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AUSGABEN:

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Operating instructions for

LOCOMOTIVE DECODERS MX66 for large scales (0, LGB, 1, 2, . . .)

in the versions MX66S 3 A contineous motor current, 8 function outputs

MX66M 3 A contineous motor current, 14 function outputs, special sound module supply

MX66V 3 A contineous motor current, 14 function outputs, adjustable voltage for function outputs (from 1,2 V), special sound module supply

C O N T E N T : Page

1. Introduction

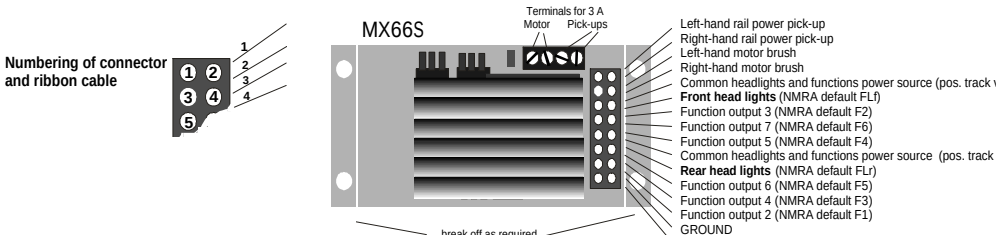
The decoders MX66x are intended for installation in large scale locomotives (0, LGB, 1, 2, . . .). They comply with the NMRA standardized DCC protocol. Therefore they can be used both with ZIMO DCC systems and with DCC systems from manufacturers like Lenz, Roco, LGB, Digitrax, etc.

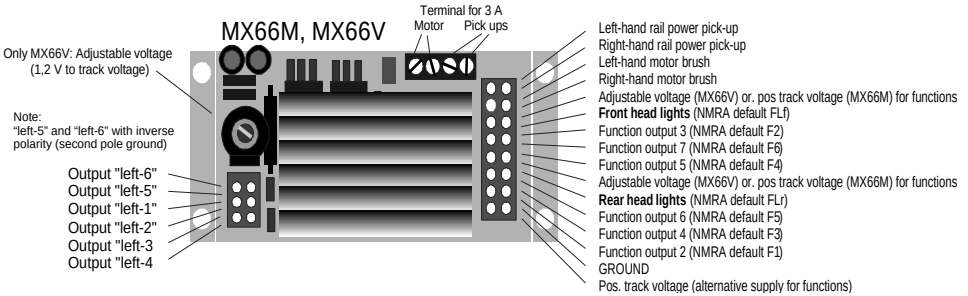
MX66S	The most frequently used MX66 version, 3 A contineous motor current, 8 function outputs with full “function mapping” according to NMRA recommended practices and additional ZIMO assignements (among other things: for swiss locos).
MX66M	As MX66S, but with 14 function outputs (2 of them with inverted polarity).
MX66V	Full-featured MX66 version, with adjustable voltage (from 1,2 V to track voltage) for low voltage lighting, etc..

2. Specifications

A 16 pin connector is used for all inputs (power pick-ups) and outputs (motor, functions); MX65S and MX65V have additional power terminals for pick-ups and motor. MX65V contains a additional printed circuit (for the low voltage regulator and for the additional function outputs) put on the main board.

Track voltage ..... 12 - 24 V
Motor current - peak (for max. 5 sec) ..... 5 A
- contineous current ..... 3 A
Max. total current function group 1 (right conn. - headlight-for, -3, -5, -7) ..... 1 A
Max. total current function group 2 (right conn. - headlight-backw, -2, -4, -6) 1 A
Max. total current function group 3 (left conn. -1 to -4 on MX66M, V) ..... 0,3 A
Max. total current motor and function outputs ..... 3 A
Max. current of adjustable low voltage (only MX66V) ..... 0,8 A
Operating emperature ..... - 20 bis 100 °C
Dimensions ..... 46 x 26 x 12 mm
(Height of connectors, otherwise lower)
.....





More detailled information: Page 11 !

3. Addressing and programming

For DCC operation each locomotive (i.e. decoder installed) must have an address for being able to control it from the cab or from the computer. ***New*** ZIMO decoders have factory installed ***address 3***; also hard reset generates address 3.

PREPRARING FOR ADDRESSING AND PROGRAMMING:

After installation into the loco (details in chapter 4) the loco can be tested on address 3. For successful addressing and programming either motor or headlights (better: both) must be connected to the decoder. It makes sense to make the full installation (all lights, smoke generator, etc.) before starting addressing and programming.

PROCEDURE FOR ADDRESSING AND PROGRAMMING:

Addressing and programming (the “configuration variables”) is done either from the cab of the Digital Command system (ZIMO system: MX2 cab) or from the computer (ZIMO Software AdaPT). Details of the programming procedure are included in the manuals of the system or of the software !

The ZIMO decoders accept both ***direct programming*** (used by ZIMO, Lenz, Digitrax “Chief”, and others) and ***paged programming*** (used by Digitrax “Big boy”, Winlok, and others). Also ***register programming*** (for CVs 1 - 8) can be done.

THE CONFIGURATION VARIABLES:

Configuration variables (“CV”s) allow the decoder to be customized for each locomotive; they are stored in non-volatile memory and do not change when power is removed from the decoder.

The meaning of the most variables is defined in NMRA RECOMMENDED PRACTICES RP-9.2.2; some CVs are ZIMO specific (in the NMRA reserved manufacturer use sector # 49 - # 64 and above # 112).

Although for CVs which are NMRA defined you must look to the following specification of each variable, because the valuerange is different from manufacturer to manufacturer.

CV-Number	Name	Range	Default	Description
# 1	Primary address	1 - 127	3	The “short” loco address; it is active, when Bit 5 in CV # 29 (configuration data) = 0 (otherwise extended address is active).
# 2	V_{start}	1 - 255	7	This value defines the internal speed step (~ voltage drive level) used for the first (lowest) external speed step. Only effective, when Bit 4 in CV # 29 = 0 (this means speed table by CVs # 2, 5, 6).
# 3	Acceleration rate	0 - 255	0	Determines the decoder´s acceleration rate. Multiplied with 0.9 it gives the time in sec from stop to full speed.
# 4	Deceleration rate	0 - 255	0	Determines the decoder´s decelaration rate. Multiplied with 0.9 it gives the time in sec from full speed to stop.
# 5	V_{high}	1 - 252	1	This value defines the internal speed step (~ voltage drive level) used for the highest external speed step (which is 14, 28 or 126, dependant on used speed step mode). Only effective, when Bit 4 in CV # 29 = 0 (means speed table by CVs # 2, 5, 6).
# 6	V_{mid}	1 - 252	1	This value defines the internal speed step (~ voltage drive level) used for the middle external speed step (which is 7, 14 or 63, dependant on used speed step mode 14, 28 or 128). Only effective, when Bit 4 in CV # 29 = 0 (means speed table by CVs # 2, 5, 6).
# 7	Version No.	read only		Decoder and software version.
# 8	Manufacturer ID	read only		NMRA assigned manufacturer number. for ZIMO this is “145" (”10010001").

Continued on next page !

CV-Number	Name	Range	Default	Description
# 9	Total PWM period	0 (high frequency) 255-176 (low frequency)	0 high ffre-quency	PWM period (in us) according to formula (131+ mantisse*4)*2^{exp}. Bit 0-4 is “mantisse”, Bit 5-7 is “exp”. The motor frequency is the reciprocal of the PWM. EXAMPLES: # 9 = 255: Motor frequency 30 Hz, # 9 = 223: Motor frequency 60 Hz, # 9 = 208: Motor frequency 80 Hz, # 9 = 192: Motor frequency 120 Hz, # 9 = 0: Motorfrequency 16 kHz or 32 kHz. (Depending of CV # 112, Bit 5)
# 10	EMF Feedback Cutoff	0 - 252	0	A value between 1 and 252 indicates the internal speed step above which the back EMF motor control is reduced to the intensity defined in CV # 113. CVs # 10, 58 and 113 define together a curve for the EMF intensity; if CV # 10 or # 113 is “0”, a default curve is valid.
#17+18	Extended address	128 - 10139 *)	0	The “long” loco address, alterna- tively to address in # 1; this is active, when Bit 5 in CV # 29 (conf. data) = 1.
# 19	Consist address	0 - 127	0	Contains an address which is used to control locomotives in consist. If there is a value unequal “0", speed and direction is controlled by the consist address. Function outputs are controlled by primary or extended address also in this mode.
# 29	Configuration data Calculation for CV # 29 is done by addition of bit values : 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 - 63	2	Bit 0 - Locomotive direction: 0 = normal, 1 = reversed Bit 1 - Speed steps and FL location: 0 = 14, 1 = 28 speed steps (Note: the instructions for 128 speed steps are always accepted, independent of this bit.) Bit 2 - Power source conversion: 0 = Digital operation only 1 = Analog oeration enabled Bit 4 - Speed characteristic: 0 = defined by CVs # 2,5,6, 1 = speed table defined by CV # 67 - 94 Bit 5 - Loco address:: 0 = Primary address CV # 1, 1 = Extended address CV 17+18 Bits 3, 6, 7 always “0" (zero) !
				EXAMPLES: # 29 = 2: normal direction, 28 speed steps, digital operation only, speed table by CVs # 2,5,6, primary address (1-127). # 29 = 6: as above, but also analog op. # 29 = 22: as above, but with analog op. and speed table by CVs # 67 - 94. # 29 = 0: 14 (instead 28) speed steps; this is the typical value for use in old digital systems.
#33-46	Output locations	0, 1	1,2,4, 8,2,4, 8,16, 4,8, 16,32, 64,128	These 10 CVs make up a matrix, which defines which function keys (on the cab) control which function outputs of the decoder. See the following pages for full information about this “funcion mapping”.
# 49	Signal controlled acceleration	0 - 255	0	Only relevant in case decoder is used within ZIMO system. The value of this CV, multiplied with 0.4, gives the time in secs from signal controlled stop to full speed.
# 50	Signal controlled deceleration	0 - 255	0	Only relevant in case decoder is used within ZIMO system. The value of this CV, multiplied with 0.4, gives the time in secs from full speed to signal controlled stop.
#51-55	Signal controlled speed limits # 52 for “U”, # 54 for “L”, # 51, 53, 55 for interim steps	0 - 252	20, 40, 70, 110, 180	Only relevant in case decoder is used within ZIMO system. ZIMO HLU- and track section modules apply signal controlled speed limits in 5 steps. The values in CVs # 51 - 55 define the internal speed step (~ voltage drive level) for each of the speed limits.
# 56	Back EMV control P- and I-value	0 - 99	55, maybe differ. in SW ver-sions	Back EMF load compensation control is done by a PID (Proportional-Integral-Differential) algorithm. The parameters (weighing) for proportional control is defined by the tens digit of CV # 56, the integral control by the last digit of CV # 56. In some cases it is useful to modify the default values in order to improve running.

*) CV # 17 contains the higher bits of the address (11000000 - 11100111); the CV # 18 the lower bits. The addressing procedure in the ZIMO cabs (MX2, MX3) makes automatically the coding of the address into the two CVs; the user needs not to deal with this.

CV-Number	Name	Range	Default	Description
# 57	Voltage reference	0 - 255	0	Divided by 10, this CV gives the absolute voltage drive level, which should be applied on full speed. Use of this CV can be useful, if the power station does not stabilize the track voltage; so not necessary within ZIMO system. # 57 = 0: (default, should be preferred) the voltage drive level are derived from track voltage.
# 58	Back EMF intensity	0 - 255	100	Intensity of load compensation by back EMF control for lowest speed. CVs # 10, 58 and 113 define together a curve for the EMF intensity; if CV # 10 or # 113 is “0”, a default curve is valid. Sometimes a reduced load compensation is better than full, e.g. in consists or for prototypical way of operation. EXAMPLES: # 58 = 0: no compensation , # 58 = 150: partial compensation, # 58 = 255: full compensation
# 59	Signal controlled reaction time	0 - 255	0	Only relevant in case decoder is used within ZIMO system. Multiplied with 10, this CV gives the time in secs for starting a signal control- led acceleration after reception of a higher speed limit (or full).
# 60	Function outputs voltage reduction	0 - 255	0	The effective voltage on the function outputs can be reduced by PWM ope-ration. This allows use of low voltage bulbs (e.g. 12 V at 20 V track voltage), improves lifetime and reduces brightness. EXAMPLES: # 60 = 0 or 255: full voltage # 60 = 180: 70 % of track voltage
# 61	Special ZIMO function mapping		0	Beyond the NMRA “function mapping” (CV # 33-42) this allows assignements for prototypical lighting for Swiss locos and for control of sound modules.
MX66M, MX66V #62-64	Speed table for sound supply	1 - 255	#62: 0 #63: 0 #64: 0	These three values define the PWM duty cycle on the sound supply output of the MX65V for “loco stopped”, “lowest speed step”, “maximum speed”. Linear inter-polation between these values.
#67-94	Individual speed table	0 - 252	4,7,10 13,16, 20,,...	Internal speed steps for each of the 28 external speed steps (interpolation when using 128 external speed steps). Only effective, when Bit 4 in CV # 29 =1.

# 112	Special ZIMO bits Calculation for CV # 112 is done by addition of bit values : 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 - 63	12 = 0000 1100	Bit 0 - Sound speed table (def. in CVs # 62-64) 0= no load dependency (default) 1 = load dependent output Bit 1 - braking by motor for standstill 0 = no (sometimes smoother stopping) 1 = yes (default) Bit 2 - Generating loco identification pulses 0 = off 1 = on (default, only in ZIMO system) Bit 3 - MAN Bit location 0 = ony new MAN; NMRA compatible also when 12 unctions are used Bit 3 = 0 : 12 function mode ! 1 = old + new MAN Bits valid (default) Bit 4 - Receiving pulse chain from LGB system 0 = no 1 = yes (pulse chains on F1 control function outputs of MX66) Bit 5 - if CV # 9 = 0 (high frequenc) select 0 = high frequency 16 kHz 1 = high frequency 32 kHz Bit 7 - Generating pulse chains on F1 in order to control LGB original sounds 0 = off 1 = pulse chain on function out-put 2 (F1) instead normal assignment
# 113	Feedback Cutoff	0 - 255	0	Intensity of back EMF control at the speed step, which is defined in CV #10. CVs # 10, 58 and 113 define together a curve for the EMF intensity; if CV # 10 or # 113 is “0”, a default curve is valid.
# 114	Dimming mask	Bits 0-5	0	Bits 0 to 5 for one function output each (Bit 0 - front headlight, Bit 1 - rear, etc.). Any bit - 0 = output dimmed to CV # 60 1 = output not dimmed
# 115	Decoupling definition (if decoupling is defined for one of the outputs in CVs # 125-128)	0 - 99	0	Tens digit (0 - 9): Time (0 - 9 msec) for full voltage pulse on the decoupler coil. Last digit (0 - 9): Percentage (0 to 90 %) of track voltage for permanent operation after the full voltage pulse defined above.
# 116	Minimum dimming	0 - 9	0	This value defines the minimum dimming intensity (percentage 0 - 90 %, default 0 = 100 %) for lighting effects defined in Cvs # 125 - 128 (like Mars light or Ditch lights). .

# 117	Flashing definition	0 - 99	0	Tens digit: Time (0,1 - 0,9 sec) on-phase Last digit: Time (0,2 - 0,9 sec) off-phase
# 118	Flashing mask	All bits	0	Bits 0 to 5 for one function output each (Bit 0 - front headlight, Bit 1 - rear, etc.) Any bit 0-5: 1 = flashing / 0 = not flashing Bit 6: 1 = "fourth" output inverse flashing Bit 7: 1 = "sixth" output inverse flashing
# 119	Dipping mask F6	Bits 0-5 and bit 7	0	Bits 0 to 5 for one function output each (Bit 0 - front headlight, Bit 1 - rear, etc.). Any bit - 1 = Output will be dipped to to CV # 60 if F6 is on 0 = No dipping. Bit 7 - 1 = Inverse effect of F6
# 120	Dipping mask F7	Bits 0-5 and bit 7	0	As # 119, but dipping by F7.
# 121	Exponential acceleration	0 - 99	00	Raising of speed slower in the low range and faster in the higher range. Tens digit: Percentage of the full speed range (from 0 to 0 - 90 %), where exponential curve should be applied. Last digit: Curvature of the exponential function (0 - 9).
# 122	Exponential deceleration	0 - 99	00	Going down of speed slower in the low range and faster in the higher range. Tens digit: Percentage of the full speed range (from 0 to 0 - 90 %), where exponential curve should be applied. Last digit: Curvature of the exponential function (0 - 9).
only MX61: # 123	Adaptive acceleration and deceleration	0 - 99	0	Raising or reducing the rated speed to the next (internal) step occurs only, if the preceding step is nearly reached. The tolerance for reaching the preceding step can be defined by this CV. A small value (close approximation) makes a smooth acceleration. Tens digit: Tolerance for acceleration Last digit: Tolerance for deceleration 0 = Adaptive method is not applied

# 124	Shunting button function Bit calculation as in CV # 29 !	0 - 7	0	This option allows to switch off or to reduce the accelleration and deceleration rates while the "shunting button" function is active. In order to avoid waiting on the acceleration and decelaration procedure, if you want do quick shunting. Bit 2 = 0: MAN key is the shunting button = 1: F4 (ZIMO digit 5) is shunt.butt. Bits 0,1 = 00: No shunting button effect = 01: deactivates expon +adapt = 10: also CV 3,4 reduced to ¼ = 11 deactivates all acc,. decel.
# 125 *)	Lighting effects on output 2 (def. F1) Light effects only, if version no. in CV # 7 is equal or higher "3" (from Aug or Sept 2001) Also Decoupling function is now defined here (as "light effect "48") (formerly there was a mask CV # 116); CV # 115 describes details of decoupling.		0	Bits 0,1 = 00: effect independent of dir. = 01: effect only when forward = 10: effect only when backward Bits 2 - 7 = 000001 Mars light = 000010 Random Flicker = 000011 Flashing headlight = 000100 Single puls strobe = 000101 Double puls strobe = 000110 Rotary beacon simul. = 000111 Gyralite = 001000 Ditch light type 1, right = 001001 Ditch light type 1, left = 001010 Ditch light type 2, right = 001011 Ditch light type 2, left = 001100 Decoupling function EXAMPLES (You want - you have to prog # 125) Mars light, only forw. - 00000101 = "5" Gyralite indep. of direction - 00011100 = "28" Ditch type 1 left, only forw. - 00100101 = "37" Decoupling function - 00110000= "48"
# 126	Light eff. outp. 3 (F2)		0	as CV # 125
# 127	Light eff. outp. 4 (F3)		0	as CV # 125
# 128	Light eff. outp. 5 (F4)		0	as CV # 125

*) Some of the lighting effects can be modified by the CVs # 116 (last digit defines the minimum dimmig - percentage 0 to 90 % - during the effect cycle, eg. Mars light) and CV # 117 (last digit defines the off-phase - 0,2 - 0,9 sec).

Special note for ditch lights: Only active if both F0 (headlights) and F2 are on ! The corresponding bits for ditch light outputs in CV # 33 and # 34 must be set; Example: If ditchlights are defined for outputs 4 and 5 (which is by default assigned to F3 and F4) by CVs # 127 and 128, bits 4 and 5 must be set in CV # 33 and 34 (i.e. CV # 33 = 00110001), CV # 34 = 00110010).

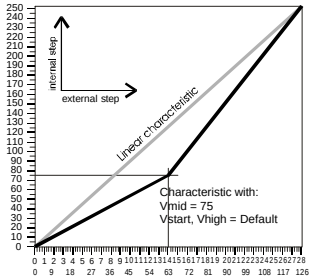
COMMENTS ON USING THE CONFIGURATION VARIABLES FOR DRIVING CHARACTERISTICS

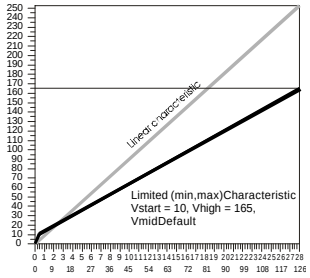
The two ways of programming the speed characteristic:

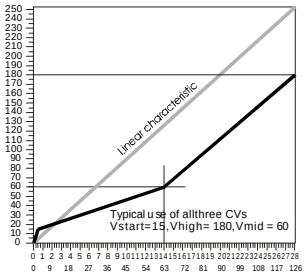
By 3 configuration variables (CVs # 2, 5, 6 for V_{start}, V_{high}, V_{mid}) - This is a simple but efficient way, easy to do from the cab of the DCC system. It is active, when ***Bit 4 in CV # 29 = 0*** (Default).

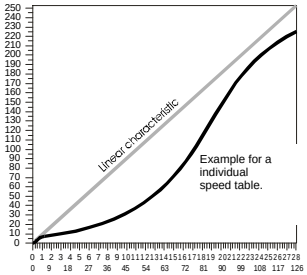
By 28 configuration variables (CVs # 67 - 94) - One internal speed step is assigned to each of the 28 external speed steps; if 128 external speed steps are used, an interpolation algorithm is used for the steps between. This is the most flexible way for defining the motor characteristic, but it needs 28 programming steps. Therefore it is more comfortable to do it from the computer (e.g. ZIMO Software ADaPT or Winlok). It is active, when ***Bit 4 in CV # 29 = 1***.

**) Default values for CVs # 67 - 94 (subject to change in new software versions):
4,7,10,13,16,20,24,28,32,36,42,48,54,60,68,76,84, 92,102,112,124,136,152,168,188,208,230,252









The motor driving frequency (Total PWM period):

The ***configuration variable # 9*** defines the motor driving frequency. The low range (30 - 150 Hz) is the usual way of digital command control systems; the high frequency (***CV # 9 = 0*** makes ***16 kHz*** or 32 kHz, depending on the bit 5 in CV # 112) is a ***noiseless way*** of driving a motor. This is optimal for motors like Faulhaber and other coreless motors; it is recommended by manufactures of the motors. The 16 kHz or 32 kHz operation is also useable for the most locos manufactured recently; therefore it is the default mode of the MX66 (in contrast to the former MX65, which used low frequency by default).

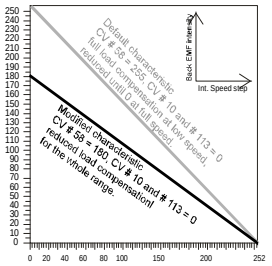
The back EMF control - load compensation:

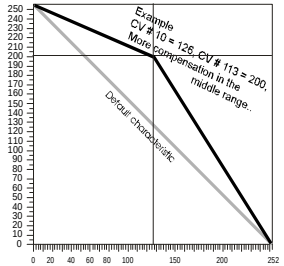
Normally it is advisable to have a full load compensation only at low speed, whereas it should be reduced at middle speed going down until zero at the maximum speed.

For consist operation there should be used a reduced load compensation (over the whole range, also low speed), in order to avoid working the locos against each other because of slightly different rated speeds.

By means of the three configuration variables # 58, 10 and 113 you can define the intensity of load compensation over the speed range. For the most applications the general reduction of the load compensation intensity by setting CV # 58 below the default value of 255 is sufficient (“255” means full compensation at low speed).

Some locos or engines require a more sophisticated characteristic, which can be reached by using CVs # 10 and 113. These both CVs must always used together in order to define a certain speed step with a certain load compensation intensity.





OVERLOAD PROTECTION:

The decoder outputs are protected against short-circuit and high current on motor and function outputs. After detection of an overload condition the output is switched off for some seconds until the reason is removed (periodic attempts for switching on are done automatically).

NOTE: The overload protection does not mean decoders are indestructible. In particular incorrect connection to rails and motor or a faulty motor could cause damage to the decoder.

Programming on-the-main

The feature “programming-on-the-main” allows to modify all configuration variables without using the programming track. Changing the loco address is not possible by “programming-on-the-main”.

With the ZIMO command station MX1 “model 2000” (MX1 and MX2 cab with a suitable software version) programming acknowledgment and reading-out of configuration variables can be used. Earlier ZIMO systems and other system do not support “on-the-main-programming” acknowledgment and reading-out.

Functions F9 - F12 only effective after changing into the “12 function mode” by CV # 112, Bit 3 = 0 (not the default)

in contrast to this: if CV # 112, Bit 3 = 1 (the default) :

output “left-3” - assigned to MAN bit
output “left-4” - assigned to“RIBI” (direction bit)
output “left-5” - assigned to PWM sound supply

NMRA "function mapping" (default, if CV # 61 = 0)

The configuration variables # 33 - 46 belong to the fuction keys of the cab resp. to the NMRA functions F0- F12; each bit belongs to a certain function output of the decoder. By setting bits each key can be assigned to a output.

NMRA function	CV	Function key of the ZIMO cab	Additional function outputs on MX66M and MX66V (left connector) left 6	left 5	left 4	left 3	left 2	left 1	Function outputs of all MX66 (connector on the right side) 7	6	5	4	3	2	Head backw.	Head forw.
F0	# 33	1 (L) vorw.							7	6	5	4	3	2	1	● 0
F0	# 34	1 (L) rückw.							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)				7	6	5	4	3	2	● 1	0			
F4	# 38	5 (Z2)				7	6	5	4	3	● 2	1	0			
F5	# 39	6 (Z3)				7	6	5	4	● 3	2	1	0			
F6	# 40	7				7	6	5	● 4	3	2	1	0			
F7	# 41	8	7	6	5	4	3	● 2	1	0						
F8	# 42	Shift - 9	7	6	5	4	● 3	2	1	0						
F9	# 43	Shift - 1	7	6	5	● 4	3	2	1	0						
F10	# 44	Shift - 2	7	6	● 5	4	3	2	1	0						
F11	# 45	Shift - 3	7	● 6	5	4	3	2	1	0						
F12	# 46	Shift - 4	● 7	6	5	4	3	2	1	0						

The table above shows the default setting; the headlights can be switched on/ off by "1" key (NMRA function F0); the output numbers are the same like the key numbers of the ZIMO cab MX2 (NMRA function numbers differ by one). By default all CVs #33 - 42 contain the value "0", or - with the same meaning- CV # 33 = 1, # 34 = 2, # 35 = 4, # 36 = 8, etc.

# 36	3 (Z)				7	6	5 ●	4	3 ●	2	1	0	
# 37	4 (Z1)	7	6	5 ●	4	3	2	1	0				
# 38	5 (Z2)	7	6 ●	5	4	3	2	1	0				

EXAMPLE: By key 3 (Z resp. F2) additionally the output 5 should be controlled; Bey keys 4 and 5 outputs “left-1” and “left-2” should be controlled instead of the origninal outputs (e.g. controlling of whistle and horn).

Necessaray input for CVs: CV # 36 = 40; # 37 = 32; # 38 = 64.

Special ZIMO function mapping

By changing the configuration variable CV # 61 to values other than "0" the NMRA "function mapping" is switched off, and instead of it the following assignements become effective.

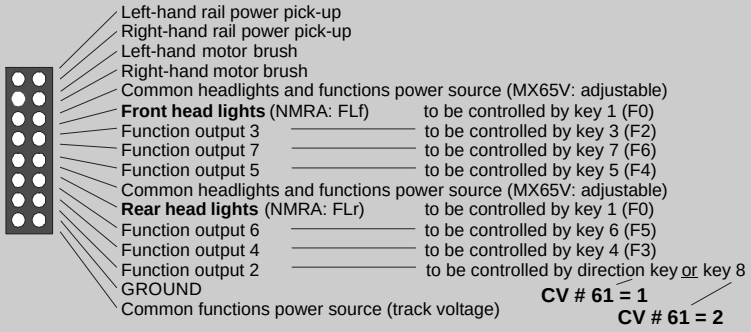
CV # 61 = 1 or 2 resp. CV # 61 = 11 or 12

Function key on the ZIMO cab	NMRA	Additional function outputs of the MX65V (left connector) left 3	left 2	left 1	Function outputs of MX66S, -M, -V (connector right side) right 7	right 6	right 5	right 4	right 3	right 2	Head rear	Head front
1 (L) forward	F0											●
1 (L) backwards.	F0										●	
2 (LL)	F1											
3 (Z)	F2			●					●			
4 (Z1)	F3	●						●				
5 (Z2).	F4						●					
6 (Z3)	F5		●			●						
7	F6			○	●							
8	F7		○							●		
Direction key										●		

Recommended use in sound modules : on/off, bell, whistle

CV # 61 = 11, 12 ; CV # 61 = 1, 2 ; CV # 61 = 1, 11 ; CV # 61 = 2, 12

*TYP. APPLICATION: Large scale locos with direction dependent head lights, otherwise unpaired functions; very similar to default (CV # 61 = 0). Difference between CV # 61 = 0, 1 or 2 is the assignement of the function output **2** (possibilty to use direction bit directly).. The sound functions (typ. whistle and bell) are controlled alternatively by keys 3 or 6 (CV # 61 =1,2) resp. 7 or 8 (CV # 61 =11,12).*



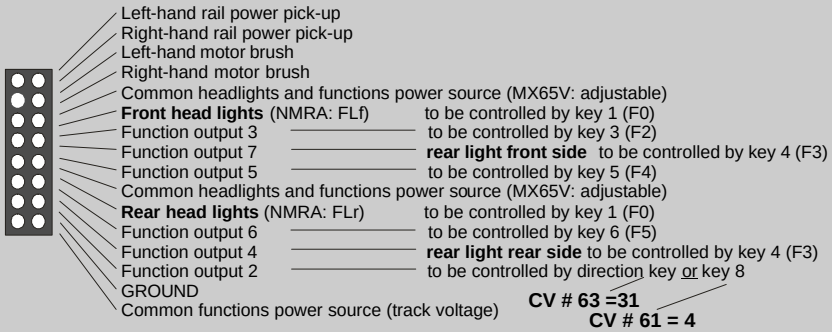
CV # 61 = 3 or 4 resp. CV # 61 = 13 or 14

Function key on the ZIMO cab	NMRA	Additional function outputs of the MX65V (left connector) left 3	left 2	left 1	Function outputs of MX66S, -M, -V (connector right side) right 7	right 6	right 5	right 4	right 3	right 2	Head rear	Head front
1 (L) forward	F0											●
1 (L) backwards	F0										●	
2 (LL)	F1											
3 (Z)	F2			●					●			
4 (Z1) forward	F3							●				
4 (Z1) backwards	F3	●			●							
5 (Z2).	F4						●					
6 (Z3)	F5		●			●						
7	F6			○								
8	F7		○							●		
Direction key										●		

Recommended use in sound modules : on / off, bell, whistle

CV # 61 = 11, 12 ; CV # 61 = 1, 2 ; CV # 61 = 3 ; CV # 61 = 4

Similar to CV # 61 = 1 or 2, but key 4 (F3) controls function outputs 7 and 4, dependent on direction.
TYP. APPLICATION: Separeted control of rear lights. The sound functions are (typ. whistle and bell) controlled alternatively by the keys 3 and 6 (CV # 61 =1,2) or 7 and 8 (CV # 61 =11,12) like on left side..



Special ZIMO function mapping (contd)

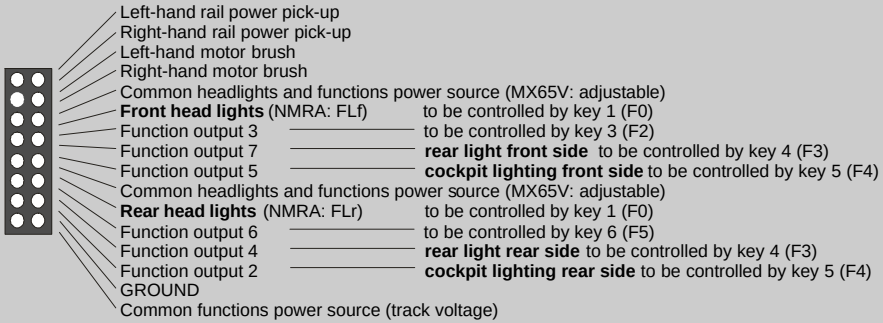
NOTE to MX66M and MX66V: *In addition to the three function outputs "left-1", "left-2", "left-3" there are outputs "left-4", "-5", "-6" on the left side of the MX66M and -V; "left-4" and "left-5" are used normally (CV # 61 between 1 and 17) for the direction bit and PWM sound supply. For connection of SONOR sound modules special mappings for "left-1" to "left-4" are provided (CV # 61 between 21 and 77).*

CV # 61 = 5 resp. CV # 61 = 15

Function key on the ZIMO cab	NMRA	Additional function outputs of the MX65V (left connector) left 3	left 2	left 1	Function outputs of MX66S, -M, -V at right side right 7	right 6	right 5	right 4	right 3	right 2	Head rear	Head front
1 (L) forward	F0											●
1 (L) backwards	F0										●	
2 (LL)	F1											
3 (Z)	F2			●					●			
4 (Z1) forward	F3	●						●				
4 (Z1) backwards	F3				●							
5 (Z2) forward	F4						●					
5 (Z2) backwards	F4									●		
6 (Z3)	F5		●			●						
7	F6			○								
8	F7		○									

CV # 61 = 15 CV # 61 = 5

TYP. APPLICATION: Electric and Diesel locos with direction dependent head, rear, and und cockpit lights, each of them to switch on and off by one function key.

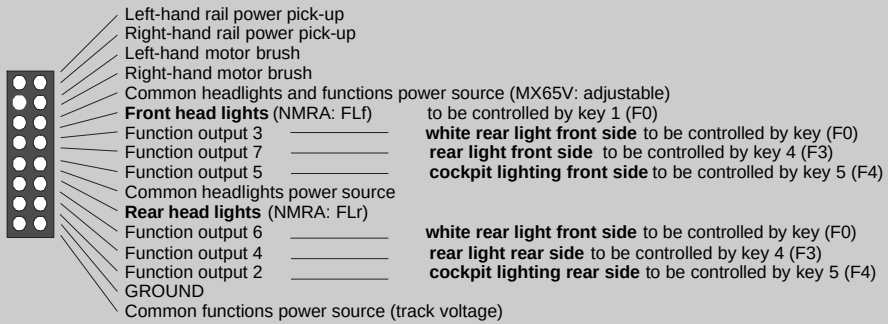


CV # 61 = 6 resp. CV # 61 = 7

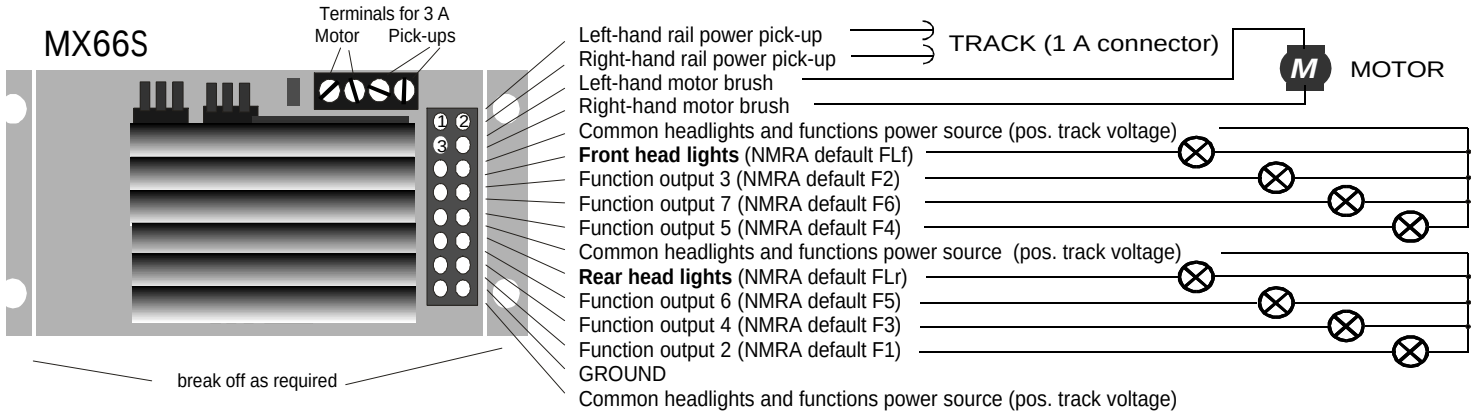
Function key on the ZIMO cab	NMRA	Additional function outputs of the MX65V (left connector) left 3	left 2	left 1	Function outputs of MX66S, -M, -V at right side right 7	right 6	right 5	right 4	right 3	right 2	Head rear	Head front
1 (L) forward	F0								●			●
1 (L) backwards	F0					●					●	
1 (L) forw., if key 4 (F3) off						●						
1 (L) backw., if key 4 (F3) off									●			
2 (LL)	F1											
3 (Z)	F2			●								
4 (Z1)	F3	●						●				
4 (Z1) backwards	F3				●							
5 (Z2) forward	F4						●					
5 (Z2) backwards	F5						○			●		
6 (Z3) forward	F6		●									
Direction key										○		

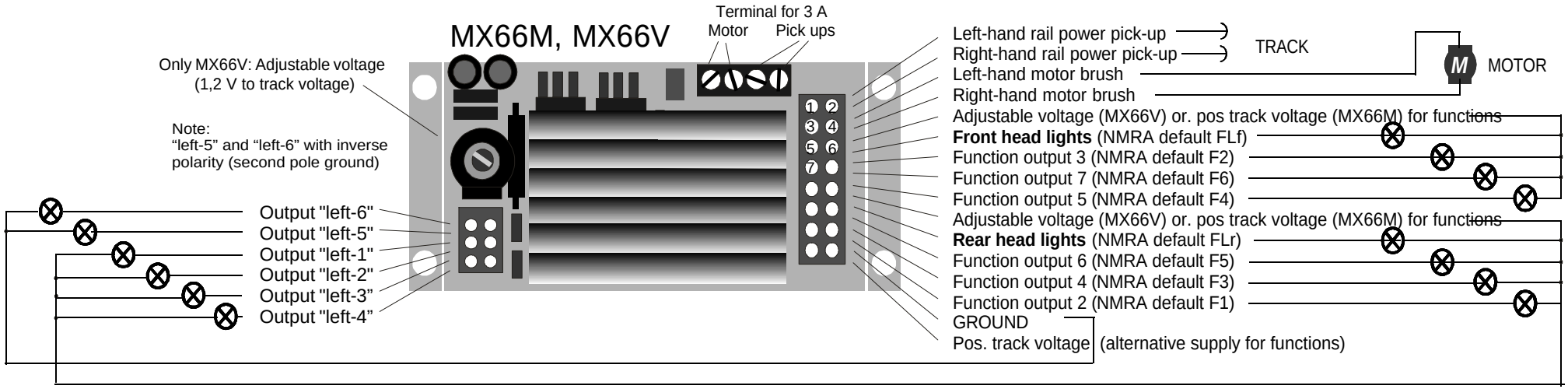
CV # 61 = 6 CV # 61 = 7 CV # 61 = 6 CV # 61 = 7

TYP. APPLICATION: Swiss Electric and Diesel locos; by key 4 (F3) you can select, whether the rear light is the white lamp on the right side or the red light.



4. **Installation and wiring**

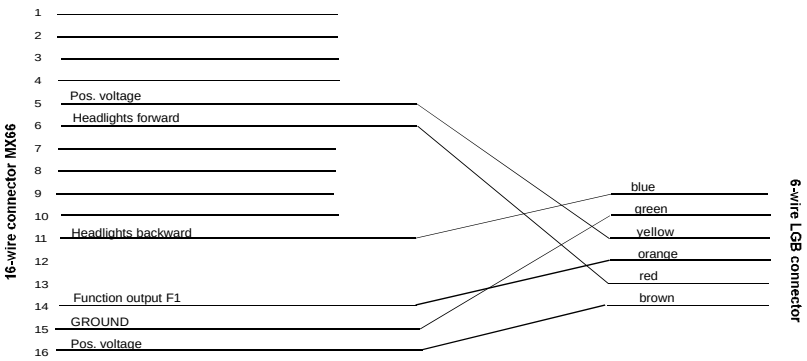




Special note: decoder installation into LGB locos with sound

Track and motor are connected directly from the decoder terminals to the loco pins (original LGB wires brown/white resp. green/yellow). Current LGB locos (from 2000) have a 6-wire connector for the headlights and the function F1. A special cable for making the connection from the MX66S (no need for MX66M or -V in this case) is available from ZIMO (MX65LGBK) or can be home-made.

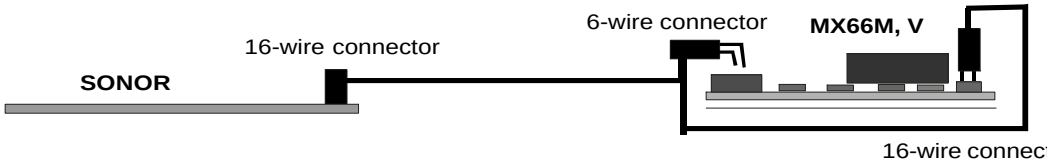
Sound functions are all controlled by the F1wire of the connecting cable. The original LGB way of operation is to press the F1 key 1 - 8 times in order to reach the various functions. The MX66 allows to control each of the functions by a separate function key (F1 - F8), if CV # 112, Bit 7 is set to 1 (automatic pulse chain generation).



Special note: decoder installation with SONOR sound modules

The ***additional (6-wire) connector*** on the left side is used alernatively to control sound modules of SOMOR GmbH.

A special feature of the MX66M or MX66V is the ***"PWM Sound supply"*** at output "left-3", if CV # 112, Bit 3 =1 (default).: Supplying a sound module from this pin (and ground pin) allows to define a special "sound speed table" by CVs # 62 - 64, which needs not to be identical with the motor speed table: for example you can specify the sound supply voltage for the still standing loco, or you can make a Diesel sound running at full volume for the first speed step.



Function of the various wires dependent of the sound module type

	STEAM			DIESEL		ELEKTRIC		
1010/11 1014/15	1016/17 1018/19	1020/21 1022/23 1024/26	2012/13 2016/17 2018/19	2020/21	3010/11	3012/13 3014/15 3016/17	3018/19	
16	Auf MASSE legen, um Anfahrpiff abzuschalten							
15	Pfiff	Pfiff	Pfiff	Horn, Anlassen	Horn, Anlassen	Pfiff	Pfiff	Panto
14		Glocke, Schlack	Glocke, Schlack, Schaufel	Horn 2	Glocke	Anlass.		Anlass.
13	Triller, Ventil							Pfiff
12								
11			Synchrone Dampfstöße über Hall-IC					
10								
9								
8	GROUND							
7	MOTOR							
6								
5	MOTOR							
4								
3								
2	TRACK							
1	TRACK							

16-wire connector of SONOR sound modules

Assignement of the outputs "left-1" - "left-4" to functions depending on the configuration variable # 61

CV # 61 =	1 ... 7	11 ... 17	21 ... 27	31 ... 37	41 ... 47	51 ... 57	61 ... 67	71 ... 77	
Zu empfehlen für SONOR-Typ:		1016/17, 1018/19, 1020/21,			2018/19, 2020/21, 3010/11,				
:		1022/23, 1024/25, 2013-17			3012/13, 3014/15, 3016/17, 3018/19				
	RIBI	RIBI	Z	Taste 7	Z	Taste 7	Z	Taste 7	left-4
	Z1	Z1	Z3	Taste 8	Z1	Z1	Z1	Z1	left-3
	Z3	Taste 8	RIBI	RIBI	Z3	Taste 8	RIBI	RIBI	left-2
	Z	Taste 7	Dauer-Masse	Dauer-Masse	RIBI	RIBI	Z3	Taste 8	left-1
									GROUND
									left-5
									Motor
									Motor
									Track
									Track

GROUND
PWM sound supply

5. Use of MX66x in various DCC systems

The ZIMO decoders comply to NMRA standards and recommended practices. Anyway, different systems have different features, default settings, etc, which can cause some little problems.

MX66 with . . .

Lenz "DIGITAL plus", Software version 2.0 or higher :

This system is able to use "direct programming" of configuration variables; so all CVs can be used (read and write access). However, CVs # 49 - 54 has no meaning outside of ZIMO systems ("signal controlled speed influence").

The Lenz cabs (handhelds) are able to control decoders with 14 or 28 speed steps, but the default setting is 14 steps. ZIMO decoders are set to 28 speed steps by default. If this conflict remains unchanged, the headlights will not work (while speed control itself still works) !!!

To make headlights working correctly ***the system must be set to 28 speed steps*** for the addresses, where ZIMO decoders are used (see Lenz manual how to do this).

Of course it also would be possible to set ZIMO decoders for 14 speed steps (CV # 29, Bit 1), but normally it does not make sense to deteriorate the operation artificially.

Lenz "DIGITAL plus", Software version lower than 2.0 :

Only configuration variables # 1 - 4 and 29 (to be accesed by "5") can be programmed by the "old" Lenz system. If you want to change other CVs of the decoder, you must do it on a ZIMO system or on a modern Lenz system (2.0 or higher).

The "old" Lenz system works with 14 speed steps only. So the decoders must be configured to 14 speed steps: CV # 29, Bit 1 set to "0" (zero).

ROCO "digital is cool" (loco mouse):

Only the loco address can be programmed by the old "loco mouse". Programmingof configuration variables must be done on an other system. The new "loco mouse 2" is able to program CVs # 1 - 99 !

The Roco system works with 14 speed steps only. So the decoders must be configured to 14 speed steps: CV # 29, Bit 1 set to "0" (zero).

DIGITRAX Chief :

Normally there are no problems at all !

The default settings for speed steps (28 and 128 active) are equal. But if headlights are not working correctly, the setting of speed steps should be checked both at the system and on the decoder (CV # 29, Bit 1 should be "1").

ZIMO decoders can be programmed both in "direct mode" and in "paged mode"; therefore programming by WINLOK (which works in the "paged mode" only) is possible, too. Programming on the main ("long form") can be used as well.