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NCI Modules

January 2005

Translation V0.95/June 2008

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N Club International Modules

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Contents

About the translation

This translation of the original N Club International standard is brought to you by N Club Finland and it is based on January 2005 version of the original unless mentioned otherwise.

The translation corrects an error in table 3, where the connector colours are in conflict with the related picture 8 in the original German language text.

The latest version of the translation can be downloaded from the web site of N Club Finland. It should be noted that later N Club Finland specific versions of the standard, indicated by a version number higher than 1.0, may deviate from the original January 2005 version by NCI.

Idea

The idea of an N Club International module was born in the meetings of NCI's local chapters in Cologne and Stuttgart where it was frequently discussed of projects where the club members could work together. N Club International participates various model railway exhibitions and other events regularly in order to promote N scale and to bring N scale enthusiasts together. A module layout which has something new and different to offer every time is a natural way to ensure that there is something fresh and interesting to showcase in every event. The idea of a module layout caught on rapidly in Cologne chapter of NCI and spread from there to Stuttgart.

The journey from a raw idea to its' implementation can be long. In the first module meeting in April 2000 in Stuttgart-Möhringen, only the basic principles of the upcoming standard were agreed on. Eventually our module system was showcased to the general public in many module gatherings and exhibitions and we got many suggestions for modifications and new features. Due to many changes the main parts of our standard were complety rewritten in 2003 introducing many new features. In the meantime, new modules were built all the time.

The most troublesome part of the standard turned out to be the electrical connection between modules. Many module builders considered 37-pin Sub-D connector and several cables ran through the modules difficult to install. In practice, many modules featured only the wiring for the tracks. For this reason we simplified electrical connections significantly. The new electrical connector system was used for the first time in our 6th annual module gathering in early 2005.

Standard

As none of the existing module standards met the wishes and requirements of our module builders, we decided to develop our own standard. In order to accommodate modules built to other systems, we build special adapter modules between our system and other systems.

Theme and era

The track on the module may be a double track mailnline, a single track branch line or a narrow gauge railway line.

If possible, the railway era should be era 3 which is usually the most interesting period of time from the point of view of variety of rolling stock. The choice of the era is, however, optional and if a module builder wants to build their modules to represent another era, it is perfectly acceptable. In past module meetings we have seen rolling stock of all the eras on the module track.

Module ends

The design of our module end is based on a module type developed earlier in Z Club International community.

Wooden module ends are equipped with two round brass blocks embedded below the ends of the tracks. Each brass block has a precision drilled hole for the alignment of module ends. As all the module ends have the alignment holes accurately in the same position, the alignment between modules can be achieved easily using metal studs inserted in the holes between two modules and thus aligning them both vertically and horizontally. Adjusting the position of track ends relative to the alignment holes is done using a jig inserted over the alignment studs. The method of using a precision jig guarantees a perfect alignment between adjacent modules.

As standard module ends and jigs are available from JÖRGER, it is not necessary to manufacture these precision components by oneself. Readymade module ends are attached to the module frame and building of the track and scenery may start. Module ends are available through N Club International (In Finland: N Club Finland):

Product no. 101995-NCI: 2 module ends with adjustment studs and screws
Product no. 111995-NCI: Precision jig

We hope that the easy availability of module supplies will advance module building.

Module end drawing

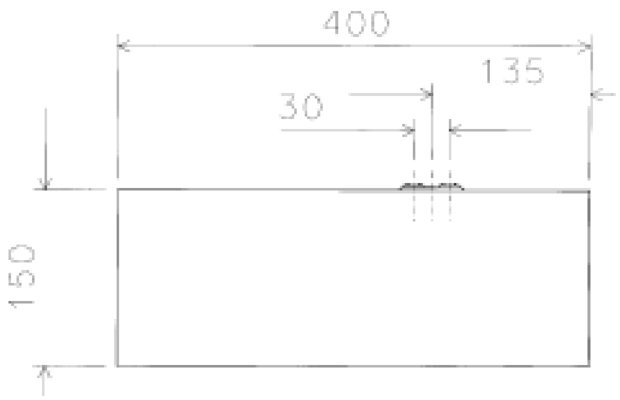


Fig. 1: Module End

Dimensions

Elevation from the floor level:	900mm to the top of the rail. Module feet should be detachable and adjustable in the range ± 30 mm. For international module meetings it should be possible to adjust the rail top level to 1000 mm above the floor level.
Module width:	400mm at the ends. The module width between two ends can be widened as necessary.
Module lenght:	Free
Background:	Height 250mm above the module end top lovel.
Touch protection (Plexiglas):	Height 100mm above the module end top level.

Module frame assembly

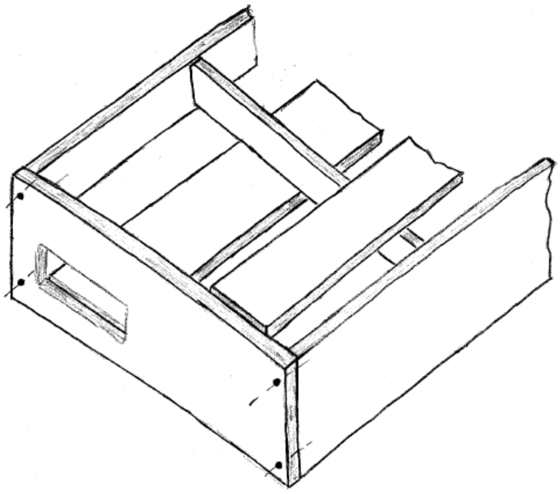


Fig. 2: Module structure.

The drawing shows a suggestion for constructing the module frame. It is important that the width of the both module ends is exactly 400 mm. For this reason it is necessary that the module front- and rear panels be attached behind the end plate viewed from the direction of the module end. This guarantees that all the moduless will join together flush and independent from the frame material thickness. If the module features the orifice reserved for the hidden station inside the module, it is necessary to ensure an easy access to the track inside the module to pick the cars fallen off the track, for instance. This can be achieved easiest by cutting a hole in the module rear panel. The supporting strip of the module top level track in the drawing is wide enough for a double track. If necessary, this can be widened. For instance, if the module theme requires an entirely flat surface, the whole module can be covered with a plate of the size of the module. The structure of the module frame should be designed to ensure the necessary structural strenght in all directions and factoring in the total length of the module.

Module directions and identification of rails

The four sides of the module are named after the cardinal directions: North, South, West and East. This convention is used in all the instructions pertaining to the modules.

The tracks are numbered beginning from the front of the module and this covers additional tracks as well when each track can be identified systematically for the needs of electrical cabling. The numbering scheme is shown in table 1.

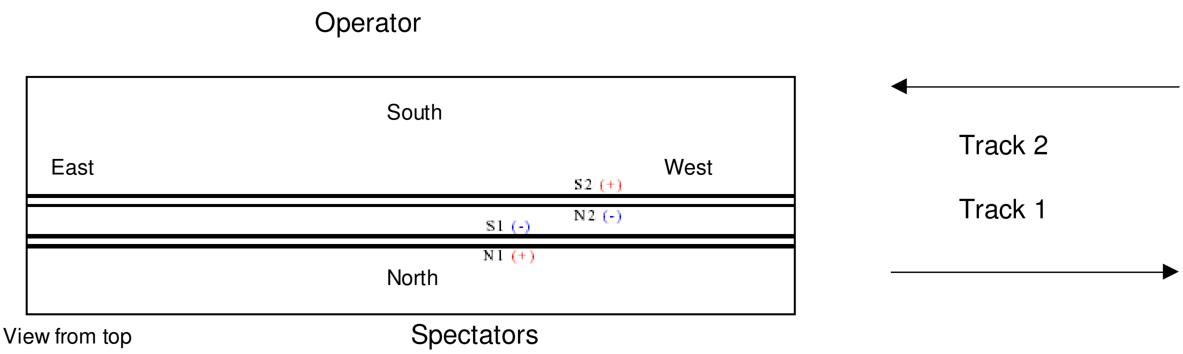


Fig 3: Module directions and rail identification.

N1	Mainline track 1, Northern rail
S1	Mainline track 1, Southern rail
N2	Mainline track 2, Northern rail
S2	Mainline track 2, Southern rail

Table 1: Rails

Single track module

NCI module standard permits also single track modules. In a single track NCI-module the position of the track corresponds to the position of track 1 of a double track module. In order to be able to integrate single track modules in a common module layout, it is necessary to introduce a module with a deviating single track branch line. A module layout may feature several single track branch lines.

Track material

The track material recommendation for visible sections of the track is Peco Finescale Code 55 which has a very prototypical look thanks to its' low profile Code 55 rail. The selection is wide enough to allow just about any imaginable track pattern. The flex track is available with both concrete and wooden ties. Finescale 55 rail is troublefree in the oprearation of many kinds of rolling stock

Basically any type of track material can be used in modules. However, most module builders prefer an uniform look in module tracks and therefore most modules feature just Peco Finescale Code 55. The track material is widely available in well stocked model railway shops. In Germany, Peco products are imported by Weinert. The material can also be obtained via mail order and usually for a very reasonable price. On hidden sections of the module layout, any track material can be used as long as the height of top of the rail is the same everywhere.

Distance between tracks

The distance between center lines of tracks in our module standard is 30 mm. Originally a distance of 25 mm was used, but this turned out to be troublesome in sections with a smaller curve radius.

The distance may vary in the module area as required. It is, however, important, that for modules intended for common module layouts, the distance at the module ends is standard.

The last 5 cm of track before the end of the module should always be level. Also, the tracks should meet the module end in 90 degree angle horizontally in order to avoid derailings and uncouplings at module ends.

Precision jig instructions

The design of the precision jig allows adjustment of track on two different distances between tracks. The disadvantage of this flexibility is that it is possible to produce a wrong distance by mistake.

At first look the jig appears to be symmetric relative to the alignment holes and track end position. This, however, is not the case. Only the alignment holes are placed symmetrically relative to the center line of double track. The centerlines of the track slots in the jig are in the distances of 12.5 mm and 15 mm from the center line of double track train line thus producing a an asymmetrical placement of tracks relative to the alignment holes with in-between track distance of 27,5 mm.

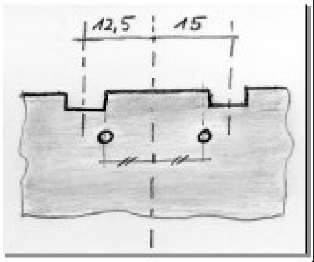


Fig. 4: Jig

To understand the reasoning behind the asymmetric placement of track slots in the jig we need to study the manufacturing technology. The jigs are manufactured using an NC milling machine and even if all the jigs were milled using the same machine, the jigs can still be different from one to another within the allowed manufacturing tolerances. In the worst case scenario, when we have two jigs where the actual position of track slots falls on the opposite ends of the tolerance range and we adjust the track of two module ends with the two jigs, the total deviation of track end positions between two modules may be too large. When the slot 15 mm from the centerline is milled only once and we use the same slot to position both tracks, the tolerance range of the final rail position is halved and the risk of incompatibility between modules is halved as well.

Despite of the asymmetry, the correct sideways positions of the two tracks are achieved easily. First we place the jig over two alignment studs pushed in the two alignments holes of the module end. The rear of the jig is against the module end. Now the 15 mm slot is used to adjust the end of track 1. When done, the jig is rotated 180 degrees around its' vertical axle and inserted in the studs again. This time the 15 mm slot is on the side of track 2 and the track's position can be adjusted. The result is two trackes with their centerlines 15 mm from the centerline of the double track and the mutual distance of 30 mm.

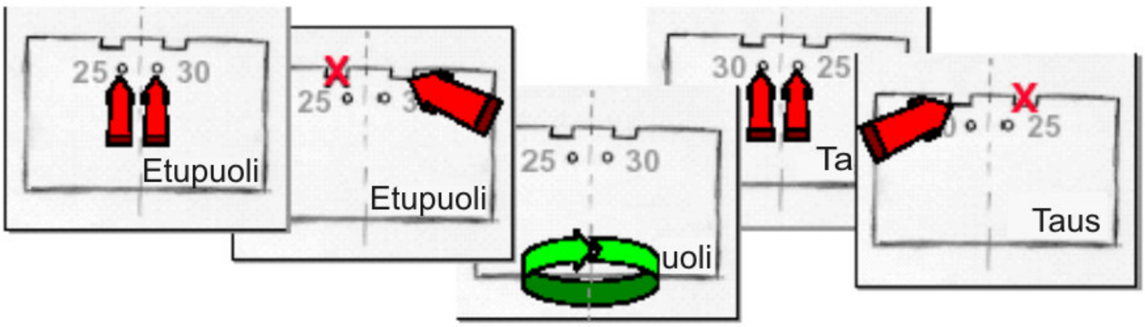
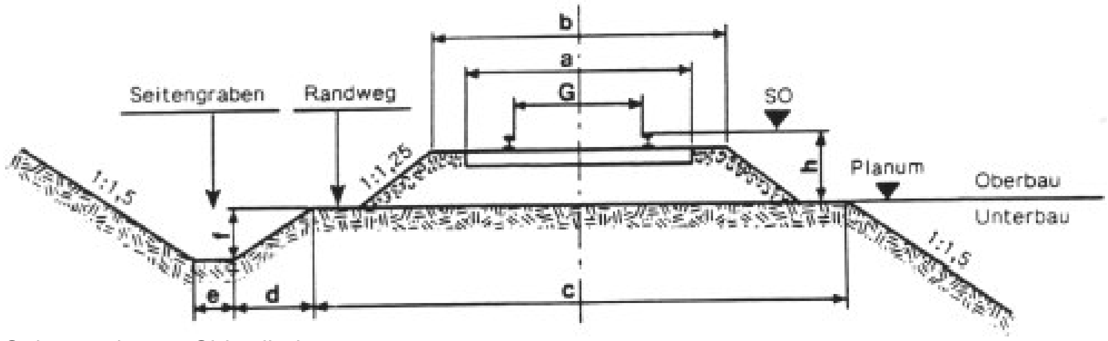


Fig. 5: Using the jig.

Road bed structure

Road bed should be built following the guidelines of NEM 122 standard ('Roadbed Profile for Standard Gauge'). The picture below shows the sectional view of a single line, straight track road bed. A deviation from standard dimensions is allowed as required in exceptional scenery spots like next to retaining walls or similar.



Seitengraben = Side ditch
Randweg = Side path
SO = Rail top
Planum = Basic level
Oberbau =Over structure
Unterbau = Under structure

Fig. 6: Sectional view of road bed.

N scale dimensions in millimeters: G = 9, a = 16, b = 22, c = 38, d = 5, e = 3, f = 3 and h = 6.

On track sections with more than one track the road beds of adjacent tracks can be combined. In practice this means that the contour of standard road bed is followed to the common center line of the two tracks for both tracks. In stations the road bed between station tracks can be filled up to the level of the top of the ties. Road bed side path can be used for signals, for instance, but the free distance to the track as determined by the loading gauge, should always be observed.

Module track operation

Operating a common module layout requires coordination and for each individual variation of the layout, the operations should be planned individually. Especially the leg from one function module to another via line modules should be considered carefully and the track needs to be divided in sections controlled by individual control boxes which are selected for each section in a meaningful way. Short circuits or dead circuits should not occur. Also, the same section should not be fed by more than one control box. All the control boxes and other control elements should be identified clearly so that even less experienced layout operators can easily operate the layout.

In order to achieve a realistic operational experience, it is recommended that the train speeds of NEM 661 standard are observed. The speed recommendation table can be found in the appendix 2.

Electrical system: Legacy connector system

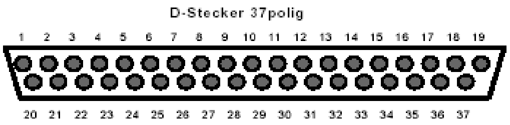


Fig. 7: Pin numbering of 37-pin D-Sub-plug.

Electrical connection between modules is based on 37-pin D-Sub connectors. The numbering of pins and their assignments are indicated in figure 7 and table 2. West side end of the module is equipped with a plug and the east end has a female connector. Pin assignments of male and female connectors are mirror images of each other.

Pin	Designation	Purpose	Notes
1	U_{SW}	AC	Always connected to both ends.
20	U_{SW}	AC	Always connected to both ends.
2			
21			
3			
22			
4			
23			
5	$+U_{F1}$	Control Box 1 (north rail, + pole)	Always connected to both ends.
24	$-U_{F1}$	Control Box 1 (south rail, - pole)	Always connected to both ends.
6	$+U_{F2}$	Control Box 2 (south rail, + pole)	Always connected to both ends.
25	$-U_{F2}$	Control Box 2 (north rail, - pole)	Always connected to both ends.
7			
26			
8			
27			
9			
28			
10			
29			
11			
30			
12			
31			
13			

Assignments for other pins can be chosen freely.

Table 2: Pin assignments for a 37-pin D-Sub connector.

Installation of D-Sub connector

There are three possibilites for the installation of D-Sub connectors:

1. **Both the plug and the socket on the cable**: Make sure that connecting to a module with fixed plugs and sockets in module frame is possible. For this reason the plugs and sockets on cables should reach about 30 cm outside the module frame. Module ends should be equipped with an opening with the size big enough to allow the D-Sub connectors through. This is important in situations when the module track is places on tables and cables can not be placed under the lower edges of modules.

2. **The socket fixed in module frame, the plug on the cable**: The plug at the end of the cable and the socket inside the frame, near the rear of the module (South) next to the East end of the module. For the cable and the openingt, the guidelines of case 1 apply.

3. **Both the plug and socket fixed in module frame**: Both the socket and the plug are fixed inside the frame, near spectator side of the module (South). The plug in West and the socket in East. The modules are connected together using about 50 cm long cables with a plug on end end and a socket on the opposite end.

Using modules built with the legacy D-Sub connector-based system together with modules built according to the current electrical connection standard is possible. In this case, adapter cables between the legacy and the new standard are required. There should be no gaps in the module bus and the wire used should have a cross section area of minimum 0,75 mm^2. The cabling/connector diagram is shown in table 3 and adapter cables should follow the plug/socket arrangement given.

Electrical system: Current standard

The legacy 37-pin D-Sub connectors are replaced by 4 mm banana plugs and sockets in the new system. All the modules should be built to the new standard at the first place and the earlier modules should be updated to be compatible with the new standard. When necessary, earlier 37-pin D-subs can still be used.

1. Plugs and sockets on cables: The cables with plugs should reach about 30 cm outside the module frame.
2. Only good quality connectors should be used. The connectors can be of spring lock type. Gold plated connectors may be used, but generally they are recommended in the case of Nn3 narrow gauge tracks. Connectors with both solder and screw attachment are allowed
3. The following table summarizes the connectors and cables of both the old and the new electrical standard beginning of the spectator side of the module (South):

East end	West end
Legacy: 37-pin D-Sub socket	Legacy: 37-pin D-Sub plug
Track 1, North (+): red plug	Track 1, North (+): red socket
Track 1, South (-): blue socket	Track 1, South (-): blue plug
Track 2, North (-): blue socket	Track 2, North (-): blue plug
Track 2, South (+): red plug	Track 2, South (+): red socket
AC for accessories: black plug	AC for accessories: black socket
AC for accessories: black socket	AC for accessories: black plug

Table 3: Module bus connectors

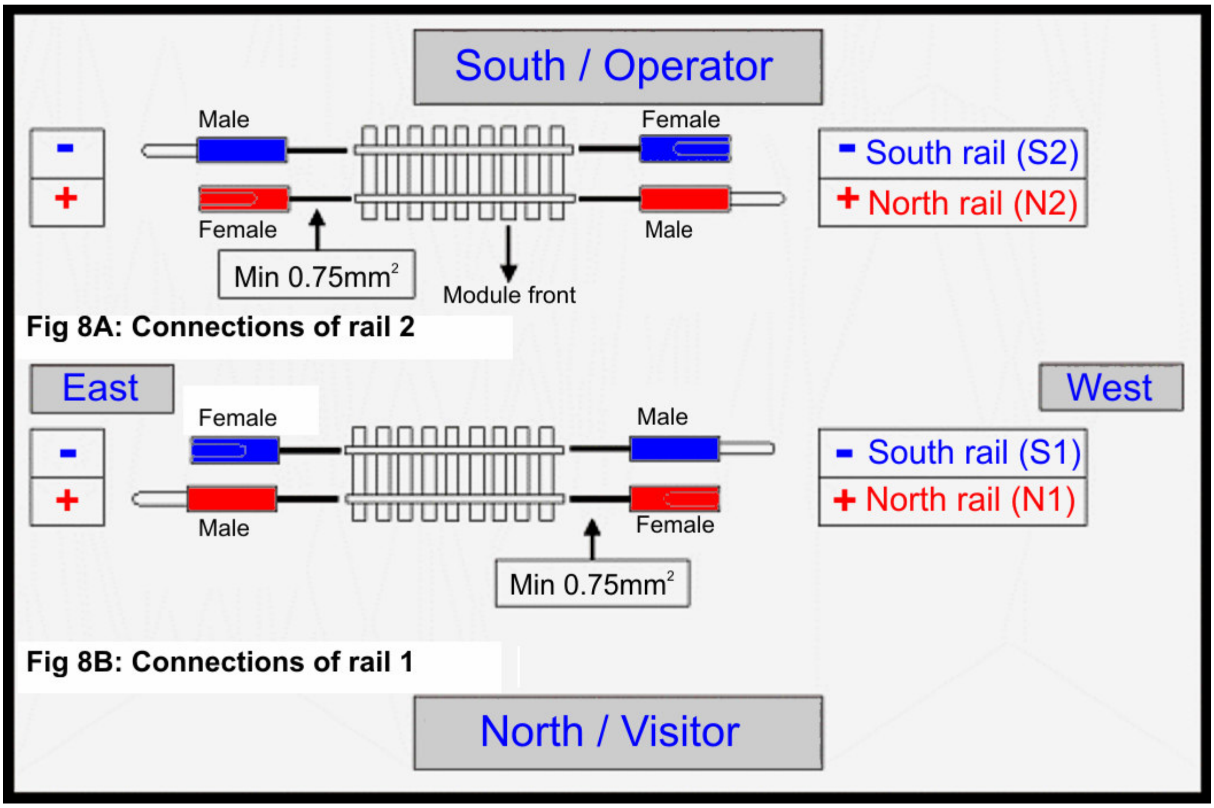


Fig. 8: Module bus connections to the track.

4. Module wiring should follow the standard colour scheme. All the connectors or wires should be colour coded. Confusing colour combinations should ne avoided (e.g a red plug on a blue wire).
5. The cross section area of all the wires should be at least 0,75 mm^2. The new system allows easily wires up to 2,5 mm^2 cross section area.
6. Standard connectors are widely available in electronics supply stores (e.g. Conrad). The table below presents some suggestions, but products from other manufacturers are equally acceptable.

Part	Hirschmann part no.	Conrad part no.	Price
Banana plug 4mm, red, screw attachment	BUELA 20 K ROT 930 726-101	730106 – 14	0,56 EUR
Banana plug 4mm, blue, screw attachment	BUELA 20 K BLAU 930 726-102	730122 – 14	0,56 EUR
Banana plug 4mm, black, screm attachment	BUELA 20 K SW 930 726-100	730114 – 14	0,56 EUR
Socket 4mm, red	KUN 30 ROT 931 804-101	737674 – 14	1,12 EUR
Socket 4mm, blue	KUN 30 BLAU 931 804-102	737682– 14	1,12 EUR
Socket 4mm, black	KUN 30 SW 931 804-100	737666 – 14	1,12 EUR

7. Instead of 4 mm plugs and sockets on cables it is acceptable to install firm 4 mm sockets on front of the module. The role of each socket should be indicated clearly (e. +S1, -N1, track 1 and +S2, -N2, track 2). In this case the modules are connected together electrically using short cables with plugs on both ends. Such cables are readily available in electronics supply stores in module standard colous: red, blue and black. In order to avoid mistakes, all the cables and firm sockets in modules should follow the standard colour scheme. It is also necessary to ensure that suitable adapter cables to default modules, built according to items 1-6, are available. This is on the responsibility of the owner of module(s) using firm sockets.

Power feed 1: Line modules

Line modules are modules with a single or double track and without switches. If a module features switches it is considered a *function module*. Power feed for function modules is described in section 'Power feed 2'.

Some line modules may require electrical connections that deviate from those of a basic line module. The instructions for special cases are included and it is up to the module builder to decide when and how to apply them.

Every module layout requires at least one module which serves as a *power feed module* which feeds current to the track and *module bus*. Module bus consists of all the modules connected together electrically. A power feed module must be equipped with 4 ea 4 mm sockets mounted in the module frame to feed current from two power packs. The four sockets must be connected to their respective pins of the module bus. The connection wires of both module ends should be electrically connected together and to power feed sockets mounted in the module frame. Usually there has been enough power feed miodules in layouts of module gatherings as anyone who uses their modules as part of a home module layout will normally need at least one power feed for their own track.

Bigger module layouts are normally operated with two power packs. Each power packs feeds power to a group of modules of their own and the modules of a group are called *circuit modules*. Normally power pack number one is connected to the northern track (spectator side) and power pack number two to the southern track. In order to supply current to switches, illumination and other accessories, the module bus has pins reserved for accessories power (AC).

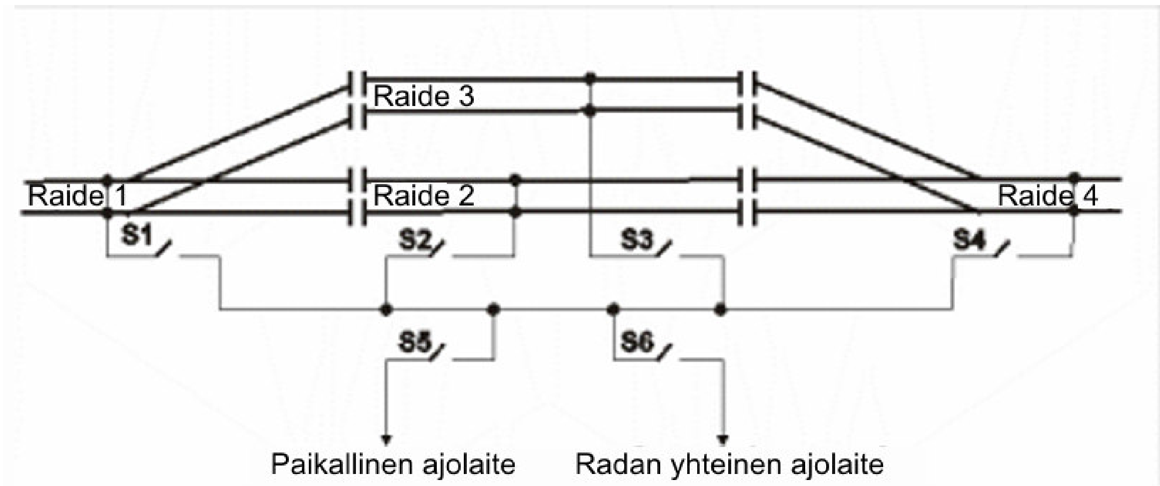
It should be possible to disconnect the track power in every module. For a module consisting of several segments, it is sufficient that only one of the segments has an option to disconnect the track power.

Power feed 2: Function modules

Function modules are modules with at least one switch. Normally function modules are needed for stations or side tracks. Power feed for function modules can be more complicated than is the case with line modules. It is recommended that like with line modules the track current can be fed from the common power packs of the layout. There should be no gaps in the common module bus between the connectors or the two ends of a function module.

To ensure the independent operation of a function module, an additional local power pack is required for the module. Such an arrangement allows local switching operations independent from the main line traffic. It should be possible to feed the main line tracks from the local power pack if necessary. General recommandations for line modules apply also to function modules. If a module consists of several segments, the power bus of the local power pack should be shared between the segments using additional wiring and connectors for this purpose. Under no circumstances should the local, module specific power bus be connected to other modules. However, for smaller home layouts it is possible to feed the main line from a local power pack in which case it is necessary to install an additional switch for the selection of power source.

In order to guarantee trouble free traffic in rail yards, the power feed of side tracks that can be accessed from the main line by a train arriving from an adjacent module should be equipped with a switch to select the power feed from the common power pack of the layout. This ensures an uninterrupted travel for the trains arriving from the main line to a side track or vice versa. For shunting operations only the local power pack should be used. As the switch that selects the power pack has ‘off’ position, it is possible to switch off the power of all the tracks when needed. More detailed wiring recommendations below. In order to satisfy the basic requirement of power feed selection for each individual track from either the local power pack or the global power pack for the entire layout, several two pole flip switches are required and the wiring schematics can be complicated. A common wiring arrangement is to have a dedicated two pole on-off switch between every track and every power pack. A somewhat simpler solution is to use a two pole three position on-off-on type switch which reduces the number of wires required as only one wire per rail between the switch and the track is needed.



Kuva 9: Power feed of a function module.

If simple on-off switches are used, wiring can be simplified using the system shown in figure 9. In this case the switches controlling the power feed of individual track are connected parallelly. Switches S1 and S4 get their power feed via a third switch (S5 or S6) which feeds power to the track either from the local or global power pack, but only from one of them, not both. The disadvantage of this wiring system is that it does not permit simultaneous shunting operations in the staion while the train traffic of the main line is operational. On the other hand, the wiring schematics is relatively simple and the number of electrical switches require is reduced. Every module builder should select a system best adapted to their individual needs and skill level.

Function modules require a dedicated control panel. Every module builder is free to choose their preferred control panel style. For instance, a control panel may be integrated in the module frame (South side) or an external control panel connected to the module with wires can be used. The latter alternative may be more preferable for easier transportation.

The design of the control panel is free, but it should be simple enough so that less familiar operators may use it without difficulties.

Feed and Return

In a DC model railway, the power is transmitted over two wires. The electricity has two potentials: One of these potentials is the reference potential - the ground (not to be confused with the Earth). The second potential is related to ground and, depending on the sign has a positive or negative potential. The difference between these potentials is called voltage. In the (DC) model railway, the direction of the locomotive depends on the polarity of the voltage.

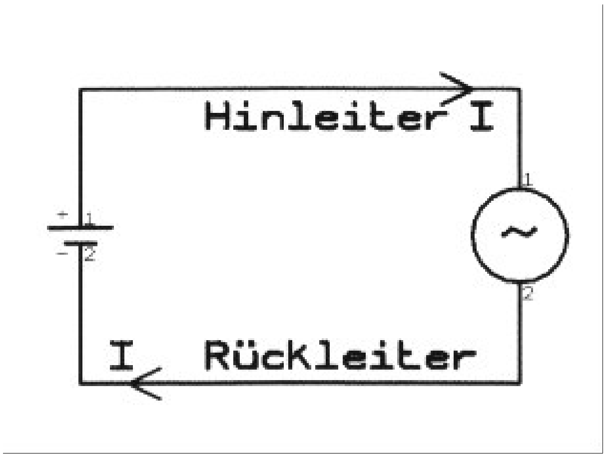


Fig.10 Feed and Return

In a simple DC circuit, the power flows from positive to negative. The flow from positive to the load is called Feed, and from load to negative is called return.These terms also apply to cases when the current reverses its direction. Then, however, there is no direct relationship between the name and current direction.
The return can also be called neutral or ground. The term neutral means that the reference voltage 0 V is assigned.
In a two-wire model railway, the two rails act as the feed and return. Overhead line can also be used for the return. This will then act as a common return, returning the current fed through the rails. In principle, this can be used as a return for all DC sources. Our module system does not make use of this method.

Agreement: The positive voltage is fed to the north rail of mainline track 1 and the south rail of mainline track 2. The south rail of mainline track 1 and the north rail of mainline track 2 is used as return.

Section Breaks

In order to operate multiple trains on the module layout, it is necessary to have section breaks. Within a module, this is the easiest to achieve using standard insulated fishplates. It is only necessary to break the return.

Each module should be built so that the rails do not finish flush to the end profile, but perhaps ending 0.5 mm before. This small rail gap makes little difference to running quality, but has the advantage that the individual modules are electrically separated. Since this separation is double pole, the power must be connected with double pole switches.

Colour Coding

It makes sense to use cable and connector colours that are already used in industry. The following table lists the colour codes used by the biggest manufacturers.

Controller Connection	Arnold	Fleischmann	Märklin	Trix	LGB
Control	Red	Yellow	Red	Red	Red
Control-Ground	Black	Yellow	Brown	Blue	Blue
Aux/Light	Brown	White	White	Black	Black
Light-Return	Grey	Black	Black	White	White

Table 4: Manufacturer Colour Codes

Connectors are usually available in the foloowing colours:
Red, Black, Yellow, Blue,Green, White.
0.75mm wire is always available in the following colours:
Red, Black, Yellow, Blue, Brown, Green/Yellow
The following colour coding is proposed:
Red: Positive pole for main line and local tracks
Blue: Negative pole for main line and local tracks, TTL-Voltage (5V), Control voltage 12V (18V)
White: Control Voltage 14-16V (AC)
Black: Control Voltage 14-16V (AC, return)
Yellow: Positive pole of Control Voltage (5V) for TTL Digital technology
Green: Positive Pole of Control Voltage 12V (18V) (Cable possibly brown)

Voltage Drops

Every wire has an electrical resistance. This resistance R depends on the cross section A, the length of the wire l, and a material constant, the specific resistance ρ (see Table 5).

Material	Rho ($Ohm*mm^2$)/m	Purpose
Copper	0,016	Cable, Windings (Motors, Coils)
Brass	0,063 [1]	Rail Profile
Nickel Silver	0,3 [1]	Rail Profile
Constantan	0,5 [1]	Resistance Wire
	10 G	Insulation

Table 5: Specific Resistance

Resistance is calculated by: $R = \rho * l / A$
We know that the resistance of a wire increases as the length of the wire increases, and decreases as the cross sectional area increases. First, we must specify a material constant:

For Brass, Nickel Silver and Constantan, the exact resistance depends on the alloy. In the following two examples, we will calculate the resistance and voltage drop for copper wire.

Example 1: Copper wire, length l = 2 m, Cross Section A = 0,16 mm², Current 1 A

R = 0,016 * 2 / 0,16 Ω = 0,2 Ω => U = 0,2 Ω * 1 A = 0,2 V

On this wire there is a voltage drop of 0,2V, therefore with a 12V supply, 11,8V will be delivered to the track.

Example 2: as example 1, however cross section A= 0,75mm²

From the results of example 1, it follows that::

R = 0,043 Ω und U = 0,043 V

Due to the almost 5 times bigger cross section, the voltage drop is almost 5 times smaller.

The examples show that the wires to the power supply are neither too long, nor too thin.

We should calculate the resistance of the track, in the same way as for wire. We will use one piece of track made from nickel silver, with a length of 1m.

For the cross sections, we can use the standard NEM 120 (rail profile). We will choose a profile that is suitable for modern main-line railways. For N Scale, profile 14 is suitable.

Example: N Scale, profile 14, Cross Section A = 0,86 mm² => R = 0,3 * 1 / 0,86 Ω = 0,35 Ω

At a current of 0,5A, and 3m length, the selected track will lose 0.5V. It follows, therefore, that on longer tracks the power must be supplied at regular intervals. This is especially important for layouts that are fed by constant voltage.

Safety Precautions

According to the VDE rules, our model railways are toys. Under these rules, for example, there must be no current higher than 5A. This is ensured by the sizing of the power supply components. For the AC voltage, it must also be taken into account that a substitution of parallel circuit voltage transformers is not permitted.

There is a danger that when a 230V transformer is disconnected from the mains, there is still 230V supplied back to the plug (the laws of transformers apply in both directions). Therefore, there is the risk of an electric shock!

Continuing the safety information, we always specify in our circuits: When working with 230 Volt electricity, it is essential to follow the VDE rules. Devices that use 230 volt electricity may only be connected by a professional. The commissioning of these circuits can only take place when the circuit is safely untouchable in a housing.

Module Colour

The modules should be painted uniformly with brown satin paint. The colour is similar to RAL 8003 (brown clay).

Curtains

Curtains are attached to the front of modules. A consistent appeareance is achieved by the following rules:

- Material: DEKOMOLTON Cotton 575 (braun), 130cm Wide
- Length: The length of the curtain is 700mm from the module underside
- Mounting: 20mm wide Velcro, flush with the bottom of the module
- Overlap: 50mm, Velcro on the West side (right side from the public point of view)
- Weights: In order to make the curtain hang taut, weights should be sewn into the bottom hem.

Price approximately €6,80/m

Background

As a backscene, the background MZZ "Sky 4-piece 84 x 476cm" Order No. 06 should be used, ensuring that no obvious breaks exist between the modules.
The backscene should be 250mm high from the module top, on modules 400mm deep. Lower modules can use higher backgrounds. The use of a background for railway stations, bridges and functional modules is optional.

Module Labelling

For the viewers, some appropriate useful information about the modules must be written on the front panels. Each module should have a module number. Sub-modules which form part of a bigger module should be labelled separately eg 3.1, 3.2, or 3a, 3b etc. The templates can be downloaded from our homepage.

- N-Club International Logo:
- Theme/Name:
- Builder:
- Special Features:
- Module-Number:

Plexiglass

To protect the module from the public, 3mm thick clear Plexiglass can be used. The Plexiglass should be 100mm from the module top, overlapping the front of the module by 5cm. The use of Plexiglass protection is optional.

Legs

Due to difficulties in providing enough tables to support the ever-growing number of modules, from the spring of 2003 all modules are required to provide their own legs. There are no set design rules, but the legs must be removable. The height of the rail surface must be adjustable by ±3cm. To prevent damage to the floor, felt or cork pads are required, and legs must be at least 2cm diameter. Before setting up the modules, the feet should be checked for sharp objects, for example small stones, and these should be removed.
For international meetings, the rail top should be 1000mm from the floor. This can be achieved by special legs, or by blocks underneath the feet.

Scatter Material

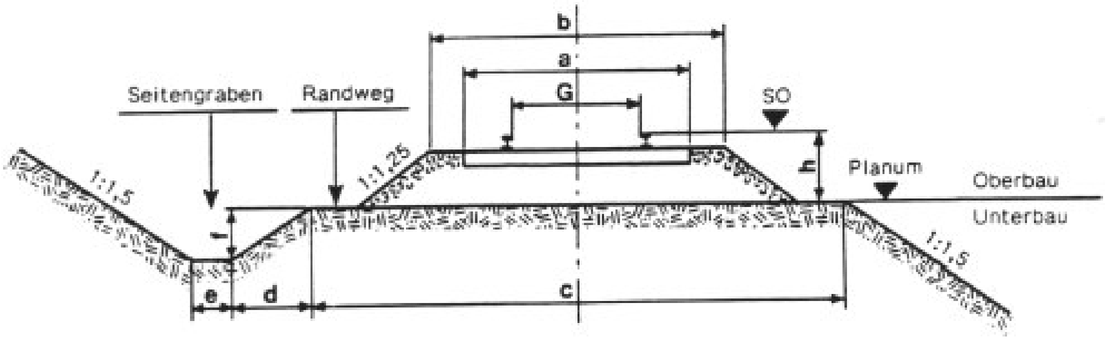
For scatter material, there is complete freedom of choice and there is now a whole series of good products. But here too we would like to standardise and Woodland Scenics is often mentioned. Through the distribution of the company NOCH we should actually have no difficulty in obtaining the material.

Crates

For transporting modules to our national and international meetings, vehicles will be rented through the club and its members. In order for us to load the vehicles without wasting space, the modules should be provided with boxes or containers. Therefore, the boxes or containers must be stackable.

Narrow Gauge

It is also possible to construct Narrow Gauge (Nm) modules. These modules should be built according to NEM 123, with the single track positioned as the front track (main-line track 1) of a standard gauge module. For the construction of the trackbed, it is best to follow NEM 123 (Sectional view of narrow gauge trackbed). The figure below shows the cross-section of a track in a straight line. Special landscapes, such as rock embankments or retaining walls, can result in changes to the cross section.



Seitengraben = Side ditch
Randweg = Side path
SO = Rail top
Planum = Basic level
Oberbau =Over structure
Unterbau = Under structure

Fig. 11: Sectional view of narrow gauge trackbed

Nm gauge dimensions in millimeters: G = 6.5, a = 12, b = 14, c = 26, d = 5, e = 2, f = 1.5 and h = 6.
For track, the "Rhätischem Prototype" from Juergen Haubrich should be used.

Outlook

Anybody can use this standard to build their own module, and then connect it to other modules at the next meeting. If only 10% of the members of our club build a module, then we will get a modular layout of fantastic size.
If you have questions or problems with module building, you can write to the club (keyword Module).

Appendix 1

Summary of important data

Standard:	N-Club International.
Theme and Era:	Double track main-line or single track branch line, era 3.
Height of the module from the floor:	900 mm to the rail top for national meetings, 1000mm for international meetings.
Module Legs:	All modules must be provided with legs. The legs can be foldable or removable. The height of the rail surface must be adjustable by ±3cm. To prevent damage to the floor, felt or cork pads are required. Legs must be at least 2cm diameter
Module Depth:	400 mm at the ends, but can be widened inbetween.
Module Length:	Any.
Background:	MZZ Background „Sky“, Part number: 106, 250 mm from the top face, at 400mm deep. The use of a background for Stations, Bridges and functional modules is optional.
Curtains:	DEKOMOLTON 575, Cotton. Curtain length is 700mm from the module base. Material is available from modellbahn9mm@gmx.de.
Module Labelling:	A template for the module label can be downloaded from the Homepage of the N-Club International.
Plexiglass Protection:	3 mm thick, height 100 mm from the module top, overlapping the module body by 50mm. The use of Plexiglass Protection is optional.
Electrical Connections:	By 4mm ‘Banana’ plugs and sockets.
Track Material:	Peco Code 55 for the visible sections. Other track can be used in hidden sections.
Track spacing at ends:	30 mm between the double tracks.
Minimum Radius:	330 mm on the double track main-line
Scatter Material:	Woodland Scenics if possible.
Colour of the module body:	Clay Brown RAL 8003

Sources

Module ends:	**NCI, Part Number 101995-NCI, Available from** www.N-Club-International.de**.**
Track jig:	**NCI, Part Number 111995-NCI, Available from** www.N-Club-International.de**.**
Module Labelling:	**Template downloadable from the Homepage of the N-Club International,** www.N-Club-International.de
Electrical Parts:	**Wire at least 0,75mm^2, Banana plugs and sockets (red and blue), Tagstrip, Switches, Power supply jacks** www.conrad.de www.ELV.de www.völkner.de
Narrow Gauge track:	**Jürgen Haubrich Modellbau, Narrow gauge track of „Rhätischem Prototype“**

Appendix 2

Speeds to NEM 661

The aim is to reach a speed on horizontal track between the scale maximum speed of the prototype and the increased speed in the following table. The scaled maximum speed gives the visual impression of an apparently low speed when reduced for scale.

Recommended speeds from NEM661

Conversion of speeds from NEM 661 to 1:160 scale

Speed Km/h	m/s	1:160 cm/s	1:160 Rounded	NEM 661 v-max cm/s	Time 1m in s	Increased 60% (N) Time for 1m in Seconds
10	2,78	1,74	1,7	2,8	57,6	**36,0**
20	5,56	3,47	3,5	5,6	28,8	**18,0**
30	8,33	5,21	5,2	8,3	19,2	**12,0**
40	11,11	6,94	6,9	11,1	14,4	**9,0**
50	13,89	8,68	8,7	13,9	11,5	**7,2**
60	16,67	10,42	10,4	16,7	9,6	**6,0**
70	19,44	12,15	12,2	19,4	8,2	**5,1**
80	22,22	13,89	13,9	22,2	7,2	**4,5**
90	25,00	15,63	15,6	25,0	6,4	**4,0**
100	27,78	17,36	17,4	27,8	5,8	**3,6**
110	30,56	19,10	19,1	30,6	5,2	**3,3**
120	33,33	20,83	20,8	33,3	4,8	**3,0**
130	36,11	22,57	22,6	36,1	4,4	**2,8**
140	38,89	24,31	24,3	38,9	4,1	**2,6**
150	41,67	26,04	26,0	41,7	3,8	**2,4**
160	44,44	27,78	27,8	44,4	3,6	**2,3**
170	47,22	29,51	29,5	47,2	3,4	**2,1**
180	50,00	31,25	31,3	50,0	3,2	**2,0**
190	52,78	32,99	33,0	52,8	3,0	**1,9**
200	55,56	34,72	34,7	55,6	2,9	**1,8**
210	58,33	36,46	36,5	58,3	2,7	**1,7**
220	61,11	38,19	38,2	61,1	2,6	**1,6**
230	63,89	39,93	39,9	63,9	2,5	**1,6**
240	66,67	41,67	41,7	66,7	2,4	**1,5**
250	69,44	43,40	43,4	69,4	2,3	**1,4**
260	72,22	45,14	45,1	72,2	2,2	**1,4**
270	75,00	46,88	46,9	75,0	2,1	**1,3**
280	77,78	48,61	48,6	77,8	2,1	**1,3**
290	80,56	50,35	50,3	80,6	2,0	**1,2**
300	83,33	52,08	52,1	83,3	1,9	**1,2**
310	86,11	53,82	53,8	86,1	1,9	**1,2**
320	88,89	55,56	55,6	88,9	1,8	**1,1**
330	91,67	57,29	57,3	91,7	1,7	**1,1**
340	94,44	59,03	59,0	94,4	1,7	**1,1**
350	97,22	60,76	60,8	97,2	1,6	**1,0**

Table 6: Speeds based on NEM 661

Appendix 3

View of a module: