

Manual



## Minitimer MT-1

"Time Switch"

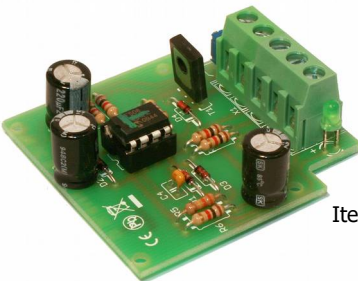
Item 51-01015 | 51-01016 | 51-01017



## Minitimer MT-2

"Delayed switching"

Item 51-01025 | 51-01026 | 51-01027



## Minitimer MT-3

"Pulse delay"

Item 51-01035 | 51-01036 | 51-01037

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#### **Printing the manual**

The formatting is optimised for double-sided printing. The standard page size is DIN A6. If you prefer a larger display, printing on DIN A5 is recommended.

## 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 minitimers MT-1, MT-2 and MT-3 are 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 minitimers MT-1, MT-2 and MT-3 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 minitimer MT-3 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:
  - MT-1 → page 17
  - MT-2 → page 18
  - MT-3 → page 19
- or one ready-built module
- or one ready-built module in a housing (complete unit).

## Required materials

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)

For testing the module you need an electric light bulb.

In order to connect the module you need wire. Recommended diameters:  $\geq 0,14 \text{ mm}^2$  for all connections.

In order to activate the circuit you need :

MT-1	push-button	e.g. push-button item no. 85-5212x, x=1,2,3,6,7
MT-2	switch	e.g. toggle switch 1xUm item no. 84-51510
MT-3	push-button	e.g. push-button item no. 85-5212x, x=1,2,3,6,7

In order to connect the devices you possibly need a relay (see sections 8, 9 and 10):

MT-1	relay 12 V	e.g. relay 1xUm 12 V, item no. 84-61010
MT-2	relay 5 V	e.g. relay 2xUm 5 V, item no. 84-61020 and protective diode 1N4148, item no.83-11100
MT-3	relay 12 V	e.g. relay 1xUm 12 V, Art.-Nr. 84-61010

## 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 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.



## 4. Operation overview

### **Minitimer MT-1 "Time Switch"**

The minitimer MT-1 is designed for controlling operations in model railways which are supposed to last for 1 to 100 seconds. The desired switching time is set via a trimming potentiometer.

Examples of use: Automatic opening of the gate at a level crossing after a certain time, automatic stop of trains at the platform for a certain time.

The circuit is triggered by a positive switching pulse at the module's input, for instance via a key switch or a reed contact. Then the output is grounded for the preset time.

Devices with a current up to 100 mA intended to be switched on can be connected directly to the minitimer's output. Devices with a higher current or devices intended to be switched off, can be controlled via a relay. It is also possible to switch over between two devices by connecting a relay.

### **Minitimer MT-2 "Delayed switching"**

The minitimer MT-2 switches on or off operations in model railways with a time delay between 0 and 25 seconds. The desired time delay is set via a trimming potentiometer.

Examples of use: Delay of a locomotive's start after changing the signal to "go" (= the engine driver's reaction time).

The circuit is triggered by grounding the module's input, e.g. via a switch. The module's output is grounded after the preset delay time has elapsed, the connected device consequently is not switched on until the delay time is over.

If the earth connection at the module's input is interrupted, the connected device is switched off with a time delay of approx. 1 second. If the time passing between making and interrupting the earth

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 MT-2: 100 mA MT-3: 1.000 mA		
Max. switching time ( $\pm 20\%$ )	MT-1: 100 seconds MT-2: 25 seconds 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 of the PCB (approx.) including housing (approx.)	48 x 52 mm 70 x 60 x 25 mm		
Weight (approx.)		assembled board	including housing
	MT-1	17 g	34 g
	MT-2	16 g	33 g
	MT-3	19 g	36 g

## 6. Assembling the kit

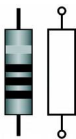
You can skip this part if you have purchased a ready-built module or device.

### 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



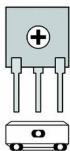
Resistors reduce current.

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:	Colour rings:
1 k $\Omega$	brown - black - red (gold)
3,3 k $\Omega$	orange - orange - red (gold)
4,7 k $\Omega$	yellow - violet - red (gold)
5,6 k $\Omega$	green - blue - red (gold)
10 k $\Omega$	brown - black - orange (gold)
47 k $\Omega$	yellow - violet - orange (gold)
330 k $\Omega$	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.

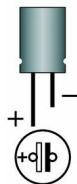
## Ceramic capacitors



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.

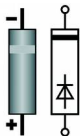
## Electrolytic capacitors



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

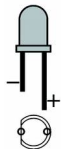


Diodes allow the current to pass through in one direction only (forward direction), simultaneously the voltage is reduced by 0,3 to 0,8 V. Exceeding of the limit voltage always will destroy the diode, and allow current to flow in the reverse direction.

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.

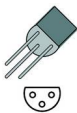
## Light emitting diodes (LEDs)



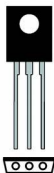
When operated in the forward direction the LEDs light. They are available in several different versions (differing in colour, size, form, luminosity, maximum current, voltage limits).

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.



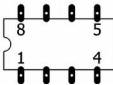
Transistors for a low power rating (e.g. BC types) have a package in form of a half cylinder (SOT-package). Transistors for a high power rating (e.g. BD types) have a flat package (TO-package), which is in use in different versions and sizes.

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.

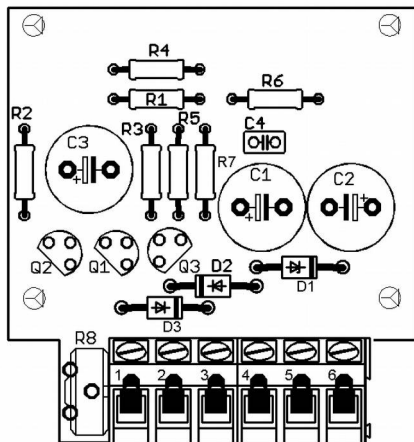
## Microcontrollers

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

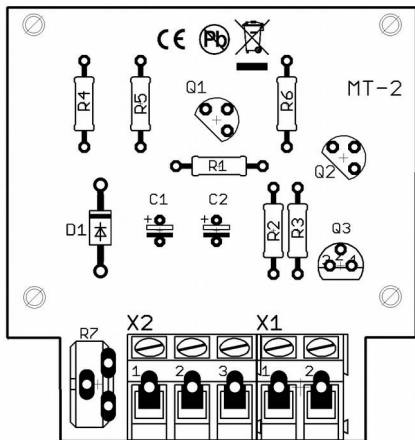
Terminal strips are solder-in screw-type terminals. They provide a solder-free and safe connection of the cables to the circuit, which can still be separated any time.



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

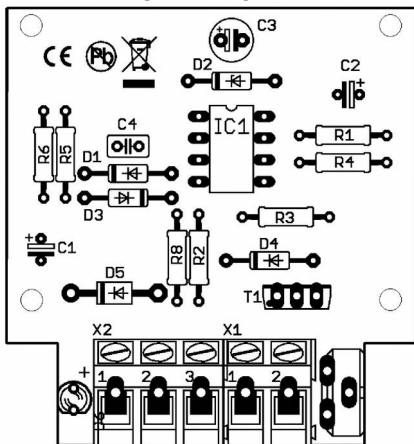
Resistors	R1, R2, R3, R4	3,3 k $\Omega$
	R5, R6, R7	1 k $\Omega$
Trim pots	R8	500 k $\Omega$
Capacitors	C4	100 nF
Electrolytic capacitors	C1, C2, C3	220 $\mu$ F / 25 V
Diodes	D2, D3	1N400x, x=2...7
Zener diodes	D1	5V1
Transistors	Q1, Q2, Q3	BC547B
Terminal strips	X1 ... X6	

## 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! 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) Mounting orientation of no importance.
4.	Transistors	Observe the polarity! The cross section of transistors for a low power rating in SOT-packages is shown in the PCB layout. 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! With wired LEDs the longer lead is always the anode (positive pole).
10.	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.

### 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 (polarized device "-")	X2	device (polarized device "+")
X3	transformer (with direct voltage "+")	X4	transformer (with direct voltage "⊥")
X5 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.

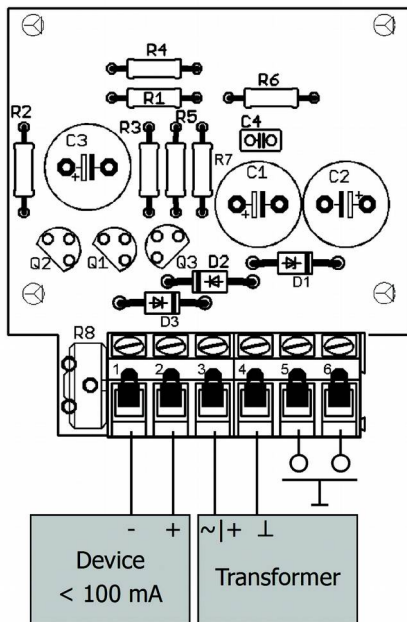
### Setting the switching time

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.

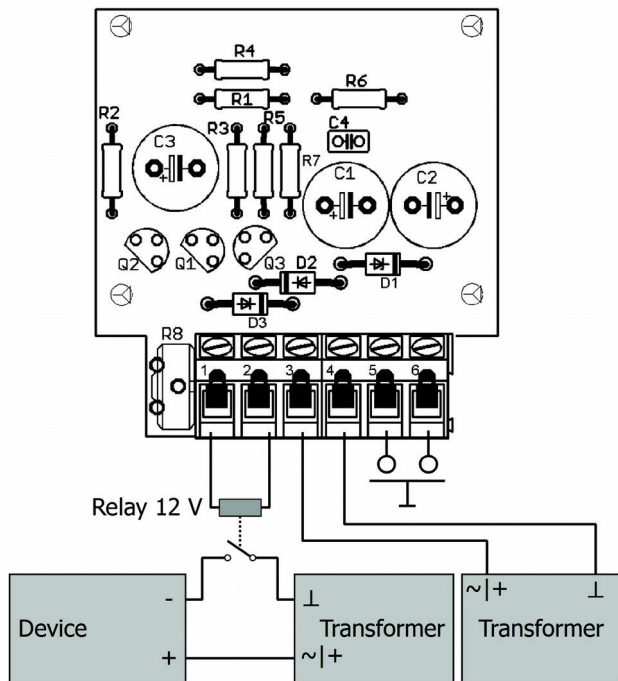
### Connecting a relay

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 (polarized device "+")	X1-2	device (polarized device "-")
X2-1	switching input		
X2-2	transformer (with direct voltage "+")	X2-3	transformer / earth (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.

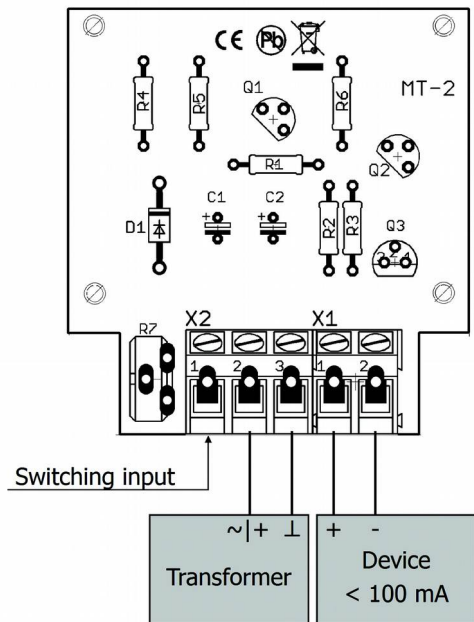
### Setting the time delay

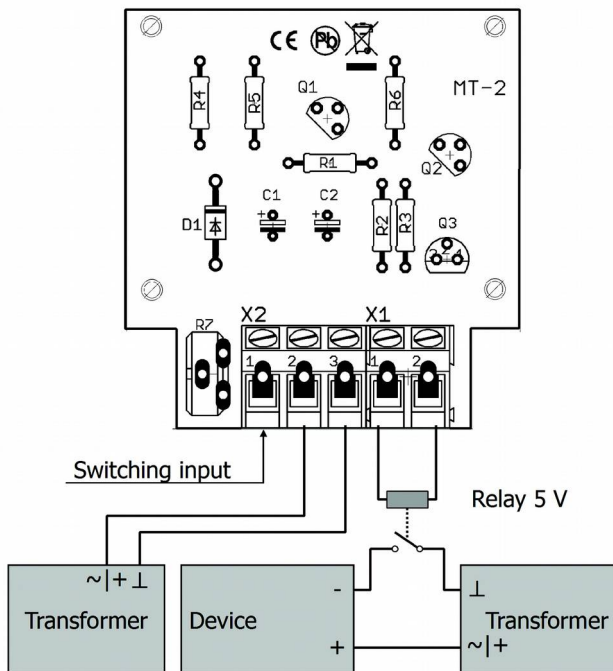
Set the desired delay time at the trimm pot R7. Please note: In case the time passing between making and interrupting the earth connection between X2-1 and X2-3 is shorter than the preset delay time, the connected device stays off.

### 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 (polarized device "+")	X1-2	device (polarized device "-")
Remark: You can connect solenoid articles directly to the output.			
X2-1	transformer / earth (with direct voltage "⊥")	X2-2	transformer (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**

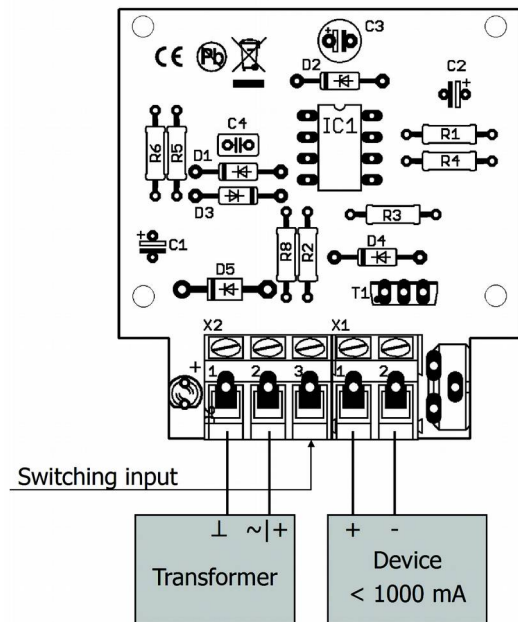
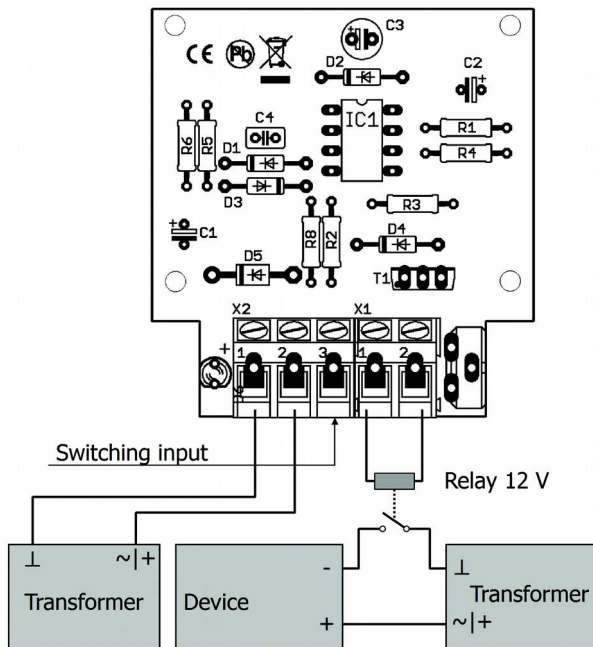



Fig. MT-3.2:

## 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)

