

# FREMO - Module Design Standard

(effektive 050615)

## Introduction

The application of CAD programs greatly improved and simplified the planning of small and large arrangements. In order to provide compatibility among the various module designs, a common design standard was devised. Currently, more than 2000 H0/H0e/H0m/H0-USA modules and/or segments exist. Only standardized designs are included into the FREMO - data base. Designs in alternate file formats, fonts, lines, layer, and colors must be adapted, because many times they need more storage space and subsequently render the arrangements unclear. The adjustment to the standard is time-consuming. Trashing and renewed drawing is often simpler than adaptation! This causes twice the amount of work and is actually unnecessary.

Often we find several arrangements in the same hall. Unfortunately, the use of varying programs and design standards cause great difficulties in the data exchange. In fact, at times the exchange of data is even virtually impossible. In order to optimize the utilization of the limited hall space, data exchange between the planners of the individual groups and arrangements is essential. The following article contains the standards, which have proven to be useful with H0. These standards should not, however, be limited to H0. Rather, hopefully they gain acceptance with all other groups and track gauges as well. In addition, a few drawing hints will be shared.

## Program

Arrangement planning takes place with AutoCAD, version 14. This program makes simple alignment and joining of modules possible. Newer program versions offer functions which are not needed for our purposes. In fact, they even create larger files. Small files form the basis for arrangement files which are collected from many individual drawings and have to fit even through narrow modem lines. Therefore, the designs are saved in the still older AutoCAD - format (\*.dwg, version 12). The file size of a track module amounts to approx. 5 Kbyte.

## Measuring of the Modules

Prerequisite for the arrangement planning is a detailed drawing of the module design. At the outset, a module must be measured accurately. When drawing lengths modules, the data of length, width, and distance of the track center from the module box (fig. 1), suffices.

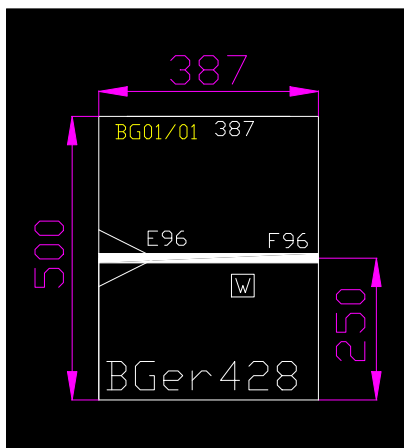


fig.1: measuring lengths module

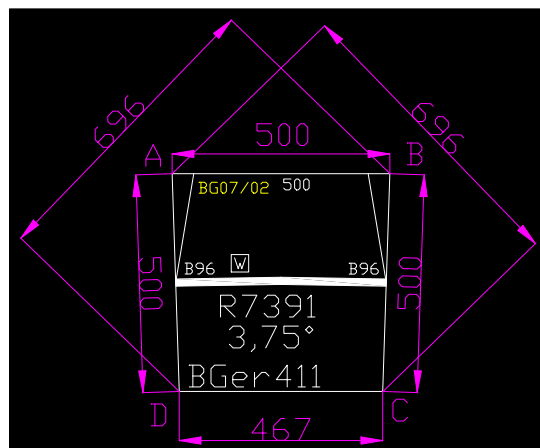


fig.2: measuring curve module

When using curve modules, lengths can be measured more accurately than angles. The lengths of the longitudinal sections (A-B, C-D), end profiles (B-C, A-D), as well as the diagonals (A-C, B-D), should always be measured precisely to the mm from corner to corner (fig. 2). The corner points refer to the terminating points of the end profiles at the exterior (fig.3 and fig.4). The measurements are seen from above (landscape view). With five longitudinal dimensions a curve module can be depicted. The sixth measure serves for verification. If the error is smaller than 3 mm, one averages. With larger deviations, unfortunately, a measuring error occurred and the measurement has to be repeated. In this case, all lines are marked in „red “and all measured dimensions are included in the design. In addition, a warning reference will be amended to the design. This module should be arranged close to a terminal point, as here deviations may be more easily tolerated. It is the design that is erroneous, not the module!

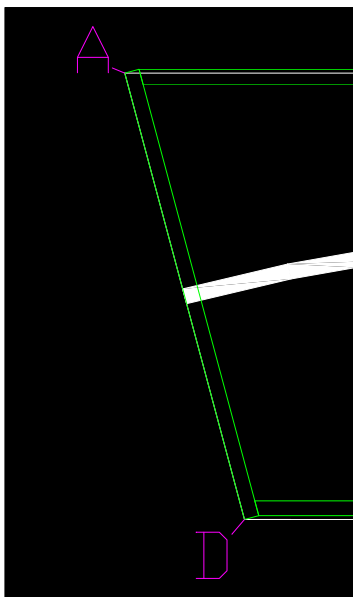


fig.3 corner points

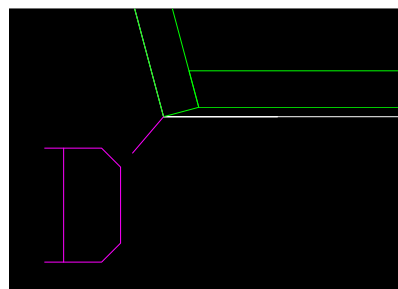
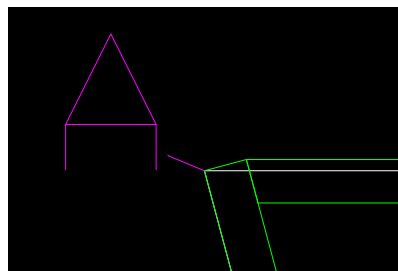


fig.4 detailed corner points

When using five- and polygonal modules, the approach is identical. The amount of measures will increase accordingly.

## Scale

The drawing scale is 1:1 with the advantage that neither halls nor module measurements must be converted. In turn transfer errors will be avoided. For printing purposes another measuring scale may apply.

## File name

A standardized file name facilitates locating the designs. The file name consists of:

First letter of the first name, e.g. **M** for **Max**

The first three letters of the surname, e.g. **Mus** for **Mustermann**

A three and/or four digit module number, which will be assigned centrally (e.g. **MMus999**).

The number remains with the module. If, for instance, the module of Max Mustermann has been sold to **Kurt Krösus**, the module name will change to **KKrös999**.

In the event that the owner initials are already assigned, two letters of the first name or 4 letters of the surname may be used.

Usually there is a design for each module. There are, however, exceptions. If a module consists of several segments which are exchangeable amongst each other, if individual segments may be omitted, or in cases where a module may be constructed in several different variations (e.g. as a one – or dual railed operational unit), then breaking down the design into several drawings will be required. In that case, the drawings receive small letters at the end, (e.g. MMus999a, MMus999b). Additionally, there is yet another design with the preferred construction variant (MMus999), which then contains the single drawings. Home signal modules or presignal modules of a rail operational unit are individual designs. However, generally they receive the same module number (e.g. MMus999e, MMus999v). This facilitates the arrangement planning. Based on this number, we can easily identify which signal module belongs to which specific operational unit.

## Module box

Type of line: Standard, Layer: 0, color: VONLAYER

The outline of the module is improved when using simple lines or, even better, a rectangle (e.g. for a straight module of 1m length: 1. Point 0, - 250 2nd point 1000.250).

Curve modules frequently show the end profile screwed in front of the tapered longitudinal sections (fig.3, fig. 4, green lines). Thus an additional corner accrues in the distance of the end profile size. This corner should not be considered within the module designs which would result in additional catching points near the proximity of the module corners. Instead, the corner points A-B and C-D are directly interconnected (white line) with each other. The minor difference between design and module is not relevant during the planning stage.

*Hint:*

*To draw curve modules is simple:*

1. activate *Drafting Settings* (“Endpoint“, “Midpoint“, “Intersection”) or enter at comandline “\_dsettings”
2. Draw line A-B (fig. 5, violet)
3. Draw circles with the radius A-C and A-D around point A, as well as B-C and B-D around point B (green).
4. Save the drawing.
5. Remeasure (red) and check the distance of the intersections C-D. During dimensioning an additional layer „Defpoint” has been created, which only disappears by using tricks.
6. Reload design, do not save!
7. Draw a rectangle and amend the corner points to the points A, B, C, D (white).
8. Delete circles and line A-B.

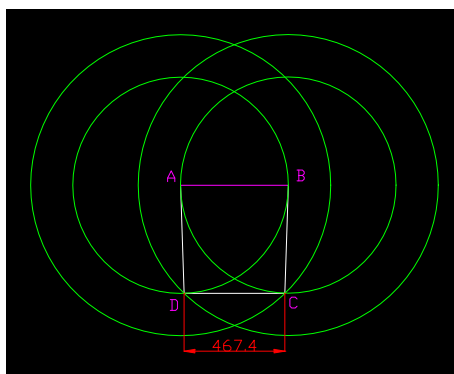


fig.5: design hint curve module

## End profiles:

Type of line: standard, layer: 0, color: VONLAYER. With filled in areas: sample SOLID.

For the H0-end profiles symbols are implemented (fig. 6):

**B88** (B-profile with high module box):

Filled in triangle on the mountain side. Starting at the point of origin of the module box, a straight line is drawn from the line of the module box to the module corner point (250 mm). From there the line continues 50 mm along the longitudinal profile and returns back to the point of origin. If the module is shorter than 50 mm or, on the mountain side, narrower than 250 mm, the lines will be abridged accordingly.

**B96** (B-profile with low module box):

Blank triangle on the mountain side. Since two lines pass through the module edges and, therefore, are invisible, it is sufficient to plot the diagonal line.

**E90** (E-profile with high module box):

Filled in equilateral triangle. The triangle has an edge length of 100 mm. One side is located parallel to the end profile and its tip points at track level toward the inner module.

**E96** (E-profile with high module box):

Blank equilateral triangle. Otherwise equal to E90.

**F96**, no markings

**P**, private railway company, no marking, outline is very similar to F96.

**D99**, (none standardized end profile: single-railed 2D99-profile, dam equal to the I87 profile).

The end profile is represented by a trapezoid. At the end profile its width is 400 mm, after 100 mm the width amounts to only 100 mm. Again, filled in area and blank symbols designate high and low module boxes. The symbol is (\_D99.dwg).

**D99QS**, (none standardized end profile, assigned to H0REQS. D99 and D99QS differ by being

comprised of an alternate dam height and a steep slope angle. The end profile is represented by a trapezoid. At the end profile its width is 300 mm, after 100 mm the width is reduced to merely 100 mm. Again, the filled in area and blank symbols identify the high and low module boxes. The design symbol is (\_D99QS.dwg).

**2B99, 2B96**, double tracked B-profiles. Same symbol as with single tracked modules.

**2E99** (E-profile with two tracks). The end profile is depicted by a trapezoid. The E90 triangle has been „cut open“ and broadened by 46 mm. At the end profile, the trapezoid is 146 mm wide; 100 mm further its width amounts to 46 mm. As in the case of a high module box, the symbol is filled in, and when drawing a low module box, the symbol is blank. This symbol exists already as a drawing (\_2E99.dwg, and/or \_2E96.dwg).

**2D99** (D-profile dam, 40 mm high, with two tracks). The end profile is depicted by a broad trapezoid. The symbol exists as a drawing (\_2D99.dwg).

Modules with the earlier used **A** and **S** end profiles are very rare. In effect, they are only used within groups of modules. For this reason, no special symbols are required. As of yet, the **2B00** end profile has not become generally accepted and a symbol has yet to be devised.

Special profiles are marked „special“.

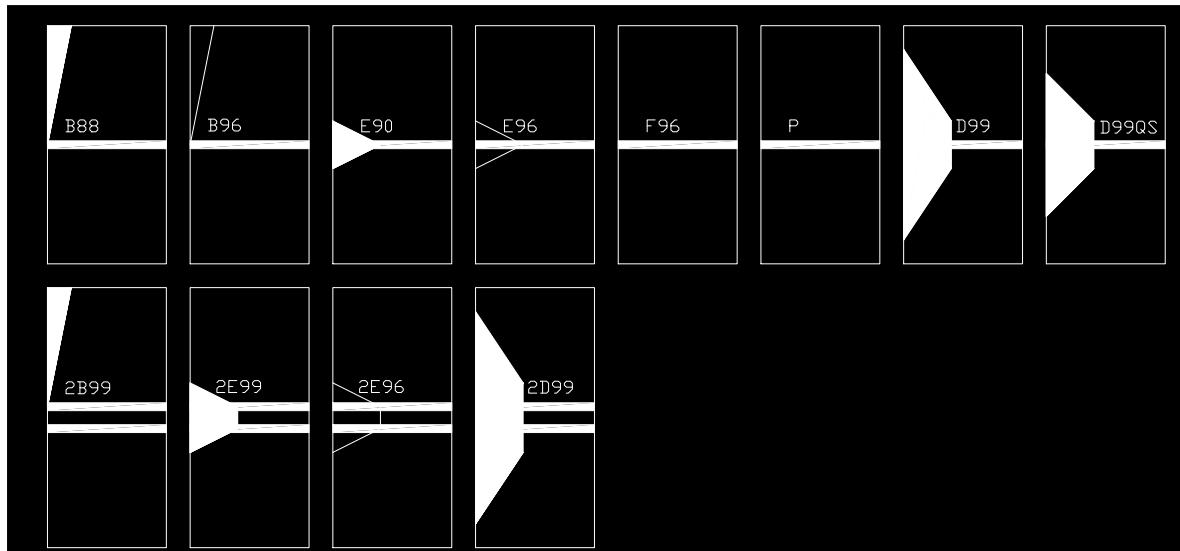


fig. 6: end profile symbols

*Hint:*

*It is important to match the end profile symbols accurately with the track termination and the module corner points. For positioning, the same function which is used for the alignment of modules proves to be useful (Modify, 3D Operation, Align). In the case of deviations additional catching points occur, which may cause errors during the module adjustment. A small trick facilitates the drawing of the end profile symbols, in particular when using curve modules. Draw a circle with a 50 mm radius round the module corner point. The intersection between circle and module box is the third corner point for the B-profile north side, next to the track termination point and the module box corner point (fig. 7).*

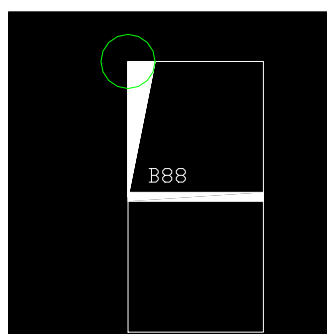


fig. 7: design assistance end profile symbol

## Tracks

Line: Polyline 16, 5 mm (H0), 12 mm (H0m), 9 mm (H0e), 7 mm (H0n2) wide, layer 0, color VONLAYER.

The tracks are depicted on purpose with a single broad line. By doing so, the track center is always the sole catching point for the module adjustment. The track line ends at the end profile. When depicting train stations, all tracks may be displayed accordingly.

*Hint: Curved tracks*

*Ideally, at first the angle should be measured. Save the design, because, while measuring the not erasable Defpoint Layer will be created, which we can do without. Then we draw a ray originating from the upper corner point of the end profile to the lower corner point of the end profile. The ray continues indefinitely. A second ray for the other end profile. In the intersection of the two rays we can measure the angle of the module. Memorize the number well, better write it down! Then reload the design, do not save! Note that by doing so we eloquently got rid of the rays. The track is depicted by a curve ranging from the starting point (center of the right end profile), to the termination point (center of the left end profile) and angle (enter the memorized angle as text, e.g. 15, 36). Save the file. Now quickly double check the radius of the curve and memorize that number once again! Reopen the file without saving it. Now the line can be converted into a polylinie of appropriate width. Later on, when we process the labeling, measurement of the angle and radius will be required.*

### Mixed-Gauge Track [with three rails]

There are already symbols in place which depict the three-rail tracks (DreischienenH0e.dwg, DreischienenH0m.dwg). The symbols are amended on the track in the direction that allows the narrow gauge to “run” along the side of the “filled in” surface (fig. 8).

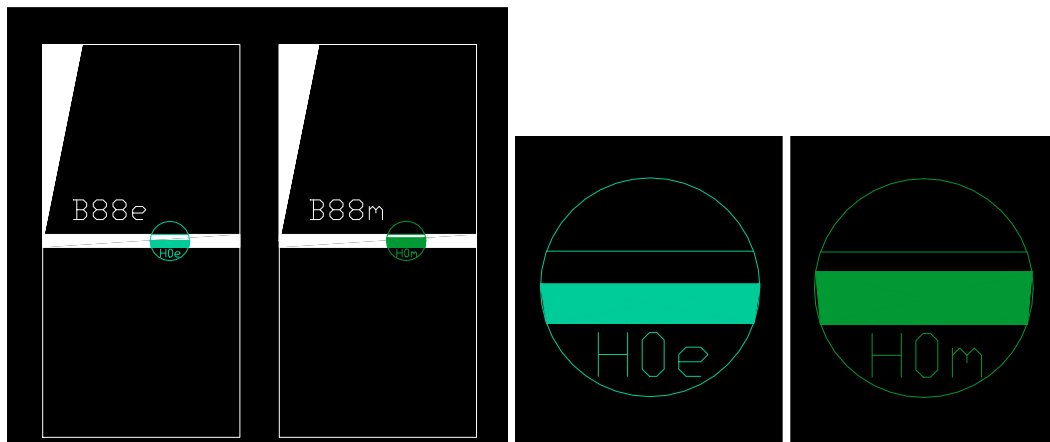


fig. 8: symbols for the three-rail track

### Labelling

Standard Font, single-spaced, height 50, layer 0, color: VONLAYER

- **Module designation** (same as file name, e.g. MMus999) in the lower left corner. In order to avoid confusing the corner catching point with the base point of the text, ensure there is enough space to the corner point.

When drawing curve modules, remark centrally under the track the radius, measured in mm (e.g. R1234) and the angle (e.g. 22, 5°) (fig. 2).

Standard Font, single-spaced, height 25, layer 0, color: VONLAYER

- **Designation of the end profiles** (e.g. B88) above the track in the proximity of the end profile. Again, in this instance a minimum distance is required, so that the base point of the text may not be confused with the catching point at the end of the track. When using three-rail track curve modules with excessive height, the ending „Ü” is replaced with the ending “e“ or „m“(e.g. B88Ü, E90m). With curve modules the end profile designation must be aligned parallel to the track.

- **Length specifications** of the module box are inserted centrally in mm (e.g. 1000) into the module box. These details are helpful when each mm counts during the planning stage and calculating becomes critical. They allow modules of similar size to be more easily identified. In addition, the length specifications are very helpful when validating the module designs. Further, when modules deviate by width, adding the latitudes proves beneficial. With unchecked modules the height amounts to 50 and thereby facilitates the legibility during verification. Following the verification, the height will be reduced to 25.

Standard Font, single-spaced, height 25, layer 0, color: YELLOW

Make a note in the left upper corner of the **drawing version** of the month/year and the **initials** of the drawer/editor (e.g. BG05/02). This simplifies the identification of the most current design.

Standard Font, single-spaced, height 50, layer 0, color: RED

Modules, which as of now have not been verified, are labeled “**unchecked**”! This label is to be removed, as soon as it has been ascertained that module and design correspond with each other. An “unchecked” is no flaw. Rather it serves as a suggestion that a consistency between module and design still has to be established. Always the design is erroneous, not the module!

Standard Font, single-spaced, height 200, layer 0, color: VONLAYER

The **name of the operational unit** is written into the control area. Then amend the initial of the train station to the name of the operational unit in parentheses (e.g. Bickburg (Bb)). Using upper case letters allows for the identification of the operational unit in those cases where the arrangement plan has been extremely minimized. This is exceptionally helpful.

## Signals

Layer 0, color: VONLAYER

Fixed signals are depicted likewise. There are already a variety of symbols in place (e.g. \_HP01.dwg, \_HP02.dwg, \_HP012.dwg) (fig. 9). In order to fit between the tracks or onto small signal modules, these symbols can be minimized accordingly.

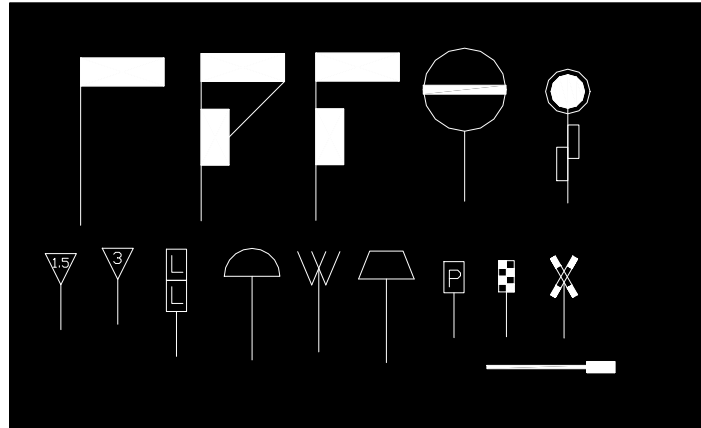


fig. 9: symbols for signals and boards

## Wattenscheider Schächte (shafts of Wattenscheid)

Layer 0, color: VONLAYER

For the Wattenscheider Schacht (standardized signal card location) a symbol exists already, a square with a W. (\_wattenscheider.dwg). The symbol has the same dimensions as the shaft.

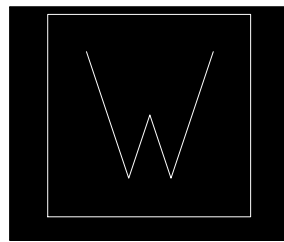


fig. 10: symbol for Wattenscheider Schacht

## Module origin

In order to avoid surprises when inserting a module into an arrangement (placement outside of a hall), it is advisable to specify the design origin (coordinate 0.0). The module is shifted in such a way that the location of the end profile is identical with the point where the left track meets 0.0. In curve modules, the inside of the curve should point downward and is rotated until it is symmetrical to the perpendicular axis of the angle.

## Control area

Shading: ANSI31, scaling factor 50 (at times it is 1000, who knows why), layer „control area“ (yellow), color VONLAYER

To provide sufficient space to manage the operational unit, it is necessary to specify the minimum area required for the operation. The vast shaded areas render the arrangement unclear. Thus a new layer was created: „control area“. This allows the fading out of all control areas in a single action. The color of the control area layer is YELLOW. The control area does not extend beyond the end profiles, thus preventing the various control areas from overlapping while joining the operational units. The prerequisites to run an operational unit differ. The following widths proved to be adequate:

**Small operational units**, e.g. stop where always only one train crew is engaged, 500 mm.



**Small stations** with dispatcher, where, if need be, two train crews are simultaneously on site: 800 mm.

**Large operational units**, where many persons bustle around, e.g. dispatcher, shunting inspector, shunter, several train crews, gawkers: 1200 mm.

**Shadow stations** need space for tables and shelf space: 1500 mm.

Fig. 14 shows an operation unit including control area.

## DCC

Layer „DCC“, color VONLAYER (cyan).

For the DCC planning, for instance, the position of firmly installed LN boxes and SPAX boosters is necessary. Firmly built-in DCC devices should be implemented into the layer DCC. LN boxes and Spaxbooster already have assigned symbols (fig. 11).



fig. 11: symbol for LN box and Spax booster

## RUT

Layer „RUT“, color VONLAYER (purple).

For the RUT planning (ring circuit for clock and telephone) e.g. the location of the RUT boxes is necessary. Therefore, firmly installed RUT devices should be amended to the layer RUT. RUT boxes have already a symbol (fig. 12).

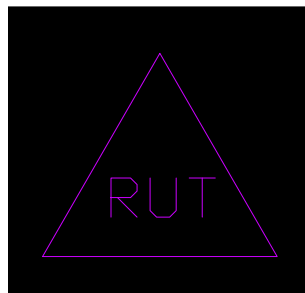


fig. 12: symbol for RUT box

## Details:

Type of line: standard. layer 0, color VONLAYER.

The module designs should not be overloaded with details. However, distinctive marks facilitate the identification of the modules during planning and setup. This refers to bridges, tunnels, roads and buildings. Once again, simple geometrical figures should be used, which may be supplemented, if needed, with text (e.g. Nettelbergbrücke). Cobblestone pavement or roof tile textures, as well as the ducklings on the lake, are not essential.



fig. 13: example module design RPau600

## Finished!

Then please forward the drawing to me, so that it can be entered into the FREMO data base. The drawings will be distributed several times annually by email to everyone that is interested. Whoever plans a meeting can request the latest drawings directly with me. At meetings I often check modules and do some touch-up work on the module designs.

In the event that someone cannot or doesn't want to draw up a design, please feel free to send the module description or handwritten drawing to me and I will be happy to produce – one by one – the module drawing. Drawings which don't correspond to the standard, I will adapt accordingly.

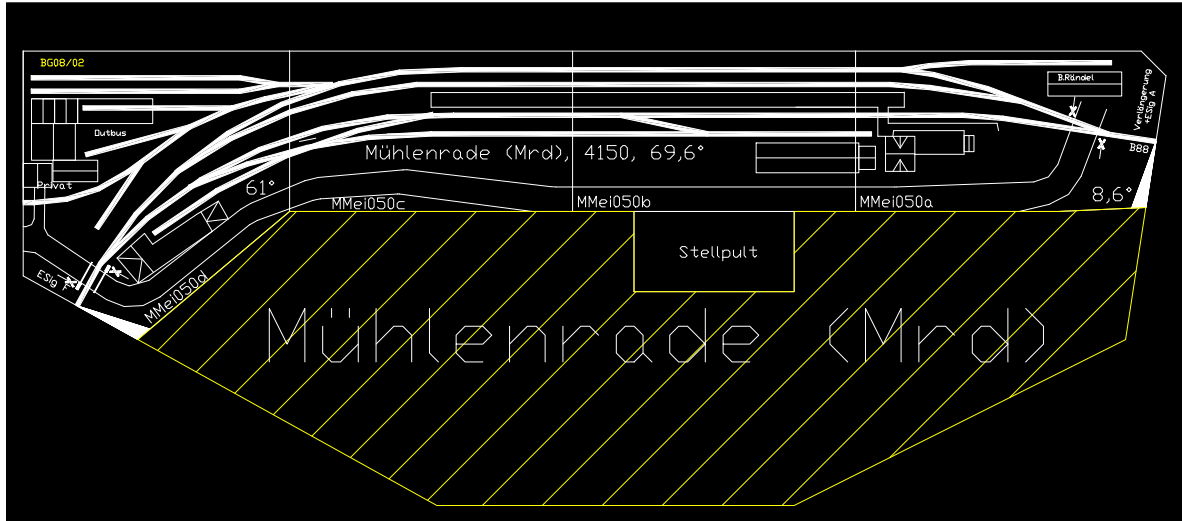


fig. 14: example module design MMei050

Have fun drawing!  
Bernd Gerlach