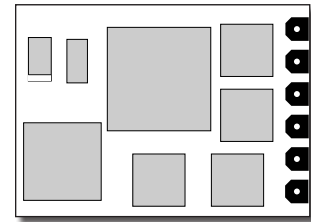




Doehler & Haass

Locomotive decoder PD10MU

User manual



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1 Introduction

The vehicle decoder supports pure DCC operation and DC analog. It can be used for normal DC as well as for bell armature motors.

The operation on alternating current supplied layouts with switching impulse is not allowed! The switching impulse destroys the decoder!

The operation of inductive consumers (decouplers, relays, etc.) requires the connection of freewheeling diodes (see supplement 3).

2 Safety instructions

This product is not suitable for children under 14 years.

It might be swallowed by children under 3 years!

An improper use involves a risk of injury due to sharp edges and points.

3 Warranty

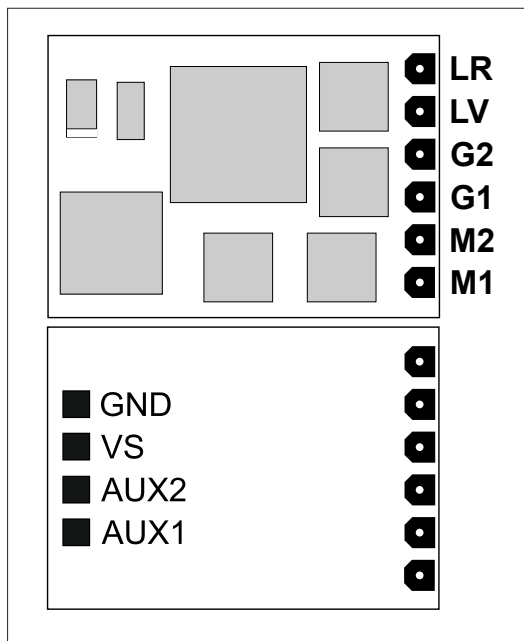
The functioning of every decoder is fully tested before delivery. Should nevertheless a failure occur, please contact the dealer where you purchased the decoder or directly the producer (Doehler & Haass). The warranty period is two years from the data of purchase.

4 Support and help

In case you have any problems or questions please contact us by email: technik@doehler-haass.de

Usually you will get an answer within a few days.

5 Locomotive decoder PD10MU



Specifications	PD10MU
Dimensions [mm]	8,5 x 11,7 x 1,8
Total load	1,0 A
Maximum motor current	1,0 A
Maximum operating voltage	30 V
Function outputs for light: LV, LR (dimnable)	each 150 mA
Function outputs: AUX1, AUX2 (dimnable)	each 300 mA
Connecting options	
With connection wires	PD10MU-3
6 pin connector for direct plugging (NEM651)	PD10MU-4

M1, M2..... Motor connection 1, 2

G1, G2..... Track connection 1, 2

LV, LR..... Front light, rear light (each 150 mA)

AUX1, AUX2..... Additional function 1, 2 (each 300 mA)

VS..... Supply voltage

GND Ground (0 V)

If necessary: Connect blue wire (common return conductor) to VS.
You can connect a buffer capacitor to VS (+) and GND (-).

5.1 Functions

- Operation can be controlled by conventional DC command stations NMRA standard (DCC)
- Automatic switch over from conventional DC to digital operation
- Short addresses (1-127), long addresses (0001-9999), with 14, 28, 126 speed steps
- State of art load regulation, in this way an especially smooth control mode
- Different control variants for an optimal adaption to the motor
- 127 internal speed steps
- Adjustable motor frequency (low frequency, 16 kHz, 32 kHz)
- Block section operation by simple diodes in digital operation
- Light and function outputs are (partly) dimmable and can be activated analogously
- Shunting gear
- Motor, light and track connections electronically changeable
- All function outputs are freely programmable
- Thermal protection
- Reset function for DCC
- Updateability of the decoder
- Timer for switching off AUX1 and AUX2

The update (the firmware download from the Internet is free of charge) is possible in the installed state of the decoder on the track (no opening of the vehicle necessary) and is done either via the FCC digital center or the programmer. If no corresponding hardware is available, Doehler & Haass will provide a programmer on loan upon request.

Decoders support braking with asymmetric digital voltage (four diodes connected in series and one antiparallel diode), slow approach (with appropriate brake modules) and the bidirectional communication (locomotive address check back signal in DCC operation, RailCom®).

5.2 Installation of the decoder

Before installation check if the locomotive is in perfect electrical and mechanical condition. Defects and dirt must be eliminated first. Pay attention to the instructions of the locomotive producer.

Only locomotives running smoothly in analogue mode should be equipped with digital decoder. New locomotives should be run in at least 30 minutes in each driving direction.

Before starting installation, insulate the motor and all its terminals completely against track connections (sliders, chassis etc.).

Both motor connections must be disconnected from the ground!

Further on all capacitors have to be removed, particularly those associated with the connections of light and motor.

Fix the decoder with a double sided adhesive tape.

5.3 Connection of the decoder

In case your locomotive is not equipped with an interface jack, the decoders must be wired individually. For this purpose you should use the decoder PD10MU-3.

If your locomotive has an interface (NEM 651), you should use the PD10MU-4 decoder. This has the connector needed for this socket.

For the wired variants connect the wires of the decoder according to the following scheme (see also graphic below):

red wirewith the right track wire

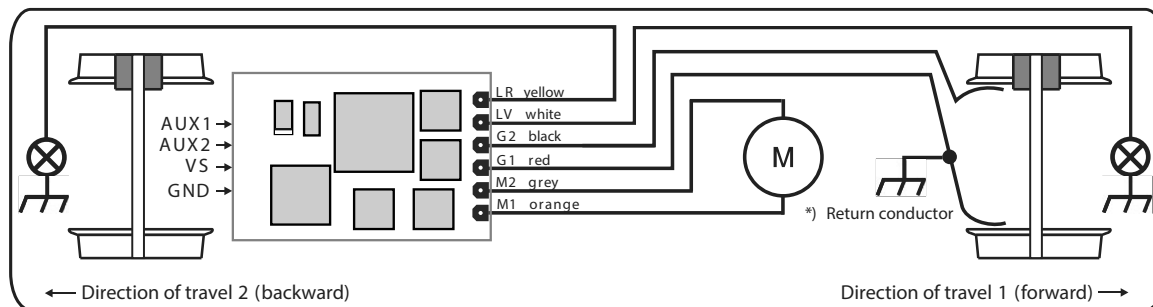
black wirewith the left track wire

orange wire.....with the motor wire, which was connected to the right track wire

gray wire.....with the motor wire, which was connected to the left track wire

white wire.....with the front light in driving direction

yellow wirewith the rear light in driving direction



*) Depending on the manufacturer, the return conductor can be connected to wheel 1 or 2 (red or black) and to the locomotive chassis

Functionsausgänge:

The function outputs AUX* may be located on the bottom side of the decoder and must be connected to the consumers with extra wires.

Notice:

In case of an incorrect wiring of motor, lighting and track, there is no need to solder off the wires as the assignment can be interchanged electronically by programming (see CV51).

5.4 Check after installation

The first test should be made in programming mode (e.g. by reading out the address). If there is not correct check back signal to the central unit ("Error"), check again the mapping of the connection or the electrical separation of the motor from the chassis.

6 System format DCC

6.1 Functions

Short address	1-27
Long address	0001-9999
Speed steps.....	14, 28,126
Speed steps (internal).....	127
Front light/rear light (dimnable).....	yes
Additional functions (dimnable)	2
Functions total	28
Operation with brake diodes	yes
Operation with brake generators.....	yes
Consist mode	yes
Programming On The Main	yes
Locomotive number output.....	yes

Notice to address range:

DCC operation allows only address values from 1 to 127 for DCC-CV01.

6.2 Setting options

The features of a locomotive operated in the DCC operating mode can be varied by programming the “Configuration Variables” (CV) freely at any time. The programming procedure is described in the instructions of your programming device.

Instructions for “Function Mapping” by default see Doehler & Haass website:

<https://doehler-haass.de/cms/pages/haeufige-fragen.php>

Wie sieht das standardmäßige „Function Mapping“ aus? (only in German)

Notice:

In case the speed steps programmed on the decoder differ from those of the control device, malfunctions may occur. Please pay attention to the information concerning your digital system.

6.2.1 List of supported CV

CV	Name and definition	Range	Standard
01	Address	1-127	3
02	Starting voltage	0-15	0
03	Acceleration time The value corresponds to the time in seconds from start to maximum speed	0-255	3
04	Deceleration time The value corresponds to the time in seconds from the maximum speed to stop	0-255	3
05	Maximum speed (see supplement 2)	0-127	92
07	Version number (read only)		
08	Manufacturer identification (read only) 97 = Doehler & Haass (Decoder reset with "8")		
09	Motor frequency	0-15	1
	Bit Function Value		
	0.....0 = 32 kHz, 1 = 16 kHz..... 1		
	1.....0 = 16/32 kHz, 1 = low frequency..... 2		
	2.....proportional part limitation 4		
	3.....Switch off short circuit protection 8		

CV	Name and definition						Range	Standard
13	Analog mode F1-F8						0-255	1
	Bit	Function	Value	Bit	Function	Value		
	0.....	F1	1	4.....	F5	16		
	1.....	F2	2	5.....	F6	32		
	2.....	F3	4	6.....	F7	64		
3.....	F4	8	7.....	F8	128			
14	Analog mode F0, F9-F12						0-63	3
	Bit	Function	Value	Bit	Function	Value		
	0.....	F0 (f)	1	4.....	F11	16		
	1.....	F0 (r)	2	5.....	F12	32		
	2.....	F9	4					
3.....	F10	8						
17	Extended address						0-255	195
18	CV17 contains the most significant byte; CV18 contains the least significant byte. Only, if activated by CV29/Bit 5=1.						0-255	232
19	Consist address Several compound locomotives run under this address (1-127) 0, 128 = deactivated Value + 128 = inverse direction						0-255	0
21	Consist mode F1-F8						0-255	0
	Bit	Function	Value	Bit	Function	Value		
	0.....	F1	1	4.....	F5	16		
	1.....	F2	2	5.....	F6	32		
	2.....	F3	4	6.....	F7	64		
3.....	F4	8	7.....	F8	128			

CV	Name and definition	Range	Standard	
22	Consist mode F0, F9-F12	0-63	0	
	Bit Function Value			Bit Function Value
	0..... F0 (f) 1			4..... F11 16
	1..... F0 (r) 2			5..... F12 32
	2..... F9 4			
3..... F10 8				
27	Brake settings	0-243	64	
	Bit Function Value			Bit Function Value
	0..... Asymmetry normal 1			4..... Negative voltage 16
	1..... Asymmetry inverse 2			5..... Positive voltage 32
	2..... Currently without function.. 4			6..... Brake diode normal 64
3..... Currently without function.. 8	7..... Brake diode inverse 128			
28	Check-back settings	0-7	3	
	Bit Function Value			
	0..... Channel 1 (Locomotive address) allowed..... 1			
	1..... Channel 2 (POM readout etc.) allowed 2			
2..... Dynamic channel utilization 4				
29	Configuration register	0-255	14	
	Bit Function Value			
	0..... Inverse direction 1			
	1..... 14 speed steps 0			
	28/126 speed steps 2			
	2..... Analog operation allowed 4			
	3..... Check back allowed 8			
5..... Locomotive address by CV17/18 32				

CV	Name and definition	Range	Standard
33	Function mapping F0(f) (see supplement 1)	0-255	1
34	Function mapping F0(r) (see supplement 1)	0-255	2
35	Function mapping F1(f+r) If CV35 is written, CV47 will be set to the same value (see supplement 1)	0-255	4
36	Function mapping F2(f+r) If CV36 is written, CV64 will be set to the same value (see supplement 1)	0-255	8
37	Function mapping F3 (see supplement 1)	0-255	16
38	Function mapping F4 (see supplement 1)	0-255	128
39	Function mapping F5 (see supplement 1)	0-255	32
40	Function mapping F6 (see supplement 1)	0-255	0
41	Function mapping F7 (see supplement 1)	0-255	0
42	Function mapping F8 (see supplement 1)	0-255	64
43	Function mapping F9 (see supplement 1)	0-255	0
44	Function mapping F10 (see supplement 1)	0-255	0
45	Function mapping F11 (see supplement 1)	0-255	0
46	Function mapping F12 (see supplement 1)	0-255	0
47	Function mapping F1 (r) In case CV47 should have a different value than CV35, you have to set CV35 first and then CV47 (see supplement 1)	0-255	4
48	Speed step characteristic Deflection of the speed step characteristic, 0 = linear ... 7 = strongly curved (see supplement 2)	0-7	5

CV	Name and definition	Range	Standard												
49	Impulse width 0 = 1 ms, 1 = 2 ms, 2 = 4 ms, 3 = 8 ms	0-3	1												
50	Control variant 0 = defined by CV56 - CV59, 1 = hard, 2 = soft, 3 = very soft	0-3	2												
51	Interchange of connections <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Bit</th> <th>Function</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>..... Motor connections</td> <td>1</td> </tr> <tr> <td>1</td> <td>..... Light connections.....</td> <td>2</td> </tr> <tr> <td>2</td> <td>..... Track connections</td> <td>4</td> </tr> </tbody> </table>	Bit	Function	Value	0 Motor connections	1	1 Light connections.....	2	2 Track connections	4	0-7	0
Bit	Function	Value													
0 Motor connections	1													
1 Light connections.....	2													
2 Track connections	4													
52	Dimming LV/LR 0 = dark ... 31 = full brightness	0-31	31												
53	Dimming low beam light 0 = dark ... 31 = full brightness	(see CV156) 0-31	15												
54	Dimming AUX1 0 = dark ... 31 = full brightness	0-31	31												
55	Dimming AUX2 0 = dark ... 31 = full brightness	0-31	31												
56	Motor control proportional Only if CV50 = 0, see: www.doehler-haass.de/ „Häufige Fragen“ (only in German)	0-7	3												
57	Motor control integral	(as CV56) 0-3	3												
58	Motor control measurement period	(as CV56) 0-3	1												
59	Motor control impulse width	(as CV56) 0-7	3												

CV	Name and definition	Range	Standard
60	Brake sections 1 or 2	0, 1	0
61	Shuntig gear speed (as CV05)	0-127	63
62	Shunting gear deceleration (as CV03)	0-255	1
63	Starting delay speed step 1 (see CV124) Each 100 ms, 0 = deactivated	0-250	0
64	Function mapping F2 (r) (see supplement 1) In case CV64 should have a different value than CV36, you must set CV36 first and then CV64	0-255	8
65	Maximum speed step in two part brake sections (see CV60) Only with brake diode	0-127	12
66	Forward trim 0 = deactivated, smaller 128 = reduction, greater 128 = enhancement of the speed	0-255	0
95	Backward trim (see CV66)	0-255	0
105	User identification 1	0-255	0
106	User identification 2	0-255	0
112	Speed reduction analog 0 = small reduction ... 31 = strong reduction	0-31	15
113	Switch off function for LV Bit 0 = F1 ... Bit 7 = F8	0-255	0
114	Switch off function for LR Bit 0 = F1 ... Bit 7 = F8	0-255	0

CV	Name and definition	Range	Standard
115	Switch off function for AUX1 Bit 0 = F1 ... Bit 7 = F8	0-255	0
116	Switch off function for AUX2 Bit 0 = F1 ... Bit 7 = F8	0-255	0
117	Timer for switch off AUX1 Each 100 ms, 0 = deactivated	0-250	0
118	Timer for switch off AUX2 Each 100 ms, 0 = deactivated	0-250	0
121	Function mapping LV+LR on / AUX1+AUX2 off Bit 0 = F1 ... Bit 7 = F8	0-255	0
122	Function mapping AUX1+AUX2 on / LV+LR off Bit 0 = F1 ... Bit 7 = F8	0-255	0
123	Slow approach speed Only with suitable brake modules	(see CV27) 0-127	63
124	Function mapping starting delay Bit 0 = F1 ... Bit 7 = F8	(see CV63) 0-255	0
134	Decision threshold for asymmetry Default value 6 corresponds approximately to 0.7 volt asymmetry and thus to the forward voltage of a silicon diode. Values smaller 3 are not useful, values greater 6 on demand.	(see CV27) 0-15	6
135	Multiplication speed check back signal 0 = deactivated	0-255	0

CV	Name and definition	Range	Standard
136	Division speed check back signal 0 = /1, 1 = /2, 2 = /4, 3 = /8, 4 = /16, 5 = /32, 6 = /64	0-6	0
137	Settings (see supplement 3) Bit Function Value 1.....Switch off energy saving mode.....2 The other bits are currently without function	0-63	0
144	Settings Bit Function Value 0.....Dynamic channel usage 1 1.....Immediate starting after current interruption 2 2.....Special bit for lighting in analog operation..... 4 The other bits are currently without function	0-31	0
154	Brake ramp forward and backward (see CV27) Recommended for constant braking distance: CV48 = 0 0 = deactivated If maximum speed step braking time is adjusted in seconds times 8, at smaller speed steps the decoder generates the brake ramp independently	0-255	0
155	Brake ramp backward (see CV154) 0 = value from CV154 is used Allows different brake times forward and backward	0-255	0

CV	Name and definition						Range	Standard
156	Dimming mask for low beam light						0-15	3
	(see CV53)							
	Bit	Function	Value	Bit	Function	Value		
	0.....LV.....		1	4.....	Currently without function	16		
	1.....LR.....		2	5.....	Currently without function	32		
	2.....AUX1.....		4	6.....	Currently without function	64		
	3.....AUX2.....		8	7.....	Currently without function	128		
260	Manufacturer identification							
	97 = Doehler & Haass							
261	Decoder number							
	PD10MU = 130							
262	Version number							
263	Date							
264	Revision number							
265	Date							

6.3 Operation

Put the locomotive on the programming track and readout the locomotive address (CV01). The default value should be 3. Program the desired locomotive address and start running the locomotive keeping these setting values. After the first check you can vary the parameters of the engine freely according to your requirements.

In case your programming device indicates "Error", please check again the correct wiring of the locomotive and pay attention to the wiring instructions for connecting the programming track. **Never put such a locomotive into operation!**

Notice:

Operation with asymmetry in the brake section is not possible with the factory settings.

In case you want this option, CV27 / bit 0 and/or bit 1 must be set to "1".

Brake section operation in direct current operating mode is not possible with the factory settings.

In case you want this option, CV27 / bit 4 and/or bit 5 must be set to "1".

Supplement 1: Notes to Function Mapping

If you want to activate a function enter the value of the corresponding output according to the following table. In case you want to activate several different functions simultaneously you must add up the related values.

Output values:

	RG	ABL	n.f.	n.f.	AUX2	AUX1	LR	LV
Value	128	64	32	16	8	4	2	1

RG = shunting gear ABL = low beam light n.f. = no function

Example:

F4 should activate the shunting gear and switch on the outputs LV and LR:
LV=1, LR=2, RG=128: so you must enter the value 131 in CV38.

Timer function

(CV117, 118)

Value = 0

The timer is switched off (continuous function)

Value = 1...250

The timer is activated, the corresponding output will be disconnected after the time of:
entered value x 0.1 [sec].

Switch off function (CV113-116)

This function gives you the option for deactivating the output (e.g. frontal driving cab light off), despite of activated output (e.g. LV by function F0).

Example:

A typical situation where to apply the switch off function is the push pull operation. The front lightning pointing to the waggon must be switched off, but the other lights must be reversed according to the driving direction (white ↔ red).

F0 Switches the light on (white or red according to the driving direction)

F2 Switches the font light off

F3 Switches the rear lighth off

CV	Function	RG	ABL		AUX2	AUX1	LR	LV
33	F0(f)				X			X
34	F0(r)					X	X	

CV	Function	F8	F7	F6	F5	F4	F3	F2	F1
113	LV off							X	
114	LR off						X		
115	AUX1 off							X	
116	AUX2 off						X		

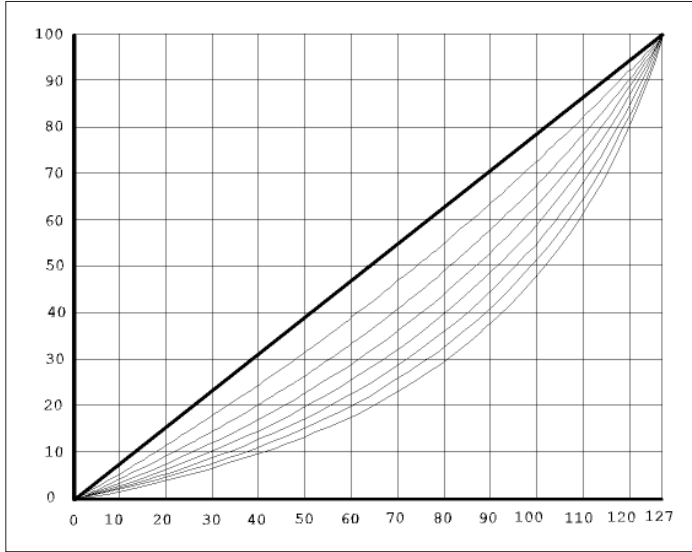
LV Front light white

AUX1 Front light red

LR Rear light white

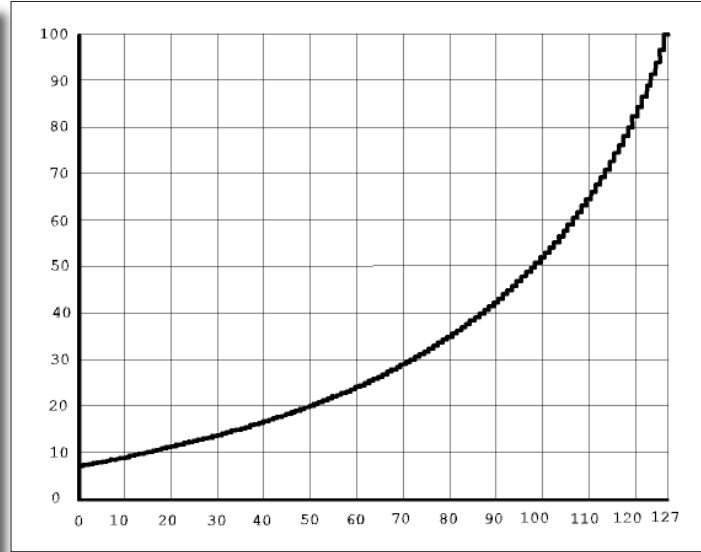
AUX2 Rear light red

Supplement 2: Speed characteristics



Speed step characteristic *),
(see CV48)

Linear..... 0
Strongly curved..... 7



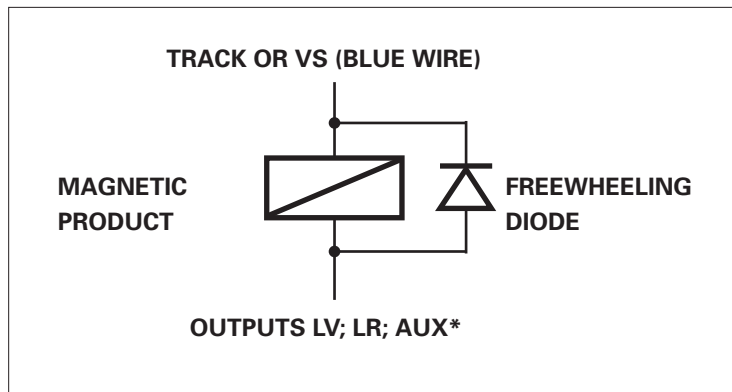
Maximum speed characteristic
(see CV05/CV61)

Supplement 3: Electric coupling / Freewheeling diode

Electric couplings – i.e. couplings, which can automatically uncouple remotely – are magnetic articles and therefore inductive consumers.

When switching off the current they may generate by the coil of the magnetic product a high voltage with opposite polarity (up to several hundred volts) by self induction. By exceeding the maximum cut off voltage of the function outputs of the most sensitive MOSFET output drivers, they can be destroyed irreparably!

It is therefore imperative to close shortly these voltages by freewheeling diodes:



Please make sure that the function output you have chosen for connecting the electric coupling has a sufficiently high capacity!

Hint:

Use the coupling functions of our decoders (timer for switching off AUX*) to make sure that the function output will be switched off in any case according to a maximum activation time specified by you. Otherwise the destruction of the electric coupling is possible.

Supplement 4: Constant braking distance

Function of the “braking ramp”

Set the desired braking method in CV27. Set in CV48 the linear characteristic (value = 0).

Make sure that CV154 contains the value 0. Before proceeding, please check if the model reaches a reasonable top speed with the highest speed step. If it is slower, please increase the value in CV05. If it is faster, please decrease the value in CV05.

Note the current value from CV04. Let the model enter the braking section with the highest speed step. If the model stops too early, please increase the value in CV04. If the model stops too late (runs through), please reduce the value in CV04. Repeat the entry into the braking section until the most suitable value for CV04 is found.

Set the determined value for CV04 multiplied by 8 now in CV154.

If you want a fine tuning, you can vary the value in CV154 in the range from -7 to +7.

Reset CV04 to the noted value.

The decoder now automatically calculates the necessary “braking ramp” for all other speed steps when entering the braking section.

For pushed push-pull trains etc. a separate value for reverse direction is available with CV155. If CV155 contains the value “0”, CV154 is valid for both driving directions. If CV155 contains a value greater than “0”, CV154 is only valid for forward direction.

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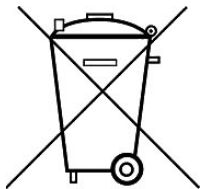
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Dieses Produkt darf am Ende seiner Nutzungsdauer nicht über den normalen Hausmüll entsorgt werden. Bitte benutzen Sie die Entsorgungsstelle Ihrer Gemeinde.

This product must not be disposed off with normal household waste at the end of its useful life. Please use the disposal point in your municipality.

Ce produit ne doit pas être éliminé avec les déchets ménagers normaux à la fin de sa vie utile. Veuillez utiliser le point d'élimination de votre autorité locale.



Nicht geeignet für Kinder unter 3 Jahren wegen der Gefahr des Verschluckens sowie der Verletzung durch scharfkantige Teile!

Not suitable for children under 36 month because of the danger of swallowing the product and of injuries due to sharp-edged parts.

Ne convient pas aux enfants au-dessous de 3 ans, dus au risque d'avaler le produit ou bien d'être blessés par des pièces à arêtes vives!

Hookstone Models

Supplied by Hookstone Models as part of a DCC Conversion Service.
www.hookstonemodels.co.uk

Company Stamp

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