INDUSTRIAL AUTOMATION & VEHICLE SENSING SOLUTIONS

THIS YEAR, IT'S ALL ABOUT SAFETY

▷ **WHAT'S INSIDE:**

BEA

CONTENT

VEHICLE SENSING SOLUTIONS

Sensing solutions developed for the recognition of motorized vehicles to improve the automation, safety and classification of vehicular traffic.

INDUSTRIAL AUTOMATION SOLUTIONS

Sensing technology that improves vehicle flow, as well as the convenience and protection of people in industrial environments.

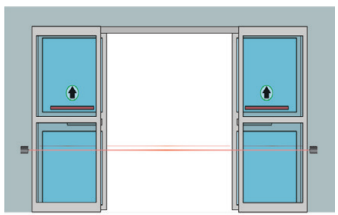
The Basics & Evolution of Opto-Electronic Sensors

An opto-electronic sensor is a transducer that converts arrays of light into an electronic signal for the purpose of detecting obstructions within a detection zone. The pedestrian door industry has regularly utilized overhead mounted opto-electronic presence sensors for power operated sliding, swinging, folding, drive-up windows and revolving doors since the early 90's. Their use is primarily for providing levels of safety for all the door types listed.

Active infrared (AIR) is commonly used in the pedestrian and industrial power-operated door industry. With a basic function to emit infrared to a target, typically the floor or ground, and analyze the reflected infrared via its internal receivers. The sensors, upon a successful setup, store a baseline reflectivity for detection. If the AIR baseline changes to either above or below its baseline, this change of reflectivity will cause the sensor to detect and reverse its output. Thus, providing a safety signal to the power operated door control.

BEAMS OF LIGHT

Photo beams, safety beams, light beams or pencil beams are all one in the same in the context of this article. They are another type of active infrared, that depend on an emitter in one location and receiver in another, aimed at each other working in tandem to provide presence detection. When a person or object interrupts the horizontal beam of light, they/it will cause the photo beam to signal the power door operator.

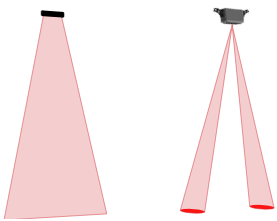


ABOVE THE DOOR HEADER

While the most basic opto-electronic sensor is in the form of horizontal light beams, presence sensors are typically mounted overhead on the door header, onto a moving swing door or the wing of a revolving door. These types of opto-electronic presence sensors utilize active infrared but are different in design and operation.

Some of these sensor types emit a focused active infrared which emits a focused beam of infrared light while other opto-electronic presence sensors emit a diffused active infrared. You can think of the diffused type as a fog of infrared. Both the focused and diffused infrared are capable in detecting movement or a static object/pedestrian.

These types of opto-electronic presence sensors have served the power operated pedestrian door industry well for many years. If installed and adjusted correctly, they provide compliance to industry standards, and reliable safety for these door types.



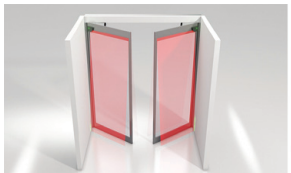
NEXT GENERATION

In late 2000's another type of opto-electronic presence sensor was introduced into the door market, Time-of-Flight (ToF) technology. These types of opto-electronic sensors are LASER-based and are challenging the pedestrian and industrial power-operated door industry as the dominant reliable safety solution.

ToF technology utilizes a LASER diode to emit IR and a photo-diode to receive the reflected LASER beam. Since we know the speed of light we can use this to our advantage using ToF technology. The time it takes to transmit a LASER pulse to the time it takes to receive it, divided by two, provides a distance component which is highly accurate. Therefore, we can now calculate where the floor/ground or target is via ToF technology.

> The time it takes to transmit a LASER pulse to the time it takes to receive it, divided by two, provides a distance component which is highly accurate.

Knowing this, we can adjust the detection field to basically hover or float a few inches above the floor. This is all assuming we are using ToF in a vertical array, but because ToF is independent of the background (floor), a horizontal application does not pose any challenges. The beauty of ToF is that it can be successfully and safely exploited in many ways in both a vertical or horizontal array.



WITHOUT LIMITATIONS

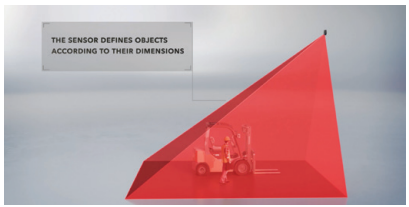
ToF technology utilizes a much higher resolution density creating a crisper defined detection field that has the ability to detect objects and people more precisely and quicker than all other active infrared sensors in the door industry to date. This technology coupled with a rotating varying degree highly precision edge beveled mirror spreads the LASER pulses at a rate of over 16,000 pulses per second with quantities of 270 points per curtain.

Along with background independence, detection fields of ToF sensors are breaking boundaries with adjustment capabilities by the inch to over 80 feet. Active focused infrared or diffused infrared presence sensors have never been capable to configure a detection field or object size detection capability to this accuracy.

Imagine an 80-foot by 80-foot ToF array with the ability to shape the field by the inch. Some can even be shaped by hand or body movement in lieu of a field programmed rectangle detection

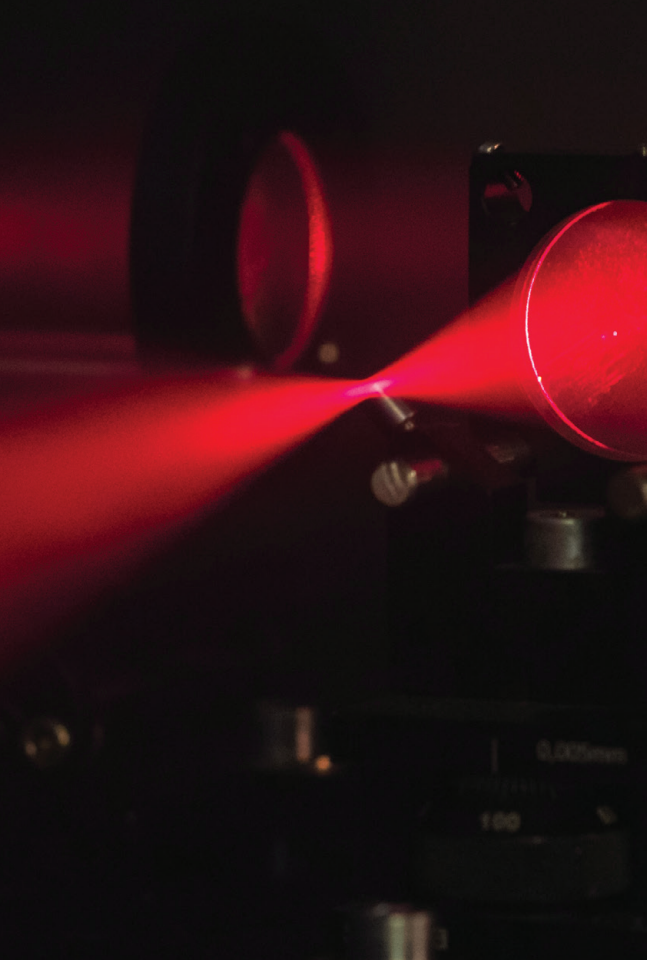
zone. Due to the higher resolution density, ToF has a smaller detection object size. For example, at 30 feet, ToF technology can detect an object of 2.75 inches. No human can defeat that.

With background independence and highly adjustable fields, the limitations of ToF sensors are proving minimal to zero. The most recent sensors are using object profiling to decipher the difference between pedestrian and vehicle traffic, as well as direction and speed with 3-D volumetric detection fields.



ToF technology is allowing installations the ability to exploit opto-electronic sensors in ways that we have never been able to in the past.

Jeff Dunham
Codes & Standards Manager, BEA



PRECISION

Detection fields can be defined to the inch

FLEXIBILITY

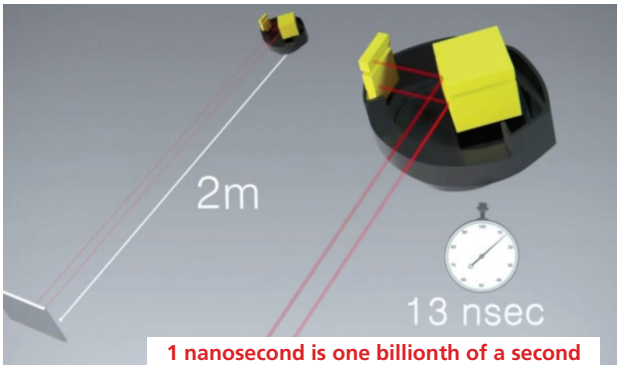
Detection with object profiling, static or moving, and trajectory

REFLECTIVITY

Not disturbed by shadows, noise, or IR interferences

HARSH ENVIRONMENTS

Housed in NEMA 4 rated enclosure



1 nanosecond is one billionth of a second

ACCURATE MEASUREMENT

Time-of-Flight is a mathematical principle that measures the distance between two objects.

LASER scanners using Time-of-Flight technology calculate the distance of an object based on the time it takes for a signal to bounce back to the transmitter.

EXAMPLE: By knowing the speed of light (299,792,485 m/s), a signal received in 13 nanoseconds has been reflected from an object two meters away.

TIME-OF-FLIGHT TECHNOLOGY

Foremost Farms USA & Deppe Enterprises partner with Rite-Hite to upgrade roll up doors in state-of-the-art cold storage facility

BEA Division - Industrial Automation Solutions

Industry Market - Cold Storage

Door Manufacturer - Rite-Hite

BEA Product(s) - LZR®-WIDESCAN; motion, presence and safety sensor for automatic industrial doors

INTRODUCTION

Foremost Farms USA and Deppe Enterprises recently partnered with Rite-Hite to upgrade a 300,000 sq. ft. dry storage warehouse in Baraboo, WI into a state-of-the-art cold storage facility. Renovations included wall-to-ceiling insulation, foundation permafrost prevention, automated pallet systems and the installation of Rite-Hite's FasTrax FR high-performance doors.

THE CHALLENGE

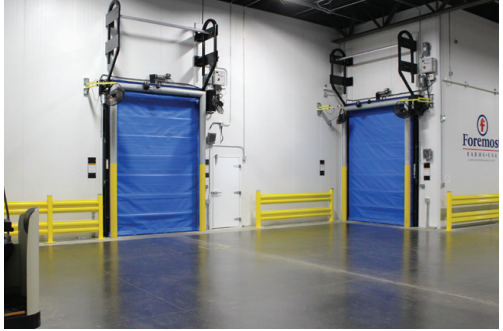
With a variety of temperature sensitive areas including coolers, freezers and ambient rooms, maintaining consistent temperatures are critical for cold storage operations. As proper food storage is demanding, Rite-Hite's FasTrax FR doors were equipped with microwave and infrared sensors to ensure proper door functionality as forklifts passed in and out. A month after renovations were complete, Deppe Enterprises received

notification that the temperature in a cooler section of the facility had climbed to unsafe levels. The culprit was a door stuck in the open position. Without noticeable floor markings or sensor tampering, the ghost cycle most likely resulted from the large fans that are used to combat frost buildup on the doors.

THE SOLUTION

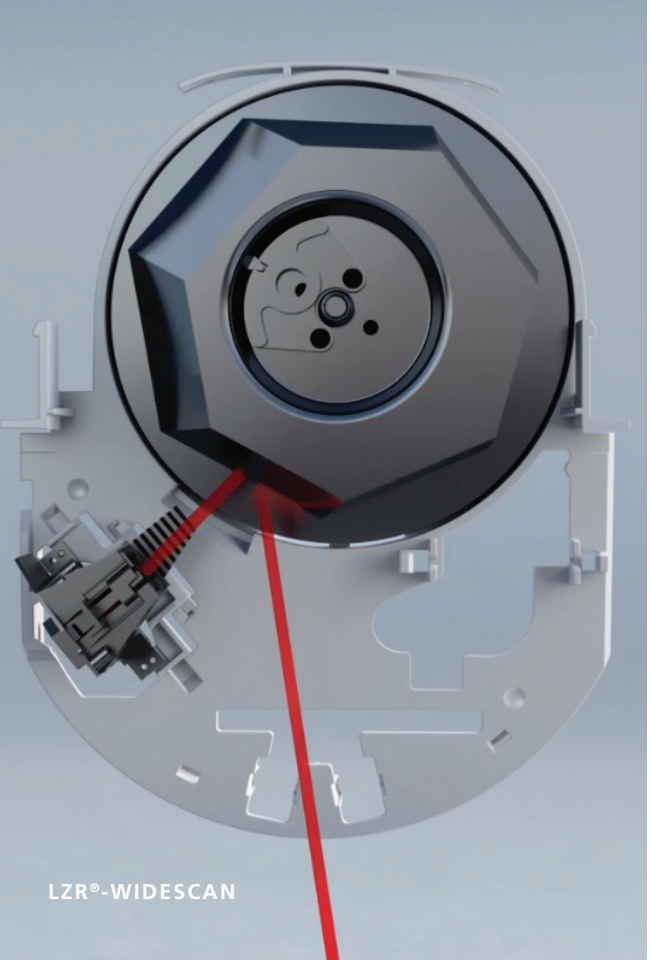
To avoid future interferences and resolve the ghosting doors, Rite-Hite worked with BEA to deploy the LZR®-WIDESCAN, a LASER-based sensor designed for activation, safety and presence detection on industrial doors. The advanced volumetric detection field has the ability to distinguish between objects based on their direction, speed, size and height. The LZR®-WIDESCAN also proved to be immune to the false activations triggered by the old sensors. Of added benefit, the LZR®-WIDESCAN included cross-traffic rejection meaning that forklifts passing, but not entering, a door would not trigger activation.

Along with utilizing a different technology, the LZR®-WIDESCAN also has a built-in heater setting, which proved essential in the -6 degree Fahrenheit storage areas. It's common for a sensor lens to frost over because of the negative degree temperatures in cold storage facilities. With the ability to turn the heater setting to auto, frosted lenses are avoided.



THE RESULTS

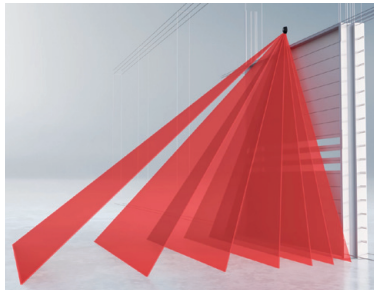
Since the LZR®-WIDESCAN sensors were installed in December 2017, the high-performance doors have been functioning without further issues.

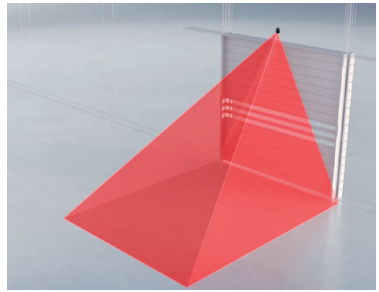


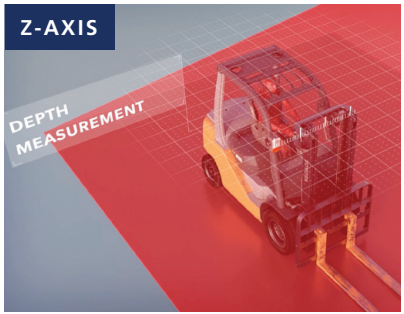
ADVANCED DETECTION

With pulses of light and a rotating mirror, LASER scanners generate multiple detection curtains. These detection curtains enable LASER scanners to provide **Volumetric Object Profiling.**

Whether the detected object is a person or vehicle, LASER scanners calculate the dimensions according to their X, Y and Z axis.







VOLUMETRIC OBJECT PROFILING

Metro Fence removes the need to saw into pavement for a non-contact solution on a barrier arm

BEA Division - Vehicle Sensing Solutions

Industry Market - Barrier Arm Safety

BEA Customer - Metro Fence Company, Inc.

BEA Product(s) - SUPERSCAN-T INDUSTRIAL - active infrared presence sensor

INTRODUCTION

Metro Fence installs fences throughout the Pittsburgh area ranging from standard chain link fences to access control gates and barriers. Approximately six years ago, their expertise in barrier arm safety was called upon by Western PA School for the Deaf (WPSD) to address a need for additional safety on barrier arms located throughout campus.

THE CHALLENGE

Access control at WPSD includes entry and exit slide gates as well as barrier arms that separate multiple parking areas throughout campus. Unfortunately, the primary entrapment protection devices began to fail on the barrier arms, meaning vehicles were no longer protected from potential arm/boom collisions.

THE SOLUTION

Instead of traditional photo beams, Metro Fence created barrier arm safety and free exit capability by daisy-chaining two SUPERSCAN-T INDUSTRIAL sensors side-by-side. The inbound sensor contains two master modules wired in a series, which both must be tripped for activation of the barrier arm; while the outbound sensors serve as a safety reset. For even more protection, the SUPERSCAN-T INDUSTRIAL sensors offer infinite detection within their range of eight to 10 feet, meaning that if an object is detected, they will never time out.

Unlike the typical transmitter and reflective receiver configuration, SUPERSCAN-T INDUSTRIAL sensors utilize triangulation; permitting the sensor to detect objects without relying on the background. A benefit of this is that it is not necessary to cut into the pavement for photo beam wiring, saving time and money.

THE RESULTS

The final install uses a combination of master sensor modules for activation and safety, while providing directionality for free exit capabilities. Without any

major maintenance issues, besides regularly cleaning the sensor lenses, all of the barrier arms have been functioning without interruptions for the past six years.

Next Generation Entrapment Protection

Within the last year, DASMA members were educated on the benefits of opto-electronic technology for the detection of objects, people and vehicles. This state-of-the-art detection method uses Time-of-Flight (ToF) LASER technology to accurately calculate the distance to and from an object. As the speed of light is measurable, we can use LASER ToF to create high-resolution detection curtains that are extremely precise. A tried and true technology, ToF is used on the golf course, on construction sites and in your own home to measure distance.

ARE THERE LIMITATIONS?

Time-of-Flight technology has few limitations and its versatility makes it ideal for the overhead door, barrier arm, and gate industries. It can be positioned vertically or horizontally and on both moving and stationary door sections. LASER technology has redefined opto-electronic sensors from infrared curtains to 3D-volumetric detection fields that can calculate the size, speed, height, direction and location of an object within its detection field.

Compared to photo beams that are typically installed near the floor area and only cover about 1% of the door opening, LASER technology can easily provide about 97% entrapment protection of a given door opening. LASER technology can easily provide about 97% entrapment protection of a given door opening. For example, the width and/or depth of the detection field can be adjusted by the inch as well as how far the

detection field hovers above the ground when used in vertical applications.

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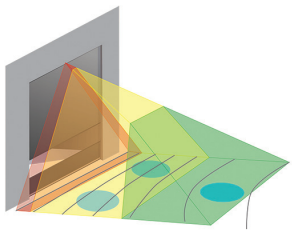
PRECISE DETECTION WITH ENDLESS POSSIBILITIES

Opto-electronic sensors utilizing LASER technology typically take measurement pulses at a rate from 10,000 to 16,000 times-per-second, while having the ability to detect objects within a fraction of a second. This amount of speed and precision creates a very high-resolution safety and/or activation device for overhead doors, gates, barrier arms and many applications outside of door/gate entrapment protection needs. Most types of sensors utilizing this technology are manufactured and assembled within a NEMA 4 / IP 65 rated housing making it suitable for inside, outside and in harsh weather conditions.

As mentioned previously, ToF technology can be used in a vertical or horizontal array:

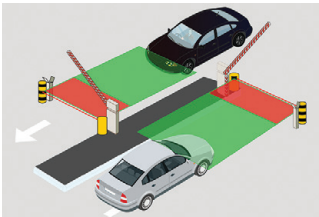
Applying this technology in a vertical plane allows the installer to shape the detection field down to the inch and have it hover just a few inches above the floor or ground, while providing an invisible LASER plane(s) of detection for most of the door opening. Depending on mounting location, the detection field can easily cover a zone that is more than 100% of a door opening and can provide extra protection to each side of an opening to detect occupants and vehicles approaching from any angle.

An example of a vertical application using ToF technology would be a high-performance door needing a pull-cord function. Since we can determine the size and location of objects with 3D-volumetric detection fields, we can configure a virtual pull-cord function



that targets a specific area. When a forklift or vehicle stops at the designated spot and for the prescribed amount of time, then and only then, the door or gate would be triggered to open. This is all done while providing entrapment protection within the vicinity of the door threshold.

Applying this technology in a horizontal plane creates an extremely effective "floating carpet affect" for barrier arms and other applications. This eliminates the need to cut loops into the ground. It can also be applied just like a photo beam but with the ability to provide a depth component.



An example of this application would be creating a virtual loop function for barrier arms with a horizontal plane on each side of the barrier arm or one side. Additional capabilities allow for directionality for initial detection to ensure the traffic is actually headed towards the barrier arm. This minimizes false detections when objects enter the detection field.

COULD THERE BE CHANGES TO UL325?

UL325 7th edition mandates external entrapment protection devices but has yet to include opto-electronic sensor technology. This is expected to change with the current language, which is now being drafted. The intent is to include LASER-based opto-electronic sensors into UL 325 to allow ToF technology to be utilized as entrapment protection devices within the commercial and residential door, vehicular gate operator and barrier arm operator industries.

Once LASER-based Time-of-Flight technology is understood, there can be limitless applications to where it can be installed, including:

- Non-contact entrapment protection
- On or off the door
- Detection and/or filtering of objects, people and vehicles
- Virtual pull cord or knowing act functions

Jeff Dunham
Codes & Standards Manager, BEA

HORIZONTAL APPLICATIONS

By operating independently from the ground, LASER-based scanners can also be mounted in **horizontal applications**.

The same benefits of LASER scanners on high-speed doors are translated into horizontal applications:

- Activation & Presence Detection
- Independent of Ground / Weather Conditions
- Trajectory Rejection
- Pedestrian Rejection
- Teach-In via Walk-Path or Remote Control

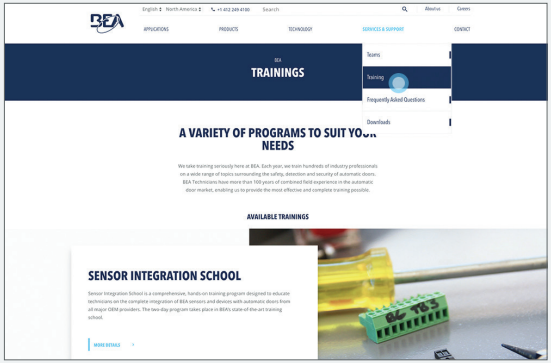
Multiple Relays

Cross-Traffic Rejection

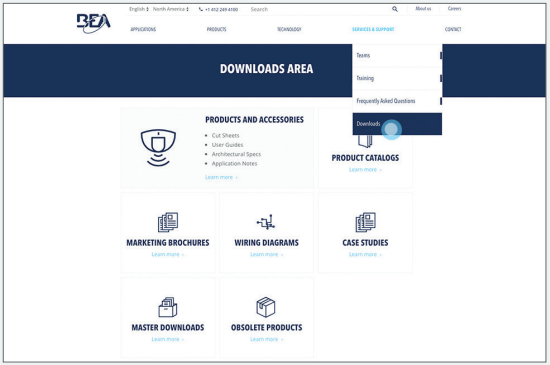
EDUCATIONAL RESOURCES

Along with Technical and Customer Service support,
BEA offers educational resources on our website:

www.BEAinc.com



Reference our Training page
for class and webinar schedules.



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