Radar Sensors for Anti-Collision and Equipment Positioning

Detection Where It's Needed. Protection When It Counts.

- Add a layer of equipment protection and hazard prevention with object detection that remains reliable even in challenging indoor and outdoor conditions

- Reduce the risk of collision and help mobile equipment move efficiently through high-traffic environments with configurable detection zones

- Enable precise positioning and control of everything from large heavy-duty vehicles to smaller specialized industrial equipment—with reliable measurement that is unaffected by size, color, or surface finish

- Improve awareness in high-traffic zones to prevent collisions and equipment damage by combining radar detection with visual and audible indication

BANNER ®

Radar's Role in Mobile Equipment

Radar supports two critical needs in operations where vehicles play a central role: avoiding collisions and ensuring accurate equipment positioning. With long sensing ranges and strong resistance to environmental conditions that compromise the reliability of other sensor technologies, radar provides reliable detection of moving and stationary objects, along with a powerful layer of protection to keep operations running.

Anti-Collision

In dynamic environments where vehicles and equipment are in motion, a momentary lapse in attention can lead to costly collisions. Equipment protection and operator feedback are two complementary anti-collision strategies: one restricts motion, the other informs action, and both help prevent equipment damage. Equipment protection means automating functional restrictions based on object detection—like forcing a stop or governing speed. Operator feedback means using detection to drive indication—like an LED and audible alarm signaling when a forklift gets too close to a structure so its operator can avoid collision.

Equipment Positioning

In applications where consistent distance or accurate alignment are essential, small miscalculations can lead to costly errors or equipment damage. Distance measurement and alignment detection are two common forms of equipment positioning: one helps ensure consistent spacing, the other ensures alignment, and both help ensure a task is completed with greater accuracy. Distance measurement involves maintaining distance relative to another object, like maintaining fixed spacing between vehicles. Alignment detection ensures correct orientation relative to a fixed target, like aligning a lifting device with a docking point.

Benefits of Radar Sensing

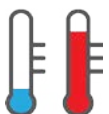Resistant to wind, rain, snow, fog, and sunlight

Long sensing range

No moving parts, durable, less downtime

Operates across a wide temperature range for indoor and outdoor use

Highly resistant to interference or crosstalk

Detects moving and stationary objects

Radar Sensors for Anti-Collision and Equipment Positioning

Q90R

Q90R2

T30RW

T30R

K50R

Anti-Collision

Obstacle Detection for Autonomous Forklifts

Challenge

Autonomous forklifts that use 2D lidar safety scanners can only detect obstacles within a single horizontal plane—usually at ground or ankle level. As a result, objects located above that plane, such as raised pallet edges, shelving overhangs, or suspended obstructions, go undetected. This leaves a large portion of the forklift's path unmonitored, increasing the risk of collisions and equipment damage.

Q90R2
High-Power
Multipurpose
Radar Sensor

Solution

- The Q90R2 Radar Sensor's 120° × 40° field of view provides complimentary coverage above the 2D lidar plane, reducing the risk of collision with elevated and suspended objects
- Two independently configurable detection windows can be set to known obstruction areas such as pallet height or shelving clearance, enabling targeted coverage and preventing collisions
- Detects both fixed and moving objects with 50-millisecond response time, helping prevent collisions with sudden obstacles like falling items

Proximity Monitoring for Boom Lifts

Challenge

Preventing costly damage and downtime caused by contact between articulating boom lifts and nearby structures requires more than operator vigilance. Even an attentive operator is not immune to accidental error. Too much focus in one direction increases the risk of missing rapidly closing gaps in others. Once an obstacle is out of sight, the risk dramatically increases. Effective monitoring would require both coverage of the full potential path of motion while reacting only to objects within a defined range and reliability in environments where dust and debris accumulate.

Q90R2
High-Power
Multipurpose
Radar Sensor

Solution

- The Q90R2 detects obstacles throughout the lift's range of motion without requiring multiple sensors for full coverage, reducing cost/complexity
- Radar-based detection is unaffected by environmental factors like dust, debris, or ambient lighting, ensuring reliable performance in a wide range of conditions
- Adjustable sensing field ignores objects beyond a defined range, reducing false detections caused by objects outside the lift's reach
- Fast 50-millisecond response time enables rapid intervention to reduce the risk of collision

Anti-Collision

Automated Speed Governor Activation for Forklifts

Challenge

Forklifts that need to operate in both outdoor and indoor environments require operators to reduce speed indoors, where obstacles are more frequent and visibility obstructed. Signage and policy alone do not eliminate operator inconsistency. Installing a fixed-speed governor to an entire fleet slows down outdoor operations where higher speeds may be allowed. Automating governor activation would require a sensor unaffected by environmental conditions and capable of detecting overhead structures of significant height.

**Q90R
High Power
Radar Sensor**

Solution

- The Q90R Radar Sensor's wide 40° x 40° beam pattern extends out to 20 meters (65 feet), detecting overhead structures to trigger a speed governor when the forklift moves indoors
- Reliable in outdoor and indoor conditions, radar-based sensing ensures consistent detection regardless of lighting, weather, or visibility
- Configure once and apply the same settings to an entire fleet of forklifts with Banner's free Measurement Sensor Software

Approach Distance Monitoring for Belt Loaders
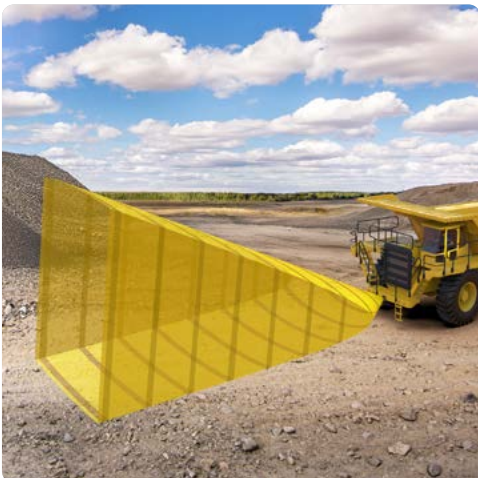
Challenge

Ground support equipment (GSE) drivers operate quickly to keep up with busy flight schedules. Aircraft ground damage caused by GSEs, such as belt loaders, can result in significant delays, costly repairs, and considerable indirect costs including aircraft replacement and passenger rebooking. To help the belt loader avoid damaging fragile aircraft, a reliable system is needed that informs the belt loader's governor when to slow the vehicle.

**Q90R2
Multidimensional
Radar Sensor**

Solution

- The Q90R2 sensor dependably detects a diverse range of targets, including shiny metal plane bodies, in varying outdoor conditions on the apron
- The 120° x 40° beam pattern reliably measures curved surfaces so it can provide accurate information about the vehicle's location in relation to aircraft, letting the governor slow the loader at the appropriate time for safer and easier positioning

Blind Spot Monitoring for Mining Vehicles

Challenge

Detecting obstacles in large blind spots around mining vehicles is especially difficult in the harsh conditions of mining operations. Most sensing technologies cannot remain reliable in the full range of environmental conditions that operators contend with on a daily basis. Dust, debris, heavy winds, rain, glaring sunlight, and other harsh environmental conditions can make detection and direct observation unreliable, forcing operators to rely on judgment in conditions with little margin for error.

**Q90R2
Multidimensional
Radar Sensor**

Solution

- The Q90R2 Radar Sensor provides an adjustable sensing field to detect obstacles in front of the vehicle, ensuring blind spots are covered while ignoring objects outside the defined range
- Compact, IP69K-rated housing and solid-state electronics withstand shock, vibration, and harsh outdoor conditions, ensuring reliable performance in rugged, off-road applications
- Configurable detection range from 0.15–20 meters (0.5–65.6 feet) allows settings that account for travel speed, stopping distance, and operator reaction time

Preventing Forklift Collisions with Objects Indoors

Challenge

In a manufacturing or warehouse setting, forklift operators can't easily see what's behind them when they are backing up. Mirrors don't show everything to operators and can't be relied on to indicate precise distance to objects.

Solution

- A Q90R2 mounted on the back of a forklift can detect the presence of objects outside the driver's field of viewing, signaling the governor to slow the forklift at the appropriate time for safer and easier positioning
- The Q90R2's configurable 120° x 40° horizontal and vertical detection area effectively detects nearby objects with different shapes, sizes, and finishes, ideal for facilities with a variety of materials and containers

**Q90R2
Multidimensional
Radar Sensor**

Anti-Collision

Obstacle Detection for Port Crane Operations

Challenge

Shipping containers and other structures can obstruct operator visibility across various port crane types, including RTG, RMG, and STS cranes. A reliable sensing solution is needed to detect objects in the crane's path and reduce the risk of collisions, helping avoid costly damage and delays.

**Q90R2
Multidimensional
Radar Sensor**

Solution

- The Q90R2's radar technology is resistant to ambient weather and light conditions, dependably sensing in challenging outdoor port environments in temperatures ranging from -40 °C to +65 °C
- The easily-configured field of view allows the sensors mounted on the crane structure to reliably detect obstacles and alert operators to objects in the path of travel

Position Monitoring for Overhead Gantry Cranes

Challenge

Though overhead gantry cranes operate along a fixed path, improper positioning and monitoring can lead to collisions with structures, machinery, or other cranes. Any structural damage or equipment damage can cause considerable downtime.

**Q90R
High Power
Radar Sensor**

Solution

- The Q90R can reliably detect obstacles and other cranes before a collision occurs
- The 40° x 40° beam pattern monitors large areas around the crane and can easily recognize varying surfaces and objects, helping avoid both stationary items and moving equipment

Equipment Positioning

Automated Distance Control for Material Transfer Vehicles

Challenge

A material transfer vehicle (MTV) must maintain a steady, controlled distance from the paver to ensure continuous paving and uniform mat quality. If the MTV's speed fluctuates, the paver may have to adjust, disrupting consistency and affecting pavement quality. With manual speed control, these variations will always occur.

Q90R
High Power
Radar Sensor

Solution

- The Q90R Radar Sensor provides continuous, real-time distance measurement, ensuring precise tracking of the paver's position
- Configurable detection range allows the system to monitor only the paver, ignoring workers, passing equipment, and the MTV's own feeding arm
- Fast response time and reliable distance measurement allow the paver to set the pace, ensuring uninterrupted, consistent paving every time

Automated Height Control for Sprayer Booms

Challenge

Ever-changing distances between agricultural sprayer booms, crops, and the ground can distribute fertilizer, herbicide, and pesticide sprays unevenly, skip application areas, and increase droplet spray drift. This can potentially damage crops and the environment, and equipment damage may occur if a boom strikes the ground.

Q90R
High Power
Radar Sensor

Solution

- The Q90R can dependably sense the distance to the ground through crops, wind, swirling dust, and agrichemical spray
- Used on booms with automatic height control, continuous sensing keeps them in the optimal position for safe and effective spray distribution, and prevents damage to crops and equipment

Approach Control for Reach Stackers

Challenge

Accurately and efficiently positioning a reach stacker's gripping device with a container's top corner fittings can be difficult—especially in conditions with limited visibility due to weather, obstructions, or low light. These factors increase the risk of misalignment, leading to failed grips, contact with the container, equipment wear, and costly delays.

Solution

- The T30R's dual discrete outputs can trigger visual indicators or integrate with vehicle control logic at preset distances, helping the operator align the spreader with the container's corner fittings without relying on visual judgment alone
- Configurable 0.15-meter to 25-meter detection range enables the system to focus on the container and ignore background interference from surrounding structures
- Fast 6-millisecond response time delivers near-instant feedback during final positioning, reducing the risk of misalignment or contact

**T30R
Long-Range
Radar Sensor**

Radar Sensors for Anti-Collision and Positioning

Q90R

Q90R2

Q90R Series

Powerful Detection and Measurement in Nearly Any Environment

- Reliable vehicle detection and distance measurement in a wide range of applications
- The Q90R2's highly-configurable, multidimensional sensing enables more intelligent detection based on distance, radial position, and speed thresholds
- Rugged IP67 and IP69K-rated housing for operation in harsh environments
- Intuitive interface enables simple integration and streamlines troubleshooting
- Enhance equipment performance with advanced configuration and detection adjustments and diagnostic viewing
- Radar Configuration Software, IO-Link, and remote teach input, for flexible set-up and configuration
- Pulse Pro output for direct integration with Banner lights; direct process feedback that only requires power; no controller needed

IO-Link®   **PULSE® PRO I/O**

Q90R Models

Beam Pattern	Operating Frequency	Communication	Output	Models
40° x 40°	60 GHz	IO-Link	Dual discrete	Q90R-4040-6KDQ
			4–20 mA analog	Q90R-4040-6KIQ
			0–10 V analog	Q90R-4040-6KUQ

Q90R2 Model

Beam Pattern	Operating Frequency	Communication	Output	Models
120° x 40°	60 GHz	IO-Link	Dual discrete	Q90R2-12040-6KDQ
			4–20 mA analog	Q90R2-12040-6KIQ
			0–10 V analog	Q90R2-12040-6KUQ
	77 GHz*		Dual discrete	Q90R2-12040-7KDQ*

*Global telecom approval for use in mobile equipment applications

Accessories

SMBAMSQ90R

Adjustable mounting bracket

SMBRAQ90R

Right-angle mounting bracket

DXMR110-8K

IO-Link master

PRO-KIT

Required for PC configuration

Radar Sensors for Anti-Collision and Positioning

T30R

T30RW

T30R Series

Bridges the Gap Between Radar and Ultrasonics

- Reliable vehicle detection where space is limited and a narrow beam is needed for single-target detection
- IP67-rated housing is unaffected by rain, wind, snow, fog, steam, sunlight, and has an operating temperature of -40 °C to 65 °C
- T30RW model features IP69K-rated housing for use in challenging environments
- Software GUI, IO-Link, remote teach input, and push buttons for flexible set-up and configuration
- Pulse Pro output for direct integration with Banner lights; direct process feedback that only requires power; no controller needed

IO-Link®   **PULSE® PRO I/O**

T30R Models

Beam Pattern	Detection Range	Communication	Output	Models
15° x 15°	0.15–15 m	IO-Link	Dual discrete	**T30R-1515-KDQ**
			4–20 mA analog and selectable discrete	**T30R-1515-KIQ**
			0–10 V analog and selectable discrete	**T30R-1515-KUQ**
15° x 15°	0.1–6 m	IO-Link	Dual discrete	**T30R-1515-CKDQ**
			4–20 mA analog and selectable discrete	**T30R-1515-CKIQ**
			0–10 V analog and selectable discrete	**T30R-1515-CKUQ**
15° x 15°	0.15–25 m	IO-Link	Dual discrete	**T30R-1515-LKDQ**
			4–20 mA analog and selectable discrete	**T30R-1515-LKID**
			0–10 V analog and selectable discrete	**T30R-1515-LKUQ**

T30RW Models

Beam Pattern	Detection Range	Communication	Output	Models
15° x 15°	0.15–15 m	IO-Link	Dual discrete	**T30RW-1515-KDQ**
			4–20 mA analog and selectable discrete	**T30RW-1515-KIQ**
			0–10 V analog and selectable discrete	**T30RW-1515-KUQ**

Accessories

SMB30A	**SMB30MM**	**DXMR110-8K**	**PRO-KIT**
Right-angle bracket	Right-angle bracket with curved mounting slots	IO-Link master	Required for PC configuration

Mobile Robot Collision Avoidance

Challenge

Mobile robots use safety sensors to detect obstructions—such as people or equipment in their path—and immediately halt forward motion to prevent a collision. However, if an object is not within the sensing path of the robot's primary safety scanners, collisions may still occur. Adding multiple safety scanners to a mobile robot surrounds it with a more comprehensive detection area, but this approach increases costs, power consumption, and complexity, while limiting onboard physical space.

Solution

- The K50RB features a 40° x 30° beam pattern, which provides full three-dimensional coverage to protect mobile robots from collisions
- Because of the K50RB's wide detection angle, fewer sensors are needed to prevent damage to equipment. This advanced radar sensor offers a cost-effective solution for comprehensive protection, its power consumption is low, and it features a more compact form factor than alternative sensing options.
- K50RB sensors can be mounted behind the outer surface of the mobile robot to prevent damage or to create a more seamless appearance

K50R Series

Standard Flush Mount

Pro Flush Mount

Standard Base Mount

Pro Base Mount

Reliable, Cost-Efficient Sensing for Short-Range Applications

- Superior and consistent operation in any environment
- Cost-efficient alternative to long-range ultrasonic sensors
- Simple integration and streamlined troubleshooting
- Easy set up and configuration with the Banner Measurement Sensor Software
- Bright, visible indication available in Pro models with configurable LEDs
- Base and flush mount options for versatile mounting
- Pulse Pro output for direct integration with Banner lights; direct process feedback that only requires power; no controller needed

Beam Pattern	Housing	Range	Type	Telecom Approval	Output	Models
80° x 60°	Flush mount	100 mm–3 m	Standard	US, Europe, UK, Canada, Australia/ New Zealand	Dual discrete	K50RF-8060-LDQ
			Pro with Configurable LEDs			K50RPF-8060-LDQ
40° x 30°		50 mm–5 m	Standard			K50RF-4030-LDQ
					4–20 mA analog	K50RF-4030-LIQ
					0–10 V analog	K50RF-4030-LUQ
			IO-Link		Dual discrete	K50RF-4030-LKDQ
			Pro with Configurable LEDs			K50RPF-4030-LDQ
	Base mount		Standard		Dual discrete	K50RB-4030-LDQ
					4–20 mA analog	K50RB-4030-LIQ
					0–10 V analog	K50RB-4030-LUQ
			IO-Link		Dual discrete	K50RB-4030-LKDQ
			Pro with Configurable LEDs			K50RPB-4030-LDQ

Pair Radar with Indication to Improve Situational Awareness

Easily Retrofit Forklifts with Rear Object Detection and Operator Alerts
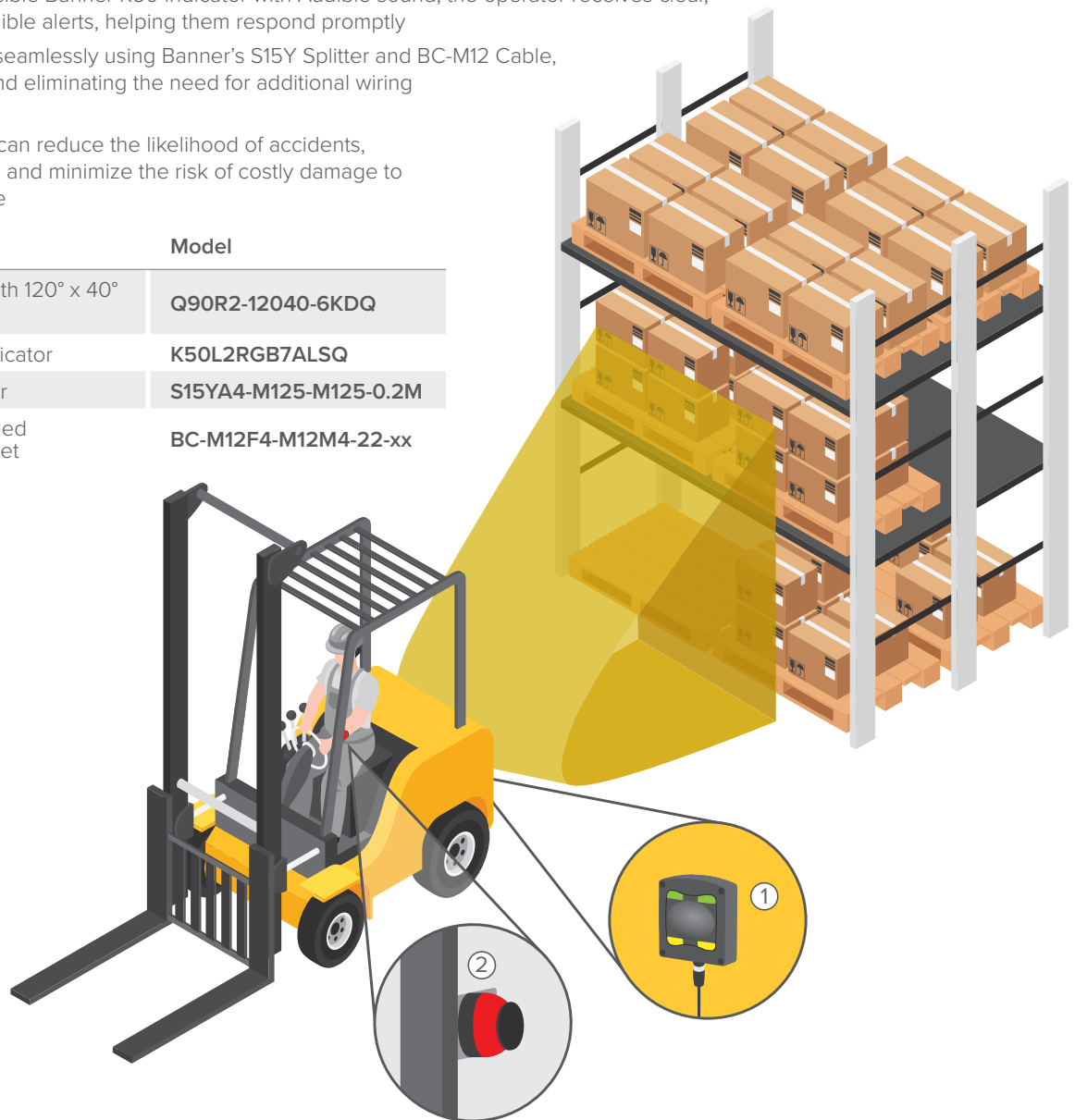
Challenge

Limited visibility significantly increases the risk of collisions when forklift operators back up in tight spaces, such as near rack systems. Retrofitting with advanced detection equipment is often costly and complex, while traditional aids like mirrors and visual checks leave blind spots, making collisions and equipment damage more likely.

Solution

- Banner Q90R2 radar sensors can be quickly and easily retrofitted onto forklifts, mounted on the back with a simple plug-and-play connection, and powered directly by the 12–24 V DC forklift battery, eliminating complicated installation
- The radar's built-in velocity measurement capability accurately determines the forklift's speed and proximity to warehouse racks, significantly enhancing situational awareness
- Paired with the highly visible Banner K50 Indicator with Audible sound, the operator receives clear, real-time visual and audible alerts, helping them respond promptly
- The solution integrates seamlessly using Banner's S15Y Splitter and BC-M12 Cable, simplifying installation and eliminating the need for additional wiring or complex setup
- This combined solution can reduce the likelihood of accidents, improve operator safety, and minimize the risk of costly damage to warehouse infrastructure

	Description	Model
1	Radar sensor with 120° x 40° beam pattern	Q90R2-12040-6KDQ
2	K50 audible indicator	K50L2RGB7ALSQ
3	S15Y M12 splitter	S15YA4-M125-M125-0.2M
4	M12 double ended extension cordset	BC-M12F4-M12M4-22-xx