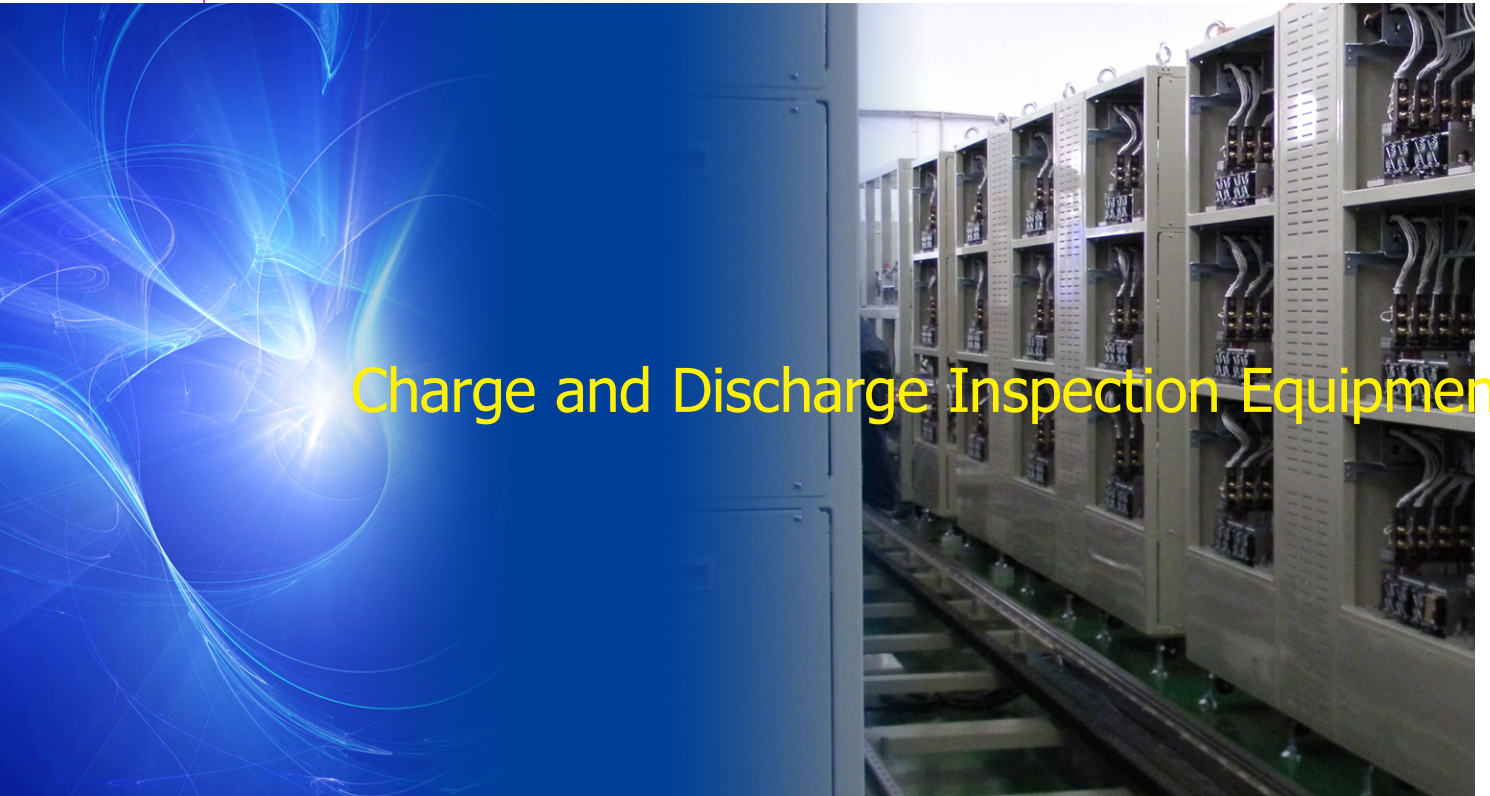


Charge and Discharge Inspection Equipment for Rechargeable Batteries



Charge and Discharge Inspection Equipment

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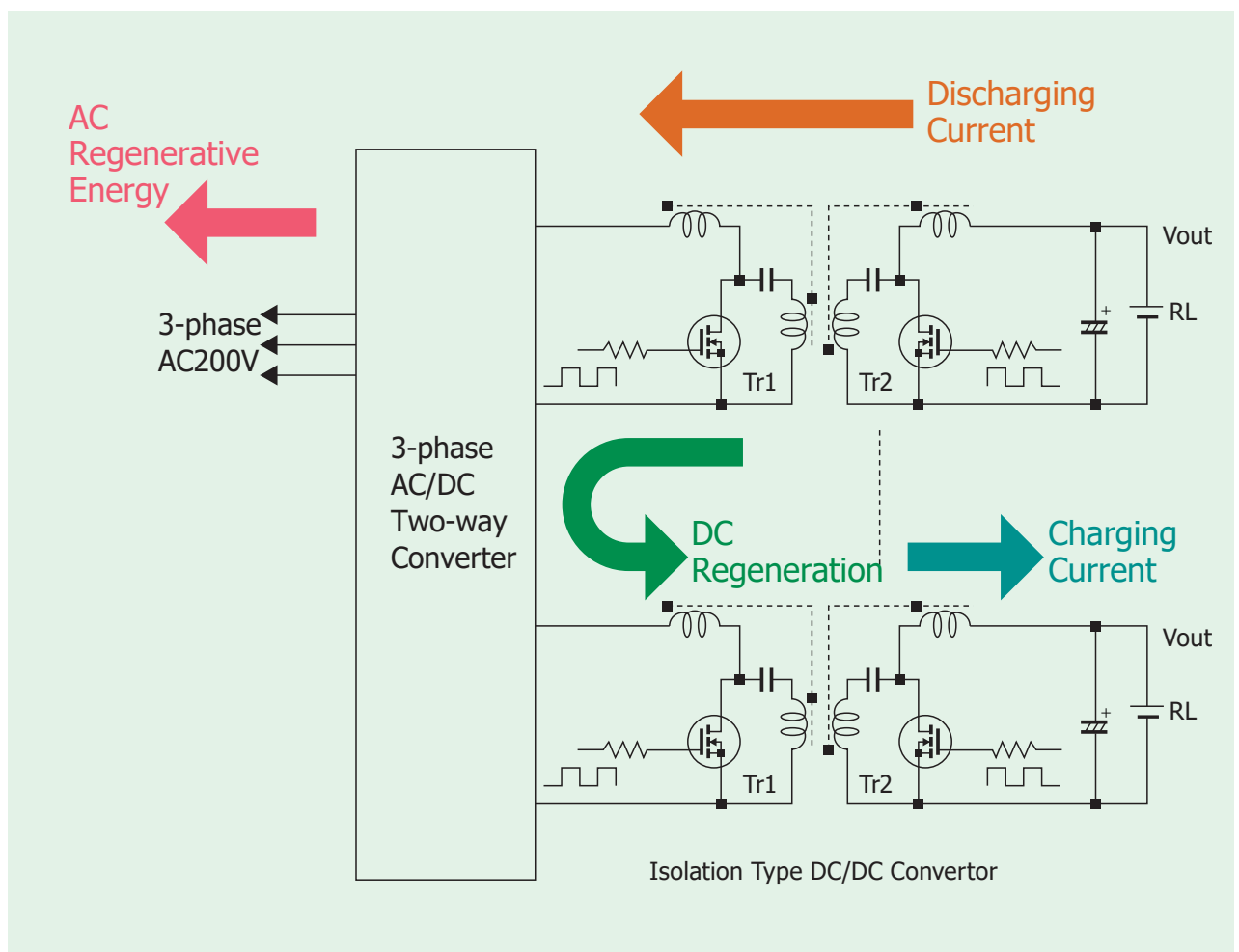
- 1 In recent times, the AC regenerative power supply in isolated type has come to be the forefront in the charge and discharge power supply technology.
- 2 Adopting the isolated power supply can prevent incidents caused by excessive energy of the large scale battery.
- 3 The isolated power supply will perform the Fail-Safe direction system and shut down power output by itself when the failure of hardware is occurred. In the system of earlier power supply, the failure of the power supply or/and the battery system often caused battery explosions by the abnormal output. And the explosion was inevitable. However, our isolated regenerative power supply will minimize that type of accident.
- 4 The charge and discharge equipment for high-volume production of EV batteries tend to adopt the regenerative power supply in order to perform in higher accuracy. We will proudly perform our 70-plus percent range regenerative efficiency. (The efficiency from battery end to AC200V input interface)
- 5 The regenerative power supply system can also contribute to energy-saving, space-saving and the extension of working life of the equipment.
- 6 Our products are designed, engineered and quality controlled in Japan while manufactured and maintained in China. This achieves low-cost production while maintaining highly functional and high reliable products which meet and exceed economical and environmental standards.

2. Our Regenerative Power Supply

Basic Structure (framework) of the AC Regeneration System

The AC regeneration system will provide 2 exclusive functions.

- Regeneration of discharged electric power to AC200V system.
- DC regeneration which will be the energy to charge the DC/DC converter in other channels.



3. Our Highly Functional and Accurate Regenerative Power Supply

Supported Power Supply All of our power supplies provide a voltage and current accuracy(actual measured value) of up to $\pm 0.05\%$ (both monitoring and output) at a **16bit of resolution**.

The charge-discharge characteristic data also operates at a highperformance specifications and can register at **1 sec cycles** which is becoming the world standard.

Power Supply only for Charging

5V3A50ch	5V3A64ch	5V6A50ch	5V6A64ch
5V10A64ch	5V50A10ch		

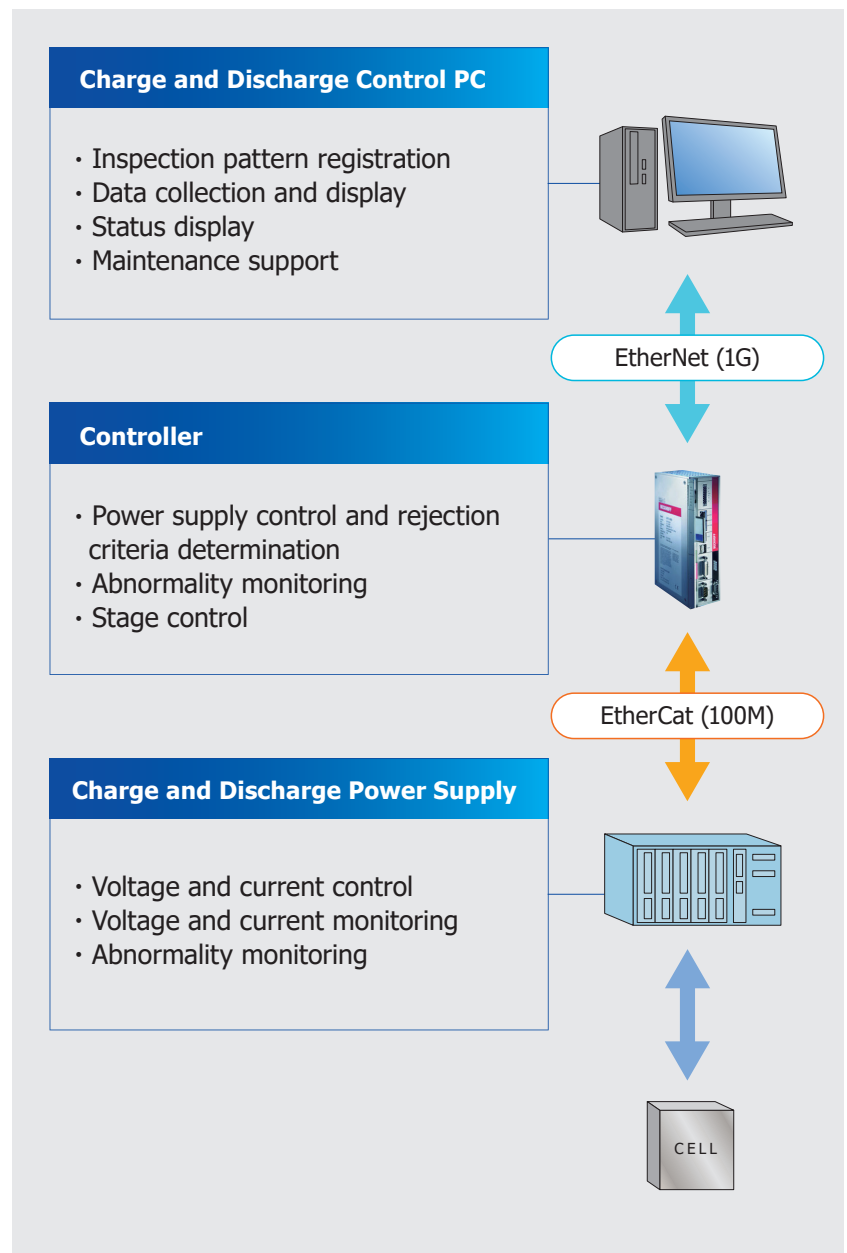
Charge-Discharge Power Supply

5V3A64ch	5V6A50ch	5V6A64ch	5V10A64ch
5V20A32ch	5V30A10ch	5V50A5ch	5V60A10ch
5V12A64ch	5V24A32ch	5V25A32ch	5V40A16ch
5V35A28ch	5V50A16ch	5V80A8ch	5V100A8ch
5V120A5ch	5V180A1ch	5V300A1ch	

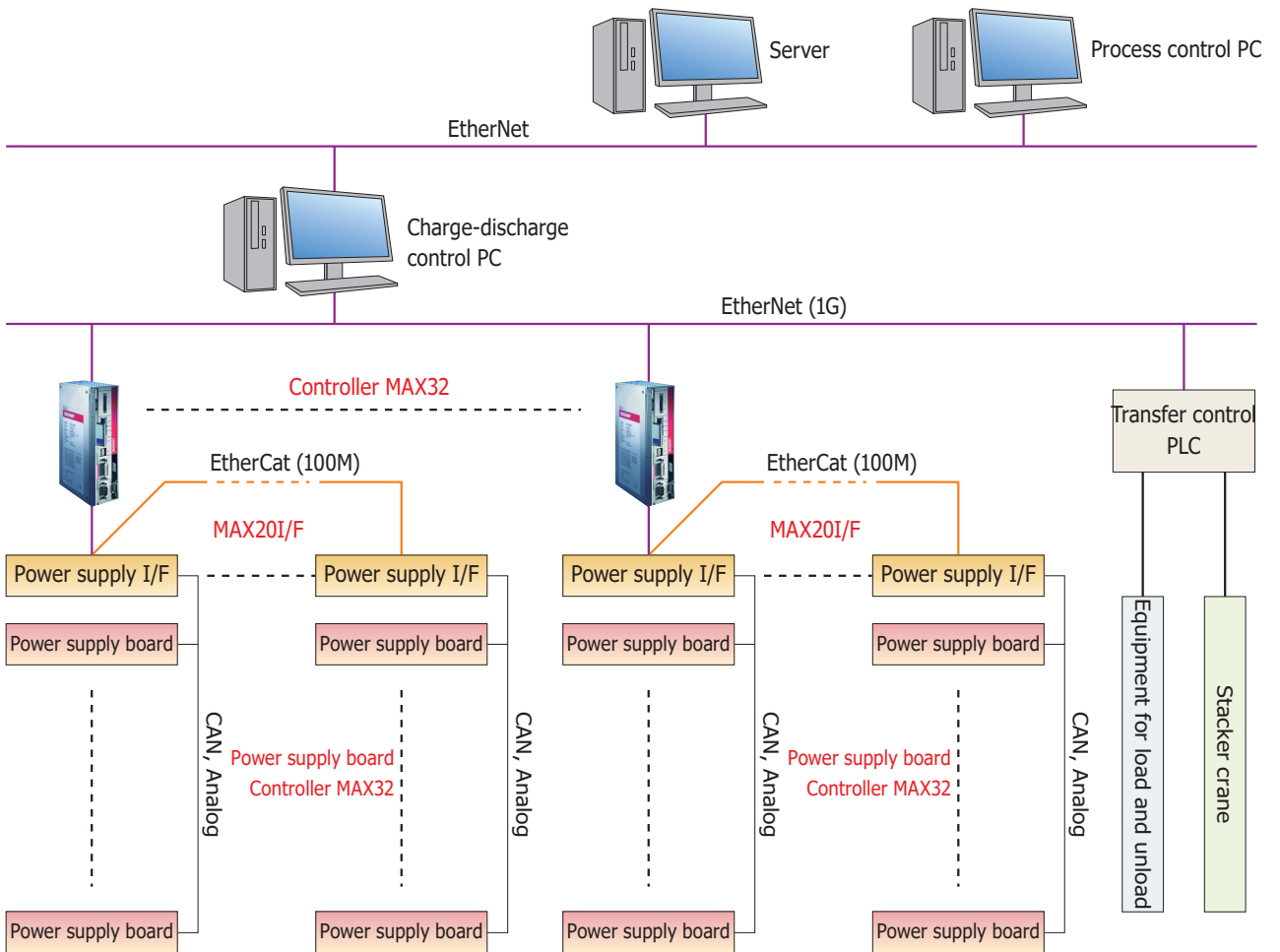
4. Our PC-based General-Purpose Controller

Controller Features

1. High-speed calculation by a PC-based PLC
2. General-purpose network with Gigabit EtherNet
3. International standard PLC programming language (IEC-61131-3)
4. High-speed communication in lower-network via EtherCAT
(EtherNet-based open field bus network)



5. System Configuration



6. Our Safety Measures and Battery Protection

(1) Safety Measures for the System

Safety Measures for the System

Power Supply Temperature Monitoring

The temperature of the power supply unit is monitored. All the channels within the power supply unit will shut down if abnormal temperatures are detected.

CPU Error Monitoring

The watchdog timer will monitors the CPU for errors. Power output within a controlled range will be shut down in the event of an error.

Network Error Monitoring

The data on the network is monitored for errors with the alternate responding timer, the CRC16, the fixed header checking and the serial number checking. Retry will be done in the event of an error.

Smoke Detection

The battery stages are monitored for smoke. Power output to all channels is stopped when smoke is detected(automatic extinguishing is also possible).

Ambient Temperature Monitoring

The ambient temperature of the subject tray is monitored. The power output to all the channels in the subject stage will be shut down in the event of abnormal temperatures(automatic extinguishing is also possible).

Adoption of Flame Resistant Materials

Flame resistant and self-extinguishing materials are used in the power supply circuits, the charge-discharge heads, the guideboards and the cables, which can prevent a fire from spreading.

Battery Protection

Current Monitoring

The current value on each channel is monitored. Power output to the subject channel will stop if the current value goes beyond its upper/lower limit.

Voltage Monitoring

Monitors the voltage value of each channel to see if the value exceeds its upper/lower limit. Power output to the subject channel stops when any error is detected.

Abnormal Current / Voltage Change Rate Monitoring

Monitors the rate of current/voltage change on each channel by dV/dt , dI/dt and ΔV . Power output to the subject channel stops when any error is detected.

Abnormal Battery Capacity Monitoring

The battery capacity on each channel is monitored according to its upper limit which is determined by the battery range. This prevents the batteries from overcharging. Power output to the subject channel stops when any abnormality is detected.

CC Time Monitoring

The constant current charge time is monitored according to its upper limit. Power output for the subject channel is shut down if a battery continues to charge in excess of a certain time.

Contact Failure Monitoring

The contact failure on each channel is monitored by comparing the voltage generated at the power supply with the voltage transferred to the battery. Power output for the subject channel will stop in the event of an error.

A dual-step protection is used in the monitoring for the purpose of contact failure prevention. The first protection involves installing a protective circuit on the power supply and the second involves using a soft-algorithm method based on battery voltage/current information.

6. Our Safety Measures and Battery Protection

(3) Safety Measures for Ignition, Smoke and Abnormal Battery Heating.

Measures for Abnormal Battery

CO₂ Extinguishing

In the event that a battery abnormality is detected, the crane will move to the subject stage and automatically extinguish the fire with the mounted CO₂ fire extinguisher.

Water Shower Extinguishing

In the event that a battery abnormality is detected, the water shower will activate at the subject stage and automatically extinguish the fire with chilled water(Auto/manual select switch).

Submersion Extinguishing

In the event that a battery abnormality is detected, the crane will move to the subject stage. After the fire is extinguished with CO₂, the subject palette will be removed and automatically transferred to a submersion tank for submersion and cooling.

7. Software System with a Wealth of Applications

The PC that controls charge and discharge provides a wide range of functions.

- Registers charge-discharge testing pattern.
- Displays various data and operational status.
- Supports equipment maintenance.

Main system

The charge-discharge equipment will basically control every inspection tray. Once inspection pattern, lot No., type, etc. are registered, the charge-discharge controlling PC will control the necessary data in a group for traceability management based on the tray barcode.

Data Display

Data for voltages, charge capacities, discharge capacities, capacity ranking, etc. will be displayed for every inspection tray.

Status Display

The operating status of the overall equipment will be displayed on 1 screen in real time. In addition, the trend graphs of charge-discharge status will be displayed.

Charge-Discharge Inspection Pattern Registration

100 standard patterns are registered as the charge-discharge inspection patterns. In addition, there can be up to 20 steps per 1 pattern of charge-discharge conditions. Setting are for mode (charging / discharging / pause), voltage value, current value, cut off condition, judgment conditions, protection condition, etc.

Maintenance Support System

The status of any occurring defects is displayed by channel at each stage. Each stage can be set up with both operating and shutting off conditions which make it possible to do maintenance without shutting down the overall equipment when there's a power failure or a mechanical machine failure.

Alarm display

The failure status of the overall equipment (stages, carriers, etc.) is displayed as alarm history.

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