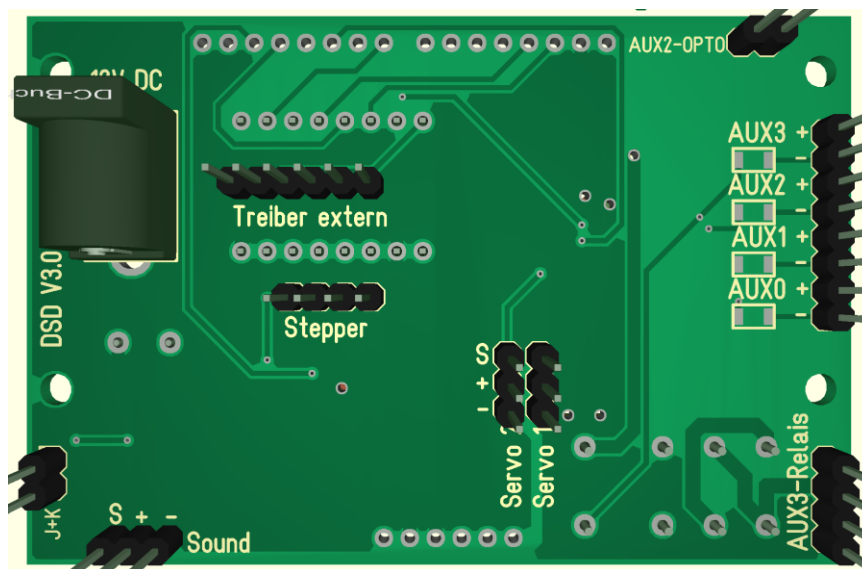


Manual turn table, transfer table controller with DCC decoder

Characteristics:

- display and keyboard for controlling
- any bipolar stepper motors up to 1,2 A (optionally 3 A or 4 A available)
- can be used for turn tables, segment turn tables, transfer tables
- **NRMA DCC** compatible (no programming necessary, setting via display)
- up to 64 different exit tracks programmable
- position is memorized for every departure separately
- gear backlash adjustable to gear revolution backlash
- any gear ratios (also 2-stage)
- speeds of slow and fast can be selected
- acceleration and braking behavior adjustable
- number of steps/revolutions selectable (100, 200, 360, 400 ...)
- up to 256 micro steps per step
- separately adjustable motor current for driving and holding
- digital base address (default 225)
- 3 outputs freely usable: signal, switch (amplified up to 400 mA, AUX0 – AUX2)
- thereof 2 outputs can be used as servo (AUX0, AUX1)
- 1 output usable as switch (amplified up to 400 mA, AUX3)
- total current of all AUX 1,2 A
- AUX3 equipped with relay for (turn?) table track polarization
- AUX2 equipped with optical coupler for feedback to "track in use" (track occupied) indicator: "platform is moving" or "platform has arrived"
- fully supported in the TrainController as "Märklin-Drehscheibe 7686" instruction set (only DCC)
- sound module connection available from version 3.6 (Art.Nr. 19899x)

connections:



Attention:

The connections are only intended for **plugging in**; please refrain from soldering attempts, the controller may be destroyed!!!

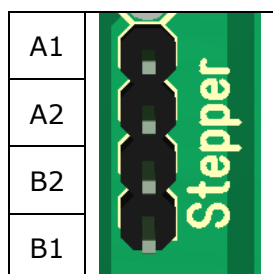
Power supply:

The power supply is done by a power supply unit, which provides a stabilized DC voltage between 9 and 24 volts. It is recommended to use the included power supply unit. This supplies a voltage of 12 volts and 1.5 A and is therefore also suitable for the stepper motors supplied by us.

**Notes:**

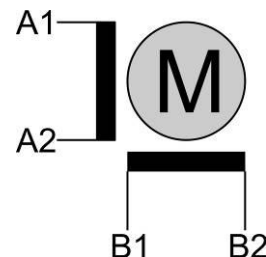
The outputs are amplified up to 400mA (1.2 A total current). Corresponding SMD 1206 resistors are to be selected by yourself. The supply voltage is connected through the supplied power supply (supplied DC power supply unit 12 Volt).

It is possible to use a separate power supply (DC max. 24 V), but please note that this also supplies the relay and the optical coupler with power (maximum 24 V DC).

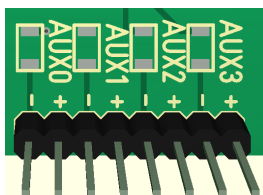
Connection of the stepper motor:

Bipolar stepper motors up to 1.2 A current consumption can be used. Please pay attention to the parameter setting of the current limitation. Check the coil pairs of the motor with a continuity tester. The poles that have continuity belong to a coil pair. Our mechanical kits contain motors with the following pin assignment: A1=black, A2=green, B1=blue, B2=red. To change the direction of rotation of the motor, swap the coil pairs: B1=Black, B2=Green, A1=Blue, A2=Red. With our stepper motor you only

need to plug in the motor plug, which is turned by 180°.

**Connect consumers to the outputs:**

AUX3 +	AUX 3 +
AUX3 -	AUX 3 -
AUX2 +	AUX 2 +
AUX2 -	AUX 2 -
AUX1 +	AUX 1 +
AUX1 -	AUX 1 -
AUX0 +	AUX 0 +
AUX0 -	AUX 0 -



Leaded resistor (SMD 1206) suitable for their consumers.

The "-" is switched, the "+" is for each output the same.

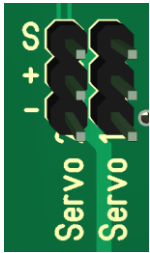
Connection for reversing the polarity of the turntable track (AUX3):

	Input digital track voltage (to central unit)
	Output digital track voltage (to turntable)

The control must be programmed accordingly!

The switch-over is potential-free and can therefore be used directly for the track occupancy message of the platform track.

Connection servos (AUX0, AUX1):



The provided solder pads can be fitted with pin headers and then used to connect servos. Normal model-maker servos operate up to a maximum of 5 Volts, which is on board.

The output (0 and 1) must be configured accordingly.

Connection feedback (AUX2) "platform is moving":



The feedback signal "platform is moving" can be connected directly to a track occupancy detector, the resistor 15K is equipped, this resistor provides the power consumption at the track occupancy detector.

The output (2) must be configured accordingly.

Digital connection:



The DCC central unit can be connected here. But the control can also be used purely analog via the control panel.

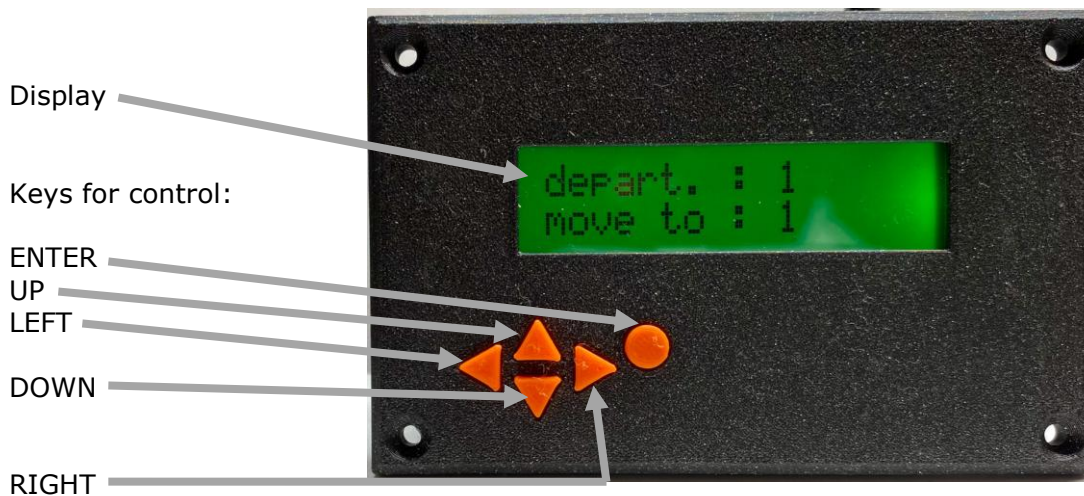
Sound modul:



With this connector you can attach the Sound modul (Item No. 19899x).

Be aware that only our Soundmodul can be attached !

Overview of operating elements:



Contrast: The contrast of the display is adjustable with a screwdriver (blue potentiometer on the back of the display board). It is also possible to turn it so that nothing is visible

Switch-on the control:

(power-on/start-up)

After switching on the controller, it is possible to adjust the displayed departure.



Key	Description
ENTER	Confirm the entry, change into operation mode
LEFT	Move one exit counterclockwise/left
RIGHT	Move one departure clockwise/right

The settings made here will not be saved and are only intended for setting the 0-point. This may be necessary, for example, if the power was switched off while driving.

This function can also be used to move the platform to the position you want the number of the departure to match.

Operation mode:

In operation mode the decoder can be controlled manually or by DCC command.



Select and start a departure:

Key	Description
UP	Select departure (up)
DOWN	Select the departure (down)
ENTER	If the preselected departure is different from the one currently displayed, the shortest route will be taken.

Take the next exit:

Key	Description
LEFT	Drive to next departure/exit counter clockwise/left
RIGHT	Drive to next departure/exit clockwise/right

180° rotation (turntable only):

Key	Description
ENTER	If the preselected departure is equal to the currently displayed departure, a 180° rotation is performed

More keyboard shortcuts:

Key	Description
DOWN+UP	Change to the control settings
DOWN+RIGHT	Change to set the departure
DOWN+LEFT	Switch light output AUX1

HINT:

To switch double key functions, you can also hold down the DOWN key and press the key for the function additionally.

Drive mode:

While the motor is running, the display changes to red. The display shows the destined departure and the number of steps to be driven (micro steps).



The driving mode cannot be interrupted; here are no settings possible.

Set the parameters of the control:

You can access the parameter settings from the operation mode by pressing the **DOWN** and **UP** keys simultaneously.



Key	Description
UP	Select previous parameter
DOWN	Select next parameter
LEFT	Changing the parameter value
RIGHT	Changing the parameter value
ENTER	The selected parameters are saved, if necessary the outputs are recalculated. -> Return to operation mode.

The control can be adapted to all possible situations, please read the meaning of the individual parameters.

It can easily happen that you get lost in the adjustment process. In this case, please reset the controller and start again!

HINT:

Not all parameters are taken over after saving, some require a restart of the controller. So it is better to restart the controller after you have changed the settings.

Bedeutung der Parameter:

Parameter	Standard	Description
general	start setting	off: neither reset is executed nor the message for initial adjustment is displayed. Start setting: the query for departure adjustment is displayed when the controller is started. Reset: you can select Reset to standard, all outputs will be recalculated and stored Wait: The decoder waits 5 seconds at startup.
no.of departures	24	Here you can choose from 2 to 64 departures. The distribution is evenly distributed over the entire route. If the departures are not evenly distributed, an adjustment can be made later.
type	Turntable	Here you can distinguish between turntable, paternoster, segment turntable, transfer table and train lift. Note: Pay attention to the correct type! A turntable can turn in a circle. A Paternoster can only drive in one direction. All other types just drive back and forth. This may lead to the destruction of your model!
gear factor	40	Here the gear ratio is entered. The assumption is a 360° rotation of the turntable or the complete path of the transfer table. Turntable, Paternoster: How many rotations the stepper motor has to make to perform a 360° rotation of the turntable. Transfer table, segment table, train lift: How many rotations must the stepper motor perform to move the transfer table from the beginning to the end.
2. gear factor	1	Here you can enter another gear factor (2-step gear). This factor is a pure calculation factor and has no effect on the stored steps. If you would exceed the maximum of 65536 possible steps with your gear factor, you can use this factor to reduce it.
backlash	28	Here you can set the number of full steps the gear in use needs to "tighten". More information can be found here: "Adapting the control to your mechanics / turntable".
moving fast	40	Maximum speed of the stepper motor
moving slow	5	Minimum speed of stepper motor
acceleration	4	Acceleration / deceleration from slow to fast and vice versa, small number means high acceleration, larger number slow acceleration
motor steps	200	Number of steps your motor needs to make one revolution (360°), please refer to the motor data sheet.

micro steps	32	Number of micro steps (intermediate steps) that the motor has to perform in order to drive a whole step. Here you can set up to 64 micro steps.
drive current	300	Current limitation of the motor when driving. How much current should be given to the motor while driving. Values between 100mA and 1700mA are possible. Note: Please do not set a higher current than your motor can handle, this will destroy the motor. Please have a look at the data sheet of the motor.
hold current	25	Current limitation of the motor during holding (in standstill) How much current should be given to the motor while it is standing still. Values between 25mA and 500mA are possible. This setting is used to "hold" the turntable or transfer table at the respective departure in standstill. Current of 0 means, switch of the stepper driver. Note: Please do not set a higher current than your motor can handle, this will destroy the motor. Please have a look at the data sheet of the motor.
DCC address	225	DCC address can be set in steps of 4. See section "DCC Addresses" for more information.
start delay	0	Here you can delay the start of the stepper motor, for example if you have to remove the platform lock The time is set in seconds.
sound level	19	Here you can set the volume of the optional available sound module.
output 0 AUX0	Aus	Here you can set how output 0 (AUX0) is to be AUX0 triggered. off: Output is deactivated. manually: Switching with DCC address or with the control panel (only AUX2) moving platform: Value in MAX is switched when platform moves, value in MIN is switched when platform stands still. by departure: After arrival at the track, in the case of even-numbered departures you switch from MAX to MIN, in the case of odd-numbered departures the switch is from MIN to MAX. This allows the frogs to be polarized for departures with overlaps. Pos. reached: Value in MAX is switched for 0.5 sec when the turntable has finished moving.
Type	Switch	Here you select the type of output: Switch: It is switched from MIN to MAX when switching on and from MAX to MIN when switching off Aperture: The fade is slowly switched from MIN to MAX when switching on, from MAX to MIN when switching off. Servo: When switching on, the value in MAX (set here maximum

		180) is approached, when switching off the value in MIN (set here minimum 0).
MIN	0	Here the value from 0 to 255 for MIN is set. Please note that the servos can only move to a value Note: Values other than 0 (off) and 255 (on) can be set, this causes a "dimming" e.g. for LED's
MAX	255	Here you can set the value from 0 to 255 for MAX. Please note that servos can only be driven to a value up to 180. Note: Values other than 0 (off) and 255 (on) can be set, this causes a "dimming" e.g. for LEDs.
output 1 AUX1	Off	... like output 0
Typ	Switch	... like output 0
MIN	0	... like output 0
MAX	255	... like output 0
output 2 AUX2	Off	... like output 0
Typ	Switch	... like output 0
MIN	0	... like output 0
MAX	255	... like output 0
output 3 AUX3	Off	Here you can set how port 3 (AUX3) should be triggered. off: Output is deactivated. Reverse polarity: Can be used to trigger a switching operation, starting from a certain departure. Here you can change the polarity of the turntable tracks.
from depart.	1	Departure/track from which the output is switched from MIN to MAX. >= Departure: Value in MAX is switched < Departure: Value in MIN is switched
MIN	0	Here the value 0 or 255 for MIN is set.
MAX	255	Here the value 0 or 255 for MAX is set.

Adapting the control to your mechanics / turntable:

After you have completed the mechanical and electrical setup, you can set and adjust the control.

Basics:

For turntable:

With the gear factor you can set the value that causes the platform to make a complete rotation (360°)

For segment turntable, transfer table, train lift:

With the gear factor you can set the value which causes the platform to drive to the last departure or beyond.

The number of exits should be selected in a way that not only their real existing exits are counted, but also the exits opposite to each other; otherwise no 180° rotation can be executed.

The only tricky parameter of the control is the setting of the backlash. This is where all the inconsistencies of the turntable and mechanics come together. Of course it is important to have a gear backlash which is as minimal as possible. But it depends strongly on the turntable and the mechanics used. When the ROCO/Fleischmann turntables are converted, there will be relatively large mechanical backlash.

Definition of backlash:

It is the "clearance" or "mechanical error" that occurs when the stepper motor changes direction. The "clearance" caused by the mechanics (gears, pivot torsion, turntable) must be increased to bring the mechanics back into tension.

Setting the basic functions:

1. After switching on, the settings in the parameter menu are adjusted according to the conditions. Save the parameters. Switch off the control.
2. After switching on the control again, move the platform to the displayed departure using the left and right keys.
3. Mark the position of the platform (e.g. by the now exactly adjusted tracks). This is now your 0 position.

TIP, for turntables when you can't get any further:

- Menu Settings: select Reset, press ENTER.
- Switch off power or restart control.
- Settings menu: set your transmission factor, then save: press ENTER. Restart the control.
- Confirm start position
- Now press ENTER to initiate a 180° rotation

Depending on that, see what happens:

- a 180 degree rotation, then the basic principle is correct
- a 90 degree rotation, then it might be a stepper motor with 400 steps/revolution ?
- a 360 degree rotation, wrong gear factor ?
- a 720 degree rotation, look again exactly what is built in there ?

Adjust the gear backlash:

Every gear has a certain backlash. This means that the stepper motor must perform a certain number of additional steps when changing the direction of rotation before the gear "starts up" again. (I can't think of anything better for a non-technician)

If you have a turntable or transfer table with equally spaced departures, you can simply use the next departures as an adjustment aid. If you don't have that, divide the total circulation or total travel distance by the number of departures you have chosen and mark the angle / distance.

Calculate the start value:

Push the platform by hand carefully in one direction (with only enough force to avoid breakage), mark the position (in relation to the edge of the pit), now push in the opposite direction and mark also the position. Measure the distance, this is your offset.

e.g.:

- turntable/platform has 1mm offset
- Stepper motor has 200 steps
- Transmission/gear is 1:40
- turntable/platform length is 183mm
- Number of steps per revolution: $(200 * 40) = 8000$
- circumference of the turntable/platform (outside): $183\text{mm} * \pi = 575\text{mm}$
- 1 step is therefore long: $575\text{mm} / 8000 = 0.071875\text{mm}$
- > 1mm offset result: $1 / 0.071875 = \text{approx. } 14 \text{ steps}$

Mark the value of your calculated offset as starting value for the backlash and start testing.

Basic setting:

When the controller is in the mode "start setting" it is possible to move the platform with the LEFT RIGHT buttons.

Procedure:

Drive the platform with the LEFT button until it starts moving. Now press the RIGHT button once: if the platform jerks or starts to move, then the clearance is too big, reduce it. If the platform does not move, press the RIGHT button and remember how many times the button has to be pressed before the movement of the platform starts.

This number of steps has to be added to the already set revolving play.

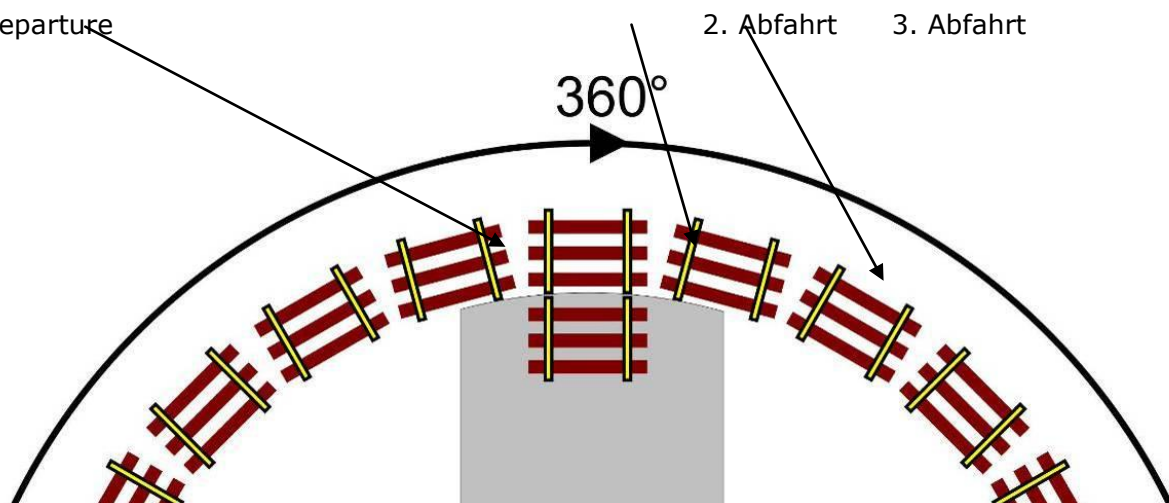
Turntable:

Total travel distance is one revolution, exits = 24, angle = 15° ($360/24$)

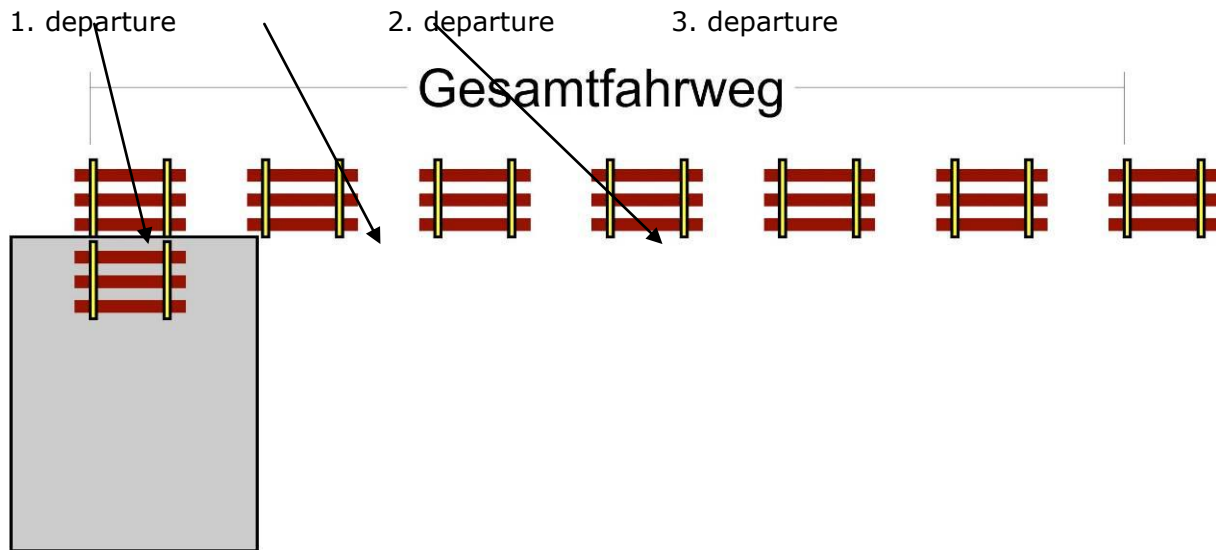
1. departure

2. Abfahrt

3. Abfahrt



Transfer table:



1. 0 Check position (1st departure)

Drive to exit 2 and then back to exit 1. Does the marking still match? If not, switch off the control unit and readjust by means of start adjustment.

2. backlash check (circulating clearance check) / setting

Drive to exit 2 and check the position.

Position reached	-> no change of the backlash necessary.
Position not reached	-> increase the backlash
Position exceeded	-> reduce the backlash

Before you change the parameters, you must return to departure 1.

Carry out this procedure until you reliably reach departure 2.

To optimize further, you can now move your turntable to a departure that is offset by 90° (for transfer table to the middle area) and check the adjustment again.

Check your settings now also with more distant departures, e.g.: 3 and 6.

Only after the backlash clearance has been set correctly, you can start with the fine adjustment of the single departures.

Adjust the individual departures:

You can access the settings of the departure from the operation mode by pressing the **DOWN** key and additionally **RIGHT**.



Here, after all other settings of the control are correct, the individual departures are readjusted. The position set here is stored.

If the departures of your turntable or transfer table are not evenly distributed, you can use this function to adjust the position of the individual departures according to their conditions.

Key	Description
LEFT	Changing the position of the departure counterclockwise / left
RIGHT	Changing the position of the departure clockwise
ENTER	The position of the departure is saved. -> Return to operation mode.

DCC addresses:

The decoder is programmed to address 225 at delivery. This is a function address (accessory), not a locomotive address. Please note that you can only select addresses in steps of 4.

NRMA DCC		Standard	Befehl	Aktion
Base adress	-4	221	(-)	AUX 3 on
Base adress	-4	221	(+)	AUX 3 off
Base adress	-3	222	(-)	AUX 2 on
Base adress	-3	222	(+)	AUX 2 off
Base adress	-2	223	(-)	AUX 1 on
Base adress	-2	223	(+)	AUX 1 off
Base adress	-1	224	(-)	AUX 0 on
Base adress	-1	224	(+)	AUX 0 off
Base adress		225	(-)	Sound on INDEX 4
Base adress		225	(+)	Sound on INDEX 5
Base adress	+ 1	226	(-)	180° rotation shortest way
Base adress	+ 1	226	(+)	preselection for end of platform at departure
Base adress	+ 2	227	(-)	next departure clockwise / right
Base adress	+ 2	227	(+)	next departure counterclockwise / left
Base adress	+ 3	228	(-)	Preselection direction of rotation clockwise / right
Base adress	+ 3	228	(+)	Preselection Direction of rotation counterclockwise / left
Base adress	+ 4	229	(-)	Take exit 1 (shortest way)
Base adress	+ 4	229	(+)	Take exit 2 (shortest way)
...		
Base adress	+ x	2xx	(-)	Departure x approach (shortest way)
Base adress	+ x	2xx	(+)	Take exit 2 (shortest way)

Note:

Different setting compared to Märklin protocol at "Preselection for end of platform at departure", here 2 commands are converted in one run: "Go to departure X and make a 180° turn" becomes "Go to end of turntable at departure X", but this only works if the opposite side is set correctly.

Setup in the software:

The control is regarding the DCC commands directly compatible with the "Märklin turntable 7686". So nothing stands in the way of a simple setup in a variety of control programs. Since the Märklin protocol only knows 24 departures, if you have more than 24 departures, you have to set up a "general turntable" and enter the operations. Example files can be found on our website.

Here is an example of the TrainController:

Select your set base address.

If you define an output as "platform" and use it with a feedback (suitable for your digital system), you can enter this output as a detector under "position monitoring".

Since version 2.2 of the decoder, direction commands of the software are taken into account. The software sends direction and departure commands; please do not be surprised if the software does not always take the "shortest" way, this is the problem in the software.

Note:

The outputs are switching outputs. They must not be connected directly to a feedback module. Here an electronic is required (e.g.: optical coupler + feedback module).

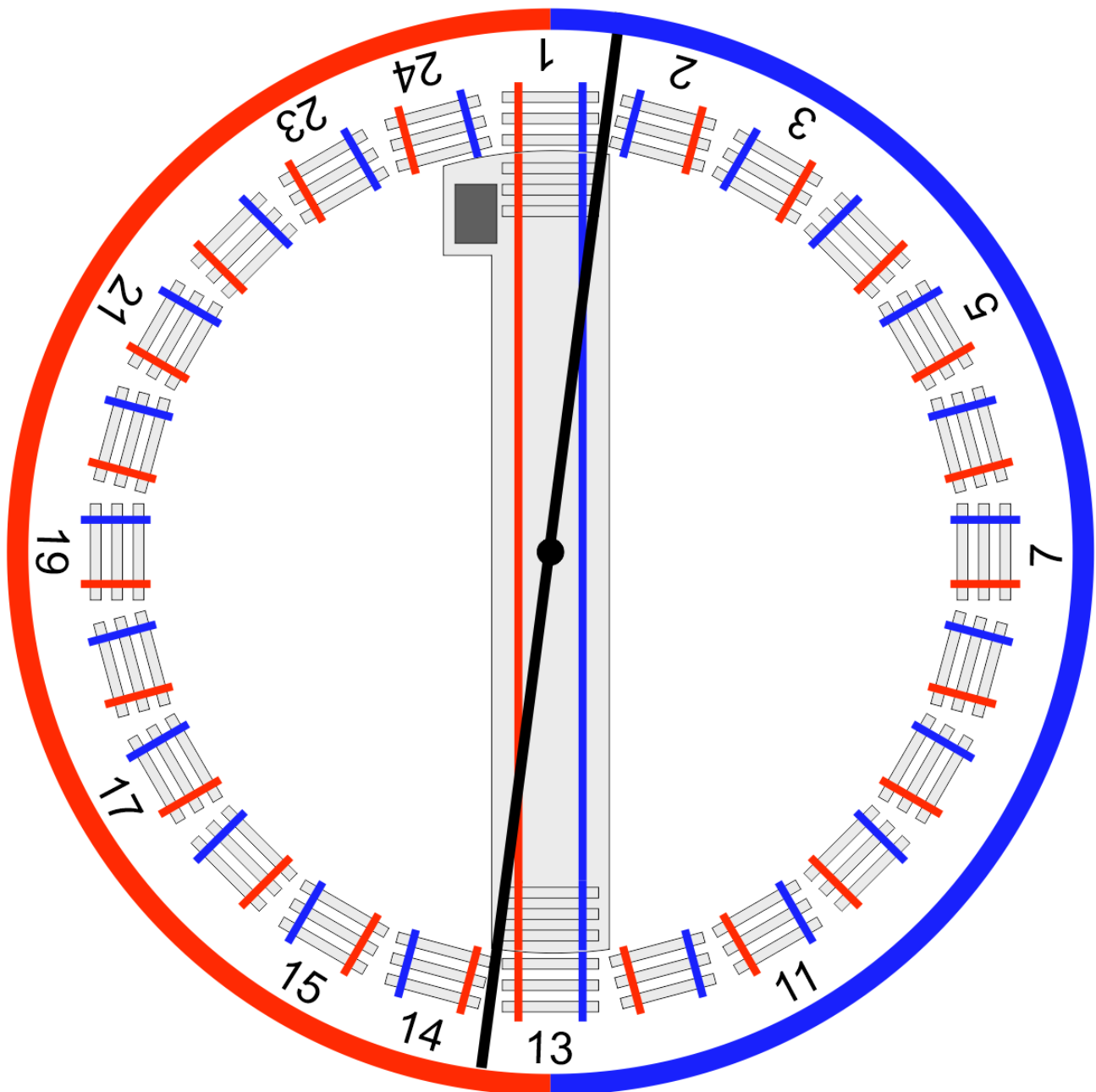
Reset at start:

Keep the **ENTER** key pressed while switching on the decoder until "Settings" appears on the display. This will take you to the "Settings Menu". Here you can reset the decoder.

Connection examples for polarity reversal:

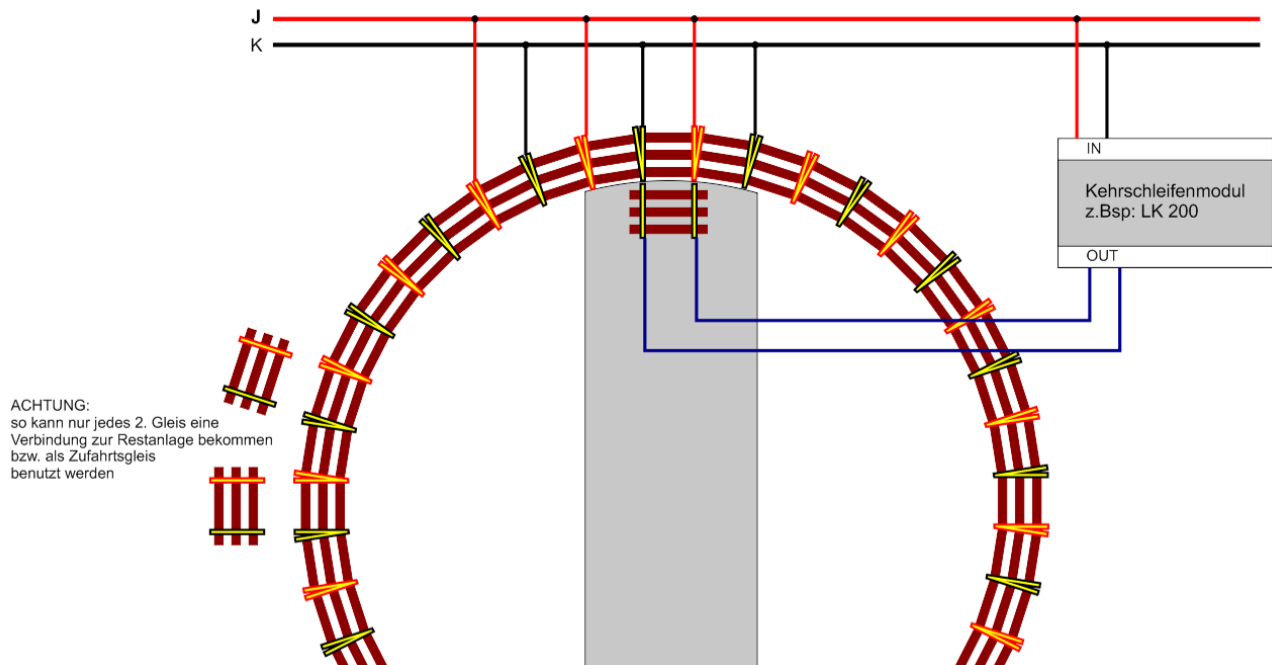
Reverse the polarity of the turntable with the relay of the control unit:

The relay can be set from departure, which means that from departure 1 to the set departure one polarity exists and from this departure to the last departure the other one.

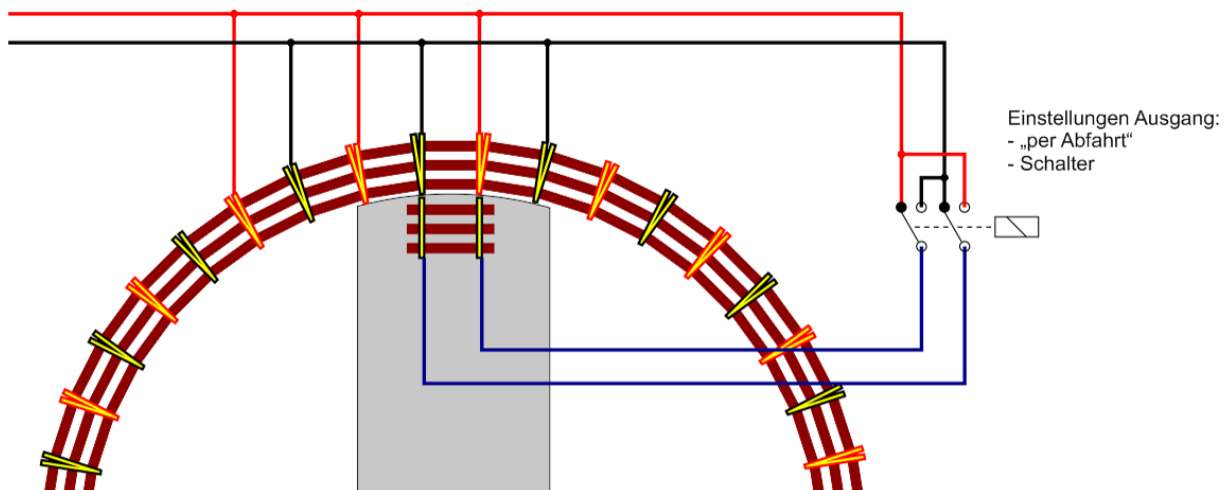


Turntable with overlapping departures

with reversing loop module:



controlled by the decoder (can also be used analog):



The sound module:

Sie können das Soundmodul mittels USB Verbindung mit ihren eigenen Dateien bespielen. Die Dateien müssen diese Namen haben und sich im Basisverzeichnis des Moduls befinden.

File	Maximum playing time	Function / Retrieval
0001.mp3	1,5 sec	This file is called before moving, after that it waits 1 sec.
0002.mp3	-	This file is called up before starting the moving. It should contain the start and the driving sound.
0003.mp3	-	This file is called up after moving.
0004.mp3	-	Retrievable by turnout address (base address -4, default: 221) Command "-".
0005.mp3	-	Retrievable by turnout address (base address -4, default: 221) Command "+".

Note:

The files are not retrieved by name but by INDEX, the INDEX is assigned by the sound module in the order of copying. The first file you copy gets the INDEX 1, the second the INDEX 2 and so on.

If you want to copy several files at the same time, create a folder to copy your files into this folder, assign the names as indicated above. Then select all files of the folder with "CTRL+A" (not with the mouse!). Copy with "CTRL+C" and then paste with "CTRL+V" into the removable disk (in the root directory).

Parameters for the control:

Sound Level: 0-29

Attention: if you use a 600mA power supply the current is not sufficient to drive the stepper motor and the SoundModule, the result is a restart of the controller

But if you run the sound with **less than level 20** it is just enough.

Finally, we wish you every success with the conversion and a lot of fun with the subsequent analog / digital operation!

Your Digitalzentrale – Team