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(Pages I to III 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 assembly of the kit or fitting of ready-built modules, 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 kit or the ready-built module can be assembled or fitted using this manual. The ready-built module is designed for use in model railways or landscape models. It controls up to 5 lighting circuits.

The kit and the ready-built module are 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 kit 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.

Operation overview

The heart of the Light Computer is a micro controller (IC). A preset program burnt into the IC repeats constantly, supplying the five outputs with power at different times. Depending on the program, different light patterns are generated through the interaction between the outputs. The select input of the IC is also used. The function differs between the various program versions of the Light-Computer.

LC-1 "Advertising light 1": 5 light bulbs go on one after the other, flash together three times and then go off. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-2 "Advertising light 2": 5 bulbs light up one after the other (running light sequences), then go on together and stay on for approx. 3 seconds. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-3 "Advertising light 3": 5 light bulbs flash in different patterns, apparently random, then go on one after the other and stay on together for approx. 3 seconds. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-4 "Building site flasher": 5 light bulbs generate a running light sequence followed by a short pause. This effect is especially effective if used as an "alley" on both sides of a road. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-5 "Flickering flame": 5 light bulbs together generate an irregular light pattern. If the bulbs are painted with transparent red and yellow varnish, the appearance of a flickering flame results. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-6 "Welding light": Each of the 5 light bulb outputs can control a blue welding light bulb. The light impulses are realistically short and strong. As each of the 5 bulbs generates a pattern of its own, it is possible to "weld" at several different workplaces at the same time (for example in a "shipyard"). There are pauses in the welding process of one or more minutes at irregular intervals. If the input JP2 is switched to earth, the light sequence switches off after the completion of the program. If the contact remains open, the program repeats continuously.

LC-7 "Traffic light control": Traffic light control for a complete intersection. Outputs 1 and 2 are green and red for direction A, outputs 4 and 5 are green and red for direction B. Output 3 is the amber for both but like the real thing, it overlaps with red when changing to green. If the input JP2 is switched to earth, the traffic lights switch to flashing amber. If the contact remains open, the traffic lights operate continuously.

LC-8 "Advertising light 4": Fusion of the advertising lights 1 to 3, coming on one after the other. If the input JP2 is switched to earth, the light sequence switches off after the completion of the three programs. If the contact remains open, the program is repeated constantly.

LC-9 "Ignition module for gas lamps": If the input JP2 is given a short electric pulse (earth), the gas lamps start to flicker and grow brighter gradually. Every ignition process is slightly different. After approx. 5 seconds the gas lamps reach their maximum brightness. During operation, the lamps flicker now and then at different times (variations of gas pressure). After the switch-off impulse, (when the input JP2 is given a short electric pulse) all lamps shine on with moderate brightness and go off completely in approx. 1.5 seconds.

LC-10 "Fluorescent Tube Simulator: If the input JP2 is given a short electric pulse (earth), the different fluorescent tubes flicker for a moment before all of them light one after the other - just like the real thing. The turning on pattern is a little different for each. When the input is switched to earth permanently, a defective tube is simulated on output 5. This tube flickers at irregular intervals, at times brightening quickly, at times slowly.

LC-11 "Occupied house": Two different programs are available. Program 1, "Home", starts if the input JP2 is switched to earth, Program 2, "Office", if the contact remains opens. The programs take approximately 15 minutes and are repeated after a short pause.

Program 1: First the light in the kitchen (output 1) goes on for a while, followed a bit later by the living room (output 2). Output 3 is assigned for connecting a blue light bulb (the TV set), which flickers like a television picture. Some time later the light in the kitchen switches off, and goes on again once during the program flow. The light in the bathroom (output 4) goes on for a short time at irregular intervals. By the end of the program the lights in the bedroom (output 5) and in the bathroom go on for some time, the bulbs connected to outputs 2 and 3 switch off.

Program 2: In the entrance-hall (output 1) the light goes on for a short time at irregular intervals. The offices (or the flats in a multiple family dwelling) are connected to the outputs 2 to 5. The lights in the offices go on one after the other, but only after the light in the entrance hall has previously been switched on. By the end of the program the lights

in the offices switch off one after the other and each time the light in the entrance hall goes on for a short time.

LC-12 "Fairground Attraction Illumination": Each of the 5 outputs can control several connected light bulbs, which form different patterns: they flash in changing sequences, form running lights, flicker irregularly etc. The input JP2 has no function in this version.

LC-13 "Candlelight simulator": After switching on the module the "candles" start to flicker - just like the real thing. At irregular intervals they brighten and dim. The input JP2 has no function in this version.

LC-14 "Signal tower box light": The 5 outputs switch at random the connected bulbs or LEDs. These light for a while and simulate the activities in a signal tower box. The input JP2 has no function in this version.

LC-15 "Emergency vehicle light": The bulbs / LEDs connected to the 5 outputs make 2 short flashes and then go off for a short time. The breaks between the double flashes are of varying duration for the five outputs. This way the characteristic light pattern for modern emergency vehicles is created. The input JP2 has no function in this version.

Further versions of the Light Computer are in preparation.

Technical specifications

Supply voltage	10-18 Volt AC or DC
Current consumption (without bulbs)	ca. 20 mA
Max. current loading	100 mA
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. 25 x 29,5 mm
Weight	ca. 3 g

Choosing a power supply

The module is designed for connection to 10-18 Volt direct (d.c.) or alternating (a.c.) voltage.

Checking the package contents

Check the contents of the package for completeness:

- 1 kit, containing the components listed in the parts list and 1 PCB or
- 1 ready-built module and socket pins,
- 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
- a pair of tweezers and long nose pliers (not necessary for the ready-built module)

- an electronic soldering iron (max. 30 Watt) with a fine tip
- tin solder (0,5 mm. diameter)
- wire (diameter: $\geq 0,22 \text{ mm}^2$ for all connections)

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.
- Observe correct polarity orientation of semi-conductors, LEDs electrolytic capacitors and integrated circuits before soldering and ensure that the solder time does not exceed 5 seconds, otherwise components can be damaged.
- 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.
- Cut the wires after soldering directly above the PCB solder side with a side cutter.
- After placing the parts, please double check for correct polarity. Check the PCB tracks for solder bridges, short circuits created by accident. This would cause faulty operation or, in the worst case, damage. You can remove excess solder by putting a clean soldering tip on the spot. The solder will become liquid again and flow from the soldering spot to the soldering tip.

Assembling the kit

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

Preparation

Put the sorted components in front of you on your workbench. An explanation of the separate electronic components follows:

Resistors



A resistor will "brake" the current. Mounting orientation is of no importance. Because resistors are very small there is no readable information on them, but their value is given with colour rings.

Key:

Value	Colour ring
1 k Ω	brown - black - red (gold)
10 k Ω	brown - black - orange (gold)

The colour ring in brackets indicates the tolerance of the resistor and is of no importance here.

Diodes



Diodes allow current to flow in one direction only and have to be placed in that direction. The characteristic for a diode is the ring at one end. Place them as drawn in the PCB layout.

Capacitors



There is a difference between "normal" capacitors and electrolytic capacitors which have to be placed in a certain direction. They have a very bright line at one end marked with the minus (-) sign. That end must always be connected to minus.

Transistors



Transistors are in fact power switches. They have three wires and a flat part on the body. They also have to be placed in a certain direction. The PCB layout will help you to place the transistor. In the layout, the flat part of the transistor is shown.



ICs:

The notch on the IC shows the mounting orientation. The PCB layout shows this marking.

Assembling the kit

Start the assembly by inserting and soldering the IC. The IC must be mounted according to the marking on the PCB.



Caution:

Do not touch the IC without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" of the IC.

Continue the assembly with resistors and diodes. First solder the components on the solder side of the PCB and cut the excess wires with the side cutter as short as possible. Then solder the transistors and finally the capacitors.



Caution:

Electrolytic capacitors, transistors, ICs and diodes must be placed in the right direction! If you solder them the wrong way the affected parts can be damaged when you connect the power. In the worst case the whole circuit can be damaged. In any case, a wrongly connected part will not function.

Performing a visual check

Even if you have a ready-built module you must perform a visual check that screws, plugs and other fasteners are firm and tight to exclude transport damage.

Caution:

Do not power up the module yet.

Damaged material and/or incorrect handling of parts can always be a danger. After assembling the kit, perform a visual inspection.

Check all nuts, pins and connections as well as the mechanical connections for correct assembly.

Remove all loose parts, wire ends or drops of solder from the PCB.

Remove all sharp wire ends.

Check solder spots that are too close to each other for short circuits.

Check that all components are polarised correctly. When you have taken all these precautions, go on to the next part.

Soldering connecting cables

Solder the connection wires directly to the holes of the PCB. It is also possible to use PCP solder pins and solder them in the holes (see accessories). PCP solder pins are used in our ready-built modules and you can use socket pins to make the connections. The advantage of this is that you can connect and disconnect the circuit very quickly.

Functional test

If you have purchased a ready-built module, check all functions. Transport damage can never be excluded.

Caution:

Do not connect light bulbs or lamps yet.

Connect the light computer to the power supply voltage only for a functional test. Check that components are not getting too hot. The resistor R6 may get warm, but this is harmless.

 **Caution:**

If a component gets too hot, disconnect the light computer and power supply from the mains **immediately**. Possible short circuit! Check the assembly.

After a successful function test, disconnect power from the light computer and continue with the remaining connections.

Connecting the Light Computer

Connection to a.c. or d.c. voltage

Connect one side of the lamps to the corresponding outputs 1-5. The maximum current of 100 mA per output is normally sufficient for the connection of 1 or 2 light bulbs. (The power of the light bulbs is often noted on the base of the lamps.) Connect the common connection of the lamps to JP4. (See fig. 2).

Connecting a push button or switch

A push button or a switch can be used to switch the light computer on and off. Connect one side to Pin JP-2 und with the other to earth. (See. Fig. 2). Push button and switch are not included in the package.

Connection of LEDs

 **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 up to 5 LEDs in parallel to each output (see Fig.3). 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. You can find out the number of the LEDs that can be connected in series to one output from the following formula:

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

FAQ

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



Disconnect the system from the mains immediately!

Possible cause: one or more components are soldered incorrectly.

→ Perform a visual check.

- The lamps connected to the module do not light.

Possible cause: one or more components are soldered incorrectly.

→ Perform a visual check.

Possible cause: A switch connected to the module is closed.

→ Check the position of switches.

If you cannot find the problem, please return the light computer 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/EWG 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 ready-built module by us. Because we have no control over the assembly of the kit, we can only guarantee the quality of the components and the completeness of the kit.

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 the kit is assembled and soldered poorly, or 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 parts other than the original ones delivered with this kit are used,
- 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.

Stückliste - Parts list

Nomenclature - Stuklijst

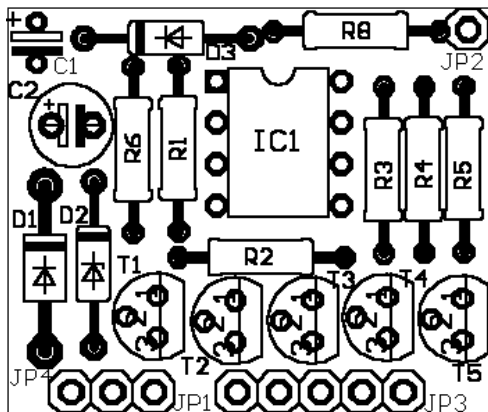
Kondensatoren - Condensers Condensateurs - Condensatoren	C1, C2	100 μ F/25V
Dioden - Diodes	D1	1N4002 *
	D3	1N4148 *
Zener-Dioden - Zener diodes Diodes Zener -Zenerdiodes	D2	ZD 5,1 V
Transistoren - Transistors	T1 - T5	BC547B *
Widerstände - Resistors Résistances - Weerstanden	R1 - R5	10 k Ω
	R6, R8	1 k Ω
Micro-Controller - Micro-contrôleur	IC1	12C508A

* oder ähnlich - or similar - ou équivalent - of gelijkwaardig

Bestückungsplan - PCB layout

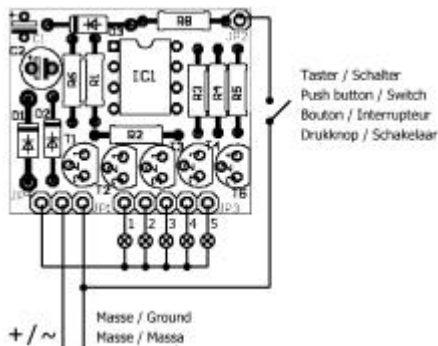
Plan d'implantation - Printplan

■ ■ ■ Fig. 1



Anschlußplan - Connections

Plan de raccordement - Aansluit plan ■ ■ ■ Fig. 2



Anschluß von LED's - Connection of LEDs

Connexion des DEL - Aansluiten van leds ■ ■ ■ Fig. 3

Ausgang 1: Paralleler Anschluß von Leuchtdioden

Ausgang 5: Serieller Anschluß von Leuchtdioden

Output 1: Parallel connection of LEDs

Output 5: Serial connection of LEDs

Sortie 1: DEL montées en parallèle

Sortie 5: DEL montées en série

Uitgang 1: Paralele aansluiting van lichtdiodes

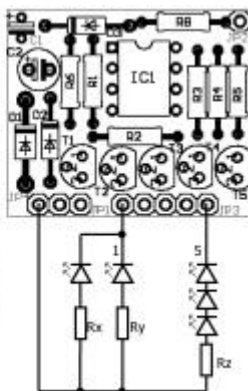
Uitgang 5: Serieële aansluiting van lichtdiodes

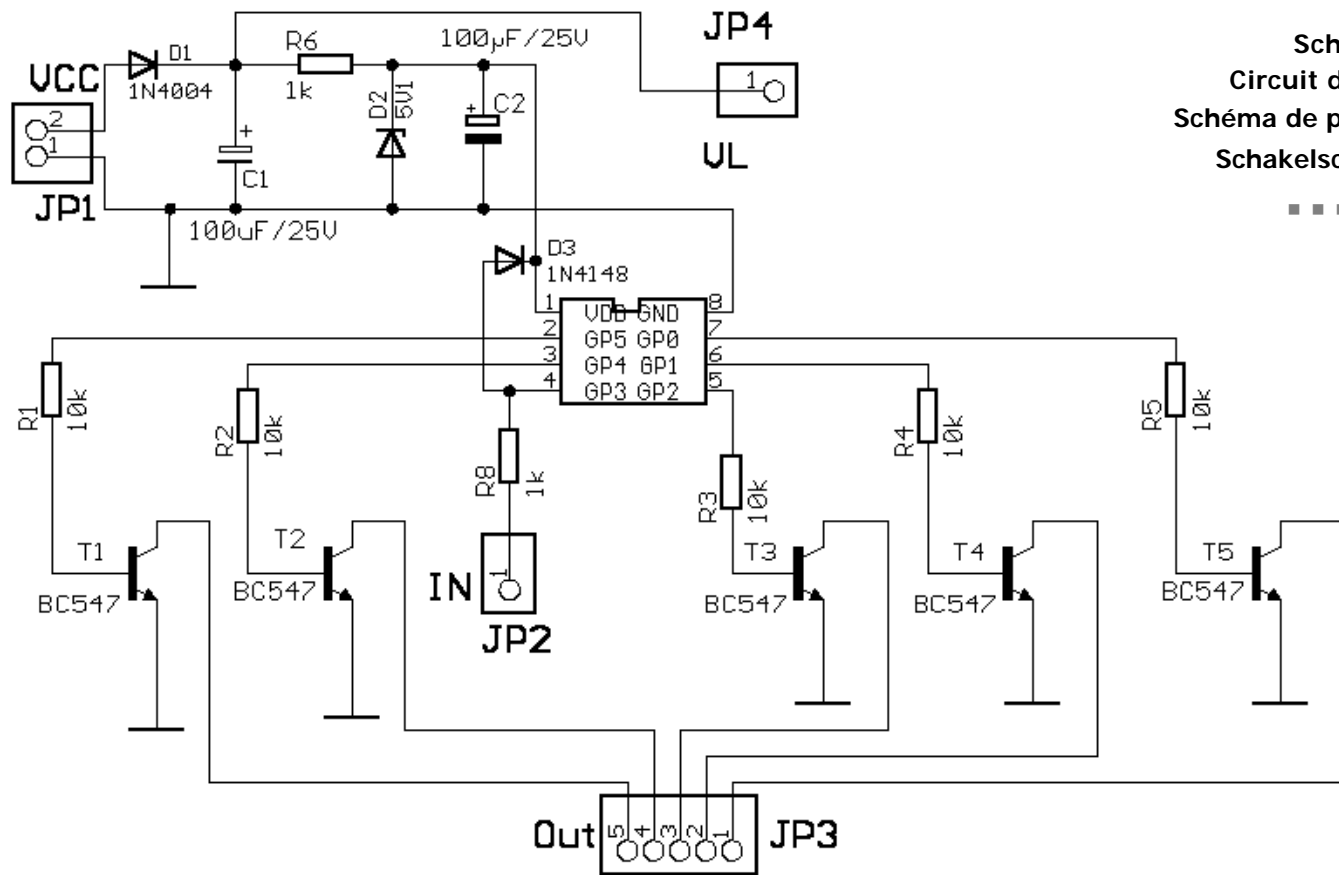
Rx, Ry, Rz = Vorwiderstand

Rx, Ry, Rz = series resistor

Rx, Ry, Rz = résistance

Rx, Ry, Rz = Voorschakelweerstand





Schaltplan
 Circuit diagram
 Schéma de principe
 Schakelschema

■ ■ ■ Fig. 4

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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