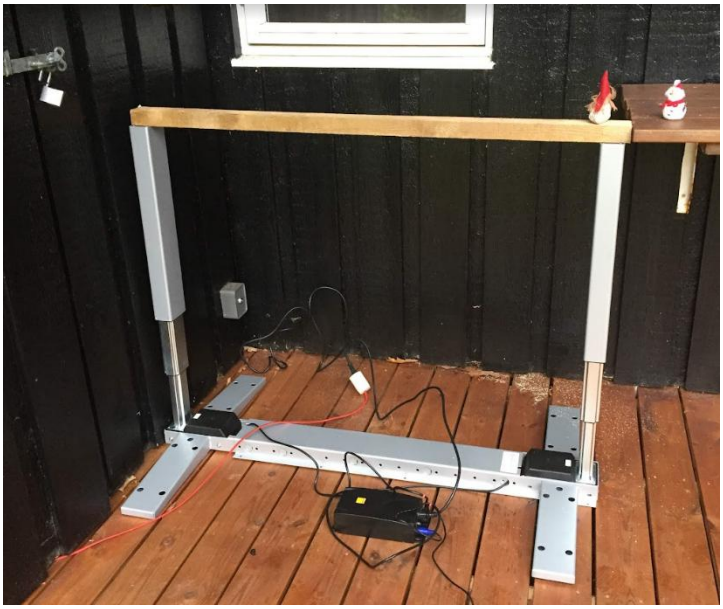
Trainelevator V2 – part 1

4-9-2025 – Jens Krogsgaard, Farum - Denmark

Table of contents

1. Intro

I built my first train elevator during Christmas 2019. It's based on a worn-out height-adjustable desk that I got from my old workplace, KMD.



After a few experiments with the desk, I decided to turn it upside down and build a display case with 7 tracks of 1.4 meters each, attaching it to the legs.
The entire structure was mounted on a base plate with adjustable leveling screws.
Note the elves, who were appointed as test pilots. 😊

Two webcams are mounted at the entrance to the elevator to make it easier to stop the elevator precisely in line with the entry track.

I've been using the original control panel with buttons that are normally mounted under the desk. The cable was extended, and the buttons were placed under the table where my PC and other equipment are located.

This setup has now been working for more than five years – but the time has come to try to make the solution more stable and easier to operate.

2. Wishes for a new version

The main reason for creating a new solution is that I want a more stable and precise train elevator. In the old setup, the display case was mounted on the side of the legs. This meant that even a small movement of the base plate caused the tracks to no longer align perfectly.
I also wanted to implement automatic movement to each track, which specifically requires the elevator to be stable and accurate.

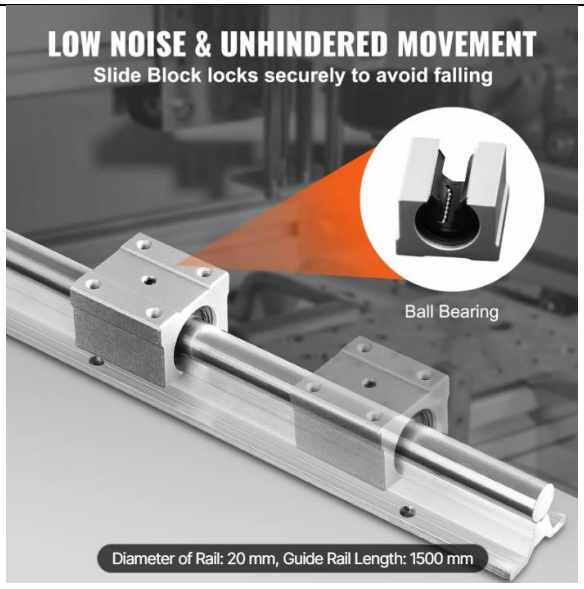
Wish list:
- More stable and precise
- Takes up less space in the room
- Straighter approach tracks – currently two R2 curves in succession
- Improved control – possibly automation – select a track and move there automatically

One important reason why I'm now starting to build the new version is the many new possibilities available today with AI – especially ChatGPT, which I use a lot. It's now possible to *"discuss"* different solution ideas, which is invaluable when working mostly on your own.

3. New version – part 1

In the old version, as mentioned, the display case was suspended from the legs of the height-adjustable desk.
In the new version, the display case will be guided by a pair of rails that are bolted to the wall. The rails used are a set of **VEVOR Linear Guide Rail Set, SBR20 1500mm**

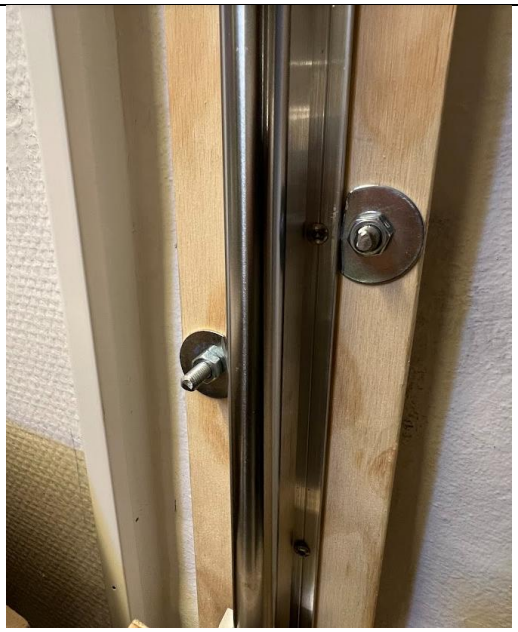
The length of 1.5 meters fits perfectly – and the 20 mm rods provide plenty of strength and stability.



There are ball bearings in the four small carriages.

The wall behind the existing elevator was insulated with 50 mm of polystyrene and covered with plasterboard. This was removed so the rails could be mounted directly onto the brick wall. At the same time, this brings the tracks closer to the wall, which helps straighten the approach track. It was a very messy job, and the lady of the house quite understandably 😊 insisted that the wall be nicely restored to match the other walls, which were renovated in 2023 after the water damage.

Eight M8 threaded rods per rail were installed – they were secured with Fischer injektionsmørtel



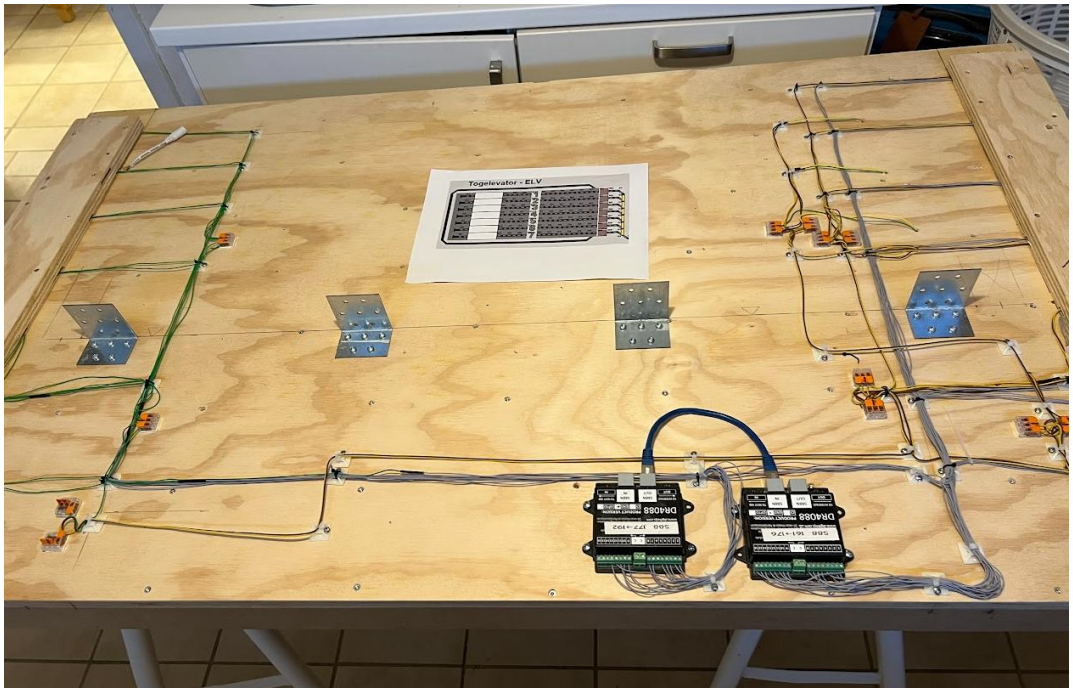
Horizontal slots were milled into the 20 mm plywood board, allowing it to be adjusted both in and out as well as sideways.

I used a Bosch Quigo krydslaser for precise alignment

Ready for mounting the display case. The height-adjustable legs are now used to lift the display case – they are no longer attached to it.

I spent a lot of time precisely aligning the rails so they are perfectly positioned. A spirit level works well for the rough alignment, while the cross-line laser provides the final accuracy. The advantage here is that you can measure both from the front and from the side.

The wiring for the display case was rerouted during the rebuild. The following functions are included:
• Power supply for the 7 tracks – can be manually switched off via a button
• LED lighting above the 7 tracks – can be manually switched off via a button
• Feedback sensors – 3 per track, a total of 21
• Position feedback – for each track – REED switches – a total of 7



- New wiring harness. The steel brackets are used as stops for the height-adjustable legs. The following connections now need to be routed to the display case:
  • Power supply for the rails
  • Power supply for the LED lighting
  • S88 network cable in
  • S88 network cable out – continuing to transfertable area


External connections to the display case – experiment with a counterweight ball – a plastic ball filled with nuts. 😊

Manual switches for lights and power.

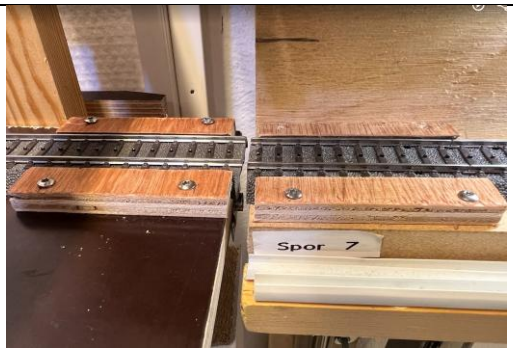
Ready for testing – the display case is bolted to the plywood board using the two small carriages.

There are ball bearings in the two small carriages.

Testing the elevator – it runs perfectly.

The control box for the height-adjustment functionality is now placed in the “foundation box.”

Reed switch for each track and a magnet. Connected to the S88 so the position can be determined.



Track adjustment – special strips were milled so the rails can be fixed in place.

Testing each track. All feedback signals are tested, and both arrival and departure are checked. Everything works perfectly!

A very patient dog – soon ready to go for a walk.

The train elevator has now been tested from Windigipet, and everything works perfectly. Most of the goals have now been achieved:

- **More stable and precise**

✓ Very stable and precise – nothing can "wobble" anymore

- **Takes up less space in the room**

✓ Previously about 30–35 cm – now only 15 cm

- **Straighter approach track – previously two R2 curves in succession**

✓ The track has been straightened – previously a 12 cm offset, now only 6 cm

- **Improved control – possibly automation – select a track and move there automatically**

Only the last point remains – that will be the focus in part 2.

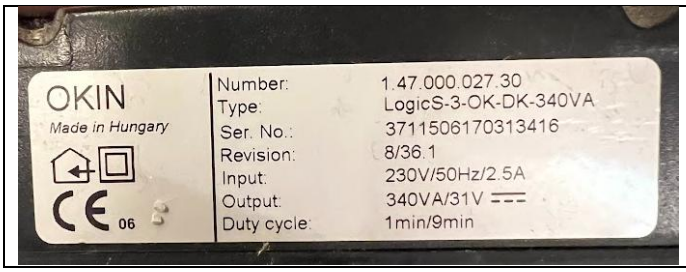
3.1. Materials list

Part	Description	Suppliers	Price euro
Linear railguide	Linear guide rail set, SBR20 1200 mm	Vevor	80
Wall repair	Paint – wood – and others	Jem og Fix	40
two component adhesive	Two-component adhesive – for securing threaded rods in brick walls	Bauhaus	25
screws, bolts	Various screws, bolts, and threaded rods	Jem og Fix / Bauhaus	40
plywood	18–20 mm plywood offcuts	Silvan	40

Part	Description	Suppliers	Price euro
electrical components	Various electrical components	Nettog/Harald Nyborg	35
Laser	Bosch Quigo Green laser	Bauhaus	80
Märklin – C-track	2 Märklin 24230 (R2) was replaced by 2 Märklin 24315 (short R3) and 24077 (77 mm straight)	Nettog	12

4. New version – part 2 – Automatic control – plan

I had a few discussions with ChatGPT about this subject – my controlbox and handset is:



The current plan is to mount two Hall sensors per track – an upper and a lower sensor. For each track, a magnet will be mounted on the display case. It must be positioned very precisely and fitted with a narrow shielding cover to increase accuracy. An ESP32 (microcomputer) reads the values from the sensors. When the first sensor is triggered, the system switches to "creep speed," and when it reaches the midpoint between the two sensors, it stops. It should be possible to stop with an accuracy of 0.2–0.3 mm. It will be exciting to see if that's achievable.

I've agreed with ChatGPT that I'll start with a small test setup to gain experience in this area. It has created sketches, code, and shopping lists – but I'll assemble and test the project myself.

I've had long conversations with ChatGPT about the project, and it's been a lot of fun. However, we both agree that starting with a small proof of concept is probably a good idea.

Proposed test setup:

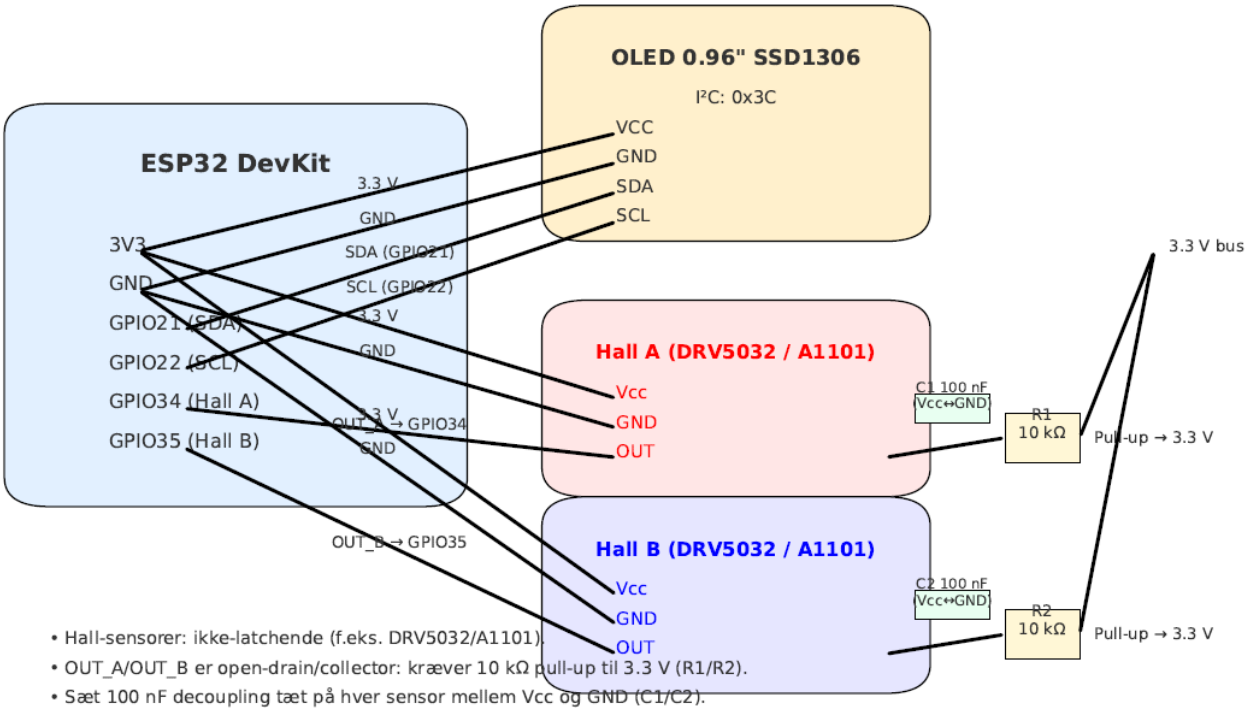
Component	Function	Note
ESP32 DevKitC	controller	Brug 3.3 V til Hall-sensorerne
2× DRV5032FB eller A1101	Hall A og B	Monter i afstand 2,2 mm center–center
1× lille magnet	simulerer elevator	Fx 3×2×1 mm N52 limet på pladen

OLED 0.96" I²C (SSD1306)	viser status	SDA=GPIO21, SCL=GPIO22
3D-print / træplade / skinne	bevægelsesakse	så magneten kan føres roligt forbi sensorerne
Breadboard + 10 kΩ pull-ups + 100 nF	nem opkobling	brug ledninger <10 cm

Test-kode:

```
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>

#define OLED_ADDR 0x3C
Adafruit_SSD1306 display(128, 64, &Wire, -1);

#define HALL_A 34
#define HALL_B 35

void setup() {
  pinMode(HALL_A, INPUT);
  pinMode(HALL_B, INPUT);
  Wire.begin();
  display.begin(SSD1306_SWITCHCAPVCC, OLED_ADDR);
  display.clearDisplay();
  display.setTextSize(1);
  display.setTextColor(SSD1306_WHITE);
}

void loop() {
  bool a = digitalRead(HALL_A);
  bool b = digitalRead(HALL_B);
  bool overlap = a && b;

  display.clearDisplay();
  display.setCursor(0, 0);
  display.printf("Hall A: %s\n", a ? "ON" : "off");
  display.printf("Hall B: %s\n", b ? "ON" : "off");
  display.printf("Overlap: %s\n", overlap ? "TRUE" : "false");
  if (overlap) {
    display.setCursor(0, 45);
    display.setTextSize(2);
    display.print("STOP!");
    display.setTextSize(1);
  }
  display.display();
  delay(50);
}
```

Forbindelsesdiagram – ESP32 + OLED (I²C) + 2× Hall-sensorer



- Hall-sensorer: ikke-latchende (f.eks. DRV5032/A1101).
- OUT_A/OUT_B er open-drain/collector: kræver 10 kΩ pull-up til 3.3 V (R1/R2).
- Sæt 100 nF decoupling tæt på hver sensor mellem Vcc og GND (C1/C2).
- OLED: SSD1306 I²C (adresse 0x3C). SDA→GPIO21, SCL→GPIO22.
- Fælles GND mellem ESP32, OLED og sensorer.