Features

1. **Easy setting, Simple operation**

   **Easy setting, simple operation with the large dial**
   Just turn and push the large setting dial to browse and select the right parameter. The reference frequency can be also set by the large setting dial.

   ![Image](image1)

   **Parameter can be set without power supply to the inverter**
   Using the optional parameter writer, you can read/write/retain/set parameters.
   It is useful in case of incorporate numbers of inverters to the machine.

   ![Image](image2)

   **Showing most frequently used parameter in EASY mode.**
   EASY key allows you switch between EASY mode and Standard mode.
   EASY mode: Scrolls through a list of most frequently used parameter.(32 parameters in maximum.)
   Standard mode: Show all existing parameters.

2. **Eco Design**

   **Long lifetime**
   Long life main-circuit capacitor is used to achieve 10 years lifetime design.

   **Harmonize with environment**
   1. Compliance with the European RoHS Directive.
   2. Built-in noise filters to suppress electromagnetic noise.
   - 1-Phase 240V models and 3-Phase 500V models: Built-in EMC noise filter complies with the European EMC Directive.
   - 3-Phase 240V models: Built-in basic noise filter.

   **Side-by-side installation**
   Side-by-side installation is possible for all VF-S15 models.
   It means that you can further save space as two or more units can be installed in close proximity next to each other.

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### Contents

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- **Useful Function and specification** p.3
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- **Functions** p.7
- **Panel and operation procedure** p.8
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- **Specifications** p.11
- **Connection diagram** p.13
- **Peripheral devices** p.15
- **To users of our inverters** p.20
3. Energy savings & Powerful operation

Along with the motor, achieve energy savings.
1. High energy saving performance PM motor can be driven normally. (For variable torque)
   Auto-tuning can set motor constant easily.
   Improve the energy saving effect of variable torque load such as fan and pump.

Easy operation of high torque load.
Vector control mode generate stable, high torque power from motor startup to a desired motor operating speed. Further, if you set the starting frequency to 0.1Hz, motor can start smoothly with strength.

When a Toshiba standard 3-phase 400V-1.5kW motor is driven by the VFS15-4015PL-W after parameters are set.

4. Applicability

Auto-tuning can setup motor constant easily.
With vector control mode and PM motor control mode (For Variable torque), auto-tuning function leads you easy access to motor constant setup and fully use of all the advantages of motor.

Motor information is required for the auto-tuning:
• Motor rated capacity (kW)
• Motor rated current (A)
• Motor rated speed (min⁻¹)
• Motor rated Voltage (V) (In case of PM: Induced voltage (RMS between the line))
  *Please find the information on the motor’s name plate.

Easily adjust the lifting application by learning function.
A learning function for setting and storing to memory required parameters while performing actual operations is also provided to facilitate adjustments. Every model is built-in braking resistor drive circuit.

5. Expandability of the system

Built-in RS485 is equipped as standard
Modbus-RTU protocol /TOSHIBA protocol is complied.
Communication speed: Maximum 38.4kpbs

Variety of communication options
CC-Link, PROFIBUS-DP, DeviceNet™, EtherNet/IP™, EtherCAT®, CANopen®

<table>
<thead>
<tr>
<th>Voltage class (Input/Output)</th>
<th>Applicable motor(kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>3φ240V/3φ240V</td>
<td>✓</td>
</tr>
<tr>
<td>1φ240V/3φ240V</td>
<td>✓</td>
</tr>
<tr>
<td>3φ500V/3φ500V</td>
<td>✓</td>
</tr>
</tbody>
</table>
Useful function and specification

Simplify the system

Panel display control
Contents of your requests, such as load condition, could be viewed on the inverter’s panel. (Using the communications)

Shows power by the pulse count
Integrated power can be output by the pulse. Even without the external wattmeter, power can be shown by the pulse count.

Flexible terminals
The terminal function settings can be changed. Multiple input terminal functions can be assigned with single input terminal to simplify the external circuit.

Useful to building the system

Control power supply backup
Control power supply is supplied from the inverter’s main circuit and also supplied by another input. It can maintain the output signal and trip indication, when the main circuit power supply circuit is also turned off due to inverter trip.

Continuously adjustment from analog input
Can be adjusted continuously by analog input, the value to be set by the parameter.

< Adjustment parameters >
- Acceleration/Deceleration time
- Upper limit frequency
- Torque boost value
- Motor electronic-thermal protection level etc.

*For processing by the internal, parameter settings are not changed

International Standards

• Compliant with major international standards

• Sink/Source control logic
It can be configured for both sink logic and source logic.

• Built-in EMC filter
1-phase 240V and 3-phase 500V model have built-in noise filter complied with the European EMC Directive.

• Wide variety of applied conditions
Power supply — 240V class model is for 200~240V, 500V class model is for 380V~500V. It can correspond to a wide range of power supply
Ambient temperature — It can be used maximum ambient temperature of 60°C.*
Altitude — Maximum altitude 3000 meter*1

*1 The maximum output current may be limited depend on the operating conditions

Easy maintenance

• Monitor number of starting
Displaying number of starting and output the alarm signal are helpful for maintenance.

• Details on history trip records
Output current, input voltage etc., a monitor to identify the cause of the problem and help to find countermeasures. VF-S15 can keep memories of the last eight trips even after resetting.

• Tracing function (Refer to Page 4)

Useful for OEM

Parameters can be set easily
• Application easy setting
6 parameters for particular usages are available. Parameters match to your machine can be displayed and setup easily by using the application easy setting.

AUA Application easy setting
1: Initial easy setting
2: Conveyor
3: Material handling
4: Hoisting
5: Fan
6: Pump
7: Compressor

• Protection of the setting parameters.
VF-S15 provides the setting protection for the setting parameters. Four-digit password is required to reinforce the security.
VF-S15 can save and restore a set of parameters.

• Setting from extension parameter writer.

• Setting and management on a PC; PCM001Z. (Refer to Page 4)

Easy wiring
• Removable control terminal board
Remove the terminal board to wiring efficiently.

Power supply
VF-S15
Main circuit
DC24V
AC240V/500V
Motor
Control circuit
+ Control power supply backup option

Forward run command ON
Preset-speed command ON

Possible to omit the relay, etc.
Two functions can be operated by one signal.

External display is unnecessary.

30KWh
Integrated power (kWh)

Ambient temperature
240V class model is for 200~240V, 500V class model is for 380V~500V. It can correspond to a wide range of power supply

VF-S15 is unnecessary.
**Safety function (Option)**

Safety function (option) prevents a disaster caused by a complex Machine, not only operator but also machine design regards to safety precaution. It is insulating the output reliability in the event of an emergency. And it can simply the system and reduce the wiring and external devices cost.

Compliant with safety standards:
Possible to disconnect the output corresponding to the safety standard.
- EN954-1 Category 3
- IEC61800-5-2/IEC61508 SIL2
- ISO13849-1 Category 3 PL “d”
- IEC60204-1 Category stop 0, 1

**PM motor drive technology**

The VF-S15 can drive Interior Permanent Magnetic Motor(IPM) and Surface Permanent Magnetic Motor(SPM) for high efficiency, high torque energy saving, downsizing and lightening.

**Dual rating (CT/VT)**

The VF-S15 can be used the constant torque and variable torque applications by dual rating operation. For example, if variable application (fan and pump) required 15kW drives, it can be operated by 11kW rated of VF-S15.

**Constant torque application**

The torque value of constant torque application require the high torque level of different motor speed for conveyors, Machine tools, Food machine and Elevator.

**Variable torque application**

The torque value of variable torque application such as Fan, Pump and HVAC require low torque unit to operating speed.

**My function (Option)**

My function enhances programming capability to inverter’s input/output signals to respond to customer needs without external relays or a PC in some cases. Easy programming tool (PCL001Z) is available.

- **Easy programming(PCL001Z)**
  
  My function parameter can be set easily by the PCL001Z

**Communication**

- **Built-in**
  

- **Network options**
  
  CC-Link
  PROFIBUS-DP
  DeviceNet™
  EtherNet/IP™-Modbus TCP
  EtherCAT®
  CANopen®

  *Registered trademark
  CC-Link is Mitsubishi Electric Corporation DeviceNet is ODVA(Open DeviceNet Vendor Association) EtherNet/IP is ControlNet International, Ltd EtherCAT is Beckhoff Automation GmbH CANopen is CAN in Automation.

**Operation Management on a PC (Free software available)**

- **Edit and monitor(PCM001Z)**
  
  The PCM001Z communication software allows you to edit, monitor, and trace parameter data on a PC, enabling easier data management from inverter startup through to maintenance.

- **Data storage of the protection operation: Tracing function(PCT001Z)**
  
  Memorize and read out the data collected at the time of tripping or triggering.

- **Remote control**
  
  Using the EtherNet option, it can be remote controlled from PC.

---

Caution: VT mode isn't compliant with UL and CSA standard.
Useful function for wide range applications
VF-S15 for machinery and facilities in various industrial sector and application

<table>
<thead>
<tr>
<th>Function &amp; Advantage</th>
<th>Material handling (Horizontal)</th>
<th>Material handling (Vertical)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ideal applicable</td>
<td>Automatic vertical storage units</td>
</tr>
</tbody>
</table>

### Easy setting
Simple operation

- External parameter writer: Parameter can be set without power supply.
- Easy setting mode: Show most frequently used parameters in EASY mode.
- Application easy setting: 6 parameters for particular uses are available.
- Password lock: A four-digit password is required to change the parameters if necessary.
- Side--by--side installation: Two or more inverter units can be installed in close proximity next to each other.
- Ambient temperature: 60°C Maximum ambient temperature: 60°C

### Eco Design

- Long lifetime: Designed for 10 years lifetime design
- Built-in noise filter: Built-in EMC noise filter comply with European EMC Directive
- Random mode: Improves hearing impression by changing the pattern of the low carrier frequency

### Energy savings & Powerful operation

- PM motor: PM motor can drive for high efficiency, downsizing and lightening (For variable torque)
- Energy saving mode: Energy can be saved in all speed areas by detecting load current and following the optimum current that fits the load.
- High torque drive: VF-S15 supports sensorless vector control mode to generate stable, high-torque power from motor startup to a predefined, desired motor operating speed.
- Auto---tuning: This auto-tuning function allows you to set the motor constant easily, which needs to be set when operating in vector control or PM motor drive.
- Learning function: Setting and storing to memory required parameter while performing actual operation is also provided to facilitate adjustments.
- Override function: Preventing loads from concentrating at a specific motor because of a load imbalance when multiple inverters are used to operate one machine

### Applicability

- ACC/DEC pattern (S-pattern) function: To minimize the shocks caused in starting and stopping and change the ACC/DEC rate according to the machine characteristics and its applications.
- DC brake function: A large braking torque can be obtained by applying a direct current to the motor.
- Dwell function: Suspends acceleration and deceleration to match the timing of brake.
- Auto---restart control: Detects the rotating speed rotational direction of the motor during coasting at the event of momentary power failure, and then after power has been restored, restarts the motor smoothly.
- PID control: To use temperature, pressure, flow and motion control
- Sleep function: Additional energy saving can be realized by stopping at lower limit setting
- Bumpless function: When switching from Remote mode to Local mode, the status of start and stop, and operating frequency at Remote mode move to Local mode.
- Network communication: Built-in RS485. Can be connected to the common industrial communication

### Expandability of the system

- Panel display control (Using the communication): Contents of your requests, such as condition, can be viewed on the inverter’s panel
- Parameter adjustment by Analog input: Parameters adjustable from external analog input
- Control power supply can be supplied from another input: Control power supply is supplied from the inverter’s main circuit and also supplied by another input. It can maintain the output signal and trip indication, when the inverter become trip.
- Torque limit: Low voltage operation function, shock monitoring function

### Other

For more details of each functions, please confirm with Toshiba representative offices or Toshiba authorized distributors in your country.
### Machinery and Facilities

<table>
<thead>
<tr>
<th>Fans &amp; Pumps</th>
<th>Food processing machinery</th>
<th>Packaging machinery</th>
<th>Daily-life-related machinery</th>
<th>Medical equipment</th>
<th>Textile line</th>
<th>Chemical machinery</th>
<th>Printing machinery</th>
<th>Machine tools</th>
<th>Processing machinery</th>
<th>Semiconductor facility equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Pumps" /></td>
<td><img src="image2" alt="Food machines" /></td>
<td><img src="image3" alt="Packaging machinery" /></td>
<td><img src="image4" alt="Daily-life-related machinery" /></td>
<td><img src="image5" alt="Medical equipment" /></td>
<td><img src="image6" alt="Textile line" /></td>
<td><img src="image7" alt="Chemical machinery" /></td>
<td><img src="image8" alt="Printing machinery" /></td>
<td><img src="image9" alt="Machine tools" /></td>
<td><img src="image10" alt="Processing machinery" /></td>
<td><img src="image11" alt="Semiconductor facility equipment" /></td>
</tr>
<tr>
<td><img src="image12" alt="Fans/blowers" /></td>
<td><img src="image13" alt="Compressor" /></td>
<td><img src="image14" alt="Commercial ironing boards" /></td>
<td><img src="image15" alt="Car washing machine" /></td>
<td><img src="image16" alt="X-ray machines" /></td>
<td><img src="image17" alt="Textile machines" /></td>
<td><img src="image18" alt="Mixers" /></td>
<td><img src="image19" alt="Printing presses" /></td>
<td><img src="image20" alt="Machine tools" /></td>
<td><img src="image21" alt="Cutters" /></td>
<td><img src="image22" alt="Semiconductor production equipment" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fan control enable: forced operation</th>
<th>Fire-control edition: Synchronously deceleration</th>
</tr>
</thead>
</table>

- Fans & Pumps
- Food processing machinery
- Packaging machinery
- Daily-life-related machinery
- Medical equipment
- Textile line
- Chemical machinery
- Printing machinery
- Machine tools
- Processing machinery
- Semiconductor facility equipment
**ACC/DEC pattern (S-parttern) function**

To minimize the shocks caused in starting and stopping and change the ACC/DEC rate according to the machine characteristics and its applications.

**Override function**

Adjust reference frequencies by means of external input.

**Bumpless function**

When switching from Remote mode to Local mode, the status of start and stop, and operating frequency at Remote mode move to Local mode.

**Learning function**

Setting and storing to memory required parameters while performing actual operation is also provided to facilitate adjustments.

**Sleep function**

If operation at the lower-limit frequency is carried out for the setting time, the inverter will automatically decelerate the motor stop for the purpose of energy-saving.

**Drooping function**

Preventing loads from concentrating at a specific motor because of a load imbalance when multiple inverters are used to operate one machine.

**PID control function**

Process control including keeping airflow, pressure, and the amount of flow constant, can be exercised using feedback signals (4 to 20mA, 0 to 10V) from a detector.

**Auto-restart control function**

Detects the rotating speed rotational direction of the motor during coasting at the event of momentary power failure, and then after power has been restored, restarts the motor smoothly.

**Auto-tuning**

This auto-tuning function allows you to set the motor constant easily, which needs to be set when operating in vector control or PM motor drive.

**DC brake function**

A large braking torque can be obtained by applying a direct current to the motor.

**Dwell function**

It prevents the occurrence of overcurrent at starting and slippage of stopping by fixing the timing with brake.
Panel and operation procedure

Values set by each setup parameter

<table>
<thead>
<tr>
<th>Title</th>
<th>Function</th>
<th>EU (Mainly in Europe)</th>
<th>US (Mainly in North America)</th>
<th>AS (Mainly in Asia, Oceania)</th>
<th>JP (Mainly in Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>yL/uy/11f</td>
<td>Frequency</td>
<td>50.0(Hz)</td>
<td>60.0(Hz)</td>
<td>50.0(Hz)</td>
<td>60.0(Hz)</td>
</tr>
<tr>
<td>P3</td>
<td>Base frequency voltage 1, 2</td>
<td>240V class 230(V)</td>
<td>230(V)</td>
<td>230(V)</td>
<td>200(V)</td>
</tr>
<tr>
<td>F307</td>
<td>Voltage class 500V class 400(V)</td>
<td>400(V)</td>
<td>460(V)</td>
<td>400(V)</td>
<td>400(V)</td>
</tr>
<tr>
<td>F319</td>
<td>V/F control mode selection</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>F411</td>
<td>Supply voltage correction</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>F411</td>
<td>Regenerative over-excitation</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>upper limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor rated speed</td>
<td>1410(min⁻¹)</td>
<td>1710(min⁻¹)</td>
<td>1410(min⁻¹)</td>
<td>1710(min⁻¹)</td>
</tr>
</tbody>
</table>

Note 1) Excluding Japan

Power on (setup parameter)

1. When power on the inverter for the first time, SE is blinking.

2. Select an area code by the setting dial. J/P/US/RS1/EU

3. Press the center of the setting dial to confirm your change. When In is displayed and then 0.0, you finish setting setup parameter.

Monitor display

The LEDs on the operation panel display the following symbols indicate operations and parameters.

LED (number)

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>-</th>
</tr>
</thead>
</table>

LED (alphabet)

Aa Bb C c Dd Ee Ff Gg H h I i Jj Kk Ll Mm Nn O o Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

R b l c d e f g h h h i, j l n o o o p q r s u w y z
Monitor items can be selected by setting parameters F110 to F118 (F120).

### Monitoring

1. **Displays operation frequency.**
   - Pressing the MODE key twice...
   - Tuning the setting dial clockwise...
   - Tuning the setting dial clockwise...
   - Tuning the setting dial clockwise...
   - Tuning the setting dial clockwise...

2. **Displays the motor rotating direction.**
   - Tuning the setting dial clockwise ...

3. **Displays operation frequency command value.**
   - Tuning the setting dial clockwise ...

4. **Displays output current (%/ampere).**
   - Tuning the setting dial clockwise ...

5. **Displays operation frequency (return to the beginning).**
   - Tuning the setting dial clockwise ...

*If you press the center of setting dial without changing the setting, the next parameter ("acc") is displayed.

### Setting

1. **Turn on the power.**
   - Pressing the MODE key ...

2. **Displays "RUN".**
   - Turning the setting dial until "ACC" is displayed ...

3. **Displays "ACC".**
   - Press the center of setting dial ...

4. **Displays the setting value.**
   - Turn the setting dial and press the center of the setting dial ...

5. **Displays "ACC", and the setting value alternately, and then the setting completed.**

### Table

#### Item displayed
- **Output frequency**
- **Parameter setting mode**
- **Direction of rotation**
- **Frequency command value**
- **Output current**
- **Input voltage**
- **Output voltage**
- **Input power**
- **Inverter load factor**
- **Output frequency**
- **Input terminal**
- **Output terminal**

#### Panel display
- **Output frequency**
- **Parameter setting mode**
- **Direction of rotation**
- **Frequency command value**
- **Output current**
- **Input voltage**
- **Output voltage**
- **Input power**
- **Inverter load factor**
- **Output frequency**
- **Input terminal**
- **Output terminal**

#### LED display
- **MON Hz**
- **PRG**
- **RUN %**
- **MON Hz**
- **PRG**
- **RUN %**
- **MON Hz**
- **PRG**
- **RUN %**
- **MON Hz**
- **PRG**
- **RUN %**
- **MON Hz**
- **PRG**
- **RUN %**

#### Description
- The output frequency is displayed (Operation at 60Hz). (When standard monitor display selection is set to 0 [output frequency])
- The first basic parameter "R6H" (history function) is displayed.
- The direction of rotation is displayed. (F-r-F: forward run, F-r-r: reverse run)
- The frequency command value (Hz/free unit) is displayed. (In case of F71 = 2)
- The inverter output current (load current) (%/A) is displayed. (In case of F71 = 2)
- The inverter input voltage (DC detection) (%/V) is displayed. (In case of F71 = 3)
- The inverter output voltage (%/V) is displayed. (In case of F71 = 4)
- The inverter input power (kW) is displayed. (In case of F71 = 5)
- The inverter output power (kW) is displayed. (In case of F71 = 6)
- The inverter load factor (%) is displayed. (In case of F71 = 7)
- The inverter output frequency (Hz/free unit) is displayed. (In case of F71 = 8)
- The ON/OFF status of each of the control signal input terminals (R, RES, S1, S2, S3, S4) are displayed in bits.
- The ON/OFF status of each of the control signal output terminals (RY-RC, OUT, FL) are displayed in bits.

#### Description
- The version of the CPU1 is displayed.
- The version of the CPU2 is displayed.
- The inverter rated current (A) is displayed.
- The inverter overload characteristic and region setting display is displayed.
- The status of signal transmission and reception of communication are displayed in bits.
- The ON/OFF status of each of the cooling fan, circuit board capacitor, main circuit capacitor of parts replacement alarm, cumulative operation time or number of starting are displayed in bits.
- The cumulative operation time is displayed. (6 hours, 1000 hours)
- Number of starting (10000 times)
- The output frequency is displayed (Operation at 60Hz).
### Dimensions and weight

**Dimensions and weight**

**MODE**
- RUN
- EASY
- STOP
- PRG
- MON

**Dimensions (mm)**
- **H1** (Mounting dimension)
- **W1** (Mounting dimension)

**EMC plate (Option)**

**Note 2**
- *58mm for 1-phase 240V-1.5, 2.2kW models.*

**EMC plate Dimensions (mm)**

<table>
<thead>
<tr>
<th>Voltage class</th>
<th>Applicable motor (kW)</th>
<th>Inverter type</th>
<th>Dimensions (mm)</th>
<th>Drawing</th>
<th>Approx. weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3-phase 240V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>VFS15-2004PM-W</td>
<td>72</td>
<td>130</td>
<td>60</td>
<td>121.5</td>
</tr>
<tr>
<td>0.75</td>
<td>VFS15-2007PM-W</td>
<td>105</td>
<td>130</td>
<td>93</td>
<td>121.5</td>
</tr>
<tr>
<td>1.5</td>
<td>VFS15-2015PM-W</td>
<td>140</td>
<td>170</td>
<td>150</td>
<td>126</td>
</tr>
<tr>
<td>2.2</td>
<td>VFS15-2025PM-W</td>
<td>150</td>
<td>220</td>
<td>170</td>
<td>130</td>
</tr>
<tr>
<td>4.0</td>
<td>VFS15-2037PM-W</td>
<td>160</td>
<td>295</td>
<td>190</td>
<td>160</td>
</tr>
<tr>
<td>5.5</td>
<td>VFS15-2055PM-W</td>
<td>180</td>
<td>310</td>
<td>190</td>
<td>160</td>
</tr>
<tr>
<td><strong>1-phase 240V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td>VFS15S-2002PL-W</td>
<td>72</td>
<td>130</td>
<td>60</td>
<td>131</td>
</tr>
<tr>
<td>0.4</td>
<td>VFS15S-2004PL-W</td>
<td>105</td>
<td>130</td>
<td>93</td>
<td>121.5</td>
</tr>
<tr>
<td>0.75</td>
<td>VFS15S-2007PL-W</td>
<td>140</td>
<td>170</td>
<td>150</td>
<td>126</td>
</tr>
<tr>
<td>1.5</td>
<td>VFS15S-2015PL-W</td>
<td>150</td>
<td>220</td>
<td>170</td>
<td>130</td>
</tr>
<tr>
<td>2.2</td>
<td>VFS15S-2022PL-W</td>
<td>160</td>
<td>295</td>
<td>190</td>
<td>160</td>
</tr>
<tr>
<td><strong>3-phase 500V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>VFS15-4004PL-W</td>
<td>107</td>
<td>130</td>
<td>153</td>
<td>93</td>
</tr>
<tr>
<td>0.75</td>
<td>VFS15-4007PL-W</td>
<td>140</td>
<td>170</td>
<td>160</td>
<td>126</td>
</tr>
<tr>
<td>1.5</td>
<td>VFS15-4015PL-W</td>
<td>150</td>
<td>220</td>
<td>170</td>
<td>130</td>
</tr>
<tr>
<td>2.2</td>
<td>VFS15-4022PL-W</td>
<td>160</td>
<td>295</td>
<td>190</td>
<td>160</td>
</tr>
</tbody>
</table>

**Note 1.** H2 means Height of EMC plate mounting area

**Note 2.** Here are the available EMC plate.

- Fig.A : EMP007Z
- Fig.B : EMP008Z
- Fig.C : EMP009Z for 3-phase 240V-4.0kW models.

**Note 3.** The models shown in Fig. A and Fig. B are fixed at two points: in the upper left and lower right corners.

**Note 4.** The model shown in Fig. A is not equipped with a cooling fan.

**Note 5.** The cooling fan of 1-phase 240V-1.5, 2.2kW models are on the upper side of the inverter.
## Specifications

### Standard specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>3-phase 240V</td>
</tr>
<tr>
<td>Applicable motor (kW)</td>
<td>0.4, 0.75, 1.5, 2.2, 4.0, 5.5, 7.5, 11, 15</td>
</tr>
<tr>
<td><strong>Type</strong></td>
<td>VFS15</td>
</tr>
<tr>
<td><strong>Capacity (kVA)</strong> Note 1</td>
<td>1.3, 1.8, 3.0, 4.2, 6.7, 10.5, 12.6, 20.6, 25.1</td>
</tr>
<tr>
<td><strong>Rated output current (A)</strong> Note 2</td>
<td>3.3 (3.3), 4.8 (4.4), 8.0 (7.9), 11.0 (10.3), 17.5 (16.4), 27.5 (25.0), 33.0 (33.0), 54.0 (49.0), 66.0 (60.0)</td>
</tr>
<tr>
<td><strong>Output voltage</strong> Note 3</td>
<td>3-phase 200V to 240V</td>
</tr>
<tr>
<td><strong>Overload current rating</strong></td>
<td>150%-60 seconds, 200%-0.5 second</td>
</tr>
</tbody>
</table>

### Power supply

| Voltage-frequency | 3-phase 200V to 240V - 50/60Hz |
| Allowable fluctuation | Voltage 170V to 264V note 4, frequency ±5% |
| Required Power supply capacity (kVA) Note 5 | 1.4, 2.5, 4.3, 5.7, 9.2, 13.8, 17.8, 24.3, 31.6 |

### Protective method (IEC60529)

| IP20 |

### Cooling method

| RAL7016 |
| For self-cooling, forced air-cooled |

### Built-in filter

| EMC filter |

### Note 1.
Capacity is calculated at 220V for the 240V models, at 440V for the 500V models.

### Note 2.
Indicates rated output current setting when the PWM carrier frequency (parameter F 3.00) is 4kHz or less. When exceeding 4kHz, the rated output current setting is indicated in the parentheses. It needs to be further reduced for PWM carrier frequencies above 12 kHz. The rated output current is reduced even further for 500V models with a supply voltage of 480V or more. The default setting of the PWM carrier frequency is 12kHz.

### Note 3.
Maximum output voltage is the same as the input voltage.

### Note 4.
At 180V-264V for the 240V models, at 342V-550V for the 500V models when the inverter is used continuously (load of 100%).

### Note 5.
Required power supply capacity varies with the value of the power supply side inverter impedance (including those of the input reactor and cables).

---

### Explanation of the type-form

<table>
<thead>
<tr>
<th>V</th>
<th>F</th>
<th>S</th>
<th>1</th>
<th>5</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>P</td>
<td>L</td>
</tr>
</tbody>
</table>

**Model name**: TOSVERT VF51 series

**Number of power phases**: 2: single-phase, None: three-phase

**Input (AC) voltage**: 2.200V to 240V, 4.300V to 350V

**Applicable motor capacity**: 0.2-2.2kW, 0.4-4.0kW, 0.75-7.5kW, 1.5-11kW, 2.2-15kW

**Additional functions I**
- L: Built-in high-attenuation EMC filter
- M: Built-in basic filter

**Additional functions II**
- W: World model
- W1: World optional model

**Operation panel**: Provided

---

**Note**: The explanation of the type-form is based on the provided specifications and is subject to the conditions and limitations stated in the document. The model name and number of power phases are indicative and may vary depending on specific requirements and configurations.
To align the inverters side-by-side horizontally, remove the protective label on the top of the inverter before use. When using the inverter in locations with temperatures above 40°C, note that the current must be reduced by 1% for each 100 m over 1000 m. For example, 90% at 2000 m and 80% at 3000 m. Note 1. Maximum output voltage is the same as the input voltage. Note 2. A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input/terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected. Note 3. Current must be reduced by 1% for each 100 m over 1000 m. For example, 90% at 2000 m and 80% at 3000 m. Note 4. When using the inverter in locations with temperatures above 40°C, remove the protective label on the top of the inverter and use the inverter with the output current reduced according to the instruction manual.

### Common specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Control system</strong></td>
<td>Sinusoidal PWM control</td>
</tr>
<tr>
<td><strong>Output voltage range</strong> (Note)</td>
<td>Adjustable within the range of 50 to 330V (240V class) and 50 to 600V (500V class) by correcting the supply voltage</td>
</tr>
<tr>
<td><strong>Output frequency range</strong></td>
<td>0.1 to 500 Hz, default setting: 0.1 to 80 Hz, maximum frequency: 30 to 500 Hz</td>
</tr>
<tr>
<td><strong>Minimum setting steps of frequency</strong></td>
<td>0.1 Hz: analog input (when the max. frequency is 100 Hz), 0.01 Hz: Operation panel setting and communication setting.</td>
</tr>
<tr>
<td><strong>Frequency accuracy</strong></td>
<td>Digital setting: within ±0.01% of the max. frequency (-10 to +60°C). Analog setting: within ±0.5% of the max. frequency (25°C ± 10°C).</td>
</tr>
<tr>
<td><strong>Voltage/temperature characteristics</strong></td>
<td>V/F constant, variable torque, automatic torque boost, vector control, automatic energy-saving, dynamic automatic energy-saving control (for fan and pump), PM motor control, V/F S-point setting, Auto-tuning. Base frequency (20-500Hz) adjusting to 1 &amp; 2, torque boost (0-30%) adjusting to 1 &amp; 2, adjusting frequency at start (0.1-1Hz).</td>
</tr>
<tr>
<td><strong>Frequency setting signal</strong></td>
<td>Setting data on the front panel, external frequency potentiometer (connectable to a potentiometer with a rated impedance of 1k-10k), 0-10Vdc / ±100Vdc (input impedance: 30kΩ), 4-20mA (input impedance: 250Ω).</td>
</tr>
<tr>
<td><strong>Terminal block base frequency</strong></td>
<td>The characteristic can be set arbitrarily by two-point setting. Possible to set: analog input (VA, VB, VC).</td>
</tr>
<tr>
<td><strong>Frequency jump</strong></td>
<td>Three frequencies can be set. Setting of the jump frequency and the range.</td>
</tr>
<tr>
<td><strong>Upper and lower frequency limits</strong></td>
<td>Upper-limit frequency: 0.5 max. frequency, lower-limit frequency: 0 to upper-limit frequency.</td>
</tr>
<tr>
<td><strong>PWM carrier frequency</strong></td>
<td>Adjustable range of 2.0 to 16.0kHz (default: 12.0kHz).</td>
</tr>
<tr>
<td><strong>PID control</strong></td>
<td>Setting of proportional gain, integral gain, differential gain and control waiting time. Checking whether the amount of processing amount and the amount of feedback agree.</td>
</tr>
<tr>
<td><strong>Acceleration/deceleration time</strong></td>
<td>Selectable from among acceleration/deceleration times 1 &amp; 2 &amp; 3 (0 to 3000 sec.). Automatic acceleration/deceleration function. 2-pattern acceleration/deceleration 1 &amp; 2 and 2-pattern adjustable. Control of forced rapid deceleration and dynamic rapid deceleration.</td>
</tr>
<tr>
<td><strong>DC braking</strong></td>
<td>Braking start-up frequency: 0 to maximum frequency, braking rate: 0 to 100%, braking time: 0 to 25.5 seconds, emergency DC braking, motor shaft fixing control.</td>
</tr>
<tr>
<td><strong>Dynamic Braking Drive Circuit</strong></td>
<td>Control and drive circuit is built in the inverter with the braking resistor outside (optional).</td>
</tr>
<tr>
<td><strong>Input terminal function (programmable)</strong></td>
<td>Possible to set from among about 110 functions, such as forward/reverse run signal input, jog run signal input, operation base signal input and reset signal input, to assign to 8 input terminals. Logic selectable between sink and source.</td>
</tr>
<tr>
<td><strong>Output terminal functions (programmable)</strong></td>
<td>Possible to set from among about 150 functions, such as upper/lower limit frequency signal output, low speed detection signal output, specified speed signal output and failure signal output, to assign to FL relay output, open collector output terminal, and RY output terminals.</td>
</tr>
<tr>
<td><strong>Forward/reverse run</strong></td>
<td>The RUN and STOP keys on the operation panel are used to start and stop operation, respectively. Forward/reverse run possible through communication and logic inputs from the terminal block.</td>
</tr>
<tr>
<td><strong>Jog run</strong></td>
<td>Jog mode, if selected, allows jog operation from the terminal block and also from remote keypad.</td>
</tr>
<tr>
<td><strong>Reset speed operation</strong></td>
<td>Frequency references + 15-speed operation possible by changing the combination of 4 contacts on the terminal block.</td>
</tr>
<tr>
<td><strong>Retry operation</strong></td>
<td>Capable of restarting automatically after a check of the main circuit elements in case the protective function is activated. 10 times (Max.) (selectable with a parameter).</td>
</tr>
<tr>
<td><strong>Various prohibition settings / Password setting</strong></td>
<td>Possible to write-protect parameters and to prohibit the change of panel frequency settings and the use of operation panel for operation, emergency stop and resetting. Possible to write-protect parameters by setting 5 digits password and terminal input.</td>
</tr>
<tr>
<td><strong>Regenerative power ride-through control</strong></td>
<td>Possible to keep the motor running using its regenerative energy in case of a momentary power failure (default: OFF).</td>
</tr>
<tr>
<td><strong>Auto-restart operation</strong></td>
<td>In the event of a momentary power failure, the inverter reads the rotational speed of the coasting motor and outputs a frequency approximate to the rotational speed in order to restart the motor smoothly. This function can also be used when switching to commercial power.</td>
</tr>
<tr>
<td><strong>Light-load high-speed operation</strong></td>
<td>Increases the operating efficiency of the machine by increasing the rotational speed of the motor when it is operated under light load.</td>
</tr>
<tr>
<td><strong>Drooping function</strong></td>
<td>When two or more inverters are used to operate a single load, this function prevents load from concentrating on one inverter due to unbalance.</td>
</tr>
<tr>
<td><strong>Overtake function</strong></td>
<td>External input signal adjustment is possible to the operation frequency command value.</td>
</tr>
<tr>
<td><strong>Relay output signal</strong></td>
<td>1c- contact output and 1a- contact output (Note2). Maximum switching capacity: 250Vac-2A, 30Vdc-2A (At resistive load &lt;=1Ω). 250Vac-1A (cosø=0.4), 30Vdc-1A (L:R=7:3ms) Minimum permissible load: 5Vdc-100mA, 24Vdc-5mA</td>
</tr>
<tr>
<td><strong>Protective function</strong></td>
<td>Stall prevention, current limitation, over-current, output short circuit, over-voltage, over-voltage limitation, undervoltage, ground fault detection, input phase failure, output phase failure, overload protection by electronic thermal function, armature over-current at start-up, load side over-current at start-up, over-torque, undercurrent, overheating, cumulative operation time, life alarm, emergency stop, braking resistor over-current / overload, various pre-alarms.</td>
</tr>
<tr>
<td><strong>Electronic thermal characteristic</strong></td>
<td>Switching between standard motor and constant-torque V/F motor, switching between motors 1 &amp; 2, setting of overload trip time, adjustment of stall prevention levels 1 &amp; 2, selection of overload stall.</td>
</tr>
<tr>
<td><strong>Reset function</strong></td>
<td>Panel reset / External signal reset / Power supply reset. This function is also used to save and clear trip records.</td>
</tr>
<tr>
<td><strong>Alarms</strong></td>
<td>Overcurrent, overvoltage, overload, overheat, communication error, undervoltage, setting error, retry in process, upper/lower limits.</td>
</tr>
<tr>
<td><strong>Causess of failures</strong></td>
<td>Overcurrent, overvoltage, overheat, output short-circuit, ground fault, overload on inverter, arm overcurrent at start-up, overload on the load side at start-up, CPU fault, EEPROM fault, RAM fault, fault communication error. (Selectable: dynamic braking resistor overload, emergency stop, under-voltage, small current, over-torque, motor overload, input phase failure, output phase failure).</td>
</tr>
<tr>
<td><strong>Monitoring function</strong></td>
<td>Output frequency, frequency command value, operation frequency command, forward/reverse run, output current, input voltage (DC detection), output voltage, torque, inverter load factor, motor load factor, braking resistor load factor, input power factor, output power, information on input terminals, information on output terminals, overload and region setting, voltage of CPU1, version of CPU2, PID feedback value, stator frequency, causes of past trips 1 to 8, parts replacement alarm, cumulative operation time, number of starting.</td>
</tr>
<tr>
<td><strong>Past trip monitoring function</strong></td>
<td>Stores data on the past eight trips; number of trips that occurred in succession; output frequency, frequency command value, forward/reverse run, output current, input voltage (DC detection), output voltage, information on input terminals, information on output terminals, and cumulative operation time when each trip occurred.</td>
</tr>
<tr>
<td><strong>Digital input</strong></td>
<td>Analog output for meter: Tnka do full-scale dc-ammmeter 0 - 20mA (4 to 20mA output: DC ammeter (allowable load resistance: Less than 600Ω) DC voltmeter (allowable load resistance: Over 1kΩ) Maximum resolution: 1/1000</td>
</tr>
<tr>
<td><strong>4-digit 7-segments LED</strong></td>
<td>Frequency: inverter output frequency, Alarm: stall alarm &quot;L&quot;, overvoltage alarm &quot;P&quot;, overload alarm &quot;I&quot;, overheat alarm &quot;H&quot;, communication alarm &quot;I&quot;,. Status: inverter status, frequency, cause of activation of protective function, input/output voltage, output current, etc. and parameter settings. Free-unit display: arbitrary unit (e.g. rotating speed) corresponding to output frequency.</td>
</tr>
<tr>
<td><strong>Indicator</strong></td>
<td>Lamps indicating the inverter status by lighting, such as RUN lamp, MON lamp, PRG lamp, % lamp, Hz lamp. The charge lamp indicates that the main circuit capacitors are electrically charged.</td>
</tr>
<tr>
<td><strong>Location of use</strong></td>
<td>Indoors; not exposed to direct sunlight, corrosive gas, explosive gas, flammable gas, flame of, or dust; and vibration of less than 5.5m/s² (10 to 55Hz).</td>
</tr>
<tr>
<td><strong>Ambient temperature</strong></td>
<td>3000 m or less (current reduction required over 1000 m) (Note 3)</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-25 to +70°C</td>
</tr>
<tr>
<td><strong>Relative humidity</strong></td>
<td>5 to 95% (free from condensation and vapor).</td>
</tr>
</tbody>
</table>

Note 1. Maximum output voltage is the same as the input voltage.
Note 2. A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measures when connecting it directly with input/terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.
Note 3. Current must be reduced by 1% for each 100 m over 1000 m. For example, 90% at 2000 m and 85% at 3000 m.
Note 4. When using the inverter in locations with temperatures above 40°C, remove the protective label on the top of the inverter and use the inverter with the output current reduced according to the instruction manual.

- To use the inverters side-by-side horizontally, remove the protective label on the top of the inverter before use. When using the inverter in locations with temperatures above 40°C, use the inverter with the output current reduced.
### Connection diagram

#### Standard connection diagram - SINK (Negative) (common:CC)

![Connection diagram - SINK (Negative) (common:CC)](image)

#### Standard connection diagram - SOURCE (Positive) (common:P24)

![Connection diagram - SOURCE (Positive) (common:P24)](image)

### Wiring devices

<table>
<thead>
<tr>
<th>Voltage class</th>
<th>Applicable motor (kW)</th>
<th>Inverter type</th>
<th>Input current (A)</th>
<th>Magnetic contactor (MC)</th>
<th>Wire size (mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-phase 240V</td>
<td>0.4</td>
<td>VFS15-2004PM-W</td>
<td>Without DCL: 3.6, With DCL: 1.8</td>
<td>Without DCL: 5, With DCL: 5</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>1.8</td>
<td>VFS15-2037PM-W</td>
<td>Without DCL: 23.8, With DCL: 15.9</td>
<td>Without DCL: 30, With DCL: 20</td>
<td>Without DCL: 32, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>3.5</td>
<td>VFS15-2055PM-W</td>
<td>Without DCL: 35.6, With DCL: 21.5</td>
<td>Without DCL: 50, With DCL: 30</td>
<td>Without DCL: 50, With DCL: 32</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>VFS15-2109PM-W</td>
<td>Without DCL: 63.1, With DCL: 41.5</td>
<td>Without DCL: 100, With DCL: 60</td>
<td>Without DCL: 100, With DCL: 60</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>VFS15-2150PM-W</td>
<td>Without DCL: 82.1, With DCL: 55.7</td>
<td>Without DCL: 125, With DCL: 75</td>
<td>Without DCL: 125, With DCL: 75</td>
</tr>
<tr>
<td></td>
<td>4.0</td>
<td>VFS15S-2037PL-W</td>
<td>Without DCL: 5.9, With DCL: 4</td>
<td>Without DCL: 10, With DCL: 5</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>VFS15S-2015PL-W</td>
<td>Without DCL: 10.0, With DCL: 7.6</td>
<td>Without DCL: 15, With DCL: 10</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>VFS15-4004PL-W</td>
<td>Without DCL: 2.1, With DCL: 0.8</td>
<td>Without DCL: 5, With DCL: 5</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>0.75</td>
<td>VFS15-4007PL-W</td>
<td>Without DCL: 3.6, With DCL: 1.8</td>
<td>Without DCL: 5, With DCL: 5</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>VFS15-4015PL-W</td>
<td>Without DCL: 6.4, With DCL: 3.4</td>
<td>Without DCL: 10, With DCL: 5</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>VFS15-4022PL-W</td>
<td>Without DCL: 8.8, With DCL: 4.8</td>
<td>Without DCL: 15, With DCL: 10</td>
<td>Without DCL: 20, With DCL: 20</td>
</tr>
<tr>
<td></td>
<td>15.0</td>
<td>VFS15-4150PL-W</td>
<td>Without DCL: 47.7, With DCL: 29</td>
<td>Without DCL: 60, With DCL: 40</td>
<td>Without DCL: 60, With DCL: 40</td>
</tr>
</tbody>
</table>

**Note 1:** Be sure to attach a surge absorber to the exciting coil of the relay and the magnetic contactor.

**Note 2:** When using the auxiliary contacts 2a of the magnetic contactor MC for the control circuit, connect the contacts 2a in parallel to increase reliability.

**Note 3:** When using the NO output terminal in sink logic mode, short the NO and NC terminals.

**Note 4:** When VIA or VIB terminal is used as logic input terminal, refer to the instruction manual.

**Note 5:** When a power supply with a normal capacity would be used.

**Note 6:** Set the slide switch SW1 to sink side or source side. Refer to the instruction manual for details. Default setting is PLC side.

**Note 7:** When using the DCL reactor, the wire sizes specified in the above table apply to DC power (copper wires shielded with an insulator with a maximum allowable temperature of 75°C) used at an ambient temperature of 50°C or less.
Power circuit

<table>
<thead>
<tr>
<th>Terminal symbol</th>
<th>Input / output</th>
<th>Function</th>
<th>Electrical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>R/L1, S/L2, T/L3</td>
<td>240V class: Three-phase 200 to 240V/50-60Hz</td>
<td>500V class: Three-phase 380 to 500V/50-60Hz</td>
<td>Grounding terminal for connecting inverter. There are 3 terminals in cooling fin or mounting part of EMC plate.</td>
</tr>
<tr>
<td>U/T1, V/T2, W/T3</td>
<td>Connect to three-phase motor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA+, PB</td>
<td>Connect to braking resistors. Change parameters F304, F305, F308, F309 if necessary.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA+</td>
<td>This is a positive potential terminal in the internal DC main circuit. DC common power can be input with PC/- terminal.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO, PA+</td>
<td>Terminals for connecting a DC reactor (DCL: optional external device). Shorted by a short bar when shipped from the factory. Before installing DCL, remove the short bar.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Control circuit terminals

<table>
<thead>
<tr>
<th>Term/ symb</th>
<th>Input / output</th>
<th>Function</th>
<th>Electrical specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Input</td>
<td>Shorting across F-CC or P24-F causes forward rotation; open causes deceleration stop. (When Standby ST is always ON)</td>
<td>No voltage logic input 24Vdc-5mA or less</td>
</tr>
<tr>
<td>R</td>
<td>Input</td>
<td>Shorting across R-CC or P24-R causes reverse rotation; open causes deceleration stop. (When Standby ST is always ON)</td>
<td>Sink/Source and PLC selectable using slide switch SW1 (Default setting is PLC side)</td>
</tr>
<tr>
<td>RES</td>
<td>Input</td>
<td>This inverter protective function is reset if RES-CC or P24-RES is connected. Shorting RES-CC or P24-RES has no effect when the inverter is in a normal condition. 2 different functions can be assigned.</td>
<td>Pulse train input (S2 terminal)</td>
</tr>
<tr>
<td>S1</td>
<td>Input</td>
<td>Shorting across S1-CC or P24-S1 causes preset speed operation.</td>
<td>Pulse frequency range: 10pps-2kpps</td>
</tr>
<tr>
<td>S2</td>
<td>Input</td>
<td>Shorting across S2-CC or P24-S2 causes preset speed operation. By changing parameter F110G setting, this terminal can also be used as a pulse train input terminal.</td>
<td>PTC input (S3 terminal)</td>
</tr>
<tr>
<td>S3</td>
<td>Input</td>
<td>Shorting across S3-CC or P24-S3 causes preset speed operation. By changing slide switch SW2 and parameter F110G setting, this terminal can also be used as a PTC input terminal.</td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>Common to input / output</td>
<td>Control circuit’s equipotential terminal</td>
<td>10Vdc (permissible load current: 10mA)</td>
</tr>
<tr>
<td>PP</td>
<td>Output</td>
<td>Analog power supply output</td>
<td>10Vdc (internal impedance: 30Ω)</td>
</tr>
<tr>
<td>VI A</td>
<td>Input</td>
<td>Multifunction programmable analog input. Default setting: 0-10Vdc (1/1000 resolution) and 5-60Hz (0-50Hz) frequency input (1/2000 resolution). By changing parameter F109G, this terminal can also be used as a multifunction programmable logic input terminal.</td>
<td>10Vdc (internal impedance: 30Ω)</td>
</tr>
<tr>
<td>VI B</td>
<td>Input</td>
<td>Multifunction programmable analog input. Default setting: 5-10Vdc (1/1000 resolution) and 0-60Hz (0-50Hz) frequency input. The function can be changed to -10+10V input by parameter F109G setting. By switching slide switch SW2 and changing parameter F110G setting, this terminal can also be used as a multifunction programmable logic input terminal.</td>
<td>10Vdc (internal impedance: 30Ω)</td>
</tr>
<tr>
<td>VI C</td>
<td>Input</td>
<td>Multifunction programmable analog input. 4-20mA (0-20mA) input.</td>
<td>4-20mA (internal impedance: 2500Ω)</td>
</tr>
<tr>
<td>FM</td>
<td>Output</td>
<td>Multifunction programmable analog input. Default setting: output frequency. The function can be changed to ammeter, 0-10Vdc or 0-20mA (4-20mA) current output by parameter F88B setting.</td>
<td>1mA dc full-scale ammeter or QS60T (option)</td>
</tr>
<tr>
<td>P24</td>
<td>Output</td>
<td>24Vdc power output</td>
<td>24Vdc-100mA (Note 3)</td>
</tr>
<tr>
<td>+24</td>
<td>Output</td>
<td>DC power input terminal for operating the control circuit. Connect a control power backup device (option or 24Vdc power supply) between +SU and CC.</td>
<td>24Vdc-100mA (Note 3)</td>
</tr>
<tr>
<td>+SU</td>
<td>Input</td>
<td>DC power input terminal for operating the control circuit. Connect a control power backup device (option or 24Vdc power supply) between +SU and CC.</td>
<td>Voltage: 24Vdc×10% Current: 1A or more</td>
</tr>
<tr>
<td>OUT</td>
<td>Output</td>
<td>Multifunction programmable open collector output. Default setting detect and output speed reach signal. Multifunction output terminals to which two different functions can be assigned. The NO terminal is an equipotential terminal. It is isolated from the CC terminal. By changing parameter F6G setting, these terminals can also be used as multifunction programmable pulse train output terminals.</td>
<td>Open collector output 24Vdc-100mA To output pulse trains, a current of 10mA or more needs to be passed. Pulse frequency range: 10~2kpps</td>
</tr>
<tr>
<td>FLA</td>
<td>Output</td>
<td>Multifunction programmable relay contact output. Detects the operation of the inverter’s protection function. (Default setting) Contact across FLA-FLC is closed and FLB-FLC is opened during protection function operation.</td>
<td>Max. switching capacity 250Vac-2A 30Vdc-2A (cosφ=1) at resistive load 250Vac-1A (cosφ=0.4) 30Vdc-1A (L/R=7ms) Min. permissible load 5Vdc-100mA 24Vdc-5mA</td>
</tr>
<tr>
<td>FLB</td>
<td>Output</td>
<td>Multifunction programmable relay contact output. Default settings detect and output low-speed signal output frequencies. Multifunction output terminals to which two different functions can be assigned.</td>
<td>Max. switching capacity 250Vac-2A (cosφ≈1) at resistive load 30Vdc-1A 250Vac-1A (cosφ≈0.4) Min. permissible load 5Vdc-100mA 24Vdc-5mA</td>
</tr>
<tr>
<td>FLC</td>
<td>Output</td>
<td>Multifunction programmable relay contact output. Default settings detect and output low-speed signal output frequencies. Multifunction output terminals to which two different functions can be assigned.</td>
<td>Max. switching capacity 250Vac-2A (cosφ≈1) at resistive load 30Vdc-1A 250Vac-1A (cosφ≈0.4) Min. permissible load 5Vdc-100mA 24Vdc-5mA</td>
</tr>
</tbody>
</table>

Note 1) When VI A terminal is used as logic input terminal, be sure to connect a resistor between P24 and VI A in case of sink logic, between VI A and CC in case of source logic. Recommended resistance: 4.7kΩ-1/2W.

Note 2) 100mA is the sum of P24 and +24.

Note 3) A chattering (momentary ON/OFF of contact) is generated by external factors of the vibration and the impact, etc. In particular, please set the filter of 10ms or more, or timer for measurements when connecting it directly with input terminal of programmable controller. Please use the OUT terminal as much as possible when the programmable controller is connected.
Peripheral devices

1. Input AC reactor (ACL)
   - Used to improve the input power factor, reduce the harmonics, and suppress external surge on the inverter power source side. Install when the power capacity is 500 kVA or more and 10 times or more than the inverter capacity or when a distorted wave generation source such as a thyristor unit or a large-capacity inverter is connected in the same distribution system.

2. DC reactor (DCL)
   - Generally, a DC reactor improves the power factor more than an input AC reactor. When the inverter is used along with equipment for which a high degree of reliability is required, an input AC reactor capable of suppressing external surges should be used along with a DC reactor.

3. High-attenuation radio noise reduction filter (NF type)
   - Effective to prevent interference in audio equipment used near the inverter.
   - Effective in noise reduction on both input and output sides of the inverter.
   - Provided with attenuation characteristics of several dB in frequencies from AM radio bands to 10MHz.
   - For noise countermeasures, insert on the secondary side of the inverter.

4. Zero-phase reactor core-type radio noise reduction filter
   - Effective to prevent interference in audio equipment used near the inverter.
   - Effective in noise reduction on both input and output sides of the inverter.
   - Provided with attenuation characteristics of several dB in frequencies from AM radio bands to 10MHz.
   - For noise countermeasures, insert on the secondary side of the inverter.

5. EMC noise filter (Compliant with European standards)
   - A high-attenuation compact EMC noise filter that can be Foot-mounted and Side-mounted.
   - Use when equipment readily affected by noise is installed in the peripheral area.

6. EMC plate
   - A steel plate used to connect shielded earth wires from inverter’s power cables or to connect earth wires from external devices.

7. Braking resistor
   - Use when rapid deceleration or stop is frequently required or when it is desired to reduce the deceleration time with large load. This resistor consumes regenerative energy during power generation braking.

8. Motor-end surge voltage suppression filter (for 500V class only)
   - Use an insulation-reinforced motor or install the surge voltage restraint filter to prevent degradation of motor insulation caused by surge voltage generation depending on cable length and wiring method, or use of a 500V class motor driven with an inverter.

9. DIN rail kit
   - Available for the 2.2kW (or 1.5kW) or less.

10. Parameter writer
    - Use this unit for batch read, batch copy, and batch writing of setting parameters.

11. Extension panel
    - Extended operation panel kit provided with LED indication section, RUN/STOP key, UP/DOWN key, Monitor key, and Enter key.

12. USB communication conversion unit
    - This unit is connected to a PLC or a computer to enable data communications. By connecting the connector cable, parameters can be easily adjusted, and data easily saved and written.

13. Communication option
    - These options allow you to connect a upper controller to multiple inverters for data transfer.

14. Remote panel
    - This panel includes a frequency meter, a frequency regulator, and RUN/STOP (forward/reverse run) switches.
External options

<table>
<thead>
<tr>
<th>Voltage class</th>
<th>Inverter model</th>
<th>Applicable motor (kW)</th>
<th>Input AC reactor</th>
<th>DC reactor</th>
<th>Radio noise reduction filter</th>
<th>Braking resistor</th>
<th>Motor-end surge voltage suppression filter</th>
<th>DIN rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-phase 240V</td>
<td>VFS15-2004PM-W</td>
<td>0.4</td>
<td>PFL-2005S</td>
<td>DCL2-2004</td>
<td>NF3005A-MJ</td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
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<tr>
<td></td>
<td>VFS15-2007PM-W</td>
<td>0.75</td>
<td>PFL-2005S</td>
<td>DCL2-2007</td>
<td>NF3005A-MJ</td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
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<tr>
<td></td>
<td>VFS15-2037PM-W</td>
<td>4.0</td>
<td>PFL-2018S</td>
<td>DCL2-2037</td>
<td>NF3020A-MJ</td>
<td>RC5078</td>
<td>PBR-2037</td>
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<tr>
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<td>VFS15-2055PM-W</td>
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<td>PFL-2025S</td>
<td>DCL2-2055</td>
<td>NF3040A-MJ</td>
<td>RC5078</td>
<td>PBR-040W015</td>
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<td></td>
<td>VFS15-2110PM-W</td>
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<td>PFL-2050S</td>
<td>DCL2-2110</td>
<td>NF3050A-MJ</td>
<td>RC5129</td>
<td>PBR7-008W7R5</td>
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<td></td>
<td>VFS15-2150PM-W</td>
<td>15</td>
<td>PFL-2100S</td>
<td>DCL2-2150</td>
<td>NF3080A-MJ</td>
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<td>PBR7-008W7R5</td>
<td>-</td>
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<tr>
<td>1-phase 240V</td>
<td>VFS15S-2002PL-W</td>
<td>0.2</td>
<td>PFL-2005S</td>
<td>DCL2-2004</td>
<td></td>
<td>RC5078</td>
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<tr>
<td></td>
<td>VFS15S-2004PL-W</td>
<td>0.4</td>
<td>PFL-2005S</td>
<td>DCL2-2007</td>
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<td>DIN003Z</td>
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<tr>
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<td>PFL-2011S</td>
<td>DCL2-2022</td>
<td></td>
<td>RC5078</td>
<td>PBR-2022</td>
<td>DIN005Z</td>
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<tr>
<td></td>
<td>VFS15S-2015PL-W</td>
<td>1.5</td>
<td>PFL-2018S</td>
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<tr>
<td></td>
<td>VFS15S-2022PL-W</td>
<td>2.2</td>
<td>PFL-2018S</td>
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<td></td>
<td>RC5078</td>
<td>PBR-2022</td>
<td>DIN005Z</td>
</tr>
<tr>
<td>3-phase 500V</td>
<td>VFS15S-4004PL-W</td>
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<td>PFL-4012S</td>
<td>DCL2-4004</td>
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<tr>
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<td>VFS15S-4007PL-W</td>
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<tr>
<td></td>
<td>VFS15S-4015PL-W</td>
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<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4022PL-W</td>
<td>2.2</td>
<td>PFL-4012S</td>
<td>DCL2-4022</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4037PL-W</td>
<td>4.0</td>
<td>PFL-4012S</td>
<td>DCL2-4037</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4055PL-W</td>
<td>5.5</td>
<td>PFL-4025S</td>
<td>DCL2-4055</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4075PL-W</td>
<td>7.5</td>
<td>PFL-4025S</td>
<td>DCL2-4075</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4110PL-W</td>
<td>11</td>
<td>PFL-4025S</td>
<td>DCL2-4110</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
<tr>
<td></td>
<td>VFS15S-4150PL-W</td>
<td>15</td>
<td>PFL-4050S</td>
<td>DCL2-4150</td>
<td></td>
<td>RC5078</td>
<td>PBR-2007</td>
<td>DIN003Z</td>
</tr>
</tbody>
</table>

The EMC noise filter is built into the 1ph-240V and 3ph-500V models by the standard.

**Communication**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type-form</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC-Link communication option</td>
<td>CCL003Z</td>
</tr>
<tr>
<td>PROFIBUS-DP communication option</td>
<td>PDP003Z</td>
</tr>
<tr>
<td>Device Net communication option</td>
<td>DEV003Z</td>
</tr>
<tr>
<td>EtherCAT communication option</td>
<td>IPE002Z</td>
</tr>
<tr>
<td>CAN open Communication option</td>
<td>CAN001Z</td>
</tr>
<tr>
<td>D-sub connector (9pins) type</td>
<td>CAN002Z</td>
</tr>
<tr>
<td>Open connector (5pins) type</td>
<td>CAN003Z</td>
</tr>
<tr>
<td>Communication option adapter</td>
<td>SBP009Z</td>
</tr>
</tbody>
</table>

Option adapter is necessary to use the communication option.

**Operation option**

**USB communication conversion unit**

Type-form: USB001Z

Inverter can be management and setting on a PC.

**Parameter writer**

Type-form: PWU003Z

Parameter can be read/write without power supply to the inverter. And inverter can be management and setting on a PC.

**Read/write/restore of parameters**

**Specification**

<table>
<thead>
<tr>
<th>Items</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery</td>
<td>AA size battery or Nickel metal hydride: Used 4 batteries Note: Batteries are not attached</td>
</tr>
<tr>
<td>languages</td>
<td>Japanese, English, Spanish, German, Italian, French</td>
</tr>
<tr>
<td>Data storage</td>
<td>SD card, SDHC card (Format is FAT32)</td>
</tr>
<tr>
<td>Attachment</td>
<td>USB cable, RJ45 cable(1m), SD card, Carry case, Shock-absorb cover, Wrist strap, Manual(Japanese/English)</td>
</tr>
</tbody>
</table>
Dimension and Connection

Input AC reactor

### Dimension

![Image of AC reactor dimension](image1)

**Terminal box with cover**

**Grounding terminal (4-ØF holes)**

**VF-S15**

**Single phase input**

**Power supply**

**Reactor model** | **Rating** | **Inverter model** | **Dimensions (mm)** | **Diagram** | **Terminals** | **Approx. Weight (kg)**
--- | --- | --- | --- | --- | --- | ---
PFL-2005S | S-phase 240V class -5.5A-50/60Hz | VFS15-2004PM-W, 2007PM-W | 105 70 140 90 55 5 40 | A | M3.5 | 1.2
PFL-2011S | S-phase 240V class -11A-50/60Hz | VFS15-2015PM-W, 2022PM-W | 130 70 140 115 60 5 50 | A | M4 | 2.3
PFL-2018S | S-phase 240V class -18A-50/60Hz | VFS15-2037PM-W, 20222PM-W | 130 70 140 115 60 5 50 | A | M4 | 2.5
PFL-2035S | S-phase 240V class -25A-50/60Hz | VFS15-2055PM-W | 125 100 130 50 83 7 | B | M4 | 2.6
PFL-2050S | S-phase 240V class -50A-50/60Hz | VFS15-2075PM-W, 2110PM-W | 155 115 140 50 95 7 | B | M6 | 3.4
PFL-2100S | S-phase 240V class -100A-50/60Hz | VFS15-2115PM-W | 230 150 210 60 90 8 | B | M8 | 8.2
PFL-4012S | S-phase 500V class -12.5A-50/60Hz | VFS15-4004PL-W, 4037PL-W | 125 95 130 50 79 7 | B | M4 | 2.3
PFL-4050S | S-phase 500V class -50A-50/60Hz | VFS15-4115PL-W | 155 140 165 50 112 7 | B | M6 | 6.8

### DC reactor

**Grounding terminal**

**Terminal box with cover**

**VF-S15**

**Power supply**

**Reactor model** | **Inverter model** | **Dimensions(mm)** | **Diagram** | **Approx. Weight (kg)**
--- | --- | --- | --- | ---
DCL2-2004 | VFS15-2004PM-W, VFS15S-2002PL-W | 72 92 75 57 42 | A | 0.6
DCL2-2007 | VFS15-2007PM-W, VFS15S-2004PL-W | 72 94 80 57 42 | A | 0.7
DCL2-2015 | VFS15-2015PM-W | 75 99 79 60 42 | A | 0.9
DCL2-2055 | VFS15-2055PM-W | 94 124 116 78 61 | A | 2.3
DCL2-2075 | VFS15-2075PM-W | 94 119 116 78 61 | A | 2.3
DCL2-2110 | VFS15-2110PM-W | 124 124 131 108 71 | B | 3.3
DCL2-2150 | VFS15-2150PM-W | 124 122 131 108 71 | B | 3.4
DCL2-4004 | VFS15-4004PL-W | 71 94 73 57 37 | A | 0.6
DCL2-4007 | VFS15-4007PL-W | 69 104 80 55 42 | A | 0.7
DCL2-4015 | VFS15-4015PL-W | 72 109 81 57 42 | A | 1.0
DCL2-4022 | VFS15-4022PL-W | 74 108 86 59 47 | A | 1.2
DCL2-4025 | VFS15-4025PL-W | 83 119 88 66 61 | A | 1.9
DCL2-4037 | VFS15-4037PL-W | 83 119 103 66 61 | A | 2.0
DCL2-4055 | VFS15-4055PL-W | 90 134 108 73 61 | B | 2.5
DCL2-4075 | VFS15-4075PL-W | 103 149 121 84 66 | B | 3.6
DCL2-4110 | VFS15-4110PL-W | 109 152 128 91 73 | B | 5.5
DCL2-4150 | VFS15-4150PL-W | 109 152 128 91 73 | B | 4.3
High attenuation radio noise reduction filter

<table>
<thead>
<tr>
<th>Filter model</th>
<th>Rated current (A)</th>
<th>Inverter model</th>
<th>Dimensions (mm)</th>
<th>Approx. Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NF3005A-MJ</td>
<td>5</td>
<td>VFS15-2004PM-W-V2007PM-W</td>
<td>174.5 160 145 110 80 32 70 20 45</td>
<td>R2.75 Length 7</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>VFS15-2015PM-W</td>
<td>267.5 250 235 170 140</td>
<td>R3.25 Length 8</td>
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<tr>
<td></td>
<td>20</td>
<td>VFS15-2037PM-W</td>
<td>214 200 185 120 90 32 70 20 43</td>
<td>M5 1.6</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>VFS15-2055PM-W</td>
<td>217.5 200 185 120 90 32 70 20 43</td>
<td>M5 2.7</td>
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<tr>
<td>NF3040A-MJ</td>
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<td>VFS15-2075PM-W</td>
<td>217.5 200 185 120 90 44 70 20 43</td>
<td>M5 1.6</td>
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<tr>
<td>NF3050A-MJ</td>
<td>50</td>
<td>VFS15-2110PM-W</td>
<td>234.5 280 260 200 150 57 100 30 65</td>
<td>M8 2.7</td>
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<td>NF3080A-MJ</td>
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<td>VFS15-2150PM-W</td>
<td>294.5 280 260 200 150 57 100 30 65</td>
<td>M8 2.7</td>
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<td>NF3010C-MJ</td>
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<td>VFS15-4004PM-W-4037PM-W</td>
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<td>NF3015C-MJ</td>
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<td>M5 1.6</td>
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<td>NF3020C-MJ</td>
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<td>NF3030C-MJ</td>
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<td>NF3040C-MJ</td>
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<td>M5 1.6</td>
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</table>

Note: For the inverter models ending with -PL, same noise filter as the ones described here is built-in standard.

Input or Output cable should be coiled over 4-times. RC5078 is recommended for the models 4.0 kW or less

Zero-phase reactor core-type radio noise filter

<table>
<thead>
<tr>
<th>Type-form: RC5078</th>
<th>Type-form: RC9129</th>
</tr>
</thead>
</table>

Braking resistor

<table>
<thead>
<tr>
<th>Resistor model</th>
<th>Rating</th>
<th>Inverter model</th>
<th>Dimensions (mm)</th>
<th>External dimension/Connection diagram</th>
<th>Approx. Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBR-2007</td>
<td>120W-2001</td>
<td>VFS15-2004PM-W-V2007PM-W</td>
<td>42 182 20 4.2 172 -</td>
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<td>A &amp; C 0.28</td>
</tr>
<tr>
<td>PBR-2037</td>
<td>120W-400</td>
<td>VFS15-2037PM-W</td>
<td>120 350 190 110 230 150</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>PBR-4022</td>
<td>120W-1600</td>
<td>VFS15-4037PL-W</td>
<td>120 350 190 110 230 150</td>
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<td></td>
</tr>
<tr>
<td>PBR-004R060</td>
<td>440W-800</td>
<td>VFS15-4055PL-W, 4075PL-W</td>
<td>120 350 190 110 230 150</td>
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<td></td>
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<tr>
<td>PBR-008W080</td>
<td>880W-50</td>
<td>VFS15-2170PM-W</td>
<td>120 350 190 110 230 150</td>
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<tr>
<td>PBR-008W300</td>
<td>880W-300</td>
<td>VFS15-4110PM-W, 4150PL-W</td>
<td>120 350 190 110 230 150</td>
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</tr>
</tbody>
</table>

Note 1: Braking resisters for VFS15-4004PL-W-4022PL-W are the same type of those for VFS15-2004PM-W-2007PM-W.
Motor end surge voltage suppression filter (for 500V class only)

<table>
<thead>
<tr>
<th>Filter model</th>
<th>Applicable motor (kW)</th>
<th>Dimensions (mm)</th>
<th>Terminal screw</th>
<th>Grounding screw</th>
<th>Approx. Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSF-4015Z</td>
<td>0.4,0.7,3,1,5</td>
<td>W 310 H 255 D 300</td>
<td>M4</td>
<td>M4</td>
<td>12</td>
</tr>
<tr>
<td>MSF-4037Z</td>
<td>2.2,3,7</td>
<td>W 310 H 255 D 300</td>
<td>M4</td>
<td>M4</td>
<td>20</td>
</tr>
<tr>
<td>MSF-4075Z</td>
<td>5.5,7,5</td>
<td>W 310 H 315 D 350</td>
<td>M5</td>
<td>M4</td>
<td>30</td>
</tr>
<tr>
<td>MSF-4150Z</td>
<td>11,15</td>
<td>W 330 H 355 D 400</td>
<td>M6</td>
<td>M5</td>
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Control power supply backup unit

<table>
<thead>
<tr>
<th>Type-form: CPS002Z</th>
<th>240V/500V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>Connection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Control power supply backup unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF-S15</td>
<td>M4</td>
</tr>
<tr>
<td>R/L1</td>
<td>U/T1</td>
</tr>
<tr>
<td>S/L2</td>
<td>V/T2</td>
</tr>
<tr>
<td>T/L3</td>
<td>W/T3</td>
</tr>
</tbody>
</table>

Remote panel

<table>
<thead>
<tr>
<th>Type-form: CBVR-7B1</th>
<th>CBVR-7B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>Panel cutout dimension</td>
</tr>
<tr>
<td>R0.5 Installation hole (M4)</td>
<td>Installation holes 2-Ø4 (M3)</td>
</tr>
<tr>
<td>Frequency meter</td>
<td></td>
</tr>
<tr>
<td>Potentiometer</td>
<td></td>
</tr>
<tr>
<td>JIS mark N1,5</td>
<td></td>
</tr>
<tr>
<td>Operation switch</td>
<td></td>
</tr>
<tr>
<td>Ø5 hole</td>
<td></td>
</tr>
<tr>
<td>Rubber bushing Ø34</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF-S15</td>
</tr>
<tr>
<td>R/L1</td>
</tr>
<tr>
<td>S/L2</td>
</tr>
<tr>
<td>T/L3</td>
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Extension panel

<table>
<thead>
<tr>
<th>Type-form: RKP002Z (It has parameter copy function)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
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<tr>
<td>Panel cutout dimension</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type-form: RKP007Z</th>
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</thead>
<tbody>
<tr>
<td>Dimension</td>
</tr>
<tr>
<td>Panel cutout dimension</td>
</tr>
</tbody>
</table>

| Communication cable model: CAB0011 (1m), CAB0013 (3m), CAB0015 (5m) |

Remote panel

<table>
<thead>
<tr>
<th>Type-form: CBVR-7B1</th>
<th>CBVR-7B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>Panel cutout dimension</td>
</tr>
<tr>
<td>R0.5 Installation hole (M4)</td>
<td>Installation holes 2-Ø4 (M3)</td>
</tr>
<tr>
<td>Frequency meter</td>
<td></td>
</tr>
<tr>
<td>Potentiometer</td>
<td></td>
</tr>
<tr>
<td>JIS mark N1,5</td>
<td></td>
</tr>
<tr>
<td>Operation switch</td>
<td></td>
</tr>
<tr>
<td>Ø5 hole</td>
<td></td>
</tr>
<tr>
<td>Rubber bushing Ø34</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>VF-S15</td>
</tr>
<tr>
<td>R/L1</td>
</tr>
<tr>
<td>S/L2</td>
</tr>
<tr>
<td>T/L3</td>
</tr>
</tbody>
</table>

Frequency meter

<table>
<thead>
<tr>
<th>Type-form: QS60T</th>
<th>QS60T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>Panel cutout dimension</td>
</tr>
<tr>
<td>Terminal (M4)</td>
<td>Installation cover</td>
</tr>
<tr>
<td>Install screw [M3]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2-Ø5.5 holes</td>
</tr>
<tr>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>FRH kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type-form: FRH-KIT*K</td>
</tr>
<tr>
<td>Frequency setting resistor (RV30YN-20S-B302)</td>
</tr>
<tr>
<td>Dimension</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>No. Connection terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CC</td>
</tr>
<tr>
<td>2 VIA</td>
</tr>
<tr>
<td>3 PP</td>
</tr>
</tbody>
</table>

Note: The wire length should be 30m or less the inverter and the operation panel.
To users of our inverters

1. For inverter users

**Notes**

**Leakage current**

This inverter uses high-speed switching semiconductors for PWM control. When a relatively long cable is used for power supply to an inverter, current may leak from the cable or the motor to the ground because of its capacitance, adversely affecting peripheral equipment. Installation of radio noise reduction filter may also increase leakage current. The intensity of such a leakage current depends on the PWM carrier frequency setting, the lengths of the input and output cables, etc., of the inverter. To prevent current leakage, it is recommended to take the following measures.

**Effects of leakage current**

Leakage current which increases when an inverter is used may pass through the following routes:

- Route (1) ... Leakage due to the capacitance between the ground and the noise reduction filter.
- Route (2) ... Leakage due to the capacitance between the ground and the inverter.
- Route (3) ... Leakage due to the capacitance between ground and the cable connecting the inverter and the motor.
- Route (4) ... Leakage due to the capacitance of the cable connecting the motor and an inverter in another power distribution line.
- Route (5) ... Leakage through the grounding line common to motors.
- Route (6) ... Leakage to another line because of the capacitance of the ground.

Leakage current which passes through the above routes may cause the following troubles:

- Malfunction of a leakage circuit breaker (ELCB) in the same or another power distribution line.
- Malfunction of a ground-relay installed in the same or another power distribution line.
- Noise produced at the output of an electronic device in another power distribution line.
- Activation of an external thermal relay installed between the inverter and the motor, at a current below the rated current.

**Measures against effects of leakage current**

The measures against the effects of leakage current are as follows:

1. Measures to prevent the malfunction of leakage circuit breakers (ELCB)
   - (1) Decrease the PWM carrier frequency of the inverter (Note).
   - (2) Use radio-frequency interference-proof ELCBs as ground-fault interrupters.

2. Measures against malfunction of ground-fault relays
   - (1) Decrease the PWM carrier frequency of the inverter (Note).
   - (2) Install ground-fault relays with a high-frequency protective function in both the same and other lines. When ELCBs are used, the inverter can operate with high PWM carrier frequency.

3. Measures against noises produced by other electric and electronic systems:
   - (1) Separate the grounding line of the inverter from that of the affected electric and electronic systems.
   - (2) Decrease the PWM carrier frequency of the inverter (Note).

4. Measures against malfunction of external thermal relays:
   - (1) Remove the external thermal relay and use the electronic thermal function of the inverter instead. (Not apply to cases where a single inverter is used to drive more than one motor. Refer to the instruction manual for measures to be taken when thermal relays cannot be removed.)
   - (2) Decrease the PWM carrier frequency of the inverter (Note).

5. Measures by means of wiring and grounding
   - (1) Separate the inverter’s grounding wire from that of other systems or install the grounding wire of each system separately to the grounding point.
   - (2) Use the shortest possible cables (100m or less) to connect the inverter to the motor. If the wire length is long, especially with the models of 4.0kW or less, perhaps over-current trip occurs by charging current through the capacitance of cable. Use the separate cable to reduce the capacitance of cable, or install the filter between the inverter and the motor as countermeasures against over-current trip.
   - (3) If the inverter has a high-attenuation EMC noise reduction filter, change the grounding capacitor switch to reduce the leakage current. Note that doing so leads to a reduction in the noise attenuation effect.

*Note* In the case of this inverter, the PWM carrier frequency can be decreased to 2.0kHz. Decrease the carrier frequency results in an increase in electromagnetic noise from the motor.

**Ground fault**

Before beginning operation, thoroughly check the wiring between the motor and the inverter for incorrect wiring or short circuits. Do not ground the neutral point of any star-connected motor.

**Radio interference**

*Noise produced by inverters*

Since this inverter performs PWM control, it produces noise and sometimes affects nearby instrumental devices, electrical and electronic systems, etc. The effects of noise greatly vary with the noise resistance of each individual device, its wiring condition, the distance between it and the inverter, etc. [Measures against noises]

According to the route through which noise is transmitted, the noises produced by an inverter are classified into transmission noise, induction noise and radiation noise. [Examples of protective measures]

- Separate the power line from other lines, such as weak-current lines and signal lines, and install them apart from each other.
- Install a noise reduction filter in each inverter. It is effective for noise prevention to install noise reduction filters in other devices and systems, as well.
- Shield cables and wires with grounded metallic conduits, and cover electronic systems with grounded metallic cases.
- Separate the power distribution line of the inverter from that of other devices and reactivities.
- Install the input and output cables of the inverter apart from each other.
- Use shielded twisted pair wires for wiring of the weak-current and signal circuits, and always ground one of each pair of wires.
- Ground the inverter with grounding wires as large and as short as possible, separately from other devices and systems.

On 1ph-240V and 3ph-500V models, noise can be greatly reduced as they have a built-in EMC noise reduction filter on their input side.

**Power factor improvement capacitors**

Do not install power factor improvement capacitors on the output side of the inverter. Installing a power factor improvement capacitor on the output side causes current containing harmonic components to flow into the capacitor, adversely affecting the capacitor itself or causing the inverter to trip.

To improve the power factor, install a DC reactor or an input AC reactor on the primary side of the inverter.

**Installation of input AC reectors**

These devices are used to improve the input power factor and suppress high harmonic currents and surges. Install an input AC reactor when using this inverter under the following conditions:

1. When the power source capacity is 500KVA or more, and when it is 10 times or more greater than the inverter capacity.
2. Selecting the Capacity (model) of the Inverter

Selection

(Capacity)
Refer to the applicable motor capacities
listed in the standard specifications.

When driving a high-pole motor, special motor,
or multiple motors in parallel, select such an
inverter that the sum of the motor rated
current multiplied by 1.05 to 1.1 is less than
the inverter's rated output current value.

[Acceleration/deceleration times]
The actual acceleration and deceleration
times of a motor driven by an inverter are
determined by the torque and moment of
inertia of the load, and can be calculated by the
following equations.

Acceleration

ta = (JM+JL) x ∆N  (sec.)

Deceleration

ta = (JM+JL) x ∆N  (sec.)

In case of variable torque characteristic
Inverters should be arranged in horizontal
rows.

[Allowable torque characteristics]
When a standard motor is combined with an
inverter to perform variable speed operation,
the motor temperature rises slightly higher
than it normally does during commercial
power supply operation. This is because the
inverter output voltage has a sinusoidal (ap-
proximate) PWM waveform. In addition,
the cooling becomes less effective at low speed,
so the torque must be reduced according
to the frequency. Regarding the allowable
torque characteristic, please consult with
the motor manufacturer.

[Starting characteristics]
When a motor is driven by an inverter, its
operation is restricted by the inverter's overload
current rating, so the starting characteristic is
different from those obtained from com-
mercial power supply operation. Although the
starting torque is smaller with an inverter
than with the commercial power supply, a high starting torque can be pro-
duced at low speeds by adjusting the V/f
pattern torque boost amount or by employ-

3. When installing, wiring and operating the inverter

Installing and wiring

[Installing precautions]
(1) Do not install any location of high
temperature, high humidity, moisture
condensation and freezing. Do not install
the inverter where there are gases that
corode metal or solvents that adversely
affect plastic.
Avoiding locations where there is exposure
to water and/or where there may be large
amounts of dust and metallic fragments.
In this case, please install inverters in the
enclosure type cabinet. The cabinet must
be considered its size and the cooling
method to allow the specifications of an
ambient temperature for inverters.

(2) Must be installed in non-inflammables
so as to install it. The rear panel gets
very hot. If installation is in an inflammable
object, this can result in fire.

(3) Inverters should be arranged in horizontal
rows.

[Wiring precautions]
Installing a molded-case circuit breaker (MCCB)
(1) Install a molded-case circuit breaker
(MCCB) on the inverter's power supply
input to protect the wiring.

(2) Avoid turning the molded-case circuit
breaker on and off frequently to turn on/
off the motor.

(3) To turn on/off the motor, close/ break the control terminals F (or R)-CC.

Installing a magnetic contactor (MC) [primary side]
(1) To prevent an automatic restart after the
power interruption or overload relay has
triped, or actuation of the protective circuit,
install an electro-magnetic contact
relay in the power supply.

(2) The inverter is provided with a failure
detection relay (FL), so that, if its contacts
are connected to the operation circuit of
the magnetic contactor, the contactor will
be opened when the protective circuit of
the inverter is activated.

(3) The inverter can be used without a
magnetic contactor. In this case, use an
MCCB (equipped with a voltage tripping
device) for opening the primary circuit
when the inverter protective circuit is acti-
vated.

(4) Avoid turning the magnetic contactor on
and off frequently to turn on/off the motor.

(5) To turn on/off the motor frequently, close/
break the control terminals F (or R)-CC.

Installing a magnetic contactor (MC) [secondary side]
(1) As a rule, if a magnetic contactor is
installed between the inverter and the
motor, do not turn on/off while running.
(If the secondary-side contactor is turned
on/off while running, a large current may
flow in the inverter, causing inverter dam-
age and failure.)

(2) A magnetic contactor may be installed to
change the motor or change to the com-
mercial power source when the inverter is
stopped. Always use an interlock with the
magnetic contactor in this situation so
that the commercial power supply is not
applied to the inverter's output terminals.

External signal

(1) Use a relay rated for low currents. Mount
a surge suppressor on the excitation coil of
the relay.

(2) When wiring the control circuit, use
shielded wires or twisted pair cables.

(3) Because all of the control terminals
except FLA, FLB, FLC, RY or RC are
connected to electronic circuits, insulate
these terminals to prevent them from
coming into contact with the main circuit.

Installing an overload relay

(1) This inverter has an electronicthermal
overload protective function. However, in
the following cases, the thermal relay operation level must be ad-
justed or an overload relay matching the
motor's characteristics must be installed
between the inverter and the motor.
(a) When using a motor having a rated
current value different from that of the

(b) When driving several motors simulta-
neously.

(2) When using the inverter to control
the operation of a constant-torque motor,
change the protective characteristic of
the electronic thermal relay according to
the setting of the constant-torque motor.

(3) In order to adequately protect a motor
used for low-speed operation, we recom-
mand the use of a motor equipped with an
embedded thermal relay.

Wiring

(1) Do not connect input power to the output
(motor side) terminals (U/T1, V/T2, W/T3),
That will destroy the inverter and may re-
sult in fire. Please pay attention to wiring
before power supply turns-on.

(2) Do not touch wires from the power
supply and ground.
ing current and the load current low or setting the PWM carrier frequency low. If you cannot decrease the starting current, please select larger capacity of inverters for current margins.

4. When changing the motor speed

Application to standard motors

Vibration
When a motor is operated with an inverter, it experiences more vibrations than when it is operated by the commercial power supply. The vibration can be reduced to a negligible level by securing the motor and machine to the base firmly. If the base is weak, however, the vibration may increase at a light load due to resonance with the mechanical system. In this case, using jump frequency to avoid resonance or changing PWM carrier frequency is also effective.

Acoustic noise
The magnetic noise of motors with inverter drives is changed by PWM carrier frequency. In case of high PWM carrier frequency settings, its acoustic noise is almost same as commercial power supply drives. Moreover, when the motors are operated over rated rotation, the windy noise of the motors is increased.

Reduction gear, belt, chain
Note that the lubrication capability of a reducer or a converter used as the interface of the motor and the load machine may affect at low speeds.
When operating at frequencies exceeding 60 Hz or higher, power transmission mechanisms such as reduction gear, belts and chains, may cause problems such as production of noise, a reduction in strength, or shortening of service life.

Frequency
Before setting the maximum frequency to 60 Hz or higher, confirm that this operating range is acceptable for the motor.

Starting method
When you drive the motor with changeable connection between star-connection and delta-connection for decreasing starting current, please connect delta-connection only. If you change motor connection while inverter drives, the protective function of inverter may activate.

Application to special motors

Gear motor
When using an inverter to drive a gear motor, inquire of the motor manufacturer about its continuous operation range due to the followings:
- The low-speed operation of a gear motor may cause insufficient lubrication
- The loss of a gear may be increased than commercial power supply drives.
- In case of the operation on high frequency exceeding 60Hz, the acoustic noise and motor temperature may be higher.

Toshiba Gold Motor (High-efficiency power-saving motor)
Inverter-driven operation of Toshiba Gold Motors is the best solution for saving energy. This is because these motors have improved efficiency, power factor, and noise/vibration reduction characteristics when compared to standard motors.

Pole-changing motor
Pole-changing motors can be driven by this inverter. Before changing poles, however, be sure to let the motor come to a complete stop. If you change motor connection while inverter drives, the protective function of inverter may activate.

Underwater motors
Note that underwater motors have higher rated current than general motors.
The current ratings of underwater motors are relatively high. So, when selecting an inverter, you must pay special attention to its current rating so that the current rating of the motor is below that of the inverter.

When the lengths of the motor cable are long, please use thicker cable than a table of “Wiring devices” because the maximum torque is decreased by the voltage dropping. Moreover, please pay attention to select leakage circuit breakers.

Single-phase motor
Because single-phase motors are equipped with a centrifugal switch and capacitors for starting, they cannot be driven by an inverter.
When single-phase motors are driven by inverters, a centrifugal switch and capacitors may be broken. In case of a single-phase, power system, a 3-phase motor can be driven by using a single-phase input inverter to convert it into a 3-phase 200V output. (A special inverter and a 3-phase 200V motor are required.)

Braking motor
When using a braking motor, if the braking circuit is directly connected to the inverter’s output terminals, the brake cannot be released because of the lowered starting voltage. Therefore, when using a braking motor, connect the braking circuit to the inverter’s power supply side, as shown on the below.

Usually, braking motors produce larger noise in low speed ranges.

5. Disposal of the inverter
For safety’s sake, do not dispose of the disused inverter yourself but ask an industrial waste disposal agent. Disposing of the inverter improperly could cause its capacitor to explode and emit toxic gas, causing injury to persons.
To users of our inverters: Our inverters are designed to control the speeds of three-phase induction motors for general industry.

⚠️ Precautions

- Please read the instruction manual before installing or operating the inverter unit.
- This product is intended for general purpose uses in industrial application. It cannot be used applications where may cause big impact on public uses, such as power plant and railway, and equipment which endanger human life or injury, such as nuclear power control, aviation, space flight control, traffic, safety device, amusement, or medical.
- It may be considerable whether to apply, under the special condition or an application where strict quality control may not be required. Please contact our headquarters, branch, or local offices printed on the front and back covers of this catalogue.
- When exporting Toshiba Inverter separately or combined with your equipment, please be sure to satisfy the objective conditions and inform conditions listed in the export control policies, so called Catch All restrictions, which are set by the Ministry of Economy, Trade and Industry of Japan, and the appropriate export procedures must also be taken.
- Please use our product in applications where do not cause serious accidents or damages even if product is failure, or please use in environment where safety equipment is applicable or a backup circuit device is provided outside the system.
- Please do not use our product for any load other than three-phase induction motors.
- None of Toshiba, its subsidiaries, affiliates or agents, shall be liable for any physical damages, including, without limitation, malfunction, anomaly, breakdown or any other problem that may occur to any apparatus in which the Toshiba inverter is incorporated or to any equipment that is used in combination with the Toshiba inverter. Nor shall Toshiba, its subsidiaries, affiliates or agents be liable for any compensatory damages resulting from such utilization, including compensation for special, indirect, incidental, consequential, punitive or exemplary damages, or for loss of profit, income or data, even if the user has been advised or apprised of the likelihood of the occurrence of such loss or damages.

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