

Interface 21MTC

Historical

This 21MTC interface was originally developed by ESU for Märklin/Trix, hence the abbreviation 21MTC (Märklin-Trix-Connector with 21 pins).



Symbol of the 21MTC interface

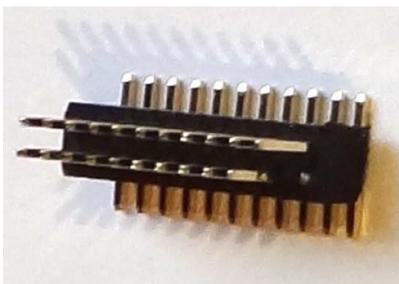
At that time, the 8-pole interface was still the measure of all things. However, Märklin did not use this interface, but designed custom-made decoders for most locomotives, which only fitted the respective locomotive model series.

In the long run, however, this became too costly; Märklin and especially ESU wanted a "standard" decoder that fitted all locomotives with a corresponding adapter. This way the decoder development could have been done at ESU and the adapter development at Märklin. In addition, at that time Märklin relied on the brushless three-phase C-Sinus motor for the premium locomotives, which needed more than just the two connections of a DC motor.

The 21MTC interface should cover these and future needs (ZugBus). Thus, the pin assignment of the 21MTC was tailored to these requirements. The driver for the three-phase motor was to be merged into one unit with the decoder at some point, instead of being used as a separate PCB. The 21MTC interface was born.

The connection mechanically consists of a double row male connector on the adapter, and a corresponding female counterpart on the decoder. The pin spacing is in 1.27mm pitch ($\frac{1}{20}$ inch).

To prevent the decoder from being plugged in 180° upside down, pin 11 was omitted or closed on both sides.



Connector of the 21MTC interface: This pin side is on the adapter, the socket side is on the decoder.

But the development went differently than planned: The three-phase motor was dropped over time for cost reasons, the train bus was hardly implemented (SUSI interface).

Instead, the need for more switchable outputs became greater and greater. But there was no more space on the 21MTC for precisely these function outputs (aux connections).

The confusion arose

This led to more and more decoder manufacturers using the connections for the sine motor, which were no longer needed, for further aux connections without further ado.

And it got worse: The two outputs Aux3 and Aux4 were, in the original definition of the 21MTC, led out directly from the processor (logic level, around 5VDC) and were needed to control the driver for the sine

motor. These could therefore not be used for the connection of consumers. If this was nevertheless attempted, it led to a defect in the decoder.

Here, too, the decoder manufacturers have deviated from the original definition and "amplified" these outputs - i.e. designed them as full-fledged consumer outputs.

At ESU these decoders are marked with "MKL" in the designation, at Zimo the decoders with amplified outputs have a "D" at the end of the article number, those with logic level a "C". Even Märklin has left the original 21MTC definition and relies fully on amplified outputs for Aux3 and Aux4.

So now we have the salad with the 21MTC. Not only are the different versions not compatible with each other, but using the wrong decoder can destroy it or cause a defect in the decoder adapter.

And it goes even further

Further "redefinitions" of the 21MTC arose with the function decoders. With these, the motor connections are not needed and were therefore simply "misused" by some manufacturers for further function outputs.

At Lüssi Hobbyartikel, we are aware of all these problems.

For this reason, we carry two versions of most newer decoder adapters:

- Without amplification of the Aux3 and Aux4 outputs, for decoders with amplified outputs.
- With amplification on the adapter, for decoders with logic level.

At https://luessi.ch/pdf/Decoderliste_21MTC.pdf we also have a list of the most common 21MTC decoders from various manufacturers, showing whether the outputs are amplified or logic-level.

Here is the comparison of the original 21MTC definition with the colours according to the Märklin house standard on the left and the definition defined in the NEM 660 with the "DCC" colours on the right.

21MTC Märklin Farben				21MTC NEM Farben			
Hallsensor 1	1	22	Schleifer, Pantograf	Hallsensor 1	1	22	Schiene rechts
Hallsensor 2	2	21	Räder, Masse	Hallsensor 2	2	21	Schiene links
Hallsensor 3	3	20	DC (-) Funktionen GND	Aux 6 (L)	3	20	DC (-) Funktionen GND
Aux 4 (L)	4	19	Motor +	Aux 4 (L)	4	19	Motor rechts (+)
Zugbus Clock	5	18	Motor -	Zugbus Clock	5	18	Motor links (-)
Zugbus Data	6	17	Motor (3)	Zugbus Data	6	17	Aux 5 (L)
Licht hinten	7	16	DC (+) Funktionen	Licht hinten	7	16	DC (+) Funktionen
Licht vorne	8	15	Aux 1 (F1)	Licht vorne	8	15	Aux 1
Lautsprecher 2	9	14	Aux 2 (F2)	Lautsprecher 2	9	14	Aux 2
Lautsprecher 1	10	13	Aux 3 (L)	Lautsprecher 1	10	13	Aux 3 (L)
Verdrehschutz	⊗	12	Vcc +5V Prozessor	Verdrehschutz	⊗	12	Vcc +5V Prozessor

Conclusion

So for adapters **without amplification**, use a decoder **with amplified outputs**.

For adapters **with amplification**, use a decoder **with logic-level outputs**.