

**FEATURES:**

- Factory preset address for the locomotive is 03.
- The **MX644C Sound Decoder** supports NMRA-DCC data format as well as the MOTOROLA protocol, in DC analog mode with DC power packs (including PWM) and with AC analog (Märklin Transformers with high-voltage pulses for direction change).
- 14, 28 or 128 selectable speed steps for DCC systems.
- Load compensation function.
- 6 function outputs + 2 logic level
- Audio amplifier 3W 8 Ohms.
- Find the full instruction manual at http://www.zimo.at/web2010/documents/MX-KleineDecoder_E.pdf.

DECODER PARAMETERS:

The sound decoder controls several parameters (CVs). You can find a list of all CVs at http://www.zimo.at/web2010/documents/cvliste%2010.2018_EN.pdf. Each CV can be configured independently using its respective command. The CVs changed in this specific sound project are shown at the end of this sheet.

DCC Systems (ZIMO, Lenz, Intellibox, etc.)

It is much easier to modify the parameters if you have a DCC compatible digital system. Please, read the corresponding chapter in your system manual (DCC decoders programming). The sound decoder supports any NMRA programming system.

ANALOG OPERATION

All ZIMO decoders are capable of operating on conventional layouts with DC power packs, including PWM throttles, in analog DC as well as in analog AC (Märklin transformers with high voltage pulse for direction change). To allow analog operation CV #29, Bit 2 = 1 must be set. This is usually the case by default (CV #29 = 14, which includes Bit 2 = 1), but analog operation may be turned off in many sound projects (sound decoders). It is recommended to turn analog mode off when operating strictly on DCC! The actual behavior during analog operation, however, is strongly influenced by the locomotive controller (power pack). Especially in combination with a weak transformer, it is easily possible that the track voltage collapses when the decoder (motor) starts to draw power which, in the worst case, may lead to intermittent performance.

Please note the following warnings: The decoder installed in your locomotive has been specifically adapted for this model and it should be used only in this particular model. Always disconnect the decoder from the power supply before doing any work on it.

If removing the speaker is necessary for maintenance purposes, please handle it very carefully.

Do not put any pressure on it or touch the speaker membrane.

The reset function is very convenient, as you can set the original manufacturing values again at any time. You can use this function with DCC and Motorola systems. To use this function, type "8" in CV #8 or "08" in register "08".

Functions	Effect	Function output	Sound function
F0	Light on/off	White light driver's cab 1 (FO0f) when driving direction forward, white light driver's cab 2 (FO0r) when driving direction backward	
F1	Sound on/off		
F2			Horn low short
F3			Horn double long
F4	Rear red lights	FO1 when driving direction forward and FO2 when driving direction backward	
F5	Interieur lighting		
F6	Lights full beam	Turn up FO0f when driving direction forward and FO0r when driving direction backward	
F7	Half speed key		
F8	Shunting key		
F9			Compressor
F10			Cornering squeal
F11			Rail joints
F12			Sanding
F13			Coupling/uncoupling
F14			Brake release
F15			Door open/close
F16			Filling brake air tank
F17			Announcement „Einfahrt“
F18			Announcement „Untersiebenbrunn“
F19			Announcement „Zug fährt ab“
F20			Conductor's whistle
F21	Mute		Mute when activated
F22			Horn high long
F23			Horn low long
F24			Webasto
F25			Spring brake
F26			Electromagnetic rail brake
F27			Volume +
F28			Volume -



Changed CV's #:

CV#	Name	Description	Range	Value
1	Short address	Locomotive address	1-127	3
2	Start voltage	Voltage with which the loco's motor starts to run	1-252	1
3	Acceleration rate	Multiplied by 0.9 equals the time in sec from standstill to full speed.	0-255	22
4	Deceleration rate	Multiplied by 0.9 equals the time in sec from full speed to standstill.	0-255	17
5	Top speed	Internal speed step applied for the highest external speed.	0-255	180
13	Analog functions F1...F8	Defines functions that should be "ON" in analog mode. Bit 0 = 0: F1 is OFF in analog mode = 1: ...ON in analog mode Bit 1 = 0: F2 is OFF in analog mode Bit 1 = 1: ...ON in analog modeF3, F4, F5, F6, F7 Bit 7 = 0: F8 is OFF in analog mode Bit 7 = 1: ...ON in analog mode	0-255	1
14	Analog functions F0 v&r, F9 – F12, Analog momentum and regulated analog operation	Defines function outputs that should be "ON" in analog mode. Bit 0 = 0: F0 (forw) is OFF in analog mode = 1: ...ON in analog mode Bit 1 = 0: F0 (rev) is OFF in analog mode Bit 1 = 1: ...ON in analog mode Bit 2 = 0: F9 is OFF in analog mode Bit 2 = 1: ...ON in analog mode -----F10, F11, F12 Bit 6 = 0: Analog operation with acceleration and deceleration according to CV #3 and #4, especially useful for sound Bit 6 = 1: Analog operation without acceleration and deceleration according to CV #3 and #4. Bit 7 = 0: unregulated DC operation Bit 7 = 1: regulated DC operation	0-255	195
29	Basic Configuration	Bit 0 - Train direction: 0 = normal, 1 = reversed Bit 1 - Number of speed steps: 0 = 14, 1 = 28 Bit 2 - Automatic DC operation (analog): *) 0 = disabled ; 1 = enabled Bit 3 - RailCom („bidirectional communication") 0 = deactivated; 1 = activated	0-255	14



		<p>Bit 4 - Individual speed table: 0 = off, CV # 2, 5 and 6 are active; 1 = on, acc. to CV 's # 67 - 94</p> <p>Bit 5 - Decoder address selection: 0 = short address as per CV #1; 1 = long address as per CV #17+18</p>		
56	P and I value for BEMF motor regulation	<p>= 55: Default setting using medium PID parameters.</p> <p>= 0 - 99: Modified settings for "normal" DC motors.</p> <p>= 100 - 199: Modified settings for coreless motors (Faulhaber, Maxxon etc.)</p> <p>Tens digit 1 - 4: Lower proportional value than default</p> <p>Tens digit 6 - 9: Higher proportional value than default</p> <p>Ones digit 1 - 4: Lower integral than default</p> <p>Ones digit 6 - 9: Higher integral than default</p> <p>Typical test values against jerky driving: CV #56 = 55 (default) □ 33, 77, 73, 71, ..</p>	<p>55 medium PID setting</p> <p>01 - 199 mod. settings</p>	33
57	Voltage reference	<p>Absolute voltage applied to the motor at full speed (max. throttle setting).</p> <p>= 0: automatic adjustment to track voltage; only useful with stabilized track voltage.</p>	0-255	140
60	Dimming	Rate on function outputs when turned on.	0-255	85
124	<p>Shunting key functions: low gear (half speed) and momentum reduction or deactivation</p> <p>NOTE: Extended shunting key selection in CV's #155, 156</p>	<p>Select a function key for LOW GEAR ACTIVATION:</p> <p>Bit 4 = 1 (and Bit 3 = 0): F3 as half-speed key</p> <p>Bit 3 = 1 (and Bit 4 = 0): F7 as half-speed key</p> <p>Select a function key for MOMENTUM DEACTIVATION:</p> <p>Bit 2 = 0 (and Bit 6 = 0): "MN" key for deactivation, Bit 2 = 1 (and Bit 6 = 0): F4 key for deactivation</p> <p>Bit 6 = 1 (Bit 2 is irrelevant): F3 for deactivation.</p> <p>Effect of above key (MN, F3 or F4) on MOMENTUM:</p> <p>Bit 1, 0 = 00: no effect on momentum = 01: removes momentum of CV #121 + #122</p> <p>= 10: CV #3 + #4 reduced to ¼.</p> <p>= 11: removes all momentum above.</p> <p>EXAMPLES:</p> <p>F3 for half speed-key: CV #124 = 16.</p> <p>F3 for half speed-key and F4 to remove momentum completely: Bits 0, 1, 2 & 4 = 1; that is CV #124 =23.</p> <p>F3 for half-speed key and removing momentum:</p> <p>Bits 0, 1, 4 &6 = 1; that is CV #124 = 83.</p>	<p>Bits</p> <p>0 - 4, 6</p>	35



144	Update and/or Programming lock Note: Programming lock does NOT work on CV #144, the locking can be disabled.	= 0: NO Update and NO Programming lock Bit 6 = 1: lock: decoder cannot be programmed in "Service mode". Note: Programming in "Operational mode" (On-the-Main"; PoM) is NOT locked! Bit 7 = 1: Software Update locked	0, 64, 128, 192	128
190	Fade-in time for 88, 89, 90 effect	Value 0 = on immediately; value 1-254 = approx. time in sec.; value 255 = 320 sec.	0-255	2
191	Fade-out time for 88, 89, 90 effect	Values see above.	0-255	1
266	Overall sound volume	The highest volume without distortion is 64; possible up to 100, but rarely above.	0-255	65
287	Brake squeal threshold	The brake squeal should start when the speed drops below a specific speed step. It will be automatically stopped at speed 0 (based on back-EMF results).	0-255	40
288	Minimum driving time before brake squeals	The brake squeal is to be suppressed when an engine is driven for a short time only, which is usually a shunting run and often without any cars (in reality it is mostly the cars that are squealing not the engine itself!).	0-255	85
310	ON/OFF-key for driving and random sounds	Select a function key that switches on/off driving sounds; at delivery this is F1.		1
313	Mute key	Fade in/out all sounds = no mute key 1= no mute if F1 activated, 2= no mute if F2 activated, etc. 101= mute if F1 activated, etc.	0 - 28 101 - 128	121
314	Mute on / off time	Time in tenths of a second for sound fading in/out when mute button is pressed. Total range is 25 seconds.	0-255	45
315	Random generator Z1 Minimum interval	The random generator generates internal pulses in irregular intervals that are used to playback a sound file assigned to the random generator. CV #315 defines the shortest possible interval between two consecutive pulses.	0-255	120
316	Random generator Z1 Maximum interval	CV #316 defines the maximum time interval between two consecutive pulses of the random generator Z1 (that is most often the start of the compressor after coming to a stop); the actually occurring pulses between the values in CV #315 and #316 are equally distributed.	0-255	160
317	Random generator Z1 Playback length	The sound sample assigned to the random generator Z1 (most often the compressor) is played back for the timespan defined in CV #317. = 0: Sample plays once (in the defined	0-255	0

		duration)		
395	Maximum volume	Max. volume for key defined with CV# 396, /#397	0-255	65
396	Volume decrease key			28
397	Volume increase key			27
516	Sound number F2	Sample number of function sound on F2		43
519	Soundnummer F3	Samplenummer des Funktionssounds auf F3		41
537	SoundnummerF9	Samplenummer des Funktionssounds auf F9		27
538	Function sound F9	Volume setting	0-255	128
546	Soundnummer F12	Samplenummer des Funktionssounds auf F12		30
547	Funktionsound F12	Lautstärkeeinstellung		128
548	Loop Info F12	Loop parameter of function sound on F12		8
549	Soundnummer F13	Samplenummer des Funktionssounds auf F13		29
550	Funktionsound F13	Lautstärkeeinstellung		128
551	Loop Info F13	Loop Parameter des Funktionssounds auf F13		8
552	Soundnummer F14	Samplenummer des Funktionssounds auf F14		37
555	Soundnummer F15	Samplenummer des Funktionssounds auf F15		38
557	Loop Info F15	Loop Parameter des Funktionssounds auf F15		8
558	Soundnummer F16	Samplenummer des Funktionssounds auf F16		26
561	Soundnummer F17	Samplenummer des Funktionssounds auf F17		33
564	Soundnummer F18	Samplenummer des Funktionssounds auf F18		34
567	Soundnummer F19	Samplenummer des Funktionssounds auf F19		128
575	Soundnummer Richtungswechsel	Samplenummer		25
576	Richtungswechsel	Lautstärkeeinstellung	0-255	128
577	Soundnummer Bremsen Quietschen	Samplenummer		36
578	Bremsen-Quietschen	Lautstärkeeinstellung	0-255	181
581	Soundnr. „Anfahrpfiff“	Samplenummer des Sounds „Anfahrpfiff“		37
673	Soundnummer F20	Samplenummer des Funktionssounds auf F20		40
674	Funktionsound F20	Lautstärkeeinstellung		128
679	Soundnummer F22	Samplenummer des Funktionssounds auf F2		42
682	Soundnummer F123	Samplenummer des Funktionssounds auf F23		44
685	Soundnummer F24	Samplenummer des Funktionssounds auf F24		28
686	Funktionsound F24	Lautstärkeeinstellung		91
687	Loop Info F24	Loop Parameter des Funktionssounds auf F24		72
688	Soundnummer F25	Samplenummer des Funktionssounds auf F25		39
690	Loop Info F25	Loop Parameter des Funktionssounds auf F25		8
691	Soundnummer F26			45
744	Z1 Soundnummer	Samplenummer		27
745	Zufalls Sound Z1	Lautstärkeeinstellung		181
746	Zufalls Sound Z1 – Info	=8: Zufallssound Z1 darf bei Stillstand kommen =64: Zufallssound Z1 darf bei Fahrt kommen		64