

Instruction Turntable decoder

Note, this manual is continuously updated. Check www.mollehem.se/doc/instruktioner/Instruction_Turntable.pdf for the latest version.

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1 DECODER FOR TURNTABLE

The turntable decoder is intended as a general drive of a turntable fitted with a stepper motor.

Control of the turntable can be done from directly connected buttons, from external control panel and/or from computer.

The turntable can have up to 22 arbitrarily placed track positions.

Basic settings, such as track position, can be set with buttons on the card alt. directly connected buttons, or via the programming app.

More settings such as speed etc. are set via the programming app.

The card has voltage connections for 5 volts, either via standard USB micro connector (normal mobile phone charger) or via screw terminal block.

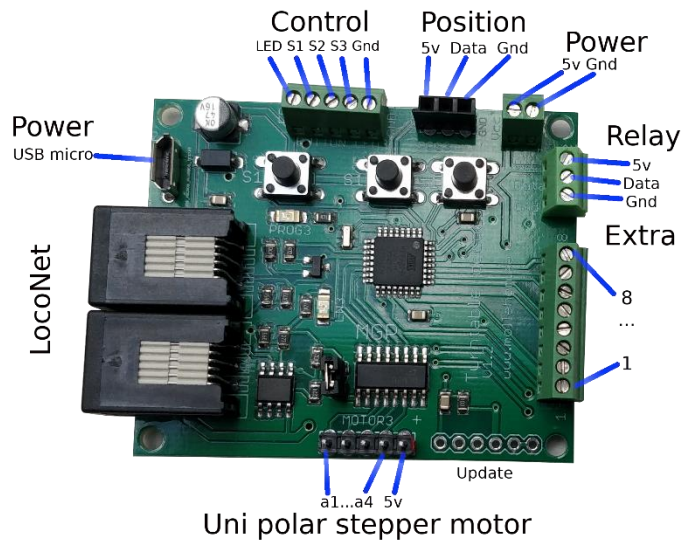
The card has three buttons directly on the card which can be used for control and basic settings of the turntable. Next to the buttons is a connection where an external set of buttons can be connected e.g. for mounting on the side of the layout.

The decoder needs to know a fixed position of the turntable, the “zero position”. This is done with an optical reading fork that can signal to the decoder when the turntable are in that position.

An external relay card can be connected if polarization of the turntable is desired. Intended for MGP relay card. A relay cannot be connected directly to the output because "data" has limited power resources.

Stepper motor (uni polar) connects to the motor output with 4 poles + voltage. The voltage is 5voltage and can power a 5volts motor directly. If the motor is used with a different voltage, only the engine terminals a1-a4 are connected and the engine is fed separately with the correct voltage.

When the decoder power is turned, the decoder will check the position by rotating the turntable until the zero position is found. It is a normal behavior and is done at every power up.



1.1 ADDRESS TO YHE DECODER

The card has an address, and this is stored in SV21.

The address of the card is on delivery **30**. This address is used for settings in the card and if you have two cards the same address, there will be problems.

The card address is changed by changing SV21 with the programming app.

Note, the address will only apply after the card has been restarted, i.e. reapply power to the card after the address has been changed.

1.2 FIRST USE OF THE DECODER

The position sensor is a requirement for the decoder to be used! Make sure the sensor is mounted correctly.

1. Turn on the voltage to the decoder. Now the turntable will start spinning until the position sensor is found and the turntable stays in this position.

2. When the turntable has stopped, a basic initiation of the decoder can be done where the decoder measures up different properties of the turntable.
Hold down buttons 2 and 3 until the green LED lights up. Now the turntable will look up the position sensor and then take a full turn where the number of steps for the turn is measured.
After this, it moves a little around the position sensor for precision measurements.
3. When the green LED goes off, the basic initialization is ready.

Once the turntable has been initialized, track positions can be inserted – see the chapter "Setting track positions".

1.2.1 SLOW MOVEMENT AT BASIC INITIATION

Before the basic initialization, the decoder does not know anything about the basic data for the turntable. Most important of these is the number of steps for one lap. The decoder bases the speed on the number of steps for a lap and on delivery, the turntable tries to run at about 15 seconds per lap.

Should the decoder have gotten the wrong setting on the number of steps per lap, e.g. by running the decoder in a test lineup or tested a freely without a zero position sensor, then the value of the number of steps per lap may have been stored as very low.

When re-initializing, this low value is then used to calculate the appropriate speed and the disc will move very very slowly.

If so, be patient and wait until it has stopped and then use the programming app to adjust the SV30, the number of steps for one lap, to a proper value (or run a full initiation).

1.3 BUTTONS

There are three buttons on the decoder used for control and settings, 1,2 and 3.
There is also terminal connectors to add external buttons.

1.3.1 CONTROL

When controlling the turntable, button 1 is used to turn the turntable half a turn.
Buttons 2 and 3 to step clockwise or counterclockwise.

1.3.2 SETTING TRACK POSITIONS

To set the position of the tracks, the decoder should be turned into programming mode. This is done by holding button1 for more than 2 seconds. The LED lights up and the decoder is now in programming mode. Programming mode ends by holding button 1 again until the LED goes out.

In programming mode, the turntable can be rotated freely with buttons 2 and 3. When the turntable is at the correct position in front of a track, press briefly button 1 and the turntable will now remember this position.
After that, more positions can be programmed or the programming ends with a long press of button 1.

To clear all track positions and start from scratch, simultaneously hold down buttons 2 and 3 for a longer period of time, more than 2 seconds.

Note, the ability to remove inserted track positions can be switched off with "Sv28, Track programming reset". If this is set to "Locked", you cannot accidentally reset the track modes.

1.3.3 INITIAL SETTING

The first time the decoder is used, a basic initiation takes place. This means that the decoder checks the gear ratio on the turntable (number of steps that make up one revolution), the appropriate speed, position and type of position sensor, etc. This may take some time and the turntable moves during this initiation.

This initiation can be started by simultaneously holding buttons 2 and 3 pressed for a long time.

The turntable then begins to move and runs through the entire initialization sequence.

This "initial setting" normally resets all track modes and you have to start all over again with the settings.

In "Sv27, Main reset", the ability to start initial setting can be removed by selecting "Locked".

An option for "Sv27, Main reset", is to set the value to "Allow basic" which allows the turntable to be reinitiated but with retained track positions.

Initial setting can also be started by EN "28: Restart initialization NOW". Set this to "Yes" and the decoder will make a re-initiation.

1.4 CONTROL THROUGH LOCONET

The turntable is addressed on the basis of the decoders basic address (Sv21).

The basic address and directly subsequent addresses are used to perform various functions. To request a function, use switch commands and the decoder responds with normal feedback for switches.

1.4.1 TRACK POSITION ADDRESSES

The turntable occupies a number of addresses depending on the number of input track positions. The total number of addresses will be $2 + 2 * \text{"number of track positions"}$.

The first two addresses ("base address" and "base address + 1" are used to control "next track position" and "Turn 180". Subsequent addresses ("base address + 2" and onwards) are used for going directly to a track position.

Each entered track position will provide two addresses in the decoder, for the "A mode" and the "B mode".

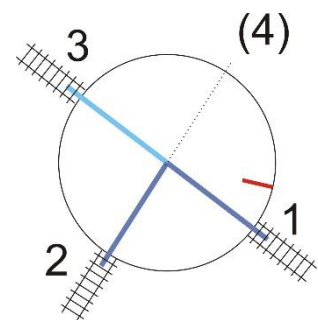
Normally, the B position is 180 degrees compared to the A position, but this can be adjusted if necessary, for example if the track on the turntable is not fully centered.

The different track positions are sorted according to their location around the turntable and receive addresses in that order.

In the picture to the right, two track positions 1 and 2 have been inserted.

In the decoder there will be 4 track positions where 3 is a through track, while 4 has no track connection. If the decoder has the basic address 30, then the track modes will get the addresses 32-34.

At these addresses, the track can be ordered to the track positions and the decoder will send feedback when the track is in position.



1.4.2 COMMANDS

1.4.2.1 MOVE TO THE NEXT TRACK POSITION

A switch command at the base address steps the turntable to the next position.

When "Closed" is ordered, the step is done clockwise, while ordering "Thrown" steps counterclockwise.

1.4.2.2 TURN THE TURNTABLE 180 DEGREES

Switch command on "base address + 1" with order "Closed" moves the turnout 180 degrees.

1.4.2.3 MOVE TO SPECIFIC TRACK POSITION

A switch command on the address of the track moves the turntable to that position.

When "Closed" is ordered, the A side is positioned to the track, while ordering "Thrown" the B side will be positioned.

1.4.3 FEEDBACK

1.4.3.1 TURNTABLE IN MOTION

The basic address of the turntable is used to indicate the status of the turntable's movement.

1. When feedback is "Closed", the turntable is in position.
2. Feedback "Unknown" is used when the turntable is moving.

For example, this feedback can be used on a panel, where a warning light may flash when moving.

1.4.3.2 TRACK POSITION ACTIVE

Feedback for when the turntable is in a specific track position is done on the address of the track position.

When the turntable is in the position of a track, feedback "Closed" on the address is sent.

When a track position goes out of position, feedback "Thrown" on the address is sent.

1.5 CONNECTING EXTERNAL SET OF BUTTONS

To control the turntable and to make settings, an additional set of buttons can be connected to the decoder and mounted in the appropriate place on the layout.

Each button should be connected with one side to its input terminal and should connect to 0 volt when the button is pressed.

There is also an output for LED. This provides 5 volts and the appropriate resistance should be connected in series with the LED.

For a standard LED, an appropriate value of the resistance can be around 500 Ohms. If the LED is too bright, increase the resistance. LED and the resistance in series, are connected between the output "LED" and "0".

1.6 CONNECTING RELAY FOR POLARIZATION OF THE TRACK

When the locomotives are driven with analog DC operation, digital DCC or similar, the tracks on the turntable need to be polarized correctly according to the direction of the track. This might already be built into the design of many turntables.

If the turntable does not have a built-in polarization, the decoder can handle this with a relay card connected to the decoder. Please note that a regular relay cannot be directly connected but must have some form of driver. A suitable relay card is available in the MGP store.

The decoder is connected to the relay output ("Relay") on the card via three wires, "+5v", "data" and "0v".

The relay will be in different positions depending on which half of the turntable is facing the track. Normally, the turntable is divided into two equal halves by the "zero point", i.e. where the position sensor is located.

The position where the polarization should be changed can be adjusted with sv's "Polarisation switch index" and "Polarization switch index – opposite". These normally have the values 0 (i.e. at the position indicator) and "half the total number of steps of the turntable".

1.7 EXTERNAL DRIVE CARD CONNECTION

The decoder has built-in drive for so-called Unipolar stepper motor, 5 volts and max 500mA.

More powerful engines or engines of the type bipolar can be used but then with an external drive.

The external driver is then controlled by 2 threads (3 if "reset" is used).

The "step" of the driver is connected to output 7 of the decoder.

The "direction" of the driver is connected to output 6 of the decoder.

If the "reset" on the driver card is to be used, it is connected to output 5.

Change "SV 50: Use motor drive" to "external 2 wires".

1.8 AUDIO FEEDBACK ON BUTTONS

A piezo element can be connected to output 8 of the decoder, to provide sound feedback on button presses. Connect the element between ZERO and the decoder output 8.

Plus on the piezo element is the one to be connected to 8.

2 TEST

At the moment there is a built-in test sequence you can run through SV setting.

In the app under "TEST" there is "Run test sequence now". Change this value to "Yes" and save.

The test sequence runs the turntable a number of full turns and counts the number of steps on each turn. Optimally, all turns would have the same number of steps, but some accuracy in the reading fork might allows values to deviate slightly.

Should the turntable mechanics have problems, then the deviations per revolution will be greater.

After the turntable has run its turns, it goes to the zero position and starts to oscillate around the zero position. Here, the deviation between reaching the sensor clockwise and counterclockwise is measured.

This value corresponds to the "Compensation" setting. The difference between clockwise and counterclockwise movement is mainly due to gaps in gearbox and mechanics, so that, for example, the gears are packed together one way or the other when the turntable turns.

2.1 READING TEST DATA

Once the turntable has gone through the test sequence and stopped, measured values can be loaded into the app by making a "Read".

Data are collected under the "TEST" >"Results from last test".

After the measured number of steps on a turn, there is also the calculated mean number of steps for one turn.

This value should be equal to, or very close to, the mechanical number of steps per revolution, i.e. the value in the "Turntable definitions" >"Steps".

"Test point, from normal" is normally 0 (or close to 0).

" Test point, from opposite" is a slightly higher value.

The number of steps between ". from normal" and "... from opposite" is roughly the value one can have in the "Turntable definitions" > "Compensation".

" Compensation" is the value with which the turntable sensor is adjusted depending on the direction to the sensor; and corresponds to, for example, a gearbox gap.

Some reading forks may have a certain "hysteresis".

This means that the change in the light beam is slightly different if you go from light to the dark, respectively from darkness to light. It should not be many steps that this would contribute to but can be observed.

" The hysteresis" means that you may need to adjust a little depending on whether the detector is passed clockwise or counterclockwise.

This is not the same as "compensation"! " Compensation" adjusts the counter at every lap, whether you pass the detector or not. "Hysteres" compensates the counter when you change direction and pass the detector. If you want to add a value in "Hysteres", "Compensation" should be reduced by the same value.

The value you get from the test sequence in "... from normal"/"... From opposite" is the sum of "Compensation" and "Hysteres".

3 SYSTEM VARIABLES - SV, TURNTABLE DECODER

NOTE – some SV’s are only visible under "advanced mode" in the programmer app.

LocoNet decoders have their settings saved as System Variables (“SV”). These can be changed through the programmer app.

The following settings exist (right now). New ones could be added during the development work.

SV number			Decoder version
13(-16)	Compensation	Measured gap in mechanics when moving clockwises	
17	Hysteresis	Hysteresis around the zero mode. Used if the zero position sensor does not specify exactly the same zero point when moving from both directions.	
21	Decoder Address	Identifies the decoder during programming. The address should be unique on LocoNet.	
23	First index	The track position to move to at start-up – the track position immediately after the reference point is 0 and then 1,2,3, etc..	
24	Number of track positions	Number of track positions	
25	Use pull-up resistor	Should input from the position indicator use internal pull-up resistor.	
26	Max speed	Speed of the turntable in seconds per revolution	4
27, bit 0-2	Main reset	Should the ability to make reset from local buttons be active. Can also be set partially active, by allowing measurement of step count on turns and accuracy, but excludes the possibility of removing track positions.	4
27, bit 3-4	Track programming reset	Allow or prevent zeroing of track modes via buttons	4
27, bit 5	Polarisation side	Track Polarization - "Normal" or "Reverse"	4
27, bit 7	TEST:	: type of feedback from track mode, either Closed for “in position” and Thrown for “Not in position”,	4

APPENDIX A, HARDWARE

MGP decoders are compatible with the Arduino circuit board family.

They can be reprogrammed with Arduino's development environment and in that case they should be used as "Arduino Pro Mini".

The six unused connection points along the side of the circuit board are the same interface as found on a "Pro Mini". Seen from the outside, "GND" is the far right hole.

To use the cards with LocoNet, the program library from "Model Railroading with Arduino" can be used. The first versions of the decoders used this library, while the later version uses, because of memory size, more compact and less general code. To use the LocoNet library, D8 should be used for incoming and D9 for outgoing communication.

To update the decoders with new versions of the software, the available load files can be used.

However, these are not suitable for use to recover a card used for other purposes. If you want to restore such decoders to original software, contact MGP.