Revised:

2001 11 15
2002 05 25
Version 3; NOT-AND instead of EXOR in CV   2003 02 25

Operating Manual for

DCC FUNCTION DECODER MX68, MX68L

Note:

ZIMO decoders contain an EPROM which stores the software that determines its characteristics and functions.

The current version may not yet be capable of all the functions mentioned in this manual. Such missing functions can be installed later by upgrading the EPROM. In some cases the EPROM may be updated with a special programming station available at Zimo and specialized dealers. Such upgrades are not covered by the warranty and will be charged to the customer. The warranty covers hardware damage exclusively, provided such damage is not caused by the user.

1. Introduction

MX68	Function decoder with 2 groups of 4 outputs each. Max. Current for each group: 0.4A. Two outputs may be used in parallel and linked through function mapping to increase current load.
MX68L	Low cost version with 4 outputs total.

The MX68 function decoder is like a locomotive decoder but without a motor output stage. Up to 8 functions (4 on the MX68L) are available for interior coach lights, tail lights and
other accessories. It is also suitable as a secondary decoder in a locomotive or pilot car.

The connected accessories can not only be switched on/off but can also be controlled by travel direction. Besides dimming, blinking and single light pulses the MX68 offers even more features:

? The **location dependent function control**, that is, the automatic activation of a function output on a predefined section of track. Special effects, like the automatic activation of interior coach lights when approaching a tunnel or an acoustic signal before entering a station become possible. Zimo MX9 track section modules are required for this feature to be used.

? the *programmable secondary address*, which can be linked electronically to the loco decoder. This allows for the assignment of one function key to switch all coach lights, head lights and taillights at the loco decoder address level.

? *automatic programming* of this secondary address. All coaches that are part of a train, containing an MX68 function decoder, can automatically accept a new loco address as the secondary address.

SPECIFICATIONS:

Operating voltage on track or bus.. 12 - 24 V
Peak current per group, right or left ....0.4 A
Idle current..max. 5 mA
Dimensions...0.8"x 0.4"x 0.17" (20 x 10 x 4,5 mm)
....

2. Addresses and Programming

Every function decoder needs its own address, just like a loco decoder, so that it may be accessed using a cab. All NMRA DCC compliant decoders have 3 as their factory default address.
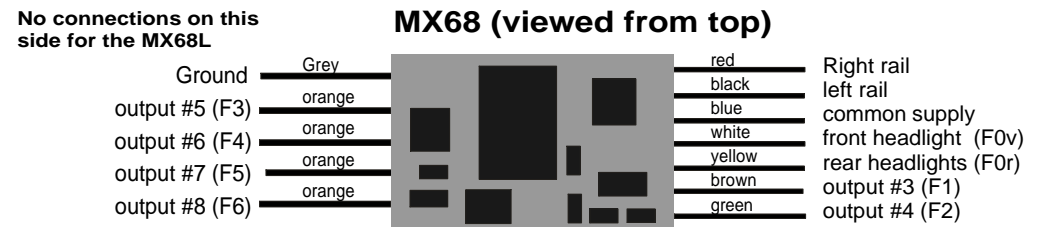
All NMRA compliant address modes are supported. This includes primary (short), extended (long) and consist address commands. In addition, Zimo offers another technique for the function decoder, known as secondary addressing. This offers the advantage of linking a complete train of lighted coaches by one key stroke.

Zimo decoders accept register, paged and direct programming modes. These different types of programming modes are invisible to the user. All these different modes ensure that Zimo decoders can be programmed by any NMRA compliant command station

Refer to Your command station and/or throttle instructions to program this decoder. This decoder acts like any other NMRA compliant decoder, as far as your command station can tell. Use the Configuration Variable information on the following pages to guide you.

Programming decoders can also be done with the assistance of your PC. Zimo offers ADAPT (free software), which is available at w3.zimo.at under Products/Partner Programs. Lenz, Intellibox and Zimo command stations are supported. See website for details.

Ground to the left may be used to establish common ground with other decoders, if needed or for ground supply to other accessories.

No connections on this side for the MX68L

MX68 (viewed from top)

Left side			Right side
Ground	Grey	red	Right rail
		black	left rail
output #5 (F3)	orange	blue	common supply
output #6 (F4)	orange	white	front headlight (F0v)
output #7 (F5)	orange	yellow	rear headlights (F0r)
output #8 (F6)	orange	brown	output #3 (F1)
		green	output #4 (F2)

The CONFIGURATION VARIABLES (CV's)**:**

The Zimo CV's are in full compliance with the NMRA DCC Recommended Practices RP-9.2.2.

CV	Name	Range	Default	Description
# 1	Primary (short) address	1 - 127	3	Short (1-byte) primary address; is active when Bit 5 in CV # 29 is cleared.(=0)
# 3	Acceleration rate	0 - 255	0	Only relevant for direction dependent F0 functions. Multiplied by 0.9 equals acceleration time in seconds from stop to full speed.
# 4	Deceleration rate	0 - 255	0	Only relevant for direction dependent F0 functions. Multiplied by 0.9 equals deceleration time in seconds from full speed to complete stop.
# 7	Version	Read only		Displays decoder and Software version.
# 8	Manufacturer ID and hard reset	Read only	145	NMRA assigned manufacturer ID; Zimo is 145. Enter 8 to initiate hard reset.
#17+18	Extended (long) address	128 - 10239	0	Long 5 digit primary address. This address is only active when Bit 5 in CV #29 is on. Otherwise address entered in CV #1 is active.
# 19	Consist address	0 - 127	0	By writing an address to CV #19 this loco and/or decoder becomes part of the entered consist address. All decoders in that consist will respond to that consists' commands simultaneously. It will ignore all primary address commands while part of a consist. The MX1 & MX2 offer easy consist setup. See chapter 6 of the MX2 manual.

CV	Name	Range	Default	Description
# 29	Configuration data Bit = 0, = 1 Bit 0: value 0 or 1 Bit 1: value 0 or 2 Bit 2: value 0 or 4 Bit 3: value 0 or 8 Bit 4: value 0 or 16 Bit 5: value 0 or 32 Bit 6: value 0 or 64 Bit 7: value 0 or 128	0, 1, 32 or 33	0	Bit 0 - Decoder (train) direction: 0 = normal, 1 =reversed Bit 5 - Decoder address: 0 = primary address CV # 1, 1 = extended address CV #17+18 Value meaning 0 normal direction with short address 1 reversed direction with short address 32 normal direction with long address 33 reversed direction with long address Bits 1, 2, 3, 4, 6, 7 are always 0 !
# 33 - 41	Function mapping # 33 F0 front # 34 F0 rear # 35 F1 # 36 F2 # 37 F3 # 38 F4 # 39 F5 # 40 F6 # 41 F7	1 2 4 8 4 8 16 32 64	0	Function mapping according to NMRA. Also see table on page 5. # 33 - 41 = 0: Outputs are set to F0 - F4 by default, function keys 1 to 5 on Zimo MX2 cab. Headlights are controlled by direction and F0 (Zimo cab key 1 or L)
# 60	Dimming	0 - 255	0	The voltage can be reduced by PWM at any function output. This allows the use of low voltage bulbs, Example: # 60 = 0 or 255 full voltage # 60 = 170: 66% of track voltage # 60 = 204: 80 % of track voltage
# 61	Dimming mask Calculate bit values as in CV #29	0-63	0	Bit 0 to 5 for one function output each (Bit 0 - front headlight, Bit 1 rear headlight etc.). Bit value: 0= dimmed to value in CV #60. Bit value: 1= output not dimmed.

# 62	Flashing and single pulse	0 - 99	0	Tens digit (x.)= on time, 0.1-0.9 sec. Ones digit (.x)= off time, 0.2-0.9 sec. If ones digit = 0, as in 10, 20, 30 then single pulse with slow illumination. Default value:00 = always on.
# 63	Flashing mask Calculate bit values as in CV #29!	Bits 0-5	0	Bit 0 to 5 for one function output each; e.g. Bit 3 = output #4. Bit value: 1= output flashing as defined in CV #62. Bit 6 = 1: fourth output flashing inverse Bit 7 = 1: sixth output flashing inverse
# 64	Short secondary address	1- 127	0	The short secondary address is active when Bit 5 in CV #112 is set to 0.
# 67 + 68 **)	Long secondary address	128 - 10239	0	The short secondary address is active when Bit 5 in CV #112 is set to 1.
# 69 - 77	Function mapping for secondary address # 69 for F0 front # 70 for F0 rear # 71 for F1 # 72 for F2 # 73 for F3 # 74 for F4. # 75 for F5 # 76 for F6. # 77 for F7	1 2 4 8 4 8 16 32 64		These 8 CV's determine which function key controls which function output. #69 - 77 = 0: Outputs are set to F0 - F7 by default, function keys 1 to 8 on Zimo MX2 cab. Headlights are controlled direction dependent by F0 (Zimo cab key 1 or L) See explanation on NMRA function mapping table on page 5.
# 78 - 86	Function mapping for location influence # 78 for F0 front # 79 for F0 rear # 80 for F1 # 81 for F2 # 82 for F3 # 83 for F4. # 84 for F5 # 85 for F6 # 86 for F7	1 2 4 8 4 8 16 32 64		Applicable to location dependent function control. These 8 CV"s determine which function bits, of the MX9 track section module (CV's #10-17, see MX9 manual) operate what function output # 78 - 86 = 0: Outputs are set to F0 - F7 by default. See explanation on NMRA function mapping table on page 5.

# 87 - 94	Individual dimming of single function outputs # 87 headlight front # 88 headlight rear # 89 third output # 90 fourth output etc.		0	Individual alternative to general dimming according to CV # 60. 0 = CV #60 active only 1 - 255 = PWM on function outputs, e.g. Dimming of light. Example: # xx = 255 full voltage # xx = 170 66% of track voltage # xx = 204 80% of track voltage # xx = 0 No effect NOTE: Dim mask in CV # 61 is also needed for this dimming function to work!
# 112	Special Zimo configuration bits		64 = 0100 0000	Bit 3 = 0 12 function mode , = 1 8 function mode Bit 5 = 0 short secondary address according to CV #64. = 1 long secondary address. Bits 6,7 = combinations between manual functions and location dependent function control (00 = none, 01 = or, 10 = and, 11= not and); Default 01 = or
# 120	Function mapping for secondary address exchange.			Future Feature

*) F5 to F8 won't be usable unless function decoder and command station are both set to the same 8 or 12 function mode. CV #112, Bit 3 of the decoder switches between the two modes. The command station can be switched by using the "E" procedure and keys "L" and "1".

**) Unlike the primary long address, the secondary long address can't be entered as one number where the command station calculates the proper values and enters them into CV #67 & 68.
Rather then calculating the figures yourself, enter the secondary long address temporarily as the primary long address. Read out CV #17 & 18 and write those values into CV #67 & 68. After that replace the primary address with the original address.

NMRA function mapping

The Configuration Variables CV # 33 to # 41 refer to the cab keys,
the single bits to the function outputs. By selecting the appropriate
bits, function keys can be assigned to operate specific outputs.
Several outputs may be assigned to one key.

NMRA function	CV	Function key on ZIMO cab	Function outputs							
			Eight output	Seventh output	Sixth output	Fifth output	Fourth output	Third output	Front light	Rear light
F0	# 33	1 (L) front	(7)	(6)	5	4	3	2	1	0 ●
F0	# 34	1 (L) rear	(7)	(6)	5	4	3	2	1 ●	0
F1	# 35	2 (LL)	(7)	(6)	5	4	3	2 ●	1	0
F2	# 36	3 (Z)	(7)	(6)	5	4	3 ●	2	1	0
F3	# 37	4 (Z1)			3	2 ●	1	0		
F4	# 38	5 (Z2)			3 ●	2	1	0		
F5	# 39	6 (Z3)		4 ●	3	2	1	0		
F6	# 40	7	5 ●	4	3	2	1	0		
F7	# 41	8			3	2	1	0		

The table above shows the default settings; key F0 (1,L) switches front and
rear headlights according to direction of travel. Key F1(2.LL) switches the third
output, key F2 (3,Z) the fourth, etc. 0 is entered in all four Cv's which is identical
to : CV #33 = 1; #34 = 2; #35 = 4, #36 = 8, #37 = 4, #38 = 8, #39 = 16, #40 = 32

An example below: Set the CV'S as shown if the headlights should be
switched individually with keys F0 and F1 (L and LL) and the third ouput
with key F2 (3, Z): CV #33 =1, #34 = 1, #35 = 2, #36 = 4.

F0	# 33	1 (L) front	(7)	6	5	4	(3)	2	1	0 ●
F0	# 34	1 (L) rear	(7)	6	5	4	(3)	2	1	0 ●
F1	# 35	2 (LL)	(7)	6	5	4	(3)	2	1 ●	0
F2	# 36	3 (Z)	(7)	6	5	4	(3)	2 ●	1	0

Key numbers in parenthesis are for Zimo cabs.

How the Output On/Off state is determined,
using primary and secondary address commands:

The primary and secondary address functions are programmed separately, and the output information is stored in the function mapping table.

After Power-on, that is, after a power loss of 1 sec minimum a secondary address command is awaited (provided the secondary address is other than 0) and the outputs are set accordingly.

The primary and secondary address commands may be programmed with different values for the same outputs. Since the Zimo command station keeps sending out all commands sent previously, an undesired continuous on/off switching of an output having opposite values in the primary and secondary address commands is the result. To prevent this from happening a primary command is not executed, unless its value is different from the previous primary command received.

Further, the "last command received is the one executed" principle applies to consecutively received primary or secondary addresses.

The results of the primary and secondary address commands are then combined with the location dependent function control, provided function bits are present in a section of track. Such function bits are sent to track sections by the MX9 track section module. By default, the location dependent function bit 0 influences the function F0, function bit 1 influences function F1 and so on. The assignment of function bits to function outputs can also be modified with the help of function mapping , CV's #78-86.

The direct commands (result of primary and secondary address commands) and the location dependent function control is an "or" combination by default, that is, a function is turned on if either the direct command calls for it <u>or</u> the necessary function bit in a track section is set.

The combinations can be changed with the help of bit 6 and 7 of CV #112 to "and" or "not-and". "And" turns a function on if a direct command calls for it <u>and</u> a function bit is set in a corresponding track section. "Not-and" allows the location dependent function control to turn a function off, contrary to a current direct command.

" On the fly " Programming

This programming method is also known as operations, or ops mode, programming. Configuration variables may be changed not only on the programming track but on the layout, without affecting other trains.