Loco decoder RB 2212

Contents

Introduction:

The loco RB 2212 decoder is designed to control HO scale locomotive models in digital (DCC) or analog mode. The decoder has a Plux22 connector or NEM652 connector, and has a BackEMF function. This decoder works in accordance with the latest DCC standard and supports the Railcom® protocol (versions with the symbol ⚙)

Basic functions:

- **The ability to set short or long type address for the locomotive.**
- **Function control outputs with possibility to map it on functions F0 - F28**

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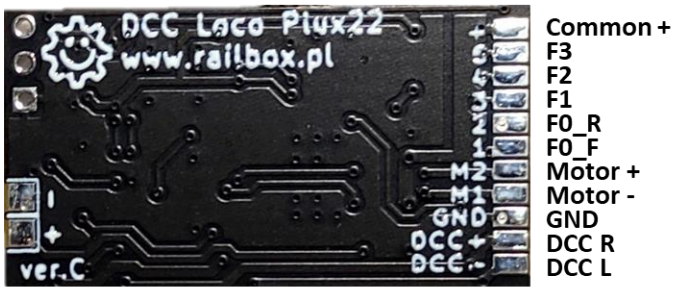
- **7 (version A and B) or 9 (version C and above) function outputs (version with Plux22 connector) or 5 function outputs (version with NEM652 connector)**
- **Easy decoder configuration ⚙ via RailBOX: Railroad Control mobile app (more info here)**
- **Direction recognition (also in analog mode)**
- **Lighting effects (see demonstration video on our YouTube channel)**
- **Supported protocol formats: DCC / Analog (decoder does not support Motorola, Marklin, MFX protocols)**

Technical parameters:

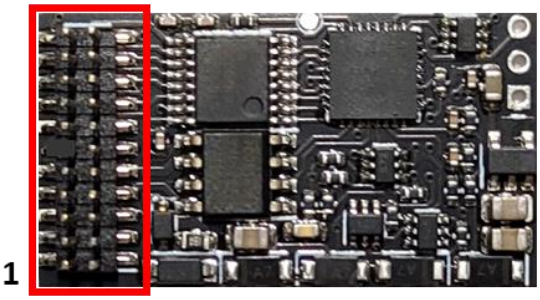
- **Decoder dimensions - 29 x 16 mm.**
- **Power supply - 12 - 22 V AC/DC or DCC**
- **Maximum continuous motor current consumption: 1.5 A**
- **Maximum output load: 0.5 A**

Connection

Note: The decoder is available in two variants: with Plux22 and with NEM652 connector.



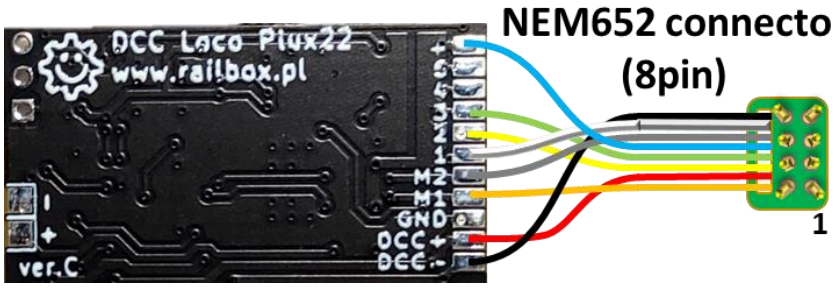
PluX22 (21pin) connector



Output	NEM652	Description
DCC –	Black	Rail L
DCC +	Red	Rail R
1	White	Front light
2	Yellow	Rear light
3	Green	Cabin light (F1)
4		F2 (Changeable)

Output	NEM652	Description
5		F3 (Changeable)
M1	Brown	Motor +
M2	Grey	Motor -
+	Blue	Common LED anode
G/GND		Ground

NEM652 connector (8pin)



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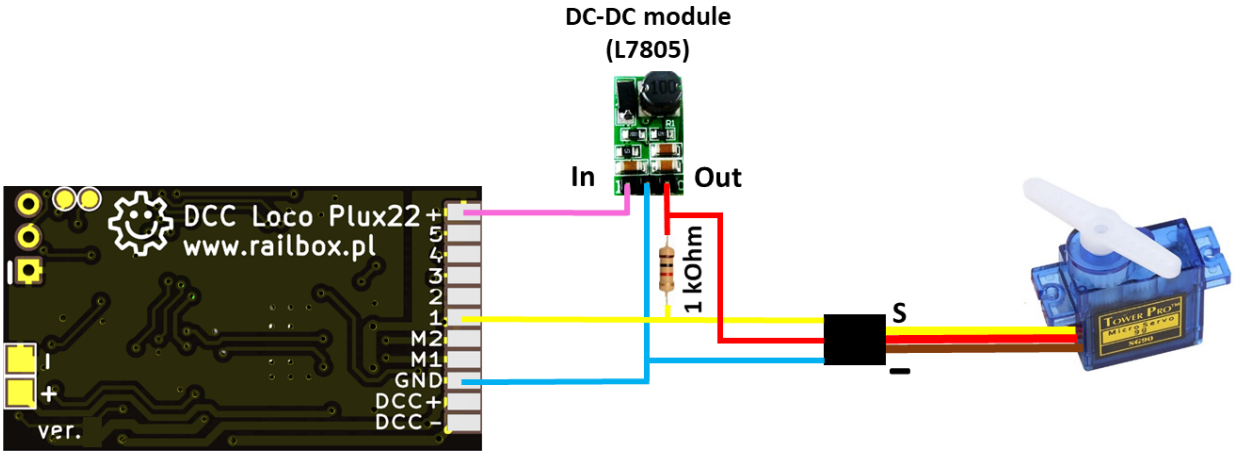
Servomotor connection to the decoder

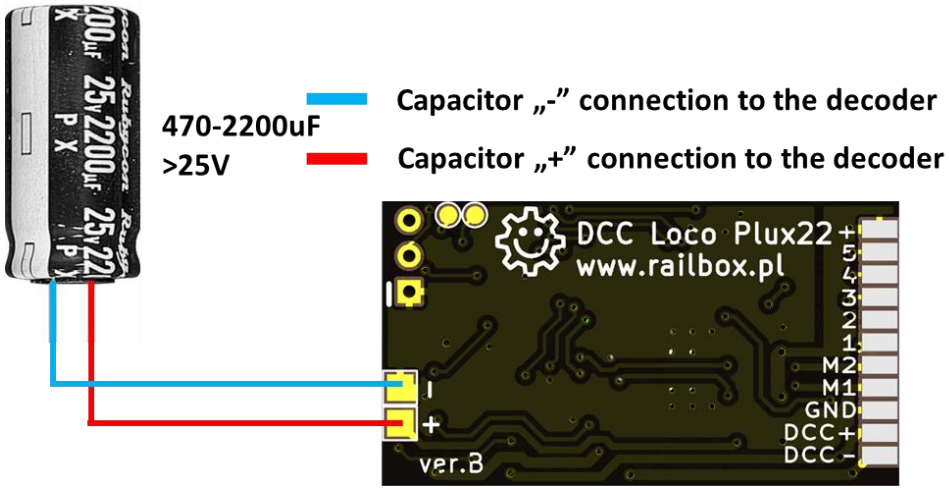
To connect the servo to the decoder, a 5V voltage regulator is required. This can be a linear regulator or a DC-DC converter. Also, one 1K Ohm resistor is necessary for each connected servo. Connection diagram:



Servo signal (S) connection to (1-5) decoder's output
Servo „-" connection to the decoder's „-" trough the „-" of DC-DC module
Input connection (In) of DC-DC module to the decoder's „+"
Servo „+" connection to the output (Out) of the DC-DC module

Connection of an external capacitor to the decoder

To improve the lighting function's work on dirty tracks, it is possible to connect an additional external capacitor. Connection diagram:



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Decoder programming

Connection with mobile app RailBOX: Railroad Control

This symbol means "Easy configuration". All RailBOX products with this symbol on the PCB or sticker on the case are enabling round-way communication (Railcom® protocol) with Railcom® Command station:

- **Automatic detection of new decoders connected to the tracks and the ability to automatically assign the address to the decoder (only with ⚙ Command stations, e.g., DCC Wi-Fi Command Station RB 1110)**
- **Ability to read and write configuration variables (CV) at any time on the main track (POM)**
- **Ability to assign a short name to the decoder (POM) for quick identification of the device in the RailBOX: Railroad Control App**

Users of RailBOX decoders with the symbol ⚙ and the DCC Wi-Fi Command station RB 1110 no longer need to manually program addresses of the decoders (accessories and RailBOX wagon and loco decoders), just connect a new device to the tracks (Command station) and the system itself will automatically find the next free address and transmit it to the decoder. In the RailBOX: Railroad Control application, a new locomotive or accessory will automatically appear with already established address.

Add this decoder in mobile app RailBOX: Railroad control

Tips on RB2212 decoder's configurations:

Parameters of the loco RB2212 decoder optimized for the standard locomotive model, however, depending on the engine type, the parameters can be adjusted. The main CV configurations are:

1. **Acceleration and deceleration (CV 3 and 4).**

2. **Maximum speed:** there are two configurations for maximum speed:

   a. CV 5-used to create a speed curve along with the average speed (CV 6) and minimum speed (CV 2).

   b. CV 60 is slightly different because it is the voltage at maximum speed that the BackEMF System will attempt to maintain at maximum speed. Therefore, if this voltage is less than the maximum BackEMF voltage on the motor, the DCC voltage will change, but the motor will still rotate at a constant speed.

3. **PID.**

   a. the main PID factor that can be customized IS KP (CV 50) and low speed KP (CV 51). This is the force of reaction to a change in engine speed. At low speed we need to have it faster to constantly maintain speed without oscillation.

b. in all tests, the integer (CV 52, CV53) does not add any improvements, so it is set to 0 by default.

c. the default value of the derivative (CV 54, CV 55) is sufficient for most cases.

d. KFF_A (CV 54) and KFF_D (CV 55) correspond to an immediate change in the applied motor voltage in the event of a change in the desired speed. Used mainly only for high accelerations and delays (values close to 255).

CV configuration table

CV	Value	Default value	Description
1	1..127	3	Decoder address
2	0..127	4	Minimum speed: Minimum speed (starting voltage)
3	0..255	34	Acceleration time: 4 - acceleration from 0 to maximum speed in 1 s 8 - acceleration from 0 to maximum speed in 2 s
4	0..255	25	Deceleration time: 4 - deceleration from maximum to minimum speed in 1 s 8 - deceleration from maximum to minimum speed in 2 s
5	0..255	255	Maximum speed
6	10..200	127	Average speed: Together with the maximum (CV5) and minimum speed (CV2) are used to create a speed curve
7			Software version: Read only
8	0..255		Manufacturer ID / Decoder reset: Manufacturer code / Write value 1 to reset decoder to factory settings
13	bit		Analog Mode 1, F1-F8 state
	0	0	F1: 0-on, 1-off
	1	0	F2: 0-off, 1-on
	2	0	F3: 0-off, 1-on
	3	0	F4: 0-off, 1-on
	4	0	F5: 0-off, 1-on
	5	0	F6: 0-off, 1-on
	6	0	F7: 0-off, 1-on
	7	0	F8: 0-off, 1-on

CV	Value	Default value	Description
14	bit		Analog mode 2, FL, F9-F12 state
	0	1	F0f: 0-on, 1-off
	1	1	F0r: 0-off, 1-on
	2	0	F9: 0-off, 1-on
	3	0	F10: 0-off, 1-on
	4	0	F11: 0-off, 1-on
	5	0	F12: 0-off, 1-on
17	192..231	192	Long address (higher byte): Long decoder address (CV17 and 18). To turn on: set bit 5 in CV29
18	0..255	3	Long address (lower byte): Same as CV17
19	0..127	0	Address for multiple traction: If CV #19 > 0: speed and direction are defined by this address
28	bit		Railcom Configuration
	0	0	Decoder address transmission in the first channel CH1: 0-off, 1-on
	1	1	Enable the second channel CH2: 0-off, 1-on
	7	1	Enable automatic detection system: 0-off, 1-on
29	bit		Decoder configuration 1
	0	0	Locomotive Direction: 0-normal, 1-reversed
	1	1	Number of speed steps: 0-14/27, 1-28/128
	2	1	Analog mode: 0-DCC only, 1-Enabled
	3	1	RailCom: 0-disabled, 1-enabled
	5	0	Address type: 0-Short address in CV1, 1-Long address in CV17 and CV18

CV	Value	Default value	Description
112	0..135	0	Lighting effect, output 1: 0: light bulb 1: flashing with frequency 1 (frequency in CV 133) 2: flashing with frequency 1 (reverse) 3: flashing with frequency 2 (frequency in CV 134) 4: flashing with frequency 2 (reverse) 5: short pulse with time with CV137 6: first own sequence (CV139-151) 7: second own sequence (CV151-164) 9: Servo Mode -- Additional effects -- + 16 enables light intensity fade in during time from CV135 + 32 enables light intensity fade in during time from CV136 + 64 enables light intensity fade in during 500 ms + 128 to the CV value will disable own sequence after 1 execution.
113	0..135	0	Lighting effect, output 2: Same as CV112
114	0..135	0	Lighting effect, output 3: Same as CV112
115	0..135	0	Lighting effect, output 4: Same as CV112
116	0..135	0	Lighting effect, output 5: Same as CV112
117	0..135	0	Lighting effect, output 6: Same as CV112
118	0..135	0	Lighting effect, output 7: Same as CV112
212	0..135	0	Lighting effect, output 8: Same as CV112
213	0..135	0	Lighting effect, output 9: Same as CV112
119	0..255	255	Maximum brightness, output 1
120	0..255	255	Maximum brightness, output 2
121	0..255	255	Maximum brightness, output 3
122	0..255	255	Maximum brightness, output 4
123	0..255	255	Maximum brightness, output 5
124	0..255	255	Maximum brightness, output 6
125	0..255	255	Maximum brightness, output 7
219	0..255	255	Maximum brightness, output 8
220	0..255	255	Maximum brightness, output 9
133	0..255	100	Flashing period 1: Flashing period 1 (value x 10 msec)

CV	Value	Default value	Description
134	0..255	100	Flashing period 2: Same as CV133
135	0..255	20	Light intensity fade in time 1
136	0..255	50	Light intensity fade in time 2
137	0..255	1	Single flash time: Single flash time (value x 10 msec)
138	0..255	1	Own sequences step time: Own sequences repetition period (value x 10 msec)
139			First own sequence, beginning: First own sequence CV139-CV151 write one byte of sequence at a time ---------- 1 Factory sequence ---------- 0xB5, 0xFD,0x6F, 0xF7, 0xB5,0xFD,0x6F,0xF7,0xB5,0xFD,0x6F,0xF7,0xB5
151			First own sequence, end: Same as CV139
152			Second own sequence, beginning: Second own sequence CV152-CV164 write one byte of sequence at a time ---------- 2 factory sequence ---------- 0xC7, 0x9F, 0xFF,0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,0xFF
164			Second own sequence, end
165	0..28	9	Shunting mode function number
166	0..1	0	Output status when power is turned on: 1-Restore outputs states when power is turned on, 0-do not remember
50	0..255	40	PID KP (fast driving): Proportional coefficient for fast driving
51	0..255	130	PID KP (slow driving): Same as CV50
52	0..10	0	PID KI (fast driving): Integral coefficient for fast driving
53	0..10	0	PID KI (slow driving): Same as CV52
54	0..40	7	PID KD (fast driving): Differential coefficient for fast driving
55	0..40	12	PID KD (slow driving): Same as CV54
56	0..50	0	PID KFF Acceleration
57	0..50	0	PID KFF Deceleration
58	40..160	80	BackEMF: PID interval
59	6..20	6	BackEMF: measurement delay
60	30..90	90	BackEMF: Voltage at maximum speed

CV	Value	Default value	Description
61	0..255	10	Acceleration time (shunting mode): 4 - acceleration from 0 to maximum speed in 1 s 8 - acceleration from 0 to maximum speed in 2 s
62	0..255	10	Deceleration time (shunting mode): 4 - deceleration from maximum to minimum speed in 1 s 8 - deceleration from maximum to minimum speed in 2 s
126	0..255	0	Minimum brightness, output 1
127	0..255	0	Minimum brightness, output 2
128	0..255	0	Minimum brightness, output 3
129	0..255	0	Minimum brightness, output 4
130	0..255	0	Minimum brightness, output 5
131	0..255	0	Minimum brightness, output 6
132	0..255	0	Minimum brightness, output 7
226	0..255	0	Minimum brightness, output 8
227	0..255	0	Minimum brightness, output 9

Output configuration table (tips on output mapping):

The table provides matrix indications of which function inputs are controlling the outputs of the digital decoder. This allows the user to customize which outputs are controlled by which input commands. Outputs that are controlled by FL (fl) are indicated in CV # 33, FL (fr) in CV#34, F1 in CV #35, to F12 in CV#46. A value of " 1 " in each bit indicates that this function controls this output. This allows a single function to control multiple outputs, or the same output can be controlled by multiple functions. CV 33-37: control outputs 1-7, CV 38-42: control outputs 4-7, CV 43-46: control outputs 7. By default, F0 (fl) controls output 1, F0 (fr) controls output 2, F1 controls output 3, and so on. The LSB (least significant bit) CV starts with the smallest controlled output as shown in the table below.

CV	Description	Default value	Bit							
			7	6 output7	5 Outpu6	4 output5	3 output4	2 output3	1 output2	0 output1
33	F0 (forward FL)	1	0	0	0	0	0	0	0	**1**
34	F0 (backward FR)	2	0	0	0	0	0	0	**1**	0
35	F1	4	0	0	0	0	0	**1**	0	0
36	F2	8	0	0	0	0	**1**	0	0	0
37	F3	16	0	0	0	**1**	0	0	0	0
38	F4	4	0	0	**1**	0	0			
39	F5	8	0	**1**	0	0	0			
40	F6	0	0	0	0	0	0			
41	F7	0	0	0	0	0	0			
42	F8	0	0	0	0	0	0			
43	F9	0	0	0						
44	F10	0	0	0						
45	F11	0	0	0						
46	F12	0	0	0						
47	Forward	0	0	0	0	0	0	0	0	0
48	Backward	0	0	0	0	0	0	0	0	0