



## Reference report: roller coasters in Bayern-Park and Rainbow Magic Land

0 to 100km/h in 3 seconds with over 1g gravity acceleration pushes the roller coaster passengers into their seats. The drive is just a quiet hum.

### The project

The “Shock” roller can be tested in Rainbow Magic Land amusement park in Valmontone Italy. It opened 24th June 2011. The coaster carriages accelerate up to 100km/h in 2.5s.

The “Freischütz” catapult roller coaster in Bayern-park in Reisach Germany was inaugurated 21st August 2011. Using a linear motor the max. 6.5 tonne carriage accelerated in 2.3 seconds up to 80km/h. The carriage has up to 12 passengers and reaches a maximum height of 24m with a looping, top hat and two heartline rolls along the way. The line is 483 m long with a maximum acceleration of 4.4 g.

Both big dippers were built by Maurer AG of Munich Germany. The drive and energy management systems come from ARADEX.

### Energy management

As the enormous amount of energy required during acceleration of the roller coaster carriage cannot be taken directly from the grid, super-caps are used as a buffer. The braking energy is also recuperated. In Valmontone energy distribution in the DC link is via 3 DC/DC converters, in Bayern Park 4 DC/DC converters are used. These serve to charge and discharge the supercaps and power consumption. Using super-caps as a buffer means easy maintenance and there is less wear and tear than with fly wheels, which are also often used in roller coasters. Using super-caps reduces the electric peak load by one third.

The main controller for all ARADEX components is a VECTONUM XL with a V8 Linux operating system. A customer-specific power box controls the semi-conductors.

## Drive system

The modern drive system consists of an LSM drive (linear synchronous motor) from ARADEX (diagram 1). The components are designed for maximum safety for the requirements of passenger transport. Special attention was also paid to efficiency, heat distribution and the mechanical load of the stators. Also, the carriage speed had to be perfectly synchronised with the speed of the moving magnetic field, as otherwise there is no acceleration. This is achieved by a sensor-free position determination.

The linear motor for the "Freischütz" big dipper uses 54 stator elements 1.62 m in length. These convert 1.5 MW of electric power into kinetic energy in a fraction of a second. This corresponds to approximately three times the power density of a transrapid drive

## Highlights

- + Using energy storage systems means minimum connection price
- + Regenerative braking of roller coaster carriages is first of its kind in the world
- + Use of super-caps as buffer for roller coasters
- + Maximum accuracy of end speed independent of charging status and environmental influences.
- + Reduction of the electric peak load for the installation.
- + Position determination of carriages without sensors
- + Fewer mechanical components (winch, gear box, hydraulic pump and hydromotor are no longer needed)
- + Wear-free electric magnetic drive

## Interested? Give us a call:

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„Minimum connection price due to energy storage systems.“

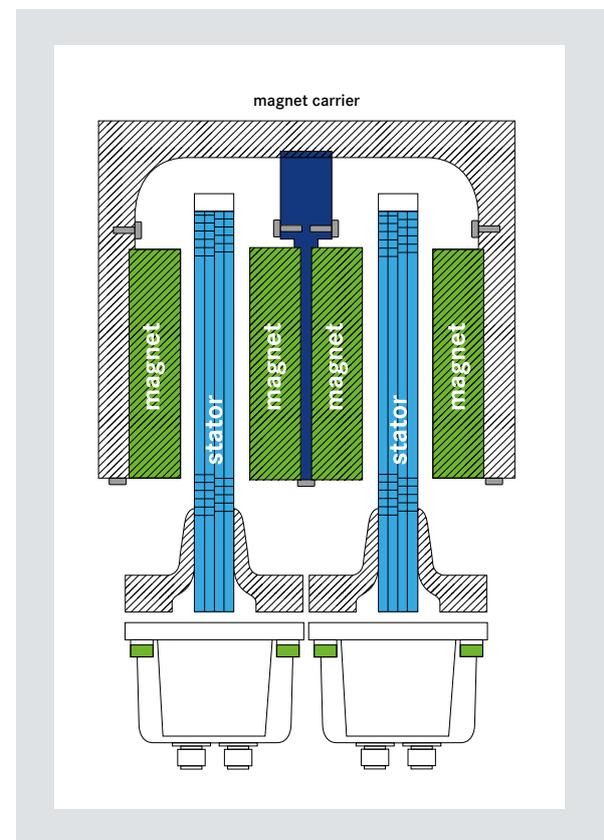


Diagram 1: sketch layout of stators and magnet carrying frame.

