

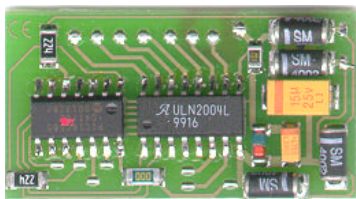
FD-2

Funktionsdecoder
Motorola-II-Format

Function decoder
Motorola-II-Format

Décodeur de fonctions
Format-Motorola II

Func tiedecoder
Motorola-II-format



- Anleitung
- Manual
- Mode d'emploi
- Handleiding

Art.-Nr. 22-01-013



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(Pages I and II in the centre of this handbook are removeable.)

How to use this manual

If you have no specialist technical training, 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 kit on to another person, please pass on the manual with it.

Intended use



Caution:

Integrated circuits 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.

The module can be used according to the specifications of this manual. It is designed for a mounting in a model railway locomotive or in a model railway carriage. It evaluates the Motorola II format data sent by the digital central unit to its address. The decoder has 7 outputs for the connection of optional accessories.

The module is not suitable for children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user. Any other use of the module is inappropriate and invalidates any guarantees.

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

- Do not touch powered, live components.
- Do not touch conducting components which are live due to malfunction.
- Avoid short circuits.
- Do not connect the circuit to a higher voltage than designed.
- Impermissibly high humidity.
- Condensation building up can cause serious injury due to electrical shock.

Take the following precautions to prevent this danger:

- Never perform wiring on a powered module.
- Only use low power for this module as described in this manual and only use certified transformers.
- Connect transformers and soldering stations only in approved mains sockets installed by an authorised electrician.
- Observe cable diameter requirements.
- Assembling the kit should only be done in closed, clean, dry rooms. Beware of humidity.
- If the humidity in the room is too high, please do not start working until after a minimum of 2 hours of acclimatisation.
- 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 life-threatening fire, burns and toxic smoke. Connect your soldering iron or soldering station only when actually needed. Use the correct soldering iron or station and 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.

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.

Little children can swallow small components with sharp edges. Life threatening! 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.

EMC declaration

This product is developed in accordance with the European standards EN 55014 and EN 50082-1, tested corresponding to the EC - directive 89/336/EEG (EMVG of 09/11/1992, electromagnetic tolerance) and meets legal requirements.

To guarantee the electromagnetic tolerance 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 layout included with this manual.
- Use only original spare parts if you have to repair the kit or the ready-built module.

Information: Motorola I and Motorola II format

The digital driving data is differently encoded and transmitted in the (old) Motorola I format and the (new) Motorola II format. The function decoder FD-2 is designed to evaluate data in Motorola II format. This limits its use in Motorola I format.

Since data of the auxiliary functions F1 to F4 sent in Motorola I Format cannot be evaluated by the decoder, it is not possible to switch these functions on or off when using Motorola I format.

Unlike the Motorola II format, no absolute direction data is sent in Motorola I format, but a single driving signal reverses the direction of travel.

Operation overview

The decoder is designed for operation in Motorola II format and can be adjusted to one of 255 addresses. It evaluates the digital data sent by the central unit to its address and switches the connected accessories (cab lighting, carriage lighting, smoke generator, noise module). Setting the decoder address is done by mounting wirebridges.

Function lighting

The lighting can be switched on and off according to the direction of travel from the central unit via the function "function". In addition, another optional accessory (e.g. cab lighting, carriage lighting) can be switched on and off independent of the direction of travel.

Auxiliary functions F1 to F4

The auxiliary functions F1 to F4 can be switched via the central unit. They are available for the switching of optional accessories (e.g. cab lighting, carriage lighting, smoke generator, noise module).

Restrictions in Motorola I format

The auxiliary functions F1 to F4 are not available in Motorola I format. It is possible to control an accessory via the function "function" independent of the direction of travel.

Point connections

X1	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via F4.
X2	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via F3.
X3	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via "function".
X4	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via F1.
X5	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via F2.
X6	Lighting for forward direction (maximum current consumption of 500 mA*). Switched via "function".
X7	Lighting for reverse direction (maximum current consumption of 500 mA*). Switched via "function".
X8	Return conductor for all functions.
X9 and X10	Connections to the rails. X9 must be connected to the centre conductor.

* Maximum current consumption of all accessories = 1.500 mA!

Technical specifications

Data format	Motorola II
Supply voltage	12-22 Volt digital voltage
Current consumption (without connected loads)	ca. 10 mA
Max. current per function output	500 mA
Max. total current	1.500 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	ca. 18 x 32 x 4 mm
Weight	ca. 2 g

Checking the package contents

Check the contents of the package for completeness:

- 1 module
- 1 manual

Required tools and consumables

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

- a heat-resistant mat
- a soldering iron stand with tip-cleaning sponge
- a small side cutter and wire stripper
- an electronic soldering iron (max. 30 Watt) with a fine tip
- tin solder (0,5 mm. diameter)
- wire (diameter: $\geq 0,08 \text{ mm}^2$ for all connections)

Safe and correct soldering



Caution:

Incorrect soldering can cause fires (through excessive heat). Avoid this danger by reading the chapter **Safety instructions** again and following the directions given.

If you have had training in soldering you can skip this chapter.

- When soldering electronic circuits never use soldering-water or soldering grease. They contain acids that can corrode components and copper tracks.
- Only use tin solder SN 60 Pb (i.e. 60 % tin, 40 % lead) with rosin-based flux.
- Solder fast: long soldering can destroy components and copper tracks, and damages through plated holes.
- 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.
- Apply the soldering tip to the soldering spot in such a way that the part and the soldering spot 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 tin solder finds its way, then remove the soldering iron.
- Do not move the component for about 5 seconds after soldering. A glossy and perfect soldering spot should remain.
- To make a good soldering joint you must 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.

Performing a visual check

Damaged materials can cause injury. Parts damaged during transit can also be dangerous. Check the module for damage, missing parts or poor soldering. If you find damage, return the module for exchange.

Mounting the function decoder

Open the locomotive or the carriage housing. Locate the position for the decoder.

Follow the connections diagrams (fig. 1a and 1b)! Solder the connections to the rails at points X9 and X10.



Caution:

The centre conductor must be connected to point X9. Otherwise the decoder does not react to the data sent by the digital central unit.

Connecting the lighting and other accessories

Follow the connections diagrams (fig. 1a and 1b)!

Disconnect any existing diodes in the leads to the lamps. Connect the lamps for forward motion to X6 and the lamps for reverse motion to point X7. If the lamps are already connected with one side to ground, you must solder in a diode between the decoder and the lamp (see fig. 1a) or you must connect the second side of the lamps according to fig. 1b to the return conductor (point X8).

Connect accessories which are switched via the function "function" and are independent of the direction of travel (e.g. carriage lighting, cab lighting) to point X3.


Connect other accessories (e.g. smoke generator, noise module), which are switched by the functions F1 to F4, to the points X1, X2, X4 and X5.



Caution:


The current consumption of all connected accessories may not exceed 1.500 mA!

You can connect the second side of the accessories either to the return conductor (point X8) or to ground. If connecting the accessory to ground you must solder in a diode.

 **Caution:**

The return conductor for all functions (point X8) must under no circumstances be connected to ground. Possible short circuit! The decoder will be damaged in operation.


Tip: If the second side of the lamps is connected to ground the lamps often flicker in operation. You can avoid the flickering of the lamps if you connect the second side to the return conductor (point X8) instead of ground.

 **Caution:**

If you connect the loads to the return conductor for all functions (point X8), the load must be insulated. The loads must not make contact with metal parts of the locomotive or the carriage. Possible short circuit! The decoder will be damaged in operation.

Connecting the LEDs

The function outputs of the decoder switch against decoder ground. For that reason you must connect the cathode (-) of the LED to the output of the relevant function.

 **Caution:**

If you use light-emitting diodes (LEDs) you must always operate them via a series resistor.

LEDs are available in many different models. There are LEDs with 2-5 mA, but also LEDs with 15-30 mA power consumption. 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. The number of LEDs connected in series to one output depends on the digital voltage.

You can determine the number of the LEDs that can be connected in series to one output from the following formula:

$$\boxed{(\text{number of LEDs} + 2) \times 1,5 < \text{digital voltage}}$$

Fixing the decoder

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

Setting the decoder address

The decoder can be set to one of 255 addresses. The setting is made by mounting wirebridges between the pins A0 to A3 and the pins A4 to A6. The assignment is shown in the list on page 60.

The decoder is set by the manufacturer to the address "40", there are no connections between the pins A0 to A3 and the pins A4 to A6.

Caution:

Use a soldering iron with a small tapered point and max. 30 Watt to make the wirebridges. Take special care to avoid short circuits. If necessary, check the wirebridges with a magnifying glass to make sure that the wirebridges are closed correctly and solder has not short-circuited adjacent components or connections.

FAQ

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



Disconnect the system from the mains immediately!

Possible cause: Short circuit. The decoder is connected to locomotive or the carriage ground.

→ Check the connections. A short circuit can result in irreparable damage.

- The lighting does not correspond to the direction of travel.
Possible cause: The forward and backward light connections have been exchanged.
→ Check the connections.
Possible cause: The locomotive decoder in the train is not connected correctly.
→ Check the connections.
- The lamps flicker (this is not a defect).
Possible cause: The lamp is connected with one side to ground.
→ If you do not want the lamp to flicker, disconnect it from ground, insulate it and connect it to the return conductor (point X8).
- The decoder does not react on the data sent by the central unit.
Possible cause: The connections X9 and X10 have been exchanged.
→ Check the connections.

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

Manufacturer's note

According to DIN VDE 0869, the person who builds this kit or 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. Domestic appliances assembled from a kit are deemed industrial products and must comply with health and safety regulations.

Certification

This product conforms with the EC- directive 89/336/EWG on electromagnetic radiation and is therefore CE certified.

Conditional warranty

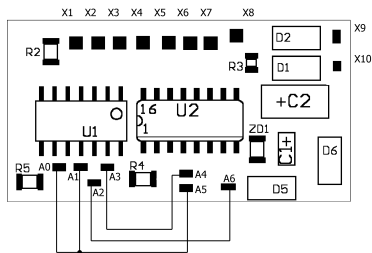
This product is guaranteed for two years. The warranty includes free repair if the problem is due to material failure or incorrect assembly of the module by us. We guarantee the quality of the components.

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 or the circuit diagram,
- if the circuit has been altered and repair attempts have failed,
- if arbitrary changes in the circuit are made,
- if parts are stored incorrectly and if the wires to the switches, the power resistors, etc. are made incorrectly,
- if the copper tracks or soldering points are damaged,
- if parts are placed incorrectly or the circuit is connected incorrectly,
- if damage occurs due to an overload of the circuit,
- if the wrong power or current is connected,
- if damaged by other persons,
- if damaged by the wrong use or abuse of the circuit,
- if parts are damaged due to static because they were touched before a discharge is performed.

Einstellung der Adresse / Adjusting the address Réglage de l'adresse / Instellen van het adres



Beispiel:

Einstellung der Adresse "21"

Example:

Adjusting the address "21"

Exemple:

Réglage de l'adresse "21"

Voorbeeld:

Instellen van adres "21"

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
01	A6	A6	A5	A5
02	A6	A6	A6	A5
03	A5	A5	A6	A6
04	A5	A5	A5	A5
05	A5	A5	A6	A5
06	A6	A5	A6	A6
07	A6	A5	A5	A5
08	A6	A5	A6	A5
09	A6	A6	A4	A4
10	A6	A6	--	--
11	A6	A6	A4	--
12	A5	A5	A4	A4
13	A5	A5	--	--
14	A5	A5	A4	--
15	A6	A5	A4	A4
16	A6	A5	--	--
17	A6	A5	A4	--
18	A6	A6	A6	A4
19	A6	A6	A5	--
20	A6	A6	A6	--

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
21	A5	A5	A6	A4
22	A5	A5	A5	--
23	A5	A5	A6	--
24	A6	A5	A6	A4
25	A6	A5	A5	--
26	A6	A5	A6	--
27	A4	A4	A6	A6
28	A4	A4	A5	A5
29	A4	A4	A6	A5
30	--	--	A6	A6
31	--	--	A5	A5
32	--	--	A6	A5
33	A4	--	A6	A6
34	A4	--	A5	A5
35	A4	--	A6	A5
36	A4	A4	A4	A4
37	A4	A4	--	--
38	A4	A4	A4	--
39	--	--	A4	A4
40	--	--	--	--

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
41	--	--	A4	--
42	A4	--	A4	A4
43	A4	--	--	--
44	A4	--	A4	--
45	A4	A4	A6	A4
46	A4	A4	A5	--
47	A4	A4	A6	--
48	--	--	A6	A4
49	--	--	A5	--
50	--	--	A6	--
51	A4	--	A6	A4
52	A4	--	A5	--
53	A4	--	A6	--
54	A6	A4	A6	A6
55	A6	A4	A5	A5
56	A6	A4	A6	A5
57	A5	--	A6	A6
58	A5	--	A5	A5
59	A5	--	A6	A5
60	A6	--	A6	A6
61	A6	--	A5	A5
62	A6	--	A6	A5
63	A6	A4	A4	A4
64	A6	A4	--	--
65	A6	A4	A4	--
66	A5	--	A4	A4
67	A5	--	--	--
68	A5	--	A4	--
69	A6	--	A4	A4
70	A6	--	--	--
71	A6	--	A4	--
72	A6	A4	A6	A4
73	A6	A4	A5	--
74	A6	A4	A6	--
75	A5	--	A6	A4
76	A5	--	A5	--

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
77	A5	--	A6	--
78	A6	--	A6	A4
79	A6	--	A5	--
80	A6	A6	A6	A6
81	A6	A6	A5	A6
82	A6	A5	A5	A6
83	--	A4	A4	A5
84	A5	A5	A5	A6
85	A6	A6	A5	A4
86	A6	A5	A5	A4
87	A5	A6	A5	A4
88	A5	A5	A5	A4
89	A6	A6	--	A6
90	A6	A5	--	A6
91	A5	A6	--	A6
92	A5	A5	--	A6
93	A6	A6	--	A4
94	A6	A5	--	A4
95	A5	A6	--	A4
96	A5	A5	--	A4
97	A6	A4	A5	A6
98	A6	--	A5	A6
99	A5	A4	A5	A6
100	A5	--	A5	A6
101	A6	A4	A5	A4
102	A6	--	A5	A4
103	A5	A4	A5	A4
104	A5	--	A5	A4
105	A6	A4	--	A6
106	A6	--	--	A6
107	A5	A4	--	A6
108	A5	--	--	A6
109	A6	A4	--	A4
110	A6	--	--	A4
111	A5	A4	--	A4
112	A5	--	--	A4

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
113	A4	A6	A5	A6
114	A4	A5	A5	A6
115	--	A6	A5	A6
116	--	A5	A5	A6
117	A4	A6	A5	A4
118	A4	A5	A5	A4
119	--	A6	A5	A4
120	--	A5	A5	A4
121	A4	A6	--	A6
122	A4	A5	--	A6
123	--	A4	A4	--
124	--	A5	--	A6
125	A4	A6	--	A4
126	A4	A5	--	A4
127	--	A6	--	A4
128	--	A5	--	A4
129	A4	A4	A5	A6
130	A4	--	A5	A6
131	--	A4	A5	A6
132	--	--	A5	A6
133	A4	A4	A5	A4
134	A4	--	A5	A4
135	--	A4	A5	A4
136	--	--	A5	A4
137	A4	A4	--	A6
138	A4	--	--	A6
139	--	A4	--	A6
140	--	--	--	A6
141	A4	A4	--	A4
142	A4	--	--	A4
143	--	A4	--	A4
144	--	--	--	A4
145	A5	A6	A6	A6
146	A5	A6	A6	A4
147	A5	A6	A4	A6
148	A5	A6	A4	A4

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
149	A5	A4	A6	A6
150	A5	A4	A6	A4
151	A5	A4	A4	A6
152	A5	A4	A4	A4
153	--	A6	A6	A6
154	--	A6	A6	A4
155	--	A6	A4	A6
156	--	A6	A4	A4
157	--	A4	A6	A6
158	--	A4	A6	A4
159	--	A4	A4	A6
160	--	A4	A4	A4
161	A5	A6	A5	A5
162	A5	A6	A5	--
163	A5	A6	--	A5
164	A5	A6	--	--
165	A5	A4	A5	A5
166	A5	A4	A5	--
167	A5	A4	--	A5
168	A5	A4	--	--
169	--	A6	A5	A5
170	--	A6	A5	--
171	--	A6	--	A5
172	--	A6	--	--
173	--	A4	A5	A5
174	--	A4	A5	--
175	--	A4	--	A5
176	--	A4	--	--
177	A5	A6	A6	A5
178	A5	A6	A6	--
179	A5	A6	A4	A5
180	A5	A6	A4	--
181	A5	A4	A6	A5
182	A5	A4	A6	--
183	A5	A4	A4	A5
184	A5	A4	A4	--

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
185	--	A6	A6	A5
186	--	A6	A6	--
187	--	A6	A4	A5
188	--	A6	A4	--
189	--	A4	A6	A5
190	--	A4	A6	--
191	A5	A6	A5	A6
192	--	A6	--	A6
193	A6	A6	A4	A6
194	A6	A4	A4	A6
195	A4	A6	A4	A6
196	A4	A4	A4	A6
197	A6	A6	--	A5
198	A6	A4	--	A5
199	A4	A6	--	A5
200	A4	A4	--	A5
201	A6	A6	A4	A5
202	A6	A4	A4	A5
203	A4	A6	A4	A5
204	A4	A4	A4	A5
205	A5	A5	A4	A6
206	A5	--	A4	A6
207	--	A5	A4	A6
208	--	--	A4	A6
209	A5	A5	--	A5
210	A5	--	--	A5
211	--	A5	--	A5
212	--	--	--	A5
213	A5	A5	A4	A5
214	A5	--	A4	A5
215	--	A5	A4	A5
216	--	--	A4	A5
217	A6	A5	A4	A6
218	A6	--	A4	A6
219	A4	A5	A4	A6
220	A4	--	A4	A6

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d'une rangé Soldeerpunten			
	A0	A1	A2	A3
221	A6	A5	--	A5
222	A6	--	--	A5
223	A4	A5	--	A5
224	A4	--	--	A5
225	A6	A5	A4	A5
226	A6	--	A4	A5
227	A4	A5	A4	A5
228	A4	--	A4	A5
229	A4	A6	A6	A6
230	A4	A6	A5	A5
231	A4	A6	A6	A5
232	--	A5	A6	A6
233	--	A5	A5	A5
234	--	A5	A6	A5
235	A4	A5	A6	A6
236	A4	A5	A5	A5
237	A4	A5	A6	A5
238	A4	A6	A4	A4
239	A4	A6	--	--
240	A4	A6	A4	--
241	--	A5	A4	A4
242	--	A5	--	--
243	--	A5	A4	--
244	A4	A5	A4	A4
245	A4	A5	--	--
246	A4	A5	A4	--
247	A4	A6	A6	A4
248	A4	A6	A5	--
249	A4	A6	A6	--
250	--	A5	A6	A4
251	--	A5	A5	--
252	--	A5	A6	--
253	A4	A5	A6	A4
254	A4	A5	A5	--
255	A4	A5	A6	--

Anschlußplan - Connections diagram - Schema de connexion - Aansluit plan

■ ■ ■ Fig. 1

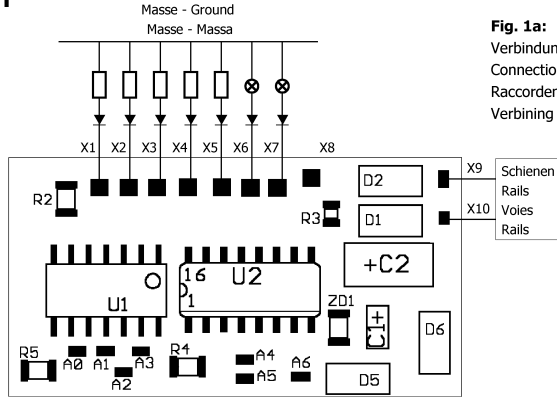


Fig. 1a:

Verbindung des 2. Anschlusses mit Masse
Connection of the 2nd side to ground
Raccordement des fonctions via le châssis / masse
Verbinding van de 2e aansluiting met de massa

➔ Diode 1N4007 oder ähnlich /
or similar / ou similaire /
of gelijkwaardig

☐ Beliebiger Verbraucher
(z.B. Rauchgenerator,
Führerstandsbeleuchtung,
Geräuschmodul)

Optional accessories
(e.g. smoke generator,
cab lighting, noise module)

Consommateurs divers
(par ex. fumigène, éclairage
cabine, module sonore)

Willekeurige verbruiker (b.v.
rookgenerator, geluidsmodule,
machinistenhuisverlichting)

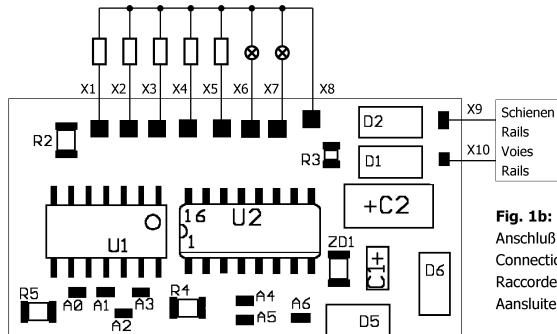


Fig. 1b:

Anschluß bei Verwendung des Rückleiters X8
Connection when using the return conductor X8
Raccordement des fonctions vi la borne commune X8
Aansluiten bij gebruik van de retourleiding X8

X1	F4
X2	F3
X3	"function" an/aus "function"on/off "function"marche / arret "function"aan/uit
X4	F1
X5	F2
X6	Beleuchtung Vorwärtsfahrt Lampe vorne: weiß - Lampe hinten: rot Lighting forward direction Lamp front: white - Lamp back: red Feux marche avant Lampe avant: blanche - Lampe arrière: rouge Verlichting vooruitrijden Lampe voor: wit - Lampe achter: rood
X7	Beleuchtung Rückwärtsfahrt Lampe vorne: rot - Lampe hinten: weiß Lighting reverse direction Lamp front: red - Lamp back: white Feux marche arrière Lampe avant: rouge - Lampe arrière: blanche Verlichting achteruitrijden Lampe voor: rood - Lampe achter: wit
X8	Rückleiter für alle Funktionen Return conductor for all functions Retour pour toutes les fonctions Retourdraad voor alle functies
X9	Schienen / Rails / Voies / Rails
X10	Masse / Earth / Masse / Massa

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