Newsletter March 2019

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REAL
16 bit sound - 22 or 44 kHz sample rate - 16 sound channels - 128 MBit flash

MS decoders

The first MS-Decoder: MS450P22
30 x 15 x 4 mm, 1.2 A, 3 Watt sound

Starting with April 2019, ZIMO sound decoders in MS technique are going to be shipped. Two components are significant for the performance of the new generation: the **state of the art 32 bit ARM processor** and the **fully digital sound amplifier**.

Additionally, the MS decoders are a fluent transition from the MX decoders: the proven power electronics (rectifier, amplifiers for power trains and function outputs, etc.) were adopted almost completely.

The main characteristic of the MS decoders is without doubt the ***16 bit sound*** – this improves the sound quality drastically.

With the 32-bit microcontroller and the 128 Mbit flash there is room for progress in every aspect. A part of this room is used from the beginning; much of the potential will be needed in continuous development - as usual after the first shipment. The results of this development will be available for all users as free software update.

✓***16 bit audio*** standard for sound samples, 8 bit for simple noises and "old" sample files.
The "REAL" 16 bits refer to the complete sound project: from the sound files stored in the flash memory, over the I^2S-bus (=Inter-IC-Sound) for playback in stereo, to the fully digital Class "D" amplifier. ZIMO dispenses with the often used (cheaper) digital-analog-conversion (10 or 14 bit), as well as with amplifiers with analog input (likewise called Class "D").
Compared to MX decoders: 8 bits for all sounds

✓***22 kHz sample rate*** by default; also for sound channels (adjustable in the sound project) with ***11 kHz*** for simple noises (e.g. station announcements) and ***44 kHz*** for HiFi quality.
Compared to MX decoders: 11 and 22 kHz

✓***128 Mbit sound memory*** for 360 seconds playback time (with 16 bits and 22 kHz, i.e. default samples and neglecting the overhead); using the memory economically (8 bit and 11 kHz, if possible) up to 1440 sec are possible.
Compared to MX decoders: 32 Mbit for 180 sec with 8 bit samples

✓The ***combination of channels*** with different bit depths (8, 16) and sample rates (11, 22, 44 kHz) can generate many additional sound minutes.

✓***16 sound channels***, which can be played back simultaneously, adjusted separately and in larger decoders are distributed on 2 speakers.
Compared to MX decoders: 6 channels

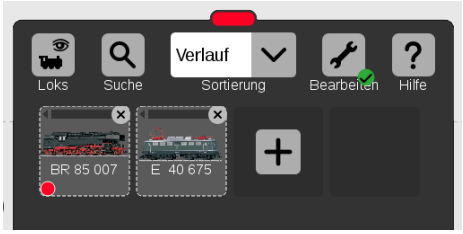
✓***Adjustable timbres*** of the driving noises (e.g. chuff sounds, diesel engine) via CV configuration of high and low pass filters.

List of types *of MS decoders on last page of this newsletter!*

The mfx able MS decoders

Introducing the MS generation, ZIMO decoders do not only work with DCC and MM, like all ZIMO decoders, but also with the ***mfx track format***, including RDS feedback and automatic registration with mfx central stations.

MS decoders are real multiprotocol (3-fold) decoders, which also work with analog operation, DC and AC.



The current MX decoders...

will NOT be removed from ZIMO's product range, **but are still offered** - as long as there is demand.

Due to the fact that the old decoders are continuously developed, also during the development of the new decoders, there may be some situations where the MX decoders have an advantage. The difference in sound is not always audible to the same extent; it may also be the familiarity with the „old" decoders.

Proven ZIMO special features also in "MS"...

5	H	Halt	7
	UH	Zwischenstufe	
L	U	Ultralangsam	S
i	LU	Zwischenstufe	t
m	L	Langsam	u
i	FL	Zwischenstufe	f
t	F	Volle Fahrt	e
s	(A	Spannung AUS)	n

HLU is not new; it was implemented 20 years ago and is still unmatched.

From start on (1980), the "signal controlled speed influence" (HLU's predecessor) is integrated in all ZIMO decoders and digital systems; since 2005 with the speed steps "Full Speed" , "Stop" and five speed limits in between, as well as function influence. DCC is known to be a communication format from the digital command station to the vehicles; a single command is distributed on the whole layout, to which (only) one decoder reacts due to the loco address sent with the command. **HLU** *is a second communication channel from an electronic unit of the insulated track section to the vehicle present on it; HLU data can be different from track section to track section (especially regarding speed limits which do NOT have an address and are valid for all ZIMO decoders).*
HLU data usually contain commands to stop trains or reduce their speed. HLU data reach the decoders practically immediately, because they are sent out about 100 times/sec.

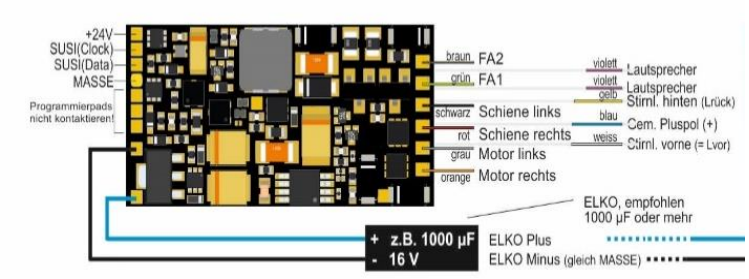
EAST-WEST: Since 2018: Driving in the right direction.

Since the model railway also works digitally, the driving direction is not track-bound but dependent on the vehicle (forward means chimney or driver's cab 1 ahead). This is often, but not always, an advantage. Therefore, the ZIMO system with its decoders has the possibility to set the train's direction in a layout-dependent direction: "East" and "West". The driving direction might as well be interpreted as "right" or "left", technically it depends on the polarity of the DCC track signal.
One of the characteristic features is that East-West does not work against, but together with the driving directions forward-backwards. This means

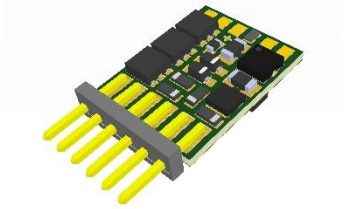
- *driving off in the "right" direction without knowing in which direction the train is placed on the tracks,*
- *to send "both directions" via RailCom to the controller, so the driver always has all the information*
- *without losing the known handling (change of directions).*

Direct connection for stay-alive capacitors (external energy storages)

Energy storage units on the decoder, i.e. Elkos or Supercaps, also known as stay-alive capacitors are highly recommended in many ways: to avoid getting stuck or sound interruptions, etc.
ZIMO decoders (at least the types with PluX22 or 21MTC interfaces, i.e. the bigger ones of the small decoders) and, of course, the large-scale decoders do not need additional diodes or powerpacks, as they already provide the possibility to connect capacitors or Supercaps. The special circuitry integrated in the decoder ensures faster charging without exceeding the allowed in-rush current, using the full capacity and in most cases it allows the usage of capacitors with a dielectric strength of only 15V (therefore they do not need much space).



MX671 *A new, cost-effective, function decoder* *Will substitute the MX681*



Dimensions **10.5 x 8 x 2.5 mm** (the smallest function decoder, smaller than its predecessor)
Versions: 6-pole NEM-651 (see CAD on the left), or with wires
0.7 A total current, **6** function outputs

Special features: RailCom, integrated feedback system for Service Mode (independent of Consumers), direct connection for stay-alive capacitors (diode/PTC to restrict charging current)

Software: like all ZIMO function decoders (programmable second address), etc.

The “fleet search“ as evolution of the “track-on search”

As already presented as **“track-on search”** (in 2018), now the next step follows: the **“fleet search”**; first we thought of the name “vehicle registration” in accordance with competitor methods. The name “fleet search” *) means that it is not the decoders that have to register, but that the central station registers the decoders on the layout according to the RailCom feedback it gets.

*) The name “fleet search” may be changed in future.

What is the difference?

“Track-on search” vs. “Fleet search”

The “track-on search” registers all decoders, which

were set on the tracks in the last minute,

i.e. before sending the search-commands (track-on search commands). These decoders report via RailCom that they were powered-up in the last minute (in respect to the supply from the tracks, independent of possible energy storage modules).

Usually, the track-on search is for vehicles of which the address was forgotten or is at all unknown.

It is completely irrelevant, if the vehicle was set on the tracks for the first time or “tilted” for about 1 sec (the latter constituted the original name “tilt-search”).

Typical display on the MX32 controller after successful track-on search:

The vehicle which reported first, is shown in the upper window, the other addresses found in this minute are shown in the list below.

The “fleet search” generally records all decoders

found on the layout,

i.e. after sending out search commands (fleet search commands). The decoders report via RailCom that they are stationed on the layout, independent of their previous history.

On the one hand this determines, if previously registered decoders are still on the tracks, and on the other hand if new ones - not registered yet - have joined. This “inventory” makes it possible to update the system database. It does this automatically or under control of the user, by deleting registered (but not found) decoders, or entering found (but not registered) decoders. It is especially important that conflicts of addresses are solved (new found decoders with the same address as already registered ones).

Typical fleet list, as it builds up during the searching process:

Vehicles in the database, found on the layout,

Entries in the database, which were NOT found,

new vehicles, which have a conflict of address with registered ones, ...

The fleet search by ZIMO can be used to register and list all present decoders (marked by the individual Unique IDentifiers (=UID)). Nevertheless, this simple process is NOT the use intended by ZIMO.

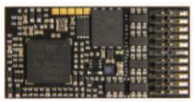
Within the ZIMO system, the fleet search shall take over a **number of tasks**:

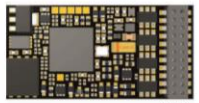
- **Cleaning** the central vehicle database *) by supporting the user-controlled or automatic deletion of obsolete addresses, i.e. of vehicles that are not present on the layout anymore,
- **Add** vehicles that are new (and not yet registered) on the layout,
- **Solve** conflicts of addresses by an integrated procedure to readdress: in case of a new vehicle with the same address as one already stored in the database, as well as in case of more than one vehicle with the same address (e.g. some locos with address “3” are new to the layout at the same time),
- **Compare** differences in vehicle names between entries in the database and the decoder,
- **Take over** the GUI stored in the decoder to the database by an integrated procedure to read out GUI data,
- **Store** the GUI defined or modified in the system into the decoder.

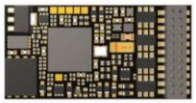
*) In every digital system there is a database (list, directory, or named otherwise) of the vehicles and addresses which can currently be controlled actively and which are integrated in the refresh-cycle of driving and function commands. This database usually also contains the GUI, i.e. name, function symbols, loco picture, etc. for every loco. The database of ZIMO decoders can hold up to 4000 addresses (which is more than in other systems).

In the best case this database contains all actually existing vehicles (i.e. those, which are present on the layout or at least are partly present). This way, no DCC range is wasted and search processes are simplified. Therefore, not only vehicles new to the layout shall be added, but also obsolete ones deleted – e.g. entries which were produced by wrongly entered addresses.


REAL PICTURE


REAL PICTURE


CAD


CAD

PICTURES ARE NOT YET AVAILABLE

	Standard HO				Miniature				Next	large-scale
	MS450, MS450R, MS450F	**MS450P22**	**MS440C** MTC in VHDM standard	**MS440D** MTC avriation by ZIMO	**MS480,** MS480R, MS480F	**MS480P16**	**MS490,** MS490R, MS490F	**MS490N, L**	**MS590N18**	**MS990L, K**
Dimensions (mm) wired types: PCB without shrinking tube	30 x 15 x 4	30 x 15 x 4	30 x 15 x 4	30 x 15 x 4	20 x 11 x 4	20 x 11 x 4	23 x 9 x 4	23 x 9 x 4	25 x 10.5 x 4	50 x 40 x 13
Interface *Wires and/or standard interface*	***13** wires* NEM-652, NEM-651	***PluX**-22*	***21MTC*** FO3, FO4, FO5, FO6 logic level (standard)	***21MTC*** FO3, FO4, FO5, FO6 „reinforced" outputs	***11** wires* NEM-652, NEM-651	***PluX**-16*	***11** wires* NEM-652, NEM-651	*NEM-**651** directly*	***Next**18*	*Pins or sockets*
Continuous current motor+sound+FOs (peak)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**0.8** A (1.5 A)	**0.8** A (1.5 A)	**0.7** A (1.5 A)	**0.7** A (1.5 A)	**0.8** A (1,.5 A)	**6** A (10 A)
thereof: **motor current cont.** (peak)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**1.2** A (2.5 A)	**0.8** A (1.5 A)	**0.8** A (1.5 A)	**0.7** A (1.5 A)	**0.7** A (1.5 A)	**0.8** A (1.5 A)	**6** A (10 A)
thereof: **function outputs** ONLY function outputs together	**0.8** A	**0.8** A	**0.8** A	**0.8** A	**0.6** A	**0.6** A	**0.5** A	**0.5** A	**0.6** A	**2** A
Function outputs incl. 2 x headlight (+ logic level outputs)	**10** 4 on wires, 6 on pads (+ 2 logic level)	**10** 9 on pins, 1 on pad (+ 2 logic level)	**8** 4 on pins, 4 on pads (+ 6 logic levell)	**8** all on pins (+ 2 logic level)	**6** 4 on wires, 2 on pads (+ 2 logic level)	**5** 4 on pins, 1 on pad (+ 2 logic levell)	**4** all on wires (+ 2 logic level)	**4** 2 on pins, 2 on pads (+ 2 logic level)	**4** all on pins (+ 2 logic level)	**8** or **14**
Servo - control wires (complete with 5V supply)	**2** alternative use of logic level (NO, ext. 5V needed)	**2** alternative use. of logic level (NO, ext. 5V needed)	**2** alternative use of logic level (NO, ext. 5V needed)	**2** alternative use of logic level (NO, ext. 5V needed))	**2** alternative use of logic level (NO, ext. 5V needed))	**2** alternative use of logic level (NO, ext. 5V needed))	**2** alternative use of logic level (NO, ext. 5V needed))	**2** alternative use of logic level (NO, ext. 5V needed))	**2** alternative use of logic level (NO, ext. 5V needed))	**4** complete 3-pole servo connection YES
SUSI - connection elegible SUSI, I2C, sound loading protocol	yes alternative use of logic level on solder pads	yes alternative use of logic level on PluX	yes alternative use of logic level on MTC	yes alternative use of logic level on MTC	yes alternative use of logic level on solder pads	yes alternative use of logic level on PluX	yes alternative use of logic level on solder pads	yes alternative use of logic level on PluX	yes alternative use of logic level on PluX	yes 4-pole SUSI connection
Inputs for cam sensors, Reed- contacts, etc.	**1** on solder pads + 2 alternative use of logic level	**1** on PluX + 2 alternative use of logic level	**2** on MTC + 2 alternative use of logic level	**2** on MTC + 2 alternative use of logic level	2 alternative use of logic level	2 alternative use of logic level	2 alternative use of logic level	2 alternative use of logic level	2 alternative use of logic level	**3** on pins or socktet
Energy storage - conn. 15V - Elkos/Supercaps DIRECTLY on decoder .	yes with wires	yes on PluX	yes on solder pads	yes on solder pads	-	-	-	-	-	internal capacitors with three Supercaps and yes external energy storage on pins or sockets
Speaker outputs depending: 8Ω or 4Ω (2 x 8Ω parallely)	**1** 3 Watt / 4Ω with wires	**1** 3 Watt / 4Ω on PluX	**1** 3 Watt / 4Ω on MTC	**1** 3 Watt / 4Ω on MTC	**1** 1 Watt / 8Ω with wires	**1** 1 Watt / 8Ω on PluX	**1** 1 Watt / 8Ω with wires	**1** 1 Watt / 8Ω on PluX	**1** 1 Watt / 8Ω on PluX	**2** 10 Watt / 4Ω on sockets / pins

MS decoders

The denomination of the MS decoders is similar to corresponding MX decoders, e.g. ***MS450*** corresponds to the dimensions and most of the technical data to the ***MX645***, equally, the ***MS480*** corresponds of the ***MX648***, etc.

Everything that has proven useful with the "MX-decoders" will be integrated in the new generation, i.e. number and type of function and other inputs/outputs, as well as those parts of the hard- and software which are responsible for the **excellent driving performance typical for ZIMO**. Various improvements like the energy storage connection on the MTC-decoders (now, 15V capacitors are enough) were made.