

Manual

# Booster B-4

Item no. 40-19407 | 40-19417



tams elektronik  
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To increase the text's readability we have refrained from referring to this point in each instance.

## 1. Why Boosters?

The three essential functions of boosters are:

1. Supplying the power needed for the operation of digital controlled locomotives and points and other digital consumers.
2. Bringing the voltage to the rails, in order to make sure that all vehicle and accessory decoders receive the digital switching and control commands.
3. Making sure the current is switched off in case of a short-circuit on the layout (e.g. when a vehicle derailed), in order to prevent damages at rails and vehicles.

In layouts monitored by RailCom the booster also provides the so-called RailCom-cutout needed to transfer RailCom-feedback data.

You can measure the power consumption as follows:

1 locomotive gauge N	600 mA
1 locomotive gauge H0	800 mA
1 locomotive gauge 0	1.000 mA
wagon light	50 - 200 mA
another consumer (such as a sound module)	100 - 300 mA
reserve for points	10% of the calculated sum of power consumption

The Booster B-4 can provide 2 to 5 A current depending on the settings. If your overall power demand exceeds the capacity of one booster you have to connect additional boosters according to the special requirements of your layout.

## 2. Getting started

### **How to use this manual**

This manual gives step-by-step instructions for safe and correct connecting of the booster, 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 booster on to another person, please pass on the manual with it.

### **Intended use**

The booster B-4 is designed to be operated according to the instructions in this manual in model building, especially in digital model railroad layouts. Any other use is inappropriate and invalidates any guarantees.

The booster B-4 should not be mounted by children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user.

### **Checking the contents**

Please make sure that your package contains:

- Booster B-4, depending on the version
  - without display (item no. 40-90407) or
  - with display (item no. 40-90417);
- one 3-pin and one 4-pin connector;
- five short-circuit jumpers;
- a CD (containing the manual and further information).

## Required materials

In order to connect the booster you need:

- Wire. Recommended diameter:
  - for the connection to the transformer and the rails:  $\geq 1,5 \text{ mm}^2$
  - for the connection to the digital control unit:  $\geq 0,25 \text{ mm}^2$
- A transformer. The recommended voltage and the minimum power of the transformer depend on the desired settings.

## Determining the transformer's voltage

Desired track voltage	Recommended transformer's voltage	
	AC voltage	DC voltage
10 – 12 V	12 V	desired track voltage + 2 V
12 – 15 V	15 V	
15 – 18 V	16 V	
18 – 22 V	18 V	
> 22 V	20 V	

## Determining the transformer's minimum power

desired track voltage  $\times$  desired interrupting current  
= minimum transformer's power

Example:  $18 \text{ V} \times 3 \text{ A} = 54 \text{ VA}$



### Please note:

Use a transformer with a nominal voltage not much higher than the desired track voltage. The power resulting has to be dissipated as heat by the booster otherwise. When this power is too high, the booster overheats and switches off.

### 3. Safety instructions



#### **Risk of fire**

The booster is cooled by a ventilating fan to prevent overheating. Thus be careful to allow the air to flow unhindered through the ventilation slits at the booster's top and back surface. If the vents are blocked components can overheat and catch fire.

#### **Risk of electric shock**

- 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:
- Only operate indoors in a dry environment.
  - Wiring should only be carried out when the booster is disconnected.
  - Only use low power for this device as described in this manual and only use certified transformers.
  - Only connect the transformer in an authorised manner to the house power supply.
  - Use adequately thick cable for all wiring. Too thin a cable can overheat.
  - If the layout is exposed to condensation, allow at least two hours for drying out.

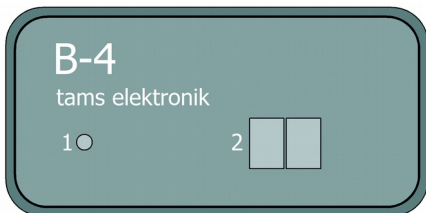
## 4. Your B-4

### Technical specifications

Supply voltage	12 – 20 V AC voltage 12 – 26 V DC voltage
Maximum output current	2, 3, 4 or 5 A
Output voltage	10 – 24 volts digital voltage
Power	max. 120 Watt
Digital formats	DCC, Motorola, mfx (control commands only)
Feedback log	RailCom
Interface	DCC-conforming booster port (3-pole)
Track signal	symmetrical
Protected to	IP 00
Ambient temperature in use	0 ... +60 °C
Ambient temperature in storage	-10 ... +80 °C
Comparative humidity allowed	max. 85 %
Dimensions	approx. 95 x 135 x 45 mm
Weight	- without display - with display
	approx. 238 g approx. 254 g

**Front side of the B-4**

- 1 LED
- 2 7- segment display  
(item no. 40-19417)

**Data formats and ports**

The B-4 is a multi protocol booster and capable of amplifying data sent in the Motorola or the DCC format. It transmits control commands in mfx-format as well, but no mfx feedback signals.

It can be connected either to a DCC-conforming booster port or to the rail output of the control unit.

**RailCom**

The booster B-4 can provide the so-called RailCom-cutout needed to transfer RailCom-feedback data in RailCom-monitored sections.

When using the B-4 with control units sending a DCC signal but not compatible to RailCom, providing the RailCom-cutout can cause malfunction. Some older DCC vehicle decoders and current decoders (especially of US American manufacturers) which are not designed for use with Railcom, do not react to driving commands properly with the RailCom cutout activated. With sound decoders not compatible to RailCom interferences in the sound playback can occur.

Thus with the B-4 it is possible to switch RailCom on or off (at delivery RailCom is switched on). With pure Motorola control units, malfunction due to sending the RailCom-cutout is impossible on principle.



## Using the ABC-braking method

The booster amplifies the track signal completely symmetrically. This allows the ABC-braking method to be used in DCC-controlled layouts. The DCC-input of the booster B-4 is isolated through an opto-coupler.

## Balanced track voltage

The booster B-4 provides a regulated track voltage, which can be set to a value between 10 and 24 V in 1 V-steps. At delivery the track voltage is set to 18 V.

Regulating the track voltage to a constant value prevents changes in locomotive speeds and lighting brightness, resulting from voltage variations.

Rated size	Recommended track voltage	Value in state of delivery
Z	12 V	
N and TT	14 V	
H0	18 V	18 V
0, I and II	20 - 24 V	

## Short-circuit protection

The Booster B-4 provides an integrated short circuit breaking in shape of an integrated current limitation. This causes the booster to switch off automatically when a short circuit occurs at the track output and thus prevents damages to the booster, the tracks and the vehicles.

When the short circuit feedback line is connected to the booster port of the control unit, the B-4 sends a feedback to the DCC control unit when a short circuit occurs and then the control unit switches off the booster.

The short circuit sensitivity or the interrupting current, can be set to 2, 3, 4 or 5 A. In order to prevent damage effectively when a short circuit occurs, the short circuit sensitivity should not be set too high.

Rated size	Recommended short circuit sensitivity (= interrupting current)	Value in state of delivery
Z and N	2 A	
TT and H0	3 A	
0, I and II	$\geq 4$ A	5 A

**Please note:**

The set short circuit sensitivity should **not** exceed the maximum transformer's current. In case the maximum interrupting current is higher than the maximum transformer's current, the booster cannot detect an overcurrent and thus does not switch off the current to protect electronic components, vehicles and the tracks from damage.

**Risk of fire !****Automatic switching on after a short circuit**

After a short circuit the B-4 switches on automatically after 4 to 10 seconds (adjustable). If the short circuit is still there, it switches off again immediately.

In state of delivery, the automatic switching on will be interrupted for one minute after the booster has been switched on and off five times. This autostarting time can be set individually:

- to the set autostarting time after a short circuit (4 to 10 seconds) or
- to an individual autostarting time between 0 and 90 seconds (adjustable in 10 sec.-steps).

### **Short circuit warning**

As a basis for a PC controlled booster management the B-4 can send a short circuit warning when a limiting value underneath the set interrupting current is exceeded. The PC control can switch off carriage lighting in an overloaded booster section then, for example, when a short circuit due to overload is imminent.

The limiting value for the short circuit warning can be set from a value 0 to 1.0 A below the set interrupting current. The short circuit warning is sent as in form of a second pulse periodical switching on and off in the short circuit feedback line.

### **Switching off at overtemperature**

When overheating the booster switches off automatically for safety reasons. Possible causes:

- Hindrance to the flow of air through the ventilation slits at the booster's top and back surface.
- Significantly higher rated voltage of the transformer than the set track voltage in combination with a high current consumption.

### **Watchdog function**

With this function the control unit (usually controlled by a PC software) sends in intervals of 5 seconds a DCC points switching command to an address assigned to the B-4. As soon as the B-4 does not receive these commands any longer, it switches off automatically.

After switching on the booster the watchdog function is initially inactive. It will be activated by sending a switching command to the assigned points address. This allows you to run the layout without a PC control and without deactivating the watchdog function.

### **Switching on and off the B-4 with a DCC points switching command**

The B-4 can be switched on and off via a a DCC point switching command sent to an assigned points address.

Points "straight" → B-4 on

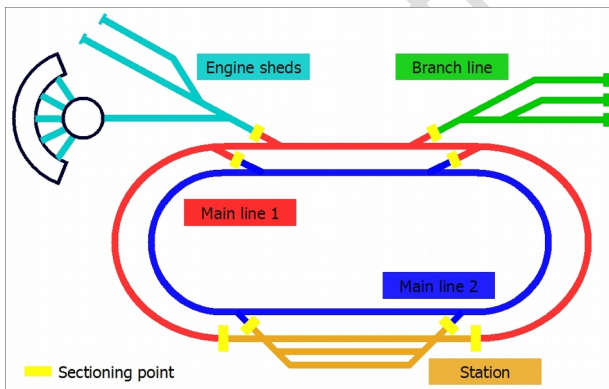
Points "branch" → B-4 off

## 5. Splitting your model railway layout

Split your model railway layout in several track sections electrically isolating them from each other. Every section has to be supplied by a booster of its' own. In each section a maximum of three to five locomotives should run at the same time. The following divisions are useful:

- station
- engine sheds
- the main lines (if necessary in several sections)
- the branch lines (if necessary in several sections)

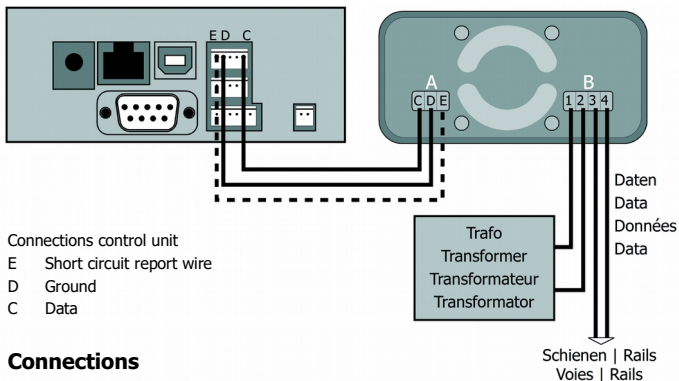
Make sure that section borders are not crossed too often.



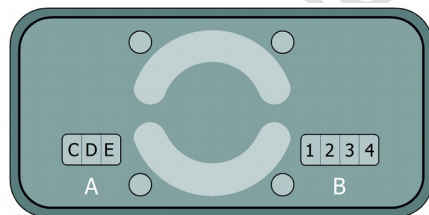
Isolate the borders between the booster sections as follows:

- With 2-rail systems: one rail. Be sure to isolate in all booster sections on the same rail ("left" or "right"). In large confusing layouts it is recommended to isolate both rails.
- With 3-rail systems: the middle conductor.

## 6. Connecting the B-4



### Connections



**Rear side of the B-4**

<b>A</b>	Connections to the control unit and following boosters	<b>B</b>	Connections to the transformer and the tracks
C	data (+)	1	transformer
D	earth / data (-)	2	transformer
E	short circuit feedback line	3	outer conductor / left rail
		4	middle conductor / right rail

In order to connect the cables to the booster use the enclosed connectors which are designed to screw on the cables.

**Please note:**

Do not block the flow of air through the ventilation slits at the booster's top and back surface, otherwise the booster can overheat. **Risk of fire!** You should never cover the ventilation slits. When connecting the booster be sure to keep sufficient distance to other devices, walls, and the like.

**Connecting the control unit**

You can connect the connection "A" of the booster either to

- the control unit's track output (connections C and D only) or
- the control unit's DCC booster connection.

Check that the pin assignment of the control unit's booster interface corresponds to that of the booster.

If you want the control unit to switch off the booster when a short circuit occurs, you have to connect the short circuit feedback line. If you do not connect the short circuit feedback line, the booster will be switched off automatically when a short circuit occurs and automatically on again after a set time.

**Connecting an additional booster**

In order to connect another booster connect an additional cable to each of the three connections of "A".

Hint: Only use boosters of one type and made by one manufacturer to avoid problems such as:

- Problems with data transfer to the decoders.
- Current leakage that make locomotives move by themselves when other locomotives cross the borders between two track sections.
- Short circuits when crossing sections.

## Connecting the tracks

Connect the booster's track port to both rails (with 2-rail systems) or to one rail and the middle conductor (with 3-rail systems). These connections should be repeated every 2-3 meters, because the resistance at the connection points of the tracks is quite high. When choosing too high intervals, problems with the short circuit indication or the power supply of the vehicles may occur.



### **Please note:**

The connection order of the rails (or the rail and the middle conductor) to the two poles of the track port is not significant, if you haven't already connected a booster to your layout. If you have then please note:

The left pole of the second booster's track port has to be connected to the same rail as the left pole of the booster already connected. The same goes of course for the right pole of the boosters' track ports. In case the connections are mixed up short circuits will occur when vehicles cross the boundaries of the track sections.

## Connecting the power supply

Connect the transformer to the booster's transformer port. The required voltage and the minimum power of the booster depend on the desired track voltage and the desired interrupting current. See section "Determining the necessary transformer's voltage" on page 5.



### **Please note:**

You must not interchange the connections to the tracks and to the transformer. Interchanging these connections normally causes damages at the booster, in the worst case beyond repair.



## 7. Settings

The booster B-4 can be set to individual requirements by programming on main (POM) or by inserting short-circuit terminations (jumpers).

	Possible settings	Manu- facturers settings	Setting with jumpers
Track voltage	10 – 24 V, to be set in 1 V-steps	18 V	yes, 16 – 22 V
Autostarting time after a short circuit	4 – 10 Sek., to be set in 1 sec.-steps	4 sec.	4 sec.or 10 sec.
Max. track current (interrupting current after a short circuit)	2 – 5 A, to be set in 1 A-steps	5 A	yes
RailCom	active or inactive	active	no
Switching off with a DCC points switching command	active or inactive / assigning the points address	inactive	no
Watchdog	active or inactive / assigning the points address	inactive	no
Limiting value for short circuit warning	0,2 – 1 A, to be set in 0,2 A-steps	0 A inactive	no
Autostarting time after 5 short circuits	10 – 100 sec.	60 sec.	no

## 7.1. Programming the B-4

The booster B-4 is set by programming on main (POM). This is possible only with control units supporting this programming mode.

In order to start programming the booster, input the value "62" for CV#7 of any DCC locomotive address. Proceed as described in the manual of your control unit. This input has no effect on a decoder with the chosen address, as locomotive decoders do not allow setting a value for CV#7 (= version).

After having started the programming mode (input the value "62" for CV#7), the LED flashes quickly with a yellow light. You can now alter the booster's settings by choosing CV#7 again and inputting a value from the following list.

If you do not input a value for CV#7 within 30 seconds, the programming mode will be switched off. After setting the value the programming mode is ended automatically. If you want to alter further settings, you have to start the programming mode again by inputting the value "62" for CV#7.

Function	Value for CV#7	Settings / Remarks
Reset	8	Reset. Sets the values back to the default values.
Track voltage (output value) Default value: 18 V	10	10 volts
	11	11 volts
	12	12 volts
	...	13 ... 23 volts
	24	24 volts
Autostarting time after a short circuit Default value: 4 sec.	34	4 seconds
	35	5 seconds
	36	6 seconds
	...	7 ... 9 seconds
	40	10 seconds
Max. track current (interrupting current) Default value: 5 A	42	2 amperes
	43	3 amperes
	44	4 amperes
	45	5 amperes
RailCom. Default value: active	51	active
	52	inactive
Switching off with a DCC points switching command Default value: inactive	71	active
	72	inactive
	73	Change over into the progr. mode. When within 30 sec. a DCC points switching command is set, the B-4 takes over the corresponding points address to release the switching off function. Condition: Switching off function = "active".

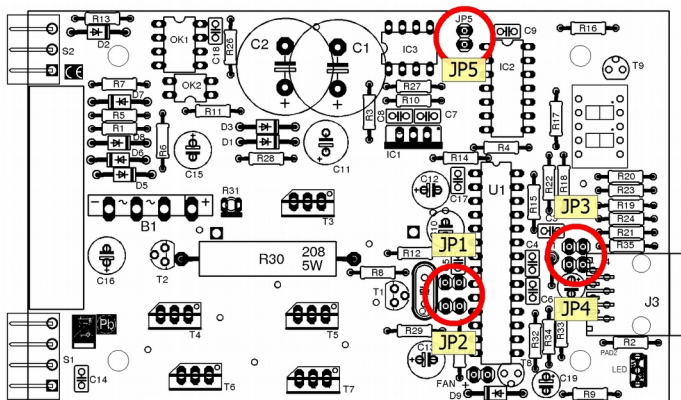
Function	Value for CV#7	Settings / Remarks	
Watchdog Default value: inactive	74	active	
	75	inactive	
	76	Change over into the programming mode. When within 30 sec. a DCC points switching command is set, the B-4 takes over the corresponding points address to release the watchdog function. Condition: Watchdog function = "active".	
Limiting value for short circuit warning Default value: 0 A	81	0 A	Hint: The short circuit warning will be sent, when the set interrupting current less the value is exceeded. Example: Interrupting current = 3 A set = 0,2 A → limiting value for the short circuit warning = 2,8 A
	82	0,2 A	
	83	0,4 A	
	84	0,6 A	
	85	0,8 A	
	86	1,0 A	
Autostarting time after 5 short circuits Default value: 60 sec.	100	= set autostarting time after a short circuit	
	101	10 Sekunden	
	102	20 Sekunden	
	103	30 Sekunden	
	...	40 - 80 Sekunden	
	109	90 Sekunden	

## 7.2. Setting the B-4 with jumpers

With control units not supporting programming on main (POM) the booster B-4 can be set by inserting short-circuit terminations (jumpers). Please note: It is not possible to set the whole range of values by inserting jumpers.

Before inserting the jumpers you have to open the booster's housing. In order to release the clips bolting the two red half shells of the housing, press in the housing on it's side above / underneath the ventilations slits. It is recommend to release the clips on one side first and then on the opposite side.

Set the jumpers on the PCB is shown in the figure. When no jumper is inserted the programmed values are set.



**Assignment of the programming jumpers**

Jumper	Settings
JP1 inserted, JP2 open	Track voltage = 16 volts
JP1 + JP2 open	Track voltage = 18 volts (in state of delivery) or the last set value
JP2 inserted, JP1 open	Track voltage = 20 volts
JP1 + JP2 inserted	Track voltage = 22 volts
JP3 + JP4 inserted	Max. track current (interrupting current) = 2 amperes
JP3 inserted, JP 4 open	Max. track current (interrupting current) = 3 amperes
JP4 inserted, JP3 open	Max. track current (interrupting current) = 4 amperes
JP3 + JP4 open	Max. track current (interrupting current)= 5 amperes (in state of delivery) or the last set value
JP5 open	Autostarting time after a short circuit = 4 seconds (in state of delivery) or the last set value
JP5 inserted	Autostarting time after a short circuit = 10 seconds

## 8. Operation

### Shunting the boundry between two booster sections

You should take care not to allow locomotives or trains to halt directly on the boundary between two sections. This would lead to a connection between the outputs and possible damaging of the two connected boosters. The short circuit indication does not work under these circumstances.

### LED

The LED on the front lights or flashes indicating the operation modes or problems that occur.

LED	Meaning
red – constantly lighting	Short circuit at the track output.
red – quickly flashing	Switching off after exceeding the max. temperature.
yellow – constantly lighting	Booster in operation.
yellow – slowly flashing (approx. 1 sec. cycle)	No signal from the control unit.
yellow – quickly flashing	Programming has been started.
yellow – 2x flashing   break   2x flashing	The booster has been switched off by a points switching command.
red – 2x flashing   break   2x blinken	The watchdog has been released and the booster has been switched off in consequence.

## Display

In the version art.-no. 40-19417 the booster B-4 has a two-digit 7-segment display. During operation it shows the present current [A]. After a short circuit the remaining seconds till the re-switching on are displayed.

In addition, the display shows the following operating status:

Display	Meaning
--	The booster has been switched off by a points switching command.
--	The watchdog has been released and the booster has been switched off in consequence.

This version also enables you to read out and display the current booster's settings.

In order to read out the settings, input the value "62" for CV#7 for any DCC locomotive address. Proceed as described in the manual of your control unit. After having chosen CV#7 again and set a value from the following list for this value, the current setting is shown.

Value for CV#7	Currently set value
91	Autostarting time after 5 short circuits
92	Limiting value for short circuit warning [A]
93	Watchdog: "ON" = active, "OF" = inactive
94	Switching off command: "ON" = active, "OF" = inactive
95	Software release
96	Autostarting time after a short circuit [sec.]
97	Railcom. "ON" = active, "OF" = inactive
98	Track voltage [V]
99	Max. track current (interrupting current) [A]



## 9. Check list for troubleshooting

- The booster is getting very hot and/or starts to smoke.



Disconnect the system from the mains immediately!

Possible reason: The connections to the track and the power supply have been mixed up. → Alter the connections. Possibly the booster has been damaged.

- The LED at the booster does not light and the locomotives cannot be driven.

Possible reason: The power supply has been interrupted. → Check the connections to the power supply (transformer).

The LED flashes slowly in the colour yellow.

Possible reason: The control unit has been switched off or the connection to the control unit has been interrupted. → Check the control unit and the connections.

- The booster switches off, the LED flashes quickly in the colour red.

Possible reason: The booster is poorly ventilated. → Ensure the ventilation slits at the booster's top and back surface allow the air to flow unhindered.

Possible reason: The nominal voltage is a lot higher than the set track voltage. The power resulting from the difference between the real transformer's voltage and the desired track voltage and the taken current has to be dissipated as heat by the booster. If this power is too high, the booster overheats and switches off due to overtemperature. → Use a transformer with a nominal voltage minimally higher than the set track voltage.

- The LED on the booster lights alternatively red and yellow, then red for appr. 1 minute, then alternatively red and yellow again.

Possible reason: There is a short circuit at the track output. Therefore the booster switches off automatically and after the set

autostarting time automatically on again. In case the short circuit is still there after autostarting, the booster switches off immediately. This procedure is repeated five times, followed by a one minute break. → Eliminate the short circuit.

- The watchdog function is not active after switching on the booster although it has been set active.

Possible reason: The watchdog function will only be activated after a switching command has been sent to the assigned points address. → Enter a switching command for the points address.

- After a points switching command the booster has been switched off, the LED flashes yellow.

Possible reason: The points address in question has been assigned to the function "switching off by a DCC switching command". → Set the function inactive or avoid to use the points address in question.

- After a points switching command the booster has been switched off, the LED flashes red.

Possible reason: The points address in question has been assigned to the watchdog function, but there is no PC Control with this function in use. → Set the function inactive or avoid to use the points address in question.

**Hotline:** If problems with your device occur, our hotline is pleased to help you (mail address on the last page).

**Repairs:** You can send in a defective device 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 50 % of the sales price according to our valid price list. We reserve the right to reject the repairing of a device when the repair is impossible for technical or economic reasons.

Please do not send in devices for repair charged to us. In case of warranty we will reimburse the forwarding expenses up to the flat rate we charge according to our valid price list for the delivery of the product. With repairs not covered by guarantee you have to bear the expenses for sending back and forth.

## 10. Guarantee bond

For this product we issue voluntarily a guarantee of 2 years from the date of purchase by the first customer, but in maximum 3 years after the end of series production. The first customer is the consumer first purchasing the product from us, a dealer or another natural or juristic person reselling or mounting the product on the basis of self-employment. The guarantee exists supplementary to the legal warranty of merchantability due to the consumer by the seller.


The warranty includes the free correction of faults which can be proved to be due to material failure or factory flaw. With kits we guarantee the completeness and quality of the components as well as the function of the parts according to the parameters in not mounted state. We guarantee the adherence to the technical specifications when the kit has been assembled and the ready-built circuit connected according to the manual and when start and mode of operation follow the instructions.

We retain the right to repair, make improvements, to deliver spares or to return the purchase price. Other claims are excluded. Claims for secondary damages or product liability consist only according to legal requirements.

Condition for this guarantee to be valid, is the adherence to the manual. In addition, the guarantee claim is excluded in the following cases:

- if arbitrary changes in the circuit are made,
- if repair attempts have failed with a ready-built module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

## 11. EU declaration of conformity

 This product conforms with the EC-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying standards: EN 55014-1 and EN 61000-6-3. To guarantee the electromagnetic tolerance in operation you must take the following precautions:

- Connect the transformer only to an approved mains socket installed by an authorised electrician.
- Make no changes to the original parts and accurately follow the instructions, connection diagrams and PCB layout included with this manual.
- Use only original spare parts for repairs.

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

## 12. Declarations conforming to the WEEE directive



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

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

tams elektronik

tams elektronik

Information and tips:

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

Warranty and service:

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