

Proposal for Optimal Primary Lithium and Nickel-Metal Hydride Batteries for IoT Trackers in Maritime Shipping Containers

With the rapid growth of e-commerce and the advancement of globalization, the scale of international logistics continues to expand year by year. Amid these changes, the logistics industry faces several key challenges:

- Improving operational efficiency through digital technologies to address global labor shortage
- Reviewing transportation routes and optimizing fuel consumption in response to stricter CO₂ emission regulations
- Ensuring transport quality by monitoring cargo location and condition in real time

To address these challenges, logistics tracking systems utilizing IoT technology are increasingly being adopted. This article focuses specifically on IoT trackers for maritime shipping containers (hereafter referred to as “container trackers”).

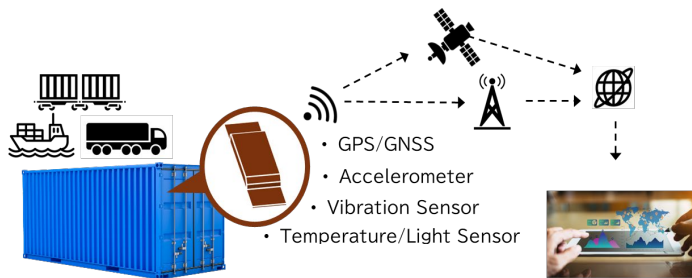


Fig.1 Image of Container Tracker Usage

1. What is a Container Tracker?

A container tracker is an IoT device that not only uses GPS to determine the location of cargo containers, but also senses real-time conditions such as temperature, humidity, vibration, shock, and brightness. These data are transmitted wirelessly, enabling remote and accurate monitoring of cargo during transportation. This improves efficiency in both shipping and inventory management and allows for the design of transport routes that consider environmental impact.

2. Technical Requirements for Container Trackers

Container trackers must meet several critical technical requirements to function effectively in global logistics environments. First, advanced communication capabilities are essential. Since container trackers are used across borders and in remote areas, they must support low-power data transmission technologies such as LPWA (Low Power Wide Area). Recently, satellite-enabled trackers have also become available, allowing for stable communication even during maritime transport or in isolated regions. Second, the physical design of the tracker must accommodate strict size constraints. Trackers are typically installed in small recess areas on the surface of containers. If the device protrudes beyond these recesses, it risks being damaged during handling or transit. Therefore, a slim and compact form factors are crucial. Finally, container trackers must be highly durable. They are exposed to harsh environmental conditions, including extreme temperatures, vibration, rain, wind, and salt corrosion. As such, they require robust engineering to ensure reliable performance throughout the shipping process.

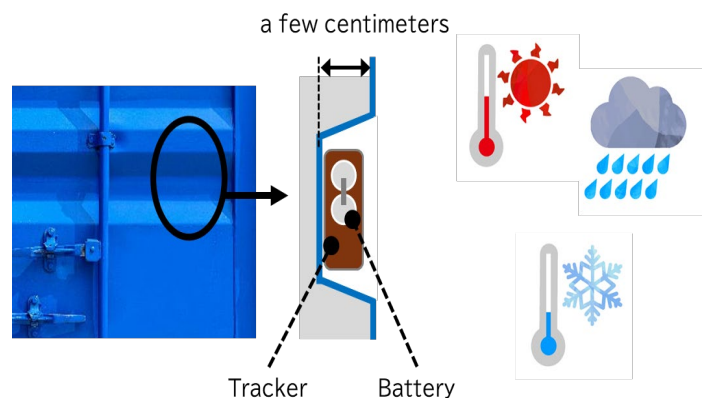


Fig.2 Technical Requirements for Container Tracker

3. Battery Requirements for Container Trackers

Container trackers are typically battery-powered, and these batteries must meet several key technical requirements.

First, high energy density is essential. As trackers become smaller and thinner, they need to store more energy in limited space. This is especially important as features like satellite communication and real-time sensing increase power consumption, making compact, high-capacity batteries critical.

Second, high reliability is vital. Trackers face harsh conditions during transport—extreme temperatures, wind, rain, and vibrations so batteries must deliver stable power in these environments.




Third, long operational life is required. Trackers are expected to run for years without maintenance, so batteries must perform consistently over time.

To meet these needs, large-capacity primary lithium batteries are commonly used. Rechargeable batteries paired with solar panels are also gaining traction as a sustainable, long-lasting solution.

4. Battery Options for Container Trackers

We offer a wide range of both primary and rechargeable batteries, allowing you to select the most suitable option based on your specific requirements.

Table 1 Our Products for Container Tracker

Type	Primary Lithium	Nickel Metal Hydride	
Model	CR-LAZ 	BK330 APH 	BK310 CHU 
Capacity	3,000 mAh	3,200 mAh	3,100 mAh
Charge Temp	-	-10 ~ +60°C	-20 ~ +75°C
Discharge temp	-40 ~ +85°C	-10 ~ +60°C	-20 ~ +75°C
Diameter (mm)	17.0	18.2	25.8
Height (mm)	50.5	67.5	50.0
Feature	<ul style="list-style-type: none"> Excellent high-rate discharge characteristics Long operating time enabled by high-capacity battery 	<ul style="list-style-type: none"> High safety (non-flammable) No restrictions on air transport, offering high logistical flexibility Usable across a wide temperature range 	

5. Key Features of CR-LAZ Primary Lithium Battery

5-1. High Capacity and Long Life

Our CR-LAZ battery offers industry-leading capacity and longevity. As shown in Figure 3, even after more than 1,000 hours of discharge under room temperature conditions, it maintains a stable voltage. This performance enables long-term, reliable operation of container trackers used in maritime shipping, where frequent battery replacement is difficult.

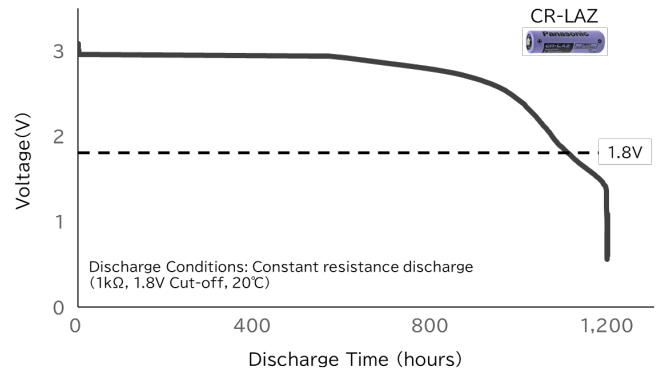


Fig.3 Continuous Discharge Characteristics of CR-LAZ

5-2. Wide Operating Temperature Range

One of the key features of the CR-LAZ battery is its ability to operate reliably across a wide range of temperatures. As shown in Figure 4, it maintains discharge performance comparable to room temperature even in high temperature environments such as 45°C and 60°C. Furthermore, it supports pulse discharge while maintaining stable voltage even in extremely low temperatures, such as -20°C and -40°C. This ensures consistent power supply to trackers during container transport in both hot and cold regions.

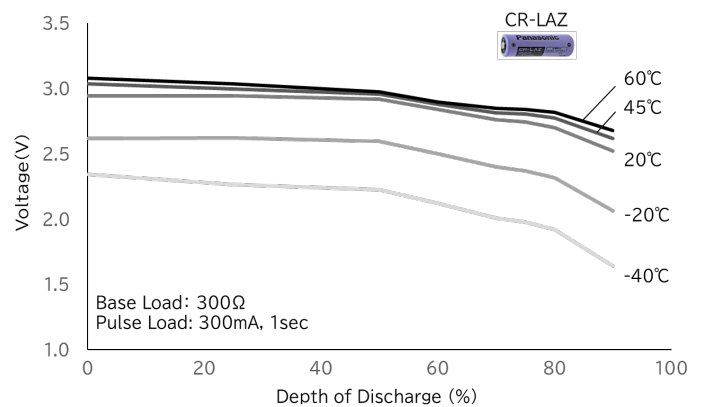


Fig.4 Pulse Discharge Characteristics of CR-LAZ

6. Key Features of Our NiMH Batteries

This section highlights the features of our “BK310CHU” model, a U-type battery known for its excellent temperature tolerance. In addition to the U-type, we offer a wide range of products in various sizes and specifications. For more details, please feel free to contact us.

6-1. Charge and Discharge Performance Across a Wide Temperature Range

Figure 5 shows the results of charging tests under different temperature conditions. As illustrated, the BK310CHU maintains stable charging performance even in extreme environments ranging from -20°C to 75°C , demonstrating its ability to charge reliably in sub-zero conditions during cold-region transport.

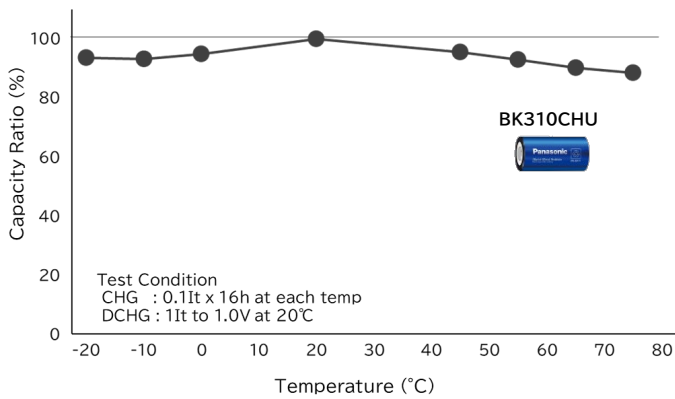


Fig.5 Temperature-dependent Charging Characteristics

Figure 6 presents the results of discharge tests under varying temperatures. The battery maintains high discharge performance even at -20°C and delivers performance comparable to room temperature even in high temperature environments up to 65°C .

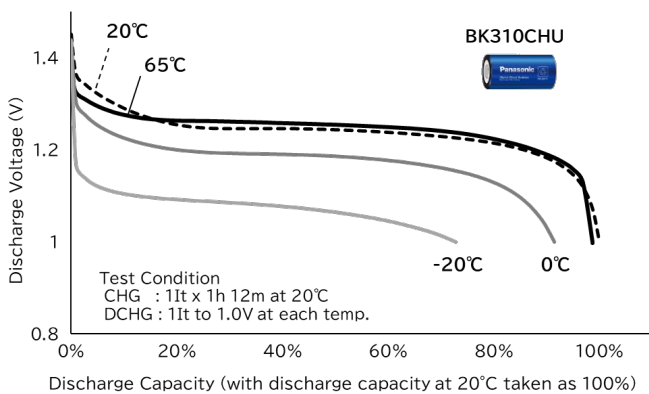


Fig.6 Temperature-dependent Discharging Characteristics

Trackers are often exposed to direct sunlight and heat from the container surface, which can cause the internal temperature of the device to rise significantly. As a result, high temperature tolerance is a critical requirement for batteries installed inside the tracker. Our nickel-metal hydride batteries offer stable charge and discharge performance even in high temperature environments, making them a reliable choice for use in demanding conditions.

6-2. Long Life Performance

The rechargeable batteries inside container trackers are typically charged over long periods through solar power on the container surface, following a day-night cycle to maintain a full charge. This charging pattern requires strong resistance to overcharging. Figure 7 shows the results of a trickle charge test (a method of continuous low-current charging) under accelerated high temperature conditions. As shown, the battery maintains stable capacity over time even at 40°C . This demonstrates that our batteries can be used with confidence in solar-powered applications requiring long-term durability.

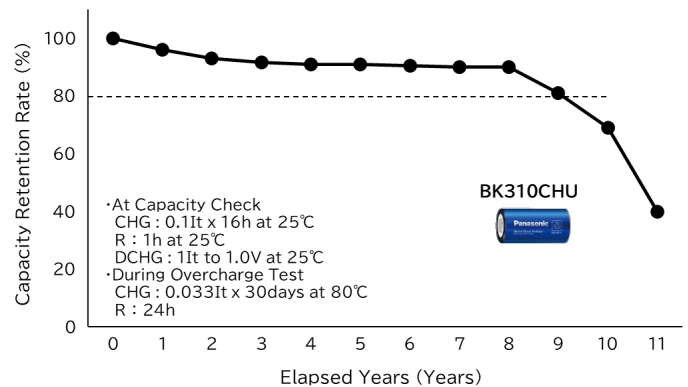


Fig.7 Battery Life Estimation at 40°C

6-3. Pack Configuration Options

We can supply battery packs assembled from multiple individual cells to meet your specific requirements. Custom configurations, including connectors and lead wires, are also available upon request.

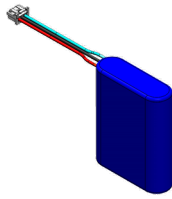


Fig.8 NiMH Battery Pack Example (3 cells)

7. Globally Reliable Supply Chain

With multiple manufacturing and sales locations not only in Japan but also overseas, we are able to deliver products efficiently and reliably through a global supply chain. This also enables close, localized communication with customers in each region.

At Panasonic Energy, our business spans from everyday dry batteries that support convenient and comfortable living, to batteries that power social infrastructure and the automotive industry—including electric vehicles. We are committed to contributing to a sustainable society where enriched lifestyles and environmental responsibility coexist in harmony.

■For inquiries regarding this document, please contact us via the following link:

▾ [Link to Contact page](#) ▾



The information in this document is current as of June 2025.

The values listed are not guaranteed and product specifications may change without notice.

■Product Lineup

Category	Type	Product page
Primary Lithium	CR-LAZ	Link
Nickel Metal Hydride	BK310 CHU	Link
	BK330 APH	Link
	Long Life Models (U Type)	Link
	High-Rate Discharge Models (PH Type)	Link
	Standard Models (H Type)	Link