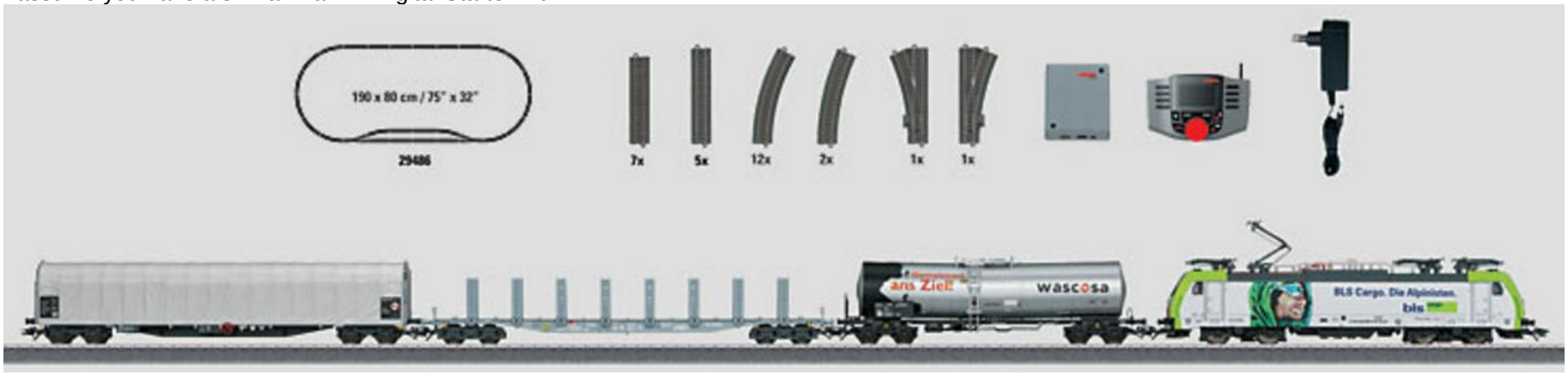
Auteur **Gérald Litzistorf – 22 avril 2017 – www.gelit.ch – gelit@bluewin.ch**
The author assumes no responsibility for performing these operations yourself !

§1 Goal **This document explains how it is possible to replace the Maerklin or Central Station Mobile Station with an Arduino Due board**
It also shows the potential of this solution to automate your models including 10,100, ... trains

§1.1 Prerequisite I assume you have a similar Marklin Digital Starter Kit :

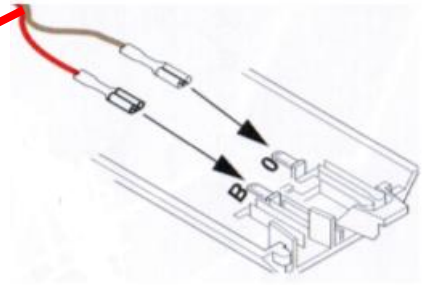


§1.2 Maerklin The components provided by Maerklin are :

Mobile Station
The Arduino Due module (about CHF 40) will replace this Mobile Station

The CAN bus facilitates this expansion

Gleisbox (connection box)



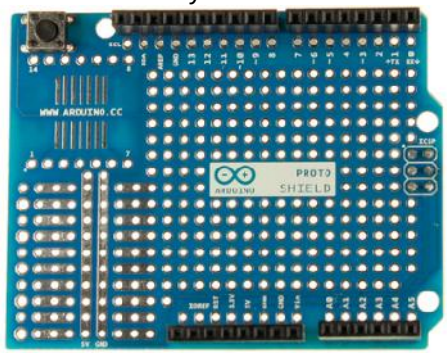
Rail
B is connected to the central conductor
The rail is connected to 0

§1.3 Railuino This initiative is based on **Jörg Pleumann's Railuino** project.

Several constraints (memory space, reactivity, ...) forced me to use the Arduino Due board in order to benefit from resources such as f = 84 MHz, 96 kB SRAM and 512 kB flash memory.

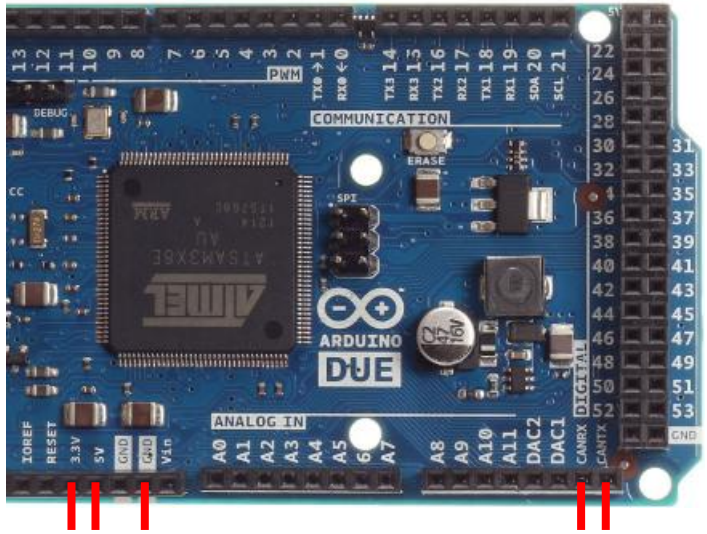
§2 Arduino Due

Arduino Due offers 2 CAN interfaces. We only use the Can0 controller and add a transceiver.
Use a Proto Shield

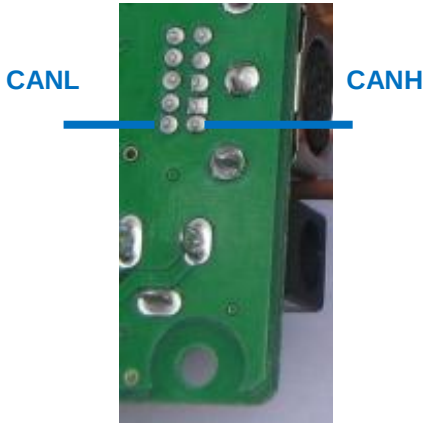


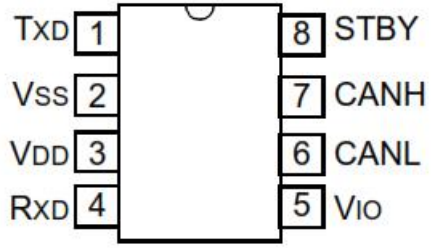
Add a transceiver MCP2562; Connect it according to this table

I prefer to solder on the printed circuit of the Gleisbox because the male connector is very difficult to find !



Arduino Due	MCP2562	Gleisbox
CANTX	1	
GND	2	
5 V	3	
CANRX	4	
3.3 V	5	
	6	CANL
	7	CANH
GND – 100kΩ	8	





§3 Installation

How to install Arduino IDE based on https://www.arduino.cc/en/Guide/ArduinoDue
I use Windows 7

1) Install the development tool from https://www.arduino.cc/en/Main/Software

2) Add https://www.arduino.cc/en/Guide/Cores

3) Install the library https://github.com/collin80/due_can
If necessary, use https://www.arduino.cc/en/Guide/Libraries

4) Install the library http://www.gelit.ch/Raildue.zip

5) I use putty (http://www.putty.org/) to communicate with the program (Serial.print)

6) Menu offered by the Basic program (lowercase letter)

```
case 'a': if (Speed < 600) {Speed = Speed + 100; cmd.LocSpeed(Loc,Speed);} break;
case 'b': if (Speed != 0)  {Speed = Speed - 100; cmd.LocSpeed(Loc,Speed);} break;
case 'd': if (Dir == 1) {Dir = 2;} else {Dir = 1;} cmd.LocDir(Loc,Dir); break;
case 'l': if (Light) {Light=false; cmd.LocFunction(Loc,0,0);} else {Light=true;cmd.LocFunction(Loc,0,1);} break;
case 't': cmd.SetT(9,true, Turn_Delay); break;
case 'f': cmd.SetT(9,false,Turn_Delay); break;
```

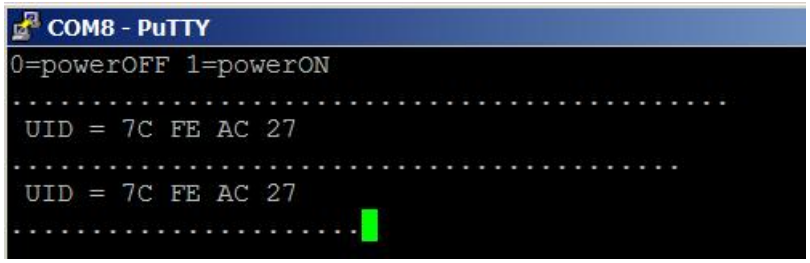
The Basic program uses the Maerklin locomotive 29486 → http://www.maerklin.ch/en/products/details.html?art_nr=29486
It is delivered with address 25 and uses the protocol MM2

The following section explains how to manage an MFX locomotive

§4 MFX Recent locomotives are MFX compatible to prevent the user from manually entering an address
The dialogue between locomotive and Mobile Station is not published by Maerklin

§4.1 no MS Disconnect the Mobile Station

Use the Get_MFX_UID program to find the unique identifier of your locomotive



§4.2 with MS You can get this UID by resetting the locomotive with your Mobile Station

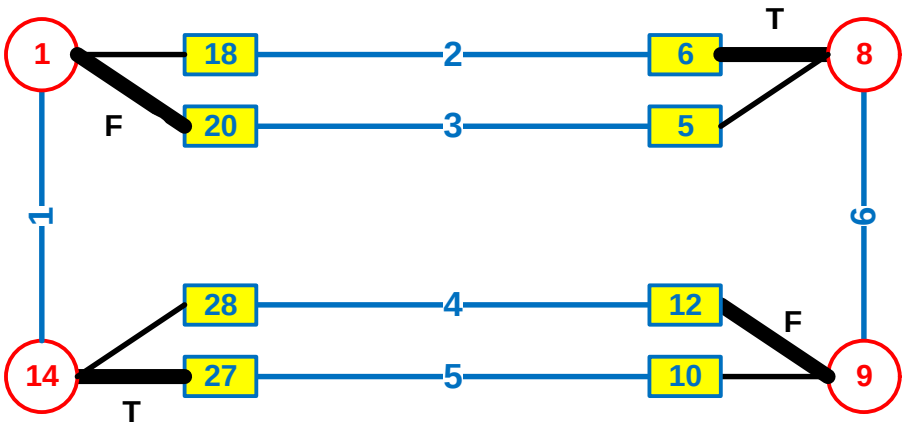
```
UID = 7D FA 5A C3
```

§4.3 Remarques Works based on http://desktopstation.net/mfx_identification.html (thanks to Yaasan)
https://www.maerklin.de/fileadmin/media/service/software-updates/cs2CAN-Protokoll-2_0.pdf

I decided not to support the functions MFxDiscovery, ...

So I add one line per locomotive in my programs; See program Sequence

§5 Automation The Sequence program controls 2 MFX trains and uses 4 needles

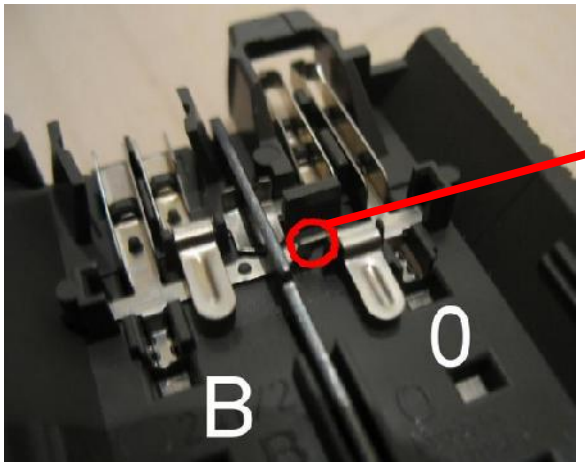


- The network comprises 6 segments
- Trains are to be stopped on segments 2 to 5
- The length of trains must not exceed the length of the shortest segment

- Locomotive A performs sequence 2 - 1 - 5 - 6 – 2
- Locomotive B performs sequence 4 - 1 - 3 - 6 – 4

- The position of the turns 1, 8, 9, 14 is fixed

§5.1 Detection To automate the movements of the train, it is essential to know its position
In the example, segment 2 is created from feedback (detection) 6 and 18 on rails 15 to 20 cm in length
The loc A will brake thanks to the retro 6 and stop on the retro 18
It can start if segment 1 is free



- The Maerklin C track consists of 2 galvanically connected rails + 1 central conductor

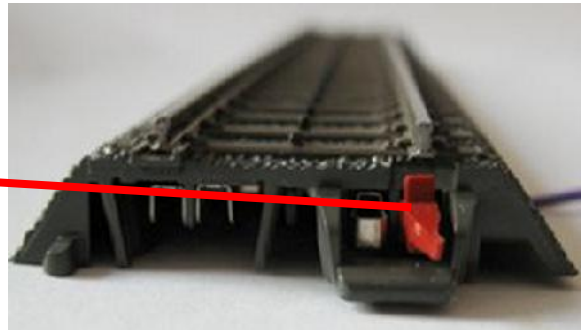
- **Use cutting pliers to remove this bridge at both ends of the rail**

- **Isolate at both ends with 74030**

- Solder 1 wire to the insulated rail; Connect it to an input of the Littfinski module

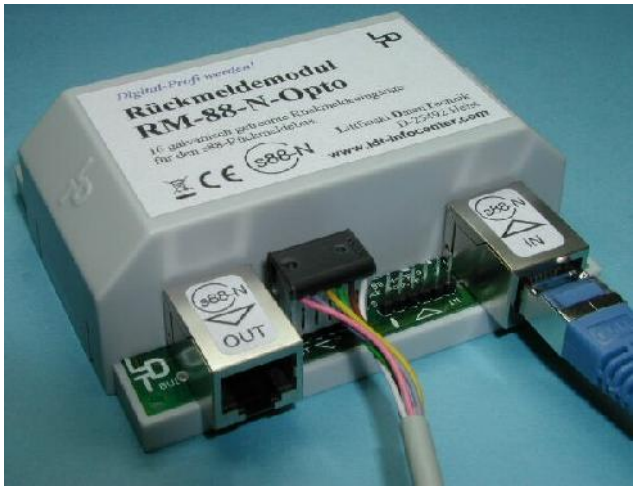
- Train detection will occur when loc. or wagons will short-circuit the 2 rails

- Be careful not to turn off the power !



§5.2 S88

- I recommend **Littfinski's RM-88-N-Opto**
  https://www.ldt-infocenter.com/dokuwiki/doku.php?id=de:rm-88-n-o
- It is a converter 16 parallel inputs - 1 serial output that uses 4 Arduino ports due + 2 supply wires
- **Connect the terminal Ref of each module to the center conductor of the rail**
- These modules are easily cascaded with simple ethernet cables (RJ-45 connector)



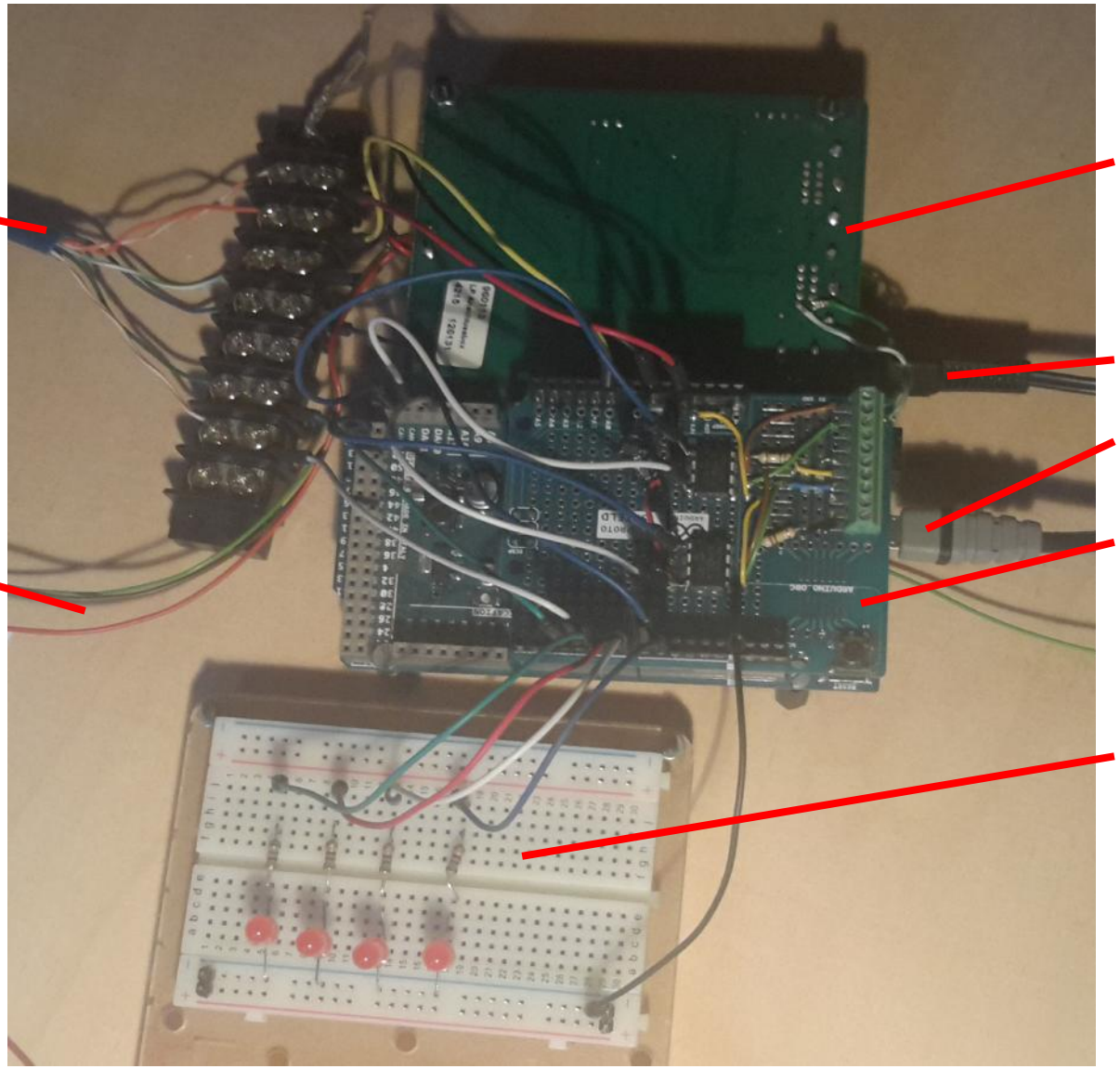
§5.3 Wiring

- 2 power wires
  +5V
  GND
- Sequence program uses
  Arduino pin **A0 = data**
  Arduino pin **8 = clock**
  Arduino pin **3 = load**
  Arduino pin **4 = reset**

s88-N wiring standard		
RJ45 pen	**Colour in UTP cable**	**s88-N, BMD16N, BMD16N-SD**
1	Orange-white	+5V/+12V
2	Orange	Data
3	Green-white	GND
4	Blue	Clock
5	Blue-white	GND
6	Green	Load
7	Brown-white	Reset
8	Brown	Railsignaal

From http://www.floodland.nl/aim/info_s88_kabels_en_1.htm

§6 Overview


S88
Gleisbox
Gleisbox power
USB cable to PC
Arduino Due + 2 transceivers
Only 1 is necessairy
Rail Maerklin
4 LEDs to debug (optional)

§7 Thanks **I want to thank those authors who helped me in my learning**

1) Jörg Pleumann → https://code.google.com/archive/p/railuino/

2) D. Meurisse → http://wiki.mchobby.be/index.php?title=Railuino
http://wiki.mchobby.be/index.php?title=Railuino-Asm-Cable

Signal	RJ45	Mini-DIN	Couleur
CAN_H	1	4	Orange - blanc
CAN_L	2	8	Orange
GND	7	2	Brun - blanc
12V	8	1	Brun

3) Yaasan → http://desktopstation.net/

4) Maerklin → https://www.maerklin.de/fileadmin/media/service/software-updates/cs2CAN-Protokoll-2_0.pdf