

# WD-1

Weichendecoder

Motorola-Format

Points decoder

Motorola format

Décodeur d'aiguillage

Format Motorola

Wisseldecoder

Motorola-Format

**Anleitung**

**Manual**

**Mode d'emploi**

**Handleiding**



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## How to use this manual

If you have no specialist technical training, this manual gives step-by-step instructions for safe and correct assembly of the kit and fitting of the ready-built 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 or the ready-built module 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 kit or the ready-built module can be assembled or operated in model railways using this manual. It analyzes the digital data in motorola format sent by the central unit and switches up to four points or other solenoid accessories.

The kit and the ready-built module should not be assembled or fitted 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.

## 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.
- 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.

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.

## **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.

## Operation overview

The central unit sends digital data in motorola format for one of four points or other solenoid accessories numbered in succession (e.g. 1 to 4, 5 to 8, 9 to 12 etc.) to the points decoder which analyzes the data and switches the appropriate points. Jumpers are used to select addresses.

The data flow in the points decoder is as follows: When the central unit sends data, IC2 on the points decoder checks if the data is assigned to its address. If so, the data is transmitted to IC1, which chooses the right points and drives the relevant power transistor to switch the points.

## Technical specifications

Supply voltage	Digital voltage of the central unit or 14 – 20 V alternating voltage
Current consumption (without connected loads)	approx. 20 mA
Max. current per output	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	approx. 73 x 80 mm
Weight	approx. 47 g

## Checking the package contents

Check the contents of the package for completeness after unpacking:

- one kit, containing the components listed in the parts list (see page I) and one PCB or one ready-built module,
- one manual.

## Required tools and consumables

Make sure you have the following tools 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 and wire stripper,
- a pair of tweezers and long nose pliers (not necessary for the ready-built module),
- tin solder (0,5 mm diameter),
- wire (diameter:  $\geq 0,22 \text{ mm}^2$  for all connections).

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

- 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.
- Observe correct polarity orientation of semi-conductors, LEDs electrolytic capacitors and integrated circuits before soldering and ensure that the solder time does not exceed 5 seconds, otherwise components can be damaged.
- Apply the soldering tip to the soldering spot in such a way that the part 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.
- Do not move the component for about 5 seconds after soldering.
- 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.
- Cut the wires after soldering directly above the PCB solder side with a side cutter.
- After placing the parts, please double check for correct polarity. Check the PCB tracks for solder bridges and short circuits created by accident. This would cause faulty operation or, in the worst case, 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.

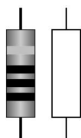
## Assembling the kit

You can skip this part if you have purchased a ready-built module.

### Preparation

Put the sorted components in front of you on your workbench. The separate electronic components have the following special features you should take into account to prevent mistakes in assembling:

## Resistors



Resistors reduce current. Their mounting orientation is of no importance. The value of resistors for smaller power ratings (under 5 W) is indicated through colour rings. Every colour stands for another figure. The colour ring in brackets indicates the tolerance of the resistor which here is of no importance.

Value	Colour rings
1,5 k $\Omega$	brown - green - red (gold)
4,7 k $\Omega$	yellow - violet - red (gold)
22 k $\Omega$	red - red - orange (gold)
47 k $\Omega$	yellow - violet - orange (gold)
100 k $\Omega$	brown - black - yellow (gold)
220 k $\Omega$	red - red - yellow (gold)
330 k $\Omega$	orange - orange - yellow (gold)

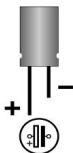
## Capacitors



Among other things capacitors are used for filtering interference voltages or as frequency determining parts. Ceramic capacitors are not polarized, for that reason their mounting orientation is of no importance. Normally they are marked with a three-digit number which indicates the value coded.

Value	Number
1,8 nF	182
3,9 nF	392
100 nF	104

## Electrolytic capacitors

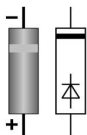


Electrolytic capacitors are often used to store energy. In contrast to ceramic capacitors they are polarized. One of the two leads is marked with a minus sign which indicates the mounting orientation. The value is given on the casing.

Electrolytic capacitors are available with different voltage sustaining capabilities. Using an electrolytic capacitor with a

voltage sustaining capability higher than required is always possible.

## Diodes



Diodes allow the current to pass through in one direction only (forward direction), simultaneously the voltage is reduced by 0,3 to 0,8 V. Exceeding of the limit voltage always will destroy the diode, and allow current to flow in the reverse direction.

The diode type is printed on the body.

Diodes must be mounted in a given direction. The negative end is marked with a ring. This is shown in the PCB layout.

## Zener diodes

Zener diodes are used for limiting voltages. In contrast to „normal“ diodes they are not destroyed when the limit voltage is exceeded.

## Transistors



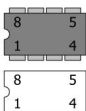
Transistors are current amplifiers which convert low signals into stronger ones. They have three contacts. As they are polarized, they have to be mounted in a certain direction.

BC-Types have a housing in form of a half cylinder (SOT-housing). The cross section is shown in the PCB Layout which determines the mounting orientation.



The BD types have a flat housing (TO-housing) with the type designation printed on the front side. The metallic rear is unlabelled, on the PCB layout the rear is marked by a thick line.

## Integrated circuits (ICs)



Depending on the type, ICs fulfil various tasks. They are polarized and therefore have to be mounted in a certain direction. The most common housing form is the so-called "DIL"-housing, from which 4, 6, 8, 14, 16, 18 or more "legs" (pins) are arranged along the long sides. The mounting orientation is shown by a semicircular or circular marking at the end of the housing, which is also shown on the PCB layout.

ICs are sensitive to damage during soldering (heat, electrostatic charging). For that reason in the place of the ICs IC sockets are soldered in, in which the ICs are inserted later. The mounting orientation of the sockets is preset as well. The markings on the PCB, the socket and the IC must lie on top of each other after mounting.

## Terminal strips

Terminal strips are solder-in screw-type terminals. They provide a solder-free and safe connection of the cables to the circuit, which can still be separated any time. When several terminal strips have to be mounted side by side, they have to be put together before mounting.

## Assembling the kit

Start the assembly with the resistors. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter, as short as possible. Insert the wire bridges Br1 to Br4, using the off-cut wires of the resistors.

Continue the assembly with the diodes. Then insert and solder in the IC-sockets. The sockets must be mounted according to the marking on the PCB. Continue the assembly with the diodes. Next solder the capacitors and the transistors.

**Caution:**

Diodes, ICs, electrolytic capacitors and transistors must be placed in the right direction! If you solder them the wrong way the affected parts can be damaged when you connect the power. In the worst case the whole circuit can be damaged. In any case, a wrongly connected part will not function.

Then solder the terminal strips X1 to X3 and the solder pins JP1 and JP7 to JP10. Before mounting, assemble the terminal strips. Finally, insert the ICs into the soldered IC-sockets.

**Caution:**

Do not touch the ICs without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" of the ICs when inserting them into the sockets. Check that the markings on the PCB, the socket and the IC show to the same direction.

## Performing a visual check

Due to material defects and/or improper assembly there may be risks of injury. Transport damage to ready-built modules is also possible. So you must perform a visual check after the assembly or after unpacking the module.

**Caution:**

Do not power up the module yet.

Check all nuts, pins and connections as well as the mechanical connections for correct assembly. The following points are inapplicable if you have purchased a ready-built module.

- Remove all loose parts, wire ends or drops of solder from the PCB. Remove all sharp wire ends.
- Check that solder contacts which are close to each other are not unintentionally connected to each other. Risk of short circuit!
- Check that all components are polarised correctly.

When you have remedied all faults, go on to the next part.

## Connecting the points decoder

### **Caution:**

Switch off the central unit before connecting the points decoder!

There are terminal strips soldered to the in- and outputs. Insert the connecting cables into the relevant terminals and fasten the screws. The connections diagram (figure 3) shows the correct assembly.

Start by connecting the points with the relevant outputs of the points decoder. Continue by connecting the central unit to the points decoder, which has interconnected connection points on two sides. This offers the possibility of connecting further decoders. It is irrelevant which side of the decoder you connect to the central unit.

### **Caution:**

Take care to connect the red and the brown wire of the central unit correctly.

Set how the decoder and the points are supplied with current by setting a jumper:

connection between 1 and 2: Power supply via the central unit,

connection between 2 and 3: Power supply via a transformer of their own.

Next adjust the required address on the decoder. The table on page 61 shows how to assemble the short-circuit terminations. Then turn on the central unit and switch the four points to check that they switch correctly.

## FAQ

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

### **Disconnect the system from the mains immediately!**

Possible cause: one or more components are soldered incorrectly.

→ Perform a visual check.

- The points decoder does not work.  
Possible cause: The connection of the decoder to the points or to the central unit is interrupted. → Check the connections.  
Possible cause: The wires from the central unit to the points decoder are incorrectly connected. → Check the wiring against the connections diagram (fig. 3).  
Possible cause: The central unit is not operating. → Check if the central unit is ready for operation.  
Possible cause: The points are defective. → Check the points.
  - The points only work in one direction.  
Possible cause: The relevant power transistor (Q2 to Q9) is defective or mounted in the wrong way. → Check the transistor.
- If you cannot find the problem, please return the module 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/EEG 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. As we have no control over the correct and proper assembly and mounting we can only guarantee the quality of the components and the completeness of kits. We guarantee the function

of the parts according to the parameters in not mounted state as well as 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.

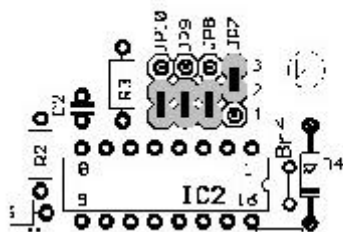
The following invalidate the warranty:

- using an unsuitable soldering iron, solder containing liquid acids or similar,
- if the kit is assembled and soldered poorly, or if damage is caused by not following the instructions in this manual,
- if the ready-built module has been altered and repair attempts have failed,
- if arbitrary changes in the circuit are made,
- if the circuitry is changed in any way, through adding or omitting wiring or components, or through modifying the circuit board,
- if parts other than the original ones delivered with this kit are used,
- if the copper tracks or soldering eyes are damaged,
- when components are mounted incorrectly, or if the components or the circuit are poled incorrectly, also subsequent damage resulting from these faults,
- 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.



# Einstellung der Adresse / Adjusting the address

## Réglage de l'adresse / Instellen van het adres



Beispiel:

Einstellung der Adresse "1"

Example:

Adjusting the address "1"

Exemple:

Réglage de l'adresse "1"

Voorbeeld:

Instellen van adres "1"

Adresse Address Adresse Adres	Weiche Points Aiguillage Wissel	JP7	JP8	JP9	JP10
1	1 – 4	2 – 3	1 – 2	1 – 2	1 – 2
2	5 – 8	--	1 – 2	1 – 2	1 – 2
3	9 – 12	1 – 2	2 – 3	1 – 2	1 – 2
4	13 – 16	2 – 3	2 – 3	1 – 2	1 – 2
5	17 – 20	--	2 – 3	1 – 2	1 – 2
6	21 – 24	1 – 2	--	1 – 2	1 – 2
7	25 – 28	2 – 3	--	1 – 2	1 – 2
8	29 – 32	--	--	1 – 2	1 – 2
9	33 – 36	1 – 2	1 – 2	2 – 3	1 – 2
10	37 – 40	2 – 3	1 – 2	2 – 3	1 – 2
11	41 – 44	--	1 – 2	2 – 3	1 – 2
12	45 – 48	1 – 2	2 – 3	2 – 3	1 – 2
13	49 – 52	2 – 3	2 – 3	2 – 3	1 – 2
14	53 – 56	--	2 – 3	2 – 3	1 – 2
15	57 – 60	1 – 2	--	2 – 3	1 – 2
16	61 – 64	2 – 3	--	2 – 3	1 – 2
17	65 – 68	--	--	2 – 3	1 – 2
18	69 – 72	1 – 2	1 – 2	--	1 – 2

Adresse Address Adresse Adres	Weiche Points Aiguillage Wissel	JP7	JP8	JP9	JP10
19	73 – 76	2 – 3	1 – 2	--	1 – 2
20	77 – 80	--	1 – 2	--	1 – 2
21	81 – 84	1 – 2	2 – 3	--	1 – 2
22	85 – 88	2 – 3	2 – 3	--	1 – 2
23	89 – 92	--	2 – 3	--	1 – 2
24	93 – 96	1 – 2	--	--	1 – 2
25	97 – 100	2 – 3	--	--	1 – 2
26	101 – 104	--	--	--	1 – 2
27	105 – 108	1 – 2	1 – 2	1 – 2	2 – 3
28	109 – 112	2 – 3	1 – 2	1 – 2	2 – 3
29	113 – 116	--	1 – 2	1 – 2	2 – 3
30	117 – 120	1 – 2	2 – 3	1 – 2	2 – 3
31	121 – 124	2 – 3	2 – 3	1 – 2	2 – 3
32	125 – 128	--	2 – 3	1 – 2	2 – 3
33	129 – 132	1 – 2	--	1 – 2	2 – 3
34	133 – 136	2 – 3	--	1 – 2	2 – 3
35	137 – 140	--	--	1 – 2	2 – 3
36	141 – 144	1 – 2	1 – 2	2 – 3	2 – 3
37	145 – 148	2 – 3	1 – 2	2 – 3	2 – 3
38	149 – 152	--	1 – 2	2 – 3	2 – 3
39	153 – 156	1 – 2	2 – 3	2 – 3	2 – 3
40	157 – 160	2 – 3	2 – 3	2 – 3	2 – 3
41	161 – 164	--	2 – 3	2 – 3	2 – 3
42	165 – 168	1 – 2	--	2 – 3	2 – 3
43	169 – 172	2 – 3	--	2 – 3	2 – 3
44	173 – 176	--	--	2 – 3	2 – 3
45	177 – 180	1 – 2	1 – 2	--	2 – 3
46	181 – 184	2 – 3	1 – 2	--	2 – 3
47	185 – 188	--	1 – 2	--	2 – 3
48	189 – 192	1 – 2	2 – 3	--	2 – 3
49	193 – 196	2 – 3	2 – 3	--	2 – 3

Adresse Address Adresse Adres	Weiche Points Aiguillage Wissel	JP7	JP8	JP9	JP10
50	197 – 200	--	2 – 3	--	2 – 3
51	201 – 204	1 – 2	--	--	2 – 3
52	205 – 208	2 – 3	--	--	2 – 3
53	209 – 212	--	--	--	2 – 3
54	213 – 216	1 – 2	1 – 2	1 – 2	--
55	217 – 220	2 – 3	1 – 2	1 – 2	--
56	221 – 224	--	1 – 2	1 – 2	--
57	225 – 228	1 – 2	2 – 3	1 – 2	--
58	229 – 232	2 – 3	2 – 3	1 – 2	--
59	233 – 236	--	2 – 3	1 – 2	--
60	237 – 240	1 – 2	--	1 – 2	--
61	241 – 244	2 – 3	--	1 – 2	--
62	245 – 248	--	--	1 – 2	--
63	249 – 252	1 – 2	1 – 2	2 – 3	--
64	253 – 256	2 – 3	1 – 2	2 – 3	--
65	257 – 260	--	1 – 2	2 – 3	--
66	261 – 264	1 – 2	2 – 3	2 – 3	--
67	265 – 268	2 – 3	2 – 3	2 – 3	--
68	269 – 272	--	2 – 3	2 – 3	--
69	273 – 276	1 – 2	--	2 – 3	--
70	277 – 280	2 – 3	--	2 – 3	--
71	281 – 284	--	--	2 – 3	--
72	285 – 288	1 – 2	1 – 2	--	--
73	289 – 292	2 – 3	1 – 2	--	--
74	293 – 296	--	1 – 2	--	--
75	297 – 300	1 – 2	2 – 3	--	--
76	301 – 304	2 – 3	2 – 3	--	--
77	305 – 308	--	2 – 3	--	--
78	309 – 312	1 – 2	--	--	--
79	313 – 316	2 – 3	--	--	--
80	317 – 320	1 – 2	1 – 2	1 – 2	1 – 2

## Stückliste - Parts list

## Nomenclature - Stuklijst

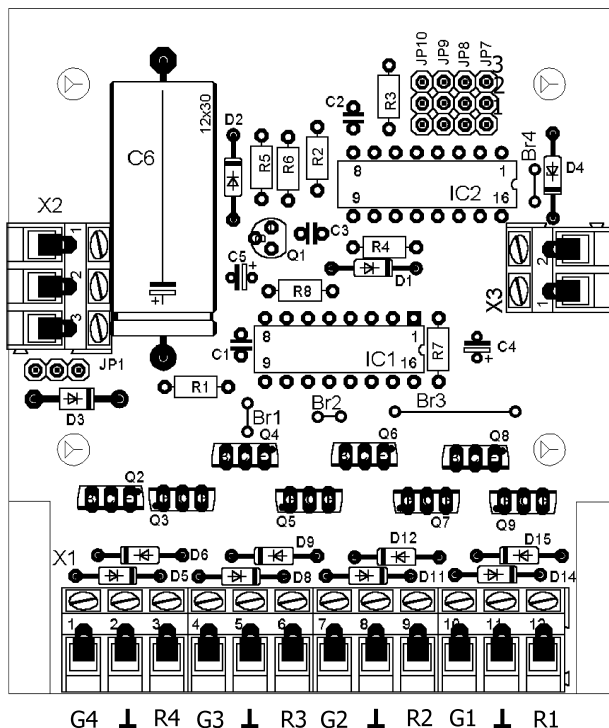
Widerstände Resistors Résistances Weerstanden	R1	1,5 k $\Omega$
	R2	220 k $\Omega$
	R3	22 k $\Omega$
	R4	100 k $\Omega$
	R5	47 k $\Omega$
	R6	330 k $\Omega$
	R7, R8	4,7 k $\Omega$
Kondensatoren - Condensers Condensateurs - Condensatoren	C1	100 nF
	C2	1,8 nF
	C3	3,9 nF
	C4	100 $\mu$ F
	C5	10 $\mu$ F
	C6	1000 $\mu$ F/25 V
Dioden - Diodes Diodes - Diodes	D1, D2, D5 - D15	1N4148 *
	D3	1N4004 *
Zener-Dioden - Zener diodes	D4	ZD 5,1 V *
Transistoren - Transistors	Q1	BC547B *
	Q2-Q9	BD679 *
IC's - ICs - CI's - ICs	IC1	4051
	IC2	145027
IC-Sockel - IC-socket Soquet IC - IC-voetje	IC1	16-pol.
	IC2	16-pol.
Anreihklemmen - Terminal strips Borniers - Printkroonsteen	X1	12-pol.
	X2	3-pol.
	X3	2-pol.
Stiftleisten - Solder pins Fiches - Pinstrips	JP1, JP7 – JP10	3-pol.

Kurzschlußstecker Short circuit terminators Jumpers – Kortsluitstekkers		5 Stück
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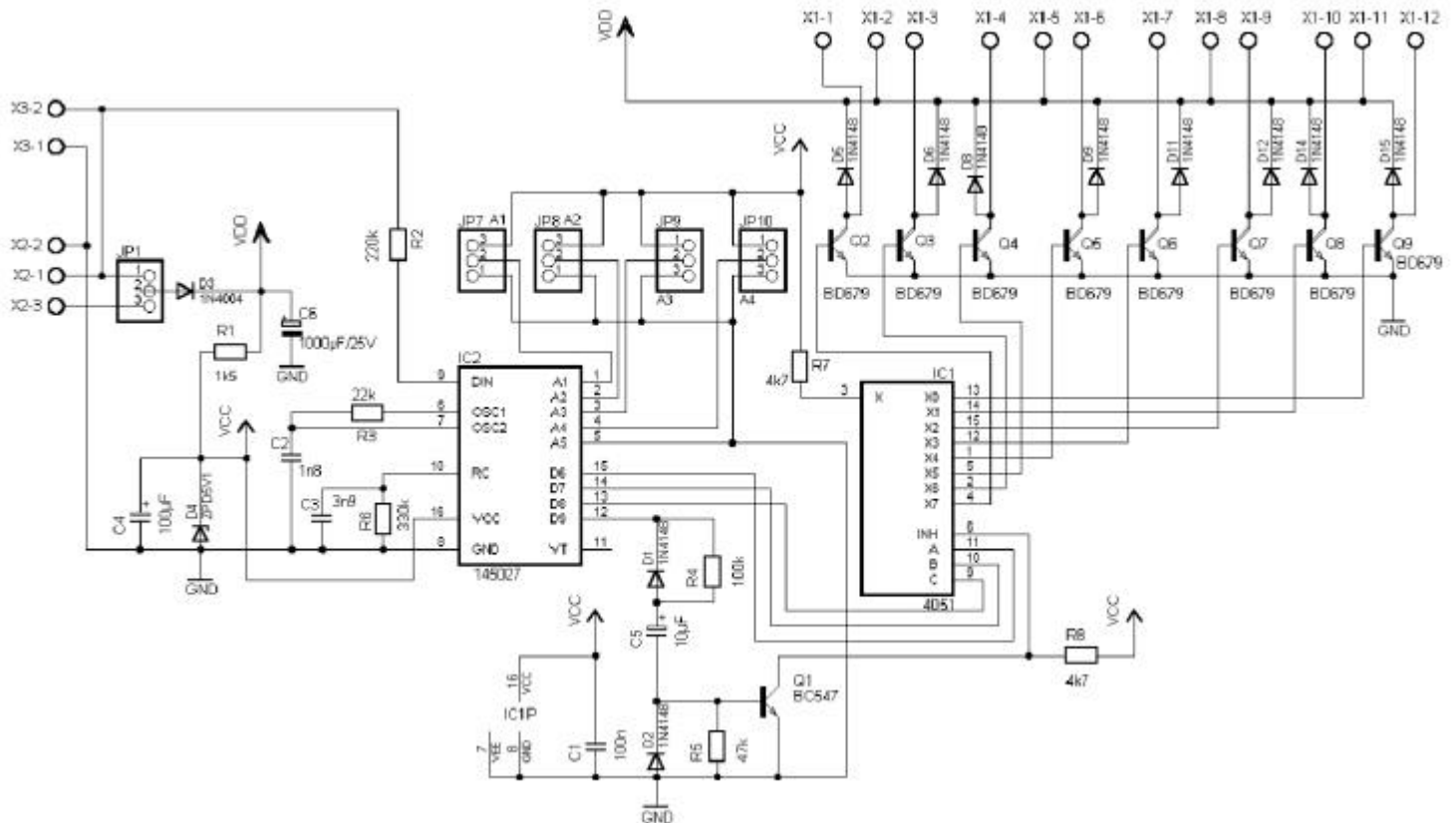
\* oder ähnlich - or similar - ou équivalent - of gelijkwaardig

## Bestückungsplan - PCB layout Plan d'implantation - Printplan

■ Fig. 1



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



■ **Fig. 3: Anschlußplan – Connections – Plan de raccordement – Aansluit plan**

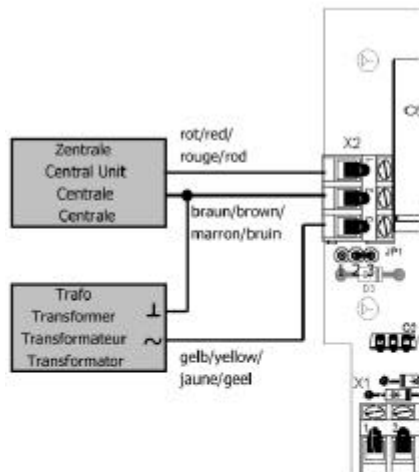


Fig. 3a:  
Anschluß an separate Stromversorgung.  
Connection to a seperate transformer.  
Connexion à une alimentation séparée.  
Aansluiting op de aparte stroomvoorziening.

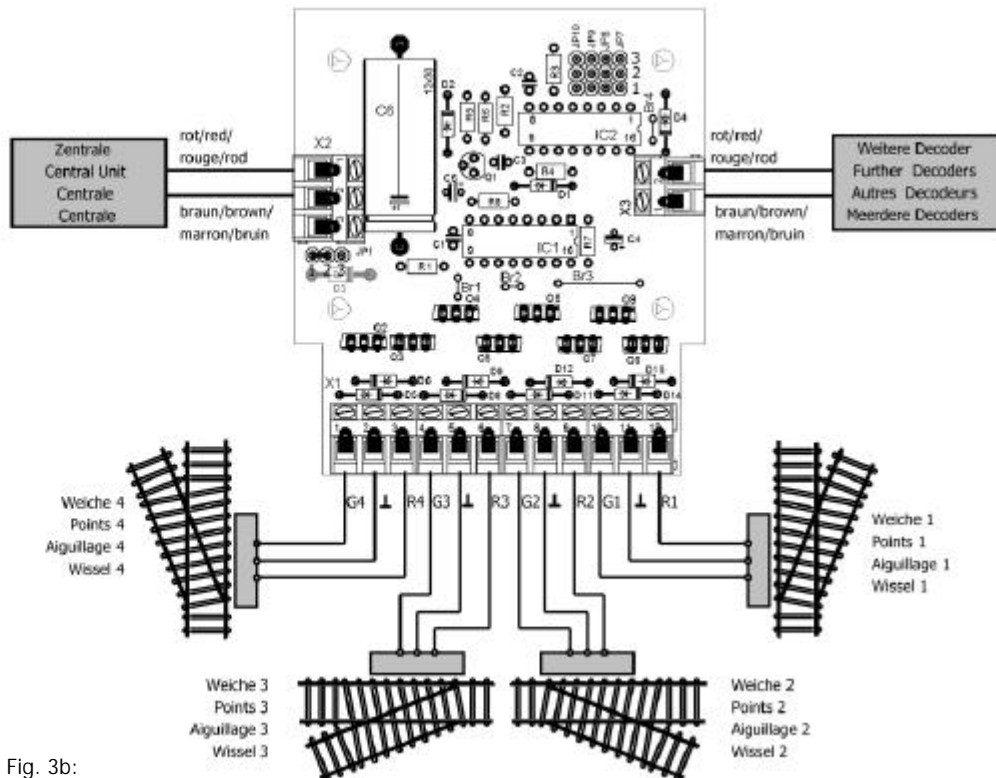


Fig. 3b:

Anschluß direkt an Digitalspannung.  
Connection directly to digital voltage.  
Connexion au courant numérique.  
Aansluiting direct aan de digitaalspanning.

Aktuelle Informationen und Tipps:

Information and tips:

Informations et conseils:

Actuele informatie en tips:

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

Garantie und Service:

Warranty and service:

Garantie et service:

Garantie en service:

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