

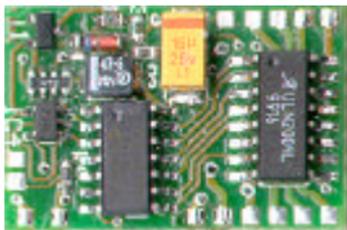
LD-G-6

Lokdecoder
für Gleichstrommotoren
DCC-Format

Locomotive Decoder
for DC engines
DCC-Format

Décodeur pour locomotive
avec moteur continu
Format-DCC

Locdecoder
voor gelijkstroommotoren
DCC-format



- **Anleitung**
- **Manual**
- **Mode d'emploi**
- **Handleiding**

Art.-Nr. 22-01-048
Art.-Nr. 22-01-049



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(Pages I to II in the centre of this handbook are removeable.)

How to use this manual

If you have no specialist technical training, this manual gives step-by-step instructions for safe and correct fitting of the module, and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the FAQ chapter. 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 on to another person, please pass on the manual with it.

Intended use



Caution:

Integrated circuits 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.

The module can be used according to the specifications of this manual. It is designed for the mounting in a model railway locomotive with d.c. motor. It evaluates the DCC format data sent by the digital control unit to its address. The decoder controls the vehicle performance (velocity, direction of travel, acceleration), switches the lighting and seven further functions.

The module is not suitable for children under the age of 14.

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

Any other use of the module is inappropriate and invalidates any guarantees.

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

- Do not touch powered, live components.
- Do not touch conducting components which are live due to malfunction.
- Avoid short circuits.
- Do not connect the circuit to a higher voltage than designed.
- Impermissibly high humidity.
- Condensation building up can cause serious injury due to electrical shock.

Take the following precautions to prevent this danger:

- Never perform wiring on a powered module.
- Only use low power for this module as described in this manual and only use certified transformers.
- Connect transformers and soldering stations only in approved mains sockets installed by an authorised electrician.
- Observe cable diameter requirements.
- Assembling the kit should only be done in closed, clean, dry rooms. Beware of humidity.
- If the humidity in the room is too high, please do not start working until after a minimum of 2 hours of acclimatisation.
- 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 life-threatening fire, burns and toxic smoke. Connect your soldering iron or soldering station only when actually needed. Use the correct soldering iron or station and 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.

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.

Little children can swallow small components with sharp edges. Life threatening! 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.

EMC declaration

This product is developed in accordance with the European standards EN 55014 and EN 50082-1, tested corresponding to the EC - directive 89/336/EEG (EMVG of 09/11/1992, electromagnetic tolerance) and meets legal requirements.

To guarantee the electromagnetic tolerance 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, circuit diagram and PCB layout included with this manual.
- Use only original spare parts if you have to repair the kit or the ready-built module.

Information: Speed mode

Digital control units for DCC format can send 14, 28 or 128 speed levels depending on the model and the settings. The number of speed levels sent by the digital control unit (=speed mode) must be set at the decoder as well.

The speed mode set at the digital control unit for a particular locomotive address must correspond to the speed mode saved in the locomotive decoder. Otherwise the performance of the locomotive may be incorrect.

Information: Configuration variables (CVs)

You can set the so-called configuration variables of the decoder from the central unit. The programming of the variables allows the adjustment of the decoder to the particular driving characteristics of the locomotive and to the individual needs of the user.

The configuration variables are saved in the decoder and are also preserved if the locomotive is switched off. Changing the configuration variables is possible at any time from the digital control unit.

The configuration variables for the DCC format are standardised. The variables that can be set depend on the decoder type.

Operation overview

The decoder is designed for operation in DCC format and can be adjusted to one of 127 basic addresses or to one of 10.239 extended addresses. It evaluates the digital data sent by the central unit to its address and transmits it to the locomotive. It is designed to be controlled from digital control units that are set on the 14- or the 28-speed mode.

The configuration variables of the LD-G-5

The following configuration variables (CVs) can be set from the digital control unit:

- Basic address (CV 1)
- Starting voltage (CV 2)
- Acceleration rate (CV 3)
- Braking rate (CV 4)
- Maximum voltage (CV 5)
- PWM-Period (CV 9)
- Extended address (CV 17 and CV 18)
- Consist-Address (CV 19)
- Configuration data 1 (CV 29)
- Operation of the outputs X4 and X5 (CV 56): lighting according to the direction of travel for forward and reverse motion or a fixed light.

The locomotive decoder outputs

The locomotive decoder has seven outputs that can be connected to accessories that have a current consumption of maximum 500 mA each.

Caution:

The maximum total current of all connected loads including the motor is 3A!

| | |
|------------|---|
| Output X4 | Light forward motion |
| Output X5 | Light reverse motion |
| Output X6 | Optional accessory, switched via function F1 |
| Output X7 | Optional accessory, switched via function F2 |
| Output X8 | Optional accessory, switched via function F4 |
| Output X9 | Optional accessory, switched via function F6 |
| Output X10 | Optional accessory, switched via function F5 |

Function F0 (Light)

The lights for forward and reverse motion can be switched from the digital control unit. You can either set the lighting according to the direction of travel or a fixed light for both directions of travel by programming the configuration variable CV 56.

Functions F1, F2, F4 to F6

These functions allow accessories connected to the assigned outputs to be switched on or off. They are intended for optional accessories (e.g. smoke generator, cab lighting, sound module).

Function F3

The Function **F3** allows the switching to the shunting gear. This facilitates a fine speed control for shunting operations at low speeds. Higher speeds are not possible in this mode.

Technical specifications

| | |
|--|----------------------------|
| Data format | DCC |
| Supply voltage | 12-24 Volt digital voltage |
| Current consumption (without connected loads) | ca. 10 mA |
| Max. current for motor | 3 A |
| Max. current per function output | 500 mA |
| Max. total current | 3 A |
| Protected to | IP 00 |
| Ambient temperature in use | 0 - + 60° C |
| Ambient temperature in storage | -10 - + 80° C |
| Comparative humidity allowed | max. 85 % |
| Dimensions | ca. 27 x 18 x 8 mm |
| Weight | ca. 5 g |

Checking the package contents

Check the contents of the package for completeness:

- 1 module resp. 1 module with soldered NEM 652 interface connector
- 1 manual

Required tools and consumables

Make sure you have the following tools, equipment and materials ready for use:

- a heat-resistant mat
- a soldering iron stand with tip-cleaning sponge
- a small side cutter and wire stripper
- an electronic soldering iron (max. 30 Watt) with a fine tip
- tin solder (0,5 mm diameter)

- wire, diameter: $\geq 0,08 \text{ mm}^2$ up to a current of 1 A
resp. $\geq 0,22 \text{ mm}^2$ (from a current of more than 1 A)
- When the total current consumption is more than 1,5 A:
a heat sink, e.g. a SMD heat sink with a base of 7 x 19 mm

Safe and correct soldering



Caution:

Incorrect soldering can cause fires (through excessive heat). Avoid this danger by reading the chapter **Safety instructions** again and following the directions given.

If you have had training in soldering you can skip this chapter.

- When soldering electronic circuits never use soldering-water or soldering grease. They contain acids that can corrode components and copper tracks.
- Only use tin solder SN 60 Pb (i.e. 60 % tin, 40 % lead) with rosin-based flux.
- Solder fast: long soldering can destroy components and copper tracks, and damages through plated holes.
- Use a small soldering iron with max. 30 Watt. Keep the soldering tip clean so the heat of the soldering iron is applied to the solder point effectively.
- Apply the soldering tip to the soldering spot in such a way that the part and the soldering spot are heated at the same time. Simultaneously add solder (not too much). As soon as the solder becomes liquid take it away. Hold the soldering tip at the spot for a few seconds so that the tin solder finds its way, then remove the soldering iron.
- Do not move the component for about 5 seconds after soldering. A glossy and perfect soldering spot should remain.
- To make a good soldering joint you must use a clean and unoxidised soldering tip. Clean the soldering tip with a damp piece of cloth, a damp sponge or a piece of silicon cloth.

Performing a visual check

Damaged materials can cause injury. Parts damaged during transit can also be dangerous. Check the module for damage, missing parts or poor soldering. If you find damage, return the module for exchange.

Mounting the locomotive decoder

Open the locomotive housing. Locate the position for the decoder. Take into account the room needed for the heat sink, if necessary. Disconnect the motor from the rail current collector respectively the change-over switch from the motor and rails if you have a locomotive with electronic change-over switch.



Caution:

The interference suppression devices mounted to the motor or the connecting wire must not be removed! Motor and interference suppression devices are one unit. If even one part is removed, it can cause extreme interference!

Connecting

Follow the connections diagrams (fig. 1a and 1b)!

Solder the connections to the rails at points X1 and X2 and the connections to the motor at the points X11 and X12.

Connecting the lighting

Follow the connections diagrams (fig. 1a and 1b)!

Disconnect any existing diodes in the leads to the lamps. Connect the lamps for forward motion to X4 and the lamps for reverse to point X5. If the lamps are already connected with one side to locomotive ground, you should solder a diode between the decoder and the lamp (fig. 1b). If not, connect the second side of the lamps to the return conductor (point X3) according to fig. 1a.

Connecting other accessories

Follow the connections diagrams (fig. 1a and 1b)!

Connect the accessories that are to be switched via the functions F1, F2 and F4 to F6 to the assigned points. Connect the accessories' second line to the return conductor for all functions (point X3).



Caution:

The return conductor for all functions (point X3) should under no circumstances be connected to locomotive ground. Possible short circuit! The locomotive decoder will be damaged in operation.



Caution:

You should always insulate loads that are connected to the return conductor (point X3). The loads should not make contact with metal parts of the locomotive. This can cause short circuiting and resulting damage to the locomotive decoder!

Connecting the LEDs

The function outputs of the locomotive decoder switch against decoder ground. For that reason you must connect the cathode (-) of the LED to the output of the relevant function.



Caution:

If you use light-emitting diodes (LEDs) you must always operate them via a series resistor.

LEDs are available in many different models. There are LEDs with 2-5 mA, but also LEDs with 15-30 mA power consumption. The series resistor limits the current flow of the LED and will need to be calculated for each model. Ask for the max current rating when buying your LEDs.

You can connect several LEDs in parallel to each output. In this case every LED must have a series resistor of its own. If you connect several LEDs to one output in series, only one series resistor is needed. The number of LEDs connected in series to one output depends on the digital voltage.

You can determine the number of the LEDs that can be connected in series to one output from the following formula:

$$\boxed{(\text{number of LEDs} + 2) \times 1,5 < \text{digital voltage}}$$

Fixing the locomotive decoder

After completing all connections fix the locomotive decoder with double-sided adhesive tape, for example.



Caution:

The locomotive decoder can get warm during operation. For that reason it should not be fixed with shrinking hose or hot adhesive.



Caution:

When the total current consumption is more than 1,5 A you should cool the decoder. As a heat sink you could use a SMD heat sink with a base of 7 x 19 mm. Fix the heat sink on the diodes D1 to D4, using an appropriate glue (e.g. super glue). Take care that the heat sink does not contact the adjoining IC1. Risk of short circuit!

Using an NEM 652 interface connector

Some locomotives already have an NEM 652 interface connector mounted. Using a convenient connecting plug you save disconnecting the connections and you do not need to solder at the locomotive.

The list shows how to connect the contacts of the interface connector to the connecting points of the locomotive decoder.

| Contact | Connection | Colour of cable | Connecting points |
|---------|--|-----------------|-------------------|
| 1 | Motor connection 1 | orange | X11 |
| 2 | Lighting back (-) | yellow | X5 |
| 3 | Not used or F1 | green | X6 |
| 4 | Power supply left | black | X1 |
| 5 | Motor connection 2 | grey | X12 |
| 6 | Lighting front (-) | white | X4 |
| 7 | Common conductor for all functions (+) | blue | X3 |
| 8 | Power supply right | red | X2 |



Attention:

When the current intensity is higher than 1A, the the wires should have a diameter of at least 0,22 mm². This is especially important in the wiring of the rail current collectors and the motor.

Programming the locomotive decoder

The locomotive decoder is programmed from the digital central. See chapter in the manual of your digital control unit where the programming of configuration variables (CVs) is explained.

You can programm the following locomotive decoder variables:

| CV-name | CV-no. | input value / (state of delivery) | remarks |
|-------------------|--------|-----------------------------------|---|
| Basic address | 1 | 1 ... 127 (3) | |
| Starting voltage | 2 | 0 ... 255 (10) | = the voltage to be output to the motor at speed level 1. The value "0" corresponds to 0 Volt, the value "255" to the max. voltage. |
| Acceleration rate | 3 | 1 ... 255 (1) | = length of the delay before the switching to the next higher speed level when the locomotive is accelerating The delay is calculated as follows: (value of CV#3) x 0,9 sec. / number of speed levels |
| Braking rate | 4 | 1 ... 255 (1) | = length of the delay before the switching to the next lower speed level when the locomotive is braking. The delay is calculated as described in CV#3. |
| Maximum voltage | 5 | 2 ... 255 (255) | = the voltage to be output to the motor at the highest speed level. The value "2" corresponds to 0,8 %, the value "255" to 100 % of the max. voltage. |

| CV-name | CV-no. | input value / (state of delivery) | remarks | | | | | | | | | | | | | | | | | | |
|----------------------|----------|-----------------------------------|--|-----------------|--|----------------------|-------|-------------------|-------|-----------------|--------|-----------------|--------|-----------------|--------|-------------------|-------|-----|-------|-----|-------|
| PWM-period | 9 | 160 .. 167 (165) | value of CV#9 <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">frequency</td> <td></td> </tr> <tr> <td style="text-align: right;">160</td> <td>2 kHz</td> </tr> <tr> <td style="text-align: right;">161</td> <td>1 kHz</td> </tr> <tr> <td style="text-align: right;">162</td> <td>500 Hz</td> </tr> <tr> <td style="text-align: right;">163</td> <td>250 Hz</td> </tr> <tr> <td style="text-align: right;">164</td> <td>125 Hz</td> </tr> <tr> <td style="text-align: right;">165</td> <td>62 Hz</td> </tr> <tr> <td style="text-align: right;">166</td> <td>31 Hz</td> </tr> <tr> <td style="text-align: right;">167</td> <td>15 Hz</td> </tr> </table> | frequency | | 160 | 2 kHz | 161 | 1 kHz | 162 | 500 Hz | 163 | 250 Hz | 164 | 125 Hz | 165 | 62 Hz | 166 | 31 Hz | 167 | 15 Hz |
| frequency | | | | | | | | | | | | | | | | | | | | | |
| 160 | 2 kHz | | | | | | | | | | | | | | | | | | | | |
| 161 | 1 kHz | | | | | | | | | | | | | | | | | | | | |
| 162 | 500 Hz | | | | | | | | | | | | | | | | | | | | |
| 163 | 250 Hz | | | | | | | | | | | | | | | | | | | | |
| 164 | 125 Hz | | | | | | | | | | | | | | | | | | | | |
| 165 | 62 Hz | | | | | | | | | | | | | | | | | | | | |
| 166 | 31 Hz | | | | | | | | | | | | | | | | | | | | |
| 167 | 15 Hz | | | | | | | | | | | | | | | | | | | | |
| Extended adress | 17 18 | 1 ... 10239 (-) | | | | | | | | | | | | | | | | | | | |
| Consist-address | 19 | 1 ... 127 (0) | = 2. address | | | | | | | | | | | | | | | | | | |
| Configuration data 1 | 29 | 0,1,2,3,32,33, 34 or 35 (2) | This data is set by entering the sum of the numerical values. <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Numerical value</td> <td></td> </tr> <tr> <td style="text-align: right;">direction "standard"</td> <td>0</td> </tr> <tr> <td style="text-align: right;">reverse direction</td> <td>1</td> </tr> <tr> <td style="text-align: right;">14 speed levels</td> <td>0</td> </tr> <tr> <td style="text-align: right;">28 speed levels</td> <td>2</td> </tr> <tr> <td style="text-align: right;">Basic addresses</td> <td>0</td> </tr> <tr> <td style="text-align: right;">Extended adresses</td> <td>32</td> </tr> </table> | Numerical value | | direction "standard" | 0 | reverse direction | 1 | 14 speed levels | 0 | 28 speed levels | 2 | Basic addresses | 0 | Extended adresses | 32 | | | | |
| Numerical value | | | | | | | | | | | | | | | | | | | | | |
| direction "standard" | 0 | | | | | | | | | | | | | | | | | | | | |
| reverse direction | 1 | | | | | | | | | | | | | | | | | | | | |
| 14 speed levels | 0 | | | | | | | | | | | | | | | | | | | | |
| 28 speed levels | 2 | | | | | | | | | | | | | | | | | | | | |
| Basic addresses | 0 | | | | | | | | | | | | | | | | | | | | |
| Extended adresses | 32 | | | | | | | | | | | | | | | | | | | | |

| CV-name | CV-no. | input value / (state of delivery) | remarks |
|------------------------------------|--------|-----------------------------------|---|
| Operation of the outputs X4 and X5 | 56 | 0 or 1 (1) | This data is set by entering the sum of the numerical values. <div style="text-align: right;">Numerical value</div> Constant light 0 Lighting according to direction of travel 1 |

Operation

Track sections with bad contacts (e.g. some types of points) may give an unsatisfactory performance. You can improve the locomotive performance by soldering a capacitor $\geq 100 \mu\text{F} / 35 \text{V}$ to the points X3 and X15 (see fig. 1a and 1b).

FAQ

- Parts are getting too hot and/or start to smoke.



Disconnect the system from the mains immediately!

Possible cause: one or more connections are soldered incorrectly.

→ Check the connections.

Possible cause: The connection of the motor is connected to locomotive ground.

→ Disconnect the connection from locomotive ground.

- The locomotive lighting does not correspond to its direction of travel.

Possible cause: The forward and reverse light connections have been exchanged.

→ Check the connections.

Possible cause: The connections of the motor to the points X11 and X12 have been exchanged.

→ Exchange the connections.

- The lighting goes on and off when the speed levels are turned up or the lighting cannot be switched on or off.

Possible cause: The speed mode of the decoder and the digital control unit do not correspond. Example: The central is set to the mode 28 speed levels, but the decoder to the mode 14 speed levels.

→ Change the speed mode at the central and / or at the decoder.

If you cannot find the problem, please return the decoder for repair (address on the cover page).

Manufacturer's note

According to DIN VDE 0869, the person who builds this kit or brings the circuit into operation is the manufacturer of the product. If he sells the product to another person he is responsible for passing on all the relevant papers. Domestic appliances assembled from a kit are deemed industrial products and must comply with health and safety regulations.

Certification

This product conforms with the EC- directive 89/336/EEG on electromagnetic radiation and is therefore CE certified.

Conditional warranty

This product is guaranteed for two years. The warranty includes free repair if the problem is due to material failure or incorrect assembly of the module by us. We guarantee the quality of the components.

Other claims are excluded. By law, we are not responsible for damages or secondary damages in connection with this product. We retain the

right to repair, make improvements, supply spare parts or return the purchase price.

The following invalidate the warranty:

- using an unsuitable soldering iron, solder containing liquid acids or similar,
- if damage is caused by not following the instructions in this manual or the circuit diagram,
- if the circuit has been altered and repair attempts have failed,
- if arbitrary changes in the circuit are made,
- if parts are stored incorrectly and if the wires to the switches, the power resistors, etc. are made incorrectly,
- if the copper tracks or soldering points are damaged,
- if parts are placed incorrectly or the circuit is connected incorrectly,
- if damage occurs due to an overload of the circuit,
- if the wrong power or current is connected,
- if damaged by other persons,
- if damaged by the wrong use or abuse of the circuit,
- if parts are damaged due to static because they were touched before a discharge is performed.

Anschlußplan - Connections diagram - Schema de connexion - Aansluit plan

■ ■ ■ Fig. 1

Fig. 1a:

Anschluß bei Verwendung des Rückleiters X3
 Connection when using the return conductor X3
 Raccordement des fonctions vi la borne commune X3
 Aansluiten bij gebruik van de retourleiding X3

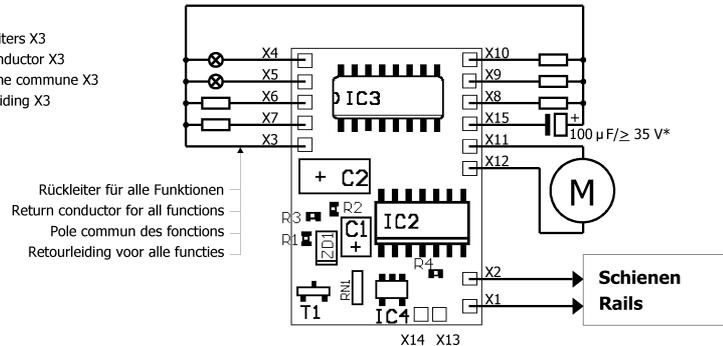
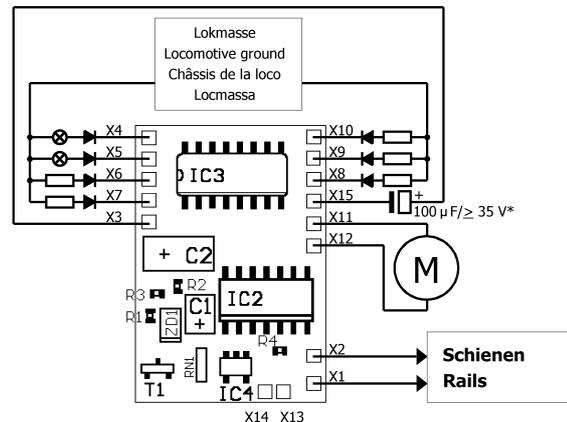


Fig. 1b:

Verbindung des 2. Anschlusses mit Lokmasse
 Connection of the 2nd side to locomotive ground
 Raccordement des fonctions via le châssis de la loco
 Verbinding van de 2e aansluiting met de lokmassa



| X1 / X2 | Schienen / Rails / Rails / Rails |
|-----------|--|
| X3 | Rückleiter für alle Funktionen Return conductor for all functions Pole commun des fonctions Retourleiding voor alle functies |
| X4 | Beleuchtung Vorwärtsfahrt Lighting forward direction Feux marche avant Verlichting vooruitrijden |
| X5 | Beleuchtung Rückwärtsfahrt Lighting reverse direction Feux marche arrière Verlichting achteruitrijden |
| X6 | F1 |
| X7 | F2 |
| X8 | F4 |
| X9 | F6 |
| X10 | F5 |
| X11 / X12 | Motor / Motor / Moteur / Motor |
| X13 / X14 | ohne Belegung / ohne Belegung ohne Belegung / ohne Belegung |
| X15 | Anschluß (-) zusätzl. Kondensator Anschluß (-) zusätzl. Kondensator Anschluß (-) zusätzl. Kondensator Anschluß (-) zusätzl. Kondensator |

| | |
|--|--|
| | Diode 1N4007 oder ähnlich / or similar / ou similaire / of gelijkwaardig |
| | Beliebiger Verbraucher (z.B. Rauchgenerator, Führerstandsbeleuchtung, Geräuschmodul) Optional accessories (e.g. smoke generator, cab lighting, noise module) Consommateurs divers (par ex. fumigène, éclairage cabine, module sonore) Willekeurige verbruiker (b.v. rookgenerator, machinistenhuisverlichting, geluidsmodule) |

| | |
|---|--|
| * | falls erforderlich / if necessary si nécessaire / indien noodzakelijk |
|---|--|

Aktuelle Informationen und Tipps:

Information and tips:

Informations et conseils:

Actuele informatie en tips:

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

Garantie und Service:

Warranty and service:

Garantie et service:

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