Technological information

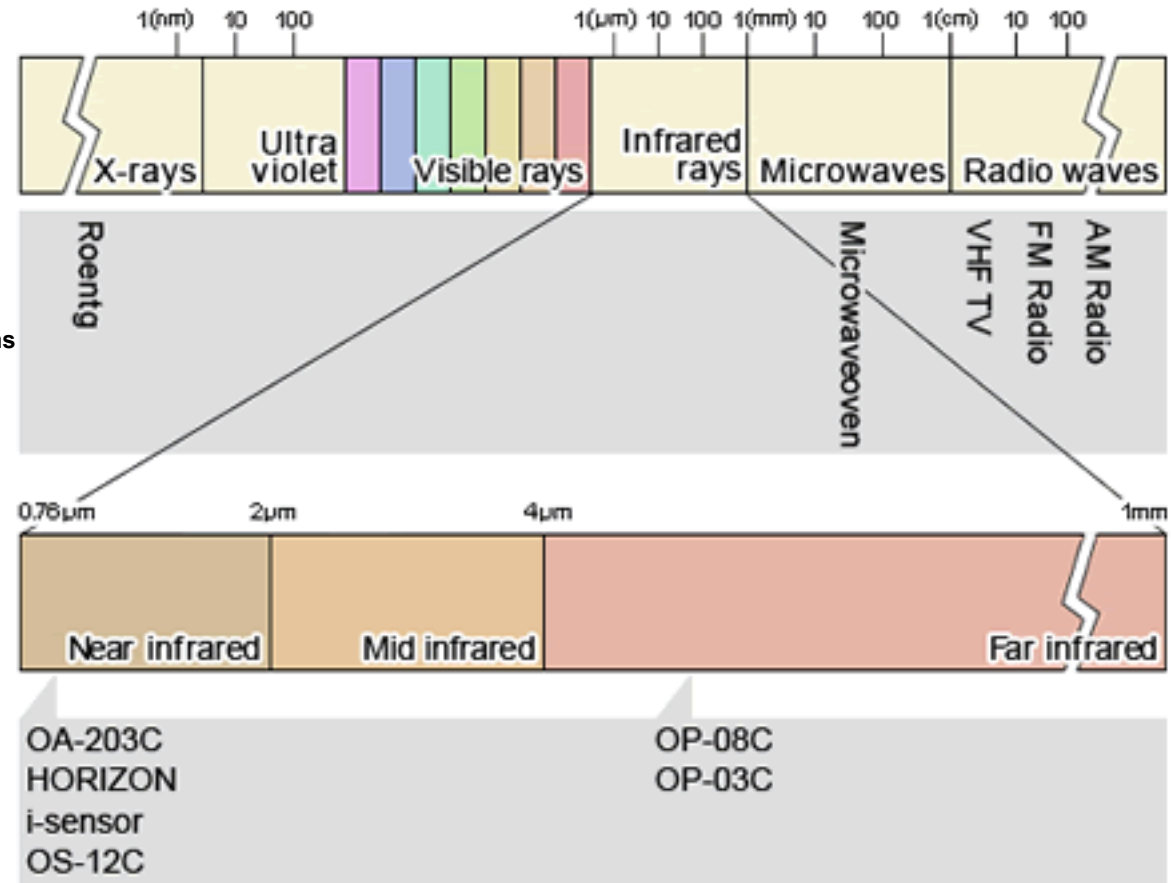
>>What are infrared rays?

It has long been known that the warmth from the sun is transmitted through infrared rays. These rays have wavelength between visible light and microwaves and are invisible to the human eye. The wavelength range is between 0.76 and 1,000 microns (a micron is one-millionth of a meter).

Infrared rays are further divided into near, mid, and far infrared rays according to their wavelengths. Far infrared rays are those in the spectrum of 4 microns or greater.

Far infrared rays with wavelengths ranging from 2.5 to 30 microns are absorbed by a variety of plastics, paints, fibers and foods. Far infrared rays therefore have a wide range of applications in industry, including a heat source for heating and drying. The properties of infrared rays are also used in applications such as OPTEX automatic door sensors.

Classification of electromagnetic waves and infrared rays



Electronics applications

OPTEX Example of product representative

Principle of sensor operation

>>Active infrared sensors

The principle behind infrared automatic door sensors is the transmission and receiving of infrared light. An element known as a light emitting diode (LED) transmits active infrared light, which is reflected on the floor and received by an optical receiver known as a photo diode (PD). As long as there is no movement or object in the path of the light beam, the light pattern is static and the sensor remains in stand-by.

When a person or object crosses the beam, the reflection of the light is distorted. This is registered by the PD, which gives off an impulse for opening the door.

Sensors differ in the number of rows of active infrared spots. These spots are collectively referred to as the detection field.

Because objects cause a distortion in the reflected light pattern, active infrared sensors also react to shopping carts and other moving objects.

Initially, the sensor is set according to the situation at the location. Any time there is a change in this standard state, it is recognized. The sensor is also able to continue to recognize this situation.

Active infrared sensors are excellent as a safeguard at the door opening because of their ability to continue recognizing changes that occur in the detection field. Some sensors may incorporate a second row of detection fields to create a safety field in addition to the standard first row. The safety field prevents the door from closing prematurely.

As long as there is a person or object in the detection field, the sensor remains active, preventing the door from closing. This ensures an additional layer of safety over other types of sensors as the door does not close while someone is in the detection field. There is no theoretical limit to the maximum time that can be set for a sensor, though this does depend on the type of sensor. A safety field is sometimes employed for when the door is open for a long period of time.

Active infrared door sensors are generally immune to the effects of external factors such as rain, snow and falling leaves. Although the sensor registers this type of movement, intelligent software is employed to screen such factors out.

>>Passive infrared sensors

A passive infrared door sensor works on the basis of ambient temperature. It measures the temperature and emits a pulse as soon as there is a change, recognized as 1 ° C or about 1.8 ° F when a person is walking at 1.2 meters (4 feet) per second. A passive infrared sensor therefore reacts only to objects that radiate a particular temperature, such as humans or animals. Baby carriages, shopping carts and wheelchairs are not detected, though the person behind or in them are. In practice, a passive infrared sensor is mainly intended for use in a conditioned environment, such as inside buildings.

>>Microwave sensors

A door sensor using a microwave technique works according to a completely different principle than one based on infrared rays. With microwaves, an antenna constantly emits a “balloon” at a specific frequency (24.125 GHz). As soon as there is a change in the volume of the balloon, the sensor reacts. This may be triggered by either an object or a person. A microwave sensor thus reacts to baby carriages, shopping carts and wheelchairs as well as people.

A major difference from other sensor types is that the microwave sensor becomes accustomed to anything in its detection field if it remains. The microwave sensor therefore stops emitting the pulse for opening the door if a person or object stays in the field.

Most microwave sensors are available in two types, unidirectional or bi-directional. If a faster closing door is required, a unidirectional microwave type is recommended. Such sensors react only to exiting traffic.

Some microwave sensors also incorporate both functionalities. The desired function can be switched according to need.

>>Safety beams

Safety beams also use an active infrared technique. Safety beams are fitted in the door opening, serving to prevent the doors from closing prematurely. The transmitter and receiver are installed opposite each other. As long as the beam is interrupted between the transmitter and receiver, the door is prevented from closing.

A miniature safety beam guarantees stable and dependable operation, even in bad circumstances. The innovative design makes installation very simple and fits all door profiles.

Insensitive to sunlight

The safety beam is insensitive to horizontal, incident light, even sunlight. The infrared beam is emitted by a light emitting diode (LED) installed in the transmitter head and detected by a photo diode (PD) in the receiver head. The wavelength of the infrared beam is about 0.9 mm (near infrared).

Pulsating code

The beam type used in the safety beam photo-electric detector is sensitive to a variety of light such as sunlight, car headlights and lightning flashes. A pulsating code is therefore used in the infrared beam to filter out these light sources from the emitted safety beam. The safety beam receiver is constructed so that it reacts only to interruptions in this pulsating infrared beam. Other light sources therefore do not affect the receiver.

Strong light filter system

Conventionally, safety beams are affected by directly incident sunlight in the receiver, resulting in non-activation. OPTEX has incorporated a light filter in the safety beam to ensure faultless operation even in strong sunlight.

Comparison of features

>>Comparison of Sensor Characteristics

		Active Infrared Sensor	Microwave sensor
Characteristics	Advantages	Not affected by temperature change Stationary detection possible	Not affected by changes in the floor area. The detection area does not change due to the color or temperature of the detection object.
	Disadvantages	Detection possible only when there is a difference in the amount of reflected light between the floor surface and the object	Stationary detection impossible The area is not well defined.
Functions	Stationary detection	Possible	Not possible.
	Mutual interference	May be solved with a changeover switch.	Although interference is possible in principle, malfunction does not occur.
	Detection of carts	Possible. A constant amount of reflected light is required.	Detection is made normally.
Environmental factors	Rain, wind and snow	Snow and rain detected. A microcomputer may be employed as a filter. Snowstorms can also be detected. When the detection glass is wet, beam diffusion may cause malfunction.	Cancelled out by computer. Malfunction may nevertheless occur when the cover is wet.
	Mist, smoke and steam	Can be detected.	Detection is made normally.
	Water pools	Pools of water in the detection area can be detected.	Does not malfunction..
	Reflective objects such as mats, hard aluminum and textured paving blocks	Deflection off the transom or vibration transfer may cause malfunction.	Malfunction may occur if fluorescent light is reflected off a hard metal surface and enters the sensor..
	Temperature change	No problem.	Does not malfunction.
	Insects and small animals	May be detected. A microcomputer may be employed to filter out.	Detection is made normally.
	Optical noise from fluorescent and strobe lights	May cause malfunction. Microcomputers do not filter these factors out. Care should be taken with new products.	May malfunction with fluorescent light.
	Noise of radio wave	More resistant	Weaker than light rays.
	Products using infrared rays	Interference may result. Care should be taken when the detection glass is black and the detection area is near the door.	Does not malfunction.