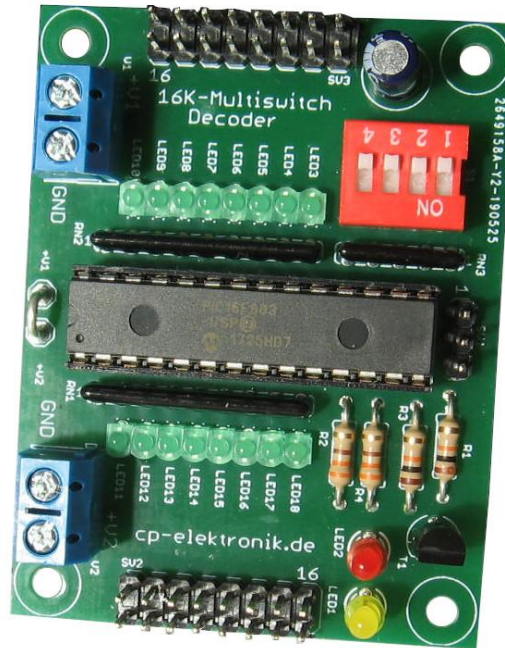




16-channel multiswitch decoder

Assembly and operating instructions



When properly installed, the product complies with national and European directives.

Safety instructions

Intended use

Warnings

Product description

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- Necessary basic knowledge
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Safety instructions

- *Read this manual completely and carefully before installing or operating this module. Keep this manual for future reference.*
- *The module must not be operated on mains voltage (230 V). There is a danger to life!*

- *Under load, the power transistors can become very hot. Caution when touching! Danger of burns!*
- *If the module is overloaded, there is a risk of fire due to high heat generation!*
- *The valid VDE regulations must be observed.*
- *The module must be protected from moisture, splash water and heat.*
- *The module is not a toy! Keep the device away from children.*
- *Do not use the module if it is damaged.*
- *Do not operate the module in an environment where flammable gases, vapors or dust are present.*
- *Repairs may only be carried out by a specialist.*
- *Faulty switching functions can never be completely ruled out due to transmission errors of the remote control or software/hardware errors in the module. Always operate the module and its functional model in such a way that such faulty switching cannot cause any danger to you or third parties.*

Intended use

The intended use of the module is the switching of resistive loads in the field of RC functional model building with a max. current consumption of 2 A at a max. voltage of 24 V.

The module is connected to a remote control receiver.

Warnings

- Inductive loads must be operated with a protective diode. Otherwise there is a risk of electric shock and damage to the module.
- Basic knowledge of electrical engineering is required to connect consumers.
- Never operate the module outside the power limits, not even for a short time. The voltage to be switched must not exceed 24 V, the current to be switched per channel must not exceed 2 A. The maximum total load capacity with several loads switched on simultaneously is 5 A.
- Always ensure that the polarity is correct. If loads are connected with reversed polarity, both the load and the module may be damaged (risk of short circuit - risk of fire or electric shock).
- Only connect the module to remote control receivers. Observe the polarity here as well!
- Do not operate the module if external damage is visible.

Product description

The 16-channel Multiswitch Decoder is connected to the remote control receiver and switches 16 different loads (light bulbs, LEDs, sirens, small electric motors, ...) on or off independently of each other via a switching or proportional channel of the remote control. Prerequisite for operation is a suitable 16-channel Multiswitch Encoder in the remote control transmitter:

- cp-elektronik Encoder
- Futaba 8084 Encoder
- Graupner 4108 Encoder
- Graupner transmitter with activated multi-channel.

For all switching functions there is a visual switching control by LED.

Structure

Please check the kit for completeness using the parts list before assembly. If a component is missing, please contact cp-elektronik (contact details on the last page of this manual).

Parts list

Number	Designation	Value	Component
1			Printed circuit board for the 16-channel multiswitch decoder
1	C1	100 nF	SMD multilayer capacitor, type 1206
1	C2	47 μ F	Elko, RM 2.5 mm
1	IC1	PIC 16F883	programmed microcontroller Housing: 28-pin SDIP
1			28-pin IC socket SDIP
1	LED1	yellow	Light emitting diode 3 mm
1	LED2	red	Light emitting diode 3 mm
16	LED3 - LED18	green	Light emitting diode 1.8 mm
1	R1	10 k Ω	Carbon film resistor 1/4 W
1	R3	47 k Ω	Carbon film resistor 1/4 W
2	R2, R4	330 Ω	Carbon film resistor 1/4 W
2	RN1, RN2	270 Ω	Resistor network, star-shaped 8 resistors, 9 pins
1	RN3	47 k Ω	Resistor network, star-shaped 4 resistors, 5 pins
1	S1		DIP switch, 4-pin
1	SV1		3-pin male connector RM 2.54 mm for patch cable Receiver connection
2	SV2, SV3		2 x 8-pin male connector RM 2.54 mm

			for consumer connection
1	T1	BC 547 B	NPN transistor, TO92 package
8	T2 - T9	IRF 7303	Dual N-channel MOSFET power transistor, SOIC8 package
2	V1, V2		Connection terminal, 2-pole, RM 5 mm for external supply of the consumers

The connection or mounting of the module in the model is at your own discretion. The following components (not included in the kit) are recommended:

Number	Designation	Article no. (shop.cp-elektronik.de)
1	3-pin servo patch cable with 2.54 mm socket on both ends, suitable for receiver	CAB-002 (Futaba plug-in system) or CAB-003 (plug-in system Graupner/JR)
16	Connection cable for consumers with 2-pin socket 2.54 mm; Wire cross-section 0.14 mm ²	CAB-004
4	Cylinder head screws M3x16 incl. M3 nuts	FIT-001
4	Spacer sleeves 5 mm	

Necessary basic knowledge

For the construction of the circuit, basic knowledge of the correct handling of the components is assumed. You should also have some practice in soldering electronic components.

Components in MOS technology (microcontrollers, MOSFET transistors) are sensitive to static electricity and can easily be destroyed when touched! Before touching these components, you should therefore ground yourself (e.g. via a water pipe, a heater or a metal housing of an electrical device connected to the protective conductor of the house installation).

Notes on the structure

- Work absolutely conscientiously when soldering and wiring.
- Take your time with each solder joint and make sure that there are no cold solder joints.

- Use an adjustable soldering station or a small soldering iron with a power of max. 30 Watt with a small soldering tip for soldering.
- Semiconductors are sensitive to heat. Do not solder too long on one pin (max. approx. 3 seconds). If necessary, let the component cool down again in between.
- The use of leaded solder (Sn60Pb40) makes soldering easier for the beginner. If the requirements of the RoHS directive are to be met, only lead-free solder may be used.
- For some components it is necessary to pay attention to the correct polarity or orientation. In these cases, this is indicated in the text.

Wired components

The connecting wires of wired components are inserted from the side with the placement imprint through the corresponding holes of the PCB and soldered on the track side.

Components with axial connection wires, such as resistors or diodes, are bent beforehand to the appropriate pitch. The use of a bending gauge is recommended for this purpose. It allows the exact bending in the grid dimensions 7.5/10/12.5/15/17.5 mm. For resistors, a grid dimension of 10 mm applies unless otherwise specified.

After soldering, the protruding ends of the connecting wires are removed with a side cutter.

Processing of SMD components

SMD components (Surface Mounted Device) are significantly smaller than wired components and therefore save space and weight on the PCB. They are soldered directly onto the track side of the board. If you follow a few rules, they are very easy to process:

- 0.5 mm diameter solder
- suitable soldering iron with small soldering tip
- good light conditions
- Magnifying glass and good visibility
- (SMD-) tweezers for fixing the component
- work with little solder

First apply very little solder to one of the pads on the PCB. Then place the SMD component in the correct position with tweezers and heat the already tinned pad with the soldering iron while holding the component in position with the tweezers and pressing down slightly. This will allow you to tack one terminal of the component to the pad. Then, using a small amount of solder, solder the other connections in place. Finally, re-solder the first connection.

Placement

When assembling the SMD components, follow the assembly plan for the track side, Fig.1.

C1

Start the assembly of the PCB by soldering the SMD capacitor C1 to the PCB track side. Orientation does not have to be observed.

T2 - T7

Now solder the SMD power transistors IRF 7303 to the trace side. Observe the orientation in fig. 1 and 2. One side of the housing is beveled by 45°, pin 1 of the component is located on this side. Often pin 1 is also marked with a small circular mark on the top of the housing.

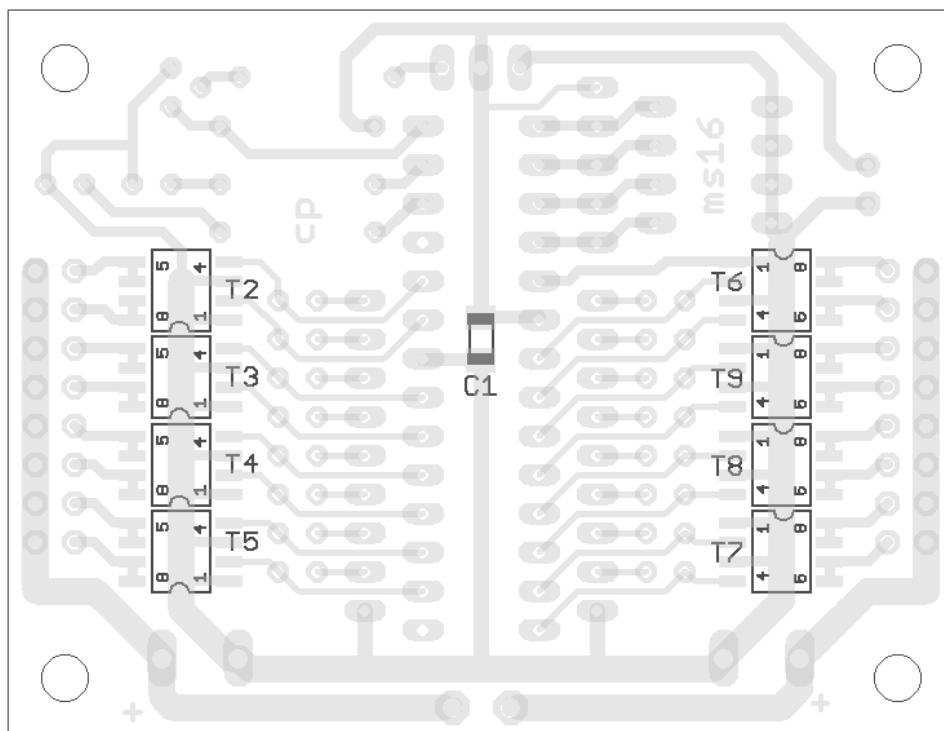


Fig.1 Circuit board layout plan, top view of solder side

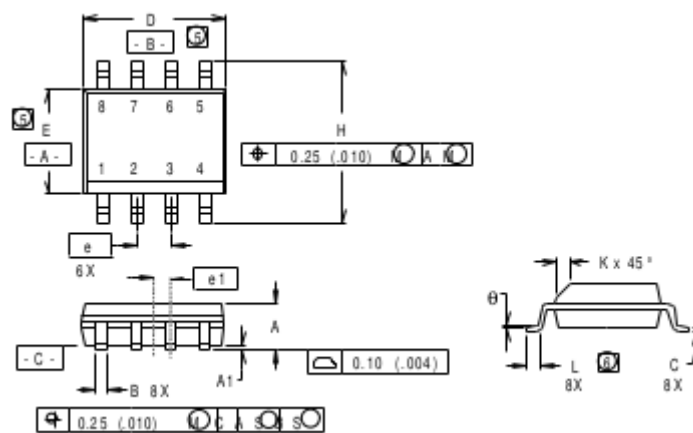


Fig. 2: Location of pin 1 on the IRF 7303 (excerpt from the data sheet © International Rectifier)

The transistors are soldered on so that the beveled edge (and thus pin 1) faces the inside of the PCB.

Now assemble the wired components. Orientate yourself with the help of Fig. 3.

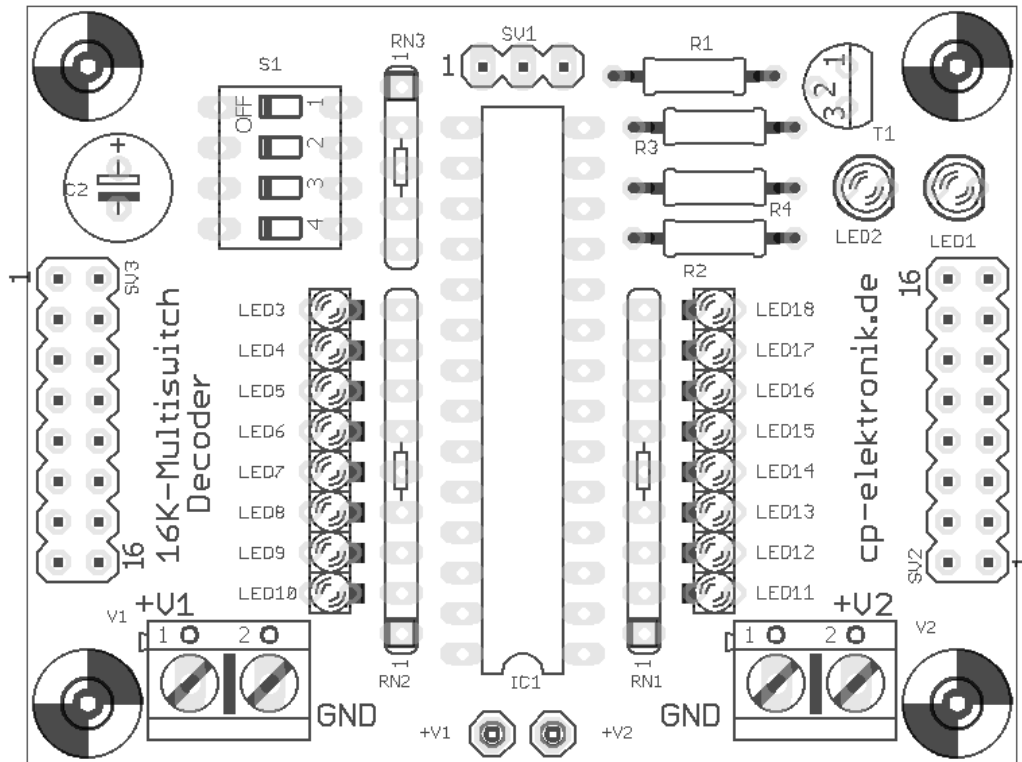


Fig. 3: Position of the wired components on the assembly side of the printed circuit board

Resistors R1 - R4

No orientation needs to be observed for the resistors.

The color code of the resistors is as follows:

- R1: 10 k Ω , brown-black-orange-gold
- R3: 47 k Ω , yellow-purple-orange-gold
- R2, R4: 330 Ω , orange-orange-brown-gold

LEDs LED3 - LED18

Note the orientation of the LED! The connecting wires of the LED are of different lengths.

- the longer connecting leg is the anode (positive pole)
- the shorter connecting leg is the cathode (negative pole)

Solder the LEDs in such a way that the longer connection leg faces the outside of the board and the shorter connection leg faces IC1.

Attention: LEDs are very sensitive to overheating! Keep the soldering time as short as possible and let the LED cool down in between if necessary.

Resistor networks RN1-RN3

Now equip the resistor networks. Orientation must be observed here as well! The networks contain eight or four resistors with one common terminal each. This common terminal is

marked on the housing with a white dot and must always point to the outside of the board, as shown in Fig. 3.

- RN1, RN2: 270 Ω , 9 pins, inscription 271
- RN3: 47 k Ω , 5 pins, inscription 473

Socket for IC1

The socket for the microcontroller has a small notch on one face. This notch must point in the direction of the two solder connections +V1/+V2.

Switch S1

The 8-pin DIP switch S1 contains four individual switches, which are numbered 1 - 4 on the housing. Solder the component in such a way that switch no. 1 (groove on the front side) faces the outside of the board and switch no. 4 faces the inside of the board.

LEDs LED1, LED2

The connecting wires of the LED are of different lengths. The longer of the two wires is the positive terminal of the diode.

- LED1: yellow
- LED2: red

Solder the two LEDs in such a way that the longer connection wire points towards R4 and the shorter connection wire towards the outside of the board.

Transistor T1

Solder the transistor BC 547B so that the flat side of the package faces the outside of the board.

Capacitor C2

C2 is a polarized electrolytic capacitor (electrolytic capacitor)! The negative pole is marked on the housing and must point in the direction of the pin header SV3. The positive pole (longer connecting wire) points towards the outside of the board.

Pin headers SV2 and SV3

The pin headers are used to connect the consumers. It is best to fix the pin headers with a piece of adhesive tape and solder only one pin at first. Then check the position of the pin header and correct it if necessary by heating this pin again. If the pin header is seated correctly, solder the other pins as well.

Pin header SV1

This 3-pin header is used to connect the decoder to the receiver. Again, you can fix the pin header with a strip of tape and solder only one pin at first and the other pins only when the header is properly seated.

Connection terminal V1 and V2

The screw terminals are used to connect an external supply for the consumers. The cable entries must face the outside of the board.

Inserting the microcontroller

Finally, carefully push the programmed microcontroller into the 28-pin socket, making sure not to jam the IC. Pay attention to the notch on the housing, which must point in the direction of the notch on the socket. Often the connector legs of the PIC stick out a bit and are not bent exactly at right angles. Hold the front of the case between the thumb and forefinger of both hands and carefully bend the legs of one side together to a vertical position on a flat surface (table). Repeat the process for the second side. It should now be easy to insert the PIC into the socket.

Connection

Observe the correct polarity for all connections!

Connection at the receiver

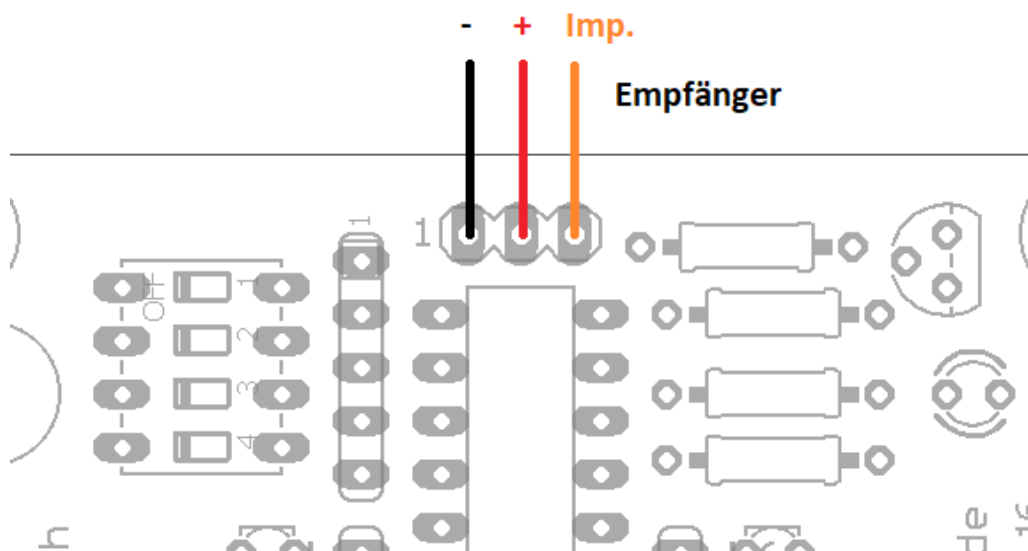


Fig.4: Receiver connection

The module is connected to the receiver like a servo using a 3-pin patch cable (with 3-pin plugs on both sides in 2.54 mm pitch). Suitable patch cables are available as accessories from cp-elektronik.de. When connecting the 3-pin connector to the module, ensure that the polarity is correct. Depending on the connection cable used, the colouring may differ:

	Impulse line	Positive pole	Minus pole
System Graupner	orange	red	brown
System Futaba	white	red	black

Connection of the consumers and the external supply

The consumers are connected via pin headers with 2.54 mm pitch. Suitable 2-pin connection cables are available at cp-elektronik.de.

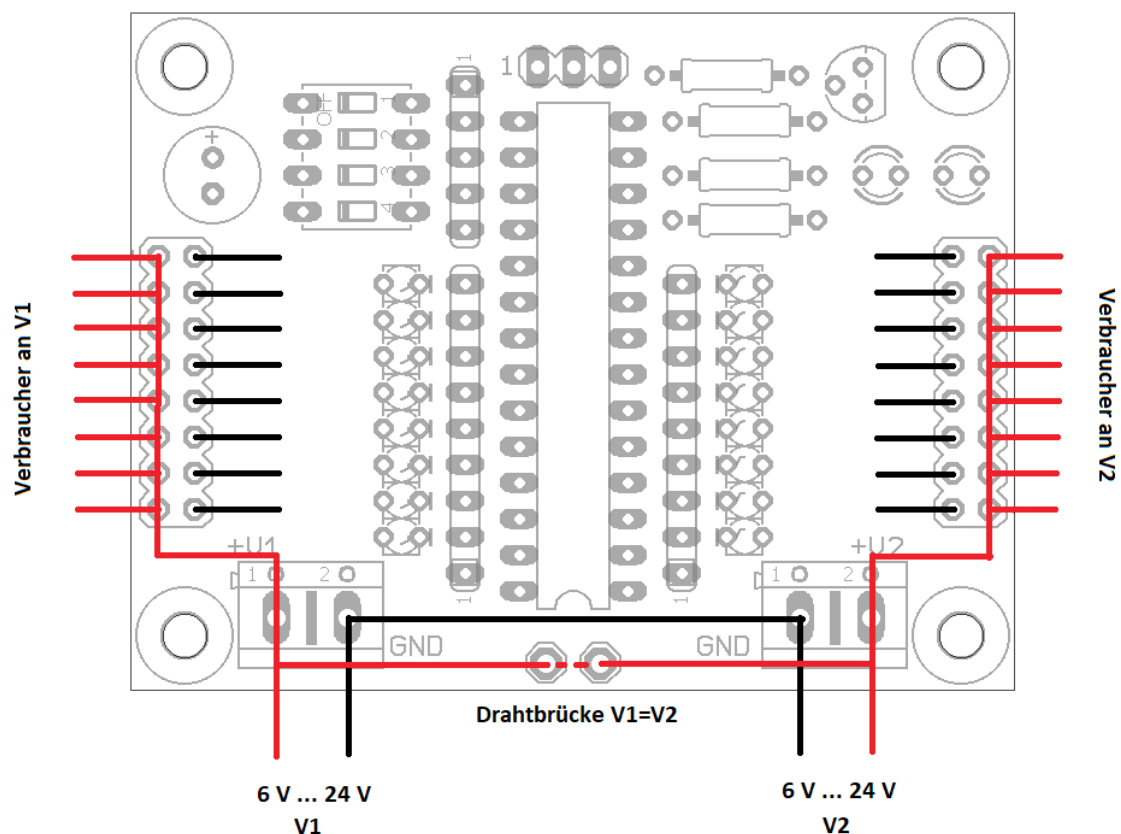


Fig. 5: Connection of consumers and external supply

The loads are connected through to negative and all have a common positive pole. They are supplied from one or two external voltage sources 6 V to 24 V, which is connected on the printed circuit board via a screw terminal.

Fig. 6 shows an example of the connection of an incandescent lamp to an output channel.

When connecting LEDs, please observe the polarity (red: positive pole, black: negative pole) and do not forget a suitable series resistor.

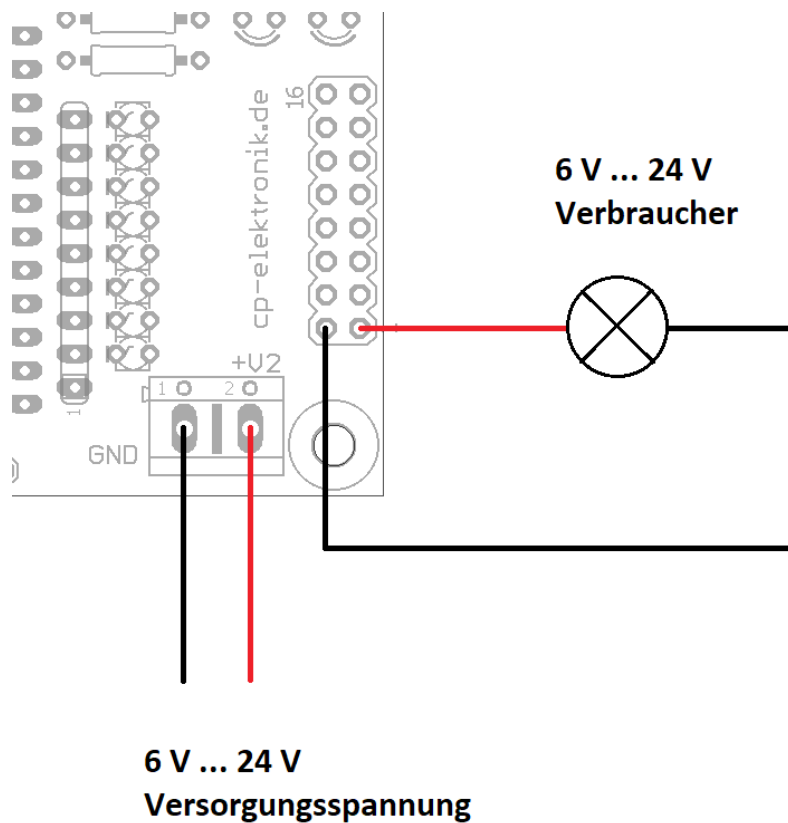


Fig. 6: Connection of a consumer to the decoder

If only one external voltage source is used, the wire bridge can be equipped. All 16 loads are then supplied from this source, which can be connected to V1 or V2.

However, it is also possible to connect two different voltage sources (e.g. with different voltage) to V1 and V2. The wire jumper must then remain open. The two negative poles of the voltage sources are connected to each other via the circuit board. Consumers connected to SV3 are supplied from V1, consumers connected to SV2 from V2.

The maximum current per switching function is 2 A. The total load of the module with several loads switched on must not exceed 5 A. If these values are exceeded, the module will be damaged!

If higher currents are to be switched, the use of a relay module is recommended. With the relay module part no. KIT-012 or MOD-012 currents up to 16 A can be switched.

When connecting inductive loads (e.g. electric motors), sufficient interference suppression must be ensured. To protect the output stage, inductive loads (electric motors, relays) must be operated via a free-wheeling diode (see Fig. 7 and Fig.8). The max. current consumption must not exceed 2 A.

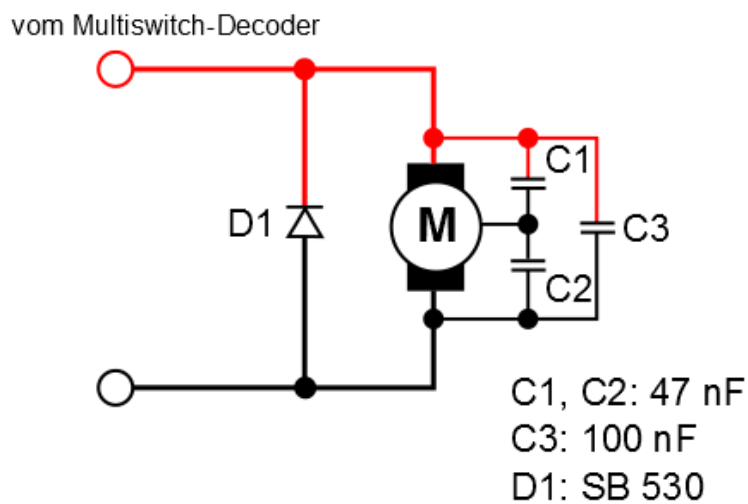


Fig. 7: Connection of a motor with interference suppression capacitors and free-wheeling diode.

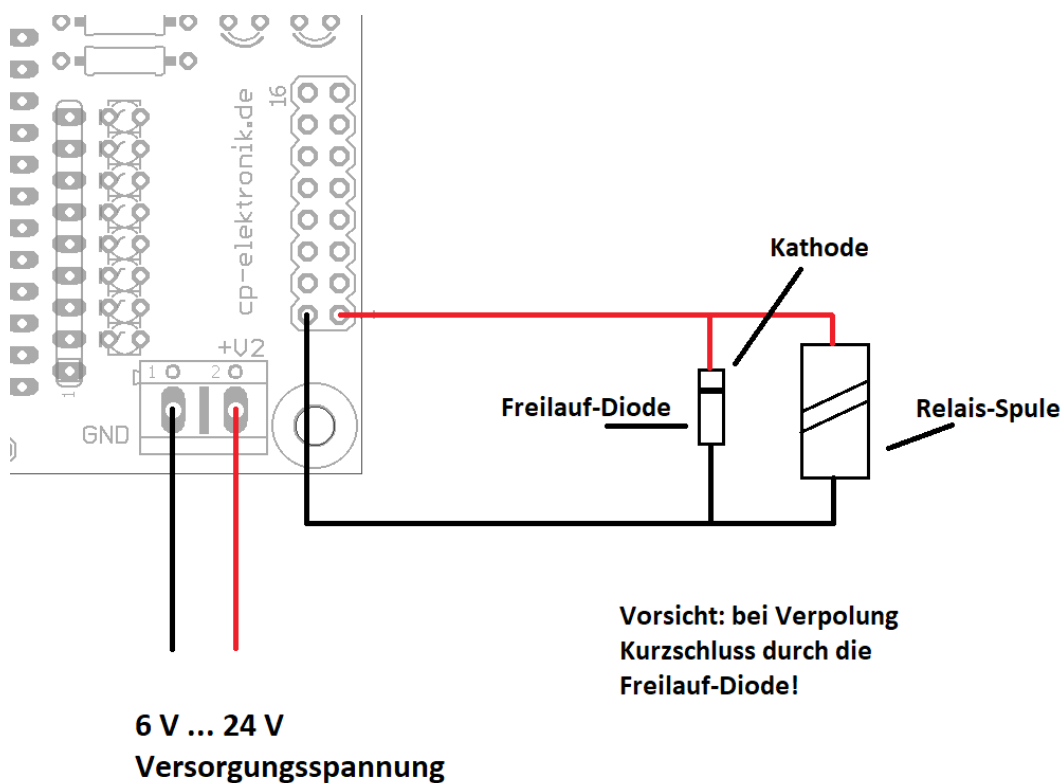


Fig. 8: Use of a free-wheeling diode when connecting a relay. Purchased relay modules usually already have a freewheeling diode integrated, therefore the polarity must be observed!

The PCB can be fixed in the model with four M3 screws and two 5 mm spacer sleeves on a module carrier. The module must be installed protected from splash water and contact.

Operation

Encoder selection

Before switching on the module, use DIP switches 3 and 4 to set the decoder to the encoder used in your transmitter:

DIP Switch 3	DIP Switch 4	Encoder type
OFF	OFF	cp-elektronik Encoder: <ul style="list-style-type: none"> • Transmitter F-14 (7- and 8-channel version) • FC series transmitter, 35/40 MHz • all Graupner transmitters 35/40 MHz with retrofit option for Nautic module 4108
OFF	ON	Graupner Nautic Module 4108 <ul style="list-style-type: none"> • all 35/40 MHz Graupner transmitters with Nautic Module 4108 • Graupner transmitter with multi-channel option (also iFS, HoTT)
ON	OFF	Futaba® Encoder 8084: <ul style="list-style-type: none"> • Transmitter F-14 (7- and 8-channel version), 35/40 MHz • FC series transmitter, 35/40 MHz
ON	ON	Futaba® Encoder 8084: <ul style="list-style-type: none"> • F-14 transmitter with PCM coding 35/40 MHz, • F-14/FC series (8-channel version) with 2.4 GHz module TM-24 FHSS Air

Please note that the position of the switches are evaluated immediately after switching on the module, changes of the switch positions during operation have no influence on the function.

Commissioning

Connect the decoder to the receiver and switch on the power supply to the receiver. The transmitter remains switched off for the time being. The red LED should now light up indicating that no valid signal is being received.

Now switch on the transmitter. The red LED should go out and you should be able to switch all channels with the switches on the encoder.

In general, you should always turn on the transmitter first, then the receiver.

If the yellow LED lights up continuously when the transmitter is switched on, or if not all channels can be switched, please carry out the pulse width setup described below. This allows the decoder to be programmed to the pulse widths used by the transmitter.

Note when using the multi-channel with Graupner transmitters: with transmitter types MC-16/20 Hott or MC-24 Hott various switching channels on the transmitter are combined by software to form a multi-channel. To operate the decoder on these transmitter types it is necessary to set the servo centre to a value of +5% in the transmitter settings.

Note when using a Futaba encoder with Futaba transmitters: for FC transmitter types the channel used must be set to MULTI and to Servo Reverse (REV) in the transmitter menu. Please also refer to the instructions for operation with a Multiswitch module in the manual for your transmitter.

Setup of the pulse lengths

This step is optional and should only be carried out if the commissioning could not be carried out without errors.

The pulse widths which code the switch on or synchronisation functions may differ slightly between different transmitter types. During the pulse width setup the maximum and minimum pulse width is measured by the decoder and stored in the EEPROM. Data stored in the microcontroller's EEPROM is retained even after the supply voltage is switched off and is therefore permanently stored. By repeating the setup procedure new values can be stored, the old data will be overwritten.

For the correct execution of the setup it is very important to execute all steps listed below exactly in this order and exactly as described.

Step no.	Action						
1	Switch off transmitter and receiver						
2	<p>This step depends on the encoder used (switching module in the transmitter).</p> <table border="1"> <tbody> <tr> <td> <ul style="list-style-type: none"> cp-elektronik Encoder in one <ul style="list-style-type: none"> Futaba transmitter or Graupner/JR Transmitter </td> <td> <p>switch at least one of the eight switches up or down at the encoder and leave it switched there (it is best to select a switch with a latching function for this, if available).</p> </td> </tr> <tr> <td> <ul style="list-style-type: none"> Original Graupner Encoder 4108 or Graupner Multichannel Option </td> <td> <p>on the transmitter, move at least one of the switches to the down position and at least one switch to the up position. During setup, the switches must remain in this position.</p> </td> </tr> <tr> <td> <ul style="list-style-type: none"> Original Futaba Encoder 8084 </td> <td> <p>all switches on the encoder are in the neutral position (middle position).</p> </td> </tr> </tbody> </table>	<ul style="list-style-type: none"> cp-elektronik Encoder in one <ul style="list-style-type: none"> Futaba transmitter or Graupner/JR Transmitter 	<p>switch at least one of the eight switches up or down at the encoder and leave it switched there (it is best to select a switch with a latching function for this, if available).</p>	<ul style="list-style-type: none"> Original Graupner Encoder 4108 or Graupner Multichannel Option 	<p>on the transmitter, move at least one of the switches to the down position and at least one switch to the up position. During setup, the switches must remain in this position.</p>	<ul style="list-style-type: none"> Original Futaba Encoder 8084 	<p>all switches on the encoder are in the neutral position (middle position).</p>
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<ul style="list-style-type: none"> Original Futaba Encoder 8084 	<p>all switches on the encoder are in the neutral position (middle position).</p>						
3	Set the DIP switches on the multiswitch decoder as follows: DIP switch no. 1: OFF						

	DIP switch no. 2: ON Set switches No. 3 and No. 4 according to the type of encoder used, see page 13.
4	Switch on transmitter
5	Switch on receiver/multiswitch decoder
6	Measurement is started automatically. In the following approx. 5 seconds the minimum and maximum pulse length are measured and permanently stored in the EEPROM of the controller. The red LED must not light up, otherwise no valid pulses will be detected. In this case check the wiring of the encoder in the transmitter and the connection of the multiswitch decoder at the receiver.
7	Measurement is automatically terminated after approx. 5 seconds. The yellow and the red LED start flashing alternately.
8	Switch off the receiver while the yellow and red LEDs flash alternately.
9	Wait 30 seconds and leave the receiver/multiswitch decoder switched off during this time. The capacitors must discharge completely.
10	Move DIP switch no. 2 on the decoder back to the OFF position.
11	Switch on the receiver/multiswitch decoder again. The newly measured pulse lengths are now active and all switching functions should be operable with the switches on the transmitter.

The pulse width setup settings remain stored until a new setup is performed.

Setup of the memory function

When the memory function is activated, a switching channel switches on the first time it is actuated, but does not switch off again until the second time it is actuated. This means that two functions can be switched on at the same time, if they are actuated with a switch on the transmitter. In order to be able to determine which channels should have a memory function and which should not, there is the Memory Setup mode. If DIP switch no. 1 on the decoder is switched on, the microcontroller is in memory setup mode.

For the correct execution of the setup it is very important to execute all steps listed below exactly in this order and exactly as described.

Step no.	Action
1	Switch off transmitter and receiver

2	<p>Set the DIP switches on the multiswitch decoder as follows: DIP switch no. 1: ON DIP switch no. 2: OFF</p> <p>Set switches No. 3 and No. 4 according to the type of encoder used, see page 13.</p>
3	Switch on transmitter
4	Switch on receiver/multiswitch decoder
5	<p>You now have 30 seconds to make the memory settings.</p> <p>All channels which are to have a memory function are switched on at the transmitter/encoder. The corresponding switch control LEDs on the decoder light up. So that both channels of a switch can also be switched on simultaneously, all channels have a memory function for the duration of the setup. To switch a channel off again, the switch is switched on again from the neutral position.</p> <p>If you do not want a memory function on any of the channels, leave all channels off in Setup mode.</p> <p>The entire process must be completed after 30 s at the latest.</p>
6	<p>The setting mode is automatically terminated after approx. 30 seconds. The yellow and the red LED start flashing alternately. All channels that were switched on at this time now have a memory function.</p>
7	Switch off the receiver while the yellow and red LEDs flash alternately.
8	Wait 30 seconds and leave the receiver/multiswitch decoder switched off during this time. The capacitors must discharge completely.
9	Move DIP switch no. 1 on the decoder back to the OFF position.
10	Switch on the receiver/multiswitch decoder again. The new settings are now active and all switching functions should be operable with the switches on the transmitter.

The settings remain stored until a new setup is performed. The memory setup can be repeated if necessary.

Setup of the turn signal or flasher function

A flasher function can be configured for the eight switching channels of port A of the microcontroller (40 ms on, 460 ms off, frequency 2 Hz) and a flashing function with a frequency of approx. 1 Hz (500 ms on, 500 ms off) can be configured for the eight outputs of port B. The flasher/flasher operates on all ports with the same frequency, but with different

phase depending on the switch-on time, so that several configured flasher functions generally do not flash with the same phase.

The procedure for configuring the turn signal function is exactly as described for the memory setup. However, both DIP switches No. 1 and No. 2 must be switched on before switching on the power supply. Channels which are to have a flashing function are switched on at the transmitter.

For the correct execution of the setup it is very important to execute all steps listed below exactly in this order and exactly as described.

Step no.	Action
1	Switch off transmitter and receiver
2	Set the DIP switches on the multiswitch decoder as follows: DIP switch no. 1: ON DIP switch no. 2: ON Set switches No. 3 and No. 4 according to the type of encoder used, see page 13.
3	Switch on transmitter
4	Switch on receiver/multiswitch decoder
5	You now have 30 seconds to make the turn signal settings. All channels which are to have a flash/flash function are switched on at the transmitter/encoder. The corresponding switch control LEDs on the decoder flash. So that both channels of a switch can also be switched on simultaneously, all channels have a memory function for the duration of the setup. To switch a channel off again, the switch is switched on again from the neutral position. If you do not want flashing on any of the channels, leave all channels off in Setup mode. The entire process must be completed after 30 s at the latest.
6	The setting module is automatically terminated after approx. 30 seconds. The yellow and the red LED start flashing alternately. All channels that were switched on at this time now have a flashing function.
7	Switch off the receiver while the yellow and red LEDs flash alternately.
8	Wait 30 seconds and leave the receiver/multiswitch decoder switched off during this time. The capacitors must discharge completely.
9	Move DIP switches no. 1 and no. 2 on the decoder back to the OFF position.

10	Switch on the receiver/multiswitch decoder again. The new settings are now active and all switching functions should be operable with the switches on the transmitter.
----	--

The memory function and the flash/flash function are independent of each other and can be set individually per channel. If necessary, the setup can be repeated at any time and the flash/flash functions can be reassigned.

Setup configuration with the DIP switch

The following table summarizes the function of the setup switches again:

DIP Switch 1	DIP Switch 2	Setup type
OFF	OFF	normal operation mode
ON	OFF	Memory Setup
OFF	ON	Pulse Width Setup
ON	ON	Flasher/indicator setup

Care and maintenance

Protect the module from splash water, heat and contact. The module is maintenance-free.

Malfunction and repair

If the red LED lights up continuously, this indicates faulty receiver pulses and points to reception faults or a transmitter which has been switched off. If necessary, check the correct connection at the receiver and the correct connection of the servo cable.

If the yellow LED lights up continuously, this indicates a fault with the encoder in the transmitter or an unknown multiswitch protocol. Make sure the encoder is compatible and perform a pulse width setup if necessary.

A repair of the module may only be carried out by a specialist. If you need help with a repair, please contact cp-elektronik.de (address on the last page of this manual).

Technical data

Dimensions	62.1 mm x 47.2 mm
------------	-------------------

Weight without connection cable	25 g
Voltage (ext. supply)	6 ... 24 V
max. current per channel	2 A
max. total current (sum of all channels switched on simultaneously)	5 A
max. current consumption (from receiver)	130 mA
Operating voltage (receiver)	4,8 ... 5,4 V

Contact

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Disposal



Electrical and electronic equipment that falls under the ElektroG may not be disposed of with the residual waste, but can be handed in free of charge at the municipal collection points (e.g. recycling centres).



Status: 20.10.2021. Subject to change without notice.