ATTENTION - PRELIMINARY SOFTWARE

MX21 and MX21FU cabs delivered until **May until November 2004** contain **Software** that **is incomplete**. The description in some areas may be different from the actual operation and is often not mentioned in the text. See below for updates !

EDITION:

2004 0715

Instruction Manual for

The same is true for this **manual**. It is a **preliminary issue.** Planned supplementation is noted in the text.

Cab displays in this manual are shown in German language. **An English software upgrade for the MX21 cab will be available soon. Until then please refer to the English caption next to some of the illustrations.**

The most important features still missing or incomplete in the software shipped with the preliminary series (SW-Version V014):

MX21 CAB (HANDHELD)

also covers: MX21FU radio cab and MXFU radio base module

- Motorola data format
- Tabular display of stored single and consist addresses
- Using loco names, and more
- Global and/or local fast clock
- Basic cab set-up
- Turnout ladders, block control
- Bi-directional communication
- Automated operations
- Local CV-Sets
- Error messages

C O N T E N T   Page

IMPORTANT NOTE regarding SOFTWARE and SOFTWARE-UPDATES:

This product contains a FLASH- EPROM which stores software that determines its characteristics and functions.

The present software version may not contain all functions mentioned in this manual.Such functions can be "installed" later, as well as possible errors corrected, with a future software update. For the latest available software, go to the "UPDATES" page on the ZIMO web site: www.zimo.at.

The latest software is available, free of charge, from above web site and can be installed in this product using the MX1 command station "model 2000" (or newer) or MX1EC as an interface with special programming software, also available from ZIMO's web site.

Alternatively , the micro-controller can be removed, sent to ZIMO for updates and reinstalled again. The costs are minimal and are reflected by handling (the actual burning of the EEPROM) and freight charges. Also see: www.zimo.at under "UPDATES".

The manufacturer of this product, ZIMO Elektronik, can't guarantee that planned functions (including the ones described in this manual) will be implemented as intended or in a specific time frame.

1.   Introduction

This instruction manual covers the MX21 cab, the MX21FU radio cab and the MXFU radio base module.

It refers to the use of this cab together with a MX1 "model 2000", MX1HS or the MX1EC command station. Its predecessor, command station MX1/N, can also be used although with limitations, as well as the MX1/MULT with the ZIMO jumper removed, which renders it in the *DCC and/or MOTOROLA format* but not the "old" ZIMO format.

About the product . . .

The MX21 is a further development of the proven MX2 cab. The conspicuous *graphic display* offers numerous new possibilities and is easier to use. A new color scheme, expanded lettering and most of all a micro processor of the latest generation (2004) with *double the program power, multiple data memory, high calculating speed* and *online update capabilities* makes the MX21 the top performer among model railroad cabs.

Staying with good old ZIMO tradition, these performance reserves are not being used for trivial things (like a loco pictured in the display or menus for the simplest of functions) but rather for *real new developments and improved operations:* local and global fast clock, lists for direct access to loco's or consists (by address or name), processing complete CV sets, occupancy state information of track section modules, are just a few samples.

Much of the information shown in the MX21 display is in plain text (something that wasn't possible with the MX2) and will make the process of accessing seldom used operations a lot easier - as long as it won't make cab operation cumbersome.

The ZIMO cab and ZIMO system offers a lot more than what is expected from an ordinary DCC system (like operating loco's, turnouts, programming...) but this "higher level" can hardly be grasped intuitively.

It is therefore highly recommended that you do read this instruction manual!

About the structure of this manual . . .

After the introductory chapters 1 to 3 that deal with technical data and installation, *chapters 4 to 7* explain how to *access and control locos and their functions.* However, how to program decoders is not covered in this chapter but rather in chapter 10.

NOTE: The easiest way to get started and learn this system is by operating a loco equipped with a decoder whose address is already known. Zimo decoders as delivered are set to address #3, according to NMRA standards.
Decoder or locos equipped with decoders from other manufacturers may be programmed with a different address. Check the information supplied by the manufacturer.

Chapter 8 shows *how to operate accessories* connected to an accessory decoder or module (routes are explained later).

Chapter 9 explains how *system status* is managed and controlled, as far as is possible with the cab (e.g. emergency stop, re-power layout after short circuit shut down, etc.).

Chapter 10 contains all information needed *for programming* locos, accessories as well as modules (MX8, MX9), command station MX1 and boosters.

Chapter 11 deals with the *control and feedback of track sections* (MX9 track section modules).

Chapter 12 explains how to define and use *"Basic Automation" (BAB).* It is divided in to 4 areas: *turnout ladders, automated operating sequences (ABA), shuttle operation and block control*. Additional information on these subjects can also be found in other manuals (e.g. MX9 track section module).

*Chapter 13* shows how to *control turntables* with the cab.

Chapter 14 finally deals with the peculiarities of radio control, that is, the MX21FU radio cab and its close connection to the MXFU radio base module.

2.   Specifications

Power consumption (at 25 V - supplied by command station) ....100 mA
Dimensions ....6.53 x 2.91 x 1.49 in. (166 x 74 x 38 mm)
Weight MX21 .... 160 g
Weight MX21FU .... @ 265 g .

3.   Connecting cabs to command station

The cab is equipped with two *6-pin telephone sockets* at the back side that are internally wired in parallel for the so called *CAN bus*. All cabs in a system are connected in parallel, usually from the command station to the first cab and then on to others.
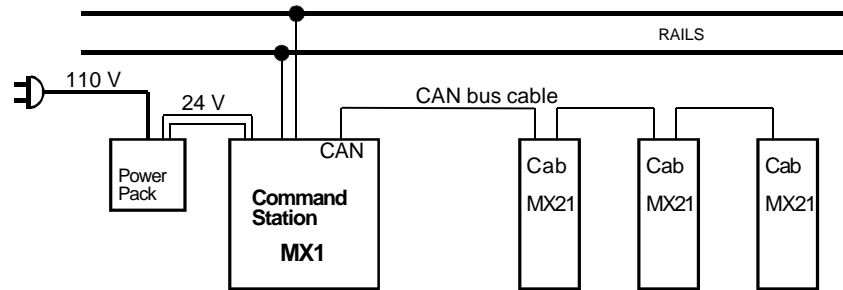

Finished CAN bus cables can be ordered from Zimo in standard length but can also be self-made. The required 6-stranded wire, connectors (50 per bag) and the special mounting plier is also available from Zimo. The connectors are mounted 1:1 to the cable, which positions them opposite to each other (see drawing below).
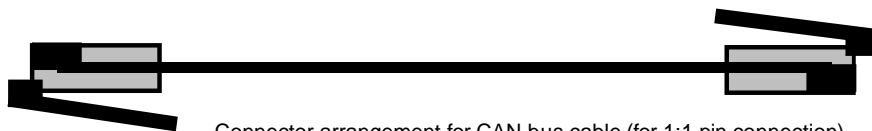

Connector arrangement for CAN bus cable (for 1:1 pin connection) between MX1 command station and MX21cab or from cab to cab respectively.

Instead of connecting the CAN bus from cab to cab a *6 stranded CAN bus cable* may be *installed to the layout* with sockets for cabs to be plugged in as required.

CAN bus cable along the layout with sockets.
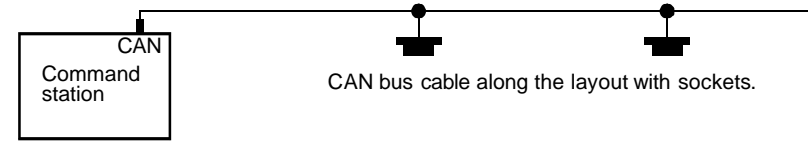
Connecting cabs to the command station is possible in most cases without restrictions (up to 10 cabs, 50 m total CAN bus length, no more than 2 cabs at the end of a 50 m long cable, no more than 5 at the end of a 20 m long cable). Some precaution is in order in cases where the number of cabs or the distances to the command station exceeds those values: install terminating resistors, typically 150 to 330 Ohm, between the two center pins of the sockets that are the farthest from the command station (consult ZIMO if necessary).

A radio base module MXFU has to be connected to the CAN bus if *radio cabs MX21FU* will be used in radio mode. See chapter 14!
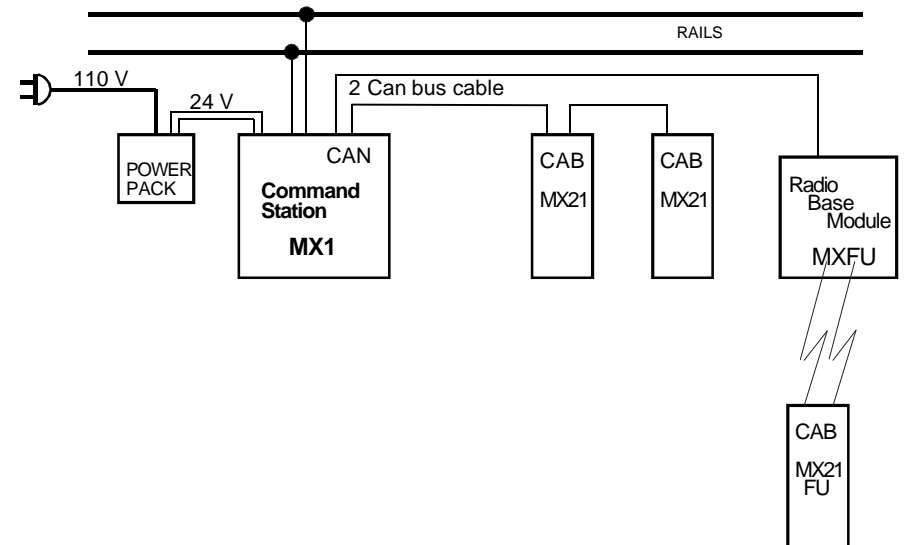
K U R Z A N L E I T U N G

W I R D   N A C H G E T R A G E N

Die Taste "MAN": Damit wird die "signalabhängige Zugbeeinflussung" unwirksam gemacht.

4.   Select and activate loco address

All basic steps required to operate a single train are explained in this chapter. It is presumed that locos with a programmed address are already on the track. Chapter 10 explains in detail how to program an address !

THE CAB IN STAND-BY MODE:

A Cab will be in stand-by mode when it is delivered or after all loco and accessory decoder addresses have been canceled (push "C" key repeatedly).

? Display background is yellow, *dotted line* in address field (= waiting for address input), communications dot flashing every other second (= cab communicates with command station) alternating with clock. All LED's above function keys are dark.

SELECT AND ACTIVATE A LOCO ADDRESS:

Have the MX21 cab: in stand-by mode (see above) or deactivated (the dotted line is visible in each case and also the previously active address if it was deactivated , background is yellow).

? After entering the desired address using the *keypad* (#1 - #0) it is displayed on the screen. Entry errors can simply be over-written. The dotted line and the yellow background remain while entering an address.

The address shown to the right, "3124", communicates with a decoder designed for the *NMRA-DCC format*. To access a decoder with the *MOTOROLA format* use the *prefix "T"* ahead of the address, which is shown in the display as "MOT" (provided no other system or cab settings are active).

? The address is activated with the *"F" key.* The *"A" key* may also be used if this same number has previously been active as a DCC loco address ; that is,

it was not assigned as a MOTOROLA, accessory or track section module address.

? The cab is now *active:* the dotted line is gone, the "F" indicator appears and the background is now green.

The number to the right of the "R" indicator shows how many loco addresses are stored in the cab's rotational memory and the current speed setting of this loco is shown below the communication point (00 .. 126).

ATTENTION: If after pressing the "A" key the accessory mode is activated (background is red and indicator "W" in the top left corner) or the entered prefix "T" is lost, deactivate the address by pressing the *"A" key* and reactivate it again with the *"F" key* (don't use the "A" key)*.* This happens when the entered address was previously used for another address type (e.g. accessory or for a different data format) and the "A" key was used instead of the "F" key.

If the activated address flashes ...

If the address in the display starts to flash after pushing the "A" or "F" key, it cannot be activated. The reason is indicated in the black bar and is also flashing.

The usual reason is that this address is already in use by another cab as either a single loco or part of a consist.

To take over a loco from another cab, use the "U" key to Unlock the address. The address is now removed from the other cab and flashing in   its display.


Enter an address as a name:

If an alpha numeric description is assigned for the loco in question (see chapter 7, "E" procedure "NAM"), the description can be entered in place of the address number.

Start by pressing the shift key "L", which changes the key pad from a numeric to an alpha numeric, then enter the information as you would with a cell phone. A table lists all names already stored. Use the "F" or "W" key to scroll, activate the highlighted name with the "A" key.
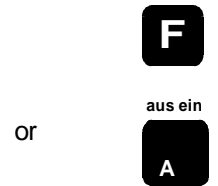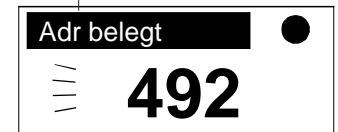
THE ACTIVATED CAB:

? Display background is green, loco address displayed in large numbers, "F" indicator lit, number of stored addresses ("R") indicated, data transfer from/to command station indicated by flashing dot, fast clock alternatively flashing with communications dot, present speed step shown below communications dot.

F   R 0   ●
**   00**
3124

If scrolling lights at the light bar to the left of the speed slider...

are visible after activating an address (upwards or downwards), it indicates that the actual speed of this loco is different from the speed regulator setting of this cab (this loco address was activated earlier
with this or another cab). The scrolling lights and their color indicate the direction of deviation. The speed slider has no effect on the loco until the speed is "caught-up" to by moving the slider in the direction indicated.
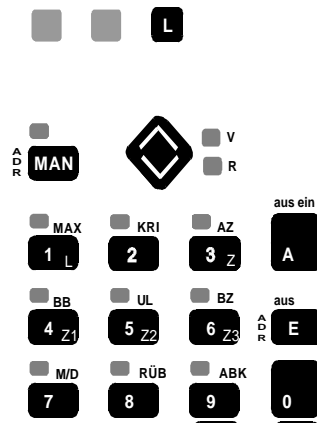
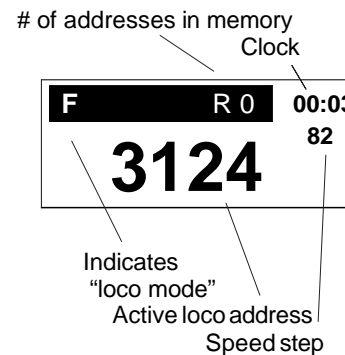All functions of the selected loco can now be accessed:

? Speed with the **speed slider**,

? Direction with the **direction key**,

? "MAN". This function by-passes the "signal controlled speed influence" and also removes or limits programmed momentum to various degree. Pressing the **"MAN" key** leaves you in full **manual control** (indicated by flashing red LED).

The "MAN" function works with all ZIMO decoders and other brands that are equipped with this feature.

? Function outputs with **keys "1"..."9"**, according to NMRA-DCC functions **F0...F8**, where the current output state is indicated with yellow LED's.

The "12-Function mode" (which is the default mode for all command stations delivered since 2003, see chapter 8) configures **keys "1"..."4"** for **outputs F9...F12** if **shift key "L"** is **held while pressing function keys.** The corresponding LED's indicate the output state.

Function outputs are by default switched on or off permanently (latched); Each function key from 1 to 8 (F0 to F7) can be changed individually to a momentary key with the help of the "E-procedures M/D".

# of addresses in memory
Clock

F   R 0   00:03
**   82**
3124

Indicates
"loco mode"
Active loco address
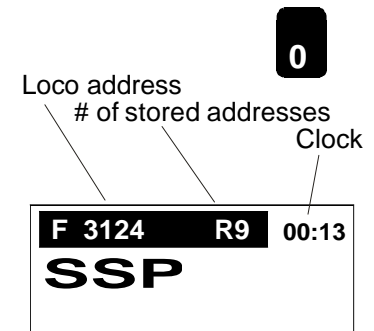Speed step

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The active cab furthermore allows:

? **Emergency stop (="SSP"** stops all trains on the layout) by pushing **key "0"** (**"SSP"** displayed in address field**,** address is moved to the upper bar)

Emergency stop for active loco only:
Key "9" is no longer available for this function as it was with the MX2 (except if activated as such in the cab settings). In its place we put the emergency stop procedure according to the NMRA RP's: hitting the direction key after the speed slider is pulled to 0 initiates an emergency stop for this loco only even with activated momentum by either the cabs "BZ" function or programmed to the decoder CV's. For programming **"E-Procedures"** see chapter 7 !

? During emergency stop the **track power can be turned** off with the help of the **"A" key.** Displayed as **"AUS"**.

? **Key "0"** gets you out of the emergency stop mode "SSP" as well as the track power-off mode "AUS" and **restores track power.**

0

Loco address
            # of stored addresses
                           Clock

F 3124   R9   00:13
SSP

A
D

F 3124   R 0   ●
AUS

0

DEACTIVATE A LOCO ADDRESS:

? The selected address is deactivated with the **"A" key** (hence the small D on the "A" key). The cab is now in the stand-by mode indicated by the dotted line and the yellow background.

THE CAB IN STAND-BY MODE:

? Background yellow and dotted line visible.

A new address can be entered and activated in this mode. The same address as before that is still visible in the display can   of course be reactivated again by hitting the "A" or "F" key.

F   R 0   00:24
**   82**
3124

A
D

Nicht aktiv.   00:26
. . 3124 . . .
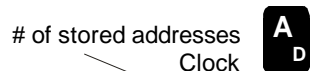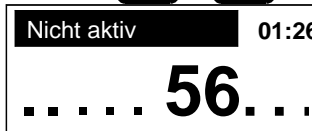
5.   Data storage and recall

In the previous chapter you learned how to activate a previously entered address with the "A" or "F" keys. There is another way to navigate between addresses using the data storage and recall feature.

Addresses deactivated with the "A" key will not be erased from the system but remain stored in the command station and are used in three different ways;

? All addresses, including their data, that were activated once are continuously sent to the loco, which allows any number of trains to be operated with a single cab. Also, in this way, if a loco decoder loses its data it will be restored without any further action.

? When an address is reactivated with the same or another cab, all pertaining data (direction, speed, functions) will be displayed on the cab automatically.

? Moreover, every deactivated address will be stored in the memory of the cab concerned; this memory "remembers" the 10 addresses last activated together with the accompanying data used. The memory holds 10 addresses by default but can be changed up or down with the help of the "E-Procedure RÜB" (see chapter 7).

? The value "R.." in the upper bar indicates how many addresses are stored in memory. A missing letter "R" means that the memory is empty.

? Pushing the "F" key recalls and displays the address from the memories first slot with all applicable data. The previously active address that just got replaced with the recalled address is moved to the last slot in the memory.

? Repeated activation of the "F" key causes the cab to rotate through the memory slots of all stored addresses.

NOTE: With the help of the E-Procedure "RÜB", the recall memory can be limited to any number of addresses between 0-10 (see chapter 7).

F   R 0   ●
                              00
3124

A
D

Nicht aktiv   **01:25**
.. 3124 ...

5   **6**

Nicht aktiv   **01:26**
..... 56...

of stored addresses
Clock

A
D

F   R 1   **01:27**
                              00
56

F

F   R 1   ●
                              82
3124

Speed step indicated
for active address

? To remove an address from memory, push the **"C" key** while the address is active. The effect is the same as with the "F" key; after the address is removed the next one stored in memory will be activated. Repeated actuation of the "C" key will remove all addresses from memory and at last the active address as well.

RECOMMENDATION: Clearing the memory of unnecessary addresses (e.g. addresses entered by mistake or that are stored in other cabs as well) facilitates operations!
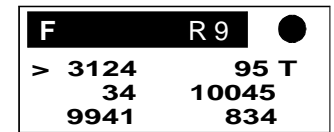
C

F   R 0   **01:29**
                              00
56
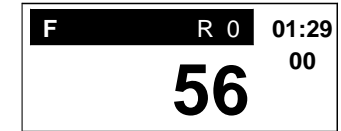
TABULAR DISPLAY OF STORED ADDRESSES

? If the cab is in active mode and at least one address is stored in memory (the example to the right shows 9 addresses in memory)...

... pushing the **"E" and "F" keys together** (press "E" key ahead) displays the addresses in a table format .

? Up to 6 loco addresses are displayed at once. The active address is marked with a ">" while addresses that are part of a consist show a "T" (=Traction) at the end.

? The **"F" and "W" keys** are now available as scroll keys, which allows the "activation" marker to be **moved up or down** and if needed to scroll through the entire memory bank.

? The **"A" key** brings you **back from the tabular to a single** address display, whereas the last marked address is now displayed as the active address;

? alternatively, pressing the **"E" key** returns to the previously active address.

F   R 9   ●
                              162
3124

F

Eₖ

F   R 9   ●
> **3124**   **95 T**
    34   **10045**
**9941**   **834**

A
D

or

Eₖ

6. Double and Multi traction

Double or multi traction (a.k.a. consisting, MU'ing) implies the simultaneous control of 2 to 10 locos with the same cab. Not only are speed changes executed by all locos included in a consist but directional changes and the MAN-function as well. All other functions, on the other hand, are still controlled individually for each loco; after all, the headlight should usually be on for the lead engine only.

? To **include** a currently active **loco address in a consist**, press the **"T" key** at speed 0 (!). A **"T"** is permanently assigned to this loco number in the display, until it is canceled by pressing the "T" key once more (again only possible at speed step 0).

? All addresses that become part of the consist are either entered with the keypad (as shown in the example to the right) or recalled from the memory using the "F" key and get a "T" attached to them, one at a time.

? All addresses in the cabs memory that are marked with a "T" belong to this cabs consist; only <u>one consist per cab</u> may exist, yet <u>any number of consists</u> may be stored in the <u>command station</u>. See note about "reactivation of consists" on next page.

? While the locos of a consist are operated as a unit, the whole memory can be scrolled through using the "F" key (single as well as consist addresses). Functions (F0, F1...) can be actuated for a single loco address that is currently active (also for a consist address marked with a "T"). Driving the consist is possible regardless of which loco is active, .e. there is no need to have the lead loco in the display.

NOTE: Momentum programmed to loco decoders in AZ, BZ, ABK and PDL (see chapter 8) is used from the currently active (displayed) loco address of the consist. Any changes in these values, with the help of the "E-procedures", will automatically be applied to all locos in the consist.

Next address is part of this consist

# of locos that are part of this consist
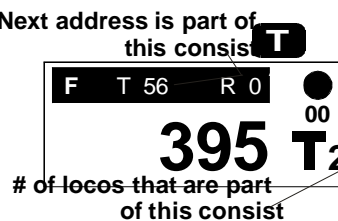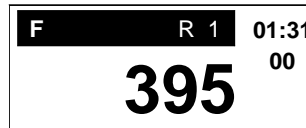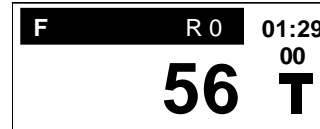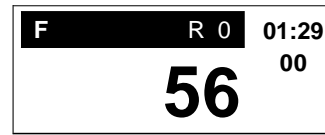
Reactivation of a consist stored in the command station:

When an address is activated with a cab that is stored in the command station as part of a consist, all addresses belonging to that consist will automatically be loaded into the cab's memory.

The flashing "T" = *(Multi)***Traction memory full:**

A flashing "T" indicates that such an upload is locked, because a consist already exists in this cab. Use the unlock key "U" to acquire the new consist, which causes the existing consist to be moved to the command station.

? As already mentioned, a **loco is removed** from a consist by pressing the **"T" key** while this address is active, which also removes the "T" marker from this address.

? If the **"C" key** is used to cancel an address that belongs to a consist, **all other addresses** of that consist are removed from the cab as well. However, the consist remains intact and stored in the command station.

TABULAR DISPLAY OF CONSISTS

? With a consist address active, pressing the **"E" and "T" keys   together** (press "E" key slightly ahead) displays the consist addresses in a table format.

? Up to 6 consist addresses are displayed at once. The active address is marked with a ">" and a capital "T" (=Traction) identifies it as a consist address.

? The **"F" and "W" keys** are now available as scroll keys, which allows the "activation" marker to be **moved up or down** and if needed to scroll through the entire memory bank.

? The **"A" key** brings you **back from the tabular to a single** address display, whereas the last marked address is now displayed as the active address; alternatively, pressing the **"E" key** returns to the previously active address.

Memory full
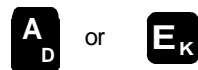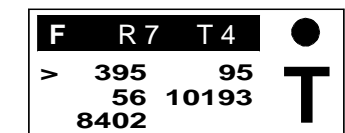
7. The "E-Procedures"

The "E-Procedures" (named after the "E" key) al-
low for an easy and uniform way to handle various set-
tings with which the driving behavior of a loco, includ-
ing acceleration/deceleration phase (applied to a spe-
cific loco address) or cab functions, can be changed.

*"E-Procedures" can be performed with an active
loco address in the cab display and in part with an ac-
tive accessory address (e.g. "M/D").*

? Each "E-procedure" is started by pressing the *"E"
key,* which is

? acknowledged with a capital "E" in the display; at the
same time the loco address is moved to the bar
above the address field.

? Press the appropriate key for the desired function to
be changed (additional text is added above each
key for reference, e.g. "PUK", "8/12". "PDL" etc.);

? the selected key is now displayed in the top bar (e.g.
E1 for "8/12", E2 for "PUK" etc.) with a description or
a table below from which a selection is made.

? Use the number key suggested ahead of the de-
scription to toggle between the choices. (In the ex-
ample to the right, the #2 key toggles between "nor-
mal" or "pulse chain commands" (=Pulskette). The
">" indicates the selected setting.

? The procedure is ended by pressing the "E" key
again. The loco address now reappears in the dis-
play. The "A" key (Acknowledge) may also be used
to exit except for special cases where this key is
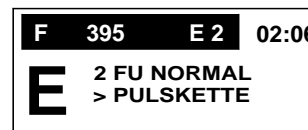used for other functions.

NOTE:

1) An "E-Procedure" can also be carried out without changing any settings.

2) An "E-Procedure" can be ended, as described above, by pushing the "E" key but *also
exits automatically after the cab sits idle for about 5 seconds* (time can be modified).

Example of performing
an "E-Procedure" (for
"PUK" setting):
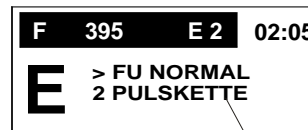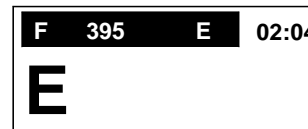
The following "E-Procedures" are available:

8 / 12 (#1 key)   8-Function Mode / 12-Function Mode

13 outputs (F0 to F12) are now standard according to the NMRA. This
*"12-Function-Mode" is the standard setting for all ZIMO products from
2003 on.* The default setting for older ZIMO DCC decoders at time of delivery
(some until the end of 2002) or after a hard reset was the 8 function mode. Still
older decoder (up to about 1999) had no 12 function capabilities and were limited
to 8 functions all together.

The data format the command station uses has to match the decoder type or its
settings respectively, otherwise the functions F5 - F8 and the MAN function will
not work as intended. This will not be an issue, however, if functions F0 - F4 are
used exclusively.

> **The "8 / 12-Function mode" issue is irrelevant for customers who
bought all ZIMO components in 2003 or thereafter!**

Therefore, if a decoder is used that works with the 8-
function mode (especially Zimo decoder), the com-
mand station has to be set to the 8- function mode for
this decoder address as well. This is done with the
"E-Procedure 8/12" as explained here.

The opposite is also possible, where some ad-
dresses need to be switched to the 12- function mode
because an (usually) older command station by de-
fault operates all addresses in the 8- function mode.

For more information on this subject see: the leaflet
"8/12 function and MAN" in the operating manual or at
www.zimo.at !

? Selecting between the 8 and 12- function mode is
possible with the help of the "E-procedures" as
explained on the left, with an active address dis-
played on the cab. Proceed by pressing the follow-
ing keys:

Key "E", Key #1 = "8/12" (Key #1 toggles between
the two where the ">" indicates the current choice).

? Exit the "E"-procedures by pressing the "E" key.
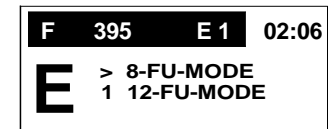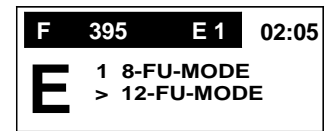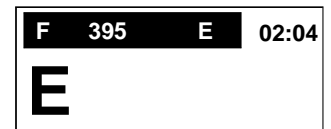
PUK (#2 key) Normal Functions or Pulse Chain Commands
(for LGB)

According to the NMRA-DCC standard, each function (F0 - F12) is sent from the command station to the decoder by one bit within the intended DCC function commands. *Only LGB sends all function commands F1 - F8 on one single function output, namely F1, by means of pulses, 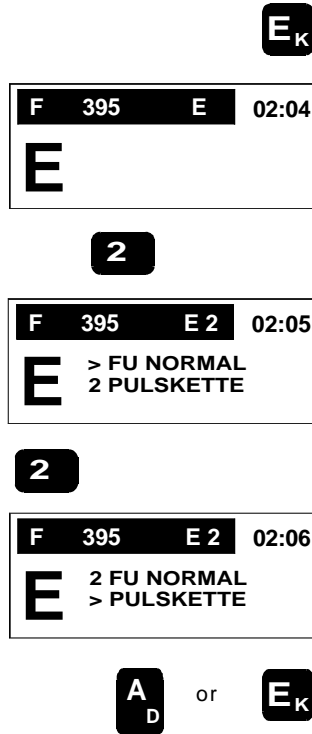according to a method that originated from the early days of DCC* (at this time, 2003, it is not known when LGB will switch to the faster and more efficient method).

The ZIMO command station can be set-up to send pulse chain commands to a loco address for a loco equipped with a LGB decoder, with the "E-Procedure PUK" described here.

☞ Selecting between the normal function commands and the pulse chain commands (= "Pulskette") is possible with the help of the "E-procedures", with an activated address on the cab. Proceed by pressing the following keys:

Key "E", key #2 = PUK, (key #2 toggles between the two choices.

☞ Exit the "E"-procedures by pressing the "E" key.

E_K

| F | 395 | E | 02:04 |

E

2

| F | 395 | E 2 | 02:05 |

E > FU NORMAL
2 PULSKETTE

2

| F | 395 | E 2 | 02:06 |

E 2 FU NORMAL
> PULSKETTE

A_D   or   E_K

NAM, NUM   (#4, #5 keys)   Assigning loco names

With the help of "E-Procedures" it is possible to assign *alpha numeric (NAM)* and *numeric (NUM, e.g. Train numbers)* to loco addresses. For example: loco address "395" could become "Big Boy". The name could then be used in place of the address number.

☞ To enter and assign a name, use the "E-procedures" when an active address is in the cab display. Proceed by pressing the following keys:

Key "E", key #4 (= NAM) resp. Key #5 (= NUM), the procedure to enter the name using the numeric keypad is the same as you most likely are familiar with from your cell phone. The keys are marked with the appropriate letters. Up to 24 characters can be entered; only digits in the "NUM" mode. Use the "C" key as backspace and the "0" for space.

☞ Use the "U" key to have the name *"hidden"*; the name will not be used in operation but remains stored in the background.

☞ The name can also be assigned to a consist by pressing the "T" key ("trak" in brackets), if the current address belongs to a consist (marked with a "T").

☞ Exit the "E"-procedures by pressing the "E" key.

ERASING A NAME (OR NUMBER)

Overwriting the first two letters or digits with the space key erases the complete name: after starting the "E-4-Procedure", press the "0" key twice. The rest of the name will be erased after that automatically.

E_K

| F | 395 | E | 02:04 |

E

4

| F | 395 | E 4 | 02:05 |

E NAME:
_____

JKL   PQRS   etc
5 5   **7 7 7**

| F | 395 | E 4 | 02:08 |

E NAME:
SF SUPER CHIEF...

Ü

| F | 395 | E 4 | 02:10 |

E NAME (hidden)
SP AC-5
"FLAT-FACED"

A_D   or   E_K

NOTE: NAME AND TRAIN NUMBER APPLICATIONS:

Every time an address (or other figure) is shown in large numbers in the address field, the name belonging to this address can be displayed by pressing the keys "E" and "4" (for names) or "E" and "5" (for train numbers). Use the same key's to remove the name and bring the loco address back again.
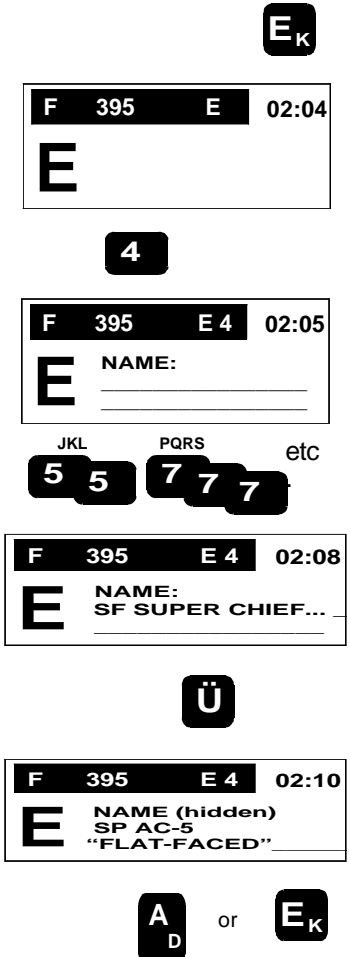
E-Procedures —— E-Procedures —— E-Procedures —— E-Procedures —— E-Procedures

AZ, ABK   (#3, #6, #9 key)
Fixed Acceleration/Deceleration rate and variable rate

The **acceleration and deceleration rates** set here are valid for any active address, independent of decoder typ and manufacturer, since these settings are carried out by the **cab and command station.**

This differs from the acceleration/deceleration values in configuration variables (CV) #3 and 4 used in loco decoders . The values in CV #3 and 4 are the basic momentum settings, which can be increased using "AZ and "BZ" but never decreased.

A value between 0 and 15 may be selected for each of these three parameters. These values will remain with the respective loco address until new values are entered, even if the address is removed from the cab. With "AZ" (key #3 = acceleration time) the total acceleration time in seconds between 0 and full speed is set and with "BZ" (key #6 = deceleration time) the total deceleration time in seconds between full speed and full stop.
"ABK" (key #9 = variable rate) is used to choose between 15 variable rates, that is, at about the same total time (according to "AZ or "BZ" respectively), the acceleration and/or deceleration proceeds slower (ABK= 1 - 8) or faster (ABK= 9 - 15) at the bottom end of the speed range. The rate remains linear with a value of "0".

☞ To change the values use the "E-procedures" anytime an address is active on the cab. Proceed by pressing the following keys; for "AZ":
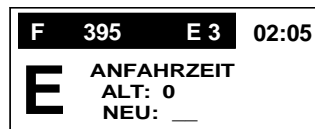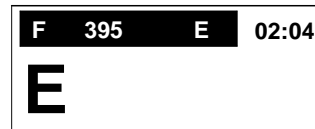
Key "E", key #3 (= AZ), enter the desired value (e.g. "14").

☞ Key "A", to continue entering the next value (BZ) without leaving the "E-Procedures"
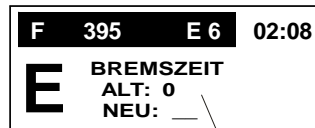
or:
the "E" key to exit the "E-Procedures".

Shortcut to turn AZ or BZ on/off:

Holding the "E" key and simultaneously pressing key #3 (=AZ) or #6 (=BZ) turns the acceleration and/or deceleration feature on or off, whereas the last used value is always used and briefly shown in the display. Two yellow LED's (in the center of the 4 vertical) are lit if the functions are turned on.

E K

| F | 395 | E | 02:04 |

E

E-Procedures

3

| F | 395 | E 3 | 02:05 |

E   ANFAHRZEIT
    ALT: 0
    NEU: ___

E-Procedures

1 **4**

| F | 395 | E 3 | 02:07 |

E   ANFAHRZEIT
    ALT: 0
    NEU: 14

Acceleration time
Old: 0
New: 14

A D

| F | 395 | E 6 | 02:08 |

E   BREMSZEIT
    ALT: 0
    NEU: ___

Deceleration time
Old: 0
New: ___

E-Procedures

E K

○ AZ
○ BZ

E-Procedures

NOTE: With the cab in the accessory mode, the E-Procedure "ABK" (= 9) can be used to select between actuating 4 paired functions (value "0") or 8 single functions (value "1").

M/D (#7 key)   Momentary/Latched Function Keys

The functions F0 to F8 (key #1 to #9) can have a permanent effect (= latched, pressing the function key turns a function on or off) or a momentary effect (function is on only as long as the function key is pressed). By default, all functions are set as permanent.
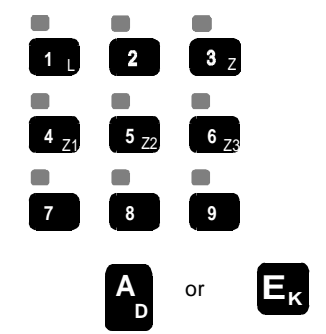
☞ Selecting between momentary and latched function keys is done with the help of the "E-Procedures". Press:

Key "E", key #7 (= M/D),

☞ use the number keys 1 ... 9 (= Functions F0 ... F8) to switch between momentary or latched. The LED's above each number key indicates the current state of each output: green = latched, red = momentary.

☞ Exit "E-Procedures" with key "E" or "A".

NOTE: The functions F9 to F12 are designed as latching keys exclusively and can not be changed using the "E-Procedures".

E K

| F | 395 | E | 02:04 |

E

7

| F | 395 | E 7 | 02:05 |

E   MOMENT/LATCH
   F0 ... F8
      RED/GREEN

1 L	2	3 Z
4 Z1	5 Z2	6 Z3
7	8	9

A D   or   **E** K
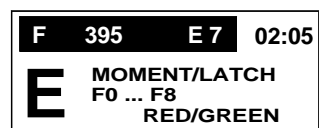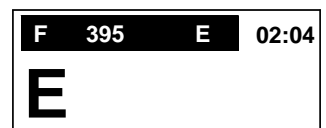
RÜB (#8 key)   Size of back-ground memory

Deactivated addresses are stored in a background memory and can be recalled using the "F" key, as described in section 5. The memory holds 10 addresses by default, which may be too many in som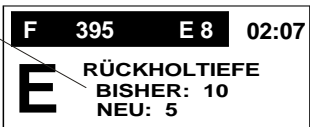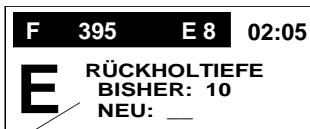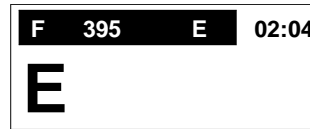e instances. For such cases, the possibility exists to **reduce the size** of the memory from 9 to 0 addresses. An **increase** in addresses of up to 30 total will also be possible with a future software update (after 2004).

✍ The memory depth is set using the "E-Procedures", see above. Press:

Key "E", key #8 (=), enter the desired number of addresses (e.g. "5"), Key "E" to exit.

Eₖ

| F | 395 | E | 02:04 |

E

8

Memory depth
Old: 10
New:___

| F | 395 | E 8 | 02:05 |

E   RÜCKHOLTIEFE
     BISHER: 10
     NEU: __

5

| F | 395 | E 8 | 02:07 |

E   RÜCKHOLTIEFE
   BISHER: 10
     NEU: 5

.

MEN ("F" key)   Menu for basic cab settings

Basic cab settings can be changed using the E-Procedure "MEN". Direct access to other components may be possible (e.g. command station) in the future as an alternative to CV programming.

Aᴅ   or   **E**ₖ

✍ To get to this area use the "E-Procedures" by pressing:

Key "E", key "F" (= MEN), ...
The following choices are available for each individual cab (this list will be amended with future software upgrade releases):

- Language (German, English, ...)

Eₖ

| F | 395 | E | 02:04 |

E

F
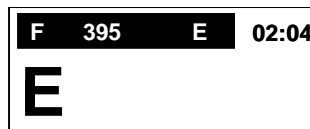
(right column — vertical label: E-Procedures)

- LED's and display dimming, color control

- Fast clock settings (time factor 1:1 to 1:160, reset, set current time),

| F | 395 | MEN | 02:04 |

M

- Choose between global fast clock (time controlled by command station, same time at every cab) or local fast clock (time controlled by each individual cab for different time zones),

- Show leading zeros in address,

- #9 key acts as emergency stop for the active train only (as known from the MX2 cab),

- Function combinations

- Display power consumption (command station data) in place of fast clock or speed steps

- Timeout for E and P functions

- Assignment of addresses in the 700 range... (Regular or BAB's)
- Assignment of addresses in the 800 range... (Regular or MX8)
- Assignment of addresses in the 900 range... (Regular or MX9)

- BABY-MODE (no address change possible etc., simple display, password required to exit this mode)

- Adopting basic settings from another cab
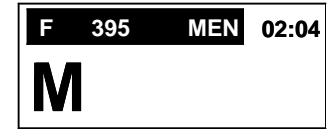
MORE INFORMATION TO FOLLOW LATER FOR:

Menu listing, scroll bar wit F, W keys (up/down), selection with "A" key, sub-menus for specific settings (e.g. fast clock), and/or entry fields.

BAB ("Ü" key)   Automation

The E-Procedure "BAB" enters the definition and actuation of automated operating sequences. These sequences are in fact pre-programmed actions (e.g.

turnout operations) that can also be influenced in part by outside events (e.g.track switches).

? Start the "E-Procedures" by pressing:
Key "E", key "Ü" (= BAB),

a **capital "B"** is now shown in the display instead of an "E", along with a list of possible automated sequences.
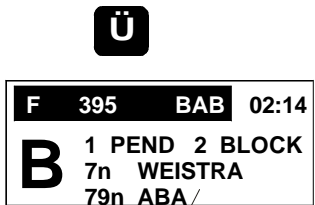
The following automated sequences are processed under "B" (this list will be amended with future software releases):

- **Shuttle train operation** (is defined and used as with the MX2 cab - applicable command station CV's do of

course apply here as well (e.g. Station stop time etc.)

- **Turnout ladders** (defined and used similar as with the MX2 cab - applicable command station CV's also apply (e.g. Switch intervals etc.)

- **Block control**   (sample run for definition and activation similar as with the MX2 cab)

- **Automated operating sequences** - a totally new class of event controlled automated operations (was not   available in earlier versions of MX1 and MX2).
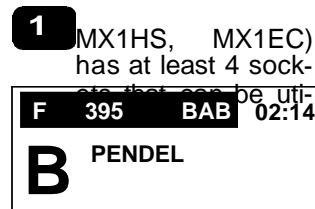
Shuttle Train Operation

Press the #1 key for shuttle train assignment.

Each command station (MX1, MX1 "model2000", MX1HS,   MX1EC) has at least 4 sockets that can be utilized for contact inputs, with which an assigned train's direction will be changed automatically(slow down of loco according to values set in"BZ", station stop, accel-

| **E**K |

| F   395   E   02:04 |
| **E** |

| **Ü** |

| F   395   BAB   02:14 |
| **B**   1 PEND 2 BLOCK |
| 7n   WEISTRA |
| 79n ABA |

1 Shuttle   2 Block
7n   Turnout Ladder
79n ABA

| **1** |

| F   395   BAB   02:14 |
| **B**   PENDEL |

eration according to "AZ" value), that is, the direction is changed if the train moves in the predetermined opposite direction.

? Shuttle train inputs are assigned to an active loco address with the number keys 1 to 4 (1 to 8). The LED's above the function keys indicate the state of that input: dark= not assigned, green = assigned to change direction forward, red = assigned to change direction backwards.

Pressing the "E" key exits from this procedure.

Station stop times can be programmed with the command station CV's (see MX1 manual)!

1) Two inputs are assigned to a loco address for a common shuttle train operation, e.g. P1 forward and P2 backwards. It follows that if 4 inputs are available 2 shuttle trains can be operated automatically, independent from each other. It is also possible though to assign more than two inputs to the same loco address.

2) On the other hand, each shuttle train input may be assigned to one loco address only. If an already assigned input is reassigned to another address, the previous assignment is canceled without warning.

3) The leading loco address (does not have to be the first loco in a consist but is the one shown in the display) is used in a double header or multi consist.

T O B E A D D E D L A T E R:
Turnout ladders, autonomous block control

Automated operating sequences, due to its size, are dealt with in chapter 12; dedicated to this subject only !
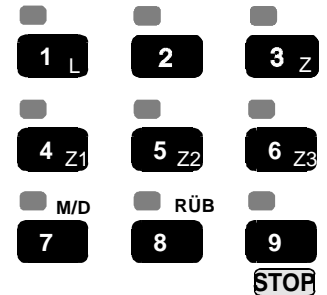
E-Procedures

COM ("T" key)   " Bi-directional communication"

The E-Procedure "COM" relates to the display and utilization of feedback information received from an active loco decoder. This information may be the result of the ZIMO train number recognition (in this case used as train locator) or from the NMRA standardized bi-directional communication.

ZIMO accessory decoders are also equipped with bi-directional communication (both, the ZIMO train number recognition method and NMRA bi-directional communication) and the results are shown in the lower bar of the display.

If, with the help of the E-Procedure "COM", the communication feed-back display is selected, a bar is drawn across the bottom of the display and the large address digits will be smaller
accordingly.

TEXT WILL BE ADDED LATER...

...that describes the different display features.

(The bi-directional communication was not finalized by the NMRA when this manual was written, September 2003)

```
┌────────────────────┐    ⬤
│ F          Rü 1    │
│       3124      82 │
│████████████████████│
└────────────────────┘
```

E-Procedures
E-Procedures
E-Procedures
E-Procedures

STU (#0 key)   Number of speed steps (14, 28, 128)

According to the NMRA standard there are three speed step systems defined;
<u>14, 28</u> or <u>128 speed steps</u>

The ZIMO system by default sends speed information with 28 steps. If so desired, each loco address can be changed individually to send either 14 or 128 speed steps, which is done with the "E-Procedure" as follows.

Modern loco decoder from most manufacturers (including all Zimo decoders ever made) handle at least two systems (14, 28), usually all three (14, 28, 128) and are set by default with CV #29, Bit1= 1 to 28/128 speed steps (speed commands with 14 or 128 steps are read without changes to the CV settings, if both are implemented). They will be compatible to the ZIMO system without any further adaptation. Although switching the system to 128 speed steps can sometimes lead to improvements.

However, there are older decoder (and also some not so old LGB decoder) that can only handle 14 speed steps or at least are set so by default. It is necessary that for such loco addresses the system is also set to 14 speed steps.

If this is omitted and the speed step system between cab/command station and decoder is not matched, it is most often noticed that the function F0 (headlights) doesn't work or only in certain speed regulator positions (as speed is increased, the lights keep turning on/off). Of course, the intermediate speed steps are also missing but that is not always noticed.

NOTE: This "problem" (of 14 and 28 speed steps not harmonized) is the single biggest cause for customer grief over the last 15 years. It is also responsible for numerous complaints and unnecessary "warranty" returns of decoders and modules with a failure report like:"headlights don't work or flicker" !!

To change the number of speed steps use either..........

. . . the **"old MX2 procedure"** .....

that is a modified "E-Procedure": Press and hold the "E" and "0" keys simultaneously during the whole process.

The LED's above the function keys 7, 8 and 9 indicate the current speed step (14, 28, 128) and is also shown in the display (as described in the MX21 procedure).

While still holding the "E" and "0" key, select the speed steps of your choice with the

appropriate key ("7" for 14, "8" for 28, "9" for 128).

---

or . . .

. . . **the new MX21 procedure:**

? Setting up the speed step system is done using the "E-Procedures", by pressing:

Key "E", key "0" (= STU), selection with keys
"7" for 14 speed steps,
"8" for 28 speed steps,
"9" for 128 speed steps.

Recommended setting for most newer decoders is 128 speed steps !

(Note: A feature is planned that would allow the setting of all decoders at once; but it is not known with which cab and command station software update this will be realized.)

Exit with key's "A" or "E".


```
7    14 STEPS
8    28 STEPS
> 128 STEPS
```

E-Procedures ——— E-Procedures ——— E-Procedures ——— E-Procedures
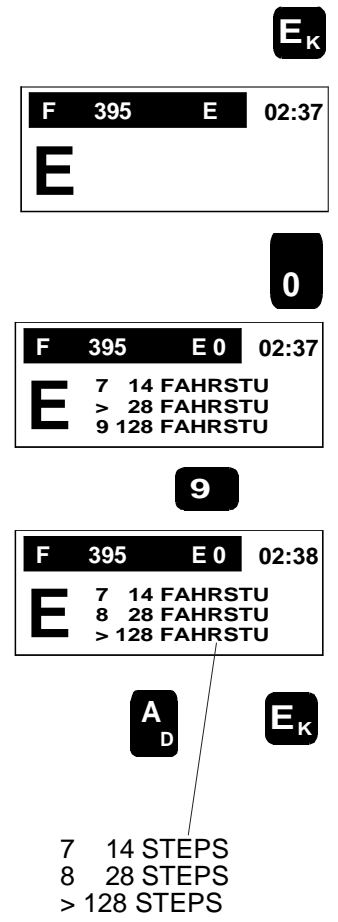
8. Actuating Accessories

Not only locos can be operated with the MX21 cab but accessories (turnouts, signals) as well, provided they are connected to **accessory decoders** or **ZIMO accessory modules** (MX8...).

Within the **DCC data format** all ZIMO accessory decoders such as the MX81, MX82, MX88 (and future models) and all other manufacturer products adhering to the NMRA-DCC standard can be actuated; the same goes for products that operate in the **MOTOROLA data format** (Märklin accessory decoder...) with the difference that in this format a prefix "T" is added to the address (except if DCC is turned off at the command station by means of jumpers or switches and therefore Motorola is the only format used).

It is allowed to use the **same numbers** for loco and accessory addresses with both, the and MOTOROLA format (once activated with the "F" key for locos and once for accessories with the "W" key). Using the "A" key for activation selects the last used application.

Accessory modules MX8 (MX8S, MX8M,...), on the other hand, operate without a data format because they are not connected to the track but are rather operated through ZIMO's own CAN bus. That's why they are called "module" and not decoder. Modules use the address numbers 800-863.

SELECTING AND ACTIVATING AN ACCESSORY DECODER:

Start with the MX21 cab in stand-by or deactivated mode. The dotted line is visible in each case and also the previously active address (in deactivated mode), background is yellow.

- The desired address is entered using the **number keys (1 to 0 with prefix "T" if necessary).** Check your entry in the display. The dotted line remains during the address entry.

Nicht aktiv	03:02
. . . **159** . . .	
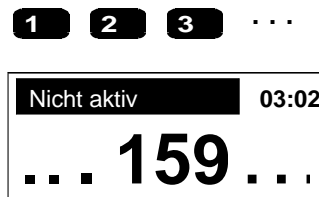
- Confirm the entered address with the "W" key, or the "A" key if the entered number was used as an accessory address previously. The cab is now in the activated (accessory) mode.

NOTE: Using the "A" key to activate an address results in the address being assigned for the same purpose (loco or accessory) as it was used the last time around. Using the "F" or "W" key instead will get you directly to the mode intended.

W	Rü 0	03:02
159		

When entering an accessory module address (800...863) the group number also needs to be entered in addition to the address, because a module usually has more than 8 outputs, which is more than the cab has function keys. The complete address looks like this: **xxx.y**, where the "." is placed automatically (there is no dot on the keyboard). The display also reflects this with "MX8" rather than just "W"!
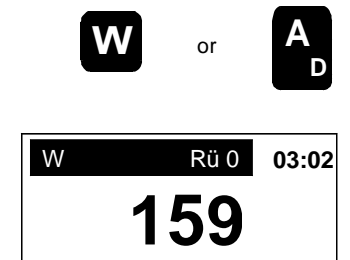
The display looks like this for an accessory module address #800-863.

MX8	Rü 0	03:02
839.2		

THE CAB IN ACTIVE ACCESSORY MODE:

- Display background is red, mode indicator either "W" or "MX8", number of stored accessory addresses displayed, clock alternating with communications dot indicating communication with command station, same as in loco mode.

- **The last activated loco(s) can still be controlled with the speed regulator, direction and "MAN" keys !**
  Functions for this loco are of course not accessible in the accessory mode since the function keys are now used to operate turnouts, signals etc. However, with the "F" and "W" key it is possible to quickly jump between the loco and turnout.

- A function can be actuated with the number keys (1 to 4 or 1 to 8 depending on the kind of module/decoder, or whether single or paired function is selected), e.g. actuate a turnout; the current position is indicated with the corresponding LED.
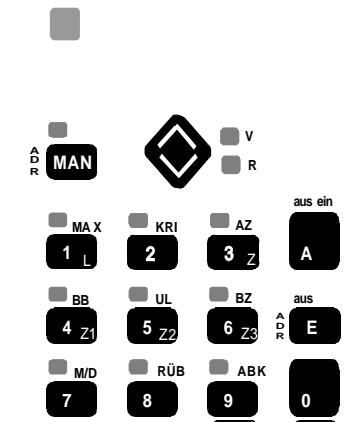
THE "E-PROCEDURES IN THE ACCESSORY MODE:

The "E-Procedures" for accessories are handled in the same way as in the loco mode (although different values may be required); see chapter 7. Press the:

"E" key, key for the function to be changed ("7" or "9"),

· · · · .... · · , Exit with the "E" key.

? The **"E-Procedure 9"** selects whether the active address of a <u>DCC accessory decoder</u> is used for **4 paired functions** (e.g. turnouts) or **8 single functions** (e.g de-coupler). Depending on the choice made, there will be 4 or 8 keys active and the LED's above each key indicates the state of the accessory (use keys "1" and "0") .
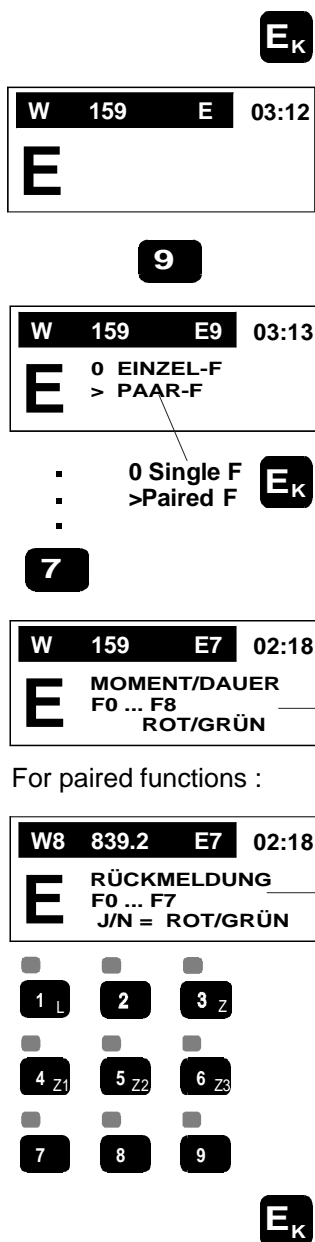
This choice is not available for accessory modules (800 ... 863), since the module is already programmed with a group number; see chapter 10 for programming !

? The **"E-Procedure 7"** (M/D), for **single functions only**, selects between **momentary and latching** function keys. Latching keys are the default (e.g. for signal light bulbs); the momentary function is ideal for de-coupler, for example.

The **"E-Procedure 7"** (M/D) can also be used for **paired functions** (turnouts), where each key can be set to flash while the turnout is operating until the **position is verified**.

This is of course practical when switch machines are used <u>as well as</u> accessory decoders (or modules) with systems that have feedback capabilities and are set-up accordingly. With MX8x modules feedback is always possible; accessory decoders (MX81, MX82) require a compatible command station software (installed in MX1 "model 2000" and MX1EC as of July 2004).

Some of the E-Procedures described in the loco section are also accessible in the accessory mode !

E_K

| W | 159 | E | 03:12 |

E

9

| W | 159 | E9 | 03:13 |

E 0 EINZEL-F
> PAAR-F

    0 Single F   E_K
    >Paired F

7

| W | 159 | E7 | 02:18 |

E MOMENT/DAUER
F0 ... F8
        ROT/GRÜN

For paired functions :

| W8 | 839.2 | E7 | 02:18 |

E RÜCKMELDUNG
F0 ... F7
J/N = ROT/GRÜN

1 L   2   3 Z

4 Z1   5 Z2   6 Z3

7   8   9

E_K

E-Procedures

DATA STORAGE AND RECALL FOR ACCESSORIES:

After deactivating an accessory address with the "A" key, it is stored in a special memory, separate from loco addresses.

Stored addresses can be activated again with the "W" key. Pushing the "W" key repeatedly cycles through all addresses stored.

There are therefore two separate memory banks, one for locos and and one for accessories. Use the "F" and "W" keys to quickly jump between the two but also to quickly flip through the addresses stored in each bank

.

Definition and Application of Turnout Ladders: see Chapter 12 !

MOMENT/LATCH
F0....F8
     RED/GREEN

Position feedback
F0....F7
  J/N = RED/GREEN

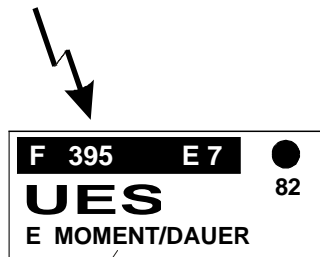## 9.   Display and management of a system shut-down

A system shut-down as is understood here may be initiated by the operator (emergency stop etc.) or the system itself (e.g. short circuit).

A system shut-down is indicated with a 3-letter code ("SSP", "UES", "AUS"); the cab may still be operational (e.g. to get a different address from memory) or only restricted (to re-power) the layout, depending on typ and software version of the command station. The address, displaced by the shut-down code, is now shown below the code.

?   EMERGENCY STOP, initiated with **key "0"(= SSP)**, is displayed with the code "**SSP**" on all cabs. Press the **"0" key (= SSP)** again to resume layout operation.

?   TURN TRACK POWER OFF with **key "A" (= AUS)** - only possible while in emergency stop, displayed with "**SSP-AUS** on all cab displays. Return to emergency stop by pressing the **"0" key (=SSP)** or directly to the operating mode (emergency stop removed and track power restored) with the **"A" key.**

?   TRACK POWER OFF can also be achieved at any time by pressing the **"0" key (=SSP)** followed by the **"A" key (=AUS).** All cabs will display **"AUS".** To return to an emergency stop state press the **"0" key (=SSP)** or press the **"A" key** to get back to the operating mode (emergency stop removed and track power restored).

?   SHORT CIRCUIT on the track is indicated with **"UES"** on all cabs. "UES" is also possible if the input voltage to the command station (from the transformer) is too low or by an overheated power supply board. Restore track power by pressing the **"A" key** after the cause ins identified and removed.

0

F	Rü 1	●
SSP		**82**
3834		

The previously active address.

A
D

F	Rü 1	04:33
AUS		
3834		

0

F 395	E 7	●
UES		**82**
E MOMENT/DAUER		

This line indicates which cab operation was performed just before the short occurred

A
D

?   SHORT CIRCUIT AT PROGRAMMING TRACK is indicated with **"UEP"** . Restore track power by pressing the **"A" key** after the cause ins identified and removed.

?   SYSTEM IN PROGRAMING MODE is indicated with **"Adr"** (the normal cab operation is interrupted because the system is busy programming). The programming state can only be exited by ending programming with the same cab the procedure was started.

?   BREAK DOWN IN COMMUNICATIONS (interrupted CAN bus to command station) is indicated with **"AAF".** This can be traced to defective wiring (or connectors), a faulty designed or overloaded network, poor ground connections, non-compatible software or a hardware defect. Poor signal strength could also be the cause with radio or infrared equipment.

CAN bus troubleshooting methods are in preparation !

F	Rü 3	●
UEP		**174**
159		

A
D

F	Rü 3	04:53
Adr		**00**
159		

F	Rü 3	●
AAF		**174**
159		

10.   Programming Procedures

Loco decoder, accessory decoder and various modules must have their own **unique address** (in some cases even several). The address is stored in a non-volatile memory (EEPROM). Depending on the decoder type, it is also possible to change the behavior of a decoder in many ways by **"re-programming" configuration variables.**

The necessary procedures differentiate themselves between

- **Decoder** (loco and accessory) for the **DCC -** Data format (ZIMO as well as other brands),
- **Decoder** for the **MOTOROLA -** Data format (doesn't include ZIMO at this time), and
- **Modules** connected to **CAN Bus** (ZIMO products only: command station, booster, accessory, track section module and more).

10.1   Programming a -   DCC - Decoder

Assigning, or **programming an address** is always done in **Service Mode**, that is on the programming track where only the one decoder (or loco) about to be programmed is allowed.

Programming of configuration variables, on the other hand, can either be done in **"Service mode"** or **"Operational mode";** also known as "on-the-fly" programming that can be performed anywhere on the main track.

| **Programming in** | |
"Service mode"	**"Operational mode"**
Loco or accessory on programming track("PROG" socket), Loco at a standstill.	Loco or accessory on main track ("On-the-main", "SCHIENE" socket), Loco moving or standing.
Address and CV-Programming.	Programming of configuration variables only.
Safe programming thanks to acknowledgment	Programming without acknowledgment (a certain degree of safety by sending multiple commands).
Read-out of configuration variables and address possible.	Read-out of configuration variables not possible. (middle of 2004, possible with bi-directional comm.").
Procedure starts with keys "E" and "MAN".	Procedure starts with "E" and "F" or "E" and "W".

Service mode - Programming on Programming Track

The loco equipped with a DCC decoder (ZIMO as well as other brands) or accessory decoder is placed (or connected to) the **programming track**, which is connected to the socket marked "PROG" of the command station MX1, MX1 "model2000", MX1EC etc.

- ? The programming procedure is started by pressing the **"E" and "MAN"** key **simultaneously**, after which a capital **"A"** is displayed.

  Pressing the "MAN" key a second time allows for module's to be programmed (MX8, MX9 etc.); which is not relevant here for programming a decoder.

- v By pressing the **"A" key** (without first entering an address) the system starts by **reading out the current address** of the decoder and displays it on the cab screen after a short waiting period. An error message is displayed if no valid address is found, see next page).
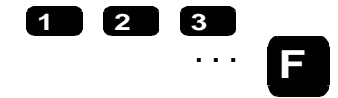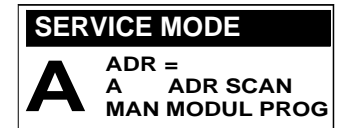
  Instead of reading out the decoder address (or afterwards) **enter the new address** using the numeric keypad and confirm with the **"F"** (for loco decoders) or **"W" key** (for accessory decoders).

  The decoder **acknowledges** a successful programming step by a short current pulse, provided the motor and/or headlights are connected. This is visible in the cab display by the letters "ACK" next to the entered address. An error message is displayed instead, if the programming was not successful.
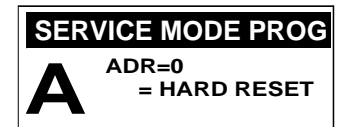
- ? Programming a decoder to **address "0"** is reserved for a **hard reset** in ZIMO decoders only (has no effect on other brand decoders). Afterwards all CV's are reset to factory default values. Press the **"A" key** after the "0" key to get out of programming (do not use the "F" or "W" key) !

- ? Pressing the **"C" key** starts the **configuration variables (CV)** programming and with "CV#__" in the display the system waits until a CV number and a value is entered.

- ? **Enter** the desired **CV number** and confirm with the **"A" key**.

MAN

E ᴋ

SERVICE MODE
A ADR = A   ADR SCAN MAN MODUL PROG

A ᴅ

SERVICE MODE ADR
A ADR=6328 READ

1 **2** **3**   . . . **F**

SERVICE MODE ADR
A ADR=6328 ACK

"ACK" appears only after decoder has acknowledged !

0   **A** ᴅ

SERVICE MODE PROG
A ADR=0   = HARD RESET

☞ When the CV number including the "=" is shown in the display, **pressing the "A" key again reads out** and displays the value of the corresponding CV.
An error code is displayed if a read out is not possible; for error codes see below.

☞ Instead of reading out the CV value (or afterwards) **enter a new value** using the numeric keypad and confirm with **the "A" key.** The decoder **acknowledges** a successful

programming step by displaying the letters "ACK" in the cab display next to the entered value. An error message is displayed instead if the programming was not successful.

  * By pressing the **"L" key** the **binary code** of the applicable CV can be displayed additionally. In this mode, the keypad doesn't work as such anymore but rather changes the Bits in the binary code corresponding to the number keys 0 ...7.

  * The decimal value of the changing binary code is recalculated as you go, in essence the cab works like a binary/decimal calculator. Press the "L" key again to exit the binary mode.
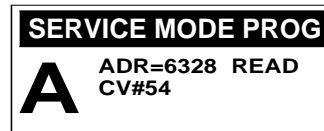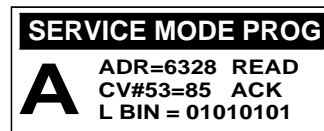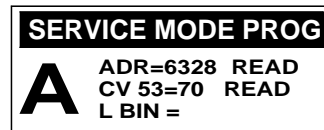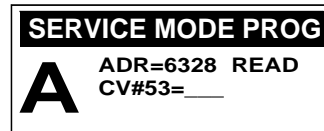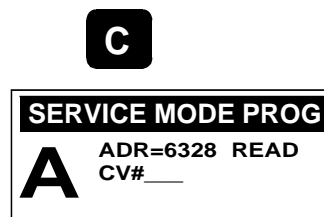
  * The binary mode is useful for CV's that are not set with a single value but rather where each Bit has a specific meaning (e.g. CV # 29, # 112, etc.).

☞ To program or read out the **next higher CV**, press the **"C" key;** overwriting a CV with a different number is possible as
explained above.

∨ Exit the programming mode with the **"E" key.**

Error messages that may be displayed during programming:

Err0: Stand-by voltage at start of programming less than 12 V
Err1: Voltage test timed out.
Err2: Over current at start of programming (higher than 250 mA)
Err3: Voltage too low for current consumption (more than 60 mA rise is necessary)
Err4: No decoder acknowledgment (doesn't necessarily mean unsuccessful programming . Could also be
        because no consumers like headlight or motor are connected or the current consumption of those is too
        low, thus decoder read-out is not possible.
Err5: Over current at programming output end stage
Err9: Selected register does not exist.

C

```
SERVICE MODE PROG
A    ADR=6328  READ
     CV#___
```
Programming

5 **3**   **A** D

```
SERVICE MODE PROG
A    ADR=6328  READ
     CV#53=___
```
Programming

A D

```
SERVICE MODE PROG
A    ADR=6328  READ
     CV 53=70   READ
     L BIN =
```
Programming

8 **5**   **A** D

```
SERVICE MODE PROG
A    ADR=6328  READ
     CV#53=85   ACK
     L BIN = 01010101
```
Programming

C

```
SERVICE MODE PROG
A    ADR=6328  READ
     CV#54
```
Programming

E K

Operational mode programming ("on-the-main")

The loco, turnout or signal equipped with a DCC decoder is connected to the main track output (marked "SCHIENE" on ZIMO command stations).

☞ Put the cab in to active mode so that the loco or accessory decoder to be programmed is displayed.

☞ The programming procedure is started by pressing the **"E"** and **"F"** or **"E"** and **"W" key simultaneously.**

  TIP: pressing the "E" key slightly ahead of the "MAN" key prevents the displayed loco from switching to the "MAN" mode.

  A capital **"P"** is now displayed along with the current address ("ADR="). The address can not be changed of course in the operational modes programming but the "CV#..." is the cue to enter the CV number to be accessed.

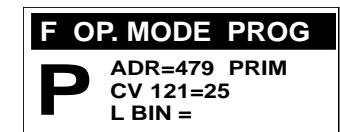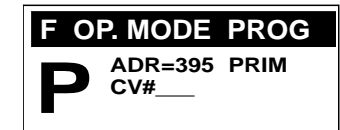☞ The remainder of the programming is the same as in the "service mode" !

  ... Enter the CV number to be programmed, "A" key,

  desired value, "A" key, "C" key advances to the next CV, "L" key changes to binary mode, ...

  Exit the programming mode with the "E" key.

NOTE:

CV's can be read, programmed and acknowledged ("READ", "ACK") "on-the-main" once the **"bi-directional communication"** is implemented in decoders, command stations and cabs (possibly at the end of 2004) !

```
F         Rü 7        ●
                          162
395
```

F

      E K

```
F OP. MODE  PROG
P    ADR=395  PRIM
     CV#___
```

1 2 **A** D   **2** **5** **A** D

```
F OP. MODE  PROG
P    ADR=479  PRIM
     CV 121=25
     L BIN =
```

C   a.s.o.   **E** K

Store and upload local CV's

Many times a situation arises where several or even large number of decoders need to be programmed with the same or similar CV settings.

It is for such occasions that the MX21 is equipped with a **special memory**, that copies and stores the programmed or read-out CV data.

? This procedure is started with the **"Ü" key** after the CV's (or at least one) were processed in service mode or operations mode programming, followed by the request to enter a memory slot number.

? Enter the appropriate memory **slot number** (1...9) where the information is to be temporarily stored and confirm with the **"A" key.** If a slot is chosen that already contains data, it is overwritten without warning (no correction or addition to already stored sets is possible).

? The MX21 confirms with "LOC" (=local, meaning its only available on this cab) and also shows how many CV's have been saved to this slot.

? Return to service mode or operations mode programming with the **"Ü" key.** As always, the "E" key exits from the programming mode altogether.

> **STORE CV-SET**
> **SLOT #____**

> **UPLOAD CV-SET**
> **SLOT #____**

Upload stored CV-Sets :

? Press the "**Ü**" key **after** the service mode or operations mode programming is started but **still before** a CV is programmed.

? Enter the **slot number** and confirm with the "**T**" (= Test) or **"L"** (= upload) key.

"T": uploading is simulated only so that the whole process can easily be followed and checked in the display.

"L": the stored values are actually uploaded to the decoder and can be observed on screen.

… In SERVICE MODE
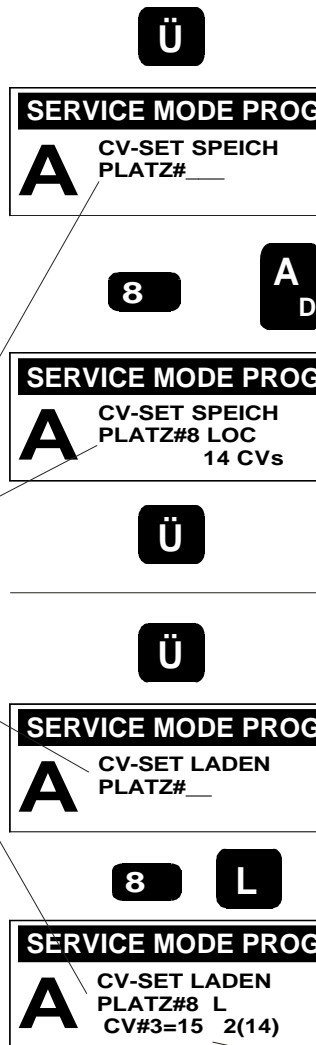
The programming proceeds on purpose not with the highest possible speed, so that the individual CV's and their values can be easily observed on screen.

? Return to service mode or operations mode programming with the **"Ü" key.** As always, the "E" key exits from the programming mode altogether.

10.2 Programming an Accessory Module

ZIMO accessory modules MX8 (in contrast to accessory decoders) are not accessible with the track data format (DCC, MOTOROLA, ZIMO) but rather direct and exclusively by the cab and/or computer via CAN bus.

The programming is started the same way as the service mode programming for decoders, by first pressing the **"E" key** and **"MAN" key simultaneously,** followed by pressing the **"MAN" key once more** to get to the module programming mode. The digit entered first determines what kind of module is being programmed; according to the list in the display: "1" for MX1, "8" for MX8 and so on.

If an MX8 is programmed with a new address, either enter a **3-digit address** from **801 to 863** (the group number 2 is thereby automatically assigned, which is the most often used group) or enter a **four digit combination** that consists of the **address and the group number (2, 3 or 4).** Confirm with the **"A" key.** (Note that the MX8 in question has to be programmed to the reset-address 800 before it can accept a new address)

If, instead of entering an address, **the "A" key is pressed immediately after the "#8" key,** the existing MX8 address is read out. Only this MX8 may be connected to the CAN bus.

After programming or reading out an address, pressing the **"C" key** starts the procedure for **programming and reading of configuration variables;** which is the same as for decoders with the DCC data format.
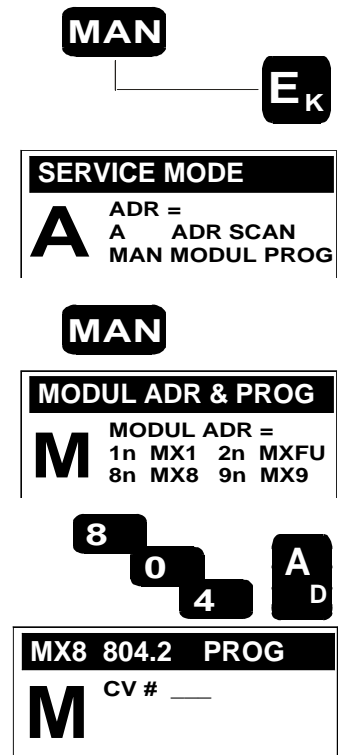
CV's are displayed and counted during programming.

Programming an MX8 to address **"800"** initiates a **hard reset,** which sets all configuration variables back to default values and prepares the module to accept a new address.

Also see MX8 manual !

10.3 Programming of track section modules

Track section modules MX9 (MX9V, MX9B) are accessed by the MX21 cab using addresses from 900 to 963.

The programming is started the same way as the service mode programming for decoders, by pressing first the **"E" key** and **"MAN" key simultaneously,** followed by another stroke of the **"MAN" key** to get to the module programming mode.

The digit entered first determines what kind of module is being programmed; according to the list in the display this is "1" for MX1, "9" for MX9, etc.
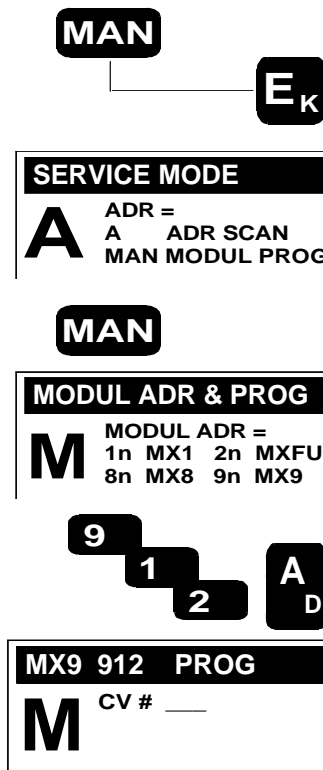
To program an MX9 with a new address (the MX9 in question must be programmed to the reset-address 900 before it can accept a new address), enter a **3-digit address** from **901 to 963** . Confirm with the **"A" key.**

If **the "A" key is pressed immediately after the "9" key** (before entering a number)**,** the existing MX9 address is read out. Only this MX9 may be connected to the CAN bus.

After programming or reading out an address, pressing the **"C" key** starts the procedure for **programming and reading of configuration variables;** which is the same as for decoders with the DCC data format.

Programming an MX9 to address **"900"** initiates a **hard reset,** which sets all configuration variables back to default values and prepares the module to accept a new address.

Also see the MX9 manual !

MAN

E **K**

SERVICE MODE

A ADR =
A   ADR SCAN
MAN MODUL PROG

MAN

MODUL ADR & PROG

M MODUL ADR =
1n MX1 2n MXFU
8n MX8 9n MX9

9
1
2
A **D**

MX9 912   PROG

M CV # ___

Programming

10.4 Programming a turn table module

See MXDS manual !

10.5 Programming of command station, booster

With the MX21 cab, the command station MX1 ("model 2000" or MX1EC) can be accessed with address 100 and boosters with 101 to 105.
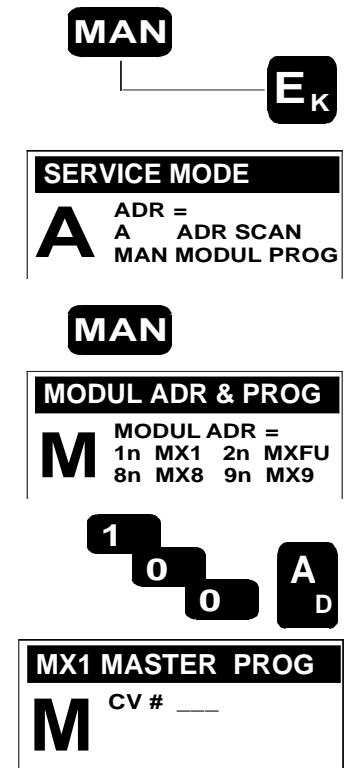
Addresses for command station and boosters are permanently assigned and can not be changed; the following deals with the programming of configuration variables only.

The programming is started the same way as the service mode programming for decoders, by first pressing the **"E" and "MAN" key simultaneously,** followed by another stroke of the **"MAN" key** to get to the module programming mode.

The digit entered first determines what kind of module is being programmed; according to the list in the display it is "1" for MX1, "9" for MX9, etc.

After entering **"100"** followed by the **"A" key** the procedure for **programming and reading out of configuration variables** is started; which is the same as for decoders with the DCC data format.

Likewise for any boosters present, after entering "101" etc.

MAN

E **K**

SERVICE MODE

A ADR =
A   ADR SCAN
MAN MODUL PROG

MAN

MODUL ADR & PROG

M MODUL ADR =
1n MX1 2n MXFU
8n MX8 9n MX9

1
0
0
A **D**

MX1 MASTER PROG

M CV # ___

11. Actuating track section modules MX9

With the cab in "deactivated mode" (after a previously active loco or accessory address was deactivated), enter the desired MX9 address and confirm with the "A" key.

A list now appears in the display showing the occupancy state of all 16 track sections; the two sub sections that are part of the same main section are shown in the vertical.

Use the number keys now to set the speed limits F, L, U, H for each of the 8 main sections.

See MX9 manual !

12. Automatic Operating Sequences (ABA)

This is really a continuation of the E-Function "BAB" in chapter 7; but due to the size and the many expected expansions (including new software versions for the cab and command station), a separate chapter is dedicated to this subject.

What are automatic operations ?

Automatic operations are timely and most often endlessly repeatable executions of loco and accessory commands recorded earlier.

While doing a sample run with a train, all commands issued by the cab for locos (speed, direction, functions) and accessories (switching of turnout and signals) are recorded together with the related points in time. Additionally, so called **"events"** are also being recorded, such as track or reed switch inputs, which are later used to synchronize the recorded sequence with the actual train movement.

There is room for 90 such recordings in the MX1 command station ("model 2000" or EC); in reality though somewhat less, since the total memory capacity is also limited. Automatic operations are stored in "ABA"-groups with addresses from 790 to 799, with 9 elements to each. It is organized in this fashion to take in to consideration the many owners of the old MX2 cab (same address numbers were used for switch ladders).

> **It is recommended to use at least two cabs to do a sample run (one for the ABA procedure and another one to operate the loco and accessories); although it can be done with just one MX21.**


☞ First enter the area of basic automation (BAB), by starting the "E-Procedures"; press:
   Key "E", key "Ü" (= BAB),

   a **capital "B"** is now shown in the display with a table for selecting different kinds of automation.

v Enter a number between 790 and 799 (ABA group) to start recording an automated operating sequence.

> **Also see the MX1 manual (command station) regarding connection, protocols, CV's !**
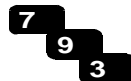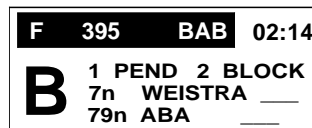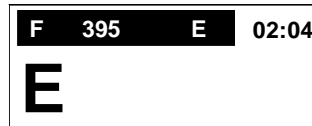
☞ By confirming the previously entered ABA group with the "A" key, a new sub menu opens up for: definition (DEF), running (RUN) and clearing (CLEAR) of individual automatic operating sequences.
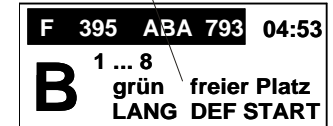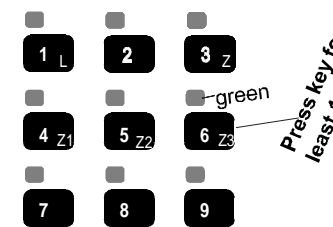   Ü KORRFAHRT = Correcting a stored operating sequence (see next page).
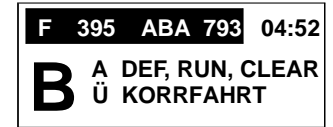
☞ The keyboard is now available to select a desired action, one at a time, with a number key (1...9). The LED's above the keys indicate the following:

   LED above key is green= memory slot is free
   LED above key is yellow = holds ABA data
   LED flashing red/green = recording of a sample run in
       progress

Defining a SEQUENCE with a SAMPLE RUN:

☞ In order to start the definition of an automated operating sequence (ABA), **press** the **key** of a **free memory slot** (green LED)
   for **at least 1 second.**

☞ The LED is now flashing red/green but the recording has <u>not yet</u> started; first, some **parameters** may be entered for this new sequence (optional):
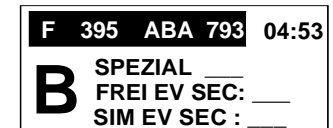
☞ SPEZIAL
   - without input (only "A") = default
   - "1", "A": an automated emergency stop is initiated
               if the next expected event takes longer than
               is programmed to the MX1-CV in question.
   - further special codes (added later).

FREI EV
   - without input (only "A") = default: event can only be unlocked by another event.
   - "1" ... "99", "A": time in seconds after which an event that just happened is unlocked

SIMU EV
   - without input (only "A") = default: no automatically simulated event
   - "1" .. "99", "A": time in seconds after a missing event is simulated by the soft ware
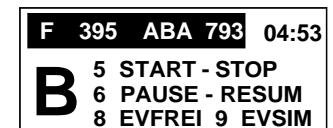
? After the three parameters are selected (or just accepted by pressing the "A" key three times), the screen required during the sample run appears. The system is now waiting for the start key "5" to be pressed; further possible interventions during the sample run are:

KEY "5" (START - STOP)

With this key the recording of a sample run is started. Since time is also recorded, start operating the loco and/or accessories without delay (needless delays will also be reflected when a recorded automatic sequence is played back). The same key is used to end the recording. It only makes sense to end the recording after a train (or several trains) is back at the starting point in order to make a repetitious automated sequence possible.

KEY "6" (PAUSE - RESUME)

This is straight forward. Pressing the key once pauses the recording and pressing it again resumes the same. During the pause, all trains involved are stopped as well as the internal clock, in order to give the user time to think and to prepare for the next steps necessary.

KEY "6" (PAUSE) FOLLOWED BY KEY "5" (= STOP recording while in Pause)

This defines a sequence to be played just once, as opposed to a normal sequence that is recorded to be repeated over and over again (cyclical).

KEY "7" (EVFREI)

Event-free. The last track switch or reed switch that initiated an event is once again "armed", which is ordinarily only possible after another event is triggered or after the time has elapsed that was programmed to FREI EV.

KEY "8" (EVSIM)

An event that is not recognized in an automated sequence due to poor switch contacts could lead to uncontrolled train movements or the cancellation of the route (according to the parameters in "SPEZIAL"). To prevent this, a missing event can be simulated after a few seconds in order to continue with the sequence even if this present sequence can't be properly synchronized.

Additional notes on the definition and use of EVENTS:

As already mentioned at the beginning of this chapter, events recorded and stored during a sample run (actuation of track switches, reed switches, etc.) serve to synchronize a sequence when replayed. That is, the time frame of a sequence is automatically adjusted (e.g. the sequence is accelerated if a train runs to slow that causes an event to be triggered too late).

Difficulties can arise if events are triggered more than once (lighted coaches, helper locos etc.) or events that are intermittent (poor switch-contacts, magnet for reed switches too weak). Thus, a trigger input is rendered ineffective after the event was triggered and is accepted again only after the next event has taken place or the trains direction has changed. A missing event causes the cancellation of an automated sequence.
The default behavior can be modified to the conditions at hand with the above mentioned parameters (and SIMEV) or the intervention during the sample run (EVFREI and EVSIM), .
Also see MX1 manual.

Replaying a stored automated sequence:

? As already explained, entering an ABA group number in the BAB menu opens the sub menu for defining (DEF), running (RUN) and clearing (CLEAR) of individual sequences using the number keypad (1 - 9).

LED above key is green = memory slot is free
LED above key is yellow = holds ABA data
LED flashes yellow = a stored sequence is running
LED flashing red/green = recording a sample run

? To start (run) a stored sequence (yellow LED) **briefly** press the key below the yellow LED.

? The yellow LED starts flashing; all locos that are part of this sequence, according to the sample run, are now automatically acquired by this cab (that is, they are deactivated on other cabs, if present).

? The stored operating sequence, if defined as cyclical, is now carried out until the same key (yellow flashing LED) is **briefly** pressed again.

In case of a non-cyclical sequence, where a sample run is terminated during a pause (see above), the sequence is automatically stopped once the end is reached.
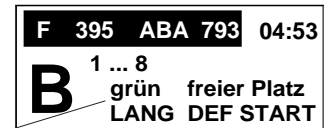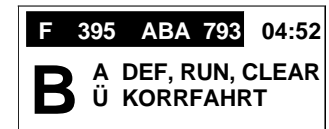
Correcting a stored operating sequence:

? After entering an ABA group number press the "Ü" instead of the "A" key. The operating sequence (to be corrected) is now started normally but can be interrupted with the "Ü" key at which point the normal run switches to a sample run.

Erasing of a stored operating sequence:

? A stored sequence (yellow LED) can be erased by
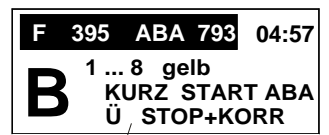
pressing and holding

the key concerned.

```
F   395   ABA 793   04:52
B   A DEF, RUN, CLEAR
    Ü  KORRFAHRT
```

A / D

```
F   395   ABA 793   04:53
B   1 ... 8
    grün   freier Platz
    LANG  DEF START
```

green free slot
HOLD DEF START

These two displays are alternating

yellow holds data
BRIEF START ABA

```
F   395   ABA 793   05:14
B   1 ... 8
    gelb   ABA gesp
    KURZ   START ABA
```

1 L   2   3 Z
4 Z1   5 Z2   6 Z3   yellow
7   8   9

Press key briefly to start (run) a sequence

Ü

```
F   395   ABA 793   04:57
B   1 ... 8  gelb
    KURZ   START ABA
    Ü   STOP+KORR
```

Ü
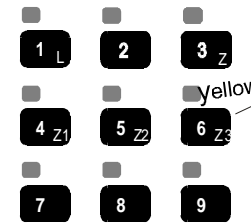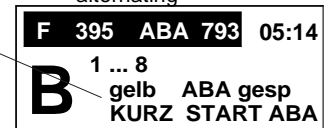
1...8 yellow
BRIEF START ABA
Ü STOP+CORRECT.

13. Actuating a Turntable

TO BE ADDED LATER

14. Radio Cab MX21FU and Radio Base Module MXFU

The radio cab is used in the same way as the tethered cab, since the MX21FU is an MX21 with the necessary radio components and a rechargeable battery pack added.
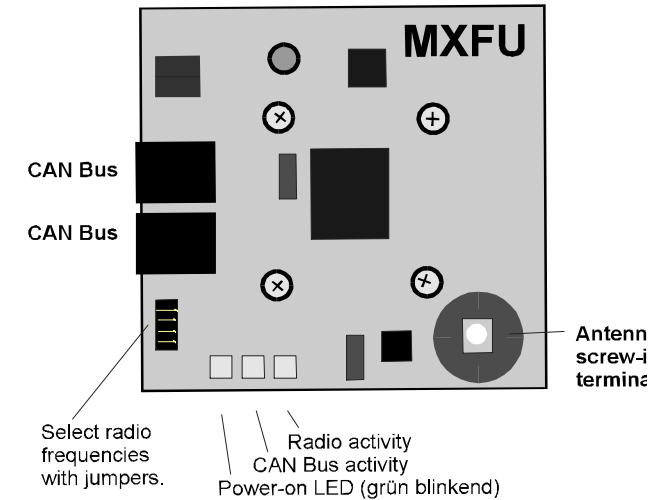
? The radio cab MX21FU is also equipped with a complete **CAN bus interface** and can be used without limitations as a tethered cab. Also, any time the cab is connected to the CAN bus the batteries are recharged automatically.

? The radio communication is **bi-directional.** The cab does not just send information to the command station (loco commands, etc.) but also receives information back (actual loco state). This allows, for example, the controlled exchange of trains between radio and tethered cabs or between radio cabs.

? Furthermore, bi-directional communication also allows the data sent by the cab to be **acknowledged,** which tells the user whether the commands were actually received (indicated by the communications dot in the cab display).

A **radio base module MXFU** is required to operate one or several radio cabs. The base module is connected to the command station with a CAN bus cable .

Three jumpers marked "1", "2"and "4" are provided for selecting between 8 different radio channels (each jumper either on or off). As delivered, all jumpers are bridged, which represents channel 0.

CAN Bus
CAN Bus
Select radio frequencies with jumpers.
Radio activity
CAN Bus activity
Power-on LED (grün blinkend)
Antenn screw-i termina
MXFU

IMPORTANT: INITIALIZE the RADIO CAB MX21FU

Before *the first use in the radio mode* as well as <u>after</u> every configuration change (data format change at the command station, new radio channel selected at the radio base module etc.); *otherwise there will be no communication:*

Before the first use in radio mode, the MX21FU has to be <u>connected to the CAN bus</u> together with the radio base module <u>and briefly operated</u> (with the command station turned on, of course) !

The new cab thereby receives important data from the command station and the radio base module as well as a signature number, so that the cab only communicates with the command station belonging to the set-up and not another ZIMO command station that happens to be in close proximity.

A new initialization process is necessary if the radio cab is connected to a different command station.

Turning the MX21FU on/off in the radio mode:

Contrary to a tethered cab that comes to life whenever the command station is turned on, a cab used in the radio mode needs to be turned on separately: by pressing the *"A" key.*

The cab turns itself off if it sits idle for 10 minutes, the battery is nearly discharged or manually by pressing the *"A" and "E"* key simultaneously.

The display in radio mode:

Basically, the display is identical to the MX21. However, additional information is shown in most active displays:

Antenna Symbol - The length of the mast symbol is an indicator of the field strength while receiving a radio signal (data and acknowledgments sent from the radio base module to the cab). Field strength in the opposite direction, cab to base module, is not indicated but will in most cases be the same.

F	R 1	01:31
Y	**395**	00
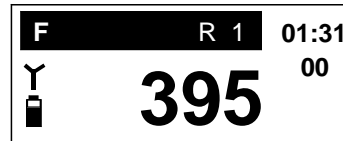
Battery Symbol - indicates an estimated battery charge level.

The rechargeable battery in the MX21FU radio cab:

The MX21FU, when operated in radio mode, is powered by the installed nickel-metal hydride battery (6 cells with a total of 7.2V and 600mA/h capacity). The battery may be changed after opening up the cab (4 mounting screws) but is hardly necessary under normal circumstances.

The cab is operational for 4 hours with a fully charged battery (may vary; depends heavily on surroundings, operating duration, illumination etc).

The radio cab can be used as a tethered cab by connecting it to the CAN bus, which at the same time also charges the battery. An alternative power source (20 - 30V DC) can also be used. The built-in fast charger recharges the battery in about 2 hours.

The current state of charge and the recharge in progress is indicated with the LED above the "9" key, in addition to the battery symbol in the display:

red flashing (in radio mode): State of charge is less than 20 %
(Cab will turn itself off in a few minutes).
red solid (in tethered mode):   Recharging
green solid (in tethered mode):   Battery is fully charged.

Noteworthy characteristics in radio mode:

Whether or not a radio communication is established is indicated to the user by the *communications dot in the display.* When actuating the cab (address activation, speed changes, directional change, function, etc.), the communications dot lights up and remains lit until an acknowledgment is received from the radio base module. A communications dot that remains lit for an extended period of time indicates that the communication is interrupted (e.g. distance too far or other sources of interference).

"AAF" is displayed if the communication is down completely.

If several radio cabs are in operation, they should not be in close proximity to each other; a minimum distance of 1m (3 feet) between two cabs is recommended.

The Antenna (enclosed with the MXFU and MX21FU):

The radio base module MXFU should never be operated without the antenna. Screw the antenna to the terminal through the opening of the cover.

The radio cab may be used without the antenna for short distances (@ 20m (60 ft.) and only few obstacles). Otherwise please mount the antenna !

Actions to take in case of radio communication interference:

There are 8 frequencies (channels) to choose from, selectable with jumpers next to the CAN bus sockets, in order to eliminate interferences coming from other radio equipment. After a frequency change is made, connect the radio cabs briefly to the CAN bus to initiate communication.

8 combinations and therefore 8 different channels are possible with the three jumpers marked "1", "2", "4". All jumpers bridged (as delivered), represents channel "0".

The signature number mentioned at the beginning of this chapter can be changed in the MXFU by means of a CV, in case two systems with the same number are operated close by.

15.   MX21 and MX21FU Software-Update

Update procedure via Computer and MX1 WILL BE ADDED LATER !

Proceed as follows when replacing the micro controller instead of an online update:

Open the cab by removing the 2 Phillips screws on each side of the cab. The micro controller (EEPROM) is plugged into a socket located on the board that is mounted in the front half of the cab housing

Pull out the old controller. Make sure that the new controller is mounted in the proper position and neither the socket nor the printed circuit board is being damaged.

16.   Notes about converting a MX2 to a MX21

Under certain conditions "old" MX2 cabs can converted to an MX21:

- only MX2 with the housing screws on each side are suitable (when the MX2 was phased into production, some cabs were produced with screws mounted from the bottom up (beneath the plastic feet), which are not suitable for a conversion).

- The conversion can be done by the consumer with sufficient electronic experience and provided the necessary tools are at hand (solder tool with small tip, preferably a de-solder station, pliers, etc), or by an electronic technician. Check with your ZIMO dealer.

- the following models can be converted: MX2 to MX21, MX2IF to MX21 (infrared function will be lost); it is not possible to convert a MX2 to a MX21FU or MX21IF to a MX21FU. Converting a MX2FU to a MX21FU is technically possible but involves many components and is rather expensive. Can only be done by ZIMO.

ZIMO offers the *MX21PLAT* conversion kit that contains the following parts:

\# The upper MX21 board with all components installed including the graphic display.

\# A strip of foil that acts as a reflector for the illumination of the new display.

\# Two new self-adhesive decals.

Important steps to follow during the conversion:

- Remove the two screws on each side of the cab. Remove the MX2 board and the switch membrane from the front housing half.

- Pull off the old MX2 decals.

- Rework the front housing half by grinding or cutting the display opening in such a way that the new MX21 display fits the opening.

- Apply the new MX21 decal to the cab (it is in some cases necessary to cut off a small strip of the decal at the right edge).

- Check the opening for the "A" key. If necessary enlarge the opening in the foil and/or housing.

- Bend and tape together the mirror foil so that it fits into the display opening of the circuit board. Use the old MX2 foil as a sample.

- Remove the flat cable between the upper and lower circuit board. Solder the flat cable from the new MX21 upper circuit board to the lower circuit board.

- Reinstall the switch membrane and the upper circuit board to the front half of the housing.

- Reassemble the two housings and install the four screws.

If the housing is also being repainted with the new color, the lower circuit board needs to be removed before the painting. Additionally, the decal needs to be trimmed at the top and right side by about 0.5mm.

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