

These instructions give additional information about the 27-pin decoders with up to 32 functions. However, the foundation or starting point is always the operating instructions included with the decoder / locomotive. The information before you is **not for inexperienced** users. We generally recommend that you document all changes to the decoder settings for possible troubleshooting.

## Voltage Buffer

The decoder has a buffer that allows you to negotiate areas of track without voltage. However, this also applies to track in front of signals or the stop button on the controller. With mix or DCC, you have the option of doing extensive settings to this buffer.

## Analog Operation

Locomotives equipped with this decoder basically can be operated with analog. Analog track voltage is recognized automatically.

You can also turn on functions for analog operation. The appropriate CVs can be found in the table on P.14.

## Notes for Operation with DCC

The CVs from CV 257 to CV 512 occupied in several instances. The appropriate selection must be set in CVs 31 and 32 in order to access these CVs (reading or writing).

Sound, individual volumes	CV31=16	CV32=0
Mapping, assignment	CV31=17	CV32=0
Mapping, timer	CV31=17	CV32=1
Mapping, altern. signal/m.u.	CV31=17	CV32=2
Current thresholds / limitation	CV31=18	CV32=0
Voltage buffer	CV31=18	CV32=1
Decoder info	CV31=255	CV32=255

## Long Address

This decoder can be controlled in DCC by means of a short (CV 1, address 1 – 127) or a long address (CV 17 & CV 18, address 1 – 10239). Both addresses are basically always occupied. CV 29, Bit 5 is used to determine which of the two addresses is currently valid. The settings for the long address are calculated as follows:

X = Address / 256 (only the whole number part)  
 CV 17 = X + 192  
 CV 18 = Address – (X \* 256)

**Example:**

Address 1324  
 X = 5 (1324 / 256 = 5,17)  
 CV 17 = 197 (5 + 192 = 197)  
 CV 18 = 44 (5 \* 256 = 1280; 1324 - 1280 = 44)

## Multiple Unit Address

If the locomotive is to be used as part of a multiple unit lashup, a multiple unit address can be entered (CV 19) that can be used to address all of the powered units in the multiple unit lashup. The normal addresses (short and long) are not effective as soon as a multiple unit address > 0 is entered.

Since a locomotive that is part of a multiple unit lashup can no longer be addressed separately, individual functions can be turned on for the multiple unit lashup too.

The appropriate CVs can be found in the table on P.14.

## Speed Levels

This decoder can be operated with 14 or 28/128 speed levels (CV 29, Bit 2). Make sure that the setting on the decoder is compatible with the settings on your controller.

## Operating Modes / Configuration of the Outputs

The decoder's switching functions can be configured. Things such as lights can be dimmed or other operating modes can be set. Appropriate CVs can be found in the table on P.14. Settings can be found in the table „Operating Modes“ on P.13.

## Function Mapping

It is possible to assign functions controlled from the decoder to function buttons as desired (mapping). This can be programmed in mix with the Central Station (60213/4/15/16/26) or in DCC by means of the appropriate CVs.

If function mapping is done in DCC, it will also be effective with mix and vice versa.

It is basically possible to assign several functions to one button and one function to several buttons.

Several functions can be controlled by means of SUSI depending on the layout of the decoder.

## Miscellaneous

Function mapping is very extensive and complex. Each individual mapping is done by means of three settings. The following is defined when doing this:

- Which function is being activated (Sound, AUX, ...)
- How is the function being activated (activator)
- Possible stipulations for this function

After this information has been set, it is stored jointly in a „line“. Up to 80 lines (0 – 79) can be stored. All stored lines are taken in by the decoder.

## Procedure

1. Which of the 80 possible lines to be read in and edited is entered in CV 33. If a new mapping is set up, this CV can remain empty.
  2. The „activator“ is indicated in CV 34 (see table „Activators & Events“).
  3. Stipulations can be indicated in CV 35 (see table „Stipulations“). This CV can also remain empty (-> Value 0).
- Note: If existing mapping lines are overwritten, a stipulation may be in that line that remains preserved if nothing is entered in CV 35.
4. Which function is to be activated is indicated in CV 36 (see table „Activators & Events“).
  5. The line in which the mapping currently set up is to be entered is indicated in CV 37. If a line already occupied is indicated here, this is overwritten by the new settings.
- A newly created mapping is not valid until it has been written in a line.

## Fictitious Example: Firebox

The flickering of the firebox together with the sound „Shoveling Coal“ is to be switched with Button F3. It is programmed such that the button initially activates the sound and the sound activates the light. This ensures that the light does not go out until the sound is ended.

Programming:

The LED is connected to AUX 3; the shoveling of coal is at Sound 6, Reading CV 257 (CV31=31, CV32=0) resulted previously in 17 mappings being entered. In the example, lines 30 and 31 are still free and are now occupied.

CV 34 -> 3 (Activator: F3)  
 CV 35 -> 0 (no stipulation)  
 CV 36 -> 182 (Sound 6)  
 CV 37 -> 30 (writing in the thirtieth line)  
 CV 34 -> 182 (Activator: Sound 6)  
 CV 35 -> 0 (no stipulation)  
 CV 36 -> 84 (AUX3)  
 CV 37 -> 31 (writing in the thirty-first line)  
 CV 128 -> 6 (Mode „Random“)  
 CV 129 -> 150 (LED dimmed)  
 CV 130 -> /  
 CV 131 -> /

## Activators, Events, Outputs, & Logical Functions

Value	Activator / Event / ...
0	F0
1	F1
2	F2
...	
31	F31
64	always
66	Direction reversal
67	Direction reversal
68	Sensor 1
69	Sensor 2
79	random
80	Front light(s)
81	Rear light(s)
82	AUX 1
83	AUX 2
84	AUX 3
85	AUX 4
86	AUX 5 (MV)
87	AUX 6 (MR)
112	ABV off
113	Switching range
114	Brake squealing off
117	Sound off (Mute)
119	Stop motor
120	Stop running sound
128	SUSI F0
129	SUSI F1
130	SUSI F2
131	SUSI F3
132	SUSI F4
133	SUSI F5
134	SUSI F6
135	SUSI F7
136	SUSI F8
137	SUSI F9
138	SUSI F10
139	SUSI F11
140	SUSI F12
141	SUSI F13
142	SUSI F14
143	SUSI F15
144	SUSI F16
145	SUSI F17
146	SUSI F18
147	SUSI F19
148	SUSI F20
160 - 167	and 1 - and 8
168 - 171	Timer 1 - Timer 4
176	Running sound

Value	Activator / Event / ...
177	Sound 1
178	Sound 2
179	Sound 3
180	Sound 4
181	Sound 5
182	Sound 6
183	Sound 7
184	Sound 8
185	Sound 9
186	Sound 10
187	Sound 11
188	Sound 12
189	Sound 13
190	Sound 14
191	Sound 15
192	Sound 16
193	Sound 17
194	Sound 18
195	Sound 19
196	Sound 20
197	Sound 21
198	Sound 22
199	Sound 23
200	Sound 24
201	Sound 25
202	Sound 26
203	Sound 27
204	Sound 28
208 - 215	or 1 - or 8
216 - 219	Xor 1 - Xor 4
224 - 231	and 9 - and 16
240	Flip Flop 1 on
241	Flip Flop 1 off
242	Flip Flop 2 on
243	Flip Flop 2 off
244	Flip Flop 3 on
245	Flip Flop 3 off
246	Flip Flop 4 on
247	Flip Flop 4 off

## Operating Modes

Value	Effect (Mode)	
0	Output off	
1	Dimmer	
2	Blinking Light 1	
3	Blinking Light 2	
4	Single blinking light	
5	Double blinking light	
6	Random generator (ex. firebox)	
7	Smoke generator	Status depends on "Stop" or "Go"
8	Light fade in / out	
9	Mars Light	
10	Gyro Light	
11	Light by "Rule 17" forward	Light dimmed at Stop
12	Light by "Rule 17" reverse	Light dimmed at Stop
13	Neon lights	
14	Energy saving lamp	
15	Telex	
16	Switching exact time	normally on, shutoff by time-control
17	Switching min. time	cannot be turned off until after predefined time
18	Exact time on, turn off with sensor	
19	Turn on continuously	
20	Buffer control	

## Stipulations

Bit	Meaning	Value	Note
0	—	0/1	
1	Stand	0/4	0 = always
2	Go	0/8	4 = only at Stop 8 = only at Go
3	Forward	0/16	0 = always
4	Reverse	0/32	16 = only in forward 32 = only in reverse
5	Level	0/64	0 = with level (on)
6	Edge	128/192	64 = without level (off) 128 = rising edge 192 = falling edge



CV	Assignment	Range	Note
1	Address	1-127	short address
2	Minimum speed	0-255	
3	Acceleration delay	0-71	
4	Braking delay	0-71	
5	Maximum speed	0-255	
8	Reset	8	
13	Functions F1 - F8 when alternative track signal present	0-255	Functions for analog
14	Functions FL, F9 - F15 when alternative track signal present	0-255	Functions for analog
17	Long address, high order byte	192-231	Long address must be activated
18	Long address, low order byte	0-255	in CV 29 Bit 5.
19	M.U. address	0-255	
21	Functions F1 - F8 when M.U. present	0-255	
22	Light functions, F9 - F15 when M.U.	0-255	
27	Bit 4 : normal braking Bit 5 : inverse braking	0, 16, 32, 48	0/16 0/32
29	Bit 0 : Direction normal/inverse Bit 1 : Number of speed levels (14/28/128) Bit 2 : Analog operation off Bit 5 : Short / long address	0-39	0/1 0/2 0/4 0/32
30	Error information	read only	0 = No error 1 = Overload 2 = Short circuit 3 = No motor
33	Mapping, read entry	0-79	
34	Mapping, set activator(s)	0-255	
35	Mapping, set stipulation	0-255	
36	Mapping, set event	0-255	
37	Mapping, write entry	0-79	
50	Bit 0: Analog AC off/on Bit 1: Analog DC off/on Bit 2: MM off/on Bit 3: mfx off/on	0-15	0/1 0/2 0/4 0/8
59	Sound when direction reversed	0-28	0 = no sound
60	Multi-station announcement Bit 0 - 3 = Number of stations Bit 4 = Last station inverts order Bit 5 = Locomotive direction defines order Bit 6 = Basic setting for order	0-126	
61	Random sound: min. interval	0-255	
62	Random sound: max. interval	0-255	
63	Volume	0-255	
64	Threshold for brake squealing	0-126	
66	Forward trim	0-255	
67-94	Speed table levels 1 - 28	0-255	
95	Reverse trim	0-255	
105	User recognition #1	0-255	
106	User recognition #2	0-255	
112	Front light(s): Mode	0-21	see table "Operating Modes"
113	Front light(s): Dimmer	0-255	see table "Operating Modes"
114	Front light(s): Period	0-255	see table "Operating Modes"
116-118	Rear light(s)	0-255	(see CV 112 - 114)
120-142	AUX1 - AUX 6	0-255	ea. 3 CV's (see CV 112 - 114)
162	Running sound by speed level or load-dependent	0-255	0 = speed level
163	Brakes squealing, coasting correction	0-255	
164	Brakes squealing, band width	0-255	
176	Minimum speed, analog DC	0-255	
177	Maximum speed, analog DC	0-255	
178	Minimum speed, analog AC	0-255	

CV	Assignment	Range	Note
179	Maximum speed, analog AC	0-255	
253	Activating constant braking path Bit 0: braking path in the braking route Bit 1: braking path outside of the braking route	0-3	
254	Constant braking path forward	0-255	Data in ~ cm
255	Constant braking path reverse	0-255	Data in ~ cm

Sound, Individual Volumes: CV 31 = 16, CV 32 = 0			
257	Number of sounds	read only	
300	Running sound volume	0-255	
301-328	Volume of Sounds 1 - 28	0-255	

Mapping, Timer: CV 31 = 17, CV 32 = 1			
261	Timer 1	0-255	CV value x 0.25 = timer duration
262-264	Timer 2 - 4	0-255	see CV 261

Mapping, Alternative Signal / M.U.: CV 31 = 17, CV 32 = 2			
260	Functions F1 - F8 when alternative track signal present	0-255	= CV 13
261	Functions Licht F9 - F15 when alternative track signal present	0-255	= CV 14
262	Functions F16 - F31 when alternative track signal present	0-255	
263	Functions F24 - F31 when alternative track signal present	0-255	
270	Functions F1 - F8 when M.U. present	0-255	= CV 21
271	Functions FL, F9 - F15 when M.U. present	0-255	= CV 22
272	Functions F16 - F31 when M.U. present	0-255	
273	Functions F24 - F31 when M.U. present	0-255	

Voltage Buffer: CV 31 = 18, CV 32 = 1			
Selecting users to be buffered			
260	Bit 0: Buffer motor Bit 1: Buffer sound Bit 2: Buffer analog sound Bit 3: Buffer SUSI	0/1 0/2 0/4 0/8	
Selecting users to be buffered			
263	Bit 0: LV Bit 1: LR Bit 2: AUX1 Bit 3: AUX2 Bit 4: AUX3 Bit 5: AUX4 Bit 6: AUX5 Bit 7: AUX6	0/1 0/2 0/4 0/8 0/16 0/32 0/64	
270	Buffering path	0-255	Route to be buffered
271	Stopping distance	0-255	Comp. constant braking path
272	Adjust motor energy	0-255	
280	Buffering duration for AUX	0-255	
281	Buffering duration for Sound	0-255	
282	Buffering duration for SUSI	0-255	
290	Min. track voltage at which the buffer is charged	0-255	

Decoder Info: CV 31 = 255, CV32 = 255			
271	Firmware Version, first byte	read only	
272	Firmware Version, second byte	read only	
273	Firmware Version, third byte	read only	
274	Firmware Version, fourth byte	read only	