Safety notes

Use the system properly by reading the Operation Manual and the Specifications carefully or consulting the dealer where you purchased the system.

Only qualified personnel with the appropriate expertise and knowledge in the relevant fields should operate the system.

Website
URL http://www.fujielectric.co.jp/products/cleanroom/

Fuji Electric Co., Ltd.
Gate City Ohsaki East Tower
1-11-2, Ōsaki, Shinagawa, Tokyo 141-0032, Japan
Phone +81-3-5435-7111

Information in this catalog is subject to change without notice.
We create optimal environments with customers.

For cleanroom technology, Fuji Electric started development of cleanroom equipment at the beginning of the 1970s and constructed our own semiconductor plant cleanroom in the 1980s. Since then, we have accumulated extensive know-how for cleanroom through improvement of the production environment jointly promoted with customers operating large-scale cleanrooms.

To solve various problems, we have developed high-performance products based on our wide range of element technologies as an electrical equipment manufacturer and materialized various solutions.

O - Performance
We are capable of offering optimum solutions, such as the state-of-the-art local unit cleanroom, indispensable for cleanliness at low cost.

A - Large scale
We can provide prompt support for large-scale cleanrooms with our industry-leading production system and experience.

C - COLOGY
Our FFU materializes the highest efficiency in the industry by diverting the hydroelectric turbine technology that we have developed and improved for many years into air cleaning and by applying our power electronics technology to flexible operation of electricity supply.

E - ACCURACY
We can provide accurate cleanroom design materializing a clean environment by using our engineering capability in airflow analysis as much as possible.

N - EW TECHNOLOGY
With our comprehensive capability as a manufacturer, we have been improving various state-of-the-art technologies, such as FFU Active Control with the particle sensor, the wind direction/velocity sensor and the ultra-precise temperature control etc.
A floor area or space, usually not well defined, operating at a lower airborne contamination level than the general surrounding environment.

Cleanroom is a specially constructed enclosed area which is environmentally controlled, with respect to airborne particulates, temperature, humidity, air pressure, air flow patterns, air motion, static charges, and lighting. To secure high-quality and reliability of products, it is very important to prevent adhesion of particles. This technology is applied to prevention of hospital-acquired infection, bacterial contamination in pharmaceutical plants, and food alteration in food plants. The industrial sectors requiring a cleanroom are constantly expanding.

**What is the cleanroom?**

Cleanroom is a specially constructed enclosed area which is environmentally controlled, with respect to airborne particulates, temperature, humidity, air pressure, air flow patterns, air motion, static charges, and lighting. To secure high-quality and reliability of products, it is very important to prevent adhesion of particles. This technology is applied to prevention of hospital-acquired infection, bacterial contamination in pharmaceutical plants, and food alteration in food plants. The industrial sectors requiring a cleanroom are constantly expanding.

**Expression of the cleanliness level**

Cleanliness of the cleanroom is generally expressed in the number of particles contained in the unit volume of air. Therefore, the smaller the numbers of the cleanliness class, the higher the grade (less dust) of the cleanroom.

For the standard of cleanliness, the U.S. Federal Standards (FS-209D E) were used generally but has been abolished when ISO14644 has been enacted (2000). However, the cleanliness class based on FS 209D is still widely used in actual cleanrooms. This expresses the fine-particulate concentration as the number of particles in 1 cubic foot (pieces/ft³).

Although the standard particle size is 0.5 μm in the FS-209D standard, the standard particle sizes are often altered to 0.3 μm or 0.1 μm at the actual sites. Thus, it is necessary to pay attention to the subject particle size and the unit volume (m³/ft³) to confirm the class.

### Cleanliness (ISO class)

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 μm</td>
<td>0.3 μm</td>
<td>0.5 μm</td>
<td>0.1 μm</td>
<td>0.3 μm</td>
<td>0.5 μm</td>
<td>0.1 μm</td>
<td>0.3 μm</td>
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<tr>
<td>LSI manufacturing wafer process</td>
<td>LSI assembly/test process</td>
<td>Silicon single crystal</td>
<td>Photo mask</td>
<td>Photore sist</td>
<td>Printed circuit board</td>
<td>Liquid crystal for display</td>
<td>Organic EL</td>
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<tr>
<td>Semiconductor fabrication/ equipment</td>
<td>Chemicals for manufacturing LSI</td>
<td>Solar panel</td>
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### Standard particle size

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<th>0.1 μm</th>
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<tr>
<td>100,000</td>
<td>M6</td>
<td>7.5</td>
<td>8.0</td>
<td></td>
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<tr>
<td>10,000</td>
<td>M5</td>
<td>6.5</td>
<td>7.0</td>
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<tr>
<td>1,000</td>
<td>M4</td>
<td>5.5</td>
<td>6.0</td>
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</tr>
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<td>M3</td>
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<td>0.5</td>
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### Industrial sectors requiring the cleanroom and levels

<table>
<thead>
<tr>
<th>Sector</th>
<th>Class 2</th>
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<th>Class 6</th>
<th>Class 7</th>
<th>Class 8</th>
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<tbody>
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<td>Medical and Pharmaceutical sector</td>
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<td>Food sector</td>
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<tr>
<td>Hospital-acquired infection</td>
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<tr>
<td>Bacterial contamination</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Various kinds of failures caused by air pollution</td>
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### Recommendation

- **FFU-method cleanroom**
- **Clean cooling equipment**
In response to current requirements and future demand, it is possible to construct an ideal cleanroom.

The FFU-method cleanroom is a method of cleaning a space by constructing a grid-shaped ceiling with aluminum frames and by installing the necessary number of FFUs (fan filter units) for materializing the required cleanliness. This is suitable for a cleanroom requiring high cleanliness with single airflow and adopted widely to large-scale cleanrooms in the semiconductor and flat panel industries.

### Components of FFU-method cleanroom

**FFU**
- A wide range of lineups covering from the large air-volume type for system ceilings to the thin type of stockers with limited spaces is provided.
- Various kinds of FFUs for manufacturing equipment, which you can select in accordance with functions and air volume, are available.

**Environmental sensor**
- Various kinds of environmental sensors such as F-Planet, a cleanroom environmental sensor, a wind direction/velocity sensor are provided, so that you can quickly support trend analysis and environment alteration.

**FFU monitoring system**
- This system provides real-time monitoring capable of stable manufacturing and improvement of yield rate. Our monitoring system, the F-SITE series, is a lineup which can at will materialize the visualization of the cleanroom covering from a large-scale to a small-scale cleanrooms.

### Merits

1. **Energy saving effects**
   - The equipment consumes less energy than the pressure chamber method requiring a large-sized air conditioner. Furthermore, you can operate the cleanroom with economy since ON/OFF switching and air velocity adjustment can be made for each FFU independently.

2. **Redundancy**
   - Even if several units of FFU fail, performance as a cleanroom can be maintained. It can be said that the system has high resistance to failures.

3. **Flexibility**
   - Cleanliness in an area is adjustable by adding or changing the position of FFUs. It is possible to flexibly handle alteration of production lines.

4. **No leakage**
   - There is no risk of particle leakage to the cleanroom side since the space above the system ceiling achieves negative pressure compared to the inside of the cleanroom.

5. **Easy maintenance**
   - With the no-leakage method, there is no risk of cleanliness deterioration in the cleanroom since maintenance service can be executed while operating the cleanroom.
Solution examples FPD

1. Cleaning of inspection areas, Gay菊
   - Evenness of 1,000 to 100,000 in a wide area can simply be cleaned without constructing a system ceiling.

2. Separate areas having different levels of cleanliness
   - Areas having different levels of cleanliness, which used to be separated with panels, can be separated with high-speed air blowers.

3. Securing air velocity required for a large area
   - Even in a space with a high ceiling more than 10 m such as a stocker area, high-speed airflow of 0.8 m/sec assures the wind velocity required for pass lines

4. Prevention of foreign substance contamination in a large area
   - Cleaning a stocker area efficiently with thick body and large air volume

5. Air cooling of glass substrates
   - Substrates after being baked are cooled with air at the cassette by the cassette. It is possible to cool the surface temperature uniformly in a short time.

6. Temperature homogenization of substrate before photo process
   - Surface temperature of substrates before entering the stepper is uniform and highly accurate. Dispersion of pattern transfer caused by uneven temperature can be reduced.

7. Large-sized air shower for G10
   - This is a large-sized air shower for large glass substrates of G10 size

8. Large-sized clean booth for G10
   - Class 10 of G10-sized inspection equipment can be materialized in a large-sized clean booth of W8000 x D6000 x H3500.

Solution examples Semiconductor

1. Cleaning of coater/developers
   - Cleaning inside of the equipment in accordance with the shape and the specifications suitable for the equipment installed. Chemical pollution of wafers can be reduced by applying improved materials/structures and incorporating chemical filters.

2. Cleaning of thermal oxidation units
   - The unit can be installed in a small space with increasing temperature by employing the small-sized heat-resisting motor. Flexibility of installation positions will be expanded.

3. Precise temperature/humidity control for the resist-coating part
   - Atmosphere of some parts requiring precise temperature/humidity management, such as the resist-coating part can be controlled at high accuracy of +/–0.01 % and +/–0.3 % with our unique controlling method. Homogenization of resist film quality can be materialized.

4. Real-time monitoring of manufacturing environment
   - Causes of fluctuation of yield rate can be determined by executing real-time monitoring of cleanliness, temperature and humidity in important processes.

5. Energy saving operation of the cleanroom
   - Energy saving operation with eliminating waste can be materialized through optimization of the air volume of an FFU in combination with the environment sensor.
Solution examples Medicine/Foods

1. **Radiation shielding**
   - Human bodies can be protected from the radiation emitted from a reagent, such as cancer drugs with the protective plate incorporating lead.
   - **Radiation shielding lead booth**

2. **Sterilization and dehydration of medical equipment**
   - It is possible to dry products requiring sterilization such as syringes of injectors efficiently with thermal insulation from outside. Since the heat-resistant filter is incorporated, it is not necessary to worry about contamination due to hot air.
   - **Hot air dehydration sterilization bench**

3. **Stabilizing quality of medical equipment**
   - For the environment of processes being influenced by humidity, such as contact lens production, dehumidification and temperature control can be provided with the freezer method.
   - **Dehumidification thermal booth**

4. **Cleanroom equipment supporting the explosion-proof areas**
   - For hazardous areas requiring the explosion proof structure, such as pharmaceutical factories and chemical factories, we can provide designs considering safety.
   - **Explosion-proof air shower**

5. **Clean dehydration of the pharmaceutical solution**
   - Dehydration of solution, which took some time previously, can be executed in a short time by blowing hot air at high speed.
   - **Hot air dehydration booth**

6. **Safety air conditioning for toxic reagents**
   - Hazardous substances and harmful microorganisms can be cleaned and exhausted without diffusing them in the room. Explosion-proof specifications are supported, too.
   - **Air curtain**

7. **Easy construction of a clean area**
   - It is easy to construct a clean area with Cleanliness Class 100,000 degrees, which is often used in pharmaceutical plants and food plants.
   - **Draft chamber**

Solution examples Automobile, Precision components, Lithium ion battery

1. **Preventing adhesion of dust in the coating line**
   - Winding up of dust in the pre-coating line of automobiles can be prevented efficiently with the FFU with the special diffuser expanding the blast area.
   - **FFU with diffuser**

2. **Highly accurate temperature control for the lens inspection process**
   - Environmental temperature in processes requiring highly accurate temperature control such as lens production of optical equipment can be controlled with accuracy of +/-0.005°C by applying our unique multi-step controlling method.
   - **Highly accurate thermal chamber**

3. **Environmental management of the production line**
   - With the trend for monitoring of the respective processes, the production environment such as temperature, humidity and cleanliness can be controlled constantly.
   - **F-Planet**

4. **Local cleaning of the production line**
   - It is possible to clean processes containing a lot of processing dust and problems of dust adhesion easily.
   - **Clean booth**

5. **LED, Solar battery, Lithium ion battery**
   - Humidity of environments of processes where humidity in the air must be avoided, such as lithium ion battery production can be reduced with the desiccant method.
   - **Low dew point dry room**

6. **Removal of dust in the cleanroom**
   - Dust can be collected efficiently by connecting to the suction hose.
   - **Dust collection unit**
**FFU for manufacturing equipment**
As conforming to the global standards, best performance is materialized in a limited installation space.
You can accurately select a system suitable for the respective use.

**Features of Fuji FFU**

**Reliable performance**
We have abundant experience for more than 40 years as a supplier of the clean equipment and have supplied more than 500,000 units of FFUs.

**Abundant lineups**
Various types of FFUs such as the large air volume type that is the highest in the industry and the thin type optimum for installing on the side panel of the stocker are available.

**Selecteable materials**
The standard material for casing is the coated steel sheet having superior corrosion resistance and cost performance. However, various kinds of materials such as stainless steel are selectable according to the purpose of use.

**Size variation**
Various sizes of FFUs can be manufactured according to the grid dimensions and the available installation space.

**Reducing the work load**
By using the multiple operation controller, the number of cable connection points can be reduced (1/4 comparison with conventional) and the installation cost can be saved, while the launching time of the cleanroom can be shortened by shortening the installation period.

**Improvement of reliability**
Occurrence of communication errors due to defective connection of cables and external noises can be reduced.

**Industry highest energy-saving motor**
The brushless DC motor having superior efficiency in comparison with the induction motor is adopted as standard. Industry highest energy-saving performance has been materialized.

**Airfoil high efficiency fan**
The waterwheel designing know-how of the hydro power generation engineering, our traditional business field, is applied to fan designing. By adopting the airfoil section in the fan shape, the efficiency has been improved.

**Adjustable air volume to the optimum**
By using our core technology, power electronics technology, highly accurate speed control becomes possible. You can set the optimum air volume for your use environment. The large-air-volume type of the industry highest class is also included in our lineups.

**Multiple operation controller**
This is our unique control system capable of operating multiple FFUs with a single controller. Once installation can be simplified, it is optimum for a cleanroom system using many FFUs.

**Comparision of FFU for equipment**

<table>
<thead>
<tr>
<th>FFU Type</th>
<th>Main FFU</th>
<th>Sub FFU</th>
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<tbody>
<tr>
<td>F-Stage (WLPA)</td>
<td>Power supply</td>
<td>Motor</td>
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<tr>
<td>D100 / 100 mm D100 / 100 mm D100 / 100 mm</td>
<td></td>
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</tr>
<tr>
<td>400 / 200 V</td>
<td>400 / 200 V</td>
<td>400 / 200 V</td>
</tr>
<tr>
<td>400 / 200 W</td>
<td>400 / 200 W</td>
<td>400 / 200 W</td>
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<tr>
<td>NEMA 34</td>
<td>NEMA 34</td>
<td>NEMA 34</td>
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<td>3/4 HP</td>
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</table>

**Features**

1. Thickness of the main unit when 40 mm filter is used.
2. *F-Stage 61, F-Cube 122 only
Clean Room - Performance curve

Outline dimensional drawing

Power supply cable
Communication cable
Electric wire fixture
Filter (size: 1220 x 610)

Performance curve

Air volume/Static pressure

Input power
Current

AC motor type WLFD

Outline dimensional drawing

Net terminal block
Riveting plate
Terminal block cover

Performance curve

Air volume/Static pressure

Input power
Current
### Controller specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>SDR3204-2R-TD</th>
<th>BDR170-T</th>
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<td>Application Motor</td>
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<td>QDG069C-TEPD79-8</td>
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<td>Rated output</td>
<td>210 W / 1460 min⁻¹</td>
<td>175 W / 1350 min⁻¹</td>
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<tr>
<td>Number of Motors</td>
<td>1 unit</td>
<td>1 unit</td>
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<td>Tolerable Motor Wire Length</td>
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<td>Max 12 m</td>
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<tr>
<td>Voltage</td>
<td>3-phase 200 V (Nominal)</td>
<td>3-phase 200 V (Nominal)</td>
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<tr>
<td>Rated Current</td>
<td>0.8 A (per 1 motor)</td>
<td>0.8 A</td>
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<tr>
<td>Voltage/Frequency variation</td>
<td>+/-10% Frequency: +/-5%</td>
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<tr>
<td>Input drop capacity</td>
<td>2%</td>
<td>2%</td>
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<tr>
<td>Required Power Capacity</td>
<td>1.1 kVA</td>
<td>310 VA</td>
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<tr>
<td>Speed control range</td>
<td>500 to 1450 min⁻¹</td>
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<td>Speed accuracy</td>
<td>+/-3% for the set value of the maximum speed</td>
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<td>Rotating direction</td>
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### CAN communication type

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<th>BFU500-1C3M</th>
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<td>500 W</td>
<td>500 W</td>
<td>1000 W</td>
<td>1500 W</td>
</tr>
<tr>
<td>Number of Motors</td>
<td>1 unit</td>
<td>2 units</td>
<td>3 units</td>
<td>4 units</td>
<td>4 units</td>
</tr>
<tr>
<td>Tolerable motor wire length</td>
<td>Max 12 m</td>
<td>Max 12 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated voltage</td>
<td>250 V</td>
<td>250 V</td>
<td>250 V</td>
<td>250 V</td>
<td>250 V</td>
</tr>
<tr>
<td>Rated current</td>
<td>1.0 Arms</td>
<td>1.0 Arms</td>
<td>2.0 Arms</td>
<td>3.0 Arms</td>
<td>4.0 Arms</td>
</tr>
<tr>
<td>Voltage/Frequency variation</td>
<td>+/-10% Frequency: +/-5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input unbalance</td>
<td>+/-3%</td>
<td>+/-3%</td>
<td>+/-3%</td>
<td>+/-3%</td>
<td>+/-3%</td>
</tr>
<tr>
<td>Rated input current</td>
<td>1.0 Arms or less</td>
<td>1.1 Arms or less</td>
<td>2.1 Arms or less</td>
<td>3.1 Arms or less</td>
<td>4.3 Arms or less</td>
</tr>
<tr>
<td>Communication rate</td>
<td>1100 min⁻¹</td>
<td>1200 min⁻¹</td>
<td>1450 min⁻¹</td>
<td>1250 min⁻¹</td>
<td>1350 min⁻¹</td>
</tr>
<tr>
<td>Speed control range</td>
<td>500 to 1100 min⁻¹</td>
<td>500 to 1350 min⁻¹</td>
<td>500 to 1450 min⁻¹</td>
<td>500 to 1350 min⁻¹</td>
<td></td>
</tr>
<tr>
<td>Speed accuracy</td>
<td>+/-5%</td>
<td>+/-5%</td>
<td>+/-5%</td>
<td>+/-5%</td>
<td>+/-5%</td>
</tr>
<tr>
<td>Carrier frequency</td>
<td>10 kHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication rate</td>
<td>2-wire half-duplex communication</td>
<td>2-wire differential communication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication method</td>
<td>EIA RS-485</td>
<td>EIA RS-485</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote operation</td>
<td>Operation (Operation/Stop)</td>
<td>Operation (Operation/Stop)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Board</td>
<td>Operation through a communication command or sensor-less method</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation control</td>
<td>Direct operation</td>
<td>Remote operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remote operation</td>
<td>Operation with the communication between upper side devices (CAN)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>GCG21155-TLFE21</th>
<th>GCG2954-T8TD17B-c</th>
<th>GBF21155-TLFE21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>170 W / 1450 min⁻¹</td>
<td>170 W / 1350 min⁻¹</td>
<td>210 W / 1450 min⁻¹</td>
</tr>
<tr>
<td>Tolerable wire length</td>
<td>Max 12 m</td>
<td>Max 12 m</td>
<td></td>
</tr>
<tr>
<td>Number of Motors</td>
<td>6A0-peak or less</td>
<td>6A0-peak or less</td>
<td>6A0-peak or less</td>
</tr>
<tr>
<td>Motor output</td>
<td>100,000 hours or more (at surrounding temperature 30 °C)</td>
<td>100,000 hours or more (at surrounding temperature 30 °C)</td>
<td>100,000 hours or more (at surrounding temperature 30 °C)</td>
</tr>
<tr>
<td>Motor current</td>
<td>0.9 A</td>
<td>0.9 A</td>
<td>0.9 A</td>
</tr>
<tr>
<td>Motor efficiency</td>
<td>95%</td>
<td>95%</td>
<td>95%</td>
</tr>
<tr>
<td>Dimensions (W x D x H) mm</td>
<td>240 x 145 x 65</td>
<td>240 x 145 x 65</td>
<td>240 x 145 x 65</td>
</tr>
<tr>
<td>Weight</td>
<td>About 1.8 kg</td>
<td>About 1.8 kg</td>
<td>About 1.8 kg</td>
</tr>
</tbody>
</table>

*Separate modules are required*
You can find the optimum answer with functions, features, and air volume.
Since the FFU for equipment is attached to the manufacturing equipment, various functions are required as a part of the manufacturing equipment. Our FFU for equipment is capable of materializing the customers’ various requirements.

### Select with functions/features

<table>
<thead>
<tr>
<th>Series</th>
<th>Functions/Features</th>
<th>Thickness</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>WLFG</td>
<td>3-p 200V supporting immediate delivery** Filter selectable</td>
<td>115mm</td>
<td>RoHS, CE</td>
</tr>
<tr>
<td>WLFH</td>
<td>1-p 100V supporting immediate delivery** Communication function</td>
<td>150mm</td>
<td>RoHS (Optional) CE (Optional)</td>
</tr>
<tr>
<td>WLI</td>
<td>Hot environment (50°C) Outgassing measure</td>
<td>105mm</td>
<td>RoHS</td>
</tr>
<tr>
<td>WLFU</td>
<td>Hot environment (50°C) Outgassing measure, wind speed 0.65 m/s</td>
<td>190mm</td>
<td>RoHS</td>
</tr>
<tr>
<td>WLFK</td>
<td>Outgassing measure communication function equipped with the chemical filter</td>
<td>230mm</td>
<td>–</td>
</tr>
</tbody>
</table>

### You can choose with air volume and air velocity

<table>
<thead>
<tr>
<th>Air volume [CM³]</th>
<th>Air velocity [m/s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>0</td>
</tr>
<tr>
<td>0.2</td>
<td>0.65</td>
</tr>
<tr>
<td>0.4</td>
<td>1.3</td>
</tr>
<tr>
<td>0.6</td>
<td>2.0</td>
</tr>
<tr>
<td>0.8</td>
<td>2.7</td>
</tr>
<tr>
<td>1.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

*1 Immediate delivery means about one week after receiving the order.
*2 When the filter of 40 mm is used
*3 F-Stage 61 and F-Stage 122 support 3-p 200V only

### Features of FFU for manufacturing equipment

**Feature 1**
Thin type: The highest level of thinness in the industry is materialized in consideration of installation in a limited space (Min 115 mm)

**Feature 2**
Energy-saving/air volume variable: As adopting DC brushless motor to all series, energy-saving operation is possible at the optimum air volume with variable speed of the motor. In comparison with the conventional FFU, the power consumption has been reduced by about 30%. (Compared with our conventional type product)

**Feature 3**
Conformance to RoHS, CE, SEMI: To export to overseas, the system conforms to various standards. It is possible to issue the parameter sheet of the export trade control order.

**Feature 4**
Outgassing measures:
Outgassing is reduced by strictly selecting constituent materials for the main unit, the outlet, the filter and the sealing materials.

**Feature 5**
Communication function:
To maximize excellent controllability of brushless DC motor, the air volume can be controlled by varying the motor speed through the communication function.
Ultra thin FFU with 115 mm thickness

Surprising thickness
The thickness of 115 mm is materialized by combining with the filter newly developed.
* When HEPA filter (Thickness 40 mm) is used

Low noise
In comparison with the conventional product, the noise has been reduced by about 10 dB.
(In comparison with our product of the biggest model)

Response to regulations
RoHS command is supported as standard CE marking is supported optionally.

Specifications

<table>
<thead>
<tr>
<th>Name</th>
<th>F-Stage40*4</th>
<th>F-Stage50</th>
<th>F-Stage61</th>
<th>F-Stage122</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (WLF)</td>
<td>G010D: 0.4</td>
<td>G110D: 6.6</td>
<td>G210D: 6.6</td>
<td>G310D: 6.6</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>D: 400</td>
<td>500</td>
<td>610</td>
<td>1220</td>
</tr>
<tr>
<td></td>
<td>W: 400</td>
<td>500</td>
<td>610</td>
<td>610</td>
</tr>
<tr>
<td></td>
<td>H: 125 (115)*</td>
<td>40 mm thickness in HEPA filter only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>19-200V / 39-200V</td>
<td>DC brushless motor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air volume [m³/min]</td>
<td>3.6(2.7)</td>
<td>6.3(4.0)</td>
<td>9.4(6.0)</td>
<td>15.1(12)</td>
</tr>
<tr>
<td>Air velocity [m/s]</td>
<td>0.5(0.35)</td>
<td>0.5(0.35)</td>
<td>0.5(0.35)</td>
<td>0.37(0.3)</td>
</tr>
<tr>
<td>Main unit materials</td>
<td>ZAM: 3,5433</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed-controlling method</td>
<td>Volume knob (0 to 100%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise (dB(A))</td>
<td>52(51)</td>
<td>51(50)</td>
<td>50(49)</td>
<td>54(54)</td>
</tr>
<tr>
<td>Power consumption (W)</td>
<td>38(31)</td>
<td>44(38)</td>
<td>65(45)</td>
<td>77(73)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>8.5</td>
<td>9.6</td>
<td>11.6</td>
<td>16.5</td>
</tr>
<tr>
<td>Environmental regulations</td>
<td>RoHS supported</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter</td>
<td>HEPA (t=40mm): 99.99% (0.3μm)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- CE support (Optional)

<table>
<thead>
<tr>
<th>Name</th>
<th>F-Stage61 (CE)</th>
<th>F-Stage122 (CE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type (WLF)</td>
<td>G210D: 10.1</td>
<td>G310D: 10.1</td>
</tr>
<tr>
<td>Power supply</td>
<td>3/200V</td>
<td>Supporting</td>
</tr>
<tr>
<td>CE marking</td>
<td>CE marking support (F-Stage 61/F-Stage 122)</td>
<td></td>
</tr>
</tbody>
</table>

- Aperture dimensions

- Standard accessory

- Optional

- Abnormality indication lamp
(If the indication lamp is mounted, abnormal signals are not outputted.)
F-Cube-N
Compact FFU available with the ordinary 1Φ100V power outlet

Power construction is not required
The equipment can be operated with the ordinary power outlet (1Φ100V) and any troublesome power construction is not required. Operation is very simple such that connecting to the ordinary outlet for power supply and turning on the equipment only. (operable with 1Φ200V or DC24V at option.)

Air volume simple adjustment
The air volume can be adjusted continuously with the adjusting dial. The operating status can be confirmed with the indication lamp.

Filter built-in structure
Highly accurate clean environment can be materialized with the built-in high-performance ULPA filter. Since the protective screen is attached to the surface, the filter may not be damaged at the time of installation.

Communication function
(Individual control, Group control, High-speed/low-speed switching, Collective fault output)
By combining the small FFU monitoring systems, the FFU air volume becomes variable and the failure monitoring is available.

Abnormal signal output
Failure signals can be outputted by using the abnormal signal output cable (optional).

Type explanation example
Identification  WLFH 40 U D
Size
30 300x300
40 400x400
50 500x500
61 610x610
122 610x1220

Symbol  Optional
P  Not available
D  Pre-filter
K  Filtration tube only
A  Abnormal signal output
C  Ceiling bracket (4 pieces)
H  Horizontal bracket
T  FFU monitoring system

Specification

Type  WLFH-30U  WLFH-40U  WLFH-50U  WLFH-61U  WLFH-122U  WLFH-122H

Dust collection efficiency
99.999% or more(0.1μm)  99.99% or more(0.3μm)

Dimensions [mm]
D 300 400 500 610 610 610
W 300 400 500 610 610 610
H 150 150 150 150 150 150

Installation/ Aperture dimensions [mm]
X 270 370 470 580 580 580
Y 270 370 470 580 580 580

Power supply
1Φ100V 50/60 Hz/1Φ200V (Optional)  DC24V (Optional)
Motor DC brushless motor 87 W  DC Brushless motor 100 W
Air volume [m3/min] 2.2 4.1 6.6 10.1 16.6 10.1 16.6
Air velocity [m/s] 0.5 0.5 0.5 0.5 0.5 0.5 0.5
Power consumption [W] 24 37 63 87 103 68 76
Noise [dB (A)] 55 55 55 58 59 51 57

Material:
Aluminum (Side panels - SUS (inlet part))

Weight [kg] 5 6.4 11.5 13.5 20.5 13.5 20.5

Communication functions
Not available
Available (optional)

Outline dimensional drawing

Standard accessory

Optional

(Refer optional)
Heat-resisting FFU

- This can be used in hot environments (50°C)
- Applicable standard RoHS/SEMI (Conformance)
- Measures against outgassing
- With the variable air volume with the volume knob and the failure output relay

This can be used in hot environments
Design withstand hot environments such as a diffusion furnace (50°C)

Measures against outgassing
Main unit: Polyester resin coating
Outlet: SUS 304 BA (Punching board)
Filter: Boron-free filter (PTFE)
Sealing materials: Low siloxane type

High air velocity type
The outlet air velocity of 0.65 m/s is materialized by adopting the high static pressure fan.

Chemical FFU

- Thin type considering storage in the device (Main unit: H = 230 mm + Chemical H = 150 mm)
- Optimum to chemical contamination measures of manufacturing devices such as coaters and developers
- Measures against outgassing
- Variable air volume and failure monitoring with communication function are available

Thin type 230 mm
Development of the thin type fan materialized 230 mm height.

Chemical filter
For the chemical filter removing chemical contaminants, the waffle cooker structure is employed for easy and quick replacement.

Measures against outgassing
Main unit materials: SUS 430BA
Filter: Boron-free filter (PTFE)
Sealing materials: Low siloxane type

Communication function
(Individual control, Group control, High-speed/low-speed switching, Collective fault output)
By combining the small FFU monitoring systems, the FFU air volume becomes variable and the failure monitoring is available.

Number of FMC200 to be connected: Max 254 units (4 ports)
Number of FMC100 to be connected: Max 100 units (1 port)

FFU monitoring system
FMC100/200

Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Heat-resisting FFU (Ultra thin type)</td>
</tr>
<tr>
<td>Type</td>
<td>WLFJ</td>
</tr>
<tr>
<td>Filter</td>
<td>ULPA filter</td>
</tr>
<tr>
<td>Particle collection efficiency</td>
<td>99.9999% or more 0.1 μm</td>
</tr>
<tr>
<td>FFFU dimensions [mm]</td>
<td>1630W × 750D × 230H</td>
</tr>
<tr>
<td>Power supply</td>
<td>115V 50/60Hz</td>
</tr>
<tr>
<td>Air volume [m³/min]</td>
<td>3 (0.15 m³/min)</td>
</tr>
<tr>
<td>External static pressure [Pa]</td>
<td>0</td>
</tr>
<tr>
<td>Noise [dB (A)]</td>
<td>73</td>
</tr>
<tr>
<td>Main unit material</td>
<td>Steel plate (Polyester resin coating)</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>38</td>
</tr>
</tbody>
</table>

Chemical FFU P-Q properties

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Chemical FFU</td>
</tr>
<tr>
<td>Type</td>
<td>WLFK</td>
</tr>
<tr>
<td>Filter</td>
<td>ULPA filter</td>
</tr>
<tr>
<td>Particle collection efficiency</td>
<td>99.9999% or more 0.1 μm</td>
</tr>
<tr>
<td>FFFU dimensions [mm]</td>
<td>1000W × 350D × 190H</td>
</tr>
<tr>
<td>Power supply</td>
<td>3/5/0.5V 50/60Hz</td>
</tr>
<tr>
<td>Air volume [m³/min]</td>
<td>16.0 (0.45m³/min)</td>
</tr>
<tr>
<td>Total static pressure [Pa]</td>
<td>160</td>
</tr>
<tr>
<td>Maximum air consumption [L/min]</td>
<td>140</td>
</tr>
<tr>
<td>Noise [dB (A)]</td>
<td>65</td>
</tr>
<tr>
<td>Main unit material</td>
<td>SUS 430BA</td>
</tr>
<tr>
<td>Weight [kg]</td>
<td>65</td>
</tr>
</tbody>
</table>
FFU monitoring system
F-SITE series

You can choose any type of the monitoring system as you like, covering from large-scale complex demands to small-scale specific demands.

F-SITE series
Select the FFU monitoring system from the series

- **Wide monitoring system (Large scale)**
  - F-SITE–FMR500
    - Clean equipment integrated monitoring system
      - FFU monitoring PC with Windows 7
      - Monitoring of the environmental sensor (F-PLANET)
      - Connection with the wind direction/wind velocity sensor
      - Connection with the temperature/humidity sensor
      - Connection with PLC
      - Supporting any I/F with various applications
  - F-SITE–FMC500
    - FFU monitoring system FANET
      - FFU monitoring PC with Windows 7
      - Connection with PLC

- **Spot monitoring system (Small scale)**
  - F-SITE–FMV300
    - Small-scale FFU display/operation unit F-MONITOR
      - Software-less FFU monitoring unit standardizing our MONITOUCH
      - RS-485 communication port is provided as standard
  - F-SITE–FMC200
    - Small-scale FFU monitoring system ICU
      - FFU monitoring system with our unique CAN interface
      - CAN communication port is provided as standard
  - F-SITE–FMC100
    - Small-scale FFU monitoring system S–ICU
      - FFU monitoring system with our unique CAN interface
      - CAN communication port is provided as standard
FFU monitoring system

You can choose the optimum system by connection size and communication type.

This is an integrated monitoring system handling measurement values of various kinds of sensors such as the operating status of an FFU, temperature, humidity, cleanliness, wind direction, and wind velocity. Visualization of the cleanroom is materialized so that the optimum manufacturing environment can be produced as saving energy.

- Supporting temperature control
- Supporting F-SITE

For details, refer to Fujielectric integrated controller MICREX-SX series SPH 3000 catalog (LH992a) http://www.fujielectric.co.jp/products/plc/firmware/sp/index.html
<table>
<thead>
<tr>
<th>PLC Communication Method</th>
<th>Wide Monitoring System</th>
<th>Spot Monitoring System</th>
<th>FFU Monitoring System</th>
<th>FFU Monitoring System</th>
<th>FFU Monitoring System</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
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<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
<td>PLC Communication Method</td>
</tr>
</tbody>
</table>

### Specifications

- **RS-485**: CAN is converted to Ethernet
- **CAN**: LSI (LAN-CAN-Interface) to S.W. HUB to Monitoring PC
- **FFU 372 units**: FFU 65,000 units
- **FFU 254 units**: FFU 100 units
- **FFU 65,000 units**: FFU 300 m (RS-485), 125 kbps, Communication rate: Between FFU
- **255 steps**: Variable speed output:
- **Data frame 64-bit**: CAN protocol method (ISO11898)
- **Transmission distance**: 300 m (RS-485), 125 kbps, Communication rate: Between FFU
- **255 steps**: Variable speed output:
- **Data frame 64-bit**: CAN protocol method (ISO11898)
- **Transmission distance**: 300 m (RS-485), 125 kbps, Communication rate: Between FFU
- **Asynchronous communication**: Synchronization method:
  - 2-wire half-duplex communication
- **EIA RS-485**: Electrical specifications:
- **300 m**: Transmission distance
- **38400 bps**: Communication rate: Between FFU
- **255 steps**: Variable speed output:
- **Data frame 64-bit**: CAN protocol method (ISO11898)
- **Transmission distance**: 300 m (RS-485), 125 kbps, Communication rate: Between FFU
- **255 steps**: Variable speed output:
- **Data frame 64-bit**: CAN protocol method (ISO11898)
- **Transmission distance**: 300 m (RS-485), 125 kbps, Communication rate: Between FFU
- **Asynchronous communication**: Synchronization method:
  - 2-wire half-duplex communication
- **EIA RS-485**: Electrical specifications:
- **300 m**: Transmission distance
- **38400 bps**: Communication rate: Between FFU

### Function

<table>
<thead>
<tr>
<th>FFU Monitoring System Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFU monitoring system functions</td>
</tr>
<tr>
<td>FFU monitoring system functions</td>
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<tr>
<td>FFU monitoring system functions</td>
</tr>
<tr>
<td>FFU monitoring system functions</td>
</tr>
<tr>
<td>FFU monitoring system functions</td>
</tr>
</tbody>
</table>

### Other Functions

- **Revolution failure**
- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3

### Model No.

- **BFFU250**
- **SDR3204-2R-TD**
- **GCG21155-TL8FE33**
- **Applicable motor**: GCG21155-TL8FE21
- **Motor rated output**: 210 W/330 W
- **Power supply voltage**: 3
- **200 V to 230 V 50/60 Hz**

### Optional Functions

- **Smoke exhaust control**
- **Fire control**
- **Latest alarm indication**
- **Alarm history**
- **Operation history**
- **Operating privileges**

### System Condition Control

- **Forced operation**
- **Emergency stop**
- **Operation/stop control by group**
- **Operation/stop control by area**
- **Operation/stop control by floor**
- **Scheduled operation/stop**
- **Control from PLC of other facilities**

### System Condition Monitoring

- **Temperature measurement**
- **Baseboard current, Temperature measurement value indication, FFU baseboard monitoring**
- **Controlling status, FFU monitoring communication failure, System condition screen, FFU monitoring**

### Control from PLC of Other Facilities

- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3

### Communication Failure

- **Revolution failure**
- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3

### Controller overheat

- **Revolution failure**
- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3

### Voltage Open Phase

- **Revolution failure**
- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3

### Controller Overheat

- **Revolution failure**
- **Motor sensor disconnection**
- **CPU failure**
- **Memory failure**
- **Overvoltage**
- **Overcurrent**
- **Protection circuit**
- **Controlling method**: PWM control
- **Power consumption**: 200 W (Max)
- **Power supply voltage**: 3
Clean equipment integrated monitoring system

F-SITE-FMR500

- FFU monitoring
- Monitoring the environmental sensor (F-PLANET)
- Connection with the wind direction/velocity sensor
- Connection with the temperature/humidity sensor
- Connection with PLC

**Features of F-SITE-FMC500**

**Materializing the visualization**

This is an integrated monitoring system handling measurement values of various kinds of sensors such as the operating status of an FFU, temperature, humidity, cleanliness, wind direction, and wind velocity. Visualization of the cleanroom is materialized so that the optimum manufacturing environment can be produced as saving energy.

**Features**

1. Monitoring screen indicating various parameters simultaneously
   - The energy can be saved as securing the optimum cleanliness by controlling the revolution of DC-FFU.

2. FFU floor drawing
   - Since the FFU arrangement is indicated on the construction CAD drawing, it is possible to monitor and operate at the indications of actual positions.

3. System diagram drawing
   - This monitors communication status between PC and FFU interface or PC and PLC, and total number of operating FFUs.

4. Schedule function
   - With the efficient operation of facilities (CR scheduled operation), it is possible to reduce the power consumption to the adequate contracted power level.

5. Alarm monitoring screen
   - Failure history of FFUs and communication units is indicated. You can narrow down the relevant data with the search function.

6. Operation history management
   - Operation history of max. 3,000 items can be saved automatically. The history can be searched with conditions, so that maintenance management can be executed easily.
FFU monitoring system (FANET)

F-SITE-FMC500

**Flexible operability**

- With this application, you can easily design and revise the screen by yourself.
- Any complicated knowledge about software and PLC is not required.

**Features of F-SITE-FMC500**

1. **FFU layout screen**
   - The FFU layout drawing exactly the same as the actual installation can be provided easily.
   - With this application, you can revise and add layouts by yourself after completion of the layout drawing. (Knowledge of software is not required.)

2. **Floor monitoring screen**
   - It is possible to monitor the respective floors of the cleanrooms.
   - If there is any failed FFU, the symbol of the floor indication screen of the applicable floor is displayed in red.

3. **Simple operation**
   - You can operate simply with icons.

**System configuration**

- FFU monitoring
- Connection with PLC

**FFU monitoring system (FANET)**

**F-SITE-FMC500**

**Features**

- Data of FFU (Operation/Stop, revolution set value) is stored on the hard disk.
- To lock the start/stop and the revolution setting operation of the FFU. If the operation is locked, release the lock. (A password must be entered.)
- To operate the FFU
- To stop the FFU
- In the event of any abnormal conditions on the FFU, recover from the abnormality, and then press the Reset button to make the device ready for operation again.
- To read the FFU data in the hard disk
- To change the revolution of the FFU
- To display the communication status of LCI (Lan Can Interface).
- All the contents, the IP number, port, and connection status with PC are displayed.
- To display the status of the FFU in the area selected with "FFU Parameters". As the contents, the revolution, the control current value, and the status are displayed.
Features of F-SITE-FMV300

Excellent operability

Our Pod MONITOUCH series are adopted and the monitoring/operation screen for FFU is mounted. With the touch panel method, it has excellent operability and visibility, and is ready for immediate operation without software.

- Abnormal status list
- Operating revolution list is displayed
- Entire control
  - Operation command
  - Five-step operation
  - Specified revolution operation
- System control
  - Operation command
  - Five-step operation
  - Specified revolution operation
- Group control
  - Operation command
  - Specified revolution operation
- Individual control
  - Operation command
  - Specified revolution operation

Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit form</td>
<td>WLZCMS-SSS</td>
</tr>
<tr>
<td>Main unit to be used</td>
<td>Type: VR10C 15.4-inch TFT color LC touch panel Power supply AC 100 to 240 V 60 Hz</td>
</tr>
<tr>
<td>Applicable FFU</td>
<td>DCBL-FFU made by Fuji Electric Controller type: EP02324-2R-TD Address setting is required previously</td>
</tr>
<tr>
<td>Communication method</td>
<td>RS485</td>
</tr>
<tr>
<td>Communication cable length</td>
<td>Max. 300 m/port</td>
</tr>
<tr>
<td>System</td>
<td>3 system</td>
</tr>
<tr>
<td>Connection port shape</td>
<td>A-system connection port: M1 (RS485) B-system connection port: M2 (RS485) C-system connection port: CN1 (2-SUB 9-pin)</td>
</tr>
</tbody>
</table>

- FFU monitoring system

F-SITE-FMV300

**System configuration**

RS-485 direct

F-MONITOR

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>Communication method</td>
<td>RS485</td>
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<td>Max. 300 m/port</td>
</tr>
<tr>
<td>System</td>
<td>3 system</td>
</tr>
<tr>
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</tr>
</tbody>
</table>

**Outline dimensional drawing**

S-100.8 92.7 41.2 28.4

**Four-unit operating type FFU**

**System configuration**

RS-485 direct

F-MONITOR

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main unit to be used</td>
<td>Type: VR10C 15.4-inch TFT color LC touch panel Power supply AC 100 to 240 V 60 Hz</td>
</tr>
<tr>
<td>Applicable FFU</td>
<td>DCBL-FFU made by Fuji Electric Controller type: EP02324-2R-TD Address setting is required previously</td>
</tr>
<tr>
<td>Communication method</td>
<td>RS485</td>
</tr>
<tr>
<td>Communication cable length</td>
<td>Max. 300 m/port</td>
</tr>
<tr>
<td>System</td>
<td>3 system</td>
</tr>
<tr>
<td>Connection port shape</td>
<td>A-system connection port: M1 (RS485) B-system connection port: M2 (RS485) C-system connection port: CN1 (2-SUB 9-pin)</td>
</tr>
</tbody>
</table>

**Outline dimensional drawing**

S-100.8 92.7 41.2 28.4

**Four-unit operating type FFU**
**FFU monitoring system**

**F-SITE-FMC200**

You can control and monitor the FFU individually or by group with simple operation without software. Furthermore, this is an operating/monitoring unit that can be connected easily through the CAN direct communication.

**F-SITE-FMC100**

This is our lightest FFU operating/monitoring unit. You can control and monitor individually or by group. Furthermore, this is an operating/monitoring unit that can be connected easily through the CAN direct communication.

### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>2.5 kg</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>170 x 320 x 62 mm</td>
</tr>
<tr>
<td><strong>Input</strong></td>
<td>AC80 ~ 250 V 50/60 Hz</td>
</tr>
<tr>
<td><strong>Rated temperature</strong></td>
<td>0 ~ 40°C</td>
</tr>
<tr>
<td><strong>Operating humidity</strong></td>
<td>90% RH or less (No condensation)</td>
</tr>
<tr>
<td><strong>FFU connected to ICIU</strong></td>
<td>Max. 300 units (Number of FFU to be connected for a single ICIU)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>LCD-4Line. 20Character</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>Power switch (ON/OFF)</td>
</tr>
<tr>
<td><strong>Fault LED</strong></td>
<td>LED-Green, LED-Red</td>
</tr>
</tbody>
</table>

### CAN communication port specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication standard</strong></td>
<td>CAN (ISO 11898) Ver. 2.0B Active</td>
</tr>
<tr>
<td><strong>Number of ports</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Form of port</strong></td>
<td>Dedicated connector</td>
</tr>
<tr>
<td><strong>Communication length</strong></td>
<td>Max. 300 mport (Number of FFU to be connected for a single ICIU)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>SSI power supply (Energized)</td>
</tr>
<tr>
<td><strong>Operation</strong></td>
<td>Power switch (ON/OFF)</td>
</tr>
<tr>
<td><strong>Fault LED</strong></td>
<td>LED-Green, LED-Red</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td>Operating temperature range 0 ~ +40°C</td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td>Fixing of the main unit with the side brackets (Screw to be used: M3)</td>
</tr>
</tbody>
</table>

*1: AWM2919 VW-1 80°C 30V 24AWG × 7TR SHIELDED LOW VOLTAGE COMPUTER CABLE: made by KDC (Korea)

---

### Simple LCD

Various kinds of control information of the registered FFU are displayed in the LCD. The FFU can be controlled by selecting the mode.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STATE MONITOR</strong></td>
<td>This is the function displaying status of the registered FFU and controlling them individually.</td>
</tr>
<tr>
<td><strong>GROUP MONITOR</strong></td>
<td>This is the function displaying status of the respective groups individually and controlling them by group.</td>
</tr>
<tr>
<td><strong>FAULT MONITOR</strong></td>
<td>This function displays the content of the abnormal conditions in the FFU.</td>
</tr>
<tr>
<td><strong>GROUP SETTING</strong></td>
<td>This is the function setting for enabling/disabling control of the FFU.</td>
</tr>
<tr>
<td><strong>GROUP MONITOR</strong></td>
<td>This function displays the content of the abnormal conditions in the FFU.</td>
</tr>
<tr>
<td><strong>GROUP SETTING</strong></td>
<td>This is the function assigning the FFU by group.</td>
</tr>
<tr>
<td><strong>GROUP MONITOR</strong></td>
<td>This function displaying status of the registered FFU.</td>
</tr>
</tbody>
</table>

### Simple operation button

All operations on this unit (setting of FFU etc.) shall be made with the buttons.

### Outline dimensional drawing

---

**ICIU**

![ICIU Outline Dimensional Drawing](image)

**S-ICIU**

![S-ICIU Outline Dimensional Drawing](image)
**LSI outlines**

LSI is connected to a PC for the upper side monitoring control through Ethernet, communicates with the FFU controller in the cleanroom through RS-485, controls the speed of the FFU, and monitors the operating status. This is required as the G/W for FMR500 (FFU monitoring system).

**System configuration**

- **RS-485** is mounted to two ports at maximum. Each port can be connected to 31 units of the controller, and it can be connected to 62 units of the controller in total. Since the controller can control four FFUs, it is possible to monitor and control a maximum of 248 FFUs.

**Cable specifications**

- **TIA 568A category**: Five cables (Recommended)
- **Specifications**: Impedance 100 ohms
- **RJ45** (shield)
- **Cable size**: 24AWG 4P single-line Shield
- **Specifications**: Impedance 100 ohms

**Communication mode**

- **RS-485**
- **Flow control**: Impossible
- **Character configuration**: Stop bit: 1 bit
- **Communication method**: Half duplex, asynchronous communication

**Specifications of the RS-485 communication part**

- **Communication mode**: RS-485
- **Communication method**: Full duplex, asynchronous communication
- **Transfer rate**: 38400 bps
- **Character configuration**: ITU-T 8 (Even), 1, or 1
- **Flow control**: Flow control is not available
- **Line-free reassembly**: Improvable

**Connector specification**

- **Terminal resistance**: 100 ohms resistor is incorporated
- **Shade**

**Specifications**

- **Type**: LSI
- **Operating temperature**: 0°C to 50°C (Max unit)
- **Storage temperature**: 0°C to 50°C
- **Humidity (Max unit)**: 20% to 80% RH (without condensation)
- **Electrical single voltage**: 220 V ± 10% (AC, power supply)
- **Noise resistance (per unit condition)**: 135 V for 100 ms (noise simulator)
- **Window resistance (Max unit condition)**: Conforms to AS02040
- **Input regulation (Max unit condition)**: Conforms to AS02040
- **Outline dimensional drawing**

**LSI Lan Can interface**

Quick cooperation between the control systems can be executed converting CAN (Controller Area Network) supporting the automotive LAN to Ethernet. This is required as the G/W of the FMC500 (FFU monitoring system)

**System configuration**

- **The equipment can be connected to 254 units in total of the controller handling one to four circuits.**

**Cable specifications**

- **TIA 568A category**: Five cables (Shielded)
- **Specifications**: Impedance 100 ohms
- **RJ45** (shield)
- **Cable size**: 0.3 sq 2 core shield RS485 * 1500 mm cabtyre (Gray)
- **Heat shrinkable tube**

**Specifications**

- **Type**: FFU
- **Rated input**: 1 phase 100/200 V 50/60 Hz
- **Consumption current**: Max. 300mA (when 220 V power supply is used)
- **Noise resistance (upper side Monitoring PC)**: Max. 100Vrs
- **Character setting**: Conforms to JIS (ISO-11898)
- **Terminal resistance**: 100 ohms
- **Flow control**: Flow control is not available
- **Line-free reassembly**: Improvable

**Connector specification**

- **Terminal resistance**: 100 ohms resistor is incorporated
- **Shade**

**Specifications of the FFU monitoring system**

- **FMR500**
- **FMC500**

**Controller**

- **Modular jack RJ-45 type**
- **5 channel**
- **1 port**
- **2 N.C.**
- **-**
- **3 -**
- **-**
- **4 -**
- **-**
- **5 -**
- **-**
- **6 -**
- **-**
- **7 -**
- **-**
- **8 -**
- **-**
- **Terminal resistance**: 100 ohms resistor is incorporated

**Connector layout**

- **Specifications**: 5051-04, 5051-04P, 5051-04R

**Environmental conditions**

- **Operating condition**: Power supply switch (ON/OFF)
- **Operating temperature**: 0°C to 50°C
- **Operating humidity**: 10% RH or less
- **Others**: *Made by Molex*
Cleanroom materials

Materials improving performance and maintenance efficiency of the cleanroom.

- Grid ceiling frame
- Lighting panel / Blank panel
- Bypass panel (Filter)
- Free access floor
- Power distribution equipment
- Joinery (Door, Window)
- Interior panel
- Maintenance hatch
- Maintenance passage

Materials required for providing total solution of the cleanroom are lined up.
High performance equipment functioning in the cleanroom more richly and safely is lined up.

With our abundant experience in system construction for large-scale factories, we have commercialized various kinds of building materials under the keywords of outgas-less, short construction period, and safety. We can respond to your requirements with the total solution covering from design to construction of the cleanroom using high performance equipment.

**Cleanroom materials**

### Maintenance hatch
This is the ceiling access panel door to ensure airtightness.

### Lighting panel / Blank panel
Lighting integrated with ceiling panels. Also, it is possible to access from the ceiling for maintenance.

### Interior panel
Low outgas materials are used for non-seal type airtight materials in consideration of the outgas pollution.

### Door / Window
This has excellent aperture ratio adjustment performance and flexibility of layout, and it is easy to make utility connections to devices installed in the upper part.

### Free access floor
This panel is dedicated to passages in consideration of safety.

### Power distribution equipment
P.56

### FFU
P.11

It is possible to manufacture various sizes of FFU in accordance with the grid dimensions and the available installation spaces.

### Grid ceiling frame
P.51

This is a frame having both flexibility and functionality in consideration of the earthquake-resistant structure.

### Dry coil

### Bypass panel (Filter)
P.53

This air volume adjustment panel is designed to have sufficient strength for walking on the panel.

### Maintenance passage
P.55

This panel is dedicated to passages in consideration of safety.
To prepare against any emergency cases with the frame of which earthquake resistance is enhanced

**Grid ceiling frame**

- **Joint part summary**
  - Joint sleeve
  - Sub frame
  - Main frame surface joint
  - Frame edge

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Main frame</th>
<th>Sub frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Aluminum drawing material</td>
<td>Aluminum drawing material</td>
</tr>
<tr>
<td>Standard length</td>
<td>8000mm</td>
<td>0~8000mm</td>
</tr>
<tr>
<td>Withstand load</td>
<td>90kg/m²</td>
<td>90kg/m²</td>
</tr>
</tbody>
</table>

**Features**

This is a frame having both flexibility and functionality in consideration of the earthquake-resistant structure.

**Easy maintenance. Providing bright, wide and comfortable spaces**

**Lighting panel/blank panel**

- **Lighting panel**
  - LED lighting panel
  - LED lamp fittings details

**Features**

The ceiling can be constructed flatly. For the fluorescent lamp type, it is possible to replace the lamp from the ceiling so that access for maintenance is easy.

The environmentally friendly LED type requires no maintenance and does not contain mercury.

**System ceiling inside**

- It is possible to walk on the panel.
- Maintenance can be executed from the top side.

**Cleanroom inside**

- Maintenance for the fluorescent lamp type can be executed from the inside of the bench.

- It has excellent load bearing on the top of the lighting, so that it is possible to walk on it.

**Specifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Light source/Lamp</th>
<th>Total flux</th>
<th>Power consumption</th>
<th>Power supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED</td>
<td>LED ×48</td>
<td>4800 lm</td>
<td>6W</td>
<td>AC100~240V 50/60Hz</td>
</tr>
<tr>
<td>Hf fluorescent lamp</td>
<td>HPh32EX-NH*2 units</td>
<td>7040 lm (5000 lm)</td>
<td>85W (58W)</td>
<td>AC100~240V 50/60Hz</td>
</tr>
</tbody>
</table>

**Blank panel**

You can choose either steel or aluminum composite panel according to the purpose of use.

**Specifications**

<table>
<thead>
<tr>
<th>Material</th>
<th>Composite panel</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic type</td>
<td>75A×1500</td>
<td>Good</td>
</tr>
<tr>
<td>Withstand load</td>
<td>Ordinary</td>
<td>Good</td>
</tr>
<tr>
<td>Workability</td>
<td>Good</td>
<td>Ordinary</td>
</tr>
</tbody>
</table>
Air volume of the aperture can be controlled, while the structure is strong and safe.

**Bypass panel (Filter)**

Air volume can be adjusted by installing the filter. Degrees of freedom for the bench layout can be expanded.

**Features**

As maintaining the required air volume, strength of the panel is also secured so that you can walk on it safely. Safety measures shall be provided at low costs.

**Specifications**

<table>
<thead>
<tr>
<th>Size</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>750</td>
<td>ZAM</td>
<td>9kg</td>
</tr>
</tbody>
</table>

**Outline dimensional drawing**

You can layout doors and windows as you like according to the aperture size and purpose of use.

**Furniture (Door, window)**

For the door of the cleanroom, the single door, the family door, and high airtight specifications are available.

**Features**

Air volume is secured while it is possible to walk on it.

**Pressure loss characteristics**

Thorough measures against outgassing. You can choose any one out of three types.

**Interior panel**

Non-seal specifications in consideration of the outgassing contamination. The low outgassing material is used for the airtight material.

**Features**

You can layout doors and windows as you like according to the aperture size and purpose of use.

**Outline dimensional drawing**

We will provide the optimum size for your layout and purpose of use.
In the design stage, operability is considered. Easier maintenance has been materialized.

**Maintenance hatch, Maintenance passage**

**Maintenance hatch**

The layout plan can be provided easily by setting the appropriate size for the grid dimensions.

**Outline dimensional drawing**

- Ceiling maintenance hatch
- Side maintenance hatch

**Maintenance passage**

Instead of providing the maintenance passage separately with the cost, you can execute maintenance more safely and easily by arranging the blank panels for walking at the time of designing.

**Outline dimensional drawing**

Four types of the floor materials are provided so that you can choose one in accordance with the purpose of use such as aperture ratio, layout, and withstanding load.

**Free access floor**

This has a high degree of freedom for the aperture ratio adjustment and layout, and it is easy to connect the device installed on it to the utility.

**Outline dimensional drawing**

**Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Punching type</th>
<th>Slit type</th>
<th>SUS type</th>
<th>SS type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Die-cast aluminum</td>
<td>Die-cast aluminum</td>
<td>SUS304</td>
<td>Die-cast aluminum</td>
</tr>
<tr>
<td>Withstanding load</td>
<td>500 ~ 800</td>
<td>500 ~ 600</td>
<td>500 ~ 600</td>
<td>500 ~ 600</td>
</tr>
<tr>
<td>Workability</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Weight</td>
<td>Light</td>
<td>Medium</td>
<td>Heavy</td>
<td>Light</td>
</tr>
<tr>
<td>Aperture ratio</td>
<td>10 ~ 60%</td>
<td>Medium</td>
<td>Heavy</td>
<td>Light</td>
</tr>
<tr>
<td>Surface finishing materials</td>
<td>Ni-Cr coat</td>
<td>Ni-Cr coat</td>
<td>Ni-Cr coat</td>
<td>Epoxy coating</td>
</tr>
<tr>
<td>Special specifications</td>
<td>Chemical resistance, Whisker measures</td>
<td>Chemical resistance, Whisker measures</td>
<td>Chemical resistance, Whisker measures</td>
<td>-</td>
</tr>
</tbody>
</table>

All power to be used in an area is supplied collectively with a single unit.

**Power distribution equipment**

This is the packaging power supply unit that is capable of supplying the power in an area, such as the FFU, the lighting, the flow control valve of the cooling coil, and the temperature controller, with a single unit.

**Outline dimensional drawing**
Do you have any problems with energy-saving measures?

It is possible to materialize energy savings by replacing the high-efficiency equipment.

**Example**

You can save the energy of 2,000 MWh equivalent to the cost saving of 17 million yen annually by replacing 1,000 FFUs.

* Based on our estimation
Replace the FFU partially in several years, you can save the investment budget required for a year and provide flexible energy-saving plans.

**Reasons why the replacement is effective**

1. **Life of the equipment**
   - **The life of the clean equipment is about 10 years.**

   **Control base board**
   - The control base board uses the aluminum electrolytic capacitor as the smoothing filter. Generally, the life of the capacitor decides the life of the entire base board. The life may vary with use conditions, for instance the higher surrounding temperature, the shorter life. It is said that the estimated period for replacement is five years.

   **Motor**
   - Although the life of the motor may be determined with various elements, it depends on the life of the bearing in most cases. Although the life of the bearing can be expressed with the mechanical life and the life of grease, we understand that the life of the motor is determined by the life of the grease since the influences on the life of the grease are significant. In general, the guaranteed life by the motor manufacturer shall be 20,000 hours.

   Since the temperature of the cleanroom is stable approximately at 23°C throughout the year, and it is a good operational environment. The actual available period is longer than the guaranteed life in the most cases. However, the life of electrical components is generally two to five years, and it is ideal to replace the equipment at around ten years.

2. **Use of subsidies**
   - **You can use the subsidies for replacing the clean equipment.**

   **Reference**
   - "Recommendation for periodic inspections for general-purpose inverter" The Japan Electrical Manufacturer's Association

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**Reasons why the energy can be saved with the clean equipment**

**Three reasons why clean equipment is effective for saving energy**

1. **Ratio is high**
   - If the power consumed in the semiconductor/LCD panel plant is classified by the purpose of use, about 40% of them are consumed in the air conditioning facilities, and it is understandable that implementation of clean equipment must be very effective for saving energy.

2. **The heat load is also reduced**
   - It is possible to reduce the exhaust heat by reviewing the cleanroom method and using high efficiency clean equipment. Then the heat load in the entire factory can be reduced and the power consumption of the refrigerating machine can be reduced.

3. **Investment can be divided**
   - By replacing the FFU partially in several years, you can save the investment budget required for a year and provide flexible energy-saving plans.
Fuji Electric can materialize more effective and smooth energy-saving.

**FFU efficiency comparison**

- **Old type FFU**: 13%
- **The latest type FFU**: 52%

**Fan efficiency**
- **Sirrocco fan**: In various rotational directions
- **Turbo fan**: Curved to backward for the rotational direction

**Motor comparison**
- **Induction motor**: Relatively inexpensive production cost
- **DC brushless motor** (using the permanent magnet)
  - The induced current flows in the rotor due to the magnetic field. The resistive losses may occur in the rotor at that time.
  - Since the permanent magnet is used in the rotor, no copper loss may occur due to induced current in the rotor.

By using the DC-FFU together with the FFU monitoring system (F-SITE series) developed by us, operation/stop and revolution and alarm history of the FFU can be managed collectively at the center, so that the cleanroom can be operated efficiently from the viewpoint of energy.

**Cleanroom energy saving operation system**

- Graphical monitoring screen based on the architectural drawings provided with AutoCAD
- Operation/Stop/Failure/Speed are indicated in colors
- It is possible to operate, stop and control the revolution from the FFU list collectively.
- Warning with alarm tone
- Max. 10,000 items each of the operation history and the alarm history can be stored.

Furthermore, the feedback operation can be made in accordance with the temperature, humidity and cleanliness by linking to our environmental sensor, so that energy saving with optimum operation of FFU can be materialized.
Fuji Electric can materialize more effective and smooth energy-saving.

Flow of replacement

Please leave everything such as the energy saving effect estimation, installation, adjustment and test to Fuji Electric.

**Site survey**
- Confirmation of the system configuration
- Confirmation of the component equipment
- Confirmation of utilities

**Design**
- System optimization design
- Selection of equipment
- Energy saving effect estimation
- Provision of drawings

**Installation on site**
- Equipment installation
- Wiring

**Local adjustment**
- Operation confirmation
- Commissioning test
- Cleanliness test

Energy saving effect example

If you replace 1000 units of AC-FFU currently used with the DC-FFU, the following amount of energy can be saved.

In consideration of performance and efficiency, an AC-FFU with power consumption of 280 W can be replaced with a DC-FFU with power consumption of 65 W (* Our calculation)

\[(280 \text{ W} - 65 \text{ W}) \times 24 \text{ hours} \times 365 \text{ days} \times 1,000 \text{ units} \]

Annual saving of energy is about **1,900 MWh**

Replacement example

In case of Company-A

- **Outlines**
  Intending the energy saving effect, FFU of the AC motor + Sirrocco fan type is replaced with the DC motor + Turbo fan type
  Number of units to be replaced: About 5,000 units

- **Energy saving effect**
  Planned value: 7,100 MWh (FFU saving energy amount)
  Actual value: 7,150 MWh (FFU saving energy amount)
Fuji Electric materialize more effective and smooth energy-saving

Fuji Electric’s cleanroom is always next to the state-of-the-art technology

**History of development of the cleanroom in Fuji Electric**

Fuji Electric has always been the supplier of the most advanced cleanroom system for 40 years and made uninterrupted efforts to innovate technology and safety.

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<th>65nm</th>
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**Engineering tool**

By using the full of unique engineering tools of Fuji Electric having abundant results and experiences, we can solve any kinds of issues that the customers currently faced.

**Cleanroom laboratory**

We have the cleanroom laboratory to verify and evaluate the developed products and verify the system design.

**Equipment to be evaluated**

By using the wind tunnel test equipment and the anechoic chamber, we can execute various measurements and evaluation such as properties, noises, vibrations and radiated noise.

**Analysis/evaluation technology**

We can analyze and evaluate particles, airflow, temperature/humidity and chemical gases in the customer’s cleanroom, and then provide suggestions for improvement.

**Airflow simulation**

With the computer simulation, airflow status in the equipment and the cleanroom, and the temperature distribution are estimated.

**Particle behavior simulation**

It makes possible to simulate particle behavior in dynamic state. Behavior of dust at the time of equipment operation can be predicted, and the results can be useful for equipment and system design.