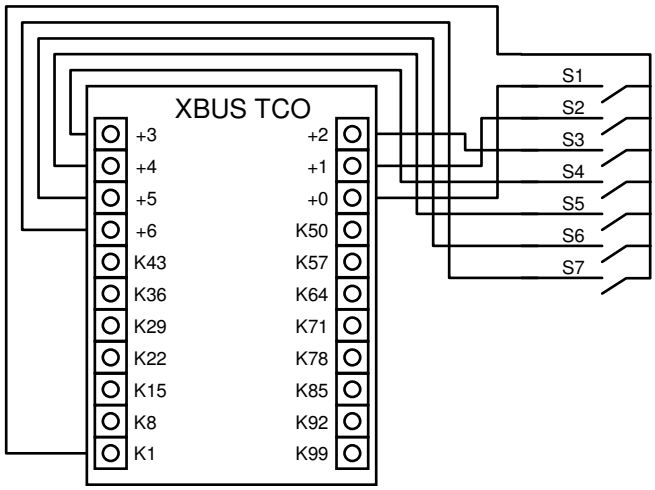
Diode boards for XBUS TCO

What's the problem?

The inputs of XBUS TCO board are multiplexed. In order for the microcontroller to recognize an input among *n*, these inputs must be equipped with diodes, which are not provided on the board.

There are seven hardware inputs marked +0 to +6. If only seven control switches are needed, there is no need for any diode and you can directly connect the switches to the board like this:



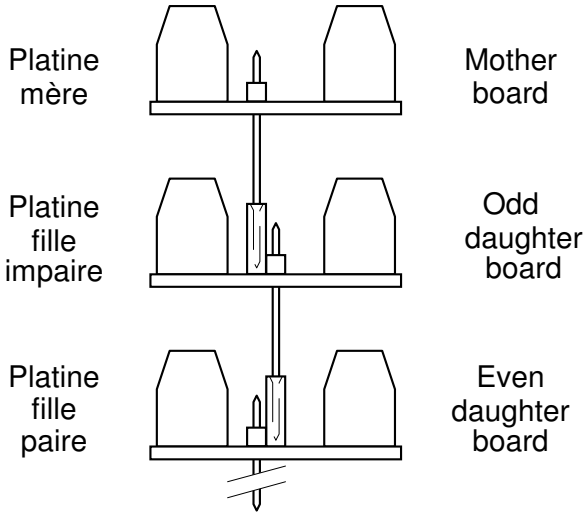
For more than seven inputs, diodes must be provided; but it is not practical to wire diodes "in the air", not to mention the risks of short-circuits and therefore system failure. That's why I offer diode boards to easily and conveniently extend the number of inputs on the XBUS TCO board.

Principle

The diodes are installed in groups of seven on small PCBs. The first one, which I call "mother board", has sixteen terminals to connect to the XBUS TCO card:

- on one side, there are seven terminals to be connected to the control switches, plus a common terminal for all these switches;
- on the other side, there are a terminal K*n* and seven terminals +0 to +6. The terminal K*n* must be connected to terminal K1 of the XBUS TCO board.

Then, a "daughter board" comes and connects under the motherboard. It also includes the eight terminals to be connected to the control inputs, but only one to be connected to the XBUS TCO card, namely the K*n* terminal. For the first daughter board, K*n* will be connected to K8. For the second, it'll be connected to K15, and so on. Connections to terminals +0 to +6 are made automatically by plug-in connectors with a 1/10" pitch.

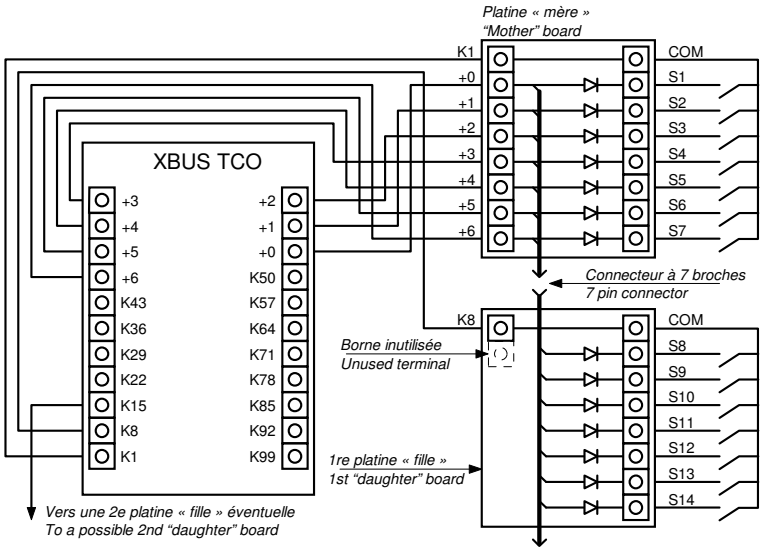


Since each level requires a male connector and a female connector side by side, they must be swapped to each other at every level. That's why I distinguish the odd-numbered daughter boards (1st, 3rd level) and the even ones (2nd, 4th level).

As a precaution, I think it is better to superimpose no more than five boards - i. e. a motherboard plus four daughter boards. This already makes it possible to connect

35 control inputs. If more are needed, you can create a second group of boards, then a third group, which makes it possible to reach the maximum capacity of the XBUS TCO board, which is 105 entries.

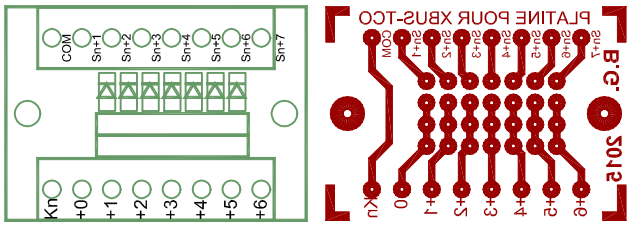
Wiring example for 14 turnouts



Making the boards

PCB

The circuit is the same for all boards, but some parts are only mounted on some boards.

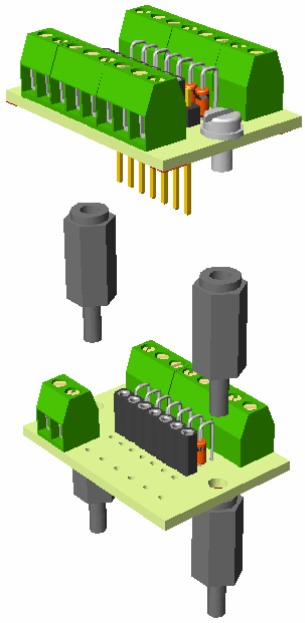


Etching mask

See Appendix.

Parts mounting

There is no difficulty in this assembly. It is only necessary to pay attention to the position of the male connectors: *the longer part of the pins must cross the printed circuit!* The diodes can be through-hole or SMD devices. If they are through-hole, the diodes must be mounted vertically.



Wiring the boards

The boards must be connected to the XBUS TCO *before being mounted on top of each other*. A new board will be fitted *under the previous ones*.

M3 threaded, 15 mm high spacers separate and hold the boards together.

Table of material according to the number of entries required

Note: M = Motherboard; OD = odd daughter board; ED = even daughter board.

Up to … turnouts	M	OD	ED	Configuration		
				1st group	2nd group	3rd group
7	0	0	0			
14	1	1	0	M+OD		
21	1	1	1	M+OD+ED		
28	1	2	1	M+OD+ED+OD		
35	1	2	2	M+OD+ED+OD+ED		
42	2	2	2	M+OD+ED+OD+ED	M	
49	2	3	2	M+OD+ED+OD+ED	M+OD	
56	2	3	3	M+OD+ED+OD+ED	M+OD+ED	
63	2	4	3	M+OD+ED+OD+ED	M+OD+ED+OD	
70	2	4	4	M+OD+ED+OD+ED	M+OD+ED+OD+ED	
77	3	4	4	M+OD+ED+OD+ED	M+OD+ED+OD+ED	M
84	3	5	4	M+OD+ED+OD+ED	M+OD+ED+OD+ED	M+OD
91	3	5	5	M+OD+ED+OD+ED	M+OD+ED+OD+ED	M+OD+ED
98	3	6	5	M+OD+ED+OD+ED	M+OD+ED+OD+ED	M+OD+ED+OD
105	3	6	6	M+OD+ED+OD+ED	M+OD+ED+OD+ED	M+OD+ED+OD+ED

In the complete configuration (105 turnouts), there are fifteen boards in three groups. In the case of two or three groups, the matching terminals +0 to +6 of all mother-boards must be connected together and to XBUS TCO board.

Bill of material

Partlist for each type of board

Prices are in Euros and are estimates, VAT included, shipping costs excluded.

Mother board

Part	Qty	Total price
Terminal block 3,5 mm pitch - 3 points	4	1,16
Terminal block 3,5 mm pitch - 2 points	2	0,40
Diode 1N4148	7	0,16
Male connector 0.1” pitch - 7 points	1	0,06
Threaded spacer M3 L = 15 mm	2	0,46
Screw M3 × 6	2	0,04
Washer M3	2	0,014
FR4 one sided copper 28 × 37 mm	1	0,17
	Total	2,47

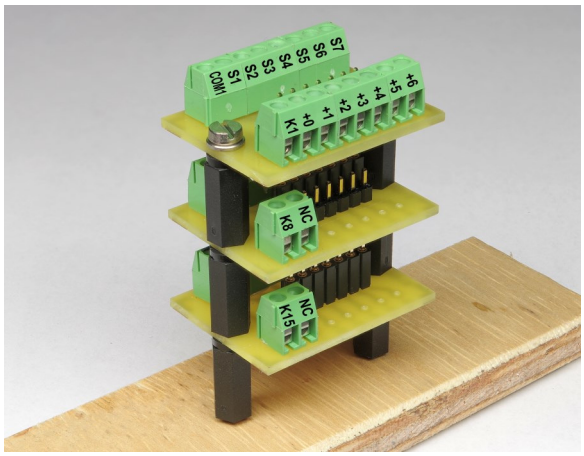
Daughter boards

Part	Qty	Total price
Terminal block 3,5 mm pitch - 3 points	2	0,58
Terminal block 3,5 mm pitch - 2 points	2	0,40
Diode 1N4148	7	0,16
Male connector 0.1” pitch - 7 points	1	0,06
Female connector 0.1” pitch - 7 points	1	0,42
Threaded spacer M3 L = 15 mm	2	0,46
FR4 one sided copper 28 × 37 mm	1	0,17
	Total	2,27

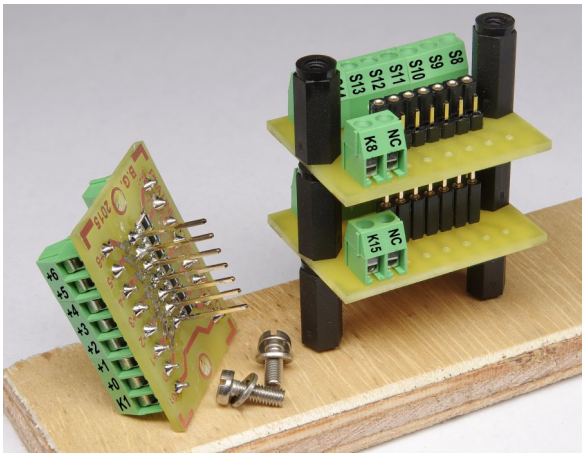
Possible suppliers (prices match the specified quantities)

Part	Qty	Price	Suppler
Terminal block 3,5 mm pitch - 3 points	10	2,90	LED-Megashop
Terminal block 3,5 mm pitch - 2 points	10	2,00	LED-Megashop
Diode 1N4148, SMD 1206 size	100	2,24	TME
Male connector 0.1” pitch - 40 points	10	2,75	TME
Female connector 0.1” pitch - 36 points	1	2,07	TME
Threaded spacer M3 L = 15 mm	10	2,27	TME
FR4 one sided copper 1,6 / 35µm, 210 × 300 mm	1	9,76	TME

Pictures of prototype



Set consisting of one motherboard and two daughter boards.



View of the disconnected motherboard bottom. Diodes are SMDs.

PLATINE A DIODES POUR CARTE XBUS TCO

DIODE BOARD FOR XBUS TCO BOARD

ÉCHELLE 1:1 - TO SCALE

