





















connection at the module's input is shorter than the preset delay time, the connected device stays off.

Devices with a current up to 100 mA intended to be switched on after a certain delay time can be connected directly to the minitimer's output. Devices with a higher current or devices supposed to be switched off can be controlled via a relay.

### **Minitimer MT-3 "Pulse delay"**

The minitimer MT-3 transfers voltage changes with a time delay between 0 and 60 seconds to a connected device on a model railway. The desired time delay is set via a trimming potentiometer.

Examples of use: Delayed triggering of solenoid operated devices (signals, points, bistable relay), delayed power cut-off in a rail section after crossing a reed contact in order to release the contact.

The circuit is controlled by an IC saving the voltage changes' sequence at the module's input and transferring them with the preset time delay between 0 and 60 seconds to the output. The time period between two voltage changes at the module's input can be as long as you like. The IC can save up to seven voltage changes within the preset delay time. With more than seven voltage changes within the preset delay time the first saved voltage change will be overwritten.

Devices with a current up to 1.000 mA can be connected directly to the minitimer's output. Devices with a higher current or devices intended to be switched invertedly can be controlled via a relay.

|   |  |
|---|--|
| <p>on</p> <p>off</p> <p>time</p> <p>Voltage at the output</p> <p>time</p> <p>on-time</p> <p>on-time</p>   | <p><b>Minitimer MT-1</b></p> <p>A = bridging the switching inputs</p> <p>B = voltage at the output</p> <p>U = voltage</p> <p>t = time</p> <p><math>\Delta t</math> = on-time</p> |
| <p>on</p> <p>off</p> <p>time</p> <p>Voltage at the output</p> <p>time</p> <p>switch-on delay</p> <p>1 sec.</p>                                    | <p><b>Minitimer MT-2</b></p> <p>A = voltage at the input</p> <p>B = voltage at the output</p> <p>U = voltage</p> <p>t = time</p> <p><math>\Delta t</math> = switch-on delay</p>  |
| <p>on</p> <p>off</p> <p>time</p> <p>Voltage at the output</p> <p>time</p> <p>delay time</p> <p>delay time</p> <p>delay time</p> <p>delay time</p> | <p><b>Minitimer MT-3</b></p> <p>A = voltage at the input</p> <p>B = voltage at the output</p> <p>U = voltage</p> <p>t = time</p> <p><math>\Delta t</math> = delay time</p>       |

## 5. Technical specifications

|   |   |                    |                      |
|---|---|--------------------|----------------------|
| Supply voltage  | 12-18 Volt a.c. or d.c. voltage                           |                    |                      |
| Current consumption (without connected devices) approx.           | 5 mA  |                    |                      |
| Max. current at the output  | MT-1: 100 mA<br>MT-2: 100 mA<br>MT-3: 1.000 mA            |                    |                      |
| Max. switching time ( $\pm 20\%$ )                                | MT-1: 100 seconds<br>MT-2: 25 seconds<br>MT-3: 60 seconds |                    |                      |
| Protected to  | IP 00   |                    |                      |
| Ambient temperature in use  | 0 ... +60 °C  |                    |                      |
| Ambient temperature in storage                                    | -10 ... +80 °C  |                    |                      |
| Comparative humidity allowed                                      | max. 85 %   |                    |                      |
| Dimensions<br>of the PCB (approx.)<br>including housing (approx.) | 48 x 52 mm<br>70 x 60 x 25 mm                             |                    |                      |
| Weight (approx.)  |   | assembled<br>board | including<br>housing |
|   | MT-1  | 17 g               | 34 g                 |
|   | MT-2  | 16 g               | 33 g                 |
|   | MT-3  | 19 g               | 36 g                 |

## 6. Assembling the kit

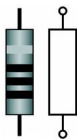
You can skip this part if you have purchased a ready-built module or device.

### 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.

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:

1 k $\Omega$

3,3 k $\Omega$

4,7 k $\Omega$

5,6 k $\Omega$

10 k $\Omega$

47 k $\Omega$

330 k $\Omega$

Colour rings:

brown - black - red (gold)

orange - orange - red (gold)

yellow - violet - red (gold)

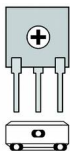
green - blue - red (gold)

brown - black - orange (gold)

yellow - violet - orange (gold)

orange - orange - yellow (gold)

## Trimm-potentiometers



Trimm-potentiometers (abrv. "trimm-pots") are resistors which allow the value of resistance to be varied and that way to be adapted to the particular demands. In the middle they have a small slot into which a small screwdriver can be put in order to vary the value of resistance. The maximum value is printed on the housing.

Depending on the mounting situation trimmpots with a lying or a standing package are used.

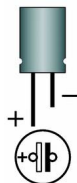
## Ceramic capacitors



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. The number 104 corresponds to the value 100 nF.

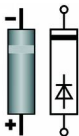
## Electrolytic capacitors



Electrolytic capacitors are often used to store energy. In contrast to ceramic capacitors they are polarized. The value is given on the package.

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 and Zener diodes

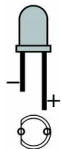


Diodes allow the current to pass through in one direction only (forward direction), simultaneously the voltage is reduced by 0,3 to 0,8 V. Exceeding of the limit voltage always will destroy the diode, and allow current to flow in the reverse direction.

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

The diode type is printed on the package.

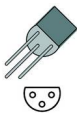
## Light emitting diodes (LEDs)



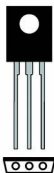
When operated in the forward direction the LEDs light. They are available in several different versions (differing in colour, size, form, luminosity, maximum current, voltage limits).

Light emitting diodes should always be connected via a series resistor which limits the current and prevents failure.

## 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.



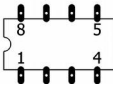
Transistors for a low power rating (e.g. BC types) have a package in form of a half cylinder (SOT-package). Transistors for a high power rating (e.g. BD types) have a flat package (TO-package), which is in use in different versions and sizes.

The three pins of bipolar transistors (e.g. BC and BD 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 "DIP"-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.

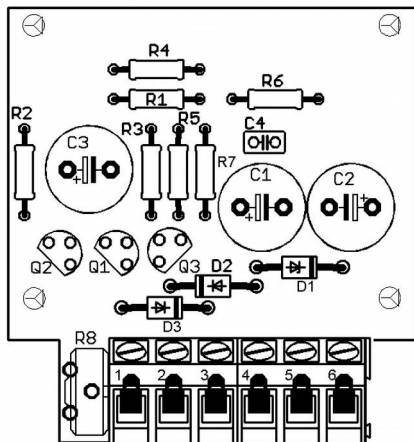
## Microcontrollers

Microcontrollers are ICs, which are individually programmed for the particular application. The programmed controllers are only available from the manufacturer of the circuit belonging to it.

## Terminal strips

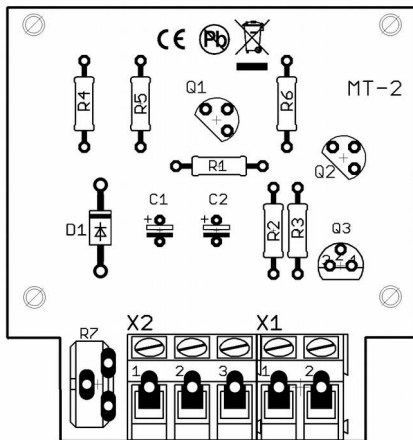
Terminal strips are solder-in screw-type terminals. They provide a solder-free and safe connection of the cables to the circuit, which can still be separated any time.



**MT-1: PCB layout and parts list**

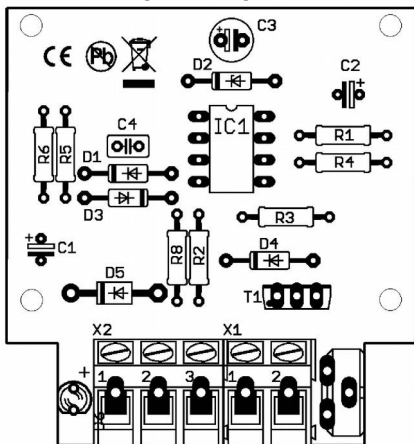
|                         |                |                    |
|-------------------------|----------------|--------------------|
| Resistors               | R1, R2, R3, R4 | 3,3 k $\Omega$     |
|                         | R5, R6, R7     | 1 k $\Omega$       |
| Trim pots               | R8             | 500 k $\Omega$     |
| Capacitors              | C4             | 100 nF             |
| Electrolytic capacitors | C1, C2, C3     | 220 $\mu$ F / 25 V |
| Diodes                  | D2, D3         | 1N400x, x=2...7    |
| Zener diodes            | D1             | 5V1                |
| Transistors             | Q1, Q2, Q3     | BC547B             |
| Terminal strips         | X1 ... X6      |                    |

## MT-2: PCB layout and parts list



|                         |            |                  |
|-------------------------|------------|------------------|
| Resistors               | R1         | 10 k $\Omega$    |
|                         | R2         | 5,6 k $\Omega$   |
|                         | R3         | 1 k $\Omega$     |
|                         | R4, R5, R6 | 47 k $\Omega$    |
| Trim pots               | R7         | 500 k $\Omega$   |
| Diodes                  | D1         | 1N400x, x=2...7  |
| Electrolytic capacitors | C1         | 100 $\mu$ F/25 V |
|                         | C2         | 470 $\mu$ F/16 V |
| Transistors             | Q1, Q2     | BC547B           |
|                         | Q3         | BC557            |
| Terminal strips         | X1, X2     |                  |

### MT-3: PCB layout and parts list



|                               |                    |                 |
|-------------------------------|--------------------|-----------------|
| Resistors                     | R1, R2, R4, R6, R8 | 1 kΩ            |
|                               | R3                 | 4,7 kΩ          |
|                               | R5                 | 330 kΩ          |
| Trim pots                     | R7                 | 500 kΩ          |
| Diodes                        | D1, D3, D4         | 1N4148          |
|                               | D5                 | 1N400x, x=2...7 |
| Zener diodes                  | D2                 | ZD 5V1          |
| LEDs                          | D6                 |                 |
| Capacitors                    | C4                 | 100 nF          |
| Electrolytic capacitors       | C1, C2, C3         | 220 µF/25 V     |
| Transistors                   | T1                 | BD679           |
| Micro-Controller / IC sockets | IC1                | PIC 12F508A     |
| Terminal strips               | X1, X2             |                 |

## 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. | Resistors              | Mounting orientation of no importance.  |
| 2. | Diodes, Zener diodes   | Observe the polarity!<br>The negative end of the diodes is marked with a ring. This is shown in the PCB layout.   |
| 3. | Ceramic Capacitors     | (MT-1 and MT-3 only)<br>Mounting orientation of no importance.  |
| 4. | Transistors            | Observe the polarity!<br>The cross section of transistors for a low power rating in SOT-packages is shown in the PCB layout.<br>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. |
| 5. | IC sockets (MT-3 only) | Mount the sockets that way, the markings on the sockets show in the same direction as the markings on the PCB board.  |

|     |  |   |
|-----|--|---|
| 6.  | Electrolytic capacitors                  | Observe the polarity! One of the two leads (the shorter one) is marked with a minus sign.   |
| 7.  | Terminal strips                          | Put together the terminal strips before mounting them.  |
| 8.  | Trimm-potentiometers                     | The mounting orientation is preset by the layout of the three pins.   |
| 9.  | Light emitting diodes (LEDs) (MT-3 only) | Observe the polarity!<br>With wired LEDs the longer lead is always the anode (positive pole).   |
| 10. | ICs in DIL-housing                       | Insert the ICs into the soldered socket.<br>Do not touch the ICs without first discharging yourself by touching a radiator or other grounded metal parts.<br>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. |

### 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

With all minitimers it is recommended to check function and switching times before mounting them. Proceed according to the sections 8. (MT-1), 9. (MT-2) or 10. (MT-3), but connect a lamp to the outputs for the devices for the test.

Set the trimm pot as follows:

MT-1: left stop (= shortest possible switching time)

MT-2: middle position (= middle time delay)

MT-3: right stop (= shortest possible delay time)

Connect the minitimer to the power supply and trigger a switching operation.



### Caution:

If a component gets too hot, disconnect the mini-timer and power supply from the mains **immediately**. Possible short circuit! Check the assembly!

## 8. Connecting the MT-1

Follow the connections diagrams fig. MT-1.1 and MT-1.2 and connect the minitimer MT-1 as follows:

|          |  |    |  |
|----------|--|----|--|
| X1       | device<br>(polarized device "-")         | X2 | device<br>(polarized device "+")         |
| X3       | transformer<br>(with direct voltage "+") | X4 | transformer<br>(with direct voltage "⊥") |
| X5<br>X6 | switching input                          |    |  |

In order to trigger the minitimer MT-1 the switching input (connections X5 and X6) has to be shunted, e.g. with a key switch. Then, the connected device will be switched on for a time between 1 and 100 seconds and be switched off after this time.



### Caution:

The power consumption of the connected device may not exceed 100 mA, otherwise the module will be destroyed. Devices with a higher power consumption can be switched via a relay.

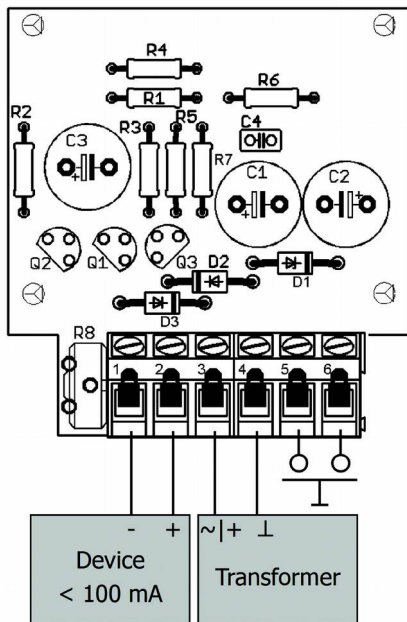
### Setting the switching time

Set the desired switching time at the trimm pot R8. It is between 1 and 100 seconds ( $\pm 20\%$ ), depending on the settings. With some mounting situations it makes sense to set the switching time while performing a functional test with a lamp.

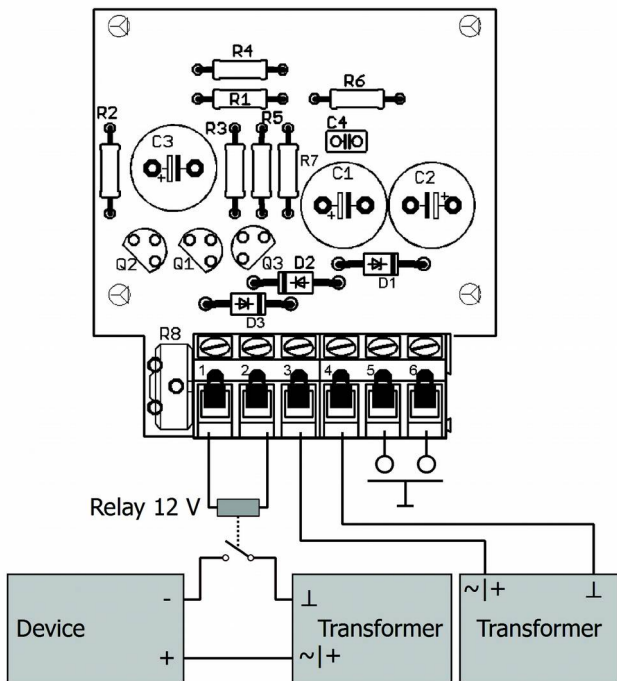
### Connecting a relay

In order to switch a device with more than 100 mA power consumption or to switch off a device you have to connect the device via a relay (12 V). In order to switch over between two devices you will need a relay (12 V).

**Fig. MT-1.1:**  
**MT-1: Connections**





**Fig. MT-1.2:****MT-1: Connection of a device via a relay**

## 9. Connecting the MT-2

Follow the connections diagrams fig. MT-2.1 and MT-2.2 and connect the minitimer MT-2 as follows:

|      |  |      |  |
|------|--|------|--|
| X1-1 | device<br>(polarized device "+")         | X1-2 | device<br>(polarized device "-")                 |
| X2-1 | switching input                          |      |  |
| X2-2 | transformer<br>(with direct voltage "+") | X2-3 | transformer / earth<br>(with direct voltage "⊥") |

In order to trigger the minitimer MT-2 you have to connect the switching input (connection X2-1) to earth (connection X2-3), e.g. with a switch. After the set delay time the connected device will be switched on. Approx. 1 second after interrupting the earth connection between X2-1 and X2-3, the device will be switched off.

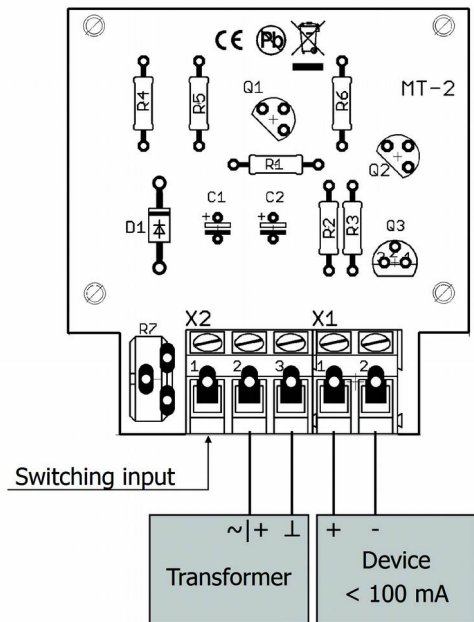
### Setting the time delay

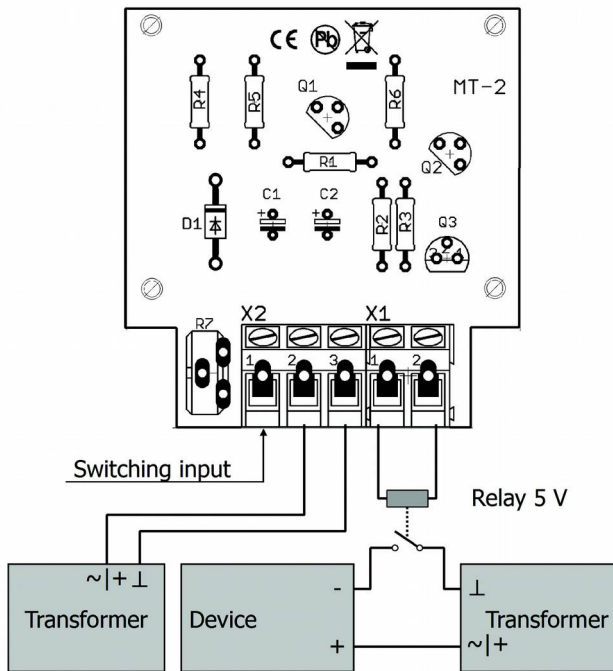
Set the desired delay time at the trimm pot R7. Please note: In case the time passing between making and interrupting the earth connection between X2-1 and X2-3 is shorter than the preset delay time, the connected device stays off.

### Connecting a relay

In order to switch a device with more than 100 mA power consumption or to switch off a device you have to connect the device via a relay (5 V) and an protective diode (e.g. 1N4148) as anti-surge diode. When operating the module without an anti-surge diode it will be destroyed after several switchings.

**Fig. MT-2.1:**  
**MT-2: Connections**



**Fig. MT-2.2:****MT-2: Connection of a device via a relay**

## 10. Connecting the MT-3

Follow the connections diagrams fig. MT-3.1 and MT-3.2 and connect the minitimer MT-3 as follows:

|   |  |      |  |
|---|--|------|--|
| X1-1  | device<br>(polarized device "+")                 | X1-2 | device<br>(polarized device "-")         |
| Remark: You can connect solenoid articles directly to the output. |  |      |  |
| X2-1  | transformer / earth<br>(with direct voltage "⊥") | X2-2 | transformer<br>(with direct voltage "+") |
| X2-3  | switching input                                  |      |  |

After applying the voltage, the LED on the module will not be switched on before the set delay time has passed, in order to check the set time delay. After the set time has elapsed, the minitimer is operational, indicated by the LED permanently lighting.

As a rule, the minitimer MT-3 is switched in series with other electronic circuits generating voltage changes at it's input (changes between open and closed ground connection between the switching input X2-3 and the ground connection X2-1). The connected device will be switched on and off to the rhythm of the voltage changes, however with the set time delay.

### Setting the time delay

Set the desired delay time at the trimm pot R7. Turning to the left will increase the delay time.

Please note: When altering the time delay during operation without disconnecting the module from the power supply, first all saved voltage changes will be "worked off" before the new set time delay takes effect.

### Connecting a relay

In order to switch a device with more than 1.000 mA power consumption or to invert the signals you have to connect the device via a relay (12 V).

**Fig. MT-3.1:**  
**MT-3: Connections**

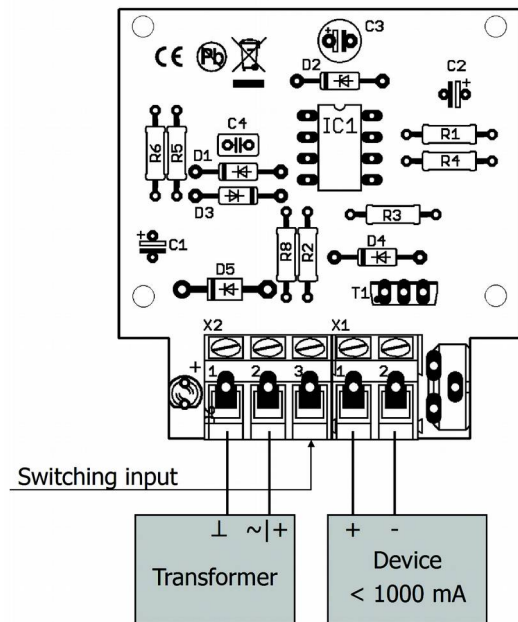
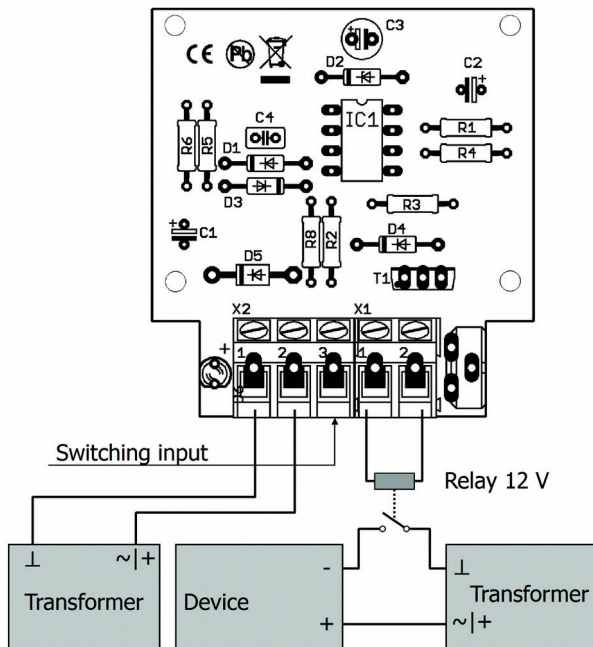


Fig. MT-3.2:

## MT-3: Connection of a device via a relay



## 11. 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 lamp connected for the functional test of the module does not light.

Possible cause: one or more components are soldered incorrectly. (MT-1: e.g. D2, MT-2: e.g. D1). → Alter the mounting direction.

Possible cause: The lamp is defective. → Check the lamp by connecting it directly to the voltage supply.

- MT-2 only: The module does not switch.

Possible cause: The length of time the input is connected to ground is shorter than the selected time delay. → Reduce the time delay or lengthen the time the input is connected to ground.



**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.

## 12. 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.

### 13. 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.

### 14. Declarations concerning the WEEE directive



This product complies with the requirements of the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE).

Do not dispose of this product in (unsorted) municipal waste, but recycle it.

Information and tips:

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

Warranty and service:

Tams Elektronik GmbH

Fuhrberger Straße 4

DE-30625 Hannover

fon: +49 (0)511 / 55 60 60

fax: +49 (0)511 / 55 61 61

e-mail: [modellbahn@tams-online.de](mailto:modellbahn@tams-online.de)

