

Manual

# FD-R Extended

Item no. 42-01130 | 42-01131 | 42-01132



Function decoder

MM

DCC



tams elektronik



## Contents

1. Getting started.....	5
2. Safety instructions.....	7
3. Safe and correct soldering.....	10
4. Operation overview.....	11
4.1. Modes of operation.....	11
4.2. Function outputs.....	12
4.3. Sound functions.....	14
4.4. Releasing the functions.....	14
4.5. Automated processes.....	15
4.6. Feedback with RailCom** .....	16
4.7. Overload Protection.....	17
4.8. POM-update.....	18
5. Technical specifications.....	19
6. Connections.....	20
6.1. Connector pin assignment.....	21
6.2. Connection to the voltage supply.....	22
6.3. Connecting accessories to the outputs.....	22
6.4. Connecting LEDs to the function outputs.....	23
6.5. Connecting inductive loads.....	25
6.6. Connecting accessories via a relay.....	25
6.7. Connecting a loudspeaker.....	26
6.8. Connecting a buffer capacitor.....	27
6.9. Connecting a suppression choke.....	27
6.10. Connecting a servo.....	28
6.11. Connecting the switching inputs.....	29
6.12. Connecting a SUSI module.....	30
6.13. Fixing the decoder.....	30
7. Programming.....	31
8. Configuration variables and registers.....	34

9. Performing a POM-Update.....	49
10. Check list for troubleshooting.....	51
11. Guarantee bond.....	55
12. Declaration of conformity.....	56
13. Declarations conforming to the WEEE directive.....	56

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### **The asterisks \*\***

RailCom® is the registered trademark of:

Lenz Elektronik GmbH | Vogelsang 14 | DE-35398 Gießen

To increase the text's readability we have refrained from referring to this point in each instance.

This manual mentions the following companies:

Gebr. MÄRKLIN & Cie. GmbH

Stuttgarter Str. 55-57 | DE-73033 Göppingen

Uhlenbrock Elektronik GmbH

Mercatorstrasse 6 | DE- 46244 Bottrop

# 1. Getting started

## How to use this manual

This manual gives step-by-step instructions for safe and correct fitting and connecting of the decoder, and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the checklist for trouble shooting. You will then know where to take care and how to prevent mistakes which take a lot of effort to correct.

Keep this manual safely so that you can solve problems in the future. If you pass the decoder on to another person, please pass on the manual with it.

## Intended use

The function decoder FD-R Extended is designed to be operated according to the instructions in this manual in model building, especially in digital model railroad layouts. Any other use is inappropriate and invalidates any guarantees.

The function decoder FD-R Extended should not be mounted by children under the age of 14. Reading, understanding and following the instructions in this manual are mandatory for the user.

## Checking the package contents

Please make sure that your package contains:

- one or five function decoders, depending on the version
  - without or with soldered connecting wires or
  - with soldered connecting wires and a soldered SUSI plug connector;
- one or five buffer electrolytic capacitors (220  $\mu$ F / 35 V);
- one or five suppression chokes (470  $\mu$ H / 90 mA);
- a CD (containing the manual, Software "POM-Updater.exe" and further information).

## Required materials

For mounting and connecting the decoder you need:

- an electronic soldering iron (max. 30 Watt) or a regulated soldering iron with a fine tip and a soldering iron stand,
- a tip-cleaning sponge,
- a heat-resistant mat,
- a small side cutter, a wire stripper and a pair of tweezers,
- electronic tin solder (0.5 mm diameter).

In order to connect decoders without soldered connecting wires you will need wire. Recommended cross sections  $\geq 0.04 \text{ mm}^2$  for all connections.

If you have a decoder without a soldered SUSI interface connector, you might need a SUSI plug connector (e.g. item no. 70-01100).

For playing back the sounds you need:

- a loudspeaker with an impedance of min. 4 Ohm and a rated load-carrying capacity of min. 0,1 Watt.

If you want to release switching operations automatically, e.g.:

- reed contacts 1 x closing contact (e.g. item-no. 84-53110)
- and / or Hall-sensors (e.g. item-no. 84-53210) and
- permanent magnets (e.g. neodymium magnets  $\varnothing$  3mm, thickness = 2mm, item-no. 84-53990).

If you want to use the output for the servo:

- one servo,
- a voltage supply for the servo (e.g. servo PCB item-no. 70-05900).

## 2. Safety instructions



### **Caution:**

Integrated circuits (ICs) are inserted on the decoder. They are sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

### **Mechanical hazards**

Cut wires can have sharp ends and can cause serious injuries. Watch out for sharp edges when you pick up the PCB.

Visibly damaged parts can cause unpredictable danger. Do not use damaged parts: recycle and replace them with new ones.

### **Electrical hazards**

- Touching powered, live components,
  - touching conducting components which are live due to malfunction,
  - short circuits and connecting the circuit to another voltage than specified,
  - impermissibly high humidity and condensation build up
- can cause serious injury due to electrical shock. Take the following precautions to prevent this danger:
- Never perform wiring on a powered module.
  - Assembling and mounting the kit should only be done in closed, clean, dry rooms. Beware of humidity.
  - Only use low power for this module as described in this manual and only use certified transformers.
  - Connect transformers and soldering irons only in approved mains sockets installed by an authorised electrician.
  - Observe cable diameter requirements.
  - After condensation build up, allow a minimum of 2 hours for

dispersion.

- Use only original spare parts if you have to repair the kit or the ready-built module.

### **Fire risk**

Touching flammable material with a hot soldering iron can cause fire, which can result in injury or death through burns or suffocation. Connect your soldering iron or soldering station only when actually needed. Always keep the soldering iron away from inflammable materials. Use a suitable soldering iron stand. Never leave a hot soldering iron or station unattended.

### **Thermal danger**

A hot soldering iron or liquid solder accidentally touching your skin can cause skin burns. As a precaution:

- use a heat-resistant mat during soldering,
- always put the hot soldering iron in the soldering iron stand,
- point the soldering iron tip carefully when soldering, and
- remove liquid solder with a thick wet rag or wet sponge from the soldering tip.

### **Dangerous environments**

A working area that is too small or cramped is unsuitable and can cause accidents, fires and injury. Prevent this by working in a clean, dry room with enough freedom of movement.

### **Other dangers**

Children can cause any of the accidents mentioned above because they are inattentive and not responsible enough. Children under the age of 14 should not be allowed to work with this kit or the ready-built module.

**Caution:**

Little children can swallow small components with sharp edges, with fatal results! Do not allow components to reach small children.

In schools, training centres, clubs and workshops, assembly must be supervised by qualified personnel.

In industrial institutions, health and safety regulations applying to electronic work must be adhered to.



### 3. Safe and correct soldering

**Caution:**

Incorrect soldering can cause dangers through fires and heat. Avoid these dangers by reading and following the directions given in the chapter **Safety instructions**.

- Use a small soldering iron with max. 30 Watt. Keep the soldering tip clean so the heat of the soldering iron is applied to the solder point effectively.
- Only use electronic tin solder with flux.
- When soldering electronic circuits never use soldering-water or soldering grease. They contain acids that can corrode components and copper tracks.
- Solder quickly: holding the iron on the joints longer than necessary can destroy components and can damage copper tracks or soldering eyes.
- Apply the soldering tip to the soldering spot in such a way that the wire and the soldering eye are heated at the same time. Simultaneously add solder (not too much). As soon as the solder becomes liquid take it away. Hold the soldering tip at the spot for a few seconds so that the solder flows into the joint, then remove the soldering iron.
- The joint should be held still for about 5 seconds after soldering.
- To make a good soldering joint you should use a clean and unoxidised soldering tip. Clean the soldering tip with a damp piece of cloth, a damp sponge or a piece of silicon cloth.
- After soldering check (preferably with a magnifying glass) tracks for accidental solder bridges and short circuits. This would cause faulty operation or, in the worst case, permanent damage. You can remove excess solder by putting a clean soldering tip on the spot. The solder will become liquid again and flow from the soldering spot to the soldering tip.

## 4. Operation overview

### 4.1. Modes of operation

#### **Digital operation**

The function decoder FD-R Extended is a multiple protocol decoder, that can operate with and automatically recognise both DCC or Motorola formats.

The number of addresses is dependant on the format being used:

- Motorola-Format: 255 addresses,
- DCC-Format: 127 Basis-addresses or 10.239 extended addresses.

In the DCC format the decoder can be driven in all speed levels (14, 28 or 128). In the Motorola format the decoder can be driven in 14 or 27 speed levels. Driving all 27 speed levels can be done only with central units which support this mode (e.g. MasterControl). With central units which allow 14 speed levels only, it is only possible to select every second speed level.

Programming the decoders is done:

- in Motorola format by setting the registers,
- in DCC format by setting the configuration variables (direct programming, DCC conform) or by POM (programming on main = main track programming). Note: The configuration variables reserved for the SUSI interface ## 897 – 1024 cannot be programmed by POM.

#### **Analogue mode**

The decoder can also be used in analogue model railway layouts run with a D.C. speed control, and with restrictions with an A.C. speed control. When putting the vehicle on the rails the decoder recognizes automatically if it is run in analogue or digital mode and sets the corresponding operation mode. The automatic recognition of the analogue mode can be switched off.

**Caution:**

Old analogue driving transformers (e.g. models in a blue housing from Maerklin\*\*) are not suitable for use with digital decoders in analogue operation! These transformers have been designed for the older supply voltage of 220 V and, due to construction, generate very high excess voltage impulses when changing the driving direction. When using them with the modern supply voltage of 230 V too high excess voltage impulses can occur, damaging electronic parts on the decoder. For that reason only use driving transformers designed for a net voltage of 230 V.

Switching the function outputs on or off is not possible in analogue mode. They can be programmed so that they are either switched on or off in analogue mode. The effects set for the outputs are active in analogue mode as well.

Outputs to be switched with F0 are switched on or off in analogue mode according to the direction of travel with layouts run with a D.C. speed control (not with an A.C. speed control), provided the return conductor of the lamps or accessories is connected to the decoder's return conductor for all functions.

## 4.2. Function outputs

The decoder has six function outputs with a maximum current of 500 mA each, which are available to connect optional accessories (e.g. lighting, smoke generator, electric coupling). The decoder's maximum total current is 1.500 mA.

### Effects of all function outputs (AUX1 to AUX6)

- Switching on and off depending on the direction of travel.
- Flashing and double flashing. Both the frequency and the keying ratio can be set. E.g. single and double flash lights or strobe lights.
- Kick function: It is possible to set the amplified function outputs so that they get the full voltage first for up to 12,5 seconds and then

are switched off. Example of use: For some types of electric couplings you need the full voltage for decoupling and the voltage then switched off to protect the couplings.

- Shunting light: You can program the outputs so that they are switched on generally during shunting operation (to be switched with F3 or F4). The dependence on the direction of travel will be nullified for these outputs during shunting operation.
- Special function for speed level 0: It is possible to program one function to switch off other functions or switch on special function outputs at speed level 0. Example of use: In some locomotive sheds it is customary that the tail lamps of parked locomotives have to be temporarily set at the front and the back.

#### **Effects of the function outputs AUX1 to AUX4**

- Dimming: Example of use: The electric bulbs of older vehicles made for analogue operation can be dimmed and thus must not be exchanged after the mounting of the decoder.
- Dimming depending on the speed level: The voltage will be dimmed depending on the speed level. This enables weak smoke generation during halts or a switched off or dimmed cab lighting while the train is moving.
- MARsight (= light intensity going up and down): Example of use: american locomotives with this type of lighting.

#### **Servo output**

The decoder has a connection to be used as a (third) switching input or as an output to control a servo optionally. The voltage supply for the servo cannot be provided by the decoder. For that reason an external voltage supply (e.g. servo PCB item-no. 70-05900) is required.

The servo is controlled by:

- setting the end positions via CVs and controlling by pushing the function keys ("on" = end position 1, "off" = end position 2) or
- input of a value for the folding square by POM, which allows to approach to any folding square.

## 4.3. Sound functions

### **SUSI interface**

A SUSI module can be connected to the FD-R Extended and read out, programmed and controlled via the decoder.

The function decoder transmits the function status and the speed level set at the central unit, to the SUSI module. This affects the SUSI module's outputs depending on the speed level (e.g. motor sound). The FD-R Extended allows the setting of the acceleration and braking delay so that the functions depending on the speed level correspond to the driving characteristics during accelerating and braking.

### **Integrated sounds**

Four integrated sounds are available:

- train conductor's whistle,
- door's bleeping when closing,
- bell,
- signal horn.

## 4.4. Releasing the functions

The function outputs, the servo output and the integrated sounds can be released by:

- pushing the function keys and / or
- automatically via the switching inputs (except SUSI module). The switching inputs are released via external contacts, e.g. via reed contacts or Hall sensors in combination with permanent magnets in the rails.

The sounds of a connected SUSI module can be triggered by the function keys as well as by the switching inputs that are assigned to these function keys.

## Mapping of the outputs to the function keys

The mapping of the outputs to the function keys and the switching inputs is arbitrary. It is possible to assign several function keys and switching inputs to one output.

Output	DCC format	MM format
AUX1 to AUX6	F0 to F28	F0 to F4 or F5 to F9 (= F0 to F4 of a 2nd decoder address)

All function outputs can be switched inverted, i.e. when set to position "on" the assigned function output will be switched off, when set to position "off" switched on.

## 4.5. Automated processes

The control software in the function decoder allows you to automate procedures and to reduce complex processes to one keystroke.

### Dimming depending on the velocity

You can automatically switch functions depending on the velocity when reaching a speed level defined in a CV. You assign an individual voltage to the function outputs for the ranges of speed levels underneath and above the defined speed level. This allows for example to switch on and off the high beam light, to control the cab light or to influence the intensity of the steam output.

### Special function for speed level 0

By programming the special function for speed level 0 you can switch on or off several function outputs and functions at the same time, you otherwise had to switch singularly. This allows e.g. to switch off several lights at once when parking a locomotive in the depot (e.g. front and back lights, cab light and undercarriage light).

## 4.6. Feedback with RailCom\*\*

RailCom is a log for bi-directional communication in digital model railway layouts controlled in DCC-format. It allows e.g. the feedback of the address and the CV values from the decoder to the digital central unit or to special receivers (so-called detectors). The decoders must be designed to send the RailCom messages.

When so programmed, the FD-R Extended sends

- on channel 1: continuously its (basic, extended or consist) address (so-called RailCom broadcast datagramm) and
- on channel 2: a CV message after a DCC CV read-out command.

Sending RailCom messages is only possible in layouts with a DCC signal on the rails. It is not possible to use the RailCom-function in a pure Motorola environment.

## 4.7. Overload Protection

As soon as the maximum total current of the decoder is exceeded, the decoder automatically temporarily switches off, in order to protect itself from overheating. This operation will be repeated until the overload has been eliminated.

When the maximum current at one output is exceeded, but not the maximum total current of the decoder, the overload protection of the decoder is without effect, the output will be damaged.



### **Attention:**

When a short circuit occurs that bypasses components on the decoder either to each other or to track voltage, the overload protection is not effective. Examples:

- contact between the decoder and the rails or metal parts of the vehicle;
- contact between not-isolated decoder connecting wires and the rails or metal parts of the vehicle;
- contact between accessories connected to the common return conductor of the decoder and the rails or metal parts of the vehicle.



## 4.8. POM-update

POM-update is a procedure allowing to update the decoder's firmware (= specific decoder software) without dismounting the decoder or using a specific device. POM-update is based upon programming on main (POM) for the DCC format.

Preconditions for using the procedure are:

- Function decoder FD-R Extended from version 2.0.
- Digital central unit with PC interface providing the DCC format and POM. Hint: As nearly every manufacturer of central units uses his own procedure for programming on main, the POM-update can be performed with the following central units only (status 01/2015):

MasterControl (Tams Elektronik)

Intellibox 1 (Uhlenbrock\*\*)

CS2 (Maerklin\*\*)

The current list of central units allowing to perform the POM-update is available on our homepage.

- PC. The system software must support Java.
- Software "POM-Updater.exe": You will find it on the CD included in delivery. It is also available on our homepage for free download.

You can download the current firmware version of the decoder free of charge from our homepage. If you want to get information on new firmware versions please subscribe to our newsletter on our homepage.

## 5. Technical specifications

Data format	DCC and MM
Feedback log	RailCom
Supply voltage	12-24 V digital voltage or max. 18 V analogue voltage
Current consumption (without connected loads) max.	40 mA
Max. total current	1 500 mA
Number of function outputs max. current per output	6 500 mA
Output for servo max. current for servo output	1 5 mA
Output for loudspeaker Playback Impedance Rated load-carrying capacity	1 mono ≥ 4 Ohm ≥ 0.1 Watt
Number of switching inputs	3 Note: One switching input is for optional use as servo output, then there are only 2 switching inputs available.
Connection for buffer capacitor Capacity Electric strength	1 220 to 1.000 µF ≥ 35 V
Interface	SUSI
Protected to	IP 00
Ambient temperature in use	0 ... +60 °C
Ambient temperature in storage	-10 ... +80 °C
Comparative humidity allowed	max. 85 %
Dimensions without SUSI connector	approx. 24 x 14 x 2,5 mm
Weight without cables / SUSI connector	approx. 2 g

## 6. Connections



### **Note the following comment in order to protect the decoder from (maybe irreparable) damage!**

Avoid all conducting connections between the decoder and accessories connected to the decoder's common return conductor for all function outputs on the one hand and metal parts of the vehicle or the rails on the other hand. Connections result for example from badly isolated connecting wires (as well as at the stripped ends of connecting wires not in use) or insufficient fixing and isolating the decoder or the accessory, for example. Risk of short circuit! In this case the overload protection of the decoder is not able to protect the decoder from damage.

Before connecting the lighting and other accessories to the outputs check if the output's current is below the maximum permissible value per output and the total current is below the safe load. Should the permissible output current be exceeded, this normally results in damage to the decoder. Exceeding the decoder's total current will lead to switching off the decoder by the overload protection.

You should under no circumstances connect the decoder's return conductor for all functions to vehicle ground. Risk of short circuit!

Old analogue driving transformers (e.g. models in a blue housing from Maerklin\*\*) are not suitable for use with digital decoders in analogue operation! These transformers have been designed for the older supply voltage of 220 V and, due to construction, generate very high excess voltage impulses when changing the driving direction. When using them with the modern supply voltage of 230 V too high excess voltage impulses can occur, damaging electronic parts on the decoder. For that reason only use driving transformers designed for a net voltage of 230 V.

## 6.1. Connector pin assignment

Front side	Colour of wire	Connection to (for use of settings in state of delivery)
X1	white	AUX1 (lighting forward motion, function key F0)
X2	yellow	AUX2 (lighting backward motion, function key F0)
X3	green	AUX3 (function key F1)
X4	violet	AUX4 (function key F2)
X5	white	AUX5 (function key F5)
X6	white	AUX6 (function key F6)
X7	brown	Loudspeaker: X7 = connection A (signal / -), X8 = connection B (+)
X8	brown	
X9	brown	Negative pole (-) of buffer capacitor; Earth connection for reed contacts, Hall sensors and servo
X10	red	Current collector (right / left in direction of motion): X10= right current collector (or slider), X11= left current collector (or vehicle ground)
X11	black	
X12	blue	Return conductor for all functions (+); Positive pole (+) of buffer capacitor; Supply voltage for Hall sensors
X13	grey	Switching input IN1
X14	grey	Switching input IN2
X15	orange	Servo output or switching input IN3
Rear side	Colour of wire	Connection to SUSI interface
X16	red	Supply voltage (PLUS)
X17	blue	Clock (CLK)
X18	grey	Data (DATA)
X19	black	Earth (GND)

## 6.2. Connection to the voltage supply

When connecting the vehicle's current collectors check the right assignment (left / right). When interchanging the connections, the outputs switched depending on the direction of motion will be switched incorrectly in regard to the direction of travel.

## 6.3. Connecting accessories to the outputs

Disconnect any existing diodes in the leads to the lamps, otherwise the lamps might not light. Connect the lamps and the accessories to the function outputs of the decoder (AUX1 to AUX6).

When you want to use the factory (default) settings of the decoder, check the preceding list. Otherwise you can assign the outputs to the function keys voluntarily by setting the configuration variables. Regard the effects "Dimming" and "MARslight" cannot be set for the outputs AUX5 and AUX6.

If the lamp or the accessory is already connected with one side to vehicle ground, the connection is complete. If not, connect the second side of the lamp or the accessory to the decoder's return conductor for all functions (point X12).



Fig. 1: Connection of the voltage supply and of accessories

## 6.4. Connecting LEDs to the function outputs

The decoder's function outputs switch respective to the decoder ground. For that reason you must connect the cathodes (-) of the LEDs to the function outputs and the anodes (+) to the decoder's common return conductor for all function outputs.



### Caution:

If you use light-emitting diodes (LEDs) you must always operate them via a series resistor, otherwise they will be damaged when put into operation or their duration of life will be reduced considerably!

When doing without a series resistor, other components undertake the series resistor's function (e.g. rails, wheels, current connectors), possibly leading to a modification of the data signal and thus to disturbances in digital operation.

Always determine the necessary series resistor's value for the peak value of the available operating voltage. With regulated boosters this corresponds to the specified boosters' output (= track) voltage. With not regulated boosters or analogue driving transformers the peak value is approx. 1,4 fold the nominal voltage specified on the transformer.

### Serial connection of LEDs

When you want to connect several LEDs to one output you can switch them in series via a common series resistor. The current consumption is max. 20 mA for all LEDs, depending on the series resistor's value. The maximum number of LEDs to be connected in series results from

$$\frac{\text{Peak value of the operating voltage}}{\text{- sum of the forward voltages of all LEDs}} > 0$$

The advantage of this solution is the low current consumption.

In order to determine the necessary series resistor for a serial LED's

connection first add the forward voltages of all LEDs. The forward voltages depend on the lighting colour and should be given in the technical specifications. In case there is no manufacturer information available, you can take as a basis 4 V for white and blue LEDs and 2 V for yellow, orange, red and green LEDs.

The remaining voltage has to be "eliminated" by a resistor. The formula for the calculation of the resistor is:

$$\text{required } R_V [\text{Ohm}] = ( U_B [\text{V}] - \sum U_F [\text{V}] ) / ( I_F [\text{mA}] \times 0.001 )$$

$U_B$  = operating voltage (peak value) |  $\sum U_F$  = sum of the forward voltages of all LEDs

$I_F$  = current with max. luminosity

### Parallel connection of LEDs

Alternatively, you can connect several LEDs in parallel, each via a series resistor of its own. The current consumption is max. 20 mA for all LEDs, depending on the series resistor's value. The maximum number of LEDs to be connected in parallel results from

maximum current at the output

- sum of the current consumption of all LEDs

> 0

Advantageous with this solution is that the LEDs already lighten when their forward voltage has been reached (2 to 4 V, depending on the fluorescent colour), which makes this solution suitable for analogue mode. Disadvantageous is the high current consumption.

The formula for the calculation of the resistor is:

$$\text{required } R_V [\text{Ohm}] = ( U_B [\text{V}] - U_F [\text{V}] ) / ( I_F [\text{mA}] \times 0.001 )$$

$U_B$  = operating voltage (peak value) |  $U_F$  = forward voltage of the LED

$I_F$  = current with max. luminosity

In order to save current, you can limit the LEDs' current consumption to 10 mA, which normally does not cause a visible loss of luminance.

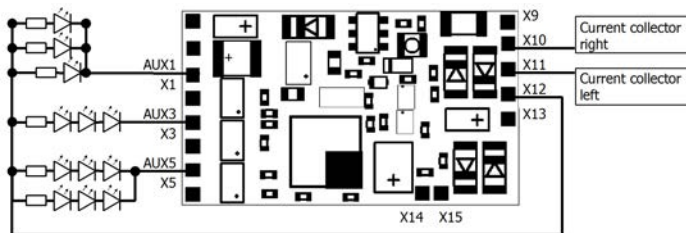


Fig. 2: Connection of LEDs (examples)

AUX1: parallel connection

AUX3: serial connection

AUX5: combination of parallel and serial connection

## 6.5. Connecting inductive loads

When connecting inductive loads (e.g. TELEX couplings, relays or other accessories with coils), you should switch a free-wheeling diode (e.g. 1N400x) in parallel, in order to avoid damage at the output. Check to connect the anode of the diode to the function output.

## 6.6. Connecting accessories via a relay

When you want to switch an accessory / accessories via the decoder, which connection would lead to exceeding the maximum current at the output or of the decoder, you can switch the accessories via a relay (e.g. 1xUm 1A 12V, item no. 84-61010) and connect them directly to the vehicle's current collector.

The current consumed by the relay depends on its type. The relay named in the example needs approx. 100 mA.

As described in the section "Connecting inductive loads" you should switch a free-wheeling diode (e.g. 1N400x) in parallel to the relay.



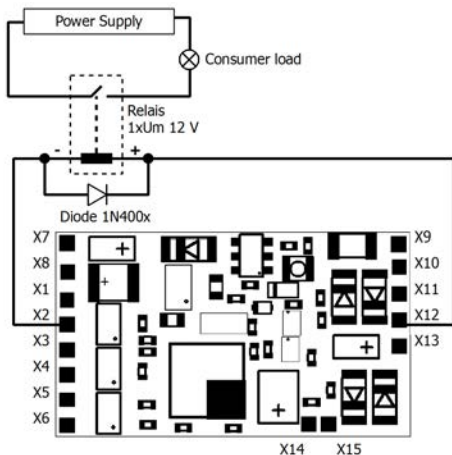


Fig. 3: Connection of an accessory via a relay

## 6.7. Connecting a loudspeaker

Use a loudspeaker with an impedance of at least 4 Ohm. When connecting a loudspeaker with a lower impedance, the output for the loudspeaker will be damaged. As a rule the playback quality increases with the loudspeaker's size. For that reason you should choose a loudspeaker as large as possible.

In addition, the correct mounting of the loudspeaker is decisive for the sound reproduction. The loudspeaker membrane should emit directly to the outside, the other side into the inside of the vehicle which should be as airtight as possible. The larger the volume in the inside, the better is the reproduction quality. Suitable for the mounting are e.g. the bottom of the vehicle or the back of the driver's cab.

## 6.8. Connecting a buffer capacitor

In sections with bad contact to the rails the power supply of the decoder can be interrupted. Possible consequences are e.g. flickering lighting or disturbing noises from the loudspeaker. In these and similar cases you can find a remedy by connecting a buffer capacitor. The electrolytic capacitor should have a capacity of minimum 220  $\mu\text{F}$  and an electric strength of minimum 35 V. Observe the correct polarity when connecting the capacitor!

## 6.9. Connecting a suppression choke

As a matter of principle the sound playback can be distorted or disturbed by a high whistling noise. In this case you should solder a suppression choke ( $\geq 470 \mu\text{H}$  / 90 mA) into one of the supply wires of the loudspeaker.

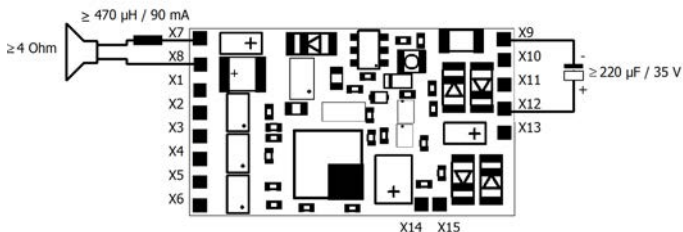


Fig. 4: Connection of a loudspeaker, a buffer capacitor and a suppression choke

## 6.10. Connecting a servo

Connect the signal input of the servo to connecting point X15 and the earth connection of the servo to point X9 of the decoder. The voltage supply for the servo should not be taken from the decoder, as the decoder cannot supply the current needed to control the servo. For that reason you need an external voltage supply for the servo (e.g. servo PCB item no. 70-05900).

Please note the connecting point X15 (IN3) has to be programmed in ##167 and 168 for the connection of a servo. When X15 has been defined as a (third) switching input, no servo signal will be sent.

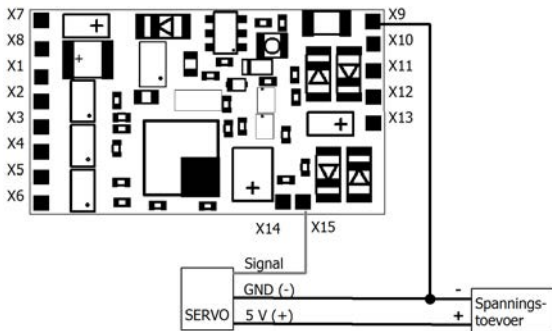


Fig. 5: Connection of a servo

## 6.11. Connecting the switching inputs

The switching inputs switch respective to the decoder ground and thus can be connected to all (external) circuits allowing to make contact to earth. It is possible to connect reed contacts or Hall sensors, for example, which make contact to earth when getting into the magnetic field of a permanent magnet.

Beside the two connecting points IN1 and IN2 you can use the connecting point IN3 (X15) as a (3<sup>rd</sup>) switching input. It is a precondition that IN3 has been defined as a switching input in CV##167 and 168 (and not as a servo output).

Connect the reed contacts to the switching inputs (X13, X14 or X15) and the earth connection. Reed contacts are not polarized, you can assign the two contacts voluntarily.

When connecting Hall sensors check for the correct polarity. Connect the earth connection of the Hall sensor to X9, the connection for the voltage supply to X12 and the output to one of the switching inputs (X13, X14 or X15).

**!** When exchanging the earth connection for the connection of the voltage supply, the Hall sensor can be damaged!

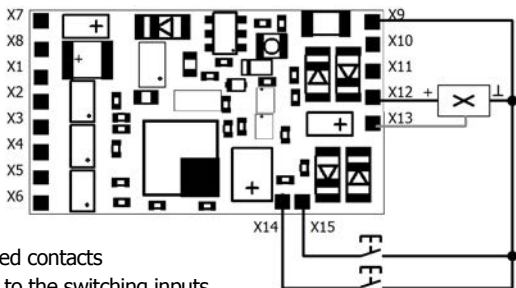


Fig. 6:  
Connection of reed contacts  
and Hall sensors to the switching inputs

## 6.12. Connecting a SUSI module

The SUSI interface is a standardized interface for the connection of accessory modules to a vehicle decoder. Controlling the SUSI module has to be carried out by the vehicle decoder. In order to make the necessary settings for the SUSI module you have to program the decoder.

With the appropriate version of the decoder there is a SUSI plug connector soldered to the decoder back side, fit to insert the socket of the SUSI module. When you have a FD-R Extended without soldered plug connector you can solder it supplementary (special component) or you can solder the connecting cables of the SUSI module directly.

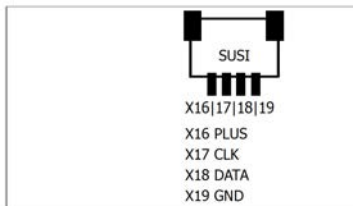


Fig. 7:  
Connection of a SUSI module

## 6.13. Fixing the decoder

After having finished all connections you should fix the decoder, to avoid short circuits by contact to metal parts of the vehicle, for example. You can use double sided adhesive tape for it, for example.

## 7. Programming

### Programming with DCC central units

You can programm the configuration variables (CV) of the decoder from the digital central unit, you can use main track programming as well. See the chapter in the manual of your central unit where the byte wise programming of configuration variables (CVs) (Direct programming) and main track programming (POM) are explained. With central units that allow only register-programming it is not possible to program the FD-R Extended.

Please note: In DCC-Format the feedback signal will not be sent by the central unit unless there is a sufficient current. For that reason you should mount an accessory with a current consumption of minimum 100 mA to one of the outputs before starting to program the function decoder.

### Programming with Motorola central units

In Motorola format the settings are saved in registers.

Please note: If you use a central unit for both DCC and Motorola format it is recommended to program the decoder in the DCC format. After having finished programming the decoder it is possible to control it in Motorola format as well.

Please note: You should connect a lamp or a LED to at least AUX1 or AUX2 before starting to program the decoder with a Motorola central unit, as the decoder shows the status of the programming by flashing the lighting connected to the outputs AUX1 and AUX 2. The flashing frequency shows, which input the decoder expects:

Slow flashing	Fast flashing
<b>Number</b> of the register to be programmed	<b>Value</b> of the register to be programmed

Put the vehicle on a track oval or a track section connected to the central unit's track output (not to the connection for the programming track). Make sure no other vehicle than the one you intend to program is set on the track as the decoder inside this vehicle might be programmed as well.

Starting the programming mode	Programming the decoder
<ol style="list-style-type: none"> <li>1. Switch on the central unit or perform a reset at the central unit (pushing "stop" and "go" simultaneously).</li> <li>2. Set the current decoder address (default value: 3) or the address "80".</li> <li>3. Set all functions to "off".</li> <li>4. Push button "stop" → switch off the track voltage.</li> <li>5. Operate the direction switch and hold it in that position. Push the button "go" at once.</li> <li>6. As soon as the lighting flashes, release the direction switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Enter the number of the register as a Motorola-address. <i>If necessary: with a leading "0".</i></li> <li>2. Operate the direction switch. → Lighting flashes faster.</li> <li>3. Enter the value you want to set into the register (as Motorola-address).</li> <li>4. Operate the direction switch. → Lighting flashes more slowly.</li> </ol> <p style="text-align: center;">Repeat steps 1 – 4 for all registers.</p> <p style="text-align: center;">Push button "stop".</p>
→ Programming mode	→ End of programming mode.

### **Programming with central units with restricted input options**

Some central units do not allow but input values up to 80 or 99. Two auxiliary registers (CV#50 and #51) make it possible to enter higher values.

### **Programming with the Central Station and the Mobile Station**

With the Central Station I or the Mobile Station of Maerklin\*\* you can program the registers. Select the article no. 29750 from the locomotive database and program the decoder as described for this article in the Central Station 's or Mobile Station 's manual.

### **Programming with the CV-Navi**

Instead of programming the configuration variables or registers of the decoder using the digital central unit, you can use the free software CV-Navi. You will find the free download under:

[www.tams-online.de](http://www.tams-online.de)



## 8. Configuration variables and registers

In the lists you will find in the column "No." the numbers of the configuration variables for programming in DCC format. The numbers of the registers for programming in Motorola format are identical to the CV numbers. The defaults are those values set in the state of delivery and after a reset.

Please note: With variables destined to set several parameters, the input value has to be calculated by adding the numerical values assigned to the desired parameters.

### Setting the address

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Basic address	1	1 ... 255 (3)	Range of values in DCC-Format: 1 ... 127
Tip: If a value higher than 127 is set for the basic address and the use of extended addresses in CV#29 is set to off, the decoder does not react to signals in DCC format!			
Extended address	17	192 ... 255 (192)	Only for DCC format. Most central units permit entering extended addresses directly. The CVs # 17, 18 and 29 are set automatically to the proper values.
	18	0 ... 255 (255)	
Consist address	19	1 ... 127 (0)	= 2nd adress In DCC format only!
2nd Motorola address	47	0 ... 255 (4)	= Address needed to switch additional functions in Motorola format. The function keys F5 to F8 are reached via the function keys F1 to F4, the function key F9 via the function key F0.

## Settings for a SUSI module

The following CV parameters are relevant only when connecting a SUSI module controlling the sound depending on the effective motor voltage.

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Starting voltage (starting velocity )	2	0 ... 255 (5)	= The voltage to be output to the motor at speed level 1. "0" = 0 Volt "255" = max. voltage
Acceleration rate	3	0 ... 255 (4)	= Length of the delay before the switching to the next higher / lower speed level when the locomotive is accelerating / braking. The value "255" corresponds to the max. delay.
Braking rate	4	0 ... 255 (2)	
Highest velocity	5	0 ... 255 (255)	= The voltage to be output to the motor at the highest / mean speed level. "255" = max. voltage
Mean velocity	6	0 ... 255 (100)	
Braking performance with d.c. voltage	27	0, 32, 64, 96 (0)	No braking with d.c. voltage 0
			Braking with negative d.c. voltage 32
			Braking with positive d.c. voltage 64
<p>Tip: It is standard to switch over into analogue mode when applying a d.c. voltage at the rails. In case that the decoder is run in a layout with a braking route based on applying a d.c. voltage (e.g. Maerklin**-braking route), the automatic recognition of the analogue mode has to be switched off (CV#29) to ensure that the locomotive reacts as expected on the braking route.</p> <p>The setting of the negative or positive d.c. voltage is related to the right rail, as seen in the locomotive 's direction of motion.</p>			

**Settings for a SUSI module** (continuation)

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Configuration data 2	49	2 ... 126 (72)	Shunting gear at F1 2
			Shunting gear at F2 4
			Shunting gear at F3 8
			Shunting gear at F4 16
			Acceleration and brake delay to be switched at F3 32
			Acceleration and brake delay to be switched at F4 64
Alternative velocity characteristic (only with mode 28 speed levels)	68 . . 95	0 ... 255 (0)	= The velocity table for the alternative velocity characteristic. Any motor voltage can be assigned to all of the 28 speed levels. "0" = 0 Volt "255" max. voltage

**Information / Read only**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Version	7	---	Read only in DCC format!
Manufacturer	8	--- (62)	Read only in DCC format!
Index for higher CV pages	31	--- (0)	Set firmly. For reading out RailCom relevant data. Only for DCC format.
	32	--- (255)	

## Auxiliary functions

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Reset	8	0 ... 255	Any input value restores the settings in state of delivery.
Auxiliary register for programming with central units with restricted input options			Allows to enter values > 80 resp. 99 with central units allowing to entries from 0 or 1 to 80 or 99.
	50	(0)	Number of CV
	51	(0)	Value of CV
<p>In CV #50 and 51 you preset the hundred and the tenner for the CV number and CV value. In order to program a CV number &gt; 80 or 99 you have to program the desired "one" value into the CV with the corresponding "one" number. Instead of a "0" you can enter "10" (with those central units not allowing to enter a "0"). Examples:</p>			
CV#137 → value 245 1. CV#50 = 13 (1= the 100   3 = 10ner) 2. CV#51= 24 (2= the 100   4 = 10ner) 3. CV#7 = 5 (7 = the one of the CV number; 5 = the one of the CV value)		CV#120 → value 230 1. CV#50 = 12 (1= the 100   2 = 10ner) 2. CV#51= 23 (2= the 100   3 = 10ner) 3. CV#10 = 0 or 10 (10 for value 0 of the one of the CV number; 0 or 10 for value 0 of the one of the CV value)	

**Settings for analogue mode**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Packet time out for analogue recognition	11	0 ... 255 (5)	The higher the set value, the longer it takes until the decoder automatically switches to analogue mode after having received the last digital signal .
Functions active in analogue mode (only for F1 to F8, not for F9 to F12)	13	0 ... 255 (0)	F1 on 1
			F2 on 2
			F3 on 4
			F4 on 8
			F5 on 16
			F6 on 32
			F7 on 64
			F8 on 128

**Basic settings**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
RailCom settings	28	0, 1, 2, 3 (3)	0 = no feedback 1 = channel 1 on only 2 = channel 2 on only 3 = channel 1 and 2 on
Configuration data 1	29	0 ... 64 (14)	Direction "Standard" 0
			Reverse direction 1
			14 speed levels 0
			28 or 128 speed levels 2
			Analoge recognition off 0
			Analoge recognition on 4
			RailCom off 0
			RailCom on 8
			Linear velocity characteristic 0
			Alternat. velocity charact. 16
Not for MM mode:			Basic addresses 0
			Extended addresses 32
<p>Example: CV#29 = 0. → Direction = "Standard". 14 speed levels. Basic addresses. Automatic analogue recognition = "off". RailCom = "off".</p> <p>Example: CV#29 = 46. → Direction = "Standard". 28 or 128 speed levels in DCC-mode. Automatic analogue recognition = "on". RailCom = "on". Extended addresses.</p> <p>Tip: If the use of extended addresses is activated in CV#29, the decoder does not react to signals in Motorola format!</p>			
Switching off at overload	48	--- (64)	<p>Determines, at which current the overload protection responds. The higher the input value, the higher is the current responding at overload protection.</p> <p>64 = 1 500 mA</p> <p>The value of 64 should be altered as an exception only!</p>

**Assignment of the function keys to the outputs**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
F0 forward on	33	0 ... 63 (1)	AUX1 1
F0 backward on	34	0 ... 63 (2)	AUX2 2
F1	35	0 ... 63 (4)	AUX3 4
F2	36	0 ... 63 (8)	AUX4 8
F3	37	0 ... 63 (0)	AUX5 16
F4	38	0 ... 63 (0)	AUX6 32
F5	39	0 ... 63 (16)	
F6	40	0 ... 63 (32)	
F7	41	0 ... 63 (0)	
F8	42	0 ... 63 (0)	
F9	43	0 ... 63 (0)	
F10	44	0 ... 63 (64)	
F11	45	0 ... 63 (128)	
F12	46	0 ... 63 (0)	
F13	180	0 ... 63 (0)	
...	...	0 ... 63 (0)	
F28	195	0 ... 63 (0)	

Factory settings: AUX1 to be switched with F0, switched on at forward motion. AUX2 to be switched with F0, switched on at backward motion. AUX3 to be switched with F1, AUX4 to be switched with F2, AUX5 to be switched with F5, AUX6 to be switched with F6.

Example: AUX2 to be switched with F5 → CV#39 = 2

Example: AUX1 and AUX3 to be switched with F6 → CV#40 = 5 (= 1+4)

## Effects of the outputs

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
AUX1	53	0 ... 255 (0)	Independent of direction 0
AUX2	54	0 ... 255 (0)	AUX off at backward motion 1
AUX3	55	0 ... 255 (0)	AUX off at forward motion 2
AUX4	56	0 ... 255 (0)	Function inverted 4
AUX5	57	0 ... 255 (0)	Flashing inverted 8
AUX6	58	0 ... 255 (0)	Flashing on 16
			MARsight (AUX1-4) on 32
			Double flashing on 64
			Kick function on 128

Factory settings: The functions F1 to F28 switch the assigned outputs independent of the direction of motion. F0 always switches dependant of the direction of motion.

Examples:

MARsight with AUX1, switched on at forward motion: → Input value for CV#53 = 33 (= 1 + 32)

Alternating flashing with AUX4 and AUX5:

→ Input value for AUX 4: CV#56 = 16 | Input value for AUX 5: CV#57 = 24 (16 + 8)

## Settings for the flash lights

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Flashing frequency of the lighting			
AUX1	106	10 ... 255 (20)	Determines the duration of one period. 10 = highest possible frequency 255 = lowest possible frequency
AUX2	107		
...	...		
AUX6	111		
Flashing frequency of the MARsight for all outputs	112	0 ... 255 (64)	0 = fast 255 = slow



**Settings for the flash lights** (continuation)

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
On-time of the flashlights			
AUX1	132	0 ... 255 (4)	The maximum value of the on-time is the value set in CV#106 et seq. The higher the input value, the longer is the on-time.
AUX2	133		
...	...		
AUX6	137		

Example: For AUX1 is set in CV#106 a value of 100 for the flashing frequency and in CV#132 a value of 60 for the on-time.

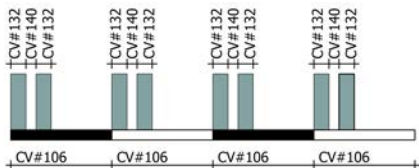


With a value of 50 in CV-132 on- and off-time would have the same length, with a value of 100 the light would be switched on permanently.

**Double flashing: Length of the break between the two flashlights.**

AUX1	140	0 ... 255 (2)	Frequency and on-time have to be set in CV#106 et sqq. and CV#132 et sqq. The length of the break is the longer the higher the input value is. For the input values for CV#106 et sqq., 132 et sqq. And 140 et sqq. applies: $(CV\#132) \times 2 + (CV\#140) < (CV\#106)$
AUX2	141		
...	...		
AUX6	145		

Example: For AUX1 is set in CV#106 a value of 100 for the flashing frequency and in CV#132 a value of 15 for the on-time. The value for the length of the break is 10.



In case 2 times the value of the on-time + the value of the length of the break would be higher than the frequency, the sequence would be interrupted when reaching the end of the period.

## Dimming of the outputs

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
AUX1	115	1...255	= Reduction of the voltage applied to the output. "1" = lowest voltage, "255" = maximum voltage
AUX2	116	(255)	
AUX3	117		
AUX4	118		

## Dimming of the outputs depending on the speed level

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips	
Internal speed level for CV#114	113	1 ... 255 (10)	= speed level, from which the outputs defined in CV#114 are dimmed with the settings in CV##123 to 126 (instead of settings in CV##115 to 118).	
Outputs dimmed depending on the speed level	114	0 ... 15 (0)	AUX1	1
			AUX2	2
			AUX3	4
			AUX4	8

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Dimming depending on the speed level			= reduction of the voltage at the output
AUX1	123	1...255 (255)	"1" = lowest voltage
AUX2	124		"255" = maximum voltage
AUX3	125		Values are applied to the outputs determined in CV#114 and starting from a speed level determined in CV#113 only.
AUX4	126		

### Shunting light

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips	
Shunting light	131	0 ... 255 (0)	for AUX1	1
			for AUX2	2
			for AUX3	4
			for AUX4	8
			for AUX5	16
			for AUX6	32
			to be switched with F3	64
			to be switched with F4	128
Example: For AUX2 and AUX 3 shunting light, to be switched with F4: → input value: 134 (= 2 + 4 + 128)				

### Kick function

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Kicking time for direction "forward"	162	0 ... 255 (32)	0 = short 255 = long
Kicking time for direction "backward"	163		

### Assignment to the switching inputs

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
<b>Assigning the function outputs to the switching inputs</b>			
IN1	59	0 ... 63 (0)	AUX1 1
IN2	61	0 ... 63 (0)	AUX2 2
IN3	63	0 ... 63 (0)	AUX3 4
			AUX4 8
			AUX5 16
			AUX6 32
<b>Assigning the servo positions to the switching inputs</b>			
IN1	60	0, 1, 2, 3 (0)	Servo position 1 1
IN2	62	0, 1, 2, 3 (0)	Servo position 2 2
			Toggling between servo position 1 and 2 3
Note: Toggling between servo positions: The servo heads to the in each case other end position.			
Note: In order to activate the settings in CV##60 and 62, the value for CV#167 has to set to "0" and the value for CV#168 to "1".			
<b>Assigning the sounds to the switching inputs</b>			
IN1	60	8,16,32,64 (0)	Door's bleeping when closing 8
IN2	62	8,16,32,64 (0)	Train conductor's whistle 16
IN3	64	8,16,32,64 (0)	Signal horn 32
			Bell 64
Note: In order to activate the settings in CV#64, the value for CV#167 has to set to "0" and the value for CV#168 to "0".			

### Setting the minimum on-time of the switching inputs

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
IN1	119	0 ... 255 (0)	= Length of time for the input to be switched on after having been connected to earth. Increasing the value by "1" will prolong the length of time by 1,1 sec. 0 = 0 sec. (off) 255 = 280.5 sec. (> 4 min.)
IN2	120	0 ... 255 (0)	
IN3	121	0 ... 255 (0)	

### Settings for integrated sounds

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Assignment of the function keys to the integrated sounds			
F1   F13	148	0 ... 192 (0)	Door's bleeping 8   136
F2   F14	149	0 ... 192 (0)	Train conductor's whistle 16   144
F3   F15	150	0 ... 192 (0)	Signal horn 32   160
F4   F16	151	0 ... 192 (0)	Bell 64   192
F5   F17	152	0 ... 192 (0)	
F6   F18	153	0 ... 192 (0)	
F7   F19	154	0 ... 192 (16)	
F8   F20	155	0 ... 192 (32)	
F9   F21	156	0 ... 192 (64)	
F10   F22	157	0 ... 192 (8)	
F11   F23	158	0 ... 192 (0)	
F12   F24	159	0 ... 192 (0)	
The smaller value applies to the function keys F1 to F12, the higher to the function keys F13 to F24. You should assign only one sound to each function key.			
Level of the integrated sounds	160	0 ... 255 (0)	0 = maximum sound level
			255 = minimum sound level

**Settings for IN3 (servo output or 3. switching input)**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips
Assignment servo output (IN3 ) to the function keys	167	0 ... 255 (2)	Allowing the servo to be controlled via POM 0
			Activation with F5 1
			F6 2
			F7 4
			F8 8
			F9 16
			F10 32
			F11 64
			F12 128
Determining the operating mode of IN3	168	0, 1 (0)	IN3 = 3 <sup>rd</sup> servo input or allowing the servo to be controlled via f-keys 0
			Entering the servo folding square via POM or via IN1 / IN2 1
Setting the servo			The value for the right stop has to be higher than the value for the left stop. 0 = highest velocity 255 = lowest velocity
left stop	169	40...250 (112)	
right stop	170	40...250 (176)	
velocity	171	0 ... 255 (16)	
Controlling the servo via POM / servo position	172	lowest value = CV#169 highest value = CV#170	The last via POM set value will be saved and the corresponding position will be headed for automatically. Note: Controlling the servo via POM is not possible until CV#167 = 0 and CV#168 = 1.

**Special functions for speed level 0**

Name of CVs / registers	No.	Input value (Default)	Remarks and Tips	
Switching off function F0 at speed level 0	173	0...255 (0)	Determines the functions (F1 to F8) to switch off the function F0 at speed level 0.	
			F1   F2	1   2
			F3   F4	4   8
			F5   F6	16   32
			F7   F8	64   128
Switching on the outputs at speed level 0	174	0 ... 63 (0)	Determines the outputs to be switched on /off via the functions defined in CV#173 at speed level 0.	
Switching off the outputs at speed level 0 In combination with CV#173	175	0 ... 63 (0)	AUX1	1
			AUX2	2
			AUX3	4
			AUX4	8
			AUX5	16
			AUX6	32
Inverting the outputs at speed level 0. off = on on = off In combination with CV#173	176	0 ... 63 (0)	Determines the outputs to be inverted via the functions defined in CV#173 at speed level 0.	
			AUX1	1
			AUX2	2
			AUX3	4
			AUX4	8
			AUX5	16
			AUX6	32

## 9. Performing a POM-Update

Hint: The POM-Update is possible with decoders FD-R Extended from version 2.0. For updating decoders with a former firmware version you have to send them in. The version number is saved in CV #7.

### Preparations

1. In order to perform the firmware update you do **not** have to dismount the decoder. Put the vehicle with the mounted decoder on the main track. Hint: You can perform a firmware update with several decoders FD-R Extended at once, the current software version of the decoders is of no importance. The individual CV settings of the decoder will not be altered by updating.
2. Save the file with the newest firmware on your PC, e.g. FD-R\_Extended\_V2\_1\_0\_0.hex for version 2.1.0.0  
You can download the newest firmware from our homepage without charge. When getting (on the part of any third parties) a packed file (e.g. \*.zip) you have to unpack it first.
3. Get ready the CD with the program "POM-Updater.exe" (included in the delivery) or download the program from our homepage.
4. Connect your central unit with the PC. At present (status: 01/2015) the POM-Update can be carried out with the MasterControl (Tams Elektronik), the Intellibox 1 (Uhlenbrock\*\*) and the CS2 (Maerklin\*\*). You find the current list of central units allowing to perform the POM-update on our homepage.
5. Before starting the update connect at least one lamp or LED to AUX2 (F0r) as the update's status is shown by lighting or flashing of the lighting connected to this output.



## Changing into the update mode

Execute the programm POM-update.exe, follow the helpfile. Proceed as follows:

1. Make the settings for the update.
2. Enter the addresses of the function decoders FD-R Extended you want to update.
3. Change into the update mode.

The lighting connected to the outputs AUX2 (F0r) of the decoders which are chosen for an update start to flash slowly. If flashing quickly, the decoder cannot be updated

- because the decoder type does not correspond to the hex-file or
- because the decoder´s firmware already conforms to the version of the hex-file.

The concerned vehicles can stay on the track, they do not affect updating the other decoders. As an alternative you can cut them from current shortly in order to stop them flashing quickly.

## Performing the POM-Update

After having changed into the update mode you can start the update. The lighting connected to the outputs AUX2 of the decoders in update mode stop to flash and show permanent lighting.

The duration of the update depends on the central unit in use and the extent of the transferred data. The progress is shown in the screen mask. As soon as the update has been finished the lighting start to flash slowly. Cut the vehicles from current shortly. Now the vehicles are in standard operation again.

When a fault occurs during updating, the update is interrupted and the lighting starts to flash quickly. In this case restart the update after altering the settings if necessary (see helpfile of the programm for further information).

## 10. Check list for troubleshooting

- Parts are getting very hot and/or start to smoke.



Disconnect the system from the mains immediately!

Possible cause: one or more connections are soldered incorrectly.  
→ Check the connections.

Possible cause: Short circuit. The decoder is connected to locomotive or carriage ground. → Check the connections. A short circuit can result in irreparable damage.

### Problems with switching of the functions

- After programming, the decoder does not react as desired.  
Possible cause: The input values for the CVs are incoherent.  
→ Perform a decoder reset and first test the decoder with the default values. Programm the decoder anew afterwards.
- An accessory / a light does not react to switching commands.  
Possible cause: The accessory is defective or incorrectly connected.  
→ Check the accessory / the connections.  
Possible cause: The output is defective (e.g. due to overload or short circuit). → Send in the decoder for check / repair (with costs).
- The lighting does not correspond to the direction of motion.  
Possible cause: The configuration data (CV29) of the locomotive decoder in the block train are programmed in a different way from the function decoder. → Alter the parameters of the locomotive or the function decoder.
- The lighting goes on and off when the speed levels are turned up or the lighting cannot be switched on or off.  
Possible cause: The speed mode of the decoder and the digital control unit do not correspond. Example: The central is set to the mode 28 speed levels, but the decoder to the mode 14 speed levels. → Change the speed mode at the central and / or at the decoder.

### Problems in analogue mode

- The decoder does not work in analogue mode.  
Possible cause: The analogue mode is switched off. → Alter the value for CV#29.
- The decoder does not switch to analogue mode (or switches over although it is still digitally controlled).  
Possible cause: The value in CV#11 is set too high or too low.  
→ Alter the value and check the settings in operation.

### Problems with switching via switching inputs

- After passing a permanent magnet in the rails no function is activated.  
Possible cause: The reed contact or the Hall sensor has been mounted incorrectly. → Check the connections.  
Possible cause: The distance to the magnet is too large or the magnet is too weak. → Alter the position of the magnet (if possible) or use a stronger one.  
Possible cause: The magnet has been mounted incorrectly polarized.  
→ Alter the mounting direction.  
Possible cause: The function has been assigned incorrectly to the switching input. → Check the settings in CV## 59-64 and 119-121.  
Possible cause: The input IN3 is determined for the connection of a servo (= default value). → Check the settings in CV## 167 and 168.

### **Problems with the sound playback**

- There is no sound to be heard after switching on.  
Possible cause: The loudspeaker has been connected incorrectly.  
→ Check the connections.  
Possible cause: The sound level has been set too low in CV#160.  
→ Check the settings.  
Possible cause: The FD-R Extended is incorrectly connected to the SUSI interface of the sound module. → Check the connections.
- The sound playback is bad, the loudspeaker hums, you can hear disturbing noises. → Mount a buffer capacitor and a suppression choke.

### **Problems with switching the servo**

- The servo does not move.  
Possible cause: The left and the right stop are defined incorrectly.  
→ Check the settings in CV##169 and 170.  
Possible cause: The input IN3 has not been determined for the connection of a servo. → Check the settings in CV## 167 and 168.  
Possible cause: The servo has been mounted incorrectly. → Check the connections  
Possible cause: The power supply is connected incorrectly → Check the connections.

### **Problems with the POM-Update**

- While updating the decoder the lighting starts to flash, the update is interrupted.  
Possible cause: The settings for the POM-Update are wrong.  
→ Check and alter the settings if necessary. The helpfile contains explanations.

**Hotline**

If problems with your decoder occur, our hotline is pleased to help you (mail address on the last page).

**Repairs**

You can send in a defective decoder for repair (address on the last page). In case of guarantee the repair is free of charge for you. With damages not covered by guarantee, the maximum fee for the repair is 50 % of the sales price according to our valid price list. We reserve the right to reject the repairing of a decoder when the repair is impossible for technical or economic reasons.

Please do not send in decoders for repair charged to us. In case of warranty we will reimburse the forwarding expenses up to the flat rate we charge according to our valid price list for the delivery of the product. With repairs not covered by guarantee you have to bear the expenses for sending back and forth.

## 11. Guarantee bond

For this product we issue voluntarily a guarantee of 2 years from the date of purchase by the first customer, but in maximum 3 years after the end of series production. The first customer is the consumer first purchasing the product from us, a dealer or another natural or juristic person reselling or mounting the product on the basis of self-employment. The guarantee exists supplementary to the legal warranty of merchantability due to the consumer by the seller.


The warranty includes the free correction of faults which can be proved to be due to material failure or factory flaw. With kits we guarantee the completeness and quality of the components as well as the function of the parts according to the parameters in not mounted state. We guarantee the adherence to the technical specifications when the kit has been assembled and the ready-built circuit connected according to the manual and when start and mode of operation follow the instructions.

We retain the right to repair, make improvements, to deliver spares or to return the purchase price. Other claims are excluded. Claims for secondary damages or product liability consist only according to legal requirements.

Condition for this guarantee to be valid, is the adherence to the manual. In addition, the guarantee claim is excluded in the following cases:

- if arbitrary changes in the circuit are made,
- if repair attempts have failed with a ready-built module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

## 12. Declaration of conformity

 This product conforms with the EC-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying standards: EN 55014-1 and EN 61000-6-3. To guarantee the electromagnetic tolerance in operation you must take the following precautions:

- Connect the transformer only to an approved mains socket installed by an authorised electrician.
- Make no changes to the original parts and accurately follow the instructions, connection diagrams and PCB layout included with this manual.
- Use only original spare parts for repairs.

2011/65/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS). Underlying standard: EN 50581.

## 13. Declarations conforming to the WEEE directive

This product conforms with the EC-directive 2012/19/EG on waste electrical and electronic equipment (WEEE).



DE 37847206

The Tams Elektronik GmbH is registered with the WEEE-no. DE 37847206, according to. § 6 sect. 2 of the German electro regulations from the responsible authority for the disposal of used electro equipment.

Don't dispose of this product in the house refuse, bring it to the next recycling bay.

Information and tips:

<http://www.tams-online.de>

Warranty and service:

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