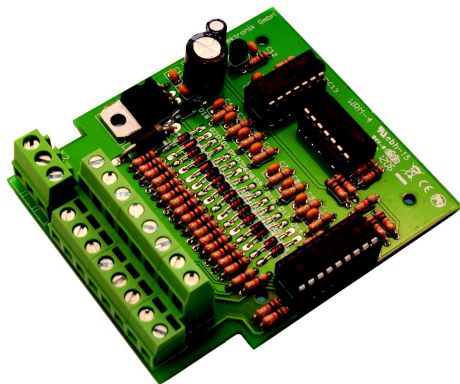


Manual

# WRM-4

Art. 52-02045 | 52-02046 | 52-02047



Points indicator | 4-fold

tams elektronik





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Subject to technical modification.

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## 1. Getting started

### **How to use this manual**

This manual gives step-by-step instructions for safe and correct assembly of the kit and fitting and connecting 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 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 kit or the ready-built module on to another person, please pass on the manual with it.

### **Intended use**

The WRM-4 is designed to be operated according to the instructions in this manual with analogue or digital model railways. Any other use is inappropriate and invalidates any guarantees.

The WRM-4 should not be assembled or mounted by children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user.



#### **Caution:**

The WRM-4 contains integrated circuits. These are very sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

## Checking the package contents

Please make sure that your package contains:

- one kit, containing the components listed in the parts list and one PCB or
- one ready-built module or
- one ready-built module in a housing (complete unit),
- one manual.

## Required materials

For assembling the kit 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 and wire stripper,
- as necessary a pair of tweezers and long nose pliers,
- electronic tin solder (0,5 mm. diameter).

In order to connect the module you need cable. Recommended diameters:  $\geq 0,10 \text{ mm}^2$  for the connections to the points and the voltage supply. You can use smaller diameters for connecting lamps and LEDs.

For displaying the position of points you need lamps or LEDs (with suitable series resistors).

It is recommended to test the points indicator's functions before mounting it into the layout. For this you need points and two lamps.

## 2. Safety instructions

### **Mechanical hazards**

Cut wires can have sharp ends and can cause serious injuries. Watch out for sharp edges when you pick up the PCB.

Visibly damaged parts can cause unpredictable danger. Do not use damaged parts: recycle and replace them with new ones.

### **Electrical hazards**

- Touching powered, live components,
  - touching conducting components which are live due to malfunction,
  - short circuits 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 or a regulated soldering iron.
- 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.
- Insert the component connecting pins of into the PCB's holes as far as possible without force. The components should be close to the PCB's surface.
- Observe correct polarity orientation of the parts before soldering.
- Solder quickly: holding the iron on the joints longer than necessary can destroy components and can damage copper tracks or soldering eyes.
- Apply the soldering tip to the soldering spot in such a way that the 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 soldering joint 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.

## 4. Operation overview

The points indicator WRM-4 can be used both in analogue model railway layouts and in digital layouts (together with digital solenoid decoders).

The WRM-4 detects the position of the drives of points and signals with double coil drives without limit stop. As the position of the anchor in the coil is analysed, the module also reacts if points are shifted manually. In particular cases the actual position of the points can differ from the position of the drive, e.g. when there are interferences of the tongue's movement due to parts of railway ballast.

Each points indicator can detect the position of four drives of points or signals. Each of the four functional areas has two outputs for the connection of LEDs or lamps (not included in the package), displaying the actual position.

The outputs of the WRM-4 switch against earth. Thus digital feedback modules (e.g. s88 modules) or subordinated circuits (e.g. for automatic train control) can be connected to the outputs (in addition to or instead of lamps or LEDs).

## 5. Technical specifications



### Caution:

The points indicator should not be fed via the voltage supply for the digital system! Please use a separate transformer for the WRM-4 (or all points indicators in the layout) with digital layouts!

Supply voltage (Operating voltage)	12 - 18 Volt a.c. voltage or 12 – 24 Volt d.c. voltage
Current consumption (without connected devices) approx.	15 mA
Number of inputs	4 x 2
Number of outputs Max. current per output	4 x 2 250 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 of the PCB (approx.)	73 x 80 mm
Weight of the circuit (approx.)	60 g

## 6. Assembling the kit

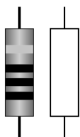
You can skip this part if you have purchased a ready-built module or device.

### 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 in assembling:

### Resistors



Resistors reduce current. Their mounting orientation is of no importance. The value of resistors for smaller power ratings (beneath 0,5 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:

1 k $\Omega$

10 k $\Omega$

47 k $\Omega$

470 k $\Omega$

Colour ring:

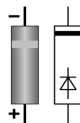
brown - black - red (gold)

brown - black - orange (gold)

yellow - violet - orange (gold)

yellow - violet - yellow (gold)

### 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.

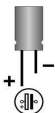
## Capacitors



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. The number 103 corresponds to a value of 10 nF, the number 104 to 100 nF.

## 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.

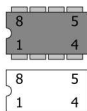
## Transistors

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.

## Integrated circuits (ICs)

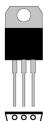


Depending on the type, ICs fulfil various tasks. They are polarized and therefore have to be mounted in a certain direction. The most common housing form is the so-called "DIL"-housing, from which 4, 6, 8, 14, 16, 18 or more "legs" (pins) are arranged along the long sides.

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.

## Voltage regulators



Voltage regulators are ICs, which convert a variable, non regulated input voltage in a constant output voltage. They are produced in transistor housings with three connecting pins for input, output and earth.

## 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.

## Assembly



### Caution:

Diodes, electrolytic capacitors, transistors, ICs and voltage regulators should be inserted in the right direction! If you solder them the wrong way around the affected parts can be damaged when you connect the power. In the worst case the whole circuit can be damaged. At the best, a wrongly connected part will not function.

Start the assembly with the resistors and the diodes. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter.

Next solder in the IC-sockets. They have to be mounted according to the marking on the PCB.

Continue the assembly with the capacitors, the transistor, the electrolytic capacitors and the voltage regulator. Before soldering, bend the voltage regulator's pins to 90 degrees, so that you can solder it in corresponding to the PCB layout with the labelled front side facing upwards.

Next solder the terminal strips. Put together the terminal strips before mounting them.

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

Perform a visual check after the assembly of the module and remove faults if necessary:

- 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.

## 7. Connecting the WRM-4

The module is equipped with terminal strips used for inserting and screwing the connection cables.

### Pin assignment

⊥   -	X2 1	Voltage supply (12-18 V a.c. voltage or 12 – 24 V d.c. Voltage) Check the polarity when connecting to d.c. Voltage. When connecting the module to a.c. voltage the polarity is of no importance.
~   +	X2 2	
RL	X2 3	Reverse conductor for the outputs
E1a	X1 1	points 1, position ahead
E1b	X1 9	points 1, position branch
...		...
E4b	X1 12	points 4, position branch
A1a	X1 5	LED / lamp for points 1 / ahead
A1b	X1 13	LED / lamp for points 1 / branch
...		...
A4b	X1 16	LED / lamp for points 4 / branch



## Functional test

Before mounting the WRM-4 in the layout it is recommended to perform a functional test, especially when you have assembled the module from a kit. Perform the functional test with one point and two lamps by connecting them according to the details given in the following sections and the connection diagram fig. 3.

Perform the functional test for the four function areas one after another:

- connecting one point to the module's inputs (a and b);
- connecting one lamp to each of the two corresponding outputs;
- connecting and switching on the voltage supply;
- switching the points manually into both positions. The two lamps should light alternately.



### Attention:

When a component gets hot, disconnect the module from the voltage supply immediately! Risk of short circuit! Check the assembly.

## Connecting the points

Connect the inputs of the points indicator to the points. Mind the correct assignment.

## Connecting lamps or LEDs

Lamps are not polarised, thus the assignment of the two connections to the outputs of the WRM-4 (A1a to A4b) and to the return conductor for the outputs (RL) is optional.

With LEDs you have to observe the polarity, otherwise they do not light. Connect the cathodes (-) to the outputs of the WRM-4 (A1a bis A4b) and the anodes (+) to the return conductor for the outputs (RL). With standard LEDs the longer connecting pin is the anode (+).

**Attention:**

When using LEDs you always have to connect them via a series resistor as the LED will be damaged when put into operation or its duration of life will be reduced considerably.

The necessary value of the series resistor depends on the voltage supply to be available, the forward voltage of the LED (which depends on the colour) and the current.

Calculating the series resistor:

$$\text{necessary } R_v [\text{Ohm}] = (U_B [\text{V}] - U_F [\text{V}]) / (I_F [\text{mA}] \times 0,001)$$

$U_B$  = operating voltage

$U_F$  = forward voltage of the LED

$I_F$  = current with max. luminosity

For red and green LEDs you can take 2 V as a basis for the forward voltage. The luminosity depends on the current draw, with standard LEDs the difference between 10 and 20 mA is not visible.

Connection to a.c. voltage			Connection to d.c. voltage		
Note: The operating voltage of an a.c. transformer is approx. 1,4 fold the nominal voltage given.			Note: With d.c. Power packs the operating voltage corresponds to the nominal voltage given.		
Nominal voltage	Necessary series resistor with current draw		Nominal voltage	Necessary series resistor with current draw	
	10 mA	20 mA		10 mA	20 mA
12 V ~	1,5 k $\Omega$	820 $\Omega$	16 V =	1,5 k $\Omega$	820 $\Omega$
14V ~	1,8 k $\Omega$	820 $\Omega$	18 V =	1,5 k $\Omega$	820 $\Omega$
16 V ~	2,2 k $\Omega$	1 k $\Omega$	20 V =	1,8 k $\Omega$	1 k $\Omega$
18 V ~	2,2 k $\Omega$	1,2 k $\Omega$	22 V =	2,2 k $\Omega$	1 k $\Omega$

## Connecting the power supply

Connect the voltage supply according to the list "pin assignment" and the connection diagrams. Observe the polarity when connecting to a d.c. power pack.

When connecting the WRM-4 to an a.c. transformer, first of all the polarity is of no importance. However, when making the connections between the different components you have to be careful to assign earth and voltage consistently.

## Embedding in a digitally controlled model railway layout

When you want to use the WRM-4 in combination with a points decoder in a digital layout, make the connections according to fig. 4.



### Attention:

Do **not** connect the WRM-4 to the voltage supply for the digital system. The occurring leakage current would damage the module irreparably! Use a separate transformer as voltage supply for the WRM-4 (and in case further points indicators).

## 8. Connecting subordinate circuits

The WRM-4 evaluates the income signals against earth. Thus you can connect the outputs of the WRM-4 to:

- the inputs of digital feedback modules (e.g. s88 modules);
- the inputs of subordinate electronic circuits with a current consumption of max. 250 mA;
- relays to switch the inputs of subordinate electronic circuits with a current consumption of more than 250 mA or to switch circuits requiring to be galvanically isolated;
- relays to switch the outputs of subordinate modules.

### Connecting s88 modules

In order to occupy a number of inputs of the feedback modules as small as possible, you can connect only one output of each function area (for one position). In theory, the drive must be in the other position when the connected output is not connected to earth.

In order to increase the safety of the feedback system, it possibly makes sense to connect each of the two outputs of a function area to one input of the feedback module. This enables you to supervise both positions.

### Directly connecting subordinate circuits

You can connect the inputs of circuits with a maximum current of 250 mA like lamps directly to the outputs of the WRM-4 and to the return conductor for all outputs.



#### **Attention:**

When connecting loads with a current consumption of more than 250 mA the outputs of the WRM-4 will be damaged.

### Connecting subordinate circuits via a relay

- Loads with a current consumption of more than 250 mA;
- circuits or modules requiring to be galvanically isolated (e.g. track sections);
- outputs of subordinate circuits

must be connected via a relay to the WRM-4 as a rule. In addition you should connect a free-wheeling diode (e.g. 1N400x) in parallel to the relay in order to avoid damages to the outputs of the WRM-4. Pay attention to connect the anode of the free-wheeling diode (+) to the output of the WRM-4.

**Attention:**

When connecting the outputs of the WRM-4 directly to the outputs of subordinate circuits (without relay), current possibly flows back from the subordinate circuit into the WRM-4. This causes damage to the output, possibly to the complete WRM-4.

## 9. Check list for troubleshooting

- 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.  
→ In case you have mounted the module from a kit, perform a visual check (→ section 6.) and if necessary, remedy the faults. Otherwise send in the module for repair.

- The lamps or LEDs connected to the module do not light.

Possible cause: The voltage supply is interrupted. → Check the connection to the voltage supply.

Possible cause: LEDs are connected incorrectly polarised → Check the connections.

Possible cause: The lamps or LEDs are defective. → Check the lamps by connecting them directly to the voltage supply.

Possible cause: The diode D17 is soldered in the wrong way around.  
→ Alter the mounting direction.

- Both lamps for one point light permanently.

Possible cause: the points have not switched properly and have stopped midway. → Check the position of the points..

- There is no change over from the one to the other lamp or LED after switching the points.

Possible cause: The points are not properly connected to the points indicator. → Check the three connections to the points..

- A connected relay "rattles" (does not switch properly).

Possible cause: This phenomenon occurs when supplying the WRM-4 with a.c. voltage. → Solder a capacitor in parallel to the relay ( $\geq 100 \mu\text{F} / 25 \text{V}$ ).

**Hotline:** If problems with your module occur, our hotline is pleased to help you (mail address on the last page).

**Repairs:** You can send in a defective module 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 the difference between the price for the ready-built module and the kit according to our valid price list. We reserve the right to reject the repairing of a module when the repair is impossible for technical or economic reasons.

Please do not send in modules 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.

## 10. 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.



## 11. EU declaration of conformity



This product conforms with the EC-directive 2004/108/EG on electromagnetic compatibility and is therefore CE certified.

It is developed and tested in accordance with the harmonised European 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.

## 12. Declarations conforming to RoHs and WEEE directives



This product conforms with the EC-directives 2002/96/EG on waste electrical and electronic equipment (WEEE) and 2002/95/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).



DE 37847206

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.

## Stückliste | Parts list | Nomenclature | Stuklijst

Widerstände Resistors	R3, R4, R11, R12, R19, R20, R27, R28	1 k $\Omega$
Résistances Weerstanden	R2, R5, R6, R9, R10, R13, R14, R17, R18, R21, R22, R25, R26, R29, R30, R33, R34	10 k $\Omega$
	R1, R35, R36, R37, R38	47 k $\Omega$
	R7, R8, R15, R16, R23, R24, R31, R32	470 k $\Omega$
Dioden Diodes	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16	1N4148
	D17	1N540x, x=2...7
	D18	1N400x, x=2...7
Kondensatoren Capacitors	C2	10 nF
Condensateurs Condensatoren	C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C15	100 nF
Elkos   Electrolytic capacitors	C1	470 $\mu$ F / 25 V
Condensateurs électrolytiques   Elco 's	C14	100 $\mu$ F / 25 V
Transistoren   Transistors	T2	BC327
IC	IC1	40106N
CI	IC2	ULN2803
	IC3	LM339N
IC-Sockel   IC-sockets	IC1, IC3	14-pol.
Soquets CI   IC-voetjes	IC2	18-pol.

Spannungsregler Voltage regulators Régulateurs de tension Spanningsregelaars	IC4	7812
Anreihklemmen Terminal strips Borniers Aansluitklemmen	X1 X2	2 x 8-pol. 1 x 3-pol.

Fig. 1: Bestückungsplan | PCB layout  
Plan d'implantation | Printplan

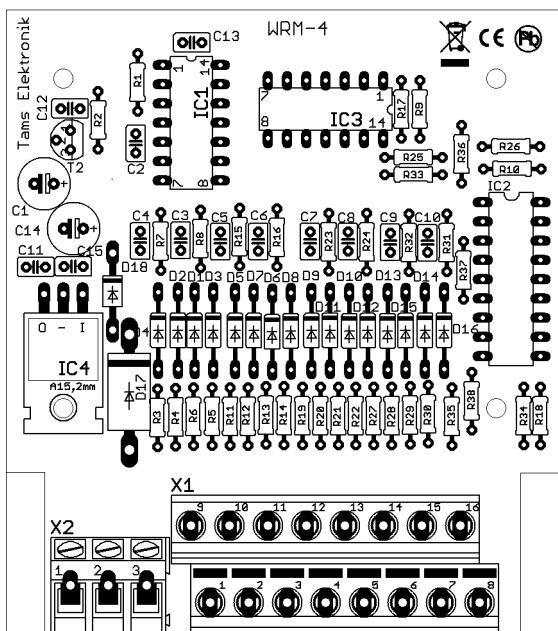


Fig. 2: Schaltplan | Circuit diagram  
Schéma de principe | Schakelschema

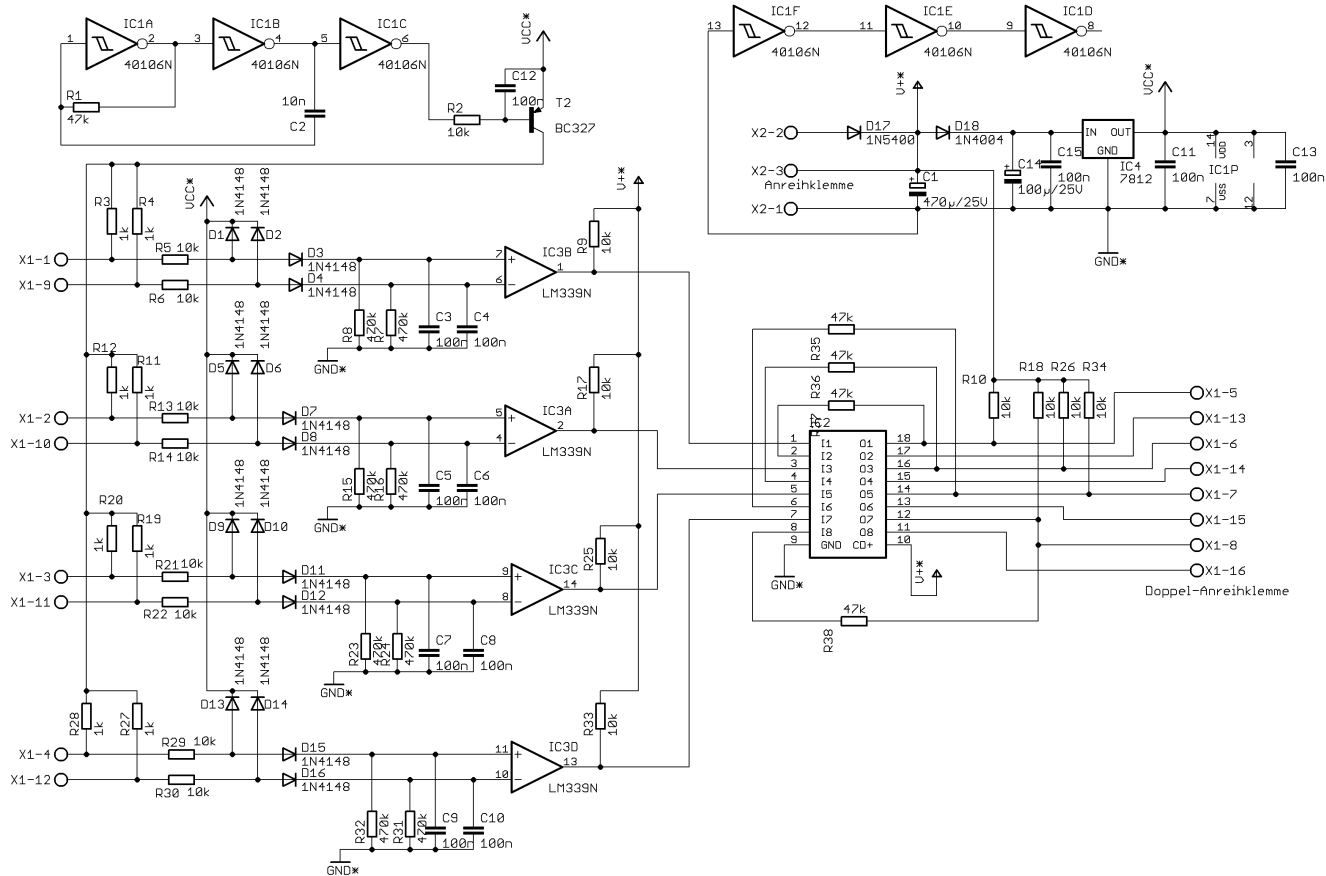


Fig. 3: Anschlussplan 1 | Connections 1  
Schéma de branchement 1 | Aansluit plan 1

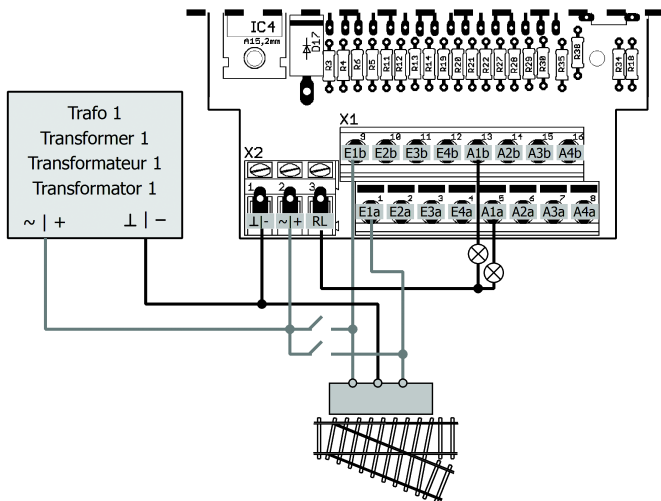


Fig. 4: Anschlussplan 2 | Connections 2  
Schéma de branchement 2 | Aansluit plan 2

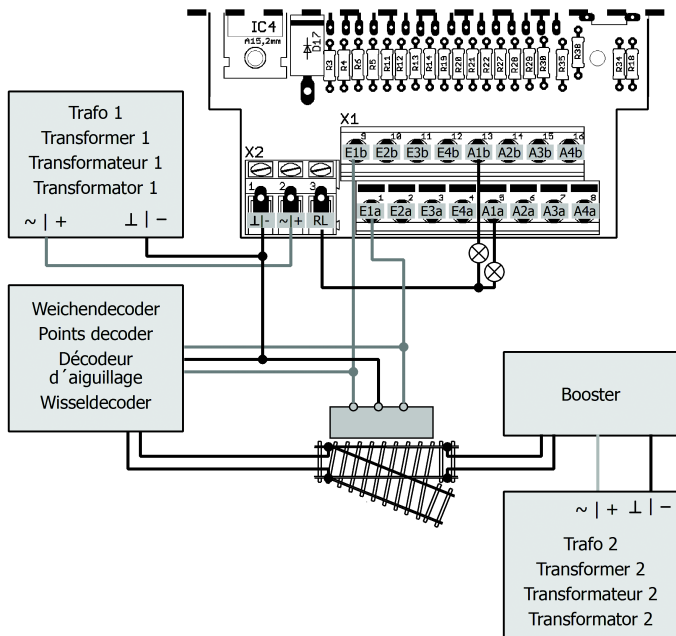


Fig. 5: Anschlussplan 3 | Connections 3  
Schéma de branchement 3 | Aansluit plan 3

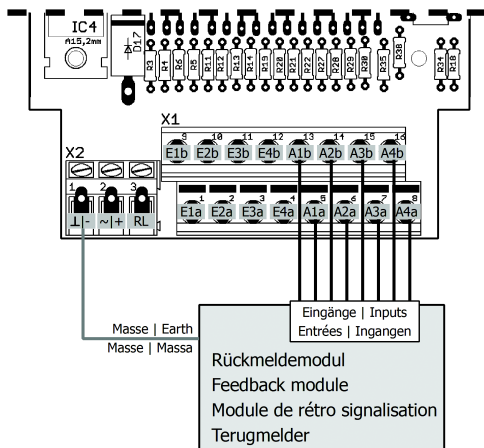
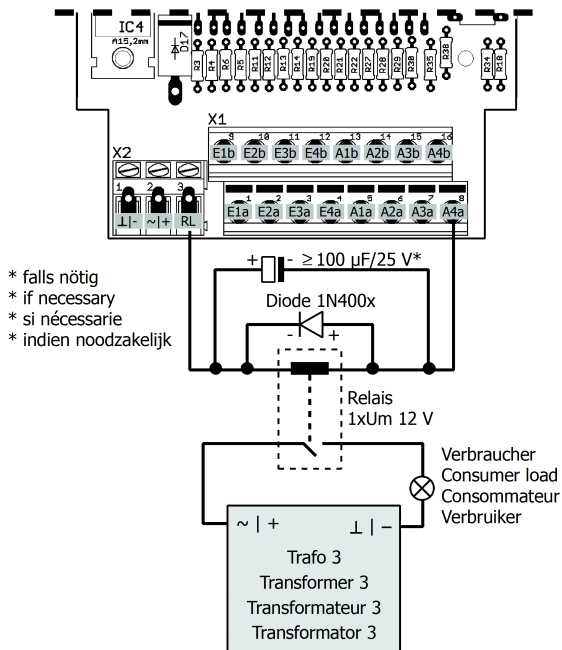


Fig. 6: Anschlussplan 4 | Connections 4  
Schéma de branchement 4 | Aansluit plan 4





Information and tips:

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