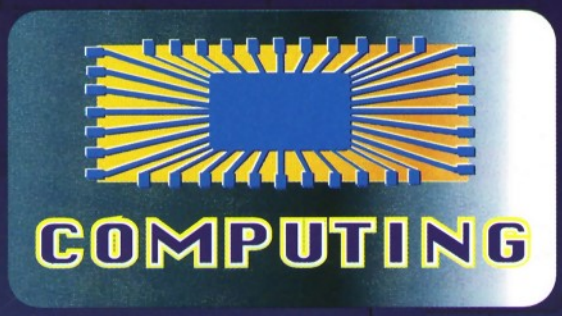
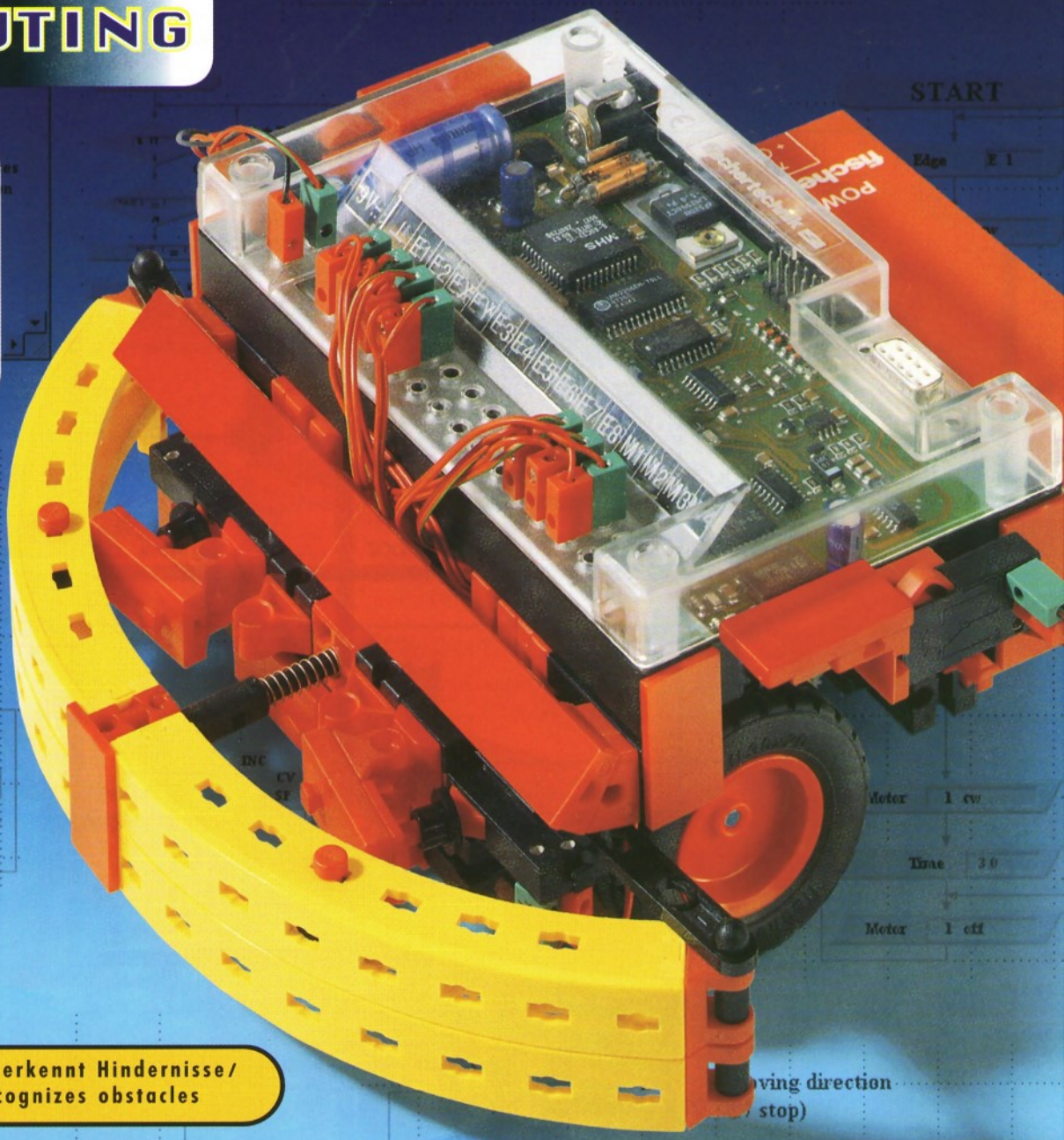
# Mobile Robots




**8 models**



MR2- erkennt Hindernisse/
recognizes obstacles

fischertechnik®

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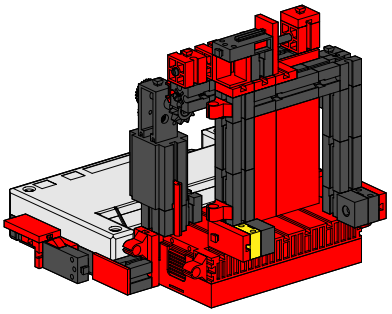
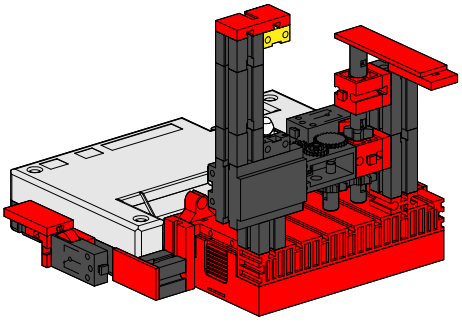
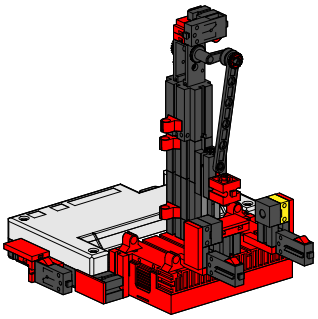


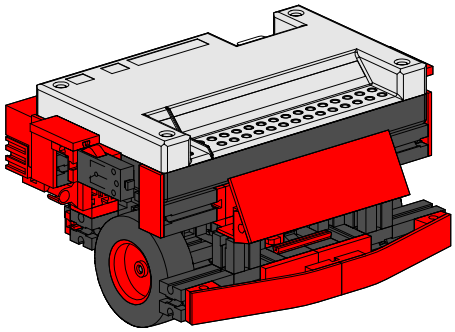




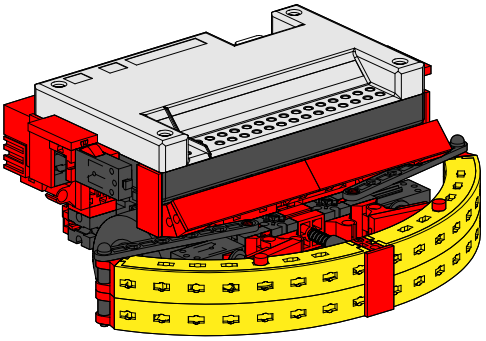




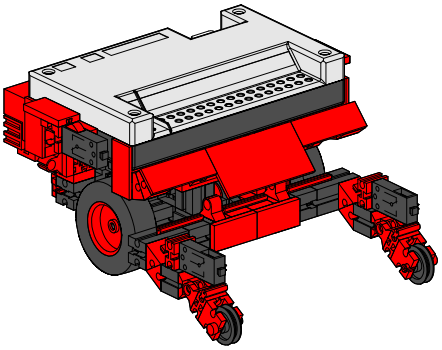
Mobile Robots:



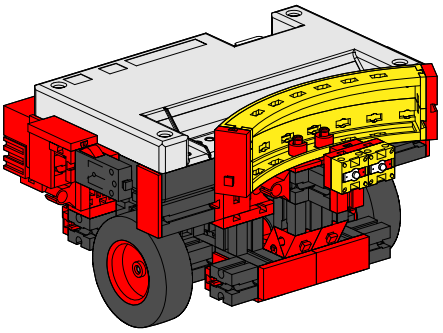
**MR1**
Basismodell / Base Model 16



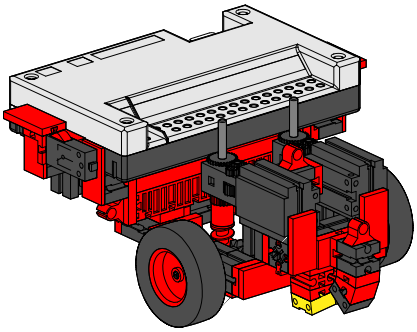
**MR2**
erkennt Hindernisse / recognizes obstacles 20



**MR3**
erkennt Abgründe / recognizes ledges 24



**MR4**
folgt einer Lichtquelle / follows a light source 27



**MR5**
folgt einer Spur / follows a path 30

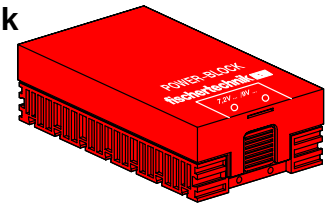
# Einzelteilübersicht
# Spare parts list

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 60° | 31010 4x | | 31690 3x | | 32913 2x | | 36134 2x |
| 30° | 31011 2x | | 31848 2x | | 35031 2x | | 36147 1x |
| | 31021 2x | | 31915 2x | | 35033 2x | | 36165 1x |
| 60 | 31032 2x | 15° | 31981 8x | | 35049 6x | | 36227 1x |
| | 31053 1x | | 31982 12x | | 35054 4x | | 36334 1x |
| | 31058 2x | | 32064 3x | | 35055 4x | | 36443 1x |
| 15 | 31060 4x | 7,5° | 32071 3x | 30 | 35063 2x | | 36532 2x |
| 30 | 31061 6x | | 32085 1x | 45 | 35064 2x | | 36573 1x |
| | 31063 2x | | 32293 2x | | 35069 1x | | 36819 4x |
| | 31078 2x | | 32321 1x | | 35073 1x | 75 | 36923 2x |
| | 31082 2x | | 32330 6x | | 35088 1x | | 36983 1x |
| | 31124 3x | | 32870 2x | 98 | 35414 1x | | 37157 2x |
| | 31336 16x | | 32879 6x | | 35797 2x | | 37237 10x |
| | 31337 18x | | 32880 2x | | 35945 4x | | 37238 6x |
| | 31360 1x | | 32881 16x | | 35969 9x | | 37468 4x |
| | 31426 2x | | 32882 7x | | 35986 1x | | 37636 2x |
| | 31436 6x | | 32883 2x | | 36132 2x | | 37679 2x |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 37783 6x | | 38240 6x | | 38249 1x | | 38428 4x |
| | 37858 2x | | 38241 5x | | 38251 2x | | 38464 2x |
| | 37875 1x | | 38242 2x | | 38258 4x | | |
| | 38216 1x | | 38244 2x | | 38423 7x | | |

## Akku– / Batteriehalter
## Rechargeable battery holder

### Power–Block




**6 Akkus, 1,2 V Mignon, KR 15/51 AA**
oder, or
**6 Batterien, 1,5 V Mignon LR 06 (R6)**

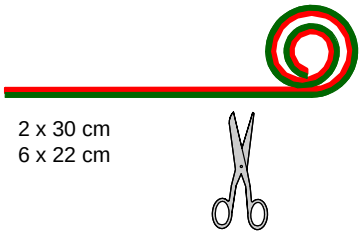
Batterien sind nicht Inhalt der Packung
Batteries not included

- 6 Akkus oder 6 Batterien (Mignon)
  Leere Akkus zum Laden aus dem Power–Block entnehmen.
  Verbrauchte Batterien dem Sondermüll zuführen.
- Spannung: 7,2 V ⎓ / 9 V ⎓
- Sicherung: Kurzschluß • Überlastung • Verpolung

- 6 rechargeable batteries or 6 dry cells
  Remove discharged battery and place in charger for recharging.
  Discard spent dry cells at special waste disposal centre.
- Voltage: 7,2 V ⎓ / 9 V ⎓
- Fuse protection: Short circuit • overload • reverse connection

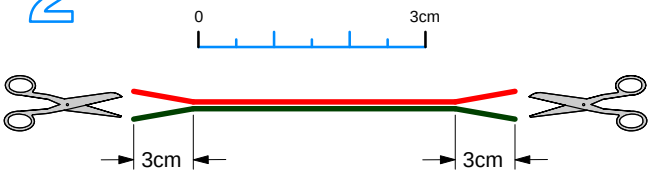
## Kabel und Stecker
## Plugs and cables

1



2 x 30 cm
6 x 22 cm

2

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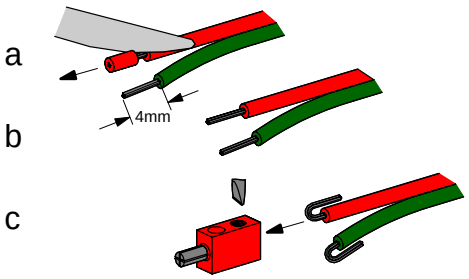


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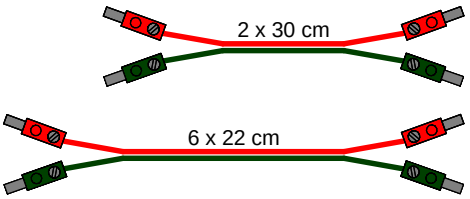
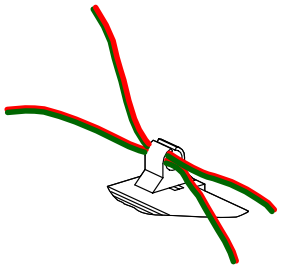
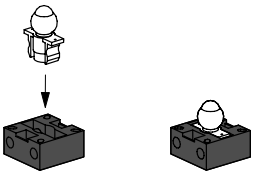


# Montagehilfen und Hinweise
# Assembly aids and instructions

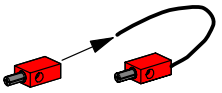


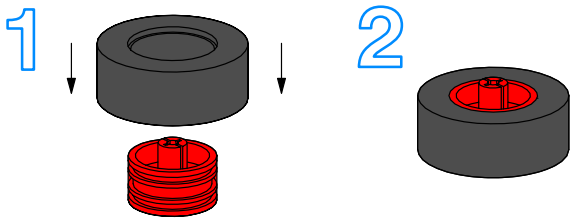


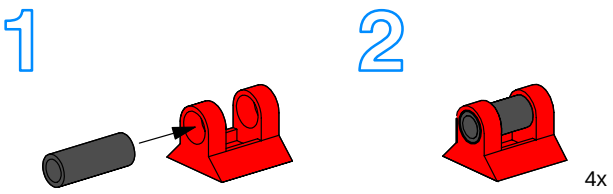
Linsenlampe
Lens tip lamp

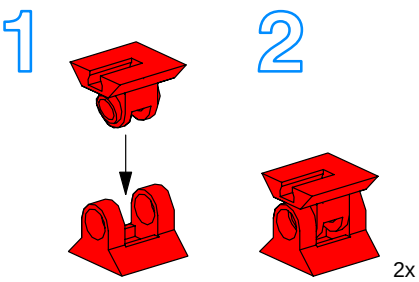
Fototransistor
Achtung:
Beim Anschluß auf richtige Polung achten. Rot = +

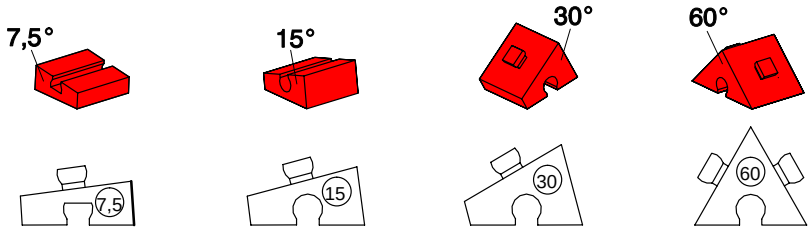
Phototransistor
Caution:
Make sure the terminals are connected correctly. Red = +






- Alle elektrischen Bauteile (Sensoren, Motoren, Lampen) dürfen ausschließlich an fischertechnik Stromversorgungen (Powerblock oder Netzgerät) angeschlossen werden.

- All electrical components (sensors, motors, lamps) may only be connected to fischertechnik power supplies (Powerblock or AC adapter).

- Alle Einzelteile, insbesondere bewegliche Teile sind falls notwendig zu warten und zu reinigen.
- Achtung
  Verletzungsgefahr an Bauteilen mit funktionsbedingten scharfen Kanten und Spitzen!

- All components, especially moving parts, should be maintained and cleaned as necessary.
- Caution
  Be careful not to hurt yourself on components with sharp or pointed edges!

- Weitere Informationen über “Mobile Robots”, das “Intelligent Interface” und die Software LLWIN sind auf der CD–ROM “LLWIN” (Art.–Nr. 30407) zu finden. Diese CD–ROM enthält außerdem ein detailiertes Beispiel zur Einführung in die fischertechnik–Computing–Welt.

- For more information on ”Mobile Robots”, the ”Intelligent Interface”, and the ”LLWIN” software, refer to the ”LLWIN” CD–ROM (part No. 30407). This CD–ROM also contains a detailed introduction to the world of fischertechnik computing.

# Montage Interface
# Mounting Interface

1
2x
2x
2x
2x

2x

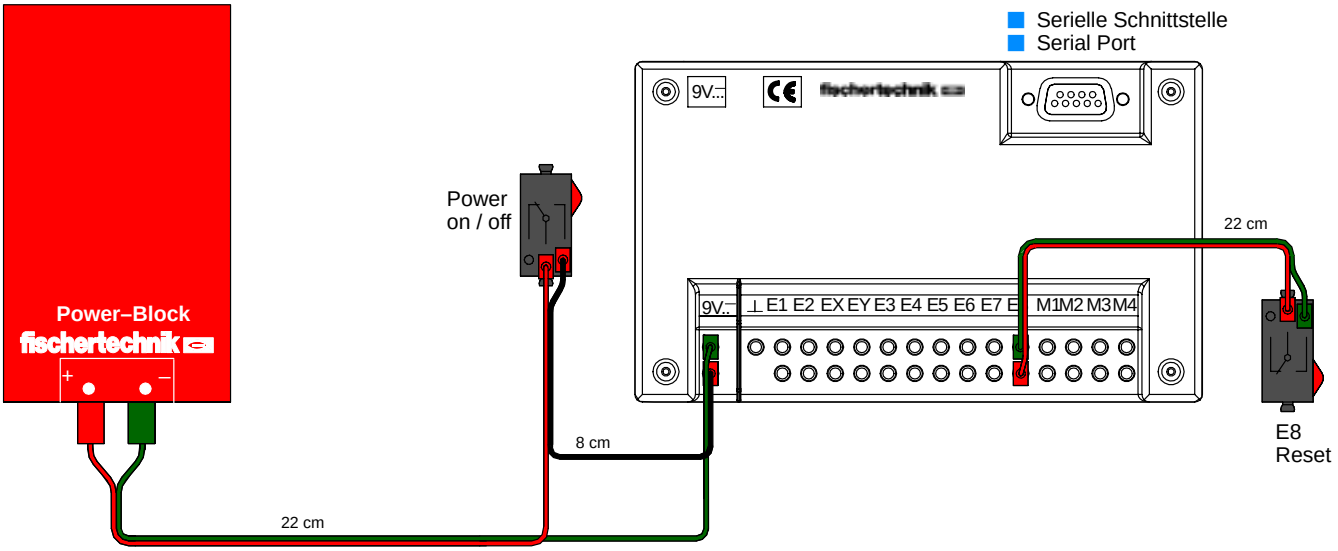
2
1x

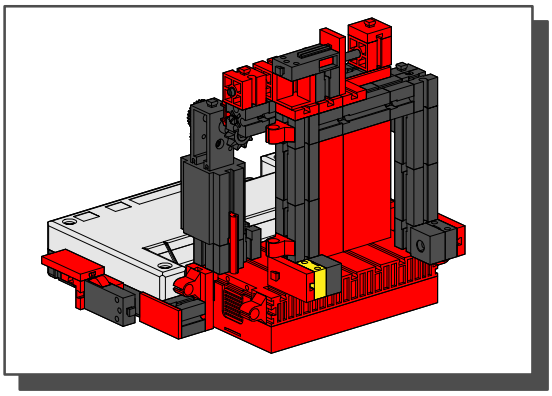
Power on/off

3
1x

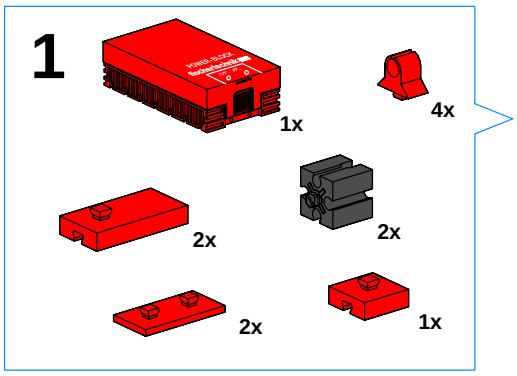
E8, Reset

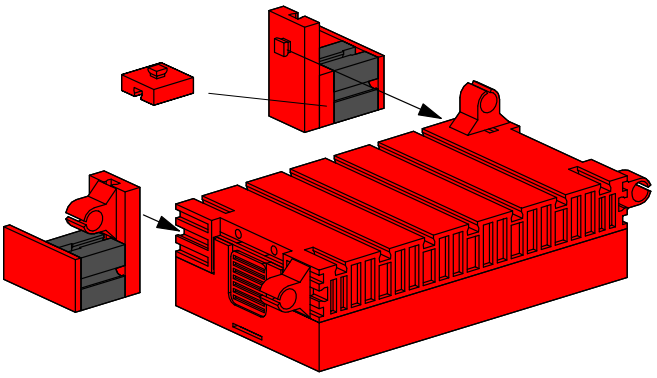
## Schaltplan
## Circuit diagram

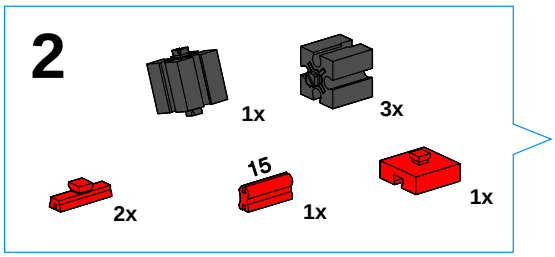


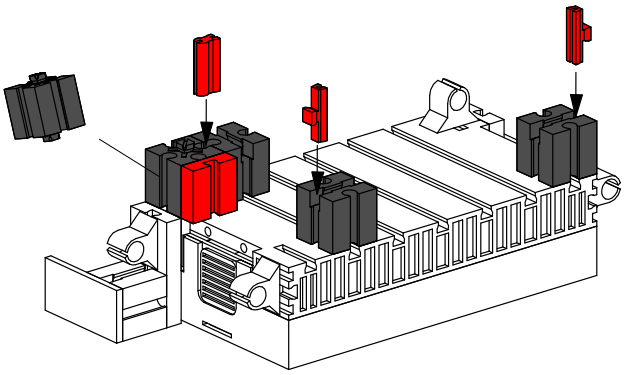


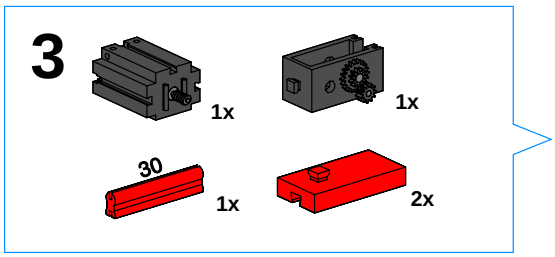
# Schiebetür
# Sliding Door

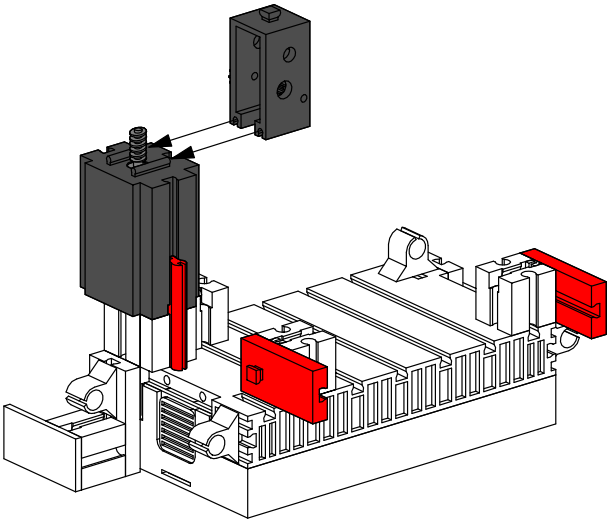






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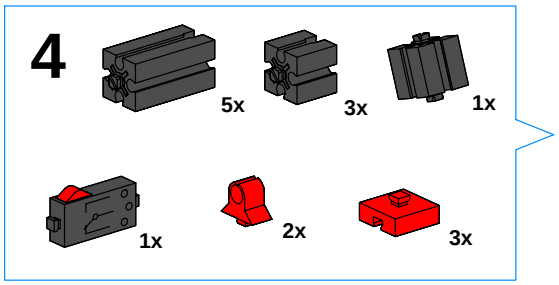


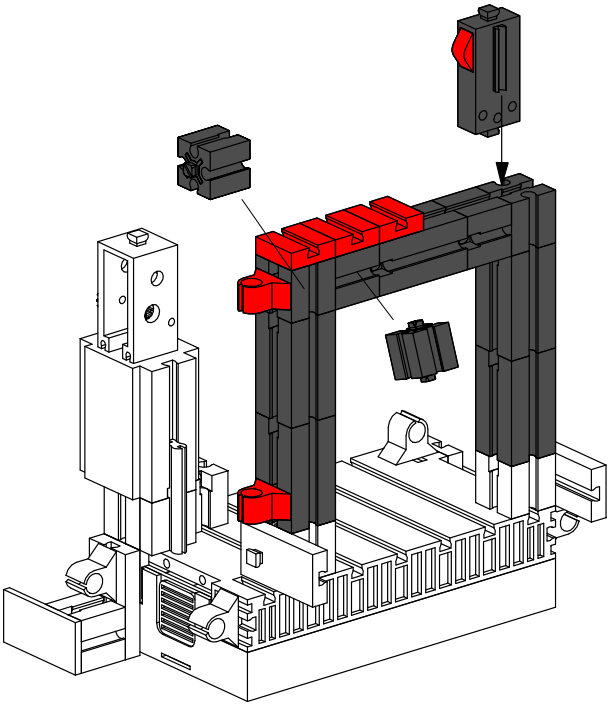

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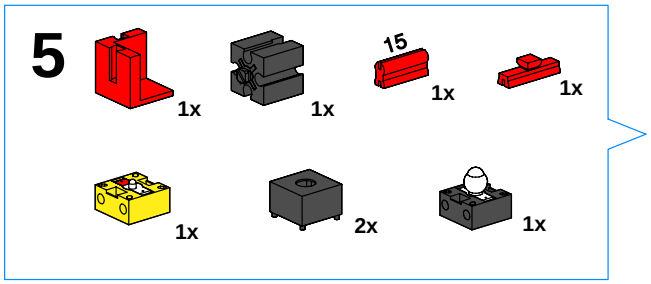
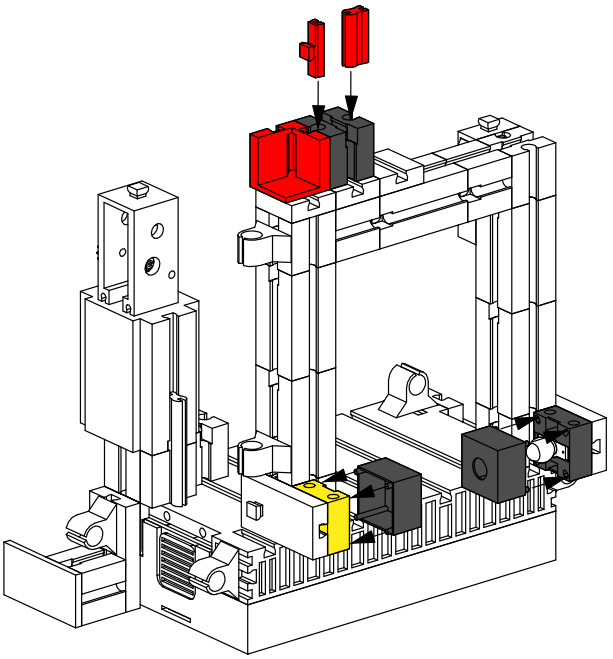
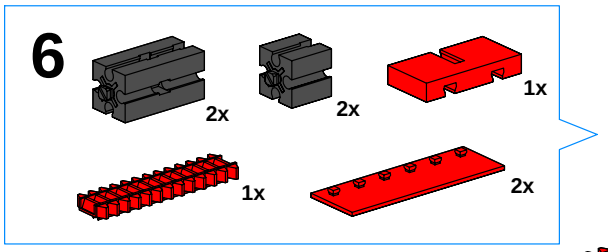
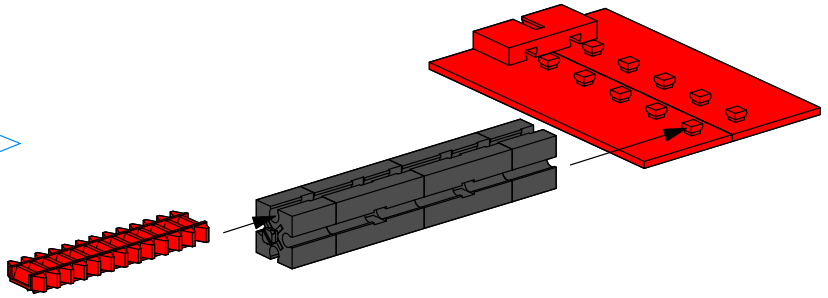
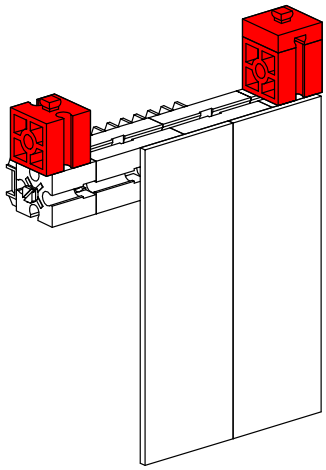


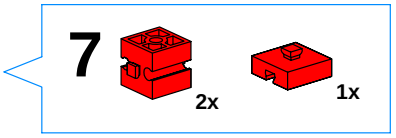



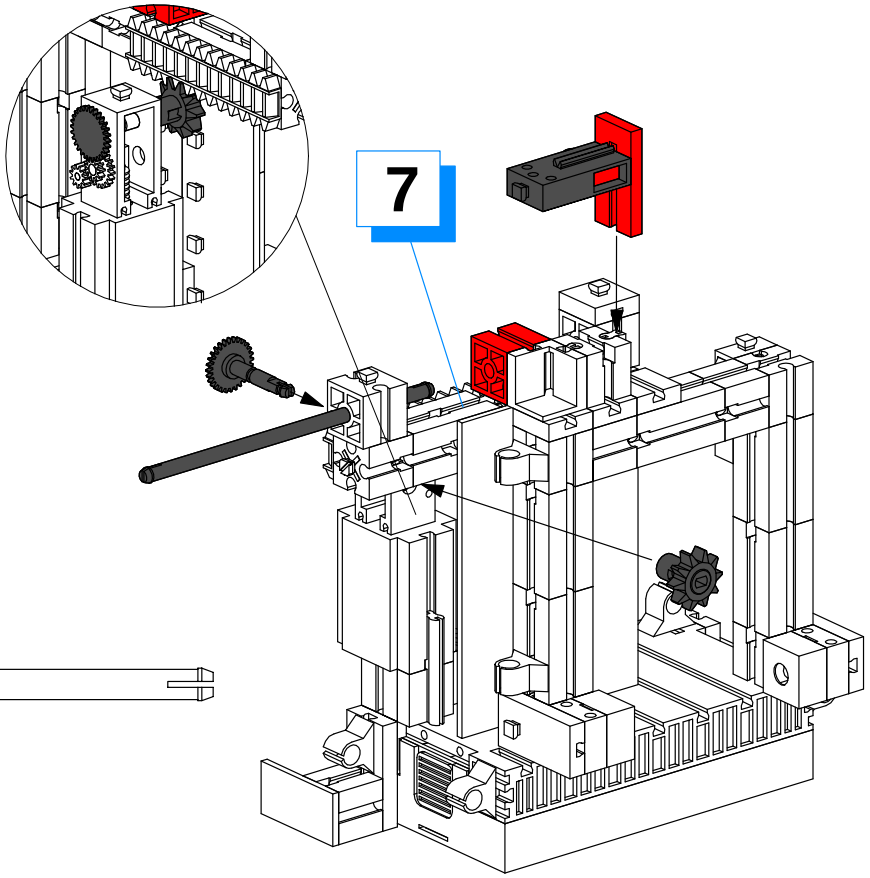
## 6






7
2x
1x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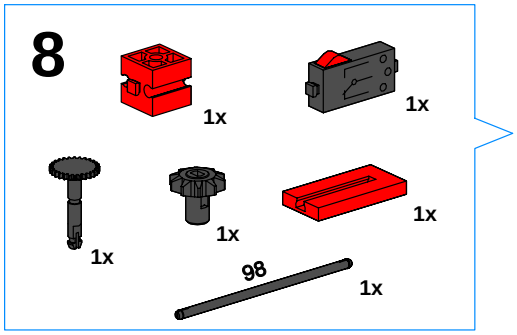
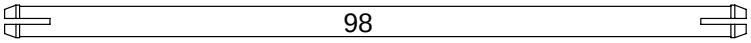
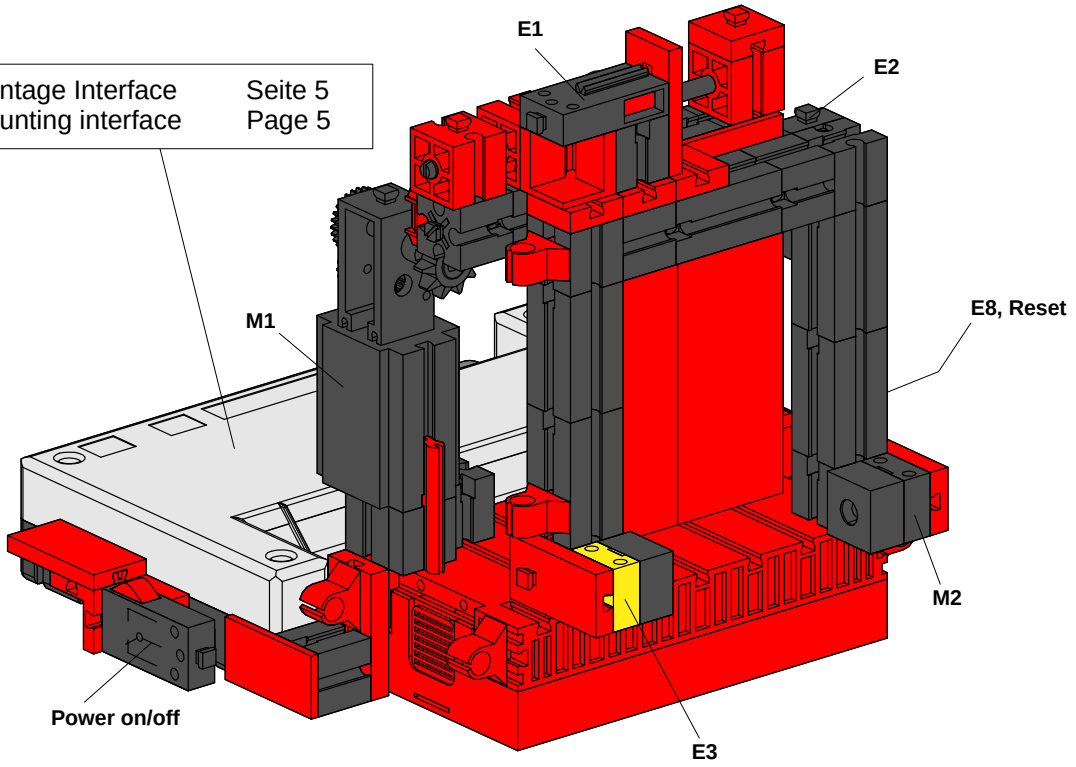
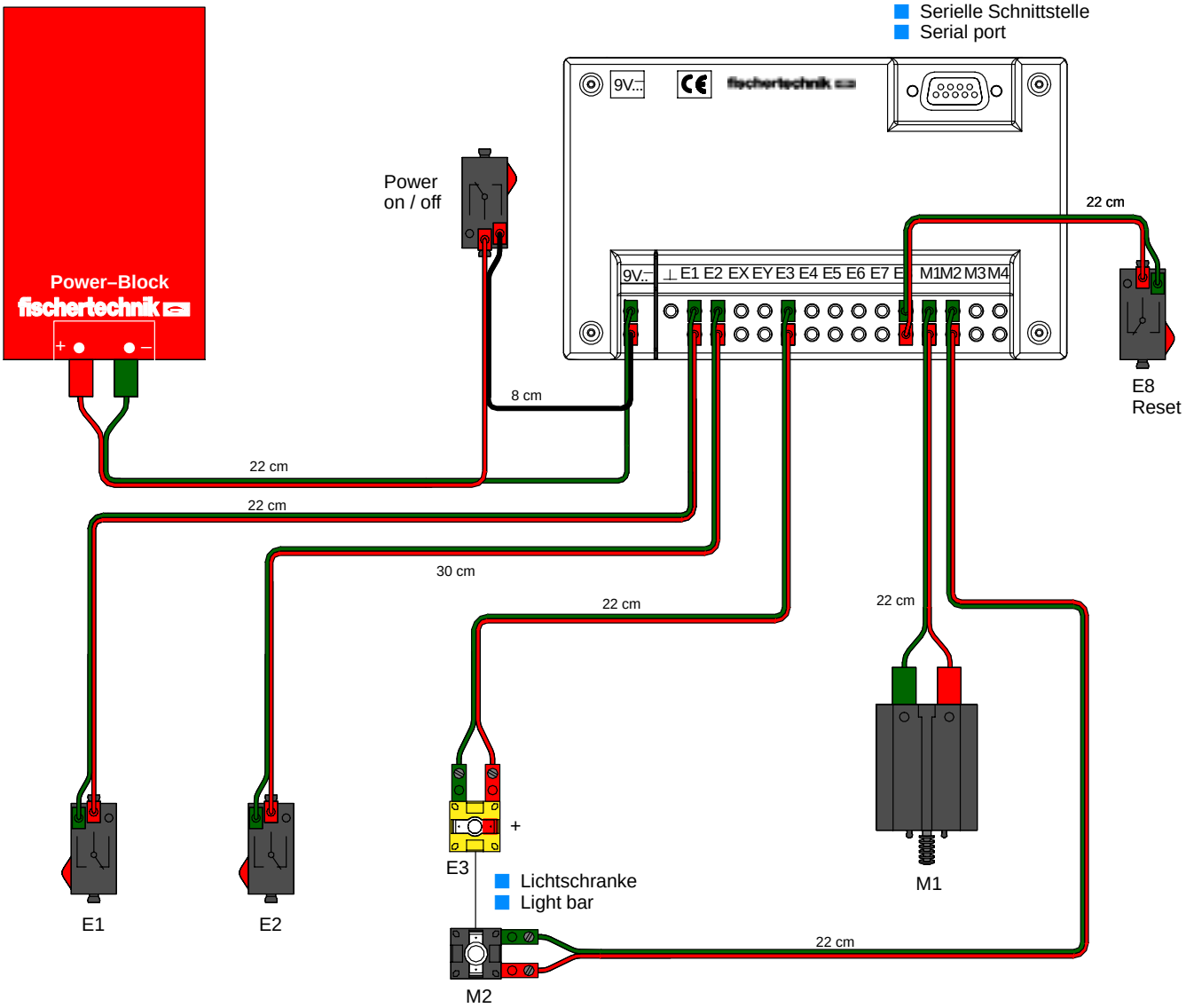

8
1x
1x
1x
1x
1x
98
1x


98


Montage Interface Seite 5
Mounting interface Page 5
E1
E2
M1
E8, Reset
M2
Power on/off
E3

## Schaltplan
## Circuit diagram

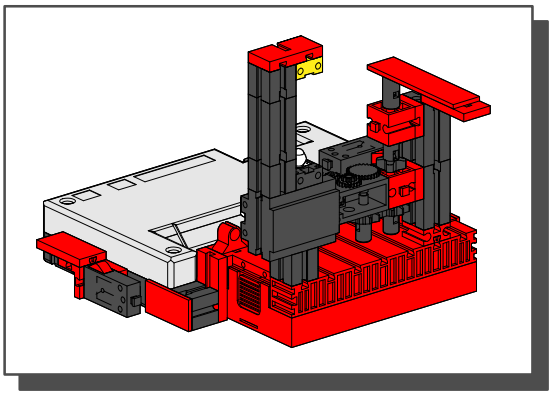



### Beispielprogramm: tuer.mdl

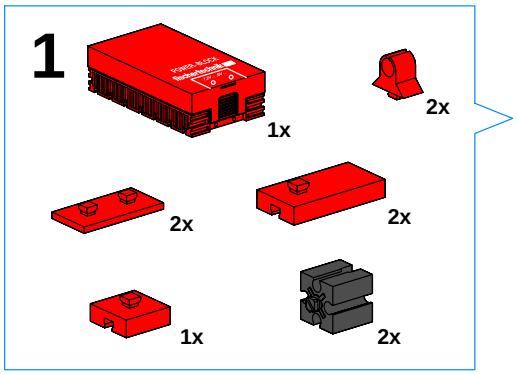
**Funktionsweise:**
Unterbricht man die Lichtschranke, öffnet sich die Tür. Nach einer bestimmten Zeit wird sie automatisch wieder geschlossen. Im Passiv–Modus (siehe Soft–warehandbuch) wird am Terminal angezeigt, ob die Tür offen oder geschlossen ist und wie oft sie schon geöffnet wurde.

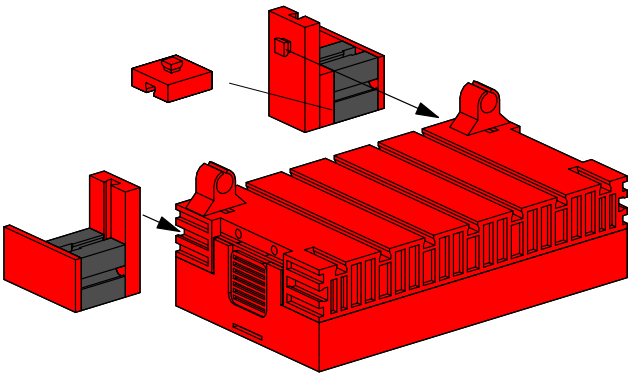
### Program example: door.mdl

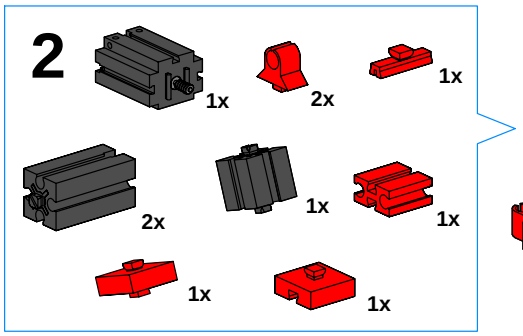
**Operational description:**
If the light barrier is interrupted, the door opens. After remaining open for a specified period of time, the door closes. In the passive mode (refer to the software manual), the terminal indicates whether the door is open or closed, and how often it has been opened.

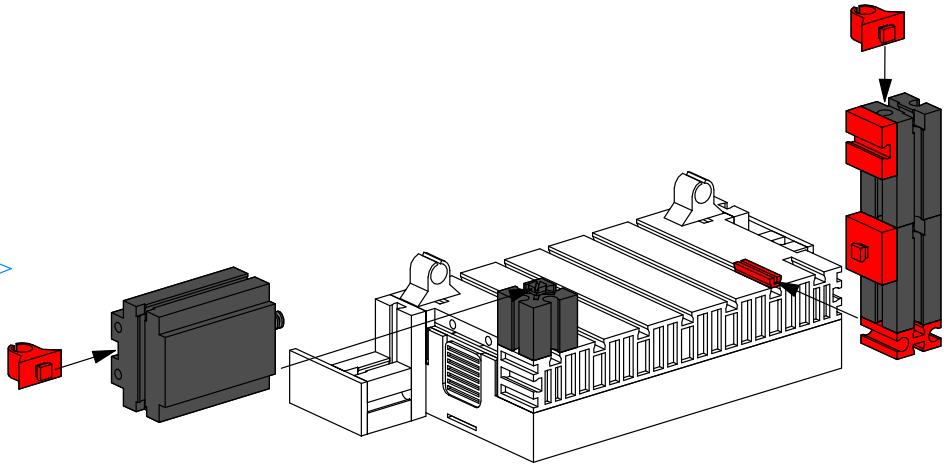


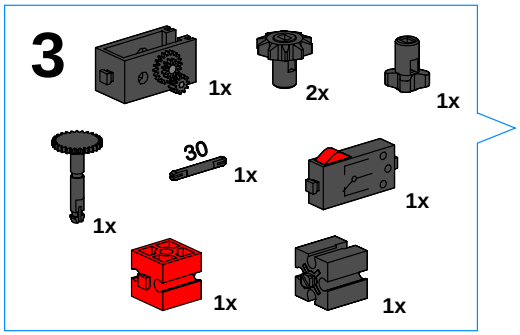
# Impulszähler
# Pulse Counter

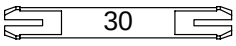


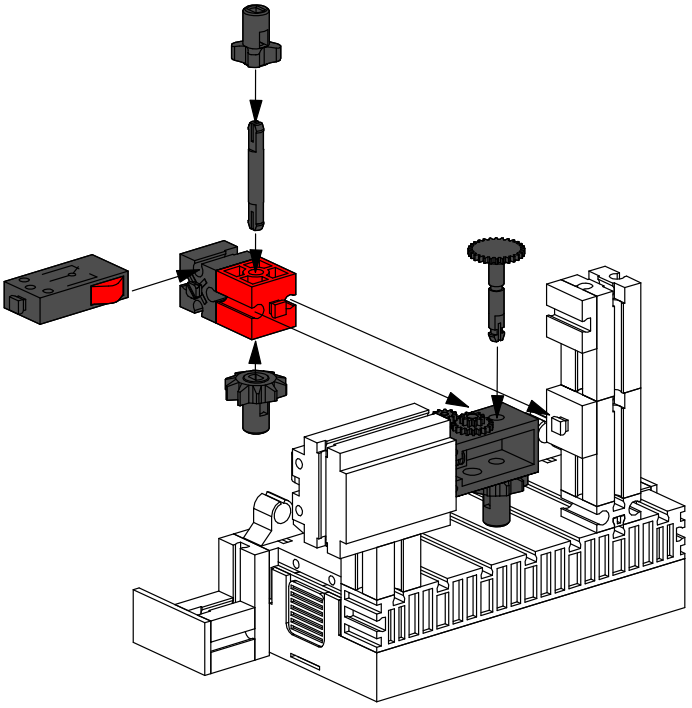



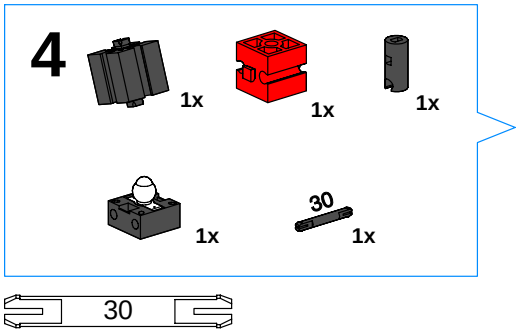


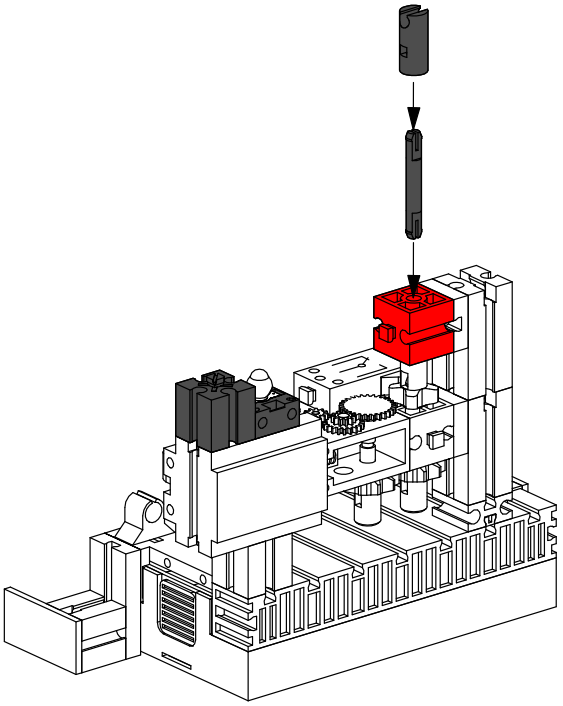



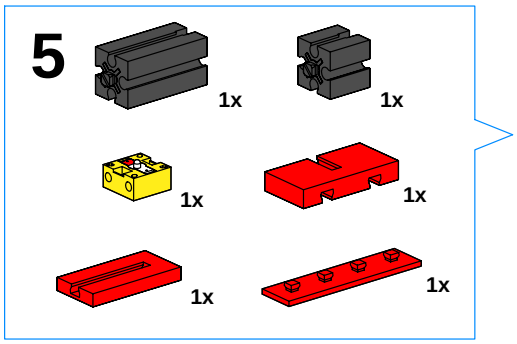



4
1x
1x
1x
1x
30
1x
30

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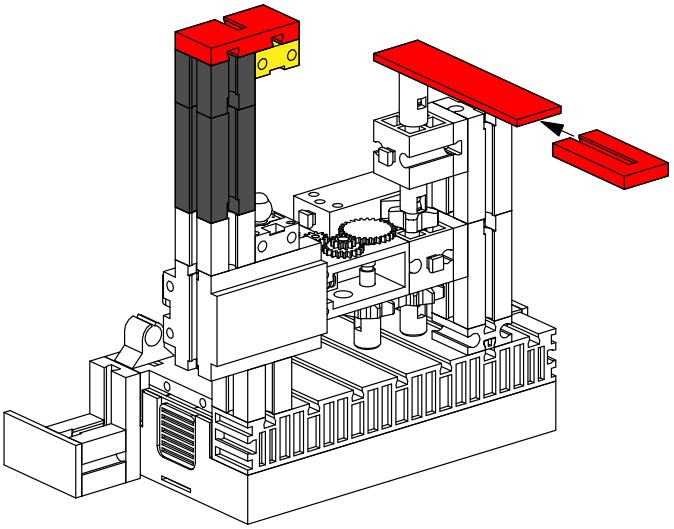
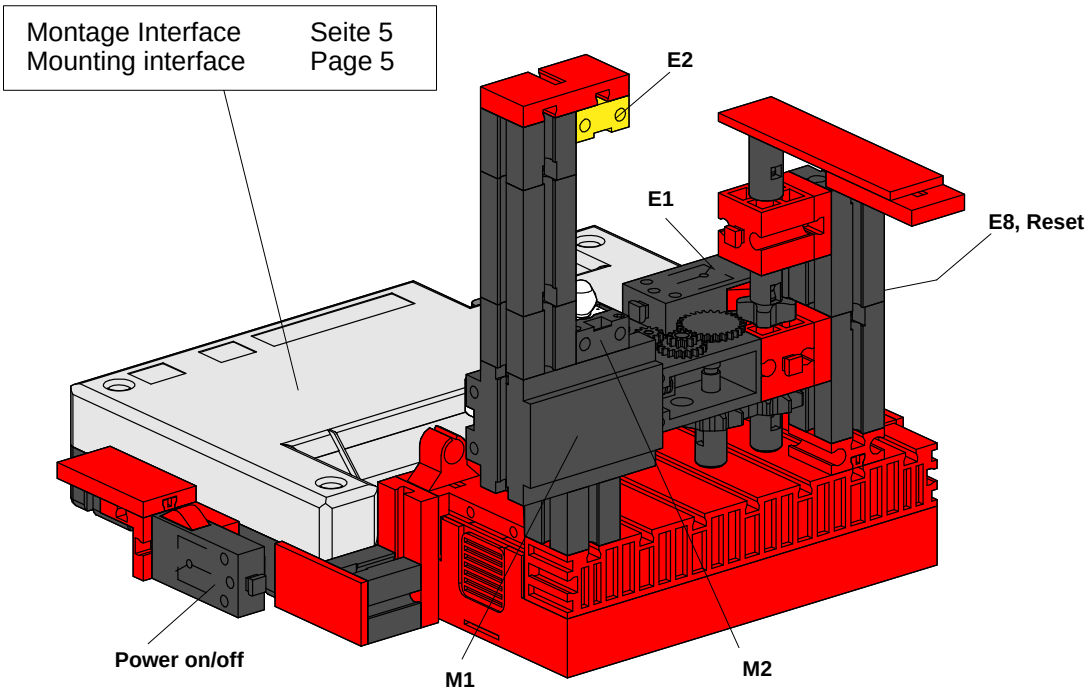
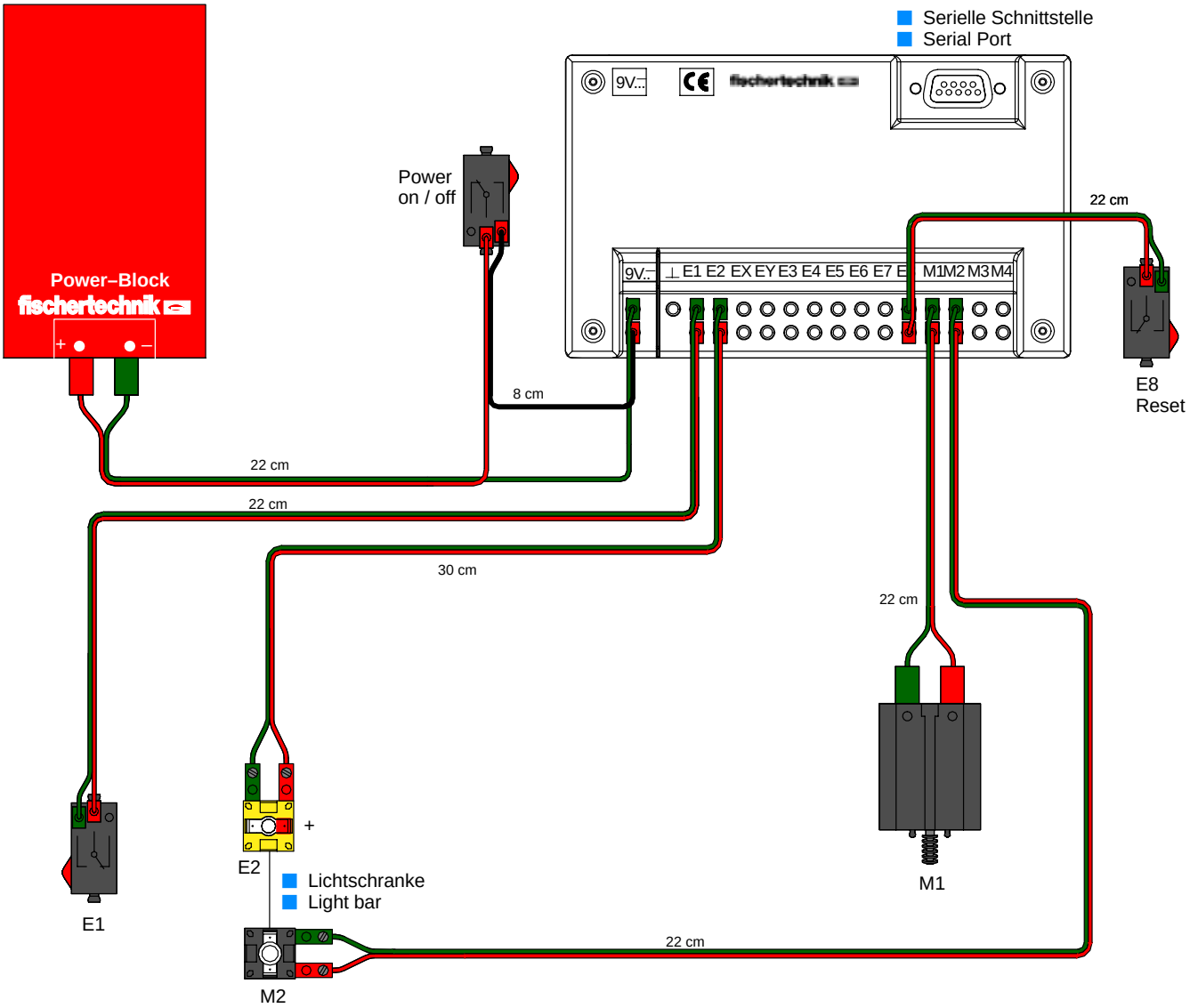
1x
1x
1x
1x
1x




Montage Interface Seite 5
Mounting interface Page 5
E2
E1
E8, Reset
Power on/off
M1
M2

## Schaltplan
## Circuit diagram

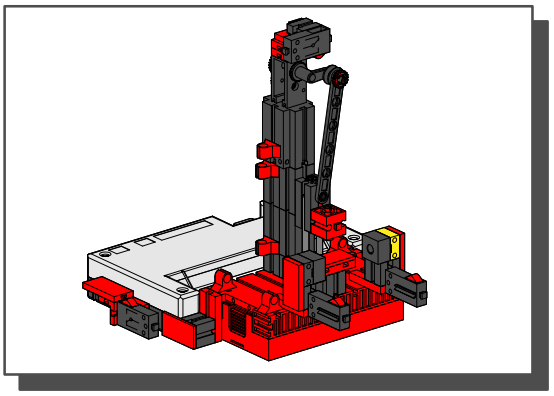



### Beispielprogramm: impuls.mdl

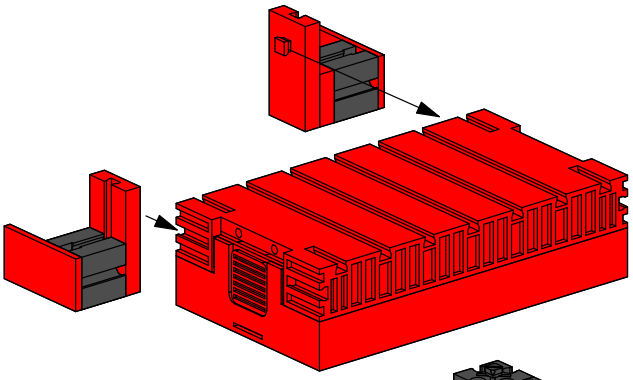
**Funktionsweise**
Die von Motor M1 angetriebene rotierende Bauplatte unterbricht bei jeder Umdrehung einmal die Licht–schranke. Gleichzeitig zählt der Taster an E1 über das Impulsrad acht Impulse pro Umdrehung. Nach zehn Umdrehungen stoppt der Motor. Die gezählten Impulse werden im Passiv–Modus am Bildschirm mit dem Softwarebaustein Terminal angezeigt.
Dieser Versuch zeigt, welche Auflösung beim Zählen von Impulsen mit einem Impulsrad erreichbar ist.
Mit den Impulsrädern werden bei den mobilen Robotern die zurückgelegten Wegstrecken “gemessen”.

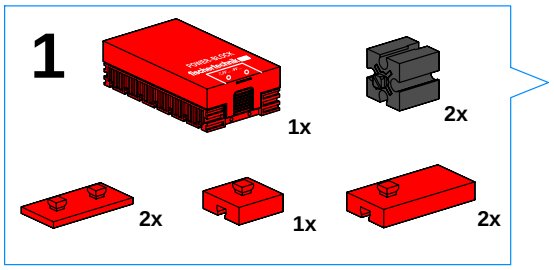
### Program example: pulse.mdl

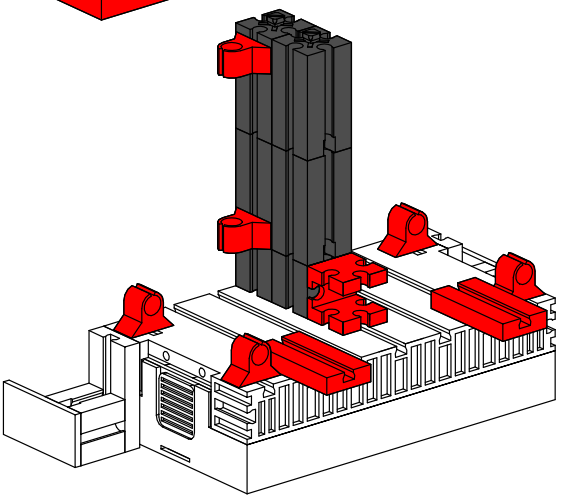
**Operational description:**
Once every rotation, the turning base plate driven by motor M1 interrupts the light barrier. At the same time, the feeler on E1 counts eight pulses per rotation from the pulse wheel. The motor stops after ten rotations of the plate. The number of pulses counted is displayed on the screen by the terminal software building block in the passive mode.
This test shows the resolution that can be achieved by counting pulses with a pulse wheel.
Pulse wheels are used by mobile robots to ”measure” the distances they have traveled.

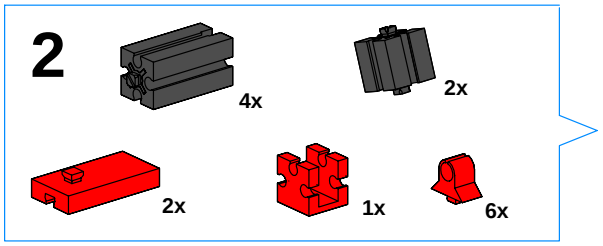


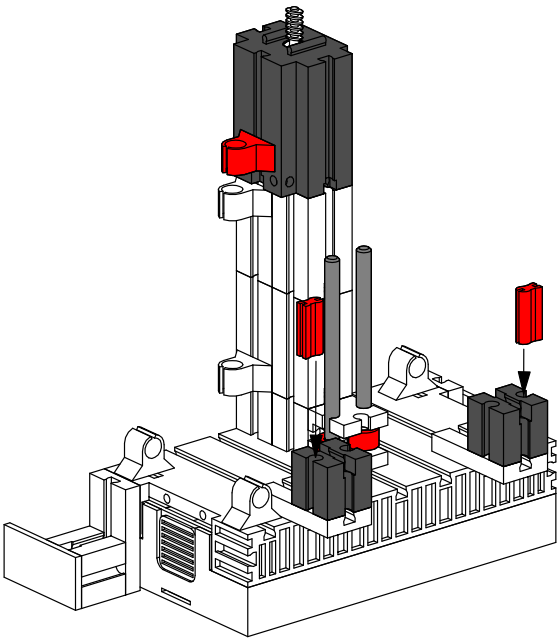
# Stanze
# Stamp

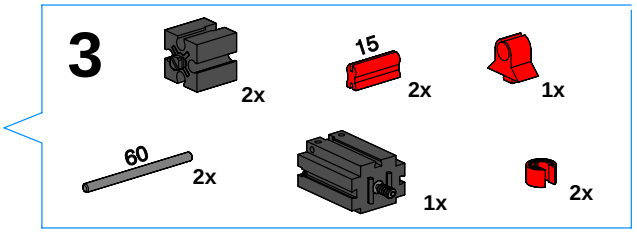






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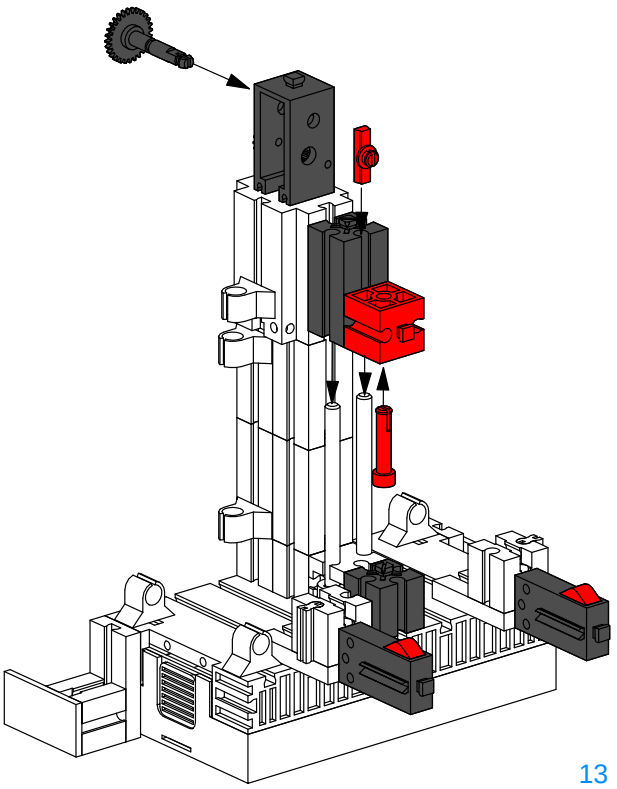
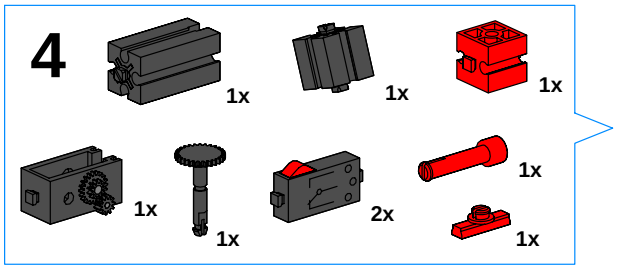
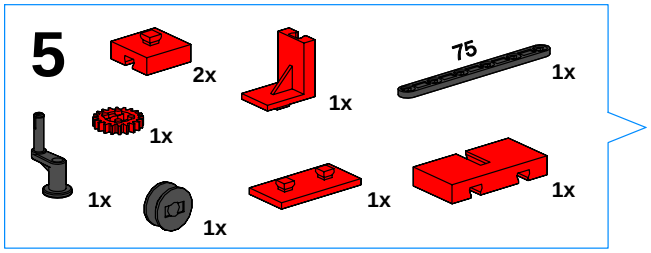
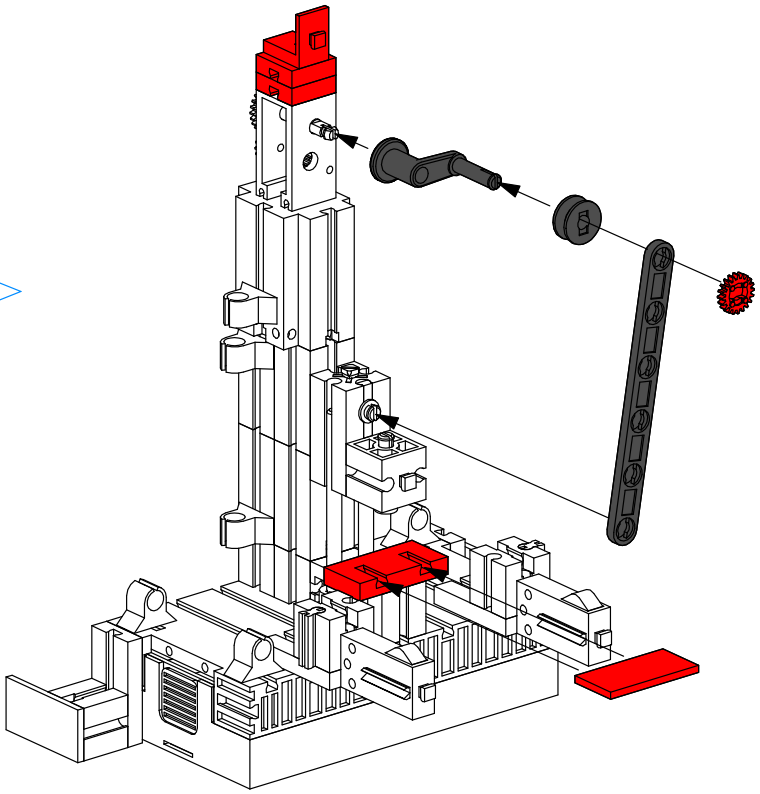
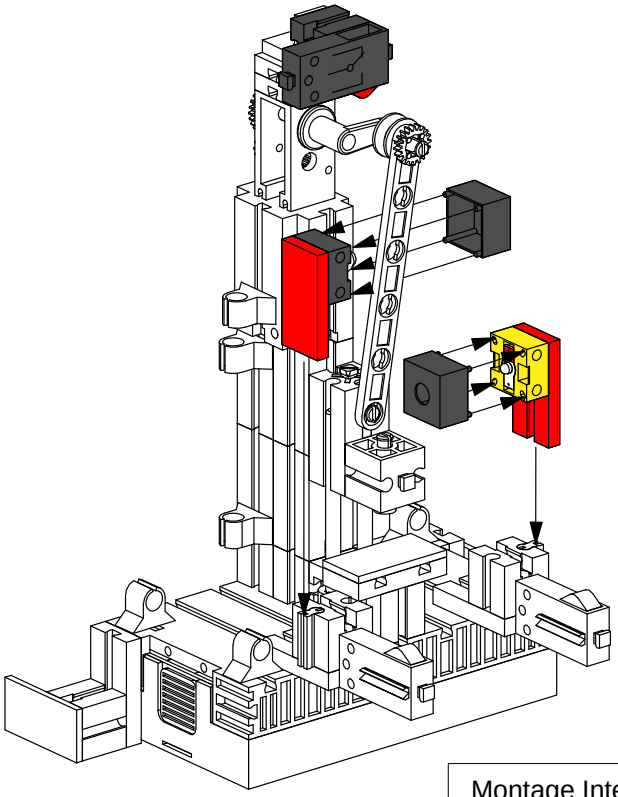
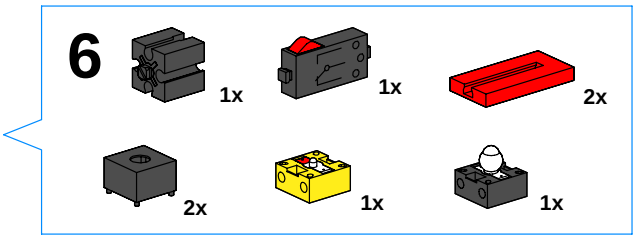


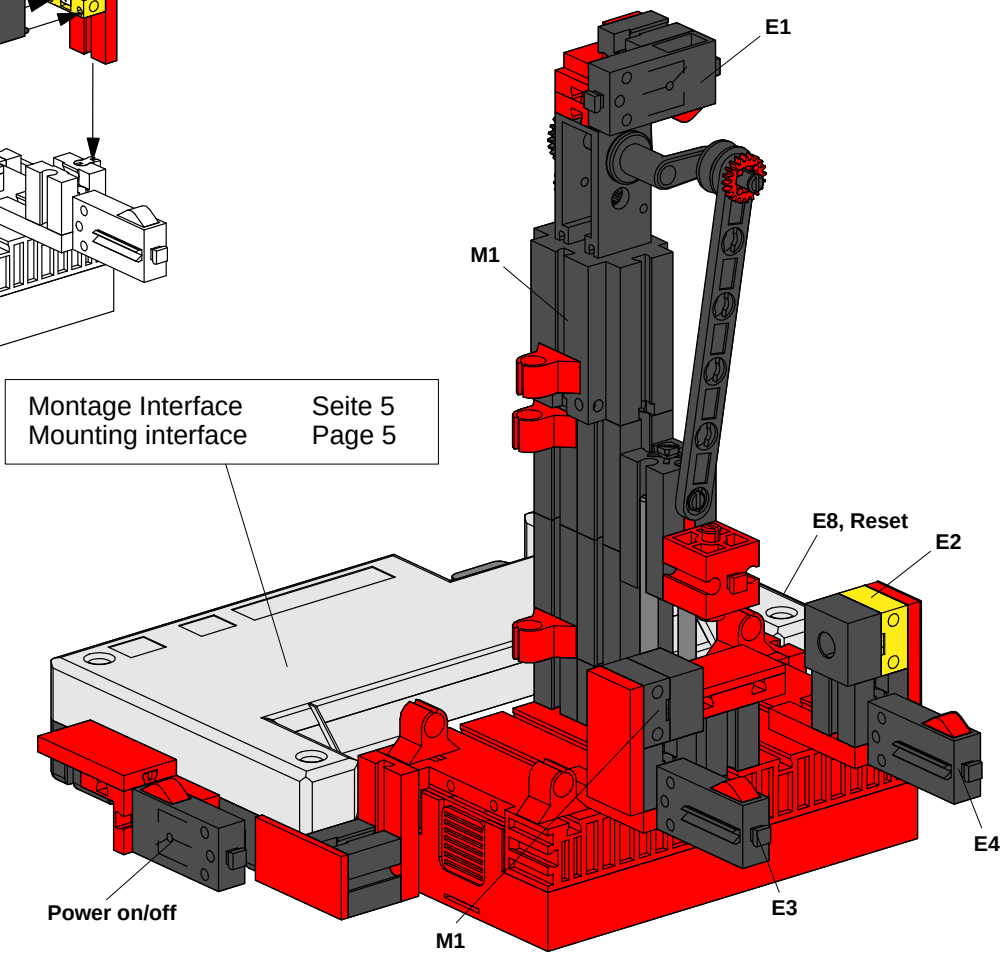




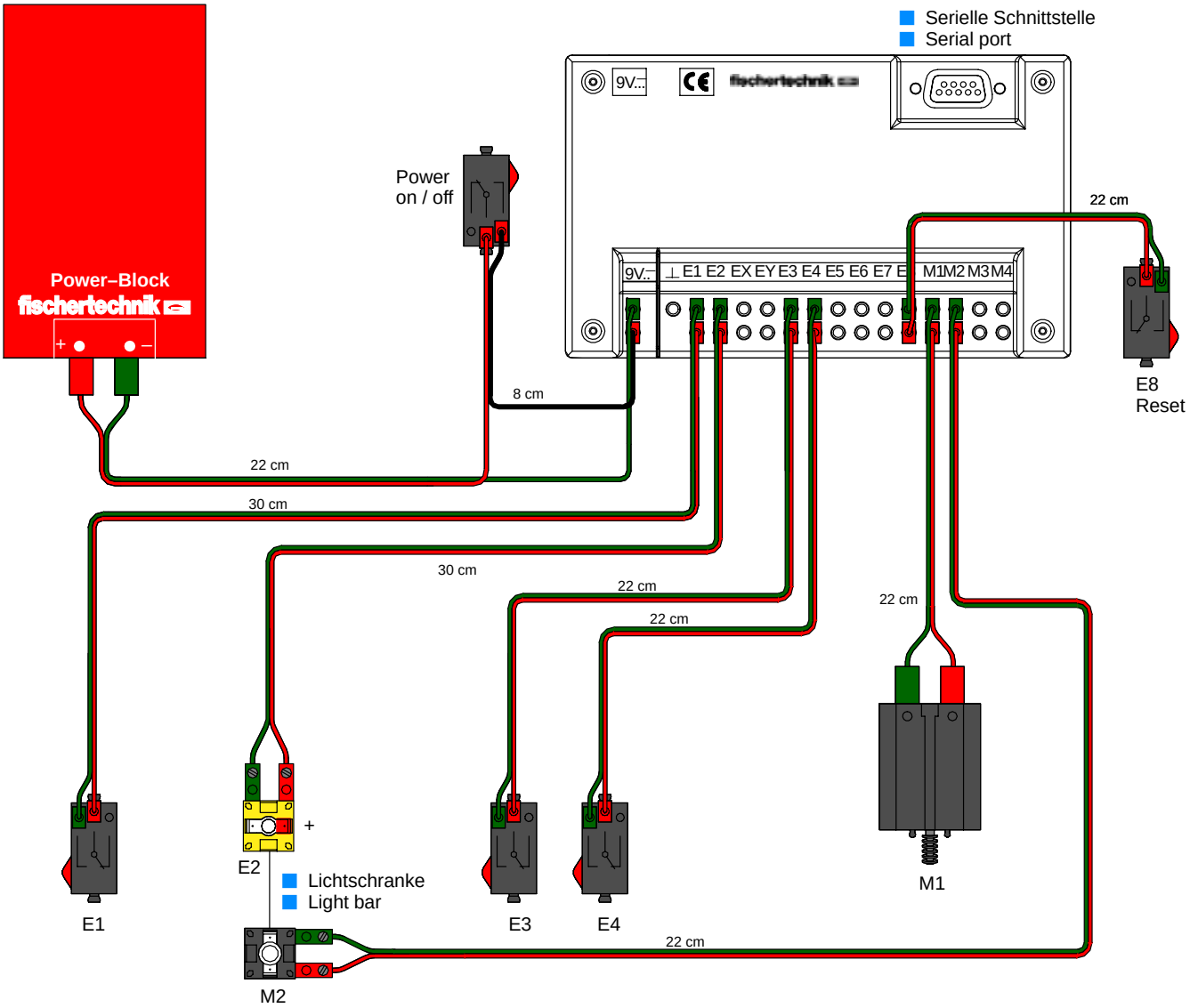





Montage Interface Seite 5
Mounting interface Page 5

## Schaltplan
## Circuit diagram



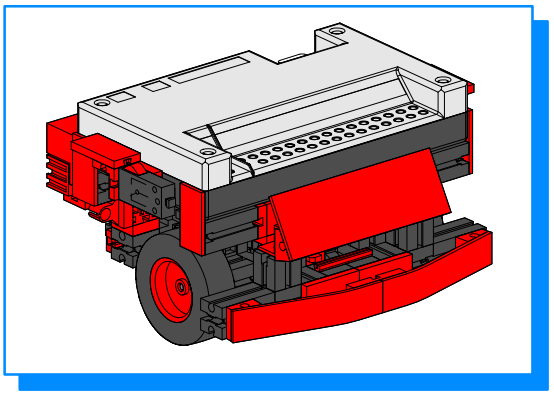

### Beispielprogramm: stanze.mdl

**Funktionsweise:**
Durch gleichzeitiges Drücken der Taster E3 und E4 wird die Maschine in Gang gesetzt und führt eine bestimmte Anzahl von Hüben aus. Unterbricht man die Licht–schranke, stoppt die Maschine und muß neu gestartet werden. Im Passiv–Modus werden am Terminal die Anzahl

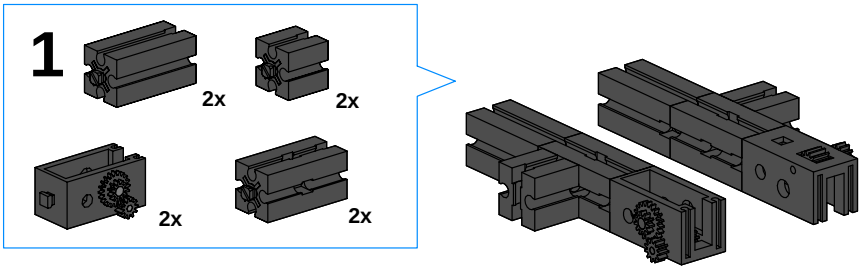
der Hübe und die Zahl der Durchgänge angezeigt.

### Program example: stamp.mdl

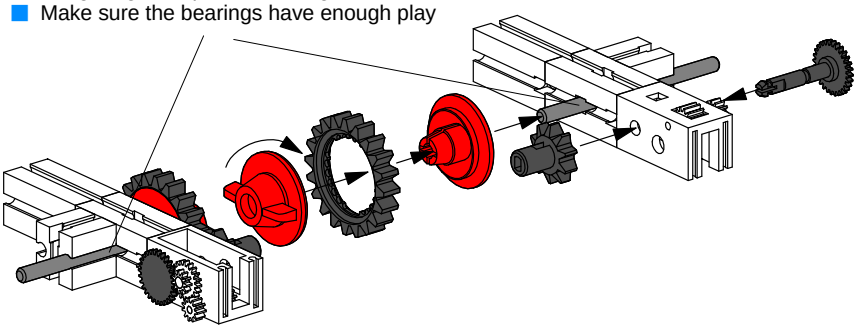
**Operational description:**
Simultaneously pressing switches E3 and E4 puts the machine in gear and causes it to carry out a specific number of strokes.If the light barrier is broken, the machine stops and must be restarted. The number of strokes and the number of completed runs are shown on the terminal in the passive mode.

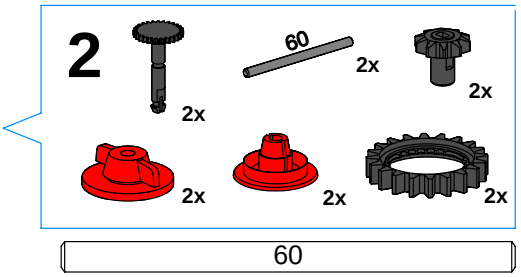


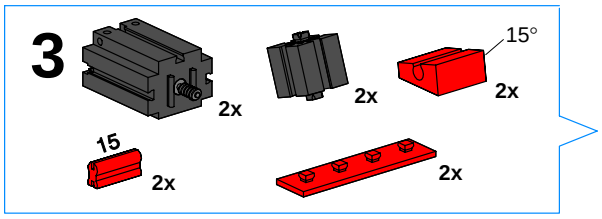
# MR 1
## Basismodell
## Base Model

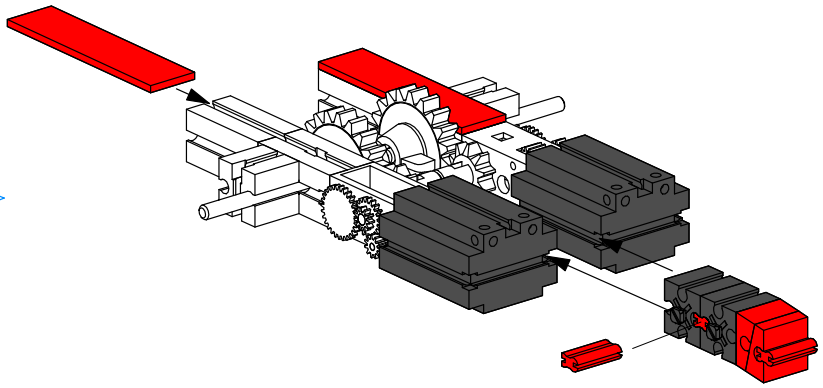


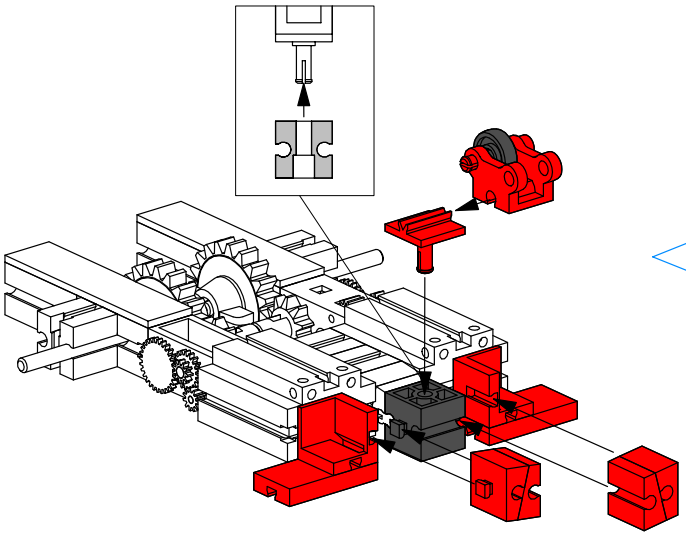

- Auf genügend Spiel in den Lagern achten
- Make sure the bearings have enough play

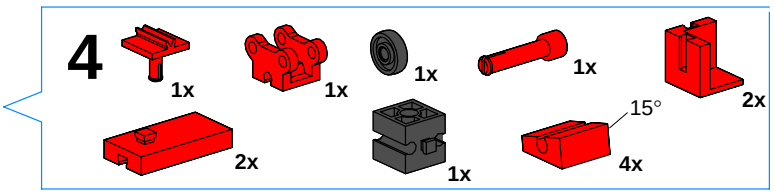


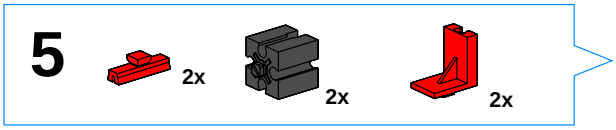


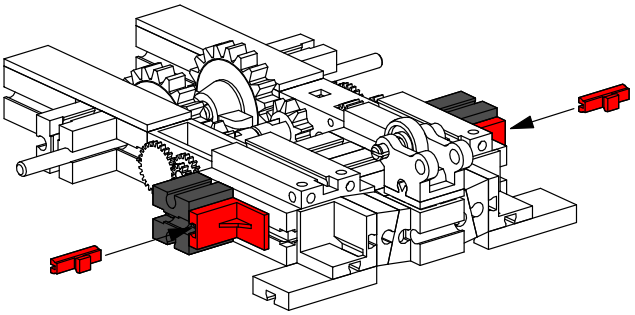



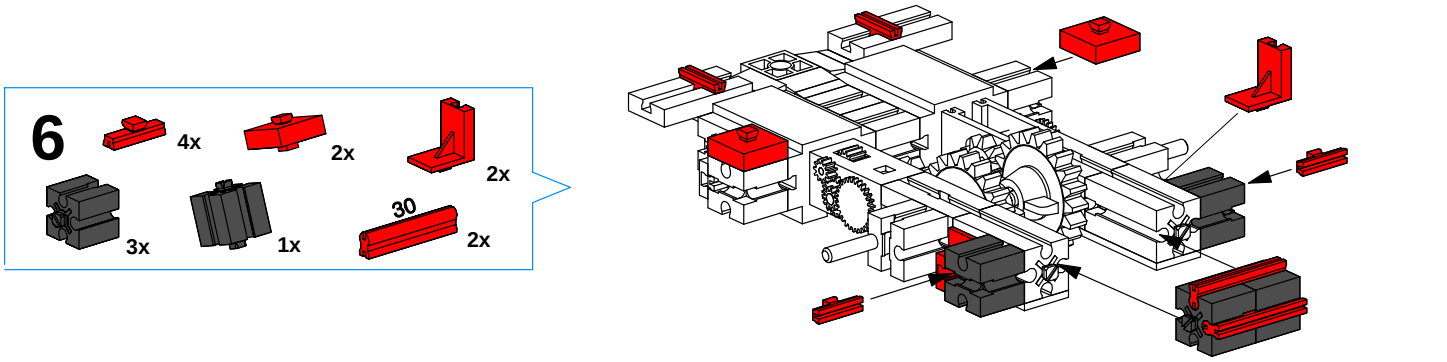





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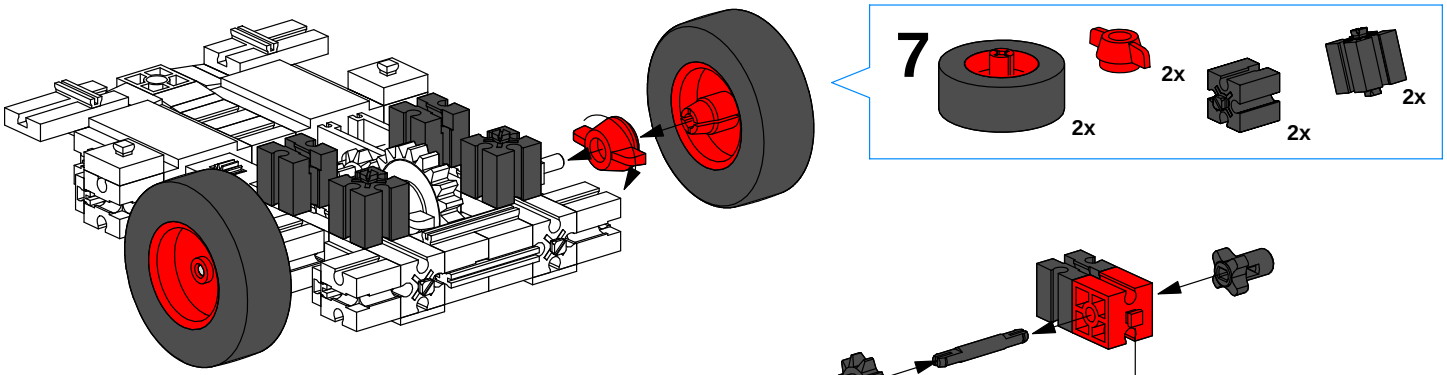
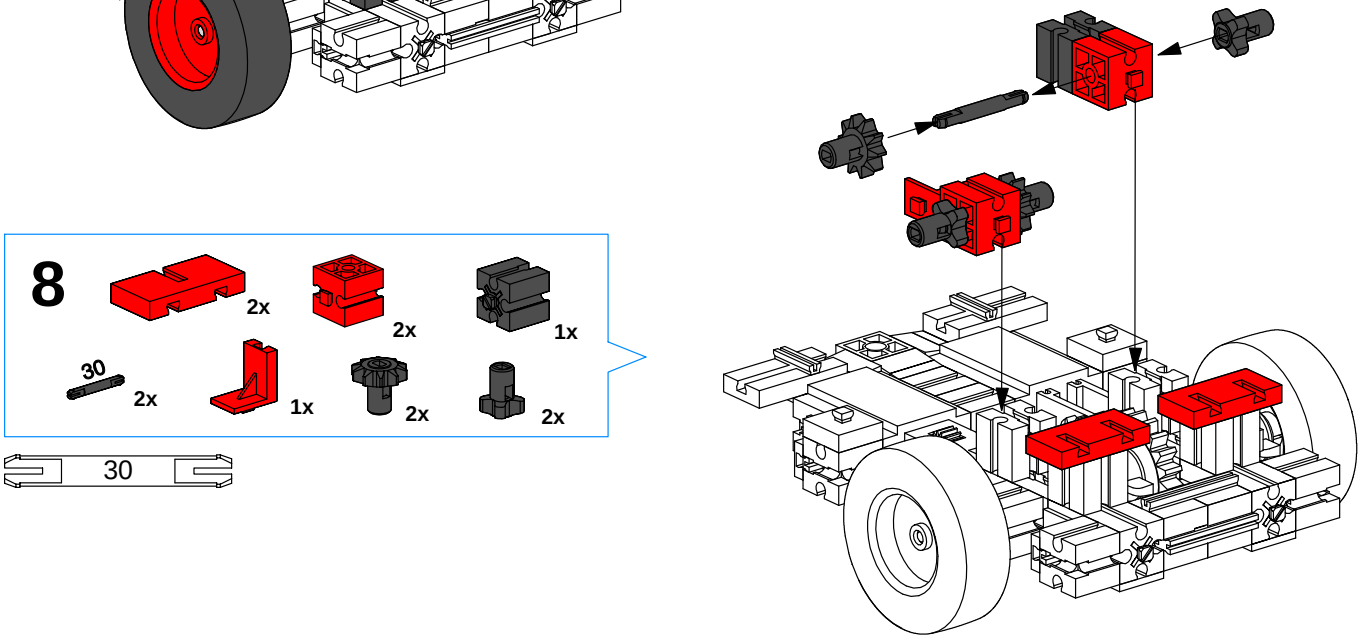
4x
2x
2x
3x
1x
30
2x


7
2x
2x
2x
2x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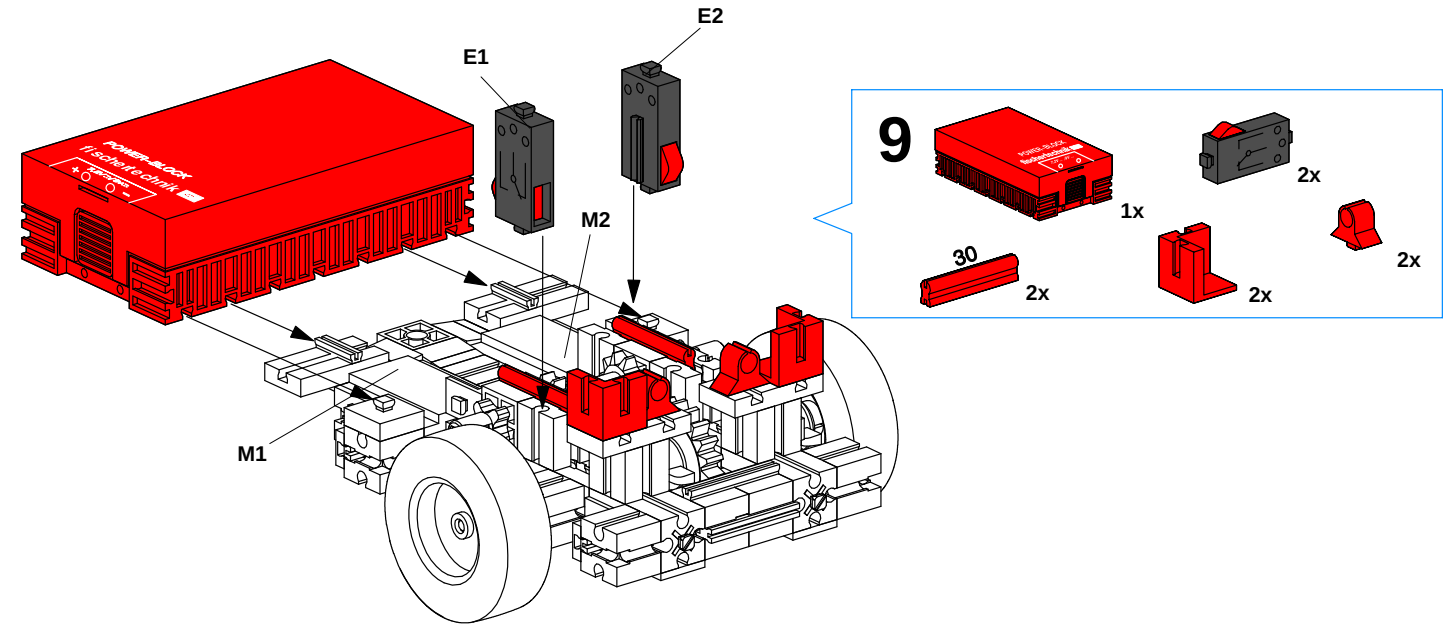
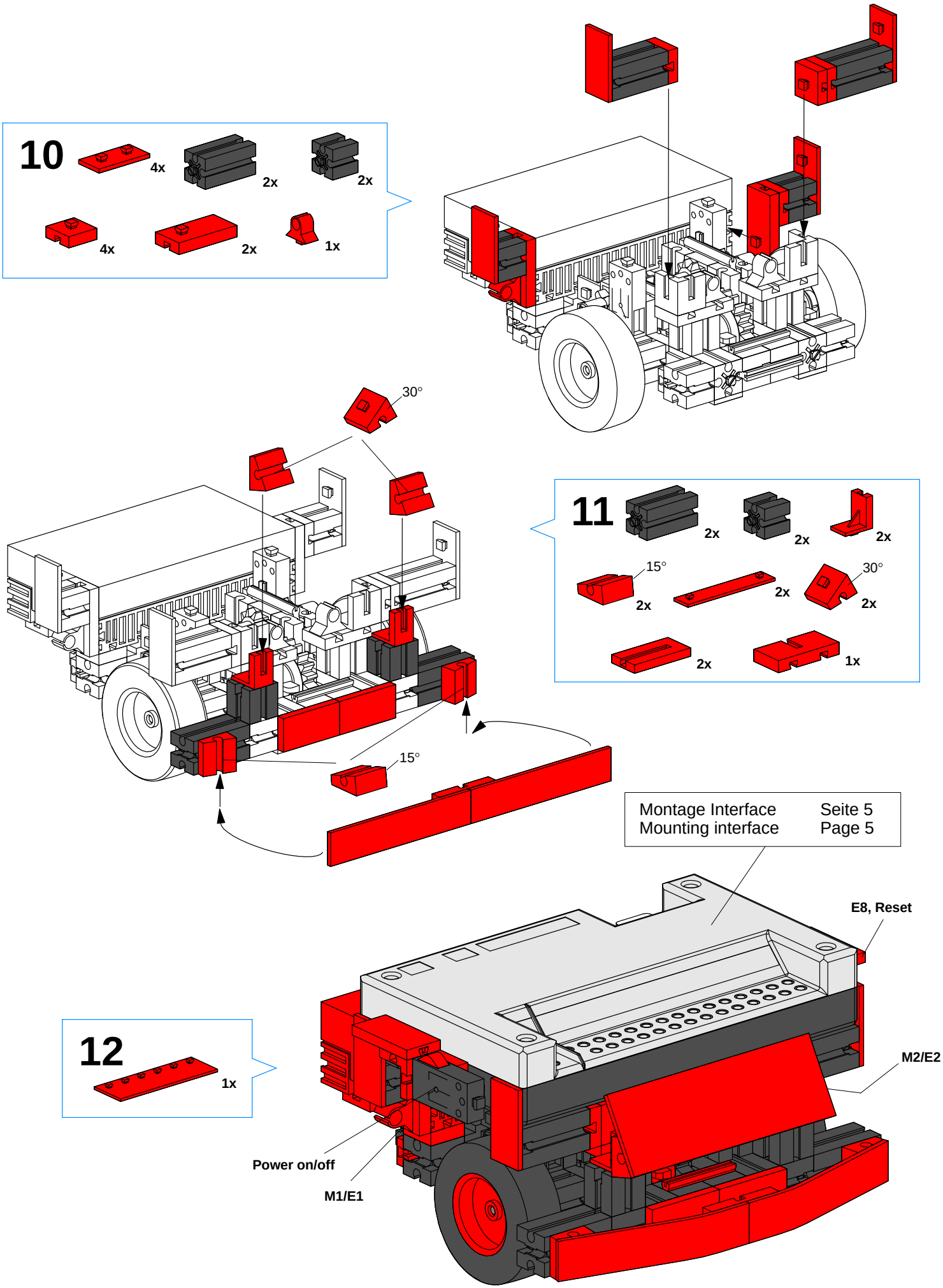
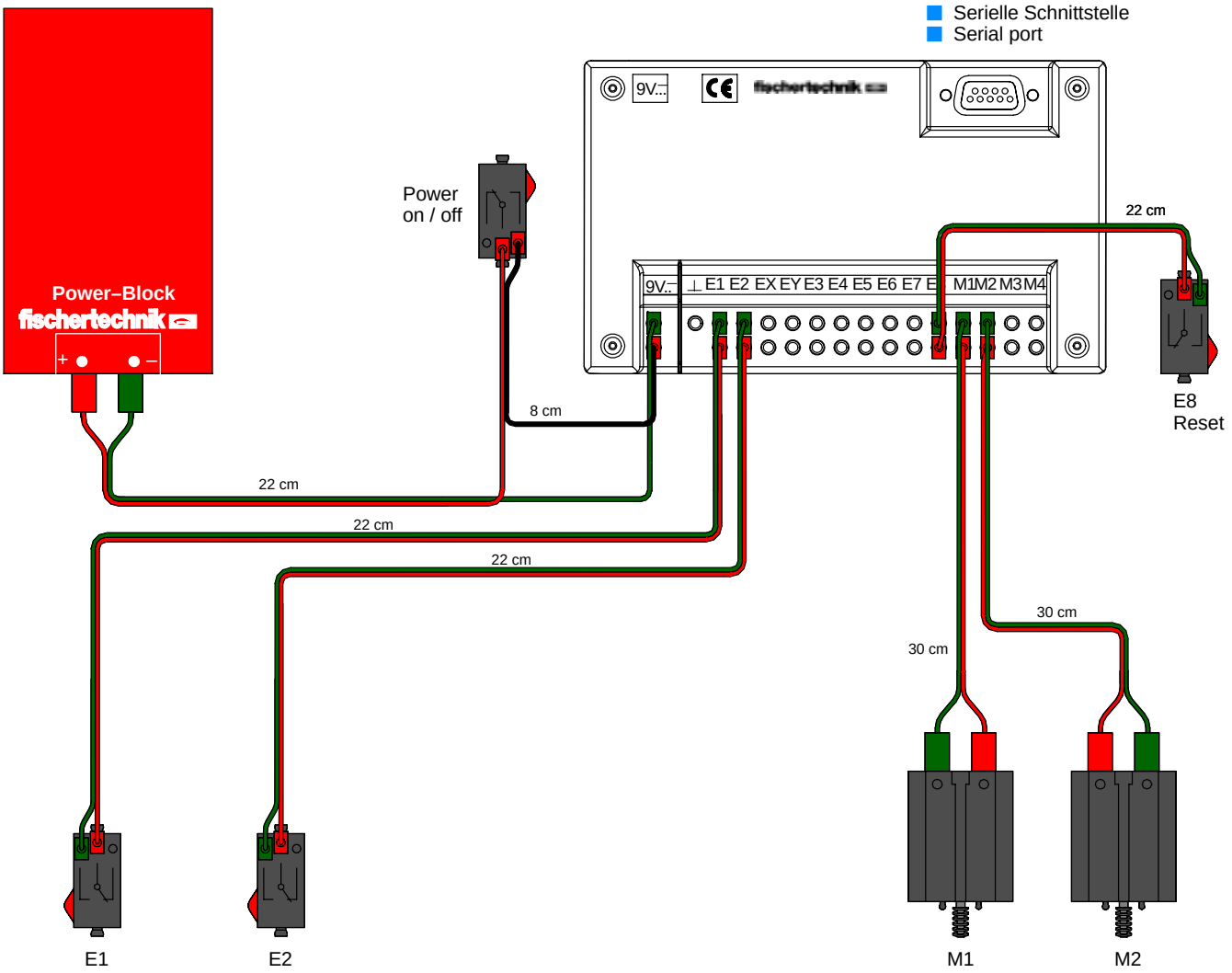
2x
2x
1x
30
2x
1x
2x
2x
30


E1
E2
M2
M1
9
1x
2x
2x
30
2x
2x


10
4x
2x
2x
4x
2x
1x
30°
15°
11
2x
2x
2x
15°
2x
30°
2x
2x
1x
Montage Interface Seite 5
Mounting interface Page 5
E8, Reset
M2/E2
12
1x
Power on/off
M1/E1

## Schaltplan
## Circuit diagram

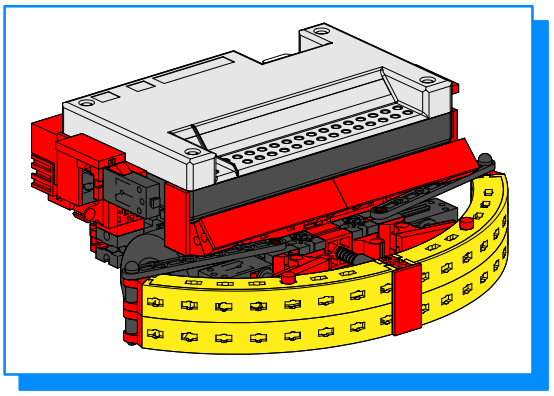



### Beispielprogramm: mr1.mdl

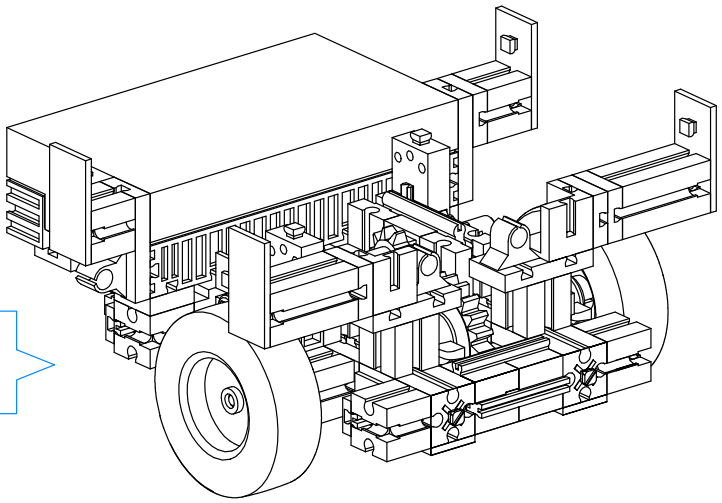
**Funktionsweise:**
MR1 ist in der Lage, definierte Strecken vorwärts, rückwärts, nach links und rechts zurückzulegen. Er besitzt jedoch keine Sensoren um beispiels–weise Hindernisse zu erkennen.
Dieses Modell bildet den Einstieg in die Welt der mobilen fischertechnik Roboter.

### Program example: mr1.mdl

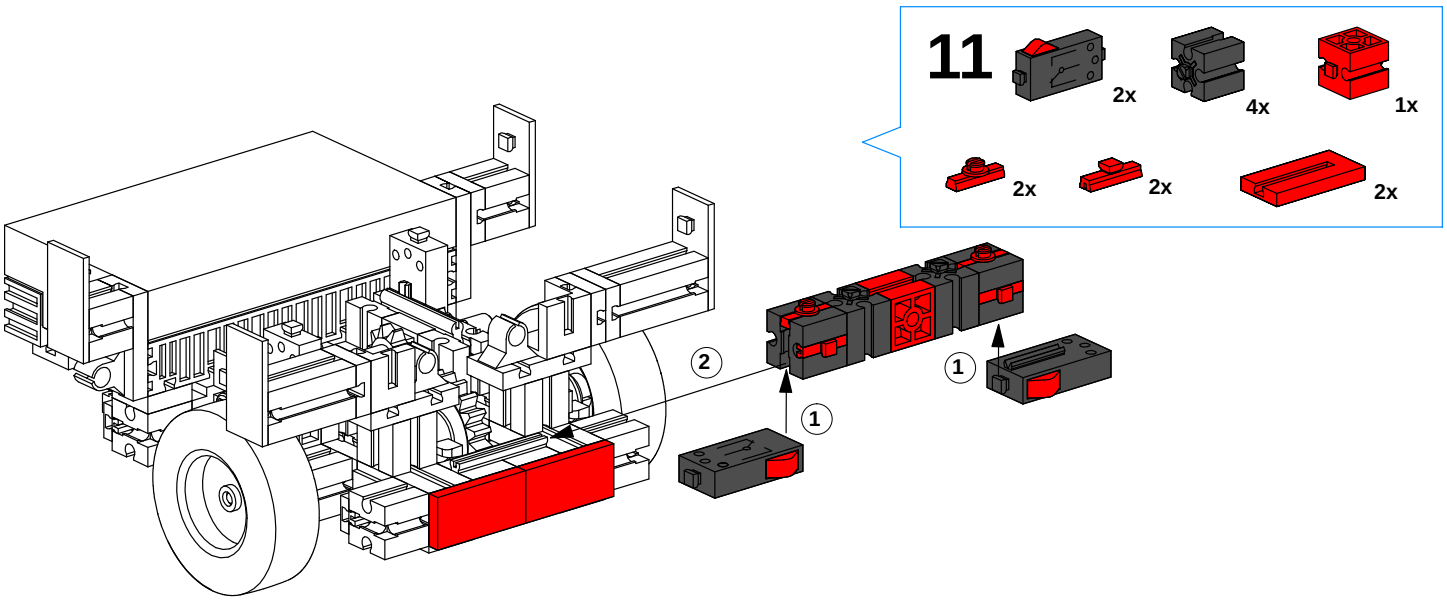
**Operational description:**
MR1 is able to travel for designated distances forwards, backwards, to the left, and to the right. It is not, however, equipped with any sensors to, for example, recognize obstacles.
This model offers an introduction into the world of fischertechnik's mobile robots.

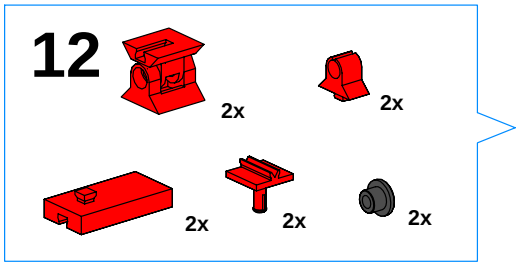


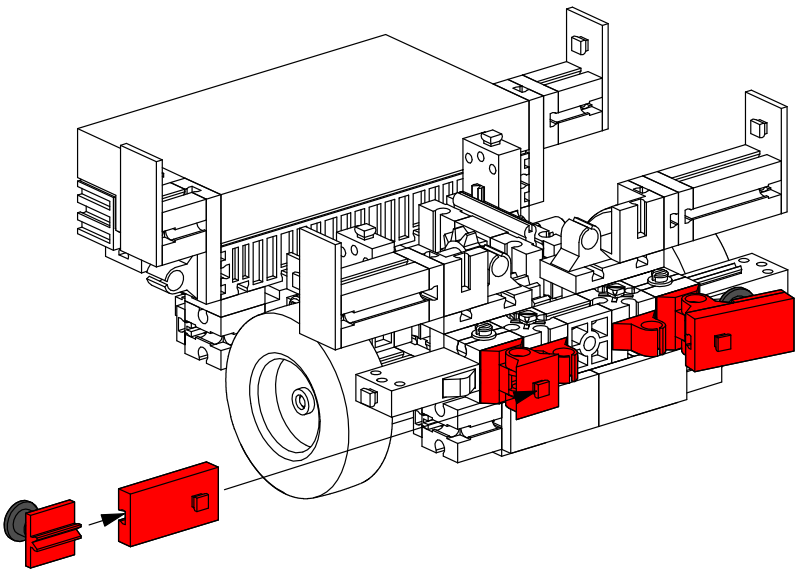
## MR 2
erkennt Hindernisse
recognizes obstacles

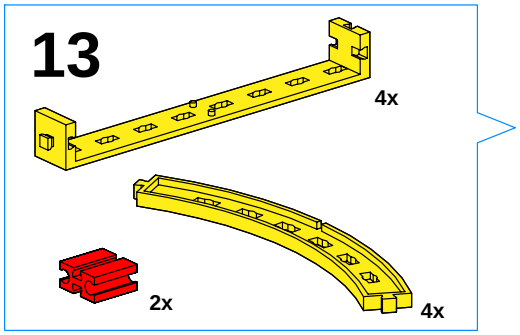


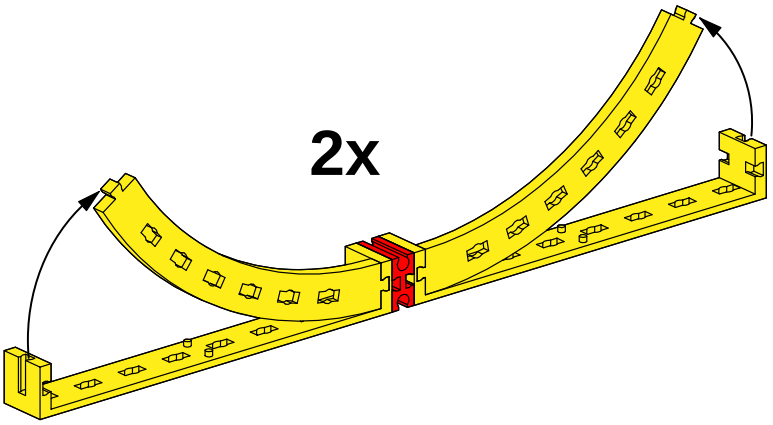
**1–10** Seite 16 – 18
Page 16 – 18

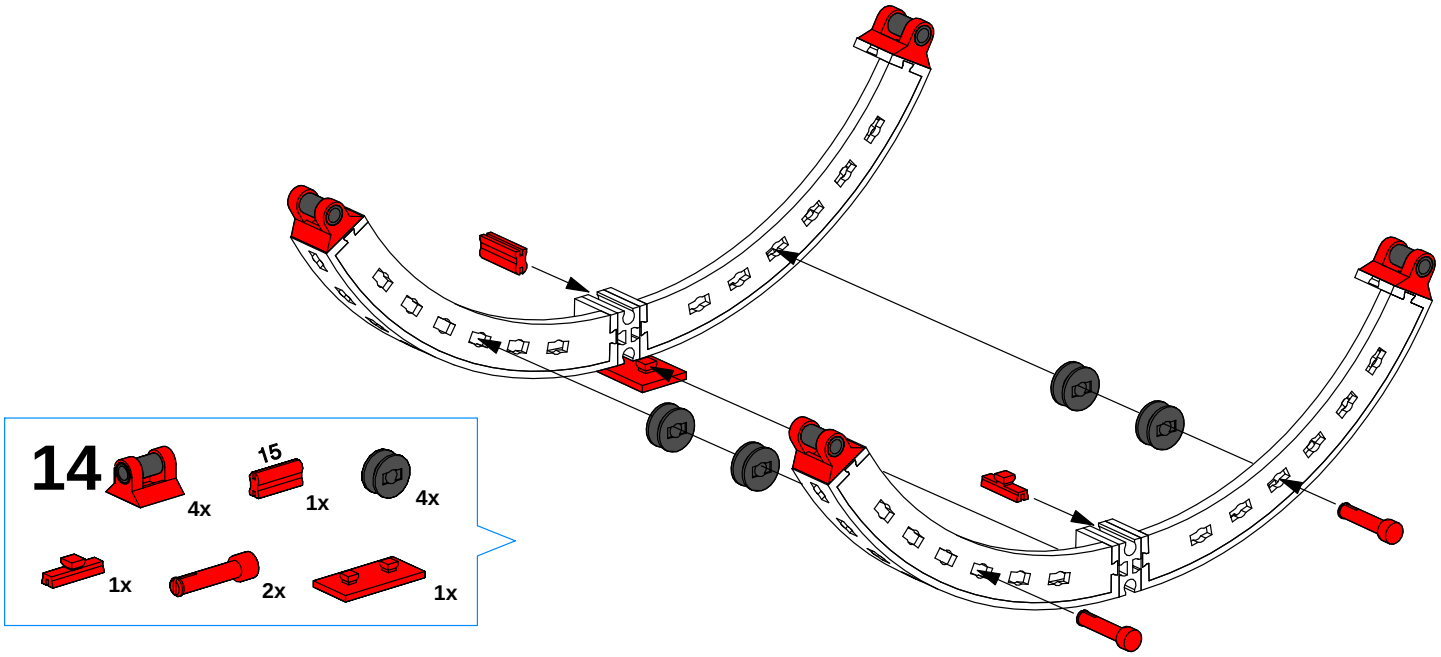


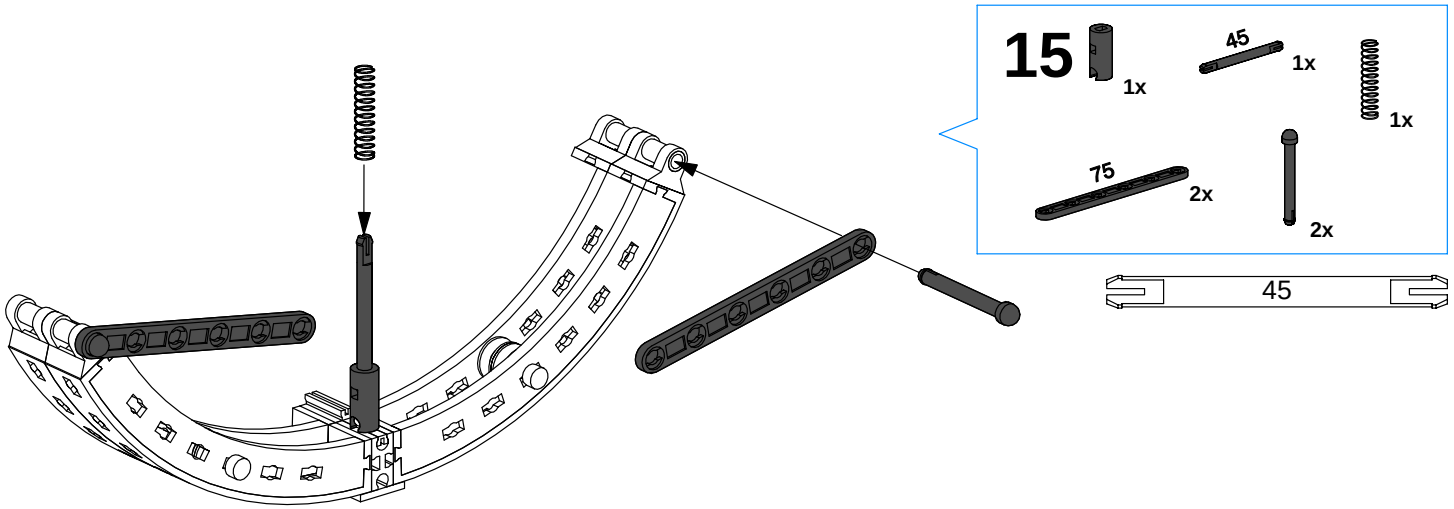



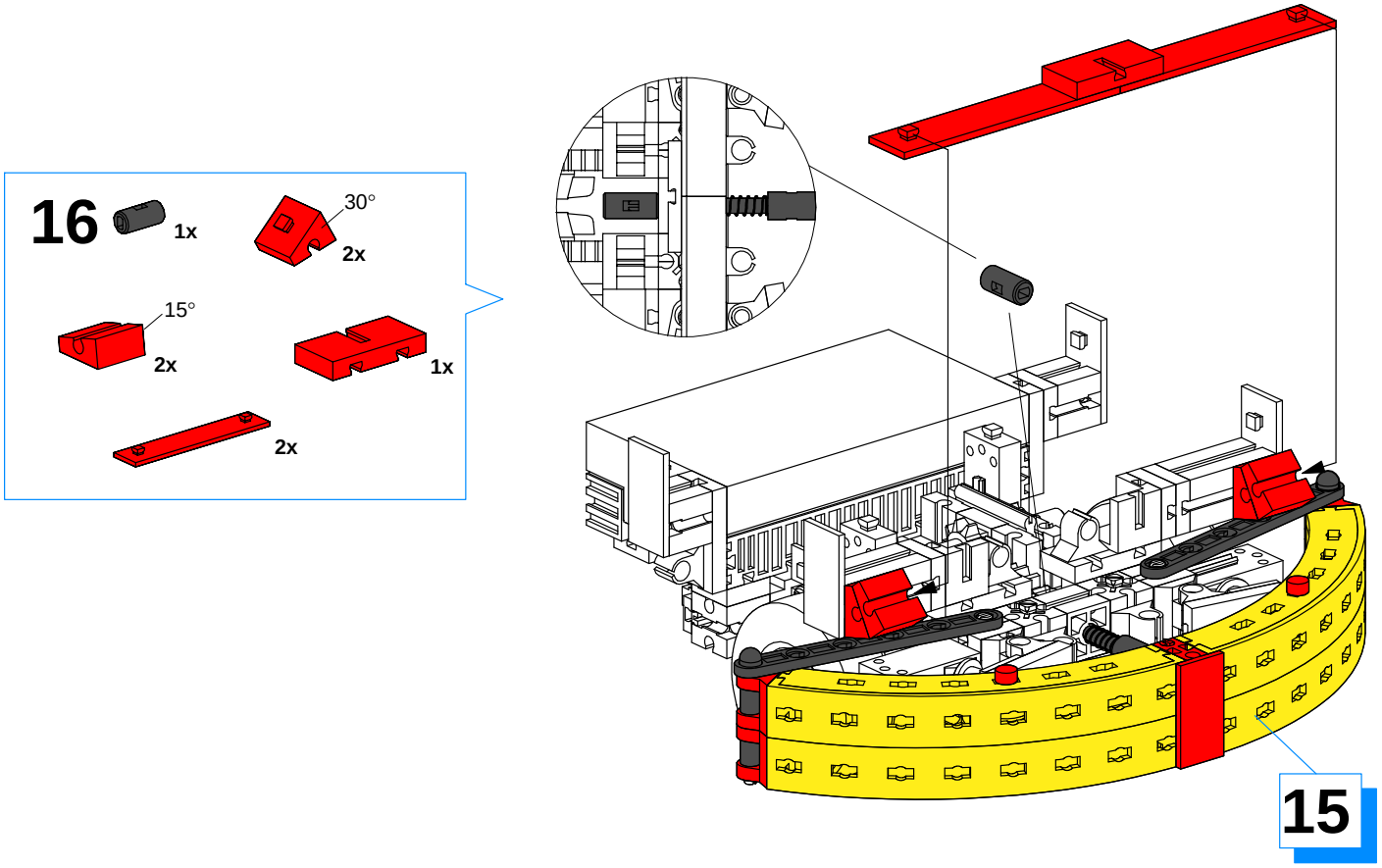



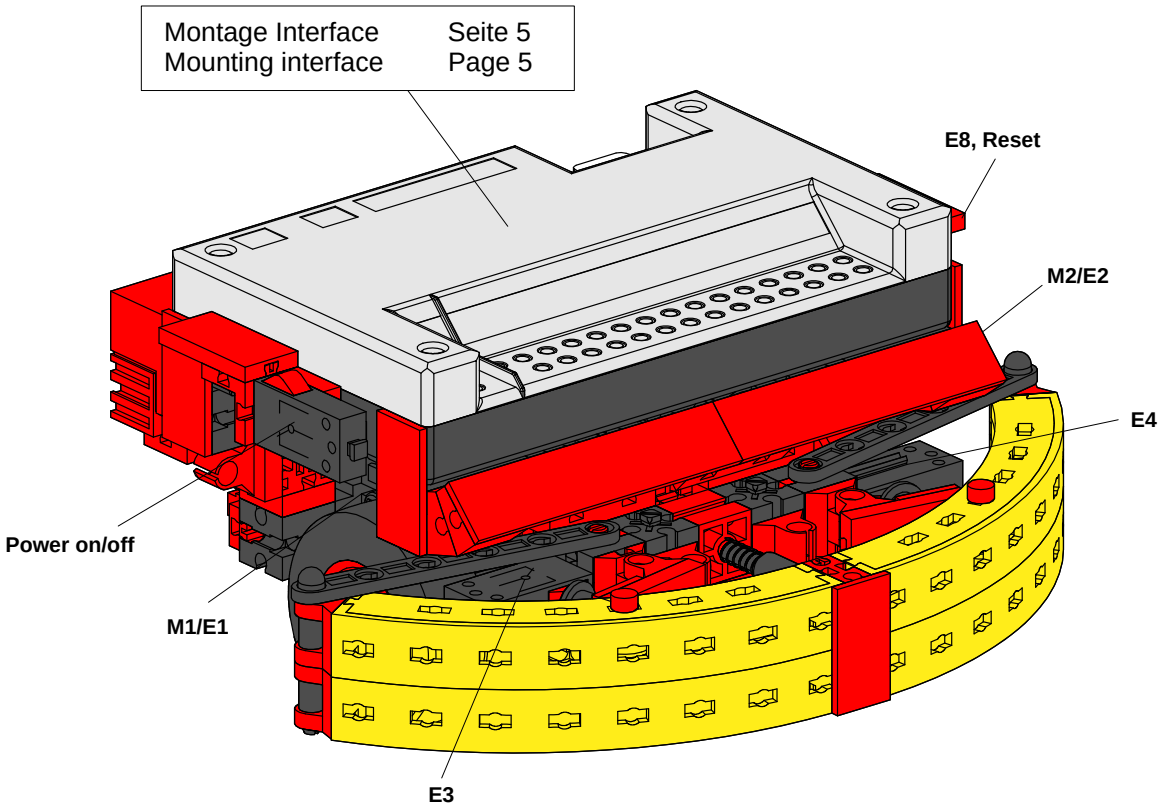

13
4x
2x
4x


2x

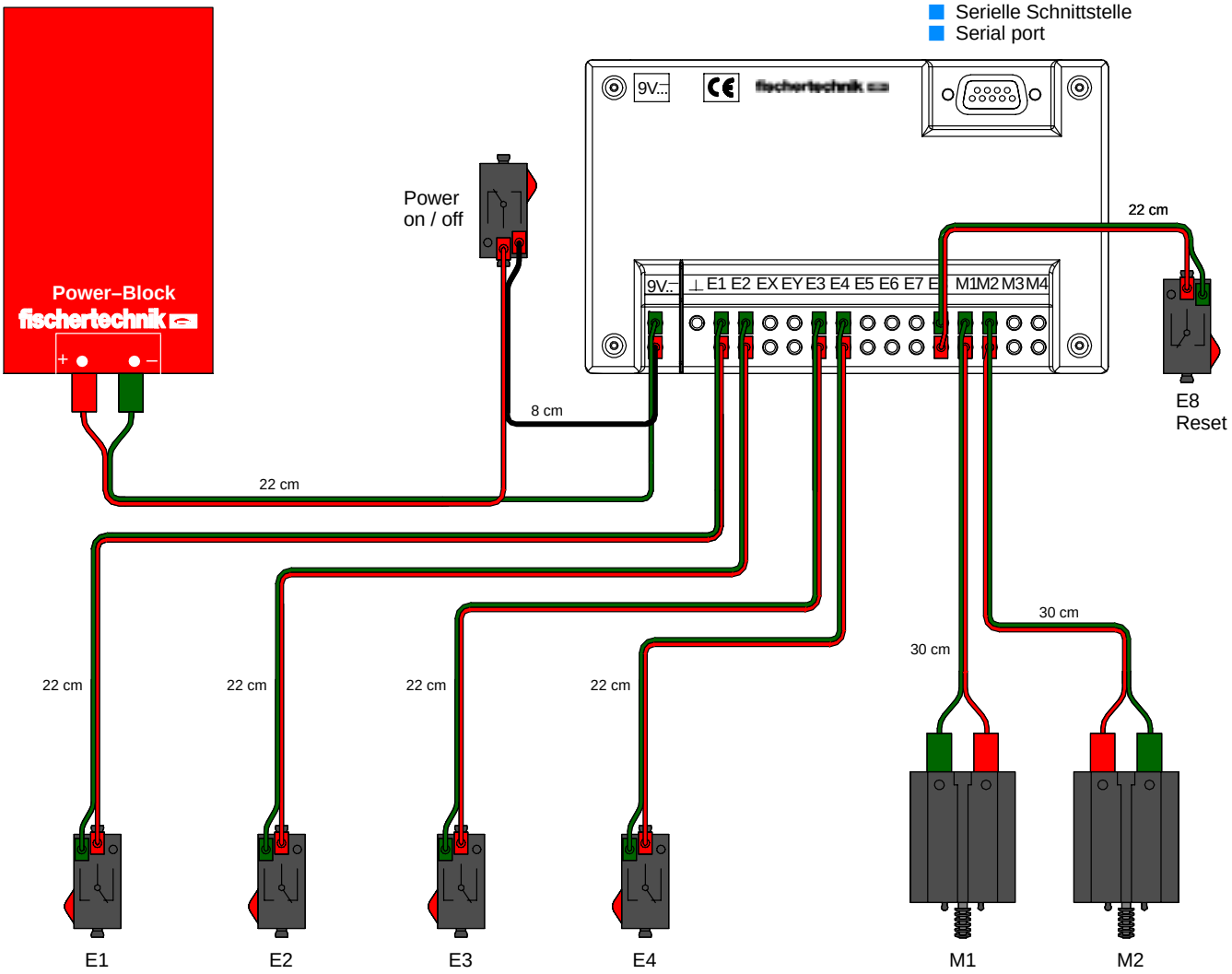

14
4x
15
1x
4x
1x
2x
1x


15
1x
45
1x
1x
75
2x
2x
45


16
1x
30°
2x
15°
2x
1x
2x
15


Montage Interface Seite 5
Mounting interface Page 5
E8, Reset
M2/E2
E4
Power on/off
M1/E1
E3

## Schaltplan
## Circuit diagram

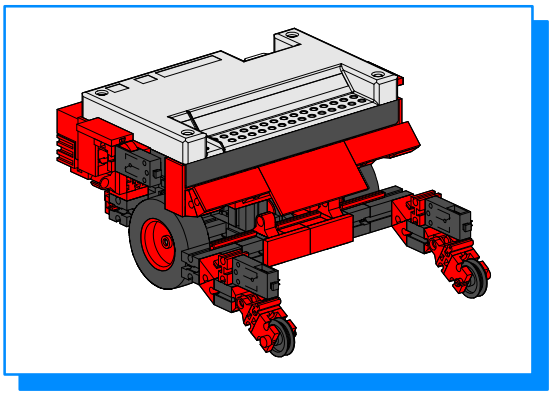



### Beispielprogramm: mr2.mdl

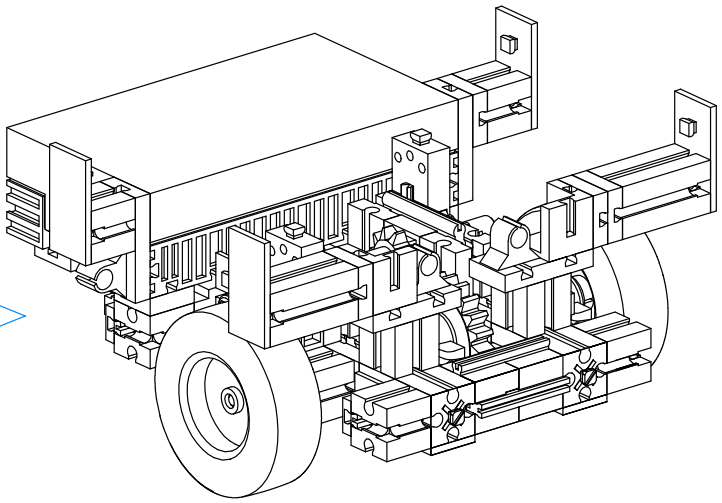
**Funktionsweise:**
MR2 kann, sobald er mit seiner Stoßstange auf ein Hindernis trifft, diesem Hindernis ausweichen. Die Stoßstange löst zwei Taster, E3 und E4, aus. Das Modell weicht dann nach rechts oder links aus, je nachdem welcher der beiden Taster gedrückt wird.

### Program example: mr2.mdl

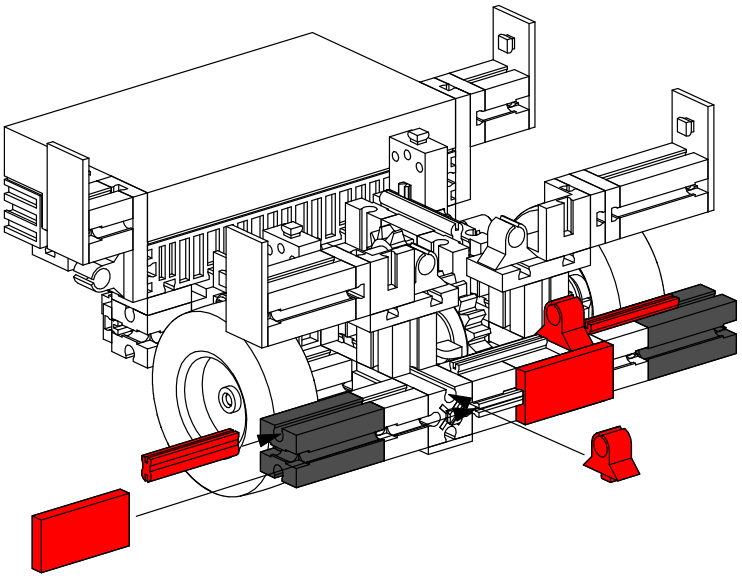
**Operational description:**
As soon as its bumper runs into an obstacle, MR2 can attempt to circumvent it. The bumper activates two switches, E3 and E4. The model then moves either to the right or the left, depending on which switch was activated.



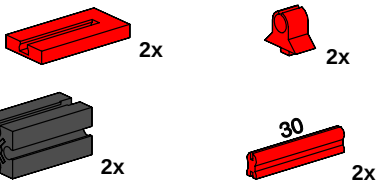
## MR3
erkennt Abgründe
recognizes ledges



**1–10** Seite 16 – 18
Page 16 – 18



**11**

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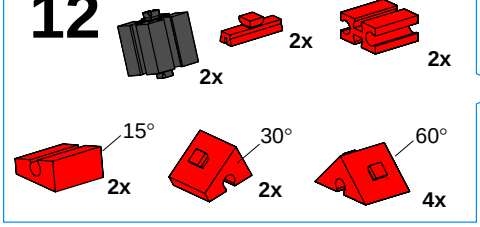
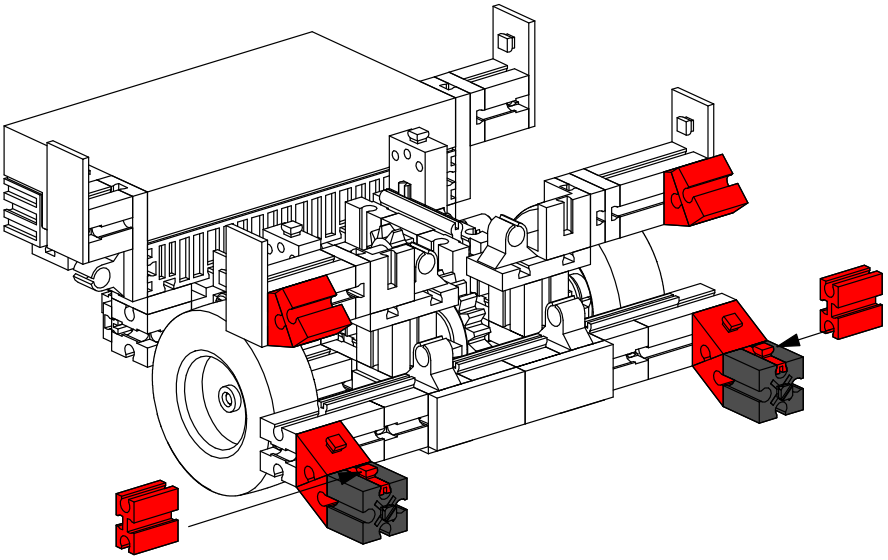
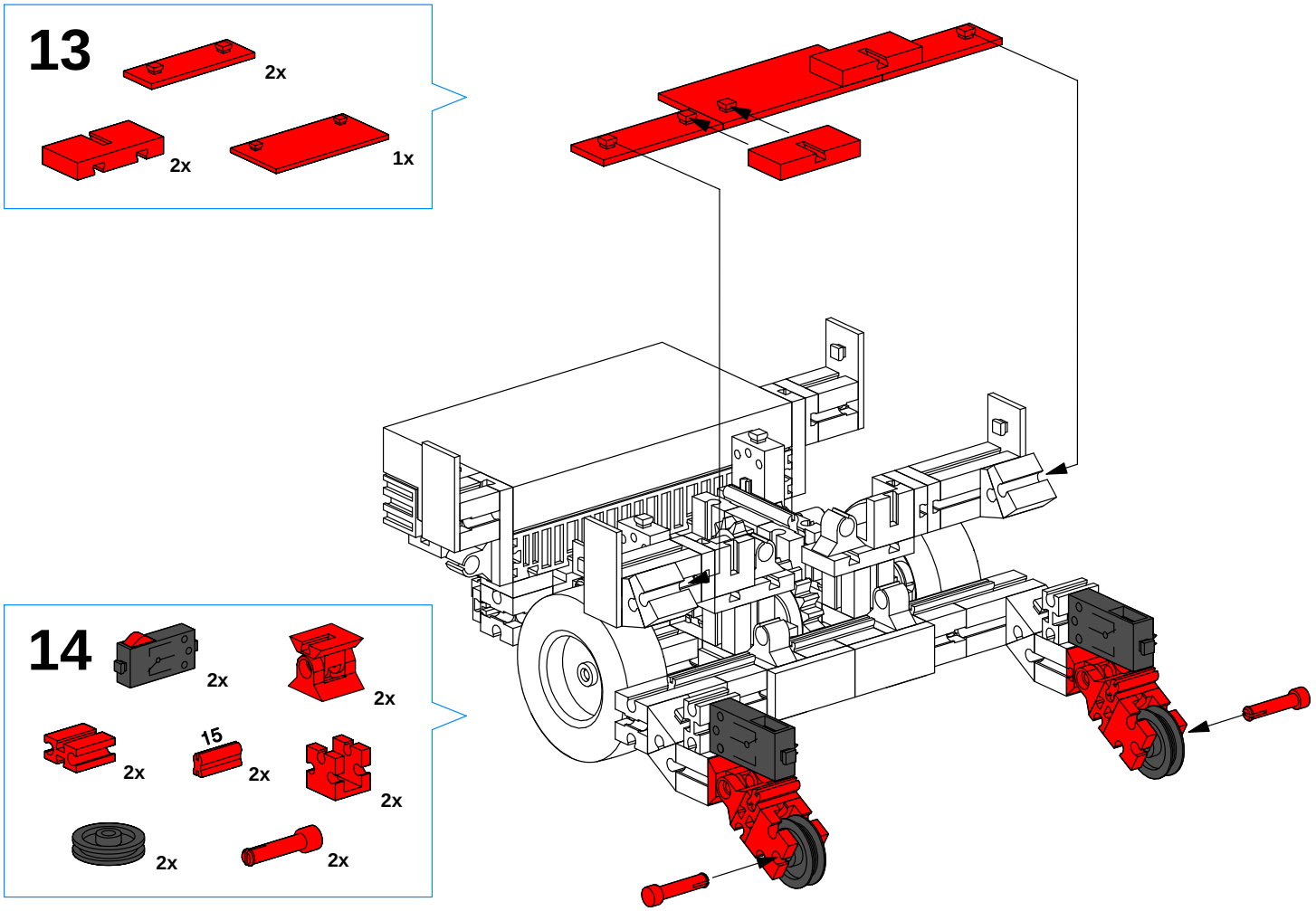
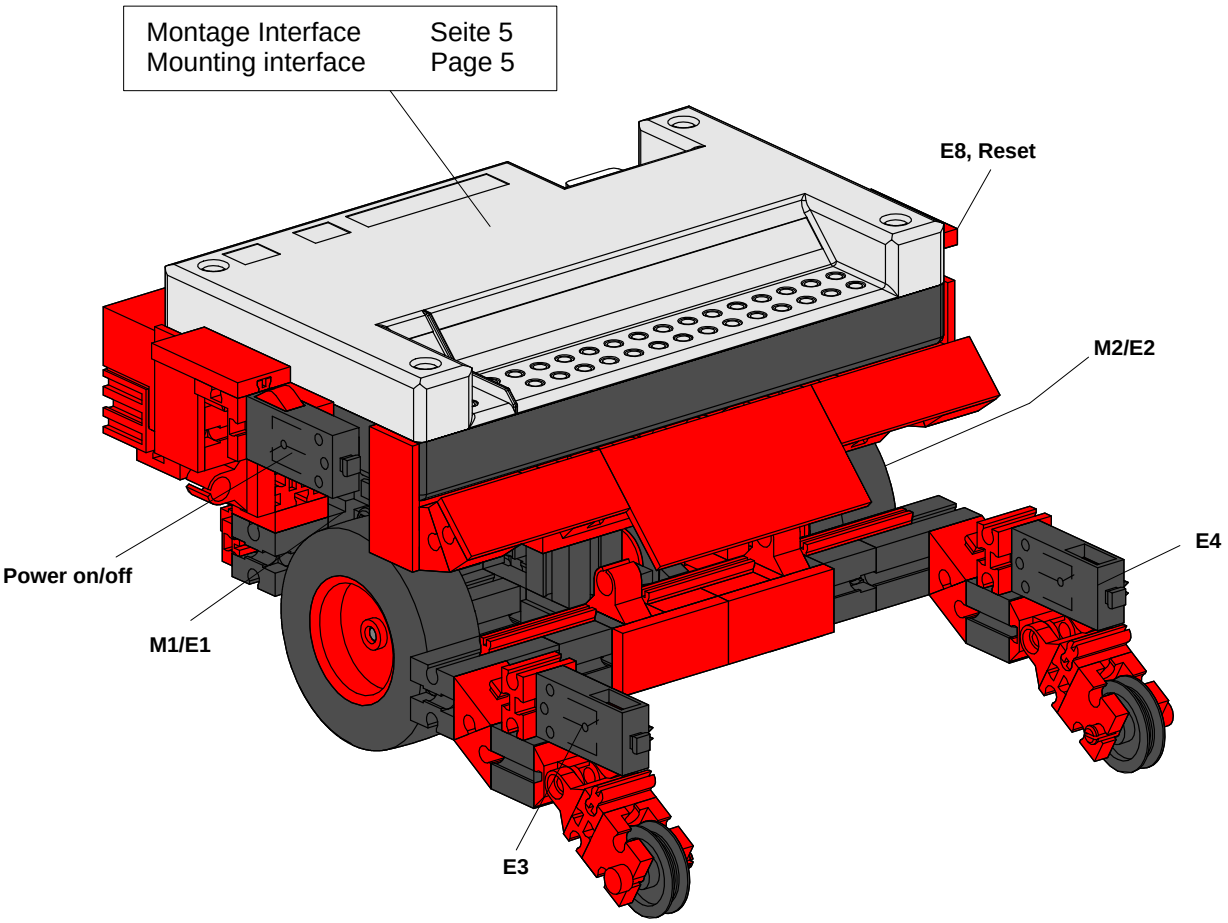
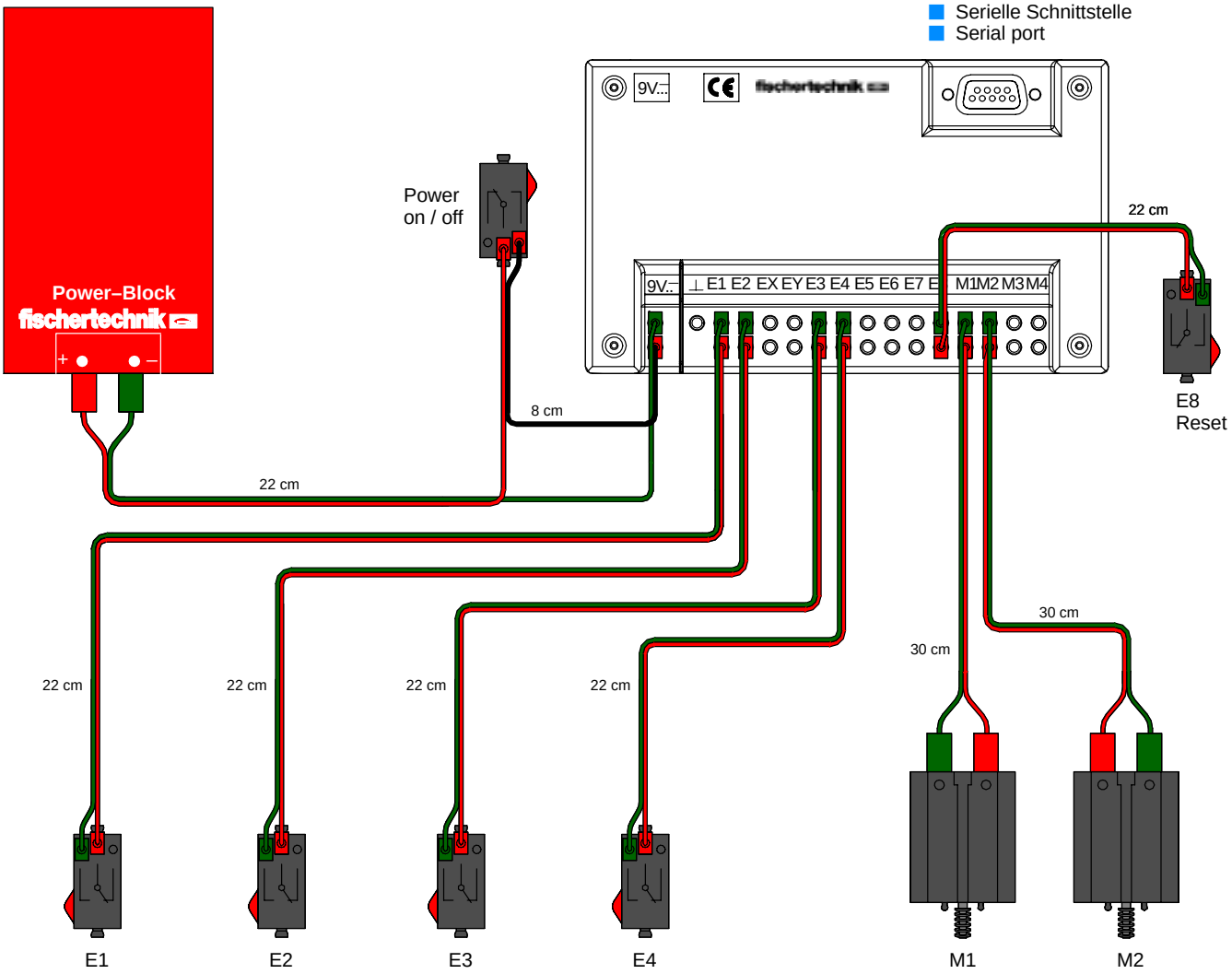



13
2x
2x
1x
14
2x
2x
2x
15
2x
2x
2x
2x


Montage Interface Seite 5
Mounting interface Page 5
E8, Reset
M2/E2
E4
Power on/off
M1/E1
E3

## Schaltplan
## Circuit diagram

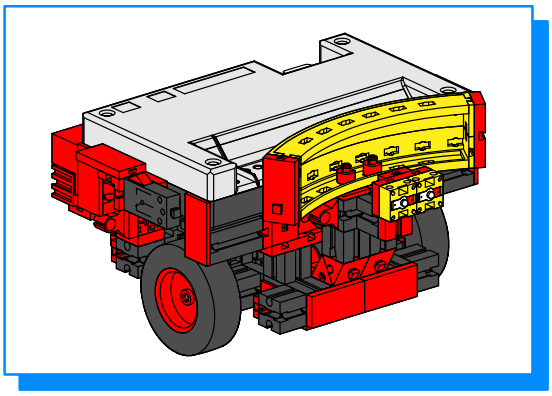



### Beispielprogramm: mr3.mdl

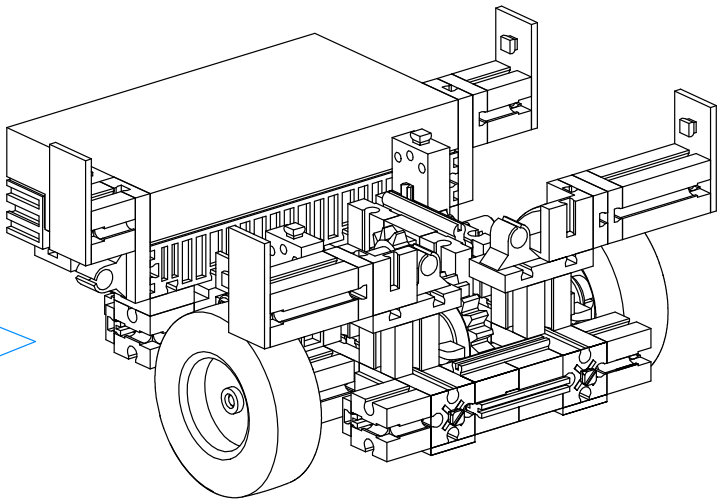
**Funktionsweise:**
MR3 besitzt Rollen, die nach unten abklappen, wenn er sich einem Abgrund, z.B. einer Tischkante, nähert. Dadurch werden die Taster E3 und E4 ausgelöst. Je nachdem, welcher Taster sich öffnet, kann das Modell nach links oder rechts ausweichen oder umkehren.

### Program example: mr3.mdl

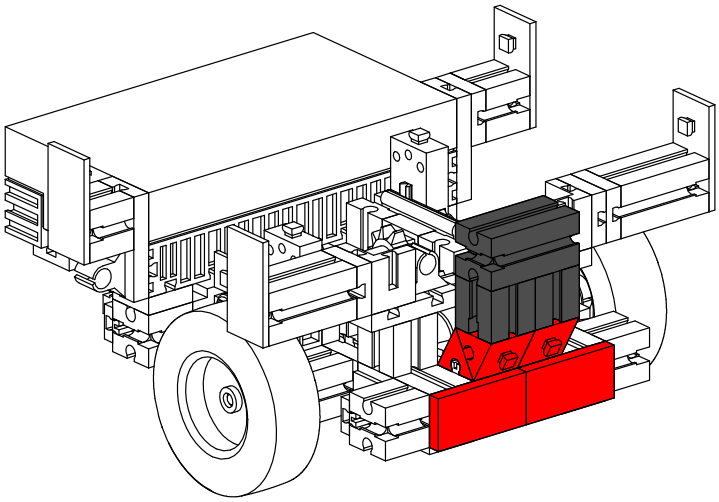
**Operational description:**
MR3 is equipped with rollers that fold downwards if the unit encounters open space under it, e.g., the edge of a table.The rollers activate switches E3 and E4. Depending on which switch is activated, the model can turn to the left or the right, or reverse direction.



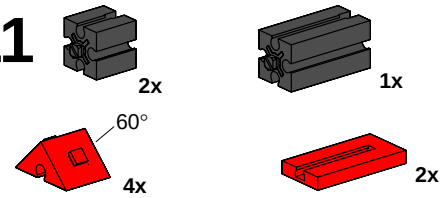
## MR4
folgt einer Lichtquelle
follows a light source



**1–10** Seite 16 – 18
Page 16 – 18



**11**

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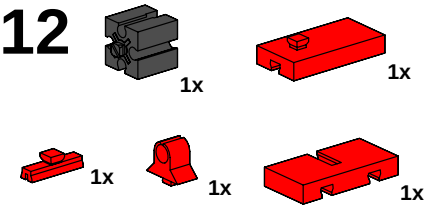
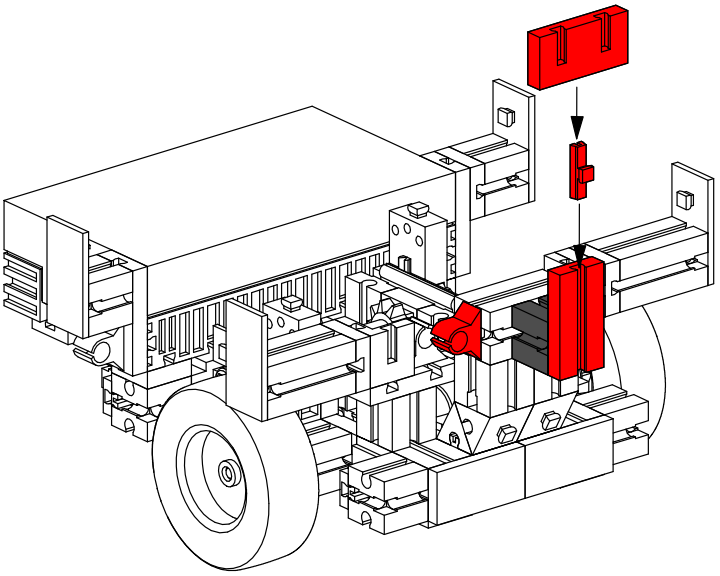
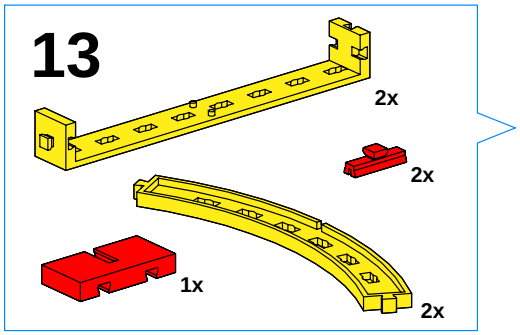
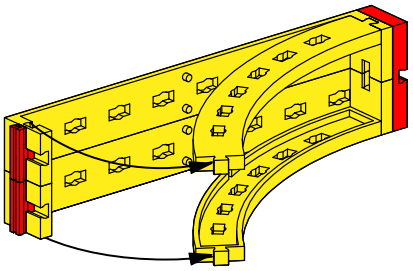
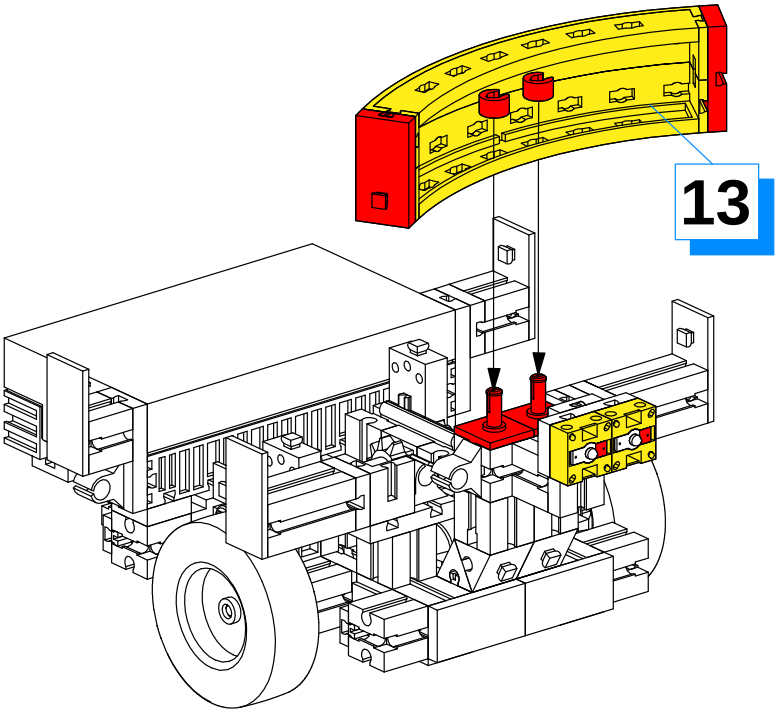



13
2x
2x
1x
2x

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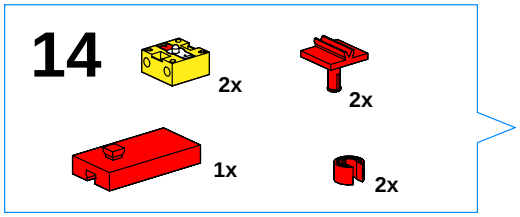
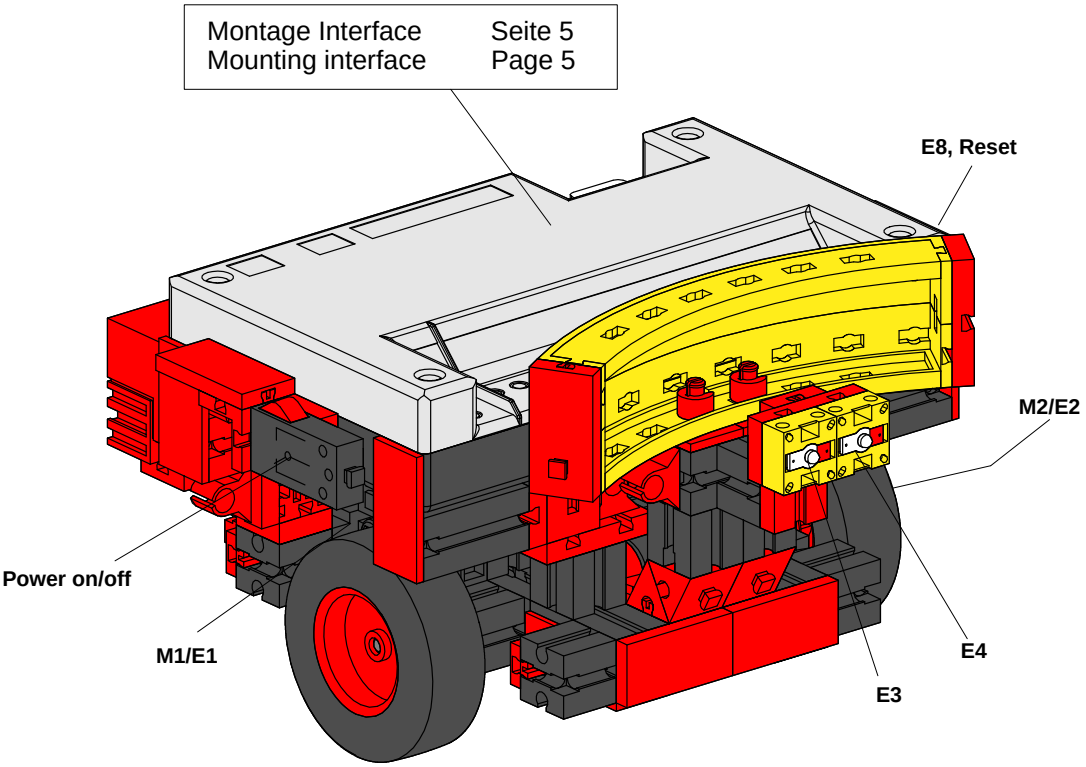
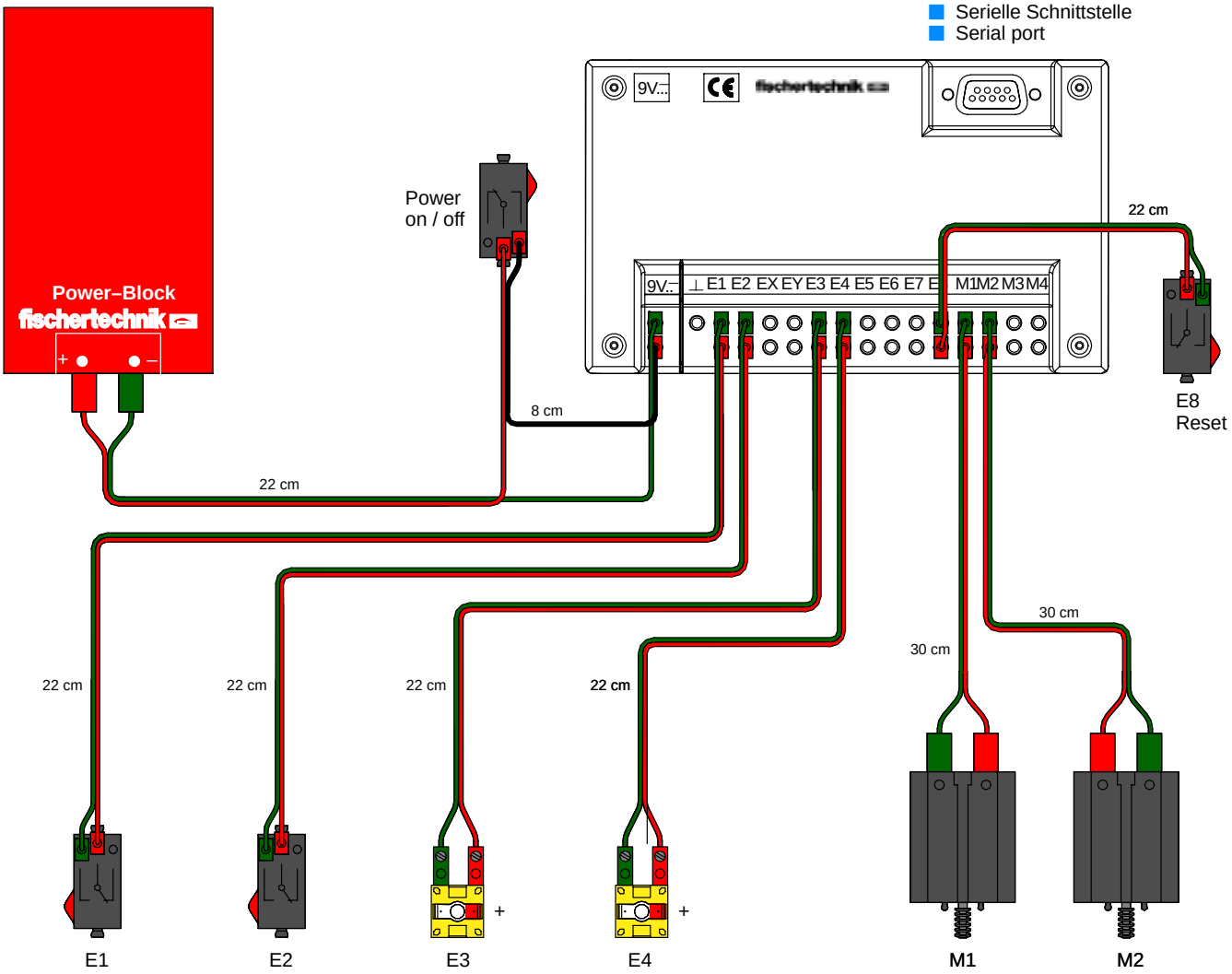

14
2x
2x
1x
2x


Montage Interface Seite 5
Mounting interface Page 5
E8, Reset
M2/E2
Power on/off
M1/E1
E4
E3

## Schaltplan
## Circuit diagram

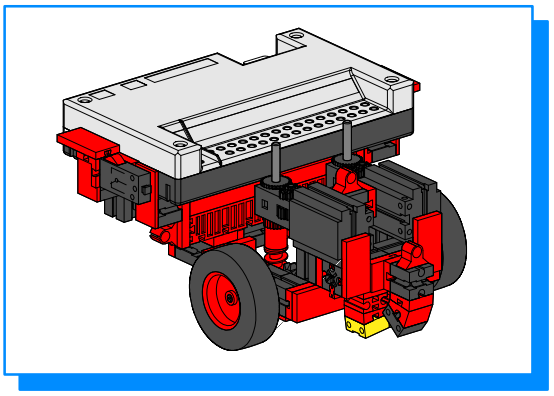



### Beispielprogramm: mr4.mdl

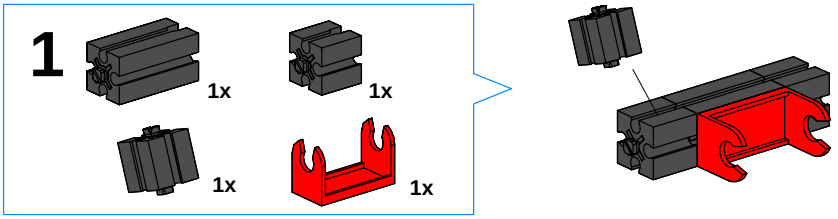
**Funktionsweise**:
MR4 sucht sich zunächst eine Lichtquelle, die ihn anstrahlt, z.B. eine Taschenlampe. Erkennen die beiden Fototransistoren eine Lichtquelle, fährt MR4 darauf zu und folgt dem Licht. Die Lichtquelle darf sich jedoch nicht zu schnell oder zu ruckartig bewegen. Verliert das Modell den Kontakt zum Lichtstrahl, beginnt es erneut zu suchen.

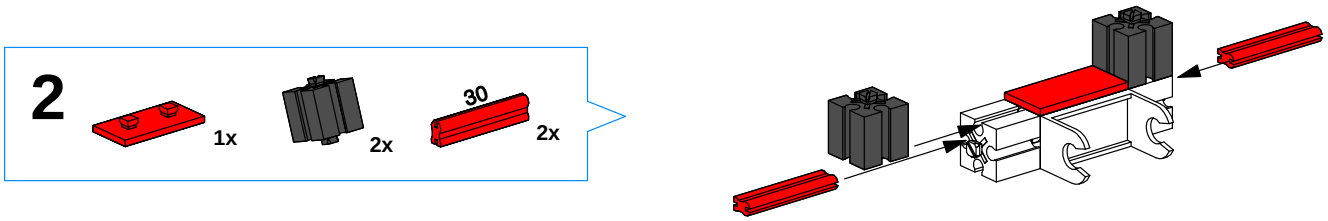
### Program example: mr4.mdl

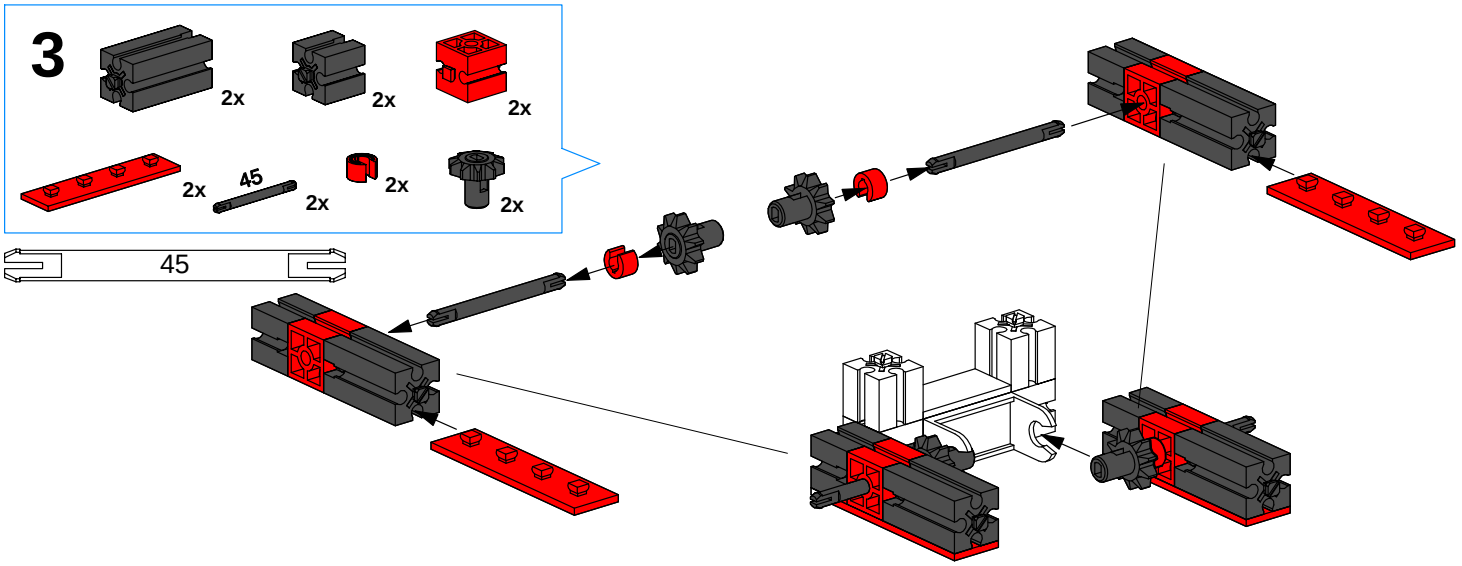
**Operational description:**
MR4 first searches for a light source (e.g., a flashlight) shining on it. If both phototransistors identify a light source, MR4 moves towards it and follows it. However, the light source must not be moved too rapidly, and must move smoothly. If the model looses contact to the light source, it begins a new search.

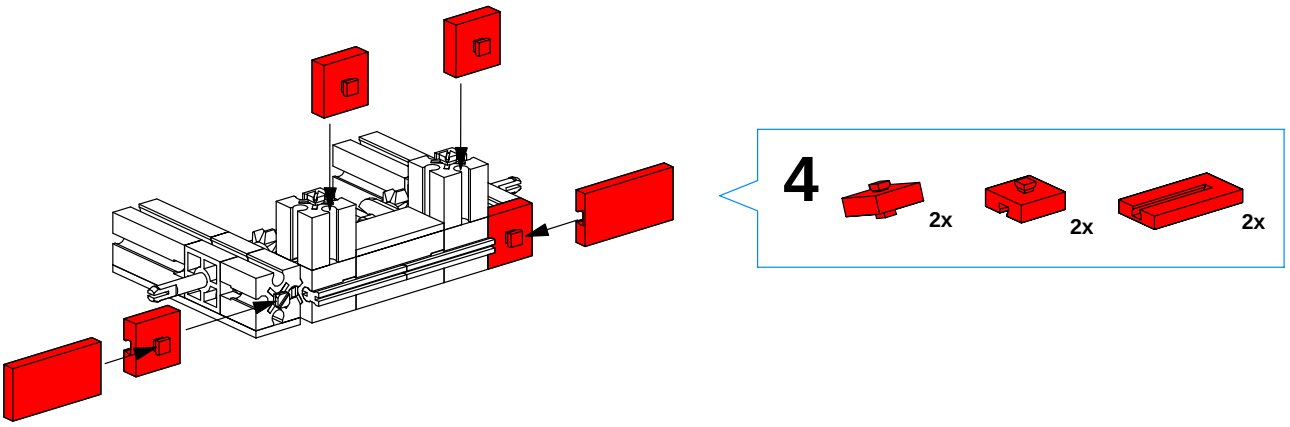


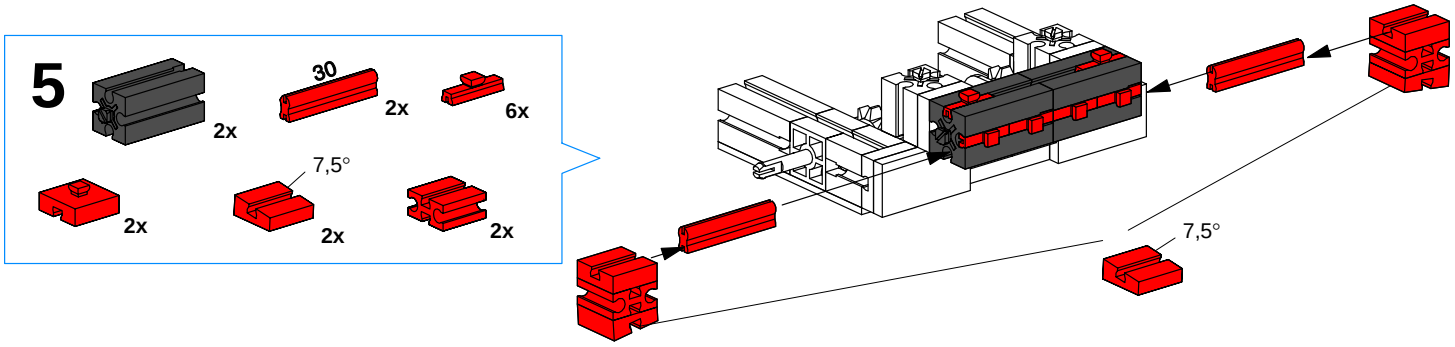
# MR5
## folgt einer Spur
## follows a path

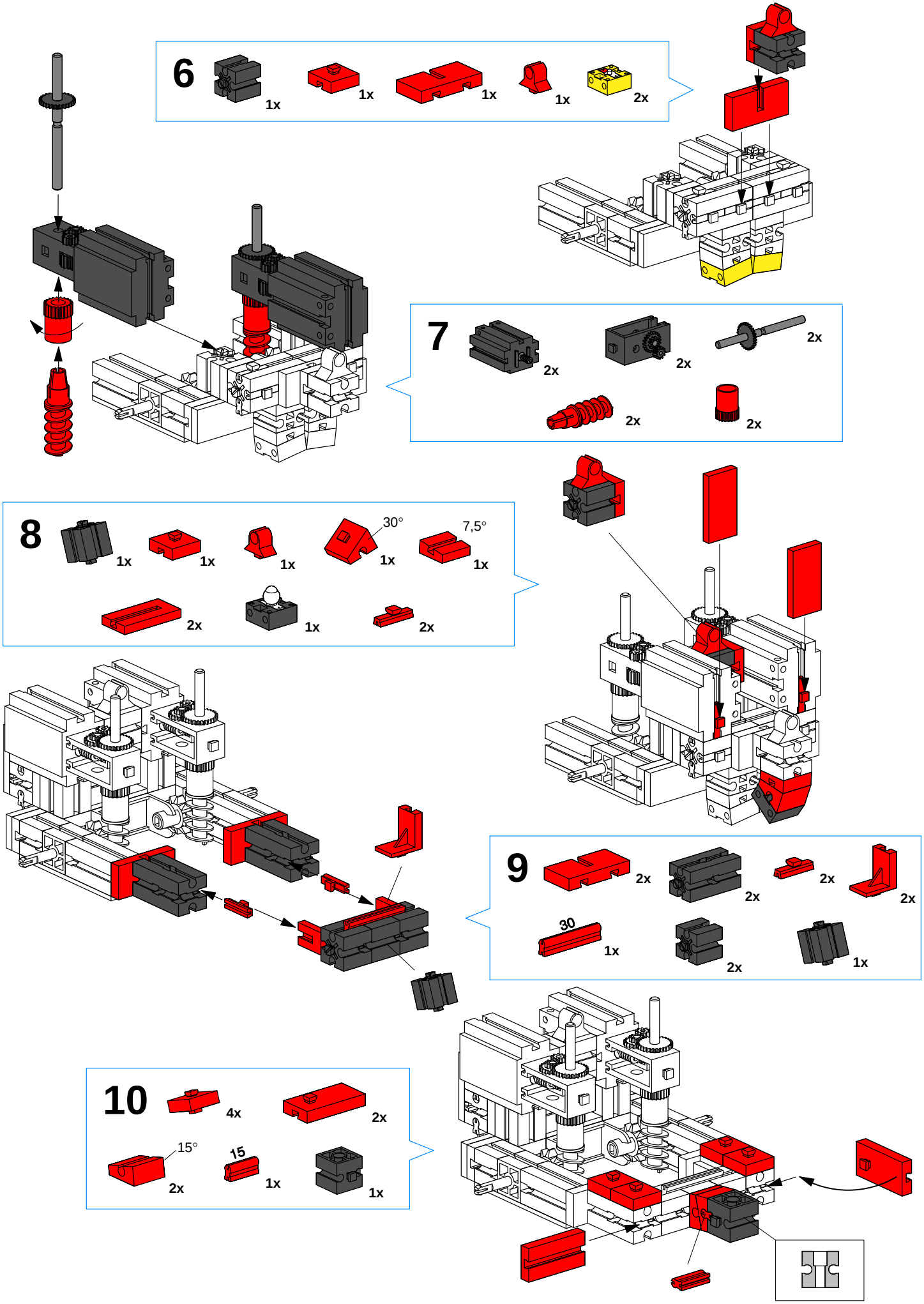


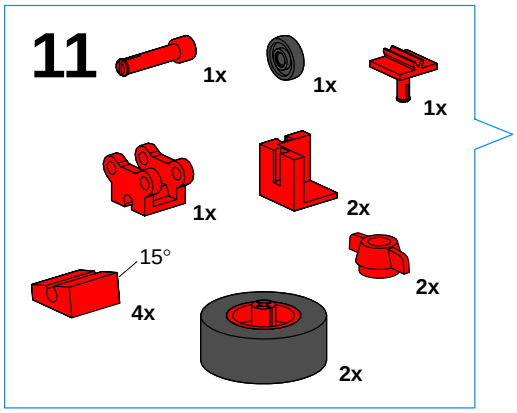



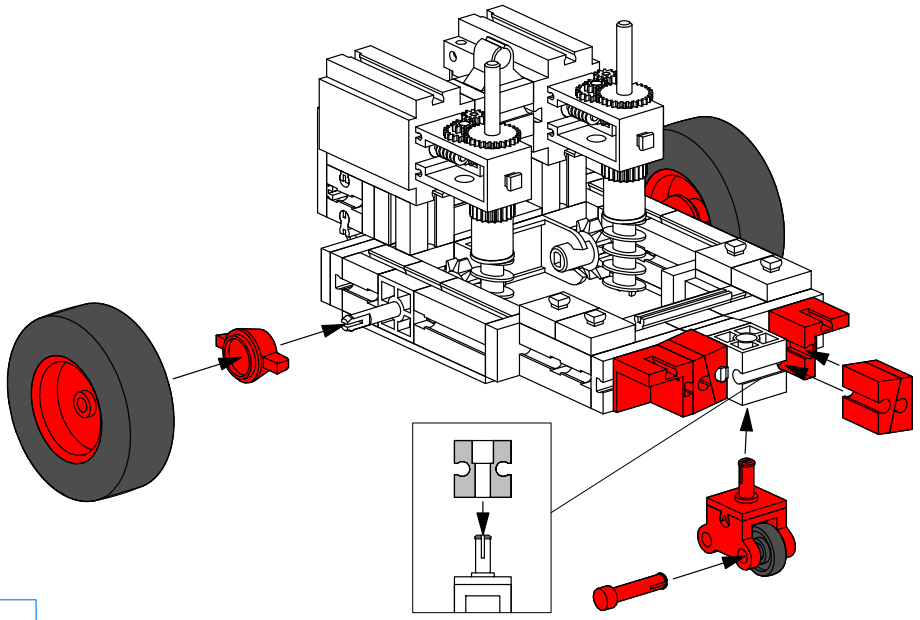



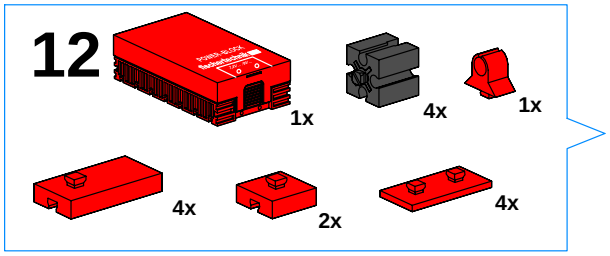



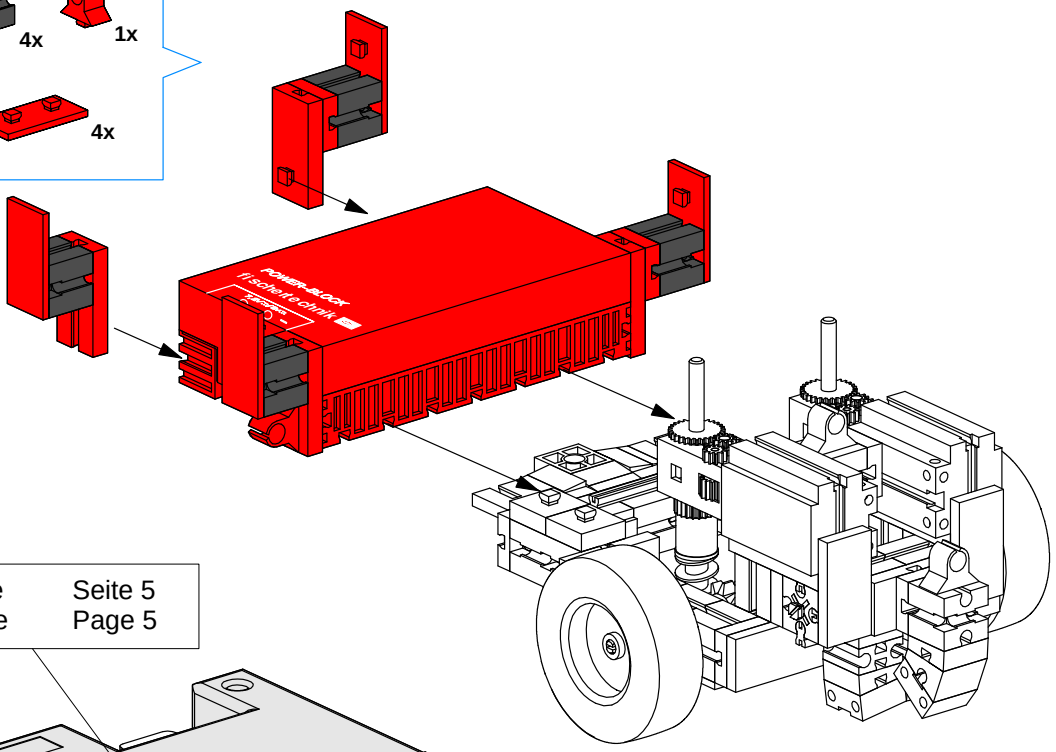



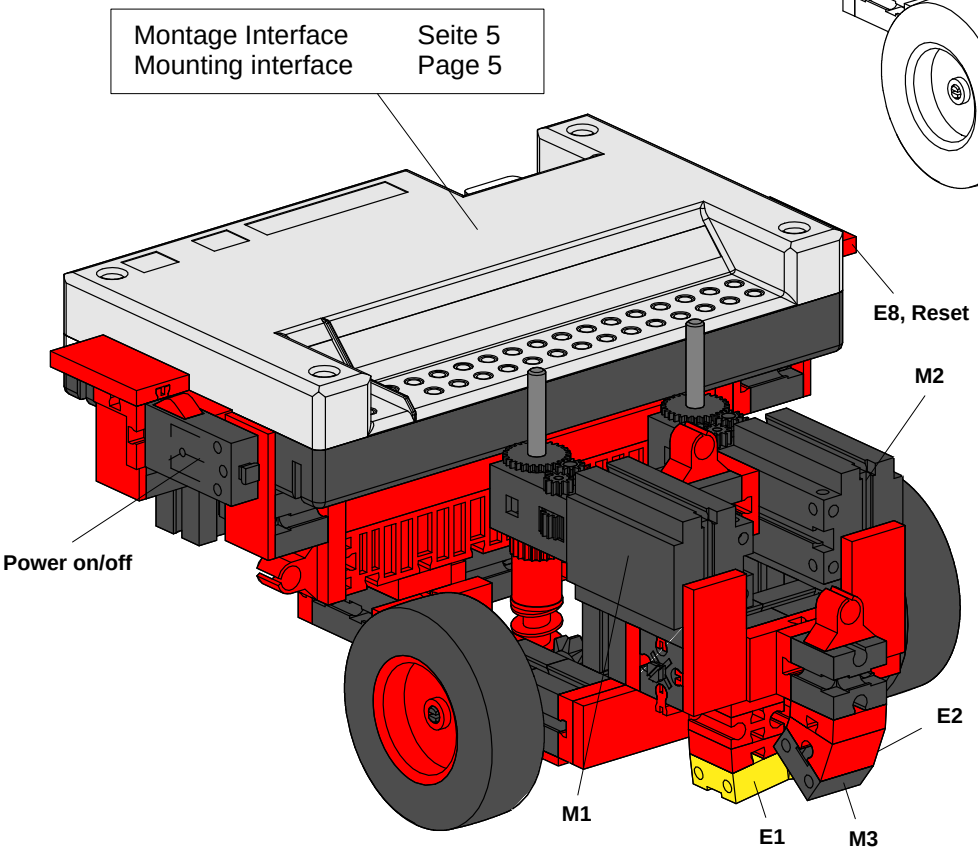

6
1x
1x
1x
1x
2x
7
2x
2x
2x
2x
2x
8
1x
1x
1x
30°
1x
7,5°
1x
2x
1x
2x
9
2x
2x
2x
2x
30
1x
2x
1x
10
4x
2x
15°
2x
15
1x
1x


11
1x
1x
1x
1x
2x
15°
2x
4x
2x

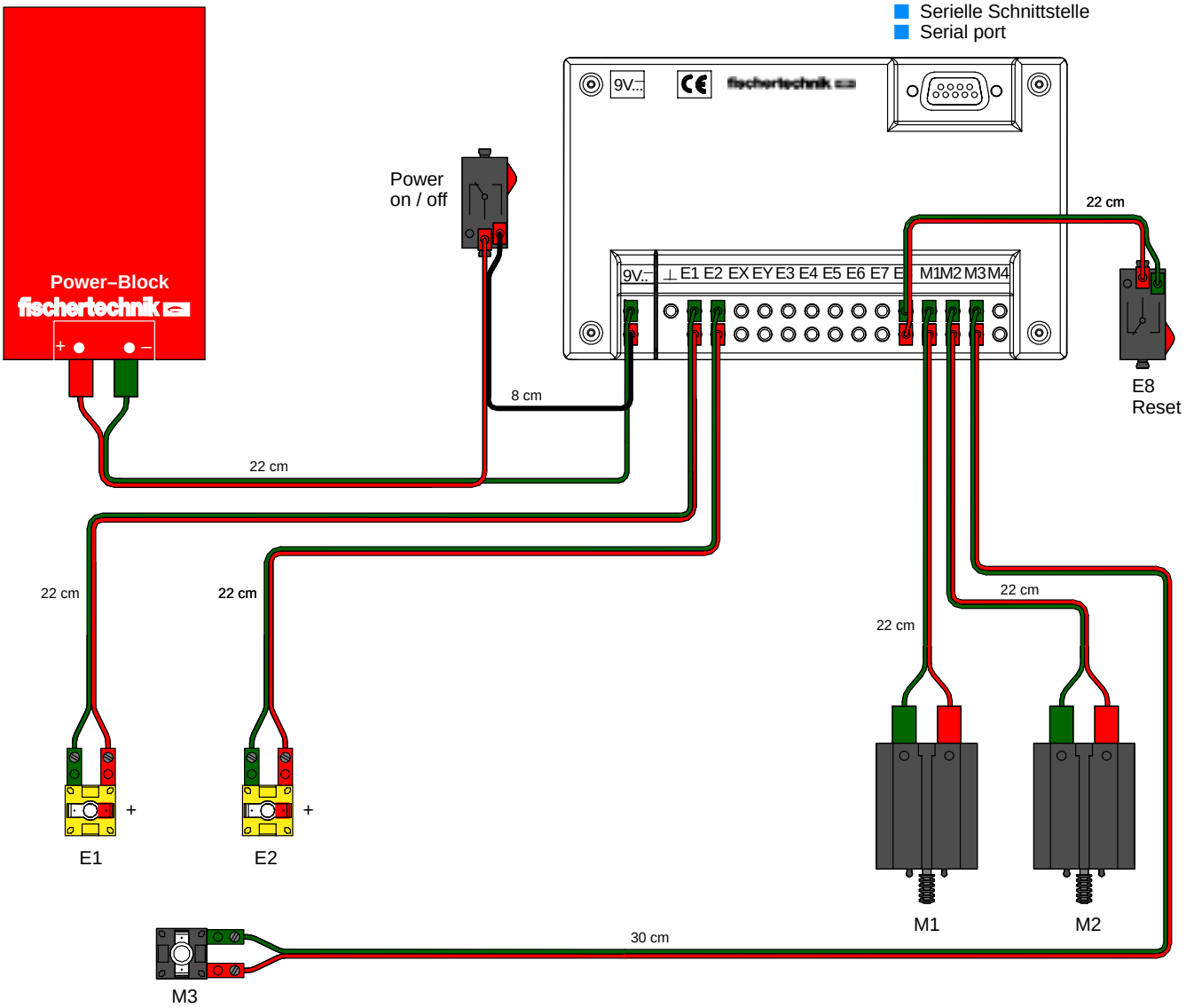



12
1x
4x
1x
4x
2x
4x


POWER-BLOCK
fischertechnik


Montage Interface Seite 5
Mounting interface Page 5
E8, Reset
M2
Power on/off
E2
M1
E1
M3

## Schaltplan
## Circuit diagram



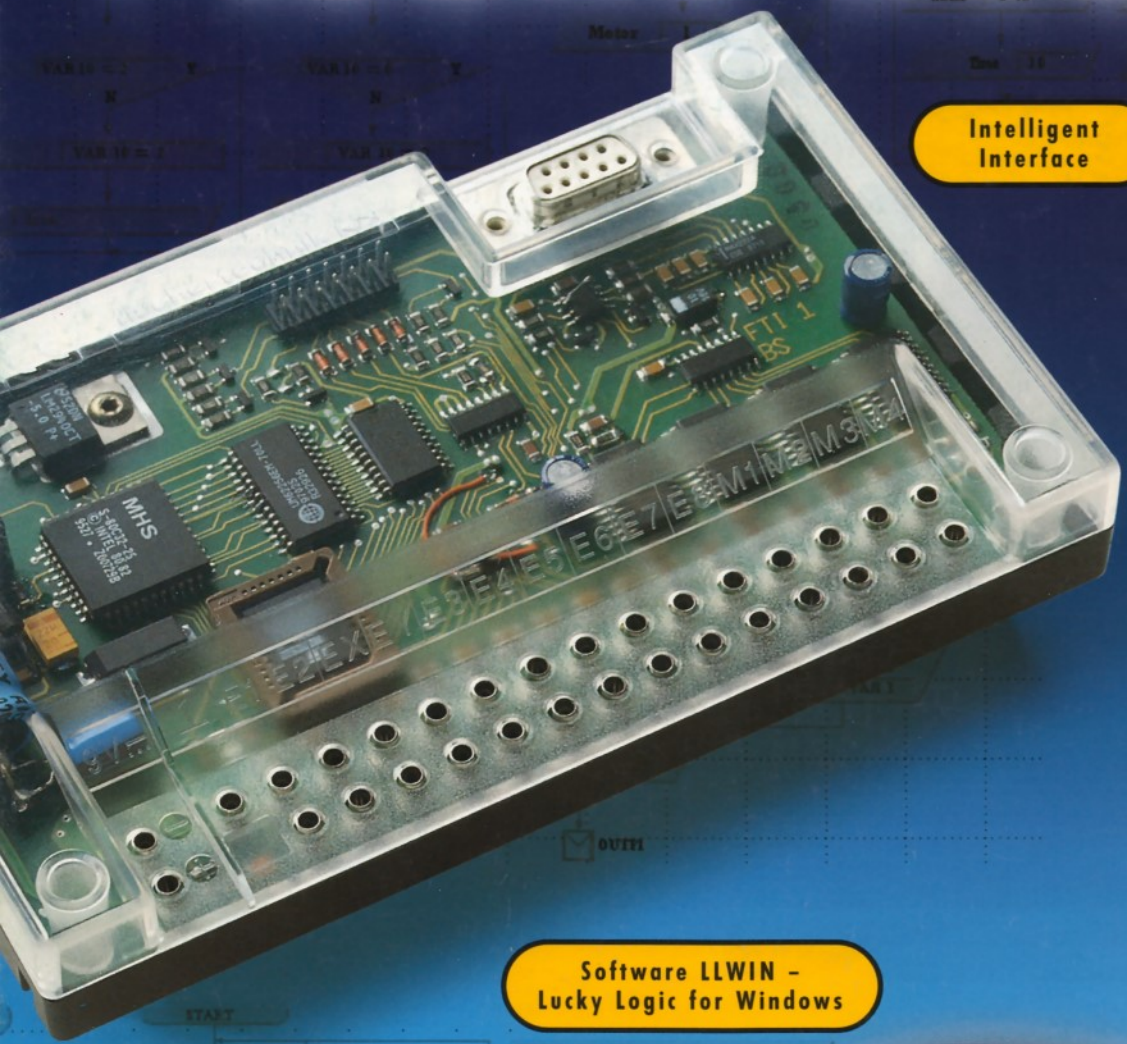

### Beispielprogramm: mr5.mdl

**Funktionsweise:**
MR5 ist in der Lage, auf einer schwarzen Spur, die sich auf einem hellen Untergrund befindet, entlang zu fahren. Die Spur sollte ca. 1 cm breit sein. Dazu klebt man idealerweise schwarzes Isolierband auf einen weißen Untergrund. Es funktioniert auch mit dickem schwarzen Filzstift auf weißem Papier.
Bei diesem Modell muß man unter Umständen etwas experimentieren, bis es einwandfrei funktioniert. Die Lampe, die die Spur beleuchtet, scheint unterschiedlich hell, je nachdem ob man mit Batterien, Akkus oder einem Netzgerät arbeitet.
Je nach Umgebungshelligkeit und Kontrast zwischen Spur und Untergrund ist die Schaltschwelle der Foto–transistoren unterschiedlich. In der Interfacediagnose kann man ablesen, ob die Fototransistoren die Spur als dunkel und die Umgebung der Spur als hell erkennen. Gegebenenfalls muß der Kontrast zwischen Spur und Untergrund vergrößert oder die Position der Lampe optimiert werden.

### Program example: mr5.mdl

**Operational description:**
MR5 can proceed along a black path laid out against a light background. The path should be approx. 1 cm (1/2”) wide. The best way to make a path is to use black insulation tape on a white surface. You can also use a wide, black magic marker to draw a path on a white sheet of paper.
You may need to experiment a bit to get the model to work properly. The strength of light the model uses to illuminate the path differs, depending on whether you use batteries or the power adapter.
The activation threshold of the phototransistors also varies, depending on the amount of ambient light and the contrast between the path and the background. The interface diagnostics indicate whether the photo–transistors recognize the path as a dark strip and the background as a light area.You may need to increase the contrast between the path and the background, or mover the light to a better position.

# Mobile Robots



Intelligent Interface

Software LLWIN – Lucky Logic for Windows

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