

## Abstract of <http://gelit.ch/Train/DirectRail.pdf> by Gérald Litzistorf – Mai 2020

After 5 years with Märklin Gleisbox 60113, it was time to emulate this box.

I explain in my French document the main defects that force the software based on Raildue to wait.

Giving a command to a locomotive is a trivial operation which consumes a time less than 13 ms with **DirectRail**.

It is necessary to pause after a change of position of the turn to avoid excessive current consumption.

During this pause equal to 500 ms, DirectRail allows locomotives commands through S88 detection.

In case of conflict between locomotive & turn commands, locomotive commands have priority and will be executed ASAP (1-13 ms); turn commands will be postponed to the next packet of 13 ms.

This process control is full **determinist** and is possible with the power of SAM3X used by Arduino Due.

1. The electrical signal is not generated by the CPU (Ardu rail) but with the PWM (Pulse Width Modulation) cell embedded in SAM3X.
2. The computing power of SAM3X is similar with the first Pentium. It is 25 faster as Arduino Uno for fast the same price !
3. You will find a lot of interesting features in SAM3X in this document of 1459 pages !  
[http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-11057-32-bit-Cortex-M3-Microcontroller-SAM3X-SAM3A\\_Datasheet.pdf](http://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-11057-32-bit-Cortex-M3-Microcontroller-SAM3X-SAM3A_Datasheet.pdf)

DirectRail is a software & **hardware** project :

- You add L293D H\_Bridge + external DC 18V
- **You don't need Box** like Railuino, Raildue or Ardu rail

DirectRail uses MM2 protocol

- You are limited to F0-F4 functions
- ... but with ESU Locdecoder, I have 16 functions on my beautiful BEMO RHB Ge 4/4 III 651  
<https://shop.zugkraft-stucki.ch/de/11812/bemo-rhb-ge-4-4-iii-651-glacier-on-tour-h0-normalspur-3l-ws-mit-esu-loksound-m4-v4-0-decoder>

DirectRail is a **minimal demo software for hobbyist** who can implement other features like :

- S88 detection → my personal version manage 80 inputs in 4 ms during packet time = 13 ms  
Read <https://forum.arduino.cc/index.php?topic=677437.0> to find the GOOD time
- Turn optimization to avoid executing unnecessary commands : `seT (5,0)` ; ~~`seT (5,0)`~~ → `seT (5,1)` ;
- Current consumption
- GUI → my personal version based on Windows 10 uses WPF technologies  
In automatic mode, it displays positions of trains and statistics  
A **master**=PC – **slave**=Arduino mechanism is initiated each 5 second  
You can observe how time accuracy of Windows 10 is bad  
The reason is not the power of my Intel i7 (Task Manager : CPU under 10%)  
**I will never control my trains with Windows; I prefer Arduino Due !**
- **Don't forget to test the comfort of the Debug**  
I use another Arduino Due  
The first Arduino Due sends to Serial3  
The second receives on Serial3 and transmits to Putty terminal via USB

**Enjoy to control trains & turn with simply & powerful technologies based on Arduino Due**

**It's determinist, easy to debug and powerful enough to 100 trains !!!**

... I will explore ASAP