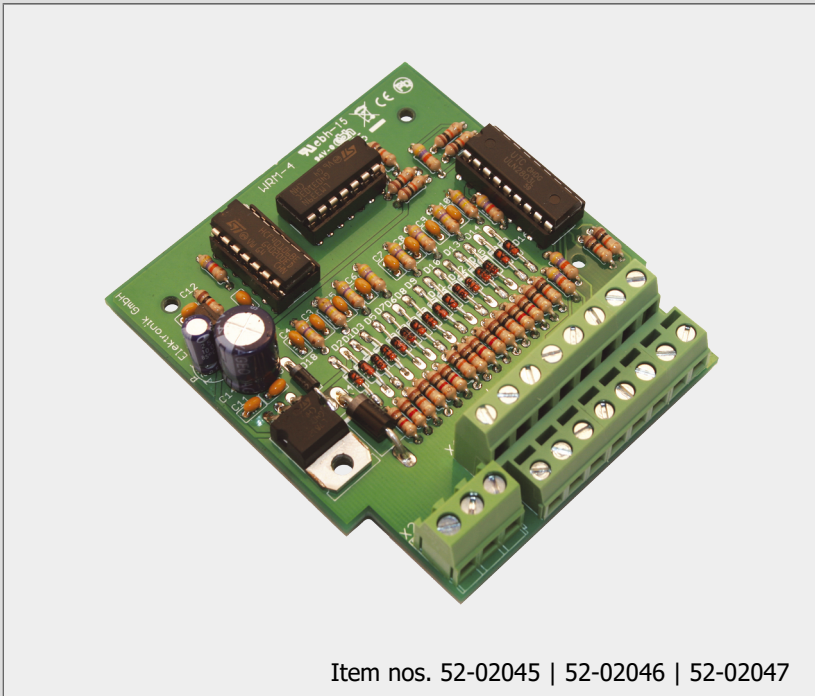


# WRM-4

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Turnout detector  
4-fold

Manual



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**Printing the manual**

The formatting is optimised for double-sided printing. The standard page size is DIN A5. If you prefer a larger display, printing on DIN A4 is recommended.

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## 1. Getting started

The instructions will help you step by step with the safe and proper assembly of the kit and installation and use of your turnout detector. Before you start to assemble the kit or put the turnout detector into operation, read this manual completely, especially the safety instructions and the section on possible errors and their elimination. You will then know what you have to pay attention to and thus avoid errors that sometimes can only be rectified with a lot of effort. Keep the instructions in a safe place so that you can restore functionality later in the event of any malfunctions. If you pass the turnout detector on to another person, also give the instructions with it.

### 1.1. Contents of the package

1 kit WRM-4 (item no. 52-02045-01), containing the components listed in the parts list (→ section 3.4.) and one PCB or

1 ready-built and tested circuit board WRM-4 (item no. 52-02046-01) or

1 turnout detector WRM-4 in housing (item no. 52-02047-01)

### 1.2. Accessories

#### **To assemble the kit you will need**

- a soldering iron with temperature control and a thin tip and a deposit stand or a controlled soldering station
- a scraper, rag or sponge
- a heat-resistant pad
- a small pair of side cutters and wire strippers
- tweezers and flat-nose pliers if necessary
- electronic solder (preferably 0.5 to 0.8 mm diameter)

#### **Connection cables**

The use of stranded wire is recommended for making the connections. Stranded wires consist of several thin individual wires and are therefore more flexible than rigid wires with the same copper cross-section. Recommended cross-sections:

- Connections to the turnouts and the power supply: > 0.10 mm<sup>2</sup>
- Connections of lamps or LEDs: > 0.04 mm<sup>2</sup>

#### **Display of the turnout position**

To indicate the turnout position, you need 2 LEDs (with suitable series resistors) or small lamps for each turnout.

#### **Function test**

It is recommended to test the detector's functions before mounting it into the layout, especially if you have built the module from a kit. For this you need a turnout and two light bulbs.

### 1.3. Intended use

The turnout detector is intended for use in model railway layouts as specified in the instructions. Any other use is not in accordance with the intended use and will result in the loss of the warranty claim. Intended use also includes reading, understanding and following all parts of the instructions. The detector is not intended to be used by children under the age of 14.

### 1.4. Safety instructions

**Note:**

The turnout detector contains integrated circuits (ICs). These are sensitive to electrostatic charging. Therefore, do not touch these components until you have "discharged" yourself. For this purpose, e.g. a grip on a radiator is sufficient.

Improper use and non-observance of the instructions can lead to incalculable hazards. Prevent these dangers by carrying out the following measures:

- Only use the turnout detector in closed, clean and dry rooms. Avoid moisture and splash water in the environment. After condensation has formed, wait two hours for acclimatisation before use.
- Disconnect the detector from the power supply before carrying out wiring work.
- Supply the detector only with extra-low voltage as specified in the technical data. Use only tested and approved transformers.
- Only plug the mains plugs of transformers into properly installed and fused earthed sockets.
- When making electrical connections, ensure that the cable cross-section is sufficient.
- Heating of the detector during operation is normal and harmless.
- Do not expose the detector to high ambient temperatures or direct sunlight. Observe the information on the maximum operating temperature in the technical data.
- Regularly check the operational safety of the detector, e.g. for damage to the connection cables.
- If you notice damage or if malfunctions occur, disconnect the connection to the power supply immediately. Send the turnout detector in for inspection.

### 1.5. Care

Do not use any cleaning agents to clean the turnout detector. Only wipe the detector dry. Disconnect the detector from the power supply before cleaning.

## 2. Operation overview

The turnout detector 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 turnouts and signals with double coil drives without limit switching. As the position of the anchor in the coil is analysed, the detector also reacts if turnouts are shifted manually. In particular cases the actual position of the turnout 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 detector can detect the position of four drives of turnouts 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).

### 3. Assembling the kit

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

#### 3.1. 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.

##### **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.

## 3.2. Soldering properly

- Use a soldering iron with temperature control, which you set to approx. 300 °C.
- Only use electronic solder with a flux.
- Never use soldering water or soldering grease when soldering electronic circuits. These contain an acid that destroys components and conductor paths.
- Insert the connecting wires of the components as far as possible through the holes of the board without using force. The body of the component should be close above the board.
- Make sure that the polarity of the components is correct before soldering them.
- Solder quickly: soldering for too long can cause pads or tracks to become detached or even destroy components.
- Hold the soldering tip on the soldering point in such a way that it touches the component wire and the pad at the same time. Add (not too much) solder simultaneously. As soon as the solder begins to flow, remove it from the soldering point. Then wait a moment for the solder to flow well before removing the soldering iron from the soldering joint.
- Do not move the component you have just soldered for about 5 seconds.
- A clean, non-oxidised (scale-free) soldering tip is essential for a perfect soldering joint and good soldering. Therefore, before each soldering, wipe off excess solder and dirt with a damp sponge, a thick damp cloth or a silicone wiper.
- After soldering, cut off the connecting wires directly above the soldering point with a side cutter.
- After assembly, always check each circuit again to ensure that all components are correctly inserted and polarised. Also check that no connections or tracks have been accidentally bridged with tin. This can lead not only to malfunction, but also to the destruction of expensive components. You can re-liquefy excess solder with the clean hot soldering tip. The solder then flows from the board to the soldering tip.

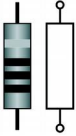


### 3.3. Preparation

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



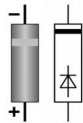
Resistors reduce current.

The value of resistors for smaller power ratings is indicated through colour rings. Every colour stands for another figure.

Carbon film resistors have 4 colour rings. The 4th ring (given in brackets here) indicates the tolerance of the resistor (gold = 5 %).

Value:	Colour rings:
1 k $\Omega$	brown - black - red (gold)
10 k $\Omega$	brown - black - orange (gold)
47 k $\Omega$	yellow - violet - orange (gold)
470 k $\Omega$	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.

#### Ceramic capacitors

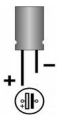


Among other things ceramic capacitors are used for filtering interference voltages or as frequency determining parts. Ceramic capacitors are not polarized.

Normally they are marked with a three-digit number which indicates the value coded:

Number:	Value:
103	10 nF
104	100 nF

#### Electrolytic capacitors

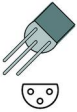


Electrolytic capacitors are often used to store energy. In contrast to ceramic capacitors they are polarized. One of the two leads is marked with a minus sign which indicates the mounting orientation. The value is given on the casing.

Electrolytic capacitors are available with different voltage sustaining capabilities. Using an electrolytic capacitor with a voltage sustaining capability higher than required is always possible.

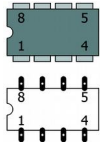
## Transistors

Transistors are current amplifiers which convert low signals into stronger ones. There are several types in different package forms available. The type designation is printed on the component.



Transistors for a low power rating (e.g. BC types, BS types) have a package in form of a half cylinder (SOT-package). The three pins of bipolar transistors (e.g. BC, BD and BT types) are called basis, emitter and collector (abbreviated with the letters B, E, C in the circuit diagram).

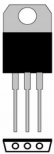
## Integrated circuits (ICs)



Depending on the type, ICs fulfil various tasks. 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.

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.

## 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.

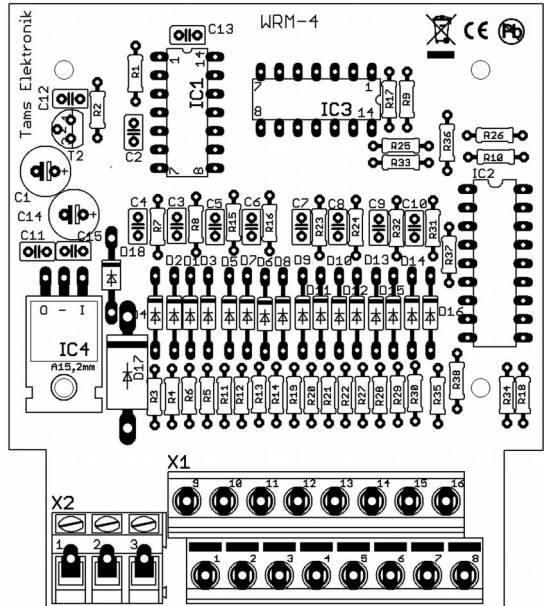
With voltage regulators in a flat TO-housing the unlabelled rear is marked by a thick line on the PCB layout.

## 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.

### 3.4. PCB layout and parts list

#### PCB layout



**Parts list**

Carbon film resistors	R3, R4, R11, R12, R19, R20, R27, R28	1 k $\Omega$
	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 $\Omega$
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
Ceramic capacitors	C2	10 nF
	C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C15	100 nF
Electrolytic capacitors	C1	470 $\mu$ F / 25 V
	C14	100 $\mu$ F / 25 V
Transistor	T2	BC327
Integrated circuits (ICs)	IC1	40106N
	IC2	ULN2803
	IC3	LM339N
IC-sockets	IC1, IC3	14-pole
	IC2	18-pole
Voltage regulators	IC4	7812
Terminal strips	X1	2 x 8-pole
	X2	1 x 3-pole

### 3.5. Assembly

Proceed according to the order given in the list below. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter. Follow the instructions on soldering in section 3.2.

#### **Caution:**

Several components have to be mounted according to their polarity. When soldering these components the wrong way round, they 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.

1.	Resistors	Mounting orientation of no importance.
2.	Diodes	Observe the polarity! The negative end of the diodes is marked with a ring. This is shown in the PCB layout.
3.	IC sockets	Mount the sockets that way, the markings on the sockets show in the same direction as the markings on the PCB board.
4.	Ceramic Capacitors	Mounting orientation of no importance.
5.	Transistor	Observe the polarity! With transistors for a high power rating in TO packages (e.g. BD types) the unlabelled back side is marked in the PCB layout by a thick line.
6.	Electrolytic capacitors	Observe the polarity! One of the two leads (the shorter one) is marked with a minus sign.
7.	Voltage regulators	Observe the polarity! 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.
8.	Terminal strips	Put together the terminal strips before mounting them.
9.	ICs in DIL-housing	Insert the ICs into the soldered socket. Do not touch the ICs without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" when inserting them into the sockets. Check that the markings on the PCB, the socket and the IC show to the same direction.

### 3.6. Performing a visual check

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

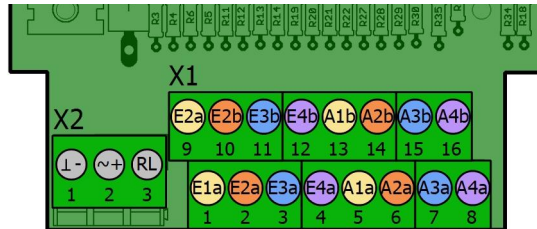
- Remove all loose parts, wire ends or drops of solder from the PCB. Remove all sharp wire ends.
- Check that solder contacts which are close to each other are not unintentionally connected to each other. Risk of short circuit!
- Check that all components are polarised correctly.

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

## 4. Connecting the WRM-4

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

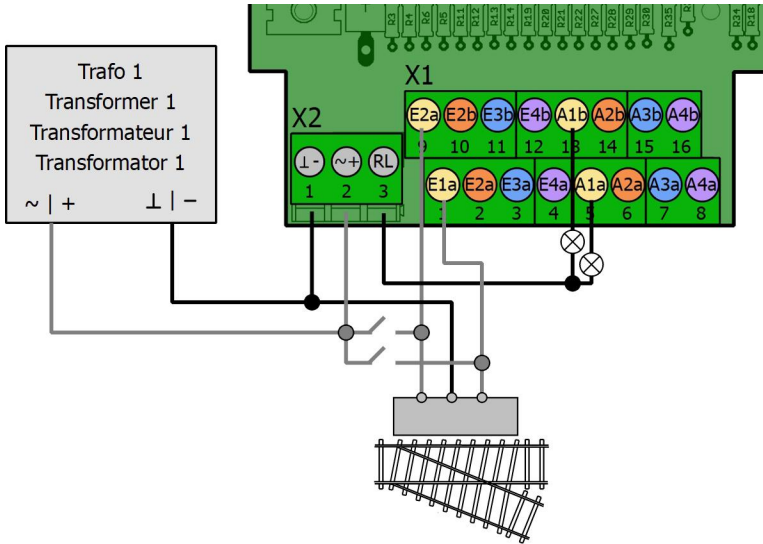
### 4.1. Pin assignment



⊥   -	X2 1	Voltage supply (12-18 V a.c. voltage or 12 – 24 V d.c. Voltage)
~   +	X2 2	Check the polarity when connecting to d.c. Voltage. When connecting the detector to a.c. voltage the polarity is of no importance.
RL	X2 3	Reverse conductor for the outputs
E1a	X1 1	turnout 1, position ahead
E1b	X1 9	turnout 1, position branch
...		...
E4a	X1 4	turnout 4, position ahead
E4b	X1 12	turnout 4, position branch
A1a	X1 5	LED / lamp for turnout 1 / ahead
A1b	X1 13	LED / lamp for turnout 1 / branch
...		...
A4a	X1 8	LED / lamp for turnout 4 / ahead
A4b	X1 16	LED / lamp for turnout 4 / branch

## 4.2. Functional test

Before mounting the WRM-4 in the layout it is recommended to perform a functional test, especially when you have assembled the detector 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 diagram.



### ⚠ Attention:

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

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

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

## 4.3. Connecting the turnouts

Connect the inputs of the turnout detector to the turnouts. Mind the correct assignment.



## 4.4. 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 kΩ	820 Ω	16 V =	1,5 kΩ	820 Ω
14V ~	1,8 kΩ	820 Ω	18 V =	1,5 kΩ	820 Ω
16 V ~	2,2 kΩ	1 kΩ	20 V =	1,8 kΩ	1 kΩ
18 V ~	2,2 kΩ	1,2 kΩ	22 V =	2,2 kΩ	1 kΩ

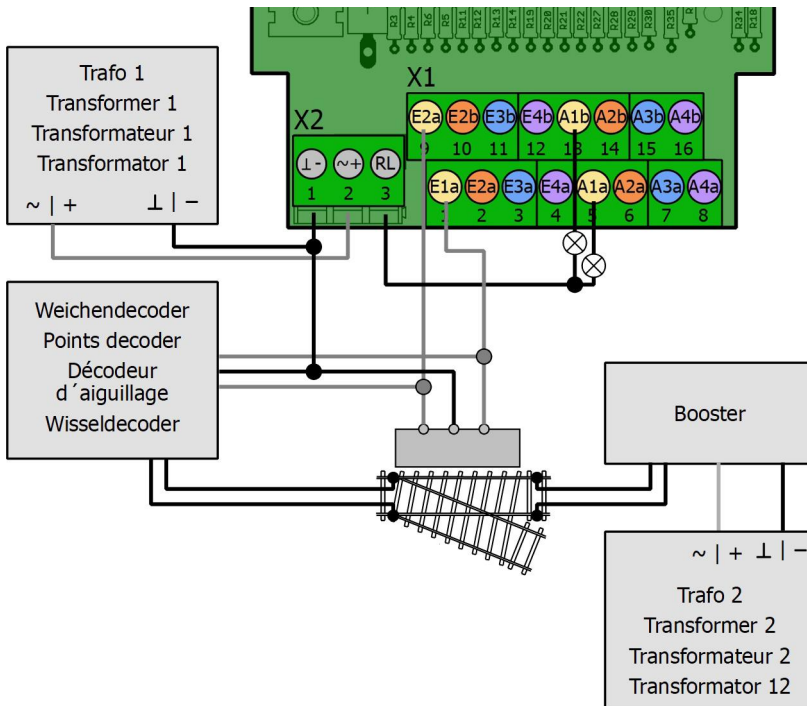
## 4.5. Connecting the power supply

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.

## 4.6. Embedding in a digitally controlled layout

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



### ⚠ Attention:

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

## 5. Connecting subordinate circuits

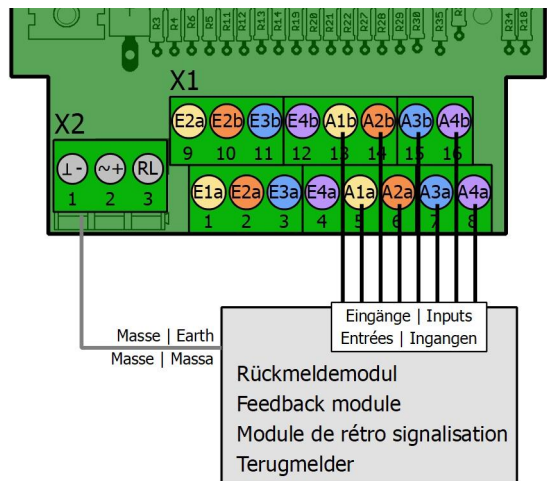
The WRM-4 evaluates the income signals against earth. Thus you can connect the outputs of the WRM-4 to:

- the inputs of 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 current at the outputs of subordinate modules;
- the inputs of digital feedback modules (e.g. s88 modules).

### 5.1. 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 detector. This enables you to supervise both positions.



### 5.2. 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.

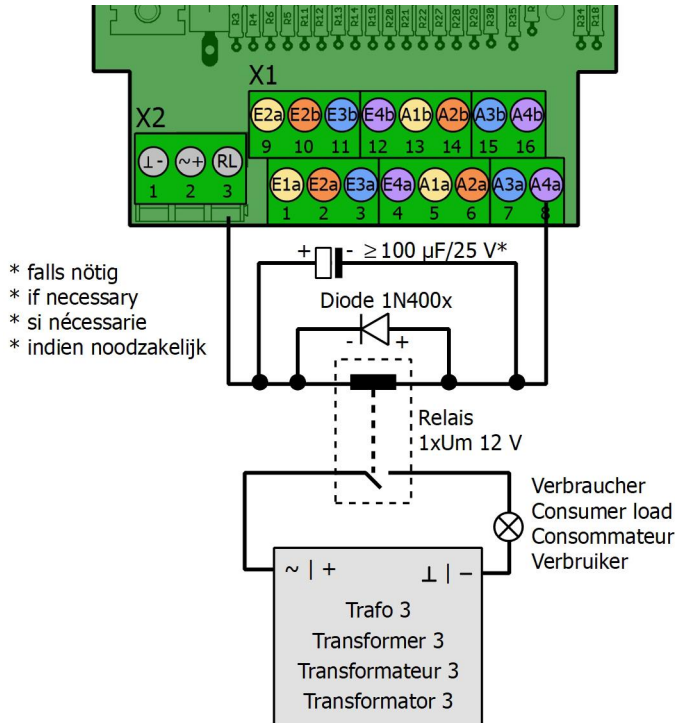
### 5.3. Connecting subordinate circuits via a relay

- 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.

When supplying the WRM-4 with a.c. voltage, the relay possibly does not switch properly ("rattles") in operation. In this case you should mount an electrolytic capacitor ( $\geq 100 \mu\text{F} / 25 \text{V}$ ) in parallel to the relay.



**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.

## 6. Checklist for troubleshooting and error correction



### **Warning:**

If you notice a strong heat development, immediately disconnect the connection to the supply voltage. **Fire hazard!**

Possible causes:

- One or more connections are faulty. → Check the connections.
- "Kit" version: one or more components are soldered incorrectly. → Carry out a visual inspection (→ section 3.5.) and eliminate the faults, if necessary.
- The turnout detector is defective. → Send the detector in for inspection.

### **The lamps or LEDs connected to the detector do not light.**

Possible causes:

- The voltage supply is interrupted. → Check the connection to the voltage supply.
- LEDs are connected incorrectly polarised → Check the connections.
- The lamps or LEDs are defective. → Check the lamps by connecting them directly to the voltage supply.
- The diode D17 is soldered in the wrong way around. → Alter the mounting direction.

### **Both lamps for one point light permanently.**

Possible cause:

- The turnouts have not switched properly and have stopped midway. → Check the position of the turnouts.

### **There is no change over from the one to the other lamp or LED after switching the turnout.**

Possible cause:

- The turnout is not properly connected to the turnout detector. → Check the three connections to the turnout.

### **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 ( $\geq 100 \mu\text{F} / 25 \text{V}$ ). Also note the information in section 5.3.

## 6.1. Technical Hotline

If you have any questions about the use of your turnout detector, our technical hotline will help you (telephone number and e-mail address on the last page).

## 6.2. Repairs

You can send us a defective turnout detector for repair (address on the last page). In the event of a warranty or guarantee claim, the repair is free of charge for you. As proof of any warranty or guarantee claim, please enclose the proof of purchase with your return.

If there is no warranty or guarantee claim, we are entitled to charge you the costs of the repair and the costs of the return shipment. We charge a maximum of 50% of the new price for the repair according to our valid price list. We reserve the right to refuse the repair if it is technically impossible or uneconomical.

If you want to clarify whether a repair is possible or economical before sending it in, please contact our Technical Hotline (telephone number and email address on the last page).

Please do not send us repair shipments freight collect. In the event of a warranty or guarantee claim, we will reimburse you for the regular shipping costs.

## 7. Technical data

### Inputs and outputs

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Number of inputs	4 x 2 For the connection of turnouts and signals with double coil drives without limit switching
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
Number of outputs	4 x 2 For the connection of <ul style="list-style-type: none"> <li>▪ LEDs or lamps to indicate the turnout position</li> <li>▪ subordinate circuits</li> <li>▪ the inputs of digital feedback modules</li> </ul>
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### Electrical characteristics

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Supply voltage (Operating voltage)	12 - 18 Volt a.c. voltage or 12 – 24 Volt d.c. voltage
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 The turnout detector should not be fed via the voltage supply for the digital system! Please use a separate transformer for the WRM-4 (or all turnout detectors in the layout) with digital layouts!

Current consumption (without connected devices)	approx. 15 mA
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Maximum current per output	250 mA
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### Protection

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Protection class	<p>Ready-made module (without housing): IP 00 Meaning: No protection against foreign bodies, contact and water.</p> <p>Ready device (in housing): IP 20 Meaning: Protected against solid foreign bodies with diameter <math>\geq 12.5</math> mm and access with a finger. No protection against water.</p>
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**Environment**

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For use in closed rooms

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Ambient temperature during operation	0 ~ + 30 °C
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Permissible relative humidity during operation	10 ~ 85% (non-condensing)
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Ambient temperature during storage	- 10 ~ + 40 °C
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Permissible relative humidity during storage	10 ~ 85% (non-condensing)
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**Other features**

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Dimensions (approx.)	Circuit board: 72 x 82 mm
	Ready device including housing: 100 x 90 x 35 mm

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Weight (approx.)	Assembled board (ready-made module): 60 g
	Ready device including housing: 108 g

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## 8. Warranty, EU conformity & WEEE

### 8.1. 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-made module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

## 8.2. EU Declaration of Conformity

 This product fulfils the requirements of the following EU directives and therefore bears the CE marking.

2001/95/EU Product Safety Directive

2015/863/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

2014/30/EU on electromagnetic compatibility (EMC Directive). Underlying standards:

DIN-EN 55014-1 and 55014-2: Electromagnetic compatibility - Requirements for household appliances, electric tools and similar electrical appliances. Part 1: Emitted interference, Part 2: Immunity to interference

To maintain electromagnetic compatibility during operation, observe the following measures:  
Only connect the supply transformer to a professionally installed and fused earthed socket.  
Do not make any changes to the original components and follow the instructions, connection and assembly diagrams in this manual exactly.  
Only use original spare parts for repair work.

## 8.3. Declarations on the WEEE Directive

This product is subject to the requirements of the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE), i.e. the manufacturer, distributor or seller of the product must contribute to the proper disposal and treatment of waste equipment in accordance with EU and national law. This obligation includes

- registration with the registering authorities ("registers") in the country where WEEE is distributed or sold
- the regular reporting of the amount of EEE sold
- the organisation or financing of collection, treatment, recycling and recovery of the products
- for distributors, the establishment of a take-back service where customers can return WEEE free of charge
- for producers, compliance with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive.



The "crossed-out wheeled bin" symbol means that you are legally obliged to recycle the marked equipment at the end of its life. The appliances must not be disposed of with (unsorted) household waste or packaging waste. Dispose of the appliances at special collection and return points, e.g. at recycling centres or at dealers who offer a corresponding take-back service.



Further Information and Tips:

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

Warranty and Service:

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