Return to Factory Setting (Reset)
Two CVs (CV8, CV59) can be used in DCC programming and one CV (CV59) in Motorola programming to return the decoder to factory settings. If you do not want to rewrite all available areas, you can decide which areas should be set to default.
The to be programmed value 1-5 places the following CVs into factory setting:
1 = CV0 - 256, as well as CV257 - 512 (RailCom® Bank 7) CV31=0, CV32=255

2 = CV257 - 512 (RailCom Plus® Banks 5 & 6) CV31=1, CV32=0 and CV31=1, CV32=1

3 = CV257 - 512 (extended function Mapping Banks 1 & 2) CV31=8, CV32=0 and CV31=8, CV32=1

4 = CV257 - 512 (PWM-Modulation Function outputs banks 3 & 4) CV31=8, CV32=3 and CV31=8, CV32=4

Please note! After a reset of the decoder, all default configurations are overwritten! Therefore, please only do a reset in case of an important and urgent emergency. If you still reset your decoder, you eventually have to reprogram the individual function mapping (see FAQ for more information)!

Programming
Configurations variables (CVs) form the basis of all possible settings of the decoder. The decoder can be programmed with DCC and Motorola control panels.

Technical Data

Addresses:	1-9999 (extended DCC address)
Max. motor current / Load:	0,65 A* short-term to 1 A
Function outputs:	0,4 A each
Size:	19 x 14 x 3,5 mm

*Continuous load, may vary depending on the installation situation

Note: This product is not a toy and is not suitable for children under the age of 14. Any liability for damages of any kind caused by improper use or not observing these instructions is excluded.

CV	Description	Range	Value
1	**Loco address**	DCC: 1 - 127 Motorola: 1 - 80	3
2	**Minimum speed** (change, until the loco drives with speed step 1)	1 - 63	1
3	**Acceleration** 1 means that every 5ms the actual speed is increased by 1. If the internal maximum speed is set to 200 (CV5=50 or CV94=200), then the accelaration from 0 to Fmx is 1sec.	0-255	5
4	**braking interia** (time factor like CV3)	0-255	5
5	**Maximum speed** (must be greater than CV2)	1 - 63	48
6	**Middle speed** (must be greater than CV 2 and less than CV5)	1 - 63	24
7	**Software version** (the processor can be updated)	-	different
8	**Manufacturer ID** Decoder reset, values as CV59	different	162
12	**Operating modes** **Value** Bit 0=0 DC (Analog operation DC) off 0 Bit 0=1 DC (Analog operation DC) on 1* Bit 2=0 Data format DCC off 0 Bit 2=1 Data format DCC on 4* Bit 3=0 Data format Motorola off 0 Bit 3=1 Data format Motorola on 8*	0-15, 255	255
17 18	**Expensive loco address** 17 = High Byte 18 = Low Byte	1 - 9999 192 - 231 0 - 255	2000 199 208
27	**Brake signal settings (automatic stop)** **Value** Bit 0 = 1 -> ABC right rail more positive 1 Bit 1 = 1 -> ABC left rail more positive 2 Bit 4 = 1 -> DC with direction of travel opposite 16 Bit 5 = 1 -> DC with direction of travel equal 32 Bit 7 = 0 -> ABC Direction of travel forward, if bit 0 = 1 or bit 1 = 1 0 Bit 7 = 1 -> ABC Direction of travel backwards, if bit 0 = 1 or bit 1 =1 128	0-179	0
29	**Configuration according to DCC standard** **Value** Bit 0=0 normal direction of travel 0* Bit 0=1 opposite driving direction 1 Bit 1=0 14 drive levels 0 Bit 1=1 28 drive levels 2* Bit 2=0 only digital operation 0 Bit 2=1 automatic analog/digital switching 4* Bit 3=0 RailCom® off 0* Bit 3=1 RailCom® on 8* Bit 4=0 drive level about CV 2, 5 and 6 0* Bit 4=1 use characteristic line from CV 67 - 94 16 Bit 5=0 short address (CV 1) 0* Bit 5=1 long address (CV 17/18) 32	0-63	14
30	Error memory for function outputs, motor and temperature monitoring 1 = fault function outputs, 2 = fault motor, 4 = overtemperature	0-7	0
31	1. Marker CV for CV-Banks	0, 1, 8	0
32	2. Marker CV for CV-Banks	0,1,3,4,5,255	255
33-46	**SImple Function Mapping** **Relation of the function outputs to the CVs** CV 33 Light function key (F0) forwards 1 CV 34 Light function key (F0) backwards 2 CV 35 Function key F1 4 CV 36 Function key F2 0 CV 37 Function key F3 0 ..... 0 CV 46 Function key F12 0		
59	**Reset to factory defaults** (even with CV8) 1 = CV 0 - 256, as well as CV257 - 512 (RailCom® bank 7) 2 = CV 257 - 512 (RailCom Plus® banks 5 & 6) 3 = CV 257 - 512 (extended function mapping banks 1 & 2) 4 = CV 257 - 512 (PWM-Modulation function output banks 3 & 4)	0 - 4	0

Note:
You can find a detailed instruction manual for the PIKO Hobby Decoder on the web page of the respective product in our web shop.

NOTE: This product is not a toy and is not suitable for children under 14 years of age. Any liability for damage of any kind caused by improper use or by failure to observe these instructions is excluded. is excluded.

Service:
Internet: www.piko.de
E-Mail:info@piko.de
Hotline: Di + Do 16-18 Uhr

In case of a possible defect, please send us the module with the proof of purchase, a short error description and the decoder address.

Warranty Declaration
Each component is checked for its complete functionality before delivery. Should an error nevertheless occur within the warranty period of 2 years, we will repair the module free of charge upon presentation of the proof of purchase. The warranty claim is void if the damage was caused by improper handling. Please note that, according to the EMC law, the module may only be operated within vehicles bearing the CE mark.

56122-90-7005_2023

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#56122 PIKO Hobby Decoder 8-pol. NEM652 multiprotocol

Description
This locomotive decoder is a small, high performance multiprotocol decoder. It can be used with DCC-, and Motorola digital systems and also operates in analog mode with DC currents.
The decoder works on a frequency of 18,75 kHz and is therefore not only suitable for DC current but also for bell-shaped armature motors (e. g. Faulhaber, Maxon, Escap) up to a continuous current consumption of 0.65 A. Short-term higher motor currents up to 1 A are well tolerated.
The decoder is also RailCom® and RailCom Plus® capable and is in command of ABC braking as well as ABC Slow Running. Setting of the motor characteristics is done via minimum, medium and maximum speed (simple characteristic) or via the extended characteristic with individual adjustments for 28 drive positions.
The decoder has two headlight outputs depending upon direction of travel and one additional special function outputs. Slow moving extended shunting operations and the three possibilities in starting out, brake action delays can be set by function keys.

Characterictics
- Suitable for DC current and bell-anchor motors up to 0,65 A.
- Quiet motor running by motor control with 18.75 kHz
- 14, 28, 128 gears, depending upon data format.
- Short (1-127) and long (128-9999) Addresses
- NMRA conformity
- RailCom® and RailCom Plus®
- Adjustable minimum, maximum and medium speeds.
- Extended driving gear characteristics are adjustable.
- Shunting gear (half-speed) adjustable.
- 3 settings for startup and brake delay, individually adjustable via F0 - F28
- Headlight outputs in direction of travel dimmable.
- Adjustable activation of the light- and function outputs adjustable for analog operation.
- Second dim function for lighting and A1 adjustable switchable.
- Simple function mapping, brake delay and shunting operations.
- Extended Function Mapping, F0 - F68 for switching multiple outputs depending on linked conditions
- Train illumination disengageable.
- Function outputs: Blinking with variable shutoff time.
- Function exists: 2 phase for alternative flashers.
- Load dependent smoke generator controls.
- Firebox with adjustment parameters for brightness changes and flicker rhythm.
- Fading in, or out of the lighting- and function outputs, adjustable.
- Energy saving lighting effect: After attaining maximum brightness after time setting.
- Fluorescent lighting, switching-on effect with adjustable flash time and –number.
- 8 PWM banks with 64 modulation entries each for e. g. American light effects such as Mars Light, Gyra Light, Strobe etc.
- Brakes with DCC braking signal, braking track with DC current or ABC-Brakes.
- ABC-Slow Moving Distance with LENZ BM2
- 2 settings for braking distance in cm, activated by ABC-, DC- and DCC-brake signal, as well with driving speed 0 with adjustable speed level step.
- 2 motor control types for a precise motor control with many control settings
- All outputs are secured against short circuits.
- Error memory for motor and function outputs as well as temperature shutoff.
- Conventional DC operation with automatic switch-over to the individual mode of operation.
- All CVs must be programmed with digital devices with DCC formats and Motorola.
- In DCC-operation, programmable per register, CV directly or page programming.
- Main track programming (DCC)
- Decoder programming lock.

Connection of the PIKO Hobby Decoder
Remove the socket plug from the 8pole interface of your vehicle. Stick the locomotive decoder carefully into the same place of the interface socket. If the vehicle is running in the wrong direction and the light outputs work laterally reversed or not at all, please turn the decoder 180°.
Make sure that no conductive connection is possible anywhere. Make sure that no short-circuits can occur even after closing the locomotive. The first start-up should be carried out on the programming track when the programming mode of the control unit is called up. Usually very small currents flow during reading or programming, which do not damage the decoder in the event of a short circuit.

Special Functions A1
The special function A1 of the decoder can only be used when the designated user are already connected to the interfaces 8pole in the vehicle or on when there are solder pads available on the main circuit board.

CAUTION: Soldering on the decoder should only be performed by experienced experts with proper tools. For decoders which were damaged by improper handling, any warranty becomes void.

A short circuit with the motor, lighting, third rail pickup and wheels can destroy the device and eventually the locomotive electronics!

Decoder Startup (delivered condition)
Enter address 3 into the control unit. The decoder operates depending on the data format used in DCC-Operation with 28 speeds or in Motorola operation. With a RailCom Plus® capable digital center, the decoder is up and running within a few seconds and can be operated immediately. If the decoder is used on conventional systems, it can be controlled with a DC drive unit. The operating mode is automatically recognized by the decoder. The status of functions F0 - F12 can be set for analog operation via CVs 13 and 14.

Analog Operation with DC Voltage
The locomotive decoder is suitable for analogue operation with DC voltage, which is self-detected.
NOTE: In DC operation, your vehicle will only start up at higher voltage (speed controller turned up further) than you might have been used to in operation with analogue vehicles.

Function outputs in analog operation
It is possible to set the decoder in such a way that the function keys F0 - F12, as assigned in Function Mapping, can also be switched on in analog mode. For this purpose, CVs 13 & 14 must first be programmed with a digital control unit. The corresponding values can be found in the CV table.

Motorola
In order to be able to reach the functions F1 - F2 when used with Motorola command stations, the decoder has 3 Motorola addresses, which are stored trinary in CV47-49. These 3 addresses are also used for decoding. If an address is programmed decimal in CV1, the decoder automatically stores the trinary equivalent in CV47 up to address 79. For example, in order to use Motorola locomotive addresses up to 255, CVs 47 - 49 must be programmed directly decimal via Motorola programming.
These CVs can be read but not programmed on the DCC programming track.
If the CV47 is programmed via Motorola, CV1 is not changed and therefore the DCC data format in CV12 is switched off, so that the decoder cannot be accessed by mistake via 2 addresses.
If bit 5 (DCC long address) is set in CV29, the Motorola data format is switched off except for Motorola programming, so that the decoder cannot react to 2 addresses.

Configurations-CVs
Besides the decoder address, the configuration CVs of a locomotive decoder are certainly the most important CVs. These are the CVs 29 and 50 of the PIKO Hobby Decoder, and a configuration CV usually contains different settings of a decoder, which are displayed in a maximum of 8 bits (0 - 7). The value to be entered for a CV is calculated from the respective CV table by adding the values of the desired functions. The following table shows you the meaning and content of the configuration CVs, as well as an example calculation of the value:

Bit	Configuration CV29	default
0	normal direction reversed travel	0 1
1	14 / 27 speed steps 28 / 128 speed steps	0 2
2	only digital operation automatic analogue / digital switching	0 4
3	RailCom® switched off RailCom® switched on	0 8
4	speed steps from CV2, 5 and 6 speed characteristics from CV67 to 94	0 16
5	short address (CV1) long address (CV 17/18)	0 32

Example (CV 29):

Normal driving direction	Value = 0
28 Speed steps	Value = 2
Auto. Analog/Digital detection	Value = 4
RailCom® off/on	Value = 8
Speed steps using CV 2, 5, 6	Value = 0
Short address	Value = 0

The sum of all the values is 14.
This value is set to CV29 as factory default value.

Bit	Configuration CV50	Value
0	Motorola 2. address not use Motorola 2. address use	0 1
1	Motorola 3. address not use Motorola 3. address use	0 2
2	light output not switch light output switch	0 4
3	Frequenzy Light, A1 = 156Hz Frequenzy Light, A1 = 24KHz	0 8

RailCom®, RailCom Plus®
The RailCom® technology developed by LENZ® is based on the transmission of data from the decoder into the specially prepared (CutOut) DCC digital signal on the track. Detectors must be located on the track to evaluate this decoder data and, if necessary, forward it to the control center. The decoder sends, depending on the setting, the decoder address and, when read out via the main track programming, CV values which can be displayed by the digital control panel (depending on the detector and control panel). The CV29 RailCom® can be switched on or off in the decoder via bit 3 of the CV29 RailCom®. Further RailCom® settings can be made in CV 28. There, for example, RailCom Plus® is also switched on via bit 7. If RailCom Plus® is switched on, the decoder will automatically log on to a RailCom Plus® capable control unit (e. g. PIKO SmartControl) with its locomotive symbol, decoder name and special function symbols within a few seconds. Thanks to this RailCom Plus® technology, there is no need to store locomotive data in the central control unit and no locomotive addresses have to be programmed into the decoder.

Braking Behavior

Märklin Braking Track
The decoder reacts to a Märklin braking distance (brakes with analogue DC voltage on the track) when CV29 bit 2 and CV27 bit 4 or bit 5 are set to 1 (factory setting 1 and 0).
CV27 Bit 4 = 1 -> DC with opposite direction of travel.
CV27 Bit 5 = 1 -> DC with direction of travel.

ABC - Brakes
If the decoder detects a lower amplitude of the digital voltage on one side of the track, a braking process begins.
On which side of the rail the digital voltage should be more positive in order to activate the braking process can be set via CV27:
CV27 = 1, brake when right rail is more positive
CV27 = 2, brake when left rail is more positive
CV27 = 3, brake irrespective of which rail is more positive
The voltage difference can be set in CV97. The desired difference corresponds to the CV value * 0.12V.
If an ABC slow speed signal is detected according to a Lenz BM2 module, the decoder brakes to the internal speed range (0 - 255) which can be set in CV98.

Constant Braking Distance in cm
The decoder offers the possibility of two adjustable, constant braking distances in centimeters, true to scale.
The constant braking distances can be triggered by various events. These include the ABC brake signal, the brake signal of a DCC brake generator, the brake signal of a DC braking section, as well as speed 0. When braking with speed 0 (e. g. manual operation) it is possible to enter a speed step threshold above which the constant braking distance is only carried out. If the internal speed step of the locomotive decoder is lower than the entered speed step threshold, the vehicle stops at nominal speed 0 with the set brake delay from CV4, or CV145, or CV147.
CV138 = 1 - 255 -> Current speed step above which braking is carried out with a constant braking distance when the nominal speed is set to zero.
CV139 = Braking distance in cm
CV140 = alternative braking distance, can be activated via the CROSS bit (see "Advanced Function Mapping")
CV141 = maximum speed of the model locomotive in cm/s
CV142 = If the value determined for CV141 exceeds 255, the remainder is entered in CV142 (possibly track 1 IIm (G).
CV143 = Activation of the constant braking distance by:
Bit 0 = 1 -> reference speed = 0, with current internal speed according to CV138 and higher
Bit 1 = 1 -> ABC Brakes
Bit 2 = 1 -> DC Brakes
Bit 3 = 1 -> DCC Brake signal
CV143 = 0 -> No constant brake distance

If braking is initiated with a constant braking distance, the decoder does not react to driving commands again until the locomotive has come to a standstill. This process can be interrupted by switching on the shunting gear.

Determining the maximum speed of the model locomotive
Program the CV of the maximum speed in the decoder to the maximum possible value (CV5 = 63, or when using the extended gear stage characteristic CV94 = 255)
Mark a starting point on a sufficiently long, straight track section from which the vehicle can drive for approx. 2 seconds without hindrance at the possible maximum speed. Lay down a folding rule (inch rule) at the selected starting point. Now enter this section at maximum speed, e.g. the speed governor is set to the highest speed. When you reach the starting point, start the time measurement for 2 seconds. After these 2 seconds have elapsed, note the position of the vehicle on the yardstick and read the value in cm. Divide this value by 2 and you will get the speed in cm/s. This value is now entered in CV141. In the track widths 1 and IIm (G) for very fast vehicles, the determined value may possibly exceed 255. In this case, please enter the value 255 in CV141 and the rest of the determined value in CV142.
After this measurement, the CV for maximum speed (CV5 or CV94) can be set to the desired maximum speed for driving.

Function Outputs
Simple Function Mapping
The following settings of the decoder are only possible with simple function mapping (CV 96 = 0).
In the simple function mapping, the assignments of switching tasks such as lighting, special function outputs, shunting gear and switchable starting and braking delay can be freely assigned to the function keys F0 to F12 of the digital control center. The value that is written to a CV of the function mapping determines the functions that can be switched using a function key assigned to the CV. The CVs 33 to 46 serve this purpose according to the following scheme.

Assignment of Function keys to the CVs	Default	Assignment of the Bits	Value
CV 33 Light function key F0 forwards	1	Bit 0 Light function key front	1
CV 34 Light function key F0 backwards	2	Bit 1 Light function key back	2
CV 35 Function key F1	4	Bit 2 Function key A1	4
CV 36 Function key F2	8	Bit 6 Shunting	64
		Bit 7 Starting-/brake delay	128
CV 46 Function key F12			

Example 1: The rear light output should only be switched with the function key F5.
The CV to be programmed is CV39 for function key F5, in which the value 2 (rear light output) is programmed. So that the rear light output is no longer switched backwards in the direction of travel via function key F0, CV34 must also be programmed for function key F0 in the direction of travel backwards to the value 0.
Example 2: The function output A1 and the shunting gear are to be switched together with the function key F10.
The CV to be programmed is CV44 for function key F10, in which the value 4 (function output A1) plus 64 (shunting gear) is programmed, e.g. the value 68. So that the function output A1 is no longer switched via function key F1 and the shunting gear no longer via function key F5, CVs 35 for function key F1 and 39 for function key F5 must also be programmed to the value 0.

Simple and extended Function Mapping
The following settings of the decoder are possible for simple (CV96 = 0) and extended (CV96 = 1) function mapping.

Dimming of Light and Function Outputs
The light and function outputs A1 can be set to any dimming level. These settings are stored in CVs 116 (Light) and 117 (A1).

Softly fade in and out light and function outputs
If the output is switched on or off, it is softly faded in or out.
In CV186, you can specify which output should receive this dazzle function.

	Value
Bit 0 Light output with dazzle function	1
Bit 1 A1 with dazzle function	2

A combination (total of the single values) is individually possible.
The setting of the CV187 determines how fast the glare function should work. The step size is CV value * 1ms.

Blinking of the Light- and Function Outputs
The locomotive decoder has a flashing generator which can be assigned to the outputs. Both the switch-on and switch-off time of the flashing generator can be set separately from each other.
In CV109, you can specify which output is to use the flash generator. In addition, the CV110 can be used to determine which output is to use the blinking generator with 180° phase rotation. For example, a variable flasher can be implemented.

CV 109:	Value
Bit 0 Light output w/ flashing generator	1
Bit 1 A1 with flashing generator	2

CV 110:	Value
Bit 0 Light output w/ flashing generator 180°	1
Bit 1 A1 with flashing generator 180°	2

A combination (total of the single values) is individually possible.
In CV111 the switch-on time can be set in steps of 100ms and in CV112 the switch-off time in steps of 100ms.

Turn-on Effect of a Neon Tube / Fluorescent Tube
The switch-on effect of a defective fluorescent lamp can also be output at the light and function outputs. This effect consists of an adjustable, maximum number of flashes (accidentally a flash up to a maximum number of flashes) and an adjustable flash time, e.g. how fast the flashes should follow each other.

CV 188:	Value
Bit 0 Light output w/ fluorescent lamp effect	1
Bit 1 A1 w/ fluorescent lamp effect	2

A combination (sum of the single values) is of course also possible here.
The flash time is set in 5ms increments via CV 189. The maximum number of flashes in CV 190.

Energy-saving lamp effect when switching on the light and function outputs
When an energy-saving lamp is switched on, it first produces a basic brightness before it slowly reaches its maximum brightness. This effect can be assigned to the outputs of the decoder as follows.

CV 183:	Value
Bit 0 Light output as energy-saving lamp	1
Bit 1 A1 as energy-saving lamp	2

A combination (total of the single values) is of course again possible here.The basic brightness can be adjusted via CV184. The setting of CV185 determines how fast the final brightness value (PWM1 in CVs 116 light - 117 A1) should be reached. The step size is CV value * 5ms.

Firebox flickering
The outputs light, A1 can be assigned a random flickering. This effect is used for example for the flickering of a firebox.

CV 181:	Value
Bit 0 Light output with flickering	1
Bit 1 A1 with flickering	2

A combination of (the total of the single values) is of course possible here again.
In CV182, the settings for the flicker rhythm and the brightness change are entered:
Bits 0 - 3 change the flicker rhythm (value range 1 to 15).
Bits 4 - 6 change the brightness (value range 16, 32, 48, 64, 80, 96,112).
With the value 128 the output is always bright, but can be combined with the value range 16 to 112.
As only one value can be programmed in a CV, the flickering results from the sum of the single values of the flicker rhythm plus the sum of the single values of the brightness (sum of bits 0 -3 plus sum of bits 4 - 6).
The combination of all bits leads to different random flicker images. The rule here is "try it out".

Adjustable PWM - Frequency of light and function outputs
The output voltage of a function output is pulse width modulation (PWM) at a given frequency.
The function outputs of the decoder are factory set to a frequency of 156 Hz. This frequency can be increased to 24 kHz for outputs A0. The frequency switching can be set in the CV50 in bit 3. Bit 3 = 0 -> 156Hz,
Bit 3 = 1 -> 24KHz.