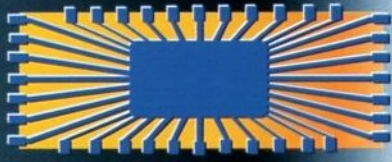


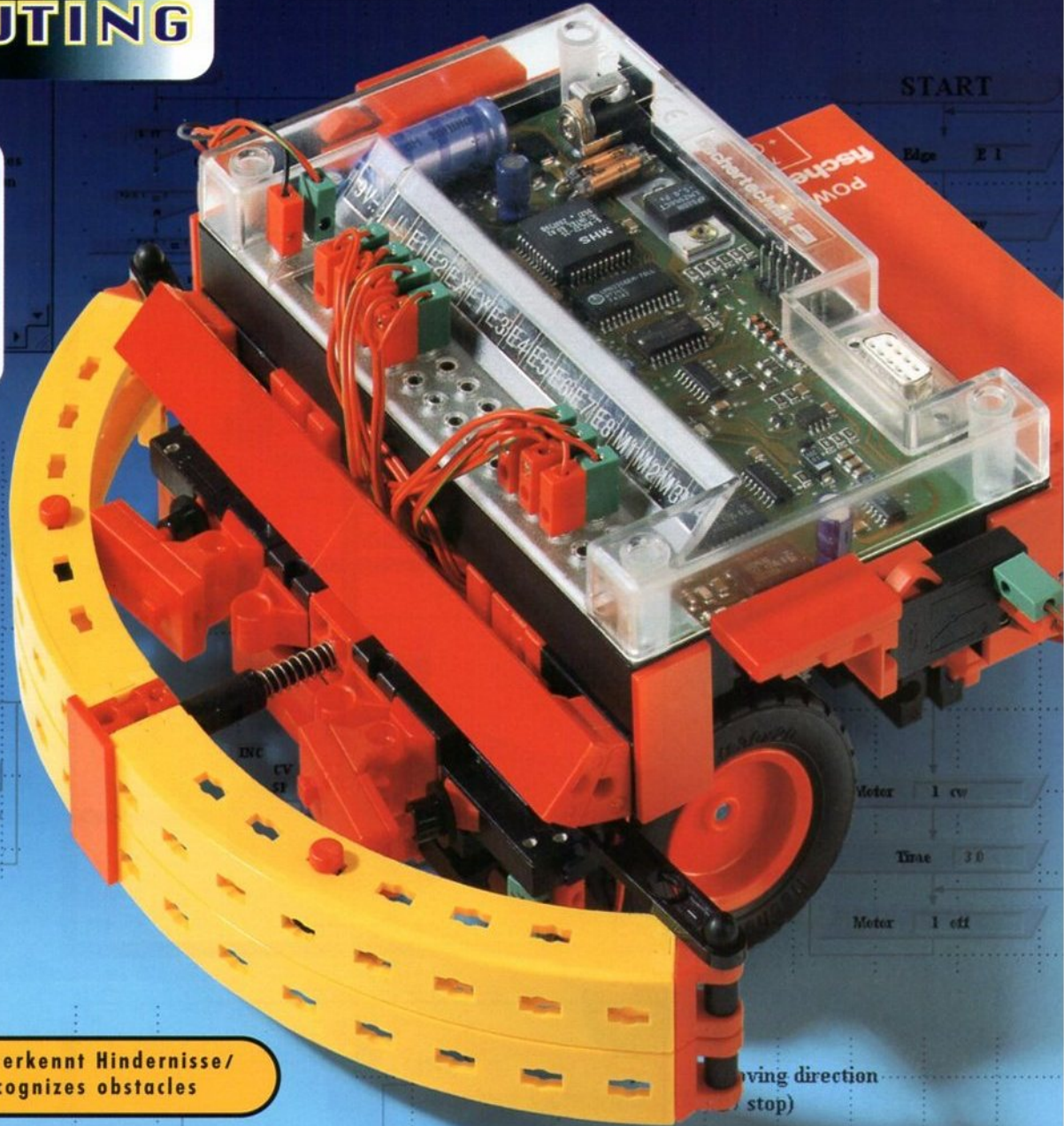
Mobile Robots



COMPUTING

8

models



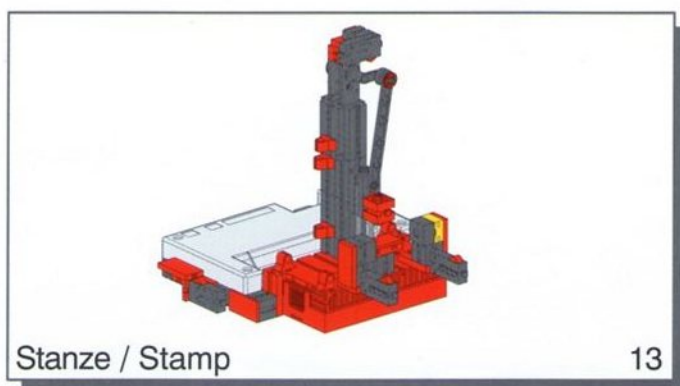
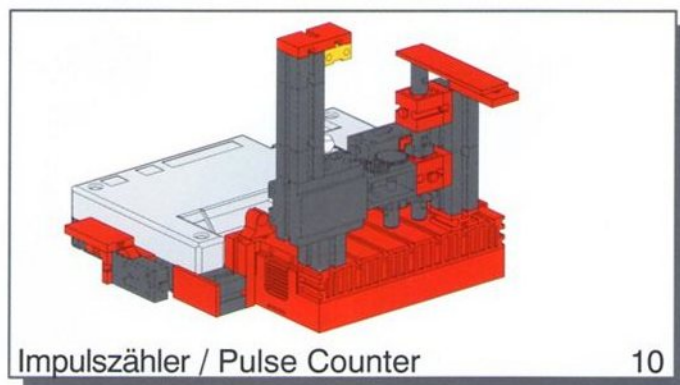
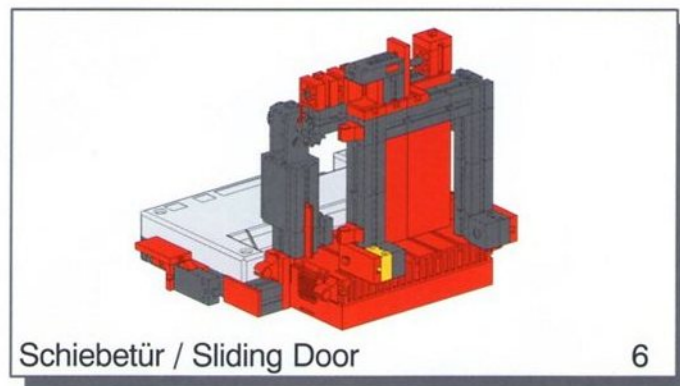
MR2- erkennt Hindernisse/
recognizes obstacles

fischertechnik®

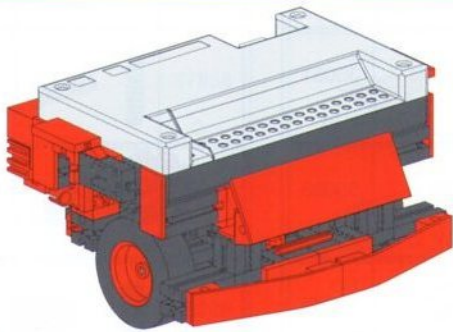


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Akku-, Batteriehalter / Rechargeable battery holder	3
Kabel und Stecker / Plugs and cables	3
Montagehilfen und Hinweise / Assembly aids and instructions	4
Montage Interface / Mounting interface	5
Einführungsmodelle / Introductory Models	6

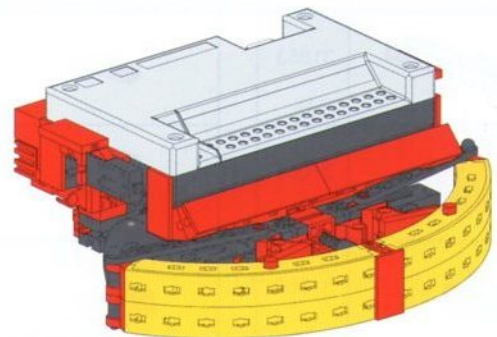


Mobile Robots:

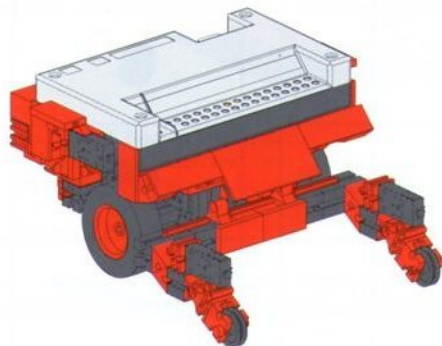


MR1
Basismodell / Base Model

16

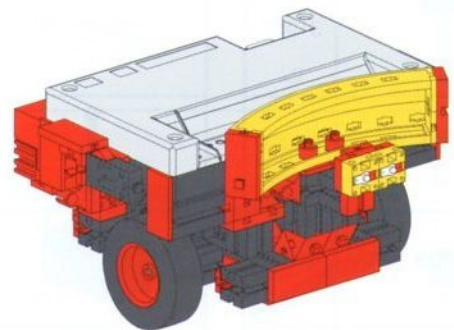


MR2
erkennt Hindernisse / recognizes obstacles 20

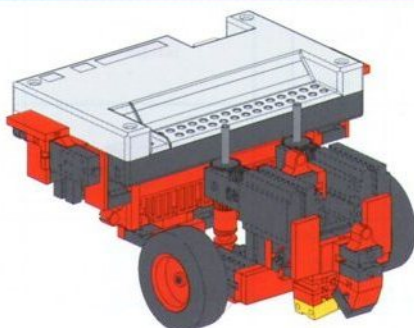


MR3
erkennt Abgründe / recognizes ledges

24



MR4
folgt einer Lichtquelle / follows a light source 27



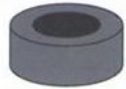































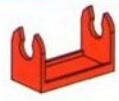

















































MR5
folgt einer Spur / follows a path

30

Einzelteilübersicht

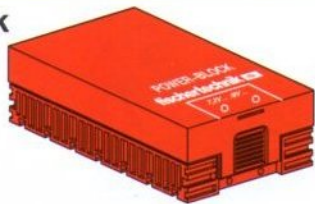
Spare parts list

	31010 4x		31690 3x		32913 2x		36134 2x
	31011 2x		31848 2x		35031 2x		36147 1x
	31021 2x		31915 2x		35033 2x		36165 1x
	31032 2x		31981 8x		35049 6x		36227 1x
	31053 1x		31982 12x		35054 4x		36334 1x
	31058 2x		32064 3x		35055 4x		36443 1x
	31060 4x		32071 3x		35063 2x		36532 2x
	31061 6x		32085 1x		35064 2x		36573 1x
	31063 2x		32293 2x		35069 1x		36819 4x
	31078 2x		32321 1x		35073 1x		36923 2x
	31082 2x		32330 6x		35088 1x		36983 1x
	31124 3x		32870 2x		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

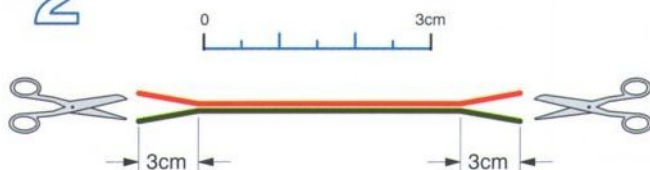
1



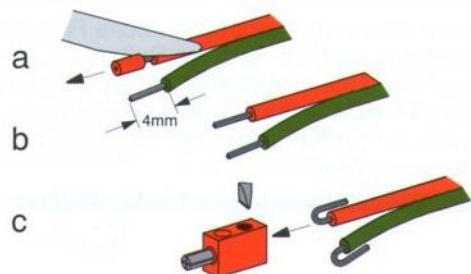
2 x 30 cm
6 x 22 cm



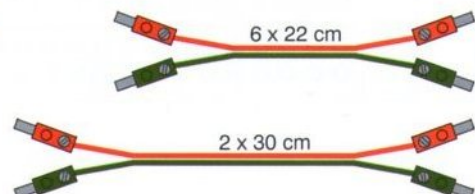
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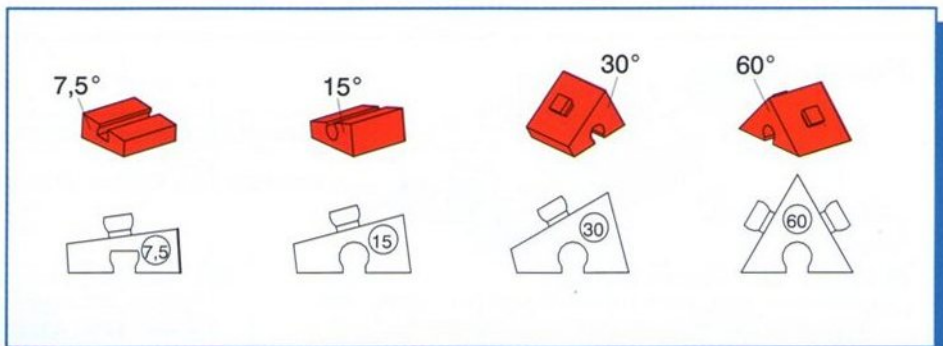
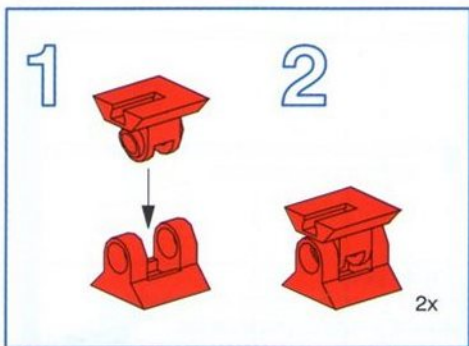
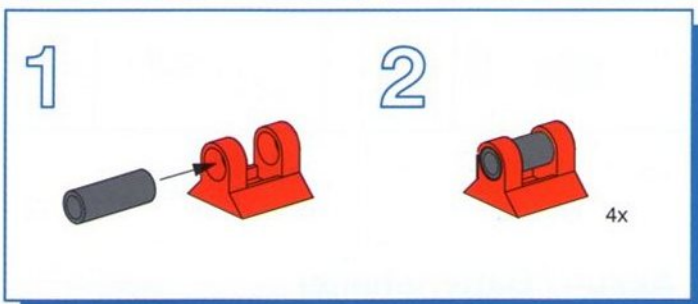
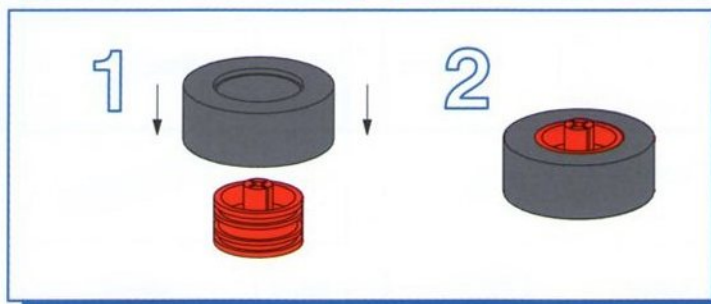
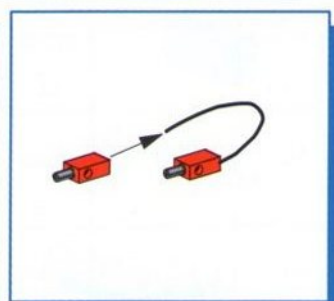
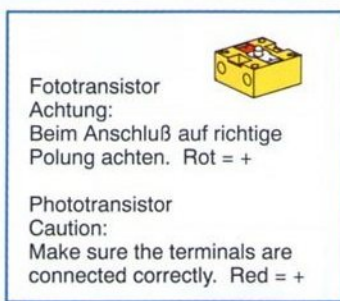
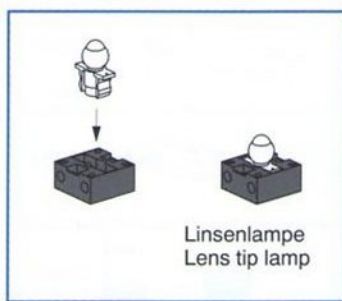
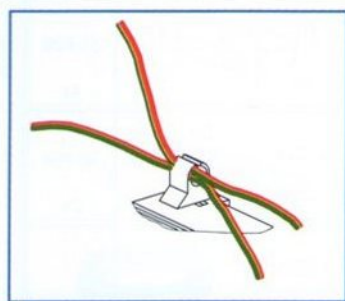
3



4



Montagehilfen und Hinweise Assembly aids and instructions



■ 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.

■ All components, especially moving parts, should be maintained and cleaned as necessary.

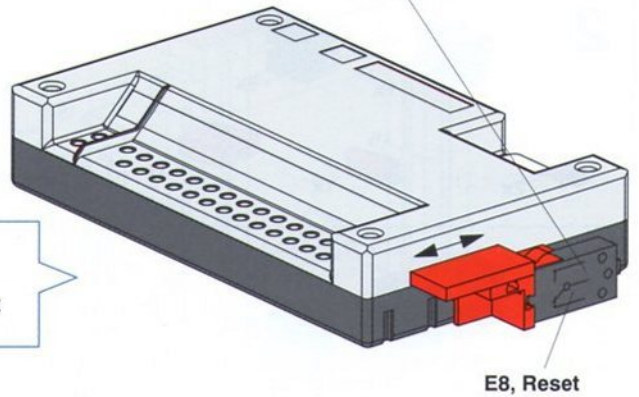
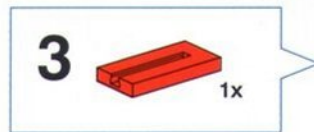
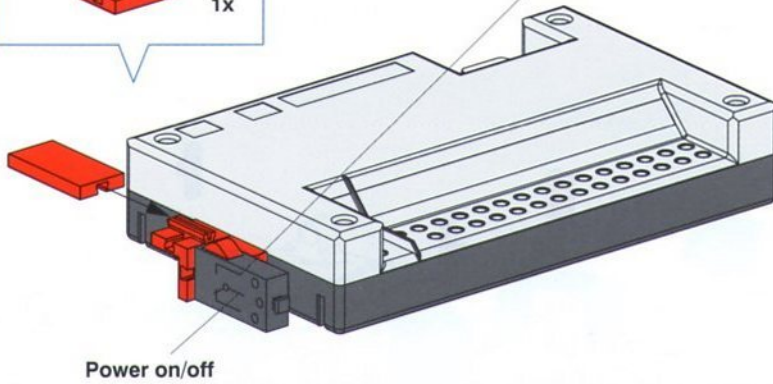
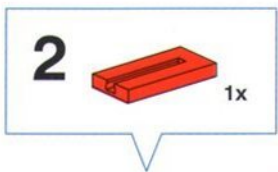
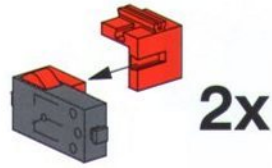
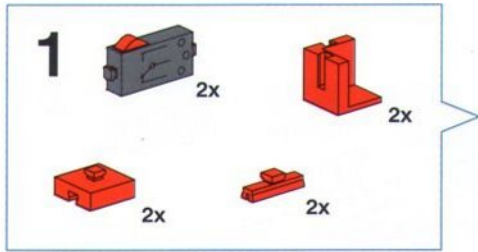
■ Achtung
Verletzungsgefahr an Bauteilen mit funktionsbedingten scharfen Kanten und Spitzen!

■ Caution
Be careful not to hurt yourself on components with sharp or pointed edges!

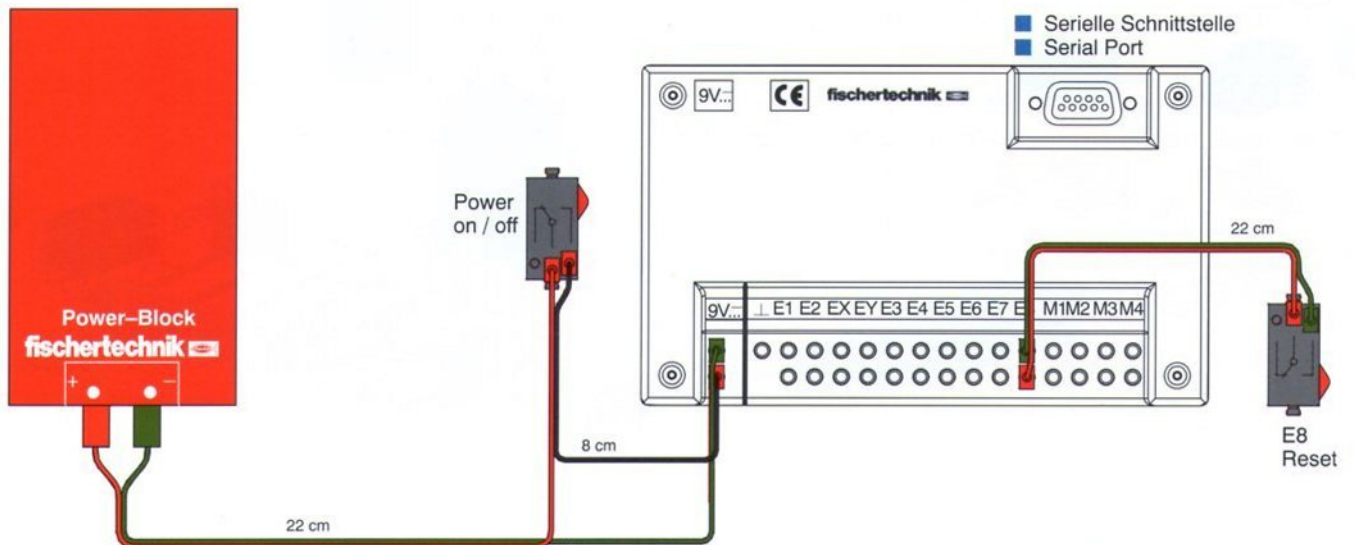
■ Weitere Informationen über "Mobile Robots", das "Intelligent Interface" und die Software LLWIN sind auf der CD-ROM "LLWIN" (Art.-Nr. 30407) zu finden. Diese CD-ROM enthält außerdem ein detailliertes Beispiel zur Einführung in die fischertechnik-Computing-Welt.

■ 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.

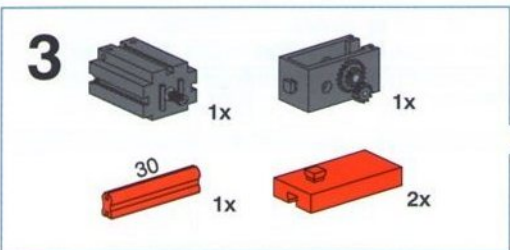
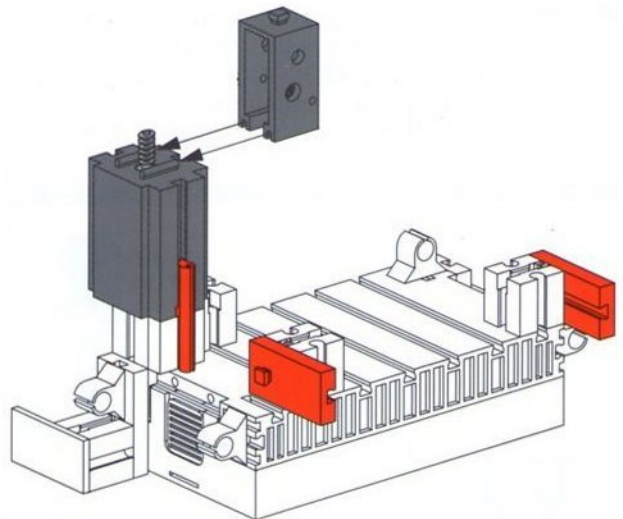
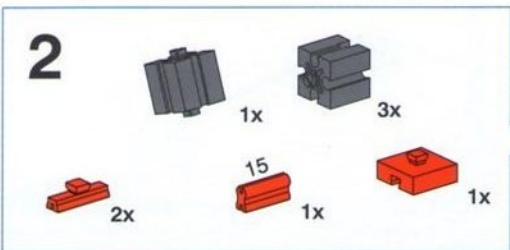
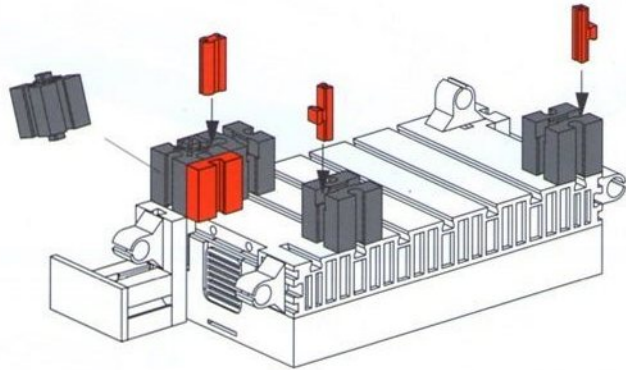
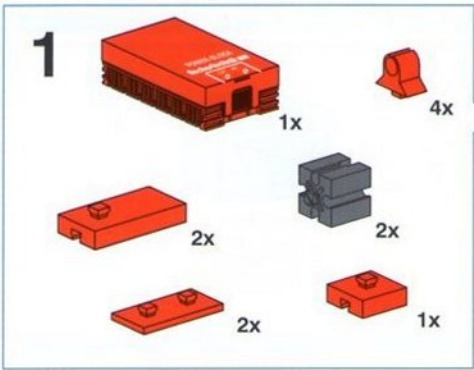
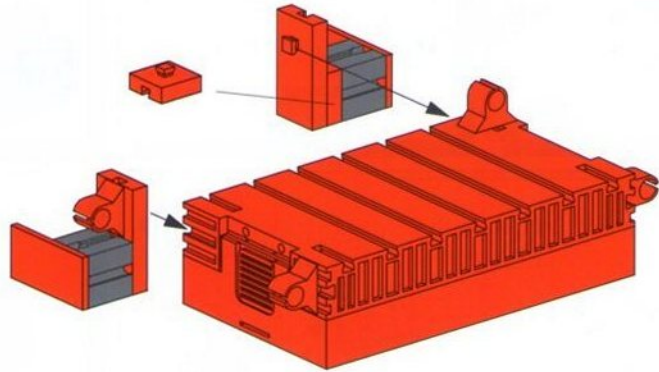
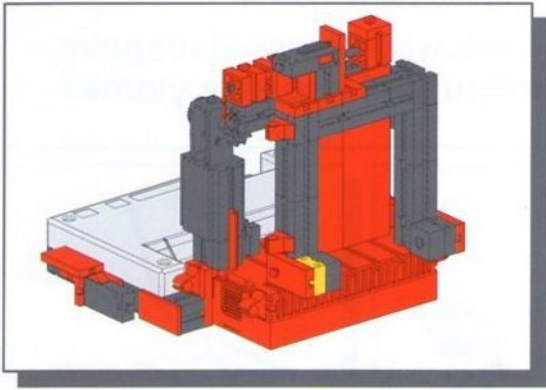
Montage Interface Mounting Interface

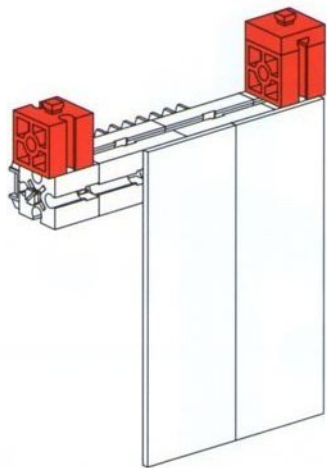


Schaltplan Circuit diagram



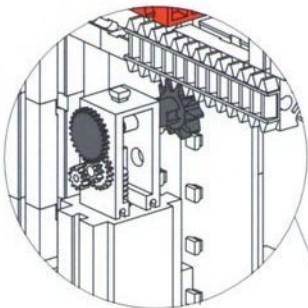
Schiebetür Sliding Door





7

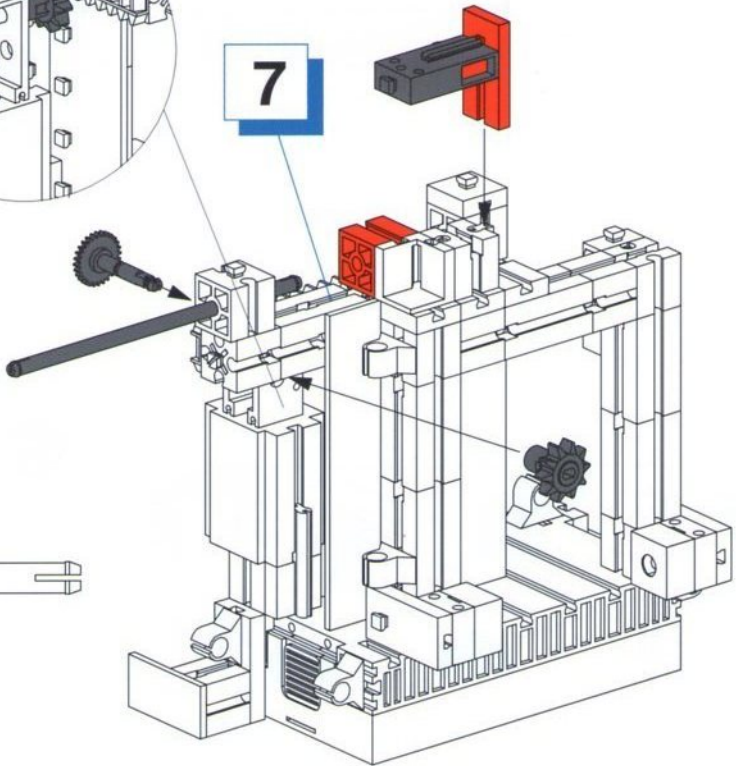
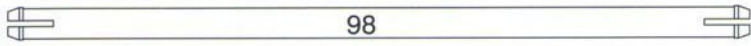
2x 1x



7

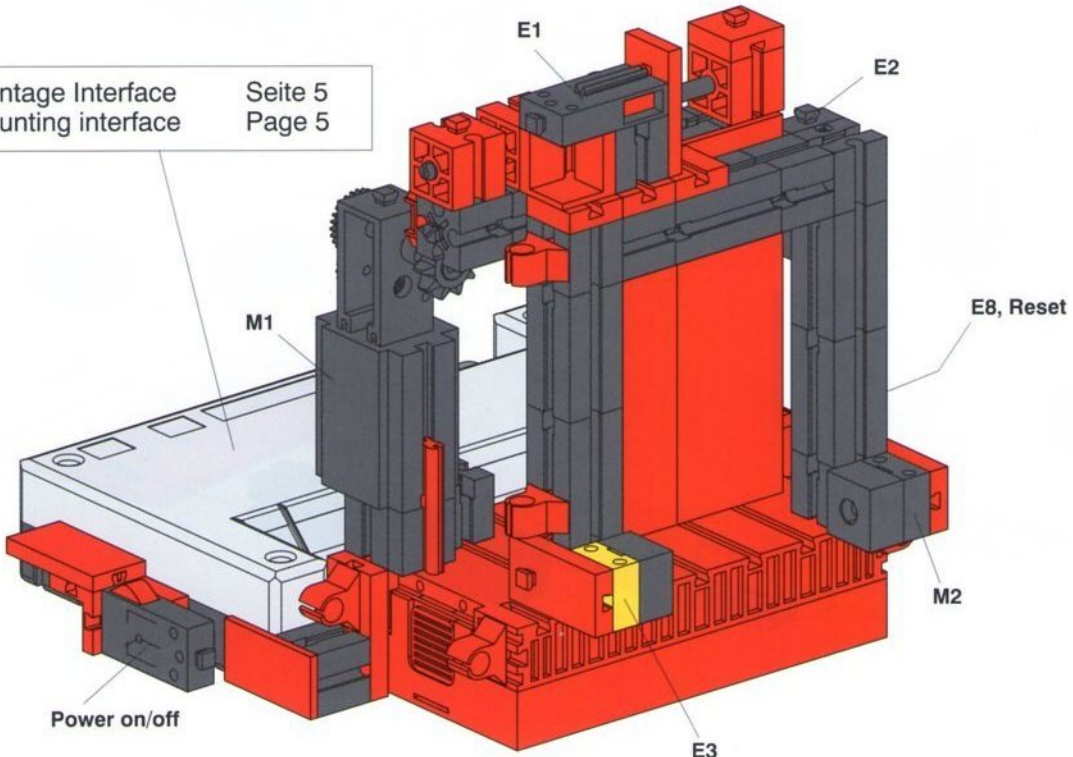
8

1x 1x 1x 1x 1x 98 1x

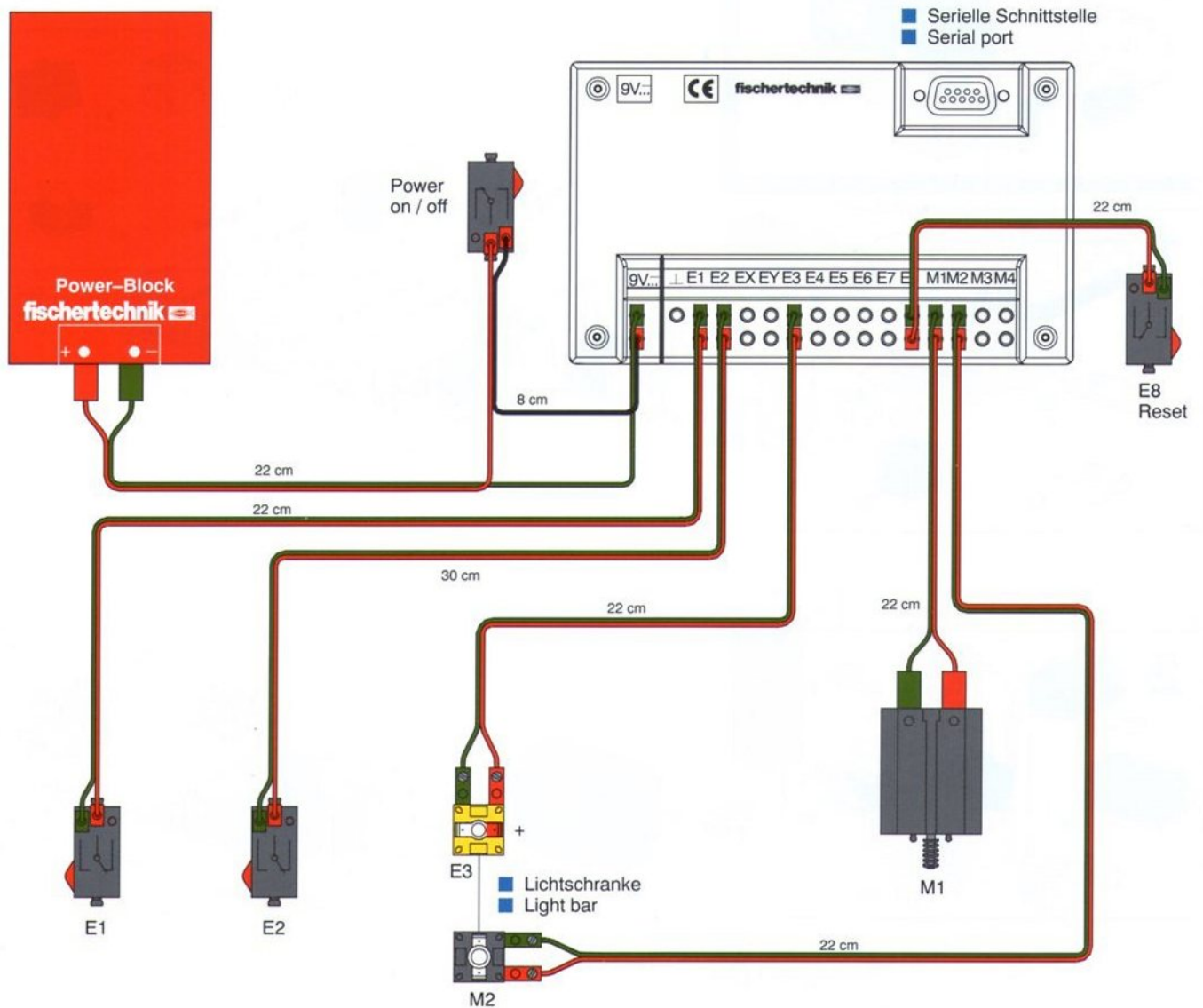


Montage Interface
 Mounting interface

Seite 5
 Page 5



Schaltplan Circuit diagram



■ Beispielprogramm: tuer.mdl

Funktionsweise:

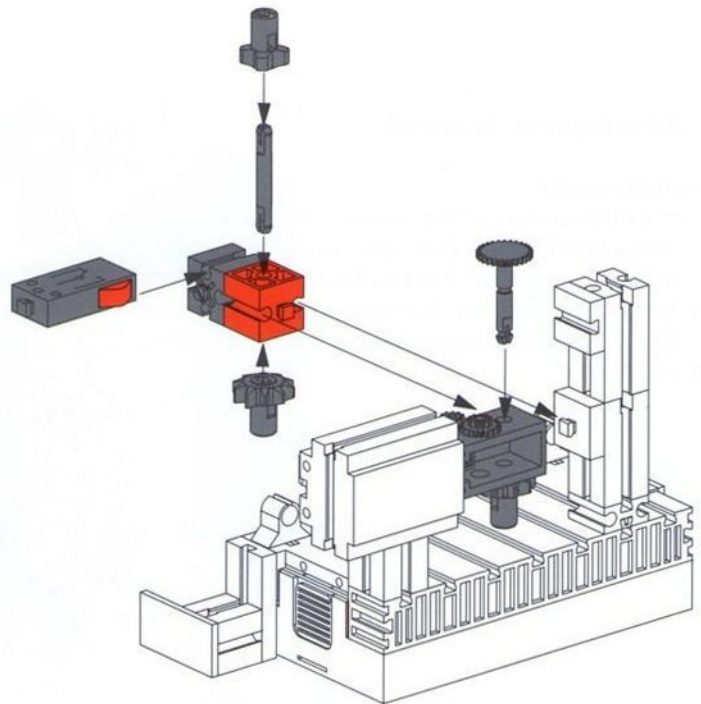
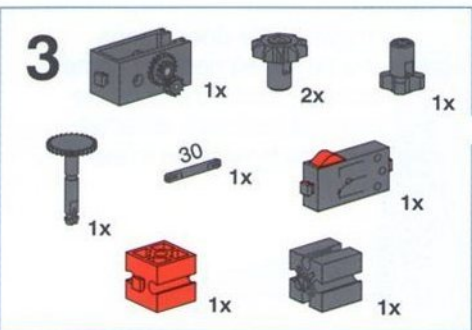
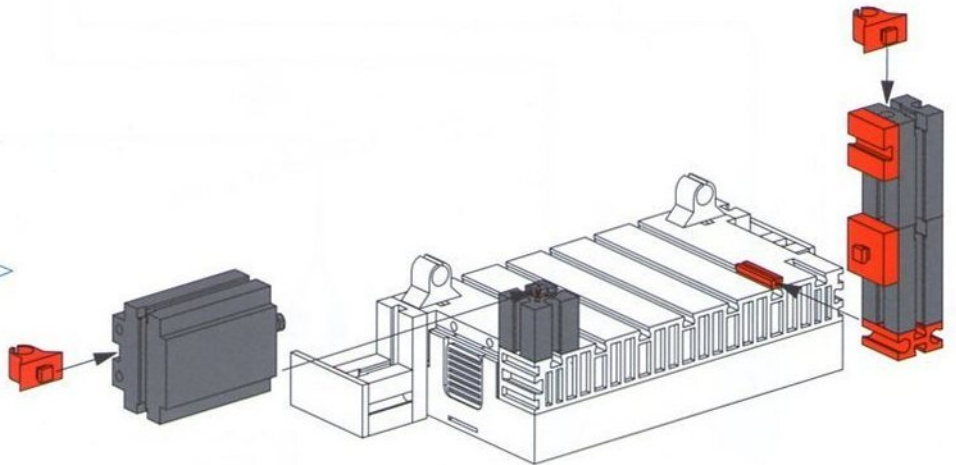
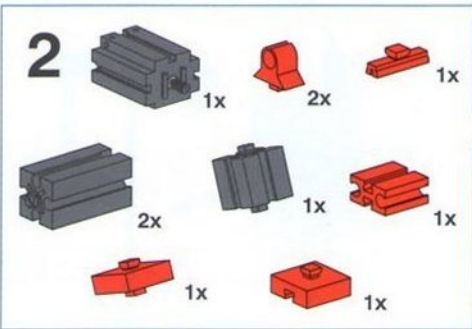
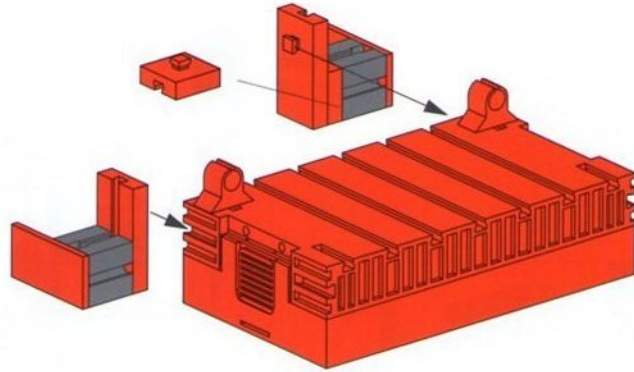
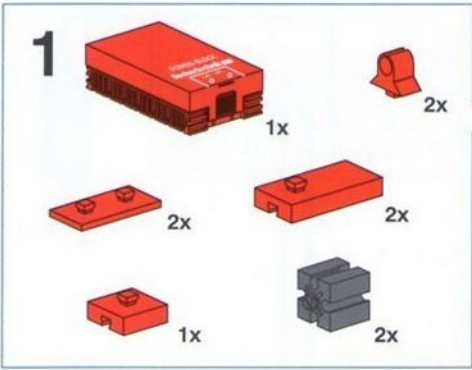
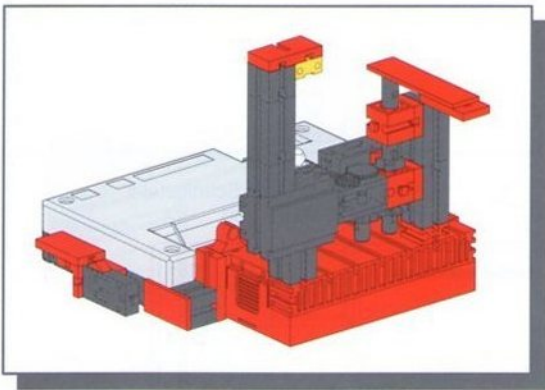
Unterbricht man die Lichtschranke, öffnet sich die Tür. Nach einer bestimmten Zeit wird sie automatisch wieder geschlossen. Im Passiv-Modus (siehe Softwarehandbuch) wird am Terminal angezeigt, ob die Tür offen oder geschlossen ist und wie oft sie schon geöffnet wurde.

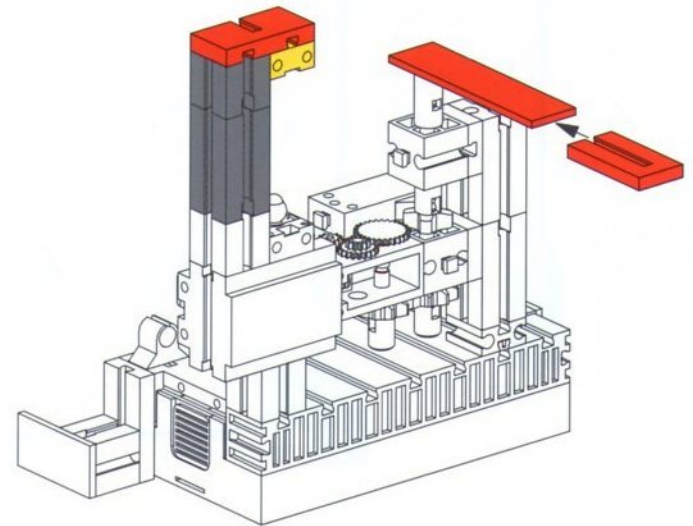
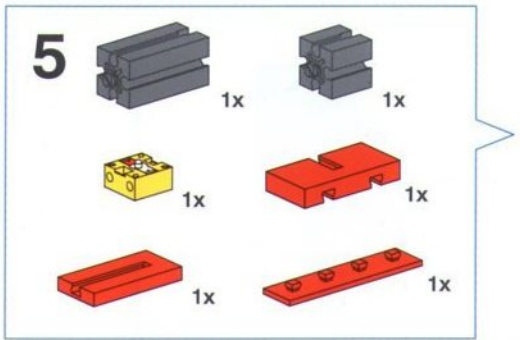
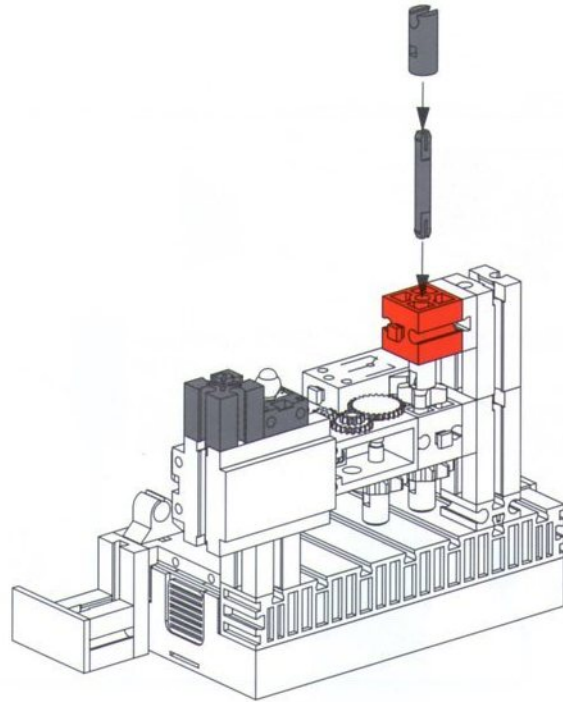
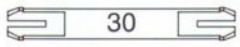
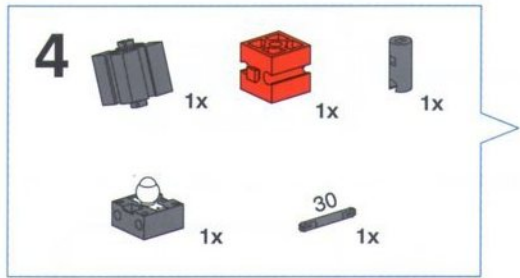
■ Program example: door.mdl

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.

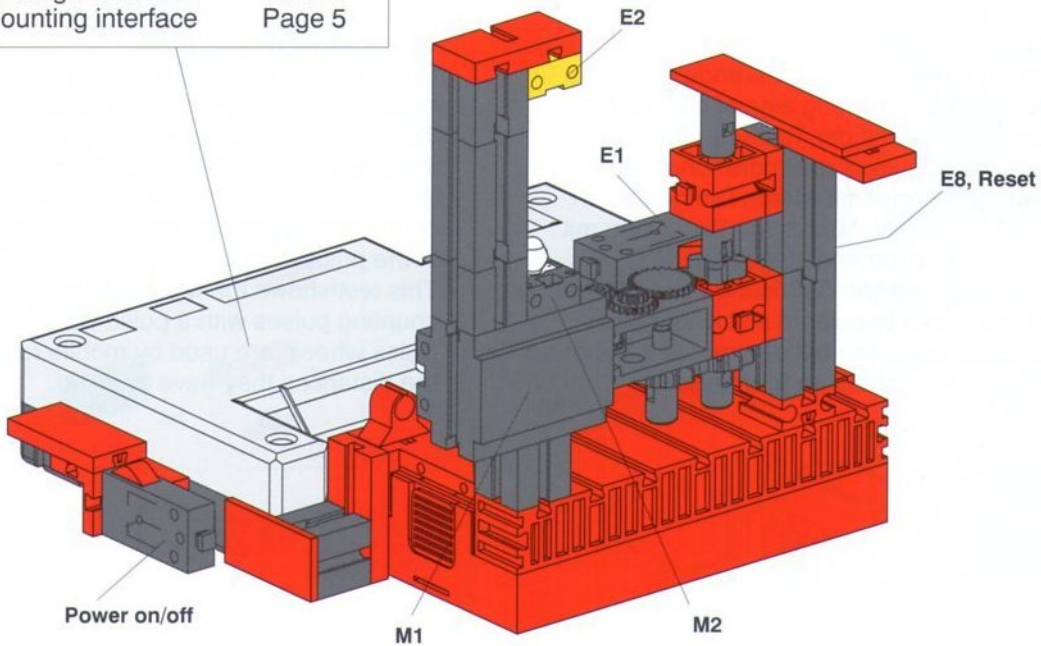
Impulszähler Pulse Counter



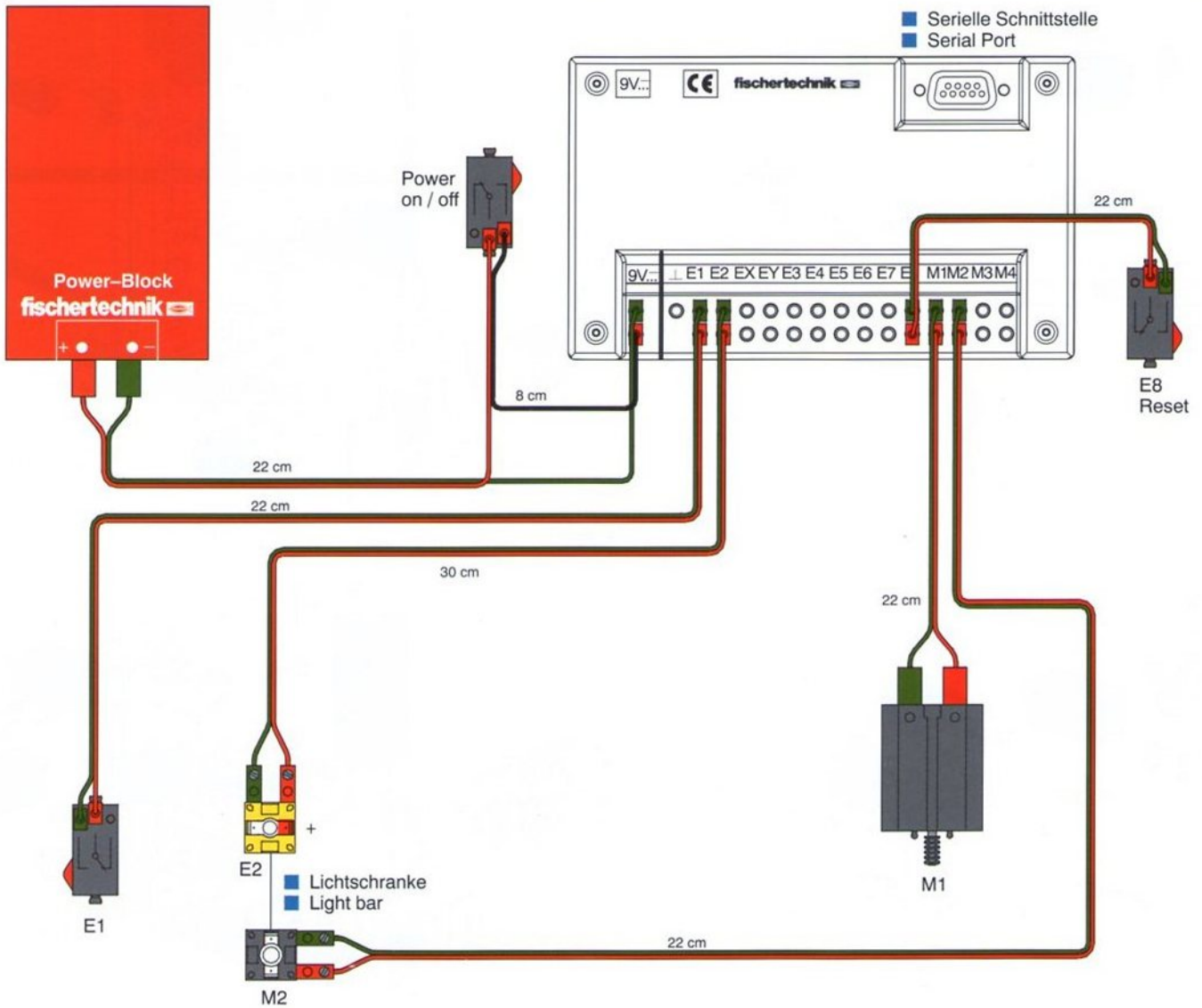


Montage Interface
Mounting interface

Seite 5
Page 5



Schaltplan Circuit diagram



■ Beispielprogramm: impuls.mdl

Funktionsweise

Die von Motor M1 angetriebene rotierende Bauplatte unterbricht bei jeder Umdrehung einmal die Lichtschranke. 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".

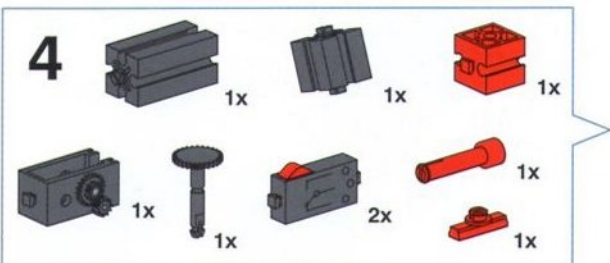
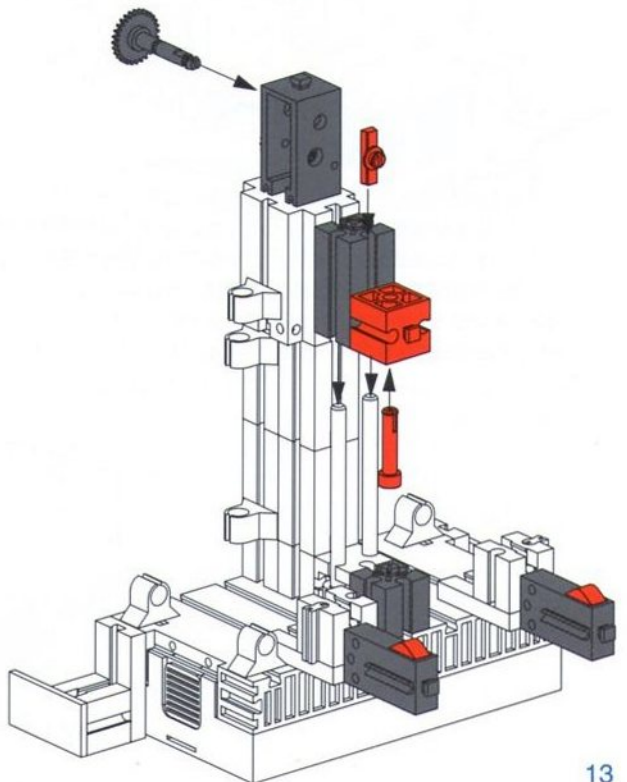
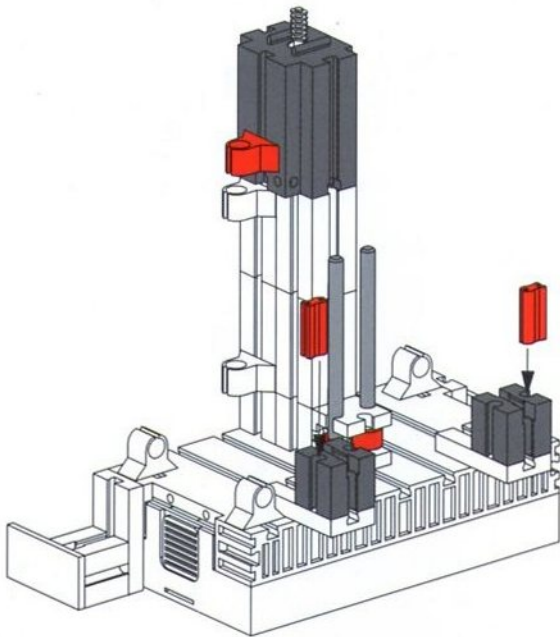
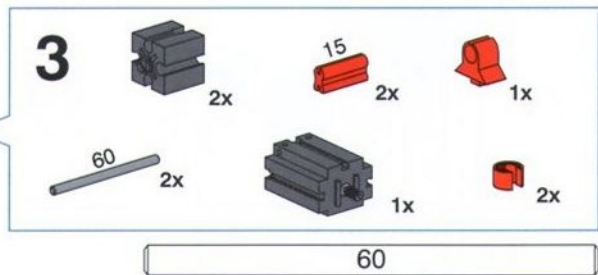
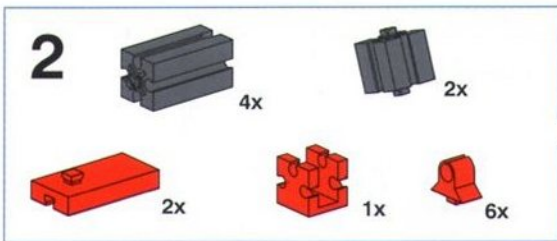
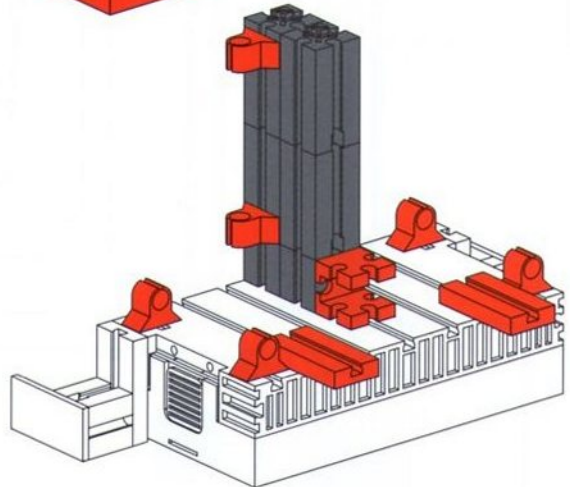
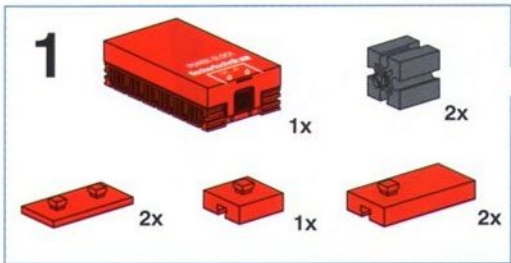
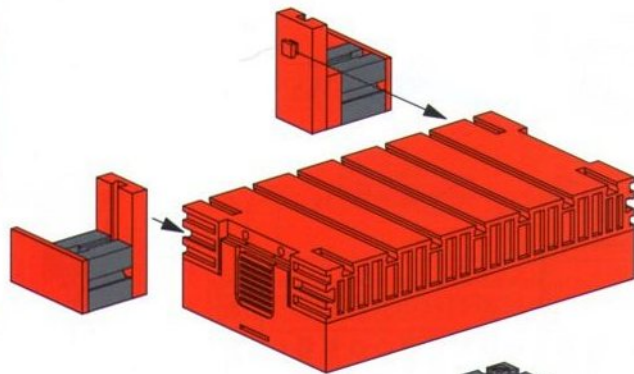
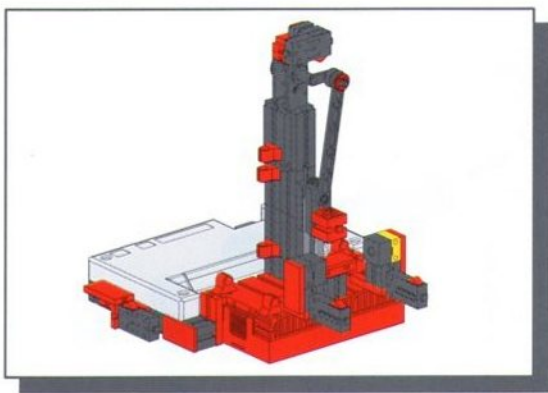
■ Program example: pulse.mdl

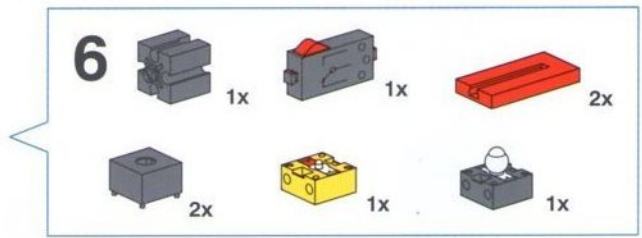
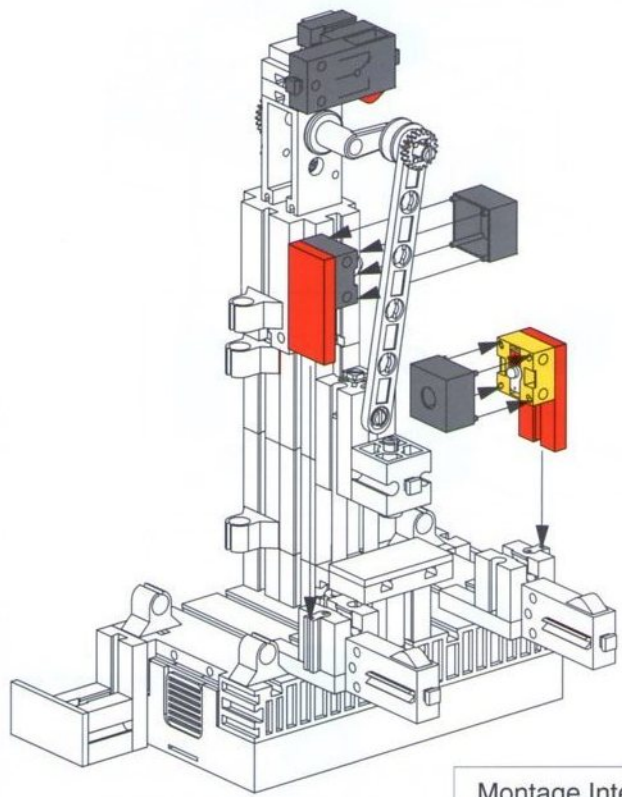
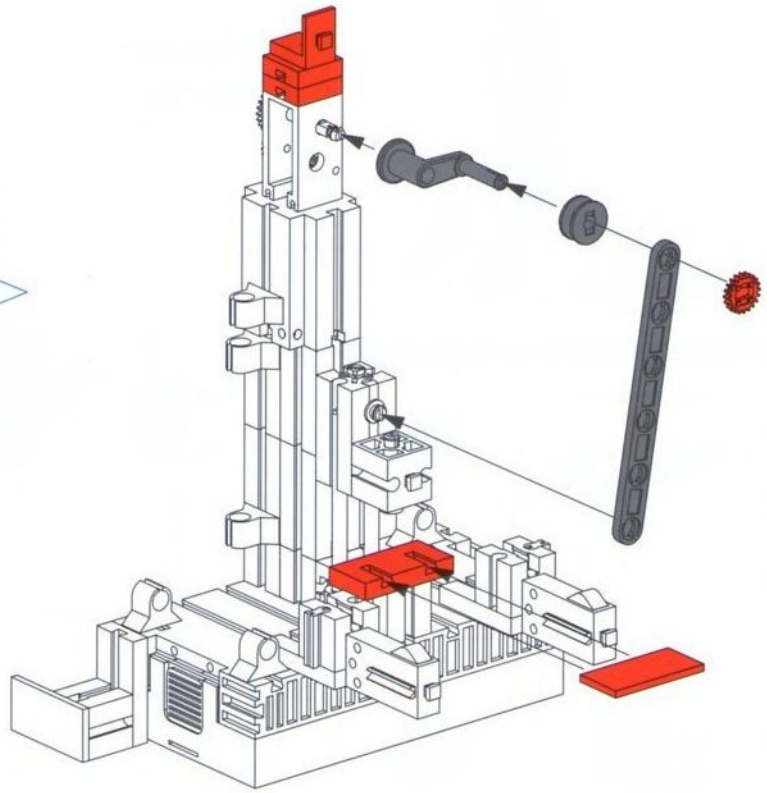
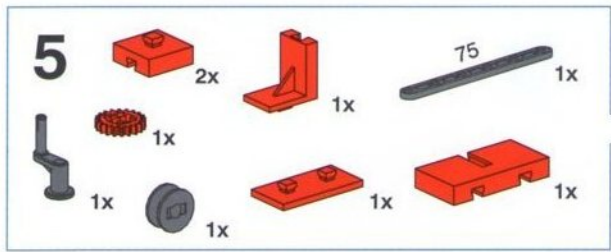
Operational description:

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.

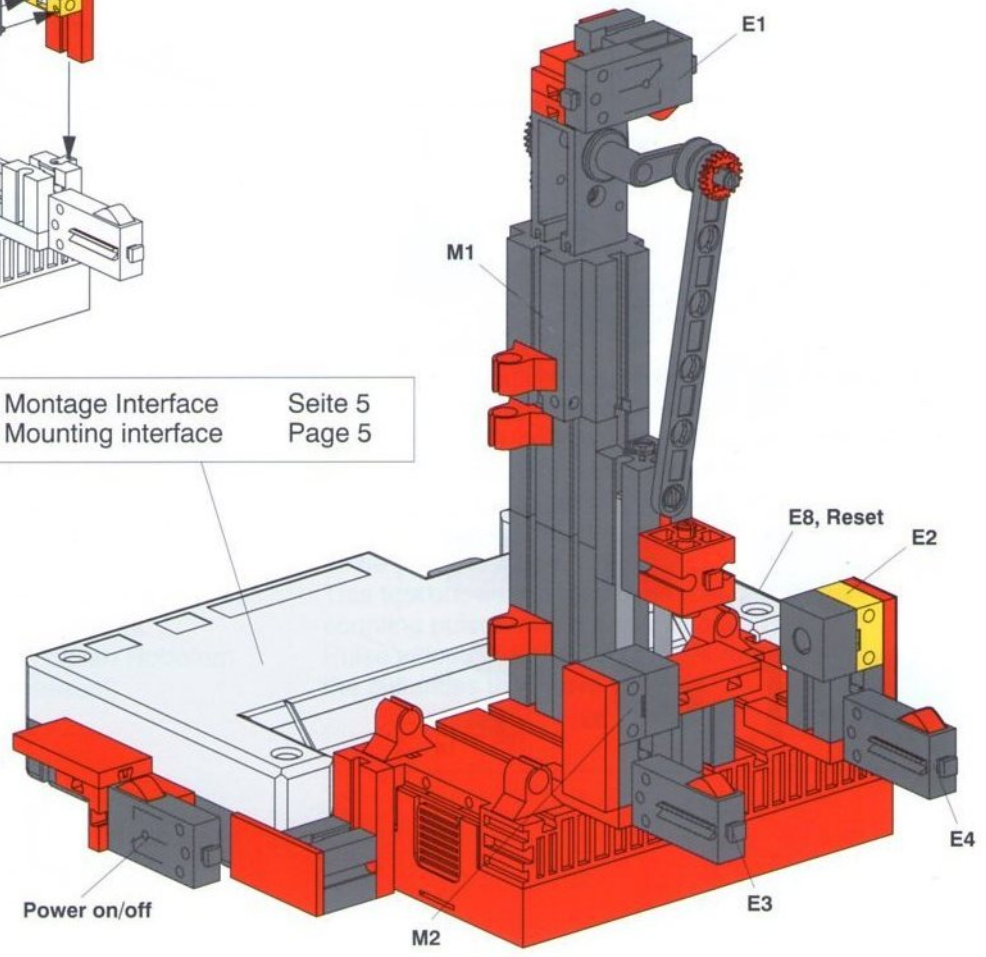
Stanze Stamp



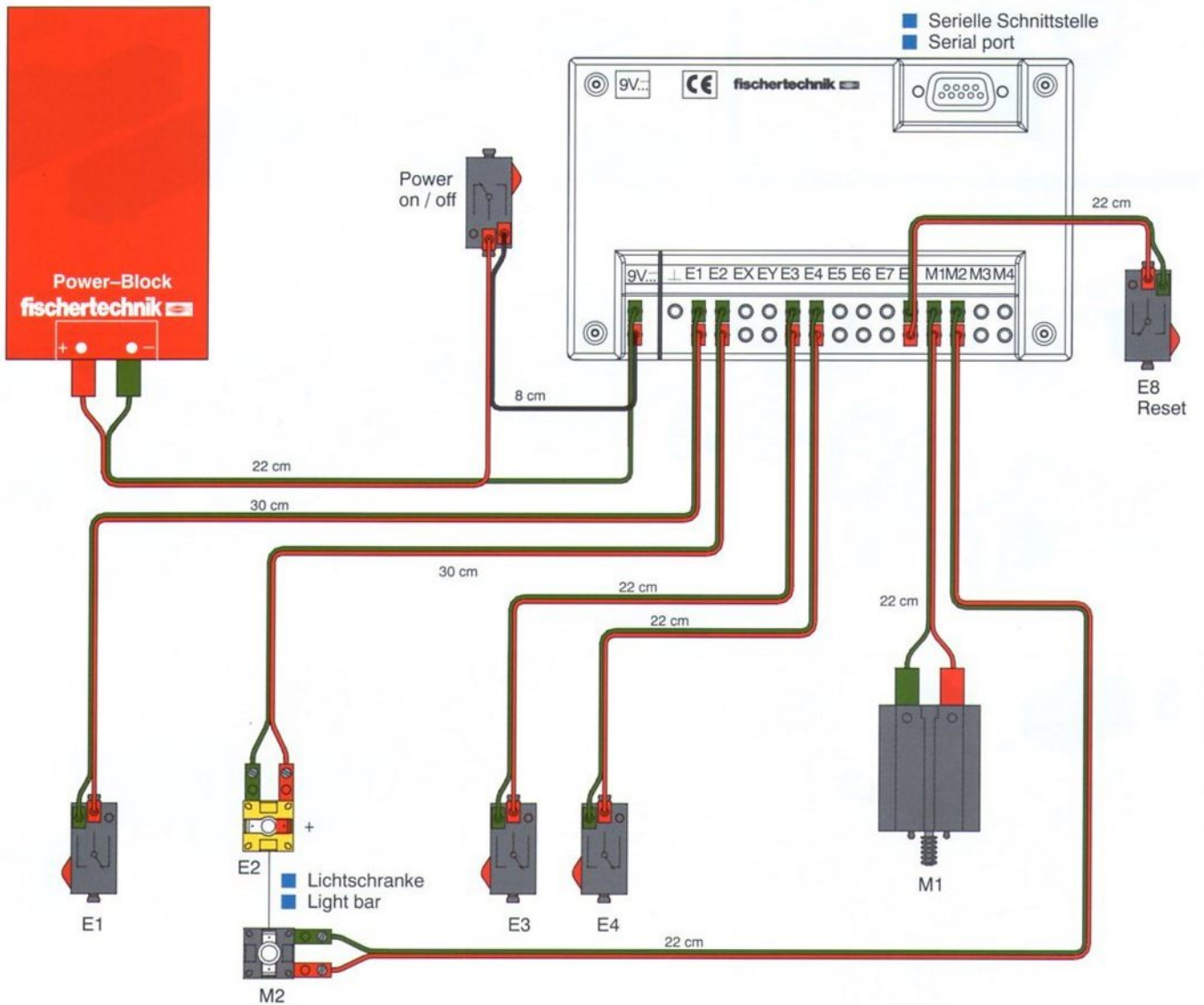


Montage Interface
Mounting interface

Seite 5
Page 5



Schaltplan
Circuit diagram



■ Beispielprogramm: stanze.mdl

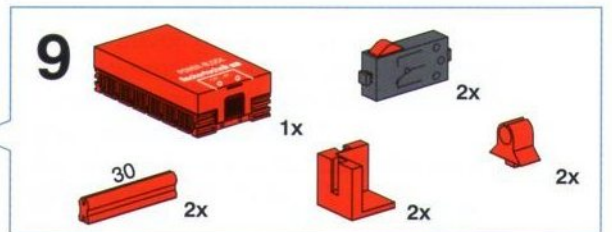
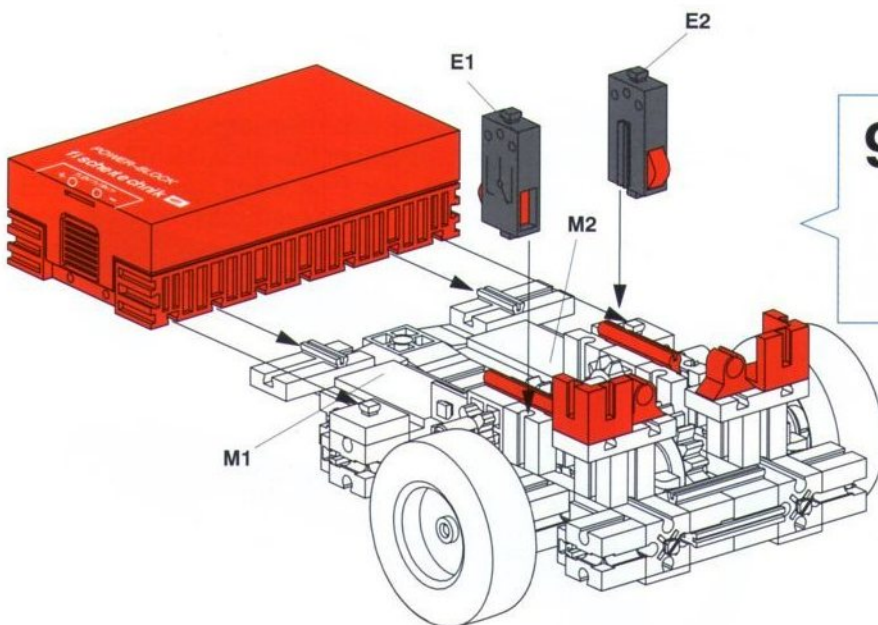
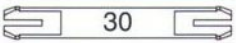
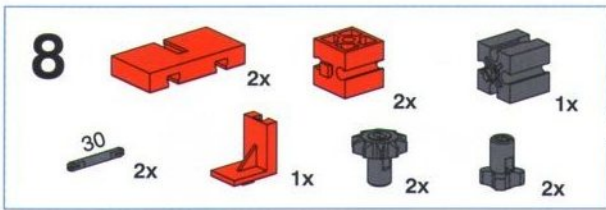
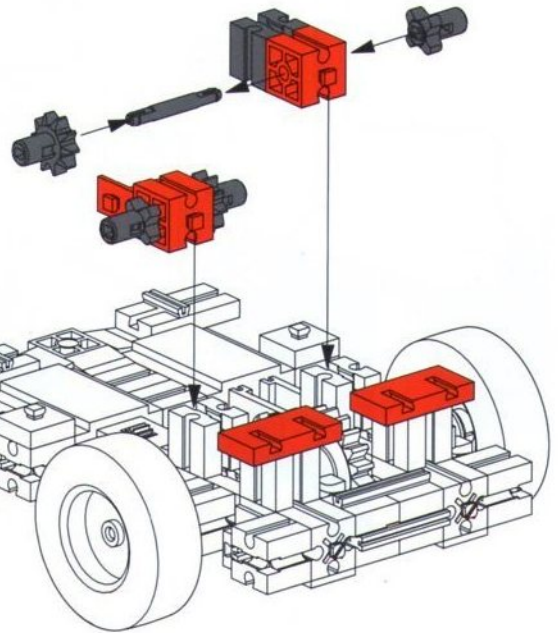
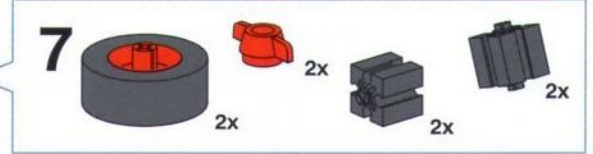
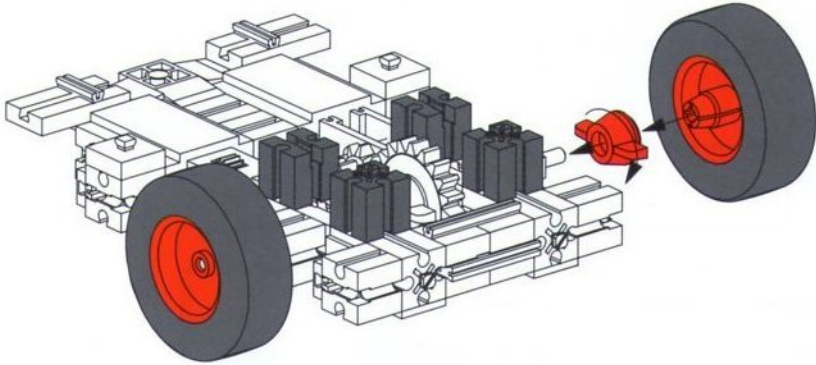
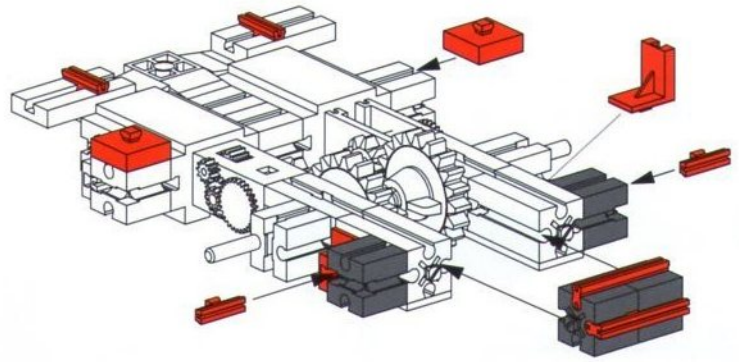
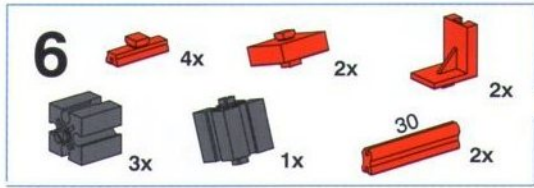
Funktionsweise:

Durch gleichzeitiges Drücken der Taster E3 und E4 wird die Maschine in Gang gesetzt und führt eine bestimmte Anzahl von Hügen aus. Unterbricht man die Lichtschranke, stoppt die Maschine und muß neu gestartet werden. Im Passiv-Modus werden am Terminal die Anzahl der Hüge und die Zahl der Durchgänge angezeigt.

■ Program example: stamp.mdl

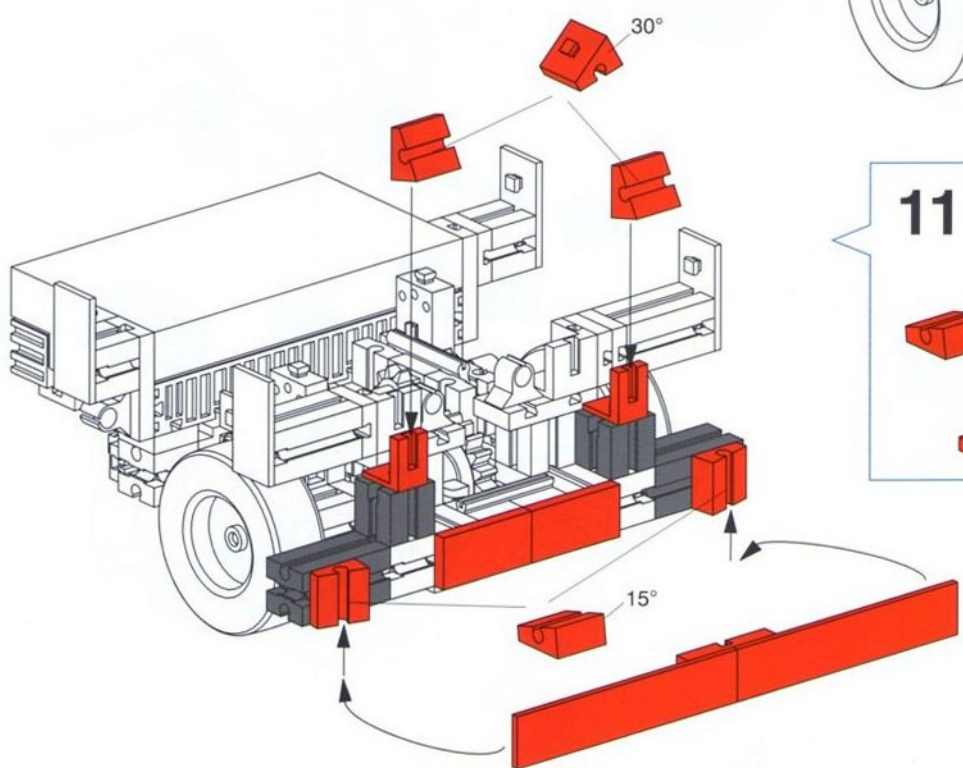
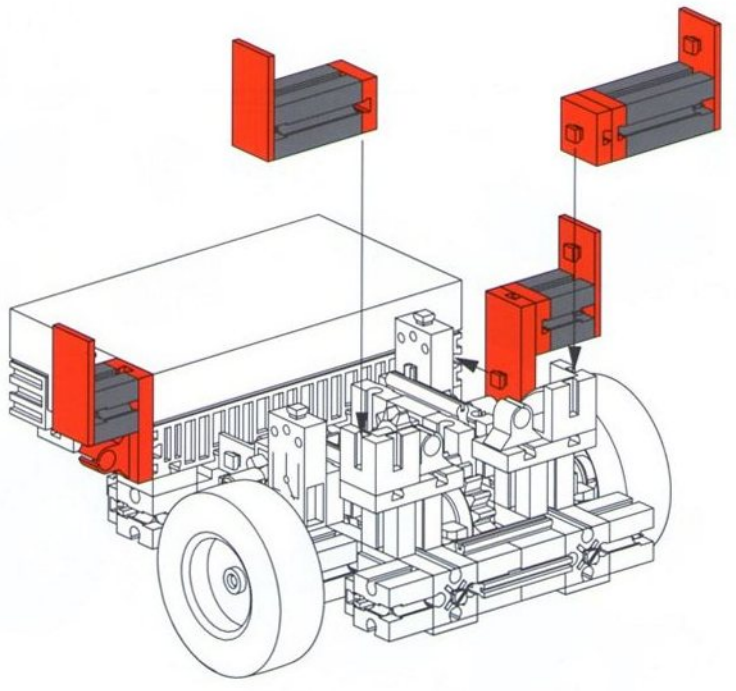
Operational description:

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.



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- 4x [Red 1x2 Technic Brick]
- 2x [Grey 1x3 Technic Beam]
- 2x [Grey 1x3 Technic Beam]
- 4x [Red 1x2 Technic Brick]
- 2x [Red 1x3 Technic Beam]
- 1x [Red 1x2 Technic Brick]



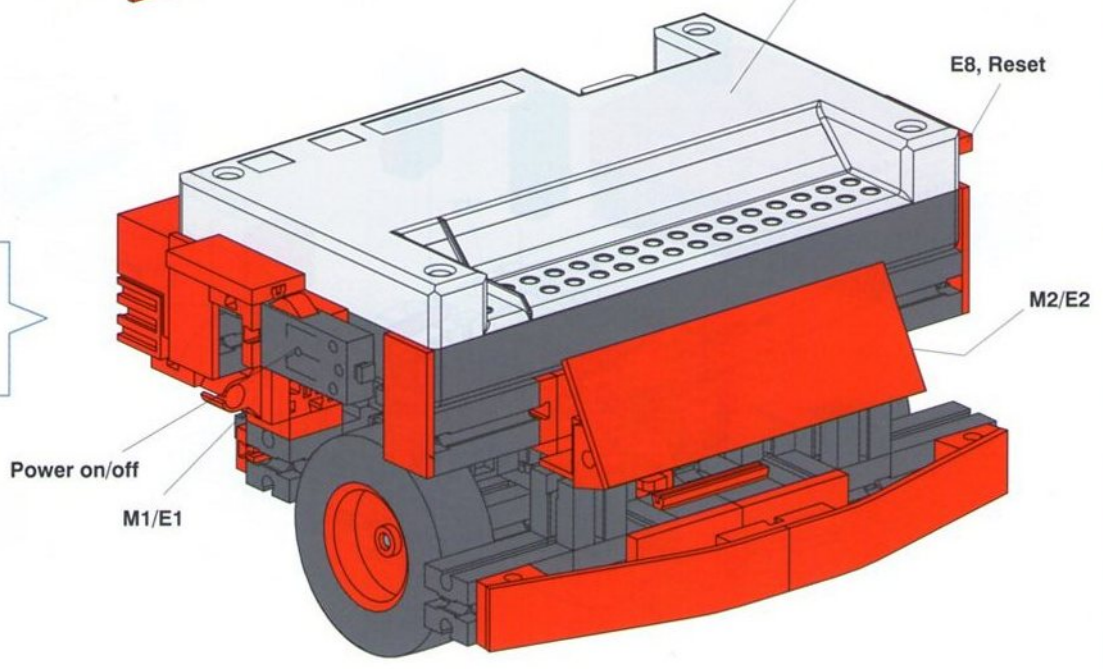
11

- 2x [Grey 1x3 Technic Beam]
- 2x [Grey 1x3 Technic Beam]
- 2x [Red 1x2 Technic Brick]
- 2x [Red 1x2 Technic Brick]
- 2x [Red 1x2 Technic Brick]
- 2x [Red 1x3 Technic Beam]
- 2x [Red 1x2 Technic Brick]
- 2x [Red 1x2 Technic Brick]
- 1x [Red 1x2 Technic Brick]

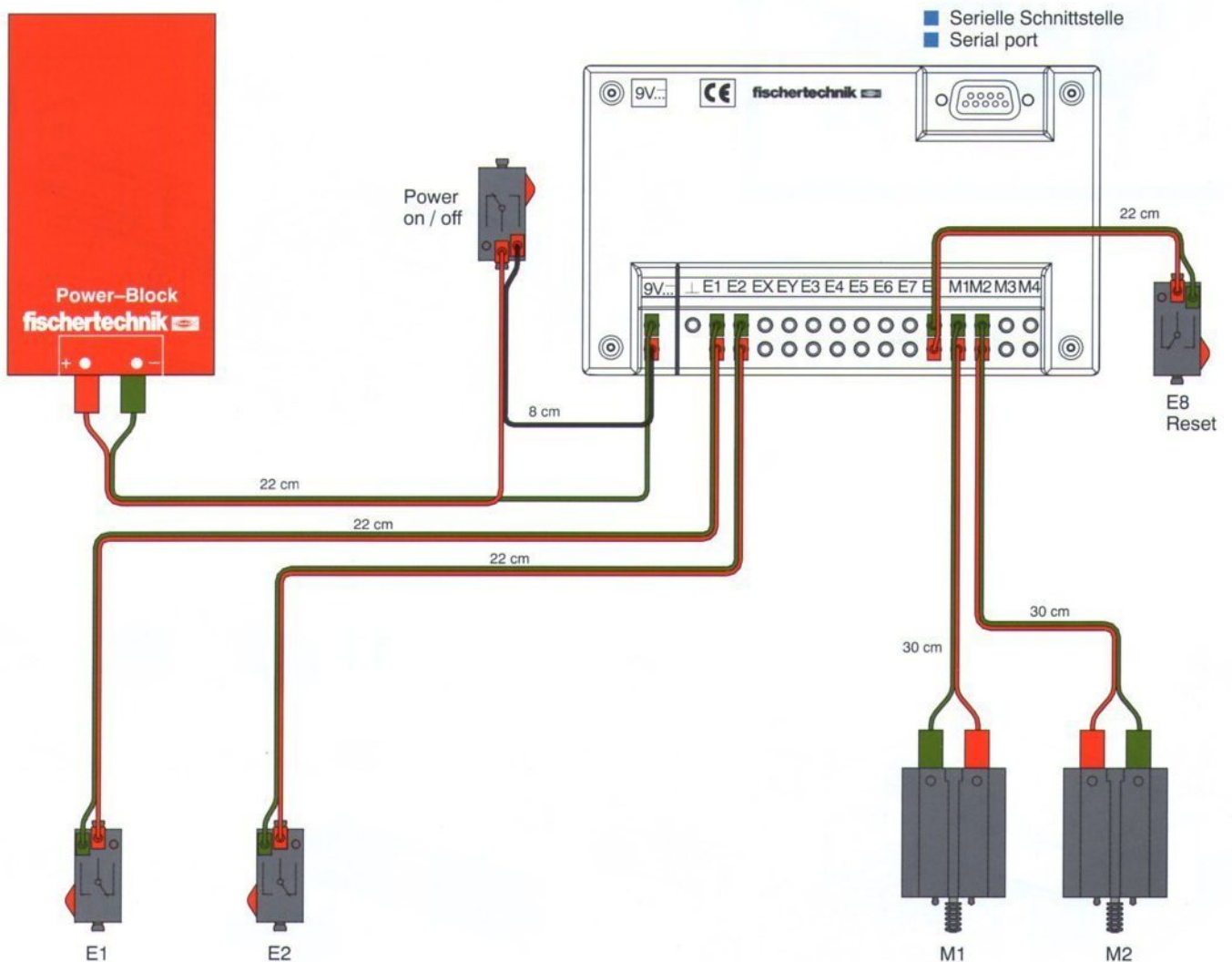
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- 1x [Red 1x6 Technic Beam]



Schaltplan Circuit diagram



■ Beispielprogramm: mr1.mdl

Funktionsweise:

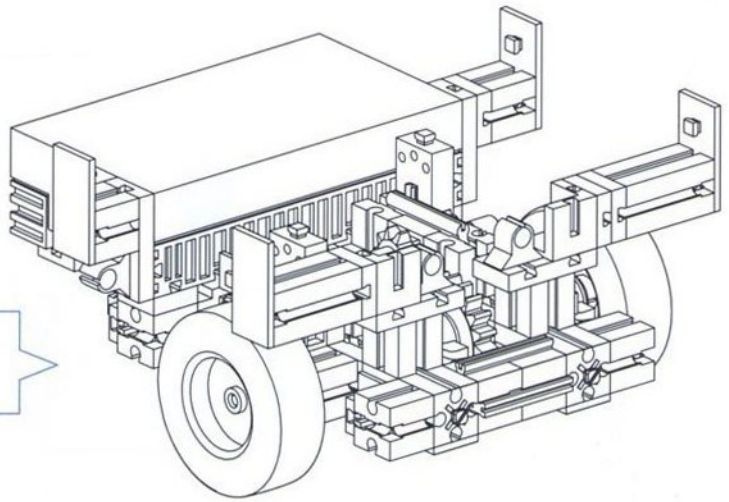
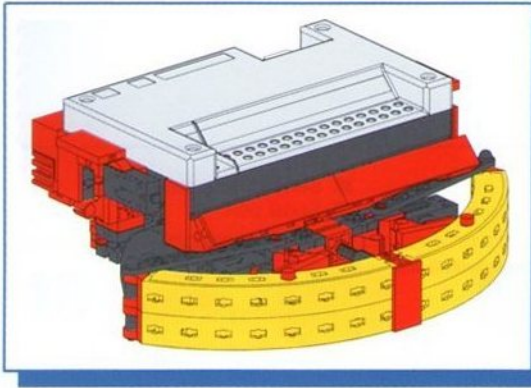
MR1 ist in der Lage, definierte Strecken vorwärts, rückwärts, nach links und rechts zurückzulegen. Er besitzt jedoch keine Sensoren um beispielsweise Hindernisse zu erkennen. Dieses Modell bildet den Einstieg in die Welt der mobilen fischertechnik Roboter.

■ Program example: mr1.mdl

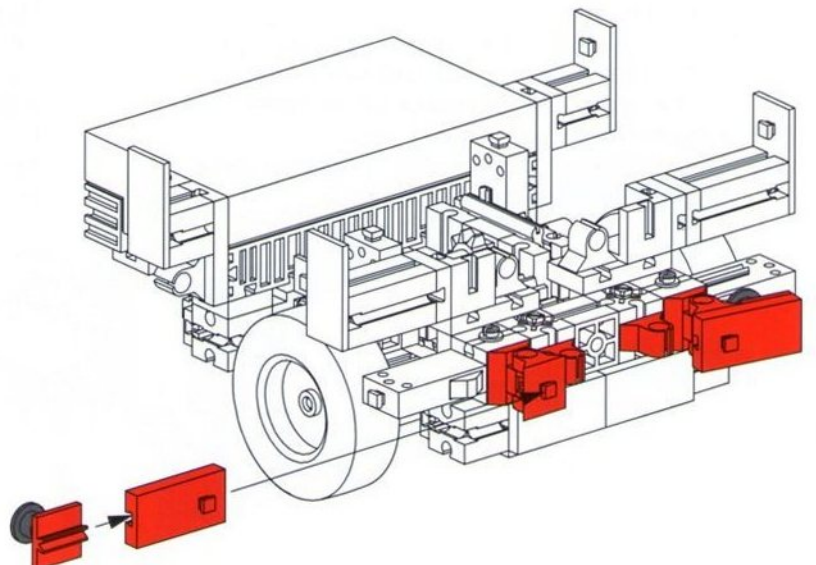
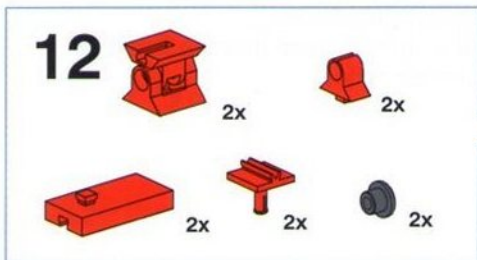
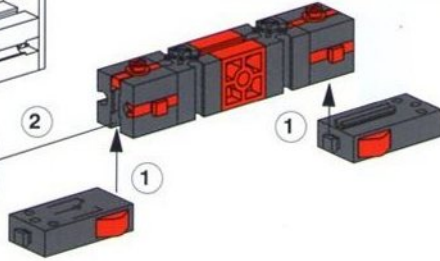
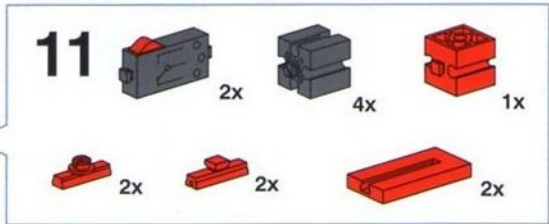
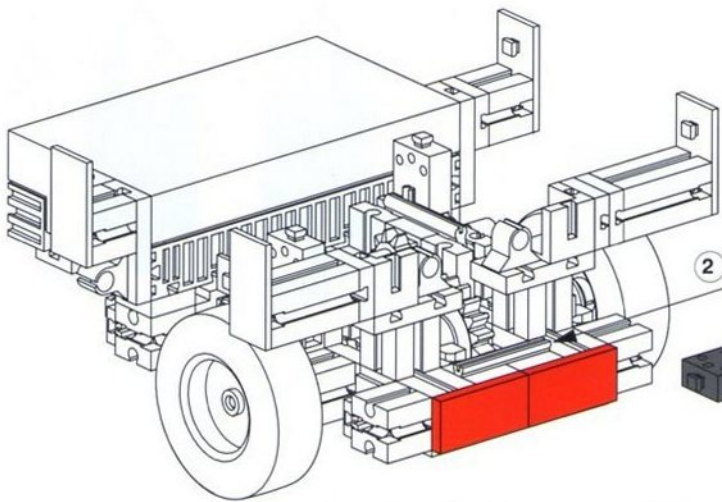
Operational description:

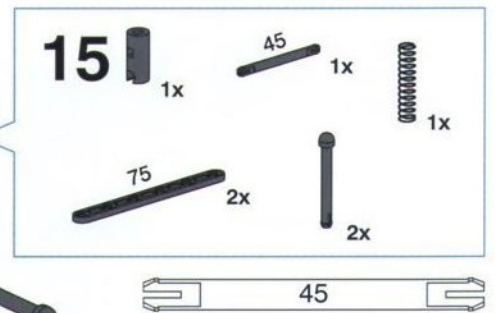
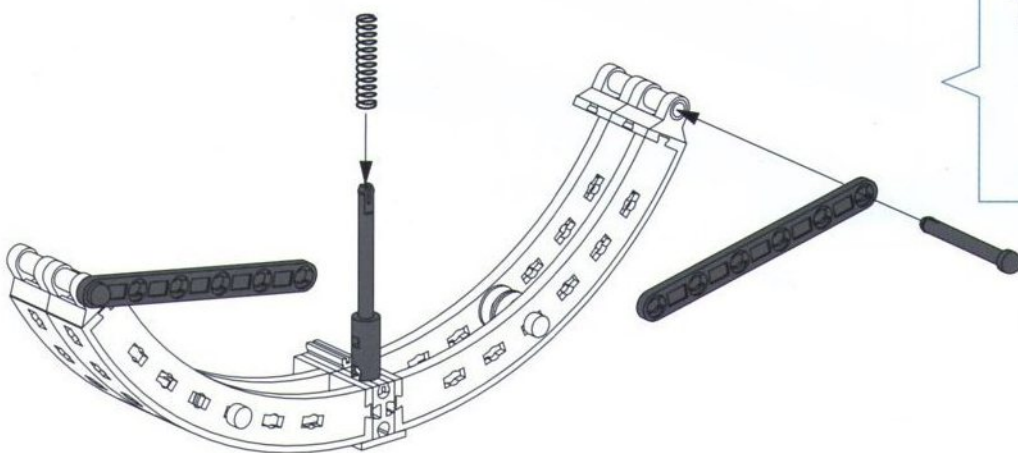
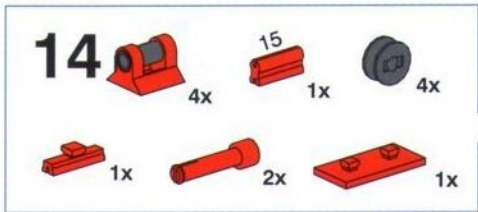
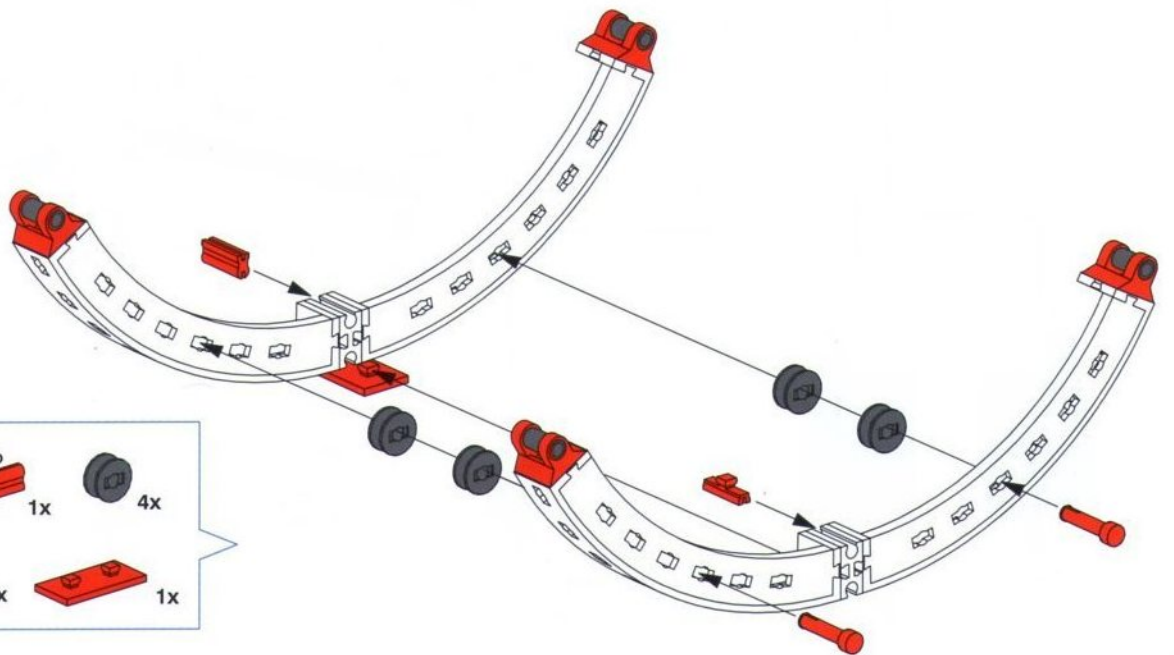
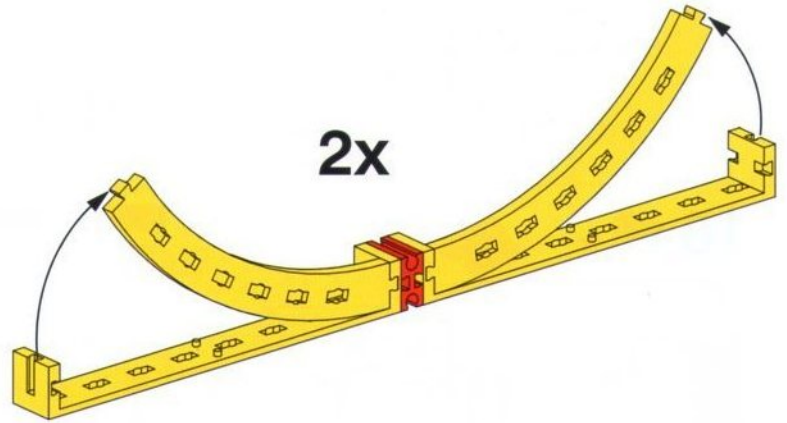
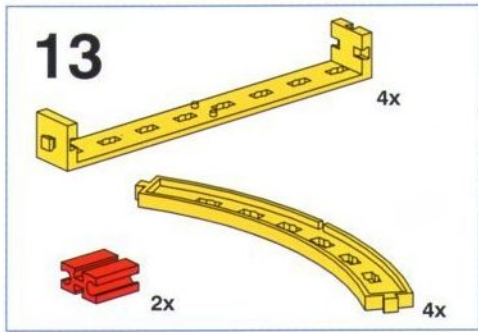
MR1 is able to travel for designated distances forwards, backwards, to the left, and to the right. It is not, however, equipped with any sensors to, for example, recognize obstacles. This model offers an introduction into the world of fischertechnik's mobile robots.

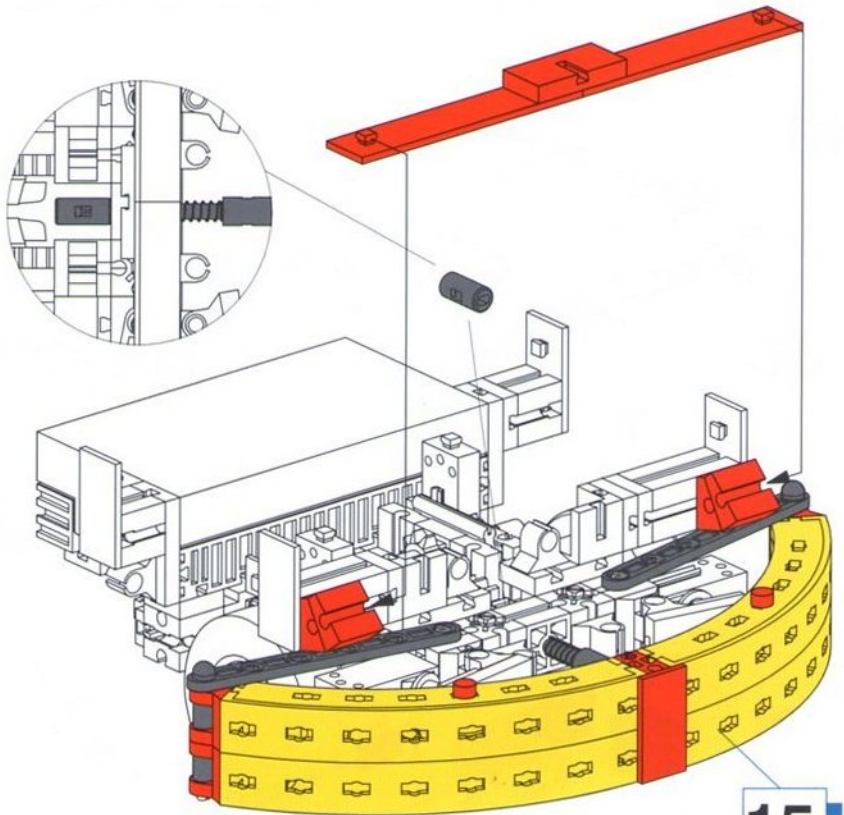
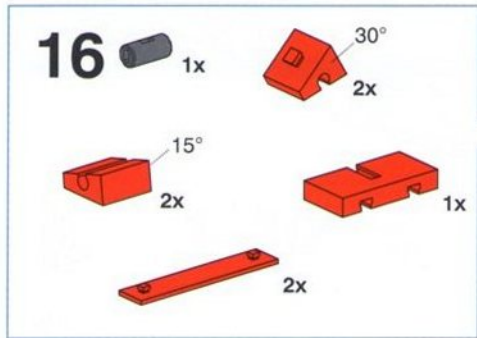
MR 2
 erkennt Hindernisse
 recognizes obstacles



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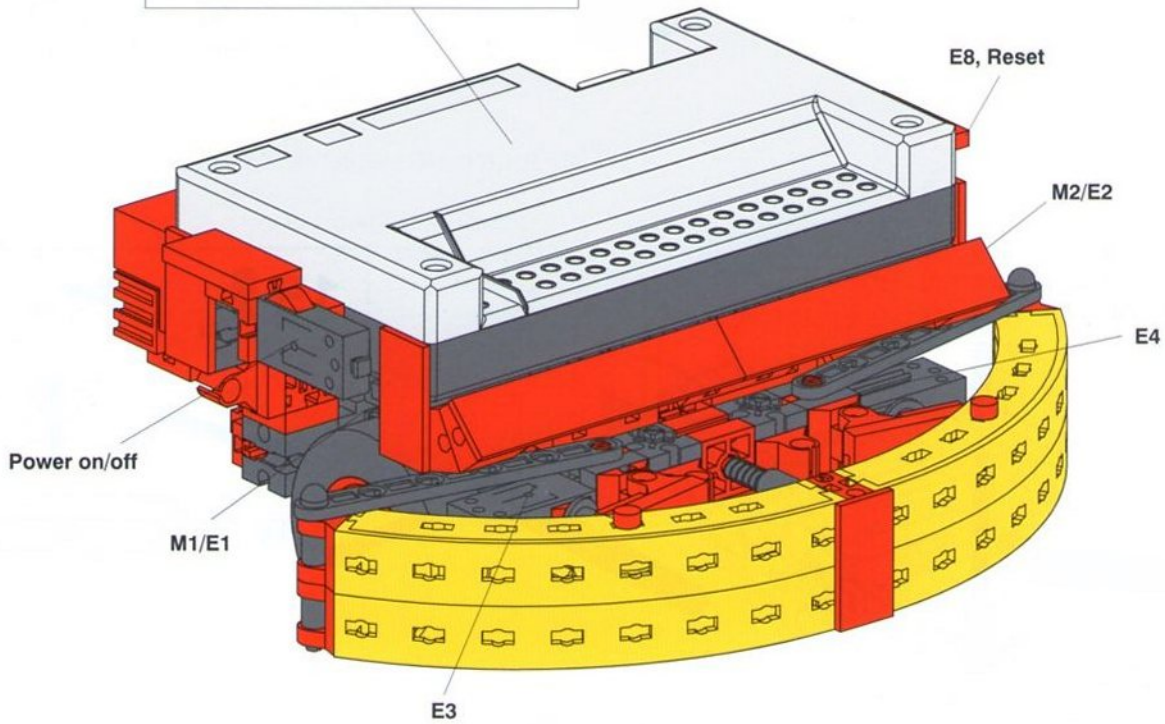




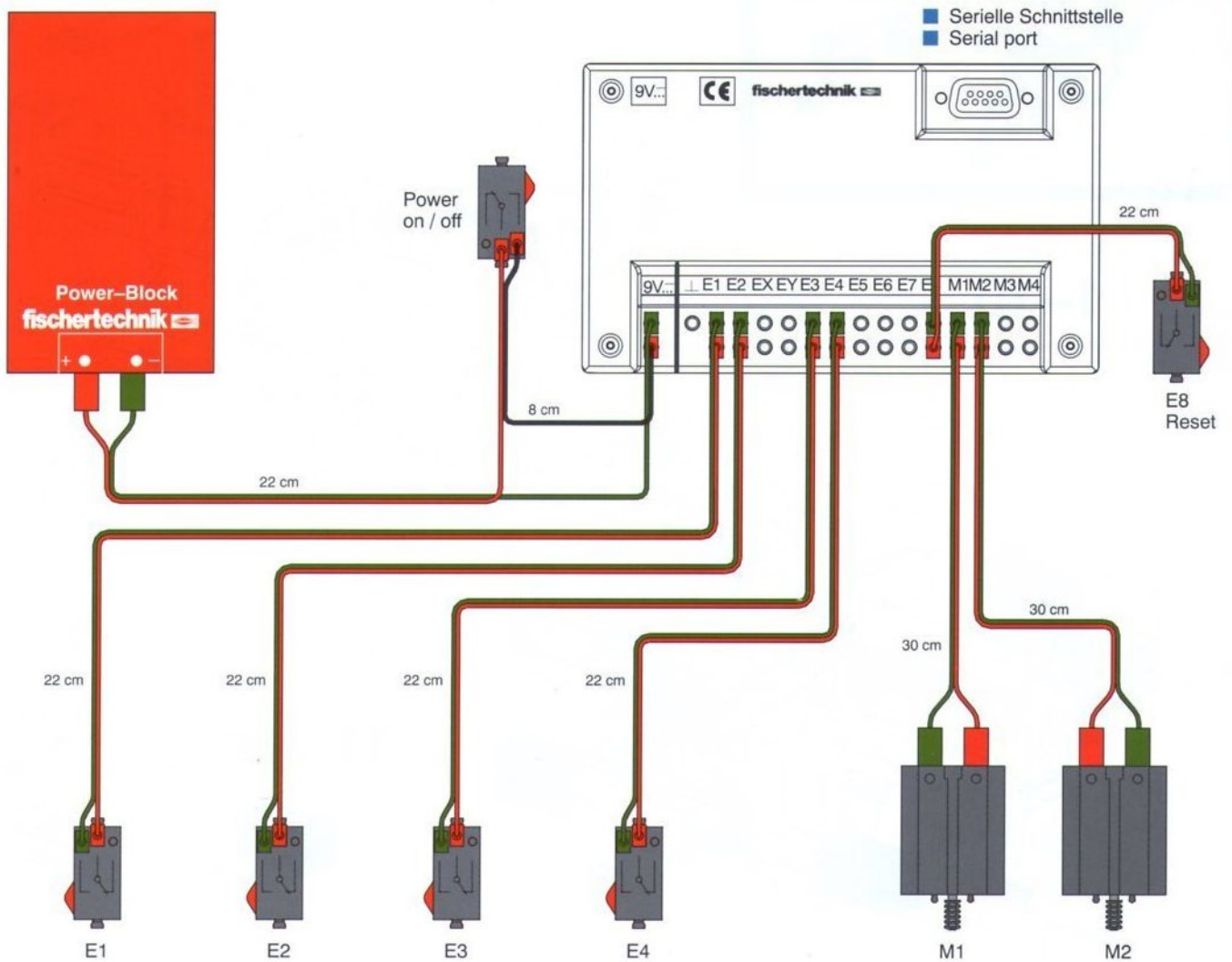


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 Mounting interface Page 5



Schaltplan Circuit diagram



■ Beispielprogramm: mr2.mdl

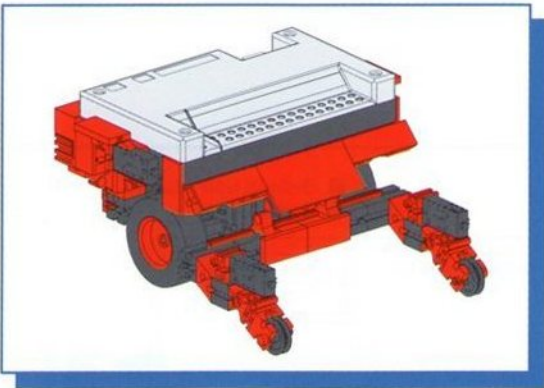
Funktionsweise:

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

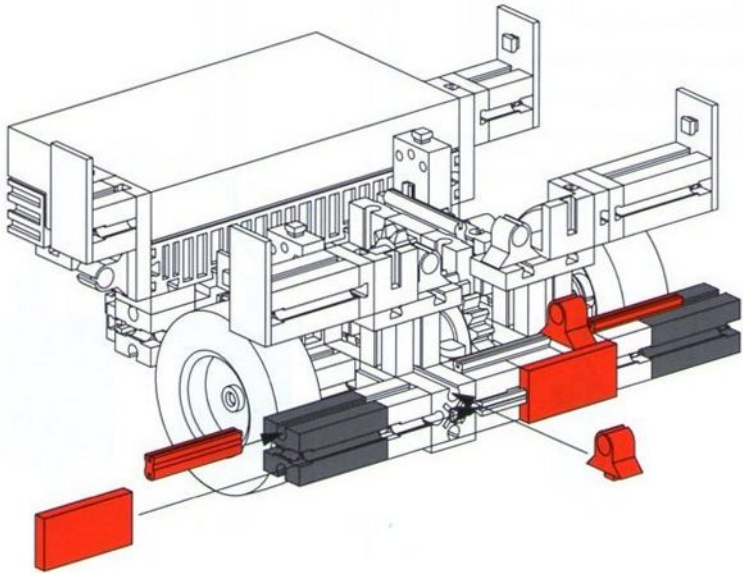
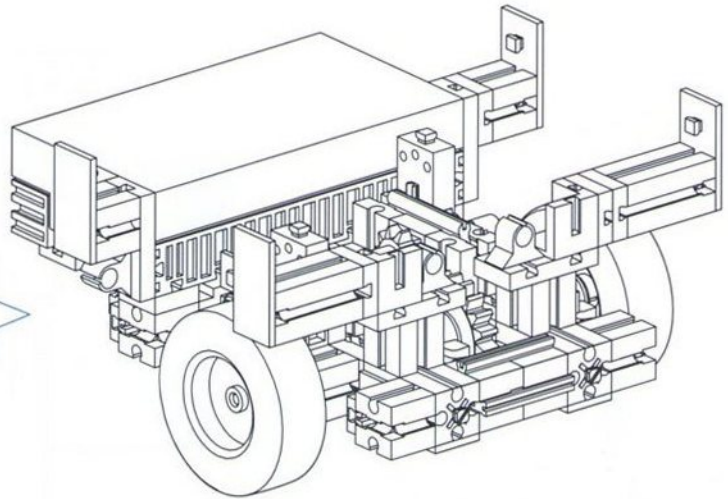
Operational description:





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.









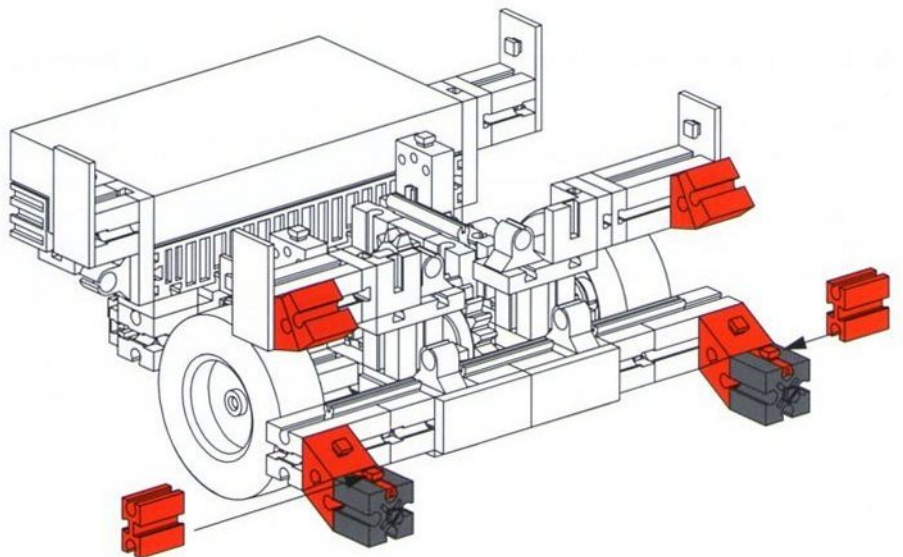
MR3
erkennt Abgründe
recognizes ledges

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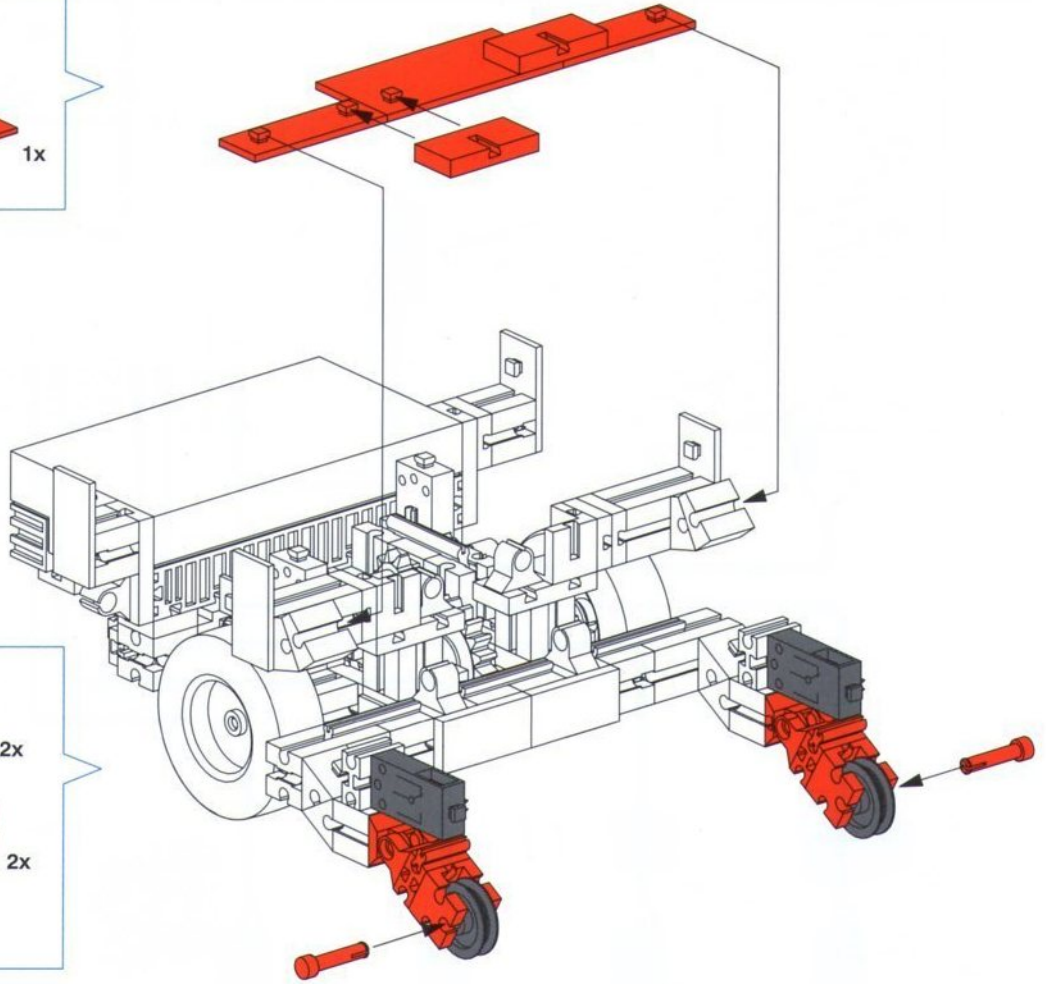
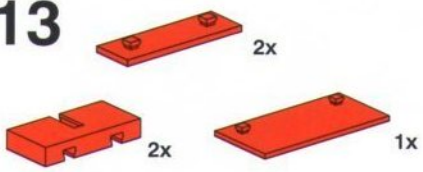


- 11**
-  2x
 -  2x
 -  2x
 -  2x

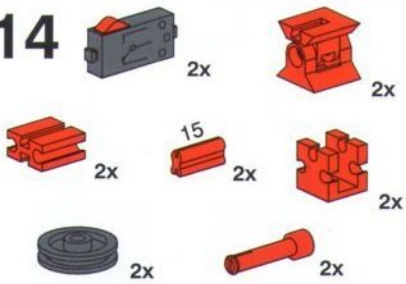
- 12**
-  2x
 -  2x
 -  2x
 -  2x
 -  2x
 -  4x



13

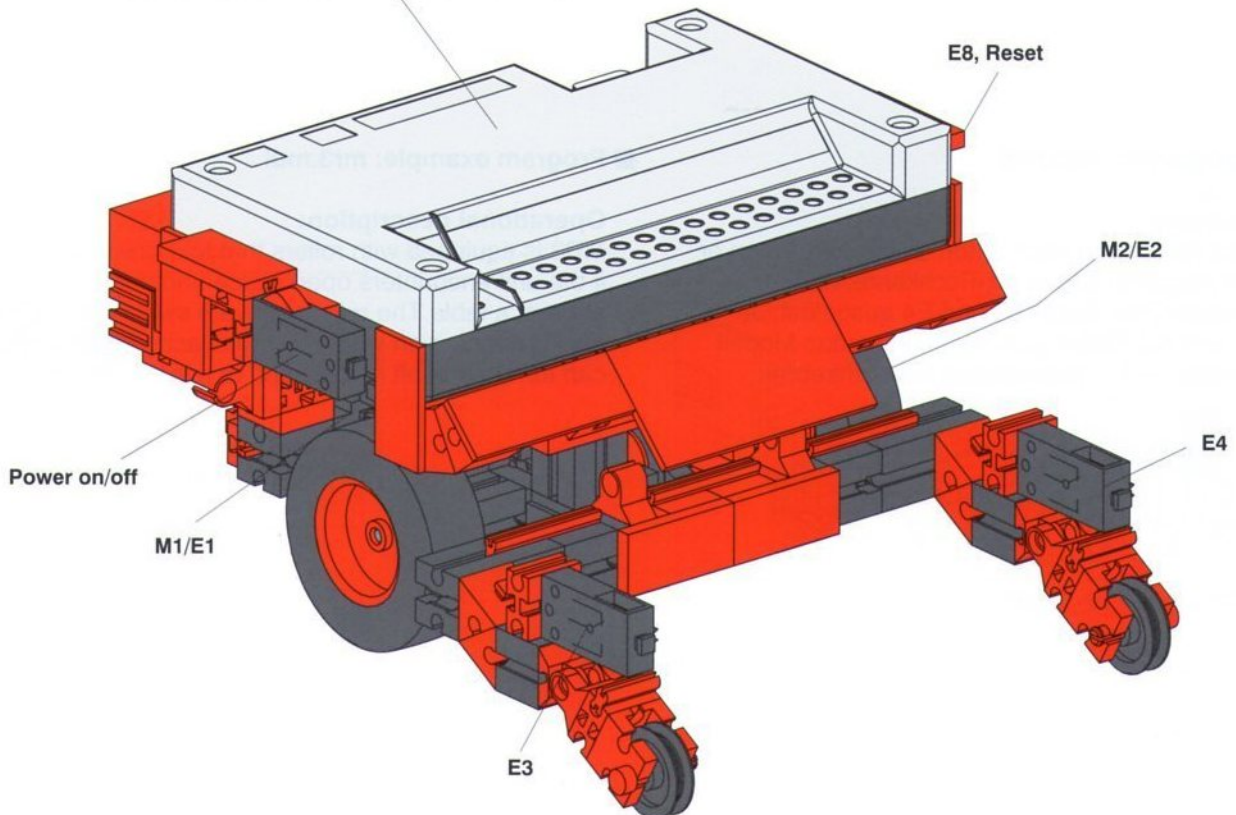


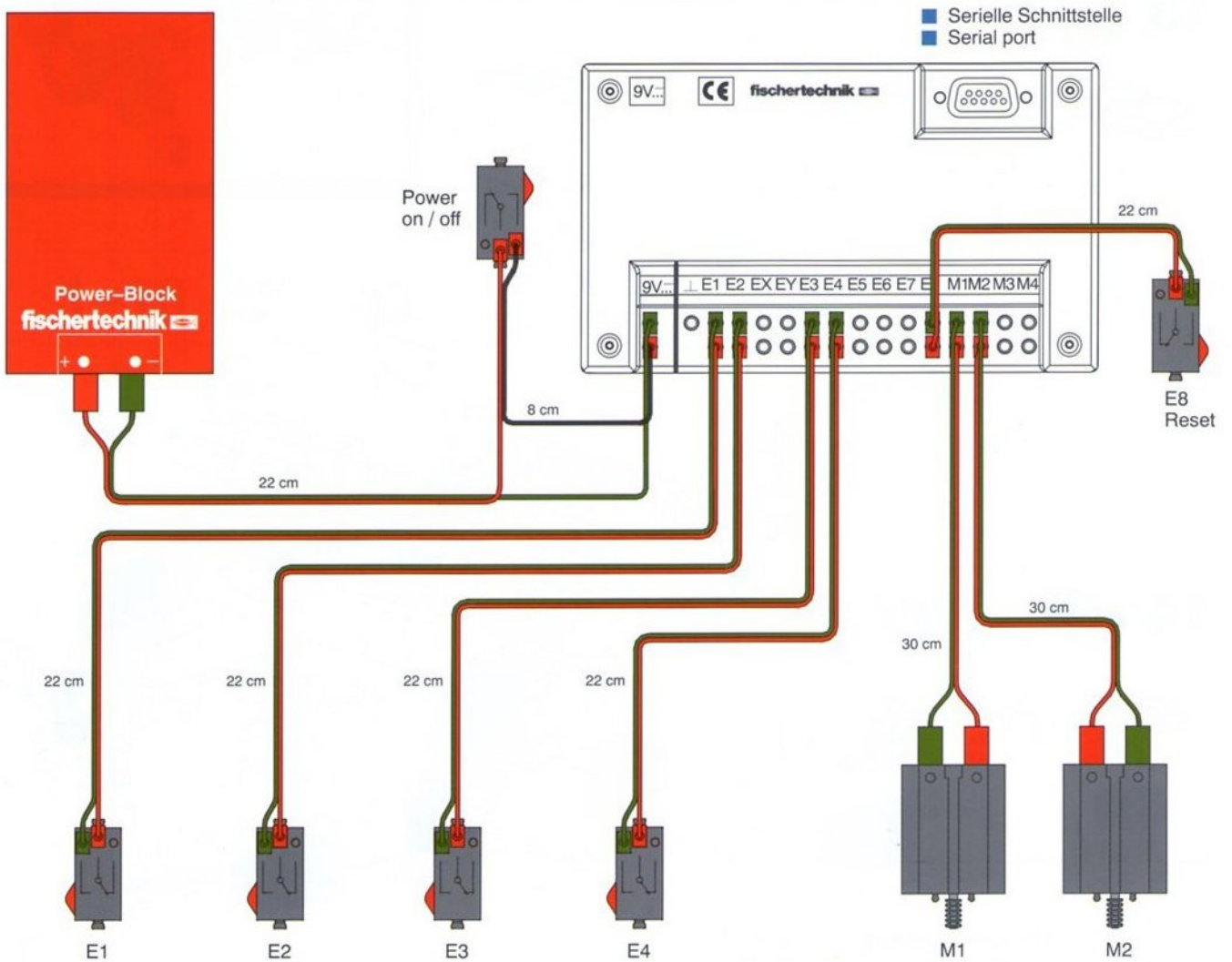
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Montage Interface
Mounting interface

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■ Beispielprogramm: mr3.mdl

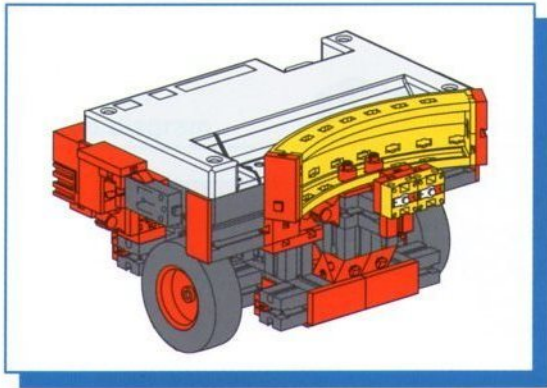
Funktionsweise:

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

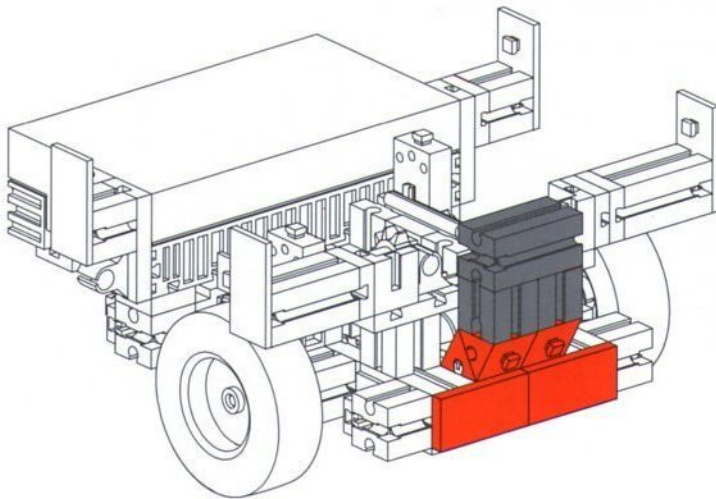
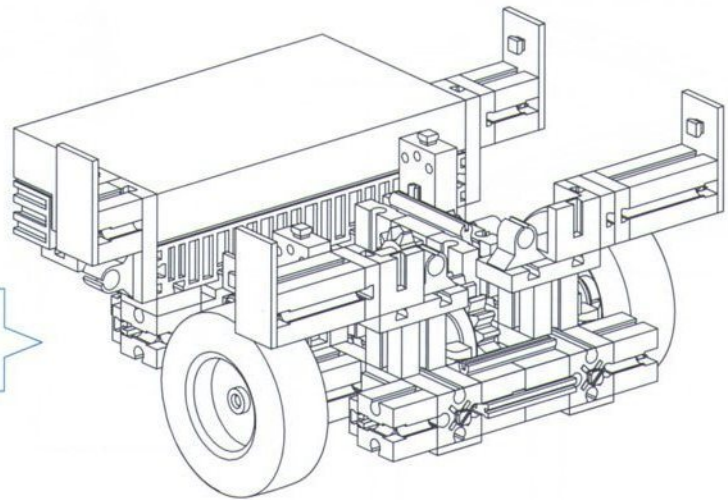
Operational description:

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

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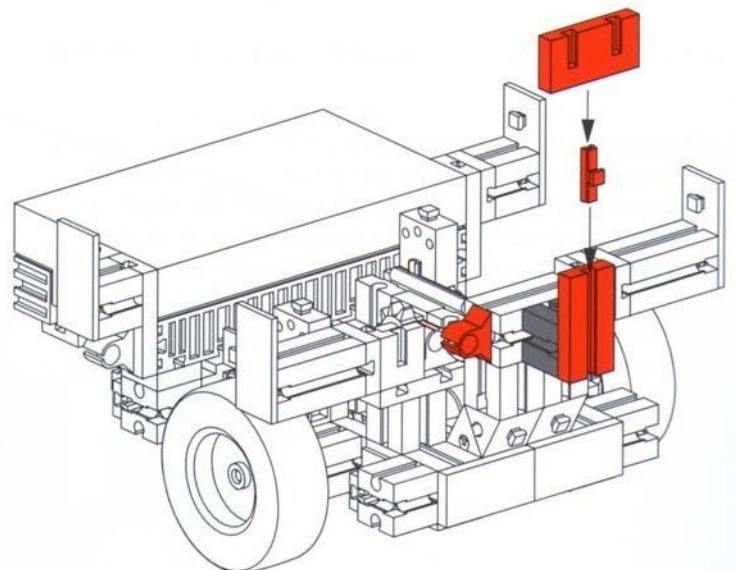


11

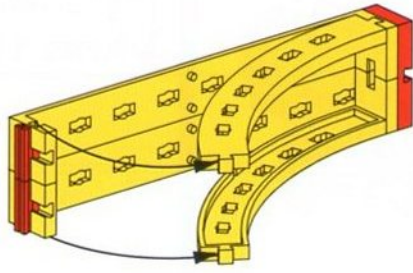
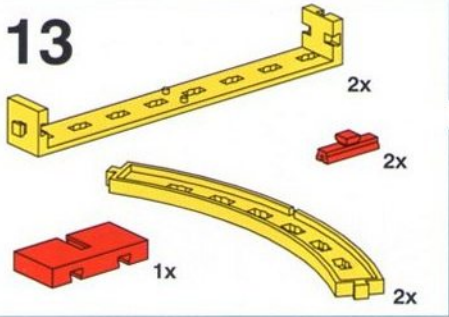
	2x		1x
	4x		2x

12

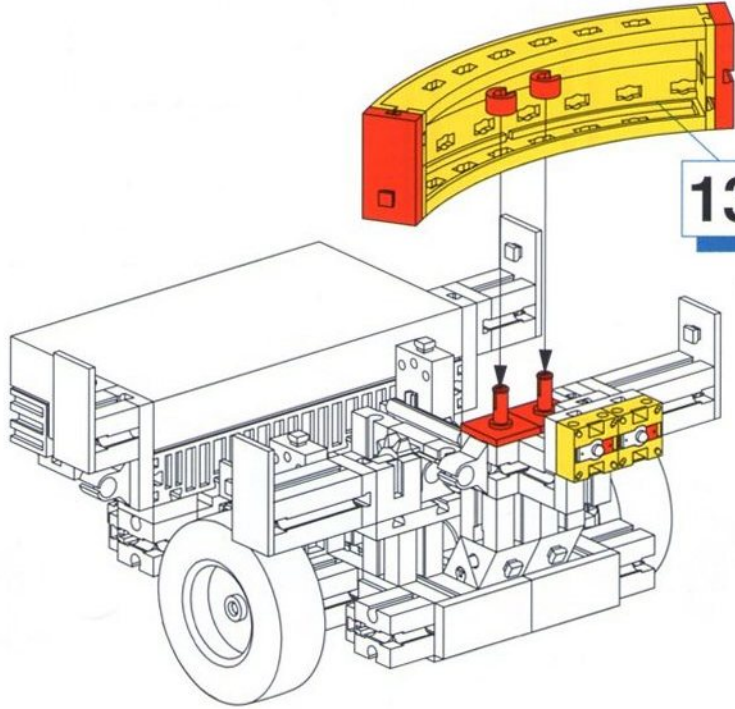
	1x		1x
	1x		1x
	1x		1x



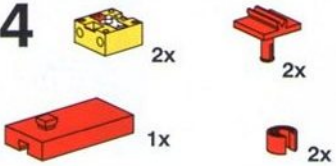
13



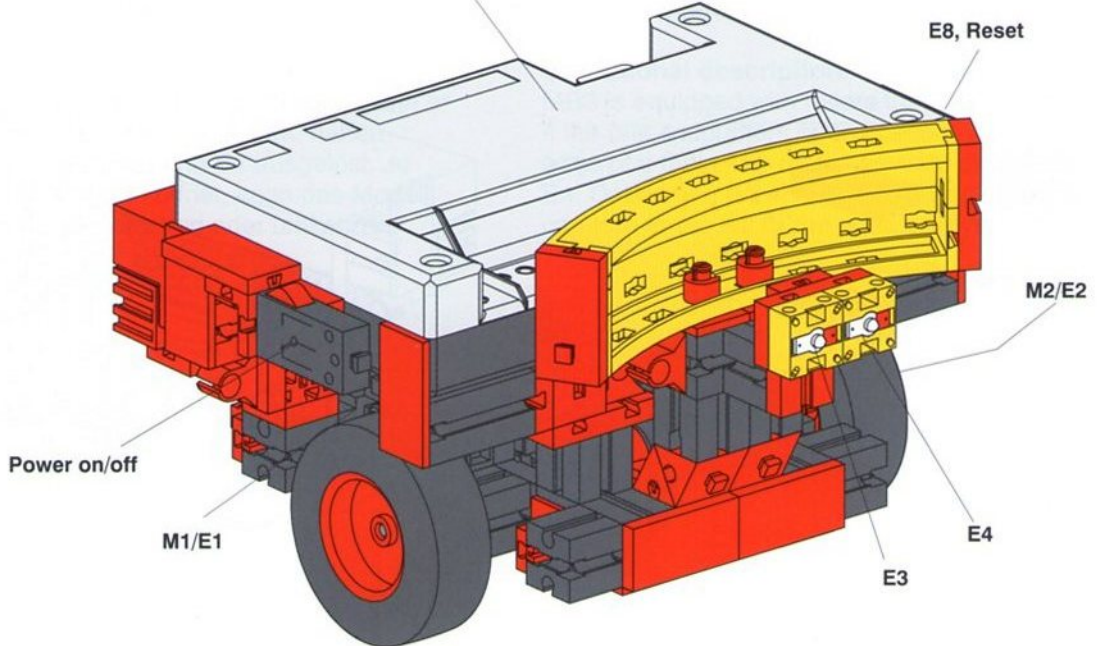
13



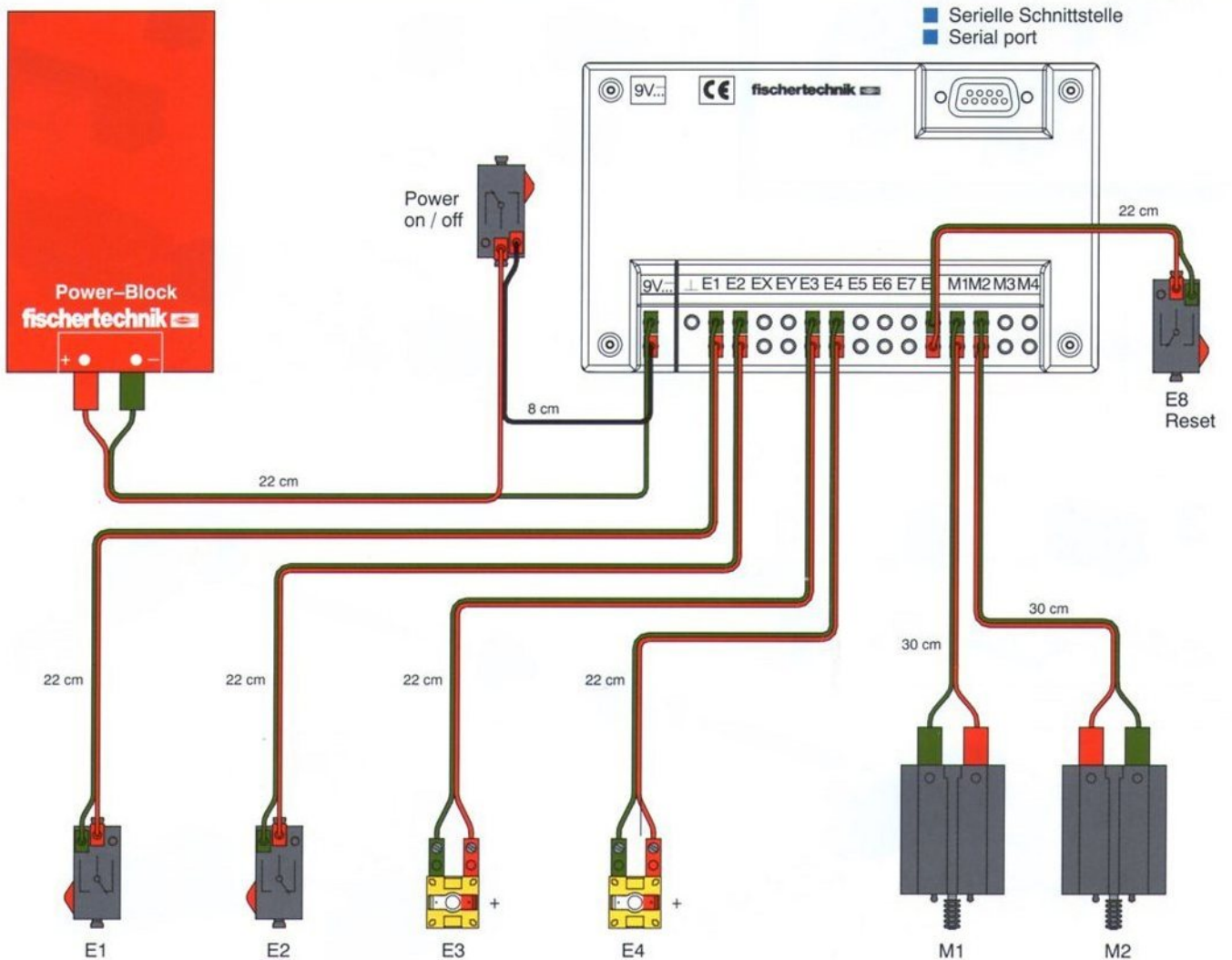
14



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 Mounting interface Page 5



Schaltplan Circuit diagram



■ Beispielprogramm: mr4.mdl

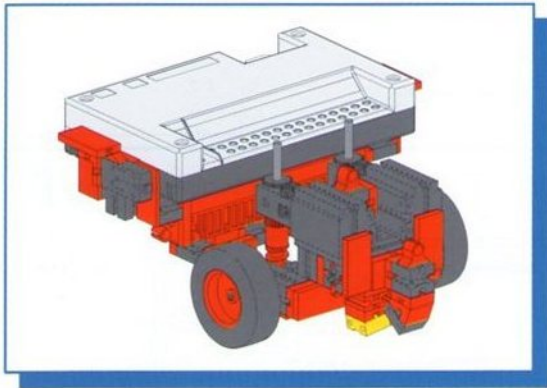
Funktionsweise:

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

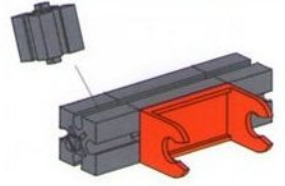
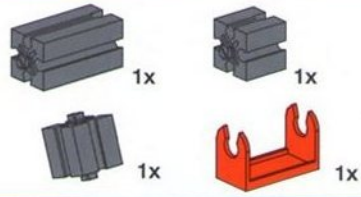
Operational description:

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 loses contact to the light source, it begins a new search.

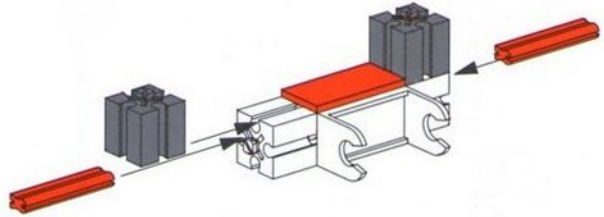


MR5
folgt einer Spur
follows a path

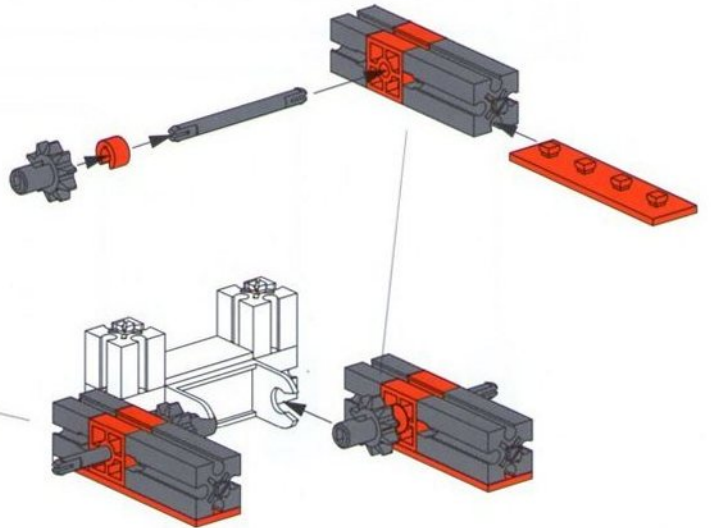
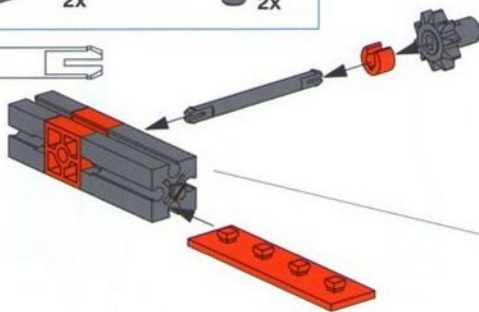
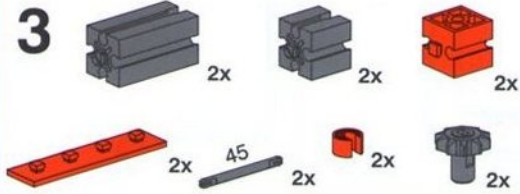
1



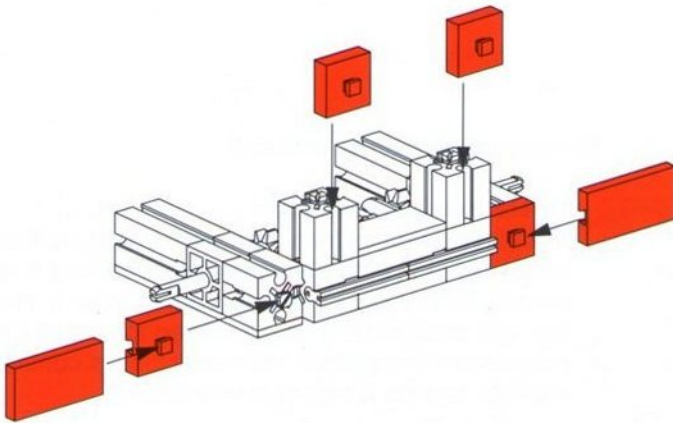
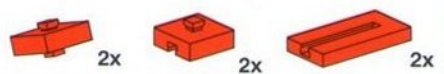
2



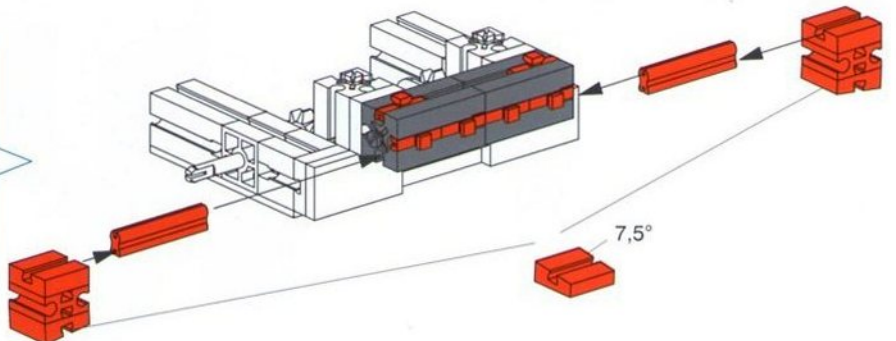
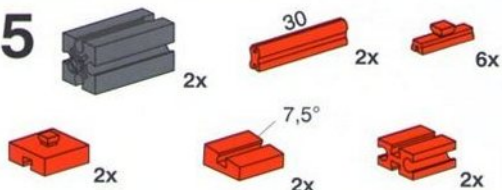
3



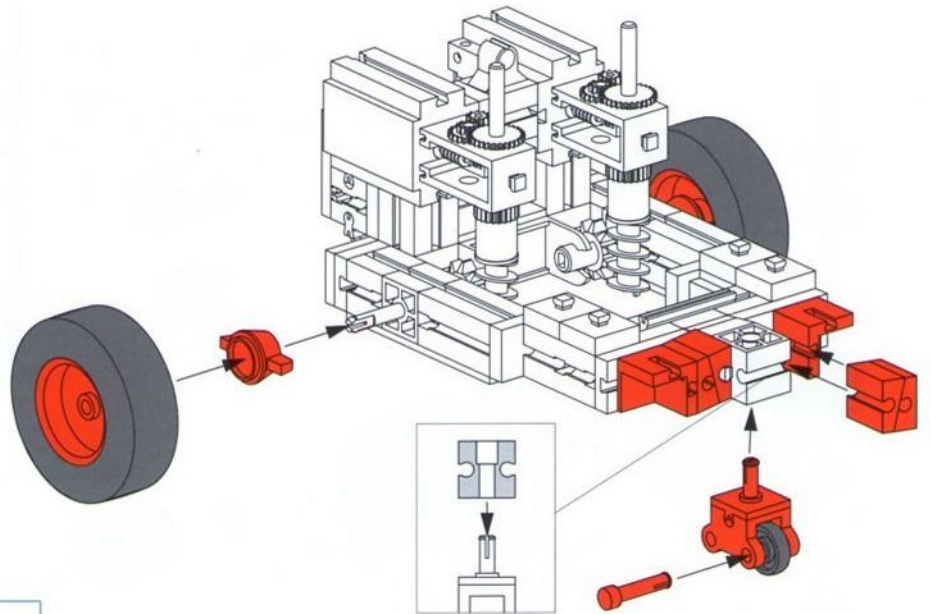
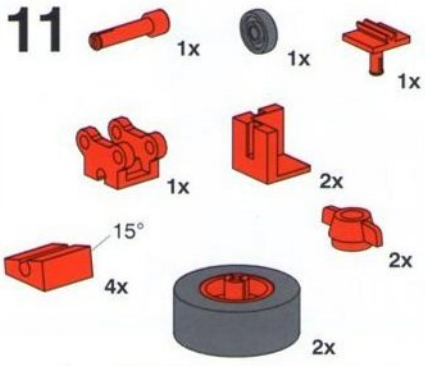
4



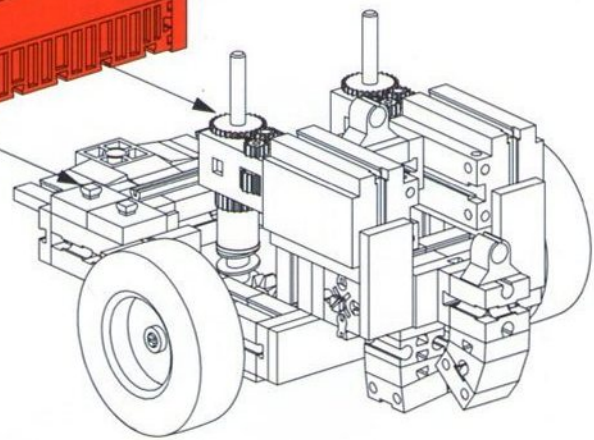
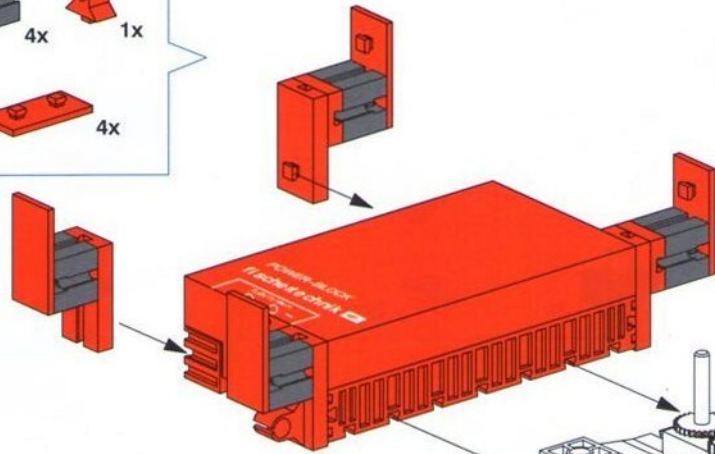
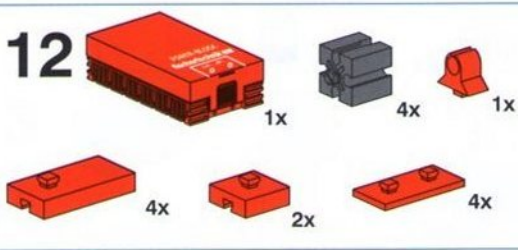
5



11

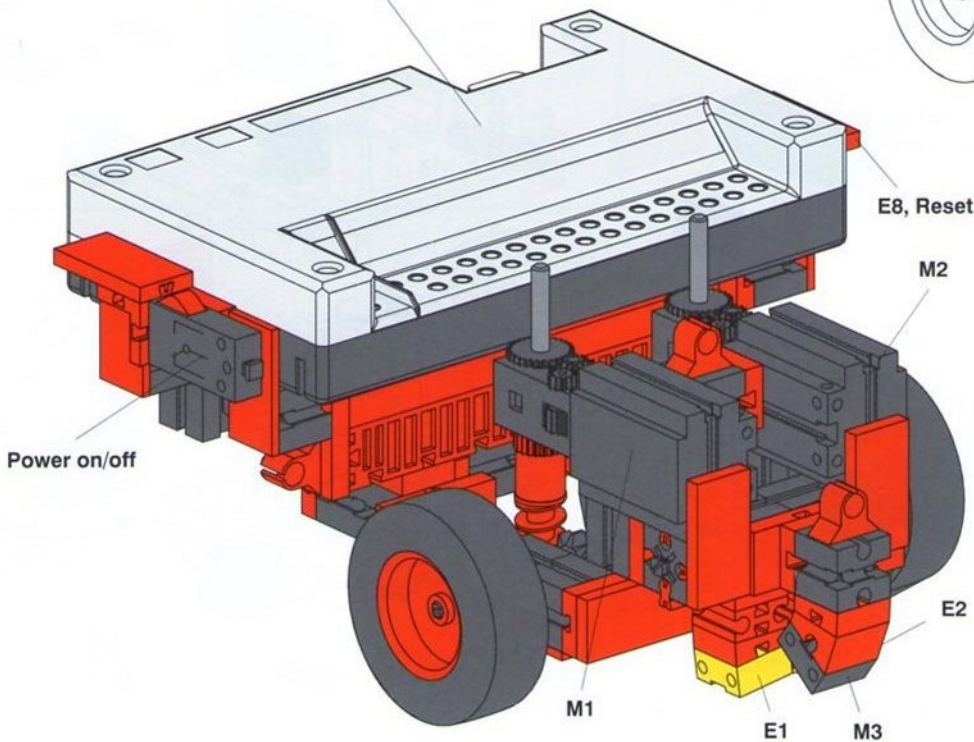


12

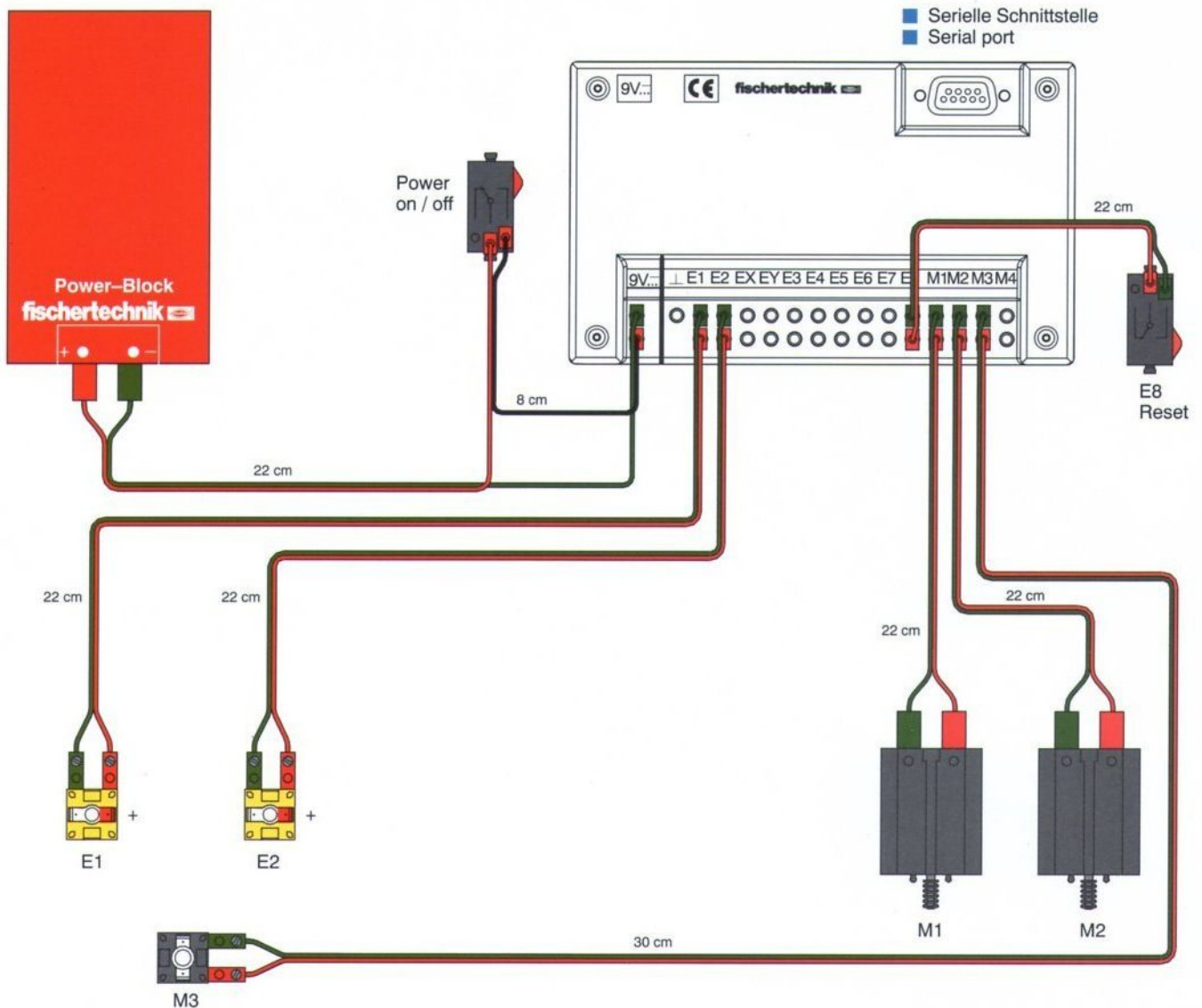


Montage Interface
 Mounting interface

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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 Fototransistoren 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:

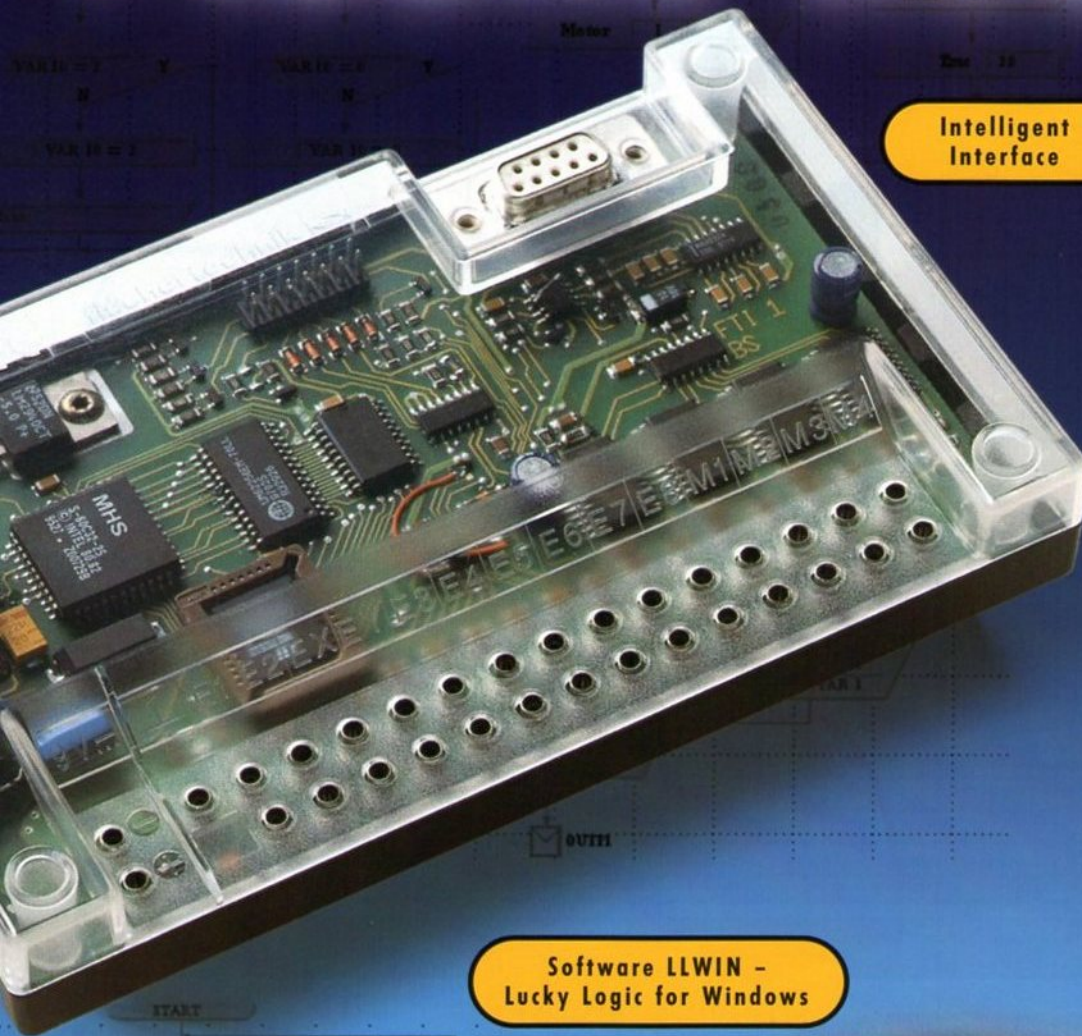
MR5 can proceed along a black path laid out against a light background. The path should be approx. 1 cm (1/2") wide. The best way to make a path is to use black insulation tape on a white surface. You can also use a wide, black magic marker to draw a path on a white sheet of paper.

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.

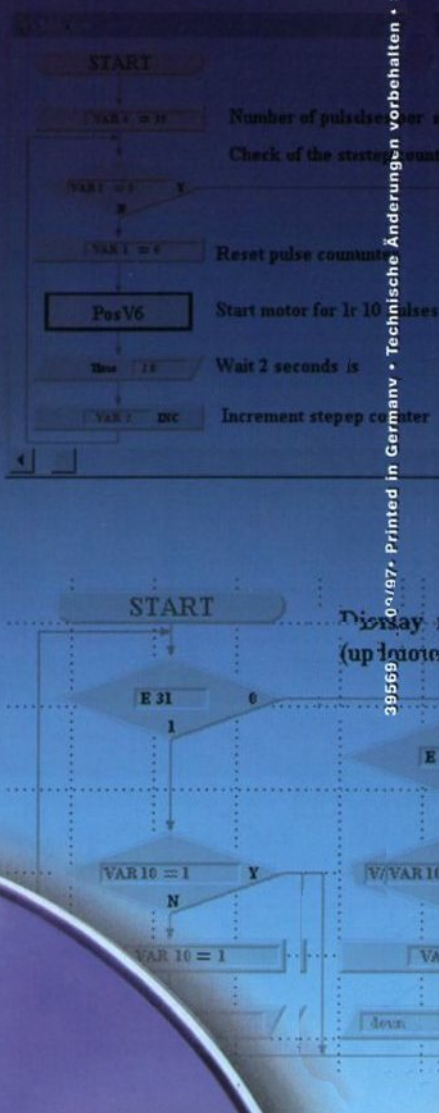
The interface diagnostics indicate whether the phototransistors recognize the path as a dark strip and the background as a light area. You may need to increase the contrast between the path and the background, or move the light to a better position.

Mobile Robots



Intelligent Interface

Software LLWIN -
Lucky Logic for Windows



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