



ETE Great Lakes Chapter Modular Layout Specification 48 in × 25.5 in

Revision F.0

September 1, 2021

1 Overview

This specification defines a set of lightweight, standardized layout modules for the setup of ETE Great Lakes Chapter modular layout. Each standard straight module is 48" long by 25.5" wide (1221.6 mm x 647.7 mm). These standardized modules, when joined to a set of four corner sections, will allow for the quick setup, operation and teardown of temporary Märklin C-track based layouts for public display.

1.1 Goal

To present an operating *Continental European* themed mobile railroad to audiences with the expressed purpose of educating the public on European railroads and European railroad modeling.

1.2 Purpose

The purpose of this specification is to define the construction of easy to transport modules with the intent of quickly and easily joining them together in order to entertain and educate members of the public with a fully operational European-themed railway. The modules allow ETEGL members to construct interesting and entertaining scenes and dioramas that reflect the uniqueness that is Europe.

1.3 Theme

The theme of our railroad is Europe, all of Europe, any nation and any era. We do encourage a consistent time, season and location theme for individual modules.

1.4 Deviations from Spec

Our specifications are not designed to restrict the creativity or vision of our module builders. However, they are designed to reduce incidents of electrical and mechanical problems, module damage, and "downtime", i.e. situations where trains are not running on the layout. No ETEGL member is an island—your decisions on deviating from the specification have implications for everyone else. As such, we ask that any deviations from the specification be submitted to the *ETEGL Mod Squad* prior to construction of a module.

1.5 Design Objective

The objective of this layout design is to have a standardized spec that will result in a modular layout that will require no more than 2 hours to set up with running trains and nor more than 2 hours to tear down with a small crew. To do this we want standardized modules and module construction techniques. Each module will be electrically isolated to make setup and troubleshooting easier.

We fully understand members would like to be creative in how they build. However we would like to keep the initial modules standardized to ensure layout functionality.

1.6 Definitions

Core Module These are the modules that form the *core* of the ETEGL modular layout. The ETEGL maintains physical possession and control of these modules.

Personal Module These are modules owned and maintained by individual chapter members. These modules

are used at shows to expand the size of the core layout. Members are responsible for transporting these modules to the show and storage between shows.

Track The Märklin C-track used to construct the layout.

Trackbed The “ballast looking” plastic piece permanently attached to the Märklin C-track.

Roadbed The flat surface on top of which the track is mounted. This is not the plastic ballast attached to the Märklin C-track. The roadbed provides a continuous flat surface between the two endplates, upon which the track is mounted. The height of the module is measured from the top of the roadbed to the floor.

Endplate The club specified laser cut piece to ensure precise joining of two modules

Audience Left & Right As seen from our Audience’s point of view outside the layout. This is the viewpoint used when discussing an individual module’s construction and appearance.

Operator Left & Right From the point of view of the operator looking out from inside the layout. This is the viewpoint used when operating the layout.

Educating the Public Means that after they see the layout and interact with ETEGL members, they walk away more informed about European railroads and model railroading than when they came.

Having Fun Means we don’t have any “epoch police”, nor encourage “rivet counters”, nor do we try to advance any political or other personal agendas. Most importantly, having fun means our audience is the central focus of that fun. When they have fun, they will learn about European railroads.

2 The ETEGL Layout

The chapter layout is a modular design comprised of both member provided *personal modules* and *core modules*. The core modules consist of the specialized modules such as corner modules, the lift bridge and the yard. Members supply the straight modules that expand and connect the core modules to build a temporary layout at public events and shows. Modules will share a common endplate design that will provide for precise alignment of the modules and track. Each module will have a set of folding legs. Hand clamps will be used to hold the modules together. All electrical and catenary connections will be made manually.

The layout itself is in a dual track mainline configuration with an inner and outer loop. Each module will be electrically isolated from other modules in order to facilitate troubleshooting in the event of issues. Likewise, both mainline circuits will be electrically isolated from each other. Accessory power will be an independent bus with its own electrically isolated ground wire as part of the bus. Each module contains a set of bus wires and a receptacle at each end for a patch cable. Patch cables will connect each module to the next inline.

Powered catenary, driven by an analog transformer, is provided. The purpose of powering the catenary is to demonstrate the ability to run models prototypically off the catenary wires.

2.1 Core Layout

The core of the ETEGL layout is a double loop rectangular layout of 6 x 3 straight modules and four corner modules. This core is intended to be the layout that will be exhibited at *Fisher Hall* in Frankenmuth. The core layout includes the lift bridge and staging yard. All 26 modules making up this core layout shall be considered the *core modules*.

2.2 Controls Architecture

The layout will be powered and controlled via a Märklin Central Station 3 Plus (CS3+). The CS3+ will power the outside mainline loop. A Märklin 60175 booster will power the inside mainline loop. Separate conventional transformers will power the accessory bus as well as catenary power.

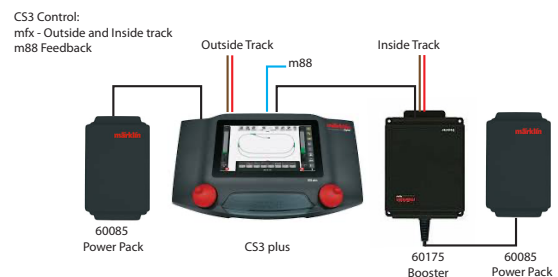


Figure 1: CS3+ & booster setup

The layout will be equipped with signal blocks. Each corner module will control a signal block triggered via contact tracks connected to Märklin s88 modules. Two s88 modules will be installed in two corner modules. Feedback signals from the other two corner modules will pass through the bus to their respective s88 units on their side of the layout.

The s88s will in turn be connected in series to the CS3+ using RJ45 ethernet cables. These signal blocks will allow a total of 6 simultaneous trains to run on the layout. The signals will be decoder equipped and controlled by the CS3+ allowing the operator to turn the block system on or off as required as well as providing manual control of the signals.

To ensure train detection on the contact track, members running consists with DC wheelsets need to ensure a sufficient number of axles will electrically bridge the two rails.

3 Module Technical Specification

This module specification defines the interface of the modules (the left and right ends mechanically and electrically). The goal is to have modules that are quick and simple to connect. Standard straight 48" x 25.5" (1221.6 mm x 647.7 mm) modules, shall be interchangeable, ie modules should be able to be mechanically and electrically joined to any other module in any order.

3.1 Straight Module

- A straight module shall be 1221.6 mm (48.09") long as defined by the length of the following set of Märklin sectional track.
 - 3x 24188 (3 x 188.3 mm)
 - 3x 24172 (3 x 171.7 mm)
 - 2x 24071 (2 x 70.8 mm)
- Track shall be mounted flush to the edge of both endplates.
- Sectional track connecting tabs shall be cut off so track will mate between modules with a flush joint.
- Module length may be adjusted slightly during build to accommodate variations in sectional track length and/or track sections may be cut to length.
- A standard radius turnout may added to a standard length of track by substituting a R2 switch or crossing in place of a 24188.
- A wide radius (R9) turnout or crossing may be added by using a 24711/24712 or 24740 in combination with 1x 24236, 2x 24229, 1x 24077 & 1x 24071 (equal to 1080 mm) plus the 2x additional 24071.
- Modules may be wider than 25.5" in between the ends with the exception that modules should not be extended into the operator's area without prior approval

from the *ETEGL Mod Squad*. This does not preclude building a small shelf for the placement of control boxes or the like. Building out into the spectator's area is allowed, even encouraged with the proviso that each module, or the ends of a super module set, must start and end in the same line. In other words, you can't start one module at point X and end up $X + Y$ inches out into the spectator's area.

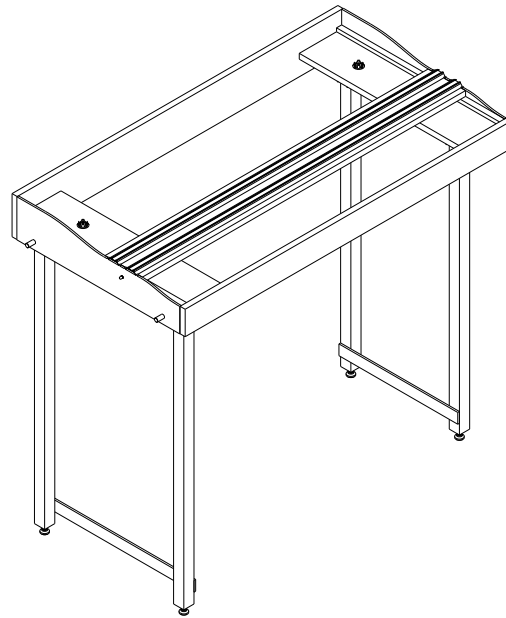


Figure 2: Standard straight module

3.2 Super Modules

Super modules are any module (or set of modules) constructed as a multiple of the standard module. A super module may be constructed in one piece or may be broken down into smaller sections. The interior interfaces between modules of a super module set is entirely up to the builder. It follows, therefore, that the length of the individual modules is also entirely up to the builder as long as the whole super module is a multiple of 48" in length. This rule is intended to encourage trackwork and scenery that cannot be accommodated in a single standard module and/or the standard specification.

- The first and last section of a super module set shall begin and end using a standard endplate.

- The overall deviation from

$$Length_{overall} = n \times 48 \text{ in}$$

where n is the number of equivalent standard modules) shall be $\pm 0.25"$. This allows for trackwork that doesn't result in a precise multiple of 48".

- While super module interior interfaces are up to the builder, we encourage using club endplates. In addition to the standard endplates, endplates designs for flat modules, with and without the scenery dip at the front of the module, are available. It is also possible to have custom interior endplates manufactured.
- All super modules shall follow the ETEGL electrical specification.

3.3 Corner Modules

Four of the core modules are corner modules. Each of these corner modules will consist of a 90° turn made from R4 & R5 curves. In addition, the corners will be equipped with folding steel table legs and will serve as the "anchors" for the layout.

- A corner module outer loop track section shall be constructed from 1x 24188, 3x 24530 & 1x 24188.
- A corner module inner loop track section shall be constructed from 1x 24188, 3x 24430 & 1x 24188.

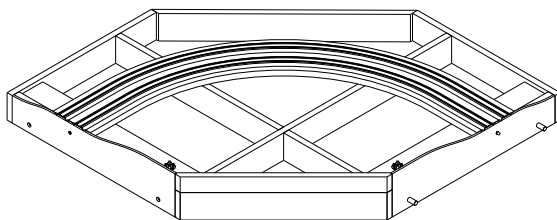


Figure 3: Corner Module viewed from operator side

3.4 Module Roadbed Height & Legs

- The module roadbed height shall be 42.25" (1,073 mm) as measured from the floor to the top of the roadbed.
- Each module shall be equipped with an integrated set of folding legs. The module should be free standing during set-up and tear down of the layout.

- Height adjustment shall be built into the module legs to allow for uneven floors. Wherever we assemble the layout we'll choose one module to be the "master height" module and adjust all the others, within reason, to meet that height.
- Our recommended leg hinge mechanism is the *Rockler Posi-Lock Folding Leg Bracket* with 1.5" square wooden legs. These mechanisms lock in both the up and down positions.

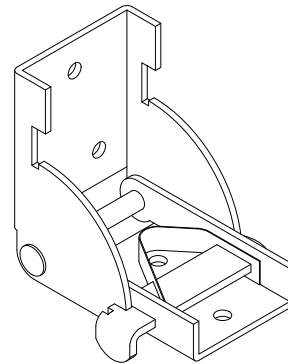


Figure 4: Posi-Lock Folding Leg Bracket

3.5 Endplates

Laser cut endplates will be supplied at cost via the the club and are mandatory to use. These endplates are precision cut ($\pm 0.1\text{mm}$ tolerance) to ensure highly accurate alignment of the joining modules. To ensure smooth running of trains the endplates include tabs to position track with exact 64.3 mm spacing.

- Endplates shall be 24.0" (609.6 mm) wide, 6.2 mm (0.244") thick birch plywood.
- The endplates shall be laser cut (via www.ponoko.com) to ensure precise and repeatable geometry where modules meet.
- The endplate shall define the position of the top of the roadbed for modules and shall include tabs with a 64.3 mm centerline spacing for mainline C-track positioning.
- Steel support dowels shall be installed on the lefthand endplate. These 2"-3" long dowels will be 0.5" in diameter and will fit the precut holes in the endplate.

- A table leaf pin shall be mounted in the lefthand endplate and the corresponding leaf pin receptacle bushing mounted in the right hand endplate (*Hafele 8 mm Table Pins*) Together with the 0.5" pins, the table leaf guide the precision alignment of the modules.
- The endplates shall be mounted to a support structure to add rigidity to the module and ensure dimensional stability. Additionally the builder must take care to ensure the endplates are mounted square to the module's axes. Any misalignment of the endplates may result in possible misalignment of or gaps in the tracks once modules are joined.
- The standard module endplate profile is loosely based upon the ETE standard with both up and down elevations. A flat plate and custom endplates are available for yards and other non-standard super modules. However, each set of super modules must start and end with a standard endplate.

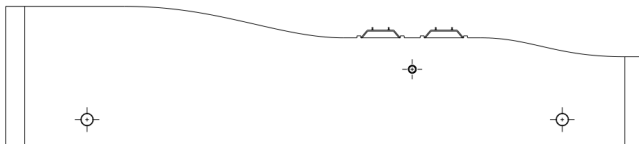


Figure 5: Left view of module

3.6 Track Specification

- The standard track type shall be Märklin C-track
- Märklin K-track may be used on personal modules as long as the track pieces at both ends of the module (or super module set) are C-track to allow joining with any other module. The builder must ensure the K-track rail height is the same as the C-track so as to avoid any "dips" in the mainline.
- Märklin M-track shall not be used due to toy like appearance and incompatibility with non-Märklin wheelsets.
- There shall be two mainlines spaced 64.3 mm apart centerline to centerline. This is the "natural" spacing of the two tracks off of a Märklin 24711/24712 large radius turnout as well as the spacing between the R4 and R5 curves that we use for the corner modules.
- The minimum mainline track radius shall be R3.
- The minimum branchline and siding radius shall be R2.
- All turnouts and crossings connecting the two mainline tracks shall be R9 wide radius (24711/12) in order to preserve the mainline's 64.3 mm centerline spacing.
- Turnouts off the mainline and into a siding or branchline may be R2 (24611/12) or R9 (24711/12)
- Functional turnouts shall be equipped with switch motors and a decoder (either built into the road bed or via m83(s) in the module). The ETEGL will provide decoder address assignment numbers. Turnouts do not require switch motors and decoders if they are non-functional and are only to be manually operated.
- The use of grades on the mainline is not allowed. Grades are allowed for branchlines and sidings and are encouraged to add interest to module designs.
- Direction of travel on the double track mainline is right-handed (i.e. the direction of travel of the mainline closest to you is to the right as you face the module.)

3.7 Catenary Specification

- Both mainlines shall be equipped with powered Märklin catenary.
- Modules shall be bridged using a Märklin 70142 (142 mm) catenary wire. Thus the first and last catenary masts on a module shall be placed 71 mm from the left and right ends.
- On a standard straight module, three 70360 (360 mm) catenary wires will span the distance between the first and last mast. Combined with the 70142 transition, this provides a catenary length of 1222.0 mm (48.11").
- One mast on each line shall have a power feed.
- Catenary is optional on branchlines and sidings.

3.8 Electrical Specification

Electrical power and feedback will be carried through the modules using an 8 wire bus connected to the chapter control station. Each module will be electrically isolated from it's neighbors. The purpose of this is to allow each module to be independently powered (with the exception of catenary) so in the event of an electrical problem the fault can be quickly identified, isolated and repaired.

Individual modules will be equipped to independently feed power to each of the mainline loops, the catenary and

accessory bus. Power and signals will be passed through modules via an eight wire bus. Each module's bus will be equipped with a pair of Neutrik connectors at both ends (mounted to the crossbrace, facing downward). The modules will be fed in series by connecting the Neutrik connectors on neighboring modules with a patch cable. This allows individual modules to be disconnected from the bus for fault isolation and troubleshooting.

Bus (run) wires The bus wires carry electrical power and digital signals around the length of the layout. Hence we use a thicker wire in order to reduce power and signal losses.

Feed (tap) wires Feed wires are used to tap into the bus wires and connect power and signals to the track, digital accessories and other electrically powered features on the module. Since they are used for short local runs, these wires may be thinner than the bus wires.

Table 1: Bus name, Neutrik pin & color

Pin	Color	Bus	Label
1+	red	Outside Track Power	OTPwr
1-	black	Track Ground	TGnd
2+	orange	Inside Track Power	ITPwr
2-	green	Catenary Power	CPwr
3+	purple	Inside Track Feedback	ITFB
3-	blue	Outside Track Feedback	OTFB
4+	yellow	Accessory Power	APwr
4-	brown	Accessory Ground	AGnd

- Each bus wire shall be identified by color or abbreviation. The color, name and abbreviation of the bus wires are shown in Table 1. These colors are used to identify each wire to facilitate troubleshooting. The wires may be jacketed in the indicated color, or flagged by means of electric tape, shrink tubes, labeled or by any other suitable method.

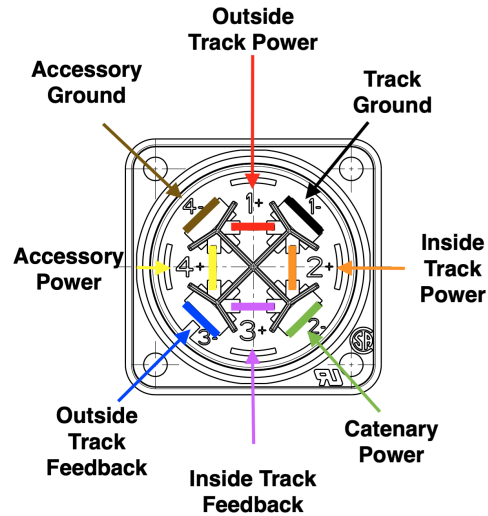


Figure 6: Back view of Neutrik NLT8MP with pins

- Modules shall be equipped with an eight wire bus.
- All eight bus wires shall be connected, even if they are not otherwise used by that given module.
- The bus wire shall be 14 AWG.
- Feed wires shall be 22 AWG (18-22 AWG optional).
- All wires, both bus and feed, shall be jacketed to reduce the likelihood of short circuits.
- All wires shall be firmly secured to the module at regular intervals. Care must be taken to ensure no wires dangle below the bottom of the module or are a snag hazard in any other way.
- Each module shall be equipped with two downward facing *NLT8MP Chassis Connectors* mounted underneath the module, on both ends, near the operator side of the module. The connectors are positioned here so as to allow the operator to connect patch cables to connect the bus between modules.
- Patch cables used to connect modules shall use the *Neutrik NL8FC speakON Connector 8 Pole Cable Mount* on both ends of the cable.
 - Every module is required to have one patch cable
 - Patch cables shall be approximately 24" long
 - Patch cables shall use 14 AWG or larger wire
 - Patch cables shall include all eight bus wires
 - Each wire shall connect to the same pin on both ends of the cable
 - To allow the Neutrik connectors to properly grip the wire bundle for strain relief, heat shrink tubing shall be used on the last 3" of wires on both ends where they enter the Neutrik connector

- Tapping off the internal bus shall be done using 22 AWG wire connected to the bus wires with 3M 905 Scotchlok suitcase connectors or equivalent. Please note the wire gauge and connector match is essential to ensuring a reliable electrical connection. You may deviate from this standard, however you must take care to ensure all your electrical connections are reliable.
- Although personal super modules are not required to use these same Neutrik connectors for internal connections, it is recommended for reliability and diagnostic purposes.
- **Note:** *The two feedback wires in the bus, the blue and purple wires (ITFB & OTFB) are reserved for chapter use and will pass through each module. Do not connect anything to these two wires.*
- The standard ground cover should extend at least 2" into each module at each end, and blended to transition into whatever ground cover the builder chooses if different from the standard. This avoids the sudden transition from grassy green to concrete at a module edge. The appearance of ground cover is specified to establish an overall consistent look to the modules. If your module appearance differs a lot from this rule the appearance at the module ends should adhere to this spec for the sake of visual continuity.
- Paint both the front and rear face of the module flat black. This helps the module blend in with the skirting which is used on both the inside and outside of the layout.

3.9 Appearance Specification

To provide a uniform transition between modules, a common appearance at both left and right ends of a module is specified. It is up to the builder to determine the appearance of the modules in-between and we like to encourage variety. The standard module endplate profile has both up and down elevations to encourage getting away from the flat table-top look so many other club modules have. While individual modules may transition up or down from this profile, and indeed are encouraged to have variation, all modules must adhere to the end profile shape and color at the point where they join the next module.

- The color to be used to represent "earth" or "dirt" is *Brown Moss* (Waverely Home Classics by Valspar WV37012 available from Lowe's). Get the paint in the matte variety. Paint the entire top surface of the module with this color. All additional landscaping and track roadbed is placed on top of this color.
- The roadbed ballast shall be *Busch 7069 Track Ballast*. This color matches the color of the plastic C-track roadbed and if blended with the C-track roadbed does a good of emulating traditional ballasted track.
- Standard ground cover shall consist of a blend of two-thirds (by volume) of *Woodland Scenics Blended Turf Green Blend* (T1349) with one-third *Blended Turf Earth Blend* (T1350). Into this mix you can add various colors of weeds, flowers, etc as per your desired effect. You could make the ground cover nearest the tracks a little more "earthy" or yellowish to simulate weeds but that's up to you.

3.10 Module Skirting

Each module receives a heavy opaque black skirting that should hang down from the module edge to the floor. The skirting will be attached with hook and loop fasteners (Velcro), both on the inside and outside of the layout.

- Each module shall have a 1" Velcro strip (hook side) running along the lower surface of both the front and back panels.
- Skirting shall extend to approximately 1" from the floor.

4 Revisions

Rev A Original version—never formally released

Rev B Circulated for review on 26 June 2004

Rev C Released on 17 October 2009

- Removed references to counterbore on end pieces, Rule #3 – Section #1, as they are no longer needed.
- Cleaned up drawing Fig. #1 in Section #1
- Added specification for new style Märklin catenary in Section #3.
- Cleaned up Section #3 on catenary
- Revised Rule #8 in Section #1 on allowing modules to extend into the operator area but only with prior approval.
- Added Rule #4 in Section #4 on painting the front and rear of the modules flat black

Rev D Released on 23 September 2015

- Revised Section #4 – Rule #3 Groundcover to give examples of which Woodland Scenics ground cover to use.

Rev E Released on 27 January 2016

- Revised Section #2 – Rule #1 The BUSS
- Because the source of the CON-60 connector, All Electronics, has changed the colors of the wires, the spec has been rewritten to show the proper buss connections relative to the position of the pins on the connectors.

Rev F Draft Circulated for review starting 2019

- Complete redesign of the module and rewrite of the module specification
- Initial release 1 September 2021

5 Appendix

5.1 Standard C-Track to make up a 48 in Module Length

Table 2 lists the track sections used to make up the 1221.6 mm standard straight module track length. This standard track length was arrived at starting from a desired 48" module length plus using Märklin's 360 mm spacing unit for section track. Three units equals 1080 mm. The addition of 2x 24071 (70.8 mm) sections of track provides an overall length of 1221.6 mm or 48.09". The track length to accommodate wide radius turnouts results in a length of 1220.7 mm and is based on the sectional track making up a 1080 mm length as defined by Märklin in the 24711/12 manual. The 0.9 mm variation is within the length tolerance.

Table 2: Märklin C-track standard sections for a 48 in module

Catalog Number	Quantity	Overall Length
24071	2	1221.6 mm
24172	3	
24188	3	
24071	2	1221.6 mm
24360	3	
For wide radius turnouts		
24071	3	1220.7 mm
24077	1	
24229	2	
24236	2	

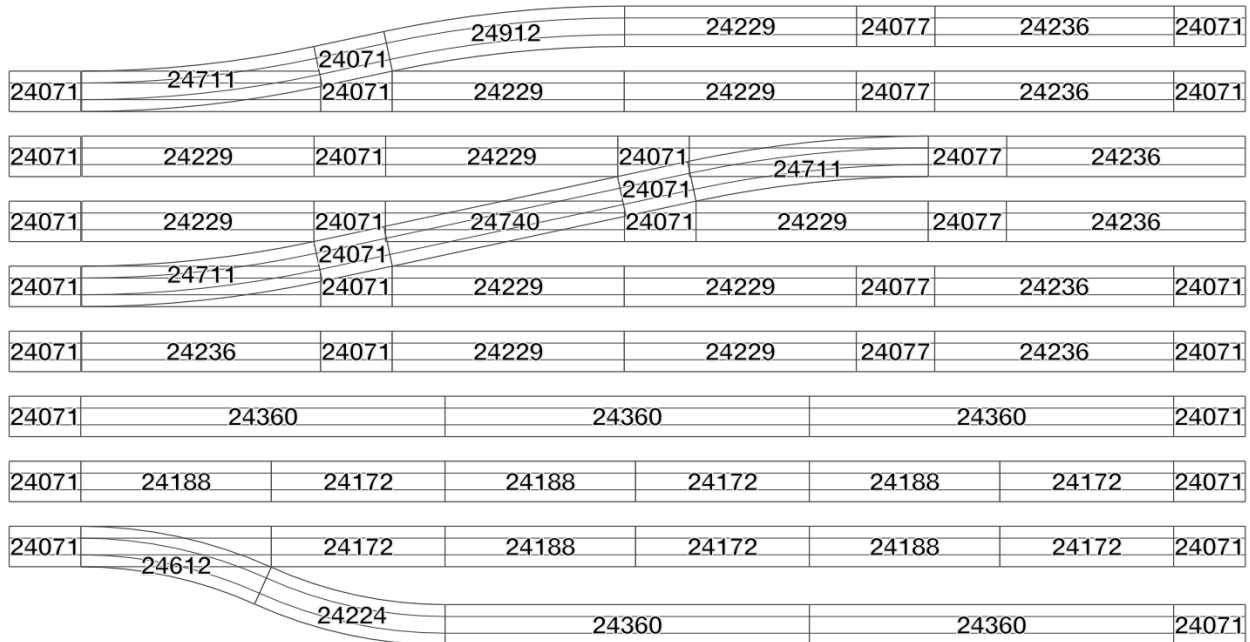


Figure 7: 1221.6 mm track combinations including turnouts

5.2 Track Building Blocks

Various Märklin C-track combinations can be used to build up track sections to a desired length. Table 3 lists the basic Märklin section track lengths.

Table 3: Märklin straight sectional C-track

Catalog Number	Short Name	Length
24064	064	64.3 mm
24071	071	70.8 mm
24077	077	77.5 mm
24094	094	94.2 mm
24172	172	171.7 mm
24188	188	188.3 mm
24229	229	229.3 mm
24236	236	236.1 mm
24360	360	360.0 mm

Table 4 is a list of equivalent track sections. The C-track geometry is such that the shorter pieces of track may be combined to build the equivalent of a longer section of track.

Table 4: Märklin straight C-track equivalents

Catalog Number		Combinations	Length
24172	=	24094 + 24077	171.7 mm
24188	=	24094 + 24094	188.3 mm
24229	=	24094 + 24071 + 24064	229.3 mm
24236	=	24172 + 24064	236.1 mm
24360	=	24172 + 24188	360 mm

Table 5 is a list of sectional track combinations which approximate the 4 ft length of our modules. Some combinations are shorter and some are a bit longer. This table maybe useful of you if you are building a super module. It may be more advantageous to use your desired track to build close to the module length and then cut one track to make a precise fit.

Table 5: Märklin C-track combinations table (approx 4 ft)

Catalog Number	Quantity	Overall Length
24064	1	
24229	4	
24236	1	1217.6 mm
24188	4	
24229	1	
24236	1	1218.6 mm
24094	1	
24188	1	
24229	1	
24236	3	1220.1 mm
24071	3	
24077	1	
24229	2	
24236	2	1220.7 mm
24071	4	
24229	1	
24236	3	1220.8 mm
24064	2	
24077	2	
24229	1	
24236	3	1221.2 mm
24071	2	
24172	3	
24188	3	1221.6 mm
24071	2	
24360	3	1221.6 mm