Manual

Multi-Timer

Item no. 51-01055 | 51-01056 | 51-01057

Time switch
for analogue and digital
model railway layouts

tams elektronik

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Version 2.1 08/2021

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 Multi-Timer 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 Multi-Timer 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 Multi-Timer 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 (→ page 24) and one PCB or
- one ready-built module or
- one ready-built module in a housing (complete unit)
- 4 short circuit connectors (jumper) to set the operation mode

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)

In order to connect the module you need

- wire. Recommended diameters:
  ≥ 0,10 mm² for buttons and switches (e.g. item no. 73-1021x, x=0..9)
  ≥ 0,25 mm² for all other connections (e.g. item no. 73-1031x, x=0..9)

For testing the module you need

- an electric light bulb with a separate power supply a
- a switch

For the connection to the switching inputs you need:

- for use as a time switch or a pulse delay (operation mode 1 or 2):
  four push buttons, e.g. item no. 84-5212x, x=1..5 (or circuits to release a switching pulse);
- for use as a random switch (operation mode 3):
  four switches, e.g. item no. 84-51510 (or comparable circuits);
- for use as a start-brake-stopover switch (operation mode 4):
  one switch, e.g. item no. 84-51510 (or a circuit to switch over the signal);
  one reed kontact (e.g. item no. 84-53110) or Hall sensor (e.g. item no. 84-53210) in combination with a magnet (e.g. item no. 84-53990)
  or a photoelectric barrier or similar for initiating of braking;
  one push-button (e.g. item no. 84-5212x, x=1..5) or switch (e.g. item no. 84-51510) to extend the duration of stay manyually.

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 coffe 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 coffe 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

Four outputs

The Multi-Timer has 4 outputs to control downstream circuits. In order to release the switching operations, the contacts of the 4 related switching inputs have to be closed. The switching duration can be set via trim-pots individually for the different switching operations.

Four modes of operation

When used in analogue or digital layouts:

1. time switch
2. pulse delay
3. random switch

When used in analogue layouts:

4. start-brake-stopover switch

Setting the mode of operation

The mode of operation has to be set by means of jumpers. The operation modes 1 and 2 are set to the 4 outputs of the Multi-Timer individually. Thus using one Multi-Timer as a combined time switch and pulse delay is possible. When using one Multi-Timer as a ramdom switch or a start-brake-stopover switch, the setting is effective for the whole module.

Operating principle "switch"

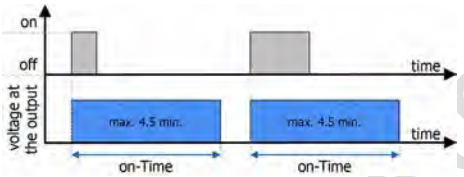
The Multi-Timer works like a switch and does not provide current for the operation of downstream circuits at it´s outputs. Therefore the downstream circuits have to be provided externally with current. It is possible to use d.c. as well as a.c. voltage for the power supply.

4.1. Operation mode 1 "Time Switch"

→ Use in analogue or digital layouts

The activating time has to be set individually at a trim-pot for each output. The maximum activating time is 4,5 minutes.

After the closure of the contacts of a switching input the related output is switched on for the set time. In order to release a switching pulse push-buttons or comparable external circuits can be used.



In this operation mode the Multi-Timer can be set either to allow it to be retriggered or not.

To be retriggered: When the contacts of the switching input are closed again (e.g. by activating the push-button again), before the set time has run out, the time starts to run from scratch again. Example: When at a set time of 60 seconds the contacts of the switching input are closed again after 30 seconds, the overall activating time is 90 seconds.

Not to be retriggered: When the contacts of the switching input are closed again, before the set time has run out, this has no effects. A new switching operation cannot be released befort the set activating time has run out.

Application

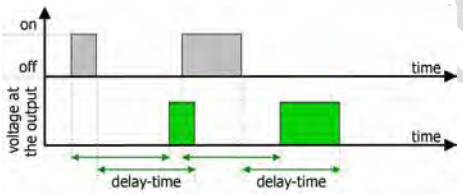
You can apply the operation mode 1 for all actions you want to be switched on for a certain time and to be switched off automatically after the time has run out.

4.2. Operation mode 2 "Pulse Delay"

→ Use in analogue or digital layouts

The delay time has to be set individually at a trim-pot for each output. The maximum activating time is 30 seconds.

Each change in state at one of the switching inputs is transmitted to the related output with the set delay. One change in state is as well an opening as a closing of the contacts of the switching input. A maximum of 64 changes in state can be saved within the set time of delay. In case there are more changes of state within the time of delay, the changes of state first executed will be deleted.



Application

You can apply the operation mode 2 for all actions that should be executed with a time delay after a preceding occurance, e.g. opening the level-crossing after a train has passed or setting the signal to stop after a train has passed.

The operation mode 2 can be used as well to release switching operations delayed, in order to prevent switching contacts from being blocked permanently. Example: The power supply in a rail section has to be switched off (and the train brought to a stopp), as soon as the train has passed a reed contact. In case the train would stop immediately after passing the reed contact, it would be impossible to switch on the rail section again. With the Multi-Timer it is possible to

delay the switching pulse so that the train does not stop before the reed contact will not be released any more.

4.3. Operation mode 3 "Random Switch"

→ Use in analogue or digital layouts

The 4 outputs of the Multi-Timer are switched separately for a time at random. The time interval after which the random generator decides whether to release a switching operation or not, can be set for each output individually via a trimpot, the maximum interval is 4,5 minutes. The downstream circuit can stay switched on or off for several time intervals (maximum 10)

When connecting switches (or similar circuits) to the switching inputs of the Multi-Timer, the random control can be affected manually. As soon as the contacts of the switching inputs are closed (= on), the current state of the related output will be "frozen" and the random switch has no more influence on the output. The output will be controlled by the random switch only after the contacts of the switching input are opened again (= out).

Application

You can apply the operation mode 3 for all actions to be switched on and off at random.

4.4. Operation mode 4 "Start-Brake-Stopover Switch"

→ Use in analogue layouts only

The Multitimer controls

- braking, stopping and starting of analogue locomotives (e.g. in a station or at a signal stop).
- optionally: the signal position (stop or clear)
- the driving characteristics of a locomotive in the connected rail section. In conjunction with the PWM it is set to control the locomtoive´s movement within the rail section.

Length of time for braking, stopping and starting

The length of time for braking, stopping and starting and the supply voltage when starting has to be set via trim-pots. The maximum time to be set for stopping is 4,5 minutes, you can reduce or prolong it via a switch as required. The maximum time for braking and starting is 12 seconds. The supply voltage when starting can be set so that the locomotive in fact starts without delay, but at a low rate. The maximum supply voltage is not applied before the end of the starting time.

PWM for locomotive´s motor

It is possible to set either a low or a high PWM for the connected rail section by corresponding setting of the jumpers. The PWM is the rate controlling the locomotive´s motor. Whether a low or a high PWM is more suitable, depends on the individual characteristics of the motor.

- low PWM: higher motor output, but loud and possibly disturbed engine running;
- high PWM: lower motor output, but quiet and smooth engine running.

Sequence

Via a switch connected to switching input 1, the signal is set to "stop" (switching input closed) or to "clear" (switching input open). Semaphore signals are to be switched directly, light signals can be switched via bistable relays as well. It is also possible to do without connecting signals, the outputs 1 and 2 stay then open.

The switching input 2 is used to release the braking, as soon as the locomotive passes a contact at the beginning of the braking track and thus the contacts of the switching input are closed. Here a reed contact or a hall sensor in combination with a magnet or a photoelectric barrier can be used.

Depending on the signal position (= switching input 1 closed or open), the locomotive will brake and stop or drive on. The signal´s change to "clear" is carried out either

- automatically after the set stop time has elapsed or
- before the stop time has elapsed by opening the switching input 1.

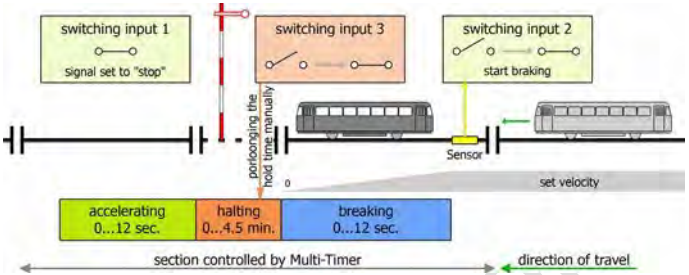
You can prolong the stop time by closing the contacts at switching input 3. The signal remains on "stop" as long as the input 3 is closed, but at least for the set stop time.

As soon as the signal turns to "clear", the locomotive starts with the set starting delay and starting supply voltage.

Example 1: Signal set to "Stop" (switching input 1 closed)

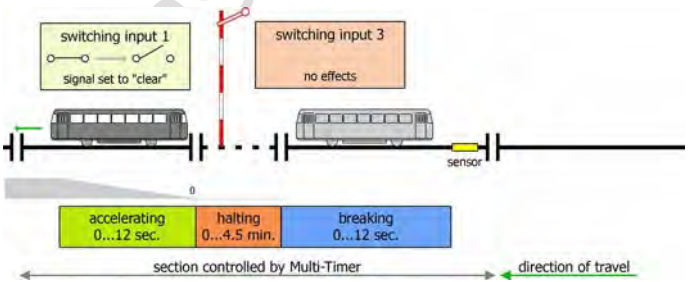
1. When passing the sensor at the beginning of the braking track, switching input 2 is closed and consequently the braking process is started. The braking track´s length depends on the time period set for braking.

In order to guarantee a reliable stop before the signal, you can install an additional security section switched currentless when the signal is set to "Stop".

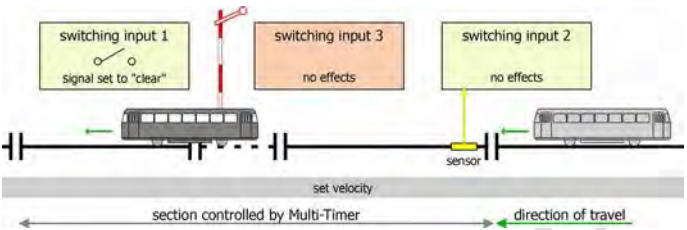


2. The locomotive stops in front of the signal until the hold time has expired (and switching input 1 has been switched to "open" automatically) or until switching input 1 has been opened (e.g. by means of an external switch).

By closing switching input 3 (e.g. by means of an external switch) while keeping switching input 1 closed at the same time, you can prolong the hold time and prevent switching input 1 from automatically been opened after the halting has expired. If switching input 3 is opened before the set hold time has expired, the automatic operation will be restarted after the hold time has expired.



Example 2: Signal set to "Clear" (switching input 1 open)



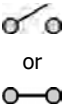
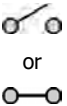
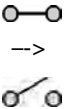
Passing the sensor at the beginning of the braking track has no effect, the braking process is not started. The state of switching input 3 has no effects, too.

Hint: If the signal would be set to "Stop" before the locomotive has passed, it would stop (abruptly) at the signal or in the security section switched currentless in front of the signal.

Effects of the swtich position

 switching input open

 switching input closed

Switching input 1 → Signal stop/clear	Switching input 2 → release braking	Switching input 3 → prolong hold time	Effects
			Passage with the set velocity. The state of switching inputs 2 and 3 has no effects.
			Braking with or without braking delay. Hold time: The switching input 1 is automatically opened after the set hold time.
			Braking with or without braking delay. Hold time: Switching input 1 is kept closed until switching input 3 is opened **and** the hold time has expired.

5. Technical specifications

Caution:
Do **not** use the same transformer for the power supply of the Multi-Timer as used for the power supply of downstream circuits or the rails.

Supply voltage	12-18 Volt d.c. or a.c. voltage
Current consumption (approx.)	50 mA
Number of outputs Max. switching current per output	4 1,500 mA
Number of switching inputs	4
Operation mode 1: Max. switching time	approx. 4,5 Minuten
Operation mode 2: Max. delay time	approx. 30 seconds
Operation mode 3: Max. time interval to be set (.)	 approx. 4.5 minutes
Operation mode 4: Max. stopping time to be set (approx.) Max. braking / starting time (approx.)	 approx. 4.5 minutes approx. 12 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.) Dimensions including housing (approx.)	72 x 82 mm 100 x 90 x 35 mm
Weight of the assembled board (approx.) Weight including housing (approx.)	55 g 103 g

6. Assembling the kit

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

6.1. 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 kΩ	brown - black - red (gold)
1,5 kΩ	brown - green - red (gold)
10 kΩ	brown - black - orange (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.

Rectifiers

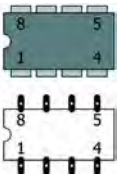
Rectifiers convert alternating into direct voltage. They have four pins: two for the input voltage (a.c. voltage) and two for the output voltage (d.c. voltage). The pins for the output voltage are polarized.

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 high power rating (e.g. BD types, BT types) have a flat package (TO-package), which is in use in different versions and sizes.
The three pins of the field effect transistors (e.g. BS types, FETs, MOSFETs) are called "source", "gate" and "drain" (abbreviated with the letters S, G, D 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.

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.

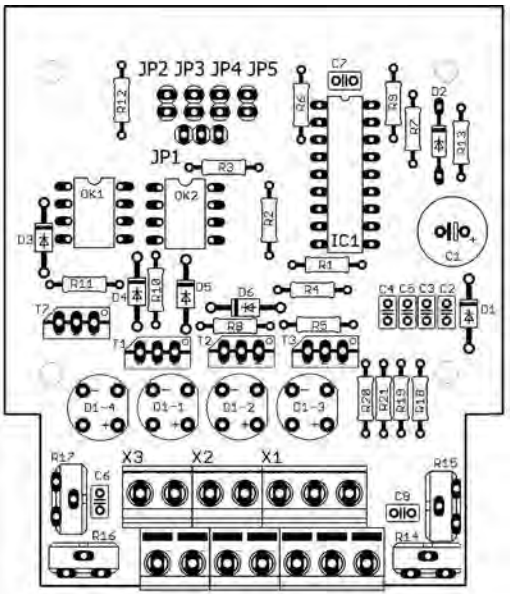
Opto couplers

Opto couplers are ICs, which work similar to laser beam switches. They combine in one housing a light emitting diode and a photo transistor. Their task is the transmittion of information without galvanic connection. They are in a DIL-housing with at least 4 pins.

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.

6.2. PCB layout



6.3. Parts list

Carbon film resistors	R1, R2, R3, R4, R12, R18, R19, R20, R21	1 kΩ
	R13	1,5 kΩ
	R5, R6, R7, R8, R9, R10, R11	10 kΩ
Trim pots	R14, R15, R16, R17	500 kΩ
Ceramic capacitors	C2, C3, C4, C5, C6, C7, C8	100 nF
Electrolytic capacitors	C1	100 µF / 25 V
Diodes	D1, D3, D4, D5, D6	1N400x, x=2...7
Zener diodes	D2	5V1
Rectifiers	D1-1, D1-2, D1-3, D1-4	B80C1500
Transistors	T1, T2, T3, T7	IRLZ34N
Microcontrollers	IC1	PIC 16F1847P
Opto couplers	OK1, OK2	PC827
IC-sockets	IC1	18-pol.
	OK1, OK2	8-pol.
Double Terminal strips	X2, X3	2x2-pol.
	X1	2x3-pol.
Solder pins	JP1	---
	JP2, JP3, JP4, JP5	1x2-pol.

6.4. 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	Mounting orientation of no importance.
4.	IC sockets	Mount the sockets that way, the marking on the sockets shows in the same direction as the markings on the PCB board.
5.	Rectifiers	Observe the polarity! The pin connections are printed on the housing. The longer connecting pin is the positive pole.
6.	Trimm-potentiometers	The mounting orientation is preset by the layout of the three pins.
7.	Solder pins	

8.	Electrolytic capacitors	Observe the polarity! One of the two leads (the shorter one) is marked with a minus sign.
9.	Transistors	Observe the polarity! With transistors for a high power rating in TO packages (e.g. MOSFETs) the labelled front side is marked by a beveled line in the PCB layout.
10.	Double terminal strips	Put together the terminal strips before mounting them.
11.	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.

6.5. Performing a visual check

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

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

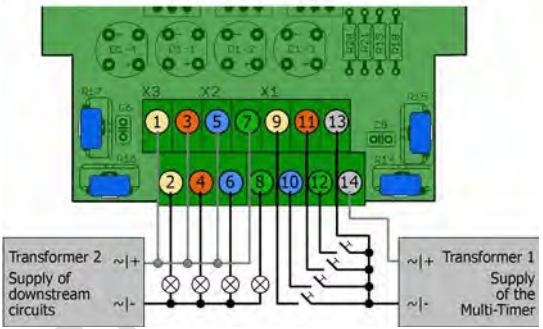
When you have remedied all faults, go on to the next part.

7. Connecting the Multi-Timer

7.1. Functional test

Especially, when you have mounted the Multi-Timer from a kit, you should perform a functional test before mounting it in your layout.

Connect an electric bulb with a separate power supply to output 1 (connections 1 and 2) and a push-button to switching input 1 (connection 9) as described in section 7.3 for operation mode 1. Connect the Multi-Timer to the power supply.



Choose operation mode 1 (r) for testing all outputs, so do not insert a jumper to any of the solder pins (→ section 8). Set a short switching time (trim-pot as far as it will go to the left). Then check all four outputs and switching inputs one after the other.

Caution:
When a component gets hot, disconnect the module from the power supply immediately! Risk of short circuit! Check the assembly!

7.2. Voltage supply

You can use a d.c. or an a.c. transformer with 12 to 18 V as a power supply for the Multi-Timer.

Caution:

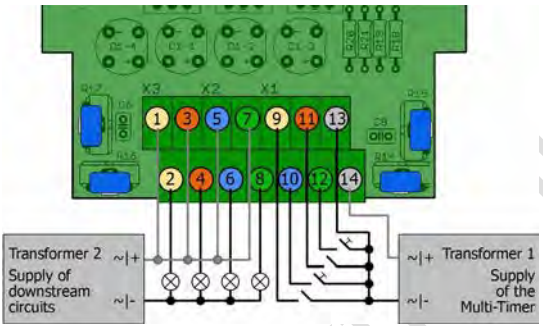
Do **not** use the same transformer for the power supply of the Multi-Timer as used for the power supply of downstream circuits or the rails. The arising stray electric currents could possibly damage the output transistors of the Multi-Timer.

Caution:

If you use a d.c. transformer for the power supply of the Multi-Timer, you generally have to respect the polarity when connecting it. If using an a.c. transformer the polarity is of no importance first.

When connecting several outputs to circuits supplied by the same transformer, all connections have to be polarized the same way as a rule. Otherwise a short circuit could occur damaging connected devices.

7.3. Connections with operation modes 1, 2 and 3



1 | 2	Output 1		
3 | 4	Output 2		
5 | 6	Output 3		
7 | 8	Output 4		
9	Switching input 1	Operation mode 1 and 2: push-button 	Operation mode 3: switch 
10	Switching input 3		
11	Switching input 2		
12	Switching input 4		
13 ~/-	Voltage supply and return conductor for switching inputs. With d.c. transformers: -		
14 ~/+	Voltage supply. With d.c. transformers: +		

Connection to the outputs (operation modes 1, 2 and 3)

The Multi-Timer works like a switch. It does not provide current for the operation of downstream circuits at it´s outputs. That is why these need an external voltage supply (d.c. or a.c.).

When using the Multi-Timer with operation modes 1, 2 or 3 (as time switch, pulse delay or ramdom switch), connect the downstream circuits to the four outputs according to your needs.

Connection to the switching inputs (operation modes 1 and 2)

As soon as the contacts of the switching inputs are closed, the switching operations will be released at the related outputs.

For the operation modes 1 or 2 you have to connect push-buttons to the switching inputs. As an alternative you can mount upstream circuits releasing a short switching pulse – like push-buttons.

Connection to the switching inputs (operation mode 3)

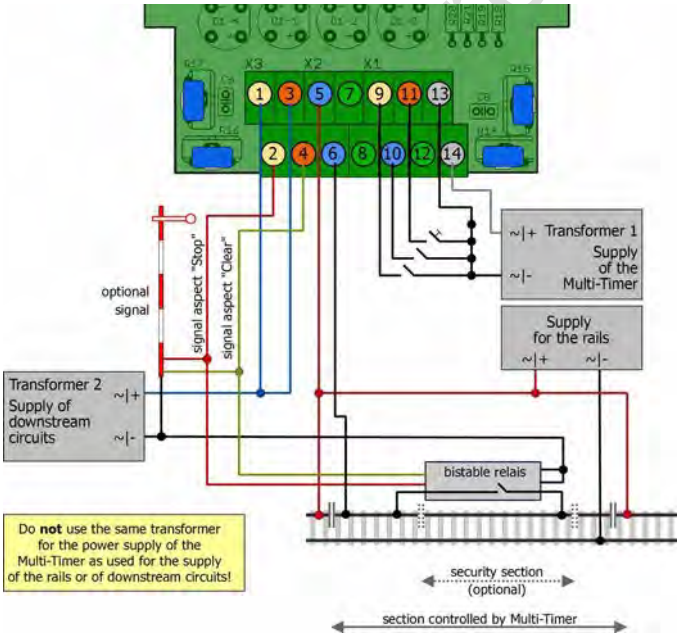
In order to affect the random control manually, you have to connect switches (or circuits with a similar mode of operation) to the switching inputs. As soon as the contacts of the switching inputs are closed, the previously by the random switch set state will be "frozen".

7.4. Connection with operation mode 4

For use as a start-brake-stopover switch you have to isolate the rail section to be controlled by the Multi-Timer from the remaining layout. These can be e.g.:

- rail sections with a signal stop (e.g. block sections)
- flag stops

Here cut with 3-rail systems the middle conductor and with 2-rail systems the same conductor you have cut for other applications. In addition, you can cut off a security section switched currentless when the signal is set to "Stop".



1 | 2 3 | 4	Output 1 Output 2	Signal position "stop" Signal position "clear" You can do without connecting a signal, the outputs 1 and 2 stay open then.
5 | 6	Output 3	Rail With 3-rail systems: middle conductor With 2-rail systems: cut conductor
7 | 8	Output 4	Not in use
9	Switching input 1	Switch for toggling between signal position "clear" (= open) and "stop" = closed You can connect any upstream circuits working according to the principle of a switch and toggling between the two signal positions. When using instead of a solenoid article with double coil drive (e.g. semaphore signal) a light signal, you have to mount an additional bistable relay.
10	Switching input 3	Switch, push button or upstream circuits The locomotive stops as long as the switching input is closed, but at least for the set stop time.
11	Switching input 2	Push button, reed contact, Hall sensor, photoelectric barrier or similar to release the braking operation When switching input 1 is closed simultaneously (signal to "stop"), the braking operation will be released as soon as the contacts of switching input 2 are closed at at switching pulse.
12	Switching input 4	Not in use
13 14		Voltage supply for Multi-Timer, signal and bistable relay for security section (**not** driving transformer!). 13 = Return conductor for switching inputs

8. Setting the Multi-Timer

Setting the operation mode

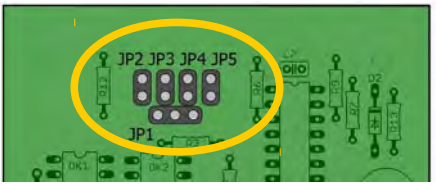
You can set the following operation modes on your Multi-Timer by inserting jumpers to the solder pins JP2 to JP5:

1. time switch
2. pulse delay
3. random switch
4. start-brake-stopover switch

The Multi-Timer reads in the currently set operation mode immediately after having been switched on. If altering the order of the jumpers after the switching on, this has no effect until the Multi-Timer has been switched off and on again.

The operation modes 1 and 2 have to be set on the 4 outputs separately. Therefore you can use the Multi-Timer as a combined time switch and pulse delay. With the operation modes 3 and 4 the setting is valid for all four outputs.

With the operation mode 1 "time switch" you can choose whether you want to retrigger the outputs or not. For the operation mode 4 "start-brake-stopover switch" you have to define either a low or a high PWM for the locomotive motor.



Jumper				Operation mode			
JP2	JP3	JP4	JP5	Output 1	Output 2	Output 3	Output 4
-	-	-	-	1 (r)	1 (r)	1 (r)	1 (r)
-	-	x	x	2	1 (r)	1 (r)	1 (r)
-	-	x	-	2	2	1 (r)	1 (r)
-	-	-	x	2	2	2	1 (r)
x	-	-	-	1 (nr)	1 (nr)	1 (nr)	1 (nr)
x	-	x	x	2	1 (nr)	1 (nr)	1 (nr)
x	-	x	-	2	2	1 (nr)	1 (nr)
x	-	-	x	2	2	2	1 (nr)
-	x	-	-	2	2	2	2
x	x	-	x	3	3	3	3
x	x	x	-	4 (PWM-)	4 (PWM-)	4 (PWM-)	4 (PWM-)
x	x	x	x	4 (PWM+)	4 (PWM+)	4 (PWM+)	4 (PWM+)

- Jumper not inserted

x Jumper inserted

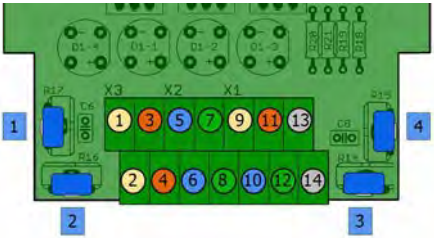
1 operation mode 1 "time switch"
2 operation mode 2 "pulse delay"
3 operation mode 3 "random switch"
4 operation mode 4 "start-brake-stopover switch "

(r) to be retriggered
(nr) not to be retriggered

(PWM-) low PWM-rate
(PWM+) high PWM-rate

Setting the switching times

You set the swtching times and with operation mode 4 the starting and braking delay as well as the voltage supply when starting at the four trim-pots related to the outputs. When setting the trim-pot as far as it will go to the right you will define the maximum value.



Please notice that with operation mode 3 "random switch" not the maximum toggling time is set, but the time interval, which elapses before the Multi-Timer decides at random if to toggle the output or not.

Operation mode	Trim-pot 1 → output 1	Trim-pot 2 → output 2	Trim-pot 3 → output 3	Trim-pot 4 → output 4
1	Switching time			
2	Delay time			
3	Time interval between two decisions to toggle or not			
4	Length of time for braking	Length of stay	Length of time for starting	Voltage at the track when starting

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.

- There is no reaction after releasing a switching operation.

  Possible cause: The push-button, the switch or the circuit used to close the contacts of the switching input are defective or connected incorrectly. → Check the push-button, the switch or the circuit and the connections.

  Possible cause: The downstream circuit is defective or connected incorrectly. → Check the circuit and the connections. In this case you should exchange the circuit by an electric bulb for a test and set operation mode 1 for the output concerned.

With use as a start-brake-stopover switch

- The locomotive does not start although the signal has been set to "clear" / the stopping time has elapsed.

  Possible cause: The PWM is set to "high", but the voltage at the track is not sufficient for the locomotive. → Alter the setting to "low PWM".

- The locomotive´s engine running loud and disturbed.

  Possible cause: A low PWM has been set. → Alter the setting to "high PWM". Notice: Possibly the locomotive does not run with these settings as the track voltage is not sufficient.

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

CE 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.

12. 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:

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