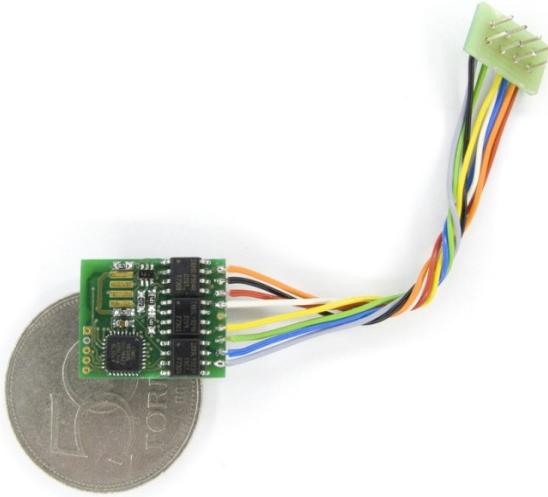


TM-56231



# Load-regulated locomotive decoder

User's manual



5 998975 300582



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## Safety warning

During the operation of the device the specified technical parameters shall always be met. At the installation the environment shall be fully taken into consideration. The device must not be exposed to moisture and direct sunshine.

A soldering tool may be necessary for the installation and/or mounting of the devices, which requires special care.

During the installation it shall be ensured that the bottom of the device should not contact with a conductive (e.g. metal) surface!

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## Properties

- Developed for NMRA DCC systems
- Load-controlled motor driving
- Two AUX outputs
- Individual effect for each output
- Changeable motor PID regulation parameters
- DirectCV and POM programming mode
- Interchangeable function numbers
- Compact designs
- Mountable into H0 and certain TT models

## Technical parameters

Supply voltage: 5-20V

Idle mode current consumption: 20 mA

Max. current consumption: 1000 mA

AUX load current: 200mA

Connector type: NEM652 + extension cable

Motor excitation frequency: 32KHz

Address range: 1-9999 + Consist Address

Dimensions: 22x15 mm

## Short description

The most important advantage of the load-regulated decoder is the constant motor revolution number at low speed. The decoder contains switchable outputs, where to various external loads can be connected.

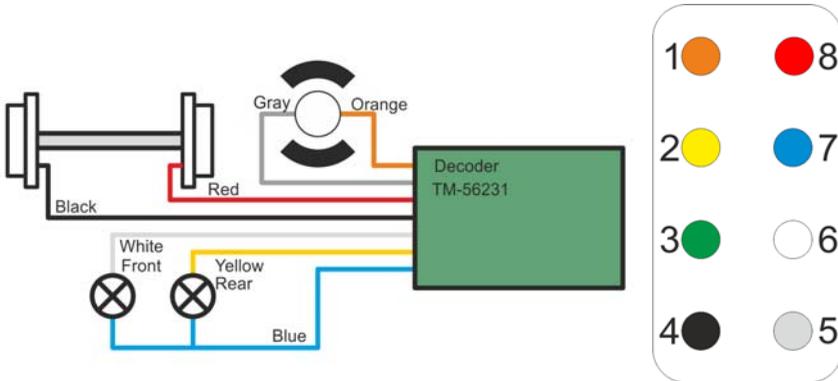
## Mounting of the decoder

**Important!** Each capacitor on the motor poles and the engine frame must be removed!

Contact assignment of the standard NEM652 connector

(Name, pin number, wire color):

+ Motor (1, orange)	Right side rail (8, red)
Rear light / Back-up light (2, yellow)	+ supply, common (7, blue)
AUX 1 (3, green)	Front light / Headlight (6, White)
Left side rail (4, black)	- Motor (5, grey)



## Mechanical mounting

The decoder is externally insulated, so it can be fastened to the frame easily and without risk. It is to be considered that the motor is not mechanically hindered by the decoder and its wires.

If the engine is not prepared for the reception of a digital decoder, it is practicable to apply a preparatory module. (Pl. TM-56271)  
Point 1 of the NEM652 connector is marked by a circle ( ° ).

## Function outputs

Never exceed the load capacity of the function outputs! It is possible to use LED, traditional bulb, smoke generator etc.

Individual effects can be selected for each function output. On the outputs common „+ supply voltage“ system is applied. Consequently, each load shall be connected between the output (FL, RL, AUX1, AUX2) and the +16V (blue wire). (This is the standard NMRA connection).

**If bulb is connected:** Take care that the rated voltage of the bulb be greater than 12V. Generally the bulbs inside the engines have been prepared for 16V system, thus no intervention is required.

**If LED is connected:** Engines originally provided with LEDs contain the serial current limiting resistors as well. If separate LEDs are applied, a serial current limiting resistor is to be used for each of them. Generally a 4,7 KOhm 0,6W resistor is suitable for most LEDs.

**If smoke generator is connected:** Insulate the metal case of the smoke generator from the engine frame! The frame of some engine types (mainly the older ones) is electrically not independent of the rail collectors. In this case a shrinkable tube or an insulation tape can be used for insulation.

**Usage of back-up light, auxiliary lights and AUX2:** The „AUX2“ output is not terminated to the standard eight-pole NEM652 connector. This output can be connected by means of a separate wire of purple color.

## **DCC speed formats**

The decoder automatically detects the speed formats.  
Supported speed formats: 14/27/28/128.

The correct operation of the speed modes is guaranteed and tested in the following systems:

- ESU ECoS ®
- Roco ® Lokmaus 2, Lokmaus 3, Multimaus
- Uhlenbrock ® Intellibox
- Lenz ® Digital Plus V2
- ZIMO ® MX1

In systems Lenz ® Digital Plus V3.0 only the 28/128 speed formats are available.

## Digital and analog operating mode

Change-over occurs automatically. In digital mode the motor is regulated, in analog mode the decoder transfers maximal supply voltage for the motor. Thus in analog mode the decoder intentionally ignores the acceleration and deceleration parameters.

The speed mode 128 is proposed to achieve smooth running!

In analog mode the decoder operates over 5V!

## Decoder settings (programming)

The so-called CVs (Configuration Variable) can be used for setting. The decoder keeps these settings even after being switched off.

The decoder CV programming mode can be accessed by various methods depending on the digital centre. The user's manual of the digital centre contains detailed information.

### NMRA standards

The decoder complies with the specification of the NMRA (National Model Railroad Association) standard in every respect. Thus the setting addresses meet the standard.

### Programming process

The procedure can be explained by a simple address setting example. The original address 3 will be changed to **79** in our example (less than 127):

#### 1. Direct CV mode

We need a separate programming rail with only the engine to be programmed!

In our digital centre select the Direct CV setting mode. The system prompts for the setting address. Enter the CV address of the „primary address“: 1.

Give the new CV value entering „79“ and start programming. A short motor moving and a flashing light indicate to the digital centre that the decoder has performed setting. Thereafter the decoder can be controlled through the new address „79“.

## 2. POM mode

In this case no separate programming rail is required, but we have to be aware of the current address of the decoder.

In this mode first the engine address then the CV address and at last the new value shall be given.

The user's manual of the digital centre contains detailed information on programming.

## Decoder address settings

**Using short addresses:** According to the DCC standard the decoders can have an address range of 1 to 127 in case of short addressing.

For short address programming two register values shall be set:

CV1: Short address

CV29 – bit 5: Selection of short and long address.

Enter address 79 in our example.

CV1 = 79

CV29 – bit 5 = 0

**Using long addresses:** This address range shall be used between 128 and 9999. Long addresses are often used when the track number of the engine is in question.

Three register values shall be modified:

CV17: Upper address byte

CV18: Lower address byte

CV29 – bit 5 = Selection of short and long address.

In our example we give address 5009 to the engine.

*We should use the long address setting if the digital centre is provided with this option. If the digital centre fails to modify the*

*CV29 value, the bit 5 shall be set to 1 by bit modification or value rewriting.*

Calculation of the CV17 and CV18 values:

$5009 / 256 = 19$  with remainder 145

$CV17 = 192 + 19$

$CV18 = 145$

Our web page helps you to calculate the addresses and settings:

[http://www.trainmodules.hu/tips\\_decoder\\_address.html](http://www.trainmodules.hu/tips_decoder_address.html)

## **Motor regulation**

Due to the original setting of the load-regulating decoder it is suitable for the proper driving of most motor types. Furthermore, the fine-tuning of regulation parameters is also possible.

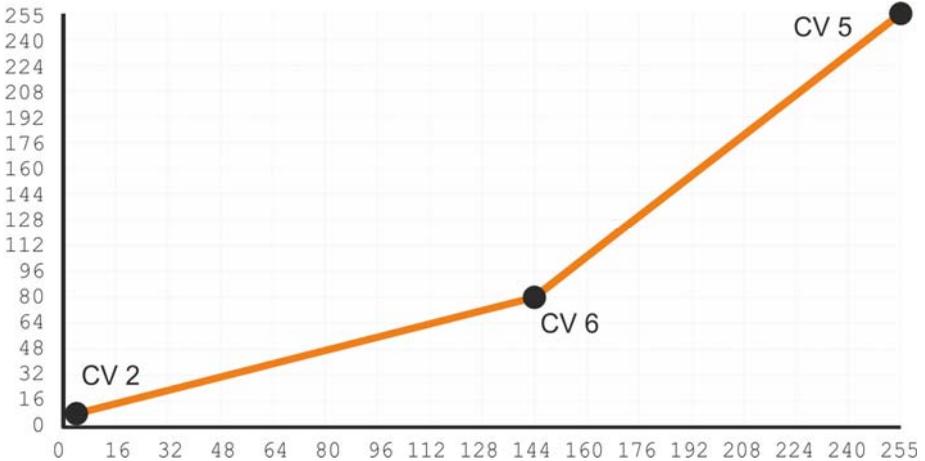
**„P” parameter:** Proportional element. Its increasing shortens the response time but the regulation overshoot increases as well. Decrease this value if the motor runs up too quickly at starting.

**„I” parameter:** Integrating element. It is for decreasing the difference between the required speed (Base signal) and the effective speed. Decrease this value if the motor speed permanently „fluctuates”.

**„D” parameter:** Differential element. Overshoot compensating element.

**Load regulation range:** The speed stage can be set in the decoder, under which the load-regulated mode is effective. To stop the load-regulation, set the CV57 value to 0. For regulation in max. speed range, set the value to 127.

**Speed curve:** With CV2, CV5 and CV6 we can adjust the acceleration and deceleration speed curve.



## Base function

**F0:** Light (Front and Rear) – Normal engine light, dependent on the running direction.

**F1:** AUX1 OFF/ON

**F2:** AUX2 OFF/ON

**F3:** Marshalling run (50% speed usual for decoders)

**F4:** Ignoring acceleration and deceleration parameters

**F5:** Beam deflectors

F0 Front, F0 Rear, F1, F2 functions can be programmed for separate light effects. See: CV113 - CV116

## Restoring the decoder base settings

Each setting of the decoder reverts to the original value if value „8“ is written in the CV8 register.

## Decoder CV table

Name	CV	Value range	Original setting
Primary address	1	1-127	3
Min. speed	2	0-75	0
Acceleration	3	0-63	50
Deceleration	4	0-63	50
Max. speed	5	0-63	63
Medium speed	6	0-63	22
Version number	7	Read only	
Reset / Manufacturer ID	8	Writing value 8 everything returns to original basic setting	
Analog functions (F1-F8)	13	0/1 = F1 0/2 = F2 0/4 = F3 0/8 = F4 0/16 = F5 0/32 = F6 0/64 = F7 0/128 = F8  Example: $F1+F2+F4 = 1 + 2 + 8 = 11$	0
Extended address	17+ 18	192-9999	192
Consist Address	19	1-127 – Normal direction 129-255 = Reverse direction	0
Consist Function	21	0/1 = F1 0/2 = F2 0/4 = F3 0/8 = F4 0/16 = F5 0/32 = F6 0/64 = F7 0/128 = F8  Example: $F1+F2+F4 = 1 + 2 + 8 = 11$	0
Setting reg. I.	29	0/1 = Normal/Reverse direction 0/2 = 28 and 128 speed stage. 0/4 = Digital only / Analog-Digital mode 0/8 = BiDi communication OFF/ON 0/32 = Primary address range / Extended address (17-18 reg. setting!)  Example: Engine speed + Analog-Digital mode = 2 + 4 = 6	4
PID regulating „P“ (proportional element)	54	0-80	25
PID regulating „I“ (integrating element)	55	0-80	5

Name	CV	Value range	Original setting																										
PID regulating „D“ (deriving element)	56	0-80	48																										
PID regulating range	57	0-127 Changing point related to the speed format 128	127																										
Light effect frequency	112	4-64	33																										
Front light	113	<table border="1"> <tr><td>Normal light intensity</td><td>Vol</td></tr> <tr><td>Blinking (Phase 1)</td><td>Vol+16</td></tr> <tr><td>Blinking (Phase 2)</td><td>Vol+32</td></tr> <tr><td>Flashing</td><td>Vol+48</td></tr> <tr><td>Double flashing</td><td>Vol+64</td></tr> <tr><td>Fire effect</td><td>Vol+80</td></tr> <tr><td>Smoke generator</td><td>Vol+96</td></tr> <tr><td>Increase intensity</td><td>Vol+112</td></tr> <tr><td>„Marslight“</td><td>Vol+128</td></tr> <tr><td>„Gyrolight“</td><td>Vol+144</td></tr> <tr><td>„Rule 17“ for front light</td><td>Vol+160</td></tr> <tr><td>„Rule 17“ for rear light</td><td>Vol+176</td></tr> <tr><td>Pulse output</td><td>Vol+192</td></tr> </table> Vol = Max. light intensity Range: 0-15	Normal light intensity	Vol	Blinking (Phase 1)	Vol+16	Blinking (Phase 2)	Vol+32	Flashing	Vol+48	Double flashing	Vol+64	Fire effect	Vol+80	Smoke generator	Vol+96	Increase intensity	Vol+112	„Marslight“	Vol+128	„Gyrolight“	Vol+144	„Rule 17“ for front light	Vol+160	„Rule 17“ for rear light	Vol+176	Pulse output	Vol+192	127
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AUX1	115	<table border="1"> <tr><td>Normal light intensity</td><td>Vol</td></tr> <tr><td>Blinking (Phase 1)</td><td>Vol+16</td></tr> <tr><td>Blinking (Phase 2)</td><td>Vol+32</td></tr> <tr><td>Flashing</td><td>Vol+48</td></tr> <tr><td>Double flashing</td><td>Vol+64</td></tr> <tr><td>Fire effect</td><td>Vol+80</td></tr> <tr><td>Smoke generator</td><td>Vol+96</td></tr> <tr><td>Increase intensity</td><td>Vol+112</td></tr> <tr><td>„Marslight“</td><td>Vol+128</td></tr> <tr><td>„Gyrolight“</td><td>Vol+144</td></tr> <tr><td>„Rule 17“ for front light</td><td>Vol+160</td></tr> <tr><td>„Rule 17“ for rear light</td><td>Vol+176</td></tr> <tr><td>Pulse output</td><td>Vol+192</td></tr> </table> Vol = Max. light intensity Range: 0-15	Normal light intensity	Vol	Blinking (Phase 1)	Vol+16	Blinking (Phase 2)	Vol+32	Flashing	Vol+48	Double flashing	Vol+64	Fire effect	Vol+80	Smoke generator	Vol+96	Increase intensity	Vol+112	„Marslight“	Vol+128	„Gyrolight“	Vol+144	„Rule 17“ for front light	Vol+160	„Rule 17“ for rear light	Vol+176	Pulse output	Vol+192	15
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Pulse output	Vol+192																												

Name	CV	Value range	Original setting
AUX2	116	Normal light intensity Vol	15
		Blinking (Phase 1) Vol+16	
		Blinking (Phase 2) Vol+32	
		Flashing Vol+48	
		Double flashing Vol+64	
		Fire effect Vol+80	
		Smoke generator Vol+96	
		Increase intensity Vol+112	
		„Marslight“ Vol+128	
		„Gyrolight“ Vol+144	
		„Rule 17“ for front light Vol+160	
		„Rule 17“ for rear light Vol+176	
		Pulse output Vol+192	
		Vol = Max. light intensity Range: 0-15	

## Function association table

	Value	1	2	4	8	16	32	64	128
CV	Function	FHL	RHL	AUX1	AUX2	AUX3	AUX4	Shunt	AccDec
129	F0 fwd	1							
130	F0 rev		2						
131	F1 fwd			4					
132	F1 rev			4					
133	F2 fwd				8				
134	F2 rev				8				
135	F3 fwd							64	
136	F3 rev							64	
137	F4 fwd								128
138	F4 rev								128
139	F5 fwd								
140	F5 rev								
141	F6 fwd								
142	F6 rev								
143	F7 fwd								
144	F7 rev								
145	F8 fwd								
146	F8 rev								
147	F9 fwd								
148	F9 rev								
149	F10 fwd								
150	F10 rev								
151	F11 fwd								
152	F11 rev								
153	F12 fwd								
154	F12 rev								

	<b>Value</b>	<b>1</b>
<b>CV</b>	<b>Function</b>	<b>Dimmer</b>
156	F0 fwd	
157	F0 rev	
158	F1 fwd	
159	F1 rev	
160	F2 fwd	
161	F2 rev	
162	F3 fwd	
163	F3 rev	
164	F4 fwd	
165	F4 rev	
166	F5 fwd	1
167	F5 rev	1
168	F6 fwd	
169	F6 rev	
170	F7 fwd	
171	F7 rev	
172	F8 fwd	
173	F8 rev	
174	F9 fwd	
175	F9 rev	
176	F10 fwd	
177	F10 rev	
178	F11 fwd	
179	F11 rev	
180	F12 fwd	
181	F12 rev	

## **Guarantee and legal statement**

Each parameter of the device was submitted to comprehensive testing prior to marketing. The manufacturer undertakes one year guarantee for the product. Defects occurred during this period will be repaired by the manufacturer free of charge against the presentation of the invoice.

The validity of the guarantee will cease in case of improper usage and/or treatment.

Attention! By virtue of the European EMC directive the product can be used solely with devices provided with CE marking.

*The mentioned standards and branch names are the trademarks of the firms concerned.*

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