



## Selecting the Proper Radio Technology to Meet Your Mobile Data Collection Needs

As the Automatic Identification and Data Capture (AIDC) industry continues to discover the value of mobile solutions, more and more IT managers are selecting cordless handheld bar code readers rather than the corded alternatives. Industries fueling this growth include healthcare, manufacturing, warehouse and logistics, as well as retail and banking.

The reasons for this are clear:

**Mobility:** Mobility is critical for data capture applications, even in situations where the operator needs to be mobile within a limited area. For example, cordless readers would be beneficial in automotive production lines where the operator moves around the vehicle on the line, or for patient care activities in the healthcare industry. Bar code readers with 10-15 m / 30-40 ft long cables were used in the past to provide the user with mobility; however, these cables can be very restrictive in their

use, not to mention the safety hazard posed by long cables.

**User Productivity:** During most scanning activities, it is much easier to bring a bar code reader to the object to be scanned, rather than the other way around. For years, long cables were the best (and only) solution to accomplish this task; however, these cables can easily become entangled, wasting valuable labor as the operator struggles with jumbled cords.

**Safety:** Long cables are a major safety risk. Objects can easily become entangled or pulled off shelves when using corded scanners, which can damage products and potentially injure employees. Even if the cables can be stretched across a workspace, they still pose a tripping hazard that could result in serious injuries or be the cause of an industrial accident.

**Cost:** Initially, investing in cordless bar code scanners is more expensive when compared to a corded solution. However, it is important to note that the benefits of mobility, user productivity and safety have a relevant impact in the reduction of the total cost of ownership. For example, costs eliminated by cordless readers through increased productivity often pay for the cost difference and beyond. Additionally, there is a decreased downtime caused by broken cables and the cost for cable replacement is eliminated.

## Things to Consider

Several cordless scanning solutions have been proposed by different scanning manufacturers over the years, however, not all solutions are reliable or comparable in terms of performance.

Consider the following key points when selecting a cordless scanner:

### **Reliability of the Radio Connection:**

The operator of a bar code reader is often a great distance from the host and cannot visually verify that scanned data has been received by the host. A radio connection needs to be reliable in order to be effective, otherwise, the 'mobile' aspect has no value.

**Bi-directional Communication:** At lower protocol levels, bi-directional communication is useful to guarantee data integrity and to manage the data flow. Without this communication, the user is not aware that the scanned data has been received by the host. This should be a minimal requirement of radio communications to assure data integrity.

At higher levels of application, the bi-directional communication increases the value and versatility of the wireless solution. For example, the host can send back useful information, confirmation or instructions to the operator, increasing the operator's efficiency. This is a value-added feature of the STAR Cordless System™ solution.

Some readers offer the capability of visual communication with the user through a text display, manual data entry using a numeric keypad, or both.

**Radio Range:** Depending on the application, the radio range required can vary from a few meters / yards to tens of meters / yards. Generally, the greater the radio coverage, the better the scanning device. When a user goes outside the radio range, operators experience a loss of efficiency as the user is either stopped from working or has to work 'offline.' This increases the likelihood of errors. Increasing radio coverage, however, is not always possible or convenient for a number of reasons:

- Maximum radiated power, or the strength of the signal, is normally regulated by national legislation.
- Higher radiated power may interfere with other radio systems.
- Higher radiated power may limit the maximum number of devices able to work in the same area (or drastically reduce the communication speed when the number of devices increases).
- Higher radiated power means higher power consumption which reduces battery life.

**Battery Life:** Batteries must be able to last a full shift in order to avoid losing time and efficiency. If the operator has to walk back to the office to change the batteries the entire enterprise loses productivity. The use of an 'on site' charger provides the best solution for most applications, the exception being extensive three-shift applications where the device is continuously in use and there is no opportunity for battery charging.

Tool-free removable batteries are useful for scan-intensive operations. They can be recharged in separate battery chargers while the scanner remains in use.

**Modularity and Expandability:** Cable elimination is the first benefit of cordless scanners, yet they can do much more. Choosing a cordless reader enables a completely different process design, where many operators can work in the same area and be connected to the same host at the same time. Advanced features such as networking or roaming allow employees to increase their work space to include the whole facility. Furthermore, modularity and expandability of the radio system offers investment protection.

**Coexistence:** More and more equipment, tools and machines are becoming cordless. It is important that devices are designed to work alongside each other without causing interference.



## Choosing Your Radio System

Different hardware manufacturers offer different solutions. At Datalogic Scanning, we divide them into two categories: Standards-Based Radio Systems and Custom Radio Systems.

### Standards-Based Radio Systems

Standards-based radio systems are designed to industry standards for interoperability (i.e. IEEE 802.11 for Wi-Fi or and IEEE 802.15 for Bluetooth® wireless technology). In theory, any two devices built to the same standard should be able to communicate with each other, regardless of the manufacturer.

**Advantages:** Traditionally, different readers from different manufacturers could be used for the same application. The possibility of mixing readers allowed users to replace old units or add new units as newer models or upgrades became available, providing the user with options to take advantage of the best offer available at that time. Users could also use standard radios to connect to equipment they already own, for example, computers equipped with Bluetooth® wireless technology.

**Disadvantage:** In reality, compatibility between readers from different manufacturers is quite rare. Cordless scanner users often have functional needs that are not well addressed in the standards. For this reason, most suppliers offer 'closed' solutions, or devices that communicate with components supplied by the same manufacturer (although they are based on a standard radio) in order to satisfy the customer's desire for a 'plug and scan' solution.

Another disadvantage is the general purpose nature of the wireless communication standards, compared to the more specific needs of a bar code scanner. The standards are intended to address a wide variety of possible applications and these additional features add unneeded complexity. The standards have not been optimized for the basic and simple needs of bar code readers.

The most common standard radio systems are:



### Bluetooth® Wireless Technology

The standard for Bluetooth wireless technology was defined to allow a user to quickly and easily create an individual WPAN (Wireless Personal Area Network). Typically, Bluetooth wireless technology is used for:

- Cordless communications at the operator's desk.
- File sharing and synchronization between devices (i.e. PDAs, lap tops and mobile phones).
- Wireless headsets for voice communications on mobile phones.

The standard is defined by IEEE 802.15.1. It is called 'P' for 'Personal,' as radio coverage normally limits the network to a single room and it connects peripherals normally used by a single person, such

as a wireless keyboard, mouse or printer. WPAN is dynamic as it doesn't require an access point and can be created anywhere by simply connecting and disconnecting devices. Bluetooth wireless technology is based on the ISM band centered at 2.4 GHz.

**Advantages:** WPAN is a good solution for applications needing a permanent wireless connection of static devices, such as connecting a printer to a PC, or for applications that require occasional connection of mobile devices for limited data exchange. For example, WPAN is ideal for data synchronization between a PDA and a laptop.



**Disadvantages:** Since Bluetooth wireless technology shares the same radio frequency as Wi-Fi, it is possible for the two systems to cause problems for each other.

Most manufacturers use base stations with added features and radio systems from different manufacturers which are not usually compatible with each other. This can create communication issues.

#### **Wi-Fi**

Wi-Fi Radio Systems are defined by the IEEE 802.11 standards (a, b, g and n) and are normally used for wireless local area networking, with very fast digital data rates for high throughput. Wi-Fi uses the same ISM (Industrial, Scientific and Medical) band centered at 2.4 GHz. Like Bluetooth wireless technology, these systems are commonly found in homes, offices, stores, warehouses and public places. Wi-Fi is the system used for lap tops, PDAs, mobile computers and printers. Networking, high mobility and high data communication speed are key factors of this system.

**Advantages:** This standard is an evolution of the traditional wired Ethernet LAN and allows the operators to have access to key

business systems, including the Internet via mobile devices.

**Disadvantages:** Wi-Fi is overkill for a 'simple' bar code reader. In addition to RF components, it requires a powerful microprocessor, an operating system and high capacity batteries. It is considered expensive and too over-engineered for standard bar code scanning applications. For this reason it is uncommon to use Wi-Fi for a handheld bar code scanner.

Other emerging standards include:

#### **ZigBee**

This is a radio protocol similar to Bluetooth wireless technology and defined by IEEE 802.15.4. It operates in both the ISM band at 2.4 GHz and in narrow band 433.869 and 910 MHz. Zigbee is specialized for very low power consumption and very low data rates, often for wireless instrumentation.

#### **WUSB (Wireless USB)**

This technology features very high data rates at a relatively short range of up to 10.0 m / 32.8 ft. It operates in a very wide frequency range from 3.1 to 10.6 GHz and is based on ultra wide band (UWB) from WiMedia.

#### **Custom Radio Systems**

Custom radio systems are defined by the company that manufactures them, not based on universal standards. Different manufacturers offer different solutions that are usually not compatible with each other. Some use a narrow band (433.869 and 910 MHz) and others use the ISM band (2.4 GHz). For example, the Datalogic STAR Cordless System™ solution is a narrow band radio communication solution featuring total mobility, real-time communications and affordability. The Datalogic STAR-System™ solution does not require any operating licenses, yet it provides one of the most flexible wireless connections between data and business.

**Advantages:** As developed by bar code reader manufacturers, proprietary radio systems have been designed for the unique needs of bar code and data capture applications. All of the radio parameters are completely under the control of the protocol developer who also controls secondary parameters, such as battery consumption. The bar code reader manufacturer owns and manages both the hardware and the software of its radio products, which guarantees the stability and continuity for the customer.

**Disadvantages:** Different radio systems from different manufacturers are not usually compatible and cannot communicate with each other; however, this may also be the case with closed standard based systems.

## Growing Trend in Cordless Scanning

Today, the AIDC industry estimates that around 16% of the bar code reader market is cordless; however, this sector is growing much faster than its corded counterpart. The price gap between the corded and cordless solution has been reduced significantly in the last few years but it is still too high to allow a complete mass migration of all applications to cordless.

It is Datalogic Scanning's goal is to reduce this gap to make the cordless solution more accessible for all customers.

For example, Datalogic Scanning's QuickScan™ QM2100 cordless reader has made the ratio of price to performance

exceptionally favorable for the migration to a cordless system.

Due to the growing demand of cordless scanners, there has been a recent proliferation of cordless solutions in the bar code reader market. Some bar code reader manufacturers are offering narrow band radios and protocols, just like Datalogic Scanning. Others use existing standards, most commonly Bluetooth wireless technology.

## Choosing Your Cordless Solution

Datalogic Scanning understands that one system is not always better than another. Every organization's situation is unique and depends upon the customer's needs and the requirements of their application. This is why Datalogic Scanning offers two radio system options:

- The exclusive Datalogic STAR Cordless System solution based on 433 and 910 MHz frequencies.

- Bluetooth wireless technology standards-based radio.

If you are unsure whether the Datalogic STAR Cordless System or Bluetooth wireless technology is right for your business, the table below shows a breakdown of some key features regarding radio expectations (see Fig. 1). The score is assigned with stars, ranging from one star (lowest value) to five stars (highest value). The scores are summed up at the bottom and the average score calculated indicates the higher value of the Datalogic STAR Cordless System solution.

Key Factors	Datalogic STAR Cordless System	Bluetooth Wireless Technology	Notes
AMBIENT PROPAGATION	★★★★★	★★★	Bluetooth wireless technology is more sensitive to obstacles and some materials (like water).
SENSITIVITY TO NOISE	★★★★	★★	2.4 GHz is a 'crowded' band width. Bluetooth wireless technology is a connection oriented system (transmits even when it is not required by the user).
TRANSMISSION SPEED	★★★	★★★★★	Bluetooth wireless technology is nominally faster working at 1 MB per sec. This is useful for large amounts of data, but negligible below hundreds of characters.
MAXIMUM DISTANCE	★★★★	★★★★★	Bluetooth wireless technology can transmit to farther distances but uses higher emitted power with the potential risk of interference with other radio devices.
NETWORK CAPABILITY	★★★★★	★★	Hundreds of devices can be used simultaneously with the STAR Cordless System configuration, only seven with Bluetooth wireless technology, as it was developed and designed purely for cable replacement purposes.
POWER CONSUMPTION	★★★★★	★★	Bluetooth wireless technology is a 'connection oriented' system, which requires a permanently 'live' connection.
STABILITY OF STANDARD	★★★★★	★★★	Bluetooth wireless technology is continuously evolving.
CONTROL OF TECHNOLOGY	★★★★★	★	Narrow band radios allow 100% of technological control.
PROTECTION/ENCRYPTION	★★★★★	★★★★★	Both protocols allow data protection.
<b>Average Score</b>	<b>4.6</b>	<b>3.1</b>	

Fig. 1

## The Following Scenarios Illustrate the Versatility of the STAR Cordless System:

### Point-to-Point Connection

A point-to-point connection infers that one scanner or device is connected to one cradle only, creating a one-to-one connection. In the example shown below, a QuickScan™ QM2100 reader relays 'scanned data' back to the cradle, which in turn is cabled into the PC, providing 'real-time' scanning (see Fig. 2).



Fig. 2

### Point-to-Multipoint Connection

A point-to-multipoint connection has one cradle (receiver) with up to 32 devices when using the PowerScan™ PM8300 readers or 16 devices when using the Gryphon™ cordless readers, working simultaneously, all transmitting data back to the same cradle. A point-to-multipoint connection with a bi-directional base (STAR-Modem™) is capable of receiving and transmitting data from the scanner. Additionally, it is able to transmit data to another peripheral, such as a printer. The base (STAR Modem) is cabled into the PC, creating 'real-time' updates. The PowerScan™ PM8300 readers are shown utilizing this connection (see Fig. 3).

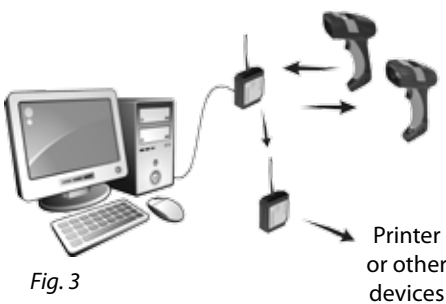


Fig. 3

In a point-to-multipoint connection using the PowerScan base station, the scanner is capable of receiving and transmitting data while the base station is cabled into the PC.

The term 'Bind' refers to the 'marrying' of one (main) scanner to the base station. This is required. Additional scanners are 'Joined' to the connection, able to communicate with the base station, capable of receiving and transmitting data (see Fig. 4).



Fig. 4

*Note: In the above configuration, any of the PowerScan™ cordless readers may be used.*

### Network Connection

A network can consist of up to 16 STAR Gate receivers and/or cradles connected via RS-485 using an Ethernet CAT-5 cable. A network allows the user to cover a larger area which allows up to 255 scanning devices working simultaneously with coverage over the entire area or warehouse. This provides seamless roaming and automatically connects the scanning device to the nearest receiver.

Using Datalogic Scanning hardware, a network can be created using the STAR Gate, the PowerScan™ 8XXX cradles and by 'daisy-chaining' one base to another (see Fig. 5).



Fig. 5

## Conclusion

Here are some general guidelines for selecting the best choice for different applications. Users should consider:

- Datalogic STAR Cordless System solution is the best solution for all applications where a limited amount of data needs to be transmitted (for example, codes of up to 100 characters). In fact, the only disadvantage of this radio compared with Bluetooth wireless technology is a lower data transmission rate.
- Bluetooth wireless technology is preferred for applications where a high volume of data must be transmitted (i.e., 2D or stacked bar codes, image based applications, etc.). In addition, Bluetooth wireless technology is also preferred when a direct connection of a bar code reader to the host occurs without the addition of an external receiver (i.e., direct transmission of the bar code to a laptop, PDA or mobile phone that already has its own embedded Bluetooth® wireless technology radio).

## Datalogic Scanning Cordless Solutions

Datalogic Scanning has been a pioneer in cordless technology and offers the following cordless products.

### The QuickScan Series

The QuickScan I QM2100 reader with the Datalogic STAR Cordless System solution offers economical mobility for simple point-to-point radio communications.

### The Gryphon Series

The Gryphon line of handheld readers is the premium, feature-rich solution for general purpose applications. All Gryphon scanners offer top reading and decoding speed including unmatched performance on high resolution codes plus Datalogic's patented 'Green Spot' technology for good read feedback. Cordless products are available with the Datalogic STAR Cordless System solution or Bluetooth® wireless technology.

### The PowerScan Series

Datalogic's PowerScan industrial handheld readers are data collection's definitive example of ruggedness and durability. Often imitated but never rivaled, the PowerScan products rise above the fray with their outstanding performance and unyielding reliability. Designed for industrial applications or abusive environments, PowerScan cordless products are available with the Datalogic STAR Cordless System solution or Bluetooth® wireless technology.







Datalogic Scanning Cordless Products	Radio Type	Bi-directional Capability	Point-to-point Configuration	Point-to-multipoint Configuration	Network Configuration	433 MHz/910 MHz Radio Frequency	2.4 to 2.48 GHz Radio Frequency
<b>QuickScan™ QM2100 Linear Imager</b> 	STAR		★			★	
<b>Gryphon™ GM4100 Linear Imager</b> 	STAR	★	★	★		★	
<b>PowerScan™ PM8300 Laser Scanner</b> 	STAR	★	★	★	★	★	
<b>PowerScan™ PM8500 2D Area Imager</b> 	STAR	★	★	★	★	★	
<b>Gryphon™ GBT4100 Linear Imager</b> 	Bluetooth		★	★			★
<b>PowerScan™ PBT7100 Linear Imager</b> 	Bluetooth		★	★			★

Fig. 6



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