



# INSTALLATION INFORMATION FOR ZF'S ENERGY HARVESTING SWITCH

As a supplement to the technical data you will find instructions for installing the energy harvesting switch to achieve optimum efficiency.

## 1 Range

The range of the wireless switch is limited by the power. The signal gets weaker with increasing distance.

There are several factors which will cause the signal transmission to get even weaker and which you need to consider when positioning switches and receivers.

The ideal location for installation is one where the following sources of interference can be minimized:

### 1.1 Damping the radio waves due to obstacles

Generally the following applies:

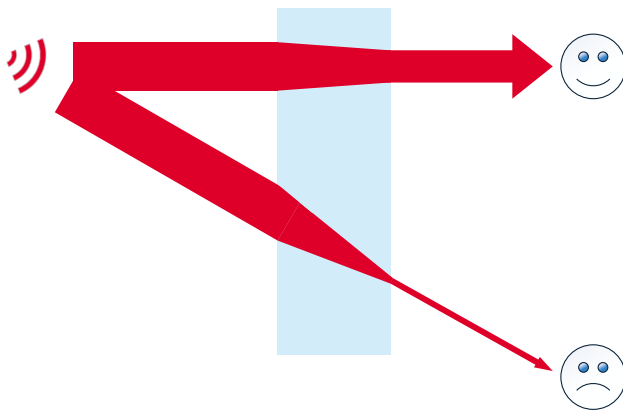
- Any obstacle that is situated in the transmission path will impede the range.
- The loss of performance depends on the material and increases the stronger the obstacle is.
- If an obstacle is in the path of the transmission which absorbs or reflects (e.g. metal) the radio waves, then a so-called frequency shadow forms behind the object. The signal is not able to reach a receiver which is installed in the frequency shadow.

Damping with different materials:

Material	Strength	Damping
Wood	< 30 cm	1 ... 10%
Plasterboard	< 10 cm	1 ... 10%
Glass (uncoated)	< 5 cm	1 ... 10%
Plastic, rubber	< 5 cm	1 ... 10%
Stone, chipboard	< 30 cm	30%
Pumice	< 30 cm	10%
Porous concrete	< 30 cm	20%
Brick	< 30 cm	35%
Concrete with steel reinforcement	< 30 cm	30 ... 90%
Metal grid	< 1 mm	90 ... 100%
Metal, aluminum covering	< 1 mm	100%

*All figures are approximate and for guidance only.*

The strength of the material to be penetrated varies with the angle at which the signal passes through the material.



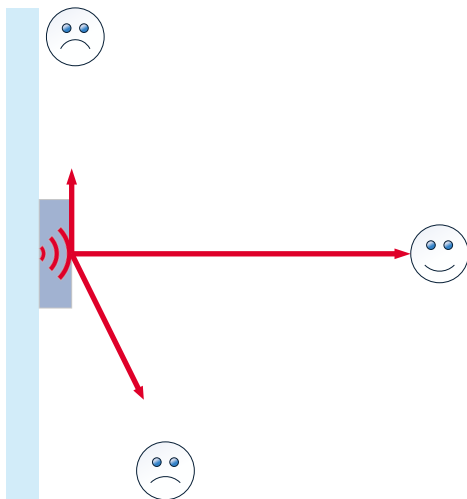
*Fig. 1 A greater angle of incidence results in increased signal damping*

This results in the following options for optimizing:

- Avoid obstacles between transmitter and receiver. Note that the damping accumulates for several obstacles.
- Position the transmitter and receiver so that radio waves can penetrate an obstacle on the shortest route. The more acute the angle to the obstacle, the greater the thickness to be penetrated.

## 1.2 Propagation and reflection of radio waves

Radio waves propagate in free space. In the wall area there is scattering and reflection:



*Fig. 2 Propagation of radio waves with interference by reflection in the wall area*

Optimization:

- Install the energy harvesting switch preferably opposite the receiver, i.e. not on the same wall.

### 1.3 Reflection and interference

Radio waves which are reflected from smooth surfaces (metal, glass, mirrors) can overlap with unreflected waves (interference). This interference may increase or decrease the radio signal.

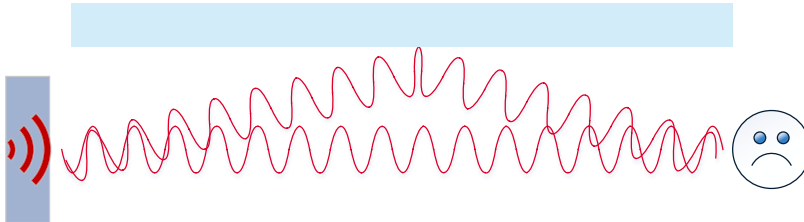


Fig. 3 Formation of interference by reflection

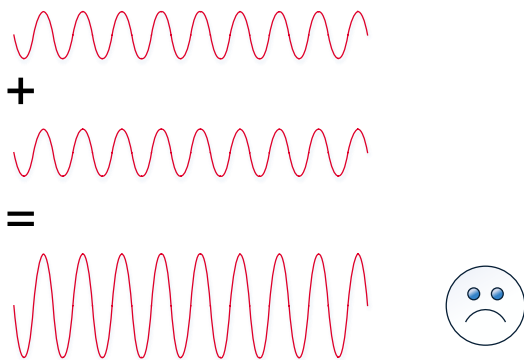


Fig. 4 Amplification of the radio wave by overlapping

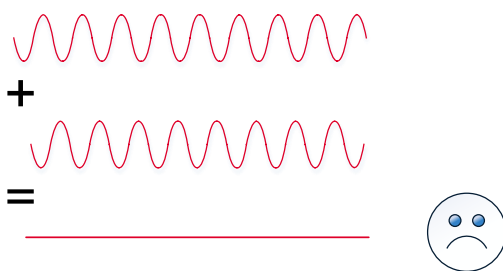


Fig. 5 Cancellation of the radio wave by overlapping

Optimization:

→ Change the position of the transmitter or receiver.



## 1.4 Jamming

Electronic devices, such as computers, microwaves, audio/video devices or mobile phones, can emit waves and therefore interfere with the reception.

Optimization:

- Position the transmitter and receiver at a distance of more than 50 cm to the source of interference.

## 2 Summary

- Avoid obstacles between transmitter and receiver.
- Align the long side of the radio switch at right angles to the receiver.
- If you suspect any interference, change the position of the transmitter or receiver.
- Position the transmitter and receiver at a distance of more than 50 cm to the source of interference.

Europe:  
ZF Friedrichshafen AG  
Electronic Systems  
Cherrystraße  
91275 Auerbach  
Germany

North America:  
ZF Electronic Systems  
Pleasant Prairie LLC  
11200 88th Avenue  
Pleasant Prairie, WI 53158  
USA

Asia-Pacific:  
ZF Electronics Asia Limited  
2/F Technology Plaza  
29-35 Sha Tsui Road  
Tsuen Wan, New Territories  
Hong Kong

Internet: [www.switches-sensors.zf.com](http://www.switches-sensors.zf.com)

E-Mail: [switches-sensors@zf.com](mailto:switches-sensors@zf.com)