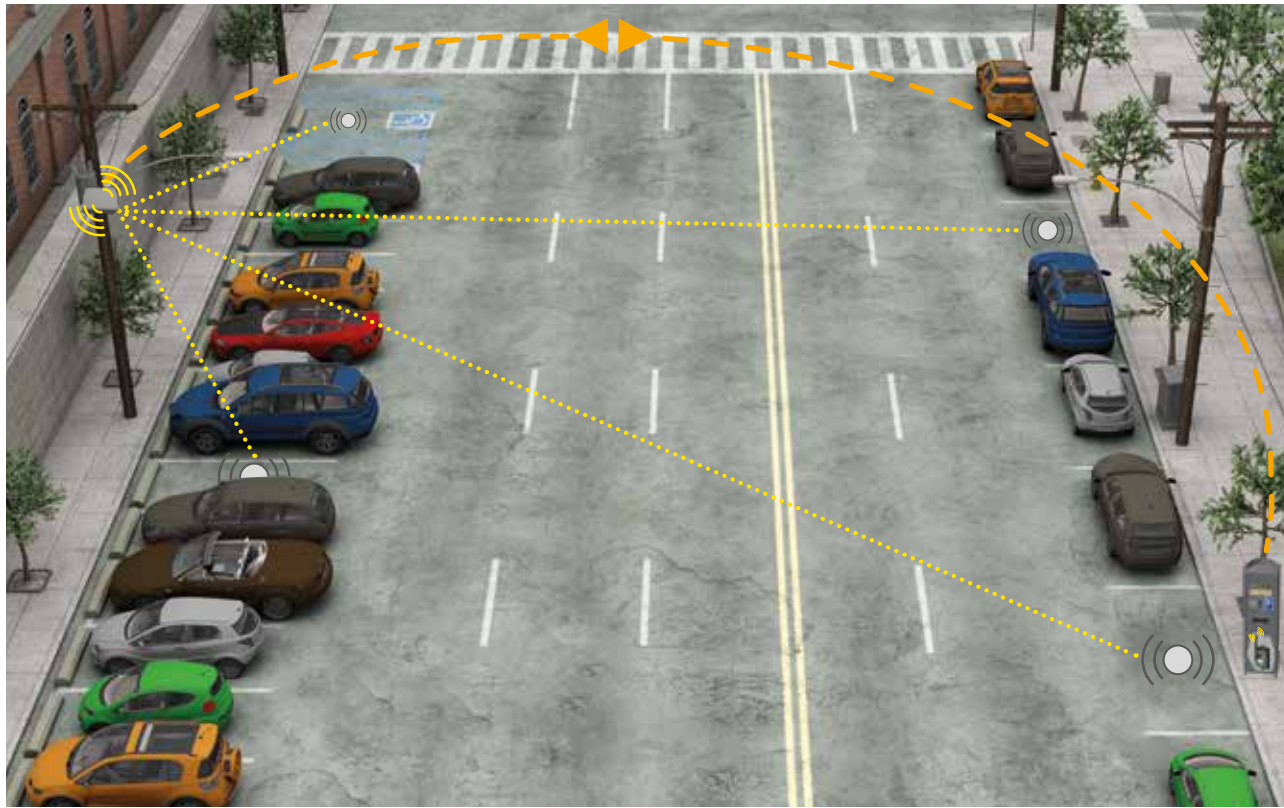


Wireless Solutions for Smart Parking





Solutions for On-Street Parking

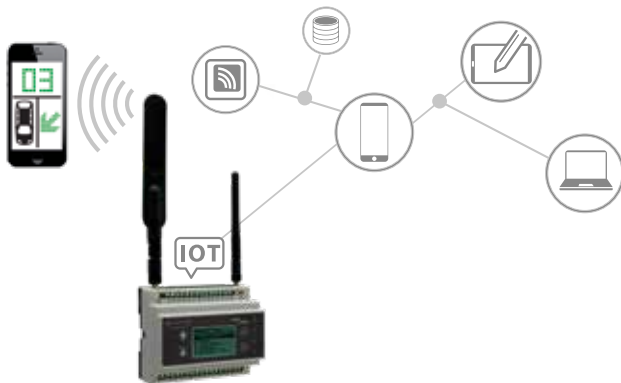
Background

Increased population density in growing communities often correlates to increased levels of vehicle congestion on roadways, limiting mobility, access to businesses, housing, and leisure activities as well as the availability of on-street parking.

Solution

The wireless M-GAGE Parking Sensor is a compact and easy to deploy solution for monitoring single parking spaces, allowing cities to better manage the parking challenges of today and tomorrow.

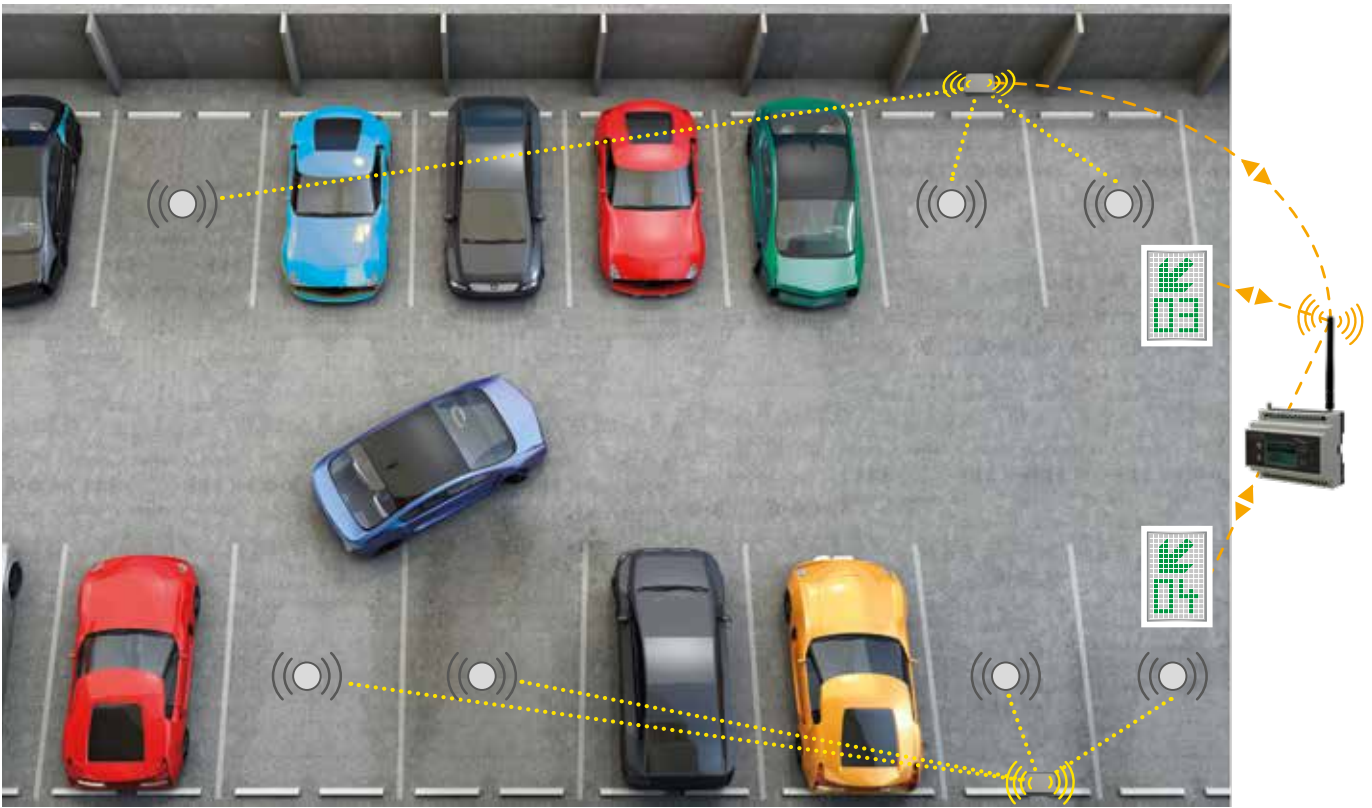
- Reliably detects large ferromagnetic objects using a three-axis magneto-resistive technology
- Automatically communicates parking space status by radio to the closest Gateway
- Parking space availability information can be sent to a remote supervision system for real-time visualization and statistics or enforcement via GSM/Cellular, RS-485 or Ethernet using a DXM100 Wireless Controller



Extended Connectivity to Smart Devices
For detailed product information, see page 13.



M-GAGE Parking Sensors
For detailed product information, see pages 10 and 12.



Solutions for Off-Street Parking

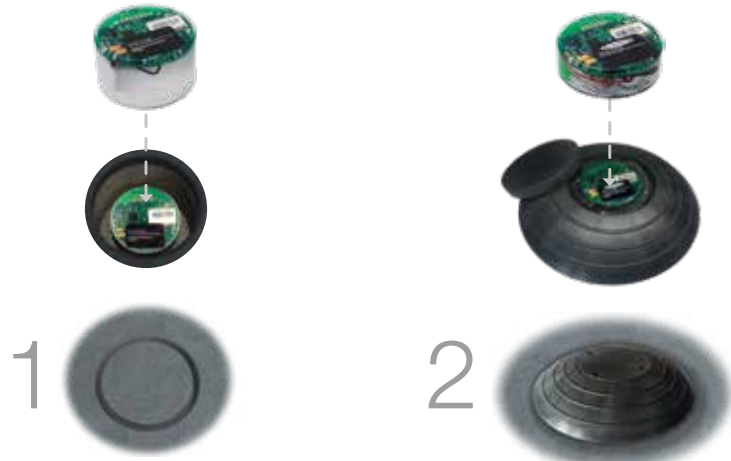
Background

The layout of an off-street parking facility, its exposure to the elements, the material used to pave the surface, and the maintenance required at the facility are all necessary considerations for deploying a smart parking solution.

Solution

Banner Engineering offers three different installation possibilities to cover all scenarios:

1. **Underground:** a fully potted and epoxy sealed sensor is installed under the road surface
2. **Surface mount:** a heavy duty protective enclosure houses the sensor and is affixed to the road surface, allowing easy access to the sensor – this is the fastest and least intrusive installation



Two Different Installation Options
For detailed product information, see page 10.



Solutions for Underground Parking

Background

Underground parking garages often support above ground businesses, shops, and entertainment venues in urban areas. The design and build of these facilities can pose unique challenges in the implementation of a smart parking solution.

Solution

Banner offers a simple, cost-effective solution that enables motorists to quickly find available parking in underground parking facilities. This solution combines sensors and indicators in a wireless network, enabling rapid deployment in any parking facility.

Ultrasonic Sensor Node:

- Uses sound waves to detect objects and can be mounted directly on the ceiling of a parking garage to identify the presence of a car in the parking space below
- Has an integrated lithium D-cell battery with a seven year lifespan which reduces the cost of installation by eliminating the need to run wires and conduit

Wireless Light Node:

- Flashes green to direct drivers to the nearest available parking spaces
- Has an integrated lithium D-cell battery



Wireless Gateway



Light Node



Ultrasonic Node



For detailed product information, see pages 11 and 12.



Effective Parking Guidance

Background

Helping motorists to quickly find available parking can minimize traffic congestion and vehicle emissions in confined and enclosed underground parking garages. The diverse configurations of these facilities can challenge the effectiveness of many parking guidance systems.

Solution

- A single Light Node can provide clear indication of availability for up to six parking spaces when mounted on the side or in the middle of a garage corridor
- The supervision system can link a specific Light Node with a group of Ultrasonic Nodes, keeping the green LEDs active as long as at least one parking space of the group is free, which reduces the overall cost of installation
- All display solutions for driver information and guidance that use RS-485 modbus RTU communication can be managed with Banner wireless devices, allowing users to avoid the expense and hassle of additional cabling



The green lights on the node are OFF when there are no parking spaces available.



The green lights on the node are ON when a parking space is available.



Vehicle Detection and Counting

Background

Detecting, counting, and classifying vehicles is essential to many parking applications. To manage time and ensure availability at shared recharging stations for electric cars, the parking system must be able to detect unauthorized vehicles and alert authorities to their presence.

Solution

R-GAGE radar sensors are capable of solving a more diverse range of vehicle detection applications than other sensing technologies, including inductive loops.

- Detects moving and stationary targets up to 24 m away
- Frequency modulated continuous wave (FMCW) radar ensures reliable detection in all weather conditions
- Rugged IP67 rated housing withstands harsh conditions
- Non-intrusive, easy-to-install and easy-to-use solution that does not require any specific maintenance



Easy Accessible DIP-Switches



R-GAGE Radar Sensor
For detailed product information, see page 14.



Access Control

Background

The ability to reliably detect the presence of a vehicle is common to many access control applications. Infrastructure and conditions at any given deployment can vary. Solutions that are easy to install and use can help reduce deployment costs and minimize downtime at a site.

Solution

Banner offers a range of minimally intrusive sensing solutions that include radar, magnetic field, and photoelectric sensors.

M-GAGE™ Q7LMEB Flat-Pak:

- Reliably detects large metal objects using a three-axis magneto-resistive technology
- Minimally intrusive solution can be installed below ground in a shallow, narrow trench or above ground on the side of the inspection area
- Protected by a heat shrink sealed encapsulated circuit board housing and adhesive-lining
- Installs in a fraction of time required to repair or replace failed inductive loops

SureCross® Q45:

- First self-contained wireless standard photoelectric solution developed to solve highly challenging detection applications
- Highly scalable, this wireless sensor can detect vehicles in a range of applications without pulling cables



M-GAGE Q7LMEB Flat-Pak Sensor
For detailed product information, see page 15.



Q45 Wireless Sensor
For detailed product information, see page 14.

Network Layout with DX80 Performance Gateway

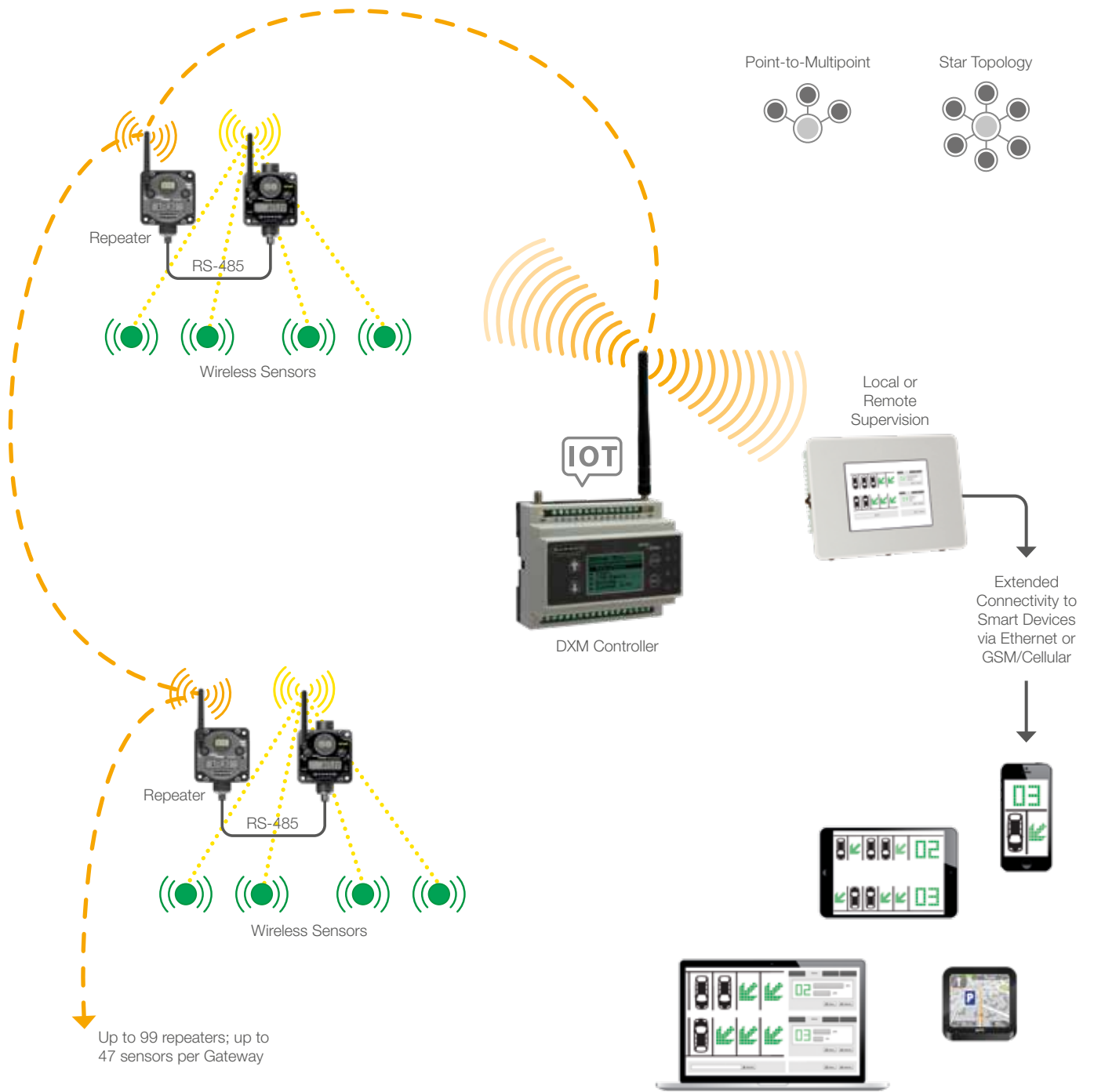
Banner's DX80 Star topology is based on Performance Gateways to create a point-to-multipoint network using parking sensors (up to 47 sensors depending on local signal strength). This network topology features bit-pack functions for fast response time in specific applications like vehicle counting or monitoring a large number of parking spaces.

The gateway for each of the DX80 Performance networks can be hard wired to a MultiHop Data Radio so that it can use repeaters to cover long distances and bring back all of the information to a DXM100 Wireless Controller.

The DXM100 Controller offers extended connectivity capabilities (GSM/Cellular, Ethernet, USB, Serial communication) and can push data to a PLC or a web server.

Key Features:

- Simple yet highly expandable
- Supports Point-to-Multipoint and Star network topologies
- Quick communication feature with bit-pack functions

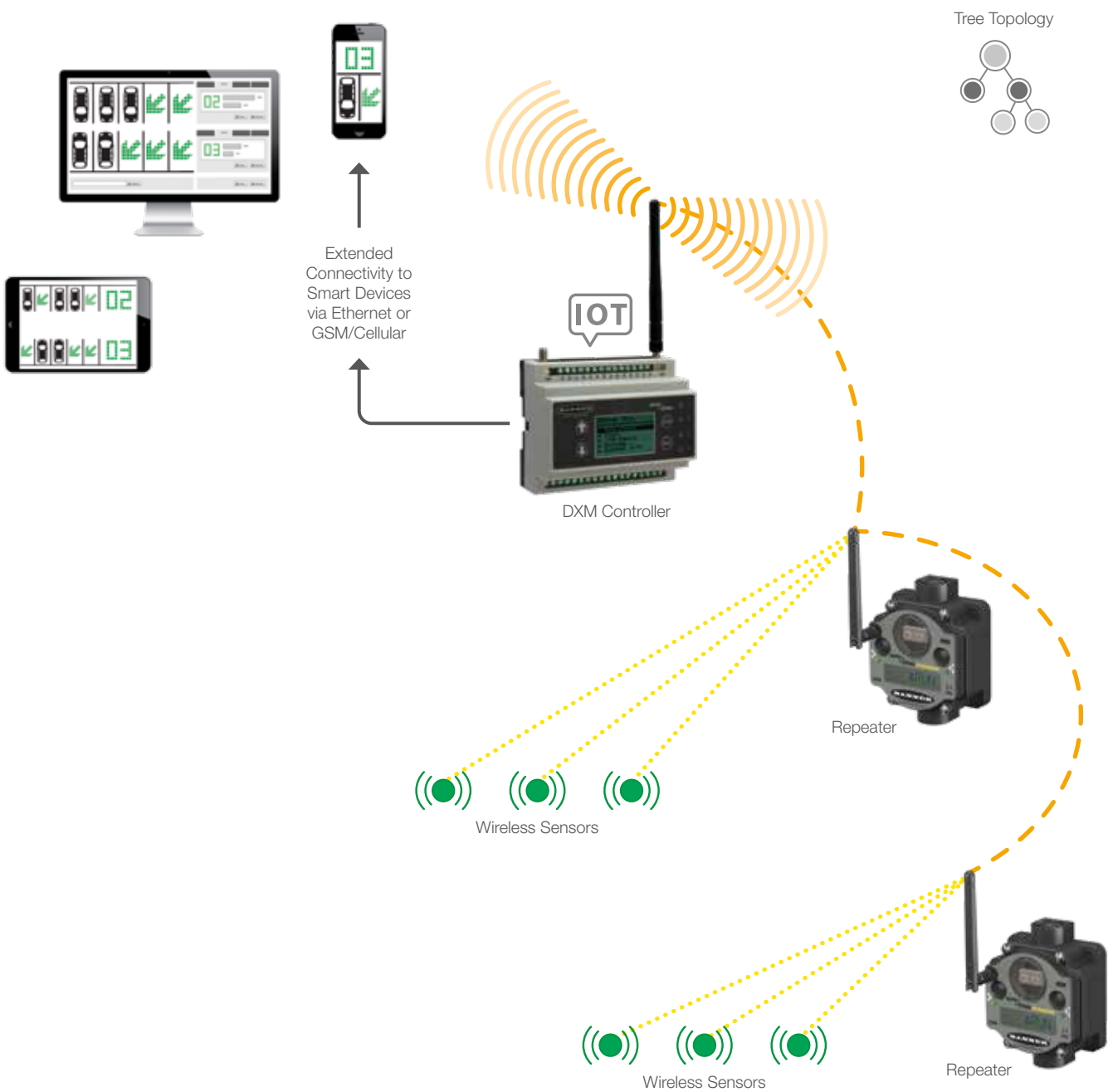


Network Layout with MultiHop Data Radio

The MultiHop Data Radio is a tree topology network with self-healing capability that includes wireless parking sensors transmitting information to repeaters, which ultimately transmit to the master radio. The use of repeaters can greatly extend the range of the network. This configuration is used for extended site with distant wireless sensors as for specific on-street applications. This network must have a host controller that controls the master radio or a DXM100 Wireless Controller to extend the connectivity capabilities (GSM/Cellular, Ethernet) and push data to a web server or a supervision system.

Key Features:

- Self-healing, auto-routing RF network with multiple hops extends the network's range:
 - 900 MHz, 1 Watt: up to 9.6 km (6 miles)
 - 2.4 GHz, 65 mW: up to 3.2 km (2 miles)
- Flexible: each radio is DIP switch selectable to be a master, repeater or slave
- User-selectable communication between RS-485 and RS-232 that can be used to manage remote devices



Wireless Sensor Model Selection



M-GAGE Parking Sensor – Low Profile

- Adjustable sensor parameters
- 3x A-cell lithium batteries integrated into housing
- 8 years battery lifetime (with standard settings and effective communication strength)
- Fully potted and sealed housing contains the power source, sensor, and antenna for a completely wireless solution

M-GAGE Low Profile Parking Sensor with Integrated Batteries

Model	P/N	Type	Frequency	Protection	Temperature	Dimensions
DX80N2X1W0P0ZTA DX80N9X1W0P0ZTA	800196 800195	Sensor Node	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	H 22.6 mm x ø 72.5 mm
DX80DR2M-HMTA DX80DR9M-HMTA	800198 800197	MultiHop	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	H 22.6 mm x ø 72.5 mm

Mounting Accessories for Low Profile Parking Sensor

Model	P/N	Description
BWA-HSG-MGS-003	808225	Surface Mount Dome Housing: protective heavy duty housing can be fixed on the road surface. The sensor remains accessible for maintenance purposes.
BWA-HSGMG-HW-001	807963	M-Gage Dome Housing Installation Hardware: Mounting Kit for Anti-Rotation includes thread forming screws and washers (100 pcs each)
BWA-HSGMG-HW-002	807964	M-Gage Dome Locking Hardware Kit: Locking Kit for Anti-Tamper includes Steel Punch, Steel Drill Bit, and 25 Stainless Steel Roll Pins



M-GAGE Parking Sensor – D-cell

- Adjustable sensor parameters
- 1x D-cell lithium battery integrated into housing
- 12 years battery lifetime (with standard settings and effective communication strength)
- Fully potted and sealed housing contains the power source, sensor, and antenna for a completely wireless solution

M-GAGE D-cell Parking Sensor with Integrated Battery

Model	P/N	Type	Frequency	Protection	Temperature	Dimensions
DX80N2X1W0P0ZTD DX80N9X1W0P0ZTD	92926 92925	Sensor Node	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	H 42 mm x ø 74 mm
DX80DR2M-HMD DX80DR9M-HMD	92947 92948	MultiHop	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	H 42 mm x ø 74 mm

Wireless Sensor Node Model Selection



Ultrasonic Sensor Node

- Wireless industrial I/O device with an ultrasonic sensor integrated into the housing
- FlexPower® technology driven by 1x lithium primary battery
- Easily replaceable D-cell lithium battery (integrated into the housing)
- 7 years battery lifetime (with standard settings and effective communication strength)
- Power-efficient occupancy sensor for parking applications
- Range up to 4000 mm; sample rate 10 s (adjustable)

Ultrasonic Sensor Node (typical for indoor use)

Model	P/N	Type	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80N2X1W0P0U DX80N9X1W0P0U	25663 25662	Sensor Node	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	80.3 x 60 x 80.8 mm



Wireless Light Node

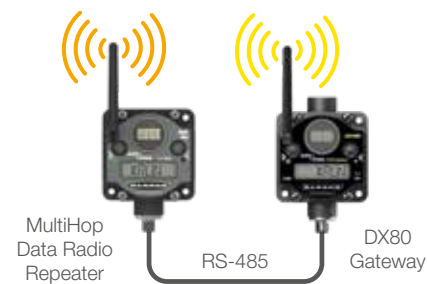
- 180° flashing LEDs
- Easily replaceable D-cell lithium battery (integrated into the housing)
- 2 years battery lifetime (with standard settings and effective communication strength)

Wireless Light Node (typical for indoor use)

Model	P/N	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80N2X1W0L1 DX80N9X1W0L1	25638 25661	2.4 GHz 900 MHz	IP67	-40 °C to +85 °C -40 °F to +185 °F	80.3 x 60 x 80.8 mm

Cluster Head Model Selection

The cluster head is a combination of two radio devices connected together by RS-485. The Gateway of the DX80 network collects the local sensor's status. The MultiHop Data Radio repeater transfers all information to the master in the control room. Both Gateway and Data Radio repeater are available as IP20 boards or in IP67 housings.



Cluster Head in IP67 Housing

- Radio range: 900 MHz: up to 9.6 km (6 miles) or 2.4 GHz: up to 3.2 km (2 miles)
- Interface: 2-wire half-duplex RS-485 Modbus RTU
- Power: +10-30 VDC or 3.6-5.5 VDC

DX80 Performance Gateway – Star topology

Model	P/N	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80G2M2S-P	82048	2.4 GHz	IP67	-40 °C to +85 °C	80.9 x 47.2 x 107.1 mm
DX80G9M2S-P	82047	900 MHz		-40 °F to +185 °F	

MultiHop Data Radio – Tree topology

Model	P/N	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80DR2M-H	11433	2.4 GHz	IP67	-40 °C to +85 °C	80.9 x 47.2 x 107.1 mm
DX80DR9M-H	11431	900 MHz		-40 °F to +185 °F	



Cluster Head as Board

- Radio range: 900 MHz: up to 9.6 km (6 miles) or 2.4 GHz: up to 3.2 km (2 miles)
- Inputs/outputs: Modbus RTU RS-485 + discrete + analogue
- Power: +10-30 VDC or 3.6-5.5 VDC

DX80 Performance Board Modules – Star topology

Model	P/N	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80G2M6S-PB2	25756	2.4 GHz	IP20	-40 °C to +85 °C	94 x 26.8 x 53 mm
DX80G9M6S-PB2	25755	900 MHz		-40 °F to +185 °F	

MultiHop Data Radio Board Modules – Tree topology

Model	P/N	Frequency	Protection	Temperature	Dimensions (L x W x H)
DX80DR2M-HB2	17423	2.4 GHz	IP20	-40 °C to +85 °C	94 x 26.8 x 53 mm
DX80DR9M-HB2	17422	900 MHz		-40 °F to +185 °F	

Wireless Controller Model Selection

The DXM100 Controller is an industrial wireless controller developed to facilitate Ethernet connectivity and Industrial Internet of Things (IIoT) applications. Available with an internal DX80 Gateway or a MultiHop Data Radio, this powerful Modbus communications device connects local wireless networks with the internet and/or host systems.



DXM Wireless Controller

- ISM radios available in 900 MHz and 2.4 GHz for local wireless network
- Converts Modbus RTU to Modbus TCP/IP or Ethernet I/P
- Logic controller can be programmed using action rules and text language methods (scripting)
- Micro SD card for data logging
- Email and text alerts
- Local I/O options: universal inputs, NMOS outputs, and analog outputs
- Powered by 12 to 30 VDC, 12 VDC solar panel, or battery backup
- RS-232, RS-485, and Ethernet communications ports; and a USB configuration port
- LCD display for I/O information and user programmable LED's
- 2.4 GHz Compliance: models listed are in accordance with EN 300 328: V1.8.1 (2012-06)
- -20 °C to +80 °C (-4 °F to +176 °F) operating temperature
- Dimensions 105 x 60 x 86 mm (L x W x H)

Model	P/N	Frequency	Topology	Protection	Discrete I/O		Analogue I/O	
					IN	OUT	IN	OUT (DAC)
DXM100-B1R3 DXM100-B1R1	800137 95651	2.4 GHz 900 MHz	DX80 Radio	IP20	PNP-NPN	NMOS	4–20 mA, 0–10 V, Counter, Temperature 10 kΩ Thermistor	0-20 mA or 0-10 VDC

DXM100-B1R4 DXM100-B1R2	800138 95652	2.4 GHz 900 MHz	MultiHop Radio	IP20	PNP-NPN	NMOS	4–20 mA, 0–10 V, Counter, Temperature 10 kΩ Thermistor	0-20 mA or 0-10 VDC
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Battery Based Repeater Model Selection



Autonomous MultiHop Repeater

- 6x Replaceable D-cell batteries embedded
- Radio range: 900 MHz (1 W): up to 9.6 km (6 miles) or 2.4 GHz (65 mW): up to 3.2 km (2 miles) (line of sight with included 2 dB antenna)
- IP67-rated housing for demanding environments

Battery Repeater

Model	P/N	Frequency	Protection	Dimensions (L x W x H)
MH2-BATT-REPEATER MH9-BATT-REPEATER	800830 800180	2.4 GHz 900 MHz	IP67	199.6 x 149.7 x 75.3 mm

R-GAGE Radar Sensor Model Selection



R-GAGE QT50R-AF Sensor

- FMCW (true-presence) radar detects moving and stationary objects
- Higher sensitivity and shorter range
- Adjustable sensing field – ignores objects beyond setpoint
- Easy setup and configuration of range, sensitivity, and output with simple DIP switches
- Resilient to outdoor environment (Rain, Fog, Snow, Wind, Vibrations), it can be placed behind a plastic window for antivandalism purposes
- Operating Temperature from -40 °C to +65 °C (-40 °F to +149 °F)
- 12 to 30 VDC (<100 mA) – Bipolar 1x NPN, 1x PNP; Dip-Switch Selectable Outputs N.O. or N.C.

R-GAGE QT50R-AF Sensor

Model	P/N	Connector	Detection Zone	Maximum Range	Protection
QT50R-EU-AFS	54270	5-wire 2 m cable	Single Adjustable Zone	3.75 m	IP67
QT50R-EU-AFSQ	54271	5-pin M12	Single Adjustable Zone	3.75 m	IP67
EU in model name: Telecom approved for Europe, UK, Australia, New Zealand, China and Japan. For South-Korea, replace EU in model name with KR.					
QT50R-EU-AFH	25366	5-wire 2 m cable	Single Adjustable Zone	24 m	IP67
QT50R-EU-AFHQ	25370	5-pin M12	Single Adjustable Zone	24 m	IP67
EU in model name: Telecom approved for Europe, UK, Australia, New Zealand, China and Japan. For US, Canada and Brazil, replace EU in model name with US. For South-Korea, replace EU in model name with KR. For Taiwan, replace EU in model name with TW.					

Q45 Wireless Sensor Model Selection



Q45 Wireless Sensor

- True self-contained wireless with no cables, cordsets or external power
- 1 km line-of-sight
- Built-in antenna
- 2.4 GHz unlicensed frequency
- Used exclusively with Banner's DX80 Gateways
- Default sensing interval 62.5 milliseconds

Q45 Wireless Sensor

Model	P/N	Protection	Sensing Mode	Range
DX80N2Q45LP*	26110	IP67	Polarized retroreflective	0.15 m to 6 m (6 in to 20 ft)
DX80N2Q45CV*	26111	IP67	Convergent	Up to 38 mm (100 ft) (38 mm focal point)
DX80N2Q45F	26114	IP67	Fiber optic	1.3 m in opposed mode with IP23S fibers or 100 mm in diffuse mode with BT23S fibers
DX80N2Q45D	26112	IP67	Diffuse	101 mm to 300 mm (4 in to 12 in)

*Region specific Telecom approved models are available for South-Korea: add -KR at end of model name.

M-GAGE Flat-Pak Sensor Model Selection



M-GAGE Q7LMEB Flat-Pak

- Suitable for below ground installation, designed for indoor or outdoor applications, above or below grade
- Encapsulated circuit board housing sealed with adhesive-lined heat shrink
- Capable of detecting vehicles that have stopped within the sensor's sensing field
- 3-axis magneto resistive-based technology; senses 3-dimensional changes to the earth's magnetic field caused by the presence of ferrous objects
- Compact, robust one-piece, self-contained sensor package replaces inductive-loop sensing technology; no external controller needed
- Designed to minimize the effects of temperature swings and destabilizing magnetic fields
- Sensor learns ambient background and stores settings; sensor will not lose configuration or range when power is cycled

M-GAGE Q7LMEB Flat-Pak

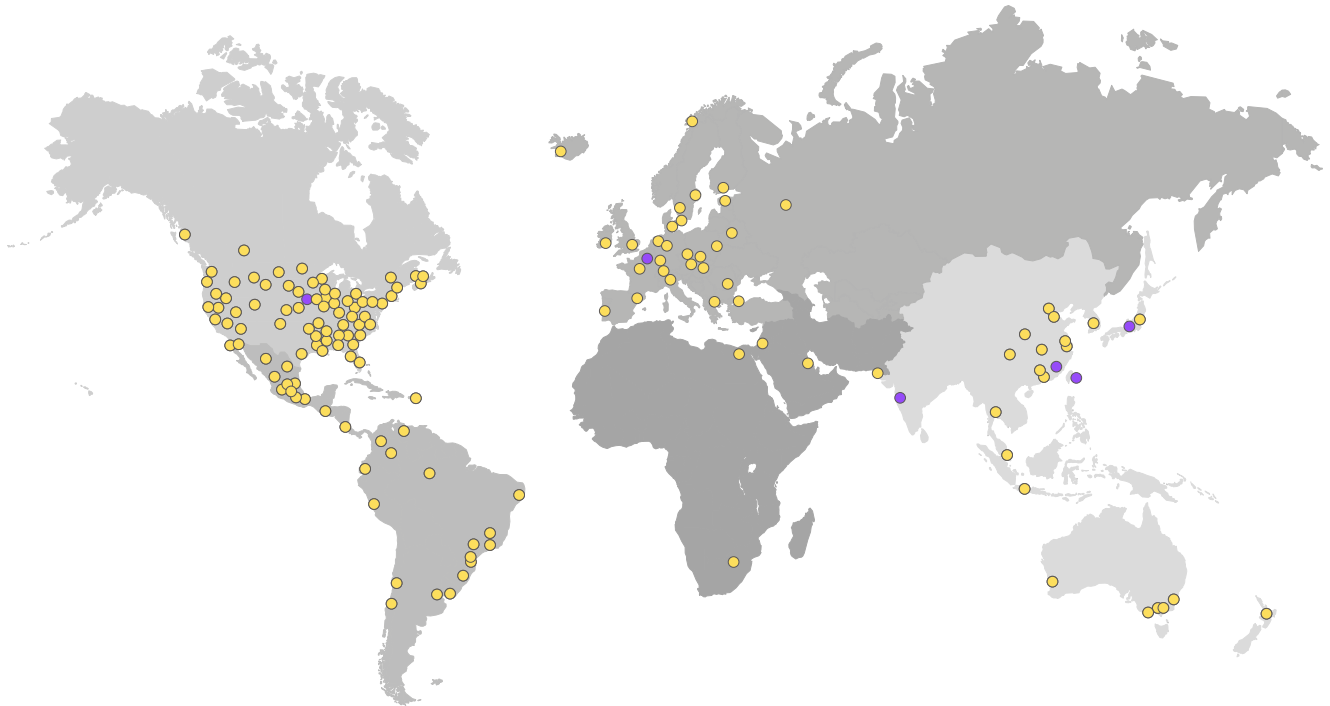
Model	P/N	Cable	Cable Type	Supply Voltage	Output Type
Q7LMEB W/6	86321	1.83 m (6 ft) cable	26 gage/5-wire shielded cable with 4 mm (0.160 in) diameter polyurethane jacket	10 to 30 VDC	Bipolar NPN/PNP
Q7LMEB W/15	86320	4.57 m (15 ft) cable			
Q7LMEB W/30	86319	9.14 m (30 ft) cable			
Q7LMEB W/50	86318	15.2 m (50 ft) cable			
Q7LMEB W/100	31942	30.5 m (100 ft) cable			
Q7LMEB W/200	31943	61 m (200 ft) cable			

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