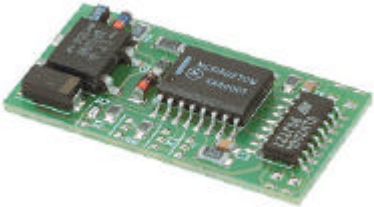
FD-1

Funktionsdecoder
Motorola-I-Format

Function decoder
Motorola-I-Format

Décodeur de fonctions
Format-Motorola I

Functiedecoder
Motorola-I-format



Anleitung

Manual

Mode d´emploi

Handleiding

Art.-Nr. 22-01-018

CE

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Technische Änderungen vorbehalten.

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Technische wijzigingen voorbehouden.

Table of contents

(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 I format data sent by the digital central unit to its address. The decoder has 4 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/EWG (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-1 is designed to evaluate data in Motorola II format. When using only Motorola II format the decoder FD-1 cannot be used. In mixed Motorola I / II format the decoder can be used.

Operation overview

The function decoder FD-1 is designed for operation in Motorola **I** format and switches the auxiliary functions F1 to F4. It does not react on data sent in Motorola II format.

The decoder can be adjusted to one of 80 adress. 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). The setting of the decoder address is made by mounting solder bridges.

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).

Point connections

X1 to X4	Solder points for setting the address.
X5 and X6	Connections to the rails. X5 must be connected to the central conductor.
X7	Accessory /-ies with a maximum current consumption of 800 mA*. Switched via F3.
X8	Accessory /-ies with a maximum current consumption of 500 mA*. Switched via F4.
X9	Accessory /-ies with a maximum current consumption of 800 mA*. Switched via F1.
X10	Accessory /-ies with a maximum current consumption of 800 mA*. Switched via F2.

* Maximum current consumption of all accessories = 1.000 mA**!**

Technical specifications

Data format	Motorola I
Supply voltage	12-24 Volt digital voltage
Current consumption (without connected loads)	ca. 10 mA
Max. current per function output	500 resp. 800 mA
Max. total current	1.000 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 35 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: $\geq$ 0,05 mm² 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.
- 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.

- Solder fast: long soldering can destroy components and copper tracks, and damages through plated holes.
- 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.
- 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.
- Do not move the component for about 5 seconds after soldering. A glossy and perfect soldering spot should remain.

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 X5 and X6.

Caution:

The central conductor must be connected to point X5. Otherwise the decoder will not react on 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 lamps and accessories (e.g. smoke generator, noise module), which are switched by the functions F1 to F4, to the points X7 to X10.

Caution:

The current consumption of all connected accessories may not exceed 1.000 mA!

You can connect the second side of the lamps and the accessories either to the return conductor of the corresponding output or to ground. If connecting the accessory to ground you must solder in a diode.

Caution:

The return conductors 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 of the corresponding output instead of ground.

Caution:

If you connect the load to the return conductor 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:

(number of LEDs + 2) x 1,5 < digital voltage

Fixing the decoder

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

Setting the decoder adress

The decoder can be set to one of 80 addresses. The setting is made by mounting solderbridges between the pins X1 to X4. The assignment is shown in the list on page 54.

The decoder is set to the address 79 by the manufacturer.

Caution:

Use a soldering iron with a small tapered point and max. 30 Watt to make the solderbridges. Take special care to avoid short circuits. If necessary, check the solderbridges with a magnifiying glass to make sure that the solderbridges 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 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 of the corresponding output.

- The decoder does not react on the data sent by the central unit.

  Possible cause: The connections X5 and X6 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

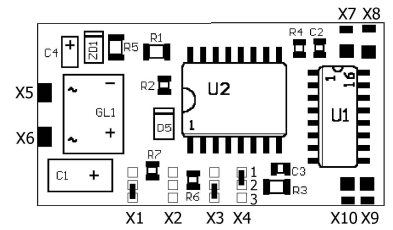
This product is guaranteed for two years. The warranty includes free repair if the problem is due to material failure or incorrect assembly of the module by us. We guarantee the quality of the components.

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 points 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 components are exchanged for other types, or the circuit is altered in any way at all.
- if the copper tracks or soldering points are damaged,
- when connections have been connected with reverse polarity resulting in damage to this product and other connected components.
- 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 "33"
Example:
Adjusting the address "33"
Exemple:
Réglage de l´adresse "33"
Voorbeeld:
Instellen van adres "33"

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d´une rangé Soldeerpunten			
	A0	A1	A2	A3
01	1-2	2-3	2-3	2-3
02	--	2-3	2-3	2-3
03	2-3	1-2	2-3	2-3
04	1-2	1-2	2-3	2-3
05	--	1-2	2-3	2-3
06	2-3	--	2-3	2-3
07	1-2	--	2-3	2-3
08	--	--	2-3	2-3
09	2-3	2-3	1-2	2-3
10	1-2	2-3	1-2	2-3
11	--	2-3	1-2	2-3
12	2-3	1-2	1-2	2-3
13	1-2	1-2	1-2	2-3
14	--	1-2	1-2	2-3

Adresse Address Adresse Adres	Lötfeld - Soldering field Plots d´une rangé Soldeerpunten			
	A0	A1	A2	A3
15	2-3	--	1-2	2-3
16	1-2	--	1-2	2-3
17	--	--	1-2	2-3
18	2-3	2-3	--	2-3
19	1-2	2-3	--	2-3
20	--	2-3	--	2-3
21	2-3	1-2	--	2-3
22	1-2	1-2	--	2-3
23	--	1-2	--	2-3
24	2-3	--	--	2-3
25	1-2	--	--	2-3
26	--	--	--	2-3
27	2-3	2-3	2-3	1-2
28	1-2	2-3	2-3	1-2

Adresse Address Adresse	Lötfeld - Soldering field Plots d´une rangé Soldeerpunten			
Adres	A0	A1	A2	A3
29	--	2-3	2-3	1-2
30	2-3	1-2	2-3	1-2
31	1-2	1-2	2-3	1-2
32	--	1-2	2-3	1-2
33	2-3	--	2-3	1-2
34	1-2	--	2-3	1-2
35	--	--	2-3	1-2
36	2-3	2-3	1-2	1-2
37	1-2	2-3	1-2	1-2
38	--	2-3	1-2	1-2
39	2-3	1-2	1-2	1-2
40	1-2	1-2	1-2	1-2
41	--	1-2	1-2	1-2
42	2-3	--	1-2	1-2
43	1-2	--	1-2	1-2
44	--	--	1-2	1-2
45	2-3	2-3	--	1-2
46	1-2	2-3	--	1-2
47	--	2-3	--	1-2
48	2-3	1-2	--	1-2
49	1-2	1-2	--	1-2
50	--	1-2	--	1-2
51	2-3	--	--	1-2
52	1-2	--	--	1-2
53	--	--	--	1-2
54	2-3	2-3	2-3	--

Adresse Address Adresse	Lötfeld - Soldering field Plots d´une rangé Soldeerpunten			
Adres	A0	A1	A2	A3
55	1-2	2-3	2-3	--
56	--	2-3	2-3	--
57	2-3	1-2	2-3	--
58	1-2	1-2	2-3	--
59	--	1-2	2-3	--
60	2-3	--	2-3	--
61	1-2	--	2-3	--
62	--	--	2-3	--
63	2-3	2-3	1-2	--
64	1-2	2-3	1-2	--
65	--	2-3	1-2	--
66	2-3	1-2	1-2	--
67	1-2	1-2	1-2	--
68	--	1-2	1-2	--
69	2-3	--	1-2	--
70	1-2	--	1-2	--
71	--	--	1-2	--
72	2-3	2-3	--	--
73	1-2	2-3	--	--
74	--	2-3	--	--
75	2-3	1-2	--	--
76	1-2	1-2	--	--
77	--	1-2	--	--
78	2-3	--	--	--
79	1-2	--	--	--
80	2-3	2-3	2-3	2-3

Anschlußplan - Connections diagram - Schema de connexion - Aansluit plan

Fig. 1

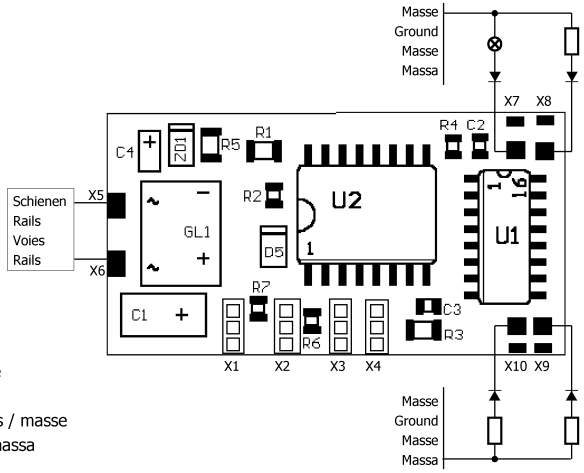


Fig. 1a:
Verbindung des 2. Anschlusses mit Masse
Connection of the 2nd side to ground
Raccordement des fonctions via le châssis / masse
Verbining van de 2e aansluiting met de massa

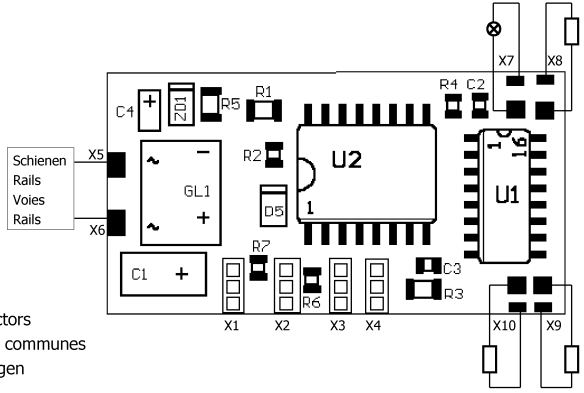
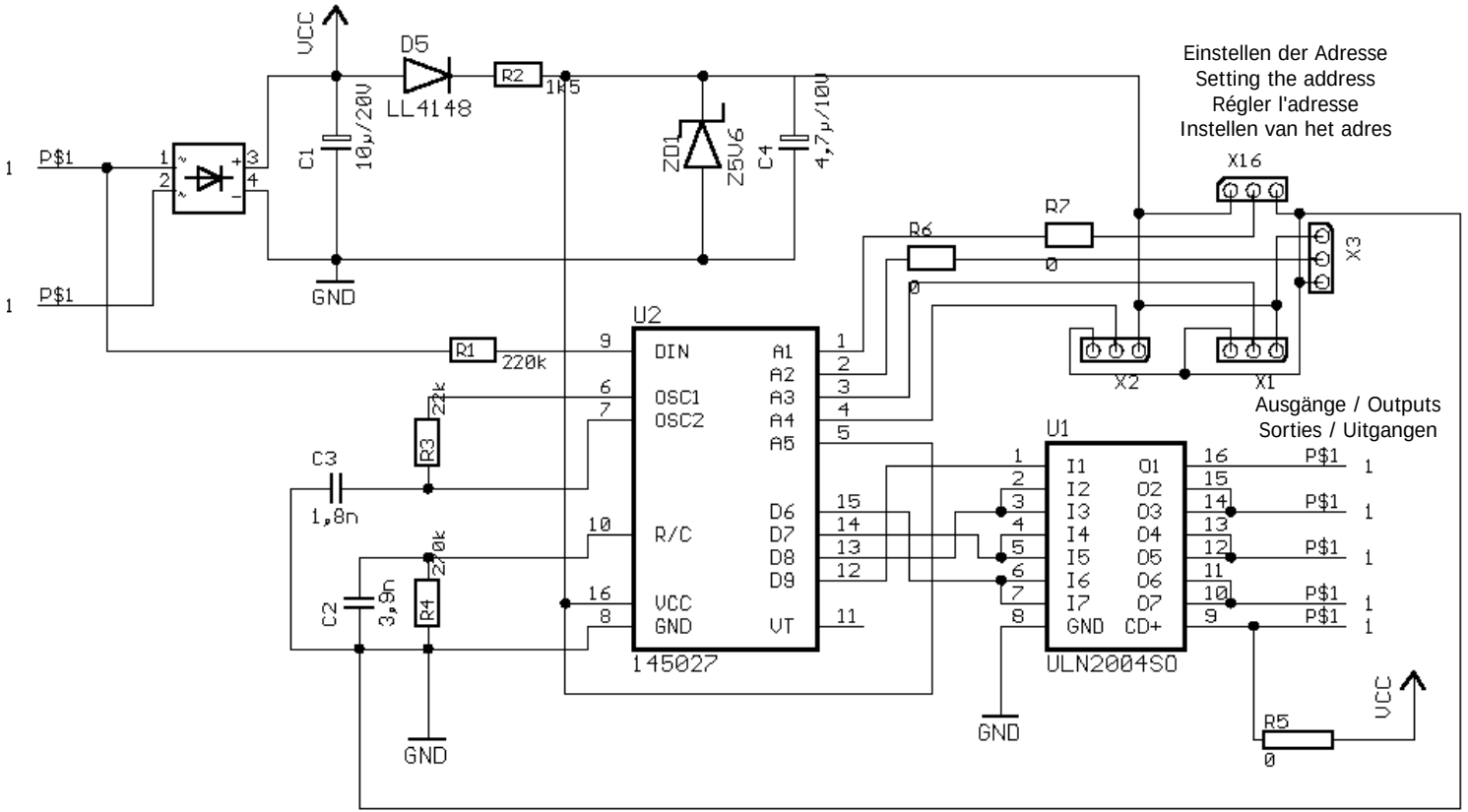


Fig. 1b:
Anschluß bei Verwendung der Rückleiter
Connection when using the return conductors
Raccordement des fonctions vi les bornes communes
Aansluiten bij gebruik van de retourleidingen

X1-X4	Lötpads zur Einstellung der Adressen Solder points for setting the addresses Points de soudage pour choix des adresses Soldeerbruggen voor het instellen van de adressen
X5	Schienen / Rails / Voies / Rails Mittelleiter / Central conductor / Frotteur central / middengeleider
X6	Masse / Ground / Masse / Massa
X7	F3
X8	F4
X9	F1
X10	F2
→|	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)

Schaltplan - Circuit diagram - Schéma de commutation - Schakelplan

Fig. 2



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