

SHELDON BLACKAMORE

Business Development Associate

DRIVING THE EVOLUTION: INNOVATIVE SOLUTIONS FOR THE SMALL MOBILITY MARKET

March 2025

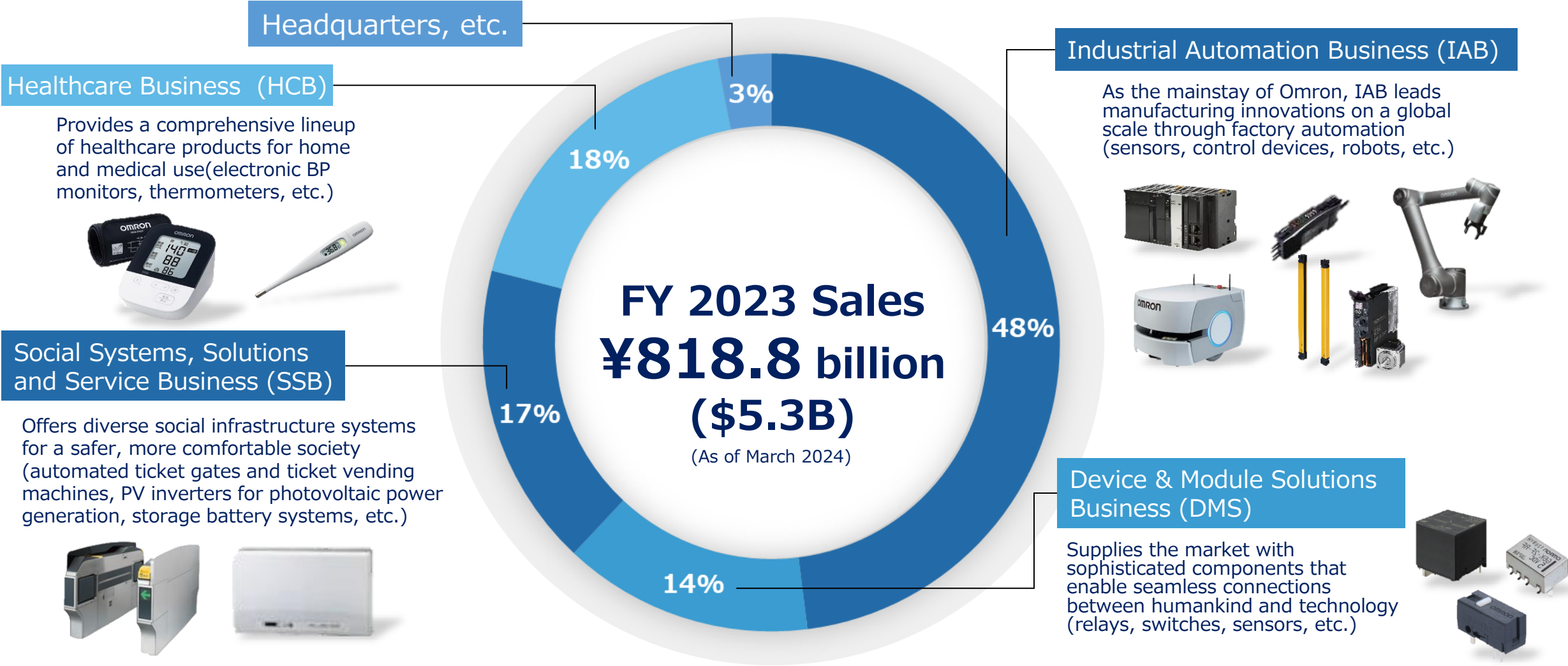
- 1 Introduction of OMRON
- 2 Market Trends
- 3 DC Relays
- 4 Sealed Micro Switches
- 5 New Technology Solutions

What brings you to this Webinar section?

1. Interested in learning about OMRON's Small Mobility Solutions.
2. Seeking potential replacements for the switching device currently in use.
3. You are researching future trends within the Small Mobility market.
4. In the process of selecting relays or switches for your application.

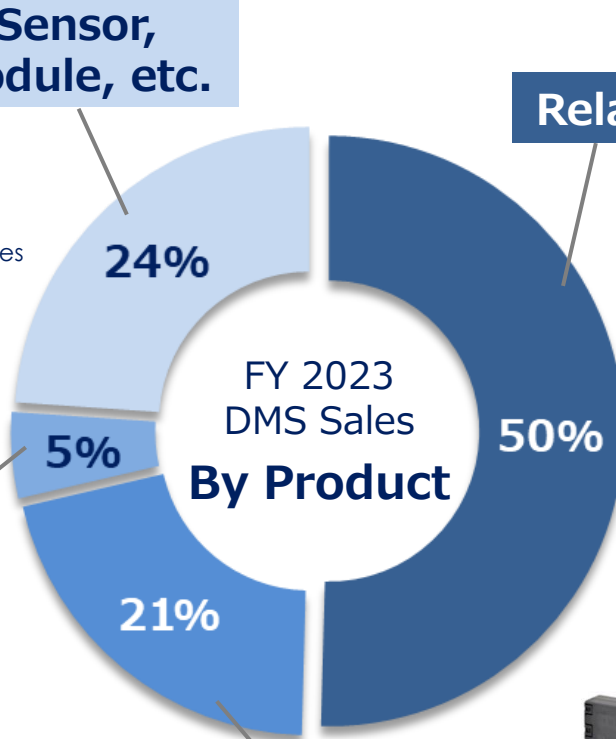
OMRON's Corporate Overview

As the leading company of automation, OMRON is comprised of various businesses including industrial automation, healthcare, social systems, and electronic devices and modules. Established in 1933, Omron currently employs approximately 28,000 staffs around the world and provides products and services in around 120 countries and regions.



Device & Module Solutions Company (DMS) Products

DMS devices and modules provide solutions to develop product features that are essential to achieving carbon-neutrality and realizing a digital society.



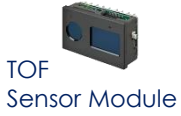
OKAO Human Vision Image Sensing Technology (Software)



MEMS Flow Sensors
Seismic Sensors



Photomicro Sensor
IoT Modules



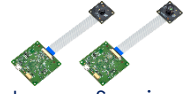
TOF Sensor Module



Light Convergent Reflective Sensors/
Diffuse Reflective Sensors



Color Sensors



Human Image Sensing Components HVC-P2



MIL Flat Cable Connectors



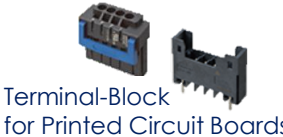
FPC/FFC Connectors



D-Sub Connectors



DIN Connectors



Terminal-Block for Printed Circuit Boards



Easy-wire Connectors for Industrial Components



Half-pitch Board-to-Board Connectors



USB Connectors



General-purpose Relays



MOS FET Relays



Automotive Relays



Power Relays



MOS FET Relay Modules



Surface Mount Detection Signal Relays



AC/DC Power Relays



Power Latching Relays



Solid-state Relays



Small Basic Switches



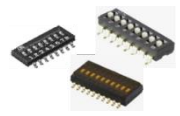
Ultra-small Tactile Switches



Trigger Switches



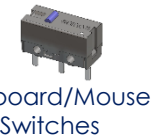
Sealed Ultra-subminiature Basic Switches



DIP Switches



Thumbwheel Rotary Switches



Keyboard/Mouse Switches

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Small Mobility

Leading with OMRON's existing Device and Module solutions, start to penetrate the small mobility market to gain an understanding of market needs by actively researching, prospecting, and promoting

Golf Cart



- Commercial Use Golf Carts
- Personal Use Golf Carts

Forklift & Scissor Lift



- Warehouse Operations
- Enabling Safety
- Efficiency Focus

Agriculture & Heavy Equipment



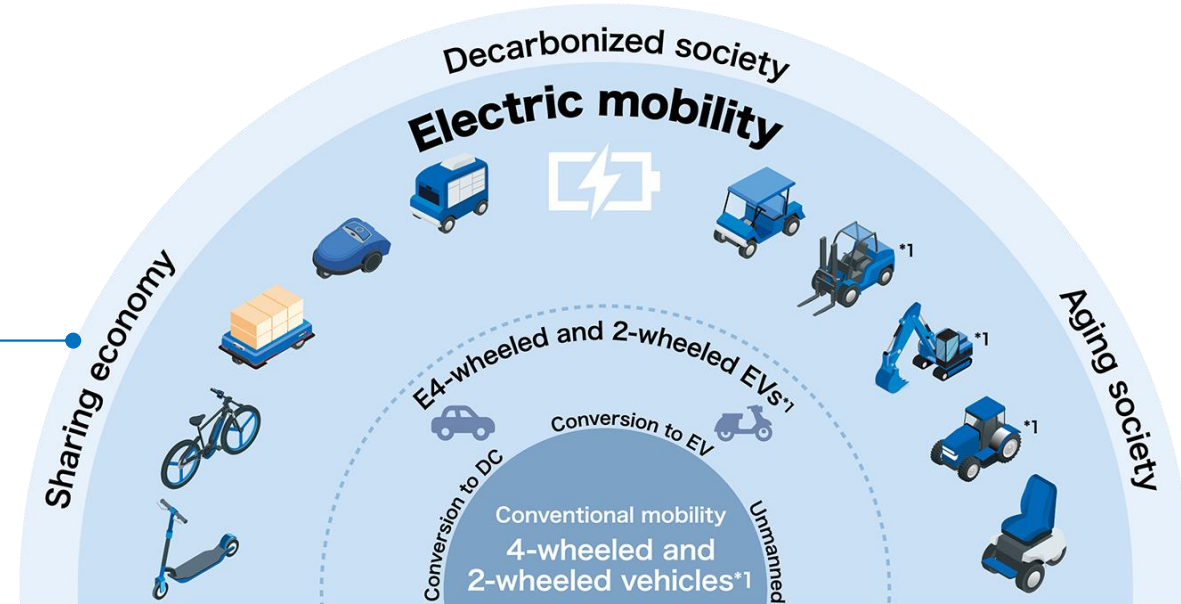
- Construction machinery
- Farming Equipment
- Forest Machinery



Design Challenges faced by engineers

Value required for components

OMRON's recommended electronic components



"Safety & Reliability"
Safe driving in various situations

"Energy-Saving"
Improved mileage

"Design & Functionality"
Compact & slim

① **Stable energizing and interruption**

② **Low power consumption**

③ **Miniaturization**

DC relay

Microswitch

Forklifts and Logistics Roadmap

LOGISTICS

FORKLIFTS

1900s

Mass production of the Ford Model T (USA)

Revolutionized how goods were manufactured

1950s

The world's first commercially successful container ship, the "Ideal X," is launched.

Sparked the influence of containerization and transporting goods

2000s

The emergence of the Supply Chain Management (SCM) concept

Increased market size and demand for forklifts

The spread of the Internet and the rise of e-commerce

Advancements and implementation of IoT, AI, robotics

Calling for more autonomous warehouses and intelligent solutions

2030s

2030s

- Generalization of Drone Delivery
- Full Automation
- Local Production for Local Consumption

2050s

- Establishment of a Fully Unmanned AI Logistics Network
- Energy Optimization Across the Entire Supply Chain
- Spread of the Sharing Economy and On-Demand Logistics

2050s

EARLY DEVELOPMENT AND GROWTH

TECHNOLOGICAL ADVANCEMENTS AND PROLIFERATION

SUSTAINABILITY AND SMART TECHNOLOGIES

A KEY PILLAR OF SUSTAINABLE AND EFFICIENT FUTURE LOGISTICS

"Synergy and High Efficiency"

- ✓ **Right Machine, Right Job**
-> compatibility, integration of data across different devices
- ✓ **High Efficiency**
-> inventory, route optimization, fast charging, maintenance
- ✓ **Full Automation**
-> predictive maintenance, remote monitoring, security

Current Issues

- The ability to energize and interrupt DC loads reliably even under vibration and shock conditions.
- Wasteful power consumption
- Limited Board Space Savings

OMRON Solutions

- Stable energizing performance even under vibration and shock
- Waste-free power consumption
- Compact size products allowing board space savings

Examples of problems faced by engineers

We want to realize safety control of DC loads in various driving environments.



"Larger battery capacity. Is that DC load control really safe?"

We want to realize low power consumption design while maintaining/improving functionality



"People talk about energy savings, but we have to add the ability to interrupt large loads..."

We want to achieve both functionality and design



"We want functionality, but we also want a slim, compact design..."

Selection point (value provided by OMRON)

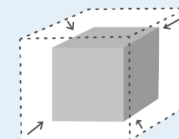
Stable energizing and interruption even under vibration and shock



Waste-free power consumption

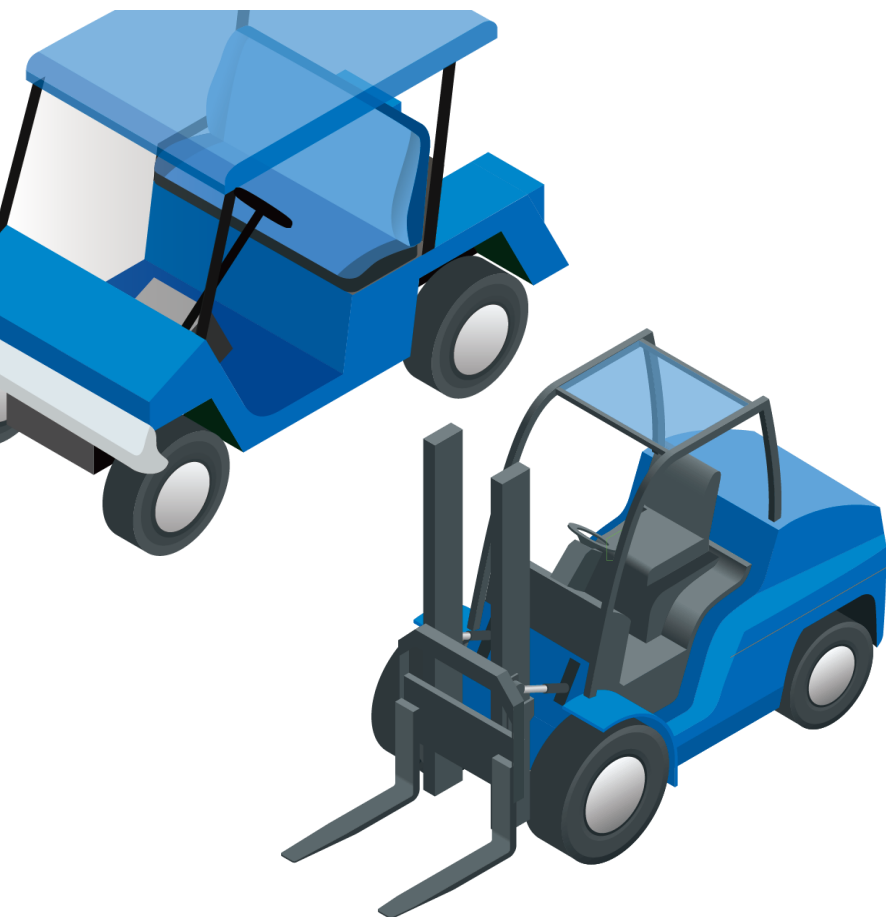


Thoroughly pursued ultra-compact



Which market of Small Mobility are you Interested in learning more about?

1. Golf Carts
2. Forklifts / Scissor Lifts
3. Agriculture Equipment
4. Other



In Development

IoT Gateway

Enhance Safety / Functionality

With Omron sensors and IoT gateway, keep players and carts safe as well as increasing functionality.



Optical Technology



Differentiate Yourself

With OMRON's optical technology, make your product unique and classy.

Grip/touch sensor

Enhance Safety

Measure human capacitance
Prevent unintentional F/R switching



Temperature Monitoring

Sensor capable of measuring the surface temperature of stationary or moving objects to monitor overheating.



MP Items

DC Power Relays

"G9E series"
Battery, Motor, Charging station ..etc.



DC Mini Power Relays

"G8K, G8G, G8PM series"
Radiator fan, Horn, Head lamp ..etc.



Sealed Type Mini Switches

"D2HW, D2AW, D2GW, D2AW-R series"
Steering column, Seat belt buckle ..etc.



Brake Lamp Switches

"C8EA series"
Brake lamp ..etc.



OKAO®

Preventing accidents caused by unqualified personnel
Driver identification* with OMRON's OKAO

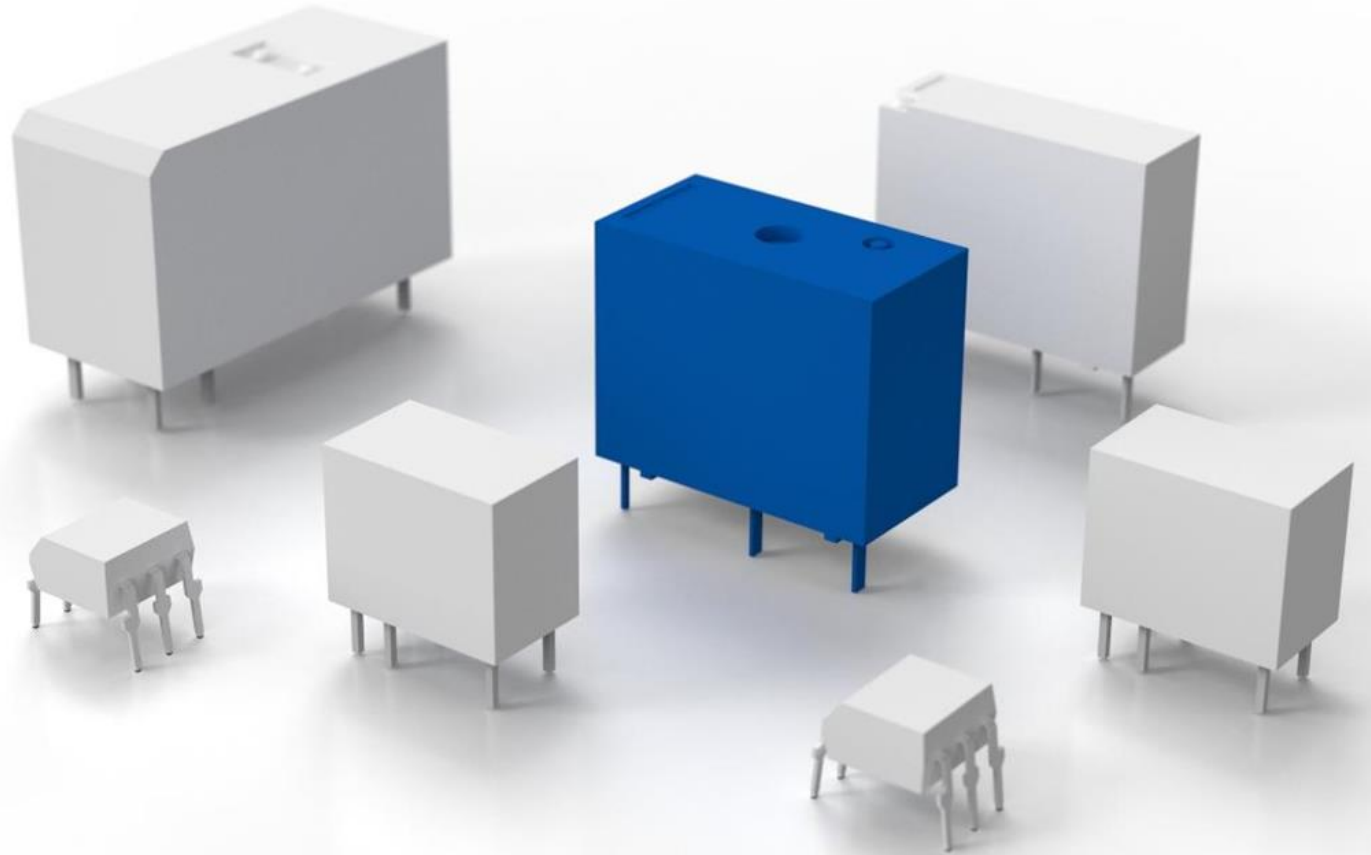


Identification*: by pre-registration

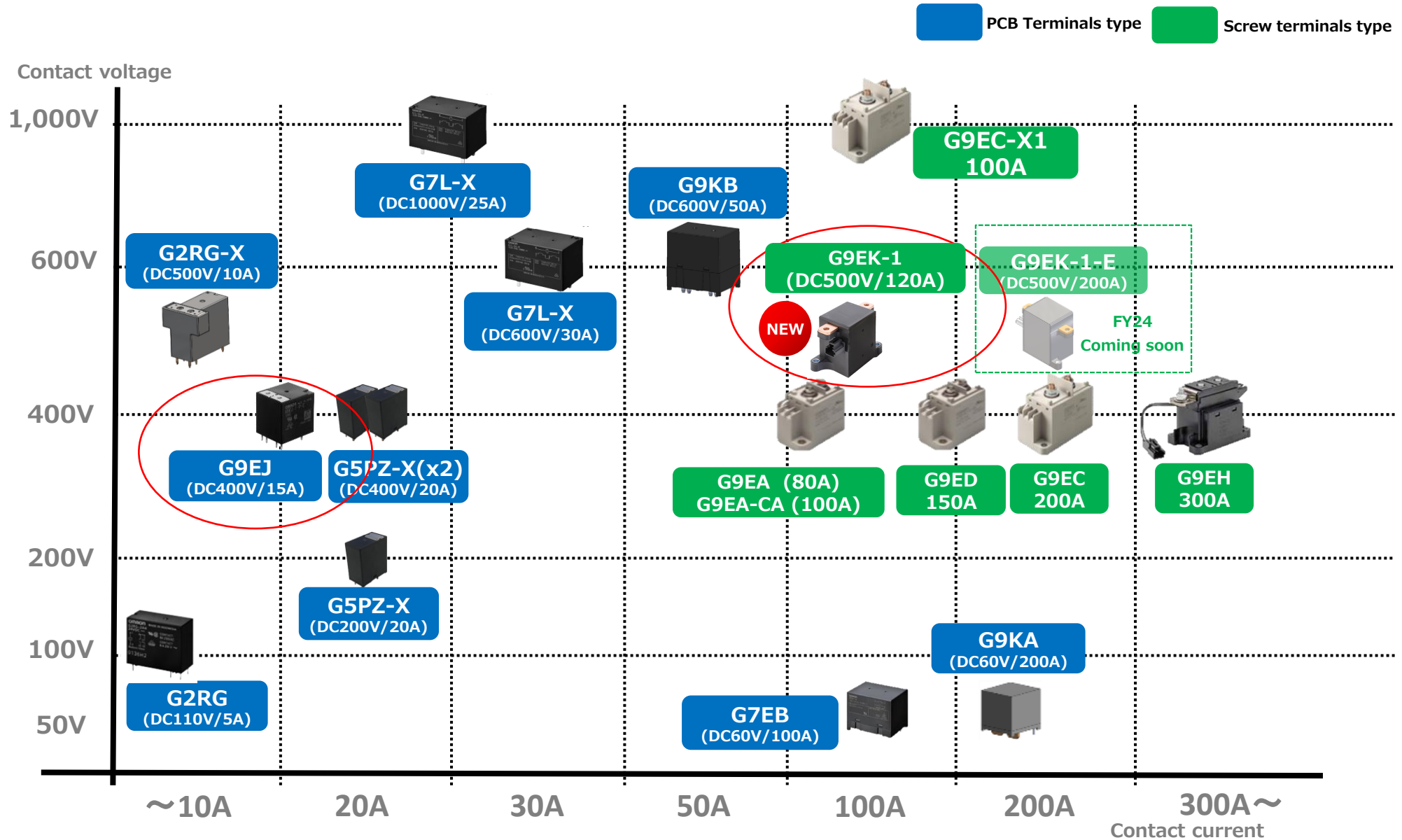
*To improve lives and contribute to a better society"

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OMRON High Capacity Relays

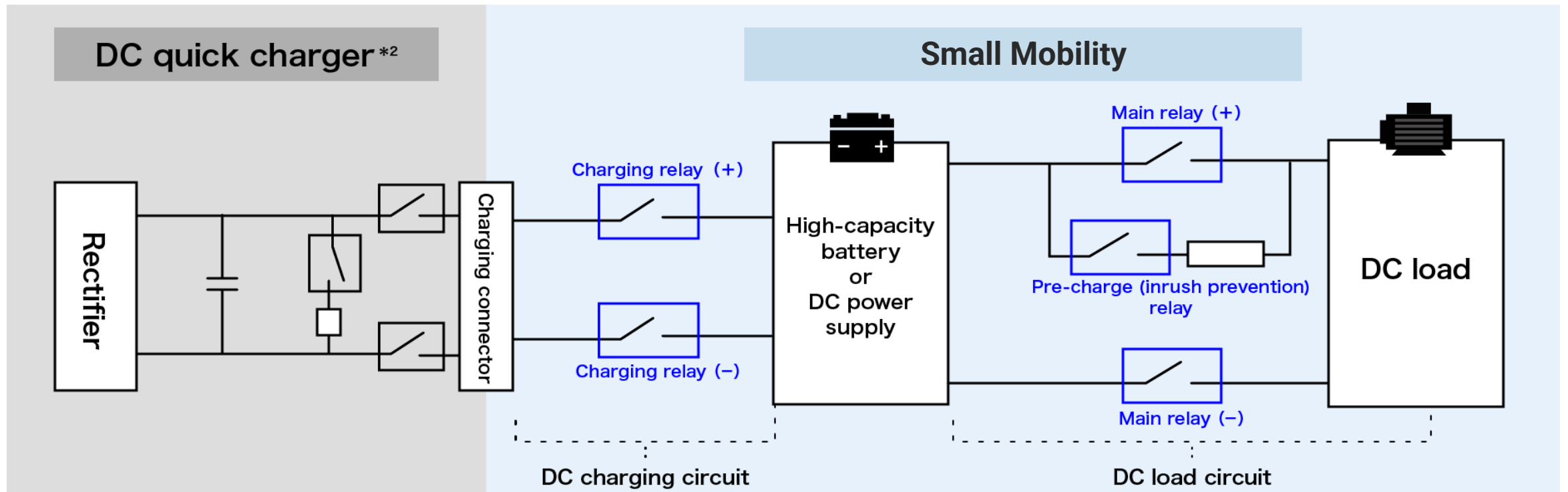


DC Power Relays Product Lineup



DC Relays (High-Capacity Range)

Electric mobility has three major components: charging device, battery (DC power source), and DC load. DC relays are required to play two roles, one for interrupting and the other for pre-charging. This is an application where safety is strongly required.



DC Power Relay: G9EK-1

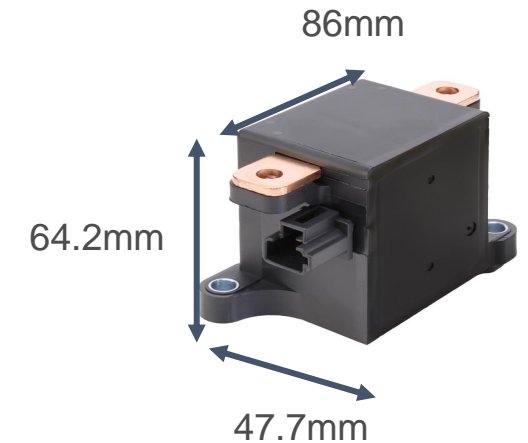


Delivers low power consumption and high short-circuit performance for energy savings.

Rated load: 120 A at 500 VDC

- Achieves 120 A capacity with bidirectional switching, no sealed gas-filled structure needed.
- Its sealed design requires no arc space, making it safer and smaller for applications.
 - Vibration and impact-resistant, ideal for mobile use.
 - UL and C-UL approved.

G9EK-1

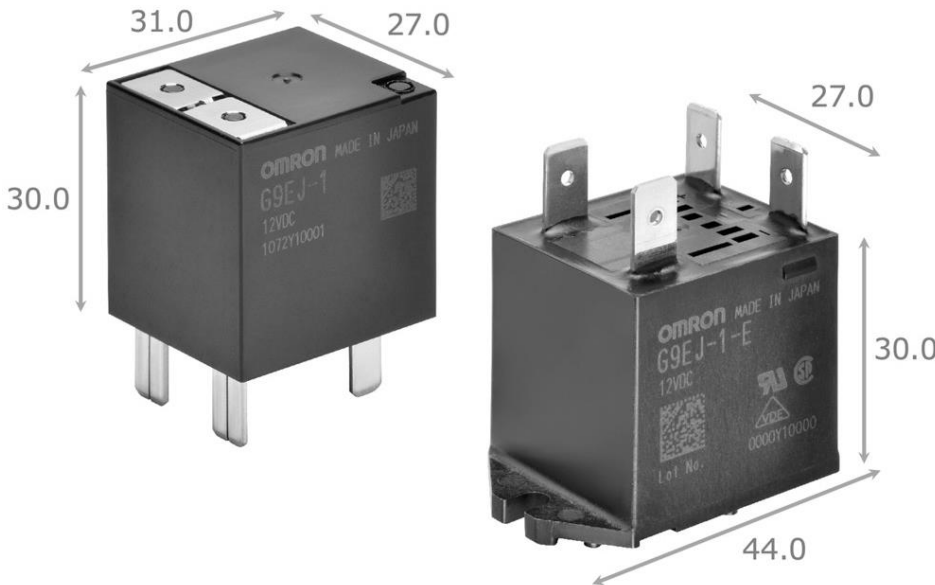


Use Cases



Battery Charging
DC isolation / safe
disconnection

DC Power Relay: G9EJ-1-E



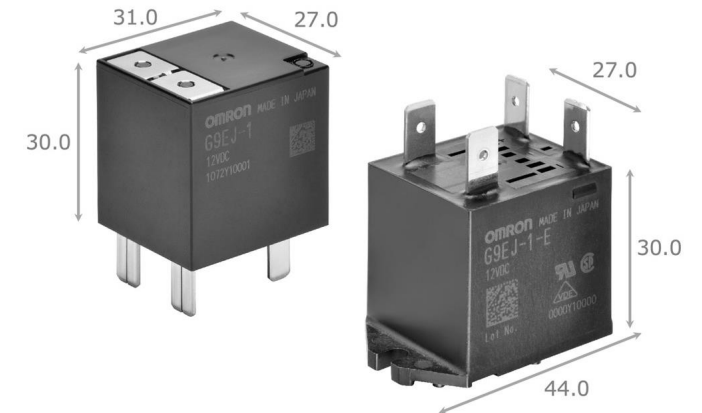
G9EJ-1-E Product Features

High inrush resistance + long life" that can be achieved even with a small size

Rated load: 400 VDC/15 A

- Combines high inrush resistance and electrical durability despite its small size.
(Guaranteed 100,000 times at 400 VDC/25 A)

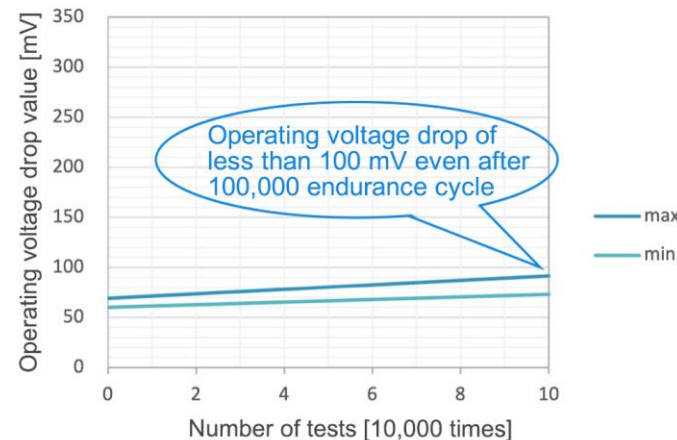
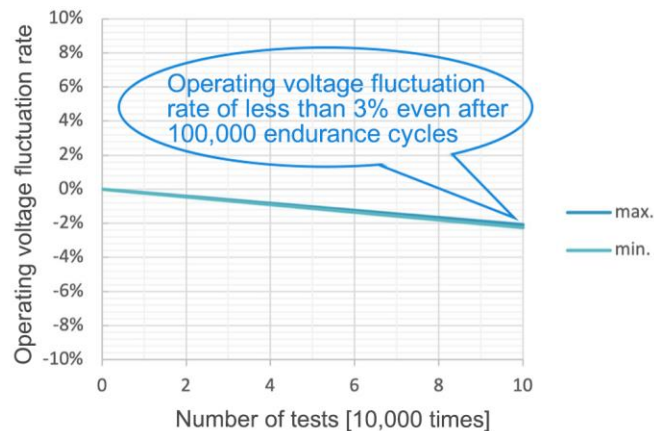
G9EJ-1-E



Use Cases



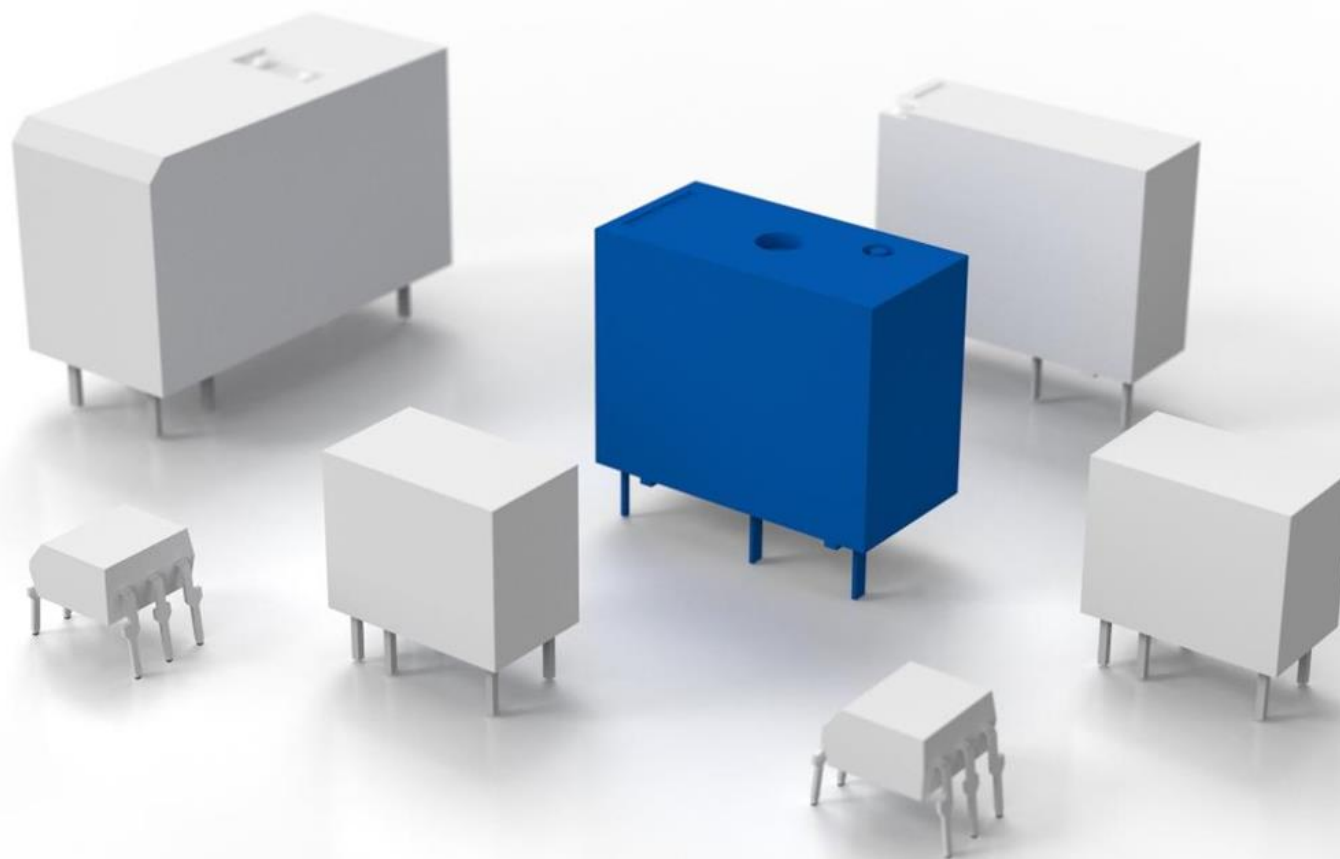
DC inrush bypass for battery charging applications



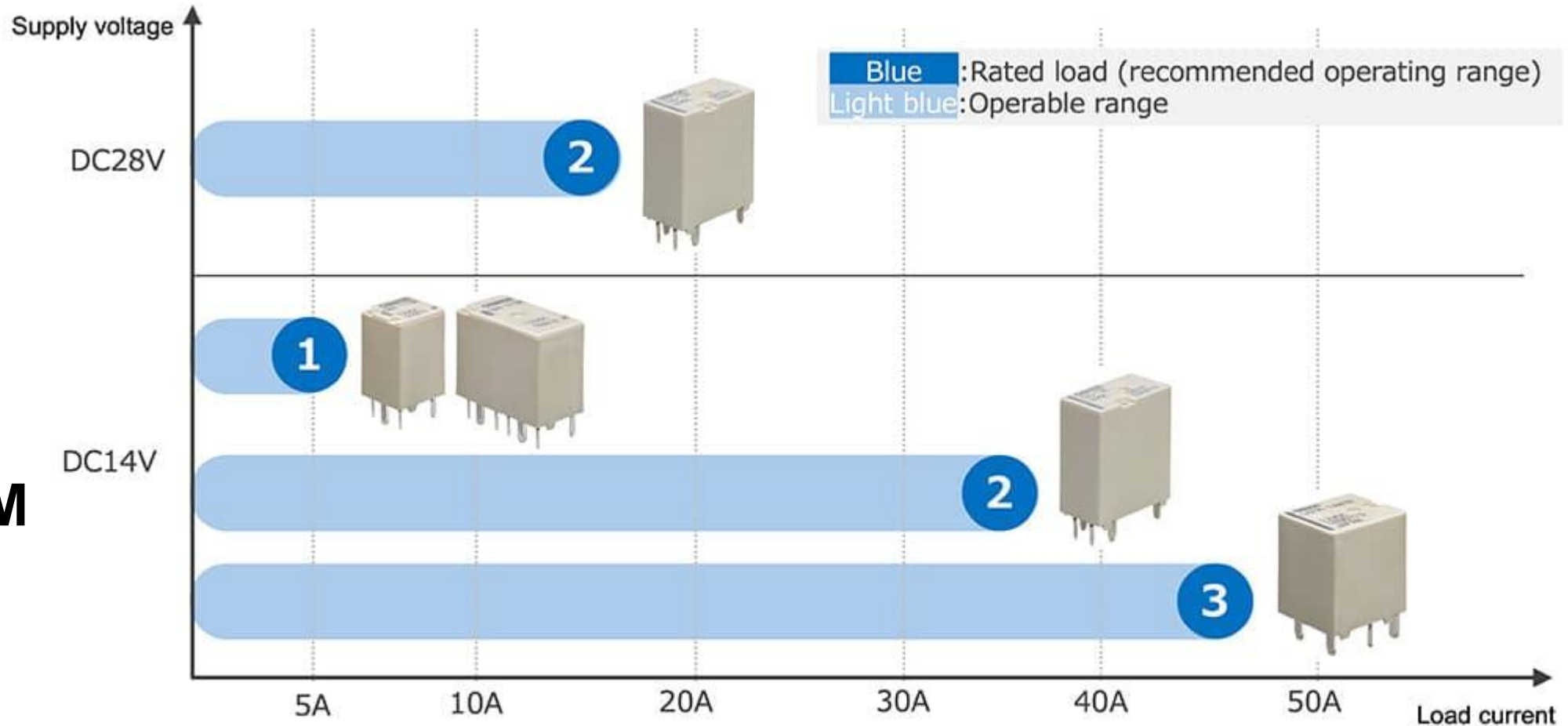
What are the design challenges you face with your current relay solution?

1. Thermal Design: Your current solution generates too much heat
2. Space Reduction: Your current solution takes up too much space
3. Cost Reduction: Your current solution costs too much
4. Power Requirements: Your current solution consumes too much power
5. Other

OMRON Low Capacity Relays



DC Low-Capacity Relays Product Lineup



- 1) G8K
- 2) G8G
- 3) G8PM

G8K Low-Capacity Relay

Industry's smallest class*⁸ ultra-compact DC relay

Rated load: 14 VDC / 5 A

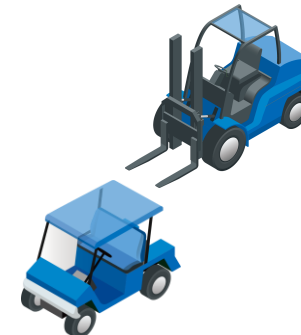
- High-density design and extremely small mounting space with a low current
- The terminal arrangement simplifies PCB wiring and enables ultra-high-density mounting in positive and negative circuits.
- Miniature low-load relay for motor, heater, and fan applications

G8K



Use Cases

- Forklifts,
- Golf Carts,
Motor Controls, Fan Controls



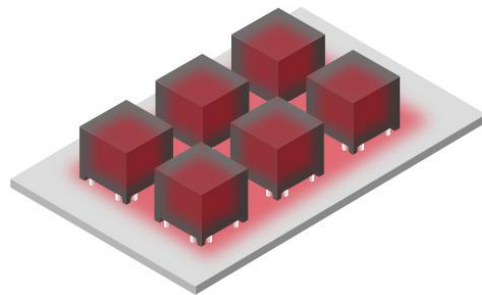
*8 According to OMRON's research in October 2023

G8G Low-Capacity Relay

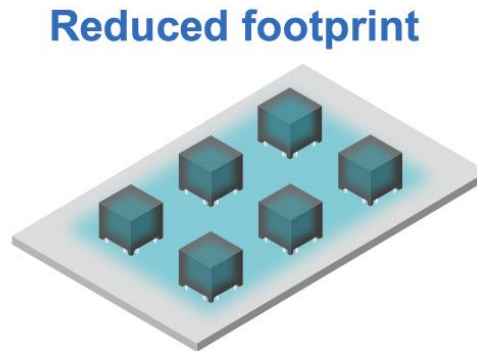
Miniaturization to achieve a high heat dissipation design with less than conventional PCB size

Rated load: 14 VDC/35 A ; 28 VDC/14 A

- Reduced relay footprint enables high heat dissipation design
- Miniature low-load relay for motor, heater, and fan applications



Typical relay



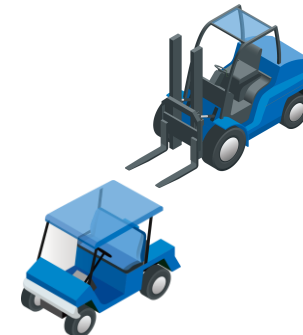
G8G

G8G



Use Cases

- Forklifts,
- Golf Carts,
Motor Controls, Fan Controls



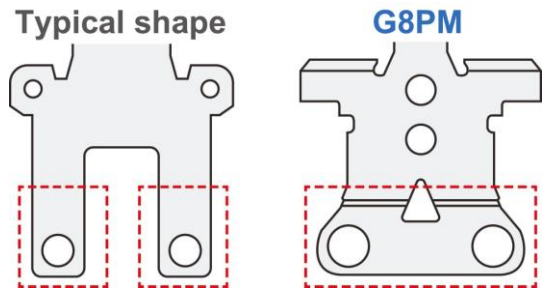
G8PM Low-Capacity Relay

Unique twin contact structure for high current-carrying reliability

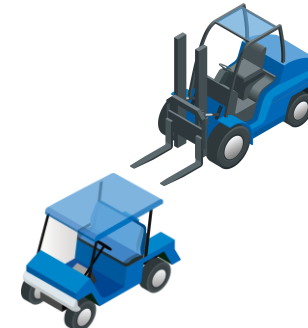
- "Capacity of 40 to 60 A, yet this small"

Rated load: 14 VDC/ 45 A

- Improved contact reliability with a structure that stabilizes contact resistance.
- Compact design with high heat dissipation characteristics.



Large heat radiation area allows dispersion of heat load



G8PM

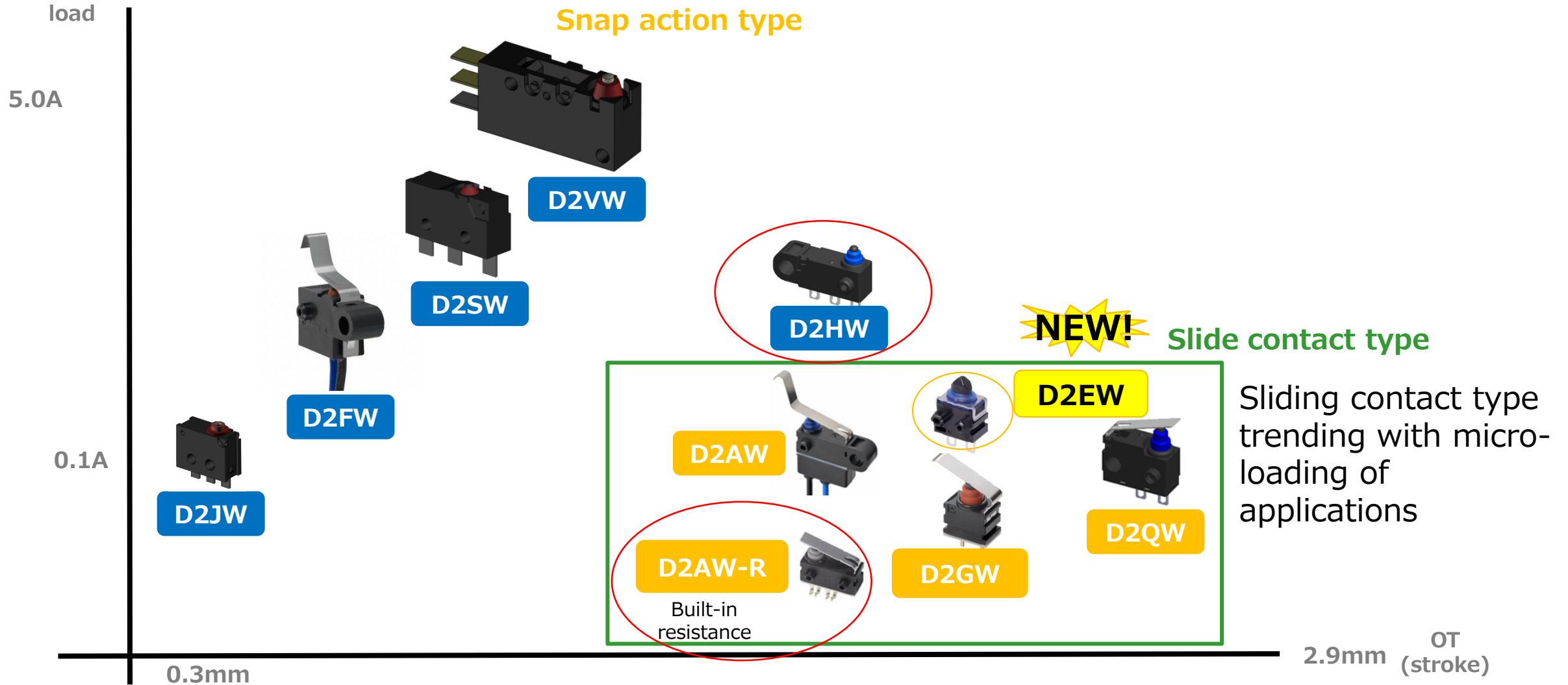


Use Cases

Forklift & Golf Cart
Motor Controls, Fan
Controls, Lamp
Controls

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OMRON Sealed Type Micro Switches

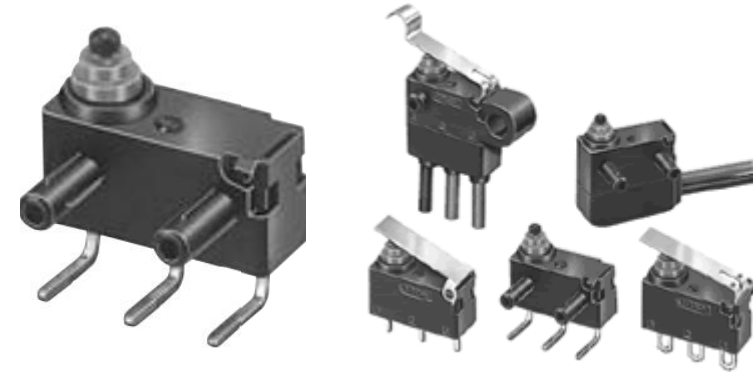


D2HW Sealed Ultra Subminiature Basic Switch

Smallest sealed snap-action switch in the industry

- Very long stroke for reliable ON/OFF action
- The case dimensions are 78% of conventional models, contributing to down-sizing of mechanical modules
- Offers SPDT contact form and SPST molded lead wires.

D2HW



Use Cases



- Pedals Detection
- Limit Position

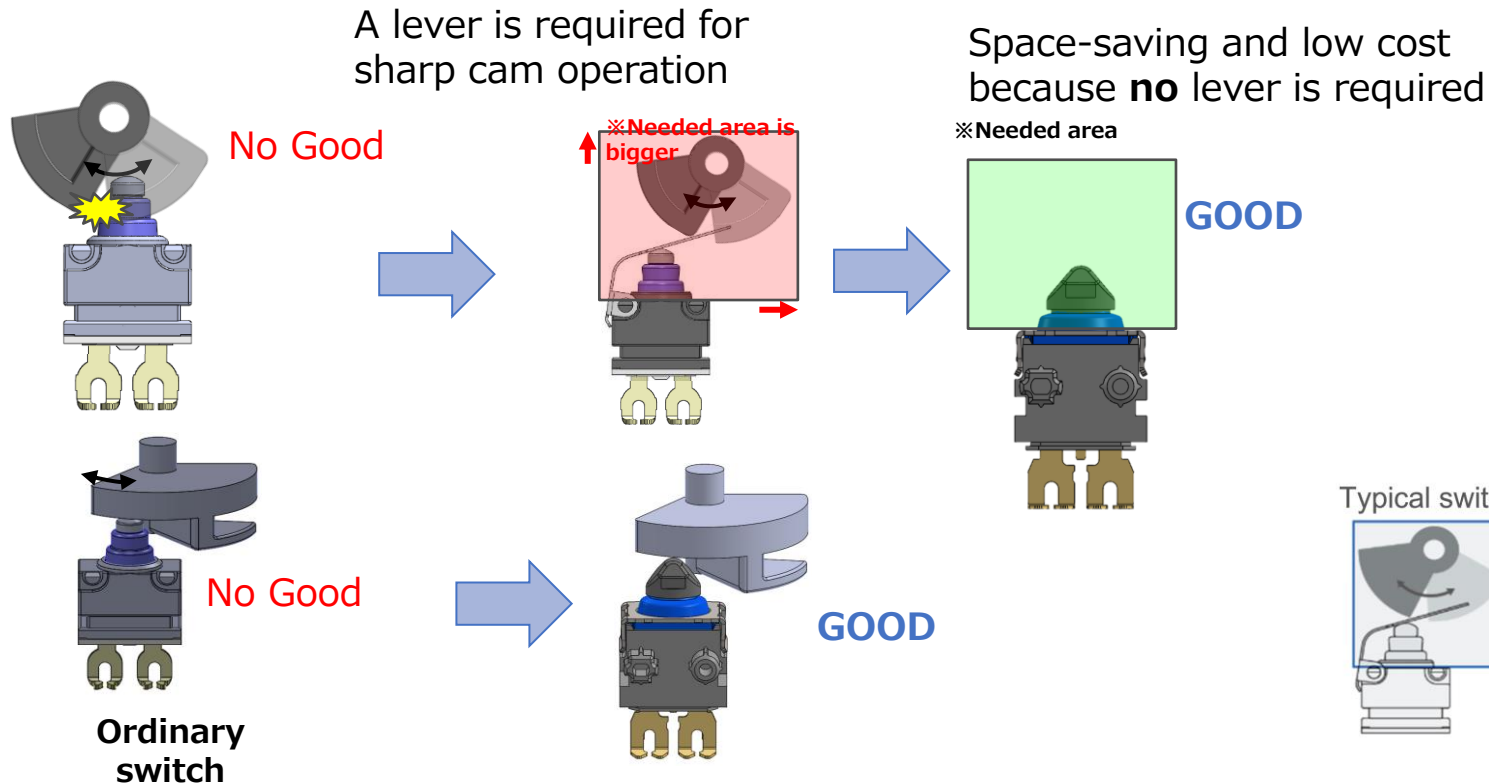


- Seatbelt Buckle Buckle Detection

D2EW Sealed Microswitch

No lever needed! "Onigiri-shaped switch" for multi-angle operation

- Small microswitch for operation from the top, left, and right minimizes the detection mechanism.

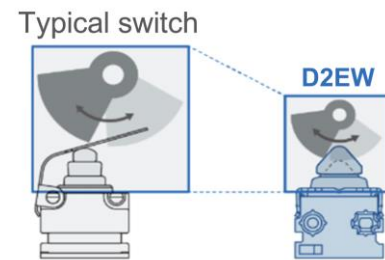


D2EW



Use Cases

-  Control Valve Detection
-  Latch Detection



D2AW-R Sealed Ultra Subminiature Basic Switch OMRON 30

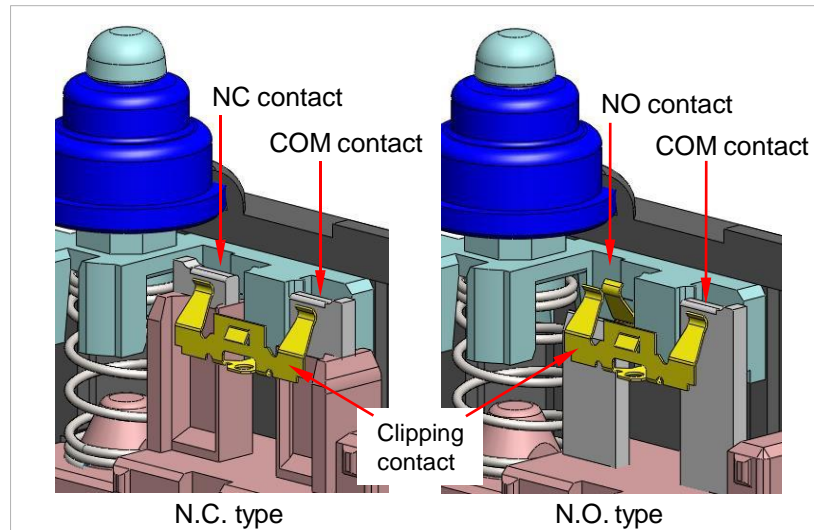
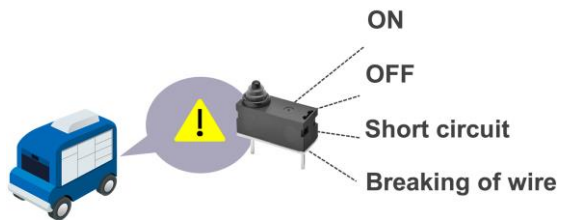
Output of four modes with one switch!

- Built-in resistor type, capable of outputting 4 types of states: ON, OFF, short-circuited, or disconnected.
- A sliding contact construction achieves high contact reliability and quiet operating sound.
- High performance of insulation resistance by unique contact structure.

D2AW-R



Use Cases



- Tractor/Forklift Hood/lever Detection
- Parking brake Detection.

What feature is most important to you when selecting a component for your application?

1. Energy Efficiency
2. Compact Size
3. Design Flexibility
4. High Power Capabilities
5. Other

Forklift Common Functions

Power Distribution

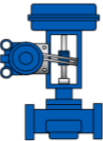
ON/OFF

PCB mini power relays

- G8PM
- G8PM-K
- G8G
- G8K



Control Valve



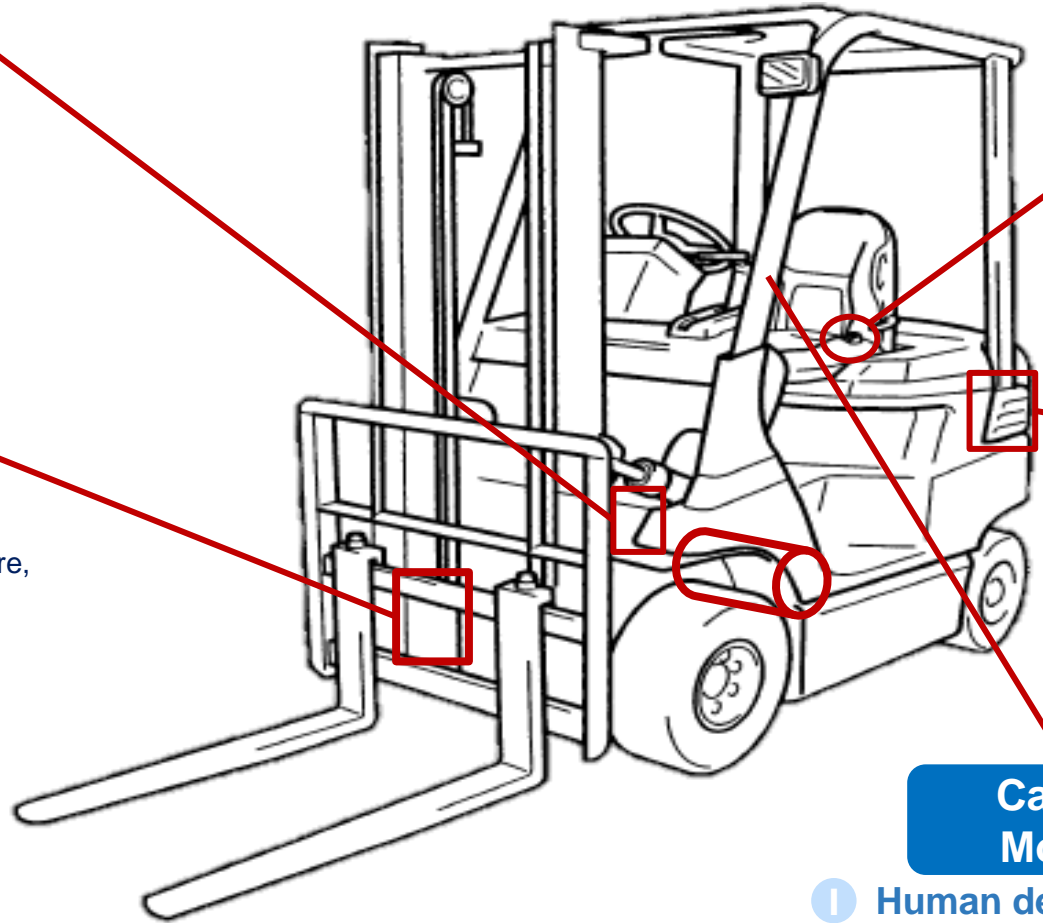
Used as operating equipment for process quantities required in the plant, such as liquid volume, pressure, temperature, liquid level, etc.

Valve detection

Valves open/close detection.
Need to have high durability for water, dust, dirt

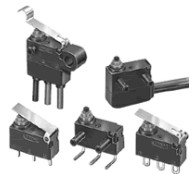


- D2HW
- D2EW



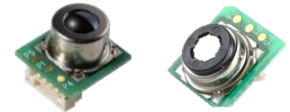
Seat Belt

- Seat belt detection
Sealed-type micro-SW
Long harness type
- D2HW



Charging

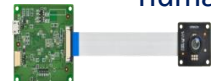
- Temperature sensor
For safety, monitoring overheating allows for automatic shutdown.



- D6T

Camera Module

- Human detection
Plug & play camera module for safety and human detection



- HVC-P2 & OKAO

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OKAO Human Image Sensing Software




OMRON

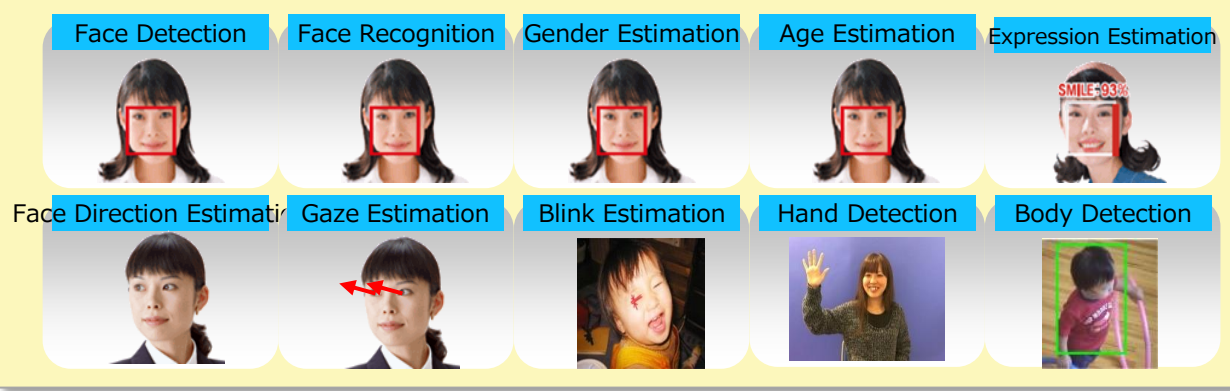
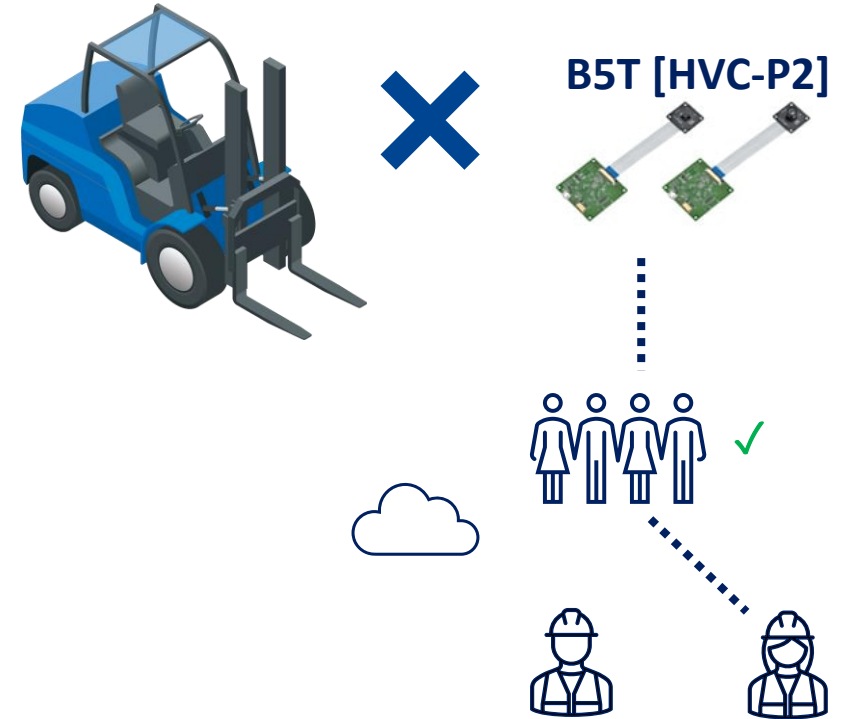
OKAO is a Software Library* with image sensing functions for understanding humans.

Detect	Face Detection	Human Body Detection	Hand Detection	Eye Detection	Pet Detection
Detect In Detail	Facial Part/Contour Detection	Blink Estimation	Gaze Estimation	Human Body Silhouette Detection	
Recognize / Estimate	Face Recognition	Age/Gender Estimation	Smile Degree Estimation	Expression Estimation	Imposter Prevention
Adjust	Red-Eye Reduction		OKAO Beauty		

Functions - Human Vision Components (HVC-P2)

The device is a camera module that includes the following 10 image sensing functions.

Powered by 

HVC will send the following results to the host after detection/estimation

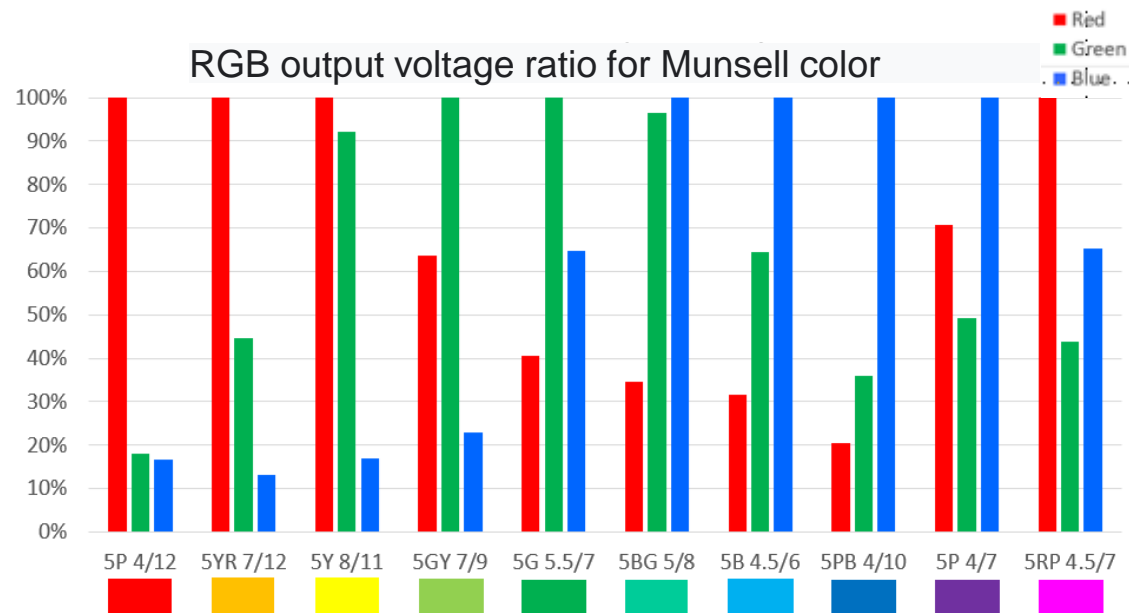
Function	Results
Face Detection, Body Detection, Hand Detection	• Result count (max:35) • Center coordinates (X & Y) • Detection size (pixel) • Degree of confidence
Face Direction Estimation	• Yaw degree • Pitch degree • Roll degree • Degree of confidence
Gaze Estimation	• Yaw degree • Pitch degree
Blink Estimation	• Blink degree (left-side eye/right-side eye)
Age Estimation	• Age • Degree of confidence
Gender Estimation	• Gender • Degree of confidence
Expression Estimation	• 5 expressions: "neutral", "happiness", "surprise", "anger", "sadness" and their respective score • Expression degree (positive/negative)
Face Recognition	• Individual recognition result • Score
Image output	• choose one: none, 160×120pixels, 320×240pixels • Image format: 8-bit Y data

Color Sensor B5WC



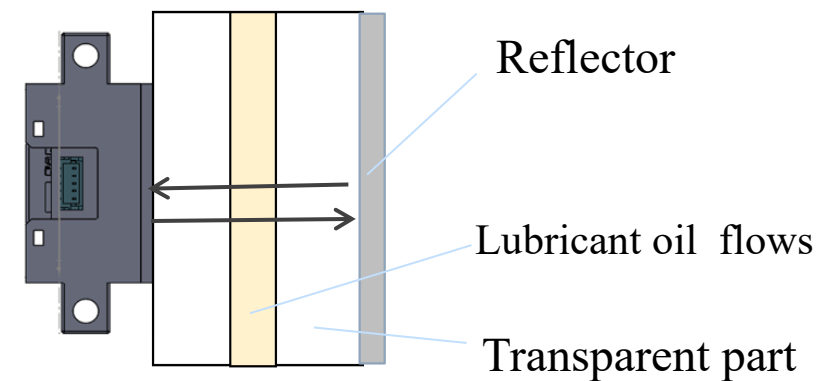
Features

- Output different voltage values depending on the color of the sensing object
- Receives the light reflected by the sensing object and outputs the RGB output voltage in the color of the sensing object.

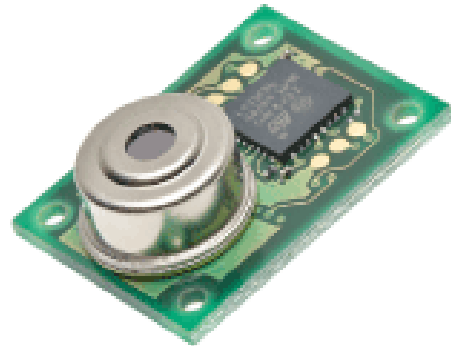


Application: Engine Oil Monitoring

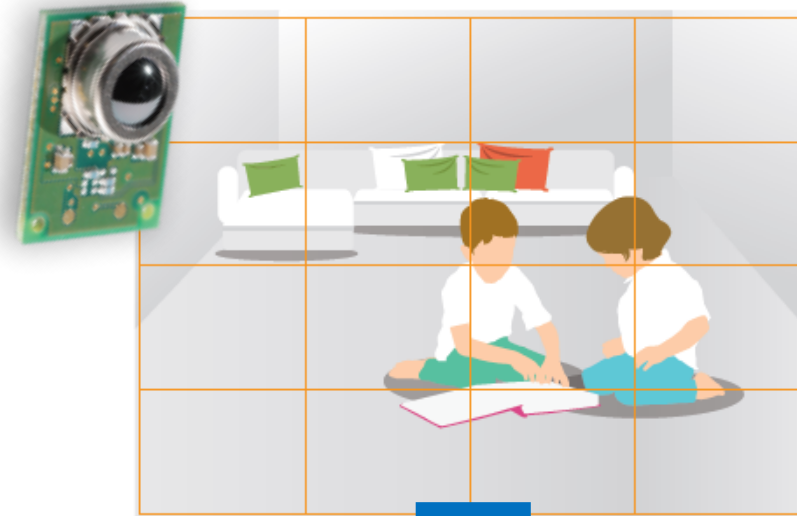
- The B5WC can monitor the color changes of liquids.
- Able to monitor the deterioration of lubricating oil by color
- It is possible to estimate that it is time to exchange the lubricating oil when it changes to a specified color that can be customized.



Thermal IR Sensor D6T



- Touchless Sensor capable of measuring the surface temperature of stationary or moving objects
- Designed to detect human presence within an area
- Sensor can measure multiple data points within FOV
 - 1x1, 1x8, 4x4, and 32x32 pixel count resolutions available
- Digital I²C output




Digital I2C

20.0	21.4	22.8	27.2
21.3	25.3	28.3	29.6
23.5	25.1	29.5	29.9
23.4	23.7	27.4	27.1



Application Overview

Thermal sensor





20.0	21.4	22.8	27.2
21.3	25.3	28.3	29.6
23.5	25.1	29.5	29.9
23.4	23.7	27.4	27.1

Output:
Temperature(degC)
of 16 places

↓
Temperature data collected by the D6T sensor can be analyzed and evaluated by customers in various applications

Supported Application Types

Human Detection	Object Detection	Temperature Detection
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">H</div> <div style="display: flex; gap: 5px;"> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> <div style="background-color: #e74c3c; color: white; padding: 5px;">30.0</div> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> </div> <div style="margin-left: 10px; text-align: center;">  </div> </div> <p style="text-align: right; margin-top: 10px;">- Air Conditioning - Lighting Control</p> <p>D6T sensor can detect a human presence based on the temperature change</p>	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">O</div> <div style="display: flex; gap: 5px;"> <div style="background-color: #add8e6; padding: 5px;">10.0</div> <div style="background-color: #ffd700; padding: 5px;">40.0</div> <div style="background-color: #add8e6; padding: 5px;">10.0</div> <div style="background-color: #add8e6; padding: 5px;">10.0</div> </div> <div style="margin-left: 10px; text-align: center;">  </div> </div> <p style="text-align: center; margin-top: 10px;">- Battery Monitoring</p> <p>Useful in cases where detected objects may be much warmer/cooler than the surrounding environment</p>	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">T</div> <div style="display: flex; gap: 5px;"> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> <div style="background-color: #e74c3c; color: white; padding: 5px;">80.0</div> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> <div style="background-color: #008040; color: white; padding: 5px;">25.0</div> </div> </div> <p style="text-align: right; margin-top: 10px;">- Charger</p> <p>Useful in applications detecting abnormal temperature conditions or overheating components</p>

Human Detection Algorithm

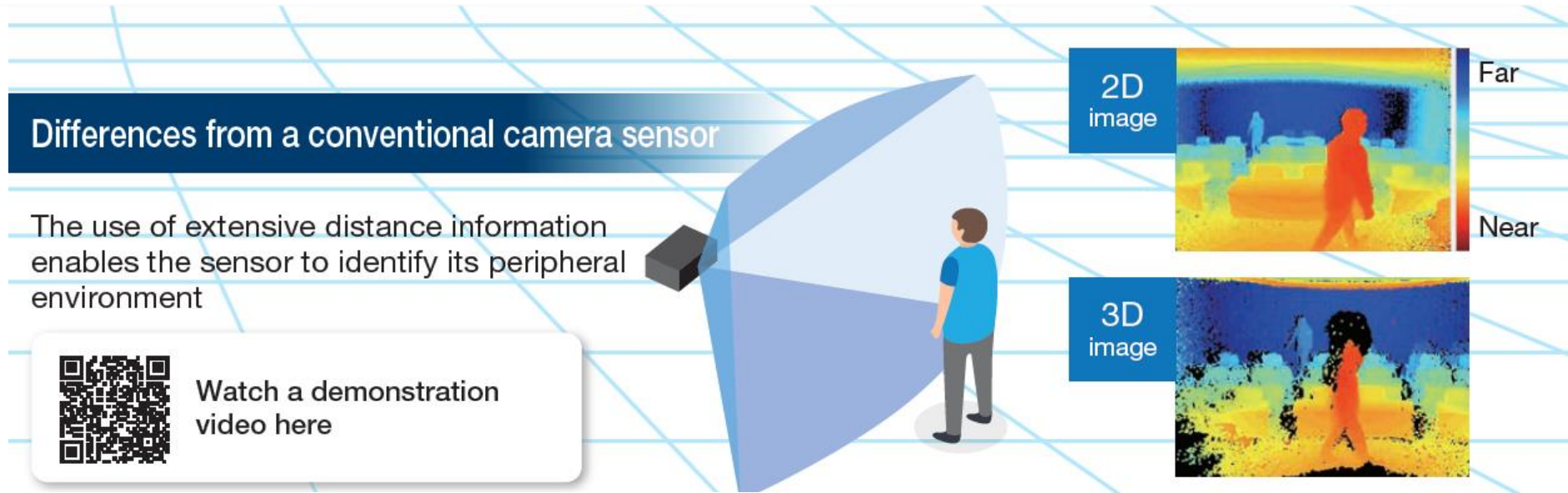
The screenshot displays a software interface for a thermal camera. On the left, the text "Thermal Sensor D6T-32L-01A" is shown above an image of the sensor. Below this, two data boxes are visible: "Human Count" with the value "2" and "Social Distancing Alert (%)" with the value "0". The central part of the interface is a large heatmap grid where colors represent temperature, with a red and orange area indicating a human figure. On the right, a video feed shows a top-down view of a person sitting at a desk. The interface includes standard camera controls like a settings gear, zoom, and a "カメラ" (Camera) label.

Time of Flight Sensor B5L Series



Product Overview

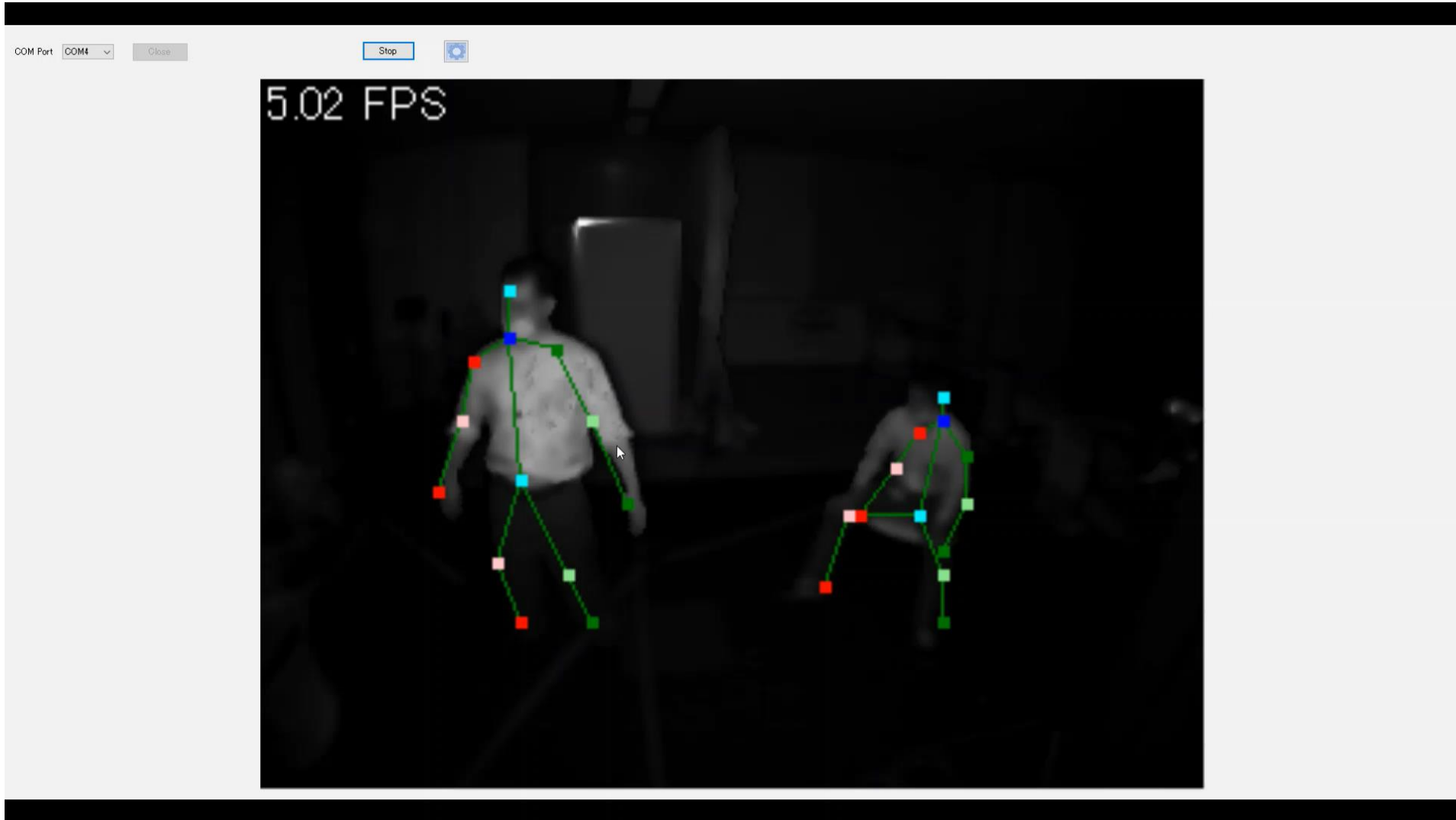
- Real-Time 3D Environment Sensing
- Capable of detecting stationary or moving objects, humans
- Time of Flight (ToF) method of object sensing; LED Array



Watch a demonstration video here

AMR/ Service robots		Logistics and conveyance		Monitoring and observation		Automatic doors/elevators	
Drop detection/ Environment recognition	Periphery recognition/ Human recognition	Volume and shape measurement	Empty space detection	Behavioral understanding and observation of patients under long-term care		Counting people and tracking traffic flows	

Skeletal Detection



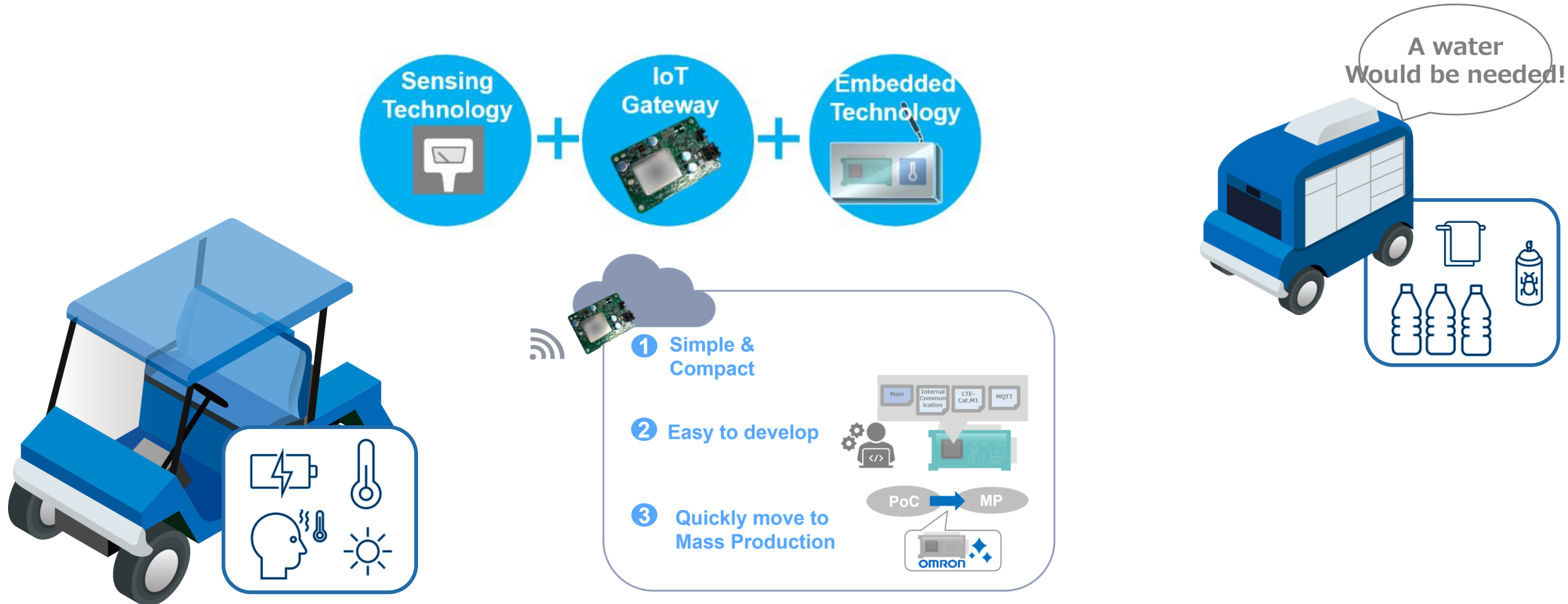
OMRON IoT Gateway Module



OMRON IoT Gateway × Golfcart application idea

Watch remotely? Creating a luxury experience for players

Knowing the situation around each player with sensors to protect players' safety, brings a luxurious experience. Omron's IoT gateway can connect and allow for intelligent features.



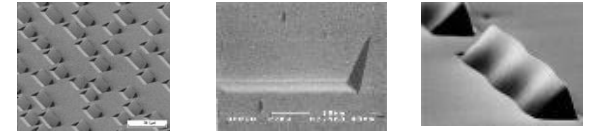
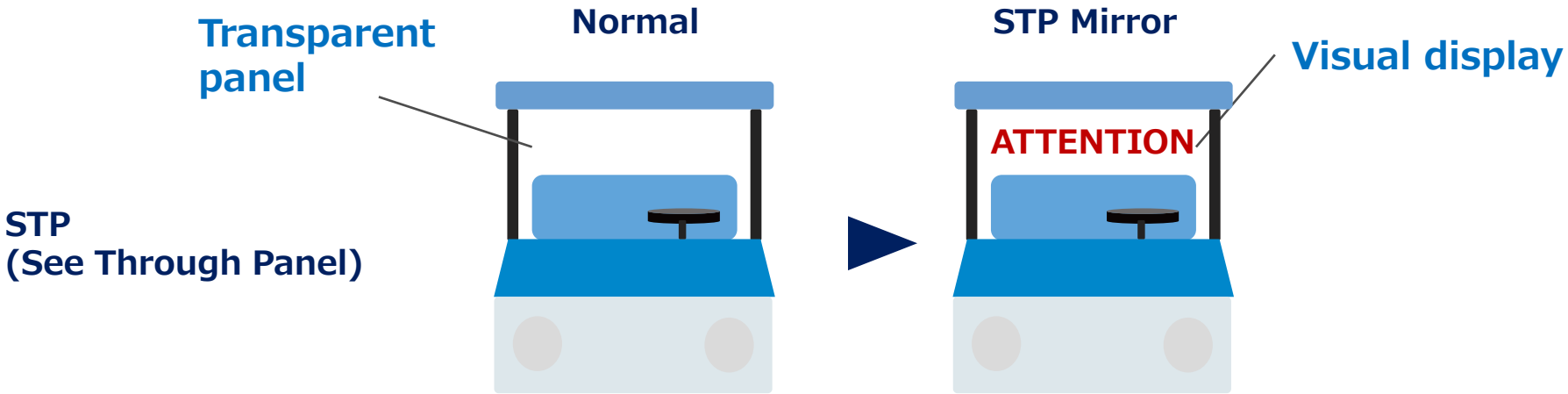
OMRON Optical technology × Golfcarts application

More classy design?

With OMRON's optical panel, the ideal design with functionality comes true.



A transparent panel



Complicated optical control with various patterns

STP
(See Through Panel)

SW-MLA
(Multi Layered Array)



with one switch/space



Four patterns depends on space

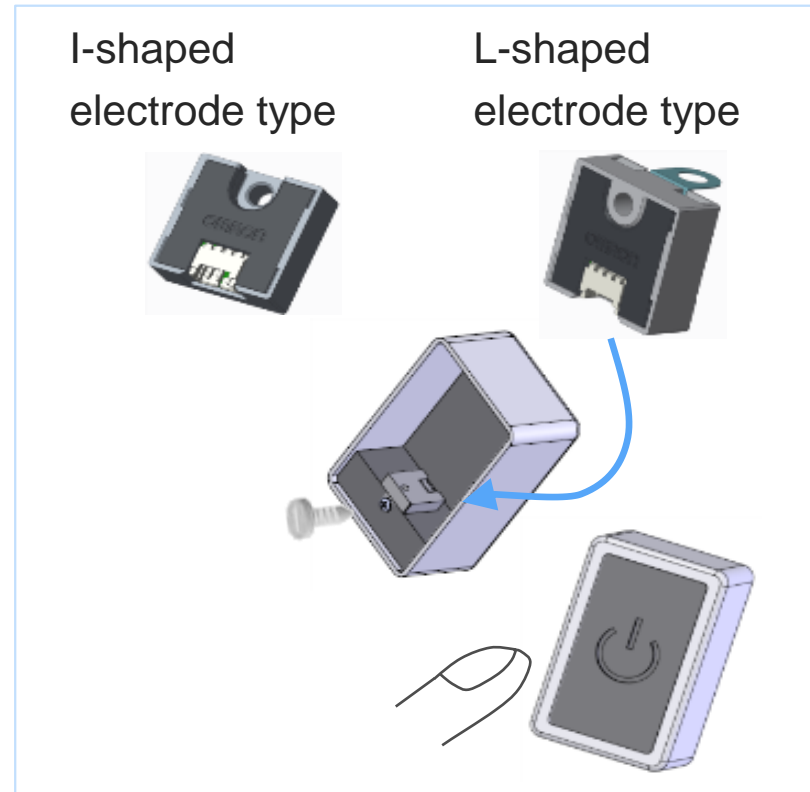
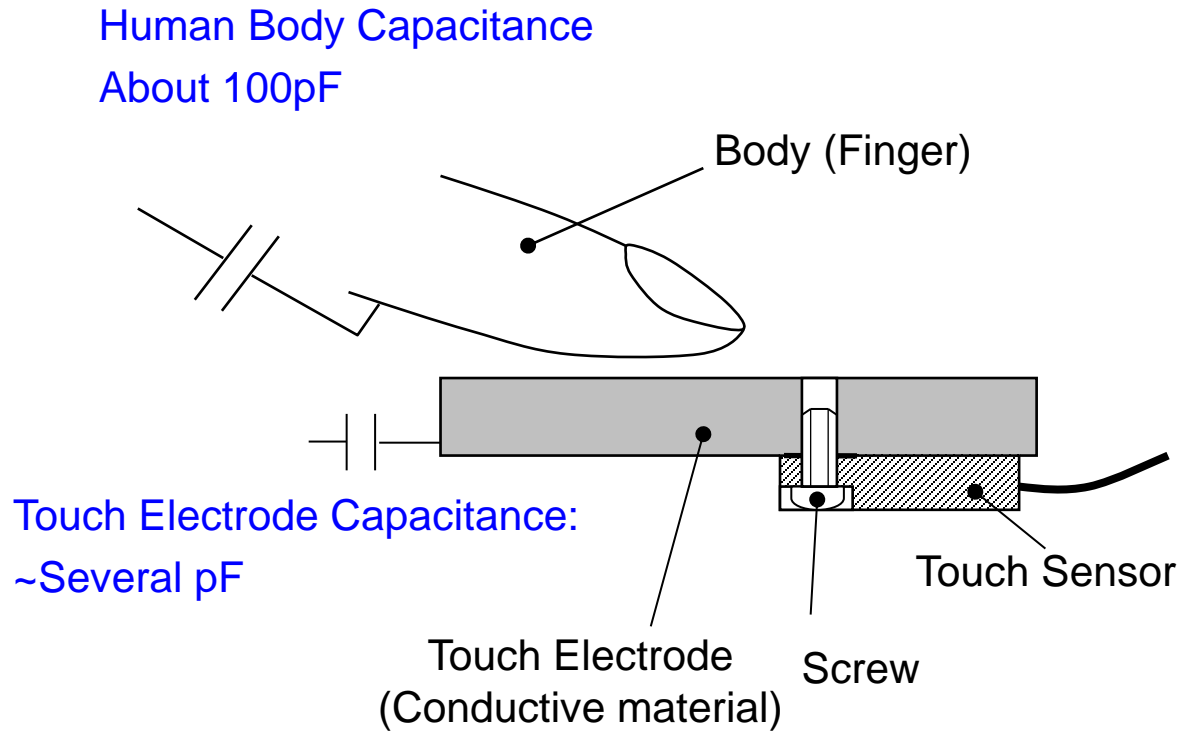


Capacitive Touch Sensor W7ED



OMRON Human Body Capacitance Sensor

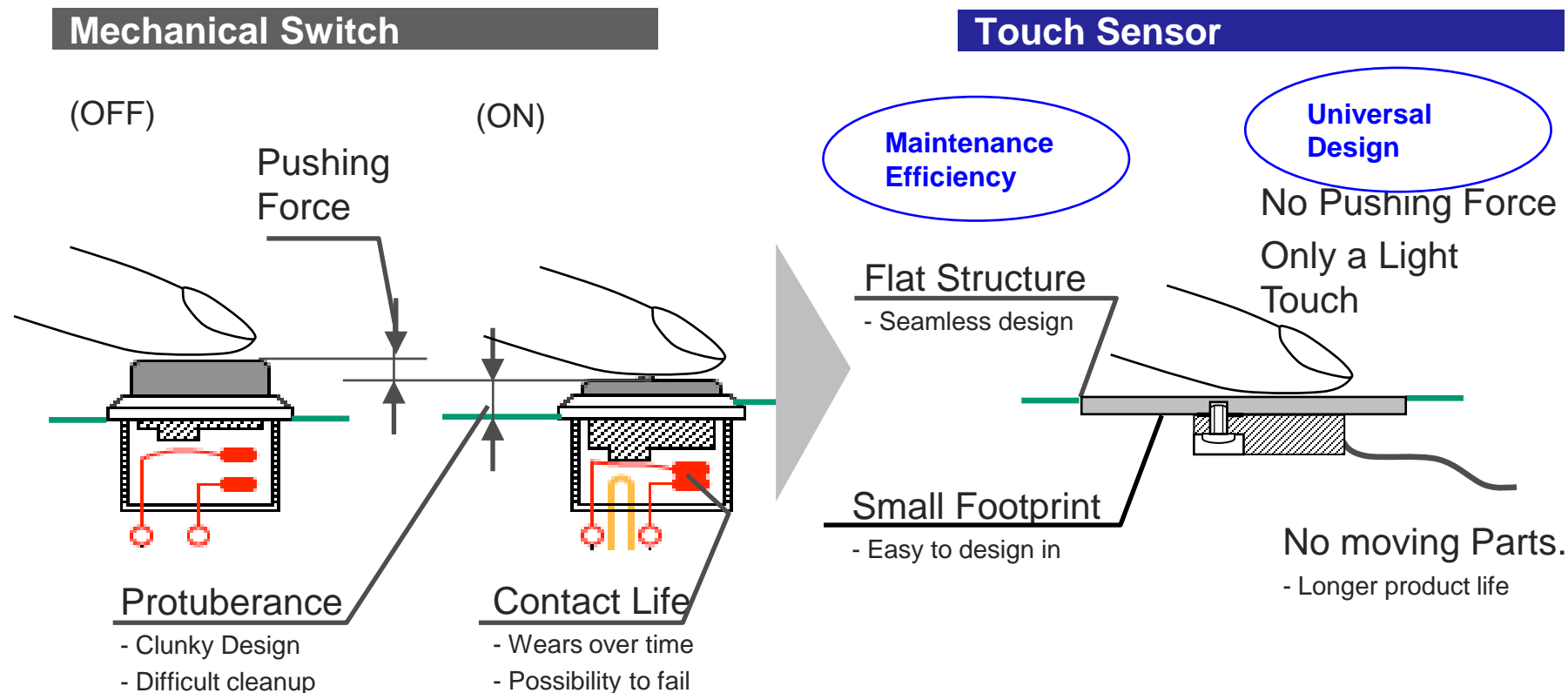
- Measure human capacitance through a touch electrode
- Compact design allows for easy implementation
- The electrode can be directly connected or through a wire.



Touch Sensor Advantages

Compared to Mechanical Switch:

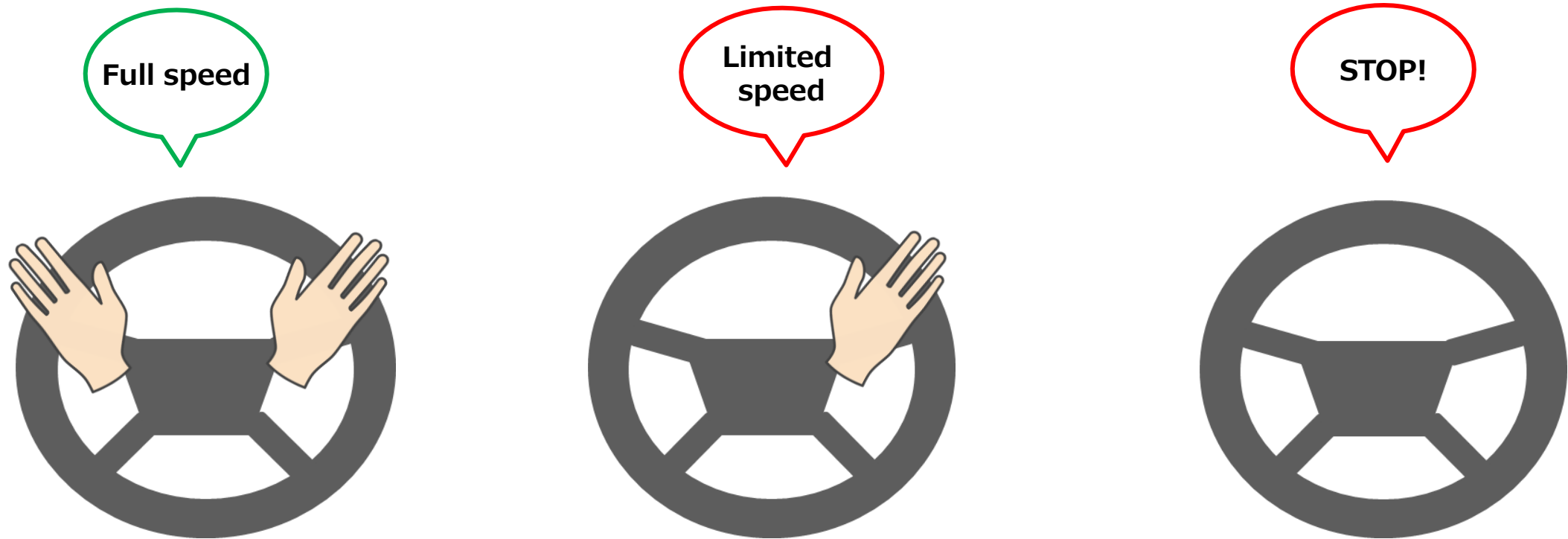
- Longer Life, due to no moving parts
- Good maintenance efficiency (small vertical footprint) due to flat structure
- Good design flexibility from Touch Electrode Design
- Contributes to Universal Design because pushing force is not needed



Grip sensor for safety controls

Omron has mechanical and electronic know-how to integrate solutions to help promote safe solutions for operators and the environment around them.

Measure human capacitance using a customizable touch electrode that can be adjusted for sensitivity based on the application.



Following this Webinar: What solution would you like to learn more about?

1. High-Capacity Relays
2. Low-Capacity Relays
3. Sealed Micro Switches
4. Sensor Technology
5. Future Solutions

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THANK YOU!

