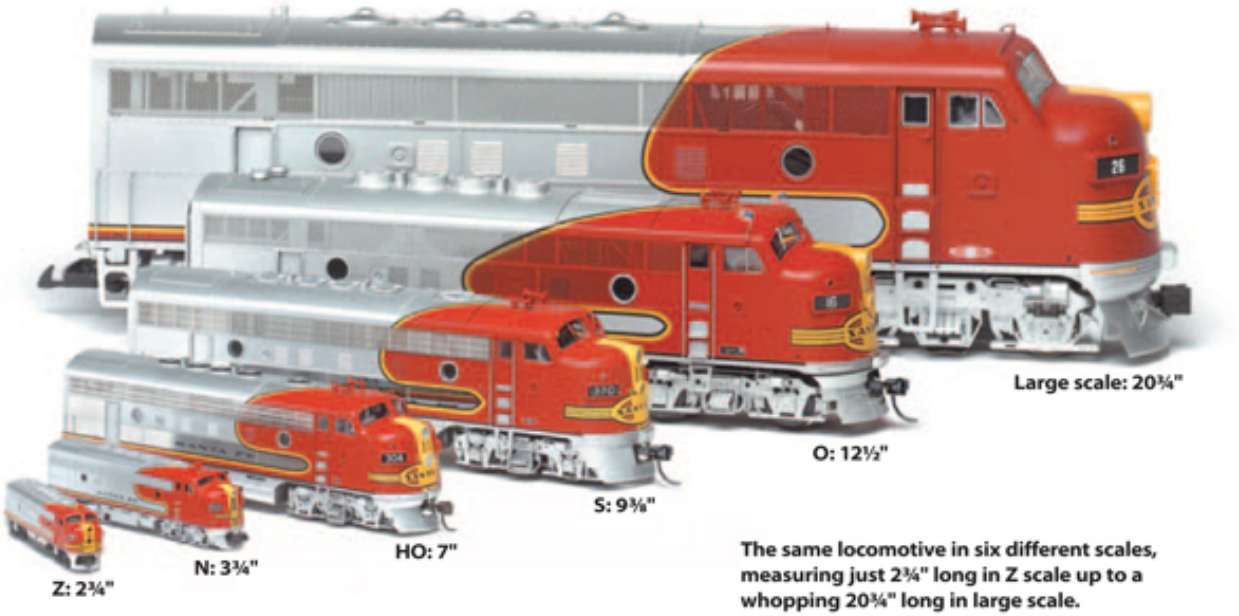


Model



Prototype

Gauge is the distance between railheads, measured inside running edge to inside running edge.



The same locomotive in six different scales, measuring just 2¾" long in Z scale up to a whopping 20¾" long in large scale.

Module Base Color

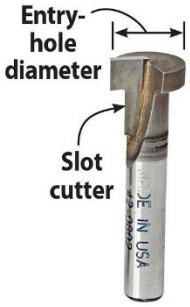
The module wood base, legs, and any exposed Styrofoam must be painted. The standard color is available at The Home Depot, as follows:

BEHR Prem Plus Interior Satin Enamel/Deep Base 7300-Brown				
CLRNT:	**BL:**	**IL:**	**KXL :**	**TL:**
OZ 384TH	1 226	0 314	0 191	0 37
Barcode 9/18/2018 25418417735				

Skyboard Construction

Item	T-TRAK Standard	B.B.M.R.A. Recommended
Skyboard requirement	Optional	Optional
Height (above module)	457mm / 18” max Make removable	254mm / 10” maximum from top of base Must be Removable Anchor using one of the methods below.
Top Corners	—	Rounded top corners ¾” radius or less for flat top skyboards. Continuous rounded skyboards allowed.
Base Color	Blue	See Skyboard Color.

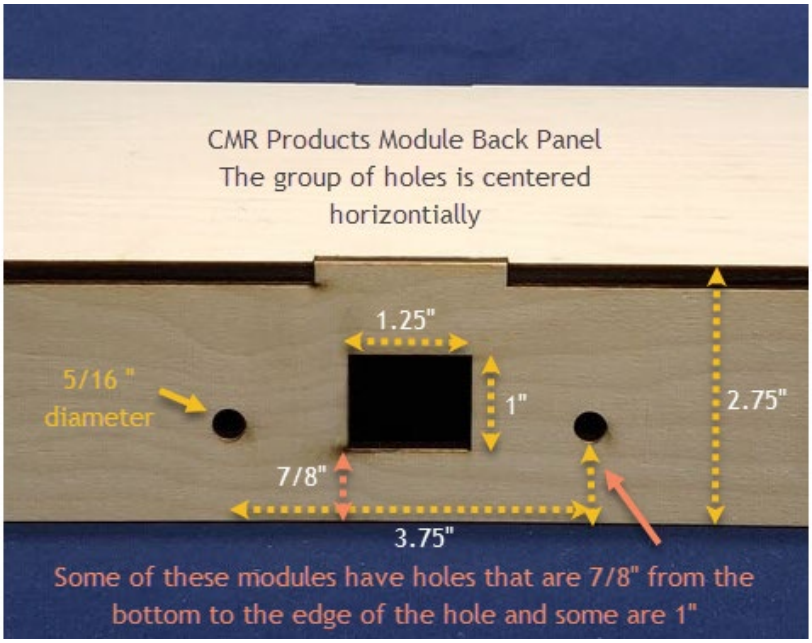
The length of the skyboard should be approximately 1/8" less than the width of the module on which it is mounted. This is to prevent any alignment problem with the skyboard on adjacent modules.



Anchor with T-notch keyhole at 1” from each end and at the center of >1x modules. Adjust for longer modules. Use a keyhole router bit to cut the slot in the rear of your module. Using a router can be tricky if you have not used one previously. A hand router can veer off your measured line easily. You may want to use a table router to cut your slots so they will be even and uniform in position on the rear of your modules. A ¼ x 1-inch carriage bolt should be long enough to go through both the skyboard and the rear panel of your module. Use a wing nut for

tightening the bolt. A washer is suggested on the wing nut side.

An alternative method may be used when you are using the Anderson Power Pole connectors and using a snap-in receptacle housing. The dimensions are shown in the figure below.



The front, top edge and side edges of all skyboards must be kept in good repair. Chips, gouges, dents, etc. must be smoothed and filled, then painted the standard color.

A copy of this template is available in **Appendix A**. It can be cut out and used for marking your module for preparation.

Skyboard Color

Skyboards must be painted front and back. The Club has a light blue paint standard (paint available from Lowe's) for skyboards to ensure that all skyboards are the same color, as defined in the following box:

BEHR Prem Plus Interior Flat Matte/Medium Base 1400-Blue			
CLRNT:	**CL:**	**EL:**	**VUL**
OZ 384TH	0 23	1 11	0 133
Barcode 1/17/2019 25419427845			

The front of the skyboard must be a flat finish, while the rear must be a gloss finish. This can be achieved by the application of clear gloss over the flat skyboard color.

Module Construction

Module construction techniques and materials are at the owner's option. Module kits for basic 12-1/8" x 8-1/4" straight modules and both 12-1/4" and 14-3/8" corner modules are available from Masterpiece Module Kits http://www.masterpiecemodules.com/T-trak_N_Scale.php and from CMR Products https://www.cmrproducts.com/store/T-TRAK-Modules-&-Accessories-c24790145. Some Club members may be willing to construct T-TRAK modules for other members. There are many resources on the Internet describing T-TRAK module construction techniques.

Straight module kits from NTRAK include three sides (fascia's); no side is on the rear. It is highly recommended that all T-TRAK modules be constructed with four sides (fascia's).

It is very important when assembling modules that the module is square, the sides are exactly vertical (90°), and the top is square with the sides. Otherwise, it may be difficult to connect the module to the adjoining module.

Joining and Separating Modules

Joining modules together is simple — align the UniJoiners, adjust the module feet as necessary to ensure good vertical alignment, and then firmly push the modules together. The more tracks between modules with locked UniJoiners the more difficult it is to separate the modules. For separating modules consider inserting a narrow paint scraper (or equivalent) between modules near the tracks, and then twisting sideways until the modules pop apart.

UniJoiners

As good as UniJoiners are it is still possible to plug tracks together and have a rail joiner slide under the foot of its intended rail, effectively making a jump in the surface of the rail. This misalignment can be difficult to see, but it can usually be felt by running your finger or a Bright Boy over the surface of the rail. Closely watching a train for sudden bumps or lurches as it makes the first few laps around the layout can also help to spot such problems. The more tracks being joined together at the same time the more this problem can occur.

Restrictions on Placement of Modules

Based on experience with several T-TRAK layouts there are clearly some restrictions on the placement of T-TRAK modules in the layout, as follows:

- Never place an inside corner module next to an outside corner module. This creates an "S" curve in the track at the boundary between the two modules. "S" curves can cause longer locomotives and rolling stock with body-mounted couplers, especially passenger cars, to derail as the couplers cannot swing far enough to handle the sharp change in direction.
- The Kato Unitrack Single Track and Double Track Truss Bridges (Cat. Nos. 20-430 — 20-434 and 20-435 — 20-438) are 186 mm (7-5/16") long. There are two issues with these bridges on T-TRAK modules:
    - As provided these bridges do not meet NMRA and/or NTRAK clearance standards. They do not have enough clearance for double-stack and autorack cars, but they can be easily modified to provide the necessary clearance.
    - If the end of the bridge is also the end of the module, do not place the bridge end of

the module next to a corner module. The overhang of some longer locomotives/cars can strike the end of the bridge as they travel around the corner module and enter the bridge.

Non-Standard Modules

These standards allow T-TRAK modules to be located on a standard 30” folding table. Any module that goes outside the dimensions of the standard modules defined above is considered a non-standard module, even if it still matches up and interfaces with the standard TTRAK base modules. While non-standard modules are allowed, special consideration is required when using them and it is the responsibility of the module owner to deal with these considerations.

Non-standard modules include, but are not limited, to the following:

- Larger Corner and Junction Modules - The track radii specified on the T-TRAK Outside Corner, End Cap, and Junction modules may not permit the reliable operation of some longer equipment. Corner modules using larger radius Unitrack can be created if such modules interface with standard T-TRAK modules at each mating end. The use of such modules requires special table considerations to accommodate the two parallel sides of the layout and must be paired with matching corner modules at the opposite end of the layout. The use of non-standard radius curves also prevents the use of standard Junction modules in a cross-table configuration in the layout. Junction modules will still work side-by-side to allow a side loop to branch from the table, or in a cross-table configuration if a "bridge" module is used to join the two Junctions.
- 25mm Track Spacing — While the standard track spacing is 33mm between centerlines, some situations can benefit from closer track placement. In urban or street running track that is designed for streetcar or other small format trains, track may be run with 25mm spacing between centerlines. This provides a more realistic appearance in streetcar operations, but 25mm-spaced curves will be problematic for normal modern sized trains, and thus should only be used in specialized settings. 25mm-spaced track on the straightaway works fine with modern-sized trains.Balloon Modules - These modules reverse trains that are traveling on the one track so they re-transit the same module on the other track. A pair of these modules permits a single row of T-TRAK modules, such as along a wall.
- Long Modules - Modules longer than Quads are problematic because of transportation and storage issues. All modules should be 2 mm short of a multiple of 310 mm for compatibility with standard modules.
- Modules that Extend out the Front of a Base Module - Effects such as a yard or a station scene, for example, could require a module to extend outwards more than the 1½ “of the standard module. Such modules must be constructed so they can overhang the table front without requiring special bracing, and generally should not extend more than 3” or 4” to the front.
- Deep Modules — Modules deeper than 14-3/8” must have complementary modules of smaller depth on the other side of the table so that both modules fit on a 30” deep table when arranged back-to-back in loop layouts. Modules can be made to extend across the entire table depth to accommodate the tracks on both sides of the table. These modules must be 732mm (28 7/16") deep, and, of course, can only be used in layouts arranged back-to-back with standard corners/end caps.

- Transition Modules - A module where the tracks swing from the front to the rear must have complementary modules that bring the tracks back to the normal position at the front of the module.
- Yard Modules - Yards can be parallel yards or built at an angle to the main module set. They play a very useful role in the staging of trains, especially during a train show.

In the design of yard modules consider the following:

- Use Kato Unitrack # 6 turnouts wherever possible. Their use creates track spacing (49.5 mm) that allows for easier placing of rolling stock on the track(s). When Kato #4 turnouts are used, they should be modified to provide smooth operation. The modifications are described as a Wikidot Tutorial http://ttrak.wikidot.com/how-to-tweak-the-standard-kato-no-4-turnout-for-reliable-per or in a YouTube video https://www.youtube.com/watch?v=H0y2Cq_CY7I&t=64s .

- Keep all turnouts located on one module at each end (the throat modules). This allows scalability of the yard, simplifies maintenance of the turnouts, and minimizes control issues. Include scenery. Yards can be made interesting with the addition of towers, maintenance facilities, yard offices, plus some MOW equipment parked in the yard.

- In almost all cases non-standard modules must be provided in pairs so the layout will match at the opposite side of the table. All other applicable T-TRAK standards (e.g. electrical) must be met. On all modules, the track must extend at least 1 mm beyond the ends of the module. This allows the UniJoiners to lock onto the next module and hold the layout together.

Layout Planning

For ease of T-TRAK layout planning, we should refer to available space in terms of the number of equivalent single-width T-TRAK modules, just as in NTRAK we use equivalent 4' modules. This allows an easier determination of the space available as modules are placed in the layout.

Special Considerations for Junction Modules

Junction modules do not match the dimensions of standard modules. Thus, if they are not used face-to-face or back-to-back in pairs you will require some special-length modules to get the layout to come out even. *See Note 1 page 4*.

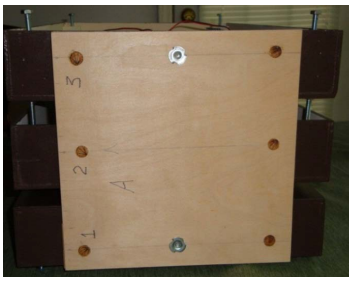
Module Transportation

T-TRAK modules will be transported normally from the owner's home to a show location, and back. Care must be taken to ensure the modules are not damaged during transport. In addition to the usual items to protect, such as the scenery, it is very important to protect the rail ends and UniJoiners that extend beyond the module ends.

One method is to construct special end plates that hold modules together for transport, while also protecting the track ends and UniJoiners. Such plates can also protect the top of the module and scenery. The UniJoiners extend about 6 mm/1/4" beyond the end of the track, which extends 1–2 mm from the end of the base. Thus a 5/16" – 3/8" spacer (or clearance hole)

is required.

An example of such endplates, constructed by Dave Thompson of the North Raleigh Model Railroad Club, is shown below. These particular end plates provide a safe transport package for three (3) double-wide modules that are 14-3/8” deep. Note the method of securing the endplates to the overall package — bolt with T-nut at top and bottom — and ensuring the spacing of the modules is maintained — wood dowels, two per module. Note also that the plate is spaced out from the module end by the extra pieces of plywood to protect the track ends and UniJoiners.



Note plate anchored to the module set by the bolt and T-nut at top and bottom

Note plywood spacers protect the track ends and UniJoiners

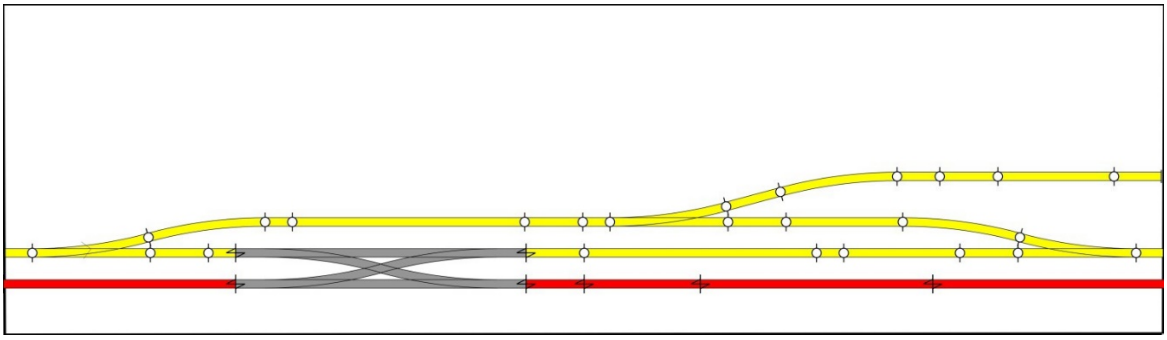
For proper positioning of the modules when packaged for transport note the labeling in the photos above and below. The endplates are identified as A and B. The modules are identified by numbers (1, 2 and 3) or by name. These numbers/names and end letters are also placed in the underside of the module, and the ends are also labeled in the underside of the module. This ensures the package goes together in the proper manner even when the owner is not present. Another example is shown in the photo below.

Depending on transportation space the leveling screws may fully need to be retracted or they may be left at the length used in a layout. When retracting or expanding the leveling screws a powered screwdriver with the appropriate hex head driver helps speed up the process. If the leveling screws are left extended sometimes vibration during transport will cause them to turn in or out; a large rubber band around two or all four leveling screws will help prevent movement.

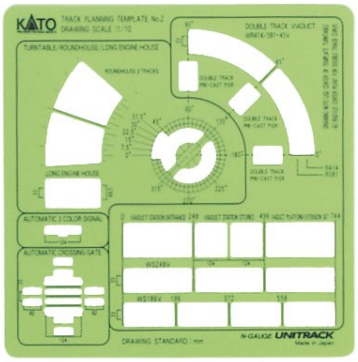
Module Identification

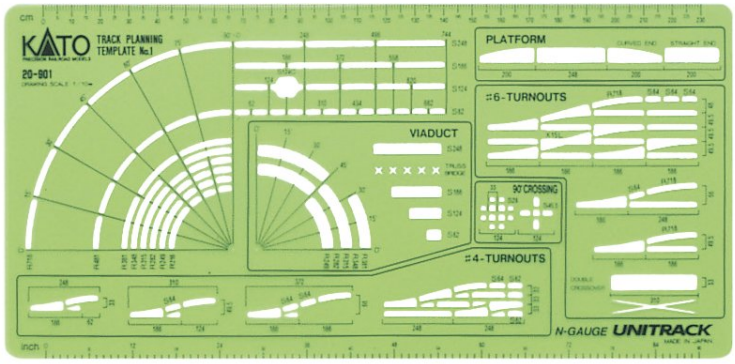
All T-TRAK modules should be uniquely identified by either a module name or an ID code, which appears at the center bottom of the module’s front side (fascia), and the owner’s name and contact information should appear on the underside or rear of each module. For layout planning purposes each T-TRAK module should have a completed Module Information Sheet, provided at the end of this document.

A track plan drawn by a CAD program, such as *AnyRail*, or, as a minimum a top-down photograph should be included with the Module Information Sheet for layout planning purposes. An example of a CAD drawing is shown below — this module is a quad module (2 x double modules) that is 14” deep.



As well as a CAD program track plans can be drawn by hand or using the Unitrack template available from Kato (Cat. No. 20-901), shown below.





4. Kato Unitrack for T-TRAK N Scale Modules

About Kato Unitrack

Kato Unitrack is a sectional track system with the roadbed built in that is the standard track for T-TRAK layouts. A wide variety of pieces are available, including turnouts, a double crossover, straights, curves, crossings and more.

The design philosophy of Kato Unitrack is based on a horizontal grid of 62 mm, a primary vertical grid of 33 mm, a secondary vertical grid of 49.5 mm and a radial grid of 15 degrees.

The Horizontal Grid (62 mm)

The horizontal grid is 62 mm because the length of all the regular straight pieces are multiples of 62 mm —62, 124,186 and 248 mm. The other straight pieces are designed to get you back on the grid.

- The 60 mm and 64 mm straight pieces are specifically designed to be used with the #4 turnout.
- The 29 mm and 45.5 mm straight pieces are specifically designed to be used with the 33 mm 90-degree crossing.

The Primary Vertical Track-to-Track Spacing (33 mm)

The primary vertical track-to-track spacing is 33 mm because the #4 turnouts and the radius of the standard curved tracks are spaced 33 mm apart. By keeping the track-to-track spacing at 33 mm and on-grid, a 4-track mainline or yard can be bent anyway you desire.

The Secondary Vertical Track-to-Track Spacing (49.5 mm)

The secondary vertical track-to-track spacing is 49.5 mm because the #6 turnouts and the 15-degree crossings work well on this grid, however, bending parallel tracks is a little tricky. Since the radius of the standard curved tracks is not spaced 49.5 mm apart, you must know how to connect converging tracks with the 78 mm-to-108 mm extendable straight section, or how to cut a straight section to length.

The Radial Grid is 15 Degrees

The radial grid is 15 degrees because all the curved tracks are multiples of 15 degrees and all the turnouts are 15 degrees. It is impossible to get off the radial grid, which is very good. Any two converging tracks can be connected using the 78 mm to 108 mm extendable straight pieces, sometimes also with a 29 mm or 45.5 mm straight piece.

Standards & Recommended Practices for Track Placement

Item	T-TRAK Standard	B.B.M.R.A. Recommended
Track distance from the front of the module	38 mm / 1½" from module edge to ballast edge of the front track	Same as T-TRAK at left
Track Spacing	25 mm / 1" center-to-center	33mm / 1½" center-to-center. See note
Space between tracks	0 mm / 0" (Note 1)	8 mm / 5/16"
Mainline tracks	100% Kato Unitrack	100% Kato Unitrack
Other Tracks	All Kato OR Kato for module connectors	All Kato OR Kato for module connectors
Mountain Tracks	No Standard or RP (Note 2)	No Standard or RP (Note 2)
Track Ballast (non-Kato track)	—	User choice
Track Designation	—	Outer main track (front): Red Inner main track (rear): Yellow

Note 1: Owners of modules with 25 mm track spacing must provide transition module(s) to 33 mm spacing.

Note 2: Discussion is underway about using the Kato 216 mm / 8-9/16" radius track, which maintains the 33 mm track spacing, and a height of 60 mm.

Paint First

Some initial painting of the T-TRAK module base is suggested before laying track. Mark the location of the tracks on the module. Find gray spray paint with a shade of gray that is reasonably close to the gray in the Unitrack base, and then spray the area that will be under the track, between the tracks, and about ½ inch outside the track forward and back edges. This provides a good base roadbed color for future scenicing with or without ballast.

You should also paint the sides of the module base the standard brown color approved by the BBMRA, and the remainder of the top a color that will complement the planned scenicing of the module

Track Planning

There are some basic rules to follow when planning the layout of the track on a T-TRAK module. These are:

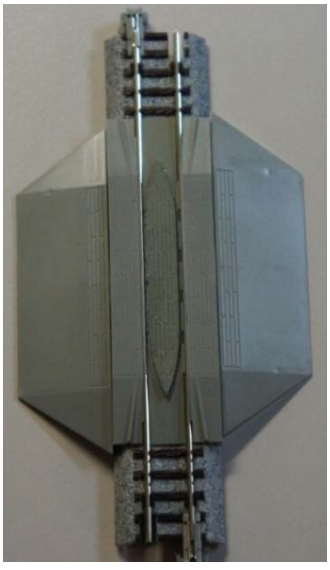
- Use only Unitrack #6 turnouts and the double crossover on the Red and Yellow main lines and passing sidings. Unitrack #4 turnouts can cause derailments and must not be used on the main lines unless they have been "tuned"; see below.
- Use the longest section of Unitrack that will fit the space available as this provides for smoother train operation. For example, instead of using 124 mm + 62 mm sections, use a single 186 mm section.

Correct Spacing of Mainlines

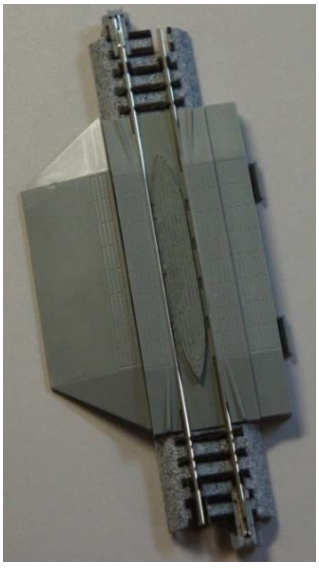
To ensure proper connectivity between modules it is essential that the mainline tracks be set at the correct 33 mm spacing. The simplest way to do this is to make use of the notches that are part of the Kato 24-000 Unitrack Rerailer / Track Spacing Tool, as shown below. The notches in the side fit the rail tops and are the correct 33 mm distance for track separation. There are three (3) sets of notches so three parallel tracks can be spaced correctly.

This tool can be made even more useful by filing out the area between the sets of notches, as shown in the following photo. This enables track spacing where there are obstructions such that an unmodified Rerailer does not sit down on the rails.

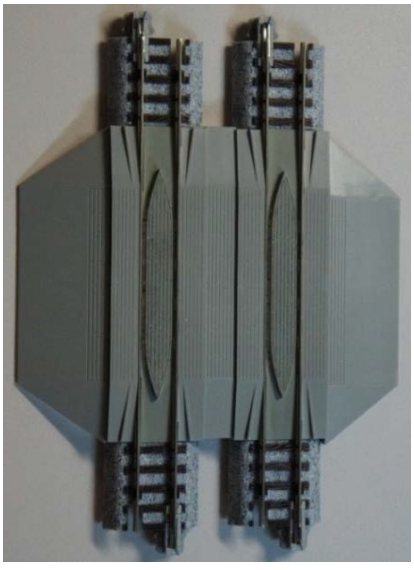
Another method is ensuring the correct track spacing is the use of two of the Kato 128 mm Unitrack 20-021 Road Crossings. The Road Crossing comes with a spacer section to make a multi-track road crossing, which gives the proper 33 mm track spacing. See photos.



Single track crossing



Single track with spacer



Double track crossing at 33 mm spacing

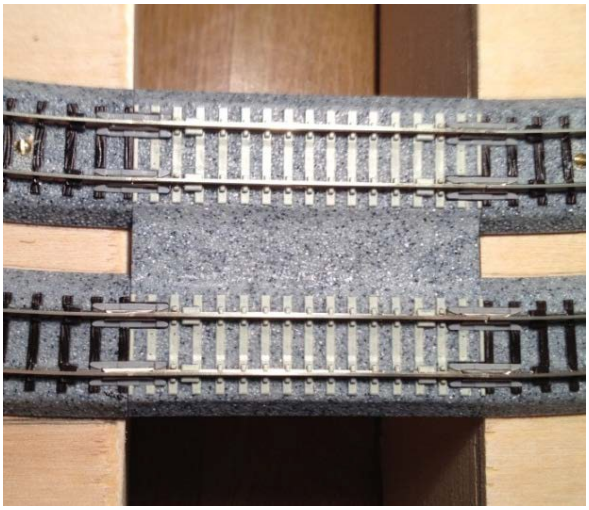
Yet another method is to use the Unitrack double track sections, Cat. No. 20-004 (248 mm / 9¾") and Cat. No. 20-042 (62 mm / 2-7/16"), Cat. No 20-043 (62 mm / 2-7/16") with Track Feeders, which feature concrete ties. These are spaced at the correct 33 mm apart.

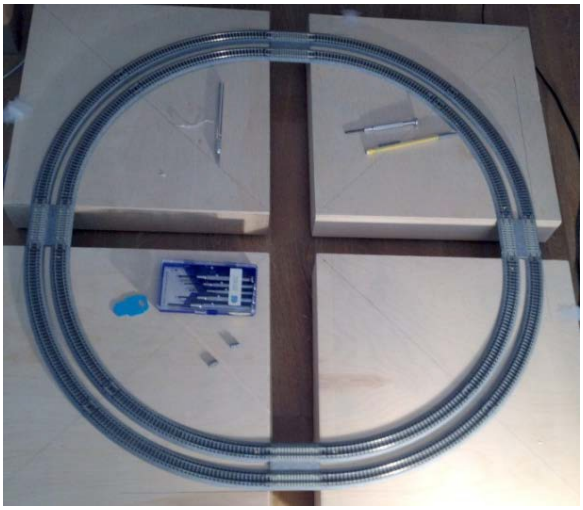
Track Spacing on Corner Modules

As well as using the Unitrack Rerailer to set the correct track spacing, the following method, using the 62 mm double-track sections, can be used, as follows, especially when placing track on multiple corner modules:

- Measure and locate the front (red) track; anchor in place.
- Place a 62 mm double-track section between the modules.
- Add the rear track by connecting to the 62 mm section, which forces

the rear track to the correct 33 mm spacing. See the photos below.





Correct Track Overhang at Module Ends

T-TRAK modules are sized such that the track extends about 1 mm / 1/16" at each end. It is extremely important that each track connecting to another module extend the same amount at each end. It the track extensions are not identical then the module may have difficulty locking to the next module.

Joining Track at an Angle at Module Ends

Your track plan may require tracks to meet at an angle at the module ends. An example is a crossover track or a yard lead. It is difficult, if not impossible, to join the UniJoiners with the tracks at an angle. The solution is to be sure the rails are anchored securely to the module close to the module end. Then remove the UniJoiners. When the modules are joined together using the UniJoiners on the other tracks, the tracks at the angle will be kept in

alignment. You must remember to add power feeds to the track on both sides of the gap.

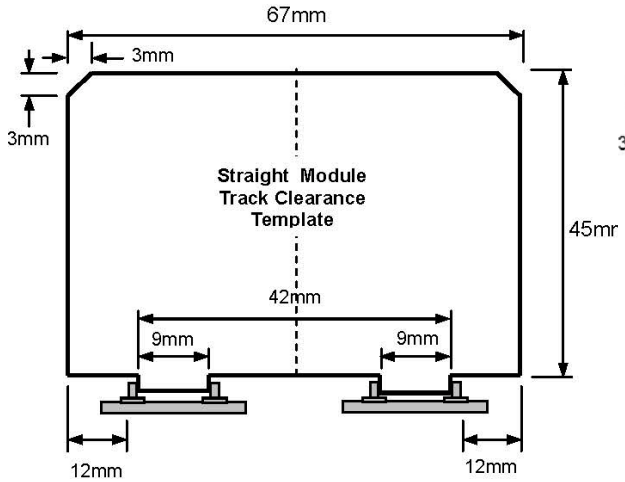
Track Clearances

Track Clearance refers to the minimum distance an edge of an object can be from the track before it is likely to be hit by passing trains. **Vertical Clearance** refers to the minimum distance above the top of the rails for bridges, overpasses, tunnel portals, etc., and **Side Clearance** refers to the minimum distance from the side of the outermost rails. Due to the overhang of locomotives and rolling stock the side clearance must be increased on curves. Minimum clearances are listed in the following table:

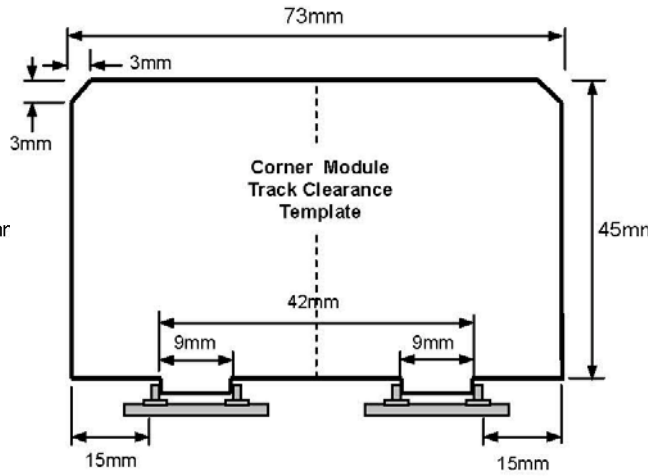
	Clearance	
	Straight Module	**Corner Module**
Minimum Width of Right-of-Way	67 mm / 2.64”	73 mm / 2-7/8”
Vertical Clearance	45 mm / 1¾”	45 mm / 1¾”
Side Clearance	12 mm / 0.5”	15 mm / 0.6”

These clearances will accommodate virtually all N scale rolling stock and locomotives including double-stack containers and auto- racks. They must be observed when adding scenery and structures to a T-TRAK module.

The Australian T-TRAK–N group has published the following Track Clearance Templates (not full size). Note that these templates should not be used for setting track spacing.



Straight Module Clearance



Corner Module Clearance

Fastening Kato Unitrack to T-TRAK Modules

For reliable train operation, the tracks on a T-TRAK module must be anchored to the module. There are several methods of doing this; which method to use is the modeler’s choice. Remember that the North Raleigh Model Railroad Club has adopted the 33 mm track spacing as standard.

Fastening Using an Adhesive (Not Recommended)

The term “adhesive” includes both glues and caulks. Be sure to use a glue or caulk that will not damage either the wood surface of the module or the plastic base of the Unitrack. Glue sparingly. The entire length of the track does not need to be glued, just the ends, and on longer pieces also the center.

Suitable glue is Loctite PL Premium Polyurethane Construction Adhesive. It is recommended for wood and plastic. Track anchored with this Loctite can be removed. Carefully slide a putty knife underneath the track then tap it with a hammer — this should release the track. White glue can also be used; run a bead along the roadbed and the module to hold the tracks to the module. Use heavy objects to hold the tracks in place while the glue dries or the caulk sets.

Another glue that can be used is Hot Glue. It does an excellent job of positioning the track quickly and can be softened again with a hairdryer if it needs to be repositioned or removed. Liquid Nails for Projects can also be used.

If you anchor your Unitrack with glue or caulk **DO NOT** use these materials to anchor Unitrack turnouts, as any glue or caulk that seeps into the mechanism could lock up the turnout and render it useless. Since turnouts are the least reliable part of trackwork this enables easier removal and replacement.

Be very careful **NOT** to get glue on the rails or in the pockets where the joiners snap; stray adhesive will either glue the existing joiner in place or prevent the other joiner from clicking in place.

Fastening Using Track Nails (Not Recommended)

Each Unitrack section has a molded location(s) that can be drilled up from the bottom to create a hole in the roadbed where an anchor can be used to fasten the track section to the T-TRAK module. Use a 1/16” drill. Place the track in place then drill down through the hole to make a dimple in the module base. This will prevent the track nail from wandering as it is inserted.

Once the hole is drilled out you can use Atlas track nails (or equivalent) to anchor the Unitrack to the T-TRAK module. Be sure you do not drive the nail below the natural surface of the track base. This will cause the base to bow inward narrowing the track gauge.

You should also leave the nail in each track closest to each end of the module slightly loose. This will allow a slight horizontal movement of the track ends and could aid in easier joining to the adjacent module.

Fastening Using Wood Screws (Preferred)

Each Unitrack section has a molded location(s) that can be drilled up from the bottom to create a hole in the roadbed where an anchor can be used to fasten the track section to the T-TRAK module. Use a 1/16” or No. 60 drill. Place the track in place then drill down through the hole to make a dimple in the module base. This will prevent the wood screw from wandering as it is inserted.

Once the hole is drilled, use a suitably sized wood screw to fasten the Unitrack to the T-TRAK module. There are two alternatives:

- #0 x 3/8” brass wood screws (Micro-Mark #60742, 40/pack or equivalent) work well. Be sure you do not drive the screw below the natural surface of the track base. This will cause the base to bow inward narrowing the track gauge.
- Steel countersunk Phillips-head screws anodized black. These fit flush after a small countersinking. (Trainaidsa.com screws for Kato Unitrack, available in two lengths – 3/8” x ½”).

You should also leave the screw in each track closest to each end of the module slightly loose. This will allow a slight horizontal movement of the track ends and could aid in easier joining to the adjacent module.

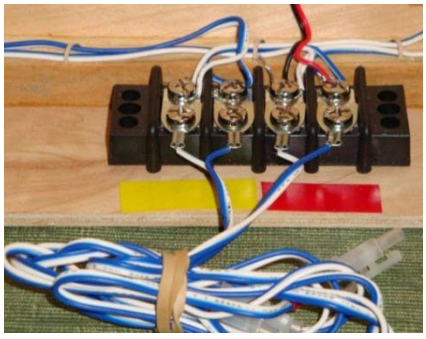
Connecting Track Feeders to Kato Unitrack

Track feeders provide power to the individual tracks (red, yellow, others) from the main power supply (DC or DCC) via the Track Bus. Although it is recommended, not every T-TRAK module requires track feeders, but enough modules in a layout must have power feeds so that trains do not encounter low-voltage as they get further from feeders. *Refer also to Sections 6 and 7*.

At the least, all corner modules should have track power feeds. If there are more than eight (8) feet between corner modules, then additional track power feeds should be installed.

Feeder Track Strain Relief

Track feeder wires connected to the track by any of the methods below are somewhat fragile and can be easily broken if tugged hard. Always provide strain relief for the track feeder wires; this could take the form of a 4-position dual-row Barrier Strip (shown on next page at left top), Radio Shack Cat. No. 274-658), a 12-position European-Style Terminal Strip (shown on next page at the left bottom, Radio Shack 274-680, easily cut into three 4-position terminal strips as shown), or another anchor that securely fastens the feeders leaving a little slack between the strain relief and where the feeder attaches to the track.



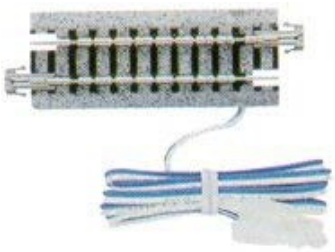
In this example, the terminal block is fastened in place using two-sided foam tape or appropriately sized wood screws. The blue and white wires are connected to terminal UniJoiners in the track. They are dressed and anchored in place using the clips shown. Insulation is stripped from the ends and the wires are wrapped around the screws; spade lugs could be used if desired.

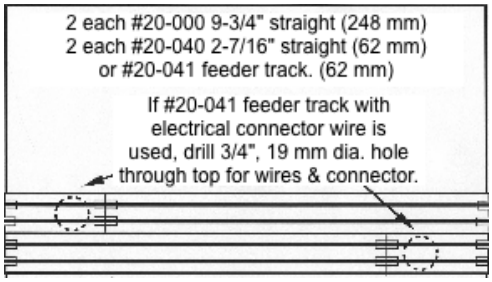
Note the color-coding for the red and yellow tracks. The wiring corresponds to the standard blue — white — white — blue configuration.

The bundle of wires held together with the elastic band has a male Kato plug at the ends to connect to the track bus; they are also color-coded near the plugs to match the Red and Yellow at the terminal block.

The red and black wires connected to the Red track terminals provide track power to a Digitrax DS52 stationary decoder, which controls the turnouts on this module. Refer to Sections 6 and 7.

Using the 20-041 62 mm Feeder Track





This is the method normally recommended at t-trak.org for feeding track power to T-TRAK modules. One feeder track is used for each of the main tracks on the module. In order to maintain the convention of blue wire to the outside these feeder tracks must be oriented in the opposite direction in the second track; see the diagram above right for the orientation. Drill a ¾" hole under each track so the connector will fit through.

If you use this method it is recommended you use five-minute epoxy, or equivalent, to cement the miniature plug to the underside of the feeder track. This prevents the plug from being out of the socket when the feeder wires are pulled through the holes that have been drilled in layout surface.

Using the 24-818 Terminal UniJoiners (Preferred)

There will probably be places on T-TRAK modules where using the 20-041 Feeder Track will not be suitable, such as where a 62 mm track section will not fit and on corner modules. The Terminal UniJoiners, shown below, is the answer and provides the most flexibility to supply track power to a module.

In order to use the Terminal UniJoiners, you must first remove the existing UniJoiners from the sections of Unitrack that will be connected using the Terminal UniJoiners. To do this use the UniJoiners Remover tool that came in the Terminal UniJoiners package, as follows:

- Insert the UniJoiners through the hole in the remover (Kato logo facing out).
- Slide down and lock the UniJoiners with the latches
- Pull out on the tab.

Now install the Terminal UniJoiners being careful to watch polarity — joiner with blue wire to the outside, i.e. front of the red track and rear on the yellow track.

Be careful when handling the Terminal UniJoiners not to pull the wires where they are attached to the joiners as they can be pulled loose without too much effort. Once in place leaver a little slack in the wires, and then anchor so they cannot be pulled.

Note that you can make your own Terminal UniJoiners using standard UniJoiners. See the references for a link to a page that describes how this can be done.

Using Atlas Code 80 Terminal Rail Joiners

In order to use the Atlas terminal rail joiner, you must first remove the existing UniJoiners from the sections of track that will be connected using the Atlas joiner. To do this use the UniJoiners Remover tool that came in the Terminal UniJoiners package, as follows:

- Insert the UniJoiners through the hole in the remover (Kato logo facing out).
- Slide down and lock the UniJoiners with the latches
- Pull out on the tab.

Now install the Atlas Terminal Joiners. Since the wires from the joiners are black it will be necessary to mark one for “blue” and the other for “white” to correspond with Unitrack color codes — joiner marked as “blue” to the outside, i.e. front of the red track and rear on the yellow track.

The use of Atlas joiners removes the locking effect of the Kato UniJoiners. If you use Atlas joiners be sure to anchor both adjacent sections of track to the module base and/or solder the rail joiner in place.

Soldering Track Feeder Wire Directly to the Unitrack Rails

Track feeder wires can be soldered to Kato Unitrack, in the same manner, they are soldered to flex track. Drill holes in the roadbed between ties and close to the rail. Feed the wire up through the hole and solder to the nickel silver rail.

When soldering remember that the Unitrack roadbed is plastic and can be easily distorted or otherwise damaged by too much heat or errant soldering iron. Proceed with caution.
It is recommended the modeler use blue and white colored feeder wires to match the standard Unitrack color coding.

Soldering Rail Joints within Modules

Unitrack UniJoiners are reliable and conduct electricity well if you are careful when scenicing not to get glue, paint, scenery stuff, etc. in the joiner. If you prefer to solder all your rail joints then do it as soon as you are finished installing and testing the track, and before you start scenery. **Do not solder the UniJoiners at turnouts as turnouts are the most likely track component to fail, and need replacing.**

If you choose to ignore this advice and get “stuff” in your UniJoiners, and conductivity becomes a problem then you can add feeder wires directly to the Unitrack rails, as described in the previous section.

Preferred Soldering Technique

Following is the preferred method for soldering feeder wires to Unitrack:

- Drill a tiny (1/16”) hole between two ties, on the outside of the rail, and through the

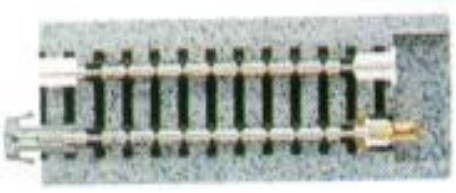
roadbed and the module base. Poke a short length of 18-gauge or 20-gauge solid wire through the hole; the wire does not need to be insulated. Bend the top tip of this wire into a hook shape that will rest on the base of the rail.

- Use a tiny wire brush to clean and brighten the rail to be soldered, being sure that any ballast or paint that adheres to the rail is scraped off. Apply a small amount of resin flux to the rail and the tip of the wire.
- Make sure that the wire will stay put while soldering. The way soldering works is to make a mechanically-sound joint (one that stays together without solder), heat the joint, and let the solder flow into the joint by capillary action. The soldering iron is not used to push the solder around.
- Use only resin-core solder for electrical and electronics work. Acid core solder is intended for soldering copper pipes and will corrode wiring and electronic circuitry.
- Use a 25-watt maximum soldering iron with a fine pointed tip. Be sure the tip is clean and freshly tinned, and hot. Heat sinks, damp cotton or other heat limiting devices are not needed.
- Press the soldering iron to the junction of the rail and wire for 1 – 3 seconds, touch the tip of the solder to the wire making sure the solder wets the rail and wire, and then remove the soldering iron and solder. Do not touch the joint until the solder cools.
- Observe the joint after it has cooled down. The solder should be shiny. If it is dull you have a cold solder joint, which does not ensure good contact. A cold-solder joint is normally caused by the movement of one of the parts being soldered while the solder is cooling. Heat the solder again to the point of melting, and then let cool being very careful that the wire does not move.

Connecting Unitrack to Other Brands of Track

Unitrack was designed in a manner that allows connection to other brands of track, such as Atlas, Peco, Model Engineering, etc. Since Unitrack uses Code 80 rail the easiest connection will be to other brand Code 80 rail, although it is simple to adapt the connection for Code 55 or 65 rails.

Using the 20-045 62 mm Sectional Track Conversion Track



The 20-045 62 mm Sectional Track Conversion Kit is marketed to connect with Unitrack on one end and with Code 80 sectional or flex track on the other end. Normal nickel silver rail joiners are used at the sectional track end. The sectional or flex track will need a cork or other suitable roadbed to maintain the same height as the Unitrack rail.

However, this item is inappropriately labeled and is not needed to connect to standard brands of Code 80 track. To join regular Code 80 track simply remove the UniJoiners from the Unitrack, place regular metal rail joiners on the rail ends, join the tracks and shim up the regular track to support it.

The 20-045 Sectional Track Conversion Track was specifically designed to connect Unitrack to the track of Kato's larger Japanese competitor, Tomix. The shelf on the end of the conversion track is just wide enough and high enough to support the Tomix track roadbed.

Directly Connecting Another Brand Track to Unitrack

Simply remove the UniJoiners from the end of a section of Unitrack and replace it with a standard nickel silver rail joiner into which the conventional sectional or flex track to the Unitrack. To remove the existing UniJoiners use the UniJoiners Remover tool that came in the Terminal UniJoiners package, as follows:

- Insert the UniJoiners through the hole in the remover (Kato logo facing out).
- Slide down and lock the UniJoiners with the latches
- Pull out on the tab.

Note that cork or another suitable roadbed will be required to maintain the same rail height as the Unitrack.

A little bit of Unitrack 240-039 ballast should blend another manufacturer's track into the end of the Unitrack rails.

Cutting Unitrack to a Non-Standard Length

Sometimes you will need a piece of Unitrack with a length different from the standard available lengths. If that length cannot be accommodated using the Unitrack 20-050 78–108 mm Expansion Track you must cut a longer piece of Unitrack down to the needed length. There are three methods:

- Using a razor saw, such as X-Acto or Atlas.
    - Measure the length of track needed. Double-check the measurement.
    - Using the razor saw, saw the Unitrack piece to a length very slightly less than the measured length.
    - Cut notches in the cut end of the track like the gaps at the uncut end of the track.
    - Use standard Atlas metal joiners to connect to the adjacent piece of Unitrack.

    Do not use the cut end at the end of a module as the Atlas joiners do not hold as tight as the Kato UniJoiners. If the cut piece of track is very short, consider soldering the joints as these short pieces of rail may move out of position.

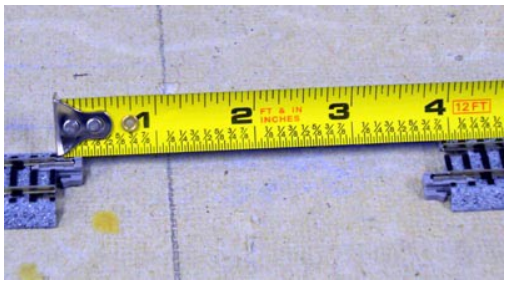
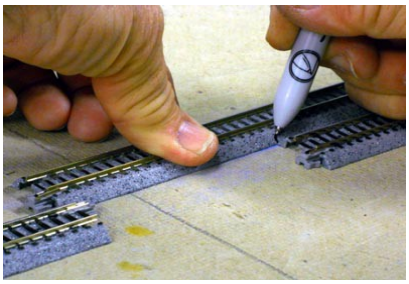
- The following method is from the T-TRAK Email list on Yahoo Groups, by Andrew George:
    - Look carefully at a piece of Unitrack. Notice that at one end there are a couple of stake marks on the rail to fix the rail to the base. Call this the fixed end.
    - With a razor saw, cut just the base about ½ of the total length desired, from the fixed end. Do this in the ballast area, rather than the tie area.
    - Slide the base off the free end and cut the removed base section to the remaining desired length. File the ends of the base for an exact fit, if necessary.
    - Slide the free base back on and glue the base sections together with liquid styrene cement. If necessary, reinforce with lengths of styrene strip. Let dry at least two hours.
    - Cut of the rails flush to the end with rail nippers, and file smooth if necessary.
    - Cut notches in the cut end of the track like the gaps at the uncut end of the track.

- Use standard Atlas metal joiners to connect to the adjacent piece of Unitrack.

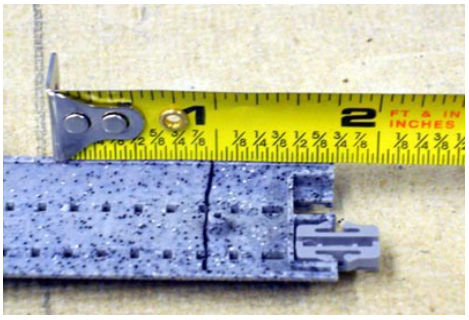
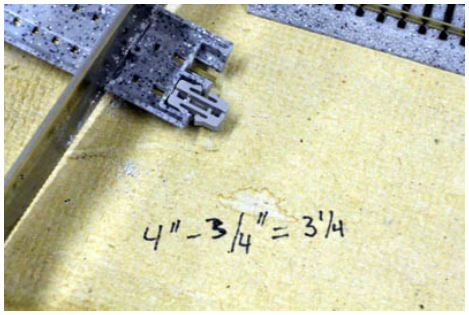
Note: This procedure can be done with both straights to get custom lengths and curves to get odd angles of curvature.

Mike Fifer of Fifer Hobby Supply has published on his web site a third method of making your own lengths of Unitrack. Go to https://www.fiferhobby.com/how-to-make-your-own-lengths-of-kato-unitrack/ or follow the steps below (used with permission):

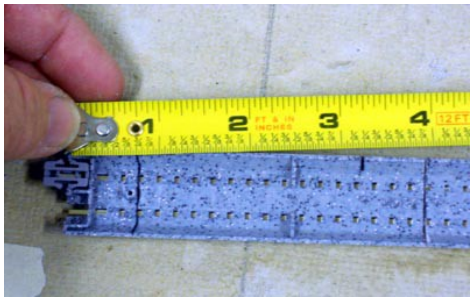
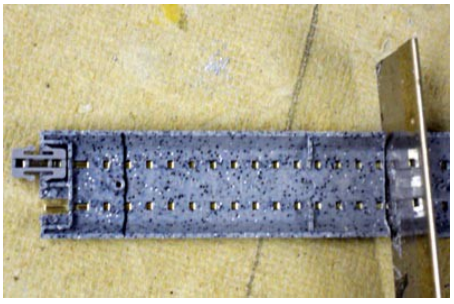
You will need a tape measure, a razor saw, rail nippers, a small flat file, and some Testors plastic cement. The first thing to do is to determine what size piece of track you will need.

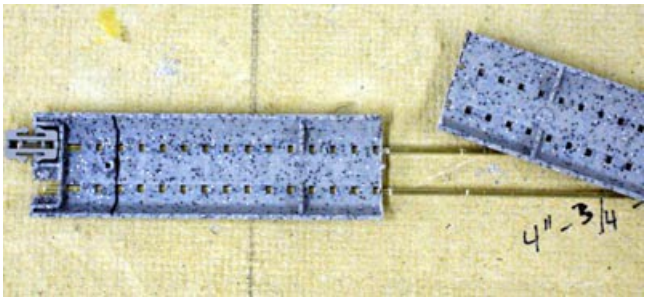
In this case, I needed a 4” piece and using a fine point sharpie or pencil mark the length on any piece of longer Kato Unitrack.

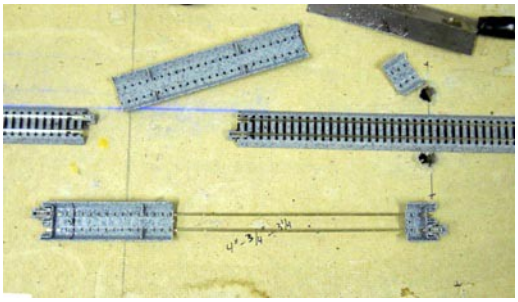



Our first cut to be made will be one either end of our track piece to be cut and you can see that we need to leave 3/4“of the end to retain our joiner section. You can also see that I subtracted the ¾” from our original measurement and the remainder of 3 ¼” is the next length to cut from the other end of the piece.

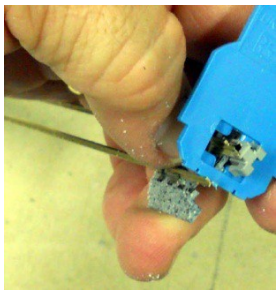
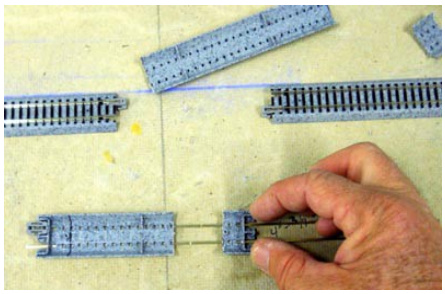
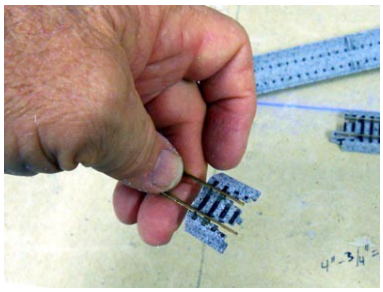



Once the second cut is made the piece of roadbed to be removed is now carefully popped off the rail.

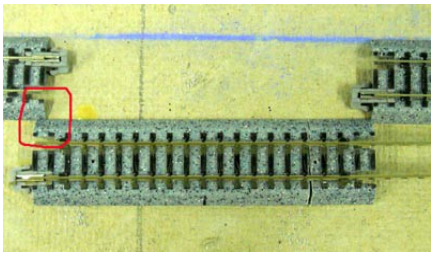
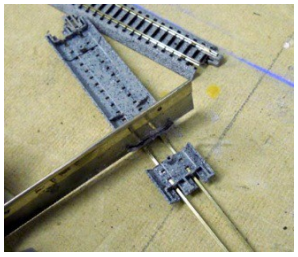
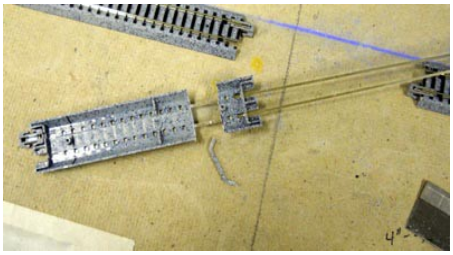




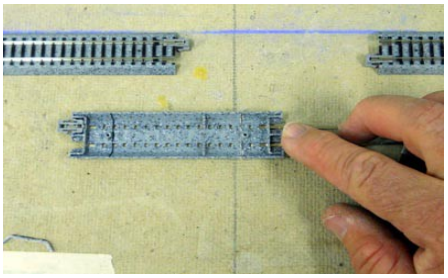
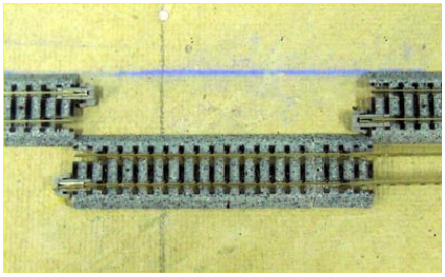
Now remove the UniJoiners from the ¾” end section and slide it towards the longer

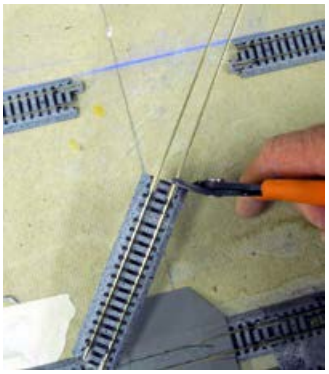
Now we need to test fit the piece we have made, and oops it is still a little long, so we need to cut a small slice out to shrink it some more.

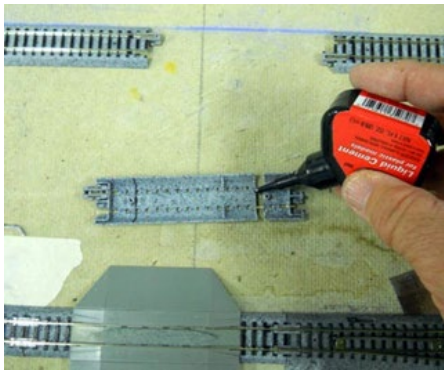




Now that our slice has been cut out slide the short end back down and re-test fit. Now the piece fits perfectly.

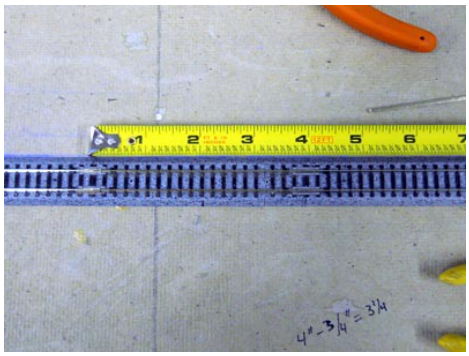
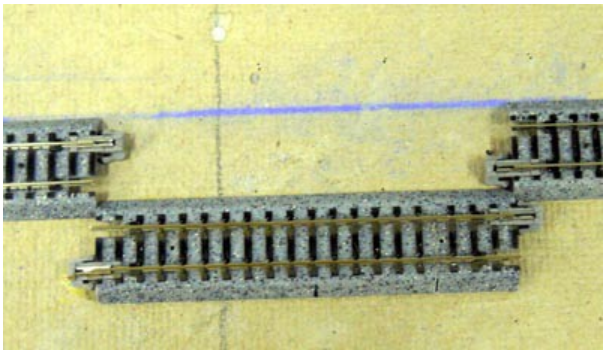
Now using your rail nippers cut the track flush with the end of the short cut end and file smooth with an emery board or small flat file.



At this point, you have the option of gluing or not gluing the roadbed together. The section will work either way, but I prefer to glue them, and I find that Testors liquid cement works well and bond fast.

Once glued you can re-install the UniJoiners that you took off to slide the small section and you have now created your own 4” section of track and it looks and fits perfectly!

This same procedure can be used to get specific degrees of radius to meet certain needs as well.

What You Need to Know About Unitrack Turnouts

Kato produces three types of Unitrack turnouts — #4 left and right, #6 left and right, and a #6 double crossover. These are power- routing turnouts (the #4 can be optionally set for non-power routing), and the machines to operate the turnouts are pre-wired and builtin. Unlike most turnout machines that have three wires, Unitrack turnouts use a bi-polar solenoid drive that has only two wires and is operated by reversing the polarity. The #4 turnout comes with a two-wire control cable with plugs at each end, while the #6 turnouts and the double crossover do not have a plug at the turnout end.

Note: If for any reason you remove the bottom from any of these turnouts, be very careful. Leave the turnout on a table upside down the entire time you are working on it. The internal parts can easily fall out; something will almost certainly fall out of place. As soon as you remove the bottom plate check to see if anything looks out of place and put it back.

The #6 turnouts are reliable and work well and allow any N scale locomotives and rolling stock to run through them, whereas the #4 turnouts require “tuning” (see below) for reliable and

derailment free operation. **It is highly recommended that only #6 turnouts and/or the #6 double crossover be used on the T-TRAK mainlines, with #4 turnouts used on secondary and yard tracks where #6 turnouts may not fit.**

Types of Unitrack Turnouts

The standard center-to-center spacing of Unitrack is 33 mm. The #4 turnouts and the #6 double crossover are designed to work with this 33 mm spacing. The #6 turnouts are not designed to 33 mm spacing, but instead to 49.5 mm spacing.

Kato 20-202 #6 Left-Hand Turnout (EP718-15L)

Left-Hand Turnout

Kato 20-203 #6 Right-Hand Turnout (EP718-15R)

Right-Hand Turnout

These are power routing turnouts (like a Peco Electrofrog turnout) and are not DCC-friendly. The turnout power routes the frog rail. The point-to-stock rail gap is very large, so any rolling stock that stays on the track should have no trouble clearing the points.

Since T-TRAK modules can be configured in any order, in order to ensure problem-free operation and configuration insulated Unitrack UniJoiners should be placed in all four rails at the frog end of the turnout, and track power feeders installed beyond the insulated UniJoiners.

Two #6 turnouts connected back-to-back as a crossover between two tracks creates a center-to-center spacing of 49.5 mm, not the Kato standard 33 mm; insulated UniJoiners are required in the diverging route between the two turnouts. The turnout itself can be physically hacked to make the spacing 33 mm, but this is a project only for the advanced modeler.

Kato-20-210 Double Crossover (310 mm)

The #6 double crossover consists of four (4) #6 turnouts and one 15° crossing and provides the standard 33 mm center-to-center track spacing. The four turnout machines are wired to a single cable coming out of the turnout, so all four turnouts will switch at the same time.

Except for the two outside stock rails, nothing else is wired through on this crossover, i.e. it is isolated in the center of the crossover. Power feeds are required to the stock rails at the four stock rail legs of the crossover. Insulated UniJoiners are not needed anywhere on this crossover.

Kato 20-220 #4 Left-Hand Turnout (EP481-15L)

Left-Hand Turnout

Kato 20-221 #4 Right-Hand Turnout (EP481-15R)

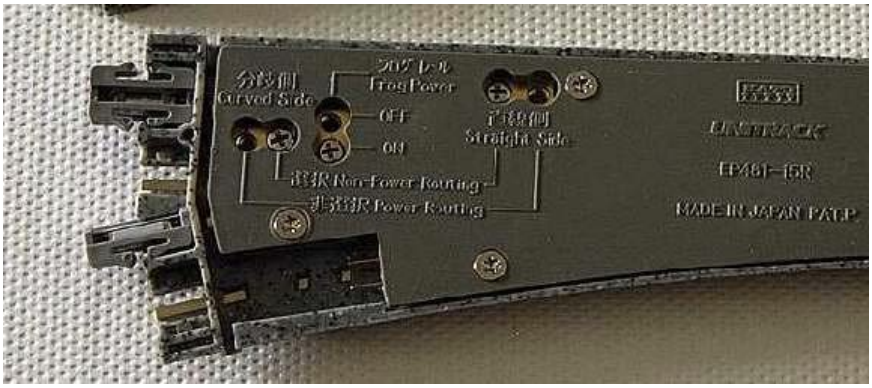
Right-Hand Turnout

These turnouts can be set to be either power-routing or non-power routing and are thus DCC friendly. They can be operated electrically, manually or as a spring switch. The frog can be powered or not as desired.

The **Power Routing** feature switches power in the direction the turnout is thrown, with the track in the other direction dead (just like a PECO Electrofrog turnout). The **Non-Power Routing** feature supplies power to both lines of the track without interruption (just like a PECO Insulfrog turnout). **Frog Power** ON prevents the stalling of small locomotives while passing over the turnout and is the recommended setting; the frog power is always power-routing to prevent short circuits. The factory settings for the #4 turnout are Power Routing and Frog Power ON.

When used as a Spring Switch set the turnout to Non-Power Routing and Frog Power OFF.

Note: The power routing screws on the bottom of the turnout are mislabeled, as are the directions that are included with the turnout. Please see the correct explanation below.



The frog itself can be set to either fully insulated or power-routing; for our T-TRAK purposes, it should be set to power-routing using the screw on the bottom of the turnout — set to the ON position.

There are two additional screws for power routing, which do not do what you think. See the tables below; note the terminology may seem wrong, but it is correct in view of the mislabeling of the screws mentioned above.

1. **Power Routing Functionality — When "Non-Power Routing" is Selected**

	Straight Frog Rail	Divergent Frog Rail
Straight Route Selected	Powered w/appropriate polarity for that route.	Dead
Divergent Route Selected	Dead	Powered w/appropriate polarity for that route.

2. **Power Routing Functionality — When "Power Routing" is Selected**

	Straight Frog Rail	Divergent Frog Rail
Straight Route Selected	Powered w/appropriate polarity for that route.	Powered w/appropriate polarity for that route.
Divergent Route Selected	Powered w/appropriate polarity for that route.	Powered w/appropriate polarity for that route.

For most T-TRAK applications set the Frog power to ON and follow the settings in Table 2. This sets the turnout to be non-power routing, i.e. the same as a *Peco Insulfrog* turnout.

If for any reason power routing is selected, i.e. Frog power on and the setting in Table 1, be sure to put insulated UniJoiners in all 4 rails at the frog end of the turnouts and track power feeders installed beyond the insulated UniJoiners. This is good practice even if the turnout is set to non-power routing and is mandatory in layouts where individual DCC track buses are used.

Special Care Must be Taken with #4 Turnouts on T-TRAK Modules

Special 62 mm contoured sections of Unitrack are provided in the package for use at the frog ends of the turnouts, connected to either the straight or diverging route. The special tracks are S60L for a left-hand turn out and S60R for a right-hand turnout. This enables the use of a standard section of Unitrack in the other route. Use of this special 60 mm section in the straight route may mean that the overall track for the module could be 4mm short, depending on the configuration of the rest of the track. It may be necessary to modify the shape of a 64 mm section to match the contour of the special 60 mm section. Note the UniJoiners is also modified to fit properly.

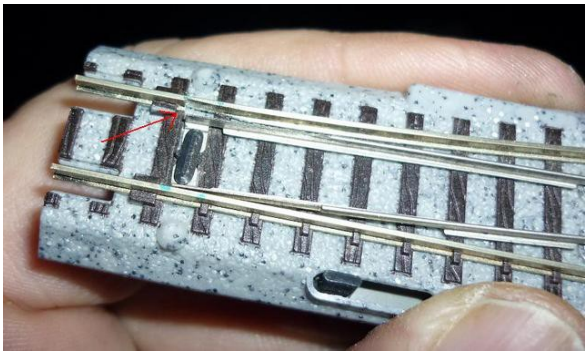
Operational Issues with Unitrack #4 Turnouts on T-TRAK modules

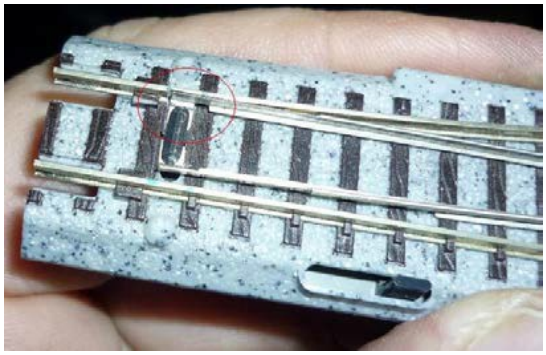
The Kato Unitrack #4 turnouts are sometimes prone to derailments, which can be fixed by tuning the points and the adjacent stock rails. A wheel can hit the end of the point, run up over the point and settle down on the wrong side, derailing the train.

The problem is the points are square, not a point, and there is no notch in the stock rails for the points to fit into. Do the following:

- Sharpen the points. While blocking and supporting the turnout points *carefully* file the points slightly so the points fit completely into the notch in the stock rail.
- File a notch in the adjoining stock rail for the points to sit into. This can be done by placing the points in the position opposite to the stock rail being filed and *very carefully*

carving a notch using a thin flat file. See the photos below for how the resulting notch should look.





Sometimes derailments happen at the point marked by the arrow in the photo below because the end of the point where it pivots doesn't line up with the stock rail. *Very carefully* bend the stock rail slightly with a pair of long-nose pliers so the rails line up. Take special care not to damage the pivot point while doing this.

As well as tuning the #4 turnouts operation will be more reliable if the wheels on rolling stock are clean and rolling stock is weighted according to NMRA Recommended Practices.

Control of Unitrack Turnouts

The Unitrack turnout is moved by a turnout motor, a tiny bi-polar solenoid drive which is hidden under and inside the base of the turnout. Because it is bi-polar it operates on direct current (DC) and has only two (2) wires. Most turnouts (Atlas, twin-coil, etc.) will run on AC or DC and have three (3) wires. Because it has only two wires the turnout is operated by simply reversing the polarity of the power feed.

The turnout motor is only fed electricity for the moment it takes to move the points. This is very important — **feeding power for too long a time can burn out the motor**.

Manual Control

Unitrack turnouts can be controlled manually or electrically. There is a manual lever sticking out of the ballast strip next to the free end of the point rails. Simply move the lever to the other position to move the points**. Do not manually push the points as you would do with a Peco turnout. Pushing the points can damage the turnout. Use the manual slide lever.**

DC Control from a Powerpack

Unitrack turnouts can be electrically controlled using all Kato components, or you can make your own control configuration.

Using Kato Components

This involves using the Kato 24-842 DC Converter (shown at the top left), the Kato 24-840 Turnout Controller (bank of 5 shown on next page) and, if necessary, the Kato 24-841 Turnout Extension Cord (not shown).

For a Kato power pack, the DC Converter is not needed. The Turnout controller(s) are snapped into the side of the Kato power pack.

If you are using another brand of power pack then connect the DC Converter wires to the accessory AC terminal, usually 16VAC, on the power pack. DC is fed out the snap connectors.

The Turnout Controllers are blue plastic electrical switches, with snap connectors on both sides (male on one, female on the other) which allow a row of controllers to be snapped together. The DC Controller is snapped to the left side of the first Controller to supply electricity to the entire row. A socket on the back mates with the plug on the cord from the turnout motor, or from the Turnout Extension Cord, where used.

The Turnout Controller is a momentary contact Double-Pole, Double Throw (DPDT) switch. As the control handle is moved from one position to the other, contact is made for a fraction of a second, sending DC power of the appropriate polarity to the turnout motor Move the control handle in a slow steady manner, but don't let it stop anywhere as it is moved; the stop position could be the point where electrical contact is made and leaving the handle too long in that position could burn out the motor.

The Kato 24-842 DC Converter is simply a standard bridge rectifier circuit. It can handle up to 17 VAC in (via the wires) and puts out 12VDC (via the snaps). Since it is a standard bridge rectifier it can be fed DC and the correct polarity power will be output at the snaps.

Constructing your own Control

You can use a momentary contact Double-Pole, Double-Throw (DPDT) switch (Momentary On / Off / Momentary On) to duplicate the operation of the Kato Turnout Controller. This Momentary DPDT switch is wired the same as a reversing switch for track power is wired, but the power coming in is fixed DC from the power pack, and the power going out goes to the turnout motor. Note thefollowing:

- You must use a fixed DC output from the power pack. Do not connect to the auxiliary AC power terminals.
- You will have to cut off the Kato connector on the cord from the turnout motor and hardwire to the momentary DPDTswitch.

- The DPDT switch can be mounted on the front, rear or top of the T-TRAK module; the module rear may not be available if the module has a skyboard.
- If you use an ordinary DPDT switch instead of a Momentary DPDT switch you will burn

out the turnout motor.

With the use of a momentary DPDT switch, you cannot tell which direction the turnout is in after it has been thrown — the position of the DPDT switch is always in the center. The Kato Turnout Controller always shows the position of the turnout. You can overcome this problem as follows:

- If you insert a momentary push button on one of the wires from the DPDT switch to the turnout you can use a normal (non- momentary) DPDT switch. The position of the toggle switch will point in the direction the turnout is thrown. You operate the turnout by moving the DPDT switch to the desired position and depress the momentary push button. This is a two-step process since you must move the DPDT switch then press the button.

There are other alternatives using only push buttons that will work, but they are more complicated and will not be discussed here.

Digital Command Control (DCC) of Unitrack Turnouts

DC control of turnouts requires an additional power bus running to all modules equipped with turnouts. The additional bus can be eliminated using DCC control of turnouts since the stationary decoder used for control will connect to the track. Of course, this requires the layout, or at minimum one track, to be DCC powered.

Several stationary decoders from several manufacturers are available that can control Kato Unitrack turnouts. Since Digitrax is the system of choice for T-TRAK Digitrax stationary decoders are listed, as follows:

Digitrax DS51K1 Stationary Decoder

The Digitrax DS51K1 can be mounted under the T-TRAK module below the corresponding turnout. It is rated at 0.5 Amp and measures 0.319” x 0.509” x 0.152” (8.11 mm x 12.94 mm x 3.88 mm).

The orange and gray wires from the decoder are connected to the turnout motor, and the red and black wires are connected to track power (perhaps using Terminal UniJoiners). After installation, the decoder is programmed to the desired address following the simple instructions provided by Digitrax

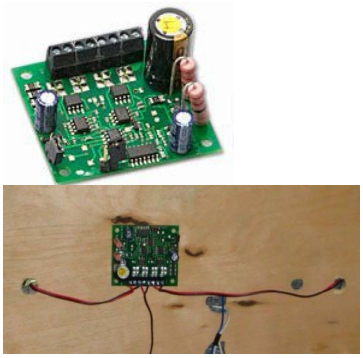
Since the DS51K1 does not have a LocoNet connection it must be connected to DCC track power to receive its commands. For T- TRAK modules it is recommended to connect the red and black wires to the Red track. If the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the red and black leads so the connection to the Red track can be turned off, as DC track power will damage the DS51K1 decoder.

IMPORTANT NOTE: The DS51K1 stationary decoder **DOES NOT** have enough power to operate the 20-310 Unitrack #6 Double Crossover.

Digitrax DS52 Dual Stationary Decoder

The Digitrax DS52 will operate two individual 2-wire bi-polar solenoid turnouts. Its capacitive discharge provides enough power for the Kato 20-310 #6 Double Crossover. Decoder addresses can be separate or sequential.

The DS52 can be mounted under the T-TRAK module below the corresponding turnouts it will operate. It has screw terminals for connecting to track power and to the turnouts. Configuration and programming the desired turnout address are simple and straightforward following the Digitrax instructions included with the decoder.



The DS52 can be mounted to the underside of the module top by double-sided foam tape, as shown. The red and black wires extending out each side connect to the two turnouts being controlled. The red and black wires extending down connect to red track power via terminal UniJoiners. Note the DS52 red and black wires could be connected to a separate bus if a suitable bus is available in the layout. The decoder is configured to operate the bi-polar solenoid motors in the Unitrack turnouts.

Since the DS52 does not have a LocoNet connection it must be connected to DCC track power to receive its commands. For T-TRAK modules it is recommended to connect the DS52 to the Red track. If the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the leads so the connection to the Red track can be turned off, as DC track power will damage the DS52 decoder.

Digitrax DS64 Quad Stationary Decoder

The Digitrax DS64 can operate four (4) 2-wire bi-polar solenoid turnouts (as well as other types), and the Kato 20-310 #6 Double Crossover. Each output can handle two turnout motors. Power can be track power or an external power supply such as the Digitrax PS14. As well as throttle control the DS64 can be controlled by push-button switches.

The DS64 can be mounted under the T-TRAK module below the corresponding turnouts it will operate. It has screw terminals for connecting to track power and to the turnouts, as well as push-button control switches. This decoder will most likely have application for modules with several turnouts.

The DS64 has LocoNet connections so it can receive commands both the track or via LocoNet. If the DS64 is connected to DCC track power to receive its commands (connect to Red track is recommended), and if the module will be used with DC power on the Red track, rather than DCC power, a DPDT switch should be inserted in the leads so the connection to the Red track can be turned off, as DC track power will damage the DS64 decoder.

There are several stationary decoders from DCC manufacturers other than Digitrax that will work with Kato Unitrack turnouts. These are not covered here since Digitrax is not BBMRA standard.

5. T-TRAK Module Electrical Standard

Recommended Standards for Wiring T-TRAK Modules

Item	T-TRAK Standard	B.B.M.R.A. Recommended
Connector	Kato Compatible	Kato and/or Mini-Tamiya (Note)
No. of Modules with Power Feed	DC-every 30 feet	DC and DCC — every 8 feet maximum All corner and junction modules must have track feeders. Modules with DCC accessory decoders powered from the track. Others as necessary.
Power Feed Connectors	Kato / Mini-Tamiya	Kato / Mini-Tamiya for track feeders.
Track Bus Connectors	—	Anderson Powerpole 30A connector
Track Feeder Color Code	Blue–White-White-Blue	Blue–White-White-Blue
Track Bus	—	12-gauge with Powerpole connectors 2', 4' and 8' Long Track Bus -- 6" Track Bus Feeder sections One or two track buses as required by layout configuration.
Accessory Power	No standard	15 or 16 VAC @ 5A Each module must provide conversion to needed voltage for accessories (diodes for DC, voltage regulators for less than 15V)
Accessory Power Bus	No standard	12-gauge with Powerpole connectors 2', 4' and 8' long Accessory Bus -- 6" Accessory Bus Feeder Sections -- Single bus per layout
Control	DC	DC and/or DCC
System	User choice	DC: User choice DCC: Digitrax

Note: The Mini-Tamiya connectors are correctly referred to as Tamiya/Kyosho connectors. The Tamiya connector is the female housing with male pins. The Kyosho connector is the male housing with female pins and the clip tab that holds it to the Tamiya connector. Kato uses these connectors with a 22-gauge blue/white wire pair for track power, and a red/black wire pair for turnouts.

Following is ordering information:

- Male/Female set with two housings and pins for one Tamiya and one Kyosho connector: Cat. No. 2913
- Male (Kyosho) connector w/female pins and clip tab: Cat. No. 2914
- Female (Tamiya) connector w/male pins: Cat. No.2917
- The pins require a standard Molex type crimp tool capable of crimping .062" diameter pins, such as the GC/Waldorm W-HT-1921.

These connectors can be ordered from Maxx Products at http://www.maxxprod.com/, and other suppliers. The crimp tool is available at Allied Electronics.

Electrical Basic Components

Electrical problems are the predominant problem encountered in setting up a new layout, and the hardest to diagnose and resolve. For this reason, it is important that compliance with a strict set of standards is enforced.

Electrical systems to run a T-TRAK layout consist of 3 basic components:
Control Unit (See I. Control Unit for more detail) – This is some combination of power packs for tracks running in DC mode, and/or a DCC control system for those tracks running in DCC mode. Since the two tracks in a T-TRAK layout are electrically isolated, DC mode will require a power pack for each track, while a single DCC control system can be used for multiple circuits.
Track Bus (See II. Track Bus for more detail) – The power to the tracks is carried from the control unit to the layout through a heavy (12 gauge) cable usually in the form of a zip cable. The track bus normally lays in the trough created between the backs of the modules placed on either side of the layout table. There should be a Track Bus for each track (Red and Yellow) to maintain electrical isolation between the tracks. Feeder Connectors come off the Track Bus to allow connection to individual modules. Note: On smaller layouts, the Track Bus may consist of Kato electrical components.
Module Connectors (See III. Module Connectors for more detail) – Modules are connected through the use of wires which are attached to the tracks and come out from the module to plug into the connectors on the Track Bus cables. While not all modules in a layout need be connected to the Track Bus, the recommended practice to equip all straight modules with feeder cables so that the layout does not have large gaps where no power connection is available.

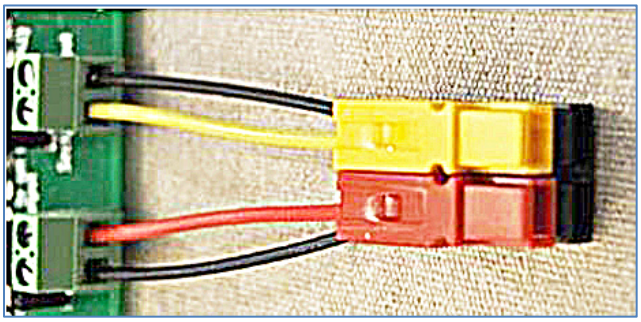
I. Control Unit

There are two predominant modes of control in model railroading, Direct Current (DC) and Digital Command Control (DCC). When setting up layouts for use by numerous people and clubs, it is often necessary to accommodate both modes of operation at the same time. This is facilitated by the fact that the 2 mainline tracks are independent of each other. Many clubs have built control systems that can handle either mode on each track. At their core, these systems simply have a DPDT toggle switch to change a given track from one power source to another.

In the DCC mode, several options exist to allow the operator to control his/her train(s). Most popular among these are the wireless throttles that allow the operator to follow their train around the layout. While DCC systems are proprietary and for any given brand of system, all the throttles used on that system must be from that manufacturer, there are “front end” components which can be used to interface with most major brands. Chief among these is the JMRI software available for most computer platforms and mobile devices

II. Track Bus

Connecting the Control Unit to the Track Bus An adaptor connector is used to connect the Control Unit to the standard Track Bus Powerpole connectors. The gauge of the cable used in this adaptor should be compatible with the connectors on the Control Unit and should be as short as possible to avoid voltage loss when using the smaller wire required to connect to most units. It is also critical that both Track Bus cables be connected independently to isolated circuits coming from the control unit. And because the polarity of the two mainline tracks on



the layout have opposing polarity (from the B-W-W-B wiring standard), it is recommended that the adaptor from the Yellow track bus cross the wire polarity to prevent cross-over tracks from shorting out the layout. If this is done, care must be taken that it is only done once for each power district, and it only applies to the Yellow track.

Wire for the Track Bus

Track bus cables should be constructed of 12 gauge "zip" wire with Anderson Powerpole 30A connectors on each end. There must be a cable supplied for each circuit used in the layout. In a simple layout, this would be one cable for the Red track, and one for the Yellow track. When multiple inner circles are created in the layout, each of the inner circuits must be independently cabled. Track Buses should be identified by color as to which track, they service to avoid crossing the circuits. A simple piece of colored tape or Velcro strap around each end of the Track Bus will accomplish this. The following is a suggested set of color/circuit identification pairs:

Circuit	Color	Example
Red Track	Red	
Yellow Track (Inner Loop 1)	Yellow	
Inner Loop 2	Blue	
Inner Loop 3	Green	
Inner Loop 4	Yellow & White	
Inner Loop 5	Blue & White	
Inner Loop 6	Green & White	

The color coding for the wires of a Track Bus are the following:

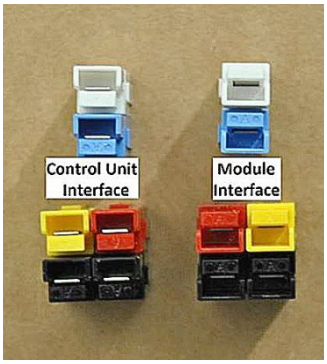
- Inner Rail = Kato white wire = red wire (when using red/black zip cable)
- Outer Rail = Kato blue wire = black wire (when using red/black zip cable)

Connecting Track Bus to Each Other

The Track Bus connectors to be used for T-TRAK layouts are the 30 Amp Anderson Powerpole connectors. The connector shell colors shall be blue and white for single cable bus wire or red/yellow and black if the buses are connected into a single cable. All connectors must be aligned vertically with the end facing the control unit configured with the white (or red/yellow) connector on top and the blue (or black) connector on the bottom. The opposite end of the cable will have the connectors reversed so that the ends of the Track Bus connect to each other and the colors match.

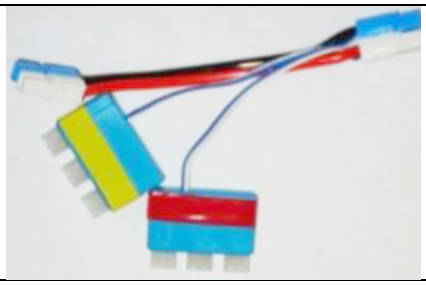
The following table is a summary of the Powerpole configuration.

Application	End	Stacking	Configuration
Single Bus	Control Unit	Vertical	White over Blue
	Module	Vertical	Blue over White
Red Track Bus	Control Unit	Vertical	Red over Black
	Module	Vertical	Black over Red
Yellow Track Bus	Control Unit	Vertical	Yellow over Black
	Module	Vertical	Black over Yellow

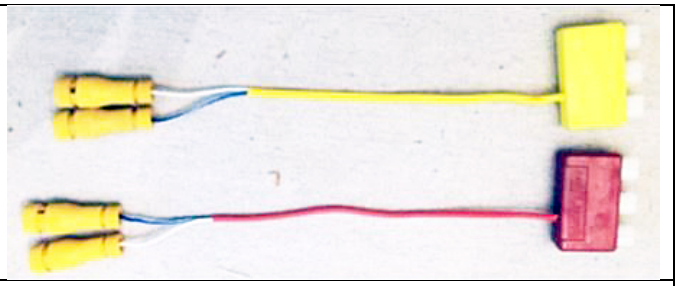


Connecting Modules to the Track Bus

The module connection points on the Track Bus must be compatible with the connectors provided by Kato with their Unitrack line. The most common source for plugs to attach to the Track Bus are the Kato Terminal Adapter Cord (part #24-843) and the Kato 3-way extension cables (part # 24-827) which allow for multiple modules to connect to a single feeder cable. Note that when connecting Kato blue/white cable to a red/black bus cable, the blue wire should always connect to the black wire of the bus. When using the Tamiya (female) connector on the Track Bus Feeder pigtail, the blue wire goes to the square opening and the white wire to the round opening on the connector.



Track Bus Feeder Cables (hardwired to the bus.)



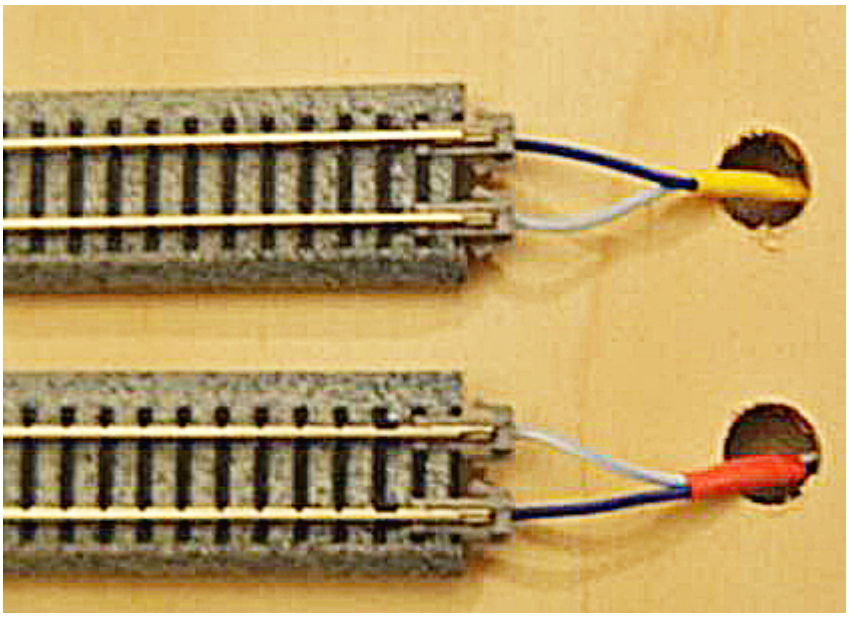
Track Bus Feeder Cables (attached with cable taps.)

Connectors in Europe and Australia – Many T-TRAK modelers in Europe and Australia have adopted RCA jacks and plugs instead of Kato and Powerpole connectors. If you plan to use your modules in those areas, refer to the “Australian T-TRAK-N Guidelines”.

III. Module Connectors

The only electrical components connected to the module are the Module Connectors. The recommended connector is the Kato Terminal UniJoiners (part #24-818). Other similar connectors are available, but their reliability has been proven to be lower than the UniJoiners. The ends of the Module Connectors must be clearly marked to indicate whether they provide a connection to the Red or Yellow line on the module.

Item	T-TRAK Standard	B.B.M.R.A. Recommended
Track Feeder Connector	Kato Compatible	Blue–White-White-Blue
Modules with Power Feed	At least 1 on each side of the table	All straight modules should be equipped with Track Feeders. Modules with lighting, animation, or DCC accessory decoders should also have independent 12V Accessory Power Feeds.
Track Bus Connectors	Anderson Powerpole 30A	When using blue/white connectors, cables should be identified as red or yellow circuits with colored tape, paint, or heat shrink.
Track Feeder Color Code	Blue–White-White-Blue	



Tracks must be wired **blue-white-white-blue**

Color Code

The b-w-w-b color code for track feeders originated at the first inception of T-TRAK by Lee Monaco-FitzGerald and Jim FitzGerald, as follows:

> "Kato had the 20-041 2-7/16" straight track with an electrical connection. This required no soldering and a variety of wiring extension units were available. Because of the solid ends of the module box/base unit used, there needed to be a way to change of check that the special connector was plugged into the track unit. That meant that a ¾" diameter hole needed to be drilled through the module top, centered under the track and 1¾" in from the end of the base. This was done at the right end of the front track and the left end of the rear track. When done this way, there was easy access to the wiring of each track loop.
>
> Because the #20-041 tracks were facing in the opposite directions, the "b-w-w-b" wiring was the result. At that time (2001) there was no Kato double crossover on the market and very little DCC in use on N Scale layouts."
>
> From Jim FitzGerald, May 6, 2012

DCC on T-TRAK would, in general, be a lot easier if we had "b-w-b-w", but the standard is "b-w-w-b" and that is followed in this document.

Track Feeders

Many T-TRAK layouts that fill one or two tables can operate satisfactory with a single set of feeders, especially if the control is DC. With DCC, however, more feeders are needed, especially as the layout becomes larger and more complex. For DCC-controlled layouts, it is recommended that all corner modules be equipped with track feeder cables. This ensures that no module is ever more than about 8 feet away from a power feed, with most modules within 4 feet.

It is recommended that the following T-TRAK modules be equipped with track feeders:

- All corner and junction modules
- Modules with track sections between two turnouts with insulated UniJoiners at the four frog rails of the turnouts (e.g. a passing siding).
- Modules with DCC stationary decoders to operate turnouts should also have their own track feeders or, as a minimum, be located directly beside a module with track feeders.
- Other modules with specific needs for track power feeders.

For the most flexibility, especially at train shows, it is recommended you equip all modules with track feeders, even though there are times when they will not be used. You can arrange the show layout however you want without worrying about where modules with feeders are located.

It is important to label the feeders, so it is known to which track each is connected; use red and yellow colored tape. For Junction Modules mark the straight through track as the Red Track, and, looking at the module from the front (straight) mark the curved track feeders as left and right.

6. Digital Command Control for T-TRAK Layouts

Originally designed for DC (analog) control, T-TRAK layouts have evolved to wireless Digital Command Control (DCC). Trains are operated today on T-TRAK layouts with both DC and DCC active on the same layout, with only DC or with only DCC control. BBMRA T-TRAK layouts are 100% DCC control.

Digital Command Control System

Since most clubs with T-TRAK modules also have NTRAK modules the default DCC system for T-TRAK is usually the same system used for NTRAK layouts — the Digitrax Digital Command Control System. The remainder of this document will be directed specifically to the Digitrax system, although most information will be applicable to any brand of DCC system.

Track Bus

Much effort has been applied to specifying the track bus for the successful design, setup and operation of NTRAK layouts. The NTRAK track bus concept using Powerpole connectors and 12ga bus wire is the basis for the T-TRAK track bus specification. Uniformity with NTRAK allows power supplies/boosters and cables to be easily interchanged between T-TRAK and NTRAK and allows a Club to use the same parts for both modular formats.

In NTRAK, each track (red/yellow/blue/green, etc.) has its own track bus. This concept can also be applied to the two T-TRAK mainlines (red/yellow). However, since T-TRAK layouts tend to be much smaller and less complex than NTRAK layouts, for many applications a single-track bus will meet the layout needs. Following are the rules for the number of track buses needed:

- If both tracks are DCC-only powered, then one track bus may be enough.
- If one track is DC powered and the other is DCC powered, then each track must have its own track bus.
- If both tracks are DC powered and each track is to be controlled separately from DC power packs then each track must have its own track bus.
- Any track that will be switched from DC to DCC or vice-versa during a show will require its own track bus, i.e. two buses total.

This track bus design for T-TRAK specified in this document provides the flexibility for clubs to use either a single-track bus or one-track bus per mainline as they deem necessary for their layout configuration. The track bus design can also be used for DC-controlled layouts.

The overall track bus consists of two components:

- The Track Bus — the main bus under the modules, which connects to other track bus sections and track feeder bus sections, and to the DCC Booster or DC power pack.
- The Track Feeder Bus — a short bus section with blue/white pigtail leads to a Tamiya connector, which connects to the module track feeder.

Bus Wire Fundamentals

Track bus wires should be constructed in 2-foot, 4 foot and 8 to 10-foot lengths of 12-gauge wire with Anderson Powerpole connectors on each end. The intent is to provide enough length so that the junction between track bus wires falls under the corner modules in the layout, plus the shorter lengths allow connecting power to any other modules with track feeders.

The color coding for the track bus will be the following:

- DCC Rail "A" = Kato white wire = NTRAK red wire (ribbed wire)
- DCC Rail "B" = Kato blue wire = NTRAK black wire

Track Bus Connectors

The track bus connectors to be used for T-TRAK layouts are the 30 Amp Anderson Powerpole connectors, the same connectors specified in the 2011 NTRAK Electrical Standard. The connector shell colors shall be blue and white. For layouts that normally use one track bus per mainline the Powerpole connector shells could be red/white and yellow/white.

Connectors in Europe and Australia

Many T-TRAK modelers in Europe and Australia have adopted RCA jacks and plugs instead of Kato/Tamiya and Powerpole connectors. RCA twin sockets are mounted on the module backboard or equivalent. The White RCA socket is connected to the Front track and the Red socket is connected to the Back track. For each socket, the Inner pin connects to the Inner rail and the Outer skirt connects to the Outer rail. For more information refer to the "Australian T-TRAK-N Guidelines".

Track Bus Design

Each track bus must be 12-gauge stranded copper zip wire (red/black zip wire, outdoor low-voltage lighting wire or speaker wire), or equivalent. This wire has a thin section between the two wires and can be "zipped" apart. One side of the covering has a rib molded along its length; connect the ribbed wire (or red wire in the case of red/black zip wire) to the white connector at the end of each bus.

- The lengths of the bus wire are to be 2 feet, 4 feet and 8 – 10 feet.
- Each bus will be connected to the next bus using Anderson PP30 30 Amp Powerpole connectors at each end of the bus.

The following table is a summary of the Powerpole configuration.

Application	End	Stacking	Configuration
Single Bus	Right	Vertical	Blue over White
	Left	Vertical	White over Blue
Red Track Bus	Right	Vertical	Red over White
	Left	Vertical	White over Red
Yellow Track Bus	Right	Vertical	Yellow over White
	Left	Vertical	White over Yellow

The Powerpole housings are to be stacked *vertically* using the built-in dovetails, hood up, tongue down, *white over blue* on one end of the cable and *blue over white* on the *right* end.

An example of a track bus cable is shown in the photograph.

Track Bus Feeder Connectors

The connectors used for track feeders must be compatible with the connectors provided by Kato with their Unitrack line. These connectors are Mini-Tamiya connectors The Mini-Tamiya connectors are correctly referred to as Tamiya/Kyosho connectors. The Tamiya connector is the female housing with male pins. The Kyosho connector is the male housing with female pins and the clip tab that holds it to the Tamiya connector. Kato uses these connectors with a 22-gauge blue/white wire pair for track power, and a red/black wire pair for turnouts.

Following is ordering information:

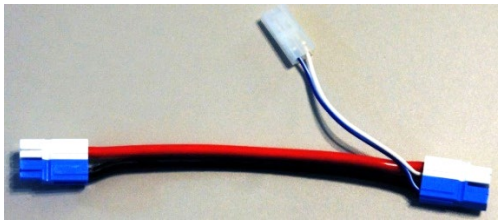
- Male/Female set with two housings and pins for one Tamiya and one Kyosho connector: Cat. No. 2913
- Male (Kyosho) connector with female pins and clip tab: Cat. No. 2914
- Female (Tamiya) connector with male pins: Cat. No. 2917

The pins require a standard Molex type crimp tool capable of crimping .062” diameter pins, such as the GC/Waldorm W-HT-1921. These connectors can be ordered from Maxx Products at http://www.maxxprod.com/, and other suppliers.

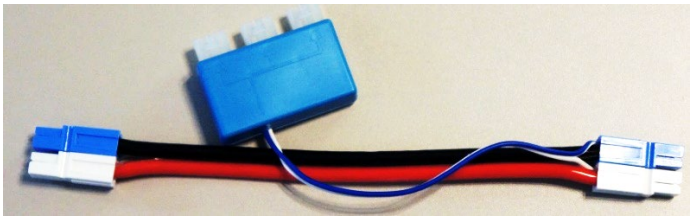
The Tamiya (female) connector (Cat. No 2917) is the connector used on the Track Bus Feeder pigtail. (The Kyosho 2914 male housing with clip connector and female pins attaches to the Track wire coming from the track feeder sections or terminal UniJoiners.) The blue wire goes to the square opening and the white wire to the round opening on the 2917 connector.

Track Bus Feeder Design

The track bus feeder is a short (6” – 8”) pigtail bus constructed just like a normal track bus, but with a feeder cable connected to the Powerpole connectors at the blue over white end. When inserted between two Track Bus cables, in correct polarity orientation, this cable provides power feed to the Red track. When inserted between two Track Bus cables in the reverse polarity orientation this cable provides power feed to the Yellow track yet keeps both the Red and Yellow tracks with the same polarity for successful DCC control and operation

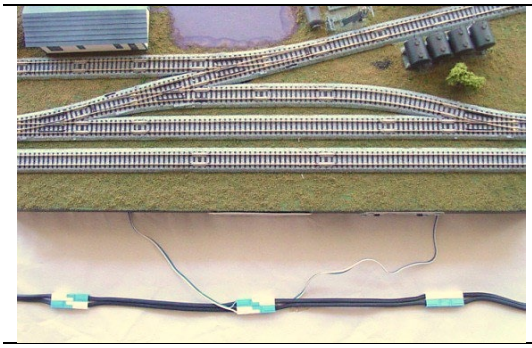


A track bus feeder with pigtail is shown above.



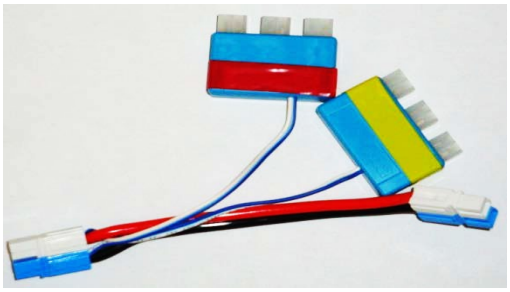
The photo above shows track bus feeder with the Kato 3-way connector to connect to multiple module track feeders.

The Track Bus Feeders shown above can be used in the layout with either a single-Track Bus or one-Track Bus per track.

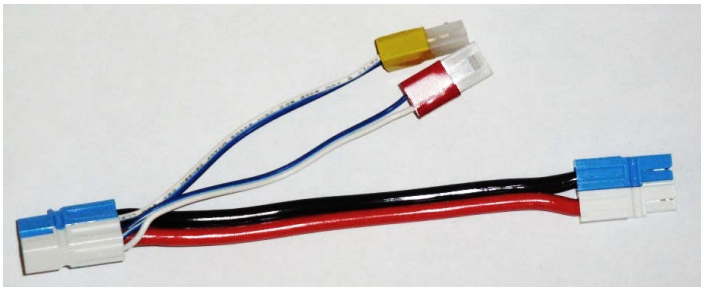


This last photo shows the connection of the track bus feeders reversed to permit changing the blue-white-white-blue to blue-white-blue- white needed for single bus DCC control and operation.

The following track bus feeders can be used with a single-Track Bus only.



Track Bus Feeder with Color-coded Pigtails for Red and Yellow Tracks



Track Bus Feeder with Kato 3-Way Connectors

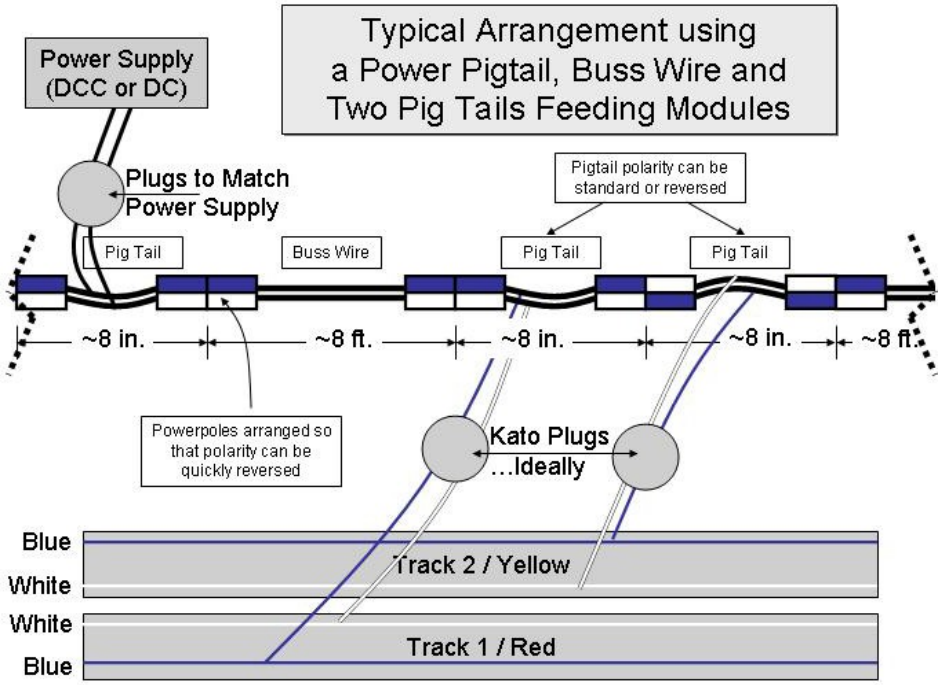
Connecting Power Supplies to the Track Bus

A modified version of the Track Bus Feeder is used to connect the track bus(es) to the layout power supplies, whether a DCC Booster or a DC powerpack. The design is identical to the track Bus Feeder except the feeder cable has the appropriate gauge wire and connectors for the power supply.

The Whole Picture

The following diagram shows how everything fits together for a single-Track Bus in terms of the power supply, the track bus, the track feeder bus with the connection to the module.

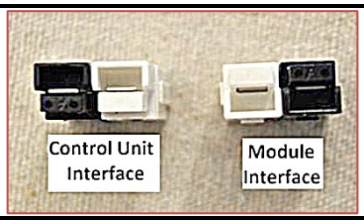
Note that following the configuration described here means that loops (Balloon modules) and wyes will require reversing sections.



Accessory Bus

Some T-TRAK modules will include operating accessories (such as building and streetlights, animated scenes, etc.) that require low voltage power to operate. Rather than having individual power supplies such as wall-warts, an Accessory Bus should be available. It is run in the trough parallel to the Track Bus(es), color-coded and configured as shown in the table.

Application	End	Stacking	Configuration
Accessory Bus	Control Unit	Horizontal	White/Brown on right, hood up
	Module	Horizontal	White/Brown on left, hood down



Local option can determine whether this bus will be 12VDC power or 15/16VAC power. If using DC, the cable should be labeled as a White cable. If using AC, the cable should be labeled as Brown. In layouts with AC accessory power buses, modules that need DC must use a bridge rectifier circuit to convert the power to DC. Voltage regulators should be mounted on the module(s) as required to provide the correct voltage to specific accessories. (e.g., Miller Engineering signs require 4.5V AC/DC.)

Item	T-TRAK Standard	Recommended Practice
Bus Connectors	Anderson Powerpole 30A	White=positive, black=neutral
Bus Cable	12-gauge cable	zip cable

Supplied Power	12VDC or 15/16 VAC	Each module must provide conversion to needed voltage for accessories
Accessory Power Feed Connectors	Anderson Powerpole 30A	

Accessory Buss Feeder

The Accessory Bus Feeder will follow the design of the Track Bus Feeder, i.e. a short (6" – 8") pigtail bus constructed just like a normal accessory bus It is the responsibility of the module owner to provide the Accessory Bus Feeders for their module(s) with appropriate connectors, voltage regulators and/or bridge rectifiers mounted to the bottom of the module at the module end of the pigtail cable.

Electronics for Accessories

Much of the accessories mounted on modules will probably not accept 15VAC as their input power. An accessory may require DC power or AC or DC power at a lower voltage than 15V. Some possible solutions are:

- If the device requires DC but can accept a voltage as high as 15V then a simple diode bridge rectifier will convert the AC to DC. The following are suitable diode bridge rectifiers. Choose based on the amperage requirement.
    - Radio Shack Cat. No. 276-1161 VM08 Bridge Rectifier, 1A 50PIV
    - Radio Shack Cat. No. 276-1152A Silicon Bridge Rectifier 1.5A, 100PIV
    - Radio Shack Cat. No. 276-1146 Bridge Rectifier 4A 50PIV
- If the device requires DC at a lower voltage, then use a voltage regulator. Voltage regulators are available with outputs ranging from 1.5VDC to 12VDC. Note than incandescent light bulbs will operate on either AC or DC if the correct voltage is supplied.

Be sure to put an appropriately sized fuse in series with the Accessory Bus Feeder to protect the device electronics in the event of a short circuit.

Two good sources of voltage regulators and DC control devices are Bakatronics LLC in Wallingford CT at http://www.bakatronics.com and Quality Kits in Kingston ON Canada at http://store.qkits.com. Most circuits are available as either a kit or built-up, and prices are reasonable. Useful devices are the following:

- Model AAR3 Automatic Reversing Circuit for DC Locomotives, trolleys, etc. Circuit board requires 10–16V AC or DC fixed input, plus 0–12VDC for speed control. Supplied assembled.
- Model BKD-2000 Current Detector, used with AAR3 for intermediate stops.
- Model FK804 DC Motor Speed Control: Input: 12VDC. Output: 0–12VDC, 1.5A (Pulse Width Modulation). The assembled version is model FA804.
- FK807 DC Voltage Regulator. Input: 12VDC. Output: 0–12VDC, 500 mA. This is pure DC. The assembled version is model FA807.
- FK808 DC Voltage Regulator. Input 0–30V AC or DC, 1A. Output: 0–30V DC, 1A. With 15VAC accessory bus power the output is 0–15VDC. The assembled version is

Model FA808.

- Model FK815 Adjustable Voltage Regulator Kit. Input 15VAC, 1A. Output: 1.5, 3, 5, 6, 9, 12VDC, 1A. The assembled version is model FA815. This device can be considered a universal voltage regulator since it can be set to several output voltages.
- Tam Valley Depot offers a Train Shuttle controller which is a self-contained 2-digit DCC system powered by a 12VDC supply. It includes the ability to automatically reverse a decoder-equipped locomotive/trolley and provide a mid-stop option. Speed and delay times at the end and mid-point are individually adjustable. Momentum using the decoder CVs is available.

Turnout Control with DCC Accessory Decoders

Kato Unitrack turnouts can be controlled with DCC accessory decoders. These include the following Digitrax accessory decoders: DS81K1, DS52, and DS64. Accessory decoders from other manufacturers can also be used. All accessory decoders can receive their commands from a connection to DCC track power. For T-TRAK modules it is recommended that any accessory decoders receive their track power from the Red track. Doing this has two requirements:

- The Red track must be DCC powered.
- If there is any chance the Red track could be DC powered, then a DPST switch must be inserted in the leads between the accessory decoder(s) and the Red track so the connection can be broken when the Red track is DC powered. DC power will damage the accessory decoder.

Electrical Districts

When the current (ampere) requirements of a T-TRAK layout exceed the capacity of a single DCC Booster the layout must be split into two or more electrical districts, just as is done with NTRAK layouts. Each district will have its own Booster (or section of a Power Manager). The electrical district boundary will feature the following:

- Standard UniJoiners will be replaced with Insulated UniJoiners.
- The Track Bus connectors will not be plugged up underneath the modules on each side of the boundary.
- The Boosters will be in approximately the geographical center of their electrical district.
- LocoNet cables will be run from the Command Station to the Booster(s).

Command Stations and Boosters for T-TRAK Layouts

Kato electrically rates its Unitrack product line at 12V and 3A, i.e. 36 watts. The reliable rail connections provided by the UniJoiners ensure the DCC signal is dependably transmitted.

The 3A current limit means that a Power Manager (PM), set to trip at 3A maximum, must be placed between any Booster and the track if the Booster outputs 3A or more, and is recommended even when the output is less than 3A. The following table lists the various Digitrax Command Station/Boosters (CS/B) and Boosters (B), indicating whether a Power Manager is required:

Designation	Model	Type	Output	PM Required	PM Setting	Memory Slots
Zephyr	DCS50	CS/B	2.5A	Recommended	1.5A	10
Zephyr Extra	DCS51	CS/B	3.0A	Recommended	1.5A	20
Chief	DCS100	CS/B	5.0A	Yes	3A Max	22 or 120
Chief	DCS200	CS/B	8.0A	Yes	3A Max	22 or 120
DB100	DB100	B	5.0A	Yes	3A Max	n/a
Empire Builder	DB150	CS/B	5.0A	Yes	3A Max	22
DB200	DB200	B	8.0A	Yes	3A Max	n/a

Important Note:

N Scalers often connect 5A Boosters directly to the track without a Power Manager. **Do not do this with T-TRAK**. A 5A Booster at 12V is 60 watts, which significantly exceeds the safe rating for Kato Unitrack. A short circuit may not only damage a locomotive or other rolling stock, but it can also damage the track as the heat may melt or distort the plastic base.

Suitable Power Managers are the PM42 from Digitrax and the DCC Specialties PSX Power Managers, or equivalent. The PM42 can be set to 1.5A minimum, and the PSX can be set to 1.27A minimum. The PM42 has an advantage in that it can be connected to LocoNet and its trip current can be set using JMRI or LocoNet Checker software loaded on a computer connected to LocoNet via a LocoBuffer or PR3 (see later section).

For many smaller and less complex T-TRAK layouts the Zephyr and Zephyr Extra Command Station/Boosters provide enough capacity to operate the layout. Of the two, the Zephyr Extra provides 3.0 Amps and 20 memory slots vs. the Zephyr at 2.5 Amps and 10 memory slots and is recommended.

Memory slot management is important for T-TRAK layouts just as it is for larger NTRAK layouts, especially if using a DCS50, DCS51 or DB150 as the Command Station. Operators should be encouraged to un-consist them consists, set the locomotive speed to “0”, and Release their locomotives after they are finished operating on the layout.

Booster Common (Grounding)

This is a definite requirement for complex NTRAK layouts, but not needed for almost all T-TRAK layouts. When needed the same guidelines as for NTRAK layouts will apply.

Example of a Command Station/Booster Configuration for T-TRAK Layouts

The photograph below shows the basic Command Station/Booster configuration used by the North Raleigh Model Railroad Club for its T-TRAK layouts.

- The base is ¼" plywood 8½" x 11" on ½" x ½" frame.
- Digitrax Zephyr Extra DCS51 Command Station/Booster, 3A, 20 slots with Digitrax PS314 Power Supply (both secured to the base with Velcro)
- Five outlet 6-wire LocoNet connector plugged into LocoNet Jack A on Zephyr Extra.
- DCC Specialties PSX Circuit Breaker, set at 1.27A, connected to Zephyr Extra Track A and B.
- Outputs using Powerpole connectors for Program Track (Red/Black) and Track Bus (Purple/Black
- Digitrax UR92 Duplex Radio Transceiver. Front panel removed and mounted above PSX breaker using brackets. Powered by external Digitrax PS14 power supply. Rear LocoNet jack connected to LocoNet Jack B on Zephyr Extra. (The North Raleigh Model Railroad Club is about 80% duplex.)

The physical size of the mounting board was chosen to be the same as a standard sheet of paper (8½" x 11") for ease of transport in containers such as a banker's box.

LocoNet Distribution for T-TRAK Layouts

If desired, Universal Panels (UP3, UP5, others) can be mounted on the front side (fascia) of T-TRAK modules, especially corner modules, for the distribution of LocoNet around the layout, where needed.

T-TRAK modules are usually placed on standard hotel-style 30" x 8' or 30" x 6' banquet tables, which can be made of wood or plastic. All these tables have a lip around the edges, to which Universal Panels (UP) can be attached. Clamps can be used for this purpose; screws should not be used to fasten Universal panels to banquet tables.

Either C-clamps or spring clamps can be used to fasten the UPs, although spring clamps are easier to use.

UPs, where used, should be in the center of the tables supporting the modules, on each side, as this will provide for easy access by operators. Thus, a length of 9 – 10 feet will be about right for LocoNet cables going between tables, and about 33” for cables going from the UP on one edge of each table to the other edge of the same table.

Some unique length cables may be required for special needs such as radio receivers/transceivers, etc.

It is unlikely that a T-TRAK layout will be so complex that the LocoNet would have to be broken down into a separate ThrottleNet and BoosterNet as may be required with NTRAK layouts. A single LocoNet running from the Command Station to all DCC devices should suffice. Should circumstances indicate a need for separate LocoNets the same guidelines as for NTRAK layouts apply.

Wireless Throttles for T-TRAK Layouts

Since most T-TRAK layouts can be viewed from both sides of the banquet tables only wireless throttles should be used on T-TRAK layouts at train shows. This will keep throttle cables away from the space that could be occupied by spectators. T-TRAK layouts must provide the ability to use Digitrax wireless throttles, and should also provide the ability to utilize the JMRI WiThrottle tool

Digitrax Wireless Throttles

Provision must be made for operators who use Digitrax wireless throttles, both simplex and duplex. This is accommodated using UR91 Radio receivers for simplex throttles and UR92 Duplex Radio Transceivers for duplex throttles, both of which will require a LocoNet connection to the LocoNet network and 14VDC power (PS14 or equivalent).

For most T-TRAK layouts a single UR91 and/or UR92 will suffice. However, just like for NTRAK layouts the UR91/UR92 units should be mounted as high as possible, at least five (5) feet above the table to ensure best signal reception/transmission. The mounting can be a pole that is clamped to the edge of a table or a stand that can be mounted on a table. The UR91/UR92 tower should be in approximately the geographical center of the layout.

Both a UR91 and UR92 can be mounted one above the other (UR91 on top) on the same pole or stand, leaving about 3” between them vertically, and both can be powered from a single power supply. Jumper wires can be run from the UR92 to the UR91 to provide power to the UR91.

Both the UR91 and UR92 must be connected to LocoNet. Connect a short LocoNet cable from the UR91 to the UR92, and then connect a cable of enough length to connect the UR92 down the pole or stand to the nearest LocoNet connection such as a Universal Panel.

Note that the UR91 and UR92 do not require Rail Sync signals so the LocoNet Cable from the UR91/UR92 can be connected to any jack on a Universal panel.

JMRI WiThrottle

Provision should be made for a computer running the JMRI suite to be connected to the Command Station (via a LocoBuffer or PR3) and to a wireless router so that the WiThrottle application can be used to permit operators with an iPhone, iPad or iPod Touch device to control their train using the iOS WiThrottle App, and operators with an Android device to

use the Android Engine Drive App.

Computer Control & Monitoring

Computer control and monitoring of a T-TRAK layout consists of a computer running JMRI or LocoNet Checker software and interfaced to the Command Station via a Digitrax PR3 or RR-CirKits LocoBuffer. While most T-TRAK layouts will probably not need computer monitoring and control, it can be very useful for tasks such as setting the LocoNet ID and Duplex Group Name and Channel, setting PM42 trip current, and monitoring the slots. Slot monitoring is especially useful if the Command Station is a DCS50, DCS51 or DB150 with their limited number of slots.

7. Scenicing T-TRAK Modules

Scenicing

T-TRAK modules can be sceniced using the same techniques employed with NTRAK module or home/club layouts, including insulation foam, plaster, foam-core project board, etc. If using "messy" techniques, make sure you don't extend past the end edges of the module — the line that extends up from the corners and edges of the module, so the scenery does not interfere with the adjacent module.

The type of scenery on a T-TRAK module is entirely the choice of the modeler. However, the modeler must be careful to observe the clearance requirements stated earlier.

Note that a module can be constructed in such a manner as to allow scenery to extend below the track level, taking care that the module structure remains sufficiently rigid.

Weathering the Rails

The appearance of Kato Unitrack can be improved immensely by weathering the rails. Use one of the following techniques:

- Using an airbrush spray rust-colored paint on both sides of the rails. Be sure to stay away from any rail joiners that are not soldered and be very careful around the moving parts of turnouts. Use a Bright Boy or equivalent to clean any paint off the top and inside top of the rails.
- At a craft store purchase paint-in-pen applicators in two shades of brown (Floquil also makes paint pens). Apply to the sides of the rails. Be sure to stay away from any rail joiners that are not soldered and be very careful around the moving parts of turnouts. Use a Bright Boy or equivalent to clean any paint off the top and inside top of the rails.
- Paint on a solution such as Micro Engineering Blacken It. This is an acid which darkens the rails, so they look like Micro Engineering weathered rails.

Consider weathering the ties as well with paint such as Floquil railroad tie brown since they are a shiny plastic.

Ballast

Kato ballast blends very well with the existing Unitrack "ballast" and should be used at least where other track joins to Unitrack. Be sure to keep ballast to a minimum around the moving parts of turnouts.

Skyboards

Since the size of skyboards on T-TRAK modules is relatively large compared to the size of the basic module the overall appearance of the module will be enhanced significantly if the skyboard reflects the scenicing of the module, rather than being plain blue. This could include:

- A painted backdrop
- Three-dimensional scenery with or without building flats, etc.
- Commercially available backdrop compatible with the foreground scenery
- Other

Skyboards for T-TRAK modules must be removable as a specific layout configuration may require that skyboards not be used. Any scenery that extends above the base towards the rear of the module must have its back surfaces painted to fit in with the scenery or to match the module base color.

Roads for Motor Vehicles

Consistent with the purpose and scenery of the module, each module should have a paved road for motor vehicles at each end of the module that is 18½ feet wide (2 vehicle lanes) and with the edge of the road closest to the module front no less than ½"/13 mm or more than 5/8"/16 mm from the rear of the rear (Yellow) track.

As appropriate for the module the width of the road may be varied to include sidewalks, parking lanes, etc. A good gauge for road width is the Woodland Scenics ReadyGrass® Vinyl Mat Road Ruler/Scraper. It includes dimensions for a two-lane road, a parking lane, and a sidewalk.

In summary, the various dimensions needed to lay out virtually any road are:

Road Part	Prototype Width, Feet	N Scale Width, Inch/mm
2-Lane Road	18½	1-3/8"/35 mm
Parking Lane	8	21/32"/15 mm
Sidewalk	4	5/16"/7.5 mm

By adding together, the components above for the road you wish to model you can get the necessary width. Example: two-lane road with parking lane each side, and sidewalk each side would be 3-3/16"/80 mm.

8. Train Show Planning and Operations

Planning

Just as an NTRAK layout at a Train Show must be planned, so must a T-TRAK layout.

The first task is to determine the number and size of banquet tables available for the layout, either as requested and/or assigned by the show host. Once the space available has been learned then a determination must be made of the T-TRAK modules that are available and will be in the layout. Top down photographs of T-TRAK modules in the Club, reduced to a common scale, can be used to plan the layout; CAD drawings of modules and their track configuration can also be used.

The following factors are part of the layout planning and setup functions.

1. Determine the space available, its location at the show venue and how many banquet tables are available, and their size. If standard banquet tables are not available determine what layout support is available or plan to bring the necessary tables. Also, determine the availability of chairs for members to sit on.

   Determine whether the table configuration will enable spectator access to all sides of the layout. If not, consider setting up the modules without skyboards to enable the spectators to view the modules in the rear. Not using skyboards also enables operators to better follow their trains around the layout.

2. Determine the T-TRAK modules available for the show and plan the layout configuration based on those module commitments and the available space and table configuration. See the next section.

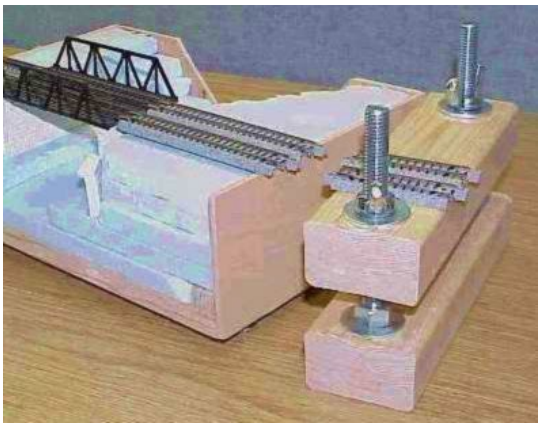
3. Ensure all necessary control equipment (DCC and/or DC), cables (120VAC, LocoNet, Track Bus, Track Bus Feeders), extension cords, surge protectors, etc., plus spares are available.

4. Ensure spare parts (Unitrack, UniJoiners, ¼-20 bolts, etc.) and necessary tools and supplies for setting up and maintaining the layout are available.

5. Ensure wood blocks are available to ensure all tables are at the same level.

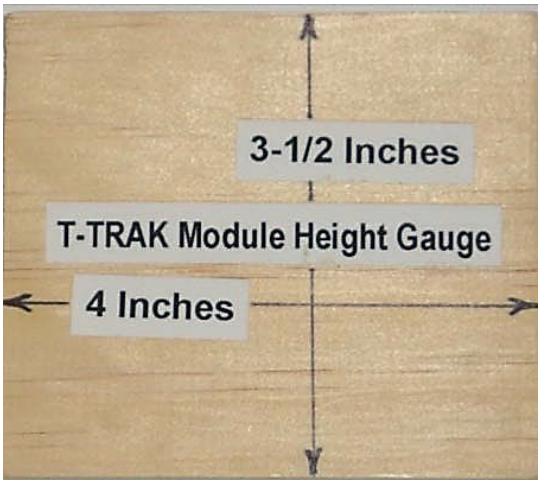
6. Ensure a means of leveling the modules on the tables and setting them to the correct height (3½ “) is available. Jigs/gauges can be used to simplify the process. Two types are shown below:

Paul Musselman created the adjustable alignment jig shown below:



The Big Bend Model Railroad Assertion has selected 3½" as the height of the module top above the table at BBMRA-hosted shows. The jig shown below is a constructed from ¼" plywood and is 3½" x 4" so it can be used for BBMRA layouts and other T-TRAK layouts where the normal module height is 4". Designed by David Thompson.

Construction details are provided in "The Unofficial T-TRAK Handbook" at http://T-TrakHandbook.com.



The planning process can be mechanized through the use of appropriate model railroad CAD software such as AnyRail. AnyRail CAD Software can be found at http://www.anyrail.com/index_en.html. It is used by several T-TRAK clubs and has T-TRAK module templates. A full unlimited version of AnyRail is $59.00, but the trial version (free download) may be enough for all but layout coordinators and planners.

Determining the Number of Modules That Fit on the Banquet Tables Available

The following tables provide guidelines for determining the total linear number of single-width T-TRAK modules that will fit on 30”/762 mm width banquet tables by either 6’/1829 mm and 8’/2438 mm long, assuming the tables are arranged linearly (end-to-end). In each case, it is assumed that there are two outside corners at each end. Since there are two lines of modules the actual number of modules required for the layout is twice the number stated in the tables below.

Six Foot Tables in Linear Configuration

No. of Tables	Linear Single-Width Modules	Total Single-Width Modules	Note
1	3.5	6 + Two half-width modules	1
2	9.5	18 + Two half-width modules	1
3	15	30	2
4	21	42	2
5	27	54	–

Notes: 1. The use of half-width modules fills the table to the maximum extent possible.
2. Two half-width modules could be added if the tables are pulled slightly apart rather than being butted against one another.

Eight Foot Tables in Linear Configuration

No. of Tables	Linear Single-Width Modules	Total Single-Width Modules	Note
1	5.5	10 + Two half-width modules	1
2	13	26	2
3	21	42	2
4	29	58	–
5	37	74	–

Notes: 1. The use of half-width modules fills the table to the maximum extent possible.
2. Two half-width modules could be added if the tables are pulled slightly apart rather than being butted against one another.

Six Foot Tables in L-Shaped Configuration

The following figures are for one 6’ table butted against another 6’ table in an “L” configuration. This configuration is equipped with five outside corner modules and one inside corner module. It consists of 6 table sides, two of which are 30”/762 mm. The table below lists the other 4 sides, indicating the number of linear single-width T-TRAK modules that will fit.

Table Side Length	No. of Single-Width Modules	Note
72”/1829 mm	3.5	1
102”/2591 mm	6	–
72”/1829 mm	4	–
42”/1067 mm	2	–

Notes: 1. The use of half-width modules fills the table to the maximum extent possible.

The number of T-TRAK modules required for additional tables along one or both directions of the “L” must be calculated separately.

Eight Foot Tables in L-Shaped Configuration

The following figures are for one 8’ table butted against another 8’ table in an “L” configuration. This configuration is equipped with five outside corner modules and one inside corner module. It consists of 6 table sides, two of which are 30”/762 mm. The table below lists the other 4 sides, indicating the number of linear single-width T-TRAK modules that will fit.

Table Side Length	No. of Single-Width Modules	Note
96”/2438 mm	55	1
126”/3200 mm	8	–
96”/2438 mm	6	–
76”/1676 mm	4	–

Notes: 1. The use of half-width modules fills the table to the maximum extent possible.

The number of T-TRAK modules required for additional tables along one or both directions of the “L” must be calculated separately. Combinations of 6’ and 8’ tables in any configuration, the use of other types of tables, or other shapes of layouts (e.g. rectangular) will require the space for available modules to be manually calculated.

Setup

1. At show setup time, after all necessary modules and other items have arrived at the show venue, do the following:
    - Ensure tables are lined up correctly for the layout design and are level. Place suitable covers on all tables. The covers should extend close to the floor so that boxes, etc. are hidden.

      Suitable covers are the following:

      - Colored plastic sheets. Note that moving modules or turning the leveling screws without lifting the module off the plastic sheet can cause a tear in the sheet.
      - Queen bed-sized bed sheets of an agreed color. Be sure not to use fitted sheets. Note that moving modules or turning the leveling screws without lifting the

module off the sheet can cause a twist or tear in the sheet.

Note: some venues may require any cloth sheets to be made of flame-retardant material to conform to local Fire Codes.

- If there is any possibility that the tables may move out of alignment during the show, they need to be anchored together. Potential methods are rope, bungee cord, plywood, and C-clamps.
- Place all modules in their assigned location and set to the correct height using the Club height jig.

  Take extreme care when leveling modules, both side-to-side and front-to-back, so tracks are totally aligned. An incorrect side-to-side height adjustment can cause one rail to be higher than the other at the joint. This can cause, for example, a step on a locomotive pilot to hit the end of the rail and stop or derail the locomotive. Failure to level the module front-to-back causes a twisting motion as the train crosses the boundary, which can cause derailments

  In addition to the above take extra care when a module straddles a table boundary and the tables are not exactly the same height.
- Ensure any track feeders on modules are released from their anchor and dressed to the rear of the module, also accessory feeders.
- Align the tracks and snap the modules together.
- Complete all necessary wiring for track feeders, other necessary module power, LocoNet, the Command Station/Boosters, and the 120VAC supply. Ensure appropriate cord covers are used if cables cross aisles where the public may walk. Check track polarity as the wiring of modules proceeds.

  When modules are used without skyboards all module wiring should fully be placed under the modules possible so as not to be a distraction for the spectators.
- Clean track and test operations of the layout
- Put the appropriate club and module signage in place.
- Finally, clean up the space around the layout so nothing is a hazard to members of the public viewing the layout or Club members operating the layout.

2. Protection must be provided to prevent the public and especially small children, from touching and damaging trains and modules. This could take the form of stanchions and ropes, as the club does with its NTRAK layouts or with Plexiglas sheets of a suitable dimension clamped to the edge of the banquet tables.

   If protection cannot be used due to space constraints then members must be very observant of the public, especially in times of high traffic.

   “Do Not Touch” signs should be fastened to the tables, at least one each side depending on the size of the layout.

3. When a member is kneeling on the floor, with an NTRAK layout the member often uses the NTRAK module for support as he/she stands up. When a T-TRAK module is used in the same manner it will often rotate around the two tracks, with the rear lifting as the

member puts his weight on the module. **Do not lean on T-TRAK modules or hold for support when standing up.**

Operations

1. The double-track T-TRAK main lines will normally be operated directionally based on right-hand running. The Red Track direction will be counter-clockwise, while the Yellow Track direction will be clockwise. The layout coordinator must approve any changes to this normal directional running.

   Engineers may run their trains in the reverse direction on the main tracks as necessary to access sidings and yards on the layout. These engineers are responsible for the safety of their trains and any trains operating in the normal direction; inform the engineer of trains running normally on the track in use about your reverse move.

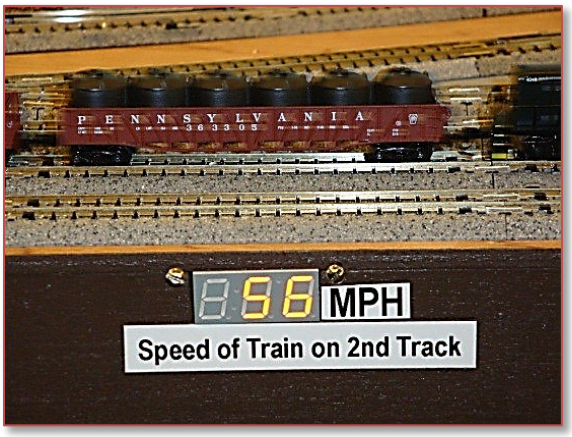
2. Unitrack turnouts must be operated using either the sliding lever or, if powered by a DCC accessory decoder, by using DCC switch commands. **Do not manually move the points like a Peco turnout, as this can damage a Unitrack turnout.**

   A roster should be kept of all DCC accessory decoders by module, listing the addresses assigned to each. This roster will be used to ensure there are no duplicate addresses in use on the layout.

3. Trains should be operated at realistic speeds, perhaps even slower than on an NTRAK layout since T-TRAK layouts are generally small. The following table provides a method of estimating train speed when crossing a single, double and quad module:

Prototype Speed	Time in Seconds to Cross Module		
MPH	Single Width	Double Width	Quad Width
75	1.5	3.0	5.9
60	1.9	3.7	7.4
45	2.5	4.9	9.9
30	3.7	7.3	14.8

The red track on one T-TRAK module (Green River) in the BBMRA has been equipped with the Train Speed speedometer manufactured by TDP & Associates. The Train Speed speedometer measures the speed in miles-per-hour of the train passing on the red track and is accurate to about 1%.



4. The layout coordinator should ensure that all engineers wishing to operate trains are allotted enough time, in turn, to operate their trains.
5. Keep a record of any problems encountered or module deficiencies (e.g. tree fallen over, plaster white spot, etc.) so they can be resolved after the show, but before the next show.
6. Also, keep a record of ideas and/or suggestions for improvements and enhancements to the layout and modules for future shows.
7. Following completion of the show and tear down of the layout the Layout Coordinator should issue a report discussing the show, problems encountered, deficiencies, ideas and suggestions arising from the show. This report should be sent to the members via the Club's email list.

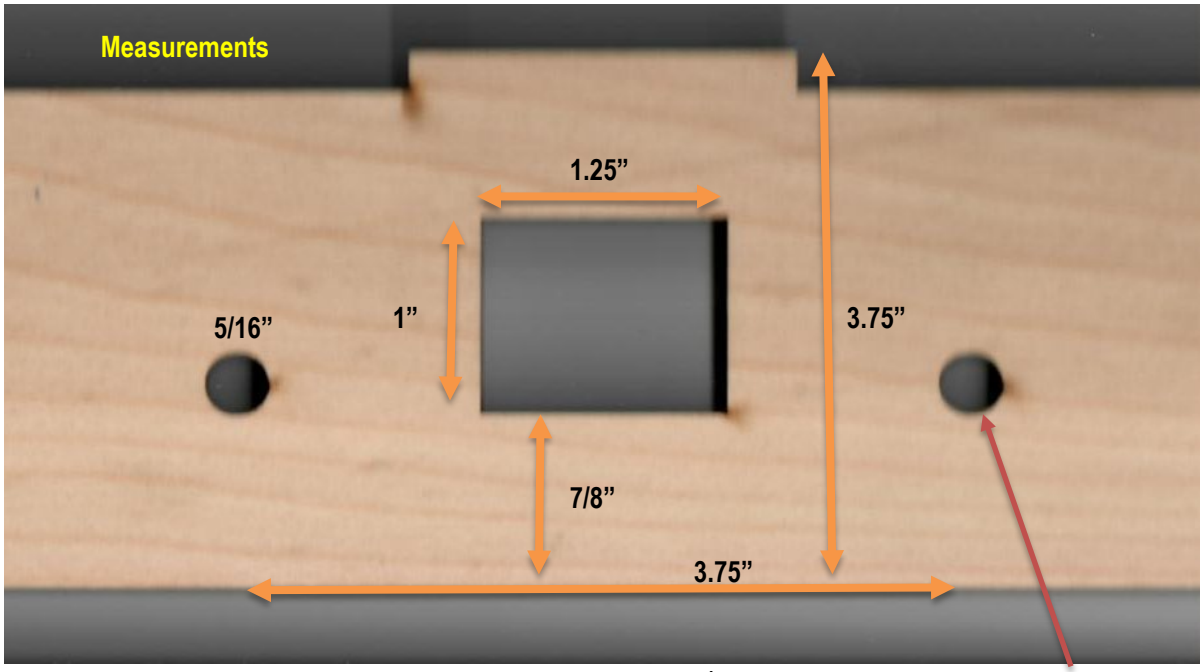
9. References

- Documentation from T-TRAK official web site at http://www.t-trak.org and NTRAK Newsletters.
- Email communications with several people.
- Glenn McLain, Northern Virginia NTRAK, “Your First/Second/Third T-TRAK Module”, “T-TRAK Inside Corner”
- Glenn McLain & Steve Jackson, Northern Virginia NTRAK, “T-TRAK Powerpole Bus Wires”
- Paul Musselman, “The Unofficial T-TRAK Handbook”, at http://T-TrakHandbook.com
- Kato Unitrack information from Kato official web site at http://www.katousa.com.
- “Power Routing Correction” from Kato USA web site http://www.katousa.com/consumers/N-4-turnouts.html
- Wiring for DCC, Alan Gartner at http://wiringfordcc.com.
- Thomas M. Tuerke, “Shelf-Top Modules”, Thomas.Tuerke.Net at http://thomas.tuerke.net/on/mrr/?thread=1173489516
- T-TRAK Email list at Yahoo Groups
- Digitrax Email list at Yahoo Groups
- JMRI Users Email list at Yahoo Groups
- Kato Unitrack Email list at Yahoo Groups
- Andrew George, Phillip Hillebrand, Ted Heath, John Rumming, Eddie Stavieu, David Bromage, Adrian Cooper, and Trevor May, “Australian T-TRAK–N Guidelines, published by Andrew George, Version 2, December 2009.
- Chaz, “The Tao of N Gauge Kato Unitrack”, Anyrail.com Forum, February 12, 2012
- Mike Fifer, “How to Make Your Own Lengths of Kato Unitrack”, Fifer Hobby Supply, http://www.fiferhobby.com/index.html
- Mike Fifer, http://www.fiferhobby.com/index.html, “How to Make Your Own Kato UniJoiners Power Feeders”, Fifer Hobby Supply.
- Spookshow International, a web site with valuable N scale information at http://www.visi.com/~spookshow/trainstuff.html
- Photograph of CMR rear panel with measurements, Dr. Neal Meadows

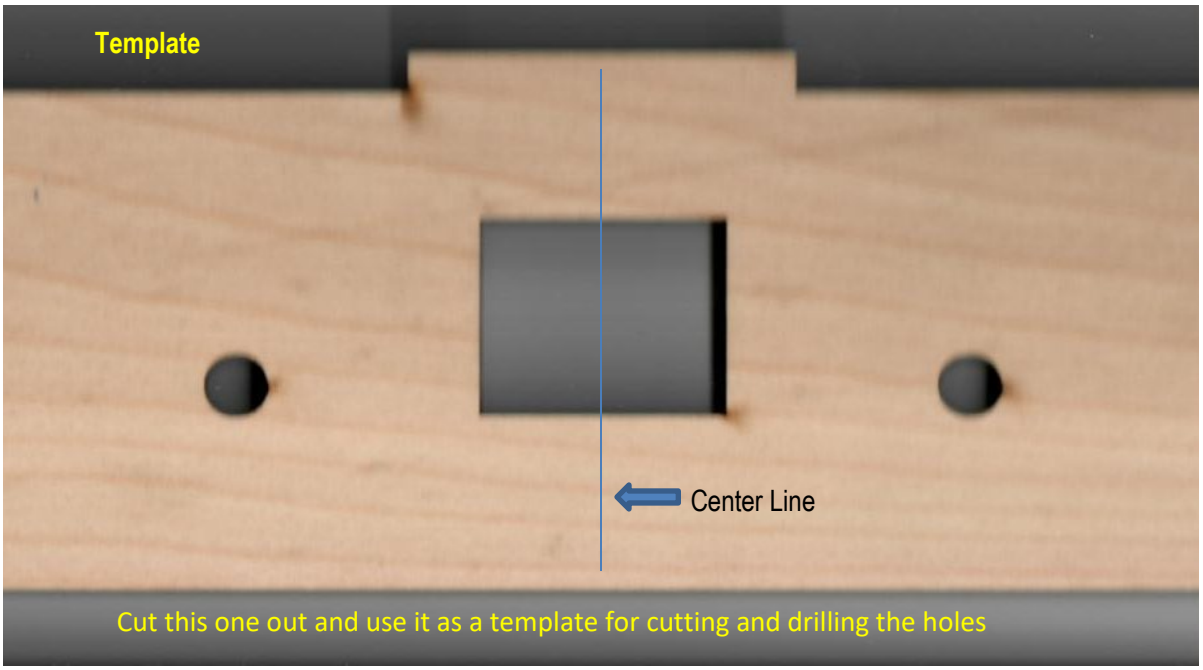
Appendix A

N Scale T-Trak Module hole cutting Template

Template for cutting access holes on the rear of an N Scale T-Trak Module for using Anderson Power Pole Connectors and mounting Sky Boards.



Some of these modules have the bolt holes that are 7/8” from bottom of the module to the bottom of the round hole. Some are 1”. The sky boards should have slots so they are adjustable.



BIG BEND MODEL RAILROAD ASSOCIATION

T-TRAK — N Module Information Sheet

Module Name or ID Code:_____

Owner: _____

Module Description:

Module Design (place an "X" in the appropriate spaces):

Single		Double		Triple		Quad	
Corner		Inside Corner		Junction		180 Degree Corner	
Crossover		Siding		Skyboard			
Other (describe):							

Depth (required for all single to quad-sized modules):_____

Track Spacing: _____

Electrical Information:

Kato/Tamiya Power Connectors	Y / N	Accessory Power Required:	Y / N
Specify required volts/amps:		Digitrax UP5:	Y / N
DCC Accessory Decoder:	Y / N	specify type:	
120VAC Required:	Y / N		
Date Constructed:		Date of Certification:	
Date of Major Alteration or Rehab:			

Module Condition (Place an "X" in the appropriate spaces):

	Excellent (scenery complete; no issues with scenery, wiring, track, etc.
	Good (scenery not complete; no issues with scenery, wiring, track, etc.): Marginal (minor issues, but nothing that would prevent running trains)
	Unserviceable (major issuers that are fixable; add estimated date for repairs):
	Under Construction (nothing that prevents running trains)
	Other Comment and Background re Module Configuration:

Please attach front photograph, top-down photograph and CAD track plan (if available

Big Bend Model Railroad Association T-TRAK Module Certification Form

Module Name: _____ Module Size/Depth: _____

Module Owner: _____ Date Module Built: _____

1. MECHANICAL CERTIFICATION

Is module base scratch or kit built?_____If kit-built, manufacturer? _____

If scratch-built, are appropriate materials used to build? _____

If scratch built or kit built was good construction practice used? _____

Joints securely fastened_____Side and corners square _____

Is the module frame painted?_____Is paint the correct BBMRA brown? _____

What type of leveling screw is used?_____Can the module be set at 4" height? _____

Can the leveling screws be adjusted from the top of the module? _____

Is the module equipped with a skyboard?_____What is the skyboard height? _____

Is the skyboard removable?_____How is it anchored to the base? _____

Is the skyboard painted front and back with the correct BBMRA color? _____

2. TRACK CERTIFICATION

Are the mainline tracks (red/yellow) spaced as required between each other & from the front of the module? _____

Does the track extend the required 1 mm beyond each end of the module base? _____

Straight or smooth curves_____Lays flat om base in all places _____

How fastened securely to base_____Screws countersunk _____

Are there turnouts on the module?_____What size on the main lines? _____

Are there any Kato #4 turnouts on the module?_____If so, have they been "tuned"? _____

For turnouts are there insulated gaps on both rails at the frog end of all turnouts? _____

Is the track ballasted?_____Are the flangeways clear of ballast? _____

Do the main track clearances meet the NTRAK high/wide standard? _____

3. WIRING CERTIFICATION

Item	Red	Yellow	Accessory	Note
Feeder present				
Feeder extends minimum 12” beyond the base rear				
Wiring connected to track			n/a	
Wiring connected to accessory(ies)	n/a	n/a		
Wiring connected to Tamiya male connectors				
Connectors color-coded				
Polarity correct at the track (BWWB)			n/a	
Polarity correct at both track connectors			n/a	
Continuity check OK			n/a	
Wires firmly fastened to the underside of the module				
General appearance of wiring				
Good electrical practice followed				
Accessory Bus fuse installed / ampere rating	n/a	n/a		
All connections soldered/screwed				
Appropriate electrical devices for Accessory Bus	n/a	n/a		
Accessory devices operate normally	n/a	n/a		

Note: 120VAC wiring is prohibited on all T-TRAK modules. Presence of 120VAC wiring is a Module Certification failure

4. SCENERY CERTIFICATION

Item		OK	Item	OK
No bare plywood			Scenery consistent with the theme of the module	
No scenery damaged			Buildings consistent with the theme of the module	
No buildings damaged			Scenery material does not interfere with the operation	
Building construction complete			Scenery material anchored to the module, cannot move onto tracks	

5. **NOTES**

Classification: _____ **Inspected by:** _____

Inspection Date: _____ _____

Instructions

- Check each item on the checklist sequentially in the order listed.
- For compliance simply place a checkmark (√) in the appropriate box on the form.
- For the total absence of an item, simply write "no" or "n/a" in the appropriate box on the form.
- For non-compliance, enter a number (sequential numbers for more than one item of non-compliance) in the appropriate box on the form, and, using the same number as a reference, write an explanation of the non-compliance in the "Notes" section (Section 5) on the form. This provides a full explanation to the module owner of the item(s) of non-compliance.

When complete, copies of the checklist should be given to the module owner and the Club Secretary. The module owner can then use the form as proof of Certification or as a list of items that need to be corrected. The Club Secretary will use the form for updating the list of certified modules. The original will be retained by the Standards Committee as a record of the Certification.