Manual

FD-R Basic 2

Item no. 42-01160 | 42-01161
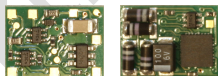
Function decoder
and RailCom transmitter

| MM | DCC | Rail((Com |

tams elektronik

Contents

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 refering 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 Basic 2 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 Basic 2 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 soldered connecting wires or
    with soldered connecting wires;

■ 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 mm² for all connections.

In order to bridge short current interruptions you need:

- an electrolytic capacitor with a capacity of 100 to 470 µF and a proof voltage of minimum 25 V.

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 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

The FD-R Basic 2 can be used as

- a function decoder, e.g. to switch the lighting in a control car and / or
- a RailCom transmitter in addition to a locomotive or function decoder that is not compatible to RailCom.

4.1. Modes of operation

Digital operation

The function decoder FD-R Basic 2 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 Basic addresses.

In the DCC format the decoder can be driven in all speed levels (14, 28 or 128).

Programming the decoders is done:

- in Motorola format (MM) 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).

Analogue mode

The decoder can also be used in analogue model railway layouts run with a D.C. speed control (not 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.

It is not possible to switching the function outputs on or off in analogue mode. 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, provided the return conductor the lamps or accessories is connected to the decoder´s return conductor for all functions.

4.2. Function outputs

The decoder has three function outputs for the connection of optional accessories (e.g. lighting, smoke generator, electric coupling):

- two outputs with a maximum current of 300 mA each and
- one output with a maximum current of 100 mA each.

Effects of all function outputs

- Switching on and off depending on the direction of travel.
- Flashing: frequency, keying ratio (= ration of on to off) and starting time within a phase can be set. Examples of use: single flashlights, alternating flashlights or strobe lights.
- 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.

4.3. Releasing the functions

The function outputs can be released by pushing the function keys. The mapping of the outputs to the function keys is arbritary. It is possible to assign several function keys and switching inputs to one output.

Output	DCC format	MM format
AUX1 to AUX3	F0 to F28	F0 to F4

4.4. 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 Basic 2 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.

It can be programmed that way it transfers after a CV read-out command

- the CV values programmed for its operation as a function decoder or
- the CV values corresponding to those of an added vehicle decoder not compatible to RailCom.

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.

4.5. 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:

- 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 subsribe to our newsletter on our hompage.

5. Technical specifications

Data format	DCC and MM
Feedback log	RailCom
Supply voltage	12-24 V digital voltage or max. 18 V analogue d.c. voltage
Current consumption (without connected loads) max.	20 mA
Max. total current	700 mA
Number of function outputs max. current per output	3 AUX1 and AUX2: 300 mA AUX3: 100 mA
Connection for buffer capacitor Capacity Electric strength	1 100 to 470 µF $\geq$ 25 V
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. 13 x 9,5 x 3,5 mm
Weight without cables with cables	approx. 0,8 g approx. 1,3 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 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!
>
> 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.
>
> You should under no circumstances connect the decoder´s return conductor for all functions to vehicle ground. Risk of short circuit!

6.1. Connector pin assignment

|	Colour of wire	Connection to (for use of settings in state of delivery)
X1	white	AUX1 (lighting forward motion, function key F0) max. current: 300 mA
X2	green	AUX2 (function key F1) max. current: 300 mA
X3	brown	Negative pole (-) of buffer capacitor
X4 X5	black red	Current collector (right / left in direction of motion): X4= left current collector (or vehicle ground) X5= right current collector (or slider)
X6	yellow	AUX3 (lighting backward motion, function key F0) max. current: 100 mA
X7	blue	Return conductor for all functions (+) Positive pole (+) of buffer capacitor
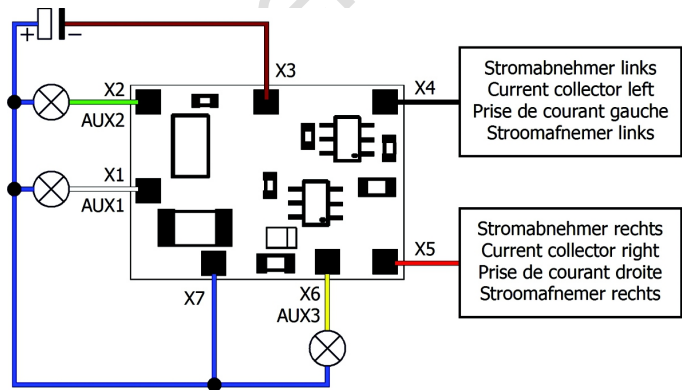
Fig. 1: Connections

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 AUX3). Observe the maximum current of the outputs (AUX1, AUX2: 300 mA, AUX3: 100 mA).

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.

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 X7).

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 (point X7).

> ### ⚠ 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

Peak value of the operating voltage
- 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:

required R_V [Ohm] = (U_B [V] − $\Sum U_F$ [V]) / (I_F [mA] x 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:

required R_V [Ohm] = (U_B [V] − U_F [V] / (I_F [mA] x 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.
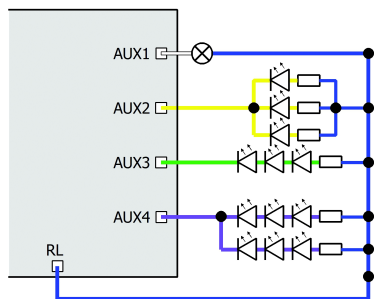
Fig. 2: Connection of LEDs and accessories to the funtion outputs (examples)

AUX1: lamp

AUX2: parallel connection of LEDs

AUX3: serial connection of LEDs

AUX4: combination of parallel and serial connection of LEDs

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

The current consumed by the relay depends on its type. The relay named in the example needs approx. 100 mA.
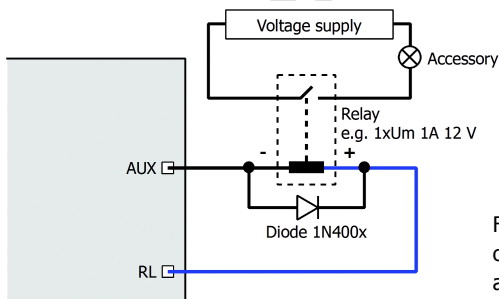
Fig. 3: Connection of an accessory via a relay

6.7. 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. In these and similar cases you can find a remedy by connecting a buffer capacitor. The electrolytic capacitor should have a capacity of 100 to 470 µF and an electric strength of minimum 25 V. Observe the correct polarity when connecting the capacitor!

6.8. 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

7.1. Programming with different types of central units

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 DCC central units that allow only register-programming it is not possible to program the decoder.

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
Number of the MM-register to be programmed	**Value** of the MM-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
1. Switch on the central unit or perform a reset at the central unit (pushing "stop" and "go" simultaneously).	1. Enter the number of the register as a Motorola-address. If necessary: with a leading "0".
2. Set the current decoder address (default value: 3) or the address "80".	2. Operate the direction switch. → Lighting flashes faster.
3. Set all functions to "off".	3. Enter the value you want to set into the register (as Motorola-address).
4. Push button "stop" → switch off the track voltage.	4. Operate the direction switch. → Lighting flashes more slowly.
5. Operate the direction switch and hold it in that position. Push the button "go" at once.	Repeat steps 1 – 4 for all registers.
6. As soon as the lighting flashes, release the direction switch.	Push button "stop".
→ 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. With these central units it is not possible to make all possible settings.

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 MM-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

(estimated from july 2015)

7.2. Memory areas of the FD-R Basic 2

Area "function decoder"

contains all CVs (MM registers) programmed for the use as function decoder. The values of these CVs are transmitted on a CV read-out command, when

- in CV #888 the operating mode "function decoder" is set,
- in CV #28 the RailCom-channel 2 is switched on and
- in CV #29 RailCom is switched on.

Area "RailCom transmitter"

contains the CVs (MM registers) of the supported vehicle decoder not compatible to RailCom. The values of these CVs are transmitted on a CV read-out command, when

- in CV #888 the operating mode "RailCom transmitter" is set,
- in CV #28 the RailCom-channel 2 is switched on and
- in CV #29 RailCom is switched on.

Common area

contains the CVs (MM registers) that can be set for both areas in common only:

- basic address (CV #1),
- extended address (CV #17 and 18),
- consist adress (CV #19),
- RailCom settings (CV #28),
- configuration data (CV #29),
- operating mode of the decoder (CV #888).

The address is sent continuously via RailCom when

- in CV #28 the RailCom channel 1 is switched on and
- in CV #29 RailCom is switched on.

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┌─────────────────────────────────────────────┐
│              FD-R Basic 2                     │
├──────────────────────┬──────────────────────┤
│    Memory area       │    Memory area        │
│  function decoder     │  RailCom transmitter  │
│                       │                       │
│    CV #888 = 1        │    CV #888 = 0        │
│  CV #28 = 2 or 3      │  CV #28 = 2 or 3      │
│ CV#29→RailCom "on"    │ CV#29→RailCom "on"    │
├──────────────────────┴──────────────────────┤
│           Common memory area                  │
└─────────────────────────────────────────────┘
```

Basic, extended, consist address
CV #28 = 1 or 3 and CV #29 → RailCom "on"

Rails (RailCom detector)

Central unit

CV read-out command

CV read-out command
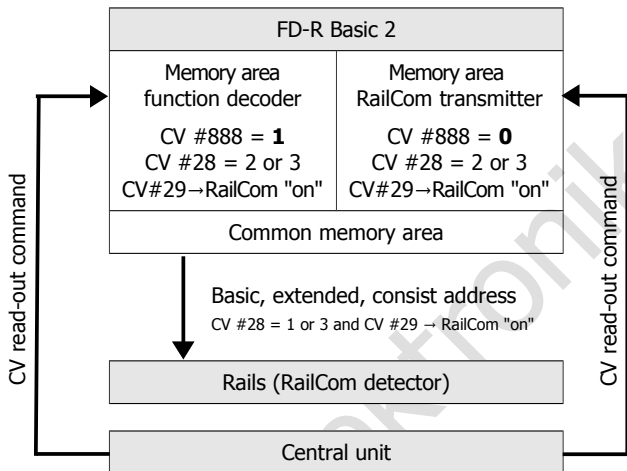
8. Configuration variables and MM-registers

Memory area "function decoder"

In the lists you will find in the column "No." the numbers of the configuration variables for programming in DCC format, that can be set for the function decoder area of the FD-R Basic 2. 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.

Memory area "RailCom transmitter"

You can save either the values of CVs #1 to #256 of a DCC decoder (that is not compatible to RailCom) or the registers #1 to #256 of a Motorola decoder (that is not compatible to RailCom).

When using suitable PC software you can read out the decoder´s settings and afterwards re-save them jointly for both decoders.

Common memory area

The following configuration variables (or MM registers) are programmed in common for both areas:

- basic address (CV #1),
- extended address (CV #17 and #18),
- consist adress (CV #19),
- RailCom settings (CV #28),
- configuration data (CV #29),
- operating mode of the decoder (CV #888).

Setting the operating mode

This setting takes the following effects:

- choice of the memory area the ongoing programming is taken over for;

- choice of the memory area the CV values are transmitted from after a RailCom CV read-out command.

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips	
Operating mode	888	0 ... 1 (0)	Function decoder	0
			RailCom transmitter	1

Please note: If the FD-R Basic 2 gets the same address as another decoder in the same vehicle, the mentioned decoder will be programmed anew as well. If you want to avoid this, you can interrupt the decoder´s connection to a rail collector before programming the FD-R Basic 2.

Setting the address

Name of CVs / MM-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!

Information / Read only

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips
Version	7	---	Read only in DCC format!
Manufacturer	8	--- (62)	Read only in DCC format!

Auxiliary functions

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips
Reset	8	0 ... 255	Any input value restores the settings in state of delivery.

Basic settings

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips	
Consist-Control for F1 to F8	21	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
Settings in CV #21 have no effect unless in CV #19 a consist address has been programmed.				
RailCom settings	28	0 ... 3 (3)	no feedback	0
			channel 1 on	1
			channel 2 on	2
Channel 1: Continuous feedback of the decoder address				
Channel 2: Feedback of the CV values after a RailCom read-out command				
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
			Basic addresses	0
		Not for MM mode:	Extended addresses	32
Factory settings: Direction = "Standard". 28 or 128 speed levels in DCC-mode. Automatic analogue recognition = "on". RailCom = "on". Basic addresses.				
Example: CV #29 = 0. → Direction = "Standard". 14 speed levels. Automatic analogue recognition = "off". RailCom = "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!				

Assignment of the outputs to the function keys

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips	
F0 forward on	33	0 ... 31 (2)	AUX1	2
F0 backward on	34	0 ... 31 (4)	AUX2	1
F1	35	0 ... 31 (1)	AUX3	4
F2	36	0 ... 31 (0)		
...	...	...		
F12	46	0 ... 31 (0)		

Factory settings: AUX1 to be switched with F0, switched on at forward motion. AUX3 to be switched with F0, switched on at backward motion. AUX2 to be switched with F1.

Example: AUX2 to be switched with F5 → CV #39 = 1

Example: AUX1 and AUX2 to be switched with F6 → CV #40 = 3 (= 1+2)

Dimming of the outputs

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips
AUX3	49	1...64 (64)	= Reduction of the voltage
AUX1	50	1...64 (64)	applied to the output.
AUX2	51	1...64 (64)	"1" = lowest voltage, "64" = maximum voltage

Effects of the outputse

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips	
AUX3	53	0 ... 63 (0)	Independent of direction	0
AUX1	54	0 ... 63 (0)	AUX off at backw. motion	1
AUX2	55	0 ... 63 (0)	AUX off at forward motion	2
			Shunting light at F3	16
			Shunting light at F4	32

Example: Shunting light at AUX1 to be switched with F3 and at forward motion off
→ CV #54 = 18 (= 16 + 2)

Settings for the flash lights

Name of CVs / MM-registers	No.	Input value (Default)	Remarks and Tips
Flashing frequency	9	0 … 255 (0)	Settings common for all lighting
			10 = highest frequency
			255 = lowest frequency

Examples for the flashin frequency:
CV #9 = 7 → 1 Hz / CV #9 = 14 → 0,5 Hz

| Duration till "on" | Duration "on" | | Duration till "on" | Duration "on" |

| Phase length = 255 | | Phase length = 255 |
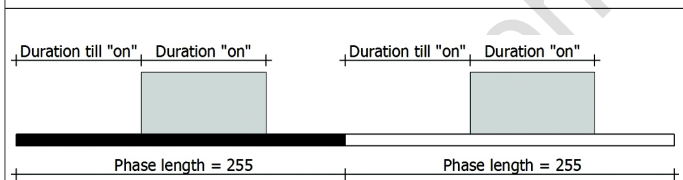
Duration till "on"			
AUX3	58	0...255 (255)	0 = immediate switching on at the beginning of a phase
AUX1	59	0...255 (255)	1 … 254 = delayed switching on
AUX2	60	0...255 (255)	255 = permanently off

Duration "on" within a phase			
AUX3	61	0...255 (0)	0 = permanently off
AUX1	62	0...255 (0)	1 = minimal duration
AUX2	63	0...255 (0)	255 = permanently on

The sum of the values for "Duration till on" and "Duration on" must not exceed 255, otherwise the duration of "on" will be reduced. Example:
CV #58 = 100 and CV #61 = 200. In this case CV #61 will be reduced to 155.

9. Performing a POM-Update

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 Basic 2 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_Basic_2_V1_1_0_0.hex for version 1.1.0.0

   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 AUX3 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 Basic 2 you want to update.
3. Change into the update mode.

The lighting connected to the outputs AUX3 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 AUX3 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 the area "function decoder"

- After programming, the FD-R Basic 2 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 transmitter
  area of the FD-R Basic 2. → Program the function decoder area
  anew, making sure that in CV #888 the value "0" is set.

- An output cannot be switched on.

  Possible cause: The values set in CV #49 to #63 for an output,
  contradict one another. → Alter the values for CV #49 to #63 .

- The lighting does not correspond to the direction of travel.

  Possible cause: The configuration data (CV #29) 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 central unit do not correspond. Example: The central unit 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 area "RailCom transmitter"

- The CV values cannot be read out.

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

  Possible cause: The RailCom channel 2 switched off. → Alter the value in CV#28 to "2" or "3".

  Possible cause: In CV #888 the function decoder area is activated instead of the RailCom transmitter area. → Alter the value in CV #28 to "1".

  Possible cause: Instead of saving the settings into the RailCom transmitter area they have been saved into the function decoder area. → Programm the RailCom transmitter area anew and pay attention to set the value "1" for CV #888.

- A combination of the FD-R Basic 2 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 2 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 2 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 2 the decoder not compatible to RailCom combined with the FD-R Basic 2 does not react like before.

  Possible cause: You have altered values in the function decoder area of the FD-R Basic 2. As the other decoder´s address is the same as the one of the FD-R Basic 2, the changes were taken over for the decoder as well. → Set the value "1" for CV #888. Then you program the RailCom transmitter area and the combined decoder not compatible to RailCom. The function decoder area of the FD-R Basic 2 will be unchanged.

Problems with the POM-Update

- While updating the decoder the lighting starts to flash, the update is interrupted.

  Possible cause: The settints 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

CE 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).

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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