

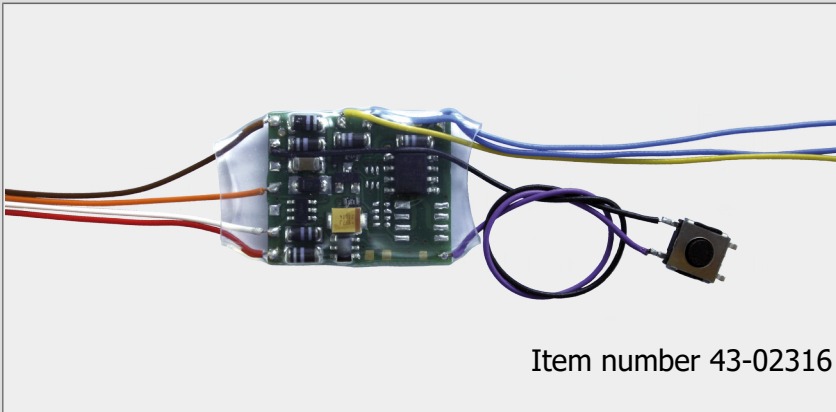
WD-31

1-fold Turnout Decoder

MM

DCC

Manual



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Printing the manual

The formatting is optimised for double-sided printing. The standard page size is DIN A5. If you prefer a larger display, printing on DIN A4 is recommended.

Contents

1. Getting started.....	4
1.1. Contents of the package.....	4
1.2. Accessories.....	4
1.3. Intended use.....	4
1.4. Safety instructions.....	5
2. Operation overview.....	6
3. Connections.....	7
3.1. Safety instructions.....	7
3.2. Safe and correct soldering.....	9
3.3. Connecting the decoder.....	10
3.4. Connection examples.....	10
3.5. Completion.....	11
4. Settings.....	12
4.1. Setting the addresses.....	12
4.2. Basic settings.....	13
4.3. Configuration data.....	14
5. Checklist for troubleshooting and error correction.....	15
5.1. Technical Hotline.....	16
5.2. Repairs.....	16
6. Technical data.....	17
7. Warranty, EU conformity & WEEE.....	19
7.1. Guarantee bond.....	19
7.2. EU Declaration of Conformity.....	20
7.3. Declarations on the WEEE Directive.....	20

1. Getting started

The instructions will help you step by step with the safe and proper installation and use of your turnout decoder. Before you start to put the decoder into operation, read this manual completely, especially the safety instructions and the section on possible errors and their elimination. You will then know what you have to pay attention to and thus avoid errors that sometimes can only be rectified with a lot of effort.

Keep the instructions in a safe place so that you can restore functionality later in the event of any malfunctions. If you pass the turnout decoder on to another person, also give the instructions with it.

1.1. Contents of the package

Turnout decoder WD-34:

- 1 turnout decoder WD-31 (item no. 43-02316-01) with soldered push button
- 1 piece double-sided adhesive tape for fixing the decoder and the push-button

1.2. Accessories

To connect the decoder you 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)

1.3. Intended use

The turnout decoder is intended for use in model construction, especially in model railway layouts, according to the specifications in the manual. Any other use is not in accordance with the intended use and will result in the loss of the warranty claim. Intended use also includes reading, understanding and following all parts of the instructions. The turnout decoder is not intended to be used by children under the age of 14.

1.4. Safety instructions

**Note:**

The turnout decoder contains integrated circuits (ICs). These are sensitive to electrostatic charging. Therefore, do not touch these components until you have "discharged" yourself. For this purpose, e.g. a grip on a radiator is sufficient.

Improper use and non-observance of the instructions can lead to incalculable hazards. Prevent these dangers by carrying out the following measures:

- Only use the turnout decoder in closed, clean and dry rooms. Avoid moisture and splash water in the environment. After condensation has formed, wait two hours for acclimatisation before use.
- Disconnect the decoder from the power supply before carrying out wiring work.
- Supply the decoder only with extra-low voltage as specified in the technical data. Use only tested and approved transformers.
- Only plug the mains plugs of transformers into properly installed and fused earthed sockets.
- When making electrical connections, ensure that the cable cross-section is sufficient.
- Heating of the decoder during operation is normal and harmless.
- Do not expose the decoder to high ambient temperatures or direct sunlight. Observe the information on the maximum operating temperature in the technical data.
- Regularly check the operational safety of the decoder, e.g. for damage to the connection cables.
- If you notice damage or if malfunctions occur, disconnect the connection to the power supply immediately. Send the decoder in for inspection.

2. Operation overview

The 1-way turnout decoder WD-31 is specially designed for installation in H0 turnouts or in the track. It is used to control a solenoid accessory (with or without limit switching) or a main light signal. Examples of use:

- turnout with twin coil drive
- semaphore signal with twin coil drive
- decouplers
- 2-term main light signal

Setting options

- Switching time ("On-Time"): The length of the pulses for switching solenoid accessories can be set in the CVs to a value between 50 ms and approx. 12 seconds.
- Fading time: When changing between the two signal terms of a main light signal, a smooth fading is possible. The time can be set in the CVs to a value between 10 ms and approx. 25 seconds.

Extra output for an additional consumer

The WD-31 has an additional, switchable output for connecting another consumer (up to 300 mA current).

Application example: Lighting of the turnout lantern

Control via turnout setting commands

The outputs are switched via turnout setting commands, which are sent from the control unit in DCC or Motorola format to the turnout address(es) of the decoder. The decoder automatically recognises the data format in which the commands are sent.

The extra output is controlled

- either together with the solenoid accessory or the main light signal
- or via its own turnout address. For this purpose, the extra output is automatically assigned the address that follows the address for controlling the solenoid accessory / the main light signal.

It is not possible to control the decoder via vehicle commands (at locomotive addresses).

Programming

With a DCC control unit the address and the properties of the turnout decoder can be changed by programming the configuration variables (CVs). Alternatively, the address can be set with the soldered button.

When using a Motorola control unit, the address must be set with the programming button. Changing the other decoder properties is not possible with Motorola control units.

Power supply

The turnout decoders and the connected accessories can be supplied

- either with digital voltage from the booster circuit, i.e. via the integrated booster of the digital central unit or a separate booster,
- or via its own transformer to relieve the digital circuit.

3. Connections

3.1. Safety instructions

 **Caution:**

Integrated circuits (ICs) are inserted on the decoder. They are sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

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 mount vehicle decoders.

**Caution:**

Little children can swallow small components with sharp edges, with fatal results! Do not allow components to reach small children.

In schools, training facilities, hobby and self-help workshops, the assembly, installation and operation of electronic modules must be supervised by trained personnel.

In commercial facilities, the relevant accident prevention regulations must be observed.

3.2. Safe and correct soldering

**Caution:**

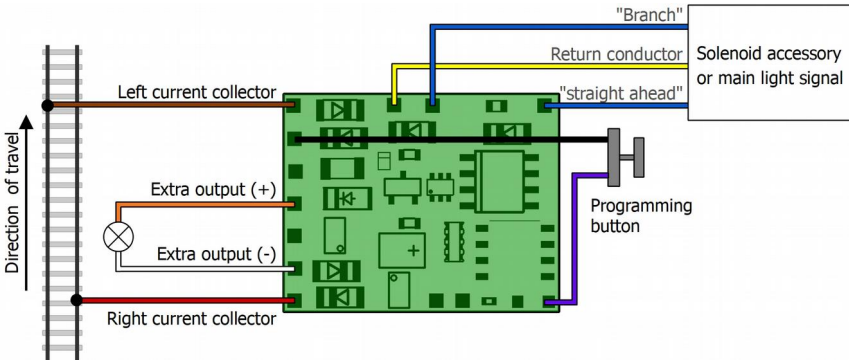
Incorrect soldering can cause dangers through fires and heat. Avoid these dangers by reading and following the directions given in the chapter **Safety instructions**.

- Use a soldering iron with temperature control, which you set to approx. 300 °C.
- Only use electronic solder with a flux.
- Never use soldering fluid or soldering grease when soldering electronic circuits. These contain an acid that destroys components and conductor paths.
- Solder quickly: Soldering for too long can detach solder pads or tracks or even destroy components.
- Hold the soldering tip on the soldering point so that it touches the 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 created solder joint for about 5 seconds.
- A clean, non-oxidized 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, check (preferably with a magnifying glass) whether connections or tracks have been bridged with solder by mistake. This can lead to malfunction or destruction of components or, in the worst case, the complete circuit. You can re-liquefy excess solder with the clean hot soldering tip. The solder then flows from the board onto the soldering tip.

3.3. Connecting the decoder

Make the connections one after the other:

- to the turnout, to the semaphore signal, to the decouplers or to the main light signal
- to the additional consumer (e.g. to a turnout lantern)
- the rails



Note:

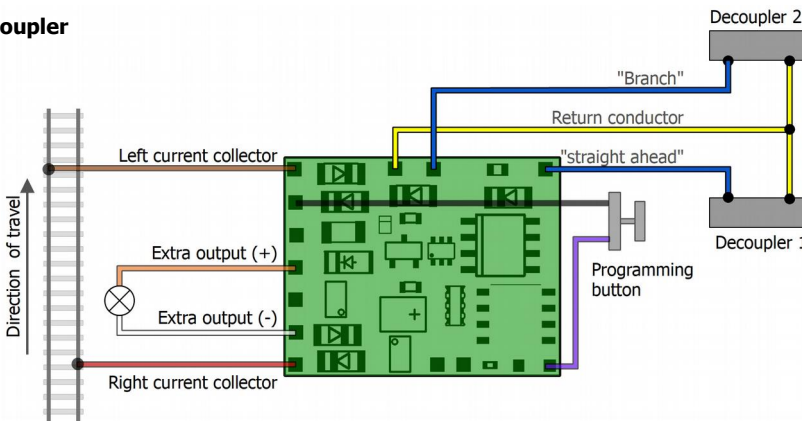
While connecting the decoder, switch off the digital control unit.

Make sure that the decoder does not touch any live parts after installation. **Risk of short circuit!** The decoder can be irreparably damaged when the power supply is switched on.

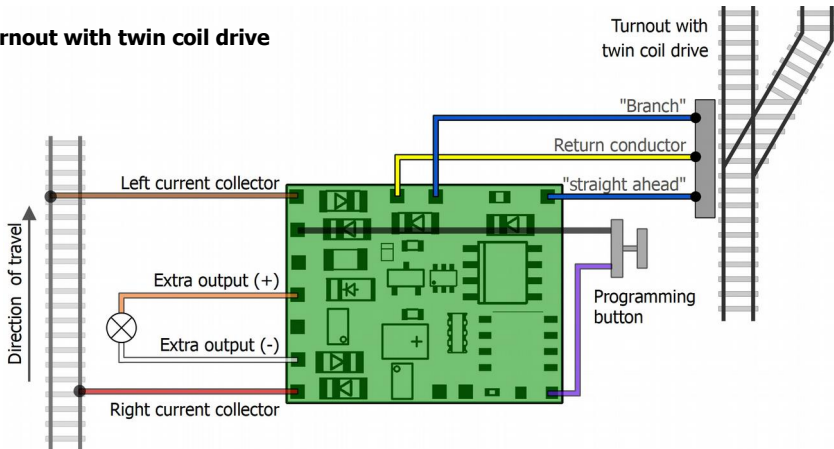
If a component becomes hot, immediately disconnect the component from the supply voltage. Danger of short circuit! Check the assembly.

3.4. Connection examples

Decoupler



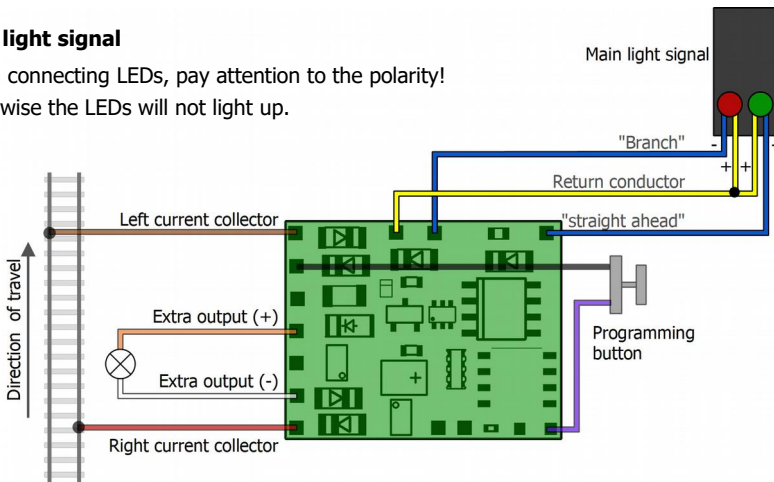
Turnout with twin coil drive



Tip: If the turnout switches contrary to the turnout setting commands entered, you can swap the turnout setting by changing the CV settings (→ CV5).

Main light signal

When connecting LEDs, pay attention to the polarity!
Otherwise the LEDs will not light up.



3.5. Completion

Fixing the decoder

To permanently prevent contact between the decoder and current-carrying parts, you must fix the decoder. You can use the enclosed double-sided adhesive tape for this purpose.

Fixing the programming button

The programming button should also be fixed, e.g. by using a small piece of the enclosed double-sided adhesive tape. If you do not want to use the button permanently, you should cut it off, including the cables. Make sure that the ends of the cables do not come into contact with electrically conductive parts.

4. Settings

With a DCC control unit you can program the configuration variables (CVs). To do this, refer to the relevant section in the operating instructions for your control unit, which describes how to program the CV variables byte by byte.

If you are using a Motorola control unit, you can use the programming button to set the address. Changing the CV values is not possible with Motorola control units.

4.1. Setting the addresses

You can set the decoder address either by programming the CVs with a DCC control unit or by using the programming button. Note that address 1020 is the highest address that can be controlled in Motorola format.

Setting the address with the push-button

With Motorola control units, the address can only be set using the programming button, which is soldered to the circuit board. With DCC control units it is often easier to set the address using the programming button than to program the decoder address using CVs. To do this, proceed as follows:

1. Press the programming button for approx. 5 seconds. As soon as the turnout (signal, decoupler) starts switching, the decoder is in programming mode.
2. Now enter the desired address and a switching command on the control unit.
3. The decoder accepts the new address and exits the programming mode. If you do not enter an address and a switching command, the programming mode is automatically ended after approx. 30 seconds.

Setting the address via CVs

Instead of setting the address using the programming button, you can alternatively set it by programming the CVs with a DCC control unit. The turnout address, via which the switching commands are sent, results from the addition of the values set for CV3 ("basic value") and CV4 ("additional value"):

CV name	CV-no.	Input value (default value)	Explanations and notes
Decoder address "Base value"	3	0, 1, 2, 3, ... 7 (0)	The "base value" of the decoder address results from multiplying the input value by 256.
Decoder address "Additional value"	4	0, 1, 2, ... 255 (1)	The decoder address results from the addition of the "additional value" to the "basic value".

Value in CV3	0	1	2	3	4	5	6	7
→ Base value	0	256	512	768	1024	1280	1536	1792
Value in CV4	1...255	0...255	0...255	0...255	0...255	0...255	0...255	0...248
→ Adress	1 ... 255	256 ... 511	512 ... 767	768 ... 1023	1024 ... 1279	1280 ... 1535	1536 ... 1791	1792 ... 2040

4.2. Basic settings

CV name	CV-no.	Input value (default value)	Explanations and notes
Version	7	---	Readable only!
Manufacturer	8	(62)	Readable only!
Reset	8	0 ... 255	By entering any value, all settings are reset to the values in the delivery state.

4.3. Configuration data

CV name	CV-no.	Input value (default value)	Explanations and notes
Configuration data	5	0, 1, 2, 4, 5, 8, 9, 10, 12 (1)	Extra output off when switched on. Extra output switchable with own address. 0
			Extra output on when switched on. Extra output switchable with own address. 1
			Extra output permanently on. No own address. 2
			Extra output is switched together with turnout / signal. No own address. 4
			Swap turnout position (branch / straight ahead) 8
<p>Note: If the extra output is to be switched together with the turnout / signal, you can also set whether the output is to be off (→ input value: 4+0 = 4) or on (→ input value: 4+1 = 5) when switched on.</p>			
Switching time ("On-Time") of the solenoid accessory	6	1, 2 ... 255 (2)	= Length of the switching pulse for switching a solenoid accessory Setting in 50ms steps Default value $\hat{=}$ 100 ms
		0 (2)	= Special case for controlling a main light signal. The output remains permanently on until the next switching pulse.
<p>! Note: If you connect a solenoid accessory, a value of at least 1 must always be entered in CV6 for the switching time. With a value of 0, current is permanently applied to the outputs. Solenoid accessories without limit switching can be damaged in this case!</p>			
Fading time of the main light signal	9	0, 1, 2 ... 255 (0)	Setting in steps of 100ms The setting of the fading time in CV9 is only active if the value "0" is set for the switching time in CV6.

5. Checklist for troubleshooting and error correction



Warning:

If you notice a strong heat development, immediately disconnect the connection to the supply voltage. **Fire hazard!**

Possible causes:

- One or more connections are faulty. → Check the connections.
- The decoder is defective. → Send the decoder in for inspection.

No reaction of the decoder

Possible causes:

- The connection of the decoder to the central unit and / or the power supply is interrupted. → Check the connections.
- The connection of the decoder to the accessory or the turnout is interrupted. → Check the connections.
- The central unit is not operating. → Check if the central unit is ready for operation.
- The connected accessory or the connected turnout is defective. → Check the accessory or the turnouts.

No reaction of the decoder after programming

Possible cause:

When programming the decoder address, you must enter values in CV3 and CV4. The address results from:

Input value for CV3 multiplied by 256 + Input value for CV4

Check your input and reprogram the address if necessary. Instead of entering the values for CV3 and CV4, you can alternatively set the address using the programming button.

Problems when switching the main light signal

- The signal lights up only briefly and is switched off although no change-over command was sent.
Possible cause: In CV6 ("On-Time") a value > 0 is set. → Check the setting and change the value if necessary.
- When changing the signal terms, the system switches over hard (without fading), although the fading time is set in CV9.
Possible cause: In CV6 ("On-Time") a value > 0 is set. → Check the setting and change the value if necessary.

5.1. Technical Hotline

If you have any questions about the use of the decoder, our technical hotline will help you (telephone number and e-mail address on the last page).

5.2. Repairs

You can send us a defective decoder for inspection / repair (address on the last page). Please do not send us your return freight collect. In the event of a warranty or guarantee claim, we will reimburse you for the regular shipping costs.

Please enclose the following with your shipment

- proof of purchase as evidence of any warranty or guarantee claim
- a brief description of the defect
- the address to which we should return the product(s)
- your email address and/or a telephone number where we can reach you in case of queries.

Costs

The inspection of returned products is free of charge for you. In the event of a warranty or guarantee claim, the repair and return are also free of charge for you.

If there is no warranty or guarantee case, we will charge you the costs of the repair and the costs of the return. We charge a maximum of 50% of the new price for the repair according to our valid price list.

Carrying out the repair(s)

By sending in the product(s), you give us the order to inspect and repair it. We reserve the right to refuse the repair if it is technically impossible or uneconomical. In the event of a warranty or guarantee claim, you will then receive a replacement free of charge.

Cost estimates

Repairs for which we charge less than € 25.00 per item plus shipping costs will be carried out without further consultation with you. If the repair costs are higher, we will contact you and carry out the repair only after you have confirmed the repair order.

6. Technical data

Digital protocols

Data formats	Motorola DCC (according to NMRA and RCN standard)
Address range Hint: The address range to be used also depends from the control unit.	MM: 1020 turnout addresses DCC: 2040 turnout addresses
Feedback format	---

Outputs

Number of outputs	3 in total, of which: 2 switching outputs for connecting a solenoid accessory or main light signal 1 extra output for an additional consumer
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Electrical properties

Power supply	Digital voltage of the booster circuit (12 - 24 volts)
Current consumption (without connected devices)	maximum 40 mA
Maximum current per output	Switching outputs: up to 2 seconds: 1,500 mA persistent: 800 mA Extra output: 300 mA

Protection

Protection class	IP 20 Meaning: Protected against solid foreign bodies with diameter ≥ 12.5 mm and access with a finger. No protection against water.
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Environment

For use in closed rooms

Ambient temperature during operation	0 ~ + 30 °C
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Permissible relative humidity during operation	10 ~ 85% (non-condensing)
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Ambient temperature during storage	- 10 ~ + 40 °C
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Permissible relative humidity during storage	10 ~ 85% (non-condensing)
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Other features

Dimensions (approx.)	Circuit board: 22 x 17 x 4 mm incl. heat shrink tubing: 30 x 19 x 5 mm
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Weight (approx.)	4 g
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7. Warranty, EU conformity & WEEE

7.1. 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-made module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

7.2. 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.

7.3. Declarations on the WEEE Directive

This product is subject to the requirements of the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE), i.e. the manufacturer, distributor or seller of the product must contribute to the proper disposal and treatment of waste equipment in accordance with EU and national law. This obligation includes

- registration with the registering authorities ("registers") in the country where WEEE is distributed or sold
- the regular reporting of the amount of EEE sold
- the organisation or financing of collection, treatment, recycling and recovery of the products
- for distributors, the establishment of a take-back service where customers can return WEEE free of charge
- for producers, compliance with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive.



The "crossed-out wheeled bin" symbol means that you are legally obliged to recycle the marked equipment at the end of its life. The appliances must not be disposed of with (unsorted) household waste or packaging waste. Dispose of the appliances at special collection and return points, e.g. at recycling centres or at dealers who offer a corresponding take-back service.

Further Information and Tips:
<http://www.tams-online.de>

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