# {Ti*kZ-trackschematic}

A TikZ library for track schematics

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A. Symbology

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1. Introduction

1.1. About tikz-trackschematic

The TikZ-trackschematic library is a toolbox of symbols geared primarily towards creating track schematic for either research or educational purposes. It provides a TikZ 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 measures.

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\textit{k}Z and it is based the following packages: tikz, lmodern, xcolor, and etoolbox. Further more it uses the following TikZ 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 \texttt{\usepackage{tikz}} 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:

\begin{verbatim}
\documentclass{standalone}
\usepackage{tikz}
\begin{document}
\begin{tikzpicture}
  \draw (-1,0) -- (1,0); % draw a track
  \draw (0,0) -- (1,0); % place a train on the track
  \end{tikzpicture}
\end{document}
\end{verbatim}

2
2. Usage

2.2. Placement

To place symbols in a track schematic, they need to be placed and oriented correctly. The placement is done through the given TikZ coordinate. There are a few assumptions 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 $n \cdot 45^\circ$.

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 inhibit their meaning from reading left to right being 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.

\[ \text{\texttt{\small \textbackslash train[face=forward ] at (coordinate) label ();}} \]

\[ \text{\texttt{\small \textbackslash train[face=backward] at (coordinate) label ();}} \]

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.

\[ \text{\texttt{\small \textbackslash turnout[forward ,branch=left ] at (coordinate) label ();}} \]

\[ \text{\texttt{\small \textbackslash turnout[forward ,branch=right] at (coordinate) label ();}} \]

\[ \text{\texttt{\small \textbackslash turnout[backward,branch=left ] at (coordinate) label ();}} \]

\[ \text{\texttt{\small \textbackslash turnout[backward,branch=right] at (coordinate) label ();}} \]

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 is 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}
\begin{document}
\begin{tikzpicture}
\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}
\begin{document}
\begin{tikzpicture}
\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 principal as drawing a line in TikZ. There are two generell options 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 separated):
- forward or backward (mandatory)
- friction=length unit (optional)
- foreground=color (optional, default: black)
3. Provided Symbols and their commands

3.1. Track closures

\texttt{\textbackslash trackclosure at (coord)}; 
No options available.

3.1.2. Turnouts and similar

\texttt{\textbackslash turnout[options] at (coord) label \{name\};}

values for options (comma separated):

- forward or backward \textit{(mandatory)}
- branch=left or branch=right \textit{(mandatory)}
- operation=manual \textit{(optional)}
- fouling point \textit{(optional)}
- points=left or points=right \textit{(optional)}
- shift label=\{(label-coord)\} \textit{(optional, default: (0,0))}
- foreground=\texttt{color} \textit{(optional, default: black)}

\textbf{Diamond crossings}

\texttt{\textbackslash crossing[options] at (coord) label \{name\};}

values for options (comma separated):

- branch=left or branch=right \textit{(mandatory)}
- fouling point \textit{(optional)}
- shift label=\{(label-coord)\} \textit{(optional, default: (0,0))}
- foreground=\texttt{color} \textit{(optional, default: black)}
3. Provided Symbols and their commands

**Slip switches 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)
Provided Symbols and their commands

- 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 TikZ \coordinate command.

### Shunting movements

\begin{tikzpicture}
\shunting[options] at (coord) label (name);
\end{tikzpicture}

values for options (comma separated):

- movement (optional)
- forward or backward (mandatory)
- length=\textit{length unit} (optional, default 4cm)
- operation=manual or operation=automatic (optional)
- bend left at={\(bend\)-\(coord\)} (optional, default: \textit{none})
- bend right at={\(bend\)-\(coord\)} (optional, default: \textit{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 TikZ \coordinate command.

### Train runs

\begin{tikzpicture}
\train[options] at (coord) label (name);
\end{tikzpicture}

values for options (comma separated):

- run=slow, run=normal or run=fast (optional)
- forward or backward (mandatory)
3. Provided Symbols and their commands

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 TikZ \coordinate command.

3.3. Traffic control

3.3.1. Stationary signals

► Generic signal command

\signal[\text{options}] \text{at} \ (\text{coord}) \ \text{label} \ (\text{name})

values for options (comma separated):

- at least one of the following: distant, speed type, block, route, shunt limit, shunting and/or berth
- forward or backward (mandatory)
- speed=\text{value} (optional)
- distant speed=\text{value} (optional)
- locked=\text{false} (default) or locked=\text{true} (optional)
- position=left or position=right (optional, default: traffic practice)
- shift label= (\text{label-coord}) (optional, default: (0,0))
- foreground= \text{color} (optional, default: black)

► Distant signal

\distantsignal[\text{options}] \text{at} \ (\text{coord}) \ \text{label} \ (\text{name})

values for options (comma separated):
3. Provided Symbols and their commands

forward or backward (mandatory)

distant speed=value (optional)

color

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

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);

\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);

\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)
3. Provided Symbols and their commands

shift label={\(label-coord\)} (optional, default: (0,0))
foreground=color (optional, default: black)

This command is equivalent to:
\(\text{\texttt{\signal{block,options} at (coord) label (name);}}\)

► Route signal

\(R1\)

\(\text{\texttt{\routesignal{options} at (coord) label (name);}}\)

values for options (comma separated):
- 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={\(\text{\texttt{(label-coord)}}\)} (optional, default: (0,0))
- foreground=color (optional, default: black)

This command is equivalent to:
\(\text{\texttt{\signal{route,options} at (coord) label (name);}}\)

► Shunting signal

\(\text{\texttt{\shuntsignal{options} at (coord) label (name);}}\)

values for options (comma separated):
- forward or backward (mandatory)
- locked=false (default) or locked=true (optional)
- position=left or position=right (optional, default: traffic practice)
- shift label={\(\text{\texttt{(label-coord)}}\)} (optional, default: (0,0))
- foreground=color (optional, default: black)

This command is equivalent to:
\(\text{\texttt{\signal{shunting,options} at (coord) label (name);}}\)
3. Provided Symbols and their commands

- **Shunt limit**

\[\text{\texttt{\textbackslash shuntlimit}[options] at (coord) label (name);}\]

values for options (comma separated):

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

This command is equivalent to:

\[\text{\texttt{\textbackslash signal[shunt limit,options] at (coord) label (name);}}\]

- **Berth signal/sign**

\[\text{\texttt{\textbackslash berthsignal}[options] at (coord) label (name);}\]

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

\[\text{\texttt{\textbackslash berthsign}[options] at (coord) label (name);}\]

values for options (comma separated):

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

This command is equivalent to:

\[\text{\texttt{\textbackslash signal[berth,options] at (coord) label (name);}}\]

3.3.2. Non-stationary points

- **View point**

\[\text{\texttt{\textbackslash viewpoint}[options] at (coord) label (name);}\]
3. Provided Symbols and their commands

\viewpoint\textbf{[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)

\textbf{Braking point}

\brakingpoint\textbf{[options]} at (coord) label (name);

values for options (comma seperated):

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

\textbf{End of movement authority}

\movementauthority\textbf{[options]} at (coord) label (name);

values for options (comma seperated):

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

\textbf{Danger point}

\dangerpoint\textbf{[options]} at (coord) label (name);

values for options (comma seperated):
3. Provided Symbols and their commands

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

### 3.3.3. Clearing points

**Generic clearing point**

\(\texttt{\textbackslash clearingpoint}[\text{options}] \text{ at (coord) label (name);}\)

values for options (comma separated):

- 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**

\(\texttt{\textbackslash standardclearing}[\text{options}] \text{ at (coord) label (name);}\)

values for options (comma separated):

- 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:

\(\texttt{\textbackslash clearingpoint}[\text{standard, options}] \text{ at (coord) label (name);}\)

**Block clearing point**

\(\texttt{\textbackslash blockclearing}[\text{options}] \text{ at (coord) label (name);}\)
values for options (comma separated):

- 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:

```latex\\ clearingpoint[block,options] \text{ at } (coord) \text{ label } (name);```

### Route clearing point

```latex\\ route\text{clearing}[options] \text{ at } (coord) \text{ label } (name);```

values for options (comma separated):

- 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:

```latex\\ clearingpoint[route,options] \text{ at } (coord) \text{ label } (name);```

### 3.3.4. Transmitters

#### Generic transmitter command

```latex\\ transmitter[options] \text{ at } (coord) \text{ label } (name);```

values for options (comma separated):

- 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)
### 3. Provided Symbols and their commands

#### Balise

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

Values for `options` (comma separated):

- `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:

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

#### Loop

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

Values for `options` (comma separated):

- `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:

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

#### 3.3.5. Miscellaneous

#### Route

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

Values for `options` (comma separated):

- `forward` or `backward` (mandatory)
- `foreground=color` (optional, default: `black`)
3. Provided Symbols and their commands

3.4. Constructions

 Platforms

\platform[options] at (coord);
values for options (comma separated):
- 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 separated):
- 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)

 Bridges

\bridge[options] at (coord);
values for options (comma separated):
- length=length unit (optional, default 4cm)
- width=length unit (optional, default 0.5cm)
- shift left=length unit (optional, default 0cm)
3. Provided Symbols and their commands

`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. Measures

► Track distance

```
\trackdistance between (coord1) and (coord2) distance (value);
```
No options available.

► Train berth

```
\berth[options] at (coord) length (value);
```
values for options (comma separated):
3. Provided Symbols and their commands

- 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**

\texttt{\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 TiKZ \coordinate command. Specify a common hectometer base and orientation if you have to place multiple hectometers, i.e. with: \texttt{\tikzset{hectometer base={(base-coord)},orientation=right};}

**Messure line**

\texttt{\messureline (coord1) -- (coord2);}
\texttt{\messureline (coord1) -- (coord2) -- (coord3) -- etc.;}

No options available.
This command is equivalent to:

\texttt{\path[draw=foreground!50!background,dashed,shorten <=0.75cm,shorten >=0.75cm] (coord1) -- (coord2);}
## A. Symbology

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Symbol</th>
<th>See section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>main track</td>
<td></td>
<td>3.1.1</td>
</tr>
<tr>
<td>2</td>
<td>secondary track</td>
<td></td>
<td>3.1.1</td>
</tr>
<tr>
<td>3</td>
<td>track number</td>
<td>![symbol]</td>
<td>3.1.1</td>
</tr>
<tr>
<td>4</td>
<td>bufferstop</td>
<td>![symbol]</td>
<td>3.1.1</td>
</tr>
<tr>
<td>5</td>
<td>friction bufferstop</td>
<td>![symbol]</td>
<td>3.1.1</td>
</tr>
<tr>
<td>6</td>
<td>track closure</td>
<td>![symbol]</td>
<td>3.1.1</td>
</tr>
<tr>
<td>7</td>
<td>turnout</td>
<td>![symbol]</td>
<td>3.1.2</td>
</tr>
<tr>
<td>8</td>
<td>turnout with fouling point indicator</td>
<td>![symbol]</td>
<td>3.1.2</td>
</tr>
<tr>
<td>9</td>
<td>turnout operated manually</td>
<td>![symbol]</td>
<td>3.1.2</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Symbol</td>
<td>See section</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>10</td>
<td>double-slip turnout</td>
<td><img src="abcd" alt="Symbol" /></td>
<td>3.1.2</td>
</tr>
<tr>
<td>11</td>
<td>diamond crossing</td>
<td><img src="ab" alt="Symbol" /></td>
<td>3.1.2</td>
</tr>
<tr>
<td>12</td>
<td>turnout with points in right position</td>
<td><img src="ab" alt="Symbol" /></td>
<td>3.1.2</td>
</tr>
<tr>
<td>13</td>
<td>turnout with points in left position</td>
<td><img src="ab" alt="Symbol" /></td>
<td>3.1.2</td>
</tr>
<tr>
<td>14</td>
<td>turnout with moving points</td>
<td><img src="ab" alt="Symbol" /></td>
<td>3.1.2</td>
</tr>
<tr>
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### B. Revision History

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<th>Author(s)</th>
<th>Description</th>
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<tr>
<td>0.1</td>
<td>2018-09-14</td>
<td>MS</td>
<td>Basic concept of a library with railway topology symbols and some examples.</td>
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<tr>
<td>0.2</td>
<td>2018-12-19</td>
<td>MS</td>
<td>Added transmitters and minor improvements.</td>
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<tr>
<td>0.3</td>
<td>2019-04-04</td>
<td>MS</td>
<td>Moved snippet folder to root folder and defined and used color foreground and background.</td>
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<td>0.4</td>
<td>2019-07-21</td>
<td>MS</td>
<td>Reworked library for common tikz library layout.</td>
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<tr>
<td>0.5</td>
<td>2020-01-14</td>
<td>MS</td>
<td>Introducing new syntax and providing a documentation.</td>
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</table>
Modified symbol "end of movement authority"; added symbols "braking point" and "danger point".

Martin Scheidt (MS)