Newsletter - SEPTEMBER 2011

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English version

MX10 - the new Base Station
the 400 W Digital Central

FRONT

- Knob on the left: on & off switch, adjust rail voltage rail, emergency stop, navigate on the screen, select addresses, driving, ...
- Display: track voltage & current, DCC, RailCom, Bus, USB & LAN monitor, ABA* , driving & switching commands from the device, ...
- Buttons for sound decoder update, sound project loading, as well as driving and switching from the device,
- USB host socket for USB stick to update decoders, load sound projects, and to update the software on the device,
- CAN Bus socket for ZIMO controllers (CABs), and other devices (in parallel with CAN socket on the back).

REAR

- Large screw terminals for power supply (no transformer), from 90 to 500 watts (24 to 30 V),
- Medium size screw terminals for "Track 1" (main output up to 12 A),
- Small screw terminals for "Track 2" (programming and update track, or a second output up to 8 A),
- Three screw terminal for Rail DC (both circuits) and Ground,
- In additon: 16 input/output pins for external emergency stop buttons, ... ABA* and other rail connection inputs,
- Socket for external devices via respective adapter cable: Roco Lokmaus, Fred (LocoNet), S88-bus, external booster
- CAN socket for ZIMO devices with sync cables for booster, track section modules, etc.
- Sockets for Ethernet (LAN, e.g. wireless router), USB client (for computer connection), and Zigbee antenna.

*ABA = AOS =
=Automatic Operating Sequences
=a record of a set of commands which enable automatic running of a train or a number of trains (including the setting of signals and points/switches).

The ZIMO Product Range is now complete

In the course of 2010, ZIMO‘is well known production and delivery of the "old system" was shut down. It became clear that the ZIMO products - MX1 (base unit) and MX31 (cabs) – were simply no longer the current state of the art. The MX1 - model 2000 – even has the "birth date" carried in the name. Some competitors still deliver today technology from the 80s and 90s, or develop new products in the style of this period, but that's another story ...

The new MX10 Zimo command station is constructed and equipped according to modern times and has a suitable "styled" handy (well actually easy to handle) housing. The mechanical dimensions are remarkably small – considering the technical capability and compared with some clunky boxes, or with the predecessor models of ZIMO

The high performance, ie the "watt and ampere numbers" predestines the instrument, of course, for large and garden layouts, but for many other applications it might be regarded as excessive, however keep in mind that a high maximum current, at not much extra cost, was always provided in the ZIMO tradition in the old technology. The use of the MX10 to deliver lower power (eg, 5 A for the main layout and 1A on the programming track instead of 12 + 8 A), in place of the higher specs would achieve cost savings of less than 10%.

In one way, the wattage is delivered in a very cost effective manner: namely, the power supply, this is not built into the base unit MX10, so the power can be delviered according to your needs by a suitbale size power supply.

A digital system is of course defined by many properties, more than by the electric power, and in many respects ZIMO has set new standards, which were not easy to implement, therefore, rarely found in model railway equipment, nevertheloess they are very useful. An example is the socket for USB flash drives, or the LAN connection, which when built in the era of "i "...' s and" smart "... 's is actually a" must ", or the small graphics display, which shows just the information that should be seen on the base unit, even if it would be cheaper to display on the connected devices.

The separate display along with the rotary knob and some buttons enables MX10 to operate independetly as a basic DCC controller, so no external control devices such as controllers (CABs), smart phones or computers are needed. It provides functions like address settiing, simple driving operations, switching of points, single line CV programming, and most of all software updates for ZIMO decoders and sound poject loading. This saves the purchase of a separate decoder update device.

Technical Data of the MX10

Primary supply, depending on power supply unit	24 bis 30 V, zwischen 80 und 500 Watt
(maximum input voltage, for special applications needing high rail voltage	35 V)
Rail voltage output for the main line, adjustable	10 - 24 V
(Special operations with increased rail voltage	bis 27 V)
Rail current output on the main line	12 A
Rail voltage at the second output for programming and update track, or branch line	10 - 24 V
Rail current on the second ouput	8 A
Supply to the CAN Bus for Controllers (CABs) and other devices	32 V, 3 A
Memory in device	Program memory 512KB (fast) and 5 MB (slow in RAM), static RAM 512 KB, dynamic RAM 64 MB, NAND-Flash 4 GB
Built-in rechargeable battery for maintaining the operating data (static RAM) and the real time clock	100 mAh
Radio properties	Zig-Bee 2,4 GHz, 10 mW, 256 kBd, for 64 Wireless Devices
Dimensions (without Antenna)	170 x 200 x 40 mm
Weight	about 1 kg

The following description is partly taken (updated) from July 2011 Newsletter

Brief technical description of the MX10

Driving voltage and current:

The necessary primary supply comes from an external power supply; thus the transformation of the grid voltage, and the rectification of the mains voltage are "outsourced", which achieves a significant reduction of power consumption and heat in comparison to the "old" appliances. Therefore, the high output power (400 W) is possible despite the compact design.

The driving voltage is available in a wide range (10 - 24 V), is adjustedable, fully-stabilized (as usual, and has always been from a ZIMO base station), and is divided into the main output ("Track 1") and a second output ("Track 2"). Naturally current overload and short circuit protection is builtin, the maximum continuous power at the main output is 12 A, the second output, an additional 8 A. The current limit and the shutdown time (on the bridge of small short-circuiting switch heart, etc.) are adjustable, and the design of high-frequency switching regulator ensures that no major energy peaks occur in the short-circuit case. Moreover, a "differential overcurrent detection" circuit, which could lead to a sudden increase in power on shut down, mainly in small scales (N, TT, ...) which protects the wheels and pick-ups in the short-circuit situation.

Booster Solution:

Due to the high driving current of the MX10 (12 A + 8 A) only relatively large systems in general need will need an additional booster, and mainly because of a large track area. In these cases, the preferred means is to use

an additional MX10, which is synchronized with the "central“ MX10. The use of foreign boosters is possible, but less advantageous, since the only communication with such devices is on the outdated NMRA "control bus".

CAN Bus and other Bus Systems:

The MX10 includes (as is usual for ZIMO) two parallel CAN bus connectors (RJ-45, 6-pin) for connection to ZIMO system products such as controllers (MX32 and predecessors), switch/turnout and track section modules (MX8, MX9 and successors). A socket for connecting non-ZIMO products (X-bus, S88, possibly Loconet for Fred's) exists, the extent of Implementation of these third-party protocols is still open.

Wireless Communication*:*

The MX10 in the wireless version is equipped with a ZigBee module, "ZigBee" is a modern, globally standardized and approved wireless standard in the 2.4 Ghz - band. Compared to Bluetooth (also 2.4 GHz), it offers a much greater range up to several 100 m and higher throughput, in contrast to an integrated wireless network capability, and in comparison to the 344 MHz - Technology (previously used by ZIMO), and the same worldwide interoperability as Bluetooth. Potential disadvantages compared to 344 MHz are with respect to the penetration of radio signals through buildings (no practical tests have been done), so each device (the CAB) is also a repeater, and messages can be relayed.

The ZigBee technology provides the ideal basis for the extension of railway radio communication system in the direction of direct radio link to locos, which is particularly interesting for large area and garden railways.

Interface to Computer:

The USB (client) interface is provided for external software decoder programming (PfuSch, TrainProgrammer, etc.) or for complete layout control (STP, ESWGJ, TrainController, etc.) via a computer connection.

ZIMO offers free programs ZIRC ("ZIMO Rail Center") and ZSP ("ZIMO Sound Program"), whose main tasks are the implementation of software updates for ZIMO products (from the center to the decoder), loading and editing sound projects for ZIMO sound decoders, and the management and programming of the parameters (CV's) of ZIMO system products and decoders.

In preparation for future applications, especially for connecting a wireless router for mobile phones and tablet PCs - with the appropriate app on the MX10, an Ethernet socket is also available.

USB (host) - Interface:

This is provided for connecting a USB stick that is used both for software update of the MX10, as well as for software updates of decoders and for loading sound projects into a sound decoder.

The many years of experience (eg with MX31ZL) shows that this method of software updates is unproblematic, because some uncertainties with the operating system, drivers, interfaces from a connected computer disappear. For MAC and LINUX users this is especially important. Therefore, despite the relatively high cost, ZIMO does not want to do without the MX10 USB (host) – port , as mentioned in MX32 and MXULF.

Track protocol:

DCC and Motorola are certainly the obvious basic protocols. The hardware and software are open for expansion to other standards, if such a need arises, especially for faster methods of data transmission.

Of course, standard protocols are implemented to the maximum possible, so for DCC, there are 10,239 locomotive addresses, 2048 accessory addresses (each with 4 sub-addresses), 14/28/128 speed steps, 28 functions, etc.

RailCom and alternative Feedback Systms:

The "bi-directional communication" known as "RailCom" is a natural part of all relevant components within the new ZIMO system, and no additional devices are necessary.

The MX10 is equipped with a "Global RailCom Precision Detector". "Global" means all those RailCom functions that are independent of the current position of the vehicle, whereas "Local" detectors are concerned with the address detection in single track sections. "Precision" means that the evaluation of the RailCom messages is not only using the simple threshold method, but that the RailCom signal is analyzed in detail in order to decipher garbled messages and thus to become immune to the electrical interference which can occurs in the practical operation of a large system.

RailCom messages may be utilized in the control panel itself to improve efficiency of data transmission: RailCom messages can acknowledge any DCC packets which can be considered answered and need not be repeated, but above RailCom reports information whose contents can be re-transmitted controllers and computers. The simplest applications are: reading and display of CV values in the "operational mode" (also called "PoM") from the vehicle on the main track, continuous display of the actual driving speed detected by the decoder, power consumption, alert messages, or the switch (point) position, etc.

ZIMO MX10 is also prepared as the basic unit for its own feedback system "ZACK", which is an evolution of "Zimo Train ID".

Auxiliary Inputs:

The MX10 has (similar to the existing MX1) 12 "logic level" - inputs (usable, if required, as outputs), which serve to connect simple DIY-button signal boxes, for connection of emergency stop switches, or for ABA events ("ABA" = AOS= Automated Operating Sequences).

Display and Control:

The 128 x 32 pixel - graphic display on the front panel, is monochromatic, but is equipped with multi-colored backlighting. The large rotary and push button switches fulfill (depending on the situation) different functions: setting the rail voltage and the current limits, navigation in the display, number selection, speed control, ... The three keys are employed primarily in connection with the software update of decoders and the loading of sound project, and of course in MX10-controlled loco and switch/point operation.

Data Management for Vehicles and Accessories:

This is the second main task of a digital system (in addition to supplying the layout with a track supply and the DCC or other control signals) for vehicles and accessories, need an efficient way for specific information from the input devices (control panels, computers, ..) to be transferred to decoders, and kept consistent, both in the case when supported by a feedback system such as ZACK or RailCom, or in the case when none are active. It must always be tolerant to faults on the data channels, given that in model railways there are many interruptions in the contact between rail and vehicle.

MX10 is therefore equipped with a powerful micro controller, and generously sized memory (RAM and Flash) and with a storage battery, which allow the simultaneous support of 512 active vehicles and, of course, all addressable accessory products ABA's ("Automated operations"), etc.

The MX10 as Decoder Update Device:

Thesupport of the loading of new software versions and sound projects in the decoder is a fundamental task of a modern digital system. At least this should be possible for the decoder of the system manufacturer, in this case, the ZIMO decoders. So the owner of such an MX10 does not need a separate update device or sound programmer.

MX10 can be used in two ways for the decoder update:

1) Connect the MX10 via USB cable to the computer, and run the software decoder update process using ZIRC, so use the MX10 as an interface between the computer and decoder, or

2) Save the decoder update file or sound projects on a USB stick, plug the USB stick into the MX10, and run the decoder update process and sound project loading using the keys and display of the MX10.

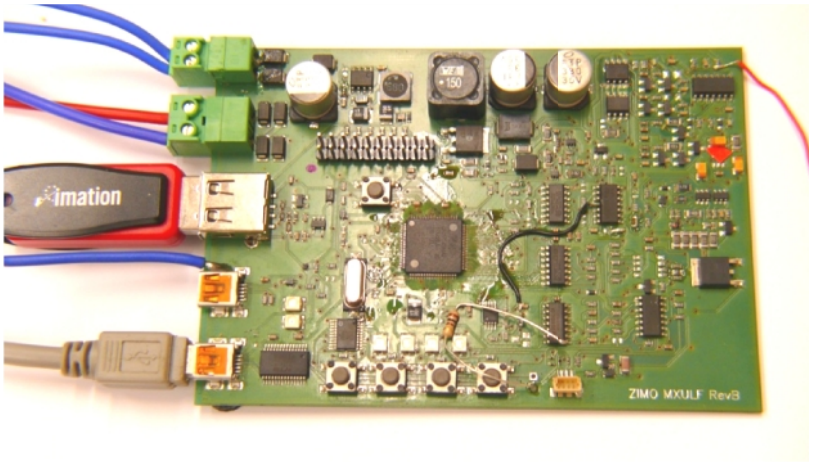
The MX10 as Stand Alone – Digital Controller:

Users who do not attach importance to using "physical" hand control, can use the computer with appropriate software (eg ESTWGJ, STP, TrainController) and then show on the screen to use automatic controls to control the layout, in which case the MX10 can be used without a connected controller (CAB). Even in such cases, the high output power together with a polished current and voltage protection, RailCom detector, gices many benefits - and gives the option later to have true walk-around control.

***)** RailCom is a Tarde Mark of Lenz GmbH

The following description is partly taken (updated) from July 2011 Newsletter

MXULF - the new Decoder Update Device

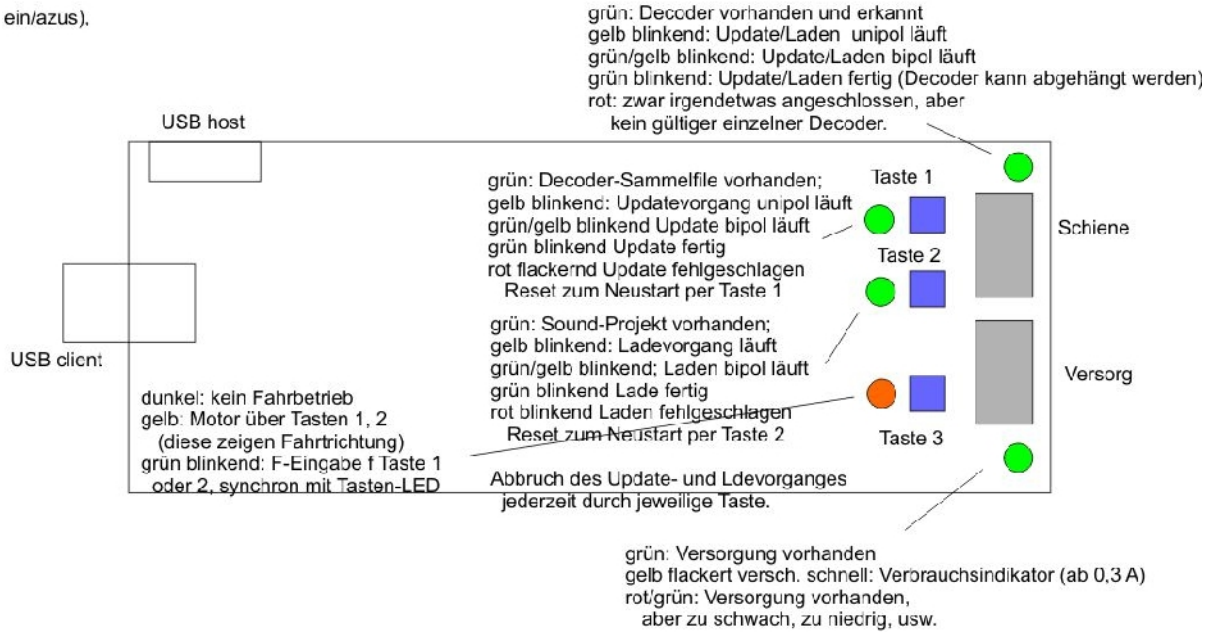


The left picture shows the MXULF NOT, as it will soon be available ... but here we have a prototype board that is used for software development and testing.

Meanwhile, the software update and the sound project loading functions, and about 20 test boards (as pictured) are now distributed to test-users.

The final board will then be much smaller (which is achieved by dense packing along the lines of the decoder), and have to operate with an optimal arrangement of buttons and LEDs.

The diagram below and the following information are about the functioning of the MXULF ("ULF" = Update decoder, Load sound project, Drive =*Fahr in German*).



Decoder Software Update and Sound Project Loading with MXULF from USB Stick:

First, a power supply must be connected (very flexible, from 10 V, for example, power supply or rail voltage), whether this is sufficient, is displayed on an LED. Then connect the decoder, or the locomotive with the decoder or the rail ("update track") with the locomotive on it. Another LED indicates that the (ZIMO) decoder has been detected.

Then the USB drive is inspected, the corresponding LED indicates whether a decoder update file collection and / or a sound project was found. With that, then a key (1 or 2) will start the update process or the sound project loading.

The LEDs then show success or failure.

Test driving with MXULF:

(probably not available on first delivery of MXULF, but avaiable later after upgrade of the MXULF software via USB stick)

The key 3 is used to switch on the driving function, and the adjacent LED indicates this is switched on. With the keys 1 and 2, you can gradually move the speed up and down (or leave running at constant speed). By pushing key 3 many times, functions can also be turned on and off.

The same 3 keys can also be found on the MX10 and the functionality is very similar to the MXULF for decoder updates and sound projects loading. The MX10 has a display so that a choice can be made between several update files or between different sound-projects.

Brief description and MX32FU MX32 cab (from July newsletter, print Sinsheim)

As this section contains many screen shots of the MX32, it has not been translated into English.

Please see one of these sources for more information in the MX32 :-

- **September News Letter in German**
- **July Newsletter in English**
- **MX32 User Maual in English**

Please keep checking the website for updates to the MX32 software.

New from Heinz Däppen . . .

Consolidation of all U.S. projects, so that as in the RhB and HSB projects, all functions are always on the same function key.

New sound projects are to be released for the following U.S. Models (Gauge 1):

1. BigBoy,
2. Virginian 2-6-6-6 Allegheny Class
3. Rio Grande L-131
4. Dash 8

New sound projects for narrow gauge will be released:

1. for many US sound projects, there will be an oil burning version
2. the Shay with more versions,
3. the Davenport 2245, with an extremely low speed 22 liter Caterpillar diesel V8 from 1936,
4. the Rio Grande C-19
5. the Mason Boogie, (D S P & P R R and SPC)
6. one small loco version, for example the LGB 2017,
7. a sound project for the smallest Bachmann G Scale locomotive, the Porter.

12 x 6.5 x 2.2 mm *No Sound 0.7 A - 4 Function Outputs* ***CAUTION**: only DCC and DC Analogue (**not** MOTOROLA)*

MX621 *Family*	**Sub-miniature Decoder**, reduced features, compared with other decoders, for N, H0e, H0m, TT, H0, 00 with very limited space.
MX621	7 connection wires (very flexible wire) for rails, motor, 2 function outputs (120 mm long wire). For the 2 further function outputs there are 2 solder pads on the circuit board.
MX621R	Like MX621, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX621F	Like MX621, but with 6 pin plug as defined in NEM651) on 70 mm long wires.
MX621N	Like MX621, but with 6 pin interface as defined in NEM651 (= "small interface" in NMRA RP 9.1.1.), pins directly soldered to circuit board, for vehicles with correct 6 pin socket, no wires.

20 x 11 x 3.5 mm *No Sound 1.0 A - 6 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

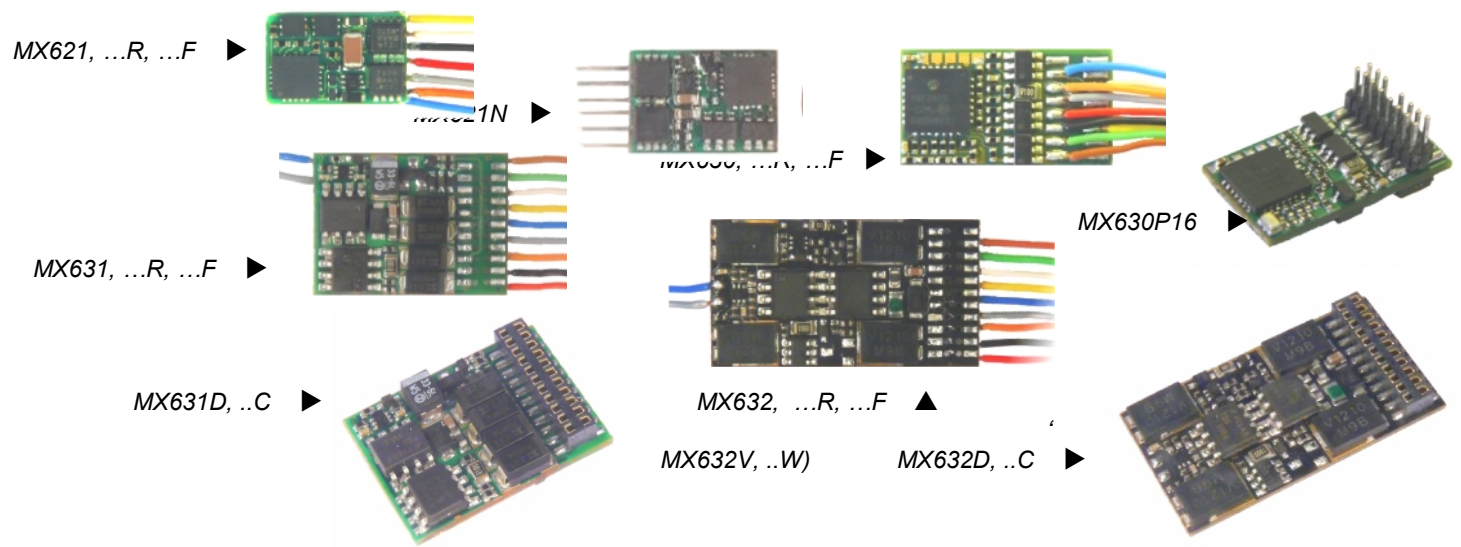
MX630 *Family*	**H0/00 Decoder**, compact design, for universal use, most popular ZIMO decoder (with no sound)
MX630	9 connection wires (very flexible wire) for rails, motor, 4 function outputs (120 mm long wire), solder pads for 2 more function outputs, 2 logic level outputs or servo control, and SUSI
MX630R	Like MX630, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX630F	Like MX630, but with 6 pin plug as defined in NEM651 on 70 mm long wires.
MX630P16	Like MX630, but with **16 pin PluX - Interface** (pins soldered directly on circuit board).

20.5 x 15.5 x 4 mm *No Sound 1.2 A - 6 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

MX631 *Family*	**H0/00 Decoder**, similar to MX630, higher power, with **Energy Storage (Stay-Alive),** for H0/00 and small 0 scale.
MX631	11 connection wires (120 mm long) for rails, motor, 4 function outputs, solder pads for 2 more function outputs, logic level outputs, servo control, and SUSI
MX631R	Like MX631, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX631F	Like MX631, but with 6 pin plug as defined in NEM651 on 70 mm long wires.
MX631D	Like MX631, but with **21-pin "MTC" - interface** (socket soldered direct on circuit board).
MX631C	Like MX631D, but for vehicles which need FA3 and FA4 as logic outputs (e.g. **Märklin**, **Trix, tw. HAG, LS, ..)**

28 x 15.5 x 4 mm *No Sound 1.6 A - 8 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

MX632 *Family*	**High Power Decoder,** with **Energy Storage Circuit (Stay Alive),** for H0, 00 and 0 scale.
MX632	11 connection wires(120 mm) for rails, motor, 4 function outputs, solder pads for 4 more function outputs, logic level outputs, servo control, and SUSI.
MX632R	Like MX632, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX632D	Like MX632, but with **21-pin "MTC" - Interface** direct on circuit board.
MX632C	Like MX632D, but for vehicles which need FA3 and FA4 as logic outputs (e.g. **Märklin**, **Trix, tw. HAG, LS)**
MX632V, VD ***MX632W, WD***	Versions with low voltage supply for function outputs MX632V – 1.5 V or MX632W - 5 V MX632VD or MX632WD - with 21 pin interface.



30 x 15 x 4 mm ***SOUND*** *1.2 A - 8 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

MX644 *Family*	**H0/00 Sound Decoder, 3 Watt Audio on 4 Ohm (or 2 x 8 Ohm), 6 Sound Channels,** for H0, 00, 0, with **Energy Storage (Stay Alive).**
MX644D	with **21-pin "MTC" - Interface** (socket soldered onto circuit board)
MX644C	Like MX644D, for vehicles, which need FA3 and FA4 as logic level outputs (e.g. **Märklin**, **Trix, tw. HAG, LS, ..)**

30 x 15 x 4 mm ***SOUND*** *1.2 A - 10 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

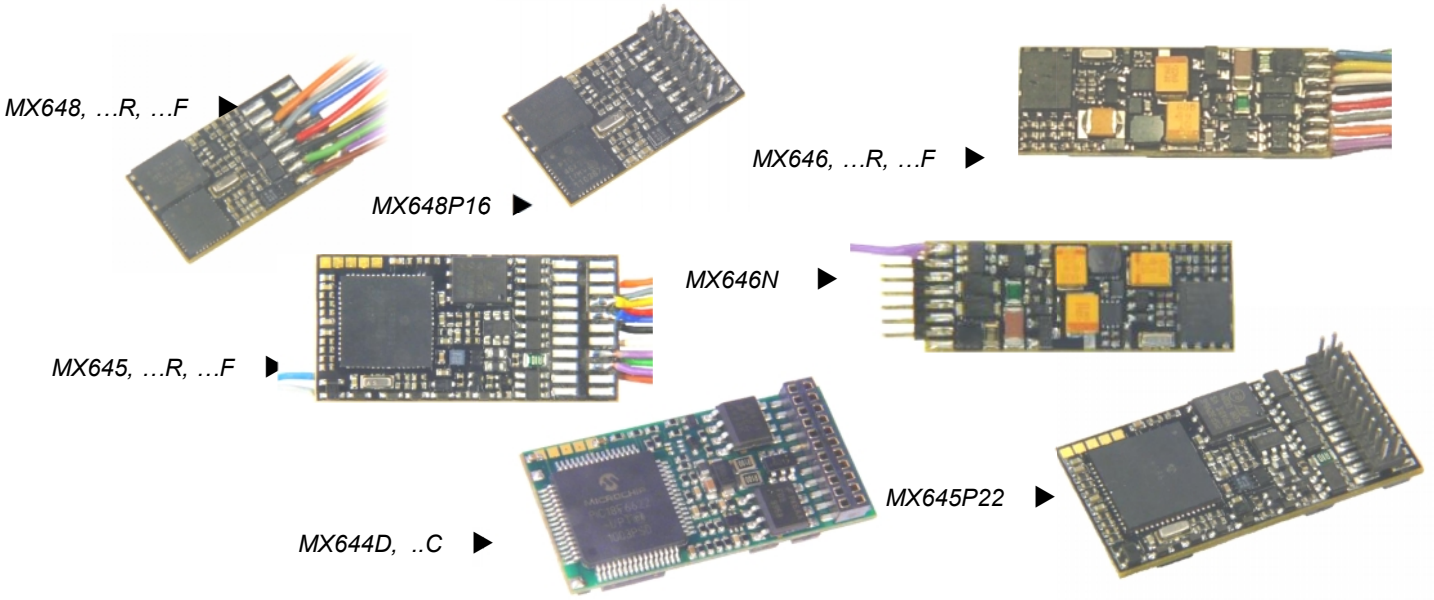
MX645 *Family*	**H0/00 Sound Decoder, 3 Watt Audio on 4 Ohm (or 2 x 8 Ohm), 6 Sound Channels,** for H0, 00, 0, with **Energy Storage (Stay Alive).**
MX645	13 connection wires (120 mm long) for rails, motor, 6 function outputs, loudspeaker, Energy Storage, solder pads for more function outputs, logic level outputs, servos and SUSI.
MX645R	Like MX645, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX645F	Like MX645, but with 6 pin plug as defined in NEM651 on 70 mm long wires.
MX645P16	Like MX645, but with **16 pin PluX - Interface** (plug soldered on circuit board).
MX645P22	Like MX645, but with **22 pin PluX - Interface** (plug soldered on circuit board).

28 x 10.5 x 4 mm ***SOUND*** *1.0 A - 4 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

MX646 *Family*	**Miniature Sound Decoder, 1 Watt Audio on 8 Ohm**, for N, TT, H0e, H0m; H0 or 00 with limited space.
MX646	9 connection wires for rails, motor, 2 function outputs, loudspeaker, solder pads for 2 further function outputs, logic level outputs, servos and SUSI.
MX646R	Like MX646, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX646F	Like MX646, but with 6 pin plug as defined in NEM651 on 70 mm long wires.
MX646N	Like MX622, but with 6 pin interface as defined in NEM651 (= "small interface" as in NMRA RP 9.1.1.), pins directly soldered to circuit board, for vehicles with correct 6 pin socket, no wires, 2 connection wires for loudspeaker.
MX646L	Like MX646, but with 6 pin interface as defined in NEM651 (= "small interface" as in NMRA RP 9.1.1.), **90 ° right angle** version, 6 pins directly soldered to circuit board, 2 connection wires for loudspeaker.

20 x 11 x 4 mm ***SOUND*** *0.8 A - 6 Function Outputs - 2 Servos - SUSI DCC, MM, DC Analogue, AC Analogue*

MX648 *Family*	**Sub-miniature Sound Decoder, 1 Watt Audio on 8 Ohm**, for N, TT, H0e, H0m; H0 or 00 with limited space.
MX648	9 connection wires for rails, motor, 2 function outputs, loudspeaker, solder pads for 2 further function outputs, logic level outputs, servos and SUSI.
MX648R	Like MX646, but with 8 pin plug as defined in NEM652 on 70 mm long wires.
MX648F	Like MX646, but with 6 pin plug as defined in NEM651 on 70 mm long wires.
MX648P16	Like MX646, but with **16-pin PluX - Interface** (plug soldered on circuit board).



The Large Scale Decoder MX695 is available in 5 standard models, including 4 with sound. There are also special versions for specific applications with slightly modified features (for example, for a particular project a different number of outputs).

51 x 40 x 13 mm (alle Typen MX695)

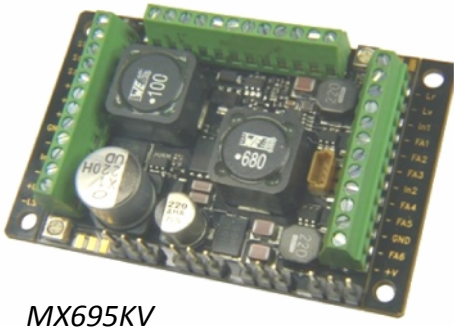
MX695K ...	**Sound Decoder with screw terminal connections**

MX695KV	Full Version:	36 screw terminal connections 14 function ouputs (including headlights) 1 special connection for smoke fan 3 low voltage outputs: 5 V, 10 V, variable 4 servo ouptuts (each 3-pin: Control, Minus, + 5 V) 2 regulators (sound volume, low voltage output) 1 connection for external energy storage
MX695KS	Reduced Version:	28 screw terminal connections (2 x 12 und 1 x 4) 8 function ouputs (including headlights) 1 low voltage output: 10 V 1 connection for external energy storage

MX695L ...	**Sound Decoder with pin connections**

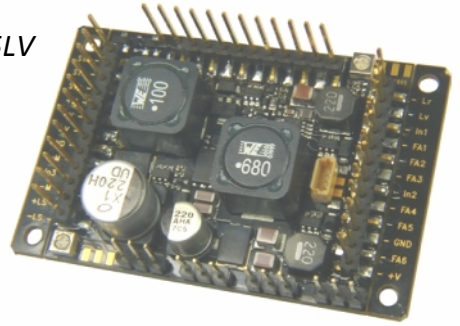
MX695LV	Full version:	3 sets of pin connections, each 12 pins 14 function ouputs (including headlights) 1 special connection for smoke fan 3 low voltage function outputs: 5 V, 10 V, variable 4 servo ouptuts (each 3-pin: Control, Minus, + 5 V) 2 regulators (sound volume, low voltage output) 1 connection for external energy storage
MX695LS	Reduced Version:	2 sets of pin connections, each 12 pins (fits ESU circuit board) 4 solder pads for further connections 8 function ouputs (including headlights) 1 low voltage function output: 10 V 1 connection for external energy storage

MX695KN	**Nicht-Sound-Decoder mit Schraubklemmen**
	20 screw terminal connections (1 x 8 und 1 x 12) 8 function ouputs (including headlights) 3 low voltage function outputs: 5 V, 10 V, variable 4 servo ouptuts (each 3-pin: Control, + 5 V)

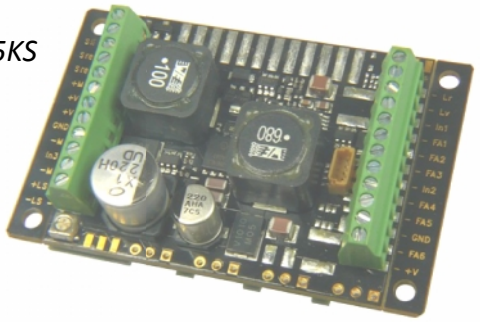


MX695KV

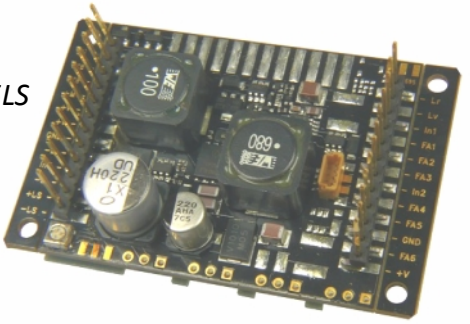
MX695LV



MX695KS



MX695LS



Function decoders are vehicle decoder for non-powered vehicles, so there is no current for the motor, but there are some special features for use in carriages or wagons, which are usually located in the train with a powered vehicle (locomotive). The MX685 function decoder is derived from the locomotive decoder MX630 (the hardware board is almost identical), the MX686 from the MX631 locomotive decoder, and the MX681 miniature function decoder from the MX621 miniature decoder. These 3 function decoders each have the dimensions and most properties from the parent decoder.

A feature of all ZIMO function decoders is the programmable second address (CV # 64 to 68), with which a carriage or wagon with a function decoder can be assigned an alternate address, which is usually set to the address of the decoder in the loco. If the other items of rolling stock in the train are equipped with functions decoders, then all can be reached through a single address (for example, turn on all the lights with a single click of a key), this is the simplest form of a (virtual) "Zug Bus" ("TrainBus") that will certainly play a significant role in the future bring the whole train under digital control.

12 x 6.5 x 2 mm *0,7 A - 6 Function Outputs only DCC and DC Analogue (**not** MOTOROLA)*

MX681 *Family*	***Miniature Function Decoder***, with reduced ZIMO Features (missing from the software: MM (Motorola), servos, SUSI, ZIMO special function mapping.)
MX681	7 connections for rail, 4 function outputs (120 mm long wires); there are solder pads for more function outputs.
MX681N	As MX621, but with 6-pin digital interface as in NEM651 (= "small interface" according to NMRA RP 9.1.1.) direct connection, i.e. 6 pins soldered.
(MX681R) ***(MX681F)***	(type with 8 pin connector as in NEM652 or 6 pin connector can be made, if requested)

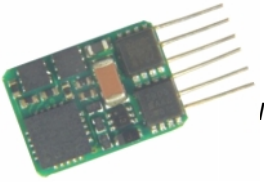
20 x 11 x 3.5 mm *1.0 A - 8 Function Outputs - 2 Servos - SUSI*

MX685 *Family*	***Function Decoder***, compact size, for normal use.
MX685	7 connections for rail, 4 function outputs (120 mm long wires); there are solder pads for more function outputs and 2 Servos or SUSI connections.
MX685P16	As MX686, with **21-pin "MTC"-Interface** socket on board.
(MX685R) ***(MX685F)***	(type with 8 pin connector as in NEM652 or 6 pin connector can be made, if requested)

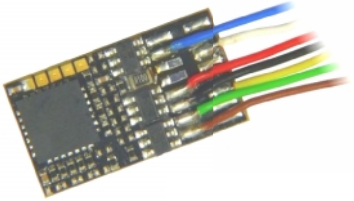
20.5 x 15.5 x 4 mm *1.2 A - 8 Function Outputs - 2 Servos - SUSI*

MX686 *Family*	***Function Decoder***, high power, with ***Energy storage connection.***
MX686	7 connections for rail, 4 function outputs (120 mm long wires) ; there are solder pads for more function outputs and 2 Servos or SUSI connections.
MX686D	As MX686, with **21-pin "MTC"-Interface** socket on board.
(MX686R) ***(MX686F)***	(type with 8 pin connector as in NEM652 or 6 pin connector can be made, if requested)

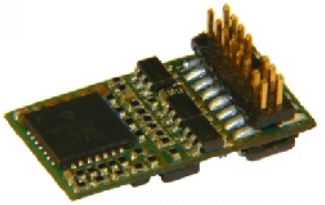
MX681



MX681N

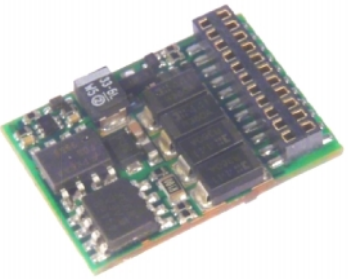


MX685



MX685P16

MX686



MX686D