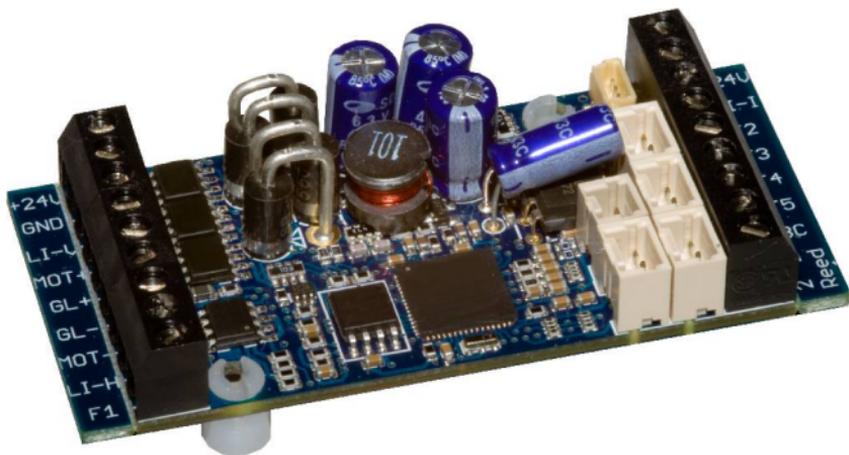


# Massoth<sup>®</sup>



## eMOTION XLS Sound Decoder

Version 2.5 - 01/10

# **! ATTENTION !**

**The factory setting of the light and function outputs is full track voltage!**

**Make sure that the outputs are set to the appropriate value according to the CV list (page 32 and on) before hooking up the lights or other units.**

**We cannot be held responsible for damages if this is disregarded.**

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## 1. General and safety details

Congratulations on your purchase of an eMOTION XLS Sound Decoder. The eMOTION XLS Sound Decoder is an exceptional, high-performance Digital Decoder designed for G-Scale by Massoth Elektronik GmbH, Germany. We highly recommend reading this manual and the documentation carefully and thoroughly before operating your eMOTION XLS Sound Decoder.

Massoth Elektronik GmbH used the latest in technology in designing and manufacturing the eMOTION XLS Sound Decoder. Excellent operation at all times is assured by the high safety standard in data processing and by

delivering an exceptional power output and performance. Future alterations in the DCC standards are easily implemented in the eMOTION XLS Sound Decoder by updating. The latest Flash-Technology is utilized in the eMOTION XLS Sound Decoder to provide a safe and consumer-friendly operation during updating.

## 1.1. Layout of Terminals

- 1 x eMOTION XLS Decoder**
- 1 x Manual**
- 1 x Speaker**
- 1 x Interface-cable for LGB**
- 1 x Interface-cable for ARISTOCRAFT DCC**
- 2 x Screws**

## 2. Important information for the operation

Install your decoder in compliance with the connecting diagram in this manual. The decoder is protected against shorts and excessive loads. However, in case of a connection error e.g. a short between a light and the motor, this safety feature cannot work and the decoder will be destroyed subsequently.

The decoder is originally programmed on address #3 with 14 speed steps. In case you want to use a high address, you have to program CV17, CV18, and CV29 accordingly. If you want to use 28 speed steps you need to set CV29-Bit1 to "2". Otherwise the lights might not work or may flicker.

### Properties of the eMOTION XLS Sound Decoder

#### ***Decoder functions:***

- Loco decoder for digital and analog operation
- Motor output max. 3 Amps (or 2 motors with 1.5 Amps each)
- 3 light outputs with 300 mAmps each (front, rear, interior)

- 8 function outputs 4 with 600 mAmps each (F1-4), 4 with 10 mAmps each (F5-8)
- Overload and excess temperature protection for motor and functions
- Hookup utilizing 18 C-clamps
- Easy installation with 2 plastic brackets and screws

### ***Sound functions:***

- 6 channel play-back (6 sounds at the same time)
- 1 Watt amplifier for 8 Ohms loudspeaker
- Memory capacity for max. 200 sec of recorded sound
- 4 driving sounds and 12 side noises selectable
- Play-back frequency 10 kHz – 16 kHz
- Pulse generator interface for synchronization and reed switch terminal for manual function triggering
- Volume control by potentiometer or CV programming (also individual Sounds)
- Sound functions usable in analog mode
- Sounds and software changeable

### ***Digital and analog properties:***

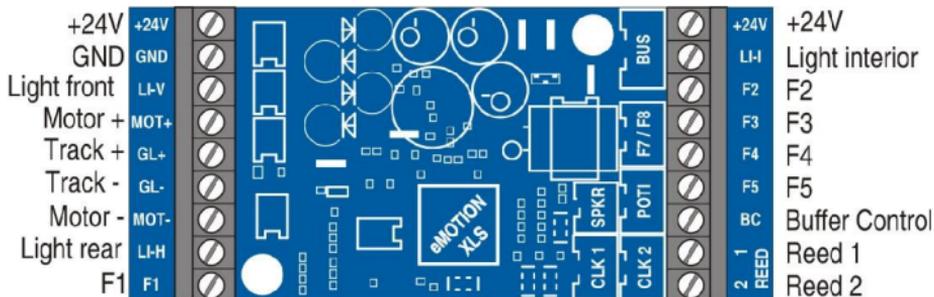
- 10239 programmable locomotive addresses
- 4, 28, and 128 speed steps
- Programmable driving curve
- Adjustable start, mid, and max. speed
- Adjustable acceleration and deceleration
- Adjustable motor frequency
- Load control for digital and analog mode (pat.pend.)
- 16 functions (selectable) NMRA compatible
- Switching speed and acceleration/deceleration selectable with F-key
- Parallel and serial control for all light outputs and function outputs, including triggering of parallel updated sound boards (LGB®)

- Comfortable function mapping (parallel and serial) with direction assignment
- Programmable flashing light and short term functions
- Dimmable light and function outputs, usable in analog mode
- Many settings may be used in analog mode
- Update feature
- Comprehensive reset functions for all Configuration Variables (Cvs)
- Bus connector for SUSI interface and LGB-control

## 2.1. Installation and Hook-Up

Installation of the eMOTION XLS Sound Decoder is very basic and straightforward. The eMOTION XLS Sound Decoder comes with a basic set of cables and screws required.

Please note the terminal assignments shown in the following illustrations and pay attention to the factory preset function outlet assignments of F1 to F6. These outlets need to be set according individually to your personal needs.



*Illustration 1: Contact Assignment with Pulse Generator, Loudspeaker, ext. Poti, F7/F8 and Bus connector (upper side)*

### 2.1.1. Connectors on the Upper Surface

The eMotion XLS Sound Decoder features six additional connectors on the upper side (see illustration 2).

CLK1 is the connector for an external pulse generator, CLK2 is the

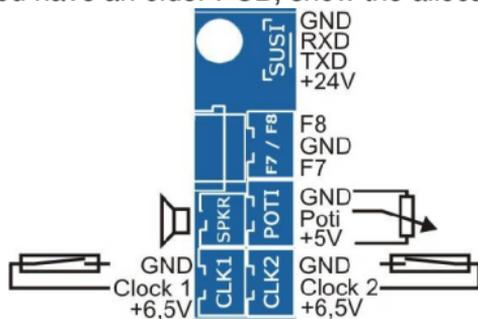
connector for a second pulse generator (current not connected), e.g. for Mallet locomotives. These connectors are custom made for the connection with our pulse generator unit #8242030. Alternatively a reed contact may be utilized as pulse generator (see illustration 2). The SPKR connector connects a loudspeaker to the eMotion XLS Sound Decoder, and the POTI connector connects an external potentiometer (4.7K Ohms) to the decoder to facilitate manual volume control. A potentiometer board is available with the item # 8242010.

The F7/F8 outputs are accessible with a connector port or as solder pads on the reverse side. **Please do not use both connections at the same time!** Please note that the F7/F8 outputs are designed for a max. load of 10 mAmps only.

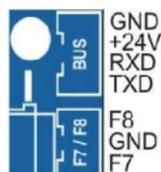
The bus-connector is provided to control e.g. pantographs or pulsed smoke generators. The bus connector may be programmed by LGB control or soon on SUSI interface.

**The illustration shows the allocation of the connectors (see Illustration 2)**

If you have an older PCB, show the allocation like Illustration 3.



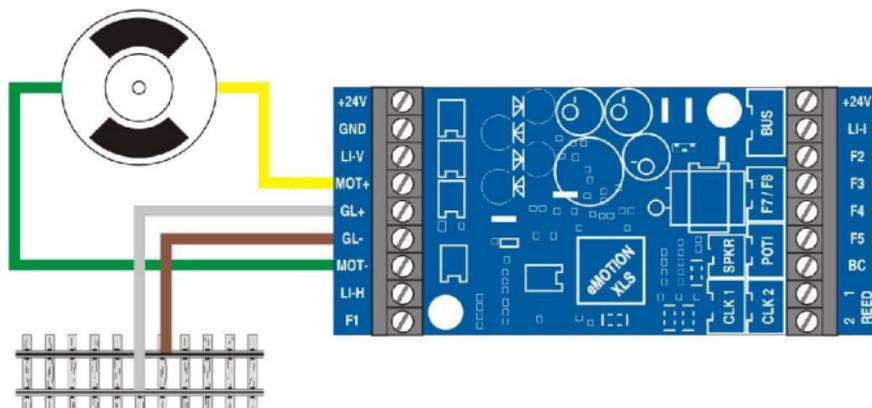
*Illustration 2: Assignment of connectors*



*Illustration 3: Assignment of old Massoth-Bus*

You may utilize the cable-set item # 8312108 to connect to the terminals in illustration 2. The cable set comes with preinstalled connectors.

The color coded wires needed for the installation come with the decoder. Connect the wires to the decoder and the motor and power shoes or gear box according to the schematic.



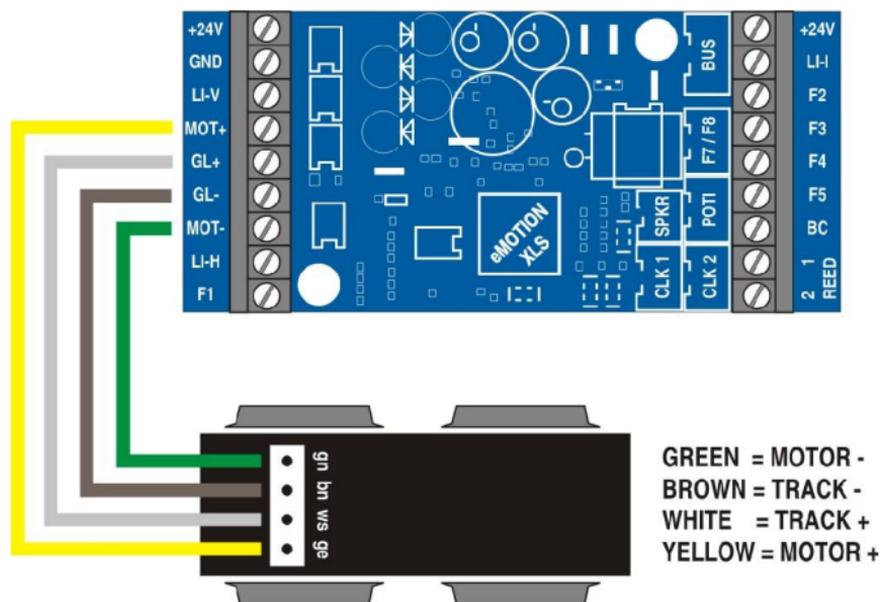
*Illustration 4: Installation of the eMOTION XLS Sound Decoder*

Color code of the eMOTION XLS Sound Decoder:

|        |         |                                    |
|--------|---------|------------------------------------|
| YELLOW | Motor + | (Motor in driving direction left)  |
| WHITE  | Track + | (Track in driving direction left)  |
| BROWN  | Track - | (Track in driving direction right) |
| GREEN  | Motor - | (Motor in driving direction right) |

### 2.1.2. Setup with a LGB® gear box

All current LGB® gear boxes feature 4 contact pins on the upper side. To utilize these gear boxes for digital operation the pins must be connected to the eMOTION XLS Sound Decoder according to the schematic below. Very old LGB gear boxes have 3 contact pins only. These gear boxes need to be changed for digital operation. One pin is connected to the motor and the track. This must be disconnected as the motor and the track must be isolated for digital operation.



*Illustration 5: Connection eMOTION XLS Sound Decoder to a LGB Gear Box*

## 2.2. Manufacturer's settings of the eMOTION XLS Sound Decoder

These are the most important factory settings of the eMOTION XLS Sound Decoder:

- **Loco address 3**
- **14 speed steps** (compatible to MTS I, II and III)
- **Light outputs deliver full voltage** (for 19V/24V bulbs)
- **Start locomotive engine/ engine shut down** (Diesel/Electric) F5
- **Cylinder side noises on/off** F5 (Steam)
- **Sound (amplifier) on/off** F6
- **Time delays on/off** F16
- **Switching speed on/off** (half speed) F8
- **Function output F1 (Steam) on/off** F7
- **Function outputs F2 to F8 conform with function keys** F2 to F8

## 2.3. Installation

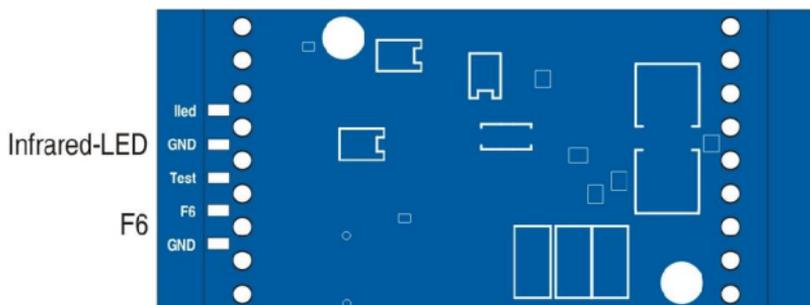
Please make sure that no electronic component is damaged on installation. Mishandling may subsequently render a repair.

## 3. Advanced setup

Listed below you will find all other functions the eMOTION XLS sound decoder features besides the basic functions already mentioned in chapter 2.2.

### 3.1. Connectors on the lower surface

Two solderable contacts are located on the lower side of the eMOTION XLS Sound Decoder where an Infrared LED for data transfer and 1 function output (F6) may be connected.



*Illustration 6: Contact Assignment of the Solderable Contacts (lower side)*

### 3.2. Installation of the eMOTION XLS with a LGB® interface

Using the LGB® decoder interface cable the eMOTION XLS can be easily installed in LGB® locomotives with a decoder interface. The light and sound functions will be handled via this cable. The LGB® interface cable may be purchased as LGB® item No. 55026. Remove the female crimp contacts and remove 1/8 in of the insulation. Screw the wires to the eMOTION XLS terminals according to the wiring diagram. Adjust the Dip switch at the interface in accordance with the LGB operating instructions. **Neglect can lead to the destruction of the Decoders!**

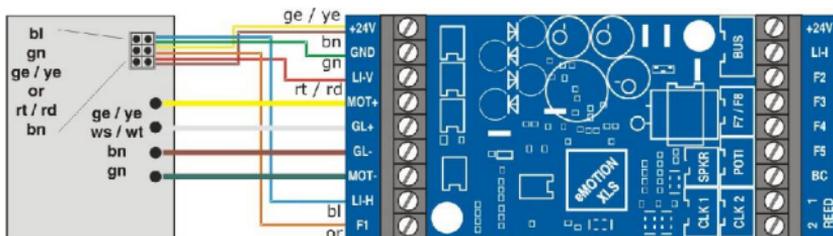


Illustration 7: Installation in a Loco with LGB® Decoder Interface

### 3.3. Connection with the DCC interface cable

Current LGB® locomotives (with DCC interface only) or those from Aristocraft are provided with an interface for digital components. For installation use the interface cable provided. Remove the dummy plug from the loco board.

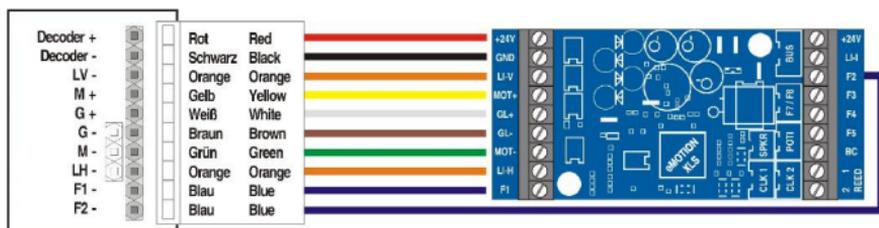


Illustration 8: Using the DCC Interface Cable with LGB® DCC Interface

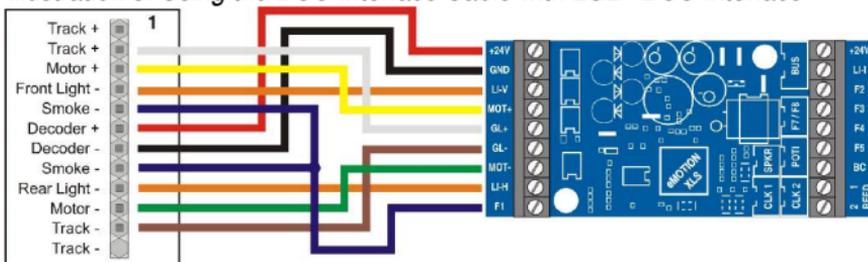


Illustration 9: Using the DCC Interface Cable with the Aristocraft DCC Interface

Please note the amperage of Aristocraft® locomotives. Big Aristocraft® locomotives may be equipped with up to 4 motors and take up to 6 Amps of driving current. We strongly advise to use two decoders in these cases.

### 3.4. Massoth bus interface

Components featuring a digital control function (e.g. the Massoth Pulse Smoke Generator) may be connected to the Massoth bus interface.

### 3.5. Light and function outputs

The eMOTION XLS Sound Decoder features 3 light outputs, front light, rear light, and interior light. The front light and rear light are switched according to the driving direction, the front light output is “on” when driving forward, and the rear light is illuminated when driving in reverse. The interior light is steadily “on” when the lights are switched “on”. You may use this function to illuminate the interior of the cab of your locomotive or to illuminate the connecting rods of a steam locomotive or to implement the typical rear light of RhB locomotives because these lights are always “on”.

Please observe the total current drain of the connected bulbs. The limit is 300 mAmps per output.

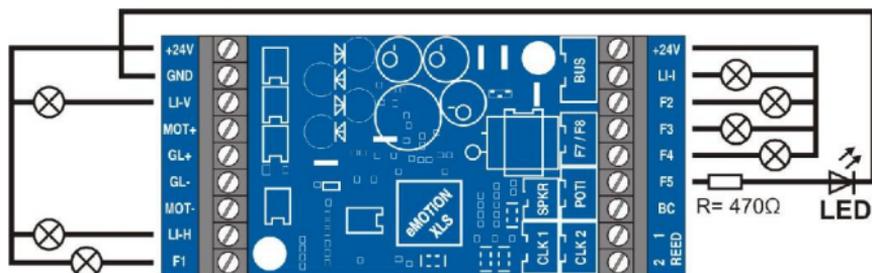


Illustration 10: Connection Scheme of the Light and Function Outputs

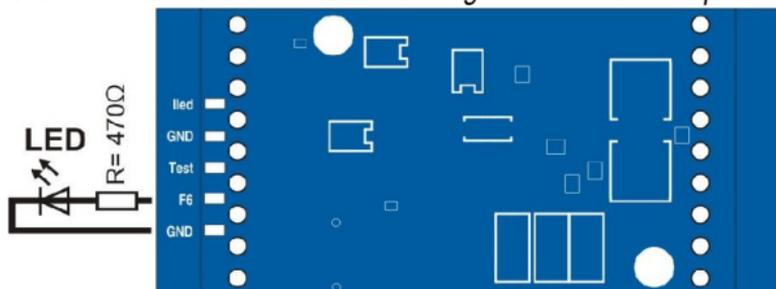


Illustration 11: Light and function output on bottom side

In addition to the 3 light outputs, the eMOTION XLS Sound Decoder features 8 separate function outputs which may be used in different ways. Five outputs are located on the upper side as clamps, two additional outputs on a jack (F7/F8) and one on the rear side as solderable contact (F6).

The factory setting of the light and function outputs gives full track voltage to them. With 24 V on the track the outputs will deliver 24 V when activated.

The voltage supplied by the outputs 5 to 8 is 5Volts, and the maximum allowable load is 10 mAmps.

The function (e.g. F-key assignment, light display according to driving direction, flashing and short term function) as well as the voltage of each output may be programmed by setting the respective CVs. For details please review the CV-table.

The outputs may be controlled by NMRA/DCC commands or with serial LGB® pulse strings. The light outputs and the outputs F1 to F4 are dimmable.

NOTE: The proper operation of the light functions depends on the selected speed steps. In case CV29 (speed steps) does not carry the same setting as the digital system the lights may flicker or might not work at all (not relevant for 128 speed steps)

### **3.6. Power buffer hook up**

The eMOTION XLS features a separate connector for power buffers (Massoth 8151001 + 8151501).

The power buffer bridges brief power interruptions caused by contaminated tracks or bad power supply on switches. The power buffer is to be connected to the connectors marked “+24V“ (rt), “GND“ (sw) und “BC“ (ws) on the decoder board. The maximum charging Amperage is 500mAmps.

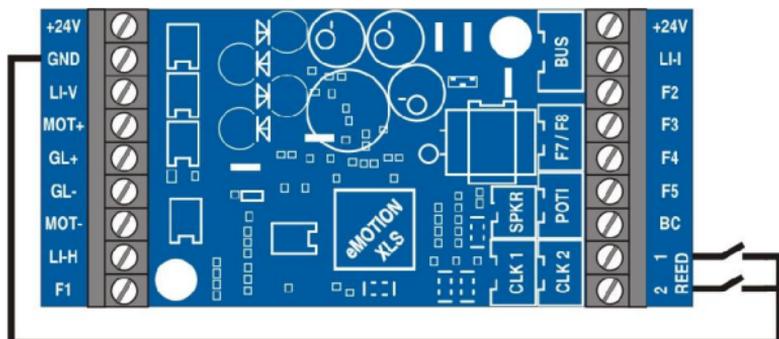
The power buffer works in analog as well as in digital operation. In analog eMOTION XLS Sound Decoder

operation the power buffer works fully automatic. After the locomotive has stopped, the power buffer switches off the decoder after the standing noises were released.

The lag time of the sound may be set in digital operation in CV 129, in analog mode in CV 130.

### 3.7. Reed contacts to trigger bell and whistle by track magnets

You may utilize up to two reed contacts to trigger sounds with track magnets. The CV configuration (CV 190, 191) defines which sound is to be triggered by which reed contact. A special feature is the possibility to trigger a sound depending on the driving direction (to activate use CV149 Bit4).



*Illustration 12: Connection Scheme for Reed Contacts*

### 3.8. Motor control

Depending on which the digital system you are utilizing different speed steps can be used. The more steps you use the smoother the throttle works. In garden G-Scale 14 speed steps are used and 28 speed steps are recommended when supported by the digital system.

- The direction of driving (including the direction related functions) can be defined by setting CV29 - bit0 accordingly.

- Three settings of speed control are available:  
14 speed steps (CV29 – bit1 = Off)  
28 speed steps (CV29 – bit1 = On)  
128 speed steps (is detected automatically)

Using the eMOTION XLS Sound Decoder with LGB® MTS I or II requires a 14 speed step setting. This is the factory setting of the decoder.

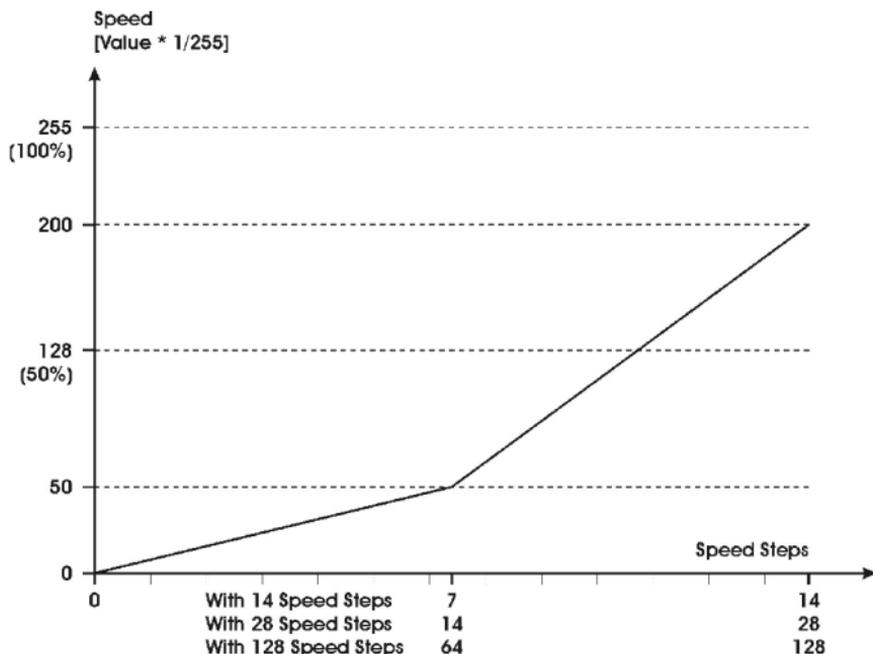
Several CV settings in the eMOTION XLS Sound Decoder influence the acceleration and deceleration characteristics of the locomotive. The acceleration/deceleration characteristic is defined by 2 CVs:

- Acceleration delay (CV3)
- Deceleration delay (CV4)

The time lag between speed 0 and the maximum speed (or reverse) is 0.5 sec if the setting is “1”, maximum possible is 128 sec (setting “255”). Simply multiply your desired time delay with “2” to acquire the respective CV setting.

## **Driving curve**

The speed characteristic of the locomotive is defined by the driving curve which is programmed by 3 CVs. The standard driving curve is linear.



*Illustration 13: Internal Driving Curve of the eMOTION XLS Sound Decoder, Adjustable with CV2 (Starting Voltage), CV5 (Maximum Speed), CV6 (Mid Speed)*

Recent decoders like the eMOTION XLS Sound Decoder feature 3 CVs to define the speed parameters. The basic setting of the eMOTION XLS Sound Decoder is shown in the illustration above.

- The start voltage (CV2) defines the driving voltage of speed step1. The smaller the voltage the slower the locomotive drives. If the PI-Load Control is “off” and the locomotive does not move in speed step 1, the start voltage should be increased.
- The maximum speed (CV5) may be reduced by inserting smaller values.
- The mid-speed (CV6) defines how many speed steps are available. In the case CV6 is half of the value of CV5, all speed steps are distributed equally. In case CV6 is smaller than half the value of CV5 the

locomotive will drive slower at mid-speed; the slow speed range will be extended.

As an alternative you may program the driving curve individually in 28 speed steps (CV67 - CV94). This driving curve is activated by CV29- bit4. In this case the CVs 2, 5, and 6 are deactivated!

## Motor control frequency

Basically the motor runs quieter and smoother when the control frequency is increased. The motor control frequency is defined in 4 steps by CV9. At 24 kHz the motor is operated at its optimum and runs very quiet. A few types of motor may require a lower setting if they do not run smoothly or get hot. The integrated load control works only with 24 kHz. The eMOTION XLS Sound Decoder is usable with all kinds of DC motors.

## Load control

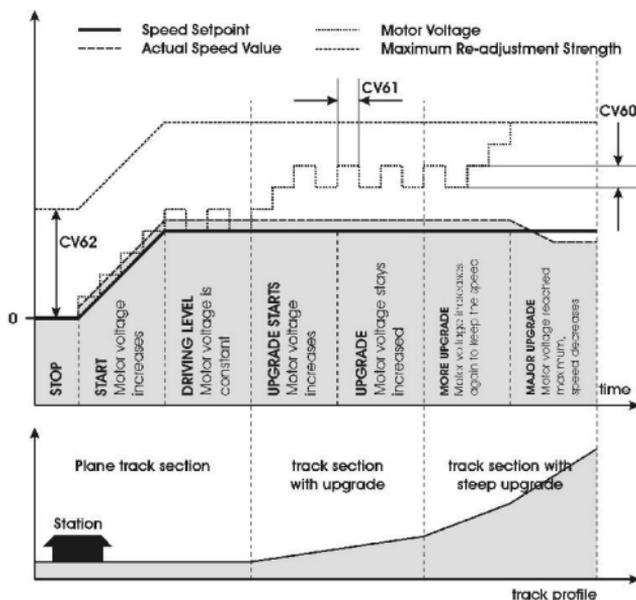


Illustration 14: Operating Modes of the PI-Load Control

The eMOTION XLS Sound Decoder monitors the driving performance of the locomotive and regulates the driving voltage. The load control governs the speed of the locomotive regardless of up or down grades or the length of the train. This means the decoder delivers more voltage to the motor(s) if the locomotive is running uphill in order to keep the speed constant. The eMOTION XLS Sound Decoder is equipped with a state-of-art integrated PI-Load Control (proportional-integral) that can be programmed efficiently by 3 CVs. These 3 CVs define the characteristics of the PI-Load Control by the following parameters: maximum re-adjustment factor (allowed readjustment per adjustment interval), re-adjustment retardation (frequency of the adjustment intervals), and maximum re-adjustment strength (maximum re-adjustment to the speed setpoint).

### **Maximum re-adjustment factor (CV60)**

The maximum re-adjustment factor sets the range of change per re-adjustment interval for the motor voltage, input range is 0 ... 255. The larger the value the more aggressive the decoder will react to load changes. In the most extreme cases the locomotive will overcontrol and tend to drive jerky during load changes.

### **Re-adjustment retardation (CV61)**

The re-adjustment retardation defines how often the eMOTION XLS Sound Decoder is allowed to re-adjust per second. Increasing the value means an increase of re-adjustments per second. The eMOTION XLS Sound Decoder is able to perform up to 4000 adjustments per second. The basic setting is "60". This results in a leisurely and realistic control characteristic. Formula:  $4000 / (\text{CV-value}) = \text{Number of adjustments per second}$

### **Re-adjustment strength (CV62)**

An example will explain this matter best: The motor voltage is insufficient

to keep the speed as the load increases. The PI-load control kicks in and regulates (increases) the motor voltage accordingly to make sure the locomotive continues with the same speed. The re-adjustment strength is the maximum allowable voltage to achieve the required speed. The selectable value range is 0...255. The basic setting is “255”, the maximum strength. This means the eMOTION XLS Sound Decoder is allowed to increase the motor voltage up to the track voltage if so required. If you lower this value you set a ceiling for the motor voltage which must not be exceeded. This might meet reality closely as the power reserve of real locomotives is not unlimited. Entering a track segment with an upgrade the locomotive will be only partially able to cope with the new power demand and will decrease the speed at some point. With the setting at “128” the readjustment is limited to 50%. In case the locomotive reaches this limit, a speed decrease will occur under an increased load. The basic setting of the PI-load control is set to “fast”. This enables fast speed changes but may result in over regulating and thus to bucking. The PI-load control may be switched off in CV49.

### **Slow approach load control (Back-EMF) triggering level and regulation time (CV63) (from version 2.5)**

CV63 controls the load control at slow approach operation. The CV-value is an addition of two values: triggering level and regulation time.

The triggering level defines the switchover point from slow approach load control to regular load control. (The value is always a multiple of 16; but limited to max 15 x 16.) Every value corresponds to 16 of the total of 256 internal speed steps.

The regulation time (comp. CV 61) adjusts the speed of load control regulation (value 1...15; 1= fast; 15 = slow regulation).

Example (factory default):

3 Steps at 16 = 48 + reg. time 12 = value 60

### **3.8.1. Special driving functions**

#### **Switching speed**

The maximum speed is reduced by half to facilitate a more effective driving characteristic during switching. This feature may be set on any programmable function key. With CV59 = 0 the function is "off". Values between 1...16 define the number of the function key. The basic setting is "8".

#### **Dis-engageable acceleration/deceleration times**

Disabling acceleration value and braking value: the programmed values of CV3 and CV4 may be reduced to a minimum by a single keystroke. With CV64 = 0 the function is "off". Values between 1...16 define the number of the function key. The basic setting is "7".

#### **Automatic Braking (since V1.3)**

There are two methods to stop a train in front of a stop signal automatically. The first method uses DCC brake signals produced by a booster with a braking module (Broadcast), the second method utilizes a DC signal (Brake-On-DC). For both methods a track portion in front of the signal must be totally isolated and powered by the respective signal. For Brake-On-DC the option for analog operation must be blocked (CV 29, Bit2). Please check your DCC system manual for further information.

#### **Starting Inhibit (since V2.2)**

The Dekoder possesses a starting check function in CV 150 for digital or analog mode that can be activated. If the appropriate bit is set, the locomotive starts only after the complete start-up phase is final in the sound. This function is adjustable only for E-Locos.

#### **Electronic Parking Brake (since V2.1)**

You may activate an electronic parking brake in CV49. This feature prevents a heavy train from moving once it is parked on a downhill track

section. The brake is only set with the throttle (dial) in the "0" position. The brake is released automatically if the throttle is moved out of the "0" position. See attachment 2 (page 38).

### **Pausing time during shuttle operation**

Programming a pausing time in a simple shuttle operation in analog and digital mode with stopping times can be achieved. With CV58=0 this function is deactivated, values between 1 and 255 define a waiting time in 1 to 255 seconds. The activated pausing time is executed only if the driving direction is reversed during operation, e.g. by an analog electronic shuttle control. In case the locomotive is stopped and started in the same direction, the pausing time will not be executed.

### **3.9. Analog mode**

In analog mode the eMOTION XLS Sound Decoder is fully functional with as little as 5V track voltage. The operation in analog mode may be deactivated with CV29–Bit2. The eMOTION XLS Sound Decoder features an internal motor characteristic curve which enables a smooth operation by measuring the track voltage. An analog load control (pat.pend.) may be activated (CV49–Bit2).

The 3 light outputs are always activated according to the driving direction. The 6 function outputs (CV13) may be activated in analog mode also, including the dimming and flashing features.

### **4. The Sound in the decoder**

The eMOTION XLS Sound Decoder contains a driving decoder as well as a full fledged digital power amplifier which reproduces all sounds and side noises of a locomotive in high quality and very realistically. The eMOTION XLS Sound Decoder produces a locomotive's prototypical operating sound as well as an array of additional sounds which may be utilized according to your taste and needs. This allows you to individualize locomotives of the same type.

The eMOTION XLS Sound Decoder manages up to 16 sound functions (F1 to F16 according to the latest NMRA/DCC standard). The memorized sounds are assigned to functions and function commands by CV programming. The CV settings of the eMOTION XLS Sound Decoder may vary depending on the original locomotive and the sounds stored in the memory.

## **Sound and function assignment**

Each locomotive displays certain sounds and side-noises which are characteristic for the respective type of engine. In addition to the basic sounds each eMOTION XLS Sound Decoder carries sounds and side-noises which are individually assigned and therefore can not be listed in this table. Each eMOTION XLS Sound Decoder carries up to 12 sounds and side-noises which are assigned to the F-keys. Besides the sounds other functions are assigned, e.g. sound on/off, accel./deceleration on/off, switching speed on/off. The sounds and the functions may be assigned to the 16 F-keys by CV-programming. You may alter the F-key assignment at any time according to your personal needs and move for example the braking sounds from F3 to F12. Or sounds may be switched off completely. In-depth information can be found in the CV-Tables as well as in the corresponding attachments, starting at page 30.

**Important:** In case the F-key assignment is greater than F12, CV49=Bit0 must be set to „0“ (only parallel data processing)

### **4.1. Driving sounds**

The driving sound vary with the locomotive type: steam, diesel, or electric.

#### **4.1.1. Steam locomotive**

##### **Start up the locomotive**

During the engine start up the noise of leaking steam is produced.

##### **Standing noises**

The noise of the leaking steam is produced in the background all the time.

After a run the locomotive produces the programmed standing noises. These noises may contain an air pump, coal shuffling, pressure relieve valves or the generator. The noises will be produced only once, but with the use of the random generator these noises may be produced in random order.

### **Driving sounds**

The steam sound varies with the speed of the locomotive, additionally the cylinder side noises are produced. This sound derives from leaking steam at the cylinders and it sounds like a hissing noise in synch with the chuffs.

### **Shut down of the locomotive**

The steam noise stops.

## **4.1.2. Diesel locomotive**

### **Start up of the engine**

First a compressor starts, thereafter the main engine starts.

### **Standing noise**

The Diesel engine runs in idle as the locomotive rests. A compressor may start or excessive air pressure may be released depending on the programmed sounds.

### **Driving sound**

The Diesel engine produces a sound depending on the speed of the locomotive.

### **Locomotive shut down**

The Diesel engine is switched off and the sound of the engine running down is produced.

## **4.1.3. Electric locomotive**

### **Locomotive start up**

If available the sound may start with the sound of the air valve. Thereafter the main switch is flipped and the compressor starts. The sequence is completed by the sound of the starting cooling fan.

## Standing noises

The standing noises consist of the sound of the cooling fan only.

## Driving sound

While driving, the sound of the driving motor is produced, depending on the speed of the locomotive.

## Locomotive shut down

First the cooling fan stops, the the vacuum pump starts. The sequence is completed with the main switch.

## 4.2. Additional sounds

### 4.2.1. Sound selection, number of loops (endless loop) and volume

Additional sounds may be triggered by F-keys e.g. operational sounds of the locomotive, whistle, bell, generator, compressor, or station announcements. The allocation of these sounds is accomplished by CV settings (configuration variables).

The whistle, sound #1, is assigned to CVs 131, 151 and 201. The whistle with echo, sound #2, is assigned to CVs 132, 152 and 202, and so on.

The first CV contains the number of the F-key, which triggers the sound, in this case "1", which stands for F-key 1.

CV151 contains the number of loops (repetitions) of the sound. The sound will be repeated once if the CV contains a "1", twice if the CV contains a "2", and so on.

The sound may be repeated up to 15 times. In case "16" is set in CV 151, the sound is repeated endlessly. This means, the F-key switches the sound on and it will stop only after the F-key is switched off again.

The volume of each sound may be programmed separately in steps of four:

3 = max. volume

2 =  $\frac{3}{4}$

1 =  $\frac{1}{2}$

0 =  $\frac{1}{4}$

This value is set in CV201 for sound #1, in CV202 for sound #2, in CV203 for sound #3, etc.

### **4.3. Automatic sounds**

#### **4.3.1. Starting signal**

The engineer gives a warning signal with the whistle shortly before the train starts moving. The sound for this starting signal is defined in CV 188/189. No sound is produced if this CV contains a "0". The factory setting of the eMOTION XLS sound decoder defines a 30 sec. Pause between two starting signals. This means, the locomotive has to rest at least 30 sec. To trigger the next starting signal. The pause time may be deactivated in CV149 by subtracting 64.

#### **4.3.2. Operational noises**

During acceleration a multiple contact switch is operated in an electric locomotive. The sound used is defined in CV234. The speed at which this sound is produced is set in CV229 and CV233. These values are for digital mode. The decoder computes the stages for the analog mode, as an offset is added of 80.

#### **4.3.3. Braking noise**

This sound is produced automatically when the locomotive is slowing down for stopping. This feature is activated per factory setting. The activation of the braking noise is achieved by setting CV149 to "32". Two threshold values may be set for this feature: CV168 (factory setting "64") is the unblocking threshold. A locomotive has to accelerate to a predefined speed to enable the braking noise when slowing down. Next the locomotive has to fall below a predefined speed to trigger the braking noise (trigger threshold) CV169 (factory setting "30"). The braking sound is produced until the locomotive stops or until it accelerates again. These thresholds have a programmable range of 0...255, 255 being the maximum speed. In case a locomotive is generally operated at very low

speeds, CV168 may be lowered to e.g. "32".

#### **4.3.4. Random generator**

The random generator handles a maximum of 4 sounds. The number of the sounds are set in CV180 to CV183, the number of loops are set in CV184 to CV187. The frequency of occurrence is set in CV179, 1 = frequent occurrence to 3 = infrequent occurrence.

The random generator is activated by adding "1" to the CV149 setting (to set Bit 0).

#### **4.3.5. Standing noises**

The standing noises is a series of max. 4 sounds which are produced after the locomotive has stopped. These sounds are activated by adding "2" to the CV149 setting (to set Bit 1). The sounds are defined in CV171 to CV174 and the loops in CV175 to 178.

### **4.4. Loudspeaker + external volume control**

#### **4.4.1. Total volume**

The total volume of the sound is set in CV200, range 0...64. The factory setting is "32".

#### **4.4.2. External volume control**

The total volume of the eMOTION XLS sound decoder may be controlled by an external potentiometer. CV200 must be set to "255" to activate the external volume control.

##### **4.4.2.1 Activating the external volume control in analog operation**

The manual volume control may be activated easily in analog operation. Connect the volume control board (Item Nr.: 8242010) to the eMOTION XLS sound decoder and adjust the volume to more than half volume. If you increase the track voltage until the sound starts, the eMOTION XLS sound decoder will recognize the external volume control and subsequently will program CV200 to 255. Thereafter a reset will take

place and your external volume control will be activated.

#### **4.4.3. Loudspeaker specifications**

The power amplifier of the eMOTION XLS Sound Decoder delivers 1 Watt with a loudspeaker of 8 Ohms impedance. 8 Ohms impedance is a must for all loudspeakers used with the decoder to ensure proper operation and a long-life cycle. Use only loudspeakers with at least 1 Watt capacity. The basic rule says: the play back quality of a loudspeaker grows with the capacity.

#### **4.5. RPM control, control in- and outputs**

The synchronization of the sound with the rotation of the wheels can be achieved with a pulse generator or by speed steps. CV195 defines the method used. Setting CV195 to "0" defines the speed steps to be the controlling parameter for the sound.

Recommendable a hall sensor is to be used as master clocks. This is switched by a magnet. Therefore it must be indicated in the register of the wheel sensor (CV 195) how many magnets are necessary around a steam impact to produce.

Steam locomotives:

0 = Control by speed steps

1 = one chuff per magnet

2 = one chuff per two magnets

4 = one chuff per four magnets

Diesel locomotives and Electric locomotives:

0 = Control by speed steps

1 = Control by pulse generator (wheel sensor)

CV196 and CV198 apply for steam locomotives only. CV196 sets the duration of the steam chuff, range 0 to 32. This relates to a time frame between 32 msec to 1.28 sec. CV198 defines the pause time between steam chuffs (in relation to the duration of the chuffs).

In addition track magnets may trigger sounds. The sound assignment is set in CVs 190 and 191.

#### 4.5.1. Trigger output for the pulsed smoke generator

The F3 output may be set to operate as a trigger output for the pulsed smoke generator in case a real pulse generator is not available. For this purpose CV114 must be set to „30“. Connect the wire described in the smoke generator manual to F3. The pulsed smoke generator will then operate synchronized to the chuffs produced by the XLS.

#### 4.5.2 Hook-up of an RC servo

The eMOTION XLS sound decoder features a special output (F7) to control an RC servo. **This output may not be used for its regular function once the servo control function is activated.** An RC servo is ideal for a point to point movement (e.g. to operate an uncoupler or pantograph) or for a circular motion. The RC servo requires an additional 5Volt controller (see illustration 15) and the control signals of the decoder. The limit CVs define the end positions. The servo will move to one end position if the function is “on” and it will move to the other end position if the function is “off”. In addition the velocity of the motion may be adjusted.

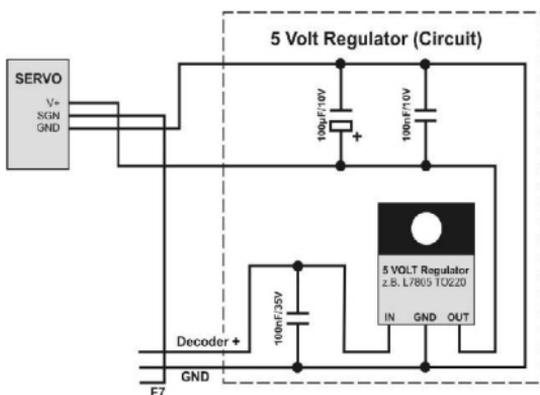


Illustration 15: 5 Volt regulator for the RC servo

## 5. Explanation of basic CV settings

### 5.1. Locomotive address

As mentioned in “ A brief introduction into digital control” above, each locomotive operated by the NMRA/DCC standard needs a digital address to receive its specific command.

- The NMRA standard provides two kinds of addresses:
  - Low (short) addresses (1...127)
  - High (long) addresses (128...10239)
  - Multiple Unit addresses (Consist addresses) (1...99)
- The address must be stored in the decoder to enable the decoder to recognize the commands that are meant for it.
- The low address is stored in CV 1. The maximum value is “127”. In addition bit5 in CV 29 must be “off” (value 0).
- The high address is divided into two values and is stored in CV17 and CV18. In addition bit5 in CV29 must be set to “on”.
- The Multiple Unit address (Consist address) (CV 19) is programmed automatically, if Lenz Digitalsystem multiple traction is called. In normal operation CV must be 19= 0. If the driving direction is to be reversed, a value of 128 must be added to CV 19

#### **The long address must be calculated as follows:**

CV17 = address / 256 (store only the whole-numbered value)

CV18 = address – (CV17 x 256)

In case you want to calculate the locomotive address “3005”, please proceed as follows:

Step 1:  $3005 / 256 = 11.74$  , so CV17 will be “11”

Step 2:  $3005 - (11 \times 256) = 3005 - 2816 = “189”$

Consequently you have to program CV17 with “11” and CV18 with “189”.

Current digital systems (e.g. the DiMAX-System) offer a comfortable programming method of the addresses. All CVs including CV29 are being calculated automatically and programmed at the same time when using the function “Loco Address Programming”. The original address setting of

the eMOTION XLS Sound Decoder is “3”. In case of a decoder reset the address will be reset to this value.

## **5.2. Serial and Parallel Data Transfer**

The factory setting of the eMOTION XLS Sound Decoder enables both serial and parallel data transfer making the decoder compatible to all NMRA/DCC systems. The serial data transfer may be disabled to eliminate the short waiting time of about ½ second when using F1. The F1 function will be triggered instantly.

Pulse generator (sound synchronization with the wheel cycle)

The eMOTION XLS Sound Decoder may be synchronized directly with the revolutions of the locomotive wheels. The installation of the pulse generator in the model varies with the type of model and may be done on different axles. Three CVs are utilized to define the synchronization setting.

## **5.3. Reset functions**

In case the settings of your eMOTION XLS Sound Decoder are messed up or obscure, you may reset the decoder to the manufacturer’s settings by using specific CV values. A distinctive feature of the eMOTION XLS Sound Decoder is that you can reset a specific part of the decoder without changing the remaining parts. The CVs are combined to function groups and reset as a group. You may reset the driving characteristics, the light functions, or sound settings separately. Please find detailed information about the reset functions of the eMOTION XLS Sound Decoder in the CV-table.

## 6. CV - table (drive-settings)

This table shows the standard settings of eMOTION XLS Sound Decoders. An = Analog

| CV  | Description  | Default | An | Value                               | Note  |
|-----|--|---------|----|-------------------------------------|---|
| 1   | Loco Address (Standard Short)  | 3       |    | 1 - 127                             |   |
| 2   | Starting Voltage   | 2       |    | 1 - 255                             | CV2 x (1/255 track voltage)   |
| 3   | Acceleration Time  | 3       | √  | 1 - 255                             | CV3 x 2ms x (1/255 track voltage)   |
| 4   | Braking Time   | 3       | √  | 1 - 255                             | CV4 x 2ms x (1/255 track voltage)   |
| 5   | Top Speed  | 200     | √  | 1 - 255                             | CV5 x (1/255 track voltage)   |
| 6   | Mid Speed  | 50      |    | 1 - 255                             | CV6 x (1/255 track voltage)   |
| 5+6 | Programming in Register Mode:<br>Register 6 = CV No.<br>Register 5 = Value | ---     |    | ---                                 | CV5 and CV6 are not affected  |
| 7   | Software Version   | 22      |    | ---                                 | read only   |
| 7   | Decoder Reset Functions<br>(5 Ranges available)                            | ---     |    | 55<br>66<br>77<br>111<br>122<br>133 | reset basic setting<br>reset motor setting<br>reset lights and functions<br>reset CV131 - CV167<br>reset CV171 - CV199<br>reset CV200 - CV212<br>see attachment 6 |
| 8   | Manufacturer ID  | 123     |    | ---                                 | read only   |
| 9   | Motor Frequency  | 0       | √  | 0 ... 3                             | 0=16 kHz, 1=2 kHz,<br>2=250 Hz, 3= 60 Hz  |
| 13  | Function Outputs in Analog Mode<br>(on if Value Set)                       | 3       | √  | 0 ... 255                           | F1 = 1, F2 = 2;<br>F3 = 4, F4 = 8;<br>F5 = 16, F6 = 32;<br>F7 = 64, F8 = 128<br>add the values of the desired<br>functions!                                       |
| 17  | Long Loco Address (High Byte)  | 128     |    | 128 ...<br>10239                    | high loco address active,<br>if CV29-Bit5 = 1   |
| 18  | Long Loco Address (Low Byte)   |         |    |                                     |   |
| 19  | Multiple Unit Address (Consist Address)                                    | 0       |    | 0 ... 99<br>+128                    | Address to drive in multiple<br>traction<br>+128 = reverse direction  |
| 29  | Configuration Table NMRA   | 4       | √  |                                     | see attachment 1  |
| 49  | Configuration Table Massoth  | 2       | √  |                                     | see attachment 2  |

| CV              | Description  | Default      | An | Value     | Note  |
|-----------------|--|--------------|----|-----------|---|
| 50              | Light: Dimming Value (PMW)                               | 32           | √  | 1 ... 32  | 32 = full track voltage   |
| 51              | Front Light: Command Allocation                          | 128          |    |           | see attachment 3  |
| 52              | Rear Light: Command Allocation                           | 64           |    |           | see attachment 3  |
| 53              | F1 + F2 Dimming Value                                    | 32           | √  |           | see attachment 4  |
| 54              | F1: Command Allocation                                   | 7            |    |           | see attachment 3  |
| 55              | F1: Special Function                                     | 0            | √  |           | see attachment 5  |
| 56              | F2: Command Allocation                                   | 2            |    |           | see attachment 3  |
| 57              | F2: Special Function                                     | 0            | √  |           | see attachment 5 + 5a   |
| 58              | Pause Time for Stop with Reversing                       | 0            | √  | 0 ... 255 | 0.5 sec per value   |
| 59              | Switching Speed (Half Speed) Command Allocation          | 8            |    | 0 ... 16  | 0 = Off, 1...16 = F-key   |
| 60              | PI-Load Control: Maximum Readjustment Factor             | 2            | √  | 1 ... 255 | large value = strong readjustment                                   |
| 61              | PI-Load Control: Readjustment Retardation                | 60           | √  | 1 ... 255 | large value = slow readjustment                                     |
| 62              | PI-Load Control: Readjustment Strength                   | 255          | √  | 1 ... 255 | 1 = fast limitation<br>254 = slow limitation<br>255 = no limitation |
| 64              | PI-Load Control On/Off: Command Allocation               | 16           |    | 0 ... 16  | 0=Off, 1...16: No. of function key                                  |
| 67<br>...<br>94 | Freely Programmable Driving Curves in 28 Steps           | 1 ...<br>255 |    | 1 ... 255 | see attachment 7<br>(if CV29-Bit4=16)                               |
| 105             | Type of Sound  | *            |    | ---       | read only   |
| 106             | ID for Decoder Type<br>(Only Needed for Software Update) | 202          |    | ---       | read only   |
| 112             | F3+F4 Dimming Value                                      | 32           | √  |           | see attachment 4  |
| 113             | F3: Command Allocation                                   | 3            |    |           | see attachment 3  |
| 114             | F3: Special Function                                     | 0            | √  |           | see attachment 5 + 5a   |
| 115             | F4: Command Allocation                                   | 4            |    |           | see attachment 3  |
| 116             | F4: Special Function                                     | 0            | √  |           | see attachment 5 + 5a   |
| 117             | F5: Command Allocation                                   | 5            |    |           | see attachment 3  |
| 118             | F5: Special Function                                     | 0            | √  |           | see attachment 5  |
| 119             | F6: Command Allocation                                   | 6            |    |           | see attachment 3  |
| 120             | F6: Special Function                                     | 0            |    |           | see attachment 5 + 5a   |
| 121             | F7: Switching Function                                   | 13           |    | 0 ... 16  | 0=light, 1...16 = F-key   |
| 123             | F8: Switching Function                                   | 14           |    | 0 ... 16  | 0=light, 1...16 = F-key   |

| CV  | Description                                   | Default | An | Value     | Note                    |
|-----|---|---------|----|-----------|-------------------------|
| 124 | RC servo control on function output F7        | 0       |    | 0 .. 9    | See attachment 9        |
| 125 | Servo: lower end position                     | 16      |    | 5 .. 50   | Depending on servo      |
| 126 | Servo: upper end position                     | 32      |    | 5 .. 50   | Depending on servo      |
| 127 | Servo: turning velocity                       | 1       |    | 1 .. 15   | 1 = fast                |
| 129 | Lag time with power buffer, digital operation | 0       |    | 2 ... 255 | Only use Goldcap buffer |
| 130 | Lag time with power buffer, analog operation  | 0       | √  | 2 ... 255 | Only use Goldcap buffer |

## 7. CV - table (sound settings)

The sound settings vary with the sound programmed in the decoder therefore the settings are not listed.

| CV  | Description  | Default | Value     | Note  |  |
|-----|--|---------|-----------|---|--|
| 131 | Add. Sound 1 : Switching Command                             | *       | 0 ... 16  | 0=deactivated:<br>sound can not be triggered by F-key                         |  |
| 132 | Add. Sound 2 : Switching Command                             | *       | 0 ... 16  |   |  |
| 133 | Add. Sound 3 : Switching Command                             | *       | 0 ... 16  | 1...12 = F-key assignment:<br>sound will be triggered by the respective F-key |  |
| 134 | Add. Sound 4 : Switching Command                             | *       | 0 ... 16  |   |  |
| 135 | Add. Sound 5 : Switching Command                             | *       | 0 ... 16  |   |  |
| 136 | Add. Sound 6 : Switching Command                             | *       | 0 ... 16  |   |  |
| 137 | Add. Sound 7 : Switching Command                             | *       | 0 ... 16  |   |  |
| 138 | Add. Sound 8 : Switching Command                             | *       | 0 ... 16  |   |  |
| 139 | Add. Sound 9 : Switching Command                             | *       | 0 ... 16  |   |  |
| 140 | Add. Sound 10 : Switching Command                            | *       | 0 ... 16  |   |  |
| 141 | Add. Sound 11 : Switching Command                            | *       | 0 ... 16  |   |  |
| 142 | Add. Sound 12 : Switching Command                            | *       | 0 ... 16  |   |  |
| 147 | Amplifier (Sound) Off/On : Switching Comand                  | 6       | 0 ... 16  |   |  |
| 148 | Loco Start up/Shut down, resp. Cylinder Sound (Steam Engine) | 5       | 0 ... 16  |   |  |
| 149 | Configuration Register Massoth-Sound                         | 2       | 0 ... 255 | see attachment 8  |  |

| CV  | Description                                       | Default | Value     | Note  |
|-----|---|---------|-----------|---|
| 150 | Starting Inhibit between starting-phase           | 0       | 0 ... 3   | 0=Off<br>1=Digital on<br>2=Analog on<br>3=Digital + Analog on<br>If on, loco starts after starting-phase  |
| 151 | Add. Sound 1 : Number of Loops                    | *       | 0 ... 16  | 0= no sound repetition:<br>the sound will be triggered only once<br><br>1...15: number of repetitions:<br>e.g. the number of bell rings or the blow of a whistle<br><br>16: sound steady on:<br>the sound is started with a F-key and repeated until the F-function is switched off |
| 152 | Add. Sound 2 : Number of Loops                    | *       | 0 ... 16  |   |
| 153 | Add. Sound 3 : Number of Loops                    | *       | 0 ... 16  |   |
| 154 | Add. Sound 4 : Number of Loops                    | *       | 0 ... 16  |   |
| 155 | Add. Sound 5 : Number of Loops                    | *       | 0 ... 16  |   |
| 156 | Add. Sound 6 : Number of Loops                    | *       | 0 ... 16  |   |
| 157 | Add. Sound 7 : Number of Loops                    | *       | 0 ... 16  |   |
| 158 | Add. Sound 8 : Number of Loops                    | *       | 0 ... 16  |   |
| 159 | Add. Sound 9 : Number of Loops                    | *       | 0 ... 16  |   |
| 160 | Add. Sound 10 : Number of Loops                   | *       | 0 ... 16  |   |
| 161 | Add. Sound 11 : Number of Loops                   | *       | 0 ... 16  |   |
| 162 | Add. Sound 12 : Number of Loops                   | *       | 0 ... 16  |   |
| 167 | Control Register: Type of Sound (Do Not Change!!) | *       | ---       | read only<br>1=Steam, 2=Diesel, 6=Electric  |
| 168 | Release Threshold: Brake                          | 64      | 0 ... 255 |   |
| 169 | Trigger Threshold: Brake                          | 30      | 0 ... 255 |   |
| 171 | 1. Standing Noise : Sound Assignment              | *       | 0 ... 12  | 0= no standing noise<br>1...12= assignment of additional sounds<br>the sounds selected are played in the order 1-4 while the loco holds   |
| 172 | 2. Standing Noise : Sound Assignment              | *       | 0 ... 12  |   |
| 173 | 3. Standing Noise : Sound Assignment              | *       | 0 ... 12  |   |
| 174 | 4. Standing Noise : Sound Assignment              | *       | 0 ... 12  |   |
| 175 | 1. Standing Noise : Number of Loops               | *       | 0 ... 15  | 0= no sound repetition:<br>the sound will be triggered only once<br>1...15: number of repetitions:<br>e.g. the number of air pump sounds  |
| 176 | 2. Standing Noise : Number of Loops               | *       | 0 ... 15  |   |
| 177 | 3. Standing Noise : Number of Loops               | *       | 0 ... 15  |   |
| 178 | 4. Standing Noise : Number of Loops               | *       | 0 ... 15  |   |
| 179 | Time Value of Random Generator                    | 3       | 1 ... 3   | 1= frequent triggering,<br>3=infrequent triggering  |

| CV  | Description                                      | Default | Value     | Note   |
|-----|--|---------|-----------|--|
| 180 | 1. Random Sound: Sound Allocation                | *       | 0 ... 12  | 0= no random sound   |
| 181 | 2. Random Sound: Sound Allocation                | *       | 0 ... 12  | 1...12= assignment of additional sounds:   |
| 182 | 3. Random Sound: Sound Allocation                | *       | 0 ... 12  | the sounds selected are triggered randomly   |
| 183 | 4. Random Sound: Sound Allocation                | *       | 0 ... 12  |  |
| 184 | 1. Random Sound: Number of Loops                 | *       | 0 ... 15  | 0= no sound repetition:  |
| 185 | 2. Random Sound: Number of Loops                 | *       | 0 ... 15  | the sound will be triggered only once  |
| 186 | 3. Random Sound: Number of Loops                 | *       | 0 ... 15  | 1...15= number of repetitions:   |
| 187 | 4. Random Sound: Number of Loops                 | *       | 0 ... 15  | e.g. number of air pump sounds   |
| 188 | Warning Signal Moving Forward: Sound Allocation  | *       | 0 ... 12  | 0= no sound allocated  |
| 189 | Warning Signal Moving Backward: Sound Allocation | *       | 0 ... 12  | 1...12= allocation of the additional sounds:   |
| 190 | (Reed) Contact 1: Sound Allocation               | *       | 0 ... 12  | The sound selected will be presented depending on the operational status of the locomotive |
| 191 | (Reed) Contact 2: Sound Allocation               | *       | 0 ... 12  |  |
| 192 | Brake Application: Sound Allocation              | *       | 0 ... 12  |  |
| 193 | Trigger Threshold: Sound Output in Analog Mode   | *       | 0 ... 255 | alignment of the sound to the motor RPM when starting to move                              |
| 194 | Trigger Threshold: Sound Output in Digital Mode  | *       | 0 ... 255 |  |
| 195 | Pulse Generator: Control Register                | 0       | 0 ... 4   | 0= no external pulse generator<br>1...4= number of magnet poles per each steam chuff       |
| 196 | Duration of a Steam Chuff                        | 28      | 0 ... 32  | 0...32= duration of a steam chuff  |
| 198 | Spacing Between Steam Chuff                      | 1       | 0 ... 16  | 0...16 pause time between steam chuffs<br>(only active if CV195 is set to "0")             |

| CV  | Description   | Default | Value              | Note  |
|-----|---|---------|--------------------|---|
| 200 | Total Volume Level  | 32      | 1 ... 63<br>or 255 | 1= low, 63= loud,<br>255= ext. potentiometer  |
| 201 | Add. Sound 1: Individual Volume Level                     | *       | 0 ... 3            | 0= 25% volume level<br>1= 50% volume level<br>2= 75% volume level<br>3= 100% maximum volume |
| 202 | Add. Sound 2: Individual Volume Level                     | *       | 0 ... 3            |   |
| 203 | Add. Sound 3: Individual Volume Level                     | *       | 0 ... 3            |   |
| 204 | Add. Sound 4: Individual Volume Level                     | *       | 0 ... 3            |   |
| 205 | Add. Sound 5: Individual Volume Level                     | *       | 0 ... 3            |   |
| 206 | Add. Sound 6: Individual Volume Level                     | *       | 0 ... 3            |   |
| 207 | Add. Sound 7: Individual Volume Level                     | *       | 0 ... 3            |   |
| 208 | Add. Sound 8: Individual Volume Level                     | *       | 0 ... 3            |   |
| 209 | Add. Sound 9: Individual Volume Level                     | *       | 0 ... 3            |   |
| 210 | Add. Sound 10: Individual Volume Level                    | *       | 0 ... 3            |   |
| 211 | Add. Sound 10: Individual Volume Level                    | *       | 0 ... 3            |   |
| 212 | Add. Sound 12: Individual Volume Level                    | *       | 0 ... 3            |   |
| 217 | Volume Turn-on phase (since V1.3)                         | *       | 0 ... 3            |   |
| 218 | Volume Standing phase (since V1.3)                        | *       | 0 ... 3            |   |
| 219 | Volume Turn-off phase (since V1.3)                        | *       | 0 ... 3            |   |
| 220 | Volume Driving phase (since V1.3)                         | *       | 0 ... 3            |   |
| 229 | Trigger Threshold 1: Multiple-contact switch digital mode | 16      | 0 ... 255          |   |
| 230 | Trigger Threshold 2: Multiple-contact switch digital mode | 32      | 0 ... 255          |   |
| 231 | Trigger Threshold 3: Multiple-contact switch digital mode | 48      | 0 ... 255          |   |
| 232 | Trigger Threshold 4: Multiple-contact switch digital mode | 112     | 0 ... 255          |   |
| 233 | Trigger Threshold 5: Multiple-contact switch digital mode | 160     | 0 ... 255          |   |
| 234 | Sound on accelerate, Multiple-contact switch              | 11      | 0 ... 255          |   |

Values marked with „\*“ : see the respective locomotive manual.

## 7.1. Sound assignment

The settings for the sound in the eMOTION XLS Sound Decoder start at CV131. In this section specific sounds and noises may be assigned to desired F-keys. In addition a triggered sound may be looped for a

prolonged play-back; you may arrange the sounds of your locomotive to your own needs, tastes and ideas.

## **7.2. Standing sounds and noises (CV171 to CV178)**

During the standing phase a locomotive produces several different sounds from various functions and places on the locomotive. The origins of these sounds can be air pumps, valves, pressure reducers, compressors, hydraulic pumps, generators, and other components. The frequency of occurrence and the allocation of the sounds may be changed at any time.

## **7.3. Random generator (CV179 to CV189)**

Depending on the prototype of the locomotive, the standing sounds and noises are allocated and played back realistically randomly. If required the sounds and noises may be changed or substituted by other sounds.

## **7.4. Signals before start (CV188, CV189)**

Sounds to signal the imminent start of a locomotive may be allocated depending of the direction of the movement.

## **7.5. Sound allocation for reed contacts (CV190, CV191)**

Allocate sounds of your choice to the reed contacts (contact 1 and contact 2). Please note that you may choose between basic reed contact triggering or direction related triggering which may be done with CV149.

## **7.6. Total volume level (CV200) and individual volume level (CV201 to CV212)**

The eMOTION XLS Sound Decoder features volume control by CV-programming. The volume of the sound may be changed by PoM programming at any time while operating a locomotive. In addition you may change the volume of each and every sound and noise individually.

## 7.7. Volume Control Driving Sound (CV217 – CV220) (since V1.3)

### • Effect of the CVs in an Electric Locomotive:

During the start of the operation of an electric locomotive the main switch, the pantographs or the compressor are switched on before the cooling fan starts running. The volume of these sounds is controlled by CV217. The cooling fan volume is set with CV218. The shut-down sound of the cooling fan is controlled by CV219. The volume of the driving sound is adjusted by CV220.

### • Effect of the CVs in a Diesel Locomotive:

Before the main diesel engine is started auxiliary units are switched on, e.g. the auxiliary diesel or the oil pump. The volume of the auxiliary units is controlled by CV217. The idle volume of the main diesel engine is set with CV218, the driving sound volume is adjusted with CV220. The volume of the shut-down sound is controlled by CV219.

### • Effect of the CVs in a Steam Locomotive:

The volume of the standing noise of a steam locomotive is set with CV218. The volume of the cylinder side noise is controlled by CV219 and the volume of the main sound is adjusted with CV220.

## 8. Attachment 1: (CV29) - NMRA-Configuration

| Bit | Off (Value=0)              | Application | On                               | Value | Note                                     |
|-----|----------------------------|-------------|----------------------------------|-------|--|
| 0   | Standard Driving Direction |             | Reverse Driving Direction        | 1     |  |
| 1   | 14 Speed Steps             |             | 28 Speed Steps                   | 2     | automatic recognition of 128 speed steps |
| 2   | Digital Operation Only     |             | Digital + Analog Operation       | 4     |  |
| 3   | Not Used                   |             |                                  |       |  |
| 4   | Internal Driving Curve     |             | Programmable Driving Curve       | 16    | CV 67 - 94                               |
| 5   | Short Address (CV1)        |             | Long Address (stored in CV17+18) | 32    |  |
| 6   | not used                   |             |                                  |       |  |
| 7   | not used                   |             |                                  |       |  |

## 8.1. Attachment 2: (CV49) - Massoth-Configuration

| Bit | Off (Value=0)                        | Application                        | On | Value | Note                                    |
|-----|--------------------------------------|------------------------------------|----|-------|---|
| 0   | Parallel Data Transfer Only          | Seriell + Parallel Data Transfer   |    | 1     | automatic detection of seriell/parallel |
| 1   | Digital Load Control = Off           | Digital Load Control = On          |    | 2     |   |
| 2   | Analog Load Control = Off            | Analog Load Control = On           |    | 4     |   |
| 3   | F1-Output Standard Function          | Fast Pulse String (P-Update) on F1 |    | 8     | Bit3 "on" only with Bit0 "on"           |
| 4   | Electronic parking brake deactivated | Electronic parking brake activated |    | 16    | Only activ on halt of loco              |
| 5   | Not Used                             |                                    |    |       |   |
| 6   | Not Used                             |                                    |    |       |   |
| 7   | Not Used                             |                                    |    |       |   |

## 8.2. Attachment 3: Switching Output Commands (CV51, 52, 54, 56, 113, 115, 117, 119)

| Value    | Application  | Note                           |
|----------|--|--------------------------------|
| 0 ... 16 | 0 = Switch Function with Light Key, 1...16 = Switch Function with F-Key No. 1-16 |                                |
| + 64     | Switching Output "on" in Reverse Only  | additional value must be added |
| + 128    | Switching Output "on" in Standard Driving Direction Only                         | additional value must be added |

## 8.3. Attachment 4: Dimming Values (CV53, 112)

| Value    | Application   | Note   |
|----------|---|--|
| 1 ... 32 | Voltage in Percent of Track Voltage on Output (Both outputs dimmed) | 1 Unit = approx. 3% of track voltage<br>1 = 3% of track voltage (0.75V)<br>32 = 100% track voltage (24V) |
| + 64     | F1 resp. F3 is dimmed only  | F1 = value in CV53<br>F3 = value in CV112*   |
| + 128    | F2 resp. F4 is dimmed only  | F2 = value in CV53<br>F4 = value in CV112*   |

\* = Command Allocation Value must be added to Voltage Value

## 8.4. Attachment 5: Special Function F1 + F2 + F3 + F4 + F5 (CV55, 57, 114, 116, 118)

| Value               | Application   | Note   |
|---------------------|---|--|
| 0                   | 0 = Steady "On" (Standard Operation)                      |  |
| 1 ... 15            | Flashing symmetrical (Time Base 0.25 sec/value)           | symmetric flashing                                       |
| (1 ... 15)<br>+ 64  | Short Term Function (Monoflop) (Time Base 0.25 sec/value) | output switches off after time out                       |
| (1 ... 15)<br>+ 128 | Asymmetric Flashing (1/3 on, 2/3 off)                     | short "on", long "off"<br>additional value must be added |
| (1 ... 15)<br>+ 192 | Asymmetric Flashing (2/3 on, 1/3 off)                     | long "on", short "off"<br>additional value must be added |

## 8.5. Attachment 5a: Expanded Special Functions F2 + F3 + F4 + F6 (CV57, 114, 116, 120)

| Value | Application   | Note  |
|-------|---|---|
| 16    | Inverse Coupling with Output F1, resp. F3 or F5<br>Alternating Flashing | CV57 (F2 with F1)<br>CV116 (F4 with F3)<br>CV120 (F6 with F5)               |
| 30    | Pulse simulation for the pulsed smoke generator (Only F3)               | CV 114  |
| 31    | Charging Control of Voltage Buffer in Programming Mode                  | only in CV116: buffer controlled by F4<br>only in hardware <1.4 (green PCB) |

## 8.6. Attachment 6: CV 7 Default Settings at Resets

Write the desired reset value into CV7 (software version of the decoder) to reset the decoder settings to the basic settings. The reset values 111 and 122 reset the sound settings of the sound decoder. These values vary with the sound version and are therefore not listed.

| RESET | CV-Values on Reset Programing   |
|-------|---|
| 55    | 1=3, 17=0, 18=128, 29=4, 49=2, 58=0, 59=8   |
| 66    | 2=2, 3=3, 4=3, 5=200, 6=50, 9=0, 60=2, 61=60, 62=255, 64=16   |
| 77    | 13=3, 50=32, 51=128, 52=64, 53=32, 54=7, 55=0, 56=2, 57=0, 112=32, 113=3, 114=0, 115=4, 116=0, 117=5, 118=0, 119=6, 120=0 |
| 111   | CV131 - CV167 Reset of Sound Functions (values vary with sound type)  |
| 122   | CV171 - CV199 Reset Standing Phase Sounds (values vary with sound type)   |
| 133   | CV200 - CV220 Reset Volume Settings   |

## 8.7. Attachment 7: Basic Values of Freely Programmable Driving Curve (CV67...CV94)

The Programmable driving curve is set to the setting below as basic setting. This setting is not subject to the reset functions.

### Basic values of freely programmable driving curve (CV + Value)

67=6, 68=8, 69=10, 70=13, 71=16, 72=19, 73=22, 74=26, 75=31, 76=36, 77=42, 78=48, 79=54, 80=60, 81=68, 82=76, 83=84, 84=92, 85=102, 86=112, 87=124, 88=136, 89=152, 90=168, 91=188, 92=208, 93=228, 94=232

## 8.8. Attachment 8: (CV149) – Massoth-Sound-Configuration

| Bit | Off (Value=0)             | Application | On                                      | Value | Note                                      |
|-----|---------------------------|-------------|---|-------|---|
| 0   | Random Generator Off      |             | Random Generator Active                 | 1     |   |
| 1   | Standing Phase Noise Off  |             | Standing Phase Noise Active             | 2     |   |
| 2   | Standard Driving Sound    |             | Load-Dependent Sound                    | 4     | rolling noise during coasting             |
| 3   | Cylinder Valves Closed    |             | Cylinder Valves Open                    | 8     | only steam locos during start of movement |
| 4   | Contacts Standard         |             | Reed Contact Inputs Direction Sensitive | 16    |   |
| 5   | Automatic Side Noises Off |             | Automatic Side Noises Active            | 32    |   |
| 6   | Start Signal Delay Off    |             | Start Signal Delay On                   | 64    | since V1.2 (written in CV 7)              |
| 7   | Not Used                  |             |   |       |   |

## 8.9. Attachment 9: RC servo function

The function for RC servo control is activated in CV124. The default setting is „0“, RC servo deactivated.

These are the settings:

| Value | Function   | Note                                       |
|-------|--|--|
| 0     | No special function, regular switching output                  |  |
| 1     | RC servo operation with two end positions with function on/off | e.g. uncoupler, pantograph                 |
| 2     | n/a  |  |
| +4    | Inverse RC servo operation                                     | Only for RC servos with inverse capability |
| +8    | The RC servo is switched off after a motion                    | The control signal is switched off         |

## 9. Decoder programming + update

The eMOTION XLS Sound Decoder supports all programming methods in accordance with the latest NMRA/DCC standards. Please note that not all of the DCC systems currently available can be programmed according to this standard. The manufacturer of your DCC system should give you in-depth information. Choose the programming method applicable to your digital system. The eMOTION XLS Sound Decoder confirms every successful programming cycle with a short beep via the loudspeaker. This ensures the correct reception and accomplishment of the programming command.

### 9.1. Reading Configuration Variables (CVs)

The readout of CV parameters shall not be mistaken for a programming procedure. However, it is essential for checking the programmed settings. The eMOTION XLS Sound Decoder provides this function and the readout can be easily accomplished with a handheld controller. After inserting the requested CV No. the controller will display the value of the respective variable.

## 9.2. Writing Configuration Variables (CVs)

Programming (writing) the CV values is the easiest way of programming the decoder. This method is utilized by most of the DCC systems. Using your handheld controller, the central station, or the PC - you select the desired CV parameter and insert your desired value. Programming is done on a separate programming track or a piece of track that is used as programming track, depending on the digital system. Please check the manual of your central station.

## 9.3. Writing the Configuration Variables (CVs) bit by bit

Some of the CV (e.g. CV29, CV49) parameters consist of multiple binary values. This means that several values are combined in one value. Each function has a bit and a value. Programming a CV of this kind requires that all values of all functions controlled by this CV need to be summed up. A deactivated function always is "0", an active function must be programmed with the respective value according to the CV-table. The sum represents the value of the CV and must be written into the CV parameter. All known programming methods may be used.

Let's look at the NMRA configuration register for example (CV 29). You intend to program "normal driving direction, 28 speed steps, digital and analog operation, internal driving curve, and a short locomotive address". This sums up to  $2+4=6$  according to the attachment list #1. So CV should be programmed with "6".

## 9.4. Register programming / writing CVs indirectly

Register programming was the first method of CV programming. The eMOTION XLS Sound Decoder supports this programming method. The CV value is to be entered into an intermediate variable. The decoder thereafter does the real programming. The input into register 5 and 6 is accomplished with the handheld controller. The CVs 1 to 4 are entered directly; all other CVs with higher numbers are programmed indirectly.

Let's assume you want to set the total volume (CV 200) to "10". The first step is to go into the register programming mode, insert "6" thereafter "200". If this was successful you have to program "5" with "10". Now your volume is set to "10".

### 9.5. PoM Programming on Main (main track)

The PoM method is the only procedure to accomplish programming on the main track. All of the CV programming can be done except CV1, 17+18 (address) with the eMOTION XLS Sound Decoder. **PoM programming should only be performed when the locomotive is not in motion.**

### 9.6. Software and Sound Update

The software of the decoder may be updated utilizing the Massoth PC-Modul (DiMAX 100A, 8175001). In addition the decoder may be reprogrammed with other sounds. Programming must be accomplished via the programming track terminal of the PC-Module. Thus the decoder may be updated even if it is installed in a locomotive.

**NOTE: The data volume transferred is tremendous. An optimum track contact during this procedure is a must.** We recommend to utilize the loco's power socket if available or the Massoth Rolling Road. The update procedure starts with an extensive test of the communication line. In case the update shuts down prematurely, a better contact must be provided.

## **10. Warranty:**

MASSOTH ELECTRONICS USA warrants this product for 1 year from the original date of purchase. This product is warranted against defects in materials and workmanship. Peripheral component damage is not covered by this warranty. Normal wear and tear, consumer modifications as well as improper use or installation are not covered. Errors and changes excepted.

### **10.1. Warranty Claims:**

Valid Warranty Claims will be serviced without charge within the warranty period. To initiate a warranty claim, please contact your dealer or MASSOTH ELECTRONICS USA for an RMA (Return Merchandise Authorization). MASSOTH ELECTRONICS USA cannot be responsible for return shipping charges to our repair facility. Please include your Proof of Purchase with the returned goods.

### **10.2. Technical specifications:**

Power supply: 0-24 Volts DC/DCC (in peaks max. 27Volts)

Current: 30-500 mAmps (depending on sound, w/o motor + functions)

Maximum Motor current: 3Amps

Maximum function current: 1,2Amps (max. 600 mAmps per output)

Loudspeaker: 8 Ohm (at least 1,5W)

Temperature range: -4°F to 113°F

Measurements: 60 x 32 x 18 mm (L x W x H)

Important notice regarding temperature: The accumulation of condensed water must be avoided at all times. If you intend to operate the electronic unit in temperatures below or close to freezing, make sure to have it stored in a heated environment before operation. The heat resulting from the normal operation is sufficient to prevent condensation.



This Decoder conforms to the CE Standards

**RoHS**

This Decoder is manufactured according to the latest EG Standards for lead free manufacturing conforming to RoHS Standard.



Please dispose of according to your State regulations.



Do not dispose of in open fire.

## 11. Support:

For support and technical questions contact: [sales@massoth.com](mailto:sales@massoth.com)

### 11.1. Manufacturer:

|   |  |
|---|--|
| Massoth Elektronik GmbH<br>Frankensteiner Str. 28<br>D-64342 Seeheim-Malchen<br>GERMANY | For technical support contact:<br>Massoth Electronics USA<br>6585 Remington Dr. Suite 200<br>Cumming, GA 30040 |
|---|--|

Hotline hours USA: 9:00 a.m. to 4:00 p.m. EST Mo thru Fr

Ph. 770-886-6670

Fax 770-889-6837

Email [sales@massoth.com](mailto:sales@massoth.com)

Internet [www.massoth.com](http://www.massoth.com)

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