Radar Solutions for Collision Avoidance & Vehicle Detection
# Radar Sensing

The ultimate outdoor sensing solution

## Benefits of Radar Sensing

<table>
<thead>
<tr>
<th>Unaffected by wind, rain, snow, fog and sunlight</th>
<th>Long sensing range</th>
<th>No moving parts, durable, less downtime</th>
<th>Detects moving and stationary objects</th>
</tr>
</thead>
</table>

Wide operating range to function in extreme outdoor environments

## Beam Pattern Considerations

Radar Sensors are available in narrow and wide beam patterns to avoid false detection of objects outside of your region of interest or to ensure complete detection of the desired target in your field of view.

### Narrow Beam Applications
- Drive-through
- Gantry crane
- Overhead crane
- Loading docks

### Wide Beam Applications
- Mobile equipment collision avoidance
- Vehicle detection: Train, car, boats

## Object Detection

**Good Targets Include:**
Objects containing metal, large amounts of water, or similar high-dielectric materials

**Poor Targets Include:**
Many plastics, cloth, wood, fiberglass, and organic materials
Adjustable-Field and Retroreflective Radar Sensors

An adjustable-field radar sensor can detect vehicles and other objects by sensing the reflection of the radio waves bouncing off the object.

A retroreflective radar sensor uses a taught reference condition like a wall, floor, or special retroreflective target. The sensor detects objects between it and the reference target by looking for disruptions in the signal coming back from the reference target.

Retro sensing has the most reliable detection with no dead zone. The output will turn on even if the object being sensed does not reflect the signal back to the sensor, as long as it blocks the reference target.

DIP Switch and GUI Configuration

**DIP Switch Configuration**
- Easy to set up
- No PC required

**GUI Configuration**
- Clear visual of configuration
- Tamper-proof

**Remote Teach**
- Remotely configure sensor
- No manual interaction required
Challenge
Detection from cranes to prevent collision during operation can be extra challenging in dusty or harsh environments.

Solution
- Radar works in dusty environments where laser products are not as reliable
- It has no moving parts and a rugged design that resists high-shock and vibration conditions and is a more reliable solution than traditional laser scanner solutions
- Dual-zone Q240R is used to avoid the roof and other indoor obstacles

(Indoor) Overhead Crane in Dusty or Harsh Environments

Collision Avoidance

Challenge
Collision avoidance solutions for mining equipment minimize the risk of accidents, save costs, and improve efficiency. Poor visibility, blind spots, dust and debris, and ambient weather conditions can reduce the effectiveness of collision avoidance measures.

Solution
- Q130RA radar sensors are installed at the front and rear of mining vehicles and provide active object detection in vehicle blind spots
- The Q130RA is unaffected by dirt, dust, wind, rain, and other environmental challenges
- The IP67 housing ensures reliable operation even in harsh conditions

PC GUI
No Moving Parts
Challenge
Rubber tire gantry cranes (RTG) are used in port and mobile equipment industries to transport heavy and cumbersome loads. Since RTG cranes are hauling such large loads, it is vital to ensure they move safely throughout the port area to avoid collisions.

Solution
- The Q120R radar sensor has a narrow beam pattern, high sensitivity, and long range detection to view obstacles in the way of the crane.
- The sensor has no moving parts and a rugged design that resists high-shock and vibration conditions better than laser scanners.

Challenge
When multiple cranes are moving in tight spaces, it's imperative to reliably detect the presence of another crane or obstacle and activate stop or warning signals to the operator.

Solution
- The Q240R radar sensor is ideal for monitoring a specific area without detecting adjacent objects, featuring a very narrow 11° by 13° beam pattern.
- With two independent adjustable sensing zones, the sensor provides far and near proximity warning signs with the capability to detect objects up to 100 m away.
- Extremely robust; provides reliable detection capabilities, ideal for outdoor applications.
Traffic Monitoring

Radar sensors use Frequency Modulated Continuous Wave (FMCW) technology to reliably detect moving or stationary targets, including cranes, cars, trains, trucks and cargo in extreme weather conditions. They operate at 24 GHz in the Industrial, Scientific and Medical (ISM) telecommunication band.

Enhance the performance of your moving assets and ensure operator and equipment safety. You can depend on products and solutions from Banner to solve your most challenging applications.

Boats on Waterways, Locks and Dams; Shipyard Logistics

Challenge
To establish and maintain an efficient operating routine, all vessel traffic must be monitored as it enters and exits ports. Ship detection can be difficult because of local wind and wave conditions, ship size/type and close range noise. Sensing solutions must accurately detect a ship’s arrival.

Solution
- The Q120R radar sensor functions are unaffected by wind, rain, fog, light, humidity and air temperature, making it ideal for outdoor harbor conditions
- The radar sensor detects objects up to a specified distance, ignoring objects and backgrounds beyond the set point, allowing for accurate ship detection

Train Detection Including Flatbeds

Challenge
Railways present many difficulties for sensing equipment. The harsh and dirty environment is extra challenging. Passing trains create high winds and kick up dirt. Proper identification of the content on cargo trains is essential. Radar sensors detect container trains to activate RFID antennas.

Solution
- The Q120R radar sensor is an effective alternative to ultrasonic or photoelectric sensors
- Radar technology is unaffected by wind or by dust and dirt build-up on the sensor
- FMCW radar can detect both stationary and moving targets for a more reliable solution than doppler radar

R-GAGE sensors allow for easy configuration by using DIP Switches

Radar Sensors are unaffected by snow, fog, heavy rain or humidity and strong wind; they are sunlight immune and operate reliable even under extreme temperature fluctuations.
Challenge
Cargo trains are inspected with gamma rays to ensure the cargo matches the expected load.

Solution
- The QT50R radar sensor uses one or two independent, adjustable sensing zones for most reliable detection
- It can detect moving or stationary objects up to 24 m away
- The rugged IP67 housing withstands harsh environments

Challenge
Trucks pass the inspection zone, where radar sensors activate cameras to verify the cargo matches the corresponding customs declaration information.

Solution
- The QT50R radar sensor is installed to sense large vehicles
- The adjustable sensing field allows to ignore objects beyond the setpoint
- The rugged IP67 housing and radar technology is immune to weather and light changes

Maintenance free and vibration resistant.  

Wide Beam Radar Sensors
Detection of Stationary and Moving Vehicles

The ability to reliably detect vehicles offers significant advantages for asset management, resource allocation, site safety, traffic control, and loading dock management. Application needs and deployment requirements can be diverse, ranging from indoor, outdoor and partially protected. FMCW radar is an ideal solution for these applications since it can detect moving and stationary objects in all weather conditions.

Loading Dock Monitoring, Vehicle Counting

Challenge
For an efficient flow of products in and out of a truck, it is important that operators are immediately notified of a truck’s arrival. In order to accurately detect the presence of vehicles at a loading dock, a reliable sensor is needed to withstand extreme weather conditions.

Solution
- The QT50R is a retroreflective sensor and provides the most reliable detection with no dead zone
- The QT50R radar sensor can sense trucks up to 12 meters away, for quick and easy detection to alert operators
- Status monitoring with the radar sensor is simple with highly bright, visible LED indicators

Cars in Turn Lanes, Entry/Exit Gates, Parking Ramps

Challenge
Parking lots see considerable traffic and properly managing the entrance can keep efficiency high. Typically, parking lot entrances are exposed to various weather conditions and potential impact from vehicles.

Solution
- The QT50R radar sensor detects objects up to a specified distance, ignoring objects and backgrounds beyond the set point
- The radar sensor provides reliable vehicle detection to assist in counting the number of cars passing through.
- Radar is unaffected by wind and temperature where ultrasonic solutions are not as robust
Challenge
Drive thru applications require reliable vehicle detection to alert employees to a customer’s presence at a window, count cars passing through, monitor time spent in the drive thru, and more. Vehicle detection devices can be susceptible to tampering by customers or staff.

Solution
- Q130 RA radar sensors reliably detect both stationary and moving vehicles, regardless of shape or color
- The Q130RA is easily configured using an intuitive graphical user interface and is resistant to tampering.
- The software also allows users to easily copy configurations from one sensor to another for faster setup.

Challenge
To detect and count parked vehicles and prevent parking at non-permitted areas, a system is required to identify unauthorized vehicles and alert officers to their presence. Because the charging station is located in public areas, the system must not be vulnerable to vandalism.

Solution
- The QT50R radar sensor detects objects up to a specified distance, ignoring objects beyond the set point
- The radar sensor can be embedded in the charging station, preventing vandalism
Sensors use one adjustable sensing zone to reliably detect moving or stationary objects up to 40 meters away.

**PC GUI Configurable, Narrow and Wide Beam Sensor**

- Reliable detection of moving and stationary targets
- Simple setup and precise control with intuitive graphical user interface
- Unaffected by ambient weather, including rain, snow, fog, sunlight, and temperatures from -40 to 65° C
- Rugged IP67 housing for dependable long-term operation in harsh environments
- Features half the dead zone as previous US radar products
- 90.8 x 170.5 mm rectangular housing

<table>
<thead>
<tr>
<th>Model</th>
<th>Beam Pattern</th>
<th>Range</th>
<th>Telecom Approval</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q130RA-9076-AFQ</td>
<td>90° x 76°</td>
<td>24 m</td>
<td>US, Europe, China, Australia/New Zealand</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>Q130RA-2450-AFQ</td>
<td>24° x 50°</td>
<td>40 m</td>
<td></td>
<td>N.O/N.C. Configurable</td>
</tr>
</tbody>
</table>

### Optional Accessories and Mounting Brackets

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>SMBWSQ120</td>
<td>Heavy-duty, rear-mount protective rain cover (sensor face must be kept free of heavy water and ice build-up)</td>
</tr>
<tr>
<td>SMBQ240SS1</td>
<td>2-piece bracket, provides ±20° of tilt on one axis</td>
</tr>
<tr>
<td>SMBQ240SS2</td>
<td>Can be used with SMBQ240SS1 for ± 20° tilt on second</td>
</tr>
<tr>
<td>SMBQ240SS3</td>
<td>Full bracket assembly, ±20° of tilt in all directions (SS1 + SS2)</td>
</tr>
<tr>
<td>MQDEC2-506</td>
<td>2 m cordset (other lengths available)</td>
</tr>
<tr>
<td>MQDC-506-USB</td>
<td>Pro Converter Cable, 1.83 m M12/Euro-style quick disconnect to Device and USB to PC, Required for connection to configuration software</td>
</tr>
</tbody>
</table>
Radar Configuration Software Overview

Easy setup and configuration of range, sensitivity, and output using the Banner Radar Configuration Software and Pro Converter Cable.

- Get up and running in 3 easy steps: simply set the switch point distance, signal strength threshold, and response time using the intuitive configuration software. Now the radar sensor is ready to begin detecting targets.
- Easily monitor status via the software or bright on-board LED indicators
- Visualize the application in real-time
- Make adjustments to settings on the fly

![Diagram of Radar Configuration Software](image)

- **Navigation Toolbar**
  - Connect to the sensor, save or load a configuration, or reset to factory defaults

- **Live Sensor Data and Legend**
  - Signal strength versus distance, select options to display data on the graph

- **Summary pane**
  - Displays the distance to the target, the signal strength, and the output status

- **Live Sensor Data Controls**
  - Record, freeze and play real-time sensor data

- **Status Bar**
  - Shows that the sensor is connected, a software update is available, and if the sensor data is being recorded to a file

- **Sensor Settings**
  - Set the sensor parameters
Sensors use two independent, adjustable sensing zones to reliably detect moving or stationary objects within a narrow beam pattern up to 100 meters away.

**Narrowest Beam, Longest Range Sensor**
- Narrow 11° x 13° beam pattern (± 5.5/6.5)
- Two independent adjustable sensing zones
- Range: up to 100 meters
- 187 x 160 x 55 mm rectangular housing
- Rugged IP67 housing withstands harsh environments

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<tr>
<th>Model</th>
<th>Range</th>
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</tr>
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<tbody>
<tr>
<td>Q240RA-US-AF2Q</td>
<td>40 m</td>
<td>US, Canada, Brazil, Mexico, Taiwan</td>
<td>2 Discrete (NPN/PNP configurable)</td>
</tr>
<tr>
<td>Q240RA-EU-AF2Q</td>
<td></td>
<td>US, Europe, Australia/New Zealand, Brazil Japan, Singapore, South Korea</td>
<td></td>
</tr>
<tr>
<td>Q240RA-CN-AF2Q</td>
<td></td>
<td>China</td>
<td></td>
</tr>
<tr>
<td>Q240RA-US-AF2LQ</td>
<td>100 m</td>
<td>US, Canada, Brazil, Mexico, Taiwan</td>
<td>2 Discrete (NPN/PNP configurable)</td>
</tr>
<tr>
<td>Q240RA-EU-AF2LQ</td>
<td></td>
<td>US, Europe, Australia/New Zealand, Brazil Japan, Singapore, South Korea</td>
<td></td>
</tr>
<tr>
<td>Q240RA-CN-AF2LQ</td>
<td></td>
<td>China</td>
<td></td>
</tr>
<tr>
<td>Q240RA-US-ULQ</td>
<td>100 m</td>
<td>US, Canada, Brazil, Mexico, Taiwan</td>
<td>1 Analog (0-10 V) and 1 Selectable NPN/PNP</td>
</tr>
<tr>
<td>Q240RA-EU-ULQ</td>
<td></td>
<td>US, Europe, Australia/New Zealand, Brazil Japan, Singapore, South Korea</td>
<td></td>
</tr>
<tr>
<td>Q240RA-CN-ULQ</td>
<td></td>
<td>China</td>
<td></td>
</tr>
<tr>
<td>Q240RA-US-ILQ</td>
<td>100 m</td>
<td>US, Canada, Brazil, Mexico, Taiwan</td>
<td>1 Analog (4-20 mA) and 1 Selectable NPN/PNP</td>
</tr>
<tr>
<td>Q240RA-EU-ILQ</td>
<td></td>
<td>US, Europe, Australia/New Zealand, Brazil Japan, Singapore, South Korea</td>
<td></td>
</tr>
<tr>
<td>Q240RA-CN-ILQ</td>
<td></td>
<td>China</td>
<td></td>
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</tbody>
</table>

**Optional Accessories and Mounting Brackets**

- **Q240WS** Rain cover for Q240RA with hydrophobic coating to repel rain and prevent snow build up
- **SMBQ240SS1** 2-piece bracket, provides ±20° of tilt on one axis
- **SMBQ240SS2** Can be used with SMBQ240SS1 for ± 20° tilt on second
- **SMBQ240SS3** Full bracket assembly, ±20° of tilt in all directions (SS1 + SS2)
Q120RA Series

Sensors use one or two independent, adjustable sensing zones to reliably detect moving or stationary objects up to 40+ meters away.

**Highest Sensitivity, Long Range, Narrow Beam Sensor**
- Narrow total beam pattern: horizontal: $24^\circ$ ($\pm 12$), vertical: $50^\circ$ ($\pm 25$)
- One or two independent adjustable sensing zones
- Range: up to 40+ meters
- 90.8 x 159.5 mm rectangular housing
- Rugged IP67 housing withstands harsh environments

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<tr>
<td>Q120RA-US-AFQ</td>
<td>12 m</td>
<td>US and Brazil</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>Q120RA-EU-AFQ</td>
<td>26 m</td>
<td>Europe, Australia/New Zealand, Japan and China</td>
<td>2 Discrete (NPN/PNP configurable)</td>
</tr>
<tr>
<td>Q120RA-US-AF2WQ</td>
<td>40 m</td>
<td>US and Brazil</td>
<td>2 Discrete (NPN/PNP configurable)</td>
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<tr>
<td>Q120RA-EU-AF2WQ</td>
<td></td>
<td>Europe, Australia/New Zealand, Japan and China</td>
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<tr>
<td>Q120RA-US-AF2Q</td>
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<td>South Korea*</td>
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</tr>
<tr>
<td>Q120RA-EU-AF2Q</td>
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<td>South Korea*</td>
<td></td>
</tr>
<tr>
<td>Q120RA-US-AF2Q</td>
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<td>South Korea*</td>
<td></td>
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<tr>
<td>Q120RA-EU-AF2Q</td>
<td></td>
<td>South Korea*</td>
<td></td>
</tr>
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</table>

For 5-wire 2 m integral cable versions, remove suffix Q from the model number (e.g. Q120RA-EU-AF).
* Models for South Korea: 12 to 24 V dc

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**Optional Accessories and Mounting Brackets**

- **SMBWSQ120**: Heavy-duty, rear-mount protective rain cover for Q120RA (sensor face must be kept free of heavy water and ice build-up)
- **SMBQ240SS1**: 2-piece bracket, provides $\pm 20^\circ$ of tilt on one axis
- **SMBQ240SS2**: Can be used with SMBQ240SS1 for $\pm 20^\circ$ tilt on second
- **SMBQ240SS3**: Full bracket assembly, $\pm 20^\circ$ of tilt in all directions (SS1 + SS2)
- **MQDEC2-506**: 2 m cordset (other lengths available)
QT50R-AF Series

Sensors use one or two independent, adjustable sensing zones to reliably detect moving or stationary objects up to 24 meters away.

**Widest Beam, Smallest Sensor**
- Detects objects up to 24 m
- One or two independent adjustable sensing zones
- Total beam pattern 90° (± 45) x 76° (± 38)
- Rugged IP67 housing withstands harsh environments

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<tr>
<td>QT50R-US-AFHQ</td>
<td>24 m</td>
<td>US, Canada and Brazil</td>
<td>Bipolar NPN/PNP</td>
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<tr>
<td>QT50R-EU-AFHQ</td>
<td>24 m</td>
<td>US, Europe, Australia/New Zealand, Japan, China</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>QT50R-KR-AFHQ</td>
<td></td>
<td>South Korea*</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>QT50R-TW-AFHQ</td>
<td></td>
<td>Taiwan</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>QT50R-SG-AFHQ</td>
<td></td>
<td>Singapore</td>
<td>Bipolar NPN/PNP</td>
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<tr>
<td>QT50R-US-AF2Q</td>
<td>24 m</td>
<td>US, Canada and Brazil</td>
<td>2x Selectable NPN/PNP</td>
</tr>
<tr>
<td>QT50R-EU-AF2Q</td>
<td>24 m</td>
<td>US, Europe, Australia/New Zealand, Japan, China</td>
<td>2x Selectable NPN/PNP</td>
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<tr>
<td>QT50R-KR-AF2Q</td>
<td></td>
<td>South Korea*</td>
<td>2x Selectable NPN/PNP</td>
</tr>
<tr>
<td>QT50R-TW-AF2Q</td>
<td></td>
<td>Taiwan</td>
<td>2x Selectable NPN/PNP</td>
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<tr>
<td>QT50R-EU-AFSQ</td>
<td>3.5 m</td>
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<td>Bipolar NPN/PNP</td>
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<tr>
<td>QT50R-KR-AFSQ</td>
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<td>South Korea*</td>
<td>Bipolar NPN/PNP</td>
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</tbody>
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For 5-wire 2 m integral cable versions, remove suffix Q from the model number (e.g. QT50R-EU-AFH).
* Models for South Korea: 12 to 24 V dc

### Optional Accessories and Mounting Brackets

- **QT50RCK**: Weather deflector, includes mounting hardware (sensor face must be kept free of heavy water and ice build-up)
- **SMB30SC**: Split clamp with swivel bracket with 30 mm mounting hole for sensor, black reinforced thermoplastic polyester. Stainless steel mounting hardware included.
- **SMB30MM**: 12-gauge stainless steel bracket with curved mounting slots for versatile orientation. Mounting hole for 30 mm sensor.
- **MQDEC2-506**: 2 m cordset (other lengths available)
QT50R-RH Series

Retro-wave sensor – use of a reference signal (retroreflective target, floor, wall, or other stationary object) enables reliable detection of weak targets in the foreground or for loss of detection of the reference target.

Robust Retroreflective Sensing Mode
- Detects objects up to 12 m
- Effective beam angle equals size of retro target
- Ignores objects in the background beyond the retroreflective target
- Rugged IP67 housing withstands harsh environments

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<tr>
<td>QT50R-US-RHQ</td>
<td>0 to 12 m</td>
<td>US, Canada and Brazil</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>QT50R-EU-RHQ</td>
<td>0 to 12 m</td>
<td>US, Europe, Australia/New Zealand, Japan, China</td>
<td>Bipolar NPN/PNP</td>
</tr>
<tr>
<td>QT50R-KR-RHQ</td>
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<td>South Korea*</td>
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</tr>
<tr>
<td>QT50R-TW-RHQ</td>
<td></td>
<td>Taiwan</td>
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<tr>
<th>Accessory</th>
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<tr>
<td>BRTR-CC20E</td>
<td>Retroreflective target for use with QT50R retroreflective model (required accessory). Large corner-cube reflector in protective plastic enclosure.</td>
</tr>
<tr>
<td>QT50RCK</td>
<td>Weather deflector, includes mounting hardware (sensor face must be kept free of heavy water and ice build-up)</td>
</tr>
<tr>
<td>SMB30SC</td>
<td>Split clamp with swivel bracket with 30 mm mounting hole for sensor, black reinforced thermoplastic polyester. Stainless steel mounting hardware included.</td>
</tr>
<tr>
<td>SMB30MM</td>
<td>12-gauge stainless steel bracket with curved mounting slots for versatile orientation. Mounting hole for 30 mm sensor.</td>
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<td>MQDEC2-506</td>
<td>2 m cordset (other lengths available)</td>
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