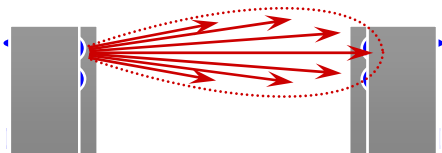
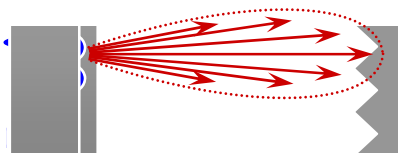


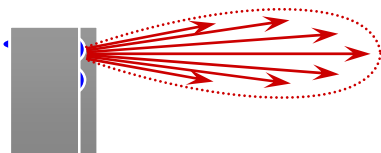
# Proximity sensors



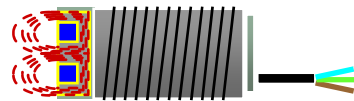
Optical – Through-beam



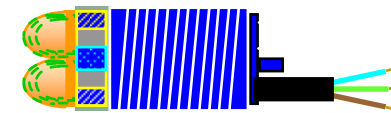
Optical – Retro-reflective



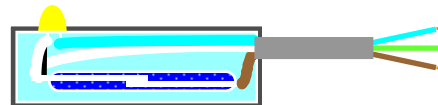
Optical – Diffuse



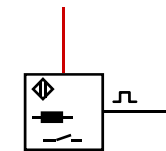
Inductive



Capacitive



Reed switch



Symbols



Inductive magnetic

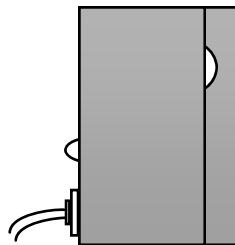
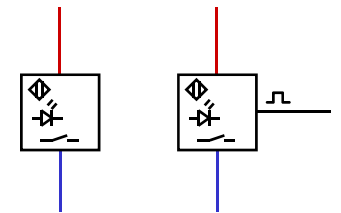
Connection

## Optical sensors (Through-beam)

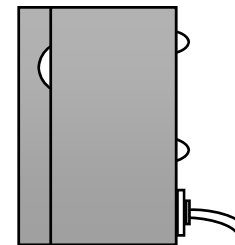
Type : Through-beam

# Optical sensors (Through-beam)

Type : Through-beam



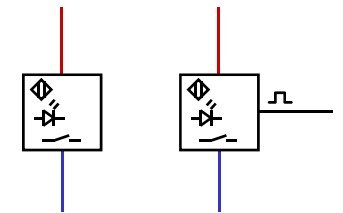
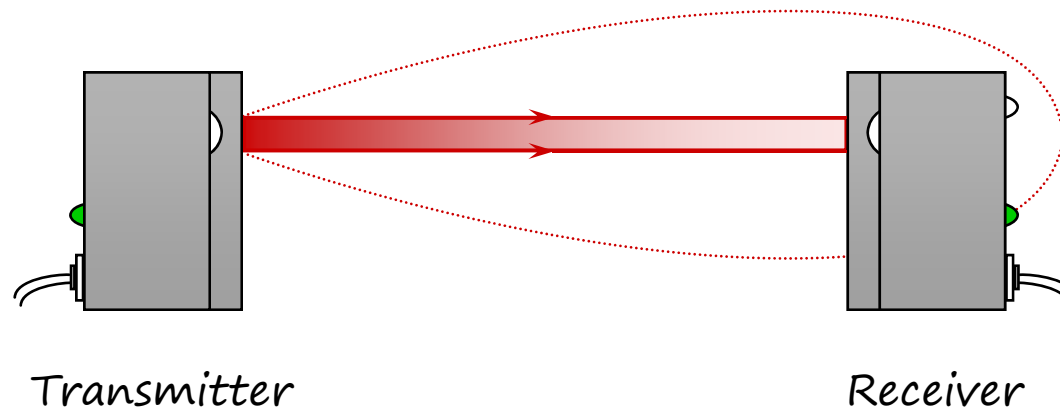
Transmitter



Receiver

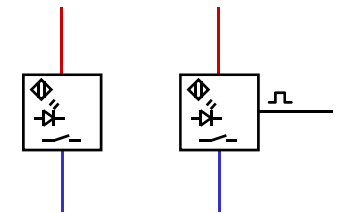
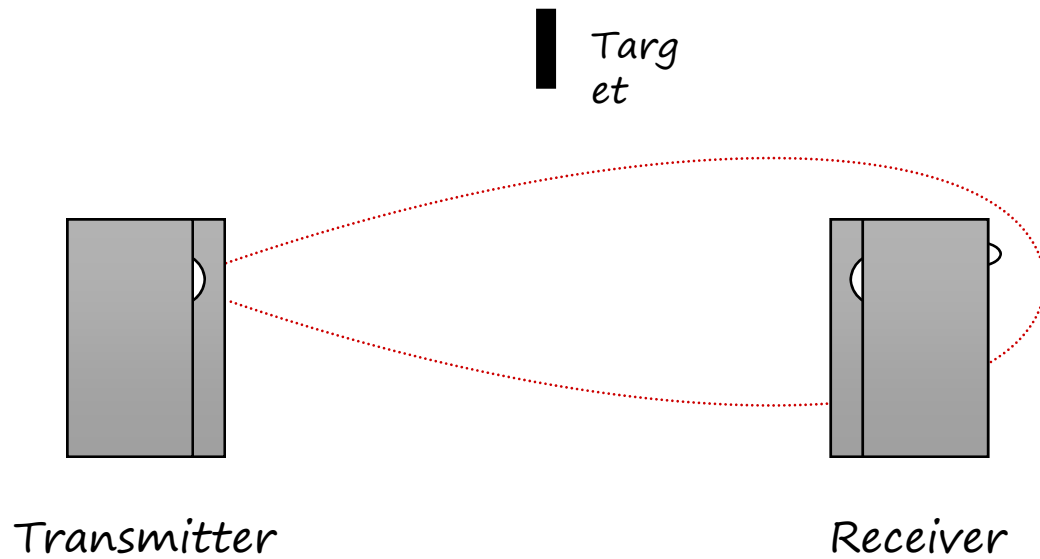
# Optical sensors (Through-beam)

Type : Through-beam



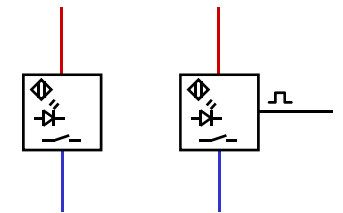
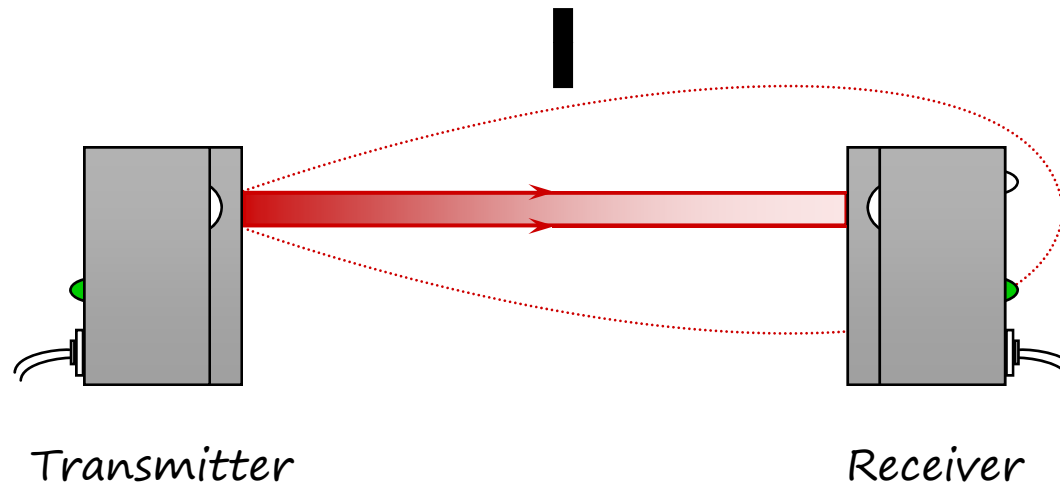
# Optical sensors (Through-beam)

Type : Through-beam



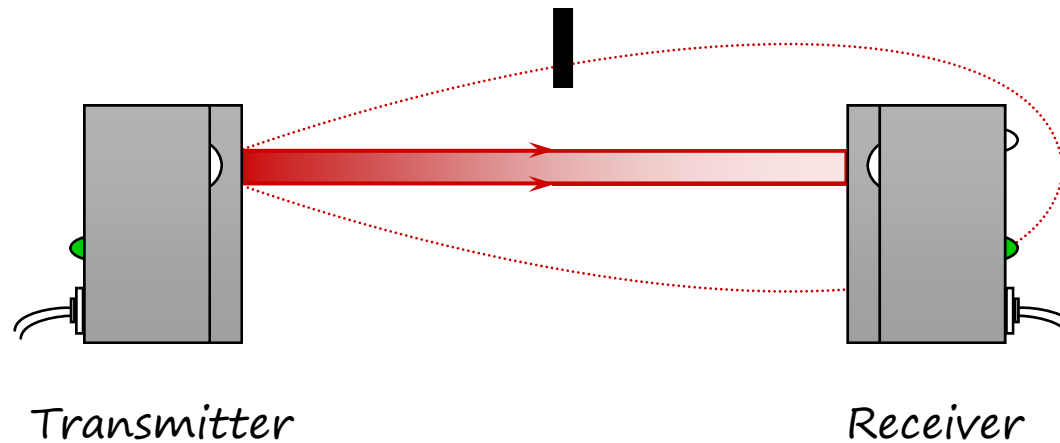
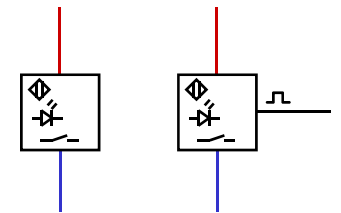
# Optical sensors (Through-beam)

Type : Through-beam



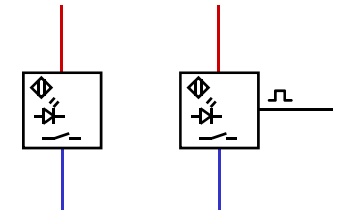
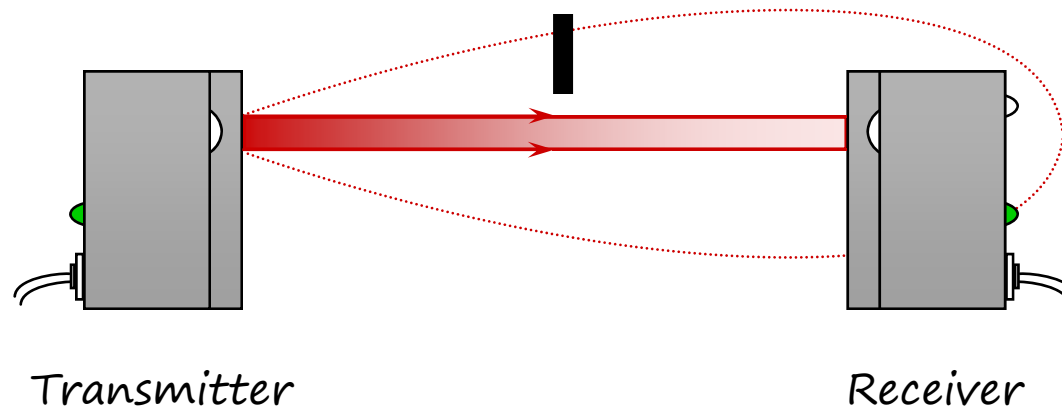
# Optical sensors (Through-beam)

Type : Through-beam



# Optical sensors (Through-beam)

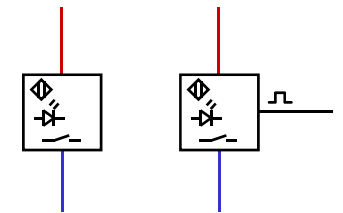
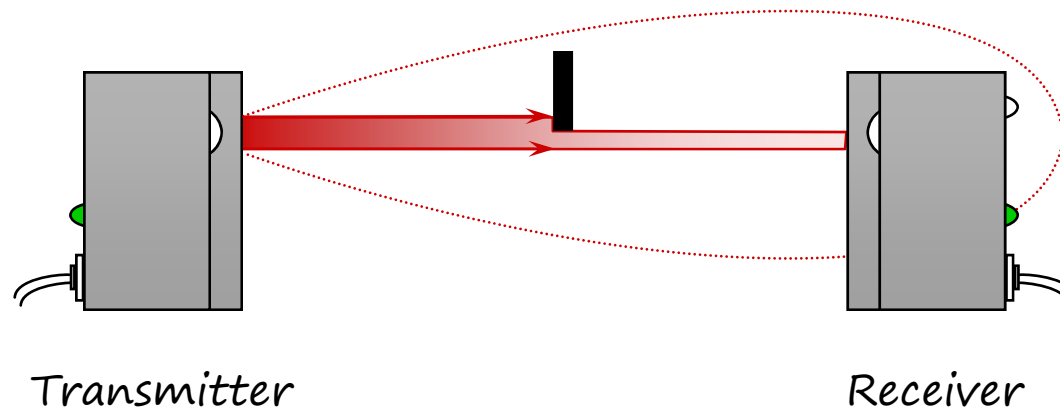
Type : Through-beam





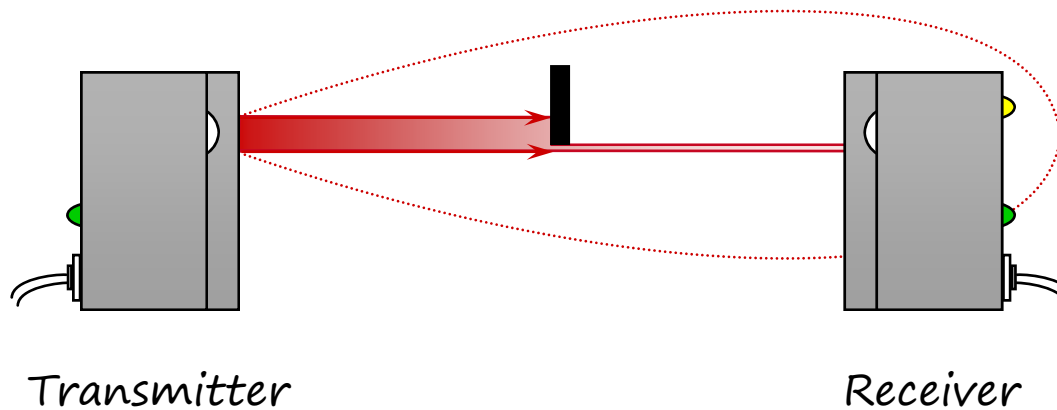
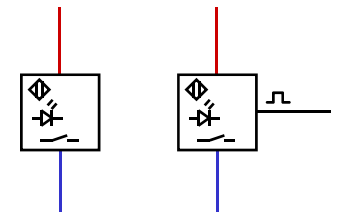
# Optical sensors (Through-beam)

Type : Through-beam



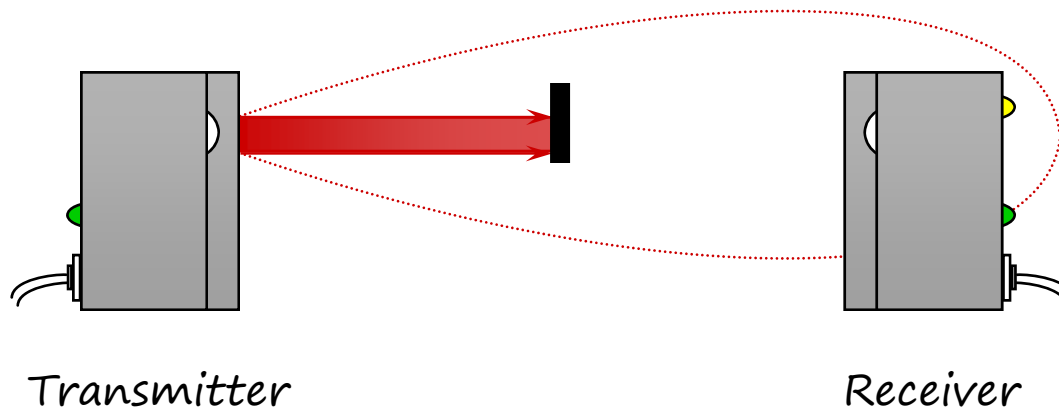
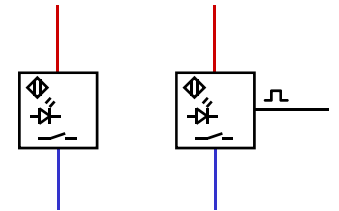
# Optical sensors (Through-beam)

Type : Through-beam



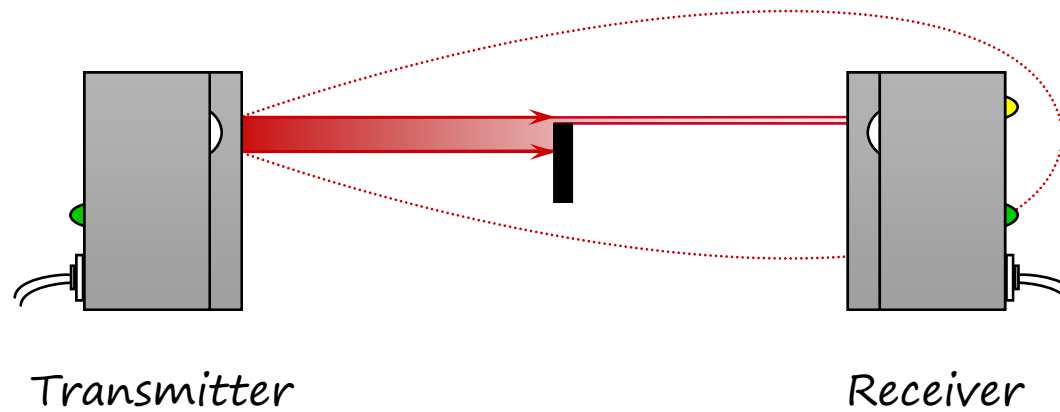
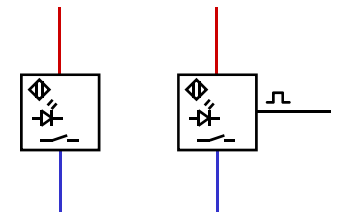
# Optical sensors (Through-beam)

Type : Through-beam



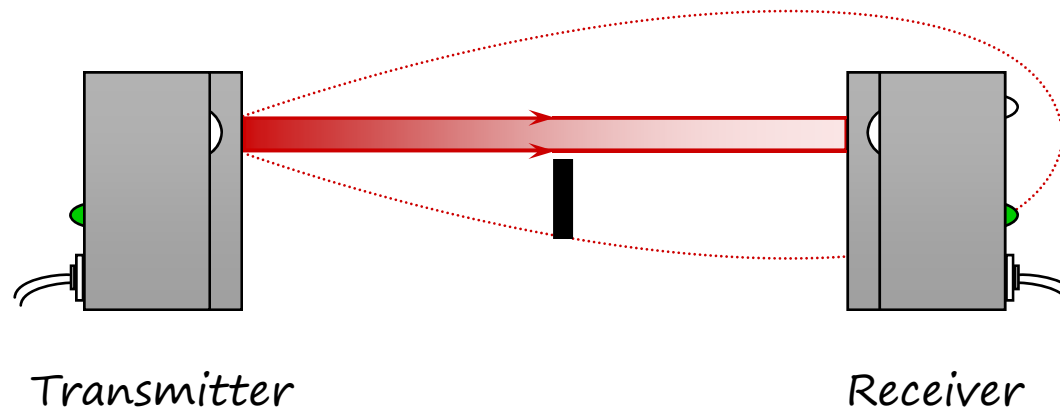
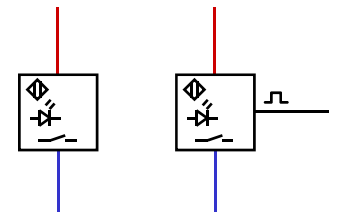
# Optical sensors (Through-beam)

Type : Through-beam



# Optical sensors (Through-beam)

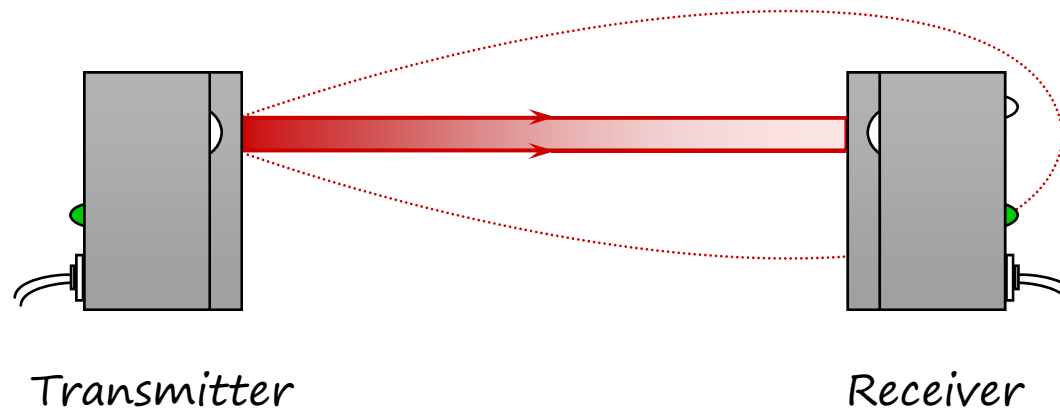
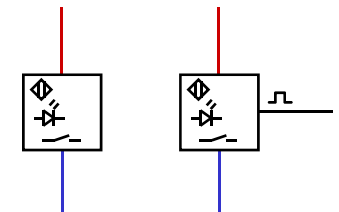
Type : Through-beam



# Optical sensors (Through-beam)

Type : Through-beam

█ Target



Long sensing distance: up to 30 metres with some devices

Will detect all but very transparent materials

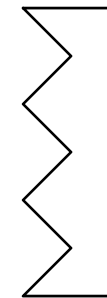
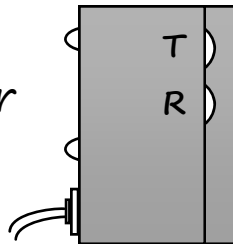
Must be accurately aligned

## Optical sensors (Retro-reflective)

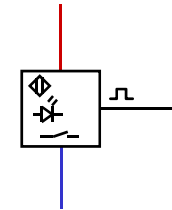
# Optical sensors (Retro-reflective)

Type : Retro reflective

Transmitter  
/Receiver



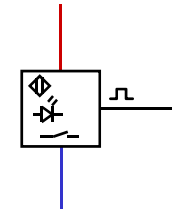
Reflector  
(prismatic  
)



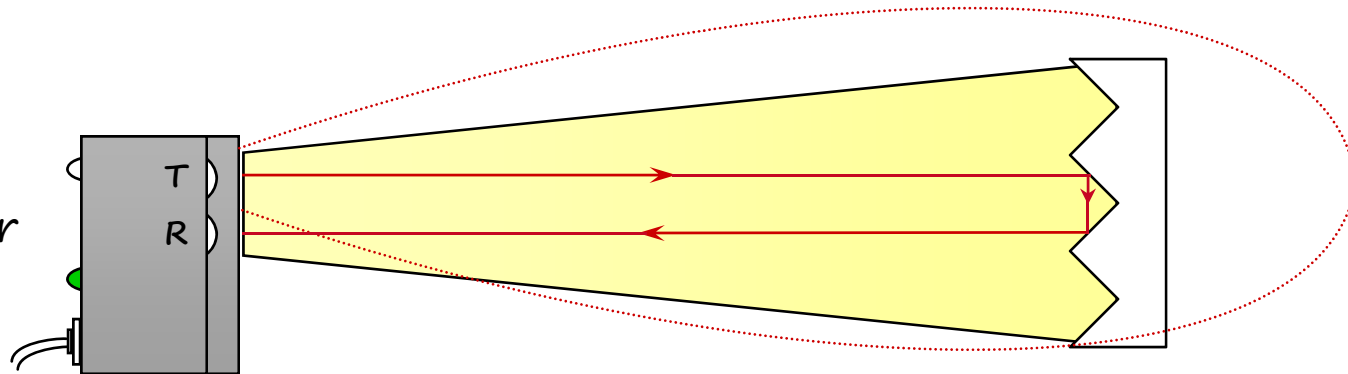


# Optical sensors (Retro-reflective)

Type : Retro reflective



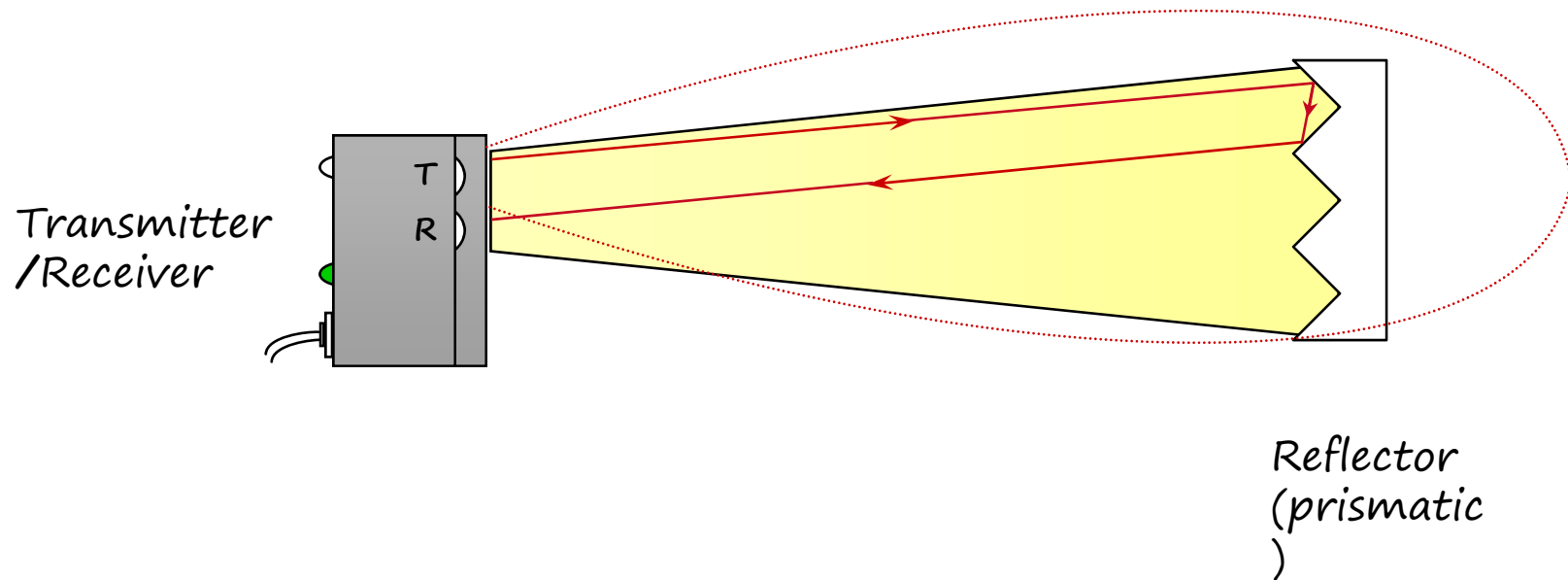
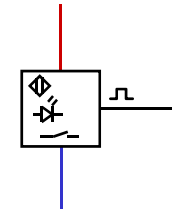
Transmitter  
/Receiver



Reflector  
(prismatic)

# Optical sensors (Retro-reflective)

Type : Retro reflective

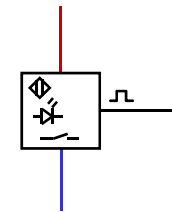


# Optical sensors (Retro-reflective)

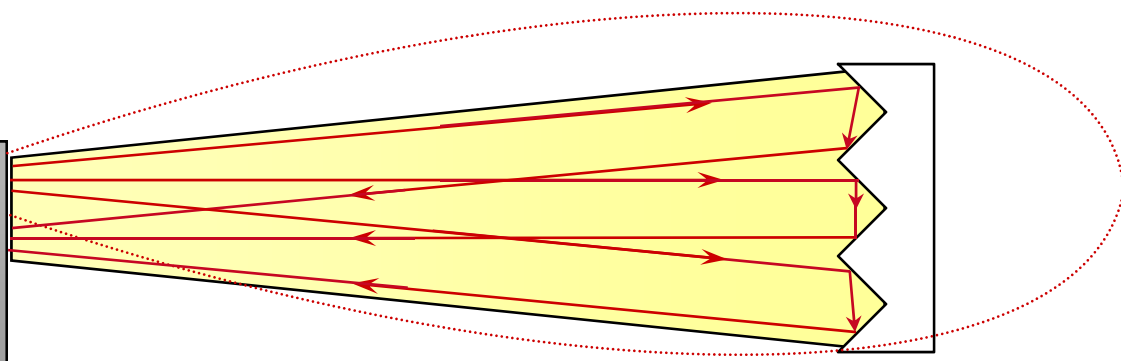
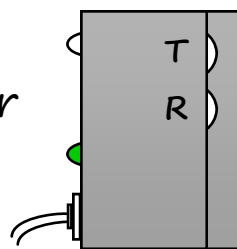
Type : Retro reflective



Target



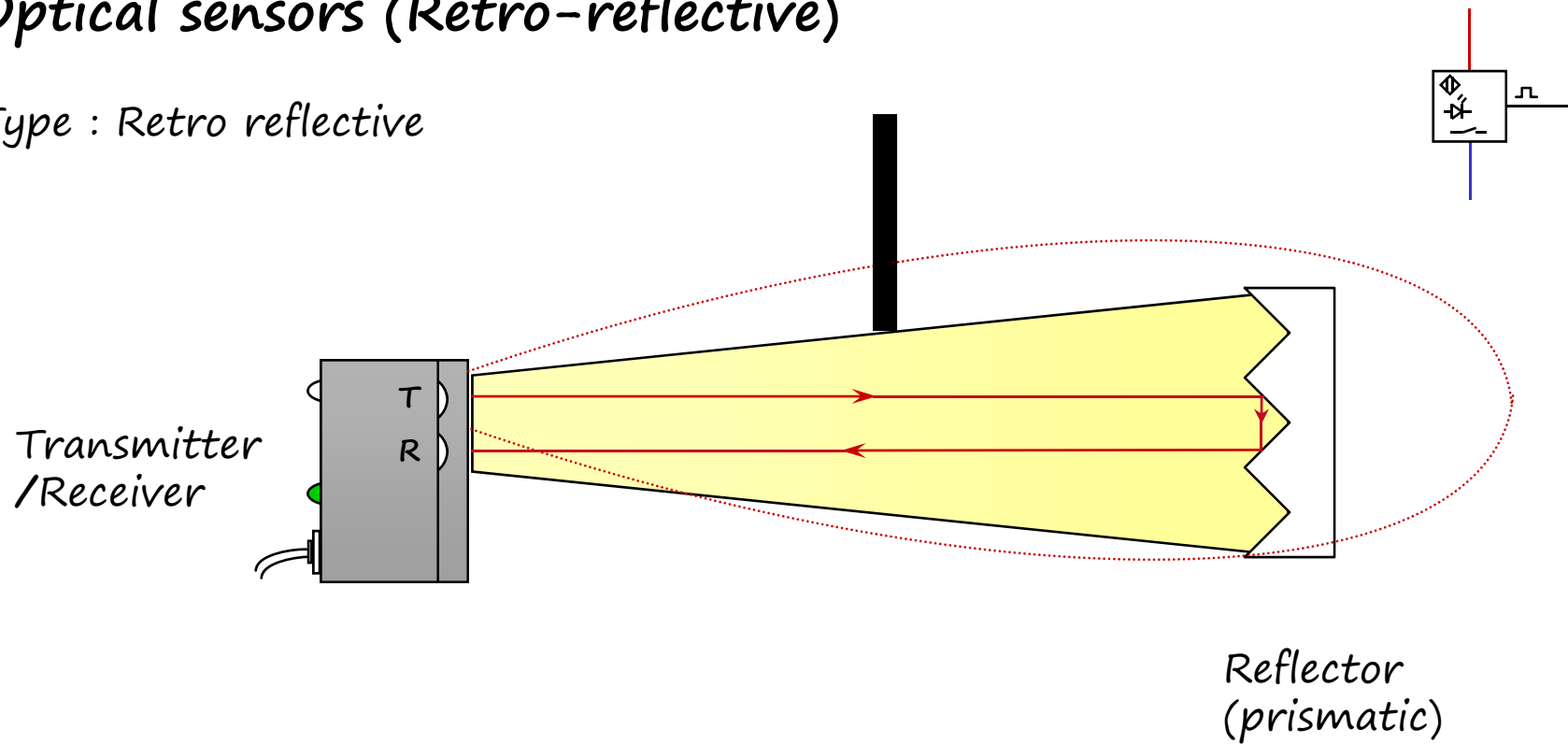
Transmitter  
/Receiver



Reflector  
(prismatic)

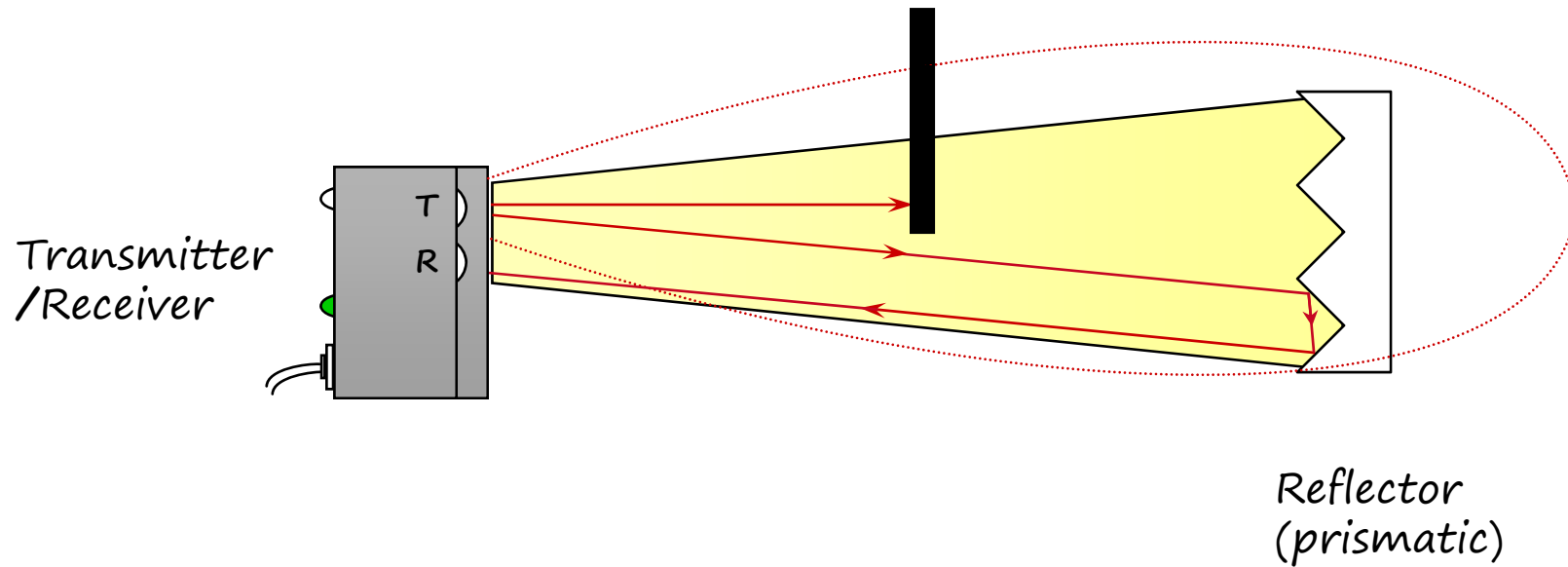
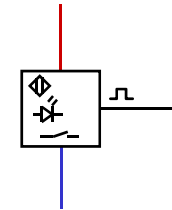
# Optical sensors (Retro-reflective)

Type : Retro reflective



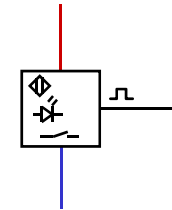
# Optical sensors (Retro-reflective)

Type : Retro reflective

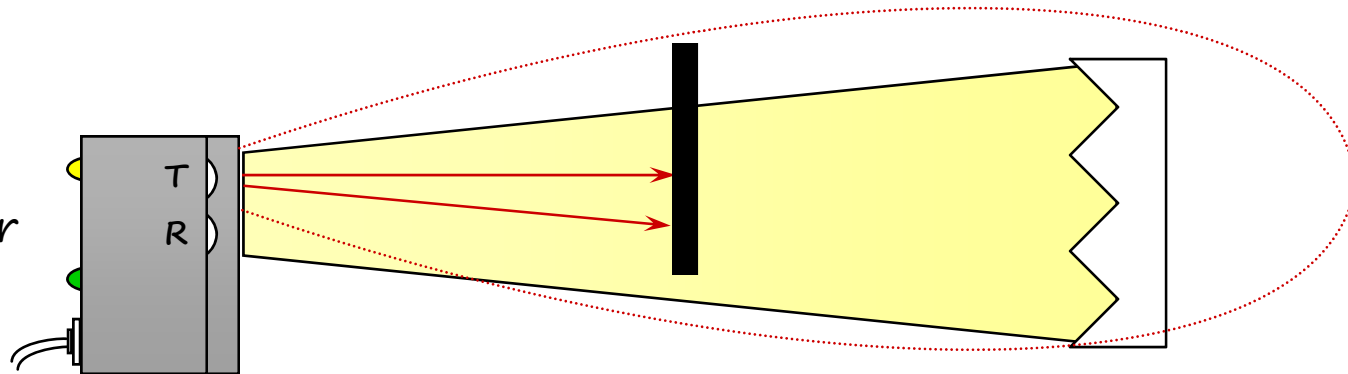


# Optical sensors (Retro-reflective)

Type : Retro reflective



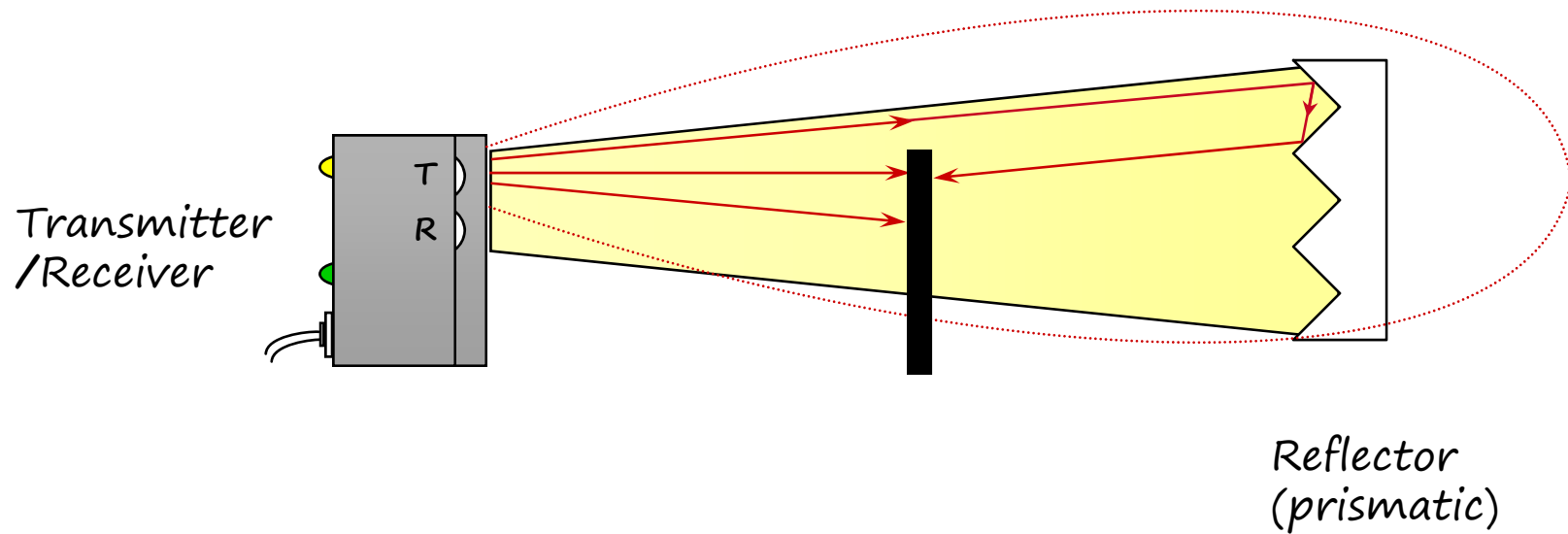
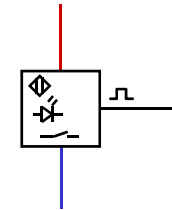
Transmitter  
/Receiver



Reflector  
(prismatic)

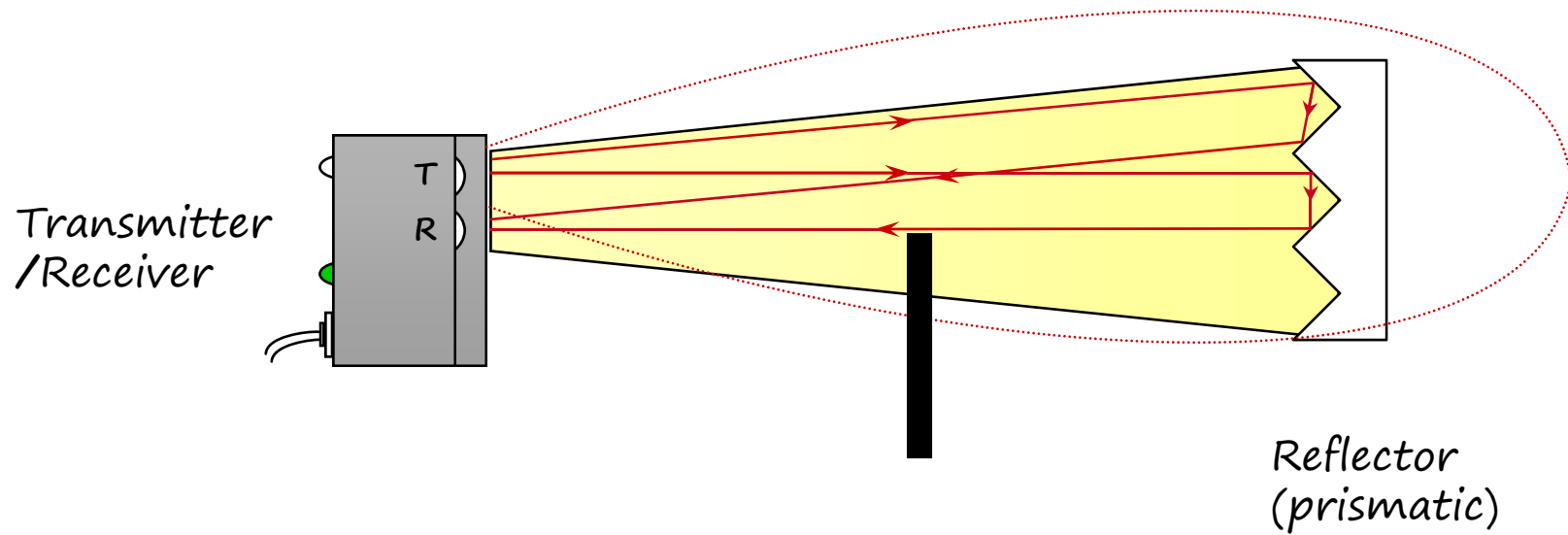
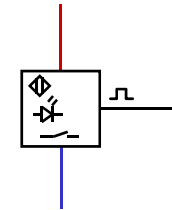
# Optical sensors (Retro-reflective)

Type : Retro reflective



# Optical sensors (Retro-reflective)

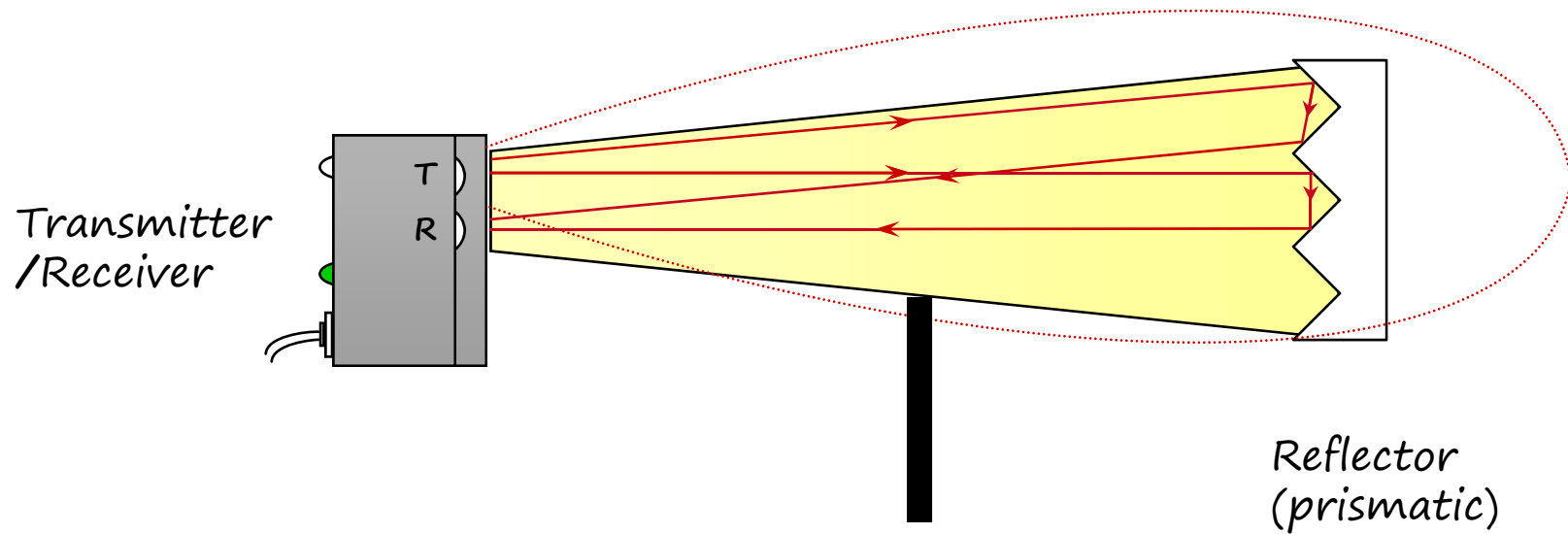
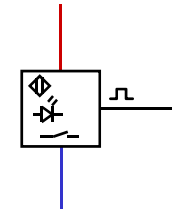
Type : Retro reflective





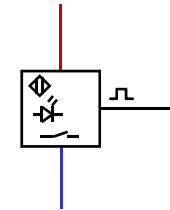
# Optical sensors (Retro-reflective)

Type : Retro reflective

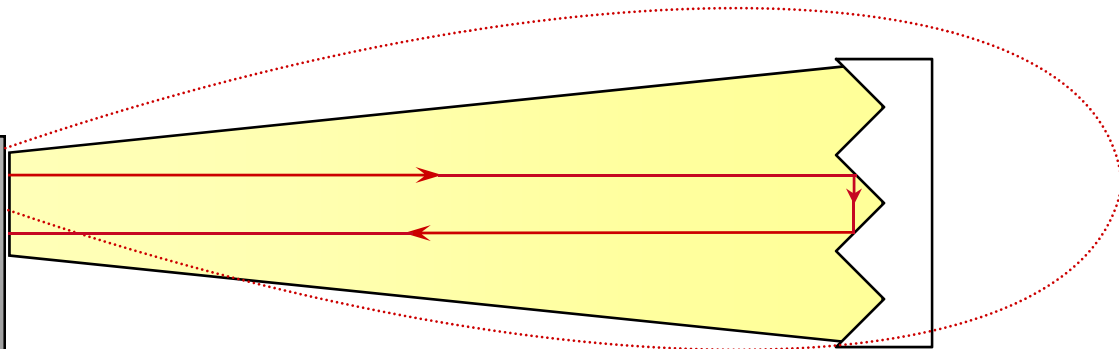
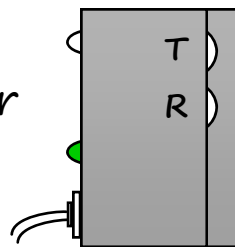


# Optical sensors (Retro-reflective)

Type : Retro reflective



Transmitter  
/Receiver



Reflector  
(prismatic)

Sensing distance : 1/2 to 1/3 of through-beam type

Not suitable for reflective or transparent targets

Target should be larger than the reflector

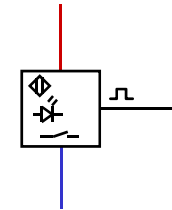
## Optical sensors (Diffuse)

Type : Diffuse

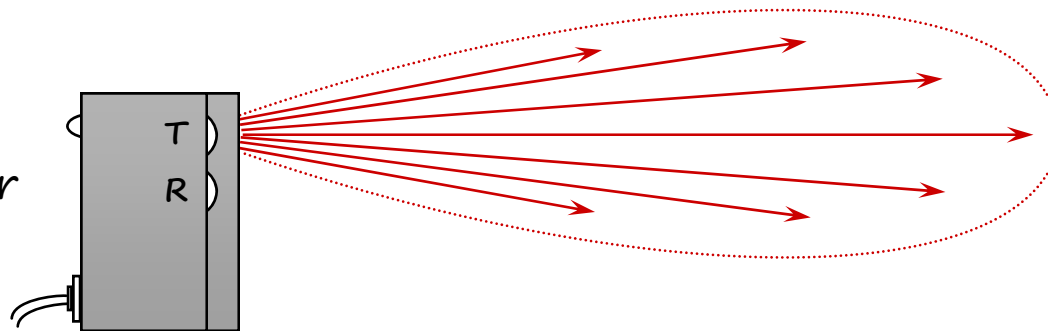
# Optical sensors (Diffuse)

Type : Diffuse

Target



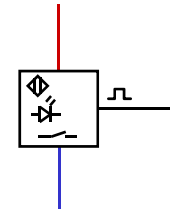
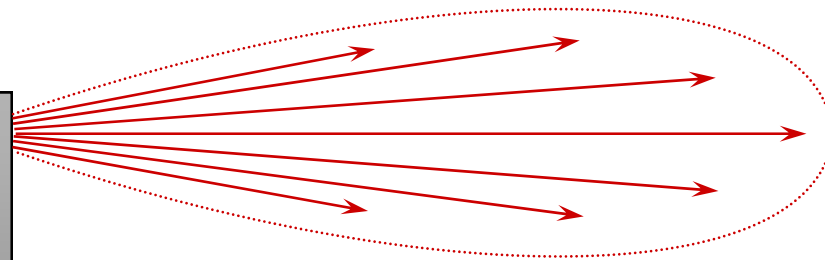
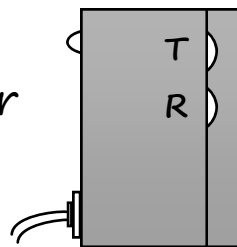
Transmitter  
/Receiver



# Optical sensors (Diffuse)

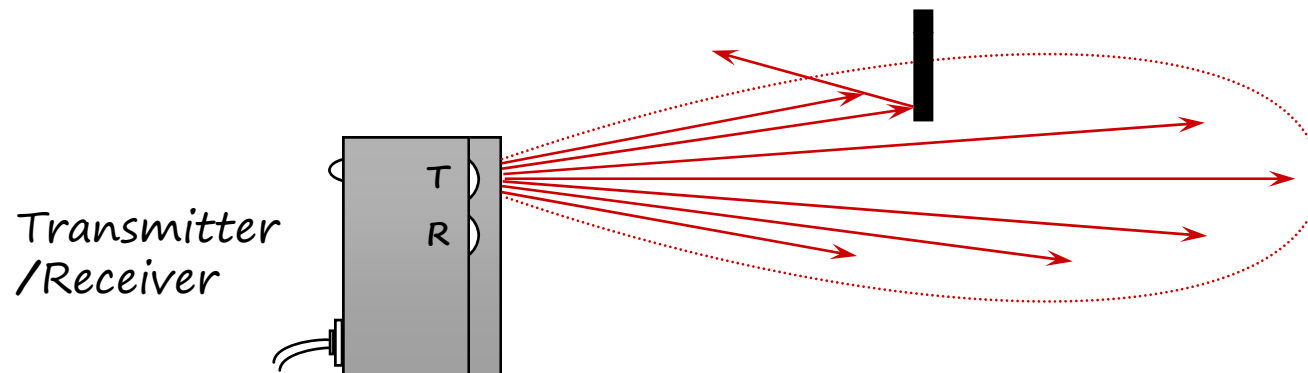
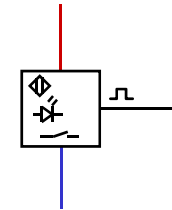
Type : Diffuse

Transmitter  
/Receiver



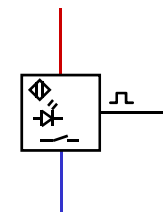
# Optical sensors (Diffuse)

Type : Diffuse

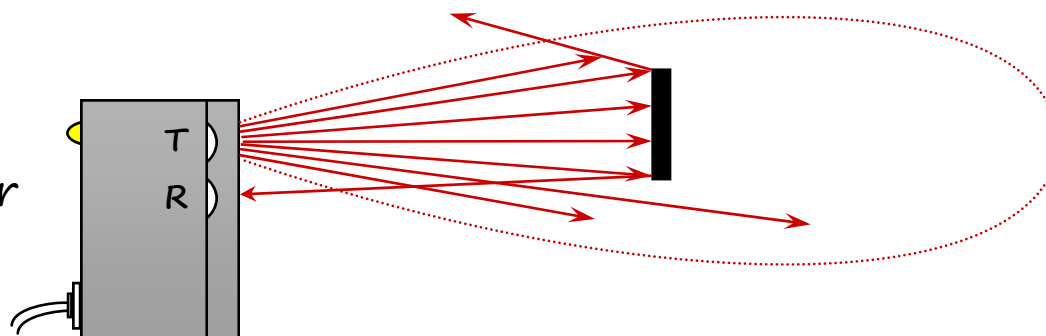


# Optical sensors (Diffuse)

Type : Diffuse

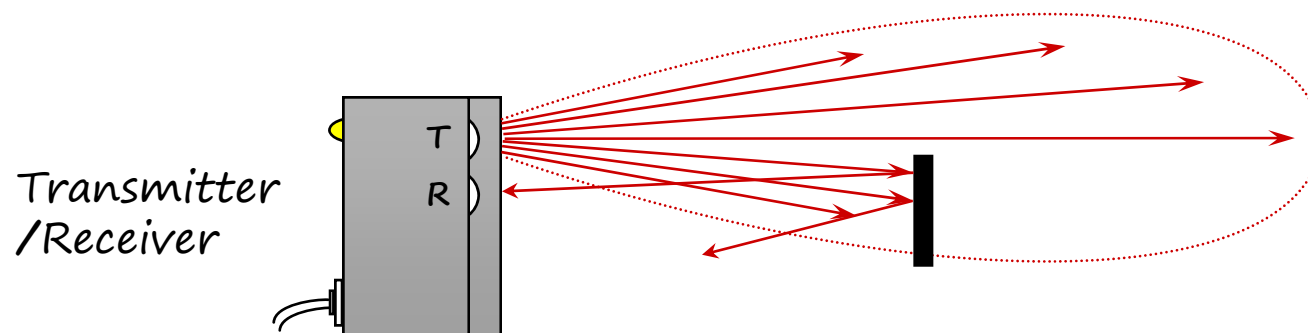
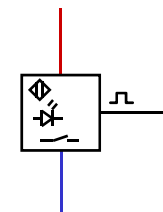


Transmitter  
/Receiver



# Optical sensors (Diffuse)

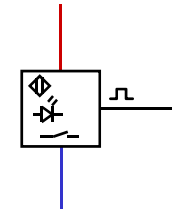
Type : Diffuse



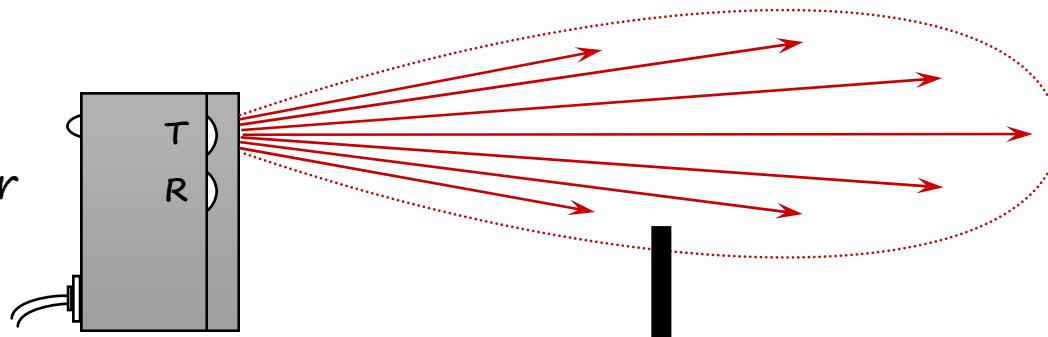


# Optical sensors (Diffuse)

Type : Diffuse



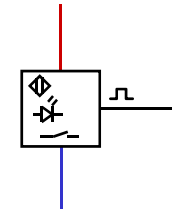
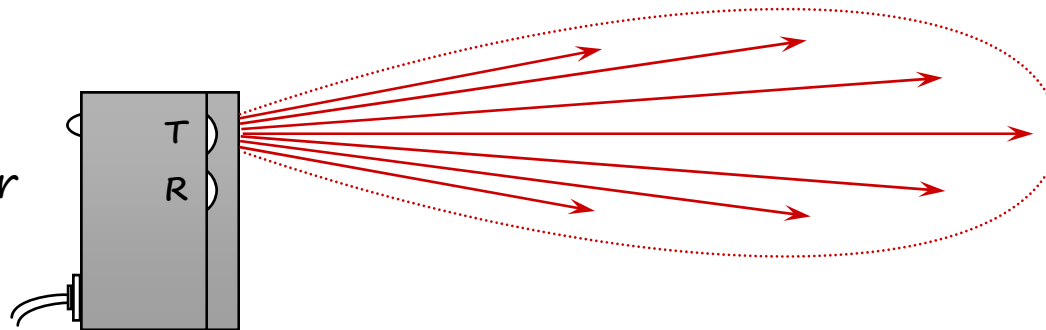
Transmitter  
/Receiver



# Optical sensors (Diffuse)

Type : Diffuse

Transmitter  
/Receiver



Sensing distance: much less than reflex type, actual distance depends on colour and reflective nature of the surface

Larger targets result in longer sensing distances

Not suitable for dirty environments

# Inductive sensors

# Inductive sensors

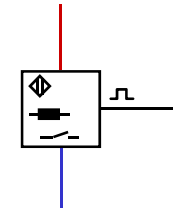
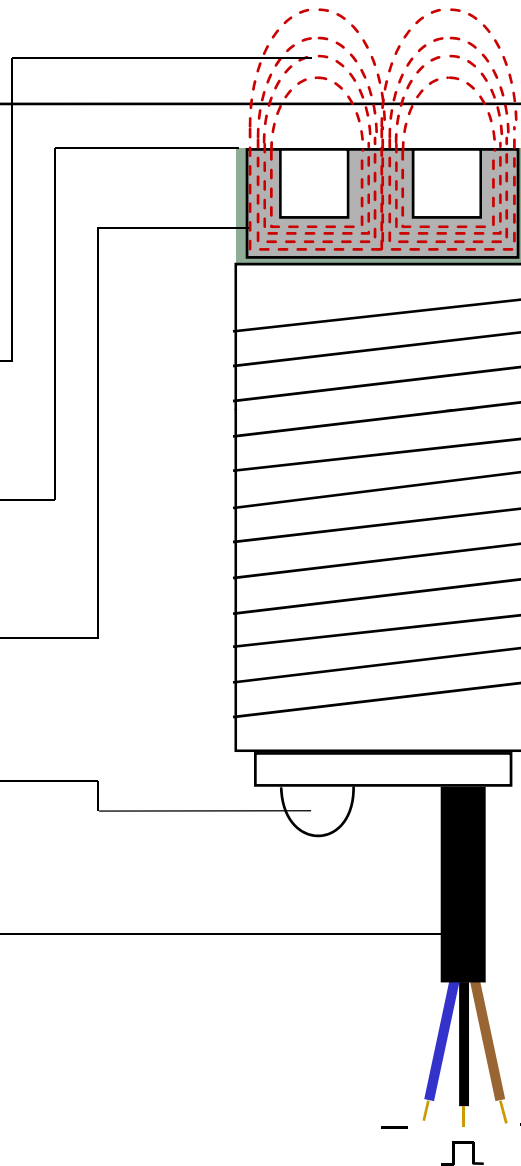
High frequency magnetic field (300 to 800 kHz)

Active surface

Resonant circuit coil

LED indicator

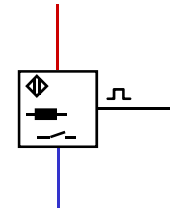
Connection cable



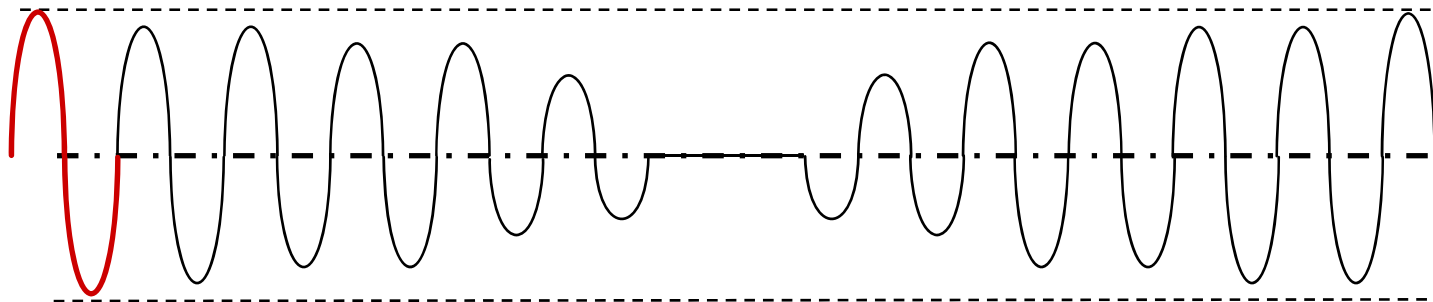
Targ  
et

# Inductive sensors

Sensor

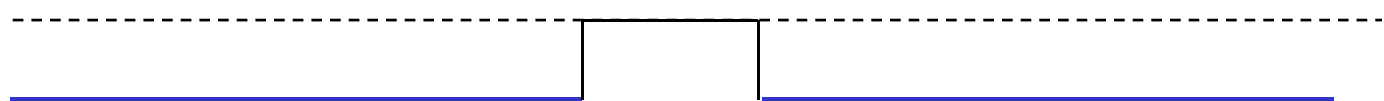


Oscillation  
Amplitude



Sensor  
output  
signal

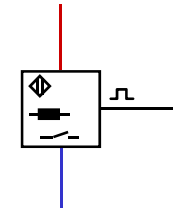
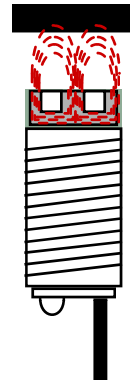
ON  
OFF



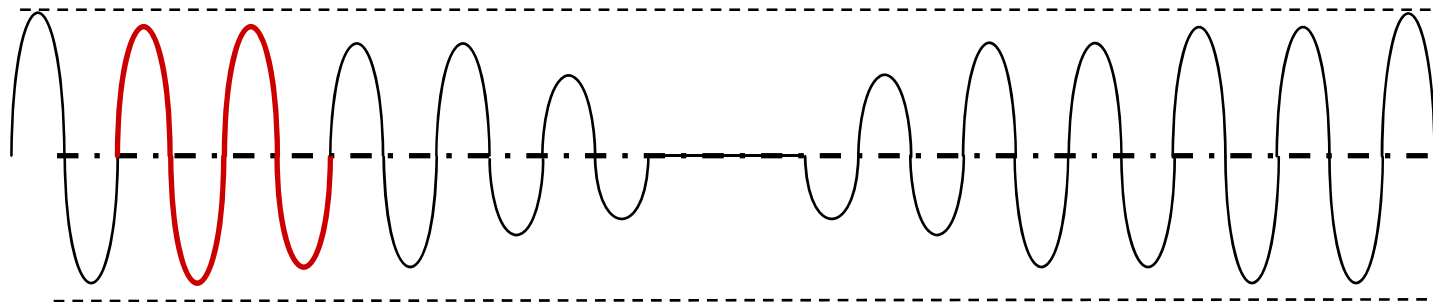
Target

# Inductive sensors

Sensor

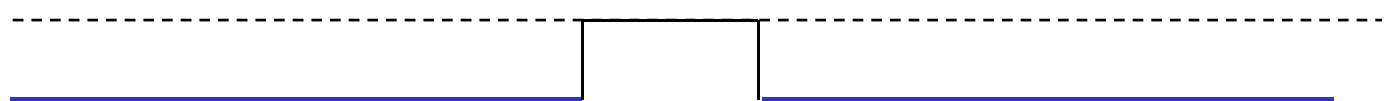


Oscillation Amplitude



Sensor output signal

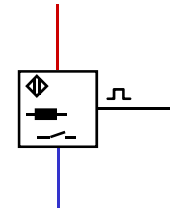
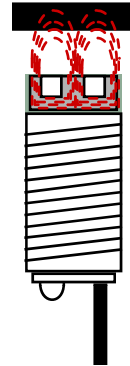
ON  
OFF



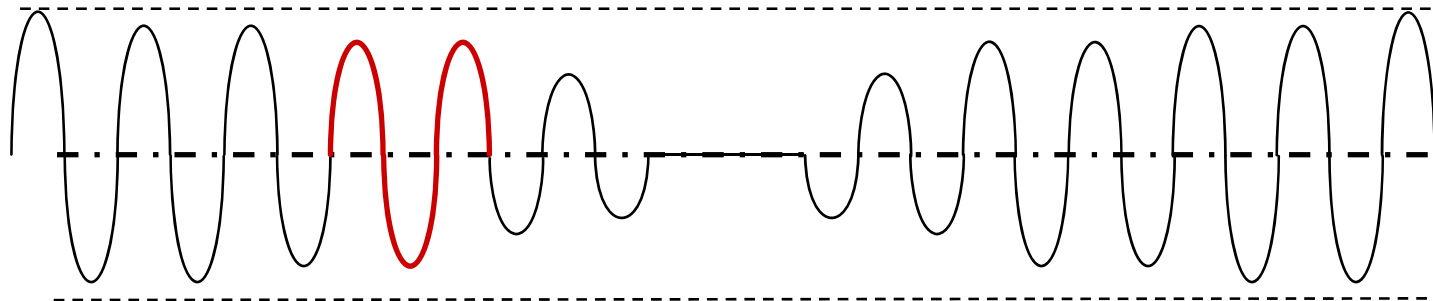
Target

# Inductive sensors

Sensor



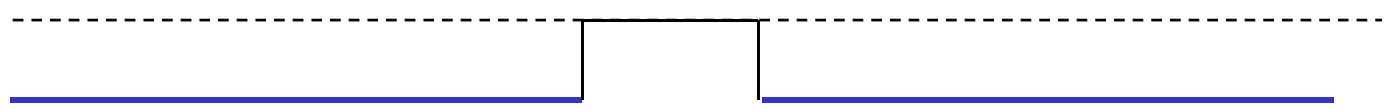
Oscillation Amplitude



Sensor output signal

ON

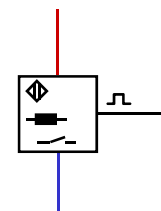
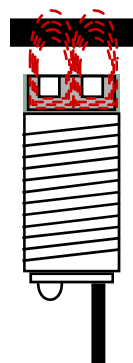
OFF



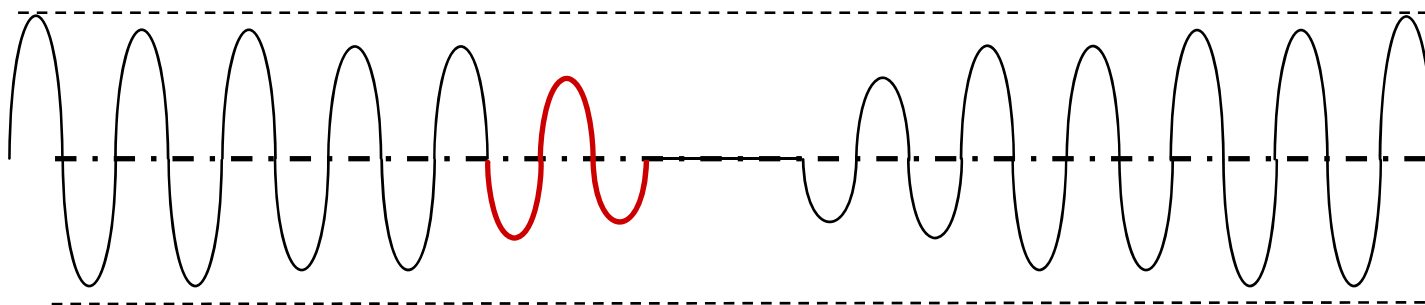
Target

# Inductive sensors

Sensor



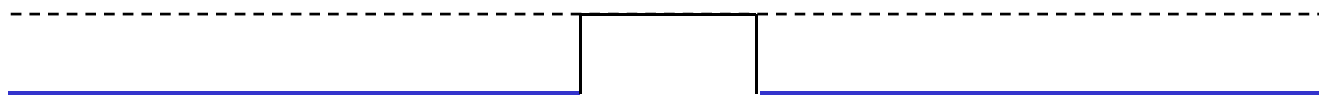
Oscillation Amplitude



Sensor output signal

ON

OFF

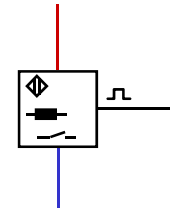
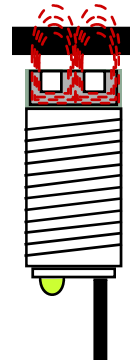




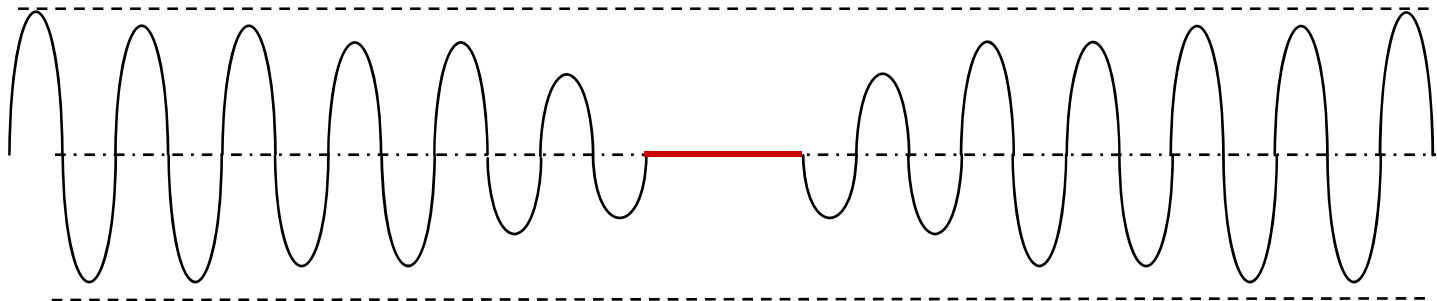
Target

# Inductive sensors

Sensor



Oscillation Amplitude



Sensor output signal

ON

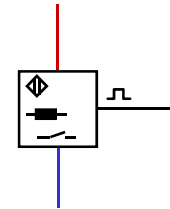
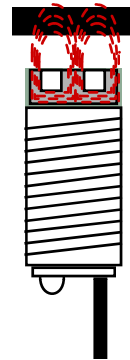
OFF



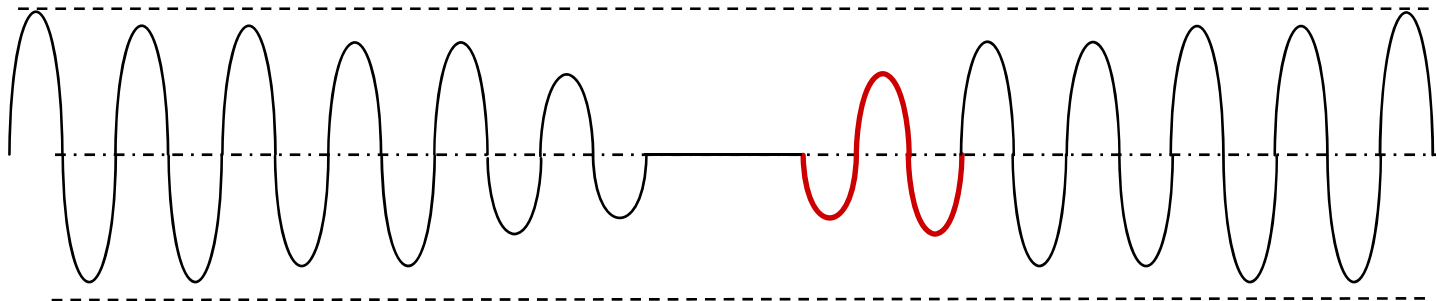
Target

# Inductive sensors

Sensor



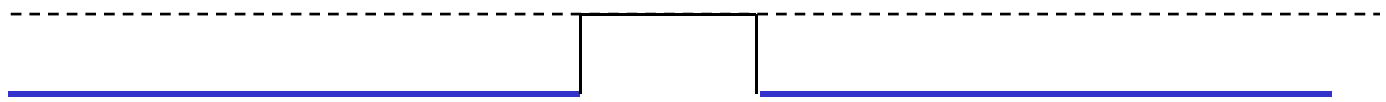
Oscillation Amplitude



Sensor output signal

ON

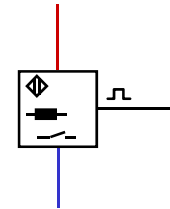
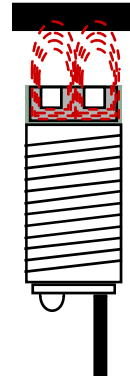
OFF



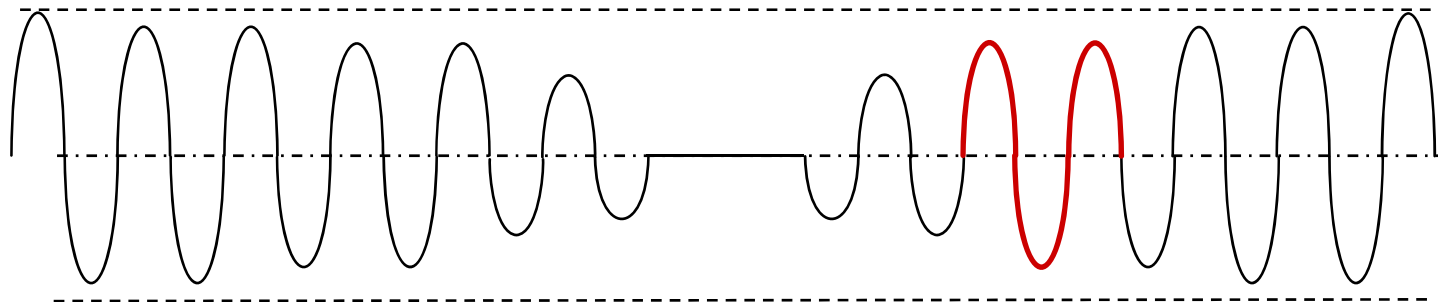
Target

# Inductive sensors

Sensor

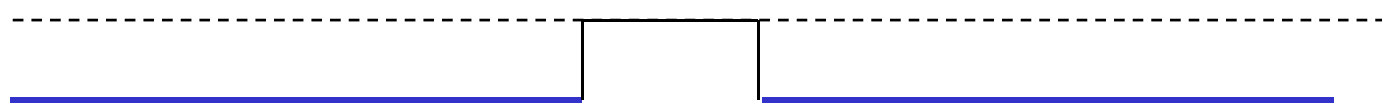


Oscillation Amplitude



Sensor output signal

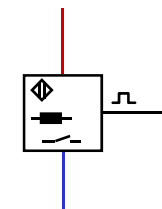
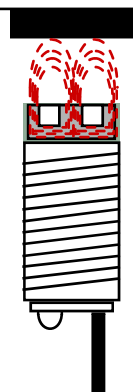
ON  
OFF



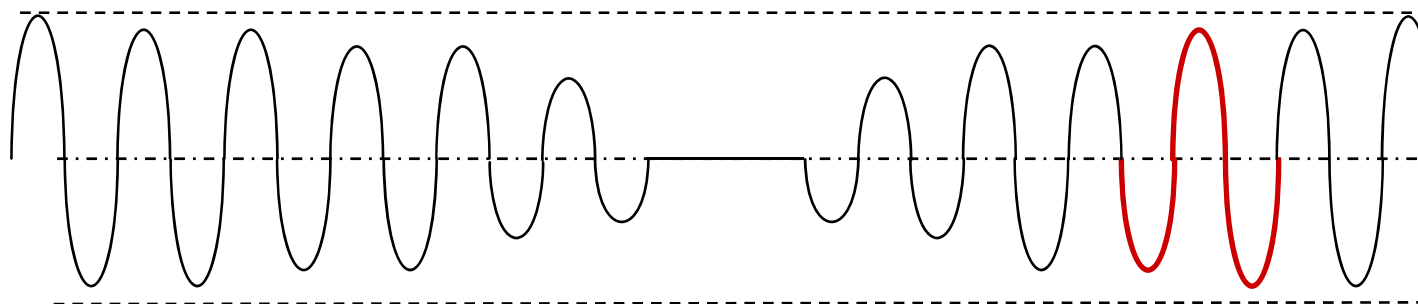
Target

# Inductive sensors

Sensor

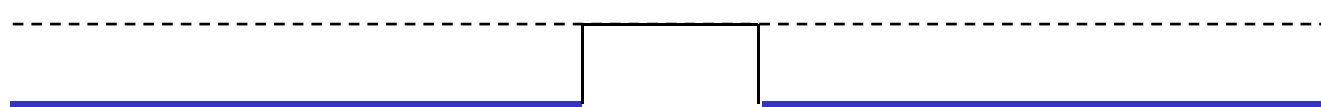


Oscillation Amplitude



Sensor output signal

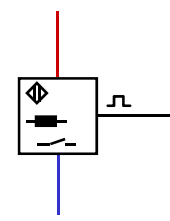
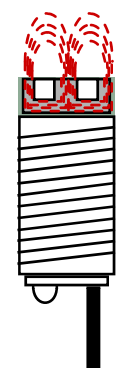
ON  
OFF



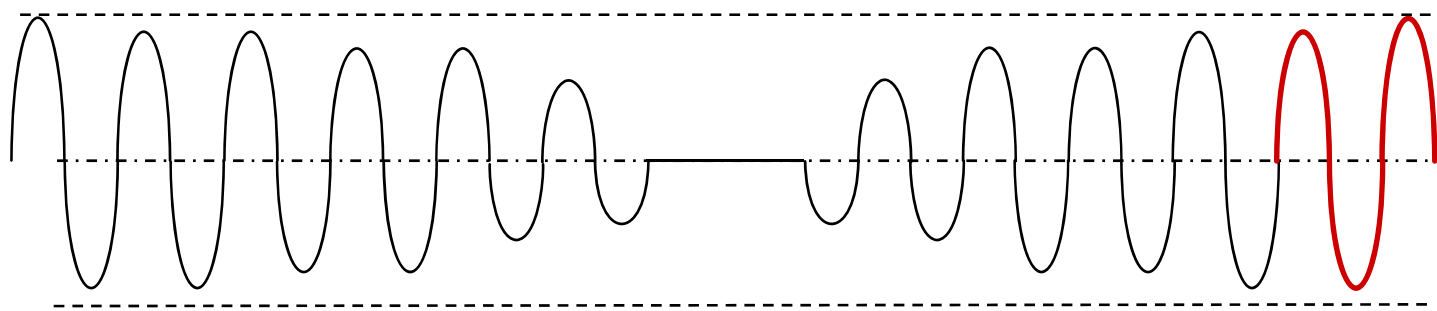
Target

# Inductive sensors

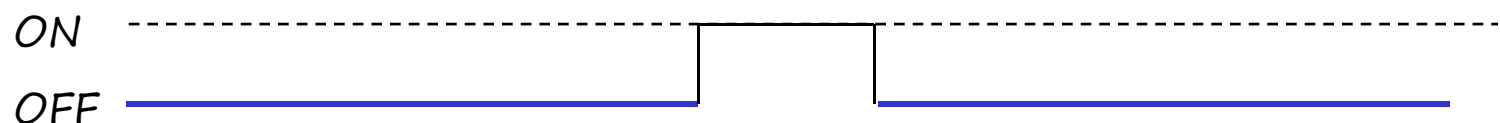
Sensor



Oscillation Amplitude



Sensor output signal



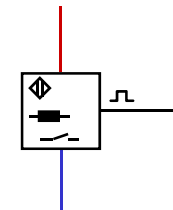
## Inductive sensors

Will detect any conductive material

Quoted distances are for mild steel

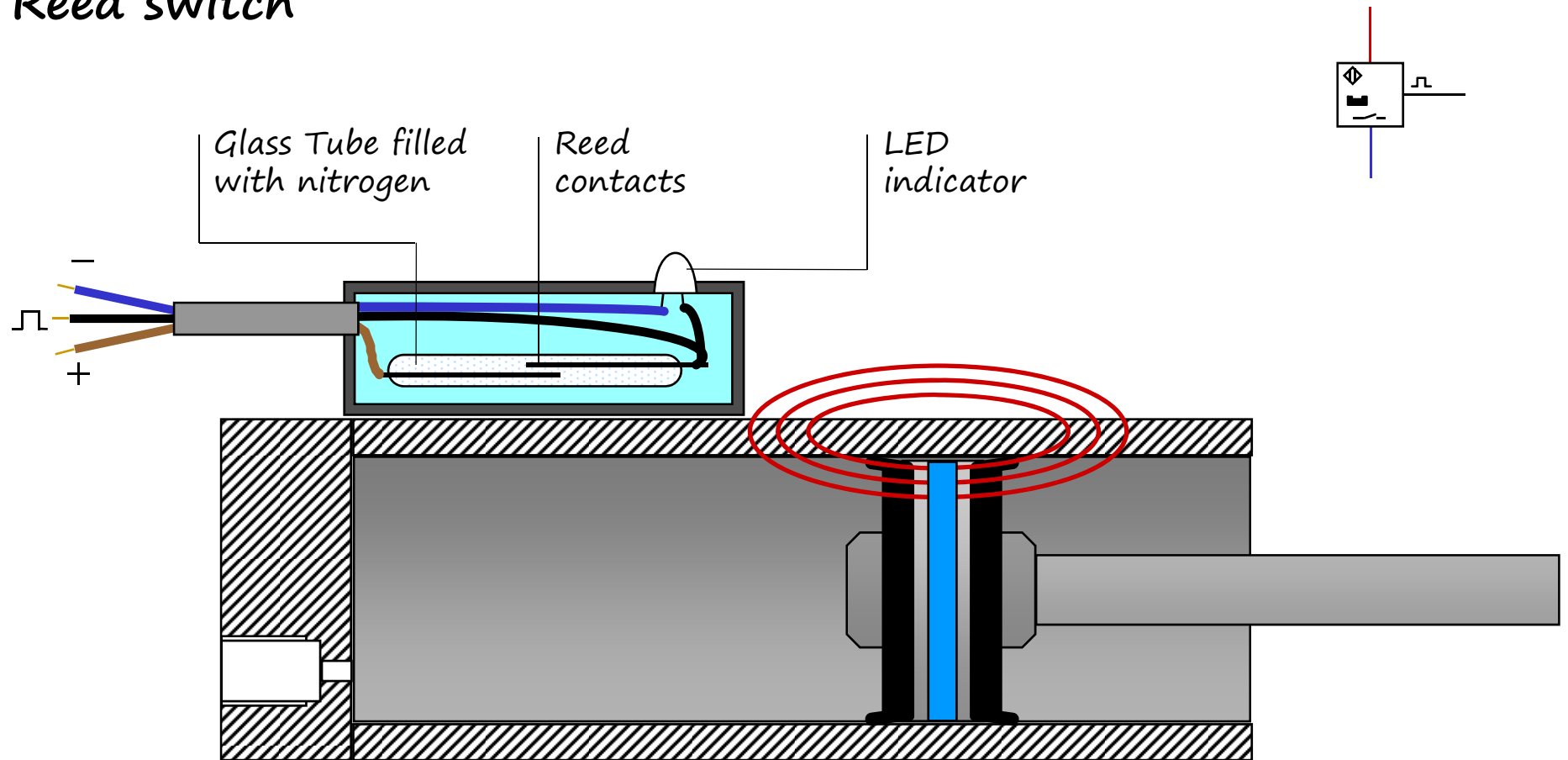
Sensor performance can be affected by:

- Temperature
- Target material
- Target dimensions



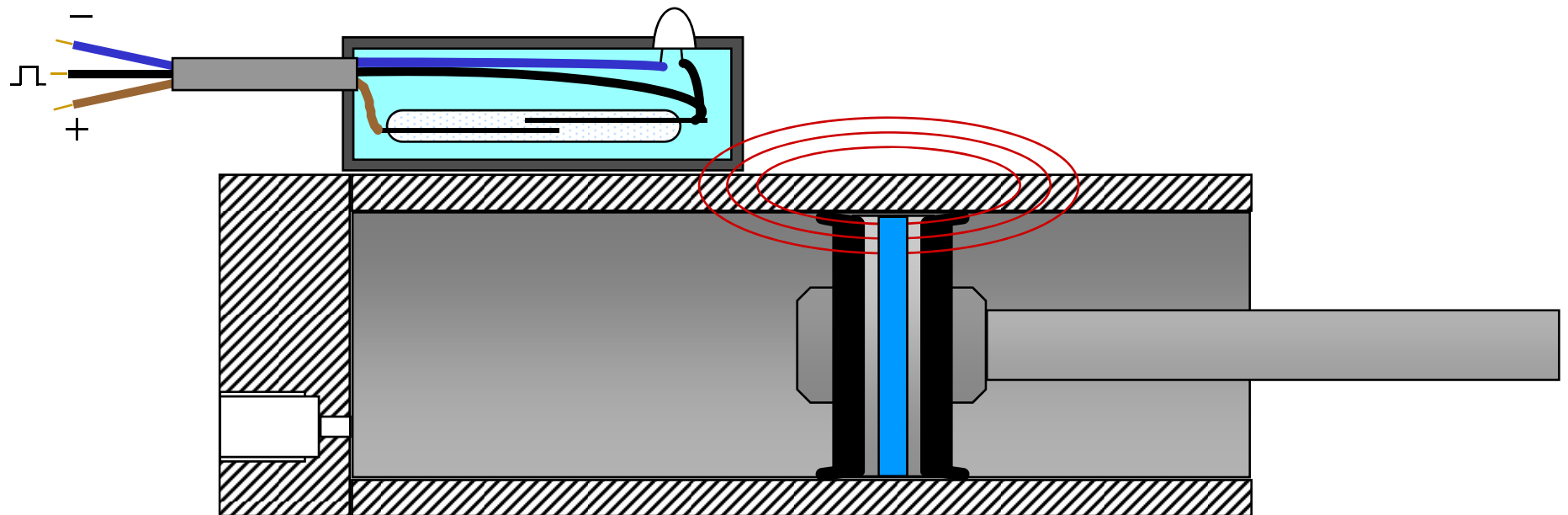
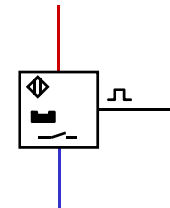
# Reed switch

# Reed switch

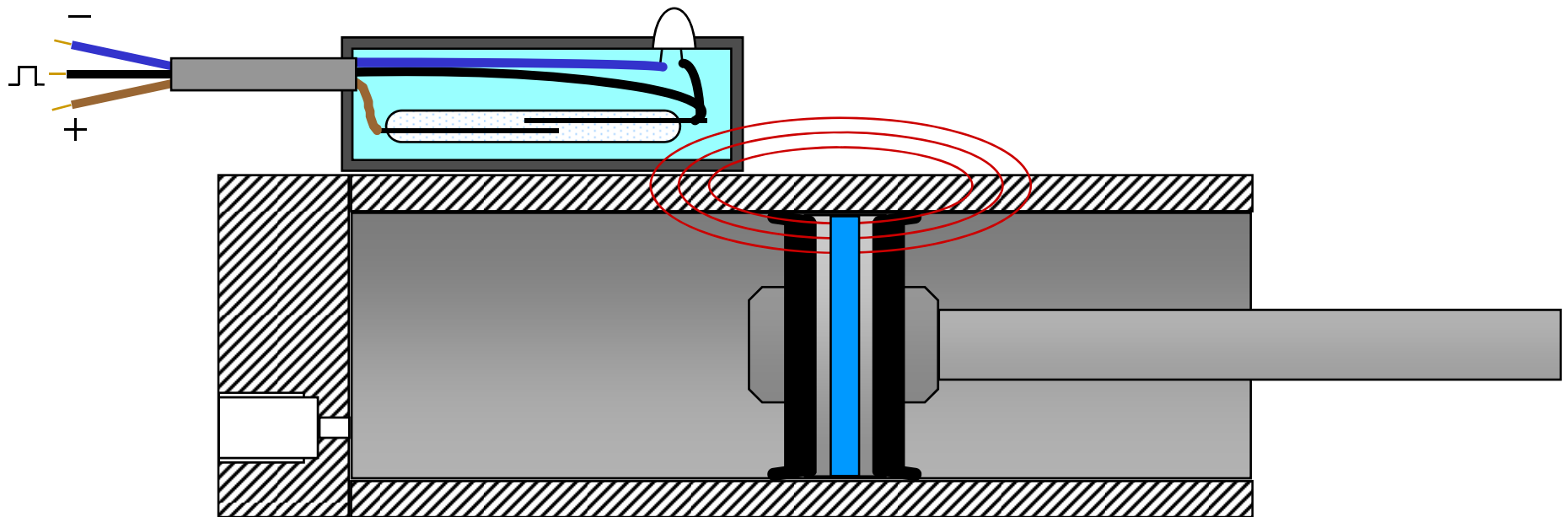
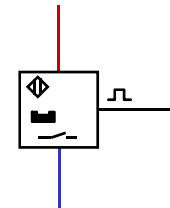




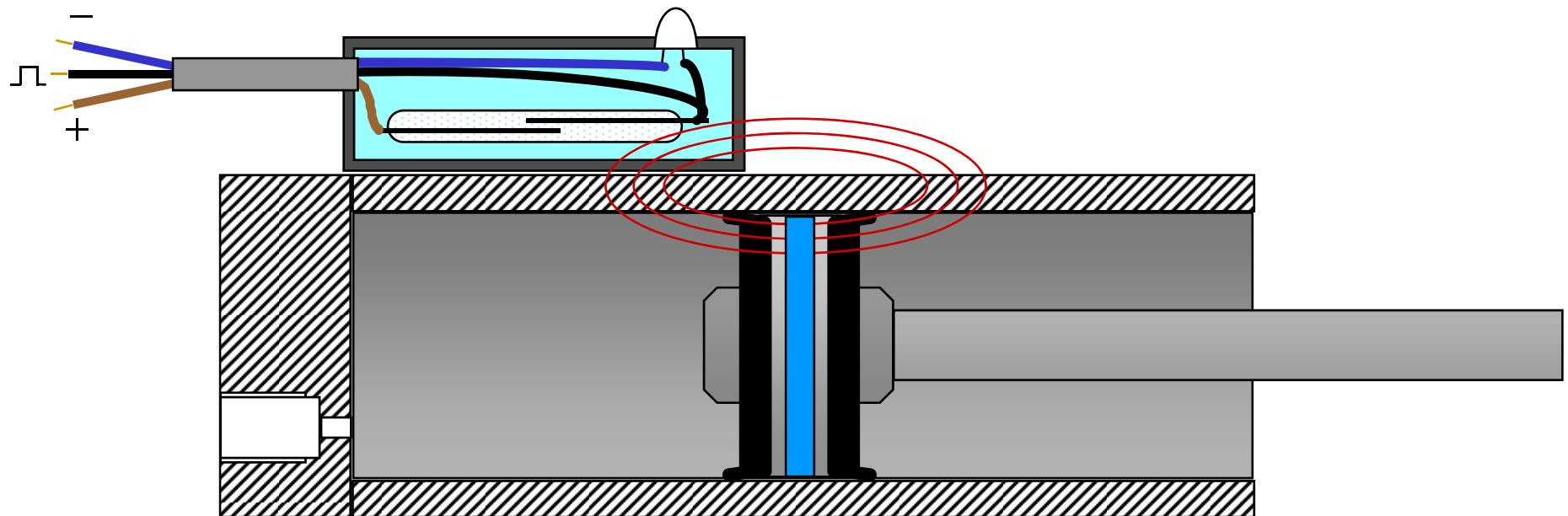
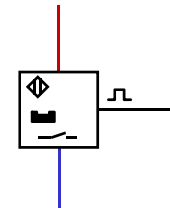
# Reed switch



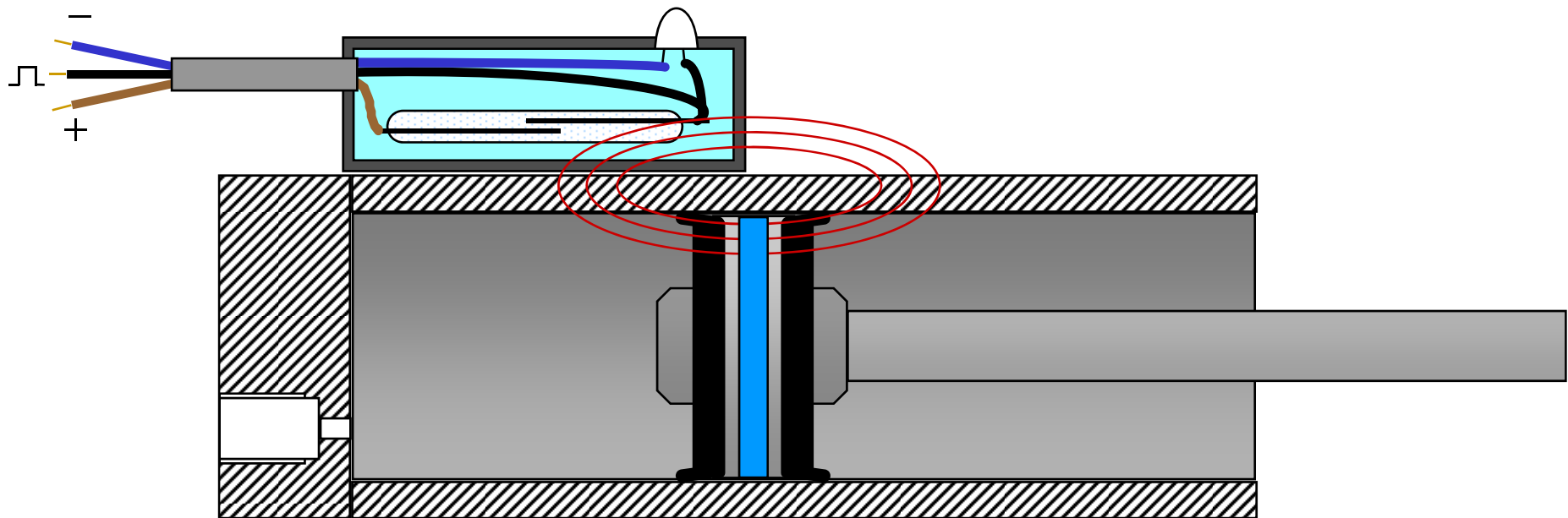
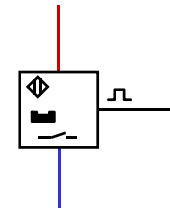
# Reed switch



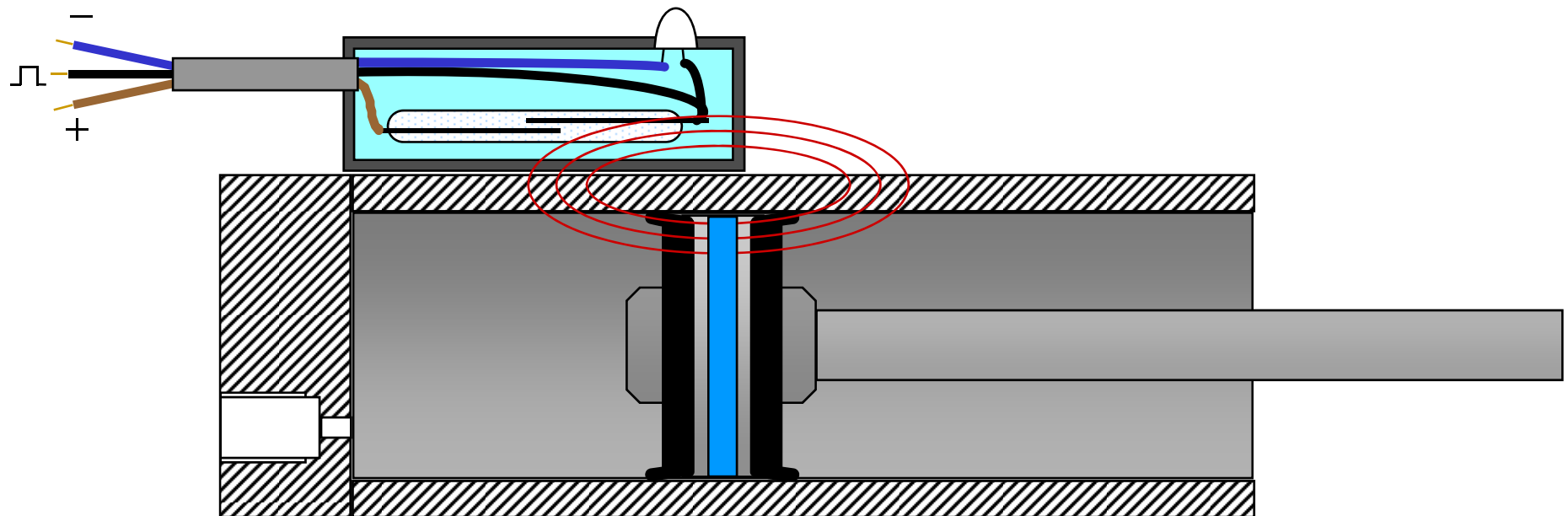
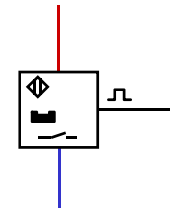
# Reed switch



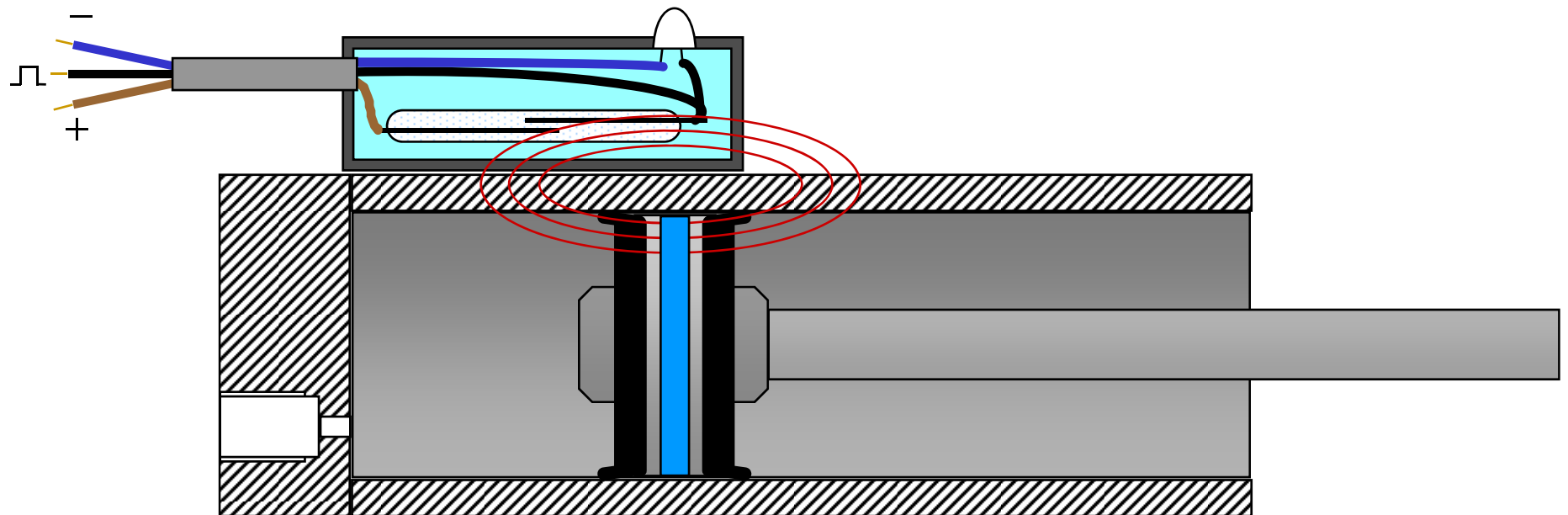
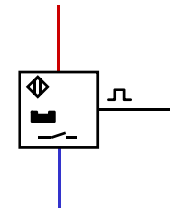
# Reed switch



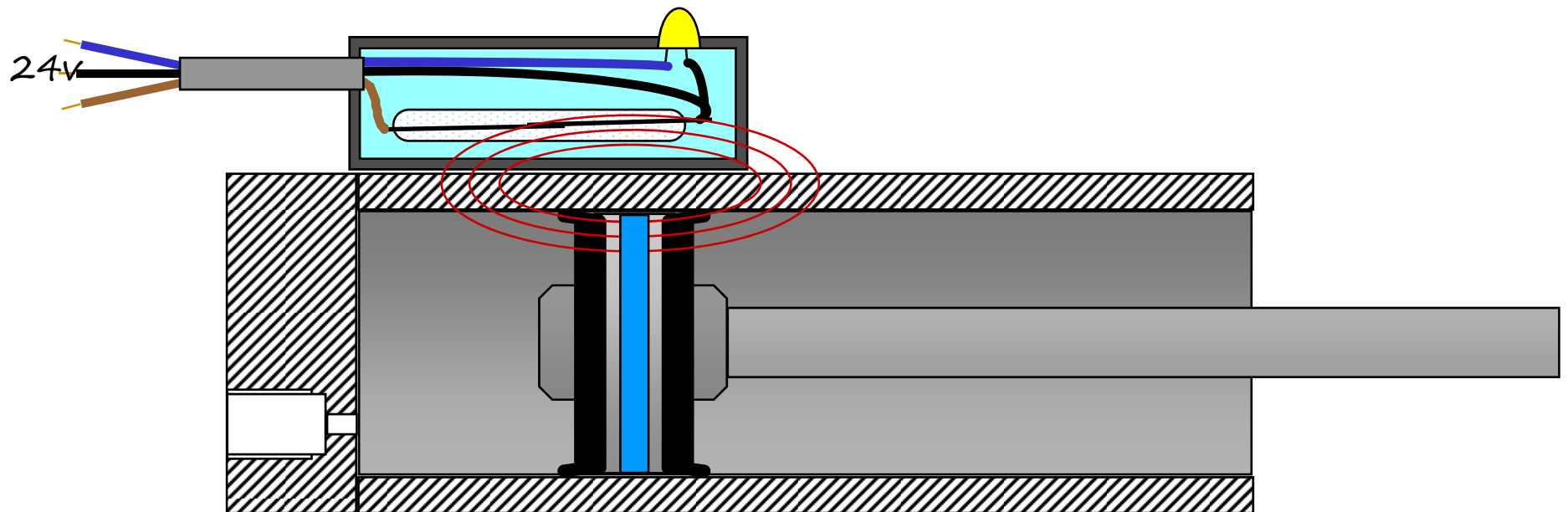
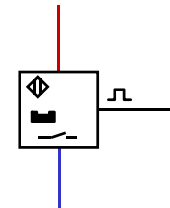
# Reed switch



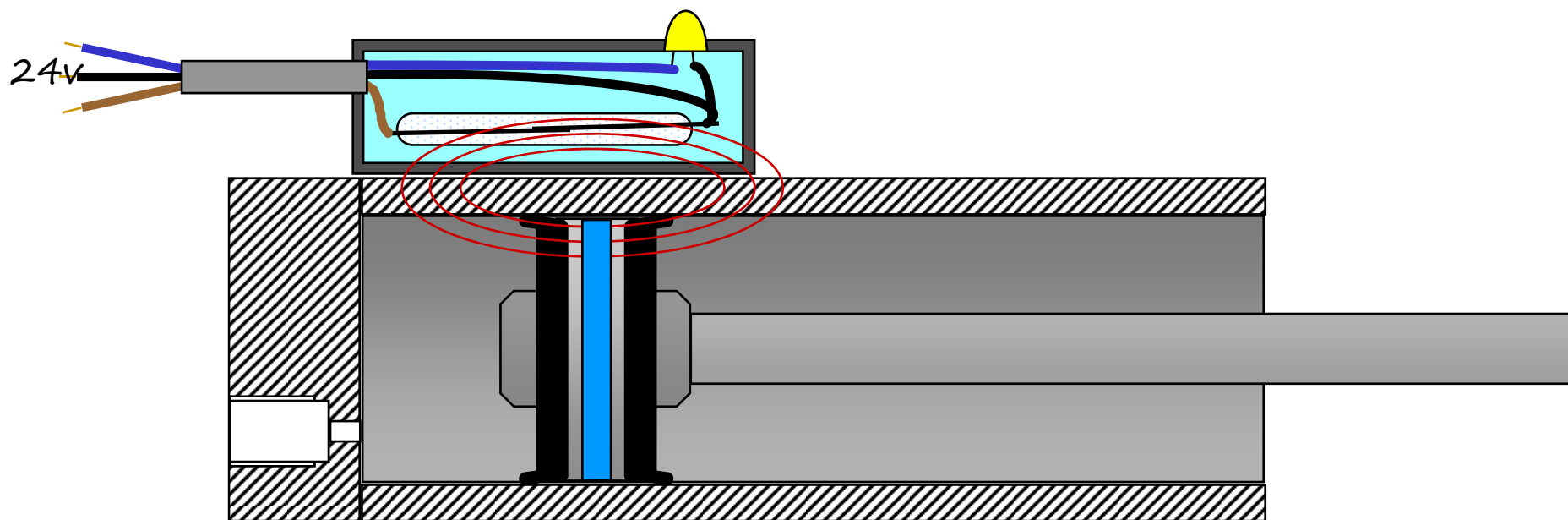
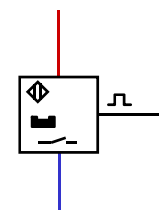
# Reed switch



# Reed switch



# Reed switch



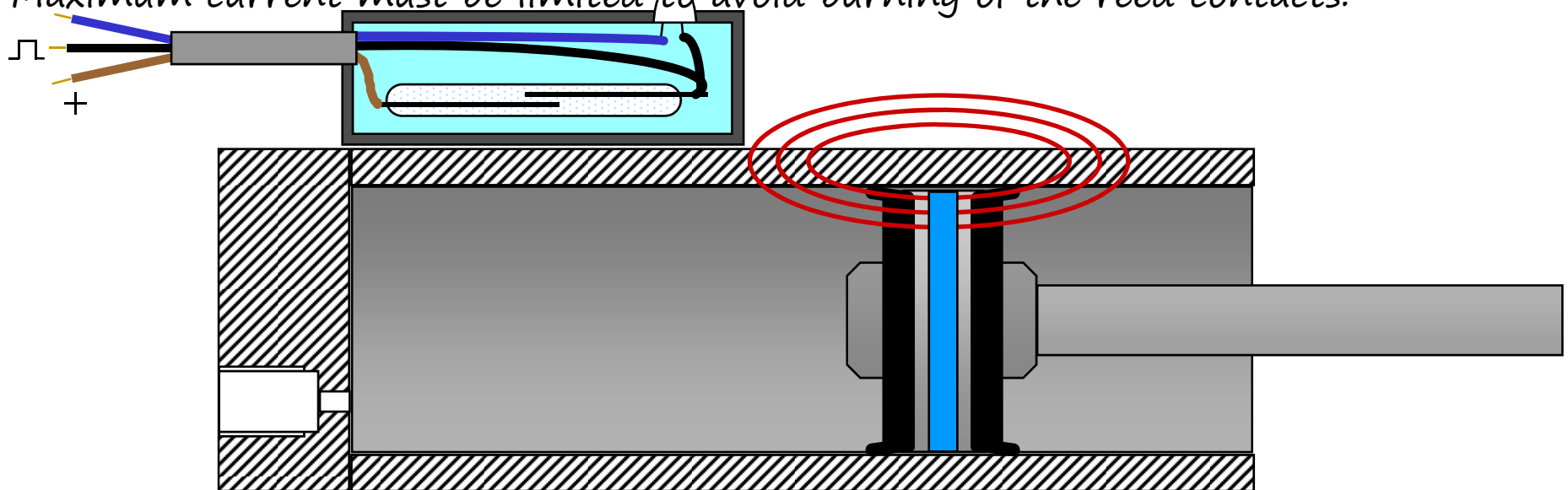
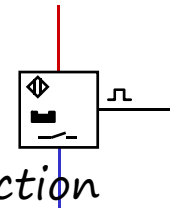


## Reed switch

Interference from other magnetic fields must be avoided.

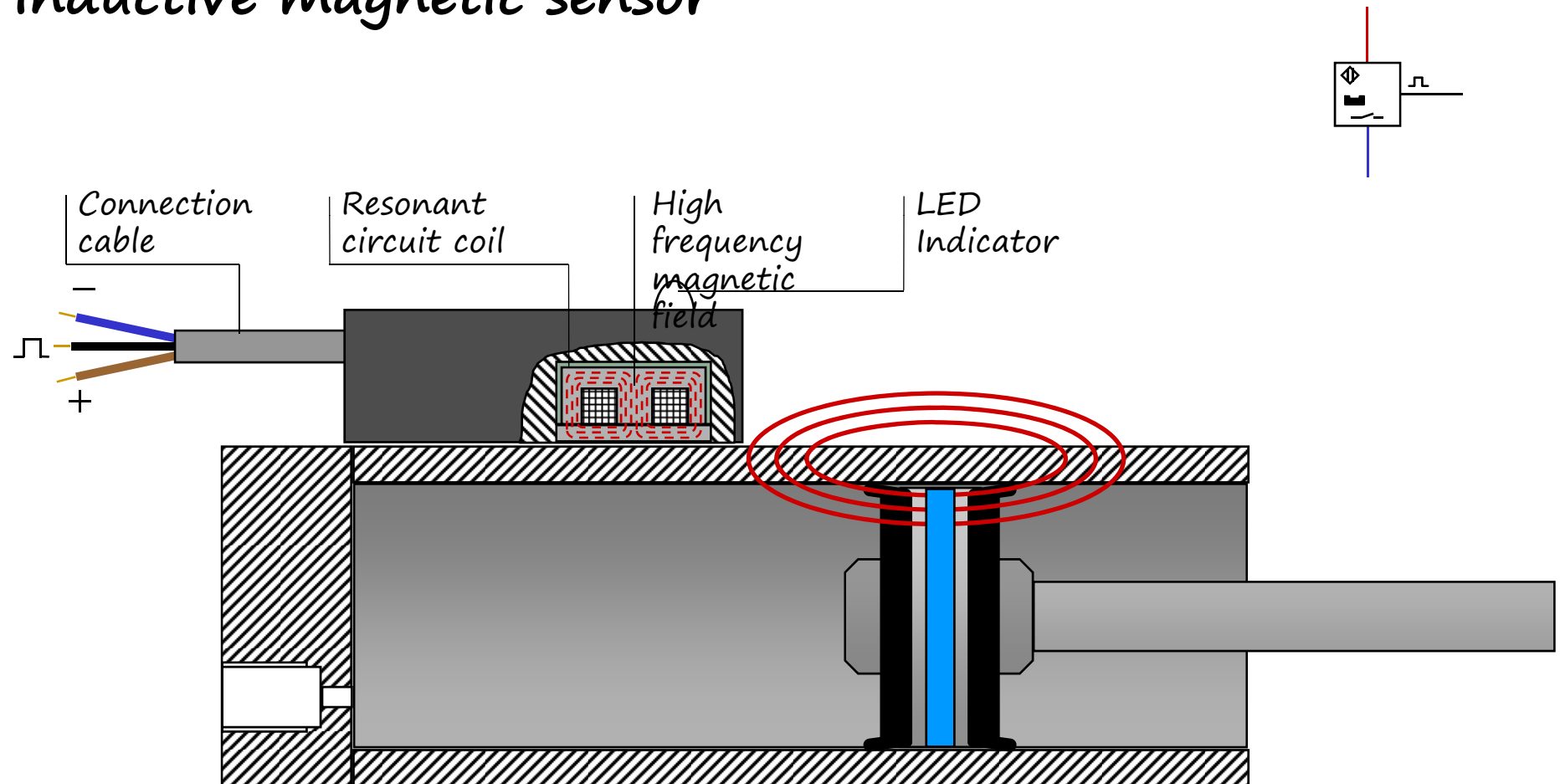
If positioned in mid stroke, switching point will vary depending on direction of approach.

Maximum current must be limited to avoid burning of the reed contacts.

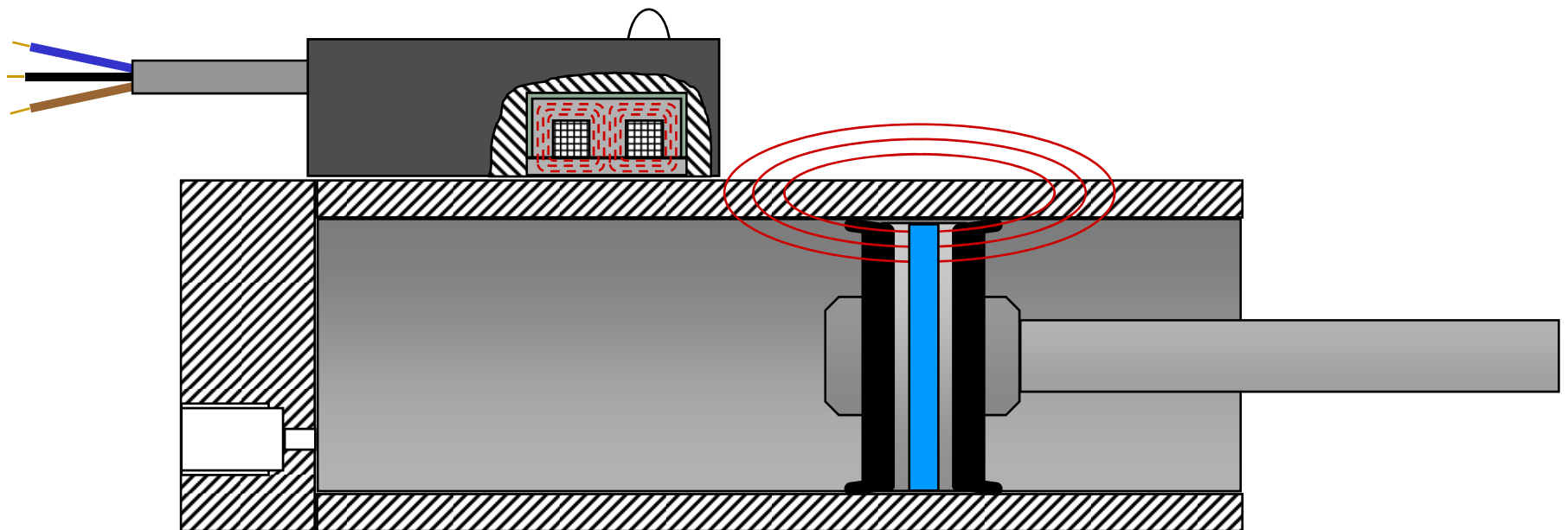
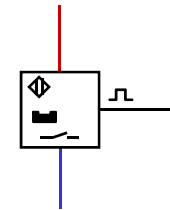


# Inductive magnetic sensor

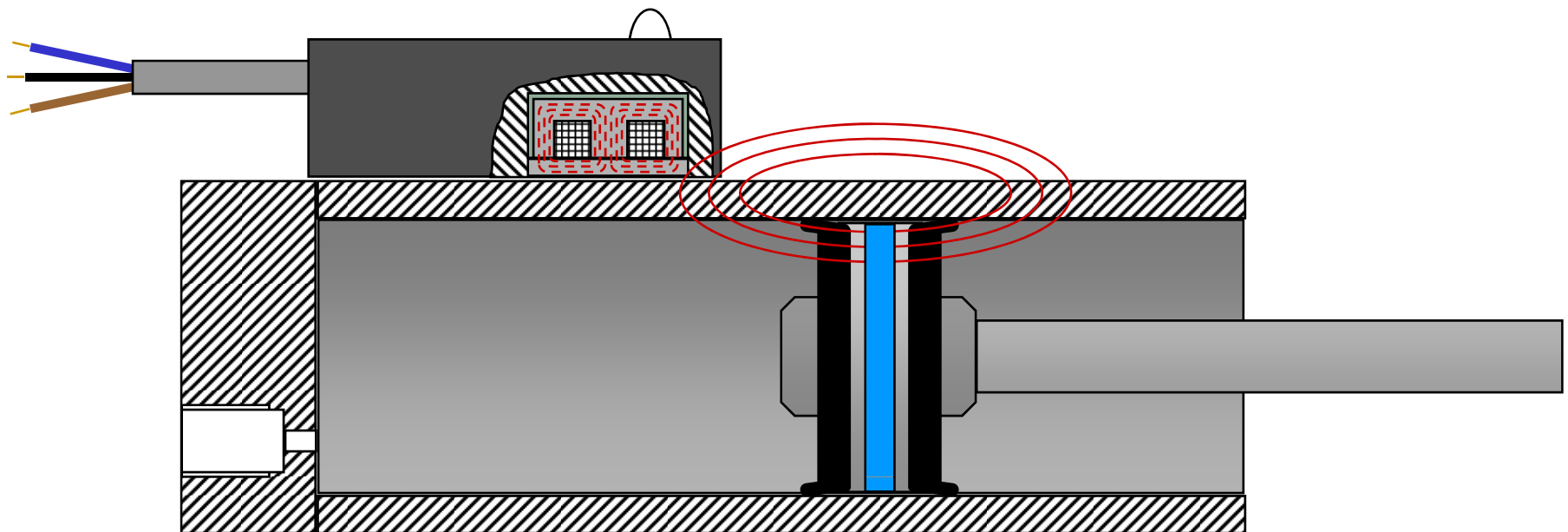
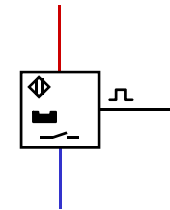
# Inductive magnetic sensor



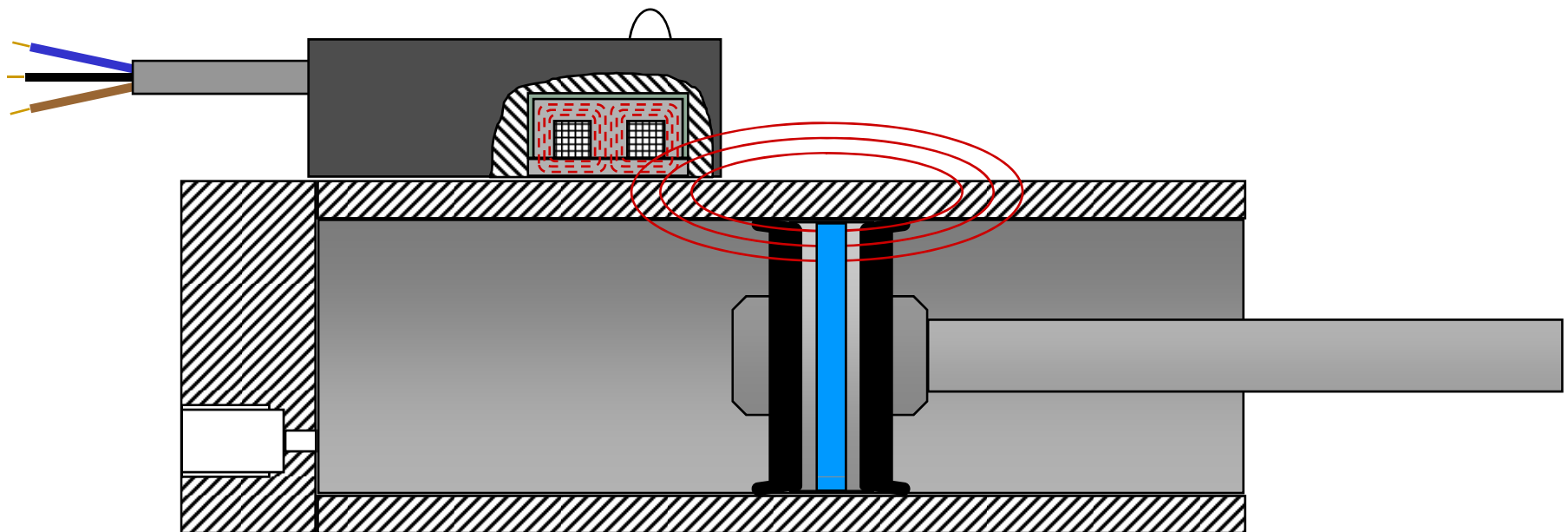
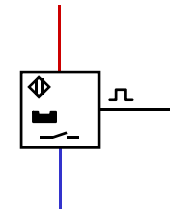
# Inductive magnetic sensor



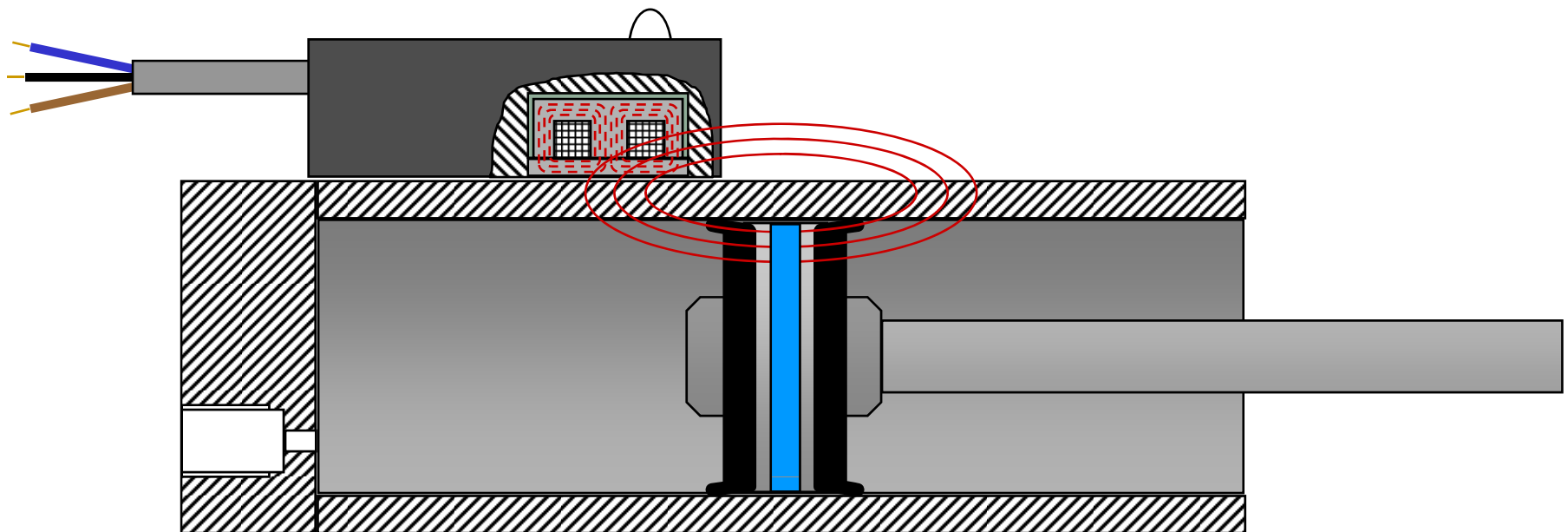
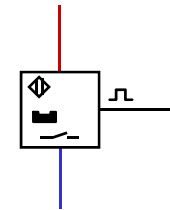
# Inductive magnetic sensor



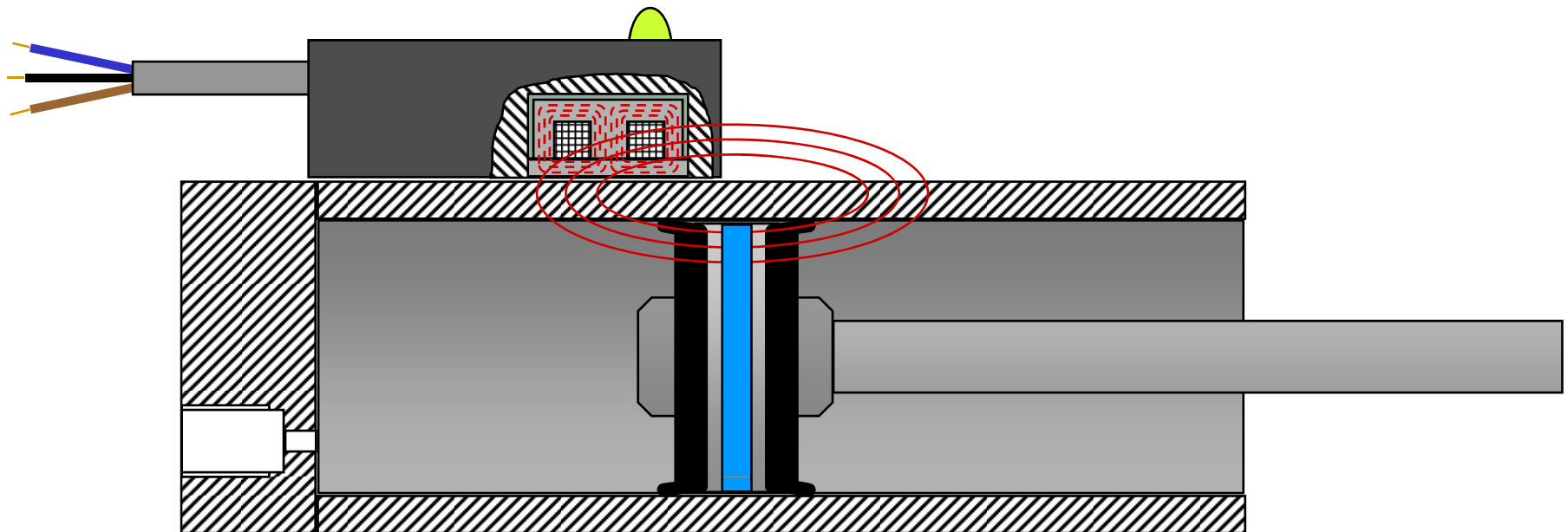
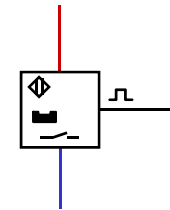
# Inductive magnetic sensor



# Inductive magnetic sensor

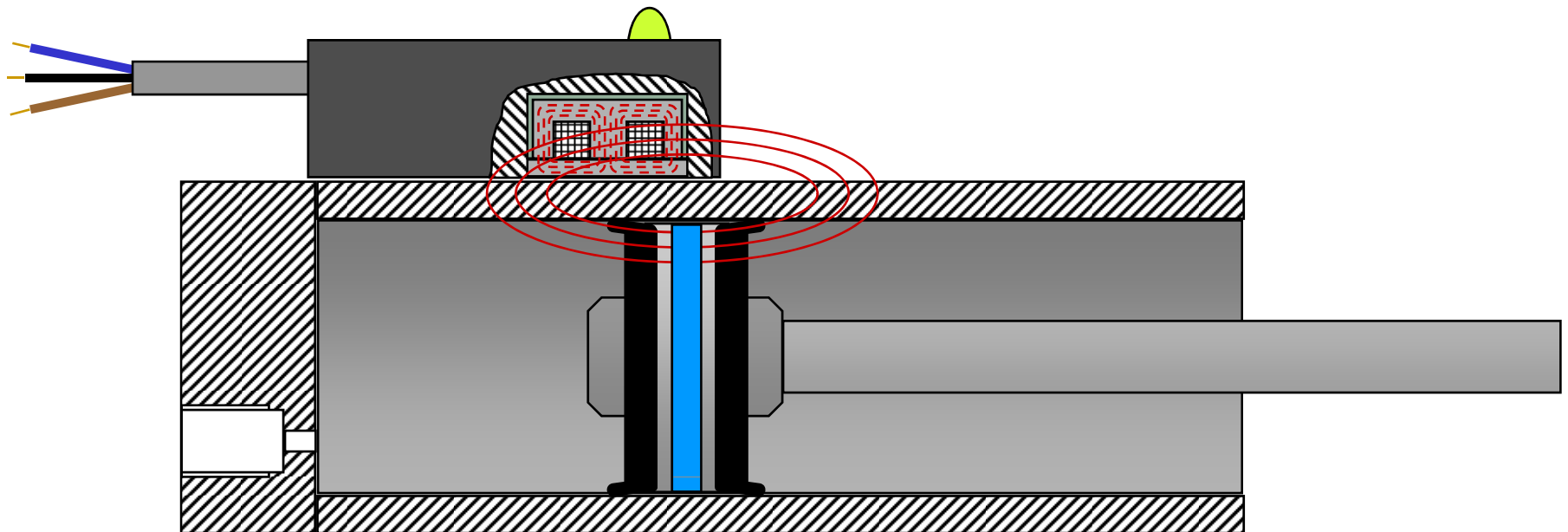
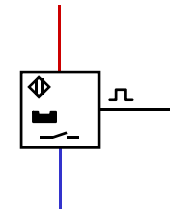


# Inductive magnetic sensor



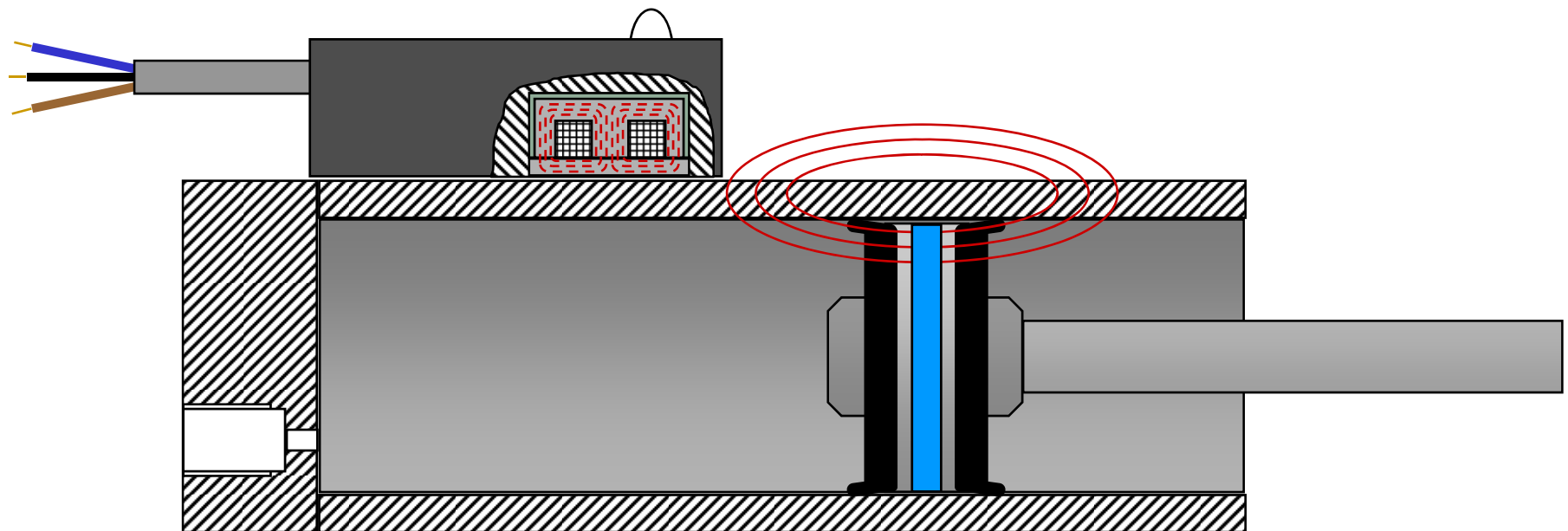
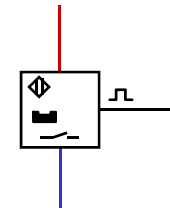


# Inductive magnetic sensor



# Inductive magnetic sensor

Inductive principle of operation - but only reacts to magnetic fields  
 Interference from other magnetic fields must be avoided.  
 Solid state device - higher switching frequency - 1kHz



# Capacitive sensor

# Capacitive sensor

Sensor is looking for a change in capacitance in the active field

Electrostatic field

Active surface

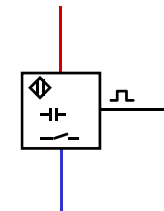
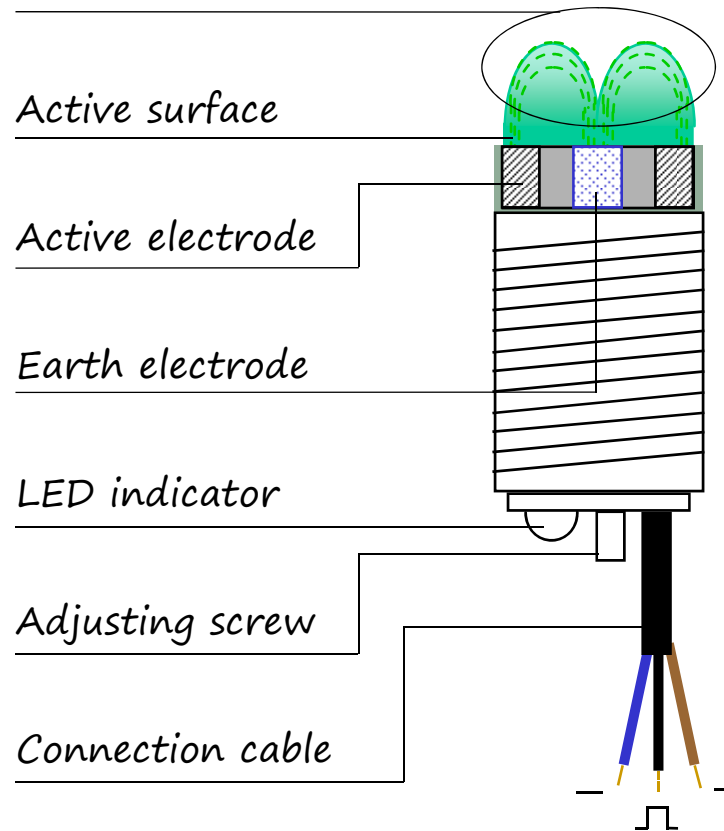
Active electrode

Earth electrode

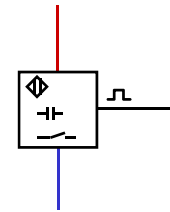
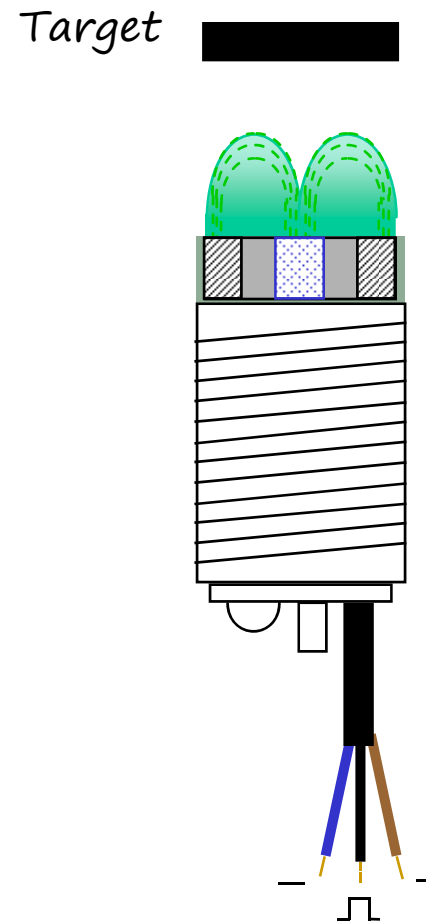
LED indicator

Adjusting screw

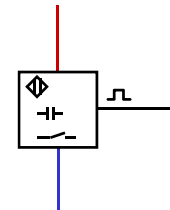
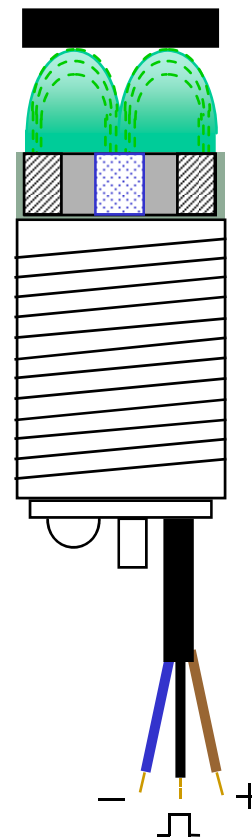
Connection cable



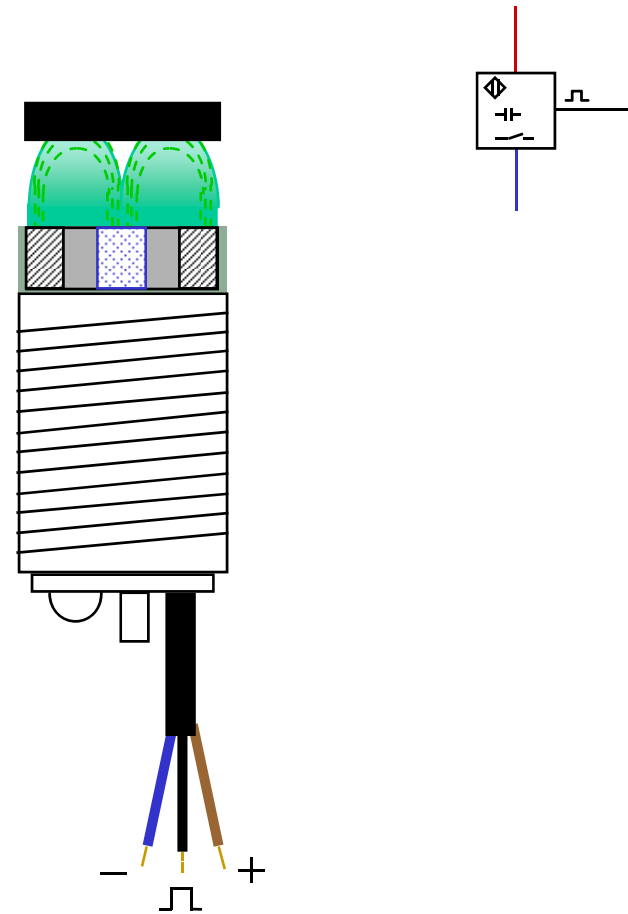
# Capacitive sensor



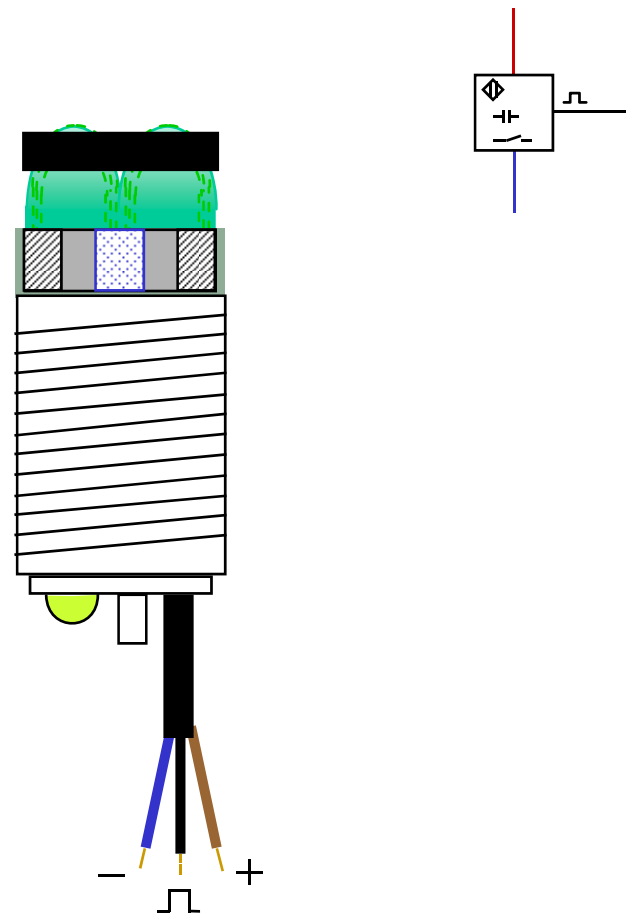
# Capacitive sensor



# Capacitive sensor



# Capacitive sensor



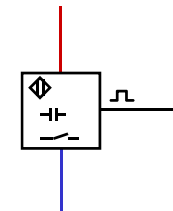
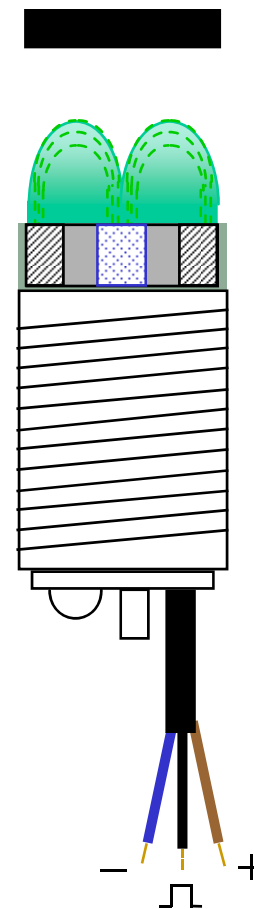


# Capacitive sensor

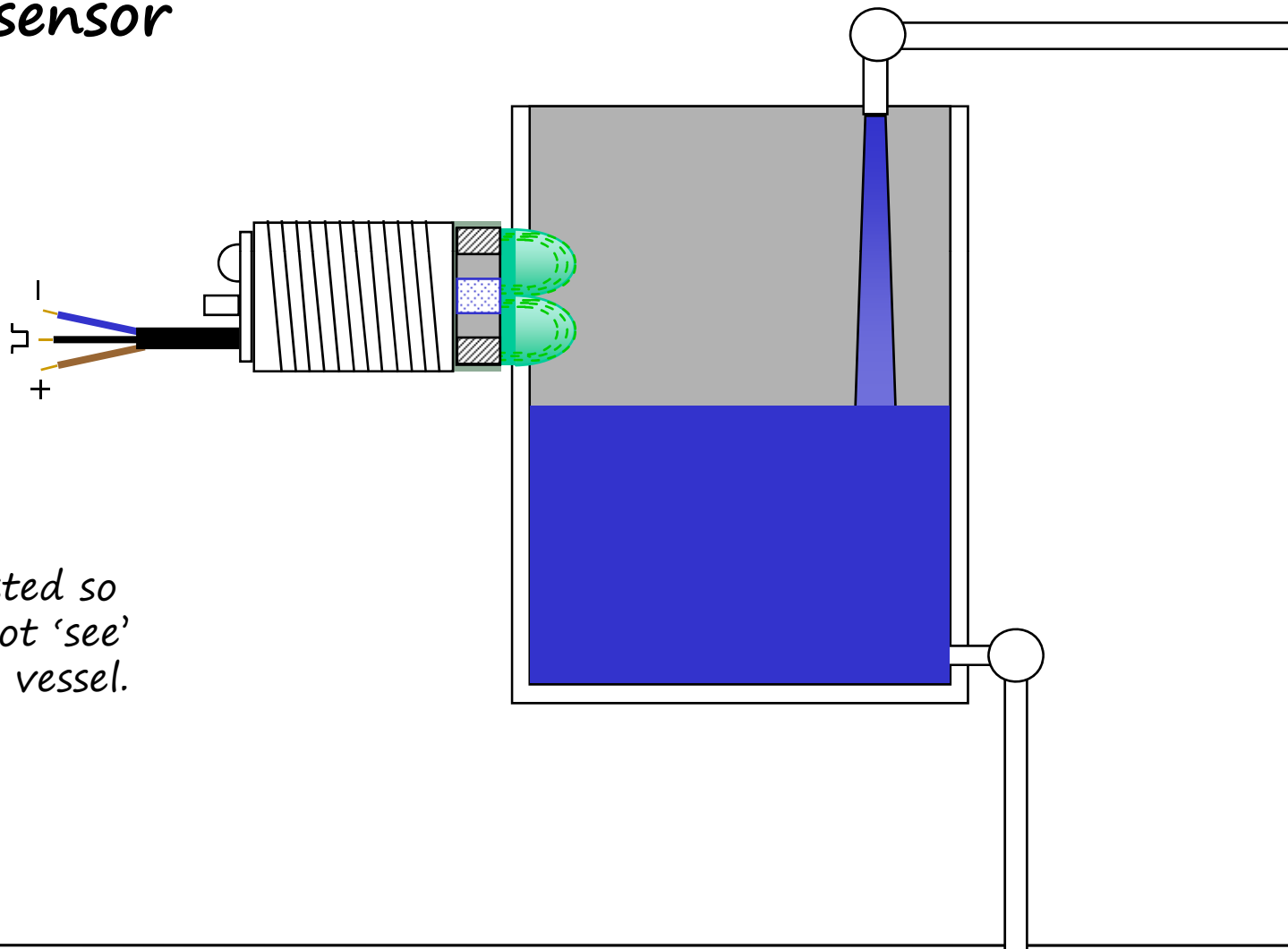
*Detects any material denser than air  
(as long as there is enough of it)*

*Can be adjusted for sensitivity*

*Can be affected by dusty  
environments*

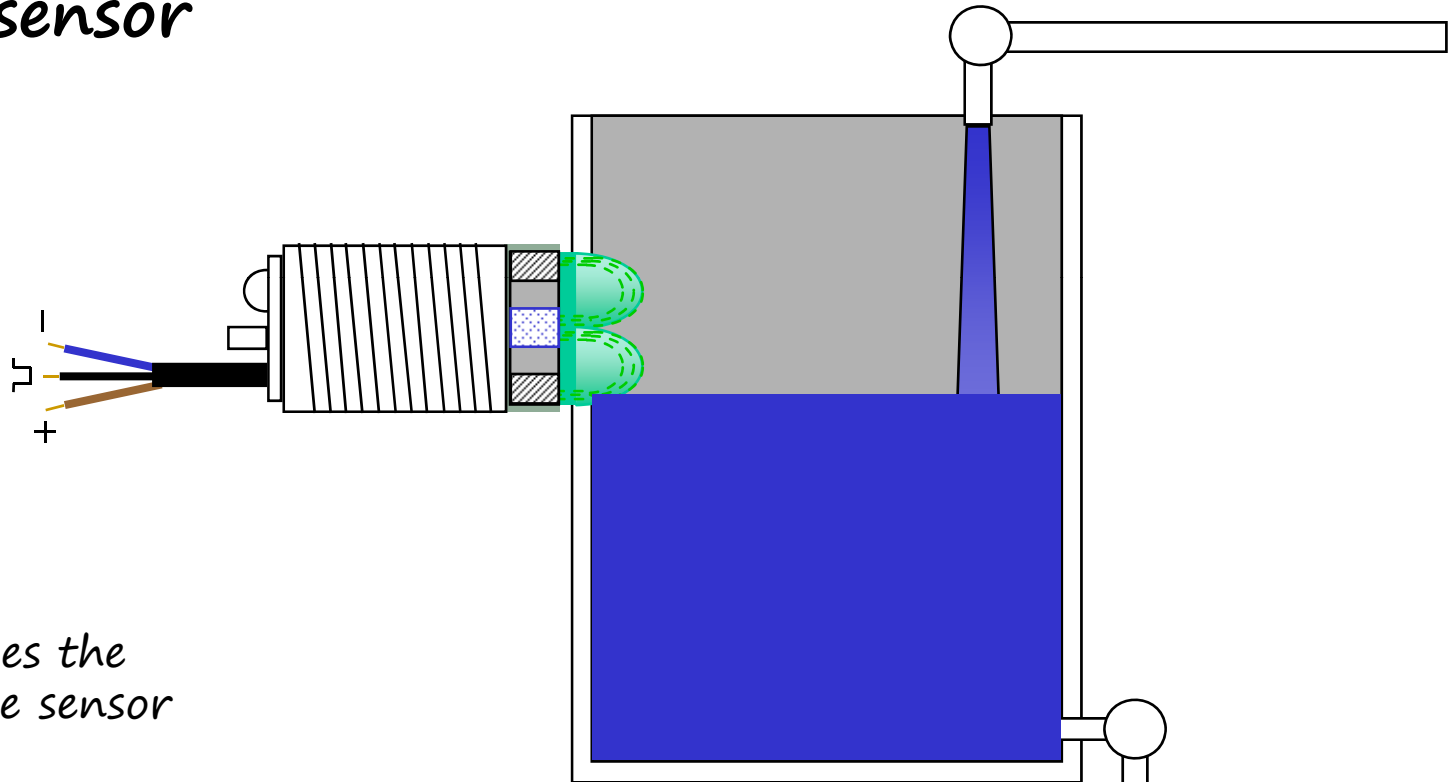


# Capacitive sensor



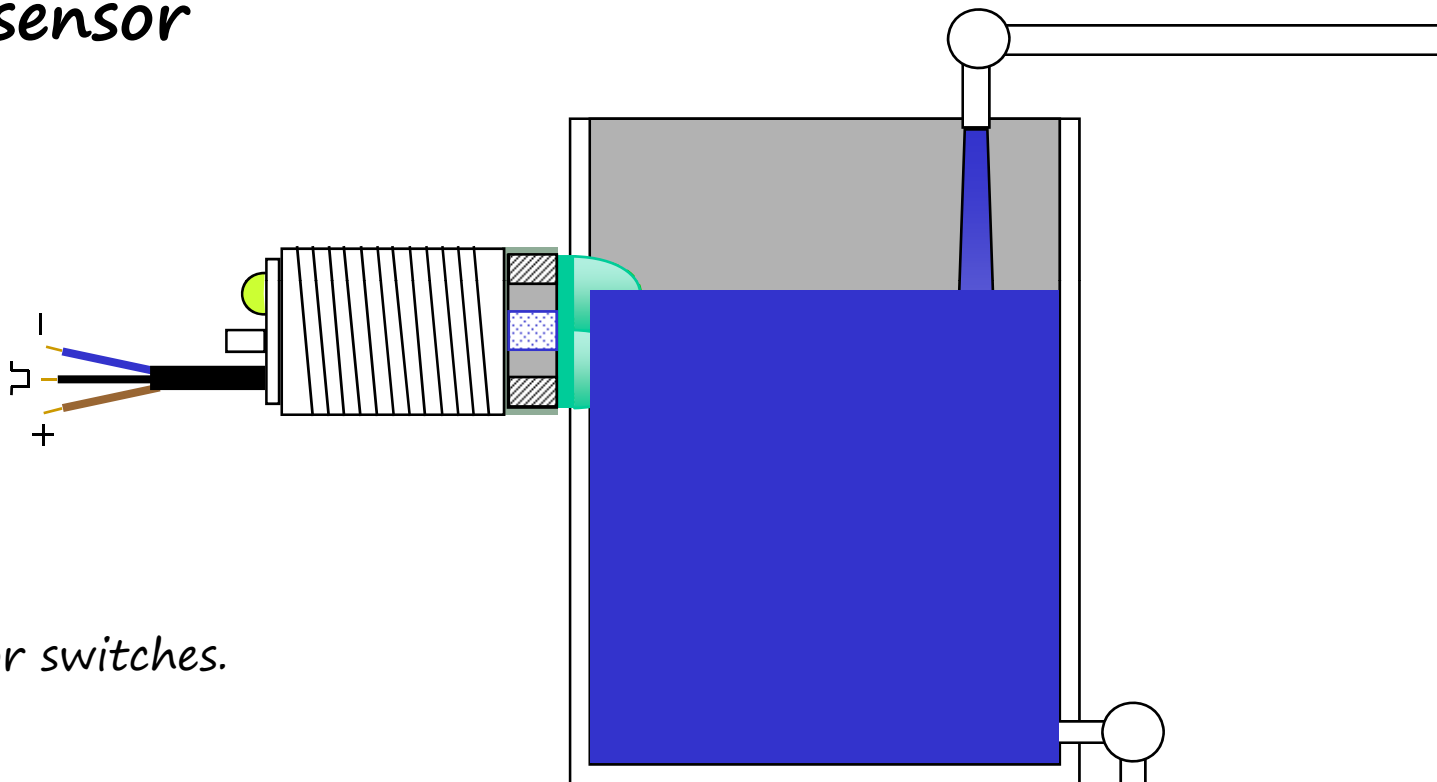
Sensor is adjusted so that it does not 'see' the wall of the vessel.

# Capacitive sensor



As the level rises the fluid affects the sensor field.

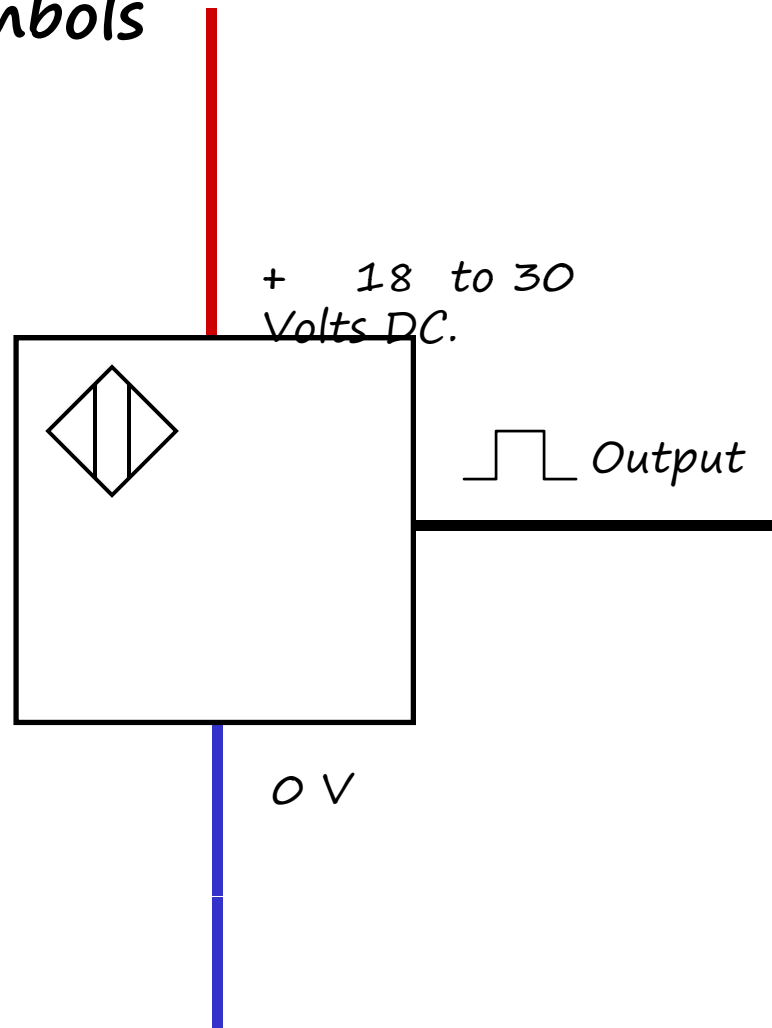
# Capacitive sensor



Until the sensor switches.

# Sensor symbols

# Sensor symbols



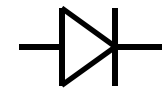
Inductive



Capacitive



Optical



Magnetic



Ultrasonic



Normally open

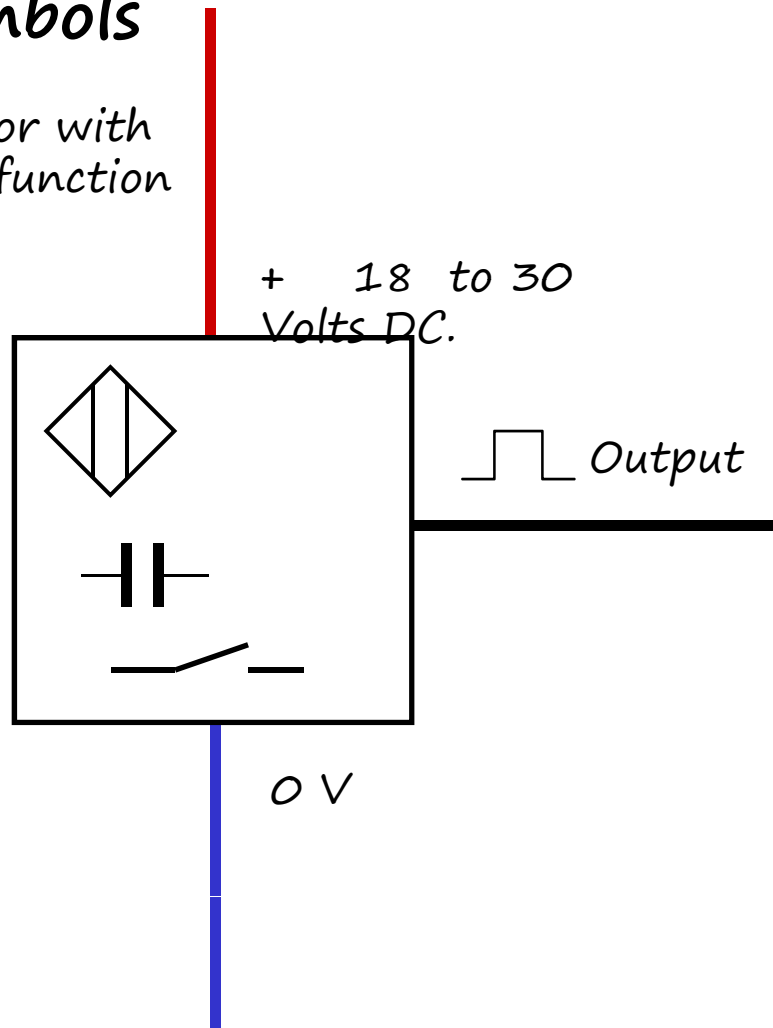


Normally closed



# Sensor symbols

Capacitive Sensor with Normally open function



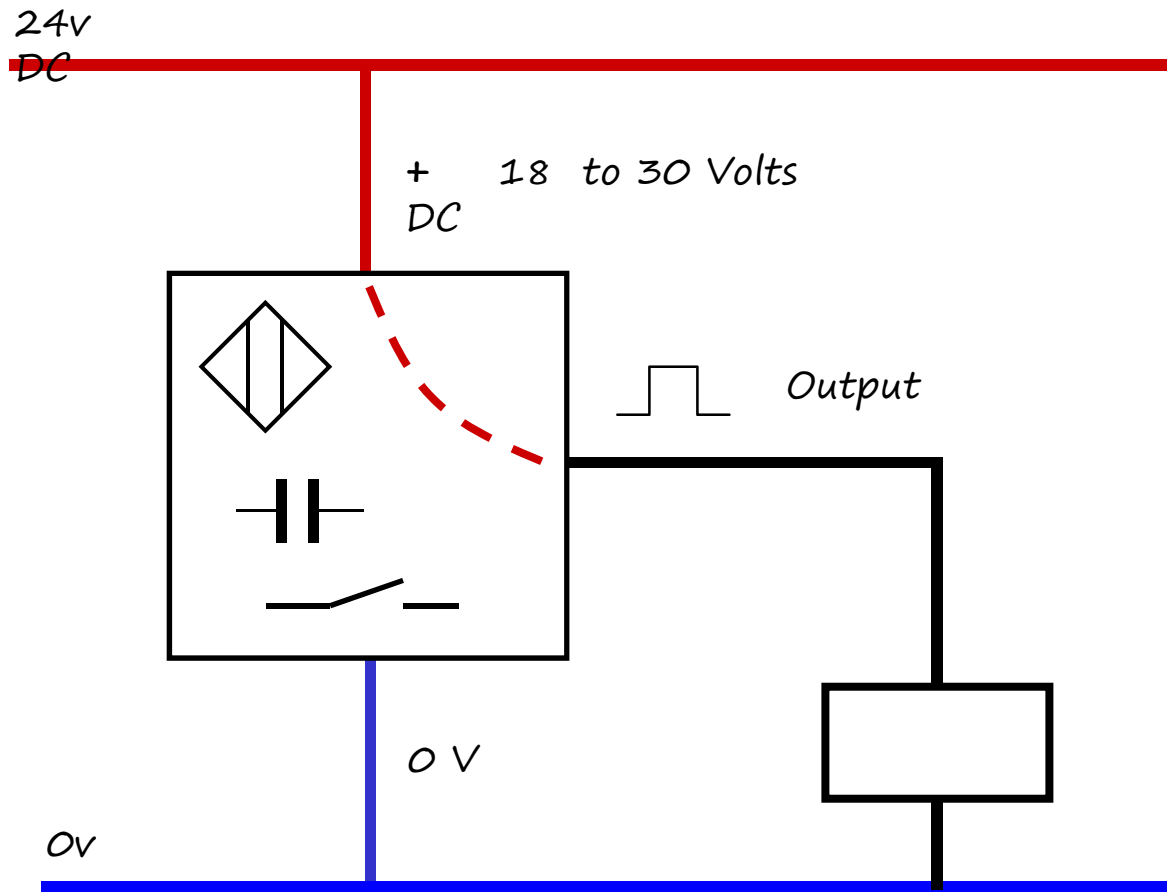
# Sensor connection



# Sensor connection

PNP Type

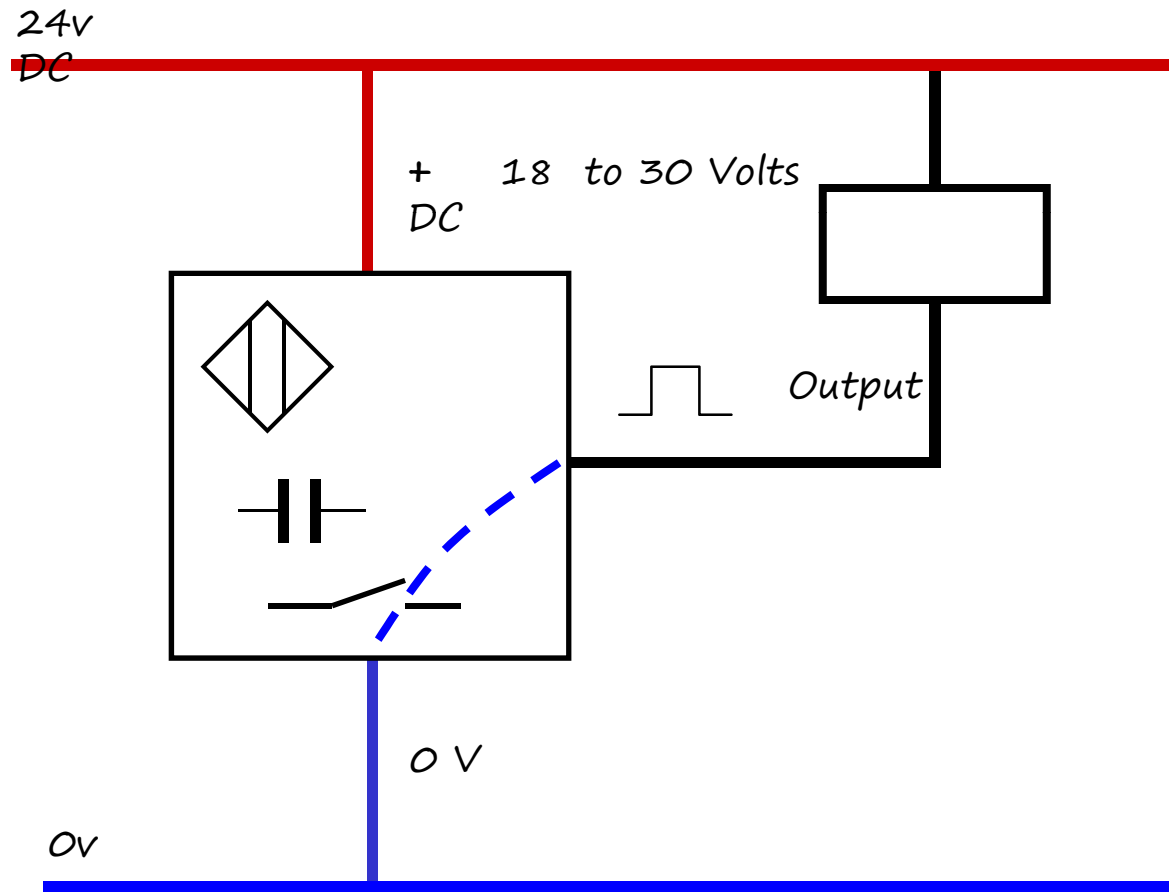
- Output is Positive
- Positive switching



# Sensor connection

NPN Type

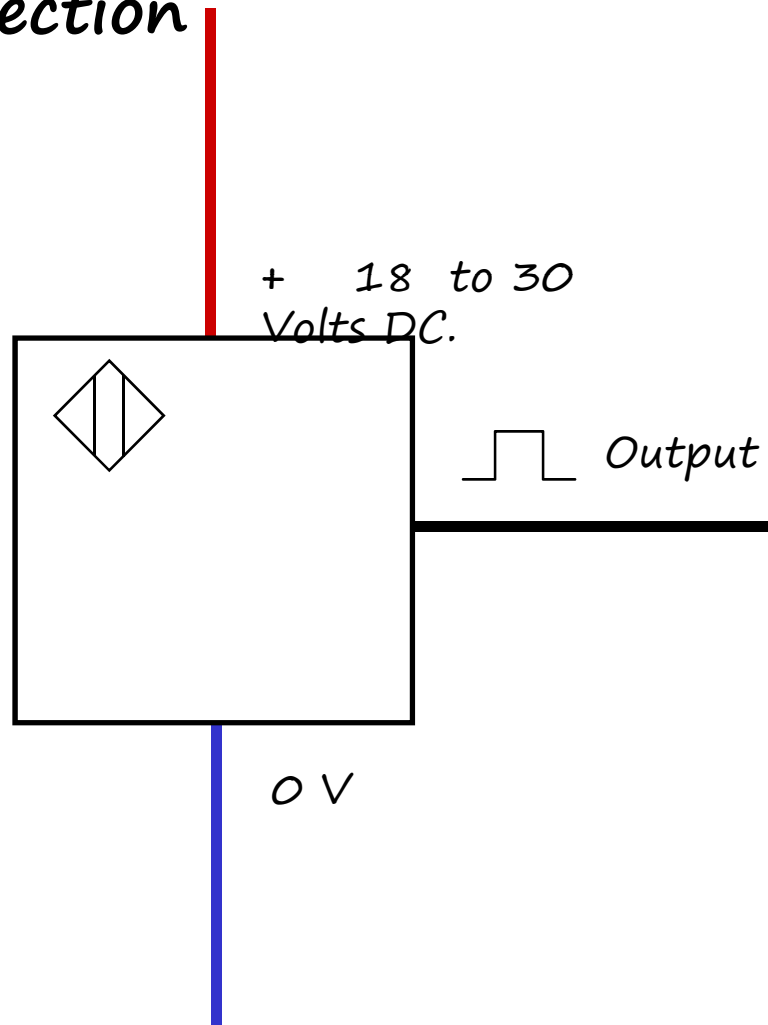
- Output switches through to 0v
- Negative switching



# Sensor connection



# Sensor connection



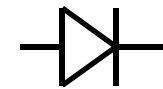
Inductive



Capacitive



Optical



Magnetic



Ultrasonic



Normally open



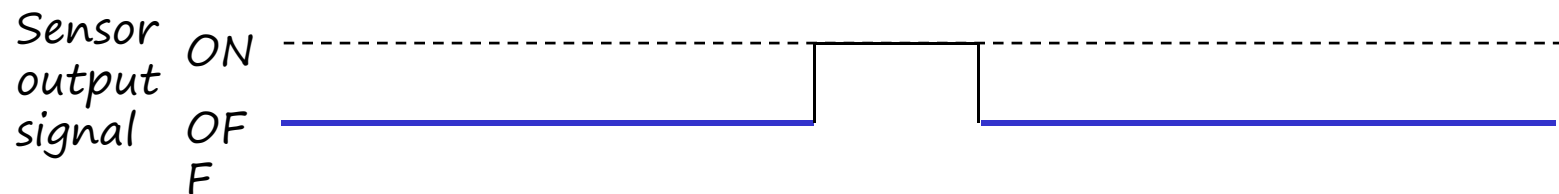
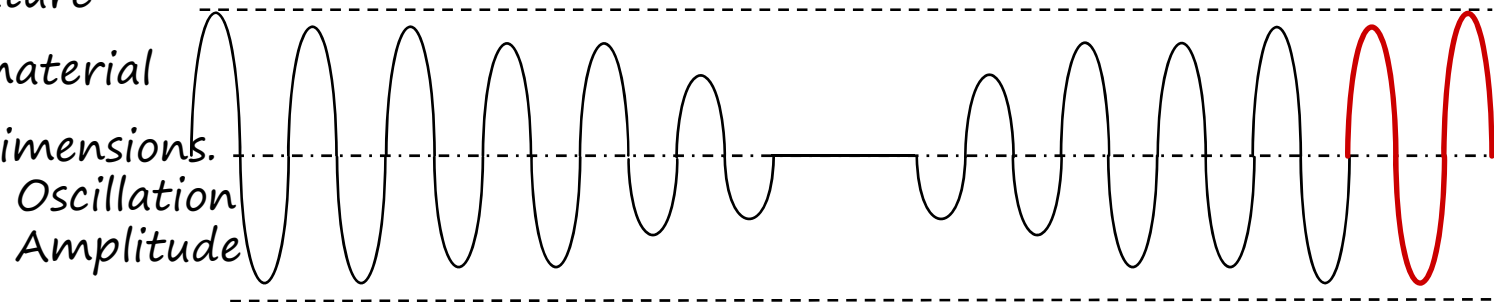
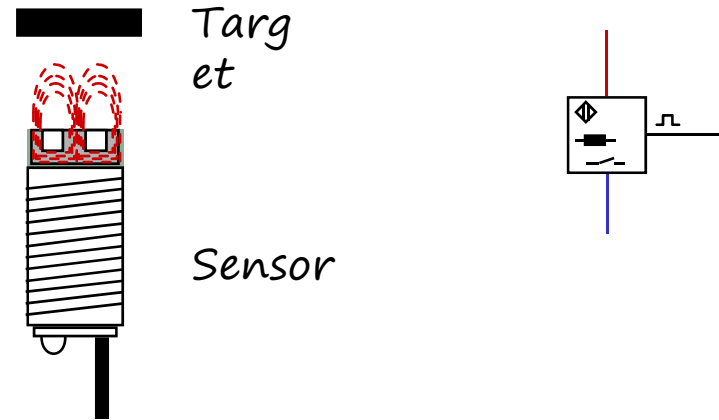
Normally closed



# Inductive sensor

Will detect any conductive material  
 Quoted distances are for mild steel  
 Sensor performance can be affected by:-

- Temperature
- Target material
- Target dimensions.

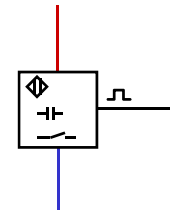
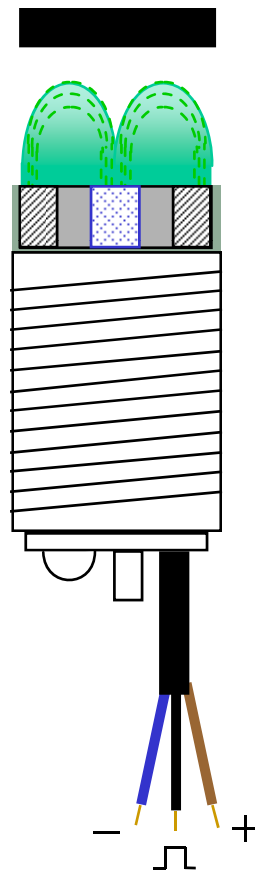


# Capacitive sensor

*Detects any material denser than air.  
(as long as there is enough of it)*

*Can be adjusted for sensitivity*

*Can be affected by dusty environments*



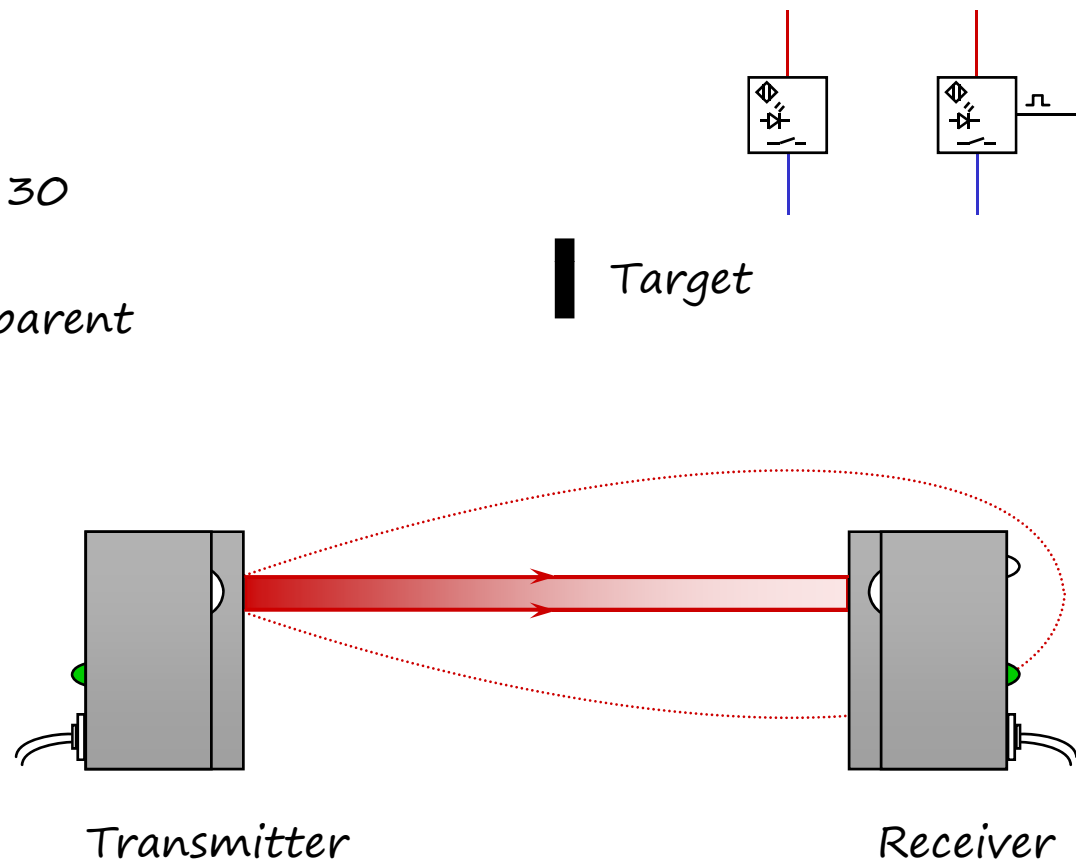
# Optical sensors

Type: Through-beam

Long sensing distance : up to 30 metres with some devices

Will detect all but very transparent materials

Must be accurately aligned



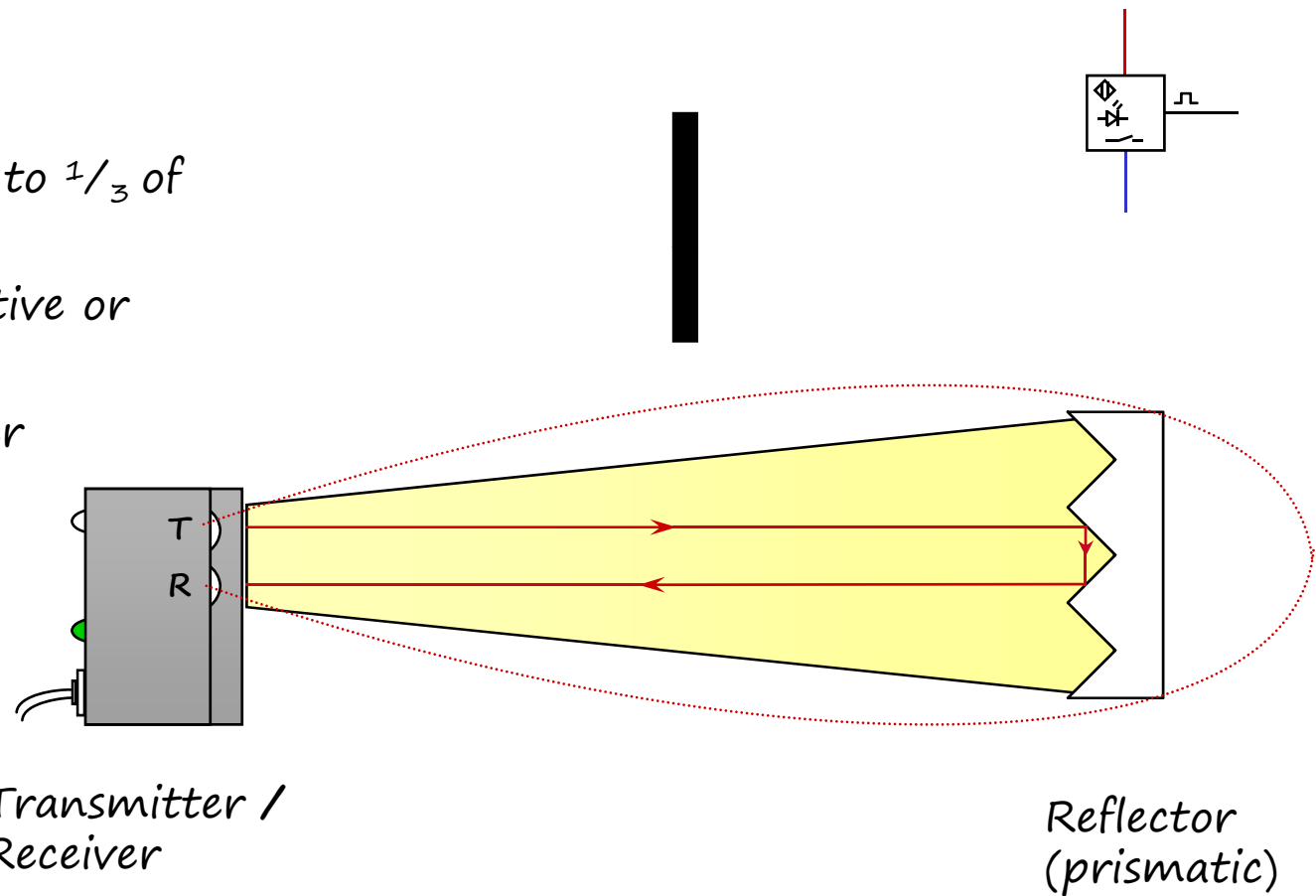
# Optical sensors

Type: Retro-reflective

Sensing distance :  $\frac{1}{2}$  to  $\frac{1}{3}$  of through-beam type.

Not suitable for reflective or transparent targets

Target should be larger than the reflector





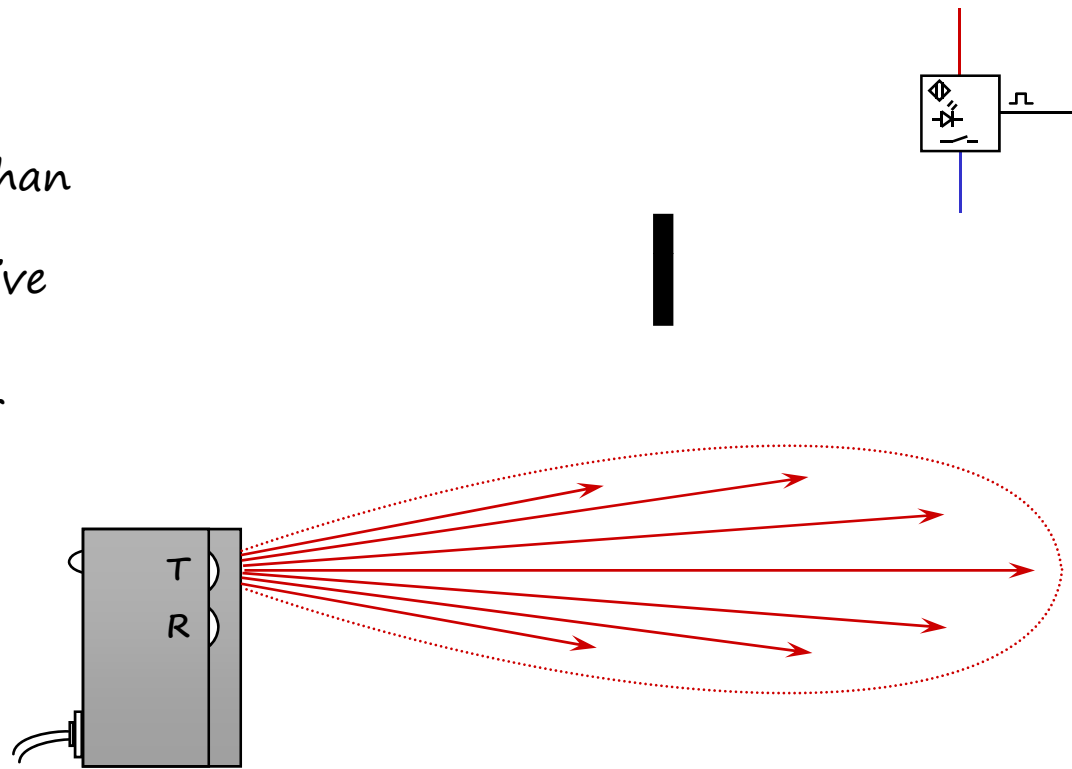
# Optical sensors

Type : Diffuse

Sensing distance : much less than reflex type, actual distance depends on colour and reflective nature of the surface

Larger targets result in longer sensing distances

Not suitable for dirty environments



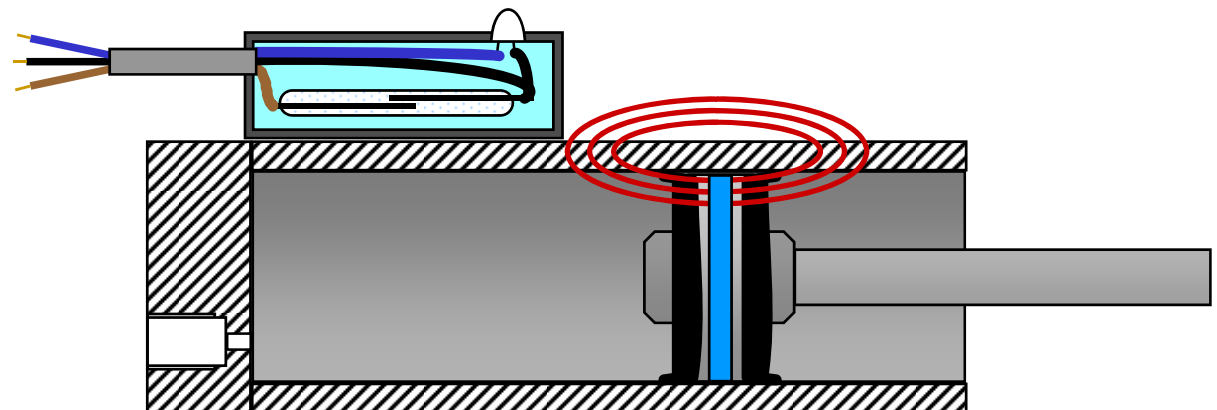
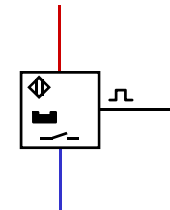
Transmitter / Receiver

## Reed switch

Interference from other magnetic fields must be avoided.

If positioned in mid stroke, switching point will vary depending on direction of approach.

Maximum current must be limited to avoid burning of the reed contacts.



# Inductive magnetic sensor

Inductive principle of operation  
 - but only reacts to magnetic fields

Interference from other magnetic fields must be avoided

Solid state device - higher switching frequency - 1kHz

