EDITION:

Combined operating instructions for MX61 and MX62: 2000 08 25
strategy for optimizing the CV settings: 2000 12 05
2002 03 15
2002 07 30
MX64 added: 2003 01 10

Operating instructions

LOCOMOTIVE DECODERS MX61 - model 2000 , MX64 , and MX62

for DCC systems conforming to NMRA standards

also in versions MX61R, MX64R (with medium plug) and MX61F, MX64F (with small plug),
MX6H, MX64HR, MX64HF (high current versions),
resp. MX62W (with 7 wires instead of plug) and MX62R (with medium plug)

CONTENT :

NOTE:

ZIMO decoders are driven by the software stored in a microcontroller. The version of the software of an individual decoder can be found out by reading the configuration variable # 7.

The current version of the decoder possibly does not match with the operating instructions in all details. Because of the huge variety of possible applications it is not practicable to test everything before shipping.

New software versions (which could correct problems or could improve properties of the decoder) can be implemented by reprogramming or replacing the microcontroller chip. This can be done at the ZIMO factory by order and for account of the customer (not covered by the guarantee). The guarantee covers hardware faults caused by defect electronic components or manufacturing problems.

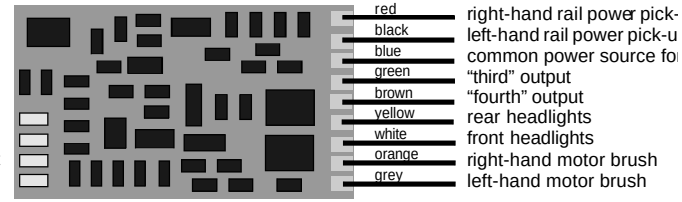
1. Introduction

The decoders MX61 and MX62 are intended for installation in small scale locomotives (H0, N and similar). 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 ("digital is cool"), Arnold, LGB, Uhlenbrock, Digitrax, etc.

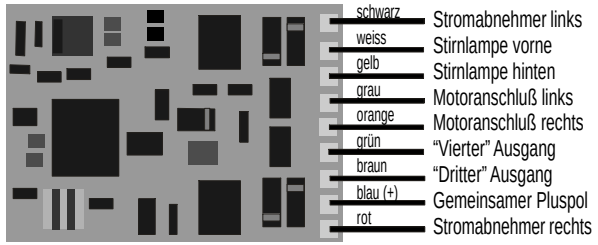
MX61	Loco decoder for all usual D.C. (including Faulhaber and other coreless motors and A.C. motors) up to 1 A maximum current; PWM period low frequency range 50 to 150 Hz, *high frequency 16 kHz or 32 kHz* for noiseless operation. 4 amplified function outputs (400 mA each) and 2 logical function outputs (usable with external amplifier).
MX61R	As MX61, with interface plug, according to NMRA RP-9.1.1, medium.
MX61F	As MX61, with interface plug, according to NMRA RP-9.1.1, small.
MX62	Miniaure loco decoder up to 0,7 A; with interface plug, according to NMRA RP-9.1.1, small .
MX62W	As MX62, with 7 wires instead of plug.
MX62R	As MX62, with with interface plug, according to NMRA RP-9.1.1, medium (8 pins)
MX64	Loco decoder as MX61 up to 1,2 A maximum current; PWM period low frequency range 50 to 150 Hz, *high frequency 20 kHz or 40 kHz* for noiseless operation. 4 amplified function outputs (400 mA each) and 3 logical function outputs.
MX64R	As MX64, with interface plug, according to NMRA RP-9.1.1, medium.
MX64F	As MX64, with interface plug, according to NMRA RP-9.1.1, small.
MX64H	As MX64, with additional rectifier for a total current of 1,5 A.
MX64HR	As MX64H, with interface plug, according to NMRA RP-9.1.1, medium.
MX64HF	As MX64H, with interface plug, according to NMRA RP-9.1.1, small.

MX61 Bottom view

The outputs on this side are "logic level outputs"; they must not be loaded by currents more than 1 mA. So they only can be used with external amplifier modules like M4000Z.



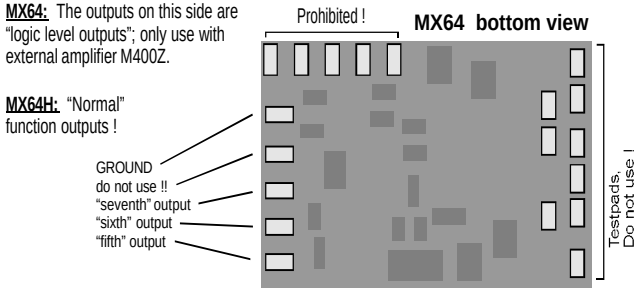
MX64 Top view



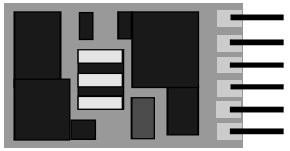
MX64: The outputs on this side are "logic level outputs"; only use with external amplifier M400Z.

MX64H: "Normal" function outputs !

MX64 bottom view



MX62 Top view



Wire colors MX62W

rear headlight	yellow
front headlight	white
right hand pick-up	black
left-hand pick-up	red
left-hand motor brush	grey
right-hand motor brush	orange

MX62 Bottom view

Logic level outputs

"Third" output"

"Fourth output"

The "logic level outputs" must not be loaded by more than 1 mA; only usable with external amplfiers M4000Z.

Common power source for functions (blue wire on MX62W)

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. Incorrect connections to rails and motor (most critical: short circuit between a motor terminal and a rail pick-up) or a faulty motor could cause damage to the decoder.

2. Specifications

Track voltage .....MX61: 12 - 24 V ... MX62: 12 - 20 V
Motor output - Continuous current ..... MX61: 1 A ..... MX62: 0, 6 A
- short-time current ..... MX61: 2 A ..... MX62: 1,5 A
Headlight current (L_V, L_H) ..... MX61: 0,4 A ..... MX62: 0,2 A
"Third" and "fourth" function output current ..... only MX61: 0,4 A
Decoder total current .....MX61: 1,2 A ..... MX62: 0,7 A
Logic level function outputs externally amplified with M4000Z ..... 0,5 A
Operating temperature ..... - 20 - 100 ^{o}C
Dimensions ..... MX61: 21 x 13 x 4 mm .... MX62: 14 x 9 x 3 mm
Length of connecting wires of MX61, MX62W 120 mm
Length of connecting wires to interface plug of MX61R, MX62R .....70 mm

Track voltage ..... 12 - 24 V
Motor output - Continuous current ..... MX64: 1 A ..... MX64H: 1,5 A
- short-time current ..... 1,5 A
Headlight and function output current (L_V, L_H, "third", "fourth") ..... 0,4 A
Function outputs total current ..... 0,5 A
Decoder total current ..... MX64: 1,2 A ... MX64H: 1,6 A
Logic level function outputs externally amplified with M4000Z ..... 0,5 A
Operating temperature ..... - 20 - 100 ^{o}C
Dimensions ..... MX64: 26 x 16 x 3 mm .... MX64H: 26 x 16 x 5 mm
Length of connecting wires ..... 120 mm
Length of connecting wires to interface plug of MX64R, MX64HR .....70 mm

3. Addressing und programming

New ZIMO decoders are addressed to 3 (as required by the NMRA DCC standard).

PREPARING 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, because they are used for acknowledgments in the programming mode. 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 CVs, Configuration Variables) is done either from the cab of the Digital Command Control system (ZIMO system: MX2 cab) or from the computer (ZIMO Software ADaPT).

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

THE CONFIGURATION VARIABLES (table of CVs and comments next pages):

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 sectors). Although most CVs are NMRA defined, you must look to the following specification of each variable, because for example the allowed values is different from manufacturer to manufacturer.

# 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	Vstart	1 - 252	2	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 simple 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 deceleration rate. Multiplied with 0.9 it gives the time in sec from full speed to stop.
# 5	Vhigh	0 - 252	252	This value defines the internal speed step (~ voltage drive level) used for the highest external speed step (which is 14, 28 or 126, dependent on used speed step mode). Only effective, when Bit 4 in CV # 29 = 0 (this means simple speed table by CVs # 2, 5, 6).
# 6	Vmid	0 - 252	0	This value defines the internal speed step (~ voltage drive level) used for the middle external speed step (which is 7, 14 or 63, dependent on used speed step mode 14, 28 or 128). The default value “0" means automatic assignment of 1/3 of value in CV # 5 (Vhigh). Only effective, when Bit 4 in CV # 29 = 0 (this means simple speed table by CVs # 2, 5, 6).
# 7	Version No.	No write		Decoder and software version.
# 8	Manufacturer ID and HARD RESET	No write access	145	NMRA assigned manufacturer ID; for ZIMO this is “145” (”10010001”) Programming to “8” produces Hard reset.
# 9	Total PWM period	0 (high frequency) 255-176 (low frequency)	0 (high-frequency)	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: Motor frequency 16 kHz or 32 kHz. (Depending of CV # 112, Bit 5)

CV number Name Range Default Description
“Default” is the value of the CV in case of a new decoder or after a a “hard reset” (”Hard reset” is done by addressing to “0” on ZIMO cab)

# 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.
#13	Analogous mode function status	0 - 255	0	Function outputs (F1 - F8), which should be on in analogous mode; each bit corresponds to one function (Bit 0 = F1, Bit 1 = F2, etc.).
#17+18	Extended address	128 - 10239 *)	0	The “long” loco address, alternatively to address in # 1; this is active, when Bit 5 in CV # 29 (configuration data) = 1.
# 19	Consist address	0 - 127	0	Contains an address which is used to control locomotives in a 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.
# 21	Function control by consist addr. Active for F1-F8	0 - 255	0	Function outputs (F1 - F8), wich are controlled by the consist address (Bit 0 for F1, Bit 1 for F2, etc.). Bit x = 0: function output controlled by primary or extended adress Bit x = 1: function output controlled by consist address
# 22	Function control by consist addr. Active for FL	0 - 3	0	Function outputs (headlights front and rear), wich are controlled by the consist address (Bit 0 for front, Bit 1 for rear headlight). Bit x = 0: function output controlled by primary or extended adress Bit x = 1: function output controlled by consist address

*) CV # 7 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.

# 23	Acceleration adjustment	0 - 255	0	Bit 0 - 6: Acceleration time added to CV # 3 or subtracted from CV # 3. Bit 7 = 0: Add ! = 1: Subtract !
# 24	Deceleration adjustment	0 - 255	0	Bit 0 - 6: Deceleration time added to CV # 3 or subtracted from CV # 3. Bit 7 = 0: Add ! = 1: Subtract !
# 29	Configuration data Calculation for CV # 29 is done by addition of bit values : 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 accepted always, independent of this bit.) Bit 2 - Power source conversion: 0 = Digital operation only 1 = Analog operation enabled Bit 4 - Speed characteristic: 0 = defined by CVs # 2,5,6, 1 = speed table defined by CVs # 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. address in CV # 1 (1 - 127). # 29 = 6: as above, but with power source conversion. # 29 = 22: as above, but with power source conversion and speed table defined by CVs # 67 - 94. # 29 = 0: 14 (instead 28) speed steps; this is the typical value for use in old Lenz systems or ROCO´s “digital is cool”.

# 33 # 34 # 35 # 36 # 37 # 38 # 39 # 40	Output locations		0	“Function mapping” according to NMRA: # 33 - 40 = 0: By default the function outputs are assigned to F0 to F4 (the two headlight outputs direction dependant with F0, other outputs a function each).
# 49	Signal controlled acceleration Only if used within a ZIMO system.	0 - 255	0	The value of this CV, multiplied with 0.4, gives the time in sec from signal controlled stop to full speed.
# 50	Signal controlled deceleration Only if used within a ZIMO system.	0 - 255	0	The value of this CV, multiplied with 0.4, gives the time in sec from full speed to signal controlled stop.
# 51 # 52 # 53 # 54 # 55	Signal controlled speed limit # 52 for “U”, # 54 for “L”, # 51, 53, 55 for interim steps	0 - 252		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 EMF control P- and I- parameter	0 - 99	55	Back EMF load compensation control is done by a PID (Proportional-Integral- Differential) algorithm. The CV # 56 contains the parameters (weighting) for proportional control (the tens digit) and integral control (the last digit). In some cases it is useful to modify the default values in order to improve the running characteristic. If low speed operation is not smooth enough with default setting, try values like “73”, “82”, “91” (rather for high-quality modern locos) or “77”, “88”, “99” (rather for old locos). Of course all other values are allowed, too.

# 57	Voltage reference	0 - 255	MX610 MX62140	Divided by 10, this CV gives the absolute voltage drive level, which should be applied on full speed. # 57 = 0 (default): in this case the absolute voltage drive level follows (only MX61) follows automatically the track. MX62 does not provide the "0" option. Use of this CV (e.g. "150" for a track voltage of about 15 V) can be better than the default "0", if the power station does not stabilize the tracks voltage (which is not the case for ZIMO systems) or if the loco rail power pick ups are of inferior quality or if the rails and wheels are very dirty (i.e. all kinds of very uneven supply).
# 58	Back EMF intensity	0 - 255 (see special notes)	255	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 compensation, e.g. in consists or for more prototypical way of operation. EXAMPLES: # 58 = 0: no compensation, # 58 = 150: partial compensation, # 58 = 255: full compensation.
# 59	Signal controlled reaction time Only if used within a ZIMO system.	0 - 255	0	Multiplied with 10, this CV gives the time in sec for starting a signal control- led acceleration after reception of a higher than actual speed limit (or full).
# 60	Function outputs voltage reduction	0 - 255	0	The effective voltage on the function outputs can be reduced by PWM operation. 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 - 6 (see special table)	0	Beyond the NMRA function mapping this allows assignments for prototypical lighting of Swiss locos and other applications.

# 112	Special ZIMO Configuration data	0 - 255	12 00001100	Bit 2 - Loco identification pulses off (0), on (1) Bit 3 - only NMRA MAN-Bit (0), both MAN-Bits (1) Bit 5 - high frequency 16 kHz (0), 32 kHz (1) Bit 7 - reduce EMF measuring gap t 1/4.
# 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	0 - 99	0	If in CV # 125 .. 128 = 48 (decoupling). Tens digite (0 - 9): Time interval full volt. Wert:: 0 1 2 3 4 5 6 7 8 9 sec: 0 - 0,1 - 0,2 - 0,4 - 0,8 - 1 - 2 - 3 - 4 - 5 Last digit (0 - 9): Percentage (0 - 90 %) of the track voltage for the rest of the function time.
# 116	Decoupling mask	Bits 0-5	0	Bits 0 to 5 for one function output each (Bit 0 - front headlight output, Bit 1 - rear headlight output, Bit 2 - "third" function output, etc.). Any bit - 0 = output used for decoupler 1 = output not used for decoupler
# 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	Slower acceleration rate 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	Slower deceleration rate 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).
# 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 functions 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 MX2: digit 5) is shunting button. 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. Bit 3 = 0: No half speed function = 1: F7 is half speed button

# 125 *)	Light eff. output "head front" (F0) <u>Lighting effets</u> and: Slow power up of the function output (avoiding the high current start pulse because of a cold bulb) Only if version CV # 7 >= 11 (from march 2002) Modifications of the lighing effects by CVs # 62 - 64 !		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 unused = 001101 slow dimming up of the functtion output <u>EXAMPLES</u> (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. output "head rear" (F0)		0	wie CV # 125
# 127 *)	Light eff. "Third" output (F1)		0	wie CV # 125
# 128 *)	Light eff. "Fourth" output 5 (F2)		0	wie CV # 125
# 62	Modifications of the lighting effects		0	Last digit: Minimum dimming value ("FX_MIN_DIM") Tens digit: not used
# 63	Modifications of the lighting effects		51	Tens digit: Cycle time for effect (0 - 9, default 5), or: slow dimming up if 001101 (0-0,9 s) Last digit: extending the off time
# 64	Modifications of the lighting effects		5	Last digit: Ditch light off time modification Tens digit: not used

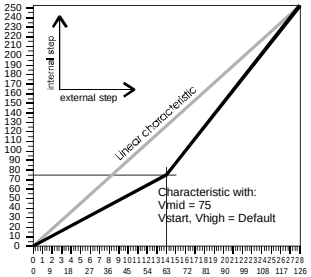
SOME NOTES ON USING THE CONFIGURATION VARIABLES:

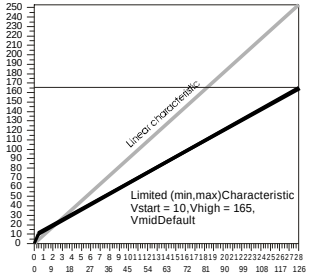
The two ways of programming the speed characteristic:

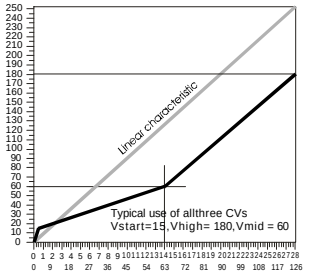
By 3 configuration variables (CVs # 2, 5, 6 for V_{start}, V_{high}, V_{mid}) - This is a simple but efficient way, easy to do from the cab of the DCC system. It is active, when ***Bit 4 in CV # 29 = 0*** (Default).

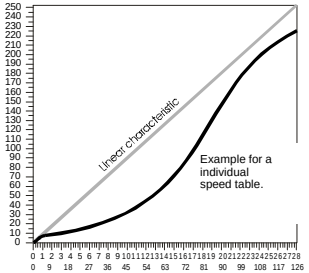
By 28 configuration variables (CVs # 67 - 94) - One internal speed step is assigned to each of the 28 external speed steps; if 128 external speed steps are used, an interpolation algorithm is used for the steps between. This is the most flexible way for defining the motor characteristic, but it needs 28 programming steps. Therefore it is more comfortable with a 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 high frequency (***CV # 9 = 0*** results in ***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 (or 32) kHz operation is also useable for the most locos manufactured recently; therefore it is the default mode of the MX61 “model 2000” and MX62 (in contrast to the former MX61, which used low frequency by default).

The back EMF control - load compensation:

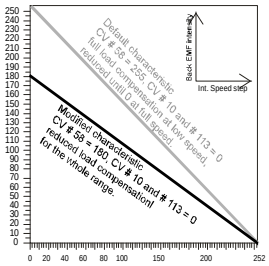
Normally it is advisable to have a full load compensation only at low speed, whereas it should be reduced at middle speed going down until zero at the maximum speed (which is done by the default settings of the relevant CVs).

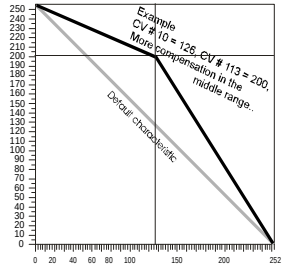
For consist operation a reduced load compensation should be used (over the whole range, also low speed), in order to avoid working the locos against each other because of slightly different rated speeds.

By means of the three configuration variables # 58, 10 and 113 you can define the intensity of load compensation over the speed range. For 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. Both CVs must always be used together in order to define a certain speed step with a certain load compensation intensity.

Simplified representation!





Strategy for optimizing the CV settings:

* Select number of speed step system (14, 28, 128): ZIMO decoders are set by default to 28 / 128 speed steps. Only if the digital system is restriected to 14 speed steps (some old and very low-end systems), it is necessary to clear Bit 1 in CV # 29.

* Choose of the lowest internal speed step, which should be applied for the lowest non-zero position of the controller, by **CV # 2**. If the loco runs too slow (or jerky, even after adjusting CV # 56, see below) or too fast on spped step one, CV # 2 must be set to a higher or lower value, respectively.

* **CV # 56** is able to to improve the low speed operation. This happens in most cases by increasing the "proportional" part of the PID control (tens digit); depending on the kind of the motor also the inetgral part could be increased (last digit). For modern locos values like "73", "82", "91" (= high proportional, low integral) should be tried first, for old locos rather "77", "88", "99" (= high both prop. and int.) could be useful.

* If the optimal low speed value of CV # 56 makes an uneven medium speed operation, **CV # 58** should be reduced (try "220", "200", "180", etc.).

* If the loco starts abruptly, this can be improved by **CV # 123** ("adaptive acceleration"). Values "30", "20", "10" should be tried. With the last digit an "adaptive deceleration" could be added (for smoother stopping), e.g. "33", "22", "11". But this results in a less inaccurate stopping point (particularely if combined with deceration rate in CV # 4), and is therefore not always advisable. Of course combinations like "13" or "24" (much adaption for acceleration, only some for deceleration) could be chosen.

* Now acceleration and deceleration rate could be set by **CVs # 4 and # 5**.

* In order to improve the acceleration (and deceleration) sequence, **CVs # 121 and # 122** ("exponential") could be used; typical values are "25", "35", "45", "55".

* When using ZIMO's "signal controlled speed influence", **CVs # 51 ... 55** (thespeed limits) and **CVs # 49 and # 50** (acceleration and deceleration) have to be defined.

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.

The NMRA "function mapping"

The Configuration variables # 33 - 40 belong to the function keys of the cab; each bit belongs to a certain function output of the decoder. By setting bits each key can be assigned to an output.

Note: In case of MX62 "Third" and "Fourth" outputs are logic level; no "Fifth" and "Sixth" in MX62.

NMRA-function	CV	Function key of the ZIMO cab			Logic level function outputs		Amplified function outputs			
					"Sixth" output	"Fifth" output	"Fourth" output	"Third" output	Head rear	Head front
F0	# 33	1 (L) forw.	(7)	(6)	5	4	3	2	1	0 ●
F0	# 34	1 (L) backw.	(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)			3	2	1	0		
F6	# 40	7			3	2	1	0		

The table above shows the default settings; the headlights can be switched on / off by ZIMO cab key "1" (NMRA function F0); the "third" and "fourth" outputs are switched on / off by ZIMO keys "2" and "3")NMRA functions F1, F2), etc. For this setting all CVs contain "0" (default) or - with the same meaning - CV # 33 = 1, # 34 = 2, # 35 = 4, # 36 = 8, etc.

EXAMPLE (below): The two headlights should be switched on / off seperatly with the ZIMO cab keys "1" and "2" (F0 and F1); the "third" output with key "3" (F2). For this the following programming is necessary: CV # 33 = 1, # 34 = 1, # 35 = 2, # 36 = 4.

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

Special ZIMO function mapping

By programming the configuration variable # 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 oder 2

Function keys on the ZIMO cab	NMRA		Logic level function outputs		Amplified function outputs			
			"Sixth" Ausgang	"Fifth" Ausgang	"Fourth" Ausgang	"Third" Ausgang	Head rear	Head front
1 (L) forw.	F0							●
1 (L) backw.	F0						●	
2 (LL)	F1	*CV # 35*						
3 (Z)	F2				●			
4 (Z1)	F3			●				
5 (Z2).	F4		●					
6 (Z3)	F5							
8	F7					●		
Direction key						●		

CV # 61 = 1 **CV # 61 = 2**

CV # 61 = 3 oder 4 (not for MX62)

Function keys on the ZIMO cab	NMRA		Logic level function outputs		Amplified function outputs			
			"Sixth" Ausgang	"Fifth" Ausgang	"Fourth" Ausgang	"Third" Ausgang	Head rear	Head front
1 (L) forw.	F0							●
1 (L) backw.	F0						●	
2 (LL)	F1	*CV # 35*						
3 (Z)	F2				●			
4 (Z1) forw.	F3			●				
4 (Z1) backw.	F3		●					
5 (Z2).	F4							
6 (Z3)	F5							
8	F7					●		
Direction key						●		

CV # 61 = 3 **CV # 61 = 4**

CV # 61 = 5

Function keys on the ZIMO cab	NMRA		Logic level function outputs		Amplified function outputs			
			"Sixth" Ausgang	"Fifth" Ausgang	"Fourth" Ausgang	"Third" Ausgang	Head rear	Head front
1 (L) forw.	F0							●
1 (L) backw.	F0						●	
2 (LL)	F1	*CV # 35*						
4 (Z1) forw.	F3			●				
4 (Z1) backw.	F3		●					
5 (Z2) forw.	F4					●		
5 (Z2) backw.	F4				●			

TYP. APPLICATION: direction dependant rear lights (F3) and direction dependant cab lighting (F4).

CV # 61 = 6

Function keys on the ZIMO cab	NMRA		Logic level function outputs		Amplified function outputs			
			"Sixth" Ausgang	"Fifth" Ausgang	"Fourth" Ausgang	"Third" Ausgang	Head rear	Head front
1 (L) forw.	F0							●
1 (L) backw.	F0						●	
1 (L) forw., if F3 off					●			
1 (L) backw. If F3 off						●		
2 (LL)	F1	*CV # 35*						
4 (Z1) forw..	F3			●				
4 (Z1) backw.	F3		●					

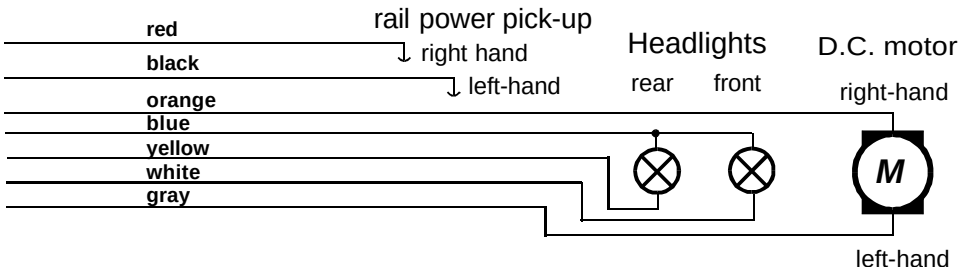
TYP. APPLICATION: Swiss locos, whre can select by F4, wther there should be used the red rear light or the single white rear lighting.

4. Decoder installation and wiring

. . . in a D.C. locomotive (motor and headlights):

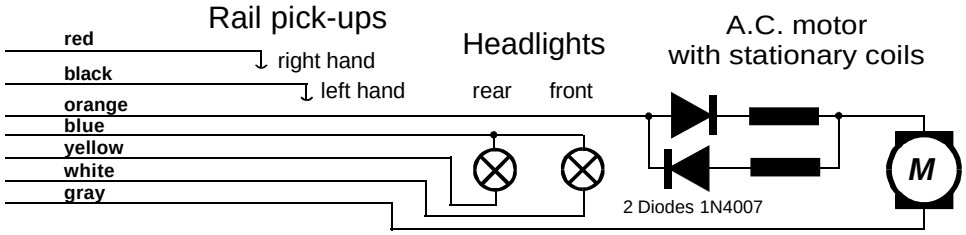
The following schematic is the most frequent application for MX61 and MX62. If the loco has the standardized NMRA interface (medium), MX61R / MX62R is used instead; even in this case the schema is valid.

NOTE:
If one pole of the headlights is connected to the chassis of the locomotive (and on this way to one of the rail pick-ups) and cannot be disconnected, the second pole of the headlights is connected to the white resp. yellow wire of the decoder on the same way as above and the blue wire remains unused. The headlights are working in this case with reduced brightness.



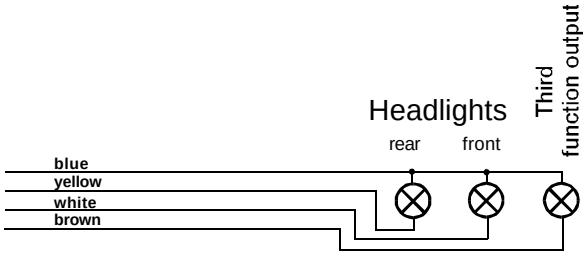
. . . in an A.C. locomotive:

Basically the same as for D.C. locos. But the A.C. motor has 3 connections to connect; two rectifiers (diodes) are necessary for motor connection and to allow a change in driving direction, when commanded by the cab.



. . . use of the "third" and "fourth" function outputs of MX61:

The third function output (green and brown wires) are used in the same way as the headlight outputs; e.g. for a smoke generator or for an additional bulb.

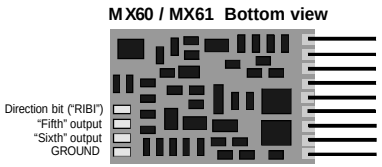


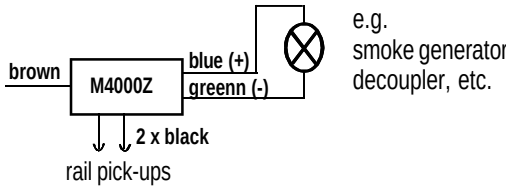
NOTE:
You must bear in mind the maximum current of 400 mA on the function outputs. If this is not sufficient, then one of the logic level outputs could be used together with an external amplification module M4000Z.

. . . use of the logic level function outputs (MX61 - the "fifth" and "sixth" / MX62 - the "third" and "fourth"):

The only allowed use of these function outputs is the connection to the input (brown wire) of an ***external amplification modules M4000Z .*** Also the direction bit "RIBI" is a logic level output of the MX60 / MX61 which can be amplified by M4000Z.

Each M4000Z has its own wires (black) to rail power pick-ups and its output (blue, green wires) is able to drive lightings, smoke generators, decouplers, etc. up to 500 mA.





Use of ZIMO decoders in various DCC systems

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

MX61 and MX62 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 (hand-held) are able to control decoders with 14 or 28 speed steps, but the default setting could be (depending on version) 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 assigned 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 accessed 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, too: CV # 29, Bit 1 set to "0" (zero).

ROCO "digital is cool" :

Only the loco address can be programmed by the old "loco mouse" (the new mouse "2", has better programming features). Programming of configuration variables must be done on an other system.

The Roco system works with 14 speed steps only. So the decoders must be configured to 14 speed steps, too: 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.