Medium-voltage Drives
FRENIC4600FM6e
Offering comprehensive benefits throughout the entire lifecycle from installation of new equipment to renewal.

1. Industry’s top class **design** enables installation with a wide range of equipment.
2. Contributes to **stable operation** by improvement of various functions and reliability.
3. Contributes to **preventive maintenance** by improved convenience during maintenance.

**Application field**

- **Steel**
  - Fans, induction blowers, dust collectors, cooling water pumps
- **Petrochemicals**
  - Granulators, compressors, fans and pumps
- **Water treatment**
  - Drainage pumps, water conveying pumps, water supply pumps
- **Cement**
  - Fans, kilns, separators, bucket elevators
- **Other**
  - Turbo refrigerators, Banbury mixers, ball mills
Industry’s top class design enables installation with a wide range of equipment.

**Industry-leading compact structure**

Simple main circuit configuration enables a smaller and lighter design than that of conventional models. Also contributes to a reduction in installation costs, such as building construction expenses, and enables a wider choice of installation locations.

- **Volume:** reduction of approx. 27% compared to conventional models
- **Footprint:** reduction of approx. 17% compared to conventional models

**Effective utilization of electric compartment space**

With complete access possible from the front of the unit, there is no need to provide maintenance space on the rear side. This enables the space in the electric compartment to be effectively utilized.
Contributes to stable operation by improvement of various functions and reliability.

**Inverter cell structure makes full use of Fuji Electric’s experience and expertise.**

Inverter output is switched over according to the phase of the system voltage. This function enables the power supply to be switched over without instantaneous disruption and shock, so the equipment does not need to be shut down.

- Reduction of fault rate by reducing the number of parts
- *Comparison with FRENIC 4600FM5e

**Equipped with cell bypass function**

In the event of a cell fault, it is possible to bypass the failed cell and operate the unit using only healthy cells. Automatic switch-over during inverter operation does not stop the equipment.

**Auto-restart function upon an instantaneous power failure can be selected to match the purpose of the equipment.**

- Selection of major fault
- Selection of free-run restart (optional)
- Selection of continued operation (optional)
  - Operation continues for 300 msec from the instantaneous power failure detection level (detected at system voltage = 85% or less)

**Backup by a commercial bypass system**

A commercial bypass system can be constructed by using a commercial start-up circuit in combination. Enables equipment operation to continue when the inverter is stopped.

- A reactor (optional) is required on the inverter output side for this function.

**Structured input or disconnection function that enables the power supply to be switched over without stopping the equipment.**

Power system diagram

- Inverter input circuit breaker
- FRENIC4600FM6e
- Reactor
- Synchronization input or disconnection (optional)
- Commercial start-up breaker

Synchronization input or disconnection waveform

- Phasing in progress
- Synchronization complete
- Circuit breaker lapping in progress

- *A reactor (optional) is required on the inverter output side for this function.
Contributes to preventive maintenance by improved convenience during maintenance.

Quick exchange of cells is possible.

Easy-to-carry structure enables cells to be easily exchanged also in the event of a fault.

Standard equipped LCD touch panel features good visibility.

7-inch liquid crystal display mounted on the front enables easy monitoring and operation.

Air filters can be replaced without touching the high voltage charging section

Air filters that need to be replaced on a regular basis are mounted on the outside of the panel. There is no danger of coming in contact with the high-voltage charging unit when replacing the filter.

Main functions of LCD touch panel

- Start and stop of the inverter
- Set, change and display of control parameters
- Display of actual value data as bar graphs
- Display of fault causes (first fault, detailed display)
- Display of trends

* Japanese, English and Chinese are available for the LCD touch panel display language.

After installation, change to a film capacitor is possible (optional)

Electrolytic capacitors are equipped in the standard specification. Change to a film capacitor is possible during component maintenance. Selection is possible to meet the customer’s requirements with regard to installation cost and running cost.

Interactive and easily accessible DDC loader maintenance tool

Maintenance and adjustment are normally performed using the touch panel, but a DDC loader is also available for use as a maintenance adjustment tool. The DDC loader can be used easily and interactively on the screen of a personal computer.

Main functions of maintenance tool

- Set, change, display, and save control parameters
- Operating status display: Display of block diagrams, actual values, and internal data
- Display of fault causes: first fault, detailed display, trace back data

* Japanese and English are available for the display languages.

Windows 7 is the currently supported OS. (Support for Windows 10 is planned.)
Reduction of stress on power supply and motors

Reduces power supply side harmonic current and does not affect the equipment.

A multiphase diode rectification system is used to prevent obstacles caused by harmonic currents generated by equipment using semiconductors. This inverter does not stress the power supply in compliance with the harmonic suppression guideline.*

Switching losses are reduced by multilevel pulse width modulation (PWM) control.

Harmonic losses of the input transformer primary winding are reduced, and this reduces harmonic current on the power supply side.

Multiphase diode full-wave rectification enables operation with the power supply power factor as the high power factor.

Phase-advancing capacitors and DC reactors for improving the power supply power factor are not necessary.

Inverter operation is possible with a lower capacity power supply.

High efficiency with an overall efficiency of approx. 97%

- Output transformer is not required, and this eliminates output transformer losses.
- Switching losses are reduced by multilevel pulse width modulation (PWM) control.
- Harmonic losses of the input transformer primary winding are reduced, and this reduces harmonic current on the power supply side.

High power factor with a power supply power factor of 95% or more (at full load).

- Multiphase diode full-wave rectification enables operation with the power supply power factor as the high power factor.
- Phase-advancing capacitors and DC reactors for improving the power supply power factor are not necessary.
- Inverter operation is possible with a lower capacity power supply.

Various functions that reduce stress on motors

- Output current waveform becomes almost sinusoidal with multilevel PWM control and reduces the motor torque ripple.
- Switching surge is minimized and reduces motor stress.
- Output current is almost sinusoidal and reduces motor harmonic losses.

Providing higher quality and full support

Global Sales and Service Network

Our service network spans the globe.
For service information, please contact your local FUJI Electric sales and service staff.

Providing stable quality and full support

From manufacturing to inspection to shipment, our power electronics factory (Suzuka city, Mie prefecture) handles all processes to provide products of reliable quality to our customers.

* Guideline on harmonics countermeasures for consumers receiving high voltage or special high voltage power, as established on September 30, 1994.
### 3 kV series

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1. Output current is limited at an output frequency of 25 Hz or less. (70% of the rated current at a frequency of 0.2 Hz)
2. The required maintenance space in front of the unit is 1500 mm. (Space requirement is common to models of all capacities.)
3. Approximate mass is for the standard specification, and may vary depending on the use of optional features.

#### Model description

**FRN46-6**

1. **Basic type**
   - Code symbol: FRN46-6
   - Product category: FRENIC-4600FM6

2. **Control method**
   - Code symbol: [Vector with sensor]
   - Control method: [Vector with sensor]

3. **Input voltage, frequency**
   - Code symbol: [Vector with sensor]
   - Input voltage: [Vector with sensor]

4. **Output voltage**
   - Code symbol: [Vector with sensor]
   - Output voltage: [Vector with sensor]

5. **Output capacity**
   - Code symbol: [Vector with sensor]
   - Output capacity: [Vector with sensor]

6. **Auxiliary power supply**
   - Code symbol: [Vector with sensor]
   - Auxiliary power supply: [Vector with sensor]

7. **Location of manufacture**
   - Code symbol: [Vector with sensor]
   - Location of manufacture: [Vector with sensor]

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### 6 kV series

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1. Output current is limited at an output frequency of 25 Hz or less. (70% of the rated current at a frequency of 0.2 Hz)
2. The required maintenance space in front of the unit is 1500 mm. (Space requirement is common to models of all capacities.)
3. Approximate mass is for the standard specification, and may vary depending on the use of optional features.

Note: The external dimensions are subject to change.
Standard specification

### Ambient conditions

- **Ambient temperature**: Ambient temperature: 0 to 40°C  
  Storage temperature: −10 to 60°C  
  Transport temperature: −20 to 70°C (−20 to −10°C, 60 to 70°C: within 24 hours)
- **Humidity**: Up to 90% RH (non-condensing)
- **Altitude**: 1000 m above sea level
- **Vibration**: 4.9 m/s² or less (10 to 50 Hz)
- **Location of installation**: Indoor (General environment without corrosive gas, dust, flammable or volatile gases)

### Applicable standard

JIS, JEC, JEM

### Structure

- **Panel structure**: Steel sheet, self-standing enclosed structure, with maintenance access at front
- **Protective structure**: IP20
- **Cooling method**: Forced air cooling using ceiling fan
- **Paint color**: Munsell 5Y7/1, semi-gloss

### Input

- **Main circuit**: Three-phase 3000/3300/6000/6600 V, 50/60 Hz
- **Control power supply**: Single-phase 200 V, 50/60 Hz  
  220 V, 50/60 Hz
- **Fan power supply**: Three-phase 200 V, 50/60 Hz  
  220 V, 50/60 Hz
- **Allowable power supply fluctuation**: Voltage: −10% to +10%, frequency: ±5%

### Control method

- **Output frequency**: 0 to 72 Hz (12 Hz to 120 Hz, optional)
- **Frequency accuracy**: ±0.5Hz
- **Frequency resolution**: 0.005%
- **Acceleration, deceleration time**: 0.1 to 5500 S
- **Overload tolerance**: 110% 60s
- **Main control functions**: Current limit, deceleration overvoltage avoidance, instantaneous power failure restart, cell bypass function (optional)
- **Main protective functions**: Overcurrent, main circuit fuse blown, overvoltage, undervoltage, CPU abnormality, cooling fan stop, etc.
- **Transmission function (optional)**: Modbus, Profinet-DP, T-LINK

### Standard connection diagram

- **Main circuit power supply**: 3p 380/415/600 V, 50/60 Hz
- **Control power supply**: Single 230/250 V, 50/60 Hz
- **Cooling fan power supply**: 3p 380/230 V, 50/60 Hz

#### Connections

- **Frequency command**: DC4-20mA
- **Input breaker status signal**: Class A grounding (medium-voltage inverter dedicated)
- **Input breaker trip command**: Class A grounding (medium-voltage inverter dedicated)
- **Overload**: 110% 60s
- **Run command**: "Closed" during operation (contact a)
- **Stop command**: "Opened" when stopped (contact a)
- **Stand-by**: "Closed" when prepared (contact a)
- **Ready for operation**: "Closed" when prepared (contact a)
- **Main control functions**: Overcurrent, overvoltage, undervoltage, CPU abnormality, cooling fan stop, etc.
- **Main protective functions**: Overcurrent, main circuit fuse blown, overvoltage, undervoltage, CPU abnormality, cooling fan stop, etc.
- **Transmission function**: Modbus, Profinet-DP, T-LINK

#### Air conditioning

- **Control power supply**: Single-phase 200 V, 50/60 Hz  
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- **Transmission function**: Modbus, Profinet-DP, T-LINK

#### Standard interface

**Input side**

- **Main circuit voltage**: Three-phase 3800/3000/6600 V, 6000/6600 V, 50/60 Hz
- **Control power supply**: Single-phase 200/200 V, 50/60 Hz
- **Fan power supply**: Three-phase 200 V, 50 Hz, 220 V, 50/60 Hz
- **Frequency setting**: 0 to 10 V, 0 to 100% or Input impedance: 1 MΩ  
  4 to 20 mA, 0 to 100% Input impedance: 250 Ω

**Output side**

- **Main control panel**: DDC Loader
- **Analogue output**: 4 points
  - −10 to +10 VDC (optional)
  - −10 to +10 VDC (optional)
- **Frequency command**: DC4-20mA
- **Input breaker status signal**: Class A grounding (medium-voltage inverter dedicated)
- **Input breaker trip command**: Class A grounding (medium-voltage inverter dedicated)
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