

LEGO® GySEV/ROeEE Siemens Vectron Locomotive

By Donát Raáb

1. Introduction

Vectron locomotives are part of the Europrinter family of locomotives built by Siemens Mobility. These locomotives are quite universal, they are powerful enough to pull heavy freight trains, and their performance makes them capable of pulling passenger trains with great acceleration and top speeds. Most locomotives of the Europrinter family are capable of running under different catenary supplies. Dual-voltage locomotives can serve under AC-supply on different voltages and frequencies, while multi-system locomotives support different AC- and DC-supplies as well. It is also possible to equip the machines with a little diesel motor unit so they can serve the industrial tracks as well, where in most cases no catenary is built.

The GySEV/ROeEE railway company ordered nine of these locomotives from Siemens Mobility, with different equipment (two AC with diesel module, three MS and four AC locomotives). This company is owned by the Austrian and Hungarian State, and also partly by private funds. They serve on different lines both in Austria and Hungary, where two different types of AC catenary support is used (Austria: 15 kV, 16.7 Hz; Hungary: 25 kV, 50 Hz). Since I'm building XXI Century, Hungary-related electric locomotives, electric motor units and modern passenger wagons using LEGO® bricks, I decided to try this locomotive in 8W (Fig.1).



Fig.1: Dual-voltage Siemens Vectron locomotive in GySEV/ROeEE colour pattern

2. Building techniques

I first designed the train in LEGO® Digital Designer. LDD offers the ability to play with virtual bricks, so I can try different solutions for the patterns and shapes of the locomotive without spending any money on real bricks. LDD does not allow certain building techniques (like stressing cheese slopes facing each other). It does have a hinge tool that allows 0.01 degree rotations of bricks and plates with clips, so I could design most of the body of the train in LDD. Once I had a good understanding of the parts I was going to need I moved on to the physical build. The following are some of the special techniques I used to recreate the key features of this locomotive.



Fig.2: The completed LEGO-locomotive. Letters from 'A' to 'F' mark different building techniques – see text for further explanation. Bottom right image shows the LEGO® locomotive in front of the real one.

(A) The sloped pattern: I was thinking for some time on how to create the angular green line on the side of the locomotive. The nearly horizontal lines were easy with plates, but the angular pattern needed a less blocky solution. A single 2×2 green tile is set between white cheese slopes. The tile is held in a place by a hinge brick from the inside. The top part of the angular green pattern is a green cheese slope.

(B) The half-plate problem: Since for the green angular pattern I built three studs in SNOT (1 stud in width equals 2.5 plates in height), a half-plate thin space remained. I used white flag 2×2 parts to fill this gap. The flags are held in place from the inside of the locomotive.

(C) Usage of panel 1×2×1 part: This locomotive has its lights right at the edge, so fixing Power Function LED lights is not trivial. These yellow panels allow some space behind the placement of lights, and this space is enough to mount fiber optics cables – which is perfect for leading the LED light from the blocky Power Function part to the front of the locomotive.

(D) The fiber optics cable also helped me with the top light, as there was no space for the Power Function element between the inverted green slopes and the hinge part fixing the whole windscreen.

(E) The sloping windscreen's edges are also sloping in an awkward direction – I needed a hinge connection capable of maintaining the sloping pattern made from cheese slopes. Fortunately the older finger hinge connection (with 2 and 3 fingers) – which is less bulky in height at the hinge than the newer bar and clip hinges – provided a solution. Though to make the outer green slopes look continuous, a half-stud offset was needed, and this was provided by jumper plates.



Fig.3: The completed build.

(F) Boundary of differently sloped surfaces: When two surfaces meet, closing at a non-parallel or non-perpendicular angle, it always creates the problem of how to minimize the gap between surfaces. In this case I used two rows of cheese slopes (green and yellow), with both rows built in from the top to the bottom.

3. What is inside?

I was personally happy with the building techniques used during the build of the locomotive, but I really wanted to implement something new, something which had not been done before. As I mentioned in the introduction, the real locomotives are dual-voltage or multi-system, so I tried to equip mine with different electric systems of different LEGO® Train eras as a simulation of the different catenary supplies of different countries. Since many 9V/RC operating LEGO® trains have been displayed in the past, I decided to create a unique one, capable of running on both 9V and 12V tracks. And do you remember the diesel module in the real locomotive? This function can be perfectly simulated with the option of running from an internal battery box.

Having 9V, 12V and RC systems together in the same locomotive required some special solutions. The main problem was that if I wanted to use all three operation modes, then RC (driven from SBrick) and 12V pickups should have connected to the 9V train motor. But a 9V train motor can't be separated from 9V track without part modification (and I didn't want to do that with the 9V train motor) – if the locomotive stayed on 9V track it may run. The next problem grew from this fact – I didn't want to short circuit my SBrick by putting current from the track on its output, and connecting the 9V track and internal battery box through the SBrick. A further problem was related to 9V and 12V operation – when the locomotive runs in 9V mode, the '+' and '-' poles of 12V pickups may short circuit the locomotive when both 12V pickups touch the same 9V rail ('+' or '-') when going over a point.

The solution for these problems was to build Power Function polarity reversal bricks into the model, as with the middle '0' position I'm able to separate the SBrick and 12V pickups from the 9V train motor. Both polarity reversal bricks are driven with a 1-1 Power Function M-motor – this allows for remote switching between operation modes (each M-motor is plugged on the outputs of the SBrick). In RC-mode the SBrick powers the 9V motors, while 12V is disconnected (by default this mode is only allowed on non-9V track). In 12V-mode the circuit between the 12V-pickups and the train motor is continuous and in 9V-mode both 12V and SBrick are disconnected. The final problem was to fit all the cables, polarity reversals, M-motors and LED lights into the locomotive. The schematic circuit diagram can be seen in Fig.4.

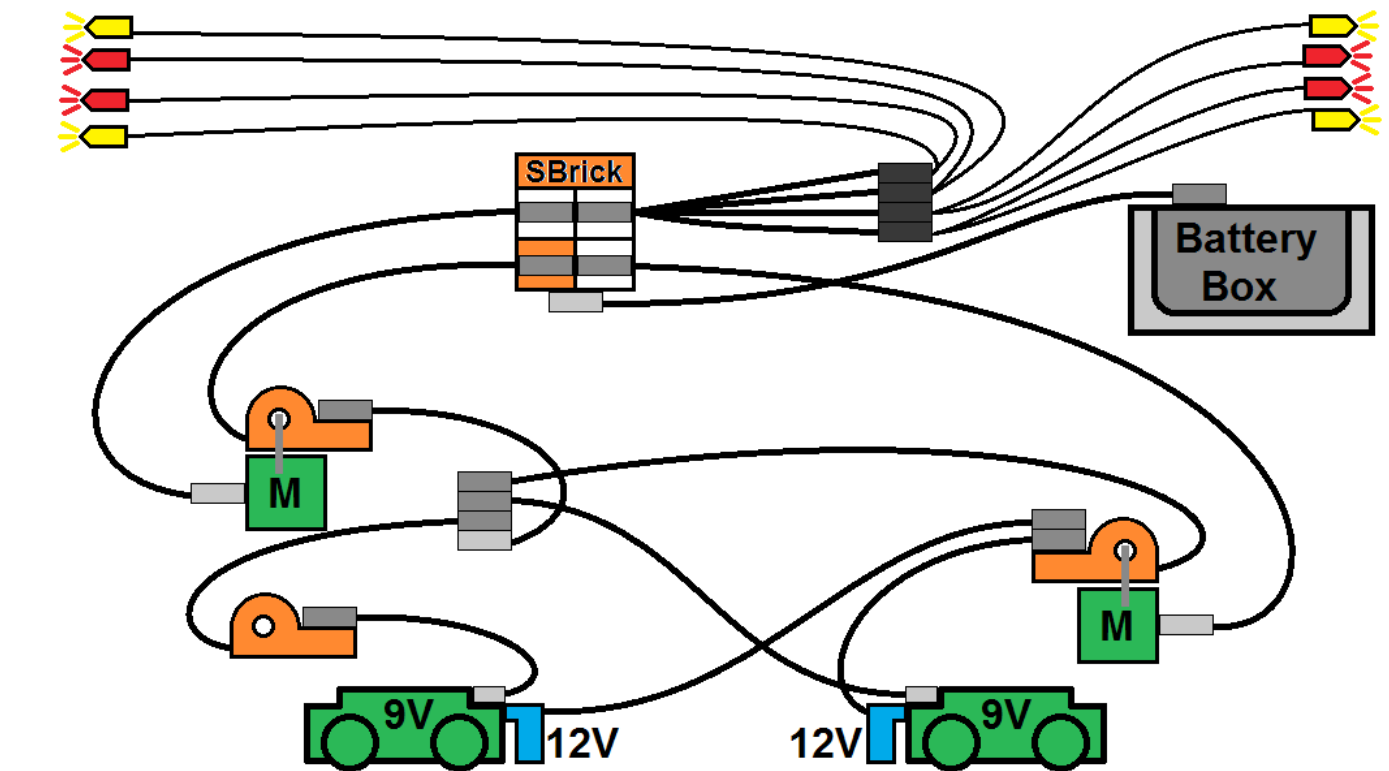


Fig.4: Electrics inside the locomotive. Light gray boxes are the 9V/PF plugs of Power Function extension cables, dark gray ones are the PF-only ends.

There are two minor non-purist solutions in this LEGO-locomotive. The PF LED lighting circuits are modified to allow polarity-sensitive turning on of the lights – depending on polarity only one of the two lights will be lit on the same brick (V. Kovacs, 2011[1]). The other modification concerns the cables between the 12V-pickups and PF-system – these are halved PF-cables. The cut part is screwed into the 12V LEGO-part (which is however original and intended for 12V connectors).

So far I have tested the locomotive at two different LEGO® events. It runs smoothly in 9V and RC, but I could only test the 12V-mode on a short track, since I don't own much of this type of track. However, the 12V experiments were promising, and after carefully cleaning both the track and the pickups it worked like a dream on my 160 stud long test track.



Photo by GySEV



4. Acknowledgements

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[1] V. Kovacs – Power Function Signal Lights, Railbricks Issue #9, pp.21., 2011
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