High-efficiency, Full IGBT

Fuji Large-capacity UPS

UPS7000HX-T4 Series (three-phase, four-wire)

UPS7000HX-T4 Series

Installation requirements

˔ This equipment is for indoor use.

˔ When installing this equipment, please avoid areas exposed to direct sunlight, wind, and rain, as well as to the elements, and install it in a UPS room of noncombustible construction.

˔ Avoid places with a lot of dust and dirt, as well as hot and humid places.

˔ This equipment is designed for use in locations with temperature conditions ranging from 0 to +40°C, but from the standpoint of the service life of the batteries and the stable operation of the UPS, we recommend operating in temperatures below 25°C.

˔ Do not use for loads that may cause regenerative power.

˔ Use of this equipment for any of the following applications will require careful consideration of such issues as multiplexing of the system and installation, operation, maintenance, and management of emergency power generation equipment. Please contact us in advance to discuss such special requirements.

˔ Medical equipment directly involved with human life

˔ Equipment that could lead to personal injury

˔ Critical social and public computer systems

In the event of any trouble occurring due to the use of this product (hardware and software), Fuji Electric will not compensate for any damages whatsoever, including damages caused by errors or trouble in connected equipment or software, as well as any other secondary damages.
Ideal High-reliability, High-efficiency UPS for Critical Systems

The progress of our societies based upon information technology, the widespread expansion of Internet data centers and semiconductor manufacturing plants, the industrial facilities using IT — all of these application scenarios absolutely require an uninterrupted supply of electrical power. The UPS devices used for such applications must be equipped with a high degree of reliability. Based on our proven UPS technology, in our Fuji UPS7000HX-T4 Series we made full use of state-of-the-art device and power electronics technologies to create large-capacity UPS products that feature high reliability and high efficiency.

High efficiency of 96.5% achieved with a three-phase, four-wire constant inverter power supply system

- At NPC 3-level (same 3-level) conversion technology
- Application of Fuji-made RB-IGBT elements
- Circuit rationalization, such as transformerless isolation, by means of DC voltage control
- Significant reduction in inverter weight

High reliability achieved through systematic and our proven track record

- Synchronised switchover system with bypass
- Parallel redundant system (See system introduction example 1 on page 6)
- Standby redundant system (See system introduction example 2 on page 6)

Features

- High efficiency
- 7000HX-T4
- Features
- High reliability

7000HX-T4 FEATURES

Features

- High functionality
- Space-saving design

Compact and lightweight design

- The reduced the footprint of the facility equipment while maintaining the space for owners.

Basic UPS configuration

Constant-voltage and constant-frequency inverter power supply system

- A UPS consists of a rectifier, inverter, and bypass. At normal times, the UPS continues to provide stable electric power at constant voltage and constant frequency (CVCF) through the inverter while synchronizing with the commercial power supply. In the event of a power failure, the UPS activates and continues to provide electric power to connected equipment while maintaining the inverter frequency. A UPS is able to continue providing electric power without any instantaneous interruption. If an overcurrent on the load side occurs, power is supplied through the bypass circuit. When the load current returns to normal, the inverter begins supplying electric power once again.

Full protection against power failures

- Power walk-in function
- Battery performance assessment
- Simple Network Management Protocol (SNMP, MODBUS) (It can respond by using an option)

Full IGBT model UPS

- Increased high input power factor

By controlling the AC input voltage and current to be in-phase, most of the reactive power is eliminated which makes the input power factor almost 1.0 and thus enables the input capacity to be reduced.

Startup is shockless on input power

The soft-start function (power walk-in control) of the input current when the UPS starts up or when power is recovered after a power failure prevents any shock on the input power.

Pulse width modulation (PWM) converter operating principle

The operating principle of the PWM rectifier is explained in terms of a single-phase circuit. The PWM rectifier generates the voltage Vrec so that the instantaneous input current is sinusoidal and, as a result, the input power factor is high. This suppresses the harmonic current and achieves the high power factor.

Pulse width modulation (PWM) Inverter

- The soft-start function (which gently raises the output voltage) of the output voltage during start-up achieves a load-friendly start-up system that suppresses the inrush current from load equipment (such as transformer and capacitive loads).

Life cycle of an inverter with hybrid FeCPC

- By means of instantaneous switch-on control, even for loads (rectifier loads) with distorted current such as from PCs, the output voltage waveform is controlled to be sinusoidal, thus achieving output voltage that is mostly free of harmonics.

Life cycle of the switch-on function with hybrid FeCPC

- By means of separate three-phase control, unbalanced three-phase loads will cause almost no imbalance into the output voltage.

Pulse width modulation (PWM) Inverter

- Startup is shockless on loads

The soft-start function (which gently raises the output voltage) of the output voltage during start-up achieves a load-friendly start-up system that suppresses the inrush current from load equipment (such as transformer and capacitive loads).
Ideal High-reliability, High-efficiency UPS for Critical Systems

The pace of our societies based upon information technology, the widespread expansion of Internet data centers and semiconductor manufacturing plants, the industrial facilities using IT — all of these application scenarios absolutely require an uninterrupted supply of electrical power.

The UPS devices used for such applications must be equipped with a high degree of reliability.

Based on our proven UPS technology, in our Fuji UPS7000HX-T4 Series we made full use of state-of-the-art device and power electronics technologies to create large-capacity UPS products that feature high reliability and high efficiency.

High reliability achieved through systemization and our proven track record

- Synchronized switch-over system with bypass
- Parallel redundant system (See system introduction example 1 on page 8.)
- Standby redundant system (See system introduction example 2 on page 8.)

High efficiency of 96.5% achieved with a three-phase, four-wire constant inverter power supply system

- AT-NPC 3-level (new 3-level) conversion technology
- Application of Fuji’s-made RBIGB elements
- Circuit rationalization, such as transformerless isolation, by means of DC voltage control
- Significant reduction in inductance
- *At NPC: Advanced T-Type Neutral Point Clamped

Full protection against power failures

- Constant voltage and constant-frequency inverter power supply system
- A UPS consists of a rectifier, inverter, and bypass. At normal times, the UPS continues to provide stable electric power at a constant voltage and constant frequency (CVCF) through the inverter while synchronizing with the commercial power supply. In the event of a power failure, the UPS automatically switches to the bypass circuit. When the load current returns to normal, the inverter begins supplying electric power once again.

High functionality

- Variety of functions achieved through our proven track record
- Soft-start to suppress line current
- Power walk-in function
- Battery management function
- Simple Network Management Protocol (SNMP, MODBUS) (It can respond by using an option)

Basic UPS configuration

- Full protection against power failures
- Constant voltage and constant-frequency inverter power supply system

- PWM rectifier

Suppresses input harmonic current

The input current harmonic current is suppressed using microprocessor waveform control to make the input current of the rectifier sinusoidal, and for this reason, there is no effect from harmonic current on the input to increase power generation equipment or phase advance capacitors.

Increased high input power factor

By controlling the AC input voltage and current to be in-phase, most of the reactive power is eliminated which makes the input power factor almost 1.0 and thus enables the input capacity to be reduced.

Startup is shockless on input power

The soft-start function (power walk-in control) of the input current when the UPS starts up or when power is recovered after a power failure prevents any shock on the input power source.

PWM Inverter

- Start-up is shockless on loads

The soft-start function (which gently raises the output voltage of the output voltage during startup) achieves a load-friendly startup system that suppresses the inrush current from load equipment (such as transformer and capacitive loads).

- Line balancing of a three-phase load with distorted current

By means of instantaneous waveform control, even for load (rectifier load) with distorted current such as from PCs, the output voltage waveform is maintained to be sinusoidal, thus achieving output voltage that is mostly free of harmonics.

- Output voltage or load current (bypass) circuit switching

By means of separate three-phase control, unbalanced three-phase loads will cause almost no imbalance of the output voltage.

- Load-friendly static frequency inverter

By controlling the load transfer when switching between the direct (bypass) power supply and the inverter (by reflecting the sharing of the direct power supply load current and the inverter power supply load current), a switching system is achieved that suppresses voltage transitions and is gentle on the direct power supply.

Full IGBT model UPS

- PWM rectifier

- PWM Inverter
The progress of our societies based upon information technology, the widespread expansion of Internet data centers and semiconductor manufacturing plants, the industrial facilities using IT — all of these application scenarios absolutely require an uninterrupted supply of electrical power.

Based on our proven UPS technology, in our Fuji UPS7000HX-T4 Series we made full use of state-of-the-art device and power electronics technologies to create large-capacity UPS products that feature high reliability and high efficiency.

High-capacity UPS products that feature high reliability and high efficiency. Use of state-of-the-art device and power electronics technologies to create

Based on our proven UPS technology, in our Fuji UPS7000HX-T4 Series we made full use of state-of-the-art device and power electronics technologies to create large-capacity UPS products that feature high reliability and high efficiency.

High efficiency of 96.5 % achieved with a three-phase, four-wire constant inverter power supply system.

* NPC: Advanced T-R type Neutral Point Clamped

Significant reduction in running cost. Circuit rationalization, such as transformerless isolation, by means of DC voltage control

We reduced the footprint of the facility space for servers.

Note: The 7000HX-T4 series does not require any space at the rear.

Comparison of space for 500 kVA units

**High functionality**

**7000HX-T4 FEATURES**

**Features**

**Space-saving design**

Compact and lightweight design. The reduced the footprint of the facility equipment while maintaining the space for servers.

A 65% reduction in space! Comparison of space for 500 kVA units

**Basic UPS configuration**

Constant-voltage and constant-frequency inverter power supply system

A UPS consists of a rectifier, inverter, and battery. At normal times, the UPS continues to provide stable electric power at constant voltage and constant frequency (CVCF) through the inverter while synchronizing with the commercial power supply. In the event of a power failure, the UPS detects it and becomes necessary to continue providing electric power without any instantaneous interruption. If an overcurrent or overvoltage occurs, power is supplied through the bypass circuit. When the load current returns to normal, the inverter begins supplying electric power once again.

If an overcurrent on the load side occurs, power is supplied through the bypass circuit. When the load current returns to normal, the inverter begins supplying electric power once again.

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### AT-NPC 3-level Circuit

#### AT-NPC 3-level conversion circuit

AT-NPC 3-level conversion circuit using RB-IGBT

- Compared with AT-NPC 3-level and conventional methods, by adopting our in-house-developed RB-IGBT, we have achieved conductive loss reduction and reactor loss reduction in an AT-NPC 3-level (T-type) conversion circuit.

#### AT-NPC 3-level circuit

- Reduction in switching losses
- Reduction in filter losses

#### Comparison of equipment efficiency (Compared with our conventional model)

Customer equipment can be monitored and shut down over a network.

- Includes eight Netshut licenses.
- UPS can be monitored and mail sent over the network.

#### Network equipment

- Conventional equipment
- Conventional equipment

#### Operation display panel

- UPS7000HX-T4 series
- UPS7000HX series

### Rated Specifications and External Dimensions

#### Rated specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AT-NPC 3-level series</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC input</td>
<td>1000 V, 300 A</td>
</tr>
<tr>
<td>AC input</td>
<td>220 V, 300 A</td>
</tr>
<tr>
<td>Battery capacity</td>
<td>2000 Wh</td>
</tr>
<tr>
<td>Battery voltage</td>
<td>195 V</td>
</tr>
<tr>
<td>Frequency accuracy</td>
<td>&lt;±1 %</td>
</tr>
<tr>
<td>Voltage accuracy</td>
<td>&lt;±1 %</td>
</tr>
<tr>
<td>Number of phases</td>
<td>3-phase, 4-wire</td>
</tr>
<tr>
<td>Power factor</td>
<td>&gt;0.99</td>
</tr>
</tbody>
</table>

#### External dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>UPS main unit</th>
<th>Side view</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass</td>
<td>2400 kg</td>
<td>1950 mm</td>
</tr>
<tr>
<td>Width</td>
<td>1600 mm</td>
<td>1000 mm</td>
</tr>
<tr>
<td>Depth</td>
<td>1600 mm</td>
<td>1000 mm</td>
</tr>
</tbody>
</table>

#### AT-NPC 3-level Circuit

- Reduction in switching losses
- Reduction in filter losses

### Comparison of AT-NPC 3-level and conventional methods

- Conventional technology
- Fuji Electric’s proprietary technology (World’s first)

#### AT-NPC 3-level module

- Conventional model: NPC
- AT-NPC 3-level

#### UPS7000HX-T4/500

- UPS7000HX series
- UPS7000HX-T4 series
AT-NPC 3-level Circuit

AT-NPC 3-level conversion circuit

AT-NPC 3-level conversion circuit using RB-IGBT

Comparison of AT-NPC 3-level and conventional methods

Compared with conventional 2-level and 3-level products, by adopting our in-company developed RB-IGBT, we have achieved noticeable noise reduction and reactor loss reduction in an AT-NPC 3-level (T-type) conversion circuit.

AT-NPC 3-level circuit

Reduction in switching losses

Reduction in filter losses

Comparison of equipment efficiency (Compared with our conventional model)

Network enables products

Connecting the UPS to a network

Shutting down servers over a network

Operation display panel
### Rated Specifications and External Dimensions

<table>
<thead>
<tr>
<th>Specifications</th>
<th>AT-NPC 3-level</th>
<th>New 3-level model</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC input</td>
<td>240 V AC</td>
<td>240 V AC</td>
</tr>
<tr>
<td>Bypass input</td>
<td>120 V DC</td>
<td>120 V DC</td>
</tr>
<tr>
<td>AC output</td>
<td>240 V AC</td>
<td>240 V AC</td>
</tr>
<tr>
<td>Battery</td>
<td>1200 V DC</td>
<td>1200 V DC</td>
</tr>
<tr>
<td>Mass</td>
<td>2400 kg</td>
<td>2400 kg</td>
</tr>
</tbody>
</table>

### AT-NPC 3-level Circuit

#### AT-NPC 3-level (New 3-level) conversion circuit

AT-NPC 3-level conversion circuit using RB-IGBT

- **Comparison of AT-NPC 3-level and conventional methods**
  - Compared with conventional 3-level and 3-level products, by adopting our in-house R&D RB-IGBT, we have achieved conductive loss reduction and reactor loss reduction in an AT-NPC 3-level (T-type) conversion circuit.

#### AT-NPC 3-level circuit

- **2-level system**
  - 2-level system
  - Reduction in filter losses
- **3-level system**
  - 3-level system
  - Reduction in switching losses

### Comparison of equipment efficiency (Compared with our conventional model)

<table>
<thead>
<tr>
<th>Load [%]</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency [%]</td>
<td>85</td>
<td>88</td>
<td>90</td>
<td>92</td>
<td>94</td>
<td>96</td>
<td>98</td>
<td>99</td>
<td>99</td>
<td>99</td>
<td>100</td>
</tr>
</tbody>
</table>

### Network-enabled products

- **Customer equipment**
  - UPS7000HX series

#### Connecting the UPS to a network

- **Function**
  - Network management
  - Web/SNMP
  - FTP

- **Description**
  - Requires additional license for more than 100 shutdowns.
  - Includes eight Netshut licenses.

#### Shutting down servers over a network

- **Software**
  - Netshut
  - Advanced system shutdown software

#### Additional features

- **Monitoring**
  - UPS status
  - Battery status
  - Switch status

#### Operation display panel

- **Main features**
  - Data display
  - Operation display
  - Screen name
  - Additional licenses
  - Email settings

- **Additional information**
  - UPS7000HX-T4 series
  - 3-phase, 4-wire
  - Input voltage: 380/400/415 V ±15%
  - Output voltage: 380/400/415 V ±15%
  - Frequency: 50/60 Hz ±5%
  - Power factor: >0.99 for 3-phase, 4-wire

### AT-NPC 3-level (New 3-level) conversion circuit

In addition, together with the AT-NPC 3-level circuit, we have also achieved noise reduction by optimizing the number of reactive voltage steps.

- **Note:** A reverse blocking IGBT (RB-IGBT) is a low-loss, high-frequency device that reduces standing voltage performance and allows the partial inductance in the circuit to be reduced.

### External dimensions

- **UPS main unit**
  - Height: 1950 mm (including base)
  - Width: 1000 mm
  - Depth: 1600 mm
  - Mass: 2400 kg

### Technical details

- **Internal backfeed protection**
  - IP20

- **Environmental conditions**
  - Temperature: 5°C to 35°C
  - Humidity: 85% RH or less
  - Altitude: 1000 m or less

- **Construction**
  - Forced air cooling
  - Dimensions: 1950 mm x 1000 mm x 1600 mm

- **Performance**
  - Frequency accuracy: ±0.01 Hz
  - Voltage accuracy: <±1 %
  - Load power factor: 0 to 1.0
  - Voltage waveform distortion factor: < 2 % (Linear load), < 5 % (Non-linear load IEC62004-3)

- **Electromagnetic compatibility (EMC)**
  - Safety (CB scheme warranted)
  - Compliance: IEC62040

- **Mass**
  - Height: 1950 mm (including base)
  - Width: 1000 mm
  - Depth: 1600 mm
  - Mass: 2400 kg

### Product name

- **Model**
  - UPS7000HX series

- **Series**
  - UPS7000HX-T4 series

### Additional information

- **Graphic references**
  - Front view
  - Side view
  - Connection view

- **Network management**
  - Simple Network Management Protocol (SNMP, MODBUS) (It can respond by using an option)

- **Other standards**
  - Compliance: IEC62040

- **Battery**
  - 2400 kg

- **External dimensions**
  - 1950 mm (Height including base)
  - 1000 mm
  - 1600 mm

- **Floating charge voltage**
  - 480 VDC (240 cells) to 528 VDC (264 cells)

- **Rated voltage**
  - 240 V AC

- **Performance**
  - Frequency accuracy: ±0.01 Hz
  - Voltage accuracy: <±1 %
  - Load power factor: 0 to 1.0

Examples of System Configurations

Flow of power in a UPS standby redundant operation mode

Power flow in a parallel redundant UPS operation mode (fully independent type)

- Normal power flow (with power failure measures)
- Normal-use UPS power flow during power failure or maintenance (with power failure measures)
- Normal-use UPS and standby UPS power flow both during power failure (without power failure measures)
- Power flow during maintenance of common units (without power failure measures)

Note: A common maintenance bypass circuit may be provided to serve both UPS units as shown in this figure, or a separate maintenance bypass circuit may be provided for each UPS.
System introduction example 1

- An example of a 500 kVA, parallel redundant UPS operation system (N + 1 system) using 4 UPS units.
- Up to 8 UPS units can be connected in parallel.
- High reliability can be expected from a system that is redundant from input to UPS output.
- During UPS system maintenance or in the event of a failure of one UPS unit, the UPS system will still provide power.

System introduction example 2

- Example of a standby redundant UPS operation system (system using normal-use UPS units + 1 standby UPS unit) (N + 1 system).
- High reliability can be expected from a system that is redundant using normal-use and standby units from input to UPS output.
- During UPS system maintenance or in the event of a failure of one UPS unit, the UPS system will still provide power.
Installation requirements

- This equipment is for indoor use.
  When installing this equipment, please avoid areas exposed to direct sunlight, wind, and rain, as well as to the elements, and install it in a UPS room of noncombustible construction.
- Avoid places with a lot of dust and dirt, as well as hot and humid places.
- This equipment is designed for use in locations with temperature conditions ranging from 0 to +40°C, but from the standpoint of the service life of the batteries and the stable operation of the UPS, we recommend operating in temperatures below 25°C.
- Do not use for loads that may cause regenerative power.
- Use of this equipment for any of the following applications will require careful consideration of such issues as multiplexing of the system and installation, operation, maintenance, and management of emergency power generation equipment. Please contact us in advance to discuss such special requirements.
  - Medical equipment directly involved with human life
  - Equipment that could lead to personal injury
  - Critical social and public computer systems

In the event of any trouble occurring due to the use of this product (hardware and software), Fuji Electric will not compensate for any damages whatsoever, including damages caused by errors or trouble in connected equipment or software, as well as any other secondary damages.