



*Unterwegs für die Spur N !*



# Module Standard

Version 2023

Module Standard of N-Club-International e.V.

# Module Standard

## Version 2023

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- E-Mail: [info@n-club-international.de](mailto:info@n-club-international.de)
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### **Translation note:**

*The translation was done on a voluntary basis by members and not by professional translators.*

*Texts in images have not been translated and are therefore given in German in brackets in the text.*

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## **2 Preface**

The current module standard of N-Club International has been adapted continuously over the years. After the first edition in 2000, changes in 2003, 005, 2008 and 2012 have been made.

The version of 2019 takes account of experience of operation of numerous modular layouts since 2012 and current developments. The compatibility to previous standards is still guaranteed. Modules built in the past can still be used without additional adaptations.

The 2021 edition includes some minor corrections to text and figures.

## 3 Definition

### 3.1 Modules

A Module is a transportable part of a flexible model railway layout, which can be assembled in any configuration to create small or large layouts by means of standardized mechanical and electrical interfaces. This is different to an individual layout made from pieces for transportation.



Figure 1: Module

### 3.2 Module sides

The 4 sides of a Module will be named (view from above) after the four compass points. The side for visitors and operators are set as follows.

- The Northside of a module is the visitor side (Besucherseite)
- The Southside of a module is the operator side (Bedienerseite)
- The East- and Westside of the modules are the transition to the next module

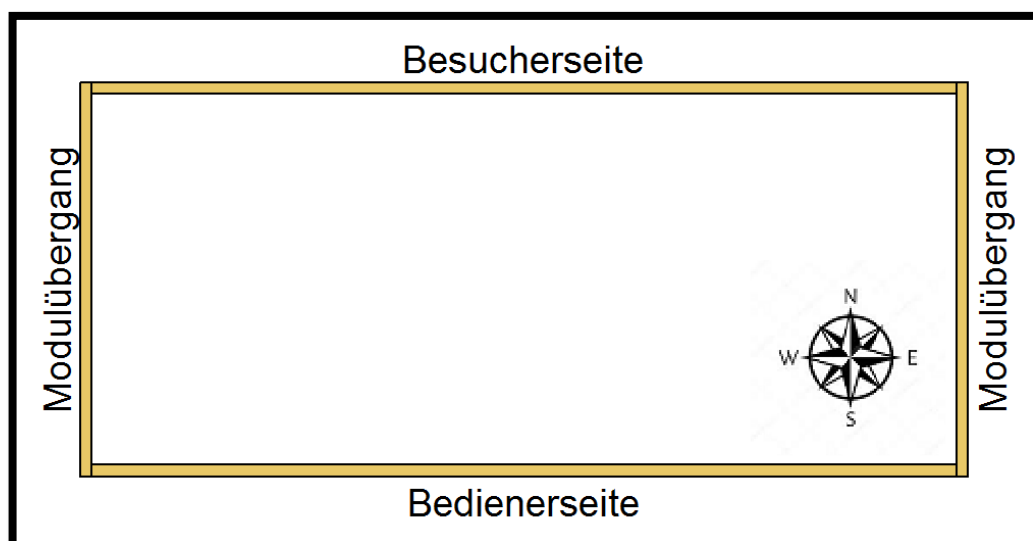


Figure 2: Top view of a Modul

### 3.3 Module categories

Basically, modules may be organized into 2 categories:

- Function modules
- Line modules

All modules with operable elements are “Points of operation” and will be called Function modules. These are Railway-Stations, Turns, Branches, Points of signals and Cross overs and so on.

Line Modules are Lines between points of operations which contain a driving line without operable elements.

Function modules with optional operation elements may also be used as line modules.

### 3.4 Operation voltage

The kind of supply voltage (analogue or digital) is not fixed. It is not intended that both kinds of operational voltage are used in one layout.

### 3.5 Tracks

One or more tracks form a line. The tracks will be counted from North to South at the module transition and named as followed:

- Track 1 = North-Track
- Track 2 = South-Track

### 3.6 NEM

The "European model railway standards" (abr. NEM) is a collection of standards. NEM-standards are used by model railway industry and hobbyists in Europe. This is the base for this standard and can be viewed free of charge at following link:

<https://www.morop.org/index.php/de/nem-normen.html>

## 4 Module box

The module box is the basic frame for a module. The dimensions are only fixed (standardized) at the module end, while modules can be any size. It is very important however, to consider the ability to transport and store a module before choosing the size.

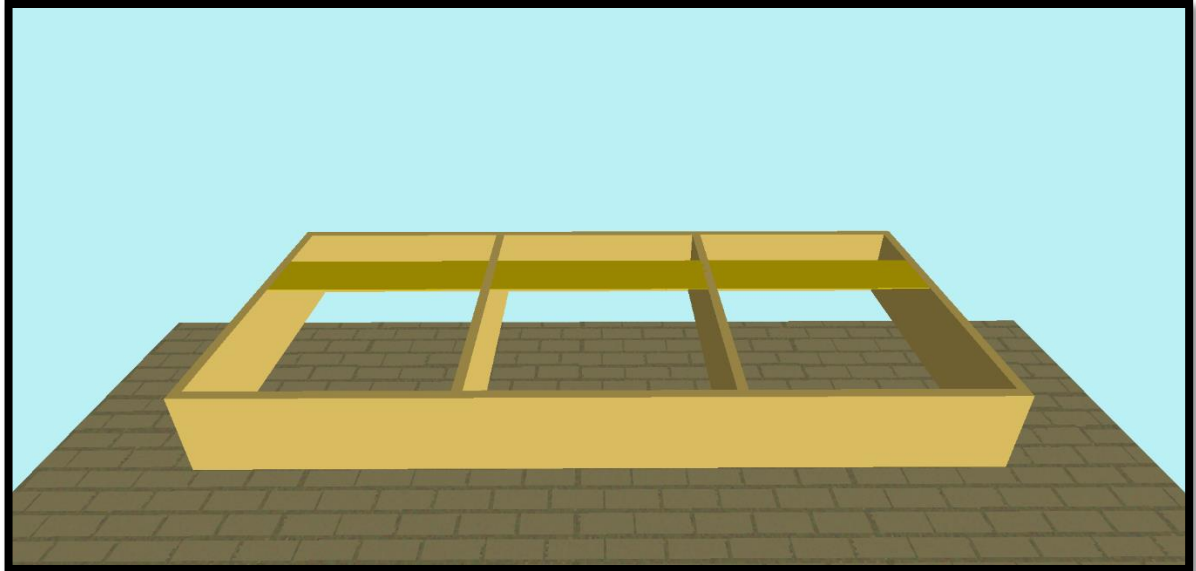


Figure 3: Module box in 3D

### 4.1 Material

A light but stable kind of wood should be used to build a module box.

#### **Recommendation**

*It is recommended to use good quality 10mm Birch or Poplar Plywood.*

### 4.2 Length

Modules can be made to any length.

#### **Recommendation**

*It is recommended to build modules in length increments of 30cm (i.e. 30cm, 60cm, 90cm, 120cm etc.)*



### 4.3 Width

The width of the module box at the module end is fixed at 40 cm. In between the ends, the width may be varied as desired.

#### **Recommendation**

*On-line modules, it is recommended that the 40cm width at the ends is maintained throughout.*

### 4.4 Height

The height of the module box at the module end is fixed at 15 cm. In between the ends, the height may be varied as desired.

#### **Recommendation**

*On-line modules, it is recommended that the 15cm height at the ends is maintained throughout.*

### 4.5 Transverse frames

Transverse frames (ribs) should be used to enhance the stability of modules. A passage through (hole) for cables should be considered.

#### **Recommendation**

*Transverse frames should be placed on selected increments (e.g., 30 cm)*

## 4.6 Track foundation

A sub roadbed board (Trassenbrett) may be used for the track foundation. Instead of a board the whole module box may be covered. Cover or board must finish flush with the edge of module end. It should not reach above the edge.

### Recommendation

*The width of the board of railway line should be at least 8 cm.*

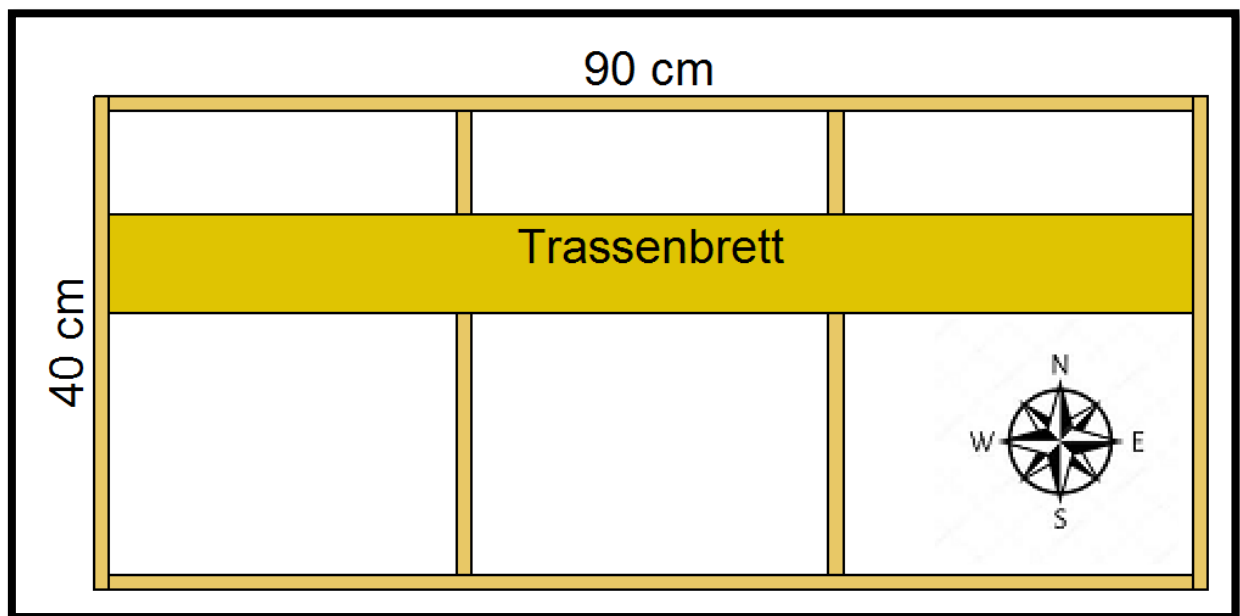


Figure 4: Top view of a module box (example measures)

## 4.7 Module ends

Module ends form the mechanical connection between two modules.

The dimensions of module ends are L.: 40 cm, W.: 15 cm, Thickness: 1 cm and positions of fixing holes have to be very exactly made to reflect the standards. High Quality module ends, containing metal sockets for adjusting heads among each other, as shown below, may be purchased via NCI online shop.

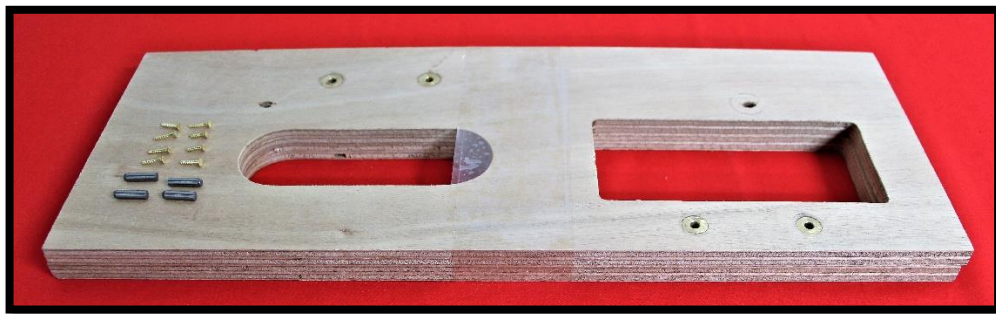


Figure 5: Module heads

For beginners we offer alternatively more reasonable, simplified module ends without metal sockets for adjustment (dimensions: L.: 40 cm, W.:15 cm, Thick.: 1.2 cm). Both types of module ends are mechanically compatible!

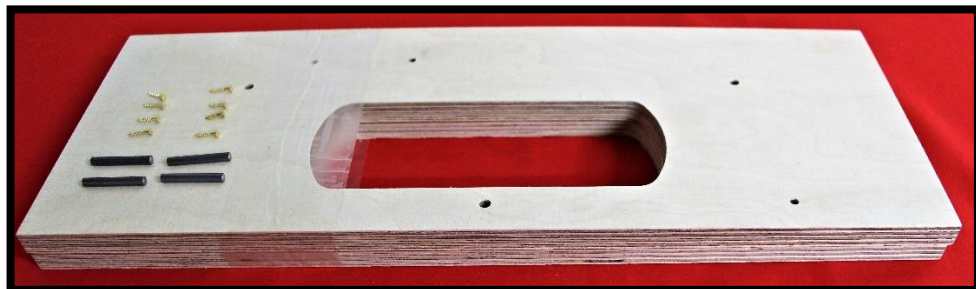


Figure 6: simple module ends without adjusting sockets

These module ends will be assembled on East- and West- side of module box.

## 4.8 Color

Module boxes will be painted on North- and Southside with the color "Clay brown, silk dull" (RAL 8003). Module ends (East- and Westside) should not be painted. The connecting surface to neighboring modules may stick (glue) together during assembly.

### **Recommendation**

*To protect the wood of module boxes, the use of paint with a hard surface e.g. hybrid) is recommended.*

## 4.9 Touch protection

To protect against damage by viewers a plexiglass (15 cm height, min 3 mm thick) will be attached at the Northside of the module box. This will be attached so that the top is 10 cm above module edge.

## 4.10 Background scene

The use of background scene is optional.

If it is used, at the Southside of the module box a 40 cm high sky scene should be fitted. (e.g. MZZ company, background scene No. 107) The scene will be attached so that it is 25 cm above module boxes edge.

### **Recommendation**

*It is recommended to design the background scene to be easily removable or to be used only for modules with a width of 80cm or more.*

## 4.11 Velcro

To fix curtains to modules, a 2cm velcro band (hook type) is used. This will be permanently fixed to the whole length on the north-side of the module.

## 4.12 Legend

Every NCI member will get a unique number by the Module manager (on request). The legend, completed with additional information, will be assembled on the Northside of each module. A template of this label, as shown below, can be downloaded at the NCI homepage. It contains name of builder (Erbauer), subject (Thema), construction year (Baujahr), construction time (Bauzeit), dimensions (Abmessungen), specialties (Besonderheiten)


	Modul-Nr.:
	Erbauer:
	Thema:
	Baujahr:
	Bauzeit
	Abmessungen:
Besonderheiten:	

Figure 7: Legend Label for a Module



## 5 Module accessories

### Recommendation

*It is recommended to include permanently all accessories used on the module. This makes sure everything is available at module usage.*

### 5.1 Screws

Modules will be connected mechanically with four M5 wing screws, four M5 wing nuts and eight washers, using the provided standard holes at the module ends.

### 5.2 Fitting pins

An exact adjustment between two modules is provided by two to four fitting pins. They will be put into the metal sockets (diameter 4 mm) at each module end. The pins should be at least 16 mm in length. With module ends purchased from the NCI online shop, these fitting pins are included.

### 5.3 Module base

The module is set up on removable legs. The height of a module must be easily adjustable +/- 2 cm. The feet of the legs must be prepared to avoid damage on floors at rooms.

For international exhibitions module legs must be adaptable to 100 cm Track height. NCI German legs height (90 cm) can be expanded by wooden cubes by 10 cm.

### Recommendation

*For module legs a light, easy adjustable, quick removable solution should be considered*

## 5.4 Curtain

The free visible space between modules lower edge and floor will be covered with a brown color (579) curtain of molton. The curtain should be min. 76 cm height and should be 5 cm longer than the module used to overlap to the next module on west-side.

To fix the curtain on the module, a 2cm velcro band (loop type) should be used. It needs to be sewn on to the inside of the curtain. To overlap the upper edge on the right outside, the last 5 cm will be set with a hook part of the velcro. See drawing below.

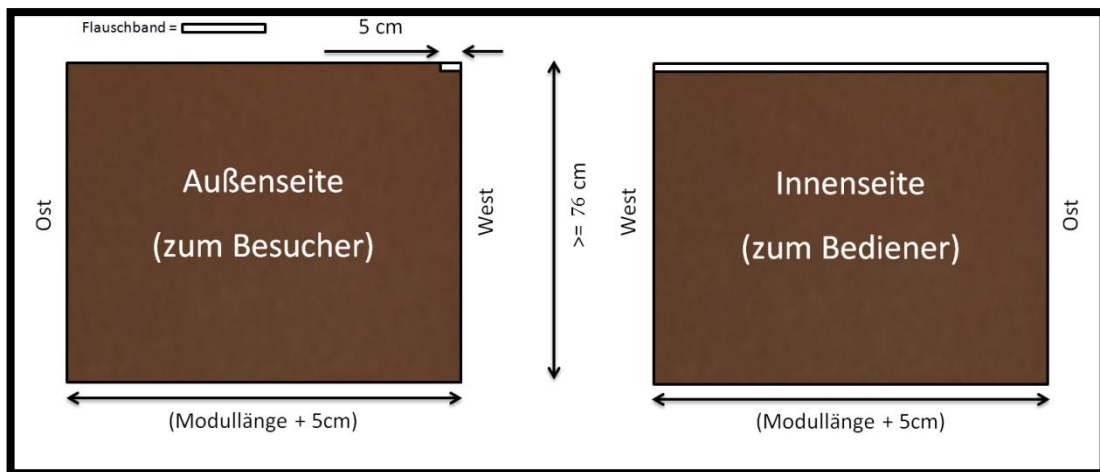


Figure 8: Measures of Curtain

### Recommendation

*It is recommended, that the curtain covers a height of 86 cm. This is necessary to use it at international competitions / Layouts. To adapt / cover height a 2nd loop tape needs to be assembled on the inside of the curtain in a way that the lower height (76 cm) is turned inside.*

*Also, it is helpful to label the curtain to ensure to which module it belongs to.*

## 5.5 Transportation box

Every module needs a wooden box for transportation to exhibitions etc. The box should be stackable and stable, but light. To carry the box, handles should be provided.

### Recommendation

*Poplar plywood 10mm strength is recommended*

*If the total weight of box incl. module is more than 50 kg additional wheels under the box are recommended.*

For clear Identification, every box must have ID-Labels on two sides. A label, as shown below, is available from the NCI homepage in the download area. It indicates name of builder or owner (Erbauer), notes (Hinweise), information about the box, Weight (Gewicht), length (Länge), width (Breite) and height (Höhe) plus a photo or a top view sketch.


		<b>N-Club International e.V.</b> Wollgrasweg 37 70599 Stuttgart Deutschland			
<div style="font-size: 48px; text-align: center;">000</div> <div style="text-align: center;">1 / 1</div>	<b>(Modulname)</b>  (Erbauer) (ggf. Eigentümer/Verantwortlicher)  (Hinweise)		<b>Angaben zur Transportkiste</b>		
			Gewicht	0,0	kg
			Länge	0,00	m
			Breite	0,00	m
			Höhe	0,00	m
<b>(Draufsicht)</b> <b>(Foto oder Planungsskizze)</b>					

Figure 9: ID-Label for Transportation box

The dimensions and weight of a transportation box needs to be reported to the module manager of the NCI.



## 6 Track construction

### 6.1 Type of lines

There are four types of lines to select:

- Two-track mainline
- Two-track high-speed line
- One-track branch line
- One-track narrow-gauge Line

Mainline and high-speed line modules may be connected directly to each other. To connect a two-track mainline module to a one-track branch line requires a special functional module such as a Railway-Station. This also applies when connecting a narrow-gauge module to a standard-gauge module.

The following description is for a two-track mainline module. All other lines may have different regulations.

### 6.2 Railway body

The following drawing shows the standard profile of a two track mainline of a straight German track layout.

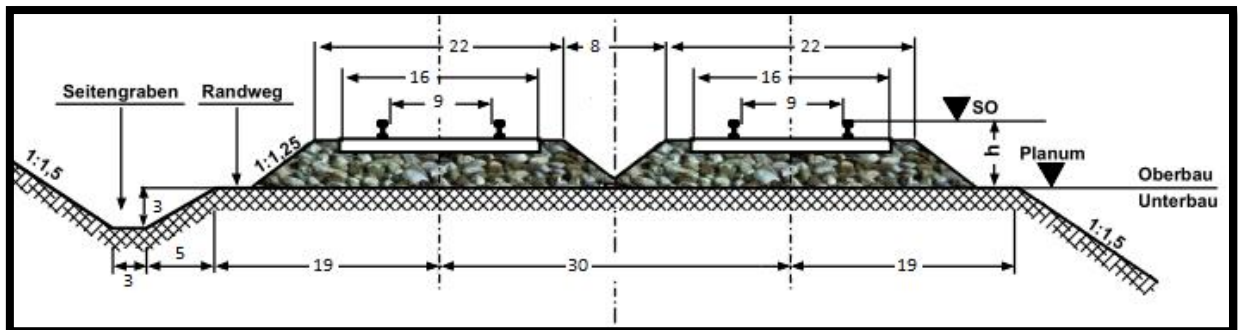


Figure 10: Permanent way profile

The track profile follows NEM 122, except that the height “h” is different. The exact measure for “h” is fixed by using the NCI module and track templates. A continuous ballast bed can be made between the two tracks. The track profile shown may be built different too.

### 6.3 Top edge of track

Depending on the kind of module layout, two different heights are used for the upper edge of the track (SO) to floor level.

- National Module Layout: 90 cm
- International Module Layout: 100 cm

Ground unevenness at assembly may be leveled by height adjustment on each leg.

### 6.4 Track position

The North-Track distance (track middle to north edge of module at module transition) is 120 mm. The South-Track distance (track middle to south edge of module at module transition) is 150 mm. The distance (track middle – track middle at module transition) is 30 mm. The track position is always fixed by means of module – and track – template.

Between module transition the distance between tracks may be set as needed.

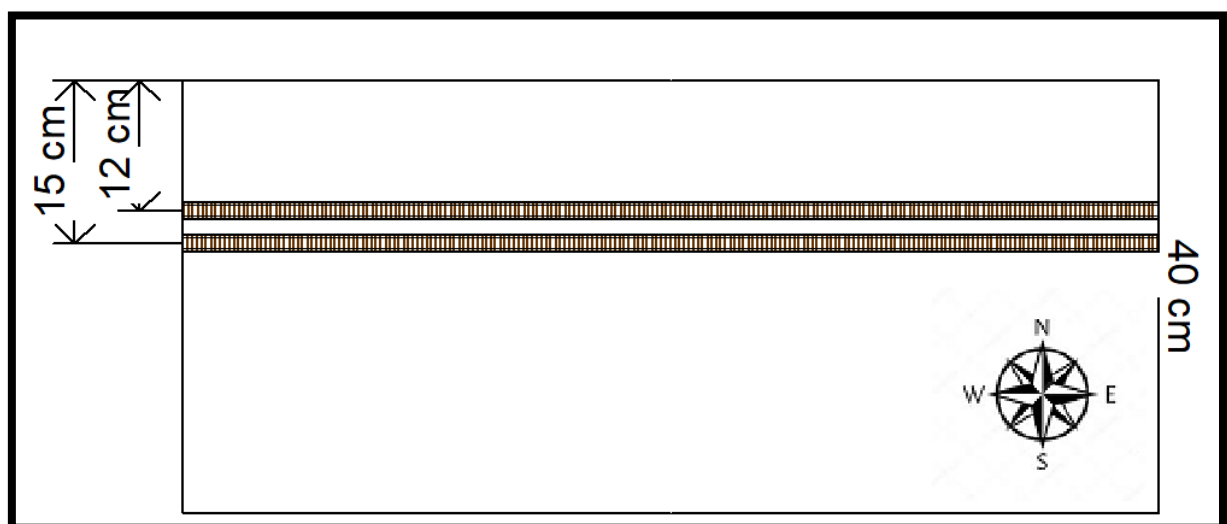


Figure 11: Track position - top-down view

### 6.5 Track material

There is no specification for track material. The module builder is free to choose.

#### Recommendations

*At visible areas, track PECO Code 55 is strongly recommended.*

### 6.6 Track ballast

There is no specification for ballast material. The module builder is free to choose.

## 6.7 Curve radius

A minimum curve radius in all areas is fixed to 300 mm.

### Recommendation

*For visible areas, curve radius not less than 450 mm should be used.*

## 6.8 Module transition

Tracks will not be joined mechanically at module transition; however, they need to meet at 90 degrees at the Module end. The rails must not touch and create an electrical connection when modules are connected, even considering expansion by raising temperature. To avoid unexpected electrical connections, the ends of the rails on each module should be 0,2 - 0,5 mm shorter than the module end edge. To avoid misplacement or damage of tracks at the module end edge, the NCI shop supplies (in conjunction with module ends) brass screws. They may be used to fix tracks by soldering correctly adjusted rails on top.

### Recommendation

*For a safe track crossover fix the last 5 cm at each module head straight and rectangular. To protect the track itself at module head edge, use something to fix them e.g. brass screws or track anchors.*

## 6.9 Catenary

The type of masts, the distance to the module end and spacing between masts is not specified. The distance between track middle and masts head is up to the producer's recommendation.

The catenary masts will be used without catenary wire. The height of catenary line has to be 41 mm above upper track edge. It may be necessary, to use sockets under the masts to achieve this clearance.

### **Recommendation**

*The grid between masts should be about 30 cm. The distance between module head edge and first mast should be one half of length grid of the masts. (e.g.  $\frac{1}{2}$  of length 30 cm = 15 cm).*

*Pantographs of Electric locomotives need to fit under the catenary wire = 38 mm above upper edge of track.*

## 7 Electric

### 7.1 Module connection

To provide electrical connections between modules good quality banana- sockets and plugs with 4 mm diameter will be used. Sockets and plugs must be connected with cable (flex braid) with a minimum of 1 mm<sup>2</sup> (AWG 18). To identify the two tracks (4 connections), at the module end different colors are used. North-Track is RED, South-Track is BLUE. The cables (flex braid) must be at least 30 cm in length after the module end. The association of plugs and sockets to the appropriate track on both ends is shown at the following table:

East-side		Module (View: bottom up)		West-side
Plug	North-Rail	North-Track	North-Rail	Coupling
Coupling	South-Rail		South-Rail	Plug
Coupling	North-Rail	South-Track	North-Rail	Plug
Plug	South-Rail		South-Rail	Coupling

(Coupling = Bushing)



Figure 12: Association of banana-, socket and plugs - bottom-up view

#### Recommendation

*Plugs with additional sockets (Cross hole) are recommended.*

## 7.2 Joker-Modules

The track position on a module is asymmetric. Because the visitor -/operator – side needs to be changed at certain situations of layouts, modules which change visitor – and operator side on one or two adjacent modules can be built. They are called “Joker-modules”, where the South- and North - Tracks are reversed. These modules have equal Plug - Socket associations on both Module heads. See following schematic below.

Additional special adapters for electrical connections are not necessary.

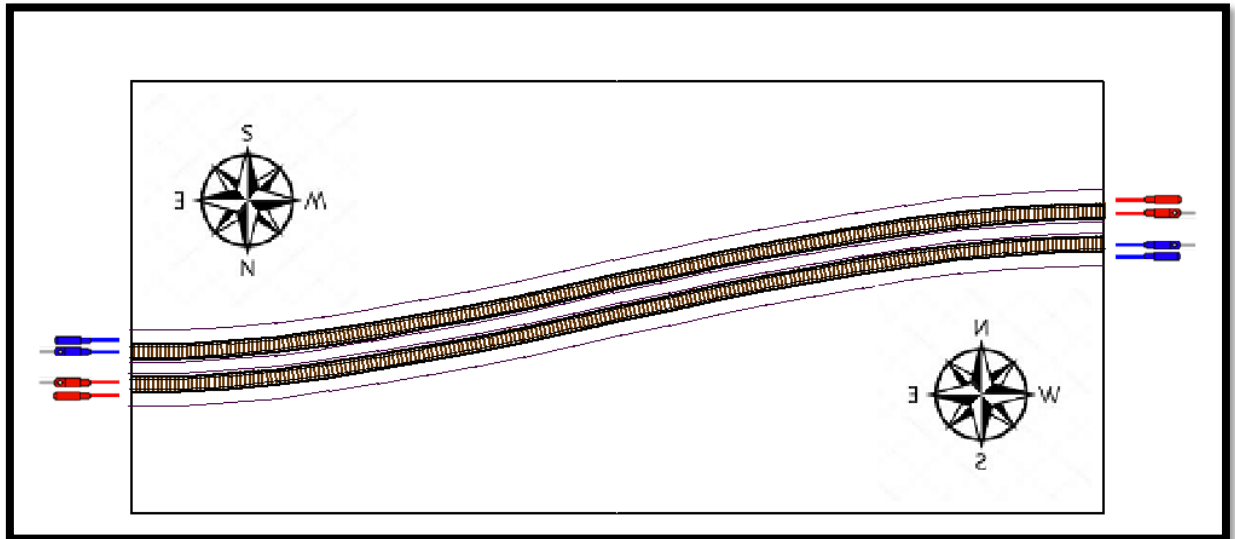


Figure 13: Joker-Module Type 1 bottom-up view

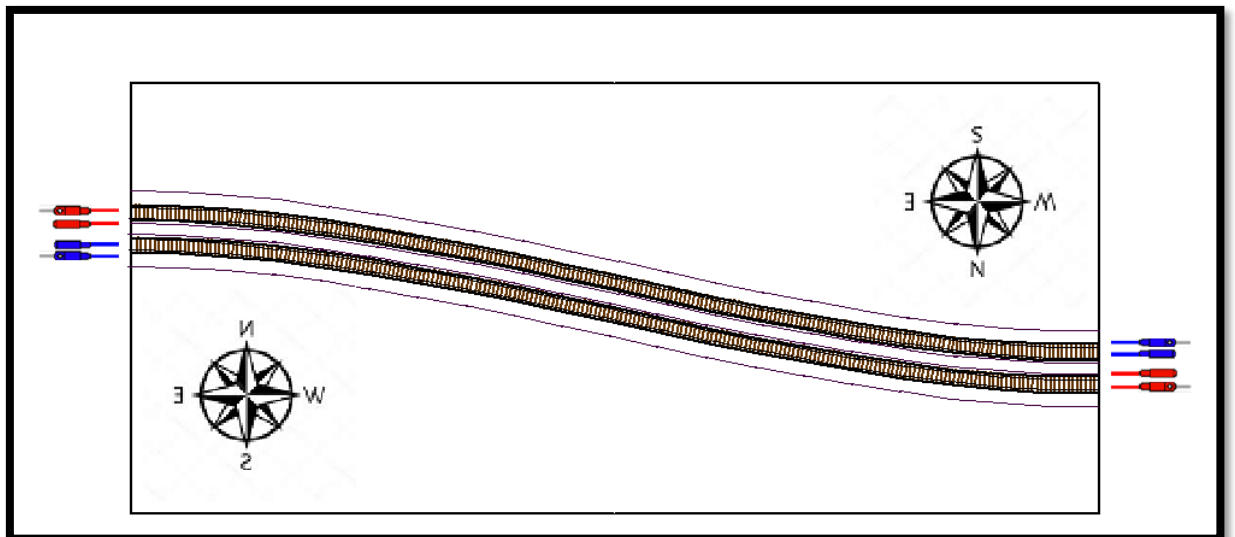


Figure 14: Joker-Module Type 2 bottom-up view

### 7.3 Analogue Operation

With analogue voltage for trains, the polarization of the rails needs to be opposite. This is necessary to provide different moving directions for trains on both tracks.

North-track and south-track are supported with two different power supplies. See figure 15 below.

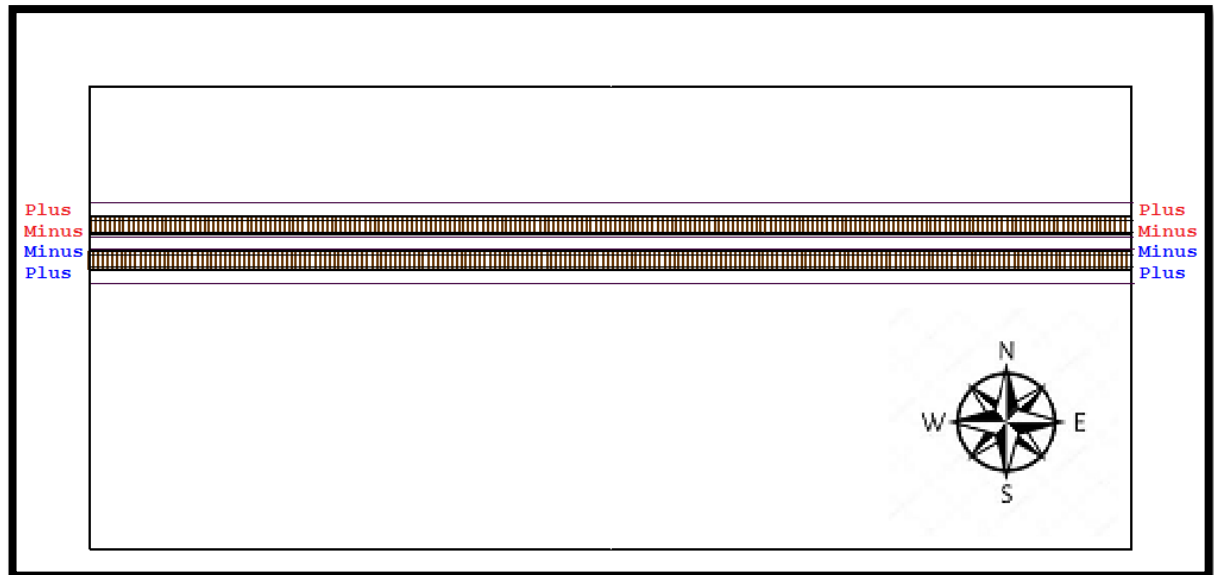


Figure 15: Polarity of tracks (analogue) bottom-up view

#### Recommendation

*To allow track block control (NCI & Austrian Standard) on layouts, it is recommended that there is complete electrical separation between train / track voltage supply and additional devices (like slow down or relay or other electrical components).*

## 7.4 Digital operation

Using digital train / track control polarity of both tracks must be the same. North-track and south-track are supplied by the same booster. Loops will be controlled (polarity change) while the train is passing via reversing loop electronic modules. See schematic below.

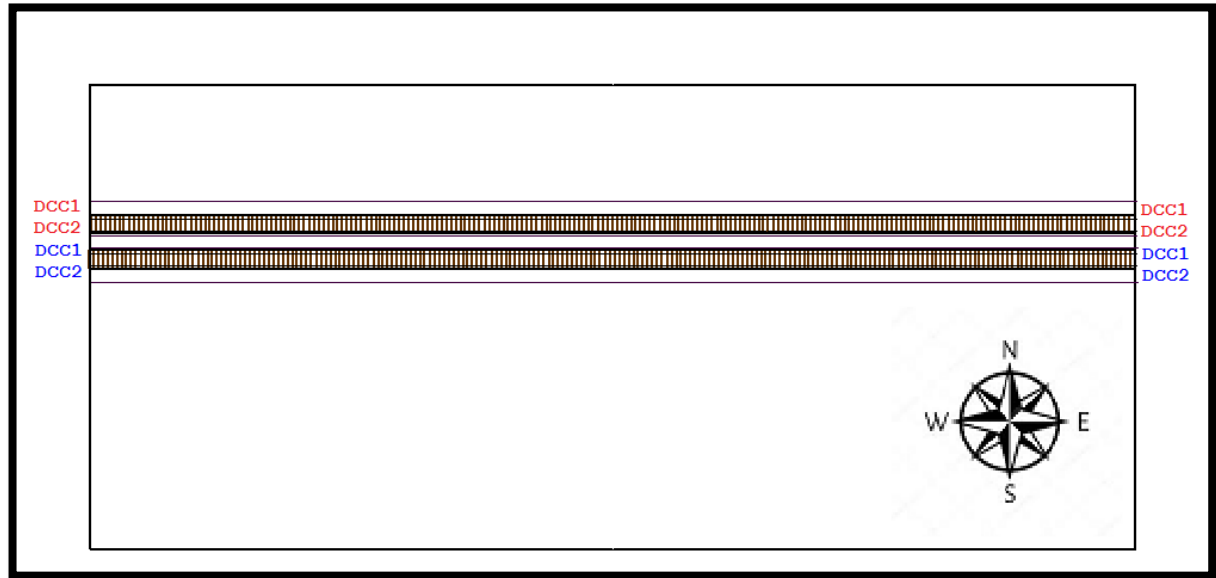


Figure 16: Polarity of tracks (digital) bottom-up view

The digital voltage supply signal should not be influenced by other Electronics on the module. Regular line – modules without electronics are suitable with no restriction. Function – modules are only suitable, if electronic devices (like track occupancy-, slow down- or relays for stop sections or other relays) are totally disconnected from tracks or could be overridden.

### Recommendation

*To allow usage of loops with track sensors, it is recommended to separate the loop into a beginning, middle and end-section, with the middle section allowing for polarity change. Each section should be connected independently, with both rails between sections being isolated. The sensor sections should be at least 15 cm in length.*



## 7.5 Safety guidance

Following VDE – Regulations (VDE = Association of German Electric Engineers) a model railroad is a toy, meaning a maximum of 5 Amps is allowed. This must be taken into account when specifying the power supplies for the control voltages.

VDE - regulations must be considered when mains power is used. Electrical devices using Mains Power (Germany 230V) must be connected by certified professionals only! Such devices may only be operated if the housing is undamaged, safe and tested.

Use of mains power directly on modules is prohibited. Only low power supplies with suitable housed transformers are allowed. It is also forbidden to pass mains power through a module.

## 8 Shaping

### 8.1 Motif

The motif displayed at a module is the decision of the owner / builder. Anything starting 1949 (German Ep 3) up until now may be subject to display. On Module layouts various trains of this time frame will be in operation.

### 8.2 Model landscaping

Terrain construction or design of the landscape is complete free.

#### **Recommendation**

*For model landscaping it is recommended to prefer easy but stable materials e.g. hard foam (XPS) instead of plaster*

*For raw terrain construction green or brown colour is recommended as a base*

### 8.3 Scatter material

Used scatter material is optional. Use whatever you like!

#### **Recommendation**

*As a base for green gridding "Blended Turf" (T49) provided by Woodland is recommended. Different areas or landscapes may be set up with lawn, trees or bushes of various producers.*

### 8.4 Car System

The use of multi- module Car system layouts is not more standardized.

## 9 Summary

### 9.1 Module box

Subject	Standard	Recommendation
Material	wood	poplar locking-lever wood 10mm Strength
Length	-	30 cm grid
Width	40 cm at Module head	40 cm continuous
Height	15 cm at Module head	15 cm continuous
Travers frames	-	30 cm grid
Track profile	-	>= 8cm with
Module head	10 mm x 400 mm x 150 mm [with socket] 12 mm x 400 mm x 150 mm [simplified, without socket]	Module head used available at NCI online shop
Color	Clay brown, silk matt (RAL 8003)	Paint (e.g. hybrid-varnish)
Touch- protection	Plexiglas XT, >= 3mm with, height 15 cm, 10 cm beginning Module upper edge North side	-
Background- scenery	MZZ company, background scene „Himmel“ (107) height 40 cm, 25 cm up of Module upper edge South side	No use of background scenery
Curtain	Velcro scrap, 2cm width	-

### 9.2 Module Accessories

Subject	Standard	Recommendation
Screws	4 wing screws M5 with Washer & wing nuts	-
Fitting pins	2 bis 4 Pins Ø 4 mm & length >= 16 mm	-
Module legs	removable, adjustable $\pm 2$ cm, expandable by 10 cm	easy & quick removable
Curtain	Molton brown (579) Hight = 76 cm Length = Module length + 5 cm with Velcro scrap, 2cm with	height = 86 cm, provide with curtain label inside
Transport case	Wooden case with handle	Poplar plywood 10mm strength more than 50 kg fixable roller

### 9.3 Track construction

Subject	Standard	Recommendation
Line	4 different Line types	-
Railway body	NEM 122 height follows module template	-
Track- upper edge	National: 90 cm International: 100 cm	-
Track position	North-Track 120 mm South-Track 150 mm Track distance 30 mm Exact dimensions by module template	-
Track material	-	Peco Code 55
Ballast	-	-
Curve radius	$\geq 300$ mm	$\geq 450$ mm for visible Curves
Modul- transition	Rectangle 0,2 - 0,5 mm Track gap	5 cm straight before Module transition
Catenary	Masts without catenary wires Catenary wires height 41mm	1. Mast at 15 cm Mast distance 30 cm

### 9.4 Electricity

Subject	Standard	Recommendation
Module- Module connection	Lab plug /-socket, 4mm min. 1 mm <sup>2</sup> cable cross section length 30 cm from Module transition color North-Track: red color South-Track: blue	Plug / socket with cross hole
Joker-Modules	Identical assignment for Plugs and sockets on both sides (Module heads)	-
Analog operation	- different rail polarization, each Track own power supply	set up additional electronic with connection to tracks totally interruptible
Digital operation	different rail polarization per Track, one booster for both Tracks.	loops at least in three separate connectable sections, Sensor sections min $\geq 15$ cm
Security	consider VDE-Regulations NO Main voltage within a Module used, NO passing through of main voltage alternate-current (F.E: 225V AC)	-

## 9.5 Design / Layout

Subject	Standard	Recommendation
Terrain construction	-	Light construct. (e.g. XPS) Raw terrain base color in brown or green
Scatter material	-	Woodland blended turf (T49) as a base
Car System	No standards	-

## 10 Differences to high-speed lines

The standard of two-track high-speed lines is different to two-track main lines as follows:

### 10.1 Module box

#### Recommendation

*The width of the board of the railway body should be 10 cm minimum*

### 10.2 Railway body

The figure below shows cross section of a two-track high-speed line with straight track guidance.

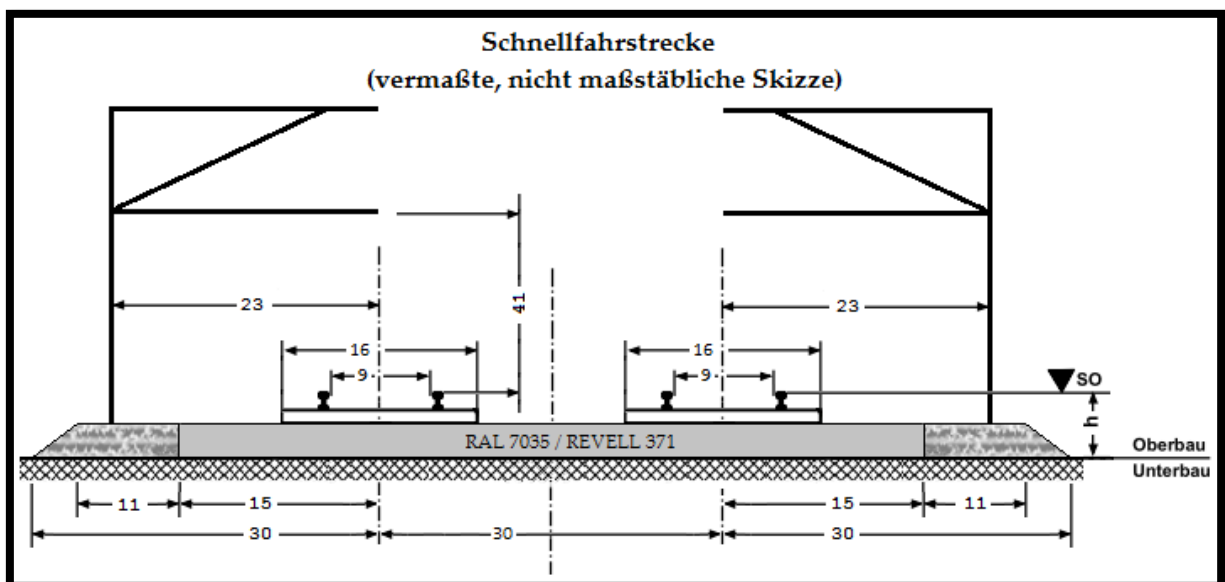


Figure 17: railway body high-speed-line

The exact Measure of "h" must be adjusted by module- and track-template always.

Color for upper track construction should be "light grey" (RAL 7035 / REVELL 371)  
For Constructions along the line e.g. bridges, retaining wall ect. Color "Stone grey" (RAL 7030 / REVELL 75) shall be used.

## 10.3 Track material

### Recommendation

*For all visible areas, the "Track with concrete sleepers" in Code 55 design from Peco is recommended. For turnouts, the "Turnout with wooden sleepers, large radius" from Peco is recommended as a substitute, since turnouts with concrete sleepers are available.*

## 10.4 Track ballast

### Recommendation

*For Ballast "Granite- Ballast Art. Nr. 1609) der ASOA company is recommended*

## 10.5 Curve radius

A minimum curve radius at all areas is fixed to 2000 mm.

## 10.6 Catenary

Masts for overhead system must be assembled

### Recommendation

*Catenary Mast for high-speed line (Art. Nr. 432) is available at Sommerfeldt company.*

## 11 Differences to branch lines

The standard for a one-track branch line varies to a two-track main line as follows:

### 11.1 Track position

The so called North-Track will be used for branch-line.

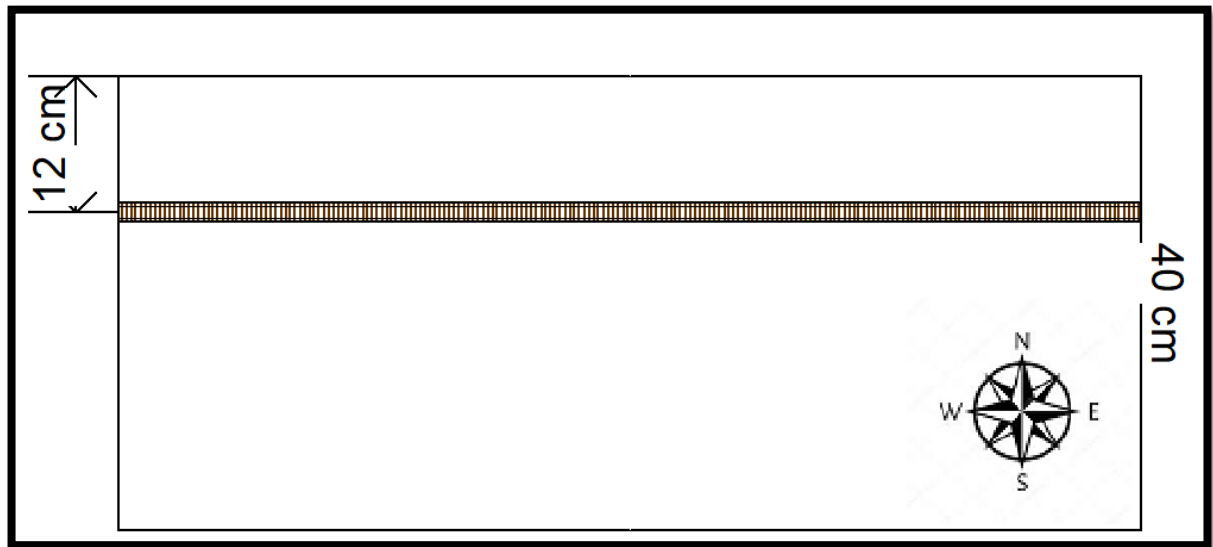


Figure 18: Track position North-Track

### 11.2 Motif

Any adequate scenery of any epoch may be displayed.



## ***12 Differences to narrow-gauge line***

The standards of one-track narrow-gauge line are described at a separate document.

I-N-G-A.net narrow-gauge standard (I-N-G-A.net-Norm Schmalspur)

It may be downloaded from NCI-Homepage as well.

## 13 Appendix

### 13.1 Instructions for module- and track-template

To fix tracks at the exact position on module-transition (module-head) a module- and track-template should be used. Both can be received at our online shop.

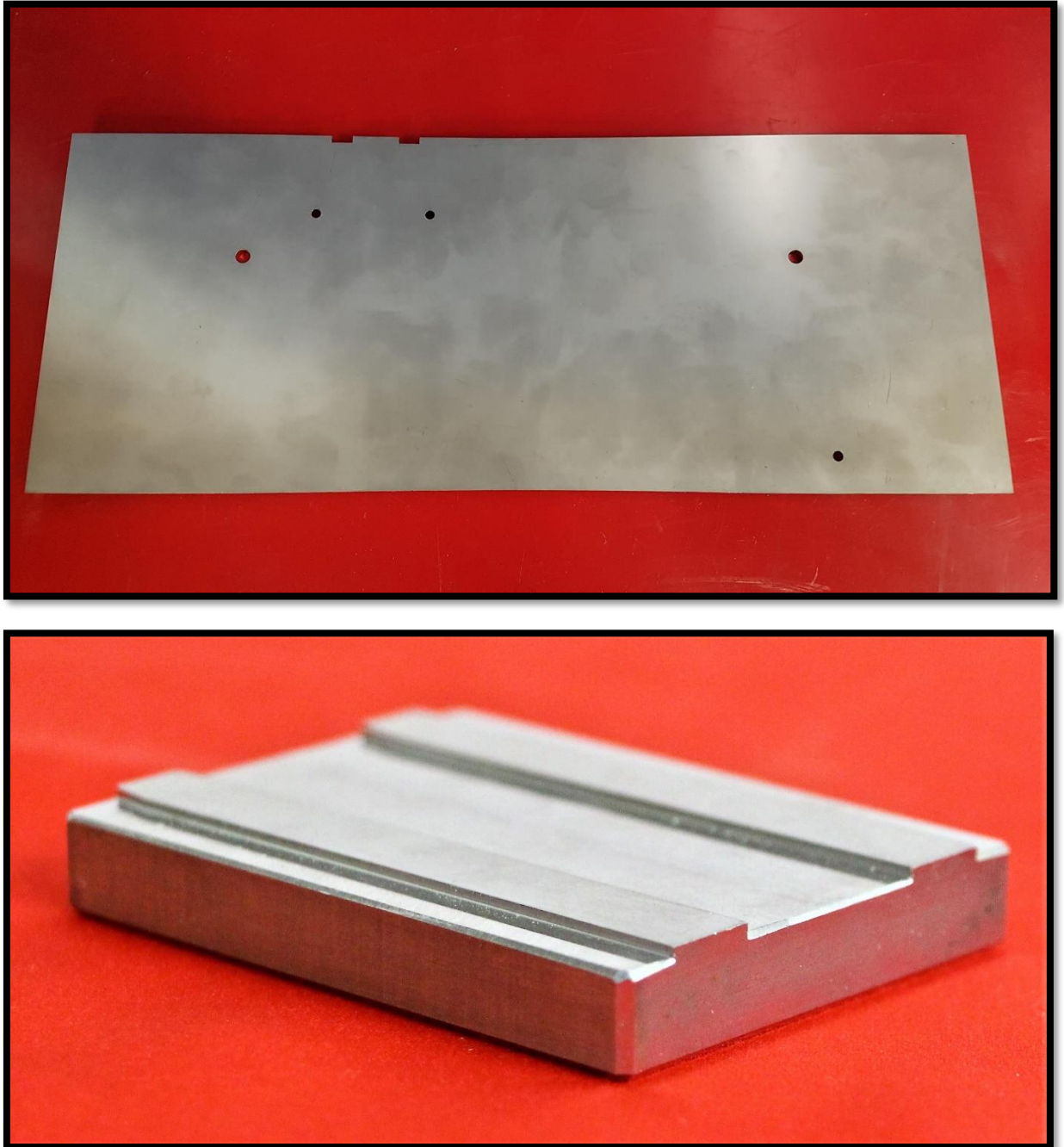


Figure 19: module- and track-template

To position the module-template exactly, first two locating pins and two 5 mm screws are placed and fixed in bearing bushes and holes at the Module head. The notches for the track will be North-Track oriented.



Figure 20: assembly module-template

Next step is to shift the track-template from the outside into the notches of the module-template to determine location and height of the tracks. The optimal position of track is when the track-template slides into the template from both directions without noise and without additional resistance. Precise work is required here, since even small deviations in position or height lead to frustrating derailment of the rolling stock or uncoupling.

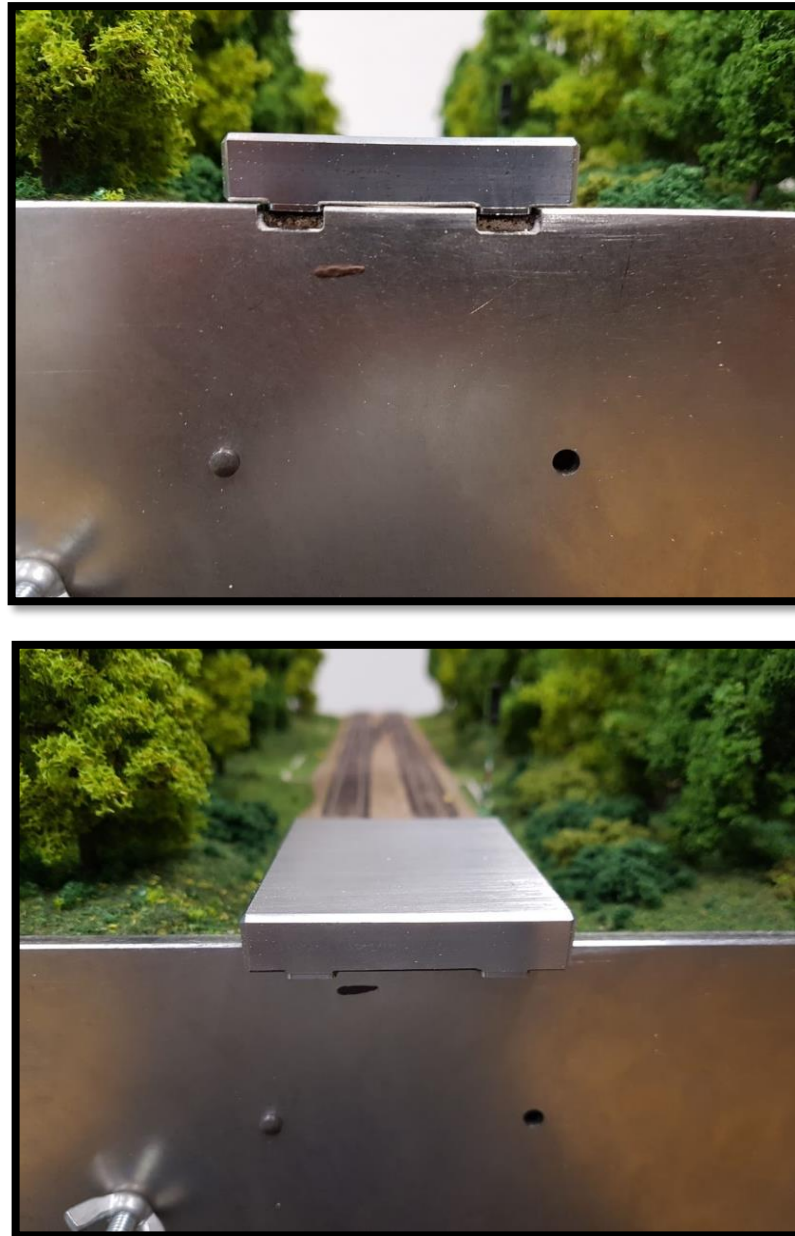


Figure 21: assembly track-template

### **Recommendation**

The *height* of tracks should be checked frequently. It may be done with your *fingertips*. Minor differences are recognized this way too.



## 13.2 Dimensions of Module head according to standard 2019

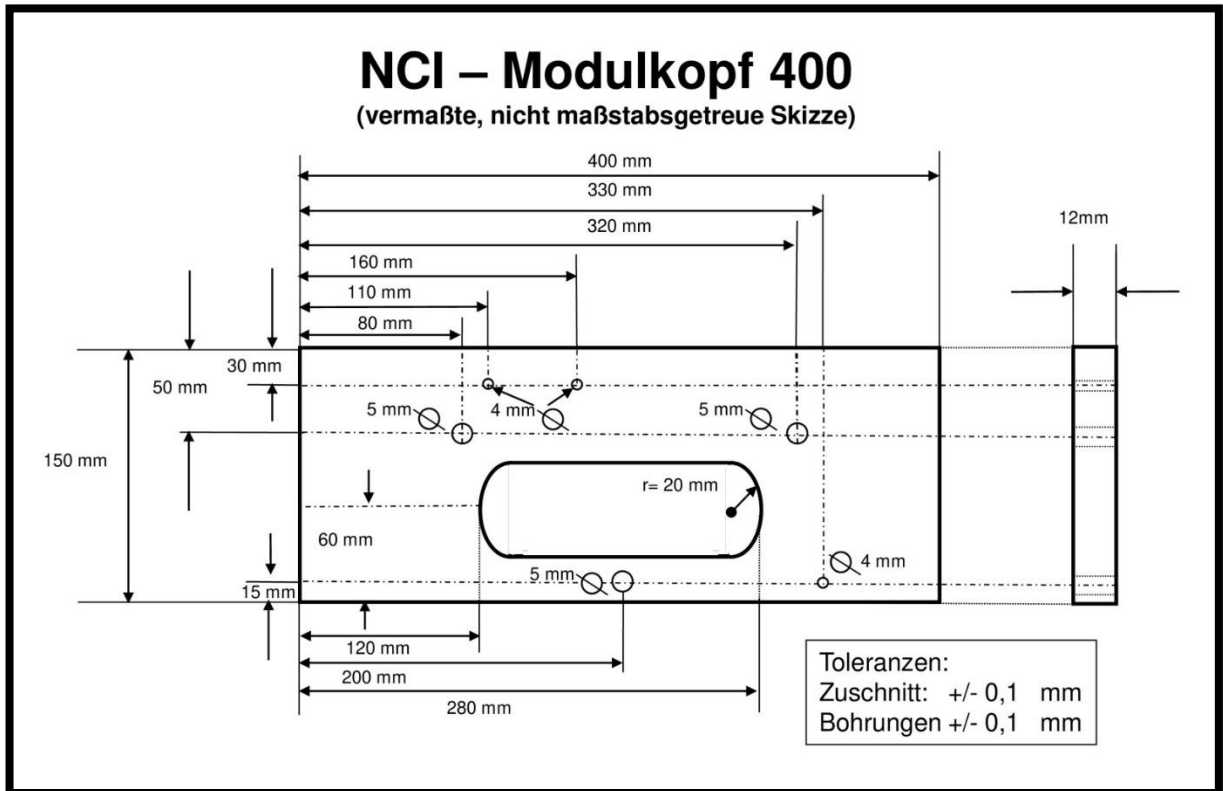


Figure 22: Modul head sketch

### 13.3 Drawing of a module with all dimensions

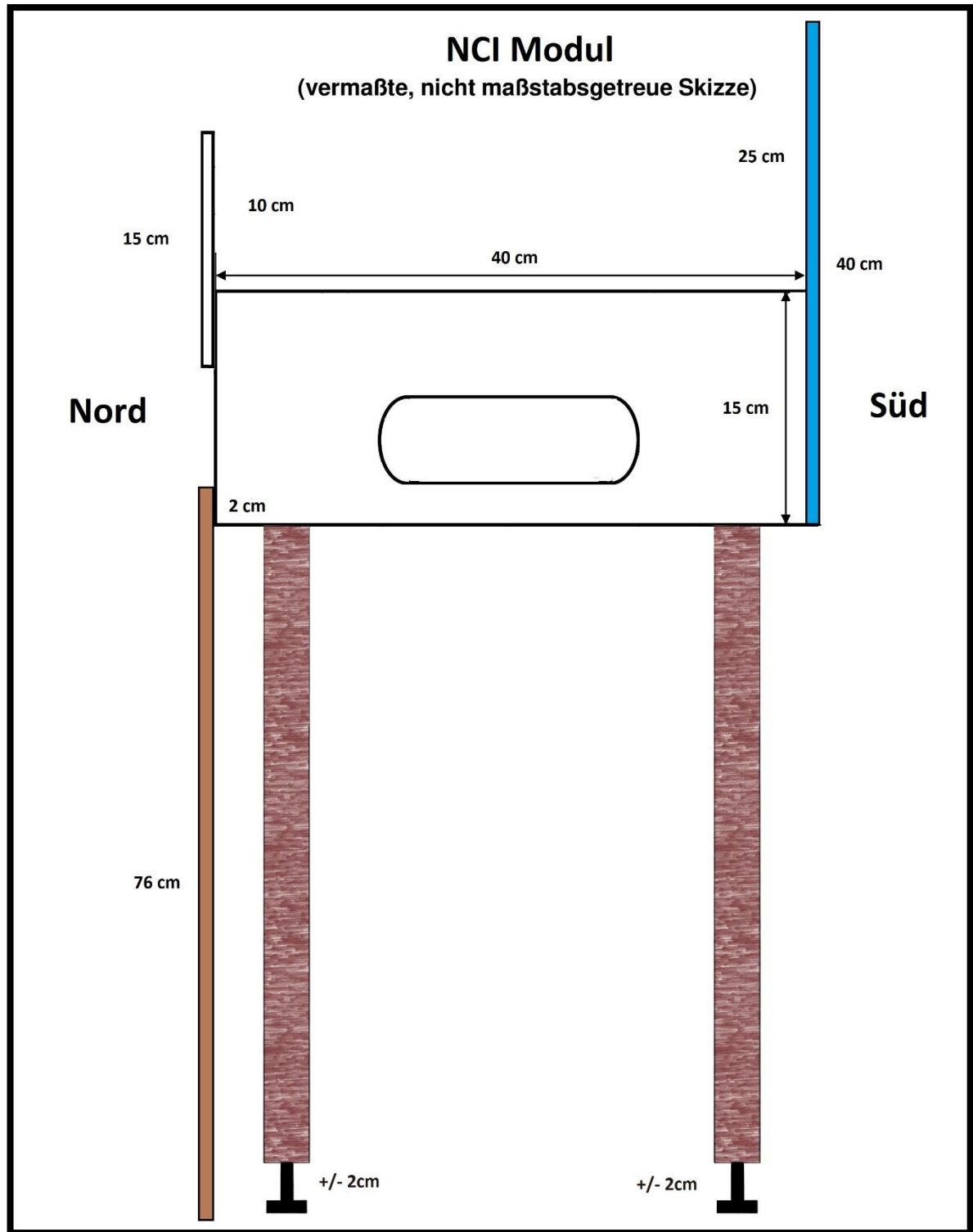


Figure 23: Module with all dimensions

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