Improved Immunity to Ambient Light

Today’s elevators require light screens to be totally immune to all ambient light sources. Many passenger elevators in new buildings use glass window panels that expose them to direct sunlight. In addition, many new buildings are utilizing the newer fluorescent light fixtures that pulse at much higher frequencies. These situations can cause erratic performance by elevator door light screens designed in the past.

In industrial and airport buildings, many forklift trucks and passenger vehicles use high-powered strobes that can also interfere with light-screen door-control performance. The newly introduced Leading Edge™ system is designed to withstand all ambient light sources found in these and other tough environments. It should also be noted that the new high-frequency fluorescent lights and high-powered strobes can also interfere with some of the original backup photoeyes mounted 5 inches and 29 inches above thresholds on many elevators equipped with mechanical safety edges. This can be an overlooked problem in some applications.

Improved Immunity to Static Discharged and RF Transmitters

Even today, many elevator passengers reach out and place their hands across the edge of doors, as they did on mechanical door edges in the past, to keep the doors from closing on them. When this hand contact occurs today, a high-voltage static discharge could go through the housing and circuitry of the electronic light screen arrays. These high-voltage discharges cause “unexplained” door-protection system failures that often occur in winter months when humidity is extremely low. An example would be walking across a carpet and touching the edge. The new systems are designed to withstand interference from static electricity discharge, as well as from high-powered walkie talkies, cell phones and strong RF signals radiating from airport radar systems.

Improved Resistance to Water Damage

Many elevators are exposed to the detrimental effects of water. This is especially true with outdoor elevators, with parking garage elevators and during elevator lobby cleaning. The Tri-Tronics system was designed for the National Aeronautics and Space Administration (NASA) to withstand the release of 320,000 gallons of water on the launch-pad elevators during shuttle launches. There are no “O” rings or gaskets used; instead the system is completely epoxy filled. It will even resist leakage when completely submerged and will survive high vibrations. The Leading Edge is excellent for condos, hotels and other buildings located near saltwater, since it will resist contamination and circuit-board corrosion.

Improved Operation Under Brownout and Power-Up Conditions

The 120VAC power used for accessory control devices found in many elevators can sometimes vary to the point where it can be quite low. To be safe during a brownout condition, the light-screen edge should operate at a voltage of 85 to 90VAC. The power supply/controller should also be capable of withstanding high voltages of 150 to 160VAC. After a power outage, when the power is restored, the system must also withstand erratic transients that in the past have “locked up” many microprocessors. These types of failures usually require a service call. It is important to utilize a system that can withstand these conditions.
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The Need for Wide-Beam Optics

Early light screen edge designs often made it difficult to align the multiple transmitted light beams with the receivers. This is a problem on older unstable elevator doors. The Leading Edge design allows the system to operate on doors that are misaligned by as much as ±30° at a distance of four feet between doors. This system has also been used with success on many round elevators that have a very tight turning radius.

The Need for System Compatibility

Many systems are designed with the microprocessor and control logic built into the power supply/controller. This requires the purchase of all three components, the controller/power supply, the light source array and the receiver array. A system that incorporates the microprocessor and logic necessary to function built into the arrays is a more effective setup. In some cases, only the light source and receiver arrays need to be purchased.

Simplifying Installation

Low-cost light-screen door controls are often the most difficult to install. If they take longer to install, the initial cost savings of the equipment can quickly disappear and additional costs could incur. The Tri-Tronics system is easier and quicker to install. Threaded studs and brackets are used on the doors. For mounting the arrays on difficult door jams, nylon adapters that screw onto the studs are provided. Push-in nylon fasteners then make it easy to mount on the jam by simply drilling holes.

Center-opening door installation

Easy push-in fastener array installation

The control board includes array connections that are interchangeable and short-circuit protected. It also includes a System Test button to simulate a beam break for a complete system test and a Control Relay Test button. As a result, Leading Edge installation can be accomplished by a “single installer,” and the entire system can easily be tested from the top of the cab.

Simplifying Diagnostics

Most light-screen door controls include a full complement of LED indicators on both the receiver and light source arrays that are useful for troubleshooting problems. All that is required to test the Leading Edge system is the use of the relay and system test buttons on the control board while monitoring the response of the system.

Side-parting door installation

Simple two-button diagnostics
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If the output control relay does not energize when depressing the Control Relay Test button, the problem is most likely the control circuit board. If the relay energizes and the door does not close, the problem could be faulty control relay contacts or failure of the door operating system itself.

If the system does not respond properly when depressing the System Test button, the problem is with one of the arrays. Monitoring the LEDs on the arrays will reveal which one is faulty.

Enhancing Appearance

The interior appearance of the elevator has become a more important issue with today’s new building and renovation designers. The Leading Edge offers arrays in a choice of conventional black, brilliant silver or gold to enhance any elevator decor.

Lowest Applied Cost

In the selection of elevator door controls, a system that incorporates low initial purchase price and installation costs and high reliability is of paramount importance.

Robert A. Warner has been instrumental in the design, development and manufacture of photoelectric sensing devices since 1969. He served as part owner and vice president of Unidyne during the 1970s. When Tri-Tronics purchased Unidyne in 1976, Warner served as senior vice president of Product Development. He has continued in the innovative development of photoelectric elevator door products for the past 17 years.
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by Jennifer Fenton, Marketing Manager, Memco Ltd.

Memco Ltd. and its sister company in the U.S., Janus Elevators, offer an extensive range of elevator door safety products coupled with a wide range of fitting solutions to offer maximum flexibility to customers.

At Memco, the research and development team works closely with input and feedback from the sales and service teams to ensure that new products are relevant to the needs of customers. The products are also designed for ease of installations, saving time for everyone.

The Memco Detector Families

Pana40 Plus

The Pana40 Plus family of detectors is programmed using a Model 840 series controller to generate either a 40-beam parallel light curtain or an optional 194-beam crisscross pattern. Any interruption to the infrared beams across the lift door opening activates a relay which, through the door operator, can stop or reverse the closure of the lift doors. The detectors are available in a range of widths from 43.5mm down to 9mm and with a special thin version for slampost mounting. The availability of profiles in these sizes simplifies fitting to the widest range of door types, both dynamically and statically.

The 840 controllers use micro-controller technologies with software to:

- Control the detectors
- Perform self-test checks
- Measure the received infrared signal
- Update trigger thresholds
- Make trigger decisions
- Switch the system into “sleep mode” when not in use

The controller's printed circuit board and metal housing have been designed to allow easy access and installation. A pluggable terminal block is provided for easy wiring installation. The main trigger relay has a socket, which is provided for quick relay replacement if necessary.

LED displays are provided for status updates. The service engineer can easily locate these; there is a window in the controller housing that allows the display to be viewed without removing the lid. In Normal Mode, the display indicates whether the controller is scanning, triggered or in one of the timeout states shown in Figure 1. The controller can also be switched to test mode, which allows the display to show diagnostic information.

Other safety features, which service engineers can use to help with setting-up and checking, include:

- A Tone Switch – When enabled, the controller emits an audible tone if the unit is triggered, i.e., if either detector is unplugged, or the cable severed.
- System Self-Test – The controller’s software measures the regulated power supply voltage. If it senses that a detector has become unplugged or the cables are cut, it will cause the lift doors to be held open.
- Fail Safe Operation – The controller has been designed to fail-safe in the event of system fault or the loss of the supply voltage. It will hold the lift doors open until the fault is cleared.
- Light Curtain Timeout – This switch allows a partially damaged detector to continue working safely until it can be replaced. It does this by ignoring a permanent trigger on up to five non-adjacent beams (e.g., due to vandalism). The timeout period is adjustable from 10 seconds to 70 seconds. On 194-beam controllers, only four non-adjacent beams are allowed to timeout.

Pana40 Plus 3D

This is the Memco second generation detector family. Internationally patented, Pana40 Plus 3D is designed to deliver the optimum in passenger safety.

The 3D detection system holds the lift doors open when it senses objects or people approaching in a detection zone outside the landing doors. The system is designed so that doors do not begin to close until the detection zone is clear, thus reducing collisions and therefore damage between landing doors and wheelchairs, pushchairs, etc. In addition to the convenience to lift users, door damage is sharply reduced, often by 50% or more.

The latest generation system improves safety with two independent detection systems (see Figure 2):

![Figure 2: The operating principle of the Pana40 Plus 3D showing the sensitive zone projected in the landing](image)
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1. Light curtain – Infrared beams operating between the doors.
2. 3D detection – Infrared proximity detection operating in the landing zone.

Any object causing interruption of the direct beams or reflections within the 3D detection zone will trigger the system and re-open the lift doors.

The 3D detection is achieved by infrared light beams reflecting from objects in the 3D zone. These beams operate upwards, downwards or straight out from the detectors at an angle of approximately 45° to the plane of the door. The 3D detection range is approximately half the width of the car door opening.

The system can be configured for different operating modes to suit different installations, for example in an assisted-living facility the elderly and infirm may take some time to pass safely in and out of the lift. Any object that interrupts the direct beams or reflections within the 3D detection zone will trigger the system and reopen the lift doors.

The 3D detectors are suitable for both new and existing lifts and can be manufactured in various profiles (as the Pana40 Plus system) to suit a wide variety of doors, including both center- and side-opening doors.

Standard: Part No. 770 000

The Standard detectors are designed to fit on the side of the door, flush with the door edge. They are fixed using self-tapping screws, through height-adjustable brackets and covered by a vandal-resistant finger guard (see Figure 3). These detectors are particularly suitable for center-opening doors with a wide running clearance where the detector also doubles as a sightguard. The cable may be routed from the top of the detector or down inside the housing and out the middle of the back. The cable can be secured with the P-clips provided.

Leading Edge: Part No. 770 010

The Leading Edge detectors are designed to fit on the leading edge of the door or on the slampost. These detectors are particularly suitable for side-opening doors, but can be used on center-opening doors. The door or slampost is drilled in four places, and the detectors fitted by means of captive bolts, sliding in a track on the back of the detectors. Alternatively, the detectors may be secured through the detector housing on the door edge, using the screws provided (see Figure 4). Fixings for both methods are included in the fixing kit.

Mixed Set (Standard and Leading Edge): Part No. 770 020

The Mixed Set is convenient for side-opening doors, where it is desirable to have a Standard TX detector on the door and a Leading Edge RX detector on the slampost (see Figure 5). If the door opens in the opposite direction, it will be necessary to swap the plastic lenses so that the TX is kept on the left-hand side.

Slimline: Part No. 771 000

The Slimline detectors are 15.5mm wide and designed to fit on the side of close-coupled doors. The detectors are mounted to the side of the car doors using the self-tapping screws provided in the fixing kit. Optional PVC finger guards (Part Nos. 007 137 and 007 138) are available to fill the 30mm gap found on some door types (see Figure 6).

Ultraslim: Part No. 774 000

The Ultraslim detectors are 9.8mm wide, which allows them to be fitted to virtually all lifts. They are particularly suited to lifts with narrow running clearances. The detectors are mounted to the side of the car doors using self-tapping screws provided in the fixing kit (see Figure 7).

The Pana40 Plus 3D Controllers operate the Pana40 Plus 3D detectors. They are housed in a black steel box, which is normally fitted on top of the lift car using self-tapping screws. The controllers are available in several versions to suit individual requirements.

The Elite Range

This range is centered on the 632 and 633 models, which are designed for both new and existing installations.
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The detectors are fitted either dynamically on the doors or statically on car-mounted brackets. They generate a crisscross curtain of 154 infrared beams.

Memco uses surface mount technology to build the Elite Model 632 detectors and improvements in optics now allow diagonal beams to function to door close. The special lenses are used with the surface mount transmit and receive diodes. Each detector is housed in a 9mm profile.

The Elite Model 633 consists of two 32mm-wide detectors and shares the software features of the 632. For example, a timeout option is available. If this is enabled, then it will allow up to five non-adjacent infrared TX diodes to be ignored if they are permanently obstructed. After a 10-second delay, beam scanning is then resumed – a useful service feature as the TX diodes can be ignored while arrangements are made to replace the unit.

New to Memco is the Elite 3D system – Model 674. This latest development complements the Pana40 Plus 3D family and adds extra functionality to the Elite range.

**What Are the Main Differences Between the Pana40 Plus 3D System and This Innovative Elite 3D System – Model 674?**

Model 674 has the same two independent detection systems as the Pana40 Plus 3D coupled with a light curtain of 154 crisscross beams. This has been designed for both new and existing installations with low power consumption. Each detector housed is in a profile 9.8mm wide. There are two orange LEDs positioned 29cm and 31cm from the top of the TX detector to give the service engineer status information when checking the installation.

Memco recommends installing the 674 system with a Memco 280 or 281 power supply. However, in many installations, a separate controller is unnecessary, and the detectors can be connected directly to the door controller or lift operator, if it has a suitable power supply and “door-reopen” circuit (see Figure 8).

Memco offers after-sales support and service and a wide range of brackets, clamp plates, clips, coverstrips and sightguards to cover as many installation options as possible. For dynamic installations, the Igus claim protects the detector cable (see Figure 9).

There is also a fixed installation kit containing all fixings needed for installing a set of 9mm profile detectors in a fixed position at either end of the lift car sill. See typical installation in Figure 13.

Memco offers after-sales support and service and a wide range of brackets, clamp plates, clips, coverstrips and sightguards to cover as many installation options as possible. For dynamic installations, the Igus claim protects the detector cable (see Figure 9).

Other elevator safety products from Memco include two new products:
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A) Memco Vision System

This is a new sensor for both landing doors and automatic doors, providing video output, currently being launched in Europe. The system is designed to be mounted above the door on the landing and to open the door according to the movements of people within the field of view of the camera. The sensitive zone is fully variable over a span of 0.5 to four meters from the door and three-meters wide via internal switches. There is no need for any further mechanical adjustments.

Main features of the Memco Vision System

- Detects moving and stationary passengers right up to door entrance.
- Fast, easy fitting using single digital module with up to two vision heads.
- Eight different operating modes; flick a switch to match the system to the application.
- Streamlined door operation; opens only when needed, ignoring passing traffic.
- Provides video surveillance of the door area for security of lift lobbies and landings.
- Four-meter approach zone allowing no waiting for doors to fully open.

B) Chromaline

The Chromaline edges glow green as the lift doors open and glow red as the doors are about to close and while they are closing.

This full line of door protection systems will ensure safe and reliable elevator operation on both new as well as existing elevator installations.
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INFRARED DOOR PROTECTION DEVICES
INSTALLATION AND MAINTENANCE

by Peter Thomson, GM Engineering, and Ned Badis, Technical Manager, TL Jones (Microscan) Ltd.

Modern elevators are generally fitted with a power-operated car and landing doors, which automatically open and close on arrival and departure from the floors they serve. Relevant elevator codes worldwide call for door re-opening devices to be fitted to these power-operated doors, which, in the event of an obstruction occurring during the automatic door-closing sequence, operate to re-open the doors. In the past, these re-opening devices were in the form of a mechanical edge or shoe device, which when contact was made with an obstruction would operate a mechanical switch to initiate the elevator door operator’s re-opening circuitry. While these devices were generally reliable and efficient, they relied on having to make “physical contact” with the obstruction or person before operating and re-opening the car and landing doors. Development of “non-contact” door re-opening devices has now, in most cases, rendered the mechanical type safety edges obsolete, these non-contact devices are generally infrared-based technology and consist of multi-beam transmitters and corresponding receivers, which interface with the elevator door control circuitry via “dry or voltage-free” relay contacts.

These electronic microprocessor-based infrared devices, which are sometimes referred to as “light curtains” or “entrance detector screens” normally consist of three parts: a power supply, a receiver unit and a transmitter unit. The receiver and transmitter units are normally mounted on the car doors adjacent to the leading edge, opposite each other, providing dynamic coverage across the elevator entrance. The power supply is mounted on top of the car or in the car-operating panel. The power supply also contains the relay interface for connection to the elevator door operator circuitry. These systems are designed to be fail safe. If power to the systems is lost or a cable is broken, the output relay is de-energized resulting in the re-opening of the elevator door, the same event would occur when there is an obstruction or “broken beam” in the door opening.

The systems are tested to ensure high immunity to EMC electrical radiation and do not emit harmful radiation. They are also immune to sunlight or any other direct light sources, and most systems carry the appropriate approvals and certifications. The systems are normally factory pre-wired and fully tested. Plug-in wiring kits and the necessary mounting hardware ensure trouble-free and simple installation.

The advantages of these infrared door protection systems over earlier traditional mechanical systems are many but include additional protection provided by multi-beam cross-scanning features (up to 212 functional beams), which, if any one or more are broken or interrupted will, if the doors are closing, immediately signal the doors to reverse without having to “make contact” with the obstruction and, if already open, will not attempt to close until the car entrance is clear and unobstructed. This is a major benefit in situations such as hospitals, retirement residences, hotels and office buildings, where the intimidation of users by moving doors is of concern. Where the elevator installation has a slow-speed door-closing feature, a nudging feature and warning alarm can also be incorporated into this system. This is used to signal that after a predetermined time, the doors close at a reduced speed and torque in accordance with relevant elevator codes. A further advantage of the infrared door protection systems’ “broken beam” principle of the doors not closing while an obstruction is present, is the elimination of the large number of door-reversing cycles the door operator equipment is forced to perform with the mechanical-edge system until the obstruction has been removed. A door system fitted with an infrared re-opening device will not attempt to close if open and does not have to repeatedly “make contact” with an obstruction in the entrance before re-opening. Over the lifetime of the door operator, this greatly reduces the wear and tear on this expensive piece of equipment, thus reducing maintenance costs. Historical evidence has also revealed that elevators fitted with infrared “non-contact” door protection devices have significantly less door-related problems compared with those fitted with mechanically operated “contact” devices.

Infrared door protection devices can also be seen as an excellent device for “modernization” and “refurbishing” projects, providing an upgrade to the latest in door protection technology at a very reasonable cost making this a very viable first step in a modernization program. Infrared door protection devices can also be configured to meet individual OEM door-operator manufacturer’s specifications and requirements and can be incorporated into their “door packages” shipped direct to the customer.
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Installation

Most infrared door protection systems consist of a receiver unit, a transmitter unit and a power supply/controller unit. These parts are connected to each other through cables ranging from specialized multi-wire cable looms to very simple three-way cables. Although infrared systems are supplied ready for center-opening doors installation, most manufacturers supply special kits for installation on side-opening doors (strike jamb kit).

During the installation of the infrared units, it is important to pay extra attention to the following points:

- It is recommended that the transmitter and the receiver units be mounted slightly back from the leading edge of the door panels (e.g., 1/4 inch). This prevents repetitive impact damage to the transmitter and the receiver and therefore prolongs the life of the door protection system.
- Ensure that both transmitter and receiver are vertically plumb and inline. Both transmitter and receiver should be placed on a packer (e.g., 1/4-inch-thick wooden block) to ensure that both units are installed to the same height from the floor. Please note: it is important that the bottom beam height be within one inch of floor level as this provides foot detection.
- Door-detection systems supplied with means for unit grounding offer extra protection against electrical noise. Special care should be taken to ensure that the grounding is done properly. It is also advisable to make sure that a continuous ground connection between the elevator doors and the elevator car is achieved. This could save the installer unnecessary callouts for intermittent faults caused by bad grounding.
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As infrared-detection systems transmit beams from one side of the entrance to the other, it is important to make sure that the receiver and transmitter units are properly aligned.

For elevators with side-opening doors, make sure that the edge to be mounted on the door panel (receiver or transmitter) is installed first, and then use this side as a guide to align the edge installed on the strike jamb. Pay particular attention to alignment when the doors are fully closed.

The cables should be routed away from and not run parallel with other wiring to minimize the possibility of electrical interference. It is advisable to avoid any bending over sharp radius, as this could cause damage to the cable over a period of time. The use of cable ties in the appropriate positioning helps minimize the risk of cable damage, while the use of cable restraints prevents the cables from swaying and catching on other elevator parts.

It is always a good practice to make sure that the door protection system is powered from a clean supply power source, and that the system’s power supply unit is properly grounded to the elevator car.

After the system has been initially installed, check that the path of the beams between the transmitter and the receiver is not blocked by the door gear equipment (door vane pickups, couplers, etc.).

Maintenance
During routine elevator maintenance visits, it is recommended that the following procedures are carried out.

- Use a clean, damp cloth of nonabrasive material to wipe the receiver and transmitter lenses. Avoid vigorous rubbing as this can cause static buildup. Dust may accumulate on the lenses and can affect the operation of the system if left unattended.
- Closely inspect the cables between the transmitter/receiver and the power supply/controller unit for any cuts and chaffing or rubbing. These could indicate potential cable failures.
- Ensure that the cables are hanging freely and not likely to snag or catch on other equipment. Check with the car doors both fully open and closed.
- Check connectors and terminations between transmitter, receiver and power supply for any loose fixings.
- A routine check should also be carried out for damage and that the units are securely fixed to the car doors and strike jam.
- Finally, check that the system operates correctly by blocking any of the beams and check that the doors re-open. If the system has a nudging feature, check that this operates after the predetermined time delay and that, if fitted, the warning alarm sounds.

Troubleshooting
Most infrared door protection systems are equipped with diagnostic indicators on the receiver/transmitter.
and/or power supply/controller unit to assist elevator field personnel with fault finding. Each manufacturer uses a different indicator combination to indicate a particular failure scenario, such as “broken beam” conditions, but the process of troubleshooting is generally very similar. The following are possible scenarios and corresponding steps to follow:

Elevator doors remain open without any obstruction between the doors.

- Check lenses for dust, dirt or any other object that might be stuck to the lenses.
- Check transmitter and receiver for alignment.
- Check power supply for correct supply voltage and good contact on output signals terminal blocks.
- Check that both transmitter and receiver are powered. (Using indicator lights or a multi-meter to verify supply voltage).
- Check cables for any cuts or breakages, and check connectors and terminations to ensure good contact is made.
- Check relay activity by turning power on and off to the power supply unit.
- Check for any source of excessive direct infrared light to the receiver.

Elevator doors intermittently re-open during closing without any obstruction between the doors.

- Check lenses for dust, dirt or any other object that might be stuck to the lenses (also check for excessive buildup of floor wax on lower section of the lens, this can also cause this problem).
- Disable door operator and manually close doors to the point where the unit false fires. At this point, check for misalignment between the transmitter and receiver. Also check for breaks in the cables which could cause intermittent faults.

**Conclusion**

Electronic door-detector units have changed significantly during the last two decades. It is now a mature product, and the first choice in providing car door protection for most companies.

Major benefits include:

- Longer life for the door operators due to lower number of operations.
- Compliance with the disablement codes.
- Potentially less callbacks for door-related problems.

There has been a significant change in the initial cost for these products and reliability has improved, so that now, most manufacturers are offering extended warranties.

Important issues to note when selecting electronic door-detector units are:

- Selecting a unit that is suitable for both side- and center-opening doors. This will keep inventory costs down and save time at the site.
- Consider the time it takes to install different units. The savings you may think is available with the initial purchase price may be lost at the installation time.
- Check the cable used on the units. As these products are installed on the leading edge of the car door, the cable will be constantly moving. Look for simple plug-in cables and the lower the number of cable conductors the better.
- Water and dust will cause problems. It is better to look for a detector that has a high rating for this. Look for either Nema 13 or IP65 as a minimum requirement. Most callbacks to detectors will be attributed to water and or dust entering the units.

This technology will continue to develop further. Currently combination 2D and 3D units are available. These products provide a degree of sensing into the landing area. Right now, this detection is limited to a triangular zone from the transmitter and receiver units. The distance between the car doors determines the area of 3D scanning. Combination mechanical safety shoes with electronic detectors built into the nose of the shoe are also available. This type of unit can provide the best of both technologies. In most cases, the safety shoe will be provided in the same mechanical design as the proprietary product.

When choosing a supplier for electronic door-detection devices, look beyond the initial unit cost. There are other areas of potential hidden costs.

Have a checklist:

- Initial cost.
- Installation time.
- Reliability of cables.
- Choose a unit that has angled beams in operation at final door closure. Units that switch to only parallel beams as the doors close will leave areas where there is no detection.
- Units to suit both side and center openings.
- Availability of supply.
- Delivery time.
- Product support, both before the purchase and after.
- Warranty period.
- Cost of spare parts.