

Coin-Type Primary Lithium Batteries

Suitable for Active RFID Tags

1. What Is Smart Logistics?

Smart logistics refers to initiatives that improve logistics operations’ efficiency through the use of IT technologies. By leveraging advanced technologies such as IoT, AI, big data, and robotics, smart logistics seeks to optimize logistics operations as a whole, enabling faster, more accurate deliveries and more efficient warehouse management.

In recent years, the logistics industry has undergone a significant transformation driven by the expansion of e-commerce (EC) and the diversification of consumer needs. Along with the increasing volume of logistics, the industry is facing labor shortages among truck drivers and warehouse staff, as well as the ongoing aging of the workforce. In addition, the rise in small-lot deliveries (last-mile delivery) and redeliveries due to customer absence has increased the need for efficiency improvements to reduce driving distances and driver operational burdens. At the same time, the globalization of businesses and advances in IT have expanded global supply chains that support EC. Against this backdrop, the smartification of logistics as a whole has been attracting increasing attention in recent years.

2. Evolution of Tracking Systems

Smart logistics can be broadly categorized into “mechanization” and “digitalization.” Mechanization refers to initiatives such as automated delivery using robots or drones, and warehouse organization through material handling equipment. Digitalization, on the other hand, includes the electronic processing of documents, the systematization of truck reservations and dispatch management, and the tracking of cargo traceability, as well as the location and status of equipment and staff within warehouses.

In recent years, demand for tracking systems that use communication technologies such as RFID, Wi Fi, BLE (Bluetooth Low Energy), and LPWA (Low Power Wide Area) has been growing. Among these communication technologies, RFID—whose adoption is increasing in logistics warehouses, ports, and similar facilities—is a data carrier that enables batch reading of up to several hundred tags within a specific area, contactless reading and writing of data stored in tags, and wireless transmission and reception. The introduction of RFID eliminates the need to open packages to check their contents, thereby improving operational efficiency and reducing workers’ workload. This paper provides a detailed overview of RFID.

3. Passive RFID and Active RFID

RFID tags can be broadly classified into passive and active RFID tags. Passive RFID operates at low cost and does not require a battery; however, its communication range is short, making it suitable for inventory management and inbound/outbound identification. In contrast, active RFID offers a longer communication range and larger data capacity, making it well-suited for wide-area tracking and status monitoring. Due to these characteristics, active RFID meets the needs of logistics operations handling large volumes of goods across expansive sites such as warehouses and ports, particularly for asset management and traceability.

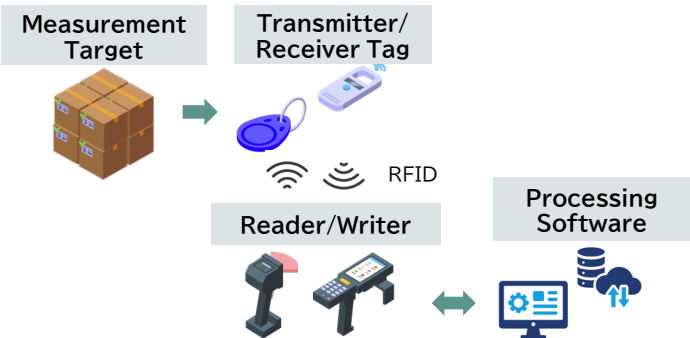


Figure 1. Basic Configuration of an RFID-Based Tracking System

Table 1. Comparison of Passive RFID and Active RFID

	Communication Range	Tag Power Consumption	Memory Data Capacity
Passive RFID	3~5 m	Very low	Several hundred bytes
Active RFID	Up to 100 m	Medium to high	Several kilobytes

4. Requirements for Batteries Used in Active RFID

Active RFID tags require a power source, such as a battery, to read and write data stored in memory. Coin type primary lithium batteries are commonly used due to their compact size and slim form factor. The key requirements for batteries used in active RFID tags are as follows:

•High Capacity

Active RFID tags are required to transmit large volumes of data over long distances via radio waves and, in some cases, operate sensors over extended periods. Therefore, high-capacity batteries are essential for long-term operation.

•Wide Operating Temperature Range (Low-Temperature Performance)

Since RFID tags are used in environments where ambient temperatures vary depending on seasons and weather conditions, batteries must operate reliably over a wide temperature range. In particular, stable performance at low temperatures during winter is critical.

•Long-Term Reliability

Active RFID tags are often deployed in harsh environments such as warehouses and ports. As a result, batteries must offer high resistance to humidity and mechanical shock, ensuring safe and reliable operation over long periods.

5. Panasonic Energy’s Battery Solutions for Active RFID

Panasonic Energy offers the CR series of coin type primary lithium batteries, well-suited for active RFID applications.



5-1. Extensive Product Lineup

Panasonic Energy offers a wide range of products, from thin-profile batteries to high-capacity models, enabling customers to select the most suitable battery to meet diverse requirements.

Table 2. Panasonic Energy CR Series Coin-Type Primary Lithium Battery Lineup

Type	Model	Normal Capacity (mAh)	Continuous Standard Load (mA)	Dia. (mm)	Height (mm)	Approx. Weight (g)	Operating Temp. (°C)
Standard	CR1025	30	0.1	10.0	2.5	0.6	-30~85
	CR1216	25		12.5	1.6	0.7	
	CR1220	35			2.0	0.9	
	CR1616	55		16.0	1.6	1.0	
	CR1620	75			2.0	1.3	
	CR1632	140			3.2	1.9	
	CR2012	55	0.2	20.0	1.2	1.4	
	CR2016	90			1.6	1.6	
	CR2025	165			2.5	2.3	
	CR2032	225		23.0	3.2	2.8	
	CR2330	265			3.0	3.7	
	CR2354	560			5.4	5.7	
	CR2412	100	24.5	1.2	2.0		
	CR2450	620		5.0	6.2		
CR2477	1000	7.7		10.5			
CR3032	500	30.0	3.2	6.9			
High-Temperature (Wide Temperature Range)	CR2032A	210	0.2	20.0	3.2	3.0	-40~125
	CR2032B						-40~120
	CR2050A	345			5.0	4.1	-40~125
	CR2050B2					-40~120	
	CR2450A			550		6.2	-40~125
	CR2450B	560		-40~105			

In addition, for applications requiring long-term operation, Panasonic Energy offers the BR series of coin type primary lithium batteries, which feature low self-discharge and are suitable for long-term storage. For applications that require even higher capacity, cylindrical primary lithium batteries are also available. For further details, please visit the Panasonic Energy website for business customers.

5-2. Wide Operating Temperature Range

The standard type supports an operating temperature range of -30°C to +85°C, while the high temperature (wide temperature range) type supports -40°C to +125°C. This enables reliable operation across a wide variety of temperature environments, regardless of season. Figure 2 shows the pulse discharge characteristics at -20°C of the standard type (CR2032) and the high temperature types of the same size (CR2032A and CR2032B).

Even under low temperature conditions, where voltage tends to drop, all models maintain a stable voltage of 1.8 V or higher up to a depth of discharge of 80%.In particular, the high temperature type employs Panasonic Energy’s proprietary negative electrode formulation, achieving excellent discharge performance even in low temperature environments.

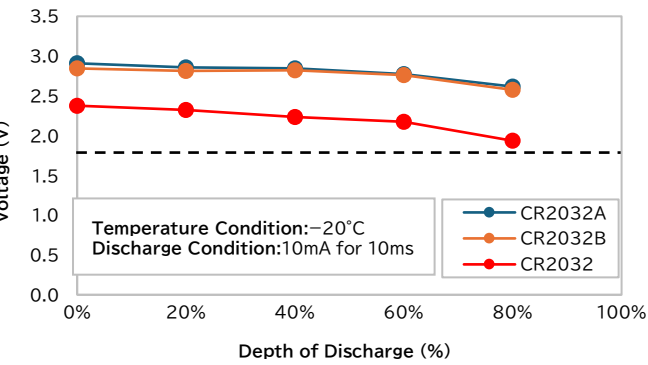


Figure 2. Pulse Discharge Characteristics (CR2032, CR2032A, CR2032B)

In addition, Panasonic Energy’s proprietary sealing technology provides excellent moisture resistance, enabling stable device operation even in environments such as warehouses and ports.

5-3. One Stop Solution

Panasonic Energy offers a comprehensive lineup that extends beyond primary lithium batteries for RFID tags to include secondary lithium-ion batteries for RFID readers. By maintaining an integrated production system from cell manufacturing to battery pack assembly, Panasonic Energy ensures consistent and reliable quality control. Through its one stop solution approach, Panasonic Energy responds to a wide range of battery related requirements.

5-4. Stable Global Supply Chain

Panasonic Energy maintains multiple sites for battery material procurement and cell and pack production. Through an efficient and stable global supply chain, Panasonic Energy ensures the long term, reliable supply of the required products.

In addition, with sales offices around the world, Panasonic Energy can provide attentive, localized communication to customers in each region.

Panasonic Energy’s business domains include dry batteries that support everyday convenience and comfort, batteries that underpin a wide range of social infrastructure, and batteries for the automotive industry, including electric vehicles. Through these businesses, Panasonic Energy is committed to contributing to the realization of a sustainable society in which enriched living and environmental responsibility are harmoniously balanced.

■ If you have any questions about this document, please contact the following:
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