{Ti*k*Z-trackschematic}

A Ti*k*Z library for track schematics

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Version 0.5 from 2020-01-14

Contents

1. Introduction

1.1. About tikz-trackschematic

The Ti*kZ-trackschematic* library is a toolbox of symbols geared primarily towards creating track schematic for either research or educational purposes. It provides a Ti*kZ* frontend to some of the symbols which maybe needed to describe situations and layouts in railway operation. The library is divided into four sublibraries: `topology`, `trafficcontrol`, `vehicles`, `constructions`, and `messures`.

1.2. Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 826347.

1.3. Requirements

The library uses Ti*kZ* and it is based the following packages: `tikz`, `lmodern`, `xcolor`, and `etoolbox`. Further more it uses the following Ti*kZ* libraries: `calc`, `intersections`, `patterns`, and `arrows.meta`.

1.4. License

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1.5. Alternatives

Apart from this library, there is also a Signalschablone with german (Deutsche Bahn) symbols for MS Visio.

2. Usage

2.1. A complete minimal example

The command \usetikzlibrary{trackschematic} will load the library; place it somewhere in your preamble. Here is a complete working minimal example which will produce a single PDF file with the figure on the right:

```latex
\documentclass[tikz]{standalone}

% loading the library
\usetikzlibrary{trackschematic}

\begin{document}
 \begin{tikzpicture}

  % draw a track
  \maintrack (0,0) -- (6,0);

  % place a train on the track
  \train[forward] at (5,0) label ();

 \end{tikzpicture}
\end{document}
```
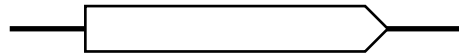
2.2. Placement

To place symbols in a track schematic, they need to placed and oriented correctly. The placement ist done through the given TikZ coordinate. There are a few assumaptions made about the placement:

1. Parallel tracks are drawn at a distance of 1 cm (which is the base unit of TikZ).

2. Tracks are only drawn at an angle of $n \cdot 45°$.

2.3. Orientation system

The orientation is controlled via given TikZ options or pgfkey. The orientation options/pgfkeys are named in relation to orientation-based coordinates, which inhibate thier meaning from reading left to right beeing `forward` and relate `left`/`right` to that movement.

```
                    left
                     ↑
       backward ←————┼————→ forward
                     ↓
                   right
```
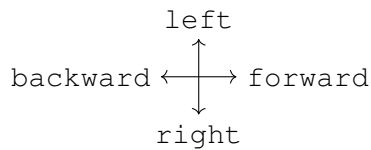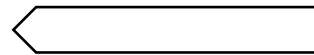
The main option/pgfkey is the `face` option to control in which direction an object will face. The key can take one of the following two values: `forward`, and `backward`.

```
\train[face=forward ] at (coordinate) label ();
```
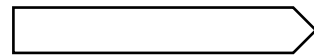
```
\train[face=backward] at (coordinate) label ();
```

As a shortcut you may also just give the option `forward` or `backward` without the `face=` in front of it. If you have objects which branch either to the left or the right you have to give the `branch` option which takes one of the following two values: `left`, and `right`.

```
\turnout[forward ,branch=left ] at (coordinate) label ();
```

```
\turnout[forward ,branch=right] at (coordinate) label ();
```

```
\turnout[backward,branch=left ] at (coordinate) label ();
```

```
\turnout[backward,branch=right] at (coordinate) label ();
```

There is no shortcut and the key `branch=` must be given contrary to the key `face=`.

2.4. Left- and right-hand traffic

The traffic practice to divide bidirectional traffic has impact mostly on traffic control. The default traffic practice for this library ist right-hand traffic. You can change it either globally or locally with
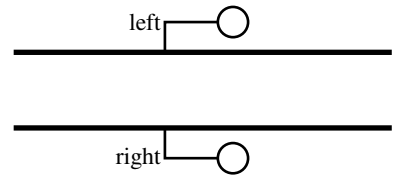
the key `traffic practice=left`. There is also the alias `position` for single local entries.

```
\documentclass[tikz]{standalone}

% load the library
\usetikzlibrary{trackschematic}

\begin{document}
  \begin{tikzpicture}
    % set the traffic practice
    \tikzset{traffic practice=left}

    \maintrack (0,1) -- (5,1);
    \maintrack (0,0) -- (5,0);
    \routesignal[forward] at (2,1) label (left);
    \routesignal[forward,position=right] at (2,0) label (right);
  \end{tikzpicture}
\end{document}
```

2.5. Colors: background and foreground

The two main colors `white` and `black` are set for the `background` and `foreground` keys by default. If you want to change them, provide a new value for the keys. For example like this:

```
\documentclass[tikz]{standalone}

% load the library
\usetikzlibrary{trackschematic}

\begin{document}
  \begin{tikzpicture}
    % set the colors
    \tikzset{background=lightgray,foreground=violet}

    \maintrack (0,0) -- (6,0);
    \train[forward] at (5,0) label (grey train);
  \end{tikzpicture}
\end{document}
```

3. Provided Symbols and their commands

Each sublibrary provides different symbols. The following section will go through each symbol their command and options.

3.1. Topology

3.1.1. Tracks

Drawing a track follows the same pricipal as drawing a line in Ti*k*Z. There are two generell optionss of track with different commands: `main tracks`, and `secondary tracks`.

► **Main track**

```
\maintrack (coord1) -- (coord2);
\maintrack (coord1) -- (coord2) -- (coord3) -- etc.;
```

No `options` available.
This command is equivalent to:

```
\path[draw=foreground,line width=2pt] (coord1) -- (coord2);
```

Beware of the placement assumption by the library (see Section 2.2).

▶ **Secondary track**

```
\secondarytrack (coord1) -- (coord2);
\secondarytrack (coord1) -- (coord2) -- (coord3) -- etc.;
```

For the secondary track you may also use the following alias:

```
\sidetrack (coord1) -- (coord2);
```

No `options` available.
The command is equivalent to:

```
\path[draw=foreground,line width=0.7pt] (coord1) -- (coord2);
```

Beware of the placement assumption by the library (see Section 2.2).

▶ **Track number or track label**

```
\tracklabel at (coord) label (number);
```

No `options` available.
This command is equivalent to:

```
\node[fill=background,text=foreground] at (coord) {number};
```

▶ **Buffer stops**

```
\bufferstop[options] at (coord);
```

values for `options` (comma seperated):

> `forward` or `backward` (mandatory)
>
> `friction=`*length unit* (optional)
>
> `foreground=`*color* (optional, default: `black`)

▶ **Track closures**

```
\trackclosure at (coord);
```

No `options` available.

3.1.2. Turnouts and similar

▶ **Turnouts**

```
\turnout[options] at (coord) label (name);
```

values for `options` (comma seperated):

  `forward` or `backward` (mandatory)

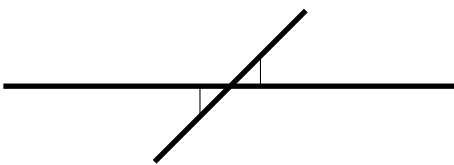 `branch=left` or `branch=right` (mandatory)

  `operation=manual` (optional)

  `fouling point` (optional)

  `points=left` or `points=right` (optional)

  `shift label={`*(label-coord)*`}` (optional, default: (0,0))

  `foreground=`*color* (optional, default: `black`)

▶ **Diamond crossings**

```
\crossing[options] at (coord) label (name);
```

values for `options` (comma seperated):

  `branch=left` or `branch=right` (mandatory)

  `fouling point` (optional)

  `shift label={`*(label-coord)*`}` (optional, default: (0,0))

  `foreground=`*color* (optional, default: `black`)

▶ **Slip switchs or slip turnouts**
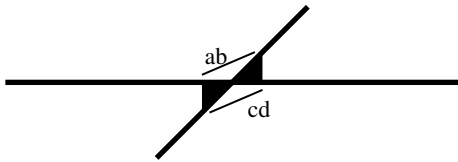
```
\slipturnout[options] at (coord) label (name1)(name2);
```

values for `options` (comma seperated):

      `branch=left` or `branch=right` (mandatory)

      `slip=double` (default), `slip=none`, `slip=left` or `slip=right` (mandatory)

      `operation=manual` (optional)

      `fouling point` (optional)

      `forward points=left` or `forward points=right` (optional)

      `backward points=left` or `backward points=right` (optional)

      `shift label={`*(label-coord)*`}` (optional, default: (0,0))

      `foreground=`*color* (optional, default: `black`)

▶ **Derailers**
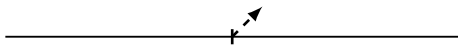
```
\derailer[options] at (coord) label (name);
```

values for `options` (comma seperated):

      `forward` or `backward` (mandatory)

      `branch=left` or `branch=right` (mandatory)

      `shift label={`*(label-coord)*`}` (optional, default: (0,0))

      `foreground=`*color* (optional, default: `black`)

3.2. Vehicles

▶ **Parked vehicles**

```
\parkedvehicles[options] at (coord) label (name);
```

values for `options` (comma seperated):

      `length=`*length unit* (optional, default 4cm)

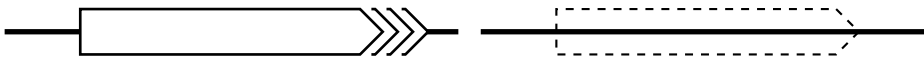`label at={`*(label-coord)*`}` (optional, default: *center*)

`label align=left` or `label align=right` (optional, default: center)

`foreground=`*color* (optional, default: `black`)

`background=`*color* (optional, default: `white`)

The value for *(label-coord)* is relative to *(coord)*. An absolute *(label-coord)* can be specified with the Ti*k*Z \coordinate command.

► **Shunting movements**


```
\shunting[options] at (coord) label (name);
```

values for `options` (comma seperated):

`movement` (optional)

`forward` or `backward` (mandatory)

`length=`*length unit* (optional, default 4cm)

`operation=manual` or `operation=automatic` (optional)

`bend left at={`*(bend-coord)*`}` (optional, default: *none*)

`bend right at={`*(bend-coord)*`}` (optional, default: *none*)

`label at={`*(label-coord)*`}` (optional, default: *center*)

`label align=left` or `label align=right` (optional, default: center)

`foreground=`*color* (optional, default: `black`)

`background=`*color* (optional, default: `white`)

The value for *(label-coord)* and *(bend-coord)* is relative to *(coord)*. An absolute *(label-coord)* or *(bend-coord)* can be specified with the Ti*k*Z \coordinate command.

► **Train runs**


```
\train[options] at (coord) label (name);
```

values for `options` (comma seperated):

`run=slow`, `run=normal` or `run=fast` (optional)

`forward` or `backward` (mandatory)

length=*length unit* (optional, default 4cm)

operation=manual or operation=automatic (optional)

ghost (optional)

bend left at={*(bend-coord)*} (optional, default: *none*)

bend right at={*(bend-coord)*} (optional, default: *none*)

shift label={*(label-coord)*} (optional, default: (0,0))

label align=left or label align=right (optional, default: center)

foreground=*color* (optional, default: black)

background=*color* (optional, default: white)

The value for *(label-coord)* and *(bend-coord)* is relative to *(coord)*. An absolute *(label-coord)* or *(bend-coord)* can be specified with the Ti*k*Z \coordinate command.

3.3. Traffic control

3.3.1. Signals

► **Generic signal command**

```
\signal[options] at (coord) label (name);
```

values for options (comma seperated):

at least one of the following: distant, speed type, block, route, shunt limit, shunting and/or berth

forward or backward (mandatory)

speed=*value* (optional)

distant speed=*value* (optional)

locked=false (default) or locked=true (optional)

position=left or position=right (optional, default: *traffic practice*)

shift label={*(label-coord)*} (optional, default: (0,0))

foreground=*color* (optional, default: black)

► **Distant signal**
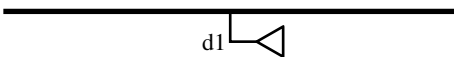

```
\distantsignal[options] at (coord) label (name);
```

values for options (comma seperated):

> forward or backward (mandatory)
>
> distant speed=*value* (optional)
>
> position=left or position=right (optional, default: *traffic practice*)
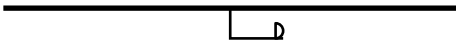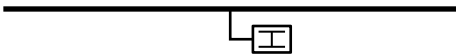>
> shift label={*(label-coord)*} (optional, default: (0,0))
>
> foreground=*color* (optional, default: black)

This command is equivalent to:

```
\signal[distant,options] at (coord) label (name);
```

► **Speed signal/sign**
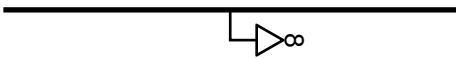

```
\speedsignal[options] at (coord) label (name);
```

For the speed signal you may also use the following alias:

```
\speedsign[options] at (coord) label (name);
```

values for options (comma seperated):

> forward or backward (mandatory)
>
> speed=*value* (optional)
>
> position=left or position=right (optional, default: *traffic practice*)
>
> shift label={*(label-coord)*} (optional, default: (0,0))
>
> foreground=*color* (optional, default: black)

This command is equivalent to:

```
\signal[speed type,options] at (coord) label (name);
```

► **Block signal**
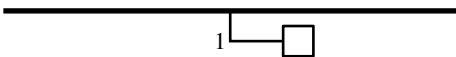

```
\blocksignal[options] at (coord) label (name);
```

values for options (comma seperated):

> forward or backward (mandatory)
>
> speed=*value* (optional)
>
> position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

This command is equivalent to:

```
\signal[block,options] at (coord) label (name);
```

► **Route signal**
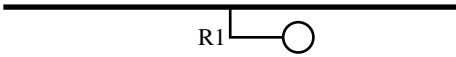
R1

```
\routesignal[options] at (coord) label (name);
```

values for options (comma seperated):

    forward or backward (mandatory)
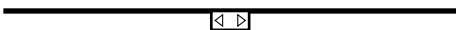
    speed=*value* (optional)

    locked=false (default) or locked=true (optional)

    position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

This command is equivalent to:

```
\signal[route,options] at (coord) label (name);
```

► **Shunting signal**

```
\shuntsignal[options] at (coord) label (name);
```

values for options (comma seperated):

    forward or backward (mandatory)

    locked=false (default) or locked=true (optional)

    position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

This command is equivalent to:

```
\signal[shunting,options] at (coord) label (name);
```

▶ **Shunt limit**


```
\shuntlimit[options] at (coord) label (name);
```

values for `options` (comma seperated):

`forward` or `backward` (mandatory)

`position=left` or `position=right` (optional, default: *traffic practice*)
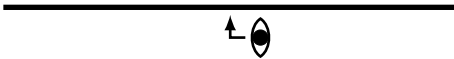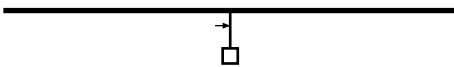
`shift label={(label-coord)}` (optional, default: (0,0))

`foreground=color` (optional, default: `black`)

This command is equivalent to:

```
\signal[shunt limit,options] at (coord) label (name);
```

▶ **Berth signal/sign**


```
\berthsignal[options] at (coord) label (name);
```

For the speed signal you may also use the following alias:

```
\berthsign[options] at (coord) label (name);
```

values for `options` (comma seperated):

`forward` or `backward` (mandatory)

`position=left` or `position=right` (optional, default: *traffic practice*)

`shift label={(label-coord)}` (optional, default: (0,0))

`foreground=color` (optional, default: `black`)

This command is equivalent to:

```
\signal[berth,options] at (coord) label (name);
```

3.3.2. Clearing points

▶ **Generic clearing point**

```
\clearingpoint[options] at (coord) label (name);
```

values for `options` (comma seperated):

at least one of the following: `standard`, `block` and/or `route`

  forward (default) or backward (optional)

  position=left or position=right (optional, default: *traffic practice*)

  shift label={*(label-coord)*} (optional, default: (0,0))

  foreground=*color* (optional, default: black)

► **Standard clearing point**


```
\standardclearing[options] at (coord) label (name);
```

values for options (comma seperated):

  forward (default) or backward (optional)

  position=left or position=right (optional, default: *traffic practice*)

  shift label={*(label-coord)*} (optional, default: (0,0))

  foreground=*color* (optional, default: black)

This command is equivalent to:

```
\clearingpoint[standard,options] at (coord) label (name);
```

► **Block clearing point**


```
\blockclearing[options] at (coord) label (name);
```

values for options (comma seperated):

  forward (default) or backward (optional)

  position=left or position=right (optional, default: *traffic practice*)

  shift label={*(label-coord)*} (optional, default: (0,0))

  foreground=*color* (optional, default: black)

This command is equivalent to:

```
\clearingpoint[block,options] at (coord) label (name);
```

▶ **Route clearing point**

```
\routeclearing[options] at (coord) label (name);
```

values for options (comma seperated):

    forward (default) or backward (optional)

    position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

This command is equivalent to:

```
\clearingpoint[route,options] at (coord) label (name);
```

3.3.3. Transmitters

▶ **Generic transmitter command**

```
\transmitter[options] at (coord) label (name);
```

values for options (comma seperated):

    type=balise or type=loop (mandatory)

    forward, backward or bidirectional (optional)

    position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

▶ **Balise**

```
\balise[options] at (coord) label (name);
```

values for options (comma seperated):

    forward, backward or bidirectional (optional)

    position=left or position=right (optional, default: *traffic practice*)

    shift label={*(label-coord)*} (optional, default: (0,0))

    foreground=*color* (optional, default: black)

This command is equivalent to:

```
\transmitter[type=balise,options] at (coord) label (name);
```

► **Loop**


```
\trackloop[options] at (coord) label (name);
```

values for `options` (comma seperated):

       `position=left` or `position=right` (optional, default: *traffic practice*)

       `shift label={`*(label-coord)*`}` (optional, default: (0,0))

       `foreground=`*color* (optional, default: `black`)

This command is equivalent to:

```
\transmitter[type=loop,options] at (coord) label (name);
```

3.3.4. Miscellaneous

► **View point**


```
\viewpoint[options] at (coord);
```

values for `options` (comma seperated):

       `forward` or `backward` (mandatory)

       `position=left` or `position=right` (optional, default: *traffic practice*)

       `foreground=`*color* (optional, default: `black`)

► **End of movement authority**


```
\movementauthority[options] at (coord) label (name);
```

values for `options` (comma seperated):

       `forward`, `backward` or `bidirectional` (mandatory)

       `direction arrow=true` (default) or `direction arrow=false` (mandatory)

       `position=left` or `position=right` (optional, default: *traffic practice*)

       `shift label={`*(label-coord)*`}` (optional, default: (0,0))

       `foreground=`*color* (optional, default: `black`)

▶ **Route**

```
\route[options] at (coord);
```

values for `options` (comma seperated):

      `forward` or `backward` (mandatory)

      `foreground=`*color* (optional, default: `black`)

3.4. Constructions

▶ **Platform**

```
\platform[options] at (coord);
```
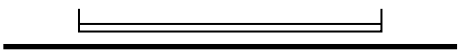
values for `options` (comma seperated):

      `side=left`, `side=right` or `side=both` (mandatory)

      `length=`*length unit* (optional, default 4cm)

      `width=`*length unit* (optional, default 0.5cm)

      `foreground=`*color* (optional, default: `black`)

▶ **Level crossings**

```
\levelcrossing[options] at (coord);
```
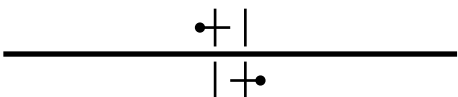
values for `options` (comma seperated):

      `barrier=none` (default), `barrier=semi` or `barrier=full` (optional)

      `side=both` (default), `side=left` or `side=right` (optional)

      `road width=`*length unit* (optional, default 0.4cm)

      `width=`*length unit* (optional, default 0.5cm)

      `no road` (optional)

      `foreground=`*color* (optional, default: `black`)

▶ **Bridge**
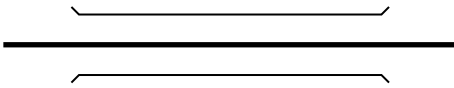
```
\bridge[options] at (coord);
```

values for `options` (comma seperated):

`length=`*length unit* (optional, default 4cm)

`width=`*length unit* (optional, default 0.5cm)

`shift left=`*length unit* (optional, default 0cm)

`shift right=`*length unit* (optional, default 0cm)

`side=both` (default), `side=left` or `side=right` (optional)

`foreground=`*color* (optional, default: `black`)

`background=`*color* (optional, default: `white`)

`no background` (optional)

▶ **Interlocking**

```
\interlocking at (coord);
```

No `options` available.

▶ **Hump**

```
\hump at (coord);
```

No `options` available.

3.5. Messures

▶ **Track distance**

4,50
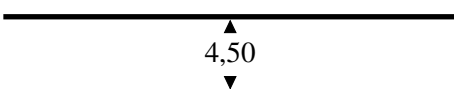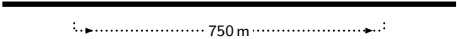
```
\trackdistance between (coord1) and (coord2) distance (value);
```

No `options` available.

► **Train berth**

```
\berth[options] at (coord) length (value);
```

values for `options` (comma seperated):

     `forward`, `backward` or `bidirectional` (mandatory)

     `length=`*length unit* (optional, default 4cm)

     `position=left` or `position=right` (optional, default: *traffic practice*)

     `foreground=`*color* (optional, default: `black`)

► **Hectometer**
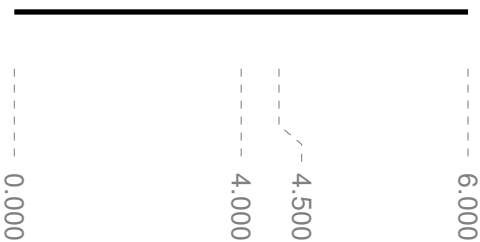
```
\hectometer[options] at (coord) mileage (name);
```

values for `options` (comma seperated):

     `hectometer base={`*(base-coord)*`}` (mandatory)

     `orientation=left` or `orientation=right` (mandatory)

     `shift label={`*(label-coord)*`}` (optional, default: (0,0))

     `hectometer color=`*color* (optional, default: `foreground!50!background`)

The value for *(base-coord)* and *(label-coord)* is relative to *(coord)*. An absolute *(base-coord)* or *(label-coord)* can be specified with the Ti*k*Z \coordinate command. Specify a commen hectometer base and orientation if you have to place multipile hectometers, i.e. with: \tikzset{hectometer base={(base-coord)},orientation=right};.

▶ **Messure line**
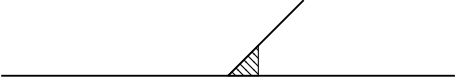
```
\messureline (coord1) -- (coord2);
\messureline (coord1) -- (coord2) -- (coord3) -- etc.;
```
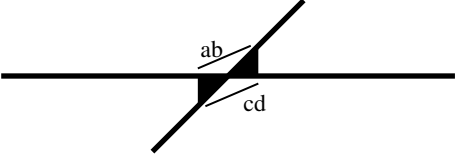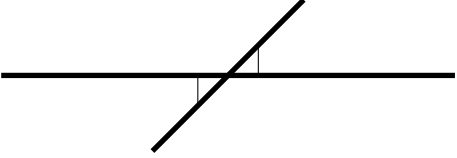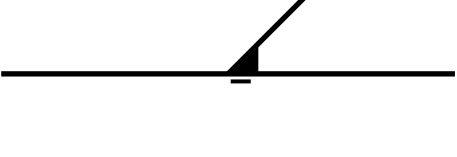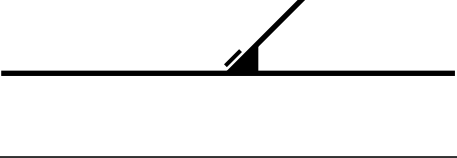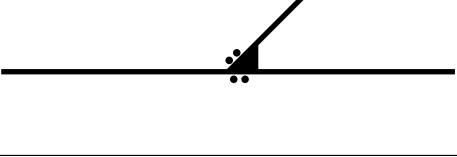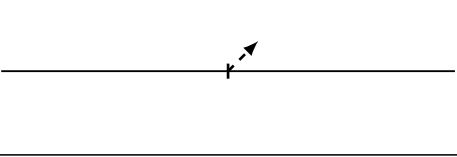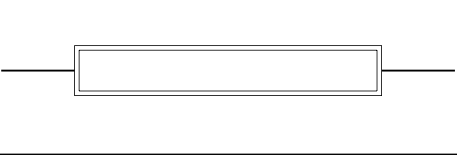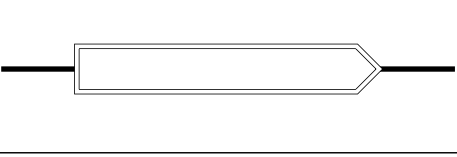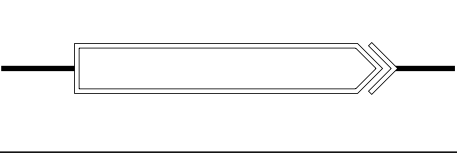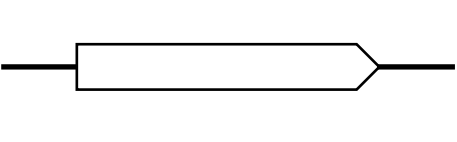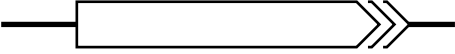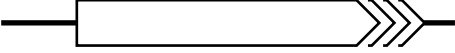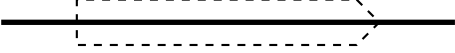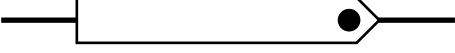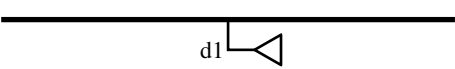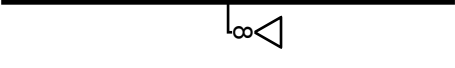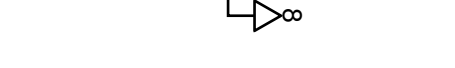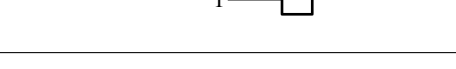
No `options` available.
This command is equivalent to:
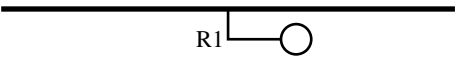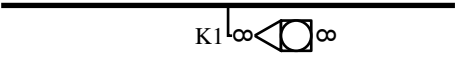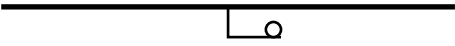
```
\path[draw=foreground!50!background,dashed,shorten <=0.75cm,shorten >=0.75cm] (coord1) -- (coord2);
```
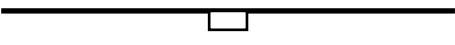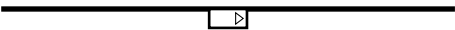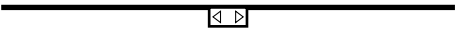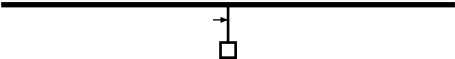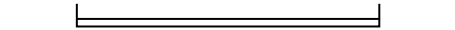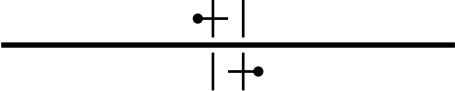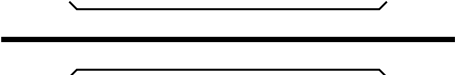
A. Symbology

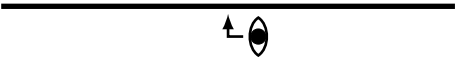| No.	Name	Symbol	See section
1	main track		3.1.1
2	secondary track		3.1.1
3	track number	No.	3.1.1
4	bufferstop		3.1.1
5	friction bufferstop		3.1.1
6	track closure		3.1.1
7	turnout		3.1.2
8	turnout with fouling point indicator		3.1.2
9	turnout operated manually		3.1.2
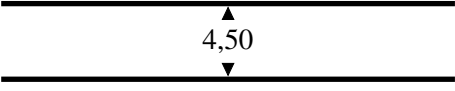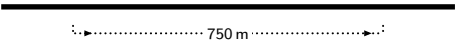
No.	Name	Symbol	See section
10	double-slip turnout		3.1.2
11	diamond crossing		3.1.2
12	turnout with points in right position		3.1.2
13	turnout with points in left position		3.1.2
14	turnout with moving points		3.1.2
15	derailer		3.1.2
16	parked vehicles		3.2
17	train in shunting mode		3.2
18	train shunting		3.2
19	train		3.2

No.	Name	Symbol	See section
20	train moving slow		3.2
21	train moving		3.2
22	train moving fast		3.2
23	train ghost		3.2
24	train operated automatic		3.2
25	train operated by human		3.2
26	distant signal		3.3.1
27	distant signal with speed indicator		3.3.1
28	speed signal		3.3.1
29	block signal		3.3.1

No.	Name	Symbol	See section
30	route signal		3.3.1
31	combined signal (distant, block and route signal)		3.3.1
32	shunt signal		3.3.1
33	shunt signal locked		3.3.1
34	shunt limit		3.3.1
35	train berth sign		3.3.1
36	clearing point		3.3.2
37	block clearing point		3.3.2
38	route clearing point		3.3.2
39	transmitter		3.3.3

No.	Name	Symbol	See section
40	transmitter effective forward		3.3.3
41	transmitter bidirectional		3.3.3
42	loop transmitter		3.3.3
43	view point		3.3.4
44	block end marker (end of movement authority)		3.3.4
45	route		3.3.4
46	platform		3.4
47	level crossing		3.4
48	bridge		3.4
49	hump		3.4

No.	Name	Symbol	See section
50	interlocking		3.4
51	track distance (in m)		3.5
52	train berth shape		3.5
53	hectometer		3.5
54	Messure line		3.5

B. Revision History

Revision	Date	Author(s)	Description
0.1	2018-09-14	MS	Basic concept of a library with railway topology symbols and some examples.
0.2	2018-12-19	MS	Added transmitters and minor improvements.
0.3	2019-04-04	MS	Moved snippet folder to root folder and defined and used color foreground and background.
0.4	2019-07-21	MS	Reworked library for common tikz library layout.
0.5	2020-01-14	MS	Introducing new syntax and providing a documentation.

Martin Scheidt (MS)