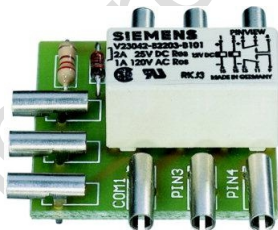


Manual

# RL-2

Item no. 72-00055 / 72-00056



Relay Circuit Board

## Table of contents

1. Getting started.....	3
2. Safety instructions.....	5
3. Safe and correct soldering.....	7
4. Operation overview.....	9
5. Technical specifications.....	9
6. Assembling the kit.....	10
7. Performing a functional test.....	13
8. Connecting the relay circuit board.....	14
9. Check list for troubleshooting.....	16
10. Guarantee bond.....	17
11. EU declaration of conformity.....	18
12. Declarations conforming to the WEEE directive.....	18

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Subject to technical modification.

## 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 relay circuit board RL-2 is designed to be operated according to the instructions in this manual in model building, especially with model railways. Any other use is inappropriate and invalidates any guarantees.

The RL-2 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.

### **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
- a CD (containing the manual and further information)

## 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).

For testing the module you need an electric light bulb.

In order to connect the module you need wire. Recommended diameters:  $\geq 0,25 \text{ mm}^2$  for all connections (e.g. item no. 73-1031x, x=0..9).

For the connection to the switching inputs you need:

- two push buttons, e.g. item no. 84-5212x, x=1..5 (or circuits to release a switching pulse).

## 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 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 module switches a bistable relay with two switches which are separate from each other. It is triggered by 12 to 18 Volt direct (d.c.) or alternating (a.c.) voltage. The relay is switched by an earth contact and can be switched by any earth compatible output (e.g. by a points decoder). This enables the module to switch two connected electric loads in joint action. It is possible to connect e.g. a light signal and the block section that it controls.

## 5. Technical specifications

Supply voltage	12 - 18 Volt a.c. or d.c. voltage
Number of switches Maximum current per switch	2 1 A
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. 26 x 28 mm
Weight of the assembled	approx. 7.5 g

## 6. Assembling the kit

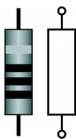
You can skip this part if you have purchased a ready-built module.

### 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 in assembling:

### Resistors



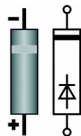
Resistors reduce current.

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

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

220  $\Omega$  red - red - brown (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 package.

### Relays

Relays are electronic switches, depending on their position the one or other (internal) connection is closed. The mode of operation of monostable relays can be compared to that of a push-button switch, i.e. the connection is only closed as long as the voltage is applied.

Bistable relays keep their status after switching – comparable to a switch.

Relays which combine two switches in one housing are common as well (shortly 2xUM). The switching between the two connections can be heard clearly because of the resulting clicking sound.

### PCB sockets

The widely spread 2,6 mm model railway connectors fit exactly to the sockets. These are used for the connection to the voltage supply and to connected modules or components.

### Parts list

Resistor	R1	220 $\Omega$
Diode	D1	1N4148 (or similar)
Relay	Bistable relay 2xUm	
PCB-sockets	VCC, S1, S2, COM1, COM2, PIN1, PIN2, PIN3, PIN4	

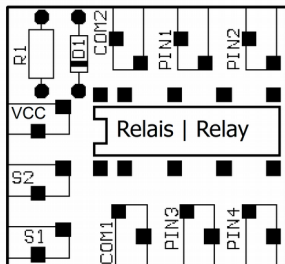


Fig. 1:  
PCB layout

## 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.



### 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.	PCB sockets	
2.	Resistors	Mounting orientation of no importance.
3.	Diodes	Observe the polarity! The negative end of the diodes is marked with a ring. This is shown in the PCB layout.
4.	Relays	The mounting orientation is given by the layout of the pins.

### 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. Performing a functional test

You can perform a functional test with an electric light bulb before mounting the relay circuit board. First connect the relay circuit board and the light bulb as follows:

Relay circuit board VCC   COM1   COM2	Connection to transformer $\perp / -$
Lampe Anschluss 2	Connection to transformer $\sim / +$

Then perform the following tests:

Relay circuit board S1	Temporary connection to transformer $\sim / +$ → Relay switches when indicated
Lamp connection 1	to PIN3 → lamp does not light to PIN4 → lamp lights
Lamp connection 1	to PIN1 → lamp does not light to PIN2 → lamp lights

Relay circuit board S2	Temporary connection to transformer $\sim / +$ → Relay switches when indicated
Lamp connection 1	to PIN3 → lamp lights to PIN4 → lamp does not light
Lamp connection 1	to PIN1 → lamp lights to PIN2 → lamp does not light



**Caution:** If a component gets too hot, disconnect the module and power supply from the mains **immediately**. Possible short circuit! Check the assembly.

After a successful test, disconnect the power supply and the lamp from the module. Mount the module as desired in your model railroad.

## 8. Connecting the relay circuit board

### Connecting the power supply

If you use a d.c. transformer for the power supply of the relay circuit board, you have to regard the polarity when connecting it, if using an a.c. transformer the polarity is of no importance. If you supply several components by one a.c. transformer you have to be careful to connect all devices with the same polarity.

VCC	Connection to transformer $\sim / +$
Relay circuit board switching inputs S1   S2	Connection to transformer $\perp / -$ via push-buttons switching to earth

### Connection of the downstream accessories

Relay circuit board output PIN1	Accessory 1 connection 1 (connected to input 2, when S2 is switched)
Relay circuit board output PIN2	Accessory 2 connection 1 (connected to input 2, when S1 is switched)
Relay circuit board output PIN3	Accessory 3 connection 1 (connected to input 1, when S2 is switched)
Relay circuit board output PIN4	Accessory 4 connection 1 (connected to input 1, when S1 is switched)
Accessories 1 – 4 connection 2	Connection to transformer $\sim / +$
Relay circuit board inputs COM1   COM2	Connection to transformer $\perp / -$

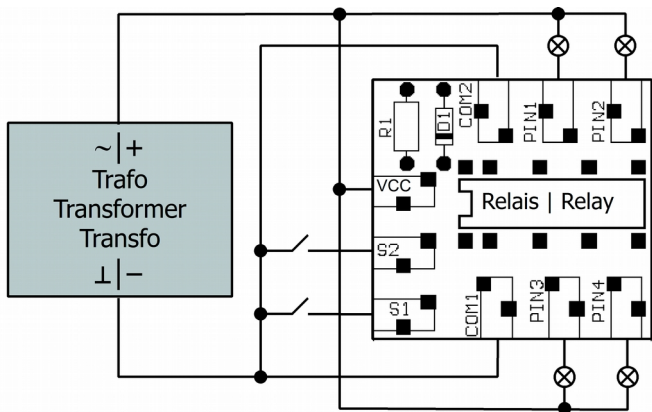


Fig. 2: Connections

It shows as an example, the connection of the relay circuit board to a double purpose light signal.

## 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 relay does not switch.

Possible cause: The diode D1 is soldered the wrong way. → Swap the mounting direction.

Possible cause: The power supply is not connected properly.  
→ Check the connections.

**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-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying 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.

2011/65/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS). Underlying standard: EN 50581.

## 12. Declarations conforming to the WEEE directive



This product conforms with the EC-directive 2012/19/EG on waste electrical and electronic equipment (WEEE).

Don't dispose of this product in the house refuse, bring it to the next recycling bay.

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