

Electronics with the Modular System

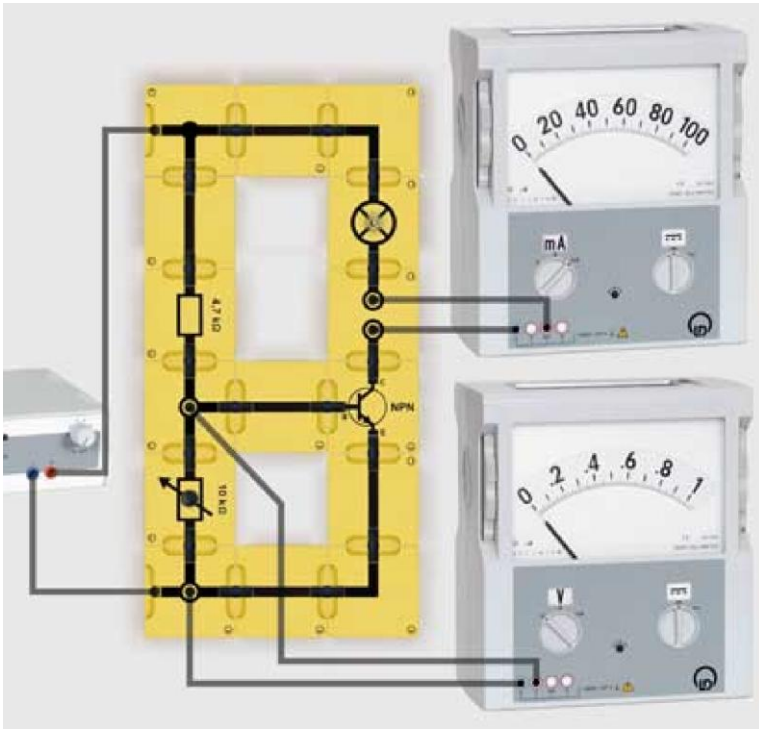
Basic Electronic Circuits
Transistors

Transistor as an electronic switch

Objective of the experiment

To demonstrate the working principle of a transistor as an electronic switch.

Setup



Apparatus

1	539 043	Transistor NPN, BD 137, BST
1	539 012	Photoresistor LDR 05, BST
1	539 015	Resistor 10 kΩ, BST
1	539 024	Lamp socket E10, BST
1	from 505 15	Incandescent lamp, 6 V, 0.05 A, E10
5	539 001	Connector blocks BST, straight
1	539 003	Connector blocks BST, 90° angle
2	539 004	Connector block BST, T branch
1	539 006	Connector blocks BST, T branch w. socket
16	539 007	Bridging plug, BST
2	531 906	Demo multimeter, passive
2	521 49	Power supply, 12 V DC, 230 V
1	500 644	Safety connection lead, 100 cm
6	301 300	Demonstration experiment frame
1	301 301	Adhesive magnetic board

Carrying out the experiment

- Adjust a voltage of approx. 6 V at the power supply and set the variable resistor to minimum resistance.
- By increasing the resistance on the variable resistor, slowly increase the voltage U_{BE} . Observe the incandescent lamp and the pointer deflection on the ampere meter (I_C).

Observation

A collector current I_C can only be detected when the base-emitter voltage U_{BE} has exceeded a value of approx. 0.6 V.

Evaluation

The collector current I_C depends on the base-emitter voltage U_{BE} .

A collector current I_C only flows when the base-emitter voltage U_{BE} has reached a value U_S .

The voltage U_S is also known as the threshold voltage and is equal to approx. 0.6 V in the experiment example.

The dependence of the collector current I_C on the base-emitter voltage U_{BE} is used to employ the transistor as an electronic switch:

$U_{BE} < U_S \rightarrow I_C = 0 \rightarrow$ Switching state: OFF

$U_{BE} > U_S \rightarrow I_C > 0 \rightarrow$ Switching state: ON

With transistors, very rapid and mechanically wear-free switching actions are possible.