TOSHIBA

E6582156②

# TOSVERT™ VF-AS3

## DC power supply connect to inverter

Toshiba Industrial Products and Systems Corporation

Note

1. Read this manual before installing or operating the inverter. Keep it in a safe place for reference.
2. All information contained in this manual will be changed without notice.

# Safety precautions

The items described in the instruction manual and on the inverter itself are very important so that you can use safely the inverter, prevent injury to yourself and other people around you as well as to prevent damage to property in the area. Thoroughly familiarize yourself with the symbols and indications shown below and then continue to read the manual. Make sure that you observe all warnings given.

* Read the Safety precautions of the instruction manual (CD-ROM) of VF-AS3 inverter (E6582062) for information not mentioned here.

Explanation of markings

| Marking | Meaning of marking |
|---|---|
| ⚠ WARNING | Indicates that errors in operation will lead to death or serious injury. |
| ⚠ CAUTION | Indicates that errors in operation will lead to injury*1. |
| NOTICE | Indicates that errors in operation will cause damage to physical property*2. |

*1 Such things as injury, burns or electric shock that will not require hospitalization or long periods of outpatient treatment.
*2 Physical property damage refers to wide-ranging damage to assets and materials.

Meanings of symbols

| Marking | Meaning of marking |
|---|---|
| ⃠ | Indicates an inhibition (Don't do it).<br>Detailed information on the inhibition is described in illustration and text in or near the symbol. |
| ❗ | Indicates a mandatory action that must be followed.<br>Detailed information on the mandatory action is described in illustration and text in or near the symbol. |
| △ | Indicates a warning or caution.<br>Detailed information on the warning or caution is described in illustration and text in or near the symbol. |

# 1. Introduction

## ⚠ CAUTION

Mandatory action

- Provide pre-charge circuit when the inverter is supplied by DC power source.
  If proper pre-charge circuit is not provided, it will cause fire or damage the inverter.
- Disconnect the grounding capacitors on inverter when PWM converter (ex. harmonics reduction filter or regeneration) is connected to DC power terminal on the inverter.
  Leakage current from PWM converter can cause a component damage inside the inverter and finaly it can cause fire.

For some type-forms, if you want to use VF-AS3 connected on a DC power supply, you need to provide one or more pre-charge circuits on your side. (Pre-change circuit: A circuit for suppression of inrush current to the DC BUS capacitor of the inverter at power on.)
For details on type-forms that need pre-charge circuits, please refer to the following combination chart.

- **Frame size A1, A2, A3, A1E, A2E, A3E**

  No pre-charge circuits are required.
  Connect a DC power supply to the DC input terminals (terminals [PA/+] and [PC/-]) of VF-AS3, and set the parameter [F640: DC supply input] to "1: Enabled".

- **Frame size A4, A5, A6, A7, A8, A4E, A5E**

  Provide pre-charge circuits on your side.
  For details on required pre-charge circuits, refer to Chapter 2.

- **Frame size A7, A8**

  In addition to providing pre-charge circuits, you need to change power connection of inverter fans (cooling fans). Refer to Chapters 2 and 3.
  The frame size A1 to A6 of VF-AS3 inverter has a built-in DC reactor as standard, and the frame size A7 and A8 attached with a DC reactor, no option is available.

## ■ Pre-charge circuit combination chart

| Voltage class | Frame Size | Type-form | Pre-charge circuit | DC current (A) [HD/ND]* | Change power supply connection for Cooling FAN |
|---|---|---|---|---|---|
| 240V class | A1 | VFAS3-2004P | No required | 2.1 / 3.7 | No required |
| | | VFAS3-2007P | | 4.0 / 7.2 | |
| | | VFAS3-2015P | | 7.4 / 10 | |
| | | VFAS3-2022P | | 11 / 19 | |
| | A2 | VFAS3-2037P | | 19 / 25 | |
| | A3 | VFAS3-2055P | | 25 / 33 | |
| | | VFAS3-2075P | | 33 / 48 | |
| | A4 | VFAS3-2110P | Required | 49 / 65 | |
| | | VFAS3-2150P | | 65 / 80 | |
| | | VFAS3-2185P | | 80 / 94 | |
| | A5 | VFAS3-2220P | | 96 / 129 | |
| | | VFAS3-2300P | | 129 / 158 | |
| | | VFAS3-2370P | | 158 / 191 | |
| | A6 | VFAS3-2450P | | 193 / 234 | |
| | | VFAS3-2550P | | 234 / 320 | |

| Voltage class | Frame Size | Type-form | Pre-charge circuit | DC current (A) [HD/ND]* | Change power supply connection for Cooling FAN |
|---|---|---|---|---|---|
| 480V class | A1 | VFAS3-4004PC | No required | 1.1 / 2.0 | No required |
| | | VFAS3-4007PC | | 2.2 / 3.8 | |
| | | VFAS3-4015PC | | 4.0 / 5.5 | |
| | | VFAS3-4022PC | | 5.7 / 9.8 | |
| | | VFAS3-4037PC | | 10 / 13 | |
| | A2 | VFAS3-4055PC | | 13 / 18 | |
| | | VFAS3-4075PC | | 18 / 26 | |
| | A3 | VFAS3-4110PC | | 26 / 35 | |
| | | VFAS3-4150PC | | 36 / 43 | |
| | | VFAS3-4185PC | | 44 / 51 | |
| | A4 | VFAS3-4220PC | Required | 52 / 68 | |
| | | VFAS3-4300PC | | 70 / 85 | |
| | | VFAS3-4370PC | | 86 / 102 | |
| | A5 | VFAS3-4450PC | | 104 / 125 | |
| | | VFAS3-4550PC | | 127 / 169 | |
| | | VFAS3-4750PC | | 172 / 203 | |
| | A6 | VFAS3-4900PC | | 209 / 250 | |
| | | VFAS3-4110KPC | | 250 / 296 | |
| | | VFAS3-4132KPC | | 296 / 353 | |
| | A7 | VFAS3-4160KPC | | 363 / 489 | Required |
| | A8 | VFAS3-4200KPC | | 449 / 554 | |
| | | VFAS3-4220KPC | | 499 / 625 | |
| | | VFAS3-4280KPC | | 625 / 700 | |

Note) HD/ND

VF-AS3 inverter has multi-rating.

Select rating with the parameter [AUL: Multi-rating select] according to the characteristics of the load to be applied.

[AUL]="2: ND rating (120%-60s) (0 after execution)"

- Select it to apply equipment with variable torque characteristic.
- Example) Fans, pumps, blowers, etc.

[AUL]="3: HD rating (150%-60s) (0 after execution)"

- Select it to apply equipment with constant torque characteristic.
- Example) Conveyors, load transporting machinery, cranes, mixers, compressors, making machines, machine tools, etc.

For details, refer to the instruction manual of VF-AS3 inverter.

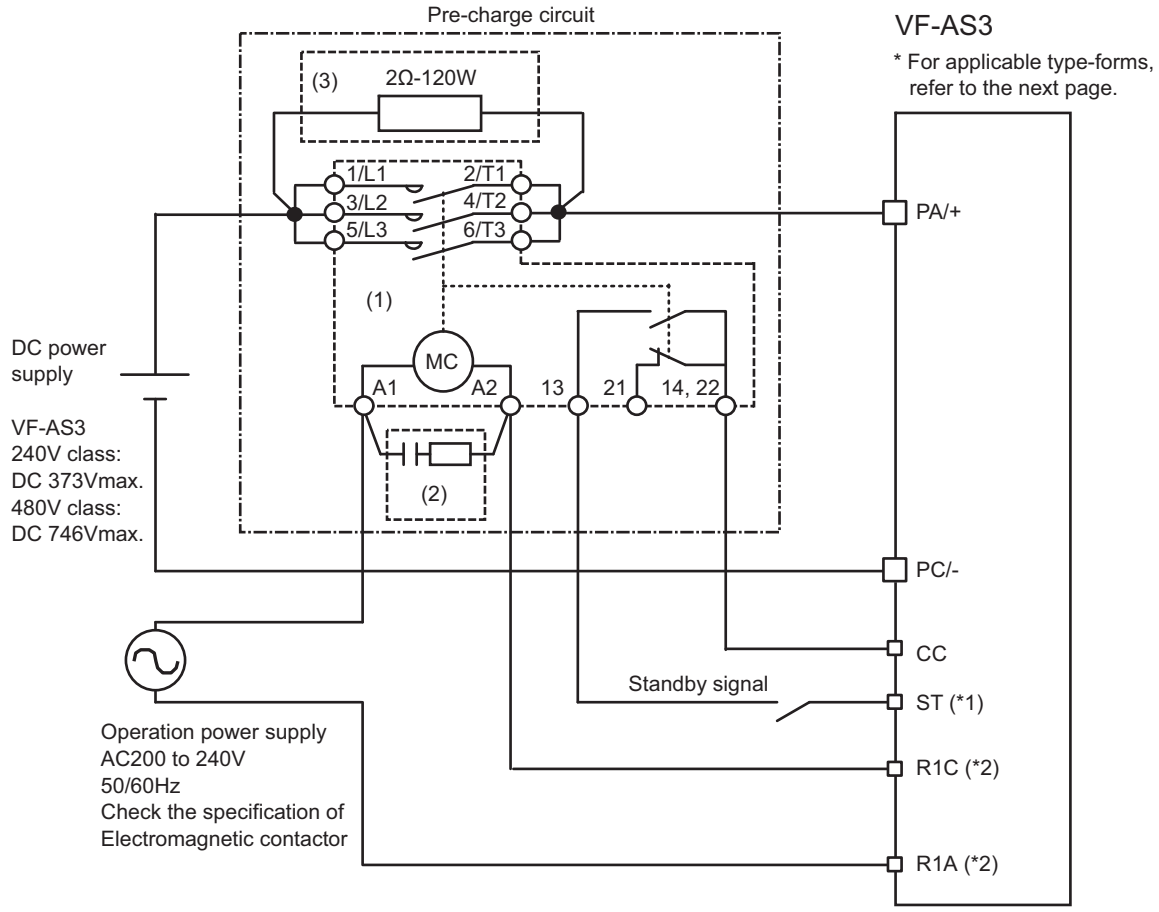
# 2. Connection of Pre-charge circuit

| ⚠ WARNING | |
|---|---|
| Prohibited | • Do not connect AC power supply to the DC terminals, PA/+ and PC/-, of inverter.<br>That can cause a fire. |
| Mandatory action | • Connect correctly the DC terminals, DC power supply + to the DC terminals PA/+ of inverter with the same polarity.<br>If the polarity is incorrect, it will destroy both the inverter and the option, and can result in fire.<br>• Connect the output signal of standby, to the inverter's control system.<br>If inverter drives in case of the output signal of standby OFF, this can result in fire. |

This chapter applies to frame sizes A4, A5, A6, A7, and A8.

This chapter describes the configuration of a pre-charge circuit, along with examples of compatible parts. When selecting parts according to the following examples of compatible parts, note that some type-forms of frame size A6 and all type-forms of frame sizes A7 and A8 require parallel connection of multiple pre-charge circuits. For details, refer to the subsequent pages.

## ■ Pre-charge circuit configuration (Sample circuit)



Examples of compatible parts for the pre-charge circuit

| No. | Part name | Example of compatible parts | |
|---|---|---|---|
| | | Type-form | Manufacturer |
| (1) | Electromagnetic contactor | SC-N3/SE (SC65BAS-222) | Fuji Electric |
| (2) | Surge absorber | - (*3) | - (*3) |
| (3) | Rush current protective resistor | 120W-2ohm | MICRON |

(*1) Set parameter [F110] to "0", and assign and use ST (Standby) terminal (Function number 6) for an unused digital input terminal.

(*2) Set the terminal [R1A]-[R1C] of the inverter (parameter [F133]) or the terminal [R2A]-[R2C] (Parameter [F134]) to "114: For external relay of rush current suppression".
The figure indicates the case of using the terminal [R1A]-[R1C].
Note) Set [F640: DC supply input]= "1: Enabled".

(*3) For SC-N3/SE, Surge absorber is no required. But if other Electromagnetic contactor is used, check the specification. And connect Surge absorber if needed.

- Refer to the instruction manual of VF-AS3 inverter for wire size of the DC section.
- For the control circuit, use shielded wires whose size is 0.75mm$^2$ or more, and for the operation power supply, use the electric wires whose size is 2.0mm$^2$ or more.

When the pre-charge circuit of sample is used, some type-forms of frame size A6 and all type-forms of frame sizes A7 and A8 require parallel connection of multiple pre-charge circuits. For details on the numbers and wiring of connected pre-charge circuits, refer to the following.

## ■ Number of connected pre-charge circuits - HD rating

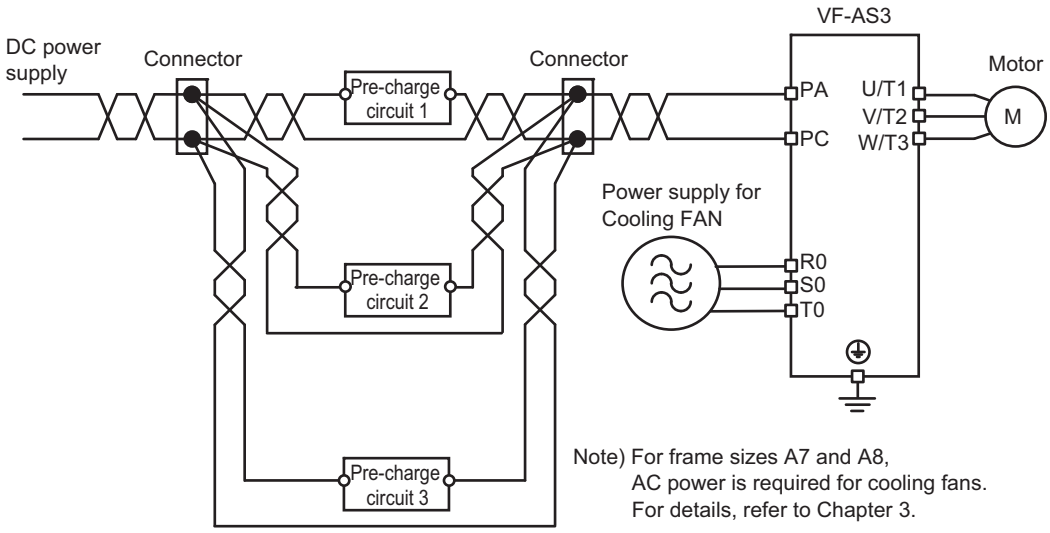
| Voltage class | HD/ND | Frame Size | Type-form | Applicable motor (kW) | DC current (A) | Pre-charge circuit |
|---|---|---|---|---|---|---|
| 240V class | HD | A4 | VFAS3-2110P | 11 | 49 | Pre-charge circuit x 1 |
| | | | VFAS3-2150P | 15 | 65 | |
| | | | VFAS3-2185P | 18.5 | 80 | |
| | | A5 | VFAS3-2220P | 22 | 96 | |
| | | | VFAS3-2300P | 30 | 129 | |
| | | | VFAS3-2370P | 37 | 158 | |
| | | A6 | VFAS3-2450P | 45 | 193 | |
| | | | VFAS3-2550P | 55 | 234 | |
| 480V class | HD | A4 | VFAS3-4220PC | 22 | 52 | Pre-charge circuit x 1 |
| | | | VFAS3-4300PC | 30 | 70 | |
| | | | VFAS3-4370PC | 37 | 86 | |
| | | A5 | VFAS3-4450PC | 45 | 104 | |
| | | | VFAS3-4550PC | 55 | 127 | |
| | | | VFAS3-4750PC | 75 | 172 | |
| | | A6 | VFAS3-4900PC | 90 | 209 | |
| | | | VFAS3-4110KPC | 110 | 250 | |
| | | | VFAS3-4132KPC | 132 | 296 | Pre-charge circuit x 2 (parallel) |
| | | A7 | VFAS3-4160KPC | 160 | 363 | |
| | | A8 | VFAS3-4200KPC | 200 | 449 | |
| | | | VFAS3-4220KPC | 220 | 499 | |
| | | | VFAS3-4280KPC | 280 | 625 | Pre-charge circuit x 3 (parallel) |

## ■ Number of connected pre-charge circuits - ND rating

| Voltage class | HD/ND | Frame Size | Inverter model | Applicable motor (kW) | DC current (A) | Pre-charge circuit |
|---|---|---|---|---|---|---|
| 240V class | ND | A4 | VFAS3-2110P | 15 | 65 | Pre-charge circuit x 1 |
| | | | VFAS3-2150P | 18.5 | 80 | |
| | | | VFAS3-2185P | 22 | 94 | |
| | | A5 | VFAS3-2220P | 30 | 129 | |
| | | | VFAS3-2300P | 37 | 158 | |
| | | | VFAS3-2370P | 45 | 191 | |
| | | A6 | VFAS3-2450P | 55 | 234 | Pre-charge circuit x 2 (parallel) |
| | | | VFAS3-2550P | 75 | 320 | |
| 480V class | ND | A4 | VFAS3-4220PC | 30 | 68 | Pre-charge circuit x 1 |
| | | | VFAS3-4300PC | 37 | 85 | |
| | | | VFAS3-4370PC | 45 | 102 | |
| | | A5 | VFAS3-4450PC | 55 | 125 | |
| | | | VFAS3-4550PC | 75 | 169 | |
| | | | VFAS3-4750PC | 90 | 203 | |
| | | A6 | VFAS3-4900PC | 110 | 250 | Pre-charge circuit x 2 (parallel) |
| | | | VFAS3-4110KPC | 132 | 296 | |
| | | | VFAS3-4132KPC | 160 | 353 | |
| | | A7 | VFAS3-4160KPC | 220 | 489 | |
| | | A8 | VFAS3-4200KPC | 250 | 554 | Pre-charge circuit x 3 (parallel) |
| | | | VFAS3-4220KPC | 280 | 625 | |
| | | | VFAS3-4280KPC | 315 | 700 | |

## ■ Parallel connection of pre-charge circuits (Sample circuit)

### 1) Power circuit




### 2) Control circuit

(*1) Set parameter [F110] to "0", and assign and use ST (Standby) terminal (Function number 6) for an unused digital input terminal.

(*2) Set the terminal [R1A]-[R1C] of the inverter (parameter [F133]) or the terminal [R2A]-[R2C] (Parameter [F134]) to "114: For external relay of rush current suppression".
The figure indicates the case of using the terminal [R1A]-[R1C].
Note) Set [F640: DC supply input]= "1: Enabled".

- Refer to the instruction manual of the main inverter unit for wire size of the DC section.
- For the control circuit, use shielded wires whose size is 0.75mm$^2$ or more, and for the operation power supply, use the electric wires whose size is 2.0mm$^2$ or more.

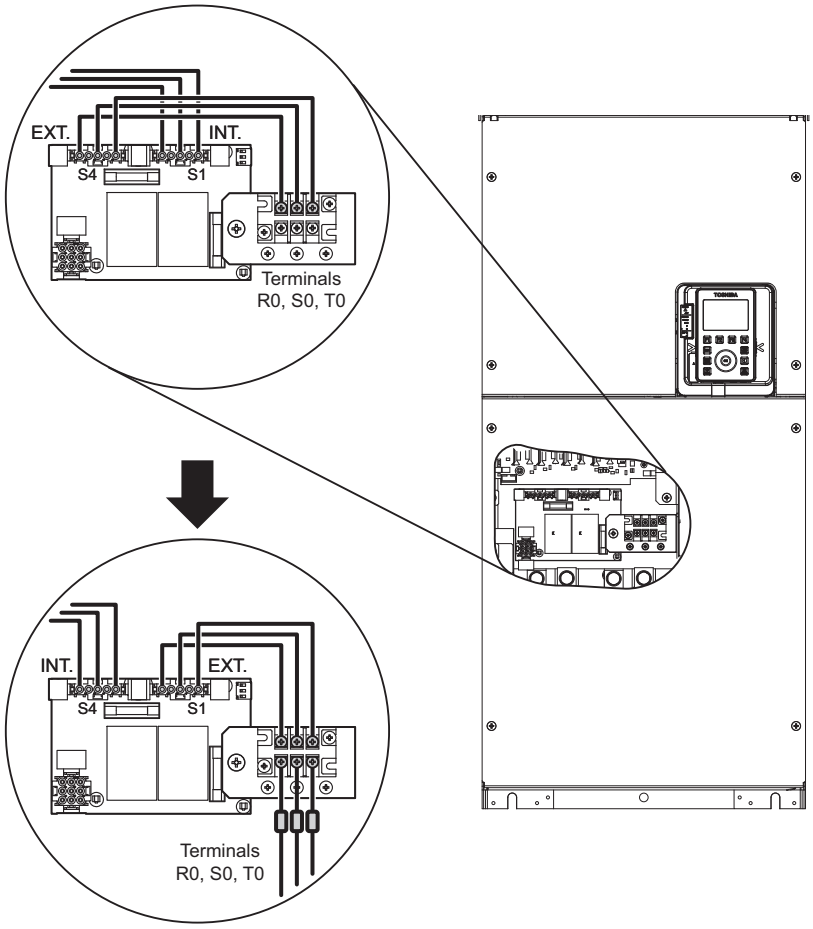
# 3. Power supply connection for inverter's Cooling FAN

This chapter applies to frame sizes A7 and A8.

For frame sizes A7 and A8, three-phase AC power supply is required for cooling fans of the inverter. Refer to the following to change power connection of the fans.

- On the board in the inverter shown in the figure below, exchange the wires connected to connectors at “S1” with the wires connected to connectors at “S4”. This allows for supplying three-phase power from terminals [R0], [S0], and [T0] shown in the figure to the cooling fans.
- Connect a three-phase power supply shown in the table below to terminals [R0], [S0], and [T0].

Factory-set wiring: fans powered internally by [R/L1], [S/L2] and [T/L3].




Modification for fans powered externally by [R0], [S0] and [T0].

| Frame Size | Inverter Type-form | Fan power supply voltage [R0], [S0], [T0] | Consumed power of Cooling FAN | Recommended wire size | Recommended Molded-case circuit breaker (MCCB) |
|---|---|---|---|---|---|
| A7 | VFAS3-4160KPC | 3-phase 380 to 440V-50Hz or 3-phase 380 to 480V-60Hz (*1) | 700 VA | 1.5mm$^2$ (AWG14) | 5A |
| A8 | VFAS3-4200KPC | | 1300 VA | | |
| | VFAS3-4220KPC | | | | |
| | VFAS3-4280KPC | | | | |

(*1): In case of corner earthed power supply system, connect to power supply under the surrounding according to OVC2 (Over Voltage Category 2).