e-Front runners

Full IGBT Type On-line UPS

Fuji Large-capacity UPS

UPS7700F Series

Three-phase 100 to 600kVA

Fuji Electric Systems Co., Ltd.

REC 82-15b

Fuji's UPS for today's computerized world

On-line support for all applications

Data communication devices and computers constitute the backbone of society today and so require utmost reliability. First and foremost, a stable power supply without momentary failures is indispensable. Fuji Electric dominates the market for UPS which protect such devices and systems against power failures and disturbances. The Fuji UPS7700F series features the latest in power electronics, systems, digitization and high-frequency switching. It also offers outstanding load matching and suppression of harmonic currents commonly found in electronic devices.

UPS: Uninterruptible Power Supply (System)

- **Internet data center**
- **Banks, insurance companies, securities firms**
- **Satellites, broadcasting, media, telecommunications**
- **Traffic control systems (aviation, railroad, automobile)**
- **Semiconductor, LC, automobile, power, and chemical plants and manufacturing factories**
- **Information processing services, medical systems, etc.**

Features

Full IGBT type UPS

PWM*1 rectifier

- High input power factor: 0.99 or higher (almost 1.0)
- Low input harmonic content: 5% or less (needs no external filter)
- Power walk-in function provided as standard (soft shift of load to emergency generator)

High-frequency PWM inverter

- Performance optimum for computer load.
  Under rectifier load, the waveform distortion is small (below 5%), and the transient voltage variation is also small.

Efficiency of 94% or more

- Latest IGBTs
- Latest circuit design
- Energy saving (Lower running cost)

High performance

- Uninterruptible on-line type (double conversion) UPS
- Wide range of input voltage: 380, 400, 415V ±15%
- Overload capacity: 125% for 10min, 150% for 1min

High reliability

- Fewer parts thanks to latest devices
- Screening test, burn-in test, high quality control
- High quality backed by strong track record

High power rectifier

- The standard rectifier can charge a long-life battery.

Can be used for many types of system (fault tolerance)

- Synchronized and uninterrupted switching with bypass
- Standby redundancy system
- Parallel redundancy system
- Battery monitoring (automatic deterioration diagnosis, replacement advance notice indication)
- Guidance function

*1: **P**ulse **W**idth **M**odulation

We provide our customers with optimum solutions and attentive service, capitalizing on our proven track record in UPS production.

We provide optimum solutions for UPS devices, our core products, and attentive service, capitalizing on sophisticated technology backed by our proven track record.

Experienced of Fuji's UPS business

Market

Fuji Electric has been in the UPS business for 40 years, with the total capacity of UPS units supplied to the market amounting to 1,500 MVA. We have the dominant share of the Japanese industry, and our UPS units are widely acclaimed as high-quality power supply systems.

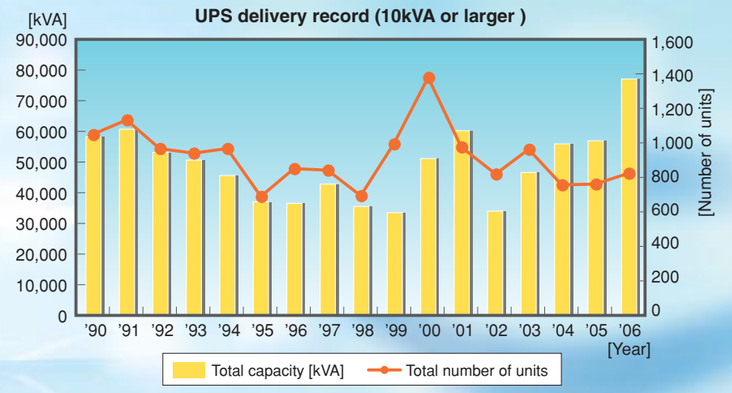
Topics

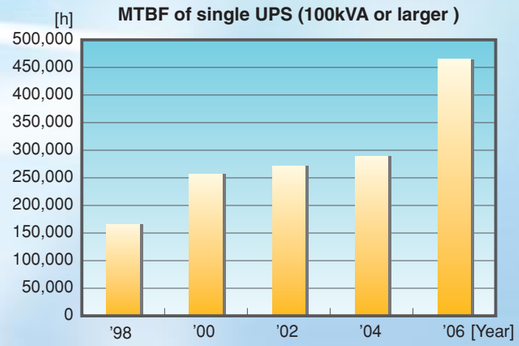
- **1966** The 1st shipment of 10kVA for a steel plant
- **1971** Completion of parallel redundant system: 2×50kVA for Japan Racing Association
- **1984** Sales Agreement with TRIAD in the U.S.A.
- **1991** Released Full IGBT UPS 600 Series (20 to 1,000kVA)
- **1997** 4×500kVA for Shanghai Stock Exchange
- **2003** No.1 market share in Japan
- **2004** 7000F Series acquired Network Access License from government of P.R.China
- **2005** 8000D Series The Japan Machinery Federation Award

Reliability

The reliability (MTBF*1) for the large capacity UPS is high as shown by the record in the figure on the right side.

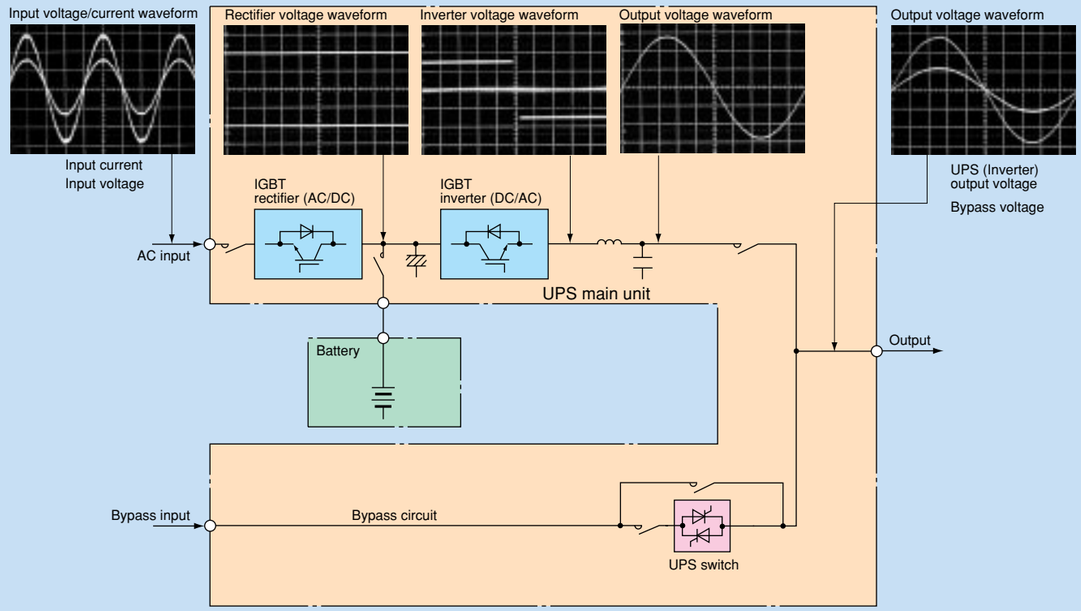
*1: **M**ean **T**ime **B**etween **F**ailure



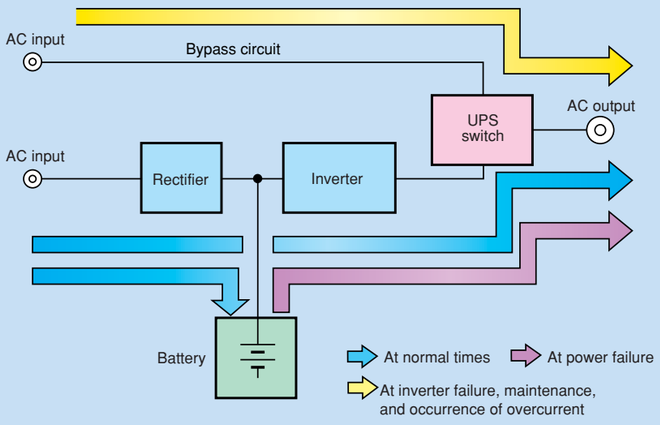


MTBF of UPS system : 2,654,280h
Availability of UPS system : 99.9998%

Basic UPS Configuration Diagram



Operation of on-line type UPS

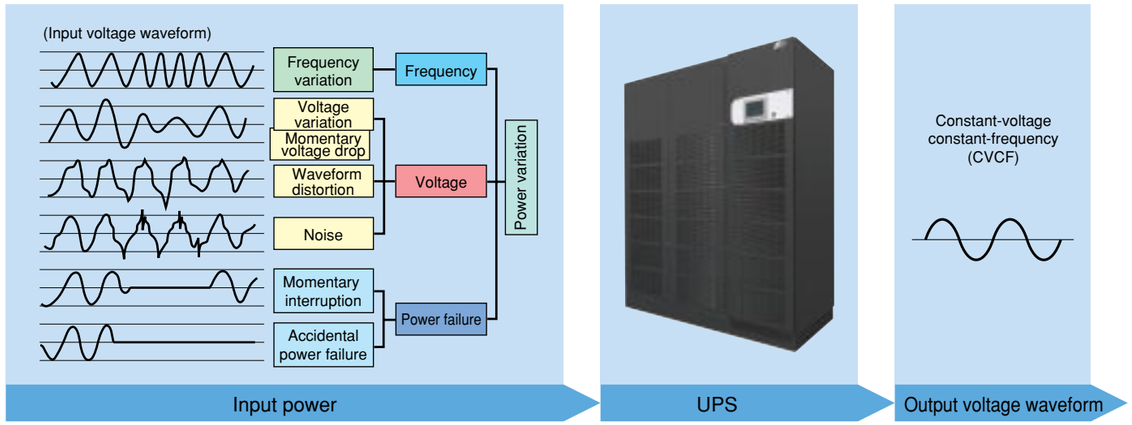


A UPS consists of a rectifier, inverter, and battery. At normal times, the UPS keeps providing stable electric power at a constant voltage and frequency (CVCF) via the inverter, while synchronizing with the bypass power.
If AC input power failure occurs, the inverter draws on battery power to keep providing electric power without any instantaneous interruption.
If an overcurrent to the load occurs, power is supplied through the bypass circuit. Once the normal load current is restored, the inverter resumes supplying electric power.

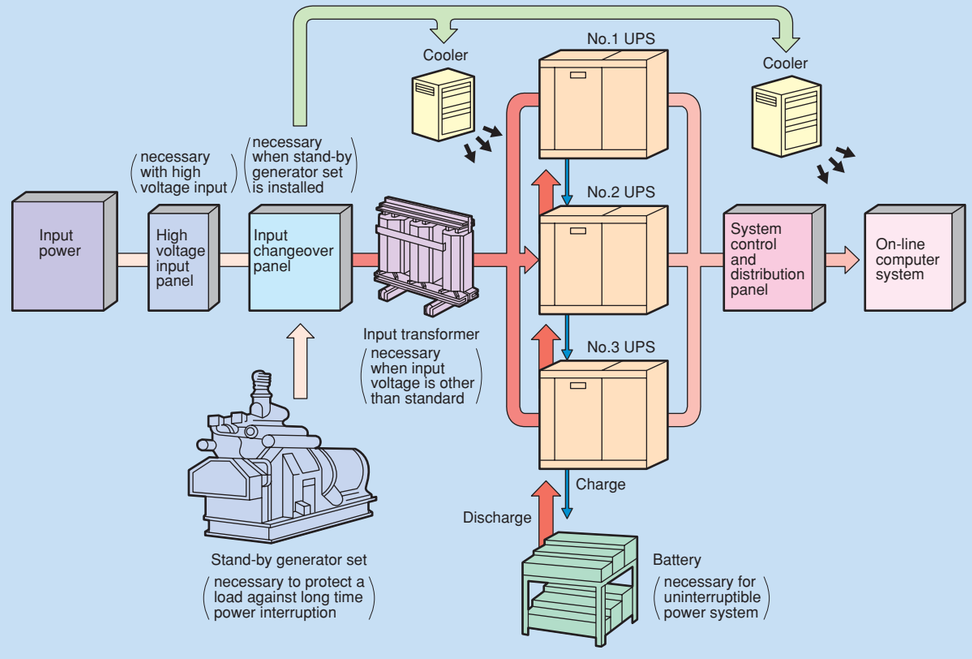
Operation of Uninterruptible Power System

Fuji Large-capacity UPS
UPS7700F Series

Full protection from power disturbances



Example of UPS system



Full IGBT Type UPS

PWM Rectifier

A new fifth-generation IGBT is also adopted for the rectifier to achieve higher performance based on PWM rectifier control through the feed forward*1 and the observer*2 functions.

*1: Forecast control *2: State monitoring

Suppresses input harmonic current

The momentary waveform control function controls the rectifier input current to be sinusoidal, thereby suppressing harmonic current and eliminating the effect of harmonic current on the local generator or the phase advance capacitor. A harmonic suppression filter need not be installed on the input side.

Higher input power factor

By controlling AC input current to the same phase as the voltage, most of the reactive power has been eliminated, and the input power factor is kept around 1.0, thus minimizing the input capacity.

Power walk-in

The soft start (power walk-in control) of input current at the startup of the UPS or power restoration after a power failure does not cause shock to the input power.

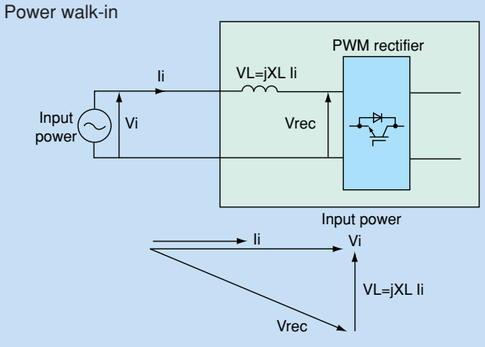
Operation principle of PWM converter

The operation principle of the PWM rectifier is described using a single-phase circuit as an example.
The PWM rectifier generates voltage (Vrec) so that the input current (Ii) is kept at the same phase as the input voltage (Vi) and sinusoidal, which suppresses harmonics and achieves a higher power factor.

PWM rectifier method

DK7520

Power walk-in



PWM Inverter

Zero deviation prediction type instantaneous PWM inverter control has decreased the distortion factor of the output voltage and improved the stability of parallel running.

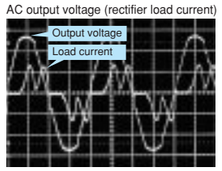
No shock to loads

The soft start function of gradually increasing the output voltage at startup suppresses the rush current from load systems (such as a transformer and capacitive loads), thus achieving a startup system which is gentle on loads.

Stable sinusoidal voltage

The instantaneous waveform control keeps the waveform of the output voltage from the load that feeds distorted current such as PCs (rectifier load), thus achieving output voltage that contains almost no harmonics.

AC output voltage (rectifier load current)

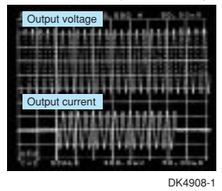


DK7518

Output voltage free from excessive transient variations

Even if an abrupt 100% load change occurs, the output voltage is kept stable with almost no variations.

Output voltage waveform
(at the occurrence of abrupt 100% load change)



DK4908-1

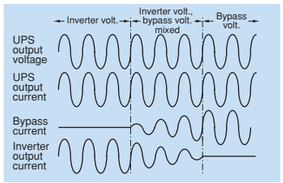
Voltage is balanced between phases

Almost no unbalance of output voltage is generated even with unbalanced load over three phases, thanks to individual three-phase control.

Suppresses the voltage variation at bypass switching

Soft shift of load allows switching with bypass, free from excessive voltage variations.

Output voltage waveform
(under 100% load, switched to bypass circuit)



High Reliability and Performance Achieved by DDC*1 with Integrated Advanced Technologies

Fuji Large-capacity UPS
UPS7700F Series

The fully digital system with high-performance processor, DSP*2, and ASIC*3 delivers high performance and high reliability.

- Fewer parts raises reliability.
- The substantial self-diagnostic function performs accurate system failure diagnoses, backing up the system. (The intelligent sequence allows optimum judgment.)
- The configuration consisting of DSP, which is for sequences including communication, display, guidance, operation, failure history processing, measurement, failure monitoring, startup, and switching, DSP, which is for PWM rectifier control and PWM inverter control, ASIC, which is a PWM pulse and overcurrent quick judgment circuit, high-speed judgment sequence, and ASIC, which is an auto switching circuit for when a failure occurs, allows the control function and failure monitoring function to act independently from each other. Furthermore, by duplexing part of the monitoring function both in software and hardware, even higher reliability has been achieved.
- Since all the adjustments are set digitally, a control circuit having minimum fluctuation due to secular changes or least affected by temperature fluctuation has been adopted.

*1: **D**irect **D**igital **C**ontrol
*2: **D**igital **S**ignal **P**rocessor
*3: **A**pplication **S**pecific **I**ntegrated **C**ircuit

High efficiency thanks to the latest UPS technology

■ Comparison of annual energy bills (saving electricity charges)

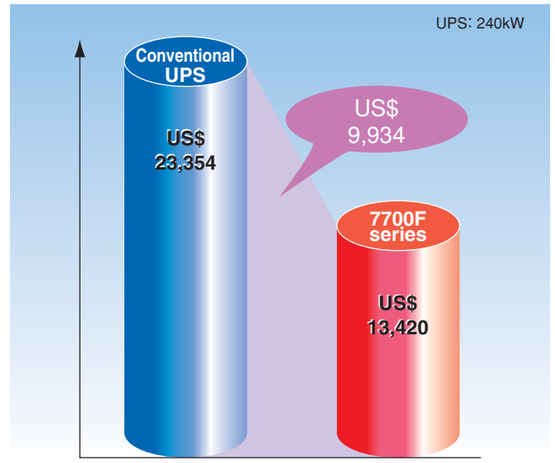
The difference in loss from the UPS is the difference in operating cost. The following table demonstrates that this difference amounts to US$9,934 annually for 240kW devices. Since the amount increases or decreases in proportion to the capacity of the devices used, the 1,000kW type offers a saving of approximately US$41,400. In addition, since the size of air-conditioning unit to be installed in the UPS room is determined in proportion to the extent of the loss from the UPS, the difference of operating cost increases further, with the power consumption of the AC unit taken into consideration.
Our environment-friendly UPS can thus be operated at a lower operating cost and with fewer CO_2 emissions.

Comparison of electricity charges due to loss

Item	Conventional UPS	7700F series	Note
Output [kVA/kW]	300/240	**300/240**	
Efficiency [%]	90	**94**	
Loss [kW]	26.66	**15.32**	
Annual power loss [kWh]	233,542	**134,203**	= Loss [kW] × 24 hours × 365 days
Annual amount due to loss [US$]	23,354	**13,420**	Calculated assuming an electricity cost of US$ 0.1/kWh.

The above figures are rough calculations assuming that the UPS is continuously operated at 100% load.

Comparison of annual electricity charges (due to loss)



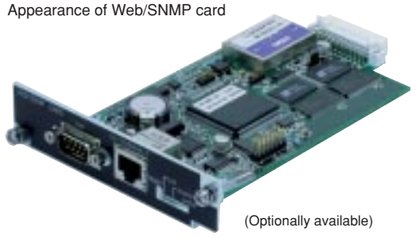
The power consumption of the air-conditioning unit used is taken into account in actual calculations.

Network-capable Remote Maintenance System*1

The Web/SNMP card equipped as standard allows the latest network applications to be used.

A JEMA-MIB-compliant Web/SNMP card for UPS has been developed.

Appearance of Web/SNMP card



(Optionally available)

Web function

The UPS status can be monitored and settings changed by using a browser such as Internet Explorer.

Mailing function

The destination of mails to be transmitted at the time of UPS events, failures, and periodic communications can be freely set by the UPS user.

Remote maintenance function

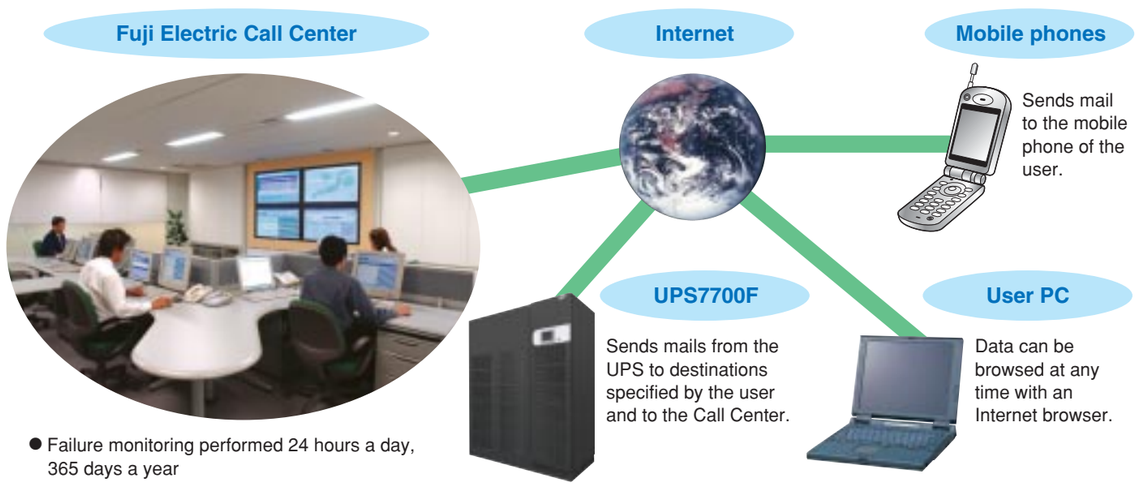
By using your own mailing function, you can request Fuji Electric Call Center to monitor your system for failures 24 hours a day, 365 days a year.

Note: A remote maintenance agreement must be signed separately.

UPS monitoring main window

E-mail notification setting window

Typical system configuration

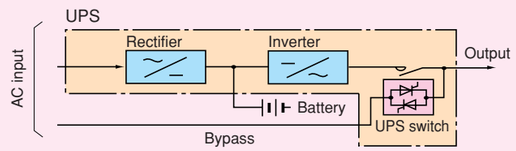
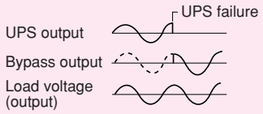
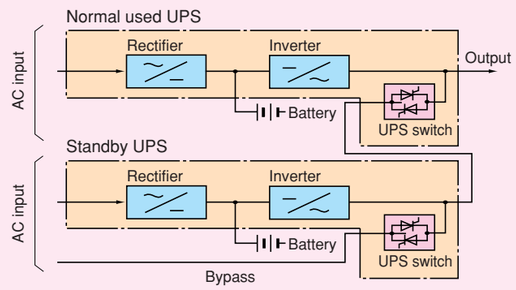
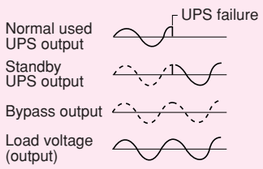
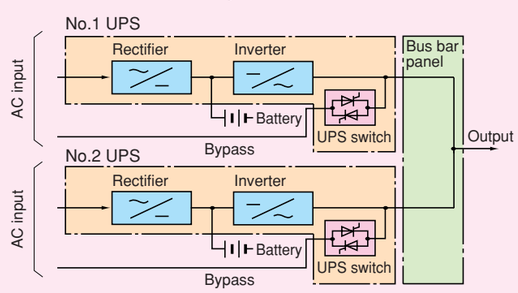
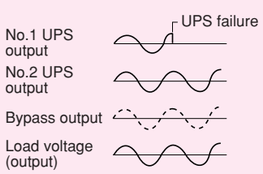


- Failure monitoring performed 24 hours a day, 365 days a year
- Measures taken by trained engineers

*1: Operable only in japan.

System Configuration

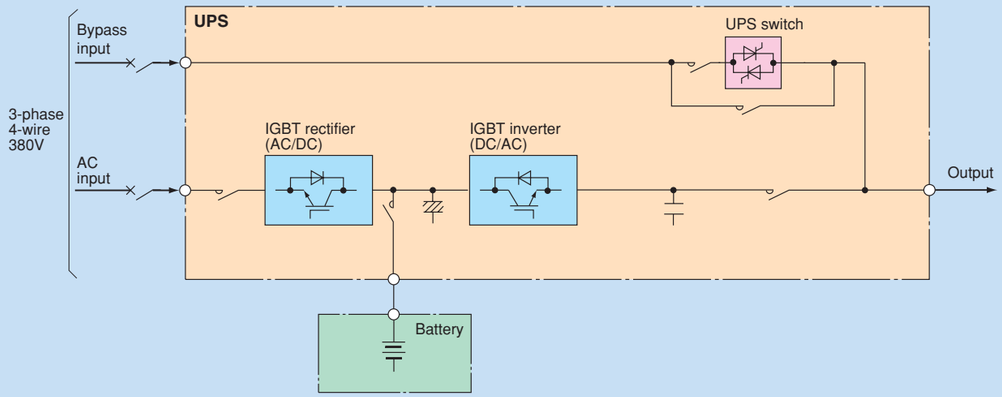
Fuji Large-capacity UPS
UPS7700F Series

Operation method	Circuit configuration	Waveform switching at occurrence of UPS failure	Outline
Single unit operation with bypass FSP−V			Since a thyristor switch is used, uninterruptible switching to the bypass circuit can be made even if the UPS fails.
Standby operation FSP−IX			The normal used UPS and a standby UPS are provided. If a normal used UPS fails, it is switched synchronously and without interruption to the standby UPS. Since the standby circuit is also protected by UPS, the reliability is significantly higher than the above uninterruptible backup method.
Parallel operation FSP−VIII−2	**Parallel redundant system** 		The redundant system with two or more fully independent UPS provided with a bypass circuit connected in parallel is easy to upgrade from only one UPS system, to create an exceptionally reliable system.

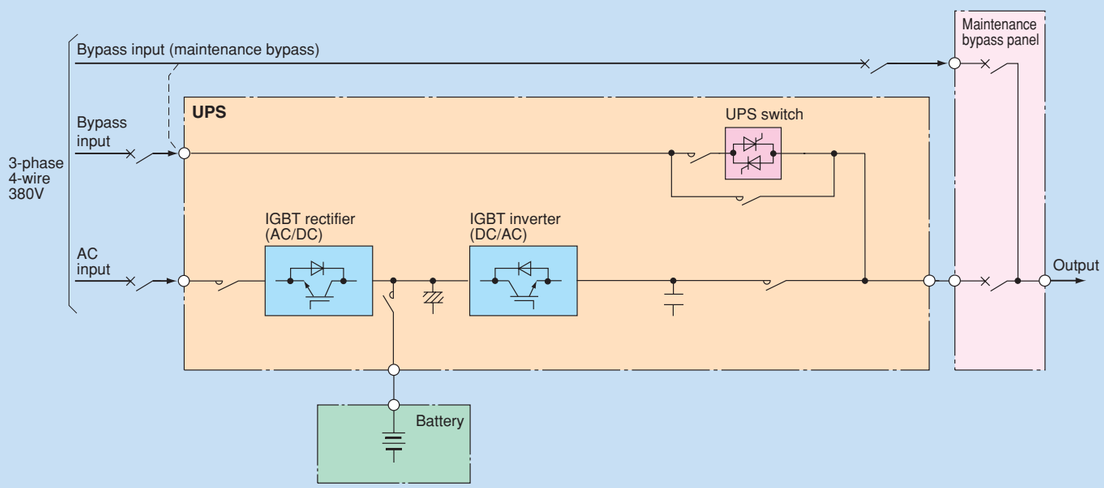
Circuit Configuration (I)

The following configuration represents a single system consisting of only one UPS unit.
It is a typical uninterruptible backup system provided with a bypass circuit.
The configuration is often used for small to medium-scale systems.

3-phase 4-wire 380V input/output (without bypass circuit for maintenance)



3-phase 4-wire 380V input/output (with bypass circuit for maintenance)



Circuit Configuration (II)

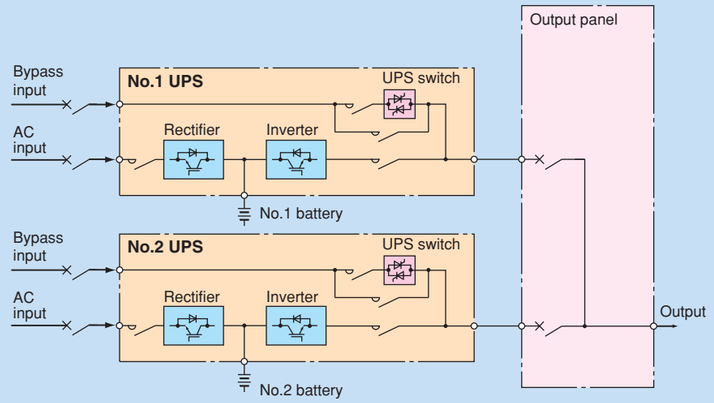
Fuji Large-capacity UPS
UPS7700F Series

The parallel redundant system is a new system with even greater reliability thanks to our excellent individual control function.

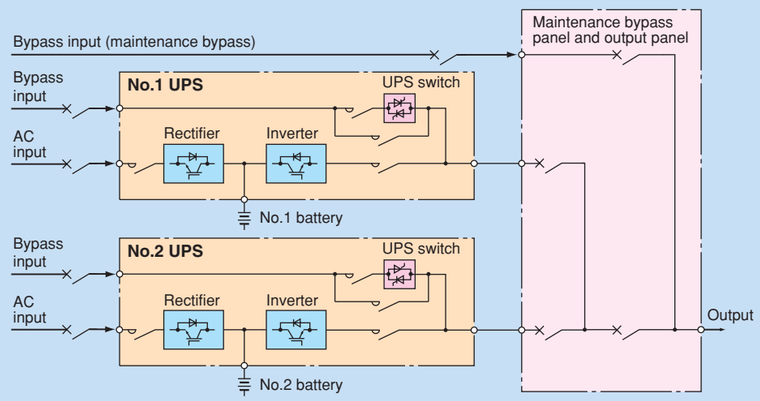
Parallel redundant system

Redundancy has been accomplished even with the bypass circuit with common parts eliminated completely, so all the redundant units can be maintained independently.

Without bypass circuit for maintenance

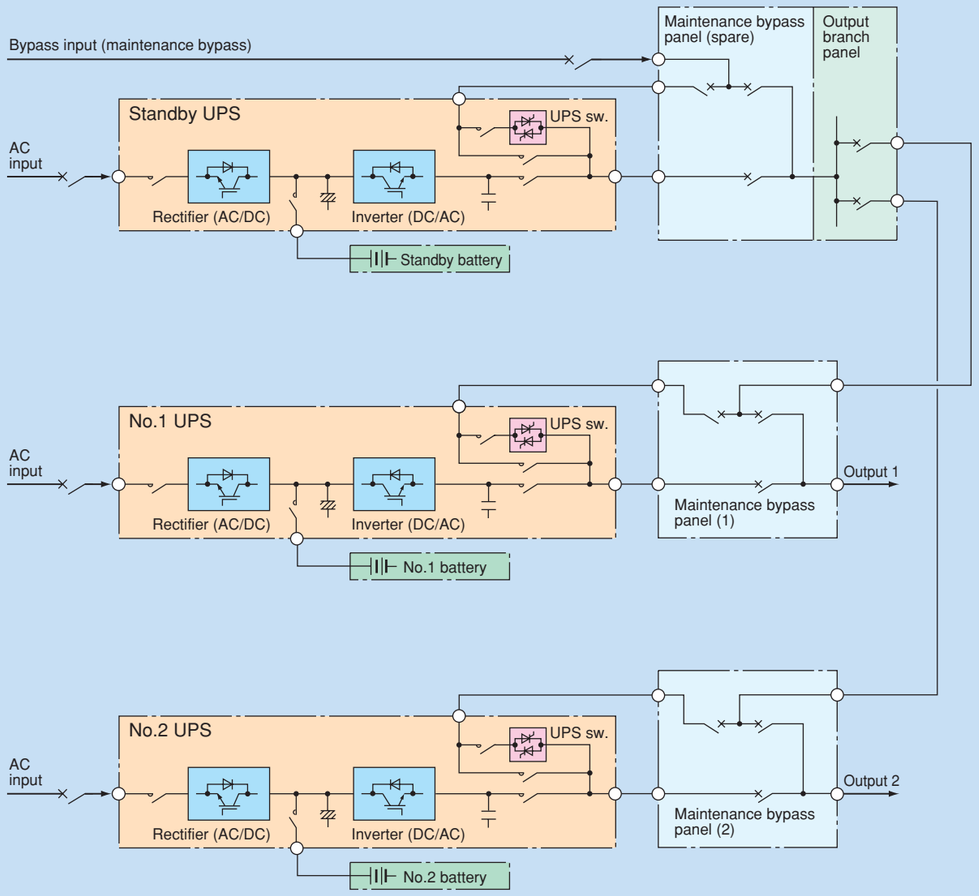


With bypass circuit for maintenance



Circuit Configuration (III)

The following configuration represents a typical standby redundant system consisting of two normal used UPS units and one standby UPS unit.



- High reliability comparable to parallel redundant systems can be obtained.
- Operation of the existing UPS need not be suspended for expansion.
- The capacity of each UPS for normal use need not be identical.

Rated Specifications

Fuji Large-capacity UPS
UPS7700F Series

Series		UPS7700F Series					
Model		3/100	3/200	3/300	3/400	3/500	3/600
Input	Voltage [V]	380, 400, 415±15%					
	Frequency [Hz]	50 or 60±5%					
	No. of phases and wires	3-phase, 4-wire					
	Harmonic current	5% max.					
	Power factor	0.99 min.					
DC circuit	Rated voltage*1 [V]	480 (lead acid battery: 240 cells)					
	Voltage variation range*1 [V]	400 to 552					
Output	Rated apparent power [kVA]	100	200	300	400	500	600
	Voltage [V]	380, 400, 415					
	Frequency [Hz]	50 or 60					
	No. of phases and wires	3-phase, 4-wire					
	Load power factor*2	0.7 (lag) to 1.0, Rated value: 0.8 (lag)					
	Voltage tolerance (steady state)	±1.0%					
	Transient voltage regulation	(1) ±5%: at abrupt step load from 0 to 100% or vice-versa (2) ±5%: at abrupt ±15% change of input voltage (3) ±5%: at failure/recovery of input power (4) ±5%: at disconnection of one module (for parallel operation systems only) (5) ±5%: UPS ← Bypass (for uninterruptible backup systems only) Conditions at switching between UPS and bypass circuits vary depending on the characteristics of the bypass power. Conditions (1) to (5) should not be overlapped.					
	Voltage waveform distortion (total harmonic distortion)	2.5% max. (root mean square value of total harmonics under 100% linear load) 5% max. (root mean square value of total harmonics under 100% rectifier load)					
	Voltage unbalance	±2% (under 100% unbalanced load)					
	Frequency tolerance	±0.1% (for internal oscillation)					
	External synchronization range	±1%					
	Overload capability	125% for 10min, 150% for 1min					
	Overcurrent limiting value	150% (current drooping characteristics function when overcurrent exceeds 150%, keeping the overcurrent to less than 150%.)					
	Voltage adjustment range	±5% (under rated load)					
Others	Ambient temperature	−10 to +40℃ (for operation), +18 to +27℃ (recommended)					
	Relative humidity	30 to 90%					
	Altitude	1000m max.					
	Noise	75dB (A) max.					

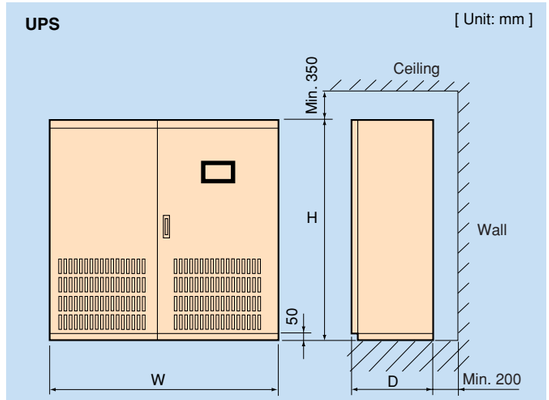
*1: When a lead acid battery is used
*2: Rated electric power is guaranteed for rated power factor of up to 1.0.

External Dimensions and Mass

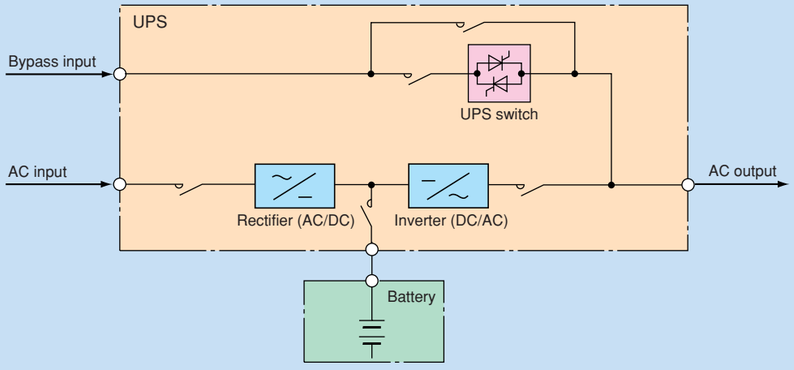
■ UPS main unit

UPS power [kVA]	Dimensions [mm] W	D	H	Mass [kg]
100	500	800	1900	450
200	1000	800	1900	900
300	1500	800	1900	1350
400	2000	800	1900	1800
500	2500	800	1900	2250
600	3000	800	1900	2700

Note 1: For one UPS main unit
Note 2: Excluding the bypass transformer and bypass circuit for maintenance
Note 3: Excluding the battery



■ UPS system configuration



Hub network

Fuji Large-capacity UPS
UPS7700F Series

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Installation Conditions

- This unit is designed to be used indoors.
  Do not install in a place exposed to direct sunlight, wind or rain.
- Avoid a dusty, hot and/or humid place.
- Our UPS is designed to work in a temperature range of −10 to +40℃.
  However, we recommend that it be used at +25℃ or lower to ensure stable operation over the entire life of the UPS.
- System multiplexing, installation of an emergency generator set, and special measures for operation, maintenance and control are required when the system is to be used for the following applications.
  Contact us in such cases.
  - Medical equipment that directly affects human life
  - Equipment that may cause personal injury
  - Computer systems of social or public importance

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