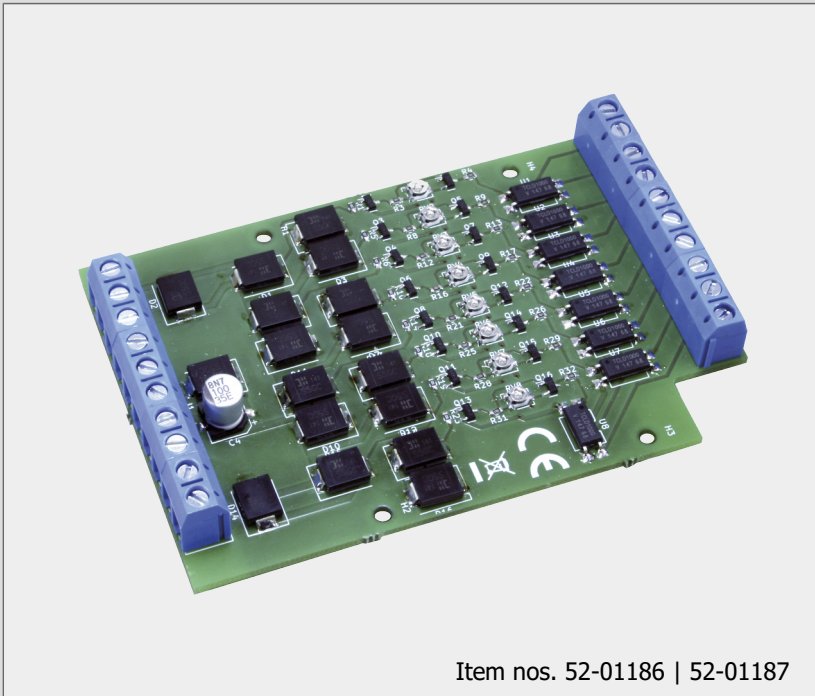


GBM-8.2

Track Occupancy Indicator
8-fold

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.

**** The asterisks**

The asterisks indicate further products from the Tams Elektronik GmbH product range :

- Track occupancy indicator GBM-1 | Item numbers 52-01015, 52-01016, 52-01017
- s88 feedback module S88-3 | Item numbers 44-01305, 44-01306, 44-01307
- s88 feedback module S88-6 | Item numbers 44-01606, 44-01607

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1. Getting started

The instructions will help you step by step with the safe and proper installation and use of your track occupancy indicator. Before you put the track occupancy indicator 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 track occupancy indicator on to another person, also give the instructions with it.

1.1. Contents of the package

- 1 ready-built and tested circuit board GBM-8.2 (item no. 52-01186-01) or
- 1 track occupancy indicator GBM-8.2 in housing (item no. 52-01187-01)

1.2. Accessories

Connection cables

The use of stranded wire is recommended for making the connections. Stranded wires consist of several thin individual wires and are therefore more flexible than rigid wires with the same copper cross-section. Recommended cross-sections:

- Connections to the tracks and the booster / the driving transformer: $\geq 0.25 \text{ mm}^2$
- Connections to digital feedback modules: $\geq 0,10 \text{ mm}^2$

Displaying the occupancy messages

If you want to display the busy signals, you will need

- LEDs and suitable series resistors (e.g. $1 \text{ k}\Omega$)
- for connection to AC voltage additionally:
 - 1 electrolytic capacitor $10\dots100 \mu\text{F} / 25 \text{ V}$
 - 1 diode $1\text{N}400\text{x}$, $x = 2\dots7$

Monitoring of switched off track sections

To be able to monitor track sections that are to be switched off during operation (e.g. in the staging yard), you need additional resistors with a value of max. $1.5 \text{ k}\Omega$.

1.3. Intended use

The track occupancy indicator is intended for use in model railway layouts as specified in the instructions. 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 track occupancy indicator is not intended to be used by children under the age of 14.

1.4. Safety instructions

**Note:**

The track occupancy indicator 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 track occupancy indicator 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 track occupancy indicator from the power supply before carrying out wiring work.
- Supply the track occupancy indicator 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 track occupancy indicator during operation is normal and harmless.
- Do not expose the track occupancy indicator 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 track occupancy indicator, 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 track occupancy indicator in for inspection.

1.5. Care

Do not use any cleaning agents to clean the track occupancy indicator. Only wipe the track occupancy indicator dry. Disconnect the indicator from the power supply before cleaning.

2. Operation overview

The GBM-8.2 track occupancy detector can monitor up to eight independent track sections. It can be used in analogue and digital model railway layouts of all nominal sizes with a maximum current consumption of 6 A per track section.

Adjustable sensitivity

The "correct" sensitivity at which a current consumer in a section is detected by the track occupancy detector depends on several factors: If, for example, vehicles whose axles are coated with resistive paint are to trigger an occupancy signal, a very high sensitivity is required. In digital systems, however, high sensitivity can become a problem if interference voltages from the digital system cause false alarms. Therefore, a lower sensitivity is usually recommended for use in digital systems.

With the GBM-8.2, the sensitivity is adjusted separately for each track section at a trimmer potentiometer and adapted to the individual requirements.

Evaluation of the busy signals

As soon as the GBM-8.2 detects a current consumer in a connected track section, the corresponding output is internally connected to the output M. The output of the GBM-8.2 thus acts like a switch that switches to ground. Digital feedback modules that switch to ground (e.g. s88 feedback modules) can be connected directly to the outputs. The GBM-8.2 is only conditionally suitable for the connection of relays or other circuits that switch to earth, as the maximum current of the outputs is limited to 50 mA. For these applications, the 4-fold track occupancy detector GBM-1** is more suitable.

Display of the busy messages

To display the busy messages, LEDs (with suitable series resistors) can be connected to the outputs of the GBM-8.2. Since the outputs of the GBM-8 can be loaded with a maximum of 50 mA each, they are not suitable for connecting incandescent lamps.

Power supply

The GBM-8.2 is supplied with power directly via the rails. The track sections must be in one booster circuit or supplied via a common driving transformer.

2.1. Use in analogue layouts

In analogue DC or AC systems, the GBM-8.2 is mainly used to visualise the occupied track sections (e.g. in a control desk).

With the appropriate sensitivity setting, the GBM-8.2 detects vehicles with a current consumption of at least 1 mA (e.g. illuminated locomotives or wagons) located in the connected sections. Even the small current that flows in DC systems when an axle of a vehicle is coated with resistive paint is sufficient to generate an occupancy signal when the sensitivity is set to the lowest setting.

In principle, the GBM-8.2 can only detect vehicles in analogue DC systems that enter the monitored track section from one direction of travel. Note: If the detection of vehicles from both directions of travel is required, it is recommended to use a GBM-1** track occupancy detector instead of a GBM-8.2.

2.2. Use in digital systems

The GBM-8.2 can be used independently of the digital format with which the layout is controlled. A typical application in digital systems is the combination with feedback modules that read in ground contacts (e.g. s88 feedback modules). The eight outputs of the GBM-8.2 are arranged in such a way that they can be directly connected to the inputs of the s88 feedback modules from the Tams Elektronik product range (e.g. S88-3** or S88-6**).

In digital systems, a high sensitivity of the occupancy sensor can become a problem if interference voltages from the digital system cause false alarms. With the GBM 8.2, the sensitivity can be set separately for each track section at a trim potentiometer so that interference from the digital system has no influence on the busy signals.

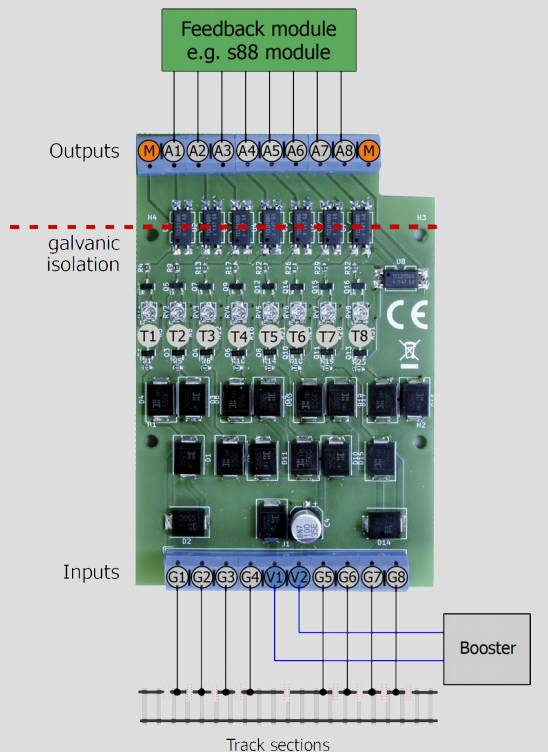
The inputs and outputs of the GBM-8.2 are galvanically separated from each other by optocouplers. This filters out interference peaks and effectively prevents ground loops ("hum loops") and fault currents.

Info: Galvanic isolation

In digital layouts, the circuits for supplying the tracks and the digital devices can either be galvanically (i.e. electrically) separated from each other or connected to a common, continuous ground. Establishing a common, continuous ground is prone to errors in practice and therefore unreliable, especially in larger layouts.

With the use of galvanically separated circuits, ground loops ("hum loops") and fault currents, which can cause malfunctions and in the worst case damage to the digital devices, can be reliably prevented.

With track occupancy detectors such as the GBM-8.2, the inputs (for connecting the monitored track sections) are galvanically separated from the outputs (for connecting digital feedback devices). The signals (i.e. occupancy messages) are passed on, but no electrical energy.

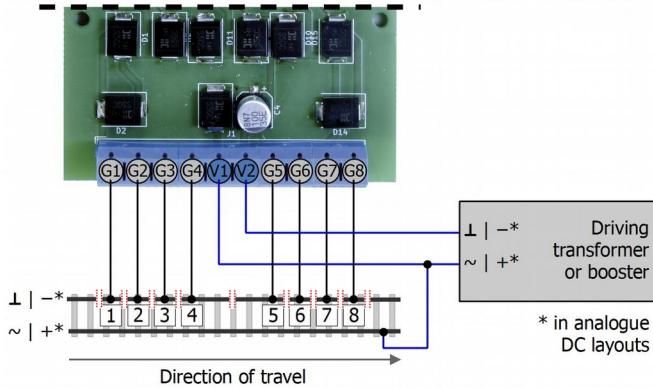


3. Connections GBM-8.2

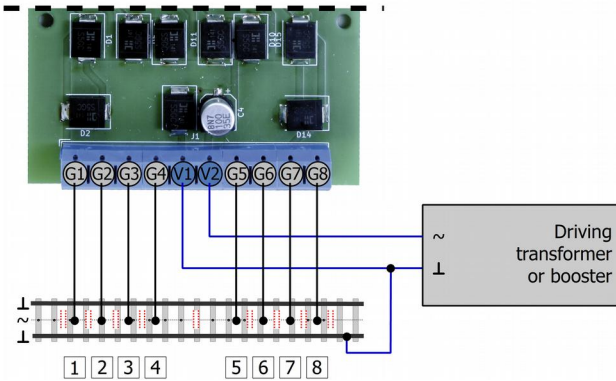
The module is equipped with modular terminals into which you insert the connection cables and screw them tight.

3.1. Connecting the power supply and the track sections

Connections to 2-rail systems



Connections to 3-rail systems



Connecting the power supply

Please note that all track sections must be in one booster circuit or must be supplied via a common driving transformer.

GBM-8.2	Track output of the booster or the driving transformer	
V1	+ / ~	⚠ Please note: If you use a DC voltage transformer as the driving transformer, you must always observe the polarity when connecting it. If you use an AC voltage transformer, the polarity is not important.
V2	- / ⊥	

Connecting the track sections

The busy status can only be reported trouble free, if one conductor is isolated at both ends of each section to be monitored:

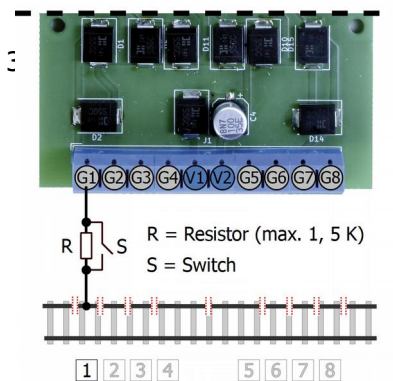
- 3-rail systems: centre conductor or both rails
- 2-rail systems (analogue): "-" rail
- 2-rail systems (digital): one of the two rails

Please note that, due to the principle, in analogue 2-rail systems (DC systems) only vehicles are detected that enter the track section in the direction marked as "direction of travel" in the connection diagram.

GBM-8.2	Connection to
G1, G2, G3, ... G8	isolated conductors in the track sections
V1	uninterrupted conductor

Monitoring of switched-off track sections

Track sections that are to be switched off during operation (e.g. in a staging yard) can also be monitored with the GBM-8.2. For this purpose, a resistor with a value $\leq 1.5 \text{ k}\Omega$ must be installed in the supply line to the track section concerned in such a way that it bridges the switch in the switched-off state.



3.3. Connection of LEDs

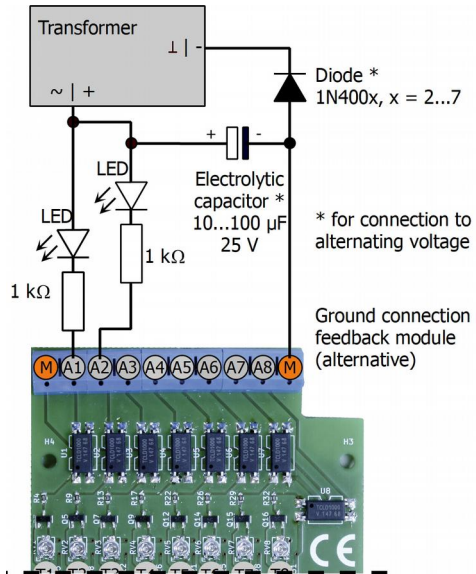
To display the busy signals (e.g. in analogue systems), connect the cathodes (-) of LEDs (with series resistors, e.g. $1\text{ k}\Omega$) to the outputs of the GBM-8.2.

! Always with series resistor!

Never operate LEDs without a series resistor, the LEDs will be destroyed very quickly in this case!

! Separate transformer!

Do not use the driving transformer for the power supply of the LEDs, but a separate transformer, e.g. to supply other lights! If you use the driving transformer to supply the LEDs, the equalising currents that occur can damage connected components.



Supply with alternating voltage

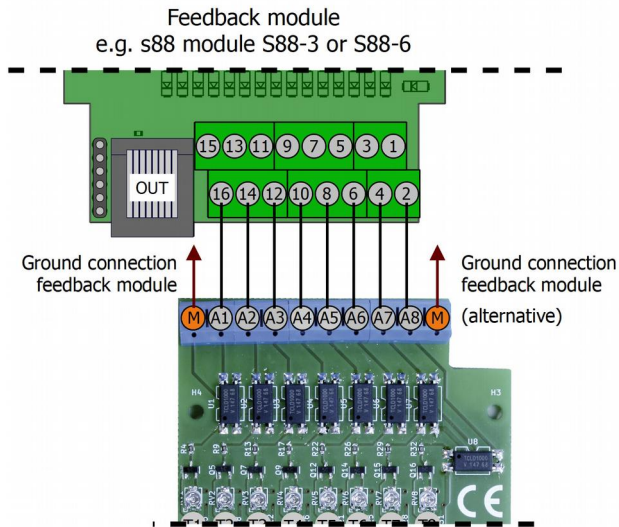
If you connect the LEDs to an AC transformer, you should also connect a protective diode (e.g. 1N400x, $x=2\dots7$) and a capacitor with a capacity between 10 and 100 μF and a dielectric strength of at least 25 V. This will prevent the LEDs from flickering.

! No incandescent lamps!

Never connect incandescent lamps to the outputs, as they usually consume more than 50 mA of current. The outputs of the GBM-8.2, which are designed for a maximum current of 50 mA, would be destroyed during commissioning!

3.4. Connection of digital feedback modules

You can connect the inputs of digital feedback modules that switch to ground (e.g. s88 feedback modules) directly to the outputs of the GBM-8.2. Connect the ground output of the feedback module to one of the two connections M of the GBM-8.2.

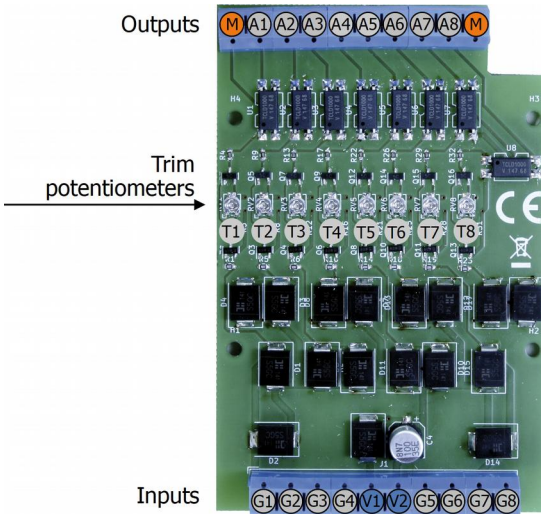


4. Setting the sensitivity


Adjust the sensitivity of the track occupancy detector for each of the 8 track sections at the associated trim pot. Use a small screwdriver for the adjustment.

Settings:

- Left stop: highest sensitivity (setting on delivery)
- Right stop: lowest sensitivity



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 GBM-8.2 is defective. → Send the track occupancy indicator in for inspection.

Connected LEDs do not light up

Possible causes:

- The power supply is interrupted. → Check the connection of the LEDs and the track occupancy detector to the transformer supplying the LEDs.
- One or more LEDs are defective. → Check the LEDs by connecting them directly (via a series resistor) to the power supply.

Occupied sections are not recognised

Possible causes:

- The sensitivity for the relevant track section is set too low. → Check the position of the corresponding trim pot and correct the setting (left stop = highest sensitivity).

5.1. Technical Hotline

If you have any questions about the use of your track occupancy indicator, 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 track occupancy indicator for repair (address on the last page). In the event of a warranty or guarantee claim, the repair is free of charge for you. As proof of any warranty or guarantee claim, please enclose the proof of purchase with your return.

If there is no warranty or guarantee claim, we are entitled to charge you the costs of the repair and the costs of the return shipment. We charge a maximum of 50% of the new price for the repair according to our valid price list. We reserve the right to refuse the repair if it is technically impossible or uneconomical.

If you want to clarify whether a repair is possible or economical before sending it in, please contact our Technical Hotline (telephone number and email address on the last page).

Please do not send us repair shipments freight collect. In the event of a warranty or guarantee claim, we will reimburse you for the regular shipping costs.

6. Technical data

Number of monitored sections	maximum 8
Evaluation of the occupancy messages	against mass of the downstream components
Galvanic isolation	between inputs and outputs

Inputs and outputs

Inputs	8 inputs for the connection of the monitored track sections
Outputs	8 outputs for the connection of the inputs of downstream feedback devices and/or LEDs for displaying the occupancy status

Electrical characteristics

Power supply	via the rails Note: All track sections must be in one booster circuit or supplied via a common driving transformer.
Current consumption (without connected loads)	approx. 15 mA
Max. current in the track sections	6.000 mA per rail section
Max. current per output	50 mA
Sensitivity	1 mA ... ∞ separately adjustable for each of the 8 track sections at a trim potentiometer

Protection

Protection class	Ready-made module (without housing): IP 00 Meaning: No protection against foreign bodies, contact and water. Ready device (in housing): 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

Permissible relative humidity during operation 10 ~ 85% (non-condensing)

Ambient temperature during storage - 10 ~ + 40 °C

Permissible relative humidity during storage 10 ~ 85% (non-condensing)

Other features

Dimensions (approx.) Circuit board: 63 x 97 mm
Ready device including housing: 100 x 98 x 35 mm

Weight (approx.) Assembled board (ready-made module): 43 g
Ready device including housing: 91 g

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

 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>

Warranty and Service:

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