

## Working model decoder 67 900

### Description

The stationary Decoder, for installing in working models (e.g. model crane), has two outputs for motors and four additional switch outputs.

The working model decoder is suitable for working models in Märklin or DCC Digital systems. It can be operated with either 14 or 28 (DCC) speed steps.

Each motor output can be switched on and off using any programmable special function. The motor speed can be controlled by the speed control.

All function outputs can be programmed to blink and/or be dimmed. A1 and A2 can also have a timed 'on' period.

All parameters can be configured with either DCC CV programming or with a Motorola Digital centre.

The decoder can be loaded with up to 1A and is protected against short circuits.

### Connection

#### Digital Power (Track)

Connection is made via 2-way screw terminals block.

#### Motors

The two motors are connected via the 4-way screw terminal block.

**Note:** *The Working model decoder is preset for 12V - 20V motors. When using smaller motors the maximum motor potential must be set to an appropriate value. For this CV6 must be programmed accordingly (see CV-Table).*

#### Function Outputs

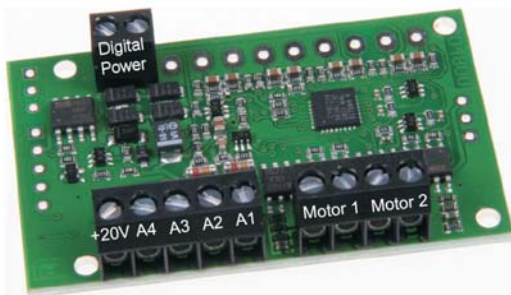
Function outputs A1 to A4 and the common return line of +20V are connected via the 5-way screw terminal block. That can be for loads such as lighting, lifting magnet etc. These can then be controlled by function keys f0 (A1), f3 (A2), f4 (A3) and f5 (A4).

### Start-up

On your digital centre call up locomotive address 3 to be operated. On the centre set (if possible) locomotive address 3 to the DCC 28 data format or operate address 3 in Motorola format.

**Note:** *The decoder can only be operated with 14 or 28 speed steps!*

If special function f1 is switched on, the centre speed control can control motor 1. With special function f2 switched on, you can control motor 2 with the speed control. The speed step in use remains when switching over.



## Programming

Configuration variables (CV's) form the basis of all programmable settings of the decoder in accordance with the DCC standard. The decoder can be programmed with the Intellibox, DCC centers and Motorola centers.

### Programming with the Intellibox

Irrespective of the format to be used later we recommend that the decoder be programmed via the programming menu for DCC decoders.

The Intellibox supports DCC programming with a simple input menu. Long addresses do not have to be laboriously calculated, they can be entered directly. The Intellibox automatically calculates the values for CV17 and CV18. Additionally it sets Bit 5 of CV 29 to 1 so that the decoder uses the long address.

For the exact process please read the appropriate chapter in the Intellibox manual.

### Special case decoder addresses 80 to 255

The Intellibox supports an address range up to 255 in the Motorola data format. Addresses 1 to 80 can also be programmed (problem free) using DCC Programming. If, however, an address above 80 is to be used it must always be programmed as outlined in the chapter "Programming with a Märklin Centre".

After this programming is complete, CV1 will contain a value of 0 and the decoder will respond to a Motorola address above 80.

### Programming of long Addresses without the Programming Menu

For programming with a centre which does not support programming with an input menu, the value for CV17 and CV18 must be calculated. Here is an example for programming the address 2000.

- Divide the addresses by 256 ( $2000/256 = 7$  remainder 208).
- Take the result (7) and add it to 192.
- Program this value (199) into CV17.
- Program the remainder (208) into CV18.

**Important:** Set Bit 5 of CV 29 to 1, so the decoder uses the long address.

### Calculating the CV value

CV29 and CV49 allow several settings on the decoder to be changed. The value to be entered is calculated using the CV table by simply adding up the values of the desired functions.

#### Example CV 49

Motorola off

Value = 1

DCC on

Value = 0

f1 toggle A1/A2

Value = 64

The sum of all values is 65.

This value is set into CV 49.

Bit	Function CV49	Value
0=0	Motorola on	0
0=1	Motorola off	1
1=0	DCC on	0
1=1	DCC off	2
6=0	F1 switches A1 and f2 switches A2	0
6=1	F1 toggle A1/A2	64

### Programming with a Märklin Centre

All CV's can be programmed with a Märklin Centre but they cannot be read.

1. Turn the centre off and on.
2. Select the decoders address.
3. Switch the direction 5 times in a row until a motor gives a short jerk.
4. Set the speed control to "Zero".
5. Enter the number of the CV to be programmed (as for the locomotive address).
6. Quickly switch the direction. The motor jerks quickly.
7. Enter the desired value for the CV (like the locomotive address).
8. Quickly switch the direction. The motor jerks quickly.

If more CV's are to be programmed, repeat points 5-8.

When programming is complete set the Centre to "STOP" or enter address "80" and quickly switch direction.

**Note:** As a Motorola digital centre can only program values from 01 to 80, a value of "0" must be given as address "80".

### **Page Register for entering a CV number greater than 79**

CV addresses above 79 can only be programmed with the help of the page register. The page register is CV66. If CV66 is set to a value greater than 0 then the following programming values have 64 added to them. The entered value must be between 1 and 64.

When leaving Motorola programming mode, the page register (CV66) is automatically reset to Zero.

### **Offset Register for entering CV values above 79**

CV values greater than 79 can only be programmed with the help of an offset register. CV65 is the offset register. If CV65 is set to a value > 0 the following programmed values are multiplied by 4 and added to the value entered for the CV.

When leaving Motorola programming mode, the offset register (CV65) is automatically reset to Zero.

#### **Example**

If CV6 is to be programmed with a value 127, CV65 must first be programmed with a value of 25. Subsequently CV6 can be programmed with a value of 27. The decoder will now be programmed to value  $4 \times 25 + 27$ .

**Note:** When programming CV65 and CV66 the contents of the offset and page registers are ignored.

### **Decoder Lock**

Decoder Lock offers the possibility to control up to 255 working model decoders under the same locomotive address. So for example all working models in a particular area can be called up together. The various functions can then be switched without having to change the decoder address.

The decoder is assigned an identification number (ID) from 1 to 255 in CV16. Then it is locked against a further programming by assigning value to CV15 which is different from the value in CV16.

If the programming of the decoder is to be changed the value in CV15 must first be set equal to that in CV16.

### **Assignment of Function numbers to the Outputs**

In each case 2 CVs are used to allocate an output to a function. All functions from 0 (light) to 32767 (Motorola 0-4, DCC 0-32767) can be used. In each case CVs 35, 37, 39, 41, 43 and 45 contain the byte with high order value and CVs 36, 38, 40, 42, 44 and 46 the low order byte of the function code.

**Calculation:** Function number = high byte x 256 + low byte

If an output is to be switched by functions 0-28 the CV for high order byte must contain the value 128.

**Example 1:** Special function f12 is to switch output A1.

CV 39 = 128 (Factory setting)

CV 40 = 12

For higher functions the CV contains the appropriate high value byte.

**Example 2:** Special function 2000 is to switch A1.

- Divide the address value by 256 ( $2000/256 = 7$  remainder of 208).
- Enter the integer result (7) into CV 39.
- Enter the remainder (208) into CV 40.

**For Experts:** The decoder controls all functions which are defined in the newest version of the NMRA-DCC standard. Only CVs 35 to 46 are defined differently from the NMRA-DCC standard.

There are functions 0-28, and two further possibilities for switching functions on a decoder which are specified with Binary State Control (BSC). If CVs 35, 37, 39, 41, 43 or 45 (High byte) have a value of 128 the respective outputs of the decoder are controlled by the DCC special function commands (0-28). If CVs 35, 37, 39, 41, 43 or 45 contains a value smaller than 128 then the respective outputs of the decoder will be controlled by BSC and function codes 0-32767 will be used. In this case (CVs 35, 37, 39, 41, 43 or 45 = 0) the outputs are also controlled by BSC when function codes 0-28 are used.

### **Timed “On Period” of Outputs A1 and A2**

CV98 determines whether an output is to be switched on for a limited period. If the bit for the respective output has the value “1” then the output is switched on for a limited time. The time period can be specified in CV99 in 1s steps and is valid for all outputs which are activated for the timed On Period in CV98.

### **Blinking of Outputs A1 to A4**

In CV100 you can specify whether an output is activated to be cyclically switched on and off, e.g. for a signal light. If the bit for the respective output is assigned to “1” the output is cyclically switched on and off. CV101 contains the time constant for this cyclic switching process. A value of 10 means the outputs are switched on and off 10 times per second. A value of 100 causes the outputs to be switched on and off once per second. The time constant is valid for all outputs specified to blink in CV100.

### **Dimming of Outputs A1 to A4**

In CV102 you can specify whether an output is to be dimmed or not. If the bit assigned to the respective output has the value “1” the output will be dimmed according to the value in CV103. The valid values are “0” (dark) to “64” (bright).

### **Technical Data** (Factory setting)

Addresses:	1-9999 (long DCC Address)
Max. Total Load:	1A
Function outputs:	1A each
Size:	52.5 x 32.5 x 11.5 mm

The decoder is preset to address 03, operating with 28 speed steps and can be run and programmed in DCC and Motorola data format. It automatically switches between the two Formats.

## Table of individual CV's (Configuarion Variables)

CV	Description	Value range	Factory default
1	<b>Short Locomotive address</b>	1-127	3
2	<b>Minimum Speed</b>	1-63	5
3	<b>Start Inertia</b>	1-63	2
4	<b>Brake Inertia</b>	1-63	2
5	<b>Maximum Speed</b> <i>Must be greater than CV2</i>	1-63	20
6	<b>Maximum Motor Potential in Digital operation</b> <i>Example: 63 = 5V 127 = 10V 255 = 12-20V</i>	1-255	255
7	<b>Software version</b> (The processor used can be updated)	-	varies
8	<b>Manufacturer ID</b>	-	85
15	<b>Decoder Lock</b>	1-4	1
16	<b>Decoder Lock ID</b>	1-4	1
17	<b>Long Decoder address</b>	1-9999	2000
18	17 = high byte 18 = low byte	192-231 0-255	199 208
29	<b>Configuration DCC Standard</b> Bit 0=0 Running Direction not swapped Bit 0=1 Running Direction swapped Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 5=0 Short Address used (CV 1) Bit 5=1 Long Address used (CV 17 and 18)	Value 0 * 1 0 2 * 0 * 32	0-35 2
35	<b>Function number for motor output 1</b>	0-128	128
36	35 = High byte 36 = Low byte	0-255	1
37	<b>Function number for motor output 2</b>	0-128	128
38	37 = High byte 38 = Low byte	0-255	2
39	<b>Output mapping A1</b>	0-128	128
40	39 = High byte 40 = Low byte	0-255	0
41	<b>Output mapping A2</b>	0-128	128
42	41 = High byte 42 = Low byte	0-255	3
43	<b>Output mapping A3</b>	0-128	128
44	43 = High byte 44 = Low byte	0-255	4
45	<b>Output mapping A4</b>	0-128	128
46	45 = High byte 46 = Low byte	0-255	5
49	<b>Decoder Configuration</b> Bit 0=0 Motorola on Bit 0=1 Motorola off Bit 1=0 DCC on Bit 1=1 DCC off Bit 6=0 f1 switches A1 and f2 switches A2 Bit 6=1 f1 toggle A1/A2 (switches between A1 and A2) f1 off: A1 off and A2 on f1 on: A1 on and A2 off  <i>Note: When Motorola data format is turned off via Bit 0 and the DCC data format is switched off via Bit 1 the decoder will not accept any switch commands but can still be programmed.</i>	Value 0 * 1 0 * 2 0 * 64	0-195 0
65	<b>Motorola Programming Offset Register</b>	0-255	0
66	<b>Motorola Programming Page Register</b>	0-64	0
98	<b>Timed switching of Outputs A1 and A2</b> Bit 0=0 A1 time switched off Bit 0=1 A1 time switched on Bit 1=0 A2 time switched off Bit 1=1 A2 time switched on	Value 0 1 * 0 2 *	0-3 0
99	<b>Maximum On time</b> in Seconds for outputs in CV98	0-255	45

CV	Description	Value range	Factory default
100	<b>Blinking of Outputs A1 to A4</b> Bit 0=0 A1 blinking off Bit 0=1 A1 blinking on Bit 1=0 A2 blinking off Bit 1=1 A2 blinking on Bit 2=0 A3 blinking off Bit 2=1 A3 blinking on Bit 3=0 A4 blinking off Bit 3=1 A4 blinking on	Value 0* 1 0* 2 0* 4 0* 8	0-15        0
101	<b>Blink rate</b> in 10 ms steps for outputs in CV100		0-255        100
102	<b>Dimming of Outputs A1 to A4</b> Bit 0=0 A1 dimming off Bit 0=1 A1 dimming on Bit 1=0 A2 dimming off Bit 1=1 A2 dimming on Bit 2=0 A3 dimming off Bit 2=1 A3 dimming on Bit 3=0 A4 dimming off Bit 3=1 A4 dimming on	Value 0* 1 0* 2 0* 4 0* 8	0-15        0
103	<b>Dimming for Outputs in CV102</b> 0 = dark 64 = bright		0-64        32

The factory default values are marked with \*.

## Guarantee declaration

Each component is tested for its complete functionality before distribution. If a fault should arise within the guarantee period of 2 years, we will repair the component free of charge upon production of proof of purchase. The warranty claim is void if the damage was caused by inappropriate treatment.

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