FD-R **Basic**

| DCC | | MM | | _Rail_ ((Com |

RailCom-Sender und
Funktionsdecoder

RailCom transmitter
and function decoder

Emetteur RailCom et
décodeur de fonctions

RailCom-zender en
functiedecoder

- Anleitung

- Manual

- Mode d´emploi

- Handleiding

Art.-Nr. 42-01100 | 42-01101

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Remark: RailCom® is the registered trademark of the Lenz Elektronik GmbH, Hüttenbergstraße 29, D-35398 Gießen. To increase the text´s readabiliy we have refrained from refering to this point in each instance.

1. Getting started

How to use this manual

This manual gives step-by-step instructions for safe and correct fitting of the module, and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the FAQ chapter. 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 module on to another person, please pass on the manual with it.

Intended use

The module FD-R$_{Basic}$ is designed for mounting in a model railway locomotive or in a model railway carriage. It can be used as a function decoder and / or as a RailCom transmitter in addition to a locomotive or function decoder that is not compatible to RailCom.

The module 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. Any other use is inappropriate and invalidates any guarantees.

⚠ **Caution:**

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

Checking the package contents

Check the contents of the package for completeness immediately after unpacking:

- one module, with or without soldered connecting wires, depending on the version.
- one manual.

Required tools and materials

Make sure you have the following tools, equipment and materials ready for use:

- an electronic soldering iron (max. 30 Watt) with a fine tip,
- a soldering iron stand,
- a tip-cleaning sponge,
- a heat-resistant mat,
- a small side cutter, a wire stripper and a pair of tweezers,
- tin solder (0,5 mm. diameter),
- wire (diameter: $\geq 0,05$ mm² for all connections).

2. Safety instructions

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,
- connecting the circuit to another voltage than specified,
- impermissibly high humidity,

- 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.
- Mounting the module 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 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 module.

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, mounting and operation must be supervised by qualified personnel.

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

3. EMC declaration

This product is developed and tested in accordance with the European standards EN 55014-1 and EN 61000-6-3 and meets the EC - directive 2004/108/EG and legal requirements.

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, circuit diagram and PCB layut included with this manual.
- Use only original spare parts if you have to repair the kit or the ready-built module.

4. 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.

5. Operation overview

The module FD-R^{Basic} can be used both as a function decoder and as a RailCom transmitter in addition to a locomotive or function decoder that is not compatible to RailCom.

Driving in digital Operation

The FD-R^{Basic} is a multiple protocol function decoder, that can operate with and automatically recognises 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).

Programming the decoder is done in DCC format by setting the configuration variables and in Motorola format through the registers.

Operation in analogue mode

The FD-R^{Basic} can also be used in analogue model railway layouts that are run with an D.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.

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.

Function outputs

The decoder has two amplified function outputs with a maximum current of 100 mA each, which are available to connect optional accessories (e.g. lighting).

In DCC format the function outputs can be switched via the function keys F0 to F12. In Motorola format the function outputs can be switched via the function keys F0 to F4. The functions F5 to F9 can be switched via the function keys F1 to F4 and F0 by assigning them to a second address. The functions F10 to F12 are not available in Motorola format.

You can assign the function keys to the function outputs freely. It is possible to assign several function keys to one function output.

Effects of the function outputs

It is possible to set the following effects for all function outputs individually:

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.

Switching on and off depending on the direction of travel: This function can be assigned either to the individual outputs or to the function keys.

Flash Lights: Both the frequency and the keying ratio can be set. E.g. single and alternating flash lights or strobe lights.

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 control unit or to special receivers (so-called detectors). The decoders must be designed to send the RailCom messages.

The FD-R^{Basic} has a special RailCom memory area, from which (continuously) the (basic, extended or consist) address is sent to the detectors (so-called RailCom broadcast datagramm) and from which a CV message can be transferred after a DCC CV read-out command.

The FD-R^{Basic} can be used as a function decoder compatible to RailCom with an address of it´s own or it can be mounted in addition to a DCC or Motorola locomotive or function decoder that is not compatible to RailCom. In this case it serves as a RailCom transmitter (should the occasion arise to switch additional functions). After taking over the settings of the non compatible decoder into the memory area of the FD-R^{Basic} they can be sent as RailCom messages.

Sending RailCom messages is only possible in layouts with a DCC signal on the rails. That is the reason why is not possible to use the FD-R^{Basic} as a RailCom transmitter in combination with a Motorola decoder in a pure Motorola environment, but only when at least one other locomotive or function decoder on the layout is controlled in DCC format.

6. Technical specifications

Data format	DCC and Motorola
Feedback log	RailCom
Supply voltage	12-24 Volt digital voltage
Current consumption	
(without connected loads)	approx. 10 mA
Max. current of the function outputs	100 mA each
Max. total current	300 mA
Protected to	IP 00
Ambient temperature in use	0 - + 60° C
Ambient temperature in storage	-10 - + 80° C
Comparative humidity allowed	max. 85 %
Dimensions	approx. 12,5 x 9,5 x 3,3 mm
Weight	approx. 0,6 g

7. Mounting the FD-R^{Basic}

Follow the connection diagram fig. 1.

Open the vehicle´s housing. Locate the position for the module.

Solder the connections from the rail current collectors at the points X4 and X5. Assign the connections as follows:

X4:   left rail current collector (seen in direction of motion)

X5:   right rail current collector (seen in direction of motion)

Tip: It is not possible to send a confirmation signal to the central unit in DCC format when there is not sufficient current consumption. Therefore you should connect at least one accessory with a current consumption of max. 100 mA before starting to program the module if using it as a function decoder. In case you use the module as a RailCom-transmitter only, this is not necessary.

Tip: When programming the module with a Motorola central unit the switch into the programming mode, and the status of the programming, are shown by flashing the lighting connected to the outputs AUX1 to AUX 2. You should therefore connect lighting to at least one output before starting to program the module with a Motorola central unit.

Connecting accessories to the outputs

Before connecting the lighting and other accessories to the outputs check if the current is below the maximum permissible value of 100 mA per output. If lighting or other accessories with current larger than 100 mA are connected the decoder will be damaged when put into operation.

Disconnect any existing diodes in the leads to the lamps. Connect the lamps and the accessories to the function outputs (AUX1 to AUX2) of the decoder. The assignment of the function outputs to the function keys will be made when programming the decoder.

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 return conductor of the decoder (point X6).

⚠ Caution:

If you connect the accessories to the return conductor for all functions (point X6), the accessories must be insulated. The accessories should not make contact with metal parts of the vehicle. Possible short circuit! The decoder will be damaged in operation.

⚠ Caution:

The return conductor for all functions (point X6) must under no circumstances be connected to vehicle ground. Possible short circuit! The decoder will be damaged in operation.

Factory settings

If you want to use the factory settings, you have to connect the lighting and the accessories as follows:

Front lighting: AUX1

Back lighting: AUX2

Connecting the LEDs

The function outputs of the module (AUX1 and AUX2) switch to the module ground. For that reason you must connect the cathode (-) of the LED to the function outputs.

⚠ **Caution:**

If you use light-emitting diodes (LEDs) you must always operate them via a series resistor. LEDs are available in many different models. The series resistor limits the current flow of the LED and will need to be calculated for each model. Ask for the max. current rating when buying your LEDs.

You can connect several LEDs in parallel to each output. In this case every LED must have a series resistor of its own. If you connect several LEDs to one output in series, only one series resistor is needed.

Connecting a smoothing capacitor

In track sections with bad contacts the power supply may be interrupted shortly. You can solder a capacitor (e.g. 100 µF/35 V) between the points X3 and X6 to conterat this effect (see fig. 1).

Fixing the module

After completing all connections fix the module with double-sided adhesive tape, for example.

8. Programming the FD-R^{Basic}

The FD-R^{Basic} can be used both as a function decoder and as a RailCom transmitter in addition to a locomotive or function decoder that is not compatible to RailCom. The settings for it´s function as a function decoder and the settings of the decoder it serves as a RailCom transmitter are saved in two seperate memory areas, the function decoder area and the RailCom area.

To take over the data into the RailCom area from DCC decoders or Motorola decoders with register programming, the decoder and the RailCom area of the FD-R^{Basic} are programmed together. With Motorola decoders without register programming for instance, the address can be saved in the RailCom area of the FD-R^{Basic}.

In DCC format it is possible to program register or configuration variables (CVs), main track programming can be used as well. In Motorola format the settings are saved in registers.

Programming with DCC central units

You can programm the configuration variables (CV) of the module from the digital central unit. See the chapter in the manual of your central unit where the byte wise programming of configuration variables (CVs) is explained. With central units that allow only register-programming it is only possible to program the variables CV#1 and CV#29 (= register 1 and 5).
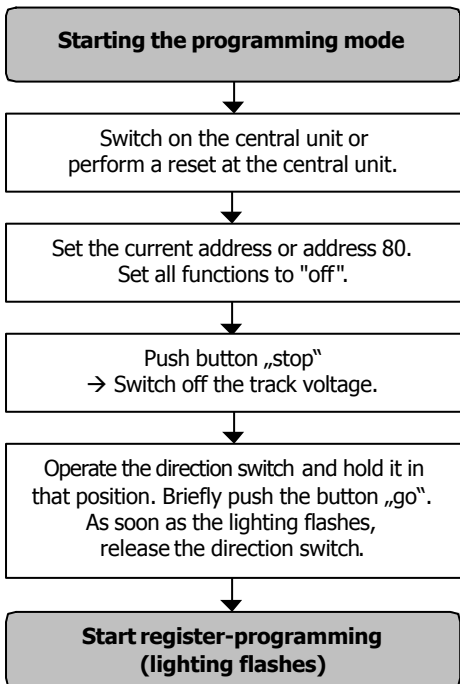
Programming with the Central Station and the Mobile Station

With the Central Station or the Mobile Station of Märklin* you can program the registers, but the value to be set is limited to 80. 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 Motorola central units

Put the locomotive on a track oval or a track section connected to the central unit's track output. 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.

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

```
┌────────────────────────────────────────────────┐
│          Starting the programming mode           │
└────────────────────────────────────────────────┘
                          ↓
┌────────────────────────────────────────────────┐
│          Switch on the central unit or           │
│         perform a reset at the central unit.      │
└────────────────────────────────────────────────┘
                          ↓
┌────────────────────────────────────────────────┐
│        Set the current address or address 80.     │
│              Set all functions to "off".          │
└────────────────────────────────────────────────┘
                          ↓
┌────────────────────────────────────────────────┐
│                Push button „stop"                 │
│          → Switch off the track voltage.          │
└────────────────────────────────────────────────┘
                          ↓
┌────────────────────────────────────────────────┐
│   Operate the direction switch and hold it in     │
│  that position. Briefly push the button „go".     │
│          As soon as the lighting flashes,         │
│            release the direction switch.          │
└────────────────────────────────────────────────┘
                          ↓
┌────────────────────────────────────────────────┐
│           Start register-programming              │
│              (lighting flashes)                   │
└────────────────────────────────────────────────┘
```

Reset the central unit (by simultaneously pushing the buttons "stop" and "go" for some time) or quickly switch the central unit off and on. First enter the current address or the address "80" (e.g. if you do not know the current address). Manufacturers setting is "3". Set all functions (function, f1 to f4) to "off".

Push the "stop" button at the central unit. Next, operate the direction switch and hold it in that position while briefly pushing the "go" button. As soon as the lamps connected to the outputs AUX1 or AUX2 flash (after approx. 2 seconds) the module is in the programming mode and you an release the direction switch.

After having started the programming mode (and when the locomotive´s lighting flashes) you can program the module´s registers as follows:

1. Choose the register you want to programm by setting the register´s number with the Motorola locomotive address at your central unit. Please note that with some central units a leading "0" has to be entered.
2. Operate the direction switch. The lighting stops flashing.
3. Set the desired value of the register by setting the register´s value as Motorola locomotive address at your central unit.
4. Operate the direction switch again. The lighting starts flashing again.

Repeat the steps 1 to 4 for all registers you want to program. In order to choose a register for programming or to enter a value for a register you have to confirm the entered number like selecting a Motorola locomotive address. The lighting shows which kind of entry the module expects:

- lighting flashes → entry of a CV´s number
- lighting stops to flash → entry of a CV´s value

In order to stop the programming mode push "stop".

Switching on and off RailCom

In CV#29 (DCC format), or in register #7 (Motorola format), is defined if RailCom is switched on or off. Usually, several configuration data are saved here. The value "0" (for RailCom **off**) or "8" (for RailCom **on**) has to be added to the value of the other configuration data. The settings have the following effects:

RailCom off	Programming the function decoder area of the FD-R$^{\text{Basic}}$. Please note: A decoder with the same address will be programmed as well!
RailCom on	Programming the RailCom area of the FD-R$^{\text{Basic}}$. Please note: The function decoder area of the FD-R$^{\text{Basic}}$ will not be programmed!

Common CVs and registers

The following configuration variables (DCC format) or registers in (MM format), are programmed jointly for the function decoder and the RailCom area and cannot be changed separately for one of the areas:

- basic address (CV#1 / register #01)
- extended addresses (CV#17 and 18, register #04 and 05)
- consist address (CV#19, register #06)
- configuration data (CV#29, register #07)

Programming the function decoder area

In order to programm the function decoder area of the FD-R$^{\text{Basic}}$ RailCom must be switched **off** in CV#29 (DCC format) or in register #7 (Motorola format).

When the FD-R$^{\text{Basic}}$ is used as a function decoder with an address of it´s own, it is programmed as used with locomotive and function decoders. If it gets the same address as another decoder you must be careful not to overwrite the other decoder´s settings by accident. If necessary you can interrupt the decoder´s connection to a rail collector before programming the FD-R$^{\text{Basic}}$.

In order to change the CVs or the registers used in both the FD-R^{Basic} and a decoder with the same address you can proceed as follows as well:

RailCom on	Reading out the decoder´s settings.
RailCom off	Programming the function decoder area of the FD-R^{Basic}. NB: Simultaneously you alter the respective CVs or registers of the decoder with the same address.
RailCom on	Programming the decoder with the data read out before. The settings are saved in the RailCom area of the FD-R^{Basic} only.

Advice: When not using the FD-R^{Basic} as a RailCom transmitter, RailCom should be switched off.

Programming the RailCom area

TIP: When using the FD-R^{Basic} both as a function decoder and as RailCom transmitter, first program the function decoder area as described in the previous section.

In order to program the RailCom area of the FD-R^{Basic}, RailCom must be switched **on** in CV#29 (DCC format) or in register #7 (Motorola format). All settings made for this area can be fed back via RailCom to special detectors. You can save in this RailCom area either the values of CVs #1 to #205 of a DCC decoder (that is not compatible to RailCom) or the registers #1 to #205 of a Motorola decoder (that is not compatible to RailCom) or the settings from the function decoder area of the FD-R^{Basic}.

Taking over a decoder´s data

To take over the data of a decoder (that is not compatible to RailCom) into the RailCom area of the FD-R^{Basic} proceed as follows:

RailCom on	If applicable: Reading out the decoder´s settings.
	Programming jointly the RailCom area of the FD-R^{Basic} and the decoder. NB: The function decoder area of the FD-R^{Basic} will not be altered in this case – this can be done only with RailCom switched off.
Please note:	Add the value "8" to the value of CV#29 (DCC format) or in register #7 (Motorola format), in order to switch on RailCom.

When using suitable PC software you can read out the decoder´s settings and afterwards re-save them (jointly for the RailCom area of the FD-R^{Basic}and the decoder). Ensure that in CV#29 (DCC format) or in register #7 (Motorola format), RailCom has to be switched **on** (value of the CV / the register + 8).

In combination with a Motorola decoder not designed for register-programming, you can save the decoder address in the RailCom area of the FD-R^{Basic}. In this case ensure that in CV#29 (DCC format) or in register #7 (Motorola format), RailCom has to be switched **on** (value of the CV / the register + 8).

Taking over the data from the function decoder area

When using the FD-R^{Basic} as an independent function decoder compatible to RailCom with an address of it´s own, you have to take over the data from the function decoder area into the RailCom area. Proceed as follows:

RailCom off	Reading out the decoder´s settings from the function decoder area.
RailCom on	Programming the RailCom area of the FD-R^{Basic}. NB: The function decoder area of the FD-R^{Basic} will not be altered.
Please note:	Add the value "8" to the value of CV#29 (DCC format) or in register #7 (Motorola format), in order to switch on RailCom.

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

9. Configuration variables and registers of the FD-R^{Basic}

The following list shows all configuration variables (for the DCC format) and registers (for the Motorola format), that can be set for the FD-R^{Basic}. Except the CVs 1, 17, 18, 19 and 29 or the registers 01, 04, 05, 06 and 07, which are valid for both the function decoder and the RailCom area of the FD-R^{Basic}, the settings are saved in the function decoder area of the FD-R^{Basic} only.

In the list you will find in the column "CV-no." the numbers of the configuration values for programming in DCC format and in the column "Reg.-no." the numbers of the registers for programming in Motorola format. The defaults are those values set in the state of delivery and after a reset.

* For some configuration variables, the input values have to be calculated by adding the numerical values assigned to the desired parameters.

Name of CVs / Registers	CV-no.	Reg. no.	Input value (Default)	Remarks and Tips
Basic address	1	01	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!				
Version	7	---	---	Read only in DCC format!
Manufacturer	8	---	(62)	Read only in DCC format!
Reset	8	03	0 ... 255	Any input value restores the settings in state of delivery.

functions active in analogue mode (only for F1 to F8, not for F9 to F12)	13	41	0 ... 255 (0)	Numerical value*
				F1 on 1
				F2 on 2
				F3 on 4
				F4 on 8
				F5 on 16
				F6 on 32
				F7 on 64
				F8 on 128

Name of CVs / Registers	CV-no.	Reg. no.	Input value (Default)	Remarks and Tips
Extended address	17	04	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	05	0 ... 255 (255)	
Consistadresse	19	06	1 ... 127 (0)	= 2nd adress In DCC format only!

Configuration data 1	29	07	0 ... 64 (14)	Numerical value*
				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
				Basic addresses 0
			Not for MM mode:	Extended addresses 32

Example: CV#29 = 0. → Direction = "Standard". 14 speed levels. RailCom = "off". Automatic analogue recognition = "off". Basic addresses.

Example: CV#29 = 46. → Direction = "Standard". 28 or 128 speed levels in DCC-mode. Automatic analogue recognition = "on". RailCom = "on". Extended Addresses.

Tip: If the use of extended addresses is activated in CV#29, the decoder does not react to signals in Motorola format!

Tip: In order to program the function decoder area, you have to set RailCom to "off". Programming the data for the RailCom area is done in a separate step with RailCom set to "on".

Name of CVs / Registers	CV-no.	Reg. no.	Input value (Default)	Remarks and Tips
Assignment of the function keys to the outputs				
F0 forward on	33	08	0 … 31 (1)	
F0 backward on	34	09	0 … 31 (2)	Numerical value*
F1	35	10	0 … 31 (0)	Assigned output:
F2	36	11	0 … 31 (0)	AUX1 1
…	…	…	0 … 31 (0)	AUX2 2
F12	46	21	0 … 31 (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.
Example: AUX2 to be switched with F5 → CV#39 = 2
Example: AUX1 and AUX2 to be switched with F6 → CV#40 = 3 (= 1+2)

Dimming of the outputs:				= Reducing the voltage
AUX1	49	22	1 … 64 (64)	applied to the output A.
AUX2	50	23	1 … 64 (64)	value of "1" corresponds to the minimum, "64" to the maximum voltage.

Dependant on the direction of motion				Numerical value*
of the outputs				independent of direction 0
AUX1	53	26	0 … 63 (0)	AUX off at forward motion 1
AUX2	54	27	0 … 63 (0)	AUX off at backward motion 2
				Shunting light AUX at F3 16
				Shunting light AUX at F4 32

Example: Shunting light at AUX1 to be switched with F3 and at forward motion off
→ CV#53 = 17 (= 16 + 1)

Keying ration of the flash lights				= Phase´s length of the
AUX1	61	34	0…255 (255)	on-/off states of the lighting
AUX2	62	35	0…255 (255)	0 → lighting off
				128 → regular flashing light
				255 → continuous lighting

Name of CVs / Registers	CV-no.	Reg. no.	Input value (Default)	Remarks and Tips
Flashing frequency of the lighting	112	38	10 ... 255 (48)	Settings common for all lighting.
				10 → highest frequency
				255 → lowest frequency
Examples for the flashin frequency: CV#112 = 10 → 2 Hz / CV#112 = 48 → 0,7 Hz CV#112 = 100 → 0,25 Hz / CV#112 = 255 → 0,125 Hz				
2nd Motorola address	114	40	1 ... 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.

10. Operation with RailCom

Requirements

For reading out the data via RailCom, special detectors and boosters compatible with RailCom are required.

It is not possible to read out data via RailCom unless the CV#29 (DCC format) or the register #07 (Motorola format) of the FD-R^{Basic} RailCom is switched on.

RailCom-Messages can only be transferred in model railway layouts with a DCC signal on the rails. When the FD-R^{Basic} is operated in combination with a Motorola decoder, RailCom messages cannot be sent unless simultaneuously at least one other locomotive or function decoder is controlled in DCC-Format.

RailCom messages

Only the data saved in the RailCom area of the FD-R^Basic can be sent as RailCom messages. Data saved in the function decoder area of the FD-R^Basic cannot be read out via RailCom.

When querying a CV (or a register) with no value programmed, the FD-R^Basic sends the value "255".

Simultaneous use as function decoder and RailCom transmitter

When the FD-R^Basic is operated in combination with another decoder that is not compatible to RailCom, only the decoder´s data are saved in the RailCom area of the FD-R^Basic. Only these data (and not the data in the function decoder area) can be transferred as a RailCom message.

If you want to transfer the settings in the function decoder area of the FD-R^Basic via RailCom, you have to program them in a second step into the RailCom area. This is useful only when the FD-R^Basic is operated as a mere function decoder with an address of it´s own.

The FD-R^Basic can be used as an additional function decoder with two outputs as well, when operated in combination with another decoder. As the function decoder area and the RailCom area are programmed separately you can program the FD-R^Basic and the other decoder individually (except the common CVs or registers). When programming the FD-R^Basic you should coordinate the assignment of the function keys with the other decoder´s assignment of the function keys.

11. Check list for trouble shooting

▪ 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 module is connected to
   locomotive or carriage ground. → Check the connections. A short
   circuit can result in irreparable damage.

Problems with the function decoder area of the FD-R^{Basic}

▪ After programming, the FD-R^{Basic} does not react as intended.

   Possible cause: The set values for the CV are inconsistent.
   → Perform a decoder reset and first test the decoder with the
   default values. Program the decoder anew.

   Possible cause: Instead of saving the settings into the function
   decoder area the settings were saved into the RailCom area of the
   FD-R^{Basic}. → Program the function decoder area anew, making sure
   that in CV#29 RailCom is set "off".

▪ An output cannot be switched on.
   Possible cause: The values set in CV# 53 to 54 for an output,
   contradict one another. → Alter the values for CV #53 to 54.

▪ The lighting does not correspond to the direction of travel.
   Possible cause: The configuration data (CV29) of the locomotive
   decoder in the train vary from the configuration data programmed
   in the function decoder. → Change the programming or the
   function or the deocder.

▪ The decoder does not react in analogue mode.
   Possible cause: The analogue mode is switched off. → Alter the
   value for CV #29.

- 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 with the RailCom area of the FD-R^{Basic}

- The CV values cannot be read out.

  Possible cause: RailCom is switched off. → Alter the value of CV#29.

  Possible cause: The settings of the function decoder area have not been transferred into the RailCom area. → Program the RailCom area with the data of the function decoder area.

  Please note: When operating the FD-R^{Basic} together with another decoder, only the decoder´s settings are transferred via RailCom. Only when the FD-R^{Basic} is used as a function decoder with an address of it´s own, are it´s data transferred.

- A combination of the FD-R^{Basic} and another Decoder cannot be programmed together or the data cannot be read out from one of the modules.

  Possible cause: This malfunction occurs especially with older DCC decoders. → In most cases you can sidestep this malfunction by programming the RailCom area of the FD-R^{Basic} and the decoder via main track programming. In case this does not work as well, you should read out or program the RailCom area of the FD-R^{Basic} and the decoder individually. For that purpose interrupt the connection to the rail connector of that module that is not going to be programmed.

Problems with the combined Decoder

▪ After programming the FD-R^{Basic} the decoder combined with the FD-R^{Basic} does not react like before.
Possible cause: You have altered values in the function decoder area of the FD-R^{Basic}. As the other decoder´s address is the same as the one of the FD-R^{Basic}, the changes were taken over for the decoder as well. → Set RailCom to "on" and programm the decoder anew. The settings will be taken over automatically into the RailCom area of the FD-R^{Basic}, the function decoder area of the FD-R^{Basic} will be unchanged.

If you cannot find the problem, please return the decoder for repair (address on the cover page).

11. Manufacturer's note, CE and warranty

Manufacturer's note

The person who brings the circuit into operation is the manufacturer of the product. If he sells the product to another person he is responsible for passing on all the relevant papers.

Certification

This product is developed and tested in accordance with the European standards EN 55014-1 and EN 61000-6-3. This product conforms with the EC- directive 2004/108/EG on electromagnetic radiation and is therefore CE certified.

Conditions of warranty

This product is guaranteed for two years. The warranty includes the correction of faults which can be proved to be due to material failure or factory flaw. We guarantee the adherence to the technical specifications of the circuit when assembled and connected according to the manual.

Other claims are excluded. By law, we are not responsible for damages or secondary damages in connection with this product. We retain the right to repair, make improvements, supply spare parts or return the purchase price.

The following invalidate the warranty:

- using an unsuitable soldering iron, solder containing liquid acids or similar,
- if damage is caused by not following the instructions in this manual, if the module has been altered and repair attempts have failed,
- if arbitrary changes in the circuit are made,
- if additional components are added which are not described in the manual,
- if the copper tracks or soldering eyes are damaged,
- if damage occurs due to an overload of the module,
- if connected to a incorrect voltage or current,
- if damaged by other persons,
- if damaged by faulty operation or if damaged by careless use or abuse,
- if damaged by touching components before electrostatic discharging of the hands.

The asterisks **

This manual mentions the following companies:

- Gebr. MÄRKLIN** & Cie. GmbH
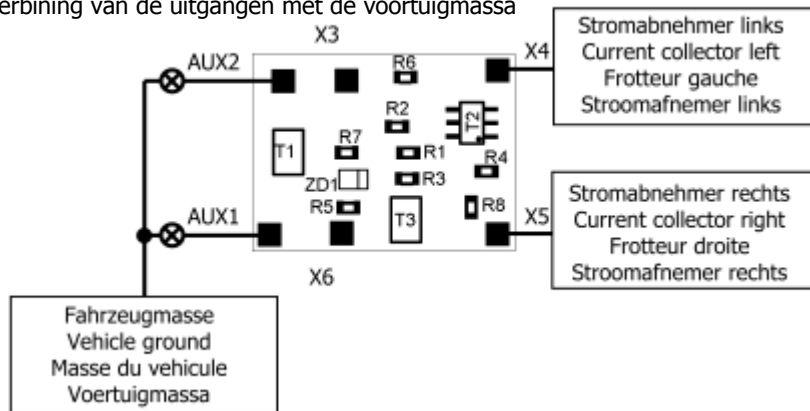 Postfach 8 60, D-73008 Göppingen

Fig. 1: Anschlussplan - Connections - Plan de connexion - Aansluitplan
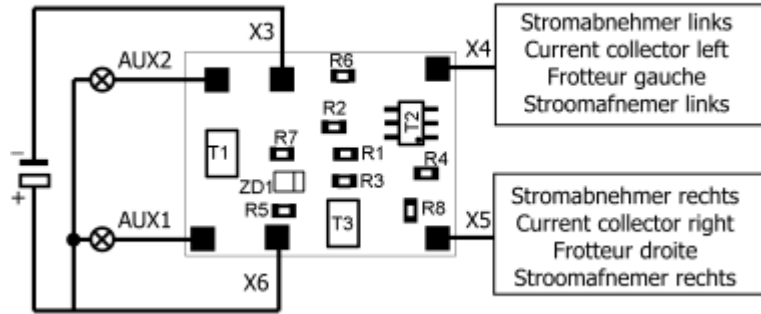
oder: Anschluss der Ausgänge an Fahrzeugmasse
or: Connection of the outputs to vehicle ground
ou: Raccordement des sorties via la masse du vehicule
of: Verbining van de uitgangen met de voortuigmassa

AUX1 AUX2	Ausgänge (max. 100 mA) Outputs (max. 100 mA) Sorties (max. 100 mA) Uitgangen (max. 100 mA)
X3	Decodermasse Decoder ground Masse du décodeur Decodermassa
X4	Schienenabnehmer links Rail current collectors left Prises de courant de la voie gauches Railstroomafnemers links
X5	Schienenabnehmer rechts Rail current collectors right Prises de courant de la voie droites Railstroomafnemers rechts
X6	Rückleiter für alle Funktionen Return conductor for all functions Pole commun des fonctions Retourleiding voor alle functie
– +	Elko z.B. 100 µF/35V (falls erforderlich) Elko e.g. 100 µF/35V (if necessary) Elko p.e. 100 µF/35V (si necessaire) Elko b.v. 100 µF/35V (indien noodzakelijk)

Fig. 2: Schaltplan - Circuit diagram - Schéma de principe - Schakelschema

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(Pb) CE